MUNICIPAL CONSULTATION FILING

Connecticut General Statutes Section 16-50*l*(e)

For a Certificate of Environmental Compatibility and Public Need

Greater Hartford – Central Connecticut Reliability Project

Newington, West Hartford, Hartford, and Berlin, Connecticut

December 2015

Submitted to:
Chief Elected Officials
Newington, West Hartford, Hartford, and Berlin, Connecticut

Submitted by:
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EXECUTIVE SUMMARY

ES.1 PROJECT PURPOSE AND LOCATION

To improve the reliability of the electric transmission system in the Greater Hartford and Central Connecticut study area, The Connecticut Light and Power Company doing business as Eversource Energy (Eversource or the Company) proposes to construct and operate a new 115-kilovolt (kV) underground transmission line, to perform associated upgrades to three existing Eversource substations (Newington, Southwest Hartford, and Berlin), and to modify a 0.01-mile section of an existing overhead 115-kV transmission line (referred to as the Newington Tap) that connects to Newington Substation.

The new 3.8-mile underground electric transmission cable system would extend between Eversource's existing Newington Substation in the Town of Newington, through the Town of West Hartford, to Eversource's existing Southwest Hartford Substation in the City of Hartford. To interconnect the new 115-kV cable to the transmission grid, Eversource proposes to expand and make related improvements to both substations. In addition, Eversource proposes to modify its existing Berlin Substation, located in the Town of Berlin. All of the proposed substation modifications would be on Eversource property.

These proposed electric transmission system improvements, referred to as the Greater Hartford – Central Connecticut Reliability Project (GHCCRP or Project; refer to Figure ES-1), is one of a suite of projects required to bring the electric supply system in the Greater Hartford Sub-area[1] (refer to Figure ES-2) into compliance with applicable national and regional electric reliability standards and criteria and to fulfill a need to improve the capability of the transmission system to move power across Connecticut from east-to-west when the system is under stress. Specifically, the Project would eliminate potential thermal overloads and voltage criteria violations in the Greater Hartford Sub-area, as identified in studies conducted by the Independent System Operator - New England (ISO-NE), the independent system planning authority for the New England states.

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[1] For the purpose of electric system planning, the Greater Hartford Sub-area includes 17 municipalities: Hartford, West Hartford, Newington, Berlin, Cromwell, Rocky Hill, Wethersfield, Plainville, New Britain, Farmington, Burlington, Avon, East Hartford, Bloomfield, Windsor, East Granby, and Granby. The system planning studies that identified the need for the project discussed in this Municipal Consultation Filing considered needs in the Greater Hartford Sub-area, as well as the sub-areas of Northwest Connecticut, Manchester – Barbour Hill, and Middletown, together with the need to transmit additional power across Connecticut from east-to-west. The entire study area is designated the Greater Hartford – Central Connecticut area.

Figure ES-1: GHCCRP: Proposed Project Location

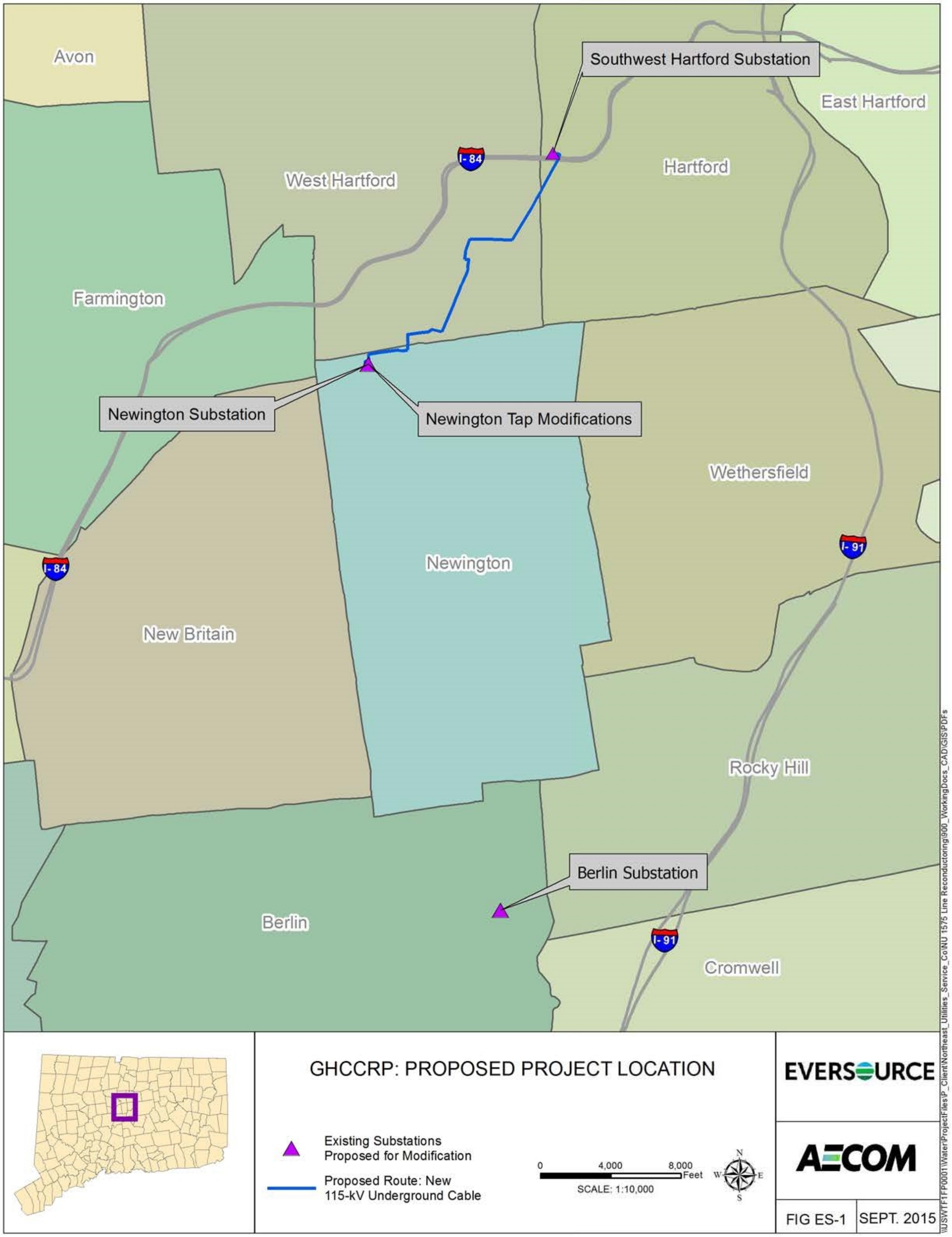
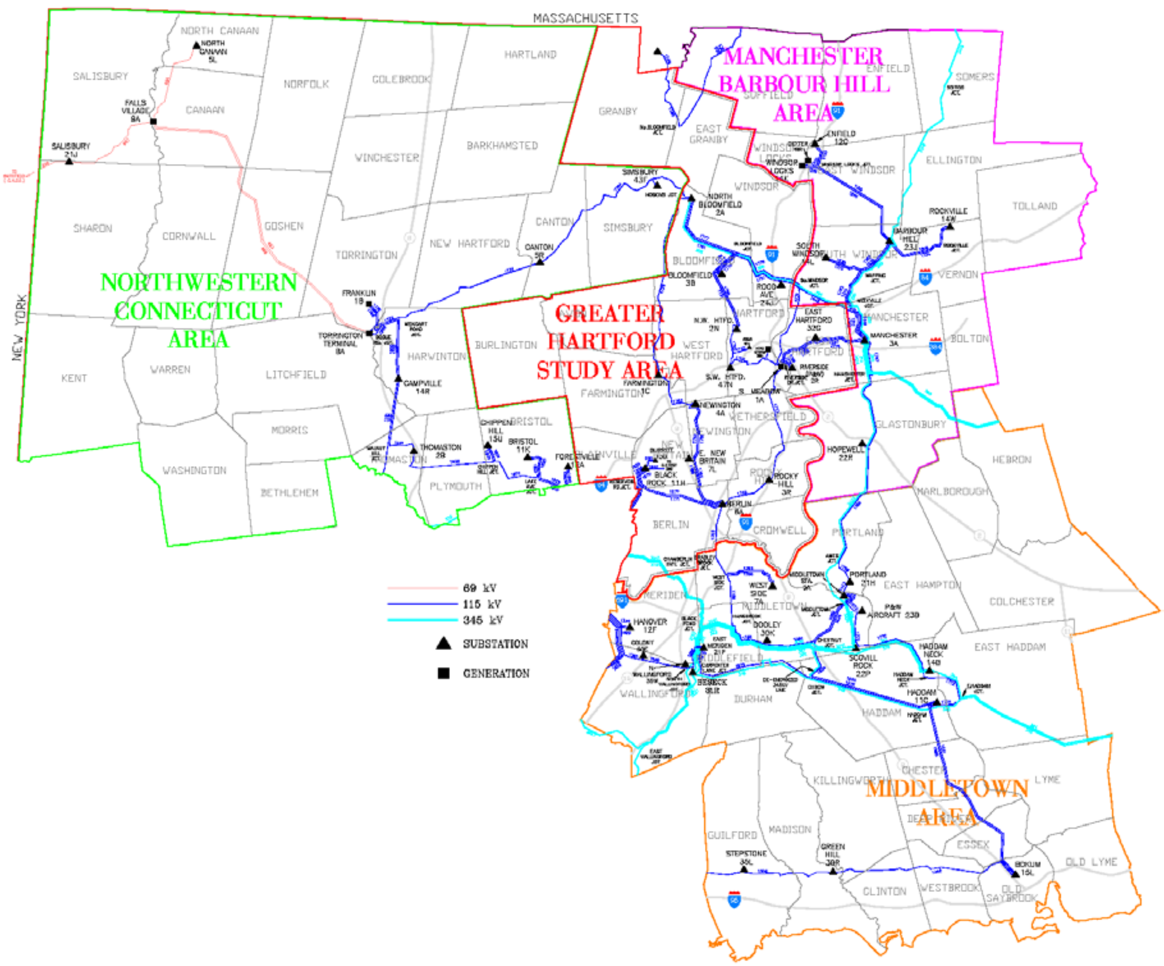
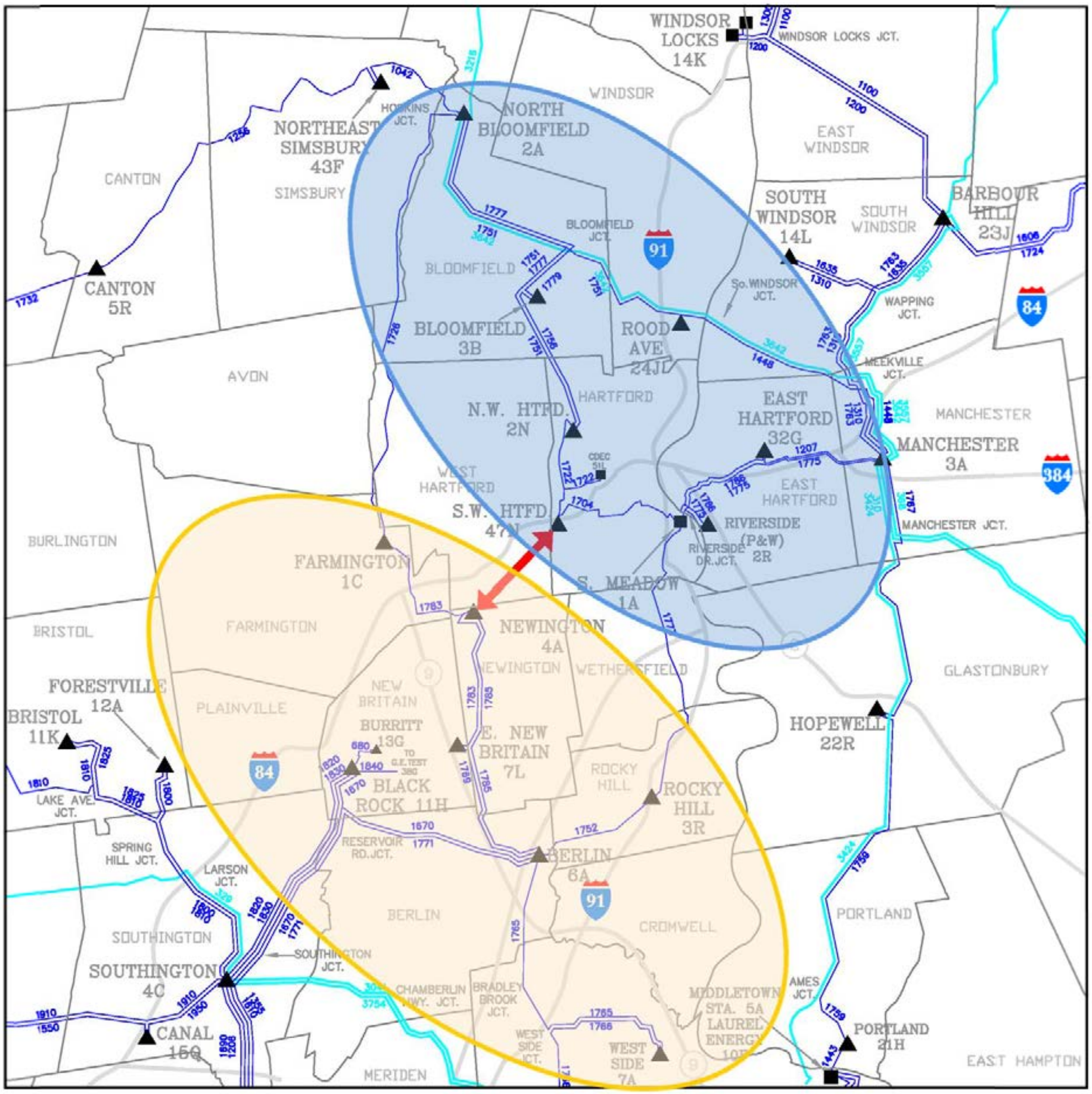


Figure ES-2: Greater Hartford – Central Connecticut Study Area



The Project would significantly improve the reliability of the transmission system in the Greater Hartford – Central Connecticut study area by providing a new 115-kV transmission connection between Newington and Southwest Hartford Substations. Although in close proximity, these substations are located in two different electrical "load pockets" – areas with insufficient generation and transmission to serve customer load when the electric system is placed under stress. The proposed new underground transmission line will link the two load pockets so that the transmission systems in each load pocket will be available to serve the other when needed. Figure ES-3 conceptually illustrates the two load pockets and the new 115-kV electrical connection between them. In addition, the new line will add an element to the Western Connecticut Import interface, thus improving the ability of the transmission system to move power across Connecticut from east-to-west when the system is under stress.

Figure ES-3: Two Load Pockets in the Greater Hartford Sub-area and Proposed 115-kV Cable Connection



ES.2 PURPOSE OF THE MUNICIPAL CONSULTATION FILING

The proposed Project is subject to the regulations of the Connecticut Siting Council (Council or CSC) and other state regulatory agencies. In the first quarter of 2016, Eversource plans to submit an *Application for a Certificate of Environmental Compatibility and Public Need* (*Application*) to the Council. Prior to the submission of such an application, the Council requires applicants to provide project information, in the form of a Municipal Consultation Filing (MCF), to the potentially affected municipalities.

The MCF is a key mechanism both for informing the public and municipal representatives about a proposed project and for soliciting comments about the project. To provide the public and municipal representatives with currently-available information concerning this Project, the format of this MCF follows the anticipated format of the *Application* and includes three volumes:

- ***Volume 1*** describes the proposed Project (including anticipated schedule and cost); identifies the Project need; summarizes the planning studies and alternatives analyses that led to the selection of the Project; provides technical specifications and construction / operational information for the Project facilities; discusses existing environmental / cultural resources, potential Project impacts, and impact mitigation measures; and reviews data concerning electric and magnetic fields (EMF) near the Project facilities.

- ***Volume 2*** includes information supporting the data presented in Volume 1, including environmental and cultural resource reports, electric system planning analyses, and copies of agency correspondence.

- ***Volume 3*** presents Project mapping, including aerial-based maps of the proposed 115-kV underground transmission cable route and substation facilities, as well as drawings of the planned substation modifications.

ES.3 PROPOSED PROJECT FACILITIES

115-kV Underground Transmission Line. The proposed 3.8-mile 115-kV transmission line between Newington and Southwest Hartford Substations (designated by Eversource as the 1346 Line) would cross portions of three Hartford County municipalities: Newington (0.7 mile), West Hartford (2.6 miles), and Hartford (0.5 mile). In all three municipalities, the cable system would be aligned primarily beneath or adjacent to local and state public road rights-of-way (ROWs) or other paved areas.

The single-circuit 115-kV underground transmission line will consist of three cables, or phases. The cable would be cross-linked polyethylene (XLPE) and would be contained within polyvinyl chloride (PVC) conduits (typically encased in a concrete duct bank), as well as concrete splice vaults, which would be required at intervals of approximately 1,800 – 2,000 feet along the 3.8-mile cable route. Splice vaults are required to stage the installation (pulling) of the transmission cable through the conduits, to accommodate activities required to splice together the cable sections, and to provide access to the cable system for maintenance and repair activities.

In addition to the transmission line cables, three fiber optic cables would be installed in the duct bank. Two fiber optic cables are required for remote protection and control of the cable system and associated equipment, and the other fiber optic cable would be for monitoring the operating temperature of the cables. A ground continuity conductor also would be installed to ground the cable sheaths and equipment within the splice vaults.

The exact location of the cables and the splice vaults within and adjacent to public road ROWs will be determined based on final engineering design, taking into consideration the constraints posed by existing buried utilities, the location of other physical features, and the requirements and preferences of the entity that maintains each road.

Substation Modifications. Modifications to both Newington and Southwest Hartford Substations, which involve proposed expansions to each station's developed area (and thus an extension of the substation fence lines), are required to interconnect the new 115-kV cable to the transmission system. The proposed Project modifications to Berlin Substation would be accomplished within the existing substation fence line.

- ***Newington Substation*** occupies approximately 1.7 acres of Eversource's 11.4-acre property, which is located in a residential area in northern Newington. The proposed Project modifications would involve an expansion of the developed portion of Newington Substation by approximately 0.3 acre and the addition of a retaining wall on the south and west sides of the substation fence line to maintain the grade for the expanded portion of the substation.

- ***Southwest Hartford Substation***, which occupies approximately 2.1 acres of a 7.1-acre property owned by Eversource, is located in a commercial area in southwestern Hartford and is bordered on the south by Interstate 84 (I-84) and to the north by a brook. To accommodate the facilities required to interconnect the new 115-kV cable system, Eversource proposes to expand the existing substation fence line by approximately 65 feet to the east and to modify the existing access road and gates off New Park Avenue. In total, these modifications will expand the developed portion of the substation (i.e., the area within the fence line) by approximately 0.3 acre.

- ***Berlin Substation*** is located in the northeast portion of the Town of Berlin and occupies approximately 6.5 acres of a 94.9-acre Eversource property. The proposed Project modifications consist of equipment that would be added to the existing substation yard.

***Newington Tap*.** Adjacent to Newington Substation, a 0.01-mile segment of an existing 115-kV overhead line (the 1783 Line) that connects to the substation would be modified as part of the Project. The 1783 Line extends from Farmington Substation (located in the Town of Farmington) to East New Britain Substation (located in the City of New Britain), passing adjacent to Newington Substation. The 1783 Line connects to the substation via the 0.01-mile overhead transmission line, referred to as the Newington Tap. This existing 0.01-mile transmission line will be removed, relocated, and rebuilt with larger conductors. These modifications will provide space within the substation to accommodate the new 115-kV underground cable termination and will enable the tap line to avoid voltage overloads under certain contingencies, such as when Newington Substation tries to simultaneously supply both East New Britain and Farmington substations.

ES.4 PROJECT CONSTRUCTION AND OPERATION / MAINTENANCE PROCEDURES

Eversource would construct, operate, and maintain the proposed Project facilities in accordance with all regulatory approvals and its standard practices. The proposed Project would be constructed in full compliance with the national electrical codes and standards, good utility practice, and the Connecticut Department of Energy and Environmental Protection (CT DEEP), Public Utilities Regulatory Authority (PURA) regulations covering the method and manner of high voltage line construction. Construction details would be provided in the Project's Development and Management (D&M) Plan[2], which must be submitted to and approved by the Council prior to the start of construction.

[2] The Project D&M Plan would include specifications for Project construction, operation, and maintenance, including environmental mitigation measures. A D&M Plan is a pre-requisite condition of the Council's issuance of an approval to construct the Project.

Transmission Cable. The installation of an underground transmission cable system within a public road usually requires a minimum width of 30 feet to accommodate the excavation of the cable trench, equipment, and temporary storage of equipment and materials. During the construction planning and installation of the cable system within public roads, Eversource would coordinate with other underground and overhead utility companies, as well as with the three involved municipalities and the Connecticut Department of Transportation (ConnDOT; for state roads), regarding the location of the cable facilities and concurrence concerning the methods and schedule to be used to install the cable system. During construction, primary consideration will be given to public safety, traffic control, adherence to approved work hours, conformance to regulatory commitments, and outreach to municipalities and the public.

The following typical construction activities are involved in underground cable system installation within or adjacent to roads:

- Establish traffic control procedures to minimize traffic disruption and provide a safe construction work zone;
- Excavate for and install splice vaults (each splice vault typically requires an excavation area approximately 12 feet wide, 12 feet deep, and 30 feet long);
- Sawcut and remove pavement, and excavate a trench for the cable conduits;
- Install the conduits;
- Encase the conduits in concrete;
- Backfill the trench (a fluidized thermal backfill[3] may be used) and repave disturbed areas;
- Complete site restoration work (e.g., permanent paving), as necessary;
- Pull the cables into the conduits;
- Splice together the cables within the splice vaults;
- Install cable terminations at the riser structures within Newington and Southwest Hartford Substations; and
- Test and commission the new 115-kV line.

[3] Fluidized thermal backfill is a concrete-like mix.

During normal operation, the 115-kV cable system will be monitored and maintained in accordance with Eversource's standard procedures. The location of the system along / within roads will provide ready access to splice vaults and other areas of the cable system in the event that maintenance is required.

Substation Modifications. The proposed Project modifications at all three substations would require similar construction activities, such as establishment of construction support / staging or material laydown areas; site preparation; foundation construction; installation of equipment; wiring, testing, and interconnections, and final site clean-up, restoration, and security. In addition, the proposed expansion of Newington and Southwest Hartford Substations would involve vegetation removal and earth-moving activities, such as grading and filling. Further, at Newington Substation, due to the earth-moving activities (cut and fill) required to create a level area for the substation expansion, a retaining wall will be constructed along the expanded south and west substation fence lines. The proposed Project modifications to the three existing Eversource substations would not substantially affect or alter existing maintenance practices at these facilities.

Newington Tap. The modifications to the Newington Tap will require the removal of two existing 115-kV transmission line structures and the installation of one new structure, as well as the development of a new termination point for the 1783 Line within Newington Substation. Standard overhead transmission line construction procedures will be used for these modifications.

ES.5 ENVIRONMENTAL RESOURCES, POTENTIAL EFFECTS, AND MITIGATION MEASURES

To identify and assess environmental conditions in the Project study area, Eversource conducted baseline research, performed field investigations, and consulted with representatives of the three involved municipalities. Environmental information for the Project is compiled, mapped, and described in accordance with the Council's A*pplication Guide for an Electric Transmission and Fuel Transmission Line Facility* (April 2010).

Using both the baseline environmental data and the plans for the development of the proposed Project, Eversource identified and analyzed the potential short- and long-term effects that the construction and operation of the Project would have on the environment, ecology, scenic, cultural (historic and archaeological), and recreational values, and also identified possible measures for avoiding, minimizing, or mitigating adverse effects. The avoidance, minimization, and mitigation of adverse effects to environmental resources, land uses, and cultural resources were key considerations in the Project planning process and will continue to be important during the finalization of Project design and the preparation of the D&M Plan.

In general, the proposed Project would minimize adverse environmental effects by locating the new 115-kV transmission line underground, within existing road ROWs or other developed areas, and by developing the proposed substation modifications and Newington Tap reconfiguration on property that is already designated for utility use. The Project will not result in any significant adverse effects on environmental resources, cultural resources, land uses, or recreational resources. Further, for those unavoidable adverse effects (such as those related to soils disturbance and traffic), Eversource has identified measures that can be effectively applied to mitigate these effects to the extent practical.

During the installation of the underground cable system, impacts would principally include increased potential traffic congestion, delays or detours, as well as nuisance effects (e.g., noise, dust) from work activities. Because the proposed cable system would be located within or adjacent to road ROWs or other paved areas, the Project would have minimal effects on water and biological resources. The cable route would traverse two unnamed tributaries to Piper Brook and Trout Brook (all in West Hartford). The unnamed tributaries are culverted beneath roads; the underground cable is expected to be aligned above these culverts. Eversource proposes to install the cable beneath Trout Brook using an open cut method, which will minimize the time required to perform the crossing and the size of the construction support areas required on either side of the brook.

After the installation of the cable system, the affected road ROWs and any affected off-road areas will be restored. The underground cable system will not be visible and will not result in any long-term impacts.

Similarly, the proposed modifications to the three substations would result principally in short-term, construction-related impacts localized to the vicinity of each site. At all three substations, excavations for foundations, the operation of construction equipment, and the performance of earth-moving and other work will increase noise levels and the potential for dust and other air quality effects. After the completion of Project construction, the substation operations will not change significantly from the present.

The reconfiguration of the Newington Tap will also result in highly localized impacts during the construction phase. The removal of the two existing 1783 Line structures and the installation of the new 1783 Line structure would modify the visual character of the area, replacing two existing transmission line structures with a new monopole structure.

ES.6 EMF ANALYSES

As required by the Council's *Electric and Magnetic Fields Best Management Practices for the Construction of Electric Transmission Lines (EMF BMP Document)*, Eversource calculated predicted electric fields (EF) and magnetic fields (MF) from the operation of the proposed Project facilities. In the case of underground transmission lines, EF are screened by the cable sheath and so are eliminated above the cable. MF are not shielded by the cable sheath or the earth, so there are magnetic fields associated with underground transmission. However, certain inherent features of an underground design reduce MF. In particular, the conductors of an underground cable system are arrayed in much closer proximity to one another than can be achieved with an overhead line. This close proximity creates a cancellation effect that reduces the fields immediately surrounding the conductors, and produces fields that decay much more rapidly with increased distance from the conductors as compared to overhead lines.

The proposed modifications to substation equipment would not increase MF levels at the substation property lines, which are comparable to background levels typically found in homes, except where transmission lines enter and exit the substation. In those locations, the dominant MF source is the transmission line.

ES.7 ALTERNATIVES CONSIDERED

The proposed Project is the result of a comprehensive evaluation process, which began with a determination of the need for the Project, then continued with the identification and analysis of alternative solutions for addressing the need, and concluded with the examination of specific alternative routes and route variations for the proposed transmission facilities. As a result of these analyses, the Proposed Route and underground cable system design, along with the proposed modifications to Newington, Southwest Hartford, and Berlin Substations and the reconfiguration of the Newington Tap, were selected as the preferred alternative for the Project. The following types of alternatives were considered:

- **No Action Alternative**. Under this alternative, no new transmission facilities would be developed and no improvements would be made to the existing electrical transmission system or to otherwise resolve electric reliability problems in the Greater Hartford area. The no action alternative was rejected because it would do nothing to correct violations of national and regional reliability standards and criteria; and thus the Greater Hartford Sub-area would continue to be at risk for unplanned electrical outages and Eversource would be exposed to being fined by federal regulators for its failure to take action to resolve identified criteria violations. Failure to take action to bring the Greater Hartford electric supply into conformity with applicable reliability standards and criteria would also undermine the long-range plan of ISO-NE and Eversource for providing reliable transmission service throughout Connecticut.

- **System Alternatives**. Following the evaluations of the need for the Project, both transmission system and non-transmission system alternatives that would potentially meet that need were identified and evaluated. Two alternative new 115-kV transmission lines were considered:

  (1) A new 115-kV overhead line, located adjacent to an existing 115-kV overhead line, between Eversource's Farmington and North Bloomfield substations; and

  (2) A new 115-kV line between Newington and Southwest Hartford Substations, which are not presently connected. (Due to the density of urban and suburban development, Eversource recognized that a line between these two substations would need to be entirely or mostly underground.)

  Both alternatives addressed the target reliability criteria violations, and their cost was essentially the same. Eversource therefore selected the Newington - Southwest Hartford line as more consistent with the Connecticut policies, having fewer environmental effects, and requiring no system outages during construction. Although potential non-transmission alternatives (e.g., generation, demand reduction) that could address the need served by the transmission solution were investigated, no practical non-transmission alternative was identified.

- **Transmission Line Route Alternatives and Route Variations**. After the analyses of system alternatives identified a new 115-kV transmission line to connect Newington and Southwest Hartford Substations as preferred, Eversource used an iterative approach to identify and evaluate alternative routes and designs for the new line. As a result, a 115-kV underground transmission cable, to be aligned along the Proposed Route, was identified as preferred.

  In addition, Eversource identified nine route variations, each of which could potentially replace a portion of the Proposed Route. Although the 115-kV transmission line could be constructed along any of the route variations, each includes attributes that make it comparatively less preferred than the portion of the Proposed Route that it would replace. Eversource also evaluated alternative construction techniques for installing the cable system across Trout Brook in the Town of West Hartford. Although an open cut method is preferred for the Trout Brook crossing, alternative subsurface installation methods, such as horizontal directional drilling and jack and bore, also were assessed.

Eversource is continuing to investigate the feasibility of one route alternative for the alignment of the new 115-kV transmission line between Newington and Southwest Hartford Substations. This alternative would involve a predominately overhead transmission line configuration that would be aligned along a combination of public and private ROWs, as well as the CT*fastrak* (busway) and Amtrak railroad corridor, a portion of which extends through the eastern Project area. Preliminary information concerning this alternative is presented in the MCF; further engineering and constructability reviews to assess the feasibility of collocating the transmission line adjacent to the busway / railroad corridors are underway and will be provided in the Application to the Council.

ES.8 COST AND SCHEDULE

The estimated capital cost of the Project is approximately $99.8 million, of which approximately $75 million is for the 115-kV underground transmission cable and $24.8 is for the associated substation modifications. Project construction is anticipated to commence in mid-2017.

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1. DESCRIPTION OF THE PROPOSED PROJECT

1.1 PROJECT OVERVIEW

To improve the reliability of the electric transmission system in the Greater Hartford and Central Connecticut area, The Connecticut Light and Power Company doing business as Eversource Energy (Eversource or the Company) proposes to construct and operate a new 115-kilovolt (kV) underground cross-linked polyethylene (XLPE) transmission line and to modify three existing substations in central Connecticut. The new underground electric transmission cable system is planned to extend for approximately 3.8 miles between Eversource's existing Newington Substation in the Town of Newington, through the Town of West Hartford, to Eversource's existing Southwest Hartford Substation in the City of Hartford.

To interconnect the new 115-kV cable to the transmission grid, Eversource also proposes to expand and make related improvements to both substations, and to modify a 0.01-mile section of an existing overhead 115-kV transmission line (referred to as the Newington Tap) that connects to Newington Substation. In addition, Eversource proposes to make related modifications at its existing Berlin Substation, located in the Town of Berlin.

These proposed electric transmission system improvements, referred to as the Greater Hartford – Central Connecticut Reliability Project (GHCCRP or Project), are required to help bring the electric supply system in the Greater Hartford Sub-area[4], into compliance with applicable national and regional electric reliability standards and criteria, and to improve the ability of the transmission system to move power across Connecticut from east-to-west when the system is under stress. Figure 1-1 illustrates the general location of the proposed Project facilities.

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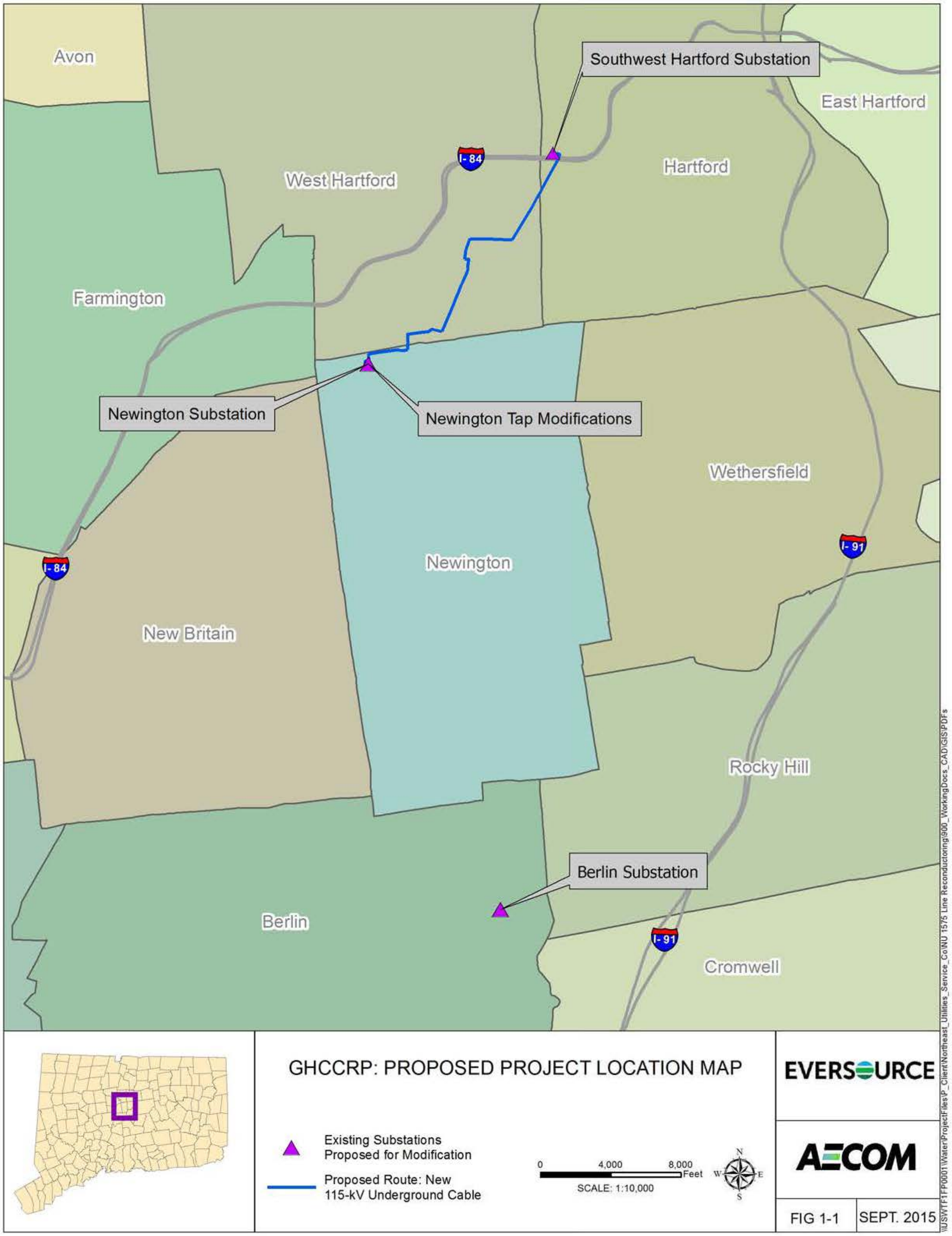
[4] As discussed in detail in Section 2, for electrical transmission planning purposes, Connecticut is divided into areas and sub-areas. The Greater Hartford - Central Connecticut Study Area includes four contiguous sub-areas that encompass much of the northwest and central portions of the state. These sub-areas are Greater Hartford, Manchester – Barbour Hill, Middletown, and Northwestern Connecticut (refer to Figure 2-1 for the location of these sub-areas). The Greater Hartford Sub-area, which is the focus of this Project, includes 17 municipalities: Hartford, West Hartford, Newington, Berlin, Cromwell, Rocky Hill, Wethersfield, Plainville, New Britain, Farmington, Burlington, Avon, East Hartford, Bloomfield, Windsor, East Granby, and Granby.

Figure 1-1: GHCCRP: Proposed Project Location Map



The need for the proposed Project facilities was identified as a result of electric system planning studies and alternatives analyses performed by the Independent System Operator – New England (ISO-NE), the independent regional system planning authority.

After these ISO-NE analyses determined a need for a new 115-kV transmission line in the Greater Hartford Sub-area to improve system reliability[5], Eversource identified and analyzed potential alternatives (including major routing alternatives, as well as both underground and overhead configurations and route variations for the new transmission line, and options to the substation modifications). Based on the results of these analyses, Eversource identified the proposed 3.8-mile cable system and associated substation modifications as the preferred solution.[6]

The proposed 115-kV underground cable system would traverse portions of three municipalities in Hartford County (Newington, West Hartford, and Hartford) and would be aligned primarily beneath or adjacent to local and state public road rights-of-way (ROWs). All three of the substations that would be modified as part of the Project are located on Eversource fee-owned properties that have been devoted to utility use for many decades. Detailed maps illustrating the proposed cable system route and the modifications to the three substations are provided in Volume 3.

As proposed, the Project reflects Eversource's primary objectives for designing transmission facilities that can be constructed and operated to:

- Comply with state and federal statutory requirements, regulations, and siting policies;
- Minimize adverse effects to natural and human resources; and
- Achieve a reliable, operable, and cost-effective solution.

[5] In addition to eliminating all of the reliability criteria violations, the proposed new 115-kV line also would have better voltage performance, would not adversely affect existing transfer limits; and would be cost-effective, compared to other system alternatives initially considered. Refer to the discussion of Project Need in Section 2 and the discussion of System Alternatives in Section 10.

[6] Sections 10 through 12 of this document describe the alternatives analyses conducted for the Project.

Based on these overarching objectives, the principal factors considered in selecting the Proposed Route for the new 115-kV underground cable system and the proposed substation modifications were:

- Availability of existing public, utility, or other ROWs or Eversource-owned property where the proposed facilities could be developed so as to avoid or minimize the need for additional easement acquisition.
- Avoidance or minimization of effects on environmental resources, significant cultural resources (archaeological and historical), and designated scenic resources.
- Consideration of visual effects.
- Constructability / engineering considerations.
- Minimization of conflicts with developed areas.
- Maintenance of public health and safety.
- Accessibility of the ROW for construction and maintenance.
- Cost.

The proposed Project best meets these objectives, while representing Eversource's preferred solution for providing reliable, cost-effective, and environmentally sound improvements to the regional electric transmission system.

1.2 PROPOSED PROJECT FACILITIES

1.2.1 New 115-kV Transmission Underground Cable System

The proposed new 115-kV transmission line between Newington Substation and Southwest Hartford Substation (referred to by Eversource as the 1346 Line) would consist of approximately 3.8 miles of underground 115-kV XLPE cable (which would be encased in a concrete duct bank), as well as splice vaults (which are required for interconnecting the cable sections and subsequently maintaining the transmission cables).

The majority of the cable system would be buried within or adjacent to state and local road ROWs or on Eversource property, following the Proposed Route illustrated in Figure 1-2 and detailed on the Volume 3 maps. Overall, the proposed cable route would traverse 0.7 mile in the Town of Newington, 2.6 miles in the Town of West Hartford, and 0.5 mile in the City of Hartford.

1.2.2 Substation Modifications

Modifications to both Newington and Southwest Hartford Substations, which involve proposed expansions to each station's developed area, are required to interconnect the new 115-kV cable to the transmission system. In addition, at Newington Substation, a 0.01-mile segment of an existing overhead 115-kV line (the 1783 Line) that connects to the substation will be modified.

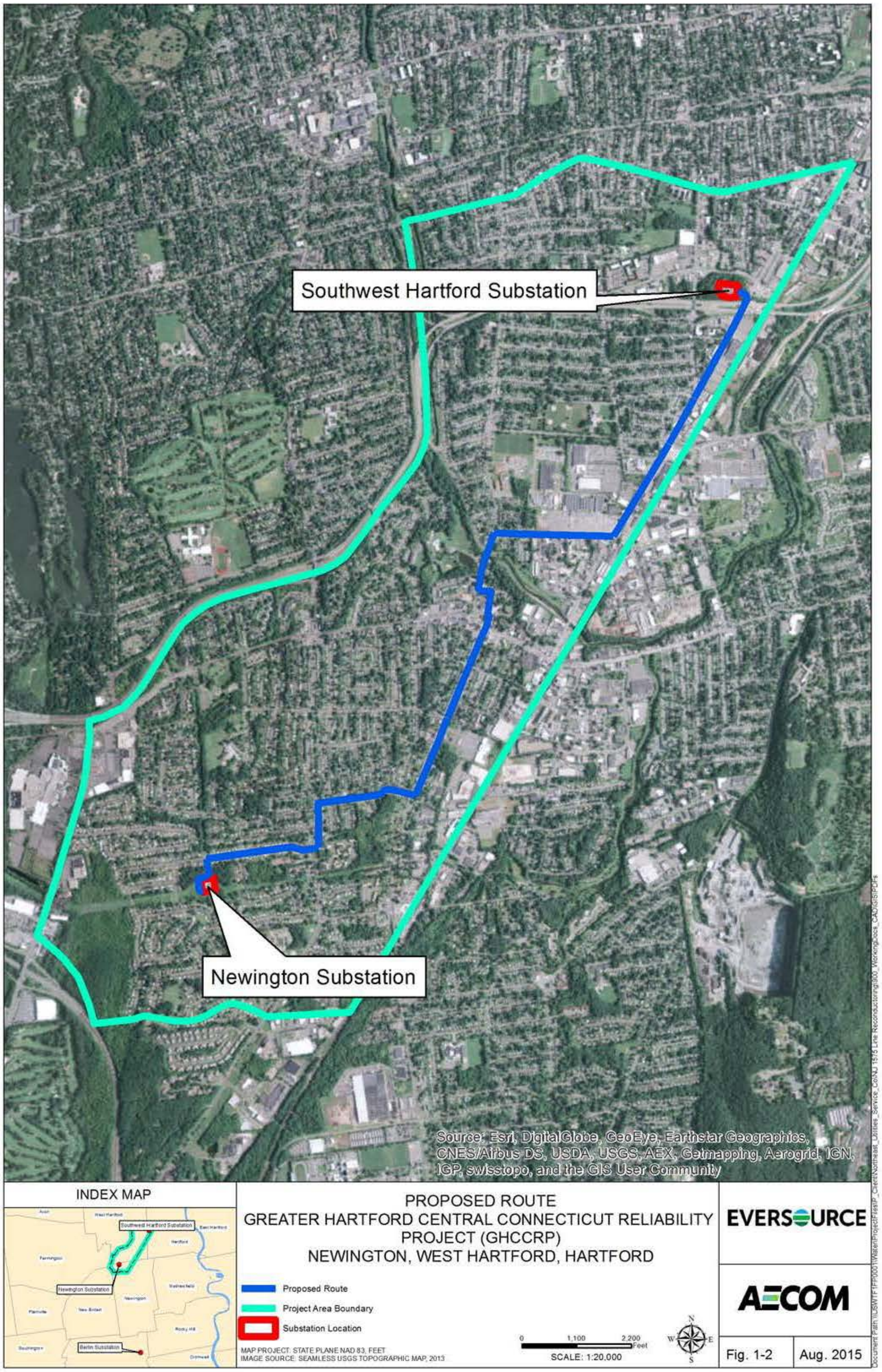
The 1783 Line extends from Farmington Substation (Town of Farmington) to East New Britain Substation (City of New Britain). In between, the 1783 Line is aligned adjacent to Newington Substation. The 1783 Line connects to Newington Substation via the 0.01-mile overhead transmission line "tap" that extends from a structure on the 1783 Line ROW to the substation. Referred to as the Newington Tap, the existing short transmission line connection to Newington Substation will be removed, relocated, and rebuilt with larger conductors.

The modifications to the Newington Tap will provide space within the substation to accommodate the new 115-kV cable termination; will facilitate a more direct 1783 Line interconnection to the substation; and will enable the tap line to avoid thermal overloads under certain contingencies, such as when Newington Substation tries to simultaneously supply both East New Britain and Farmington substations.

The proposed modifications to Berlin Substation, which are required to eliminate thermal and voltage violations in the GHCCRP area, would be accomplished within the existing substation fence line.

These proposed substation modifications, including the Newington Tap modifications, are summarized below and are illustrated on the maps and drawings in Volume 3.

Figure 1-2: Proposed Route of the Underground Cable System



1.2.2.1 Newington Substation

Eversource's Newington Substation, which includes both a 115-kV transmission yard and a 23-kV distribution yard, is located at 185 Cherry Hill Drive in the northwestern portion of the Town of Newington. The substation occupies approximately 1.7 acres of the 11.4-acre Eversource property. The Eversource property is bordered by single-family residential properties on all sides, along Cherry Hill Drive to the north, Avery Road to the east, Barnard Drive to the southeast, Reservoir Road to the south, Thornton Drive to the southwest and Quincy Lane to the west.

Newington Substation property was acquired for utility use in the early 1950s, and the substation has been in operation for approximately 60 years. The residences adjacent to the Eversource property also were constructed in the early 1950s.

Eversource ROWs, occupied by overhead transmission lines and overhead and underground distribution lines, extend from the substation to the north, south, east, and west. Specifically, two existing overhead 115-kV transmission lines presently connect to the substation: (1) the 1783 Line, which connects to the substation from the west; and (2) the 1785 Line, which connects to the substation from the south. Existing distribution lines connect to the substation from the north, east, and west.

To accommodate the modifications required to interconnect the new 115-kV transmission cable, Eversource proposes to expand the substation by approximately 30 feet to the south and 35 feet to the west. As a result of the proposed Project modifications, the developed portion of the substation will be increased by approximately 0.3 acre.

To allow for the interconnection of the new underground cable to the existing 115-kV yard facilities on the western side of the substation, the existing 1783 Line terminal position within the substation will be relocated and the 0.01-mile Newington Tap segment of the 1783 Line adjacent to the substation will be relocated to enter the substation from the south. The modifications to the Newington Tap will be performed on Eversource property.

The technical details regarding Newington Substation and Newington Tap modifications are discussed in Section 3. The proposed substation expansion and the associated improvements to the Newington Tap also are illustrated on the Volume 3 maps and drawings.

The following summarizes the Project modifications that will be performed at Newington Substation and for the Newington Tap:

Substation Modifications

- Reconfigure the existing substation 115-kV yard into a ring bus, with two new circuit breakers. One line terminal position will be relocated and one is being added.
- Construct a new enclosure (approximately 700 square feet) to house new protection and control equipment.
- Connect the new 1346 115-kV underground line to the substation at the existing 1783 Line terminal position. To allow the installation of the new 1346 Line, the 1783 Line terminal will be relocated to a presently unused terminal position. The final configuration for each line terminal position will include one arrestor, one disconnect switch and one Capacitance Coupling Voltage Transformer (CCVT) per phase.
- Transition the new underground 1346 Line to a rigid substation bus, using one pothead per phase. The height of this terminal will be 16.5 feet, which is the approximate height of the existing bus.
- Install a new dead end structure within the substation in order to relocate the 1783 Line interconnection in the station to the south. This structure will be approximately 70 feet high.
- Extend the existing substation ground grid as required, to address the expanded substation footprint.
- Perform grading and evaluate drainage and storm water improvements to accommodate the substation modifications.
- Install a retaining wall on the south and west sides of the substation to maintain grade for the expanded portion of the substation.

Newington Tap Improvements

- For the relocated line tap, install one new approximately 95-foot-tall vertical monopole structure, supporting 1,590,000 circular mil (1590 kcmil) aluminum conductor with steel support (ACSS), on the existing ROW south of the substation. The new tap line will connect to the substation from the south.
- Remove two existing structures (a 67 foot-tall H-frame structure and a 57 foot-tall single pole), as well as conductors and related equipment that comprise the current tap.
- Reconfigure the guying arrangement on two existing transmission line structures.

1.2.2.2 Southwest Hartford Substation

Southwest Hartford Substation is located at 219 New Park Avenue, in a commercial area in the southwestern portion of the City of Hartford, near the border with the Town of West Hartford. The substation occupies approximately 2.1 acres of a 7.1-acre property owned by Eversource. The Eversource parcel is bordered by I-84 to the south, New Park Avenue to the east, Kane Street to the north, and Prospect Avenue to the west. The access road to the substation connects to New Park Avenue, adjacent to a tributary to the South Park River (sometimes referred to as Kane Brook).

Southwest Hartford Substation property was acquired for utility use in 1968. Two underground 115-kV transmission lines (i.e., the 1722 Line and the 1704 Line) and nine 23-kV distribution lines presently connect to the substation. The existing 115-kV lines are high-pressure fluid filled (HPFF) cables that extend out of the substation to the northeast.

To interconnect the new 115-kV cable system to Southwest Hartford Substation, Eversource proposes to modify the 115-kV substation facilities, which will require the expansion of the existing station fence by approximately 65 feet to the east and the relocation of the existing access road and gates. Volume 3 includes maps and plan drawings depicting the proposed modifications to Southwest Hartford Substation.

In total, the developed portion of the substation will be expanded by approximately 0.3 acre and the following Project modifications will be performed:

- Reconfigure the existing substation 115-kV yard into a ring bus, with two new circuit breakers.
- Add one line terminal position and relocate the existing line terminal. The new 1346 Line will enter the substation underground, as does the existing 1722 Line. However, to accommodate the installation of the new 1346 Line within the substation, a portion of the 1722 Line and related substation equipment will be relocated. The facilities for each line will include one series reactor, circuit switcher, disconnect switch, arrestor, CCVT and pothead per phase. Although both the new 1346 Line and the 1722 Line enter the substation underground, a bypass will be necessary for the operation of the reactors. This will require the installation of two new 70-foot tall dead end structures, per line (for a total of four new dead end structures) within the substation.
- Extend the existing substation ground grid as required, to address the expanded substation footprint.
- Perform grading and evaluate drainage and stormwater improvements to accommodate the substation modifications.
- Relocate or remove existing HPFF interconnection piping and associated valve cabinet.

1.2.2.3 Berlin Substation

Eversource's Berlin Substation, which is located at 388 Beckley Road in the northeast portion of the Town of Berlin, is centrally located in relation to the high electric demand areas in Berlin and Southington. The substation occupies approximately 6.5 acres of a 94.9-acre Eversource property. Eversource acquired portions of the 94.9-acre property in 1920 and 1951, completing the acquisition of the entire parcel in 1971.

The Eversource property is bordered to the west by Beckley Road and is otherwise surrounded by undeveloped property. The Berlin Fairgrounds and residential areas are located to the west of the substation, along Beckley Road.

The proposed modifications to Berlin Substation are required to eliminate the voltage violations in the load pocket from Berlin toward Middletown and would be constructed entirely within the developed (fenced) portion of the station. As illustrated on the Volume 3 maps and drawings, these proposed substation modifications include:

- Reconfigure the existing substation 115-kV yard by adding two additional circuit breakers and relocation of a capacitor bank.
- Relocate an existing circuit breaker and install a new circuit breaker beside it. This change will require one new manually-operated disconnect switch and the redesign of existing buswork. An existing capacitor bank will be relocated and will require one new circuit breaker, manually-operated disconnect switch, reactor, and lightning arrestor per phase.
- Modify the existing substation ground grid within the existing substation fence, as required, to accommodate the new equipment.

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2. PROJECT BACKGROUND AND NEED

This section explains how the Project (GHCCRP) was developed to perform the "double duty" of upgrading the transmission system serving the Greater Hartford electric sub-area and increasing transfer capability across the Western Connecticut interface. The Greater Hartford Sub-area consists of Avon, Berlin, Bloomfield, Burlington, Cromwell, East Granby, East Hartford, Farmington, Granby, Hartford, New Britain, Newington, Plainville, Rocky Hill, West Hartford, Wethersfield and Windsor. The section first identifies the applicable reliability standards and reviews how they evolved as the North American electric supply system was developed. The section then summarizes a group of reliability studies known as the Greater Hartford - Central Connecticut (GHCC) studies. These studies identified the need for a group of projects to resolve reliability problems throughout the Greater Hartford and Central Connecticut areas, including the GHCCRP, which is proposed in this application. Finally, this section describes how the GHCCRP will effectively address electric system reliability needs. In the following subsections, the term "GHCC" is used as an abbreviation in describing the Greater Hartford - Central Connecticut studies, whereas the term "GHCCRP" is used to refer to this specific project – the Greater Hartford - Central Connecticut Reliability Project – that resulted from those studies.

2.1 THE SYSTEM PLANNING PROCESS AND RELIABILITY CRITERIA

Maintaining continuity of service to customers has been the primary objective of electric utilities in North America since their very beginning. As electric supply systems have grown and become more complex, more interconnected, and increasingly critical to human welfare and a healthy economy, standards for ensuring continuity of service have become mandatory and more stringent, requiring the use of increasingly sophisticated analytical tools. Today, engineers using detailed and highly sophisticated and accurate computer models are able to evaluate the reliability of the existing interconnected transmission system and to plan modifications or additions needed to comply with those standards by simulating the performance of the existing system, as well as the system with proposed potential improvements to it. The following sections review the development of reliability planning standards and their current application.

2.1.1 A Brief History of Electric Reliability Planning

During the first half of the 20th Century, individual power systems each developed and applied their own planning criteria. By mid-century, however, with the dramatic growth of synchronous interconnections and the increasing use of the electric transmission system to move power over longer distances, utilities began to coordinate their planning activities.

When the Northeast Blackout of 1965 occurred, it became obvious that a more closely coordinated strategy was necessary. Shortly after the blackout, the electric utilities across North America formed regional reliability councils to promote and improve the reliability of the interconnected bulk power system. In northeastern North America, the involved electric utilities formed the Northeast Power Coordinating Council (NPCC), consisting of the six New England states, New York State, and the Canadian provinces of Ontario, Québec, New Brunswick, and Nova Scotia. The U.S. systems of the NPCC also formed two new power pools: the New England Power Pool, which eventually became ISO-NE, and the New York Power Pool, which evolved into the New York Independent System Operator (NYISO).

Each regional reliability council established its own reliability criteria. Each also developed procedures for assessing conformance with these criteria. With time, individual electric utilities and power pools often developed their own more detailed and stringent planning and operating procedures to ensure the reliability of their portions of the interconnected bulk-power electric system; however, those procedures had to continue to comply with the broader regional criteria requirements.

In 1968, the U.S. regional reliability councils formed the National Electric Reliability Council (NERC) to coordinate their activities nationally and developed voluntary reliability guidelines for their collective systems. NERC has evolved over the years. In 1981, its name was changed to the North American Electric Reliability Council, to reflect the addition of Canadian members. But the most dramatic changes occurred in the wake of the August 14, 2003 Midwest / Middle Atlantic blackout. The Energy Policy Act of 2005 (EPAct) directed the Federal Energy Regulatory Commission (FERC) to establish an Electric Reliability Organization (ERO), whose major role would be to develop and enforce mandatory reliability standards for planning and operations. After a period of study, FERC designated NERC as the ERO, and its name was changed to the North American Electric Reliability Corporation, Inc.

2.1.2 Modern Reliability Standards and Criteria

The NERC standards today are subject to approval by FERC and are much more specific than they were in the past. Further, transmission owners' compliance is mandatory under federal law. Violations are punishable by fines as high as $1 million per day per violation. Regional reliability councils may have their own criteria[7], but these must conform to all NERC requirements – planning, system design, and operations. Similarly, whereas ISOs and individual electric systems may also have their own criteria and procedures, they all must conform to both NERC standards and the regional criteria. Thus, in conducting planning studies, all transmission owners in New England are required to comply with NERC standards, NPCC criteria, and ISO-NE planning procedures. ISO-NE has developed a *Transmission Planning Technical Guide* for the implementation of these standards and criteria, a copy of which is included in Volume 2.

2.1.3 Simulating Contingencies

A key element of the reliability standards is the consideration of "contingency" events wherein generation and/or transmission facilities are assumed to suddenly and unexpectedly trip out of service. Such contingency events could be caused by weather; by generator, transmission line, or substation equipment failures; by contingencies on other transmission systems connected to the New England transmission system; or by some combination of these factors.

NERC, NPCC, and ISO-NE standards, criteria, and procedures specify the contingencies that must be considered in planning studies. The NPCC criteria and ISO-NE procedures must be consistent with all NERC standards. Thus, NPCC criteria may be more stringent than, but must at a minimum conform to, the NERC standards. Likewise, ISO-NE

[7] Although "standards" and "criteria" may be synonymous in many cases, in electric reliability planning, "standards" are correctly used to refer to the mandatory NERC standards, and "criteria" to the rules adopted by subordinate reliability organizations, which must be consistent with the NERC standards.

procedures may be even more stringent, but also must conform to the NPCC criteria and NERC standards.

When a generating unit or a transmission line suddenly and unexpectedly trips out of service, power flows change instantaneously on the transmission lines that remain in-service. (This is in accordance with the laws of physics as applied to electric power systems.) Thus, an area's transmission system must be designed not only to transmit and/or import power required to offset anticipated generation deficits with all transmission facilities in service, but also must be capable of transmitting or importing power reliably following specific contingencies, as required by the mandatory national standards and regional criteria. Otherwise, post-contingency power flows could exceed emergency transmission element ratings and/or result in low voltage conditions (below prescribed minimum levels) on portions of the electric system.

Because each transmission line must be able to carry the additional current that would instantaneously flow in the event of the sudden loss of a generating unit, transmission line, or other system element, normal power flows on transmission lines will typically be well below the thermal ratings of the line.

Contingencies, as specified by NERC, NPCC, and ISO-NE standards and criteria, are usually characterized as loss of a single system element – that is, a generator, transmission line, bus section, etc. Sometimes, however, a single contingency can result in the loss of two transmission elements, such as where two electric circuits share a common set of towers, forming a "double-circuit tower" (DCT) transmission line. Both of these types of events are referred to as "N-1" contingency events. Another type of contingency involves the occurrence of two separate and unrelated outages within a short period of time (30 minutes per NPCC criteria and ISO-NE procedures). These are referred to as "N-1-1" events. When such a contingency event is simulated, reliability standards and criteria require an assumption that there will be sufficient time between contingency events for the system operator to implement specific "manual system adjustments" to the system before the second contingency event occurs.

Thus, the reliability standards and criteria applicable to the New England electric system (referred to herein as "the Applicable Reliability Standards") require that in a planning study, after performing each of the required N-1 contingency analyses with all transmission facilities assumed to be initially in service, planning engineers test the ability of the system to be operated reliably with a key facility out of service. To do this, they apply a contingency; document system performance prior to readjusting or reconfiguring the system (with "manual system adjustments"); and then apply a second (unrelated) contingency and study the electric system's response. The criteria governing planning studies for the New England control area provide that, to make the system ready for the next contingency, only those manual adjustments that can be implemented within 30 minutes may be considered. These include adjusting the output of generation units, activating "quick start" generating reserves, and changing phase angle regulator taps.

To evaluate compliance with the Applicable Reliability Standards, the specified contingencies are simulated on computer models developed to represent the power grid with expected future modifications and additions, operating with projected future loads. If the simulations show that currents on a transmission element will exceed its thermal ratings (a thermal overload), or that system voltages cannot be maintained within acceptable limits following one or more of the contingencies (a voltage violation), appropriate solutions must be developed and implemented in order to maintain the reliability of the electric grid.

Because years are required for the design, siting, engineering, and construction of major transmission improvements once they are recognized to be needed, transmission reliability studies are conducted by modelling expected future system conditions, including expected future generation resources, other planned transmission improvements, and projected future loads. A study year in the future is selected, and conditions expected for that year are modelled. ISO-NE uses a 10-year planning horizon; therefore, transmission reliability analyses consider those system conditions expected 10 years in the future from the date a study is commenced.

Modelling of the specific contingencies prescribed by the NERC standards for power-flow analyses identifies improvements that will protect the transmission system against the actual occurrence of those design contingencies. That is, should one of the specified contingency events occur, the remainder of the system would survive without a transmission element overload, an unacceptably low voltage condition, instability, cascading outages, system separation, or loss of firm customer load. However, modelling of these specific contingencies does more than demonstrate how the power grid would perform should the specific events being modelled occur. These simulations also represent stresses that could result from multiple other potential events, some of which may not even be foreseeable at present. The objective of the simulations is not just to ensure that the system will withstand the specific contingencies defined by the standards, under the specific conditions modelled, but also to document that the system will be strong and robust enough to survive a wide range of potential events that could impose comparable stresses.

2.1.4 Generation Dispatches in Power-Flow Simulations

In accordance with the reliability criteria and procedures of NPCC and ISO-NE, the regional transmission power grid must be designed for reliable operation during stressed system conditions. Stressed conditions are simulated, in part, by developing generation dispatches. First, a base case that reflects the planners' expectation of likely generation resources availability in the study period is constructed. Such generation resources may be assumed to be unavailable in the base case, as predicated on operating experience, announced generation facility retirement, or other reasons. Then, to simulate critical system conditions, at least the largest and most critical generating unit or station in an area is assumed to be out of service (OOS) and, in most cases, two generation resources are assumed as OOS.

Assuming generators to be OOS in a base case addresses issues such as the following:

- Higher generator-forced outage rates than other transmission system elements
- Higher generator outages and limitations during stressed operating conditions such as a heat wave or a cold snap
- Past experience with simultaneous unplanned outages of multiple generators
- High cost of Reliability Must Run Generation
- Generator maintenance requirements
- Unanticipated generator retirements
- Fuel shortages

As with modelling contingencies, modelling existing generators as OOS in planning studies is not conducted simply to ensure that the system will be able to do without those generators in specific system conditions. This technique also tests the performance of the system under stresses that it may be required to withstand, whether from the unavailability of those specific generators or for other reasons.

Generating units assumed to be unavailable or otherwise OOS should not be confused with the loss of a generating unit as a contingency, as described earlier. The former is a base case assumption – the system as represented before any contingency is applied. The latter is one of the many contingencies specified by the NERC, NPCC, and ISO-NE standards, criteria, and procedures, which the pre-contingency system must be able to withstand without experiencing a transmission line or substation element overload, a low voltage condition, instability, cascading outages, system separation, or loss of firm customer load.

2.1.5 Transmission Interfaces

"Interfaces" are sets of designated transmission facilities that can be used to reliably transfer power, within defined limits, from one area to another. They can be visualized as "boundaries" between areas of the system – all transmission lines that cross such a boundary are by definition part of that interface. As will be discussed further on in this section, the interface most relevant to the GHCCRP is the Western Connecticut (WCT) Import Interface, which defines the capability of the system to transfer power across the state from east-to-west.

The transfer capability across an interface depends on the power flows that all of the transmission elements crossing the interface can carry without violating prescribed limits of system stability, current carrying capability, or permissible ranges of voltage. Transfer capabilities are expressed in terms of the power flow that the transmission elements can safely carry under normal conditions, and that which they can carry under defined contingency conditions. Since system conditions, such as load and the amount and location of available generation, can vary significantly from day-to-day and sometimes from hour-to-hour, transfer capabilities across an interface are properly expressed as a range of values. Transfer capacity across an interface is an important measure of the capacity of the transmission system to move power into a load area when power from outside the area is needed, particularly at times of high demand when the system is under stress. Increased capacity to import power from other areas may also provide better access to lower cost generation than would otherwise be available.

2.1.6 Coordinating Ongoing Studies

At any point in time, there are numerous studies of the New England transmission system. The New England planning process requires study teams to communicate with other study teams to ascertain if the different teams have identified issues that may be addressed, in whole or in part, by a common solution, or if changes to the transmission system are being proposed that might impact another study. In order to assure that needed improvements to the system will be identified and designed efficiently and cost-effectively, studies of area needs are sometimes combined and/or split apart as they proceed. As discussed in Section 2.3.3, development of the GHCCRP was done in coordination with the development of several other projects for the Greater Hartford – Central Connecticut (GHCC) areas, as part of the GHCC studies; and the GHCC studies as a whole were conducted in coordination with studies of the Southwest Connecticut system needs.

2.2 DEVELOPMENT OF THE GREATER HARTFORD RELIABILITY PROJECT

The proposed GHCCRP is the product of more than nine years of planning studies. In 2005, ISO-NE identified potential future criteria violations on the 115-kV system in the Greater Hartford area in the course of early studies that ultimately resulted in the New England East-West Solution (NEEWS) Plan, a comprehensive set of 345-kV improvements to the Southern New England transmission system in Connecticut, Rhode Island, and Massachusetts. Accordingly, potential solutions initially considered for the regional problems addressed by NEEWS and presented to ISO-NE's Planning Advisory Committee (PAC)[8] in 2006 included improvements to the Greater Hartford 115-kV system, principally a new 115-kV line between Eversource's East Hartford and Manchester substations.

However, by 2009, further analyses showed that there were additional "load serving" issues in the Greater Hartford area that would not be resolved by this line. Therefore, in early

[8] The ISO-NE PAC is an advisory committee open to all parties interested in regional system planning activities in New England. ISO-NE is required by its FERC-approved tariff to conduct an open and transparent planning process. Pursuant to this requirement, ISO-NE presents to the PAC the scope of work, assumptions, and draft results for its annual Regional System Plan and for supporting studies, including Needs Assessments and Solution Studies, and considers the comments of the PAC members in developing its final plans and recommendations.

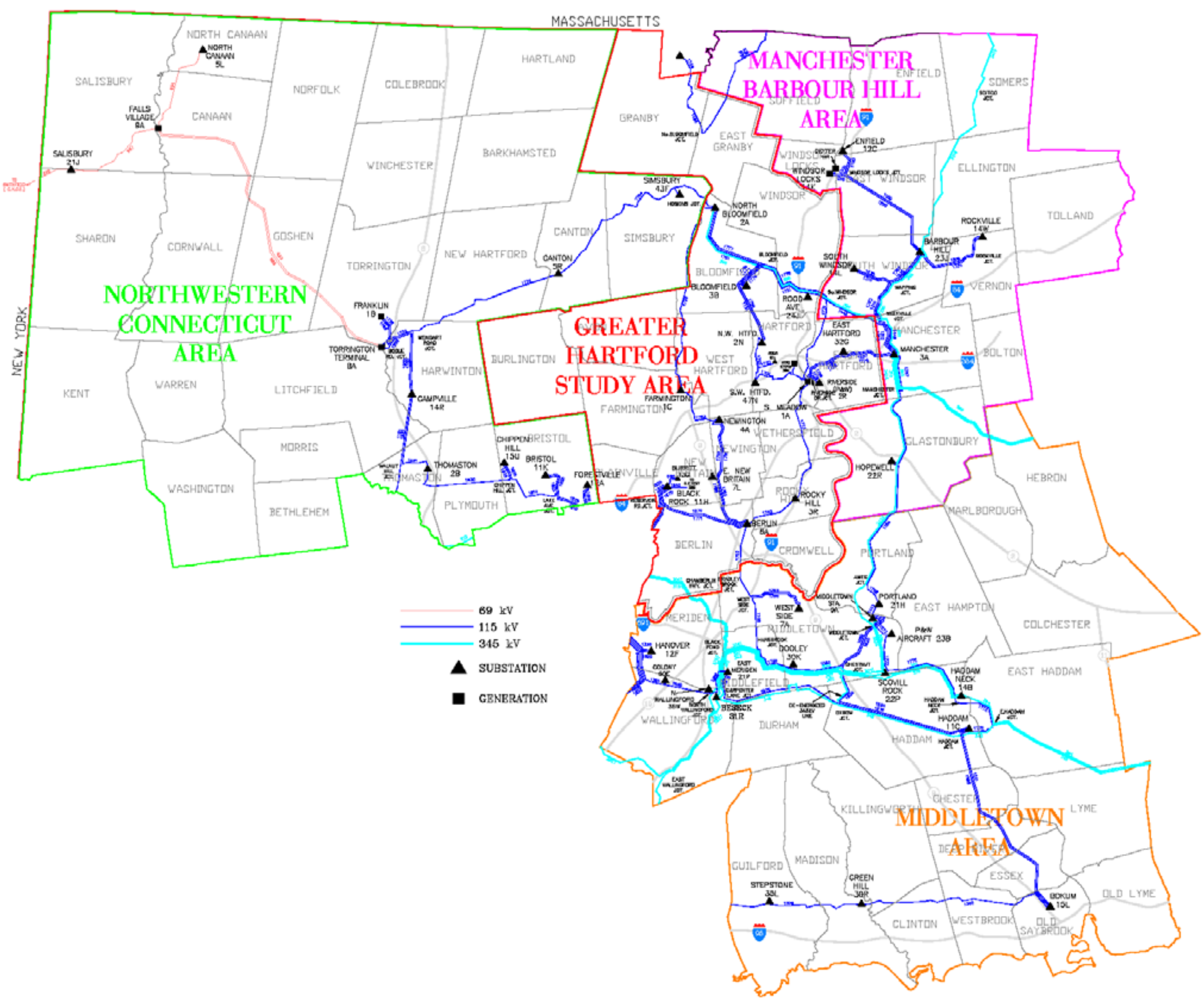
2010, ISO-NE removed these 115-kV issues from the scope of the NEEWS studies and initiated a new study supplementary to the NEEWS studies that would take a comprehensive fresh look at the Greater Hartford area problems and seek a cost-effective solution for all of the problems in the area. This was known as the Greater Hartford Area Reliability Study. In early 2011, ISO-NE combined this study, along with other ongoing studies, into an assessment of load serving problems in four contiguous areas of Connecticut:

- Greater Hartford
- Manchester – Barbour Hill
- Middletown
- Northwestern Connecticut

To conduct this study, ISO-NE formed a working group consisting of transmission planners from ISO-NE, from Northeast Utilities Service Company (now Eversource Energy Service Company), and from The United Illuminating Company. The combined study area is illustrated in Figure 2-1.

In addition, an ongoing reassessment of the need for the Central Connecticut Reliability Project (CCRP), one of the four original NEEWS 345-kV projects, was folded into the combined study. The CCRP reassessment was pursuant to ISO-NE's obligation, in accordance with Section 4.2(a) of Attachment K to its FERC-approved Open Access Transmission Tariff, to update its needs assessments as new resources materialize through the Forward Capacity Auction process.

Figure 2-1: Greater Hartford – Central Connecticut Study Area



At the time of the needs reassessment, CCRP was planned to consist primarily of a new 345-kV transmission line from North Bloomfield Substation, in Bloomfield, Connecticut to Frost Bridge Substation in Watertown, Connecticut, and was designed to greatly increase the capability of the transmission system to transfer power from east-to-west across the WCT import interface. The preliminary results of the CCRP reassessment indicated that the need for such increased transfer capability had been substantially reduced by changes in system conditions and forecasted load, but not eliminated. Accordingly, the GHCC analysis was expanded to identify needs for both local reliability issues and western Connecticut import requirements, with the expectation that both sets of needs could be addressed by a single integrated 115-kV solution, which would both replace CCRP and meet local load serving needs.

The GHCC studies proceeded to consider potential interdependencies in the load serving needs and potential solutions for the four sub-areas and ultimately determined that the solutions for the different sub-areas could be analyzed independently of one another, because the needs in each were largely driven by criteria violations following the loss of critical 115-kV sources into each sub-area. After many presentations to the PAC, ISO-NE published a final Needs Assessment in May, 2014 (the "*GHCC Needs Report*"). Because the study scope and assumptions were finalized in 2012, the study considered system needs in the study year of 2022, consistent with ISO-NE's 10-year planning horizon.

After further presentations to the PAC, in early 2015 ISO-NE published a report identifying preferred solutions for the needs of the entire Greater Hartford and Central Connecticut study area, including the improvements in the Greater Hartford Sub-area proposed in this filing (the "*GHCC Solutions Report*"). After additional detailed studies and review, and a positive recommendation by its Reliability Committee, on April 16, 2015, ISO-NE issued a technical approval of the preferred GHCC solutions, including the Greater Hartford improvements proposed in this filing.

2.2.1 The Greater Hartford Sub-area

The Greater Hartford Sub-area net load for 2022 after demand resources are subtracted is estimated at approximately 1,227 megawatts (MW). Generation in the sub-area totals approximately 252 MW, consisting of three generators, totaling about 103 MW, that may be classified as regular units and four generators, totaling about 149 MW, that are classified as fast-start units. The sub-area is a net importer of energy and relies on the surrounding areas to serve local load. The major 115-kV lines that supply this sub-area are:

- Three 115-kV lines from North Bloomfield (Lines 1726, 1751, and 1777)
  - 1726: North Bloomfield – Farmington
  - 1751: North Bloomfield – Northwest Hartford – Rood Avenue
  - 1777: North Bloomfield – Bloomfield

- Three 115-kV lines from Manchester (Lines 1207, 1448 and 1775)
  - 1207: Manchester – East Hartford
  - 1448: Manchester – Rood Avenue
  - 1775: Manchester – Riverside Drive – South Meadow

- Two 115-kV lines from Southington (Lines 1670 and 1771)
  - 1670: Southington – Black Rock – Berlin
  - 1771: Southington – Berlin

- One 115-kV line from Middletown (Line 1765) – 1765: Westside – Berlin

Figure 2-2 provides a geographic map of the sub-area, illustrating the existing transmission lines, substations, generation resources and, in some cases, line terminations outside of the sub-area.

2.2.2 The Need for Transmission Improvements in the Greater Hartford Sub-area

The GHCC studies showed that there were criteria violations in two distinct "load pockets" within the Greater Hartford Sub-area. Load pockets are areas that have insufficient generation and transmission to serve their load. The two load pockets were defined as the South Meadow – Berlin – Southington Area (shown in yellow in Figure 2-3) and the North Bloomfield – Manchester Area (shown in blue in Figure 2-3).

The South Meadow – Berlin – Southington area has no generation located within it; the North Bloomfield – Manchester area has limited generation; and both areas have limited transmission capability. The GHCC studies showed that, as a result, the transmission system in each load pocket is subject to overloads and low voltages when the system attempts to serve peak load under many contingent conditions. Neither of these load pockets have sufficient generation and transmission to serve peak load under contingent conditions.

Figure 2-2: Greater Hartford Sub-area

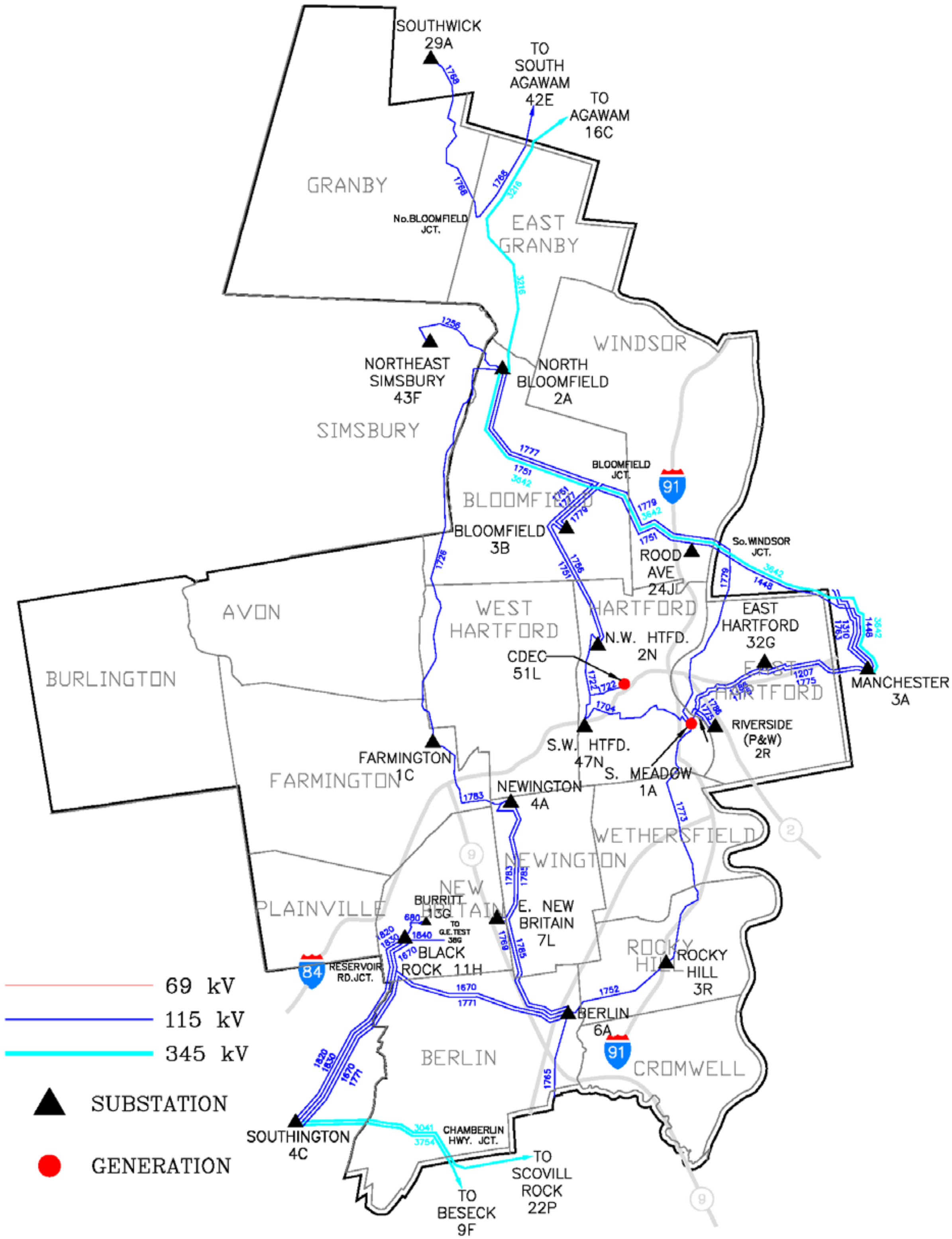
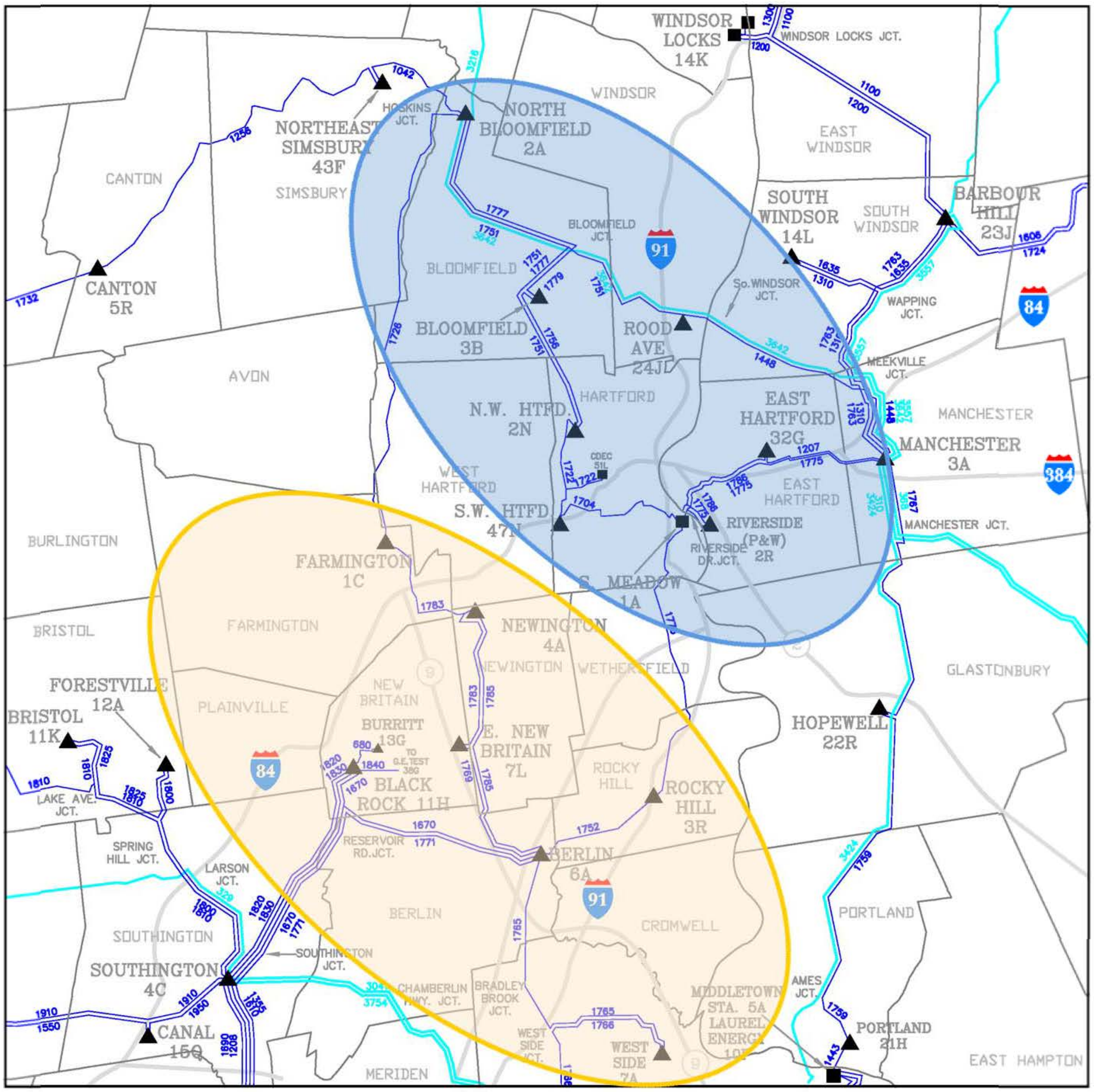


Figure 2-3: Greater Hartford Sub-area: Two Load Pockets



Note: Area shown in yellow = South Meadow – -Berlin – Southington Area Load Pocket
Area shown in blue = North Bloomfield – Manchester Area Load Pocket

2.2.2.1 Power-Flow Modelling Assumptions

The assumptions built into the power-flow modelling are set forth in detail in the *GHCC Needs Report.* In summary, the power flow study cases were derived from the ISO-NE model representing the New England electric system, with selected upgrades to reflect relevant system conditions in 2022. All transmission projects with ISO-NE Proposed Plan

Application approvals as of the April 2011 Regional System Plan Project listing were included in the base case. These projects included three NEEWS projects - the Greater Springfield Reliability Project (GSRP), the Rhode Island Reliability Project (RIRP), and the Interstate Reliability Project (Interstate or IRP). The CCRP was not included in the case because the need for it was being reassessed as part of the study. New projects in Connecticut that were relevant to the study area were added to the base case as of the October 2013 project listing.

Both existing generation plants and new projects expected to be in-service during the study years because they have accepted a Forward Capacity Market (FCM) Capacity Supply Obligation, were included in the study base case. All existing and proposed units that accepted a supply obligation in ISO-NE's Forward Capacity Auction #7 (FCA 7) were included. FCA 7 was held in February, 2013, and resulted in the purchase of resources to meet forecasted demand in 2016 – 2017. Certain generation units that were expected to retire imminently (and which have since retired) were assumed to be out of service. [Units assumed OOS were Bridgeport Harbor 2, AES Thames, Norwalk 1, 2 and 10.] The planned Towantic Generating Station in the Town of Oxford, Connecticut was not included in the study because it was not entered in FCA 7.

In accordance with ISO-NE planning procedures, the modeled load was based on the 90/10[9] weather forecast for 2022 in ISO's 2013 Capacity, Energy, Loads, and Transmission (CELT) load forecast. The forecast 2022 summer peak 90/10 was 34,105 MW. This load, adjusted to take system losses into account, was distributed across New England based on 2013 load distribution data. The forecast Connecticut load was 8,825 MW. Area loads were then adjusted downwards to reflect the effect of passive and active demand response measures committed in FCA 7 and predicted future energy efficiency measures that were expected to be implemented by 2022. Transfers of power into and out New England were

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[9] The 90/10 forecast of peak demand is used by ISO-NE for utility infrastructure planning. "The 90/10 forecast is a plausible worst-case hot weather scenario. It means there is only a 10 percent chance that the projected peak load would be exceeded in a given year, while the odds are 90 percent that it would not be exceeded in a given year. Put another way, the forecast would be exceeded, on average, only once every ten years. While this projection is extremely conservative, it is reasonable for facility planning because of the potentially severe disruptive consequences of inadequate facilities: brownouts, blackouts, damage to equipment and other failures. State utility planners must be conservative in estimating risk because they cannot afford the alternative." Connecticut Siting Council, Review of the Ten Year Forecast of Connecticut Electric Loads and Resources, 2008 – 2017, at 6.

modeled in accordance with applicable reliability criteria and standard practice. Finally, generator dispatch scenarios in each sub-area under study were constructed. In this set of studies, twenty two dispatches were set up for the four study areas and for the assessment of the need to import power into Connecticut and within Connecticut from east-to-west, across the western Connecticut import interface. The dispatches were set up by taking out either one or two critical units in each sub-area studied. The generation in the Greater Hartford Sub-area (all of which is located within the City of Hartford) is listed in Table 2-1.

Table 2-1: Greater Hartford Sub-area Generation

Unit	Qualified Summer Capacity (MW)	Fast-Start Unit
CDECCA (Capitol District Energy Center Cogeneration Association)	55	No
South Meadow 5	23	No
South Meadow 6	25	No
South Meadow 11	36	Yes
South Meadow 12	38	Yes
South Meadow 13	38	Yes
South Meadow 14	37	Yes

ISO-NE planning practice requires an assumption that approximately 20% of fast start generation will be OOS. Accordingly, one of the four fast start units was assumed OOS. Four dispatches were tested, two of which were two-units-out dispatches. In accordance with ISO-NE Planning Procedure #3, the output of generation in the study area and its vicinity was reduced following a first contingency if the re-dispatch would position the system so that a second contingency would not result in a violation.

2.2.2.2 Power-Flow Modelling Results – Thermal and Voltage Criteria Violations

Many thermal criteria violations were found in the GHCC study area for N-1 and N-1-1 contingency events. The detailed results are provided in the *GHCC Needs Analysis*. The Greater Hartford Sub-area had four transmission elements with N-1 thermal violations and four 115-kV buses with N-1 low-voltage violations. Under N-1-1 conditions, there were 27 elements with thermal violations and ten 115-kV Pool Transmission Facilities (PTF) buses with low voltage violations. Two 115-kV non-PTF buses also had low voltages. There were no N-0 violations. Violations occurred with all of one-unit-out and two-unit-out dispatches. A significant number of violations were dispatch-independent: that is, the violation occurred with all dispatches. Although the study year modelled in the *Needs Assessment Report* was 2022, the study showed that the improvements required to meet the identified needs should be constructed as soon as possible.

ISO-NE calculates a “year of need” for system improvements by estimating when the “critical load level” (CLL) for which improvements are needed will be reached. The CLL is the demand level at which criteria violations begin to occur. Above this load level, the system needs to be expanded to continue to reliably support the demand. The *2012 Needs Assessment Report* found that the year of need for the Greater Hartford improvements was 2013, because the Connecticut peak load forecast for 2013 was 7,776 MW, whereas thermal violations began to occur at a 4,756 MW net load and low voltage violations began to occur at a 4,319 MW net load. Moreover, the majority of the worst-case violations in the Greater Hartford Sub-area occurred at the 2013 net load level.

2.3 THE PROPOSED SOLUTION FOR THE GREATER HARTFORD SUB-AREA NEEDS

The *GHCC Solutions Report* identified preferred solutions for the load serving problems documented in the *GHCC Needs Report* in each of the four load-serving sub-areas, and determined that the improvements would also serve the “double duty” of providing a needed increase to the capability of the system to transfer power across the WCT Import Interface. The major element of the solution recommended for the Greater Hartford Sub-area was the addition of a new, approximately 4-mile 115-kV underground cable between Newington and Southwest Hartford Substations, which also requires the installation of associated terminal equipment including a 2% series reactor in series with the new cable and a 115-kV 3% reactor on the existing underground cable between South Meadow and Southwest Hartford Substations in the City of Hartford.

2.3.1 The Newington – Southwest Hartford Cable and Its Associated Terminal Equipment Improvements

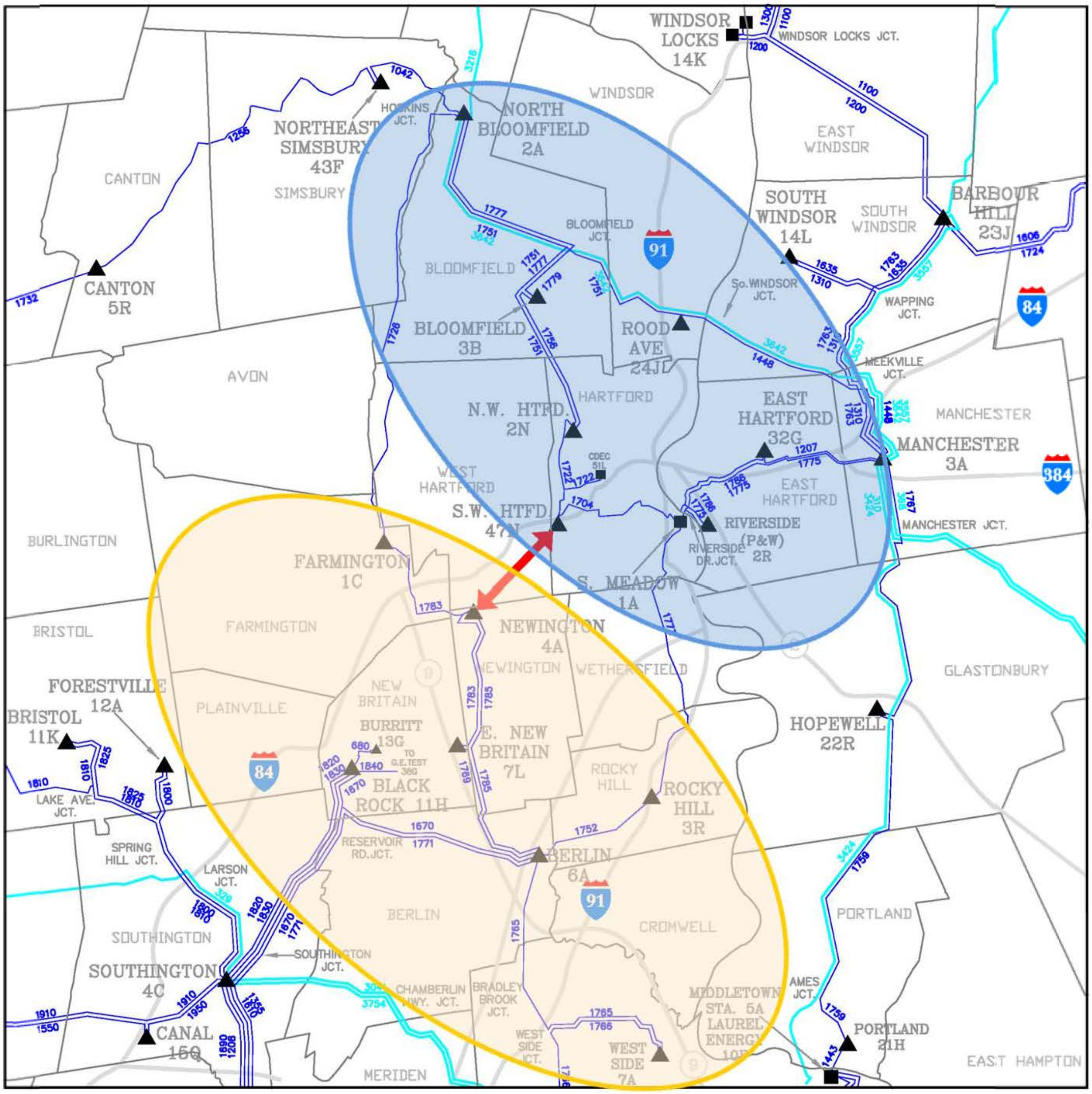
Although this 115-kV cable would be under 4 miles long, it will provide a large reliability improvement by connecting the South Meadow – Berlin – Southington load pocket and the North Bloomfield – Manchester load pockets, as shown in Figure 2-4.

The installation of the new cable system will require the installation of series reactors. Underground cables have lower impedance than their corresponding overhead lines. Accordingly, in the event of the loss of one or more system elements in either of the two load pockets that will be joined by the new cable, the cable will provide the path of least resistance for the automatic redistribution of load. A protective measure is therefore required to limit flow on the cable in order to prevent other local area elements from being loaded beyond their thermal capacity. This required protection will be provided by a 115-kV 2% reactor that will be installed at Southwest Hartford Substation. An existing underground cable (the 1704 Line) between Southwest Hartford and South Meadow substations will be protected by the installation of a 115-kV 3% reactor, also at Southwest Hartford Substation.

As a result of these improvements, the transmission system in each load pocket will be able to serve the other when needed. In the event of contingencies in either area, there will be an additional high voltage transmission element to share the load that will be automatically redistributed from the failed system element; and each area will have a new high capacity path by which generation from outside both load pockets may reach the load within each.

The cable and its associated improvements will also provide incremental transfer capability across the western Connecticut import interface. As the 345-kV CCRP would have done, the proposed 115-kV cable adds another transmission element to the interface and it therefore increases transfer capability across the interface. The increment in transfer capability provided by this improvement to the 115-kV system is less than would have been provided by the 345-kV CCRP solution, but it is adequate because less capability is needed under the modeled updated system conditions to eliminate criteria violations.

Figure 2-4: GHCCRP Cable Connection of Load Pockets



2.3.2 Other Improvements Identified by the GHCC Studies Proposed in this Application

2.3.2.1 Reconductoring the 115-kV Newington Tap

The 1783 115-kV overhead line extends from Farmington Substation to East New Britain Substation. In between these end points, it is "tapped" into Newington Substation, thus creating a three terminal line, such that Newington Substation can feed both East New Britain and Farmington substations. The "tap" extends from a structure on the Farmington – East New Britain ROW for a distance of 0.01-mile to Newington Substation. The GHCC studies showed that in certain contingencies, the tap line is overloaded, as Newington Substation tries to simultaneously supply both East New Britain and Farmington. In order to avoid such an overload, the tap line's existing 336,000 circular mil (336 kcmil) aluminum conductors with steel reinforcement (ACSR) will be replaced by larger 1590 kcmil ACSS. The current carrying capacity of the larger conductors will enable them to accept the redistributed load without overheating.

2.3.2.2 Reconfiguring the Berlin 115-kV Substation

The Berlin Substation (located in the northeast corner of the Town of Berlin) is in the heart of the South Meadow – Berlin – Southington load pocket, and is affected by several contingencies involving 115-kV lines serving it. Improvements are needed to avoid a loss of service in contingent events.

<u>Relocation of a 50.4 MVar Capacitor Bank</u>

Capacitors are installed in substations to support voltage, among other things. Several capacitor units are combined in "banks," the capacity of which is measured in mega VARs (MVar). There are currently three banks of capacitors in Berlin Substation, two rated at 37.8 MVar and one at 50.4 MVar. All three are connected to the same bus (the 115-kV B1 bus). The GHCC studies showed that there are contingencies that would result in the loss of all three of these capacitor banks, which would cause low voltage violations at Berlin Substation and at other neighboring substations. These criteria violations can be avoided by disconnecting the 50.4 MVar capacitor bank from the 115-kV B1 bus and relocating it to the 115-kV A bus, in series with a new 115-kV circuit breaker. With that configuration, capacitance sufficient to maintain required voltage levels is provided even with the occurrence of the contingencies.

<u>Addition of a 115-kV Circuit Breaker</u>

The system is currently exposed to certain N-1-1 design contingencies that result in the overload of the 115-kV North Bloomfield – Farmington 1726 Line and 115-kV Farmington – Newington 1783 Line. The exposure to these contingencies will be avoided by the installation of a new circuit breaker at Berlin Substation in series with the existing 26T circuit breaker between the 1785 Line and the 115-kV East Newington – Berlin 1769 Line. The requirement for this 115-kV circuit breaker is separate from, and additional to, that for the 115-kV circuit breaker required in connection with the relocation of the 50.4 MVar capacitor bank.

2.3.3 Conformance to Long-Range Plan for Expansion of Electric Power Serving the State and Interconnected Utility Systems

FERC has charged ISO-NE with the responsibility for conducting long-term transmission system planning for New England. To discharge that responsibility, the ISO continually assesses the needs of the entire New England bulk power system, through the preparation of annual Regional System Plans and long-term studies.

As explained in Section 2.2, the proposed Project is an outgrowth of the NEEWS studies (which began in 2006 and considered [among many other things] the need to move power across Southern New England and Connecticut) and the Greater Hartford area study (which began in 2010.) Ultimately, the need for the CCRP component of NEEWS and the load serving needs of the Greater Hartford, Manchester – Barbour Hill, Middletown, and Northwest Connecticut sub-areas were examined together in the *GHCC Needs Analysis*. The grouping of these needs into a single study was to assure that coordinated and cost efficient solutions to the identified needs would be developed.

In parallel, ISO-NE has also been examining transmission needs in Southwest Connecticut in 2022. The GHCC and Southwest Connecticut studies have been coordinated so as to avoid redundant solutions. Together, the GHCC and Southwest Connecticut studies identify coordinated solutions for Connecticut's transmission system that will comply with applicable reliability requirements through 2022, and that form a part of the ISO-NE Regional System Plan for all of New England.

2.3.4 Identification of Facility in the Forecast of Loads and Resources

Pursuant to Section 16-50r(a) of the General Statutes, concerning forecasts of electric loads and resources, Transmission Owners are required to file with the Connecticut Siting Council

(Council or CSC) periodic reports that include, among other things, a list of planned transmission lines on which Proposed Route reviews are being undertaken or for which certificate applications have already been filed, and a decription of the steps taken to upgrade existing facilities. The Company's report filed on March 3, 2008, advised the Council that it was planning to propose the CCRP 345-kV line and that it was evaluating transmission reinforcement projects in the Greater Hartford area, including the construction of several 115-kV transmission lines in the area to improve reliability and address growing demand.

Since then, the Company has kept the Council informed of the evolution of these projects. For instance, in its March 1, 2012 report, the Company advised the Council about the ongoing GHCC Needs Assessment, and that the re-evaluation of the CCRP had been combined with that study. Most recently, in its March 2, 2015 report, Eversource advised the Council of the completion of the GHCC studies; identified as "Proposed Transmission Line Projects" the new Newington – Southwest Hartford 115-kV line and the Newington – Newington Tap 115-kV reconductoring; and reported that Eversource expected the CCRP to be replaced by the GHCC solutions.

2.4 CONCLUSION

The Project is the product of years of careful study of reliability needs in the Greater Hartford Sub-area, coordinated with studies of needs in the Northwest Connecticut, Manchester – Barbour Hill, and Middletown Sub-areas, and with those of Southwest Connecticut. The Project will address violations of reliability criteria identified in these studies, and will assist Eversource in the discharge of its obligation to maintain the reliability of the Connecticut bulk transmission system in accordance with mandatory federal and regional standards and criteria.

3. TECHNICAL PROJECT SPECIFICATIONS

This section describes the technical specifications for the proposed Project, including:

- The new 115-kV underground transmission cable system along the Proposed Route between Newington Substation and Southwest Hartford Substation;
- Modifications to Eversource's existing Newington, Southwest Hartford, and Berlin Substations; and
- Modifications to Eversource's existing 1783 Line connection into Newington Substation (Newington Tap).

The technical information provided for the Project includes:

- Cable system route length, by municipality, and terminal points;
- Cable system design, including conductor size and specifications;
- Design voltages and capacities;
- ROW and proposed access to the cable route;
- Substation connections and proposed modifications; and
- Estimated capital (construction) and life-cycle costs.

3.1 PROPOSED 115-KV TRANSMISSION CABLE SYSTEM FACILITIES

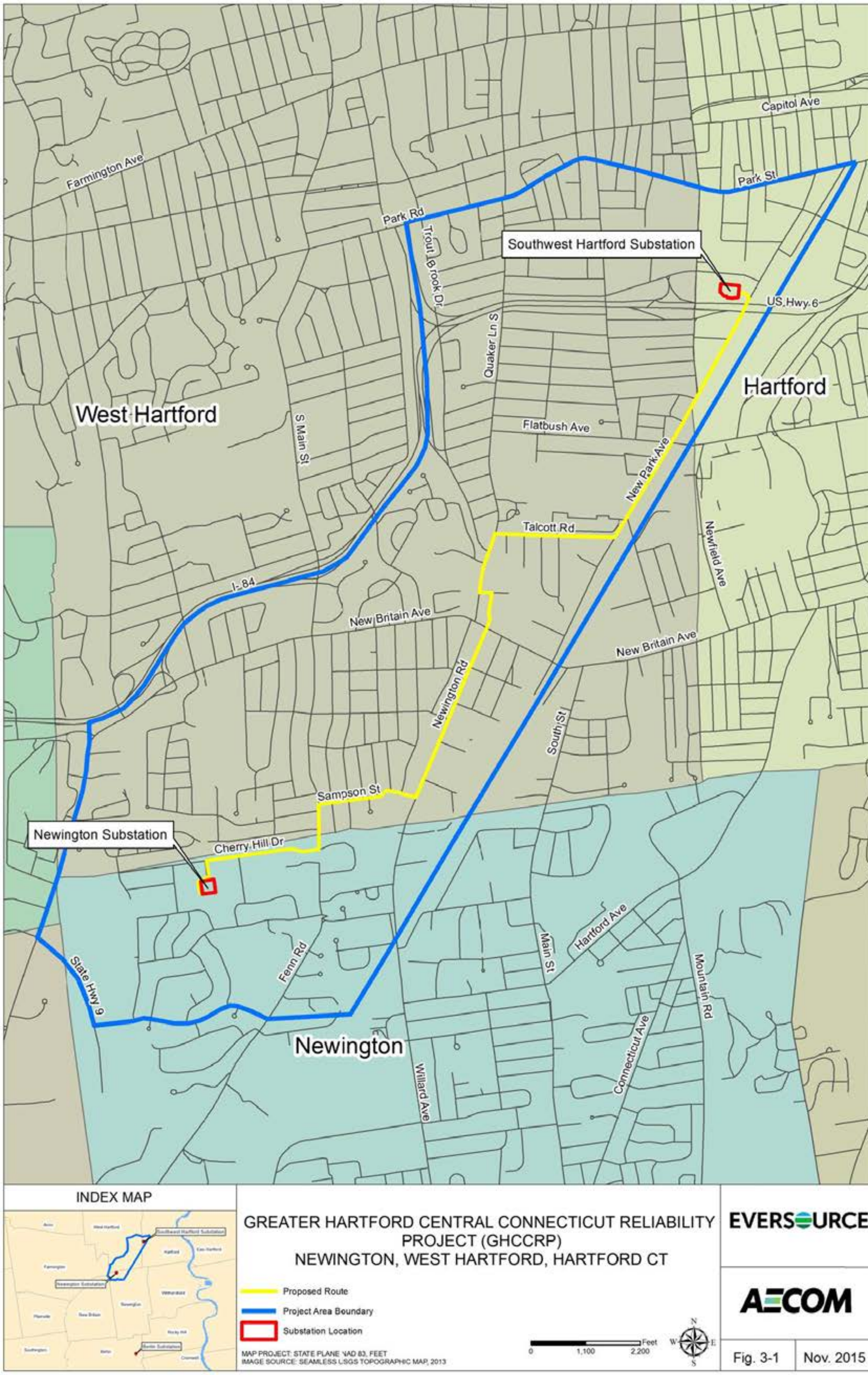
The proposed underground 115-kV transmission system, which would extend for approximately 3.8 miles between Eversource's Newington and Southwest Hartford Substations, would consist of single-circuit cross-linked polyethylene (XLPE) cable system, which would be contained within a concrete-encased duct bank (consisting of several polyvinyl chloride [PVC] conduits), as well as concrete splice vaults. Splice vaults are required to stage the installation (pulling) of the transmission cable through conduits, to accommodate activities required to splice together the cable sections, and to provide access to portions of the cable system to perform maintenance and repair activities. Splice vaults would be buried at intervals of approximately 1,800 feet along the route. Each splicing location would require a single vault to accommodate splicing of all three phases of the circuit.

In addition to the transmission line cable, three fiber optic cables would be installed in the duct bank. Two fiber optic cables are required for remote protection and control of the cable system and associated equipment, and the other fiber optic cable would be for monitoring the operating temperature of the cables. A ground continuity conductor also would be installed to ground the cable sheaths and equipment within the splice vaults. The fiber optic cables would be spliced and pulled into a pre-cast hand hole located near each splice vault location.

Eversource proposes to install the underground cable system principally within or adjacent to public roads in Newington, West Hartford, and Hartford along the Proposed Route as depicted generally on Figure 3-1 and shown in more detail on the maps in Volume 3. Overall, the proposed cable route would traverse approximately 0.7 mile in the Town of Newington, 2.6 miles in the Town of West Hartford, and 0.5 mile in the City of Hartford and would be aligned along the following areas:

- **Newington**
  - Cherry Hill Drive
  - West Hartford Road
- **West Hartford**
  - South Main Street
  - Sampson Street
  - Newington Road (State Road 173)
  - New Britain Avenue (State Route 529) (crosses this avenue)
  - Elmwood Community Center parking lot
  - Burgoyne Street
  - South Quaker Lane (crosses Trout Brook adjacent to this road)
  - Talcott Road
  - New Park Avenue
- **Hartford**
  - New Park Avenue

Figure 3-1: Proposed Route

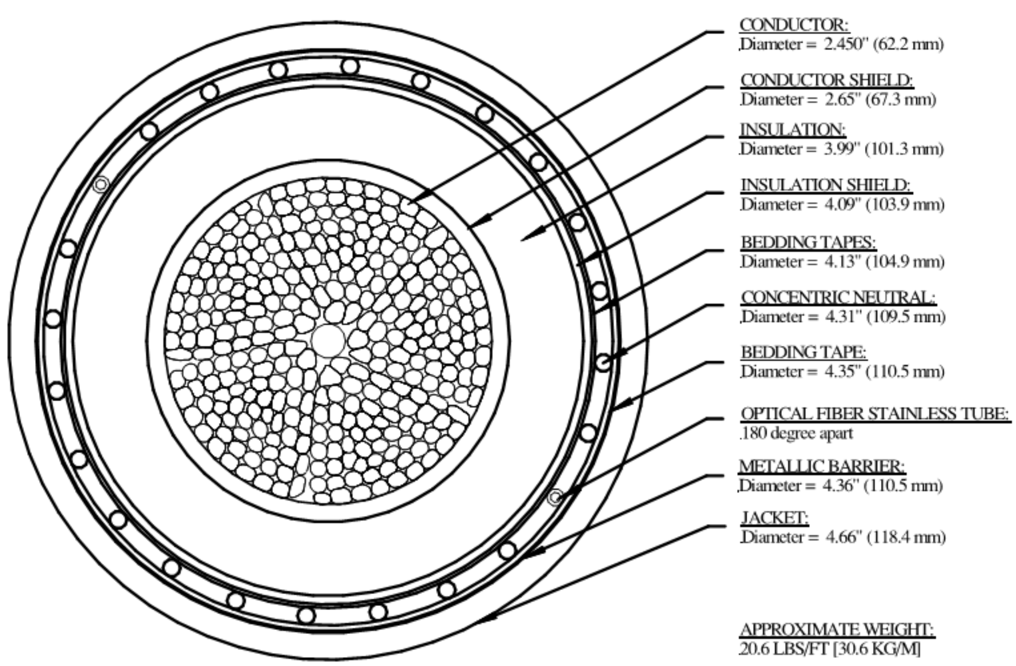


The exact location of the cables and the splice vaults within and adjacent to public road ROWs would be determined based on final engineering design, taking into consideration the constraints posed by existing buried utilities, the location of other physical features, and the requirements and preferences of the entity that owns each road (municipality, state, or private).

3.1.1 Cable Design and Specifications

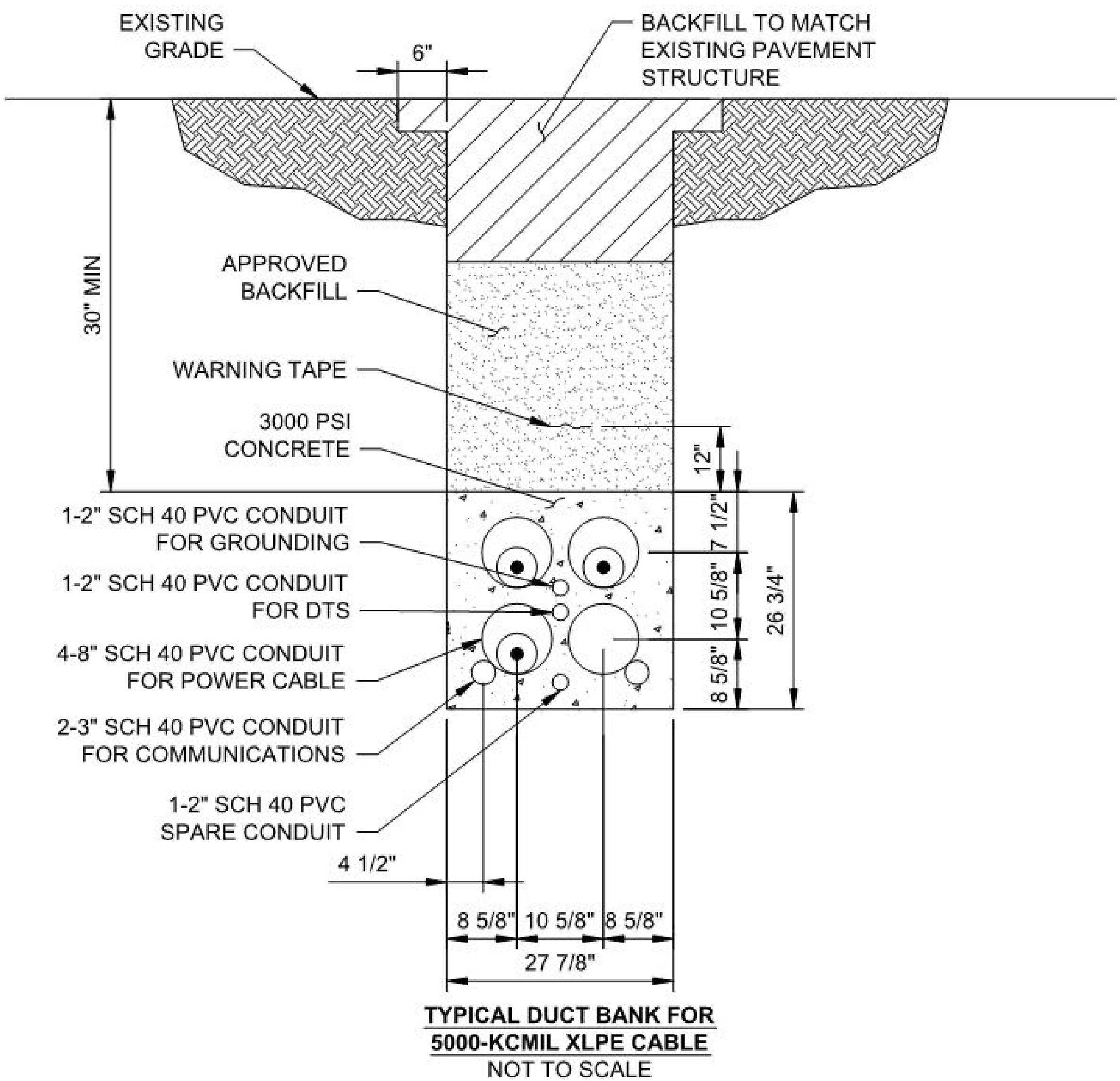
The Project's single-circuit 115-kV underground transmission system would consist of three cables, or phases. Each phase of the circuit would consist of one 5000-kcmil copper conductor cable insulated to 115-kV with approximately 1.4 inches of XLPE insulation. Each cable would be approximately 4.66 inches in diameter. Figure 3-2 provides a cross-section of a typical 5000-kcmil copper conductor XLPE 115-kV cable. (Note: Figure 3-2 illustrates a specific cable design; the exact dimensions and construction of the cable used for this Project may vary slightly from this example shown, which should be considered representative).

Figure 3-2: Typical 5000-kcmil Copper Conductor 115-kV Cable Cross-Section



Three electric cables would be installed in PVC ducts encased in concrete. Smaller conduits would also be installed for the communications, temperature monitoring, and ground continuity cables. Figure 3-3 illustrates a typical underground duct back. The power cables would be installed one cable per duct. One duct is a spare.

Figure 3-3: Typical Underground XLPE Cable Duct Bank Cross-Section



XLPE cables are designed to withstand water penetration by the use of a metallic barrier. In this case the cable will have a copper-laminate sheath. The cables and splices are capable of continuous long-term operation under a 30-foot head of water, with no water ingress. The capacity to prevent water penetration is tested in accordance with International Electro-technical Commission (IEC) standard IEC 60840.

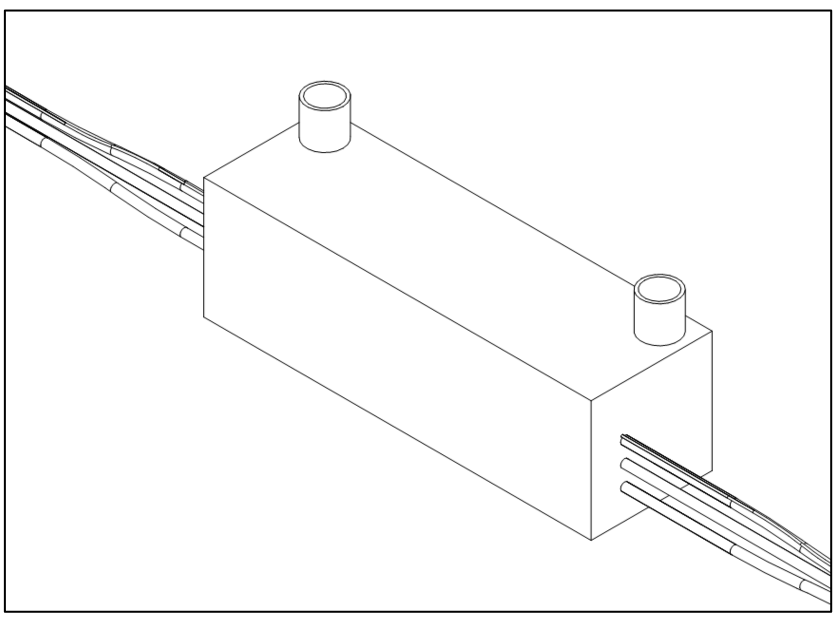
If soil and/or water were to enter into the splice vaults during a flood event, thermal issues are unlikely to occur because water has a much lower thermal resistivity than air. If vaults were to fill with water, vacuum trucks would be used to dewater the vaults. After removing the water, the vaults would be washed as necessary. The clamps and the racking system used to support the cables in the vaults would be specified to be non-magnetic and non-corrosive, which reduces the risk of corrosion.

3.1.2 Splice Vaults

Along the Proposed Route, the underground XLPE cable must be installed in sections, due to limitations such as the maximum allowed pulling tension (while installing the cable in the conduit), maximum allowed side wall pressure (while pulling the cable into the conduit), and maximum length of cable that can be transported on a cable reel. As a result, underground splice vaults are required at intervals of approximately 1,800 feet along the cable route, with the 1,800-foot distance representing the typical length of a cable section.

The splice vaults consist of reinforced concrete. Figure 3-4 depicts a typical splice vault installation.

Figure 3-4: Typical Splice Vault Installation



The splice vault size and layout is determined by the space required for cable pulling, cable splicing, and supporting the cable in the vault. The outside dimensions of the splice vaults for the Project are expected to be 24 feet long by 8 feet wide and 8 feet high. The top of the splice vault would be installed a minimum of 30 inches below grade with two access holes, or manhole covers, each approximately 36 inches in diameter.

3.1.3 Design Voltage and Capacity

The new 115-kV 5000-kcmil XLPE underground cable would provide approximately 250 Megavolt Amperes (MVA) of summer normal line capacity, a summer long-term emergency (SLTE) capacity of 450 MVA, and a summer short-term emergency (SSTE) capacity of 550 MVA.

3.1.4 ROW and Access Roads

The proposed cable system would be located principally within Eversource's fee land, and within existing public road ROWs. In such areas, Eversource would not have to acquire an easement for the cable system. In areas where portions of the cable system (duct bank or splice vaults) are proposed for location or must be situated outside of public road ROWs, Eversource would negotiate a permanent easement with the private property owner.

The public road ROWs beneath which the cable system would be installed would also afford ready access to the cable system. No access roads would be required to construct or operate the Project. During operation of the new circuit, the splice vault manholes would provide access to the cables for maintenance and repair purposes.

3.2 PROPOSED SUBSTATION MODIFICATIONS

In order to interconnect the new 115-kV transmission cable with the existing transmission system, modifications would be required at Eversource's existing Newington and Southwest Hartford Substations. In addition, modifications to Eversource's Berlin Substation are required. All of the modifications to the three substations will be performed on Eversource-owned property.

The proposed Project modifications at Berlin Substation would be accomplished within the existing developed (fenced) area of the station. The proposed Project modifications to Newington and Southwest Hartford Substations would require expansion (on Eversource property) beyond the existing developed (fenced) areas of the stations.

Preliminary design drawings of the proposed station modifications are included in Volume 3 and are reproduced in this section. The technical specifications regarding these modifications are detailed for each substation, as follows.

3.2.1 Newington Substation

3.2.1.1 Substation Work

Newington Substation is a 115- to 23-kV substation with three 115- to 23-kV transformers. The existing 1785 Line and the 1783 Line each connect to separate circuit breakers. A transformer connects to these two circuit breakers. Each of these lines leaves the substation overhead.

To accommodate modifications required to interconnect the new 115-kV transmission cable, Eversource proposes to expand the substation by approximately 30 feet to the south. In addition, a 160-foot section of the substation's eastern fence line will be expanded 30 feet to the east in order to provide space for the construction of a new battery enclosure. In total, the developed portion of the substation will be expanded by approximately 0.3 acres. Volume 3 (Exhibit B.2) illustrates the proposed Newington Substation modifications.

For the Project modifications to the substation, Eversource proposes to:

- Reconfigure the existing substation 115-kV yard into a ring bus, with two new circuit breakers in an open air double-breaker assembly. One overhead line terminal position will be relocated and one underground line terminal position will be new. One disconnect switch (per phase) will be installed on either side of the double-breaker assembly for operation and maintenance.

- Construct a new control enclosure (of approximately 700 square feet) to house protection and controls equipment. This enclosure will mainly house DC battery components.
- Connect the new 1346 Line (i.e., the 115-kV underground line) to the substation by utilizing the 1783 Line terminal position. The 1783 Line terminal will be relocated to a currently unused line terminal position. The final configuration for each line terminal position will include one arrestor, one disconnect switch and one Capacitance Coupling Voltage Transformer (CCVT) per phase.
- The new underground 1346 Line will have one pothead per phase to accommodate the underground to overhead transition. The height of this terminal will be 16.5 feet, which is the approximate height of the existing bus. Included in the line terminal position is the installation of a new motor-operated disconnect switch. This three-phase disconnect switch will have control and indication cable routed underground to the existing control enclosure. New duct bank will be constructed within the substation for these control and indications cables in addition to duct bank that currently exists within the substation.
- The Newington Tap will have a new overhead transmission take-off structure located within the substation fence. The height of this structure will be approximately 70 feet and the transmission line phase conductors will be attached approximately 40 feet above the ground. The substation take-off structure will include a three-phase motor-operated disconnect switch and a wave trap located on one phase.
- Extend the existing substation ground grid as required, to address the expanded substation footprint. All structures and equipment casing will be tied to this grid using appropriate ground conductor. Foundation, conduit and fence are also grounded.
- Perform grading and evaluate drainage and storm water improvements to accommodate the substation modifications. A retaining wall also will be required on the southwest side of the substation in order to maintain grade for the expanded portion of the substation.

3.2.1.2 Line Work (Newington Tap)

The 1783 Line relocation will require moving the transmission line entry from the current bay position on the east side to a new bay position on the south side of the substation. This will require removing or modifying (relocating guy and anchors, as well as replacing cross arms and cable support hardware) several of the existing structures on the substation property. It will likely require removing and replacing the three-pole structure on the south side of the substation with a new structure in a similar location. The new structure will be about 30 feet taller than the existing structure to accommodate the line taps required to connect to the new bay position. This will require vegetation removal to accommodate the relocation of the 1783 Line. Figure 3-5 illustrates the proposed modifications to the Newington Tap.

3.2.2 Southwest Hartford Substation

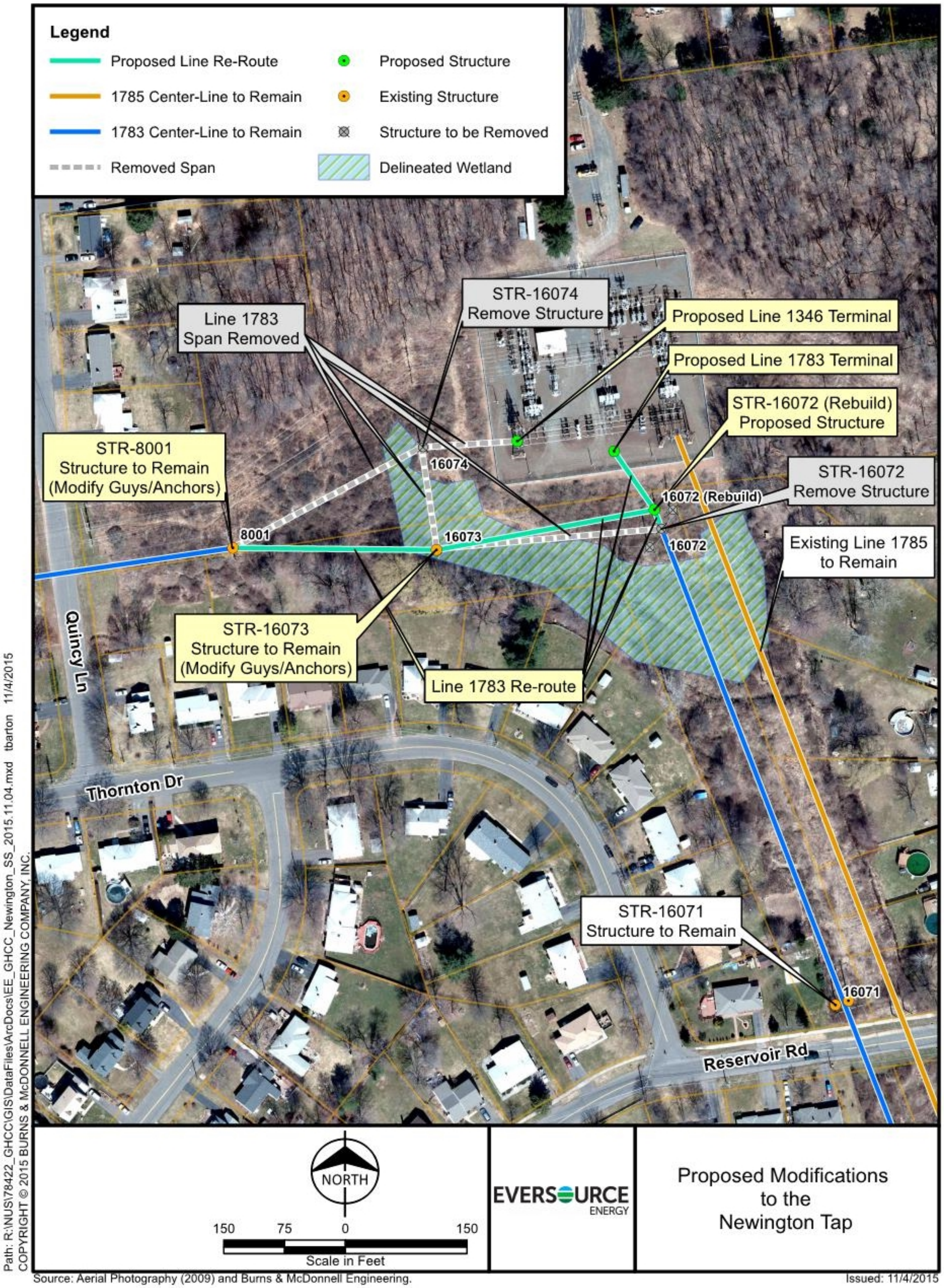
Southwest Hartford Substation is a 115- to 23-kV substation with two 115- to 23-kV transformers. The two lines 1722 and 1704 terminate into these transformers. There is a tie circuit breaker that currently ties the two lines together. Both lines leave the substation as underground cable.

The scope of the modifications to this substation includes expanding the 115-kV portion of Southwest Hartford Substation and adding an additional underground line terminal. Two 115-kV circuit breakers will also be added to complete a ring bus. The new terminal will use the position between the two circuit breakers. Series reactors will be added to the new 1346 Line and to the existing 1704 Line. Each series reactor will have a circuit switcher bypass.

The design includes physical substation design and protection and control design to accommodate the required equipment. A fence expansion will be necessary to house the new line terminal and reactors. A control enclosure expansion is not required.

To interconnect the new 115-kV cable system to Southwest Hartford Substation, Eversource proposes to add the following facilities to the substation, which will require the expansion of the existing station fence by approximately 65 feet to the east and the relocation of the existing access road and gates (Volume 3, Exhibit B.2):

Figure 3-5: Modifications to Newington Tap



- Reconfigure the existing substation 115-kV yard into a ring bus, with two new circuit breakers. One line terminal position will be added. One disconnect switch (per phase) will be installed on either side of the each circuit breaker for operation and maintenance.
- Both the relocated 1704 Line and the new line will enter the station underground. Each line will have one series reactor, circuit switcher, disconnect switch, arrestor, CCVT and pothead per phase. Although the lines will enter the substation underground, a bypass is necessary for the operation of the reactors. This will require two new 70-foot dead end structures per line within the station. The bypass will require strain bus that will be tensioned between the two dead end structures. These dead end structures will accommodate all the equipment above except the circuit switchers and reactors. The circuit switchers and reactors will be at approximately 20 feet above grade. The strain bus will be approximately 40 feet above grade.
- Extend the existing substation ground grid as required, to address the expanded substation footprint. All structures and equipment casing will be tied to this grid using appropriate ground conductor. Foundations, conduits, and the substation fence also will be grounded.
- Perform grading and evaluate drainage and stormwater improvements to accommodate the substation modifications.

3.2.3 Berlin Substation

The existing Berlin Substation is a 115- to 23- to 13.8-kV substation with three 115-kV transformers. The existing 115-kV yard consists of a circuit breaker and half configuration with three bays fully populated with six lines. The 115-kV yard also has three capacitor banks connected to the bus via a circuit breaker. The three capacitor banks consist of two 37.8-MVAR capacitor banks, and one 50.4-MVAR capacitor bank.

The scope of the modifications includes relocation of the existing 50.4-MVAR capacitor bank from its current bus connection to another connection, installation of a new capacitor bank circuit breaker, and installation of two new circuit breakers.

The design includes physical substation design and protection and control design to accommodate the required equipment. No fence expansion will be necessary for the addition of the new 115-kV equipment. A control enclosure expansion is not required. Exhibit B.2 in Volume 3 illustrates the location of the Proposed Project modifications to Berlin Substation.

The proposed modifications to Berlin Substation would involve additional facilities within the developed (fenced) portion of the station. These proposed modifications include:

- Reconfiguring the existing substation 115-kV yard by adding two additional circuit breakers in an open air double-breaker assembly. One disconnect switch (per phase) will be installed on either side of the double-breaker assembly for operation and maintenance. In addition, a capacitor bank will be relocated from the north side of the yard to the south side of the yard.
- Redesign of existing buswork to accommodate the circuit breaker installation. The relocation of the capacitor bank will require the installation of a new circuit breaker, disconnect switch, reactors and buswork.
- Extending the existing substation ground grid as required, to accommodate the new equipment. All structures and equipment casing will be tied to this grid using appropriate ground conductor. Foundations, and conduit, also will be grounded.

3.3 ESTIMATED PROJECT COSTS

The estimated capital cost of the Project is approximately $99.8 million. Of this amount, transmission line costs are approximately $75.0 million and substation modification costs are approximately $24.8 million.

3.4 FACILITY SERVICE LIFE AND LIFE CYCLE COSTS

In accordance with the Council's Life-Cycle Cost Studies for Overhead and Underground Transmission Lines (2012), Eversource performed a present-value analysis of capital and operating costs over a 40-year economic life of the transmission line portion of the Project and the Project in its entirety. The following items and assumptions were included in this study:

- Annual carrying charges of the capital cost;
- Annual operation and maintenance costs;
- Cost of energy losses; and
- Cost of capacity.

Applying these factors, the life-cycle cost for the transmission lines is approximately $152.1 million.

4. CONSTRUCTION AND OPERATION / MAINTENANCE PROCEDURES AND METHODS

The proposed Project would be constructed in full compliance with the National Electrical Safety Code (NESC), standards of the Institute of Electrical and Electronic Engineers (IEEE) and the American National Standards Institute (ANSI), good utility practice, and the Connecticut Department of Energy & Environmental Protection (CT DEEP) Public Utilities Regulatory Authority (PURA); regulations covering the method and manner of high voltage line construction and in accordance with Eversource's specifications, best management practices, final engineering plans, and the conditions specified in approvals obtained for the Project. This section describes the procedures and methods that would be used to construct the Project facilities. During actual construction, certain work activities and sequences may vary, based on factors such as site-specific conditions, final Project designs and the requirements of regulatory approvals.

4.1 UNDERGROUND TRANSMISSION CABLE CONSTRUCTION PROCEDURES

The proposed 115-kV underground transmission cable system would be constructed principally within or adjacent to public roads. Public roads provide both linear corridors for the cable route and roadway access along the entire cable system for construction and maintenance.

The Project's underground 115-kV cable system would consist of XLPE electric transmission cables, which would be contained within a concrete-encased duct bank (consisting of several PVC conduits), as well as concrete splice vaults. One splice vault would be buried at intervals of approximately every 1,800 feet along the route.

In addition, three fiber optic cables would be installed in the duct bank. Two fiber optic cables are required for remote protection and control of the cable system and associated equipment, and the other fiber optic cable is for monitoring the operating temperature of the cables. A ground continuity conductor would also be installed for grounding the cable sheaths and equipment within the proposed splice vaults. The fiber optic cables would be spliced and pulled into a precast hand hole located near each splice vault location.

4.1.1 Land Requirements

Eversource proposes to install the underground cable system principally within or adjacent to public road ROWs in Newington, West Hartford, and Hartford. The exact location of the duct bank and the splice vaults within or adjacent to such roads would be determined based on final engineering designs, taking into consideration the constraints posed by existing buried utilities and the location of other physical features.

4.1.1.1 Duct Bank Requirements for In-Road Construction

The installation of a transmission cable system within a public road usually requires a minimum width of 30 feet to accommodate the excavation of the cable trench, equipment, and temporary storage of equipment. Installation of the cable system within public roads would require coordination with other underground and overhead utilities and permission from the three involved municipalities and the Connecticut Department of Transportation (ConnDOT; for state roads) regarding the location of the cable facilities and concurrence concerning the methods and schedule to be used to install the cable system.

4.1.1.2 Splice Vault Requirements for in-Road Construction

The outside dimensions of splice vaults for 115-kV XLPE cables are approximately 8 feet wide by 8 feet high and 24 feet long. The installation of each splice vault therefore typically requires an excavation area approximately 12 feet wide, 12 feet deep, and 28 feet long. The actual burial depth of each vault would vary, based on site-specific topographic conditions and on the depth of the adjacent cable sections that must interconnect within the vault (the depth of the cables at any location would be based on factors such as the avoidance of other buried utilities).

Vaults may be installed within paved travel lanes of public roadways. However, in order to avoid conflicts with existing buried utilities in public roadways, they may be installed in suitable locations adjacent to such roads (e.g., beneath parking lots, sidewalks, road shoulders, or road medians). Some such locations may be within the public road ROWs, but outside of road travel lanes.

4.1.1.3 Duct Bank and Splice Vault Requirements for Off-Road Construction

Although Eversource proposes to locate the cable system within public road ROWs to the extent possible, there may be locations where the duct bank or splice vaults would have to be located outside of such ROWs due to constraints, such as the presence of underground utilities, etc. To construct the underground cable system outside of public road ROWs, Eversource would coordinate with the affected property owner(s) to obtain both a temporary easement, consisting of space to accommodate construction activities (e.g., materials storage, construction equipment), and a permanent easement, comprised of space for future maintenance and repair activities as well as for the installed cable system components.

Within the easements for the off-road cable facilities, certain uses such as the development of structures and growth of trees over the duct bank and/or splice vault would be prohibited to avoid damage and impacts to the operation of the cables.

4.1.1.4 Construction Support Areas

To support the underground cable system a contractor yard(s), as well as other staging, storage, and laydown support areas will be required. During construction, areas for temporarily storing and staging construction materials and equipment would be required in the vicinity of the cable route. To the extent possible, these construction support areas would be sited on previously disturbed property (e.g., Eversource property, existing parking lots, and properties formerly used for other types of construction staging, such as highway work). Landowner permission and regulatory approvals (as appropriate) would be obtained for the temporary use of such sites.

Generally, Eversource's Project contractor(s) would establish one or more primary construction yards near the Project area. Such yards, which usually encompass several acres in size, are used to store construction equipment, bulk materials (including the conduits and splice vaults), and supplies, as well as to park contractor vehicles. Materials may also be assembled in the yards before they are delivered to work sites. After the completion of construction, the yard sites would be restored.

In addition, smaller staging areas would be established near active construction work sites. Such staging areas, established within or adjacent to roads (e.g., within paved travel lanes, on road shoulders, on road medians, in parking lots), would be used temporarily to park equipment, establish sanitary facilities, and store limited amounts of materials needed for cable system installation (e.g., trench boxes, backfill material). Material deliveries would be more frequent in areas where less storage space is available.

As construction progresses along the route, temporary support sites would be moved to keep equipment and materials near work locations. Once a temporary construction support area is no longer needed, it would be restored as near to its previous condition as possible.

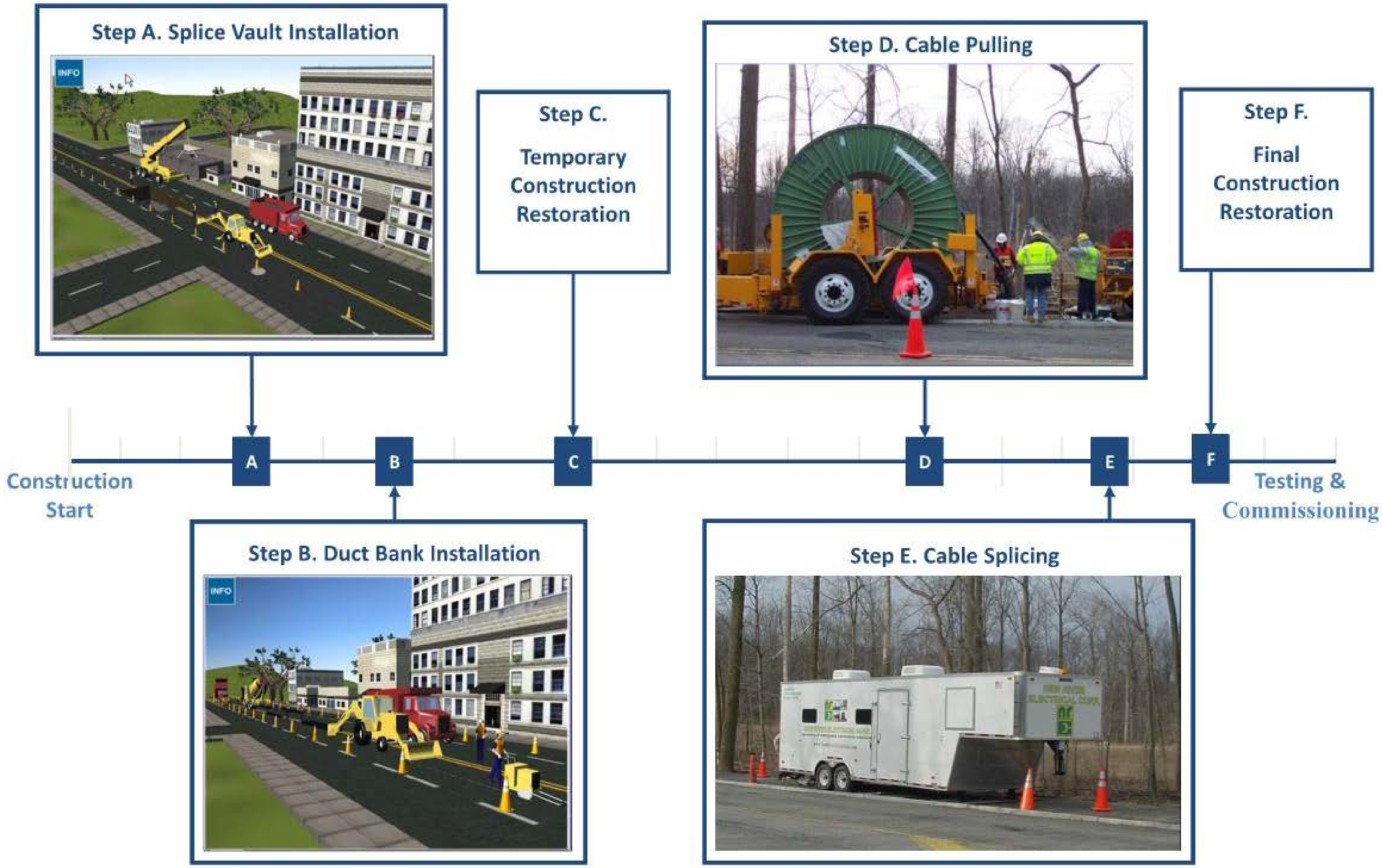
4.1.2 General Construction Sequence: Cable Systems in or Adjacent to Road ROWs

The following typical construction activities are involved in underground cable installation within or adjacent to roads:

- Establish traffic control procedures to minimize traffic disruption and provide a safe working environment;
- Excavate for and install splice vaults;
- Sawcut and remove pavement and excavate a trench for the cable conduits;
- Install the conduits;
- Encase the conduits in concrete;
- Backfill the trench with excavated spoils and/or a concrete-like substance known as a fluidized thermal backfill (FTB) and repave disturbed areas;
- Pull the cables into the conduits;
- Splice the cables within the splice vaults; and
- Complete site restoration work (e.g., paving), as necessary.

The sequence in which some of these construction activities are performed depends on site-specific factors and construction scheduling. The types of activities generally involved in an underground cable system installation along or adjacent to a road ROW are illustrated on Figure 4-1 and discussed in more detail below.

Figure 4-1: Typical Underground Cable-System Construction within Road ROW



4.1.2.1 Pre-Construction Planning

Prior to starting construction, Eversource would complete pre-construction planning activities which would involve consultation with the three involved municipalities and the ConnDOT, and conducting site-specific studies and surveys aimed at designing a construction pathway for the Project that would minimize adverse effects. Construction details would be provided in the Project's Development and Management (D&M) Plan, which must be developed after receipt of the Council's Certificate and which must be approved by the Council prior to the start of construction. In addition to the preparation of the D&M Plan, typical pre-construction planning activities would include, but not be limited to:

- Conduct surveys to identify existing underground and above ground infrastructure along the cable route and, in accordance with consultations with the infrastructure facility owners, develop plans for avoiding such facilities or for temporarily or permanently relocating the facilities (such as electric, gas, water, sewer, telecommunication facilities, utility poles, traffic signals, hydrants and bus stops).
- Perform studies of soil and groundwater conditions along the Proposed Route and prepare plans for soil and groundwater handling during construction.

4.1.2.2 Typical Construction Sequence

The first step in the underground cable construction process would be to deploy appropriate erosion and sedimentation controls (e.g., catch basin protection, silt fence or straw bales) at locations where pavement or soils would be disturbed. Construction of the Project would conform to Eversource's *Best Management Practices Manual Connecticut Construction & Maintenance Environmental Requirements* (2011: BMP Manual, available on Eversource's website at http://www.transmission-nu.com/contractors/pdf/CT_BMP.pdf). Within roads and other paved areas, the pavement then paved areas, the pavement then would be sawcut and removed.

To install the duct bank, a trench would be excavated approximately 6 to 10 feet deep and approximately 5 feet wide (for trench depths requiring shoring to stabilize the sidewalls). Excavated material (e.g., pavement, subsoil) would be placed directly into dump trucks and hauled away to a suitable disposal site or hauled to a temporary storage site for screening /

testing prior to final disposal or re-used in the excavations for backfill. If groundwater is encountered, dewatering would be performed in accordance with authorizations from applicable regulatory agencies and may involve discharge to catch basins, temporary settling basins, temporary holding tanks (frac tanks), or vacuum trucks.

The duct bank system would consist of 8-inch PVC conduits for the XLPE cables; 2-inch PVC conduits for the ground continuity conductors and temperature sensing fiber, and 3-inch PVC conduits for the fiber optic relaying cables and the temperature sensing fiber cables. The conduit would be installed in sections, each of which would be about 10 to 20 feet long and would have a bell and spigot connection. Conduit sections would be joined by swabbing the bell and spigot with glue then pushing the sections together. After installation in the trench, the conduits would be placed into spacers that hold the conduit in the desired configuration and then encased in high strength concrete. The trench would then be backfilled with excavated spoils or FTB with sufficient thermal characteristics to help dissipate the heat generated by the cables. Refer to Figure 3-3 for a cross-section of this installation.

Trenching, conduit installation, and backfilling would occur all along the project route. For a given work crew at a given location, this work would proceed progressively along such that relatively short sections of trench (typically 200 feet per crew) would be open at any specific 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. Disturbed areas would be permanently repaved as part of final restoration.

At intervals of approximately 1,800 feet along the 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 shipped) and site constraints, both above and below grade, that would impact the ability to place a vault at a given location. The specific locations of splice vaults would be determined during final engineering design and in some areas could be closer than the 1,800 foot interval stated above.

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.

After the vaults and duct bank are in place, the conduits would be swabbed and tested (proofed), using an internal inspection device (mandrel), to check for defects. Mandrelling is a testing procedure in which a “pig” (a painted aluminum or wood cylindrical object that is slightly smaller in diameter than the conduit) is pulled through the conduit. This is done to ensure that the “pig” can pass easily, verifying that the conduit has not been crushed, damaged, or installed improperly.

After successful proofing, the transmission cables and ground continuity conductors would be installed and spliced. Cable reels would be delivered by special tractor trailers to each splice vault location, where the cable would be pulled into the conduit using a truck-mounted winch and special cable handling equipment. A single cable would be pulled into place within each conduit.

To install each transmission cable, ground continuity conductor, communications cable, and temperature-sensing fiber-optic cable within the conduits, the large cable reel would be set up over the splice vault, and a winch would be set up at one of the adjacent splice vault locations. The cables and the ground continuity conductors (during a separate mobilization) would then be inserted in the conduits by winching a pull rope attached to the ends of each cable. The splice vaults would also be used as pull points for installing the communications cables temperature sensing fiber-optic cables under a separate pulling operation. In addition, pull boxes would be installed near the splice vaults for the pulling and splicing operations required for the remaining fiber optic cables.

After the transmission cables and ground continuity conductors are pulled into their respective conduits, the ends would be spliced together in the vaults. Because of the time-consuming and precise nature of splicing high-voltage transmission cables; the sensitivity of the cables to moisture, which reduces cable life; and the need to maintain a clean working environment; splicing XLPE cables involves a complex procedure that requires a controlled atmosphere. This "clean room" atmosphere would be provided by an enclosure or vehicle that must be located over the manhole access points during the splicing process. It is expected to take approximately five to seven days to complete the splices in each splice vault (three XLPE 115-kV cable splices in each splice vault). Each cable and associated splice would be stacked vertically and supported on the wall of the splice vault on a racking system.

At Newington and Southwest Hartford Substations, terminations would be connected to the ends of the cables. These terminations would link the underground cables to switches and bus work within the substations.

4.1.2.3 Trout Brook Crossing

The underground cable system would cross only one open watercourse, Trout Brook in the Town of West Hartford. Eversource proposes to install the cable system beneath this watercourse utilizing open-trench excavation. This method would involve excavating a trench for the underground cable system directly through the stream bed and any associated riparian wetlands.

This "open-trench" method, which will minimize the amount of time required to install the cable crossing, would incorporate appropriate construction management techniques to maintain stream flow around the work area, allowing the actual trenching and cable system installation process to be performed "in the dry". This approach will minimize sedimentation and thus water quality impacts. Construction techniques to accomplish this include, but are not necessarily limited to, alternatives such as the use of temporary flume pipes, culverts, and coffer dams.

After completion of the installation across the watercourse the trench will be backfilled to the pre-construction stream-bed grade, with the upper portion of the backfill utilizing native soils or streambed material of the same nature, type and characteristics as the adjacent soils or streambed material and the bank will be restored.

The Trout Brook crossing would be performed in accordance with the specifications of the CT DEEP and United States Army Corp of Engineers (USACE), as applicable.

4.1.2.4 Rock Removal and Dewatering

Since underground cable installation would involve both the excavation of a continuous trench and areas for splice vaults, rock and/or groundwater could be encountered in some areas. Where bedrock or boulders are at or near the surface or groundwater is encountered, special construction measures would be employed, as described below.

4.1.2.4.1 Groundwater

If groundwater is encountered, the trench or splice vault excavation would be dewatered as necessary. Depending on authorizations from state and local regulatory agencies, dewatering activities could result in groundwater discharge to catch basins, temporary settling basins, sanitary sewer, or watercourses (if the water is sufficiently free of sediments). Alternatively, the water may be pumped into a tank truck for off-site disposal. Any dewatering activity would be in accordance with permit conditions.

4.1.2.4.2 Rock Removal

Rock would be removed using mechanical methods, or mechanical methods supplemented by controlled drilling and blasting, if necessary. If blasting is required, a controlled drilling and blasting plan would be developed by a certified blasting contractor and approved by Eversource, in compliance with state and local regulations. Business owners and residents along the route would be consulted in advance of the blasting. Pre-blast surveys would be performed as appropriate, and the specific locations where controlled blasting would be required along the route would be determined by conducting field studies (borings).

4.1.2.5 Construction Schedule and Traffic Coordination

The installation of the cable facilities within public road ROWs would be carefully scheduled to minimize adverse effects on traffic and adjacent land uses. Construction work would be accomplished in stages (refer to Figure 4-1), each of which would require in-road activities that would temporarily affect traffic patterns in the localized vicinity.

These activities would be performed sequentially, but not continuously. Thus, after the installation of a splice vault in a particular location, the disturbed portion of the roadway would be temporarily repaved. Additional construction work at that particular splice vault would not be required until cable pulling and splicing. Therefore, at the completion of one stage of construction, there would be no other effect on traffic or adjacent land uses in that immediate area until the next phase of construction commences.

The length of a typical construction work zone within a road ROW would be 600 to 800 feet. This area is needed to accommodate both construction materials and equipment. Within this work zone, approximately 100 feet of complete trenching and conduit installation would generally be achievable in a day. In areas where special construction measures are required (e.g., to excavate rock, dewater the trench), trenching and conduit installation progress would be slower and less than 100 feet would be achieved in a typical work day.

Eversource would consult with ConnDOT and local officials to schedule construction activities to minimize interference with traffic and adjacent land uses to the extent possible. The timing of construction work would be a function of the characteristics of the road ROW, traffic volumes, and adjacent land uses. Such time frames for construction would be discussed with each of the affected municipalities and, for installation of the cable within state road ROWs, with ConnDOT.

In order to minimize potential conflicts with traffic flow and business operations though areas bordered principally by commercial uses along the proposed cable route, it is anticipated that, if possible, construction would occur at night or during other non-peak travel times. Night construction would require lighting and would result in localized noise and glare. Installation of the Project facilities within public road ROWs where adjacent land uses are predominantly residential, such as Cherry Hill Drive, would likely occur during daylight hours, to minimize potential effects on residents during the nighttime, when noise sensitivity is greater.

4.1.2.6 Typical Construction Equipment

The equipment typically required for the installation of underground cable systems within roads is listed by construction phase, as follows:

Site Preparation

- Traffic cones, signs, warning lights, barricades and other devices to control vehicular and pedestrian circulation, in compliance with municipal and state procedures.
- Transport trucks to deliver portable field offices, sanitary facilities, equipment, and construction materials.

General Construction Activities

- Vehicles to transport personnel.
- Trucks to haul sanitary and solid wastes from construction sites.
- Pickup trucks for supplies.

Earth Work

- Sawcutting equipment to cut the road pavement.
- Backhoe, excavator and hand tools for trench excavation.
- Earth hauling trucks to remove excavated materials from site.
- Portable air compressors with pneumatic excavating tools.
- Water pumps when dewatering is required.
- Frac tanks for settling of removed groundwater
- Pneumatic drivers for shoring.
- Temporary shoring.
- Pavement breakers.
- Boring, jacking or tunneling equipment where required.
- Thick steel plates to cover the trench as needed.

Installation

- Side booms, fork lifts and cranes to handle pre-cast splice vaults, conduit, equipment and materials.

- Ready-mix concrete trucks and pumps for encasing the conduits and any cast-in-place splice vaults that might be required if pre-cast vaults cannot be installed.
- Truck-mounted winch to pull cable, and trailers containing the reels of cable.
- Radio equipment for communications between splice vaults.
- Splicing trailers to regulate splice vault environment during splicing.
- Trucks carrying testing and miscellaneous equipment.

Backfill and Restoration

- Backhoe.
- Concrete trucks or dump trucks delivering thermal backfill.
- Tampers, compactors.
- Paving equipment.
- Tree spades, small cranes, pickup and flatbed trucks to deliver and install landscape plantings (if required).

4.2 SUBSTATION CONSTRUCTION PROCEDURES

To accommodate the new 115-kV facilities at the existing Southwest Hartford and Newington Substations, Eversource proposes to expand both stations, increasing the size of the developed yards (fenced area) at each site. In contrast, the proposed modifications to Berlin Substation would occur within the station's existing fenced area.

The construction of these substation improvements would involve similar sequences of activities. However, because the facilities to be installed and the modifications at each substation vary, the construction procedures for each substation are discussed separately in the following subsections. Actual sequences and construction methods may vary based on the characteristics of each site and the final specific engineering designs for each station.

The typical equipment required to install the new facilities at the three substations would be similar, and would typically include bulldozers, backhoes, man-lift vehicles, compressors, trucks (various sizes), large capacity crane (e.g., 100-ton), and flat-bed trailers.

4.2.1 Newington Substation

A sequential construction approach would be used to modify Newington Substation. Work would include the primary activities, as described below.

4.2.1.1 Site Preparation

Site preparation activities will include vegetation removal within the substation expansion areas, followed by grading and filling as necessary to create a level area to accommodate the new substation facilities. The substation will require a retaining wall along the south side due to the existing grade. This retaining wall will be installed first, along with fill necessary to bring the remainder of the station to the desired elevation. Details regarding wall type, fill quantity, and site grading will be finalized as part of the final design process.

These modifications will require the relocation of the substation perimeter fence, which will be extended by 30 feet to the south and 30 feet to the east. For security and safety concerns, this fence will be erected in conjunction with the site preparation.

Temporary erosion and sedimentation (E&S) controls (e.g., silt fence, hay/straw bales) would be installed prior to the filling and grading work. Such controls would be maintained and replaced as necessary throughout the construction and would conform to best management practices for E&S control, including those provided in the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control* and the Company's BMP Manual.

4.2.1.2 Foundation Construction

Foundation construction would commence after the completion of rough grading. Foundations will be required for all steel structures that support electrical equipment: bus, terminal structure, CCVT, arrestor, circuit breaker and disconnect switch. The foundation installation process would involve excavation, form work, steel reinforcement, and concrete placement. Excavated material would either be reused on-site or disposed of off-site in accordance with applicable requirements.

4.2.1.3 Installation of Equipment

After the foundations are installed, construction activities would shift to the erection of steel-support structures for electrical equipment, such as insulators, buswork, circuit breakers, lightning masts, and disconnect switches. In addition, protection and control conduits as well as ground-grid conductors would be installed beneath the substation grade. Protection and control conduits will be roughly 2 feet to 4 feet below grade. The ground grid will be roughly 1.5 feet below grade. Construction efforts will also support an additional enclosure necessary to house Protection and Control Equipment.

4.2.1.4 Wiring, Testing and Interconnections

All of the new substation equipment would be tested prior to final connection to the transmission grid. This includes all low voltage equipment installed in the control enclosure for protection and control. New structures and associated conductors would be installed to connect the new transmission line terminals at Newington Substation, to the new 115-kV underground transmission facilities.

4.2.1.5 Final Cleanup, Site Security and Restoration

As the final phase of Project construction at the substation, areas of disturbed soils within the substation fence will be surfaced and stabilized with trap rock or gravel. Areas of disturbed soils located outside of the station fence typically will be seeded, mulched, and allowed to re-vegetate in low-growing shrub or grass species.

Any remaining construction debris would be collected and removed from the site. Temporary erosion controls would be maintained until the areas affected by construction are satisfactorily stabilized.

The substation perimeter fence, as expanded to accommodate the Project modifications, will be maintained to prevent unauthorized access to the site.

4.2.1.6 Overhead Transmission Construction Procedures: Newington Tap

The Newington Tap will require moving the transmission line entry from the current bay position on the east side to a new bay position on the south side of the substation. The following summarizes the activities, materials, and equipment generally expected to be involved in the relocation of the line entry.

- Survey and stake the proposed structure locations and flag vegetation clearing boundaries and tree trimming.
- Identify and mark areas to be avoided (e.g., sensitive cultural or environmental resource areas).
- Perform vegetation clearing and trimming
- Install erosion and sedimentation controls in accordance with the best management practices for E&S control, including those provided in the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control* and the Company's BMPs.
- Construct new access roads provide a minimum travel-way of 16 to 20 feet in width (overall a 20-to-25-foot-wide footprint, including road shoulders). This typically requires bulldozers or front loaders, excavators, dump trucks for crushed stone or gravel, pickups or stake-body trucks for culverts, and/or mat installers for wetland mats. Gravel and stone roads may be permanent for use during both construction and the subsequent maintenance of the lines. Roads must have sufficient width and capacity for heavy construction equipment for both over-the-road and off-road vehicles, including oversized tractor trailers.
- Prepare level work (crane) pads as necessary at new structure sites, conductor pulling sites. Work pad installation may involve grading and requires the installation of a stable base (consisting of gravel, construction mats, or equivalent) for drilling and other structure installation equipment.
- Construct structure foundations and erect / assemble new structures, This requires flat-bed trucks for hauling new structure components, new hardware, and augers, other trucks for hauling reinforcing rods, drill rigs, cranes, concrete trucks for structures that require concrete for foundations, dump trucks for structures that require crushed rock backfill, and bucket trucks. Dump trucks are also needed for foundation work if excess excavated material has to be removed from the ROW. In wet conditions or if groundwater is encountered during excavation, pumping (vacuum) trucks or other suitable equipment would be used to pump water from the

excavated areas. The water then would be discharged in accordance with applicable local, state, and federal requirements.

- Install counterpoise, where needed. Depending on site-specific soil conductivity, supplemental grounding will be installed. A ditch witch is typical equipment for this activity.
- Install shield wires, Optical Ground Wire (OPGW), and conductors. The equipment required for these activities would include conductor reels, conductor pulling and tensioner rigs, and bucket trucks. Helicopters also may be used to install the initial pulling lines for the conductors or shield wires.
- Demolish and remove from the property the existing structures being replaced, as well as the existing shield wires, conductors, and other line materials on the spans being removed. The equipment required for these activities would be generally the same as required for installing the new structures, conductors, and OPGW, as described above.
- Maintain temporary erosion and sediment controls until vegetation is re-established or disturbed areas are otherwise stabilized. After site stabilization is achieved, all temporary erosion and sedimentation controls that are not biodegradable (e.g., geotextile material, twine, stakes) would be removed from the ROW and disposed of properly.

4.2.2 Southwest Hartford Substation

A sequential construction approach, similar to that described for Newington Substation, would be used for the Project modifications to Southwest Hartford Substation. At Southwest Hartford Substation, the eastern fence line would be expanded 65 feet to the east to increase the size of the developed portion of the station in order to accommodate the new 115-kV cable facilities and related equipment. The primary construction activities are described below.

4.2.2.1 Site Preparation

Site preparation activities will include vegetation removal within the substation expansion areas, followed by grading and filling as necessary to create a level area to accommodate the Project modifications. These modifications will require the expansion of the substation perimeter fence. For security and safety concerns, this fence will be erected in conjunction with the site preparation activities. Details regarding final fence line layout, access road modifications, extent of tree removal, civil site design, and vegetation design will be finalized as part of the final design process

Temporary erosion and sedimentation controls (e.g., silt fence, hay/straw bales) typically would be installed in conjunction with the filling and grading work. Such controls would be maintained and replaced as necessary throughout the construction process and would conform to best management practices for E&S control, including those provided in the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control* and the Company's *BMP Manual*. The primary objective of these controls would be to minimize the potential for off-site erosion and sedimentation, particularly given the location of the substation property adjacent to the tributary to the South Branch of the Park River.

4.2.2.2 Foundation Construction

Foundation construction would commence after the completion of rough grading. Foundations will be required for all steel structures that support electrical equipment: bus, terminal structure, CCVT, arrestor, circuit breaker and disconnect switch. The foundation installation process would involve excavation, form work, steel reinforcement, and concrete placement. Excavated material would either be reused on-site or disposed of off-site in accordance with applicable requirements.

4.2.2.3 Installation of Equipment

After the foundations are installed, construction activities would shift to the erection of steel-support structures for electrical equipment, such as insulators, buswork, circuit breakers, reactors, lightning masts, and disconnect switches. In addition, protection and control conduits, as well as ground-grid conductors would be installed beneath the substation grade. Protection and control conduits will be roughly 2 feet to 4 feet below grade. The ground grid will be roughly 1.5 feet below grade.

4.2.2.4 Wiring, Testing and Interconnections

All of the new substation equipment would be tested prior to final connection to the transmission grid. This includes all low voltage equipment installed in the control enclosure for protection and control. New structures and associated conductors would be installed to connect the new 115-kV transmission line terminals at the existing substations, to the new 115-kV underground transmission facilities.

4.2.2.5 Final Cleanup, Site Security and Restoration

After the Project construction work at the substation is complete, any remaining construction debris would be collected and removed from the site. Temporary erosion controls would be maintained until the disturbed areas that are not otherwise developed are satisfactorily stabilized. The substation perimeter fence will be intact during the entire construction sequence and there will be no access for general public to the site before, during and after construction. The work area would be surfaced with trap rock or gravel.

4.2.3 Berlin Substation

All of the Project modifications at Berlin Substation will be within the fence line of the existing substation. As a result, whereas the construction sequence for the proposed modifications at Berlin Substation are similar to those described for Newington and Southwest Hartford Substations, no vegetation removal or grading / filling is expected to be required.

4.2.3.1 Site Preparation

At Berlin Substation, the areas where the new facilities are proposed are presently graded and surfaced with crushed rock. Eversource's contractor would remove the crushed rock surfacing, re-compact the earth, and install temporary erosion and sedimentation controls (e.g., silt fence, straw bales) if necessary[10]. If required, these controls would be maintained

[10] Controls would not be installed if there is no potential for off-site erosion or sedimentation, or if the placement of the controls within the developed portion of the substation would affect construction activities or worker safety.

throughout the construction process and would conform to best management practices for E&S control, including those provided in the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control* and the Company's BMPs.

4.2.3.2 Foundation Construction

Foundation construction typically would involve excavation, form work, use of steel reinforcement, and concrete placement. Foundations will be required for all steel structures that support electrical equipment: bus, arrestor, circuit breaker, reactor, capacitor, potential transformer and disconnect switch. If large boulders or bedrock are encountered, mechanical rock removal would be used. Excavated material would either be reused on-site or disposed of off-site in accordance with applicable requirements.

4.2.3.3 Installation of Equipment

After the foundations are installed, construction activities would shift to the erection of cable terminations, as well as structures and equipment, including circuit breakers, insulators, bus work, capacitors and disconnect switches. In addition, protection and control conduits as well as ground grid would be installed beneath the substation grade. Protection and control conduits will be roughly 2 feet to 4 feet below grade. The ground grid will be roughly 1.5 feet below grade. The work area would be surfaced with trap rock or gravel.

4.2.3.4 Wiring, Testing and Interconnections

All of the equipment would be commission-tested prior to final connection to the transmission grid. This includes all low voltage equipment installed in the control enclosure for protection and control. New structures and associated conductors and wires would be installed, as necessary, to connect the existing substation equipment.

4.2.3.5 Final Cleanup, Site Security and Restoration

After the Project construction work at the substation is complete, any remaining construction debris would be collected and removed from the site. Areas affected by construction excavation work would be re-stabilized by re-surfacing with gravel or trap rock. Temporary erosion controls, if required, would be removed upon the completion of trap rock or crushed stone stabilization.

4.3 OPERATION AND MAINTENANCE

4.3.1 Cable System

The 115-kV cable system will be monitored and maintained in accordance with Eversource's standard procedures.

4.3.2 Substations

The proposed Project modifications to the three existing Eversource substations would not substantially affect or alter existing maintenance practices at these facilities.

4.3.3 Overhead Transmission

The overhead transmission system will be monitored and maintained in accordance with Eversource's standard procedures.

4.3.4 Emergency Operations and Shutdown

If the transmission cables experience failure, then high-speed protective relaying would immediately remove the line from service, thereby protecting the public and the line. If equipment at the stations experiences a failure, then protective relaying would immediately remove the equipment from service, thereby protecting the public and the equipment within the substations.

Protective relaying equipment is incorporated into the Project design to automatically detect abnormal system conditions and send a protective trip signal to the respective circuit breaker(s) at each end of a line to isolate the faulted section of the transmission system. The protective relaying schemes include fully redundant primary and backup equipment. This ensures that if a line or station equipment failure were to occur at the time when one of the protective relaying schemes fails or is removed from service for maintenance, the redundant protective relaying scheme would initiate the removal from service of the faulted transmission facility being monitored.

Fiber optic cables will provide a robust and reliable communications path for the protective relaying systems. There will be two independent runs of fiber installed in parallel to the new 115kV underground cable from Southwest Hartford to Newington. Additionally, existing relaying will also utilize the overhead transmission line facilities for electronic communications between substations using signals impressed upon line conductors ("carrier signal") for protective relaying and operations.

4.3.5 Fire Suppression Technology

Smoke detection systems are already in place in the existing relay and control enclosures at the three Project substations. In the event that smoke is detected, these smoke detection systems would automatically activate an alarm at the Connecticut Valley Electric Exchange (CONVEX), and the system operators then would take the appropriate action. The relay / control enclosures at each station are equipped with fire extinguishers.

The new protective relaying and associated equipment within the substations, along with a Supervisory Control and Data Acquisition (SCADA) system for remote control and equipment monitoring, would be installed in the existing relay and control enclosures.

4.3.6 System Security

Pursuant to Section VI.N.4 of the Council's A*pplication Guide*, a description of siting security measures for the proposed Project facilities, consistent with the Council's "White Paper on the Security of Siting Energy Facilities", will be prepared. This security description will be included in the Project's Application to the Council.

5. DESCRIPTION OF EXISTING ENVIRONMENT

This section describes the existing environmental and cultural resources along, and in the vicinity of, the proposed new 115-kV transmission line route, as well as at and near Eversource's existing Newington, Southwest Hartford, and Berlin Substations. Section 5.1 discusses the existing environmental and cultural conditions along and in vicinity of the proposed new 115-kV transmission line, whereas Section 5.2 describes the existing environmental and cultural conditions at Newington, Southwest Hartford, and Berlin Substations. The information concerning these existing environmental and cultural conditions reflects the results of baseline data research (e.g., as available through the Connecticut Environmental Conditions Online viewers[11]), as well as field investigations conducted along the proposed 115-kV transmission line route and at the three substation sites. Supporting documents (e.g., wetlands and watercourses report, cultural report) are provided in Volume 2.

Aerial-photographic based maps depicting the existing environmental and cultural conditions in the Project vicinity are included in Volume 3. The principal environmental conditions, land use features, and natural resources shown on the Project maps include, but are not are limited to:

- Location of existing ROWs, transmission line structures, and Eversource transmission lines in the vicinity of the Newington, Southwest Hartford, and Berlin Substations;
- Location of Eversource fee-owned properties;
- Municipal boundaries;
- Municipal zoning classifications;
- Topography;
- Federal and state jurisdictional wetlands;
- Water resources, including streams, and rivers;

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[11] http://www.cteco.uconn.edu/

- Special Flood Hazard Areas including floodplains, as designated by the Federal Emergency Management Agency (FEMA);
- Public recreational, scenic, open space, and other protected areas, including forests, parks, water supply areas, hunting / wildlife management areas, and designated recreational trails;
- Schools and community facilities; and
- Existing infrastructure, including roads, utility corridors, and railroads.

5.1 PROPOSED TRANSMISSION LINE ROUTE

The Proposed Route for the new 115-kV transmission cable traverses approximately 3.8 miles underground in a general northerly to northeasterly direction, extending between Eversource's existing Newington Substation, located in the Town of Newington, and the existing Southwest Hartford Substation, located in the City of Hartford. The cable system would be aligned within or adjacent to existing state and local road ROWs, through portions of the towns of Newington and West Hartford and the City of Hartford, in Hartford County, Connecticut.

5.1.1 Topography, Geology, Soils

5.1.1.1 Topography

The Proposed Route is situated within the Central Valley (or Newark Terrane), which is located within the Connecticut River Valley.[12] This region is characterized by relatively flat areas bordered by variably hilly terrain with local areas of considerable topographic relief, mostly along the western portion of the route in Newington. Elevations along the route generally range from approximately 50 feet to 200 feet above mean sea level. The principal topographic feature along the route is associated with Trout Brook in West Hartford.

[12] Connecticut Geologic Survey Department of Energy and Environmental Protection. 1990, revised 2013.

5.1.1.2 Geology

Based on examinations of geologic mapping, the eastern portion of the Proposed Route primarily traverses areas with glacial meltwater deposits, whereas the western portion of the route is largely characterized by thin till deposits. The Proposed Route does not traverse any traprock ridge or amphibolite ridge areas as identified in the Connecticut General Statutes (CGS) Chapter 124, § 8-1aa (1). No rocky outcrops were identified in or near the route. The glaciers and the associated outwash meltwaters have resulted in a flattened Connecticut River Valley. Bedrock is comprised of brownstone, which is a sedimentary rock that erodes easily; therefore, the Central Valley is almost totally free of boulders that the glaciers deposited elsewhere[13]. The predominant surficial deposits along the Proposed Route are comprised of fine glacial meltwater deposits with flat to moderate topography. Bedrock depths generally exceed 30 feet beneath the sand, gravel, and fines deposits and are often more than 100 feet below the ground surface. Floodplain deposits, which are post-glacial deposits comprised of alluviums of fine outwash, are found in association with Trout Brook. Bedrock is generally deep (greater than 30 feet) beneath these floodplain deposits.

5.1.1.3 Soils

Based on examination of soil mapping[14], information regarding the soils along the Proposed Route is provided in Table 5-1. This table summarizes the principal soil associations along and in the general vicinity of the Proposed Route. The table also identifies farmland soils classified by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) as Prime Farmland or Statewide Importance Farmland. For compilation purposes, Table 5-1 includes soils identified in the vicinity of the Proposed Route and around all three substations. Numbers in parentheses following soil names are mapping codes as designated by the NRCS.

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[13] Bell, Michael, The Face of Connecticut, People, Geology, and the Land: Geological and Natural History Survey of Connecticut, Bulletin No. 23, 1985

[14] U.S. Department of Agriculture, Natural Resources Conservation Service Web Soil Survey, accessed 2015

Table 5-1: Soils and Soil Characteristics

Unit No.	Name	Slope (%)	Parent Material	Hydric Soil	Depth to Restrictive Feature (inches)	Depth to Water Table (inches)	Farmland	Bedrock	Proposed Route	Newington Substation	Southwest Hartford Substation	Berlin Substation
9	Scitico, Shaker, Maybid soils	0-5	very deep, poorly drained soils formed in silty and clayey sediments	Yes	>72	10-12	Statewide Important	Very deep	Yes	No	No	Yes
20A	Ellington silt loam	0-5	moderately well drained soils formed on coarse loamy eolian deposits over glaciofluvial deposits	No	>72	18-30	Prime	Very deep	No	Yes	No	No
26A	Berlin Silt loam	0- 3	moderately well drained and somewhat poorly drained soils formed in silty, clayey glaciolacustrine deposits	No	>72	12-30	Prime	Very deep	No	No	No	Yes
30B	Branford silt loam	3-8	very deep, well drained soils formed in loamy over sandy, gravelly outwash	No	>72	>6 feet	Prime	Very deep	Yes	Yes	No	No
40A	Ludlow silt loam	0-3	moderately well drained soils formed in loamy lodgment till	No	24-40	18-30	Prime	Very deep	No	No	No	Yes
87B	Wethersfield loam	3-8	Coarse-loamy lodgment till derived from basalt and/or sandstone and shale	No	20-40 to Densic material	18-30	Prime	Very deep	Yes	No	No	Yes
104	Bash Silt Loam	3- 8	very deep, somewhat poorly drained soils formed in recent alluvial deposit, In nearly level soils on floodplains	Yes	>72	6-18	Statewide Important	Very deep	Yes	No	No	No
225B	Brancroft [Bancroft]-Urban land complex	0-8	very deep, moderately well drained soils formed in silty, clayey glacial lacustrine deposits	No	>72	18-30	None	Very deep	Yes	No	No	No
230B	Branford Urban Land Complex	0-8	Well drained soils formed on coarse loamy eolian deposits over glaciofluvial deposits	No	>72	>6 feet	None	Very deep	No	Yes	No	No
306	Udorthents-Urban land complex	varies	Urban land, variable. Udorthents are soils disturbed by filling.	No	>72	54-72	None	Very deep	Yes	No	Yes	No
307	Urban land	varies	Urban land, variable	No	Variable	Variable	None	Variable	Yes	No	No	Yes
308	Udorthents, smoothed	varies	Urban land, variable. Udorthents are soils disturbed by filling.	No	>72	24-54	None	Very deep	Yes	No	Yes	No
309	Udorthents, flood control	varies	Moderately well drained. Udorthents are soils disturbed by filling.	Possible Inclusions	>72	24-54	None	Very deep	Yes	No	No	No

Source: USDA NRCS, Online Soil Surveys, Geographic Data and Soil Data Mart Information of Hartford County, accessed July 2015.

Along the Proposed Route, soils identified as Prime Farmland located within the Town of Newington include Branford (30B) and Wethersfield (87B). In addition, mapped Statewide Important Farmland soils, such as Scitico, Shaker, and Maybid (9) and Bash (104), are found in the vicinity of the route in Newington. Both of the Statewide Important Farmland soils are also considered hydric (see definition below). In Newington, the Proposed Route extends lands which have been developed for residential uses. Therefore, none of these mapped farmland soils are used for agricultural purposes. No agricultural uses are present along the vegetated portion of the ROW, which is in Newington.

A portion of the area along Trout Brook to the west of the Proposed Route is identified as Statewide Important Farmland Soils (Bash); however, the soils along and in the vicinity of the proposed crossing of Trout Brook are not characterized as farmland. The remainder of the Project area is comprised of soils not identified with farmland importance.

The baseline soils information obtained from the NRCS maps and surveys is a supplement to the field investigations that are required to identify Connecticut wetlands, which are defined based on the presence of poorly drained, very poorly drained, or floodplain soils. Soils identified along the Proposed Route are primarily well-drained with water tables greater than 18 inches, no or moderate slopes, and very deep bedrock. Where wetlands are identified, soils are poorly drained.

5.1.2 Water Resources

Water resources in the Project area include watersheds and drainage basins, inland wetlands, watercourses (intermittent and perennial streams and rivers), waterbodies (ponds), and floodplains. Also discussed in this section are surface and groundwater resources, including public water supplies and water quality. Water resources (i.e., state and federal wetlands and watercourses) along the Proposed Route were identified and delineated through field investigations conducted during May and June 2015.

5.1.2.1 Watersheds

The Proposed Route is located within three different watersheds,[15] all of which are located in the Connecticut River (major and regional) drainage basins. Within these watersheds, the Proposed Route crosses two watercourses. The three watersheds and associated watercourse crossings along the Proposed Route are:

- **Piper Brook Watershed**: This watershed encompasses the southern portion of the Project Area and includes Newington Substation. Within this watershed, the Proposed Route crosses one watercourse: a culverted, unnamed tributary to Piper Brook. The Proposed Route would cross this watercourse in two locations in West Hartford; beneath Newington Road (State Route 173) north of the intersection with Sampson Street and near the intersection of Sampson Street and Madsen Road.
- **Trout Brook Watershed:** This watershed encompasses the central portion of the Project area. Within this watershed, the Proposed Route traverses Trout Brook adjacent to South Quaker Lane in West Hartford.
- **Park River Watershed:** This watershed encompasses the northern portion of the Project area. Watercourses located within this watershed in the Project area include the unnamed tributary to the South Branch of the Park River, which borders Southwest Hartford Substation. This tributary intersects with the Park River east of the substation, past the railroad tracks. The Proposed Route does not cross this tributary.

5.1.2.2 Wetlands

Given the suburban / urban areas traversed by the Proposed Route, wetlands along and in the vicinity of the transmission line route are limited to the undeveloped vegetated areas found adjacent to Newington Substation and within Eversource's existing transmission line and distribution line ROWs that extend into the substation. No wetlands will be crossed by the Proposed Route.

[15] CT DEEP sub-regional watershed summary fact sheets.

Maps provided in Volume 3 illustrate the locations of the wetlands within the general Project area. Wetlands are located near the transmission line route in the vicinity of Newington Substation. Specific descriptions of wetlands and field data forms are included in the *Wetlands and Watercourses Report* provided in Volume 2, including the jurisdictional designation of each wetland (i.e., state, federal). This report summarizes the characteristics of each wetland and watercourse investigated for the Project and includes representative photographs and associated data forms. During the field delineations, wetlands and watercourses were field-demarcated using numbered flagging. These boundary flags were subsequently surveyed using a Trimble Global Positioning System (GPS) survey unit with flag coordinates differentially corrected and plotted onto the Project maps provided in Volume 3.

5.1.2.3 Watercourses

Three watercourses located within the Project area include the unnamed tributary to Piper Brook, which crosses under Newington Road and Sampson Street in in Newington, Trout Brook in the approximate center of the Project area in West Hartford, and an unnamed tributary to the South Branch of the Park River adjacent to Southwest Hartford Substation in Hartford.

At the proposed crossing location, Trout Brook is approximately 70 feet wide from bank to bank. The northern bank at the proposed crossing location is armored and covered by a wooded canopy. Limited tree cover is present near the proposed crossing at the south bank, and this area is characterized by maintained grass areas and parking areas.

At the proposed crossing locations, the unnamed tributary to Piper Brook is culverted and located beneath the roadways noted above. As observed through storm sewer drainage grates, the unnamed tributary to Piper Brook appears to be approximately 5 feet wide beneath the roadways and the flow was slow and shallow (several inches).

Though no crossing is proposed here, the unnamed tributary to the South Branch of the Park River near Southwest Hartford Substation is approximately 25 feet wide from bank to bank. Tree cover exists in the area. The stream is culverted beneath New Park Avenue.

In accordance with *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979), used for the National Wetlands Inventory (NWI), watercourses in the Project area are classified on the NWI maps as Riverine unconsolidated bottom[16] (RUB) that are permanently flooded (i.e., Trout Brook) or Palustrine unconsolidated bottom (PUB) (i.e., Beachland Pond) that are permanently flooded. These habitats may also be defined as Palustrine Open Water (POW). Areas of open water may exist as man-made or natural waterbodies. This habitat was observed in Trout Brook, the unnamed tributary to Piper Brook and in the unnamed tributary to the South Branch of the Park River. The Proposed Route does not cross any rivers designated as a National Wild and Scenic River under the National Wild and Scenic Rivers Act (16 U.S.C. §§ 1271-1287). The Connecticut Protected Rivers Act (CGS §§ 25-200 through 25-210) requires the CT DEEP to adopt a list of rivers in the state considered appropriate for designation as protected river corridors. To date, the CT DEEP has not designated any rivers along the Proposed Route under the Protected Rivers Act.

5.1.2.4 Waterbodies

Only one waterbody, Beachland Park Pond, is located within the Project area. This pond is situated west of the Proposed Route, within Beachland Park, at 847 South Quaker Lane in West Hartford. The Proposed Route extends along South Quaker Lane at the entrance to Beachland Park, which is located approximately 150 feet to the east of this pond. The water quality classification for this pond is Class A.

5.1.2.5 Floodplains

FEMA classifies Special Flood Hazard Areas, including flood zones, for insurance and floodplain management purposes and has prepared maps designating certain areas according to the frequency of flooding. An area within the 100-year flood designation has a 1% chance of flooding each year or is expected to flood at least once every 100 years. An area within the 500-year flood designation has a 0.2% chance of flooding each year.

[16] "Unconsolidated bottom" is a term used to describe wetland and deepwater habitats with at least 25% cover of particles smaller than stones, and a vegetative cover less than 30%.

A review of FEMA maps indicates that the Proposed Route extends across the 100-year flood zone associated with Trout Brook. No floodplain is mapped in association with Piper Brook where the unnamed tributary crosses beneath the Proposed Route in Newington. The floodplain associated with the South Branch of the Park River is discussed in the Section 5.2.2 (Southwest Hartford Substation). Mapped floodplains in the Project area are shown on the Volume 3 maps. In addition, Trout Brook is managed for flood control purposes by the CT DEEP and in certain locations is bordered by a levee. No Project construction activities will affect the levee or other flood control measures.

5.1.2.6 Surface Water Quality

The CT DEEP maintains detailed water resources information concerning the drainage basins in Connecticut and promotes watershed management efforts to improve water quality. As a central element of the state's clean water program, the CT DEEP also has established Water Quality Standards and Classifications, which identify the water quality management objectives for each waterbody. Overall, Connecticut's water quality policies are established to protect surface and groundwater from degradation; restore degraded surface waters to conditions suitable for fishing and swimming; restore degraded groundwater to protect existing and designated uses; and to provide a framework for establishing priorities for pollution abatement. The use goals that the state has established for surface waters are summarized in Table 5-2.

Table 5-2: Summary of Connecticut Water Use Goals – Surface Waters

Water Resource Class	Classification Use Description
Class AA	Public water supply, fish and wildlife habitat, recreation.
Class A	Potential public water supply, fish and wildlife habitat, recreation, industrial water supply, agricultural water supply.
Class B	Fish and wildlife habitat, recreation, industrial water supply, agricultural water supply, discharge of treated wastewaters.
Class C, D	Goal is Class B. Impaired water quality affecting one or more Class B uses.

The watercourses along and in the immediate vicinity of the Proposed Route have a CT DEEP-designated water resource class of either A (Trout Brook) or B (unnamed tributary to the Piper Brook). The following provide CT DEEP's description of each water resource segment along or near the Proposed Route:

- **Piper Brook (Segment 2) (CT4402-00_02):** This impaired segment of Piper Brook has a water quality classification of B, due to elevated bacteria concentrations, affecting the designated use of recreation. Designated uses include habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. As there are no designated beaches in these segments of Piper Brook, the specific recreation impairment is for non-designated swimming and other water contact related activities.
- **Trout Brook (Segment 1) (CT4403-00_01):** This segment of Trout Brook, which includes the Proposed Route crossing, is approximately 1.1 miles long and begins at the upstream side of I-84 near Exit 42 and ends at the confluence with Piper Brook above the South Branch Park River just downstream of the railroad crossing near New Britain Avenue in West Hartford. This segment has been altered by human activities, including rerouting and channelization prior to 1985 and has a water quality classification of A due to elevated bacteria concentrations, affecting the designated use of recreation. Designated uses include potential drinking water supply, habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. As there are no designated beaches in these segments of Trout Brook, the specific recreation impairment is for non-designated swimming and other water contact related activities.
- **South Branch of the Park River (Segment 2) CT4400-01_02):** This impaired segment of the unnamed tributary to the South Branch of the Park River has a water quality classification of B, due to elevated bacteria concentrations, affecting the designated use of recreation. Designated uses include habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. As there are no designated beaches in this segment, the specific recreation impairment is for non-designated swimming and other water contact related activities.

5.1.2.7 Groundwater Quality, Public Water Supplies, and Aquifer Protection Areas

According to the USDA NRCS, in the vicinity of the Proposed Route, groundwater ranges from 6 inches below soil surface to greater than 6 feet deep, depending on soil type and location on the landscape (i.e., elevation above mean sea level). The use goals that the state has established for groundwater are summarized in Table 5-3. The groundwater for the majority of the Proposed Route located east of South Quaker Lane and Newington Road is identified as Class GB, which reflects the developed characteristics of the general region. Groundwater along the southwestern of the Project area is designated as Class GA in Newington.

Table 5-3: Summary of Connecticut Water Use Goals – Groundwater

Water Resource Class	Classification Use Description
Class GAA	Public water supply.
Class GAAs	Existing or potential public supply, stream base flow industrial and miscellaneous, tributary to a public reservoir. Natural quality, or suitable for drinking
Class GA	Existing private water supply and potential public water supply suitable for drinking without treatment.
Class GB	Industrial water supply and miscellaneous non-drinking supply.
Class GC	Assimilation of wastes, such as landfill leachate.

There are no public water supplies (either wells or reservoirs) located within the Project area. In the vicinity of the Proposed Route, potable water service is provided by the Metropolitan District Commission (MDC), a public non-profit municipal corporation created by the General Assembly in 1929 to provide quality potable water and sewer systems for people and businesses in the Hartford area. The MDC serves Bloomfield, East Hartford, Hartford, Newington, Rocky Hill, West Hartford, Wethersfield and Windsor.[17] The primary source of supply for the MDC is from reservoirs located approximately 1.5 miles west of the

[17] http://www.themdc.com/what-we-do/geographic-information-services Accessed July 2015

Project area. According to the CT DEEP's Aquifer Protection Area Program, there are no designated Aquifer Protection Areas within the Project area.[18]

5.1.3 Biological Resources

Biological resources include vegetative communities, wildlife and fisheries resources, vernal pools, and rare species (plants and wildlife). The biological resources along the Proposed Route are discussed below. No vernal pools were observed or identified during vernal pool assessments performed in the Project area in the spring of 2015.

5.1.3.1 Vegetative Communities

Vegetation along the Proposed Route consists principally of lawns and landscaping characteristic of urban / suburban environments. From a vegetative community perspective, the "urban areas" designation refers to urban and suburban residential developments, subdivisions, areas developed for industrial or commercial use, recreational areas (such as parks), maintained lawns, and roadside vegetation. In addition, near Newington Substation, Eversource's managed ROWs provide shrub-scrub and other habitats.

Near the Proposed Route, Beachland Park is the largest open space / recreational area,; this park is characterized by approximately 25 acres of lawn, lawn, mature trees, playing fields (soccer, baseball), and landscaping. Trout Brook flows through Beachland Park is bordered by areas of riparian vegetation.

Eversource's existing transmission and distribution line ROWs, which extend into Newington Substation, include a mix of vegetative associations and cover types, providing a variety of wildlife habitats that are otherwise not present along the Proposed Route. Eversource manages the vegetation along these ROWs to ensure consistency with existing transmission and distribution line use and conductor clearance requirements.

Similarly, although most of the lands near the terminus of the Proposed Route at Southwest Hartford Substation are developed for commercial or industrial purposes, the riparian

[18] http://www.ct.gov/deep/cwp/view.asp?a=2685&q=322248 Accessed July 2015

corridor along the tributary to the South Branch of the Park River is characterized by forested and open water habitats.

Overall, in addition to urban areas, five habitat types / land uses were documented in the Project area, either within the managed portions of the existing Eversource ROWs or along the Proposed Route.

- **Old Field / Shrub Land**: This habitat type includes Eversource's existing managed ROWs, in most areas proximate to the substations. The ROW is maintained in accordance with a vegetation management program to periodically remove woody vegetation. As a result, the predominant vegetation types within the managed portions of these ROWs consist of successional cover types such as dense shrub and herbaceous species (old field / shrubland).
- **Upland Forest**: This forest type includes mature mixed deciduous / coniferous forests and woodland adjacent to the existing ROW in upland areas. Mature mixed forests consist typically of tree species common to the Northeast such as maples, oaks, hickories, spruce, and pine. Only minor areas of upland forest occur in the Project area. The ratio of deciduous to coniferous species and age of stands varies.
- **Scrub-Shrub Wetland**: Palustrine Shrub Swamp (PSS) areas exist in portions of the wetlands identified along existing ROW areas near Newington and Berlin Substations. These types of wetlands typically include components of emergent marsh, where shrub coverage is not substantial.
- **Emergent Wetland**: Palustrine Emergent marshes (PEM) exist in portions of the wetlands identified along existing ROW areas near Newington and Berlin Substations and are dominated by herbaceous wetland plant species. This habitat is located adjacent to Trout Brook in two areas.
- **Open Water**: Open water resources include the unnamed tributary to Piper Brook and Trout Brook, as well as the unnamed tributary to the South Branch of the Park River and Beachland Pond.

5.1.3.2 Wildlife

The following summarizes the wildlife habitats and some of the wildlife species that commonly occur in the vegetative communities found along the Proposed Route.

- **Urban Lands**: Cover types located in the Project area include suburban and urban residential areas, commercial and industrial developments, developed recreational areas (e.g., municipal parks and playgrounds), maintained lawns, and road corridors. Wildlife in these habitats can be abundant, as animals are attracted to human food sources (e.g., bird feeders, landfills), but the species inhabiting them must be tolerant to some degree of human disturbance. Some of the most recognizable wildlife species can be found in these areas, such as white-tailed deer, raccoons, woodchucks, and birds such as Canada geese, robins, house sparrows, and other numerous bird species frequenting feeders. Other less visible species, such as red fox, coyotes and skunk are also common. Nuisance wildlife species such as crows, rats, and other small rodents are also often abundant in these habitats. Some wildlife species are even dependent on human activity to thrive, such as birds nesting almost exclusively in human structures (e.g., chimney swift, starlings). Reptiles and amphibians tend to be scarce in these habitats because they are typically less tolerant of human activity than birds or mammals.
- **Old Field / Shrub Lands**: Species inhabiting these areas rely on herbaceous vegetation, grasses, shrubs, and young trees for food and cover. Mammalian wildlife typical of these habitats include small mammals such as meadow voles, short-tailed shrews, and deer mice; woodchuck, rabbit, and white-tailed deer; and predators such as red fox, coyote, weasel, skunk, and raccoon. Various species of shrubland birds, reptiles, and amphibians are also typically present. Due to the surrounding residential / urban nature of the managed ROW proximate to Newington Substation, only a smaller percentage of these species would likely be found in this habitat.
- **Upland Forest**: Upland forest is present in minor areas in proximity to the Proposed Route, but is very limited in land area and is largely fragmented from other forest blocks. In general, forest vegetation supports a high diversity of wildlife. White-tailed deer may frequent mature deciduous forest areas in the fall when oak and beech mast crops are available for food, but move in the winter into coniferous areas providing better shelter from snow and wind. At other times, deer would utilize

wetlands or residential areas. Other mammal species typically common in forested habitats include rabbit, coyote, fox, striped skunk, Virginia opossum, chipmunk, squirrel, and numerous smaller mammals (e.g., deer mouse, red-backed vole, shrews, and bats). Various species of birds, as well as reptiles and amphibians also are common in forested areas. Birds typical of forested areas include raptors (owls, hawks), wild turkey, woodpeckers, and numerous species of songbirds. Reptiles and amphibians likely to occur in forested areas include salamanders, as well as certain species of toads, frogs, turtles and snakes.

- **Forested Wetlands / Scrub-Shrub Wetlands / Emergent Wetlands / Open Water:** Freshwater wetlands found along the managed ROW and other aquatic habitat (e.g., streams, ponds) provide excellent habitat for a wide range of wildlife species. Many of the species using forested and shrubland habitats also utilize forested wetland, shrub swamp, shallow marsh, or wet meadow communities. Additionally, there are species that are adapted primarily to wetland or other aquatic habitat. These include beaver, muskrat and water shrew, as well as birds such as herons, waterfowl and certain types of raptors and songbirds. Reptiles and amphibians are particularly adapted to wetlands and aquatic habitats. Typical species include mole salamanders and, at some time in their life-cycle, frogs, turtles and snakes. Due to the existing residential / urban nature of the area, species variety and habitat use is anticipated to be low in these areas.

According to the CT DEEP, Connecticut Critical Habitats depicts the classification and distribution of 25 rare and specialized wildlife habitats in the state. No Critical Habitats have been identified within the Project area.

5.1.3.3 Fisheries

The Proposed Route crosses two freshwater watercourses which support fish populations although no published data defines these watercourses as containing fish habitat. Despite the name “Trout Brook”, there is no CT DEEP information to indicate that this watercourse is part of CT DEEP’s 1999 *Trout Management Plan*, developed based upon the compilation of fish population, physical habitat and water chemistry information for approximately 800 Connecticut streams. In addition, the CT DEEP’s *2015 Connecticut Angler’s Guide* did not identify any of the watercourses within the Project area as fisheries habitat although this

Guide did identify Beachland Park Pond located to the west of the Proposed Route as sunfish habitat. No fisheries information was noted for the unnamed tributary to Piper Brook or the unnamed tributary to the South Branch of the Park River. The unnamed tributary to Piper Brook is culverted in the proposed crossing location and would not support fish populations. No crossing is proposed of the culverted unnamed tributary to the South Branch of the Park River.

5.1.3.4 Rare Species

To assess the potential for federal or state listed species to occur in the Project area, Eversource conducted baseline data research and evaluated habitats during field surveys of the Project area. As described below, no federal or state rare species have been mapped or identified in the field within the Project area.

Specifically, Eversource used the U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation System (iPAC) to determine whether there is a potential for the Project to affect species identified by federal authorities as threatened, endangered or species of concern, or Critical Habitat. The iPAC data indicated that the Northern Long-eared Bat (*Myotis septentrionalis*) is the only federally -listed species in the Project area. However, no critical habitat (e.g., roosting sites, etc.) is known or has been designated for this species in the Project area. The proposed Project area does not support large stands of mature trees that are preferred habitat for this species.

In addition, Eversource reviewed the CT DEEP's publically available Natural Diversity Database (NDDB), which provides general polygons that depict approximate locations of state- and federal-listed species and significant natural communities. This research indicated that there are no CT DEEP NDDB mapped polygons or known species within the Project Area. NDDB confirmed that there are no known state-listed species in the Project Area. On September 2, 2015, NDDB[19] provided concurrence that "there are no anticipated impacts to state-listed species based on the maps and proposed activities for this project."

[19] Dawn McKay, CT DEEP, via email communication

5.1.4 Land Use

5.1.4.1 Existing Land Uses

The Proposed Route would be aligned within or adjacent to existing state and local road ROWs through Newington, West Hartford and Hartford. Lands in the Project area are characterized by a variety of uses and types, predominantly transportation corridors (state and local roadways) and residential, commercial, and industrial developments. Recreational areas and community facilities also are located along or near the Proposed Route.

To identify and assess land uses along the Proposed Route, as well as existing and future land use plans and conditions in the Project area, Eversource consulted existing published resources utilizing a geographic information system (GIS); analyzed aerial photography and maps; examined state, local, and regional land use plans; and reviewed data concerning public and private recreational resources, including the CT DEEP's watershed summary sheets. In addition, Eversource conducted research to identify whether any parcels preserved by local land trusts (e.g., West Hartford Land Trust, Wintonbury Land Trust in Bloomfield, etc.) are located near the Proposed Route.

Based on this research, Eversource determined that the Project is not located near any Connecticut Heritage Areas, national scenic or historic trails, state- or federally-designated scenic highways, or ConnDOT scenic land strips[20]. Similarly, no land trust parcels are located along or in the immediate vicinity of the Proposed Route.

As shown on the Project mapping, several dominant land uses are evident within the Project area. These general land uses include commercial / industrial, retail, and residential. The following summarizes the primary land use patterns, by town, along and in the vicinity of the Proposed Route.

- **Town of Newington:** The Proposed Route would traverse approximately 0.7 miles in northwestern portion of the Town of Newington. Specifically, the Proposed Route would extend north from Newington Substation adjacent to Eversource's existing

[20] http://ctecoapp1.uconn.edu/simpleviewer/ezviewer.htm Accessed July 2015

station access road, and then would turn east along Cherry Hill Road and north onto South Main Street before crossing into West Hartford. Adjacent to the roads within which the cable system would be located, land uses consist of single-family residences.

- **Town of West Hartford:** The Proposed Route traverses approximately 2.6 miles through the Town of West Hartford. From the Newington border, the Proposed Route would be aligned within or adjacent to State Highway 173 (Newington Road) where it crosses New Britain Avenue (State Highway 71) toward the Elmwood Community Center. The Proposed Route would traverse through the Community Center's parking lot to an unnamed access road where the route turns west onto Burgoyne Street until the intersection with South Quaker Lane. The route would then follow South Quaker Lane north crossing Trout Brook adjacent to Beachland Park. At the intersection with Talcott Road, the route would diverge from South Quaker Lane, following Talcott Road east to New Park Avenue and extending north along New Park Avenue to the border with the City of Hartford. In West Hartford, land uses in the vicinity of the Proposed Route include a mix of single- and multi-family residences, public and private recreational areas (including the Elmwood Community Center property, Beachland Park, Trout Brook, and Trout Brook Trail), and commercial / industrial properties. Commercial and industrial properties are predominant along portions of Talcott Road and New Park Avenue.
- **City of Hartford:** The Proposed Route follows New Park Avenue into Hartford for approximately 0.5 mile, crossing under I-84 / US Highway 6 before extending west into Southwest Hartford Substation. In Hartford, land uses in the vicinity of the Proposed Route include a mix of residences and commercial / industrial developments.

5.1.4.2 Open Space / Recreational Areas

The Proposed Route does not cross any national wildlife refuges, forests, or parks, or state-designated Wildlife Management Areas (WMAs) or greenways (CGS § 2-100). The Proposed Route traverses or is located adjacent to West Hartford's Beachland Park and Pool, as well as Trout Brook Trail, and the Elmwood Community Center. These recreational areas are described below and are depicted on the Volume 3 maps.

- **Beachland Park and Pool:** The Beachland Park and Pool, which is owned and managed by the Town of West Hartford, encompasses approximately 25 acres and is located west of South Quaker Lane adjacent to and south of Trout Brook. The area includes Beachland Pond, which is open during the summer, playing fields (soccer, baseball), basketball courts, a playground, and clubhouse. The Proposed Route is planned for location within or adjacent to South Quaker Lane, near the park's paved parking lot.
- **Trout Brook Trail:** The Trout Brook Trail is part of West Hartford's long-term greenway project to provide a safe and enjoyable route for walkers and bicyclists. Phase 2 (begun in Spring 2014) will expand the trail along the west side of Trout Brook Drive between South Quaker Lane and Jackson Avenue. Presently, access to the Trail is via the Beachland Park parking area; the paved Trail extends for approximately 1 mile along the south bank of Trout Brook in the immediate vicinity of South Quaker Lane. An unpaved portion of trail is located on the north bank of Trout Brook, atop the flood control structures.
- **Elmwood Community Center:** The Elmwood Community Center, which is owned and managed by the Town of West Hartford, is a multi-purpose facility used for both educational and recreational purposes. The center offers a variety of year-round leisure activities, instructional programs, and special events. Facilities include an auditorium, gymnasium, dance studio, pottery and ceramics studio, billiards, library, lounge area, classrooms, meeting rooms, and kitchen facilities. The Center also houses the YMCA Elmwood Early Learning Center which hosts a child care program.

5.1.4.3 Designated Protected and Scenic Resources

The Proposed Route does not traverse any designated national scenic areas or state heritage corridors, as designated in July 2009 pursuant to Connecticut Public Act No. 09-221 (CGS § 23-81). As set out in CGS § 23-81, a heritage area is defined as a place within Connecticut that has historic, recreational, cultural, natural, and scenic resources that form an important part of the state's heritage.

The proposed 115-kV underground transmission line would be located near two areas that have scenic attributes: Trout Brook Trail and Beachland Park and Pool. However, neither of these areas is designated as scenic in local or regional land use plans.

5.1.4.4 Community Facilities

The Council's *Application Guide for Electric and Fuel Transmission Facilities* (April 2010; Section VI.G) specifies that the application shall include a proposed route map or aerial photo of the proposed route showing its proximity to certain community facilities must be identified. These facilities include public and private schools, licensed daycare centers, licensed youth camps, and public playgrounds; hospitals; group homes; and recreational areas. A review of public records indicates the Proposed Route is not located within 500 feet of any schools, licensed child day-care facilities, youth camps, hospitals, or group homes with the exception of the Elmwood Community Center as shown in Table 5-4.

The community facilities near the Proposed Route are summarized in Table 5-4 and are shown on the Volume 3 maps. The Proposed Route runs below the access road and a portion of the parking lot of the YWCA child care facility at the Elmwood Community Center, and also traverses or is near two recreational areas (Trout Brook Trail and Beachland Park).

5.1.4.5 State, Regional, and Local Land Use Plans

Eversource reviewed available information concerning federal, state, regional, and local land use plans, including Connecticut's *Conservation and Development Policies Plan*, 2013-2018 (*C&D Plan*), prepared by the Connecticut Office of Policy and Management, and consulted with representatives of the three municipalities along the Proposed Route.

Table 5-4: Community Facilities in General Vicinity of the Proposed Route[21]

Facility Type	Name	Address	Distance from Proposed Route
School	Charter Oak School	425 Oakwood Avenue West Hartford	1,400 feet west of Proposed Route at New Park Avenue
School	Wolcott Elementary School	71 Wolcott Road West Hartford	2,000 feet north of Proposed Route at Cherry Hill Road
School	St. Brigid School	100 Mayflower Street West Hartford	700 feet west of Proposed Route at South Quaker Lane
School	Anna Reynolds Elementary School	85 Reservoir Road Newington	1,000 feet south of substation
Child day care center	YWCA Child Care – Elmwood Center	1106 New Britain Avenue West Hartford	20 feet west of Proposed Route at Elmwood Center access road and parking lot
Day care / group home	CRT-ECE Grace Street Center	37 Grace Street Hartford	1,750 feet north of Southwest Hartford Substation
Day care / group home	Hartford Job Corps Academy Child Development Center	100 Wm. Shorty Campbell St. Hartford	2,000 feet east of Proposed Route at New Park Avenue
Day care / group home	Our Lady of Fatima Day Care Center	40 Fatima Square Hartford	1,000 feet north of Southwest Hartford Substation
Day care / group home	NECCI at Anna Reynolds	85 Reservoir Road Newington	1,250 south of substation
Day care / group home	West Hartford Extended Experience – Charter Oak School	425 Oakwood Avenue West Hartford	1,400 feet west of Proposed Route at New Park Avenue
Day care / group home	YWKidslink at Wolcott School	71 Wolcott Road West Hartford	2,000 feet north of Proposed Route at Cherry Hill Road
Day care / group home	St. Agnes Home Family Center Day Care	104 Mayflower Street West Hartford	1,600 feet west of Proposed Route at South Quaker Lane
Day care / group home	West Hartford YMCA St. Brigid School Age Program	100 Mayflower Street West Hartford	700 feet west of Proposed Route at South Quaker Lane
Recreational Areas	Trout Brook	at South Quaker Lane West Hartford	Adjacent to Proposed Route at South Quaker Lane
Recreational Areas	Beachland Park and Pool	847 South Quaker Lane West Hartford	Adjacent to Proposed Route at South Quaker Lane
Playing Fields	Goodrich Fields	Corner of Flatbush Avenue and South Quaker Lane West Hartford	1,000 feet north of Proposed Route
Playing Fields	Sterling Field adjacent to Charter Oak School	365 Price Boulevard West Hartford	1,500 feet north of Proposed Route in Talcott Road
Playing Fields	Wolcott Park	Off Chatfield West Hartford	2,500 feet north of Proposed Route at Cherry Hill Road

[21] http://www.dir.ct.gov/dcf/Licensed_Facilities/listing_CCF.asp Accessed July 2015

5.1.4.5.1 State and Regional Plans

The objective of the *C&D Plan* is to guide and balance response to human, environmental, and economic needs in a manner that best suits Connecticut's future. Based on the general planning information provided in the *C&D Plan*, the Project is consistent with the overall goals and objectives of the *C&D Plan* and is particularly relevant to the Plan's Growth Management Principle #1: Redevelop and Revitalize Regional Centers and Currently Planned Infrastructure. The Project would serve a public need by providing an environmentally-sound approach to the reliable transmission of electricity, which, as the *C&D Plan* (p. 8) notes is needed, along with other physical infrastructure, to "…take full advantage of Connecticut's strategic location within the Northeast Megaregion[22], while also proactively addressing the needs and desires of a changing demographic base."

According to the Locational Guide Map for the Proposed Route, the majority of the route is located in Neighborhood Conservation areas with the exception of the area of work in the City of Hartford which is mapped as Regional Center and the Trout Brook crossing which is identified as open space, preservation, and conservation areas.

"Neighborhood Conservation Areas" are defined as, "Support for maintenance of basically stable developed neighborhoods and communities as well as intensification of development when supportive of community stability and consistent with the capacity of available urban services." "Regional Centers" are defined as, "Highest priority for affirmatively supporting rehabilitation and further development toward revitalization of the economic, social, and physical environment of Regional Centers."

In addition, the Capitol Region Council of Governments (CRCOG) services the municipalities along the Proposed Route.[23]. Eversource reviewed the ***2014-2024 Regional*** *Plan of Conservation and Development* (POCD) adopted May 21, 2009 by CRCOG. While the CRCOG POCD does not speak directly to electric transmission projects or the electric infrastructure, although it does support clean energy initiatives, the Growth Management

[22] Megaregions are clustered networks of American cities that may share infrastructure systems, economic linkages, environmental systems, topography, etc.

[23] http://www.ct.gov/sots/cwp/view.asp?q=392406 Accessed July 2015

Principle #1: Redevelop and Revitalize Regional Centers and Area with Existing or Currently Planned Infrastructure identifies the need for development relative to existing and proposed utility improvements. The Project is consistent with this overall goal.

5.1.4.5.2 Local Land Use Plans

To evaluate the consistency of the proposed Project with land management objectives, the plans listed below were obtained and reviewed. All three municipalities traversed by the Proposed Route have published POCDs as summarized below. In general, these plans identify the areas traversed by the Proposed Route as continuing to maintain current land use patterns in the future (e.g., public recreational or protected lands, low-density residential development, commercial / industrial areas). None of the plans identify local land use policies that would be inconsistent with the development of the new 115-kV transmission line.

Newington: *2010 – 2020 Town Plan of Conservation and Development (June 30, 2010)*: The Newington POCD has the following goals, which describe the importance of maintaining and improving the electric infrastructure within the community.

- **Business Development General Goals:** Ensure that commercial and industrial areas are fully serviced with public utilities and adequate roadway capacity to accommodate future growth.
- **Utility Infrastructure General Goals:** (1) Provide for adequate utility infrastructure to meet community needs; and (2) Use utility infrastructure to support the desired overall community structure.

West Hartford: *2009 – 2019 West Hartford Plan of Conservation & Development* (2009): The West Hartford POCD does not directly address electric transmission projects or the electric infrastructure, although it does support clean energy initiatives.

Hartford: *2020 Hartford's Plan of Conservation and Development* (June 2010, reissued June 2011): The Hartford POCD does not directly address electric transmission projects or the electric infrastructure, although it does support clean energy initiatives.

5.1.5 Cultural (Historical and Archaeological) Resources

Heritage Consultants LLC (Heritage), a firm specializing in historical and social sciences, was retained by Eversource to compile and prepare a report about the history and prehistory of the Project area. The objectives of this report were: (1) to gather and present data regarding previously identified cultural resources situated within the vicinity of the proposed project items; (2) to investigate the proposed project region in terms of its natural and historical characteristics; and (3) to evaluate the need for completing additional cultural resources investigations.

The Heritage *Cultural Resources Review of the Project Region Associated with the Greater Hartford Connecticut Reliability Project* (May 19, 2015) which addresses both archaeological and historic resources, is included Volume 2. The Heritage report is based on information obtained from the Office of State Archaeology, previously published technical studies of cultural resources, reviews of the National or State Registers of Historic Places (NRHP / SRHP) listings, the Historic American Engineering Record (HAER) Connecticut Inventory, and consultations with the State Historic Preservation Office (SHPO) and the Connecticut State Archaeologist.

The SHPO is responsible for reviewing projects to ensure that significant cultural resources would be protected or otherwise preserved. In Connecticut, the SHPO is part of the Department of Economic and Community Development. Eversource has provided the Heritage report to the SHPO for review and is committed to working with the SHPO in protecting and mitigating potential impacts to preserve Connecticut's cultural heritage.

At this time, there are no potential impacts to any historical or archaeological resources along the Proposed Route. Cultural resources identified in the Project area are provided in the Table 5-5.

Table 5-5: Cultural Features

Name	Location	Town	Type	Approximate Distance from Proposed Route
Sarah Whitman Hooker House	1237 New Britain Avenue	West Hartford	NRHP	2,800 feet west of Proposed Route in West Hartford
Charles E. Beach House	18 Brightwood Lane	West Hartford	NRHP	3,000 feet west of Proposed Route in West Hartford
Royal Typewriter Co. Building	New Park Avenue	Hartford	NRHP	800 feet northeast of Southwest Hartford Substation (Site burned down in 1992)
Unnamed Greek Revival House	1168 New Britain Avenue	West Hartford	NRHP	1,400 west of Proposed Route in West Hartford
Timothy Goodman House	567 South Quaker Lane	West Hartford	NRHP	2,800 feet north of Proposed Route in West Hartford
Parkville Historic District	See Heritage report	Hartford	NRHP Historic District	300 north of Southwest Hartford Substation
Newington Junction North Historic District	See Heritage report	Newington	NRHP Historic District	650 feet east and south of Proposed Route in Newington

5.1.6 Soil and Groundwater Areas of Environmental Concern

Because portions of the Proposed Route extend through urbanized areas that have previously been used for various commercial and industrial purposes, Eversource commissioned a review of published data concerning potential areas of environmental concern with respect to soil and groundwater oil / hazardous materials conditions. Accordingly, state and federal regulatory information for potential sites of environmental concern located in the vicinity of the Project area was compiled

As an initial screening, environmental release related and hazardous material storage database listings were reviewed on or immediately adjacent to the Proposed Route. Each database listing was evaluated for its potential to result in current contamination beneath the corridor segment. Areas that appear to have a high likelihood of encountering soil or groundwater contamination during excavation, based on listings directly along the Proposed Route include: New Park Avenue, Flatbush Avenue – South Quaker Lane to Price Boulevard, New Britain Avenue, and State Highway 173.

5.1.7 Air Quality and Noise

5.1.7.1 Air Quality

Ambient air quality is affected by pollutants emitted from both mobile sources (e.g., automobiles, trucks, fuel burning equipment) and stationary sources (e.g., manufacturing facilities, power plants, and gasoline stations). Naturally occurring pollutants, such as radon gas or emissions from forest fires, also affect air quality.

In addition to emissions from sources within the state, Connecticut's air quality is significantly affected by pollutants emitted in states located to the south and west, and then transported into Connecticut by prevailing winds. Ambient air quality in the state is monitored and evaluated by the CT DEEP. Air quality conditions are assessed in terms of compliance with the National Ambient Air Quality Standards (NAAQS) for selected "criteria" pollutants, as well as conformance with regulations governing the release of toxic or hazardous air pollutants. Criteria pollutants include sulfur dioxide, carbon monoxide, nitrogen dioxide, particulate matter, lead, and ozone.

Hartford County is in conformance with all NAAQS established by the Federal Clean Air Act Amendment standards, except for the 8-hour ozone criterion.

The U.S. Environmental Protection Agency (EPA) has determined that carbon dioxide (CO_2) is a pollutant and has included CO_2 in its list of criteria pollutants. Areas of non-attainment have not yet been established for CO_2 or other greenhouse gases.

In an effort to reduce particulate emissions, the CT DEEP has promulgated regulations (RCSA § 22a-174-18) that prohibit unnecessary idling for more than three minutes. Exceptions are made for weather extremes and certain service vehicles.

5.1.7.2 Noise

Existing noise levels in the vicinity of the Proposed Route vary as a function of land use, and can be expected to range from sound levels typical of an urban environment to those typical of quiet, residential areas. Noise levels are also variable throughout the day, and are influenced by diverse factors such as vehicular traffic, commercial and industrial activities and outdoor activities typical of suburban environments. Table 5-6 lists typical sound levels associated with different types of environments and activities.

The ambient noise environment along the Proposed Route also varies. For instance, the southwestern portion of the route (near Newington Substation and north to New Britain Avenue) is generally characterized by residential development. In comparison, the New Britain Avenue area, as well as Talcott Road and North Park Avenue are bordered by commercial and industrial uses typical of a busy urban environment. In addition, the existing noise environment is influenced by traffic noise, including I-84, as well as the Amtrak Railroad corridor, and the CT*fastrak* corridor, also known as the New Britain-Hartford Busway. CT*fastrak*, which generally is aligned parallel to and east of the northern portion of the Proposed Route, is a bus rapid transit line located between Hartford and New Britain, Connecticut. The CT*fastrak* opened to the public on March 28, 2015.

The State of Connecticut has noise regulations (RCSA §§ 22a-69-1 to 22a-69-7.4) identifying the sound limits that can be emitted by certain types of land uses. The state regulations define daytime vs. nighttime noise periods; classify noise zones based on land use; and identify noise standards for each zone. Table 5-7 summarizes Connecticut's noise zone standards, by emitter (source) and receptor (receiver) noise classification. In general, the regulations specify that noise emitters must not cause the emission of excessive noise beyond the boundaries of their noise zone so as to exceed the allowable noise levels on a receptor's land.

As illustrated in Table 5-6, the allowable noise levels vary by type of noise emitter and type of noise receptor. For example, an industrial noise emitter is allowed a 70 dBA (decibel, on the A-weighted scale) level on another industrial receptor's property, but only a 61 dBA (daytime) level on a residential receptor's property. Where multiple noise emitter / noise receptor types exist on the same property, the least restrictive limits apply.

The regulations also restrict the production of prominent, audible discrete tones. If a facility produces such sounds, the applicable limits in Table 5-7 are reduced by 5 dBA to offset the undesirable nature of tonal sound in the environment. The regulation defines prominent discrete tones on the basis of one-third octave band sound levels. Construction noise is exempted under RCSA § 22a-69-1.8(h); therefore, the noise limits presented in Table 5-7 do not apply to construction of this Project.

Table 5-6: Typical Noise Levels Associated with Different Indoor and Outdoor Activities

Outdoor Noise Levels	A-Weighted Sound Level (dBA)	Indoor Noise Levels
Jet aircraft take-off at 100 feet	+120	
Riveting machine at operator's position	+110	
Cut-off saw at operator's position	+100	
Elevated subway at 50 feet		
		Newspaper press
Automobile horn at 10 feet		
	+90	Industrial boiler room
Diesel truck at 50 feet		Food blender at 3 feet
Noisy urban daytime	+80	Garbage disposal at 3 feet
Diesel bus at 50 feet		
		Shouting at 3 feet
	+70	
Gas lawn mower at 100 feet		Vacuum cleaner at 10 feet
Quiet urban daytime	+60	Normal conversation at 5 - 10 feet
		Large business office
Quiet urban nighttime	+50	Open office area background level
Substation (transformer)	+43	
Quiet suburban nighttime		
	+40	Large conference room
		Small theater (background)
Quiet rural nighttime	+30	Soft whisper at 2 feet
		Bedroom at nighttime
	+20	Empty concert hall

Source: Connecticut's noise zone standards

Table 5-7: State of Connecticut Noise-Control Regulations by Emitter and Receptor Land Use Classification

Noise Emitter Class	Noise Receptor Class			
	C: Industrial	B: Generally Commercial	A: Residential Day	A: Residential Night
C: Industrial	70 dBA	66 dBA	61 dBA	51 dBA
B: Generally Commercial	62 dBA	62 dBA	55 dBA	45 dBA
A: Residential	62 dBA	55 dBA	55 dBA	45 dBA

Definitions: Day = 7:00 AM to 9:00 PM Monday – Saturday; 9:00 AM to 9:00 PM Sunday
Night = 9:00 PM to 7:00 AM Monday – Saturday; 9:00 PM to 9:00 AM Sunday

In accordance with the CGS § 22a-73, municipalities also may adopt noise-control ordinances. Such ordinances must be approved by the Commissioner of the CT DEEP and be consistent with the state noise regulations. Noise ordinances applicable to construction noise in Newington, West Hartford, and Hartford are as follows:

- **Newington Noise Ordinance (Chapter 291):** Noise generated by any construction equipment operated during daytime hours is exempted from this chapter.
- **West Hartford Noise Ordinance (Chapter 123):** Noise generated by construction activity shall be exempted between the hours of 7:00 AM to one hour after sundown, Monday through Saturday.
- **Hartford Noise Ordinance (Chapter 23):** Noise generated by any construction equipment operated between the hours of 7:00 AM and 6:00 PM on weekdays and Saturdays is exempted, provided the operation of the same on Saturday has been approved by the director of licenses and inspections or the director of public works, which approval shall be applied for at least seven days prior to the date for which approval is sought.

5.1.8 Transportation, Utilities, and Energy Facilities

The Proposed Route extends through suburban / urban areas that are characterized by a well-developed transportation network, as well as a full range of utilities (electric, natural gas, sewers, public water, cable). Major transmission lines are shown in Volume 3.

As listed in Table 5-8 and shown on the maps in Volume 3, the road transportation network in the vicinity of the Proposed Route and surrounding region is well developed and consists of a variety of federal, state, and local roads. Principal roads include I-84 and State Route 173 (Newington Road and New Britain Avenue) and State Route 71/529 (New Britain Avenue).

The CT*fastrak*, a public busway that commenced operation in March 2015, provides rapid transit service between the cities of New Britain and Hartford. The CT*fastrak* corridor extends through the eastern portion of the Project area. Two Amtrak rail lines border the CT*fastrak* to the east. Amtrak and the Federal Railroad Administration are in the process of upgrading this Amtrak corridor to accommodate high-speed rail service between New Haven, Hartford, and Springfield, Massachusetts.

There are no airports within the Project Area. The nearest airport is the Hartford-Brainard Airport located approximately 4 miles east of the Project Area.

Table 5-8: Road Crossings – Proposed Route

Road Name	Road Type
Newington	
Avery Road	Local Road (2 lane)
West Hartford Road	Local Road (2 lane)
Willard Avenue (State Highway 173)	State Highway (2 lane)
West Hartford	
New Britain Road (State Highway 173) Newington Road (State Highway 173)	State Highway (4 lane) State Highway (2 lane)
New Britain Avenue (State Highway 71/529)	State Highway (4 lane)
South Quaker Lane	Local Road (2 lane)
Talcott Road	Local Road (2 lane)
New Park Avenue	State Highway (4 lane)
Northfield Dam Access Road	Local Road (2 lane)
Hartford	
Yankee Expressway (US Interstate Highway I-84)	Federal Highway (varies)
Berlin	
Beckley Road	Local Road (access) (2 lane)

5.2 SUBSTATIONS

To interconnect the new 115-kV transmission line to the transmission system, Eversource proposes to modify the two substations that are located at the terminal points of the proposed new line (i.e., Newington Substation and Southwest Hartford Substation). Work is also proposed at Berlin Substation, which is located approximately six miles south of Newington Substation in the Town of Berlin.

The following subsections describe the existing environmental and cultural resources at each of the three substations. Certain environmental features (e.g., geology, air quality) are common to the general Project region and, while discussed for the Proposed Route, are also applicable to the substations. Such common environmental features are not reiterated in the discussion of environmental resources in the vicinity of the substations.

5.2.1 Newington Substation

The existing 1.7-acre Newington Substation, which is accessible via an access road from Cherry Hill Drive, is located within an 11.4-acre Eversource parcel. To interconnect the new 115-kV transmission line, Eversource proposes to expand Newington Substation by approximately 0.3 acre, extending the southern station fence by approximately 27 feet to the south and 31 feet to the west. The “Newington Tap” is an approximately 0.01-mile overhead transmission line which connects the 1783 Line to Newington Substation. This short transmission line connection will be replaced with larger conductor and reconfigured to a new terminal position on the south side of the substation.

5.2.1.1 Topography, Geology and Soils

Newington Substation is situated at approximately 150 feet in elevation above mean sea level. The topography on the developed portion of Newington Substation has been modified by the installation of the utility facilities and is generally flat, whereas the area immediately outside the substation fence (but on Eversource property) is more variable and is characterized by steep slopes to the south. The developed portion of the substation is elevated, relative to the surrounding areas. As described below, a wetland feature is located immediately south of the substation. An approximately 10 foot high berm is located at the south side of Newington Substation. The geologic materials beneath the substation are comprised of glacial meltwater deposits.

Soils at and in the vicinity of the substation are comprised of Branford silt loam (30B) with and Branford urban land complex (230B) north of the substation. To the south of the substation, soils are comprised of Udorthents (306) and Ellington silt loam (20A). Two of the four soils types are considered as Prime Farmland including the Branford silt loam (30B) and the Ellington silt loam (20A). Of these soils, none are considered hydric.

5.2.1.2 Water Resources

Wetlands: One wetland, referred to as Wetland N-1, was delineated in the vicinity of Newington Substation. This wetland is located adjacent to the substation to the south and west and is classified as PSS. Dominant species encountered included the following: red-osier dogwood (*Cornus sericea*), sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomea*), common reed, silver maple (*Acer saccharinum*), and moneywort (*Lysimachia nummularia*). As illustrated on the Volume 3 maps, this wetland is located immediately outside of the substation expansion limits, to the south of the fence line, and is in the vicinity of the proposed Newington Tap modifications. Although this area is mapped with Ellington soils (non-hydric), the soils were found to have hydric soil characteristics during the field investigation.

Watersheds and Drainage Basins: Newington Substation is located within the Piper Brook watershed. Within this watershed, the closest watercourse is the unnamed tributary to Piper Brook which is located over 3,000 feet northeast of the substation.

Waterbodies: No waterbodies are located on or adjacent to Newington Substation.

Surface Water Quality: As there are no watercourses or waterbodies, there is no data for surface water quality in the substation area.

Groundwater: In Newington, groundwater beneath and around the substation is designated as Class GB (industrial water supply and miscellaneous non-drinking supply).

Public Water Supplies: There are no known public water supplies (ground or surface water) in or around Newington Substation.

Aquifer Protection Areas: According to the CT DEEP, there are no designated Aquifer Protection Areas within the Project area.

Floodplains: There are no FEMA mapped floodplains in the vicinity of Newington Substation.

5.2.1.3 Biological Resources

Vegetative Communities: There is no vegetation within the fence line of Newington Substation. Vegetated communities immediately surrounding the substation include managed Eversource ROWs, urban lands, upland forest, old field / shrub land, forested wetlands and other undeveloped lands on and adjacent to the 11.4-acre Eversource property, as well as residential development adjacent to local roads as described in Section 5.1.4.1.

Wildlife: The wildlife species expected to occur near Newington Substation are those common to the vegetative communities found in the area as described in Section 5.1.4.2.

Fisheries: As Newington Substation is not located near to any water bodies or watercourses, there are no fisheries habitats at or near to the substation.

Vernal Pools: No vernal pools were observed or identified at that time on or near the substation during the spring 2015 vernal pool assessments.

Rare Species: There are no mapped Critical Habitats or federal- or state-listed threatened and endangered species habitats located at or near Newington Substation.

5.2.1.4 Land Use

Newington Substation is located in the northern portion of the Town of Newington and is bordered to the north by Cherry Hill Road, to the east by Avery Road, to the west by Quincy Lane, and to the south by Thornton Road, Reservoir Road, and Barnard Drive. Lands along these local roads are zoned and developed for single-family residential use. Eversource's managed utility ROWs (which are occupied by both transmission and distribution lines) extend out of the substation to the north, south, east, and west.

Newington Substation was developed originally in the 1950s and has undergone various modifications in subsequent years. The residential developments in the vicinity also date to the 1950s and 1960s.

There are no designated recreational or visual resources in the vicinity of the substation. Views of the substation from residences are generally screened by forested vegetation that borders the Eversource property.

In Connecticut's *C&D Plan* Locational Guide Map, the substation property is classified as being in a Neighborhood Conservation Area. In Newington's POCD, as summarized in Section 5.1.4.5.2, improvements at Newington Substation are consistent with the Business Development and Utility Infrastructure General Goals.

5.2.1.5 Cultural (Historical and Archaeological) Resources

As described in Section 5.1.5, Heritage conducted initial research concerning cultural (historical and archaeological) resources in the vicinity of Newington Substation. The results are included in the *Cultural Resources Review of the Project Region Associated with the Greater Hartford Connecticut Reliability Project* (May 19, 2015) in Volume 2.

There are no NRHP or SRHP properties located in or adjacent to Newington Substation. The Heritage assessment identified the area around Newington Substation as having moderate / high archaeological sensitivity. There are several level, dry areas with good drainage characteristics adjacent to the substation that appear to have been only impacted in a localized way. As a result, these areas have been assessed as retaining a moderate / high archaeological sensitivity. Eversource is coordinating with the SHPO regarding the need for any additional studies that may be required to identify and evaluate the known or potential significant cultural resources in proximity to the substation. Eversource is sensitive to Connecticut's cultural heritage and is committed to working with the SHPO in protecting and mitigating potential effects to these resources.

5.2.1.6 Air Quality and Noise

Air quality conditions at and in the vicinity of Newington Substation are the same as those described for the Proposed Route in Section 5.1.7. The ambient sound environment near the substation is characteristic of the surrounding residential areas, with noise levels expected to be influenced predominantly by residential activities, traffic on local roads, and the operation of the existing facilities at the substation.

5.2.1.7 Transportation and Utilities

Newington Substation is accessible via Eversource's station access road off Cherry Hill Road and the existing road network. Access to the substation is depicted on the Volume 3 maps. Two 115-kV transmission lines presently interconnect to the substation: the 1785 Line, which extends into the substation along a ROW from the south and the 1783 Line, which connects to the substation from the west. Twelve existing distribution lines are connected to the station: four overhead circuits and one underground circuit connect from the east; two overhead circuits and one underground circuit connect from the north; and four overhead circuits connect from the west. The width of each ROW is approximately 150 feet.

5.2.2 Southwest Hartford Substation

The 2.1-acre Southwest Hartford Substation is situated on a 7.1-acre Eversource property in the City of Hartford. The Project modifications to Southwest Hartford Substation could not be accommodated entirely within the footprint of the existing substation, and, as a result, Eversource proposes to expand the developed portion of the substation (extending the existing substation fence) by approximately 0.3 acre. The expansion would be on uplands, would not affect water resources, and would be entirely on Eversource property. Currently, two 115-kV underground transmission lines, 1722 (Northwest Hartford) and 1704 (South Meadow) leave Southwest Hartford Substation from the northeast side of substation. Two distribution feeder circuits leave the station from the east and two distribution feeder circuits leave the station from the north.

5.2.2.1 Topography, Geology and Soils

Southwest Hartford Substation at the northern terminus of the proposed new 115-kV transmission line is located at approximately 50 feet in elevation above mean sea level. The majority of the substation is relatively flat with a slight rise outside of the fence to the south toward I-84. The geologic setting of Southwest Hartford Substation is the same as that described in the Project Area (refer to Section 5.1.1.2).

Soils in this location are comprised of Udorthents-Urban land complex which are primarily areas that have been disturbed by filling. This soil type is common to areas that are heavily developed and have also been heavily altered by either cutting or filling. As this area is comprised of glacial outwash, some of the substation and/or vicinity may have been used for the fill associated with I-84.

Soils identified adjacent to Southwest Hartford Substation are also comprised of two types of Udorthents. Principal topographic features include a tributary to the South Branch of the Park River, which borders the Eversource property on the north and northeast.

5.2.2.2 Water Resources

Wetlands: No wetlands are associated with Southwest Hartford Substation site. The site is comprised of upland forest adjacent to the unnamed tributary to the South Branch of the Park River.

Watersheds and Drainage Basins: Southwest Hartford Substation is located within the Park River watershed, which encompasses the northern portion of the Project area including the unnamed tributary to the South Branch of the Park River. This tributary intersects with the Park River over 1,000 feet to the east of the substation past the Amtrak railroad tracks in the City of Hartford.

Waterbodies: No waterbodies are located on or adjacent to Southwest Hartford Substation property.

Surface Water Quality: The substation is located approximately 120 feet west of the unnamed tributary to South Branch of the Park River. South Branch Park River (Segment 2)

(CT4400-01_02) is considered an impaired segment of the Park River with a water quality classification of B. Designated uses include habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. These segments of the river are currently impaired due to elevated bacteria concentrations, affecting the designated use of recreation. According to the State, the specific recreation impairment is for non-designated swimming and other water contact related activities.

Groundwater: In Hartford, the groundwater beneath and around the substation is designated as Class GB (industrial water supply and miscellaneous non-drinking supply).

Public Water Supplies: There are no known public water supplies (ground or surface water) in or around Southwest Hartford Substation.

Aquifer Protection Areas: According to the CT DEEP, there are no designated Aquifer Protection Areas within Southwest Hartford Substation area.

Floodplains: The FEMA mapped floodplain adjacent to the unnamed tributary to the South Branch of the Park River is shown on the maps provided in Volume 3. This watercourse, as well as its 100-year flood zone boundaries, is depicted on the maps in Volume 3. The floodplain is located primarily to the north of the substation is north of the access road to the substation. No work is located within this mapped floodplain nor will the floodplain be crossed as part of this Project. There is no 500-year floodplain mapped in the area of the substation.

5.2.2.3 Biological Resources

Vegetative Communities: There is no vegetation within the fence line of Southwest Hartford Substation. Vegetated communities immediately surrounding the substation include the forested riparian area along the unnamed tributary to the South Branch off the Park River, an upland forested area to the west, and herbaceous and shrub vegetation along the I-84 embankment, which borders the Eversource property to the south. The upland forest in this area includes mature mixed deciduous / coniferous trees species common to the Northeast such as maples, oaks, hickories, spruce, and pine. Thick stands of the invasive Japanese knotweed (*Fallopia japonica*) are located adjacent to the river.

Areas of maintained lawn are also present along the access drive to Southwest Hartford Substation.

Wildlife: The wildlife species expected to occur near the substation are those common to the vegetative communities found in the area. Wildlife is likely to be present, although limited, in this developed landscape due to the presence of trees located next to the unnamed tributary. Wildlife is expected to be comprised of species that are tolerant of noise and activity typically found in urban settings.

Fisheries: It is likely that common fish can be found in the unnamed tributary located adjacent to the substation.

Vernal Pools: No vernal pools were observed or identified at that time on or near the substation during the spring 2015 vernal pool assessments.

Rare Species: There are no Critical Habitats, or federal- or state-listed threatened and endangered species habitats located at or near Southwest Hartford Substation.

5.2.2.4 Land Use

Southwest Hartford Substation is located in the southwest corner of the City of Hartford and is bordered by New Park Avenue on the east, the tributary to the South Branch of the Park River and Kane Street on the north, commercial uses and undeveloped municipal-owned property on the west (abutting Prospect Street), and I-84 to the south. The property is zoned for industrial use.

Eversource acquired Southwest Hartford Substation property in 1968 and developed the substation in the 1970s. Southwest Hartford Substation is zoned for industrial use. Areas to the south and east are zoned for business, commercial, and industrial uses. Areas to the north across the unnamed tributary and Kane Street are zoned for residential, business, and commercial areas. In addition to the I-84 corridor, nearby land uses consist of commercial uses, as well as vacant industrial land (refer to the Volume 3 maps). There are no designated scenic or recreational areas in the vicinity of the substation. In Connecticut's *C&D Plan* Locational Guide Map, the area surrounding and including the substation is classified as Regional Center with the unnamed tributary identified as Conservation Area.

Per the Hartford POCD, as summarized in Section 5.1.4.5.2, improvements at Southwest Hartford Substation are consistent with the goals stated in that plan.

5.2.2.5 Cultural (Historical and Archaeological) Resources

As described in Section 5.1.5, Heritage conducted initial research concerning cultural (historical and archaeological) resources in the vicinity of Newington Substation. The results are included in the *Cultural Resources Review of the Project Region Associated with the Greater Hartford Connecticut Reliability Project* (May 19, 2015) in Volume 2.

The Heritage studies did not identify any cultural features at Southwest Hartford Substation. The closest cultural feature is the Royal Typewriter Co. building located approximately 800 feet across New Park Avenue from the substation property, which is listed on the NRHP. The Parkville Historic District is also located in the area in the City of Hartford approximately 800 feet to the east of the substation. This district was created in March of 2015 and includes an historic neighborhood within the City of Hartford called Parkville. The district begins to the north of Kane Street which is approximately 300 feet north of the substation property across the unnamed tributary to the South Park River.

5.2.2.6 Air Quality and Noise

Air quality characteristics at this substation are similar to the Proposed Route and described in Section 5.1.2. As stated in this section, the City of Hartford's Noise Ordinance (Chapter 23) exempts any noise generated by any construction equipment from the normally applicable noise level limits, provided that such construction work is conducted between the hours of 7:00 AM and 6:00 PM on weekdays and Saturdays.

5.2.2.7 Transportation and Utilities

The environment surrounding Southwest Hartford Substation consists of busy urban roads, including I-84, as well as the Metro-North Railroad corridor. East of the substation across New Park Avenue is the CT*fastrak*, also known as the New Britain-Hartford Busway which is a bus rapid transit line located between Hartford and New Britain, Connecticut. Access to the substation is off of driveway from New Park Avenue. Currently, two 115-kV underground transmission lines, the 1722 Line (Northwest Hartford) and the 1704 Line (South Meadow) connect to exit the substation from the northeast. Two distribution feeder circuits exit the station from the east and two distribution feeder circuits exit the station from the north

5.2.3 Berlin Substation

The Berlin Substation occupies 6.5 acres of an approximately 94.9-acre Eversource property. The Project modifications to Berlin Substation would be located within the presently developed, fenced portion of the substation. Within the existing substation fence, the proposed Project modifications will involve equipment and facility additions near the west fence line and the relocation of equipment within the substation (from the north to the south).

5.2.3.1 Topography, Geology and Soils

The Berlin Substation is located at approximately 80 feet above sea level in a low valley between two elevated landforms that reach 200 feet above mean sea level to the west and 120 feet to the east. The actual substation area is flat with elevations rising to the north and lowering to the south. The surficial geology of this area is comprised of thin till deposits generally less than 12 to 15 feet thick that is loose to moderately compact, generally sandy, commonly stony. Possible trap rock ridges (CGS Chapter 124, § 8-1aa (1))[24] are identified in to the east and west of Berlin Substation but not at the substation.

Soils identified at the substation include Urban Land (307) and is surrounded by Scitico, Shaker, and Maybid soils (9), Berlin Silt loam (26A), Ludlow silt loam (40A), and Wethersfield loam (87B) as described in Table 5-1.

5.2.3.2 Water Resources

Wetlands: Two wetlands (designated B-1 and B-2) were delineated adjacent to Berlin Substation; these wetlands are classified as Palustrine Forested (PFO) and PSS. Dominant species encountered in these adjacent wetlands include the following: silky dogwood, red-

[24] Town of Berlin 2013 Map of Possible Trap Rock Areas

osier dogwood, sensitive fern, broad-leaf cattails, silver maple, moneywort, rice cut grass (*Leersia oryzoides*), and jewelweed.

Watersheds and Drainage Basins: The Berlin Substation is located within the Mattabesset River Watershed. The Mattabesset River is located approximately 3,000 feet east of the substation. Spruce Brook, a tributary to the Mattabesset River is located 3,000 feet southeast of the substation. The Mattabesset River is the water quality classification is Class A.

Waterbodies: No waterbodies are located on or adjacent to Berlin Substation.

Surface Water Quality: There are no watercourses or waterbodies in the immediate vicinity of the substation.

Groundwater: In Berlin, the groundwater beneath and around the substation is designated as Class GA (existing private water supply and potential public water supply suitable for drinking without treatment.)

Public Water Supplies: There are no known public water supplies (ground or surface water) in or around Berlin Substation.

Aquifer Protection Areas: According to the CT DEEP, there are no designated Aquifer Protection Areas within the Project area. Berlin has one level A Protection Area located in the southcentral part of Town in areas draining into Silver Lake (approximately 2.7 miles southwest of Berlin Substation).

Floodplains: There are no FEMA mapped floodplains in the vicinity of Berlin Substation.

5.2.3.3 Biological Resources

Vegetative Communities: There is no vegetation within the fence line of Berlin Substation. Vegetated communities immediately surrounding the substation include forested wetlands and uplands, managed ROW, and maintained lawn adjacent to Beckley Road as described in Section 5.1.4.1.

Wildlife: The wildlife species expected to occur near Berlin Substation are those common to the vegetative communities found in the area as described in Section 5.1.4.2.

Fisheries: As Berlin Substation is not located near to any water bodies or watercourses, there are no fisheries habitats at or near to the substation.

Vernal Pools: No vernal pools were observed or identified at or near the substation during the spring 2015 vernal pool assessments.

Rare Species: There are no Critical Habitats, or federal- or state-listed threatened and endangered species habitats located at or near Berlin Substation area.

5.2.3.4 Land Use

The Berlin Substation is located within an area zoned for single-family residential and is bordered to the west across Beckley Road from the Berlin Fairgrounds and agricultural fields, south of residential developments, and north of additional residential dwellings. The substation property and lands to the north, east, and south are zoned for industrial use. Lands across Beckley Road and further south of the substation are zoned for residential. Eversource's managed utility ROWs (which are occupied by both transmission and distribution lines) extend out of the substation to the south, east, and west.

The Berlin Substation was developed originally in the 1920s and has undergone various modifications in subsequent years. The residential developments in the vicinity date from the 1970s and 1980s.

There are no designated recreational or visual resources in the vicinity of the substation. Views of the substation from the roadway are generally screened by forested vegetation that borders the Eversource property.

In Connecticut's *C&D Plan* Locational Guide Map, the substation property is classified as being in a Priority Development Area. Similarly, in Berlin's POCD (September 2013) of the six goals included in its plan, Goal #3 (*The Town shall encourage economic development in those areas best suited to sustain growth given current environmental, infrastructure and* *transportation conditions*) discusses the reliability of infrastructure and acknowledges the need to improve infrastructure like the “compromised electrical supply”.

Berlin is located within the Central Connecticut Regional Planning Agency (CCRPA) district which has a POCD also adopted in 2013. While this plan does not have any direct goals which focus on utilities, the plan does recognize that electric infrastructure must also be built with the construction of new homes and businesses and that “facilities and infrastructure deteriorate and need replacement.”

5.2.3.5 Cultural (Historical and Archaeological) Resources

As described in Section 5.1.5, Heritage conducted initial research concerning cultural (historical and archaeological) resources in the vicinity of Berlin Substation. The results are included in the *Cultural Resources Review of the Project Region Associated with the Greater Hartford Connecticut Reliability Project* (May 19, 2015) in Volume 2.

One NRHP site – the Ezekiel Kelsey House at 429 Beckley Road in Berlin – is located approximately 1,100 feet south of the substation site. This NRHP site is not visible from the substation and the substation is not visible from the site. No other NRHP or SRHP sites are located within 1,000 feet of Berlin Substation.

According to Heritage, “Since Berlin Substation is already in place, any reorganization of its internal structure will not constitute an impact to the Ezekiel Kelsey House.” In addition, Heritage continues: “Thus, this parcel of land was assessed as having little, if any, potential to yield intact cultural deposits. As a result, no additional archaeological testing of Berlin Substation is recommended prior to construction.”

5.2.3.6 Air Quality and Noise

Air quality conditions at and in the vicinity of Berlin Substation are the same as those described for the Proposed Route in Section 5.1.7. The ambient sound environment near the substation is characteristic of the surrounding residential areas, with noise levels expected to be influenced predominantly by residential activities, traffic on local roads, and the operation of the existing facilities at the substation. The Town of Berlin does not have a noise ordinance or bylaw.

5.2.3.7 Transportation and Utilities

Berlin Substation is accessible via Eversource's station access road off Beckley Road and the existing road network. Access to the substation is depicted on the Volume 3 maps. The area accessing Berlin Substation is comprised of local roads and state highways. State Highway 9 is located approximately one mile south of the substation.

6. POTENTIAL ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

This section first identifies and analyzes the potential short- and long-term effects that the construction and operation of the Proposed Project would have on the environmental, ecological, scenic, cultural, and recreational values, and then describes the measures that Eversource proposes to implement to avoid, minimize or mitigate adverse effects. The avoidance, minimization and mitigation of adverse effects to environmental resources, land uses and cultural resources were key considerations in the Project planning conducted to date, and will continue to be important as the Project develops. Section 6.1 discusses the potential environmental effects and mitigation measures associated with the construction and operation of the proposed 115-kV underground transmission line. Section 6.2 discusses the potential environmental effects and mitigation measures related to the proposed modifications at Eversource's existing Newington, Southwest Hartford, and Berlin Substations, including to the Newington Tap.

Overall, Eversource has designed the proposed Project to avoid or minimize adverse environmental, cultural, and visual resource impacts by locating the new 115-kV transmission line underground within or adjacent to public road ROWs and by developing the proposed substation modifications within uplands on Eversource property that is already designated for utility use. Most Project impacts would be short-term, lasting only during construction, and would be mitigated to the extent practical. The anticipated impacts and proposed mitigation measures are based on Eversource's historical experience in the construction, operation and maintenance of similar underground transmission cable systems and substations in New England generally and in Connecticut in particular, as well as on the results of Project-specific engineering analyses, constructability reviews, environmental and cultural field investigations and agency consultations conducted to date. Additional measures to avoid or minimize adverse effects on the environment may be identified as part of the Municipal Consultation process, during the Council's review of the application or through the process of acquiring Project-specific permits and approvals from other state and federal agencies, including the CT DEEP and the USACE. Mitigation measures, as described herein or as included as conditions of regulatory approvals, would be reflected in the final Project design and incorporated into Project plans, such as the Development and Management Plan (D&M Plan) or other Project specifications, as appropriate.

6.1 UNDERGROUND TRANSMISSION LINE

6.1.1 Topography, Geology, and Soils

The Project would have negligible, if any, adverse effects on topography and geology. Little to no grading would be required to install the cable underground within existing road ROWs.[25] Localized impacts to soils would occur as a result of activities such as excavating the cable trench and splice vault sites and establishing and using contractor yards and material staging sites (if not otherwise located on paved areas). However, these impacts would be short-term (limited to the construction phase). After the installation of the cable system duct bank and splice vaults, the areas disturbed by these activities would be restored to grade (if construction required a temporary grade change) and repaved or otherwise stabilized.

Cable installation would involve the excavation of a continuous trench, as well as the excavation for one concrete splice vault at approximately 1,800 foot intervals along the underground cable route. Typically, the cable system is expected to be installed within the paved portions of the public road ROWs or in parking areas. However, in some locations, splice vaults or the cable system could require soil disturbance (excavation) in vegetated areas adjacent to paved ROWs.

If piles of soil, subsoil, or rock excavated from the trench must be temporarily stored on-site, measures would be implemented, as required, to avoid or minimize the potential for sedimentation into watercourses (i.e., Trout Brook) and/or catch basins, as well as for tracking of dirt onto public road travelways. Excess excavated materials and materials not suitable for backfilling the cable trench would be trucked off-site and disposed of in accordance with applicable regulations.

[25] Note: If the cable trench or splice vaults must be installed, in certain areas, adjacent to, but not within, existing paved road ROWs or parking lots, grading may be required to create a level work area.

6.1.1.1 Erosion Control

Typically, at work sites where soils will be disturbed or construction activities (e.g., pavement saw-cutting, soil stockpiling) could cause sedimentation, temporary erosion controls would be installed and maintained. Such controls would be deployed based on the field judgment of Eversource's experienced personnel. The types of erosion controls used would be appropriate to the urban / suburban areas along the Proposed Route, and may include hay/straw bales, core logs, catch basin protection, or silt fence.

Temporary erosion controls would be maintained, as necessary, throughout the period of active construction until disturbed sites are appropriately restored, either by re-paving (where the cable system is located within road ROWs or across other paved areas) or by reseeding and mulching (in areas where the cable facilities must be installed beneath lawn or other vegetated areas). The decision to remove temporary erosion controls would be made by Eversource's experience field construction personnel, based on the effectiveness of restoration measures, in accordance with applicable permit and certificate requirements.

Eversource would adhere to its *BMP Manual* and would prepare a Project-specific Erosion and Sedimentation Control Plan (E&S Plan*)*, which would be included in the D&M Plan prepared for the Project. The E&S Plan would conform to the requirements of the CT DEEP's *General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities* and with the *2002 Connecticut Guidelines for Soil Erosion and Sedimentation Control*. Eversource would implement the *BMP Manual* to minimize or eliminate potential adverse environmental effects during the construction, including the implementation of measures to reduce the likelihood of sediment migration away from construction sites.

6.1.1.2 Rock Removal and Blasting

In the event that bedrock is encountered, mechanical methods (such as the use of mechanical excavators, drilling, or pneumatic hammers) would be the preferred methods to remove rock. Rock removal activities will generate dust and vibration / noise in the immediate vicinity of the work site. Although not anticipated, if extensive bedrock is encountered during trench or splice vault excavation, mechanical methods supplemented by controlled blasting would be considered. If blasting is required, Eversource would develop a

Blasting Control Plan in compliance with state, industry, and Eversource standards. This plan would be provided to the state and local Fire Marshals.

Furthermore, if blasting is necessary, Eversource would require its construction contractor(s) to employ methods to minimize potential adverse effects (refer to Section 4.1.2.4.2). For example, blasting charges, if required, would be designed to loosen only the material that must be removed to provide a stable base, and to avoid fracturing other rock. Excavated material that cannot otherwise be used at the site would be removed and properly disposed of elsewhere, pursuant to Project specifications.

Prior to construction, geotechnical investigations will be performed along the Proposed Route to further characterize the physical and structural characteristics of the subsurface soils and geologic features.

6.1.2 Water Resources

Neither the construction nor the operation of the cable system would have any long-term adverse effects on surface or groundwater resources, water quality, or floodplains. Eversource would construct the cable system in accordance with approvals received from the Council, CT DEEP, and the USACE, as well as with Eversource's *BMP Manual*.

6.1.2.1 Watercourses and Wetlands

The construction of the cable system would involve short-term impacts to Trout Brook and adjacent riparian areas. However, no other water resources would be affected by the construction of the cable system. The cable system will not result in the placement of any permanent fill in wetlands or watercourses.

Eversource proposes to install the cable system beneath Trout Brook using an "open cut dam and pump" method, which will minimize the time required to install the crossing and thus the potential for water resource impacts. As discussed in Section 4, this construction technique will involve the use of a cofferdam upstream of the proposed cable crossing to temporarily dam the flow of the brook and create a dry channel for the excavation and installation of the cable duct bank. Pumps would be used to direct flows of Trout Brook around the work site and back into the brook downstream of the work site. Eversource would perform the open cut in accordance with seasonal stream crossing “windows” (during low stream flow), consistent with Eversource’s *BMP Manual* and in compliance with the conditions of Project-specific water resource permits from the CT DEEP and USACE. It is anticipated that the crossing using this technique will require less than one week to implement.

In general, Eversource anticipates that the following measures would be employed to minimize the potential for impacts to Trout Brook:

- Staging areas required to support the crossing would be set back from the brook to the extent practical and appropriate erosion controls would be installed as needed to prevent or minimize the potential for sedimentation into the brook.
- No petroleum products would be stored, mixed, or loaded within 25 feet of the brook.
- No equipment or machinery would be refueled within 25 feet of the brook unless appropriate spill prevention and containment measures are implemented. Typically, construction equipment and machinery will not be refueled within 25 feet of Trout Brook, with the exception of less mobile equipment, including pumps to divert water flow (if required). For any refueling activities that must be performed within 25 feet of the brook, protective measures will be implemented to avoid the potential for releases of fuel to the environment.
- Streambed materials excavated from the trench would be temporarily stockpiled either in the dry construction work area of the stream channel (e.g., next to the trench) or in adjacent upland staging areas.
- After the installation of the duct bank, the trench would be backfilled with FTB and then the affected streambed areas would be restored to pre-construction grade using the original surficial streambed materials. Any excess streambed materials will be removed from the site and disposed of appropriately.
- The stream bottom and stream banks will be stabilized and restored by either armoring, bioengineering or combination to ensure that erosion is prevented and that conditions are established to restore habitat conditions.

Use of the open cut crossing method in this instance is preferred over trenchless options, as the latter options would require significant areas of land disturbance both north and south of Trout Brook to accommodate the operation, and would take considerably longer to implement.

6.1.2.2 Groundwater Resources and Public Water Supplies

Groundwater could potentially be encountered in either the cable trench, which would be excavated to a depth of approximately 8-10 feet, or during installation of the splice vaults, which require excavations to depths of approximately 13 feet. However, the cable system traverses developed urban areas, where groundwater is not used for direct potable water supply.

If groundwater is encountered during cable / splice vault excavation, the water would be pumped from the excavated areas, filtered, and discharged into municipal storm water catch basins or pumped into a tank truck for disposal outside of the Project area. The D&M Plan would include specific procedures and information on construction site dewatering as needed. Dewatering would be performed in accordance with authorizations from applicable regulatory agencies and with the CT DEEP's *General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities* and with the *2002 Connecticut Guidelines for Soil Erosion and Sedimentation Control.*

Eversource has conducted initial analyses of public utilities, including potable water supply lines, located beneath roads along the Proposed Route. Additional investigations to more specifically locate the depth and alignment of these subsurface facilities would be performed as part of the final engineering design of the cable system. During construction, care would be taken to avoid impacts to municipal water lines and other utilities located within road ROWs traversed by the Proposed Route.

6.1.2.3 Floodplains

A review of FEMA maps indicates that the Proposed Route extends across the 100-year flood zone associated with one watercourse, Trout Brook, where it crosses South Quaker Lane. The 115-kV cable system will be installed beneath the brook and will not result in any long-term change in grade or other modifications that would affect the brook's flood storage.

Trout Brook east of South Quaker Lane is managed for flood control purposes by the CT DEEP, and in certain locations is bordered by a levee. No Project construction activities will affect the levee or other flood control measures.

No floodplain is mapped in association with the unnamed tributary to Piper Brook, which the Proposed Route crosses along Newington Road (State Route 173) in Newington. The floodplain associated with the South Branch of the Park River is discussed in Southwest Hartford Substation (Section 6.2.2). However, no permanent changes in grade are proposed within either of these floodplain areas, and thus no loss of flood storage will occur due to the construction of the Project. Therefore, no adverse effects on floodplains are anticipated.

6.1.3 Biological Resources

Because the cable system is planned for alignment primarily beneath paved road ROWs in urban / suburban areas, neither the construction nor the operation of the underground transmission line would result in significant adverse impacts to vegetation and wildlife resources. Nonetheless, in certain areas, roadside vegetation, including trees, may be impacted during the installation of the cable.

6.1.3.1 Vegetation

Wherever possible, construction activities would be staged and performed within streets or other paved areas. However, to accommodate the construction of the underground cable, in some locations, trees or other vegetation may have to be trimmed or removed. For example, appropriate clearance from vegetation is required for large construction equipment, such as excavators and cranes, to work safely. Therefore, trees with limbs overhanging roads along which the cable would be installed may have to be pruned.

Similarly, in locations where splice vaults must be installed adjacent to paved surfaces, existing lawns and other ornamental vegetation may have to be removed (splice vaults on private property will be located, to the extent possible, to avoid the removal of trees). The amount of vegetation affected would depend on the actual locations of splice vaults and off-paved surface staging areas required. In such locations, any vegetation within the construction workspace would have to be removed and some trees located outside the workspace could have to be pruned to provide the necessary clearance for the operation of large construction equipment.

Eversource recognizes that the excavation work required for the cable system could potentially affect the root systems of nearby vegetation. The impacts would be highly variable and depend on factors such as vegetation species, size, and location, and would therefore need to be evaluated on a case-by-case basis.

Eversource understands the importance of the existing vegetation to the local communities. Existing vegetation may have to be removed or pruned. Eversource will work closely with local officials, and any affected private landowners, to develop an appropriate vegetation restoration plan that would be implemented at the completion of construction.

After the installation of the cable system, Eversource would restore affected areas to pre-construction grade and seed previously vegetated sites. In the absence of other specific requirements, disturbed areas would be re-vegetated in compliance with the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control*. Timely restoration of the limited vegetated areas that may be disturbed during construction would further minimize the potential for erosion.

6.1.3.2 Wildlife and Fisheries

The construction of the cable system will not significantly affect wildlife habitat. The wildlife species common to the urban / suburban areas traversed by the Proposed Route can be expected to avoid work sites during construction. The installation of the cable system across Trout Brook would be scheduled during a low flow period and would be designed to minimize short-term impacts to water quality and the aquatic species that inhabit the brook. To minimize the potential for indirect impacts to Trout Brook as a result of sedimentation from upland work areas, appropriate temporary erosion controls would be deployed and maintained around nearby work sites. These temporary controls would remain in place until the disturbed areas are stabilized. After the installation of the cable duct bank beneath the brook, the streambed would be restored and the stream banks would be reseeded and stabilized, resulting in no long-term adverse effects to fishery or other aquatic organisms. As described in Section 5.1, Trout Brook is limited to more tolerant warm water fisheries. Such species are quite adaptable to short-term disturbances of the type that will occur during the open cut crossing method, and will avoid the construction zone during the roughly one-week period when construction will occur.

6.1.3.3 Threatened and Endangered Species

Eversource has consulted with both the CT DEEP and the USFWS regarding the presence of any state or federal listed species in the Project vicinity. Based on the results of these consultations, there are no listed species present in the Project area. Accordingly, no effects on rare plants, wildlife, or habitats would occur as a result of the Project.

6.1.4 Land Use

The construction of the proposed underground cable system would cause localized and short-term impacts to land uses stemming principally from construction-related nuisance effects on nearby residential, commercial, and industrial areas. Overall, however, the underground cable system will not result in significant short- or long-term adverse effects on land uses (including community facilities), recreational areas, or scenic resources.

The Project is consistent with the overall objective of providing a reliable transmission system to assist in promoting economic growth. All three municipalities traversed by the Proposed Route have published plans of conservation and development as summarized below. In general, these plans identify the areas traversed by the Proposed Route as continuing to maintain current land use patterns in the future (e.g., public recreational or protected lands, low-density residential development, commercial / industrial areas). None of the plans identify local land use policies that would be inconsistent with the development of the new 115-kV transmission line. The state, regional, and land use plans are described in greater detail in Section 5.1.4.5.

The construction of the cable system will have minor and highly localized impacts on land uses, resulting from the temporary disturbance associated with the installation of the duct bank and splice vaults. However, disturbed sites will be restored after the installation of the cable system, resulting in no long-term changes to land uses. According to local zoning and associated regulations, the Proposed Route traverses areas zoned for business, commercial, industrial and residential use.

The Project is in compliance with local, regional, and state land use plans, as described in Section 5.1.4 for the Proposed Route and Section 5.2 for each of the substations. In addition, the Project is not located in any local, regional, state, or federally designated sensitive areas (i.e., rare species habitat, heritage areas, etc.) In general, these land use plans identify the areas traversed by the Proposed Route as continuing to maintain current land use patterns in the future (e.g., public recreational or protected lands, low-density residential development, commercial / industrial areas). None of the plans identify local land use policies that would be inconsistent with the development of the new 115-kV transmission line.

There are no designated visual resources in the immediate vicinity of the Proposed Route. During the installation of the cable system, work sites will be visible to the public. However, after the completion of the Project, the underground cable system will have no effect on the existing visual character of the areas along the Proposed Route.

The Proposed Route traverses or is located near one park, and two recreational areas (including trails): Beachland Park and Pool, Trout Brook, and the Elmwood Community Center. The recreational areas crossed by or near the Proposed Route are described in Section 5.1.4.2 and are depicted on the maps located in Volume 3. The potential impacts to these recreational areas as a result of the Project are summarized below:

- **Beachland Park and Pool:** The Proposed Route would be located within South Quaker Lane, which borders the park to the east and provides primary access to it. In addition, Eversource proposes to use a portion of the Park’s paved parking lot near South Quaker Lane to stage the installation of the transmission cable system across Trout Brook. Eversource will consult with West Hartford representatives to coordinate appropriate measures to maintain access to the Park during construction, as well as to keep the town apprised of the construction schedule. After restoration, the underground cable system would have no effect on Beachland Park.
- **Trout Brook Trail:** The installation of the cable system across Trout Brook Trail would temporarily disturb the affected section of trail. However, signs would be posted informing trail users of the construction activities and temporary detours around the construction site would be provided. Eversource will work with the town to provide appropriate signage and to minimize impacts to the trail users. After the

installation of the cable system, the affected section of the trail would be restored. No long-term impacts to the trail would occur.

- **Elmwood Community Center:** The proposed work is located within the parking lot and access road of the community center. The long-term presence of the underground cable will not have any effect on the Center. During construction there may be temporary rerouting of traffic and/or parking. Eversource will work closely with the Center's managers and the Town of West Hartford.

Based upon publicly available data, there are no schools, licensed child day care facilities, licensed youth camp facilities, hospitals, group homes, or playgrounds within 500 feet of the Proposed Route with the exception of the Elmwood Community Center.[26] The Center also houses the YMCA Elmwood Early Learning Center which hosts a child care program.

6.1.5 Cultural (Historical and Archaeological) Resources

The Heritage cultural resources assessment[27] of the proposed Project area (which is included in Volume 2 and summarized in Section 5.1.5), which researched published data concerning both standing historic structures and archaeological sites and evaluated the sensitivity of the Proposed Route for discovering new archaeological resources, determined that the construction of the underground cable system would not cause adverse impacts to any known cultural resources with the Proposed Route.

6.1.6 Air Quality and Noise

6.1.6.1 Air Quality

The proposed Project would result in short-term, highly localized effects on air quality during construction, primarily from fugitive dust generated during activities such as saw cutting pavement and cable trench and splice vault excavations, as well as emissions from the

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[26] http://www.dir.ct.gov/dcf/Licensed_Facilities/listing_CCF.asp; https://www.elicense.ct.gov/Lookup/DownloadRoster.aspx

[27] Heritage Consultants, LLC. May 19, 2015. Cultural Resources Review of the Project Region Associated with the Greater Hartford Central Connecticut Reliability Project, Hartford, Newington, and Berlin Connecticut

operation of construction equipment and vehicles. To minimize the amount of dust generated by construction activities, water is typically used when saw cutting pavement. Vehicular emissions would be limited by requiring contractors to properly maintain construction equipment and vehicles, as well as to conform to Connecticut's vehicular anti-idling regulations (RCSA 22a-174-18).

Roadways within the construction zone would be regularly inspected and swept to remove any excess accumulation of dirt. In addition, to minimize dust, water may be used to wet down disturbed soils along the Proposed Route, as needed. There would be no expected effects on air quality associated with the operation of the Project facilities.

6.1.6.2 Noise

Construction-related noise, which would be short-term and highly localized in the vicinity of work sites, would result from the operation of construction equipment; truck traffic; earth moving vehicles and equipment; and jackhammers. The operation of the Project would not result in any adverse noise impacts.

During construction, activities such as pavement removal, trench excavation, the installation of splice vaults, and the general operation of construction equipment would increase ambient sound levels in the immediate Project vicinity. A majority of the Project would be aligned within suburban / urban road ROWs (e.g., New Park Avenue, South Quaker Lane, Newington Avenue), where the existing sound environment is influenced by traffic noise, including traffic along I-84 (in the northern portion of the Project area). Work in residential areas might only be permitted during day-time hours, and further restricted on weekends and holidays. To the extent feasible, construction work would be scheduled to minimize disruptions to traffic and to residential and business uses. Construction noise is exempted under the Connecticut regulations for the control of noise, RCSA 22a-69-1.8(h). However, the temporary increase in construction related noise could potentially raise ambient sound levels near work sites. The extent of a noise effect to humans is dependent upon a number of factors, including the change in noise level from ambient, the duration and nature of the noise, the presence of other non-Project noise sources, people's attitudes concerning the Project, the number of people exposed to the noise and the type of activity affected by the noise (e.g., sleep, recreation, conversation). The effect of construction-generated noise would also depend on the source location as sound attenuates with distance and with the presence of vegetative buffers or other barriers.

In general, construction activities would typically occur during the daytime (approximately 7:00 AM to 7:00 PM[28], Monday through Saturday), when human sensitivity to noise is lower. During the Council's review process, Eversource expects to further define appropriate work hours for construction activities. Work hour specifications would be included in the D&M Plans for the Project.

Standard types of construction equipment would be used for the Project. In general, the highest noise levels from this type of equipment is approximately 92 dB(A) at the source. Taking into consideration the factors that would cause an increase in sound levels to cause public annoyance at noise sensitive receptors, the following procedures may be employed during construction to minimize noise effects at these sites.

- Engine-powered construction equipment would be properly muffled and maintained to minimize excessive noise to the extent possible.
- In areas where rock removal is required, efforts would be made to schedule work to minimize noise and vibration disturbances.

Sound pressure levels at all points along the property lines of both substations would continue to meet state regulations as specified in CGS § 22a-69-3.3, -3.5(a), -3.7, -4(g).

In accordance with the CGS § 22a-73, the affected municipalities have also adopted noise-control ordinances. Such ordinances must be approved by the Commissioner of CT DEEP and be consistent with the state noise regulations. The proposed activities will be implemented in compliance with these local ordinances, except in special situations in which continuous construction activity or emergency repairs may be required, as permitted by a local town or city and outline in the D&M Plan approved by the Council.

[28] Ordinance hours vary by town and city.

6.1.7 Transportation and Utilities

The installation of the underground cable system within or adjacent to public roads in Newington, West Hartford, and Hartford would require the temporary closure of travel lanes and consequently would result in localized traffic disruption, delays, detours or congestion. Construction workers traveling to and from work sites, as well as the movement of construction equipment to work sites, could also temporarily cause localized increases in traffic volumes, further aggravating Project-related traffic congestion. These effects could cause temporary inconvenience to the public.

Underground utilities would be carefully located as part of the final Project design, and the cable system would be aligned to avoid impacts to such existing infrastructure.

The operation of the underground cable system would have no effect on buried utilities and no effect on transportation, except when cable system maintenance or repairs are required. Any such work would likely be localized to a specific splice vault manhole or a segment of the cable duct bank, thereby minimizing potential effects on traffic patterns.

Overall, the installation of the cable facilities within or adjacent to public road ROWs would be scheduled to minimize adverse effects on traffic and adjacent land uses to the extent practicable. Construction work would be accomplished in several stages, and each stage may require in-road activities that temporarily affect vehicle and pedestrian traffic patterns and land uses in the immediate vicinity. In summary, the construction activities that may affect vehicle and pedestrian traffic patterns are:

- Reconfiguring traffic patterns and setup of traffic control devices
- Marking the cable system alignment and locating existing utilities
- Establishing temporary erosion and sediment control measures
- Probing to locate rock and groundwater
- Relocating existing overhead and underground utilities
- Trimming or removing trees, fencing, landscaping
- Installing the splice vaults

- Trenching and installing the duct bank configuration for the transmission cable
- Temporary pavement restoration
- Testing / proofing the transmission conduits (mandrelling and video inspection)
- Pulling the transmission cables into the conduits
- Pulling the ground continuity conductors into the conduits
- Splicing the transmission cables
- Testing cables inside splice vaults
- Pulling the temperature sensing fiber optic cables
- Installing pull boxes for remote operation and control of the fiber optic cables
- Pulling the fiber optic cables for remote operation and control
- Installing the final roadway pavement
- Installing off-road pavement and sidewalks
- Reestablishing lawns and fencing

To define appropriate measures to minimize traffic disruption during construction, Eversource would consult with local officials. In addition, Eversource would inform businesses, landowners, and residents along the cable route of the construction schedule. Consideration would be given to minimize the impact of construction activity on vehicular traffic and pedestrians in the vicinity of the Project.

During construction, steel plates would be used to cover open excavations during non-work periods and thereby to minimize disruption to access along affected roads. In addition, the installation of the cable beneath major road crossings (such as New Britain Avenue) may be performed and performing in phases to maintain traffic flow.

When heavy equipment and large structure components must be transported along public roads for delivery to the ROW, temporary disruptions in local traffic patterns, delays, or detours could occur. Activities involving the installation of the conductors at or near road crossings also could result in minor, short-term, and localized traffic congestion, delays, or detours. However, any such traffic volume increases would be short-term, as would any detours. Eversource would employ personnel to direct traffic at construction work sites along public roads, as needed, and would erect appropriate traffic signs to indicate the presence of construction work zones.

6.1.8 Public Health, Safety, and Security

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. 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.

6.2 SUBSTATIONS

As described in the following subsections, the proposed modifications to Newington, Southwest Hartford, and Berlin Substations would result in minor impacts that would be limited to the Eversource substation property or to areas in the immediate vicinity of each site.

6.2.1 Newington Substation

Due onsite conditions, including the configuration of the existing and proposed 115-kV equipment within the substation and the required transmission line tie-ins, the proposed 0.3 acres expansion of Newington Substation fenceline to the south and west represents the most cost-effective and least environmentally intrusive option. To allow for the interconnection of the new underground cable to the existing substation on the western side of the substation, the 0.01-mile Newington Tap segment of the 1783 Line will be relocated to enter the substation from the south. Installation of a retaining wall on the south and west sides of the substation will assist in maintaining the existing grade for the expanded portion of the substation.

6.2.1.1 Topography, Geology and Soils

The proposed Project modifications to Newington Substation will require topographic modifications (grading and filling) of an approximately 0.3 acre area immediately adjacent to the south of the existing station fence. This grading and filling will be required to create a level surface for the new substation facilities. A retaining wall will be needed at the south and west edge of the proposed fill area to the south and west of the substation. The wall will generally follow the existing toe of slope of the current substation area. The wall will primarily face to the south of the Substation, into an area that is wooded and generally not visible to any surrounding residences. Expansion of the substation to the west is anticipated to require only minimal grade change, however existing soils will be removed and replaced with appropriate bedding material to support the substation features. The overall effect of these changes in grade and cover type will be minimal on the environment.

Eversource would prepare, and would require its construction contractor to implement, a Project-specific Stormwater Pollution Prevention and Control Plan, in accordance with CT DEEP requirements as specified in the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities.

In addition to soil disturbance from the substation footprint expansion, soils would also be temporarily disturbed from the limited areas of trenching required to extend the cable system to the substation. Activities within the extended fenceline, such as installation of structure footings and foundations within the fenceline, would also temporarily disturb onsite soils. Upon completion of all construction activities, soils would be appropriately stabilized within the fenceline via the installation of gravel and traprock. Outside the expanded fence line, temporarily disturbed soils would be restored, including installation of appropriate topsoil, and these areas would be re-seeded. Erosion control blankets or hay would be applied to seeded areas to allow vegetation to establish.

Temporary erosion and sedimentation controls (e.g., silt fence, hay/straw bales) would be installed in conjunction with the filling and grading work. Soil erosion and sedimentation controls will be installed and maintained in accordance with Eversource BMP Manual, which incorporate guidance and techniques from CT DEEP's *2002 Connecticut Guidelines for Soil Erosion and Sediment Control*. Soil erosion and sedimentation controls will be installed prior to conducting earthwork required for the substation expansion and will be maintained throughout the project duration.

6.2.1.2 Water Resources

As described in Section 5.2.1.3, there are no watercourses, waterbodies, or floodplains in proximity to Newington Substation; thus, no adverse effects will occur to these resources. As illustrated on the Volume 3 maps, Wetland N-1 borders the south side of the substation. Portions of this wetland would be temporarily affected by the modifications to the Newington Tap. In addition, a retaining wall is proposed to limit the encroachment of fill. The retaining wall is proposed to permanently impact under 500 square feet and is needed to reduce further impacts to the wetland, nonetheless, a small (under 500 square feet) area of the wetland will be impacted for construction along the north side of Wetland N-1 for construction of the substation improvements. Erosion and sediment control measures will be implemented to avoid or minimize the potential for indirect adverse effects to the wetland. For example, construction mats (or other appropriate erosion control) will be used to minimize impacts during construction. Temporary impacts will consist of placement of construction mats which will be removed when construction is complete. Restoration of the temporary wetland impacts will occur as needed.

During the construction of the station modifications, appropriate temporary soil erosion and sedimentation controls would be installed and maintained, pursuant to Eversource's regulatory approvals and best management practices. These erosion and sedimentation control measures would minimize the potential for off-site sedimentation into nearby water resources. Similarly, appropriate spill prevention, control, and countermeasure procedures would be implemented during construction to minimize the potential for inadvertent spills or leaks from construction equipment. Such procedures would be specified in the D&M Plan governing the substation modification work.

The operation of the modified Newington Substation would not affect water resources. Eversource would apply standard operation and maintenance procedures to avoid or minimize the potential for off-site erosion and sedimentation. During facility operation, Eversource also would conform to standards for minimizing the potential for spills or leaks from electrical equipment.

6.2.1.3 Biological Resources

The 1.7-acre Newington Substation is situated within 11.4 acres of Eversource property that is undeveloped except for various transmission and distribution line ROWs that extend from the substation. These ROWs are maintained in low-growth vegetation consistent with overhead transmission / distribution line use. Outside of these managed ROWs, mature trees border the 11.4-acre Eversource parcel to the north and south, providing a vegetative screen between the substation and surrounding residential developments. No effects to the existing tree screen will occur as a result of the proposed substation expansion. Effects on associated wildlife would similarly be minimal, and no state or federally-listed wildlife are known within this area.

6.2.1.4 Land Use

No significant adverse land use effect from the substation expansion is anticipated. The proposed substation expansion will involve modification of the fenceline to the south and will extend substation elements approximately 30 feet closer to select residences located on Thornton Drive. No significant increases to visibility / audibility are anticipated as a result of the proposed substation expansion as the substation is already located on a higher level than Thornton Drive. Landscaping improvements or tree screening installations along the new fence line or along the Thornton Drive property boundaries will be installed if acoustic / visual modelling deems these improvements necessary. No effects to the existing tree screen are anticipated as a result of the proposed substation expansion.

6.2.1.5 Cultural (Historical and Archaeological) Resources

Based on the cultural resource studies conducted to date (refer to the Heritage report in Volume 2), no potential impacts to any historical or prehistorical resources are anticipated as a result of the modifications to Newington Substation or to the Newington Tap.

6.2.1.6 Air Quality and Noise

Air quality characteristics and effects at this substation are similar to the Proposed Route and described in Section 6.1.6. The proposed facilities would result in temporary and highly localized air emissions from the operation of construction vehicles and equipment, as well as fugitive dust emissions as a result of the construction activities required to accomplish the substation modifications. However, these impacts will be minor, and will last only during the construction period.

Noise impacts resulting from the proposed substation and Newington Tap modifications would be limited to the construction phase of the Project. The primary noise-generating activities will include those involving earth moving (e.g., grading, filling), trenching, general equipment operations, installation of electric components, and the movement of equipment and construction vehicles to and from the substation site using local roads. Construction noise is expected to be localized in the vicinity of the substation and would typically occur during the daytime (between 7:00 AM and 7:00 PM), when human sensitivity to noise is lower.

Construction noise generated at the substation may be audible in the residential areas that border the Eversource property. However, the nearest residences are approximately 200 to 400 feet from areas of the substation where the Project modifications will occur. Noise levels diminish at a rate of approximately 6 dBA per doubling of distance from a localized noise source. For example, a noise level of 84 dBA measured at 50 feet from the noise source to the receptor would reduce to 78 dBA at 100 feet from the source to the receptor and would reduce to 72 dBA at 200 feet from the source to the receptor. The existing tree buffer around the Eversource property would assist in attenuating construction-related noise.

Under certain circumstances, especially when circuit outages are required, night work and weekend work could be necessary at the substation. Night construction could require lighting and may result in localized, temporary increases in noise levels.

The construction of the associated facilities would cause temporary and highly localized noise, resulting from construction activities involving earth moving, equipment operation and other related work. The potential effects of construction noise would be limited in duration and would be mitigated by the performance of work during daylight hours.

The operation of the proposed termination facilities for the 115-kV transmission cables would not require the use of any equipment that would generate noise.

6.2.1.7 Transportation and Utilities

Newington Substation is accessible via a network of local roads and State Route 172. The proposed substation modifications would not adversely affect long-term transportation or access patterns. During construction, minor and short-term effects on vehicular traffic would occur as construction vehicles use local public roads leading to the site.

No full-time personnel would be based at Newington Substation. As a result, the operation of the modified substation would have no effect on transportation patterns or traffic.

6.2.2 Southwest Hartford Substation

The proposed Project modifications to Southwest Hartford Substation would require an expansion of the developed portion of the substation (extending the existing substation fence) by approximately 0.3 acre. The expansion would be on uplands, would not affect water resources, and would be entirely on Eversource property.

6.2.2.1 Topography, Geology and Soils

Southwest Hartford Substation at the northern terminus of this Project is located at approximately 50 feet in elevation above mean sea level. The majority of the Substation is relatively flat with a light rise outside of the fence location to the south toward I-84. Soils in this location are comprised of Udorthents-Urban land complex. This soil type is common to areas that are heavily developed and have also been heavily altered by either cutting or filling.

The proposed expansion at this substation will consist of a relatively minor expansion to the east side over existing level terrain, and therefore will require only minor grading changes. Existing unsuitable soils will be removed and replaced with appropriate bedding material to support the substation features and operational needs.

Activities within the extended fence line, such as installation of structure footings and foundations, would temporarily disturb onsite soils. Upon completion of construction activities, soils would be appropriately stabilized within the fenceline via the installation of gravel and traprock. Outside the expanded fence line, temporarily disturbed soils would be restored, including installation of appropriate topsoil, and these areas would be re-seeded. Erosion control blankets or hay would be applied to seeded areas to allow vegetation to establish. The access road will be re-configured in this area as appropriate.

Soil erosion and sedimentation controls will be installed in accordance with Eversource's *BMP Manual*, which incorporate guidance and techniques from CT DEEP's *2002 Connecticut Guidelines for Soil Erosion and Sediment Control.* Soil erosion and sedimentation controls will be installed prior to conducting earthwork required for the substation expansion and will be maintained throughout the project duration.

6.2.2.2 Water Resources

Southwest Hartford Substation is adjacent to an unnamed tributary to the South Branch of the Park River. The proposed substation will not encroach upon any portion of the tributary or its associated 100-year floodplain. However, construction activities will occur approximately 300 feet from the watercourse.

At the substation site, there is no bordering wetland along the watercourse, as the grade of the land adjacent to the watercourse increases sharply to the level land on which the substation is situated. This change in grade provides a distinct landform break, which will facilitate the management of construction activities to avoid or minimize the potential for direct or indirect impacts to the watercourse. No fill will be placed within the tributary's 100-year FEMA floodplain; thus, no loss of flood storage or change in peak flows will occur from the substation expansion.

During the construction of the station modifications, appropriate temporary soil erosion and sedimentation controls would be installed and maintained, pursuant to Eversource's regulatory approvals and best management practices. These erosion and sedimentation control measures would minimize the potential for off-site sedimentation into nearby water resources. Similarly, appropriate spill prevention, control, and countermeasure procedures would be implemented during construction to minimize the potential for inadvertent spills or leaks from construction equipment. Such procedures would be specified in the D&M Plan governing the substation modification work.

The operation of the modified Southwest Hartford Substation would not affect water resources. Eversource would apply standard operation and maintenance procedures to avoid or minimize the potential for off-site erosion and sedimentation. During facility operation, Eversource also would conform to standards for minimizing the potential for spills or leaks from electrical equipment.

6.2.2.3 Biological Resources

The 0.3-acre area proposed for the expansion at Southwest Hartford Substation supports limited vegetated cover, consisting of scattered shrubs and trees. The removal of this vegetation and conversion of the area to utility use will represent a long-term, but minor impact to vegetation and wildlife habitat. However, the amount of affected wildlife habitat also is minor. Similar habitat is available elsewhere on the Eversource site, as well as along the stream corridor to the northeast. Habitat along the stream corridor will not be altered.

6.2.2.4 Land Use

Southwest Hartford Substation is located within an area zoned for commercial and industrial uses. The proposed modifications to the substation would be located on Eversource property; would be consistent with the existing uses of the site for utility purposes, and would not conflict with any land use plans. Accordingly, no adverse land use effect from the substation expansion is anticipated. Due to the adjacent commercial and transportation-related land uses, no landscaping improvements or tree screening measures area anticipated at this substation.

6.2.2.5 Cultural (Historical and Archaeological) Resources

There are no identified cultural features at Southwest Hartford Substation. The closest cultural feature is the former Royal Typewriter Co. building, which is listed on the NRHP and is located approximately 800 feet to the east across New Park Avenue from the substation property. This building burned down in 1992 and the site was redeveloped, therefore a sight line does not exist between the NRHP site and the substation, due to vegetative and building screening. No adverse effect to this property is anticipated from the minor expansion proposed. The adjacent unnamed tributary has not been identified as being sensitive for archaeological sites, most likely because of past man-made disturbances.

6.2.2.6 Air Quality and Noise

The air quality and noise impacts associated with the proposed modifications to Southwest Hartford Substation would be similar to those described for Newington Substation expansion (refer to Section 6.2.1.6). However, Southwest Hartford Substation abuts busy urban roads where the existing noise environment is significantly influenced by traffic noise, including I-84, as well as the Metro-North Railroad corridor.

6.2.2.7 Transportation and Utilities

The environment surrounding Southwest Hartford Substation consists of busy urban roads, including I-84, as well as the CT*fastrak* and Amtrak railroad corridor. During construction, minor and short-term effects on vehicular traffic may occur as construction vehicles use local public roads leading to the site. The operation of the additional equipment at Southwest Hartford Substation would have no effect on transportation patterns or traffic because no full-time personnel would be assigned to the station.

6.2.3 Berlin Substation

The Project modifications to Berlin Substation take place within the presently developed fenced portion of the substation, which is situated on Eversource property. The proposed Project modifications will involve equipment and facility additions near the west fence line and the relocation of equipment within the substation (from the north to the south). Due to the size of the existing Eversource parcel, the nature of the proposed impacts, and the distance from adjacent residences, the planned improvements are not expected to result in visible or audible impacts to adjacent property owners. These limited modifications would have only minor and temporary environmental effects, as summarized below.

6.2.3.1 Topography, Geology and Soils

The addition of the proposed facilities to Berlin Substation would require site preparation activities, such as the removal of gravel / trap rock, limited grading, and soil disturbance at work sites within the fence line. Soils excavated from work sites will be either stockpiled on site (and protected with erosion and sediment controls as necessary) or trucked off-site for proper disposal. Because the proposed modifications will be contained within the developed substation, there is minimal potential for off-site erosion or sedimentation. Eversource would install temporary erosion and sedimentation controls, as appropriate. In addition, construction activities would be performed in accordance with a *Stormwater Pollution Prevention and Control Plan*, the D&M Plan for the station, and the Company's spill prevention and control plan.

Soil erosion and sedimentation controls will be installed in accordance with Eversource's *BMP Manual*, which incorporate guidance and techniques from CT DEEP's *2002 Connecticut Guidelines for Soil Erosion and Sediment Control.* Soil erosion and sedimentation controls will be installed prior to conducting earthwork required for the substation expansion and will be maintained throughout the project duration.

6.2.3.2 Water Resources

Construction modifications to the substation are proposed within the fenceline, therefore, there will be no impacts to the wetlands located on the surrounding Eversource property. There are no wetlands, watercourses, or floodplains located on or immediately adjacent to Berlin Substation. Groundwater, if encountered during excavations for the proposed Project modifications, would be dewatered in accordance with Eversource's *BMP Manual* and the *Stormwater Pollution Prevention and Control Plan*.

6.2.3.3 Biological Resources

Because the proposed Project facilities would be confined to developed (graveled) areas within the existing substation fence line, no vegetation or wildlife resources would be affected. Eversource does not propose to use any off-station areas of the property for staging / construction support.

6.2.3.4 Land Use

The Berlin Substation is located within an area zoned for single-family residential and is located across the street from the Berlin Fairgrounds and areas of residential developments. The proposed modifications to the substation would be located on Eversource property; would be consistent with the existing uses of the site for utility purposes, and would not conflict with any land use plans. The existing substation has operated within this land use without conflict, and the proposed minor expansion will occur away from the primary residential area in proximity to the site. Accordingly, no adverse land use effect from the substation expansion is anticipated.

6.2.3.5 Cultural (Historical and Archaeological) Resources

The proposed Berlin Substation modifications will be confined to the developed substation site, where soils have been disturbed by prior substation equipment installations and related earth-moving activities. As a result, the proposed substation modifications will have no potential to affect intact archaeological deposits. Further, as described in Section 5.1.5, whereas one NRHP site – the Ezekiel Kelsey House – is located approximately 1,100 feet south of the substation site, this site is not visible from the substation and the substation is not visible from the site. As a result, the proposed substation modifications will have no indirect visual effects on this NRHP property.

6.2.3.6 Air Quality and Noise

Air quality and noise characteristics and effects at this substation are similar to the Proposed Route and described in Section 6.1.6. Due to the size of the existing Eversource parcel the nature of the proposed impacts within an existing substation, and the distance from adjacent residences (approximately 200 feet), the planned improvements are not expected to result in visible or audible impacts to adjacent property owners.

6.2.3.7 Transportation and Utilities

The roadway system adjacent to Berlin Substation is comprised of local roadways and state highways. During construction, minor and short-term effects on vehicular traffic may occur as construction vehicles use local public roads leading to the sites. The operation of the modified station would have no effect on transportation patterns or traffic.

7. POWER TRANSMISSION ELECTRIC AND MAGNETIC FIELDS

Electric fields (EF) and magnetic fields (MF) (EF and MF collectively EMF) are forms of energy that surround an electrically charged device. Transmission lines are common sources of EMF, as are other components of electric power infrastructure, ranging from transformers and distribution lines, to the wiring and appliances in a home.

EF are produced within the surrounding area of a conducting object (e.g., a wire) when a voltage is applied to it. EF are measured in units of kilovolts per meter (kV/m). The level of an EF near line conductors carrying current depends on the applied voltage, the distance between the conductors, and the distance to the measurement location.

MF are produced within the surrounding area of a conductor or device that is carrying an electric current. In the United States, MF associated with electric power transmission are usually measured in units of milliGauss (mG). The level of a MF near to line conductors carrying current depends on the magnitude of the current, the distance between conductors, and the distance from the conductors to the measurement location.

Both electric and magnetic fields decrease rapidly as the distance from the source increases, and even more rapidly from electric equipment in comparison to line conductors. EF levels are further weakened by obstructions such as trees and building walls, while MF are not weakened as they pass through most obstructions. In the case of parallel lines of circuit conductors, the levels of EF and MF are also dependent on the phasing orientation of the circuits.

7.1 EMF FROM UNDERGROUND TRANSMISSION CABLES

In the case of underground transmission lines, EF are screened by the cable sheath and so are eliminated above the cable. MF are not shielded by the cable sheath or the earth, so there are magnetic fields associated with underground transmission. However, certain inherent features of an underground design reduce MF. In particular, the conductors of an underground cable system are arrayed in much closer proximity to one another than can be achieved with an overhead line. This close proximity creates a cancellation effect that reduces the fields immediately surrounding the conductors, and produces fields that decay much more rapidly with increased distance from the conductors as compared to overhead lines.

MF directly above underground cables can be higher than MF directly under overhead lines because, at 3-5 feet below ground, the underground cables are closer to people passing directly above them than overhead lines are to people directly below. However, because MF fields associated with the underground lines fall off sharply with distance, the MF levels associated with underground transmission cables are, overall, lower than those associated with overhead lines.

7.2 EMF IN THE VICINITY OF SUBSTATIONS

The levels of fields from substation equipment decrease rapidly as the distance from the source increases. These fields reach very low levels at relatively short distances beyond the fenced-in area. Beyond the fence line, MFs from sources within the substation will usually be in the same range as the background MF levels in homes, which average one to two mG but can range up to four mG. The highest levels of EMF around the perimeter fence of a substation occur where transmission and distribution circuits cross over or under the substation boundary. In these locations, EMF levels are determined by the properties of the line, rather than by substation equipment.

7.3 CONNECTICUT SITING COUNCIL POLICY CONCERNING TRANSMISSION LINE ELECTRIC AND MAGNETIC FIELDS

To address concerns regarding potential health risks from exposure to EMF, the Council conducted a lengthy proceeding that resulted in the issuance of a policy document entitled *Electric and Magnetic Fields Best Management Practices for the Construction of Electric Transmission Lines in Connecticut* (*EMF BMP Document*).

The *EMF BMP Document* summarized the latest information regarding scientific knowledge and consensus on EMF and health concerns and prescribed best practices concerning the design of new transmission lines with respect to EMF. In the *EMF BMP Document*, the Council recognized “that a causal link between power-line MF exposure and demonstrated health effects has not been established, even after much scientific investigation in the U.S. and abroad,” but “that timely additional research is unlikely to prove the safety of power-line

MF to the satisfaction of all." Accordingly, the Council takes a "cautious approach" to transmission line siting that advocates "the use of effective no-cost and low-cost technologies and management techniques on a project-specific basis to reduce MF exposure to the public while allowing for the development of efficient and cost-effective electrical transmission projects." (*EMF BMP Document*, pp. 3,4)

Pursuant to this policy, the Council requires that an applicant proposing to build an overhead electric transmission line to develop and present a Field Management Design Plan that identifies design features to mitigate MF that would otherwise occur along an overhead electric transmission ROW. However, the *EMF BMP Document* also recognizes that underground installation of transmission lines itself reduces MF exposure, and accordingly requires additional steps to reduce MF associated with underground lines only in special circumstances (*EMF BMP Document*, p. 5).

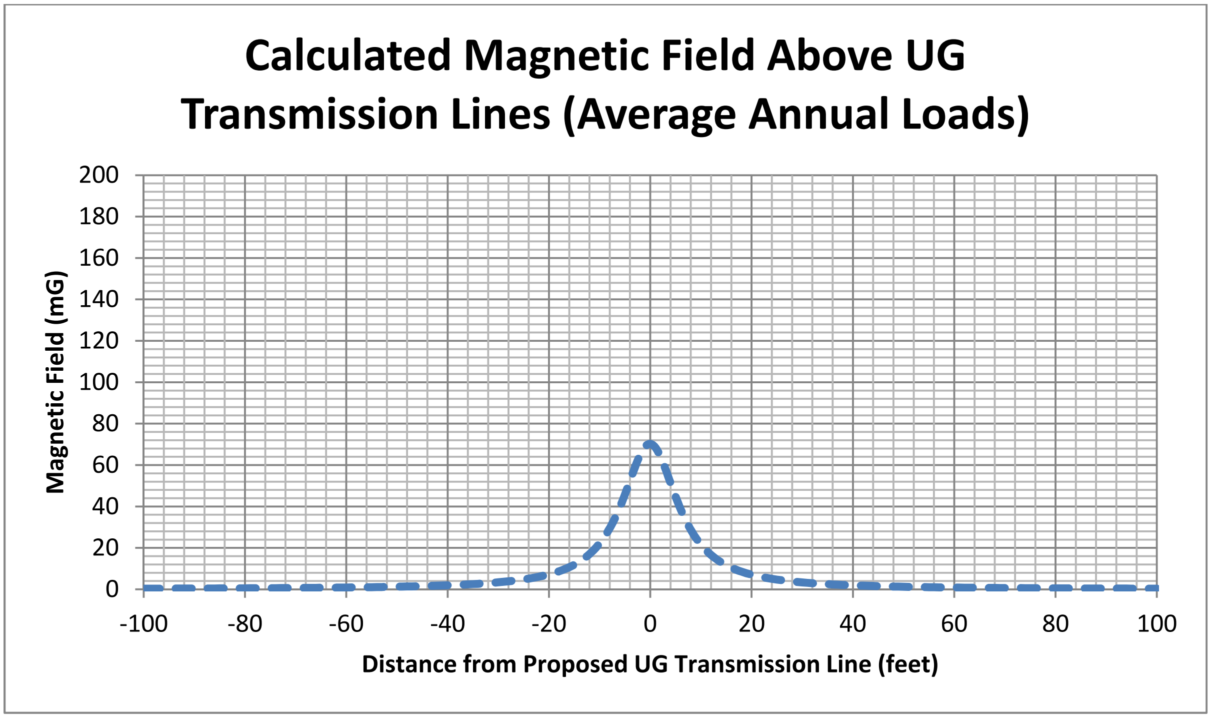
In order to assure that the Council's information with respect to potential health effects of EMF is kept current, the *EMF BMP Document* requires applicants to submit "evidence of any new developments in scientific research addressing MF and public health effects or changes in scientific consensus group positions regarding MF." Accordingly, Eversource commissioned an independent expert to prepare a report concerning any such developments. This report will be included in the Project Application to the Council.

7.4 ELECTRIC AND MAGNETIC FIELDS FROM THE PROPOSED FACILITIES

7.4.1 The Proposed 115-kV Underground Transmission Line

Eversource prepared calculations of predicted magnetic fields from the new underground transmission line along the Proposed Route under average annual load conditions. The results of these calculations are shown in Figure 7-1 and Table 7-1. The graph illustrates the anticipated MF, under a projected average annual loading condition in the year 2024, with respect to distance from the centerline of the transmission cable trench. These calculations apply at 1 meter (3.28 feet) above grade, and assume that the depth below grade of the uppermost cable is 3.5 feet. The calculations show that the MF is highest at 70.2 mG directly above the line and will drop to below 2.0 mG within 40 feet on either side of the transmission line.

Figure 7-1: Projected Magnetic Fields along the Preferred Route



mG	0.3	0.5	0.9	1.9	7.2	70.2	7.1	1.9	0.9	0.5	0.3

7.4.2 Substations

At the existing Newington and Southwest Hartford Substations, electric fields will be unchanged as a result of the proposed Project modifications, and magnetic fields will be unchanged except for those associated with the new underground transmission line. The reconfiguration of the existing Newington Tap will not cause a measureable change of the electric and magnetic fields beyond the substation property. The proposed Project modifications to Berlin Substation equipment, which will be installed within the existing substation fence, will not cause a change of the electric and magnetic fields beyond the substation property.

Table 7-1: Tabulated Magnetic Field Levels for Average Annual Loads

Distance From Transmission Line (feet)	Magnetic Field (mG)
-100	0.3
-90	0.4
-80	0.5
-70	0.6
-60	0.9
-50	1.3
-40	1.9
-30	3.4
-20	7.2
-10	22.2
0	70.2
10	21.6
20	7.1
30	3.3
40	1.9
50	1.2
60	0.9
70	0.6
80	0.5
90	0.4
100	0.3

7.5 CONCLUSION

There will be no above ground electric fields associated with the installation of the transmission line beneath public roads or with the proposed substation modifications. Magnetic fields associated with the new transmission line will drop quickly to background levels as the distance from the centerline of the cables increases.

The proposed Project changes to the existing Newington, Southwest Hartford, and Berlin Substations will not cause changes in magnetic fields beyond the property lines, other than those related to the new underground line.

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8. PROPOSED PROJECT SCHEDULE

Table 8-1 illustrates the key activities in Eversource's proposed timeline for developing the proposed GHCCRP. As indicated on the timeline below, Eversource would file the *Application* with the CSC during the 1st quarter of 2016, after completing the municipal consultation period. The timeline in Table 8-1 does not list the planning activities that Eversource performed for the Project prior to the submittal of the MCF, but rather focuses on the future Project timeline.

Table 8-1: GHCCRP – Estimated Preliminary Timeline

Key Activities	Q4 '15	Q1 '16	Q2 '16	Q3 '16	Q4 '16	Q1 '17	Q2 '17	Q3 '17	Q4 '17	2018
Municipal Consultation Filing issued to Towns and scheduling of Open House	■	■								
Siting Application Filed with the CSC		■								
CSC Hearing(s) and Decision (12 months)			■	■	■	■				
CSC Decision						■				
Development & Management Plans						■	■			
State and Federal Permitting				■	■	■	■			
Construction								■	■	■
Project Outreach	■	■	■	■	■	■	■	■	■	■

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9. PERMITS, APPROVALS, AND CONSULTATIONS

As part of the Project planning process, Eversource initiated consultations with representatives of the four municipalities (Newington, West Hartford, Hartford, and Berlin) within which Project facilities are proposed. Eversource will continue similar proactive consultations as the planning for and review of the Project proceeds. This section identifies the permits and approvals that would be required for the construction and operation of the Project, and summarizes the federal and state agency and municipal consultations that Eversource has conducted to date concerning it.

9.1 AGENCY PERMITS AND APPROVALS REQUIRED FOR THE PROJECT

In addition to a Certificate of Environmental Compatibility and Public Need from the Council, the Project may require permits and approvals from other Connecticut and federal agencies. At the federal level, the Project must comply with the Clean Water Act (CWA), the Endangered Species Act, and the National Historic Preservation Act. At this time, only temporary impacts are proposed to wetlands at Newington Substation which may require a Category 1 permit from the USACE. There are no proposed impacts to rare species or cultural resources as none are located along the Proposed Route. At the state level, along with compliance with the Council's requirements, Eversource will have to obtain Project-specific permits or approvals, as applicable, pertaining to water quality (pursuant to Section 401 and 404 of the CWA), stormwater management, threatened and endangered species, and cultural resources. Additional state approvals may be required, depending on the final design of the Project.

Table 9-1 summarizes the federal and state permits and approvals expected to be required for the proposed Project. This summary is based on currently available data concerning the Project, and may be modified as the Project planning, design, and review process moves forward.

Table 9-1: Potential Permits, Reviews, and Approvals Required for the Project

Agency	Certificate, Permit, Review, Approval or Confirmation	Activity Regulated
FEDERAL		
U.S. Army Corps of Engineers (USACE) New England District	Section 404 CWA Connecticut General Permit Program Category 1	Discharge of dredge or fill material into waters of the U.S. (wetlands or watercourses)
U.S. Fish and Wildlife Service (USFWS)	Coordinates with USACE regarding endangered or threatened species (non-marine); provides input to USACE permit application review	Construction or operation activities that may affect federally-listed endangered or threatened species. Based on research, no federally-listed species are present in the Project area.
U.S. Environmental Protection Agency (EPA)	Provides input to USACE permit application review, as necessary	Construction or operation activities that may affect water, air, or other resources
CONNECTICUT		
Connecticut Siting Council (CSC)	• Certificate of Environmental Compatibility and Public Need • Development & Management Plan approval prior to construction of Project facilities	General transmission facility need, siting, construction, environmental compatibility, safety, and maintenance
Connecticut Department of Energy and Environmental Protection (CT DEEP)	401 Water Quality Certification (WQC)	CT DEEP 401 WQC is required along with USACE Section 404 authorization. Category 1 includes a categorical 401 WQC.
	General Permit for Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities	Stormwater, erosion / sedimentation control, and dewatering management during construction
CT DEEP Public Utilities Regulatory Authority (PURA)	Approval pursuant to CGS Section 16-243	Method & Manner of Construction Approval to Energize Lines
State Historic Preservation Office (SHPO) [29]	Approval of proposed Project consistency with the National Historic Preservation Act; comments during Council and USACE processes	Construction and operation activities that may affect archaeological or historic resources.
Connecticut Natural Diversity Data Base (NDDB)	Clearance - Endangered Species Act (Conn. Gen. Stat. §26-303 to §26-315)	Impacts on rare species; based on current data, no state-listed species are located in the Project area.
Connecticut Department of Transportation (ConnDOT)	Encroachment permit	Transmission line crossing of state Stormwater management during construction

[29] The SHPO is part of the Connecticut Department of Economic and Community Development.

9.2 FEDERAL AND STATE AGENCY CONSULTATIONS

In conjunction with the overall Project planning, Eversource will initiate consultations with the federal and state agencies, as appropriate, likely to be involved in the review or approval of the new 115-kV transmission line and related substation modifications. The purpose of these initial consultations will provide the agencies with preliminary information regarding the proposed Project, and to solicit baseline information concerning the Project area or input concerning potential Project-related issues. Volume 2 includes copies of correspondence to and from agencies regarding the Project.

9.3 MUNICIPAL, PUBLIC, AND OTHER CONSIDERATIONS

In March of 2015, Eversource initiated consultations with public officials of the towns in which the Project would be located. Table 9-3 summarizes the primary meetings that Eversource has held to date with municipal officials and state and federal officials. The purpose of these consultations was to inform the public officials of the proposed Project and solicit input from the towns concerning the scope of the work, especially about the routing of the new line. West Hartford's requested change to the route has been incorporated into the Proposed Route. Newington's proposed variation coming out of Newington Substation is under evaluation for potential inclusion in the application. In addition, state legislators were offered briefings prior to the MCF filing. Property owners and abutters along the Proposed Route of the new transmission line and next to the substations will be notified of the Project and invited to the Open House scheduled for the MCF period. This public outreach process conforms to the Council's MCF requirements. Eversource intends to continue this proactive outreach as the Project moves forward.

The overall objective of the municipal consultation process is to obtain input regarding the proposed Project from representatives of each of the towns potentially affected by the proposed transmission facilities, as well as from the interested public. In accordance with the Council's requirements, within 15 days of filing the Application for the Project, Eversource will provide to the Council a summary of the consultations with the towns, including any comments or recommendations issued by the municipalities, as well as copies of comments received from the public. Table 9-2 summarizes the primary meetings that Eversource has held to date with municipal officials and state and federal officials.

Table 9-2: Meetings Held To-Date with Municipal Officials, State and Federal Officials, and Other Key Stakeholder Groups

Stakeholder Group	Contact	Date	Purpose of Meeting
Municipal Officials			
Newington	John Salamone, Town Manager Chris Greenlaw, Engineer Tom Malloy, Highway Craig Minor, Planner Andy Brecher, Economic Development	March 5, 2015	Project Introduction
		April 7, 2015	Routing Discussion
		October 2, 2015	Follow-up briefing on Proposed Route
West Hartford	Ronald Van Winkle, Town Manager Duane Martin, Engineer Mark McGovern, Community Services Peter Privitema, Finance John Phillips, Public Works	March 16, 2015,	Project Introduction
		May 13, 2015	Routing Discussion
		August 24, 2015	Follow-up briefing on Proposed Route
		August 31, 2015	Routing Field Visit
Hartford	Mayor Pedro Segarra	The City declined the offer of a briefing	Project Introduction
Berlin	Denise McNair, Town Manager	November 16, 2015	Project Introduction/ MCF Briefing

10. SYSTEM ALTERNATIVES

This section complies with the provision in the Council's *Application Guide* (April 2010) that requires an applicant to identify "system alternatives and the advantages and disadvantages of each." Below, in Section 10.1, a "No Action" alternative is briefly discussed. Next, in Section 10.2, transmission system alternatives are discussed. This section describes the process by which a "double duty" preferred transmission solution for both local load serving problems in the Greater Hartford Sub-area and for the increase of transfer capacity across the WCT Import interface was developed as part of the GHCC studies. Finally, in Section 10.3, the evaluation of potential non-transmission system alternatives (NTAs) is discussed. NTAs include the addition of generation resources, often referred to as "supply-side" measures, and strategies to reduce load, often referred to as demand-side management (DSM) or DSM measures.

10.1 NO ACTION ALTERNATIVE

Under the no action alternative, no new transmission facilities would be developed and no improvements would be made to the existing electrical transmission system or to supply or demand resources in either of the two load pockets addressed by GHCCRP (the South Meadow – Berlin – Southington load pocket and the North Bloomfield – Manchester load pocket). This alternative was rejected because it would do nothing to correct violations of national and regional reliability standards and criteria; and thus the Greater Hartford Sub-area would continue to be at risk for electric outages and Eversource would be exposed to being fined by FERC for its failure to take action to resolve identified criteria violations. Failure to take action to bring the Greater Hartford electric supply into conformity with applicable reliability standards and criteria would also undermine the long-range plan of ISO-NE and Eversource for providing reliable transmission service throughout Connecticut.

10.2 TRANSMISSION ALTERNATIVES

Transmission alternatives are improvements to the transmission system that would resolve reliability problems with different transmission system configurations or technologies than those of the preferred solution. As part of the GHCC studies, an ISO-NE Working Group comprised of transmission planners from ISO-NE, Eversource, and The United Illuminating

Company, evaluated transmission alternatives in all of the sub-areas studied, including the Greater Hartford Sub-area and, at the same time, evaluated alternatives for providing required increases to the transfer capacity across the WCT Import Interface. The outcome of this evaluation process determined the optimal solution for presentation to, and subsequent review and approval by, the ISO-NE PAC.

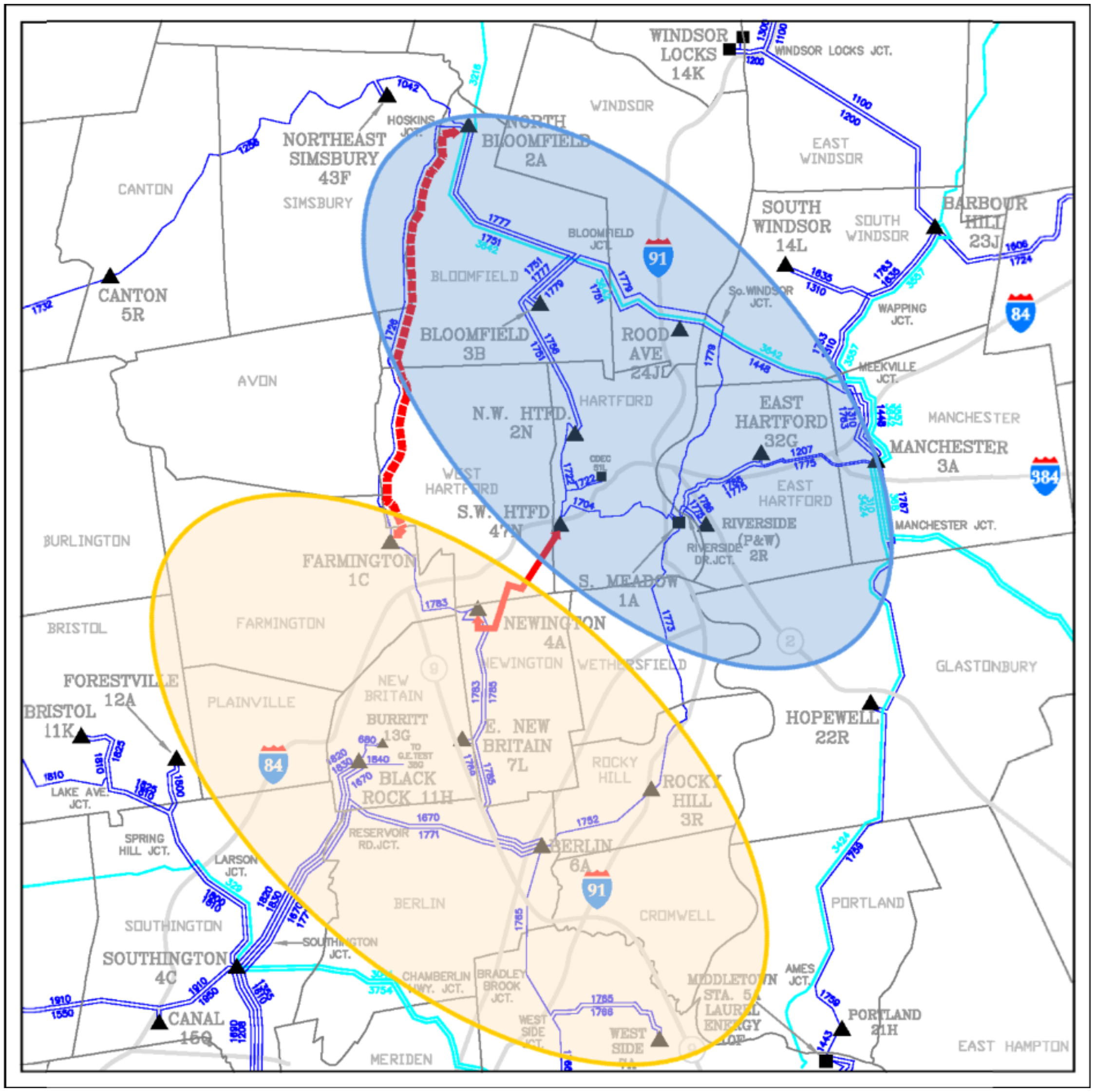
10.2.1 Transmission Alternatives Considered: Overview

As described in Section 2.3.1, the conceptual solution to resolve the criteria violations in the targeted South Meadow–Berlin–Southington and North Bloomfield–Manchester load pockets was to connect them with a new transmission line so that the transmission system in each load pocket would be able to serve the other when needed. In the event of contingencies in either area, this solution would provide an additional transmission element to share the load that would be automatically redistributed from a failed system element; and each area would have a new high capacity path by which generation from outside both load pockets may reach the load within each load pocket.

In addition, a new transmission line connecting the two load pockets would provide incremental transfer capability across the WCT Import Interface. As the 345-kV CCRP would have done, a new 115-kV circuit in this location will add another transmission element to the interface and therefore will increase transfer capability across the interface.

The Working Group identified two sets of logical terminal points for such a new transmission line. One set was Newington and Southwest Hartford Substations, which are not currently interconnected and were ultimately selected as the preferred solution, with the proposed development of an underground 115-kV cable between the two substations. The other set of terminal points considered for a new transmission line were Farmington Substation (located in the Town of Farmington) and the North Bloomfield Substation (located in the Town of Bloomfield). These two substations are presently connected by an existing 11.7-mile 115-kV overhead ROW. An adjacent second 115-kV line could be built in an overhead configuration. Figure 10-1 illustrates the general location of these two alternatives within the Greater Hartford Sub-area.

Figure 10-1: Potential Transmission Connections for Two Load Pockets in the Greater Hartford Sub-area



Because of the dense urban and suburban development in the area between Newington and Southwest Hartford Substations, an all-overhead transmission line route was determined to be impractical. Accordingly, the two alternatives that were analyzed in detail were the preferred underground between Newington and Southwest Hartford Substations and the overhead alternative between Farmington and North Bloomfield Substations.

10.2.2 Description of the Farmington – North Bloomfield Overhead Alternative

Eversource investigated the transmission system alternative involving the construction and operation of a new 115-kV transmission line along Eversource's existing ROW between Farmington and North Bloomfield substations. Under this option, the new 115-kV line would be aligned adjacent to an existing Eversource 115-kV line (the 1726 Line) and would extend for approximately 11.7 miles, traversing five towns in Hartford County, as illustrated on Figure 10-2.

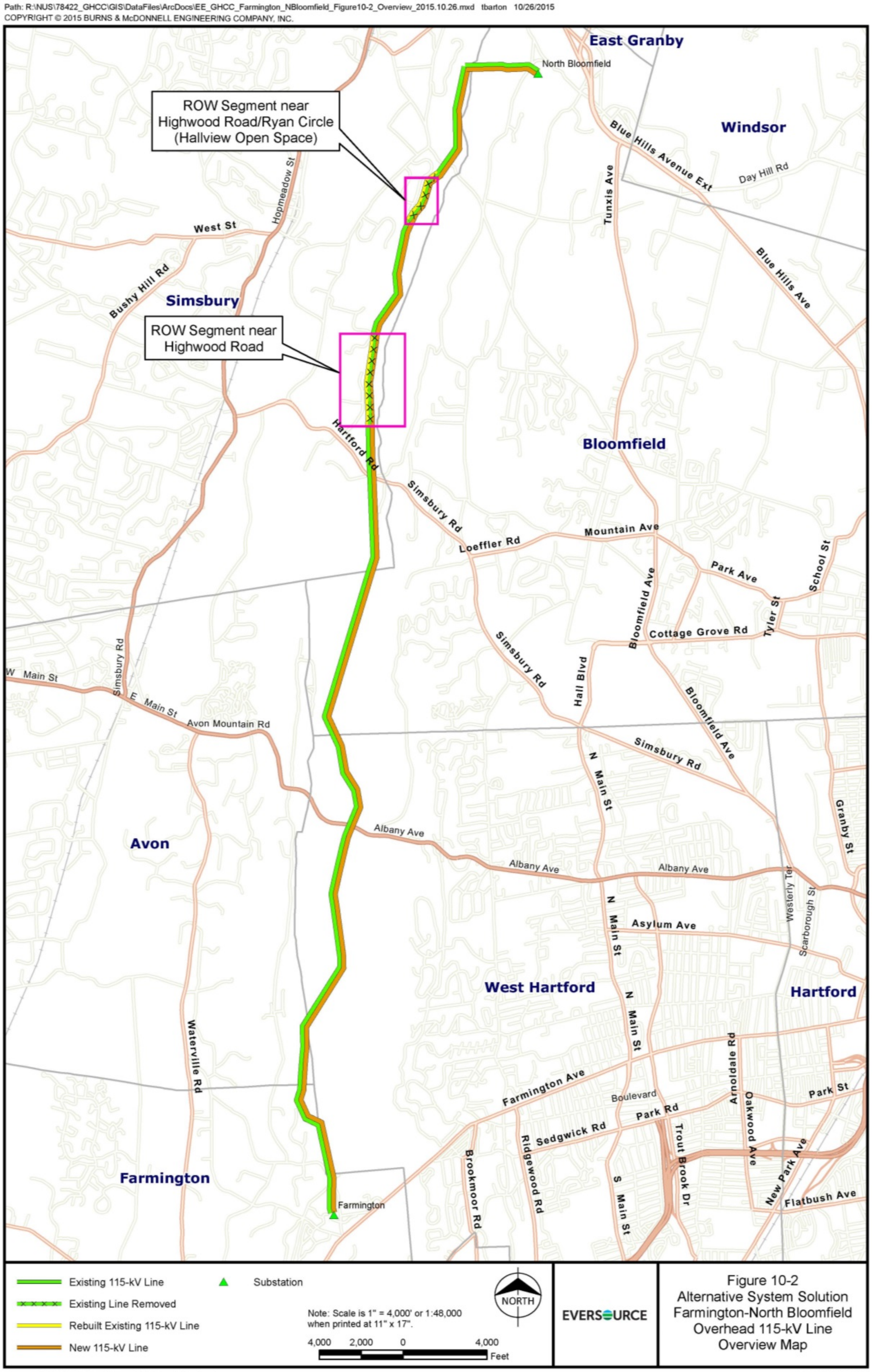
Specifically, the existing transmission line ROW between Farmington and North Bloomfield substations extends through these five towns:

- Farmington .... 0.8 mile
- Avon .... 0.6 mile
- West Hartford ...... 3.2 miles
- Simsbury .... 4.9 miles
- Bloomfield .... 2.2 miles

The ROW between Farmington and North Bloomfield substations averages 150 feet wide and is currently occupied by the 1726 Line, which was rebuilt in 1989 pursuant to a Certificate issued by the Council in its Docket 97, in February 1989. As rebuilt, the 1726 Line is supported on H-frame structures that are approximately 60 feet in height. Eversource performs vegetation management (to maintain low-growth vegetation consistent with overhead transmission line conductor clearances) on approximately 90-100 feet of the 150-foot-wide ROW, with un-managed vegetation principally along the east side of the ROW.

The existing transmission support structures are generally aligned along the west side of the ROW. Therefore, for most of its 11.7-mile length, the new line would be constructed in the vacant position on the ROW to the east of, and parallel to, the existing line.

Figure 10-2: Farmington – North Bloomfield Transmission Line Route



However, along two segments of ROW in the Town of Simsbury, totaling 1.1-mile in length, the existing 1726 Line structures are shifted out of alignment, toward the eastern edge of the ROW. This is because in its Decision and Order in Docket No. 97, the Council ordered that the shift be implemented in order to preserve forested buffers between the line and residences adjoining the ROW on the west, if the affected homeowners agreed to pay the incremental cost of construction of the line in the shifted position. The homeowners did make such an agreement and, as a result, the line is constructed nearer to the eastern side of the ROW along Highwood Road and Ryan Circle / Hunting Ridge Drive (near Simsbury's Hallview Open Space). (Refer to Figure 10-2 for the general location of these two ROW segments).

In light of this history, in designing the potential second line to be located along this ROW, Eversource sought to include the preservation of these forest buffers as a design element. This was a challenging assignment, which resulted in a somewhat complex potential line configuration.

10.2.2.1 115-kV Conductor Size and Specifications

The alternative overhead 115-kV transmission circuit would consist of three ACSS type conductors, each of which would be 1590-kcmil in diameter. This conductor is one of the standard conductor types that Eversource uses for new 115-kV line construction.

The 115-kV line would be protected by overhead lightning shield wires. The overhead shield wire would contain OPGW for communication purposes.

10.2.2.2 Line Design, Appearance, and Heights

Eversource would install the new 115-kV transmission line using weathering steel monopoles. In general, the structure configuration for the new 115-kV line would be self-supported tubular steel monopoles in a vertical configuration, with an average height of approximately 100 feet. Use of this configuration, as opposed to wider H-Frame structures, would preserve a position on the ROW that could be used in the future for a potential third line. Self-supported vertical tubular steel monopoles would also be used at angle points and as dead-end structures, also with a typical height of approximately 100 feet. The monopoles would be approximately 40 feet taller than the existing 1726 Line H-frame structures, and would likely be visible from portions of Penfield State Park, the Metacomet Trail, Simsbury open space lands, and nearby residential areas. Figure 10-3 below is a cross-section illustration of the typical configuration of the existing and new structures.

Along the Highwood Road and Hallview ROW segments, which total 1.1 miles (0.7 mile in the vicinity of Highwood Road and 0.4 mile in the vicinity of the Hallview Open Space), where the line design would preserve, to the extent possible, the existing forest buffers to the west of the 1726 Line, the 1726 Line would be removed and rebuilt in a vertical configuration to minimize the space between it and the new line, and to minimize the forested buffer that would need to be removed. The vertical structures would have typical heights of 100 feet. Along these two ROW segments, a total of 15 H-frame structures supporting the 1726 Line would have to be removed and replaced with vertical monopoles.

Figure 10-4 provides a cross-section illustration of the configuration of the existing and new lines along the Highwood Road and Hallview segments.

Figure 10-3: Typical Cross-Section of Alternative Overhead Line

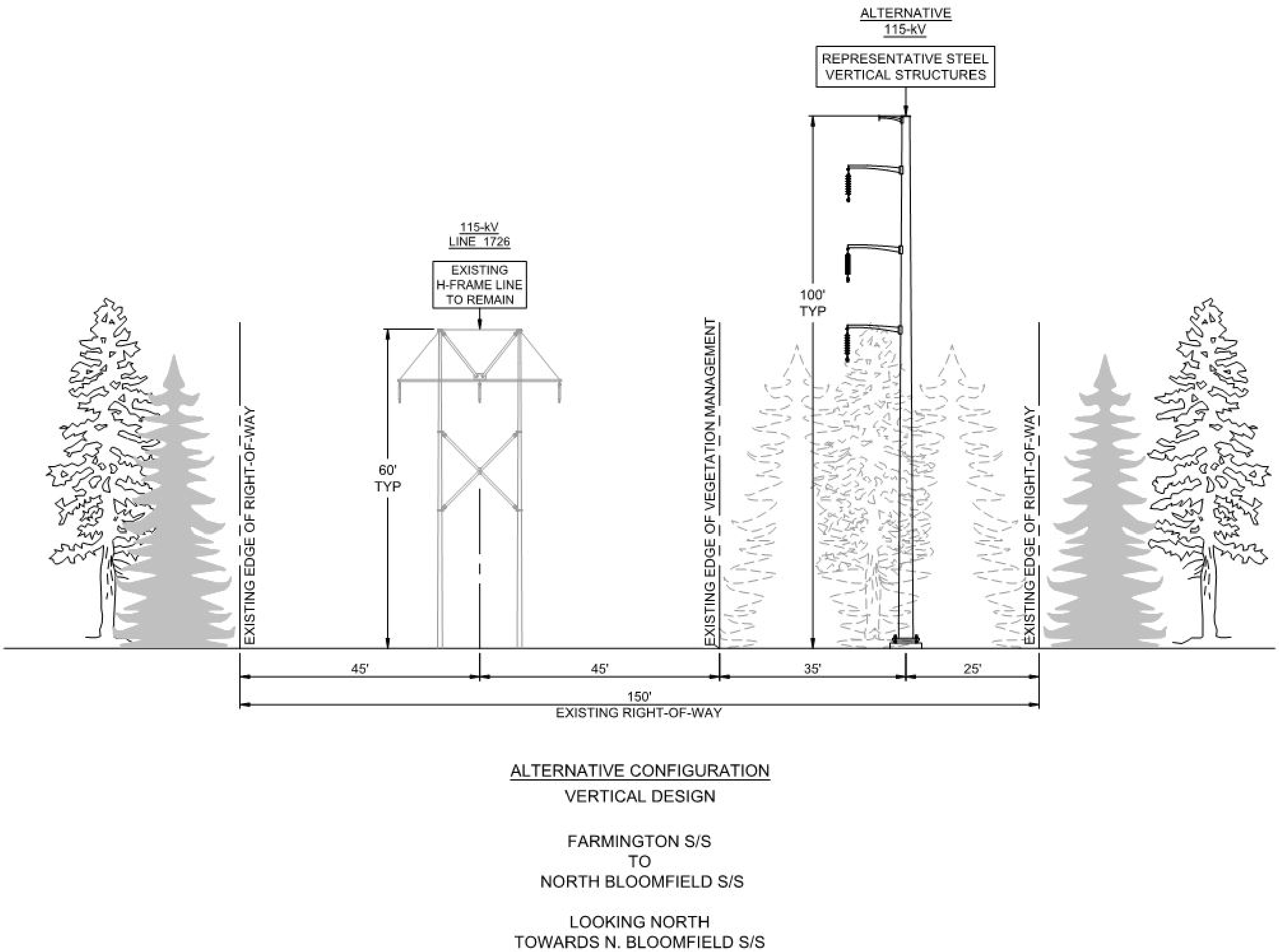
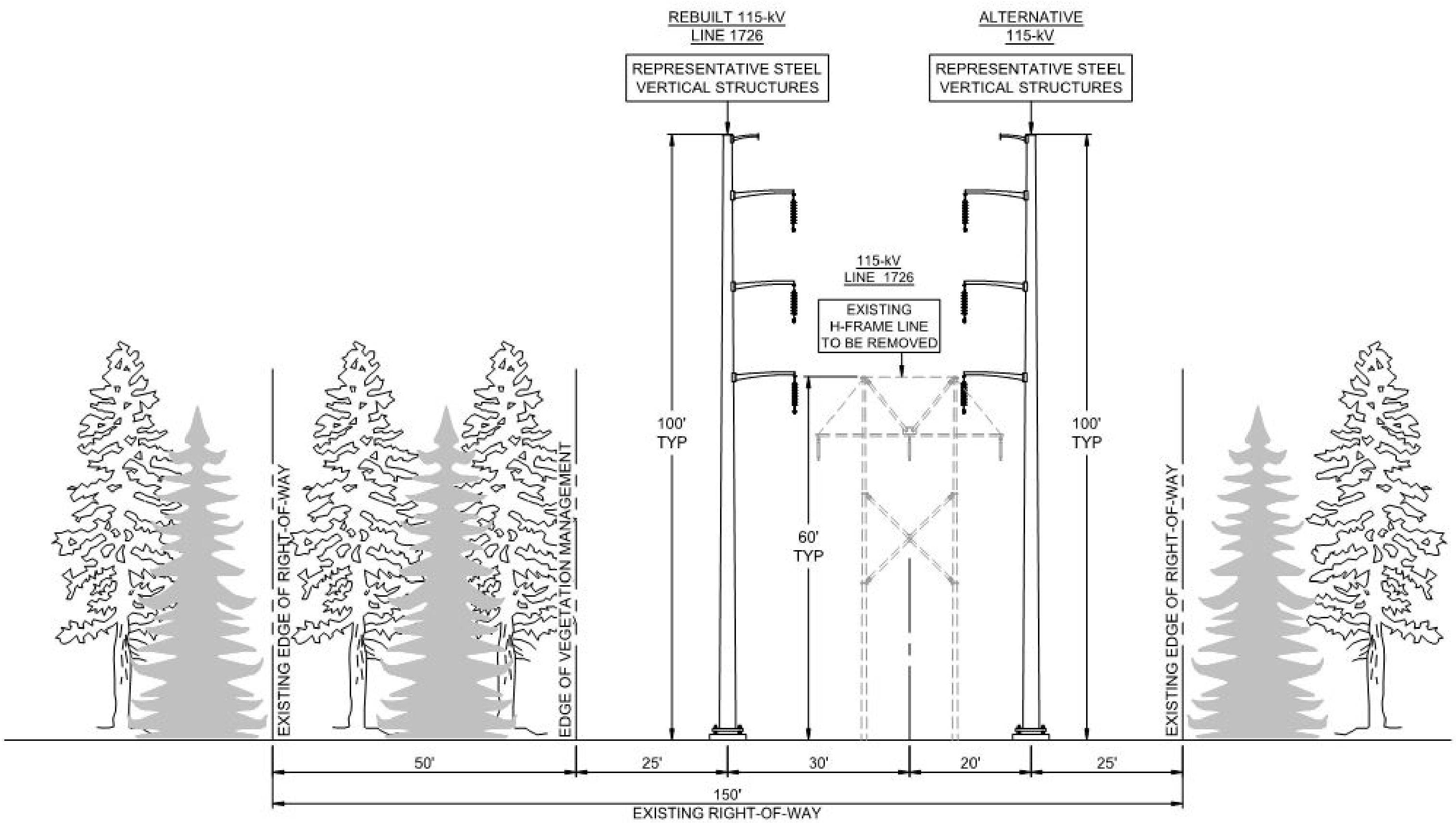


Figure 10-4: Cross-Section of Alternative 115-kV Line: Town of Simsbury ROW Segments with Rebuilt 1726 Line



ALTERNATIVE CONFIGURATION

VERTICAL DESIGN

STR. #'S 8125 TO 8132
&
STR. #'S 8145 TO 8149

LOOKING NORTH
TOWARDS N. BLOOMFIELD S/S

10.2.2.3 Construction and Outage Considerations

The construction of a new overhead 115-kV transmission line along the Farmington – North Bloomfield ROW also would pose certain constructability issues that would require further detailed engineering analyses or that would raise potential regulatory concerns, as compared to the proposed Project. For example, the installation of a new line within this ROW would require forested wetland vegetation clearing (an estimated 3.5 acres) and would potentially require permanent impacts to wetlands associated with the unavoidable placement of new structures in wetlands, as well as potential impacts to a large wetland complex near the North Bloomfield Substation. New access roads (permanent or temporary) also would likely have to be installed through wetlands. In addition, along most of the 11.7-mile route (other than the Highwood road and Hallview segments), the entire 150-foot-wide ROW would now have to be managed in low-growth vegetation consistent with overhead transmission line use.

To accomplish the removal and reconstruction of the 1726 Line structures near Highwood Road and the Hallview Open Space in Simsbury, the line would have to be taken out of service, requiring careful consideration regarding outage scheduling. In addition, the rebuilt segments of the 1726 Line would have to be installed farther to the west within the ROW, requiring additional vegetation clearing and placing the overhead line closer to residences. The two 115-kV lines would be configured to assure sufficient space between the lines for safe and reliable line operation.

10.2.2.4 ROW Considerations

As an alternate to removing and rebuilding the two segments of the 1726 Line, Eversource examined the potential for expanding the ROW to the east, while preserving the forested buffers along the west side of the ROW. However, to the east, the ROW abuts Penwood State Park, as well as the Town of Simsbury's Hallview Open Space and other town-owned open space parcels. Penwood State Park, an 800-acre park operated and maintained by CT DEEP, is situated linearly atop the Talcott Mountain Range and includes various hiking trails, including the Metacomet Trail, which was designated in 2009 as part of the New England National Scenic Trail. The Connecticut Forest and Park Association (CFPA) assists in maintaining the trails in the park, which include overlooks to the west (toward the Eversource ROW). Other recreational areas in the vicinity of the ROW include Heublein Tower, the Darling Wildlife Sanctuary, Talcott Mountain State Park, and Wilcox State Park.

To accommodate the mandatory clearance between conductors on the 1726 Line and the new line, as well as clearances between the new line conductors and vegetation, the expansion of the ROW in the vicinity of Highwood Road and the Hallview Open Space was estimated to require a total area of approximately 10 acres. Since all of the lands to the east of the existing ROW in these two areas are forested, such an expansion would require a minimum of 10 additional acres of forest clearing.

As a result, Eversource determined that any ROW expansion would be impractical due to cost considerations and potential regulatory issues associated with the acquisition of new easements and the establishment of a new, managed ROW over public lands (Penwood State Park, Town of Simsbury open space).

10.2.2.5 Summary

Eversource's analyses determined that this system alternative could be developed while preserving the forested buffers along the Highwood Road and Hallview segments of the ROW, and with no expansion of the ROW, provided that 100-foot-high vertical structures were used for the new line and that the two segments of the existing 1726 Line in Simsbury were relocated and rebuilt. However, compared to the proposed transmission line route and configuration, this alternative poses concerns with respect to outages and environmental impacts (refer to Section 10.2.3.3).

10.2.3 Comparison of the Transmission Alternatives

The two transmission alternatives were compared based on comparative performance, cost, environmental effects, and conformity to the transmission line siting policies administered by the Council.

10.2.3.1 Comparative Performance

Load flow simulations confirmed that both alternative solutions would resolve the thermal and voltage criteria violations in the two load pockets and eliminate criteria violations associated with constraints on the WCT Import Interface. Essentially, the reliability improvements offered by the two alternatives are equivalent, with the exception that the underground alternative required less re-dispatch of generating resources after a first contingency in order to position the system to withstand a second design contingency. This greater ease of operability gave it a slight advantage in the comparative performance evaluation.

10.2.3.2 Comparative Cost

Each of the alternative solutions includes common elements – reconductoring the Newington Tap, the modification of Berlin Substation, and the 3% reactor at Southwest Hartford Substation (refer to elements 5 through 7 in Table 10-1). In addition, the overhead alternative requires some system upgrades that the underground alternative does not – terminal upgrades on a 115-kV line between South Meadow and Rocky Hill and a reconfiguration of the Berlin 115-kV substation. The capital cost of the two alternatives was made on the basis of the cost of their unique components (refer to Table 10-1, element 1 vs. element 2, 3, and 4) - $91.0 million for the underground alternative, as compared to $87.1 million for the overhead line alternative. A comparison of the full scope of the two alternatives is provided in Table 10-1.

Since these planning grade cost estimates had an expected level of accuracy of +50% / -25%, this small cost difference was not decisive.

Table 10-1: Comparative Cost of GHCCRP Transmission Alternatives Underground (Newington – Southwest Hartford) vs. Overhead (Farmington – North Bloomfield)

Element		Underground ($Mm)	Overhead ($Mm)
1	Add a new 4 mile 115-kV underground cable from Newington to Southwest Hartford and associated terminal equipment including a 2% series reactor	91.0	
2	Add a new 11.7-mile 115-kV line from Farmington to North Bloomfield and associated terminal equipment		77.0
3	Terminal upgrades on the 115-kV line between South Meadow and Rocky Hill		0.6
4	Upgrade the 115-kV line between Farmington and Newington Tap (1783) – 3.6 miles		9.5
5	Reconfigure the Berlin 115-kV substation including the addition of two 115-kV circuit breakers and the relocation of a capacitor bank	4.2	4.2
6	Reconductor the 115-kV line between Newington and Newington Tap (1783) – 0.01 miles	1.0	1.0
7	Install a 115-kV 3% reactor on the underground cable between South Meadow and Southwest Hartford (1704)	3.6	3.6
TOTAL		**99.8**	**95.9**

10.2.3.3 Siting Policy and Comparative Environmental Effects

The choice of transmission alternatives in this case was unprecedented in that it was between an overhead solution and an underground solution of nearly equivalent reliability and cost. Only in recent years has the reliability of underground transmission systems approached that of overhead lines and, in this case, the usual large cost difference between the two technology types was not present because the underground line was much shorter than the overhead line (approximately 3.8 miles vs. 11.7 miles, respectively), and because there were several factors that raised the cost of the overhead construction above typical 115-kV overhead line costs. Accordingly, the choice was determined on other factors.

The Council's enabling legislation (the Public Utilities Environmental Standards Act, or PUESA) expresses a preference for underground transmission solutions, which the Council considers in balancing considerations of need, cost, and environmental impact (*See, CGS* Sec. 16-50*l*(vi), 16-50p(a)(3)(D), and 16-50r(b)). In most cases, this preference is outweighed by the much greater cost of underground transmission. However, where costs are equivalent, statutory policy considerations favor the underground solution. This consideration weighed heavily in favor of the choice of the underground alternative.

In addition, the establishment of a transmission connection between Newington and Southwest Hartford Substations (where none presently exists) offers a new, geographically diverse method for resolving the reliability issues in the Greater Hartford Sub-area. Whereas a new overhead line on the Farmington – North Bloomfield ROW would achieve the same objective of connecting the two load pockets, that option would not represent a geographically diverse transmission solution.

Eversource also considered constructability issues and the comparative environmental and social effects of the overhead and underground alternatives. For example, based on Eversource's experience in recently installing underground cable systems in urban / suburban environments, the construction of the underground alternative is expected to be less challenging to schedule and to complete because no system outages will be required. On the other hand, if approximately 1 mile of the existing 115-kV 1726 Line on the Farmington – North Bloomfield ROW were rebuilt and relocated to new structures, as would be required by the preferred line design, an extended outage of that line would be required. Since the line is an important element for east-to-west transfers across Connecticut, scheduling the necessary outage(s) would likely be challenging and could pose constraints on the construction effort.

Further, compared to the underground alternative, which would involve locating the cable system principally within or adjacent to road ROWs, the overhead alternative would result in greater environmental impacts to vegetation, wildlife, and water resources (including in wetlands). Although most of these impacts would be short-term, potential permanent impacts to wetlands (fill) and to wildlife habitat would occur. For instance, along the Farmington – North Bloomfield ROW, an estimated 3.5 acres of forested wetlands would be cleared and converted to shrub-scrub wetlands. In addition, based on initial estimates, a minimum of 3,000 feet of temporary access roads within the ROW would likely have to be constructed through wetlands.

Along the approximately 10.7 miles of the ROW, the new overhead 115-kV line would be constructed on vertical monopoles east of the existing H-frame 1726 Line structures.

Approximately 50 additional feet of vegetation on the east side of the ROW would have to be cleared. Assuming that most of this 50-foot-wide area is presently forested, approximately 65-70 acres of forest land would be cleared and converted to shrub-scrub habitat. In comparison, the underground cable system between Newington and Southwest Hartford Substations would require minimal vegetation removal or tree trimming; would cross only one water resource (Trout Brook); and would not result in any impacts to wildlife habitat.

The underground cable system would result in no long-term changes to the visual environment and thus would have no impact on any scenic resources. In comparison, a new 115-kV line, supported on 100-foot-tall monopoles that would be approximately 40 feet taller than the existing 1726 Line H-frame structures, would likely be visible from portions of Penfield State Park, the Metacomet Trail and Simsbury open space lands.

10.2.4 Conclusion

Table 10-2 summarizes the key factors used in the alternative transmission system comparison. Overall, compared to the overhead alternative between Farmington and North Bloomfield substations, the underground 115-kV cable system between Newington and Southwest Hartford Substations would provide the same system benefits, but would be more consistent with the policy of PUESA, would establish a geographically distinct new transmission path between two substations that are not presently connected, would be shorter, and would result in fewer impacts to vegetation, wildlife, water resources, and scenic resources. Accordingly, Eversource selected the underground cable configuration as the preferred transmission system solution.

Table 10-2: Summary of Key Factors Considered in Selecting Preferred Route

Factors Considered in Selecting the Preferred Solution		Underground 115-kV Cable System Alternative	Overhead 115-kV Line Alternative
Estimated Cost	Conceptual Level	$91 M *	$87 M *
Right-of-Way	Shorter overall route length	✓	✗
	Limits potential for new ROW acquisition	✓	✓
	Limits new forested vegetation clearing and long-term ROW management	✓	✗
Geographically Distinct Path		✓	✗
Operational Performance	Meets system reliability requirements	✓+	✓+
Construction Requirements	Reduces construction-related outage requirements	✓	✗
	Minimizes need for new access roads	✓	✗
Siting and Permitting	Consistent with Council's statutory preference for underground	✓	✗
	Consistent with federal policies for avoiding or minimizing impacts to wetlands and watercourses	✓	✗
	Limits environmental impacts (vegetation, wildlife, water resources)	✓	✗
	Limits potential for impacts to scenic or recreational areas	✓	✗
Preferred Solution		✓	✗

* The cost of the unique elements of each alternative. The overall Project cost also includes approximately $8.8 million for elements that are common to both alternatives. See Section 10.2.3.2.

10.3 NON-TRANSMISSION ALTERNATIVES (NTA)

As part of its examination of electric system needs and solutions in the Greater Hartford, Manchester – Barbour Hill, Middletown, and Northwest Connecticut (NWCT) Sub-areas, ISO-NE conducted two studies to identify potential solutions to the identified needs that would not require expansion of the regulated transmission system. Because these non-transmission solutions could, at least potentially, be implemented by participants in competitive markets, ISO-NE referred to them as "Market Resource Alternatives" (MRAs). Pursuant to the ISO-NE Open Access Transmission Tariff, Transmission Owners such as

Eversource are obliged to pursue regulated transmission solutions to address system needs only where the needs are not addressed by market forces. The ISO-NE MRA studies served as a signal to private developers of a potential need for such market alternatives.

In the MRA studies, ISO-NE evaluated the effects of adding new demand side and supply side resources in the same way that it evaluated system needs and transmission solutions – by running power-flow simulations to determine if the target reliability criteria violations could be eliminated by the addition of the extra resources or reductions in load. After extensive study and testing, ISO-NE presented to the PAC the results of two separate MRA studies, one of which considered exclusively demand-side alternatives, and the other supply-side alternatives. These studies identified MRAs for each of the four GHCC sub-areas.

The ISO-NE MRA analyses identified quantities of injections of power into the electrical system or load reductions that would be required at particular electrical locations in order to obviate the need for regulated transmission improvements. However, ISO-NE did not determine the types of resources and technology that could provide such injections or reductions of demand at each location. Such a determination requires consideration of the suitability of the available technologies for the particular application, including performance characteristics, cost, land requirements, access to a water supply for cooling (if necessary), availability of fuel supplies, and other factors for developing and bringing to commercial operation a new DSM program or supply-side resource. The ISO-NE MRA studies also did not undertake to estimate the cost of the NTA solutions compared to the cost of the transmission solution.

Accordingly, Eversource engaged an expert consultant, London Economics International, LLC (LEI), to perform a study of non-transmission alternatives to the preferred transmission solution for the Greater Hartford Sub-area identified in the GHCC *Solutions Report*, which includes the proposed transmission improvements that are the subject of this MCF. LEI is a consulting firm with expertise in analyses of the New England power markets, including economic evaluations, simulation modelling, asset valuation, price forecasting and market design.

Using the ISO-NE MRA analyses as the basis for its investigation, LEI considered the potential technologies that could deliver the requisite energy injections to satisfy the reliability needs of the local areas, the associated costs of these NTA technologies, and practical feasibility of each least-cost NTA solution. The results of LEI's study, as well as a detailed description of its analyses, are contained in LEI's report[30], a copy of which is included in Volume 2.

As detailed in the LEI Report, the ISO-NE analyses indicated that an NTA that would resolve the criteria violations in the two load pockets to be addressed by the GHCCRP (referred to as the "Rest of Greater Hartford" in the MRA study) would require an injection of 196 MW at the Northwest Hartford Substation, which is inside the North Bloomfield–Manchester load pocket, or an equivalent reduction in demand in the area served by that substation. Based on this ISO-NE determination, LEI then examined what actual supply-side and demand-side resources would be capable of providing the specified injections or reductions and selected hypothetical, technically feasible NTA technologies for cost analysis. LEI considered technically "feasible" technologies to be those that would provide the identified the reliability need and could be, in theory, implemented based on planning criteria and technology-specific operating profiles, and also developed a hypothetical hybrid NTA consisting of a combination of demand response and new generation.

With the assistance of Eversource personnel responsible for energy efficiency programs, LEI identified the maximum incremental demand response that could likely be implemented in the area served by the Northwest Hartford Substation, in addition to what is currently planned to be implemented pursuant to the ISO-NE Forward Capacity Market, and above and beyond what is forecast by ISO-NE to occur on the basis of current utility programs for DSM and energy efficiency. Given the projected net load at the Northwest Hartford Substation, the maximum likely achievable incremental demand response was determined to be 23 MW. Taking into consideration this incremental demand response, LEI then employed industry-standard levelized costing principles to select from the group of technically feasible NTA technologies, a preferred resource to supply the remaining balance of 172 MW needed.

[30] London Economics International, LLC: Analysis of the Feasibility and Practicality of Non-Transmission Alternatives to the Greater Hartford / Central Connecticut Reliability Project, August 31, 2015.

Based on an evaluation of operational and cost factors, LEI concluded that the best solution would be to construct a 182 MW combined-cycle natural gas fueled turbine generator (CCGT) at Northwest Hartford. LEI then computed the net direct cost to Connecticut ratepayers of this least-cost NTA portfolio. To do so, LEI first estimated the annualized cost of building and operating the NTA, and then deducted from that gross annual cost the projected average earnings that the NTA could be expected to obtain in the ISO-NE energy and capacity markets. The difference is the total net direct cost to ratepayers for this least cost technically feasible NTA solution. This net cost was estimated to range from $21 million to $33 million a year. However, this cost was knowingly understated because there were several ancillary costs of the NTA that were not estimated or included. For instance, the nearest gas pipeline supply is approximately four miles away from the Northwest Hartford Substation, so that the developer of the generator would have to fund the construction of a 4-mile pipeline lateral together with an interconnection and a metering facility. No costs for this requirement were estimated. Similarly, in order to interconnect the generator to the transmission grid, the developer would have to bear the costs of any transmission upgrades ISO-NE found to be necessary to avoid an adverse impact on the grid from the addition of the generator. No effort was made to determine what transmission upgrades would be necessary or what they would cost. Even without considering such additional cost, the estimated NTA cost was vastly greater than the Connecticut ratepayers' share of the revenue requirement associated with the proposed transmission solution (more than $4.6 million a year). The degree of this cost difference was so great that LEI concluded that the NTA would not provide a practical alternative to the transmission solution and terminated its analysis.

If the NTA evaluated by LEI were to be considered further, it would have been necessary to test it in the same manner as the transmission solution was tested in the ISO-NE solution study. The results of the ISO-NE study could indicate that additional capacity beyond that included in the LEI NTA would be needed to provide, with the required degree of reliability, the injection quantities determined to be necessary by the initial ISO-NE MRA studies. For instance, these studies could have shown that two separate units would be required for reliability purposes, instead of the single unit assumed by LEI. In addition, it is likely that an additional injection or load reduction would be found to be necessary within the South Meadow – Berlin – Southington load pocket.

Such further studies also would have evaluated a full range of the non-economic costs and benefits of the NTAs, compared to those of the transmission solution. For instance, the environmental effects of the NTAs (e.g., noise impacts and air emissions from the CCGT plants) would have to be specifically determined and subsequently compared to those of the transmission alternative, which are extensively described in this document (refer to Section 6). In addition, forward-looking simulation modelling would need to be performed to assess the relative longevity of both the transmission solution and the potential NTA technologies, and to compare the various services and other benefits that each could provide.

However, the cost difference between the NTA and transmission solutions in this case is decisive, illustrating that NTAs to the GHCCRP are economically impractical. Indeed, the economic impracticality of the NTA solution here is underscored by the fact that no one has proposed to implement an NTA for the Greater Hartford Sub-area since ISO-NE identified potential MRAs for the GHCC projects in 2012. Pursuant to the ISO-NE Open Access Transmission Tariff, since no market solution for a reliability need has been implemented, Eversource is required to proceed with a “backstop” regulated transmission solution, as proposed in this document.

11. POTENTIAL TRANSMISSION LINE ROUTE AND CONFIGURATION ALTERNATIVES AND VARIATIONS

System alternatives analyses resulted in the proposed system solution – a new 115-kV transmission line connecting Newington and Southwest Hartford Substations. Eversource then used an iterative approach to identify and evaluate route alternatives and transmission line design options. This approach was initiated with the development of a geographic study area, followed by identification of route alternatives within the study area and an assessment of those routes with design options, including both underground and overhead options, all within this geographic study area. This evaluation was performed in consideration of Eversource's established routing objectives and routing criteria, as well as with input from state and municipal officials. Sections 11.1 through 11.3 describe this alternatives evaluation process.

Alternative route analyses and system configuration studies led to the development of the Proposed Route and an underground transmission cable system design. For portions of the Proposed Route, Eversource also identified route variations along which the new transmission line could potentially be constructed. However, as discussed in Section 11.4, each of these route variations includes attributes that make it comparatively less preferred than that portion of the Proposed Route that it would replace. As a result, Eversource prefers the Proposed Route over any of the route variations identified to date.

Eversource also evaluated alternative construction techniques to install the cable system across Trout Brook in the Town of West Hartford. These alternative crossing methods are identified and evaluated in Section 11.5.

In addition, Eversource is presently in the process of performing more detailed analyses of one of the alternative routes initially identified in Section 11.3. This alternative would involve an alignment of the new transmission line along portions the recently-constructed CT*fastrak* corridor (which parallels an Amtrak railroad ROW), as well as within an existing Eversource distribution line ROW and across privately-owned properties. Section 11.6 describes this alternative route based on currently available information. Eversource expects to complete additional engineering evaluations of this alternative for inclusion in the Application to the Council.

11.1 TRANSMISSION LINE PROJECT AREA GEOGRAPHIC BOUNDARIES

As the first step in the route identification and evaluation process, Eversource determined a geographic study area within which to concentrate its investigation of potential transmission line routes, given that the new 115-kV transmission line must extend between Newington and Southwest Hartford Substations. No existing transmission line ROWs currently connect these two substations.

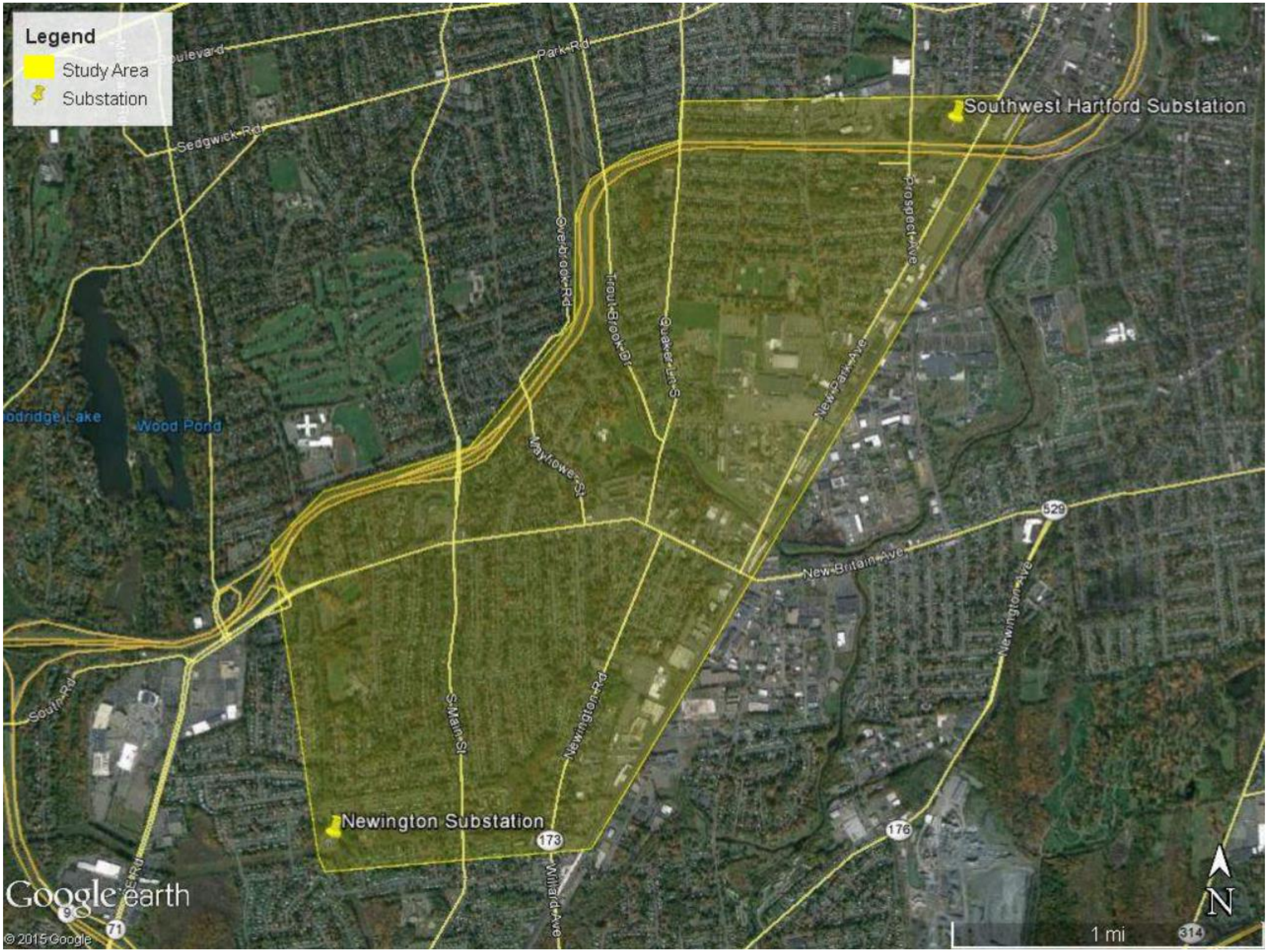
Eversource defined the geographic study area by considering the shortest possible / feasible distance between Newington and Southwest Hartford Substations, as well as the presence of both man-made and natural features (e.g., existing Eversource ROWs, I-84, CT*fastrak* bus corridor, tributary to the South Branch of the Park River). Further, because the two substations are situated in well-developed urban / suburban regions, a key factor in the definition of the geographic study area was the presence of various existing ROWs that could be potentially used for the new transmission line.

As shown in Figure 11-1 (see also Figure 1-2), the geographic study area is anchored by Newington Substation in the southwest and Southwest Hartford Substation in the northeast. On a direct line, these two substations are separated by approximately 3.0 miles.

The geographic study area, which encompasses the area immediately between the two substations, is generally defined by the following:

- Eversource's existing distribution ROWs that extend north and east from Newington Substation, forming the western and southern boundaries of the study area, respectively;
- I-84 to the north and northwest;
- Kane Street and St. James Street to the north; and
- The CT*fastrak*/Amtrak corridor to the east.

Figure 11-1: Geographic Boundaries of the Transmission Line Project Study Area



The boundaries of the geographic study area were chosen for several reasons, taking into consideration the extensive urban / suburban development in the region as a whole. The southern and western boundaries were determined based on existing potential ROWs for the new line (i.e., an existing Eversource ROW on the west and local road ROW on the south) and because there are no apparent advantages to considering other routes, all of which would increase the length of the line.[31]

I-84 was chosen as the northwest study area boundary based on existing land uses, and because there are no advantages to considering a longer potential alignment to the north and northwest (which would involve routing in immediate vicinity of Conard High School). Further to the east, Kane Street and James Street bound the study area to the north to minimize the length of the transmission line; similar to the study area boundaries on the south and west, any route to the north of these two streets would increase the length of the new transmission line with no apparent benefit.

The CT*fastrak/*Amtrak railroad corridor bounds the study area to the east. Any potential route east of this corridor would increase the length of the transmission line because it would have to follow an indirect series of road ROWs and would pose potential constructability issues associated with water crossings (e.g., Trout Brook, South Park River tributaries) and the potential need for trenchless crossings under the CT*fastrak/*Amtrak railroad corridor.

11.2 DESCRIPTION OF ROUTING OBJECTIVES AND ALTERNATIVE ROUTE ANALYSIS PROCESS

For the route alternatives analysis, Eversource applied an established set of route selection objectives to identify and compare potential routes for the new 115-kV transmission line between Newington Substation and Southwest Hartford Substation. These defined line routing objectives, which are listed in Table 11-1, include the following overarching goals:

[31] Existing Eversource ROWs extend to Newington Substation from the north, east, west, and south. The ROWs connecting to the substation from the south and west were not considered in the routing studies because they do not extend toward Southwest Hartford Substation.

- The selection of a cost-effective and technically feasible solution to achieve the required transmission system reliability improvements; and
- The avoidance, minimization, or mitigation of adverse environmental and cultural effects and minimizing impacts to the community to the extent possible.

Table 11-1: Eversource Transmission Line Route Selection Objectives

- Comply with all statutory requirements, regulations, and state and federal siting agency policies
- Achieve a reliable, operable, and cost-effective solution
- Maximize the reasonable, practical, and feasible use of existing linear corridors (e.g., transmission line, highway, railroad, pipeline ROWs)
- Minimize adverse effects to sensitive 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
- Minimize the need to acquire property
- Maintain public health and safety

Eversource applied the transmission line route selection objectives to identify potential 115-kV transmission line route alternatives involving underground and combination underground / overhead configurations. Because of the urbanized nature of the study area and the lack of available land for a new overhead transmission line corridor, no all-overhead transmission line routes were identified as viable between Newington and Southwest Hartford Substations. However, overhead line configurations along existing Eversource ROWs emanating from Newington Substation were evaluated as alternatives for portions of the new line as discussed further in this section.

As the first step in the alternative route analyses, Eversource examined the Project study area to identify distinct, existing linear corridors (e.g., federal, state, and local roads; the

CT*fastrak* bus corridor, Amtrak rail line; Eversource ROWs) for further investigation as potential routes for the new 115-kV line. The alternative routes were identified and evaluated. To determine the characteristics of each route alternative and to assess each in terms of the Project objectives and Eversource's route evaluation criteria, a team conducted field reconnaissance, performed baseline data collection, reviewed aerial photography, consulted state and local officials, assessed general constructability, and estimated costs.

These potential route alternatives were then examined using Eversource's route evaluation criteria for underground transmission cables and for overhead transmission lines (as summarized in Table 11-2 and Table 11-3, respectively) to assess the viability of each option based on operability and reliability, technical feasibility, potential effects on property, potential effects on environmental and cultural resources, and cost.

Because underground and overhead transmission line construction and operation are inherently different, the emphasis placed on some of the route evaluation criteria in the analysis of potential route options varied for these two line designs.

11.3 TRANSMISSION LINE ROUTE ALTERNATIVES

11.3.1 All Routes Initially Considered

After defining the Project study area, a network of potential route segments for the new 115-kV transmission line was identified. These initial route segments were determined based on the following primary considerations:

- Length – Segments were identified that, when connected to form a route, generally connected the two substations in as direct a manner as possible.
- Maximizing the use of existing transmission and distribution ROWs extending from Newington Substation – Existing Eversource ROWs, occupied by overhead transmission lines and overhead and underground distribution lines, presently extend out of Newington Substation. The existing ROWs that extend from the substation to the north and east were identified as potential routing opportunities that should be considered for the new 115-kV line to maximize the collocation of electric facilities.

Table 11-2: Route Evaluation Criteria for 115-kV Underground Transmission Siting

Routing Criteria	Description
Environmental and Cultural Considerations	Underground cables are preferably routed away from, rather than through, significant environmental and cultural resources. Whereas an overhead transmission line can span wetlands, watercourses, vegetation, rock outcroppings and, steep slopes, the installation of an underground cable system requires the excavation of a continuous trench. The operation of the cable system requires continuous permanent access along the entire route so that any splice vault or portion of the cable duct bank can be reached by heavy equipment as necessary for maintenance and repairs. Therefore, any sensitive environmental resources (such as watercourses, wetlands, or endangered species habitat) or cultural resources located along an underground cable route may be directly affected by the trenching required for the cable system. To mitigate such impacts, the cables can be installed, for relatively short distances, beneath these resources using subsurface construction technology, such as jack and bore or horizontal directional drilling, but at great expense. Existing public road corridors are usually considered for the installation of underground cables in preference to overland electric transmission line ROWs. Road corridors typically provide continuous permanent access along the underground cable route and often are characterized by gradual slopes. However, when sited in or adjacent to roadways, underground cables must avoid conflicts with existing underground utilities. Furthermore, alignment of underground cables along road ROWs may pose other potential environmental issues, such as excavation through areas of contaminated groundwater or soils; traffic congestion; difficult crossings of watercourses and wetlands that the roads traverse or bridge; and disturbance to vegetation and land uses adjacent to the roads (due to construction staging, heavy equipment operation, etc.)
Engineering Considerations	Steep terrain poses serious problems for underground cable construction and may cause down-hill migration and overstressing of the cable and cable splices (the point where two cables are physically connected together). Accordingly, one of the primary engineering objectives for an underground cable system is to identify routes that are relatively straight, direct, and flat and have only gradual slopes and inclines to minimize construction and maintenance costs and to avoid downhill cable migration.
Availability of Useable ROW	A new 115-kV underground XLPE cable system typically requires a minimum of 30- foot-wide work area for construction. Additionally, land must be available for burying splice vaults, each of which is approximately 9 feet wide by 9 feet deep and up to 24 feet in length. The installation of each vault would typically require an excavation of 13 feet wide, 13 feet deep, and 30 feet in length. Such vaults, which must be placed at approximately 1,600-to-2000 foot intervals along a 115-kV cable route, are required to allow the individual cable lengths to be spliced together and also must be accessible, via manholes, for cable-system maintenance and repair. Due to constraints posed by buried utilities within road travel lanes or conflicts with public highway use policies, vaults must sometimes be located behind road shoulders or on private lands adjacent to public road corridors.
Social Considerations	Underground cable system construction requires considerable time and results in noise, disruptions to traffic and impediments to access to adjacent land uses, and potential conflicts with existing in-ground utilities. Consequently, where possible, a routing consideration is to limit the length of cable installation through densely developed residential areas and central business districts. These social effects must be carefully considered and balanced against the potential lesser effects of constructing and operating overhead line segments in comparable areas or the potential additional cost of alternative underground routes. However, once installed, underground cable systems are unobtrusive and pose no changes to the visual environment (the only visible indication of an underground cable located in a street is a manhole type cover at splice vault locations).

Table 11-3: Route Evaluation Criteria for 115-kV Overhead Transmission Siting

Routing Criteria	Description
Availability of Existing ROWs for the New Line to Follow	The potential collocation of the 115-kV transmission facilities along existing ROWs where linear uses are already established (e.g., transmission lines, highways, railroads, pipelines) is a primary routing consideration. The collocation of linear utilities within existing utility corridors is strongly favored by the Federal Energy Regulatory Commission's Guidelines for the Protection of Natural, Historic, Scenic, and Recreational Values in the Design and Location of ROWs and Transmission Facilities, with which any electric transmission line approved by the Council must be consistent.[32] New ROW. The ROW width required for an entirely new 115-kV overhead line route would vary depending on the type of transmission line structure, which affects the conductor clearance required from vegetation. Typically, a line with a delta-structure configuration would require a minimum 90-foot-wide ROW, a line with a horizontal (H-frame)-structure configuration would require a 100-foot-wide ROW, and a line with a vertical-structure configuration would require a 70-foot-wide ROW. Existing ROW. The placement of a new 115-kV transmission line within an existing corridor (parallel to existing transmission lines) may or may not require expansion of an existing ROW, providing that the existing ROW is wide enough and has sufficient room to accommodate the new 115-kV transmission line.
Engineering Considerations	Whether on existing or new ROWs, the terrain and location of the transmission line route and constructability issues must be considered since both may have a significant bearing on cost and effects on environmental resources. Among the constructability factors considered is the ability to avoid or minimize the location of structures along steep slopes or embankments, in areas of rock outcroppings, or within environmentally sensitive areas, such as wetlands. Engineering requirements for the transmission line and access roads (as necessary) to cross streams, railroads, and other facilities are also assessed. Terrain and access constraints (e.g., side slopes, rugged topography) due to extreme side slopes are assessed.
Avoidance or Minimization of Conflicts with Developed Areas	Where possible, it is preferable to avoid or minimize conflicts with residential, commercial, and industrial land uses such as homes, businesses, and airport approach zones. One of Eversource's primary routing objectives for any proposed transmission line is to minimize the need to acquire homes or commercial buildings to accommodate the new transmission facilities (refer to Table 11-1).
Consideration of Visual Effects	Because 115-kV transmission line structures typically range from 70 to 105 feet tall (depending on structure configuration), structure visibility is a design consideration. In recognition of general public opinion regarding structure visibility, it is desirable to avoid placing structures in areas of visual or historic sensitivity; to consider designs for minimizing structure height; and to assess the potential visual effects of removing mature trees along ROWs, as required to conform to electrical clearance requirements (i.e., the potential implications of removing trees that provide vegetative screening). Vertical structures typically have the greatest visibility effects. However, structure visibility effects are only incremental if new overhead lines are placed within existing ROWs along which overhead transmission lines are already part of the visual landscape.
Avoidance or Minimization of Environmental Resource Effects	In accordance with federal, state, and municipal environmental protection policies, the avoidance or minimization of new or expanded ROW corridors through sensitive environmental resource or recreation areas such as parks, wildlife management areas, and wetlands is desired.
Accessibility	An overhead line must be accessible to both construction and maintenance equipment. Although access along the entire overhead line route is typically not needed, vehicular access to each structure location from some access point is required.

[32] CGS Section 16-50p(a)(3)(D)

- Trout Brook – In the study area, Trout Brook extends through suburban / urban areas in the Town of West Hartford and historically has been channelized or otherwise modified (e.g., construction of an associated levee) for flood management purposes. Based on initial review and taking into consideration land use constraints and constructability issues within the study area, only three locations were identified as potentially feasible for routing the transmission line across the brook: (1) at South Quaker Lane; (2) between commercial parking lots on the south, and Chelton Avenue on the north; and (3) at New Park Avenue.
- I-84 – The transmission line crossing of I-84 was considered a routing constraint, given the density of development in the study area and the lack of available existing ROWs to follow, particularly since most of the streets in the vicinity cross the interstate as overpasses. In the study area, New Park Avenue (directly south of Southwest Hartford Substation) is the only crossing road that extends under I-84.

The overall network of route alternatives initially considered for the new 115-kV transmission line is shown in Figure 11-2.

11.3.2 Prominent Existing ROWs Considered

After identifying the initial network of potential route alternatives for the new 115-kV transmission line, Eversource first reviewed the potential for collocating portions of the new line within or adjacent to major linear corridors. Eversource's analyses quickly determined that alternative routes involving collocation along such corridors would pose significant drawbacks and challenges. Two major alternative corridors in the study area were evaluated: the I-84 corridor and the CT*fastrak*/Amtrak corridor.

Figure 11-2: All Route Alternatives Initially Considered for New Transmission Line

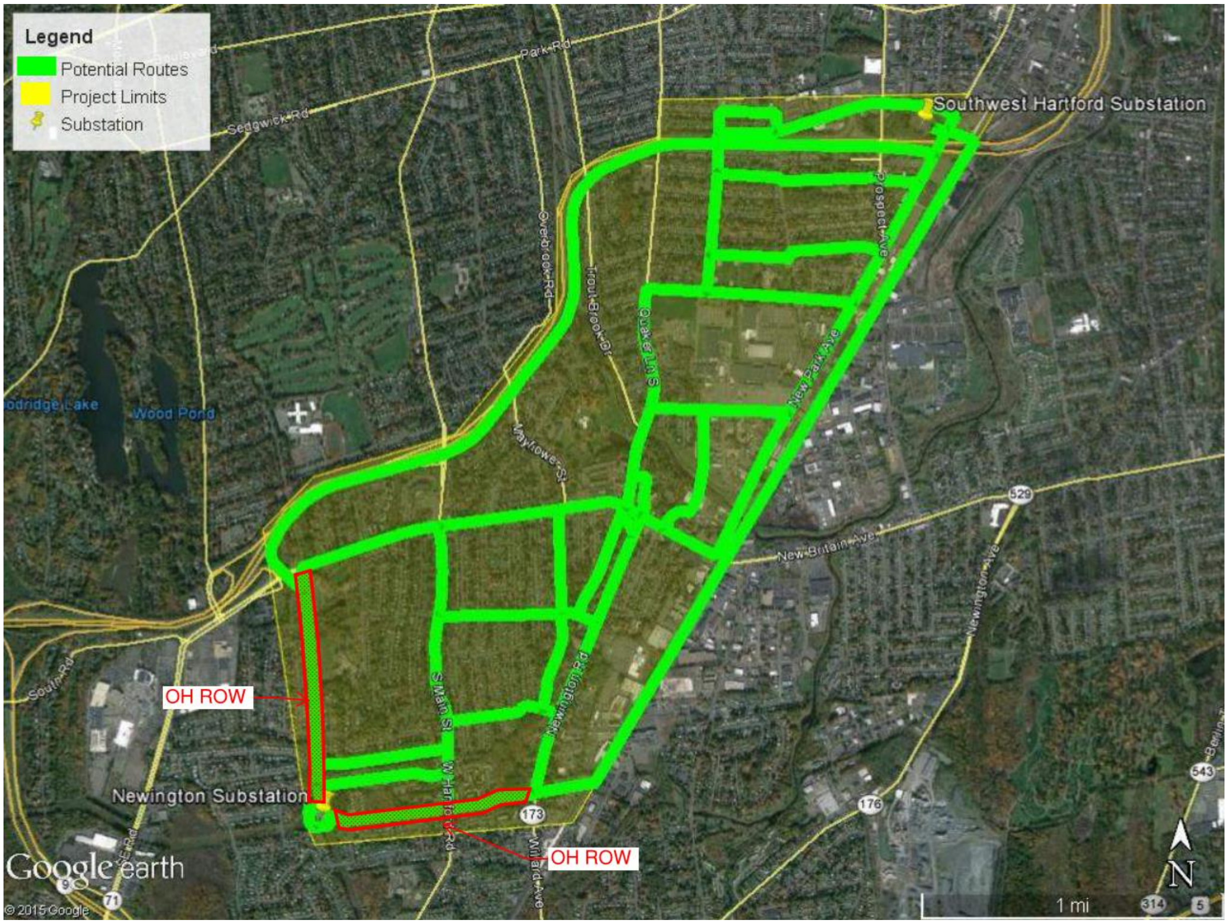
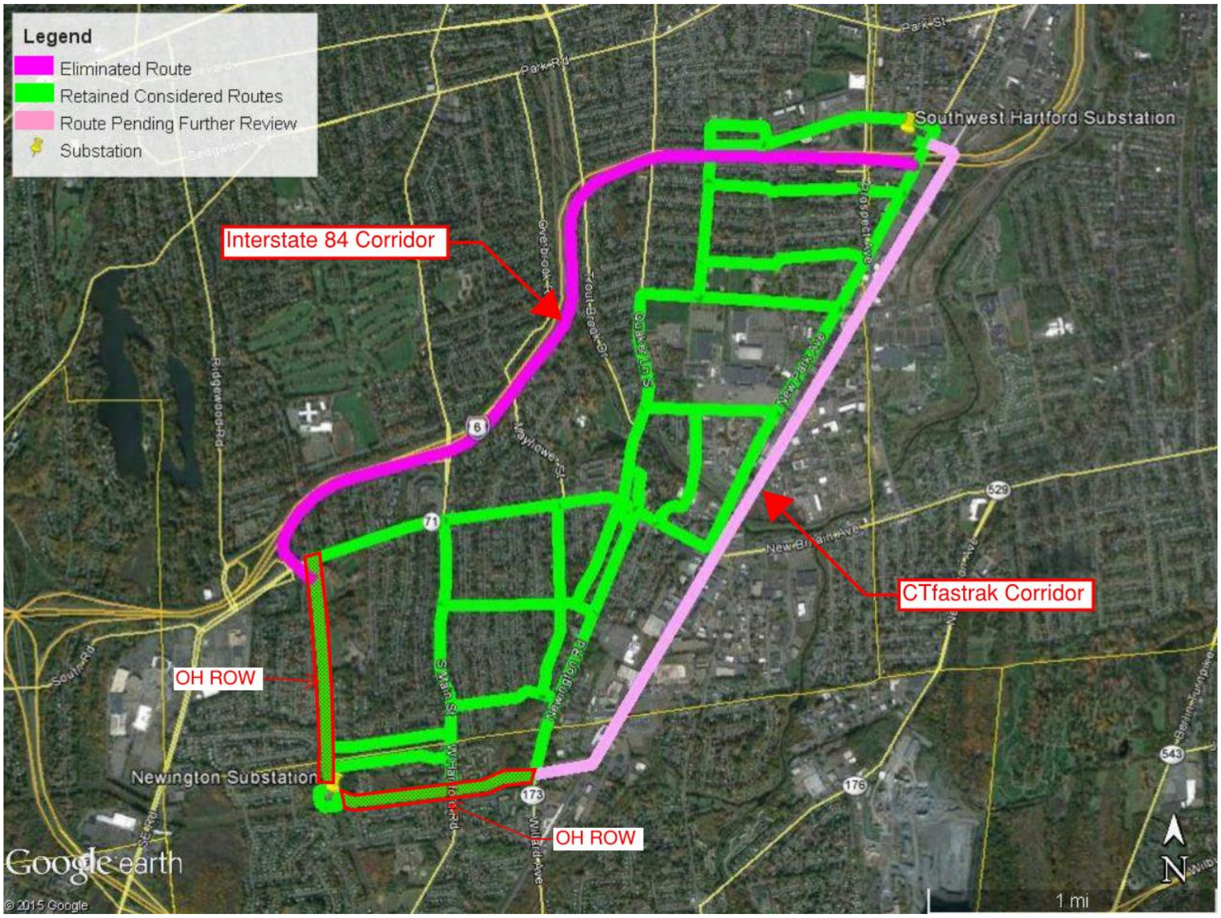


Figure 11-3 illustrates the two major route alternatives in the study area. For the reasons described in Section 11.3.2.1, the use of the I-84 corridor was eliminated from further consideration due to overriding technical or constructability issues. Further, the alignment of the new line within the I-84 ROW would conflict with ConnDOT policy.

The alignment of a new transmission line along the CT*fastrak*/Amtrak corridor also would present engineering and other challenges. Eversource is in the process of consulting further with ConnDOT (which manages the CT*fastrak)* and Amtrak regarding this alternative route, and performing additional engineering analyses of the potential issues regarding the use of this corridor. Section 11.3.2.2 introduces the CT*fastrak*/Amtrak alternative; additional information regarding this alternative, including a summary of the analyses that Eversource has completed to date regarding the feasibility of aligning the new 115-kV transmission line along the CT*fastrak*/Amtrak corridor, is included in Section 11.6.

Figure 11-3: Major Linear Route Alternatives Considered



11.3.2.1 Interstate 84 Corridor

I-84 is classified as a limited-access highway. In the study area, this interstate could potentially be used to locate only a portion of the new 115-kV line because the highway does not directly connect Newington and Southwest Hartford Substations.

However, utilization of a limited-access highway for a longitudinal installation of a foreign utility is specifically prohibited by ConnDOT, unless it is the only possible routing solution. This policy is documented in ConnDOT's Utility Accommodation Manual, and was confirmed at a meeting held on April 9, 2015 with representatives of ConnDOT regarding the Project. For this reason, collocation of the proposed new 115-kV line (in either underground or overhead configurations) within the I-84 corridor was eliminated from consideration.

11.3.2.2 CT*fastrak*/Amtrak Corridor

CT*fastrak* is a new Bus Rapid Transit (BRT) system that links central Connecticut communities. BRT is a public transit solution designed to improve travel times through heavily-congested areas by using dedicated transit "guideways" or lanes to avoid traffic. CT*fastrak* commenced service in late March 2015.

In the Project study area, the CT*fastrak* extends along a bus-only guideway (former railroad bed) and provides transit service between downtown Hartford and New Britain. Two active Amtrak rail lines parallel the guideway. An access road extends along part of the east side of the Amtrak corridor; however, this road is not continuous. Various land uses, principally commercial and industrial developments, abut the busway/Amtrak corridor.

Eversource is in the process of evaluating the potential for aligning the new 115-kV transmission line, either overhead or underground, within or along the CTf*astrak*/Amtrak corridor from just east of State Route 173 in the Town of Newington to near I-84 in the vicinity of Southwest Hartford Substation. The use of this busway/Amtrak corridor would involve aligning the new 115-kV line east from Newington Substation (following existing roads or an Eversource distribution line ROW) to connect to the corridor, north along the corridor to the vicinity of I-84, and then west across private property to cross New Park Avenue to Southwest Hartford Substation.

Had the construction of the guideway coincided with the development of the 115-kV line, it may have been possible to better coordinate the potential colocation of the new transmission line along the guideway. However, with the CT*fastrak* just recently completed, constructing the new 115-kV line within or adjacent to the guideway and Amtrak corridor without potentially significantly affecting bus and rail service was determined to be problematic. Nonetheless, because the CT*fastrak*/Amtrak corridor does offer a potential linear alignment for a portion of the new 115-kV line between Newington and Southwest Hartford Substations, Eversource determined that more detailed technical studies to assess the feasibility of this route alternative were warranted. Refer to Section 11.6 for this additional information.

11.3.3 Other Alternative Routes Considered but Eliminated

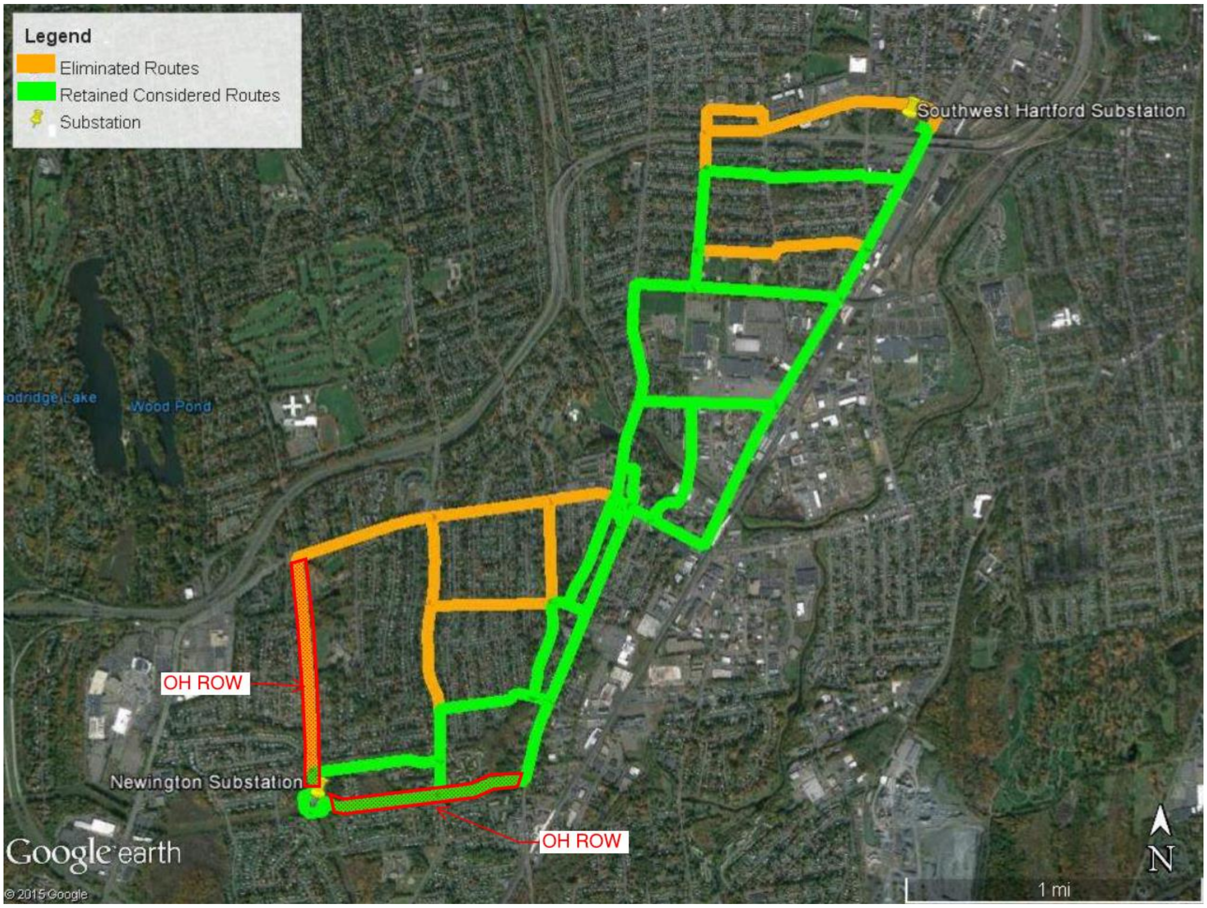
After the elimination of the I-84 corridor and determining the need to perform more detailed studies of the CT*fastrak*/Amtrak corridor, Eversource conducted further investigations of the remaining potential route segments in the study area. Initial analyses revealed that a new transmission line could technically be developed along any of the remaining segments. However, these analyses also determined that aligning a new transmission line along some of the route segments would pose environmental or engineering challenges, would be inconsistent with state and local policies regarding use of road ROWs, or would increase the length of the new transmission line between Newington and Southwest Hartford Substations, thereby increasing potential Project impacts and costs.

In particular, route segments in the following three areas (refer to Figure 11-4) were identified as less preferable:

- Alternative routes extending north from Newington Substation to New Britain Avenue;
- An alternative route located west of New Park Avenue; and
- Alternative routes located generally north of I-84 and northwest of Southwest Hartford Substation.

Because these route segments offered no advantages compared to other potentially available alignments, they were eliminated from further consideration for the specific reasons described in the following subsections.

Figure 11-4: Alternative Routes Considered but Eliminated



11.3.3.1 Routes Extending North, Newington Substation - New Britain Avenue

Various route segments extending north from Newington Substation were evaluated. From the substation, these segments would either follow an existing 150-foot-wide Eversource ROW or extend along local roads before connecting to and proceeding east along New Britain Avenue (State Route 529/71) to intersect with other route segments (see Figure 11-5).

Figure 11-5: Alternatives Eliminated: Routes North of Newington Substation to New Britain Avenue

The westernmost route segment alternative evaluated for the new 115-kV transmission line would extend north from Newington Substation along an existing Eversource distribution line ROW. This ROW, which is approximately 150 feet wide, is presently occupied by two 23-kV overhead distribution lines carried on a single pole line, with poles approximately 40 to 50 feet tall. The eastern portion of this ROW has sufficient space to accommodate either an overhead or underground 115-kV transmission line. This existing ROW extends near single-family residences, as well as Wolcott Elementary School and Wolcott Park (a West Hartford town park that includes playing fields, trails, etc.).

The other two route segment alternatives extending north from Newington Substation would follow local roads. As a result, these route segments could only reasonably accommodate a new underground transmission cable system.

Upon intersecting with New Britain Avenue, all three of these route segment alternatives would require an underground cable alignment that would extend east along New Britain Avenue, and all would increase the length of the overall transmission line between Newington and Southwest Hartford Substations (by an additional 0.2 mile).

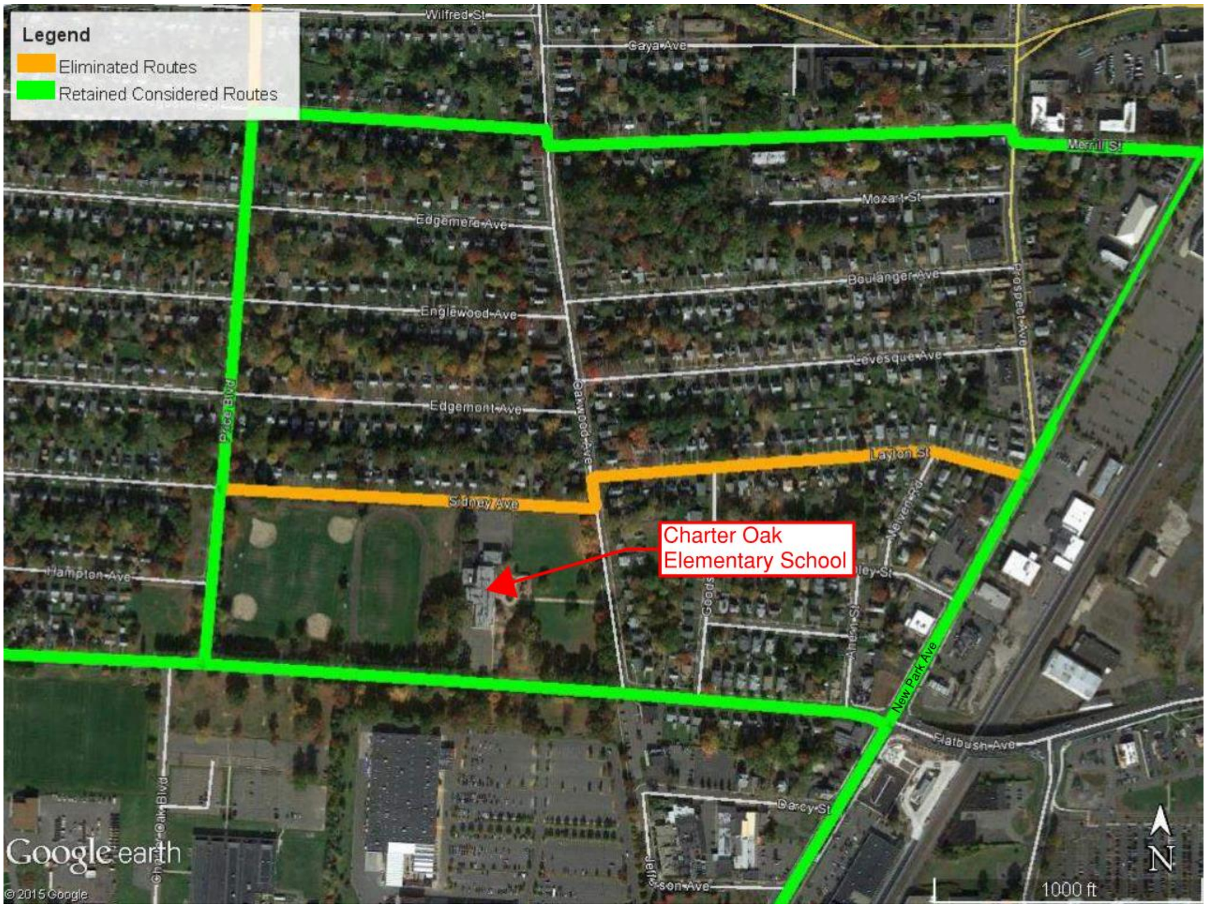
During consultations regarding the location of the proposed transmission line, representatives of both ConnDOT and the Town of West Hartford requested that Eversource minimize impacts to New Britain Avenue, particularly due to the extensive reconstruction work that was recently completed to improve this state roadway and the high volume of traffic that it carries. Furthermore, to the west of the intersection of New Britain Avenue and Berkshire Road are access points to I-84, as well as the heavily-utilized Corbins Corner and West Farms Mall shopping areas. Extensive traffic back-up resulting from construction of the underground transmission cable system on New Britain Avenue would negatively impact traffic entering and exiting I-84, and cause a significant disruption to an already heavily congested traffic area.

As a result of the increased route length, difficulty of linear construction along New Britain Avenue, and potential for environmental and other impacts, all three of these route segments were eliminated from consideration.

11.3.3.2 Route West of New Park Avenue

This route segment (shown in orange in Figure 11-6) would extend between New Park Avenue and Price Boulevard, and would be aligned along Sidney Avenue, Oakwood Avenue, and Layton Street. This route segment was eliminated due to its proximity to Charter Oak Elementary School, in light of other available options, as well as the successive sharp bends in the route that would be required to cross Oakwood Avenue (potentially necessitating an additional splice vault along the route). Other local roads provide a more direct route from New Park Avenue to the west. For these reasons, this route segment was eliminated from further consideration.

Figure 11-6: Alternative Eliminated: Routes West of New Park Avenue

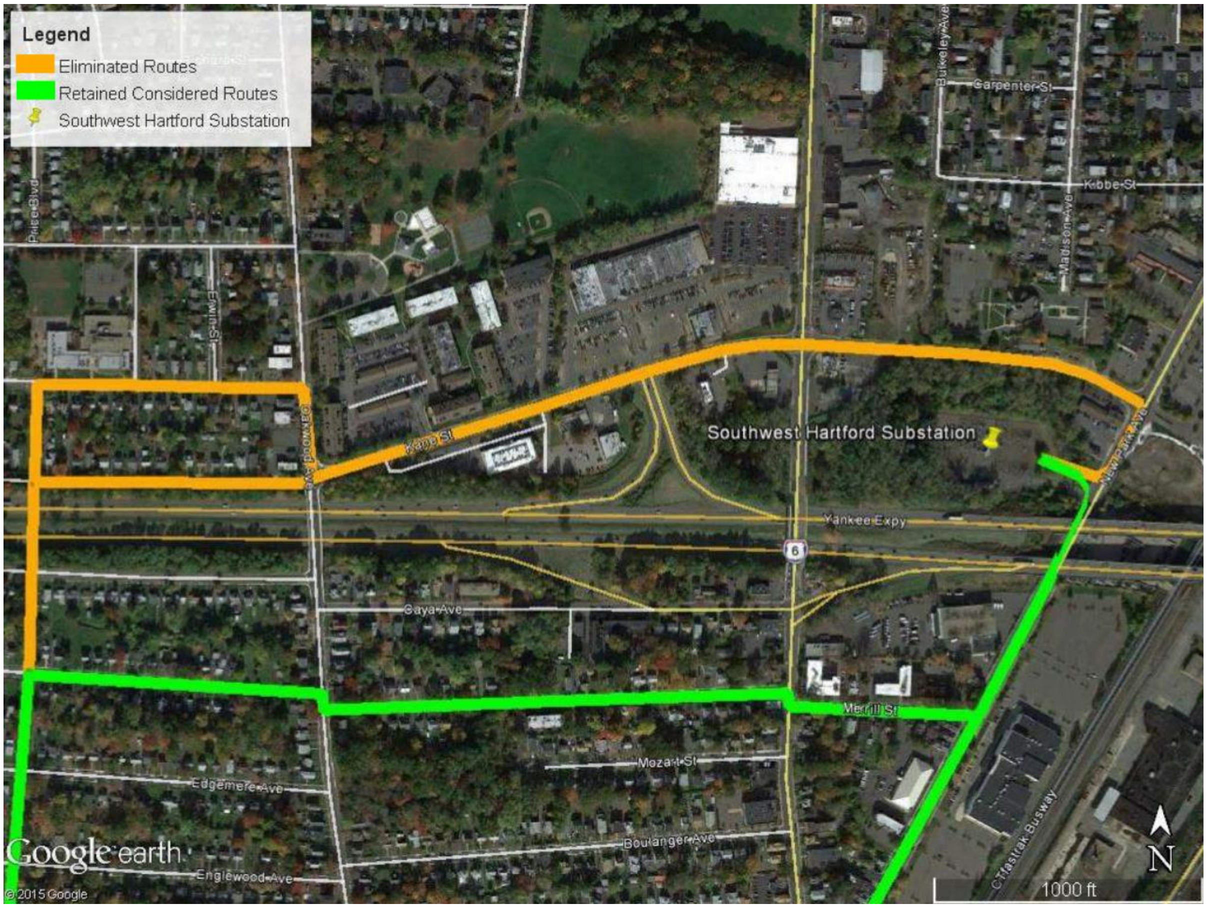


11.3.3.3 Alternative Routes: Vicinity of Southwest Hartford Substation and I-84

These segments (as shown in orange in Figure 11-7) were eliminated because they would offer no comparative advantages in terms of route length or constraints, and would have the added disadvantage of requiring a trenchless (horizontal directional drilling or equivalent) crossing beneath I-84.

In comparison, the other route segments under consideration in the vicinity of Southwest Hartford Substation would be aligned within the existing New Park Avenue ROW underpass below I-84. The alignment of the new transmission cable within New Park Avenue beneath I-84 would thereby avoid the cost and potential technical constraints associated with a trenchless crossing.

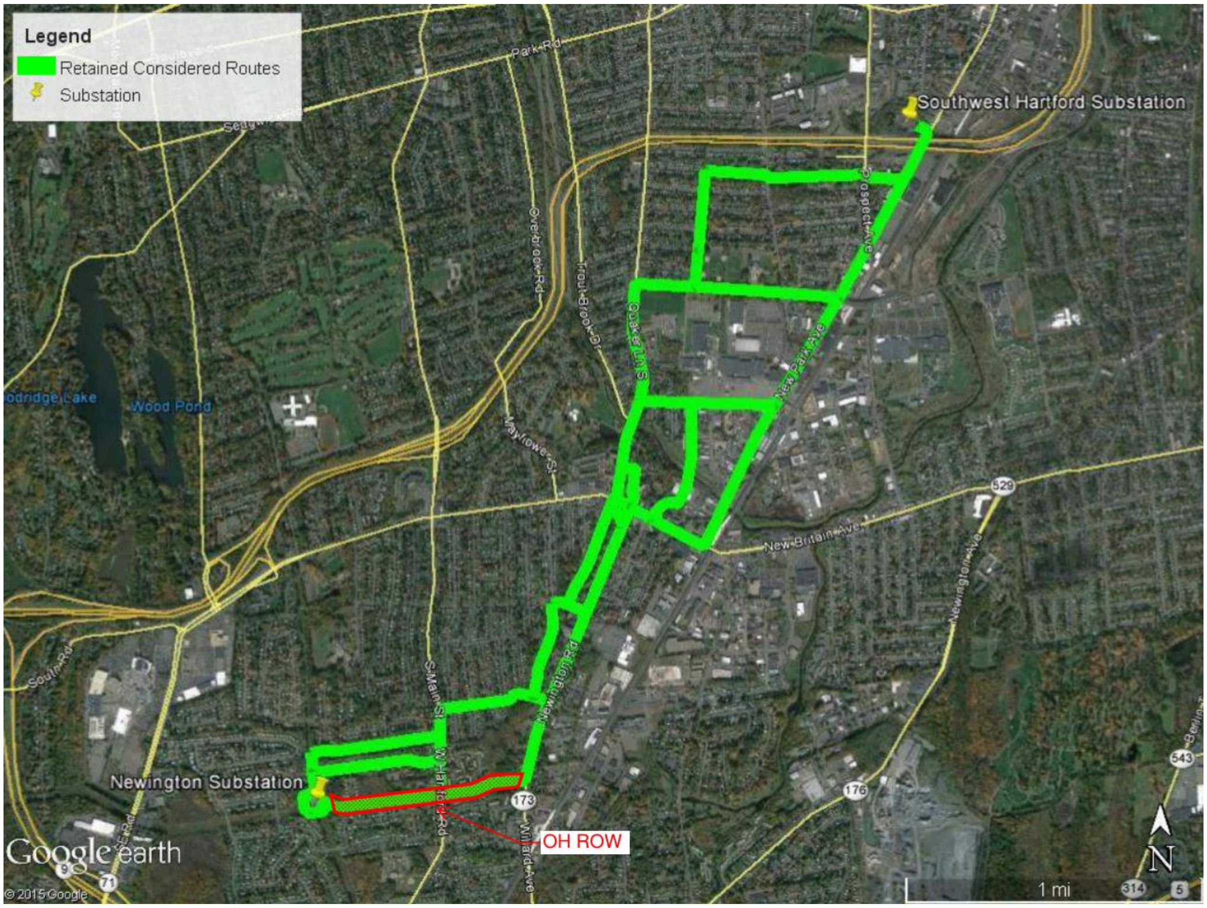
Figure 11-7: Alternatives Eliminated: Routes in Vicinity of Southwest Hartford Substation and I-84



11.3.4 Proposed Route

After elimination of various route segments from further consideration (as discussed in Section 11.3.3), Eversource then evaluated the feasibility of each of the remaining route options (refer to Figure 11-8), taking into consideration constructability, the avoidance or minimization of impacts to environmental resources, cultural resources, community facilities, transportation and infrastructure facilities, cost, and input received to date from town and state officials.

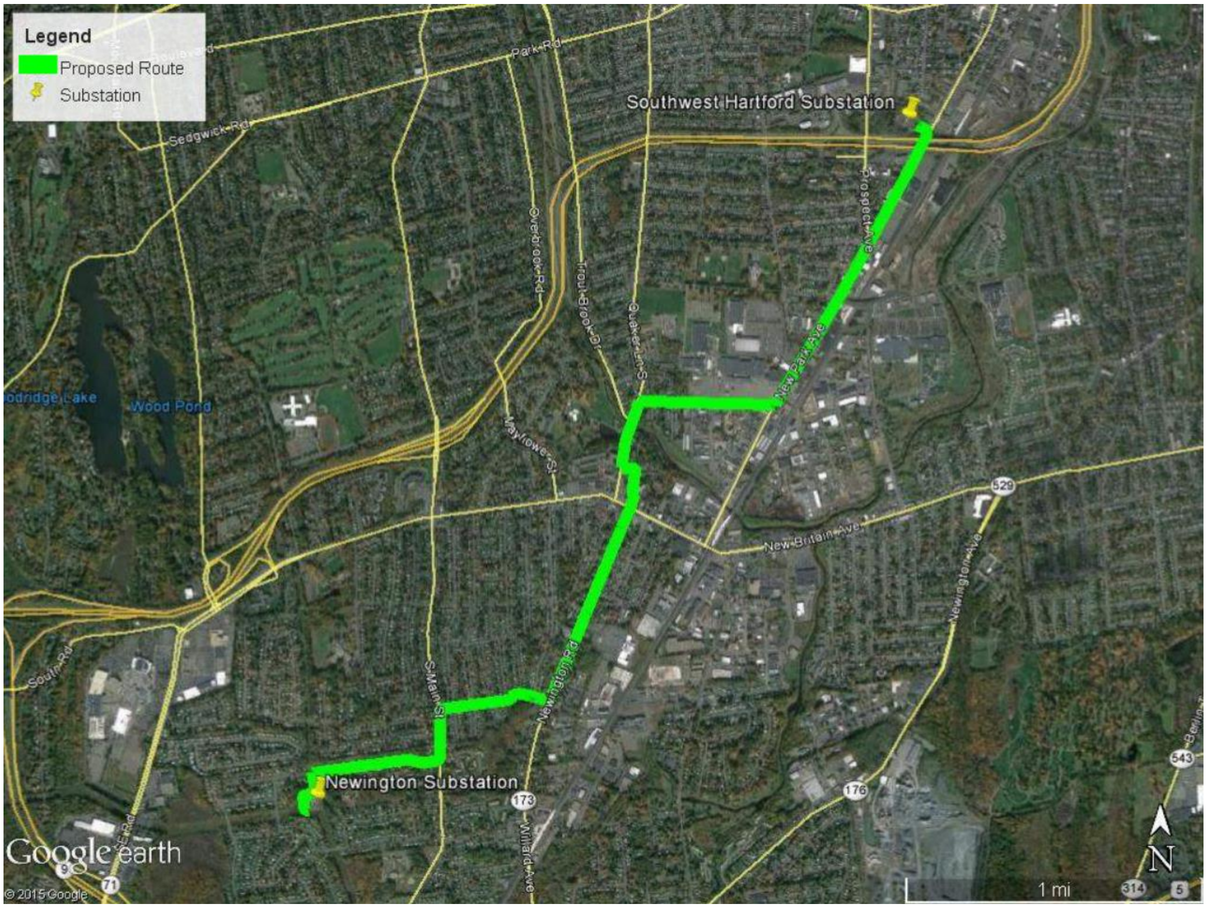
Figure 11-8: Remaining Route Segments



As a result of this evaluation, from among the potentially viable route options considered, Eversource identified the Proposed Route (see Figure 11-9) as the most economically, technically, and environmentally practicable choice for the new 115-kV transmission line between Newington and Southwest Hartford Substations.

The remaining route segments are classified as potential route variations, which – although not selected for the Proposed Route are technically feasible. As discussed in Section 11.4, whereas the new 115-kV transmission line could be constructed along these segments, each route variation has certain distinct features or characteristics that make it less desirable than that portion of the Proposed Route it would replace.

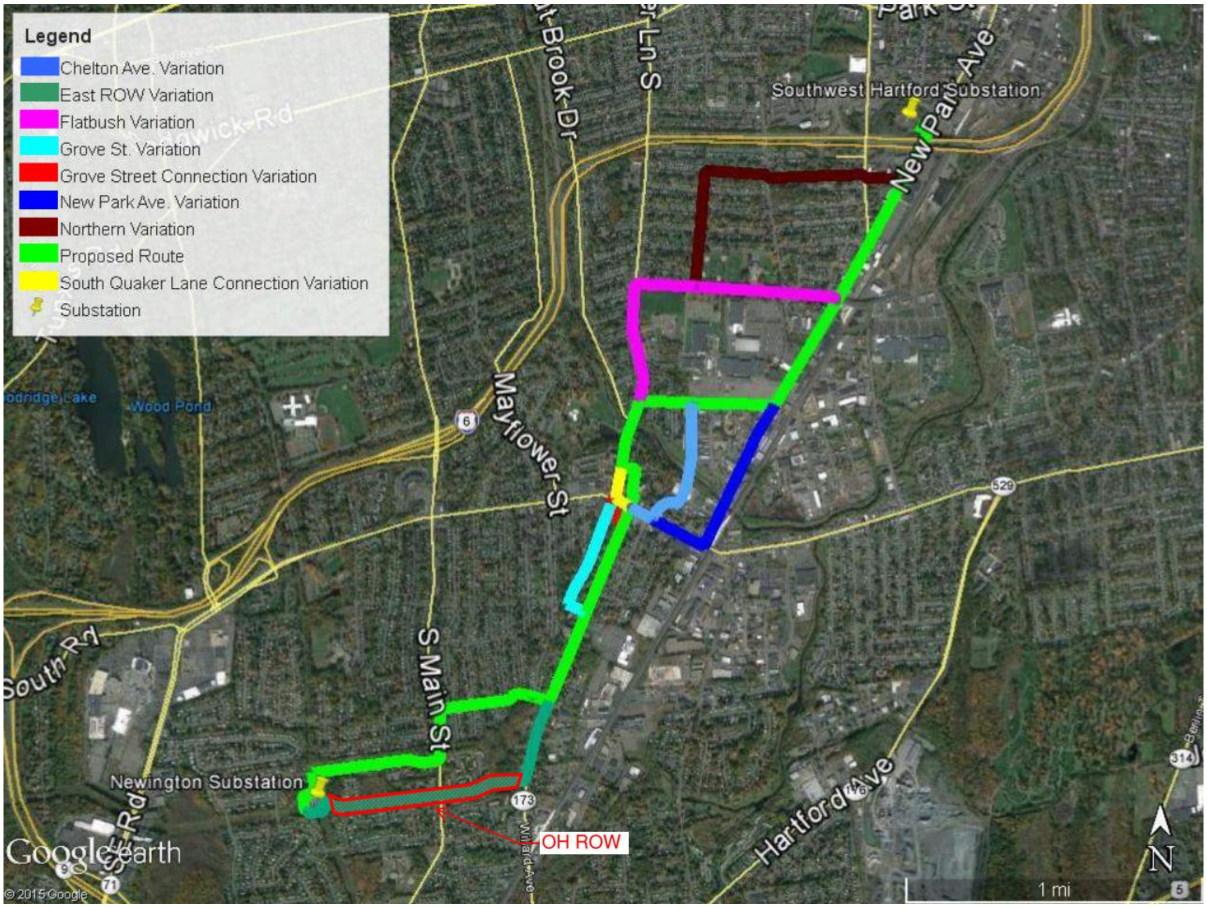
Figure 11-9: Proposed Route



11.4 VARIATIONS TO THE PROPOSED ROUTE

Based on the investigations and agency consultations that have been conducted to date, Eversource identified the Proposed Route as preferred. However, Eversource also determined that nine remaining route segments under consideration present potentially viable routing options to portions of the Proposed Route. Thus, each of the nine route segments is considered a "route variation" and was further evaluated and compared in relation to that portion of the Proposed Route that it could potentially replace. Figure 11-10 depicts the Proposed Route, along with each of the nine identified route variations. Sections 11.4.1 through 11.4.9 discuss each of these route variations.

Figure 11-10: Route Variations

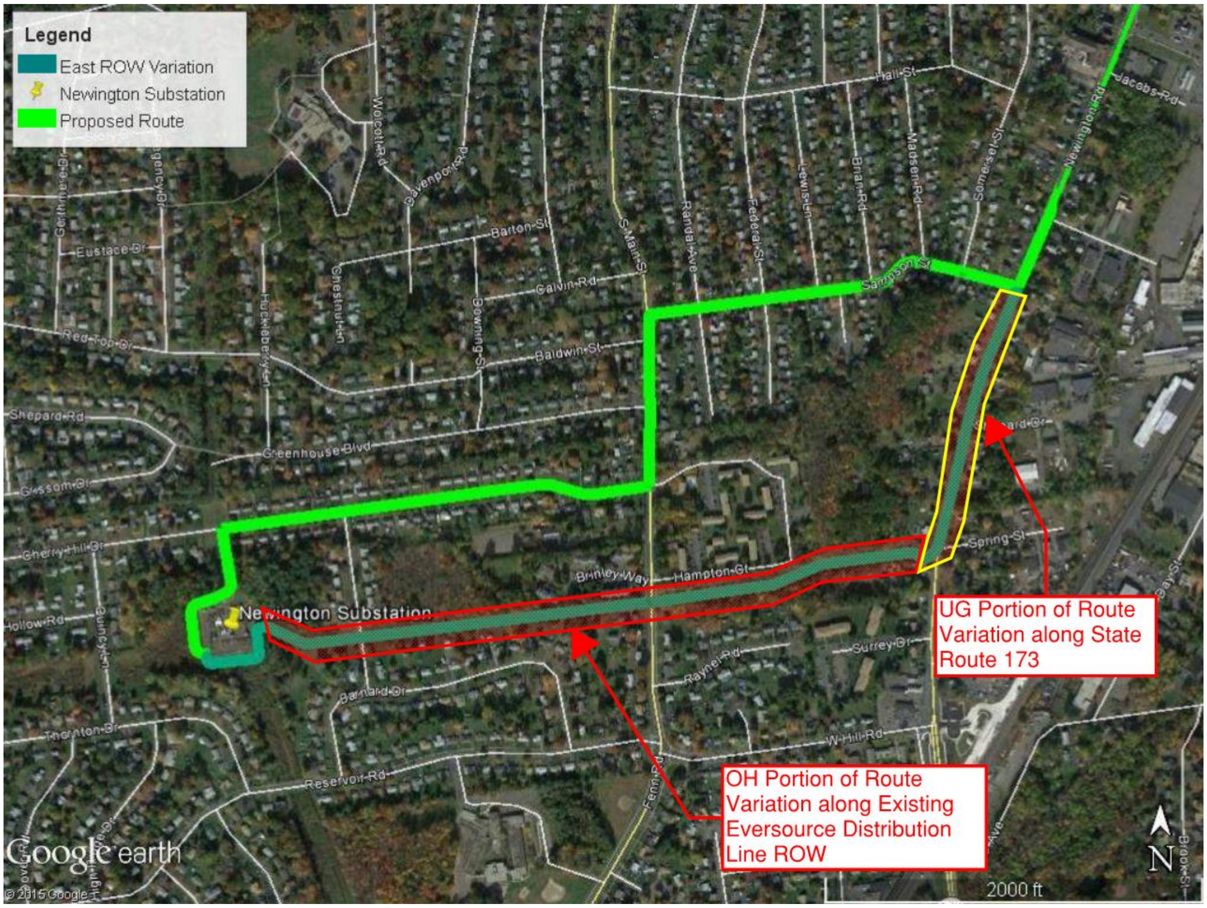


11.4.1 Eversource Distribution Line East ROW Variation (Newington and West Hartford)

The "East ROW Variation", which provides an option to the portion of the Proposed Route between Newington Substation and the intersection of State Route 173[33] and Sampson Street (refer to Figure 11-11) would extend for a total of approximately 1.1 miles and would involve both overhead (0.7 mile) and underground (0.4 mile) components. Approximately 1 mile of this route variation would be located in the Town of Newington, with the remaining 0.1 mile situated in the Town of West Hartford.

[33] State Route 173 is also known as Willard Avenue in Newington and Newington Road in West Hartford

Figure 11-11: East ROW Variation



Specifically, the new 115-kV line would be constructed in an overhead design within Eversource's existing overhead distribution line ROW between Newington Substation and Willard Avenue (State Route 173). From the intersection of the Eversource ROW with State Route 173, the transmission line would be installed in an underground configuration, extending north within State Route 173 to the intersection with Sampson Street in the Town of West Hartford.

Summary of Route Characteristics

The 0.7 mile overhead portion of the East ROW Variation along Eversource's approximately 100-foot-wide existing ROW, would extend across both Avery Road and West Hartford (Fenn) Road. To the south, the ROW is bordered by the back yards of single-family residential uses (along Barnard Road and Raynal Road), as well as by an apartment complex off Surrey Court near State Route 173. To the north, the ROW is bordered by undeveloped land, as well as residential uses along Brimley Way (single-family homes) and Hampton Court (multi-family units).

In the vicinity of the existing distribution circuits, Eversource manages the vegetation along the ROW in low-growing species, consistent with the safe operation of these electric lines. However, taller-growing vegetation (including trees) is located within the ROW, outside of these managed areas. Field investigations of the distribution line ROW and Newington Substation area identified four wetlands, designated as Wetlands N-1 through N-4 (refer to the Volume 3 maps).

Wetland N1, which is located in the vicinity of Newington Substation is classified as PSS. Wetlands N-2 and N-3, which are located in the ROW, are classified as PEM / PSS, whereas Wetland N-4 (also located in the ROW) is classified as PSS / PEM. Wetlands N2, N3, and N4 extend across portions of the distribution line ROW where the overhead route variation segment would be located. The approximately lengths of these three wetlands in the ROW are 120, 320, and 40 linear feet, respectively. Dominant species encountered in these wetlands include: silky dogwood (*Cornus amomum*), southern arrowwood (*Viburnum dentatum),* common jewelweed (*Impatiens capensis*), sedges (*Carex* spp.), broadleaf cattail (*Typha latifolia*), reed canary grass (*Phalaris arundinacea*), elderberry (*Sambucus nigra*), and goldenrod species (*Solidago* spp.) as well as the invasive species common reed (*Phragmites australis*).

No vernal pools are associated with these wetlands or are otherwise located along the East ROW Variation. Similarly, there are no watercourses, floodplains, or listed threatened or endangered species located along the variation. The wildlife inhabiting the distribution line ROW can be expected to be species common to undeveloped sites in suburban areas.

The underground portion of the East ROW Variation would extend along State Route 173 for approximately 0.4 mile (to the intersection with the Proposed Route at Sampson Street in the Town of West Hartford. As illustrated in Figure 11-11 and on the Volume 3 maps, the land uses adjacent to the underground portion of this variation consist of single-family residences.

The 0.7 mile overhead portion of the ROW encompasses undeveloped land that has the potential to be sensitive for the location of cultural resources. In addition, part of the overhead and underground portions of the variation extend into the Newington Junction North Historic District, which is listed on the NRHP. This approximately 10-acre historic district is situated along State Route 173 and is comprised of 13 contributing properties that are representative of architecture dating from 1850-1949. For additional information regarding cultural resources, refer to the cultural resources report in Volume 2.

Overview of Variation Analyses

Subsections 11.4.1.1 and 11.4.1.2 provide information regarding the design and construction of the overhead segment of the East ROW Variation. Portions of the 115-kV line overhead construction for this variation would be similar to the design and techniques described in Sections 3 and 4 for the Newington Tap modifications.

The construction of the underground segment of this route variation along State Route 173 would require the same cable design and construction techniques as described for the Proposed Route in Sections 3 and 4. Subsection 11.4.1.3 summarizes the impacts associated with the construction of the new transmission line along this route variation.

11.4.1.1 Overhead Construction Specifications Summary

This overhead portion of the East ROW Variation would extend east from Newington Substation for approximately 0.7 mile and would be aligned adjacent to the five existing distribution circuits that presently occupy the approximately 100-foot-wide Eversource ROW. The existing distribution lines consist of one underground circuit and four overhead circuits (supported on two lines of double-circuit structures).

The overhead portion of the East ROW Variation would be within the existing Eversource ROW, except for one approximately 25-foot-long section. The ROW is typically 100 feet wide, but it narrows to a minimum width of 75 feet for this 25-foot long segment. Though the ROW can accommodate the new transmission line along the majority of its length, an easement of approximately 600 square feet from a residential landowner for an additional 25 feet would be required at the narrower portion in this location to provide the required 100-foot-wide ROW.

The installation of the new 115-kV line would require relocating at least one of the existing overhead double-circuit distribution lines, which would have to be rebuilt underneath the new transmission line. Appropriate clearances would have to be maintained for the safe operation of the both the new overhead transmission line and the distribution circuits.

At either end of the overhead portion of the variation, a single-pole dead end riser structure would be required to transition from the underground transmission line segments. An additional 30 feet of vegetation clearing, to the edge of the southern ROW boundary, would be required to construct and operate the new 115-kV transmission line.

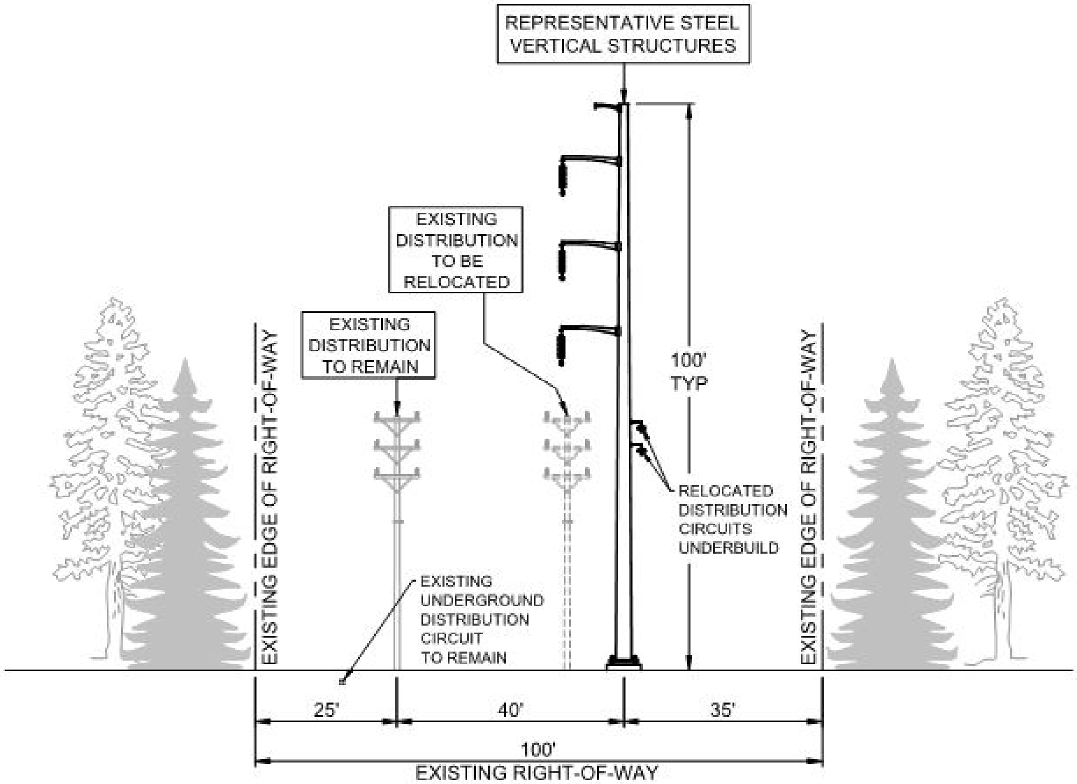
11.4.1.1.1 Proposed Overhead Line Design, Appearance and Heights

The two existing overhead distribution double circuit lines within the ROW are supported on wood poles with typical heights of approximately 38 feet above ground. In general, the proposed structure configuration for the new 115-kV line would be tubular galvanized steel monopoles in a vertical configuration that would also support distribution underbuild circuits, with an expected average structure height of about 100 feet above ground. All the new 115-kV transmission line structures would be self-supporting (no guying or anchors would be required).

The configuration of the proposed 115-kV line in relation to the distribution circuits is illustrated on the typical cross-section presented in Figure 11-12. As the cross-section shows, the steel vertical 115-kV structures would be located adjacent to an existing overhead double-circuit distribution line. The other double-circuit distribution line in the ROW would have to be relocated to accommodate the new transmission line; these two distribution circuits would be rebuilt in an underbuild configuration on the transmission structures.

However, since transmission lines typically utilize longer spans than distribution circuits, fewer transmission structures will be required so not all of the existing distribution structures would be placed on the new transmission structures. Also, in certain locations, new structure locations may be shifted to avoid sensitive environmental or cultural areas, to address constructability issues, or to minimize potential impacts to property owners.

Figure 11-12: Typical Overhead Layout



ROUTE VARIATION CONFIGURATION
VERTICAL DESIGN

NEAR NEWINGTON S/S
TO
WILLARD ROAD

LOOKING
EAST

(0.7 MILES)

11.4.1.1.2 Technical Specifications

The new overhead 115-kV transmission line would consist of three phase conductors. Each phase is comprised of one 1,590-kcmil ACSS conductor. This cable is one of the standard Eversource conductors for new 115-kV line construction.

The new line would be protected by two overhead lightning shield wires. One of the overhead shield wires would contain optical glass fibers for communication purposes (also referred to as OPGW). The other wire would be a conventional 19 No. 10 Alumoweld overhead shield wire.

The single circuit comprised of 1,590-kcmil ACSS conductors would provide approximately 401 MVA of summer normal line capacity and a summer long-term emergency (SLTE) capacity of 525 MVA at 115-kV.

11.4.1.1.3 ROW and Access Road Requirements

ROW Requirements and Easement Acquisition

Eversource would construct and operate the new 115-kV transmission line within its existing ROW. As part of the Project design process, Eversource reviewed the existing easement rights and restrictions for this existing ROW and determined that it has sufficient rights within these easement agreements to construct the new 115-kV line overhead along nearly all of this route segment. However, a new easement agreement would be required for a small area (approximately 600 square feet).

Access Road Requirements

To construct, operate, and maintain the new overhead 115-kV transmission line along the overhead portion of the East ROW Variation, contiguous access along the entire ROW segment may not be needed, though access to each transmission structure location would be required. In addition, temporary access along the ROW would be required to facilitate vegetation removal during construction.

In general, there is very limited existing access to the existing distribution lines. To safely construct an overhead transmission line, temporary and permanent access roads would have to be established and any existing access road along the distribution line ROW would have to be improved to allow the safe passage of the heavy construction equipment needed to install the new 115-kV line.

Further, if necessary to avoid traversing linearly along the ROW through sensitive environmental areas or locations with physical restrictions, access roads to the ROW would be developed across private property or across land owned by Eversource ("off-ROW access roads"). Such off-ROW access roads would typically provide access to the ROW from a public road.

The location and type of new access roads and access road improvements would depend on the terrain, presence / absence of environmental features, and whether the access road would be temporary (used only during construction) or permanent (retained for long-term maintenance of the line). Access roads must have appropriate grades and sufficient width and capacity to support the large, heavy construction equipment (such as flat-bed tractor-trailers, drilling rigs, cranes, and concrete trucks) required to construct the new 115-kV line. The need for access by flat-bed trailers and concrete trucks (including turning radii) typically determines the scope of access road improvements.

In general, all construction access roads (on- or off-ROW) must have a stable base and grades of 10% or less. Whether restored, improved, or newly constructed for the Project, on- and off-ROW access roads would have a typical 16-to-20-foot-wide travel way and, overall, a 20-to-25-foot-wide footprint (including road shoulders). However, access road widths would vary depending on site-specific conditions (principally slope and presence of water resources) and on factors such as the amount of grading (cutting and filling) required and on whether a particular section of road must accommodate equipment turning radii and/or equipment passing / turn-out locations.

Access roads would be graveled or would consist of temporary construction mats or equivalent. In general, gravel would most commonly be used in constructing access roads in upland areas. In some locations, particularly on steep slopes and at intersections with public roads, asphalt millings could be used to improve road stability and vehicle traction.

Across wetlands where only temporary (construction) access is required, construction mats would typically be used. These mats would be removed upon the completion of construction. Where permanent access is unavoidably required across wetlands, road construction would be more extensive and would involve the use of gravel. To maintain drainage patterns across the ROW, access road construction would typically incorporate construction mat (or equivalent) bridges, flumes, or culverts as needed.

Eversource would conduct a detailed evaluation of the access requirements as part of final design. Access road information would be included in the Project-specific D&M Plan.

11.4.1.1.4 Temporary Relocation of Existing Distribution Circuits

In order to install the new transmission line, sufficient clearances must be maintained between work areas and Eversource's existing energized distribution lines. Alternatively, the adjacent distribution lines will have to be temporarily de-energized (i.e., taken out of service).

Based on available information, the load on the southernmost existing distribution circuit (4A1) is relatively small and it can be taken out of service for an extended duration. However, the other circuit (4A2) is more critical and cannot be taken out of service for an extended duration. Consequently, to maintain service along this line, a temporary circuit (either by attaching to the other distribution pole line or setting poles to provide sufficient working clearance to construct the new transmission line) may have to be installed.

11.4.1.2 Standard Procedures for Overhead Transmission Construction

11.4.1.2.1 Overview of Construction Sequencing

The overhead portion of the East ROW Variation would be constructed using standard procedures and would involve several stages, some overlapping in time. The following summarizes the activities, materials, and equipment generally expected to be involved in the construction of the overhead transmission line segment:

- Survey and stake the ROW boundaries and monument line (where necessary), vegetation clearing boundaries, and proposed structure locations.

- Mark the boundaries of previously delineated wetland and watercourse areas.
- Identify and mark areas to be avoided (e.g., sensitive cultural or environmental resource areas).
- Establish construction field office area(s), typically including space for office trailer(s), equipment storage and maintenance, sanitary facilities, and parking.
- Prepare material staging sites (e.g., storage, staging and laydown areas) to support the construction effort. The preferred locations for such areas are typically in the immediate vicinity of the ROW.
- Perform vegetation clearing. Vegetation would be removed along those portions of the ROW to be used for the construction of the overhead transmission line facility, as well as areas that contain undesirable, tall-growing, woody species that could reach heights that would interfere with the operation of the transmission line should they not be removed. Vegetation also would be removed, as necessary, along existing or new access roads that may be on the ROW (but outside the designated limits of clearing) or off the ROW (but required to reach the ROW). In addition, as authorized by its easements or permission from the landowner, hazard trees outside the limits of clearing (on or off the ROW) would be removed as necessary to protect the integrity of the proposed or existing transmission lines. Vegetation removal activities typically require flatbed trucks, brush hogs or other types of mowing equipment, skidders, bucket trucks for canopy trimming, tree shears for larger trees, wood chippers, log trucks, and chip vans. Effects on wetlands, watercourses, or other environmentally sensitive areas would be minimized to the extent practicable (refer to Sections 4.2 and 6 for a discussion of potential mitigation measures).
- Install erosion and sedimentation controls in accordance with the best management practices for E&S control, including those provided in the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control* and the Company's *BMP Manual*.
- Construct new access roads or improve existing roads to provide a minimum travel-way of 16 to 20 feet in width (overall a 20-to-25-foot-wide footprint, including road shoulders). This typically requires bulldozers or front loaders, excavators, dump trucks for crushed stone or gravel, pickups or stake-body trucks for culverts, and/or mat installers for wetland mats. Roads may be temporary (for use during construction only) or permanent (for use during both construction and the

subsequent maintenance of the lines). Temporary roads may be constructed of construction mats or gravel, whereas permanent access roads are generally constructed of gravel only. Roads must have sufficient width and capacity for heavy construction equipment for both over-the-road and off-road vehicles, including oversized tractor trailers. The need for access by flat-bed trailers and concrete trucks often determines the scope of access road improvements. Road grades must be negotiable for over-the-road trucks; acceptable grades are typically 10% maximum, less if wet weather or surface conditions result in traction problems.

- Prepare level work (crane) pads as necessary at new structure sites, conductor pulling sites, and guard structure sites. Work pad installation may involve grading and requires the installation of a stable base (consisting of gravel, construction mats, or equivalent) for drilling and other structure installation equipment.
- Construct temporary distribution lines or modify existing distribution line structures as needed to provide sufficient working clearances required to install the new transmission facilities. Temporary distribution lines would typically be wood pole with direct embedded foundations; guy wires are usually needed at angle locations to support the required loadings.
- Install new structures. This requires flat-bed trucks for hauling new structure components, new hardware, and augers, other trucks for hauling reinforcing rods, drill rigs, cranes, concrete trucks for structures that require concrete for foundations, dump trucks for structures that require crushed rock backfill, and bucket trucks. Dump trucks are also needed for foundation work if excess excavated material has to be removed from the ROW. In wet conditions or if groundwater is encountered during excavation, pumping (vacuum) trucks or other suitable equipment would be used to pump water from the excavated areas. The water then would be discharged in accordance with applicable local, state, and federal requirements.
- Install counterpoise, where needed. Depending on site-specific soil conductivity, supplemental grounding will be installed. A ditch witch is typical equipment for this activity.
- Install shield wires, OPGW, and conductors. The equipment required for these activities would include conductor reels, conductor pulling and tensioner rigs, and

bucket trucks. Helicopters also may be used to install the initial pulling lines for the conductors or shield wires.

- Demolish and remove from the ROW the existing distribution structures, as well as the existing shield wires, conductors, and other line materials on and between the structures. The equipment required for these activities would be generally the same as required for installing the new structures, conductors, and OPGW, as described above.
- Remove temporary roads and construction debris and restore disturbed sites. Haul construction debris off the ROW for disposal. Vegetative materials cut along the ROW and not otherwise planned for use by the landowner (e.g., brush) may be piled, scattered, or chipped on the ROW, depending on site-specific environmental features. In some areas, disturbed ground will be back-bladed to preconstruction contours, unless directed otherwise.
- Maintain temporary erosion and sediment controls until vegetation is re-established or disturbed areas are otherwise stabilized. After site stabilization is achieved, all temporary erosion and sedimentation controls that are not biodegradable (e.g., geotextile material, twine, stakes) would be removed from the ROW and disposed of properly.

11.4.1.3 East ROW Variation Impact Summary

Unlike any of the other nine route variations under consideration, the East ROW Variation would involve both overhead and underground components. The impacts of constructing the underground portion of this variation would be similar to those described for other underground segments. However, under this variation, 0.4 additional mile of the transmission line would have to be constructed underground along or adjacent to State Highway 173.

Construction of the 0.7 mile overhead portion of this route variation would result in impacts to wetlands, vegetation and wildlife, and (potentially) cultural resources. Further, compared to the approximately 38-foot-tall distribution line poles that presently occupy the 0.7 mile Eversource ROW, the new 115-kV transmission line structures would be more than twice as tall (at 100 feet), and thus potentially more visible to both residents and travelers on nearby roads. Simulations of views of the overhead line configuration along the East ROW Variation are included in Volume 3, Exhibit B.4. The development of the 0.7 mile overhead transmission line segment also would require vegetation clearing to the southern edge of the existing ROW boundary, (about an additional 30 feet in width) and would result in an estimated 14,400 square feet (2.7 acres) of impacts to wetlands N2, N3, and N4.

Due to the significant public impact that would result from constructing in this ROW, the wetlands that would be impacted, and the visual impact of new overhead transmission structures, this variation was considered inferior to the corresponding section of the Proposed Route. Table 11-4 provides a summary comparison of the East ROW Variation versus the portion of the Proposed Route it would replace.

Table 11-4: East ROW Variation Comparison Table

Route Segment Feature / Characteristics	Proposed Underground Route Segment to be Replaced	East ROW Variation
Length		
• Total	1.15 miles	1.06 miles
Length, by Town		
• Newington	0.64 miles	0.95 miles
• West Hartford	0.51 miles	0.11 miles
• Hartford	0 miles	0 miles
Length, ConnDOT Roads		
• Route 173 (Willard Ave./Newington Rd.)	0 miles	0.28 miles
• Route 529 (New Britain Ave.)	0 miles	0 miles
Roadway Characteristics		
• Existing Utility Density	Low – Medium	Low
• Traffic Lanes	2-lane roadway	OH ROW and 2-lane roadway
Construction, Operation, & Maintenance Considerations		
• Traffic	Very low traffic volume	High traffic volume
• Accessibility	Minimal impact to traffic	Lane closures on high-volume roadways
Land Use		
• Principal Land Use Adjacent to ROW	Residential Development	OH ROW, Residential Development
Cultural Resources		
• Resources	Moderate/High Archaeological sensitivity	Newington Junction North HD National Register Area Moderate/High Archaeological sensitivity
Community Facilities		
• Facilities	None	None
Biological Resources		
• Waterway Crossings	N/A	N/A
Cost (2017 Dollars)		
• Estimated Project Cost Delta	$0 MM	-$1.04 MM

11.4.2 Eversource Distribution Line ROW/Underground Variation (Newington)

In addition to constructing an overhead transmission line within the existing ROW between Newington Substation and State Route 173, constructing the new transmission underground within the same existing ROW was also considered (see Figure 11-11). Similar to the overhead construction in the ROW, this underground variation was also considered inferior to the Proposed Route. The primary reasons for this include the wetlands disturbance that would result as the underground construction would require continuous trenching, and long-term operations and maintenance accessibility on an off-road location for an underground cable system.

11.4.3 Grove Street Variation

This variation to the Proposed Route would traverse along Elmfield Street and Grove Street (refer to Figure 11-13) and would reduce the length of cable system construction on ConnDOT roadways (State Route 173) by approximately 0.4 mile.

Figure 11-13: Grove Street Variation

However, Grove Street is a very narrow, one-way residential street with relatively high existing underground utility density. As a result, installation of an underground cable system along this street would pose difficulties and would likely require full closure of the street during certain construction periods. In addition, this variation would traverse the major New Britain Avenue and South Quaker Lane intersection in the hub of Elmwood Center. Due to the constructability challenges and the anticipated need to completely close Grove Street to perform certain underground cable construction work, this variation was considered inferior to the corresponding section of the Proposed Route. Table 11-5 compares the Grove Street Variation versus the portion of the Proposed Route it would replace.

Table 11-5: Grove Street Variation Comparison Table

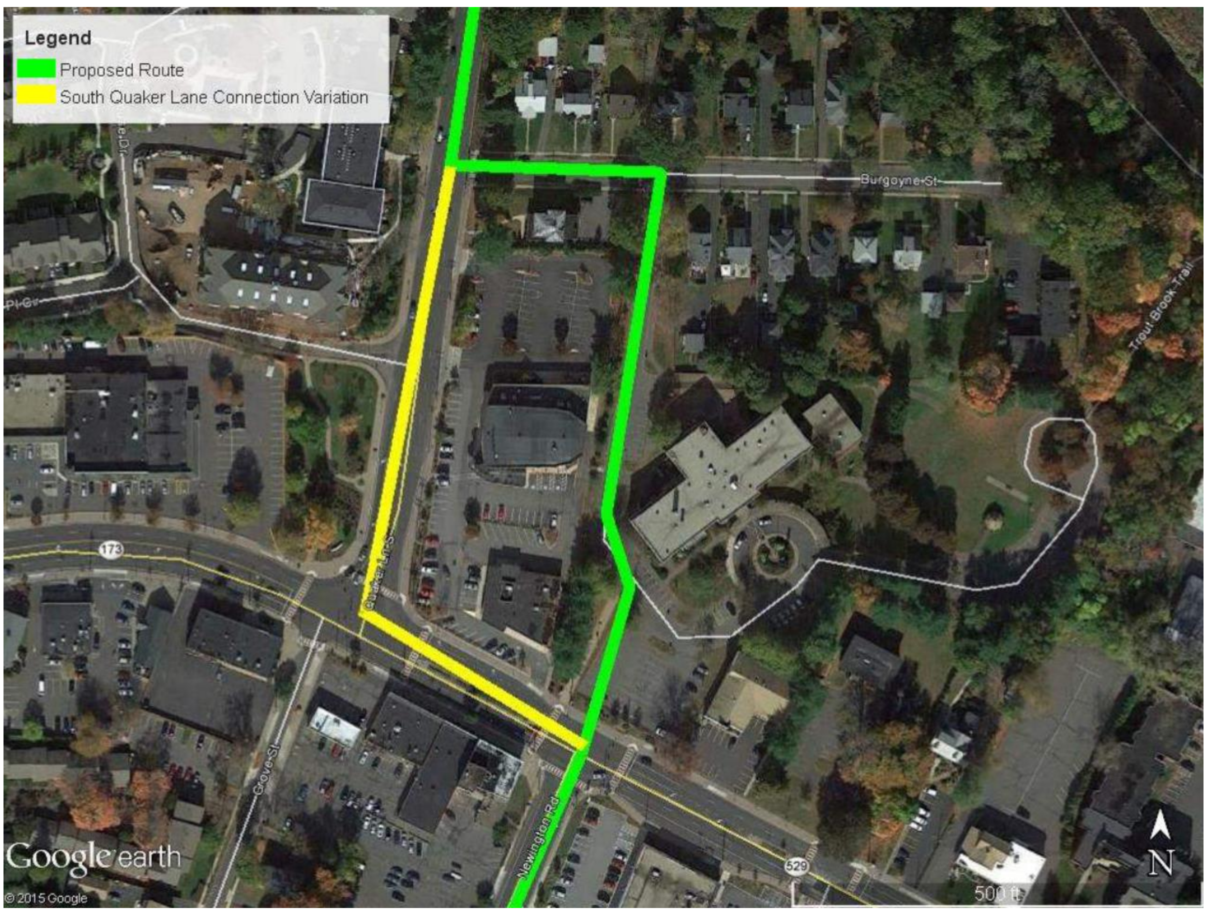
Route Segment Feature / Characteristics	Proposed Underground Route Segment to be Replaced	Grove Street Variation
Length		
• Total	0.56 miles	0.56 miles
Length, by Town		
• Newington	0 miles	0 miles
• West Hartford	0.56 miles	0.52 miles
• Hartford	0 miles	0 miles
Length, ConnDOT Roads		
• Route 173 (Willard Ave./Newington Rd.)	0.38 miles	0 miles
• Route 529 (New Britain Ave.)	0.01 miles	0.01 miles
Roadway Characteristics		
• Existing Utility Density	Medium	Medium - High
• Traffic Lanes	Parking lot / driveway and 2-lane roadway with parking lanes	Grove Street; narrow, one-way north of Page Ave., 4-lane roadway plus turn lanes
Construction, Operation, & Maintenance Considerations		
• Traffic	High traffic volume	Low - Medium traffic volume, high when crossing New Britain Ave
• Accessibility	Lane closures on high-volume roadways	Street closures on roadways [1]
Land Use		
• Principal Land Use Adjacent to ROW	Town of Hartford Community Center, Residential Development	Residential/Commercial
Cultural Resources		
• Resources	None	None
Community Facilities		
• Facilities	Town of West Hartford Community Center	None
Biological Resources		
• Waterway Crossings	N/A	N/A
Cost (2017 Dollars)		
• Estimated Project Cost Delta	$0 MM	$0 MM

[1] Grove Street is a narrow, one way street. Construction on Grove Street would require the street to be closed during construction.

11.4.4 South Quaker Lane Connection Variation

This variation to the Proposed Route would extend along both New Britain Avenue (State Route 529) and South Quaker Lane (refer to Figure 11-14). Using this variation, approximately 350 feet of the cable system would be installed longitudinally within New Britain Avenue, in front of various businesses in the Elmwood Center area. The variation would avoid an alignment of the underground cable system on the Elmwood Community Center property and along Burgoyne Street. In addition, this variation would traverse the major New Britain Avenue and South Quaker Lane intersection in the hub of Elmwood Center.

Figure 11-14: South Quaker Lane Connection Variation



Based on consultations with representatives of the Town of West Hartford and ConnDOT, avoidance or minimization of impacts to New Britain Avenue was considered a critical routing criterion for the Project. As a main thoroughfare, construction within New Britain Avenue would temporarily disrupt traffic patterns, and could cause detours and traffic congestion.

Access to local businesses would be maintained during construction of the cable system, but the general effects of work activities could discourage customers. Furthermore, there has been recent construction along New Britain Avenue as part of a ConnDOT project; thus, according to Town of West Hartford representatives, additional significant disruption to New Britain Avenue (such as would occur during the cable installation) would likely be met with strong opposition from residents and businesses in the area. Table 11-6 provides a summary comparison of the South Quaker Lane Variation to the portion of the Proposed Route it would replace.

As Table 11-6 shows, the variation would be slightly shorter (by 0.02 mile) than the portion of the Proposed Route that it would replace, and thus would be slightly less costly. However, the route variation would traverse the Elmwood Center business area and, due to the potential for greater disruption to both New Britain Avenue and South Quaker Lane, this variation was considered less favored when compared to the corresponding section of the Proposed Route.

Eversource's initial plans for aligning the underground transmission line through the Elmwood Center business district area involved the alignment of the cable along the route variation, which (as summarized in Table 11-6) would be slightly less costly than the portion of the Proposed Route that it would replace because of the shorter cable length. However, discussions with Town of West Hartford representatives revealed that the town would prefer that the Project avoid the New Britain Avenue / South Quaker Lane area due to factors such as potential effects on businesses, traffic congestion, and ConnDOT's recently completed improvements to New Britain Avenue.

The town noted that the underground cable could be effectively aligned across the parking lot of the town's Elmwood Community Center, thus avoiding these potential effects. Eversource conducted further investigations into the alignment across the town's community center property and determined that such an alignment is technically feasible. Consequently, in recognition of the town's preference, Eversource incorporated the community center alignment into the Proposed Route.

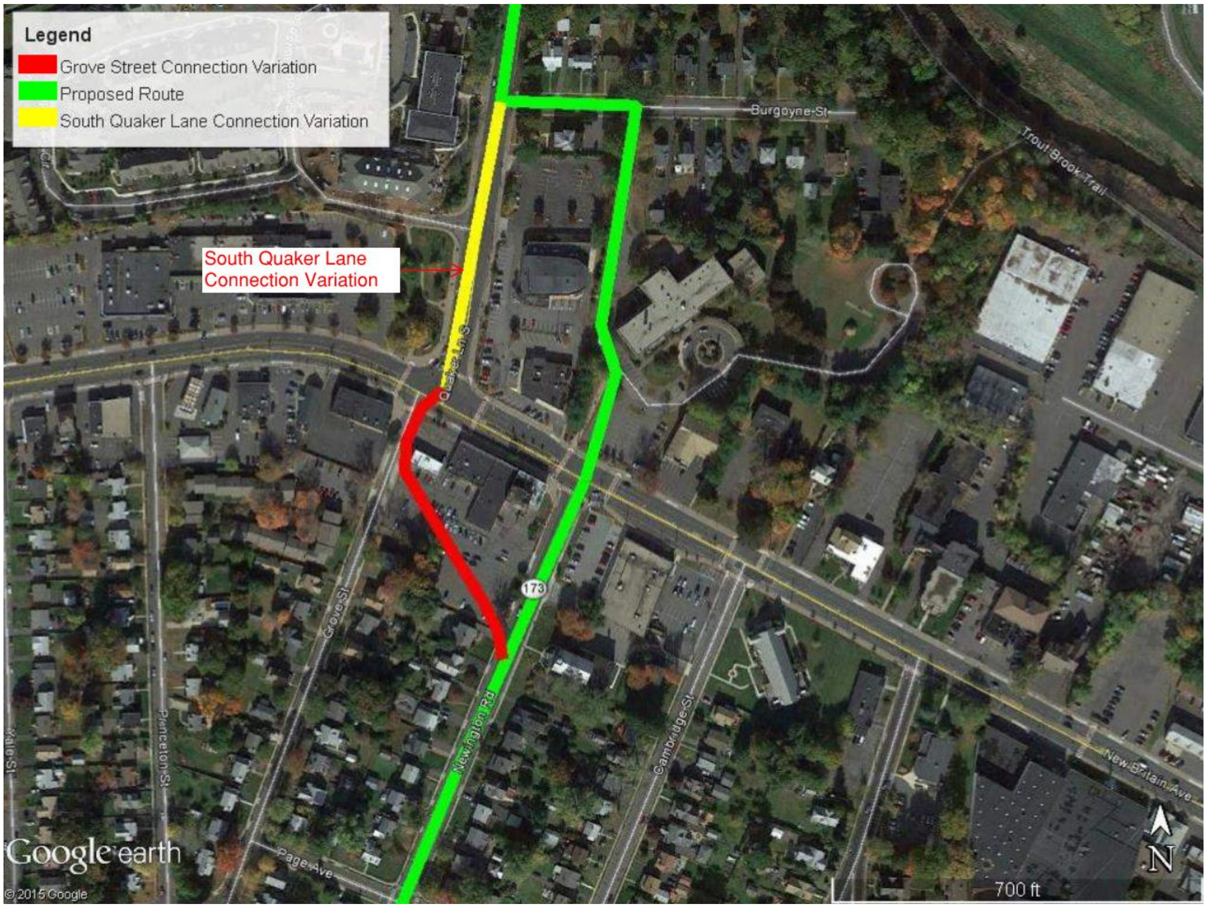
Table 11-6: South Quaker Lane Connection Variation Comparison Table

Route Segment Feature / Characteristics	Proposed Underground Route Segment to be Replaced	South Quaker Lane Variation
Length		
• Total	0.18 miles	0.16 miles
Length, by Town		
• Newington	0 miles	0 miles
• West Hartford	0.18 miles	0.16 miles
• Hartford	0 miles	0 miles
Length, ConnDOT Roads		
• Route 173 (Willard Ave./Newington Rd.)	0 miles	0 miles
• Route 529 (New Britain Ave.)	0.01 miles	0.07 miles
Roadway Characteristics		
• Existing Utility Density	Medium	Medium - High
• Traffic Lanes	Parking lot / driveway and 2-lane roadway	4-lane roadway plus turn lanes
Construction, Operation, & Maintenance Considerations		
• Traffic	Very low traffic volume	High traffic volume
• Accessibility	Minimal impact to traffic	Lane closures on high-volume roadways
Land Use		
• Principal Land Use Adjacent to ROW	Town of Hartford Community Center, Residential Development	Commercial
Cultural Resources		
• Resources	None	None
Community Facilities		
• Facilities	Town of West Hartford Community Center	None
Biological Resources		
• Waterway Crossings	N/A	N/A
Cost (2017 Dollars)		
• Estimated Project Cost Delta	$0 MM	-$0.23 MM

11.4.5 Grove Street Connection Variation

The Grove Street Connection Variation was evaluated as another option to avoid an alignment of the cable system longitudinally within New Britain Avenue. Thus, this variation would traverse from State Route 173 to the northeast, crossing private properties (parking lots) south of various Elmwood Center businesses (e.g., Fernwood Restaurant), before extending onto Grove Street and proceeding north across New Britain Avenue to South Quaker Lane (refer to Figure 11-15).

Figure 11-15: Grove Street Connection Variation



The variation would avoid a longitudinal installation within New Britain Avenue, as well as a cable alignment within the Town of West Hartford Elmwood Community Center property and Burgoyne Street, but would require easements across the parking lots located behind (and south of) the commercial buildings that front on New Britain Avenue. Table 11-7 summarizes the characteristics of the Grove Street Connection Variation versus the portion of the Proposed Route it would replace.

Table 11-7: Grove Street Connection Variation Comparison Table

Route Segment Feature / Characteristics	Proposed Underground Route Segment to be Replaced	Grove Street Connection Variation
Length		
• Total	0.26 miles	0.22 miles
Length, by Town		
• Newington	0 miles	0 miles
• West Hartford	0.26 miles	0.22 miles
• Hartford	0 miles	0 miles
Length, ConnDOT Roads		
• Route 173 (Willard Ave./Newington Rd.)	0.07 miles	0 miles
• Route 529 (New Britain Ave.)	0.01 miles	0.01 miles
Roadway Characteristics		
• Existing Utility Density	Low, high crossing New Britain Ave	Medium - High
• Traffic Lanes	Parking lot / driveway and 2-lane roadway	4-lane roadway plus turn lanes
Construction, Operation, & Maintenance Considerations		
• Traffic	Low traffic volume, high on Newington Road and when crossing New Britain Ave	Medium traffic volume, high crossing New Britain Ave
• Accessibility	Lane closures on high-volume roadways	Lane closures on high-volume roadways
Land Use		
• Principal Land Use Adjacent to ROW	Town of Hartford Community Center, Residential Development	Commercial
Cultural Resources		
• Resources	None	None
Community Facilities		
• Facilities	Town of West Hartford Community Center	None
Biological Resources		
• Waterway Crossings	N/A	N/A
Cost[1] (2017 Dollars)		
• Estimated Project Cost Delta	$0 MM	-$0.46 MM

1 Cost does not include acquisition of property or rights or easement costs.

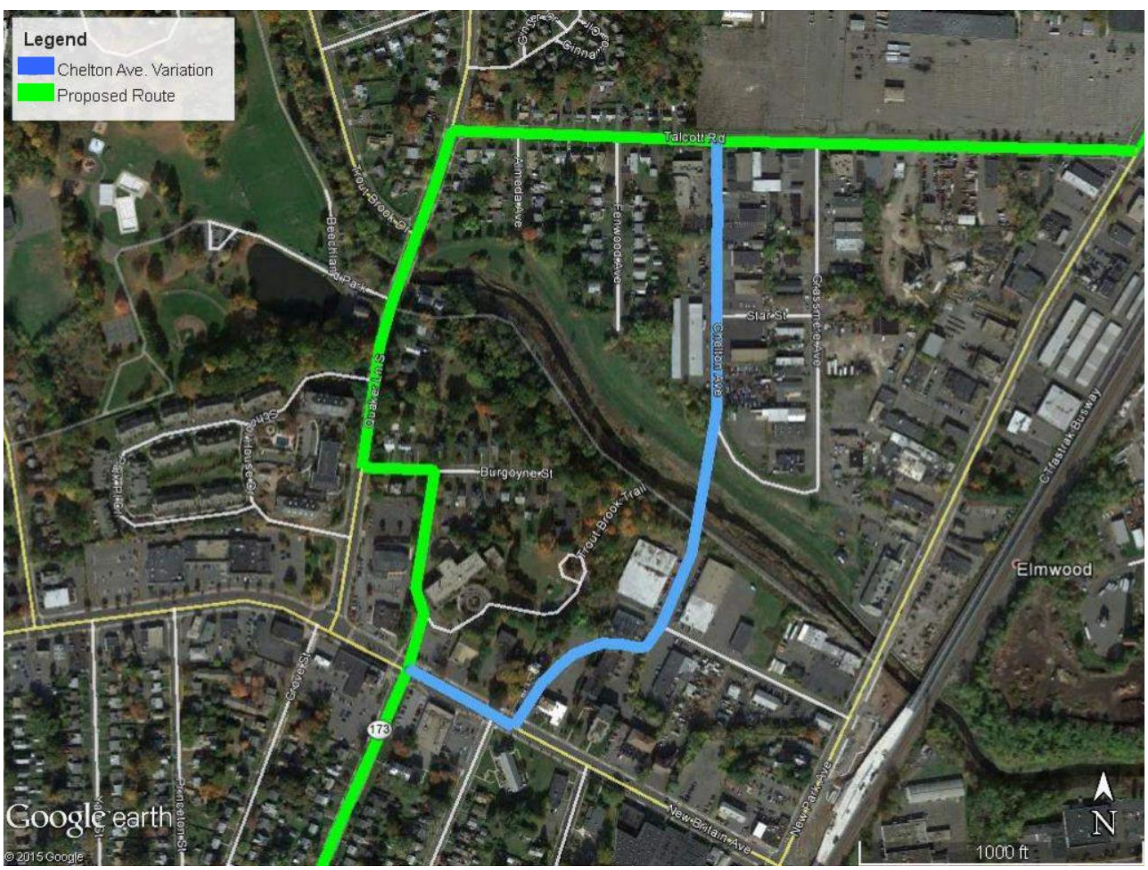
The Grove Street Connection Variation would provide a more direct route for the new cable system and thus would be approximately 0.04 mile shorter than the portion of the Proposed Route that it would replace. Because of the need for property rights and the additional costs associated with the easement acquisition, this variation was considered less favored when compared to the corresponding section of the Proposed Route.

Installation of the cable diagonally through the parking lot would encumber the future development. This impact would necessarily be reflected in the cost of acquiring the easement. This concern is heightened by information received from the Town of West Hartford that this is the last parcel in the downtown area to be redeveloped and is presently being considered for redevelopment. In addition, this variation would traverse the major New Britain Avenue and South Quaker Lane intersection in the hub of Elmwood Center.

11.4.6 Chelton Avenue Variation

The Chelton Avenue Variation would traverse along New Britain Avenue (State Route 529), private properties, and Chelton Avenue (refer to Figure 11-16) and would avoid the alignment of the cable system through the Elmwood Center business district in the vicinity of South Quaker Lane and New Britain Avenue, as well as an alignment across Trout Brook near South Quaker Lane and Beachland Park. The Chelton Avenue Variation would be aligned through principally commercial and industrial areas north of New Britain Avenue and south of Talcott Road.

Figure 11-16: Chelton Avenue Variation



This variation would result in approximately 500 feet of longitudinal cable system installation within New Britain Avenue, multiple new easement acquisitions though the area north of New Britain Avenue and south of Trout Brook, a trenchless crossing of Trout Brook, and installation in Chelton Avenue, which has a relatively high existing utility density. In this area, Trout Brook is bordered by flood-control dikes on both the north and south.

A trenchless crossing, therefore, would have to span from south of the south dike to north of the north dike, resulting in a longer and more expensive installation. Additionally, the construction through private parking lots on the south side of Trout Brook would require a property acquisition process.

Table 11-8 compares the Chelton Avenue Variation to the portion of the Proposed Route that it would replace.

The Chelton Avenue Variation was determined to be inferior to the segment of the Proposed Route that it would replace because of the comparatively higher costs associated with the trenchless crossing of Trout Brook and because the cable system would have to be aligned through various private properties for which easements would have to be acquired.

Table 11-8: Chelton Avenue Variation Comparison Table

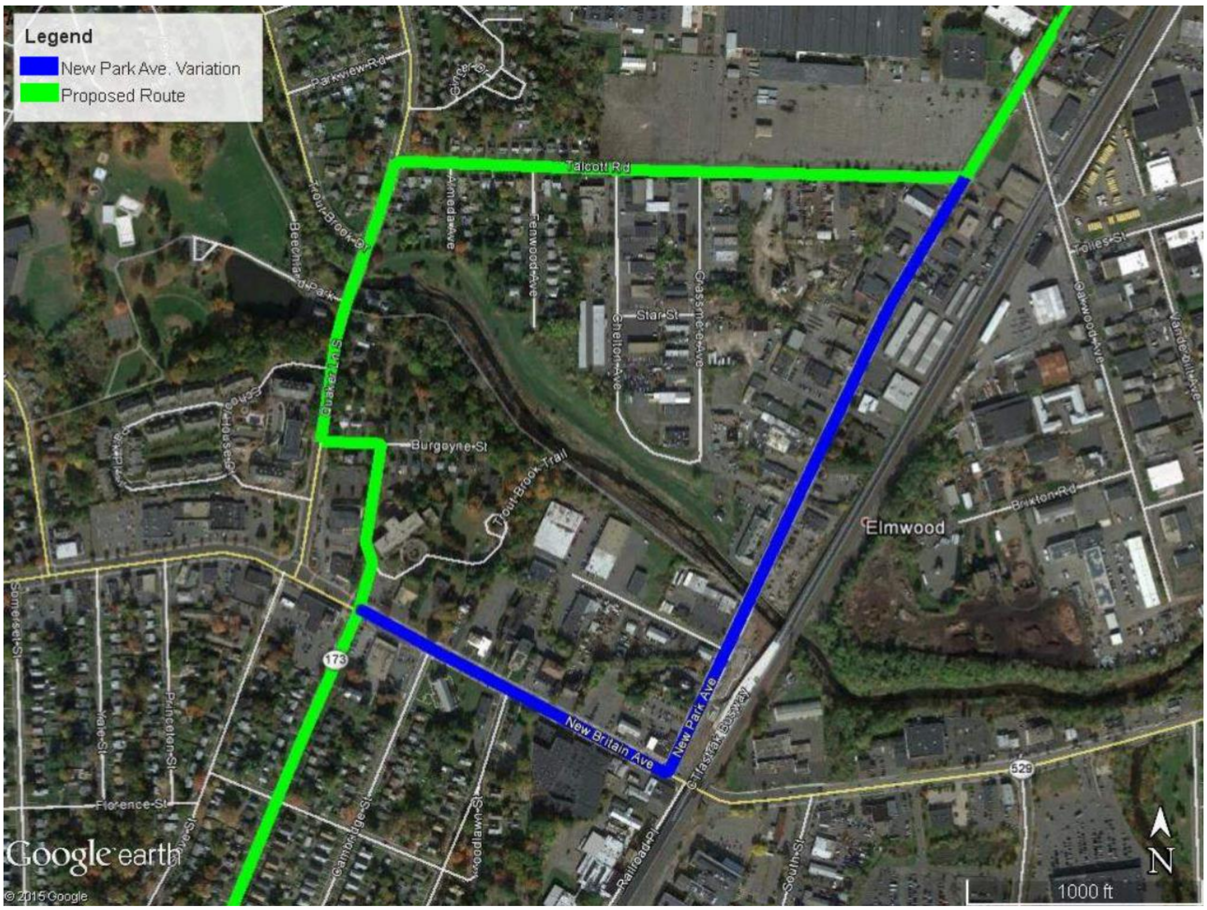
Route Segment Feature / Characteristics	Proposed Underground Route Segment to be Replaced	Chelton Avenue Variation
Length		
• Total	0.6 miles	0.54 miles
Length, by Town		
• Newington	0 miles	0 miles
• West Hartford	0.6 miles	0.54 miles
• Hartford	0 miles	0 miles
Length, ConnDOT Roads		
• Route 173 (Willard Ave./Newington Rd.)	0 miles	0 miles
• Route 529 (New Britain Ave.)	0.01 miles	0.09 miles
Roadway Characteristics		
• Existing Utility Density	Low- Medium	High
• Traffic Lanes	Parking lot / driveway, 4-lane roadway plus turn lanes, 2-lane roadway	Parking lot / driveway, 4-lane roadway plus turn lanes, 2-lane roadway
Construction, Operation, & Maintenance Considerations		
• Traffic	Medium - High traffic volume	High traffic volume on New Britain Ave, Low on Chelton Ave
• Accessibility	Lane closures on high-volume roadways	Lane closures on high-volume roadways
Land Use		
• Principal Land Use Adjacent to ROW	Town of Hartford Community Center, Residential Development	Commercial
Cultural Resources		
• Resources	None	None
Community Facilities		
• Facilities	Town of West Hartford Community Center	None
Biological Resources		
• Waterway Crossings	Trout Brook on Quaker Lane South	Trout Brook from Parking Lot to Chelton Ave
Cost[1] (2017 Dollars)		
• Estimated Project Cost Delta	$0 MM	+$1.08 MM

[1] Cost does not include acquisition of property or rights or easement costs.

11.4.7 New Park Avenue Route Variation

The New Park Avenue Variation would provide an alternate Trout Brook crossing location and, compared to the segment of the Proposed Route that it would replace, would maximize the alignment of the cable system within roads that extend through primarily commercial or industrial areas (refer to Figure 11-17).

Figure 11-17: New Park Avenue Variation



This variation also would avoid Talcott Road, within which the cable system is planned for location along the Proposed Route (refer to Figure 11-17). Because the MDC plans to install a large-diameter water pipe in portions of Talcott Road, the alignment of and schedule for the construction of the cable system along the Proposed Route in this area would have to be carefully coordinated with the MDC.

However, the New Park Avenue Variation would require an approximately 0.3 mile alignment along New Britain Avenue, which would be inconsistent with ConnDOT and Town of West Hartford objectives of avoiding impacts to the road due to its recent reconstruction. In addition, compared to the crossing of Trout Brook adjacent to South Quaker Lane, the installation of the cable system beneath the brook adjacent to New Park Avenue could be more difficult and thus is less preferable, although technically feasible.

At this location, Trout Brook is fully channelized between two approximately 20-foot-high concrete walls. Therefore, a trenchless crossing of the brook at this location would require either very deep shafts on both sides for a jack-and-bore (or equivalent), or a very long HDD. Multiple easements may be required to accommodate the trenchless alignment and associated workspace necessary to stage the crossing. Due to the concrete walls at this location, an open cut of Trout Brook is not considered a viable alternative.

Table 11-9 summarizes the characteristics of the New Park Avenue Variation versus the portion of the Proposed Route it would replace.

Due to the additional length on New Britain Avenue (State Route 529), and the need for a potentially difficult trenchless crossing of Trout Brook, this variation was considered inferior to the corresponding section of the Proposed Route.

Table 11-9: New Park Avenue Variation Comparison Table

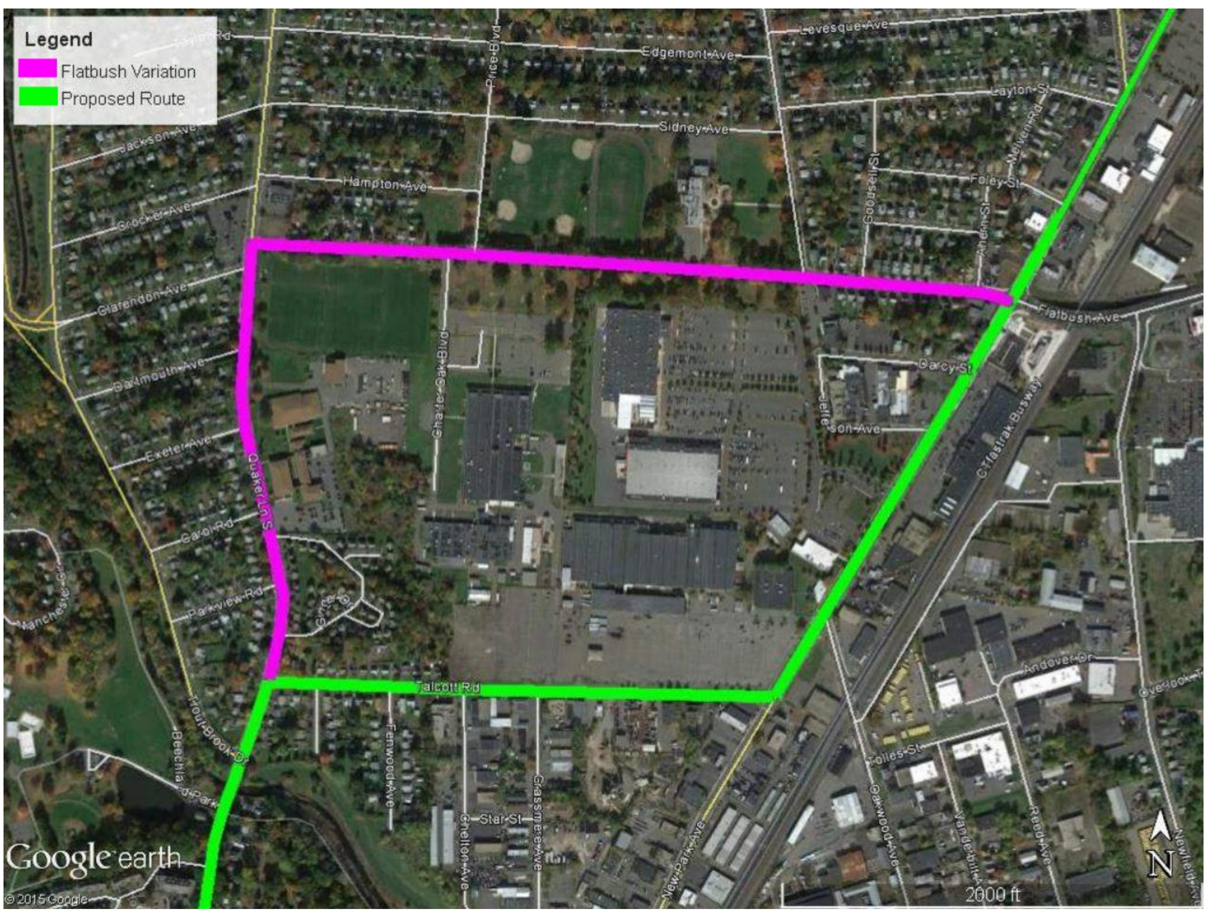
Route Segment Feature / Characteristics	Proposed Underground Route Segment to be Replaced	New Park Avenue Variation
Length		
• Total	0.88 miles	0.73 miles
Length, by Town		
• Newington	0 miles	0 miles
• West Hartford	0.88 miles	0.73 miles
• Hartford	0 miles	0 miles
Length, ConnDOT Roads		
• Route 173 (Willard Ave./Newington Rd.)	0 miles	0 miles
• Route 529 (New Britain Ave.)	0.01 miles	0.21 miles
Roadway Characteristics		
• Existing Utility Density	Low- Medium	Medium – High
• Traffic Lanes	Parking lot / driveway, 4-lane roadway plus turn lanes, 2-lane roadway	4-lane roadway plus turn lanes
Construction, Operation, & Maintenance Considerations		
• Traffic	Medium - High traffic volume	High traffic volume
• Accessibility	Lane closures on high-volume roadways	Lane closures on high-volume roadways
Land Use		
• Principal Land Use Adjacent to ROW	Town of Hartford Community Center, Residential Development	Commercial
Cultural Resources		
• Resources	None	None
Community Facilities		
• Facilities	Town of West Hartford Community Center	None
Biological Resources		
• Waterway Crossings	Trout Brook on Quaker Lane South	Trout Brook Crossing on New Park Ave
Cost (2017 Dollars)		
• Estimated Project Cost Delta	$0 MM	+$0.58 MM

11.4.8 Flatbush Avenue Route Variation

As illustrated in Figure 11-18, the Flatbush Avenue Variation would align the cable system farther north along South Quaker Lane before turning east along Flatbush Avenue to an interconnection with the Proposed Route segment along New Park Avenue. Like the New Park Avenue Variation, this variation also would provide an option to aligning the cable system within Talcott Road.

Compared to the portion of the Proposed Route that it would replace, this variation would have the primary advantage of avoiding Talcott Road, where the alignment of the cable system would have to be planned in coordination with MDC's new waste-water line, which is also proposed for location in the road.

Figure 11-18: Flatbush Avenue Variation



As summarized in Table 11-10, this variation would increase the length of the cable system and would route the transmission system to a location immediately in front of the Charter Oak Elementary School and generally near more residential areas, adjacent to both South Quaker Lane and Flatbush Avenue. Along this route variation, land uses along the north side of Flatbush Avenue consist of residential areas, the school, and playing fields.

Along the south side of the road, land use includes an industrial area, as well as some residential areas and a playing field. In comparison, except for the residential areas along the western portion of Talcott Road near Quaker Lane South, the portion of the Proposed Route that this variation would replace is bordered principally by commercial and industrial uses.

Due to the additional length of the route and the associated cost increase resulting from the extra length, as well as the fact that the route will go by Charter Oak Elementary School, this variation was considered inferior to the corresponding section of the Proposed Route.

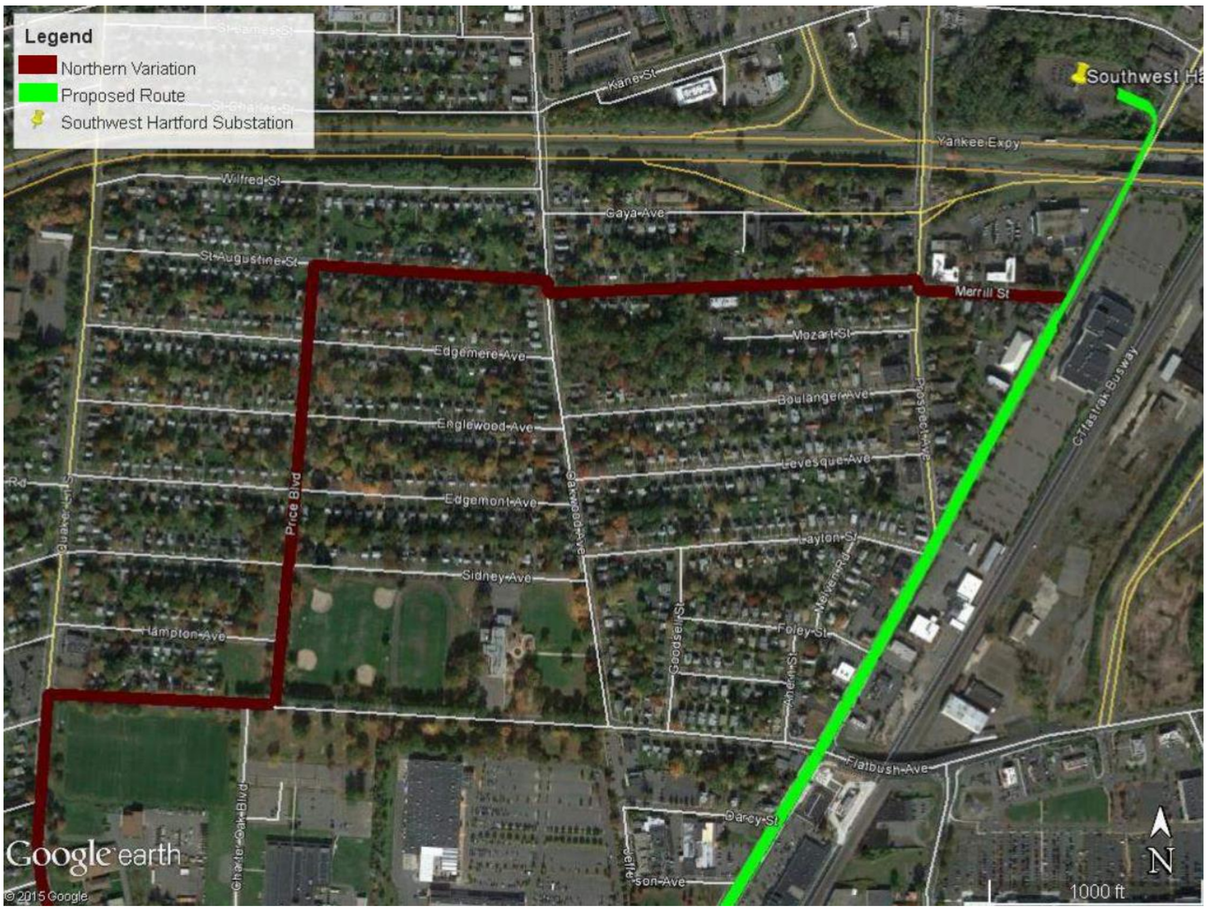
Table 11-10: Flatbush Avenue Variation Comparison Table

Route Segment Feature / Characteristics	Proposed Underground Route Segment to be Replaced	Flatbush Avenue Variation
Length		
• Total	0.87 miles	1.08 miles
Length, by Town		
• Newington	0 miles	0 miles
• West Hartford	0.87 miles	1.08 miles
• Hartford	0 miles	0 miles
Length, ConnDOT Roads		
• Route 173 (Willard Ave./Newington Rd.)	0 miles	0 miles
• Route 529 (New Britain Ave.)	0 miles	0 miles
Roadway Characteristics		
• Existing Utility Density	Low - Medium, with short segment of high	Low – Medium
• Traffic Lanes	2-lane roadway, 4-lane roadway plus turn lanes	2-lane roadway plus parking lanes
Construction, Operation, & Maintenance Considerations		
• Traffic	Low on Talcott Road and High on New Park Ave. traffic volume	Medium traffic volume. High traffic volume during school pick-up
• Accessibility	Lane closures on high-volume roadways	Lane closures on high-volume roadways
Land Use		
• Principal Land Use Adjacent to ROW	Residential, Commercial	Charter Oak Elementary School. Oakwood Ave West Hartford, Residential Development
Cultural Resources		
• Resources	None	None
Community Facilities		
• Facilities	None	1) Goodrich Park South Quaker Lane West Hartford 2) Sterling Field Price Blvd West Hartford
Biological Resources		
• Waterway Crossings	N/A	N/A
Cost (2017 Dollars)		
• Estimated Project Cost Delta	$0 MM	+$2.42 MM

11.4.9 Northern Route Variation

This variation would replace most of the northern portion of the Proposed Route along New Park Avenue and would connect with the western portion of the Flatbush Route Variation. The variation would involve the alignment of the cable system along Price Boulevard and then within St. Augustine, Westphal Street, and Merrill Streets (refer to Figure 11-19).

Figure 11-19: Northern Variation



Except for that portion of the variation located directly west of New Park Avenue, which is bordered by some commercial uses, this route would extend entirely along residential streets. Just north of the intersection with Flatbush Avenue, this variation also would be aligned west of playing fields associated with the Charter Oak Elementary School and, in addition to avoiding Talcott Road, also would avoid an alignment directly in front of Charter Oak Elementary School. As summarized in Table 11-11, the Northern Variation would be approximately 0.4 mile longer than the portion of the Proposed Route that it would replace, and would be located almost entirely within residential streets. In comparison (refer to Table 11-11), the corresponding portion of the Proposed Route extends along New Park Avenue, which is four lanes and is bordered primarily by commercial uses. As a result, the Northern Variation would be more costly to construct than the Proposed Route segment. Thus, this variation was considered inferior to the corresponding section of the Proposed Route.

Table 11-11: Northern Variation Comparison Table

Route Segment Feature / Characteristics	Proposed Underground Route Segment to be Replaced	Northern Variation
Length		
• Total	1.33 miles	1.68 miles
Length, by Town		
• Newington	0 miles	0 miles
• West Hartford	1.03 miles	1.55 miles
• Hartford	0.3 miles	0.13 miles
Length, ConnDOT Roads		
• Route 173 (Willard Ave./Newington Rd.)	0 miles	0 miles
• Route 529 (New Britain Ave.)	0 miles	0 miles
Roadway Characteristics		
• Existing Utility Density	Low - Medium	Low - Medium
• Traffic Lanes	4-lane roadway plus turn lanes	2-lane roadway plus parking lanes
Construction, Operation, & Maintenance Considerations		
• Traffic	High traffic volume	Medium traffic volume
• Accessibility	Lane closures on high-volume roadways	Lane closures on medium-volume roadways
Land Use		
• Principal Land Use Adjacent to ROW	Commercial	Residential Development
Cultural Resources		
• Resources	None	None
Community Facilities		
• Facilities	None	1) Goodrich Park South Quaker Lane West Hartford 2)Sterling Field Price Blvd West Hartford
Biological Resources		
• Waterway Crossings	N/A	Unnamed tributary south of Park Brook.
Cost (2017 Dollars)		
• Estimated Project Cost Delta	$0 MM	+$4.03 MM

11.5 TROUT BROOK CROSSING CONSTRUCTION TECHNIQUE VARIATIONS

To minimize the time required to bury the cable system beneath Trout Brook (which is approximately 45 feet wide at the planned crossing location adjacent to the South Quaker Lane bridge) and the impacts to adjacent land uses associated with the staging areas required for the crossing, Eversource proposes to use open-trench construction. This construction technique involves excavation and duct bank construction directly across and through the stream bed. Existing water flow in the brook would be accommodated in one of the following three techniques:

- Flume Pipe – a temporary flume pipe would be laid along the stream bed, with the flow of water in the brook routed through it, thus allowing excavation for the underground transmission system to cross beneath it.
- Coffer dams – a temporary coffer dam would be constructed from each bank to a midway point across the stream. The duct bank system would be installed to this point, and the coffer dam would be removed and reconstructed from the opposite bank. The balance of the duct bank across the brook would then be completed. For both steps, continuous flow of the brook would be maintained.
- Dam and Pump – the brook would be temporarily dammed to allow for construction across it, with all flow in the brook pumped around it through diversion piping.

However, before identifying the proposed open-trench method as preferred, other construction techniques, as described below, were also considered. All of these construction techniques are feasible for the Trout Brook crossing; however, none are as preferred as the proposed open cut method. Because of the short distance to cross Trout Brook, compared to a trenchless crossing of Trout Brook at this location, an open-cut installation can be completed more efficiently and cost-effectively. Additionally, environmental impacts can be minimized by installing the crossing during low-flow periods (in accordance with CT DEEP requirements).

11.5.1 Trenchless Installation: Horizontal Directional Drill

Horizontal directional drilling (HDD) is a surface-launched trenchless technology method that creates a pilot bore along a curved, planned subsurface pathway. Bentonite drilling fluid (e.g., clay mixed with water) is used in the drilling process to lubricate the drill bit, remove soil cuttings, and maintain the integrity of the bore hole. Once the pilot hole is completed, the borehole is enlarged by reaming the pilot bore to approximately 150% of the diameter of the product pipe. After a sufficiently large borehole is established, the conduit system would be pulled through the open bore hole.

To install the 115-kV cable duct bank beneath the 45-foot wide Trout Brook using HDD, an estimated drill path of 1,500 feet would be required to obtain the necessary curvature beneath the creek. At maximum depth, the drill path would be 90 to 95 feet below the surface. A bore hole of approximately 4.5 feet in diameter would be required to accommodate the casing pipe and cable conduits. This would involve potentially multiple reaming passes.

Staging areas of approximately 0.5 to 0.8 acres would be required on both sides of the Trout Brook crossing in order to accomplish the HDD. These staging areas would be required to accommodate the various specialized equipment and materials needed for the HDD, including a drill rig for the horizontal drilling operation, pilot hole pipe, and reaming pipes of various diameters. An area also is required to recirculate the drilling mud used in the process. In addition, an office trailer with support equipment is also set up in one of the staging areas. Due to the length of the HDD, these staging areas would be at locations removed from the land directly abutting Trout Brook.

The length of time required for an HDD depends on the subsurface conditions encountered along the drill path. In general, an HDD crossing typical of the length and diameter of the Trout Brook crossing would take approximately two to four months to complete, including site preparation and set-up time.

While the HDD method would avoid direct impacts to the Trout Brook stream bed, there is a potential for inadvertent "returns" of the drilling mud to occur. Because the drilling mud is under pressure, particularly during the pilot hole phase of the drilling operation, instead of flowing back to established mud pits at the staging areas, the fluid may follow the path of least resistance (e.g., via fissures in subsurface rock or interstitial spaces in subsurface soils) up to the surface. Thus, drilling mud may breach the surface either in Trout Brook, on the stream banks, or in nearby upland areas. The location and extent of inadvertent returns, if any, cannot be predicted. Typically, a response plan would be prepared to define the procedures that would be followed if inadvertent returns occur.

This method was evaluated for the Project at this location, and was determined to be inferior to the proposed open-cut installation due to the length of installation required as it would require launch and receive points at locations hundreds of feet removed from the brook itself, and the higher cost.

11.5.2 Trenchless Installation: Horizontal Bore

For this trenchless installation method, staging areas (each approximately 0.3 to 0.5 acres) would be established on both sides of Trout Brook. Within these staging areas, vertical shafts would have to be excavated on both sides of the brook. For the Trout Brook crossing, the excavations would typically be approximately 10 feet wide, 25 feet long, and 25 feet deep. A boring machine would be positioned at the bottom of the bore pit on one side of the brook, and would be used to bore a 48-inch diameter hole beneath the brook, across to the opposite pit. A 48-inch-diameter casing pipe would be installed between the bore pits. The cable ducts then would be pulled into the casing pipe. Excavation of the horizontal bore would be done by a number of different methods dependent on the length, bore diameter, soil conditions, and groundwater conditions.

This method was evaluated for the Project at this location and was determined to be inferior to the proposed open-cut installation due to the amount of disturbance that would result surrounding the launch and receive shafts, the depth at which the horizontal bore would have to be excavated, and the higher cost.

11.5.3 Attachment to South Quaker Lane Bridge

For this option, the conduit system is directly attached to the existing South Quaker Lake bridge over Trout Brook. The cable system would be attached to the bridge using a hanger system. The attachment location could be on either side of the bridge, or below the bridge deck between structural members, where sufficient space exists.

The bridge attachment option for installing the cable across Trout Brook was investigated, but found to be impractical because of the presence of other utilities that are already attached to the bridge. Specifically, the transmission cable installation would conflict with a major high-pressure gas main that is situated on the bridge. Given the location of the gas main, sufficient clearance could not be obtained between the existing gas main and the proposed transmission cable. Consequently, the cable system could not be attached to the bridge without first relocating the gas main, either underground (beneath Trout Brook) or to a different location underneath the bridge. Any relocation of the gas main would be at a significant cost and would involve additional associated construction activities in the vicinity of South Quaker Lane and Trout Brook. As a result, this option was determined to be less preferable than the open cut method.

11.5.4 Trout Brook Crossing Method Comparison

Table 11-12 provides a comparison of the different methods of crossing Trout Brook at South Quaker Lane. As this table shows, compared to the other crossing options, the proposed open-cut cable installation method will minimize the time and costs required to install the cable. Although this method will require direct disturbance to the stream bed and banks, standard, proven methods will be used to maintain water flows during construction and restore disturbed areas efficiently thereafter.

Table 11-12: Trout Brook Crossing Comparison Table

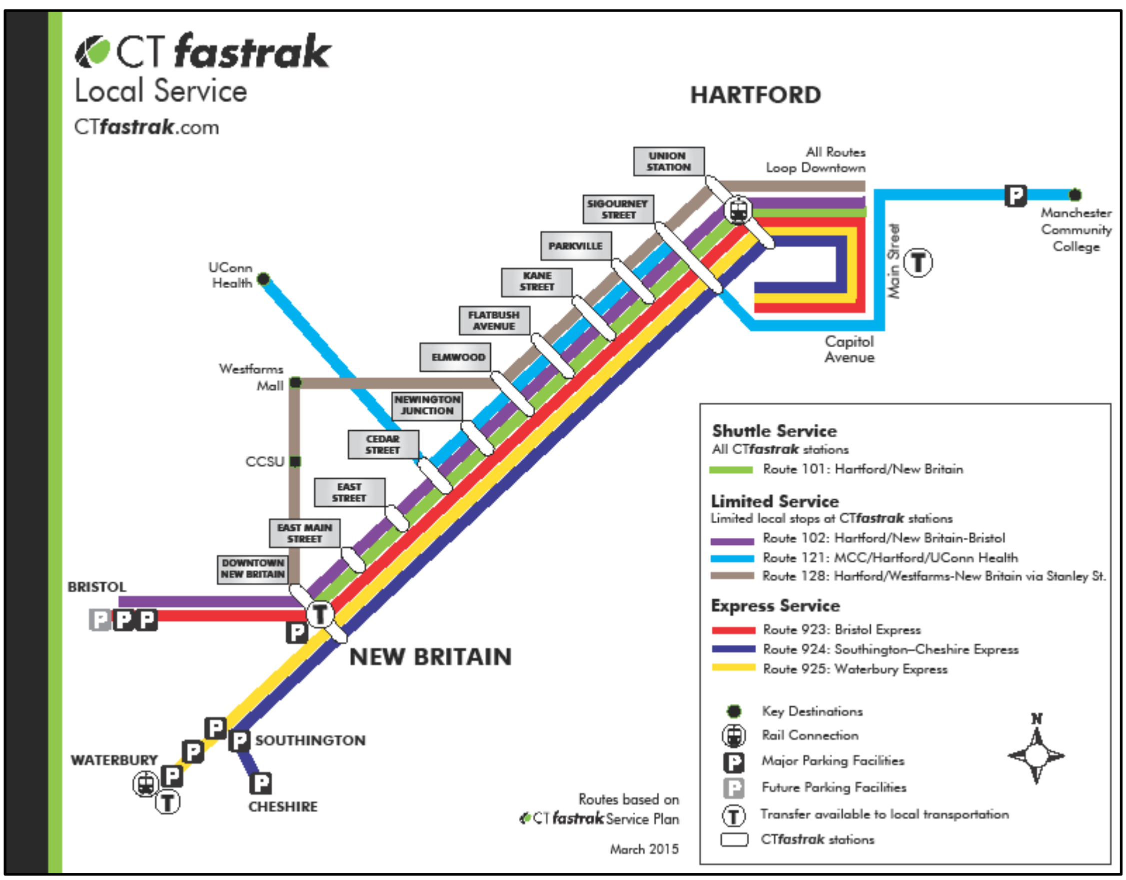
Feature / Characteristics	Open-Cut (Proposed Crossing Method)	Horizontal Bore	HDD	Attachment to South Quaker Lane Bridge
Crossing Characteristics				
• General Description	Open cut using cofferdams, flume pipes, or methods to create a dry work space in which to trench across the brook. Work would occur during low flow period.	Trenchless (subsurface) crossing involves excavation of boring and receiving pits, each estimated at approximately 25 feet deep, in staging areas on either side of brook and "jacking" of pipe casing for conduits and cables beneath the brook from one pit to the other	Trenchless (subsurface) crossing involving use of directional (horizontal) drilling involving multiple passes with drill pipe to install pipe casing for conduits and cables. Requires specified curvature for drill path, drilling mud, and staging areas for drill pipe strings	Install cable duct beneath existing South Quaker Lane bridge over Trout Brook; bridge design can accommodate electric cable, but some an existing utility (high-pressure gas main) already on bridge would have to be relocated
• Width and average water depth (feet) of Trout Brook at proposed crossing location	45-foot width, 4 feet deep	45-foot width, 4 feet deep	45-foot width, 4 feet deep	45-foot width, 4 feet deep
• Length of Crossing (feet) (staging area to staging area)	60 feet (bank to bank)	165 feet	1,500 feet	90 feet (expansion joint to expansion joint)
• Estimated depth below streambed (feet)	5 feet	20 feet	40 feet (actual drill path will reach 90 feet deep at a location removed from the brook)	N/A
• Staging Areas Required (acres); general location on each side of brook	0.1 acres	0.25-0.5 acres	0.5-0.75 acres (staging areas are not necessarily adjacent to brook)	.05 acres (space to access underside of existing bridge)
Construction, Operation, & Maintenance Considerations				
• Traffic Disturbance to Quaker Lane South During Construction	Minimal	Minimal	Minimal during drilling and reaming; High during casing and conduit pull-back operations	High - requires excavation in roadway up to bridge abutments
• Maintenance Accessibility	Possible to excavate duct bank for repairs if necessary	None	None	Conduit fully exposed where attached to bridge
Land Use				
• Land Uses Impacted	Beachland Park parking lot and South Quaker Lane, Trout Brook Trail along south side of brook?	Roadway and public park land	Roadway, public park land, private properties	Roadway, minimal public park land
Environmental Disturbance				
• Water Resource Impacts	~3,500 SF disturbance to stream bed (but work will be performed in the dry)	None	None unless there is an inadvertent return to the surface of drilling mud fluid	None
• Upland areas affected (acres)	~3500 SF	0.25-0.5 acres on each side of crossing	0.5-0.75 acres on each side of crossing	Trout Brook on Quaker Lane South as Bridge Attachment
Estimated Work Duration				
• Duration	1-2 months	2-4 months	2-4 months	1-2 months (115-kV transmission line only, third-party utility relocation duration unknown at this time)
Cost (2017 Dollars)				
• Estimated Project Cost Delta (Proposed Eversource Installation)	$0 MM	+$0.94 MM	+$3.1 MM	-$0.15 MM
• Estimated Project Cost Delta (Third-party Utility Relocation)	$0 MM	$0 MM	$0 MM	Unknown at this time

11.6 CT*FASTRAK*/AMTRAK ROUTE ALTERNATIVE

The CT*fastrak* and two adjacent active Amtrak railroad lines extend southwest-to-northeast through the eastern portion of the Project study area. Both the CT*fastrak* and the Amtrak railroad tracks occupy the same ROW, with the railroad tracks situated east of the CT*fastrak*.

The CT*fastrak*, which commenced service in late March 2015 and is operated by ConnDOT, is Connecticut's first rapid bus transit system and includes a 9.4 mile bus-exclusive road that provides local service between downtown New Britain and Hartford. Although this linear corridor does not directly connect the two Eversource substations (i.e., Newington and Southwest Hartford) that must be linked as part of the Project, it represents a primary part of a route alternative that would principally traverse near commercial and industrial areas. Figure 11-20 illustrates the location of the CT*fastrak* service area; the eastern boundary of the Project study area abuts the busway between the Newington and Kane stations (http://ctfastrak.com/files/2015-03-17_CTfastrak_Local_Map.pdf).

Figure 11-20: General Location of CT*fastrak* Service Area



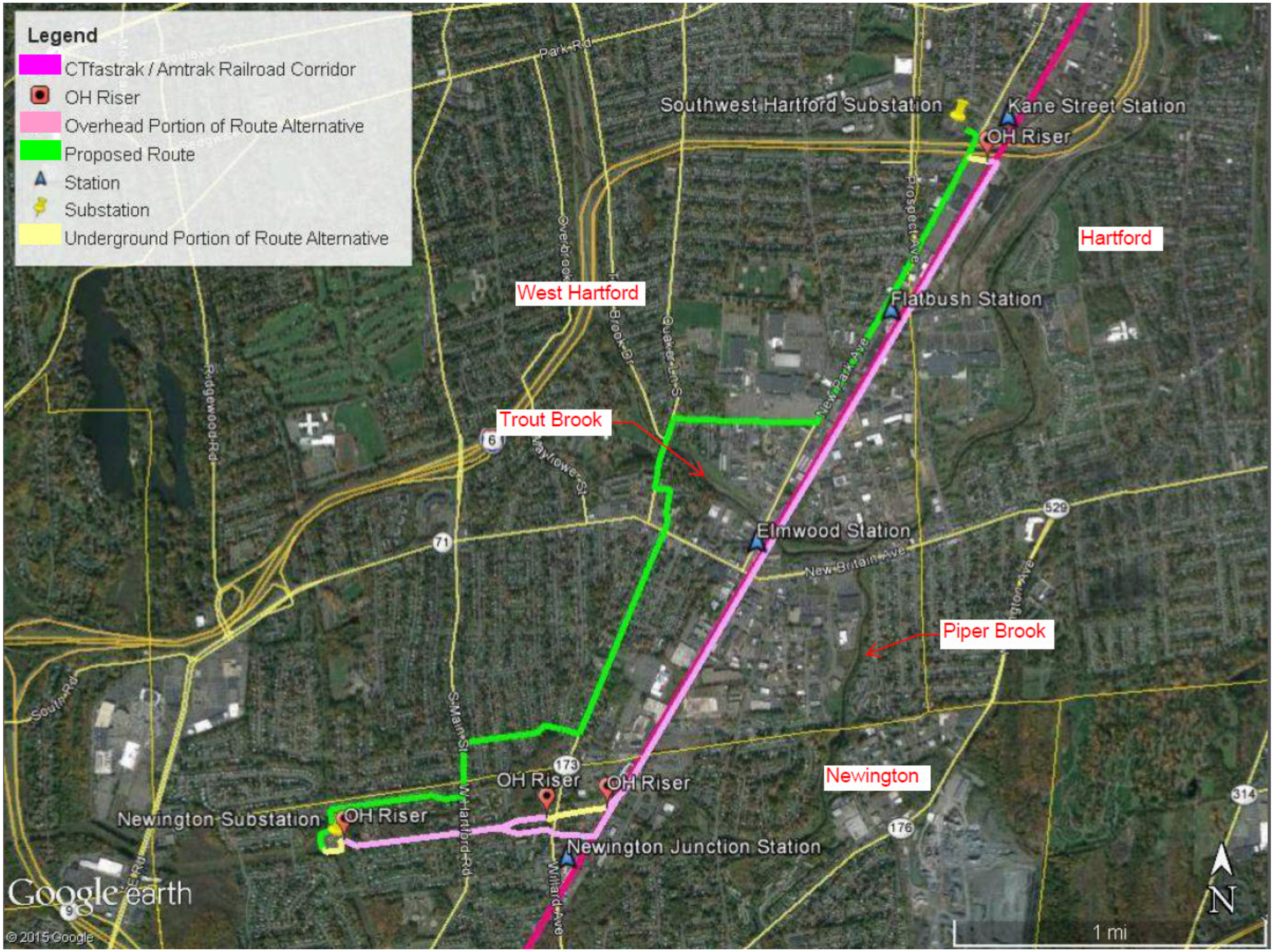
Eversource conducted initial evaluations to assess the feasibility of collocating the new 115-kV transmission line within portions of this busway/Amtrak transportation corridor and performed preliminary studies to identify a possible route alternative that would use a combination of utility ROWs, road ROWs, and private property to connect the CT*fastrak*/Amtrak corridor to Newington and Southwest Hartford Substations. Figure 11-21 illustrates this route alternative.

Based on these preliminary analyses, Eversource determined that more detailed constructability investigations would be warranted, particularly since: (1) non-standard Eversource designs would have to be used for an overhead alignment along the busway/Amtrak, given the limited space within this corridor; and (2) the two railroad lines along the busway/Amtrak corridor are being upgraded to high-speed rail service as part of the 62 mile New Haven – Hartford – Springfield (NHHS) Rail Program. The NHHS Rail Program, which represents a partnership between Amtrak, the Federal Railroad Administration (FRA), and the states of Connecticut, Massachusetts, and Vermont, will use the existing railroad tracks adjacent to the CT*fastra*k, including the portion between Newington and Kane Street in Hartford along which the route alternative is being investigated. The goal of the NHHS Rail Program is to upgrade rail service between New Haven and Springfield, providing high speed rail service equal to the nation's best passenger rail service.[34] The NHHS Rail Program, which is planned to connect to the Metro-North and Amtrak Acela rails systems, is expected to be in service in 2018. Modifications to the rail line corridor are currently underway. As part of the NHHS Rail Program, a new West Hartford Amtrak station is planned near Flatbush Avenue, along with other improvements.

Though Eversource has determined that the most feasible option is the Proposed Route, Eversource is in the process of coordinating with representatives of ConnDOT and Amtrak to fully assess the overall feasibility of locating a new 115-kV transmission line along the busway/Amtrak corridor. Potential challenges include not only the limited space within the busway/Amtrak corridor and the need for easements from ConnDOT and Amtrak, but also the special transmission line designs and construction methods that would be required. Potential implications with respect to the Project schedule also are being evaluated.

[34] Additional information regarding the NHHS Rail Program can be found on the program website at: http://www.nhhsrail.com/objectives/

Figure 11-21: Location of CT*fastrak*/Amtrak Route Alternative



This section describes the results of the studies conducted to date. Information obtained during the MCF process or from additional consultations with transportation officials, as well as the results of constructability or engineering studies will be provided in the Project Application to the Council.

11.6.1 Description of the Route Alternative

As illustrated in Figure 11-21, the approximately 3.5 mile CT*fastrak/*Amtrak Route Alternative would involve the use of a combination of Eversource-owned and private property, road ROWs, and the busway/Amtrak corridor. Eversource anticipates that the majority of the 115-kV transmission line along this alternative route would be configured overhead.

However, in the City of Hartford near Southwest Hartford Substation, a segment of the route alternative would be comprised of underground cable. In this area, there is no available space to install an overhead line due to constraints posed by the location of the busway/Amtrak corridor, New Park Avenue, adjacent land uses, and the I-84 overpass. In addition, as described below, along a segment of the alternative route in the Town of Newington, Eversource identified both an underground cable and an overhead configuration option.

As Figure 11-21 illustrates, from Newington Substation, the CT*fastrak/*Amtrak Route Alternative would extend east, following Eversource's existing distribution line ROW for approximately 0.5 mile. Along this segment of ROW, the new 115-kV line would be configured overhead, as described for the East ROW Variation (refer to Section 11.4.1). From a point located approximately 0.2 mile west of Willard Avenue (State Route 173) to the CT*fastrak*/Amtrak corridor, Eversource identified two route segment / configuration options:

- **All-Overhead Option**. Under this route segment option, the 115-kV line would be configured overhead for the approximately 0.35 mile between the distribution line ROW and the busway/Amtrak corridor. Because of lack of space to accommodate an overhead line design (without impacting existing buildings), the overhead line in this area would diverge south from the distribution line ROW, traversing private property to cross Willard Avenue south of Spring Street to reach the busway/Amtrak corridor. Therefore, new easements across private property would be required for this option.

- **Combination Overhead / Underground Cable Option**. This route segment option would involve the use of an overhead line design along Eversource's distribution line ROW for the remaining 0.2 mile to Willard Avenue (State Route 173). At the intersection of the distribution line ROW and Willard Avenue, the route option would transition to underground and would continue east, aligned within Spring Street for about 0.13 mile before intersecting with the CT*fastrak*/Amtrak corridor and transitioning to an overhead configuration. This option would minimize the need to acquire new ROW easements from private property owners.

Along the busway/Amtrak corridor, the route alternative would extend northeast for approximately 2.5 miles and would cross portions of northern Newington, southeastern West Hartford, and southwestern Hartford.

Just south of I-84, the line route would cross over the busway to the parking lot of a cinema multiplex. The overhead line would transition to an underground configuration, crossing northwest across the parking lot to New Park Avenue and then following the New Park Avenue ROW to extend beneath I-84 to Southwest Hartford Substation.

Overall, the route alternative would be aligned for approximately 1.1 miles in the Town of Newington, 1.7 miles in the Town of West Hartford, and 0.7 mile in the City of Hartford, for a total of approximately 3.5 miles.

11.6.2 Summary of CT*fastrak*/Amtrak Route Alternative Characteristics

The CT*fastrak*/Amtrak Route Alternative is characterized by the same general regional environmental features (e.g., geology, topography, air quality) as common to the other alternatives evaluated in the urban / suburban Project study area. However, compared to the other Project alternatives, the CT*fastrak*/Amtrak Route Alternative would be situated in or near more commercial / industrial areas.

The southwestern portion of the CT*fastrak/*Amtrak Route Alternative would follow the same Eversource distribution line corridor as described for the East ROW Variation (refer to Figure 11-11). Along this approximately 100-foot-wide existing ROW (occupied by electric distribution lines), the alternative would border the back yards of single-family residential uses (along Barnard Road and Raynal Road), as well as by an apartment complex off Surrey Court near State Route 173. To the north, the ROW is bordered by undeveloped land, as well as residential uses along Brimley Way (single-family homes) and Hampton Court (multi-family units).

Eversource manages the vegetation along most of the ROW in low-growing species, consistent with the safe operation of the distribution electric lines. However, taller-growing vegetation (including trees) is located within the ROW, outside of these managed areas. Three wetlands (designated as wetlands N-2, N-3, and N-4; refer to the Volume 3 maps) are located within the Eversource ROW. No vernal pools, watercourse, or floodplains are associated with these wetlands.

After crossing State Route 173, the alternative route would traverse near residential and commercial land uses, before joining the CT*fastrak*/Amtrak corridor. The CT*fastrak*, which occupies an area formerly used for a railroad track, is situated west of and adjacent to the two active Amtrak rail lines.

Overall, the busway/Amtrak corridor is bordered principally by commercial and industrial uses. Along this corridor, the 115-kV transmission line route would span New Britain Avenue, Trout Brook, Oakwood Avenue, and Flatbush Avenue. Between New Britain Avenue and I-84, the CT*fastrak*/Amtrak corridor is aligned east of and parallel to New Park Avenue, which is bordered primarily by commercial uses, with some residential areas located near I-84. An unnamed tributary to the South Branch of the Park River is culverted beneath the busway/Amtrak corridor.

The route alternative also would extend past two CT*fastrak* stations, both located in West Hartford: Elmwood Station (located north of New Britain Avenue) and Flatbush Station (located south of Flatbush Avenue).

Lands near the northern portion of the route alternative (near Southwest Hartford Substation) consist primarily of commercial and industrial uses.

There are no listed threatened or endangered species located along the route alternative. The wildlife inhabiting the existing distribution line ROW is expected to be species common to undeveloped sites in suburban areas, whereas the wildlife found near the more developed portions of the route alternative is expected to be those species typical of urbanized areas.

A portion of the route alternative traverses the Newington Junction North Historic District (refer to the cultural resources report included in Volume 2). The Newington Junction North Historic District is located in an area of residential, commercial and transportation land uses.

11.6.3 Alternative Route Transmission Line: Construction and Technical Specifications

11.6.3.1 Potential Line Configurations

As stated above, Eversource is in the process of performing a more detailed technical analysis of the potential use of the CT*fastrak/*Amtrak corridor for the location of the new 115-kV transmission line, in the event that Amtrak, ConnDOT, and NHHS representatives can agree to grant Eversource the necessary rights and approvals for the collocation, consistent with the Project schedule. In evaluating the potential feasibility of building the new line in a predominantly overhead configuration from Newington Substation to Southwest Hartford Substation, the following potential options, by alternative route segment, have been identified to date:

Alternative Route Segment: Newington Substation to CTfastrak/Amtrak ROW

Using either of the following options, the new 115-kV line would exit from Newington Substation in an underground configuration, changing to an overhead configuration at a transition structure that would be located just outside the substation fence.

- **All-Overhead**. From the transition structure just outside the substation fence, the line would continue east along the existing Eversource distribution line corridor for 0.5 mile, before diverging to the south, in an area west of Willard Avenue and then continuing east to connect to the busway/Amtrak corridor. The line diverges from the distribution line ROW because, due to development along Spring Street east of State Route 173, there is no space to accommodate a transmission line ROW. New easements across private properties would be required.

- **Combination Overhead / Underground**. Similar to the All-Overhead option, from transition structure adjacent to Newington Substation fence, using this route option, the new line would be configured overhead and would extend east along the existing Eversource distribution line ROW. The route option would follow the distribution line ROW for approximately 0.7 mile, to a transition structure near Willard Avenue. From this transition structure, the new 115-kV line would be configured as an underground cable system for approximately 0.2 mile before connecting to another transition structure just west of the CT*fastrak*/Amtrak corridor. At this structure, the line would convert to an overhead configuration and then would span the busway and continue north following the CT*fastrak*/Amtrak corridor.

Alternative Route Segment: CTfastrak/Amtrak ROW to Southwest Hartford Substation

Eversource is in the process of examining several overhead line design and location options along this 2.5 mile segment of this alternative route along the CT*fastrak*/Amtrak ROW between Newington to south of I-84. Along this segment, an estimated 35-45 transmission line structures would be required. The options under review are summarized as follows:

- **New Overhead 115-kV Line between Busway and Amtrak Railroad Tracks**. If this alternative is constructed, the overhead line would follow the CT*fastrak* corridor for about 2.5 miles with 35-45 structures installed between the CT*fastrak* busway and the Amtrak railroad tracks. In order to reduce structure heights and foundation diameters, spans lengths would typically be 300-400 feet, about a 50% reduction compared to standard span lengths on conventional Eversource corridors. Immediately south of I-84, the transmission line would turn west and span over the busway to a transition structure, located on the northeast corner of the *Bow Tie Cinema City at the Palace* movie theater parking lot. From this transition structure, the new line would be configured underground to Southwest Hartford Substation. To minimize transmission structure heights, the new 115-kV line would be supported on tangent structures in either a delta or vertical braced-post configurations. Figures

11-22 and 11-23 present typical cross-sections of each overhead configuration option.

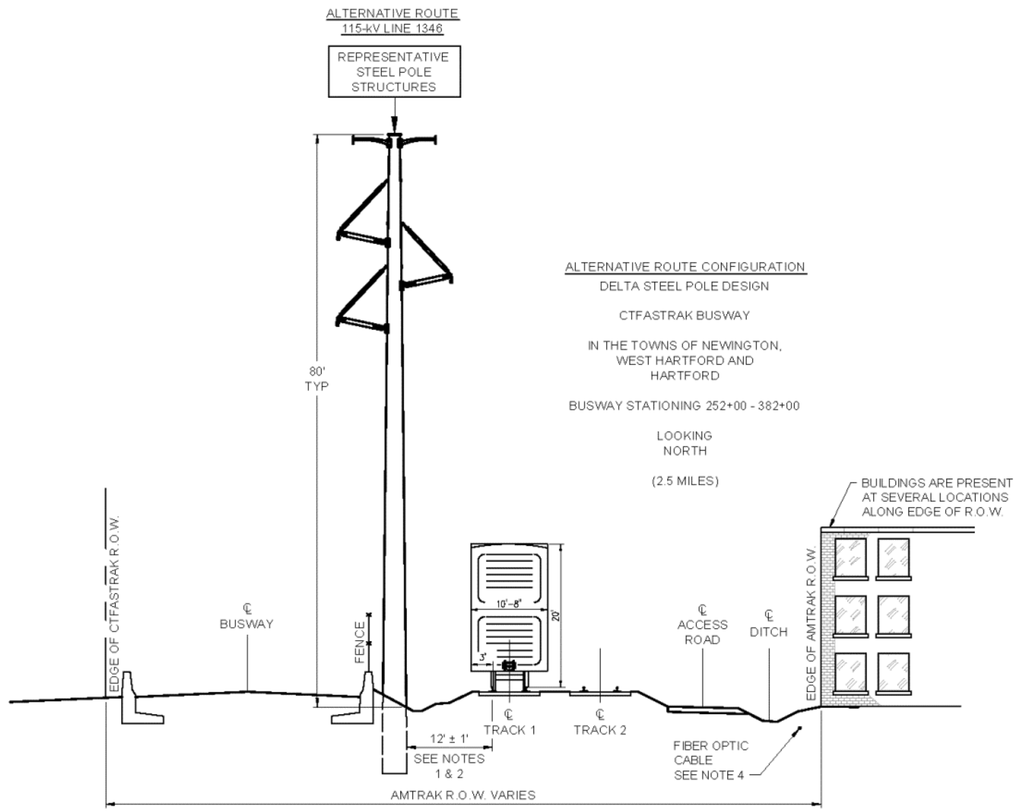
- **New Overhead 115-kV Line East of Amtrak Railroad Tracks.** This option would involve an alignment of the 115-kV line east of the eastern Amtrak railroad track (i.e., east of both the busway and the two railroad tracks). Accordingly, the 115-kV structures would be installed along the east edge of the Amtrak ROW. South of I-84, the transmission line would diverge west and span both the railroad tracks and the busway to a transition structure located on the northeast corner of the *Bow Tie Cinema City at the Palace* movie theater parking lot. From this transition structure, the new line would be configured underground to Southwest Hartford Substation. To avoid clearances violations to the edge of the Amtrak ROW when the conductors are displaced by wind, the new 115-kV line would be supported on tangent structures in a vertical configuration with arms facing toward the railway. Structure heights would likely be at least 5 to 10 feet taller than structures having a braced post configuration, spans lengths would be 300-400 feet typically. An alignment on the eastern side of the railway would minimize potential impacts to the CT*fastrak* and would allow for more conventional construction methods when sufficient workspace is available on adjacent property. A typical cross section is shown in Figure 11-24.

11.6.3.2 Construction Techniques: General

Overhead transmission line construction along the Eversource distribution line ROW would be performed as discussed in Section 11.4 for the East ROW Variation. Special constraints associated with overhead transmission line construction along the CT*fastrak*/Amtrak railroad corridor are discussed in Section 11.6.3.3.

The short underground segments of CT*fastrak*/Amtrak route alternative would be designed and constructed as described for the Proposed Route in Sections 3 and 4 of this Volume.

Figure 11-22: CT*fastrak*/Amtrak Railroad Corridor Alternative Route, Overhead Alignment between Busway and Railroad Tracks, Design Option A (Delta Steel Pole)

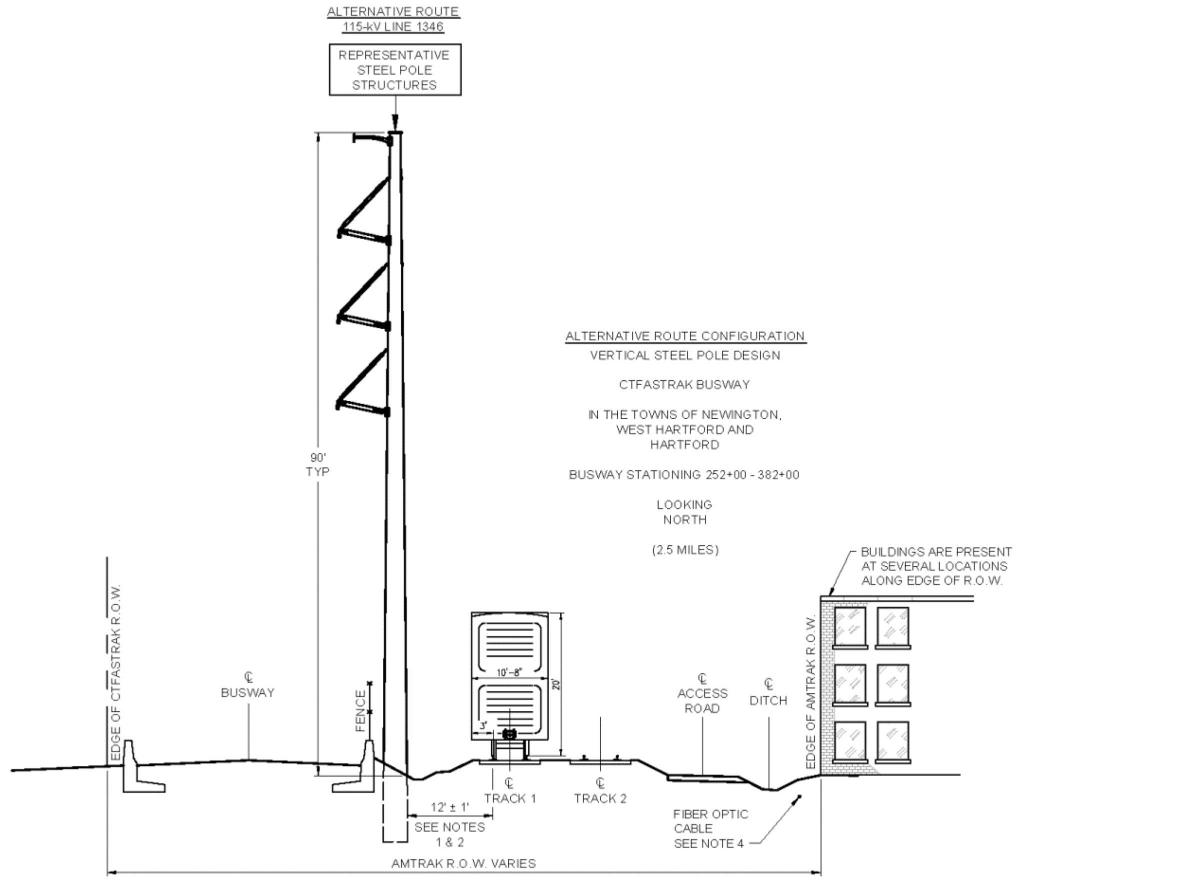


NOTES:

1. PER THE NESC 231.C.1 - WHERE RAILROAD TRACKS ARE PARALLEL OR CROSSED BY OVERHEAD LINES, ALL PORTIONS OF THE SUPPORTING STRUCTURE, SUPPORT ARMS, ANCHOR GUYS, AND EQUIPMENT ATTACHED THERETO LESS THAN 22 FEET ABOVE THE NEAREST TRACK RAILS SHALL HAVE HORIZONTAL CLEARANCES NOT LESS THAN 12 FEET FROM THE NEAREST TRACK RAIL. THIS CLEARANCE MAY BE REDUCED TO 7 FEET WITH AGREEMENT FROM AMTRAK.
2. PER THE NESC 231.C.2 - THE CLEARANCES OF RULE C1 MAY BE REDUCED BY AGREEMENT WITH THE RAILROAD(S).
3. DEPICTED STRUCTURES ARE STEEL TANGENT STRUCTURES. ANGLE AND DEADEND STRUCTURES WILL DIFFER.
4. FIBER OPTIC MARKERS IDENTIFIED DURING NOVEMBER 2015 ENGINEERING FIELD VISIT.

Figure 11-22

Figure 11-23: CT*fastrak*/Amtrak Railroad Corridor Alternative Route, Overhead Alignment between Busway and Railroad Tracks, Design Option B (Vertical Steel Pole)

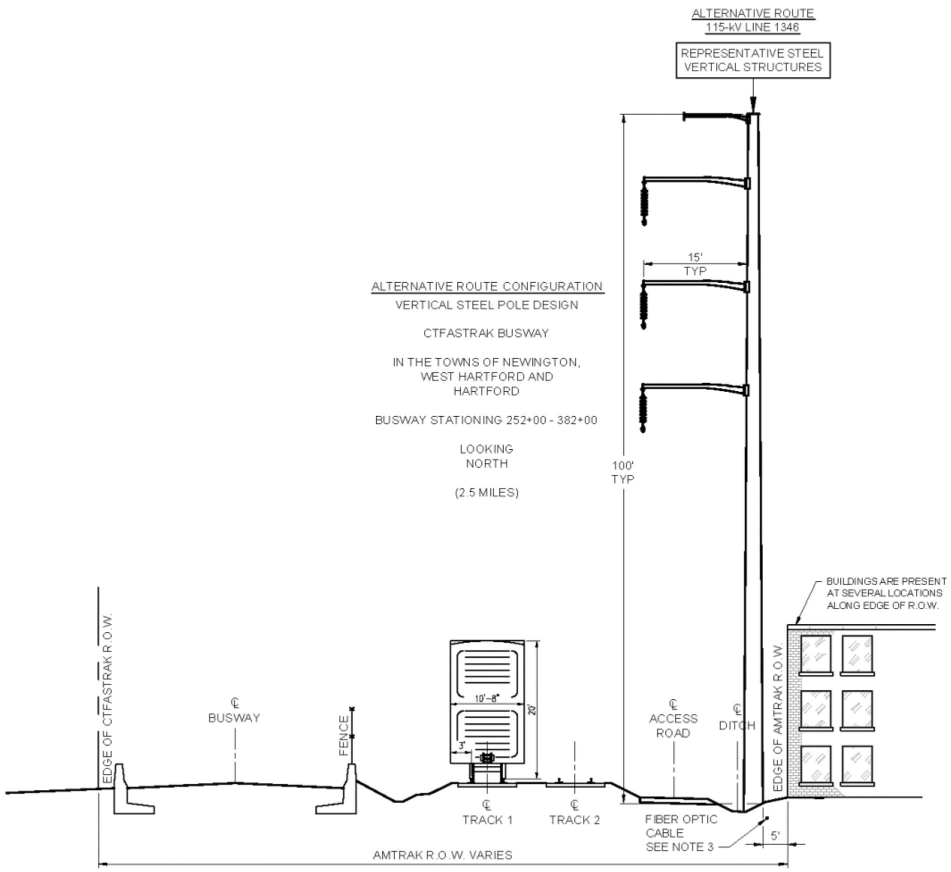


NOTES:

1. PER THE NESC 231.C.1 - WHERE RAILROAD TRACKS ARE PARALLEL OR CROSSED BY OVERHEAD LINES, ALL PORTIONS OF THE SUPPORTING STRUCTURE, SUPPORT ARMS, ANCHOR GUYS, AND EQUIPMENT ATTACHED THERETO LESS THAN 22 FEET ABOVE THE NEAREST TRACK RAILS SHALL HAVE HORIZONTAL CLEARANCES NOT LESS THAN 12 FEET FROM THE NEAREST TRACK RAIL. THIS CLEARANCE MAY BE REDUCED TO 7 FEET WITH AGREEMENT FROM AMTRAK.
2. PER THE NESC 231.C.2 - THE CLEARANCES OF RULE C1 MAY BE REDUCED BY AGREEMENT WITH THE RAILROAD(S).
3. DEPICTED STRUCTURES ARE STEEL TANGENT STRUCTURES. ANGLE AND DEADEND STRUCTURES WILL DIFFER.
4. FIBER OPTIC MARKERS IDENTIFIED DURING NOVEMBER 2015 ENGINEERING FIELD VISIT.

Figure 11-23

Figure 11-24: CT*fastrak*/Amtrak Railroad Corridor Alternative Route, Overhead Alignment East of Railroad Tracks, Vertical Steel Poles



NOTES:
1. V-STRING INSULATORS MAY BE USED INSTEAD OF I-STRING INSULATORS.
2. DEPICTED STRUCTURES ARE STEEL TANGENT STRUCTURES. ANGLE AND DEADEND STRUCTURES WILL DIFFER.
3. FIBER OPTIC MARKERS IDENTIFIED DURING NOVEMBER 2015 ENGINEERING FIELD VISIT.

Figure 11-24

11.6.3.3 Challenges along the CT*fastrak*/Amtrak ROW

Construction of the 115-kV transmission line in an overhead configuration along the busway/Amtrak corridor presents various challenges, principally due to the following:

- Because of limited space between the CT*fastrak* busway and railway, transmission line construction equipment would need to work from either the busway or railroad corridor.
- When working from the CT*fastrak* bus lane, the construction duration (including mobilization and setup) would be limited to approximately 2.5 hours per weekday to avoid conflicts with busway operations (assuming that interruptions to bus service would not be permitted by ConnDOT).
- The Amtrak schedule for rail service varies significantly. Thus, if working from the Amtrak rail corridor, at best, construction crews would have a 6-8 hour duration per day when Amtrak passenger trains are not operating. The schedule for freight trains is not consistent and no set hours of operation are known at this time.
- There is limited space for establishing construction work pads and other staging areas from which to the install the new transmission line structures.
- Presence of buildings directly abutting the busway/Amtrak corridor in several locations.
- Requirements for coordinating the work to avoid conflicts with the CT*fastrak* schedule, NHHS Rail Program improvements, and general Amtrak rail schedule. The transmission line construction schedule could conflict with anticipated improvements to the rail corridor.

In addition, non-standard construction methods may be required to install structures because of the restricted work hours and constraints associated with working in close proximity to the railway and limited space for work pads needed to install the transmission line. Further, foundations may be required because of restrictions regarding when the busway and Amtrak may be utilized for construction activities.

Based on an initial constructability review, due to the limited work space available along the corridor, it is likely that the construction work to install the new 115-kV transmission line structures would have to be staged from the railroad tracks, the busway, or both. To install structures along the east side of the ROW (the option depicted in Figure 11-24), existing Amtrak access roads would be used for construction access, where feasible. Otherwise, Eversource construction contractors would likely have to work on the railroad tracks or on private property adjacent to the Amtrak corridor, to install the new transmission line facilities.

The following summarizes some potential methods for constructing the new 115-kV in an overhead configuration along the busway/Amtrak corridor, given the existing space constraints. Any such methods would require approval from ConnDOT, Amtrak, and NHHS Rail Program.

1. Caissons could be installed with a vibratory hammer, working off of the busway, Amtrak rails, or off of the west side of the busway/Amtrak corridor at locations where access to the ROW is available for staging a crane and other equipment. This method would potentially reduce construction impacts to the adjacent CT*fastrak*/Amtrak corridor. However, in order to use a vibratory method, soils must be suitable (e.g., typically soils must be composed entirely of fine particles and free of rock or cobles). Vibratory equipment is relatively loud and this work would occur during the night to avoid conflicts with the CT*fastrak* and/or Amtrak service schedules.

2. If vibratory caissons cannot be installed due to soil or construction constraints, micropiles (a cluster of small-diameter foundation supports) could be utilized. The equipment to install micropiles is smaller and requires less workspace but would be more expensive.

3. Use the Amtrak rail to transport equipment and set structures and foundations.

Should direct embed or drill shaft foundations and structures have to be installed by staging equipment in the busway, it is likely that both lanes would need to be utilized and the CT*fastrak* corridor would be completely closed to bus traffic during construction periods.

11.6.4 Anticipated Construction Schedule

Construction work hours would have to be carefully coordinated with CT*fastrak*, Amtrak, and any NHHS Rail Program activities. It is likely that the transmission line construction activities along the busway/Amtrak corridor could only occur when these transportation services are not operating. Based on a review of the Amtrak and CT*fastrak* websites, these facilities operate continuously throughout most of the day, except as follows:

CTfastrak

- Weekdays at Night: 2.5 hours
- Saturday Night: 5.5 hours
- Sunday Night: 6.5 hours

Amtrak

- 6 to 8 hours / day. (Note that the hours that rail operations occur over the two tracks varies greatly due to the current frequency of cancelled passenger service and to the unavailability of the freight railroad schedules that use these railroad tracks. Approximately six trains use the tracks daily.)

NHHS

- The NHHS Rail Program has a planned in-service date of 2018. Once the NHHS Rail Program is operational, the frequency of train operations is expected to increase to about 17 round trips per day (exact schedules are not known at this time).

11.6.5 Environmental and Cultural Resources: Potential Impacts and Mitigation Measures

From Newington Substation east along the distribution line ROW, this route alternative contains the same wetland crossings as those in the East ROW Variation (as described in Section 11.4.1).

No additional watercourse or wetland crossings are anticipated along the portion of this route alternative east of State Route 173, along Spring Street, up to the existing the

CT*fastrak*/Amtrak corridor. One watercourse crossing would occur along the route alternative. Specifically, a crossing of Trout Brook would be necessary where Trout Brook becomes the South Branch of the Park River. The existing busway/Amtrak corridor over Trout Brook is presently comprised of a large arched bridge structure. The 115-kV transmission line along the alternative route would span Trout Brook.

The busway/Amtrak corridor also crosses over an unnamed tributary to the south Branch of the Park River. This tributary is carried through a series of culverts under New Park Avenue and again under the busway/Amtrak corridor. No impacts or associated mitigation are anticipated in association with watercourses.

Due to the lack of wetland resources along this route alternative, no wetland mitigation measures are anticipated (beyond the mitigation measures described for the proposed East ROW Variation crossings of Wetlands N-2, N-3, and N-4; refer to Section 11.4.1).

The portion of this route alternative located within the CT*fastrak*/Amtrak corridor is in a FEMA-designated 100-year flood zone where the corridor crosses over the Trout Brook bridge. While other FEMA resources are located proximate to this route alternative, these FEMA areas are located at lower elevations than the elevated busway/Amtrak corridor and therefore do not occur within this route alignment. A FEMA floodway / Zone AE resource is located at Trout Brook beneath the existing CT*fastrak*/Amtrak bridge. These FEMA areas are located beneath the existing bridge superstructure and are confined by concrete abutments. No impacts or associated mitigation are anticipated in association with FEMA areas.

As noted on the CT*fastrak*'s website (accessed November 30, 2015), "the CT*fastrak* vehicles are clean diesel - electric hybrids. The transit service replaces the need for thousands of daily automobile trips on Connecticut roads and highways. As a result, the CT*fastrak* system helps achieve better air quality and other positive environmental goals." The construction and occasional possibly maintenance activities of the 115-kV line may require temporary service disruptions along the corridor. Service disruptions would require that riders use alternative forms of transportation, which could temporarily suspend the air quality and other environmental benefits that these mass transit systems provide.

Eversource would work with ConnDOT and/or Amtrak, as appropriate, to minimize and mitigate potential service disruptions.

A portion of this route alternative traverses the Newington Junction North Historic District. The Newington Junction North Historic District is located in an area of residential, commercial and transportation land uses. To mitigate potential aesthetic impacts within the Newington Junction North Historic District, the route alternative could be located underground in this location. Appropriate coordination would occur with applicable federal agencies and with the Connecticut SHPO.

11.6.6 Summary

During the MCF process, Eversource will continue to investigate the potential feasibility of the CT*fastrak*/Amtrak Route Alternative. As part of these investigations, Eversource expects to complete constructability reviews and additional engineering analyses, including the feasibility of alternative (i.e., not standard Eversource) designs for the overhead line, as well as to obtain further information regarding the busway, Amtrak operations, and planned NHHS Rail Program from consultations with ConnDOT and Amtrak, including NHHS representatives. The results of public input received during the MCF process also will be taken into consideration. Eversource will report the results of these analyses in its Application to the Council.

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12. PROPOSED SUBSTATION MODIFICATIONS: ALTERNATIVES REVIEW

To meet the Project objectives, this new 115-kV transmission line must extend between and connect to the existing Southwest Hartford and Newington Substations. As a result, there are no alternative, geographically distinct substation sites that could be developed or modified to achieve the Project objectives. Similarly, for the reasons summarized below, the minor modifications to Southwest Hartford and Newington Substations, as proposed, would avoid or minimize environmental impacts and represent the most cost-effective and efficient approach for interconnecting the new 115-kV line to the power grid.

To meet the project objectives for modifications to Berlin Substation, alterations must be made to that specific substation. The project objectives improve reliability and stability for equipment and transmission lines that only share a common connection at Berlin Substation.

The Southwest Hartford, Newington and Berlin Substations were developed more than 50 years ago and each substation's fenced area is situated within a larger parcel of Eversource-owned property. Specifically, the 2.1-acre Southwest Hartford Substation is situated on a 7.1-acre Eversource property, whereas the existing 1.7-acre Newington Substation is located within an 11.4-acre Eversource parcel. Berlin Substation is 6.5 acres and is situated on a 94.9-acre Eversource property.

12.1 NEWINGTON SUBSTATION

The Project modifications to Newington Substation could not be accommodated entirely within the footprint of the existing substation, which includes both 115-kV and 23-kV facilities. As a result, Eversource proposes to expand the developed portion of the substation (extending the existing substation fence) by approximately 0.3 acre. The expansion would be on an upland portion of Eversource's property with minor (temporary) impacts to a wetland.

The location of Newington Substation expansion (i.e., on the south and west side of the existing station fence) is proposed based on where new Project equipment is needed to allow interconnections to the new 115-kV transmission line, which would extend into the substation underground from the south-west.

Within the existing Newington Substation, the 115-kV facilities are located on the south side of the yard and the 23-kV facilities are situated on the north side of the yard. The substation's two existing transformers are located between the 115-kV and 23-kV equipment. To accommodate the facilities required to interconnect the proposed 115-kV line the existing 115-kV portion of the yard must be modified and expanded. Because the existing 115-kV yard is located on the southern portion of the substation, the most cost-effective and least environmentally intrusive option is to expand the substation to the south and west, as is proposed.

Alternative locations for Newington Substation modifications (e.g., outside of the northern or eastern substation fence lines) would be cost prohibitive, requiring the relocation of the existing transformers and the 27.6-kV equipment. Further, expansion of the substation footprint to the east is not feasible due to the proximity of the existing 115-kV lines and equipment. Relocation of this equipment would also be required for expansion to the east. In contrast, the proposed substation expansion to the south west would not require large equipment relocation.

12.2 SOUTHWEST HARTFORD SUBSTATION

The Project modifications to Southwest Hartford Substation could not be accommodated entirely within the footprint of the existing substation, which includes both 115-kV and 23-kV facilities. As a result, Eversource proposes to expand the developed portion of the substation (extending the existing substation fence) by approximately 0.3 acre. The expansion would be on uplands, would not affect water resources, and would be entirely on Eversource property.

The location of Southwest Hartford Substation expansion (i.e., on the east side of the existing station fence) is proposed based on where the new Project equipment is needed to allow interconnections to the new 115-kV transmission line, which would extend into the substation underground from the east (i.e., from an alignment along New Park Avenue, the underground cable system would be routed into the substation generally along the station's existing access road).

Within the existing Southwest Hartford Substation, the 115-kV facilities are located on the east side of the yard and the 23-kV facilities are situated on the west side of the yard. The substation's two existing energized transformers are located between the 115-kV and 23-kV equipment. To accommodate the facilities required to interconnect the proposed 115-kV line the existing 115-kV portion of the yard must be modified and expanded. Because the existing 115-kV yard is located on the eastern portion of the substation, the most cost-effective and least environmentally intrusive option is to expand the substation onto undeveloped Eversource property located to the east of the existing station fence, as is proposed.

Alternative locations for Southwest Hartford Substation modifications (e.g., outside of the western substation fence lines) would be cost prohibitive, requiring the relocation of the existing transformers and the 27.6-kV equipment. Further, expansion of the substation footprint to the south is not feasible due to the proximity of I-84. In addition, expansion of the substation footprint to the north is constrained by the presence of a tributary to the South Park River and its associated FEMA-designated 100-year floodplain and wetlands. In contrast, the proposed substation expansion to the east would not require large equipment relocation and would not interfere with existing infrastructure and wetlands.

12.3 BERLIN SUBSTATION

The Project modifications to Berlin Substation would be located within the presently developed, fenced portion of the substation. These modifications will improve the reliability and stability of the system grid centered on Berlin Substation. Equipment and transmission lines share a common connection point only at Berlin Substation. Thus, any modifications outside of Berlin Substation would not satisfy project requirements. Within the existing substation fence, the proposed Project modifications will involve equipment and facility additions near the west fence line and the relocation of equipment primarily from the northern part of the substation to the southern portion of the substation.

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13. GLOSSARY AND TERMS

115-kV: 115 kilovolts or 115,000 volts

345-kV: 345 kilovolts or 345,000 volts

AC (alternating current): An electric current that reverses its direction of flow periodically. (In the United States this occurs 60 times a second-60 cycles or 60 Hertz.) This is the type of current supplied to homes and businesses.

ACSS: Aluminum Conductor with Steel Support, a common type of overhead conductor.

ACSR: Aluminum conductors with steel reinforcement

Ampere: (Amp): A unit measure for the flow (current) of electricity. A typical home service capability (i.e., size) is 100 amps; 200 amps is required for homes with electric heat.

ANSI: American National Standards Institute

ASTM: American Society for Testing and Materials

BMP: Best Management Practice

BMP Manual: Eversource's Best Management Practices Manual: Connecticut Construction & Maintenance Environmental Requirements (2011)

BRT: Bus Rapid Transit (see CT*fastrak*)

C&D: Conservation and Development (plan)

C&D Plan: Connecticut's *Conservation and Development Policies Plan*, 2013-2018

Cable: A fully insulated conductor usually installed underground but in some circumstances installed overhead.

CCGT: Combined cycle (natural) gas-fueled turbine

CCRP: Central Connecticut Reliability Project

CCVT: Capacitor coupling voltage transformer

CEII: Confidential Energy Infrastructure Information

CELT: ISO-NE, Forecast Report of Capacity, Energy, Loads and Transmission

Certificate: Certificate of Environmental Compatibility and Public Need (from the Connecticut Siting Council)

CFPA: Connecticut Forests and Park Association

CGS: Connecticut General Statutes

Circuit: A system of conductors (three conductors or three bundles of conductors) through which an electrical current is intended to flow and which may be supported above ground by transmission structures or placed underground.

Circuit Breaker: A switch that automatically disconnects power to the circuit in the event of a fault condition. Located in substations. Performs the same function as a circuit breaker in a home.

CLL: Critical Load Level

Conductor: A metallic wire, busbar, rod, tube or cable that serves as a path for electric current flow.

Conduit: Pipes, usually PVC plastic, typically encased in concrete, for housing underground power cables.

ConnDOT: Connecticut Department of Transportation

Contingency: The unexpected failure or outage of a system component, such as a generator, transmission line, circuit breaker, switch or other electrical element.

CONVEX: Connecticut Valley Electric Exchange

Council (or CSC): Connecticut Siting Council

CRCOG: Capitol Region Council of Governments

CT DEEP: Connecticut Department of Energy and Environmental Protection

CWA: Clean Water Act (federal)

D&M Plan: Development and Management Plan (required by the Connecticut Siting Council)

dBA: Decibel, on the A-weighted scale

DCT: Double-circuit transmission line

Demand: The total amount of electricity required at any given time by an electric supplier's customers.

Distribution: See line, system. The facilities that transport electrical energy from the transmission system to the customer.

Disconnect Switch: Equipment installed to isolate circuit breakers, transmission lines or other equipment for maintenance or sectionalizing purposes.

DR: Demand response

DSM: Demand side management

Duct: Pipe or tubular runway for underground power cables (see also Conduit)

Duct Bank: A group of ducts or conduit installed underground and usually encased in concrete.

EF, Electric Field: Invisible lines of force produced by voltage applied to conductors and equipment. The electric field is expressed in measurement units of volts per meter (V/m) or kilovolts per meter (kV/m); 1-kV/m is equal to 1,000 V/m.

Electric Transmission: The facilities (69-kV and higher) that transport electrical energy from generating plants to distribution substations.

EMF: Electric and magnetic field

EMF BMP Document: Electric and Magnetic Fields Best Management Practices for the Construction of Electric Transmission Lines in Connecticut prescribed by The Connecticut Siting Council.

EPA: United States Environmental Protection Agency

EPAct: Energy Policy Act of 2005

ERO: Electric Reliability Organization

Eversource: also referred to as “the Company”: The Connecticut Light and Power Company doing business as Eversource Energy, a legal entity authorized to provide electric transmission and distribution services in Connecticut.

Eversource Service: Eversource Energy Service Company (formerly, Northeast Utilities Service Company); a company that provides services to the public utility subsidiaries, such as Eversource, and to the other subsidiaries of Eversource Energy.

FCA: Forward Capacity Auction

FCM: Forward Capacity Market

FEMA: Federal Emergency Management Agency

FERC: Federal Energy Regulatory Commission

FTB: Fluidized thermal backfill

G: Gauss; 1G = 1,000 mG (milligauss); a unit of measure for magnetic fields.

GHCC: Greater Hartford – Central Connecticut

GHCCRP: Greater Hartford Central Connecticut Reliability Project

GIS: Geographic Information System

GPS: Global Positioning System

Ground Wire: Cable/wire used to connect wires and metallic structure parts to the earth. Sometimes used to describe the overhead lightning shield wire.

GSRP: Greater Springfield Reliability Project (part of NEEWS)

HAER: Historic American Engineering Record

HDD: Horizontal directional drill

H-frame Structure: A wood or steel structure constructed of two upright poles with a horizontal cross-arm and bracing.

HPFF: High-pressure fluid-filled; a type of underground pipe cable system.

IEC: International Electro-technical Commission

IEEE: Institute of Electrical and Electronics Engineers

Impedance: The combined resistance and reactance of the line or piece of electrical equipment that determines the current flow when an alternating voltage is applied.

Interstate (also IRP): Interstate Reliability Project (part of NEEWS)

iPac: Information, Planning, and Conservation System (USFWS)

ISO: Independent System Operator

ISO-NE: Independent System Operator – New England, Inc. New England's independent system operator.

kcmil: 1,000 circular mils, approximately 0.0008 sq. in.

kV: kilovolt, equals 1,000 volts

kV/m: Electric field unit of measurement (kilovolts/meter)

LEI: London Economics International, LLC

Lightning Shield Wire: A wire positioned such that it prevents lightning from striking transmission circuit conductors.

Line: A series of overhead transmission structures that support one or more circuits; or in the case of underground construction, a duct bank housing one or more cable circuits.

Load: Amount of power delivered as required at any point or points in the system. Load is created by the power demands of customers' equipment (residential, commercial, industrial).

Load Pocket: A load area that has insufficient transmission import capacity and must rely on out-of-merit order local generation.

MF, Magnetic Field: Invisible lines of force produced by the flow of electric currents; however, unlike electric fields, most materials do not readily block magnetic fields. The level of a magnetic field is commonly expressed as magnetic flux density in units called gauss (G), or in milligauss (mG), where 1 G = 1,000 mG.

Manhole: See Splice Vault

MCF: Municipal Consultation Filing, part of the Connecticut Siting Council application process

MDC: Metropolitan District Commission

MF: Magnetic field

mG: milligauss (see Magnetic Field)

MRA: Market Resource Alternatives

MVA: Megavolt Ampere - Measure of electrical capacity equal to the product of the voltage times the current times the square root of 3. Electrical equipment capacities are sometimes stated in MVA.

MVAR: Megavolt Ampere Reactive - Measure of reactive power.

MW: Megawatt - One megawatt equals 1 million watts, measure of the work electricity can do.

NAAQS: National Ambient Air Quality Standards

NDDB: Connecticut Natural Diversity Data Base (CT DEEP)

NEEWS: New England East – West Solution (Eversource transmission projects)

NERC: North American Electric Reliability Council, Inc. (initially, the National Electric Reliability Council)

NESC: National Electrical Safety Code

NPCC: Northeast Power Coordinating Council

NRCS: Natural Resources Conservation Service (United States Department of Agriculture)

NRHP: National Register of Historic Places

NTA: Non-transmission alternative

NWCT: Northwest Connecticut (electric sub-area); includes more than 20 towns

NWI: National Wetlands Inventory

NYISO: New York Independent System Operator

OOS: Out-of-service (as in a generating unit or station)

OPGW: Optical groundwire (a shield wire containing optical glass fibers for communication purposes)

PAC: Planning Advisory Committee (ISO-NE)

PDAL: Peak average daily loads

PEM: Palustrine emergent (wetlands)

PFO: Palustrine forested (wetlands)

Phases: Transmission (and some distribution) AC circuits are comprised of three phases that have a voltage differential between them.

POCD: Plan of Conservation and Development (regional)

Pothead: See Terminator

POW: Palustrine open water (wetlands)

Protection/Control Equipment: Devices used to detect faults, transients and other disturbances in the electrical system in the shortest possible time. They are customized or controlled per an entity's operational requirements.

PSI: Pounds per square inch

PSS: Palustrine scrub-shrub (wetlands)

PT: Potential transformer

PTF: Pool Transmission Facilities

PUB: Palustrine unconsolidated bottom (wetlands)

PUESA: Public Utilities Environmental Standards Act

PURA: Public Utilities Regulatory Authority (part of CT DEEP)

PVC: Polyvinyl chloride (material used in making conduits for XLPE-insulated cable)

RCSA: Rules of Connecticut State Agencies

Rebuild: Replacement of an existing overhead transmission line with new support structures and conductors generally along the same route as the replaced line.

Reconductor: Replacement of existing conductors with new conductors, but with little if any replacement or modification of existing support structures.

Reinforcement: Any of a number of approaches to improve the capacity of the transmission system, including rebuild, reconductor, conversion and bundling methods.

RIRP: Rhode Island Reliability Project (part of NEEWS)

ROW: Right-of-Way. When referencing Eversource ROWs, as used in this document, this term describes a defined strip of land over which Eversource has rights to construct, operate, and maintain electric transmission or distribution lines, together with various ancillary rights. Typically, these rights have been conveyed to Eversource by the owner of the underlying land. In some cases, Eversource may own the land itself in fee.

RUB: Riverine unconsolidated bottom (wetland)

SCADA: Supervisory Control and Data Acquisition

Series Reactor: A device used for introducing impedance into an electrical circuit, the principal element of which is inductive reactance.

Shield Wire: See Lightning Shield Wire

SHPO: State Historic Preservation Office

SLTE: Summer long-term emergency capacity

Splice: A device to connect together the ends of bare conductor or insulated cable.

Splice Vault: A buried concrete enclosure where underground cable ends are spliced and cable-sheath bonding and grounding is installed.

SRHP: State Register of Historic Places

S/S (Substation): A fenced-in yard containing switches, transformers, line-terminal structures, and other equipment enclosures and structures. Adjustments of voltage, monitoring of circuits and other service functions take place in this installation.

SSTE: Summer short-term emergency capacity

Steel Monopole Structure: Transmission structure consisting of a single tubular steel column with horizontal arms to support insulators and conductors.

Stormwater Pollution Control Plan: A sediment and erosion control plan that also describes all the construction site operator's activities to prevent stormwater contamination, control sedimentation and erosion, and comply with the requirements of the federal Clean Water Act.

Terminal Point: The substation or switching station at which a transmission line terminates.

Terminal Structure: Structure typically within a substation that ends a section of transmission line.

TO: Transmission owner

Transformer: A device used to transform voltage levels to facilitate the efficient transfer of power from the generating plant to the customer. A step-up transformer increases the voltage while a step-down transformer decreases it.

Transmission Line: Any line operating at 69,000 or more volts.

USACE: United States Army Corps of Engineers (New England District)

USDA: Unites States Department of Agriculture

USFWS: United States Fish and Wildlife Service

USGS: United States Geological Survey (U.S. Department of the Interior)

VAR: Volt-ampere reactive power. The unit of measure for reactive power.

Vault: See Splice Vault

Voltage: A measure of the push or force that transmits energy.

Watercourse: Rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs, and all other bodies of water, natural or artificial, public or private.

WCT: Western Connecticut

Wetland: An area of land consisting of soil that is saturated with moisture, such as a swamp, marsh, or bog.

WMA: Wildlife Management Area (CT DEEP)

XS: Cross section (drawing)

XLPE: Cross-linked polyethylene (solid dielectric) insulation for underground transmission cables