CONNECTICUT SITING COUNCIL APPLICATION

FOR THE

GREATER HARTFORD – CENTRAL CONNECTICUT RELIABILITY PROJECT

NEWINGTON, WEST HARTFORD, AND HARTFORD, CONNECTICUT

SUBMITTED BY

THE CONNECTICUT LIGHT AND POWER COMPANY

DBA EVERSOURCE ENERGY

VOLUME 1:
DESCRIPTION OF THE PROPOSED PROJECT AND ALTERNATIVES ANALYSIS

June 2017

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FORMAL REQUIREMENTS AND APPLICATION GUIDE

A. PURPOSE

The Connecticut Light and Power Company doing business as Eversource Energy (Eversource) is submitting this Application to the Connecticut Siting Council (Council) for the issuance of a Certificate of Environmental Compatibility and Public Need for the construction and operation of the Greater Hartford – Central Connecticut Reliability Project (Project), consisting of an approximately 3.7-mile 115-kilovolt (kV) electric transmission line between Newington Substation in the Town of Newington and Southwest Hartford Substation in the City of Hartford, related modifications to Newington Substation and Southwest Hartford Substation, and modification of a short section of an existing overhead 115-kV transmission line in Newington that connects to Newington Substation. The Project would bring the electric supply system in the Greater Hartford area into compliance with applicable national and regional electric reliability standards and criteria and significantly improve the reliability of the transmission system in central Connecticut.

The public can obtain information about the Project in any of the following ways:

- The Project Website at www.eversource.com
- By calling 1-800-793-2202
- By emailing TransmissionInfo@eversource.com

B. STATUTORY AUTHORITY

Eversource is applying to the Connecticut Siting Council pursuant to Connecticut General Statutes (CGS) Section 16-50g et seq.

C. LEGAL NAME AND ADDRESS OF APPLICANT

The Connecticut Light and Power Company doing business as Eversource Energy, with corporate offices at 56 Prospect Street in Hartford, Connecticut.

Mailing Address:
Eversource Energy
56 Prospect Street
Hartford, CT 06141-0270

D. APPLICANT'S CONTACTS

Correspondence and other communications with regard to the Application are to be addressed to, and notices, orders and other papers may be served upon the following:

Kenneth Roberts
Project Manager
Eversource Energy
56 Prospect Street
Hartford, CT 06103
Telephone: (860) 728- 4826
E-mail address: kenneth.roberts@eversource.com

Kathleen M. Shanley
Manager, Transmission Siting
Eversource Energy
56 Prospect Street
Hartford, CT 06103
Telephone: (860) 728-4527
E-mail address: kathleen.shanley@eversource.com

Jeffery D. Cochran
Senior Counsel, Legal Department
Eversource Energy
107 Selden Street
Berlin, CT 06037
Telephone: (860) 665-3548
E-mail address: jeffery.cochran@eversource.com

Anthony M. Fitzgerald
Carmody Torrance Sandak & Hennessey LLP
195 Church Street
P.O. Box 1950
New Haven, CT 06509
Telephone: (203) 777-5501
E-mail address: afitzgerald@carmodylaw.com

E. QUANTITY, FORM, AND FILING REQUIREMENTS

1. **Quantity:** Per the Council's request, Eversource is providing one (1) original and fifteen (15) copies of this Application, as well as an electronic copy.
2. **Administrative Notice:** Eversource requests administrative notice of the following documents.

   FEDERAL

   - Federal Energy Regulatory Commission, Guidelines for the Protection of Natural, Historic, Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities (November 27, 1970)

- National Park Service, U.S. Department of the Interior, *National Register of Historic Places* (September 2014), *available at* http://www.nps.gov/history/nr/research/index.htm

REGIONAL

- ISO New England, Inc., Transmission Operating Agreement Among ISO New England, Inc., and Participating Transmission Owners, February 1, 2005, *available at* http://www.iso-ne.com/regulatory/toa/v1_er07-1289-000_toa_composite.pdf
- ISO New England, Inc., Overview of the Bulk Power System and ISO New England, ISO 101, October 1, 2014, *available at* http://isonewengland.org/static-assets/documents/2014/08/iso101-t1-isocore.pdf
- ISO New England, Inc., Electricity Costs White Paper, June 1, 2006, *available at* http://www.iso-ne.com/pubs/whtpprs/elec_costs_wht_ppr.pdf
- ISO New England, Inc., 2014 Regional System Plan, November 6, 2014, *available at* http://www.iso-ne.com/system-planning/system-plans-studies/rsp
- ISO New England, Inc., 2015 Regional System Plan, November 5, 2015 *available at* http://www.iso-ne.com/system-planning/system-plans-studies/rsp
- ISO New England, Inc., Forecast Report of Capacity, Energy, Loads & Transmission (CELT), May 1, 2013, *available at* http://www.iso-ne.com/static-assets/documents/trans/celt/report/2013/2013_celt_report.pdf
- ISO New England, Inc., Forecast Report of Capacity, Energy, Loads & Transmission (CELT), May 16, 2014, *available at* http://www.iso-ne.com/static-assets/documents/trans/celt/report/2014/2014_celt_report_rev.pdf
- ISO New England, Inc., Forecast Report of Capacity, Energy, Loads & Transmission (CELT), May 1, 2015, *available at* http://www.iso-ne.com/static-assets/documents/2015/05/2015_celt_report.pdf
- ISO New England, Inc., Forecast Report of Capacity, Energy, Loads & Transmission (CELT), May 1, 2016, *available at* http://www.iso-ne.com/system-planning/system-plans-studies/celt
- ISO New England Inc. Transmission, Markets and Services Tariff (Formerly known as FERC Electric Tariff No. 3), October 1, 2011, *available at* http://www.iso-ne.com/regulatory/tariff/sect_1/sect_i.pdf
- Northeast Power Coordinating Council, Inc. Regional Reliability Reference Directory #1, Design and Operation of the Bulk Power System, December 1, 2009 (replaced Document A-2), *available at* https://www.npcc.org/Standards/Directories/Directory_1_TFCP_rev_20151001_GJD.pdf
- Northeast Power Coordinating Council, Inc. Regional Reliability Reference Directory #4, Bulk Power System Protection Criteria, December 1, 2009 (replaced Document A-5), *available at* https://www.npcc.org/Standards/Directories/Directory%204_TFSP_Rev_20151001_GJD.pdf

STATE

Connecticut Siting Council

- Connecticut Siting Council, Electric and Magnetic Field Best Management Practices for the Construction of Electric Transmission Lines in Connecticut, Revised on February 20, 2014, *available at* http://www.ct.gov/csc/lib/csc/emf_bmp/emf_bmp_12-14-07_20080603083907.pdf
- Connecticut Siting Council, Docket No. F-2012/2013, Review of the Ten-Year Forecast of Connecticut Electric Loads and Resources, December 12, 2013, *available at* http://www.ct.gov/csc/lib/csc/pendingproceeds/forecast_2012_2013/f2012_13_finalreport20131212.pdf
- Connecticut Siting Council, Docket No. F-2014/2015, Review of the Ten-Year Forecast of Connecticut Electric Loads and Resources, December 10, 2015, *available at* http://www.ct.gov/csc/lib/csc/pendingproceeds/forecast_2014_2015/f-2015_finalreport.pdf
- Connecticut Siting Council, White Paper on the Security of Siting Energy Facilities, October 8, 2009, *available at* http://www.ct.gov/csc/lib/csc/docket_346/whiteppr_final.pdf
- Connecticut Siting Council, Investigation into the Life Cycle Costs of Electric Transmission Lines, November 15, 2012, *available at* http://www.ct.gov/csc/lib/csc/life_cycle_rfp/43714q1.pdf
- **DOCKET NO. 217 -** Northeast Utilities Service Company application for a Certificate of Environmental Compatibility and Public Need for the construction of a 345-kV electric transmission line and reconstruction of an existing 115-kV electric transmission line between Connecticut Light and Power Company's Plumtree Substation in Bethel, through the Towns of Redding, Weston, and Wilton, and to Norwalk Substation in Norwalk, Connecticut.
- **DOCKET NO. 272 -** The Connecticut Light and Power Company and The United Illuminating Company application for a Certificate of Environmental Compatibility and Public Need for the construction of a new 345-kV electric transmission line and associated facilities between the Scovill Rock Switching Station in Middletown and the Norwalk Substation in Norwalk, Connecticut. This includes construction of the Beseck Switching Station in Wallingford, East Devon Substation in Milford, and Singer Substation in Bridgeport and modifications to the Scovill Rock Switching Station and the Norwalk Substation and certain interconnections.
- **DOCKET NO. 292 -** The Connecticut Light & Power Company application for a Certificate of Environmental Compatibility and Public Need for the construction and operation of 8.7 miles of new underground 115-kilovolt electric transmission cables extending from CL&P's existing Glenbrook Substation in the City of Stamford, through the Town of Darien, to CL&P's existing Norwalk Substation in the City of Norwalk.
- **DOCKET NO. 435 -** The Connecticut Light & Power Company application for a Certificate of Environmental Compatibility and Public Need for the Stamford

RELIABILITY CABLE PROJECT, WHICH CONSISTS OF CONSTRUCTION, MAINTENANCE, AND OPERATION OF A NEW 115-KV UNDERGROUND TRANSMISSION CIRCUIT EXTENDING APPROXIMATELY 1.5 MILES BETWEEN GLENBROOK AND SOUTH END SUBSTATIONS, STAMFORD, CONNECTICUT, AND RELATED SUBSTATION IMPROVEMENTS.

- **DOCKET NO. 466 -** THE CONNECTICUT LIGHT & POWER COMPANY D/B/A EVERSOURCE ENERGY APPLICATION FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR THE FROST BRIDGE TO CAMPVILLE 115-KILOVOLT (KV) ELECTRIC TRANSMISSION LINE PROJECT THAT TRAVERSES THE MUNICIPALITIES OF WATERTOWN, THOMASTON, LITCHFIELD, AND HARWINTON, WHICH CONSISTS OF (A) CONSTRUCTION, MAINTENANCE AND OPERATION OF A NEW 115-KV OVERHEAD ELECTRIC TRANSMISSION LINE ENTIRELY WITHIN EXISTING EVERSOURCE RIGHT-OF-WAY AND ASSOCIATED FACILITIES EXTENDING APPROXIMATELY 10.4 MILES BETWEEN EVERSOURCE'S EXISTING FROST BRIDGE SUBSTATION IN THE TOWN OF WATERTOWN AND EXISTING CAMPVILLE SUBSTATION IN THE TOWN OF HARWINTON; (B) RELATED MODIFICATIONS TO FROST BRIDGE SUBSTATION AND CAMPVILLE SUBSTATION; AND (C) RECONFIGURATION OF A 0.4 MILE SEGMENT OF TWO EXISTING 115-KV ELECTRIC TRANSMISSION LINES ACROSS THE NAUGATUCK RIVER IN THE TOWNS OF LITCHFIELD AND HARWINTON WITHIN THE SAME EXISTING RIGHT-OF-WAY AS THE NEW 115-KV ELECTRIC TRANSMISSION LINE.
- **DOCKET NO. 468 -** THE CONNECTICUT LIGHT & POWER COMPANY D/B/A EVERSOURCE ENERGY APPLICATION FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR THE SOUTHWEST CONNECTICUT RELIABILITY PROJECT THAT TRAVERSES THE MUNICIPALITIES OF BETHEL, DANBURY, AND BROOKFIELD, WHICH CONSISTS OF (A) CONSTRUCTION, MAINTENANCE, AND OPERATION OF A NEW 115-KV OVERHEAD ELECTRIC TRANSMISSION LINE ENTIRELY WITHIN EXISTING EVERSOURCE RIGHT-OF-WAY AND ASSOCIATED FACILITIES EXTENDING APPROXIMATELY 3.4 MILES BETWEEN EVERSOURCE'S EXISTING PLUMTREE SUBSTATION IN THE TOWN OF BETHEL TO ITS EXISTING BROOKFIELD JUNCTION IN THE TOWN OF BROOKFIELD; (B) RECONFIGURATION OF TWO EXISTING 115-KV DOUBLE-CIRCUIT ELECTRIC TRANSMISSION LINES AT EVERSOURCE'S EXISTING STONY HILL SUBSTATION IN THE TOWN OF BROOKFIELD; AND (C) RELATED SUBSTATION MODIFICATIONS.
- **PETITION NO. 1140 -** EVERSOURCE ENERGY PETITION FOR A DECLARATORY RULING THAT NO CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED IS REQUIRED FOR THE PROPOSED RECONDUCTORING OF A PORTION OF AN EXISTING 115-KV TRANSMISSION LINE EXTENDING FROM BARBOUR HILL SUBSTATION IN SOUTH WINDSOR TO MANCHESTER SUBSTATION IN MANCHESTER, CONNECTICUT AND MODIFICATIONS TO BARBOUR HILL SUBSTATION AND MANCHESTER SUBSTATION.
- **PETITION NO. 1154 -** EVERSOURCE ENERGY PETITION FOR A DECLARATORY RULING THAT NO CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED IS REQUIRED FOR THE PROPOSED MODIFICATIONS TO THE EXISTING HADDAM SUBSTATION AND ASSOCIATED 345-KV AND 115-KV TRANSMISSION LINES LOCATED AT 1384 SAYBROOK ROAD, HADDAM, CONNECTICUT.
- **PETITION NO. 1162 -** EVERSOURCE ENERGY PETITION FOR A DECLARATORY RULING THAT NO CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED IS REQUIRED FOR THE PROPOSED MODIFICATIONS TO ITS EXISTING HOPEWELL SUBSTATION LOCATED AT 1007 CHESTNUT HILL ROAD, GLASTONBURY, CONNECTICUT.
- **PETITION NO. 1201 -** EVERSOURCE ENERGY PETITION FOR A DECLARATORY RULING THAT NO CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED IS REQUIRED FOR THE PROPOSED RECONDUCTORING OF APPROXIMATELY 1.75 MILES OF ITS

existing No. 1810 115-kV transmission line from Forestville Junction in Southington to Lake Avenue Junction in Bristol, rebuilding and reconductoring of approximately 1.85 miles of its existing Nos. 1800 and 1810 115-kV transmission lines from Southington Substation in Southington to Structure No. 1815 in Southington, reinforcement of an existing transmission structure at Southington Substation in Southington, and related substation and transmission line structure improvements.

- **PETITION NO. 1217 -** Eversource Energy petition for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need is required for the proposed separation of the existing 1779/1777 kilovolt (kV) electric transmission lines for 1.6 miles within existing right of way from Bloomfield Substation to Bloomfield Junction; proposed separation of the existing 1751/1777 115-kV electric transmission lines for 5.3 miles within existing right of way from Bloomfield junction to North Bloomfield Substation; modifications to the existing overhead 1779 115-kV electric transmission line loop into the Rood Avenue Substation via underground cables; including related transmission line structure improvements; and modifications to the Bloomfield Substation, 40 Crestview Drive and North Bloomfield Substation, 2 Hoskins Road both in Bloomfield, Connecticut and modifications to the Rood Avenue Substation located at 275 Rood Avenue, Windsor, Connecticut.
- **PETITION NO. 1283 -** The Connecticut Light and Power Company d/b/a Eversource Energy petition for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need is required for the proposed modifications to the existing Southington Substation located at 315 Belleview Avenue, Southington, Connecticut.
- Letter from Robert Carberry, Project Manager, NEEWS Siting and Permitting, Connecticut Light & Power Company to Melanie Bachman, Acting Executive Director, Connecticut Siting Council regarding underground reconstruction of distribution line segments at transmission line road crossings, dated May 17, 2013

Department of Energy and Environmental Protection

- Connecticut Council on Soil and Water Conservation, State of Connecticut Department of Environmental Protection, Connecticut Guidelines for Soil Erosion and Sediment Control, DEP Bulletin 34, May 2002, last revised September 2007, *available at* http://www.ct.gov/dep/cwp/view.asp?a=2720&q=325660&depNav_GID=1654
- State of Connecticut Department of Energy and Environmental Protection, The Connecticut Stormwater Quality Manual, 2004, *available at* http://www.ct.gov/DEP/cwp/view.asp?a=2721&q=325704&depNav_GID=1654#download
- Connecticut Department of Energy and Environmental Protection, Amphibians and Reptiles in Connecticut, Michael W. Klemens, 2000, *available at* http://ctdepstore.com/Amphibians-and-Reptiles-in-Connecticut-101.htm
- Planning and Standards Division, Bureau of Water Management, Connecticut Department of Energy and Environmental Protection, Water Quality Standards, (Surface Water Quality Standards Effective February 25, 2011

AND GROUND WATER QUALITY STANDARDS EFFECTIVE APRIL 12, 1996), *available at* http://www.ct.gov/deep/lib/deep/water/water_quality_standards/wqs_final_adopted_2_25_11.pdf

- CONNECTICUT AIR QUALITY STANDARDS, CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION, REGULATIONS OF CONNECTICUT STATE AGENCIES (RCSA) §§ 22a-174-24, et seq.
- CONNECTICUT NOISE CONTROL REGULATIONS, CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION, RSCA §§ 22a-69-1, et seq.
- 2013 COMPREHENSIVE ENERGY STRATEGY FOR CONNECTICUT, CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION, FEBRUARY 19, 2013, *available at* http://www.ct.gov/deep/lib/deep/energy/cep/2013_ces_final.pdf
- 2014 INTEGRATED RESOURCES PLAN FOR CONNECTICUT, CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION, MARCH 17, 2015, *available at* http://www.ct.gov/deep/lib/deep/energy/irp/2014_irp_final.pdf

Department of Public Health

- CONNECTICUT DEPARTMENT OF PUBLIC HEALTH, ELECTRIC AND MAGNETIC FIELDS (EMF): HEALTH CONCERNS FACT SHEET, April 2008, *available at* http://www.ct.gov/dph/lib/dph/environmental_health/eoha/pdf/emf_fact_sheet_-_2008.pdf

Department of Transportation

- STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION, CONNDOT DRAINAGE MANUAL, 2000, LAST REVISED DECEMBER 2003, *available at* http://www.ct.gov/dot/cwp/view.asp?a=3200&q=260116

  STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION, Utility Accommodation Manual, February 2009, *available at* http://www.ct.gov/dot/lib/dot/documents/dutilities/ACCOMODATION.pdf

Other State Agencies

- STATE OF CONNECTICUT OFFICE OF POLICY AND MANAGEMENT, CONSERVATION AND DEVELOPMENT POLICIES PLAN FOR CONNECTICUT 2013-2018, JULY 30, 2013, *available at* http://www.ct.gov/opm/cwp/view.asp?q=383182
- STATE OF CONNECTICUT ENERGY EFFICIENCY BOARD, 2014 PROGRAMS AND OPERATIONS REPORT, MARCH 1, 2015, *available at* http://www.energizect.com/sites/default/files/uploads/Final%20ALR%202014%20Pages.2.26.15.pdf
- CONNECTICUT CLEAN ENERGY FUND, FY 2013– FY 2015 COMPREHENSIVE PLAN, *available at* http://www.ctcleanenergy.com/Portals/0/FY13%20Comprehensive%20Plan.pdf
- CONNECTICUT GREEN BANK, FY 2015– FY 2016 COMPREHENSIVE PLAN, *available at* http://www.ctgreenbank.com/wp-content/uploads/2015/11/CGB_FY15_and_FY16_Comprehensive_Plan.pdf
- AN ACT ESTABLISHING CONNECTICUT HERITAGE AREAS, AS AMENDED, 2009 CONN. ACTS 221 (REG. SESS.), CODIFIED AT CGS § 16A-27, 2010, *available at* http://www.cga.ct.gov/2009/ACT/PA/2009PA-00221-R00HB-06584-PA.htm

- STATE PLAN OF CONSERVATION AND DEVELOPMENT, AS AMENDED, CGS §§ 16a-27 to 16a-32a (2015).

TECHNICAL

- INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, IEEE STANDARD PROCEDURES FOR MEASUREMENT OF POWER FREQUENCY ELECTRIC AND MAGNETIC FIELDS FROM AC POWER LINES, IEEE Std 644-1994, APRIL 30, 2013, *available at* https://standards.ieee.org/findstds/standard/644-1994.html
- INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, IEEE GUIDE FOR THE DESIGN, CONSTRUCTION, AND OPERATION OF SAFE AND RELIABLE SUBSTATIONS FOR ENVIRONMENTAL ACCEPTANCE, IEEE Std 1127-1998, REAFFIRMED 2009, DECEMBER 5, 2009, UPDATED AUGUST 1, 2011, *available at* https://standards.ieee.org/findstds/standard/1127-1998.html
- AMERICAN NATIONAL STANDARDS INSTITUTE, NATIONAL ELECTRICAL SAFETY CODE, ANSI C2-2012, AUGUST 1, 2011.

ENVIRONMENTAL

- RICHARD M. DEGRAAF & DEBORAH D. RUDIS, NEW ENGLAND WILDLIFE: HABITAT, NATURAL HISTORY, AND DISTRIBUTION, UNIVERSITY OF MASSACHUSETTS PRESS, 1983, *available at* http://www.treesearch.fs.fed.us/pubs/4148
- ARAM J.K. CALHOUN & MICHAEL W. KLEMENS, BEST DEVELOPMENT PRACTICES: CONSERVING POOL-BREEDING AMPHIBIANS IN RESIDENTIAL AND COMMERCIAL DEVELOPMENTS IN THE NORTHEASTERN UNITED STATES, MCA TECHNICAL PAPER SERIES: NO. 5, METROPOLITAN CONSERVATION ALLIANCE 2002, *available at* http://www.nae.usace.army.mil/Portals/74/docs/regulatory/VernalPools/BestDevelopmentPractices20Oct2014.pdf
- ARAM J.K. CALHOUN, ET. AL., CONSERVING POOL-BREEDING AMPHIBIANS IN HUMAN-DOMINATED LANDSCAPES THROUGH LOCAL IMPLEMENTATION OF BEST DEVELOPMENT PRACTICES, WETLANDS ECOLOGY AND MANAGEMENT, 2005, *available at* http://www.environmental-expert.com/Files%5C0%5Carticles%5C9373%5CConservingpool-breeding.pdf

MAPS

- NATURAL RESOURCES DIVISION, CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION, ATLAS OF CONNECTICUT TOPOGRAPHIC MAPS, DEP BULLETIN 17, 1992, *available at* http://www.ctdepstore.com/Maps_c16.htm;jsessionid=1FF9EB902F8695DF048A7BD535715052.qscstrfrnt02
- CONNECTICUT FOREST & PARK ASSOCIATION, CONNECTICUT WALK BOOK WEST, ANN T. COLSON, ed., 19th ed. 2006, *available at* http://www.ctwoodlands.org/connecticut-walk-book-west
- NATIONAL AUDUBON SOCIETY, CONNECTICUT IMPORTANT BIRD AREAS, 2015, *available at* http://ct.audubon.org/important-bird-areas-11
- UNITED STATES GEOLOGICAL SURVEY, CONNECTICUT TOPOGRAPHIC MAP COLLECTION, *available at* http://magic.lib.uconn.edu/topographic_maps.html

MISCELLANEOUS

- United States Code of Federal Regulations Title 33, Clean Water Act, Sections 401 and 404.
- CGS § 16-243 and §§ 16-11-134, and 135 of the RSCA
- The Connecticut Light and Power Company, 2012 Forecast of Loads and Resources for the Period 2012-2021, March 1, 2012, *available at* http://www.ct.gov/csc/lib/csc/pendingproceeds/forecast_2012_2013/annual_reports/f2012-20120301-cl&p.pdf
- The Connecticut Light and Power Company, 2013 Forecast of Loads and Resources for the Period 2013-2022, March 1, 2013, *available at* http://www.ct.gov/csc/lib/csc/pendingproceeds/forecast_2012_2013/annual_reports_2013/cl&p_20130301.pdf
- The Connecticut Light and Power Company, 2014 Forecast of Loads and Resources for the Period 2012-2021, February 28, 2014, *available at* http://www.ct.gov/csc/lib/csc/pendingproceeds/forecast_2014_2015/2014documents/f2014-20140228-cl&p.pdf
- The Connecticut Light and Power Company, doing business as Eversource Energy, 2015 Forecast of Loads and Resources for the Period 2015-2024, March 2, 2015, *available at* http://www.ct.gov/csc/lib/csc/pendingproceeds/forecast_2014_2015/2015_documents/1_marchfilings/f-2014-2015-20150302_eversourcerpt.pdf
- The Connecticut Light and Power Company, doing business as Eversource Energy, 2016 Forecast of Loads and Resources for the Period 2016-2025, March 1, 2016, *available at* http://www.ct.gov/csc/lib/csc/pendingproceeds/forecast_2016_2017/2016/transmission/f2016eversource.pdf
- The New England Energy Alliance, Electricity Transmission Infrastructure Development in New England Value through Reliability, Economic and Environmental Benefits, Polestar Communications & Strategic Analysis, December 2007, *available at* http://www.newenglandenergyalliance.org/
- World Health Organization, Electromagnetic Fields and Public Health, Exposure to Extremely Low Frequency Fields – Fact Sheet #322, June 2007, *available at* http://www.who.int/peh-emf/publications/facts/fs322/en/

3. **Application Guide:** This Application is presented based on the Council's February 2016 *Application Guide for an Electric and Fuel Transmission Line Facility* (Application Guide) to assist applicants in filing for a Certificate from the Council for the construction of an electric or fuel transmission line as defined in CGS § 16-50i(a)(1) and (2). Eversource also consulted CGS §§ 16-50g through 16-50aa and §§ 16-50j-1 through 16-50z-4 of the Regulations of Connecticut State Agencies (RSCA) in preparing this Application. At the end of this section, Eversource has provided a reference table which serves as a directory between the Council's Application Guide and this Application. This table provides a summary of the Application Guide and identifies the corresponding section of the Application where the information is addressed.

4. **Pre-Application Process (CGS § 16-50*l*(e)):** Eversource consulted with representatives of each of the affected municipalities and municipalities having a border within 2,500 feet of the proposed facility prior to distribution of the Municipal Consultation Filing (MCF). In December 2015, an MCF for the Project was distributed to the Chief Elected Officials of each of these municipalities, thereby commencing the municipal consultation period for this Application. During this time, Eversource sought input from the public and local government representatives regarding the Project, as presented in the MCF.

F. APPLICATION FILING FEES

(CGS § 16-50v(a); Application Guide § IV; CGS § 16-50*l*(a))

The filing fee for this Application is determined by the following schedule:

Estimated Construction Cost	Fee
Up to $5,000,000	0.05% or $1,250.00, whichever is greater
Above $5,000,000	0.1% or $25,250.00, whichever is less

Based on this schedule and the estimated construction cost for the Project of $61.1 million a check for the filing fee in the amount of $25,250.00 accompanies this Application. Eversource understands that additional assessments may be made for expenses in excess of the filing fee, and that fees in excess of the Council's actual costs would be refunded to Eversource. Pursuant to CGS §§ 16-50*l*(a)(3) and 16-50bb, Eversource also encloses a check in the amount of $25,000.00 for the municipal participation fees.

G. PROOF OF SERVICE

(CGS §16-50*l*(b))

This Application was served on the following:

- The chief elected official, the zoning commission, planning commission, the planning and zoning commissions, and the conservation and wetlands commissions of the site municipality and any adjoining municipality having a boundary not more than 2,500 feet from the facility;
- The regional planning agency that encompasses the route municipalities;
- The State Attorney General;
- Each member of the Legislature in whose district the facility is proposed;
- Any federal agency which has jurisdiction over the proposed facility;

- The State Departments of Energy and Environmental Protection, Public Health, Economic and Community Development, Agriculture and Transportation; the Council on Environmental Quality; and the Office of Policy and Management.
- Other state and municipal bodies as the Council may by regulation designate, including but not limited to, the State Historic Preservation Officer of the Commission on Culture and Tourism and the Department of Emergency Management and Homeland Security.

Attachments to the cover letter accompanying the filing of this Application to the Council include the transmittal memos sent to these officials and agencies as well as a copy of the service list and an affidavit attesting that appropriate service was made.

H. NOTICE TO COMMUNITY ORGANIZATIONS

(Application Guide, § VIII)

The applicant made reasonable efforts to provide notice of this Application on the following:

- Affected community groups, including Chambers of Commerce, land trusts, environmental groups, trail organizations, historic preservation groups, advocacy groups for the protection of Long Island Sound, and river protection organizations within the watershed affected by the proposed facility that have been identified by a municipality where the facility is proposed to be located, or those that have registered with the Council to be provided notice; and
- Any affected water company within the watershed affected by the proposed facility.

Attachments to the cover letter accompanying the filing of this Application to the Council include a listing of the community groups and water companies to whom notice of this Application is being provided as well as the transmittal memo sent to these organizations and an affidavit that such notice was given.

I. PUBLIC NOTICE

(CGS § 16-50*l*(b))

Notice of this Application was published at least twice prior to the filing of the Application in newspapers having general circulation in the site municipalities. The notice included the name of the applicant, the date of filing, and a summary of the Application. The notice was published in not less than ten-point type. Affidavits of publication are attached to the cover letter accompanying the filing of this Application to the Council.

J. NOTICE IN UTILITY BILLS

(CGS § 16-50*l*(b))

Notice of the proposed Project was provided to each Eversource customer located within the municipalities of the 3.7-mile proposed transmission line route on a separate enclosure with each customer's monthly bill for one or more months not earlier than 60 days prior to the filing of this Application with the Council. This included all Eversource customers in the municipalities of Newington, West Hartford, and Hartford.

An affidavit attesting to delivery of the bill insert and a copy of the actual insert itself are attached to the cover letter accompanying the filing of this Application to the Council.

K. NOTICE TO OWNERS OF PROPERTY ABUTTING SUBSTATION SITES

(CGS § 16-50*l*(b))

Notice of the proposed modifications to Newington Substation in Newington, Connecticut and Southwest Substation in Hartford, Connecticut was provided to abutters of these substations via certified mail, return receipt requested. An affidavit regarding this notice is attached to the cover letter accompanying the filing of this Application to the Council.

L. APPLICATION DIRECTORY FOR COMPLIANCE WITH THE COUNCIL'S APPLICATION GUIDE FOR ELECTRIC AND FUEL TRANSMISSION LINE FACILITIES

The following table provides references to indicate where information requested in the Council's Application Guide is located in this Application.

Council's Application Guide (Section No. and Summary Description)	Eversource Application (Section Reference)
General Applicants shall consult CGS §§ 16-50g through 16-50aa and § 16-50j-1 through 16-50z-4 of the Regulations of Connecticut State Agencies (RSCA) to ensure complete compliance with the requirements of those sections.	Application meets the intent of these state requirements.
I. Pre-Application Process(CGS § 16-50*l*(e)) Requirements for municipal consultation.	Volume 1, Executive Summary, Sections 1 and 9
II. Form of Application (RCSA § 16-50*l*-2) Review of information to be included in the application.	Volume 1, Application Formal Requirements and entire Application. (Application conforms to these document component requirements.)
III. Filing Requirements (CGS § 16-50j-12) Review of requirements for submission of copies of application, bulk filings, application format, format for exhibits and sworn testimony. All application fees shall be paid to the Council at the time an application is filed with the Council. Municipal participation fee.	Volume 1, Application Formal Requirements; overall application conforms to these requirements
IV. Application Filing Fees Proof of Service (CGS § 16-50*l*(a) and RCSA § 16-50v-1a) Filing fees shall be paid to the Council at the time the application is filed.	Procedural requirement, completed at Application submission to the Council
V. Municipal Participation Account (CGS § 16-50bb; § 16-50*l*(a)(3)) Each application shall be accompanied by a payment of $25,000 to be deposited in the Municipal Participation Account.	Procedural requirement, completed at Application submission to the Council
VI. Contents of Application (CGS § 16-50*l*(a)(1)(A) and § 16-50p and § 16-50(o)) An application for a Certificate for the construction of a transmission line facility should include or be accompanied by the following:	Volumes 1 - 3
A. An executive summary	Volume 1, Executive Summary
B. A description of the technical specifications for the project, including design and cost information.	Volume 1, Section 3
C. A statement describing the need for the project.	Volume 1, Section 2; Volume 2
D. A justification for overhead portions, including life cycle cost studies comparing overhead alternatives with underground alternatives.	Volume 1, Section 3, 10, and 11
E. A program of dates showing the proposed program of ROW or property acquisition, construction, completion and operation.	Volume 1, Section 8
F. Information for property within the proposed project area, including access roads and the proposed ROW and information regarding visual inspections from public ROWs of any project areas not accessible.	Volume 3
G. A proposed route map, at a scale no smaller than 1" =2,000 feet or a USGS topographic map and aerial photographs showing details of the ROWs and proximity to defined land use and environmental features.	Volume 3
H. A narrative description of the proposed transmission line and transmission line alternatives, including the following:	Volume 1, Sections 3, 5, 10, 11, and 12; Volume 2; and Volume 3
1. <u>Existing Conditions</u> a) The ecological communities of the wetlands, watercourses and upland systems, and their functional	Volume 1, Sections 5 and 11; Volume 2; Volume 3

Council's Application Guide (Section No. and Summary Description)	Eversource Application (Section Reference)
significance including, but not limited to:	
i. Floral associations;	Volume 1, Sections 5 and 11; Volume 2; Volume 3
ii. Inventory of wildlife habitat with observed and expected wildlife users;	Volume 1, Section 5; Volume 3
iii. Species of Special Concern and rare or endangered species, including their habitats;	Volume 1, Section 5
iv. Inventory of breeding birds and their habitats;	Volume 1, Section 5
v. Riparian environments and buffer vegetation; and	Volume 1, Sections 5 and 11; Volume 2; Volume 3
vi. Fishery habitat and cold water fisheries.	Volume 1, Sections 5 and 11
b) Existing infrastructure (where applicable):	Volume 1, Sections 1, 3, 4, 5, and 11; Volume 3
i. Existing ROW boundaries;	Volume 1, Section 3; Volume 3
ii. Components of existing transmission line; and	N/A
iii. Other improvements within existing and proposed rights-of-way.	Volume 1, Section 3; Volume 3
2. <u>Proposed Conditions</u>	Volume 1, Sections 1, 2, 3, 4, 6, and 7; Volumes 2 and 3
a. Areas of disturbance (temporary and permanent)	Volume 1, Sections 3, 4 and 6; Volume 3
b. Proposed construction staging areas, conductor pulling sites, material marshaling yards, and construction field offices	Volume 1, Sections 3 and 4; Volume 3
c. Proposed access roads and opportunities for alternative access	Volume 1, Sections 3 and 4; Volume 3
d. Proposed structure location envelopes	Volume 1, Sections 3 and 4; Volume 3
e. Proposed blasting, grading, and changes to drainage	Volume 1, Sections 4 and 6
I. Proposed route plans, at a scale no smaller than 1" = 100', showing the existing conditions and certain proposed transmission line changes, expanding on the narrative descriptions in Section H.	Volume 3
1. <u>Existing Conditions</u>	Volume 3
a. Identification of existing and proposed ROW boundaries;	Volume 3
b. Location of any existing transmission line structures and accessways;	Volume 3
c. Contour mapping at 2' intervals;	Volume 3
d. Inland and tidal wetlands boundaries, vernal pools, and intermittent and perennial watercourses, as determined in the field, unless existing mapping is adequate, with a 50 foot buffer shown for wetlands and a 100 foot buffer shown for vernal pools and watercourses;	Volume 3 (no tidal areas involved in Project)
e. Coastal Management Zone boundaries;	N/A

Council's Application Guide (Section No. and Summary Description)	Eversource Application (Section Reference)
f. 100-year flood plain boundaries as identified by the Federal Emergency Management Agency;	Volume 3
g. Locations of protected and special concern species;	Volume 1, Section 5 for narrative description. General NDDB locations are shown; none along Proposed Route.
h. Areas susceptible to soil erosion;	Volume 3 (topographic contours and Plan and Profile drawings)
i. Habitat for protected and special concern species, including those represented by the CT DEEP Natural Diversity Data Base (confidential data provided in an appropriate manner); and	Refer to (g), above.
j. Fishery habitat and cold water fisheries.	Fishery habitat described in Volume 1 (Section 5); streams illustrated on the Volume 3 maps.
2. Changes to existing conditions for the proposed transmission line: a. Additional ROW width required, if any;	Volume 1, Section 3; Volume 3 maps and cross-sections (New transmission line with underground and overhead segments principally within existing utility, road, and railroad ROWs.)
b. Anticipated transmission line structure location envelopes;	N/A; work pads described in Volume 1, Section 4; Structure locations depicted on Volume 3 maps
c. Anticipated areas of disturbance (temporary and permanent);	Volume 3
d. Anticipated area of disturbance to an inland wetland buffer boundary or to an inland wetland;	Volume 3
e. Anticipated area of disturbance for material staging and conductor pulling sites;	Volume 1, Section 4
f. Anticipated access roads and opportunities for alternative access;	Volume 3
g. Substation connections; and	Volume 1, Section 3; Volume 3
h. Other sensitive areas requiring special attention.	Volume 1, Sections 5 and 6; Volume 2; and Volume 3
J. Justification for the adoption of the route selected, including a comparison of alternative routes which are environmentally, technically, and economically practical. Justification for overhead portions of transmission lines, including comparative cost studies and a comparative analysis of effects described in CGS § 16-50pl (a)(1)(A) and Section K (below) for undergrounding. Include enough information for a complete comparison between the proposed route and any alternative route contemplated	Volume 1, Sections 1, 2, 3, 10, 11, and 12
K. A description of the effect that the proposed facility would have on the environment, ecology, and scenic, historic, and recreational values, including effects on:	Volume 1, Sections 4, 6, and 7
1. Public health and safety	Volume 1, Section 7; Volume 2
2. Local, state, and federal land use plans including energy security;	Volume 1, Section 6
3. Existing and future development;	Volume 1, Section 6
4. Road and waterway crossings;	Volume 1, Sections 4 and 6

Council's Application Guide (Section No. and Summary Description)	Eversource Application (Section Reference)
5. Wetland crossings;	Volume 1, Section 6; Volume 2
6. Wildlife and vegetation, including rare and endangered species, and species of special concern, with documentation by the CT DEEP Natural Diversity Data Base;	Volume 1, Section 6; Volume 3
7. Water supply areas;	Volume 1, Section 6
8. Archaeological and historic resources, with documentation by the SHPO; and	Volume 1, Section 6; Volume 2
9. Other environmental concerns identified by the applicant, the Council, or any public agency:	Volume 1, Section 6
Coastal Consistency Analysis	N/A
Connecticut Heritage Areas	N/A
Ridgeline Protection Zones	N/A
Aquifer Protection Zones	N/A
ConnDOT Scenic Lands	N/A
State Parks and Forests	N/A
Agricultural Lands	N/A
Wild and Scenic Rivers	N/A
Protected Rivers	N/A
Endangered, Threatened, and Special Concern Species	Volume 1, Section 6
L. A statement explaining mitigation measures for the proposed transmission line including:	Volume 1, Sections 4 and 6
1. Description of proposed site clearing for access including type of vegetation scheduled for removal and quantity of trees greater than 6” diameter at breast height and involvement with wetlands	Volume 1, Section 6
2. Construction techniques designed specifically to minimize adverse effects on natural areas and sensitive areas;	Volume 1, Sections 4 and 6; Volume 3
3. Special routing or design features made specifically to avoid or minimize adverse effects on natural areas and sensitive areas;	Volume 1, Sections 3, 4, 6 and 11; Volume 3
4. Justification for maintaining retired or unused facilities on the ROWs if removal is not planned;	N/A
5. Methods to prevent and discourage unauthorized use of the ROWs;	Volume 1, Section 4
6. Establishment of vegetation proposed near residential, recreational, and scenic areas; and at road crossings, waterways, ridgelines, and areas where the line would be exposed to view;	None proposed
7. Methods for preservation of vegetation for wildlife habitat and screening;	Volume 1, Sections 4 and 6
M. Safety and reliability information, including: 1. Provisions for emergency operations and shutdowns; and	Volume 1, Section 4

Council's Application Guide (Section No. and Summary Description)	Eversource Application (Section Reference)
2. Fire suppression technology.	
N. Justification that the location of the proposed facility would not pose an undue safety or health hazard to persons or property along the area traversed by the proposed facility, including:	Volume 1, Sections 4 and 7; Volume 2
1 Measurements of existing EMF at the boundaries of adjacent schools, daycare facilities, playgrounds, and hospitals (and any other facilities described in CGS § 16-50*l*, with extrapolated calculations of exposure levels during expected normal and peak normal line loading;	Volume 1, Section 7
2 Calculations of expected EMF levels at the above listed locations that would occur during normal and peak normal operation of the transmission line;	Volume 1, Section 7
3 A statement describing consistency with the Council's "Best Management Practices for Electric and Magnetic Fields", as amended; and	Volume 1, Section 7
4 A description of siting security measures for the proposed facility, consistent with the Council's "White Paper on the Security of Siting Energy Facilities", as amended.	Volume 1, Section 4
O. A schedule of proposed program for ROW or property acquisitions, construction, rehabilitation, testing and operation.	Volume 1, Section 8
P. Identification of each federal, state, regional, district and municipal agency with which Proposed Route reviews have been undertaken or will be undertaken, a copy of each written agency position on such route, and a schedule for obtaining approvals not yet received.	Volume 1, Section 9; Volume 3
Q. Bulk filing of the most recent conservation, inland wetland, zoning, and plan of development documents of the municipality, including a description of the zoning classification of the site and surrounding areas, and a narrative summary of the consistency of the project with the Town's regulations and plans.	Narrative summary and maps in Volume 1, Sections 5 and 6; Volume 3 Bulk filing submitted separately
R. Such information any department or agency of the state exercising environmental controls may, by regulation, require.	Volume 1, Sections 5 and 6; Volume 2; Volume 3
S. Pursuant to CGS § 16-50o, the applicant shall submit into the record the full text of the terms of any agreement, and a statement of any consideration therefore, if not contained in such agreement, entered into by the applicant and any party to the certification proceeding, or any third party, in connection with the construction or operation of the facility. This provision shall not require the public disclosure of proprietary information of trade secrets.	N/A
T. Such information the applicant may consider relevant.	Application
VII. Proof of Service (CGS § 16-50*l*(b)) Each application shall be accompanied by proof of service of such application on: A. The chief elected official, the zoning commission, planning commission, the planning and zoning commissions, and the conservation and wetlands commissions of the site municipality and any adjoining municipality having a boundary not more than 2,500 feet from the facility; B. The regional planning agency that encompasses the route municipalities; C. The State Attorney General; D. Each member of the Legislature in whose district the facility is	Procedural requirement, completed at Application submission to the Council; refer to Formal Requirements section in Volume 1

Council's Application Guide (Section No. and Summary Description)	Eversource Application (Section Reference)
proposed; E. Any federal agency with jurisdiction over the proposed facility; and F. The state departments of Energy and Environmental Protection, Public Health, Public Utilities Regulatory Authority, Economic and Community Development, Agriculture and Transportation; the Council on Environmental Quality; and the Office of Policy and Management; and G. Other state and municipal bodies as the Council may designate by regulation, including but not limited to the SHPO and the Department of Emergency Management and Homeland Security.	
VIII. Notice to Community Organizations The applicant shall use reasonable efforts to provide notice of the application on the following: A. Affected community groups including Chambers of Commerce, land trusts, environmental groups, trail organizations, historic preservation groups, advocacy groups for the protection of Long Island Sound, and river protection organizations within the watershed affected by the proposed facility that have been identified by the municipality where the facility is proposed to be located or that have registered with the Council to be provided notice; and B. Any affected water company within the watershed affected by the proposed facility.	Volume 1, Section 9 provides summary information; data filings related to the MCF are submitted separately as part of Application filing process; refer to other portions of Formal Requirements section in Volume 1
IX. Public Notice (CGS § 16-50*l*(b)) Provide appropriate notice of the Application, pursuant to the Council's regulations. Notice must be published at least twice prior to the filing of the application, in a newspaper having general circulation in the site municipalities, and shall be in a format as specified by the Council's requirements.	Completed as part of Application submission process; refer to Formal Requirements section in Volume 1
X. Notice in Utility Bills (CGS § 16-50*l*(b)) For electric transmission facilities, notice shall also be provided to each electric company customer in the municipality where the facility is proposed on a separate enclosure with each customer's monthly bill.	Completed as part of Application submission process; refer to Formal Requirements section in Volume 1.

The Application also includes the information required pursuant to RCSA § 16-50j-59 (2012).

ES. EXECUTIVE SUMMARY

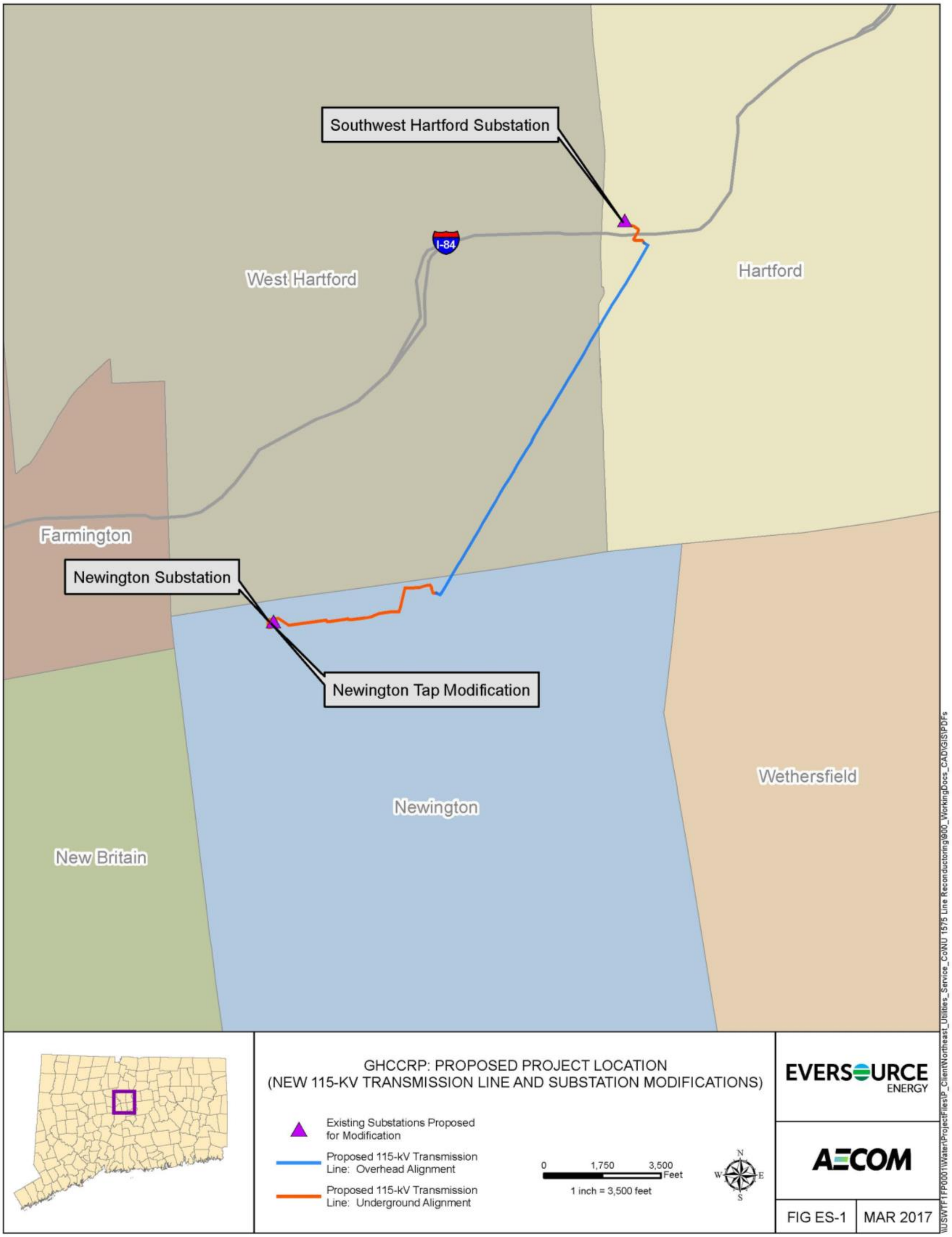
ES.1 PROPOSED PROJECT PURPOSE AND LOCATION

The Connecticut Light and Power Company doing business as Eversource Energy (Eversource or the Company) proposes to construct a new approximately 3.7-mile 115-kilovolt (kV) transmission line from its existing Newington Substation in the Town of Newington, through the eastern portion of the Town of West Hartford, to its Southwest Hartford Substation in the City of Hartford. Eversource also proposes to expand and perform associated upgrades to the Newington and Southwest Hartford substations, and to modify a 0.01-mile section of an existing overhead 115-kV transmission line (the 1783 Line) connection to Newington Substation (referred to as the Newington Tap). These proposed electric transmission system improvements, all of which would be located in Hartford County, are referred to as the Greater Hartford – Central Connecticut Reliability Project (GHCCRP or Project; refer to Figure ES-1).

The new 115-kV transmission line between Newington and Southwest Hartford substations would consist of two underground cable segments in Newington and Hartford (totaling approximately 1.3 miles) and an approximately 2.4-mile overhead segment, which would be located along an Amtrak railroad right-of-way (ROW) in Newington, West Hartford, and Hartford (collectively, the Proposed Route). The underground segments of the proposed transmission line would be aligned within an Eversource distribution line ROW and along local and state road ROWs. The overhead portion of the transmission line route would be situated within the eastern side of the Amtrak ROW, which includes two railroad tracks and the Connecticut Department of Transportation's (ConnDOT's) CT*fastrak* busway. Eversource is in the process of finalizing negotiations with Amtrak for a license agreement for the colocation of the new transmission line within the railroad ROW.

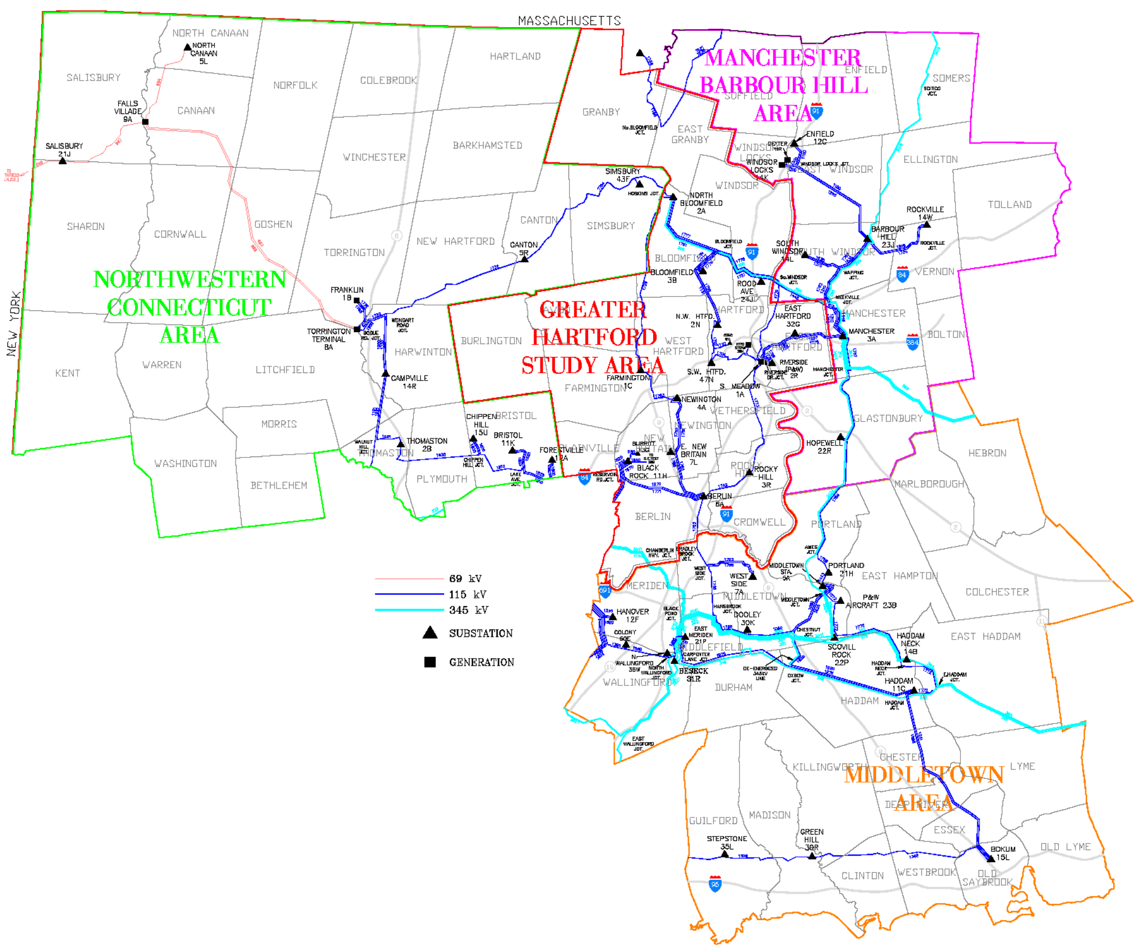
The proposed modifications to both Newington and Southwest Hartford substations would be on Eversource properties. Similarly, the modifications to the Newington Tap (Eversource's 1783 Line) would be located on Eversource's existing transmission line ROW and Newington Substation property.

Figure ES-1: GHCCRP: Proposed Project Location



The Project is 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 improve the ability of the transmission system to move power across Connecticut when the system is under stress. 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 New England, including Connecticut.

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



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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 Application 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.

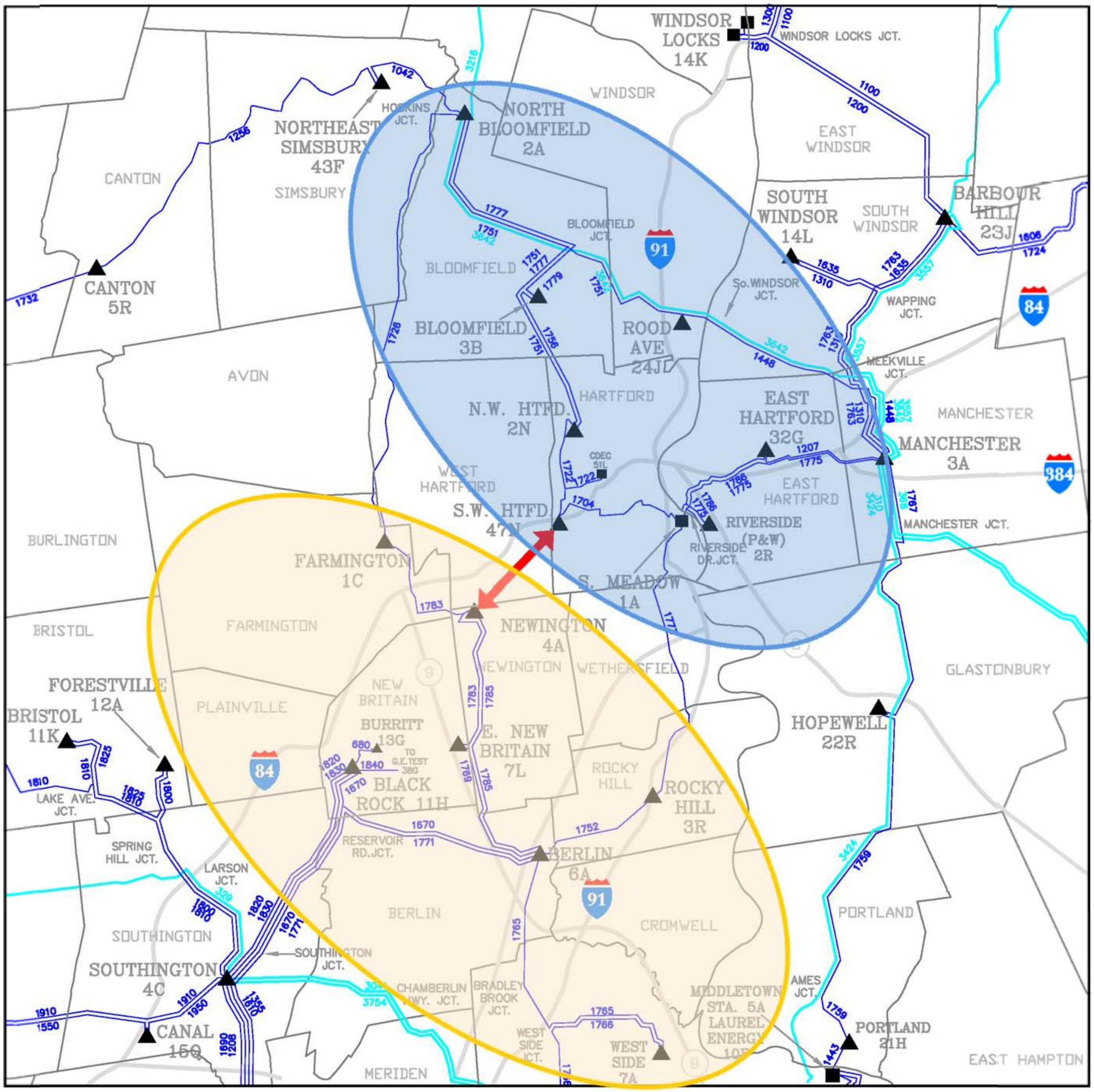
The ISO-NE analyses determined that the Project would significantly improve the reliability of the transmission system in the Greater Hartford – Central Connecticut area by providing a new 115-kV transmission connection between Newington and Southwest Hartford substations. Although in close proximity, these substations are located in two different electrical “load pockets” – areas with insufficient generation and/or transmission to serve customer load when the electric system is placed under stress. The new transmission line would link the two load pockets so that the transmission systems in each would 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.

ES.2 THE CONNECTICUT SITING COUNCIL APPLICATION: ORGANIZATION AND CONTENT

The Project is subject to the regulations of the Connecticut Siting Council (Council or CSC) and other federal and state regulatory agencies. Accordingly, Eversource submits for the Project this *Application for a Certificate of Environmental Compatibility and Public Need* (Application) to the Council. The Application includes three volumes, as follows:

- ***Volume 1*** describes the 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; presents data concerning electric and magnetic fields (EMF) near the Project facilities; and describes the alternative routes and transmission line configurations that were evaluated before selecting the Proposed Route and the underground cable/overhead line configurations.
- ***Volume 2*** includes reports that provide detailed information in support of the data presented in Volume 1, including documentation concerning water resource studies (wetland and watercourse investigations and a vernal pool assessment), cultural resource investigations, EMF information, and electric system planning analyses.
- **Volume 3** presents Project maps and drawings, including a U.S. Geological Survey (USGS) map of the Project area, aerial photography based maps at scales of 1”=400’ and 1”=100’, Plan and Profile maps for the overhead line segment, cross-section drawings of the underground and overhead transmission line segments, and drawings of Newington Substation, Southwest Hartford Substation, and Newington Tap modifications.

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



ES.3 PROPOSED PROJECT FACILITIES

ES.3.1 115-kV Transmission Line

The new 3.7-mile 115-kV transmission line between Newington and Southwest Hartford substations (designated by Eversource as the 1346 Line) would be aligned almost entirely within existing linear ROWs. The line would be comprised of two underground cable segments, connected by an overhead segment within the Amtrak ROW, along the Proposed Route as illustrated on Figure ES-1 and described briefly as follows:

- ***Underground Route Segment: Newington***. This underground segment would extend for approximately 1.1 miles from Newington Substation to the Amtrak ROW. Along this segment, the underground cable would be located for approximately 0.8 mile on Eversource's property and within an existing Eversource distribution line ROW between Newington Substation and State Route 173 (Willard Avenue). From the intersection of the Eversource ROW with State Route 173, the cable route would be aligned north along State Route 173 before turning east along a local road (Shepard Drive) then traversing a short distance, across a privately-owned paved parking lot in an industrial area to a transition structure, proposed for location adjacent to the west side of the Amtrak ROW. At the transition structure, the line would change from an underground to an overhead configuration.

- ***Overhead Route Segment: Newington, West Hartford, and Hartford***. Approximately 2.4 miles of the proposed 115-kV line would be overhead, along the east side of the Amtrak ROW. From the transition structure located at the end of the underground cable segment in Newington, the overhead portion of the line would span the CT*fastrak* and Amtrak's two existing rail lines and then would extend north within the east side of the Amtrak ROW. South of Interstate 84 (I-84), the overhead line would turn west, again spanning the Amtrak rail lines and CT*fastrak* to another transition structure, proposed for location on Amtrak property north of a movie theater parking lot.

- ***Underground Route Segment: Hartford***. This approximately 0.2-mile underground segment would extend from the transition structure at the north end of the overhead line segment into Southwest Hartford Substation. From the transition structure, the underground cable would traverse west for approximately 0.1 mile near the paved parking lot of the movie theater and then would turn north for approximately 0.1 mile, traversing along New Park Avenue, and crossing beneath I-84 to extend for a short distance within Eversource property to Southwest Hartford Substation (located adjacent to and west of New Park Avenue).

Table ES-1 summarizes the miles, by line configuration, of the Proposed Route in each of the three municipalities.

Table ES-1: Proposed Route Mileage, by Line Configuration and Municipality

Proposed 115-kV Line Configuration	Municipality (Approximate Miles)			Total
	Newington	West Hartford	Hartford	
Underground	1.16	0	0.17	1.33
Overhead	0.17	1.64	0.56	2.37
Total	**1.33**	**1.64**	**0.73**	**3.70**

The underground segments would consist of a single-circuit 115-kV, solid dielectric cross-linked polyethylene (XLPE) cable. The XLPE cable would be contained within polyvinyl chloride (PVC) conduits encased in a concrete duct bank. As part of the cable system, three buried splice vaults would be required for interconnecting the cable sections and subsequently maintaining the underground portion of the 115-kV transmission line. The three splice vaults would be located along the underground cable segment in Newington; no splice vaults would be required along the short underground cable segment in Hartford. Along the underground segment in Newington, two of the splice vaults are proposed for location in upland areas along the Eversource ROW, while the third is planned for location along Shepard Drive.

In addition to the 115-kV transmission line cable, three fiber optic cables would be installed in the underground duct bank. Two fiber optic cables are required for remote protection and control of the cable system and associated equipment, while the other fiber optic cable would be for distributed temperature sensing to monitor 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.

Eversource’s ROW is currently occupied by five existing electric distribution circuits. The anticipated location of the cable system (duct bank and two splice vaults) within Eversource’s ROW is depicted on the Volume 3 maps, which also illustrate the general location of the cable system within the road ROWs and the parking lots near the Amtrak ROW. The exact location of the cable within and adjacent to public road ROWs, as well as the location of the splice vault along Shepard Drive, would be determined based on final engineering design, taking into consideration any constraints posed by existing buried utilities, the location of other physical features, and the requirements and preferences of the entity that maintains each road.

The overhead segment of the 115-kV line would consist of 49 galvanized steel monopole structures, placed at intervals of approximately 250- to 300-feet along the Amtrak ROW, and two galvanized transition structures. The steel monopoles would be approximately 95 to 110 feet in height above ground and would be arranged in a vertical configuration. The structure design would be in accordance with an agreement between Eversource and Amtrak. Each of the two transition structures would be a steel monopole, between 95 and 105 feet in height above ground.

Based on current Project design information, all but one of the 49 proposed transmission line structures would be situated within the Amtrak ROW. Eversource would obtain an easement for the installation of the structure that must be located adjacent to the Amtrak ROW, south of Flatbush Avenue in West Hartford, where a small portion of the railroad corridor is too narrow to accommodate a 115-kV monopole. In addition, the transition structure in Newington would also be located on private property; Eversource would obtain an easement for the line on this property.

ES.3.2 Substation Modifications

Modifications to both Newington and Southwest Hartford substations are required to connect the new 115-kV line to the transmission system. The new 115-kV line would enter both substations in an underground configuration. To accommodate the equipment for the new 115-kV line connection, Eversource proposes to expand each substation by approximately 0.3 acre, extending the existing fence at each facility. Each substation, and the modifications proposed as part of the Project, are described as follows:

- **Newington Substation** occupies approximately 1.7 acres of an 11.4-acre Eversource property, is located at 185 Cherry Hill Drive in the northwestern portion of Newington. The Eversource property is bordered by residential uses. Newington Substation, which has been in operation for approximately 60 years, includes both a 115-kV yard and a 23-kV distribution yard. Eversource ROWs, occupied by overhead transmission lines and overhead and underground distribution lines, extend from the substation to the north, south, east, and west. 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 cast-in-place concrete retaining wall on the south and west sides of the substation fence line to maintain the grade for the expanded portion of the substation. Within the substation, the existing 1783 Line position would be relocated to accommodate the connection of the new 115-kV line to the existing 1783 Line position. The final configuration for each terminal position would include one lightning arrestor, one disconnect switch, and one Capacitance Coupling Voltage Transformer (CCVT) per phase. Other modifications include a new, approximately 70-foot-tall deadend structure for the relocation of the 1783 Line, the construction of a new control enclosure (having dimensions of approximately 32 feet by 14 feet) to house protection and control equipment, and the extension of the substation ground grid.

- **Southwest Hartford Substation**, which occupies approximately 2.1 acres of a 7.1-acre Eversource property at 219 New Park Avenue, is located in a commercial area in southwestern Hartford. The site is bordered on the south by I-84, on the east by New Park Avenue, to the north by a tributary to the South Branch of the Park River; and to the west by commercial areas. Eversource acquired the Southwest Hartford Substation property for utility use in 1968. Two 115-kV underground high-pressure fluid filled (HPFF) cables (the 1722 Line and the 1704 Line) and nine 23-kV distribution lines presently connect to the substation. To accommodate the Project facilities required for the new 115-kV line, Eversource proposes to expand the eastern substation fenced area by approximately 65 feet to the east and to modify the existing access road and gate off New Park Avenue. As part of the Project, grading and drainage improvements would be performed, as required. The existing 115-kV yard would be reconfigured into a ring bus, with two new 115-kV circuit breakers, and a portion of the 1722 Line and related substation equipment would be relocated. The facilities for each line would include one series reactor, circuit switcher, disconnect switch, arrestor, CCVT and pothead per phase. Although the new 1346 Line would enter the substation underground, as does the existing 1722 Line, a bypass would be necessary for the operation of the reactors. This would 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. Other Project modifications would include the extension of the substation ground grid, as well as the relocation or removal of certain existing interconnection piping and a valve cabinet.

ES.3.3 Newington Tap Modifications

Eversource's 115-kV overhead 1783 Line extends from Farmington Substation (in the Town of Farmington) to East New Britain Substation (in the City of New Britain), passing adjacent to Newington Substation. A 0.01-mile segment of the 1783 Line connects to Newington Substation. This connection, referred to as the Newington Tap (Tap), would be modified as part of the Project. Specifically, the existing 0.01-mile Tap transmission line would be relocated and rebuilt with larger conductors. These modifications would provide space within the substation to accommodate the new 1346 Line termination and would avoid overloads on the Tap line 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 Project facilities in accordance with all regulatory approvals and standard Company practices, as well as in conformance with its license agreement with Amtrak (for the overhead portion of the transmission line). The 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.

<u>115-kV Transmission Line</u>. The construction of the new 115-kV line would require temporary contractor yards, material/equipment staging sites, offices, and similar support facilities. Different procedures would be used to construct the underground and overhead segments of the new 115-kV transmission line, as summarized below.

Overhead Segment. Eversource would construct the overhead transmission line in accordance with the conditions of its license agreement with Amtrak, as well as Company and industry specifications for overhead 115-kV lines. Eversource's license agreement with Amtrak is expected to specify certain construction methods and schedules, including the performance of Project activities in accordance with time frames established by Amtrak to avoid or minimize conflicts with rail operations. As such, construction along the Amtrak ROW is expected to include night-time work.

Construction activities would be concentrated on the Amtrak ROW and adjacent support sites as needed for material and equipment staging and storage. Primary activities involved in the construction of the overhead line segment would include:

- Stake structure locations.
- Improve access along the railroad ROW and establish work pads for structure installation.
- Construct structure foundations and assemble/erect new structures.
- Install conductors and shield wires.
- Restore sites affected by construction.

***Underground Segments*.** The installation of the underground line segments would typically require a minimum width of 30- to 40- feet[3] to accommodate the excavation of the cable trench, access for construction equipment, and space for the temporary storage of equipment and materials. For the installation of the cable segment within the

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[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 authorization to construct the Project.

[3] A minimum 40-foot-wide work space width would be required along the underground segment along the Eversource distribution line ROW.

Eversource ROW, some of the overhead distribution circuits would have to be temporarily relocated. To facilitate this temporary relocation, overhead insulated conductors would be used for the relocated circuits to reduce clearances and facilitate the installation of the new 115-kV cable segment. Some additional work space would be required to accomplish the relocation (refer to the Volume 3 maps).

As part of the preparation of the final design for the location of the cable system within public roads, Eversource would coordinate with other underground and overhead utility companies, with the Newington and Hartford Departments of Public Works, and with ConnDOT regarding the location of the cable facilities, as well as the methods and schedule to be used to install the cable system. During construction, primary consideration would 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 would be involved in the underground cable system installation:

- Mark work area boundaries and clear vegetation (along the cable segment within the Eversource ROW and elsewhere as needed).
- Establish traffic control procedures to minimize traffic disruption and provide a safe construction work zone (along road ROWs and at intersections of the Eversource ROW with public roads).
- Excavate for and install splice vaults (each splice vault typically requires an excavation area approximately 12 feet wide, 12 feet deep, and 28 feet long).
- Saw cut and remove pavement (road ROWs), and excavate a trench for the cable conduits.
- Strip topsoil and stockpile separately from subsoil (Eversource ROW).
- Install the conduits.
- Encase the conduits in concrete.
- Backfill the trench (with a fluidized thermal backfill[4] or equivalent), remove temporary access roads and temporary work areas, and repave or restore subsoil/topsoil over disturbed areas and.
- Complete site restoration.
- Pull the cables into the conduits.
- Splice together the cables within the splice vaults.
- Install cable terminations at the transition (riser) structures adjacent to the Amtrak ROW and within Newington and Southwest Hartford substations.

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

During normal operation, the 115-kV line would be monitored and maintained in accordance with Eversource's standard procedures. The location of the new transmission line would provide ready access in the event that maintenance is required.

Substation Modifications. The modifications at Newington and Southwest Hartford 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 substation expansions 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 would be constructed along the expanded south and west substation fenced areas. The proposed Project modifications would not substantially affect or alter existing maintenance practices at either of the substations.

Newington Tap. The modifications to the Newington Tap would 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 would be used for these modifications.

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

To identify and assess environmental conditions in the Project 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* (February 2016) (Application Guide). The following features (among others) are illustrated on the aerial-photography-based maps in Volume 3:

- Existing infrastructure, including Eversource ROWs and properties (including substations), the Amtrak ROW (including the CT*fastrak)*, and road ROWs.
- Land uses, including residential, commercial, and industrial areas.

- Municipal boundaries and zoning classifications.
- Federal and state jurisdictional wetlands and watercourses.
- Federal Emergency Management Agency floodplain boundaries.
- Public recreational or open space parcels and community facilities.
- Cultural resources (areas listed on the National Register of Historic Places [NRHP]).

Analyzing both the baseline environmental data and the plans for the proposed Project, Eversource identified the potential short- and long-term effects that the construction and operation of the Project would have on land uses, transportation, and environmental and cultural (historic and archaeological) resources. In addition, Eversource 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 would 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 collocating the proposed new 115-kV transmission line within or along existing utility, road, and railroad ROWs, and by developing the proposed substation modifications and Newington Tap reconfiguration on property that is already designated for utility use. The Project would 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, temporary noise associated with construction, and traffic), Eversource has identified measures that can be effectively applied to mitigate these effects to the extent practical.

Based on current Project engineering plans, analyses of the existing environmental data, and the mitigation measures identified to date, the proposed Project would have localized environmental effects. Specifically, the Project would:

- Result in minimal, short-term, and localized soil disturbance as a result of the construction of the transmission line and the modifications to the Newington Tap and Newington and Southwest Hartford substations.
- Have no adverse effect on floodplains; groundwater resources; federal- or state-listed threatened, endangered, or special concern species; recreational resources; or designated scenic areas.
- Have no effect on vernal pools (none are located in the vicinity of Project facilities).
- Have minor and highly localized effects on wetlands and watercourses as a result of the installation of the underground cable segment in Newington and the

modifications to the Newington Tap. The Project would not result in any permanent fill in wetlands. Approximately 1.6 acres of wetlands would be temporarily affected during the new transmission line construction and approximately 0.5 acre would be temporarily affected during the Newington Tap modifications (e.g., by the construction of temporary access roads or work pads using timber mats or equivalent). However, the temporary mats would be removed after the installation of the new 115-kV line. Eversource would coordinate with the involved regulatory agencies to provide appropriate compensatory mitigation for these wetland/watercourse impacts.

- Convert approximately 1.9 acres of forested habitat (about 1.7 acres of forested upland and 0.2 acre of forested wetland) into upland or wetland shrub communities. This would have a localized but minor effect on vegetation and wildlife.
- Have no adverse effect on cultural resources. The Project would avoid indirect visual impacts to the integrity of NRHP districts in Newington and Hartford by locating the new 115-kV transmission line underground in the immediate vicinity of NRHP sites and overhead only within the long-established Amtrak ROW in the vicinity of predominantly industrial/commercial areas.

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 EMF from the operation of the Project facilities under a variety of load conditions. Electric field calculations were only performed for the proposed overhead segment of the 115-kV line along the Amtrak ROW. In the case of the underground transmission line segments, electric fields are shielded by the cable sheath, which grounds out the electric field outside of the cable assembly. Magnetic fields 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 magnetic fields. 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.

Electric and magnetic fields associated with the new transmission line would drop quickly to background levels as the distance from the centerline of the conductor and cables increases.

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

ES.7 ALTERNATIVES CONSIDERED

The proposed Project is the result of a comprehensive evaluation process conducted by ISO-NE, Eversource, and other stakeholders. This process began with a determination of the need for the Project, then included the identification and analysis of alternative solutions for addressing the need, and concluded, after a careful examination of alternative routes and transmission line designs and the solicitation of input from Amtrak and the involved municipalities, with the selection of the proposed Project facilities.

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 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 the North American Electric Reliability Corporation, Inc. (NERC) for its failure to take action to resolve identified criteria violations.

- **System Alternatives.** After the need for the Project was defined, transmission system alternatives that would potentially meet that need were identified and evaluated by ISO-NE, Eversource, and others. Two new geographically distinct 115-kV transmission line alternatives 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 underground 115-kV line between Newington and Southwest Hartford substations, which are not presently connected. Due to the density of urban and suburban development, it was initially anticipated that a line between these two substations would need to be entirely or mostly underground.

  Both alternatives would address the target reliability criteria violations, and their costs were 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. After Eversource's consultations with Amtrak revealed that a portion of the new line between Newington and Southwest Hartford substations could be collocated, in an overhead configuration, within the Amtrak ROW, this option was also more cost beneficial.

- **Non-Transmission Alternatives.** As part of the examination of electric system needs in the Greater Hartford Sub-area, ISO-NE conducted studies to identify potential solutions that would not require expansion of the transmission system. These studies considered demand-side alternatives and supply-side alternatives (collectively, non-transmission alternatives [NTAs]) in general, but did not determine the types of resources and technology that would be required to offset the need for transmission improvements. The ISO-NE studies also did not estimate the cost of non-transmission 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 NTAs compared to the transmission solution for the Greater Hartford Sub-area. 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 the practical feasibility of each least-cost NTA solution. The LEI study, which is provided in Volume 2, determined that NTAs to the proposed Project would be costly and overall economically impractical.

- **Transmission Line Route Alternatives and Route Variations[5].** After a new 115-kV line between Newington and Southwest Hartford substations was selected as the preferred solution, Eversource used an iterative, multi-year process to identify and evaluate alternative routes and designs for the new line. Because of the dense urban/suburban development in the Project, Initial studies anticipated that the new 115-kV line would need to be installed underground, principally within road ROWs. Accordingly, in its December 2015 Municipal Consultation Filing (MCF)[6] for the Project, Eversource identified an all-underground route for the new 115-kV line. However, Eversource also included in the MCF a detailed description of then-ongoing evaluations of the potential use of the Amtrak ROW for a portion of the new 115-kV route. Additional comprehensive engineering evaluations and consultations with Amtrak, conducted between January 2016 and early 2017, determined that 2.4 miles of the new 115-kV line could indeed practically be collocated, in an overhead configuration, within the Amtrak ROW. Subsequently, Eversource identified and evaluated options for connecting this overhead segment to the Newington and Southwest Hartford substations. These analyses resulted in the identification of two segments of underground cable, aligned within Eversource's distribution line ROW and road ROWs and totaling approximately 1.3 miles, which would optimally connect the substations to the overhead segment along the Amtrak ROW.

  As part of the alternatives evaluation process, Eversource also identified and examined route variations for the new line between Newington Substation and the Amtrak ROW. The new line could technically be installed along any of these route variations; however, compared to the underground segment along the Proposed Route, each variation is less preferable due to factors such as cost, the need for additional easements, or potential impacts to residents and NRHP sites. No practical route variations were identified to the segment of the Proposed Route between the Amtrak ROW and Southwest Hartford Substation.

  Finally, as an alternative to the Proposed Route and hybrid underground/overhead line design, Eversource identified an all-underground configuration for the line between Newington and Southwest Hartford substations that would be aligned

5 No practical alternatives were identified for the proposed modifications to Eversource's existing Newington and Southwest Hartford substations or to Newington Tap.

6 A MCF is a pre-requisite for the submission of an Application to the CSC.

predominately along state and local road ROWs (and would not involve any collocation within the Amtrak ROW). A new 115-kV cable system could feasibly be developed along this route, albeit at significantly higher cost than the hybrid configuration along the Proposed Route. The all-underground route would extend along road ROWs through primarily residential areas in Newington and West Hartford, as well as across the Elmwood commercial center in West Hartford and commercial areas along New Park Avenue in West Hartford and Hartford. The all-underground route alternative, while technically feasible, is not preferred due to the significantly higher cost.

ES.8 COST AND SCHEDULE

The estimated capital cost of the Project is approximately $61.1 million, of which approximately $44.4 million is for the proposed 3.7-mile underground/overhead 115-kV transmission line (including $1.2 million for the Newington Tap); $16.7 million is for the associated modifications to Newington and Southwest Hartford substations. Project construction is anticipated to commence in mid-2018, with an in-service date for the Project facilities of the fourth quarter 2019.

ES.9 AGENCY AND MUNICIPAL CONSULTATIONS

The municipal consultation process for the Project involved both formal and informal consultations with representatives of Amtrak; federal, state, and local agencies; and the public. These consultations spanned a two-year period, from March 2015 through the submission of this Application, and will continue as planning for the Project continues.

Federal and state agencies consulted included the U.S. Army Corps of Engineers (USACE), ConnDOT, CT DEEP, the State Historic Preservation Office (SHPO), and the U.S. Fish and Wildlife Service (USFWS). In addition, Eversource conducted extensive consultations with Amtrak, providing detailed engineering information regarding the proposed collocation of the proposed 115-kV line along the Amtrak ROW.

Pursuant to the Public Utility Environmental Standards Act, Connecticut General Statutes (CGS) § 16-50g et seq., Eversource contacted representatives of the three municipalities in which the Project facilities would be located and, on December 2015, submitted to the Chief Elected Officials of each municipality a three-volume MCF that described the proposed Project and identified alternatives. At that time, the new 115-kV transmission line was anticipated to consist of a cable system that would be installed in public streets; however, the MCF also described a potential overhead line segment, along the Amtrak ROW, as a route variation under consideration.

The MCF also was posted online and available in municipal libraries. The purpose of the MCF process, which extended for a minimum of 60 days in accordance with statutory requirements, was to both inform the municipalities and the public about the proposed Project and to solicit public and agency input regarding the Project. During the MCF process, Eversource held an open house in the Project area in January 2016. With respect to the all-underground route, West Hartford and Newington officials expressed concerns about impacts to traffic, businesses, and residents, as well as excavation in recently paved streets; in addition, they suggested route variations to mitigate some of these impacts, which Eversource was prepared to adopt.

However, after completing its initial municipal consultations in early 2016 and coordinating further with Amtrak representatives, Eversource reconfigured the proposed transmission line to the overhead/underground line proposed in this Application.

At Project briefings in March 2017, Eversource representatives advised municipal representatives of these significant changes in the Proposed Route after Eversource's negotiations with Amtrak had advanced sufficiently that Eversource was confident that it would reach a final agreement with Amtrak.

Eversource held a second open house in the Project area on April 27, 2017. This forum allowed the public and municipal officials the further opportunity to review and provide input concerning the proposed Project. The Application incorporates responses, as appropriate, to such municipal and public input.

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) transmission line and to modify two existing substations in the Greater Hartford electrical sub-area, in Hartford County. The new, proposed 115-kV electric transmission line is planned to extend for approximately 3.7 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.

The proposed 115-kV transmission line would consist of both overhead and underground segments, which would be aligned almost entirely along existing linear corridors, including an Eversource right-of-way (ROW), Amtrak Railroad ROW, and state and local road ROWs. To connect the new 115-kV line to the transmission grid, Eversource also proposes to expand and make related improvements to both Newington and Southwest Hartford 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.

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[7] into compliance with applicable national and regional electric reliability standards and criteria and to help move power across Connecticut when the system is under stress. Figure 1-1 illustrates the general location of the proposed Project facilities.

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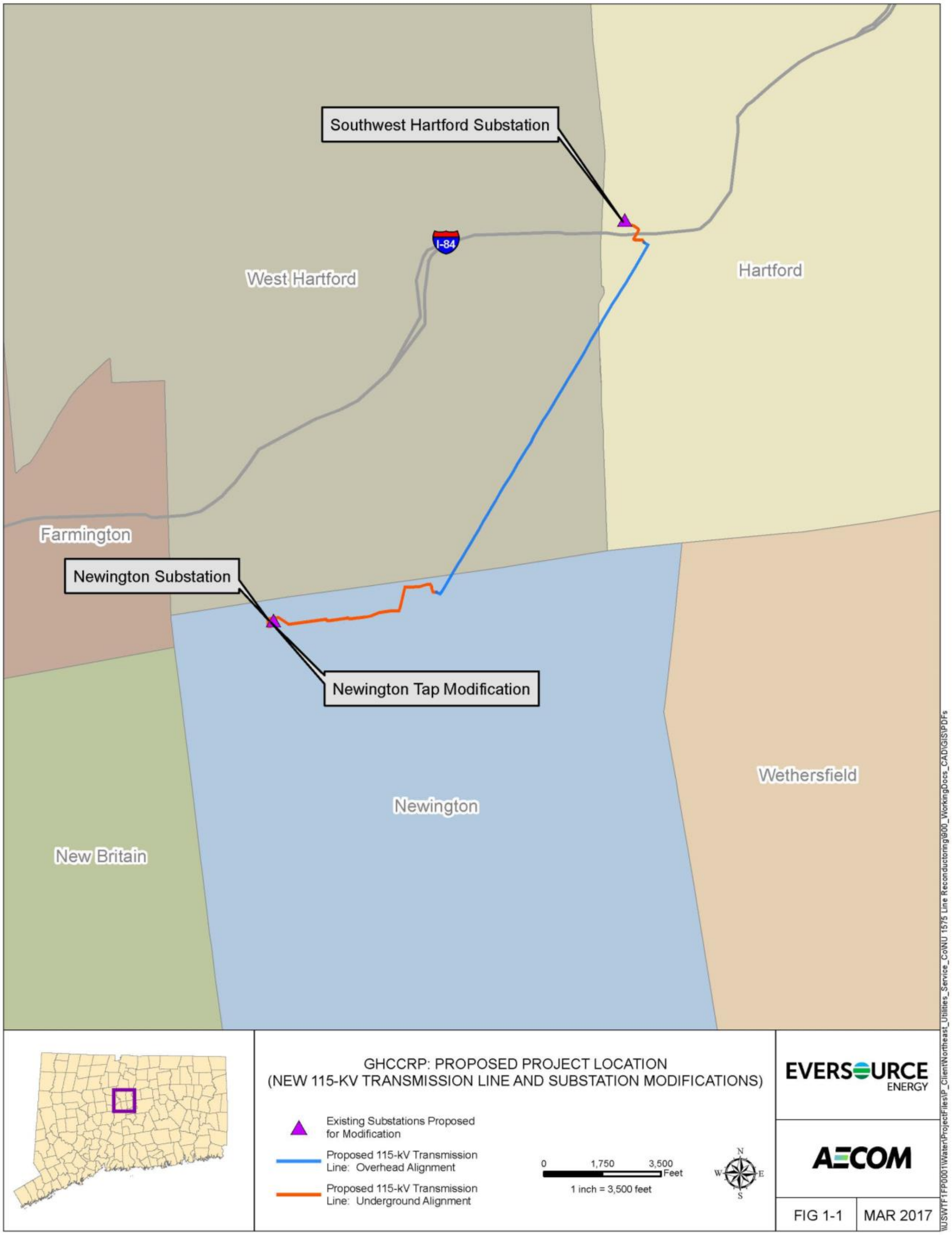
[7] As detailed in Section 2, for electrical transmission planning purposes, Connecticut is divided into areas and sub-areas. The Greater Hartford – Central Connecticut Study Area includes four contiguous sub-areas that encompass much of the northwest and central portions of the state. These sub-areas 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



Eversource would construct, own, and operate the Project facilities, which are subject to the review and approval of the Connecticut Siting Council (Council or CSC).

Accordingly, Eversource submits to the Council this *Application for a Certificate of Environmental Compatibility and Public Need* (Application) for the Project. The Application, which conforms to the Council's February 2016 *Application Guide for an Electric and Fuel Transmission Line Facility* (Application Guide), consists of three volumes:

- ***Volume 1*** describes the 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; presents data concerning electric and magnetic fields (EMF) near the Project facilities; and describes the alternatives evaluation process that led Eversource to select the proposed Project as the solution for improving the electric system in the Greater Hartford Sub-area.
- ***Volume 2*** provides detailed studies supporting the data presented in Volume 1, including environmental and cultural resource reports, EMF information, and electric system planning analyses.
- ***Volume 3*** contains Project mapping, including aerial-based maps of the proposed 115-kV transmission line route and substation facilities, as well as cross-sections of the underground and overhead portions of the 115-kV transmission line and drawings of the planned substation modifications.

1.2 SUMMARY OF PROJECT NEED AND LOCATION

The need for the proposed Project 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 for the New England region, including Connecticut. These ISO-NE analyses determined a need for improvements to the transmission system in the Greater Hartford Sub-area to enhance system reliability, including a new 115-kV transmission line between Newington Substation and Southwest Hartford Substation.[8]

[8] ISO-NE Greater Hartford and Central Connecticut Working Group, Greater Hartford and Central Connecticut *(GHCC) Area Transmission 2022 Needs Assessment* (May 2014); and *Greater Hartford and Central Connecticut (GHCC) Area Transmission 2022 Solutions Study* (February 2015).

For this proposed new transmission line, Eversource conducted detailed analyses within a defined Project study area[9] to identify and assess major routing alternatives, underground and overhead line configurations, and route variations. In addition, Eversource reviewed options for the Newington Tap, Newington Substation, and Southwest Hartford Substation modifications required to interconnect and support the proposed 115-kV line. Based on the results of these analyses, Eversource identified as the preferred solution the proposed 3.7-mile transmission line along the alignment shown in Figure 1-1 (referred to as the Proposed Route), consisting of approximately 1.3 miles of underground cross-linked polyethylene (XLPE) cable and approximately 2.4 miles of overhead line, and the associated substation modifications.[10]

The proposed 115-kV transmission line would traverse portions of three municipalities in Hartford County: Newington, West Hartford, and Hartford. The underground segments of the new line would be aligned within existing ROWs, including an approximately 0.8-mile, Eversource distribution line ROW in Newington, as well as local and state public road ROWs in Newington and Hartford. The overhead portion of the proposed transmission line would be situated along the eastern side of Amtrak's New Haven-Hartford-Springfield railroad ROW, the western portion of which contains the Connecticut Department of Transportation's (ConnDOT's) CT*fastrak* busway.[11] A transition structure, which is required to switch the 115-kV line from an underground cable to overhead line and vice versa, would be required at each end of the overhead line segment. Both transition structures would be located west of the Amtrak/CT*fastrak* corridor, one on privately-owned land in Newington and the other within the Amtrak ROW in Hartford.

Eversource would negotiate a license agreement with Amtrak to construct and operate the overhead transmission line segment within the railroad ROW, and would acquire easements for the location of any transmission line facilities that must be situated outside of public road ROWs or off the Amtrak ROW. For example, Eversource would obtain easements from

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9 Refer to Figure 1-2 for the location of the Project study area boundaries and to Section 11 for a discussion of Eversource's rationale for selecting the study area within which potential transmission line routes were identified.

10 Sections 10 through 12 of this Application describe the alternatives analyses conducted for the Project.

11 For the purposes of this document, the terms "Amtrak ROW" and "Amtrak/CT*fastrak* corridor" are synonymous.

property owners for the location of the transition structure in Newington, for one new 115-kV line structure in West Hartford that cannot be located within the Amtrak ROW, and for short sections of the underground cable (where the Proposed Route must cross private parking areas or may otherwise have to be located outside of road ROWs).

Newington and Southwest Hartford substations, both of which would be modified as part of the Project, are located on Eversource properties that have been devoted to utility use for many decades. The proposed substation modifications would not require acquisition of any additional land or easements rights. Volume 3 includes detailed maps illustrating the proposed transmission line route and the planned modifications to the two substations.

The proposed 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.

Based on these overarching objectives, the principal factors considered in selecting the Proposed Route for the new 115-kV transmission line and the related substation and Newington Tap modifications were:

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

The 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.

1.3 PROPOSED PROJECT FACILITIES

1.3.1 New 115-kV Transmission Line

The proposed 3.7-mile 115-kV transmission line (designated by Eversource as the 1346 Line) between Newington Substation and Southwest Hartford Substation would be aligned principally within existing linear ROWs, as illustrated generally on Figures 1-1 and 1-2 and shown in detail on the Volume 3 maps. The proposed transmission line would be comprised of the following underground and overhead segments.

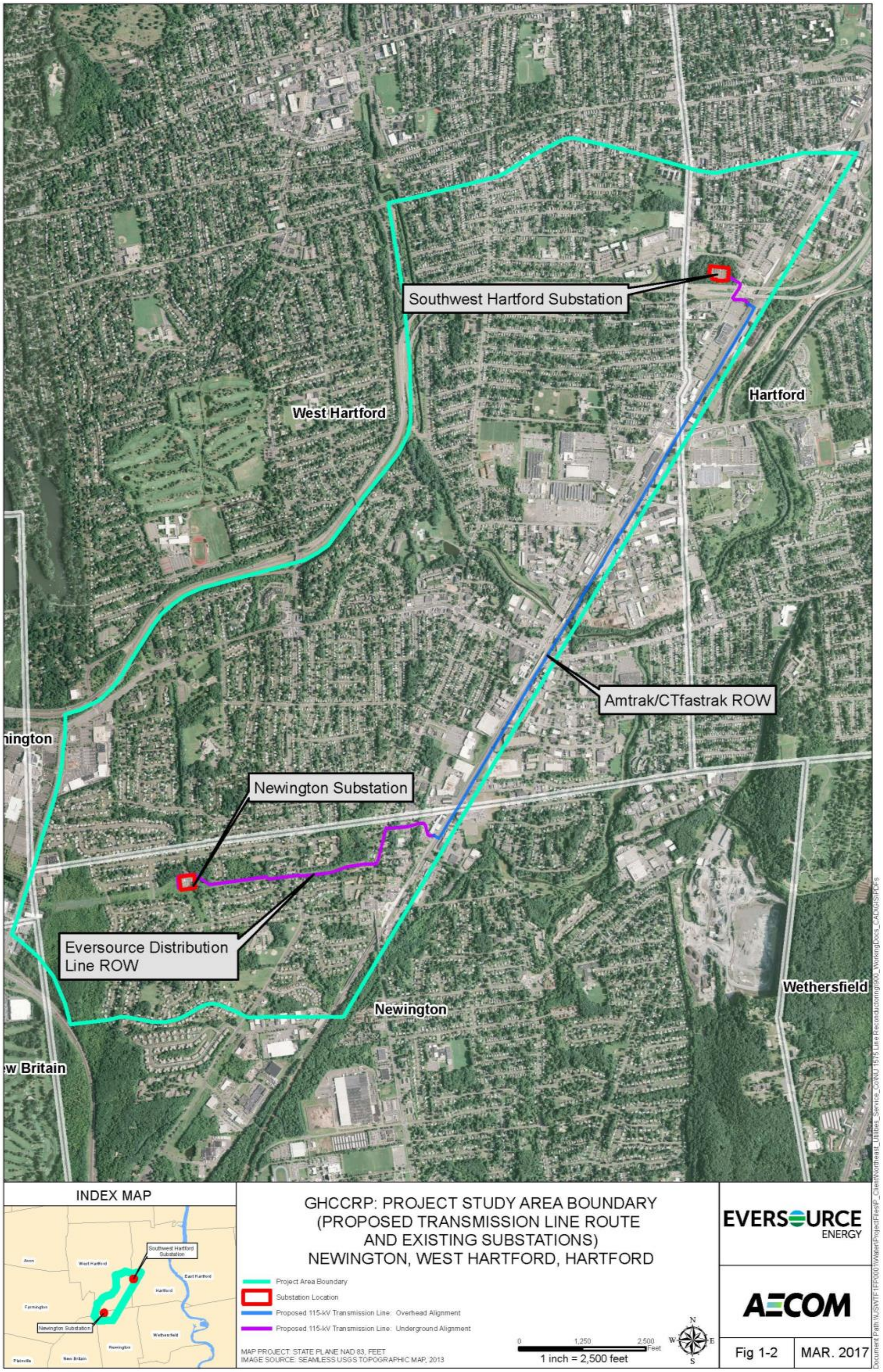
Underground Cable. The new 115-kV line would include two underground XLPE cable segments, totaling approximately 1.3 miles, along the southern and northern portions of the Proposed Route, as described below:

- ***Underground Route Segment: Newington***. This underground segment would extend approximately 1.1 miles from Newington Substation east/northeast to the Amtrak ROW. Along this segment of the Proposed Route, the underground cable would be located for approximately 0.8 mile on Eversource's property and within an existing distribution line ROW between Newington Substation and State Route 173 (Willard Avenue). From the intersection of the Eversource ROW and State Route 173, the cable route would be aligned along state and local roads and, for a short distance, across a paved parking area directly west of the Amtrak ROW. Specifically, the route would traverse north along State Route 173 to Shepard Drive and, from there, would be aligned east along Shepard Drive and then beneath a small unnamed tributary to Piper Brook and across a privately-owned paved parking area to a transition structure west of and adjacent to the Amtrak ROW.

- ***Underground Route Segment: Hartford***. This underground segment would extend for approximately 0.2 mile, traversing from a transition structure located within the Amtrak ROW at the north end of the overhead line segment into Southwest Hartford Substation. From the transition structure, the underground cable would extend west for approximately 0.1 mile across the northern portion of the paved parking lot for the Bow-Tie Cinema (a multiplex movie theater), which is situated directly south of Interstate 84 (I-84), and then would turn north along New Park Avenue, crossing beneath I-84 to Southwest Hartford Substation (located adjacent to and west of New Park Avenue).

The XLPE cable would be encased in a concrete duct bank. As part of the cable system, Eversource anticipates that three pre-cast splice vaults would be required to interconnect the cable sections and subsequently to maintain the Newington segment of the underground portion of the 115-kV transmission line. No splice vault would be required along the underground segment in Hartford.

Figure 1-2: Project Study Area (Proposed Route of the New 115-kV Transmission Line and Substations to be Modified)



Overhead Line. Approximately 2.4 miles of the new 115-kV line would be overhead. From the transition structure located at the end of the underground cable segment in Newington (in the paved parking lot of an industrial building), the overhead portion of the line would span the CT*fastrak* and Amtrak's two existing rail lines and then would extend north for approximately 2.4 miles along the east side of the Amtrak ROW in West Hartford and Hartford. South of I-84, the overhead line would turn west, again spanning the Amtrak rail lines and CT*fastrak* to another transition structure (proposed for location on Amtrak property west of the CT*fastrak*, near the theater parking lot). In total, 51 overhead transmission line structures (including the transition structures) would be installed.

Along the Amtrak ROW, the proposed 115-kV line would typically consist of galvanized steel monopoles, approximately 95 to 110 feet in height above ground level, in a vertical configuration. The structure design would be in accordance with the license agreement between Eversource and Amtrak. Each of the two transition structures would be a steel monopole, approximately 95 to 105 feet in height above ground level.

Table 1-1 summarizes the miles, by configuration that the Proposed Route would traverse in each of the three municipalities.

Table 1-1: Proposed Route Mileage, by Line Configuration and Municipality

Proposed 115-kV Line Configuration	Municipality (Approximate Miles)			Total
	Newington	West Hartford	Hartford	
Underground	1.16	0	0.17	1.33
Overhead	0.17	1.64	0.56	2.37
Total	**1.33**	**1.64**	**0.73**	**3.70**

1.3.2 Substation Modifications

The proposed modifications to both Newington and Southwest Hartford substations, which would involve expansions to each station's fenced area, are required to connect the new 115-kV line to the transmission system. The proposed 115-kV line would enter both substations underground.

In addition, a 0.01-mile segment of an existing overhead 115-kV line (Eversource's 1783 Line) that presently connects to Newington Substation would 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 transmission line structure on the 1783 Line ROW to the substation. Referred to as the Newington Tap, the existing line connection to Newington Substation would be relocated and rebuilt with larger conductors.

The modifications to the Newington Tap are necessary to provide space within the substation to accommodate the proposed new 115-kV line cable termination. In addition, the modifications to the Newington Tap would facilitate a more direct 1783 Line interconnection to the substation and would enable the tap line to avoid thermal overloads that might otherwise occur under certain contingencies, such as when Newington Substation would simultaneously supply both East New Britain and Farmington substations.

The substation modifications proposed as part of the Project, including the improvements to Newington Tap, are summarized below and are illustrated on the maps and drawings in Volume 3.

1.3.2.1 Newington Substation and Newington Tap

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 Eversource's 11.4-acre 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. This substation is accessed via Cherry Hill Drive.

Eversource acquired the Newington Substation property 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 primarily 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 line, Eversource proposes to extend the substation's existing fenced area 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 would be increased by approximately 0.3 acre.

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

The technical details regarding Newington Substation and Newington Tap modifications are discussed in Section 3. The following summarizes the Project modifications that would be performed at Newington Substation and Newington Tap:

<u>Newington Substation Modifications</u>

- Reconfigure the existing substation 115-kV yard into a ring bus, with two new circuit breakers.
- Construct a new enclosure (approximately 32 feet by 14 feet, for a total of about 700 square feet) to house new protection and control equipment, primarily DC battery components.
- Connect the proposed new 115-kV underground line (the 1346 Line) to the substation at the existing 1783 Line terminal position. To allow the installation of the new 1346 Line, the 1783 Line terminal would be relocated to the existing 2X bus position between the 1T and 2T breakers. The final configuration for each line terminal position would include one lightning 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 would be 16.5 feet, which is the approximate height of the existing bus.

- Install a new steel dead end structure within the substation in order to relocate the 1783 Line interconnection in the substation to the south. This structure would 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 cast-in place concrete retaining wall on the south and west sides of the substation to maintain grade for the expanded portion of the substation. The retaining wall would have a total length of approximately 490 feet with a maximum retained height of 7.8 feet.

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 would 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), conductors, and related equipment that comprise the current tap.
- Reconfigure the guying arrangement on two existing transmission line structures within the ROW.

1.3.2.2 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. 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).

The Southwest Hartford Substation property was acquired for utility use in 1968. Two underground 115-kV transmission lines (the 1722 Line and the 1704 Line) and nine 23-kV distribution lines presently connect to the substation. The existing underground 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 transmission line to Southwest Hartford Substation, Eversource proposes to modify the 115-kV substation facilities, which would require the extension of the existing station fenced area by approximately 65 feet to the east and the relocation of the existing access road and gates. The extension would be on Eversource property.

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

- Reconfigure the existing substation 115-kV yard into a ring bus, with two new 115-kV circuit breakers.
- Add one line terminal position and relocate the existing line terminal. The new 1346 Line would 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 would be relocated. The facilities for each line would include one series reactor, circuit switcher, disconnect switch, arrestor, CCVT and pothead per phase. Although both the new 1346 Line and the 1722 Line would enter the substation underground, a bypass would be necessary for the operation of the reactors. This would 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.

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 from east to west across the Western Connecticut (WCT) Import Interface. The Greater Hartford Sub-area consists of the municipalities 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 and 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 would effectively address these electric system reliability needs, and also would provide the required incremental transfer capability across the WCT Import Interface. 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 – one of several projects 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, 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 electric utilities in 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,[12] 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.

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

[12] 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.

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 would 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 would 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 would 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, engineering, siting, 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 would 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 would withstand the specific contingencies defined by the standards, under the specific conditions modelled, but also to document that the system would 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 the likely availability of generation resources in the study period is constructed. Some generation resources may be assumed to be unavailable in the base case, due to 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 would 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 WCT Import Interface, which defines the capability of the system to transfer power across the state from east-to-west.[13]

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.

2.2 DEVELOPMENT OF THE PROJECT

The proposed GHCCRP is the product of more than ten 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

[13] The Western Connecticut Import Interface consists of 10 transmission lines (345-kV, 115-kV, and 69-kV) that move power across Connecticut in a roughly east-west direction.

problems addressed by NEEWS and presented to ISO-NE's Planning Advisory Committee (PAC)[14] 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 a new 115-kV line. Therefore, in early 2010, ISO-NE removed the 115-kV system related issues from the scope of the NEEWS studies and initiated a new separate study supplementary to the NEEWS studies that would take a comprehensive fresh look at the Greater Hartford area 115-kV system issues and seek a cost-effective solution for all of the identified 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 of reliability issues in subareas adjacent to Greater Hartford, into an assessment of load serving problems in four contiguous electrical sub-areas of Connecticut:

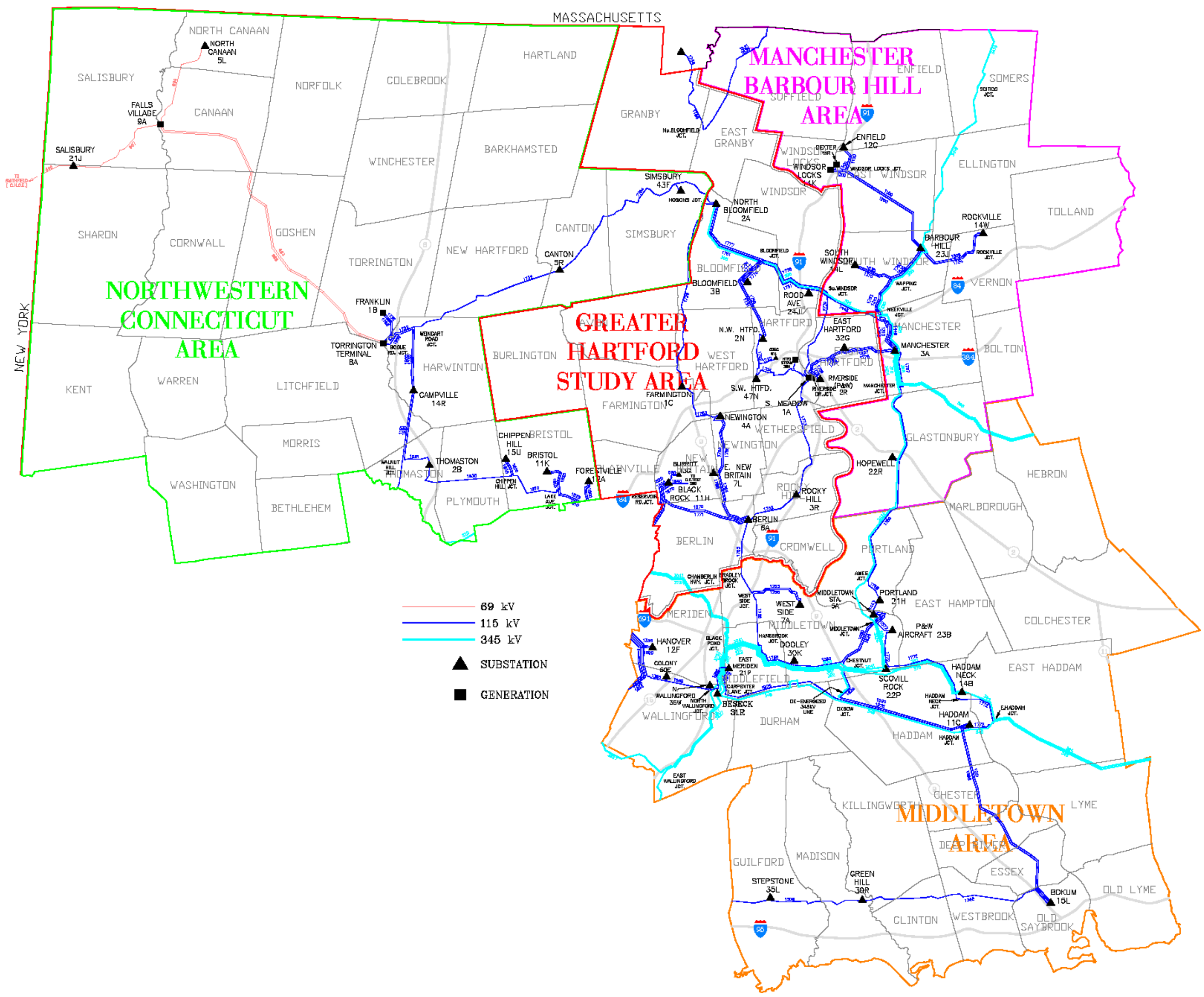
- Greater Hartford
- Manchester – Barbour Hill
- Middletown
- Northwestern Connecticut

The combined studies became known as the Greater Hartford/Central Connecticut (GHCC) study. To conduct this study, ISO-NE formed a working group consisting of transmission planners from ISO-NE, Northeast Utilities Service Company (now Eversource Energy Service Company), and The United Illuminating Company.

The GHCC study area is illustrated in Figure 2-1.

[14] 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.

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



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 GHCC 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.

At the time of the reassessment of the need for CCRP, that project 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.

In early 2015, ISO-NE published a report identifying preferred solutions for the needs of the entire GHCC study area, including the improvements in the Greater Hartford Sub-area proposed in this filing (the “GHCC Solutions Report”). After additional detailed review, and a positive recommendation by its Reliability Committee, on April 16, 2015, ISO-NE issued a technical approval of a set of preferred GHCC solutions, including a new 115-kV transmission circuit between Newington Substation and Southwest Hartford Substation, together with associated equipment additions to those substations.

The Newington and Southwest Hartford substations are located in densely settled areas. Although a portion of the Amtrak/CT*fastrak* transportation corridor extends through the Project study area east of these substations, installing overhead transmission facilities in the urban/suburban Project area was initially deemed to be impractical. Accordingly, as initially designed, the GHCCRP transmission circuit would have been entirely underground. Additional planning and engineering work by Eversource later determined that the line could be constructed as a “hybrid” line, in part overhead and in part underground, at a significant cost savings.

2.2.1 The Greater Hartford Sub-area

In the GHCC studies, the Greater Hartford Sub-area net load for 2022 after demand resources were subtracted was estimated at approximately 1,227 megawatts (MW). Generation in the sub-area totaled 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/or 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

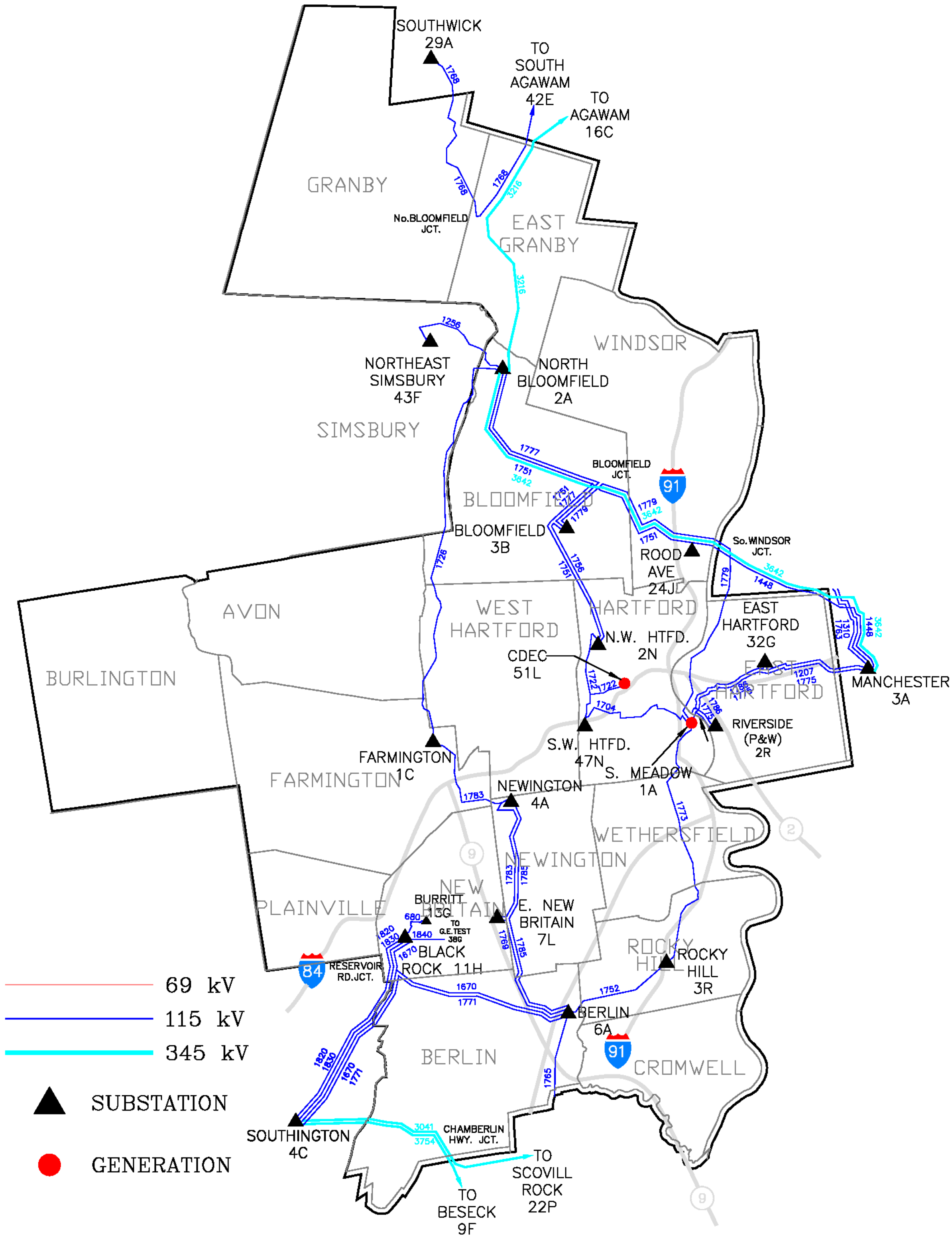
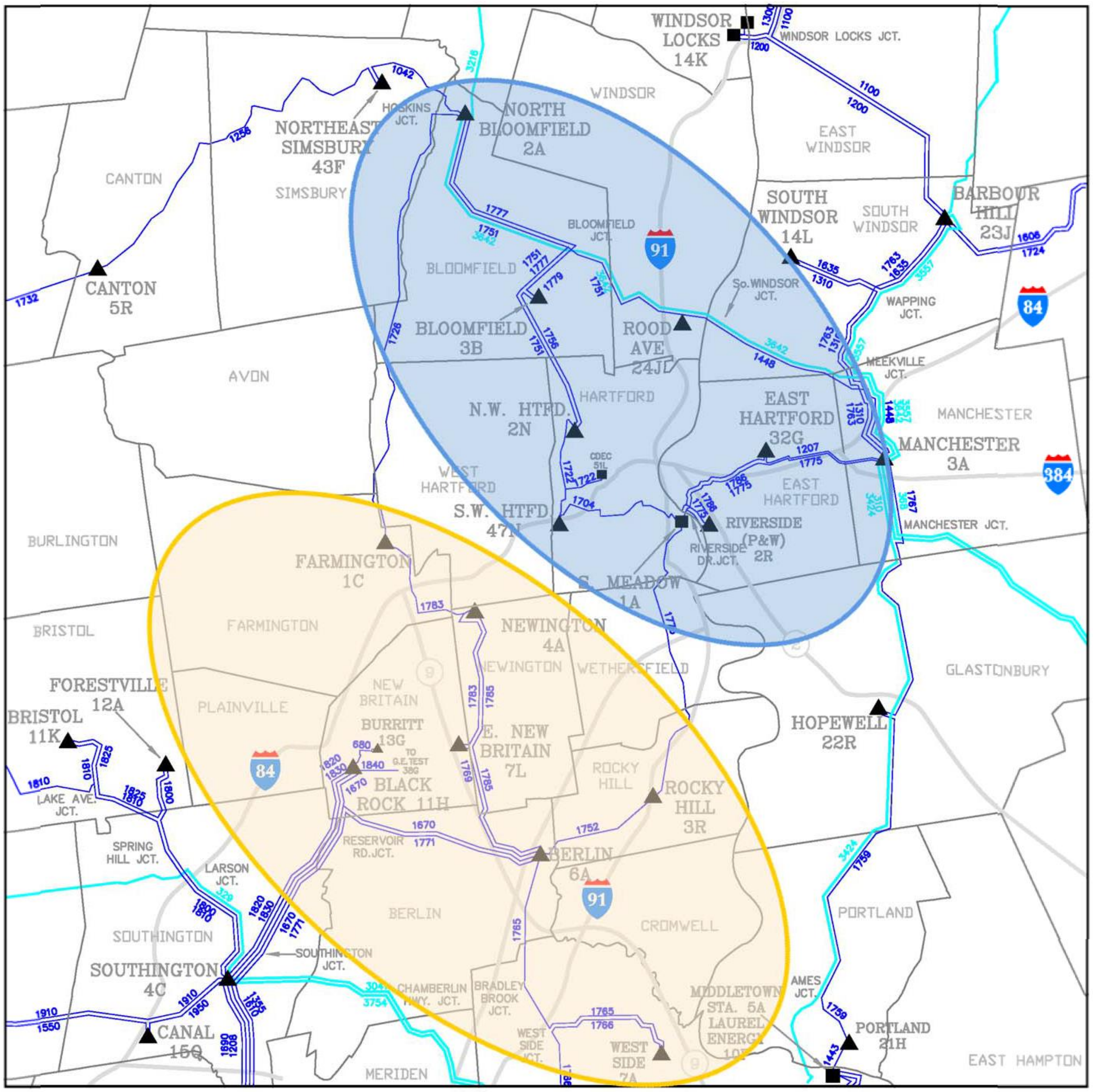


Figure 2-3: Greater Hartford Sub-area: Two Load Pockets



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.)[15]

In accordance with ISO-NE planning procedures, the modeled load was based on the 90/10[16] weather forecast for 2022 in ISO's *2013 Capacity, Energy, Loads, and Transmission* (CELT) load forecast. The forecast ISO-NE 2022 summer peak 90/10 was 34,105 MW.

[15] The planned Towantic Generating Station in the Town of Oxford, Connecticut and Units 6 and 7 in the Wallingford generating facility were not included in the GHCC study because they were not entered in FCA 7. In November, 2015, ISO-NE announced that it had performed an analysis of the GHCC study area with the inclusion of these units, which showed no significant changes, so that a Needs Reassessment would not be undertaken for the GHCC study area. ISO-NE PAC Presentation, *Southwest Connecticut (SWCT) 2025 Needs Assessment Scope of Work,* Nov. 17, 2015.

[16] 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% chance that the projected peak load would be exceeded in a given year, while the odds are 90% 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 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.

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 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, 22 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 WCT 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
CT Resource Recovery Authority Units*		
• South Meadow Unit 5	23	No
• South Meadow Unit 6	25	No
• South Meadow Unit 11	36	Yes
• South Meadow Unit 12	38	Yes
• South Meadow Unit 13	38	Yes
• South Meadow Unit 14	37	Yes

*The listed units are the remaining operable units at the South Meadow site.

ISO-NE planning practice requires an assumption that approximately 20% of fast start generation would 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 *2012 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 would 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.

The actual 2013 summer peak was close to the ISO-NE 90/10 forecast. While subsequent peaks have been lower as illustrated in Table 2-2 below, they have consistently exceeded the critical load levels at which violations begin to occur.

Table 2-2: Actual CT Peak Loads

Year	CT Peak (MW)
2013	7,128
2014	6,183
2015	6,342
2016	5,522

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. As identified in the report, the major element of the solution recommended for the Greater Hartford Sub-area was the addition of a new 115-kV transmission source into the sub-area. The preferred new transmission circuit was an approximately 4-mile 115-kV underground cable between Newington and Southwest Hartford substations. Installation of this new circuit also would require the installation of associated terminal equipment, including a 1.2% series reactor in series with the new cable.

This all-underground solution was developed on the assumption that, because of the dense urban and suburban development in the area between Newington and Southwest Hartford substations and the lack of existing utility ROWs connecting these two substations, the installation of a new 115-kV line in an overhead configuration between these points would be impractical. However, by the time of its Municipal Consultation Filing (MCF) in December 2015, Eversource had identified the possibility of significantly reducing the cost of this Project by collocating the line overhead for most of its length within or adjacent to a section of the Amtrak/CT*fastrak* transportation corridor that extends through the eastern portion of the Project area. After extensive technical studies and negotiations with Amtrak, Eversource re-configured the proposed 115-kV line to an approximately 3.7-mile hybrid overhead/underground circuit, with approximately 1.3 miles of the circuit to be constructed underground and approximately 2.4 miles overhead. This proposed line configuration is described in detail in Section 3 of this Application. Section 11 of the Application discusses the alternatives that Eversource identified and analyzed, leading to the selection of the proposed hybrid configuration, and also includes a comparative analysis of the proposed configuration to the original all-underground cable route between Newington and Southwest Hartford substations.

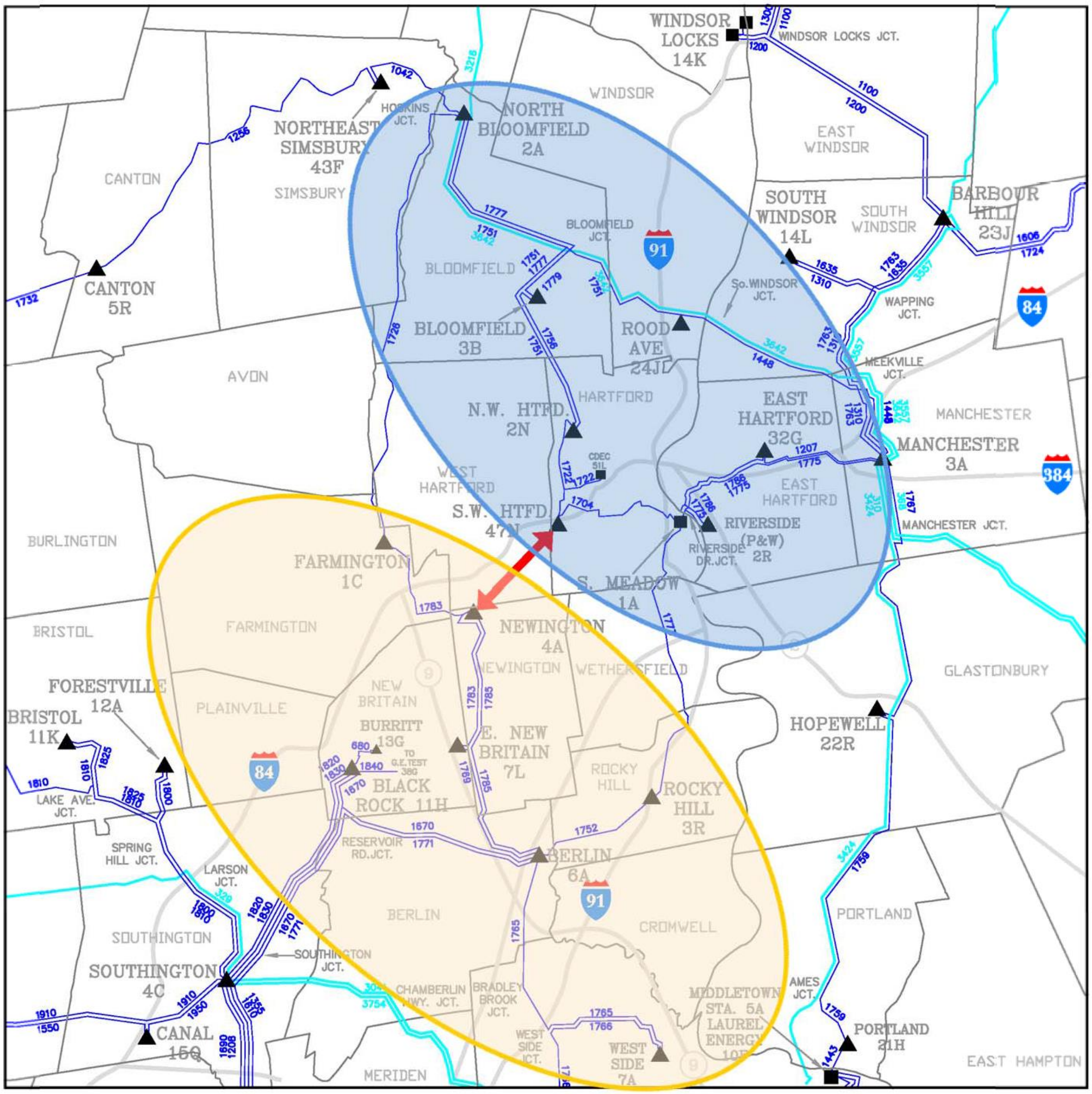
2.3.1 The Newington – Southwest Hartford Circuit and Its Associated Terminal Equipment

The proposed new 115-kV circuit would 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 circuit would require the installation of series reactors, given its underground components. 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 would be joined by the new transmission line, the line would 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 would be provided by a 115-kV 1.2% reactor that would be installed at Southwest Hartford Substation. An existing underground cable (the 1704 Line) between Southwest Hartford and South Meadow substations would 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 would be able to serve the other when needed. In the event of contingencies in either area, there would be an additional high voltage transmission element to share the load that would be automatically redistributed from the 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.

Figure 2-4: GHCCRP Connection of Load Pockets



The new 115-kV line and its associated improvements would also provide incremental transfer capability across the WCT Import Interface. As the 345-kV CCRP would have done, the proposed 115-kV line adds another transmission element to the interface and it therefore increases transfer capability across the interface.[17] 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 the GHCC studies determined it to be adequate because less capability was needed under the modeled updated system conditions to eliminate criteria violations.

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

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) would be replaced by larger 1590-kcmil ACSS. The current carrying capacity of the larger conductors would enable them to accept the redistributed load without overheating.

[17] Although the geographic direction of the new line is northwest to southeast, it adds another 115-kV circuit to the network of lines in Central Connecticut that make up the WCT Import Interface. Refer to the discussion in Section 2.1.5.

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, ISO-NE 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 would 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 Connecticut General Statutes (CGS), transmission owners are required to file with the CSC periodic "Forecasts of Loads and Resources" (FLR) 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 description of the steps taken to upgrade existing facilities. The Company first advised the Council of ISO-NE's effort to develop "new and modified 115-kV and 345-kV transmission facilities [to] address reliability problems associated with the transfer of power from eastern Connecticut to Western Connecticut" in its 2006 report. In its 2007 report, the Company advised that it was evaluating transmission improvements in the

Greater Hartford Sub-area. Thereafter, the Company kept the Council advised through its FLR filings of the evolution of the CCRP and Greater Hartford projects, culminating with its report filed in March, 2015, in which it advised the Council of the completion of the GHCC studies, the Company's intended proposal of a new Newington to Southwest Hartford 115-kV circuit, and the planned replacement of CCRP by that new circuit. These improvements were shortly thereafter collectively designated as the GHCCRP. The Company continued to advise the Council of the status of the GHCCRP in its reports filed in 2016 and 2017.

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, Middletown and Southwest Connecticut sub-areas, and with the NEEWS studies. The Project would address violations of reliability criteria identified in these studies, and would assist Eversource in fulfilling its obligation to maintain the reliability of the Connecticut bulk transmission system in accordance with mandatory federal and regional standards and criteria. Moreover, the use of a hybrid overhead/underground line configuration, rather than the all-underground cable as originally contemplated, to connect the Newington and Southwest Hartford substations, represents a cost-effective solution that would benefit consumers.

3. TECHNICAL PROJECT SPECIFICATIONS

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

- The new 115-kV combined overhead and underground transmission line (designated by Eversource as the 1346 Line) along the Proposed Route between Newington Substation and Southwest Hartford Substation;
- Modifications to Eversource's existing Newington and Southwest Hartford substations; and
- Modifications to Eversource's existing 1783 Line connection into Newington Substation (Newington Tap).

The technical information provided for the Project includes:

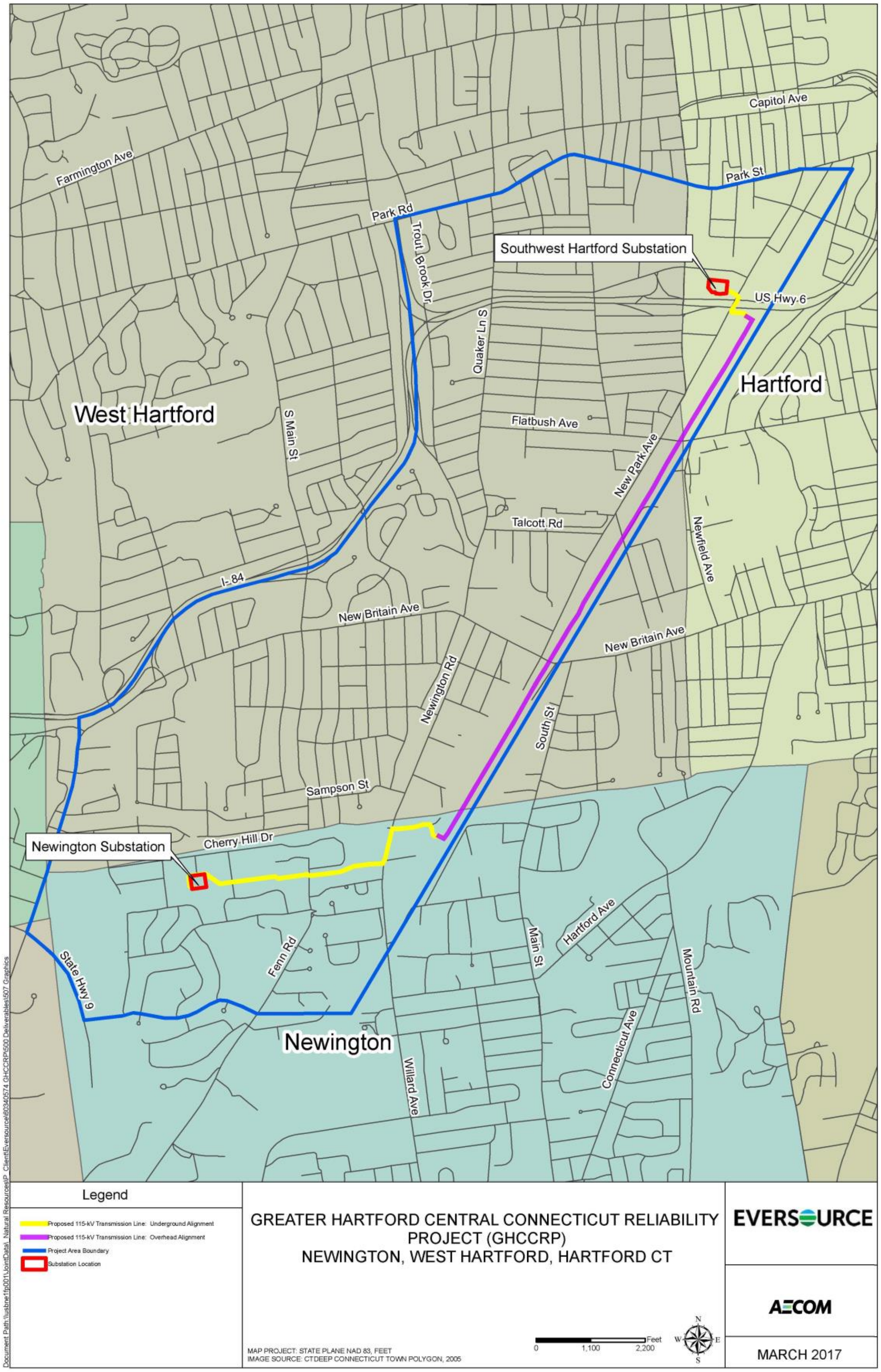
- Transmission line route length, by municipality, segment configuration (i.e., overhead and underground), and terminal points;
- Design voltages and capacities;
- Overhead transmission line design, appearance, proposed structure locations and heights;
- ROW and proposed access to the overhead segment of the transmission line route;
- Underground cable design, including conductor size and specifications;
- Splice vault design;
- ROWs and proposed access to the underground segments of the route;
- Substation connections and proposed modifications;
- Newington Tap modifications; and
- Estimated capital (construction) and life-cycle costs.

3.1 PROPOSED 115-KV TRANSMISSION LINE FACILITIES

3.1.1 Overview

The proposed 115-kV transmission line, which would extend for approximately 3.7 miles between Eversource's Newington and Southwest Hartford substations, would consist of both overhead (approximately 2.4 miles) and underground segments (approximately 1.3 miles). The Proposed Route would cross portions of Newington, West Hartford, and Hartford as depicted generally on Figure 3-1 and shown in more detail on the maps in Volume 3.

Figure 3-1: Proposed Route



Overall, the Proposed Route would traverse approximately 1.3 miles in the Town of Newington, 1.6 miles in the Town of West Hartford, and 0.7 mile in the City of Hartford (totals not exact due to rounding; refer to Table 3-1). Approximately 92% of the Proposed Route would be aligned within existing Eversource, Amtrak, or public road ROWs. The ROWs along which the proposed 115-kV line would be aligned are summarized, by municipality, as follows:

Table 3-1: Proposed 115-kV Line: Location Summary by Municipality

Route Length (Miles), Total and by Line Design	Transmission Line Design/ROW Location	
	Underground (UG)	**Overhead (OH)**
Newington		
<u>1.33 miles</u> 1.16 miles UG 0.17 mile OH	Newington Substation (Eversource property) to existing Eversource distribution line ROW between the substation and Willard Avenue (State Route 173) ROWs of Willard Avenue (State Route 173) and Shepard Drive Private property between the end of Shepard Drive and the CT*fastrak*/Amtrak ROW	Crosses the CT*fastrak* busway and two Amtrak rail lines Amtrak Rail ROW
West Hartford		
<u>1.64 miles</u> all OH	N/A	Amtrak ROW Short segment of additional easement adjacent to Amtrak ROW
Hartford		
<u>0.73 miles</u> 0.17 mile UG 0.56 mile OH	Private property south of I-84 between New Park Avenue and the Amtrak/CT*fastrak* ROW New Park Avenue road ROW to Southwest Hartford Substation (Eversource property)	Amtrak Rail ROW Crosses the CT*fastrak* busway and two Amtrak rail lines

Approximately 2.4 miles (65%) of the Proposed Route would be configured overhead, and aligned along the eastern portion of the Amtrak ROW. Amtrak has reviewed and approved an application for occupancy along its ROW, and Eversource is entering into a License Agreement with Amtrak that would provide sufficient rights to construct the Project. On each end of this segment, the overhead line would span the Amtrak/CT*fastrak* ROW to connect to transition structures on the west side of the ROW. At these transition structures, the line would change from an overhead conductor configuration to an underground cable configuration. Specifically, the overhead segment would extend from an underground-to-overhead transition structure in the parking lot of an industrial facility at the end of Shepard

Drive in the Town of Newington, and from there would span the Amtrak/CT*fastrak* ROW and extend north along the east side of the Amtrak ROW before turning west to span the rail lines and CT*fastrak* to a second transition structure planned for location on Amtrak property near the northeast corner of the Bow Tie Cinemas parking lot, south of the I-84 overpass in the City of Hartford.

The overhead portion of the route would consist of 51 galvanized steel monopoles in a vertical configuration carrying three sets of phase conductors, plus one Optical Ground Wire (OPGW). Structure foundations are expected to be direct embedded for tangent structures and drilled shaft (concrete) for strain and deadend structures. Braced-post suspension and I-string suspension insulator assemblies are expected to be used for tangent structures, while strain deadend insulator assemblies are expected to be used for strain and deadend structures. Structure locations along the Amtrak ROW have been and would continue to be reviewed by and approved by Amtrak.

Approximately 1.3 miles (35%) of the proposed transmission line would be configured underground. The underground cable segments would be located on the southern and northern portions of the Proposed Route, as follows:

- An approximately 1.1-mile segment of underground cable would extend from Newington Substation, east along Eversource's distribution line ROW, then north along State Route 173 (Willard Avenue), and east along Shepard Drive to the proposed transition structure just west of the Amtrak ROW. This underground segment would be located entirely within the Town of Newington.
- An approximately 0.2-mile segment of underground cable would be aligned from the transition structure to be located on Amtrak property near the Bow Tie Cinemas parking lot, across the northern portion of the cinema parking lot to New Park Avenue, north along New Park Avenue, and then west into Southwest Hartford Substation. This underground segment would be entirely within the City of Hartford.

The underground segments would consist of a single-circuit 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.

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 third fiber optic cable would be for distributed temperature sensing (DTS) to monitor the operating temperature of the cables.

The exact location of the cables and the splice vaults 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 or property (municipality, state, or private).

The final alignment of the 115-kV line, as determined based on final design and the results of the Council's proceedings, would be depicted in the Project's Development and Management (D&M) Plan.[18]

The proposed 115-kV transmission line 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.

3.1.2 Overhead Transmission Segment

This section describes the overhead transmission portion of the proposed new 115-kV line. More detailed transmission line design information would be provided in the Project's D&M Plan.

3.1.2.1 Proposed Overhead Line Design, Appearance, and Structure Heights

Based on preliminary design information, 51 new 115-kV structures would be located along the overhead segment, including 49 monopoles along the Amtrak ROW[19] and two transition structures, one on each end of the ROW segment. All but two of these 51 structures would be situated within the Amtrak ROW, on Amtrak property. Two structures (Transition Structure 11B in Newington and Structure 46 in West Hartford) would be located on private property adjacent to the Amtrak ROW. Eversource has initiated consultations with landowners of the properties on which these structures are proposed.

[18] 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 authorization to construct the Project.

[19] Proposed new structure numbers are those used in Eversource's coordination with Amtrak and thus begin at Structure 11B and end at Structure 61.

Typical structure heights for the new 115-kV line would range from approximately 95 to 110 feet. Figures 3-2 and 3-3 (located at the end of Section 3.1.2) provide representative cross-sections of the proposed monopole structures along the Amtrak ROW and transition structures, respectively; refer also to Volume 3 for cross-sections.

The new overhead 115-kV transmission line would consist of three phase conductors. Each phase conductor would be comprised of one 1,272-kcmil ACSS. This selection is a standard Eversource conductor utilized for new 115-kV line construction.

The new line would be protected by one overhead lightning shield wire. The overhead shield wire would contain optical glass fibers (i.e., OPGW) for communication purposes.

3.1.2.2 Proposed Structure Locations

Along the overhead line route segment, the preliminary location for each of the proposed transmission line structures was determined using transmission line design software (Power Line System's PLS-CADD™). The proposed structure locations are shown on the Plan and Profile Drawings and aerial-photography based maps in Volume 3.

In determining the line design along the Amtrak railroad ROW, Eversource recognized that standard overhead configurations, as used for structures placed on wider transmission line ROWs, could not be applied to the constrained work space within the Amtrak ROW. In addition, Eversource's transmission line design had to avoid impacts to the adjacent Amtrak railroad lines by locating structures as close to the eastern edge of ROW as possible and by confining potential wire blowout, to the extent possible, to the edge of ROW. Further, Amtrak requested that the design also account for the following:

- A future electrification catenary structure[20] line to the west of the proposed overhead 115-kV transmission line and east of the existing two railroad tracks. Figure 3-2 illustrates the potential location of catenary structures in relation to the existing railroad tracks and the proposed 115-kV transmission line.
- A future planned regional train station east of and adjacent to the tracks, just south of Flatbush Avenue in West Hartford.

[20] A catenary is a system of overhead structures and wires used to supply power to an electrified rail system.

- Where possible, provide room for a 10-foot-wide access road along the eastern portion of the ROW for Amtrak's use.[21]
- Where possible, maintain 18 feet from the center of easternmost railroad track to the face of each proposed transmission structure.

In order to accommodate these design requirements, the proposed 115-kV structures along the Amtrak ROW must be taller and more closely spaced than would be the case along a typical transmission line ROW. For example, as illustrated on the Volume 3 maps, most spans between the proposed structures along the Amtrak ROW would be approximately 250 to 300 feet. In comparison, along an existing, wider ROW, new 115-kV transmission structures would typically be shorter and spaced at 600- to 800-foot intervals.

Structure locations along the Amtrak ROW may be modified as the Project design process proceeds and coordination with Amtrak continues. For example, each proposed structure location would be further evaluated based on continued constructability studies. Future changes could occur based on information obtained from more detailed field studies (e.g., subsurface investigations, final engineering and constructability reviews), as well as input from municipalities, the Council, and other regulatory agencies.

After this additional information has been evaluated, final detailed line engineering would be performed to determine the exact locations of the new structures. Typically, the final structure locations are expected to be within 20 feet (longitudinally along the line) of the proposed structure locations, as depicted on the Volume 3, 100-scale maps.

3.1.2.3 ROW Requirements and Easement Acquisition

Along the proposed overhead segment of the new 115-kV transmission line, Amtrak's ROW varies in width from 86 feet to 155 feet, but typically is 93 to 115 feet wide. Amtrak has reviewed and approved Eversource's application for occupancy along its ROW, and Eversource is coordinating with Amtrak to finalize a license agreement that would provide sufficient rights to construct the Project within the ROW.

[21] An existing Amtrak access road extends along the portions of the Amtrak ROW, east of the eastern rail line (refer to Section 3.2.3.1 and the Volume 3 maps). Some areas of this access road may be affected by the proposed transmission line structures. In such locations, Eversource proposes to relocate the access road, if possible, within the Amtrak ROW. If not affected by the proposed transmission line structures, the access road would remain in place.

The CT*fastrak* and two Amtrak rail lines presently occupy the western and central portions of the Amtrak ROW. The two Amtrak rail lines provide primary rail service between New Haven, Hartford, and Springfield. The CT*fastrak* is a public transit system that utilizes a bus-only roadway and system bus routes. As part of its New Haven-Hartford-Springfield (NHHS) Rail Program,[22] Amtrak is in the process of upgrading the rail lines to improve service. In the future, Amtrak plans to install catenary structures within the ROW for electric train operations.

The CT*fastrak* extends along the western portion of the Amtrak ROW and occupies approximately 40 feet of the ROW. A 10-to 20-foot buffer separates the CT*fastrak* and Amtrak's two rail lines, which are located east of the busway and occupy approximately 30 feet. Within portions of the remaining 15-to-30-foot-wide ROW east of the railroad tracks, an Amtrak access road parallels the tracks. This access road, which varies in width from 10 to 15 feet, does not extend continuously along the Amtrak ROW in the Project area.

To construct and operate the new 115-kV line on the eastern portion of the ROW, Eversource would use/upgrade the existing Amtrak access road or locate access roads on the railroad ROW as needed, with Amtrak's approval. Access leading to the railroad ROW across private properties or via public roads also would be required in some locations.

Structure locations have been planned to avoid conflicts with Amtrak's future catenary structures and to make use of the available space within the Amtrak ROW. However, along a portion of railroad corridor southwest of Flatbush Avenue in West Hartford, the Amtrak ROW is only 86 feet wide and is too narrow to accommodate a proposed transmission line structure (Structure 46; refer to the Volume 3 maps).

As required for Structure 46 and if needed to accommodate a future railroad station, Eversource would acquire construction and permanent easements to avoid conflicts with Amtrak's plans for the station. Eversource would continue to coordinate with Amtrak to assure that the new transmission structures are aligned so as to avoid potential conflicts with Amtrak's future catenary structures, planned Flatbush Avenue railroad station, and existing access roads.

[22] Refer to Section 5.1.8.1 for a discussion of the NHHS Rail Program improvements.

Eversource would acquire an easement for the transmission line ROW and transition structure planned for location west of the Amtrak ROW on a private industrial site in Newington. The transition structure proposed near the Bow Tie Cinemas parking lot in Hartford would be on Amtrak property and thus would be installed in accordance with Eversource's license agreement with Amtrak.

Construction easements also may be required for off-ROW access roads or temporary staging areas. The need for such easement rights would be determined and identified in the Project's D&M Plan.

3.1.2.4 Access Road and Work Area Requirements

The Amtrak ROW is located in an urban area where access is readily available from existing public roads and potentially from adjacent commercial and industrial areas. In addition, access roads are already established along some portions of the Amtrak ROW for railroad maintenance purposes. Some of these existing access roads would have to be reconfigured or relocated to construct the proposed transmission line. To construct, operate, and maintain the new overhead 115-kV transmission segment adjacent to the Amtrak rail lines, contiguous access along the Amtrak ROW is not required and the existing access roads would be used to the extent practical.

However, during construction, temporary access to each new transmission structure location, as well as to pulling pads and guard structure (boom truck) sites, would be required. As a result, additional access roads must be established and most of the existing Amtrak on-ROW access roads would require improvements to allow the safe movement of the heavy construction equipment needed to install the new 115-kV line.

In addition, because of the limited space available within the Amtrak ROW for transmission line construction, Eversource anticipates that temporary material and equipment staging areas would be required at locations adjacent to or near structure work sites. Such temporary staging areas would be established at intervals along 2.4-mile overhead line segment and would be expected to be located in previously developed commercial or industrial sites (e.g., vacant lands, parking lots).

The locations and type of new access roads and access road improvements would depend on the presence of existing features/obstacles, access constraints, 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 (typically must be 10% or less) 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.

For this Project, any new access roads (if required) would typically have a 16-foot-wide travel way, with associated road shoulders of approximately 2 feet on either side. However, access road widths could vary depending on factors such as whether of grading (cutting and filling) is required and on whether a particular section of road must accommodate equipment turning radii.

At intersections with public roads, construction access roads would typically be wider to accommodate equipment turning radii. Access roads would be graveled or would consist of temporary construction (timber) mats or equivalent. In some locations, such as intersections with public roads, asphalt millings may be used to improve road stability and vehicle traction. Eversource would conduct a detailed evaluation of the access requirements for the Project as part of final design and would include such information in the Project D&M Plan.

Figure 3-2: Typical Configuration along Amtrak ROW

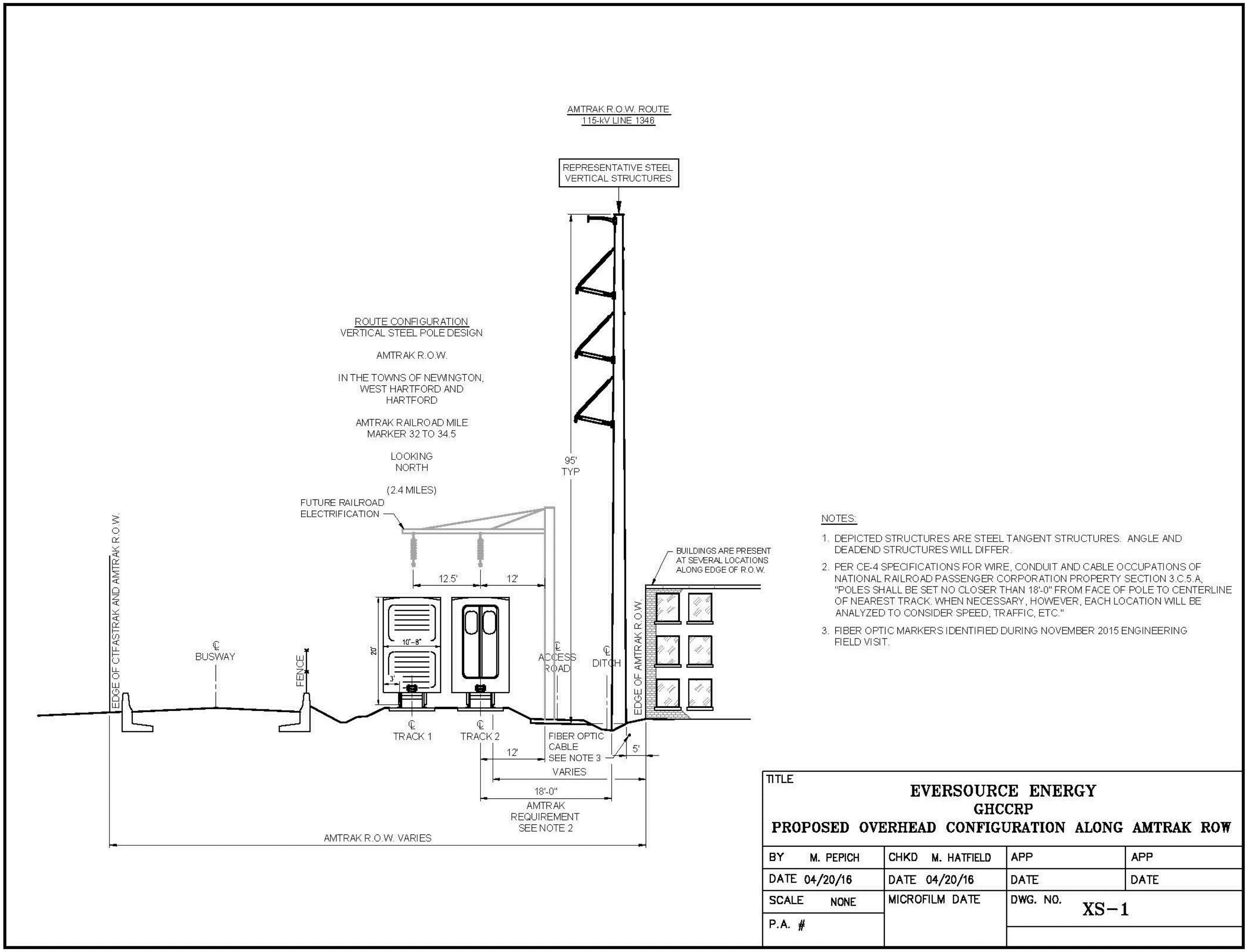


Figure 3-3: Typical Transition Structure Configuration

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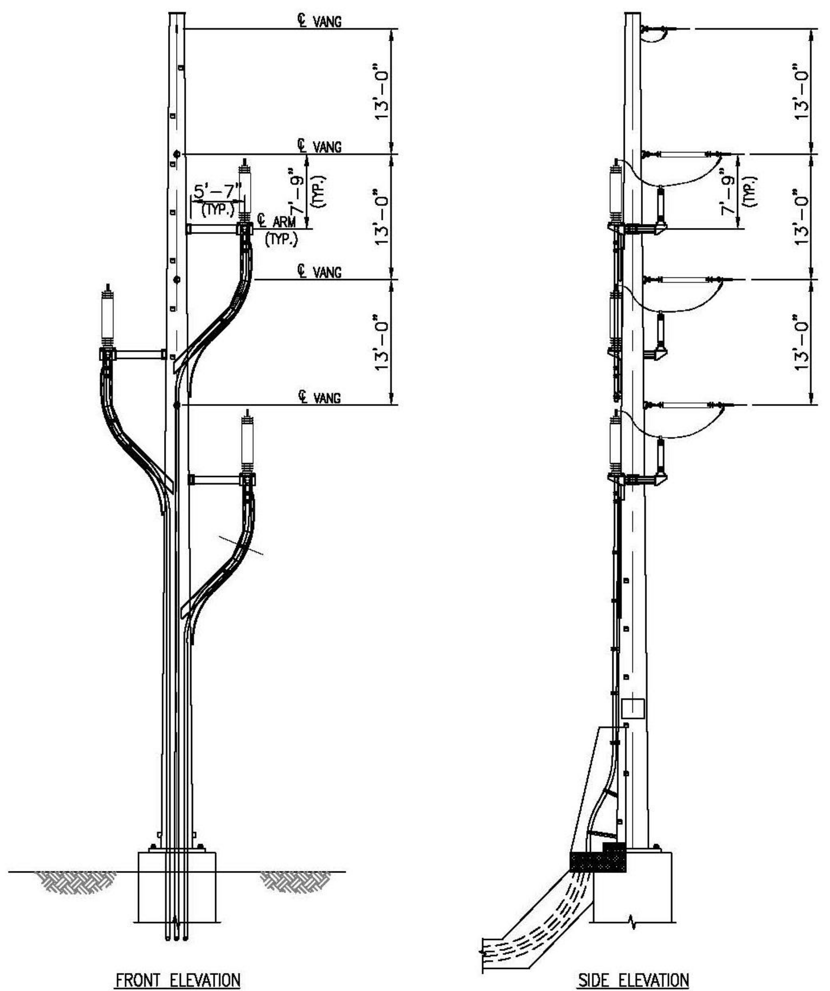


EVERSOURCE ENERGY

TITLE GHCCRP
PROPOSED TRANSITION STRUCTURE

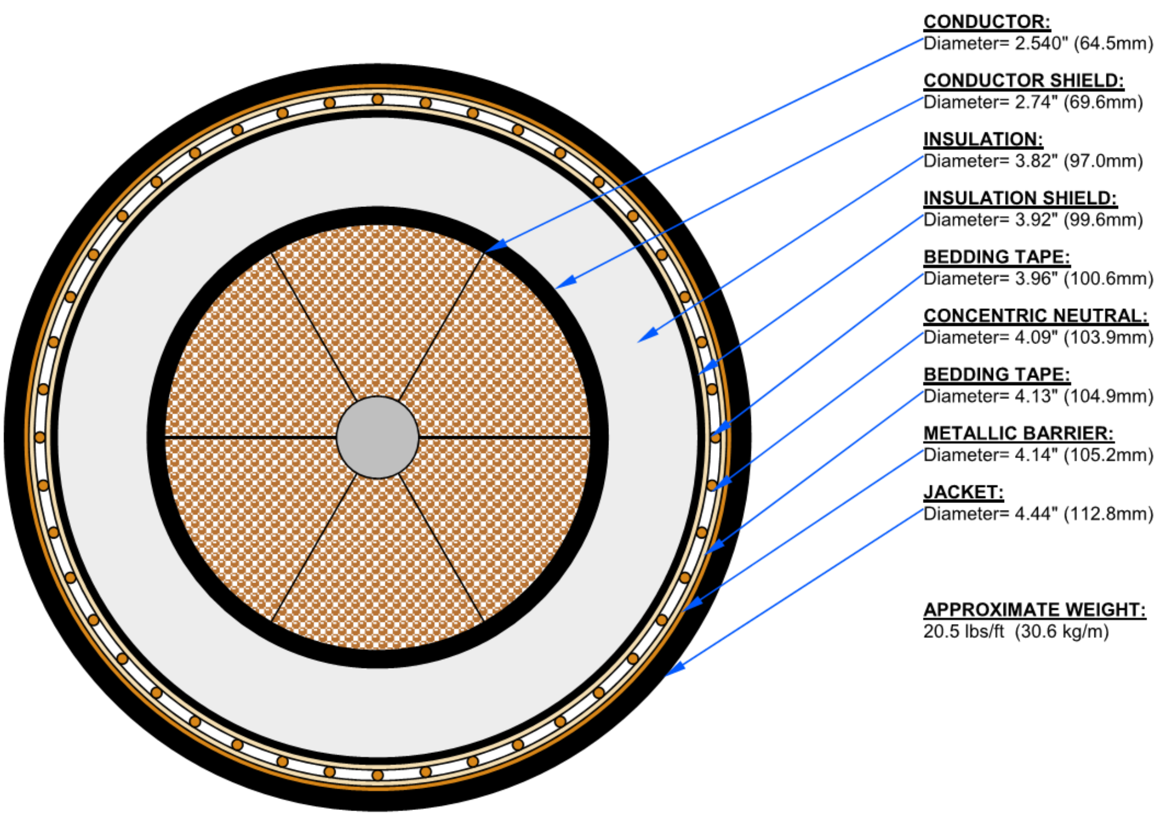
BY M. PEPICH	CHKD D. CAMPBELL	APP	APP
DATE 04/20/16	DATE 04/20/16	DATE	DATE
H-SCALE N.T.S.	SIZE A	FIELD BOOK & PAGES	
V-SCALE N.T.S.	V.S.	R.E. DWG	
R.E. PROJ. NUMBER		DWG NO. FOR REFERENCE	

3.1.3 Underground Transmission Segments

3.1.3.1 Proposed Cable System Design

For the two underground segments, the single-circuit 115-kV line 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 3-4 provides a cross-section of a typical 5000-kcmil copper conductor XLPE 115-kV cable. (Note: Figure 3-4 illustrates a specific cable design; the exact dimensions and construction of the cable used for this Project may vary slightly from the example shown, which should be considered representative.)

Figure 3-4: Typical 5000-kcmil Copper Conductor 115-kV Cable Cross-Section



In addition to the transmission line cable, two fiber-optic cables are required for remote protection and control of the cable system and associated equipment; a third fiber option cable would be 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.

3.1.3.2 Duct Bank and Splice Vault Specifications and Locations

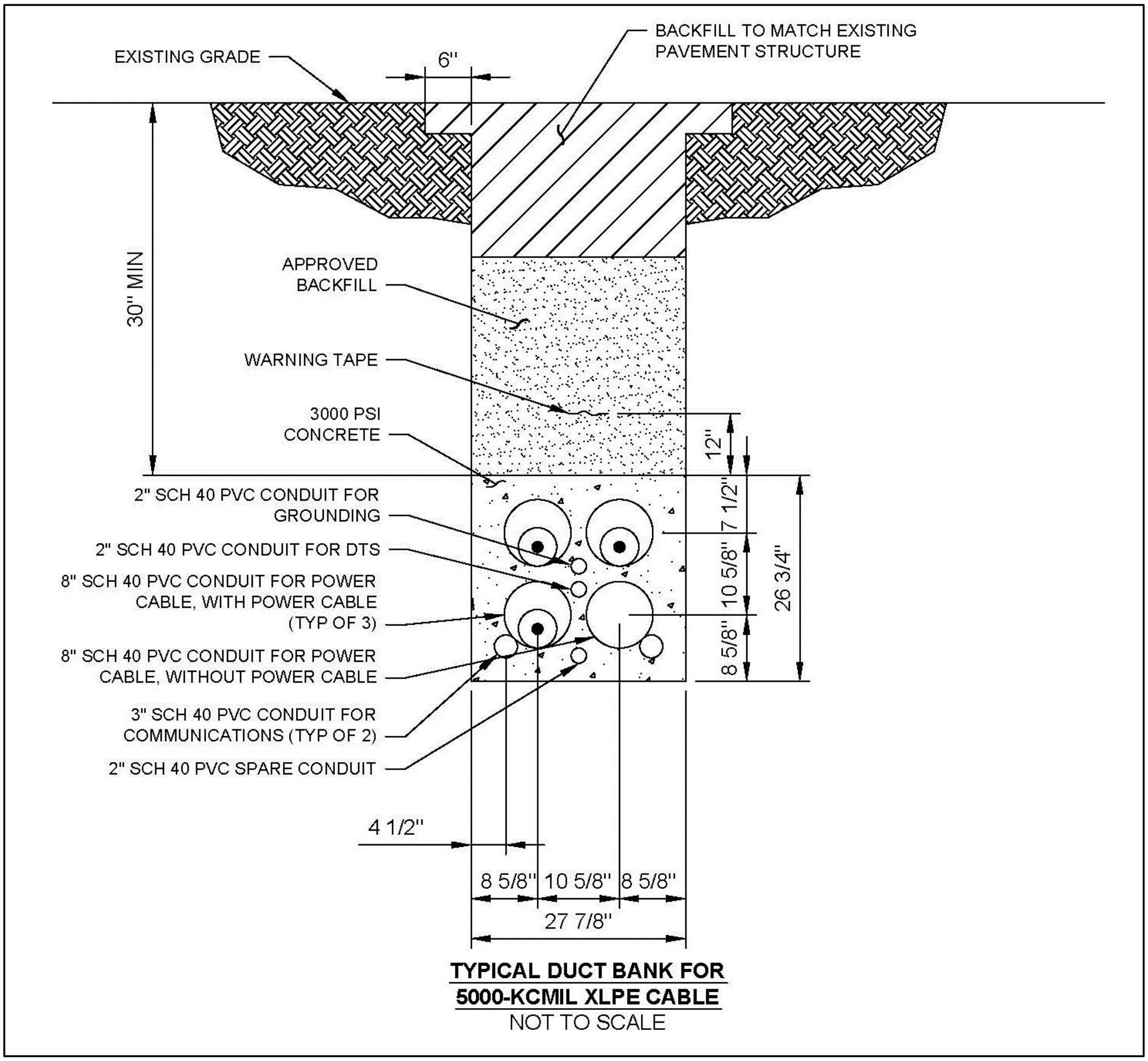
Duct Bank

Three electric cables would be installed in PVC ducts encased in concrete. Smaller conduits would be installed for the communications, temperature monitoring, and ground continuity cables. Figure 3-5 illustrates a typical underground duct back. The power cables would be installed one cable per duct. One duct would be a spare.

XLPE cables are designed to withstand water penetration by the use of a metallic barrier. In this case, the cable would 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, 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.

Figure 3-5: Typical Underground XLPE Cable Duct Bank Cross-Section



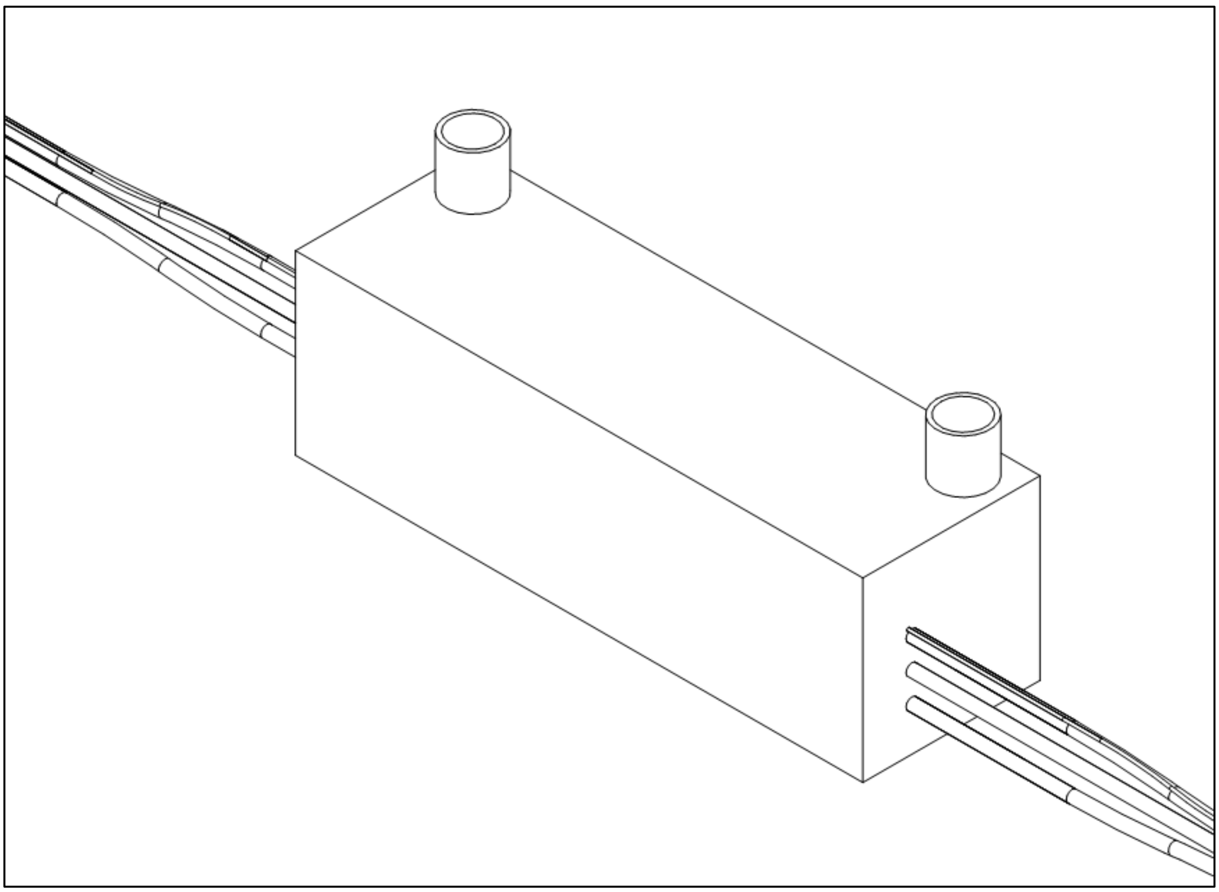
Splice Vaults

For the installation of a typical XLPE cable system, the 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 typically required at intervals of averaging approximately 1,800 feet to 2,000 feet along the cable route.

For this Project, taking into consideration the characteristics of the different ROWs along which the underground cable would be aligned and the availability of locations for access to splice vaults (for future maintenance), Eversource anticipates that vaults would be placed at approximately 1,100- to 2,200-foot intervals. Three vaults, all along the underground segment in Newington, would be required. The Volume 3 maps illustrate the preliminary locations of these splices vaults. No vaults would be required along the approximately 0.2-mile segment in Hartford.

The walls, floor, and roof of the splice vaults would be reinforced concrete. Figure 3-6 depicts a typical splice vault.

Figure 3-6: Typical Splice Vault



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.

3.1.3.3 ROW and Access Road/Work Area Requirements

The underground segments of the proposed transmission line would be located principally within Eversource's properties, Eversource's existing ROW, or along public road ROWs.

However, in certain areas, portions of the cable system (duct bank or splice vaults) must traverse private property (such as the private lands that the Proposed Route would cross between public road ROWs and the Amtrak ROW where the line transitions from underground to overhead). Furthermore, depending on the locations of underground utilities within public roads, it is possible that portions of the cable system would have to be situated outside of public road ROWs. In such locations, Eversource would negotiate a permanent easement with the private property owner.

The public road ROWs beneath which the underground line segments would be installed would afford ready access to the cable system. Thus, for the portions of the underground line segments located along roads and within parking areas, no access roads would be required to construct or operate the Project.

Access roads would be required to install the underground cable system along Eversource's ROW. Such access roads would be graveled or would consist of temporary construction (timber) mats or equivalent. In general, gravel would be used most commonly in constructing access roads in upland areas. Across the wetlands that must be crossed within the Eversource ROW, where only temporary (construction) access would be required, timber mats would typically be used. These mats would be removed upon the completion of construction. Refer to Section 4.3.1 for additional information regarding wetland crossings.

During construction, temporary staging areas and other construction support sites also would be established as needed within or adjacent to the proposed underground cable route. If not otherwise on Eversource property or existing easement areas, or within public ROWs, Eversource would obtain temporary easements from private landowners. These temporary staging areas would be identified as part of the D&M Plan process. During operation of the new 115-kV line, the splice vault manholes would provide access to the cables for maintenance and repair purposes.

3.2 PROPOSED SUBSTATION MODIFICATIONS

To connect the new 115-kV transmission line to the existing transmission system, modifications would be required at Eversource's existing Newington and Southwest Hartford substations. All of the substation modifications would be performed on Eversource property. In addition, adjacent to Newington Substation, Eversource proposes to modify the existing Newington Tap; such modifications also would be on Eversource property or ROWs.

The proposed Project modifications to Newington and Southwest Hartford substations would require expansion (on Eversource property) beyond the existing developed (fenced) areas of each station.

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

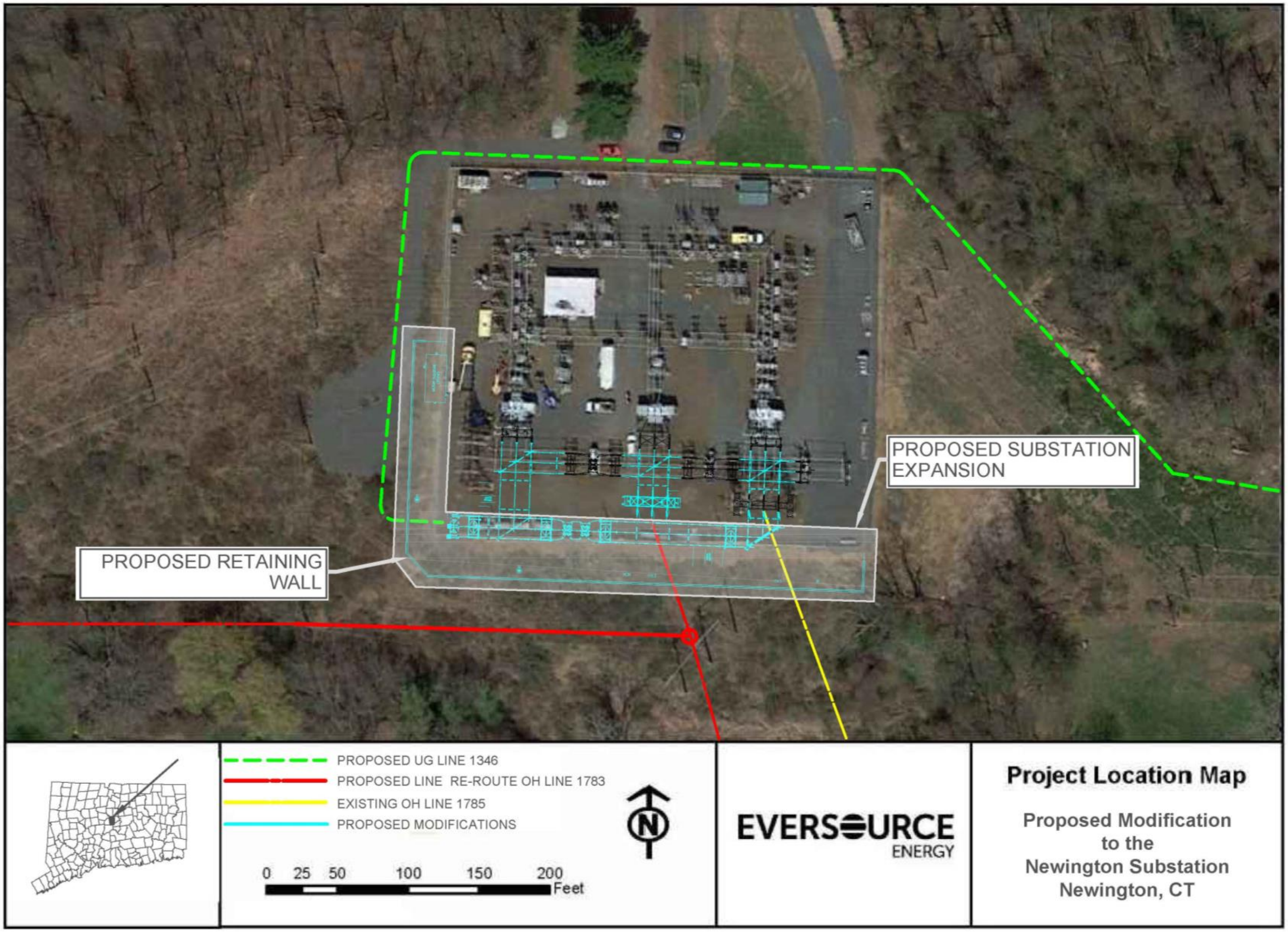
3.2.1 Newington Substation and Newington Tap

3.2.1.1 Substation Modifications

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 within the substation. A transformer connects to these two circuit breakers. Each of these existing 115-kV lines leaves the substation overhead.

To accommodate the modifications required to interconnect the new 115-kV transmission line (which would be configured underground at the substation exit), Eversource proposes to expand the substation by approximately 30 feet to the south. In addition, a 160-foot section of the substation's eastern fenced area would be expanded 30 feet to the east to provide space for the construction of a new battery enclosure. In total, the developed portion of the substation would be expanded by approximately 0.3 acre. Figure 3-7 illustrates the proposed Newington Substation modifications (refer also to Volume 3).

Figure 3-7: Newington Substation Modifications



For the Project modifications to Newington Substation, Eversource proposes to:

- Perform grading and evaluate drainage and storm water improvements to accommodate the substation modifications. A retaining wall also would be required on the southwest side of the substation in order to maintain grade for the expanded portion of the substation (refer to Volume 3).
- 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 would be relocated and one underground line terminal position would be new. One disconnect switch (per phase) would be installed on either side of the double-breaker assembly for operation and maintenance, and one additional disconnect switch would be installed in the ring bus for future maintenance.
- Construct a new control enclosure (approximately 32 feet by 14 feet for a total of about 700 square feet) to house protection and controls equipment. This enclosure would mainly house DC battery components.
- Connect the new 115-kV 1346 Line to the substation by utilizing the 1783 Line terminal position. The 1783 Line terminal would be relocated to the existing 2X bus position between the 1T and 2T breakers. The final configuration for each line terminal position would include one arrestor, one disconnect switch and one CCVT per phase.
- Construct the underground entry for the new 1346 Line with one pothead per phase to accommodate the underground to overhead transition within the substation yard. The height of this termination structure would be 16.5 feet, which is the approximate height of the existing bus. The line terminal position would include the installation of a new motor-operated disconnect switch. This three-phase disconnect switch would have a control and indication cable routed underground to the existing control enclosure. A new duct bank would be constructed within the substation for these control and indications cables, in addition to the duct bank that currently exists within the substation.
- Install a new terminal structure for the existing 1783 Line (Newington Tap) within the substation fence. The height of this structure would be approximately 70 feet and the transmission line phase conductors would be attached approximately 40 feet above the ground. The substation take-off structure would 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 would be tied to this grid using appropriate ground conductor. Foundation, conduit, and fence also would be grounded.

3.2.1.2 Newington Tap Modifications

As part of the Project, Eversource proposes to relocate and reconductor the Newington Tap, the 0.01-mile interconnection of the existing 115-kV 1783 Line into Newington Substation. The 1783 Line extends from Farmington Substation to East New Britain Substation and, in between these points, currently taps into the west side of Newington Substation, thereby allowing Newington Substation to feed both East New Britain and Farmington substations. Eversource proposes to relocate the tap from the west to the south side of the substation to accommodate the new 115-kV 1346 Line.

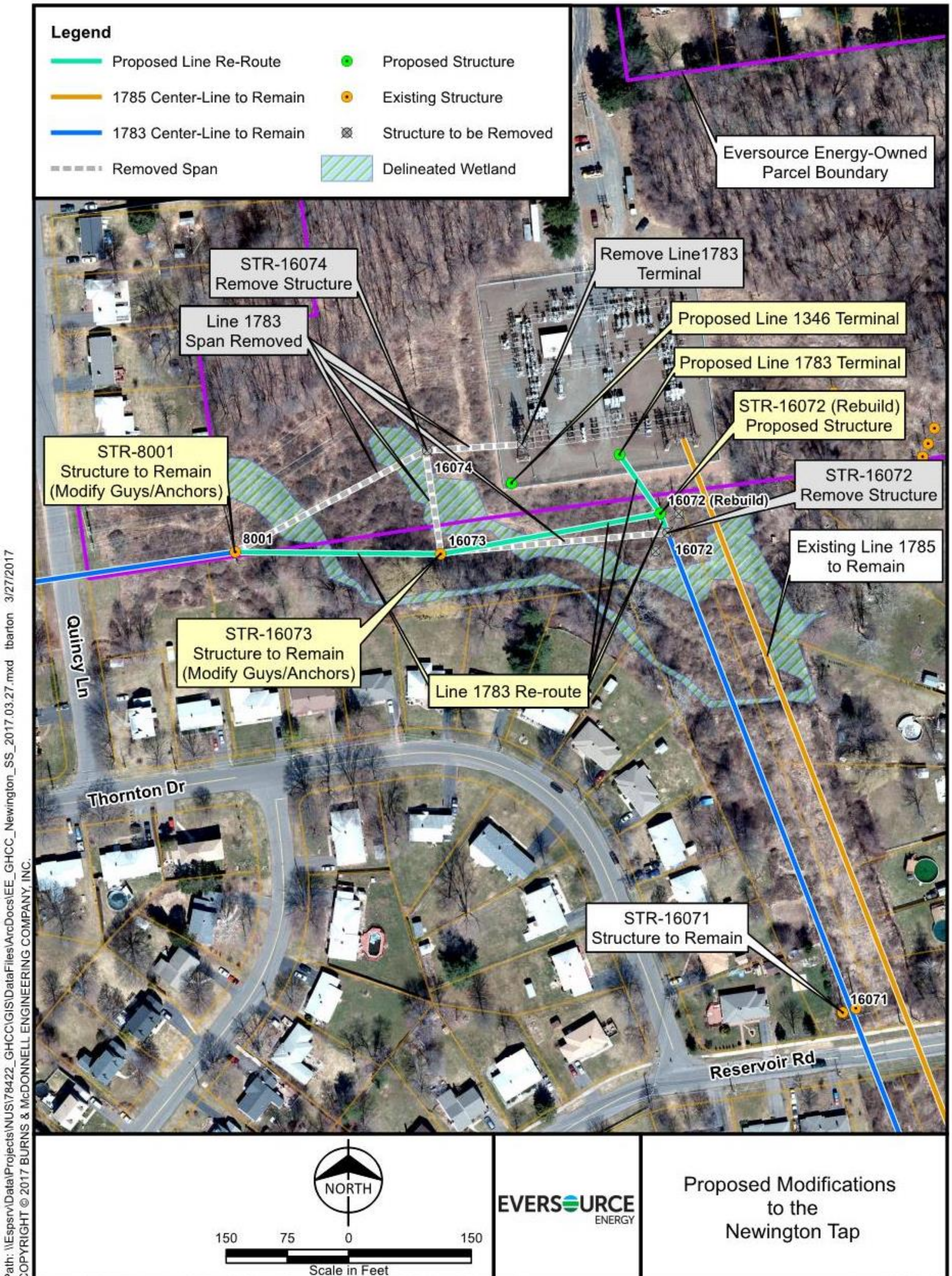
The modifications to Newington Tap would entail work both within the Newington Substation yard and within Eversource's existing transmission line ROWs located immediately adjacent to the substation.

In particular, the 1783 Line entry to the substation would be relocated from the current bay position on the west side of Newington Substation to a new bay position on the south side of the substation. To accomplish this modification, certain structures of the existing 1783 Line Tap would be removed or modified.

The proposed structure modifications include relocating guy and anchors, as well as replacing cross arms and cable support hardware. Structure 16072, a three-pole structure located south of the substation, would be removed and replaced with a new monopole structure in generally the same location.

The new structure would be approximately 30 feet taller than the existing structure to accommodate the line taps required to connect to the new bay position. This would also require vegetation removal to accommodate the relocation of the 1783 Line. Please refer to Figure 3-8 for a more detailed illustration of the proposed work at the Newington Tap.

Figure 3-8: Modifications to Newington Tap



Source: Aerial Photography (2009), AECOM wetland data and Burns & McDonnell Engineering.

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3.2.2 Southwest Hartford Substation

Southwest Hartford Substation is a 115- to 23-kV substation with two 115- to 23-kV transformers. Two Eversource 115-kV underground lines (the 1722 and 1704 lines) that connect to the substation are comprised of HPFF underground cable.[23] To interconnect the new 115-kV line to Southwest Hartford Substation, Eversource proposes to add the following facilities to the substation, which would require the expansion of the existing fenced area by approximately 65 feet to the east and the relocation of the existing access road and gates (refer to Figure 3-9 for a general illustration of the proposed substation modifications and to the Volume 3 maps and drawings for more specific information). Specifically, Eversource proposes to:

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

[23] HPFF cables (also referred to as "pipe type cables") were the most commonly used underground cable technologies in the past. Pipe type cable systems consist of three single core paper or laminated paper-polypropylene (LPP) insulated liquid-impregnated cables installed in a coated steel pipe. The pipe is pressurized to a nominal pressure of approximately 200 pounds per square inch.

Figure 3-9: Southwest Hartford Substation Modifications

3.3 ESTIMATED PROJECT COSTS

The estimated capital cost of the Project is approximately $61.1 million. Of this amount, transmission line costs are approximately $44.4 million (including $1.2 million for the Newington Tap) and substation modification costs are approximately $16.7 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 line is approximately $79 million.

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4. CONSTRUCTION AND OPERATION/MAINTENANCE PROCEDURES

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, the Public Utilities Regulatory Authority (PURA) approval of method and manner of construction; and in accordance with Eversource's specifications, best management practices, final engineering plans, and the conditions specified in permits and approvals obtained for the Project.

This section describes the procedures and methods that would be used to construct the overhead and underground segments of the proposed 115-kV transmission line and to perform the modifications to Newington Substation, Newington Tap, and Southwest Hartford Substation[24] (refer to Sections 4.1 through 4.5). Section 4.6 summarizes the D&M Plan process. Operation and maintenance procedures applicable to the new 115-kV transmission line and substation modifications are described in Section 4.7.

4.1 MATERIAL STAGING SITES AND FIELD OFFICES FOR PROJECT CONSTRUCTION

To construct the proposed Project facilities, construction field offices, temporary contractor yards, and material storage/staging areas would be required.

The material staging areas and field offices necessary to support the modifications to Newington Substation, the Newington Tap, and Southwest Hartford Substation are expected to be located on Eversource's property at each substation site. These areas, which may be situated on available space within each substation or on upland portions of the surrounding Eversource property, would be used to stage construction equipment and materials and park contractor vehicles. Temporary office trailers also may be deployed at each substation.

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[24] During Project construction, certain work activities and sequences may vary, based on factors such as site-specific conditions, final Project design, and the conditions of regulatory approvals. The procedures for overhead and underground transmission line construction are distinctly different and thus are discussed separately in Sections 4.2 and 4.3, respectively. Details regarding Project construction procedures would be provided in the Project D&M Plan.

To support the construction of the transmission line, a temporary contractor yard,[25] as well as other equipment/material staging, storage, and laydown support areas would be required in the vicinity of the Proposed Route. To the extent possible, these construction support areas would be sited on previously disturbed property (e.g., Eversource land, parking lots, and properties formerly used for other types of construction staging, such as highway or railroad work). Landowner permission and regulatory approvals (as appropriate) would be obtained for the temporary use of such sites.

Generally, a contractor yard, which can encompasses several acres, is typically used to store construction equipment, bulk materials (e.g., transmission structure components, cable conduits, 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.

Along the overhead transmission line segment, limited work space is available within the Amtrak ROW next to the active rail lines. As a result, Eversource anticipates that small staging areas may be established along the east side of the Amtrak ROW to provide additional temporary work space (e.g., to park construction equipment and store materials) as needed to support the overhead transmission line construction. Any such locations would be identified in the Project's D&M Plan.

To support the installation of the underground cable segments, smaller staging areas also may be established near active construction work sites. Such staging areas, which would be located along roads (e.g., within paved travel lanes, on road shoulders) or in parking lots, would be used temporarily to park equipment, place portable sanitary facilities, and store limited amounts of materials needed for cable system installation (e.g., trench boxes, backfill material). As construction progresses along the underground cable segments, 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 typically be restored to approximate pre-construction conditions or otherwise pursuant to landowner agreements.

[25] Eversource would typically select different construction contractors for the underground and overhead line segments. Each contractor would likely establish yards/support sites as needed to construct the Project.

The use and restoration of any staging sites (e.g., contractor yards, material storage and staging areas) would conform to conditions of the Council's approval and any other applicable regulatory requirements. Because the locations of some staging sites would not be finalized until construction contractors are selected for the Project, Eversource would either specify such sites in the D&M Plan or submit them separately to the Council for review and approval prior to use.

4.2 PROCEDURES FOR OVERHEAD TRANSMISSION LINE SEGMENT CONSTRUCTION

Eversource would construct the 2.4-mile overhead segment of the Project in accordance with the conditions of its license agreement with Amtrak, as well as with Company and industry specifications for overhead 115-kV lines.

4.2.1 Land Requirements for the Overhead Line Segment

The land requirements for the installation and operation of the overhead 115-kV transmission line segment are dictated by the width of the Amtrak ROW and the location of the proposed transmission structures, as well as by access and staging considerations. To construct the overhead portion of the line, Eversource would require some temporary construction easements and, depending on final survey, up to four permanent easements. The amount of additional property required varies with the location and Eversource is currently in discussions with all affected land owners regarding these easement requirements.

4.2.2 Overview of Construction Sequencing and Equipment Required

Eversource's license agreement with Amtrak[26] may specify certain non-standard construction methods and schedules, including the performance of Project activities during select night-time hours to avoid or minimize conflicts with rail operations.

[26] Eversource would continue to coordinate with Amtrak to finalize the design of and construction plans for the 115-kV transmission line segment; accordingly, Eversource anticipates that pre-construction planning studies, such as soil and groundwater testing and analyses, would be performed at structure sites within the Amtrak ROW as input to final design.

In general, however, the overhead transmission line would be constructed in several stages, some overlapping in time. The following summarizes the activities, materials, and equipment expected to be involved in the construction of the overhead transmission line segment:

- Survey and stake the proposed structure locations, ROW boundaries and monument line (where necessary), and the limited areas of clearing (as needed).
- Mark the boundaries of Trout Brook (the only watercourse crossing along the overhead line segment), and any other areas to be avoided or where mitigation measures are to be implemented.
- Establish a construction yard/field office, 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 would typically be, but are not limited to, the general vicinity of the Amtrak ROW.
- Perform vegetation clearing or mowing, where necessary. Vegetation removal is expected to be minimal as the entire Amtrak ROW is already cleared of tall-growing vegetation.
- Install erosion and sedimentation controls, as needed, in accordance with Amtrak specifications and (as appropriate to urban areas) Eversource's *Best Management Practices Manual for Massachusetts and Connecticut (Construction & Maintenance Environmental Requirements), September 2016* (BMPs, BMP Manual).
- Identify and if necessary, improve or construct, access to work sites along the ROW. Amtrak maintains an existing access road east of the railroad tracks, adjacent to portions of the Project's overhead segment. As part of its license agreement with Amtrak, Eversource anticipates that this access road, or other Amtrak access points, would be used for Project construction activities to the extent practical. With Amtrak approval, the existing railroad access roads may be upgraded (using gravel or timber mats) for Project construction. In addition, various public roads and private driveways and parking lots abut the Amtrak ROW; Eversource would investigate the use of such areas to provide access to Project work sites, if needed.
- Prepare level work (crane) pads as necessary at each proposed 115-kV structure site, as well as at conductor pulling sites, and (if necessary) at guard structure/boom truck sites[27]. Work pad installation may involve grading and requires the installation of a stable base (consisting of gravel, timber mats, or equivalent) for drilling and other structure installation equipment.
- Construct structure foundations and erect/assemble new structures. These activities require flat-bed trucks for hauling new structure components, new hardware, and augers, other trucks for hauling reinforcing rods, drill rigs, cranes, concrete trucks for

[27] Temporary guard structures or boom trucks with "bat wings" would be located at road and other crossings as a safety measure during conductor and OPGW installation.

structures that require concrete for foundations, dump trucks for structures that require crushed rock backfill, and bucket trucks. Dump trucks also would be needed for foundation work for the removal of excavated material from the ROW. If groundwater is encountered during foundation 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 regulatory requirements.

- Install counterpoise, where needed. Depending on site-specific soil conductivity, supplemental grounding would be installed.
- 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.
- Restore construction sites. Construction materials and debris would be removed from temporary access roads, work pads, and staging areas; such sites would then be re-graded or otherwise restored and stabilized. In the urban Project area, gravel or paving would typically be used for site restoration/stabilization. Construction debris would be removed from the Project area for proper disposal.
- Maintain temporary erosion and sediment controls until vegetation is re-established or disturbed areas are otherwise stabilized with gravel or paved. After site stabilization is achieved, all temporary erosion and sedimentation controls would be removed from construction sites and disposed of properly.

The equipment typically required for overhead transmission line construction is summarized in Table 4-1.

Table 4-1: Typical Construction Equipment for Overhead Segment Construction

Overhead Transmission Line Construction Activity	Typical Equipment
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 and Activities	• Vehicles to transport personnel. • Trucks to haul sanitary and solid wastes from construction sites. • Pickup trucks for supplies and to install erosion/sedimentation controls
Vegetation Clearing	• Mowing equipment, brush hogs, skidders, bucket trucks for canopy trimming • Chain saws • Wood chippers, tree shears, flatbed trucks
Access Road/Work Pad Construction	• Bulldozers, front loaders, excavators. • Mat installers, dump trucks
Structure Foundations/Installation	• Flatbed trucks, drill rigs, cranes, concrete trucks, dump trucks, bucket trucks • Helicopters (potentially) for conductor installation • Conductor reels, conductor pulling and tensioner rigs, bucket trucks • Ditch witch (counterpoise installation)
ROW Restoration	• Backhoes, trucks

4.2.3 Right-of-Way Preparation, Access Roads, and Work Pads

ROW preparation, which constitutes the first step in the transmission line construction process, typically involves vegetation removal (where necessary) and access road construction or improvement. In addition, during this phase of construction, exclusion fencing or other types of boundary markings are typically installed to demarcate areas of restricted construction access or environmental/land use sensitivity. Erosion and sedimentation controls also would be deployed, as needed based on site-specific requirements.

4.2.3.1 Access Roads

Access to each transmission structure site would be required during construction. However, because of the need to maintain railroad service and the narrow width of the Amtrak ROW in general, continuous access within the railroad corridor would not be possible. The existing Amtrak access road that is aligned east of and parallel to the railroad tracks would be used for construction to the extent practical, as would other existing access presently used by Amtrak for rail line maintenance. Eversource would coordinate with Amtrak to determine the existing access that could be used during the transmission line construction.

Where no access road is available to a specific structure location within the Amtrak ROW, Eversource would identify appropriate access to work sites from public road crossings or from properties adjoining the railroad corridor. Such access may include travel along private roads, through the parking areas of commercial/industrial facilities that border the Amtrak ROW, or the creation of new access. Access to the transition structures on either end of the overhead line segment would be via public roads and the parking areas of commercial/industrial facilities that border the Amtrak ROW. Eversource would negotiate appropriate easements for access across private properties.

The existing Amtrak access roads may need to be improved, widened, or otherwise modified for use during the 115-kV transmission line construction. For example, to safely support the heavy construction equipment (e.g., flat-bed trailers, cranes, drill rigs, and concrete trucks) required to install the 115-kV transmission line foundations and structures, access roads must be sufficiently wide, with a stable base and grades that typically must be 10% or less.

Depending on site-specific conditions, grading may be required to develop or to improve access roads. Access road improvements typically would include widening roads as needed to provide a minimal travel surface approximately 16 feet wide with 2-foot-wide shoulders on either side (additional width would be needed at turning or passing locations). Access roads would be graveled.

Typically, at points of intersection with public roads or other public spaces (e.g., parking lots), Eversource would install signs along the access roads that specify the roads are for construction purposes and are restricted from use by public vehicular traffic. In addition, where Project access roads intersect with public roads, rock aprons or equivalent would typically be installed to minimize tracking of dirt from construction equipment onto the public road. Public roads in the vicinity of access roads may also be periodically swept to remove dirt that is tracked from construction activities.

As planning for the Project continues, the specific locations of proposed construction access roads (both on Amtrak-owned land and on adjacent properties) would be identified. Such access roads would be illustrated in the Project D&M Plan.

4.2.3.2 Work Pads

Level areas (i.e., work pads) would be required at each transmission line structure site, as well as at conductor and OPGW pulling sites (if not collocated with the structure work pads) and at locations where temporary equipment (boom trucks) must be placed at road and other crossings during conductor and OPGW installation. These work pads would be used to provide a safe, level work base for construction equipment to install structure foundations and erect the structures; in addition, work pads would be used to stage structure components for final on-site assembly.

At the proposed transition structure location in a paved/gravel parking area in Newington, no work pad would likely be needed since construction equipment could safely operate on the level pavement/gravel; however, a work pad would be required for the transition structure site in Hartford, which is located in a lawn area near the movie theater parking lot. Similarly, along the Amtrak ROW where there is a stable gravel base from which the transmission line construction equipment can operate, work pads also may not be required. However, the installation of the proposed 115-kV line within the comparatively narrow space along Amtrak ROW represents an atypical situation and poses certain constraints for the use of typically-sized 115-kV line work pads. As a result, with Amtrak's approval, all unoccupied portions of the Amtrak ROW may be used during the construction of the overhead line segment.

The specific locations and configurations of work pads would be determined during final Project design and coordinated with Amtrak. In general, however, work pads for the line construction along the Amtrak ROW are expected to range from 3,000 to 5,000 square feet for tangent structures and 10,000 to 20,000 square feet for angle and deadened structures. Work pads would be sized to accommodate the equipment required to excavate the structure foundations, install the transmission line structures, and string conductor.

Pulling pads, which would be required in certain locations along the Amtrak ROW for conductor and OPGW installation, would be designed in accordance with Eversource requirements, factoring in the constraints posed by the width of the Amtrak ROW. The exact locations and configurations of pulling pads (which may be collocated with structure work pads) would be determined during final Project design. (Refer to Section 4.2.5 for a discussion on how pulling pads are located.)

During conductor and OPGW installation, temporary work space to accommodate a boom truck with arms (which would serve as a "guard" to prevent the conductors and OPGW from sagging or reaching the ground) would be required at road crossings, as well as the overhead line crossings of the Amtrak rail lines and CT*fastrak* busway. Typically, such temporary guard equipment work space is estimated to be approximately 50 feet by 80 feet.

Final work pad locations would be illustrated on the Project's D&M Plan maps.

4.2.4 Foundations and Structure Installation

4.2.4.1 Foundation Work (Foundation Types and Excavation)

The proposed 115-kV transmission line structures would be either direct embed or supported on drilled shaft foundations. Tangent structures would typically be direct embedded. Angle, deadend, and transition structures would typically have a drilled shaft foundation. Excavations for line-structure foundations are expected to be accomplished using mechanical excavators (drill rigs) and pneumatic hammers. During non-working hours, fencing or other Amtrak-approved barricades would be placed around or over open foundation excavations for structures.

Blasting is not expected to be required to install the new 115-kV structures. However, if site-specific subsurface conditions (as determined by borings) warrant the use of blasting, a controlled drilling and blasting plan would be developed by a certified blasting contractor in conformance with Amtrak approval and procedures, and in compliance with state and local regulations. Owners of nearby properties would be contacted in advance of the blasting, and pre-blast surveys would be performed as appropriate. (Refer to Section 4.4.2 for details regarding blasting protocols.)

4.2.4.2 Structure Assembly and Placement

The transmission line structures would be delivered to staging areas/work pads in sections, then assembled, and installed using a crane. Insulators and connecting hardware would be installed on most structures at this time. Supplemental grounding also would be installed, as needed, on the structures. Such grounding would consist of a ground ring and sometimes counterpoise (i.e., buried conductors). The type of grounding at each structure would depend on the electrical characteristics of the soil and additional grounding requirements (if any) specified by Amtrak.

4.2.5 Conductor Work

The installation of overhead line conductors and shield wires requires the use of special pulling and tensioning equipment, which would be positioned at pre-determined locations along the overhead transmission line segment. Helicopters also may be used to install the initial pulling lines at the commencement of the conductor/shield wire pulling processes.

The wires would be pulled under tension to avoid contacting the ground and other objects. The insulators and hardware would then be installed at angle and deadend structures. Finally, in accordance with industry standards and design specifications, the conductors and shield wires would be pulled to their design tensions and attached to the hardware by linemen in bucket trucks.

The selection of conductor pulling sites would be based on a variety of factors, including: accessibility, angles within the line sections where the conductors would be pulled, the locations of deadend structures (which keep installed conductors under high tension), the length of conductors and OPGW to be pulled, puller capacity, and snub structure[28] loads. Other considerations include the placement of pullers, tensioners, conductor anchors, and other associated pulling equipment, including the installation of a temporary grounding system. Conductor pulling sites would be determined based on the consideration of these factors, the design load of the structures, and the avoidance or minimization of environmental effects. Specific pulling sites would be identified during the preparation of the D&M Plan and would be confirmed by the Project construction contractor, in consultation with Eversource.

4.2.6 Cleanup and Restoration

After the installation of the new 115-kV line facilities, cleanup and restoration activities would include the removal of any remaining construction debris, signs, flagging, fencing, temporary access roads, and temporary work pads. Areas affected by construction within the Amtrak ROW would be restored or – in the case of improvements to access roads – left in place pursuant to Eversource's license agreement with Amtrak. Typically, areas affected by construction would be re-graded if necessary and re-stabilized using gravel (or equivalent), paving, or seeding. Temporary erosion and sedimentation controls would remain in place, where needed, until stabilization is achieved.

4.2.7 Transportation Considerations

The overhead line segment would be constructed to minimize the potential for disruption to transportation along the CT*fastrak*, local roads, and the Amtrak rail lines. Construction activities along the Amtrak railroad corridor would be performed, pursuant to Eversource's license agreement with Amtrak, when rail traffic is limited, when construction would not impact rail operations, or when the rail lines could be taken out of service temporarily. Such hours also would be expected to coincide with periods of non-peak use of the CT*fastrak* and of lower traffic volumes on local roads in the Project vicinity. Due to these schedule restrictions and the phasing of construction work, Project-related traffic movements are not expected to significantly affect transportation patterns or levels of service on public roads.

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[28] A structure located at one end of a sag section and considered as a zero point for sagging and clipping offset calculations. A snub is a pole stub or log that is set or buried in the ground to serve as a temporary anchor. Snubs are often used at pull and tension sites.

During the Project construction phase, vehicles and equipment would enter and exit the Amtrak ROW and adjacent transition structure work sites from various public roads. To safely move construction vehicles and equipment to and from work sites while minimizing disruptions to vehicular traffic along public roads, Eversource or its Project contractor would, as appropriate, work with representatives of Amtrak, ConnDOT, and the affected municipalities. Eversource's construction contractor would be responsible for posting and maintaining construction warning signs along public roads near work sites and for coordinating the use of flaggers to direct traffic, as necessary.

Overall, the construction and operation of the proposed overhead 115-kV line along the Amtrak ROW would not affect the existing or future plans for bus and rail transportation. The Proposed Route for the overhead segment was specifically selected, in consultations with Amtrak and ConnDOT representatives, to avoid impacts to the CT*fastrak* busway and to Amtrak's existing and planned rail facilities. Eversource would coordinate the schedule for construction along the railroad corridor with Amtrak and would hire Amtrak-approved flaggers or other comparably-trained personnel to be present during construction along the Amtrak ROW, as needed.

In addition to the main two Amtrak rail lines, several spur railroad tracks extend east from the Amtrak ROW to service industrial businesses (refer to the Volume 3 maps). Eversource would consult with representatives of Amtrak and the businesses that use these spur rail lines in order to plan and coordinate construction activities to avoid or minimize impacts to the spur railroad tracks and to maintain service to the rail customers.

4.3 PROCEDURES FOR UNDERGROUND TRANSMISSION CABLE SEGMENT CONSTRUCTION

The two proposed 115-kV underground transmission cable segments,[29] totaling approximately 1.3 miles (approximately 1.16 miles in Newington and 0.17 mile in Hartford), would be constructed principally within Eversource's existing ROW, along public roads, or beneath commercial/industrial paved parking lots or driveways. These linear corridors provide ready access for cable system construction and maintenance.

[29] Three fiber optic conduits also will be installed per segment.

As discussed in Section 3 and illustrated on the Volume 3 maps, three splice vaults would be required along the cable system. All three of these vaults would be located along the underground segment in Newington; two would be on Eversource property, while the third would be situated along Shepard Drive. No vaults would be needed along the short underground cable segment in Hartford.

4.3.1 Land Requirements for the Cable Segments

The land requirements for the installation and operation of the underground 115-kV transmission line segments are dictated by the required dimensions of the cable trench and splice vaults, as well as by land use considerations. Eversource proposes to install the underground cable segments within three principal areas:

- Eversource's existing ROW between Newington Substation and State Route 173 (Willard Avenue);
- Along public road ROWs; and
- Within private commercial/industrial parking lots and/or driveways.

The amount of land required for construction would vary slightly, depending on whether the cable system is aligned within or along paved areas (where equipment access is available) or along the Eversource ROW (where access roads must be established for construction). Additional construction work space would be required at each of the three splice vault locations. Table 4-2 summarizes typical cable system work space requirements.

The underground cable system would consist of an XLPE cable with splice vaults at intervals as required. An XLPE cable trench typically requires an excavation of 6-10 feet deep and about 5 feet wide.

The outside dimensions of the pre-cast 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, depending 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, particularly along road ROWs, would be based on factors such as the avoidance of other buried utilities).

The exact location of the duct bank and the splice vaults would be determined based on final engineering design, taking into consideration the constraints posed by existing buried utilities and the location of other physical features. However, in general, the land required for the construction and operation of the underground segments of the transmission line would be as summarized in Table 4-2.

Table 4-2: Land Requirements for Underground Cable Segments

Anticipated Construction Requirement	Proposed Cable System Location	
	Within/along Road ROWs or Paved Parking Areas, Driveways	Within Eversource ROW
Duct Bank Work Space	Minimum work space width of 30 feet is typically required to accommodate cable trench excavation, equipment, and materials/equipment staging	Minimum work space width of approximately 40 feet to accommodate cable trench excavation, construction access road, temporary spoil storage (as needed), and staging (refer to the Volume 3 maps). To provide electrical clearance necessary for the construction equipment to operate safely, some temporary modifications to the existing overhead distribution lines would be necessary. These modifications involve the temporary relocation of one distribution line on the southern pole line to the northern pole line. To facilitate this temporary relocation, overhead insulated conductors would be used for the relocated circuit to reduce clearances and make the installation possible. Some additional work space would be required to accomplish this relocation (refer to the Volume 3 maps).
Splice Vault Work Space	Excavation area approximately 12 feet wide, 12 feet deep, and 28 feet long. Additional areas as required for equipment and material staging and storage. The splice vault along Shepard Drive would optimally be located within the public road ROW (i.e., paved road or road shoulder). However, depending on the location of existing utilities buried beneath the road, the vault may need to be located outside of the road ROW.	Same as for within paved areas. However, the two vaults would be located within Eversource property, where there are no existing buried utilities.
Coordination Regarding Underground Cable Segment	Consultations with owners of underground and overhead utilities along roads; Newington and Hartford* Department of Public Works (DPW) representatives and ConnDOT (for location along State Route 173 in Newington); private landowners in areas where permanent or temporary easements are required.	Coordination with Newington DPW regarding installation of cable beneath local road crossings; Eversource Distribution regarding temporary line relocations; landowners along portions of ROW where Eversource has an easement (instead of fee-ownership). A small area of additional easement also may be required, west of Willard Avenue.

* The underground cable segments are located only in Newington and Hartford.

4.3.2 Overview of Construction Sequencing and Equipment Required

The following typical construction activities would be performed to install the underground cable segments of the new 115-kV line (certain activities would apply only to specific portions of the underground segments):

- Perform pre-construction planning (e.g., locate underground utilities, perform soil and groundwater testing) as needed to finalize the underground cable design and location.
- Establish traffic control procedures to minimize traffic disruption and provide a safe working environment (for cable installation in or adjacent to roads, or that otherwise involves construction activities that would impact traffic on roads).
- Remove vegetation, where necessary. Vegetation removal (tree and brush clearing, mowing, and side tree trimming) would be required particularly along the Eversource ROW, but may be performed as necessary to provide access for equipment along paved areas.
- Establish a construction access road, as needed, along the Eversource ROW.
- Relocate (temporarily) the distribution lines within the Eversource ROW.
- Install splice vaults.
  - Excavate for splice vaults. For the vault located along Shepard Drive, pavement saw cutting and removal would be performed as needed.
  - Install pre-cast splice vaults.
  - Backfill over top of the splice vaults with excavated spoils and/or other approved material.
  - Repave or restore disturbed areas.
- Construct duct bank system.
  - Excavate trench, including saw cutting and pavement removal for location in roads or other paved areas.
  - Install conduits in trench.
  - Encase the conduits in concrete.
  - Backfill trench with excavated spoils and/or other approved material. Other approved material may include a concrete-like substance known as a fluidized thermal backfill (FTB).
  - Repave or restore disturbed areas.
- Install cable system.
  - Pull the cables into the conduits.
  - Splice the cables within the splice vaults or terminate cables at substations.

- Return the temporarily-relocated Eversource distribution lines to permanent configuration along the Eversource ROW.
- Remove temporary access roads.
- Complete any remaining site restoration work (e.g., pave affected road ROWs and parking lots; revegetate non-paved or graveled areas, such as those along the Eversource ROW).

The equipment typically required for the installation of underground cable systems is listed, by construction phase, in Table 4-3.

Table 4-3: Typical Construction Equipment for Cable System Construction

Cable Construction Activity	Typical Equipment
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 and Activities	• Vehicles to transport personnel. • Trucks to haul sanitary and solid wastes from construction sites. • Pickup trucks for supplies.
Earth Work	• Saw cutting 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, pick-up and flatbed trucks to deliver and install landscape plantings (if required).

The specific sequence in which some of the cable system construction activities would be performed would depend on site-specific factors and construction scheduling. Underground cable installation activities are discussed in more detail in the following subsections.

4.3.3 Pre-Construction Planning (for Final Design)

As input to the final design of the underground cable segments, Eversource would complete pre-construction planning activities, including the performance of site-specific studies and consultations with the involved municipalities, ConnDOT, and private property owners. 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 segments 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 underground cable segments and prepare plans for soil and groundwater handling during construction.

The results of these pre-construction consultations and studies would be used to refine the design of and plans for the underground cable system construction. The resulting information would be reflected in the Project D&M Plan.

4.3.4 Work Area Preparation and Access

The first steps in the underground cable construction process would be to remove vegetation where required (particularly along the Eversource ROW); establish access roads, where required; and deploy appropriate erosion and sedimentation controls (e.g., catch basin protection, silt fence/straw or hay bales) at locations where pavement or soils would be disturbed. Construction of the Project would conform to Eversource's BMP Manual and any Project-specific siting and regulatory conditions.

Where the cable system route extends along roads or through parking lots, the existing paved areas would provide access for construction.

Along the Eversource ROW, access roads would need to be established to provide ingress and egress to work sites from public roads. These on-ROW access roads typically would be approximately 16 feet wide with 2-foot-wide shoulders on either side. Through wetland areas along the Eversource ROW, access roads would be temporary and would be constructed using timber mats. In upland areas, access roads would typically be graveled and – on Eversource properties – may be constructed to provide permanent access to the underground line segment.

Along the cable segment within the Eversource ROW, after vegetation removal and access road installation, topsoil would be removed, as needed,[30] from the cable trench and splice vault excavation areas. Topsoil would be stockpiled separately for future use during restoration.

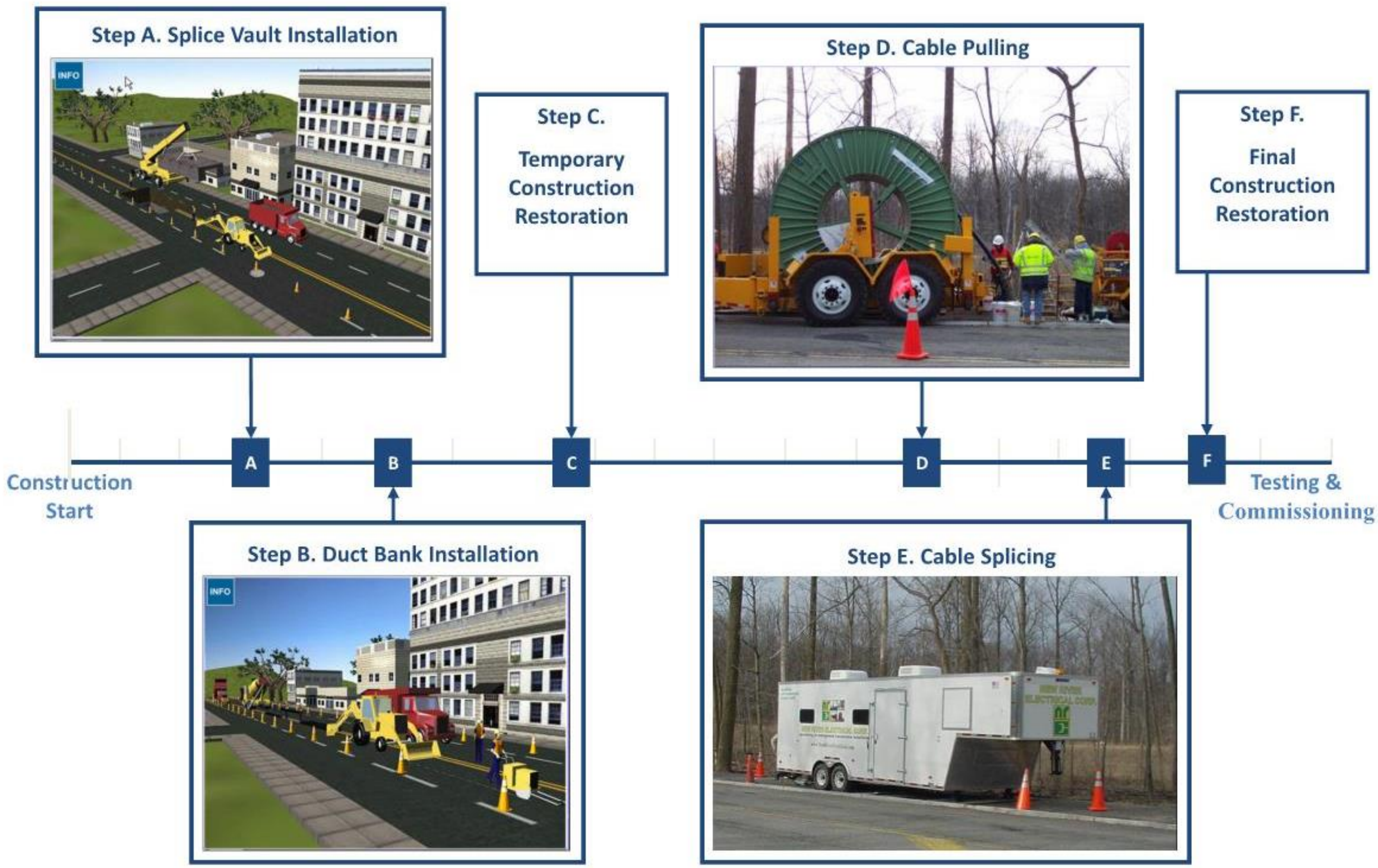
4.3.5 Duct Bank, Splice Vault, and Cable Installation

Along the cable segments within roads and other paved areas, the initial step in preparing for the duct bank and splice vault excavations would be to saw cut and remove pavement. Figure 4-1 illustrates the typical construction activities for installing a cable segment within paved areas.

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 transported to either a suitable disposal site or a temporary storage site. At the temporary storage site, materials would be screened/tested prior to final off-site disposal or to re-use as backfill in the cable system excavations. 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, wetland filter bags, temporary holding tanks (frac tanks), or vacuum trucks.

[30] Eversource anticipates that topsoil would be stripped and stockpiled where the cable route crosses wetlands and lawns.

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



At three locations,[31] pre-cast concrete splice vaults would be installed below ground. Each vault would have two entry points, via manholes, to the surface. After the area above a splice vault is backfilled and restored, only the manhole covers would be visible; these covers would be set flush with the ground or road surface.

The cable duct bank system would be installed between splice vaults, or between splice vaults and cable termination points. 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, FTB, or other approved material with sufficient thermal characteristics to help dissipate the heat generated by the cables. Refer to Figure 3-5 for a cross-section of this installation.

Trenching, conduit installation, and backfilling would proceed in a similar fashion along the portions of the underground cable system both within the Eversource ROW and along paved areas. In general, specialized construction crews would proceed progressively along the cable route 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. Similar plates may be installed over open trench areas in paved parking areas; alternatively, temporary fencing may be erected around such locations if traffic flow does not need to be maintained. After backfilling, the trench area would be restored or repaved using a temporary asphalt patch or equivalent. Disturbed areas would be permanently repaved as part of final restoration.

Along the cable segment within the Eversource ROW, open trench areas would be protected by steel plates or plywood sheets during non-work hours. After the installation of

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[31] Preliminary splice vault locations are identified on the Volume 3 maps. These locations may be modified during final Project design. Actual locations of splice vaults would be illustrated on the Project D&M Plan maps.

the duct bank, the trench would be backfilled with FTB; topsoil would be placed on top of the FTB. Wetland topsoil would be returned to wetland areas.

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 points for installing the fiber optic cables under a separate pulling operation. The fiber optic cables would be spliced and pulled into a pre-cast hand hole located near each splice vault location. 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.

All temporary access roads would be restored in accordance with local, state, or federal specifications, or if on private easements, by agreement with the property owner.

4.3.5.1 Rock Removal

Since underground cable installation would involve both the excavation of a continuous trench and areas for splice vaults, rock could be encountered in some areas. Rock would typically be removed using mechanical methods, or mechanical methods supplemented by controlled drilling. Geotechnical investigation would be performed to confirm the presence/absence of rock and to determine the technological choice of the type of drill head, earth removal method, and operation procedure. (Refer to Section 4.4.2 for a discussion of procedures to be followed if blasting is determined to be necessary for construction.)

4.3.5.2 In Street Construction 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, 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 the splice vault along Shepard Drive in Newington, the disturbed portion of the roadway would be temporarily repaved. Additional construction work at the Shepard Drive splice vault would not be required until cable pulling and splicing activities commence. 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 200 feet would be actively under construction (i.e., pavement saw cutting, trench excavation and duct bank construction, backfilling, and pavement restoration) during any work hours. Within that area, 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 Newington/Hartford DPW 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 the two affected municipalities and, for installation of the cable within State Route 173, 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 (e.g., the underground segment located in Hartford), Eversource anticipates that some in-road construction may occur at night or during other non-peak travel times.[32] Night construction would require lighting and would result in localized noise and glare.

Installation of the Project facilities within public road ROWs in Newington, where adjacent land uses are predominantly residential, would likely occur during daylight hours, to minimize potential effects on residents during the nighttime, when noise sensitivity is greater. However, along Shepard Drive in Newington, Eversource could evaluate the potential for night-time work to minimize effects on commercial uses.

[32] Construction activities within the parking lot of the Bow Tie Cinema in Hartford would be coordinated with the landowner to minimize potential disruptions to cinema patrons.

4.3.6 Cleanup and Restoration

After the installation of the duct bank and splice vaults, restoration would be performed as appropriate, and would include the removal of any remaining construction debris, signs, flagging, temporary access roads, temporary access roads, and other materials. Along the Eversource ROW, areas affected by construction would be restored to approximate pre-construction grade and seeded, as needed, to promote revegetation. Temporary erosion and sedimentation controls would remain in place, as needed, until stabilization is achieved. Along the cable route within roads and parking lots, the areas affected by construction would be repaved.

4.4 CONDITIONS REQUIRING SPECIAL CONSTRUCTION PROCEDURES (UNDERGROUND AND OVERHEAD SEGMENTS)

The following subsections describe the general construction procedures that Eversource would use for water resource crossings, blasting (if needed), soils/groundwater characterization and management, and construction site dewatering. Additional, site-specific procedures would be provided in the Project D&M Plan, as applicable.

4.4.1 Water Resource Crossings

The underground segments of the proposed 115-kV transmission line would cross three wetlands and an intermittent stream along the Eversource ROW, as well as an unnamed tributary to Piper Brook, located at the end of Shepard Drive (this tributary includes a linear wetland south of Shepard Drive). The overhead portion of the 115-kV line would span Trout Brook along the Amtrak ROW.[33]

All construction activities involving water resources would be performed in accordance with the conditions of the Council's Certificate, as well as pursuant to the conditions of water resource permits issued by the CT DEEP and the U.S. Army Corps of Engineers (USACE). In addition, construction activities would conform to Eversource's BMP Manual, as well as to

[33] The overhead line modifications to Newington Tap also would require work in wetlands. The same procedures for wetland work described in this section also would generally apply to the Newington Tap work.

Project-specific plans (e.g., *Stormwater Pollution Control Plan*; *Wetland Invasive Species Control BMPs*; *Spill Prevention and Control Plan*), which would be prepared prior to the commencement of construction.

The water resource permit conditions and related plans would be incorporated into the D&M Plan or similar Project documents. Eversource would require the construction contractor(s) to adhere to such conditions and plans during the construction of the Project facilities.

4.4.1.1 Wetlands

The proposed 115-kV underground segment would unavoidably extend through three wetlands (designated Wetlands N-2, N-3, and N-4) along the Eversource ROW. In addition, the temporary distribution line relocation (as required to allow construction of the cable system) would require additional work in Wetland N-3 (refer to the Volume 3 maps). Due to residential development adjacent to the Eversource ROW, as well as the extent of the wetlands and the constraints posed by the existing Eversource distribution lines, these wetlands cannot be avoided. Another small wetland (N-5) could potentially be temporarily affected during installation of the cable segment across the unnamed tributary to Piper Brook (refer to discussion in Section 4.4.1.2).

However, Eversource would not locate any splice vaults in wetlands and the cable trench that must unavoidably extend through the three wetlands would be restored by backfilling with stockpiled wetland topsoil in order to promote the regrowth of wetland species. Work areas required for the short-term distribution line relocations would all be temporary.

During Project construction, Eversource would limit the effects to these wetlands to the extent practical. Timber mats would be used for construction support in the wetlands. After the completion of cable installation, the temporary fill used for the work in wetlands would be removed, in accordance with the conditions of the water resource permits issued by the CT DEEP and the USACE.

The wetland boundaries along the ROW would be clearly flagged prior to the commencement of work. When working in or traversing wetlands, Eversource would:

- Comply with the conditions of the Council's Certificate and of federal and state permits related to wetlands.

- Develop access across wetlands to avoid interference with surface water flow or wetland functions.
- Install and maintain erosion and sedimentation controls and other applicable construction best management practices in and around wetlands.
- Conduct vegetation clearing in wetlands to minimize adverse effects (e.g., by using low-impact equipment and installing temporary timber mats [or equivalent] to minimize rutting).
- Pile cut woody wetland or upland vegetation in upland areas so as not to block surface water flows within wetlands or otherwise to adversely affect the wetland integrity.
- Cut forested wetland vegetation without removing stumps except over the cable trench and in other areas unless it is determined that intact stumps pose a safety concern for personnel or the movement of equipment.
- Limit grading for access roads in wetlands, if needed, to the amount necessary to provide a safe work space.
- Strip and segregate the topsoil layer that must be removed for the cable trench excavation. The wetland topsoil layer would be preserved separately from the subsoil layer and, after the installation of the duct bank, would be replaced to promote revegetation using the seed bank contained in the soil layer;
- Install temporary construction matting or equivalent for access roads across wetlands or to establish safe and stable construction work areas within wetlands, where necessary. The type of stabilization measures to be used in wetlands would depend on soil saturation;
- Implement procedures for petroleum product management to avoid or minimize the potential for spills into wetlands. For example, to the extent practical, store petroleum products in upland areas more than 25 feet from wetlands; refuel construction equipment, except for equipment that cannot be practically moved, in upland areas and if refueling must occur within a wetland, provide temporary containment. Equipment would not typically be parked overnight on access roads or work pads in wetlands.
- Restore sites in and temporary access ways through wetlands following the completion of cable installation activities.
- Restore wetlands to pre-construction configurations and contours to the extent practicable. If necessary, stabilize by seeding with annual ryegrass or native seed equivalent; otherwise, native vegetation can be expected to recolonize.

4.4.1.2 Watercourses

The 115-kV transmission line would cross three watercourses: an intermittent tributary along the Eversource ROW and an un-named tributary to Piper Brook at the end of Shepard Drive (both in Newington), and Trout Brook (in West Hartford).

The proposed overhead segment of the 115-kV line would span Trout Brook; thus, no construction access would be required across and no construction activities would occur within Trout Brook. Instead, the overhead line structures on either side of the brook would be accessed from adjacent upland areas.

The small, intermittent tributary along the Eversource ROW is situated within Wetland N-2 and would be crossed using timber mats as part of the temporary access through the wetland. Flows, if any, in this tributary would be maintained during construction; the cable duct bank would be installed across the stream by conventional trenching.

Proposed Open Cut Method: Piper Brook Tributary. To install the cable system beneath the approximately 40-foot wide unnamed tributary to Piper Brook adjacent to Shepard Drive, Eversource proposes to use open-trench construction, which would minimize the time required for the crossing. This construction technique involves excavation and duct bank construction directly across the stream bed. The proposed crossing location is adjacent to a paved road that extends from Shepard Drive to industrial facilities that border the Amtrak ROW; the tributary flows under this road via three concrete culverts. On each side of the road, the banks of the tributary are bordered by a narrow strip of vegetation.

The specific location of the cable ROW across the unnamed tributary (i.e., to the north or south of the paved road crossing and culverts) would be determined based on additional engineering and constructability reviews and would be identified in the Project D&M Plan. However, for a cable installation either north or south of the culverted road crossing, vegetation, consisting of both trees and brush, would be removed along the banks of the tributary within the cable ROW.

The crossing would be installed in accordance with CT DEEP requirements. If the stream is dry at the time of construction, Eversource anticipates that conventional trenching within the stream bed would be used to install the duct bank. If water is present during construction, flows would be maintained using techniques such as the following:

- Flume Pipe – a temporary flume pipe would be laid linearly within the stream bed; stream flow (if any) would be routed through the pipe. The cable trench would be excavated beneath the flume pipe.
- Cofferdams – temporary coffer dams would be constructed to divert stream flows (if any) around the cable excavation area. A cofferdam would first be constructed from one stream bank to a midway point across the stream. The duct bank would be

installed to this point, and the cofferdam then would be removed and reconstructed from the opposite bank. The balance of the duct bank across the stream would then be completed. For both steps, continuous stream flow would be maintained.

- Dam and Pump – the stream would be temporarily dammed on either side of the ROW to create a dry area within which the duct bank would be installed. Flows in the stream, (if any) would be pumped around the work area.

After the installation of the duct bank, the stream bed and banks would be restored and revegetated.

Alternative Trenchless Installation Methods: Piper Brook Tributary. Before identifying the proposed open-trench method as preferred, Eversource also considered two other construction methods, as summarized below. While these construction techniques could feasibly be used for installing the cable system beneath the tributary, either method would be significantly more costly and time-consuming than the proposed open cut method.

- **Horizontal Directional Drill.** Horizontal directional drilling (HDD) is a surface-launched trenchless technology 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.

  The installation of the 115-kV cable duct bank beneath the small Piper Brook tributary using HDD would be time-consuming and costly. For the approximately 40-foot-wide creek crossing, a much longer HDD drill path (likely approximately 400 to 500 feet) would be required to obtain the necessary curvature beneath the watercourse. At maximum depth, the drill path would be an estimated 15 to 20 feet below the surface. Further, to accommodate the casing pipe and cable conduits, a bore hole approximately 4.5 feet in diameter would be required, the creation of which would involve potentially multiple drilling (reaming) passes.

  For the HDD process, staging areas (each approximately 0.5 to 0.8 acre) would be required on either side of the tributary. These staging areas are needed to accommodate the 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 would be required to recirculate the drilling mud used in the HDD process. In addition, an office trailer with support equipment would also have to be set up in one of the staging areas.

  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 small Piper Brook tributary would take at least two months to complete, including site preparation and set-up time.

While the HDD method would avoid direct impacts to the 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 the 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 at higher cost.

- **Horizontal Bore.** For this trenchless installation method, staging areas (each approximately 0.3 to 0.5 acre) would be established on both sides of the Piper Brook tributary. Within these staging areas, vertical shafts would have to be excavated on both sides of the brook. Such 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 tributary, 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 could be accomplished by a number of different methods dependent on the length, bore diameter, soil conditions, and groundwater conditions. A horizontal bore could require several months to complete, depending on the subsurface conditions encountered. Thus, compared to the proposed open cut crossing method, the horizontal bore option would be more costly and time-consuming.

4.4.2 Blasting

If blasting is necessary for rock removal at work sites (e.g., for structure foundations, cable/splice vault excavation), Eversource would typically take the following steps:

- A certified blasting specialist would develop site-specific blasting procedures, taking into account geologic conditions and nearby buildings, and ensuring compliance with state regulations;
- The blasting plan would be provided to the local Fire Marshal for approval. Blasting charges would be designed to loosen only the material that must be removed to provide a stable foundation, and to avoid fracturing other rock;
- Eversource would seek to meet with each property owner in proximity to the blasting to explain where and when the blasting is expected to occur, and why blasting is necessary;
- Pre-blast surveys, to document existing conditions, would be conducted for any property within a specified distance of the area where blasting is to occur. This

distance would be determined by Eversource's blasting contractor, in consultation with the Fire Marshal, and with Eversource's approval;

- The areas where blasting is to occur would be covered with heavy blanketing materials and charges would be sized appropriately;
- Seismographs would measure each blast to confirm that levels are within prescribed limits; and
- Excavated material that cannot otherwise be used at the site would be removed and properly disposed of elsewhere, pursuant to Project specifications.

4.4.3 Soils and Groundwater Testing and Management

Management of soils and groundwater encountered during construction activities would depend on whether or not contamination is present, as determined by soil and groundwater studies that would be completed as part of the D&M Plan preparation process. As input to the final Project design, Eversource would develop and implement specific plans for characterizing the soils and groundwater (i.e., presence/absence of contaminants) along the Proposed Route, and subsequently for handling and managing such materials during construction.

These plans would be developed based upon the results of a due diligence review of existing data regarding the current and historical uses of areas along the Proposed Route and nearby off-site sources. The scope of the due diligence work would comply with Sections 8.1 and 8.2 of the American Society for Testing and Materials (ASTM) Standard E1527-05. The objective of the work would be to identify known locations of potential past or current contamination sources, such as leaking underground storage tanks, sites designated as hazardous by federal or state government, and locations of reported spills of petroleum products or hazardous material, etc.

For soil and groundwater testing and management, Eversource would conform to the guidance issued by the CT DEEP for Utility Company Excavation. This guidance applies to cases where contaminated soils/waste are encountered during construction or maintenance activities on property not owned by the utility and the contamination was not created by the utility. The utility may reuse the contaminated soil in the same excavation, within the same area of concern, without prior approval by CT DEEP provided:

- Any condition that would be a significant environmental hazard, as defined in CGS Section 22a-6(u), is reported by the utility and that the location is identified on a map submitted to the CT DEEP Remediation Division;

- Any excess contaminated material is disposed of appropriately in accordance with solid and hazardous waste regulations; and
- The upper 1 foot of the excavation is filled with clean fill material or paved.

Construction contractors would be required to conform to CT DEEP requirements and to any Project-specific material handling plans.

For example, if the results of investigations indicate that contaminants may exceed acceptable concentrations, Eversource would provide specifications for properly handling and disposing of such materials in order to minimize exposure to the general public and environmental receptors.

Soil and groundwater sampling/characterization studies along the Amtrak ROW would be coordinated with Amtrak. The results of such studies would be provided to and discussed with Amtrak.

In general, materials excavated from structure foundations along the Amtrak ROW may be loaded directly onto trucks for off-site disposal at an appropriate facility or stockpiled temporarily on-site or at a permitted facility before being disposed at a permanent facility. Soil transported from the Amtrak ROW would be transported under a Bill of Lading or a Hazardous Waste Manifest, as appropriate. These soils would be disposed of in accordance with the applicable federal, state, and local regulations.

4.4.4 Groundwater and Construction Site Dewatering

Neither the construction nor the operation of the Project is expected to result in adverse effects on groundwater resources or public water supplies. During construction, care would be taken to avoid effects to municipal water lines that may be located within road ROWs or that otherwise extend beneath the Amtrak ROW.

If groundwater is encountered during excavations for the transmission line cable system or structure foundations, the water would be pumped from the excavated areas and discharged in accordance with applicable local and state requirements. Depending on regulatory authorizations, the water may be discharged on-site into an appropriate sediment control basin/filter bag or directly into municipal storm water catch basins, if available. Proper catch-basin inlet protection would be installed as needed to prevent disturbed soils excavate and construction debris from entering storm water systems.

Contaminated groundwater, if encountered, may require treatment before being discharged to either the storm water or municipal sanitary sewer system. Contaminated groundwater may also be pumped into a temporary fractionization (frac) tank and then pumped into a tanker truck for disposal at appropriate wastewater treatment facilities. Residual silt/sediment collected at the bottom of the frac tanks would be disposed off-site at an appropriately designated disposal facility.

4.5 PROCEDURES FOR SUBSTATION AND NEWINGTON TAP CONSTRUCTION

To accommodate the new 115-kV facilities at the existing Newington and Southwest Hartford substations, Eversource proposes to expand both substations, increasing the size of the developed yards (fenced area) at each site (refer to Figures 3-7 and 3-9, and to the Volume 3 maps).

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 two 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. Construction support areas (e.g., contractor yards, office trailers, material/equipment staging) are expected to be accommodated on Eversource property at each substation. However, the specific locations of staging areas and contractor yards for the substation modifications would be identified in the D&M Plan for the Project.

4.5.1 Newington Substation and Newington Tap

A sequential construction approach would be used to modify Newington Substation, and which would include the Newington Tap area. Work would include the primary activities, as described in the following sections:

4.5.1.1 Site Preparation

Site preparation activities would 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. Because of the on-site topography and close proximity to both the site property line and delineated wetlands, a retaining wall must be installed along the south and west sides and the southeast corner of the substation expansion area. (Refer to Volume 3 for a preliminary drawing of this retaining wall.) The construction of the retaining wall would be the first step in the substation expansion; in conjunction with the installation of the retaining wall, the expansion area would be graded and filled to achieve the desired elevation. Details regarding the retaining wall composition and configuration, fill quantity, and site grading would be completed as part of the final design process.

The proposed modifications would require the relocation of the substation perimeter fence, which would be extended by 30 feet to the south and 20 feet to the west. For security and safety concerns, this fence would be erected in conjunction with the site preparation.

Temporary erosion and sedimentation controls (e.g., silt fence, hay/straw bales, stone construction entrance) would be installed prior to the filling and grading work. Such controls would be maintained and replaced as necessary throughout construction and would conform to BMPs, including those provided in the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control* (revised 2007) and the Company's BMP Manual.

4.5.1.2 Foundation Construction

Foundation construction would commence after the completion of rough grading. Foundations would be required for the battery enclosure (approximately 41 feet by 14 feet) and 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.

4.5.1.3 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 would be approximately 2 feet to 4 feet below grade. The ground grid would be approximately 1.5 feet below grade. In addition, an enclosure to house the primary and backup battery system for the protection and control equipment would be installed (refer to the Volume 3 maps for the location of this enclosure).

4.5.1.4 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 transmission facilities.

4.5.1.5 Final Cleanup, Site Security and Restoration

As the final phase of Project construction at the substation, areas of disturbed soils within the substation fence would be surfaced and stabilized with trap rock or gravel. Areas of disturbed soils located outside of the station fence typically would 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, would be maintained to prevent unauthorized access to the site.

4.5.1.6 Overhead Transmission Construction Procedures: Newington Tap

The modifications to Newington Tap would 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 (refer to Figure 3-8). The following summarizes the activities, materials, and equipment generally expected to be involved in the relocation of the line entry. To the extent that these procedures reflect overhead construction activities common to the transmission line segment along the Amtrak ROW, details are not repeated here (refer instead to Section 4.2):

- Survey and stake the proposed structure locations and flag vegetation clearing boundaries for the Newington Tap modifications.
- Identify and mark wetland areas.
- Perform vegetation clearing (tree/brush removal, mowing) and trimming.
- Install erosion and sedimentation controls in accordance with the BMP Manual.
- Install construction access road and work (crane) pad areas for the installation of the new structures and the removal of the existing Tap structures. Access road and work pad configurations would be as shown generally on the Volume 3 maps and discussed in Sections 4.2 and 4.4). Work may involve grading to create a stable base (consisting of gravel, temporary construction mats, or equivalent) for drilling and other structure installation and removal equipment.
- Construct structure foundations and erect/assemble new structures.
- Install counterpoise, where needed.
- Install shield wires, OPGW, and conductors.
- 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.

4.5.2 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 fenced area would be expanded 65 feet to the east to increase the size of the developed portion of the substation in order to accommodate the new 115-kV cable facilities and related equipment. During the substation modifications, Eversource would maintain fencing around the substation perimeter such that there would be no access for general public to the site before, during, or after construction. The primary construction activities are described below.

4.5.2.1 Site Preparation

Site preparation activities would 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 would require the expansion of the substation perimeter fence. For security and safety concerns, this fence would be erected in conjunction with the site preparation activities. Details regarding final fenced area layout, access road modifications, extent of tree removal, civil site design, and vegetation design would be finalized as part of the final design process and included in the Project D&M Plan.

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 erosion and sedimentation control, including those provided in the *2007 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.

4.5.2.2 Foundation Construction

Foundation construction would commence after the completion of rough grading. Foundations would be required for all steel structures that support electrical equipment: bus, terminal structures, CCVTs, arrestors, lightning masts(s), circuit breakers, reactors, circuit switches, and disconnect switches. 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.

4.5.2.3 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, a protection and control raceway, as well as ground-grid conductors would be installed beneath the substation grade. The protection and control raceway would be approximately 2 feet to 4 feet below grade. The ground grid would be approximately 1.5 feet below grade.

4.5.2.4 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 substation to the new 115-kV transmission facilities.

4.5.2.5 Final Cleanup, Site Security and Restoration

After the Project construction work at Southwest Hartford Substation is complete, any remaining construction debris would be collected and removed from the site. As the final phase of Project construction at the substation, areas of disturbed soils within the substation fence would be stabilized with trap rock or gravel. Areas of disturbed soils located outside of the station fence typically would be seeded, mulched, and allowed to re-vegetate in low-growing shrub or grass species. Temporary erosion controls would be maintained until the disturbed areas that are not otherwise developed are satisfactorily stabilized.

4.6 CONSTRUCTION MONITORING

In accordance with the Council's requirements, after the certification of the Project, Eversource would prepare and submit for Council approval a D&M Plan that would detail the procedures to be used to construct the proposed transmission facilities. The D&M Plan would incorporate the conditions of the Council's Certificate for the Project, as well as the conditions of the permits received from other regulatory agencies, as appropriate. Eversource would monitor the conformance of construction activities to the D&M Plan, the Council's Certificate, other regulatory requirements, and Company standards.

4.7 OPERATION AND MAINTENANCE PROCEDURES

4.7.1 115-kV Line

The 115-kV transmission line would be monitored and maintained in accordance with Eversource's standard procedures. Along the underground cable segments, maintenance activities would be performed in accordance with the Company's standard procedures, including – along the Eversource ROW - for vegetation management. The overhead line segment along Amtrak would be maintained in accordance with Eversource standards and Amtrak requirements, as specified in Eversource's license agreement with Amtrak.

4.7.2 Substation Maintenance

The proposed Project modifications to the two existing Eversource substations, including the modifications to Newington Tap, would not substantially affect or alter existing maintenance practices at these facilities.

4.7.3 Protective Equipment

For the new 115-kV transmission line, protective relaying equipment would be 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 the line to isolate the faulted section of the transmission system. Specifically, as described previously, along the new 115-kV line between Newington and Southwest Hartford substations, fiber optic cable would be installed within the underground transmission system duct bank and at shield wire positions on the overhead transmission line. This would provide a robust and reliable communications path for the protective relaying systems.

The protective relaying schemes include fully redundant primary and back up equipment. This ensures that if a line or station equipment failure were to occur at a time when one of the protective relaying schemes is removed from service for maintenance, the redundant protective scheme would initiate the removal from service of the faulted transmission facility being monitored.

If the transmission line experiences a failure, then high-speed protective relaying would immediately remove the line from service, thereby protecting the public and the transmission line. Similarly, if equipment at any of the substations experiences a failure, then protective relaying would immediately remove the equipment from service, likewise protecting the public and equipment within the substations.

4.7.4 Fire Suppression Technology

Smoke detection systems are already in place in the existing relay and control enclosures at the two 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 substation 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.

4.7.5 System Security

Pursuant to § VI.N.4 of the Council's Application 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* (White Paper), as amended[34] is included in this Application.

The Project, including the new 115-kV line and the modifications to Newington Tap and Newington and Southwest Hartford substations, would be designed in accordance with sound engineering practices and constructed in full compliance with the standards of the NESC and good utility practice. The operation of the Project facilities would be in accordance with Eversource standards for reliability, safety, and security. Should the substations or 115-kV transmission line experience a failure, protective relaying would immediately remove the equipment from service, thereby protecting the public.

Eversource's existing access driveways to Newington and Southwest Hartford substations are already gated and the perimeter of each substation is entirely enclosed with a 7-foot high chain-link fence topped with approximately one foot of barbed wire to discourage unauthorized entry and vandalism. As part of the Project, Newington and Southwest Hartford substations would be expanded; each substation perimeter fencing would be extended accordingly to encompass the expansion area.

Similarly, lighting is already installed within each of the substation yards to facilitate work at night under emergency conditions and during inclement weather. The substations also presently have low-level lighting for safety and security purposes.

[34] The *White Paper* was initially adopted in the Council's Docket 346.

During construction, access to the two substations would be controlled, with the substation gates kept closed and locked as needed. In addition, all substation gates would be padlocked at the end of the workday during Project construction and at all times after the Project is completed. Appropriate signage also is posted at Newington and Southwest Hartford substations alerting the general public of the high voltage facilities within each facility.

4.7.6 Physical Security of Proposed Facilities

The physical security at Newington and Southwest Hartford substations presently is consistent with the Council's White Paper. The White Paper Guidelines focus on the unpredictable intentional act of perpetrators designed to damage the physical structures of the certificated facilities (as opposed to, for instance, cyber security). The Project modifications also would be consistent with the Council's White Paper Guidelines.

The following summary follows the format suggested by the Council in its White Paper, which focuses on security issues associated with four areas: Planning, Preparedness, Response, and Recovery. Each section first presents the discussion topic included in the White Paper, and then provides Eversource's proposed security approach for the particular area, as relevant to the Project.

4.7.6.1 Planning

Identify the physical vulnerabilities most likely to pose a security threat:

Eversource proposes to construct the underground segments of the 115-kV transmission within its ROW, under public roadways, and in other generally developed suburban/urban areas. The overhead segment of the new line would be constructed within the busy Amtrak/CT*fastrak* transportation corridor, and the overhead Newington Tap would be reconfigured within Eversource's existing ROW near Newington Substation. These areas are not, and cannot be, fenced off from the public. Unauthorized personnel could relatively easily identify the locations of the transmission line segments and the tap, and could then gain access to the facilities, although with some difficulty in the case of the underground segments.

The Project would involve modifications to Eversource's existing Newington and Southwest Hartford substations. Existing substations typically are points of greater system vulnerability than transmission lines. Because multiple transmission and distribution circuits connect to the two substations, an attack on one of these points would be more likely to affect more than one circuit (and therefore more than one source of supply) than would an attack on a portion of a transmission line. The two substations are visible and easily accessible via Eversource access off public roads. However, the Project improvements would not add any new vulnerabilities to Newington and Southwest Hartford substations.

Identify the type and characteristics of the facility and any ways in which the facility's setting affects security concerns:

The setting of the proposed facilities poses no particular security concern. The underground segments of the 115-kV line would be installed in roadways in a suburban/urban setting and in a ROW bordered by suburban residences. The overhead segment is located within a heavily trafficked transportation corridor. The Newington and Southwest Hartford substations are also located in settled areas, and the minor modifications to them would not affect their security. In all areas where the facilities would be constructed, hostile activity is less difficult to detect in a timely manner than would be the case in isolated rural areas. The presence and activities of adjacent landowners, passers-by, and in the case of the transportation corridor, Amtrak and ConnDOT personnel all provide deterrents to, and sources of information about, attempted hostile activities.

Examine any pertinent ways in which the facility is linked to other facilities and systems and potential repercussions from a facility or system interruption. Examine whether the proximity of the facility to other electric facilities, either dependent or independent, presents security challenges:

Section 2 describes the interrelationship of the Project to the electric transmission system in central Connecticut. Because the region's electric supply systems are tightly networked, a disturbance to one part of the system can cause an overload or voltage violation on other, fairly distant parts of the system. However, in a system that is planned and operated according to applicable reliability standards, the sudden and unexpected loss of even a critical system element when the system is already under stress would not result in cascading outages, or damage to customer or utility equipment. The proposed Project facilities would help to provide such a robust system. There is nothing about the particular points of interconnection of the proposed facilities, or their proximity to other facilities, that presents any enhanced security challenge.

Examine if there is an established method to help regional, state and national security officials maintain situational awareness of this facility:

Eversource has established procedures to help regional, state and national security officials maintain situational awareness of its facilities. CONVEX monitors Eversource's transmission facilities and those of other member utilities in Connecticut and Western Massachusetts in real time, and maintains a procedure for identifying and reporting sabotage events to local and federal officials, neighboring entities, and regulatory authorities. ISO-NE similarly monitors the security status of the entire New England bulk power system. Causes of outages are investigated promptly and, when appropriate, reported to law enforcement officials. Maintaining situational awareness is a dynamic task. In 2006, when NERC applied to be designated by the FERC as an ERO, NERC included a provision for maintaining situational awareness and it continues to develop improvements to address and/or improve awareness.

4.7.6.2 Preparedness

Examine site security infrastructure, including site monitoring, physical and nonphysical barriers and access controls:

The two Project substations are presently gated and the perimeter of each substation is enclosed with a 7-foot high chain link fence topped with 3 strands of barbed wire to discourage unauthorized entry and vandalism. Access is limited through locked gates and only authorized personnel are permitted to enter. Both substations are secure and are classified as a "low" risk per the NERC Physical Security Standard. Security at low risk sites includes electronic access control and Closed Circuit TV. Site security monitoring would largely be provided by Eversource security's central monitoring station located in Berlin, Connecticut. Eversource complies with NERC guidelines for assessing the degree of protection each component of the grid should receive and recommended types of precautions that these faculties should have in place.

Review any simulated exercises that include local police, fire, and other emergency response teams. Examine whether local law enforcement/emergency response liaison is in place, and review mutual aid agreements between affected entities:

Eversource regularly consults with first responders across its service territory. The addition of the Project facilities would not call for any change in established procedures that are in place for notification and response. Eversource Public Outreach personnel are available to act as liaisons between municipal officials and the Company through well-documented and exercised protocols.

The Connecticut Department of Emergency Services and Public Protection (DESPP) Training and Exercise Division sponsors emergency preparedness training, seminars, exercises, and conferences for local first responders, as defined in Homeland Security Presidential Directive 8 (i.e., police, fire, emergency management, emergency medical services, public health, public works, private sector, non-governmental organizations and others). These presentations and seminars are designed to cover Mitigation, Preparedness, Response and Recovery. Eversource is represented on the Private Sector Council of DESPP, which meets quarterly and more frequently as needed. Eversource has participated, and would continue to participate, in state and regional emergency exercises.

4.7.6.3 Response

Examine notification procedures to public and/or local officials, including the types of security issues that would warrant such notification:

Upon completion of construction, the Project would not require any change in existing, pre-established public notification procedures. After the Project is constructed, Eversource would adhere to NERC and CONVEX protocols and would coordinate further with these entities regarding the best mechanism for communicating incidents.

Examine mitigation measures, including alternate routing of power, strategically located spares and mobile backup generation:

As discussed in Section 2, the proposed Project would improve the reliability of the grid in Connecticut, by providing a new interconnection between Newington and Southwest Hartford substations and the load pockets they serve. In the event of the interruption of the new 115-kV transmission line, power flow would be automatically redirected to other lines. Eversource continually prepares for outage contingencies. The system is planned and operated so that the sudden and unexpected loss of the new line would not result in a widespread loss of load or in damage to utility or customer equipment.

Eversource keeps an inventory of spare equipment in order to quickly restore facilities to service after most failures. For example, spare substation equipment is located in a central storage area to be deployed as required and spare cable is stored in a centralized location.

4.7.6.4 Recovery

Identify measures that will be taken, if necessary, to restore natural resources at the site of the facility:

In the event of an incident, the first priority would be to eliminate any threat to public safety and then to repair the transmission facilities. During the response to an incident, natural resources at or adjacent to the site would be protected to the extent practical and subsequently restored to pre-incident conditions as appropriate. Mitigation protocols for impacts to wetlands and water resources, if any, would be coordinated with the appropriate resource agencies, such as the USACE the CT DEEP.

Determine whether reporting procedures are established to evaluate and improve the effectiveness of local emergency response teams, methods to limit negative impacts on neighboring electric facilities, and restoration of the natural environment:

Eversource would investigate and respond to any incident associated with its infrastructure. Depending on the magnitude and consequences of the incident, Eversource's processes and/or after action reviews would evaluate what improvements may be needed to minimize the potential for future adverse effects on its facilities and the environment and neighboring electric facilities in future incidents response, as well as the effectiveness of the interface with local emergency response teams.

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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[35] (Section 5.1), as well as at, and near, Eversource's existing Newington and Southwest Hartford substations and the Newington Tap (Section 5.2). The information concerning the existing environmental and cultural conditions reflects the results of online data research (e.g., as available through the Connecticut Environmental Conditions Online viewers[36] and online Geographic Information Systems data), as well as in-field investigations[37] conducted by Eversource's consultant, AECOM, along the proposed 115-kV transmission line route and at the two substation sites. Supporting documents (e.g., wetlands and watercourses report, vernal pool assessment, cultural resources report) are provided in Volume 2.

Aerial-photographic based maps depicting existing environmental and cultural conditions in the Project vicinity are included in Volume 3. The principal existing environmental conditions, land use features, and natural resources shown on the Project maps include:

- Location of existing road, railroad, and utility ROWs, including select Eversource distribution and transmission lines in the vicinity of Newington Substation;[38]
- Location of Eversource properties;
- Municipal boundaries;
- Municipal zoning classifications;
- Topography;
- Water resources, including watercourses, and federal and state jurisdictional wetlands;

[35] Resources were evaluated within the general Project area (or "study area") between Newington and Southwest Hartford substations. Figure 1-2 illustrates the Project area.

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

[37] Access agreements along the overhead portion of the Proposed Route that would be collocated in the Amtrak ROW are being finalized. A comprehensive in-field construction review of proposed Project features and natural resources will be completed along the overhead segment, once access is secured. Eversource has completed desktop reviews and in-field investigations along this segment from publicly accessible areas.

[38] Distribution lines are shown within the Eversource ROW between Newington Substation and State Route 173 (i.e., along the Proposed Route). The existing transmission lines connecting to Southwest Hartford Substation are configured underground and are not depicted on the aerial mapsheets in Volume 3.

- 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 parks and designated recreational trails;[39]
- Schools and community facilities;
- Areas of historical significance, including those listed on the National Register of Historic Places (NRHP);[40] and
- Other existing features in the vicinity of the Project.

5.1 PROPOSED TRANSMISSION LINE ROUTE

The Proposed Route for the new 115-kV transmission line traverses approximately 3.7 miles, in a general easterly then northerly direction, extending from Eversource's existing Newington Substation (located in the Town of Newington), through the Town of West Hartford, to Eversource's Southwest Hartford Substation (located in the City of Hartford). The new transmission line would be aligned within a combination of ROWs, including an existing Eversource ROW currently containing five distribution circuits (four overhead and one underground), state and local road ROWs, and the Amtrak/CT*fastrak* corridor.

5.1.1 Topography, Geology, Soils

5.1.1.1 Topography

The entire Project area, including the Proposed Route, is situated within the Central Valley (or Newark Terrane), which is located within the Connecticut River Valley.[41] This region is characterized by relatively flat areas bordered by variably hilly terrain. Elevations along the route generally range from approximately 50 feet to 200 feet above mean sea level. The principal topographic relief feature along the route is associated with Trout Brook in West Hartford.

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39 This urban/suburban Project area is not located in the vicinity of any hunting or wildlife management areas.

40 See Table 5-6 and the Historical Resource reports included in Volume 2 for additional detail and mapping regarding additional historic resources listed with the State of Connecticut.

41 Connecticut Geologic Survey, CT DEEP. 1990, revised 2013.

5.1.1.2 Geology

Based on examinations of geologic mapping,[42] the majority of the Proposed Route is located within areas of fine glacial meltwater deposits (very fine sand, silt and clay). Other glacial and meltwater deposits located along the Proposed Route include sand overlying fines in the Newington Substation vicinity, as well as coarse (sand and gravel) deposits within the and thin till deposits within the existing Eversource ROW. In addition, post-glacial deposits of alluvium overlying fine materials are noted in the vicinity of Trout Brook. The Proposed Route does not traverse any traprock ridge or amphibolite ridge areas as identified in CGS § 8-1aa(1). No rocky outcrops were identified along or near the route.

Bedrock within the glacially flattened Connecticut River Valley is generally comprised of brownstone, which is a sedimentary rock that erodes easily. The valley is almost completely free of boulders, which the glaciers and associated outwash meltwaters deposited elsewhere.[43]

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 sand, gravel, and fine floodplain deposits, and are often more than 100 feet below the ground surface. Floodplain deposits, which are post-glacial deposits comprised of alluvium overlying fine outwash, are found in association with Trout Brook,[44] which the Proposed Route would span along the Amtrak/CT*fastrak* corridor.

5.1.1.3 Soils

Table 5-1 summarizes information regarding the mapped soil associations[45] along and in the general vicinity of the Proposed Route and both substations. The table also identifies soils classified by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) as Prime Farmland or Statewide Importance Farmland.

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[42] http://cteco.uconn.edu/maps/town/surfmat/SurfMat_westhartford.pdf; Accessed 03/15/17

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

[44] http://cteco.uconn.edu/maps/town/surfmat/SurfMat_westhartford.pdf; accessed 03/15/17

[45] U.S. Department of Agriculture, Natural Resources Conservation Service Web Soil Survey; accessed 2016

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	Presence along Proposed Route	Presence at Newington Substation	Presence at Southwest Hartford Substation
9	Scitico, Shaker, Maybid soils	0 to 5	Very deep, poorly drained soils formed in silty and clayey sediments	Yes	>72	10-12	Statewide Important	Very deep	Yes	No	No
20A	Ellington silt loam	0 to 5	Coarse-loamy aeolian deposits over sandy and gravelly glaciofluvial deposits derived from sandstone and shale and/or basalt	Possible Inclusions	>72	18-30	Prime	Very deep	Yes	No	No
30B	Branford silt loam	3 to 8	Very deep, well drained soils formed in loamy over sandy, gravelly outwash	No	>72	>72	Prime	Very deep	Yes	Yes	No
87B	Wethersfield loam	3 to 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
230B	Branford-Urban land complex	0 to 8	Coarse-loamy aeolian deposits over sandy and gravelly glaciofluvial deposits derived from sandstone and shale and/or basalt	No	>72	>72	Not Prime	Very deep	No	Yes *	No
302	Dumps	Varies	Variable	No	>72	>72	Not Prime	Very deep	Yes	No	No
306	Udorthents-Urban land complex	Varies	Urban land, variable	No	>72	54-72	Not Prime	Very deep	Yes	No	Yes
307	Urban land	Varies	Urban land, variable	No	Variable	Variable	Not Prime	Variable	Yes	No	Yes **
308	Udorthents, smoothed	Varies	Urban land, variable	No	>72	24-54	Not Prime	Very deep	Yes	No	Yes
309	Udorthents, flood control	Varies	Moderately well drained	Possible Inclusions	>72	24-54	Not Prime	Very deep	Yes	No	No

Source: USDA NRCS, Online Soil Surveys, Geographic Data and Soil Data Mart Information of Hartford County. Accessed June 2016.

* This soil map unit is located outside of Newington Substation, but is found on the northern portion of Eversource's property near Cherry Hill Drive.

** This soil map unit extends across a small portion of the access road to Southwest Hartford Substation.

As Table 5-1 shows, most of the Proposed Route extends through areas where soils have been extensively modified by urban/suburban uses and infrastructure developments; such areas include the portions of the Proposed Route along road ROWs, within parking areas, along the Amtrak/CT*fastrak* corridor, and near I-84.

As indicated in Table 5-1, areas mapped as Prime Farmland and Statewide Important Farmland soils are found along the Proposed Route in the Town of Newington. Soils identified as Prime Farmland include Ellington (20A), Branford (30B) and Wethersfield (87B). Mapped Statewide Important Farmland soils crossed by the transmission line route include Scitico, Shaker, Maybid soils series; these soils are also considered hydric (see definition below). Along the Proposed Route, none of these soils are used for agricultural purposes. Instead, the soils are found in areas developed for residential and utility ROW uses. 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 supplement the Project-specific field investigations that were performed to identify federal and Connecticut jurisdictional wetlands. Connecticut wetlands are defined based on the presence of poorly drained, very poorly drained, or floodplain soils. Based on the Project investigations, soils along the Proposed Route are primarily well-drained, with water tables at depths greater than 18 inches, no or moderate slopes, and very deep bedrock. However, wetlands were identified along portions of the Proposed Route and near Newington Substation, where soils exhibit poorly drained characteristics, as further described in Section 5.2.

5.1.2 Water Resources

Water resources in the Project area include watersheds and drainage basins, wetlands, watercourses (intermittent and perennial streams and rivers), waterbodies (ponds), and floodplains. Surface and groundwater attributes, such as public water supplies and water quality, are also discussed in this section.

Water resources along the Proposed Route and at Eversource's Newington and Southwest Hartford substations were identified and delineated by AECOM during field investigations conducted in May 2015, January 2016, and August 2016.[46] Vernal pool surveys were conducted in spring 2017; however, no vernal pools were confirmed in the survey area along the Proposed Route.[47]

The methods used to field-delineate federal and state jurisdictional water resources are described in the AECOM *Wetlands and Watercourses Report* dated May 2017 in Volume 2. The methods used to perform vernal pool assessments are described in the AECOM *Vernal Pool Assessment* dated May 2017 also in Volume 2. The Volume 3 maps identify the locations of water resources in relation to the proposed Project facilities. During the field delineations, wetlands and watercourses along the Proposed Route and at the substation properties were delineated and numbered sequentially with a Project-specific alpha-numeric label (e.g., wetland N-1 or intermittent stream IS-1) from southwest to northeast, starting at Newington Substation and ending at Southwest Hartford Substation. Watercourses and wetlands were field-demarcated using numbered surveyor's flagging tape. Boundary flag locations were subsequently surveyed using a Trimble Global Positioning System (GPS) survey unit with flag coordinates differentially corrected and plotted onto the Project mapping.

5.1.2.1 Watersheds

The Project area is located within the Connecticut River Major Drainage Basin, which includes drainages that flow ultimately to Long Island Sound. Within the Connecticut River Basin, the Project area is located in the Park River Regional Basin. Within this regional basin, the Proposed Route crosses three CT DEEP subregional basins:[48]

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46 The 2015 surveys focused on Eversource's substation properties and the all-underground routes that were initially investigated for the new 115-kV line. Subsequent surveys focused on the Proposed Route.

47 AECOM biologists conducted investigations at previously identified potential vernal pool locations along the Proposed Route. An initial investigation was performed on March 29, 2017 and a comprehensive vernal pool survey was performed on April 7, 2017. Subsequent vernal pool investigations were conducted on April 28 and May 3, 2017. No evidence of vernal pool usage by obligate vernal pool species was observed. Additional information regarding vernal pool survey results is presented in Section 5.1.3 and the Wetlands and Watercourses report included in Volume 2.

48 CT DEEP sub-regional watershed summary fact sheets and associated GIS data. Project crosses CT DEEP subregional basins 4402-01, 4403-07, 4400-01. CT ECO Website. Accessed 03/15/17: http://cteco.uconn.edu/maps/town/basin/basin_WestHartford.pdf;

- **Trout Brook Watershed:** The Proposed Route crosses only a small portion of this watershed. The northernmost portion of Eversource's property at Newington Substation is located within this subregional basin. In addition, the proposed alignment involves an overhead crossing of Trout Brook within this watershed, along the Amtrak/CT*fastrak* corridor in West Hartford.
- **Park River – South Branch and Main Stem:** The majority of the Proposed Route is located in the Park River - South Branch/Main Stem drainage basin. CT DEEP further divides this area into the Bass Brook, Park River and Piper Brook Subregional Drainage Basins:
    - **Bass Brook:** This subregional basin is located in Newington, approximately 0.2 mile west of Newington Substation, as depicted in Volume 3: Exhibit B. While the watershed appears close to Newington Substation, Bass Brook is an upstream tributary to Piper Brook and all Project activities would occur in watersheds downstream and outside of the Bass Brook watershed.
    - **Piper Brook:** The southern portion of the Project is located within this subregional basin, which encompasses most of the Newington Substation parcel; all of the Proposed Route in Newington; and the portion of the Proposed Route that extends along the Amtrak/CT*fastrak* corridor north to approximately New Britain Avenue in West Hartford. Within this subregional basin, the Proposed Route crosses two watercourses: an unnamed intermittent stream within Eversource's distribution line ROW and an unnamed tributary to Piper Brook that is culverted beneath Shepard Drive. The Newington Tap work includes an overhead crossing of an intermittent stream at the Newington Substation parcel.
    - **Park River:** The northern portion of the Project is located within this subregional basin. Approximately 1,100 feet northeast of the New Park Avenue and New Britain Avenue intersection in West Hartford, Piper Brook and Trout Brook converge to form the South Branch of the Park River. This subregional basin includes portions of the Proposed Route along the Amtrak/CT*fastrak* corridor beginning near Oakwood Avenue in West Hartford and extending north to Southwest Hartford Substation in Hartford. The Proposed Route would not cross any streams within this basin; however, an unnamed tributary to the South Branch of the Park River is located on the northern portion of the Eversource's Southwest Hartford Substation parcel. This unnamed tributary intersects with the South Branch of the Park River east of the substation and the Amtrak/CT*fastrak* corridor.

5.1.2.2 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 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 designated 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	Designated 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.

Watercourses identified herein include a CT DEEP water quality designation and associated water quality impairment description. These water quality designations are from the latest *State of Connecticut Integrated Water Quality Report* (October 2014), published in accordance with Sections 305 (b) and 303(d) of the Federal Clean Water Act. Further, the designated use classifications are in accordance with the latest Connecticut Water Quality Standards (February 2011).[49] The CT DEEP's 2016 Water Quality Classification mapping was used to confirm surface and ground water quality classifications in the Project vicinity.[50]

As further described below, watercourses along and in the immediate vicinity of the Proposed Route are designated as surface water resource Class A by the CT DEEP.

5.1.2.3 Watercourses

Five watercourses (three perennial and two intermittent; refer to the Volume 3 maps) are located in the immediate Project area:

- Newington: an intermittent stream southwest of Newington Substation (designated IS-1); an unnamed intermittent stream in wetland N-2 located along Eversource's

[49] Additional information on CT Integrated Water Resource Management is available at: https://ctdeep.maps.arcgis.com/apps/MapJournal/index.html?appid=34045baab4484809a6d9d2bbaaa47a37

[50] http://cteco.uconn.edu/map_catalog/maps/town/wtrqualcl/WtrQualCl_Newington.pdf

distribution line ROW (designated IS-2); an unnamed tributary to Piper Brook, which is culverted beneath Shepard Drive (designated PS-1).

- West Hartford: Trout Brook (designated PS-2); and
- Hartford: an unnamed tributary to the South Branch of the Park River in Hartford, which is located adjacent to Southwest Hartford Substation (designated PS-3).

Details regarding the three watercourses located along the Proposed Route (IS-2, PS-1, PS-2) are presented in this section. Watercourses on the substation parcels (IS-1 and PS-3) are described further in Sections 5.2.1 and 5.2.2, respectively. Additional detail regarding watercourses in the overall Project area is available in the Wetlands and Watercourses Report included in Volume 2. On the National Wetlands Inventory (NWI) maps, permanently flooded perennial watercourses within the Project area (e.g., Trout Brook) are classified as Riverine unconsolidated bottom,[51] in accordance with the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979) classification system.

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 Connecticut Protected Rivers Act.

5.1.2.3.1 Intermittent Unnamed Tributary to Piper Brook (IS-2)

Intermittent stream IS-2, which is located within Wetland N-2 along Eversource's distribution line ROW, is located approximately 350 feet east of Avery Road and flows to the north through a dense stand of common reed (*Phragmites australis*). The stream has been observed under both dry and flowing conditions at various times of the year. At the proposed transmission line crossing, this watercourse is approximately 4 feet wide. In accordance with the CT DEEP 2011 Connecticut Water Quality Standards,[52] intermittent streams that lack a designated water quality classification are considered Class A waters.

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[51] "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%.

[52] http://www.ct.gov/deep/lib/deep/water/water_quality_standards/wqs_final_adopted_2_25_11.pdf

5.1.2.3.2 Unnamed Tributary To Piper Brook (PS-1)

This unnamed perennial tributary to Piper Brook (PS-1), which extends through the southeastern portion of the Project area, has been altered by human activity, including rerouting and channelization. In the vicinity of the proposed transmission line crossing, the stream extends beneath Shepard Drive via three culverts, each approximately 6 feet in diameter and 30 feet long. At the proposed transmission line crossing location, the watercourse is approximately 21 feet wide and is classified by the CT DEEP as a Class A surface water.

5.1.2.3.3 Trout Brook (PS-2)

Trout Brook is a perennial stream with a bankfull width of approximately 60 feet at the location of the proposed overhead transmission line crossing along the Amtrak/CT*fastrak* corridor. This existing busway/railroad bridge has concrete abutments and wingwalls. The approximate length of the aerial crossing over Trout Brook is approximately 35 feet at this location, relative to its span across ordinary high water. The stream banks upstream and downstream of the crossing are sparsely vegetated and have largely been cleared of trees as part of a recent CT DEEP flood control project. Stands of herbaceous vegetation, small shrubs and some trees are located along the banks. Dense stands of Japanese knotweed (*Fallopia japonica*) were also noted along the banks.

This segment of Trout Brook has been altered by human activities, including rerouting and channelization activities prior to 1985. Several local flood control works, including dikes and a pumping station, are also located in this vicinity. Additional detail on the Trout Brook flood control system is presented in Section 5.1.2.6. The South Branch Park River confluence is located just downstream of the proposed overhead transmission line crossing location, near New Britain Avenue in West Hartford.

This segment of Trout Brook has a surface water quality classification of Class A. Per the 2014 *Connecticut Integrated Water Quality Report,* this reach does not fully support two designated uses: Recreation and Habitat Provision of Fish and Other Aquatic Life/Wildlife. Elevated bacteria (*E. coli*) concentrations adversely affect the recreation designated use. The report lists the physical alteration of substrate habitat (channelization), as well as unknown other causes (potentially attributable to industrial point source discharges, illicit discharges, remediation sites, groundwater contamination) alterations as adversely affecting the habitat use.

5.1.2.4 Waterbodies

There are no waterbodies (e.g., ponds, lakes) traversed by or in the immediate vicinity of the Proposed Route. Only one waterbody, Beachland Park Pond, located in West Hartford's Beachland Park (847 South Quaker Lane) is found within the general Project study area. This pond, which has a Class A water quality designation, is situated approximately 0.7 mile west of the Proposed Route.

5.1.2.5 Wetlands

Detailed descriptions of each wetland, as well as the associated field data forms, are included in the Wetlands and Watercourses Report in Volume 2. This report summarizes the characteristics of each wetland along the Proposed Route and at the substations, and also includes representative photographs. Wetland locations are illustrated on the Volume 3 maps. Each identified wetland identified met state and federal jurisdictional criteria.

Given the suburban/urban nature of the Project area, wetlands are found only within some of the undeveloped areas adjacent to Newington Substation, along portions of Eversource's distribution line ROW, and in areas immediately adjacent to watercourses. Four delineated wetland areas are either crossed by or located immediately adjacent to the Proposed Route. These are designated as Wetlands N-2, N-3, N-4 and N-5 (refer to the Volume 3 maps). Wetlands on the Newington and Southwest Hartford Substation parcels (designated as Wetlands N-1, N-1A, and H-1) are discussed in Section 5.2.1 and 5.2.2, respectively.

Three of the wetlands (Wetlands N-2, N-3 and N-4) along the Proposed Route are located within Eversource's existing ROW between Newington Substation and State Route 173. The fourth wetland identified along the Proposed Route (Wetland N-5) is a fringing wetland located south of Shepard Drive and adjacent to the banks of the unnamed tributary to Piper Brook (PS-1).

Within the portions of Eversource's ROW occupied by the existing overhead and underground distribution facilities, vegetation maintenance activities are periodically performed to promote low-growth species consistent with the safe operation and maintenance of these lines. Thus, in accordance with *Classification of Wetlands and*

Deepwater Habitats of the United States (Cowardin et al., 1979), Wetlands N-2, N-3 and N-4 are characterized as palustrine emergent marsh (PEM) and/or palustrine shrub-scrub (PSS), with dominant vegetation species including common reed (*Phragmites australis*), 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 (*Solidago* spp.). Several of the wetland areas are dominated by large stands of the invasive species common reed.

Portions of Wetlands N-2 and N-3, which extend outside the managed portions of Eversource's ROW or are located on nearby Eversource fee-owned property, are characterized as palustrine forested (PFO) wetland areas. In addition, Wetland N-5, the narrow wetland found along the banks of the tributary to Piper Brook at the Shepard Drive crossing, is classified as a PFO wetland under the Cowardin et al. system. All three PFO wetlands are dominated by silver maple (*Acer sachharinum*), red maple (*Acer rubrum*), skunk cabbage (*Symplocarpus foetidus*), common jewelweed, and horsetail (*Equisetum* sp.).

5.1.2.6 Floodplains

FEMA classifies Special Flood Hazard Areas for insurance and floodplain management purposes and has prepared maps designating certain areas according to the frequency of flooding. An area mapped 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.

A review of FEMA maps indicates that the Proposed Route extends across only one FEMA floodplain: the 100-year and 500-year floodplain associated with Trout Brook (PS-2). Though overhead lines spans are proposed over small segments of the PS-2 floodplains, no structures are proposed within any mapped floodplain. No floodplain is mapped in association with the unnamed tributary to Piper Brook (PS-1) at the proposed crossing location near Shepard Drive in Newington. The floodplain associated with the South Branch of the Park River and its tributaries does not encompass the proposed transmission line route and is discussed in Section 5.2.2 (Southwest Hartford Substation). Mapped floodplains in the Project area are depicted on the Volume 3 maps.

Trout Brook is managed for flood control purposes by the CT DEEP as part of the South Branch Park River (SBPR) Flood Control System.[53] In the proposed Project area, Trout Brook is bordered by a confining dike and upstream pumping station, which were constructed as a public safety infrastructure project. To maintain NRCS certifications[54] along this system, the CT DEEP recently conducted maintenance activities, including tree clearing, stump grinding, dredging, and soil stabilization activities along the SBPR Flood Control System. Such maintenance activities were conducted in the vicinity of the Proposed Route crossing of Trout Brook in 2016. The proposed 115-kV transmission line would be located within the Amtrak ROW and would extend over Trout Brook, thus spanning these SBPR Flood Control System features.

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. Groundwater along the southwestern portion of the Project area is designated as Class GA (areas south and west of State Route 173 in Newington). Groundwater along the majority of the Proposed Route (e.g., areas north and east of State Route 173 in Newington) is identified as Class GB,[55] reflecting the nearby industrial, transportation corridor and commercial nature along the Amtrak/CT*fastrak* corridor and near Southwest Hartford Substation.

[53] CT DEEP South Branch Park River (SBPR) Flood Control System Maintenance Project website: http://www.ct.gov/deep/cwp/view.asp?a=2720&Q=573044&deepNav_GID=1654 Accessed 10/04/2016

[54] Ibid. Per the above CT DEEP webpage (website content has since been updated): "The federal Natural Resource Conservation Service (NRCS) informed DEEP that maintenance work must be performed to bring the channel system back to its original condition or the flood control system would be decertified. There are significant financial consequences if the system is decertified, as well as increased risks to property and public safety."

[55] CT DEEP Water Quality Classifications Maps; November 2016 : http://www.ct.gov/deep/cwp/view.asp?a=2719&q=522518&deepNav_GID=1654 Accessed 01/2017

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.

In the vicinity of the Proposed Route, potable water service is provided by the Metropolitan District (MDC), a public non-profit municipal corporation created by the Connecticut 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.[56] The primary water supply source for the MDC is from a series of drinking water reservoirs [including the Barkhamsted Reservoir, the Nepaug Reservoir, West Hartford Reservoirs (Reservoirs 1-5) and Reservoir 6], the closest of which (Reservoir 1) is located approximately 2.5 miles northwest of Newington Substation.[57]

According to the CT DEEP's Aquifer Protection Area Program and analysis of publically available CT DEEP GIS data, there are no designated Aquifer Protection Areas within the Project area.[58]

5.1.3 Biological Resources

Biological resources in the Project area include vegetative communities, wildlife and fisheries resources, and threatened or endangered species (plants and wildlife). The biological resources along the Proposed Route are discussed below.

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

57 https://themdc.org/recreation-areas/reservoirs. Accessed 10/2016. Distances confirmed through analysis of publically available GIS data.

58 http://www.ct.gov/deep/cwp/view.asp?a=2685&q=322248. Accessed 07/2015.

Two potential vernal pools were identified along the Proposed Route during the August 2016 wetland delineation surveys. Because these potential vernal pools were identified outside of the typical spring-early summer amphibian breeding and migration seasons, additional field investigations were performed in spring 2017 (on March 29, April 7, April 28 and May 3). These surveys were conducted in accordance with industry standard methods, including assessment methodology outlined in *Best Development Practices, Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeastern U.S.*[59]

AECOM biologists conducted vernal pool investigations during typical amphibian breeding and migration seasons and during appropriate weather and temperature windows to assess vernal pool conditions. No evidence of vernal pool usage by obligate vernal pool species was observed during the spring 2017 field investigations. Consequently, no vernal pools were confirmed along the Proposed Route survey area. Additional details regarding the vernal pool investigations are included in Volume 2.

5.1.3.1 Vegetative Communities

Vegetation in the vicinity of most of the Proposed Route, including the segments where the new 115-kV line would be aligned underground along road ROWs or overhead within the Amtrak ROW, is characteristic of urban/suburban environments containing lawns and landscaping, as well as maintained transportation and utility corridors. Vegetative communities commonly observed in these “urban areas” are typical to residential developments, subdivisions, industrial or commercial areas, and roadsides in the northeastern U.S.

However, on the undeveloped portions of the Newington and Southwest Hartford substation parcels, as well as along Eversource’s existing transmission and distribution line ROWs that connect to Newington Substation, vegetation is characterized by a mix of vegetative associations and cover types, providing a variety of wildlife habitats that are not present elsewhere along the Proposed Route. Eversource manages vegetation along its ROWs to

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59 Calhoun, A.J.K. and M.W. Klemens. 2002 Best Development Practices: Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeastern United States. MCA Technical Paper No. 5, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

ensure consistency with existing transmission and distribution line use and conductor clearance requirements, resulting in predominantly shrub-scrub habitat within these corridors.

On Eversource-owned properties outside of the areas that are managed for electric line use along the distribution line ROW in Newington, vegetation consists principally of upland forest. In addition, a narrow riparian area of forest vegetation borders the tributary to Piper Brook, which the Proposed Route would cross along Shepard Drive in Newington. Further, although most lands near Southwest Hartford Substation are developed for commercial or industrial purposes, the riparian corridor along the unnamed tributary to the South Branch of the Park River is characterized by forested and open water habitats.

Overall, the following habitat types were documented in the Project area, either within or adjacent to the Proposed Route:

- **Old Field/Shrub Land**: This habitat type includes Eversource's existing managed ROWs and the area around Newington Substation. Eversource's ROWs are maintained in accordance with a vegetation management program to periodically remove tall-growing vegetation that could interfere with the operation of the overhead distribution or transmission lines. As a result, the predominant vegetation types within the managed portions of these ROWs consist of early successional cover types such as dense shrub and herbaceous species. Observed species include red maple saplings, oriental bittersweet (*Celastrus orbiculatus*), multiflora rose (*Rosa multiflora*), tatarian honeysuckle (*Lonicera tatarica*), American pokeweed (*Phytolacca decandra*), and rough-stemmed goldenrod (*Solidago rugosa*).
- **Upland Forest**: This forest type includes mature mixed deciduous/coniferous forests and woodlands in upland areas. Mature mixed forests consist typically of tree species common to the Northeast such as maples, oaks, hickories, spruce, and pine. Only limited areas of upland forest occur in the vicinity of the Proposed Route; these are all in Newington either on Eversource property associated with Newington Substation or adjacent to the managed portion of the distribution line ROW (refer for the Volume 3 maps). The ratio of deciduous to coniferous species and the age of the trees varies. Observed species include those from the red oak family (*Quercus rubra, Q. coccinea*), red maple, white pine (*Pinus strobus*) and shagbark hickory (*Carya ovata*).
- **Emergent Wetland**: Palustrine Emergent Marsh (PEM) exists in portions of the wetlands identified along Eversource's ROWs. This habitat type is dominated by herbaceous wetland plant species. Portions of the PEM wetlands are dominated by thick stands of the invasive common reed (*Phragmites austrailis*).
- **Scrub-Shrub Wetland**: Palustrine Shrub Swamp (PSS) areas are found within portions of the wetlands identified along Eversource's ROWs. These wetland types typically include components of emergent marsh, where shrub coverage is not

substantial. Inclusions of the invasive common reed were noted in the PSS wetlands.

- **Open Water**: Open water/palustrine unconsolidated bottom (PUB) 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. Species observed along the stream banks include red maple, northern catalpa (*Catalpa speciose*), boxelder maple (*Acer negundo*), Japanese knotweed, jewelweed, and mugwort (*Artemisia vulgaris*).
- **Forested Wetland**: Palustrine Forested Swamp (PFO) wetlands are located adjacent to the managed portions of Eversource's distribution line ROW and along the tributary to Piper Brook at the proposed Shepard Drive crossing.[60]

5.1.3.2 Wildlife

Wildlife habitats and species that were observed or commonly occur in the vegetative communities noted along the Proposed Route include the following:

- **Urban Lands**: Vegetative cover types in the Project area include suburban and urban residential areas, commercial and industrial developments, maintained lawns, and road, railroad, and utility corridors. Wildlife in these habitats can be abundant, as animals are attracted to human food sources (e.g., bird feeders), but the species inhabiting them must be tolerant of human disturbance to some degree. Some of the most recognizable wildlife can be found in these areas, such as white-tailed deer (*Odocoileus virginianus*), gray squirrel (*Sciurus carolinensis*), raccoons (*Procyon loto*r), woodchucks (*Marmota monax*), and birds such as Canada geese (*Branta canadensis*), robins (*Turdus migratorius*), house sparrows (*Passer domesticus*), and other numerous bird species frequenting feeders. Other less visible species, such as red fox (*Vulpes vulpes*), coyotes (*Canis latrans*) and striped skunk (*Mephitis mephitis*) may also be common. Nuisance wildlife species such as crows (*Corvus* spp.), rats (*Rattus* spp.), and other small rodents are often abundant. Some species are even dependent on human activity to thrive, such as birds nesting almost exclusively in human structures (e.g., chimney swift [*Chaetura pelagica*], starlings [Sturnus vulgaris]). 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, which are found along the Proposed Route only near Newington Substation and along portions of the distribution line ROW, 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 (*Microtus pennsylvanicus*), short-tailed shrews (*Blarina brevicauda*), and deer mice (*Peromyscus maniculatus*); woodchuck, rabbit (*Sylvilagus* spp.), and white-tailed deer; and predators such as red fox, coyote,

[60] Descriptions of the vegetation characteristics of all wetland types found along the Proposed Route and at Newington and Southwest Hartford substations are included in Sections 5.1.2.5, 5.2.1.2 and 5.2.2.2, as well as in the *Wetlands and Watercourses Report* (Volume 2).

weasel (*Mustela spp.*), skunk, and raccoon. Various shrubland birds, reptiles, and amphibians are also typically present. However, due to the densely-developed residential/urban areas in the Project area, only limited wildlife types are anticipated in this habitat. During AECOM's field investigations of the Proposed Route and substation properties, squirrel, common songbirds, red-tailed hawk, and signs of white-tailed deer (scat and tracks) were observed in this habitat type.

- **Upland Forest**: Upland forest is present in scattered, small areas near the Proposed Route; no large, un-fragmented forest blocks exist in the Project area. In general, forest vegetation supports a high diversity of wildlife. White-tailed deer may frequent mature forest 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 (*Peromyscus maniculatus*), red-backed vole (*Myodes gapperi*), 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 (*Meleagris gallopavo*), 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, which are found along the Proposed Route in Newington, and aquatic habitats (e.g., streams) provide desired habitat for a range of wildlife. Many species using forested and shrubland habitats also utilize freshwater wetland communities. Additionally, some species are adapted primarily to wetlands or other aquatic habitats. These include muskrat (*Ondatra zibethicus*) and water shrew (*Sorex palustris*), 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 wildlife include mole salamanders and, at some time in their life-cycle, frogs, turtles and snakes. Due to the existing residential/urban nature of the Project area, species variety and habitat use is anticipated to be low in these areas. During AECOM's on-site investigations, squirrel, common songbirds, red-tailed hawk, and signs of white-tailed deer (scat and tracks) were observed along the Proposed Route.

The Project area does not encompass any Connecticut Critical Habitats, as mapped by CT DEEP. Connecticut Critical Habitats include threatened and endangered and specialized wildlife habitats, as identified over many years by state agencies, conservation organizations, and individuals.

5.1.3.3 Fisheries

The Proposed Route crosses two perennial freshwater watercourses (PS-1 – Unnamed Tributary to Piper Brook; and PS-2 – Trout Brook). Fisheries data was obtained from CT DEEP for Trout Brook; however no data was available for the unnamed tributary to Piper

Brook.[61] The closest CT DEEP fisheries sampling point to the Proposed Route is where Trout Brook crosses beneath New Park Avenue, approximately 200 feet from the proposed transmission line crossing along the Amtrak ROW.

According to 2012 CT DEEP data for this New Park Avenue sampling site, seven species of fish were observed in Trout Brook, including American eel (*Anguilla rostrata)*, banded killifish (*Fundulus diaphanus)*, blacknose dace (*Rhinichthys atratulus)*, longnose dace (*Rhinichthys cataractae)*, rock bass (*Ambloplites rupestris*), tessellated darter (*Etheostoma olmstedi*), and white sucker (*Catostomus commersoni*). At the proposed overhead transmission line crossing, Trout Brook is likely to support warm-water tolerant fish species, rather than cold-water species, such as trout.

The CT DEEP's *2016 Connecticut Angler's Guide* does not identify any watercourses within the Project area as publically-accessible fisheries resources. No recreational fisheries information was noted for the unnamed tributary to Piper Brook, Trout Brook, or the unnamed tributary to the South Branch of the Park River.

5.1.3.4 Breeding Bird Inventory

In accordance with Council guidance, Eversource commissioned this inventory of breeding birds and their habitats in the Project vicinity. The inventory lists all breeding birds that could reasonably be expected to occur in the general Project area, as well as the habitat(s) that each species uses.

To develop the inventory, the primary sources used were *The Atlas of Breeding Birds of Connecticut* (Atlas)[62] and CT DEEP's *2015 Wildlife Action Plan (*WAP*)* which includes a list of the Species of Greatest Conservation Need (SGCN). The WAP was created to establish a framework for proactively conserving Connecticut's fish and wildlife, including their habitats[63] The Atlas is the result of a five-year study (1982-1986) of all bird species known to breed in Connecticut. The study is the most comprehensive review to date of Connecticut's breeding birds, involving the efforts of more than 500 individuals and covering

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[61] CT DEEP fisheries survey data obtained February 22, 2016.

[62] Bevier, L. R. (Ed.). Atlas of Breeding Birds of Connecticut. 1994. Bulletin 113. State Geological and Natural History Survey of Connecticut. 461 p.

[63] Connecticut's 2015 WAP was approved by the U.S. Fish and Wildlife Service (USFWS) in January 2016.

virtually all of the state's 5,009-square-mile area. The online Atlas identifies bird species whose presence are possible, probable, or confirmed. Search queries for the Atlas are populated based on USGS quadrangle maps, each of which is subdivided into six smaller quadrants. The three quadrants (51B, New Britain Quad; 52A, Hartford South Quad; and 37E, Hartford North Quad) that encompass the Proposed Route and surrounding areas were reviewed to compile the inventory of potential breeding birds in the Project area.

The initial inventory list subsequently was refined based on the availability of suitable habitat within the Project area, bio-geographical distribution, the presence or absence of critical habitat features, and minimum patch size requirements. The inventory is subdivided by habitat type. A species is listed under the habitat that represents its primary breeding type. However, a species should be considered to be potentially present within ecotones associated with their primary habitat at any given time.

To evaluate the Project area's value for species of high-conservation priority as opposed to common species and habitat generalists, the inventory of birds was prioritized based on conservation status. Species that are included either on Connecticut's *List of Endangered, Threatened and Special Concern Species* (2015) or classified as SGCN in the WAP were considered to be species of high conservation priority. SGCN fall into three categories in descending order of significance: most important, very important, and important.

Results

The Project area is highly urbanized and vegetation is generally dominated by landscaped lawns and ornamental species. Exceptions are the mix of forest, shrubland, grassland, and wetland habitats found on Eversource's properties at Newington and Southwest Hartford substations, as well as along the Eversource ROW between Newington Substation and State Route 173 (Willard Avenue). All forested areas in the Project vicinity are small (e.g., less than 20 acres) and fragmented (i.e., there are no areas of large core forests of greater than 250 acres).

Based on the review of the Atlas, 82 breeding bird species were identified as possible, probable, or confirmed breeders in at least one of the three survey quadrants in the Project area (refer to Table 5-4).

Table 5-4: Potential Occurrence of Breeding Birds in GHCCRP Area

Common Name	Scientific Name	Best Evidence [1]	State Status [2]	SGCN Status [3]	Preferred Habitat Type(s) [4]
Green Heron	*Buterides viresens*	PO			POW/PFO/PEM
Mute Swan	*Cygnus olor*	PO			POW/PEM
Canada Goose	*Branta canadensis*	CO			POW/PEM
Wood Duck	*Aix sponsa*	CO			PFO/PSS
American Black Duck	*Anas rubripes*	CO		V	PFO/PEM/PSS
Mallard	*Anas platyrhynchos*	CO			PEM/PSS/PFO
Northern Goshawk (T)	*Accipiter gentilis*	PO	T	M	UF
Broad-winged Hawk (SC)	*Buteo platypterus*	CO	SC	V	UF
Red-tailed Hawk	*Buteo jamaicensis*	PO			MF/AG/OF
American Kestrel (SC)	*Falco sparverius*	CO	SC	M	AG/OF
Ring-necked Pheasant	*Phasianus colchicus*	CO			AG/OF
Ruffed Grouse	*Bonasa umbellus*	CO		V	UF
Virginia Rail	*Rallus limicola*	PR		I	PEM
Killdeer	*Charadrius vociferus*	CO			URB
Spotted Sandpiper	*Actitis macularia*	PR			POW
American Woodcock	*Scolopax minor*	PO			UF/OF
Rock Dove	*Columba livia*	CO			URB/AG
Mourning Dove	*Zenaida macroura*	CO			URB/AG
Black-billed Cuckoo	*Coccyzus erythropthalmus*	CO			OF
Yellow-billed Cuckoo	*Coccyzus americanus*	CO		V	OF
Eastern Screech Owl	*Otus asio*	CO			UF
Great Horned Owl	*Bubo virginianus*	PO			UF

Common Name	Scientific Name	Best Evidence [1]	State Status [2]	SGCN Status [3]	Preferred Habitat Type(s) [4]
Common Nighthawk (E)	*Chordeiles minor*	PR	E	V	URB
Chimney Swift	*Chaetura pelagica*	CO		V	URB
Ruby-throated Hummingbird	*Archilochus colubris*	PO			URB
Belted Kingfisher	*Ceryle alcyon*	CO			POW
Red-bellied Woodpecker	*Melanerpes carolinus*	PR			UF/URB
Downy Woodpecker	*Picoides pubescens*	CO			UF/URB
Hairy Woodpecker	*Picoides villosus*	PR			UF
Northern Flicker	*Colaptes auratus*	CO		V	URB
Pileated Woodpecker	*Dryocopus pileatus*	PO			UF
Eastern Wood-Pewee	*Contopus virens*	CO		I	UF
Willow Flycatcher	*Empidonax traillii*	CO		I	PSS
Eastern Phoebe	*Sayornis phoebe*	CO			URB
Great Crested Flycatcher	*Myiarchus crinitus*	CO			UF
Eastern Kingbird	*Tyrannus*	CO		I	AG/OF
Tree Swallow	*Tachycineta bicolor*	CO			POW
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	CO			POW
Barn Swallow	*Hirundo rustica*	CO			AG/URB
Blue Jay	*Cyanocitta cristata*	CO			URB
American Crow	*Corvus brachyrhynchos*	CO			AG/URB
Black-capped Chickadee	*Parus atricapillus*	CO			UF
Tufted Titmouse	*Parus bicolor*	CO			UF
Red-breasted Nuthatch	*Sitta canadensis*	PO			UF
White-breasted Nuthatch	*Sitta carolinensis*	CO			UF
Brown Creeper	*Certhia americana*	PO			UF

Common Name	Scientific Name	Best Evidence [1]	State Status [2]	SGCN Status [3]	Preferred Habitat Type(s) [4]
House Wren	*Troglodytes aedon*	CO			URB/AG
Veery	*Catharus fuscescens*	CO			UF
Wood Thrush	*Hylocichla mustelina*	CO		M	UF
American Robin	*Turdus migratorius*	CO			URB/EF
Gray Catbird	*Dumetella carolinensis*	CO			OF
Northern Mockingbird	*Mimus polyglottos*	CO			OF
Brown Thrasher (SC)	*Toxostoma rufum*	CO	SC	V	OF
Cedar Waxwing	*Bombycilla cedrorum*	CO			URB/OF
European Starling	*Sturnus vulgaris*	CO			URB
Warbling Vireo	*Vireo gilvus*	CO			URB/OF
Red-eyed Vireo	*Vireo olivaceus*	CO			UF
Blue-winged Warbler	*Vermivora pinus*	CO		M	OF
Yellow Warbler	*Dendroica petechia*	CO			OF
Prairie Warbler	*Dendroica discolor*	PO		M	OF
Cerulean Warbler (SC)	*Dendroica cerulea*	PO	SC	V	UF
Black-and-white Warbler	*Mniotilta varia*	CO		I	UF
American Redstart	*Setophaga ruticilla*	CO			UF/OF
Ovenbird	*Seiurus aurocapillus*	CO		I	UF
Common Yellowthroat	*Geothlypis trichas*	CO			PSS/SS
Scarlet Tanager	*Piranga olivacea*	CO		V	UF
Northern Cardinal	*Cardinalis*	CO			URB/OF
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	CO		I	UF/OF
Indigo Bunting	*Passerina cyanea*	CO		V	OF/AG
Eastern Towhee	*Pipilo erythrophthalmus*	CO		V	OF

Common Name	Scientific Name	Best Evidence [1]	State Status [2]	SGCN Status [3]	Preferred Habitat Type(s) [4]
Chipping Sparrow	*Spizella passerina*	CO			URB
Field Sparrow	*Spizella pusilla*	CO		V	OF
Song Sparrow	*Melospiza melodia*	CO			OF
Bobolink (SC)	*Dolichonyx oryzivorus*	PR	SC	V	AG
Red-winged Blackbird	*Agelaius phoeniceus*	CO			PEM
Common Grackle	*Quiscalus quiscula*	CO			URB
Brown-headed Cowbird	*Molothrus ater*	CO			UF/OF
Baltimore Oriole	*Icterus galbula*	CO		I	URB
House Finch	*Carpodacus mexicanus*	CO			URB
American Goldfinch	*Carduelis tristis*	CO			URB
House Sparrow	*Passer domesticus*	CO			URB

[1] CO=Confirmed Breeder; PR=Probable Breeder; PO=Possible Breeder

[2] E = Endangered; T = Threatened; SC = Special Concern

[3] Species of Greatest Conservation Need (SGCN): M=Most Important; V=Very Important; I=Important

[4] UF=Upland forest; OF=Old field/shrubland; URB=Urban/suburban; AG=Agricultural land (none present along ROW); POW=Palustrine open water; PEM=Palustrine emergent wetland; PFO=Palustrine forested wetland; PSS=Palustrine scrub-shrub wetland

Source: *The Atlas of Breeding Birds of Connecticut* (Bevier 1994).

The 82 potential breeding bird species include one state-listed Endangered species (Common nighthawk), one state-listed Threatened species (Northern goshawk), and five state-listed Species of Special Concern (American kestrel, Brown thrasher, Bobolink, Cerulean warbler, and Broad-winged hawk). No federally listed threatened or endangered species were identified as present. A total of 27 species (33% of the 82 total species) are identified as SGCN. Of those 27 species, five are classified as most important, 14 as very important, and eight as important. Two of the five SGCN species identified as most important are associated with managed early successional ROW vegetation, two are associated with forested habitat, and one is found in open agricultural areas.

Of the 27 SGCN species identified, 11 are associated with forested habitat (i.e., upland forest and PFO wetlands), 10 are associated with managed, early successional vegetation (i.e., shrubland and PSS wetlands), including ROW habitats, two prefer open agricultural areas, two are found in developed areas, and two are found in emergent wetlands.

Bird species likely to breed in the vicinity of the Project area are those that are shown to use open brushy ground, shallow emergent marsh, and second growth forest, as well as species adapted to breeding in human influenced sites, including residential areas with a mix of fragmented forest blocks and open lawn, and industrial/commercial areas. Due to the level of urban/suburban development in the Project area, the most common species are likely to be habitat generalists and those that are tolerant of a mix of developed, forested, and open habitat. The most diverse habitat types are found at Newington Substation, along the Eversource ROW, and adjacent to Southwest Hartford Substation.

Of the 82 bird species identified as potentially occurring in the Project area, 25 are forest-breeding birds, including songbirds, woodpeckers and raptors; 19 prefer shrubland or early second growth forested habitats; 13 are found in wetland habitats (PFO, PEM, PSS, POW); and 25 are habitat generalist species that use suburban areas, developed industrial/commercial areas, or open agricultural areas.

5.1.3.5 Federal and State Listed or Proposed Threatened, Endangered, or Special Concern Species

To assess the potential for federal or state listed species occurrence in the Project area, Eversource conducted online data research and also evaluated habitats during Project field surveys. As described below, no federal or state threatened or endangered 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) mapping database to determine whether the Project area coincides with the known habitat or potential habitat of species identified by federal authorities as threatened, endangered or species of concern, or Critical Habitat for these species. The IPaC data indicated that the Northern Long-eared Bat (NLEB; *Myotis septentrionalis*) is the only federally-listed species potentially occurring in the Project area. However, no critical habitat (e.g., roosting sites, caves) is known or has been designated for this species in the Project area. The preferred habitat for this bat species includes caves or mines, where the bats hibernate in the winter, and within cavities or in crevices of both live and dead trees, where the bats roost in the summer. The proposed Project area does not support large stands of mature trees that are preferred habitat for this species. Coordination with USFWS regarding NLEB and potential habitat would be completed during the Project permitting process, as further outlined in Section 9.2.

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 occurrences and significant natural communities. This research, using the most recent available CT DEEP mapping (December 2016), indicates that there are no CT DEEP NDDB mapped polygons or known species along the Proposed Route. The closest mapped CT DEEP NDDB polygon is located in the vicinity of tributaries to Bass Brook located approximately 1,600 feet west of the Project area in Newington (refer to the Volume 3 maps). Because all Project activities would be focused well to the east of and downstream from this NDDB location, no effects to any species or habitat in the area are anticipated.

Additional coordination with the NDDB would be completed during the Project permitting process, as further outlined in Section 9.2. In accordance with the CT DEEP's requirements for submittal of an application for a General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, Eversource would submit to CT DEEP a Request for NDDB State Listed Species Review. If necessary based on the results of the NDDB's review, Eversource would coordinate further with the CT DEEP NDDB to develop appropriate mitigation for any identified state species of concern in the Project area.

5.1.4 Land Use

5.1.4.1 Existing Land Uses

The Proposed Route would be aligned primarily within Eversource's existing distribution line ROW, along state and local roads, and within the Amtrak ROW through Newington, West Hartford, and Hartford. Lands in the Project area are characterized by a variety of uses and types, including transportation and utility corridors (state and local roadways, Amtrak railroad corridor, the CT*fastrak* busway, Eversource's overhead transmission and distribution line ROWs) and residential, commercial, and industrial developments. Recreational greenways and trails are located in the vicinity of the Proposed Route, but no recreational areas, trails, or other community facilities would be crossed by the proposed transmission line.

To identify and assess existing and future land uses and conditions in the Project area, Eversource consulted 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 consulted with Amtrak to determine future railroad development plans. Research was conducted to identify whether any parcels preserved by local land trusts (e.g., West Hartford Land Trust) would be crossed by or 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.[64] Similarly, no land trust parcels are located along or in the immediate vicinity of the Proposed Route. However, the state-recognized Piper Brook Flood Control Greenway (part of the Newington Greenway System) and the Park River Greenway are located within 0.5 mile of the Proposed Route, as is the town-designated Trout Brook Greenway in West Hartford. Section 5.1.4.2 provides additional information regarding these greenway areas.

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

[64] http://ctecoapp1.uconn.edu/simpleviewer/ezviewer.htm. Accessed 07/2015

following summarizes primary land use patterns, by municipality, in the Proposed Route vicinity. The 115-kilovolt (kV) transmission line would extend approximately 3.7 miles in an underground (1.3 miles) and overhead (2.4 miles) configuration between Eversource's existing Newington Substation and Southwest Hartford Substation, crossing portions of:

- **Town of Newington:** The Proposed Route would traverse approximately 1.3 miles in the northwestern portion of Newington (1.1 miles in an underground configuration and 0.2 mile overhead along the Amtrak ROW). Specifically, the Proposed Route would extend east from Newington Substation along Eversource's ROW, crossing Avery Road and West Hartford Road, turning north onto Willard Avenue (State Route 173), then east onto Shepard Drive, before crossing the CT*fastrak* corridor and ultimately being collocated within and along the east side of the Amtrak ROW. Adjacent to the Eversource ROW and neighboring roads in Newington, land use consists primarily of single-family residences (located generally between Newington Substation and Shepard Drive). In addition, commercial/industrial developments are located along Shepard Drive near the Amtrak/CT*fastrak* corridor.
- **Town of West Hartford:** The Proposed Route traverses approximately 1.6 miles through the eastern portion of West Hartford. From the Newington border to the Hartford border, the Proposed Route would be aligned overhead along the east side of the Amtrak ROW. In West Hartford, land uses in the vicinity of the Proposed Route include commercial/industrial developments.
- **City of Hartford:** An approximately 0.7-mile segment of the Proposed Route would be located in southwestern Hartford (approximately 0.5 mile in an overhead configuration along the Amtrak ROW; 0.2 mile in an underground configuration). Land uses along this segment consist of industrial and commercial areas. The overhead transmission line would diverge from the Amtrak ROW south of I-84, spanning west across both the railroad tracks and the busway to a planned transition structure located on Amtrak property immediately adjacent to the Bow Tie Cinemas parking lot. From this structure, the new 115-kV line would transition to an underground configuration, extending adjacent to the movie theatre parking lot before intersecting with New Park Avenue and traversing along New Park Avenue, beneath I-84, to Southwest Hartford Substation.

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, parks, forests or greenways (CGS § 2-100), nor does it traverse any local open space or recreational areas. However, there are four open space/recreational areas/trails in the vicinity of the Proposed Route, including the state-recognized Piper Brook Flood Control Greenway (part of the Newington Greenway System) and the Park River Greenway, as well as the town-designated Trout Brook Greenway in West Hartford and the CT*fastrak* multi-use trail in Newington. These recreational features are described below and are depicted on the Volume 3 400-scale maps.

- **Piper Brook Flood Control Greenway (Newington Greenway System):** The Piper Brook Flood Control Greenway is one of four corridors in the state-recognized Newington Greenway System.[65] These greenways serve to conserve natural resources and provide opportunities for walking and other passive recreation. There are no officially designated trails within the Piper Brook Flood Control Greenway, nor are there any federal/state/municipal/private open space properties within or immediately adjacent to this area. The closest location of this designated greenway is approximately 1,700 feet southeast of the Proposed Route.
- **Trout Brook Greenway and 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.[66] The trail extends along the west side of Trout Brook Drive between New Park and Jackson avenues. Presently, access to the Trail is via the Beachland Park parking area; the paved Trail extends for approximately one 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. The Proposed Route does not cross this trail, since it spans Trout Brook approximately 265 feet to the east of the trail's eastern terminus at New Park Avenue.
- **Park River Greenway and South Branch Park River Trail:** The state-recognized Park River Greenway is mapped along both the South Branch and North Branch of the Park River within the Hartford city limits. This greenway has been designed as a recreational pathway and a commuter route, and has the potential to connect to regional greenway systems (including the Trout Brook and Piper Brook greenways). The South Branch Park River Trail is a 1,690-foot-long, 12-foot-wide multi-use paved trail that extends from Flatbush Avenue to Nilan Street in Hartford.[67] The Proposed Route would not cross either the Park River Greenway or the South Branch Park River Trail, which are located more than 0.3 mile to the east. A more extensive trail system is being planned for this area within the City of Hartford; however, none of these future trails would cross the Proposed Route. As currently envisioned, this expanded trail system would begin on the east side of the Park River at Hamilton Street across from Pope Park, then traverse south along Brookfield Street, cross Flatbush Avenue, and continue south to Newfield Avenue. The closest location of this future trail to the proposed Project is approximately 1,000 feet to the east. Other segments being considered are a meadow trail for walkers that would connect just south of the Flatbush Avenue trail head to the river; a westerly connection to the Trout Brook Trail in West Hartford, and a southerly connection along the Piper Brook Flood Control Greenway.
- **CT*fastrak* Multi-Use Trail:** A 5-mile multi-use trail, open to pedestrians and cyclists, is located along the CT*fastrak* ROW between the Downtown New Britain Station and the Newington Junction Station. The trail consists of a 10-foot wide paved path, which is separated from the busway by a fence. This trail terminates approximately 2,400 feet south of the Proposed Route, south of the Willard Avenue/Route 173

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65 http://www.ct.gov/deep/cwp/view.asp?a=2707&q=323852#2002. Accessed 1/27/2017.

66 https://www.westhartfordct.gov/gov/departments/leisure/trails/trout_brook.asp. Accessed 1/27/2017.

67 http://www.ctrcd.org/pdf/SBPRFactSheetEnglish.pdf. Accessed 1/27/2017.

overpass of the busway/railroad corridor. The Capitol Region Council of Governments and ConnDOT are working together to extend the trail from Newington Junction to Hartford along routes outside of the CT*fastrak* ROW.[68]

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 Route would be aligned underground within Eversource's existing ROW and along State Route 173 through a portion of the NRHP-listed Newington Junction North Historic District (refer to Section 5.1.5 for additional cultural and historic resource information). The Proposed Route also would be located within 0.3 mile of two state-recognized greenways and one town-designated greenway, all of which have scenic attributes. However, none of these areas are designated as scenic in local or regional land use plans.

5.1.4.4 Community Facilities

The Council's Application Guide (§ VI.G) specifies that the proximity of the proposed Project to certain community facilities must be identified in the Application. 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, youth camps, hospitals, or group homes. The route is located approximately 350 feet from a licensed daycare facility in Newington. Specifically, the new 115-kV transmission line would be located within Eversource's ROW south of the Family Tree Childcare and Learning Center (which is housed in the Temple Sinai Synagogue at 41 West Hartford Road, Newington). The community facilities within 0.5 mile of the Proposed Route are summarized in Table 5-5 and are shown on the Volume 3 maps.

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[68] http://ctfastrak.com/about/multi-use-trail-bikes. Accessed 10/07/2016.

Table 5-5: Community Facilities within 0.5-Mile of the Proposed Route

Facility Type	Name	Address	Municipality	Approximate Distance from Proposed Route (Feet)
Day Care	Private Daycare Facility	54 Sunnyside Road	Newington	1,850
Day Care	Private Daycare Facility (Possibly Closed)	64 Groveland Terrace	Newington	1,680
Day Care	Private Daycare Facility	51 Woodmere Road	Newington	1,680
Day Care	Private Daycare Facility	59 Chapman Street	Newington	1,465
Day Care	NECCI at Anna Reynolds	85 Reservoir Road	Newington	725
Day Care	Family Tree Childcare and Learning Center	41 W Hartford Road	Newington	340
Park	Beechwood Park	Brookside Road	Newington	1,930
Park	Starr Park	Brook Street	Newington	2,280
Park	Eagle Lantern Open Space	Jeffrey Lane	Newington	1,740
School	Anna Reynolds Elementary School	85 Reservoir Road	Newington	725
Day Care	Private Daycare Facility	120 Boulanger Avenue	West Hartford	2,010
Day Care	Private Daycare Facility	3 Selldan Street	West Hartford	680
Day Care	Private Daycare Facility	113 Boulanger Avenue	West Hartford	1,880
Day Care	Private Daycare Facility	6 Huckleberry Lane	West Hartford	900
Day Care	Private Daycare Facility	119 Davenport Road	West Hartford	2,110
Day Care	West Hartford Extended Experience Charter Oak School	425 Oakwood Avenue	West Hartford	1,485
Day Care	YWCA Child Care - Elmwood Community Center	1106 New Britain Avenue-	West Hartford	1,485
Day Care	Ywkidslink At Wolcott School	71 Wolcott Road	West Hartford	2,540
Day Care	Juniper Day Center Elmwood	1086 New Britain Avenue	West Hartford	1,250
Medical	UConn Health Partners Genetics	65 Kane Street	West Hartford	1,875
Park	Kennedy Memorial Park	160 Oakwood Avenue	West Hartford	1,590
Park	Sterling Field	Price Boulevard	West Hartford	1,825
Park	Elmwood Community Center	1106 New Britain Avenue	West Hartford	1,485

Facility Type	Name	Address	Municipality	Approximate Distance from Proposed Route (Feet)
Park/Playground	Beachland Park	847 Quaker Lane South	West Hartford	2,420
School	Charter Oak Academy Of Global Studies	425 Oakwood Avenue	West Hartford	1,485
School	Henry A. Wolcott Elementary School	71 Wolcott Road	West Hartford	2,985
Day Care	CRT-ECE Grace Street Center	37 Grace Street	Hartford	1,910
Day Care	Private Daycare Facility	214 Brookfield Street	Hartford	1,270
Day Care	Private Daycare Facility	34 Merrill St	Hartford	970
Day Care	Job Corps Academy Child Development Center	100 William Shorty Campbell Street	Hartford	1,675
Day Care	Private Daycare Facility	254 Flatbush Avenue	Hartford	2,520
Day Care	Private Daycare Facility	326 Brookfield Street	Hartford	1,110
Day Care	Our Lady Of Fatima Day Care Center	18/20 Madison Avenue-Fatima Square	Hartford	775
Day Care	Private Daycare Facility	48 Hollywood Avenue	Hartford	2,455
Day Care	Private Daycare Facility	27 Bulkeley Avenue	Hartford	1,875
Day Care	Warburton Day Care Center	420 Brookfield Street	Hartford	1,560
Nursing Home	Park Place Health Center	5 Greenwood Street	Hartford	1,755
Park	City of Hartford Open Space (Brookfield Street)	Brookfield Street	Hartford	1,325
Park	City of Hartford Open Space (Overlook Terrace)	Overlook Terrence	Hartford	1,185
Park	City of Hartford Open Space (Brinley Avenue)	Brinley Avenue	Hartford	2,215
Park	Harbison Playground	Hillside Avenue	Hartford	2,400
Park	Rice Heights Playground	Pulaski Drive	Hartford	1,170
School	Breakthrough Magnet School	290 Brookfield Street	Hartford	1,160
School	Parkville Community Elementary School	1755 Park Street	Hartford	2,070
School	A.I. Prince Technical High School	401 Flatbush Avenue	Hartford	1,620
Youth Camp	Boys And Girls Clubs of Hartford	1 Chandler Street	Hartford	2,280

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 land use plans prepared by each of the three municipalities along the Proposed Route.

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,[69] while also proactively addressing the needs and desires of a changing demographic base."

According to the C&D Plan's Locational Guide Map, the entire Proposed Route is mapped in an Urban Area. The C&D Locational Guide Map further indicates that the portion of the Proposed Route in Newington is in a mapped "Neighborhood Conservation Area." Neighborhood Conservation Areas are characterized as, "lands without the high incidence of the structural, occupancy, and income characteristics of Regional Centers yet are significantly built-up and well populated." These areas generally reflect stable, developed neighborhoods and communities and are often contiguous to Regional Centers.[70]

Further, the C&D Locational Guide Map indicates that the majority of the Proposed Route, located in Hartford and West Hartford, is located in a "Regional Center." Under the C&D

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

[70] http://www.ct.gov/opm/lib/opm/igp/cdplan/c_d_deinitional_criteria.pdf

Plan's Development Priority 1,[71] Regional Centers are assigned "highest priority for affirmatively supporting rehabilitation and further development toward revitalization of the economic, social, and physical environment of Regional Centers." Regional Centers encompass lands with traditional core areas of commercial, industrial, transportation, specialized institutional services, and facilities of intertown significance.[72]

In addition, the Capitol Region Council of Governments (CRCOG) services the municipalities along the Proposed Route.[73] Eversource reviewed the *2014-2024 Regional Plan of Conservation and Development* (POCD) adopted May 21, 2009 by CRCOG. While the CRCOG POCD does not directly refer to electric transmission projects or the electric infrastructure, it does support clean energy initiatives, and the POCD's Growth Management 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 reviewed. All three municipalities traversed by the Proposed Route have published POCDs, as summarized below. In general, these plans anticipate that areas traversed by the Proposed Route would continue to maintain their current land use patterns in the future (e.g., residential development, commercial/industrial areas). None of the plans identify local land use policies that would be inconsistent with the development of the proposed Project.

- **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.

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71 Ibid.

72 http://www.ct.gov/opm/cwp/view.asp?A=2990&Q=385370

73 http://www.ct.gov/sots/cwp/view.asp?q=392406

- **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): Like the West Hartford POCD, the Hartford POCD specifies support for clean energy initiatives, but does not directly address electric transmission projects or energy infrastructure.

5.1.5 Cultural (Historical and Archaeological) Resources

To evaluate historic and archaeological resources in the Project area, Eversource retained Heritage Consultants, LLC (Heritage), a firm specializing in cultural resource analyses. Heritage conducted baseline desktop research and subsequent field reconnaissance to assess the known historic and archaeological resources along the Proposed Route specifically and in the Project area in general.

As part of the Project planning and siting process, Eversource and Heritage consulted and performed field investigations with the State Historic Preservation Office (SHPO). The SHPO, which is part of the Connecticut Department of Economic and Community Development, is responsible for reviewing projects to ensure that significant cultural resources would be protected or otherwise preserved. Eversource provided relevant cultural resource investigation documentation to the SHPO for review and expects to continue to coordinate with the agency regarding the review of cultural resource information concerning the Project.

The results of Heritage's cultural resource analyses are presented in the following reports prepared by Heritage, all of which are included in Volume 2 of this Application.

- *Cultural Resources Review of the Project Region Associated with the Greater Hartford Connecticut Reliability Project* dated May 19, 2015 (2015 Cultural Resources Review Report);
- *Cultural Resources Review Report Addendum* dated November 4, 2016 (2016 Addendum); and,

- Phase IB Cultural Resources Reconnaissance Survey of the Greater Hartford – Central Connecticut Reliability Project Corridor in Newington, Connecticut dated April 2017 (2017 Phase 1B Report).[74]

The findings presented in these reports are 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, consultations with the SHPO and the Connecticut State Archaeologist, and field investigations, including archaeological testing and analyses of the viewshed to/from NRHP sites. Additional coordination with the relevant Tribal Historic Preservation Officers (THPOs) would be completed during the Project's permitting phase. Summaries of the Project cultural resource investigations and findings are presented below.

5.1.5.1 Cultural Resources Review Report Findings

The objectives of the initial 2015 Cultural Resource Review Report, which addresses archaeological and historic resources in the Project area, were: (1) to gather and present data regarding previously identified cultural (historical and archaeological) resources situated in the vicinity of the Project; (2) to investigate the proposed Project area in terms of its natural and historical characteristics; and (3) to evaluate the need for completing additional cultural resources investigations.

Various listed historic resources were identified in the Project area through desktop investigations, as presented in Table 5-6. As this table indicates, the only known cultural resource located along the Proposed Route is the NRHP-listed Newington Junction North Historic District. The next closest NRHP-designated resource is the Parkville Historic Industrial District, which is located approximately 300 feet northeast of Southwest Hartford Substation.

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74 The *2015 Cultural Resources Review Report* and *2016 Addendum* reports by Heritage are included as appendices to the *2017 Phase 1B Report*.

Table 5-6: Historic Cultural Resources near Proposed Route

Name	Location	Municipality	Type	Approximate Distance from Proposed Route
Parkville Historic District	See Volume 2 and 3 Mapping	Hartford	NRHP Historic District	300 feet northeast of Southwest Hartford Substation
Goodwin Pottery Factory*	Former Location: North Central Portion of Amtrak Corridor	West Hartford	Former SRHP Listing	Not Available. Site destroyed prior to 1966 resulting in a functional delisting from the SRHP
St. Paul's Methodist Episcopal Church/ Tempolo Sion Pentecostal Church	1886-1906 Park Street. See Volume 2 and 3 Mapping	Hartford	NRHP	2,100 feet north of Southwest Hartford Substation
Former Royal Typewriter Co. Building*	Former Location: New Park Avenue. See Volume 2 and 3 Mapping	Hartford	NRHP Listing (Component of the Parkville Historic District) Former SRHP Listing*	Approximately 800 feet northeast of Southwest Hartford Substation. Site burned down in 1992 and was subsequently demolished. Site is currently a supermarket. The site was functionally delisted from the SRHP; however, the former site remains listed on NRHP.
Newington Junction Historic Districts	See Volume 2 and 3 Mapping	Newington	NRHP Historic District	Of the four Newington Junction Historic Districts, the Newington Junction North Historic District is the only one crossed by the Proposed Route. The others (Newington Junction West, Newington Junction Railroad Depot Historic District, and Newington Junction South) are located south of the Proposed Route.

*Functionally delisted

When the 2015 Cultural Resources Review Report was published, Eversource anticipated that the proposed 115-kV line would have to be aligned, in an underground configuration, along existing road ROWs. At that time, the viability of collocating the proposed line along other ROWs (e.g., Eversource's ROW, Amtrak ROW) was in the process of being evaluated. Accordingly, the 2015 report concluded that the alignment of the new 115-kV transmission line within existing roadways would have little, if any, potential to yield intact cultural deposits. As such, Heritage concluded that the "*paved portions of the GHCCRP have been assessed as no/low sensitivity areas, and no archaeological testing of these areas is recommended prior to construction of the GHCCRP*".

The 2015 report also indicated that if the proposed 115-kV transmission line were to be aligned along the Eversource ROW, then the areas should be "*subjected to Phase IB subsurface testing prior to construction*", as the areas "*have been assessed as retaining a moderate/high archaeological sensitivity*".

5.1.5.2 Cultural Resources Review Report Addendum Findings

After determining that the proposed 115-kV transmission line could be collocated along its existing ROW in Newington (using either an overhead or underground configuration) and along the Amtrak ROW using an overhead line design, Eversource commissioned Heritage to conduct additional cultural resource investigations of those areas, as well as further consultations with the SHPO. Accordingly, the results of Heritage's additional historic and archaeological resource investigations of the Proposed Route are presented in the 2016 Addendum, and summarized below.

On May 20, 2016 Eversource Project representatives consulted with the SHPO regarding the current Proposed Route alignment and various route siting/design options under consideration. Measures to avoid or minimize potential visual impacts to above-ground cultural resources in the nearby historic districts were discussed at this in-field meeting. At the request of the SHPO, Heritage subsequently completed visual simulation tests to assess whether views of the proposed overhead transmission line structures along the Amtrak ROW would adversely affect the visual context of nearby NRHP districts. For these tests, large red weather balloons (4 feet in diameter) were floated at select locations and heights of proposed overhead structures along the Amtrak ROW; Heritage personnel then observed and photographed the balloons from various vantage points in and near the historic districts. Heritage concluded that no significant visual effects were anticipated to historic property viewsheds as a result of the overhead structures. (Refer to the 2016 Addendum in Volume 2 for additional information regarding the visual simulation tests.)

Heritage also concluded that the substations and the portion of the Proposed Route along the Amtrak ROW are previously-disturbed areas, with minimal potential to uncover intact archaeological resources. The 2016 Addendum did, however, reiterate and expand upon Heritage's 2015 recommendation that a Phase IB survey be conducted for the moderate/high probability areas of archaeological sensitivity located "*along the existing Eversource distribution line ROW between Newington Substation and Willard Avenue".*

5.1.5.3 Phase IB Cultural Resources Reconnaissance Survey Findings

In December 2016, Heritage performed Phase IB Cultural Resources Reconnaissance Survey field investigations (i.e., shovel test excavations) along Eversource's distribution line ROW, which was previously identified as having "moderate/high probability areas of archaeological sensitivity". Heritage's 2017 Phase IB Report (refer to Volume 2) provides the results of these investigations, which are summarized as follows.

Along the Eversource ROW, test pit locations were identified to coincide with anticipated Project work areas (i.e., areas of soil disturbance) along the Proposed Route[75] and with areas of potential historical/archaeological sensitivity. Heritage's 2017 Phase IB survey was completed utilizing pedestrian survey, photo-documentation, mapping, and systematic shovel testing in undisturbed areas. During the investigation, 68 of 83 (82%) planned shovel tests were excavated successfully.

The Phase IB cultural surveys resulted in the identification of a single multicomponent archaeological site (designated as Site 94-1). Site 94-1 is located on the Newington Substation parcel, and findings at this location are further discussed in Section 5.2.1.5. Heritage summarized their Phase IB findings as follows:

> *The prehistoric component yielded a single Brewerton side notched projectile point and 1 quartz flake, while the historic component consisted of a small scatter of whiteware sherds, a shell fragment and two cut bone fragments. Neither component of [survey] Site 94-1 possesses research potential or the qualities of significance as defined by the National Register of Historic Places criteria for evaluation (36 CFR 60.4 [a-d]). Thus, no additional testing of Site 94-1 is recommended.*
>
> *No other archeological deposits were identified during Phase IB cultural resources reconnaissance survey of the remainder of the proposed project corridor. It is the professional opinion of Heritage Consultants, that there will be no adverse effect on cultural resources as a result of the proposed construction.*

[75] Heritage's Phase IB Cultural Resources Reconnaissance Survey investigations considered the potential for the proposed 115-kV line to be configured either overhead or underground along the Eversource ROW. Consequently, test pits were located in areas that potentially would be affected by the proposed cable trench, access roads, and splice vaults, or by overhead transmission line structures and work pads. Section 11.5 discusses the overhead configuration option along the Eversource ROW.

Eversource submitted Heritage's 2017 Phase 1B Report to the SHPO and expects to continue to coordinate with the SHPO, as necessary, regarding the Project.

5.1.6 Soil and Groundwater Areas of Environmental Concern

Because portions of the Proposed Route extend both along the Amtrak ROW and through urbanized areas that have previously been used for various commercial and industrial purposes, Eversource commissioned a review and compilation of published data concerning potential areas of environmental concern with respect to soil and groundwater contamination and hazardous materials conditions.

For this initial screening, environmental release-related and hazardous material storage database listings were reviewed for areas located in the vicinity of the Proposed Route. Each database listing was evaluated to assess whether the reported issue (e.g., release of a reportable substance, hazardous material storage) could indicate a potential for contamination to exist along the Proposed Route. Based on the review of listings directly along the Proposed Route, soil or groundwater contamination could potentially be encountered during underground cable installation within Willard Avenue (State Route 173) and Shepard Drive in Newington or during overhead transmission line foundation drilling/installation within the Amtrak ROW from the vicinity of Flatbush Avenue to just south of the I-84 crossing.

Additional analyses regarding soil and groundwater conditions along the Proposed Route, which would typically include sampling, would be conducted as part of the Project's final engineering design. Relevant information would be reflected in the Project D&M Plan.

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 U.S. Environmental Protection Agency's (EPA) 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.

In an effort to reduce particulate emissions, the CT DEEP has promulgated regulations (Regulations of Connecticut State Agencies (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 Project area vary as a function of land use, and can be expected to range from sound levels typical of an urban environment near major transportation corridors and industrial/commercial uses (e.g., along the Amtrak/CT*fastrak* corridor, near I-84) to those typical of quieter, suburban residential areas (e.g., along the Eversource ROW in Newington). Noise levels are also variable throughout the day, and are influenced by diverse factors such as vehicular, bus, and rail traffic; commercial and industrial activities; and outdoor activities typical of urban and suburban environments. Table 5-7 lists typical sound levels associated with different types of environments and activities. As illustrated in Table 5-7, the allowable noise levels vary by type of noise emitter and type of noise receptor.

Table 5-7: 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

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 on the table, 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 5-8 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 5-8 do not apply to construction of this Project.

Table 5-8: 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 must be consistent with the state noise regulations. Noise ordinances potentially 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

5.1.8.1 Transportation and Utilities

The Proposed Route extends through suburban/urban areas that are characterized by a well-developed transportation network, and are served by a full range of utilities (electric, natural gas, sewers, public water and cable television providers). No airports are located in the Project area; the nearest airport is the Hartford-Brainard Airport, which is located approximately 4 miles east of the Project area.

As shown on the Volume 3 maps, the transportation network in the vicinity of the Proposed Route and in the surrounding region consists of a variety of federal, state, and local roads, as well as the Amtrak ROW, which presently includes two railroad tracks, the CT*fastrak* busway, and – in some areas – an access road to the east of the railroad tracks. Eversource distribution and transmission line ROWs also interconnect to Newington and Southwest Hartford substations. The Proposed Route would be aligned within Eversource's existing distribution line ROW, state and local road ROWs, and the Amtrak/CT*fastrak* corridor, and would cross other ROWs, as listed in Table 5-9 and further described below.

Extending east from Newington Substation to State Route 173 (Willard Avenue), the Proposed Route would be aligned for approximately 0.8 mile within Eversource's existing ROW. This ROW is presently occupied by five distribution circuits, consisting of one underground circuit and four overhead circuits (supported on two lines of double-circuit structures). Along this ROW, the Eversource fee-owned properties and easements are approximately 100 to 200 feet in width, in combination. The easement-only portion of the ROW (near West Hartford Road) is 100 feet wide.

Principal roads along the Proposed Route include I-84, State Route 173 (Newington Road and Willard Avenue), and State Route 71/529 (New Britain Avenue); refer also to the Volume 3 maps. As summarized in Table 5-9, the proposed 115-kV line either would be aligned across/along roads (in an underground configuration) or would span roads (in an overhead configuration; while collocated within the Amtrak ROW).

Table 5-9: Predominant ROWs along or crossed by the Proposed Route

ROW Type	Proposed Route Relationship to ROW	ROW Description
Newington		
Existing Eversource Distribution Line ROW	Aligned along ROW for approximately 0.80 mile	Overhead and underground utility distribution ROW
Avery Road	Crosses	Local Road (2 lane)
West Hartford Road	Crosses	Local Road (2 lane)
Willard Avenue/State Route 173	Crosses and aligned along road for approximately 0.15 mile	State Highway 173 (2 lane)
Shepard Drive	Aligned along road for approximately 0.12 mile	Local Road (2 lane)
CT*fastrak*	Crosses in overhead configuration	Busway managed by ConnDOT within Amtrak-owned ROW.
Amtrak Railroad	Aligned in overhead configuration, adjacent to and east of railroad tracks. Aligned in Amtrak ROW for 2.37 miles total; 0.17 mile in Newington	Two active railroad lines
West Hartford		
Amtrak Railroad*	Aligned in overhead configuration, adjacent to and east of railroad tracks. Aligned in Amtrak ROW for 2.37 miles total; 1.64 miles in West Hartford	Two active railroad lines
New Britain Avenue/SR 529*	Amtrak ROW elevated above New Britain Ave. Proposed Route would cross in an overhead configuration	State Highway 529 (4 lane)
Metropolitan District (MDC) South Hartford Conveyance and Storage Tunnel (SHCST)*	Crosses via overhead span SHCST is deep below grade (Approximate tunnel depth of 200 feet below ground surface)	Proposed 18-foot diameter MDC tunnel will be buried deep underground. Construction has recently initiated.
Oakwood Avenue*	Amtrak ROW crosses Oakwood Ave at grade. Proposed Route would cross in an overhead configuration	Local Road (2 lane)
Unnamed Service Road (AKA Homewood Place)*	Adjacent to and running parallel with service road for 0.23 mile	Private Service Road paralleling Amtrak ROW
Flatbush Avenue*	Flatbush Ave. ROW elevated above Amtrak ROW. Proposed Route would cross in an OH alignment within the Amtrak ROW and above Flatbush Ave.	Local Road (Primarily 2 lane road; 5 turning lanes on bridge at the proposed crossing location)
Hartford		
Amtrak Railroad	Aligned in overhead configuration, adjacent to and east of railroad tracks. Aligned in Amtrak ROW for 2.37 miles total; 0.56 mile in Hartford	Two active railroad lines
CT*fastrak*	Crosses in overhead configuration	Busway managed by ConnDOT within Amtrak-owned ROW
New Park Avenue	Extends along and crosses in an underground configuration for 0.07 mile, to Southwest Hartford Substation	Local Road (2 lane)
I-84 (Yankee Expressway)	Extends beneath highway in an underground configuration; Proposed Route configuration within New Park Avenue as described above. Crossing beneath I-84 approximately 0.06 mile	Major, east-west, multi-lane interstate highway. Interstate is elevated above New Park Avenue

* In West Hartford, all 1.64 miles of the proposed transmission line would be aligned in an overhead configuration along the east side of the Amtrak ROW. Road and utility crossings noted in West Hartford cross at grade, above or beneath the existing Amtrak railroad tracks via bridges and overpasses. The proposed line would be configured to provide sufficient overhead line clearances.

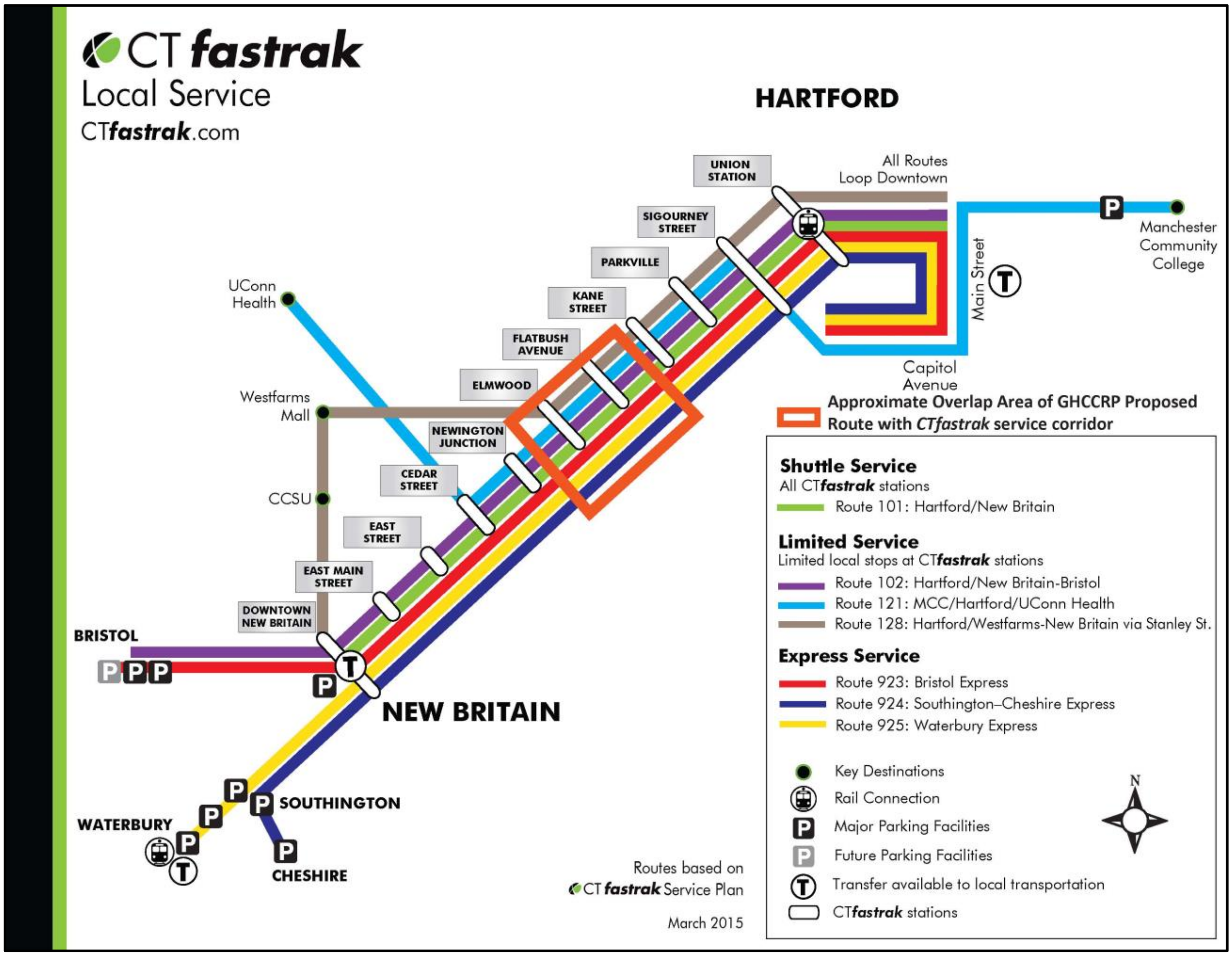
Approximately 2.4 miles of the Proposed Route would be aligned within the Amtrak ROW, to the east of the existing railroad tracks. This ROW, which includes two active Amtrak railroad lines and the CT*fastrak* busway, extends generally southwest-to-northeast. In this area, both the Amtrak railroad tracks and the CT*fastrak* are collocated along the same corridor, with the railroad tracks situated east of the CT*fastrak*. Amtrak owns the entire corridor and leases the portion occupied by the CT*fastrak* to ConnDOT. The Amtrak ROW varies in width from 86 to 155 feet along the 2.4-mile length of the overhead segment, with the typical ROW width 93 feet to 115 feet.

Amtrak's two railroad lines along this corridor are currently being upgraded to high-speed passenger 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, would use the existing railroad tracks to connect to the Metro-North and Amtrak Acela rails systems. The NHHS is expected to be in service by 2018. As part of the NHHS Rail Program, new Amtrak stations in Newington and West Hartford are planned for the future, along with other improvements.

The CT*fastrak* commenced service in late March 2015 and is operated by ConnDOT. It 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. The Newington Junction, Elmwood, Flatbush and Kane Street CT*fastrak* Stations are located in proximity to the Proposed Route. Figure 5-1 illustrates the location of the CT*fastrak* service area in relation to the Proposed Route.

Various utility lines also are located beneath or along roads in the Project area. Most of these utility lines provide distribution type service to local customers. For example, the MDC, which provides water and sanitary sewer services to the municipalities in the Project area, maintains a network of potable water, sanitary sewer, and storm sewer lines. As part of a clean water initiative designed to keep untreated wastewater from entering the Connecticut River, the MDC is in the process of initiating construction on the South Hartford Conveyance and Storage Tunnel (SHCST); a 4-mile-long deep underground rock tunnel designed to temporarily store combined stormwater and sewer overflows during rain events, and then convey the flows to the Hartford Water Pollution Control Facility for treatment.

Figure 5-1: General Location of Proposed Route and CT*fastrak* Service Area



5.1.8.2 Energy Facilities

In accordance with RCSA § 16-50j-59(15), energy facilities within 5 miles of the Project are listed in Table 5-10 and are shown on Figure 5-2.

Figure 5-2: Energy Facilities within a 5-Mile Radius of the Project

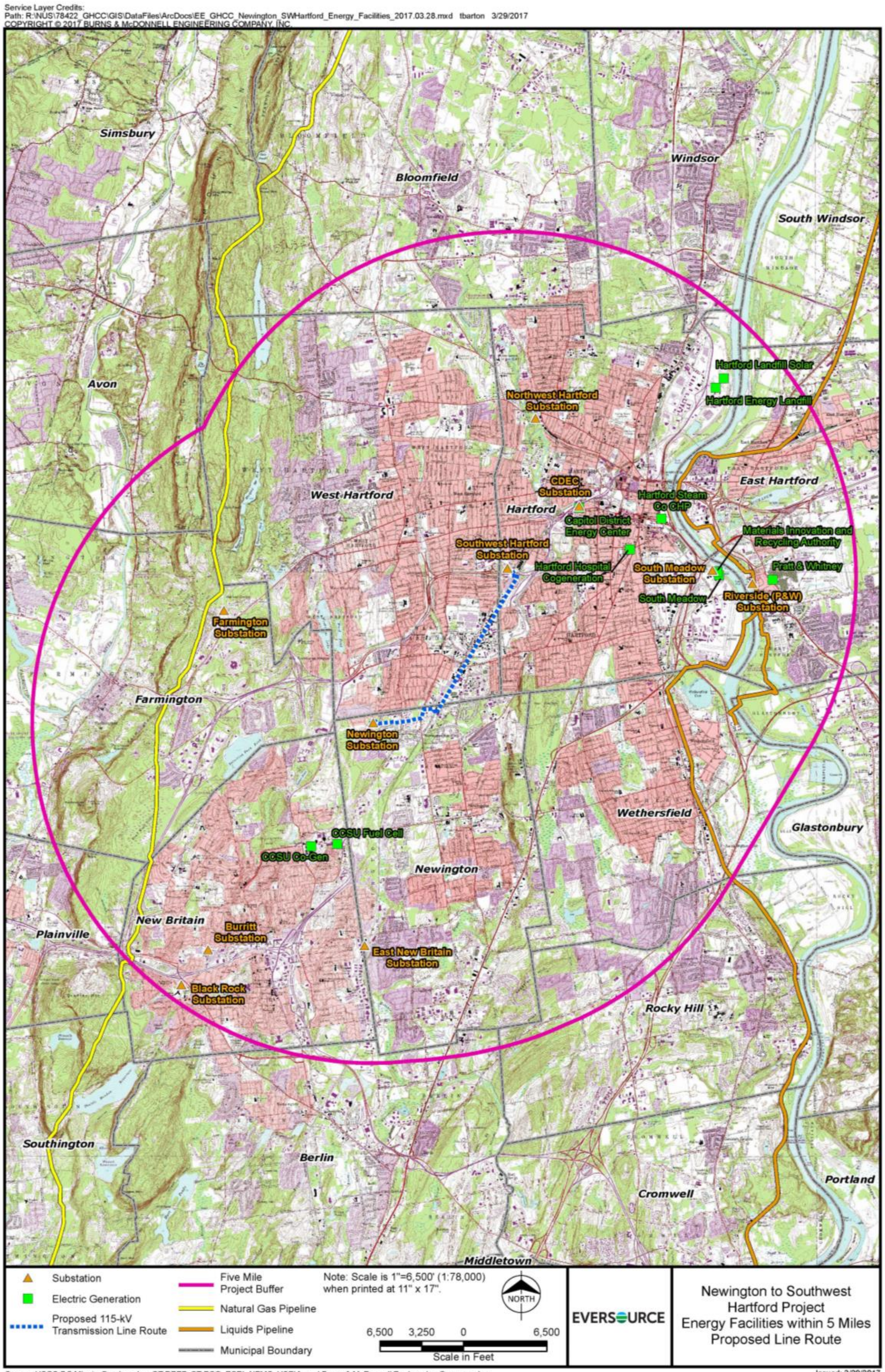


Table 5-10: Energy Facilities within 5-Miles of the Proposed Project

Transmission Substations			
Owner	**Name**	**kV**	**Town/City**
Eversource	Black Rock	115-kV	New Britain
Eversource	Burritt	115-kV	New Britain
Eversource	CDEC	115-kV	Hartford
Eversource	East New Britain	115-kV	New Britain
Eversource	Farmington	115-kV	Farmington
Eversource	Newington	115-kV	Newington
Eversource	Northwest Hartford	115-kV	Hartford
Eversource	Riverside (P&W)	115-kV	East Hartford
Eversource	South Meadow	115-kV	Hartford
Eversource	Southwest Hartford	115-kV	Hartford
Generators			
Owner	**Name**	**MW**	**Town/City**
United Technologies	Pratt & Whitney	28 MW	East Hartford
DeltaPro Energy Inc.	Hartford Energy Landfill	2.7 MW	Hartford
Hartford Steam Company	Hartford Hospital Cogeneration	9 MW	Hartford
Hartford Steam Company	Hartford Steam Co CHP	3.5 MW	Hartford
Materials Innovation Recycling Authority	Hartford Landfill Solar	1.0 MW	Hartford
Maxim Power	Capital District Energy Center	55.2 MW	Hartford
NAES Corp	CT Resource Recovery Authority	56.2 MW	Hartford
NAES Corp	South Meadow	148.4 MW	Hartford
New Britain Renewable Energy LLC	CCSU Fuel Cell	1.4 MW	New Britain
Central Connecticut State University	CCSU Co-Gen	3.6 MW	New Britain

Interstate Pipelines		
Owner	**Description**	**Material Type**
Buckeye Pipeline	East Hartford Terminal – Wethersfield BET Terminal	Liquids
Buckeye Pipeline	Rocky Hill Jct. – East Hartford Terminal 12-inch	Liquids
Buckeye Pipeline	East Hartford Terminal – South Windsor 12-inch	Liquids
Tennessee Gas	Tennessee Gas Pipeline 16-inch	Natural Gas
Transmission Lines		
Line Numbers	**Location**	**kV**
680	Black Rock – Burritt	115-kV
1704	Southwest Hartford to South Meadow	115-kV
1722	Northwest Hartford – CDEC	115-kV
1722	Northwest Hartford – Southwest Hartford	115-kV
1726	North Bloomfield – Farmington	115-kV
1751	North Bloomfield – Northwest Hartford	115-kV
1756	Bloomfield – Northwest Hartford	115-kV
1769	East New Britain – Berlin	115-kV
1773	South Meadow – Rocky Hill	115-kV
1775	South Meadow – Riverside (P&W)	115-kV
1775	Riverside (P&W) – Manchester	115-kV
1779	Bloomfield – South Meadow	115-kV
1783	Farmington – East New Britain	115-kV
1785	Newington – Berlin	115-kV
1786	South Meadow – East Hartford	115-kV
1670	Black Rock – Southington	115-kV
1820	Black Rock – Southington	115-kV
1830	Black Rock – Southington	115-kV
1840	Black Rock – GE Test	115-kV

5.2 SUBSTATIONS AND NEWINGTON TAP

To interconnect the new 115-kV transmission line to the system, Eversource proposes to modify Newington Substation and Southwest Hartford Substation, which are located at the terminal points of the proposed transmission line. In conjunction with the modifications to Newington Substation, the Newington Tap also would be reconfigured.

The following subsections describe the existing environmental and cultural resources at both substations. Certain environmental features (e.g., geology, air quality) are common to the general Project region and, while discussed for the Proposed Route in Section 5.1, 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 and Newington Tap

The existing 1.7-acre Newington Substation is located in the northern portion of the Town of Newington, within an 11.4-acre Eversource parcel that is accessible via an access road from Cherry Hill Drive. 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 30 feet to the south and approximately 20 feet to the west.

The Newington Tap is an approximately 0.01-mile overhead 115-kV transmission line that currently connects Eversource's existing 1783 Line to Newington Substation. As part of the Project, this short 115-kV transmission line connection would be replaced with larger conductor and reconfigured to a new terminal position on the south side of the substation.

This section describes the existing environmental conditions in the vicinity of both Newington Substation and Newington Tap.

5.2.1.1 Topography, Geology and Soils

Newington Substation is situated at approximately 150 feet above mean sea level, with the developed portion of the site (i.e., the substation) elevated above the surrounding undeveloped areas. To construct the existing substation, the topography on the site was modified. Lands within Newington Substation fenceline are elevated and flat, whereas the area immediately outside the substation fence (but on Eversource property) are variable and characterized by topography that slopes to the south and southwest.

The geologic materials beneath the substation are comprised of glacial meltwater deposits. Soils at and in the vicinity of the substation (refer to Table 5-1) are comprised of Branford silt loam (30B) 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). The Newington Tap, near the southwest corner of the station, is located in an area mapped as Branford silt loam (30B) and Ellington silt loam (20A). Two of the four soils types are considered as Prime Farmland, including the Branford silt loam (30B) and Ellington silt loam (20A) series. None of these soils are considered hydric, by definition; however, Project field investigations indicated hydric characteristics in select areas and, as described in Section 5.2.1.2, two related wetlands and an intermittent watercourse are located on Eversource's property, immediately south and west of the substation.

5.2.1.2 Water Resources

Wetlands: Two related wetlands, referred to as Wetland N-1 and Wetland N-1A, were delineated in the vicinity of Newington Substation. These wetlands, which meet both federal and Connecticut wetland criteria, are located to the south and west of the substation and are classified primarily as PSS habitat. Dominant species encountered in both wetlands included: common reed (*Phragmites australis*; relatively large, existing stands in each wetland), tussock sedge (*Carex stricta*), red-osier dogwood (*Cornus sericea*), sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmundastrum cinnamomeum*), and red maple.

As illustrated on the Volume 3 maps, these wetlands are located outside of the Newington Substation expansion limits and the limits of the proposed 115-kV underground cable interconnection to the substation; however, they would be temporarily impacted by access associated with the proposed Newington Tap modifications, as described in Section 6.2.1.

Watersheds and Drainage Basins: Newington Substation is located primarily within the Piper Brook watershed. A small portion of land at the northernmost extent of the Newington Substation parcel is within the Trout Brook watershed.

Surface Water Quality: As there are no perennial watercourses or waterbodies onsite, there is no readily available CT DEEP data for surface water quality in the substation area.

In accordance with the CT DEEP 2011 Connecticut Water Quality Standards[76] for unclassified waters, the onsite intermittent stream (IS-1) is considered a Class A surface water.

Watercourses: No perennial watercourses are located in the vicinity of Newington Substation or along the route of the Newington Tap. However, an intermittent stream (IS-1) crosses the western portion of the Newington Substation parcel and connects Wetland N-1A with Wetland N-1. The stream is partially confined to a man-made drainage ditch with excavated banks on portions of the property. This channelized feature appears to convey drainage received from areas west of the Newington Substation parcel. During field investigations performed by AECOM, IS-1 was observed under both dry and flowing conditions at various times of the year. Water depths of approximately 2-6 inches were noted in the stream during flowing conditions.

IS-1 originates west of Quincy Lane, flows through Wetland N-1A and then southeast across the Newington Substation parcel, where it connects with Wetland N-1. Within the proposed Newington Tap work area, IS-1 crosses beneath Eversource's existing 1783 Line ROW, flows near residential backyards, and extends along the existing overhead transmission line (1785 Line) located south of the substation. IS-1 then flows directly south, along the eastern edge of the 1785 Line ROW, before flowing into a culvert underneath Reservoir Road.

Waterbodies: No waterbodies (i.e., ponds, lakes) are located in the vicinity of Newington Substation or along the route of the Newington Tap.

Groundwater: Groundwater in the vicinity of the substation is designated as Class GA.

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

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

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76 http://www.ct.gov/deep/lib/deep/water/water_quality_standards/wqs_final_adopted_2_25_11.pdf

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, upland forest, old field/shrub land, and PFO and PSS wetlands. Lawns and ornamental landscaping are associated with the residential uses surrounding the substation parcel. Vegetation near the proposed Newington Tap Modifications is characterized by old field/shrub land and PSS wetlands. Trees such as red oak, red maple, and willow (*Salix* spp.) are located between the Newington Tap ROW and the adjacent residences.

Wildlife: The wildlife species expected to occur near Newington Substation and Newington Tap are those common to the vegetative communities found in the area, as described in Section 5.1.4.2. Eversource's Newington Substation property does not include any vernal pools or any streams that support fisheries.

Fisheries: There are no fisheries habitats known at or near the substation.

Vernal Pools: No vernal pools were observed or identified near the substation during wetland delineations or the vernal pool investigations.

Threatened or Endangered Species: There are no mapped Connecticut Critical Habitats or known federal- or state-listed species (i.e. threatened, endangered or special concern species) or significant habitats located at or near Newington Substation. The Northern Long-eared Bat is the only federally -listed species potentially occurring in the Project area. However, no critical habitat (e.g., maternity roosting sites, hibernacula) is known or has been designated for this species at or near this substation. No large stands of mature trees, which are preferred habitat for this species, are located in the areas where the proposed Project modifications would occur.

5.2.1.4 Land Use

Newington Substation is located in the northern portion of the Town of Newington. The Eversource property on which the substation is located 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, and include the 1783 Line and 1785 Line.

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. Eversource's overhead transmission and distribution lines are visible from some locations along the bordering residential streets.

In Connecticut's C&D Plan Locational Guide Map, the Newington Substation property is mapped as within a Neighborhood Conservation Area. Per the C&D Plan, these are "lands without the high incidence of the structural, occupancy, and income characteristics of Regional Centers yet are significantly built-up and well populated." As outlined in Section 5.1.4, the Project is consistent with the C&D Plan.

Improvements at Newington Substation are consistent with the Newington POCD Business Development and Utility Infrastructure General Goals, as summarized in Section 5.1.4.5.2.

5.2.1.5 Cultural (Historical and Archaeological) Resources

As described in Section 5.1.5, Heritage conducted both research and field investigations concerning cultural (historical and archaeological) resources in the vicinity of Newington Substation. Heritage's reports are included in Volume 2, and summarized below regarding the substation property.

There are no properties listed on the NRHP or SRHP in the vicinity of Newington Substation, Newington Tap, or on the surrounding Eversource property. However, Heritage's initial cultural assessment identified the area around Newington Substation as having moderate/high archaeological sensitivity for undiscovered archaeological sites. There are several level, dry areas with good drainage characteristics adjacent to the substation that appear to have been only impacted by previous land use developments in a localized way.

As such, Eversource coordinated with the SHPO and Heritage completed a Phase IB investigation on the Newington Substation parcel. During these investigations, a single multicomponent archaeological site (Site 94-1) was identified; Heritage did not recommend any further testing of this site (refer to Section 5.1.5.3 and Volume 2 for information regarding this site).

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 and traffic on local roads.

5.2.1.7 Transportation and Utilities

Newington Substation is accessible via the existing road network and Eversource's existing access road off of Cherry Hill Road. Substation access is depicted on the Volume 3 maps.

Two overhead 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, a three-tap line which extends into the substation property along ROWs west and south of the substation. The current Newington Tap configuration connects the 1783 Line to Newington Substation on the west side of the substation.

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 typically approximately 100 to 150 feet.

5.2.2 Southwest Hartford Substation

The existing 2.1-acre Southwest Hartford Substation is situated on a 7.1-acre Eversource property in the City of Hartford. Eversource proposes to expand the developed portion of the substation by approximately 0.3 acre (extending the existing substation fence). The expansion would be located in an upland area on the eastern portion of the Eversource property.

5.2.2.1 Topography, Geology and Soils

Southwest Hartford Substation is located at approximately 50 feet above mean sea level. The majority of the substation is relatively flat, with a slight rise immediately outside the existing substation fence, toward I-84, which is elevated above the substation. An unnamed tributary to the South Branch of the Park River, which borders the Eversource property on the north and northeast, is the principal topographic feature in the vicinity. The substation parcel generally slopes toward the South Branch of the Park River.

The regional geologic setting of Southwest Hartford Substation is the same as that described for the overall Project area (refer to Section 5.1.1.2). Soils within the Southwest Hartford Substation fenceline are mapped as Udorthents-Urban land complex and Udorthents, smoothed. These soil series are common to areas that are densely developed or that have been substantially from cutting and/or filling.

Soils on Eversource's Southwest Hartford Substation parcel located beyond the bounds of the fenceline include: Udorthents-Urban land complex in the immediate proximity of the substation fenceline and on portions of the Eversource parcel northeast of the South Branch of the Park River; Urban Land near the paved substation parcel entranceway; and, Udorthents, smoothed throughout the remaining portions of the parcel.

5.2.2.2 Water Resources

Wetlands: During onsite investigations in August 2016, one wetland (designated as Wetland H-1) was identified on the western portion of Eversource's the Southwest Hartford substation property. This PFO wetland is dominated by the following plant species: box elder maple, American elm (*Ulmus americana*), red maple, eastern cottonwood (*Populus deltoides*), willow, common elderberry, maple-leafed viburnum (*Viburnum acerifolium*), Tatarian honeysuckle, jewelweed, river grape (*Vitis riparia*) and poison-ivy (*Toxicodendron radicans*).

Watersheds and Drainage Basins: Southwest Hartford Substation is located within the Park River - South Branch/Main Stem drainage basin which is further identified as CT DEEP Subregional Basin 4400. The Park River is located approximately 1,500 feet east of the substation (east of the Amtrak ROW) in Hartford. Additional information regarding the Park River watershed is presented in Section 5.1.2.

Water Quality: A tributary to the South Branch of the Park River (PS-3) flows through the northeastern portion of the Southwest Hartford Substation parcel. This tributary is more fully described in the watercourse section below. On the Southwest Hartford Substation parcel, this watercourse is a Class A surface water, as designated by the CT DEEP.

Watercourses: As noted above, the unnamed tributary to the South Branch of the Park River (designated PS-3) is located on the northern portion of Eversource's Southwest Hartford Substation property (refer to the Volume 3 maps). This perennial watercourse is approximately 25 feet wide from bank to bank and flows to the east.

On Eversource's property, the watercourse is bordered by woody vegetation, including box elder maple, American elm, red maple, eastern cottonwood, and willow, as well as stands of the invasive Japanese knotweed. The tributary flows through a culvert which extends beneath New Park Avenue and daylights southeast of the road. The watercourse then flows in an easterly direction, beneath and next to existing transportation infrastructure (i.e., I-84, Amtrak ROW), to the South Branch of the Park River.

Waterbodies: No waterbodies (i.e., ponds, lakes) are located at the Southwest Hartford Substation parcel.

Groundwater: The groundwater beneath and in the vicinity of the substation is designated as Class GB.

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

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

Floodplains: The FEMA-mapped 100-year floodplain associated with the unnamed tributary to the South Branch of the Park River (PS-3) is shown on the Volume 3 maps. The 100-year floodplain boundary does not encompass the existing 2.1-acre substation site, the proposed 0.3-acre substation expansion area, or the substation access road that intersects with New Park Avenue. No FEMA 500-year floodplain is mapped along the tributary.

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 tributary to the South Branch of 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. Areas of maintained lawn are also present adjacent to the substation's existing access drive.

The upland forest in the vicinity of the substation, including within the riparian areas, includes mature mixed deciduous/coniferous trees species common to the Northeast, such as maples, oaks, hickories, spruce, and pine. In addition, thick stands of invasive Japanese knotweed are located in the understory adjacent to the tributary.

Wildlife: Wildlife species expected to occur near the substation are those common to the vegetative communities found in the general Project area (refer to Section 5.1.3). Wildlife is expected to be comprised of species that are tolerant of noise and activity typically found in busy urban settings.

Fisheries: CT DEEP maintains no fisheries information regarding the unnamed tributary to the South Branch of the Park River located adjacent to the substation. It is unlikely that significant recreational fisheries exist in this watercourse.

Vernal Pools: No vernal pools were observed or identified near the substation during Project wetland delineations or the vernal pool investigations.

Threatened or Endangered Species: There are no mapped Connecticut Critical Habitats or known federal- or state-listed species (i.e., threatened, endangered or special concern species) or significant habitats located at or near Southwest Hartford Substation. The Northern Long-eared Bat is the only federally-listed species potentially occurring in the Project area. However, no critical habitat (e.g., roosting sites, caves) is known or has been designated for this species at or near this substation. No large stands of mature trees, which are preferred habitat for this species, are located in the substation work area.

5.2.2.4 Land Use

Eversource's Southwest Hartford Substation property is located in the southwest corner of the City of Hartford and is bordered by New Park Avenue on the east, the unnamed 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 the Southwest Hartford Substation property in 1968 and developed the substation in the 1970s.

Areas to the south and east are zoned for business, commercial, and industrial uses. Areas north of the tributary and Kane Street are zoned for residential, business, and commercial uses. In addition to the I-84 corridor, nearby land uses predominantly consist of commercial development, as well as vacant industrial land (refer to the Volume 3 maps).

There are no designated scenic or recreational areas in the immediate vicinity of Southwest Hartford Substation. The nearest designated recreational/open space area is the state-recognized Park River Greenway, including its South Branch of the Park River Trail, which is located approximately 0.3 mile to the south-southeast of the substation. The substation is separated from this greenway and trail system by the elevated section of I-84, the Amtrak/CT*fastrak* corridor, and industrial/commercial lands.

In Connecticut's C&D Plan Locational Guide Map, the area including and surrounding the substation is classified as a Regional Center, with the tributary identified as a General Land Use Conservation Area. Per the Hartford POCD, summarized in Section 5.1.4.5.2, improvements at Southwest Hartford Substation are consistent with the plan's stated goals.

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 Southwest Hartford Substation. The results are included in Heritage's 2015 Cultural Resources Review Report, 2016 Addendum, and 2017 Phase IB Report, all available in Volume 2.

The Heritage studies did not identify any cultural resources (i.e., standing historic structures, known archaeological sites) at Southwest Hartford Substation. Several NRHP districts or former structures are located north and east of the substation. The closest is the former Royal Typewriter Company building, which was listed on the NRHP in 1989 and was located approximately 800 feet, across New Park Avenue, from the substation property. The former Royal Typewriter Company building burned down in 1992 and was subsequently demolished. The site is currently a supermarket; however, the former building remains listed on NRHP. The approximately 155-acre Parkville Industrial Historic District, which was listed on the NRHP in March 2015, encompasses almost 400 residential, commercial, and industrial structures. The district's southernmost boundary is at 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

The ambient air quality conditions at Southwest Hartford Substation are as described for the Project area as a whole in Section 5.1.2. Existing sound levels in the vicinity of the substation are characteristic of an urban environment, and are significantly influenced by traffic on I-84. Refer to Section 5.1.7.2 for a discussion of the City of Hartford's Noise Ordinance (Chapter 23).

5.2.2.7 Transportation and Utilities

Southwest Hartford Substation is readily accessible via a network of local roads and I-84. The Amtrak/CT*fastrak* corridor is located to the east of the substation, generally east of and parallel to New Park Avenue. Access to the substation is via a driveway from New Park Avenue.

Currently, two 115-kV underground HPFF transmission lines, the 1722 Line (to Northwest Hartford Substation) and the 1704 Line (to South Meadow Substation) exit Southwest Hartford Substation from the northeast side. Nine 23-kV underground distribution feeder circuits also leave the substation.

Various underground utilities (e.g., public water, sanitary sewer, storm sewer, natural gas) also are located, generally within public streets, in the vicinity of the substation.

6. POTENTIAL ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

This section identifies and analyzes the potential short- and long-term effects that the construction and operation of the proposed Project would have on 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 siting and planning to date, and would continue to be prioritized as the Project develops.

Section 6.1 discusses potential environmental effects and mitigation measures associated with the construction and operation of the proposed 115-kV transmission line. Section 6.2 discusses the potential environmental effects and mitigation measures related to proposed modifications at Eversource's existing Newington and Southwest Hartford substations, including the Newington Tap improvements.

Overall, Eversource has designed the proposed Project to avoid or minimize adverse environmental, cultural, and visual resource impacts to the extent practicable by:

- Using a hybrid underground/overhead configuration for the new 115-kV transmission line, aligning the line underground within Eversource's existing electric distribution line ROW and along public road ROWs through residential and densely developed commercial areas and locating the line overhead within the long-established Amtrak ROW adjacent to industrial/commercial areas; and
- Confining the proposed substation and Newington Tap modifications to 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 for this Project are based on Eversource's historical experience in the construction, operation, and maintenance of similar transmission line systems and substations in New England, and in Connecticut in particular, as well as the results of Project-specific engineering analyses, constructability reviews, environmental and cultural field investigations, and agency consultations. Additional measures to avoid or minimize adverse effects on the environment and to the public may be identified during the Council's review of this 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. In addition, Eversource would minimize impacts to public transportation (including Amtrak rail service, CT*fastrak* busway operations, and vehicular movements on state/local roads) by continuing to coordinate with Amtrak, ConnDOT, and municipal transportation authorities. Mitigation measures, as described herein or as included as conditions of regulatory approvals, would be reflected in the final Project design and would be incorporated into final Project plans, such as the D&M Plan or other Project specifications, as appropriate.

6.1 TRANSMISSION LINE

6.1.1 Topography, Geology, and Soils

The Project would have negligible adverse effects on topography and geology. Minimal to no grading would be required to install the cable underground within the Eversource's ROW, road ROWs, or other paved surfaces. The installation of the co-located portion of the overhead transmission line within the Amtrak ROW is not anticipated to result in grade changes.

Localized impacts to soils would occur as a result of activities such as excavating the cable trench and splice vault sites, and excavating for overhead structure foundations. In addition, impacts to soils could potentially occur at contractor yards and material staging sites, if they are not located on paved areas. However, these impacts would be short-term and limited to the construction phase. After the installation of the cable system duct bank and splice vaults, any disturbed areas would be restored to grade (as required) and repaved or otherwise stabilized. Work areas along the Amtrak ROW affected by the overhead transmission structure installation would be similarly restored and stabilized.

Cable installation would involve the excavation of a continuous trench, as well as excavations for three concrete splice vaults at approximately 1,100- to 2,200-foot intervals along the underground cable segment in Newington (no vaults would be required along the short underground segment in Hartford). Of the three vaults along the Proposed Route in Newington, two are expected to be located within the Eversource ROW (one to the west of

Avery Road and the other east of West Hartford Road). The third splice vault along the underground segment in Newington would be installed within or adjacent to Shepard Drive. The exact locations of the splice vaults and the cable trench would be identified in the D&M Plan.

If soil, subsoil, or rock excavated from the cable trench must be temporarily stored on-site, measures would be implemented to avoid or minimize the potential for sedimentation outside of approved work spaces into water resources and/or into catch basins. 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.

Along the overhead transmission line segment within the Amtrak ROW, spoils excavated during structure foundation work would be either temporarily stockpiled in approved work spaces or live-loaded to dump trucks for off-site disposal in accordance with applicable regulations. If excavated spoils are temporarily stockpiled on-site, measures would be implemented to avoid disrupting railroad operations and to avoid or minimize the potential for soil erosion and sedimentation beyond approved work spaces.

6.1.1.1 Erosion Control

Typically, at work sites where soils would be disturbed and/or construction activities could have the potential to cause sedimentation (e.g., as a result of mechanized vegetation clearing; grading; pavement saw-cutting; excavating for the cable trench, splice vaults, and structure foundations; general soil stockpiling), temporary erosion controls would be installed and maintained as needed. Such controls would be deployed in accordance with regulatory approvals, final Project plans, and based on the field judgment of Eversource's experienced personnel.

The types of erosion controls used would be in accordance with the 2016 Eversource BMP Manual, as appropriate to the urban/suburban areas and environmental resources along the Proposed Route, and may include hay/straw bales, coir logs, catch basin protection, silt fence, or equivalent. Eversource also would prepare a Project-specific Stormwater Pollution Control Plan (SWPC Plan), in conformance with the requirements of CT DEEP's General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities and the CT DEEP's *2002 Connecticut Guidelines for Soil Erosion and Sedimentation Control (revised 2007)*. The SWPC Plan would be implemented by

Eversource and its construction contractor to avoid, minimize or eliminate potential adverse environmental effects during transmission line construction, and would include measures to reduce the likelihood of sediment migration from construction sites.

Temporary erosion controls would remain in place and would be maintained, as necessary, throughout the period of active construction until disturbed sites are appropriately restored, either by re-paving (i.e., along underground portions of the transmission line within road ROWs or other paved areas), stabilizing to match existing gravel conditions (i.e., along overhead portions of the transmission line along the Amtrak ROW), or reseeding and mulching (i.e., along underground portions of the transmission line within Eversource's ROW or beneath lawn or other vegetated areas). The decision to remove temporary erosion controls would be made by Eversource's experienced field construction personnel, based on the effectiveness of restoration measures, and in accordance with applicable regulatory requirements.

6.1.1.2 Rock Removal

In the event that bedrock is encountered during the transmission line installation, mechanical methods (such as the use of mechanical excavators, drilling, or pneumatic hammers) would be used for rock removal. Rock removal activities would generate dust and vibration/noise temporarily in the immediate vicinity of work sites.

If extensive bedrock is encountered during construction excavations, controlled blasting may be considered as a supplement to mechanical methods. However, at this time, the need for blasting is not anticipated. 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 (refer to Section 4.3.2 for details).

Prior to construction, geotechnical investigations would 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 proposed 115-kV transmission line would result in long-term adverse effects on water resources. Eversource would construct the transmission line in accordance with approvals received from the Council, CT DEEP, and the USACE, as well as pursuant to its BMP Manual and the Project-specific SWPC Plan. As described in the following sections, based on current Project information, the construction of the 115-kV transmission line is anticipated to result in approximately 0.03 acre of temporary impacts to watercourses, 1.55 acres of temporary impacts to wetlands and 0.24 acre of conversion of forested wetlands to shrub-scrub or emergent wetland cover type.

6.1.2.1 Watercourses

Along the Proposed Route, the new transmission line would traverse three watercourses (two unnamed streams along the underground segment in Newington and an overhead span of Trout Brook along the overhead segment within the Amtrak ROW). However, the installation of the proposed 115-kV transmission line would not result in the placement of permanent surficial fill in any of these watercourses. Along the underground segment of the Proposed Route in Newington, Eversource proposes to use an open cut method to install the 115-kV cable beneath the two watercourses. After the installation of the cable trench, the watercourse substrate would be restored and stream banks would be re-established. Trout Brook, the largest of the three watercourses, would be spanned along the overhead segment of the Proposed Route; no construction activities in the watercourse would be required. Table 6-1 summarizes the proposed stream crossing techniques and identifies anticipated water resource impacts; updated information would be provided in the D&M Plan.

The use of the open cut method to install the cable trench beneath the two watercourses in Newington would minimize construction activities in and near these streams and, as shown in Table 6-1, would result in approximately 0.03 acre (1,400 square feet) of temporary impacts to the stream substrates. Refer to Section 4.3.1.2 for information regarding potential open cut crossing methods.

Eversource would perform the watercourse crossings in accordance with Eversource's BMP Manual and in compliance with the conditions of Project-specific water resource permits from the CT DEEP and USACE.

Table 6-1: Potential Watercourse Crossing Methods and Anticipated Impacts

Watercourse Name/Project Number (Location)	Watercourse Characteristics	Proposed Construction Crossing Method	Anticipated Water Resource Impacts
Intermittent Stream/IS-2 Newington Underground Segment along Eversource ROW	Approximately 5 feet wide, within wetland N-2	Open cut	400 square feet of temporary impacts
Permanent Stream/PS-1 Newington Underground Segment at Shepard Drive[77]	Approximately 25 feet wide, narrow riparian area characterized by trees and shrubs; Wetland N-5 (small linear wetland) is located along the west side of the streambank, south of Shepard Drive crossing.	Open cut	1,000 square feet of temporary impacts
Trout Brook/PS-2 West Hartford Overhead Segment along Amtrak ROW	Approximately 100 feet wide (bank to bank)	Aerial span	None

6.1.2.2 Wetlands

The construction of the proposed transmission line would involve primarily short-term impacts to three wetlands, all located in Newington: Wetlands N-2, N-3, and N-4. The exact cable crossing of PS-1 has yet to be determined; current design shows a crossing PS-1 on the north side of Shepard Drive. If the crossing is relocated to the south of Shepard Drive, a small section of a fourth wetland (i.e., Wetland N-5) would be affected by the transmission line construction; however, at this time, no impacts are anticipated to Wetland N-5.[78]

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[77] The exact location of this crossing, adjacent to the north or south side of the culverted Shepard Drive stream crossing, would be determined during final design and included in the D&M Plan. As depicted on the Volume 3 maps, the Proposed Route would cross PS-1 north of Shepard Drive to avoid wetland impacts. Watercourse impacts associated with the installation of the transmission cable either north or south of the Shepard Drive crossing would be generally the same; however, the installation of the cable south of the road crossing would add impacts to Wetland N-5.

[78] Note: No splice vaults would be situated within wetlands.

The installation of the underground transmission line would require the placement of temporary fill in wetlands (e.g., the use of timber mats for access) and would involve short-term impacts associated with trenching required to bury the cable duct bank within the wetlands. However, these impacts would be temporary and would not result in any permanent wetland fill.

In addition to these temporary impacts, approximately 0.24 acre of forested wetlands (all within the Eversource ROW) would be permanently converted to shrub-scrub or emergent marsh wetland habitat. This habitat conversion would represent a long-term cover type change, but would not be either a net loss of wetlands or an adverse impact to wetland functions and values (i.e., although the wetland cover type would change, the affected wetlands would continue to provide wildlife habitat, etc.) The locations of anticipated wetland crossings and clearing of forested wetlands are depicted on the Volume 3 maps.

Eversource proposes to install the cable system through the three wetlands within the ROW (i.e., Wetlands N-2, N-3, N-4) using an "open cut" method, which would minimize the time required to install the duct bank. As discussed in Section 4, this construction technique would involve vegetation clearing to allow for access and construction along the ROW, followed by trenching to a depth of 8-10 feet for installation of the duct bank and subsequent backfill. Generally, a temporary construction area approximately 40 feet wide would be required to install the duct bank in wetlands. This 40-foot-wide area would accommodate access/work space for the equipment required to excavate and install the duct bank (approximately 20 feet), the duct bank trench (approximately 10 feet), and temporary spoil/topsoil storage, as needed (approximately 10 feet).

As summarized in Table 6-2, the installation of the transmission cable would result in approximately 1.55 acres of temporary direct impacts within wetlands from the use of timber mats within work space areas and trenching/soil stockpiling. Upon completion of the duct bank installation, the duct bank trench would be backfilled, temporary timber mats would be removed, and wetland areas would be restored.

Table 6-2: Estimated Surface Area of Wetlands Potentially Affected by the Proposed Transmission Line

Project Activity	Wetland Number and Approximate Potential Impacts (Estimated Acres)			
	N-2	N-3	N-4	TOTAL
Total Permanent Impacts	0 acre	0 acre	0 acre	0 acre
Temporary Impact: Access/Work Space	0.44 acre	0.71 acre	0.11 acre	1.26 acres
Temporary Impact: Duct Bank Trench	0.12 acre	0.16 acre	0.01 acre	0.29 acre
Total Temporary Impacts	0.56 acre	0.87 acre	0.12 acre	1.55 acres
Secondary Wetland Effects (Tree Removal in PFO Wetlands)	0.05 acre	0.19 acre	N/A	0.24 acre

Avoidance and Minimization Measures

In general, Eversource anticipates that the following measures would be employed to avoid or minimize the potential for impacts to wetlands during construction of the transmission line:

- Conform to the requirements of USACE and CT DEEP permits and Council conditions concerning work in wetlands.
- Install appropriate erosion controls as needed to prevent or minimize the potential for sedimentation into wetlands.
- Implement procedures for petroleum product management that would avoid or minimize the potential for spills into wetlands (e.g., to the extent possible, store petroleum products in uplands more than 25 feet from wetlands, refuel construction equipment, except for equipment that cannot be practically moved, in upland areas only).
- Cut forested wetland vegetation without removing stumps except over the cable trench or in areas where the intact stumps pose a concern for the installation of timber mat access/work space and the safety of construction personnel.
- Install timber mats for access and work space in wetlands.
- Strip topsoil/organic layer from over the trench line and segregated from subsoils for use during backfill and restoration.
- Stockpile wetland soils excavated from the trench as appropriate to site conditions (i.e., temporarily stockpile adjacent to the trench within the construction work area or in adjacent upland staging areas within the ROW).
- Backfill the trench, after the installation of the duct bank, with FTB and then restore the affected wetland areas to pre-construction grade using the original surficial

wetland soils, restoring the segregated topsoil to the soil surface. Any excess excavation spoils would be removed from the site and disposed of appropriately.

- Stabilize affected wetland areas with temporary seeding (if necessary) and allow native revegetation to recolonize. Woodchip mulch and fertilizer would not be applied within wetlands. Straw (mulch) may be utilized for post-construction stabilization, as necessary.

To compensate for the effects to wetlands that would occur as a result of the Project, Eversource would consult with the USACE and CT DEEP to assess mitigation options. The extent of compensatory wetland mitigation required would depend on the final Project design. Compensatory mitigation would likely consist of in-lieu fee payment.

6.1.2.3 Groundwater Resources and Public Water Supplies

Neither the construction nor the operation of the new 115-kV transmission line would adversely affect any groundwater resources (e.g., Aquifer Protection Areas, public water supplies, private groundwater wells). In the Project area, groundwater is not used for direct potable water supply.

However, groundwater may be encountered during excavations for the cable trench, splice vaults, and transmission line structure foundations. If groundwater is encountered during transmission line construction, the water would be pumped from excavated areas, filtered, and discharged to: (1) vegetated areas within the Eversource ROW; (2) municipal stormwater catch basins; and/or (3) pumped into a tank truck for off-site disposal. The D&M Plan would include specific procedures and information concerning construction site dewatering. Dewatering would be performed in accordance with Eversource's BMP Manual and authorizations from applicable regulatory agencies, including pursuant to the CT DEEP's General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities.

Eversource has conducted initial analyses of the locations of public utilities, including potable water supply lines, located beneath roads and otherwise 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 for the transmission line. During construction, care would be taken to avoid impacts to municipal water lines and other utilities located along the Proposed Route.

6.1.2.4 Floodplains

The proposed 115-kV line would extend above the 100-year flood zone associated with one watercourse (Trout Brook, PS-2). At this location, the proposed transmission line would be aligned overhead along the Amtrak ROW and would span Trout Brook, as well as its associated floodplain.

No transmission line structures or permanent access roads would be located within floodplains. Consequently, the proposed transmission line would not result in any long-term change in grade or other modifications that would affect flood storage. Further, the Project construction activities would not affect CT DEEP's flood control dikes along the banks of Trout Brook. No loss of flood storage or other adverse effects on floodplains are anticipated as a result of the Project.

6.1.3 Biological Resources

The proposed transmission line would be aligned within a densely-developed urban/suburban area, primarily within the Amtrak ROW and along roads or within other paved areas. Consequently, neither the construction nor the operation of the 115-kV transmission line is anticipated to result in significant adverse impacts to vegetation or wildlife resources. However, the installation and operation of the new 115-kV line within Eversource's 0.8-mile ROW would result in the removal of trees and shrubs within the construction footprint. In addition, in areas where the underground cable cannot be located within paved areas, ornamental vegetation and other landscaping may be affected. Similarly, vegetation may have to be removed in some areas adjacent to the Amtrak ROW to adhere to conductor clearance requirements.

6.1.3.1 Vegetation

To accommodate the construction of the proposed transmission line within Eversource's ROW, trees and other vegetation would need to be trimmed or removed within an approximately 40-foot-wide area (in uplands and wetlands). Some vegetation clearing would be required within portions of the ROW that Eversource currently manages for the operation of the five existing distribution line circuits. However, additional vegetation removal, including tree clearing, would be required for the installation of the new 115-kV underground cable.

Approximately 1.9 acres of forested vegetation (of which approximately 0.2 acre would be forested wetland) would be removed within the Eversource ROW for the installation of the underground cable segment between Newington Substation and Willard Avenue. Other vegetation, consisting of shrub and herbaceous species, also would be cleared as required from cable installation work areas along this ROW. The two splice vaults proposed for location within Eversource's ROW are expected to be situated within upland areas, within the limits of vegetation removal depicted on the Volume 3 maps. (Note: The 100-scale Volume 3 maps illustrate the proposed work space expected to be required to construct the underground cable segment within the Eversource ROW, including the proposed limits of vegetation removal and the areas where trees would be removed.)

Trees also would have to be cleared within the work area for the installation of the underground cable beneath the unnamed tributary to Piper Brook (crossed by Shepard Drive in Newington). Additionally, in some locations (such as New Park Avenue in Hartford, just south of I-84), trees or other vegetation may have to be trimmed or removed adjacent to roadways where the underground cable system would be installed.

Appropriate clearance from vegetation is required for large construction equipment, such as excavators and cranes, to work safely. Therefore, trees with limbs that overhang roads intersecting with, or along, which the cable segments would be installed may have to be pruned or removed. In addition, depending on the locations of existing buried utilities in roads, portions of the duct bank or the third splice vault (planned for location along Shepard Drive) could potentially have to be located in lawn or other vegetated areas adjacent to a road ROW.

The excavation work required for the cable system and splice vaults could potentially affect the root systems of nearby vegetation. Such potential impacts would be highly variable and would depend on factors such as vegetation species, size, and location. Eversource understands the importance of the existing ornamental and other screening vegetation to local residents and the affected communities, and would coordinate with local officials and affected private landowners if ornamental or other vegetation requires removal for transmission line construction. Appropriate site-specific revegetation would be implemented as part of the restoration phase of Project construction.

After the installation of the cable system, Eversource would restore affected areas to pre-construction grade and seed previously vegetated sites. The areas affected by construction would typically be re-vegetated in conformance with Eversource's BMP Manual.

6.1.3.2 Wildlife and Fisheries

To minimize the potential for indirect impacts to wetlands and watercourses resulting from sedimentation in work areas, appropriate temporary erosion controls would be deployed and maintained around work sites. These temporary controls would remain in place until the disturbed areas are stabilized. After the installation of the cable duct bank along Eversource's ROW, all disturbed areas would be restored, reseeded, and stabilized.

6.1.3.2.1 Wildlife

The construction and operation of the proposed transmission line would not significantly affect wildlife resources and fisheries; however additional scrub-shrub habitat would be created as a result of an increase in the width of the managed vegetation area along Eversource's existing distribution line ROW.

The wildlife species common to the urban/suburban areas traversed by a majority of the Proposed Route can be expected to avoid work sites during construction. Along the Eversource ROW, construction activities associated with the installation of the transmission line, including the temporary relocation of the distribution circuits, would require vegetation removal and tree clearing, which would displace wildlife from both the upland and wetland areas affected. However, similar habitat exists in nearby areas and wildlife can be expected to return to the Eversource corridor once the affected areas revegetate after the completion of Project construction.

Within portions of the Eversource ROW between Newington Substation and Willard Avenue, existing forested vegetation would be removed and, after Project construction, would be managed in low-growth species compatible with underground cable system operation. A five-year study documented results of vegetation management on new transmission ROWs where the removal of trees, and subsequent increase in early successional habitat resulted in a twofold increase in the number of herbaceous species.[79] Based on such literature, the creation of additional shrub-land habitat along Eversource's maintained ROW in Newington would represent a long-term positive effect on disturbance and scrub-shrub dependent species, since shrub-land habitat is otherwise declining in New England.[80]

This decline is a result of various factors (e.g., development, ecological succession, absence of fire). Additionally, most of the historic shrub-land in the Northeast is irreversibly gone due to permanent human development. Scrub-shrub birds and other disturbance dependent species are now more dependent than ever on human activities to maintain the habitat required for their survival.[81] In this regard, transmission line ROWs are considered a major source of shrub-land habitat.[82] Increasing the amount of the shrub type habitat within Eversource's existing distribution line ROW thus may have a positive effect for early successional and shrub-land species.

6.1.3.2.2 Fisheries

The proposed transmission line would not result in any significant impacts to fisheries. Trout Brook, the only perennial watercourse along the Proposed Route that is known to support fish habitat, would be spanned by the overhead segment of the transmission line along the Amtrak ROW. Because no construction activities would be required in the brook, no impacts would occur to the warm-water fish species that inhabit the watercourse.

The only other perennial watercourse along the 115-kV line route, the unnamed tributary to Piper Brook that would be crossed by the underground cable segment in Newington, is not

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[79] Haggie, M.R., R.A. Johnstone, and H.A. Allen. 2008. *Tree, Shrub and Herb Succession and Five Years of Management Following the Establishment of a New Electric Transmission Right-of-Way through a Wooded Wetland*. In Proceedings of the Eighth International Symposium on Environmental Concerns in Rights-of-Way Management. (J.W. Goodrich, L.P. Abrahansom, J.L. Ballard, S.M. Tikalsky, Eds.). Electric Power Research Institute, Washington, D.C., pages 47-59.

[80] Nickerson, N.H. and F.R. Thibodeau. 1984. *The Effect of Power Utility Rights-of-Way on Wetlands in Eastern Massachusetts.* Final report submitted to the New England Power Company, 25 Research Drive, Westboro, Massachusetts.

[81] King, D.I., R.B. Chandler, J.M. Collins, W.R. Peterson, and T.E. Lautzenheiser. 2009. *Effects of Width, Edge and Habitat on the Abundance and Nesting Success of Scrub-Shrub Birds in Powerline Corridors*. Biological Conservation 142:2672-2680.

[82] *Saucier, L. 2003.* Scrubland habitat information from "Wildlife Habitat in Connecticut: Shrub-land". Habitat Management Program, in Connecticut Wildlife.

known to support any fish.[83] However, impacts to this watercourse, beneath which Eversource proposes to install the underground transmission cable using an open cut method, would be minimal and short-term. The installation of the cable system beneath the stream would be performed in accordance with Eversource's BMP Manual and in compliance with the conditions of Project-specific water resource permits from the CT DEEP and USACE.

6.1.3.3 Birds

The proposed Project would result in both long-term benefits and short-term, but minimal, effects on bird species.[84] These potential effects would be limited primarily to the vegetated areas that would be affected by the installation of the new 115-kV transmission line (i.e., along the Eversource ROW, at the crossing of the unnamed tributary to Piper Brook), the expansion of Newington and Southwest Hartford substations, and modifications to Newington Tap. No direct effects to bird habitat and breeding birds would occur along the portions of the Project that would involve activities in developed areas that are devoid of vegetation, such as the segments of the Proposed Route that would be located beneath roads and paved parking lots or within the Amtrak ROW.

A total of 82 breeding bird species were identified as possible, probable, or confirmed (based on a review of the Breeding Bird Atlas) in the general vicinity of the Proposed Route. Of these, seven are state-listed endangered, threatened or species of Special Concern. In addition, 27 species identified as potentially occurring within the Project area are designated as SGCN in Connecticut's WAP. Of those 27 species, five are classified as most important, 14 as very important, and eight as important. Ten of the species designated SGCN prefer shrubland and other early-successional habitats and would benefit from the conversion of forest to shrubland and the long-term maintenance of the distribution line ROW in early successional habitat. These include a number of species of high-conservation priority, including the prairie warbler, blue-winged warbler, and American kestrel.

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[83] The third watercourse crossing along the Proposed Route is an intermittent stream (IS-2), located along the Eversource ROW, that is unlikely to support any fish populations.

[84] This section describes potential impacts to bird species for the Project, which are limited to only the vegetated areas along the proposed transmission line route and associated with the substation/Newington Tap modifications.

During construction, the removal of vegetation from construction areas would impact bird habitat and displace species. This would occur at work sites at and near Newington Substation (both for the 0.3-acre substation expansion and the modifications to Newington Tap), as well as along the Eversource ROW, where access roads and excavations for the underground cable trench/splice vaults would be required. In addition, vegetation would be removed at the crossing of the unnamed tributary to Piper Brook, as well as for the expansion of Southwest Hartford Substation. Construction noise also may indirectly disturb birds in the vicinity of Project work sites.

After the completion of construction along the Proposed Route of the new 115-kV line and at the Newington Tap, the affected areas would be reseeded and Eversource would promote the establishment of low-growth vegetative species consistent with the long-term operation of underground and overhead transmission lines (and in the case of the Eversource ROW – distribution line facilities). Because such shrubland habitat is in decline in Connecticut (as well as in New England as a whole), Eversource's management of the ROW in low-growth species would represent a long-term benefit to shrubland bird species that depend on such habitats. The edge between forest and shrubland habitat also would continue to benefit birds that prefer to inhabit such areas. Overall, once construction is complete, avian utilization of the Project area is anticipated to return to pre-construction levels.

The proposed Project would result in permanent effects due to the expansion of both the Newington and Southwest Hartford substations (resulting in the conversion of a total of 0.6 acre of shrub-type habitat to utility use) and the conversion of forested habitats to shrubland/grasslands or scrub-shrub/emergent wetland along the Eversource line ROW and at the crossing of the unnamed tributary to Piper Brook. The segment of the Proposed Route along the Eversource ROW consists of areas where Eversource has performed vegetation management consistent with electric utility use, bordered by residential and some forested lands. Thus, the forested areas bordering Eversource's distribution line ROW are categorized as edge forest rather than interior forest. Edge forest is favored by ecotone specialists or forest generalists, and is not optimal breeding habitat for forest-interior birds. None of the wooded areas that would be impacted by the Project constitute high-value forest.

Shrublands in the northeastern United States are primarily disturbance-dependent and are typically ephemeral. Left unmanaged, these areas would naturally revert to forest. Despite the transient nature of shrublands and other early successional habitats, many species of birds and other wildlife require these habitats. The decline of shrublands and other early-successional cover types in the Northeast has had considerable impacts on the populations of associated wildlife. In particular, many bird species have experienced statistically significant population declines due to the loss of suitable breeding habitat.[85] By some estimates, at least 45% of all shrubland birds in the Northeast experienced statistically significant population declines between 1966 and 2000.[86]

6.1.3.4 Federal and State Listed or Proposed Threatened, Endangered, or Special Concern Species

Eversource consulted CT DEEP NDDB and USFWS publically available resources regarding the potential presence of state and federal listed species in the vicinity of the proposed Project, as described in Section 5.1.3.4. Based on the results of these reviews, the Proposed Route does not encompass any habitat for federally- or state-listed species, and thus the construction and operation of the new 115-kV transmission line is not anticipated to have an adverse effect on any such species. However, Eversource would continue to consult with the CT DEEP NDDB regarding the proposed Project. In addition, Eversource would consult with USFWS, via the USACE application process and as outlined in Section 9.2, to confirm that no NLEB or associated habitat would be impacted during the development of the proposed Project.

6.1.4 Land Use

The proposed 115-kV transmission line would be collocated along existing linear corridors that are already dedicated to utility or transportation uses. As a result, the new transmission line would result in generally limited and temporary impacts on land uses.

The construction of the proposed transmission line would cause localized, and short-term impacts to land uses. After the completion of construction, the underground segments of the transmission line would not be visible (except for the presence of manhole covers) and

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85 Witham, J. W., and M. L. Hunter, Jr. 1992. *Population Trends of Neotropical Migrant Landbirds in Northern Coastal New England*. In: J. M. Hagan and D. W. Johnston (Eds.), Ecology and Conservation of Neotropical Migrant Landbirds. Smithsonian Institution Press, Washington, D.C.

86 Dettmers, R. 2003. *Status and Conservation of Shrubland Birds in the Northeastern U.S.,* Forest Ecology and Management 185:81-93.

would result in no long-term changes to land use, except for the conversion of forested areas to shrub type habitat along Eversource's distribution line ROW.

Eversource's existing policies regarding land uses within its ROW include the installation of gates or other barriers to minimize the potential for unauthorized use of the ROW. These policies would remain applicable along portions of the new 115-kV line alignment; however, land uses associated with residential abutters, such as lawns, backyard gardens and other similar uses, would be expected to continue after the installation of the underground 115-kV cable.

Along the overhead transmission line segment, the proposed, approximately 95 to 110 110 feet in height 115-kV structures would represent a long-term modification to the visual environment. However, the Amtrak ROW has long been dedicated to transportation uses (e.g., the railroad) and now is also used for the CT*fastrak* busway. Further, the Amtrak ROW extends through industrial and commercial areas where the overall impact of this visual change would be limited. Existing industrial/commercial buildings and vegetation generally would screen long-distance views of the proposed transmission line structures.

The Project is consistent with the overall state, regional, and local objectives for providing a reliable electrical transmission system to assist in promoting economic growth. All three municipalities traversed by the Proposed Route have published POCDs (refer to discussion in Section 5.1.4.5). In general, these plans indicate the areas traversed by the Proposed Route would continue 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 proposed transmission line would be located near, but would not traverse any designated recreational areas or scenic sites.[87] As a result, neither the construction nor the operation of the proposed transmission line would have adverse effects on the recreational uses or scenic areas.

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[87] Recreational areas or designated trails located near, but not traversed by the Proposed Route include the CT*fastrak* Multi-Use Trail in Newington; the Piper Brook Flood Control Greenway in Newington; the Park River Greenway and South Branch Park River Trail in Hartford; and West Hartford's Trout Brook Trail and Greenway. Please refer to Section 5.1.4.2 for additional detail on these recreational resources.

Along the eastern portion of Eversource's ROW and State Route 173, the proposed transmission line would be configured underground through the Newington Junction North Historic District. Newington's POCD identifies both the Eversource ROW and State Route 173 as passing through this district. As discussed further in Section 6.1.5, the alignment of the new 115-kV line underground, along existing linear corridors, through this NRHP district would avoid any significant indirect adverse effects to the historic character of the district.

Based on publicly available data, there are no schools, youth camp facilities, hospitals, group homes, or playgrounds within 500 feet of the Proposed Route. The Project would have no adverse effect on these facilities. One licensed child care facility, the Family Tree Childcare and Learning Center, is located approximately 350 feet north of the Proposed Route, in the Temple Sinai building at 41 West Hartford Road in Newington. In the vicinity of this facility, the proposed 115-kV line would be located underground within Eversource's distribution line ROW. Neither the construction nor the operation of the proposed transmission line would adversely affect any community facilities.

6.1.5 Cultural (Historical and Archaeological) Resources

Heritage's desktop and in-field cultural resources assessments,[88] including consultations with SHPO representatives, archaeological field surveys, and visual resource "balloon" tests, determined that the construction and operation of the proposed transmission line would not cause adverse visual or physical impacts to any known cultural (historic or archaeological) resources. Consequently, as summarized in Section 5.1.5 and described in detail in Heritage's reports, it is Heritage's recommendation that no further cultural resource analyses are warranted for the Project.

Eversource would continue to coordinate with the SHPO and THPOs as necessary regarding the proposed Project and would include in the D&M Plan protocols for unanticipated cultural resource discoveries (i.e., archaeological sites), for implementation in the event that any intact cultural materials are unearthed during Project excavations.

[88] Cultural Resources Review of the Project Region Associated with the Greater Hartford Connecticut Reliability Project dated May 19, 2015 (2015 Cultural Resources Review Report); Cultural Resources Review Report Addendum dated November 4, 2016 (2016 Addendum); and, Phase IB Cultural Resources Reconnaissance Survey of the Greater Hartford – Central Connecticut Reliability Project Corridor in Newington, Connecticut dated April 2017 (2017 Phase 1B Report) are included in Volume 2.

6.1.6 Soil and Groundwater Areas of Environmental Concern

As summarized in Section 5.1.6, soil or groundwater contamination could potentially be encountered during cable installation along Willard Avenue (State Route 173) and Shepard Drive in Newington, during overhead transmission line foundation work within the Amtrak ROW from the vicinity of Flatbush Avenue to just south of I-84, or elsewhere along the Proposed Route.

Field investigations would be conducted along the Proposed Route prior to construction to identify specific areas of concern. Updated soil and groundwater assessment information would be included in the Project D&M Plan. During Project construction, Eversource would require its construction contractors to handle contaminated soil or groundwater in accordance with the appropriate procedures and applicable requirements regarding the handling, storage, and disposal of such materials.

6.1.7 Air Quality and Noise

6.1.7.1 Air Quality

The construction of the proposed transmission line would result in short-term, highly localized effects on air quality, primarily from emissions from construction vehicles and equipment, as well as from fugitive dust generated during activities such as vegetation clearing, construction vehicle passage along the existing Eversource ROW, saw cutting pavement and cable trench and splice vault excavations, and structure foundation drilling/excavation. The operation of the transmission line would not result in any adverse impacts to air quality.

To minimize the amount of dust generated by construction activities, water would typically be used when saw cutting pavement. The construction access road along the ROW also would be watered, if needed, to minimize dust.

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).

Paved roads affected by construction (i.e., public roads either used for access to reach the Eversource and Amtrak ROWs, or within which the underground cable segments would be located) would be regularly inspected and swept by Eversource's construction contractor to remove excess accumulations of dirt. To minimize tracking of dirt onto public roads from construction work sites in non-paved areas, crushed stone anti-tracking pads would be installed as needed along Project access roads at intersections with public roads.

6.1.7.2 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 and from vehicular traffic, including: earth moving vehicles and equipment, jackhammers, and structure installation equipment (e.g., drilling equipment, cranes). Overall, the noise from the installation of the transmission line would be typical of a construction project. Operation of the new 115-kV transmission line would not affect the noise environment.

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.

Noise levels diminish at a rate of approximately 6 dBA per doubling of distance from a 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 reduce to 72 dBA at 200 feet from the source to the receptor.

Table 6-3 summarizes noise level data compiled for various types of construction equipment and measured at 50 feet from the source. Such construction-generated noise would be localized to the vicinity of construction work sites.

Table 6-3: Noise Ranges of Typical Construction Equipment

Equipment	Noise Levels (Leq, dBA) at 50 feet[89]
Backhoe	73-95
Compressors	75-87
Concrete Mixers	75-88
Concrete Pumps	81-85
Cranes (moveable)	75-88
Cranes (derrick)	86-89
Front Loader	73-86
Generators	71-83
Jackhammers	81-98
Paver	85-88
Pile Driving (peaks)	95-107
Pneumatic Impact Equipment	83-88
Pumps	68-72
Saws	72-82
Scraper/Grader	80-93
Tractor	77-98
Trucks	82-95
Vibrator	68-82

Although construction noise is exempted under the Connecticut regulations for the control of noise (RCSA § 22a-69-1.8(h)); Project construction work would be scheduled to minimize disruptions to traffic, residences, and business uses, to the extent feasible. In addition, engine-powered construction equipment would be properly muffled and maintained to minimize excessive noise to the extent possible.

In the general vicinity of residential areas, construction activities would typically occur during the daytime Monday through Saturday (between 7:00 AM to 7:00 PM), when human sensitivity to noise is lower. Along the underground cable segments in the vicinity of commercial/industrial areas along Shepard Drive in Newington and in Hartford, work may be performed during the standard daytime hours (i.e., Monday through Saturday between 7:00

89 Modern machinery equipped with noise control devices or other noise-reducing design features do not generate the same level of noise emissions as shown in this table. Source: EPA Office of Noise Abatement and Control, 1971 and U.S. Department of Transportation, Federal Highway Administration http://www.fhwa.dot.gov/environment/noise/construction_noise/special_report/

AM and 7:00 PM), but also could be conducted during the night-time to minimize both potential inconvenience to businesses and traffic disruption.

The schedule for the installation of the overhead line segment along the railroad ROW would be coordinated with Amtrak and would be designed to minimize impacts to both passenger and freight rail operations. Based on the consultations to date with Amtrak, Eversource anticipates that some construction would need to occur during night-time hours.

During the preparation of the D&M Plan, Eversource would coordinate with Amtrak, ConnDOT, and the affected municipalities regarding proposed work hours. Construction work hours would be further defined in the Project D&M Plan.

6.1.8 Transportation, Access, and Utility Crossings

The proposed 115-kV line would be installed within and across various existing ROWs, as well as near a number of buried and overhead utility lines. The final design of the new transmission line would reflect the results of Eversource's detailed investigations regarding the locations of such utilities and ROW crossings, as well as the results of Eversource's consultations with Amtrak, ConnDOT, and municipal departments of public works. The Project D&M Plan would reflect the final Project design and specifications to avoid or minimize impacts to existing utilities and transportation services.

The operation of the new transmission line would have no effect on existing utilities and no effect on transportation, except when transmission line maintenance or repairs are required. Any such work would likely be localized to a specific splice vault manhole, a segment of the cable duct bank, or a transmission line structure, thereby minimizing potential effects on vehicular, bus, or rail traffic.

6.1.8.1 Transportation and Utilities

6.1.8.1.1 Roadways

The construction of the new transmission line would have short-term, and localized effects on transportation patterns in the immediate Project vicinity. These effects would stem primarily from additional traffic on local roads associated with the movement of construction vehicles and equipment to and from contractor yards, staging areas, and work sites along the Proposed Route, as well as due to localized lane closures associated with the installation of the underground cable segments in road ROWs.

In addition, because construction work space along the Amtrak ROW is limited, Eversource anticipates that several small, temporary staging areas may be established near transmission structure sites, adjacent to the railroad corridor. Such areas would be used as needed to temporarily store and facilitate access to construction equipment and materials. Details regarding these staging areas would be provided in the D&M Plan.

Further, when heavy equipment and large transmission line components must be transported along public roads for delivery to work sites or staging areas, temporary disruptions in local traffic patterns, delays, or detours could occur. Activities involving the installation of the transmission line at or near road crossings also could result in short-term and localized traffic congestion, delays, or 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. For work along the Amtrak ROW, Eversource would coordinate with Amtrak and retain appropriate flaggers trained in rail operations.

Overall, the installation of the underground transmission line segments along public road ROWs would have the greatest potential to cause traffic disruptions. Eversource would plan and schedule underground transmission line construction to minimize adverse effects on transportation patterns to the extent practicable. Construction work would be accomplished in several stages, and each stage may require activities that temporarily affect vehicle and pedestrian traffic patterns and land uses in the immediate vicinity. During construction, steel plates would be used to cover open excavations during non-work periods and thereby to minimize disruption to access across affected roads.

However, because approximately 3.2 miles of the 3.7-mile Proposed Route would be located within the Eversource and Amtrak ROWs, disturbance to vehicular travel is anticipated to relatively localized and minor.

To define appropriate measures to minimize potential disruption to private and public transportation during construction, Eversource would consult with state and local transportation officials. In addition, Eversource would inform businesses, landowners, and residents along the transmission line 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.

6.1.8.1.2 Amtrak/CT*fastrak*

The installation of the overhead transmission line segment within the Amtrak ROW (as well as the overhead connections to the riser structures that would span the CT*fastrak* busway and railroad tracks) would require close coordination with Amtrak and ConnDOT to define work schedules and construction sequencing. Eversource anticipates that transmission line construction can be conducted within the Amtrak/CT*fastrak* corridors without causing significant disruption or delays to these important local and regional transportation services.

6.1.8.1.3 Utilities

Transmission line construction would include notifying Connecticut's *Call Before you Dig* Program (#811 or 1-800-922-4455) of the planned work and coordinating with known utilities operators with existing or proposed facilities in the work area. During the construction planning and implementation phase, Eversource would coordinate with utility operators to avoid, relocate, or otherwise bypass other utilities in proximity to the Proposed Route.

Installation of the underground transmission line segment within the Eversource ROW would require the temporary relocation of one of the distribution pole lines (supporting two distribution circuits) in order to maintain local electric service during Project construction. As discussed in Section 4, this distribution pole line would be returned to its original location within the Eversource ROW after the cable system is installed.

As noted in Section 5.1.8, the overhead segment of the proposed transmission line would span the MDC SHCST project in West Hartford. Construction and operation of the transmission line would have no effect on the MDC's SHCST project, which would consist of a deep-bored tunnel approximately 200 feet beneath the Amtrak ROW.

6.1.8.2 Energy Facilities

The proposed Project would not result in any adverse impacts to existing energy facilities and would benefit the Connecticut energy system by helping to bring the electric supply system in the Greater Hartford Sub-area 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. The Project, which is the product of years of careful study of reliability needs, would address violations of reliability criteria and would assist Eversource in executing its mandated obligation to maintain bulk transmission system reliability in Connecticut. Moreover, the use of a hybrid overhead/underground line configuration to connect the Newington and Southwest Hartford substations represents a cost-effective solution that would benefit consumers.

6.2 SUBSTATIONS AND NEWINGTON TAP

As described in the following subsections, the proposed Newington Substation modifications, Newington Tap reconfiguration and Southwest Hartford Substation modifications would result in localized impacts limited to Eversource property.

6.2.1 Newington Substation and Newington Tap

Due to the configuration of the existing 115-kV equipment within the substation and the required transmission line tie-ins, as well as other on-site conditions, the proposed 0.3-acre expansion of the Newington Substation fenced area to the south and west represents the most cost-effective and least environmentally intrusive option for modifying Newington Substation, Newington Tap, and otherwise accommodating the proposed 115-kV transmission line. The installation of a retaining wall on the south and west sides of the substation would allow for the installation of the new substation facilities, while also minimizing the overall grading required to achieve the necessary elevations (i.e., limiting the toe of slope infringement into adjacent wetland areas).

6.2.1.1 Topography, Geology and Soils

6.2.1.1.1 Substation Modifications

The proposed Project modifications to Newington Substation would require topographic changes (grading and filling) of an approximately 0.3-acre area immediately south and west of the existing station fence. This grading and filling work would tie the expanded substation into the existing substation foundation. This work would be required in order to create additional level surface for the new substation facilities. Soils would also be temporarily disturbed from trenching required to connect the new 1346 Line, in an underground configuration, to the substation.

As part of the substation modifications, a retaining wall would be installed at the southern and western edge of the proposed substation expansion area. The retaining wall location would generally follow the existing Newington Substation toe of slope, and would allow for an expansion of the substation fence of approximately 30 feet to the south and 20 feet to the west, while avoiding permanent impacts to adjacent Wetland N-1. The proposed retaining wall, which is depicted on Mapsheet 1 of the 100-scale figures included in Volume 3, would face maintained portions of Eversource's existing 1783/1785 line ROW and generally would not be visible from nearby residences, due to the surrounding tree cover located at the ROW edge. To modify the Newington Tap (i.e., relocate the existing 1783 Line), limited tree clearing/trimming would be required, which may increase the visibility of the substation from neighboring properties. This clearing would be minimized to the extent practicable.

Expansion of the substation would require grading and filling. The existing soils would be removed and replaced with appropriate subsurface materials to provide support for substation equipment. Activities within the extended fenceline, such as installation of structure footings and foundations, would temporarily disturb on-site soils. Appropriate sedimentation and erosion controls would be deployed to minimize the potential for off-site erosion, particularly into nearby wetlands N-1 and N-1A, as described below.

No grading, trenching or permanent filling within wetlands would be required for the substation expansion. Timber mats would be used within Wetland N-1 and Wetland N-1A in order to provide temporary work space for the retaining wall construction and for the Newington Tap reconfiguration. Appropriate sedimentation and erosion controls would be employed for work near wetlands, as described below.

6.2.1.1.2 Newington Tap

The modification of Newington Tap would not require any grading or filling, except as required to create work pads necessary to remove four existing 115-kV poles and to install the new overhead Tap structure. Some activities would unavoidably occur along the 1783 Line ROW within Wetlands N-1 and N-1A, as described in Section 6.2.1.2.

6.2.1.1.3 Mitigation Measures

To minimize the potential for off-site erosion and sedimentation, especially into nearby wetlands, Eversource would prepare, and would require its construction contractor to implement, a Project-specific SWPC Plan in accordance with CT DEEP requirements as specified in the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities. The SWPC Plan would address both Newington Substation expansion and the modifications to Newington Tap.

Temporary erosion and sedimentation controls (e.g., silt fence, hay/straw bales) would be installed prior to or in conjunction with the filling and grading work for both the substation expansion and the Newington Tap modifications. Soil erosion and sedimentation controls would be installed and maintained in accordance with the Project-specific SWPC Plan and Eversource's BMP Manual, which incorporate guidance and techniques from CT DEEP's *2002 Connecticut Guidelines for Soil Erosion and Sediment Control* (revised 2007). Soil erosion and sedimentation controls would be maintained and inspected until disturbed soil areas are stabilized.

Upon completion of the substation and Newington Tap modifications, affected soils affected would be appropriately stabilized. Within the substation fenced area, soils would be stabilized via the installation of gravel and/or trap rock. Outside the fence, areas temporarily disturbed during construction would be regraded as necessary and then reseeded and mulched or otherwise stabilized.

Affected areas within Wetlands N-1 and N-1A may be reseeded and mulched with straw as necessary. The wetlands affected by construction are expected to recolonize naturally with wetland species.

6.2.1.2 Water Resources

6.2.1.2.1 Watercourses

As described in Section 5.2.1.3, there are no perennial watercourses, waterbodies, or floodplains in proximity to Newington Substation; thus, no adverse effects would occur to these resources. As illustrated on the Volume 3 maps, intermittent stream IS-1 is a man-made drainage ditch that connects Wetland N-1 and Wetland N-1A and continues south along and across the 1783 Line ROW, ultimately discharging to Piper Brook.

Stream IS-1 extends across Eversource's Newington Substation property near portions of the 1783 Line where work would be performed as part of the Newington Tap modifications. However, Eversource has planned the Newington Tap work to avoid access across or work within the stream.

Temporary erosion and sedimentation controls, in accordance with Eversource's BMP Manual and the Project-specific SWPC Plan, would be deployed and maintained to avoid or minimize the potential for indirect effects to watercourse IS-1. Appropriate spill prevention and control 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 and Newington Tap work.

6.2.1.2.2 Wetlands

Wetland N-1 borders the south side of the substation and Wetland N-1A is located to the west of the substation within the maintained 1783 Line ROW. Portions of Wetland N-1 and Wetland N-1A would be temporarily affected by the modifications to Newington Tap.

During the construction of the modifications to Newington Substation and Newington Tap, the temporary use of timber mats would be required in Wetland N-1 and Wetland N-1A. As described below, the timber mats, which would affect a total of approximately 0.37 acre in Wetland N-1 and approximately 0.14 acre in Wetland N-1A, are required to provide temporary work space during construction and would be removed after the completion of the Project modifications. Any areas of disturbed soils within these wetlands would be regraded as necessary to match existing contours, and may be re-seeded with an appropriate seed mix for wetland sites.

6.2.1.2.3 Retaining Wall

A portion of Wetland N-1 would be temporarily affected during the construction of the Newington Substation retaining wall. The proposed retaining wall was designed to minimize both the amount of fill needed to expand the substation and the amount of temporary fill within wetlands, as well as to avoid the need to permanently fill portions of Wetland N-1. After preliminary Project plans indicated that wetlands would be impacted by the substation modifications, Eversource specifically redesigned the southwest corner of the retaining wall and substation expansion in order to avoid permanent fill in wetlands.

6.2.1.2.4 Erosion Control

Temporary work pads would be required for work in wetlands associated with the Newington Tap modifications. Specifically, a single-pole structure (Structure 16074) would be removed (and would not be replaced) and an existing three-pole dead-end structure (Structure

16072) would be removed and replaced with a monopole structure (also to be designated Structure 16072). In addition, construction access would be required at Structures 8001 and 16073 in order to install new conductors and connect the new structure to the existing 1783 Line. The proposed access routes and anticipated locations of temporary timber mats (construction work pads) for the Newington Tap modifications are depicted on the Volume 3 maps.

After the completion of the retaining wall, transmission cable interconnections, and the Newington Tap modifications, the timber mats would be removed and the affected areas of Wetlands N-1 and N-1A would be restored, in accordance with the procedures in Eversource's BMP Manual and with the requirements of federal and state Project approvals. Areas of disturbed soils within Wetlands N-1 and N-1A may be re-seeded with an appropriate seed mix for wetlands.

Temporary erosion and sedimentation controls, in accordance with Eversource's BMP Manual and the Project-specific SWPC Plan, would be deployed and maintained to avoid or minimize the potential for indirect effects to Wetland N-1 and Wetland N-1A. Similarly, appropriate spill prevention and control 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 work.

Operation of the modified Newington Substation and the modified Newington Tap 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. Vegetation would be managed in accordance with Eversource's ROW vegetation management plans. During substation operations, Eversource also would conform to standards for minimizing the potential for spills or leaks from electrical equipment to adjacent waters.

6.2.1.3 Biological Resources

The modifications to Newington Substation would have minimal and highly localized effects on biological resources, associated with the permanent conversion of existing shrub habitat to utility uses within the 0.3-acre substation expansion area. This effect would be mitigated by the availability of similar shrub-type habitat within Eversource's existing ROWs and elsewhere on the surrounding 11.4-acre Eversource property. Further, the loss of the 0.3-

acre of shrub habitat at Newington Substation would be more than offset by the creation of additional shrub-type habitat in conjunction with the installation of the new 115-kV cable along the Eversource ROW.

Temporary vegetation removal also would be required within the construction work space for the Newington Tap modifications, including within Wetlands N-1 and N-1A. However, most of the affected vegetation is presently within Eversource's existing managed transmission line ROW and thus consists of lower-growing shrub and tree species.

Minimal effect to the existing tree screen would occur as a result of the proposed substation expansion. Trimming of trees within the cleared and maintained portions of the ROW may be required. Some trees located along the 1783 Line ROW would be removed or trimmed to allow for the Newington Tap reconfiguration and to achieve required clearances between vegetation and the relocated overhead lines. Effects on associated wildlife, including breeding birds, would similarly be minimal, and no state or federally-listed species are documented within Eversource's property at Newington Substation.

6.2.1.4 Land Use

No significant adverse land use effects would occur from either the Newington Substation expansion or the Newington Tap modifications. The proposed substation expansion would extend the developed substation approximately 30 feet closer to certain residences located on Thornton Drive. However, the closest residence would be approximately 200 feet from the expanded substation fenceline boundary, and an intervening screen of trees would remain.

The modifications to Newington Tap would involve the installation of one new 95-foot-tall monopole structure (Structure 16072), and the removal of the existing 55-foot-tall three-pole dead-end structure (refer to XS-16072 in Volume 3, Exhibit D). Although the new monopole structure would be taller than the existing dead-end structure, it would present a narrower profile on the ROW and thus should have limited visual effects. In addition, existing Structure 16074 would be removed and not replaced as part of the Newington Tap modifications.

No significant increases to visibility or viewsheds are anticipated as a result of the proposed substation expansion as the substation is already located on a higher level than Thornton Drive. Minimal alteration of the existing tree screen would occur.

6.2.1.5 Cultural (Historical and Archaeological) Resources

Based on the cultural resource investigations conducted for the Project (refer to the Heritage reports in Volume 2), the modifications to Newington Substation and Newington Tap would occur within areas of previous land use disturbance where the potential for intact archaeological sites is minimal. In addition, there are no standing historic structures or NRHP-listed sites near the substation or Newington Tap.

As noted in Section 5.2.1.5, Heritage's Phase IB Cultural Resources Reconnaissance Survey investigations revealed a single multi-component archaeological site (designated Site 94-1 and containing historic and pre-historic components) on Eversource's Newington Substation parcel. However, based on the existing land use and past site disturbance, no additional historic and archaeological investigations were recommended by Heritage (refer to Volume 2, Heritage's Phase IB report).

Thus, no adverse effects to cultural resources are anticipated as a result of the proposed substation and Newington Tap modifications. As described for the proposed 115-kV line, Eversource would include in the Project D&M Plan protocols to be followed in the event that unanticipated cultural resources are discovered during substation and Tap construction activities.

6.2.1.6 Air Quality and Noise

The impacts to air quality as a result of the expansion of Newington Substation and the modifications to Newington Tap would be similar to those described for the transmission line construction (refer to Section 6.1.6), and would include temporary and highly localized air emissions from the operation of construction vehicles and equipment, as well as fugitive dust emissions. However, these impacts would be minimal, localized to the vicinity of the Eversource substation property, and would occur 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 would include those involving earth moving (e.g., grading, filling), excavations, general equipment operations, installation of electric components, removal and installation of transmission line structures, and the general movements of equipment and construction vehicles to and from work sites using local roads.

Construction noise is expected to be localized in the vicinity of the substation and Tap. Construction work would occur from Monday through Saturday, during the daytime hours (typically between 7:00 AM and 7:00 PM), when human sensitivity to noise is lower. However, under certain circumstances, especially when circuit outages are required, night work and Sunday work could be necessary. Night construction could require lighting and may also result in localized, temporary increases in noise levels.

Construction noise may be audible in the residential areas that border the Eversource property. The nearest residences are approximately 200 to 400 feet from areas of the substation where the Project modifications would occur. Residences are located approximately 125 feet from the proposed Newington Tap modification work areas. The existing tree buffer around the Eversource property would assist in attenuating construction-related noise.

The operation of the modified Newington Substation and the reconfigured Newington Tap would not generate additional noise. Sound pressure levels at all points along the property lines of both substations would continue to meet state regulations as specified in RCSA § 22a-69-1 et al.

6.2.1.7 Transportation and Utilities

Newington Substation is accessible via a network of local roads and State Route 173. The proposed substation modifications would not adversely affect long-term transportation or access patterns. During construction, short-term effects on vehicular traffic would occur as construction vehicles use local public roads leading to the site.

The operation of the modified substation and Tap would require no full-time personnel to be based at Newington Substation. As a result, the operation of the modified facilities 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. However, the expansion would be within upland areas, would not affect water resources, and would be entirely on Eversource property.

6.2.2.1 Topography, Geology and Soils

The proposed modifications to Southwest Hartford Substation would consist of an expansion to the east of the existing substation fenced area, within an area that is characterized by level, upland terrain. As a result, only minimal grading would be required. However, any existing soils that are an unsuitable base for the substation facilities would be removed and replaced with appropriate bedding material to support the substation equipment and operational needs.

Activities within the extended fenced area, such as installation of structure footings and foundations, would temporarily disturb soils. Upon completion of construction, soils would be appropriately stabilized within the fenceline via the installation of gravel and/or trap rock. Outside the expanded fenced area, soils disturbed during construction would be regraded and stabilized as appropriate, either with gravel/trap rock or by seeding and mulching to establish a vegetative cover. As part of the Southwest Hartford Substation modifications, including the installation of the new 1346 Line via an underground entry, the substation access road (from New Park Avenue) would be re-configured; the realigned road would be stabilized either by paving or with gravel.

Soil erosion and sedimentation controls would be installed in accordance with Eversource's BMP Manual, which incorporates guidance and techniques from CT DEEP's *2002 Connecticut Guidelines for Soil Erosion and Sediment Control* (revised 2007), and in accordance with the SWPC Plan prepared for the Project. Soil erosion and sedimentation controls would be installed prior to or in conjunction with the earthwork required for the substation expansion and would be maintained throughout construction, particularly to protect the unnamed tributary to the South Branch of the Park River and associated wetland area, which form the northern boundary of the Eversource property.

6.2.2.2 Water Resources

6.2.2.2.1 Watercourses

Southwest Hartford Substation is adjacent to an unnamed tributary to the South Branch of the Park River (PS-3). Neither the proposed substation expansion, nor the proposed 115-kV line, would encroach upon any portion of PS-3 or its associated 100-year floodplain. Construction activities would occur approximately 300 feet from the watercourse.

PS-3 is bounded by steep banks, which then transition to the level landform on which the substation is situated. This change in grade provides a distinct topographic break, which would facilitate the management of construction activities, in terms of avoiding the potential for direct or indirect impacts to the watercourse. No fill would be placed within the tributary's 100-year FEMA floodplain; thus, no loss of flood storage or change in peak flows would occur from the substation expansion.

6.2.2.2.2 Wetlands

At the Southwest Hartford Substation site, Wetland H-1 borders Watercourse PS-3 north of the substation. No construction is proposed within this wetland; therefore, no impacts to Wetland H-1 are anticipated.

During the substation modification construction, appropriate temporary soil erosion and sedimentation controls would be installed and maintained, pursuant to Eversource's BMP Manual. These erosion and sedimentation control measures would minimize the potential for off-site sedimentation into the unnamed tributary and to Wetland H-1. Similarly, appropriate spill prevention and control procedures would be implemented during construction to minimize the potential for inadvertent spills or leaks from construction equipment to enter the watercourse. 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 grassed areas, along with scattered shrubs and trees. The removal of this vegetation and conversion of the area to electrical utility use would represent a long-term, but minimal impact to vegetation and wildlife habitat. As this area is largely paved and grassed currently, the amount of affected wildlife habitat would also be minimal. Similar habitat is available elsewhere on the Eversource site, as well as along the unnamed tributary to the South Branch of the Park River. The wooded riparian habitat along the stream corridor would not be altered.

6.2.2.4 Land Use

Southwest Hartford Substation is situated within a commercial and industrial area, adjacent to I-84. 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 local, regional, or state land use plans.

The existing Southwest Hartford Substation (and proposed substation expansion) is approximately 1,700 feet northwest of the state-recognized Park River Greenway and future expansion of the South Branch of the Park River Trail. However, this greenway and trail system is located within a highly urbanized setting. New Park Avenue, I-84, the CT*fastrak,* and the Amtrak railroad corridor are situated between the substation and existing and proposed greenway/trail. Accordingly, the proposed substation expansion would have no adverse effect on the recreational use or visual setting of the greenway/trail. Due to the adjacent commercial and transportation-related land uses, no landscaping improvements or tree screening measures are anticipated at this substation.

6.2.2.5 Cultural (Historical and Archaeological) Resources

There are no anticipated or identified cultural features at Southwest Hartford Substation (refer to the Heritage report in Volume 2). The closest identified cultural resource is the NRHP-listed Parkville Historic District, which is located approximately 300 feet from Southwest Hartford Substation at its closest point. The unnamed tributary to the South Branch of the Park River, thick woodlands along the tributary, and a carwash are located between the substation and this historic district.

The next closest cultural resource is the site of the former Royal Typewriter Company 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 into its current use as parking lot for a supermarket; however the building remains listed on the NRHP. No adverse effects to the Parkville Historic District or the former Royal Typewriter Company building property are anticipated from the proposed substation expansion.

The Southwest Hartford Substation parcel has been identified as a location with low probability for archaeological sites, due to the previously altered nature of the site. Based on the results of the visual impact assessment conducted by Heritage, no impacts to the Parkville Historic District are anticipated in relation to the substation work.

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 the 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 commercial/industrial uses and transportation noise, including traffic on I-84, the CT*fastrak*, and the Amtrak railroad corridor.

6.2.2.7 Transportation, Access, 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. The site is easily accessible directly off New Park Avenue.

During construction, short-term effects on vehicular traffic may occur as construction vehicles use local public roads, particularly New Park Avenue, 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.

7. ELECTRIC AND MAGNETIC FIELDS

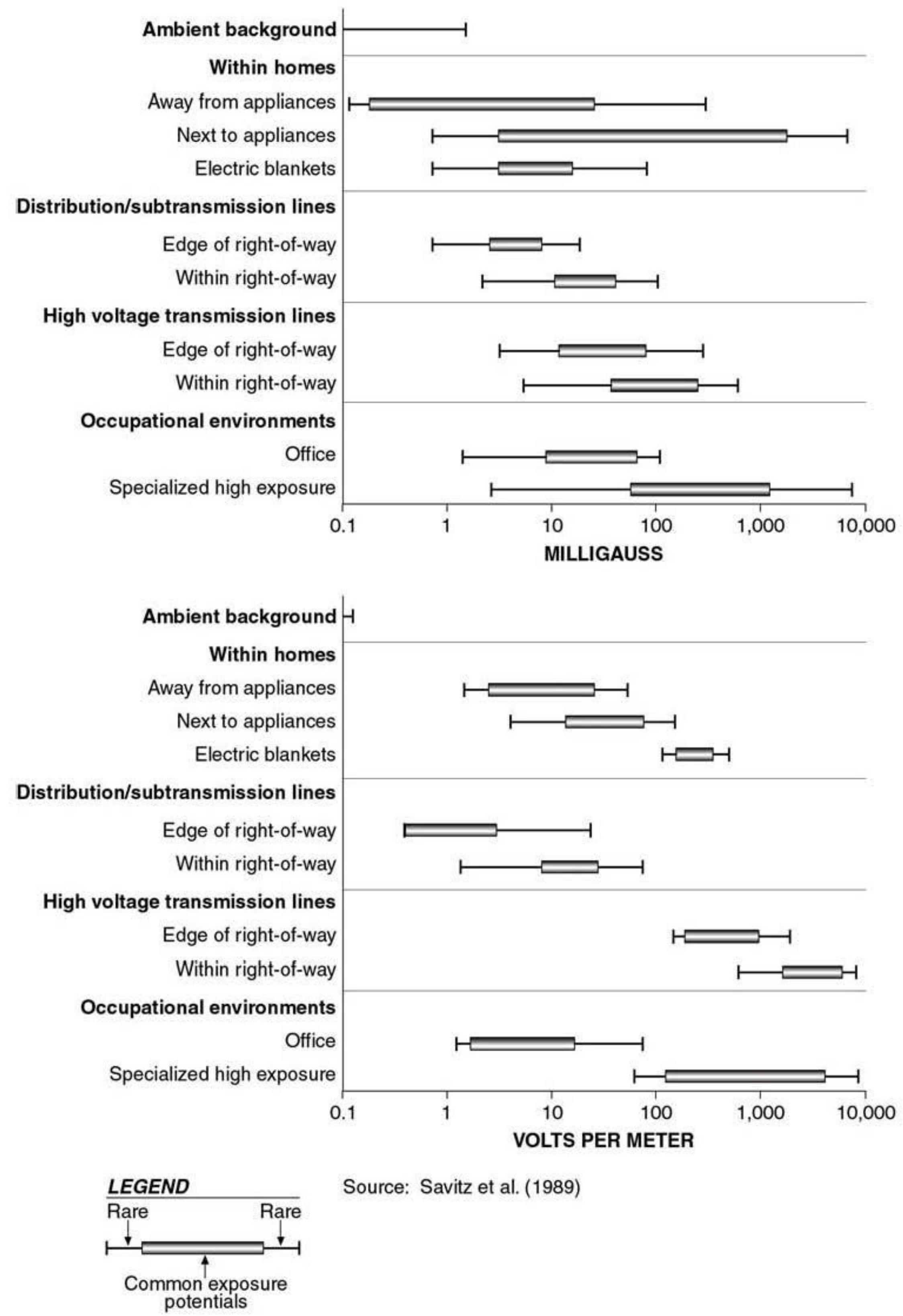
Electricity used in homes and workplaces is transmitted over considerable distances from generation sources to distribution systems. Electricity is transmitted as alternating current (AC) to all homes and over electric lines delivering power to neighborhoods, factories, and commercial establishments. The power provided by electric utilities in North America oscillates 60 times per second (i.e., at a frequency of 60 hertz [Hz]).

Electric fields (EF) and magnetic fields (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.

Electric fields are the result of voltages applied to electrical 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. Most objects, including fences, shrubbery, and buildings, easily block electric fields. Therefore, certain appliances within homes and the workplace are the major sources of electric fields indoors, while power lines are the major sources of electric fields outdoors (Figure 7-1, lower panel). It should be noted that electric fields from cables are contained within the sheaths of the individual cables. Therefore, measured electric fields from these cables in the environment would be zero.

Magnetic fields are 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. The magnetic field level at any point depends on characteristics of the source, including the arrangement of conductors, the amount of current flow through the source, and its distance from the point of measurement. The levels of both electric fields and magnetic fields diminish with increasing distance from the source.

Figure 7-1: Electric and Magnetic Fields in the Environment



Source: Savitz et al. (1989)

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 POWER LINES AND OTHER SOURCES

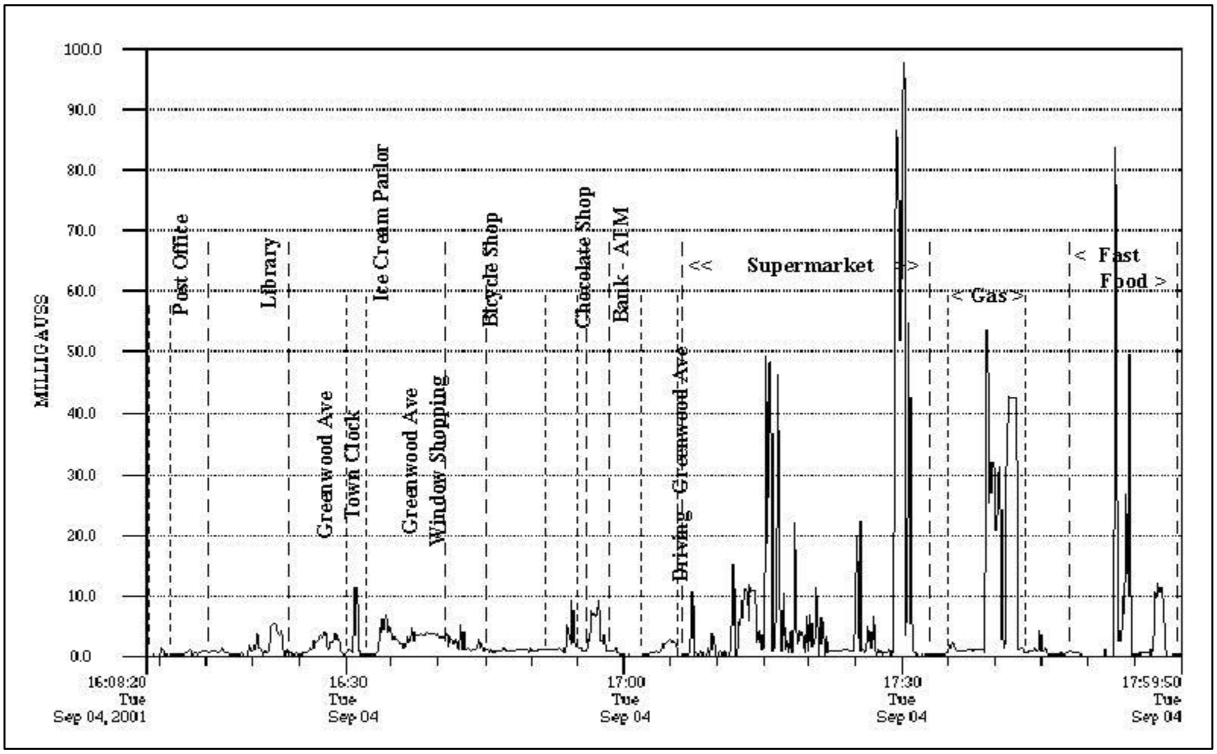
Background AC magnetic field levels in homes are generally less than 20 mG when not near a particular source, such as some appliances. Higher magnetic field levels can be measured outdoors in the vicinity of distribution lines, sub-transmission lines, and transmission lines (Figure 7-1, upper panel).

Electric appliances are among the strongest sources of AC magnetic fields encountered in indoor environments. Magnetic fields near appliances can reach 1,000 mG or more. For example, Gauger (1985) reports the maximum AC magnetic field at 3 centimeters from a sampling of appliances as follows: 3,000 mG (can opener), 2,000 mG (hair dryer), 5 mG (oven), and 0.7 mG (refrigerator). Similar measurements have shown that there is a tremendous variability among appliances made by different manufacturers. The potential contribution of different sources to overall exposure over long periods is not very well characterized, but both repeated exposure to higher fields for short times and longer exposure to lower intensity fields for a long time contribute to an individual's total exposure.

Considering EMF from a range of specific sources or environments, as illustrated in Figure 7-1, does not fully reflect the variations in an individual's personal exposure as encountered in everyday life. To illustrate this, magnetic field measurements were recorded, over a two-hour period, by a meter worn at the waist of an individual who conducted a range of typical daily activities in a Connecticut town.

As illustrated in Figure 7-2, these activities included a visit to the post office and the library, walking along the street, getting ice cream, browsing in a bicycle shop, stopping in a chocolate shop, going to the bank/ATM, driving along streets, shopping in a supermarket, stopping for gas, and purchasing food at a fast food restaurant.

Figure 7-2: Typical Magnetic Field Exposures in a Connecticut Town (Bethel)



The maximum, average and median exposures encountered during the course of the two-hour measurement period are provided in Table 7-1, below.

Table 7-1: Summary of Magnetic Fields Measured in a CT Town (Bethel)

Magnetic Fields Levels (milliGauss, mG)		
Maximum*	Average	Median
97.55	4.57	1.10

* Maximum occurred in the supermarket

As Figure 7-2 shows, from moment-to-moment in everyday life, magnetic fields are encountered that vary in intensity over a wide range. Other individual patterns of exposure to magnetic fields could be very different and reflect the individual's personal activities. For example, a rider on a commuter or long-distance electric train in Connecticut would encounter higher average power-frequency magnetic fields of perhaps 14 to 50 mG during a trip, with potential peak values in the range of 100 to 400 mG (Department of Transportation, Federal Railroad Administration, 2006).

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

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. There are no state or federal laws or regulations concerning transmission line electric and magnetic fields. However, to address concerns regarding potential health risks from exposure to EMF, the Council, after a nearly two-year-long proceeding, developed a policy document entitled *Electric and Magnetic Fields Best Management Practices for the Construction of Electric Transmission Lines in Connecticut* (EMF BMP), a copy of which is provided in Volume 2.

The EMF BMP document summarizes the latest information regarding scientific knowledge and consensus on EMF and health concerns and recommends best practices concerning the design of new transmission lines with respect to EMF. The Council most recently revised the EMF BMP on February 20, 2014.

In the EMF BMP, 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," and "that timely additional research is unlikely to prove the safety of power-line MF to the satisfaction of all." Accordingly, the Council decided to "continue its cautious approach to transmission line siting that has guided its Best Management Practices since 1993." As the Council states in the EMF BMP:

> *This continuing policy is based on the Council's recognition of an agreement with conclusions shared by a wide range of public health consensus groups, and also, in part, on a review which the Council commissioned as to the weight of scientific evidence regarding possible links between power-line MF and adverse health effects. Under this policy, the Council will continue to advocate 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.*

Pursuant to this policy, the Council requires that an applicant proposing to build an overhead electric transmission line to develop and present the following materials:

- In order to assure that the Council's information with respect to potential health effects of EMF is kept current, the EMF BMP 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."

- The EMF-BMP requires that *"an applicant shall provide design alternatives and calculations of MF for pre-project and post-project conditions.*"
- *"The Council directs the Applicant to initially develop a baseline Field Management Design Plan that depicts the proposed transmission line project designed according to standard good utility practice and incorporating "no-cost" MF mitigation design features."*
- *"The Applicant shall then modify this base design by adding low-cost MF mitigation design features specifically where portions of the project are adjacent to residential areas, public or private schools, licensed child day-care facilities, licensed youth camps, or public playgrounds."*

7.3 MEASURED ELECTRIC AND MAGNETIC FIELDS IN THE VICINITY OF THE PROJECT

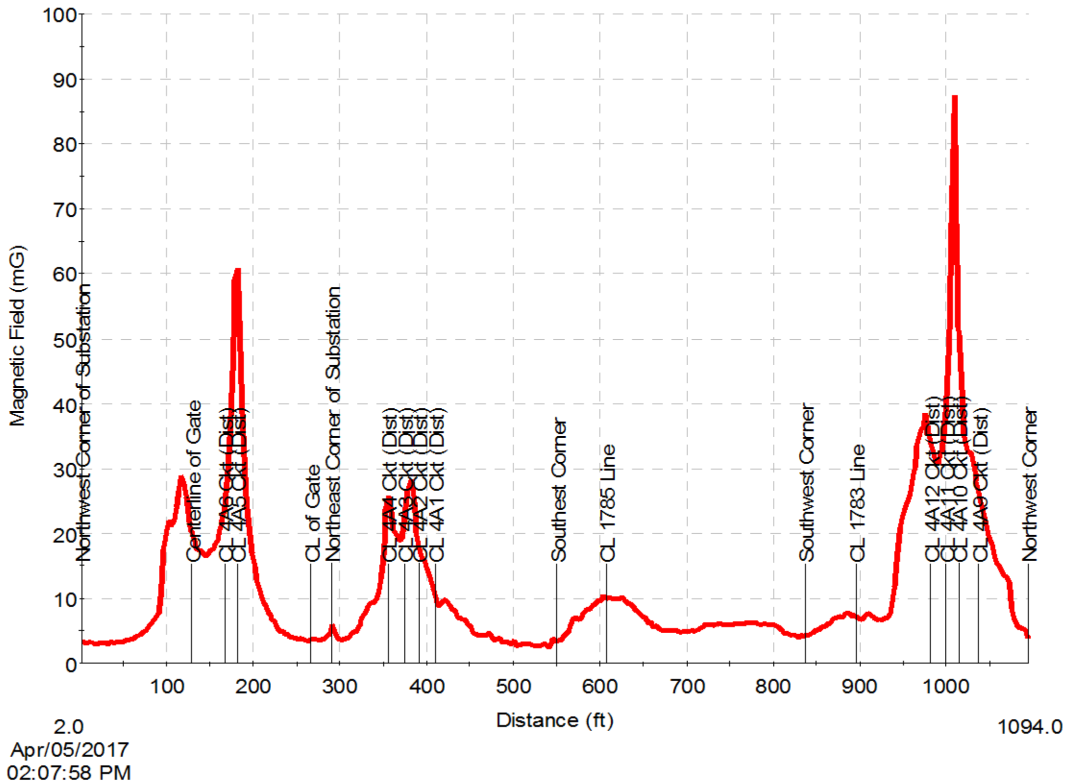
On April 5, 2017, Eversource representatives took spot measurements of existing magnetic fields at selected locations along the Proposed Route; these locations included around Newington Substation, Avery Road (Newington), Flatbush Avenue (West Hartford), and Southwest Hartford Substation (Hartford). The measurements were taken at a height of 1 meter (3.28 feet) above ground, consistent with the industry standard protocol for taking measurements of EMF (IEEE Standard. 644-1994, R2008). Measurement locations, along with graphs of the measurement results, are provided in Sections 7.3.1 through 7.3.4.

Measurements of the MF present a "snapshot" of the conditions at a point in time. Within a day, and over the course of days, months, and even seasons, magnetic field levels change at any given location, depending on the amount and the patterns of power supply and demand within the state and surrounding region. Measurements were taken along the perimeter (for substations) and on a horizontal transect of the Proposed Route (for the transmission line). The green line represents the measurement path.

7.3.1 Newington Substation (Newington)

Figure 7-3: Measurement Path around Newington Substation

Figure 7-4: Measured Magnetic Fields around Newington Substation



7.3.2 Avery Road (Newington)

Figure 7-5: Measurement Path along Avery Road

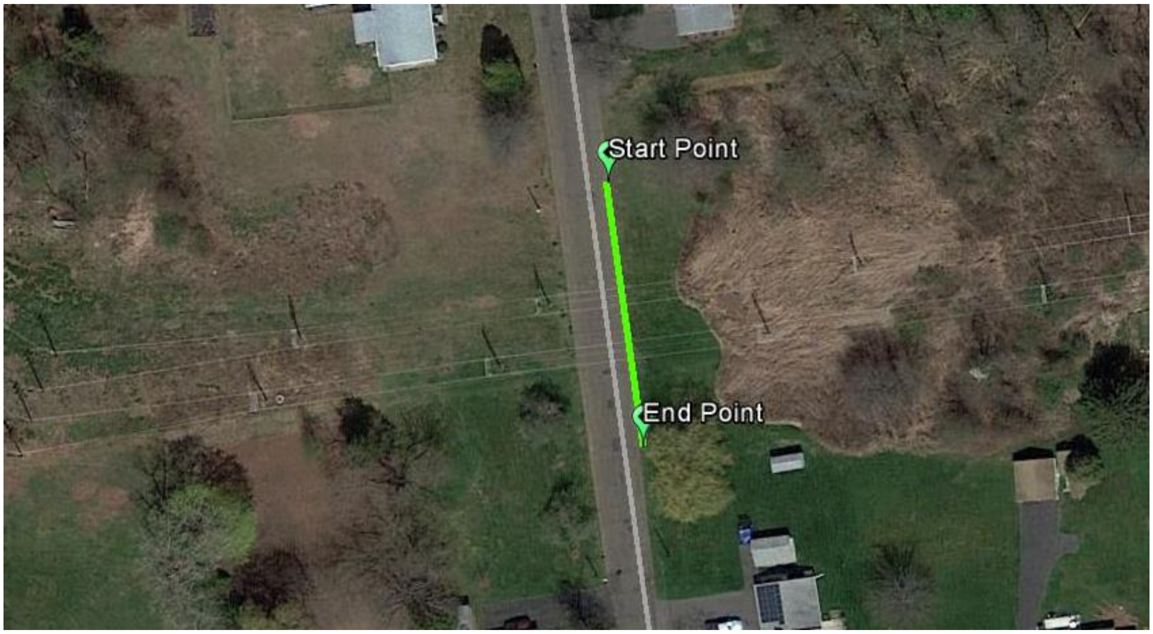
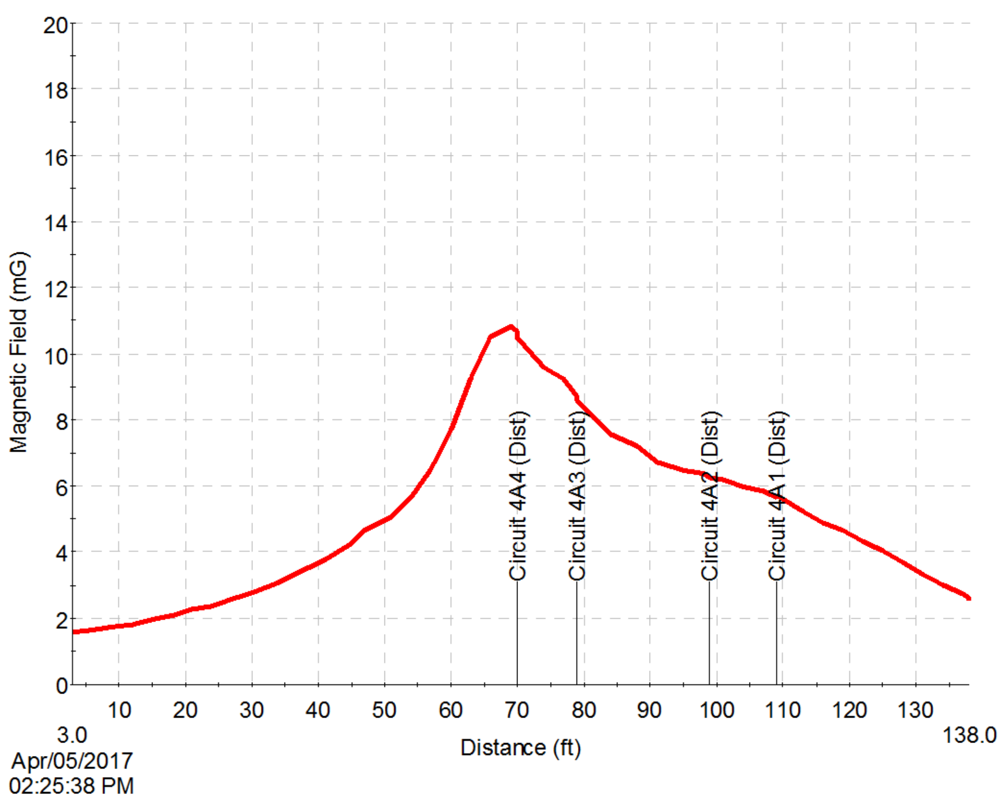


Figure 7-6: Magnetic Field Measurements along Avery Road

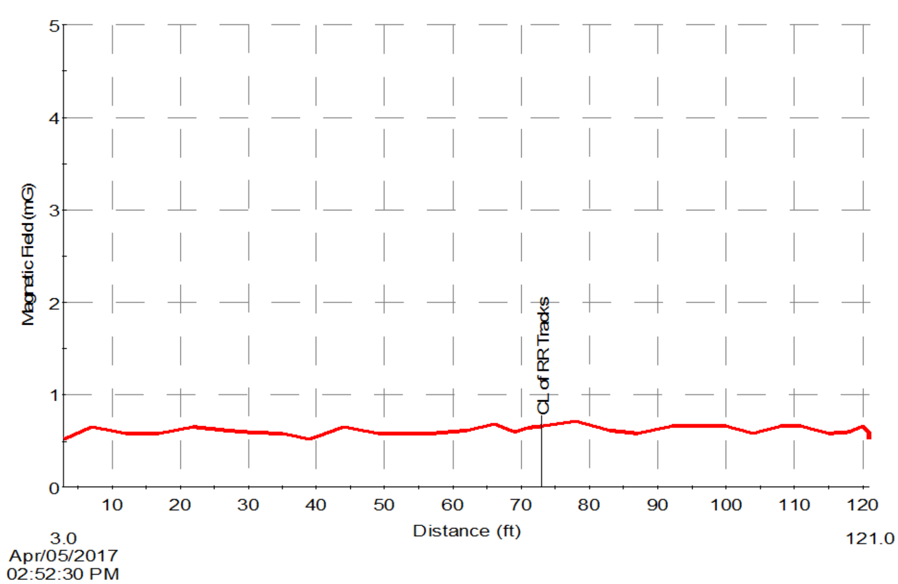


7.3.3 Flatbush Avenue (West Hartford)

Figure 7-7: Measurement Path on Flatbush Avenue Bridge

Measurements below only show magnetic field measurements. Electric fields were also measured at this location, but were all zero.

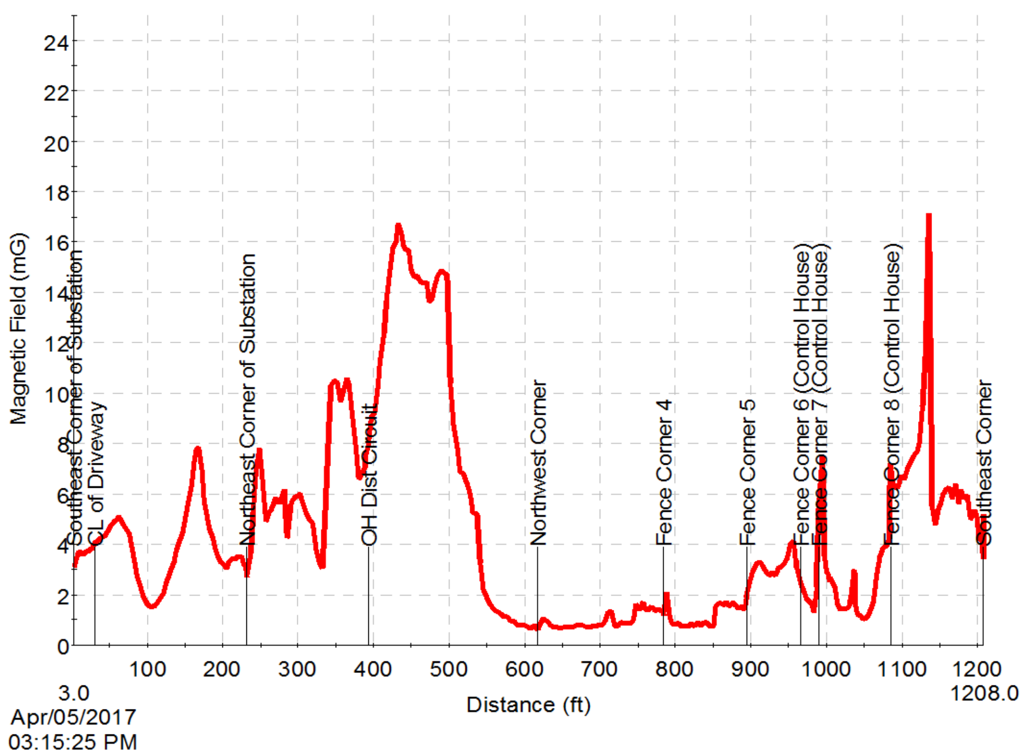
Figure 7-8: Magnetic Field Measurements on Flatbush Avenue Bridge



7.3.4 Southwest Hartford Substation (Hartford)

Figure 7-9: Measurement Path around Southwest Hartford Substation

Figure 7-10: Magnetic Field Measurements around Southwest Hartford Substation



7.4 CALCULATED ELECTRIC AND MAGNETIC FIELDS FROM THE PROPOSED FACILITIES

7.4.1 The Proposed 115-kV Transmission Line

Eversource prepared calculations of predicted electric and magnetic fields from the 115-kV transmission line along the Proposed Route under average annual load conditions. The results of these calculations are discussed in the following sections.

The calculations of MF presented here assume a projected average annual loading condition in the year 2024. Consistent with the measured values, these calculations also apply at 1 meter (3.28 feet) above grade. Electric field calculations were prepared assuming 105% of nominal voltage (121 kV) per ISO-NE Operating Procedure No. 19.

Electric field calculations were only performed for the proposed overhead segment of the transmission line along the Amtrak ROW. Along the underground segments of the Proposed Route, the sheath of the cable grounds out the electric field outside of the cable assembly.

Additionally, calculations at 25-foot intervals for electric and magnetic fields are included in Volume 2. These include calculations of electric and magnetic fields during average annual load, peak-day average load and annual peak load conditions.

7.4.1.1 Underground Transmission Line Segments

Referencing the typical arrangement for the underground duct bank (refer to Figure 3-5 and Figure 7-11), calculations for the magnetic fields in the vicinity of the underground transmission line segments assume that the depth below grade of the uppermost cable is 3.5 feet. The calculations show that the MF is highest at 63 mG directly above the line and would drop to below 3.0 mG within 32 feet on either side of the transmission line. No homes or statutory facilities would be within 32 feet of the underground section of this transmission line. The calculated fields are summarized in Table 7-2 and Figure 7-12.

Table 7-2: Summary of Calculated Magnetic Fields near UG Transmission Line

Calculated Magnetic Field (mG)		
Left Edge of ROW	Max in ROW	Right Edge of ROW
0.3	63.0	3.3

Figure 7-11: Underground Transmission Trench Detail

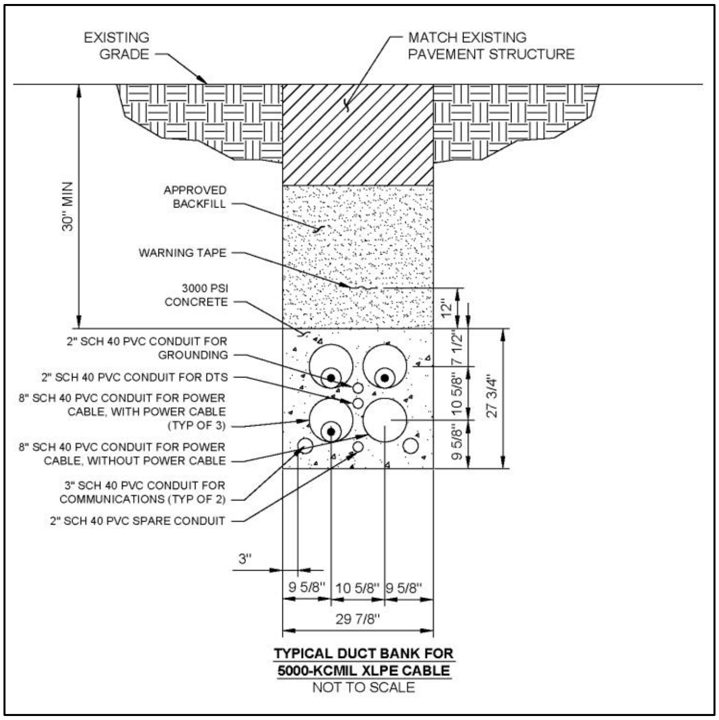
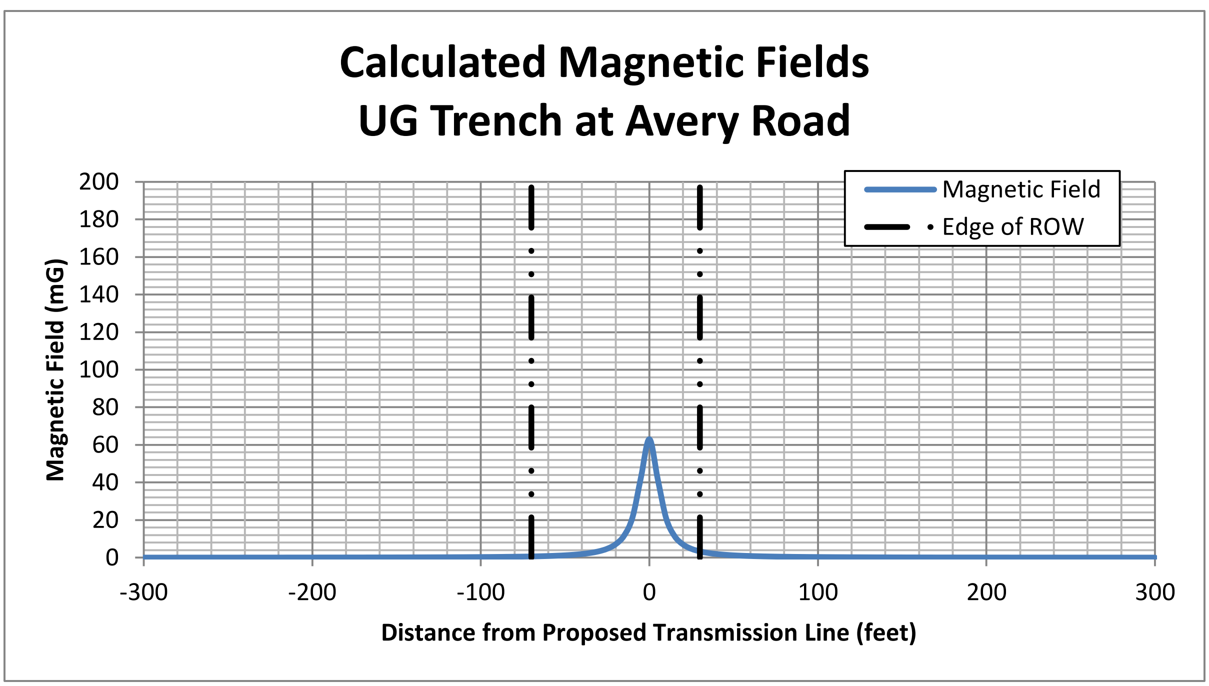


Figure 7-12: Calculated Fields from Underground Transmission Line



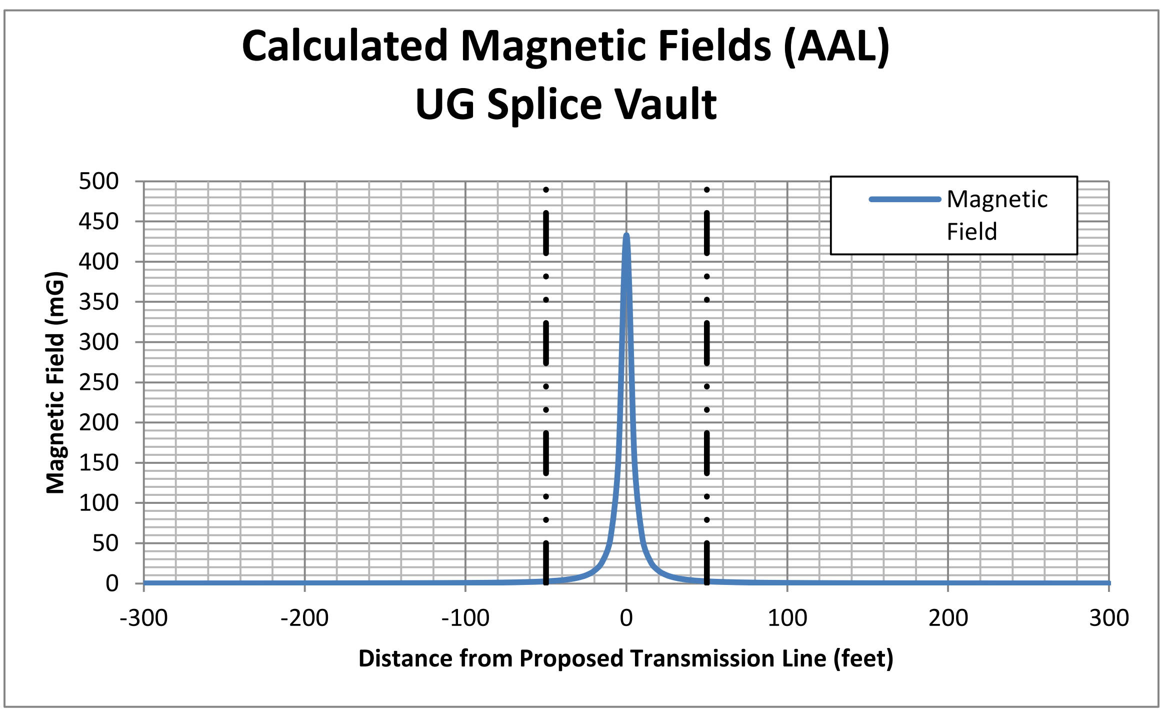
7.4.1.2 Underground Splice Vaults

In the vicinity of each of the three splice vaults required for the underground cable system, the conductors change to a vertical configuration for entry into the vault. The phases spacing increases to 18 inches. Two of the three splice vaults required for the underground line segment in Newington would be located on Eversource properties, while the third would be along Shepard Drive. Because of the increased phase spacing, the fields directly above the trench at each splice vault reach a field level of 433 mG. These fields drop to below 3 mG within 50 feet of the vault. No homes or statutory facilities are located within 75 feet of splice vault locations. The calculated fields are summarized in Table 7-3 and Figure 7-13.

Table 7-3: Summary of Calculated Magnetic Fields near Splice Vault

Calculated Magnetic Field (mG)		
Left Edge of ROW	Max in ROW	Right Edge of ROW
2.6	433.0	2.6

Figure 7-13: Calculated Magnetic Fields near Splice Vault



7.4.1.3 Overhead Along Amtrak ROW

Along the Amtrak ROW, the new transmission line would be vertically-configured with 12-foot phase spacing. Because the transmission line must be designed to accommodate future electrification of the railroad, the bottom conductor would be 55 feet above grade, which is higher than would Eversource typically design. This design is shown in Figure 7-14 for reference. The maximum magnetic field is 13.6 mG directly under the conductors. The maximum electric field is 0.44 kV/m. The calculated fields are summarized in Table 7-4 and Figures 7-15 and 7-16.

Table 7-4: Summary of Calculated Fields for OH Transmission Line

Calculated Fields near OH Line			
Field	Left Edge of ROW	Max in ROW	Right Edge of ROW
Magnetic Field (mG)	3.7	13.6	12.8
Electric Field (kV/m)	0.03	0.44	0.38

Figure 7-14: Typical ROW Cross-Section along Amtrak ROW

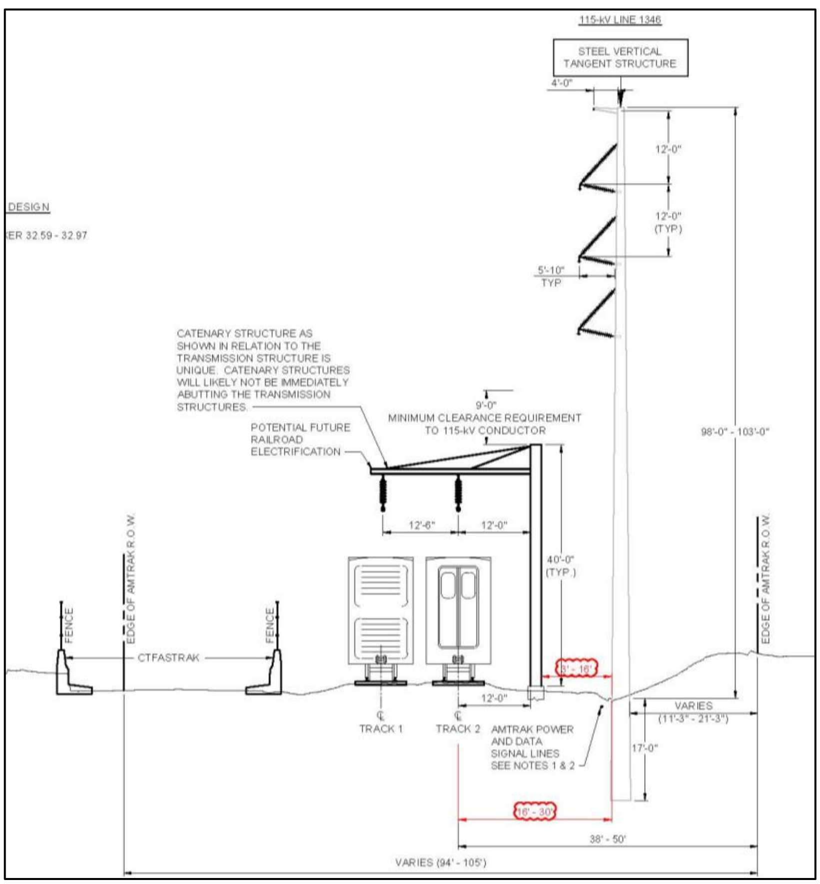


Figure 7-15: Calculated Magnetic Fields along the Amtrak ROW

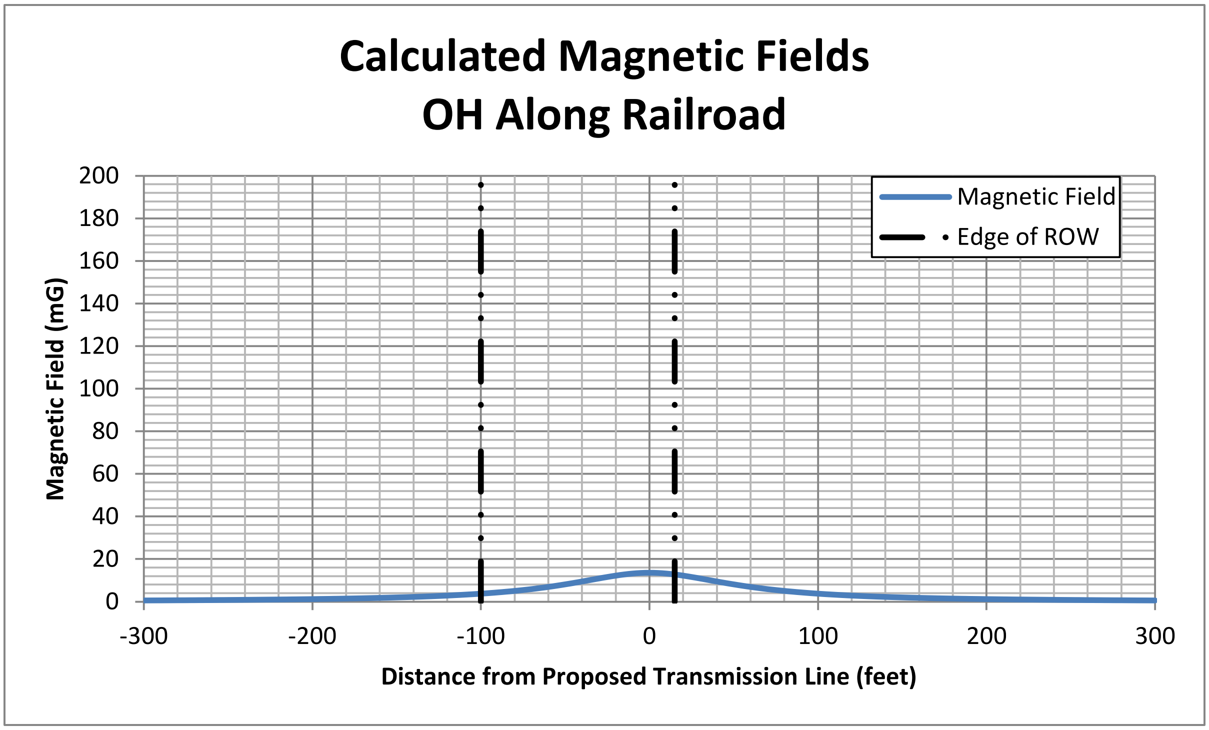
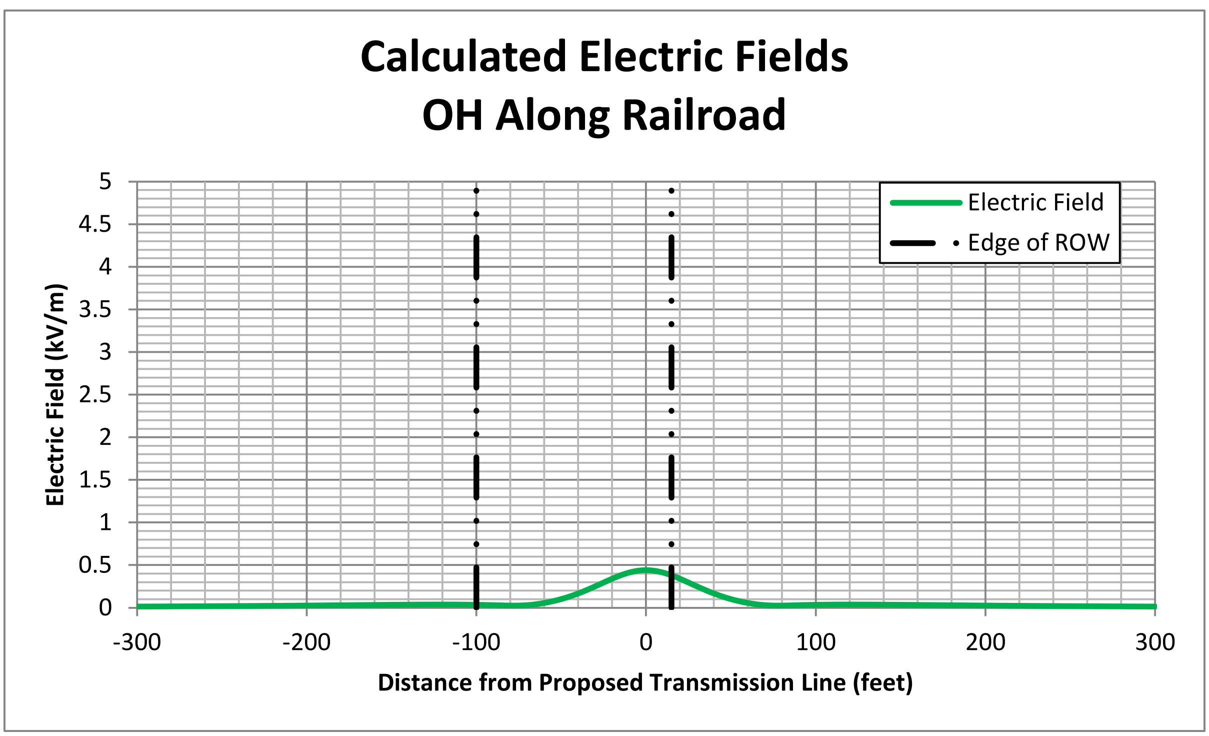


Figure 7-16: Calculated Electric Fields along the Amtrak ROW



7.4.2 Substations

At Newington and Southwest Hartford substations, electric fields would be unchanged as a result of the proposed Project modifications, and magnetic fields would be unchanged except for those associated with the new underground transmission line entries into the switchyards. The reconfiguration of the existing Newington Tap would not cause a measureable change of the electric and magnetic fields beyond the substation property.

7.5 FIELD MANAGEMENT DESIGN PLAN

The council's EMF BMP requires the applicant to "develop a baseline Field Management Design Plan" (FMDP) that incorporates "no-cost" design mitigation measures. Because Eversource's design for the overhead segment of the transmission line accounts for Amtrak's plans for future electrification of its railroad lines, the structures are necessarily taller. As a result, the conductors would be raised higher than would be typical for cross-country transmission line designs. As the Council's EMF BMP recognize, increasing the vertical distance between the conductors and the ground - by increasing the height of support structures - is an engineering control that modifies magnetic field levels.

The EMF BMP also directs the applicant to investigate additional "low-cost" mitigation measures to reduce fields associated with overhead transmission lines "where portions of the project are adjacent to residential areas, public or private schools, licensed child day-care facilities, licensed youth camps or public playgrounds." The overhead segment of the proposed 115-kV line extends through commercial and industrial areas. There are no adjacent residential areas, public or private schools, licensed child day-care facilities, licensed youth camps or public playgrounds. Moreover, the magnetic fields associated with the lines drop off sharply to background levels. Consequently, no further mitigation measures are recommended for the overhead segment of the transmission line.

With respect to underground lines, the EMF BMP recommend further EMF mitigation beyond that provided by the base design only in "special circumstances." Eversource considers that no such special circumstances are present in this case, because the underground segments would not provide sources of persistent exposure of fields above background to people or inhabited structures. In addition, typical low-cost magnetic field mitigation measures for underground transmission lines are not be appropriate for these circumstances. The use of cancellation loops, for example, may have the effect of reducing MF above the splice vaults, but fields would be higher at nearby residences. The implementation of metallic plates for cancel or shield the fields would not be possible at splice vaults because of the need for a man-hole access point negating the effectiveness of the plates.

7.6 UPDATE ON EMF HEALTH RESEARCH

In its EMF BMP, the Council recognized the consistent conclusions of “a wide range of public health consensus groups,” as well as their own commissioned weight-of-evidence review. The Council summarized the current scientific consensus by noting the conclusions of these public health groups, including a review by the World Health Organization (WHO) in 2007 and previously published reviews by the National Institute for Environmental and Health Sciences (1999), the International Agency for Research on Cancer (2002), the Australian Radiation Protection and Nuclear Safety Agency (2014), the National Radiological Protection Board of Great Britain (2004), and the Health Council of the Netherlands (2005). The Council summarized the current scientific consensus as follows: there is limited evidence from epidemiology studies of a statistical association between estimated, average exposures greater than 3-4 mG and childhood leukemia; the cumulative research, however, does not indicate that magnetic fields are a cause of childhood leukemia, as animal and other experimental studies do not suggest that magnetic fields are carcinogenic. The Council also noted the WHO’s conclusion with respect to other diseases: “the scientific evidence supporting an association between ELF [extremely low frequency] magnetic field exposure and all of these health effects is much weaker than for childhood leukemia”. (EMF BMP, pp. 2-4)

Based on this scientific consensus, the Council concluded that precautionary measures for the siting of new transmission lines include “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.” The BMP also stated that the Council will “consider and review evidence of any new developments in scientific research addressing MF and public health effects or changes in scientific consensus group positions regarding MF.” (EMF BMP, pp. 4-5)

Accordingly, in its March 16, 2010 decision approving the Greater Springfield Reliability Project, the Council evaluated extensive evidence concerning recent developments in EMF health effects research, including commentary from the CT DEEP's Radiation Division, and concluded that: "There is no new evidence that might alter the scientific consensus articulated in the Council's 2007 EMF BMP document." (Docket 370, Opinion at 12; and see Findings of Fact par. 284-286)

To assist the Council in evaluating the most up-to-date research, the Exponent report, which is provided in Volume 2, includes a review of recently published scientific research and reviews. Significantly, Exponent's report summarizes:

> *In conclusion, no recent studies provide evidence to alter the conclusion that the scientific evidence does not confirm that ELF EMF exposure is the cause of cancer or any other disease process at the levels we encounter in our everyday environment.* (Volume 2, Exhibit 2.C.2, p. 58)

7.7 STATEMENT OF COMPLIANCE WITH THE EMF-BMP

Eversource has complied with the Council's EMF BMP. It has done so by providing EMF measurements and calculations, an update of EMF Research, and a Field Management Design Plan for the proposed transmission line in accordance with the Council's Application Guide and EMF BMP.

7.8 COMPARISON OF CALCULATED ELECTRIC AND MAGNETIC FIELDS TO INTERNATIONAL GUIDELINES

Although there are no binding regulations limiting EMF exposures, there are guidelines that have been developed by the international scientific community, in particular the ICES, a committee of the Institute of Electrical and Electronics Engineers, and the ICNIRP, a specially chartered independent scientific organization. The calculations presented in Section 7.4 demonstrate that, under all projected operating conditions after the proposed line is placed in service, the calculated electric and magnetic fields would be a small fraction of the ICNIRP and ICES guidelines, which are summarized Table 7-5.

Table 7-5: International Restrictions for Electric and Magnetic Fields

	EF (kV/m)	MF (mG)
ICES	10	9,040
ICNIRP	4.2	2,000

7.9 CONCLUSION

There would be no above ground electric fields associated with the installation of the underground portions of the transmission line. Electric fields from the overhead portion of the transmission line would reach background levels at the edge of the railroad ROW. Magnetic fields associated with the new transmission line would drop quickly to background levels as the distance from the centerline of the conductor and cables increases.

The proposed Project changes to the existing Newington and Southwest Hartford substations and to the Newington Tap would not cause changes in magnetic fields beyond the Eversource 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 schedule for developing the GHCCRP. As the schedule indicates, Eversource is filing this Application with the CSC, after completing municipal consultations and issuing the MCF per the CSC requirements. The Table 8-1 timeline focuses on future Project activities and thus does not list the planning activities and field studies that Eversource performed for the Project prior to the submittal of the MCF in December 2015.

Table 8-1: GHCCRP – Estimated Timeline

Key Activities	Q4 2015-2016		2017				2018				2019			
	2015	2016	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
MCF issued to Municipalities and Open Houses														
Coordination with Amtrak														
Siting Application Filed with the CSC														
CSC Hearing(s) and Decision*														
Development & Management Plan (CSC)														
State and Federal Permitting														
Construction														
Target In-Service														

* Application filing June 2017

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9. PERMITS, APPROVALS, AND CONSULTATIONS

As part of the Project planning process, Eversource consulted with representatives of Amtrak, ConnDOT, CT DEEP, and SHPO as well as with representatives of the three municipalities (Newington, West Hartford, and Hartford) 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 would 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.

The construction of the Project as currently proposed would result in only temporary impacts to water resources along portions of the 115-kV underground segment from Newington Substation to the Amtrak ROW, as well as to wetlands in the vicinity of the Newington Tap. The Project would not result in any adverse effects to federal- or state-listed threatened or endangered species. Similarly, based on the completion of cultural resource surveys and consultations with the SHPO, the Project would not affect any known significant archaeological sites and the configuration of the new 115-kV line underground, within existing ROWs, would avoid indirect visual effects on the NRHP-listed Newington Junction North Historic District.

As a result, Eversource anticipates that a Pre-Construction Notification application would be submitted to the New England District of the USACE, under the Department of the Army General Permits for the State of Connecticut (pursuant to Section 404 of the CWA). In addition, a CWA Section 401 Water Quality Certification would be required from CT DEEP.

At the state level, along with compliance with the Council's requirements, Eversource would obtain approval of the Method and Manner of Construction from the Connecticut PURA, and would conform to the requirements of CT DEEP's General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities.

Permits or licenses also would be required from ConnDOT for work in State Route 173 and for the overhead line crossings of the CT*fastrak,* and from Amtrak for the collocation of the proposed 115-kV overhead segment within the railroad ROW. 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.

9.2 FEDERAL AND STATE AGENCY CONSULTATIONS

In conjunction with the overall Project planning, Eversource initiated consultations with the federal and state agencies likely to be involved in the review or approval of the new 115-kV transmission line and related substation and Newington Tap modifications. These consultations served both to provide the agencies with information regarding the proposed Project, and to solicit input from these groups concerning potential Project-related issues. Eversource expects to continue to consult with the involved agencies as the Project moves forward through the planning, siting, and construction phases.

9.3 MUNICIPAL, PUBLIC, AND OTHER CONSULTATIONS

In March of 2015, Eversource initiated consultations with municipal officials in Hartford, West Hartford, and Newington to inform them of the proposed Project within their municipality and to solicit input from them concerning the scope of the work, especially the routing of the new transmission line. In addition, state legislators representing the affected municipalities were briefed prior to Eversource's publication of the MCF for the proposed Project.

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 (anticipated Pre-Construction Notification)	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 prior to USACE Section 404 authorization
	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 § 16-243	Method & Manner of Construction Approval to Energize Lines
State Historic Preservation Office (SHPO) [90]	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. Eversource anticipates a SHPO determination that the Project would have no adverse effect on significant cultural resources
Connecticut Natural Diversity Data Base (NDDB)	Clearance - Endangered Species Act (CGS § 26-303 to § 26-315)	Impacts on threatened or endangered species; based on current data, no state-listed species are located along the Project route. NDDB coordination is anticipated for CT DEEP compliance, as the Project is located within 0.25 mile of an NDDB area
Connecticut Department of Transportation (ConnDOT)	Encroachment permits	Transmission line alignment across and within State Route 173 and the CT*fastrak*

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

Property owners and abutters located along the Proposed Route, route variations, and substations were notified of the proposed Project and invited to the Open House held on January 20, 2016. At that time, the planned route for the proposed Project was an all-underground route through public streets. At that time West Hartford and Newington officials expressed concerns about the Project, noting the related impacts to traffic, businesses, and residents, as well as excavation in recently paved streets. West Hartford and Newington municipal officials suggested route variations to mitigate some of these impacts, which Eversource was prepared to implement.

However, following the initial municipal consultations in early 2016 and further discussions with Amtrak, Eversource reconfigured its proposed Project design to include the hybrid overhead/underground transmission line as proposed in this Application. The new modified design would allow Eversource to reduce the length of the cables to be installed in public roads to approximately 0.4 mile in Newington and 0.2 mile in Hartford. The proposed line would be entirely overhead in West Hartford.

In March 2017, with Eversource's negotiations with Amtrak advancing toward a successful conclusion, Eversource briefed the municipalities and solicited additional input from them regarding the change in the proposed Project's design and routing. Representatives from both Newington and West Hartford indicated support for the new Proposed Route and found it preferable to the original all-underground route described in the December 2015 MCF. Hartford has not provided any feedback to Eversource regarding the proposed Project.

Representatives from Newington also inquired about the feasibility of using Spring Street, rather than Shepard Drive, for a portion of the underground route. An analysis of variations using Spring Street (which extends from Willard Avenue east to the Amtrak ROW) is included in Section 11.5.2 of the Application. While the new 115-kV line could be installed along Spring Street, this route variation presents constructability challenges and results in potential impacts to residents that make it less preferred than the Proposed Route. Eversource will continue discussions with Newington regarding this alternative to mitigate concerns with traffic impacts to Willard Avenue and Shepard Drive.

Given the changes to the Project's design, a second Open House was held in Newington on April 27, 2017 to provide the public with an opportunity to review and comment on the new Proposed Route. As with the first Open House, property owners, and abutters along the

Proposed Route, all route variations, and both substations were invited to the Open House. Upon request, Project representatives spent additional time with property owners discussing the scope of work and answering questions. Additionally, several meetings were held with certain property owners regarding the potential need to acquire access, temporary work space, or permanent easement.

Approximately 30 members of the public and four municipal officials from the Town of Newington attended the Open House on April 27, 2017. Attendees expressed interest in traffic impacts, EMF, the overall construction process and easement requirements and were invited to submit comments to Eversource. To date, Eversource has not received any written comments on the proposed Project.

Eversource intends to continue this proactive outreach as the Project moves forward. In accordance with the Council's requirements, within 15 days of filing the Application for the Project, Eversource will provide to the Council any comments or recommendations issued by the municipalities as well as copies of comments received from the public.

A summary of the primary meetings Eversource has had to date with municipal officials is provided in Table 9-2.

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, Town Engineer Tom Malloy, Highway Department Superintendent Craig Minor, Town Planner Andy Brecher, Director of Economic Development	March 5, 2015	Project Introduction
		April 7, 2015	Routing Discussion
		October 2, 2015	Follow-up briefing on Proposed Route
	Tanya Lane, Acting Town Manager	January 20, 2016	Project Overview
	Tanya Lane, Town Manager Andy Brecher, Director of Economic Development	March 22, 2017	Project Overview
West Hartford	Ronald Van Winkle, Town Manager Duane Martin, Town Engineer Mark McGovern, Director of Community Services Peter Privitema, Director of Finance John Phillips, Director of 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
	Ron Van Winkle, Town Manager Mark McGovern, Director of Community Services Helen Rubino, Director of Human and Leisure Services Greg Sommer, Civil Engineer John Phillips, Director of Public Works	December 9, 2015	Outreach Discussion
	Town Council Community Relations Sub-Committee meeting	December 15, 2015	Project Introduction and Outreach Discussion
	Ron Van Winkle, Town Manager Mark McGovern, Director of Community Services Greg Sommer, Civil Engineer	March 15, 2017	Project Overview
Hartford	Mayor Pedro Segarra	The City declined the offer of a briefing	Project Introduction
	Mayor Luke Bronin Marilyn Cruz-Aponte, Director of Public Works	January 29, 2016	Project Overview
	Mayor Luke Bronin Reginald Freeman, Acting Director of Public Works	March 22, 2017	Project Overview

10. SYSTEM ALTERNATIVES

This section complies with the provision in the Council's Application Guide (February 2016) that requires an applicant to identify "system alternatives and the advantages and disadvantages of each." System alternatives including a "no action" alternative are discussed below.

10.1 NO ACTION ALTERNATIVE

Under a 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 – North Bloomfield – Southington load pocket and the North Bloomfield – South Meadow – Manchester load pocket). This alternative was rejected because it would do nothing to correct the identified 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 NERC 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 solution for presentation to, and subsequent review and approval by, the ISO-NE PAC.

10.2.1 Transmission Alternatives Considered: Overview

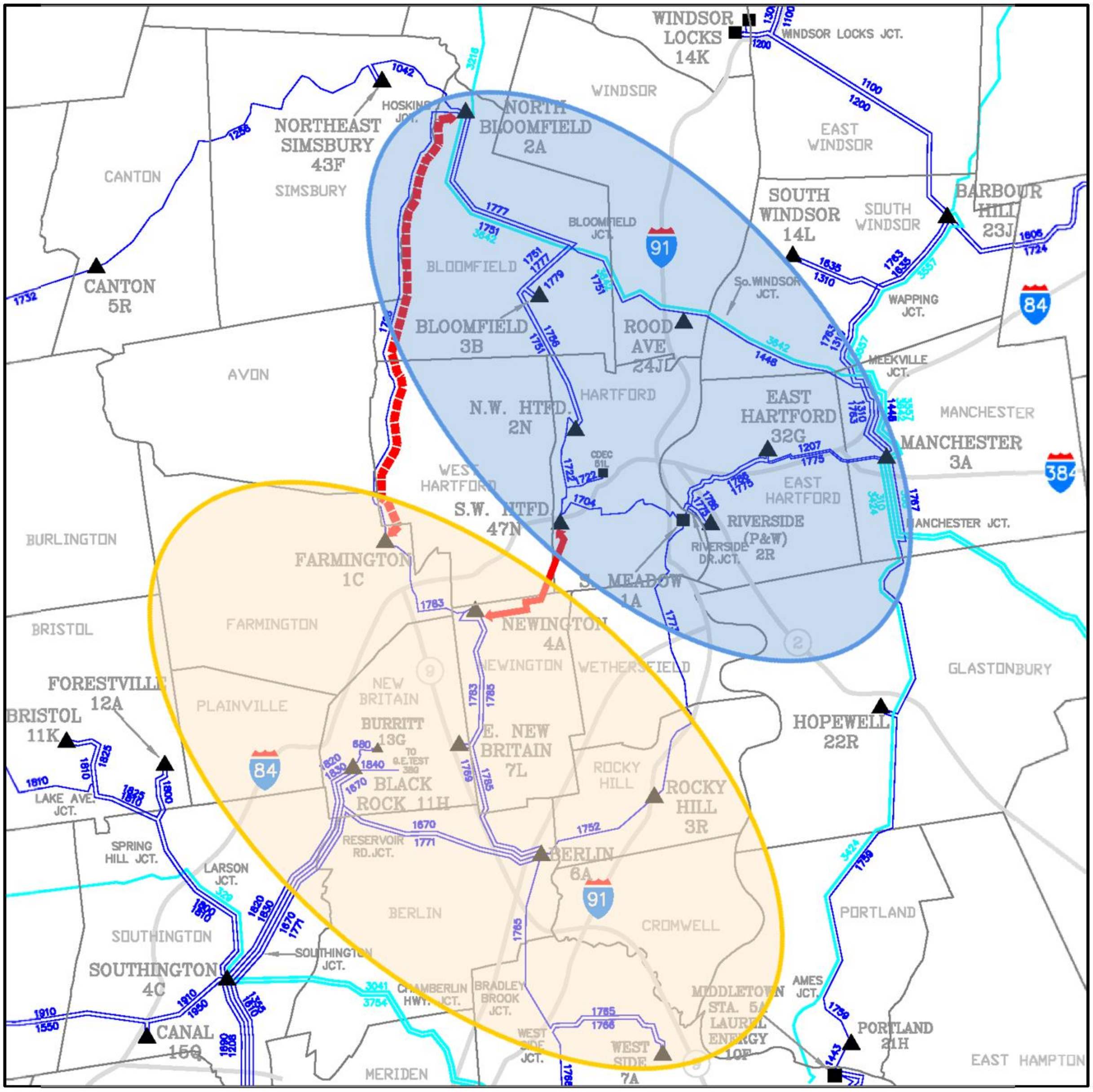
As described in Section 2.3.1, the conceptual solution to resolve the criteria violations in the targeted South Meadow – Berlin – North Bloomfield – Southington and North Bloomfield – South Meadow – Manchester load pockets was to connect them with a new transmission line so that the transmission system in each load pocket would be able to serve the other when needed. In addition, a new 115-kV transmission line connecting the two load pockets would and provide additional transfer capability across the WCT Import Interface.

The Working Group identified two sets of logical terminal points for such a new line. One set was Newington and Southwest Hartford substations, which are not currently interconnected and were ultimately selected as the terminal points of the preferred solution. The other set of terminal points considered was Farmington Substation (located in the Town of Farmington) and North Bloomfield Substation (located in the Town of Bloomfield). These two substations are presently connected by an existing 11.7-mile Eversource 115-kV overhead transmission line. A second 115-kV line could be built within the same ROW in an overhead configuration adjacent to this existing 115-kV line. Figure 10-1 illustrates the general location of these two alternatives within 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 between those points was believed to be impractical at the time the Working Group developed a preferred solution.[91] Accordingly, the two alternatives that were analyzed in detail by the Working Group were the then-preferred all-underground cable route between Newington and Southwest Hartford substations and the overhead alternative between Farmington and North Bloomfield substations.

[91] After the ISO-NE analysis had been completed, Eversource determined that it would be possible, by employing non-standard construction methods and line design and by obtaining the cooperation of Amtrak, to align a 115-kV circuit between the Newington and Southwest Hartford substations overhead for a majority of its length, by collocating it with the Amtrak transportation corridor. The southern and northern portions of the circuit (i.e., near Newington and Southwest Hartford substations) would be configured underground. This hybrid configuration is proposed as Eversource's preferred solution in this Application. Although the initial all-underground solution could be considered to be a transmission alternative, since it uses a different technology than the proposed hybrid overhead/underground 115-kV circuit, it is also a route alternative between identical terminal points. Therefore, it is discussed as such in Section 11.6 of this Application.

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



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.

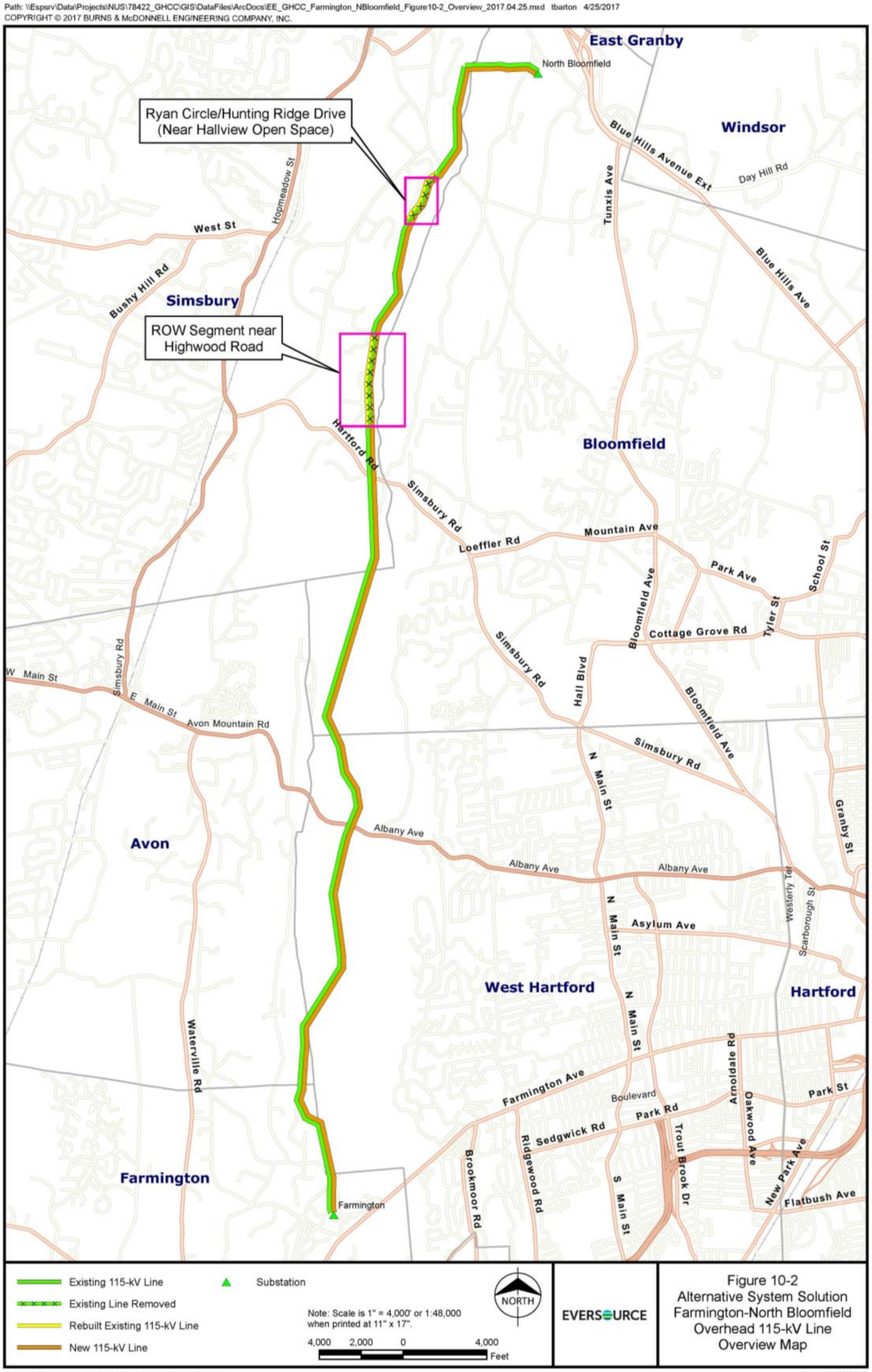
Specifically, the existing transmission line ROW between Farmington and North Bloomfield substations extends through these five towns:

- 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 reconstructed in 1989 pursuant to a Certificate issued by the Council in its Docket No. 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 115-kV 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 miles 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 1726 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 H-Frame structures which are wider, 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 (which is part of the New England National Scenic Trail), Simsbury open space lands, and nearby residential areas.

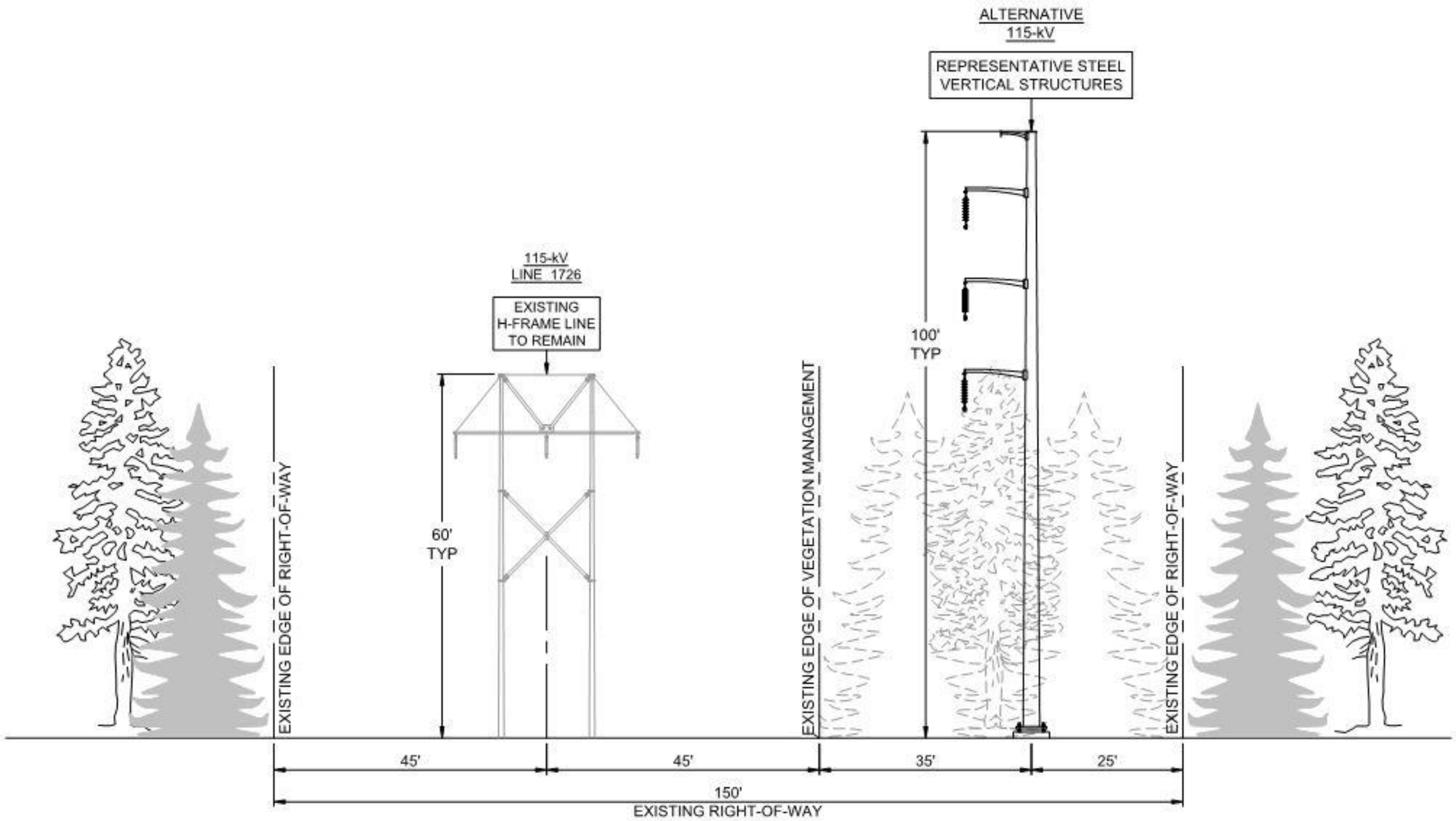
Figure 10-3 provides a cross-section illustration of the typical configuration of the existing and new structures along the majority of the Farmington-North Bloomfield ROW.

Along the Highwood Road and Hallview ROW segments in Simsbury, 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), the line configuration would differ from the typical. Along these ROW segments, the line design would preserve, to the extent possible, the existing forest buffers to the west of the 1726 Line.

Accordingly, 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

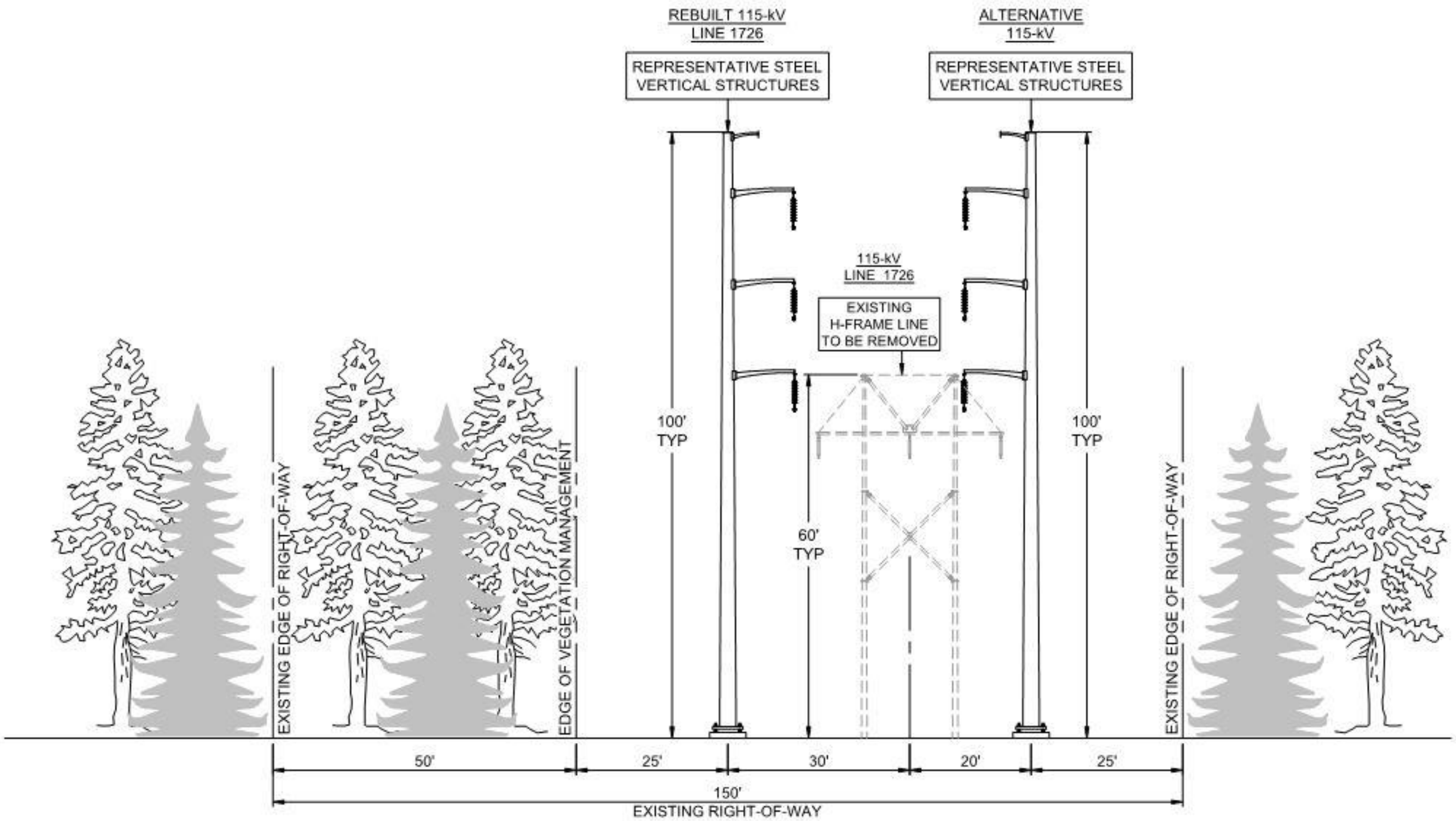


ALTERNATIVE CONFIGURATION
VERTICAL DESIGN

FARMINGTON S/S
TO
NORTH BLOOMFIELD S/S

LOOKING NORTH
TOWARDS N. BLOOMFIELD S/S

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 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 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 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).

10.2.3 Comparison of the Transmission Alternatives

The comparison of transmission alternatives occurred in two stages. First, as part of the ISO-NE Solutions Study, the estimated cost of the approximately 4-mile all-underground Newington – Southwest Hartford 115-kV cable was compared to the 11.7-mile all-overhead Farmington-North Bloomfield line (not including the cost of components that would be common to both solutions.) As a result of this comparative evaluation, the all-underground cable between Newington and Southwest Hartford substations was selected as the preferred solution. This initial comparison was a close one, because the reliability improvements provided by each of the two alternatives and their estimated costs were nearly equal. However, the all-underground route offered the advantage of providing a transmission connection between two substations that are not presently connected, thereby adding a new geographically-distinct path to the transmission grid.

Subsequently, after it became apparent that placement of an overhead segment of the Newington – Southwest Hartford line within the Amtrak transportation corridor might be achieved, the proposed hybrid overhead/underground Newington – Southwest Hartford line was again compared to the Farmington – North Bloomfield alternative. This second comparison was not a close one, because with the incorporation of an overhead configuration for approximately 65% (2.4 miles) of the 3.7-mile hybrid route, the estimated cost of the Project (not including the cost of reconductoring the Newington Tap, which was common to both solutions) declined significantly, from $91 million to $59.9 million. Moreover, as explained further in the following subsections, the hybrid overhead/underground route would be located along ROWs in urban/suburban areas, thereby avoiding or minimizing most impacts to environmental resources.

10.2.3.1 The Initial Comparison of Transmission Alternatives

The initial comparison of transmission alternatives for this Project (that is, the comparison of the Farmington – North Bloomfield overhead line to the Newington – Southwest Hartford underground line) is summarized in ISO-NE Solutions Report (refer in particular to pages 64-70, 81, and 85). As detailed in the ISO-NE report, the reliability performance of these two alternatives was found to be equivalent in that they both eliminated all of the targeted criteria violations.

However, the Newington – Southwest Hartford circuit demonstrated an operability advantage, because it required less re-dispatch of generating resources after a first contingency in order to position the system to withstand a second design contingency. It was also determined to have a constructability advantage, in that it would not require any line outages, whereas the existing heavily used 115-kV line on the Farmington – North Bloomfield ROW would need to be taken out of service to enable the construction of a segment of the new line.

The estimated costs of the two transmission alternatives considered in the ISO-NE Solutions Report were also determined to be nearly equivalent ($99.8 million for the Newington – Southwest Hartford underground alternative and $95.9 million for the Farmington – North Bloomfield overhead alternative). The estimated costs of the "unique elements" of the two transmission alternatives considered in the ISO-NE Solutions Report (that is, the cost of each solution not counting that of the elements that were common to both) was $91.0 million for the underground alternative and $87.1 million for the overhead alternative (Solution Report, p. 81, Table 7-10). Accordingly, the comparative environmental and social impacts of the two alternatives became the decisive considerations. The Solutions Report sums up the conclusion of the Working Group's analysis of these considerations as "Expected Ease of Permitting (e.g., environmental, siting, etc.)" (*Id.* p 85). However, the Working Group's analysis of these factors was extensive. As this analysis applied to the impacts of the Farmington-North Bloomfield alternative, it was the same as that set forth in Section 10.2.3.2, below. In comparison, the construction of an underground cable entirely beneath streets was determined to have fewer temporary and permanent environmental and social impacts.

10.2.3.2 Comparison of the Proposed Newington – Southwest Hartford Hybrid 115-kV Circuit to the Farmington – North Bloomfield Overhead Alternative

The hybrid 115-kV circuit between Newington and Southwest Hartford substations would include a total of approximately 1.3 miles of underground XLPE cable, consisting of two separate segments on either end of the route and extending into the substations, connected by an approximately 2.4-mile segment of overhead transmission line that would be aligned on vertical steel monopoles along the Amtrak ROW.[92] The underground segments of the route would be aligned within Eversource property and its existing distribution line ROW extending east from Newington Substation to State Route 173 (in Newington), as well as along various public road ROWs and paved parking areas (in Newington and Hartford).

New easements would have to be acquired on a few parcels in certain locations (e.g., where the 115-kV line transitions from underground to overhead and vice versa, as well as along a small segment adjacent to the Amtrak ROW in West Hartford). Overall, the hybrid route would maximize the use of existing ROWs in the urban Greater Hartford area and – at approximately 3.7 miles – would minimize the length of the new transmission line.

10.2.3.2.1 Estimated Cost

As stated in Section 3 of this Application, the estimated cost of the proposed GHCCRP, of which the approximately 3.7-mile Newington – Southwest Hartford hybrid 115-kV line is the principal element, is $61.1 million. This amount includes the $1.2 million cost of reconstructing the Newington Tap, which is common to both solutions. Thus, the $59.9 million cost of the "unique elements" of the hybrid Newington – Southwest Hartford circuit is a significant $27.2 million less than the $87.1 million estimated cost of the "unique elements" of the Farmington – North Bloomfield transmission alternative estimated in the Solution Report (Table 7-9, p. 81).

This cost differential is the decisive factor in favoring the selection of a hybrid Newington–Southwest Hartford circuit. Moreover, the hybrid circuit would be aligned principally along a

[92] As described in Section 3 of this Volume and illustrated on the Volume 3 maps, all but one of the proposed 115-kV structures would be located within the Amtrak ROW. Eversource would acquire an easement for the installation of the new structure (Structure 46) adjacent to the railroad corridor. This easement would be located adjacent to the Amtrak ROW in the Town of West Hartford, south of Flatbush Avenue.

combination of existing linear corridors (Eversource ROW, road ROWs, Amtrak ROW) through urban/suburban areas, such that the construction and operation of the new 115-kV line would have predominantly minor or short-term environmental and social impacts.

10.2.3.2.2 System Reliability

The reliability contribution of a hybrid Newington – Southwest Hartford circuit is the same as that of the previously considered all-underground circuit. Accordingly, the reliability comparison of the two transmission alternatives remains the same. While their system performance is essentially equivalent, the Newington – Southwest Hartford circuit offers an operability advantage over a second Farmington – North Bloomfield line in that it requires less re-dispatch after a first contingency.

It also has the constructability advantage of not requiring outages of existing transmission lines during construction. Finally, it offers the advantage of providing a transmission connection between two substations that are not presently connected, thereby adding a new geographically-distinct path to the transmission grid.

10.2.3.2.3 Environmental and Social Effects

A hybrid transmission line involving the use of different linear corridors and circuit configurations would have slightly greater environmental and social effects than an underground cable system constructed predominantly in streets. However, compared to the 11.7-mile Farmington – North Bloomfield alternative, the 3.7-mile hybrid alternative would result in significantly fewer impacts to environmental resources (e.g., vegetation, water resources, wetlands, wildlife) and would similarly avoid or minimize social effects.

The Farmington – North Bloomfield alternative would be located within an area characterized by low-density residential uses, as well as designated open space. The development of the new 115-kV line along the Farmington – North Bloomfield 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), vegetation (conversion of forest land to low-growth vegetation) and to wildlife 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. Moreover, the overhead 115-kV line, particularly if visible from the Metacomet Trail and nearby public open space areas, could have a long-term effect on the local aesthetic environment.

In comparison, the hybrid route would require forested vegetation clearing only for the installation of the underground cable segment along Eversource's 0.8-mile ROW. The hybrid route would not cross or be located near any public recreational areas, open space, or trails, and would avoid impacts to an existing NRHP district. The hybrid route would be aligned for approximately 1.3 miles underground, within existing ROWs, through the predominantly residential areas along the southern portion of the route in Newington, as well as through the commercial area traversed by the route near the I-84 corridor in Hartford.

Although three wetlands, all located within Eversource's existing ROW, would be temporarily affected by the installation of the new line, no long-term impacts to wetlands or other water resources would occur. Temporary wetland impacts as a result of the construction of the underground cable segment would amount to approximately 1.6 acres. An estimated 0.24 acre of forested wetlands would be permanently converted to shrub-scrub wetlands.[93] Based on the results of cultural resource analyses, the underground configuration of the proposed 115-kV line would not have any long-term adverse visual effects on historic resources and would not affect any significant archaeological sites.

The hybrid route's approximately 2.4-mile overhead segment would be situated along the Amtrak ROW, which is occupied by two railroad tracks as well as the CT*fastrak* busway. This ROW, which has been dedicated to transportation uses for decades, is bordered predominantly by a combination of industrial and commercial developments that back up to the corridor.

The installation of the new overhead 115-kV line along the Amtrak corridor would be consistent with federal policies for collocating linear facilities to the extent practical. Because of the surrounding industrial and commercial uses, the new transmission line structures would not significantly affect the visual environment. Cultural resource studies

[93] Wetland impacts are along the Proposed Route of the 115-kV line and exclude minor temporary wetland impacts associated with the Newington Tap modifications. Along the Proposed Route, a fourth small wetland may be affected temporarily by the installation of the underground cable beneath a tributary to Piper Brook.

determined that the overhead structures would have no adverse effect on nearby NRHP districts in Newington and Hartford.

10.2.4 Conclusion

Table 10-1 summarizes the key factors used in the final transmission system alternative comparison. Overall, compared to the overhead alternative between Farmington and North Bloomfield substations, the proposed 115-kV hybrid underground/overhead line between Newington and Southwest Hartford substations would provide the same system benefits, but at a far lower cost, would be shorter, and would result in fewer impacts to vegetation, wildlife, water resources, and scenic resources.

Accordingly, Eversource selected the hybrid configuration as the preferred transmission system solution.

Table 10-1: Summary of Key Factors Considered in Selecting Preferred Transmission Solution

Factors Considered in Selecting the Preferred Solution		Hybrid Overhead/Underground 115-kV Circuit System Alternative (Newington – Southwest Hartford)	Overhead 115-kV Line Alternative (Farmington – North Bloomfield)
Estimated Cost	Conceptual Level	$61.1 million *	$95.9 million *
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	Results in a new transmission connection between substations not presently linked	✓	×
Operational Performance	Meets system reliability requirements	✓+	✓+
Construction Requirements	Reduces construction-related outage requirements	✓	×
	Minimizes need for new access roads	✓	×
Siting and Permitting	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	✓	×
	Avoids potential impacts to cultural resources	✓	×
Preferred Solution		✓	

* Cost estimates are based on 2017 dollars and reflect both transmission line and substation improvements.

10.3 NON-TRANSMISSION ALTERNATIVES

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 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, 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.[94] Later on, ISO-NE advised that the later of the two studies – the supply-side study – provided the best information for designing potential NTAs, and that the injection amounts determined at each location could be modeled as either additional generation or load reduction, or a combination of both.

Although the ISO-NE MRA analyses identified quantities of injections of power or equivalent load reductions that would be required at particular electrical locations in order to obviate the need for regulated transmission improvements, they 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

[94] ISO-NE, *Market Resource Alternative Analysis – Demand-side Results*, Planning Advisory Committee Meeting, Nov. 14, 2012; ISO-NE, Market Resource Alternative Analysis – Final Supply-side Results, Planning Advisory Committee Meeting, December 13, 2012.

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 Application. 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 the 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,[95] a copy of which is included in Volume 2.

The ISO-NE MRA studies considered four separate electrical sub-areas – Greater Hartford; Manchester/Barbour Hill; Middletown; and NWCT. While the MRA reports initially cautioned that each sub-area's MRAs "work only if applied simultaneously with other sub-areas," ISO-NE later determined that the solutions for each sub-area could be analyzed independently of one another.[96] Thus, the MRA reports provided a basis for developing and analyzing NTA's for each sub-area studied. However, in order to fairly compare the estimated cost of an NTA to that of a transmission solution, all of the components of the transmission solution for which the NTA would substitute should be accounted for, and not just the cost of those components for which a siting application is required.

[95] 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.

[96] Solutions Report, at 41.

The preferred transmission solutions for the Greater Hartford area identified in the Solutions Report included the GHCCRP improvements that are proposed in this Application, but also contained additional improvements that are being implemented separately. The cost of the full Greater Hartford transmission solution set of improvements was estimated in the Solutions Report to amount to $178.9 million, of which the Newington – Southwest Hartford cable and associated GHCCRP improvements that were then planned accounted for only $95.9 million.[97] Accordingly, for the purposes of analyzing an NTA for the Greater Hartford Sub-area that would substitute for GHCCRP, LEI compared the cost to Connecticut ratepayers of the hypothetical NTA it developed to the revenue requirement that would be required to support the full $178.9 million estimated cost of the entire Greater Hartford transmission solution set.

As detailed in the LEI Report, the ISO-NE analyses indicated that an NTA that would resolve the criteria violations in the Greater Hartford Sub-area, including the two load pockets to be addressed by the GHCCRP, would require injections in each of the two "bubbles", or load pockets, that would be joined by the proposed new GHCCRP circuit. In particular, an injection of 196 MW would be required at the Northwest Hartford Substation, which is inside the North Bloomfield – South Meadow – Manchester load pocket, and a 24 MW injection would be required at the Southington Substation, which could serve the South Meadow – Berlin – North Bloomfield – Southington load pocket. Based on this ISO-NE determination, LEI considered the extent to which these injection requirements could be reduced by energy efficiency measures, and what actual supply-side resources would be capable of providing the injections required to satisfy the balance of the need. For this purpose, LEI selected hypothetical, technically feasible NTA technologies for cost analysis. LEI considered technically "feasible" technologies to be those that would meet the identified reliability need and could be, in theory, implemented based on planning criteria and technology-specific operating profiles. LEI then developed a hypothetical hybrid NTA consisting of a combination of demand response and new generation.

[97] Solution Report, Tables 7-7, 7-8, 7-9, 8-4. A composite of these tables, listing each component of the Greater Hartford transmission solution set and identifying the components of the GHCCRP is attached as Table 10A-1, which is provided in Appendix 10A to this section.

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 areas served by the Northwest Hartford and Southington substations, in addition to what was then 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 each substation, the maximum likely achievable incremental demand response was determined to be 23 MW at Northwest Hartford and 3 MW at Southington. 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 at Northwest Hartford and 21 MW needed at Southington.

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 and a 24 MW peaking plant of aeroderivative[98] technology at Southington. LEI then computed the net direct cost to Connecticut ratepayers of this hypothetical NTA portfolio. To do so, LEI first estimated the annualized cost of implementing 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 the NTA solution. This net cost of the NTA was estimated to range from $26 million to $39 million a year, depending on the revenues that the generation components of the NTA would be able to earn. 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 from the Northwest Hartford Substation and one mile from the Southington Substation, so that the developer of the generators would have to fund the construction of 4-mile and 1-mile pipeline laterals, 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

[98] Aeroderivative gas turbines use a technology that is a derivative of aircraft engines, and are designed to provide shaft power via combustion process (air and gas). Aeroderivative peaking plants are ideal for fast-start system requirements and do not require any coolant such as water

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.

In addition, before the hypothetical NTA evaluated by LEI could actually be implemented, it would have to be extensively tested in the same manner as the transmission solution was tested in the ISO-NE solution study. The results of such an 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 show that two separate units would be required for reliability purposes, instead of the single unit assumed by LEI. Eversource engineers also consider it likely that such load flow studies would indicate that significant elements of the Greater Hartford transmission solution set (in particular, improvements to the Southington Substation estimated to cost $38.3 million) would still be needed even if the NTA were implemented.

Once the full scope of the required NTA had been definitively determined, 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 time-consuming and expensive work necessary to fully develop the hypothetical NTA conceived by LEI on the basis of the ISO-NE MRA reports was not done because the cost difference between the hypothetical NTA and the sub-area transmission solution was decisive, illustrating that NTAs to the GHCCRP are economically impractical. This impracticality is demonstrated by the fact that no one has proposed to implement an NTA for the Greater Hartford Sub-area in the five years since ISO-NE identified potential MRAs for the GHCC projects in 2012.

With no private developer proposing to implement the NTA, it could be developed only with public support, meaning that the cost of the NTA would ultimately be borne by ratepayers. Moreover, there is no provision in the current regulatory structure for New England electric consumers to share the cost of NTAs across the region. In contrast, the costs of transmission projects required for regional reliability are shared among consumers in the New England states according to each state's share of the regional load. Accordingly, Connecticut ratepayers contribute, through rates, approximately 25% of the prudently incurred costs of regional transmission projects, whether they are constructed in Connecticut or elsewhere in the region.

Thus, whereas Connecticut consumers would presumably bear 100% of the $26 million - $39 million annual net costs of the hypothetical NTA, they would bear approximately 25% of the annual cost of the Greater Hartford Sub-area transmission solution. For the purpose of comparing the cost of the NTA to a transmission solution, the revenue requirement for the $178.9 million cost of the entire Greater Hartford Sub-area Solution, including both the GHCCRP and the other components of the sub-area solution not before the Council in this proceeding, was used. That cost is $178.9 million. (See Appendix 10A)

At the time that LEI performed its analysis, the proposed transmission solution included the initial all underground GHCCRP project. The average annual revenue requirement for entire Greater Hartford Sub-area solution that included that version of GHCCRP, over its 40-year life, would have been approximately $17 million, so that the share of Connecticut's ratepayers would have been approximately $4.25 million. The net annual cost of the hypothetical NTA to Connecticut ratepayers would therefore have been six to nine times that of the transmission solution, even before the NTA's full scope and cost was determined. 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.

The extensive redesign of GHCCRP since the publication of the Solution Report (February 2015) and the LEI NTA report (August 15, 2015) has widened the cost gap estimated by LEI. The hybrid overhead/underground line design now proposed has reduced the estimated cost of GHCCRP from the $95.9 million estimated in the Solution Report to $61.1 million. This reduction results in a significant reduction of the revenue requirement for the Greater Hartford solution set as a whole, and in a commensurate reduction of Connecticut ratepayers' share of those costs (from $4.6 million annually to $2.9 million annually), such that the cost to Connecticut ratepayers of the hypothetical NTA increases to 9 to 13 times that of the entire Greater Hartford transmission solution.

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APPENDIX 10A

Table 10A-1: ISO-NE Solution Report Greater Hartford Sub-area Solution Components

Component ID	Description	Cost ($M)
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
3	Loop the 1779 line between South Meadow and Bloomfield into the Rood Avenue substation and reconfigure the Rood Avenue substation	10.7
4	Reconfigure the Berlin 115-kV substation including the addition of two 115-kV breakers and the relocation of a capacitor bank	4.2
5	Add a 115-kV 25.2 MVAR capacitor at Westside 115-kV substation	2.9
6	Reconductor the 115-kV line between Newington and Newington Tap (1783) – 0.01 miles	1.0
7	Separation of 115-kV DCT corresponding to the Bloomfield to South Meadow (1779) line and the Bloomfield to North Bloomfield (1777) line and add a breaker at Bloomfield 115-kV substation	7.1
8	Install a 115-kV 3% reactor on the underground cable between South Meadow and Southwest Hartford (1704)	3.6
9	Separation of 115-kV DCT corresponding to the Bloomfield to North Bloomfield (1777) line and the North Bloomfield – Rood Avenue – Northwest Hartford (1751) line and add a breaker at North Bloomfield 115-kV substation	20.1
S1	Replace the existing 3% series reactors on the 115-kV lines between Southington and Todd (1910) and between Southington and Canal (1950) with a 5% series reactor	5.2
S2	Replace the normally open 19T breaker at Southington with a 3% series reactor between Southington Ring 1 and Southington Ring 2 and associated substation upgrades	8.7
S3	Add a breaker in series with breaker 5T at the Southington 345-kV switchyard	1.8
S4	Add a new control house at Southington 115-kV substation	22.6
Total		**178.9**

Source: Solution Report, Tables 7-7, 7-8, 7-9, 8-4

As originally designed, GHCCRP consisted of components 1, 4, 6, and 8 in the above table, and was estimated to cost $99.8 million. Since then, component 4 has been removed to be implemented separately and the redesign of the Newington-Southwest Hartford circuit has dramatically reduced the cost of that component (Item 1 in the table). Accordingly, the estimated cost of the revised GHCCRP is $61.1 million. However, for the purpose of comparing the cost of the NTA to a transmission solution, the revenue requirement for the $178.9 million cost of the entire Greater Hartford Sub-area Solution, including those components not before the Siting Council in this proceeding, was used.

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11. POTENTIAL TRANSMISSION LINE ROUTE AND CONFIGURATION ALTERNATIVES AND VARIATIONS

System alternatives analyses resulted in the identification of the proposed system solution – a new 115-kV transmission circuit connecting Newington and Southwest Hartford substations. Eversource then used an iterative approach to identify and evaluate route alternatives and transmission line design options and, from among these, to select the Proposed Route and 115-kV line design.

The route alternatives analysis involved several steps. Initially, Eversource defined a geographic (Project) study area between the Newington and Southwest Hartford substations within which a new transmission line should optimally be situated, taking into consideration the distance between the two substations, as well as factors such as the locations of major linear corridors, urban/suburban development, and environmental features. Within the study area, Eversource then applied its standard routing objectives and evaluation criteria to identify and assess potential route alternatives for the proposed 115-kV line, based on primary factors such as constructability, cost, and environmental/social impacts (refer to Sections 11.1 and 11.2). That process led to the identification of major existing corridors (e.g., I-84, Amtrak/CT*fastrak*, Eversource ROWs, roads), which then were considered further as potential locations for the 115-kV line (refer to Section 11.3).

Aligning a portion of the proposed 115-kV line along the Amtrak ROW, within which the new CT*fastrak* busway had just recently been developed, initially appeared to be impractical due to the limited width of this transportation corridor and potential constraints to transmission line construction (including the need to maintain service on both the rail lines and busway). As a result, Eversource's initial analyses focused on identifying the best route for an all-underground transmission line through the densely developed urban/suburban area between the Newington and Southwest Hartford substations. The results of that analysis, which led to the selection of an optimized all-underground route, are summarized in Section 11.6. Further, at the time of the Project's MCF (December 2015), Eversource described an all-underground route as potentially preferred, but also noted that detailed discussions with Amtrak and ConnDOT regarding the possible colocation of the 115-kV line within the railroad/busway corridor were underway.

During 2016 and through the first quarter of 2017, Eversource consulted extensively with Amtrak, first providing detailed engineering data concerning potential options for locating the proposed 115-kV transmission line within the railroad ROW and then coordinating directly with Amtrak personnel. Based on the results of those analyses and consultations, Amtrak determined that Eversource could collocate approximately 2.4 miles of the new 115-kV line, in an overhead configuration, along the eastern side of the Amtrak ROW. Consequently, Eversource examined options both for configuring the 115-kV line within the Amtrak ROW (refer to Section 11.4) and for connecting the 115-kV line segment along the Amtrak ROW to both the Newington and Southwest Hartford substations (refer to Section 11.5).

As described in Section 11.5, whereas routing options in the City of Hartford from the Amtrak ROW to Southwest Hartford Substation are limited, Eversource identified and analyzed 10 route/line configuration variations for the 115-kV line segment between Newington Substation and the railroad ROW. Although Eversource determined that the new 115-kV line could technically be developed along any of these route variations, the Proposed Route segment, involving an underground configuration along a combination of Eversource distribution line and road ROWs between Newington Substation and the Amtrak ROW, was selected as preferred based on the combined consideration of social/environmental,[99] constructability, engineering, and cost factors.

Section 11.7 summarizes Eversource's rationale for selecting the Proposed Route and hybrid underground/overhead configuration for the new 115-kV line between the Newington and Southwest Hartford substations.

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 the Newington and Southwest Hartford substations. On a direct line, these two substations,

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[99] Includes potential Project effects on land uses, cultural resources, and visual resources; as well as construction-related noise, dust, and impacts on transportation.

which are not presently connected by any transmission lines, are separated by approximately three miles.

Eversource defined the geographic study area by considering the shortest 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, Amtrak/CT*fastrak* corridor, tributary to the South Branch of the Park River, South Branch of the Park River). Further, because the two substations are situated in a densely developed urban/suburban area, a key factor in the definition of the geographic study area was the presence of various existing ROWs (i.e., local and state roads, Amtrak/CT*fastrak* corridor, Eversource ROWs) along which the 115-kV transmission line could potentially be collocated.

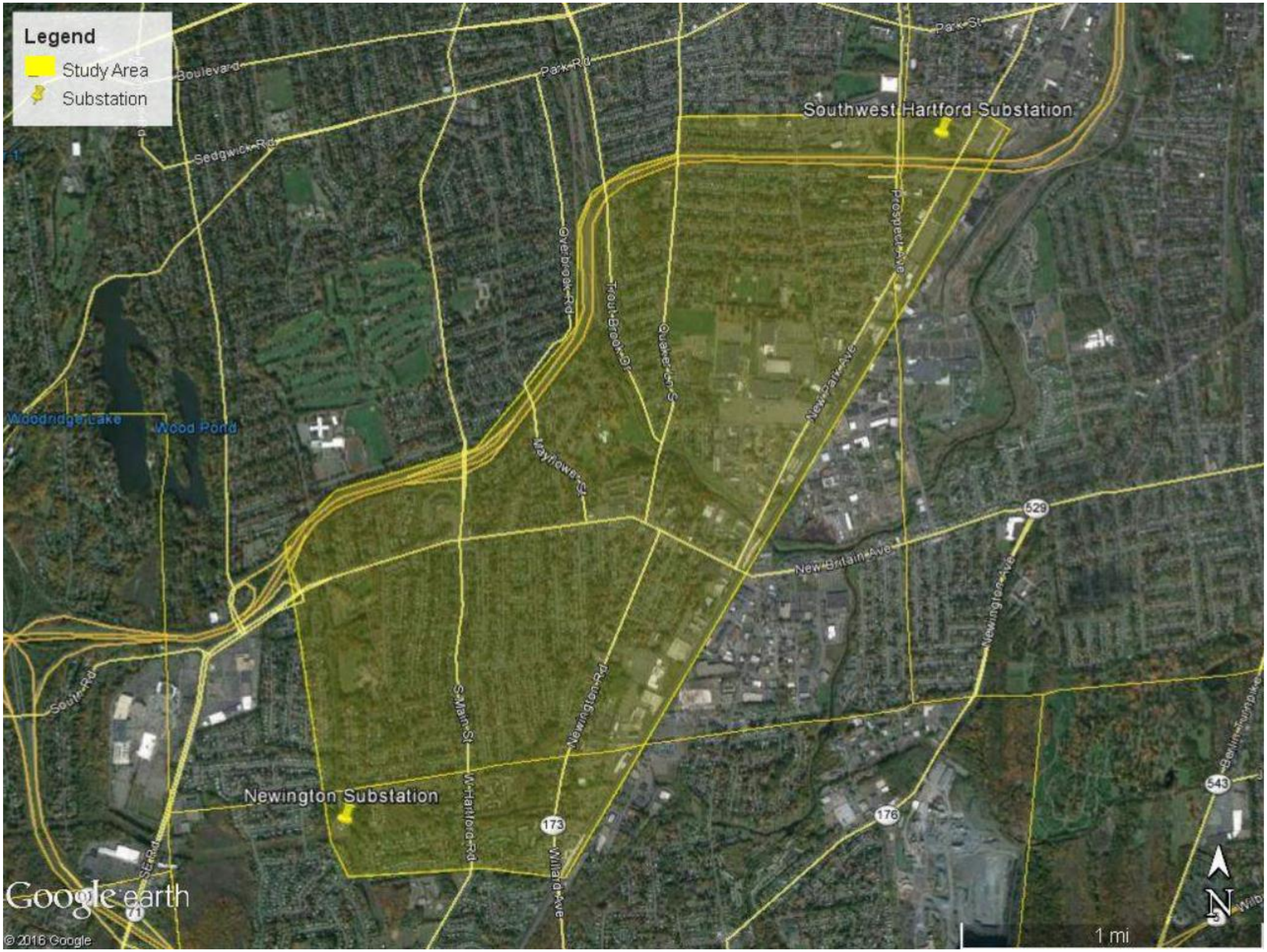
As shown in Figure 11-1, the geographic study area is anchored by Newington Substation in the southwest and Southwest Hartford Substation in the northeast, and is generally defined by the following boundaries:

- Eversource's existing ROW, currently occupied by distribution lines, which extends north from Newington Substation, forming the western boundary of the study area;
- West Hill Road to the south;
- I-84 to the north and northwest;
- Kane Street and St. James Street to the north; and
- The Amtrak/CT*fastrak* corridor to the east.

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.[100] 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 in the Town of West Hartford).

[100] Existing Eversource ROWs extend to Newington Substation from the north, east, west, and south. The ROW connecting to the substation from the west was not considered in the routing studies because it does not extend toward Southwest Hartford Substation. The other Eversource ROWs were reviewed as part of the alternatives identification and evaluation process; the Eversource ROW that extends from Newington Substation east to State Route 173 is part of the Proposed Route and also is part of certain other route variations discussed in Section 11.5.

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



Farther to the east, Kane Street and James Street bound the study area to the north; 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 Amtrak/CT*fastrak* corridor bounds the study area to the east. Any potential route east of this corridor would substantially increase the length of the transmission line due to the lack of routing alternatives other than longer in-street options. Further, such an alignment would pose potential constructability and environmental issues associated with multiple water crossings (e.g., of Trout Brook, South Park River tributaries). For these reasons, and the availability of more direct routing options within the study area, routing alternatives east of the Amtrak/CT*fastrak* corridor were not evaluated further.

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:

- 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 effects to environmental resources, cultural resources, and 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

Using the transmission line route selection objectives, Eversource examined the Project study area to identify distinct, existing linear corridors (e.g., roads; the Amtrak/CT*fastrak* corridor, Eversource ROWs) for further investigation as potential routes for the new 115-kV line, in either all-underground or combination underground/overhead configurations.

The alternative routes were then evaluated. To determine the characteristics of each route alternative and to assess each in terms of the Project objectives, Eversource representatives conducted field reconnaissance, performed baseline data collection, reviewed aerial photography, consulted federal, state, and local officials, assessed general constructability, and developed cost estimates.

Because of the urbanized nature of the Project study area and the lack of available land for a new overhead transmission line corridor, no viable all-overhead transmission line routes were identified between Newington and Southwest Hartford substations. However, as discussed further in this section and detailed in this Application, overhead line configurations along existing Eversource ROWs emanating from Newington Substation and along the Amtrak ROW were evaluated as variations for portions of the new line and – in the case of the Amtrak ROW - incorporated as part of the Proposed Route.

The 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.

In addition, to assess route options involving the Amtrak ROW, Eversource coordinated extensively with Amtrak and ConnDOT representatives and, in July 2016, provided a detailed engineering analysis of potential transmission line configurations along the railroad ROW to Amtrak for review. Amtrak requires such detailed data in order to fully evaluate whether to grant a license for occupancy of its ROW.

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 in preference to collocating with overland electric utility ROWs (transmission or distribution). 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. However, 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 in-road construction, and wider for construction not within or adjacent to roads. The final cable location must be carefully planned to avoid existing in-street underground utilities. Additionally, land must be available for burying splice vaults that cannot be located in-street, each of which is approximately 8 feet wide by 8 feet deep and up to 24 feet in length. The installation of each vault would typically require an excavation of 12 feet wide, 12 feet deep, and 28 feet in length. Such vaults, which are typically placed at approximately 1,600-to-2000 foot intervals along a 115-kV cable route (intervals vary based on project-specific conditions), 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 beneath road shoulders or on private lands adjacent to public road corridors. Alternatively, existing utilities may have to be relocated.
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 -- or in some cases distribution -- 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.[101] **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.[102] **Existing ROW**. The placement of a new 115-kV transmission line within an existing corridor (parallel to existing transmission or distribution lines or other linear facilities) 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) are similarly considered.
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 the proposed 115-kV transmission line structures typically range from 70 to 105 feet tall (depending on structure configuration and project-specific design requirements), 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.
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.

[101] CGS § 16-50p(a)(3)(D)

[102] Non-standard transmission line design (i.e., overhead structure design that differs from standard Eversource practice) can be used in select situations to minimize the width of ROW required for a new transmission line.

11.3 TRANSMISSION LINE ROUTE ALTERNATIVES

11.3.1 Potential Transmission Line Routes Initially Considered

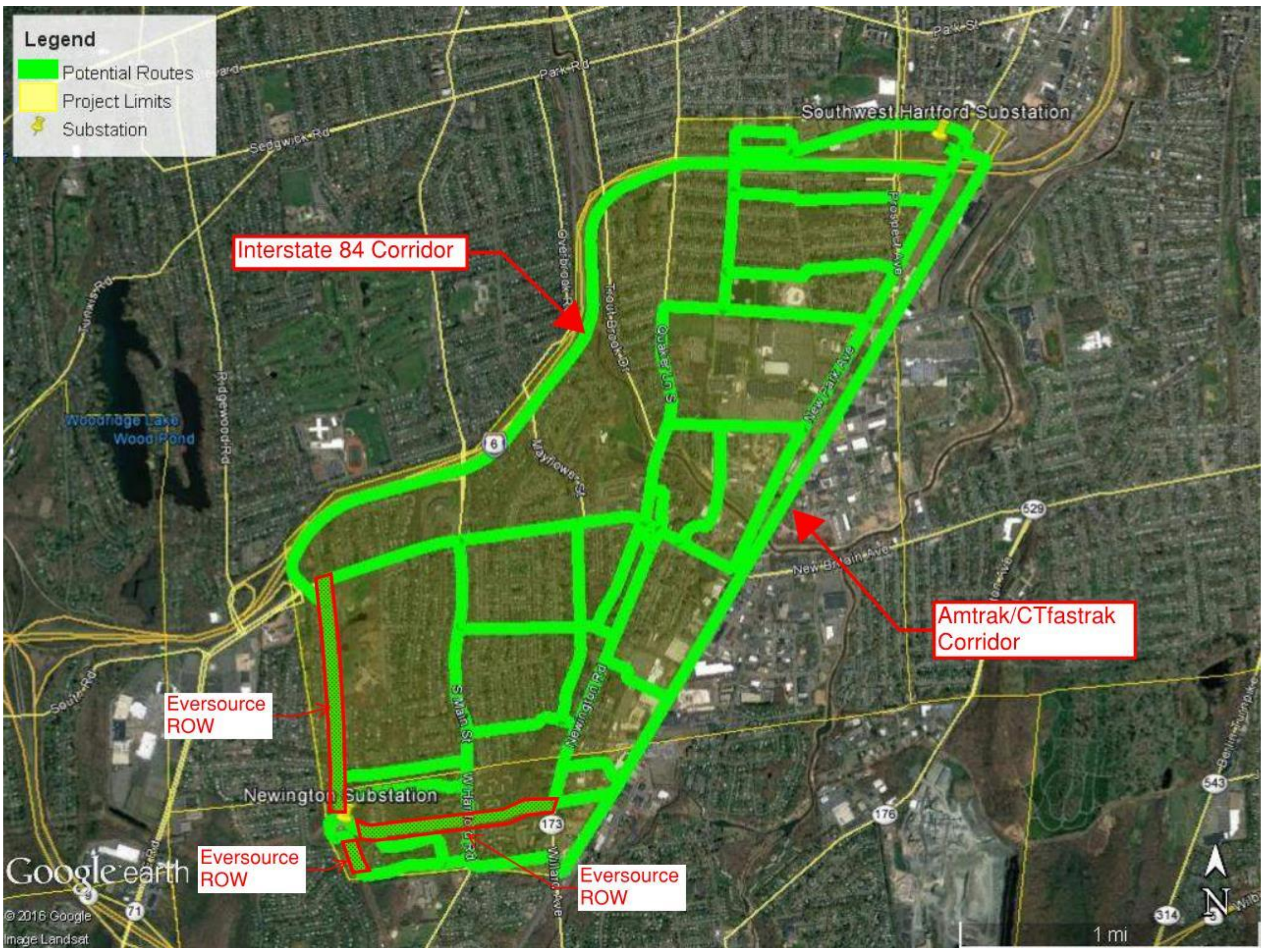
Within the Project study area, potential route segments for the new 115-kV transmission line were identified, taking into consideration Eversource's overall route selection objectives and route evaluation criteria. Because the study area primarily encompasses densely-developed suburban/urban uses, the alternatives identification process focused on the use of existing road, railroad, and electric line ROWs along which the proposed 115-kV line could potentially be aligned underground and – along some corridors – overhead. Other primary factors that were considered in the initial alternative route identification process included:

- ***Minimization of Line Length*** – Segments were identified that, when connected to form a route, would generally link the Newington and Southwest Hartford substations in as direct a manner as possible.
- ***Maximization of the use of existing Eversource ROWs extending from Newington Substation*** – Existing Eversource ROWs (consisting of Eversource properties or easements), occupied by overhead transmission lines and overhead and underground distribution lines, presently connect to Newington Substation. The existing ROWs that extend from the substation to the north, south, and east were identified as potential routing opportunities that merited consideration for the new 115-kV line to maximize the collocation of electric facilities. No ROWs occupied by existing overhead lines connect to Southwest Hartford Substation.
- ***Minimization of potential conflicts associated with alignments along state highways and local roads, as well as near homes and through central business areas and designated historic districts*** – The study area includes various major roads (e.g., I-84, State Route 173, State Route 529) characterized by high traffic volumes, as well as several NRHP districts, the Elmwood Center business district in West Hartford, and residential, commercial, and industrial land uses. Potential routes were identified to minimize conflicts with such uses to the extent practical.
- ***Availability of locations for the line crossing of Trout Brook*** – In the study area, Trout Brook extends generally west-east 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. Because of constructability issues associated with the characteristics of the watercourse and the density of development in the study area, only four locations were identified as potentially feasible for routing the transmission line across the brook. These included an overhead line configuration that would span Trout Brook along the Amtrak/CT*fastrak* corridor and underground alignments beneath the brook at three locations: (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.

- ***Availability of locations for the transmission line crossing of I-84*** – Because Southwest Hartford Substation is located north of I-84, any transmission line route from Newington Substation must necessarily cross this interstate highway. The transmission line crossing of I-84 was considered a routing constraint, given the density of development and the lack of suitable existing ROWs that cross the highway in the study area. Within the study area, there are no overhead transmission line crossings of I-84 and most of the streets in the vicinity cross the interstate as overpasses. New Park Avenue (which abuts Southwest Hartford Substation) is the only crossing road that extends under I-84.

The overall network of route alternatives (involving both overhead and underground configurations) initially considered for the new 115-kV transmission line is shown in Figure 11-2.

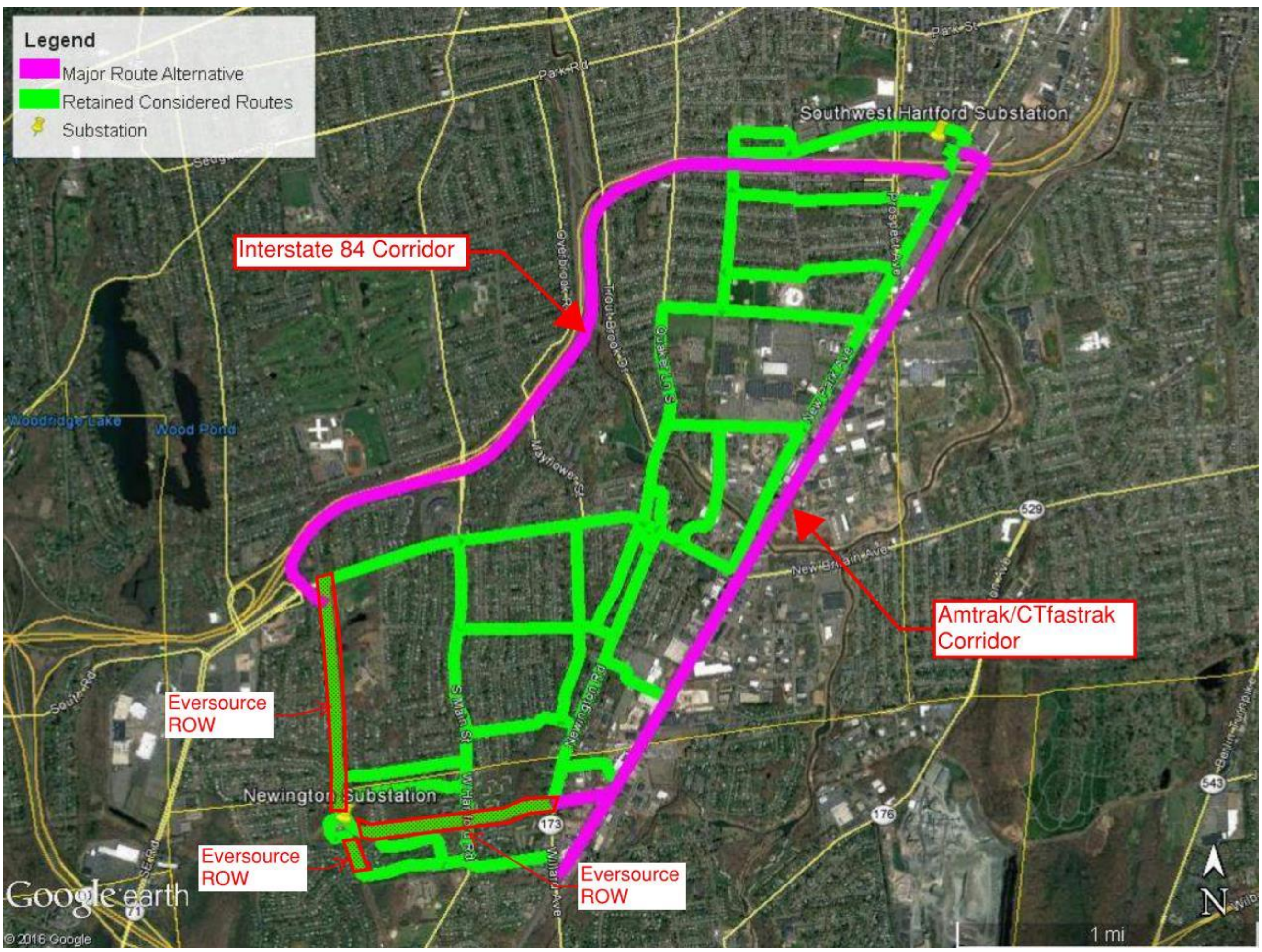
Figure 11-2: All Route Alternatives Initially Considered for the Proposed Transmission Line



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 in the study area. Two major alternative corridors in the study area were evaluated: the I-84 corridor and the Amtrak/CT*fastrak* corridor. A route along either of these corridors would connect to Newington Substation using existing Eversource ROWs. Figure 11-3 illustrates these two major route alternatives, which are described further in the following subsections.

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 Project 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 refused by ConnDOT, unless it is the only possible routing solution. This policy is documented in ConnDOT's *Utility Accommodation Manual*, and was confirmed with respect to the Project at an April 9, 2015 meeting between Eversource and representatives of ConnDOT.

If the I-84 corridor could have been used for the northern part of the new 115-kV line alignment, the remainder of the route would be proposed for alignment along an existing Eversource ROW, currently also utilized for distribution lines, to reach Newington Substation. This ROW, which is approximately 150 feet wide and extends north from Newington Substation to New Britain Avenue, 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 a new overhead or underground 115-kV transmission line. The existing Eversource 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.).

As illustrated on Figure 11-3, other route alternatives, involving the use of other existing ROWs, are available for the proposed 115-kV line in the study area. Consequently, 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 Amtrak/CT*fastrak* Corridor

Eversource's initial evaluations indicated that the alignment of a new transmission line along the Amtrak/CT*fastrak* corridor would present engineering and other challenges. However, Eversource recognized that the Amtrak/CT*fastrak* corridor would provide a relatively direct route for aligning a majority of the new 115-kV line between Newington and Southwest Hartford substations. Further, Eversource presently operates transmission lines along railroad corridors in other Connecticut locations and thus anticipated that the Amtrak/CT*fastrak* ROW merited further consideration. Consequently, Eversource consulted with both Amtrak and ConnDOT (which operates the CT*fastrak* within the ROW along lands leased from Amtrak) regarding this alternative route and performed engineering analyses to assess whether the new 115-kV line could feasibly be collocated along the Amtrak ROW, in either an underground or overhead configuration.

Figure 11-4 illustrates the location of the Amtrak/CT*fastrak* ROW in relation to the Project area and in relation to the Newington and Southwest Hartford substations, to which the new 115-kV line must be connected.

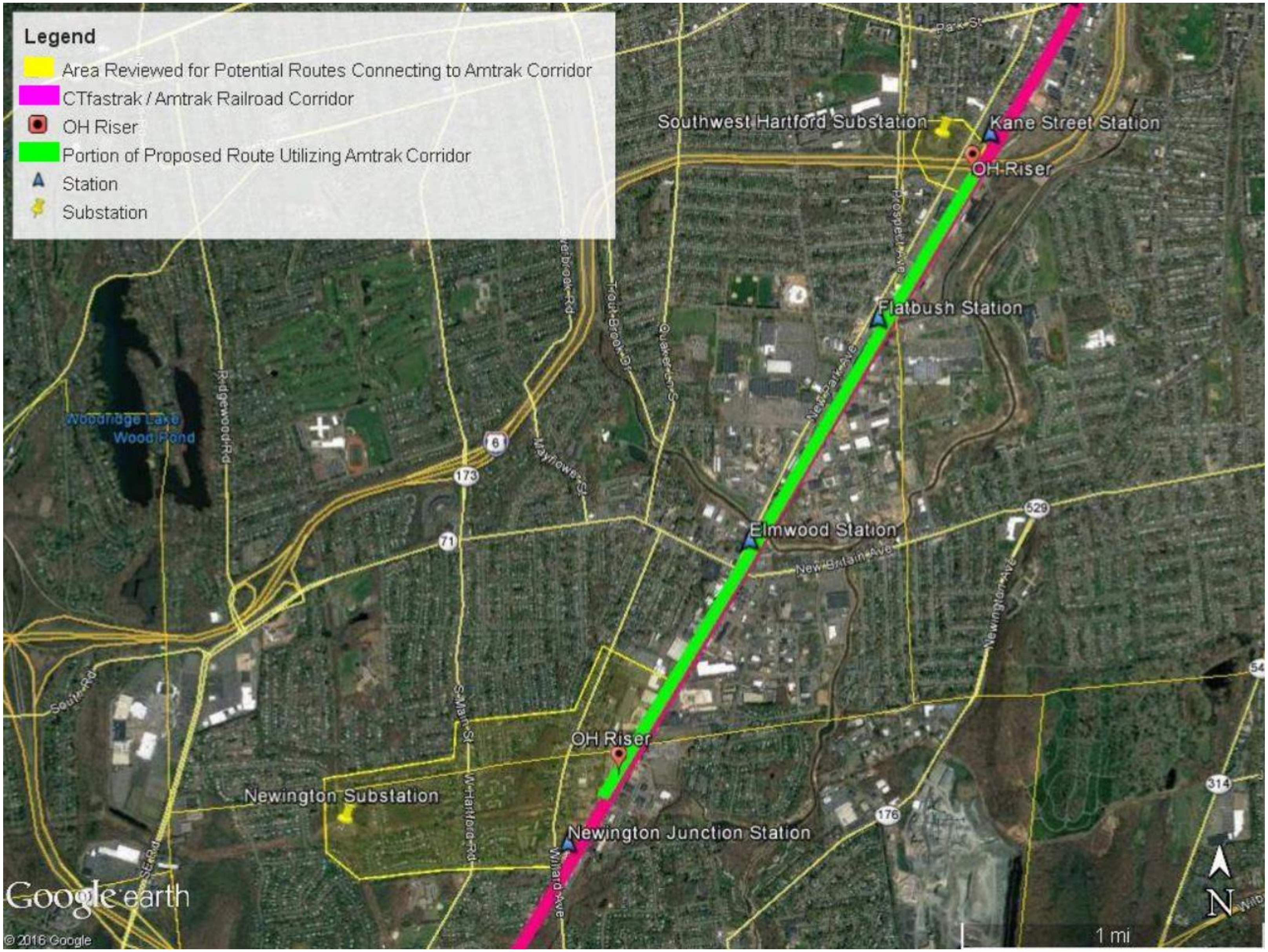
Background. Two active Amtrak railroad lines and ConnDOT's CT*fastrak* busway extend generally southwest-to-northeast through the eastern boundary of the Project study area, representing a prominent linear corridor. In this area, both the Amtrak railroad tracks and the CT*fastrak* are collocated along the same ROW, with the railroad tracks situated east of the CT*fastrak*. An access road extends along part of the east side of the Amtrak ROW; however, this road is not continuous.

Amtrak owns the entire corridor and leases the portion occupied by the CT*fastrak* to ConnDOT.[103] The Amtrak ROW varies in width from 85 to approximately 180 feet, with most of the corridor in the Project study area ranging from approximately 90 to 115 feet wide. In the Project study area, the Amtrak/CT*fastrak* corridor is bordered by commercial and industrial uses (refer to Figure 11-3 and the Volume 3 maps).

As discussed in Section 5, Amtrak's two railroad lines along this corridor are currently being upgraded to high-speed passenger rail service. The NHHS Rail Program, which will provide high-speed rail service between New Haven and Springfield, is targeted to be in service in 2018. As part of the NHHS Rail Program, new Amtrak stations in Newington and West Hartford (near Flatbush Avenue) are planned, along with other improvements. In addition to the NHHS Rail Program, Amtrak also has future plans to electrify its rail lines along this railroad corridor.

[103] The CT*fastrak* busway occupies a former Amtrak railroad bed.

Figure 11-4: Location of Amtrak/CT*fastrak* Proposed Route Segment



The CT*fastrak,* which commenced service in late March 2015 and is operated by ConnDOT, consists of a 9.4-mile bus-exclusive road that provides local service between downtown New Britain and Hartford; stations are located along the busway route. The eastern boundary of the Project study area abuts the busway between the Newington and Kane bus stations.

Pursuant to its siting objective of aligning new transmission facilities along existing corridors where practical, Eversource assessed the feasibility of collocating the new 115-kV transmission line within portions of the Amtrak ROW. Based on initial review, Eversource determined that aligning the proposed transmission line within or abutting the CT*fastrak* ROW would be impractical. Had the construction of the CT*fastrak* coincided with the development of the proposed 115-kV line, it may have been possible to coordinate the potential collocation of the new transmission line beneath or adjacent to the busway. However, the CT*fastrak* just commenced service in March 2015; thus, constructing the new 115-kV line within or adjacent to the busway without potentially significantly affecting bus and rail service was determined to be incompatible with ConnDOT objectives.

However, based on further, more detailed analyses, Eversource determined that the Amtrak ROW east of the busway could potentially offer a linear alignment for a segment of the new 115-kV line. Preliminary technical studies to assess the feasibility of this route and to evaluate consistency with known Amtrak policies indicated that a portion of the 115-kV line could potentially be collocated within the Amtrak ROW, assuming the new line could be constructed with some modifications to Eversource's current design standards. Therefore, as described further below, Eversource performed additional, more comprehensive analyses and consulted with Amtrak to evaluate the viability of collocating the new 115-kV line along the eastern portion of the railroad ROW.

Amtrak Consultations and Studies. Eversource conducted preliminary investigations of the Amtrak ROW in 2015.[104] After conducting these preliminary analyses and field investigations, Eversource determined that more detailed information was required to assess the technical feasibility of collocating the 115-kV line along the Amtrak ROW,

[104] Preliminary information regarding an alternative route along the Amtrak ROW, along with preliminary overhead line designs for the 115-kV line, was presented in the Project's MCF (December 2015), along with other then-available information concerning potential construction procedures, environmental resources, and issues for further consideration.

particularly given the variable width of the Amtrak ROW, uncertainties regarding the future plans for the railroad modifications, and a general lack of data regarding subsurface conditions. Eversource concluded that specific consultations with Amtrak (and ConnDOT as the operator of the busway) were required to determine:

- Whether Amtrak policies would allow the development of an overhead or underground 115-kV transmission line within the Amtrak ROW; and
- If the new line could feasibly be collocated within the ROW in accordance with Amtrak policies (i.e., whether any railroad or busway easement agreement procedures, construction specifications, or timing restrictions would make the route infeasible due to adverse impacts on the Project schedule or cost).

Thus, to completely evaluate the potential viability of the use of the Amtrak ROW, Eversource determined that the following information would be needed:

1. An assessment of the viability of using overhead line designs that would not conform to typical Company specifications. Eversource's initial (2015) analyses revealed that non-standard Eversource designs would have to be used for an overhead alignment adjacent to either the Amtrak railroad tracks or CT*fastrak*, given the limited space within this ROW. Additional studies were needed to further evaluate a modified line design.
2. Additional data regarding Amtrak's plans for upgrading the rail lines in the Project area. Eversource needed more specific information regarding the ongoing NHHS Rail Program in order to evaluate whether the railroad upgrades, including planned rail stations in Newington and West Hartford, would affect the land available for installing an overhead 115-kV line.
3. Amtrak and ConnDOT policies, procedures, and timelines regarding the collocation and construction/operation of the 115-kV line. Eversource anticipated that Amtrak or ConnDOT policies could potentially preclude the collocation of the new 115-kV line. Further, if a license for the new transmission line could be acquired from Amtrak on reasonable terms, Eversource anticipated that any overhead line construction activities would have to be closely coordinated with Amtrak and ConnDOT rail and bus service schedules, and that work hour restrictions or special work requirements would apply. Such requirements could pose challenges to the construction schedule and could affect construction costs.
4. Amtrak and ConnDOT preferences with respect to Eversource's preliminary overhead line designs and potential structure locations within the Amtrak ROW (options initially evaluated included potential alignments of the transmission line adjacent to the east railroad track or between the busway and railroad tracks).
5. Baseline data from Amtrak and ConnDOT regarding property ownership, ROW widths, subsurface conditions, environmental and cultural resource considerations, and as-built drawings of existing facilities.

6. Amtrak and ConnDOT procedures for obtaining rights to collocate the transmission line along the railroad/busway corridor, including the data that would have to be included in any application to obtain such rights and the time that Amtrak/ConnDOT would require to review and provide input on such an application.

On January 21, 2016, Eversource met with representatives of both Amtrak and ConnDOT to discuss the potential route along the railroad/busway corridor. The objective of the meeting was to obtain feedback from both Amtrak and ConnDOT concerning the viability of the potential route and overhead line design, taking into consideration land availability/easement agreement (land rights) protocols, rail/busway operational procedures and schedules, and specifications for the safe operation of an overhead transmission line adjacent to these public transportation systems.

Based on the results of the discussions with Amtrak and ConnDOT, the most feasible location for the new 115-kV overhead line was identified as along the eastern portion of the Amtrak ROW, east of the easternmost rail line. As identified during the meeting with Amtrak and ConnDOT officials, there is not enough space to accommodate the transmission line either along the western portion of the Amtrak ROW (i.e., west of and parallel to the busway) or between the busway and the westernmost rail line.

Because of the density of urban development adjacent to the railroad corridor, Eversource determined that the new 115-kV line segment along the railroad must be aligned within the Amtrak property, as much as possible, to avoid conflicts with commercial and industrial uses.[105] Along this alignment, the new 115-kV line would extend northeast for approximately 2.4 miles, crossing portions of northern Newington, eastern West Hartford, and southwestern Hartford.

During the meeting, Amtrak and ConnDOT representatives also identified various issues regarding the proposed transmission line collocation, including the Amtrak requirement that Eversource submit detailed engineering information (referred to as a CE4 package) regarding the proposed transmission line (e.g., line configuration, length of line proposed for location along the railroad ROW) for Amtrak review and comment.

[105] Taking private property (e.g., removing buildings, impinging upon development rights) would be inconsistent with Eversource's routing objectives. Therefore, Eversource determined that any transmission line segment along the Amtrak ROW would have to be located entirely on Amtrak property, with exceptions only in a small section where the Amtrak ROW narrows near Flatbush Avenue in West Hartford.

On June 24, 2016, Eversource submitted to Amtrak the required CE4 package, which provided all of the requisite engineering data concerning the proposed transmission line collocation. During the latter half of 2016, Amtrak evaluated the CE4 package and provided comments to Eversource.

Eversource subsequently responded to Amtrak's comments and submitted other technical information for Amtrak's for review and approval. Following Amtrak's review of this additional information, in January 2017, Eversource received Amtrak's acceptance of the revised CE4 submittal package, indicating that the collocation of the proposed 115-kV line segment within the Amtrak ROW was viable.

The engineering design data for the proposed line, as described in the updated CE4 package, is reflected on the structure locations illustrated on the Volume 3 maps. Volume 3 also includes representative cross-sections of the overhead line design endorsed by Amtrak along the railroad ROW.

Eversource's negotiations with Amtrak regarding the lease agreement for the proposed transmission line are nearly complete. Eversource expects to continue to coordinate with Amtrak throughout the Project design and construction processes. Eversource would design and construct the overhead transmission line segment along the railroad ROW to meet Amtrak requirements, and expects to submit a minimum of two more design packages to Amtrak for review before construction. These packages would be submitted as detailed design of the transmission line progresses.

Overall, as a result of the coordination with Amtrak, Eversource determined that the use of the Amtrak ROW for a primary portion of the Proposed Route would be consistent with the Project objectives, maximizing collocation with an existing linear corridor while minimizing costs, environmental impacts, and land use/social impacts. Based on the assumption that the Amtrak ROW would thus be incorporated into the Proposed Route, Eversource then evaluated the following alternatives:

- Configuration options regarding the type of transmission line design (e.g., underground, overhead) along the Amtrak ROW, as well as a route variation along the Amtrak ROW (refer to Section 11.4).
- Alignment options for routing the proposed 115-kV transmission line from Newington Substation to the Amtrak ROW and from the Amtrak ROW to Southwest Hartford Substation (refer to Section 11.5).

11.4 TRANSMISSION LINE CONFIGURATION OPTIONS AND ROUTE VARIATIONS ALONG THE AMTRAK ROW

After determining that the Amtrak ROW could be used for the Project, Eversource evaluated four alternative configurations for developing the new 115-kV transmission line along this corridor – an underground line design and three different overhead line configurations. The three overhead configurations were chosen to have the least amount of interference to both the Amtrak railway and the CT*fastrak*. These configuration options are discussed in Sections 11.4.1 and 11.4.2.

In addition, along the railroad ROW south of Flatbush Avenue in West Hartford, Amtrak proposes to develop a new railroad station. In the event that the new 115-kV line cannot be aligned within the Amtrak ROW in the vicinity of this planned railroad station, Eversource identified and evaluated a short route variation, as discussed in Section 11.4.3.

11.4.1 Underground Configuration: Amtrak ROW

Eversource assessed the potential for installing the new 115-kV line underground along the Amtrak ROW, but dismissed this configuration alternative for the following reasons:

- ***Significant Disruptions to Public Transit and Land Uses***. An underground line design for the new 115-kV line within the Amtrak ROW would optimally have been coordinated with the development of the CT*fastrak*. Had the schedules for the construction of the new transmission line and the busway coincided, the underground cable system potentially could have been efficiently installed beneath the busway pavement. However, with the busway recently completed, Eversource determined that constructing the new 115-kV line within or adjacent to the busway would significantly disrupt bus service and would be incompatible with ConnDOT objectives for promoting the use of mass transit.

  Eversource also assessed the potential for locating the transmission line underground, along an access road that extends parallel to and east of portions of the Amtrak ROW. However, this access road is not continuous and, in some locations, the Amtrak ROW abuts commercial and industrial buildings. Aligning an underground cable system, requiring continuous trenching and splice vault excavations along the railroad corridor in this area would present construction challenges and would adversely affect existing land uses. Further, an underground line would require installation beneath Trout Brook; this watercourse crossing would be challenging from a constructability viewpoint, given adjacent land uses.

- ***Significant Construction Scheduling Issues and Increased Cost***. Underground 115-kV cable installation would require the excavation of both a continuous trench and splice vaults in close proximity to the busway and the Amtrak railroad tracks.

Underground cable system construction is time-consuming and would require extensive coordination with Amtrak and ConnDOT to sequence work so as to avoid conflicts with rail and bus service. Consultations with Amtrak and ConnDOT indicated that limited daily work windows would be available for the transmission line installation; as a result, the construction period for an underground cable system would be substantially increased, consequently increasing Project costs.

11.4.2 Overhead Configurations: Amtrak ROW

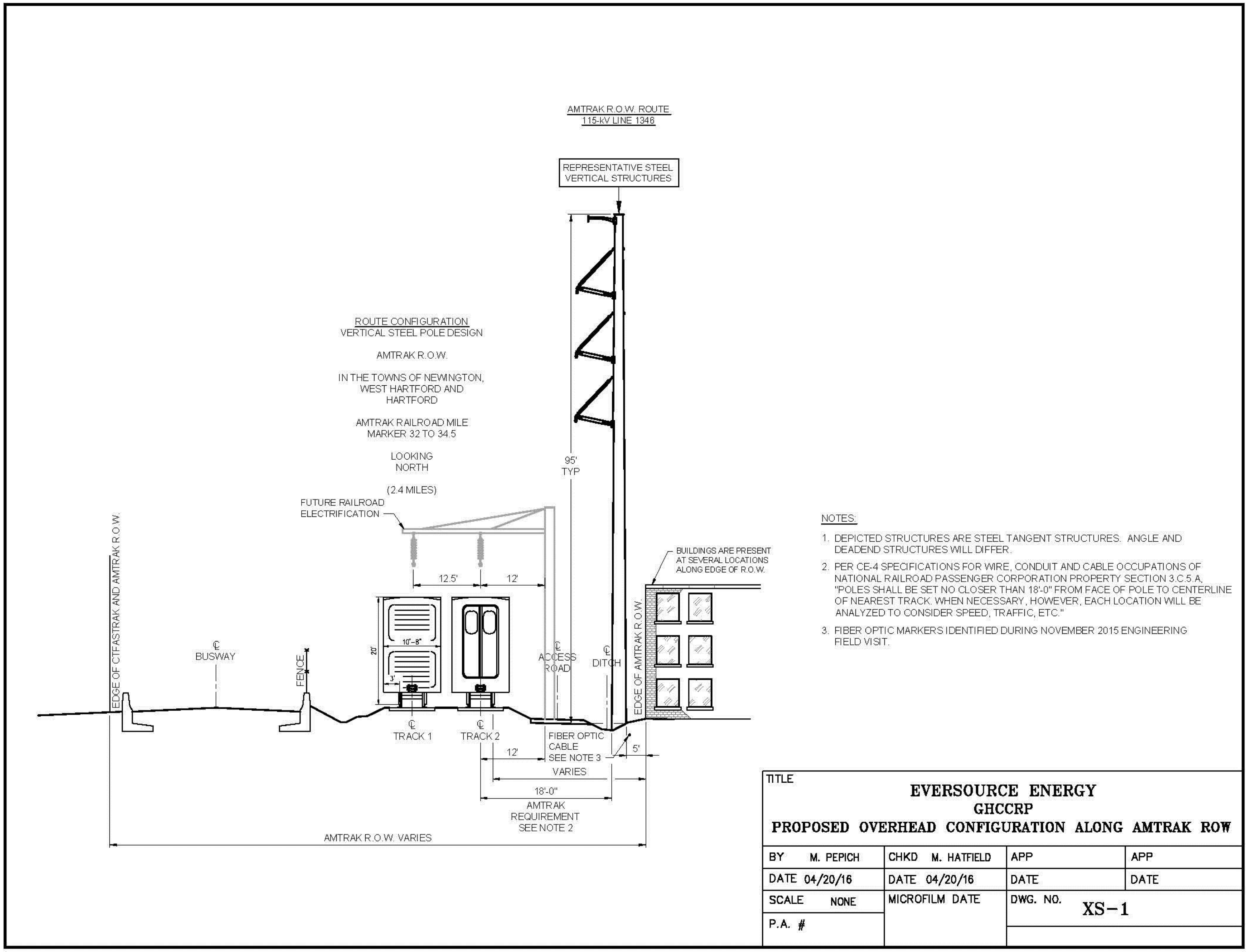
Eversource carefully evaluated overhead configuration options for aligning the proposed 115-kV line within the Amtrak ROW. These line designs took into consideration Amtrak requirements and reflect non-standard Eversource overhead line configurations, due to the limited available space in the railroad ROW. The proposed overhead configuration, as well as the two other overhead line designs, are reviewed in the following subsections.

11.4.2.1 Proposed Overhead Configuration: Amtrak ROW

After taking into consideration of the width of the Amtrak ROW, the location of the two existing Amtrak rail lines, Amtrak's plans for future rail service, and accounting for the potential for electrification of the rail line, Eversource identified as the preferred configuration a vertical structure design. A delta structure design was also evaluated but disregarded, as it would not satisfactorily accommodate the various site constraints.

As illustrated in Figure 11-5 and discussed in Section 3 of this Application (refer to Volume 3 for full-size cross-sections), the vertical structures are planned for location east of the easternmost railroad track, within the Amtrak ROW. This configuration is preferred because it would provide the maximum clearance from Amtrak's existing rail lines and potential catenary structures, while still collocating the new line within the railroad ROW. Further, from a construction standpoint, this configuration would have the least potential impact to the Amtrak railway operations.

Figure 11-5: Proposed Overhead Alignment, East of Railroad Tracks, Vertical Steel Poles, Braced-Post Insulators



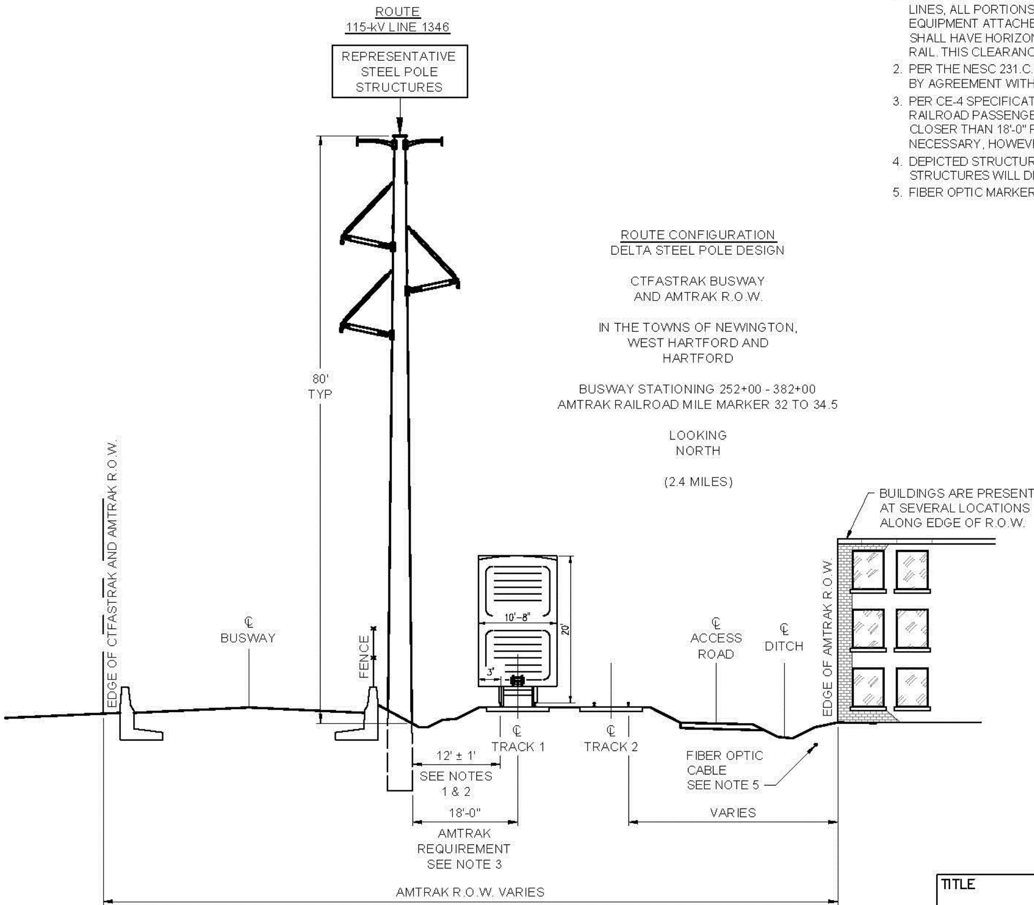
11.4.2.2 Variations to Overhead Installation within the Amtrak ROW

Prior to selecting the preferred overhead design, two other configurations were evaluated for the overhead 115-kV line installation within the Amtrak ROW. Both of these options, which were discussed with Amtrak and ConnDOT, would have involved placing the 115-kV transmission line structures, in either delta or vertical configurations, between the CT*fastrak* busway and Amtrak's western railroad track (refer to Figures 11-6 and 11-7).

Although both of these options could technically be feasible, the construction of either configuration in the middle of the railroad ROW would cause potentially significant disturbance to both the railroad and busway operations, given the need for temporary construction work space and access. Further, the transmission line construction schedule would have to be modified to accommodate the CT*fastrak* bus and Amtrak rail service.

As a result, the overhead line construction would likely be limited to only a few hours a day, resulting in a longer overall construction schedule and increased construction costs. Finally, both Amtrak and ConnDOT prefer the proposed line design. In consideration of all of these factors and in light of a more viable design, both options to place the 115-kV transmission line structures, in either delta or vertical configurations, between the CT*fastrak* busway and Amtrak's western railroad track were eliminated from further consideration.

Figure 11-6: Overhead Alignment Variation, Between CT*fastrak* and Railroad Tracks, Delta Steel Structures

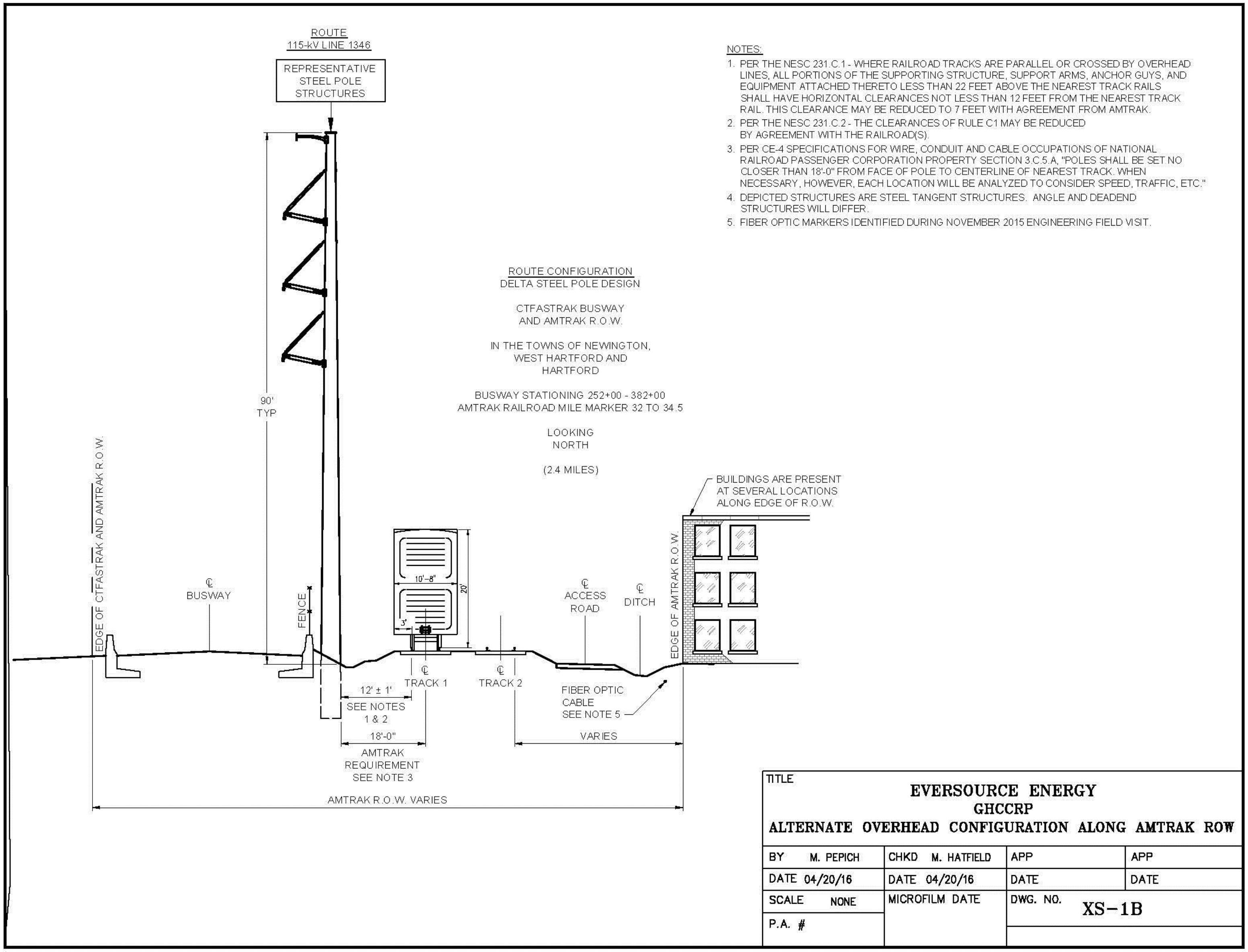


NOTES:

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. PER CE-4 SPECIFICATIONS FOR WIRE, CONDUIT AND CABLE OCCUPATIONS OF NATIONAL RAILROAD PASSENGER CORPORATION PROPERTY SECTION 3.C.5.A, "POLES SHALL BE SET NO CLOSER THAN 18'-0" FROM FACE OF POLE TO CENTERLINE OF NEAREST TRACK. WHEN NECESSARY, HOWEVER, EACH LOCATION WILL BE ANALYZED TO CONSIDER SPEED, TRAFFIC, ETC."
4. DEPICTED STRUCTURES ARE STEEL TANGENT STRUCTURES. ANGLE AND DEADEND STRUCTURES WILL DIFFER.
5. FIBER OPTIC MARKERS IDENTIFIED DURING NOVEMBER 2015 ENGINEERING FIELD VISIT.

TITLE EVERSOURCE ENERGY GHCCRP ALTERNATE OVERHEAD CONFIGURATION ALONG AMTRAK ROW			
BY M. PEPICH	CHKD M. HATFIELD	APP	APP
DATE 04/20/16	DATE 04/20/16	DATE	DATE
SCALE NONE	MICROFILM DATE	DWG. NO. XS-1A	
P.A. #			

Figure 11-7: Overhead Alignment Variation, Between CT*fastrak* and Railroad Tracks, Vertical Steel Poles



11.4.3 Potential Route Variation: Flatbush Avenue Amtrak Station

Directly south of and abutting Flatbush Avenue in the Town of West Hartford, Amtrak plans to develop a new regional railroad station as part of its future NHHS Rail Program improvements. Along this segment of the Amtrak ROW, Eversource proposes to install two new transmission line structures (Structure Nos. 47 and 48; refer to the Volume 3 maps) adjacent to the eastern Amtrak railroad line. Based on a review of Amtrak's preliminary plans, these two structures would abut the railroad station and the new 115-kV line conductors would be located very close to the edge of the station building.

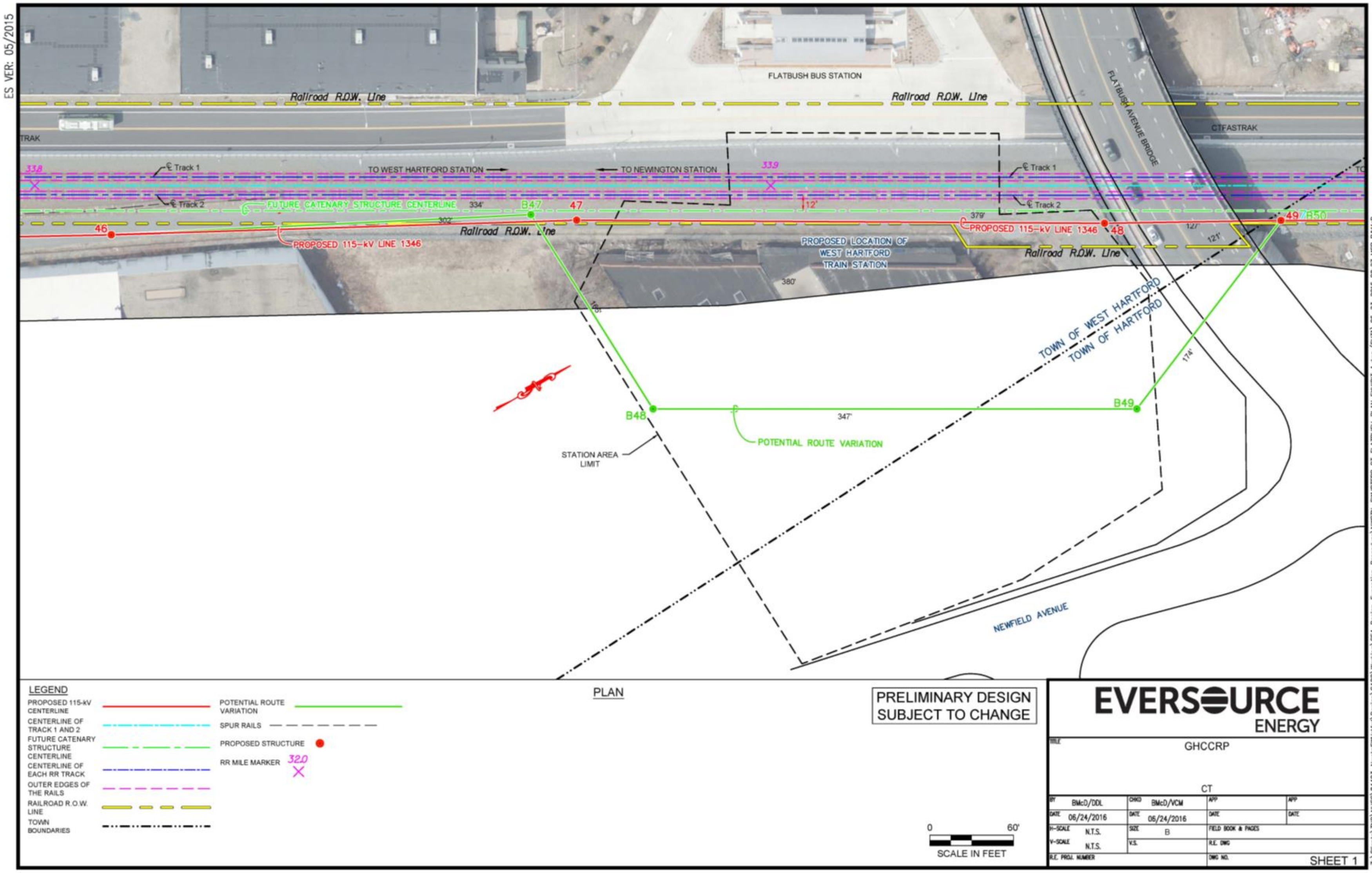
As part of its coordination with Amtrak, Eversource identified a route variation to avoid alignment of the proposed 115-kV line directly adjacent to the planned Flatbush railroad station. This route variation, as illustrated on Figure 11-8, would diverge east from the Amtrak ROW just north of proposed Structure 46 and then would turn north to extend across the potential railroad station parking lot before spanning Flatbush Avenue and intersecting with the Amtrak ROW near proposed Structure 50.

The variation would be located principally on property that is bounded by private property on the south, Newfield Avenue on the east, Flatbush Avenue on the north, and the railroad ROW on the west. Lands in the vicinity of the route variation consist entirely of commercial and industrial developments.

This route variation would be approximately 900 feet (0.2 mile) in length and would require two additional transmission structures, one on either end of the parking lot. The route variation would replace an approximately 700-foot (0.1 mile) section of the Proposed Route within the Amtrak ROW.

Eversource could develop the proposed 115-kV line along the route variation, should Amtrak determine that this option would minimize potential conflicts with the planned railroad station. Because of its slightly longer length and two additional structures, the route variation would be comparatively more costly than the portion of the Proposed Route that it would replace. Eversource would continue to coordinate with Amtrak regarding the future plans for the railroad station in relation to the proposed 115-kV line route.

Figure 11-8: Potential Route Variation: Flatbush Avenue Railroad Station
Source: Baseline data provided by Amtrak



11.5 ROUTE VARIATIONS AND LINE DESIGNS: CONNECTIONS FROM NEWINGTON AND SOUTHWEST HARTFORD SUBSTATIONS TO THE AMTRAK ROW

After determining that the Amtrak ROW could be used for the central portion of the new 115-kV transmission line, Eversource evaluated routes and design configurations for connecting the Amtrak ROW segment to both Newington Substation and Southwest Hartford Substation. For these evaluations, Eversource assessed potential routes involving the use of existing ROWs, including along local and state roads and – near Newington Substation – along Eversource's existing ROWs (refer to Figure 11-4).

Section 11.5.1 reviews the rationale for the selection of the proposed underground configuration and route from the Amtrak ROW to Southwest Hartford Substation. In this area, the existing urban development and the I-84 corridor combine to limit routing and configuration options. In contrast, in the southern portion of the Project area, from Newington Substation to the Amtrak ROW, the new 115-kV line could potentially be constructed along various routes, some using overhead or underground line designs. Section 11.5.2 identifies and discusses these multiple route and design variations and explains Eversource's reasons for selecting the Proposed Route and line design for this segment of the new 115-kV line.

11.5.1 Route Variations: Amtrak ROW to Southwest Hartford Substation

The northern segment of the Proposed Route, extending from the Amtrak ROW to Southwest Hartford Substation in Hartford, is planned for construction underground. Specifically, after extending for 2.4 miles overhead along the eastern portion of the Amtrak ROW, just south of I-84, the proposed 115-kV line would diverge to the west, crossing over the railroad tracks and the busway to a transition structure that would be located on Amtrak property near the northeast corner of parking lot for the Bow Tie Cinemas movie multiplex. There, the overhead line would transition to an underground configuration, traversing west for approximately 0.1 mile across the northern end of the cinema parking lot to New Park Avenue and then following the New Park Avenue ROW beneath I-84 to Southwest Hartford Substation (refer to Figure 11-9).

Due to limited available land in this urbanized area, and the extremely short distance to reach the Amtrak ROW, no alternative route or line design configurations were identified for this segment of the proposed 115-kV line. In this area, the transmission line could not continue, in an overhead configuration, beneath I-84.

In general, there is no available space to install an overhead line due to constraints posed by the location of the Amtrak/busway corridor, New Park Avenue, adjacent land uses, and the I-84 overpass. Aligning the 115-kV line underground, along the Amtrak ROW beneath I-84 was also determined to be impractical, because the line would then have to be aligned underground beneath the railroad tracks and CT*fastrak*, and across property north of I-84 and New Park Avenue in order to reach Southwest Hartford Substation to the west.

11.5.2 Route Variations: Newington Substation to Amtrak ROW

Between Newington Substation and the Amtrak ROW, a number of routes using local road ROWs, State Route 173, and Eversource ROWs were identified and reviewed. In general, Eversource attempted to identify route options that would provide direct routes between Newington Substation and the Amtrak ROW, while maximizing the use of existing ROWs and avoiding or minimizing the need for new easements across private properties. Underground line configurations were considered along road ROWs. However, along the Eversource ROW that extends east from Newington Substation to State Route 173, and currently contains distribution lines, an overhead line configuration also was evaluated.

Figure 11-10 illustrates the network of potential routes initially identified and reviewed between Newington Substation and the Amtrak ROW. Some of the initially identified routes were eliminated from further consideration comparatively quickly, due to factors such as longer overall length or potential impacts (refer to Section 11.5.2.1), whereas other routes were determined to merit more detailed consideration (refer to Section 11.5.2.2).

Figure 11-9: Amtrak ROW to Southwest Hartford Substation: Proposed Route

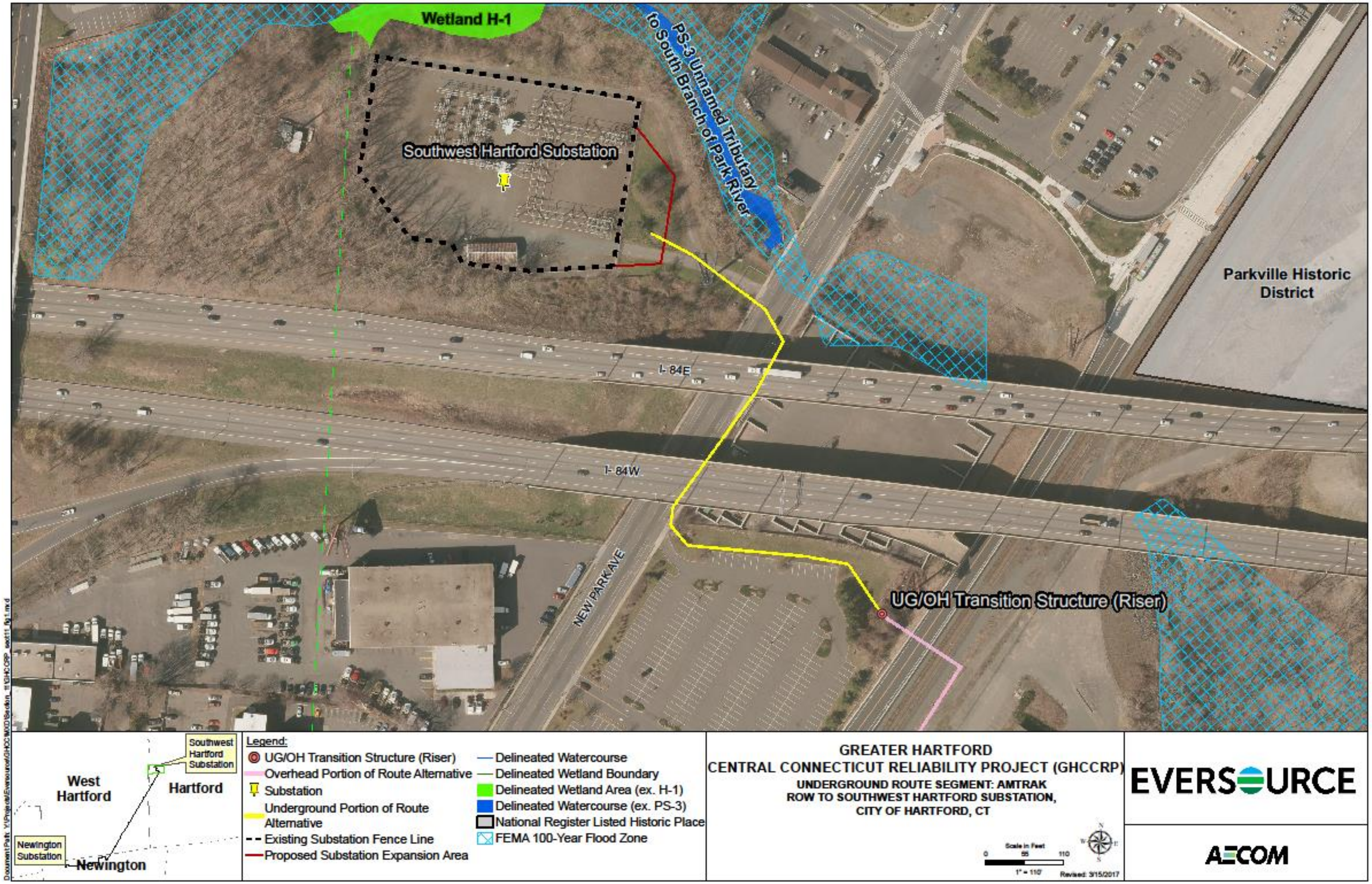


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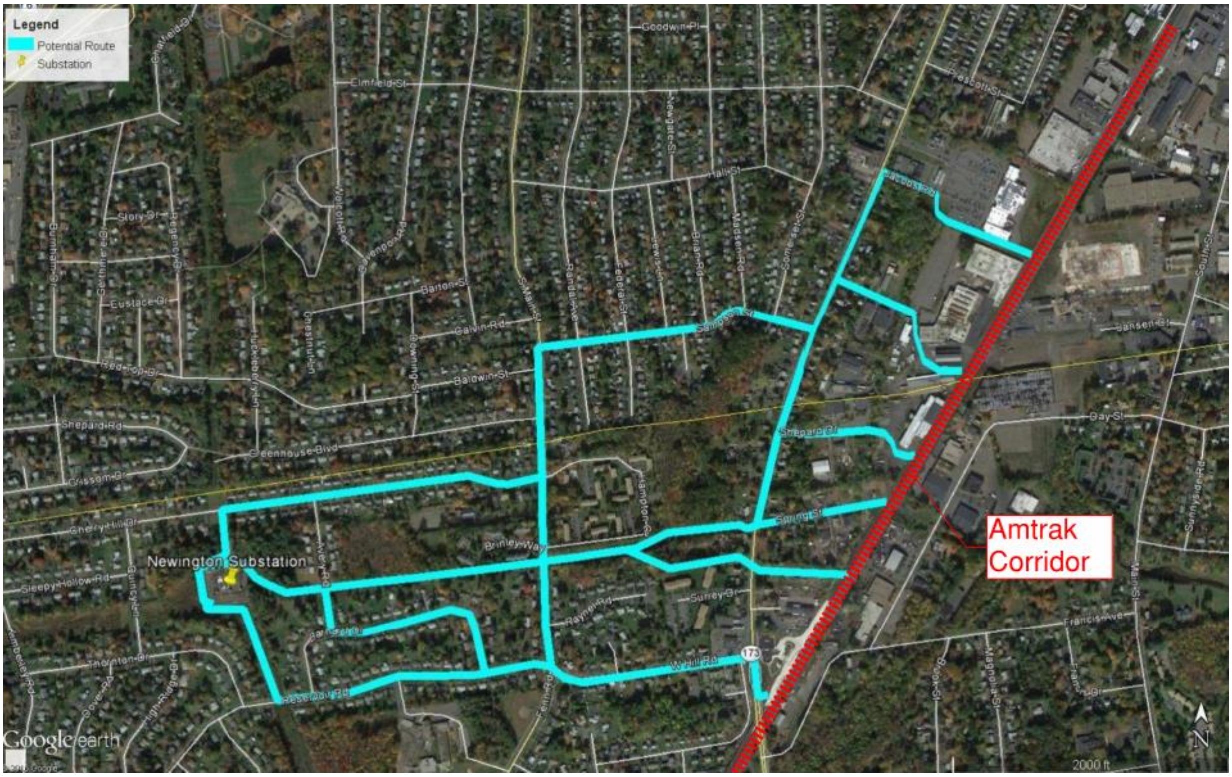
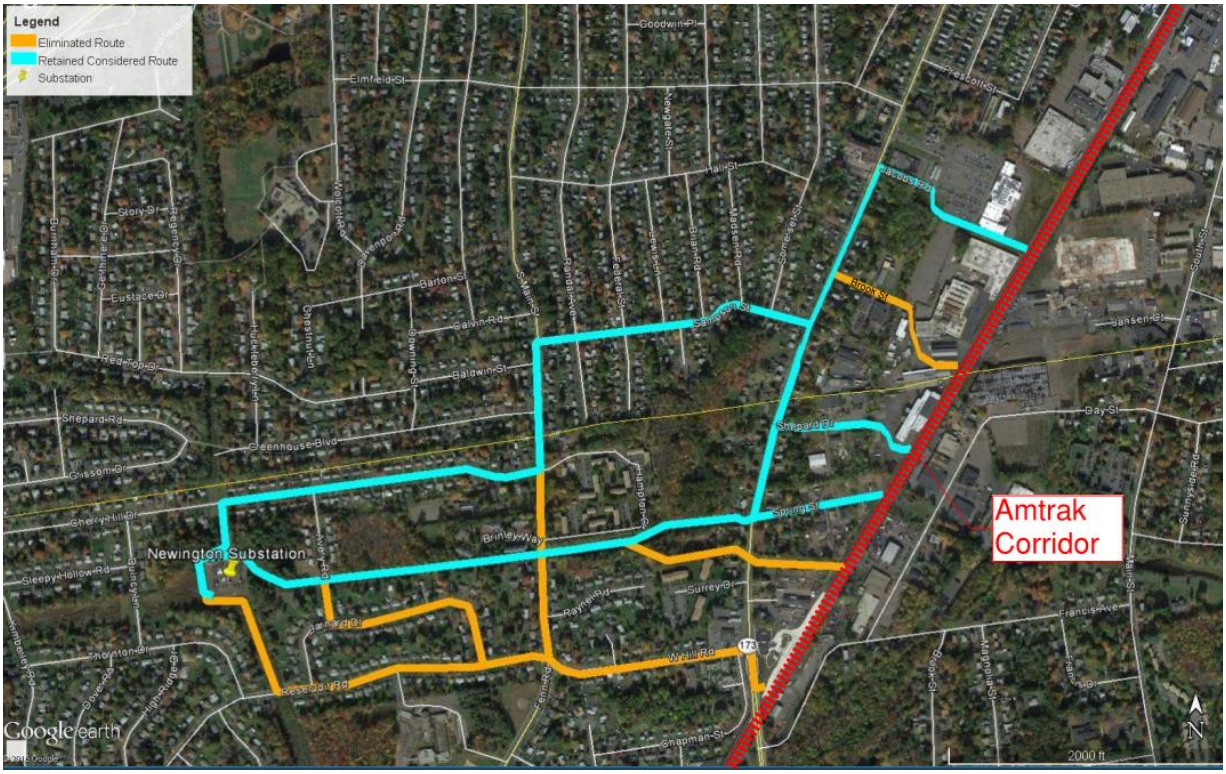
Figure 11-10: Newington Substation to Amtrak ROW: Potential Routes



11.5.2.1 Route Options Considered but Eliminated

After identifying the network of potential routes for the new 115-kV transmission line from Newington Substation to the Amtrak ROW, Eversource conducted initial engineering studies, environmental reviews, and field investigations of each route segment. Based on those analyses, Eversource comparatively quickly eliminated a number of the route options, as illustrated on Figure 11-11.

Figure 11-11: Newington Substation to Amtrak ROW: Routes Considered but Eliminated



For example, all of the routes in the Town of Newington that would traverse south from Newington Substation or south from the Eversource ROW were eliminated from consideration because they would:

- Increase the length of the 115-kV transmission line overall (including through residential areas and along the Amtrak ROW);
- Extend through NRHP districts in Newington; and/or
- Require the placement of a transition structure (for the underground to overhead line) in an unacceptable location (e.g., next to an historic structure) adjacent to the Amtrak/CT*fastrak* corridor.

Other route segments, including the route variation extending underground from the Eversource ROW north along West Hartford Road (South Main Street) in the Town of Newington and the route variation extending from State Route 173 along Brook Street to the Amtrak ROW in the Town of West Hartford, were eliminated from further consideration because they offered no engineering, environmental, or cost advantages compared to other available options. In addition, the route variation along Brook Street would require an easement across a privately owned, presently unoccupied industrial site that is undergoing environmental remediation.

11.5.2.2 Viable Route and Configuration Variations

Eversource conducted more detailed evaluations of each of the 10 remaining route variations between Newington Substation and the Amtrak ROW. Of these 10 variations, six would involve all underground line configurations, while four would combine overhead and underground segments. All of the overhead configurations would be located on Eversource's ROW. For the combined overhead/underground variations, sub-variations were considered for different structure types (vertical single-phase and vertical split-phase).

The detailed evaluations of the 10 variations considered the following:

- Route length;
- Constructability;
- The avoidance or minimization of impacts to land uses, environmental resources, cultural resources, community facilities, transportation, and infrastructure facilities;
- Cost; and
- Input received from municipal and state officials, including the SHPO.

Figure 11-12 illustrates the 10 route variations considered for the new 115-kV line between Newington Substation and the Amtrak ROW. Table 11-4 provides a comparative summary of the characteristics of the variations. For review purposes, the route variations were numbered 1 through 10. Note: Portions of eight of the route variations (numbers 3-10) would be located within the Eversource ROW; each of these variations would entail a different 115-kV line configuration, a different alignment within the ROW in relation to the existing distribution lines, or a different route (after leaving the Eversource ROW) along local streets to reach the Amtrak ROW.

As summarized in Table 11-4 and illustrated on Figure 11-12, all 10 of the route variations would involve an underground line exit from Newington Substation and would consist predominantly of underground configurations. For example, from Newington Substation, Route Variations 1 and 2 would continue underground, extending north along the substation access road to Cherry Hill Drive and thereafter following various local and state road ROWs to the Amtrak corridor.

The remaining eight route variations would include overhead or underground configurations along the Eversource ROW. However, the eastern portion of all eight route variations (from a location within the Eversource ROW just west of State Route 173 [Willard Avenue] to the Amtrak ROW) would be aligned underground to minimize impacts to the Newington Junction North NRHP District.

As a result, using any of the 10 route variations, at the end of the underground segment adjacent to the Amtrak ROW, the 115-kV line design would switch from underground to overhead via a transition structure, which would be situated west of the CT*fastrak* busway. From the transition structure, the 115-kV line would span both the busway and the two Amtrak rail lines, and then would be aligned overhead along the east side of the Amtrak ROW as discussed for the Proposed Route in previous sections of this Application. Additional transition structures would be required for the route variations involving overhead alignments along Eversource's ROW.

After analysis, Eversource determined that the proposed 115-kV line between Newington Substation and the Amtrak ROW could technically be constructed along any of the 10 route variations, using any of the alternative configurations. However, as illustrated on Figure 11-12 and summarized in Table 11-4, Route Variations 1 and 2 (each of which would entail an underground alignment predominantly along residential streets in Newington and West Hartford) were determined to be less preferable because of their comparatively longer length and higher cost, as well as public input regarding concerns about increased impacts to traffic and residences.

All of the remaining eight route variations would align the new 115-kV line along the Eversource ROW from Newington Substation to State Route 173 (Willard Avenue) and, from there, would extend to the Amtrak ROW either along Spring Street or along a combination of State Route 173 (Willard Avenue) and Shepard Drive. All of the eight route variations would be located entirely within the Town of Newington. Near the Eversource ROW, the homes that abut both Willard Avenue and Spring Street are part of the Newington Junction North NRHP District; any of the eight route variations would traverse along roads within this historic district.

Figure 11-12: Viable Route and Configuration Variations Map

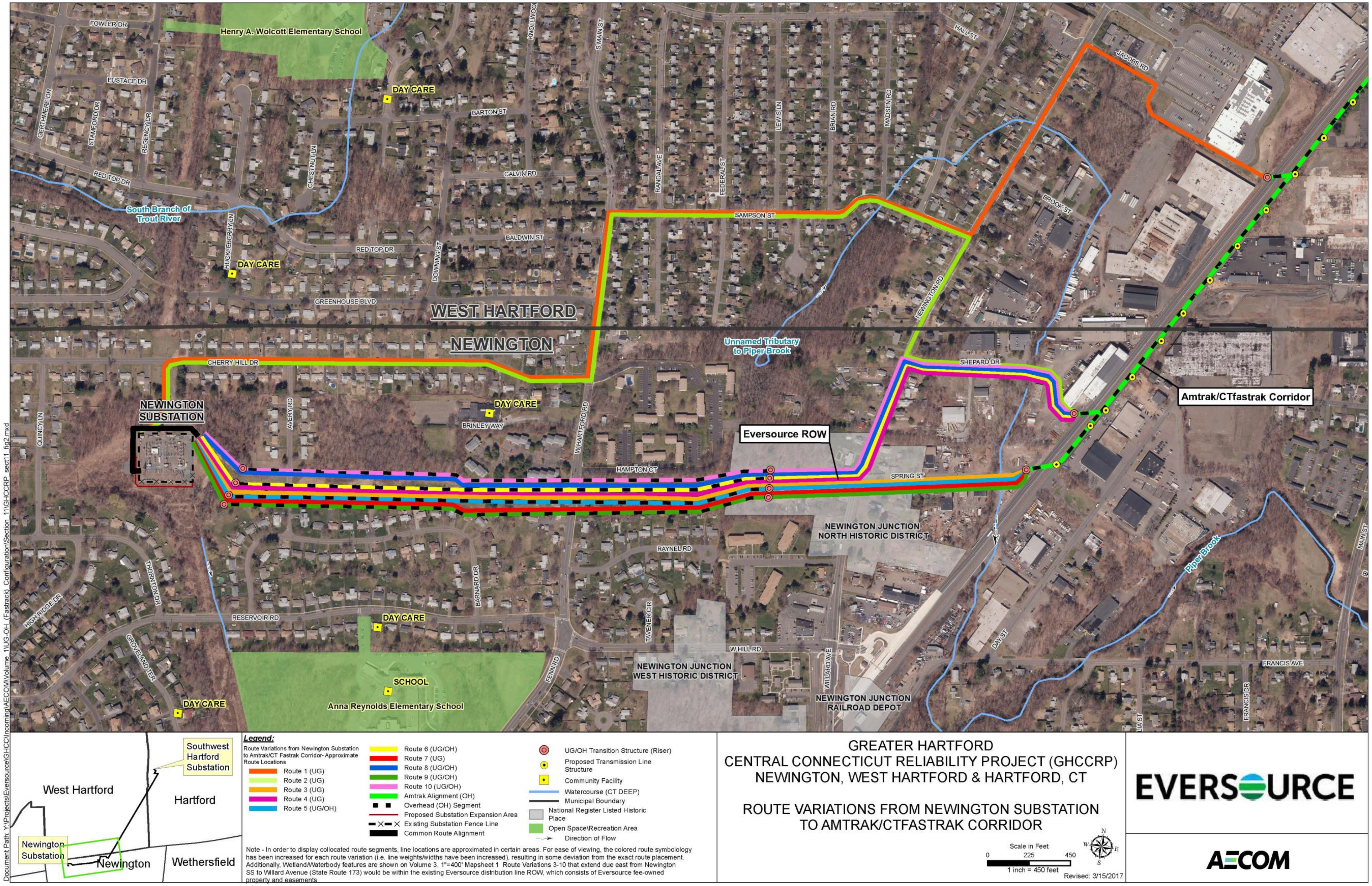


Table 11-4: Newington Substation – Amtrak Route Variation Summary

Variation No.	Transmission Line Configuration (UG, OH)	Miles (UG, OH)			General Description of Route Variation (All routes begin with an underground line exit from Newington Substation and end west of and adjacent to the Amtrak ROW, where the transmission line would transition to overhead)	Typical Land Uses/Characteristics of Route Variation	Comments
		Total	Newington	West Hartford			
Route Variations Not Along Eversource ROW							
1	UG	1.62	0.63	0.99	**Along road ROWs**: Cherry Hill Drive – South Main Street/West Hartford Road* – Sampson Street – State Route 173 (Newington Road)* – Jacobs Road	Single-family residential uses border local and state road ROWs, except along Jacobs Road, where land uses are commercial (shopping plaza, grocery store).	New easements would be required on private property for approximately 0.16 mile of the cable system, near the Amtrak ROW. ***Results of Analysis***: As the longest of the route variations, Route Variation 1 would be the most costly and also would be near the most residences As a result, this option was determined to be less preferable than others, although use of the option would avoid water resource impacts.
2	UG	1.48	0.63	0.85	**Along road ROWs**: Cherry Hill Drive – South Main Street – Sampson Street – State Route 173 (Newington Road) –Shepard Drive	Single-family residential uses border state and local road ROWs (same as for Route Variation 1), except commercial uses are located along Shepard Drive and the route variation would extend across the paved parking lot of an industrial facility near the Amtrak ROW.	New easements would be required on private property for approximately 0.07 mile of the cable system, near the Amtrak ROW. ***Results of Analysis:*** Although slightly shorter than Route Variation 1, Route Variation 2 also would be comparatively more costly than other options and would extend near more residences. The route would avoid impacts to water resources. As a result, Route Variation 2 was determined to be less preferable than other available alignment options
Route Variations Incorporating Use of Eversource ROW							
3	UG	1.00	1.00	0	**Eversource ROW – Spring Street.** The underground cable segment within the Eversource ROW would extend generally along the south side of the existing ROW, south of all five of the distribution circuits and closer to the back yards of residences along Barnard Drive and Raynel Road. The route variation would extend perpendicularly across State Route 173 (Willard Avenue), to Spring Street, a narrow, private road that dead ends at the Amtrak ROW.	Route variation would be aligned for approximately 0.7 mile within Eversource-owned property or distribution line ROW, which is bordered by single-family homes and condominium/townhouse developments. The Eversource ROW is typically 100 feet wide, but Eversource-owned property extends beyond 100 feet in some areas. Five distribution circuits (one underground circuit and four overhead circuits located on two sets of double-circuit wood poles typically 38 feet in height) occupy the ROW. Approximately 0.55 mile of the ROW consists of Eversource property; in some locations, this property is more than 200 feet wide. Outside of the areas occupied by the distribution circuits, where Eversource has managed vegetation growth consistent with overhead electric line operation, most of the Eversource property is wooded (refer to the Volume 3 maps). The route variation would cross State Route 173 (Willard Avenue) and then would be aligned along the privately owned Spring Street (bordered by residential and commercial uses) to the Amtrak ROW. The route variation would extend for approximately 500 feet through the Newington Junction North NRHP district.	Along the Eversource ROW, all existing screening vegetation within the south side of the ROW would be removed for the construction and operation of the underground segment. This would make the existing distribution poles more visible to nearby residents. In addition, construction activities within the Eversource ROW would require temporary work within wetlands and across an intermittent stream. Spring Street, which is not a public road, is narrow and is bordered by residences and businesses. At the intersection with State Route 173, the street abuts several of the historic structures within the Newington Junction North Historic District (a NRHP-listed district). Because Spring Street is a privately owned road, Eversource would have to acquire an easement to install the cable system in the road. Based on Eversource's field investigations, other underground utilities are aligned beneath the road. In total, Route Variation 3 would extend across approximately 0.18 mile of lands across which Eversource would have to acquire such new easements. To connect the underground portion of this variation to the overhead portion of the Proposed Route along the Amtrak ROW, a transition structure would be required at the end of Spring Street (adjacent to the Amtrak ROW) and an additional overhead transmission line structure would be placed along the railroad corridor. Thus, compared to the Proposed Route, this route variation would require 52 new overhead transmission line structures. ***Results of Analyses***: The use of Spring Street for the cable system poses construction challenges and would require the acquisition of easements on private property within or adjacent to the street. Due to the presence of other underground utilities and the narrow width of Spring Street, Eversource anticipates that the entire road would have to be closed during cable system construction. Such a road closure would create impacts for the residents and business owners along Spring Street. In addition, both the transition structure and the additional line structure along the Amtrak ROW directly east of Spring Street would be directly visible from the NRHP district. As a result, this route variation was found to be less preferable than others.

Variation No.	Transmission Line Configuration (UG, OH)	Miles (UG, OH)			General Description of Route Variation (All routes begin with an underground line exit from Newington Substation and end west of and adjacent to the Amtrak ROW, where the transmission line would transition to overhead)	Typical Land Uses/Characteristics of Route Variation	Comments
		Total	Newington	West Hartford			
4	UG	1.17	1.17	0	**Eversource ROW – State Route 173 (Willard Avenue) – Shepard Drive** As described for Route Variation 3, this option also would extend along the south side of the Eversource ROW.	This route variation would be aligned along the Eversource ROW and across the NRHP district as described for Route Variation 3, but at State Route 173 (Willard Avenue), would turn north, continuing in an underground configuration along the state highway to Shepard Drive and then to the Amtrak ROW.	Route Variation 4 would follow the same alignment as Route Variation 3 to State Route 173, but would then diverge north, avoiding an alignment along Spring Street. ***Results of Analysis***: Route Variation 4 would avoid Spring Street and thus would avoid or minimize impacts to private properties and historic structures located adjacent to this private street. However, alignment of the underground cable segment along the south side of the Eversource ROW would result in the removal of all existing screening vegetation, as described for Route Variation 3. As a result, Route Variation 4 was determined to be less preferable than other available alignment options.
5	Hybrid UG/OH	1.00	1.00	0	**Eversource ROW – Spring Street** Overhead configuration along the south side of the Eversource ROW, then underground along Spring Street to the Amtrak ROW. The overhead portion of the route variation would transition to underground approximately 460 feet west of State Route 173 to avoid potential visual effects to the Newington Junction North NRHP district. Approximately 0.6 mile of the route variation would be aligned overhead within the Eversource ROW. Two monopole configuration options were assessed for the overhead portion of the route segment: 5a = Vertical Single Circuit Structures; and 5b = Vertical Split-Phase Structures.[106] Both types of structures would typically be approximately 75 feet in height.	Same as Route Variation 3, except that the transmission line would be configured overhead within most of Eversource's distribution line ROW. This route variation would minimize the potential need to relocate the existing distribution circuits within the Eversource ROW during construction of the overhead line. However, comparatively greater vegetation removal would be required along the south side of the ROW and additional vegetation would likely have to be cleared outside of the ROW due to conductor clearance requirements and/or potential danger/hazard trees.	The use of an overhead configuration within the Eversource ROW would involve temporary impacts to wetlands associated with the installation and use of temporary access roads and work pads for the installation of the new 115-kV structures. In addition, some structures would potentially have to be located in wetlands. Some of the distribution circuits also would have to be temporarily relocated to allow construction of the transmission line, requiring outages on those lines and additional costs. Further, all existing vegetation along the south side of the Eversource ROW would be removed, making the existing distribution circuits and the proposed 115-kV line directly visible to the homes that back up to the ROW along Barnard Road and Raynel Drive. The overhead-to-underground transition site along the Eversource ROW (i.e., 460 feet west of State Route 173) was selected to minimize potential indirect visual impacts associated with views of the transmission line structures from the Newington Junction North NRHP district. Eversource discussed this configuration with a representative of the SHPO during an on-site meeting held in June 2016; the SHPO representative concurred with this approach as a method for minimizing indirect effects on the NRHP district. ***Results of Analysis***: Although this route variation, incorporating an overhead segment and providing the shortest alignment between Newington Substation and the Amtrak ROW, would be comparatively the least costly of the route segment variations, it would result in visual effects associated with the typically 75-foot-tall transmission line structures, placed along the southern side of the Eversource ROW, where all existing brush/tree screening would be removed. In addition, the underground portion of the route variation would result in the same social impacts associated with the closure of Spring Street during construction as described for Route Variation 3. Consequently, Route Variation 5 was determined to be less preferable than other available alignment options.
6	Hybrid UG/OH	1.17	1.17	0	**Eversource ROW – State Route 173 (Willard Avenue) - Shepard Drive** As described for Route Variation 5, approximately 0.6 mile of the route variation would be aligned overhead within the southern side of the Eversource ROW. Two monopole configuration options were assessed for the overhead portion of the route segment: 6a = Vertical Single Circuit Structures; and 6b = Vertical Split-Phase Structures	Same as for Route Variation 5 (overhead portion) and Route Variation 4 (underground portion).	Route Variation 6a or 6b would result in the same impacts along the overhead segment as described for Route Variation 5a/5b. However, the underground segment would be aligned to avoid Spring Street, thus minimizing potential impacts to NRHP-listed structures and avoiding the need to close the privately owned street during construction. ***Results of Analysis***: Although Route Variation 6a/6b would avoid impacts associated with the use of Spring Street, the alignment of the new 115-kV line overhead along the southern side of Eversource's ROW would result in long-term visual impacts (associated with the removal of existing tree screening). In addition, the existing distribution lines would have to be relocated, adding to construction costs. Accordingly, Route Variation 6 was determined to be less preferable than other available alignment options.

[106] Eversource initially investigated the use of H-frame structures, which would be approximately 65 feet in height. However, H-frames would require additional vegetation removal and, given the width of the Eversource ROW and the need to accommodate the new 115-kV line while minimizing impacts to the distribution circuits, were eliminated from consideration.

Variation No.	Transmission Line Configuration (UG, OH)	Miles (UG, OH)			General Description of Route Variation (All routes begin with an underground line exit from Newington Substation and end west of and adjacent to the Amtrak ROW, where the transmission line would transition to overhead)	Typical Land Uses/Characteristics of Route Variation	Comments
		Total	Newington	West Hartford			
7	UG	1.00	1.00	0	**Eversource ROW – Spring Street**. Underground alignment within Eversource property along the north side of the distribution line ROW for the first 1,000 feet east of Newington Substation.	Same as for Route Variation 3, except that alignment along the north side of the Eversource ROW between Newington Substation to west of West Hartford Road would maximize the use of Eversource fee-owned property, which is primarily wooded. The remainder of the underground route would be situated along the south side of the Eversource ROW.	An underground alignment along the north side of the Eversource ROW, generally from Newington Substation to near West Hartford Road, would avoid the removal of screening vegetation along the southern side of the ROW. However, Route Variation 7 would require construction within Spring Street. ***Results of Analysis***: Because Route Variation 7 would require alignment along Spring Street, this route variation was found to be less preferred than others.
8	UG (Proposed Route)	1.17	1.17	0	**Eversource ROW – State Route 173 (Willard Avenue) – Shepard Drive** Underground alignment within Eversource property along the north side of the distribution line ROW for the first 1,000 feet east of Newington Substation.	Route Variation 8 would follow the underground alignment within Eversource's distribution line ROW, as described for Route Variation 7. From the intersection of the Eversource ROW with State Route 173 (Willard Avenue), the variation would follow the same alignment along State Route 173 to Shepard Drive and the Amtrak ROW as described for Route Variation 4.	Route Variation 8 would optimize the route within Eversource's distribution line ROW, maximizing the use of Eversource fee-owned property and avoiding the potential for visual impacts to residences along Barnard Drive and Raynel Road due to the removal of screening vegetation. The underground alignment within the ROW also would minimize effects to the existing distribution circuits, and would avoid visual impacts to the NRHP district and to other nearby residential areas (e.g., townhouse/condominiums located adjacent to the ROW near West Hartford Road). The route variation also would avoid impacts associated with an alignment along Spring Street. ***Results of Analysis***: After considering constructability, cost, environmental, visual, and social factors, Eversource determined that Route Variation 8 was the preferred option for the alignment of the 115-kV line between Newington Substation and the Amtrak ROW. This route variation, which was incorporated as part of the Proposed Route, is discussed in greater detail in Sections 11.5.2.2 and 11.5.2.3.
9	Hybrid UG/OH	1.00	1.00	0	**Eversource ROW – Spring Street** As described for the other hybrid UG/OH options, approximately 0.6 mile of the route variation would be configured overhead within Eversource's ROW. Two monopole configuration options were assessed for the overhead portion of the route segment: 9a = Vertical Single Circuit Structures; and 9b = Vertical Split-Phase Structures	Same as for Route Variation 3	The overhead and underground line segments of Route Variation 9 would pose the same issues as described for the other variations that would entail overhead configurations along the Eversource ROW and an underground configuration along Spring Street. ***Results of Analysis***: For the reasons explained for Route Variations 3, 5, and 7, Route Variation 9 was deemed less preferred than other options that would avoid the use of Spring Street and would avoid visual impacts associated with the overhead line along the Eversource ROW near residential areas.
10	Hybrid UG/OH	1.17	1.17	0	**Eversource– State Route 173 – Shepard Drive** Approximately 0.6 mile of the route variation would be aligned overhead within the Eversource ROW; however, the overhead alignment would be situated along the north side of the distribution line ROW in locations where Eversource owns additional land (beyond the width of the 100-foot-wide ROW) and would switch to the south side of the ROW when additional property is not available to the north. Two monopole configuration options were assessed for the overhead portion of the route segment: 10a = Vertical Single Circuit Structures; and 10b = Vertical Split-Phase Structures	Like the other hybrid UG/OH routes, Route Variation 10 would align a 0.6-mile segment of the route within Eversource's distribution line ROW. However, for this route variation, the overhead segment would be situated to maximize the use of existing, undeveloped Eversource property along the ROW, while avoiding the removal of existing tree screening near residential areas in the Barnard Drive/Raynel Road area.	Route Variation 10 would maximize the use of an overhead configuration, situated within the Eversource ROW/fee-owned land, while minimizing the removal of tree screening near residential areas. The vertical split phase configuration (Route Variation 10b) was selected as preferred to minimize EMF at the edge of the ROW along the overhead segment. In addition, along this route variation, the overhead segment would transition to underground approximately 460 feet west of State Route 173, thereby avoiding an overhead alignment through the Newington Junction North NRHP district. To develop Route Variation 10b along the Eversource ROW, some of the existing distribution circuits would have to be permanently relocated, resulting in increased costs. ***Results of Analysis***: Of the hybrid UG/OH route variations considered, Route Variation 10b was determined to be the most practical, taking into consideration constructability, cost, and environmental factors, as well as the minimization of impacts to the visual environment and to nearby residential areas. Route Variation 10b was selected for further analysis.

Indicates Route Variation considered for further analysis.

Analyses of the remaining eight route variations focused first on a comparison of the use of Spring Street versus Willard Avenue/Shepard Drive for the alignment of the underground cable segment between the eastern end of Eversource's ROW and the Amtrak corridor (these evaluations are summarized in Section 11.5.2.3). After comparative analyses determined that Willard Avenue/Shepard Drive (i.e., part of the Proposed Route) would minimize potential effects to residents, transportation patterns, and the Newington Junction North NRHP District, Eversource then evaluated configuration options (overhead vs. underground) and alignment options (north, south, middle of the ROW) for installing the 115-kV cable within its ROW between Newington Substation and Willard Avenue (refer to Section 11.5.2.4).

11.5.2.3 Comparison of Spring Street vs. Willard Avenue/Shepard Drive Route Variation Segments

Eversource's initial analyses indicated that Spring Street would provide the most direct route between the Eversource and Amtrak ROWs. Consequently, in the Project's December 2015 MCF, this route option was identified as under consideration.

During Eversource's consultations with representatives of the Town of Newington regarding the proposed Project, Newington officials expressed a preference for routes that would be aligned along Spring Street, rather than Willard Avenue/State Route 173 (which has recently been repaved and is a primary local thoroughfare) and Shepard Drive, which is bordered by five buildings of various commercial uses. Spring Street is bordered by six residences, three of which are within the Newington Junction North NRHP District, and four commercial properties devoted to office uses.

As illustrated on Figure 11-12, Route Variations 3, 5, 7, and 9 would extend, in an underground configuration, for approximately 0.17 mile from the eastern end of the Eversource ROW, across Willard Avenue, and then along Spring Street to the Amtrak corridor. In comparison, Route Variations 4, 6, 8, and 10 would traverse along public roads (Willard Avenue for approximately 0.13 mile and Shepard Drive for approximately 0.14 mile) and across a privately-owned industrial parking lot (for approximately 0.07 mile) to reach the Amtrak ROW. As summarized in Table 11-4, the route variations along Spring Street would be approximately 0.17 mile shorter than the Willard Avenue/Shepard Drive route variations, but would pose constructability and other issues, as described further below.

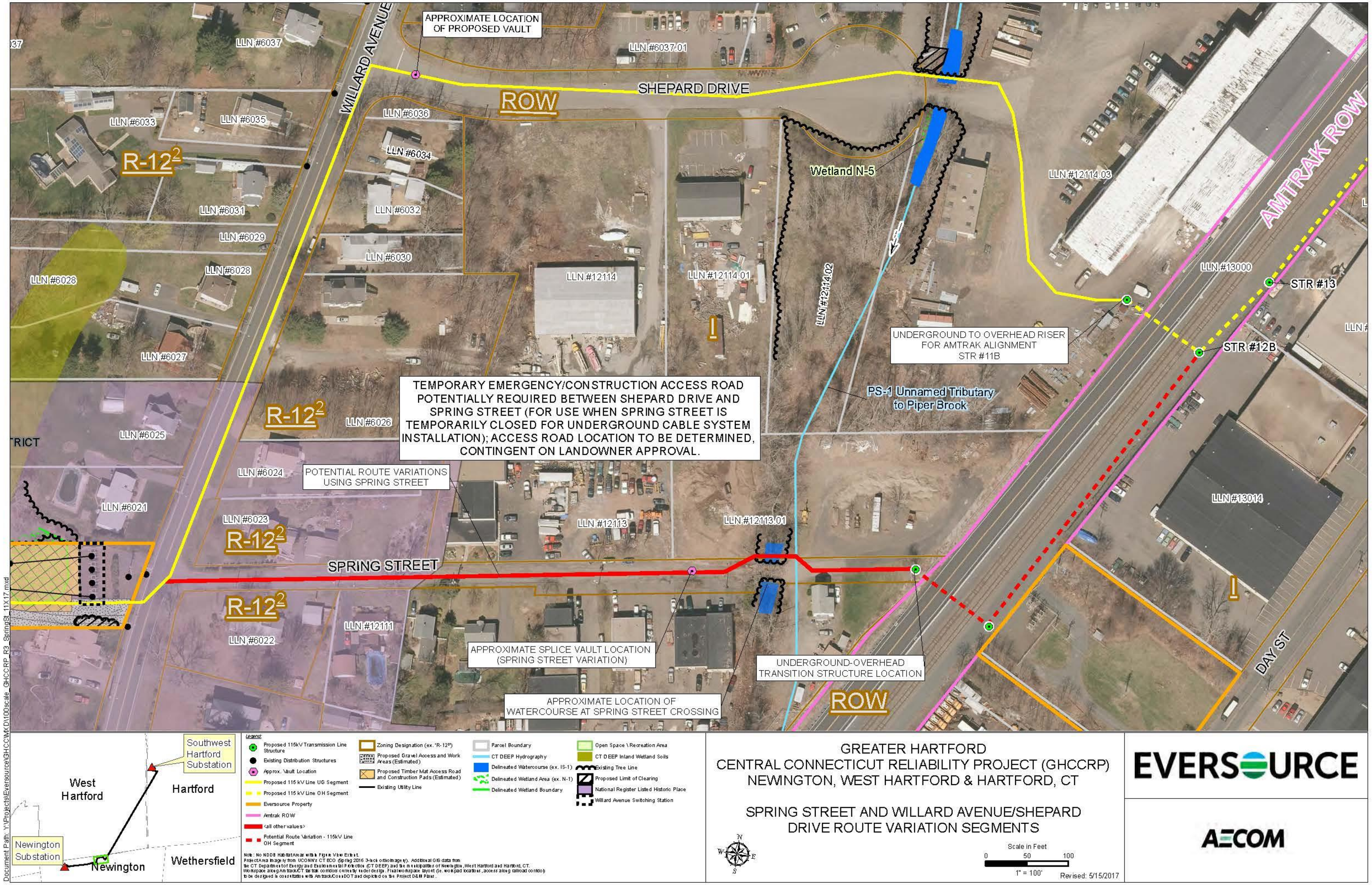
Along any of the four route variations using Spring Street, a transition structure would be required at the end of Spring Street, to convert the 115-kV line from an underground to an overhead configuration. A transmission structure also would need to be located on the eastern side of the Amtrak ROW, generally opposite the Spring Street transition structure. As addressed later in this section, both of these new overhead transmission structures would be directly visible from the Newington Junction North NRHP District. Overall, compared to the Proposed Route along Willard Avenue/Shepard Drive, the use of the Spring Street route variations would require the installation of one additional overhead transmission line structure (for a total of 52 structures instead of 51 structures). Figure 11-13 illustrates the potential cable alignment, potential vault locations, and overhead line structures along the Spring Street route variations compared to the Proposed Route along Willard Avenue/Shepard Drive.

After the submission of the MCF, Eversource conducted further, more detailed real estate and constructability reviews of route variations involving Spring Street. As a result of those analyses, Eversource determined that routes along Spring Street would pose construction, environmental (cultural), and property acquisition challenges.[107]

For example, Spring Street is a narrow (approximately 20-foot-wide), road. Various utilities, including four Eversource distribution circuits, are buried within the road, posing construction issues and making it unlikely that the underground cable system could be collocated entirely beneath the paved road surface. As a result, easements from adjacent property owners would be required. Moreover, although the Town of Newington maintains Spring Street., it has not been accepted into the municipal road system, and appears to be privately owned. Efforts to identify the current owner(s) have so far been unsuccessful. Accordingly, in order to install the cable system within the road, easements would have to be acquired from currently unidentified owners, or the necessary rights would have to be obtained by an eminent domain proceeding against unknown owner(s).

[107] The eight route variations between the Eversource and Amtrak ROWs would all involve one water resource crossing (an un-named perennial tributary to Piper Brook; refer to Figure 11-13). This stream is conveyed beneath both Shepard Drive and Spring Street via culverts; wooded riparian areas abut the stream near both roads. Installation of the cable beneath the stream would be performed using similar construction techniques and would result in similar, minor impacts. Thus, the stream crossing location was not considered a key criterion in the comparison of the route variations.

Figure 11-13: Spring Street and Willard Avenue/Shepard Drive Route Variation Segments



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In addition, because cable system construction typically requires a 30-foot-wide area, Spring Street would need to be closed completely to all traffic in order to install the new 115-kV duct bank and splice vault. This would pose inconveniences to residents and the commercial uses that abut Spring Street. To maintain access for residents and businesses during cable system construction, and for emergency vehicle access, Eversource anticipates that a new, temporary access road (approximately 0.1-0.2 mile in length) would have to be established across private commercial property between Spring Street and Shepard Drive (refer to Figure 11-13). Additional easements from private property owners would be required to construct such a temporary access road.

Lastly, the alignment of the cable system along Spring Street presents issues with respect to cultural resources (historic preservation). Because Spring Street is narrow, excavations for the cable system would be close to historic homes within the Newington Junction North Historic District. In addition, the installation of the transition structure and the additional overhead structure (each approximately 100 feet tall) along the Amtrak ROW would be directly visible from the NRHP district.

In comparison, the four route variations (4, 6, 8, and 10) that would be aligned along Willard Avenue and Shepard Drive do not pose undue construction challenges and would not require any road closures. The use of these route variations would not result in adverse impacts to the NRHP District because the cable system could be aligned along Willard Avenue, which is wider than Spring Street; thus, the cable excavations would be farther from the historic structures in the District. Further, the transition structure at the end of Shepard Drive near the Amtrak ROW would be in an industrial parking lot; views of this structure from the NRHP District would be limited by distance, intervening vegetation, and commercial/industrial buildings. In addition, construction could be scheduled to avoid conflicts with commercial uses along Shepard Drive and to minimize traffic disruptions along Willard Avenue. Further, the affected areas of Willard Avenue/Shepard Drive and the industrial parking lot would be repaved after the installation of the cable system.

As a result, although the Proposed Route along Willard Avenue/Shepard Drive would be slightly longer, it would minimize the need to acquire private property, avoid potential impacts to the Newington Junction North NRHP District, and avoid potentially significant disruptions to residents and businesses. Thus, whereas the cable system could technically be installed along Spring Street, Eversource prefers the Proposed Route.

11.5.2.4 Eversource ROW - Willard Avenue/Shepard Drive – Amtrak ROW Route Variations

From among the four options involving the use of the Eversource ROW and Willard Avenue/Shepard Drive to reach the Amtrak ROW (i.e., Route Variations 4, 6, 8, and 10), two were identified for further evaluation: Route Variation 8 and Route Variation 10b. Route Variation 8 would involve the alignment of the proposed 115-kV line in an all-underground configuration between Newington Substation and the Amtrak ROW, including within the Eversource ROW. In comparison, Route Variation 10b would entail a hybrid underground/overhead configuration between Newington Substation and the Amtrak ROW, involving an approximately 0.6-mile segment of overhead transmission line (in a split-phase vertical monopole configuration) within the Eversource ROW.

Both of these route variations would be aligned within the Eversource ROW to minimize impacts to adjacent land uses and to the five existing distribution lines that occupy the ROW. Compared to Route Variations 8 and 10b, the other eight route variations are each characterized by factors (e.g., comparatively greater cost, construction challenges, potential impacts to the public, need to acquire a greater number of easements on private property, potential direct or indirect impacts to NRHP structures) that make them less preferable.

Overall, Route Variations 8 and 10b were selected for further analysis for the Newington-Amtrak ROW segment because they would:

- Provide a comparatively direct, cost-effective alignment for the proposed 115-kV line between Newington Substation and the Amtrak ROW.
- Maximize the alignment of the new 115-kV line on existing Eversource fee-owned land and easements and limit the route through residential areas.
- Avoid potential visual effects that would be associated with overhead transmission line structures through and near the Newington Junction North NRHP District.

11.5.2.5 Alternative Line Configurations within the Distribution Line ROW: Route Variation 8 vs. 10b

Within the distribution line ROW, Eversource evaluated various configurations for the new line, including different overhead structure types (H-frames; vertical options with split-phase or single-circuit) and different locations for the line, in either overhead or underground configurations, within the ROW (e.g., south vs. north sides of the ROW, middle of the ROW). The key factors in the evaluation of these configurations were to:

- Minimize EMF at the edges of the ROW.
- Avoid or minimize forested vegetation removal (particularly, removal of vegetative buffers between the ROW and residential areas), and adverse effects on landscaping, gardens, driveways, and other encroachments.
- Avoid or minimize permanent impacts to water resources.
- Minimize cost.
- Minimize impacts to the five existing distribution circuits located within the ROW.

All configuration options would:

- Entail an underground line exit from Newington Substation.
- Require construction activities within wetlands N-2, N-3, and N-4 and across an intermittent stream in wetland N-2.
- Minimize visual effects to the Newington Junction North NRHP District by aligning the new line underground through the 0.1-mile segment of the Eversource ROW that traverses the district immediately west of State Route 173 (Willard Avenue).

Considering these factors, the split-phase vertical configuration, which would minimize EMF and the footprint of the 115-kV structures, was selected as the optimal design for an overhead configuration for the new 115-kV line within the Eversource ROW. The underground line configuration within the Eversource ROW would be the same as for the other underground portions of the Project (i.e., XLPE cable).

Considering the routing objectives, the alignment of each configuration within the Eversource ROW was optimized to minimize potential impacts and costs, with Route Variations 8 and 10b selected for further consideration, as follows:

- **All-underground configuration (Route Variation 8, selected as part of the Proposed Route).** This option would be aligned north of the distribution line circuits for approximately 0.2 mile, from Newington Substation, across Avery Road, to near the eastern end of the Eversource property north of Barnard Road. In this area, the ROW is approximately 200 feet wide (refer to XS-1 and XS-2 in Volume 3). For the remaining 0.1 mile east to West Hartford Road, the ROW narrows to about 100 feet; as a result, along this segment, the underground 115-kV line would be located between the two existing overhead distribution lines (refer to XS-3). East of West Hartford Road, the 115-kV line would be situated along the southern side of the ROW, south of the distribution lines, to State Route 173 (Willard Avenue) (refer to XS-4 and -5).

  Two splice vaults, both planned for upland locations on Eversource property, would be required along the underground segment: these preliminary vault locations are west of Avery Road and west of wetland N-3. (A third splice vault, planned for an upland location along Shepard Drive, would also be needed and may require an easement on private property.) Along portions of the ROW, the existing overhead distribution poles would have to be temporarily relocated during the installation of the new 115-kV underground cable. After the completion of cable construction, the distribution circuits would be returned to approximate pre-construction locations.

- **Underground/overhead (with split-phase) configuration (Route Option 10b).** This option would exit Newington Substation underground, but would transition to an overhead configuration, consisting of split-phase monopoles approximately 75 feet tall, immediately northeast of the substation fence, on Eversource property. Overall, approximately 0.4 mile of the line along the Eversource ROW would be configured overhead. Cross-sections depicting this hybrid configuration are included in Appendix 11A, located at the end of this section.

  In the split-phase overhead design, the 115-kV line would be aligned east, across Avery Road, along the northern portion of the ROW, for approximately 0.2 mile. Along this segment (refer to Vertical Option 10b, XS-1 and XS-2 in Appendix 11A), the existing distribution circuits would not be affected by the 115-kV line. However, just west of the Eversource-owned property (where the ROW narrows to 100 feet in width), the overhead 115-kV line would span the distribution line circuits to cross to the middle of the ROW, occupying the approximate area presently used for the southern-most distribution line poles.

  From this point to the end of the overhead segment (approximately 0.3 mile), the two existing distribution lines would be permanently relocated to the northern portion of the ROW and rebuilt using aerial spacer cable (refer to Vertical Option 10b, XS-3, -4, and -5). This would minimize additional forested vegetation clearing. Approximately 0.1 mile west of State Route 173 (Willard Avenue), the overhead line would transition to an underground configuration to minimize indirect impacts on the Newington Junction North NRHP district (refer to XS-6).

Both route variations were analyzed in detail based on the results of constructability reviews, wetland delineations, cultural resource studies, and consistency with the routing objectives.

The detailed analyses of Route Variation 8 (which was selected as part of the Proposed Route) are reflected in this Application and illustrated on the Volume 3 maps. Eversource conducted similar analyses for Route Variation 10b, including evaluations of potential transmission line structure sites and potential impacts associated with line installation (e.g., relocations of existing distribution lines, effects on water resources). Appendix 11A includes aerial-based maps that illustrate the potential locations of transmission line structures, work pads, and access roads for the installation of the 115-kV line using Route Variation 10b.

11.5.2.6 Newington Substation to Amtrak ROW Route Selection

The proposed 115-kV line could feasibly be installed within the Eversource ROW using either Route Variation 8 or Route Variation 10b. However, each route option has trade-offs in terms of potential environmental effects, visual impacts to nearby residences and to the Newington Junction North NRHP district, cost, and consistency with typical Eversource policies regarding the proposed use of underground vs. overhead configurations within existing ROWs, particularly when sufficient space is available for an overhead line design.

Based on the detailed review of the two route options, Eversource identified Route Option 8, the all-underground route within the Eversource ROW, as the preferred Newington Substation to Amtrak ROW segment of the Proposed Route. The key factors in the decision were:

- The initial Project plans and the MCF offered an all-underground route, including through residential areas. Route Variation 8 is thus consistent with the expectations of neighborhood residents.
- Route Variation 8 would minimize vegetation clearing, impacts to wetlands, and would result in no long-term change to the visual environment, particularly in the vicinity of the Newington Junction North NRHP District.
- Route Variation 10b would require more extensive and costly distribution line relocation work within the Eversource ROW.
- Route Variation 10b would require more forested vegetation clearing.
- As a result of the additional costs associated with permanent distribution line relocations that would be required to implement Route Variation 10b, the estimated cost of Route Variation 8 is slightly less than the overhead alternative.

Table 11-5 compares the portions of the two route variations along the Eversource ROW (the eastern portion of both variations, including State Route 173 (Willard Avenue) to Shepard Drive to the Amtrak ROW, would be the same).

Table 11-5: Summary Comparison: Route Variations 8 and 10b, Eversource ROW: East of Newington Substation to State Route 173 (Willard Avenue)

Feature/Characteristic	Route Option 8 (All Underground)	Route Option 10b (Underground/Overhead)
Miles, by Configuration^		
• Underground	0.6	0.08
• Overhead	0	0.52
• Total	0.6	0.6
Number of Splice Vaults	3	0
Number/Height of Split-Phase Structures	0	13 (Typical height = 75 feet)
Number/Height of Transition Structures	0	2 (90 feet and 55 feet)
Streams (Number/Type Crossed)	1 (intermittent)	1 (intermittent)
Wetlands		
• Number crossed	3 (Wetlands N-2, N-3, N-4)	3 (Wetlands N-2-N-3, N-4)
• Direct Temporary Impacts (acres)	0.43	0.26
• Permanent Impacts (fill) (acres)	0	0.01 (5 transmission line structures)
• Secondary Impacts: Forest Conversion to Shrubland (acres)	0.24	0.48
Total Forested Wetland Impacts (acres)	**0.67**	**0.75**
Upland Forest Clearing (acres)	**1.25**	**1.49**
Archaeological Resources	No adverse effects anticipated	No adverse effects anticipated
Historic Resources: Newington Junction North NRHP District (ROW crosses 0.12 mile through district)	No Impacts: all underground	0.04 mile overhead to transition structure; 0.08 mile underground to Willard Avenue
Estimated Construction Cost ($ Millions, 2017)		
• New 115-kV line (Newington to Southwest Hartford substations)	$18.83*	$17.76**
• Distribution Line Relocations along Eversource ROW	$0.66 (Temporary pole relocation)	$2.65 (Permanent pole relocation)
• Estimated Real Estate Costs	$0.29	$0.29
Total 3.70-mile transmission line cost (Excluding Eversource overheads/loaders)	**$19.78**	**$20.71**

^ For both route variations, mileage includes underground line exit from Newington Substation (0.18 mile) and 0.08 mile underground section near State Route 173.

* Cost estimates are for line as proposed.

** Cost estimates are for line as proposed except for overhead alignment as described for Route Variation 10b.

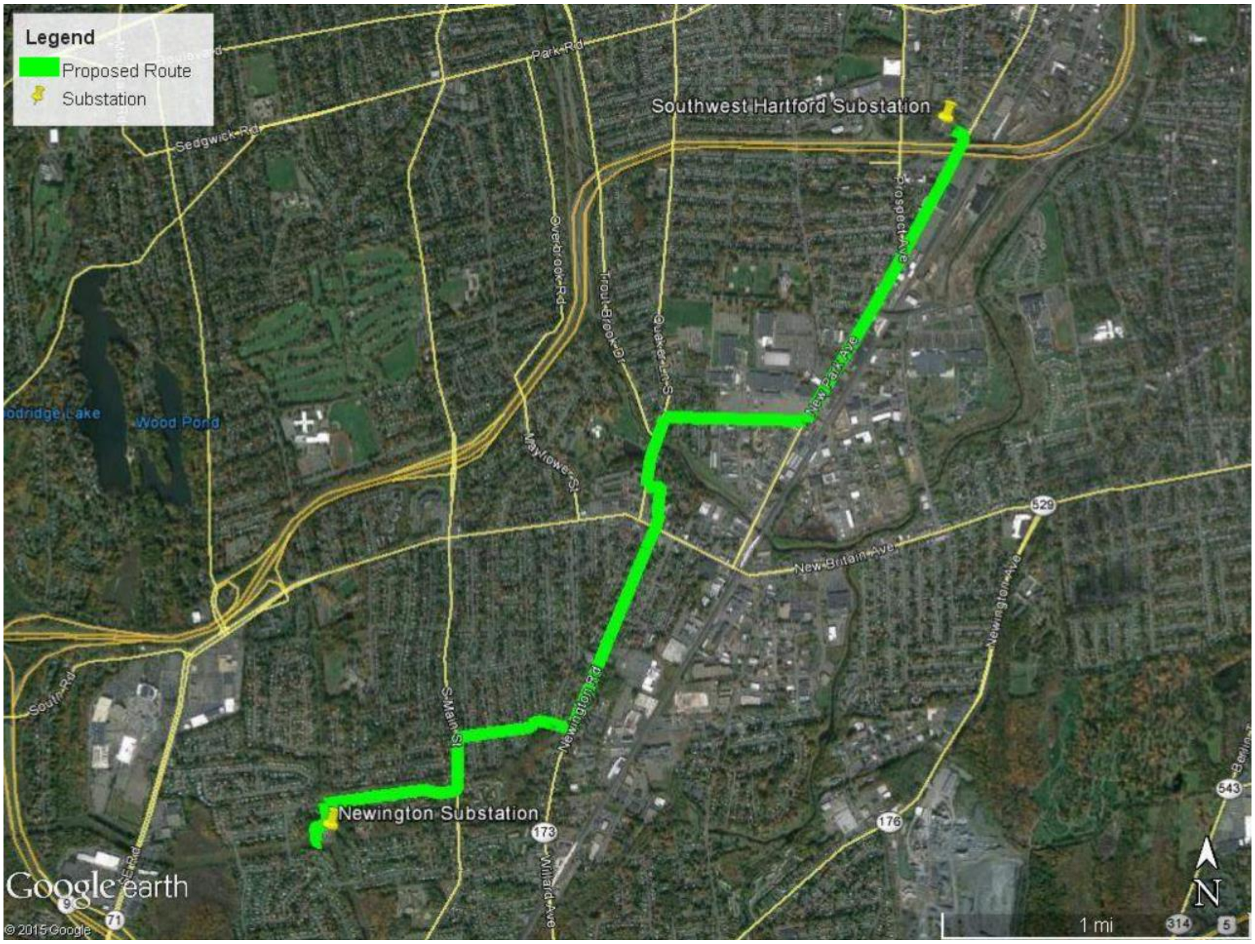
11.6 ALL-UNDERGROUND ROUTE ALTERNATIVE (NOT UTILIZING THE AMTRAK ROW)

In addition to the Proposed Route involving an overhead configuration along the Amtrak ROW with segments of underground cable connecting the route segment along the railroad ROW to the Newington and Southwest Hartford substations, Eversource conducted extensive investigations of routes for the new 115-kV line between Newington and Southwest Hartford substations that would not entail the use of the Amtrak ROW. In fact, until more detailed evaluations of the width of the Amtrak ROW and comprehensive discussions with Amtrak revealed the potential for the new line to be installed overhead along the railroad ROW, Eversource had assumed that the new 115-kV line would have to be configured underground, primarily along road ROWs, through the densely developed suburban/urban Project study area. Accordingly, in December 2015, Eversource issued a MCF that included as the then-Proposed Route, an all-underground alignment for the new transmission line.

Eversource identified this all-underground route after evaluation of a number of different route segments involving alignments along different ROWs in the Project study area (refer to Figure 11-2). The all-underground route was specifically selected because it would minimize the length of the 115-kV cable system, maximize the use of existing ROWs, and avoid or minimize impacts to environmental resources, land uses, cultural resources, and the public. Further, the identified all-underground route incorporated the results of 2015 consultations with the towns of Newington and West Hartford.

As illustrated on Figure 11-14, the all-underground route would extend for approximately 3.8 miles between Newington and Southwest Hartford substations. As described for the underground segments of the Proposed Route, the cable system would consist of single-circuit XLPE cable, contained within a concrete-encased duct bank (consisting of several PVC conduits), as well as concrete splice vaults, which would be buried at intervals of approximately 1,800 feet to 2,000 feet along the route. Each splicing location would require a single vault to accommodate splicing of all three phases of the circuit.

Figure 11-14: All-Underground Route Alternative (in Road ROWs)



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 distributed temperature sensing (DTS) to monitor 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.

The all-underground cable system would be located principally within or adjacent to public roads and would be installed across Trout Brook adjacent to South Quaker Lane in West Hartford. Eversource anticipated that the cable would be installed beneath Trout Brook using an open-cut method. Overall, the all-underground route alternative 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. The route would be aligned within or adjacent to 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

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).

The installation of the new 115-kV line entirely underground would be significantly more costly than the hybrid overhead/underground configuration along the Proposed Route. Apart from this cost differential, the all-underground route would extend through substantially more residential areas. Table 11-6 provides a summary comparison of the all-underground route and the Proposed Route for the new 115-kV line.

Table 11-6: Comparison of All-Underground Route Alternative and Proposed Route

Route Feature/ Characteristics	All-Underground Route	Proposed Route
Length, Total	3.8 miles	3.70 miles
Length, by Municipality		
• Newington	0.7 mile	1.33 miles
• West Hartford	2.6 miles	1.64 miles
• Hartford	0.5 mile	0.73 mile
Length (approx.), by ROW Type		
• Eversource ROW/Property	0.14 mile	0.82 mile
• Amtrak ROW	0	2.37 miles
• State Route 529 (New Britain Avenue)	0.02 mile	0
• State Route 173 (Willard Avenue/Newington Road)	0.69 mile	0.14 mile
• Municipal Road ROWs	2.95 miles	0.36 mile
Water Resource Crossings		
• Watercourse crossings (number, name)	2: unnamed tributary to Piper Brook and Trout Brook (open cut)	3: intermittent stream; unnamed tributary to Piper Brook (UG crossings) and Trout Brook (OH span along Amtrak ROW)
• Wetland crossings (number)	None	3 crossings (Wetland N-2, N-3, N-4)
Construction, Operation, & Maintenance Considerations		
• Transportation considerations	Varying traffic volumes; work schedule would require coordination with state and municipal highway authorities	Coordination with Amtrak and ConnDOT regarding construction schedule and maintenance of rail/bus service
• Accessibility	Road ROWs all accessible	Utility, road, and railroad corridors all readily accessible
Land Use		
Principal Land Use Adjacent to ROW	Residential Development; Commercial/industrial Uses along Talcott Road, New Park Avenue and near I-84	Residential Development; Commercial/Industrial Development along Amtrak ROW and near I-84
Cultural Resources		
NRHP Districts	0	Newington Junction North NRHP District (UG segment)
Community Facilities		
Facilities (adjacent)	Elmwood Community Center, West Hartford	None
Construction Cost (2017 $)		
Transmission Line*	$75 million	$43.2 million

* Excludes substation and Newington Tap modifications, which would be the same for either route alternative.

<u>Route Variation to the All-Underground Route Using Eversource Distribution Line ROW.</u> Whereas the all-underground route, as identified in the MCF and shown on Figure 11-13, would be aligned principally along road ROWs, Eversource also investigated the option of aligning a portion of the all-underground route along its existing distribution line ROW that extends east from Newington Substation to State Route 173. The use of this ROW would avoid cable system installation within residential streets, such as Cherry Hill Drive.

Accordingly, the all-underground route could be installed underground within this Eversource ROW, as is planned for the Proposed Route (i.e., Route Variation 8). Similarly, the 115-kV line could be developed in an overhead configuration along this ROW, as described for Route Variation 10b (refer to Section 11.5.2.3). However, the use of the Eversource ROW as part of the all-underground 115-kV line route would not appreciably reduce the length or cost of this transmission line alternative.[108]

11.7 JUSTIFICATION FOR THE SELECTION OF THE PROPOSED ROUTE AND LINE DESIGN

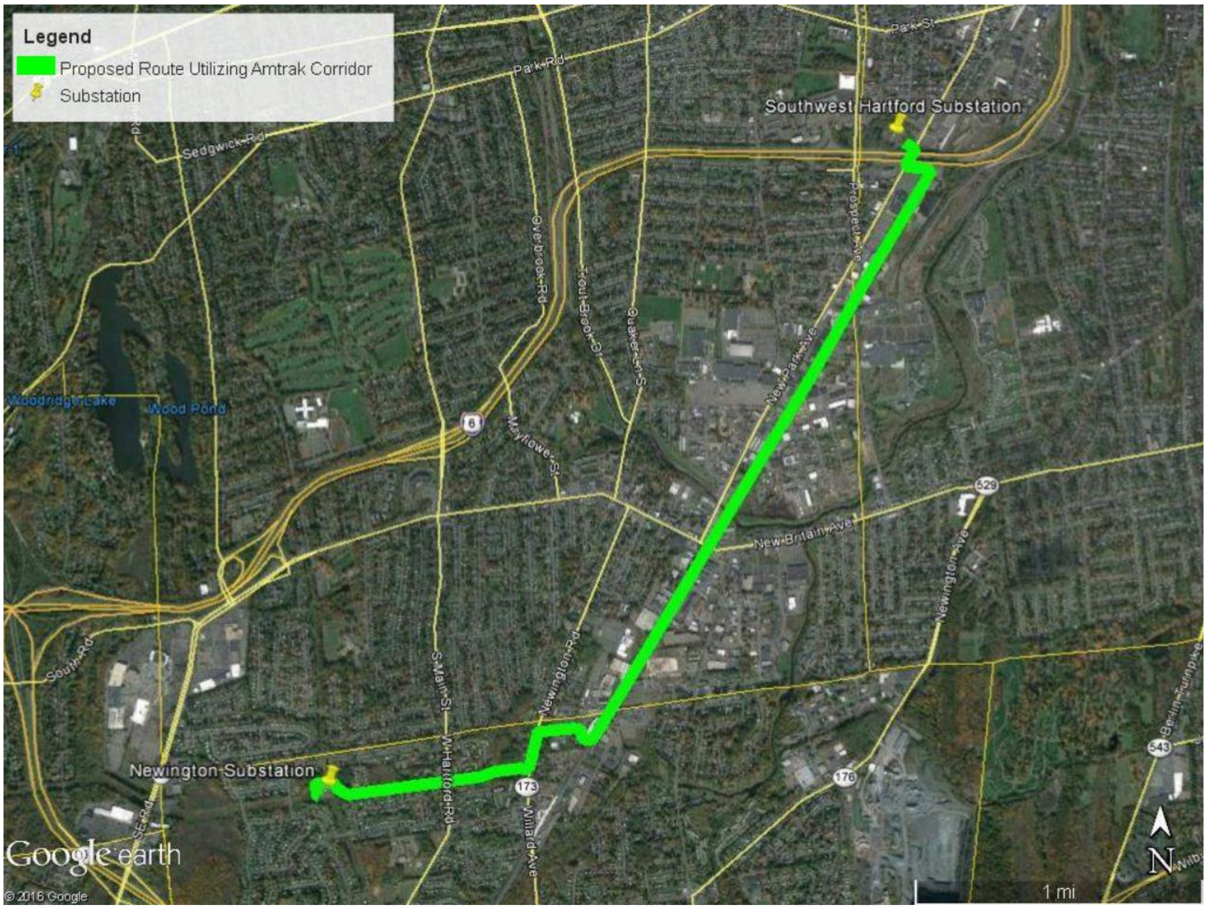
After considering various alternative technologies and routes for the new 115-kV line, Eversource identified a combination underground/overhead line as the preferred configuration and the use of existing Eversource, Amtrak, and road ROWs as the preferred alignment for the new 115-kV line between Newington and Southwest Hartford substations (refer to Figure 11-15). The Proposed Route and 115-kV line configuration meet all Project objectives, while avoiding or minimizing environmental and cultural impacts and providing a cost-effective solution.

The development of the Project, as proposed, would result in substantial cost savings to customers, without causing any significant impacts to environmental resources, land uses, or cultural resources. As a result, despite the Project's location in an urban/suburban area, due to the availability of the Amtrak ROW, the use of the more costly all-underground cable system alternative is not warranted.

[108] Alignment of the new 115-kV line in an overhead configuration along the Eversource ROW would pose the same concerns as identified for Route Alternative 10b and, due to the distribution line relocations that would be required, would not represent any cost advantages over an underground alignment.

The cost of an all-underground cable system would be substantially more than the hybrid underground/overhead configuration for the new 115-kV line that Eversource proposes, with a majority of the line located overhead along the Amtrak ROW. In particular, the construction cost for the new transmission line using the all-underground configuration and route is estimated at $75 million, significantly more than the $44.4 million estimated cost for the construction of the transmission line portion of the Project as proposed.

Figure 11-15: Proposed Route



The Proposed Route and hybrid underground/overhead line design represent the optimal Project configuration because the proposed transmission line route:

- **Maximizes the Use of Existing ROWs and Limits the Need to Acquire Additional Property for Utility Use.** The new 115-kV line would be located primarily within existing Eversource, Amtrak, and road ROWs, thus maximizing the use of existing linear corridors in the Project area. The co-location of the new line within these existing ROWs also would be consistent with federal policies regarding linear energy facility siting, as well as with Eversource objectives.

- **Minimizes Environmental and Land Use Effects.** Although unavoidable temporary effects and minor long-term impacts to site-specific environmental resources would occur as a result of the construction and operation of the proposed 115-kV transmission line, the development of the Project along existing utility and transportation corridors would be consistent with state and local land use policies and would minimize long-term adverse environmental impacts to the maximum extent practical.
- **Achieves a Reliable, Operable, and Cost-Effective Solution.** The Proposed Route and underground/overhead line design represent a cost-effective solution for a new 115-kV line in the densely developed Newington, West Hartford, and Hartford area. The proposed Project minimizes costs to Connecticut consumers and offers the optimal solution to the defined 115-kV issues in the Greater Hartford – Central-Connecticut Sub-area.

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APPENDIX 11A

ROUTE VARIATION 10b: MAPS AND CROSS-SECTIONS

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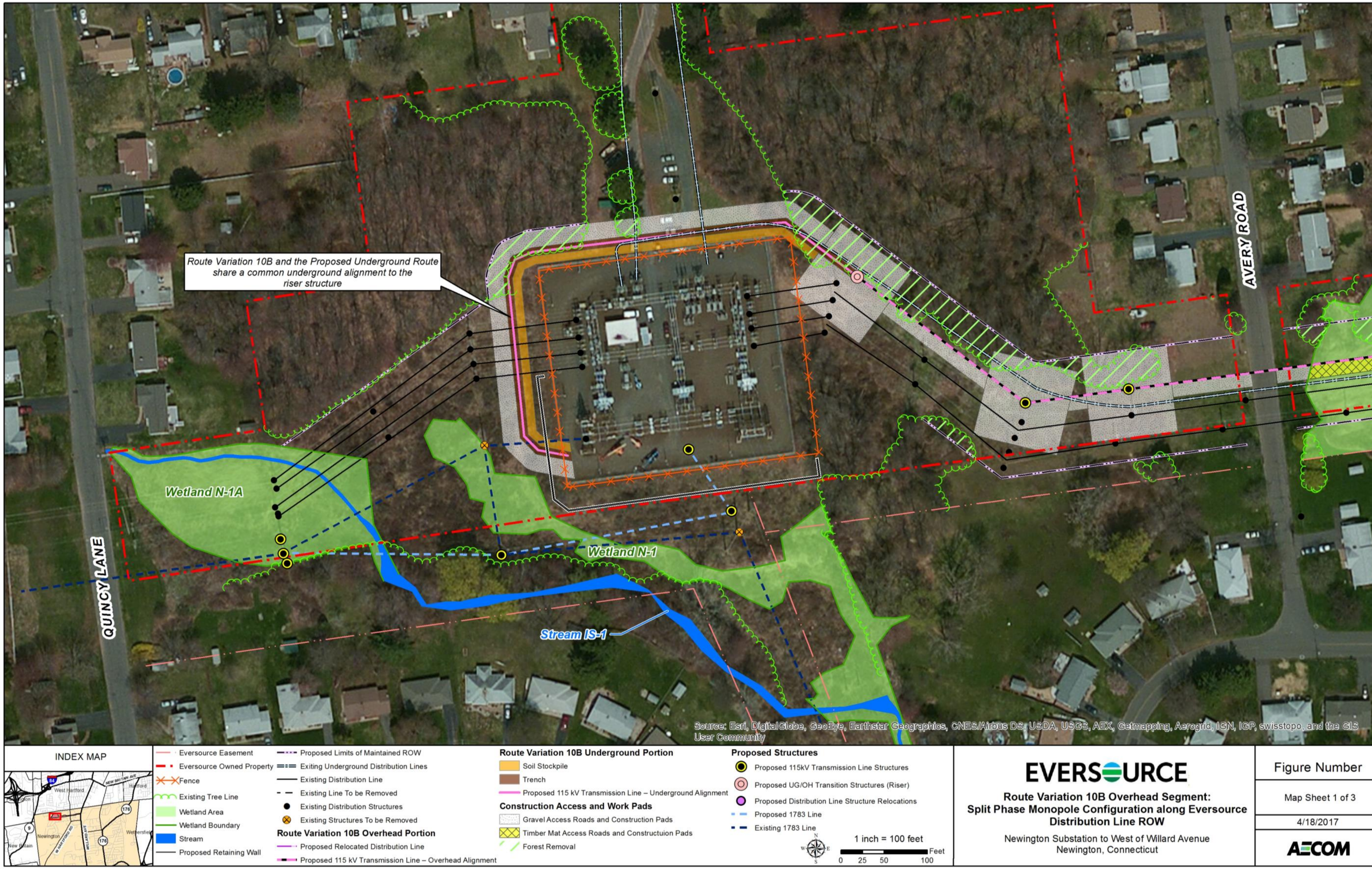
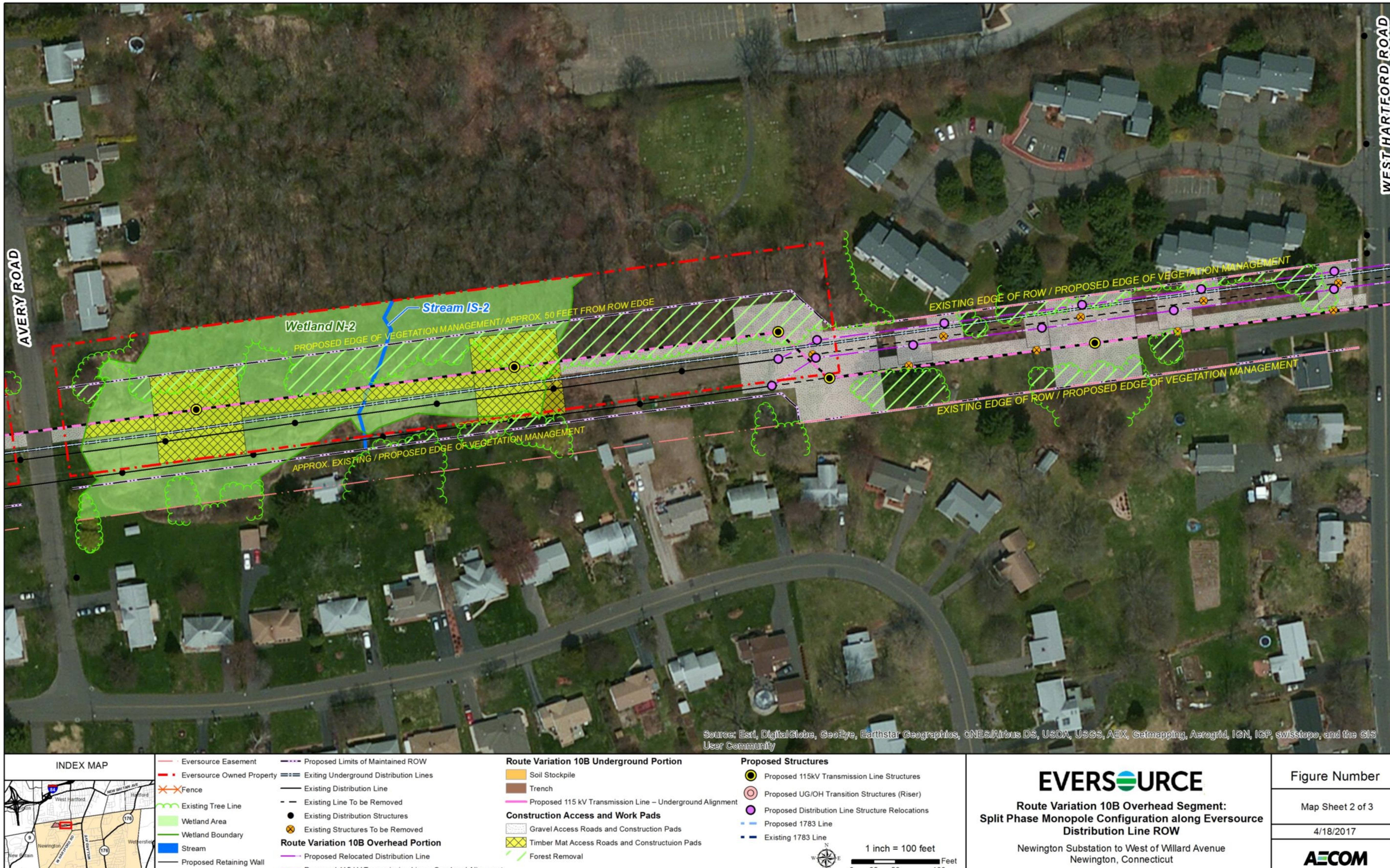
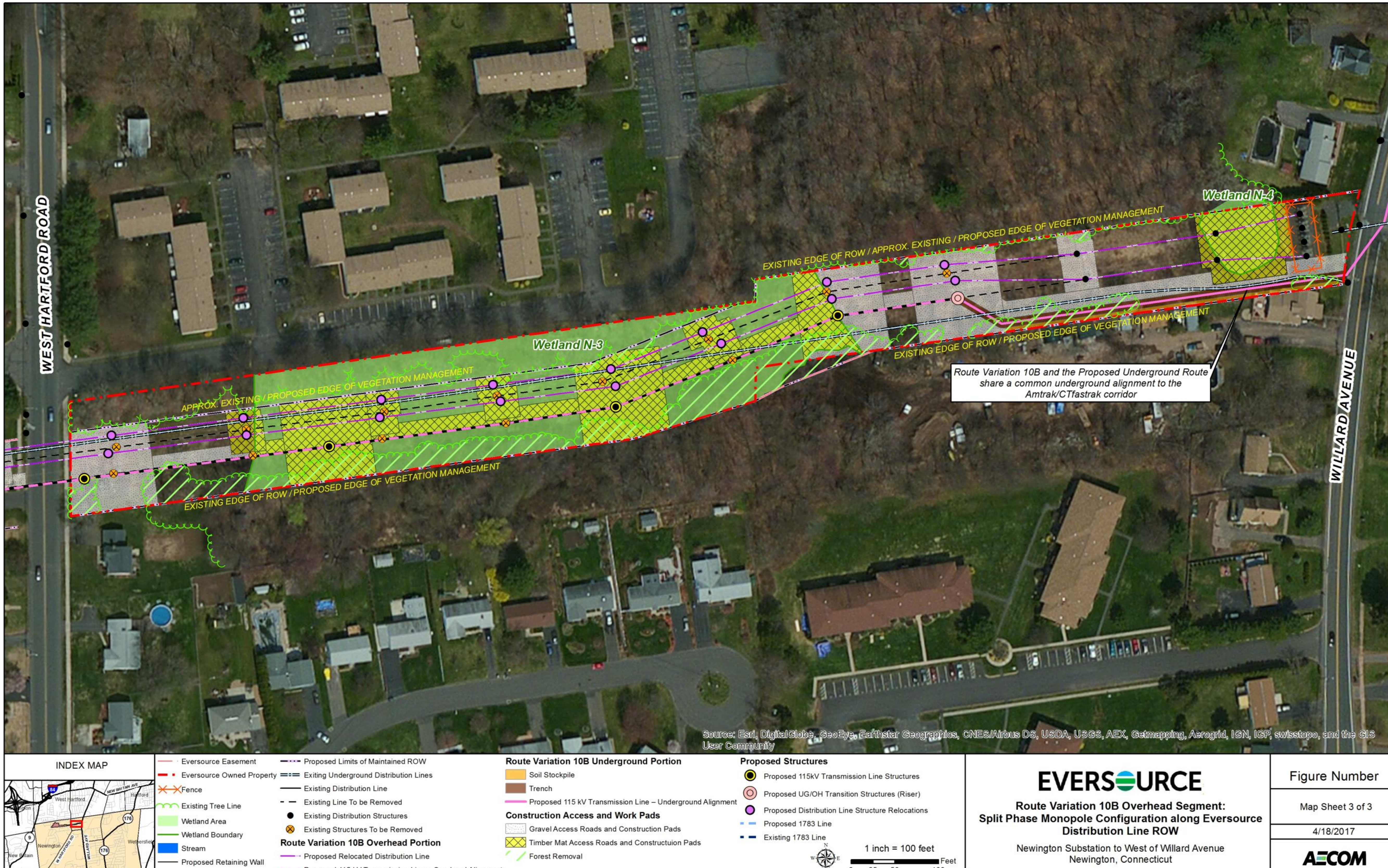

Route Variation 10B and the Proposed Underground Route share a common underground alignment to the riser structure
AVERY ROAD
QUINCY LANE
Wetland N-1A
Wetland N-1
Stream IS-1
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
INDEX MAP
Eversource Easement
Eversource Owned Property
Fence
Existing Tree Line
Wetland Area
Wetland Boundary
Stream
Proposed Retaining Wall
Proposed Limits of Maintained ROW
Exiting Underground Distribution Lines
Existing Distribution Line
Existing Line To be Removed
Existing Distribution Structures
Existing Structures To be Removed
Route Variation 10B Overhead Portion
Proposed Relocated Distribution Line
Proposed 115 kV Transmission Line – Overhead Alignment
Route Variation 10B Underground Portion
Soil Stockpile
Trench
Proposed 115 kV Transmission Line – Underground Alignment
Construction Access and Work Pads
Gravel Access Roads and Construction Pads
Timber Mat Access Roads and Constructuion Pads
Forest Removal
Proposed Structures
Proposed 115kV Transmission Line Structures
Proposed UG/OH Transition Structures (Riser)
Proposed Distribution Line Structure Relocations
Proposed 1783 Line
Existing 1783 Line
1 inch = 100 feet
0 25 50 100
Feet
EVERSOURCE
Route Variation 10B Overhead Segment:
Split Phase Monopole Configuration along Eversource Distribution Line ROW
Newington Substation to West of Willard Avenue
Newington, Connecticut
Figure Number
Map Sheet 1 of 3
4/18/2017
AECOM


AVERY ROAD
WEST HARTFORD ROAD
Stream IS-2
Wetland N-2
PROPOSED EDGE OF VEGETATION MANAGEMENT/ APPROX. 50 FEET FROM ROW EDGE
APPROX. EXISTING / PROPOSED EDGE OF VEGETATION MANAGEMENT
EXISTING EDGE OF ROW / PROPOSED EDGE OF VEGETATION MANAGEMENT
EXISTING EDGE OF ROW / PROPOSED EDGE OF VEGETATION MANAGEMENT
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
INDEX MAP
West Hartford
Hartford
NEW BRITAIN AVE
Newington
New Britain
Wethersfield
W HARTFORD RD
WILLARD AVE
Eversource Easement
Eversource Owned Property
Fence
Existing Tree Line
Wetland Area
Wetland Boundary
Stream
Proposed Retaining Wall
Proposed Limits of Maintained ROW
Exiting Underground Distribution Lines
Existing Distribution Line
Existing Line To be Removed
Existing Distribution Structures
Existing Structures To be Removed
Route Variation 10B Overhead Portion
Proposed Relocated Distribution Line
Proposed 115 kV Transmission Line – Overhead Alignment
Route Variation 10B Underground Portion
Soil Stockpile
Trench
Proposed 115 kV Transmission Line – Underground Alignment
Construction Access and Work Pads
Gravel Access Roads and Construction Pads
Timber Mat Access Roads and Constructuion Pads
Forest Removal
Proposed Structures
Proposed 115kV Transmission Line Structures
Proposed UG/OH Transition Structures (Riser)
Proposed Distribution Line Structure Relocations
Proposed 1783 Line
Existing 1783 Line
1 inch = 100 feet
0 25 50 100 Feet
EVERSOURCE
Route Variation 10B Overhead Segment:
Split Phase Monopole Configuration along Eversource Distribution Line ROW
Newington Substation to West of Willard Avenue
Newington, Connecticut
Figure Number
Map Sheet 2 of 3
4/18/2017
AECOM


WEST HARTFORD ROAD
WILLARD AVENUE
Wetland N-3
Wetland N-4
EXISTING EDGE OF ROW / APPROX. EXISTING / PROPOSED EDGE OF VEGETATION MANAGEMENT
APPROX. EXISTING / PROPOSED EDGE OF VEGETATION MANAGEMENT
EXISTING EDGE OF ROW / PROPOSED EDGE OF VEGETATION MANAGEMENT
EXISTING EDGE OF ROW / PROPOSED EDGE OF VEGETATION MANAGEMENT
Route Variation 10B and the Proposed Underground Route share a common underground alignment to the Amtrak/CTfastrak corridor
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
INDEX MAP
West Hartford
New Britain Ave
Hartford
Newington
W Hartford Rd
Willard Ave
Wethersfield
New Britain
Eversource Easement
Eversource Owned Property
Fence
Existing Tree Line
Wetland Area
Wetland Boundary
Stream
Proposed Retaining Wall
Proposed Limits of Maintained ROW
Exiting Underground Distribution Lines
Existing Distribution Line
Existing Line To be Removed
Existing Distribution Structures
Existing Structures To be Removed
Route Variation 10B Overhead Portion
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Route Variation 10B Overhead Segment: Split Phase Monopole Configuration along Eversource Distribution Line ROW
Newington Substation to West of Willard Avenue
Newington, Connecticut
Figure Number
Map Sheet 3 of 3
4/18/2017
AECOM

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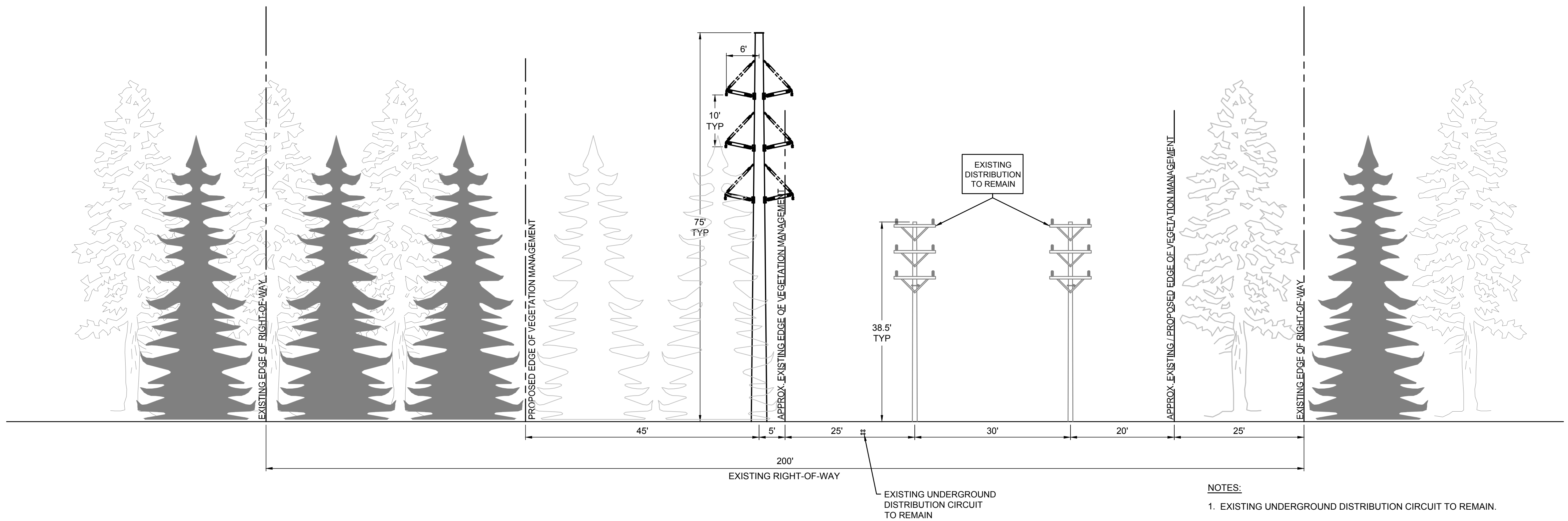
DISTRIBUTION ROW ROUTE
ROUTE 10B
CROSS SECTION 1: NEAR NEWINGTON S.S. TO AVERY ROAD
IN THE TOWN OF NEWINGTON
LOOKING EAST
(0.03 MILES)



NOTES:

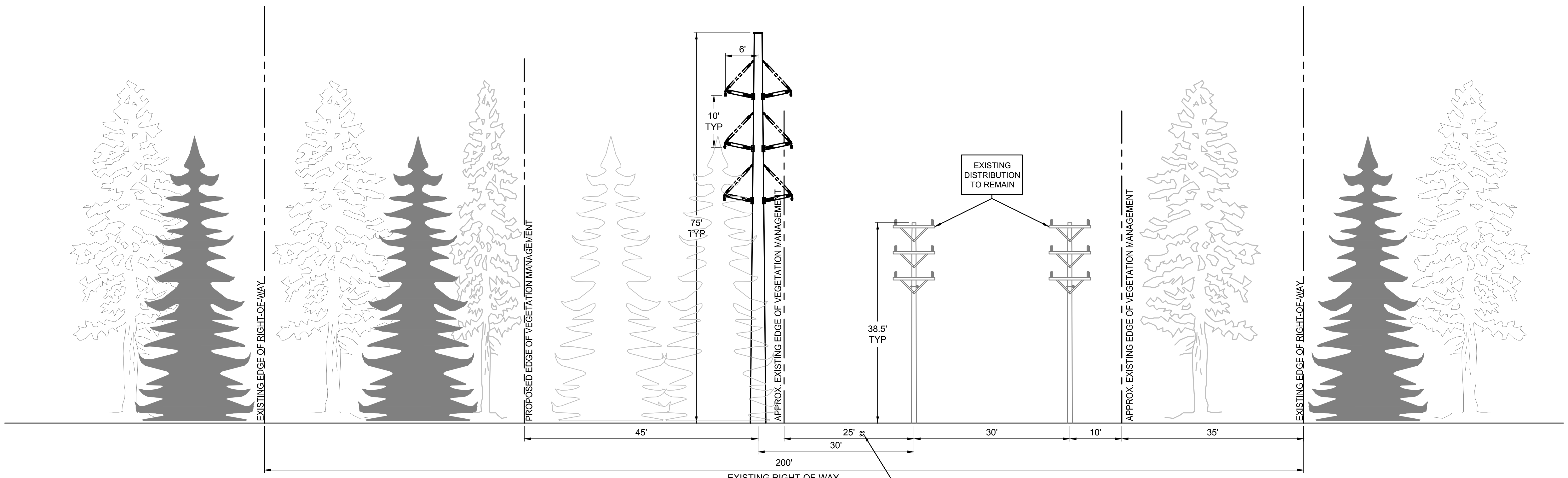
1. EXISTING UNDERGROUND DISTRIBUTION CIRCUIT TO REMAIN.
2. VEGETATION CLEARING WILL ENCOMPASS 125' OF THE 200' SECTION OF RIGHT-OF-WAY.
3. A TRANSITION STRUCTURE WILL BE REQUIRED WITHIN THIS RIGHT-OF-WAY TO LINK THE UNDERGROUND AND OVERHEAD PORTION OF THE LINE.

EVERSOURCE ENERGY

TITLE
GHCCRP
OVERHEAD ALTERNATE CONFIGURATION IN DISTRIBUTION ROW

BY M. PEPICH	CHKD V. MONTEMURRO	APP	APP
DATE 8/24/16	DATE 8/24/16	DATE	DATE
SCALE NONE	MICROFILM DATE	DWG. NO. ROUTE 10B-OH-1	
P.A. #			

DISTRIBUTION ROW ROUTE
ROUTE 10B
CROSS SECTION 2: ROW BETWEEN AVERY ROAD AND WEST HARTFORD ROAD
IN THE TOWN OF NEWINGTON
LOOKING EAST
(0.17 MILES)



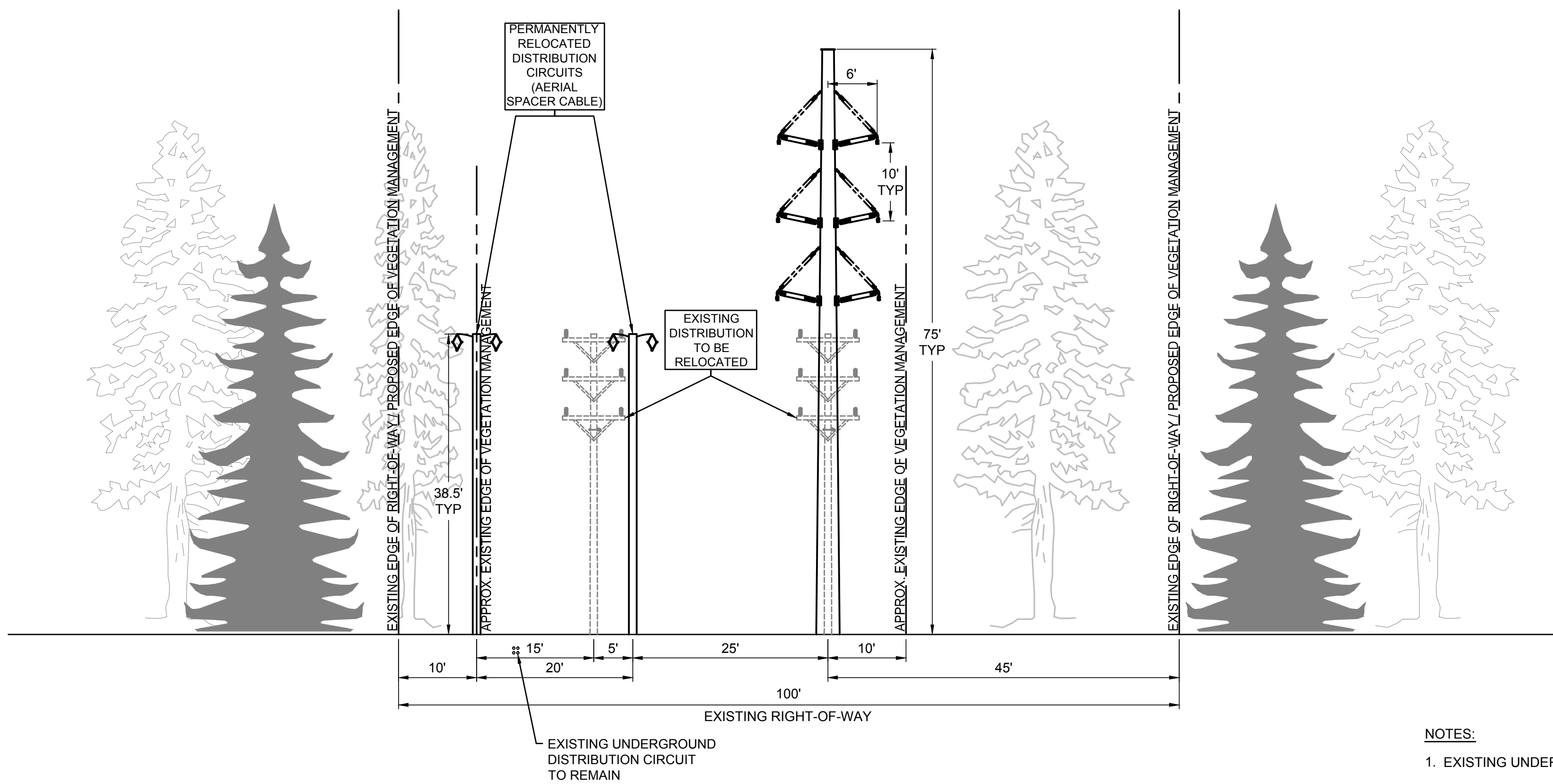
NOTES:

1. EXISTING UNDERGROUND DISTRIBUTION CIRCUIT TO REMAIN.
2. VEGETATION CLEARING WILL ENCOMPASS 115' OF THE 200' SECTION OF RIGHT-OF-WAY.

EVERSOURCE ENERGY

TITLE GHCCRP OVERHEAD ALTERNATE CONFIGURATION IN DISTRIBUTION ROW			
BY M. PEPICH	CHKD V. MONTEMURRO	APP	APP
DATE 8/24/16	DATE 8/24/16	DATE	DATE
SCALE NONE	MICROFILM DATE	DWG. NO. ROUTE 10B-OH-2	
P.A. #			

DISTRIBUTION ROW ROUTE
ROUTE 10B
CROSS SECTION 3: ROW BETWEEN AVERY ROAD AND WEST HARTFORD ROAD
IN THE TOWN OF NEWINGTON
LOOKING EAST
(0.12 MILES)



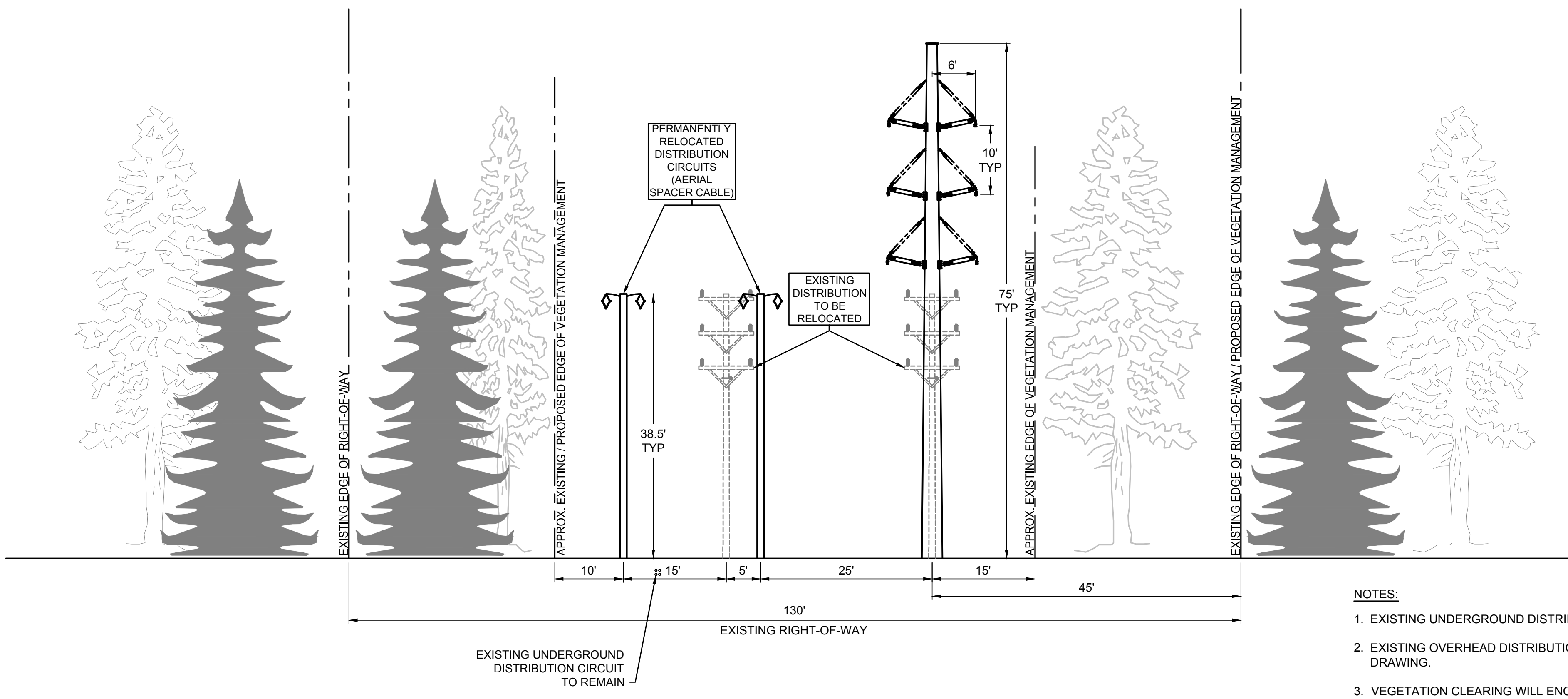
NOTES:

1. EXISTING UNDERGROUND DISTRIBUTION CIRCUIT TO REMAIN.
2. EXISTING OVERHEAD DISTRIBUTION CIRCUITS TO BE RELOCATED AS DEPICTED IN THE DRAWING.
3. VEGETATION CLEARING WILL ENCOMPASS 100' OF THE 100' SECTION OF RIGHT-OF-WAY.
4. NEW 115kV STRUCTURES ADJACENT TO DISTRIBUTION CROSSING LOCATION ARE EXPECTED TO BE 95' TALL TO MAINTAIN ADEQUATE ELECTRICAL CLEARANCE.

EVERSOURCE ENERGY

TITLE GHCCRP OVERHEAD ALTERNATE CONFIGURATION IN DISTRIBUTION ROW			
BY M. PEPICH	CHKD V. MONTEMURRO	APP	APP
DATE 8/24/16	DATE 8/24/16	DATE	DATE
SCALE NONE	MICROFILM DATE	DWG. NO. ROUTE 10B-OH-3	
P.A. #			

DISTRIBUTION ROW ROUTE
ROUTE 10B
CROSS SECTION 4: ROW EAST OF WEST HARTFORD ROAD
IN THE TOWN OF NEWINGTON
LOOKING EAST
(0.17 MILES)



NOTES:

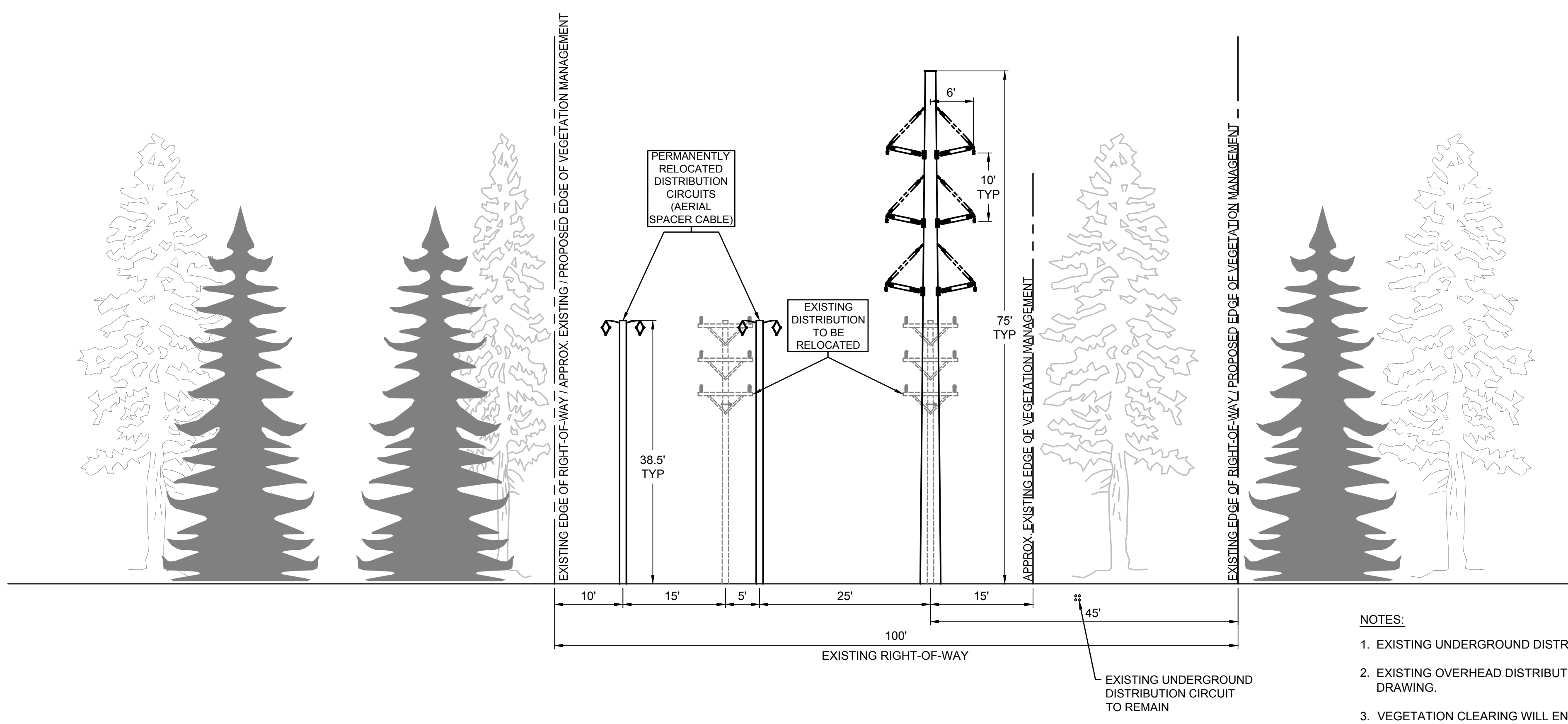
1. EXISTING UNDERGROUND DISTRIBUTION CIRCUIT TO REMAIN.
2. EXISTING OVERHEAD DISTRIBUTION CIRCUITS TO BE RELOCATED AS DEPICTED IN THE DRAWING.
3. VEGETATION CLEARING WILL ENCOMPASS 100' OF THE 130' SECTION OF RIGHT-OF-WAY.

EVERSOURCE ENERGY

TITLE
GHCCRP
OVERHEAD ALTERNATE CONFIGURATION IN DISTRIBUTION ROW

BY M. PEPICH	CHKD V. MONTEMURRO	APP	APP
DATE 8/24/16	DATE 8/24/16	DATE	DATE
SCALE NONE	MICROFILM DATE	DWG. NO. ROUTE 10B-OH-4	
P.A. #			

DISTRIBUTION ROW ROUTE
ROUTE 10B
CROSS SECTION 5: ROW EAST OF WEST HARTFORD ROAD
IN THE TOWN OF NEWINGTON
LOOKING EAST
(0.03 MILES)



NOTES:

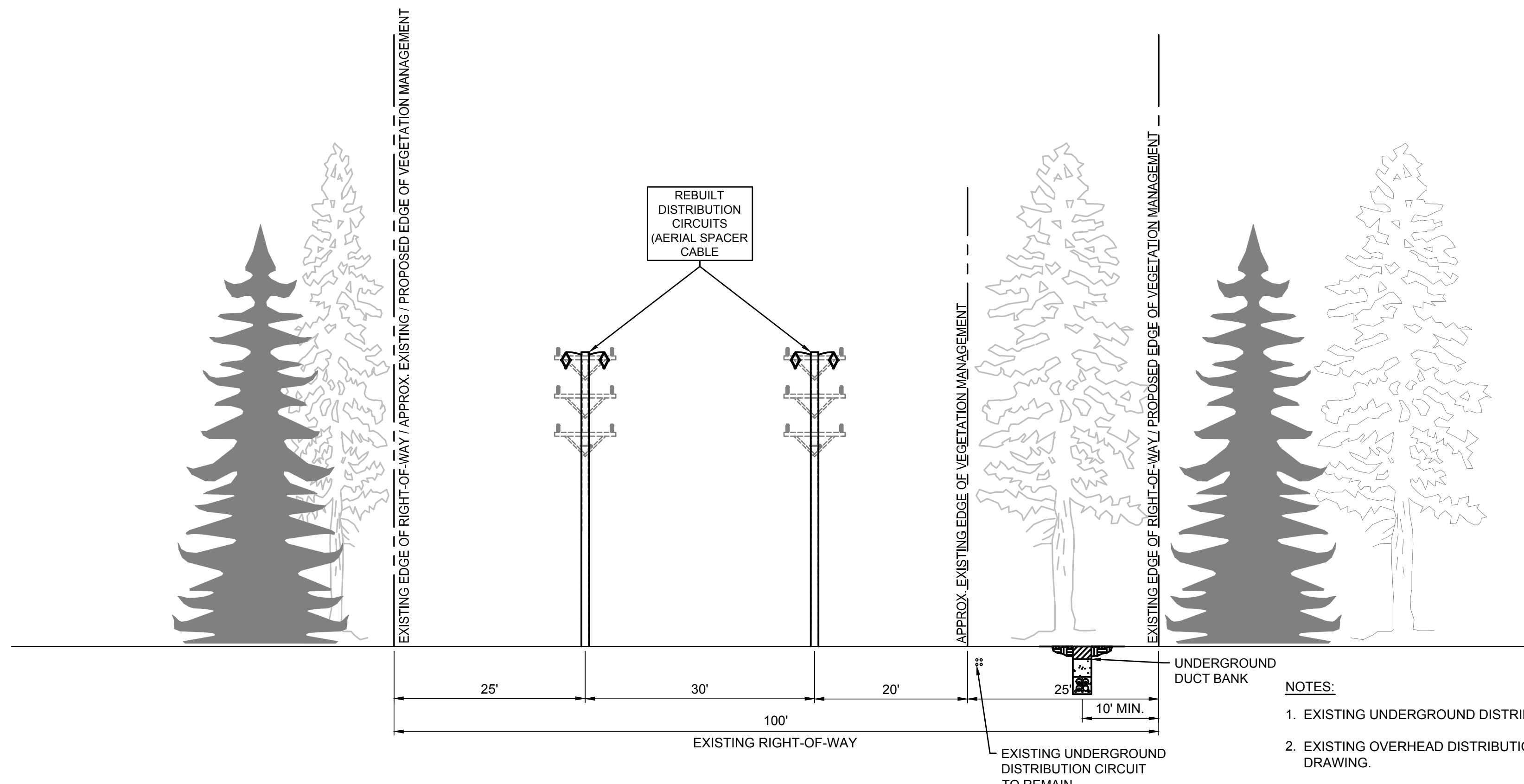
1. EXISTING UNDERGROUND DISTRIBUTION CIRCUIT TO REMAIN.
2. EXISTING OVERHEAD DISTRIBUTION CIRCUITS TO BE RELOCATED AS DEPICTED IN THE DRAWING.
3. VEGETATION CLEARING WILL ENCOMPASS 100' OF THE 100' SECTION OF RIGHT-OF-WAY.
4. A TRANSITION STRUCTURE WILL BE REQUIRED WITHIN THIS RIGHT-OF-WAY TO LINK THE UNDERGROUND AND OVERHEAD PORTION OF THE LINE.

EVERSOURCE ENERGY

TITLE
GHCCRP
OVERHEAD ALTERNATE CONFIGURATION IN DISTRIBUTION ROW

BY M. PEPICH	CHKD V. MONTEMURRO	APP	APP
DATE 8/24/16	DATE 8/24/16	DATE	DATE
SCALE NONE	MICROFILM DATE	DWG. NO. ROUTE 10B-OH-5	
P.A. #			

DISTRIBUTION ROW ROUTE
ROUTE 10B
CROSS SECTION 6: ROW EAST OF WEST HARTFORD ROAD
IN THE TOWN OF NEWINGTON
LOOKING EAST
(0.08 MILES)



NOTES:

1. EXISTING UNDERGROUND DISTRIBUTION CIRCUIT TO REMAIN.
2. EXISTING OVERHEAD DISTRIBUTION CIRCUITS TO BE REPLACED AS DEPICTED IN THE DRAWING.
3. VEGETATION CLEARING WILL ENCOMPASS 100' OF THE 100' SECTION OF RIGHT-OF-WAY.

EVERSOURCE ENERGY

TITLE GHCCRP OVERHEAD ALTERNATE CONFIGURATION IN DISTRIBUTION ROW			
BY M. PEPICH	CHKD D. GOGOL	APP	APP
DATE 8/2/16	DATE 8/2/16	DATE	DATE
SCALE NONE	MICROFILM DATE	DWG. NO. ROUTE 10B-OH-6	
P.A. #			

12. PROPOSED SUBSTATION MODIFICATIONS: ALTERNATIVES REVIEW

To meet the Project objectives, the new 115-kV transmission line must extend between and connect to the existing Newington and Southwest Hartford 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 proposed modifications to the two existing substations would avoid or minimize environmental impacts and represent the most cost-effective and efficient approach for connecting the new 115-kV line to the power grid.

Newington Substation was developed approximately 60 years ago, while Southwest Hartford Substation was built in the 1970s. Each substation's fenced area is situated within a larger parcel of Eversource 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.

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, but would result in minimal (temporary timber mat) impacts to an adjacent 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 and 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 three 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 because of potential impacts to substation facilities situated in that area, including a mobile transformer access way (20-foot gate and drive path along the eastern fence line) and a mobile transformer position on the 115-kV bus, as well as a gravel detention basin immediately outside the eastern fence line. Relocation of the existing 115-kV equipment would also be required for expansion to the east. In contrast, the proposed substation expansion to the south and 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 must be situated to allow interconnections to the new 115-kV transmission line, which would extend into the substation underground from the east. Specifically, from New Park Avenue, the underground 115-kV cable 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 line) would be cost prohibitive, requiring the relocation of the existing transformers and the 27.6-kV equipment and tree clearing. 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 Wetland H-1, as well as the unnamed tributary to the South Branch of the Park River and its associated FEMA-designated 100-year floodplain. In contrast, the proposed substation expansion to the east would not require large equipment relocation and would not interfere with existing infrastructure, wetlands, or watercourses.

At Southwest Hartford Substation, Eversource also evaluated a design option to the four 70-foot-tall dead end structures (two per line terminal) that are required to implement a bypass bus in parallel with the reactors, in a vertical orientation above the reactors. The 70-foot-tall dead end structures are taller than the existing structures at the substation.[109] However, the vertical installation of the parallel connection, as proposed, minimizes the area that is required to implement the bypass design. If the parallel connection had to be made horizontally (via structures of existing substation bus height), the footprint required to implement the reactor bypass designs would be significantly larger, thus involving an overall expansion of the substation by more than 0.3 acre. The larger footprint also would pose significant challenges; it would require significant modifications to the existing substation equipment, could be difficult to accommodate within Eversource's property, and would potentially impact Wetland H-1 and the tributary to the South Branch of the Park River. As a result, the horizontal orientation was dismissed from further consideration.

[109] At Southwest Hartford Substation, the existing underground HPFF transmission cables extend into the station underground. As a result, the tallest bus height is approximately 22 feet. An existing lightning mast, located in the middle of the station yard, is 60 feet tall.

Note: This page intentionally left blank.

13. GLOSSARY AND TERMS

Acronym	Description
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.
ACSR:	Aluminum conductors with steel reinforcement, a common type of overhead conductor
ACSS:	Aluminum Conductor with Steel Support, a common type of overhead conductor.
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
Application:	Application (to the Connecticut Siting Council) for a Certificate of Environmental Compatibility and Public Need
ASTM:	American Society for Testing and Materials
BMP:	Best Management Practices
BMP Manual:	Eversource's Best Management Practices Manual for Massachusetts and Connecticut (Construction & Maintenance Environmental Requirements) (September 2016)
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
CCRPA:	Central Connecticut Regional Planning Agency
CCVT:	Capacitance 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)
CGS:	Connecticut General Statutes

Acronym	Description
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
CT*fastrak*:	Busway operated by ConnDOT
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
DC:	Direct current
DCT:	Double circuit tower
Deadend Structure:	A line structure that is designed to have the capacity to hold the lateral strain of the conductor in one direction.
Demand:	The total amount of electricity required at any given time by an electric supplier's customers.
DESPP:	Department of Emergency Services and Public Protection (Connecticut)
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.
DPW	Department of Public Works
DR:	Demand response
DSM:	Demand side management
DTS:	Distributed Temperature Sensing

Acronym	Description
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 or Eversource Energy:	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.
FCA:	Forward Capacity Auction
FCM:	Forward Capacity Market
FEMA:	Federal Emergency Management Agency
FERC:	Federal Energy Regulatory Commission
FLR	Forecasts of Loads and Resources
FMD:	Field Management Design (Plan) (for EMF)
FRA:	Federal Railroad Administration
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 (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

Acronym	Description
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.
Hz:	Hertz, a measure of alternating current frequency; one cycle/second.
ICES:	International Committee on Electromagnetic Safety, a committee of the Institute of Electrical and Electronics Engineers)
ICNIRP:	International Council on Non-Ionizing Radiation Protection, a specially chartered independent scientific organization
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-NE:	Independent System Operator – New England, Inc., responsible for the planning and operation of the New England bulk power grid.
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 generation and transmission to serve its load.
LPP	Laminated paper polypropylene (a pipe type cable system)
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

Acronym	Description
mG:	milliGauss (see Magnetic Field)
MRA:	Market Resource Alternative
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 (345-kV transmission projects in CT, MA, and RI)
NERC:	North American Electric Reliability Council, Inc. (initially, the National Electric Reliability Council)
NESC:	National Electrical Safety Code
NHHS:	New Haven – Hartford – Springfield Rail Program
NLEB:	Northern Long-eared Bat
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
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)
PCN:	Pre-Construction Notification (USACE)
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)

Acronym	Description
POW:	Palustrine open water (wetlands)
Project:	GHCCRP
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:	Regulations 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.

Acronym	Description
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 or SWPC 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 circuit 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:	United 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.
XS:	Cross-section (drawing)
XLPE:	Cross-linked polyethylene (solid dielectric) insulation for underground transmission cables

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