DOCKET NO. 141 - A joint application of the Connecticut Light and Power Company and the United Illuminating Company for a Certificate of Environmental Compatibility and Public Need for the construction of a 115kV electric transmission line and related telecommunications equipment between the United Illuminating Company's Pequonnock Substation in Bridgeport and the Connecticut Light and Power Company's Ely Avenue Junction in Norwalk, Connecticut.

Connecticut

Siting

Council

September 18, 1991

FINDINGS OF FACT

1. On January 25, 1991, the Northeast Utilities Service Company (NU), acting as an agent for the Connecticut Light and Power Company (CL&P), and the United Illuminating Company (UI), in accordance with provisions of Sections 16-50k(a) and 16-50l of the Connecticut General Statutes (CGS), jointly applied to the Connecticut Siting Council (Council) for a Certificate of Environmental Compatibility and Public Need (Certificate) to construct an overhead 115kV electric transmission line and related telecommunications equipment between the United Illuminating Company's Pequonnock Substation in Bridgeport and the Connecticut Light and Power's Ely Avenue Junction in Norwalk, Connecticut. (CL&P/UI 1, January 25, 1991)

2. The application was accompanied by proof of service as prescribed by CGS Section 16-50l(b). (CL&P/UI 1, Attachment)

3. Notice of the application was given to the general public by publications in The Bridgeport Telegram-Bridgeport Post, on January 18 and 19, 1991, and The Hartford Courant, on January 18, 1991, as prescribed in Section 16-50l(b) of the CGS. (CL&P/UI 1, Attachment; CL&P/UI 4, Attachment)

4. Copies of the Application were supplied to municipal officials of Bridgeport, Fairfield, Westport, Norwalk, Easton, Weston, and Wilton. (CL&P/UI 1, Attachment)

5. The Office of Consumer Counsel, (OCC), the Department of Health Services (DHS), the Department of Environmental Protection (DEP), and the State Historic Preservation Office submitted written comments for the record pursuant to Section 16-50j of the CGS. (OCC Letter, dated April 3, 1991; DHS Memorandum, dated May 14, 1991; DEP Letter, dated April 15, 1991; DEP Letter, dated April 24, 1991; CL&P/UI 11, Attachment).

6. Members of the Council and its staff conducted a public field inspection of the proposed line route on April 29, 1991. (CSC Hearing Notice, Fairfield News Citizen, March 6, 1991; CSC Hearing Notice, The Hour, March 5, 1991; CSC Hearing Notice, The Bridgeport Telegram Bridgeport Post, March 6, 1991)

7. The Council, after giving due public notice thereof, held a public hearing on this application on April 29, 1991, beginning at 1:00 p.m. and continuing at 7:00 p.m., as prescribed by CGS Section 16-50m. The hearings were held in the auditorium of the Westport Town Hall, 110 Myrtle Avenue, Westport, Connecticut. (CSC Hearing Notice, Fairfield News Citizen, March 6, 1991; CSC Hearing Notice, The Hour, March 5, 1991; CSC Hearing Notice, The Bridgeport Telegram Bridgeport Post, March 6, 1991)

Need

8. The proposed facility would conform to a long-range plan for expansion of the electric power grid of the electric systems serving the state. (CL&P/UI 1, Vol. 1, p. 31; CL&P/UI 7, pp. 4, 53, 54)

9. Loads on the southwest Connecticut circuits have been growing in recent years. Area coincident summer peak loads in southwestern Connecticut have grown from 801 MW in 1986 to 885 MW in 1990, a 10.6 percent increase and are forecasted to reach 986 MW by 1995. (CL&P/UI 1, Vol. 1, pp. 22, 23, 31, Table 2; CL&P/UI 6, Q-12; CL&P/UI 8, Q-42; Tr. 31-35)

10. CL&P began upgrading the 115kV system serving southwest Connecticut by the reconstruction of the Plumtree Substation, Bethel, to Ridgefield Junction, Redding, line, completed in 1985 (Council Docket No. 26); the Trumbull Junction, Trumbull, to Old Town Substation, Bridgeport, line reconstruction, completed in June 1988 (Council Docket No. 57); and the Stevenson Substation, Monroe, to Newtown Substation, Newtown, to Plumtree Substation, Bethel, line reconstruction, scheduled for completion by May 1992 (Council Docket No. 105). Construction of the proposed project would be the next (fourth) step in the 115kV reinforcement plan for southwest Connecticut. (CL&P/UI 1, Vol. 1, pp. 1, 23)

11. The proposed construction was identified in the NU 1990 Forecast of Loads and Resources, the NU 1991 Forecast of Loads and Resources, the UI 1990 Report to the Connecticut Siting Council, and the UI 1991 Report to the Connecticut Siting Council. (CL&P/UI 1, Vol. 1, p. 31; CSC Administrative Notice Items 1-4)

12. The proposed line would be located within the customer service areas of CL&P, UI, the South Norwalk Electric

Works (SNEW), and the East Norwalk Electric Works (ENEW). The proposed line would serve the customer loads of these four utilities within the southwest Connecticut area. SNEW plans an additional future power supply from a direct tap on the proposed line. (CL&P/UI 1, Vol. 1, pp. 2, 21; CL&P/UI 6, Q-11; Tr. p. 71)

Loads

13. The southwest Connecticut area is supplied by four 115kV transmission lines containing the following circuits:

    1. Devon Substation, Milford, to Pequonnock Substation, Bridgeport, to Old Town Substation, Bridgeport, (1710 circuit); Old Town Substation, Bridgeport, to Hawthorne Substation, Fairfield, (1222 circuit); Hawthorne Substation, Fairfield, to Norwalk Substation, Norwalk, (1720 circuit);

    2. Devon Substation, Devon, to Pequonnock Substation, Bridgeport, to Weston Substation, Weston, (1730 circuit); Weston Substation, Weston, to Norwalk Substation, Norwalk, (1637 circuit);

    3. Pequonnock Substation, Bridgeport, to Ash Creek Substation, Bridgeport, (91001 circuit);

    4. Plumtree Substation, Bethel, to Ridgefield Substation, Ridgefield, to Peaceable Substation, Redding (1565 circuit); Peaceable Substation, Redding, to Norwalk Substation, Norwalk, (1470 circuit).

    In addition, one 138kV submarine cable interconnects CL&P's Norwalk Harbor Station to the Long Island Lighting Company's (LILCO) Northport Station. This circuit transports short-term energy and is not presently relied upon for long-term supply. (CL&P/UI 1, Vol. 1, pp. 23, 24; CL&P/UI 6, Q-1F; CL&P/UI 8, Q-33; Tr. pp. 87-91)

14. The Hawthorne Substation, Fairfield, to Norwalk Substation, Norwalk, 1720 circuit; the 1730 circuit between Pequonnock Substation, Bridgeport, and Weston Substation, Weston; and the 1222 circuit between Old Town Substation, Bridgeport, and Hawthorne Substation, Fairfield, are approaching the limits of their load capacity and may exceed Long Term Emergency (LTE) and Short Term Emergency (STE) ratings by the summer of 1994 under certain conditions, particularly during future summer peak periods. With the proposed line constructed and operational, these circuits would not overload until 1996 or 1997. With the proposed line constructed and

operational and with planned reinforcement of these circuits, including reconductoring with higher capacity cables and the addition of a capacitor bank at Norwalk Substation, Norwalk, overloading would not be expected until the end of the decade. (CL&P/UI 1, Vol. 1, pp. 23, 24, 28-30, Table 3A, 3B, 3C, Table 4; CL&P/UI 6, Q-12 Attachment, Q-27D; CL&P/UI 7, pp. 13-29; CL&P/UI 8, Q-34, Q-35, Q-37; Tr. pp. 28-30, 33-35)

15. During the 1960's and early 1970's, a 345kV supply system to Norwalk, either from the east or north, was planned by CL&P but was rejected in 1982, favoring new high capacity 115kV circuits. With the proposed line operational, these 115kV circuits are expected to supply the southwest area through the 1990's. (CL&P/UI 1, Vol. 1, p. 23)

16. The major load growth in the southwest area over the past 10 years has been from commercial development and increased residential sales. (CL&P/UI 8, Q-32; Tr. pp. 227-228)

17. Adding the proposed circuit as a fifth supply circuit would increase transmission capacity and improve the reliability of the power supply in the southwest area to prevent overloading, and avoid the use of additional uneconomic generation. (CL&P/UI 1, Vol. 1, p. 31; Tr. pp. 33-35)

18. Without reinforcement, including the upgrading of conductors and the addition of a capacitor bank, the existing lines would not be in compliance with reliability standards of the Northeast Power Coordinating Council and the New England Power Pool (NEPOOL). (CL&P/UI 1, Vol. 1, pp. 22-28; CL&P/UI 7, p. 19, Ex. B)

19. At least 250 MW of new generation in southwest Connecticut would be needed to defer the load on existing lines until year 2000. Although CL&P has not thoroughly investigated the construction of additional generation in southwest Connecticut because it is not needed, new generation could be five times more expensive to construct than the proposed 115kV line. (CL&P/UI 8, Q-40, Q-41; Tr. pp. 35-37)

20. Increasing uneconomic generation in southwest Connecticut from Bridgeport, Devon, Norwalk, Cos Cob, or other generators would not reduce the forecasted loads enough to prevent possible overloading of the 1730 and 1222 circuits in 1994. Additional generation from outside the area would increase east to west line loadings, particularly along the 1730 and 1222 circuits, and without the proposed project, could advance the time of possible line overloading. (CL&P/UI 1, Vol. 1, pp. 24-28; CL&P/UI 7, pp. 15, 16, Exhibit C; CL&P/UI 8, Q-40, Q-41; Tr. pp. 35-37)

Project Description

21. The proposed overhead 115kV electric transmission line would consist of a 15.3 mile line extending from UI's Pequonnock Substation at its Bridgeport Harbor Generating Plant, Bridgeport, to CL&P's Ely Avenue Junction, Norwalk. The proposed line would be located within the jointly leased right-of-way (ROW) of an existing Department of Transportation (DOT) railroad and ROW's owned or controlled by CL&P and UI. CL&P and UI have leased rights for two 115kV circuits along the Metro North Commuter Railroad (Metro North) within the railroad ROW. The width of the ROW varies from 70 to 200 feet, excluding railroad station parking areas. (CL&P/UI 1, Vol. 1, pp. 1, 4, 44; CL&P/UI 6, Q-2. H, I)

22. In the UI service territory about 2.1 miles of the transmission line would be located in Bridgeport and 4.7 miles in Fairfield. In the CL&P service territory about 4.7 miles would be located in Westport and 3.8 miles in Norwalk. (CL&P/UI 1, Vol. 1, pp. 2, 3, 17, Figures 1 and 2, Attachment; CL&P/UI 2)

23. In the Bridgeport to Norwalk area, the only existing east-west corridors for which CL&P and UI have existing rights for overhead transmission lines are the Metro North railroad and the Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, ROW. (CL&P/UI 1, Vol. 1, p. 35)

24. CL&P and UI began joint planning for the proposed project prior to 1986. By agreement, CL&P would be responsible for engineering, obtaining permits, and constructing the telecommunications system and portions of the proposed line west of UI's Pequonnock Substation, Bridgeport. UI would be responsible for engineering and construction of modifications at the Pequonnock Substation. (CL&P/UI 1, Introduction; CL&P/UI 1, Vol. 1, p. 1; Tr. p. 52)

25. The proposed construction would interconnect the Pequonnock Substation, Bridgeport, to the Darien Substation, Darien, and would be designated as the 1130 circuit. (CL&P/UI 1, Vol. 1, p. 17, Figure 15)

26. The proposed line would involve the construction of steel extensions (overbuilds) on 35 existing railroad catenary support structures (catenary); four existing river crossing structures; five existing laced channel structures; 10 existing lattice steel towers; 208 new steel pole structures; a 5/8-inch diameter lightning shield wire containing optical fibers; and three electric conductors, 1.5 inches in diameter (1590 kcmil), along the north side of the ROW. (CL&P/UI 1, Vol. 1, p. 5; CL&P/UI 1, Vol. 2; CL&P/UI 6, Q-3)

27. The south side of the ROW currently contains an existing 115 kV line comprised of 245 steel overbuilds on top of catenary structures; 20 laced channel structures; 10 lattice steel structures; four steel pole structures; one 3/4-inch diameter lightning shield wire; and three electric conductors, 1 3/8-inch (1272 kcmil) diameter cables, along CL&P circuits 1130 and 1430; and 1 1/2-inch (1590 kcmil) diameter cables along UI circuits 1430 and 91001. (CL&P/UI 1, Vol. 1, p. 5, Figures 3 to 8; Tr. p. 39)

28. The existing electric transmission and telecommunications facilities are supported on overbuild structures along the ROW. At some roadway overpasses, these facilities are supported by short tower structures with foundations built into the bridge abutment walls. The DOT plans to replace the narrow bridges with new, wider bridges in the future. The proposed transmission line construction would be consistent with the DOT plans to upgrade the existing railroad bridges. (CL&P/UI 1, Vol. 1, pp. 39-41)

29. Related telecommunications equipment consisting of an eight-foot by six-foot passive microwave reflector panel would be mounted on the top cross member and centered between the static wire terminals on structure No. 3052 near Ely Avenue Junction, Bridgeport. This unit would reflect microwave signals from Norwalk Harbor Station to Ely Avenue Junction and be integrated with the proposed fiber optic shield cable to improve CL&P's relay system between substations and generators. The microwave link is needed because an existing underground interconnection between Ely Avenue Junction and Norwalk Harbor Station would not easily accommodate the installation of a fiber optic cable. (CL&P/UI 1, Vol. 1, pp. 5, 17, 21, 31, Figure 3; CL&P Petition 264; Notification of an Exempt Modification, January 25, 1991)

30. CL&P would install a 20-foot high stub tower inside the perimeter fence of Ely Avenue Junction on the north side of the enclosure. An eight-foot parabolic antenna would be mounted at the 18-foot level. The telecommunications equipment would be contained in a single story, prefabricated concrete building containing electric equipment, automatic climate control, battery array, and an emergency generator. (CL&P/UI 1, Vol. 1, pp. 5, 17, 31, Figure 3; CL&P/UI 6, Q-19)

31. Although the Federal Communications Commission (FCC) has not assigned an operating frequency for the proposed microwave installation, the system is proposed to transmit within the frequency band between 6525 and 6875 megaHertz (MHz). The system would have a simultaneous transmission/receiving capability of 45 megabits/second and a power output of 0.631 watts. CL&P would apply to the FCC for an operating frequency about one year prior to operation. (CL&P/UI 1, Vol. 1, pp. 21, 22; CL&P/UI 6, Q-19)

32. The maximum power density for the proposed digital microwave system has been calculated for a point along the Ely Avenue Junction boundary fence at 0.108×10^{-6} milliwatts per square centermeter (mW/cm^2). The highest calculated power density level inside the fenced area would be 0.44×10^{-6} mW/cm^2. The State of Connecticut Standard and the American National Standards Institute's (ANSI) Safety Level with Respect to Human Exposure to Radio Frequency Electromagnetic Fields at the operating frequency ranges of the proposed microwave system is 5.0 mW/cm^2. (CL&P/UI 1, Vol. 1, p. 48; CL&P/UI 6, Q-17, Q-19)

Construction

33. The DOT reviewed the project and gave approval of the design and construction of independent structures to support the proposed line on the north side of the ROW. CL&P would consult with the DOT regarding the detailed line design. (CL&P/UI 1, Vol. 1, p. 42, Appendix B)

34. CL&P would apply to the DOT for permits accessing the ROW from State highways and for installation of conductors over State highways. (CL&P/UI 1, Vol. 1, p. 22)

35. CL&P would apply to the DEP for permits to construct in tidal wetlands pursuant to CGS Sections 22a-28 through Section 22a-35, and in Stream Encroachment areas pursuant to CGS Section 22a-342. (CL&P/UI 1, Vol. 1, p. 22)

36. CL&P would hold discussions with the U.S. Army Corps of Engineers regarding an application for watercourse and waterway crossing permits pursuant to the Federal Water Pollution Control Act Amendment of 1972, Section 403 and Section 404. Application for such permits would be made when necessary. (CL&P/UI 1, Vol. 1, pp. 22)

37. The transmission line construction would comply with the standards of the National Electrical Safety Code, the reports of the Joint Engineering Committee of the Association of the American Railroads and the Edison Electric Institute, and the Connecticut Department of Public Utility Control (DPUC) regulations applicable to the Method and Manner of Construction. (CL&P/UI 1, Vol. 1, p. 48)

38. CL&P's use of the existing ROW would conform to the Federal Energy Regulatory Commission's (FERC) policies as stated in The Federal Power Commission Order No. 414, dated November 27, 1970, for the selection of an existing ROW for construction of a proposed transmission line. (CL&P/UI 1, Vol. 1, p. 37; CL&P/UI 7, pp. 39, 40)

39. The proposed line would satisfy the FERC standards as stated in the Federal Power Commission's "Guidelines for the Protection of Natural, Historic, Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities" which recommends that the joint use of an existing ROW be given priority for the addition of new transmission facilities in order to minimize conflicts with existing and future land uses. (CL&P/UI 1, Vol. 1, pp. 37, 48; CL&P/UI 7, pp. 39, 40)

40. In accordance with guidelines contained in the Connecticut Conservation and Development Policies Plan, 1987-1992, CL&P has identified urban areas, urban conservation areas, areas of environmental concern, and existing preserved open spaces, to be preserved and protected during the proposed construction. (CL&P/UI 1, Vol. 1, pp. 35-38)

41. CL&P would meet all requirements of state regulatory agencies by drafting a Development and Management (D&M) Plan containing all construction specifications including access road and work-site preparation, erosion and sedimentation control, and cleanup and rehabilitation of the ROW and access roads. CL&P would submit the D&M plan to Metro North for review and to the Council for review and approval. (CL&P/UI 1, Vol. 1, pp. 49-51; CL&P/UI 7, pp. 40, 41)

42. The proposed construction schedule would require about 26 months to construct the proposed project following approvals by all regulatory agencies. To avoid forecasted overloads during the summer of 1994, a line in-service date by April 1994 would be required. (CL&P/UI 1, Vol. 1, p. 5; CL&P/UI 7, Exhibit B; Tr. pp. 116, 117)

43. During construction of the proposed project, a few short-term service outages of the area supply lines would be required. However, no disruption to customers is expected. (CL&P/UI 1, Vol. 1, pp. 32, 33; CL&P/UI 7, pp. 17-22)

44. All CL&P or UI existing facilities expected to be retired or unused would be removed. (CL&P/UI 1, Vol. 1, p. 51)

45. Possible construction material laydown areas would be located at CL&P's Flax Hill Substation, Norwalk, and UI's Bridgeport Harbor Generating Station. Additional presently unspecified laydown areas along the ROW could be required. (CL&P/UI 6, Q-2A)

Structures

46. New overbuild structures placed on catenary structures would range from 63 to 73 feet in height above ground, equivalent to the average 70-foot high existing overbuild structures on the south side of the railway. New monopole

structures would range from 80 to 120 feet above ground, averaging 15 feet taller than existing catenary overbuilds. Existing laced channel and lattice steel towers would be used to cross highways, the Norwalk River, and Saugatuck River. (CL&P/UI 1, Vol. 1, pp. 5, 12, Figures 4-8; CL&P/UI 6, Q-3, Q-4; CL&P/UI 7, pp. 4, 5)

47. Proposed overbuild structures along the north side of the railway would be designed to carry a single 115kV circuit with no additional design strength to accommodate a second 115kV circuit. (CL&P/UI 6, Q-10)

48. New pole structures would be located in the railroad ballast on the north side of the tracks so that no structure would be placed in an inland wetland. (CL&P/UI 1, Vol. 1, pp. 46, 47, 49-51; CL&P/UI 1, Vol. 2; CL&P/UI 6, Q-2.J)

49. CL&P would take soil borings at each structure location for new concrete foundations prior to construction. (CL&P/UI 6, Q-5)

50. Steel pole structures would require the construction of reinforced concrete foundations. Steel or concrete caissons would be used to stabilize the railroad ballast. The steel pole foundations would be a maximum of seven feet in diameter. Each new foundation would be no closer to the rail than the existing foundation supporting the catenary support structures, a distance of approximately 6.9 feet. The foundation would be placed laterally at least 15 feet from a catenary structure post. (CL&P/UI 1, Vol. 1, pp. 50, 51; CL&P/UI 6, Q-6, Sketch A 6.1, Sketch A 6.2)

51. Construction at the Ely Avenue Junction terminus would consist of the addition of one or two steel pole structures, an overhead line connection, a 16-foot by 11-foot telecommunications equipment building, a 20-foot steel tower, and an eight-foot microwave antenna. Two spans of line would be installed on two existing towers between the railroad and Ely Avenue Junction to connect the substation to the existing 1130 circuit. (CL&P/UI 1, Vol. 1, pp. 17, 21, Figure 10, Figure 11, Figure 12; Vol. 2, Segment 1)

52. Load growth in the area could require a temporary interim connection at Sasco Creek Substation, Westport, between Pequonnock Substation, Bridgeport, and Ely Avenue Junction, Norwalk, to maintain reliable service to areas served by the new circuit between the Sasco Creek Substation, Westport, to Pequonnock Substation, Bridgeport, during construction of the remaining section of the proposed line. (CL&P/UI I, Vol. 1, p. 17, Figure 14; CL&P/UI 7, pp. 11, 52, 53; CL&P/UI 8, Q-45)

53. If a new interim tap into Sasco Creek Substation, Westport, were needed, a temporary, guyed wood pole structure would be set between new steel poles No. 635 and No. 636, and opposite existing structure No. B635A. Conductor taps would connect the new 1590 kcmil conductors to the existing 1130 circuit by crossing the railroad and connecting to the substation. (CL&P/UI 6, Q-15, Sketch A-15)

54. Along an approximately two mile section of the proposed line west of Pequonnock Substation, Bridgeport, the single overhead composite static and fiber optic shield wire might not be sufficient to protect against ground fault currents that could be experienced in the railway area; therefore, an additional metallic lightning shield wire might be installed about five feet over the top of the catenary structures. (CL&P/UI 7, pp. 23, 24; Tr. p. 42)

Conductors

55. CL&P would use vertical and delta conductor placement configurations on the proposed structures. Vertical conductor configuration places all three conductor cables in vertical array, equidistant apart and on the same side of the pole. Delta configuration places two conductors on opposite sides of a pole at equal height above ground with the third conductor on one side of the pole at the minimum required safety distance below the other two. Vertical conductor configuration would place conductors toward the tracks, further away from the edge of the ROW and would be used where the width of the ROW would not allow a delta configuration or where the angle of the railroad would make a delta array difficult to use. All conductors would consist of 1590 kcmil Aluminum Core Steel Reinforced (ACSR) cables. (CL&P/UI 6, Q-3, Sketch A.3; Tr. pp. 49, 50)

56. Conductor mid-span sag heights above new steel pole foundation tops at ground level would be approximately 53 feet to the lowest 115kV conductor. Clearances would be slightly less at road crossings and greater at river crossings. (CL&P/UI 6, Q-14)

57. The line was designed to provide for maximum loads on the conductors by establishing a minimum conductor clearance of five feet above the existing railroad distribution lines in areas where short spans were used. (Tr. p. 38)

58. The minimum conductor clearance heights above ground level and various features would be as follows:

115kV Conductor to:	Design Clearance (ft)
Railroad track	31
Roads, streets, paved lots, driveways	23
Communication conductors/cables	10
Insulated supply cables	6

Guys, span wires, neutral conductors, and lightning protection wires	8
Trolley wire and electrified railroad conductors on separate structures	10
Open 0 to 50kV (phaseground) supply wires on separate structures	8
Open 13.2kV supply wires on same structure	6
Buildings: Horizontal (from wind-blown conductor)	11
Vertical	20
Signs, chimneys, antennas, tanks, flag poles, etc	11

These clearances were based on 1990 National Electrical Safety Code requirements plus a design and construction margin of safety. (CL&P/UI 6, Q-14)

Right-of-Way

59. The topography of the project area is mostly flat and located in the southwest coastal basin. Watershed areas in the proposed project area include Ash Creek, Mill River, Sasco Brook, Saugatuck River, Norwalk River, and other areas bordering on Long Island Sound. (CL&P/UI 1, Vol. 1, pp. 36, 37, Exhibits 3A, 3B, 3C; CL&P/UI 1, Vol. 2)

60. Within one mile of the ROW are Interstate 95 and U.S. Route 1; built up urban lands of industrial, commercial, and residential development; Sherwood Island State Park; open space including conservation areas; and Sikorsky Heliport. (CL&P/UI 1, Vol. 1, pp. 34-37, Exhibits 3A, 3B, 3C; CL&P/UI 1, Vol. 2)

Environmental Impacts

61. Potential environmental impacts that could be expected from construction activities include noise from vehicles and construction equipment, dust and mud from accessway construction, vegetation removal from accessways, localized disturbances to lawn areas or driveways where off ROW access was necessary, increased traffic volume on public thoroughfares, siltration or sedimentation of wetlands and watercourses, and effects on scenic and historic features. (CL&P/UI 1, Vol. 1, Table 6)

62. Construction techniques to minimize adverse construction impacts on the environment would include special routing and design features along the existing ROW to avoid disrupting historic features and sensitive areas such as tidal and inland wetlands, erosion and sedimentation control measures, railroad catenary structure and foundation reinforcement to minimize new tower

construction, relocation of railroad feeder wires, specialized conductor placement configurations, specialized site preparation and access road locations, restoration of disturbed railroad ballast, raking and seeding disturbed ROW areas, and restoration of wetland and stream crossing areas. (CL&P/UI 1, Vol. 1, pp. 49-51)

63. Because of continual railroad operations, use of and construction from the railroad tracks would not be expected. Access to each structure for construction would come from the edge of the railroad ballast or across adjoining properties where temporary access rights could be obtained. (CL&P/UI 1, Vol. 1, pp. 49, 50)

64. Access points to the ROW would come from highways, particularly Routes 1, 33, 135, 136, and I-95. Such access would require permits from the DOT. CL&P would also make use of existing accessways developed by others. (CL&P/UI 6, Q-2D through 2G)

65. Future new accessways, areas of vegetation clearing, and construction of corduroy or riprap roads have not been identified and secured. (CL&P/UI 1, Vol. 1, pp. 49; CL&P/UI 6, Q-2B through 2G)

66. No new, permanent ROW acquisitions for accessways outside the limits of the ROW would be anticipated by CL&P. Permission would be secured to temporarily cross lands adjacent to the ROW for access from public ways or private land. (CL&P 1, Vol. 1, p. 4; CL&P 1, Vol. 2, Segment 2)

67. New accessways would require a gravel roadway 12 to 15 feet wide. Continuous access along the ROW would not be required. Areas where the ROW progresses through terrain cuts or fills would be avoided wherever possible. Gates or other barriers would be used to restrict unauthorized use of access roads. (CL&P/UI 1, Vol. 1, pp. 49-51)

68. Vegetation clearing on the ROW would be minimal. No clearance would be required except where necessary to establish the worksite at some structure locations and on accessways in certain locations. No herbicides would be used for accessway clearing or as part of ROW management efforts. (CL&P/UI 1, Vol. 1, pp. 43, 46, 47)

69. Where steep grades or side slopes could not be avoided, erosion control measures would be used. This would include use of processed stone to surface access roads, seeding on road edges, waterbars, hay bale checkdams, culverts, fabric sediment barriers, rut grading, and mulching on graded or raw terrain. (CL&P/UI 1, Vol. 1, pp. 49, 50, Table 6)

70. Fencing or barricades would be placed around excavations during nonworking hours. (CL&P/UI 1, Vol. 1, p. 50)

71. Police protection would be provided when required for large construction equipment movement. (CL&P/UI 1, Vol. 1, Table 6)

72. No permanent water flow and quality changes would result from the construction and operation of the transmission line. (CL&P/UI 1, Vol. 1, pp. 46-47)

73. Sections of the existing ROW are screened from nearby residential neighborhoods by adjacent shrubs and trees. The ROW would be most visible from approximately 16 road crossings over the railroad. (CL&P 1, Vol. 1, p. 45; CL&P 1, Vol. 2)

Special Concerns

74. Regulated wetlands and watercourses adjacent to the north side of the railroad or potential accessways are identified in approximately 20 locations. About 13 of these would be crossed by the proposed line. Waterway crossings would involve 14 locations including the Norwalk, Saugatuck, Indian, and Mill Rivers, Ash Creek, Sasco Brook, and eight smaller brooks. All proposed crossings of waterways would be overhead. (CL&P/UI 1, Vol. 1, pp. 43, 45, Table 50; CL&P/UI 1, Vol. 2; CL&P/UI 6, Q-21)

75. Tidal marshes located on both sides of the ROW, provide food, water, shelter, and nesting areas for various birds and small mammals. Wildlife in this habitat include feeding birds, such as American Egret, Snowy Egret, and Glossy Ibis; and nesting birds, such as Yellow-crowned Night Heron, Black-crowned Night Heron, and Fish Crow. Rare and endangered species of mammals and birds, including the Least Shrew, have been sighted in areas of the Sherwood Millpond and the Sasco Creek wetlands. Since the proposed project would be confined to the north side of the ROW, construction activities would have little impact on wintering duck populations in Sherwood Millpond. (CL&P/UI 1, Vol. 1, pp. 42, 44, Table 5; CL&P/UI 6, Q-7)

76. Because the project would be located within the existing ROW in developed urban areas, construction would have minimal impact on the habitats of wildlife species in nearby areas. Such effects are expected to be reversible and temporary. (CL&P/UI 1, Vol. 1, pp. 46, 47; CL&P/UI 7, p. 36)

77. There are no wildlife management areas or land open to hunting along the north side of the railway. (CL&P/UI 1, Vol. 1, p. 46)

78. Construction of the proposed project would not affect any water supply areas. (CL&P/UI 1, p. 47; CL&P/UI 7, p. 38)

79. Construction activities would be limited to daylight working hours between sunrise and sunset except where not possible for railroad operations. (CL&P/UI 1, Vol. 1, Table 6; CL&P/UI 8, Q-48)

80. After construction, audible noise levels would not increase at any ROW boundary or at the property lines of Ely Avenue Junction, Norwalk; Pequonnock Substation, Bridgeport; or Sasco Creek Substation, Westport. (CL&P/UI 1, Vol. 1, Table 6; CL&P/UI 8, Q-48)

81. No water flow or quality changes would result from the construction or operation of the proposed telecommunications facility at Ely Avenue Junction, Norwalk. No telecommunications equipment would discharge pollutants to the ground water. No sanitary facilities are proposed for the Ely Avenue Junction facility. (CL&P/UI 1, Vol. 1, p. 47)

82. No equipment used at the proposed telecommunications facility at Ely Avenue Junction would emit air pollutants or noise except for limited periods during power outages when an emergency generator would be used. (CL&P/UI 1, Vol. 1, pp. 47, 48)

Cultural Resources

83. The railroad has been identified as a historic resource by the Office of the Connecticut State Historic Preservation Officer (SHPO). The entire historic railroad ROW includes all structures, electrical wires, and equipment that remain as original equipment and excludes any rails, ballast, or other components which have been changed. The SHPO indicated that the proposed transmission structures would affect the historical railroad resource and therefore would require documentation of the existing resource. CL&P would provide any required documentation. (CL&P/UI 1, Vol. 1, p. 41, 47; CL&P/UI 6, Q-26; CL&P/UI 11, Attachment 3)

84. Four other historic areas are located adjacent to the ROW. These are identified as follows: The National Register Historic District encompassing South Main Street and Washington Street, Norwalk; the Hanford Place National Register Historic District, containing Haviland Street and Elizabeth Street, Norwalk; the Southport National Register Historic District, Fairfield; and the Railroad Avenue National Register Industrial District in Bridgeport. (CL&P/UI 6, Q-2C, Vol. 2, Segment 3, Segment 11, Segment 16)

85. The Connecticut Historical Commission (CHC) opines that the proposed project would have no effect upon the historic engineering significance of the New Haven to Hartford electrification system, particularly in Norwalk's South Main Street-Washington Street area and in

Bridgeport's Railroad Avenue Industrial District. The CHC recommends that CL&P select colors for the proposed transmission structures that are compatible with the historic railroad-related structures. (CL&P/UI 1, Vol. 1, p. 41; CL&P/UI Exhibit 11, Attachment 3)

South Norwalk Railroad Station Redevelopment Area

86. UI and CL&P have leased rights from the railroad for two 115kV circuits along the ROW. At the time the lease was granted, the Norwalk Railroad Station property extended some lateral distance to the northwest and southeast from the tracks. In the early 1970's, title to a portion of that railroad property was transferred to the City of Norwalk. (CL&P/UI 6, Q-2; Q-26; CL&P/UI 7, p. 6)

87. CL&P's lease through the Norwalk Railroad Station in the South Norwalk (SONO) Redevelopment Project area includes present use of property on which the SONO Redevelopment Project construction is proposed. CL&P's lease would expire in year 2000, and CL&P would negotiate for long-term rights beyond year 2000 for use of this land. (CL&P/UI 1, Vol. 2, Segment 3; CL&P/UI 6, Q-2, Q-26; Tr. pp. 58, 61)

88. CL&P would need to acquire additional long-term ROW rights to two areas: one near railroad structure B517 (about 10 feet by 60 feet) to provide for a new structure, and the other along the ROW near the Norwalk Railroad Station, about 20 feet wide by 1200 feet long. (CL&P/UI 1, Vol. 1, p. 44; CL&P/UI 1, Vol. 2, Segment 3; CL&P/UI 6, Q-26; CL&P/UI 7, p. 6)

89. All existing overbuild structures along the southeast side of the Norwalk Railroad Station would be retained. The existing railroad catenary support structures are undergoing structural analysis to determine what reinforcements would be necessary to provide overbuild masts along the northwest side of the ROW. (CL&P/UI 6, Q-4)

90. For structures located in the SONO Redevelopment Project area, CL&P proposed either a vertical conductor overbuild configuration or a delta overbuild configuration for consideration by the SONO Redevelopment Project developer, Starrett Housing Corporation. Either configuration would involve higher structures than originally proposed if the proposed SONO Redevelopment Project buildings were constructed within the ROW. CL&P supports the vertical configuration in the SONO Redevelopment Project area as aesthetically superior to the delta configuration due to a more uniform height and neater appearance. (CL&P/UI 6, Q-3; CL&P/UI 9, Q-2, Q-5)

91. The heights of three overbuild structures, (B519, B520, B521) on the northwest side flanking the railroad station using a delta conductor configuration, would be respectively 70 feet, 73 feet, and 73 feet high. A revised overbuild plan, with setbacks based upon building heights and locations provided to CL&P by the SONO Redevelopment Area architect, would reinforce catenary structures and increase the heights of these three structures to 85, 85, and 86 feet using a vertical conductor configuration. To accommodate the increase in conductor heights, a steel monopole structure placed adjacent to catenary position B518 southwest of the Norwalk Station would be increased in height with the conductors placed in vertical configuration over the tracks to allow for greater lateral conductor clearance. (CL&P/UI 6, Q-3, Q-4; CL&P/UI 9, Q-5)

92. If an optional delta configuration were used, overbuild structures B519, B520, and B521 and the monopole structure adjacent to position B518 would be increased in height by 10 to 20 feet to range from 80 to 93 feet high, for the necessary clearance from a proposed SONO Redevelopment Project building on the west side of the tracks adjacent to the Norwalk Railroad Station. (CL&P/UI 9, Q-2, Q-5)

93. Use of independent steel pole structures B519, B520, and B521 would not be possible due to the unavailability of space to locate new steel pole foundations. The position of the Norwalk Railroad Station platform areas and buildings could allow a long span from the vicinity of structure B518 to structure B521. However, this optional design was rejected because of National Electric Safety Code Standards setbacks that would be necessary for buildings presently considered in the redevelopment plans. (CL&P/UI 6, Q-17; CL&P/UI 9, Q-2)

94. CL&P did not consider the use of new double circuit monopoles in the SONO Redevelopment Project area because insufficient ROW exists on both sides of the railroad to accommodate monopole foundations. In addition, the existing catenary structures would not support double circuit overbuilds on the same side of the tracks. (CL&P/UI 6, Q-4; Tr. pp. 60-64)

95. Reconfiguring the construction through the SONO Redevelopment Project area to eliminate conflicts created by the proposed redevelopment building would cost about $40,000 to $53,000, depending on the final structures. (CL&P/UI 9, Q-4; Tr. p. 61-62)

96. The City of Norwalk and the Starrett Housing Corporation maintain that CL&P should be responsible for the payment of the costs to redesign the proposed line. CL&P maintains such costs should be allocated to Starrett Housing Corporation. (CL&P/UI 9, Q-4; Norwalk 3; Starrett 5)

97. The construction of a proposed SONO Redevelopment Project building between the proposed transmission line and the SNEW property could constrain future construction of an 115kV interconnection (tap) between the SNEW facility and the proposed line. CL&P and SNEW have no immediate intentions to construct a line tap but plan such a connection when load grows. Any future overhead line tap would require an additional structure or the replacement of a proposed structure. (CL&P/UI 1, Vol. 1, p. 42; CL&P/UI 9, Q-2; Tr. pp. 63, 64, 75-77)

98. Overhead and underground alternative connections for a tap to the SNEW facility have been considered near the vicinity of structure No. 518. An underground interconnection beneath the proposed SONO Redevelopment Project building would not be feasible but could be constructed from some other unspecified location along the line. (CL&P/UI 6, Q-11)

99. CL&P has informed the Starrett Housing Corporation that a parcel of land in the vicinity of Franklin Street and the Franklin Street underpass (near Structure B517) should be retained for a future tap serving the SNEW facility located on Franklin Street (Tr. p. 64)

100. An underground section of line approximately 0.6 mile or more long would be needed to bypass the SONO Redevelopment Area via an alternate route to Ely Avenue Junction. CL&P did not develop a specific design for an optional underground route; however, CL&P found no usable locations for a termination facility in the redevelopment area. In addition, CL&P is unsure if the space at Ely Avenue station could accommodate additional steelwork bays and pumping plant required for a high pressure fluid-filled (HPFF) pipe-type underground line. CL&P did not calculate any cost estimates for this option. (Tr. pp. 54-57)

Costs

101. The proposed project is estimated to cost as follows:

Engineering	$ 2,100,000
Pequonnock Substation construction	2,100,000
Pequonnock-Ely Avenue Junction Line	18,200,000
Telecommunications System	300,000
Sub Total (1992$)	$ 22,700,000

Additional rehabilitation and accessway construction would increase the total costs to approximately $23.1 million. CL&P would assume 56.5 percent of the direct costs of construction and UI, 43.5 percent of the direct costs. CL&P and UI would bear the actual overheads and Allowance for Funds Used During Construction (AFUDC) of each companies' own direct costs. (CL&P/UI 1, Vol. 1, p. 4; CL&P/UI 6, Q-20, Q-21; Tr. p. 16)

Underground Alternatives

102. An underground alternative route through public streets from Pequonnock Substation, Bridgeport, to Ely Avenue Junction or to CL&P's Flax Hill Substation in Norwalk would be about 16.3 miles long (one mile longer than the proposed route) and would require transition stations at each end of the proposed alternate underground line. (CL&P/UI 1, Vol. 1, pp. 34, 38-39; CL&P/UI 6, Q-28; CL&P/UI 7, pp. 30-32; Tr. pp. 44-46)

103. Alternate underground systems available for installation include solid dielectric conductors and HPFF pipe-type enclosed conductor systems. CL&P would use a 115kV HPFF system for the alternative underground route. (CL&P/UI 1, Vol. 1, pp. 34, 38, 39, Figure 17; CL&P/UI 6, Q-28; CL&P/UI 7, pp. 30-32)

104. Underground transmission lines are less prone to failure than an overhead line but failures require more time to locate and repair, possibly several weeks. Overhead transmission line failures can be readily identified and repaired in a few hours. Restoration of a line failure on the proposed line along the railway could require 12 to 24 hours due to coordination of railroad operations. (CL&P/UI 1, Vol. 1, p. 39)

105. Underground transmission lines are usually constructed in urban areas where ROW acquisition for an overhead line would dislocate existing land uses and where the cost of undergrounding is not excessive in relation to the cost of an overhead line. (CL&P/UI 1, Vol. 1, p. 39)

106. Using an underground system would avoid the visual appearance of a second line along the railroad ROW. Difficulties involved with constructing an underground transmission system include disruptions of traffic along busy streets, inconvenience to adjacent property owners, environmental impacts created by cut and fill operations, and crossings of wetlands and water courses via bridges and culverts. (CL&P/UI 1, Vol. 1, pp. 38, 39; CL&P/UI 7, pp. 30-32)

107. Excavation of a four-foot wide by five-foot deep trench for a HPFF, pipe-type underground system would entail removal of rock and soil by mechanical equipment aided by blasting where necessary. Excavated material would be removed from the area and disposed in an approved manner. Two parallel, six-to-eight inch diameter steel pipes forty feet long would be welded into sections and placed into the open trench 24 inches apart. The trench would be backfilled and compacted with new sand and gravel, and three, paper-insulated conductors would be pulled through the pipe. (CL&P/UI 1, Vol. 1, pp. 38-39, Figure 17)

108. Pre-cast concrete manholes, about 15 feet long by eight feet wide by seven feet deep, would be inserted into the trench at 2000- to 2500-foot intervals for HPFF cable pulling and splicing. After the cable had been pulled through the pipe and spliced at the manholes, the pipe would be filled with an insulating fluid, pressurized, and tested at one of the pumping units at one of the terminator stations. (CL&P/UI 1, Vol, 1, p. 39)

109. An underground 115kV cable line using a HPFF pipe-type system along the Pequonnock Substation, Bridgeport, to Ely Avenue Junction, Norwalk, underground route would cost an estimated $45 to $49 million, about $27 to $31 million more than the proposed overhead project. (CL&P/UI 1, Vol. 1, p. 38; CL&P/UI 7, p. 31)

110. An alternate underground system using directly buried dielectric cable would require the excavation of a four-foot wide by six-foot deep trench with three phases placed laterally 12 inches apart and a second set of three phases placed parallel and directly above the first set. This configuration would be used with a 1600 kcmil or 1750 kcmil conductor. (CL&P/UI 6, Q-28; Sketch A.28; Tr. pp. 230-237)

111. CL&P estimated the following costs of a buried solid dielectric cable system along the alternative underground route from Pequonnock Substation, Bridgeport, to Ely Avenue Junction, Norwalk, using actual construction costs incurred by the Exeter Project (Council Docket No. 98). The estimated cost was calculated at $63.1 million (1993$) exclusive of any necessary concrete ducting. (Tr. pp. 230-237)

112. CL&P investigated the possibility of undergrounding a 3.4 mile long section of the proposed line from the Saugatuck River to the Sherwood Island Millpond, principally along Green Farms Road, Westport, to avoid the construction of the proposed overhead line adjacent to residential areas. CL&P identified two potential sites for two necessary overhead to underground transition stations for a HPFF system. Each transition station would require a fenced area 140 feet by 170 feet for the terminator equipment. A pump house to pressure the system would be located in one station. The total cost for such an undergrounded section is estimated at $10 to $11 million, or about $6.7 to $7.4 million over the cost of the proposed project. (CL&P/UI 6, Q-29, Attachment; Westport 4, Exhibit Z; Tr. p. 32)

113. Undergrounding sections of the proposed line near residential areas in Bridgeport, Fairfield, Westport, and Norwalk could increase costs to approximately $45 to $50 million. (CL&P/UI 6, Q-14 Attachment, Q-29)

114. An optional underground system along the ROW would require a 35-foot wide ROW from the post of the catenary structure to the ROW edge. About 25 percent of the north side of the ROW varies from eight feet to 16 feet. About 70 percent of the north side ROW is less than 35 feet wide. Approximately 60 percent of the south side ROW is less than 35 feet wide. (CL&P/UI 6, Q-1H, Attachment; CL&P/UI 10, Attachment)

115. The average installed cost per mile for the Pequonnock Substation, Bridgeport, to Ely Avenue Junction, Norwalk, line for various cable systems are as follows:

Proposed overhead	$1,087,000/mile
Alternate HPFF underground cable without two terminator stations	$2,740,000/mile
Optional solid dielectric underground cable	$3,820,000/mile

(Tr. pp. 45-46)

Overhead Alternatives

116. CL&P proposes the reconstruction of the existing overhead Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, double circuit line, over 16 miles in length, as an alternative to the proposed project. This proposal would require extended single or double-circuit transmission line service outages during various construction stages, exposing the southwest area to major service interruptions. (CL&P/UI 1, Vol, 1, p. 32; CL&P/UI 7, pp. 17-19)

117. Reconstruction of the Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, line in the near future would not increase the number of load-bearing circuits in the southwest area. Construction of this alternative would postpone the need for the Pequonnock Substation, Bridgeport, to Ely Avenue Junction, Norwalk, project until 1997, eventually requiring the construction of the proposed line. (CL&P/UI 1, Vol. 1, pp. 32, 33; CL&P/UI 7, p. 11)

118. CL&P did not investigate any combination of partially overhead, partially underground configurations along the alternate overhead Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, route. (CL&P/UI 6, Q-30)

119. The Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, alternate overhead rebuild would require the following:

a. About 110 existing single circuit lattice towers approximately 85-foot high would be replaced by double circuit steel poles

similar to those used in the Trumbull Junction, Trumbull, to Old Town Substation, Bridgeport, project (Council Docket 57). The new structures would range from 80 feet to 110 feet high, averaging 100 feet above ground.

b. The existing 556.5 kcmil conductors from Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, would be replaced by 1590 kcmil ACSR conductors from Old Town Substation, Bridgeport, to Weston Substation, Weston, and 1272 kcmil conductors from the Weston Substation, Weston, to Norwalk Substation, Norwalk.

(CL&P/UI 6, Q. 27)

120. The construction cost of the Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, alternate overhead project is estimated at $20 million plus an additional cost of approximately $1.5 million for a capacitor bank at Norwalk Substation. Additional costs, estimated at $5 to $10 million, would be incurred by the dispatch of uneconomic generation needed during periods when construction would remove circuits from service. Uneconomic generation would be acquired from NEPOOL or other sources including CL&P's Greenwich Station's oil-fired turbine generators. (CL&P/UI 1, Vol. 1, pp. 32, 33; CL&P/UI 6, Q-30)

121. Although the proposed line would delay the need to rebuild Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, circuits from 1994 to 1996-1997, both a new east to west circuit, such as the proposed line, and a rebuilding of the Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, circuits would be necessary for an adequate number of circuits and transmission capacity to southwest Connecticut. If the proposed project were constructed prior to reconstruction of the Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, circuits, three supply circuits would be available to the southwest area during the time of Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, reconstruction, when both of the existing circuits along this route would be out of service. This plan would improve service reliability and allow for the scheduling of outages during the Old Town Substation, Bridgeport, to Norwalk Substation, Norwalk, reconstruction.

(CL&P/UI 1, Vol. 1, pp. 32, 33; CL&P/UI 6, Q-27; CL&P/UI 7, pp. 25-29, Exhibit C, Table 3A, 3B, 3C, Table 4; UI 8, Q-37; NU 1991 Forecast of Loads and Resources, Table V-5; Tr. pp. 91-92)

122. Another alternate overhead system to the proposed Pequonnock Substation, Bridgeport, to Ely Avenue Junction, Norwalk, line would be the construction of a 345kV/115kV substation in Norwalk; a new 345kV circuit from Plumtree Substation, Bethel, to Norwalk Substation, Norwalk; and a second 345kV circuit from Long Mountain Substation, New Milford, to Plumtree Substation, Bethel. An additional 345kV circuit from some point east of the southwest Connecticut area would complete a transmission loop to the southwest area. This option would entail acquisition of new ROW and reconstruction of some existing 115kV facilities. Construction would not be completed until the late 1990's, beyond CL&P's estimated year of need for additional supply to the southwest area. (CL&P/UI 1, Vol. 1, p. 33)

123. CL&P considered the construction of common double-circuit structures along a section of ROW on the south side of the railroad from the Saugatuck River (structure No. 583) to Hills Point Road (structure No. 604), Westport. This option would cost $2.6 million (exclusive of any ROW acquisition and clearing costs), $900,000 more than the proposed single circuit. (CL&P/UI 6, Q-29)

124. An optional, reverse-phase 115kV overhead line on common double-circuit structures, along the ROW was rejected by CL&P because a double circuit structure would require 35 feet to the edge of the ROW in many locations, acquisition of some additional ROW, and would be located within 100 feet of 101 residential units along the ROW in Norwalk, Westport, Fairfield, and Bridgeport. Placing common, double-circuit structures on one side of the ROW would cost an additional $600,000 per mile or about $9.3 million more than the $18.2 million cost of the proposed line, excluding additional ROW acquisitions. (CL&P/UI 1, Vol. 1, p. 39; CL&P/UI 6, Q-3, Sketch 3A, Q-29; CL&P/UI 11; Tr. pp. 102, 103, 108-110, 210-212, 214)

125. The construction of the proposed line solely on extensions of the 240 existing railroad catenary structures over the entire distance of the line would increase stress on the existing catenary structures and foundations by about 20 percent. This construction would require reinforcement of

existing structures, foundations, and additional ROW for new accessways. In 1989, the estimated cost of this optional line was $23 million excluding the cost of additional ROW for new access. (CL&P/UI 1, Vol. 1, pp. 39-41; CL&P/UI 6, Q-1.D, Attachment)

126. CL&P has not evaluated the possibility of upgrading any of the 115kv southwestern Connecticut circuits to 138kV or 230kV capability. Such a conversion would require considerable modifications or complete rebuilding, including the addition or replacement of transformers at existing substations to step up voltage to the higher level served by each of the circuits. (CL&P/UI 6, Q-8, Q-9)

127. At summer Short Term Emergency (STE) loads, a 1590 kcmil conductor is capable of carrying approximately 400 amps more load than 1272 kcmil cable. Upgrading the existing 1130 and 1430 circuits from 1272 kcmil cable to 1590 kcmil would not fully alleviate overloading of the lines entering the area. (Tr. pp. 40-41)

Electric and Magnetic Fields

128. Operating electric transmission and distribution lines creates electric and magnetic fields (EMF). An electric field is produced by voltage which moves the electricity along the wires. The unit for measuring such an electric field is "volts per meter" or V/m. A magnetic field is produced by the current which is a function of the quantity of electricity flowing along the wires. The unit for measuring magnetic field levels is "milligauss" or mG. Electric current is measured in amperes. (CL&P/UI 1, Vol. 1, Appendix E-Bailey, p. 1; CL&P/UI 6, Q-28; CL&P/UI 7, pp. 41, 42)

129. People are constantly exposed to EMF in everyday life because EMF is created by all things using or creating electricity including transmission lines, distribution lines, indoor wiring, and electrical appliances. EMF varies during the course of each day depending on electricity use. (CL&P/UI 1, Vol. 1, Appendix E-Bailey, p. 2)

Magnetic Fields

130. Background magnetic field levels in homes are around 1 mG. Magnetic fields could range from 10,000 mG at a distance of one inch from an appliance to 100 mG at a distance of one foot

from the same appliance. Magnetic fields decrease with distance from the source. (CL&P/UI 1, Vol. 1, Appendix E-Bailey, p. 2)

131. Magnetic field levels along the edge of the ROW, at a distance of 12 feet, for the existing and proposed lines under average and maximum winter (STE) loads in 1990 and 1994, would be as follows:

Edge of Row Magnetic Fields

Year	Location	North Side Field (mG)	North Side Load (Amp)	South Side Field (mG)	South Side Load (Amp)
1990	Existing Only				
	Average	4.2	0	22.8	502
	Maximum (STE)	25.5	0	147.0	2975
1994	Existing Only				
	Average	5.0	0	26.8	591
	Maximum (STE)	25.5	0	147.0	2975
1994	Existing & Proposed				
	Average	16.1	423	22.5	430
	Maximum (STE)	119.0	2975	168.0	2975

The proposed line would reduce future increases in magnetic fields created by increasing loads on the south side line because the magnetic fields created by parallel and opposing lines tend to reduce each other. Slight changes in total magnetic fields were created as trains accelerated or decelerated past measurement points. (CL&P/UI 1, Vol. 1, Appendix E-PTI, p. 4-9, Table 1, Figures 3 to 6, and Appendix 3, p. A-5; CL&P/UI 6, Q-18, Attachments; CL&P/UI 7, pp. 42, 43; CL&P/UI 10; Tr. pp. 49, 92, 97, 98)

132. The State of Connecticut has not enacted safety standards for magnetic field levels of electric transmission lines. As a guide for this transmission line construction, CL&P has determined that the State of New York interim winter standard of 200 mG at the edge of a ROW would not be exceeded by the operation of the proposed line. (CL&P/UI 1, Vol. 1, Appendix E-PTI, pp. 7, 9; CL&P/UI 6, Q-18A and Attachment 18A; CL&P/UI 8, Q-31B and Attachment, CL&P/UI 7, pp. 46, 47; Tr. pp. 79-81)

133. Reverse phasing and compact spacing of conductors could reduce magnetic fields by as much as 85 percent. Reverse phasing occurs when two parallel circuits are arranged symmetrically but in reverse order on the same structure. (CL&P/UI 10, Attachment)

134. Placing the proposed conductors on structures approximately 300 feet apart would reduce conductor sag and the required separation between cables. This arrangement of compact spacing, when aligned to balance the opposing magnetic

fields produced by the south side line, would be termed cancellation phasing and would reduce magnetic fields created by both lines. CL&P would use compact spacing and cancellation phasing in the proposed line to reduce magnetic fields produced by 1994 loads by 20 to 44 percent on 80 to 85 percent of the proposed line. (CL&P/UI 1, Vol. 2; CL&P/UI 7, pp. 47-53; CL&P/UI 10, Attachment; Tr. pp. 47-48, 93, 96)

Underground Lines

135. Magnetic fields from an underground cable system using either 1750 or 2500 kcmil conductors in a HPFF pipe system without shielding, as measured three feet above ground level above the cable and at a 100-foot lateral distance, would be as follows:

Magnetic Fields

Cable (Kcmil)	1994 Winter Loading	Current (Ampere)	Maximum field (mG)	Field at 100' Distance (mG)
2 X 1750	Normal	2 X 1135	66.3	0.3
2 X 1750	LTE	2 X 1220	71.4	0.4
2 X 1750	STE	2 X 1245	73.4	0.4
2 X 2500	Normal	2 X 1260	74.3	0.4
2 X 2500	LTE	2 X 1357	79.4	0.4
2 X 2500	STE	2 X 1386	81.1	0.4

The values in the table assume no circulating currents in the cable sheath and no magnetic field attenuation resulting from the cables in the pipe. Although improvement in magnetic field shielding of HPFF pipe systems requires additional research, specialized pipe material could reduce magnetic fields up to a factor of 30. (CL&P/UI I, Vol. 1, Figure 17; CL&P/UI 6, Q-28)

136. The magnetic fields from 1600 kcmil solid dielectric cables buried directly underground in 13-foot wide or 4-foot wide trench configurations, as measured three feet above ground level above the cable and at a 100-foot lateral distance, would be as follows:

Magnetic Field

Trench Width (feet)	Winter Loading	Six Phase Current (Ampere)	Field at Three Feet Above Ground Level (mG)	Field At 100 Feet Distance (mG)
13	Normal	2 x 1075	601	0.3
13	LTE	2 x 1263	706	0.4
13	STE	2 x 1488	832	0.5
4	Normal	2 x 1075	178	0.0
4	LTE	2 x 1263	209	0.1
4	STE	2 x 1488	246	0.1

(CL&P/UI 6, Q-28C Attachment)

Electric Fields

137. The earth, cable sheaths, and HPFF cable pipes would completely shield electric fields from an underground pipe-type line. (CL&P/UI 6, Q-28 Attachment)

138. Electric fields produced by the south side and proposed north side lines would be shielded by the overhead railroad feeder lines, buildings, vegetation, and other objects. (CL&P/UI 1, Vol. 1, Exhibit E-PTI, Appendix 1; CL&P/UI 6, Q-18C)

139. The electric fields produced by the existing south side line and the proposed north side line for 1990 and 1994 average and maximum winter load (STE) conditions along the length of the project are as follows:

Edge of ROW Electric Field Levels

Year	Location	Northside Electric Field (kV/m)	Northside Load Amp)	Southside Electric Field kV/m)	Southside Load (Amp)
1990	Existing line				
	Average load	0.08	-	0.47	502
	Winter STE load	0.08	-	0.51	2975
1994	Existing line				
	Average load	0.08	-	0.47	591
	Winter STE load	0.08	-	0.51	2975
1994	Existing & Proposed lines				
	Average load	0.30	423	0.45	430
	Winter STE load	0.32	2975	0.49	2975

Calculated electric field levels assume the absence of any object that would alter the field. Electric fields depend on line voltage and the physical layout of the conductors, and do not vary with changing loads. (CL&P/UI 1, Vol. 1, Exhibit E-PTI, Appendix 1; CL&P/UI 6, Q-18A, Attachment, Q-18B, Attachment)

140. Connecticut does not have any electric field standards. As a guideline for this transmission line construction, CL&P has determined that the State of New York edge of the right of way maximum standard of 1.6 kV/m (1600 volts/meters), would not be exceeded by the operation of the proposed line. (CL&P/UI 1, Vol. 1, Appendix E-Appendix 1; CL&P/UI 5, (New York State Power Lines Project Scientific Advisory Panel Final Report, p. 11); CL&P/UI 7, pp. 46, 47)

Research

141. The Environmental Protection Agency (EPA) received testimony from a subcommittee of the Scientific Advisory Board to the EPA and the Peer Review Panel of the EPA regarding research on EMF as a possible human carcinogen. These two panels recommended that EMF not be given any ranging (ranking) as a potential carcinogen. (Tr. pp. 200-202, 228)

142. Epidemiological studies conducted by David Savitz, Nancy Wertheimer, and Dr. Steven Peters have indicated that weak or non-existent relationships exist between measured magnetic field levels in a home and certain types of childhood cancer. Such studies have focused on distribution lines because the number of homes near transmission lines is limited. (CL&P/UI 1, Vol. 1, Appendix E-Bailey, pp. 3, 4; Tr. pp. 120-143)

143. Human and laboratory research does not indicate that EMF at the levels expected from the operation of the proposed project would pose health risks to humans. (CL&P/UI 1, Vol. 1, Appendix E-Bailey, Executive Summary, pp. 6-10; CL&P/UI 7, pp. 43-46)

144. The Department of Environmental Protection's Radiation and Noise Control Division (DEP) submitted testimony that the electromagnetic fields produced on the north and south sides of the railway would be well below the levels found in other states' regulations. In addition, the DEP is continuing to study the possibility of setting a policy for potential EMF controls in the future. The DEP concluded that the proposed project can not be opposed on the basis of health risk to the population in the area of concern. (DEP letter, dated April 15, 1991)

145. The Department of Health Services (DHS) Division of Environmental Epidemiology and Occupational Health submitted testimony indicating the DHS has followed studies of health effects of EMF for several years. DHS has stated that studies of EMF on humans have not established a direct link between harmful health effects and EMF exposures. (DHS Memorandum, dated May 14, 1991)