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Admitted in: MA, ME, NH

May 17, 2019

James R. Beyer
Maine Dept. of Environmental Protection
106 Hogan Road, Suite 6
Bangor, ME 04401

Bill Hinkel
Land Use Planning Commission
22 State House Station
Augusta, ME 04333-0022

RE: NECEC – CMP's Response to MDEP May 9, 2019 Additional Information Request

Dear Jim and Bill:

Enclosed is the additional information the DEP requested from CMP at the May 9, 2019 hearing, as further described by Presiding Officer Miller and by Jim on May 10, 2019.

Sincerely,



Matthew D. Manahan

Enclosure
cc: Service Lists

May 17, 2019

Mr. James R. Beyer
Maine Department of Environmental Protection
Division of Land Resources Regulation
106 Hogan Road
Bangor, ME 04401

**RE: New England Clean Energy Connect Project
Response to MDEP May 9, 2019 Additional Information Request**

Dear Mr. Beyer:

Central Maine Power Company (CMP) is providing the enclosed materials for the New England Clean Energy Connect (NECEC) Project, as requested by the Maine Department of Environmental Protection (DEP) at the May 9, 2019 hearing and as further described by Presiding Officer Miller and by you on May 10, 2019.

On May 10, 2019, in an email to the service list, DEP Presiding Officer Suzanne Miller stated that the record is closed except that three sets of documents and information will be allowed to be submitted by specific parties by May 17, 2019 as follows:

- Existing maps to be submitted by Dr. Simons-Legaard / Intervenor Group 6 in response to questions from the DEP.
- Cost breakdown to be submitted by CMP in response to questions from Mr. Bergeron. Mr. Bergeron requested costs, dollars, or a numerical backup sheet for CMP Exhibits 11-B through 11-G of Mr. Bardwell's pre-filed rebuttal testimony dated March 25, 2019.
- Engineering information pertaining to pole heights and possible tree heights, to be submitted by CMP in response to questions from you.

Also on May 10, 2019, in an email to the service list, you circulated the five maps and additional direction that the Presiding Officer noted in her third bullet point above. You explained:

Attached are the files I used to produce the maps for my questions of the Engineering Panel. I produced these from the Google Earth map on our web site. The point of this line of questioning was to determine whether based on the topographic change between the proposed structure locations and the streams being crossed would allow CMP to leave existing vegetation; or if the current design would require the removal of the capable species, how much taller would the structures need to be in order to maintain a 35 foot canopy height.

Enclosed with this letter are the two document requests made of CMP. CMP reserves the right to respond to the first document request (existing maps to be submitted by Dr. Simons-Legaard) by the deadline of May 24, 2019.

Attachment A: Cost Breakdown of Exhibits CMP-11-B through CMP-11-G

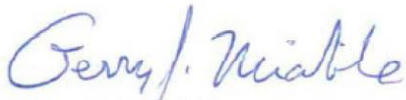
CMP attaches hereto Exhibits CMP-11-B.1 through CMP-11-G.1, which are the cost breakdowns of Exhibits CMP-11-B through CMP-11-G.

Attachment B: Pole and Tree Height Information

CMP attaches hereto: (1) a table summarizing the structure height changes required and comments on the impacts of the height changes; (2) red-lined markups from the screenshots you provided to correctly reflect the NECEC permit application structure numbers; and (3) an illustrative cross-section for a typical wildlife travel corridor in your five crossing locations. This information is responsive to your May 9 hearing questions and your May 10 email and attachments. All five crossing locations you suggested can accommodate 35' tall vegetation with limited impact to currently proposed structure heights. Three of the five crossings (Moxie Stream, South Branch Moose River, and Tomhegan Stream) require no structure height increases to accommodate 35' tall vegetation along the entire span, one span requires only one structure to increase in height by 10.5' (area near Wilson Hill Pond and Tobey Pond), and the remaining span requires only one structure to increase in height by 5.5' (area near Spencer Road). The two spans where the 35' tall vegetation is not possible for short distances along the span can accommodate up to 25' tall vegetation in those locations.

If you have any questions regarding this submittal, please give me a call at (207) 629-9717 or email me at gerry.mirabile@cmpco.com.

Sincerely,



Gerry J. Mirabile
Manager – Environmental Projects
Environmental Permitting
AVANGRID Networks, Inc.

Enclosures

cc: MDEP Service List; LUPC Service List

ATTACHMENT A
Cost Breakdown of Exhibits CMP-11-B.1 through CMP-11-G.1

Black & Veatch

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Proposed Route**
 Estimate Overall Route Length **146.88** Miles
775,504 Feet **390** Splices per Circuit

Computed By **N. Thomas**
 Checked By **J. Bardwell**

1 DC Circuits
2 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
CABLE SYSTEM INSTALATION							
UNDERGROUND CABLE AND ACCESSORIES							
320kV DC, 2500 sq. mm. Cu Cable	3,153,676	ft					\$441,514,640.00
Installed Spare	788,419	ft					\$110,378,660.00
Cable Installation, Duct	78	seg					\$8,580,000.00
Cable Laying, Direct Buried	3,127,520	ft					\$31,275,200.00
Cable Terminations-AIS	10	ea					\$800,000.00
Spare Cable Term-AIS	2	ea					\$90,000.00
Cable Joints	2,340	ea					\$163,800,000.00
Spare Cable Joints	12	ea					\$420,000.00
Surge Arresters, 209 MCOV	0	ea					\$0.00
Field Testing	1	lot					\$105,000.00
Mobilization/Demobilize (Cable)	1	lot					\$250,000.00
CABLE SYSTEM FURNISH & INSTALL SUBTOTAL				\$637,198,300.00		\$120,015,200.00	\$757,213,500.00
COMMUNICATIONS							
Fiber Optic Cable (48 Fiber)	1,590,308	ft					\$10,543,742.04
Splice Enclosure	160	ea					\$192,000.00
Splicing	160	ea					\$480,000.00
Fiber-optic Pull Boxes	780	ea					\$3,900,000.00
COMMUNICATIONS SUBTOTAL				\$6,944,924.00		\$8,170,818.04	\$15,115,742.04
DISTRIBUTED TEMPERATURE SENSING (DTS)							
DTS SUBTOTAL				\$0.00		\$0.00	\$0.00
CIVIL WORK							
GENERAL							
Mobilization/Demobilize (Prime)	3	lot					\$750,000.00
Construction Surveying & Staking	146.88	MI					\$1,835,946.97
GENERAL SUBTOTAL				\$300,000.00		\$2,285,946.97	\$2,585,946.97
OVERHEAD TO UNDERGROUND TRANSITIONS							
STRUCTURES SUBTOTAL				\$0.00		\$0.00	\$0.00
Jointing Locations							
Splice Enclosures, 12'x4'x3'	1,950	ea					\$24,375,000.00
Site work for joint bays	390	ea					\$7,800,000.00
Temporary joint bays	390	ea					\$9,750,000.00
Jointing location restoration	390	ea					\$3,120,000.00
Splice Grounding	1,950	ea					\$1,462,500.00
SPLICING ENCLOSURES SUBTOTAL				\$20,182,500.00		\$26,325,000.00	\$46,507,500.00

Owner **Avangrid** Computed By **N. Thomas**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Proposed Route** Checked By **J. Bardwell**
 Estimate Overall Route Length **146.88 Miles** **1 DC Circuits**
775,504 Feet **390 Splices per Circuit** **2 Cables per Pole**

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
TRENCHING DIRECT BURIED							
Clearing and Grubbing (Light clearing)	1077	acres					\$13,462,500.00
Access Road (3/4" Gravel over Geotextile)	1042507	sq. yd					\$40,042,681.07
Soil Erosion and Sediment Control	118.47	Mi					\$5,331,000.00
Silt Fence	1251008	lft					\$8,757,056.00
Excavation	1135174	Cu. Yd.					\$120,896,023.11
Cable Bedding	173751	Cu. Yd.					\$19,981,377.78
Concrete Cap	86876	Cu. Yd.					\$23,456,400.00
Backfill, Native	648671	Cu. Yd.					\$42,163,602.96
Vegetation Restoration (Grass/Shrub Mix)	1,077	acres					\$3,607,848.48
Dewater (50%)	312,752	lft					\$9,382,560.00
Shoring (0%) (Sloping)	0	sqft					\$0.00
TRENCH WORK SUBTOTAL				\$47,278,179.92		\$239,802,869.48	\$287,081,049.40
						Per route foot	\$458.96
<hr/>							
JACK AND BORE INSTALLATION	0	@	250 Feet Each				
JACK AND BORE SUBTOTAL				\$0.00		\$0.00	\$0.00
						Per foot	#DIV/0!
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HDD INSTALLATION (NO CASING : Land to Land)							
Mobilization/Demobilize (HDD)	1	lot					\$50,000.00
Site Preparation for HDD	150	sets					\$6,000,000.00
Horiz. Directional Drill	300,000	lft					\$148,500,000.00
Conduit for Cables, 10" DR 9 HDPE	900,000	lft					\$45,000,000.00
Conduit for Comm., 6" DR 9 HPDE	300,000	lft					\$9,000,000.00
HDPE Innerduct, 1 1/4"	900,000	lft					\$3,150,000.00
HDD INSTALLATION SUBTOTAL				\$42,600,000.00		\$169,100,000.00	\$211,700,000.00
						Per route foot	\$1,411.33

Black & Veatch

Owner **Avangrid**

Project **NECEC**

B&V File No. 400319.42.3000

Assumptions - Underground Cost Estimate, Proposed Route

General

- 1 The estimate is based on a 320 kV DC Cable installation 146.88 miles long.
- 2 ROW acquisition costs are not included in the estimate.
- 3 Environmental mitigation costs are not included in the estimate.
- 4 The estimate does not include costs related to contaminated or hazardous soils or water.
- 5 The estimate does not include allowances for existing facility relocations.
- 6 The estimate does not include allowances for work hour/location restrictions.
- 7 The estimate is in 2019 dollars and includes 3 years of escalation at 2.5%
- 8 The estimate includes a 10% allowance for prime contractor mark-up.
- 9 The estimate includes a 14.46% contingency.
- 10 The estimate includes sales tax of 5.5% on materials only.

Cable & Accessories

- 11 The estimate assumes a single +/-320kV DC circuit with 2 cables per pole.
- 12 The cables are estimated as 320kV DC, 2500 sq. mm Cu Cable.
- 13 The estimate includes an installed spare cable the full length of the line.
- 14 The estimate includes (10) AIS cable terminations, and 2 spare terminations.
- 15 The estimate includes (2,340) single-phase cable joints, with 4 spare joints.
- 16 The estimate does not include surge arrestors.
- 17 The estimate does not include optical fiber cable inside the power cable for temperature monitoring.

Communications

- 18 The estimate includes two fiber optic cable systems.
- 19 Fiber-optic cables are estimated as 48 fiber, single mode, loose tube outdoor cable.
- 20 Fiber-optic cables are installed into 1 1/4" HDPE innerducts installed in 4" PVC conduit.
- 21 Separate pull/splicing boxes are included for the fiber-optics.

Temperature Monitoring

- 22 The estimate does not include cable temperature monitoring equipment.

Overhead to Underground Transition

- 23 The estimate does not include termination supports or stands.
- 24 The estimate does not include provisions for overhead transmission connections
- 25 The estimate does not include concrete encased sweeps for the cable

Splice Housings

- 26 The estimate includes (390) jointing locations with (5) 12'x4'x3' precast concrete splice housings at each location.
- 27 Each splice housing is assumed to hold (1) splice.

Duct Bank Installation

- 28 The estimate does not include duct bank.

Direct Buried Installation

- 29 The estimate does not include conduits in the direct buried sections.
- 30 The estimate includes soil erosion and sediment control measures for green spaces.
- 31 The cables are installed in a single 5' wide trench averaging 7' deep.
- 32 The cables are installed in a thermal sand cable bedding material
- 33 The estimate includes a 9" thick concrete cap installed 18" below grade
- 34 The estimate assumes backfilling direct buried sections with native soils.
- 35 The estimate includes vegetation clearing and restoration 50' wide for construction not in roadways.
- 36 The estimate includes allowance for dewatering for 50% of the trench in uplands, and 100% in wetlands.
- 37 The estimate does not include shoring for the trenches.

HDD Installation

- 38 The estimate includes (150) sets of HDD installations in soil, 1000 feet long each.
- 39 Each HDD installation consists of the bundled FPVC or HDPE conduits pulled directly into the boreholes.
- 40 The HDD installations do not include a casing.
- 41 The HDD installations do not include grouting of the bore hole.

Engineering & Construction Management

- 42 The estimate includes surveying, and soil exploration.
- 43 The estimate includes approximate engineering costs.
- 44 The estimate includes construction management based on a 15 month construction duration.

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, New corridor portion of Proposed Route**
 Estimate Overall Route Length **53.50 Miles**
282,480 Feet

Computed By **J. Bardwell**

Checked By

1 DC Circuits
2 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
TRENCHING DIRECT BURIED							
	182480	FEET					
Clearing and Grubbing	314	acres					\$3,925,000.00
Access Road (3/4" Gravel over Geotextile)	304133	sq. yd					\$11,681,761.33
Soil Erosion and Sediment Control	34.56	Mi					\$1,555,227.27
Silt Fence	364960	lft					\$2,554,720.00
Excavation	331167	Cu. Yd.					\$35,269,328.89
Cable Bedding	50689	Cu. Yd.					\$5,829,222.22
Concrete Cap	25344	Cu. Yd.					\$6,843,000.00
Backfill, Native	189239	Cu. Yd.					\$12,300,503.70
Vegetation Restoration (Grass/Shrub Mix)	314	acres					\$1,052,527.55
Dewater (50%)	91,240	lft					\$2,737,200.00
Shoring (0%) (Sloping)	0	sqft					\$0.00
TRENCH WORK SUBTOTAL				\$13,792,593.29		\$69,955,897.68	\$83,748,490.97
						Per route foot	\$458.95
<hr/>							
JACK AND BORE INSTALLATION	0	@	250 Feet Each				
JACK AND BORE SUBTOTAL				\$0.00		\$0.00	\$0.00
						Per foot	#DIV/0!
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HDD INSTALLATION (NO CASING : Land to Land)							
	100	Sets of 2 @	1,000 Feet Each				
Mobilization/Demobilize (HDD)	3	lot					\$150,000.00
Site Preparation for HDD	100	sets					\$4,000,000.00
Horiz. Directional Drill	200,000	lft					\$99,000,000.00
Conduit for Cables, 10" DR 9 HDPE	600,000	lft					\$30,000,000.00
Conduit for Comm., 6" DR 9 HPDE	200,000	lft					\$6,000,000.00
HDPE Innerduct, 1 1/4"	600,000	lft					\$2,100,000.00
HDD INSTALLATION SUBTOTAL				\$28,400,000.00		\$112,850,000.00	\$141,250,000.00
						Per route foot	\$1,412.50

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
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282,480 Feet

Computed By **J. Bardwell**

Checked By

1 DC Circuits
2 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
CABLE SYSTEM FURNISH AND INSTALL							
UG CABLE AND ACCESSORIES SUBTOTAL				\$232,095,800		\$39,754,000	\$271,849,800
COMMUNICATIONS							
CABLE SYSTEM COMMUNICATIONS (FO) SUBTOTAL				\$2,536,280		\$2,984,003	\$5,520,283
CIVIL WORK							
GENERAL SUBTOTAL				\$300,000		\$1,118,750	\$1,418,750
OVERHEAD TO UNDERGROUND SUBTOTAL				\$272,718		\$496,809	\$769,527
SPLICING VAULT SUBTOTAL				\$7,400,250		\$11,082,500	\$18,482,750
DIRECT BURIED				\$13,792,593		\$69,955,898	\$83,748,491
Direct Buried cost per route foot				\$458.95			
HDD INSTALLATION SUBTOTAL				\$28,400,000		\$112,850,000	\$141,250,000
HDD Ductbank cost per route foot(2 Bores))				\$1,412.50			
ESTIMATED LABOR & MATERIAL COST				\$284,797,641		\$238,241,960	\$523,039,601
ESCALATION				3 Years @ 2.50%	\$21,360,000	\$17,868,000	\$39,228,000
ESCALATED CONSTRUCTION COST				\$306,157,641		\$256,109,960	\$562,267,601
Mark-Up				10.0% of Est. Labor & Mat.	\$30,616,000	\$25,611,000	\$56,227,000
ESTIMATED PROJ COST				\$336,773,641		\$281,720,960	\$618,494,601
STATE SALES TAX				5.5% of Materials	\$18,523,000		\$18,523,000
ROW ACQUISITION				\$0 per Mile			\$0
MITIGATION							\$0
TOPOGRAPHIC SURVEYING/SOIL EXPLORATION @ 40,000/mi							\$2,140,000
ENGINEERING AND CONSTRUCTION MANAGEMENT							\$18,554,838
CONTINGENCY				14.46% of project cost			\$92,426,793
ESTIMATED TOTAL PROJ COST							\$750,139,232
UNDERGROUND PROJECT TOTAL						(rounded)	\$750,000,000

Black & Veatch

Owner **Avangrid**

Project **NECEC**

B&V File No. 400319.42.3000

Assumptions - Underground Cost Estimate, New corridor portion of Proposed Route

General

- 1 The estimate is based on a 320 kV DC Cable installation 53.8 miles long.
- 2 ROW acquisition costs are not included in the estimate.
- 3 Environmental mitigation costs are not included in the estimate.
- 4 The estimate does not include costs related to contaminated or hazardous soils or water.
- 5 The estimate does not include allowances for existing facility relocations.
- 6 The estimate does not include allowances for work hour/location restrictions.
- 7 The estimate is in 2019 dollars and includes 3 years of escalation at 2.5%
- 8 The estimate includes a 10% allowance for prime contractor mark-up.
- 9 The estimate includes a 14.46% contingency
- 10 The estimate includes sales tax of 5.5% on materials only.

Cable & Accessories

- 11 The estimate assumes a single +/-320kV DC circuit with 2 cables per pole.
- 12 The cables are estimated as 320kV DC, 2500 sq. mm Cu Cable.
- 13 The estimate includes an installed spare cable the full length of the line.
- 14 The estimate includes (10) AIS cable terminations, and 2 spare terminations.
- 15 The estimate includes (864) single-phase cable joints, with 10 spare joints.
- 16 The estimate does not include surge arrestors.
- 17 The estimate does not include optical fiber cable inside the power cable for temperature monitoring.

Communications

- 18 The estimate includes two fiber optic cable systems.
- 19 Fiber-optic cables are estimated as 48 fiber, single mode, loose tube outdoor cable.
- 20 Fiber-optic cables are installed into 1 1/4" HDPE innerducts installed in 4" PVC conduit.
- 21 Separate pull/splicing boxes are included for the fiber-optics.

Temperature Monitoring

- 22 The estimate does not include cable temperature monitoring equipment.

Overhead to Underground Transition

- 23 Includes terminations stands, surge arrestor stands and dead-ends for one transition.
- 24 The estimate includes site work and foundations for a 135' square termination station
- 25 The estimate includes ground grid and fencing for a 135' square terminations station.

Splice Housings

- 26 The estimate includes (144) jointing locations with (5) 12'x4'x3' precast concrete splice housings at each location.
- 27 Each splice housing is assumed to hold (1) splice.

Duct Bank Installation

- 28 The estimate does not include duct bank.

Direct Buried Installation

- 29 The estimate does not include conduits in the direct buried sections.
- 30 The estimate includes soil erosion and sediment control measures for green spaces.
- 31 The cables are installed in a single 5' wide trench averaging 7' deep.
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- 34 The estimate assumes backfilling direct buried sections with native soils.
- 35 The estimate includes vegetation clearing and restoration 50' wide for construction not in roadways.
- 36 The estimate includes allowance for dewatering for 50% of the trench in uplands, and 100% in wetlands.
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HDD Installation

- 38 The estimate includes (100) sets of HDD installations in soil, 1000 feet long each.
- 39 Each HDD installation consists of the bundled FPVC or HDPE conduits pulled directly into the boreholes.
- 40 The HDD installations do not include a casing.
- 41 The HDD installations do not include grouting of the bore hole.

Engineering & Construction Management

- 42 The estimate includes surveying, and soil exploration.
- 43 The estimate includes approximate engineering costs.
- 44 The estimate includes approximately construction management costs.

Black & Veatch

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
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775,504 Feet **390** Splices per Circuit

Computed By **N. Thomas**
 Checked By **J. Bardwell**

1 DC Circuits
 2 Cables per Pole

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CABLE SYSTEM INSTALATION							
UNDERGROUND CABLE AND ACCESSORIES							
320kV DC, 2500 sq. mm. Cu Cable	3,153,676	ft					\$441,514,640.00
Installed Spare	788,419						\$110,378,660.00
Cable Installation, Duct Bank	232	seg					\$25,520,000.00
Cable Laying, Direct Buried	317,680	ft					\$3,176,800.00
Cable Terminations-AIS	10	ea					\$800,000.00
Spare Cable Term-AIS	2	ea					\$90,000.00
Cable Joints	2,340	ea					\$163,800,000.00
Spare Cable Joints	12	ea					\$420,000.00
Field Testing	1	lot					\$105,000.00
Mobilization/Demobilize (Cable)	1	lot					\$250,000.00
CABLE SYSTEM FURNISH & INSTALL SUBTOTAL				\$641,818,300.00		\$104,236,800.00	\$746,055,100.00
COMMUNICATIONS							
Fiber Optic Cable (48 Fiber)	1,590,308	ft					\$10,543,742.04
Splice Enclosure	160	ea					\$192,000.00
Splicing	160	ea					\$480,000.00
Fiber-optic Pull Boxes	780	ea					\$3,900,000.00
COMMUNICATIONS SUBTOTAL				\$6,944,924.00		\$8,170,818.04	\$15,115,742.04
CIVIL WORK							
GENERAL							
Mobilization/Demobilize (Prime)	3	lot					\$750,000.00
Construction Surveying & Staking	146.88	MI					\$1,835,946.97
GENERAL SUBTOTAL				\$300,000.00		\$2,285,946.97	\$2,585,946.97
Splicing Vaults							
Splicing Vaults, 30'x8'x8'	780	ea					\$89,700,000.00
Duct Bank Connections	1,560	ea					\$31,200,000.00
Manhole covers	1,560	ea					\$9,360,000.00
Splicing Vault Grounding	780	ea					\$2,925,000.00
SPLICING ENCLOSURES SUBTOTAL				\$40,755,000.00		\$92,430,000.00	\$133,185,000.00

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Underground Alternate Route**
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775,504 Feet **390 Splices per Circuit**

Computed By **N. Thomas**
 Checked By **J. Bardwell**

1 DC Circuits
2 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
DUCTBANK INSTALLATION - Roadway							
Utility Locates 15/Mile	875	ea					\$787,500.00
Traffic Control	2052	days					\$8,619,072.00
Soil Erosion and Sediment Control	58.30	Mi					\$5,830,000.00
Excavation	359128	Cu. Yd.					\$31,244,136.00
Concrete Encasement	68405	Cu. Yd.					\$16,417,280.00
Backfill, FTB	142511	Cu. Yd.					\$27,789,666.67
Backfill, Native	85507	Cu. Yd.					\$6,413,000.00
Road Bed Restoration, 9" 3/4" Crushed Rock	25,652	Cu. Yd.					\$897,820.00
Pavement Saw Cutting, Concrete	615648	lft					\$8,311,248.00
Pavement Removal, 15 feet wide	4,617,360	sqft					\$9,234,720.00
Pavement Restoration, Gravel, 30 feet wide	9,234,720	sqft					\$13,852,080.00
8" SCH. 40 PVC Conduit	1846944	lft					\$29,920,492.80
4" SCH. 40 PVC Conduit	615648	lft					\$5,756,308.80
1.25" HDPE Conduit	923472	lft					\$3,232,152.00
8" Conduit Spacers	369389	ea					\$8,495,947.00
4" Conduit Spacers	123130	ea					\$1,600,690.00
Landscaping Repair/Restoration	212	acre					\$710,200.00
Dewater (50%)	153,912	lft					\$6,156,480.00
Shoring (50%)	2,770,416	sqft					\$13,852,080.00
DUCTBANK-ROADWAY SUBTOTAL				\$70,799,626.93		\$128,321,246.33	\$199,120,873.27
						Per route foot	\$646.87
TRENCHING DIRECT BURIED							
Clearing and Grubbing	547	acres					\$6,837,500.00
Access Road (3/4" Gravel over Geotextile)	529467	sq. yd					\$20,336,814.67
Soil Erosion and Sediment Control	60.17	Mi					\$2,707,500.00
Silt Fence	635360	lft					\$4,447,520.00
Excavation	576530	Cu. Yd.					\$61,400,484.44
Cable Bedding	88244	Cu. Yd.					\$10,148,111.11
Concrete Cap	44122	Cu. Yd.					\$11,913,000.00
Backfill, Native	329446	Cu. Yd.					\$21,413,985.19
Vegetation Restoration (Grass/Shrub Mix)	547	acres					\$1,832,348.48
Dewater (50%)	158,840	lft					\$4,765,200.00
TRENCH WORK SUBTOTAL				\$24,011,568.59		\$121,790,895.31	\$145,802,463.89
						Per route foot	\$458.96
HDD INSTALLATION (NO CASING : Land to Land)							
	150 Sets of 2 @			1,000 Feet Each			
Mobilization/Demobilize (HDD)	1	lot					\$50,000.00
Site Preparation for HDD	150	sets					\$6,000,000.00
Horiz. Directional Drill	300,000	lft					\$148,500,000.00
Conduit for Cables, 10" DR 9 HDPE	900,000	lft					\$45,000,000.00
Conduit for Comm., 6" DR 9 HPDE	300,000	lft					\$9,000,000.00
HDPE Innerduct, 1 1/4"	900,000	lft					\$3,150,000.00
HDD INSTALLATION SUBTOTAL				\$42,600,000.00		\$169,100,000.00	\$211,700,000.00
						Per route foot	\$1,411.33

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Underground Alternate Route**
 Estimate Overall Route Length **146.88 Miles**
775,504 Feet **390 Splices per Circuit**

Computed By **N. Thomas**

Checked By **J. Bardwell**

1 DC Circuits
2 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
CABLE SYSTEM FURNISH AND INSTALL							
UG CABLE AND ACCESSORIES SUBTOTAL				\$641,818,300		\$104,236,800	\$746,055,100
COMMUNICATIONS							
CABLE SYSTEM COMMUNICATIONS (FO) SUBTOTAL				\$6,944,924		\$8,170,818	\$15,115,742
CIVIL WORK							
GENERAL SUBTOTAL				\$300,000		\$2,285,947	\$2,585,947
OVERHEAD TO UNDERGROUND SUBTOTAL				\$20,036		\$109,973	\$130,009
SPLICING VAULT SUBTOTAL				\$40,755,000		\$92,430,000	\$133,185,000
DUCTBANK INSTALLATION - ROADWAY				\$70,799,627		\$128,321,246	\$199,120,873
Ductbank cost per route foot	\$646.87						
DIRECT BURIED				\$24,011,569		\$121,790,895	\$145,802,464
Direct Buried cost per route foot	\$458.96						
HDD INSTALLATION SUBTOTAL				\$42,600,000		\$169,100,000	\$211,700,000
HDD Ductbank cost per route foot(1 Bores)	\$1,411.33						
ESTIMATED LABOR & MATERIAL COST				\$827,249,455		\$626,445,680	\$1,453,695,135
ESCALATION		3 Years @	2.50%	\$62,044,000		\$46,983,000	\$109,027,000
ESCALATED CONSTRUCTION COST				\$889,293,455		\$673,428,680	\$1,562,722,135
Mark-Up		10.0% of Est. Labor & Mat.		\$88,929,000		\$67,343,000	\$156,272,000
ESTIMATED PROJ COST				\$978,222,455		\$740,771,680	\$1,718,994,135
STATE SALES TAX		5.5% of Materials		\$53,802,000			\$53,802,000
ROW ACQUISITION		\$0 per Mile					\$0
MITIGATION							\$0
TOPOGRAPHIC SURVEYING/SOIL EXPLORATION @ 40,000/mi							\$5,875,030
ENGINEERING AND CONSTRUCTION MANAGEMENT							\$34,379,883
CONTINGENCY		14.46% of project cost					\$254,387,412
ESTIMATED TOTAL PROJ COST							\$2,067,438,460
UNDERGROUND PROJECT TOTAL						(rounded)	\$2,067,400,000

Black & VeatchOwner **Avangrid**

Project NECEC

B&V File No. 400319.42.3000

Assumptions - Underground Cost Estimate, Underground Alternate Route

General

- 1 The estimate is based on a 320 kV DC Cable installation 146.88 miles long.
- 2 ROW acquisition costs are not included in the estimate.
- 3 Environmental mitigation costs are not included in the estimate.
- 4 The estimate does not include costs related to contaminated or hazardous soils or water.
- 5 The estimate does not include allowances for existing facility relocations.
- 6 The estimate does not include allowances for work hour/location restrictions.
- 7 The estimate is in 2019 dollars and includes escalation at 2.5% for 3 years.
- 8 The estimate includes a 10% mark-up for a prime contractor
- 9 The estimate includes a 14.46% contingency
- 9 The estimate includes sales tax of 5.5% on materials only.

Cable & Accessories

- 10 The estimate assumes a single +/-320kV DC circuit with 2 cables per pole.
- 11 The cables are estimated as 320kV DC, 2500 sq. mm Cu Cable.
- 12 The estimate includes an installed spare cable the full length of the project.
- 13 The estimate includes (10) AIS cable terminations, including 2 spare terminations.
- 14 The estimate includes (2,340) single-phase cable joints, with 12 spare joints.
- 15 The estimate does not include surge arrestors.
- 16 The estimate does not include optical fiber cable inside the power cable for temperature monitoring.

Communications

- 17 The estimate includes two fiber optic cables for communications and monitoring.
- 18 Fiber-optic cables are estimated as 48 fiber, single mode, loose tube outdoor cable.
- 19 Fiber-optic cables are installed into 1 1/4" HDPE innerducts installed in 4" PVC conduit.
- 20 Separate pull/splicing boxes are included for the fiber-optics.

Temperature Monitoring

- 21 The estimate does not include cable temperature monitoring equipment.

Overhead to Underground Transition

- 22 The estimate does not include termination stations or supports.
- 23 The estimate does not include provisions for overhead transmission connections
- 24 The estimate does not include concrete encased sweeps for the cable

Splice Housings

- 25 The estimate includes (780) 33"x8"x10' precast concrete splice vaults.
- 26 Each splice housing is assumed to hold (3) splices

Duct Bank Installation

- 27 The estimate includes 53.8 miles of duct bank.
- 28 The estimate includes (6)8" SCH 40 PVC Conduits for high voltage cable include one spare conduits.
- 29 The estimate includes (2) 4" SCH 40 PVC Conduits for communications.
- 30 The conduits are installed in a common duct bank, 3' wide and 2' high
- 31 The estimate assumes ductbank installation will be under pavement.
- 32 The estimate includes traffic control at 200ft/day.
- 33 The estimate includes soil erosion and sediment control measures for rural streets.
- 34 The estimate assumes a 3' wide trench, averaging 6' deep.
- 35 The estimate assumes the ductbank will be backfilled with FTB to 2' below grade.
- 36 The estimate includes pavement removal and restoration for the entire route length.
- 37 The estimate includes allowance for dewatering for 50% of the trench.
- 38 The estimate includes sheeting and shoring of the trench for 25% of the route length.

Direct Buried Installation

- 39 The estimate includes 60.2 miles of direct buried installation.
- 40 The estimate does not include conduits in the direct buried sections.
- 41 The estimate includes soil erosion and sediment control measures for green spaces.
- 42 The cables are installed in a single 5' wide trench averaging 7' deep.
- 43 The cables are installed in a thermal sand cable bedding material
- 44 The estimate includes a 9" thick concrete cap installed 18" below grade
- 45 The estimate assumes backfilling direct buried sections with native soils.
- 46 The estimate includes vegetation clearing and restoration 50' wide for construction not in roadways.
- 47 The estimate includes allowance for dewatering for 50% of the trench in uplands, and 100% in wetlands.
- 48 The estimate does not include shoring for the trenches.

HDD Installation

- 49 The estimate includes (150) sets of HDD installations in soil, 1000 feet long each.
- 50 Each HDD installation consists of the bundled FPVC or HDPE conduits pulled directly into the boreholes.
- 51 The HDD installations do not include a casing.
- 52 The HDD installations do not include grouting of the bore hole.

Engineering & Construction Management

- 53 The estimate includes surveying, and soil exploration.
- 54 The estimate includes approximate engineering costs.
- 55 The estimate includes approximately construction management costs.

Black & Veatch

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Appalachian Trail**
 Estimate Overall Route Length **1.00 Miles**
5,280 Feet **2 Splices per Circuit**

Computed By **J. Bardwell**
 Checked By

1 DC Circuits
2 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST		
CABLE SYSTEM INSTALATION									
UNDERGROUND CABLE AND ACCESSORIES									
320kV DC, 2500 sq. mm. Cu Cable	21,564	ft	PROPRIETARY				\$3,018,960.00		
Installed Spare	5,391	ft					\$754,740.00		
Cable Installation, Duct	6	seg					\$660,000.00		
Cable Laying, Direct Buried	0	ft					\$0.00		
Cable Terminations-AIS	10	ea					\$800,000.00		
Spare Cable Term-AIS	2	ea					\$90,000.00		
Cable Joints	10	ea					\$700,000.00		
Spare Cable Joints	2	ea					\$70,000.00		
Surge Arresters, 209 MCOV	0	ea					\$0.00		
Field Testing	1	lot					\$105,000.00		
Mobilization/Demobilize (Cable)	1	lot					\$250,000.00		
CABLE SYSTEM FURNISH & INSTALL SUBTOTAL							\$5,018,700.00	\$1,430,000.00	\$6,448,700.00
COMMUNICATIONS									
Fiber Optic Cable (48 Fiber)	11,060	ft	PROPRIETARY				\$73,327.80		
Splice Enclosure	2	ea					\$2,400.00		
Splicing	2	ea					\$6,000.00		
Fiber-optic Pull Boxes	4	ea					\$20,000.00		
COMMUNICATIONS SUBTOTAL			\$45,980.00	\$55,747.80	\$101,727.80				
DISTRIBUTED TEMPERATURE SENSING (DTS)									
DTS SUBTOTAL			\$0.00	\$0.00	\$0.00				
CIVIL WORK									
GENERAL									
Mobilization/Demobilize (Prime)	1	lot	PROPRIETARY				\$250,000.00		
Construction Surveying & Staking	1.00	MI					\$12,500.00		
GENERAL SUBTOTAL			\$100,000.00	\$162,500.00	\$262,500.00				
OVERHEAD TO UNDERGROUND TRANSITIONS									
Substation Termination Structure, Single Cable	2		PROPRIETARY				\$250,000.00		
Termination Structure Fdn	10	ea					\$78,180.00		
Overhead Line Dead End Structure	2	ea					\$210,000.00		
Dead End Structure Fdn	2	ea					\$102,530.00		
Silt Fence	1,200	ft					\$8,280.00		
Clearing/Grading/Cut& Fill	45,000	Sq Ft					\$23,400.00		
Rock Surfacing (6" Crushed Rock)	4,050	Cu. Yd					\$260,680.28		
Fence, Galv. Chainlink	1,080	ft					\$24,840.00		
Drive Gates	4	ea					\$9,200.00		
Access Road, Permanent	0	ft					\$0.00		
Site Grounding	36,450	Sq Ft					\$128,522.70		
Ductbank Transitions (Concrete Encased Bends)	0	ea					\$0.00		
STRUCTURES SUBTOTAL							\$433,122.78	\$662,510.20	\$1,095,632.98
Jointing Locations									
Splicing Vaults, 30'x8'x8'	4	ea	PROPRIETARY				\$460,000.00		
Duct Bank Connections	8	ea					\$160,000.00		
Manhole covers	8	ea					\$48,000.00		
Splicing Vault Grounding	4	ea					\$15,000.00		
SPLICING ENCLOSURES SUBTOTAL			\$209,000.00	\$474,000.00	\$683,000.00				

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Appalachian Trail**
 Estimate Overall Route Length **1.00 Miles**
5,280 Feet

Computed By **J. Bardwell**
 Checked By

1 DC Circuits
2 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
DUCTBANK INSTALLATION - Roadway							
Utility Locates 15/Mile	5	ea					\$4,500.00
Traffic Control	12	days					\$49,840.00
Soil Erosion and Sediment Control	0.34	Mi					\$33,712.12
Access Road (3/4" Gravel over Geotextile)	0	sq. yd.					\$0.00
Excavation	2077	Cu. Yd.					\$180,670.00
Concrete Encasement	396	Cu. Yd.					\$94,933.33
Concrete Reinforcement, Rebar (0 Long)	0	ft					\$0.00
Backfill, FTB	0	Cu. Yd.					\$0.00
Backfill, Native	989	Cu. Yd.					\$74,166.67
Road Bed Restoration, 9" 3/4" Crushed Rock	0	Cu. Yd.					\$0.00
Pavement Saw Cutting, Concrete	0	lft					\$0.00
Pavement Removal, 15 feet wide	0	sqft					\$0.00
Pavement Restoration, Gravel, 30 feet wide	53,400	sqft					\$80,100.00
8" SCH. 40 PVC Conduit	3560	lft					\$57,672.00
2" SCH. 40 PVC Conduit	0	lft					\$0.00
4" SCH. 40 PVC Conduit	1780	lft					\$16,643.00
1.25" HDPE Conduit	5340	lft					\$18,690.00
8" Conduit Spacers	712	ea					\$16,376.00
4" Conduit Spacers	356	ea					\$4,628.00
Landscaping Repair/Restoration	1	acre					\$4,112.41
Dewater (50%)	890	lft					\$35,600.00
Shoring (50%)	14,543	sqft					\$72,713.00
DUCTBANK-ROADWAY SUBTOTAL				\$192,175.08		\$552,181.46	\$744,356.54
						Per route foot	\$418.18
TRENCHING DIRECT BURIED							
		0 FEET					
TRENCH WORK SUBTOTAL				\$0.00		\$0.00	\$0.00
						Per route foot	#DIV/0!
JACK AND BORE INSTALLATION	0	@	250 Feet Each				
JACK AND BORE SUBTOTAL				\$0.00		\$0.00	\$0.00
						Per foot	#DIV/0!
HDD INSTALLATION (NO CASING : Land to Land)							
	1	Sets of 2 @	3,500 Feet Each				
Mobilization/Demobilize (HDD)	1	lot					\$50,000.00
Site Preparation for HDD	1	sets					\$65,000.00
Noise Barriers	2	sets					\$250,000.00
Horiz. Directional Drill	7,000	lft					\$3,815,000.00
Conduit for Cables, 10" DR 9 HDPE	42,000	lft					\$2,100,000.00
Conduit for Comm., 10" DR 9 HPDE	14,000	lft					\$700,000.00
Conduit for GCC, 2" DR 14 FPVC	0	lft					\$0.00
HDPE Innerduct, 1 1/4"	42,000	lft					\$147,000.00
HDD INSTALLATION SUBTOTAL				\$1,893,000.00		\$5,234,000.00	\$7,127,000.00
						Per route foot	\$2,036.29

PROPRIETARY

PROPRIETARY

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Appalachian Trail**
 Estimate Overall Route Length **1.00 Miles**
5,280 Feet

Computed By **J. Bardwell**

Checked By

1 DC Circuits
2 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
CABLE SYSTEM FURNISH AND INSTALL							
UG CABLE AND ACCESSORIES SUBTOTAL				\$5,018,700		\$1,430,000	\$6,448,700
COMMUNICATIONS							
CABLE SYSTEM COMMUNICATIONS (FO) SUBTOTAL				\$45,980		\$55,748	\$101,728
CIVIL WORK							
GENERAL SUBTOTAL				\$100,000		\$162,500	\$262,500
OVERHEAD TO UNDERGROUND SUBTOTAL				\$433,123		\$662,510	\$1,095,633
SPLICING VAULT SUBTOTAL				\$209,000		\$474,000	\$683,000
DUCTBANK INSTALLATION				\$192,175		\$552,181	\$744,357
Ductbank cost per route foot	\$418.18						
HDD INSTALLATION SUBTOTAL				\$1,893,000		\$5,234,000	\$7,127,000
HDD Ductbank cost per route foot(1 Bores))	\$2,036.29						
ESTIMATED LABOR & MATERIAL COST				\$7,891,978		\$8,570,939	\$16,462,917
ESCALATION	3 Years @	2.50%		\$592,000		\$643,000	\$1,235,000
ESCALATED CONSTRUCTION COST				\$8,483,978		\$9,213,939	\$17,697,917
Mark-Up	10.0%	of Est. Labor & Mat.		\$848,000		\$921,000	\$1,769,000
ESTIMATED PROJ COST				\$9,331,978		\$10,134,939	\$19,466,917
STATE SALES TAX	5.5%	of Materials		\$513,000			\$513,000
ROW ACQUISITION	\$0	per Mile					\$0
MITIGATION							\$0
TOPOGRAPHIC SURVEYING/SOIL EXPLORATION @ 40,000/mi							\$40,000
ENGINEERING AND CONSTRUCTION MANAGEMENT							\$2,920,038
CONTINGENCY	30.00%	of project cost					\$6,881,986
ESTIMATED TOTAL PROJ COST							\$29,821,941
UNDERGROUND PROJECT TOTAL						(rounded)	\$29,800,000

Black & VeatchOwner **Avangrid**Project **NECEC**

B&V File No. 400319.42.3000

Assumptions - Underground Cost Estimate, Appalachian Trail

General

- 1 The estimate is based on a 320 kV DC Cable installation 1 mile long.
- 2 ROW acquisition costs are not included in the estimate.
- 3 Environmental mitigation costs are not included in the estimate.
- 4 The estimate does not include costs related to contaminated or hazardous soils or water.
- 5 The estimate does not include allowances for existing facility relocations.
- 6 The estimate does not include allowances for work hour/location restrictions.
- 7 The estimate is in 2019 dollars and includes 3 years of escalation at 2.5%
- 8 The estimate includes a 10% allowance for prime contractor mark-up.
- 9 The estimate includes a 30% contingency to account for potential rock variation.
- 9 The estimate includes sales tax of 5.5% on materials only.

Cable & Accessories

- 10 The estimate assumes a single +/-320kV DC circuit with 1 cable per pole.
- 11 The cables are estimated as 320kV DC, 2500 sq. mm Cu Cable.
- 12 The estimate includes an installed spare cable the full length of the line.
- 13 The estimate includes (6) AIS cable terminations, and 2 spare terminations.
- 14 The estimate includes (9) single-phase cable joints, with 2 spare joints.
- 15 The estimate does not include surge arrestors.
- 16 The estimate does not include optical fiber cable inside the power cable for temperature monitoring.

Communications

- 17 The estimate includes two fiber optic cable systems.
- 18 Fiber-optic cables are estimated as 48 fiber, single mode, loose tube outdoor cable.
- 19 Fiber-optic cables are installed into 1 1/4" HDPE innerducts installed in 4" PVC conduit.
- 20 Separate pull/splicing boxes are included for the fiber-optics.

Temperature Monitoring

- 21 The estimate does not include cable temperature monitoring equipment.

Overhead to Underground Transition

- 22 Includes terminations stands, surge arrestor stands and dead-ends for the overhead lines
- 23 The estimate includes site work and foundations for two 135' square termination station
- 24 The estimate includes ground grid and fencing for two 135' square terminations station.

Splice Housings

- 25 The estimate includes (3) jointing locations with (3) 12'x4'x3' precast concrete splice housings at each location.
- 26 Each splice housing is assumed to hold (1) splice.

Duct Bank Installation

- 27 The estimate includes 1,700 feet of duct bank.
- 28 The estimate includes (6)8" SCH 40 PVC Conduits for high voltage cable include one spare conduits.
- 29 The estimate includes (2) 4" SCH 40 PVC Conduits for communications.
- 30 The conduits are installed in a common duct bank, 3' wide and 2' high
- 31 The estimate assumes ductbank installation will be under pavement.
- 32 The estimate includes traffic control at 200ft/day.
- 33 The estimate includes soil erosion and sediment control measures for rural streets.
- 34 The estimate assumes a 3' wide trench, averaging 6' deep.
- 35 The estimate assumes the ductbank will be backfilled with FTB to 2' below grade.
- 36 The estimate includes pavement removal and restoration for the entire route length.
- 37 The estimate includes allowance for dewatering for 50% of the trench.
- 38 The estimate includes sheeting and shoring of the trench for 25% of the route length.

HDD Installation

- 39 The estimate includes (1) HDD installation in mixed soil and rock, 3500 feet long.
- 40 Each HDD installation consists of the bundled FPVC or HDPE conduits pulled directly into the boreholes.
- 41 The estimate includes erection of noise barriers around the HDD sites.
- 42 The HDD installations do not include a casing.
- 43 The HDD installations do not include grouting of the bore hole.

Engineering & Construction Management

- 44 The estimate includes surveying, and soil exploration.
- 45 The estimate includes approximate engineering costs.
- 46 The estimate includes approximate construction management costs.

Black & Veatch

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Beattie Pond**
 Estimate Overall Route Length **1.20 Miles**
6,336 Feet **3 Splices per Circuit**

Computed By **J. Bardwell**

Checked By

1 DC Circuits
1 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
CABLE SYSTEM INSTALATION							
UNDERGROUND CABLE AND ACCESSORIES							
320kV DC, 2500 sq. mm. Cu Cable	12,960	ft					\$1,814,400.00
Installed Spare	6,480	ft					\$907,200.00
Cable Installation, Duct	0	seg					\$0.00
Cable Laying, Direct Buried	21,680	ft					\$216,800.00
Cable Terminations-AIS	6	ea					\$480,000.00
Spare Cable Term-AIS	2	ea					\$90,000.00
Cable Joints	9	ea					\$630,000.00
Spare Cable Joints	2	ea					\$70,000.00
Surge Arresters, 209 MCOV	0	ea					\$0.00
Field Testing	1	lot					\$105,000.00
Mobilization/Demobilize (Cable)	1	lot					\$250,000.00
CABLE SYSTEM FURNISH & INSTALL SUBTOTAL				\$3,571,600.00		\$991,800.00	\$4,563,400.00
COMMUNICATIONS							
Fiber Optic Cable (48 Fiber)	13,272	ft					\$87,993.36
Splice Enclosure	2	ea					\$2,400.00
Splicing	2	ea					\$6,000.00
Fiber-optic Pull Boxes	6	ea					\$30,000.00
COMMUNICATIONS SUBTOTAL				\$57,616.00		\$68,777.36	\$126,393.36
DISTRIBUTED TEMPERATURE SENSING (DTS)							
				DTS SUBTOTAL \$0.00		\$0.00	\$0.00
CIVIL WORK							
GENERAL							
Mobilization/Demobilize (Prime)	1	lot					\$250,000.00
Construction Surveying & Staking	1.20	MI					\$15,000.00
GENERAL SUBTOTAL				\$100,000.00		\$165,000.00	\$265,000.00
OVERHEAD TO UNDERGROUND TRANSITIONS							
Substation Termination Structure, Single Cable	2						\$150,000.00
Termination Structure Fdn	6	ea					\$46,908.00
Overhead Line Dead End Structure	2	ea					\$210,000.00
Dead End Structure Fdn	2	ea					\$102,530.00
Silt Fence	1,200	ft					\$8,280.00
Clearing/Grading/Cut& Fill	45,000	Sq Ft					\$23,400.00
Rock Surfacing (6" Crushed Rock)	4,050	Cu. Yd					\$260,680.28
Fence, Galv. Chainlink	1,080	ft					\$24,840.00
Drive Gates	4	ea					\$9,200.00
Access Road, Permanent	0	ft					\$0.00
Site Grounding	36,450	Sq Ft					\$128,522.70
Ductbank Transitions (Concrete Encased Bends)	0	ea					\$0.00
STRUCTURES SUBTOTAL				\$386,698.78		\$577,662.20	\$964,360.98
Jointing Locations							
Splice Enclosures, 12'x4'x3'	9	ea					\$112,500.00
Site work for joint bays	3	ea					\$60,000.00
Temporary joint bays	3	ea					\$75,000.00
Jointing location restoration	3	ea					\$24,000.00
Splice Grounding	9	ea					\$6,750.00
SPLICING ENCLOSURES SUBTOTAL				\$108,750.00		\$169,500.00	\$278,250.00

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Beattie Pond**
 Estimate Overall Route Length **1.20 Miles**
6,336 Feet

Computed By **J. Bardwell**
 Checked By

1 DC Circuits
1 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
TRENCHING DIRECT BURIED							
Clearing and Grubbing	4336	FEET					\$87,500.00
Access Road (3/4" Gravel over Geotextile)	7	acres					\$277,576.27
Soil Erosion and Sediment Control	7227	sq. yd					\$36,954.55
Silt Fence	0.82	Mi					\$60,704.00
Excavation	8672	ft					\$598,608.89
Cable Bedding	5621	Cu. Yd.					\$83,106.67
Concrete Cap	723	Cu. Yd.					\$97,560.00
Backfill, Native	361	Cu. Yd.					\$208,770.37
Vegetation Restoration (Grass/Shrub Mix)	3212	Cu. Yd.					\$25,009.64
Dewater (50%)	7	acres					\$65,040.00
Shoring (0%) (Sloping)	2,168	ft					\$0.00
	0	sqft					\$0.00
TRENCH WORK SUBTOTAL				\$252,575.48		\$1,288,254.90	\$1,540,830.38
						Per route foot	\$355.36
<hr/>							
JACK AND BORE INSTALLATION	0	@	250 Feet Each				
JACK AND BORE SUBTOTAL				\$0.00		\$0.00	\$0.00
						Per foot	#DIV/0!
<hr/>							
HDD INSTALLATION (NO CASING : Land to Land)							
	2 Sets of 1 @		1,000 Feet Each				
Mobilization/Demobilize (HDD)	1	lot					\$50,000.00
Site Preparation for HDD	2	sets					\$80,000.00
Horiz. Directional Drill	2,000	ft					\$840,000.00
Conduit for Cables, 10" DR 9 HDPE	6,000	ft					\$300,000.00
Conduit for Comm., 6" DR 9 HPDE	2,000	ft					\$60,000.00
Conduit for GCC, 2" DR 14 FPVC	0	ft					\$0.00
HDPE Innerduct, 1 1/4"	6,000	ft					\$21,000.00
HDD INSTALLATION SUBTOTAL				\$289,000.00		\$1,062,000.00	\$1,351,000.00
						Per route foot	\$675.50

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Beattie Pond**
 Estimate Overall Route Length **1.20 Miles**
6,336 Feet

Computed By **J. Bardwell**

Checked By

1 DC Circuits
1 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
CABLE SYSTEM FURNISH AND INSTALL							
UG CABLE AND ACCESSORIES SUBTOTAL				\$3,571,600		\$991,800	\$4,563,400
COMMUNICATIONS							
CABLE SYSTEM COMMUNICATIONS (FO) SUBTOTAL				\$57,616		\$68,777	\$126,393
CIVIL WORK							
GENERAL SUBTOTAL				\$100,000		\$165,000	\$265,000
OVERHEAD TO UNDERGROUND SUBTOTAL				\$386,699		\$577,662	\$964,361
SPLICING VAULT SUBTOTAL				\$108,750		\$169,500	\$278,250
DIRECT BURIED				\$252,575		\$1,288,255	\$1,540,830
Direct Buried cost per route foot	\$355.36						
HDD INSTALLATION SUBTOTAL				\$289,000		\$1,062,000	\$1,351,000
HDD Ductbank cost per route foot(1 Bores))	\$675.50						
ESTIMATED LABOR & MATERIAL COST				\$4,766,240		\$4,322,994	\$9,089,235
ESCALATION		3 Years @	2.50%	\$357,000		\$324,000	\$681,000
ESCALATED CONSTRUCTION COST				\$5,123,240		\$4,646,994	\$9,770,235
Mark-Up		10.0%	of Est. Labor & Mat.	\$512,000		\$465,000	\$977,000
ESTIMATED PROJ COST				\$5,635,240		\$5,111,994	\$10,747,235
STATE SALES TAX		5.5%	of Materials	\$310,000			\$310,000
ROW ACQUISITION		\$0	per Mile				\$0
MITIGATION							\$0
TOPOGRAPHIC SURVEYING/SOIL EXPLORATION @ 40,000/mi							\$48,000
ENGINEERING AND CONSTRUCTION MANAGEMENT							\$1,612,085
CONTINGENCY		20.0%	of project cost				\$2,543,464
ESTIMATED TOTAL PROJ COST							\$15,260,784
UNDERGROUND PROJECT TOTAL						(rounded)	\$15,300,000

Black & Veatch

Owner **Avangrid**

Project **NECEC**

B&V File No. 400319.42.3000

Assumptions - Underground Cost Estimate, Beattie Pond

General

- 1 The estimate is based on a 320 kV DC Cable installation 1.2 miles long.
- 2 ROW acquisition costs are not included in the estimate.
- 3 Environmental mitigation costs are not included in the estimate.
- 4 The estimate does not include costs related to contaminated or hazardous soils or water.
- 5 The estimate does not include allowances for existing facility relocations.
- 6 The estimate does not include allowances for work hour/location restrictions.
- 7 The estimate is in 2019 dollars and includes 3 years of escalation at 2.5%
- 8 The estimate includes a 10% allowance for prime contractor mark-up.
- 9 The estimate includes a 20% contingency.
- 9 The estimate includes sales tax of 5.5% on materials only.

Cable & Accessories

- 10 The estimate assumes a single +/-320kV DC circuit with 1 cable per pole.
- 11 The cables are estimated as 320kV DC, 2500 sq. mm Cu Cable.
- 12 The estimate includes an installed spare cable the full length of the line.
- 13 The estimate includes (6) AIS cable terminations, and 2 spare terminations.
- 14 The estimate includes (9) single-phase cable joints, with 2 spare joints.
- 15 The estimate does not include surge arrestors.
- 16 The estimate does not include optical fiber cable inside the power cable for temperature monitoring.

Communications

- 17 The estimate includes two fiber optic cable systems.
- 18 Fiber-optic cables are estimated as 48 fiber, single mode, loose tube outdoor cable.
- 19 Fiber-optic cables are installed into 1 1/4" HDPE innerducts installed in 4" PVC conduit.
- 20 Separate pull/splicing boxes are included for the fiber-optics.

Temperature Monitoring

- 21 The estimate does not include cable temperature monitoring equipment.

Overhead to Underground Transition

- 22 Includes terminations stands, surge arrestor stands and dead-ends for the overhead lines
- 23 The estimate includes site work and foundations for two 135' square termination station
- 24 The estimate includes ground grid and fencing for two 135' square terminations station.

Splice Housings

- 25 The estimate includes (3) jointing locations with (3) 12'x4'x3' precast concrete splice housings at each location.
- 26 Each splice housing is assumed to hold (1) splice.

Duct Bank Installation

- 27 The estimate does not include duct bank.

Direct Buried Installation

- 28 The estimate does not include conduits in the direct buried sections.
- 29 The estimate includes soil erosion and sediment control measures for green spaces.
- 30 The cables are installed in a single 5' wide trench averaging 7' deep.
- 31 The cables are installed in a thermal sand cable bedding material
- 32 The estimate includes a 9" thick concrete cap installed 18" below grade
- 33 The estimate assumes backfilling direct buried sections with native soils.
- 34 The estimate includes vegetation clearing and restoration 75' wide for construction not in roadways.
- 35 The estimate includes allowance for dewatering for 50% of the trench in uplands, and 100% in wetlands.
- 36 The estimate does not include shoring for the trenches.

HDD Installation

- 37 The estimate includes (2) sets of HDD installations in soil, 1000 feet long each.
- 38 Each HDD installation consists of the bundled FPVC or HDPE conduits pulled directly into the boreholes.
- 39 The HDD installations do not include a casing.
- 40 The HDD installations do not include grouting of the bore hole.

Engineering & Construction Management

- 41 The estimate includes surveying, and soil exploration.
- 42 The estimate includes approximate engineering costs.
- 43 The estimate includes approximate construction management costs.

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Gold Brook**
 Estimate Overall Route Length 1.15 Miles
 6,072 Feet

Computed By **J. Bardwell**
 Checked By

1 DC Circuits
 2 Cables per Pole

3 Splices per Circuit

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
DUCTBANK INSTALLATION - Roadway							
Utility Locates 15/Mile	0	ea					\$0.00
Traffic Control	0	days					\$0.00
Soil Erosion and Sediment Control	0.05	Mi					\$5,151.52
Access Road (3/4" Gravel over Geotextile)	0	sq. yd.					\$0.00
Excavation	453	Cu. Yd.					\$39,440.00
Concrete Encasement	101	Cu. Yd.					\$24,177.78
Concrete Reinforcement, Rebar (0 Long)	0	ft					\$0.00
Backfill, FTB	0	Cu. Yd.					\$0.00
Backfill, Native	151	Cu. Yd.					\$11,333.33
Road Bed Restoration, 9" 3/4" Crushed Rock	0	Cu. Yd.					\$0.00
Pavement Saw Cutting, Concrete	0	lft					\$0.00
Pavement Removal, 15 feet wide	0	sqft					\$0.00
Pavement Restoration, Gravel, 30 feet wide	8,160	sqft					\$12,240.00
8" SCH. 40 PVC Conduit	544	lft					\$8,812.80
2" SCH. 40 PVC Conduit	0	lft					\$0.00
4" SCH. 40 PVC Conduit	272	lft					\$2,543.20
1.25" HDPE Conduit	816	lft					\$2,856.00
8" Conduit Spacers	109	ea					\$2,507.00
4" Conduit Spacers	54	ea					\$702.00
Landscaping Repair/Restoration	0	acre					\$628.41
Dewater (50%)	136	lft					\$5,440.00
Shoring (50%)	2,222	sqft					\$11,111.20
DUCTBANK-ROADWAY SUBTOTAL				\$34,866.52		\$92,076.72	\$126,943.24
						Per route foot	\$466.70
TRENCHING DIRECT BURIED							
		0 FEET					
TRENCH WORK SUBTOTAL				\$0.00		\$0.00	\$0.00
						Per route foot	#DIV/0!
JACK AND BORE INSTALLATION	0	@	250 Feet Each				
JACK AND BORE SUBTOTAL				\$0.00		\$0.00	\$0.00
						Per foot	#DIV/0!
HDD INSTALLATION (NO CASING : Land to Land)							
	2 Sets of 2 @		2,900 Feet Each				
Mobilization/Demobilize (HDD)	1	lot					\$50,000.00
Site Preparation for HDD	2	sets					\$80,000.00
Horiz. Directional Drill	11,600	lft					\$8,062,000.00
Conduit for Cables, 10" DR 9 HDPE	34,800	lft					\$1,740,000.00
Conduit for Comm., 6" DR 9 HPDE	11,600	lft					\$348,000.00
Conduit for GCC, 2" DR 14 FPVC	0	lft					\$0.00
HDPE Innerduct, 1 1/4"	34,800	lft					\$121,800.00
HDD INSTALLATION SUBTOTAL				\$1,628,200.00		\$8,773,600.00	\$10,401,800.00
						Per route foot	\$1,793.41

Owner **Avangrid**
 Project **NECEC**
 B&V File No. 400319.42.3000
 Title **Underground Cost Estimate, Gold Brook**
 Estimate Overall Route Length 1.15 Miles
 6,072 Feet 3 Splices per Circuit

Computed By **J. Bardwell**

Checked By

1 DC Circuits
 2 Cables per Pole

Item	Qty	Unit	Material Unit Cost	Total Mat'l Cost	Labor Unit Cost	Total Labor Cost	TOTAL COST
CABLE SYSTEM FURNISH AND INSTALL							
UG CABLE AND ACCESSORIES SUBTOTAL				\$5,591,200		\$1,125,000	\$6,716,200
COMMUNICATIONS							
CABLE SYSTEM COMMUNICATIONS (FO) SUBTOTAL				\$56,032		\$66,861	\$122,893
CIVIL WORK							
GENERAL SUBTOTAL				\$100,000		\$164,375	\$264,375
OVERHEAD TO UNDERGROUND SUBTOTAL				\$495,436		\$903,619	\$1,399,054
SPLICING VAULT SUBTOTAL				\$128,750		\$219,500	\$348,250
DUCTBANK INSTALLATION - ROADWAY				\$34,867		\$92,077	\$126,943
Ductbank cost per route foot \$466.70							
HDD INSTALLATION SUBTOTAL				\$1,628,200		\$8,773,600	\$10,401,800
HDD Ductbank cost per route foot(1 Bores)) \$1,793.41							
ESTIMATED LABOR & MATERIAL COST				\$8,034,484		\$11,345,031	\$19,379,515
ESCALATION		3 Years @	2.50%	\$603,000		\$851,000	\$1,454,000
ESCALATED CONSTRUCTION COST				\$8,637,484		\$12,196,031	\$20,833,515
Mark-Up		10.0% of Est. Labor & Mat.		\$864,000		\$1,220,000	\$2,084,000
ESTIMATED PROJ COST				\$9,501,484		\$13,416,031	\$22,917,515
STATE SALES TAX		5.5% of Materials		\$523,000			\$523,000
ROW ACQUISITION		\$0 per Mile					\$0
MITIGATION							\$0
TOPOGRAPHIC SURVEYING/SOIL EXPLORATION @ 40,000/mi							\$46,000
ENGINEERING AND CONSTRUCTION MANAGEMENT							\$2,291,752
CONTINGENCY		30.0% of project cost					\$7,733,480
ESTIMATED TOTAL PROJ COST							\$33,511,747
UNDERGROUND PROJECT TOTAL						(rounded)	\$33,500,000

Black & VeatchOwner **Avangrid**Project **NECEC**

B&V File No. 400319.42.3000

Assumptions - Underground Cost Estimate, Gold Brook

General

- 1 The estimate is based on a 320 kV DC Cable installation 1.15 miles long.
- 2 ROW acquisition costs are not included in the estimate.
- 3 Environmental mitigation costs are not included in the estimate.
- 4 The estimate does not include costs related to contaminated or hazardous soils or water.
- 5 The estimate does not include allowances for existing facility relocations.
- 6 The estimate does not include allowances for work hour/location restrictions.
- 7 The estimate is in 2019 dollars and includes 3 years of escalation at 2.5%
- 8 The estimate includes a 10% allowance for prime contractor mark-up.
- 9 The estimate includes a 30% contingency to account for the potential rock in the area.
- 9 The estimate includes sales tax of 5.5% on materials only.

Cable & Accessories

- 10 The estimate assumes a single +/-320kV DC circuit with 2 cables per pole.
- 11 The cables are estimated as 320kV DC, 2500 sq. mm Cu Cable.
- 12 The estimate includes an installed spare cable the full length of the line.
- 13 The estimate includes (10) AIS cable terminations, and 2 spare terminations.
- 14 The estimate includes (15) single-phase cable joints, with 2 spare joints.
- 15 The estimate does not include surge arrestors.
- 16 The estimate does not include optical fiber cable inside the power cable for temperature monitoring.

Communications

- 17 The estimate includes two fiber optic cable systems.
- 18 Fiber-optic cables are estimated as 48 fiber, single mode, loose tube outdoor cable.
- 19 Fiber-optic cables are installed into 1 1/4" HDPE innerducts installed in 4" PVC conduit.
- 20 Separate pull/splicing boxes are included for the fiber-optics.

Temperature Monitoring

- 21 The estimate does not include cable temperature monitoring equipment.

Overhead to Underground Transition

- 22 Includes terminations stands, surge arrestor stands and dead-ends for the overhead lines
- 23 The estimate includes site work and foundations for two 135' square termination station
- 24 The estimate includes ground grid and fencing for two 135' square terminations station.

Splice Housings

- 25 The estimate includes (3) jointing locations with (3) 12'x4'x3' precast concrete splice housings at each location.
- 26 Each splice housing is assumed to hold (1) splice.

Duct Bank Installation

- 27 The estimate includes 300 feet of duct bank.
- 28 The estimate includes (6) 8" SCH 40 PVC Conduits for high voltage cable include one spare conduits.
- 29 The estimate includes (2) 4" SCH 40 PVC Conduits for communications.
- 30 The conduits are installed in a common duct bank, 3' wide and 2' high
- 31 The estimate assumes ductbank installation will be under pavement.
- 32 The estimate includes traffic control at 200ft/day.
- 33 The estimate includes soil erosion and sediment control measures for rural streets.
- 34 The estimate assumes a 3' wide trench, averaging 6' deep.
- 35 The estimate assumes the ductbank will be backfilled with FTB to 2' below grade.
- 36 The estimate includes pavement removal and restoration for the entire route length.
- 37 The estimate includes allowance for dewatering for 50% of the trench.
- 38 The estimate includes sheeting and shoring of the trench for 25% of the route length.

HDD Installation

- 39 The estimate includes (2) sets of HDD installations in soil, with a combined length of 5,800 feet.
- 40 Each HDD installation consists of the bundled FPVC or HDPE conduits pulled directly into the boreholes.
- 41 The HDD installations do not include a casing.
- 42 The HDD installations do not include grouting of the bore hole.

Engineering & Construction Management

- 43 The estimate includes surveying, and soil exploration.
- 44 The estimate includes approximate engineering costs.
- 45 The estimate includes approximate construction management costs.

ATTACHMENT B
Pole and Tree Height Information

Crossing #	From Structure #	To Structure #	Current Design (10' Veg Height)		Revised Design (35' Veg Height)		Req'd Ht Increase For 35' Veg		Comment
			From Str - A.G.H. (ft.)	To Str - A.G.H. (ft.)	From Str - A.G.H. (ft.)	To Str - A.G.H. (ft.)	From Str (ft.)	To Str (ft.)	
1	541	542	120	127	120	127	0	0	Moxie Stream (rated as Scenic River). Based on the current design, a person on Moxie Stream (east of the crossing) would see the structures. Taller structures would be more visible and would create more visual impact. Based on the current design, the entire span can accommodate 35' height of vegetation.
2	767	768	97.5, 102	134	97.5, 102	134	0	0	South Branch Moose River. The structures allowing 35' vegetation will not be visible if at least 25' vegetation is preserved on the river. Due to the topography, it is likely the vegetation will be at least 25'. Entire span can accommodate 35' height of vegetation based on current design.
3	588	589	115.5	98	126	98	10.5	0	Area near Wilson Hill Pond and Tobey Pond in Johnson Mtn Twp. Structures heights allowing 35' vegetation will most likely be screened by 60' vegetation surrounding the ponds. 35' tall vegetation can be accommodated along most of the span, 25' tall vegetation can be accommodated elsewhere.
4	741	742	120.5	93.5	120.5	99	0	5.5	Not visible from No 5 Mtn or Rock Pond. The structures as currently designed will be visible from Spencer Road (private haul road) looking south and other haul roads adjacent. Taller structures will be as visible and taller structures may be more visible above regenerating forest along haul roads. 35' tall vegetation can be accommodated along most of the span, 25' tall vegetation can be accommodated elsewhere.
5	575	576	113.5	113.5	113.5	113.5	0	0	Tomhegan Stream. Structure 576 is not likely visible from Wilson Hill Road. Structure 575 may be visible. However, need to keep context in mind because the Project will parallel Wilson Hill Road in this entire area and be highly visible based on current design. Entire span can accommodate 35' height of vegetation based on current design.

Moxie Stream

- Legend**
- 1-NEW HVDC
 - 2-CO-LOCATED HVDC
 - Clearing Limit
 - FEET
 - Feature 1
 - Feature 2
 - NULL
 - PFO
 - Segment
 - Structure
 - Wyman

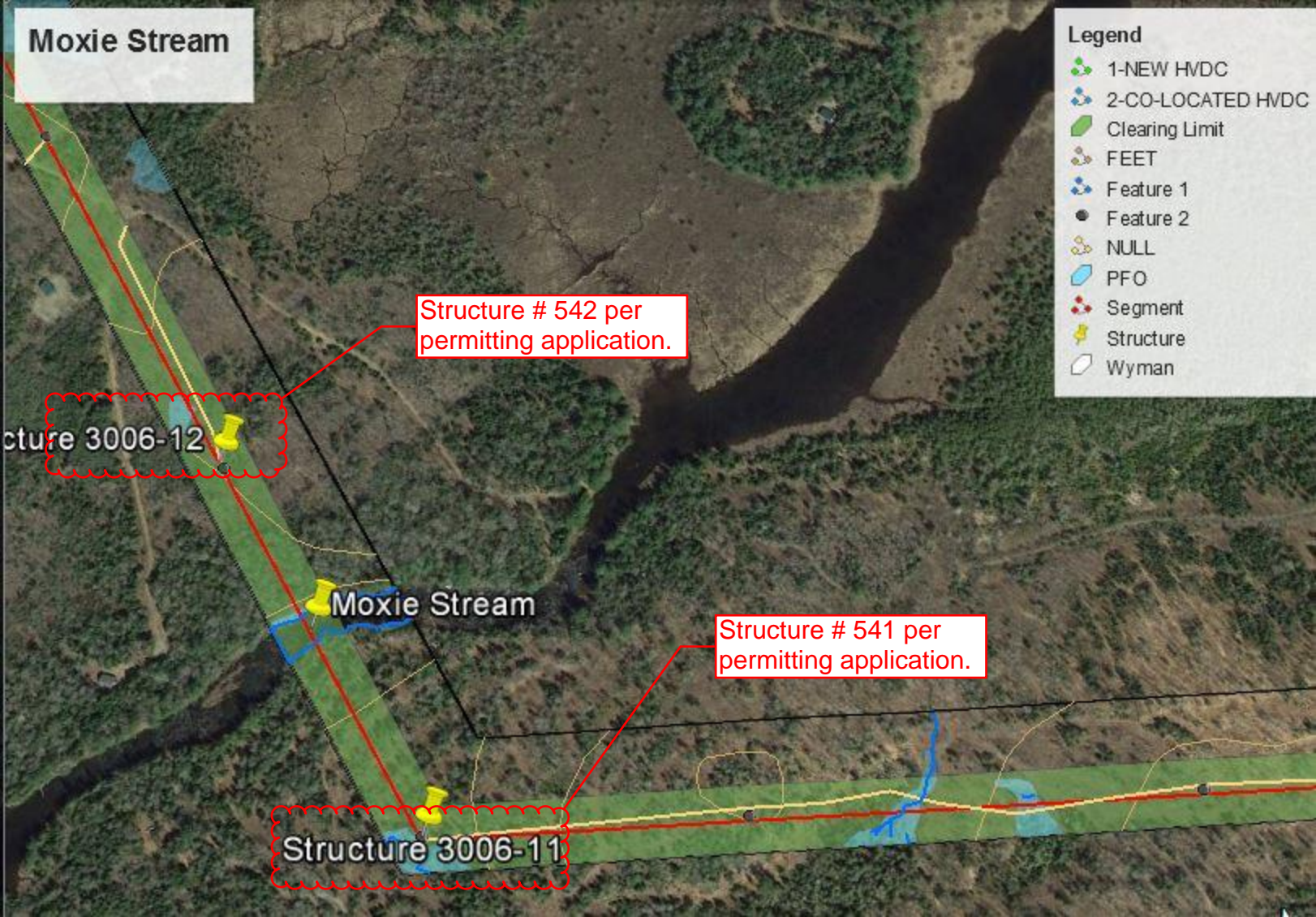
Structure # 542 per permitting application.

Structure 3006-12

Moxie Stream

Structure # 541 per permitting application.

Structure 3006-11



South Branch Moose River

Legend

- 1-NEW HVDC
- 2-CO-LOCATED HVDC
- Clearing Limit
- FEET
- Feature 1
- Feature 2
- Feature 3
- Feature 4
- NULL
- Segment
- Structure
- Wyman

Structure 238

Structure # 768 per
permitting application.

Structure 237

Structure # 767 per
permitting application.



900 ft

Structures 3006-60 and 3006-59

Legend

- 1-NEW HVDC
- 2-CO-LOCATED HVDC
- Clearing Limit
- FEET
- Feature 1
- Feature 2
- Feature 3
- Feature 4
- NULL
- Segment
- Structure
- Wyman

Structure 3006-60

Structure 59

Structure # 589 per permitting application.

Structure # 588 per permitting application.



Area between structures 212 and 211

- 1-NEW HVDC
- 2-CO-LOCATED HVDC
- Clearing Limit
- FEET
- DC Feature 1
- Feature 2
- Feature 3
- Feature 4
- NULL
- Segment
- Structure
- Wyman

Structure # 742 per permitting application.

Structure # 741 per permitting application.

Structure 212

Structure 211

Tomhegan Stream

Legend

- 1-NEW HVDC
- 2-CO-LOCATED HVDC
- Clearing Limit
- FEET
- DC Feature 1
- Feature 2
- Feature 3
- Feature 4
- NULL
- Segment
- Structure
- Wyman

Structure # 576 per permitting application.

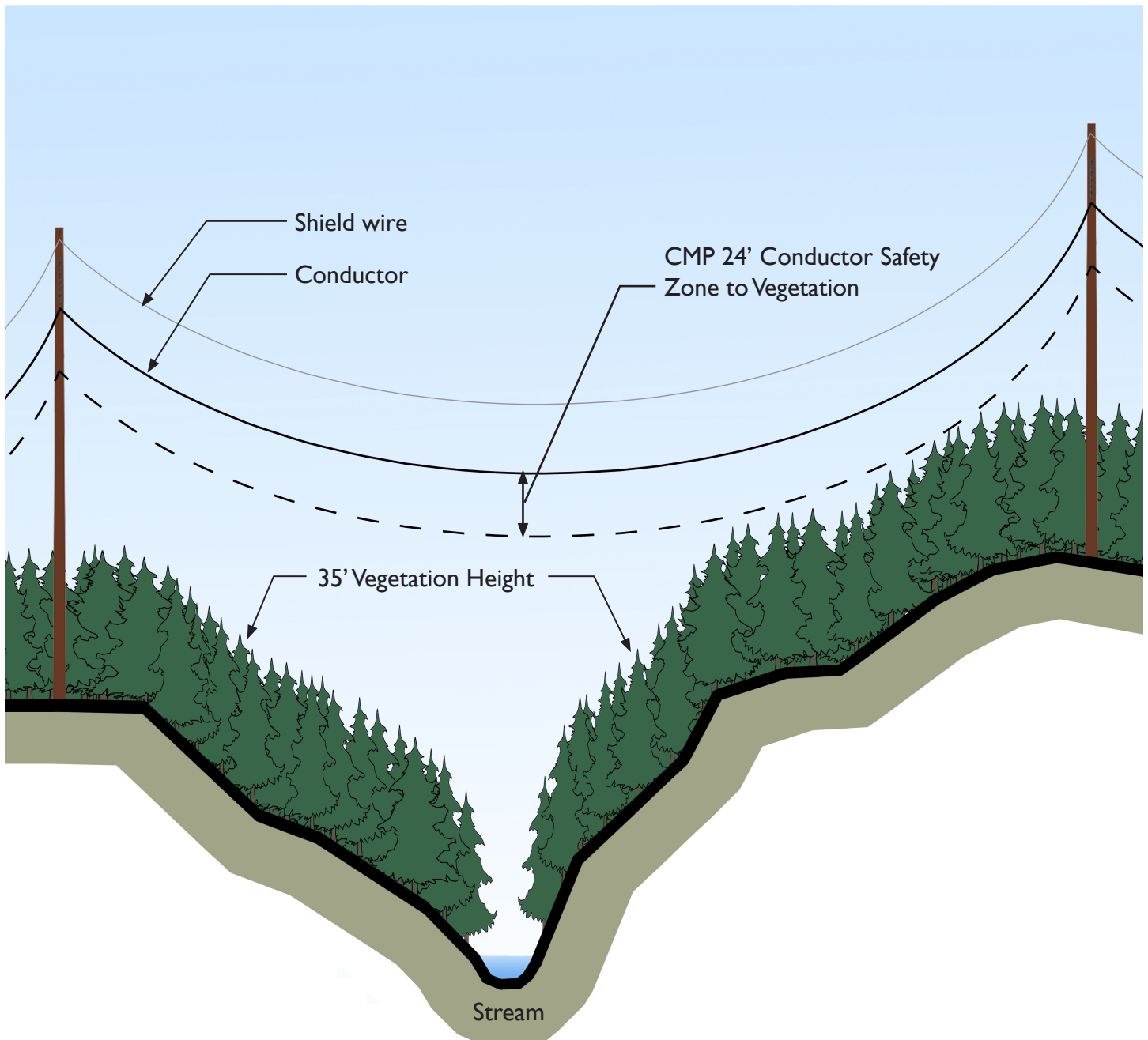
Structure 3006-47

Braided Channel on Tomhegan Stream

Structure 3006-46

Structure # 575 per permitting application.





**Cross Section
 Typical Wildlife Travel Corridor
 MDEP Areas of Interest**

Notes:
 Drawing not to scale.

The area around the base of each transmission line structure will be maintained as scrub-shrub vegetation to allow for future operation and maintenance activities. The area maintained in this manner will vary by structure type as depicted on Figure 7-1 of CMP's Natural Resources Protection Act Application.