

New Hampshire Line X-178 Rebuild Follow-Up

Planning Advisory Committee Meeting

June 20, 2024

Agenda

- Purpose
- Stakeholder Feedback and Responses
- Project Background
- Project Location
- Project Needs
- Solution Alternatives & Analysis
- Project Summary
- Questions

Purpose

- Advise ISO-NE and the PAC stakeholder community of asset condition and reliability needs driving the proposed rebuild of the 115 kV X-178 Line in New Hampshire
- Discuss additional solution alternatives developed in response to stakeholder feedback and provide analysis comparing all solution alternatives



Bog Pond within the White Mountain National Forest

Stakeholder Feedback and Responses

- Responses to written stakeholder feedback have been posted to the PAC webpage along with this presentation
 - Original PAC presentation on [February 28, 2024](#)
 - Stakeholder feedback response memo dated [June 12, 2024](#)

- Written responses cover topics including:
 - The history of the X-178 line
 - Telecommunications needs and analysis
 - Conductor reliability needs and analysis
 - Project reporting and outreach efforts
 - Development and analysis of solution alternatives

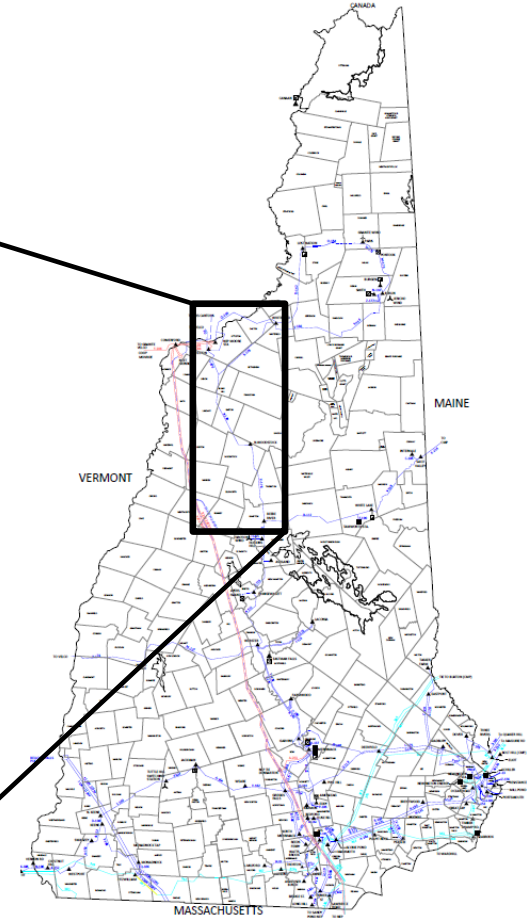
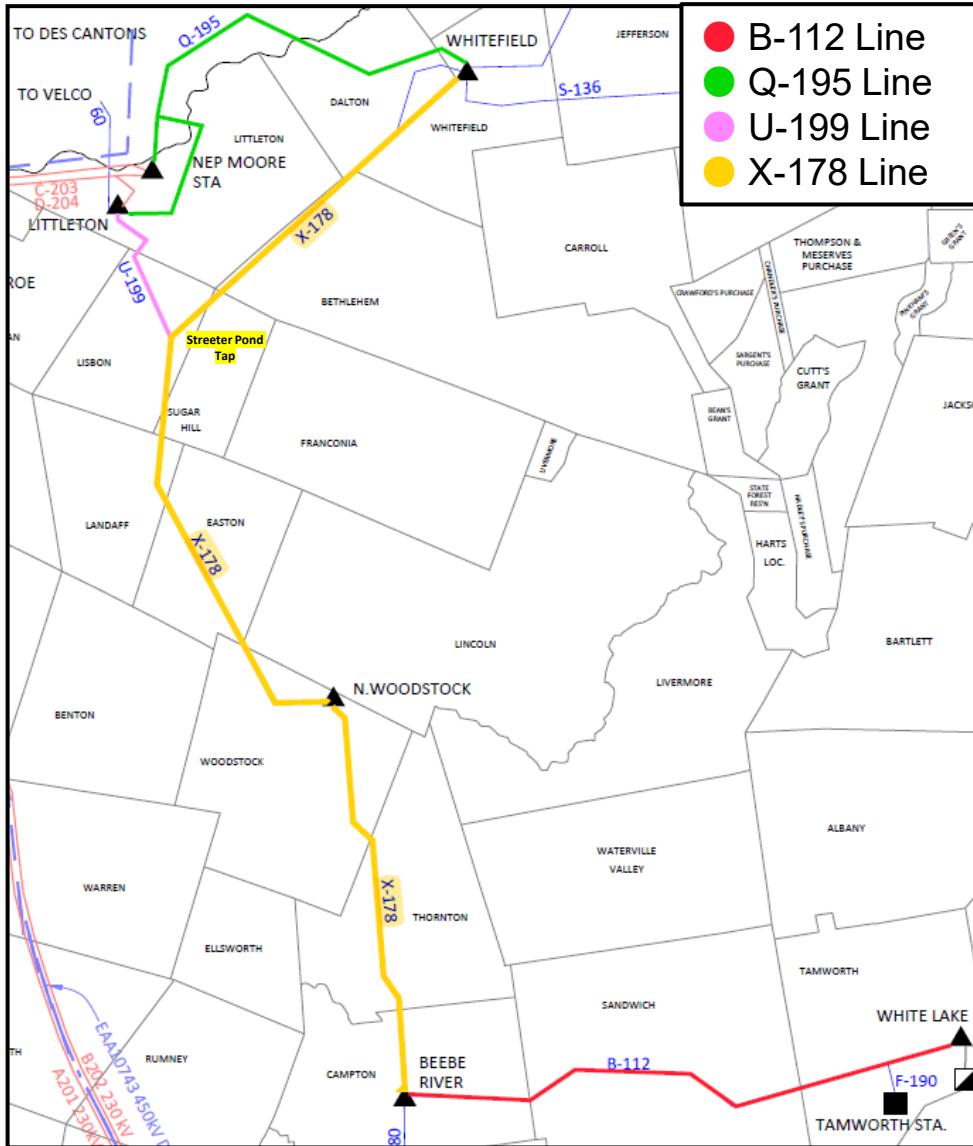
- Some questions received were beyond the scope of typical PAC discussions
 - Eversource follow-up contact information has been provided to facilitate further discussions with stakeholders

Project Background

- Eversource serves 535,000 customers in New Hampshire, with 145 transmission and distribution substations, 1,057 miles of transmission lines and 14,375 miles of distribution lines

- X-178 115 kV Line runs between Beebe River substation in Campton, NH and Whitefield substation in Whitefield, NH
 - **Northern** line section between Streeter Pond Tap and Whitefield was originally constructed in the early 1950's and significantly reconstructed in 1969
 - **Middle** line section between North Woodstock and Streeter Pond Tap was originally constructed in the early 1950's and most recently reconstructed in 1985
 - **Southern** line section between Beebe River and North Woodstock was originally constructed in the early 1950's and most recently reconstructed in 1985
- Overall length: 49 miles
- Structures: 594 structures
 - Combination of 579 natural wood, 2 laminated wood, 11 steel H-frame and 2 weathering steel
- Average structure age: 45 years old
- Conductor: 795 ACSR 26/7, 795 ACSR 36/1, and 1272 ACSS 54/19
- Shield wire: 2 runs consisting of 7/16" Steel or 7#8 Alumoweld

Project Location



Geographic location is approximate

Project Needs

- 2022 inspections of this line graded condition of structures in accordance with Electric Power Research Institute (EPRI) guidelines
 - *A: Nominal Defect, B: Minimal Defect, C: Moderate Defect, D: Severe Defect*
 - Priority C structures showed one or more of the following age-related degradations, leading to decreased load carrying capability
 - Woodpecker damage, pole top rot, cracked arms, split pole top, and/or decay
 - 43 structures (41 priority C structures and two LWS structures) identified for immediate replacement throughout the line
 - Additional replacements due to uplift will be required
 - Uplift triggered-replacements occur when a neighboring structure to one already deemed in need of replacement will not be able to handle the strain from height differences between structures
- 2024 drone inspections are ongoing and additional priority C structures may be identified

Project Needs – Photos



Structure 212 – Pole Top Rot & Rusted Hardware

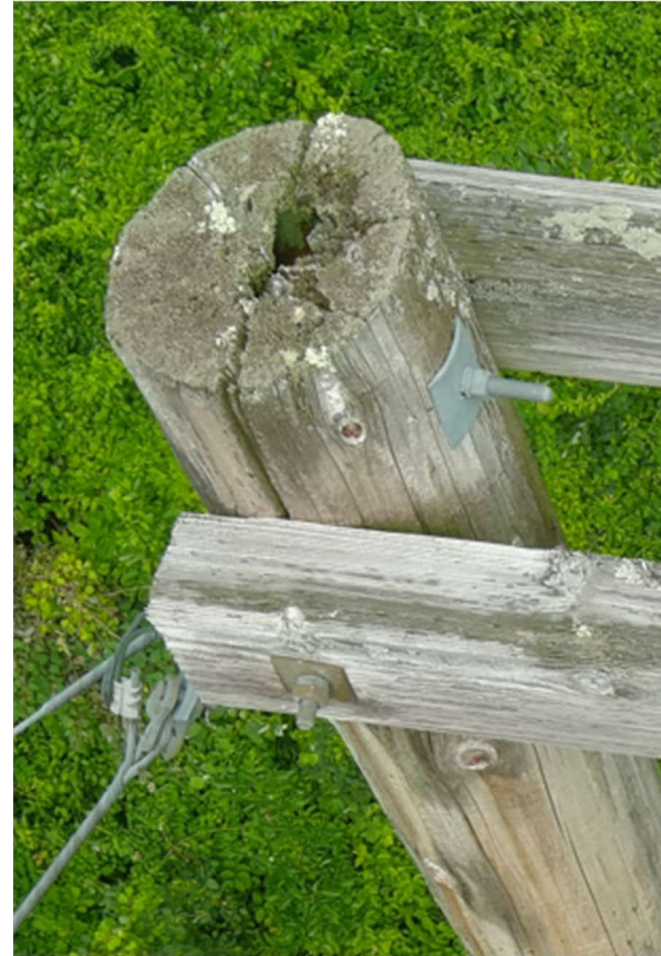


Structure 356 – Split Pole Top

Project Needs – Photos

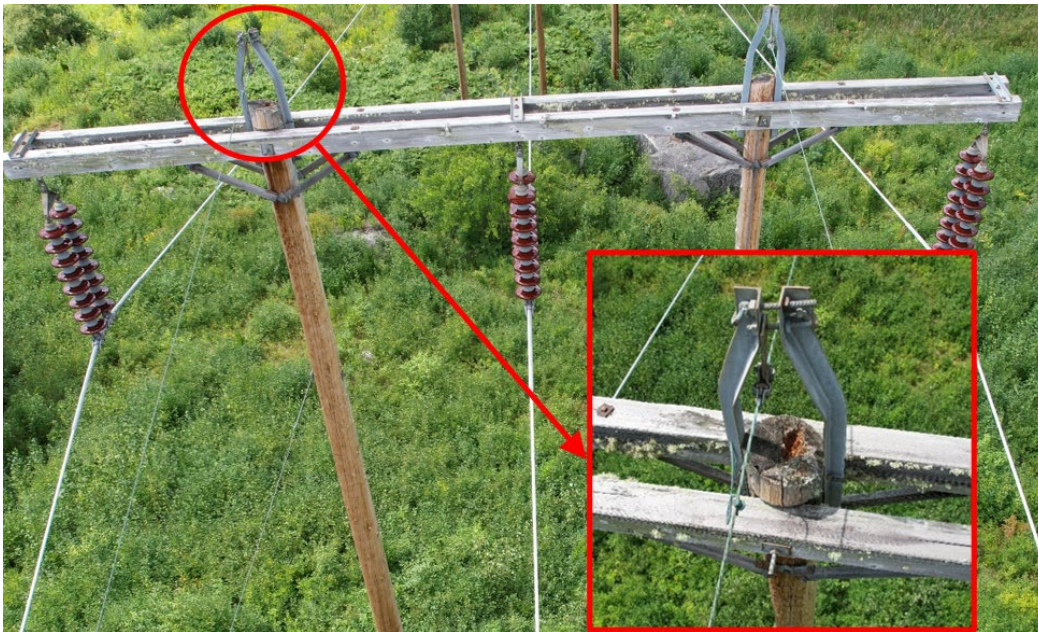


Structure 8 – Severe Structure Splitting

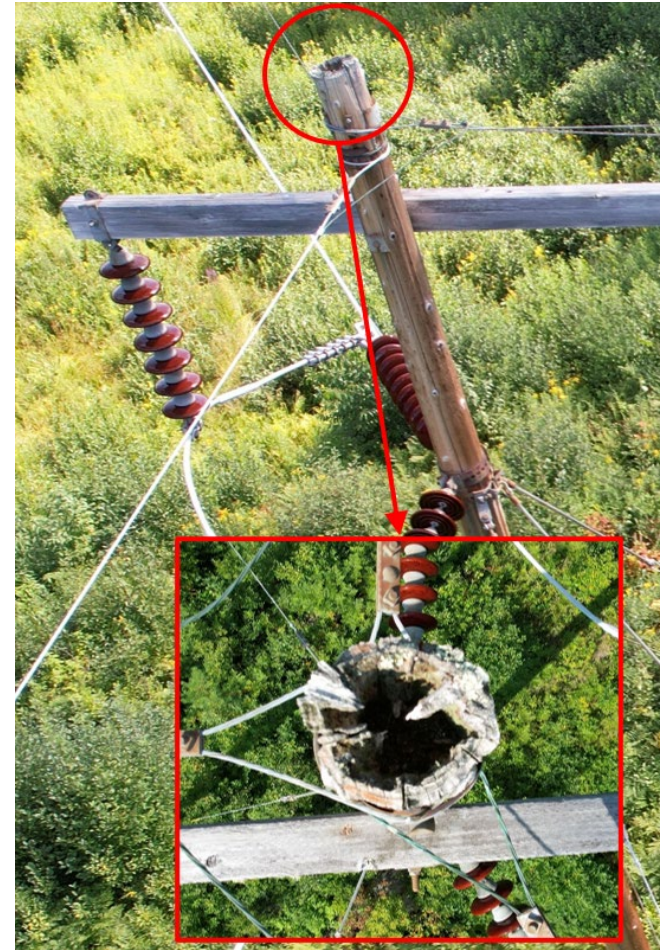


Structure 25 – Pole Top Rot and Splitting at Hardware Attachment Point

Project Needs – Photos



Structure 424 – Pole Top Checking and Large Hole in Pole Top



Structure 419 – Major Pole Top Rot

Approach to developing solution alternatives

- Eversource performed additional analysis of solution alternatives with reduced scope compared to the full rebuild presented at the February 28 PAC meeting
- Potential structure replacements were evaluated and classified as follows:
 - **Immediate replacement structures** – Structures requiring replacement due to priority C ratings from recent inspections or known performance issues (LWS structures are known to be problematic regardless of rating)
 - **Uplift structures** – Structures that become overstressed due to conductor and/or shield wire tensions created by replacement of one or more nearby structures. These structures must be replaced at the same time as the nearby structure(s) to ensure the integrity of the line
 - **Opportunity structures** – Structures that can be efficiently replaced due to construction activities necessary to access priority C and overstressed structures. All of these structures are older than 40 years and were rated priority B during the most recent inspection

Solution Alternatives Evaluated

- Alternative 1
 - Replace only immediate replacement structures and uplift structures
- Alternative 2
 - Replace structures included in Alternative 1, plus additional opportunity structures
- Alternative 3
 - Complete line rebuild, including replacement of all additional structures that are overloaded with the addition of OPGW
 - This was the preferred alternative presented to PAC on February 28

Elimination of Alternative 1 from further consideration

- Pursuing Alternative 1 would lead to many additional, future structure replacement projects on the line in the near-term as existing structures continue to deteriorate
 - Elevated reliability risk as many deteriorating and aging structures will remain present on the line
- Additional structure replacements under future projects would require access to the same portions of the ROW
 - Inefficient from a construction and cost perspective
 - Highest environmental and community impact due to repeatedly accessing the ROW over the course of several years

Solution Alternative 2

- Scope:
 - Replace immediate replacement and uplift structures
 - Replace all opportunity structures easily accessed during construction activities that would be necessary to replace immediate replacement and uplift structures
 - 170 total structure replacements
- Pros:
 - Lower initial cost
- Cons:
 - Additional structure replacements will be required in the near future as additional structures degrade and are rated as priority C in future inspections
 - Elevated reliability risk as many deteriorating and aging structures will remain present on the line
 - Additional re-entry into corridor will continue to cause additional environment and community impacts
 - Does not address capacity constraints
 - Does not address need for improved communications paths in northern New Hampshire
- **Total estimated PTF cost:** \$91.7 M (-50%/+200%, in current dollars without escalation)

Additional future work beyond Alternative 2

- Alternative 2 would leave structures that are older than 40 years in place
 - These structures will continue to deteriorate and will eventually need to be replaced through future projects
 - Additional priority C structures *not included in Alternative 2* have already been identified during the 2024 inspection cycle (which remains ongoing)
- Based on our experience with other lines in New Hampshire, we developed cost estimates for hypothetical future projects that may be necessary as additional structures deteriorate
 - First additional project:
 - Assumed that approximately 50% of remaining older structures require replacement in approximately 2030
 - Total cost of \$110.6 M (in current dollars, without escalation)
 - Second additional project:
 - Assumed that all remaining wood structures require replacement in approximately 2038
 - New conductor and OPGW would be installed at this time
 - Total cost of \$234.3 M (in current dollars, without escalation)
- Total cost over time:
 - In current dollars: \$436.6 M (-25%/+200%)
 - With assumed escalation to year of construction: \$574.1 M (-25%/+200%)
(*Year of construction varies by project*)

Solution Alternative 3

- Scope:
 - Remove 583 existing structures and install 580 new steel structures
 - 3 existing structures to be permanently removed
 - 11 existing steel structures would be reused and remain in place
 - Replace 49 circuit miles of existing conductor with 49 miles of 1272 ACSS 54/19 “Pheasant” conductor
 - Replace existing shield wire with two 49-mile runs of OPGW
 - Utilize ADSS to tie into Beebe River Substation, North Woodstock Substation, Whitefield Substation and Streeter Pond Tap
- Pros:
 - Addresses structural asset condition issues
 - Mitigates reliability risks and dramatically improves resiliency for a line exposed to among the highest elevations on the Eversource system
 - Provides a fiber communication path to northern New Hampshire, including North Country 115 kV loop
 - Takes advantage of permitting and access efficiencies
 - Reduces need for repeated re-entry into ROW over coming decades, mitigating impact to local communities, landowners, and sensitive environmental regions
- Cons:
 - Higher up-front cost
- **Total estimated PTF cost:**
 - \$360.8 M (-25%/+50%, in current dollars, without escalation)
 - \$384.6 M (-25%/+50%, in 2026 dollars) ← Estimate presented to PAC on February 28, 2024

Cost Comparison

- Alternative 2, plus additional future projects: \$436.6 M (-50%/+200%)
- Alternative 3: \$360.8 M (-25%/+50%)
 - Lower cost reflects construction efficiencies compared to Alternative 2 and additional future projects

- To support a comparison:
 - Values are presented here in current dollars, while cost estimates presented to PAC are typically escalated to the anticipated in-service year
 - For example, \$384.6 M estimate presented in PAC in 2026 dollars becomes \$360.8 M when expressed in current dollars
 - Alternative 2 and additional future project cost estimates are Order of Magnitude (-50%/+200%), but include similar percentage of contingency as Alternative 3 estimate, which is Conceptual (-25%/+50%)

- Total cost of Alternative 2 plus additional future projects has greater chance of increasing compared to estimate for Alternative 3
 - As noted above, additional contingency was *not* added to estimates for Alternative 2 and additional future projects
 - Additional future projects may be more frequent and less efficient than assumed (for example, projects every two years versus the assumed projects at years 5 and 13)

Environmental / Community Impact

- Right-of-way access is limited for the X-178 line; some access roads will be several miles long
- Repeated access is costly, time-consuming and more disruptive to the environment and abutting landowners
- Approximately 12 miles of line is routed through the White Mountain National Forest; some structures within this section can only be accessed via helicopter
- Alternative 3 limits the environmental and community impact to a single project
 - Short-term impact will be greater than Alternative 2, but will be significantly less over the long run when compared to several smaller projects



Existing Structure 267

Telecommunications Needs

- Third-party telecommunication services (i.e. leased lines) are becoming increasingly expensive and difficult to obtain
 - Third-party telecommunications providers have indicated that services may be discontinued before the end of the decade
 - Discontinuation of third-party telecommunications alternatives could require additional future investments in Eversource-owned telecommunication infrastructure
 - Installing OPGW as part of Alternative 3 enables an orderly transition to Eversource-owned communications and mitigates the risk of a potential future project
- OPGW greatly reduces reliance on leased, third-party telecommunications services for system protection, critical infrastructure protection, and other important services
- Several transmission substations will directly benefit from OPGW installation on the X-178 line
 - Fiber on the X-178 would be utilized to complete this ring, providing further redundancy and increased communication systems reliability
 - There is also a shared ring being planned between Eversource and National Grid that will provide communications to our northern New Hampshire substations

















Long-term Capacity Needs

- The X-178 line was overloaded in some 2050* Study scenarios
 - Highest loading was 344 MVA under 2050 Winter peak scenario with 51 GW New England load**
 - Existing Long-Term Emergency (LTE) rating is 229 MVA (Summer) and 254 MVA (Winter)
- Achieving an LTE rating of at least 344 MVA would require upgrades to both the X-178 line conductor and associated substation equipment
 - Installation of 1272 ACSS 54/19 “Pheasant” as part of the full line rebuild would increase the LTE rating of the conductor to 518 MVA
 - The line would then be limited to 254 MVA LTE due to substation equipment, which could be addressed as part of a future project
- 1272 ACSS 54/19 “Pheasant” is a standard conductor for Eversource and would be installed as part of the line rebuild even without the 2050 Study results
 - ACSS conductor has excellent high-temperature performance; Eversource allows operation up to a 200 degrees C conductor temperature
 - Other conductor technologies (composite core, etc.) would be more costly and are not necessary on the X-178 line

* Results published to the ISO-NE website on February 14, 2024

** Excluding scenario with 57 GW winter peak load

Solution Alternative Analysis

Key Factors	Alternative Solution 2	Alternative Solution 3
Description	Partial structure replacement	Full line rebuild
Lowest initial cost		
Lowest long-term cost		
Overall System Performance and Reliability		
Expected ease of permitting		
Ease of constructability		
Shorter initial construction duration		
Long-term environmental impact		
Long-term abutter impact		

Solution Alternative Selection

- In response to stakeholder feedback, Eversource evaluated the possibility of reducing the scope of the proposed X-178 line rebuild project
- A partial structure replacement project (Alternative 2) would:
 - Have lower initial costs, but higher anticipated costs over time as additional structures deteriorate
 - Have higher environmental and community impact over time due to repeated access to the ROW
 - Preclude the installation of new conductor and high-speed communications for many years
- A full line rebuild (Alternative 3) would:
 - Have higher initial costs but lower anticipated costs over time
 - Avoid future disruptions to the environment and local communities
 - Provide near-term improvement to telecommunications capabilities for northern New Hampshire substations and avoid potential future projects to install OPGW or upgrade conductor
- Eversource continues to select the full line rebuild (Alternative 3) as the preferred solution

Summary

- Eversource is planning a complete rebuild of the X-178 115 kV line in northern New Hampshire
 - Replace 583 existing structures with 580 structures of various types
 - Replace 49 circuit miles of existing conductor with 49 miles of 1272 ACSS 54/19 “Pheasant” conductor
 - Replace existing shield wire with two 49-mile runs of OPGW (98 miles total)
 - Utilize ADSS to tie into Beebe River Substation, North Woodstock Substation, Whitefield Substation and Streeter Pond Tap
- Full rebuild solution addresses all present and future predicted reliability needs on this line, facilitates long-term cost savings, and limits repeated disruptions to environment and local communities
- **Total estimated PTF cost:** \$384.6 M (-25%/+50%)
- **In-service date:** Q4 2026

Questions

