Reliability Analysis Update

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Transmission Expansion Advisory Committee

April 6, 2021

Changes to Existing Projects

Baseline Reliability Projects

Dominion Transmission Zone: Baseline
115kV Line #81 and 230kV Lines #239 and #2056 Partial Rebuild

Problem Statement and Solution Update

Previously Presented: 3/28/2019 SRRTEP

Baseline Reliability: TO Criteria Violation (FERC 715 (TO Criteria) Exclusion)

Problem Statement: Dominion "End of Life Criteria"

- 115kV Line #81 extends 21.6 miles from Carolina to South Justice Branch and serves 3 delivery points: Roanoke Rapids DP, Darlington DP, and Hornertown. The 18.6 mile section between Carolina and the tap to South Justice Branch is mostly wood H-frames constructed in 1959.
- There are two sections, 1.7 miles total, within the 18.6 mile section that have double circuit structures that are V series Corten. 115kV Line #81 and 230kV Line #2056 are on these double circuit structures. Additionally, 115kV Line #81 and 230kV Line #239 are on double circuit steel structures for 1.3 miles within the 18.6 mile section. These structures were installed in 1967. The conductor on this line is ACSR and the static wire is 3/8 inch steel.
- Industry guidelines indicate equipment life for wood structures is 35-55 years, conductor and connectors are 40-60 years, and porcelain insulators are 50 years.
- The 3 mile double circuit tap, lines 81 and 1001, to South Justice Branch was constructed in 2015.

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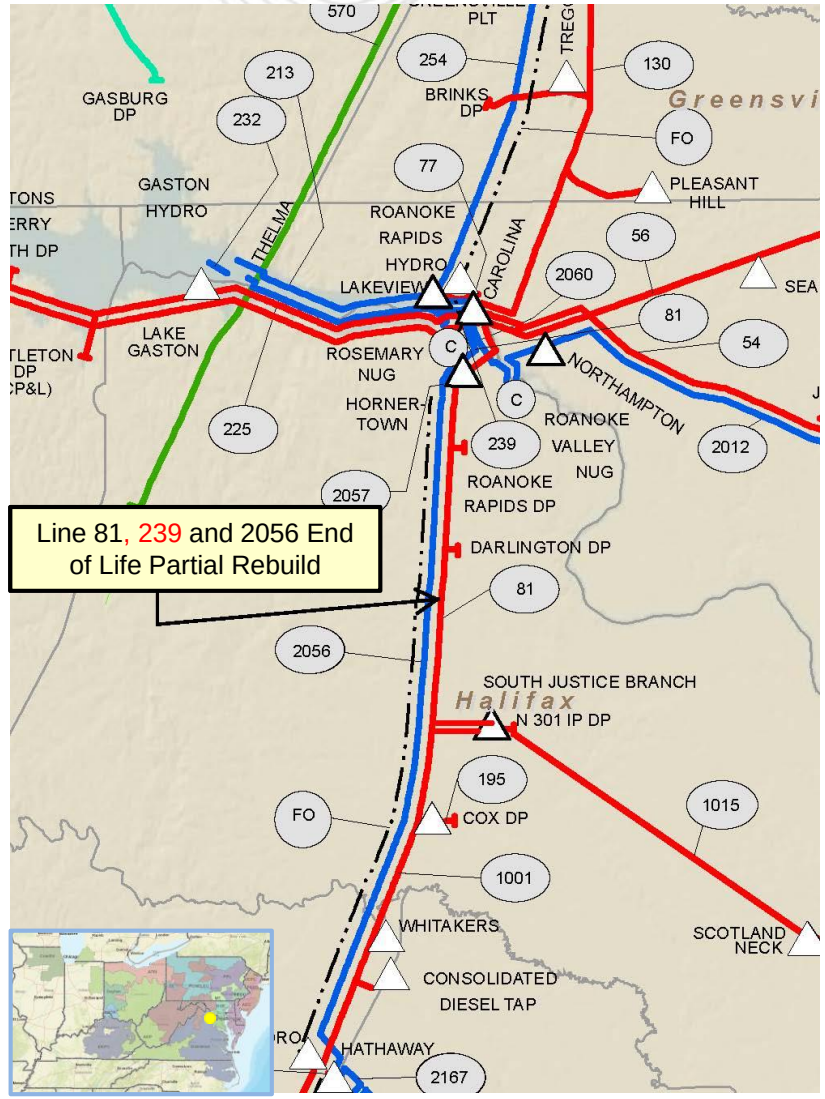


COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
	500 KV.	500 thru 599
	230 KV.	200 thru 299 & 2000 thru 2099
	115 KV.	1 thru 199
	138 KV.	AS NOTED
	69 KV.	AS NOTED

Dominion Transmission Zone: Baseline
115kV Line #81 and 230kV Lines #239 and #2056 Partial Rebuild

Solution:
Rebuild the 18.6 mile section of 115kV Line #81 which includes 1.7 miles of double circuit Line #81 with 230kV Line #2056 and 1.3 miles of double circuit Line #81 with 230kV Line #239. This segment of Line #81 will be rebuilt to current standards with a minimum rating of 261 MVA. This segment of Line #239 will be rebuilt to current standards with a minimum rating of 1046 MVA. Line #2056 rating will not change. **(b3114)**

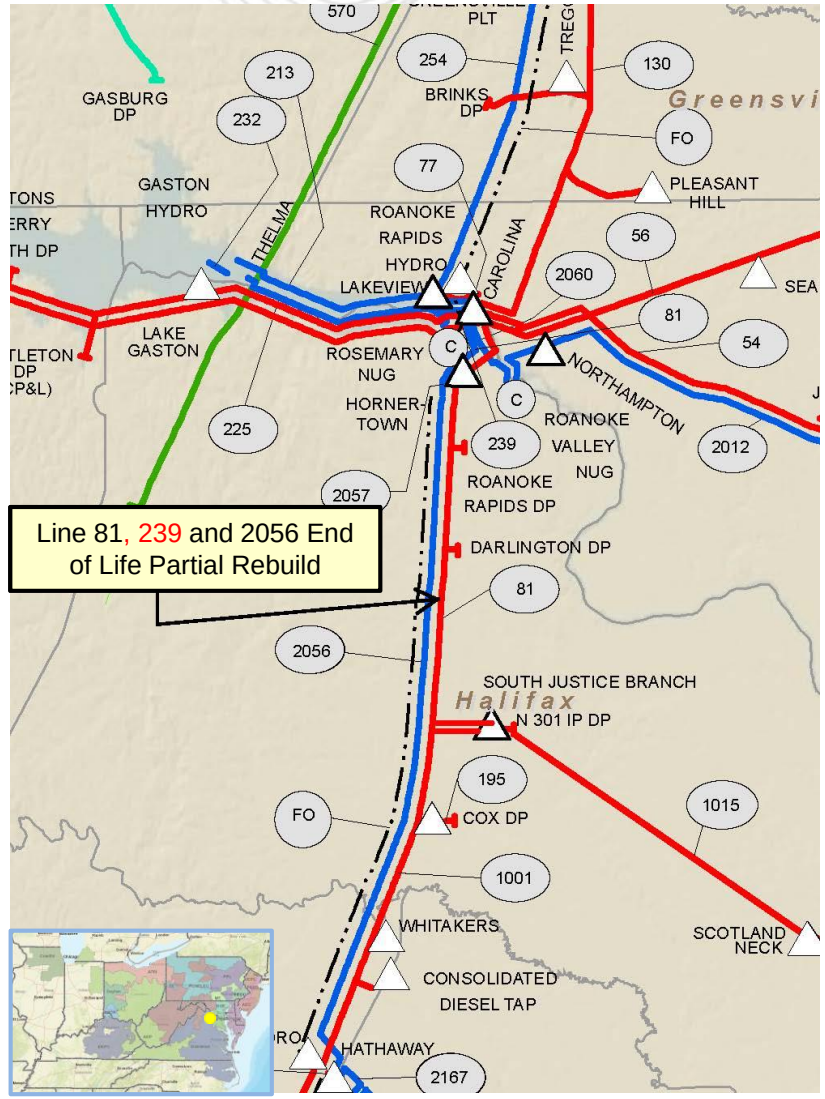
Alternative: No feasible alternatives

Estimated Project Cost: $25M

Required In-service Date: Immediate Need

Projected In-service Date: 12/31/2025

Project Status: Conceptual



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Dominion Transmission Zone: Baseline Chickahominy 230kV Breaker “SC122”, “205022”, 209122”, 210222-2”, “28722”, “H222”, “21922”, “287T2129” Replacements

Process Stage: Cancellation

Criteria: Over Duty Breaker

Assumption Reference: none

Model Used for Analysis: 2025 short circuit model

Proposal Window Exclusion: Station Equipment

Problem Statement:

Eight (8) Chickahominy 230kV breakers are over duty:

“SC122”, “205022”, 209122”, 210222-2”, “28722”, “H222”, “21922”, “287T2129”

Significant Driver:

b3213: Install 2nd Chickahominy 500/230 kV transformer. (Generator Deactivatic of Chesterfield 5 and 6).

Existing Facility Rating: 50kA interrupting rating

Solution Cancellation Driver: AB2-068 Generator Withdrawn

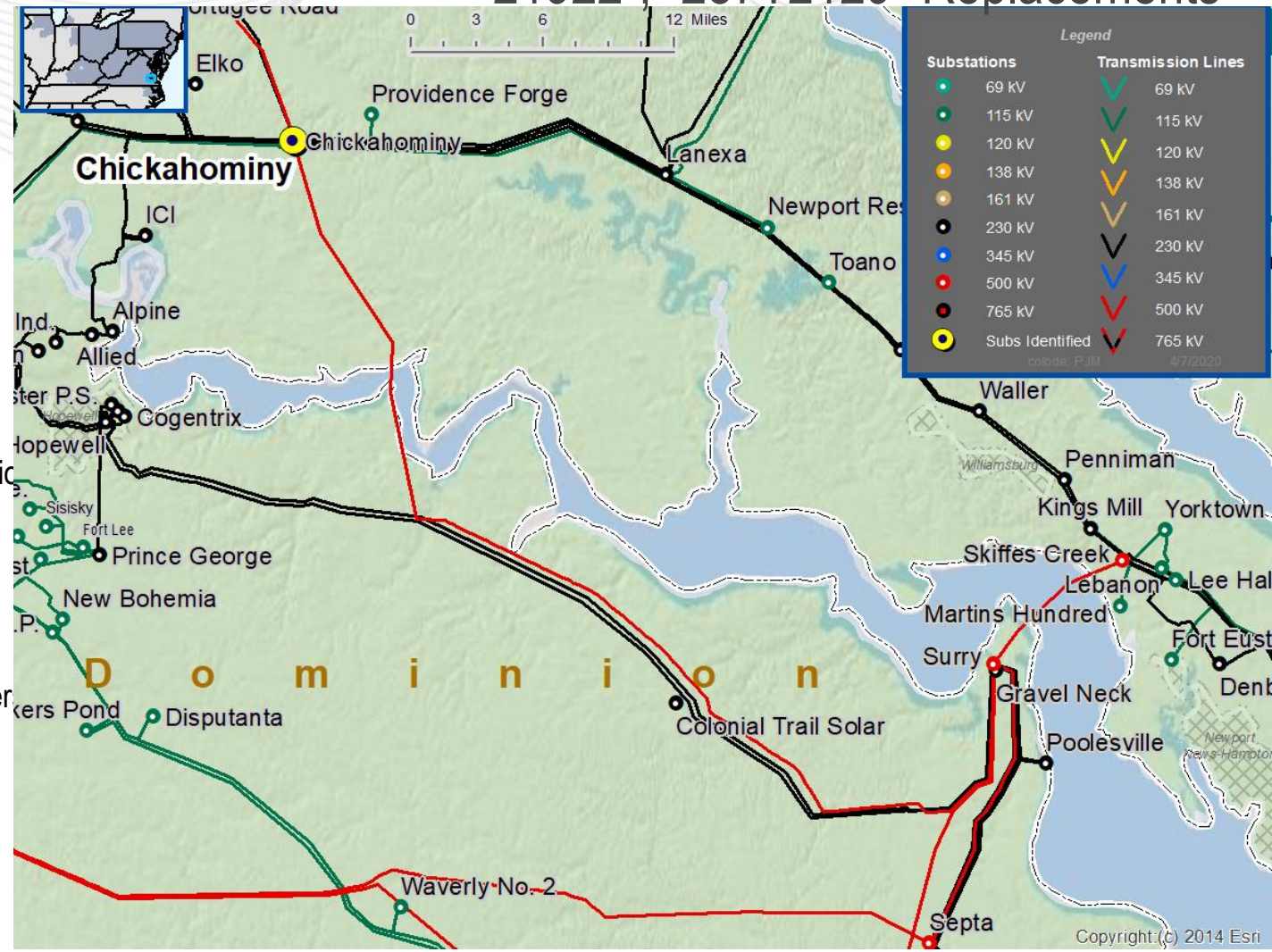
Recommended Solution Cancellation:

b3213.1: Replace the eight (8) Chickahominy 230kV breakers with 63kA breaker “SC122”, “205022”, 209122”, 210222-2”, “28722”, “H222”, “21922”, “287T2129”

- **Estimated Cost:** $3.76M Replace the eight breakers with 63kA breakers ($0.47M each)

Required In-Service: 6/1/2023

Previously Presented: 12/1/2020



APS Transmission Zone: Baseline
Flint Run 500/138 kV Substation

Problem Statement:

Increased customer load expectations connected to the Waldo Run 138 kV substation are causing several Gen Deliv, N-1 Thermal, and N-1 low voltage violations in the vicinity of Waldo Run, Oak Mound, Pruntytown and Fairview.

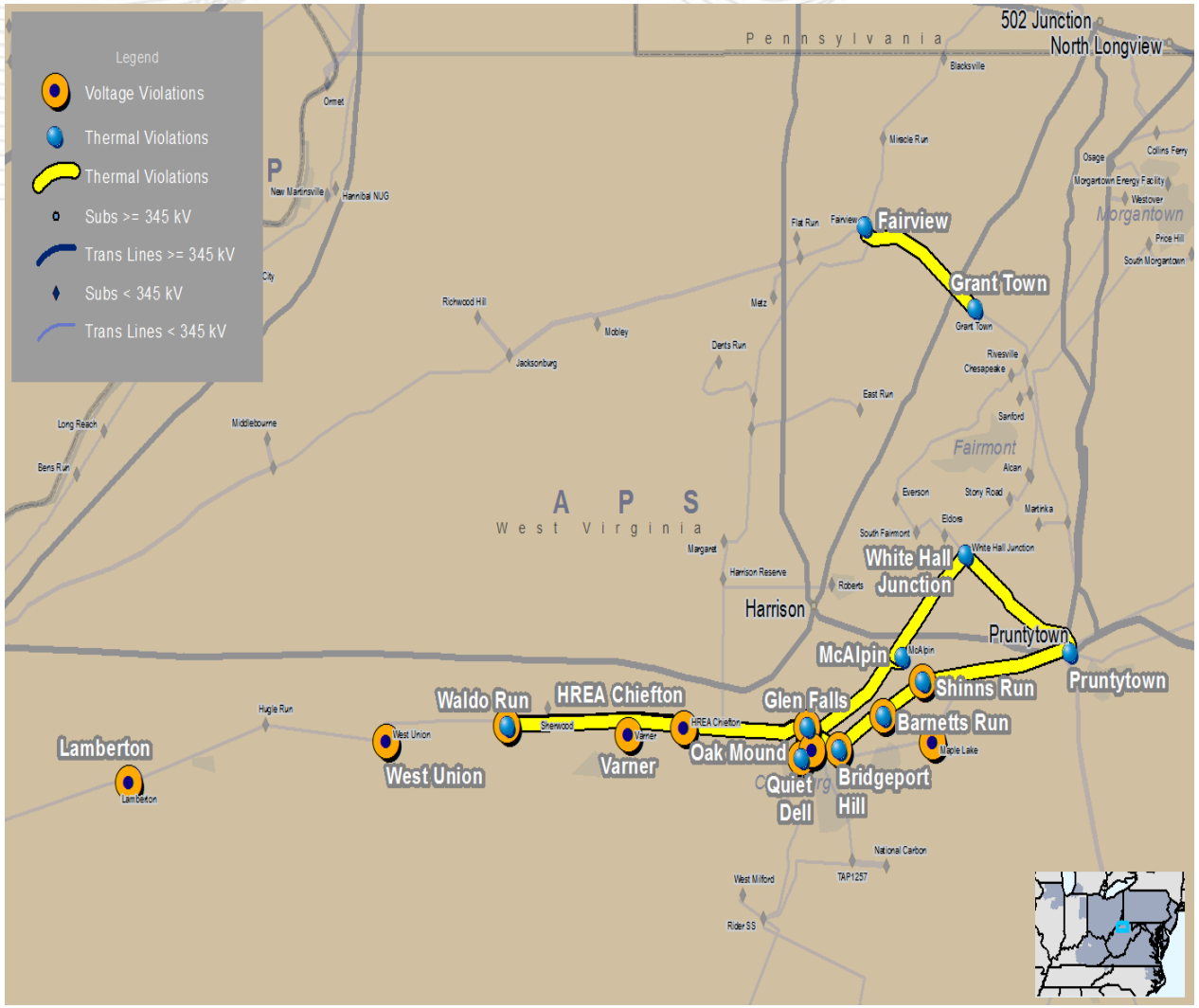
Immediate Need:

Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

Alternatives considered:

1. Reconductor/rebuild overloaded 138 kV facilities with VAR support near the load – est. cost **$160M**
2. Install new Pruntytown-Oak Mound 138 kV line, reconductor two 138 kV lines, and add VAR support near the load – est. cost **$198M**
3. Construct a new 500/138 kV substation to provide EHV source to the Marcellus shale load growth area – est. cost **$142M**

By injecting the 500/138 kV source into the area expecting Marcellus shale load growth, we are designing the BES to withstand additional load requests in the area. The alternative solutions apply a temporary resolution at a higher cost to resolve expected load concerns, with no room for growth. The gas industry is greatly expanding in the Doddridge County area of WV, and the recommended solution allows for future support.



APS Transmission Zone: Baseline
Flint Run 500/138 kV Substation

Potential Solution:

Construct a new 500/138 kV substation as a four-breaker ring bus with expansion plans for double-breaker-double-bus on the 500 kV bus and breaker-and-a-half on the 138 kV bus to provide EHV source to the Marcellus shale load growth area. Projected load growth of additional 160 MVA to current plan of 280 MVA, for a total load of 440 MVA served from Waldo Run substation. Construct additional three-breaker string at Waldo Run 138 kV bus. Relocate the Sherwood #2 138 kV line terminal to the new string. Construct two single circuit Flint Run - Waldo Run 138 kV lines using 795 ACSR (approximately **3.7** miles). After terminal relocation on new 3-breaker string at Waldo Run, terminate new Flint Run 138 kV lines onto the two open terminals.(b2996.1) **$125.3M**

Loop the Belmont-Harrison 500 kV line into and out of the new Flint Run 500 kV substation (less than 1 mile). Replace primary relaying and carrier sets on Belmont and Harrison 500 kV Remote End Substations.(b2996.2) **$16.6M**

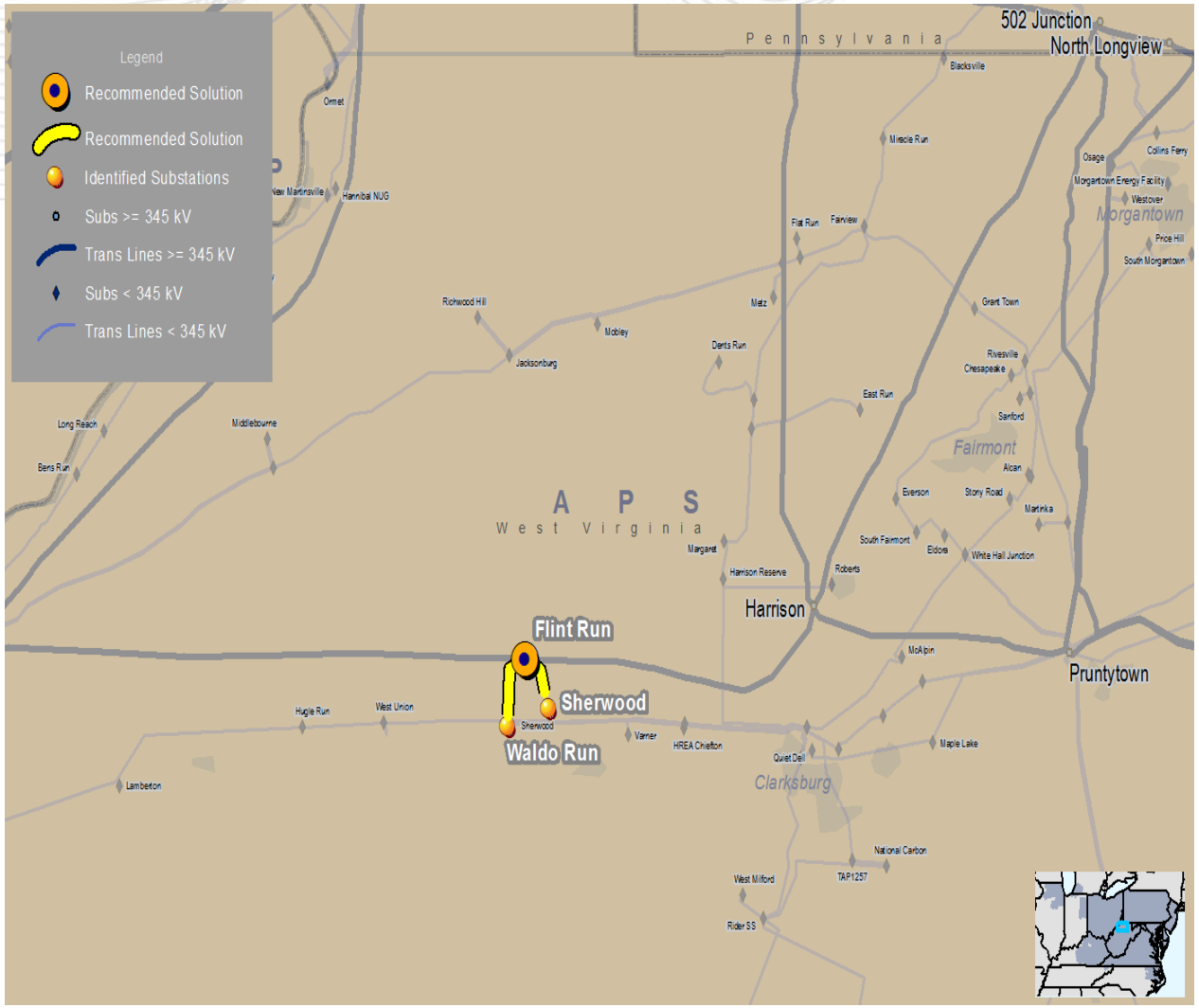
Upgrade two (2) existing 138 kV breakers (Rider 50 and #1/4 transformer breaker) at Glen Falls with 63 kA, 3000 A units. (B2996.3) **$1.5M**

Total Cost: **$143.4**

Required IS Date: **12/1/2021**

Projected IS Date: **12/1/2021**

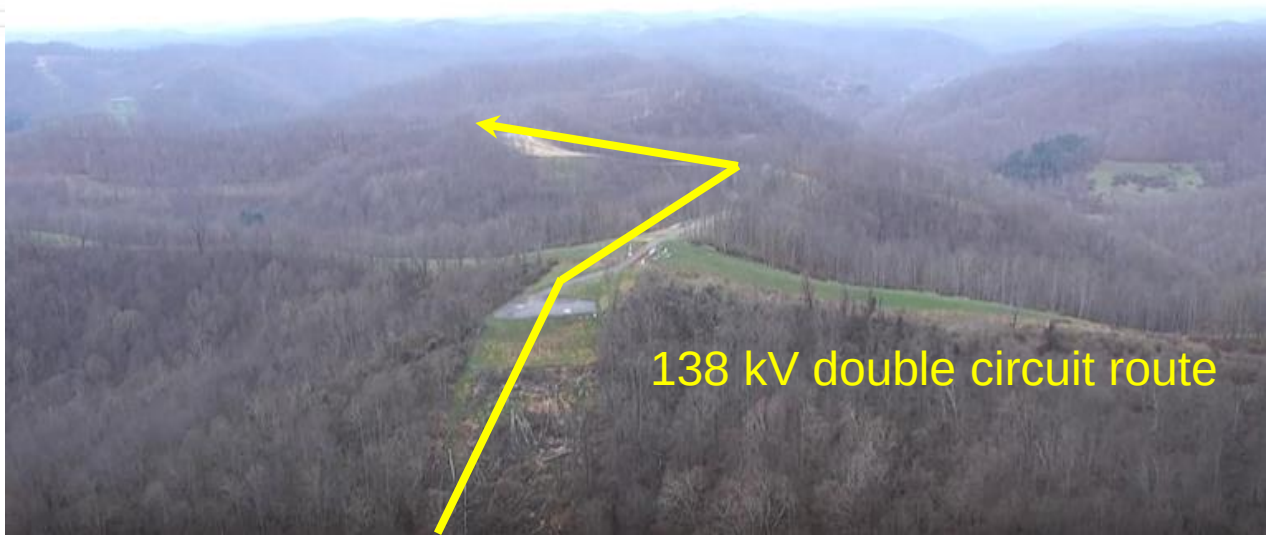
Project Status: **Under Construction**



APS Transmission Zone: Baseline
Flint Run 500/138 kV Substation

Increased cost of ~$102M primarily due to:

- 138 kV line work increased **$43M**
  - Design changed to steel poles
  - Line length increased 0.7 mile
  - Access roads
  - Vegetation control
- Substation location change increased **$41M**
  - Additional civil and environmental engineering/construction
  - Real estate costs
- Other cost increases **~$10M**
  - Retaining wall at Waldo Run Substation
  - Additional Engineering, Project Management, etc.



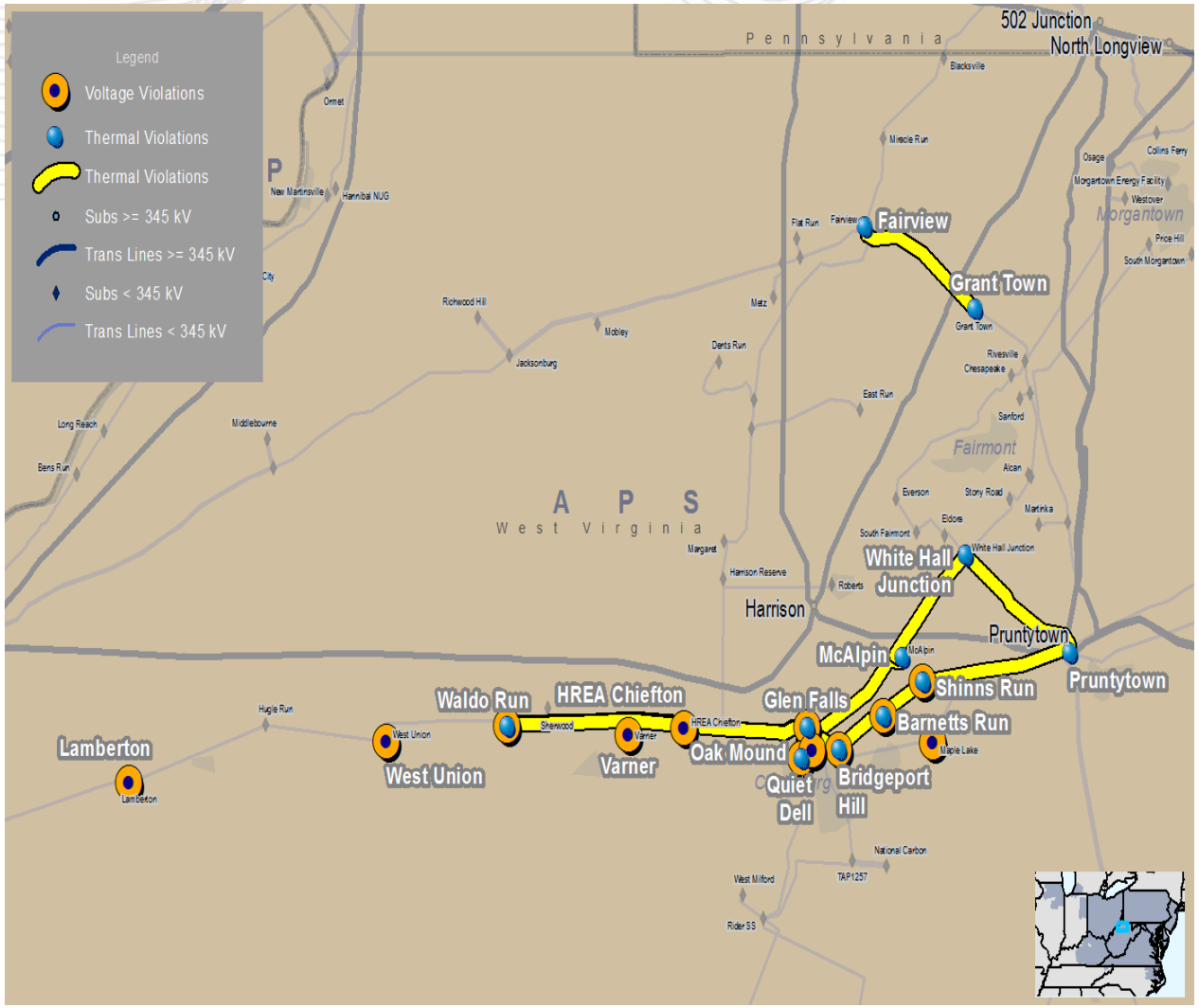
Terrain of 138 kV double circuit

APS Transmission Zone: Baseline
Flint Run 500/138 kV Substation

APS Transmission Zone: Baseline
Flint Run 500/138 kV Substation

Increased cost of alternatives primarily due to:

1. Reconductoring alternative was a desktop estimate. No detail from original estimate.
   - More refined estimate prepared for this update
   - Increased cost of $104M based on present estimating information for reconductoring
2. New Pruntytown-Oak Mound line increased $156M
   - Additional reconductoring project identified on double circuit 138 kV line ($78M)
   - Access road costs ($48M)
   - Change in line design ($16M)



2020 RTEP Window 4

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- PJM thirty-day 2020 RTEP Proposal Window 4 to address a local Transmission Owner criteria issue for the Harmon-Brewster 69 kV line
- Schedule
  - Open: March 3, 2021
  - Close: April 2, 2021
- More information to be provided at the May TEAC

2021 RTEP

- Model review in progress
- Current schedule (currently targeting the schedule below)
  - Anticipate releasing model on March 12
  - Post updates to models on a monthly basis beginning April 1 (if required)
  - Post draft PJM analysis releases on a monthly basis beginning 2nd week of April
  - Requesting FERC Form 715 analysis results from transmission owners first week of May to post second week of May
  - Targeting second week of June to open 2021 RTEP proposal window

2021 SAA Proposal Window to Support NJ OSW

2021 SAA Proposal Window Scope

- PJM is soliciting project proposals to build the necessary transmission to meet New Jersey's goal of facilitating the delivery of a total of 7,500 MW of offshore wind through 2035
  - Anticipated Schedule
    - Open Window April 15
    - Pre-bid meeting May 5
    - Close Window August 13

Contact

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Reliability Analysis Update

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Revision History

Version No.	Date	Description
1	4/1/2021	• Original slides posted