



Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project – ERCOT Independent Review – Status Update

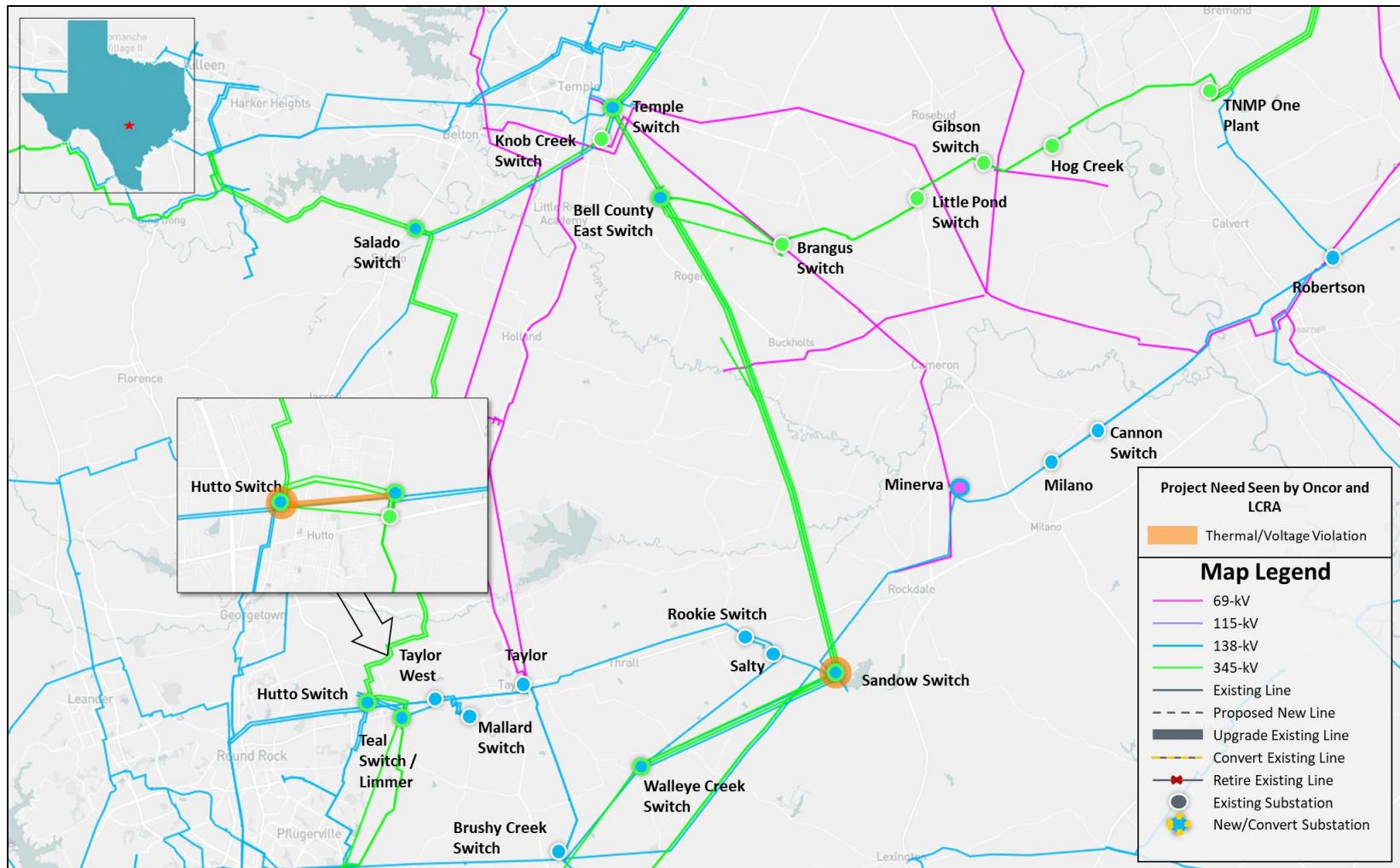
Abishek Penti

RPG Meeting
January 16, 2026

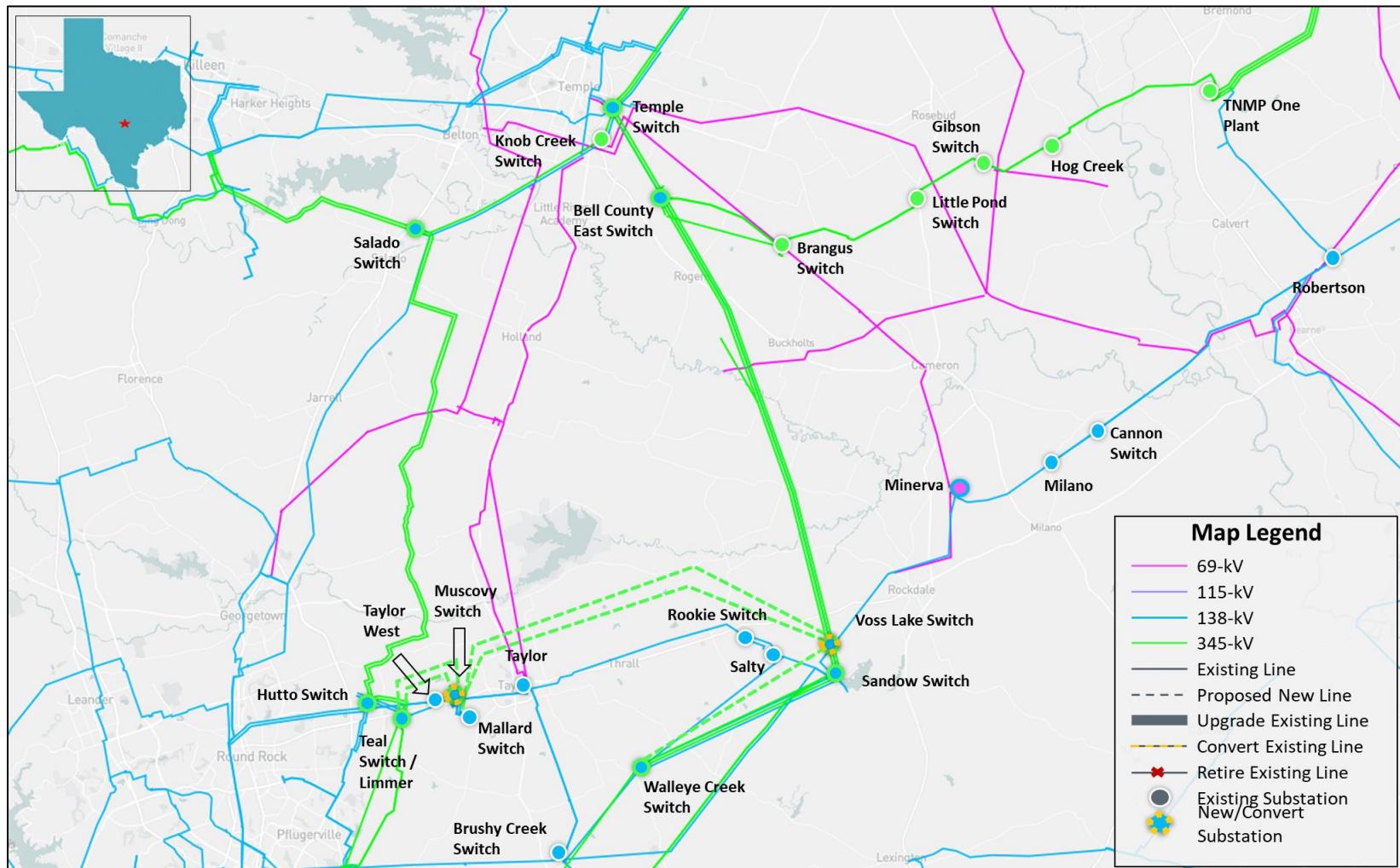
Introduction

- Oncor and LCRA TSC submitted the Muscovy and Voss Lake Project for Regional Planning Group (RPG) review in April 2025.
 - This Tier 1 project is estimated to cost \$381.83 million and will require a Certificate of Convenience and Necessity (CCN)
 - Estimated in-service date (ISD) is December 2028
 - To address reliability violations seen by Oncor and LCRA TSC
 - Observed similar violations in 2024 RTP (2024-SC28 and 2024-SC29)
- Oncor provided an overview presentation and ERCOT provided the study scope at the May RPG Meeting
 - <https://www.ercot.com/calendar/05202025-RPG-Meeting>
- ERCOT provided a status update at the June, July and October RPG Meeting
 - <https://www.ercot.com/calendar/06172025-RPG-Meeting>
 - <https://www.ercot.com/calendar/07292025-RPG-Meeting>
 - <https://www.ercot.com/calendar/10282025-RPG-Meeting>
- This project is currently under ERCOT Independent Review (EIR)

Recap – Study Area Map with project need as seen by Oncor and LCRA TSC



Recap – Project Proposed by Oncor and LCRA TSC



Recap – Project Proposed by Oncor and LCRA TSC

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 3.3 miles east of the co-located 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
 - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA
 - Install three 36.8 MVar capacitor banks
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 4-mile;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138 kV Switch, approximately 0.1-mile;

Recap – Project Proposed by Oncor and LCRA TSC

- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 1.9 miles north of Sandow 345/138-kV Switch;
 - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of atleast 750 MVA
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345-kV Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;

Recap – Project Proposed by Oncor and LCRA TSC

- Construct a new 345-kV transmission line which will require a certificate of convenience and necessity (CCN) from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2987 MVA or greater on double-circuit structures with one circuit installed initially, approximately 2-mile; and
- Construct a new, 345-kV double-circuit line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 25-mile.
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission lines to Muscovy Switch, including two circuit breakers, two switches, six coupling capacitor voltage transformers (CCVTs), and six surge arrestors, as well as two A-frame structures. All associated terminal equipment will have a minimum rating of 5000 A.

Recap – Study Assumptions – Load, Reserve, Transmission & Generation

- 2024 Regional Transmission Planning (RTP) 2029 summer peak case was used as the start case
- Load in study area
 - Loads in study area were updated to create the study base case
 - Added ~2GW of substantiated load in the study region
- Reserve
 - Reserve levels are consistent with the 2024 RTP
- Transmission
 - See Appendix A for a list of transmission projects added
 - See Appendix B for a list of RTP placeholder projects that were removed
- Generation
 - See Appendix C for a list of generation projects added

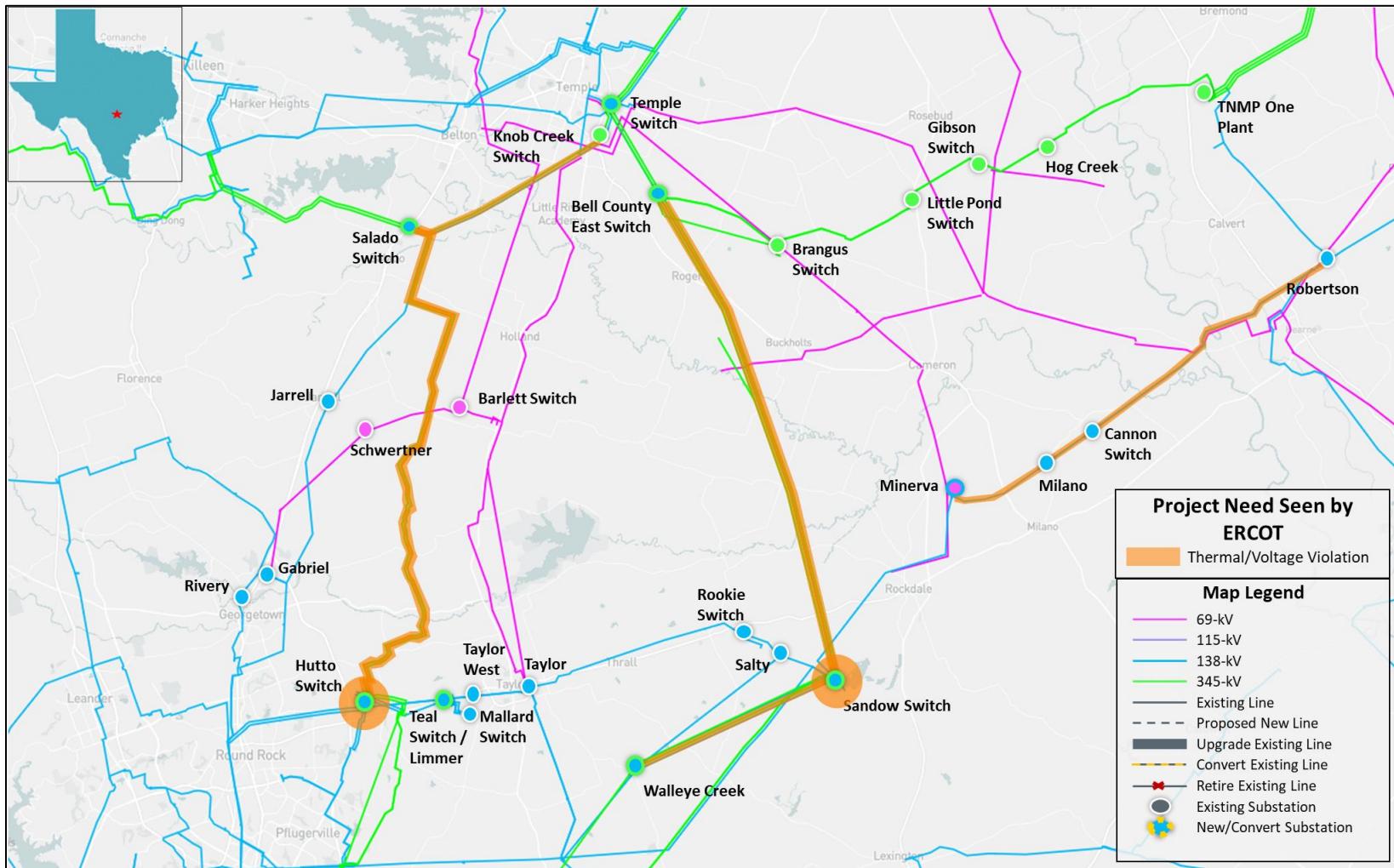
Updated – Preliminary Results of Reliability Assessment – Need Analysis

- ERCOT conducted steady-state load flow analysis for the study base case according to the NERC TPL-001-5.1 and ERCOT Planning Criteria to identify project need

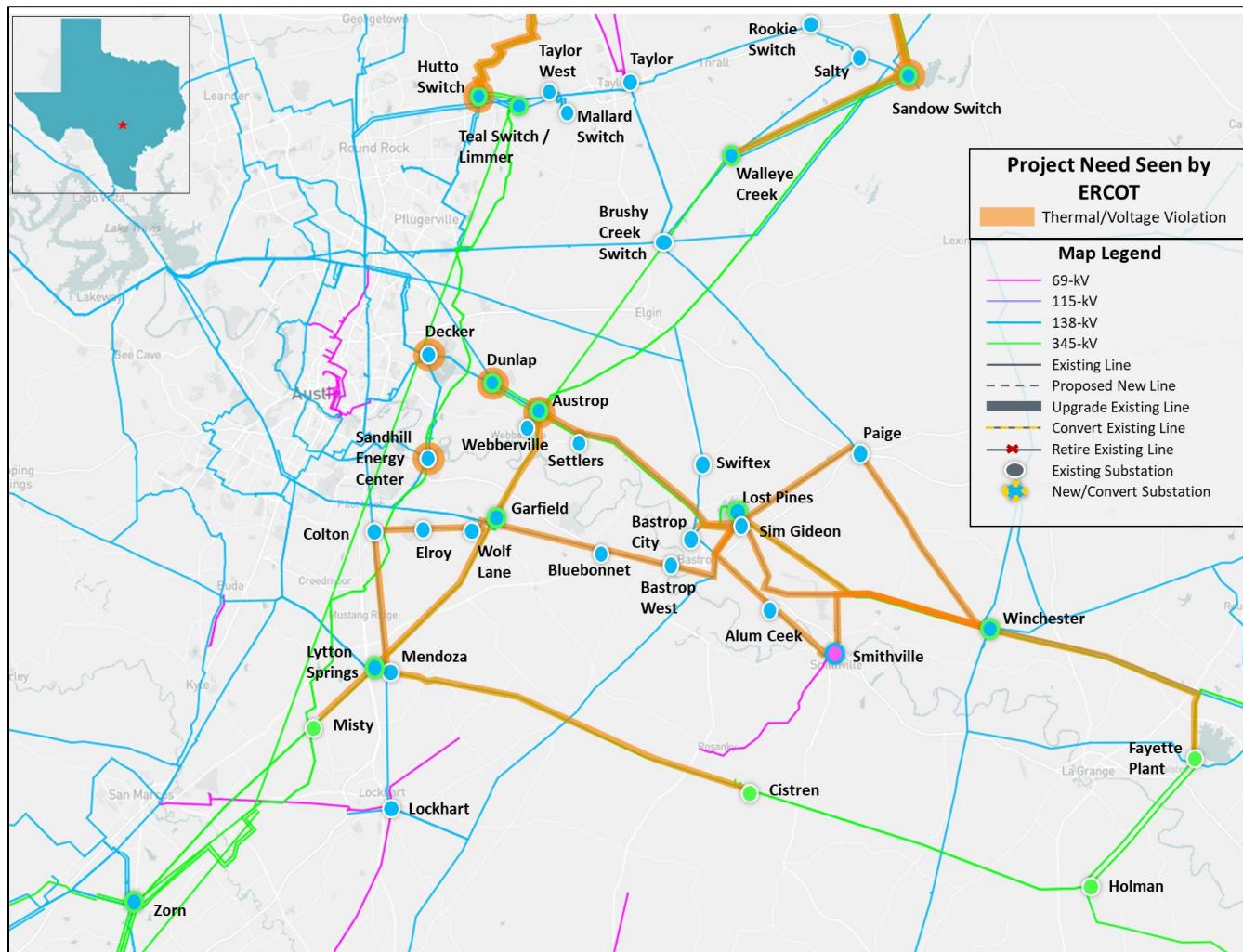
Contingency Category	Voltage Violations	Thermal Violations	Unsolved Power Flow
P0: N-0	7	16	None
P1, P2-1, P7: N-1	28	19	13
P3: G-1+N-1 *	50+	50+	25
P6-2: X-1+N-1 *	50+	40+	13

* See Appendix D for list of G-1 generators and X-1 transformers tested

Updated – Study Area 1 Map with Violations seen by ERCOT



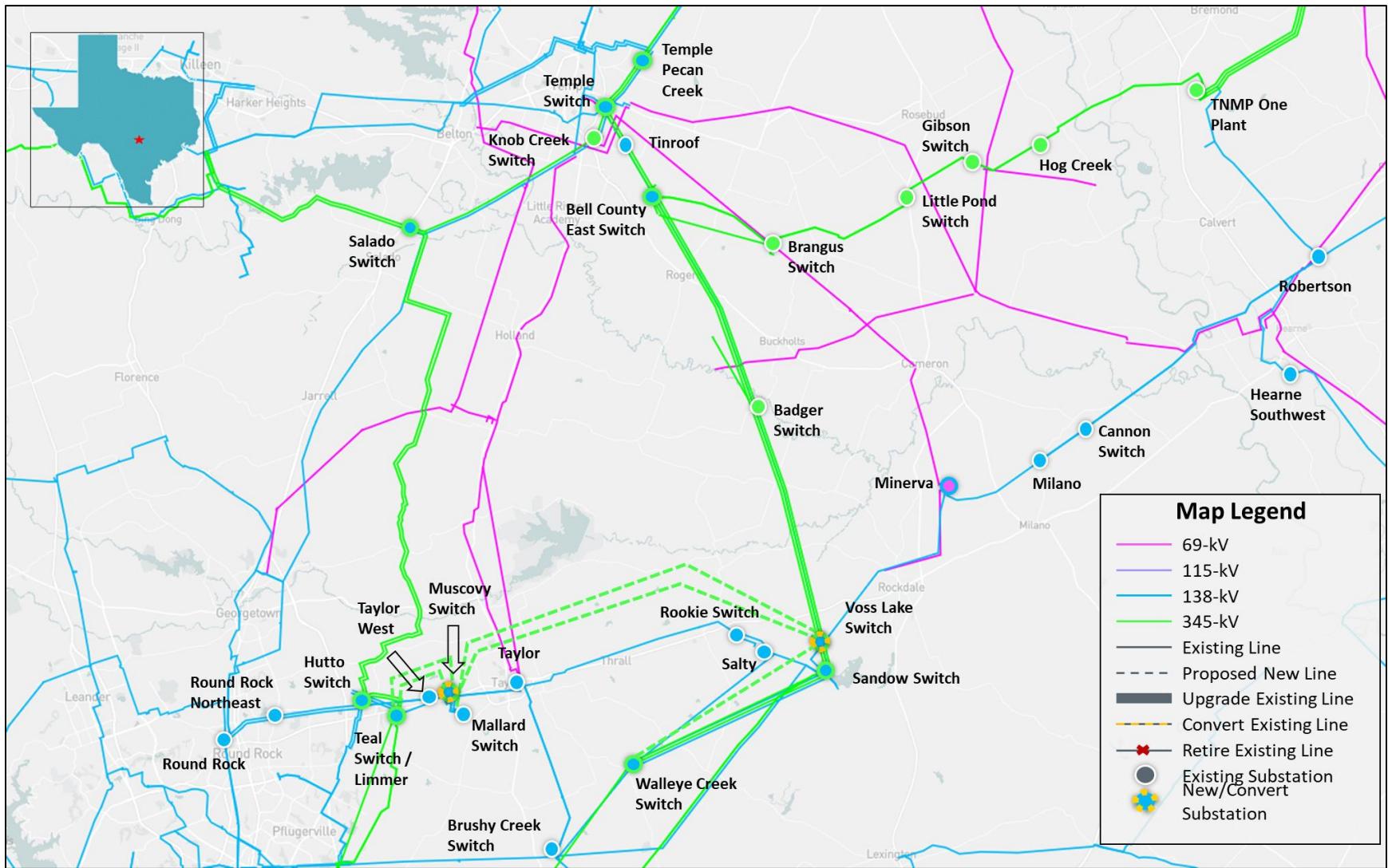
Recap – Study Area 2 Map with Violations seen by ERCOT



Recap – Phased Approach Evaluation

- The ongoing Oncor and LCRA TSC Muscovy and Voss Lake 345/138-kV Project EIR was separated into two Phases
- Phase 1 of the EIR
 - To address the violations identified in Study area 1
- Phase 2 of the EIR
 - To address the violations identified in study area 2
 - Include upgrades identified in Phase 1
 - ERCOT final recommendation will be coordinated with the 2025 RTP evaluations
 - ERCOT anticipates the completion of phase 2 EIR study after phase 1 EIR Study

Option 1 – LCRA & Oncor Option



Option 1 – LCRA & Oncor Option

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 3.3 miles east of the co-located 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
 - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA
 - Install three 36.8 MVA capacitor banks
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 4-mile;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, approximately 0.1-mile;

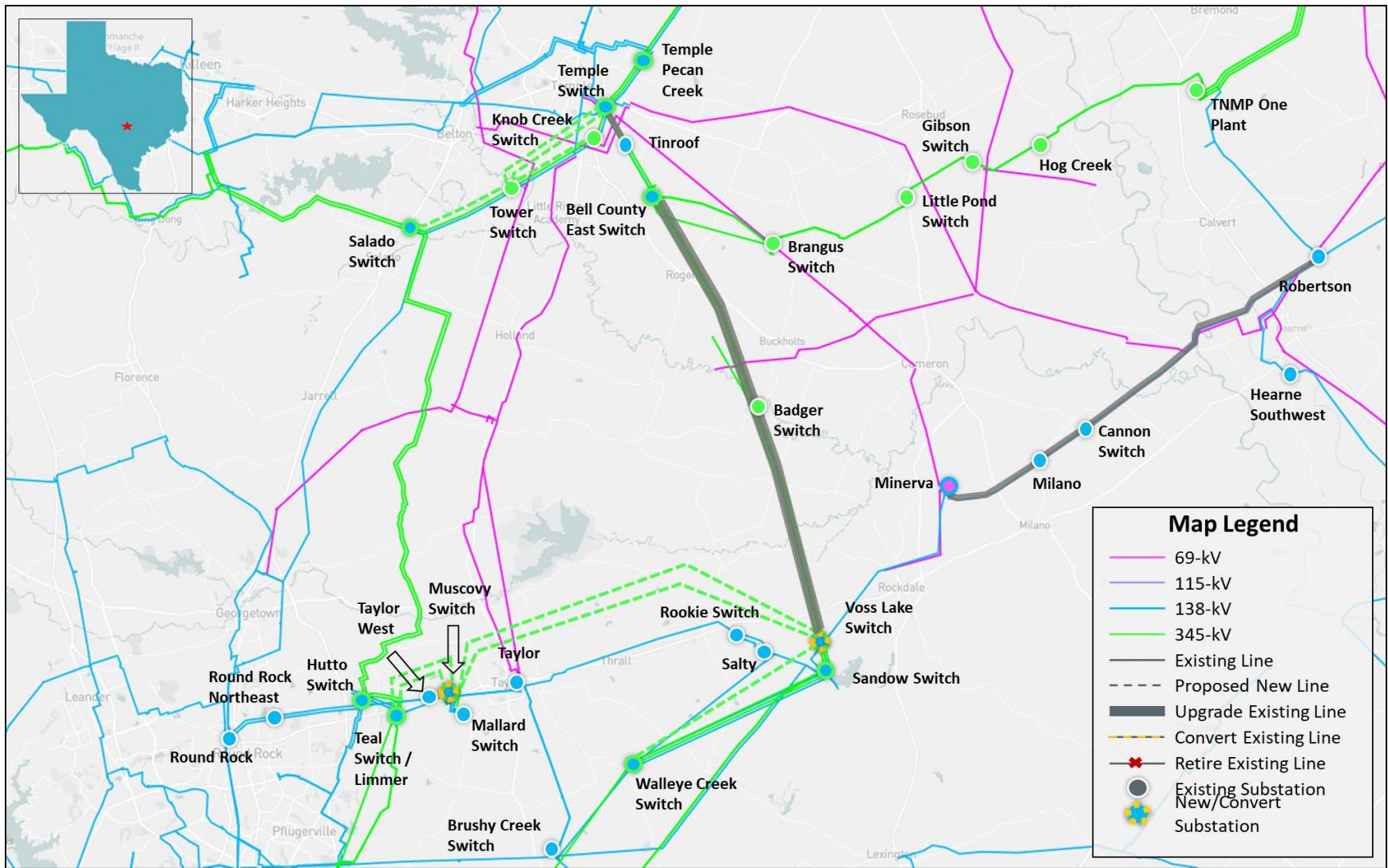
Option 1 – LCRA & Oncor Option

- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 1.9 miles north of Sandow 345/138-kV Switch;
 - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of atleast 750 MVA
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345-kV Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;

Option 1 – LCRA & Oncor Option

- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2987 MVA or greater on double-circuit structures with one circuit installed initially, approximately 2-mile; and
- Construct a new, 345-kV double-circuit line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 25-mile.
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission lines to Muscovy Switch, including two circuit breakers, two switches, six CCVTs, and six surge arrestors, as well as two A-frame structures. All associated terminal equipment will have a minimum rating of 5000 A.

Option 2 – Alternative ERCOT Option



Option 2 – Alternative ERCOT Option

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 3.3 miles east of the co-located 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
 - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA
 - Install three 36.8 MVA capacitor banks
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 4-mile;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, approximately 0.1-mile;

Option 2 – Alternative ERCOT Option

- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 1.9 miles north of Sandow 345/138-kV Switch;
 - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of atleast 750 MVA
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345-kV Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;

Option 2 – Alternative ERCOT Option

- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2987 MVA or greater on double-circuit structures with one circuit installed initially, approximately 2-mile; and
- Construct a new, 345-kV double-circuit line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 25-mile.
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission lines to Muscovy Switch, including two circuit breakers, two switches, six CCVTs, and six surge arrestors, as well as two A-frame structures. All associated terminal equipment will have a minimum rating of 5000 A.

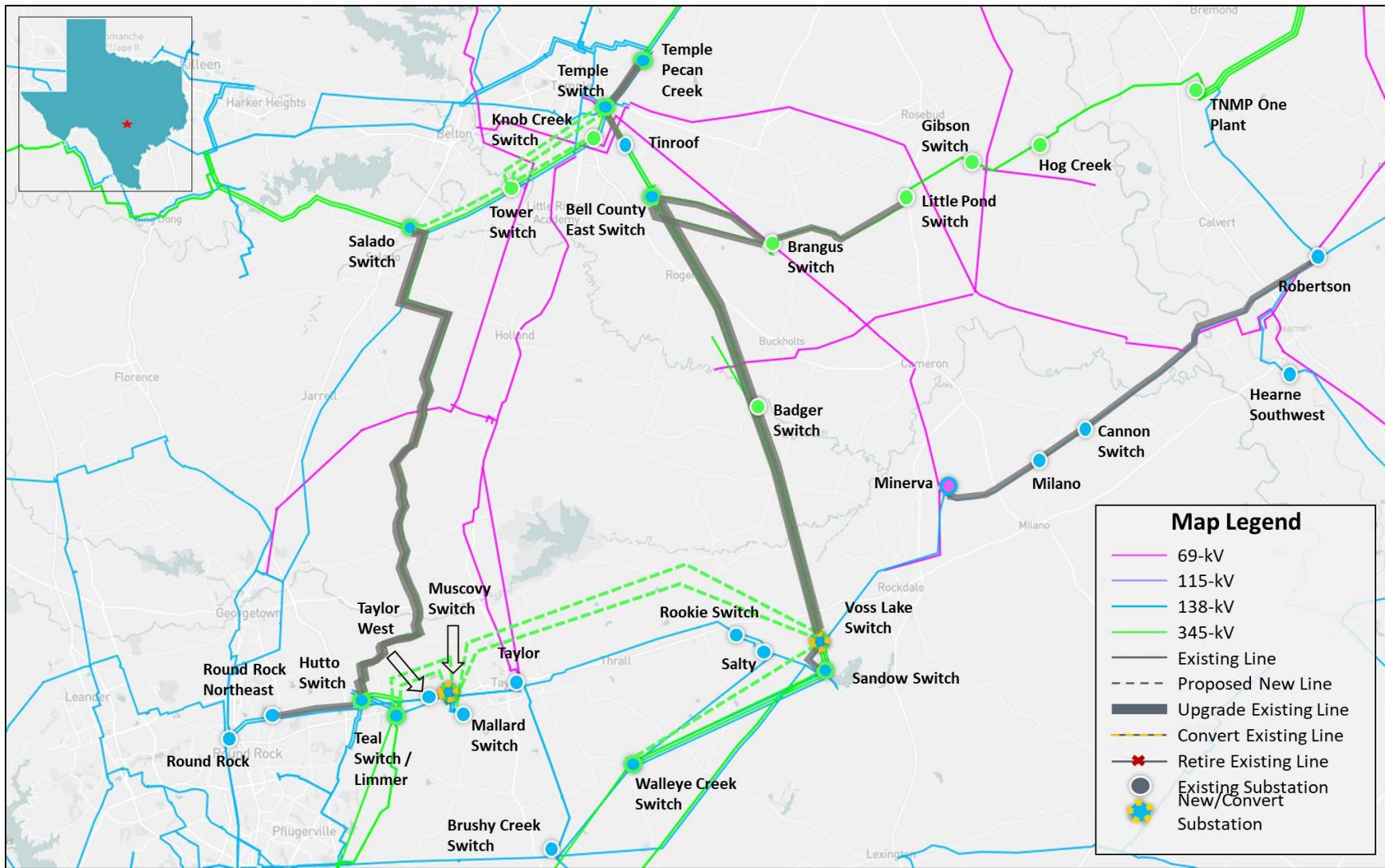
Option 2 – Alternative ERCOT Option

- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement.
 - Loop the existing Salado Switch to Knob Creek Switch 345-kV Line into Tower 345-kV Switch to create the new 12.4-mile Salado Switch – Tower Switch 345-kV Line and 2.9-mile Tower Switch to Temple Switch 345-kV Line
 - Construct two new approximately 1.2-mile 345-kV single circuit lines from Tower Switch to Knob Creek Switch on independent, single circuit structures using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), this upgrade will require a CCN
 - Ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA)
- Rebuild the 12.4-mile Salado Switch to Tower Switch 345-kV Line using double-circuit capable structures with one circuit installed, using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), and ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA), this upgrade will require a CCN

Option 2 – Alternative ERCOT Option

- Rebuild the 29.6-mile Bell County East Switch to Voss Lake Switch 345-kV Double-Circuit Line using a conductor rated 5000 A or greater (due to the existing 3200 A terminal equipment, this line will be operated at a normal and emergency rating 1912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1912 MVA)
- Rebuild the 9.9-mile Minerva Switch to Robertson 138-kV Line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)
- Rebuild the 1.85-mile Temple Switch to Tinroof 138-kV line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)

Option 3 – ERCOT Alternative Option



Option 3 – Alternative ERCOT Option

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 3.3 miles east of the co-located 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
 - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA
 - Install three 36.8 MVA capacitor banks
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 4-mile;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, approximately 0.1-mile;

Option 3 – Alternative ERCOT Option

- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 1.9 miles north of Sandow 345/138-kV Switch;
 - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of atleast 750 MVA
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345-kV Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;

Option 3 – Alternative ERCOT Option

- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2987 MVA or greater on double-circuit structures with one circuit installed initially, approximately 2-mile; and
- Construct a new, 345-kV double-circuit line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 25-mile.
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission lines to Muscovy Switch, including two circuit breakers, two switches, six CCVTs, and six surge arrestors, as well as two A-frame structures. All associated terminal equipment will have a minimum rating of 5000 A.

Option 3 – Alternative ERCOT Option

- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement.
 - Loop the existing Salado Switch to Knob Creek Switch 345-kV Line into Tower 345-kV Switch to create the new 12.4-mile Salado Switch – Tower Switch 345-kV Line and 2.9-mile Tower Switch to Temple Switch 345-kV Line
 - Construct two new approximately 1.2-mile 345-kV single circuit lines from Tower Switch to Knob Creek Switch on independent, single circuit structures using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), this upgrade will require a CCN
 - Ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA)
- Rebuild the 12.4-mile Salado Switch to Tower Switch 345-kV Line using double-circuit capable structures with one circuit installed, using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), and ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA), this upgrade will require a CCN

Option 3 – Alternative ERCOT Option

- Rebuild the 29.6-mile Bell County East Switch to Voss Lake Switch 345-kV Double-Circuit Line using a conductor rated 5000 A or greater (due to the existing 3200 A terminal equipment, this line will be operated at a normal and emergency rating 1912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1912 MVA)
- Rebuild the 9.9-mile Minerva Switch to Robertson 138-kV Line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)
- Rebuild the 1.85-mile Temple Switch to Tinroof 138-kV line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)

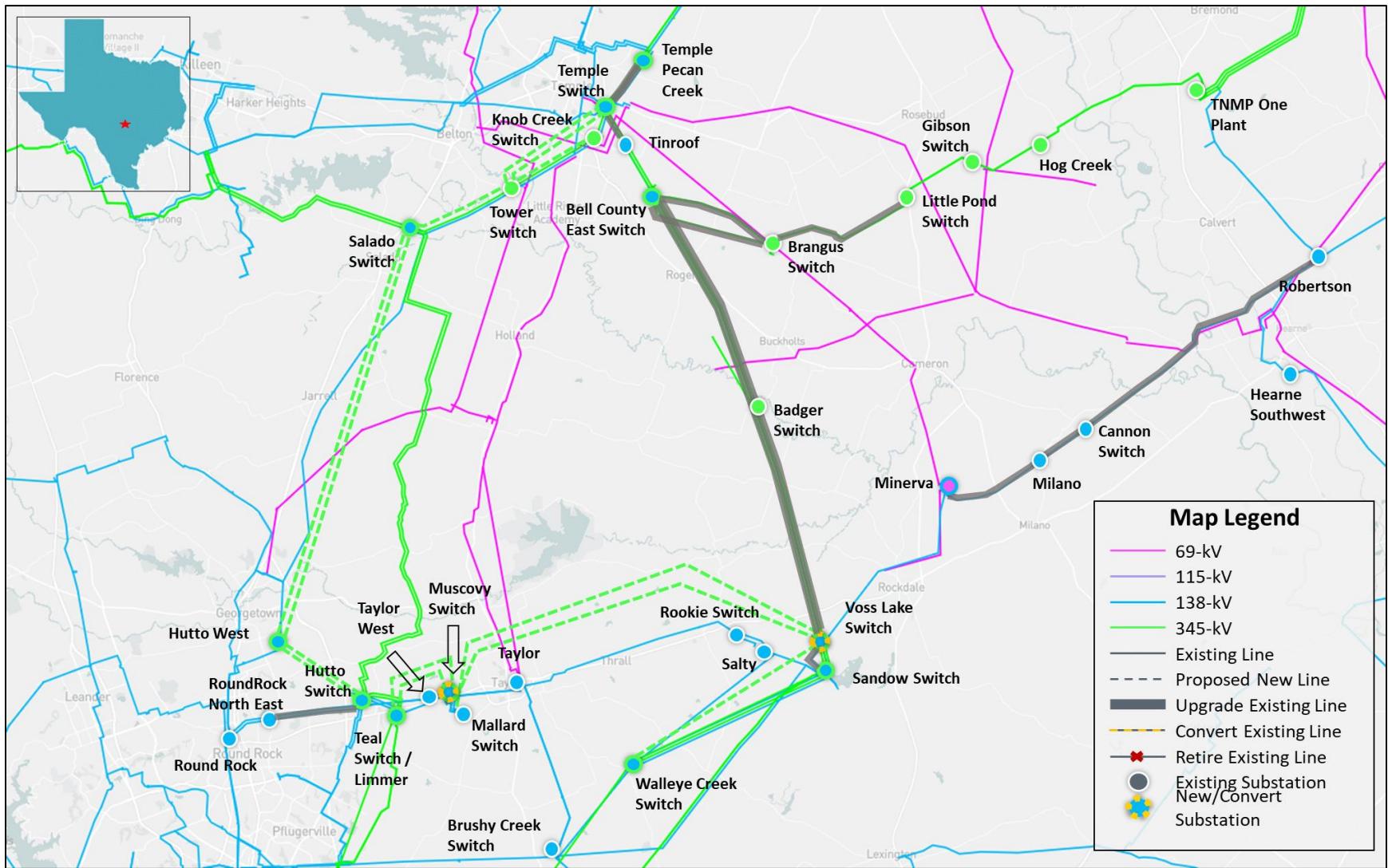
Option 3 – Alternative ERCOT Option

- Rebuild the 17.75-mile Bell County East Switch to Little Pond 345-kV Line using a conductor rated 5000 A or greater (due to the existing 3200 A terminal equipment, this line will be operated at a normal and emergency rating 1912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1912 MVA)
- Rebuild the 23.19-mile Bell County East Switch to Gibson 345-kV Line using a conductor rated 5000 A or greater (due to the existing 3200 A terminal equipment, this line will be operated at a normal and emergency rating 1912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1912 MVA)
- Rebuild the 4.5-mile Temple Switch to Temple Pecan Creek Switch 345 kV Double-Circuit Line using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA) on separate structures, and ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA)
- Rebuild the 36.9-mile Hutto to Salado 345 kV Double-Circuit Line using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), and ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA)

Option 3 – Alternative ERCOT Option

- Rebuild the 5.3-mile Hutto to Round Rock NorthEast 138-kV line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)
- Rebuild the 3-mile Hutto to Limmer 345 kV double-circuit Line on separate structures
- Install 110.4 MVAr Cap Bank at Hutto 138-kV

Option 4 – Alternative Oncor Option



Option 4 – Alternative Oncor Option

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 3.3 miles east of the co-located 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
 - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA
 - Install three 36.8 MVA capacitor banks
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 4-mile;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, approximately 0.1-mile;

Option 4 – Alternative Oncor Option

- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 1.9 miles north of Sandow 345/138-kV Switch;
 - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of atleast 750 MVA
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345-kV Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;

Option 4 – Alternative Oncor Option

- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2987 MVA or greater on double-circuit structures with one circuit installed initially, approximately 2-mile; and
- Construct a new, 345-kV double-circuit line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 25-mile.
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission lines to Muscovy Switch, including two circuit breakers, two switches, six CCVTs, and six surge arrestors, as well as two A-frame structures. All associated terminal equipment will have a minimum rating of 5000 A.

Option 4 – Alternative Oncor Option

- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement.
 - Loop the existing Salado Switch to Knob Creek Switch 345-kV Line into Tower 345-kV Switch to create the new 12.4-mile Salado Switch – Tower Switch 345-kV Line and 2.9-mile Tower Switch to Temple Switch 345-kV Line
 - Construct two new approximately 1.2-mile 345-kV single circuit lines from Tower Switch to Knob Creek Switch on independent, single circuit structures using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), this upgrade will require a CCN
 - Ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA)
- Rebuild the 12.4-mile Salado Switch to Tower Switch 345-kV Line using double-circuit capable structures with one circuit installed, using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), and ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA), this upgrade will require a CCN

Option 4 – Alternative Oncor Option

- Rebuild the 29.6-mile Bell County East Switch to Voss Lake Switch 345-kV Double-Circuit Line using a conductor rated 5000 A or greater (due to the existing 3200 A terminal equipment, this line will be operated at a normal and emergency rating 1912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1912 MVA)
- Rebuild the 9.9-mile Minerva Switch to Robertson 138-kV Line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)
- Rebuild the 1.85-mile Temple Switch to Tinroof 138-kV line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)

Option 4 – Alternative Oncor Option

- Rebuild the 17.75-mile Bell County East Switch – Little Pond 345-kV Line using a conductor rated 5000 A or greater (due to the existing 3200 A terminal equipment, this line will be operated at a normal and emergency rating 1912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1912 MVA)
- Rebuild the 23.19-mile Bell County East Switch – Gibson 345-kV Line using a conductor rated 5000 A or greater (due to the existing 3200 A terminal equipment, this line will be operated at a normal and emergency rating 1912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1912 MVA)
- Rebuild the 4.5-mile Temple Switch – Temple Pecan Creek Switch 345 kV Double-Circuit Line using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA) on separate structures, and ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA)

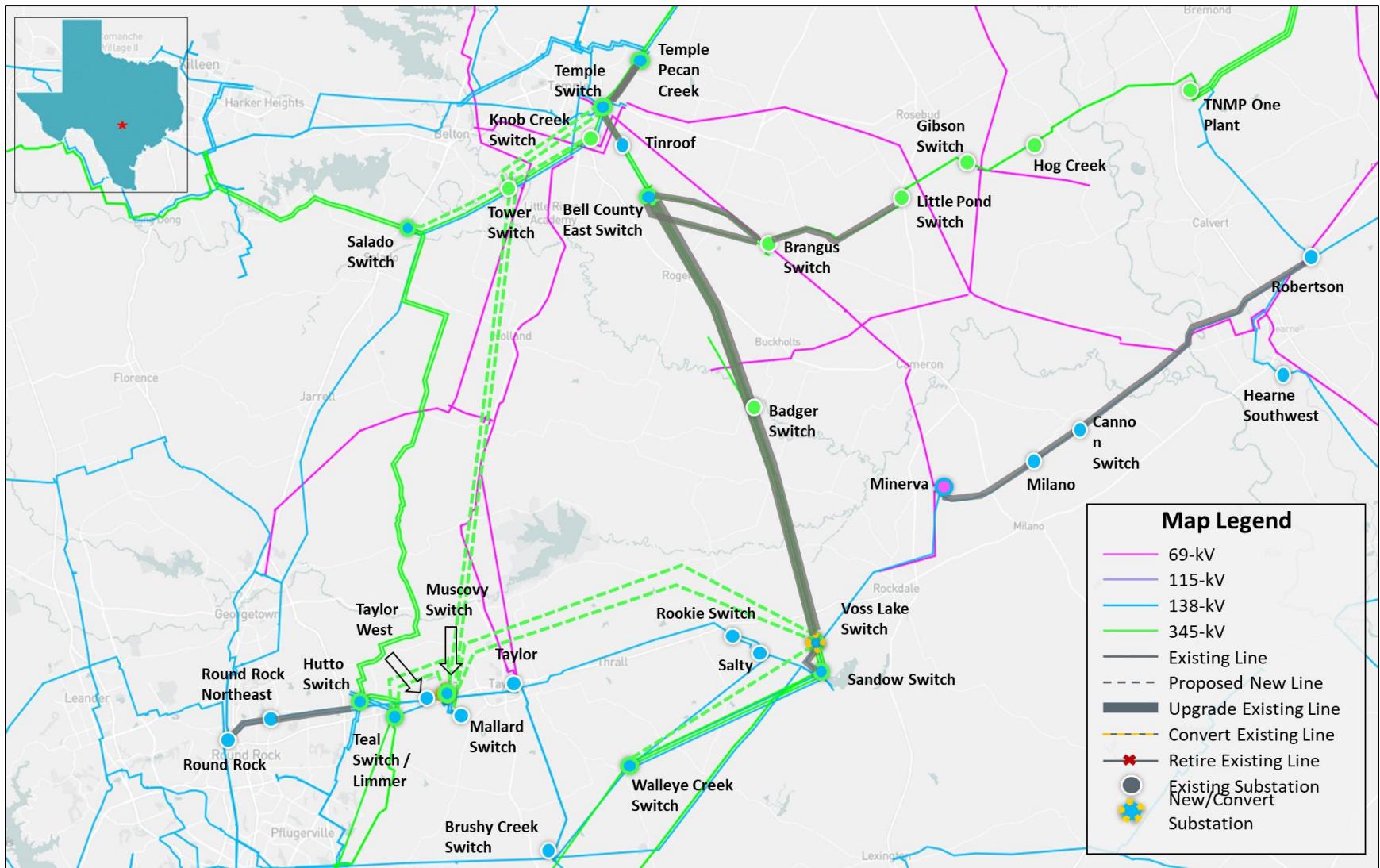
Option 4 – Alternative Oncor Option

- Establish a new Hutto West 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement.
 - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA
 - Construct new approximately 38.9-mile 345-kV double circuit lines from Salado to Hutto West Switch using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), this upgrade will require a CCN
 - Construct new approximately 10.25-mile 345-kV double circuit lines from Hutto West to Hutto Switch using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), this upgrade will require a CCN
 - Construct a loop of the existing Round Rock Westing House to Round Rock 138-kV line into the Hutto West 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;
 - Construct a loop of the existing Round Rock Westing House to Midnight 138-kV line into the Hutto West 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV

Option 4 – Alternative Oncor Option

- Rebuild the 5.3-mile Hutto to Round Rock Northeast 138-kV line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)
- Rebuild the 3-mile Hutto to Limmer 345 kV double-circuit Line on separate structures
- Install 110.4 MVAr Cap Bank at Hutto 138-kV

Option 5 – ERCOT Alternative Option



Option 5 – Alternative ERCOT Option

- Establish the new Muscovy 345/138-kV Switch by installing ten 345-kV, 5000 A and twelve 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 3.3 miles east of the co-located 345-kV Limmer Substation (LCRA TSC) and 138-kV Teal Switch (Oncor);
 - Install two 345/138-kV autotransformers with normal rating of 700 MVA and emergency rating of 750 MVA
 - Install three 36.8 MVA capacitor banks
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a new 345-kV double-circuit transmission line which will require a CCN from Limmer Substation (LCRA TSC) to Muscovy Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 4-mile;
- Construct a loop of the existing Teal Switch to Pintail Switch 138-kV double-circuit transmission line with a normal and emergency ratings of at least 614 MVA into the new Muscovy 138-kV Switch, approximately 0.1-mile;

Option 5 – Alternative ERCOT Option

- Establish the new Voss Lake 345/138-kV Switch by installing ten 345-kV, 5000 A and nine 138-kV, 3200 A breakers in a breaker-and-a-half bus arrangement, approximately 1.9 miles north of Sandow 345/138-kV Switch;
 - Install one 345/138-kV autotransformer with normal ratings of at least 700 MVA and emergency ratings of atleast 750 MVA
 - Ensure all line terminal and associated equipment elements are rated to meet or exceed 5000 A for 345-kV and 3200 A for 138-kV
- Construct a loop of the existing Sandow Switch to Bell County East Switch 345-kV double-circuit transmission line into the Voss Lake 345-kV Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Temple Switch 138-kV transmission line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;
- Construct a loop of the existing Sandow Switch to Minerva Switch 138-kV line into the Voss Lake 138-kV Switch with a normal and emergency ratings of at least 614 MVA or greater, approximately 0.1-mile;

Option 5 – Alternative ERCOT Option

- Construct a new 345-kV transmission line which will require a CCN from Voss Lake Switch to Walleye Creek Switch with a normal and emergency ratings of at least 2987 MVA or greater on double-circuit structures with one circuit installed initially, approximately 2-mile; and
- Construct a new, 345-kV double-circuit line which will require a CCN from Muscovy Switch to Voss Lake Switch with a normal and emergency ratings of at least 2987 MVA or greater, approximately 25-mile.
- Install terminal equipment in existing bays at Limmer Substation to connect both circuits of the new 345-kV double-circuit transmission lines to Muscovy Switch, including two circuit breakers, two switches, six coupling capacitor voltage transformers (CCVTs), and six surge arrestors, as well as two A-frame structures. All associated terminal equipment will have a minimum rating of 5000 A.

Option 5 – Alternative ERCOT Option

- Establish the Tower 345-kV Switch by installing ten 345-kV, 5000 A circuit breakers in a breaker-and-a-half bus arrangement.
 - Loop the existing Salado Switch to Knob Creek Switch 345-kV Line into Tower 345-kV Switch to create the new 12.4-mile Salado Switch – Tower Switch 345-kV Line and 2.9-mile Tower Switch to Temple Switch 345-kV Line
 - Construct two new approximately 1.2-mile 345-kV single circuit lines from Tower Switch to Knob Creek Switch on independent, single circuit structures using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), this upgrade will require a CCN
 - Ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA)
- Rebuild the 12.4-mile Salado Switch to Tower Switch 345-kV Line using double-circuit capable structures with one circuit installed, using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), and ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA), this upgrade will require a CCN

Option 5 – Alternative ERCOT Option

- Rebuild the 29.6-mile Bell County East Switch to Voss Lake Switch 345-kV Double-Circuit Line using a conductor rated 5000 A or greater (due to the existing 3200 A terminal equipment, this line will be operated at a normal and emergency rating 1912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1912 MVA)
- Rebuild the 9.9-mile Minerva Switch to Robertson 138-kV Line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)
- Rebuild the 1.85-mile Temple Switch to Tinroof 138-kV line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)

Option 5 – Alternative ERCOT Option

- Rebuild the 17.75-mile Bell County East Switch – Little Pond 345-kV Line using a conductor rated 5000 A or greater (due to the existing 3200 A terminal equipment, this line will be operated at a normal and emergency rating 1912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1912 MVA)
- Rebuild the 23.19-mile Bell County East Switch – Gibson 345-kV Line using a conductor rated 5000 A or greater (due to the existing 3200 A terminal equipment, this line will be operated at a normal and emergency rating 1912 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (1912 MVA)
- Rebuild the 4.5-mile Temple Switch – Temple Pecan Creek Switch 345 kV Double-Circuit Line using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA) on separate structures, and ensure all associated terminal equipment to meet or exceed 5000 A (2987 MVA)
- Construct two new approximately 36-mile 345-kV double circuit lines from Tower Switch to Muscovy double circuit structures using a conductor rated 5000 A or greater (normal and emergency rating 2987 MVA), this upgrade will require a Certificate of Convenience and Necessity (CCN)

Option 5 – Alternative ERCOT Option

- Rebuild the 3.5-mile Muscovy to Limmer 345 kV Double-Circuit Line on separate structures
- Rebuild the 5.3-mile Hutto to Round Rock Northeast 138-kV line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)
- Rebuild the 3.8-mile Round Rock Northeast to Round Rock 138-kV line using double-circuit capable structures with one circuit installed and a conductor rated 2569 A or greater (normal and emergency rating 614 MVA), and ensure all associated terminal equipment to meet or exceed 3200 A (764 MVA)
- Rebuild the 3-mile Hutto to Limmer 345 kV double-circuit Line on separate structures
- Install 110.4 MVAr Cap Bank at Hutto 138-kV

Preliminary Results of Reliability Assessment - Options

Option	N-0		N-1		X-1+N-1*		G-1+N-1*	
	Thermal Violations	Voltage Violations						
1	4	None	6	None	3	None	3	None
2	None	None	5	None	4	None	None	None
3	None							
4	None							
5	None							

* List of Transformer and Generation contingencies are listed in Appendix D

Next Steps and Tentative Timelines

- ERCOT will continue to evaluate options to resolve violations in Study Area 1 as phase 1 of this RPG evaluation and provide status updates at future RPG meetings
 - Maintenance outage evaluation
 - Long-term load-serving capability assessment
 - Cost estimates and feasibility assessment
- Generation Addition and Load Scaling Sensitivity Analyses
 - Planning Guide Section 3.1.3(4)
- Subsynchronous Oscillations (SSO) Assessment
 - Nodal Protocol Section 3.22.1.3(2)
- Congestion Analysis
 - Congestion analysis may be performed based on the recommended transmission upgrades to ensure that the identified transmission upgrades do not result in new congestion within the study area
- Tentative timeline
 - Final recommendation for Phase 1 – Q1 2026
 - Final recommendation for Phase 2 – Q2 2026

Thank you!



Stakeholder comments also welcomed through:

Abishek.Penti@ercot.com

Robert.Golen@ercot.com

Appendix A – Transmission Projects

- List of transmission projects added to study base case

RPG/TPIT No	Project Name	Tier	Project ISD	TSP
24RPG001	Temple Area Project	Tier 1	Dec-28	Oncor
24RPG013	FPP Yard 2 to Lytton Springs Transmission Line Overhaul Project	Tier 4	May-26	LCRA TSC, AEN
24RPG014	Sim Gideon to Cedar Hill Transmission Line Upgrade Project	Tier 3	May-27	LCRA TSC
24RPG018	Salado Switch to Hutto Switch 138-kV Line Project	Tier 3	May-27	Oncor
25RPG006	Resubmission for Salado Switch to Hutto Switch 138-kV Line Project	Tier 3	May-27	Oncor, LCRA TSC
72588A	Trading Post to Cedar Valley Storm Hardening	Tier 4	May-25	PEC
86319	AEN_Garfield_HiCross_CKT_963_Reconductor	Tier 4	Jun-25	AEN
86325	AEN_McNeil_Magnesium_Plant_Ckt_977_RECONDUCTOR	Tier 4	Jun-25	AEN
87758	Badger 345 kV Switch	Tier 4	Dec-25	ONCOR
87395	Caldwell Substation Addition	Tier 4	Mar-26	LCRATSC
86323	AEN_MagnesiumPlant_Northland_Ckt_979_RECONDUCTOR	Tier 4	Jun-26	AEN
86912	BEPC_TPIT_86912_Gabriel_Schwerther	Tier 4	Mar-27	BEPC
87673	Rebuild the Salado - Bell County 138 kV Line	Tier 1	May-27	ONCOR
87770	Establish a 110.4 MVAR Capacitor Bank at Midnight 138 kV Substation	Tier 4	May-27	ONCOR
87768	Establish a 110.4 MVAR Capacitor Bank at Pintail 138 kV Switch	Tier 4	May-27	ONCOR
87677	Rebuild the Fryers Creek - Temple 138 kV Line	Tier 1	May-27	ONCOR
87675	Rebuild the Bell County - Fryers Creek 138 kV Line	Tier 1	May-27	ONCOR
85973	Georgetown - Rivery Transmission Line Upgrade	Tier 4	May-26	LCRATSC

Appendix A – Transmission Projects

- List of transmission projects added to study base case

RPG/TPIT No	Project Name	Tier	Project ISD	TSP
80546C	Upgrade the Hutto & Round Rock - Salado 138 kV Line	Tier 3	May-26	ONCOR
80546E	Upgrade the Hutto & Round Rock - Salado 138 kV Line	Tier 3	May-27	ONCOR
86331	AEN_Wheless_Mueller_Ckt_1016_Reconductor	Tier 4	Jun-27	AEN
86321	AEN_Lakeshore_Northland_Ckt_916_Reconductor	Tier 4	Jun-27	AEN
86327	AEN_New_138kV_Southshore_Substation_Addition	Tier 4	Sep-27	AEN
86317	AEN_DP_OnionCreek_Ckt_924_Reconductor	Tier 4	Sep-27	AEN
86333	AEN_OnionCreek_StoneyRidge_Ckt_1026_Reconductor	Tier 4	Sep-27	AEN
87367	BEPC_TPIT_87367_TempleAreaImprovements	Tier 1	Oct-27	BEPC
87699	Belton - Killeen 138 kV Line via Belton Southwest	Tier 1	Dec-27	ONCOR
80546D	Upgrade the Hutto & Round Rock - Salado 138 kV Line	Tier 3	Dec-27	ONCOR
87707	Salado 345/138 kV Autotransformer #1 and #2	Tier 1	Dec-27	ONCOR
87701	Establish the Watercrest 138 kV Switch	Tier 1	May-28	ONCOR
86838	AEN_JustinLane_KoenigLane_Ckt_conversion_to_138kV	Tier 4	Jun-28	AEN
86315	AEN_Barton_Vega_Ckt_928_Reconductor	Tier 4	Jun-28	AEN
72588B	Trading Post to Cedar Valley Storm Hardening	Tier 4	Sep-24	PEC

Appendix B – Transmission Projects

- List of transmission projects removed from the study base case

TPIT No	Project Name	County
2022-SC7	Decker (9188) 138-kV Bus Tie Breaker Upgrade	Travis
2023-SC3	Dessau (9193) to McNeil AEN (9076) 138-kV Circuit 2 Upgrade	Travis
2023-SC15	Sim Gideon Area 138-kV Line Upgrades	Bastrop, Fayette, Williamson
2023-SC17	Georgetown Area 138-kV Line Upgrades	Williamson
2024-SC2	Trading Post (70505) 138-kV Cap Bank Addition	Travis
2024-SC8	Milano (64) to Minerva (3683) and Cannon (3707) 138-kV Line Upgrades	Milam
2024-SC11	Vega (9285) to Barton (9158) 138-kV Line Upgrade	Travis
2024-SC14	Elroy (7209) 138-kV Cap Bank Addition	Travis
2024-SC16	Limmer (7341) 345-kV Cap Bank Addition	Williamson
2024-SC17	SLR AMLC (3740) 138-kV Cap Bank Addition	Milam
2024-SC19	Hillje (44200) to Zorn (7042) 345-kV Line Upgrades	Wharton, Fayette, Bastrop, Caldwell, Guadalupe
2024-SC20	Lytton Area 138-kV Line Upgrades	Caldwell, Travis, Bastrop

Appendix B – Transmission Projects

- List of transmission projects removed from the study base case

TPIT No	Project Name	County
2024-SC21	Austrop (9328) to Dunlap (9045) 138-kV Double Circuit Line Addition	Travis
2024-SC22	Austrop 345/138-kV Transformer Addition	Travis
2024-SC23	Dunlap 345/138-kV Transformer Addition	Travis
2024-SC24	Gillelend Creek (7340) 345-kV Cap Bank Addition	Travis
2024-SC27	Lytton Springs (9074) to Garfield (7048) to Austrop (7040) 345-kV Line Upgrades	Caldwell, Bastrop, Travis
2024-SC28	Voss Lake 345/138-kV Substation Expansion and Bell County East (3687) to Voss Lake (3751) 345-kV Double Circuit Line Upgrade	Milam
2024-SC29	Muscovy 345/138-kV Substation Addition and Salado (3699) to Muscovy (3700) to Voss Lake (3751) 345-kV Double Circuit Addition	Bell, Williamson, Milam
2024-SC32	McNeil AEN (9076) 138-kV Bus Tie Breaker Upgrade	Travis
2024-E4	Bryan Area Project	Brazos, Burleson, Robertson
2024-E4	Knob Creek Switch (3413) to Salado Switch (3699) 345-kV Line Upgrade	Bell
2024-NC23	Bale (3711) to St Johns Switch (3384) to Lake Creek SES (3409) 345-kV Line Upgrades	Falls, McLennan
2024-NC24	Lake Creek SES (3410) to Riesel Switch (3702) 138-kV Line Upgrade	Falls, McLennan
2024-NC37	Bell East (3687) to Salado (3699) 345-kV Line Addition	Bell, Williamson

Appendix B – Transmission Projects

- List of transmission projects removed from the study base case

TPIT No	Project Name	County
2024-NC43	Temple Switch (3415) to Belton (3610) 138-kV Line Upgrades	Bell
2024-NC60	Bell County East Switch (3687) to Littlepond (3377) , and Bell County East Switch (3687) to Brangus Switch (3705) 345-kV Line Upgrades	Milam, Bell

Appendix C – New Generation Projects to Add

GINR	Project Name	Fuel	Projected COD	Max Capacity (~MW)	County
22INR0503	Tidwell Prairie II Batt	OTH	03/01/2026	203.6	Robertson
22INR0504	Barton Branch IA	OTH	03/01/2026	203.6	Robertson
23INR0079	Chillingham Storage	OTH	07/15/2025	153.9	Bell
23INR0118	Blevins Solar	SOL	10/30/2025	271.6	Falls
23INR0119	Blevins Storage	OTH	07/28/2025	181.3	Falls
23INR0235	Hoyte Solar	SOL	12/15/2026	206.8	Milam
23INR0249	Limewood Solar	SOL	12/31/2025	204.6	Bell
23INR0344	Hermes Solar	SOL	09/30/2025	100.4	Bell
24INR0031	Stoneridge Solar	SOL	04/30/2025	201.6	Milam
24INR0166	Stillhouse Solar	SOL	09/02/2025	210.8	Bell
24INR0169	Yaupon Storage SLF	OTH	07/01/2028	102.0	Milam
24INR0365	Hermes Storage	OTH	09/30/2025	100.4	Bell
25INR0389	Stoneridge BESS	OTH	09/01/2025	101.9	Milam
22INR0605	Camino Santiago Solar	SOL	02/18/2027	196.3	Milam
24INR0476	DOS RIOS ENERGY STORAGE SLF	OTH	03/15/2027	164.5	Milam
25INR0281	Cosper Solar	SOL	11/12/2027	148.16	Bell

Appendix D – G-1 Generators and X-1 Transformers

G-1 Generators	X-1 Transformers
Bastrop Energy Center	Sandow – Ckt 1 345/138-kV
Giga Energy Storage	Hutto – Ckt 1 345/138-kV
East Backland Solar	Teal – Ckt 1 345/138-kV
Garfield Generator	Austrop –Ckt 1 345/138-kV
LostPines Generator	Dunlap –Ckt 1 345/138-kV
	Gilleland Creek –Ckt 1 345/138-kV
	Muscovy–Ckt 1 345/138-kV
	Lytton–Ckt 1 345/138-kV
	Salado–Ckt 1 345/138-kV
	Temple–Ckt 1 345/138-kV
	Temple Pecan–Ckt 1 345/138-kV
	Voss Lake–Ckt 1 345/138-kV