Control Number: 27706

Item Number: 445

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PROJECT NO. 27706

REPORTS OF THE ELECTRIC RELIABILITY COUNCIL OF TEXAS	§	**PUBLIC UTILITY COMMISSION**
	§	
	§	**OF TEXAS**

ELECTRIC RELIABILITY COUNCIL OF TEXAS, INC.'S NOTICE OF ACCEPTANCE OF A TIER 3 TRANSMISSION PROJECT

Pursuant to ERCOT Protocol Section 3.11.4.9(1), Electric Reliability Council of Texas, Inc. (ERCOT) files this Notice of ERCOT's acceptance of a Tier 3 transmission project submitted by AEP Texas North Company, an ERCOT-registered Transmission Service Provider (TSP), as reflected in Attachments A and B. ERCOT is prepared to provide the Commission with any additional information it may request regarding this matter.

Respectfully Submitted,

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May 5, 2020

Mr. Robert W. Bradish
Vice President, Planning & Engineering
American Electric Power
8500 Smiths Mill Road, 3rd floor
New Albany, OH 43054

RE: Ballinger to San Angelo Concho 69-kV Line Rebuild Project

Dear Mr. Bradish:

The Electric Reliability Council of Texas (ERCOT) Regional Planning Group (RPG) has reviewed and accepted the following Tier 3 transmission project in accordance with ERCOT Protocol Section 3.11.4:

Ballinger to San Angelo Concho 69-kV Line Rebuild Project:

- Rebuild approximately 18 miles of the existing Ballinger to Miles 69-kV line with 138-kV standard construction but operated at 69-kV
- Rebuild portions (approximately 2 miles) of the existing Miles to San Angelo Concho 69-kV line with 138-kV standard construction but operated at 69-kV
- Upgrade the existing Rowena, Harriett, and Veribest 69-kV substations by replacing the existing switches with motor operated switches
- Upgrade the existing Ballinger, Miles, and San Angelo Concho 69-kV substations by upgrading the terminals

Should you have any questions please contact me at any time.

Sincerely,

D. W. Rickerson
Vice President, Grid Planning and Operations
Electric Reliability Council of Texas

cc:
Bill Magness, ERCOT
Warren Lasher, ERCOT
Jeff Billo, ERCOT
Shun Hsien (Fred) Huang, ERCOT
Sun Wook Kang, ERCOT
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Rebuild Ballinger to San Angelo Concho 69 kV Line Transmission Project

ERCOT Regional Planning Group Proposal

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

April 2020

Prepared by:
American Electric Power Service Corporation (AEPSC)
Texas Transmission Planning

TABLE OF CONTENTS

EXECUTIVE SUMMARY

AEPSC has seen substantial load increase on the 69 kV system around the Ballinger area and currently there is only one (1) autotransformer that provides a 138 kV source to the area. AEPSC has discovered that the projected load growth in the area will result in a thermal overload of the Ballinger to San Angelo (SA) Concho 69 kV line when the 138/69 kV autotransformer at Ballinger is forced out.

AEPSC determined that the following transmission improvements (option 1) will be required to resolve the thermal violation:

- Rebuild the Ballinger to Miles 69 kV line (18 miles)
- Rebuild the remaining portions of the Miles to SA Concho 69 kV line (2 miles)
- Upgrade Miles substation by adding one (1) 69 kV circuit breaker and upgrade Rowena substation by replacing the 69 kV switches
- Upgrade Harriet substation and Veribest Tap by replacing the 69 kV switches

The estimated cost of these improvements is approximately $27 million. The project is anticipated to be completed in the second quarter of 2022.

As the estimated cost of the project exceeds $25 million, the proposed project is being pursued as Tier 3. Completion of the proposed upgrades will alleviate NERC, ERCOT, and AEPSC reliability criteria violations associated with the projected load growth in the Ballinger area.

INTRODUCTION

AEPSC has identified the Ballinger to San Angelo Concho 69 kV line as being at risk of exceeding its emergency thermal rating by 2023 for the contingency loss of the 138/69 kV autotransformer at Ballinger. Loss of the 138 kV source at Ballinger results in additional flow on the Ballinger to SA Concho 69 kV line. A transmission system upgrade is necessary to resolve the thermal overload.

The Ballinger to Miles to SA Concho 69 kV line is an approximately 20-mile transmission line that was constructed in 1926 with wood poles. It currently serves five (5) stations and the communities that surround these stations at SA Concho, Miles, Harriett, Rowena, and Veribest. The Ballinger to SA Concho 69 kV line has been identified by AEP as a candidate in need of capital mitigation due to its condition and performance. This transmission line has experienced a total of 42.53 hours of outage interruptions, including nine (9) momentary outages and six (6) permanent outages during the period from 2014 to 2019. The number of customers affected by both momentary and sustained outages on the line is 2,828. The total amount of time that customers were without power, as measured by Customer Minutes of Interruption (CMI), is 46,670 minutes.

The purpose of this report is to 1) address system improvements necessary to ensure compliance with all NERC, ERCOT, and AEP Transmission Planning Criteria, 2) address the condition and performance of the Ballinger to SA Concho 69 kV line.

In this effort, two possible transmission upgrade options were studied:

Option 1: Rebuild the 20 miles Ballinger to SA Concho 69 kV line

Option 2: Add a second 138/69 kV autotransformer at Ballinger

STUDY ASSUMPTIONS AND METHODOLOGY

This assessment used the ERCOT SSWG 2023 Summer and 2025 Summer cases developed in June 2019 as the starting point for this study. A steady state analysis was performed using version 33.11 of Siemens/PTI Corporation's Power System Simulator for Engineers software (PSS/E) to evaluate system performance and compliance with Transmission Planning Criteria established by NERC, ERCOT, and AEPSC.

The following criteria and assumptions reflect the development of the cases and the methodology used in this analysis.

Reliability Criteria

The following loading and voltage criteria were used to evaluate the proposed options:

Thermal Rating of Lines and Transformers

- Normal operating conditions: Less than 100% of Rate A
- Contingency operating conditions: Less than 100% of Rate B

Voltage Rating of Buses

- Normal operating conditions: Greater than 95% and Less than 105%
- Contingency operating conditions: Greater than 92% and Less than 105%

The following contingency scenarios were analyzed for the study system and ties from the study system:

Type	NERC Category	Descriptions
N-0	P0	System normal, Zero elements out of service
N-1	P1,P2.1,P7	Forced outage of a single transmission line, transformer, generating unit, common tower outage, shunt or FACTS device. ERCOT Criteria considers double circuit lines greater than 0.5 mile a single circuit outage
N-A-1	P6	Loss of a 345/138 kV auto transformer followed by an N-1 event defined above
N-G-1	P3	Loss of a generating unit followed by an N-1 event defined above

Table 1 Contingency Events

The table above describes the contingency categories analyzed for this study. With the exception of P6, these categories represent those that do not allow non-consequential load loss and would require system upgrades to resolve system constraints. The remaining contingency categories that allow non-consequential load loss were not explicitly analyzed.

The transmission system must reliably operate under system normal and single contingency scenarios per ERCOT, NERC, and AEPSC reliability criteria. If it is determined that the transmission system cannot accommodate the next worst outage, the transmission system must be upgraded or area generating facilities or loads may need to be curtailed according to ERCOT operating procedures.

Dynamic Stability Analysis

A dynamic stability analysis was not performed since there are no dynamic devices introduced in the preferred option. AEPSC does not expect any dynamic issues on this part of our 69 kV system.

Short Circuit Analysis

A short circuit analysis was not performed since the preferred option does not add any new generators, presenting no short circuit current contribution to the transmission network. AEPSC does not expect any short circuit issues on this part of our 69 kV system.

Model Development

No modifications were made to the SSWG cases.

Study System Region

The study system consisted of all facilities within and around the Ballinger area. Contingencies were performed for an area defined as six (6) buses out from the Ballinger 69 kV bus (6338). The analysis also monitored an area defined as eight (8) buses out from the Ballinger 69 kV bus (6338).

ASSESSMENT OF THE EXISTING SYSTEM

A steady state assessment of the existing system was performed to identify facilities that exceed the loading or voltage criteria discussed in the previous section. Any loading or voltage issues observed within the existing system for N-0, N-1, N-A-1, or N-G-1 events are presented in the following section. The figure below illustrates the existing transmission system in the Ballinger area.

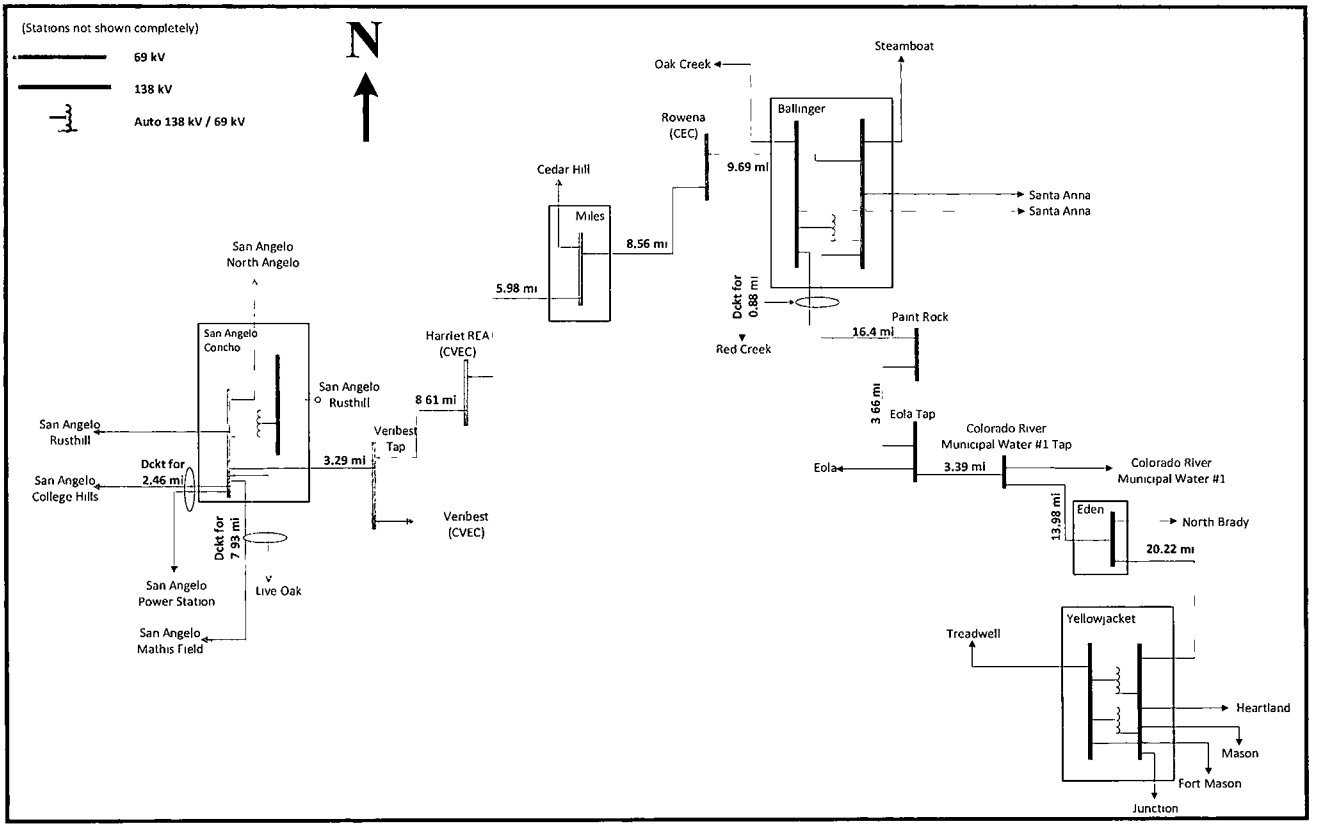

Figure 1 Existing Transmission System

Existing System N-0 Analysis in the Study Area

There were no thermal or voltage violations under normal system conditions in the study area.

Existing System N-1 Analysis in the Study Area

Table 2 demonstrates the thermal overloads identified in the existing system during N-1 conditions. The load growth in the Ballinger area causes excessive thermal overloads on the existing SA Concho to Veribest to Harriet to Miles to Rowena to Ballinger 69 kV line for the contingency loss of the 138/69 kV autotransformer at Ballinger. Table 3 demonstrates that no low bus voltages were identified.

BRANCH	OUTAGE	LENGTH	RATING	2023 SUM	2025 SUM
(29) 6409 VRBS2A 69.000 6450 CONCHO2A 69.000 1	SINGLE 6338-6340(1)	3.58	30	124.3	148.4
(29) 6409 VRBS2A 69.000 6450 CONCHO2A 69.000 1	SINGLE 6319-6351(1)	3.58	30	98.2	115.4
(1) 6410 MILE2A 69.000 6411 ROWE2A 69.000 1	SINGLE 6338-6340(1)	8.56	30	98.5	126.7
(2) 6409 VRBS2A 69.000 6412 HARI2A 69.000 1	SINGLE 6338-6340(1)	8.86	30	100.9	124.3
(1) 6338 BALLINGE2A 69.000 6411 ROWE2A 69.000 1	SINGLE 6338-6340(1)	9.69	30	78.4	105.0
(1) 6410 MILE2A 69.000 6412 HARI2A 69.000 1	SINGLE 6338-6340(1)	5.90	30	81.5	104.2

SINGLE 6338-6340(1): OPEN LINE FROM BUS 6338 [BALLINGE2A 69.000] TO BUS 6340 [BALLINGE4A 138.00] CKT 1

SINGLE 6319-6351(1): OPEN LINE FROM BUS 6319 [OAKC4B 138.00] TO BUS 6351 [NICOLE4A 138.00] CKT 1

Table 2 Existing System N-1 Branch Flows

BUS	OUTAGE	2023 SUM	2025 SUM
NONE	NONE	NA	NA

Table 3 Existing System N-1 Low Voltages

TRANSMISSION OPTIONS EVALUATED

AEPSC developed two (2) possible transmission upgrade solutions that were evaluated in order to serve the existing load and accommodate future load growth in the area. The two (2) options are as follows:

1) Rebuild approximately 20 miles of the Ballinger to Miles to SA Concho 69 kV line and upgrade remote end substations and tap stations on the line
2) Install a second 138/69 kV 130 MVA autotransformer at Ballinger

Option 1: Rebuild approximately 20 miles of the Ballinger to Miles to SA Concho 69 kV line

- Rebuild approximately 18 miles of the Ballinger to Miles 69 kV line with 138 kV standard construction but operated at 69 kV
- Rebuild approximately 2 miles of the Miles to SA Concho 69 kV line (remaining portions of the transmission line were rebuilt in 2016) with 138 kV standard construction but operated at 69 kV.
- Upgrade Rowena, Harriett, and Veribest substations by replacing the existing switches with motor operated switches
- Upgrade Ballinger, Miles, and SA Concho substations by upgrading the terminals

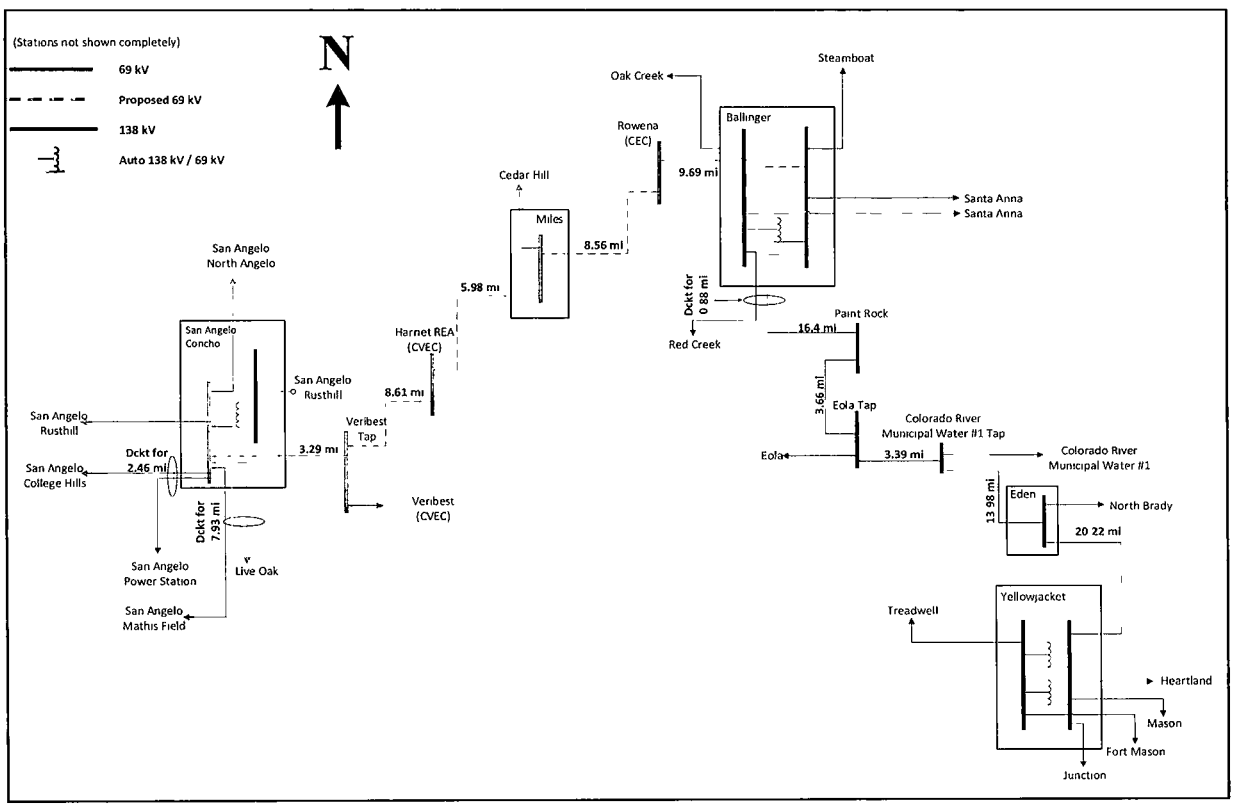

Figure 2 Option 1 One-Line Diagram

Option 2: Install a second 138/69 kV autotransformer at Ballinger

The existing Ballinger substation is a straight bus layout for 138 kV and 69 kV yards which is shown on Page 4. The addition of a second 138/69 kV 130 MVA autotransformer at Ballinger was explored and it was determined that expansion of the station is not feasible due to space limitations. Therefore, the following improvements would be required.

- Build a new 138/69 kV Ballinger substation by installing five (5) 138 kV breakers, six (6) 69 kV breakers, two (2) 138/69 kV 130 MVA autotransformers, and a distribution station.
- Re-terminate the existing transmission lines from the existing Ballinger substation to the new substation and retire the existing Ballinger substation.

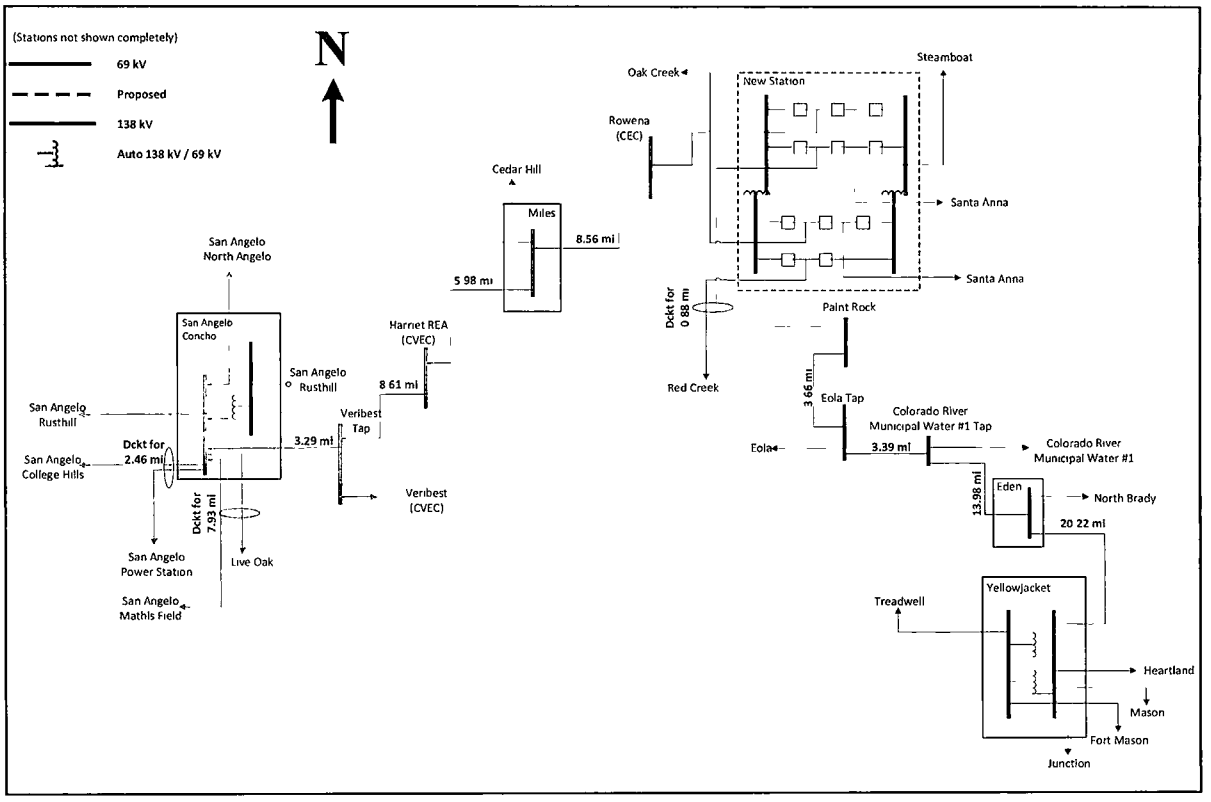

Figure 3 Option 2 One-Line Diagram

ASSESSMENT OF TRANSMISSION UPGRADE

The two (2) transmission system upgrade options were evaluated by testing whether they could address the thermal or voltage violations identified earlier.

- Option 1 resolves all N-1 issues in both 2023 and 2025
- Option 2 resolves all N-1 issues in 2023, but N-1 thermal violations exist in 2025

N-0 Analysis

There were no branch loading or low voltage issues revealed during normal system conditions.

N-1 Analysis

2023 SUM cases

BRANCH	OUTAGE	LENGTH	RATING	BASE	Option 1	Option 2
(6) 6409 VRBS2A 69.000 6450 CONCHO2A 69.000 1	SINGLE 6338-6340(1)	3.58	~30	124.3	17.5	69.4
(1) 6409 VRBS2A 69.000 6412 HARI2A 69.000 1	SINGLE 6338-6340(1)	8.86	~30	100.9	14.5	45.9
(1) 6410 MILE2A 69.000 6411 ROWE2A 69.000 1	SINGLE 6338-6340(1)	8.56	~30	100.0	14.3	25.4

SINGLE 6338-6340(1): OPEN LINE FROM BUS 6338 [BALLINGE2A 69.000] TO BUS 6340 [BALLINGE4A 138.00] CKT 1

Table 4 P1 and P7 Branch Flows including Base Case and Improvements

BUS	OUTAGE	BASE	Option 1	Option 2
NONE	NONE	NA	NA	NA

Table 5 P1 and P7 Low Voltages including Base Case and Improvements

2025 SUM cases

BRANCH	OUTAGE	LENGTH	RATING	BASE	Option 1	Option 2
(29) 6409 VRBS2A 69.000 6450 CONCHO2A 69.000 1	SINGLE 6338-6340(1)	3.58	~30	148.4	21.0	83.9
(29) 6409 VRBS2A 69.000 6450 CONCHO2A 69.000 1	SINGLE 6319-6351(1)	3.58	~30	115.4	16.0	110.2
(29) 6409 VRBS2A 69.000 6450 CONCHO2A 69.000 1	SINGLE 6442-60399(1)	3.58	~30	109.3	15.6	105.2
(1) 6410 MILE2A 69.000 6411 ROWE2A 69.000 1	SINGLE 6338-6340(1)	8.56	~30	126.7	18.4	41.5
(2) 6409 VRBS2A 69.000 6412 HARI2A 69.000 1	SINGLE 6338-6340(1)	8.86	~30	124.3	17.9	59.8
(1) 6338 BALLINGE2A 69.000 6411 ROWE2A 69.000 1	SINGLE 6338-6340(1)	9.69	~30	105.0	15.4	25.7
(1) 6410 MILE2A 69.000 6412 HARI2A 69.000 1	SINGLE 6338-6340(1)	5.90	~30	104.2	15.3	40.1

SINGLE 6338-6340(1): OPEN LINE FROM BUS 6338 [BALLINGE2A 69.000] TO BUS 6340 [BALLINGE4A 138.00] CKT 1

SINGLE 6319-6351(1): OPEN LINE FROM BUS 6319 [OAKC4B 138.00] TO BUS 6351 [NICOLE4A 138.00] CKT 1

SINGLE 6442-60399(1): OPEN LINE FROM BUS 6442 [REDCREEK4A 138.00] TO BUS 60399 [WEISS4A 138.00] CKT 1

Table 6 P1 and P7 Branch Flows with updated loads including Base Case and Improvements

BUS	OUTAGE	BASE	Option 1	Option 2
NONE	NONE	NA	NA	NA

Table 7 P1 and P7 Low Voltages with updated loads including Base Case and Improvements

N-A-1 Analysis

2023 SUM cases

BRANCH	OUTAGE	LENGTH	RATING	BASE	Option 1	Option 2
NONE	NONE	NA	NA	NA	NA	NA

Table 8 N-A-1 Branch Flows including Base Case and Improvements

BUS	OUTAGE	BASE	Option 1	Option 2
NONE	NONE	NA	NA	NA

Table 9 N-A-1 Low Voltages including Base Case and Improvements

2025 SUM cases

BRANCH	OUTAGE	LENGTH	RATING	BASE	Option 1	Option 2
NONE	NONE	NA	NA	NA	NA	NA

Table 10 N-A-1 Branch Flows including Base Case and Improvements

BUS	OUTAGE	BASE	Option 1	Option 2
NONE	NONE	NA	NA	NA

Table 11 N-A-1 Low Voltages including Base Case and Improvements

N-G-1 Analysis

2023 SUM cases

BRANCH	OUTAGE	LENGTH	RATING	BASE	Option 1	Option 2
(11) 6409 VRBS2A 69.000 6450 CONCHO2A 69.000 1	GEN181051W1:SINGLE 6338-6340(1)	3.58	~30	127.1	17.8	74.2
(11) 6409 VRBS2A 69.000 6450 CONCHO2A 69.000 1	GEN180453W1:SINGLE 6338-6340(1)	3.58	~30	124.8	17.5	70.3
(9) 6409 VRBS2A 69.000 6412 HARI2A 69.000 1	GEN181051W1:SINGLE 6338-6340(1)	8.86	~30	103.8	14.8	50.7
(9) 6409 VRBS2A 69.000 6412 HARI2A 69.000 1	GEN180453W1:SINGLE 6338-6340(1)	8.86	~30	101.5	14.5	46.8

GEN181051W1:SINGLE 6338-6340(1): REMOVE UNIT W1 FROM BUS 181051 [TTWEC_G1 34.500]; OPEN LINE FROM BUS 6338 [BALLINGE2A 69.000] TO BUS 6340 [BALLINGE4A 138.00] CKT 1

GEN180453W1:SINGLE 6338-6340(1): REMOVE UNIT W1 FROM BUS 180453 [BUFF_G_UNIT334.500]; OPEN LINE FROM BUS 6338 [BALLINGE2A 69.000] TO BUS 6340 [BALLINGE4A 138.00] CKT 1

Table 12 N-G-1 Branch Flows including Base Case and Improvements

BUS	OUTAGE	BASE	Option 1	Option 2
NONE	NONE	NA	NA	NA

Table 13 N-G-1 Low Voltages including Base Case and Improvements

2025 SUM cases

BRANCH	OUTAGE	LENGTH	RATING	BASE	Option 1	Option 2
(118) 6409 VRBS2A 69.000 6450 CONCHO2A 69.000 1	GEN181051W1:SINGLE 6338-6340(1)	3.58	~30	151.2	21.3	88.6
(118) 6409 VRBS2A 69.000 6450 CONCHO2A 69.000 1	GEN180453W1:SINGLE 6338-6340(1)	3.58	~30	148.9	21.0	84.7
(14) 6409 VRBS2A 69.000 6412 HARI2A 69.000 1	GEN181051W1:SINGLE 6338-6340(1)	8.86	~30	127.0	18.2	64.6
(14) 6409 VRBS2A 69.000 6412 HARI2A 69.000 1	GEN180453W1:SINGLE 6338-6340(1)	8.86	~30	124.7	17.9	60.7

GEN181051W1:SINGLE 6338-6340(1): REMOVE UNIT W1 FROM BUS 181051 [TTWEC_G1 34.500]; OPEN LINE FROM BUS 6338 [BALLINGE2A 69.000] TO BUS 6340 [BALLINGE4A 138.00] CKT 1

GEN180453W1:SINGLE 6338-6340(1): REMOVE UNIT W1 FROM BUS 180453 [BUFF_G_UNIT334.500]; OPEN LINE FROM BUS 6338 [BALLINGE2A 69.000] TO BUS 6340 [BALLINGE4A 138.00] CKT 1

Table 14 N-G-1 Branch Flows including Base Case and Improvements

BUS	OUTAGE	BASE	Option 1	Option 2
NONE	NONE	NA	NA	NA

Table 15 N-G-1 Low Voltages including Base Case and Improvements

ESTIMATED COST

The table below contains the estimated cost of each option.

Option	Description	Cost
Option 1	1) Rebuild approximately 20 miles of the existing 69 kV line between Ballinger and SA Concho stations 2) Install one (1) 69 kV breaker at Miles station 3) Rebuild Rowena, Harriett, and Veribest Tap stations	$27 M
Option 2	1) Construct a new Ballinger 138/69 kV station by installing five (5) 138 kV breakers, six (6) 69 kV breakers, two (2) 138/69 kV 130 MVA autotransformers, and a distribution station 2) Re-terminate the existing lines into the new station	$27.5 M

Table 16 Options Cost Estimates

RECOMMENDATIONS

As the load continues to grow in the area between Ballinger and SA Concho over the next several years, the loading on the Ballinger to SA Concho 69 kV line continues to increase and is at risk of exceeding its emergency thermal rating by 2023 for the contingency loss the 138/69 kV autotransformer at Ballinger. In this RPG submission, two (2) options were studied to resolve the thermal overload of the Ballinger to SA Concho 69 kV line and ensure compliance with all NERC, ERCOT, and AEP Transmission Planning Criteria.

Option 1: ($27.0 M) Rebuild the 20 mile Ballinger to SA Concho 69 kV line

Option 2: ($27.5 M) Add a second 138/69 kV autotransformer at Ballinger

Option 1 has a lower cost than option 2. Option 1 resolves all the thermal and voltage violations in the area under P0, P1, P3, P6, and P7 contingency categories. This option provides a long-term solution by increasing the thermal loading capability of the circuit and addresses the condition and performance of the line. Option 1 is not expected to require a new CCN.

Option 2 has higher cost than option 1 due to inability to expand the existing Ballinger station. The station would have to be relocated to a new location and the feasibility of reterminating lines into the new station would be challenging and expensive. Option 2 only resolves thermal and voltage issues in the short-term and by 2025 the Ballinger to SA Concho 69 kV line is again at risk of exceeding its emergency thermal rating. Option 2 also fails to address the issues on the condition and performance of the Ballinger to SA Concho 69 kV line. Option 2 may require a new CCN depending on the location of the new station.

Based upon power flow results presented in this report, AEPSC recommends that the ERCOT Regional Planning Group consider accepting option 1 as presented in this submission. Implementing option 1 will provide the facilities necessary to improve the near-term reliability of the Ballinger area, facilitate the long-term load growth in the region, and address the performance issues associated with the line.

APPENDIX A

Figure 5 Ballinger Area Transmission System

APPENDIX B

Figure 6 **Existing Ballinger Substation amidst Residential and Commercial Buildings**

APPENDIX C
Detailed Results

Existing System
N1_Report_121819.xl

2023 P1 and P7
N1_Report_121919.xl

2025 P1 and P7
N1_Report_010220.xl

2023
N-A-1_Report_(01022

2025
N-A-1_Report_(01022

2023
N-G-1_Report_(01032

2025
N-G-1_Report_(01032