XCEL ENERGY-TEXAS AND NEW MEXICO SUB-REGIONAL TRANSMISSION PLANNING MEETING

Reene Miranda – Manager, Transmission Planning South
Integrated System Planning

October 12, 2023

MEETING AGENDA

9:00 AM **Registration/Coffee and pastries**

9:30 AM **Welcome – Introductions, Safety Moment, Agenda Review**
Reené Miranda-Transmission Planning Manager
Adrian Rodriguez-SPS President

9:45 AM **SPS Transmission Topics - Completed 2022/2023 Projects**
Reené Miranda-Transmission Planning Manager

10:45 AM **Break**

11:00 AM **SPS Transmission Topics - 2023 and Future Projects**
Reené Miranda-Transmission Planning Manager

12:00 PM **Buffet Lunch**

12:45 PM **2023 SPS NM Integrated Resource Plan (IRP)**
Brooke Trammell-Regional Vice President, Regulatory & Pricing, SPS
Review of resource planning process and timeline. High-level summary of SPS's 2023 New Mexico IRP filing including statement of need and generic generation expansion plan

1:05 PM **Under Frequency Load Shed (UFLS)**
David Wheeler-Manager System Protection Engr, SPS
Load Shedding – Why it's Sometimes Necessary

1:30 PM **NERC Requirements Update**
Thomas Maldonado-Director, Transmission Ops Compliance, Integrated System Planning
Modeling requirements, MOD-026/MOD-027 for TOs & GOs. Resource requirements and clarification.

2:00 PM **Break**

2:15 PM **Crossroads-Hobbs-Roadrunner (CHR) Competitive Project**
Jarred Cooley-Director of Strategic Planning, SPS
CHR background, Southwest Power Pool award process of competitive projects.
Address the impacts and results of that process, both on customers in NM and future bids

2:40 PM **Questions and Adjourn**

SAFETY MOMENT

The National Institute for Occupational Safety and Health (NIOSH)

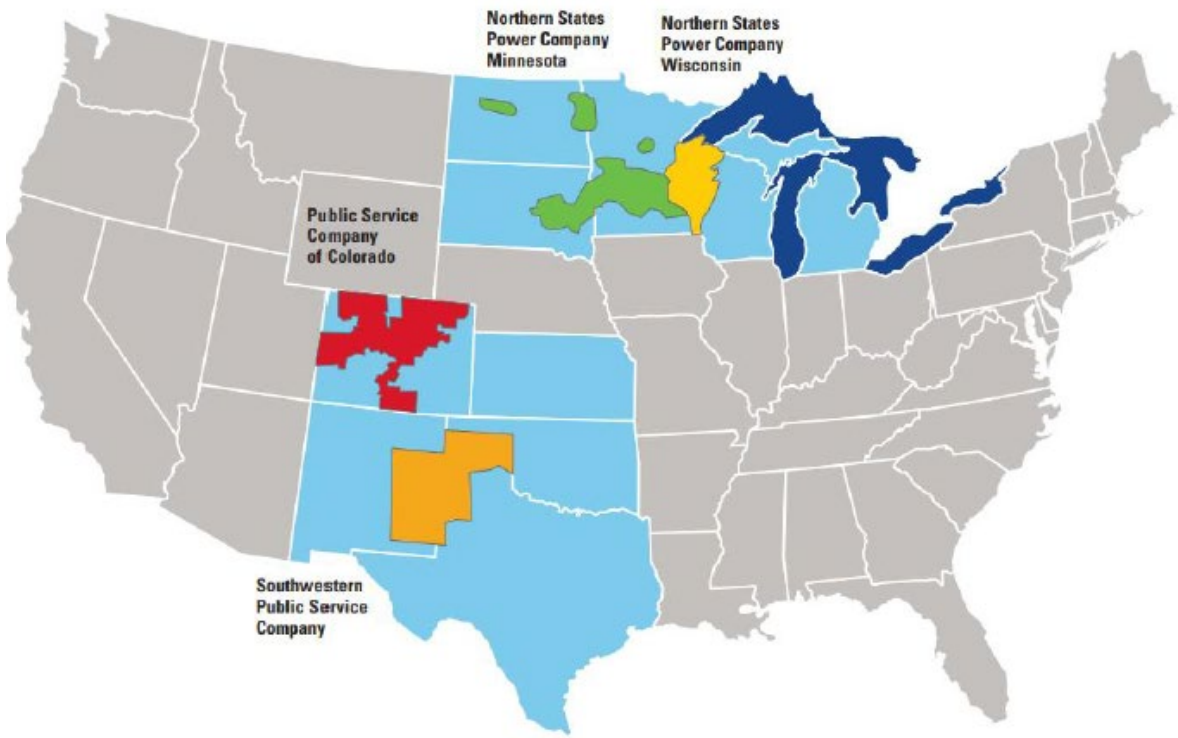
Safety Moment – Noise and Occupational Hearing Loss

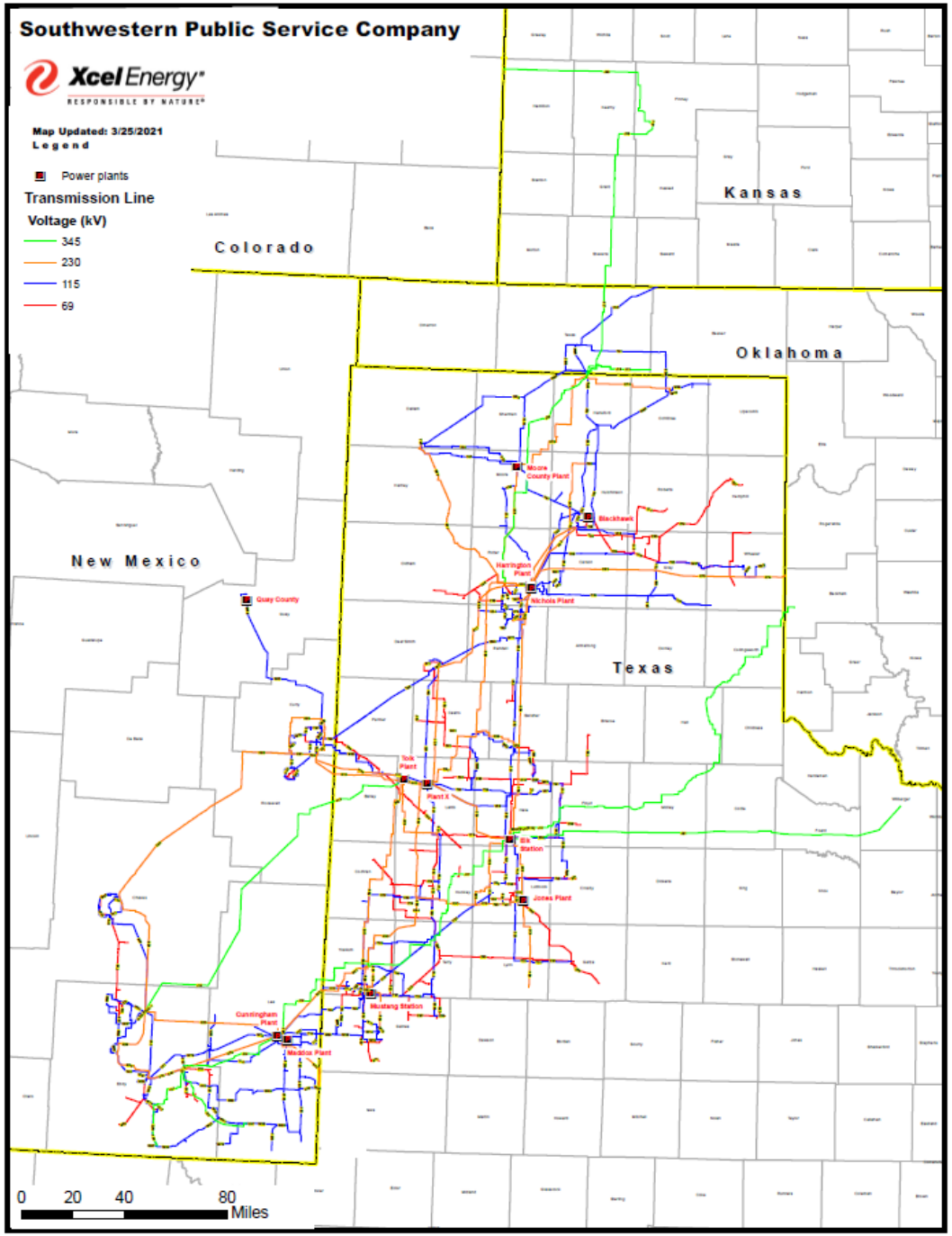
October is “The National Institute for Occupational Safety and Health (NIOSH)”

- All industries have hearing loss risks
  - Generation facilities
  - Manufacturing companies
  - Everyday activities such as
    - Using power tools
    - Moving the lawn
    - Attending a fitness class with loud music
- Preventive measures
  - Providing Personal Protective Equipment” (PPE) with noise-cancellation equipment
  - Reduce exposure to listening to loud music
  - Regular hearing tests

System Maps

Xcel Energy





Disclaimer

- All in-service dates (ISDs) of Active or Future projects are proposed and subject to change
- All projects have the possibility of changing based on new / evolving information
- These are projects from a Planning perspective as required from a reliability, load or generation interconnection, asset renewal, etc.
- Presentation is for informational purposes

TRANSMISSION SYSTEM ADDITIONS

Sept 2022 – Sept 2023

Malaga Black River Substation

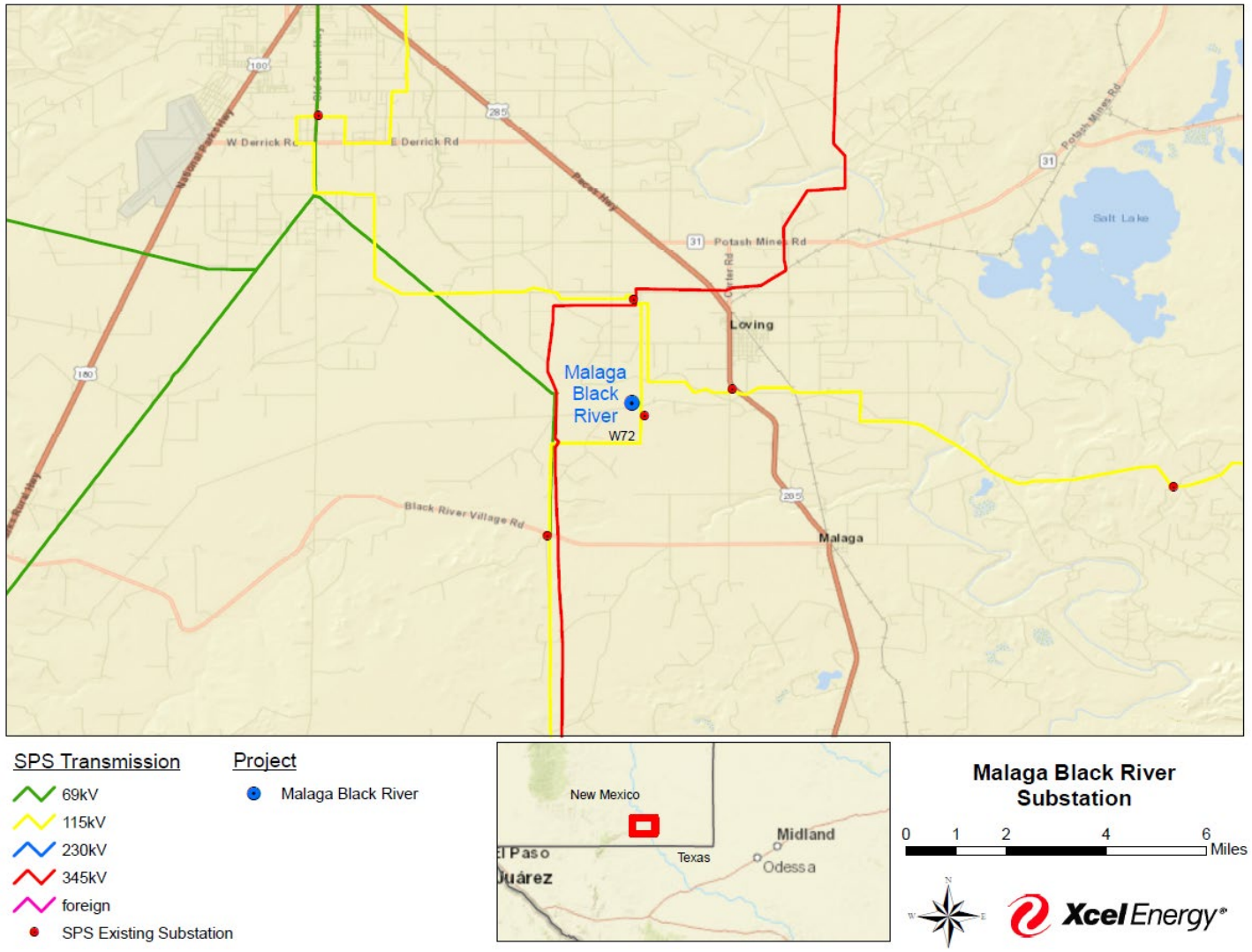
Voltage: 115 kV

ISD: November 2022

NTC: No

Description: New 115kV Tap For Customer Substation, W72

Need: Load Study



W21 Eagle Creek to Eddy County (Rebuild)

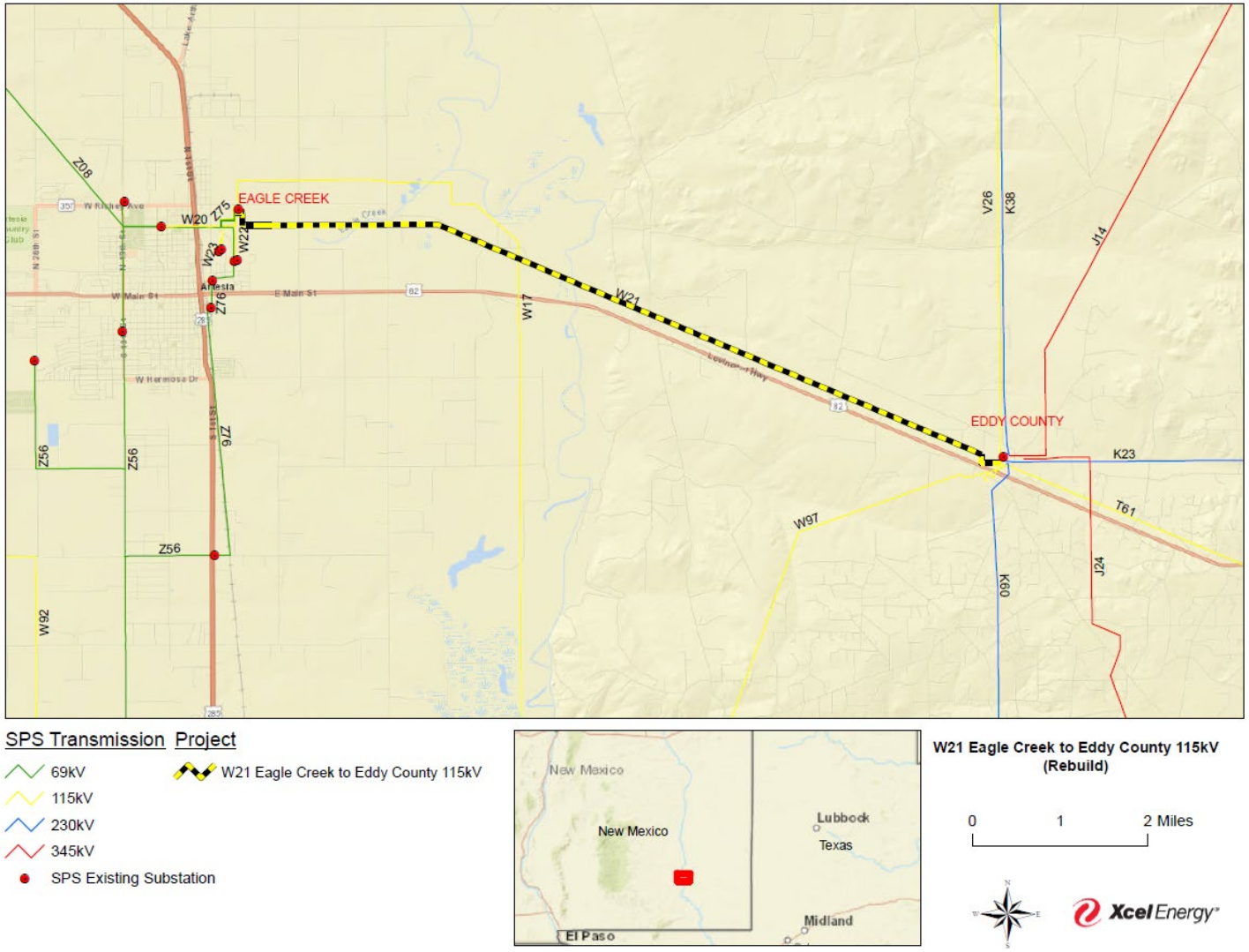
Voltage: 115 kV

ISD: November 2022

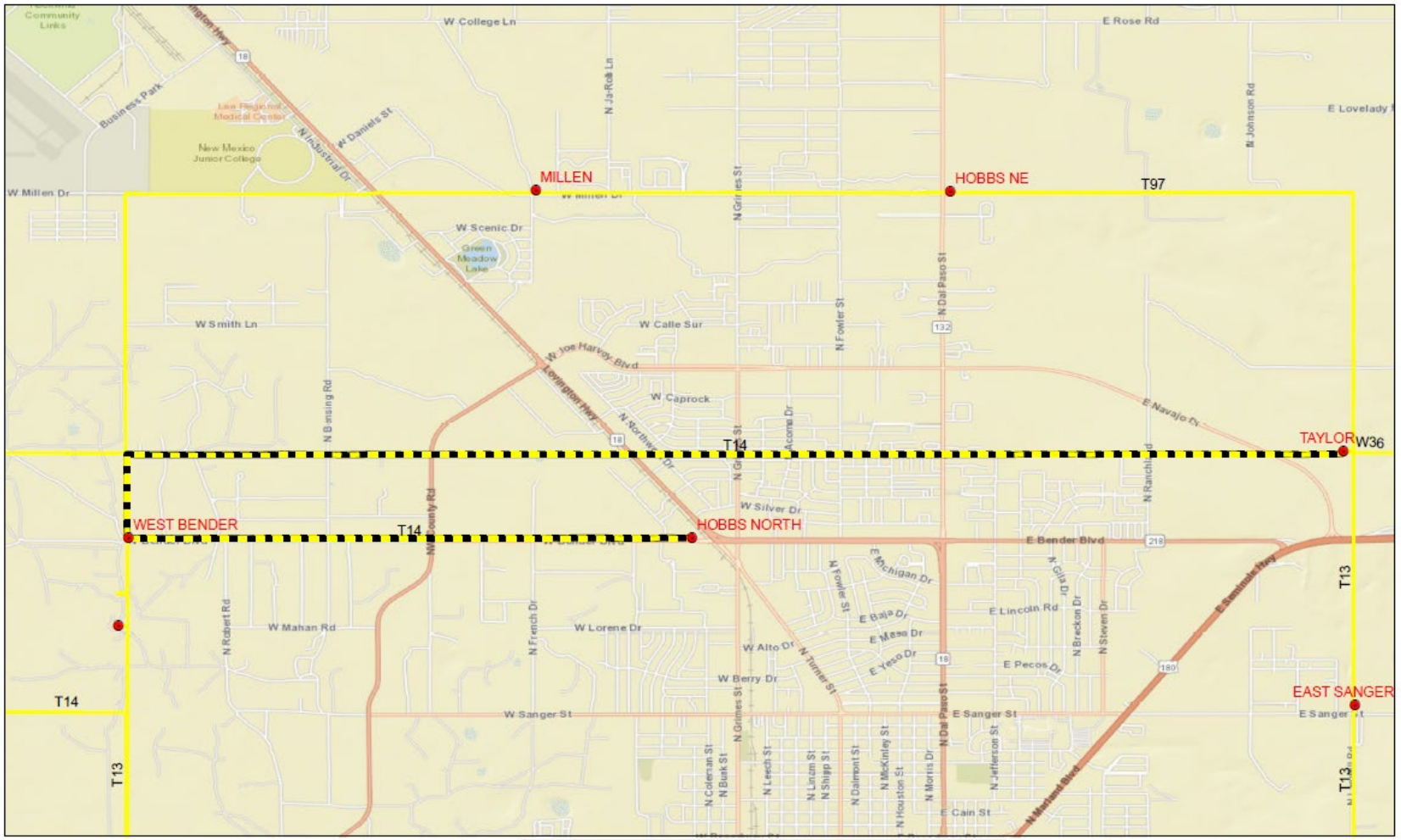
NTC: No

Description: Rebuild existing 115 kV line (~9 mile long), W21

Need: Asset Renewal



T14 Taylor to Hobbs North (Rebuild)



SPS Transmission

- 69kV
- 115kV
- 230kV
- 345kV
- SPS Existing Substation
- SPS New Substation

Project

- T14 Wreck Out/Re-Build 115kV

T14 West Bender - North Hobbs
T14 West Bender - Taylor
(Wreck out/Re-Build)

0 1 2 Miles

Xcel Energy®

Voltage: 115 kV

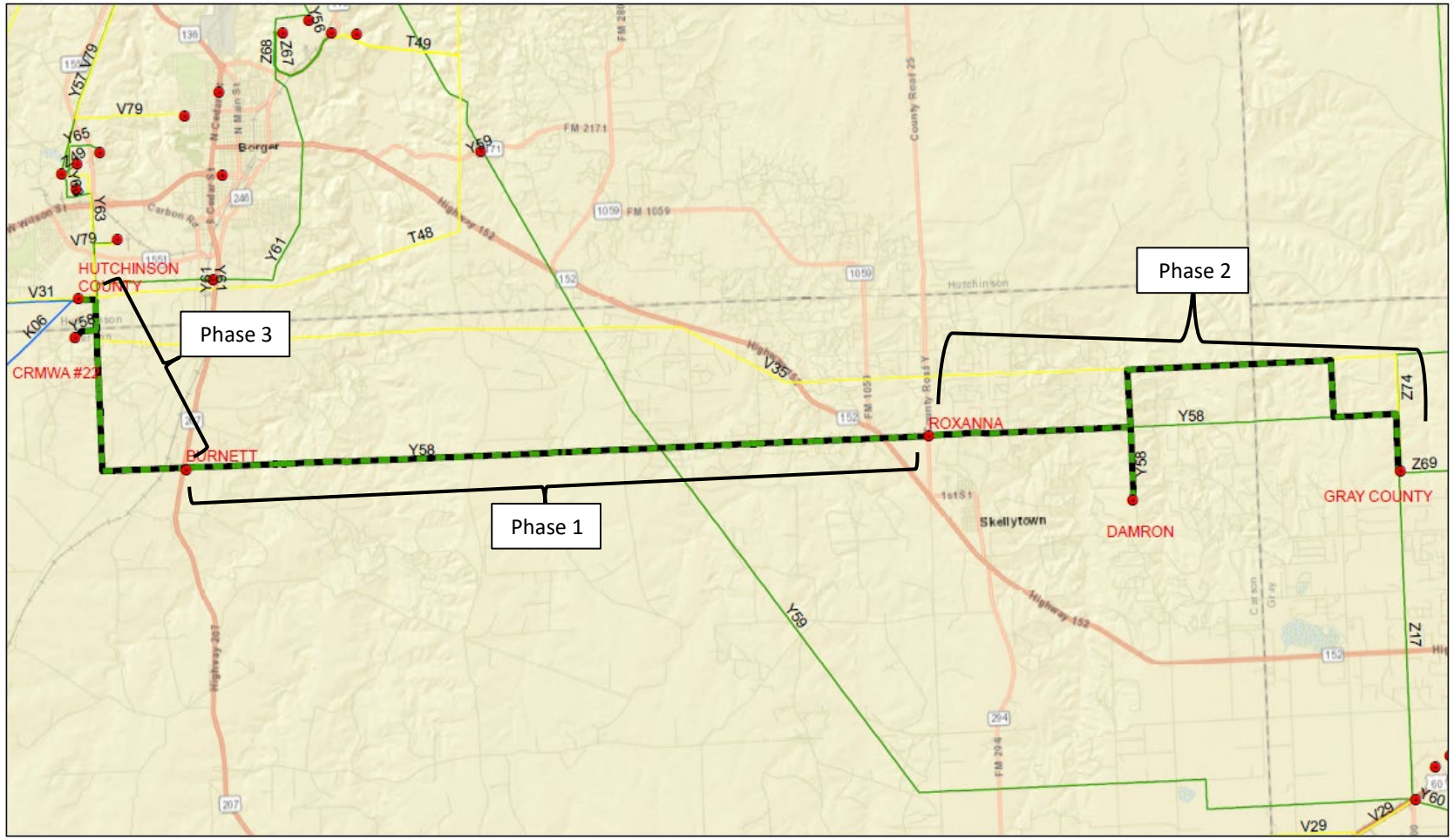
ISD: December 2022

NTC: No

Description: Rebuild 115 kV line (~9 miles long), T14

Need: Asset Renewal

Y58 Hutchinson County to Gray County (Rebuild)



SPS Transmission Project

- 69kV
- 115kV
- 230kV
- 345kV
- SPS Existing Substation
- SPS New Substation
- Y58 Hutchinson County to Gray County 69kV

Y58 Hutchison County to Gray County 69kV (Rebuild)

0 2.5 5 Miles

Xcel Energy®

Voltage: 69 kV

ISD: varied

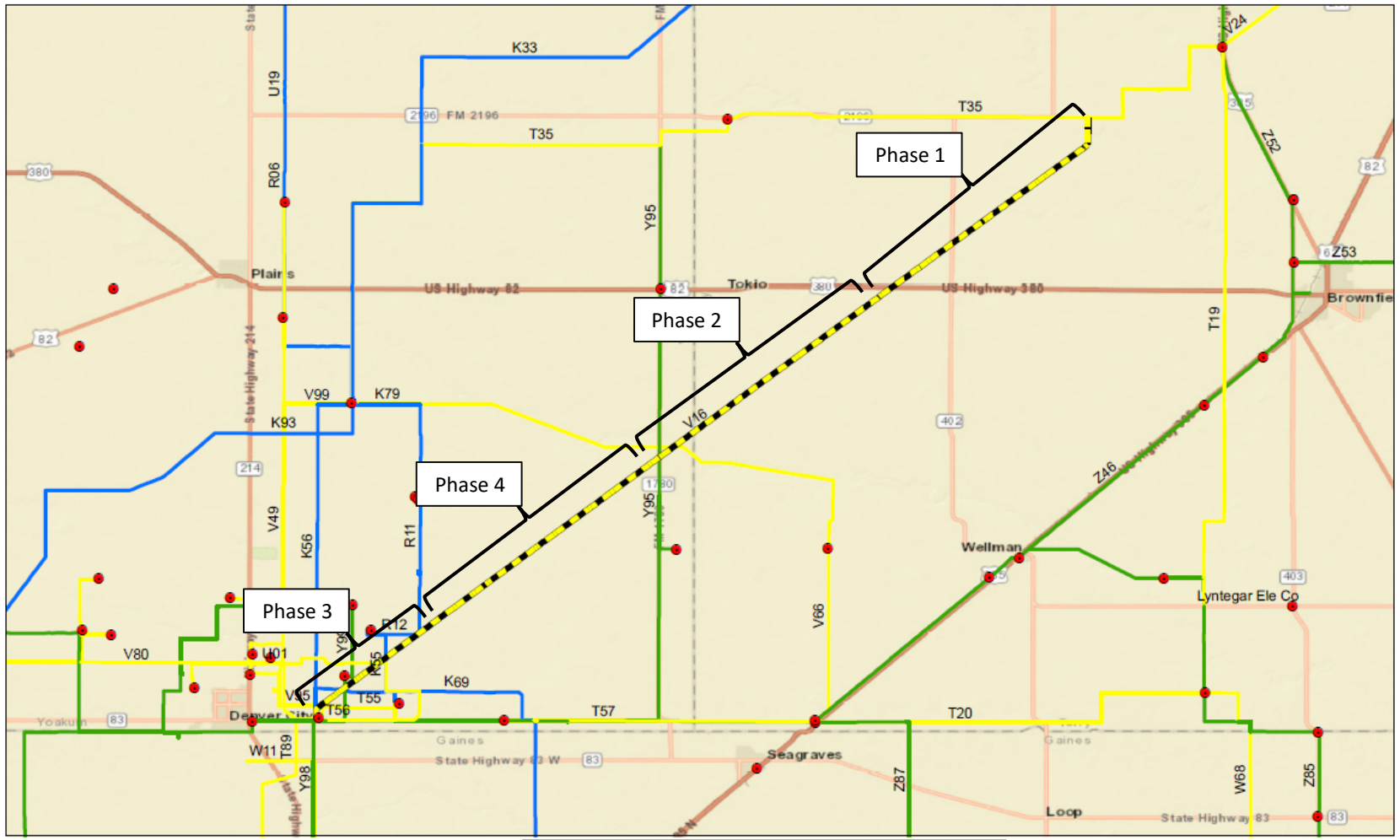
- **Phase 1: December 2022**
- Phase 2: May 2021
- Phase 3: July 2022

NTC: No

Description: Rebuild existing 69 kV line (~26 miles long), Y58

Need: Asset Renewal

V16 Terry County to Denver City (Rebuild)



SPS Transmission

- 69kV
- 115kV
- 230kV
- 345kV
- SPS Existing Substation
- SPS New Substation

Project

- V16 Wreck Out/Re-build 115kV

V16 CR 2196 to Denver City
(Wreck out/Re-Build) 115kV

0 5 10 Miles

Voltage: 115 kV

ISD: varied

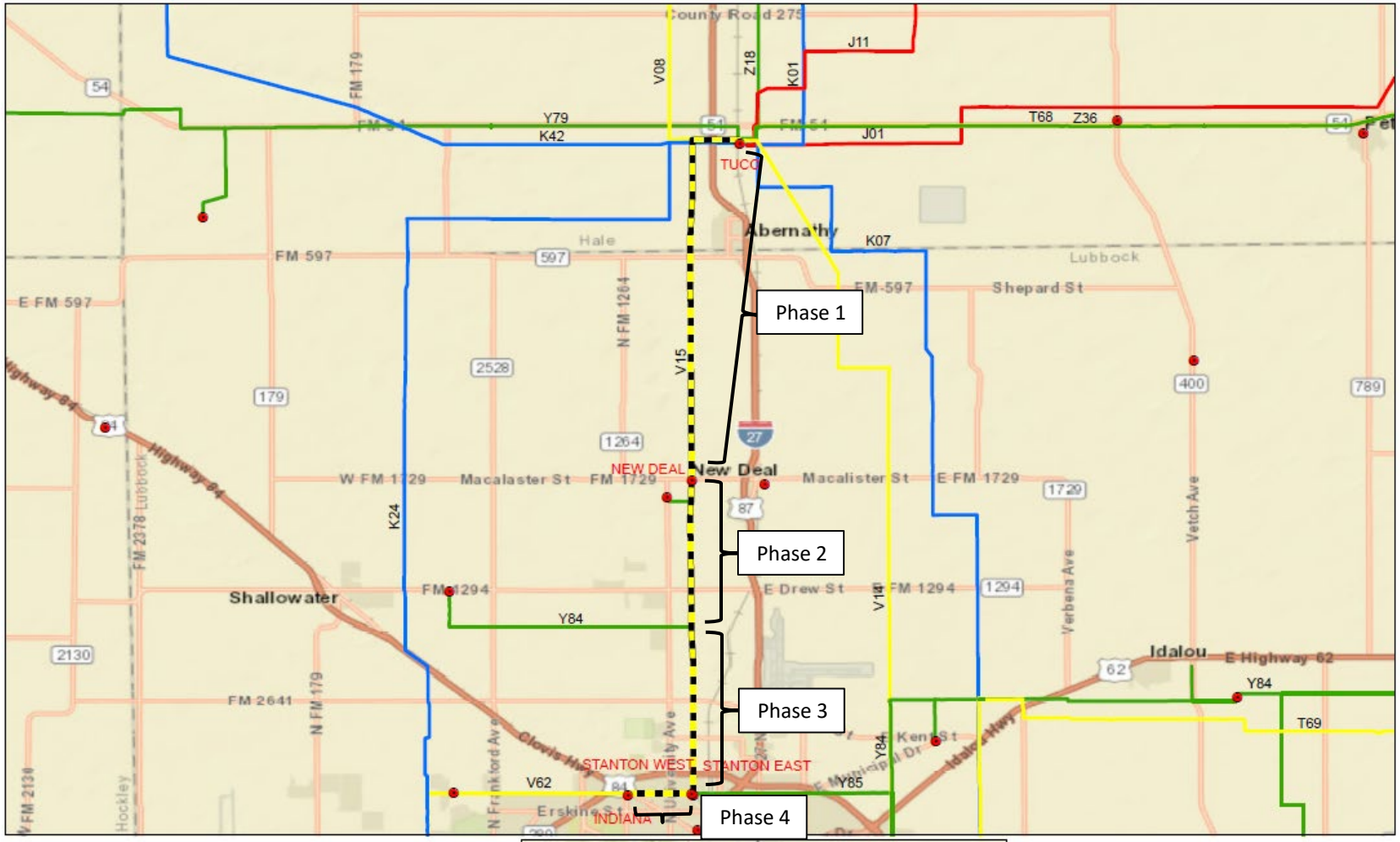
- Phase 1: May 2022
- **Phase 2: December 2022**
- **Phases 3 & 4: May 2023**

NTC: No

Description: Rebuild 115 kV line (~35 miles long), V16

Need: Asset Renewal

V15, Tuco to Indiana (Rebuild)



SPS Transmission

- 69kV
- 115kV
- 230kV
- 345kV
- SPS Existing Substation
- SPS New Substation

Project

- V15 Tuco to Indiana 115kV

V15 Tuco to Indiana 115kV
(Wreck out/Re-Build)

0 4 8 Miles

Xcel Energy®

Voltage: 115 kV

ISD: varied

- **Phase 1: Dec 2022**
- **Phase 2: Mar 2023**
- **Phase 3: May 2023**
- **Phase 4: May 2023**

NTC: No

Description: Rebuild the double circuit 115/69 kV line (~19 miles), V15

Need: Asset Renewal

Lawrence Park Substation

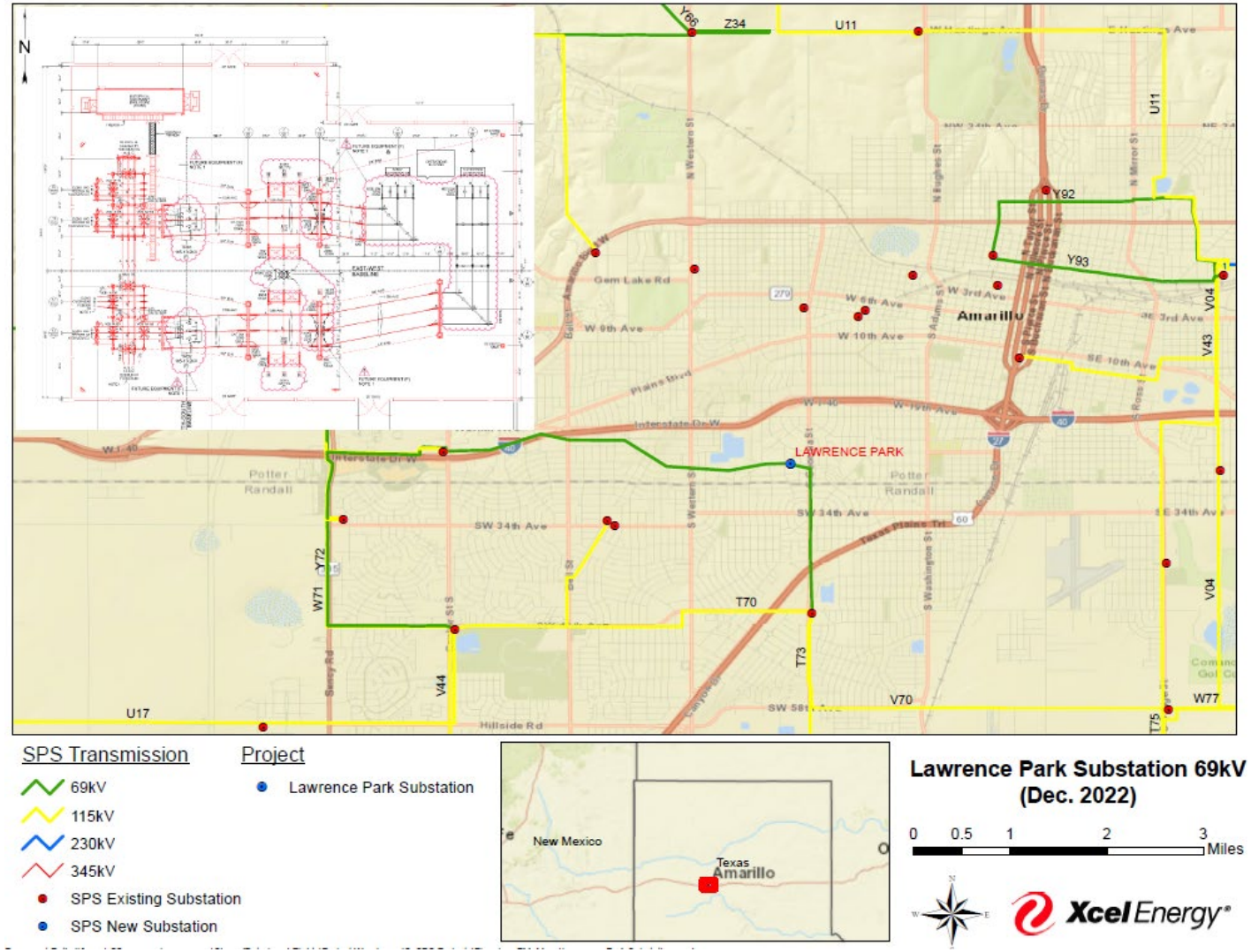
Voltage: 69 kV

ISD: March 2023

NTC: No

Description:
Replacement of existing distribution substation

Need: Asset Renewal



V02 Tap to Highland Park

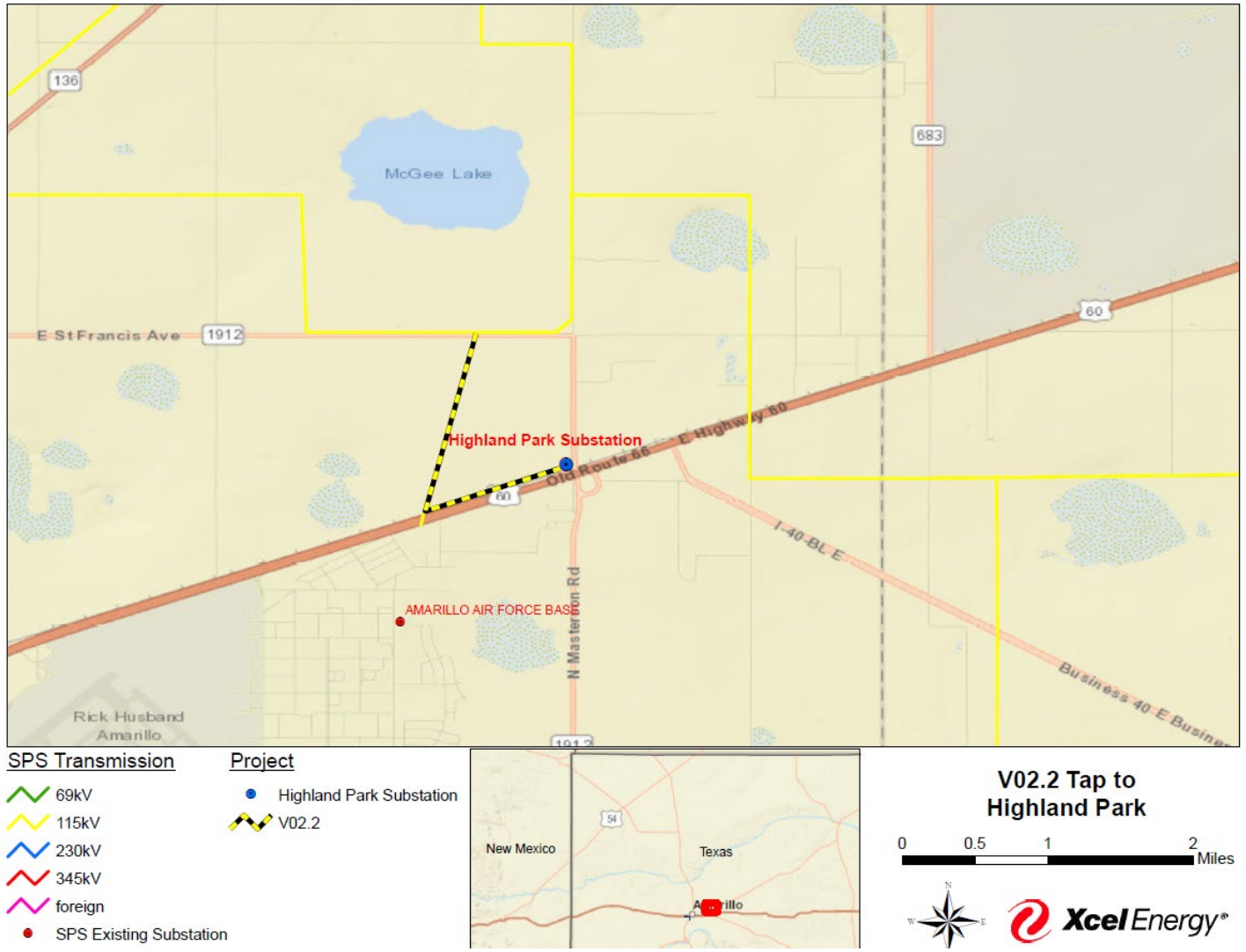
Voltage: 115 kV

ISD: April 2023

NTC: No

Description: Rebuild Line, Bad Shape

Need: Asset Renewal/Reliability



Demon Substation

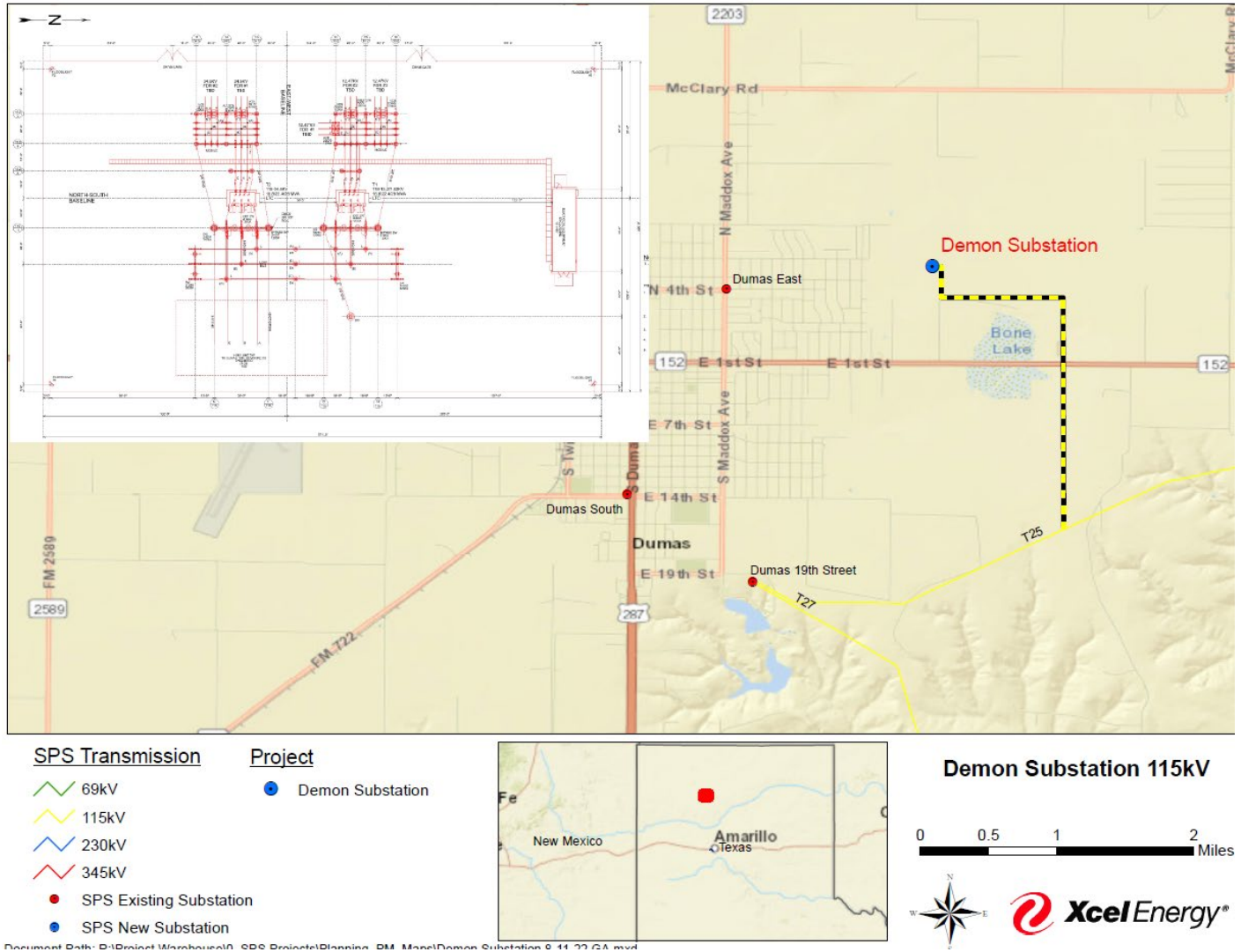
Voltage: 115 kV

ISD: May 2023

NTC: No

Description: 115kV switch tap, T25, Transmission line 2.75 miles.

Need: Distribution Driven/Load Growth



Hartmoore 115kV Tap, T47

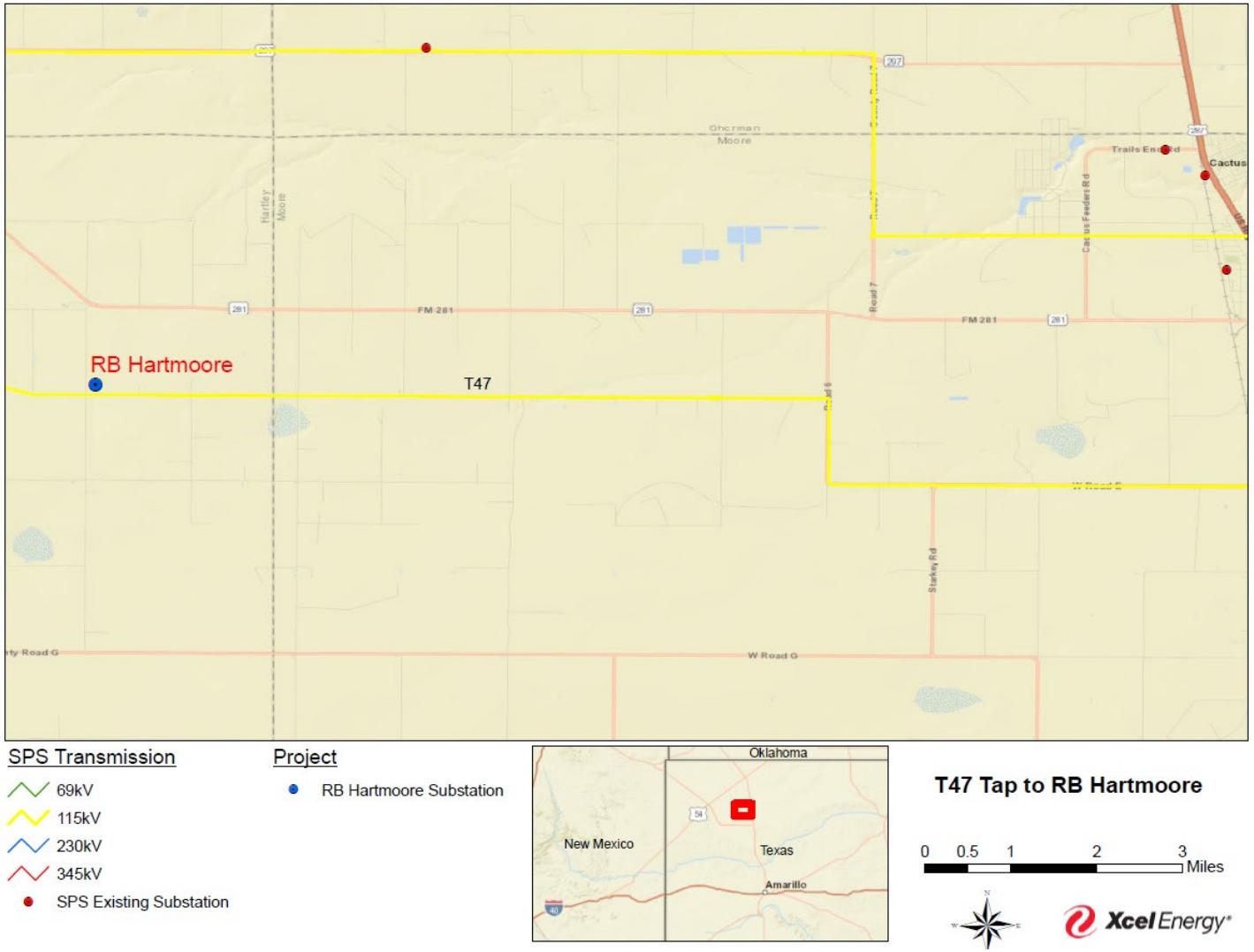
Voltage: 115 kV

ISD: May 2023

NTC: No

Description: New 115kV Tap For Customer Substation, T47

Need: Load Study/Load Growth



Magnum Substation

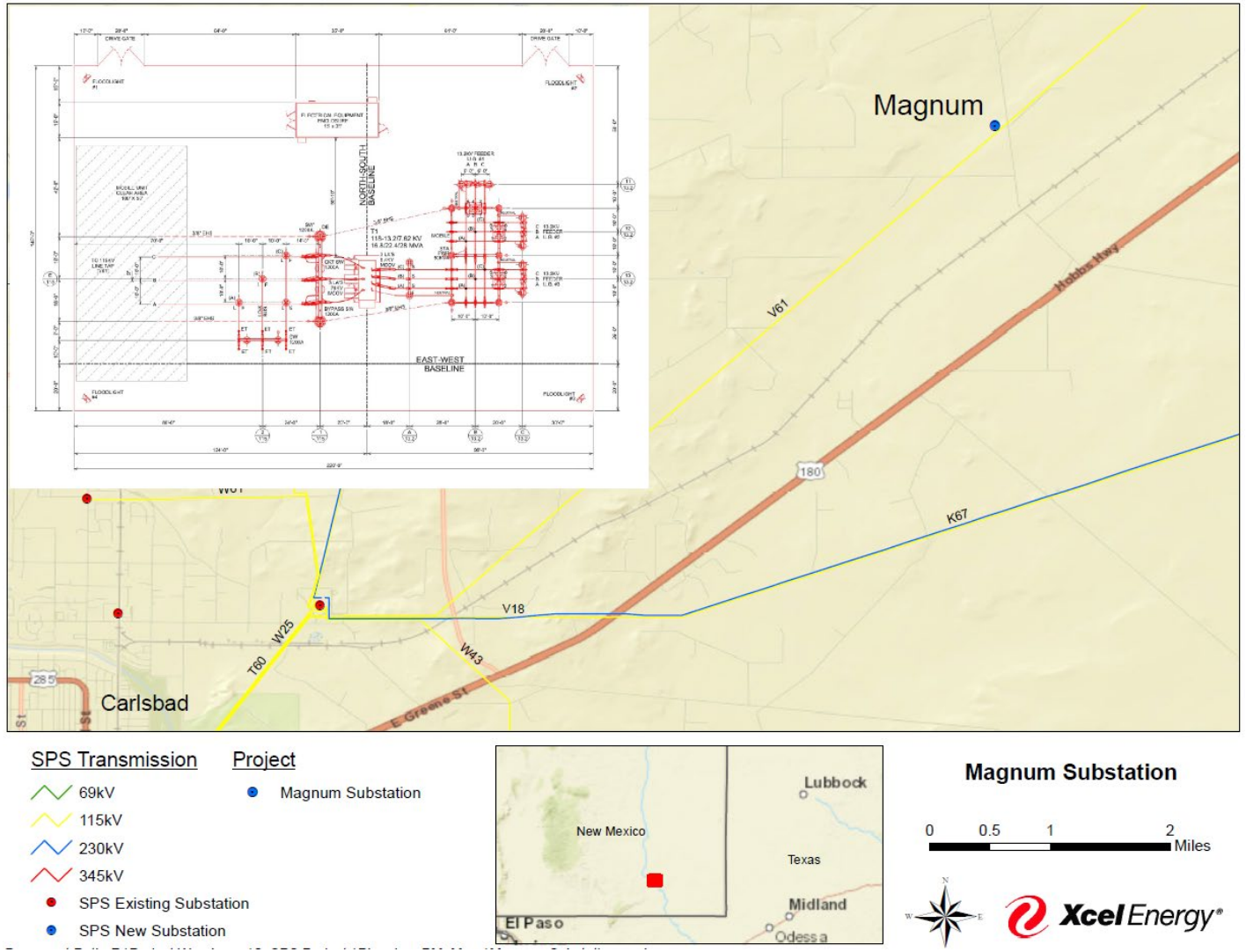
Voltage: 115 kV

ISD: May 2023

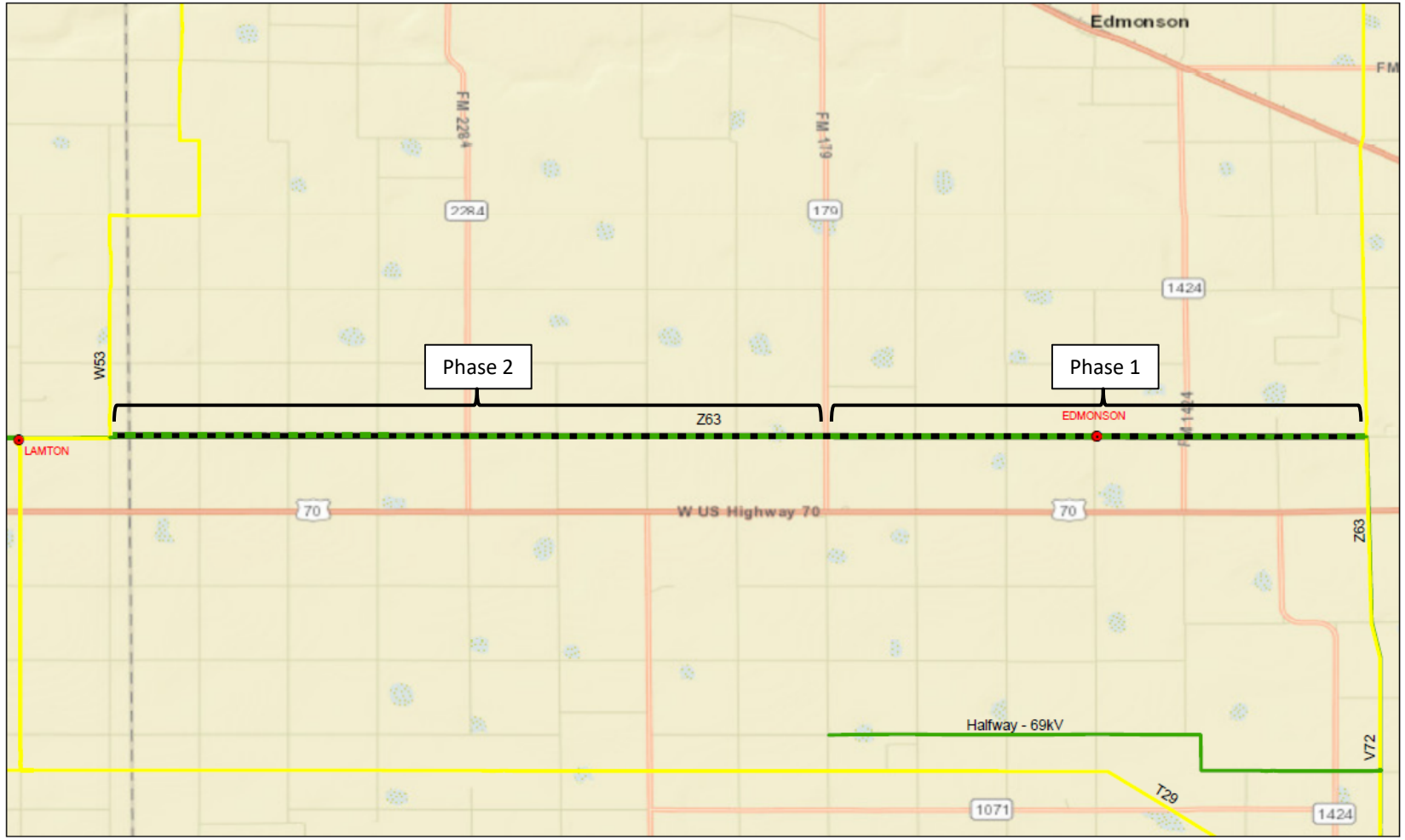
NTC: No

Description: 115kV Substation off V61 in Southeast NM

Need: Distribution Driven/Load Growth



Z63 From V72 to Structure 310 (Rebuild)



SPS Transmission
- 69kV
- 115kV
- 230kV
- 345kV
- SPS Existing Substation

Project
- Z63 Line Rebuild

Z63 Line Rebuild 69kV
Str V72-560 to V63-120

0 2 4 Miles

Xcel Energy®

Voltage: 69 kV

ISD: varied

- **Phase 1: Dec 2023**
- **Phase 2: Dec 2023**

NTC: No

Description: Rebuild 69 kV line (~14 miles) from structures #62 to #310

Need: Asset Renewal

WRB South Switching Station

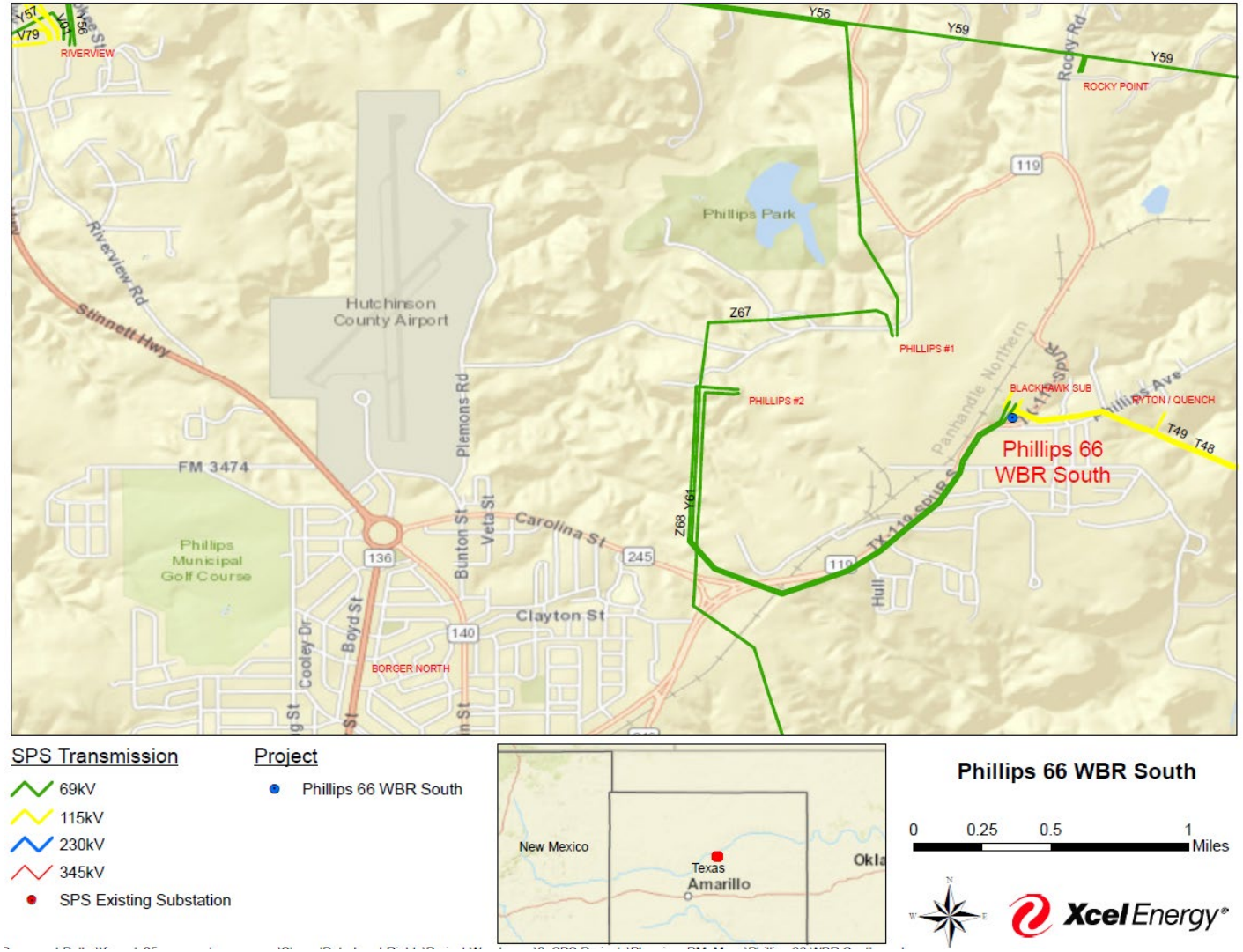
Voltage: 115 kV

ISD: May 2023

NTC: No

Description: New Customer Requested Switching Station, T48

Need: Customer Driven/Funded



Echo Substation

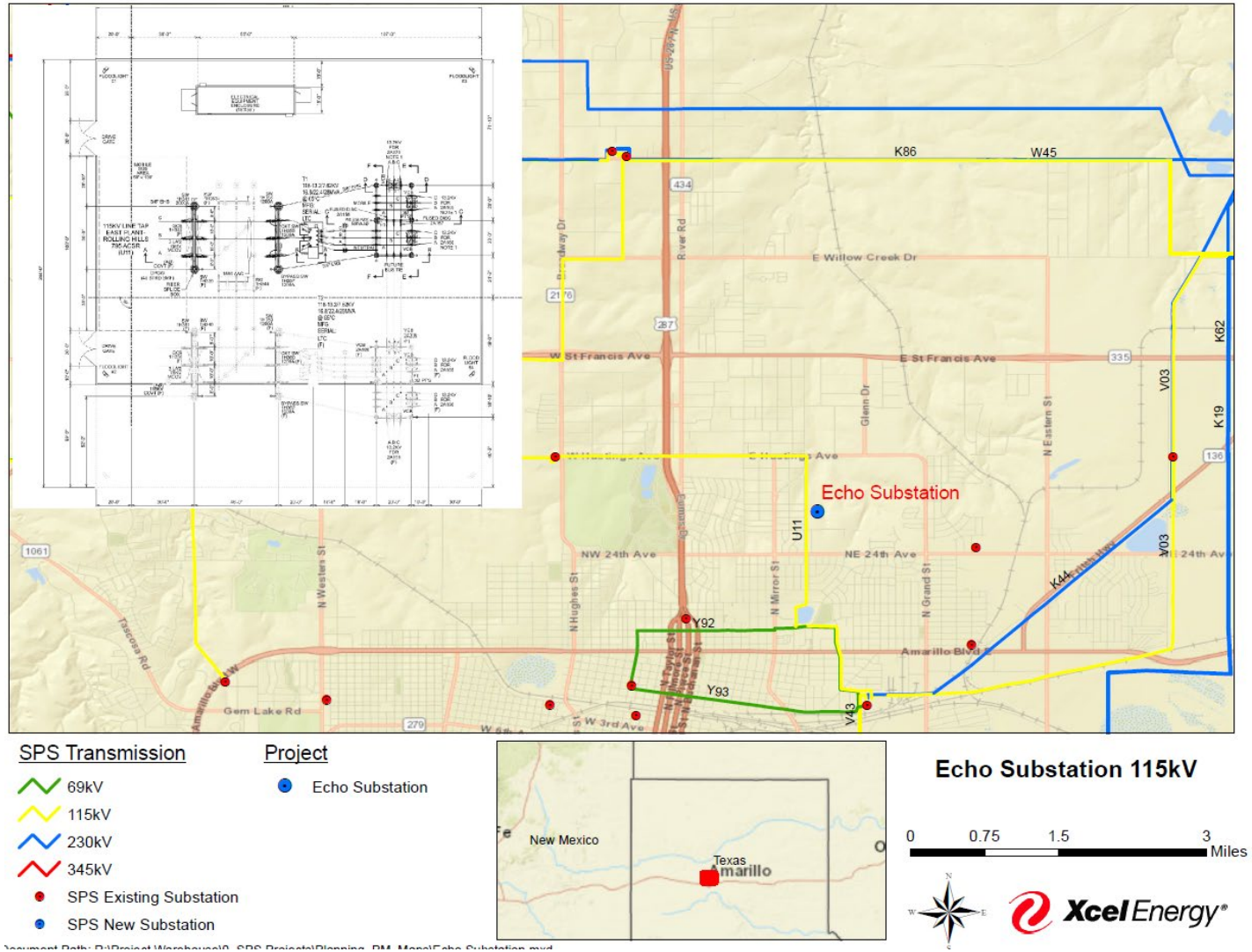
Voltage: 115 kV

ISD: May 2023

NTC: No

Description: U11 Tap, New distribution substation Amarillo, TX

Need: Distribution Driven/Load Growth



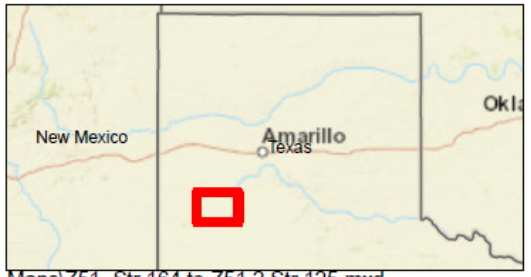
Z51 Hereford South toward Dimmit (Rebuild)

SPS Transmission

- 69kV
- 115kV
- 230kV
- 345kV
- SPS Existing Substation

Project

- Z51 Hereford South to Str 125



Z51Hereford South to Z51.2 Str 125 Wreck Out/Re-Build 69kV

0 3 6 Miles

Document Path: R:\Project Warehouse\0_SPS Projects\Planning_PM_Maps\Z51_Str 164 to Z51.2 Str 125.mxd

Voltage: 69 kV

ISD: varied

- Phase 1: May 2022
- **Phase 2: November 2022**
- **Phase 3: April 2023**
- **Phase 4: December 2023**

NTC: No

Description: Rebuild 69 kV line (~14 miles) from Hereford South to structure #125, north of Dimmit tap

Need: Asset Renewal

Eagle Creek Expansion

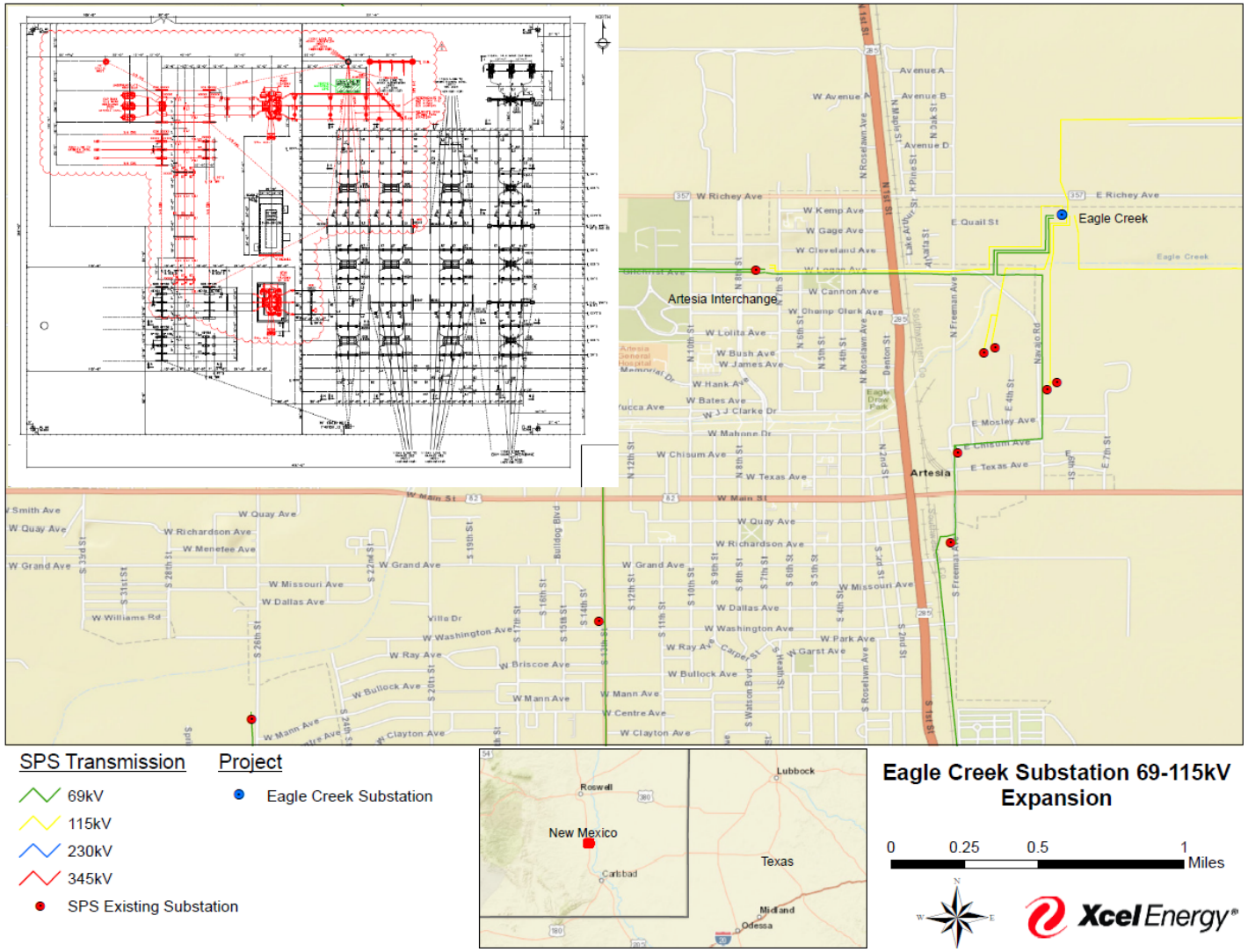
Voltage: 115/69 kV

ISD: July 2023

NTC: No

Description: Expand the existing Eagle Creek substation with a 2nd 115/69 kV TR. Wreck out Artesia Interchange substation

Need: Asset Renewal/ Reliability



Amarillo North Switching Station Retirement

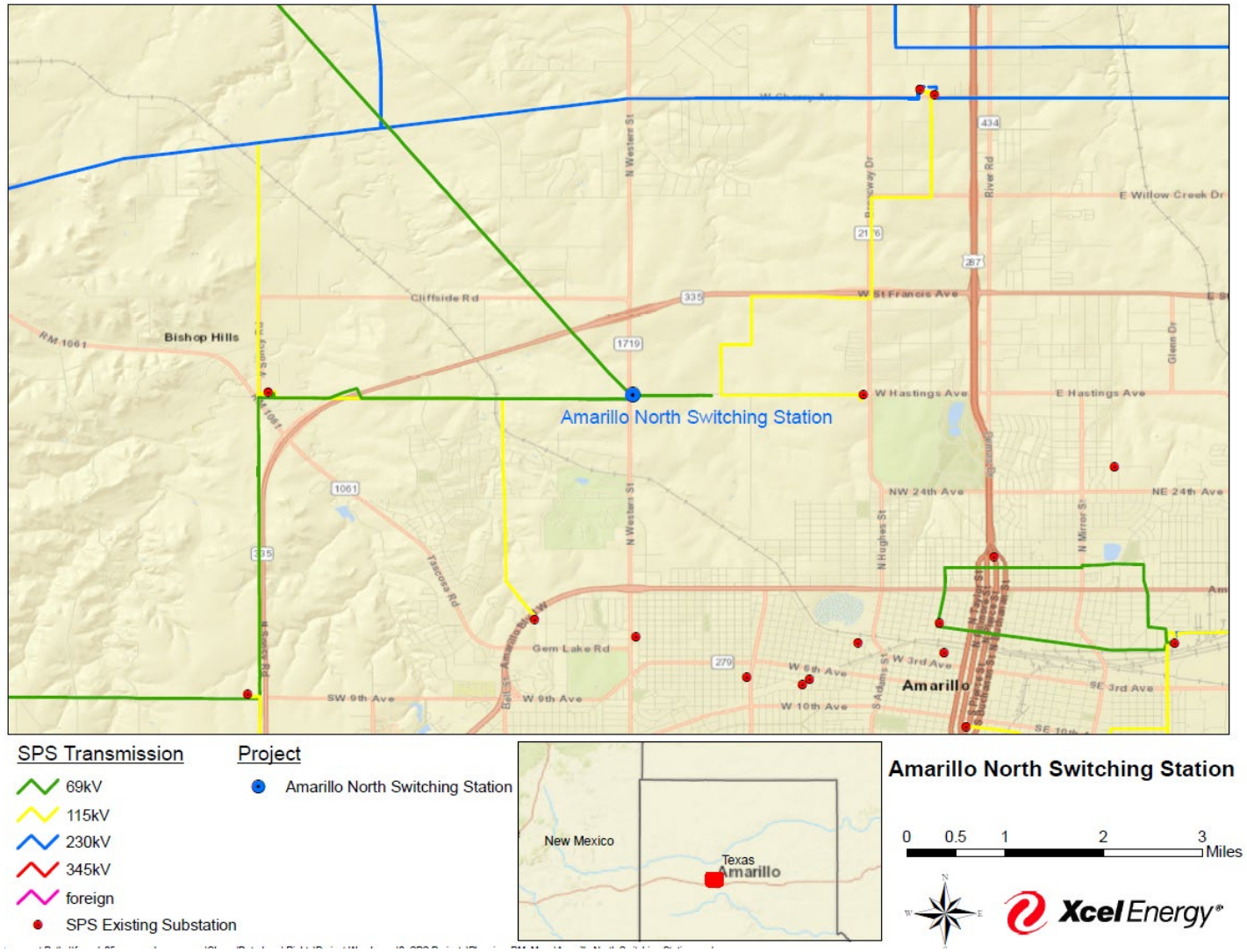
Voltage: 69 kV

ISD: August 2023

NTC: No

Description: In-lieu of breaker replacements, substation was retired.

Need: Reliability



Hilmar Cheese Substation

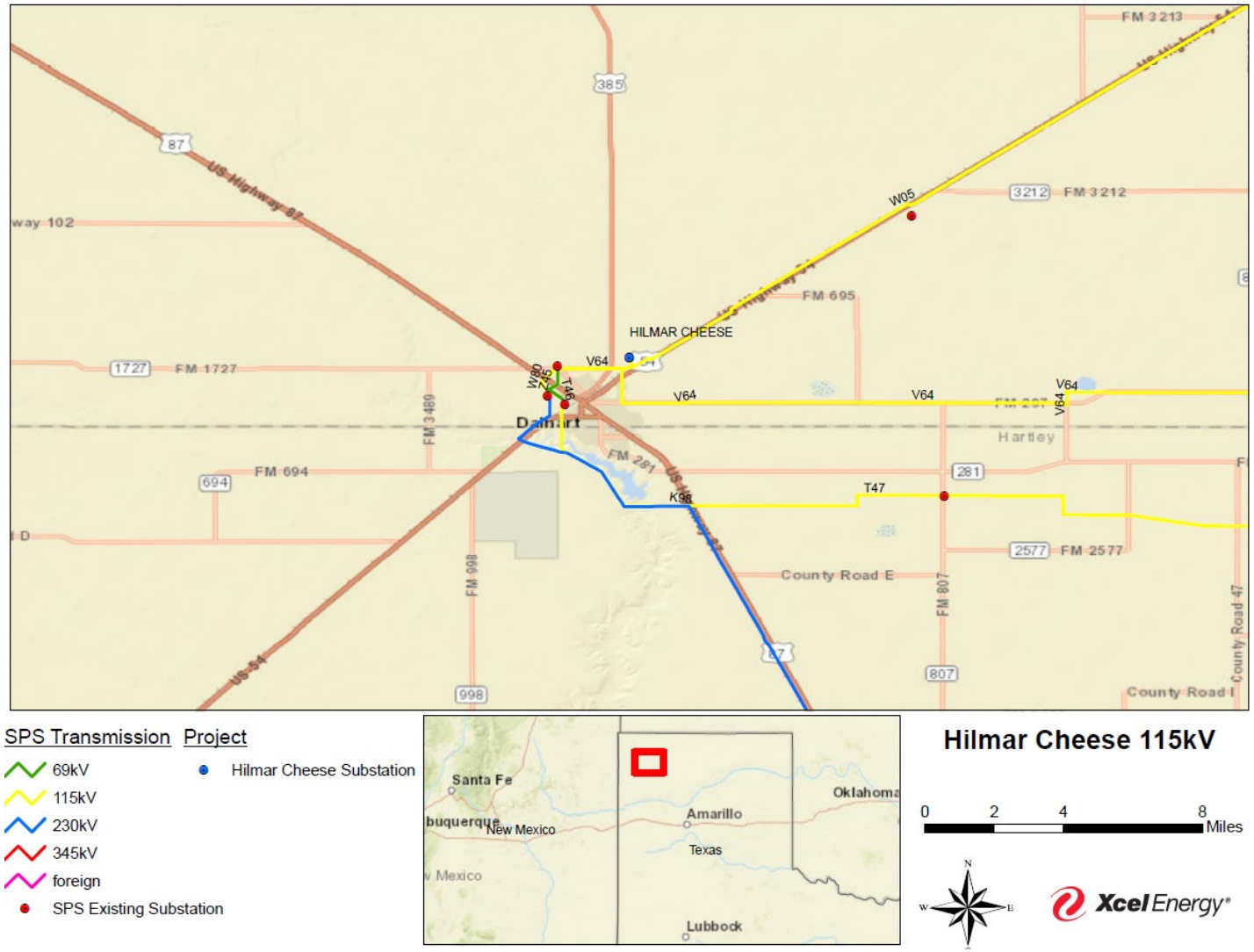
Voltage: 115 kV

ISD: August 2023

NTC: No

Description: V64 115kV Tap

Need: Customer driven request for 2nd tap, Customer Funded



BREAK

15 Minutes

Start Back 11:00AM

FUTURE PLANNED PROJECTS

October 2023 looking forward

Lubbock South Terminal Upgrade, K08

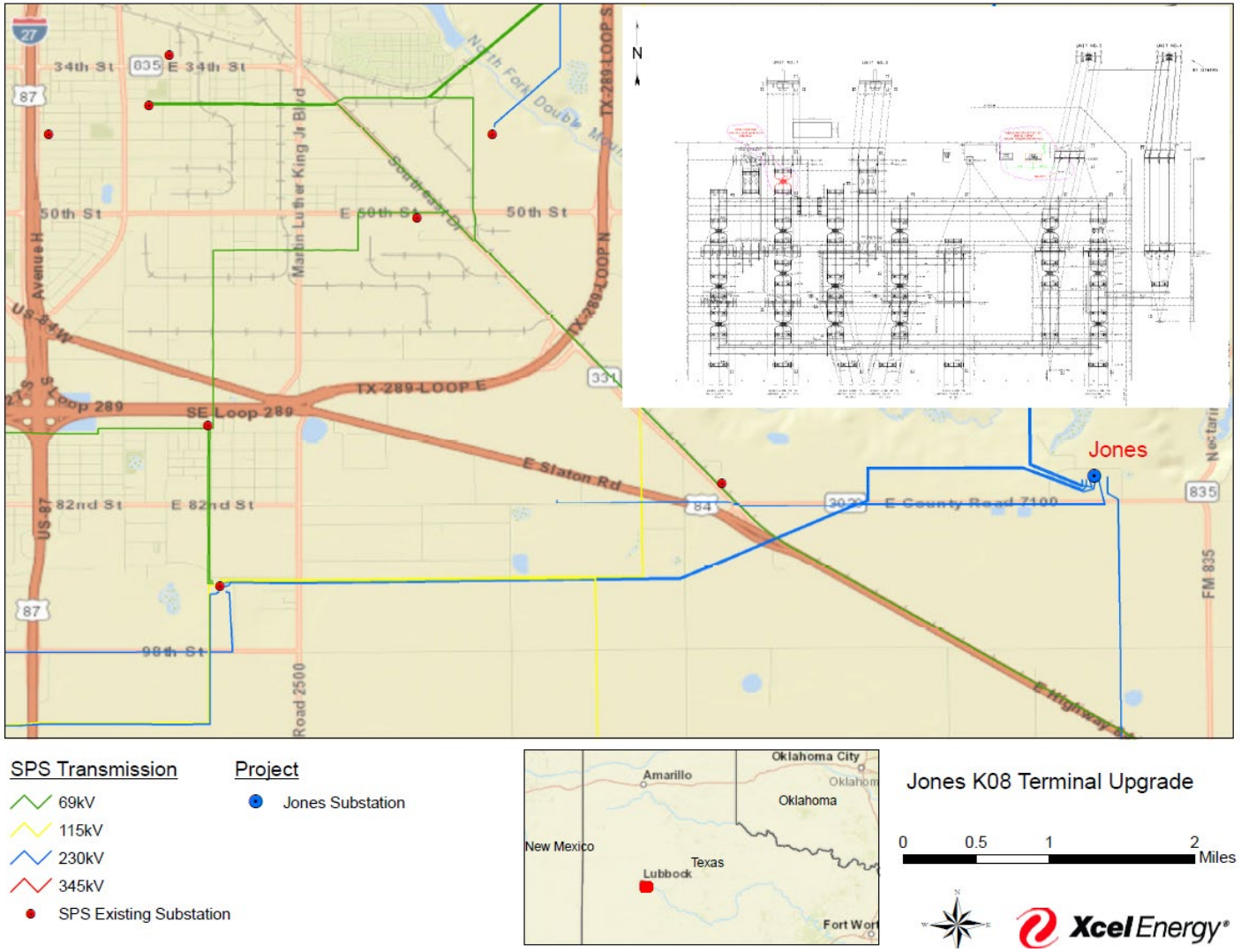
Voltage: 230 kV

ISD: October 2023

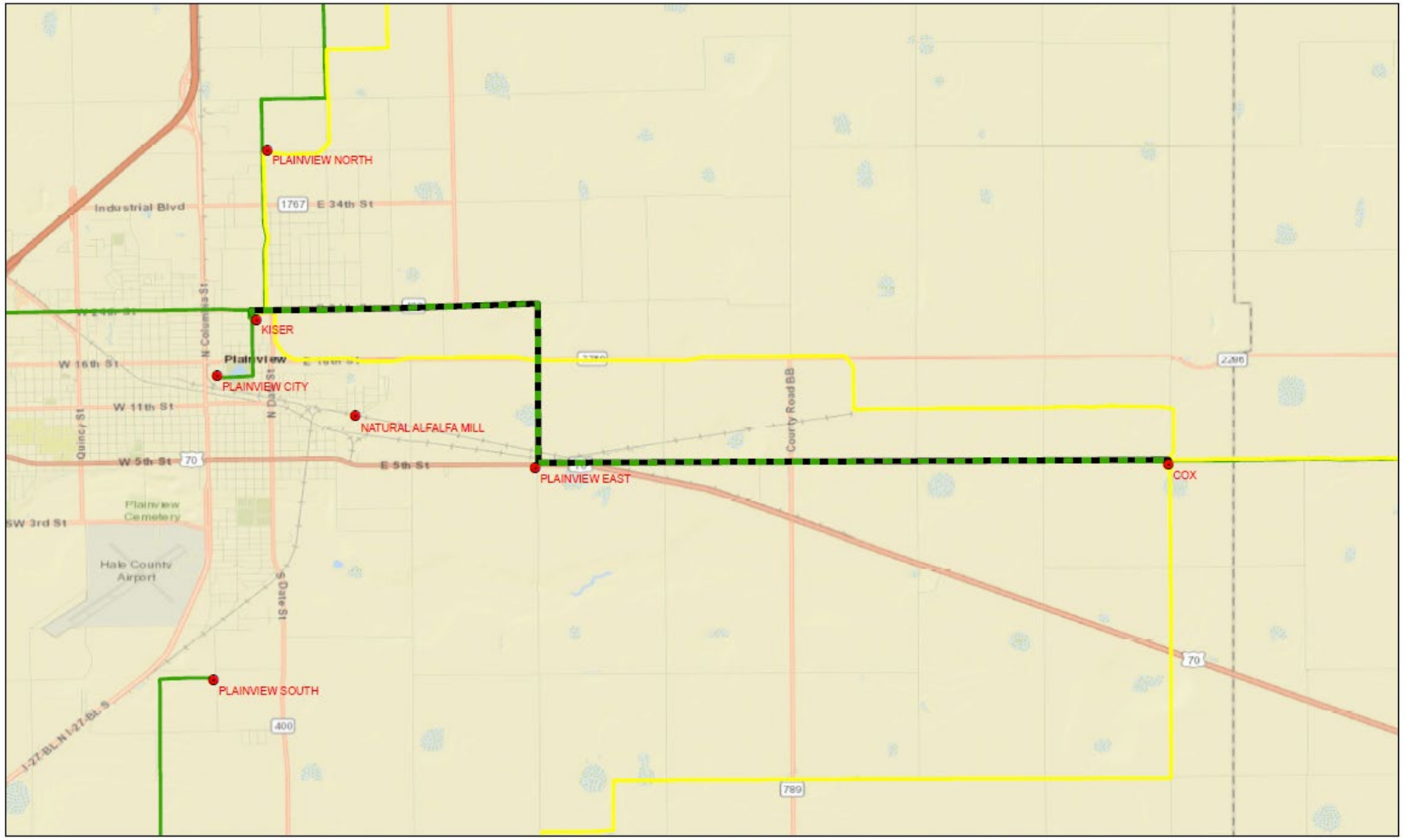
NTC: Yes, 2021 ITP

Description: Upgrade 230kV Breaker 6K00

Need: Reliability
SPP-NTC-210642



Z83 Cox to Kiser (Rebuild)



SPS Transmission

- 69kV
- 115kV
- 230kV
- 345kV
- SPS Existing Substation

Project

- Z83 Kiser to Cox 69kV

Z83 Line Rebuild 69kV
Kiser to Cox

0 1.25 2.5 Miles

Xcel Energy®

Voltage: 69 kV

ISD: October 2023

NTC: No

Description: Rebuild 69 kV line (~ 9 miles)

Need: Asset Renewal

Arnot Substation

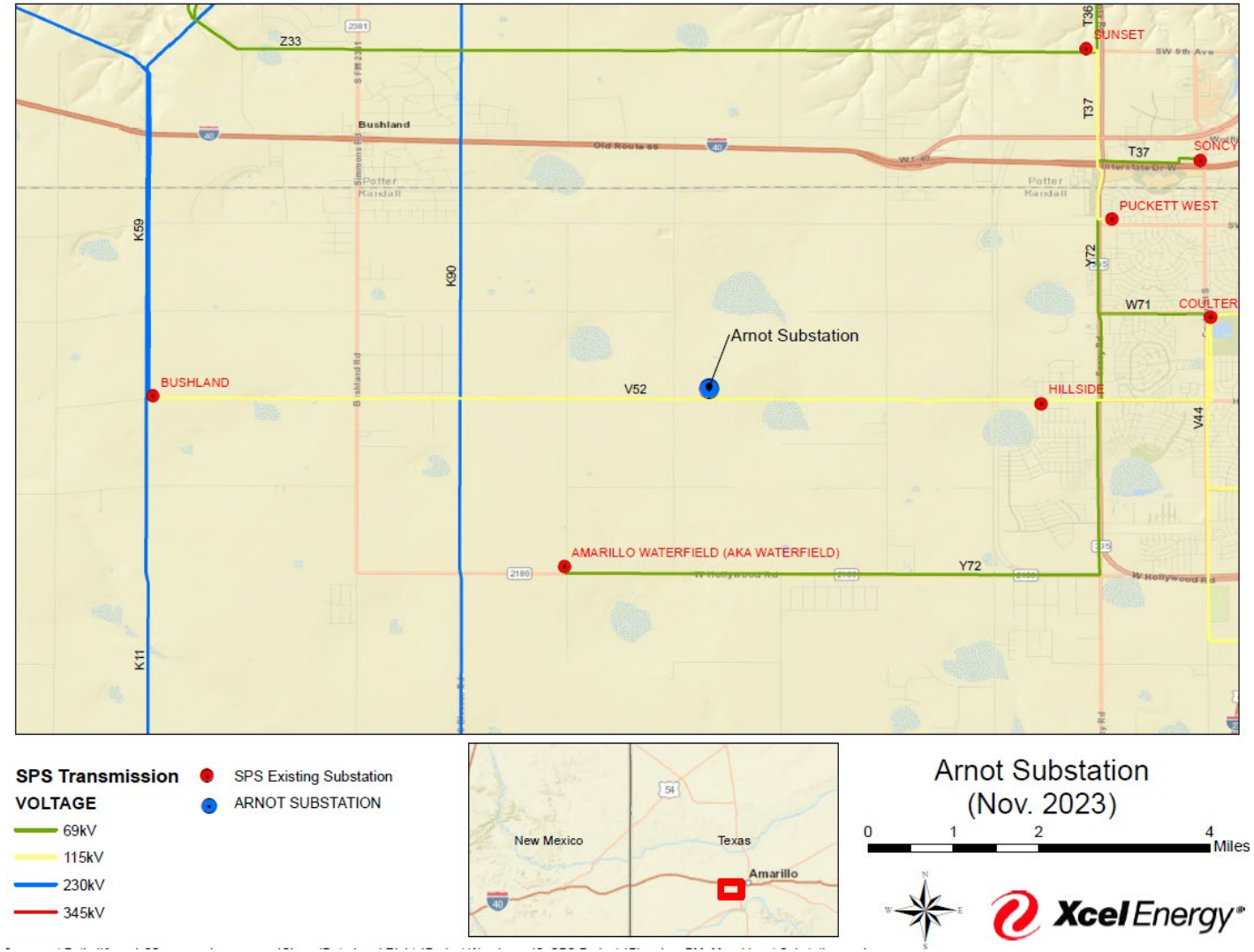
Voltage: 69 kV

ISD: November 2023

NTC: No

Description: 115kV distribution substation west of Amarillo, TX

Need: Distribution Driven/Load Growth



Z62/Z51 Phase 4

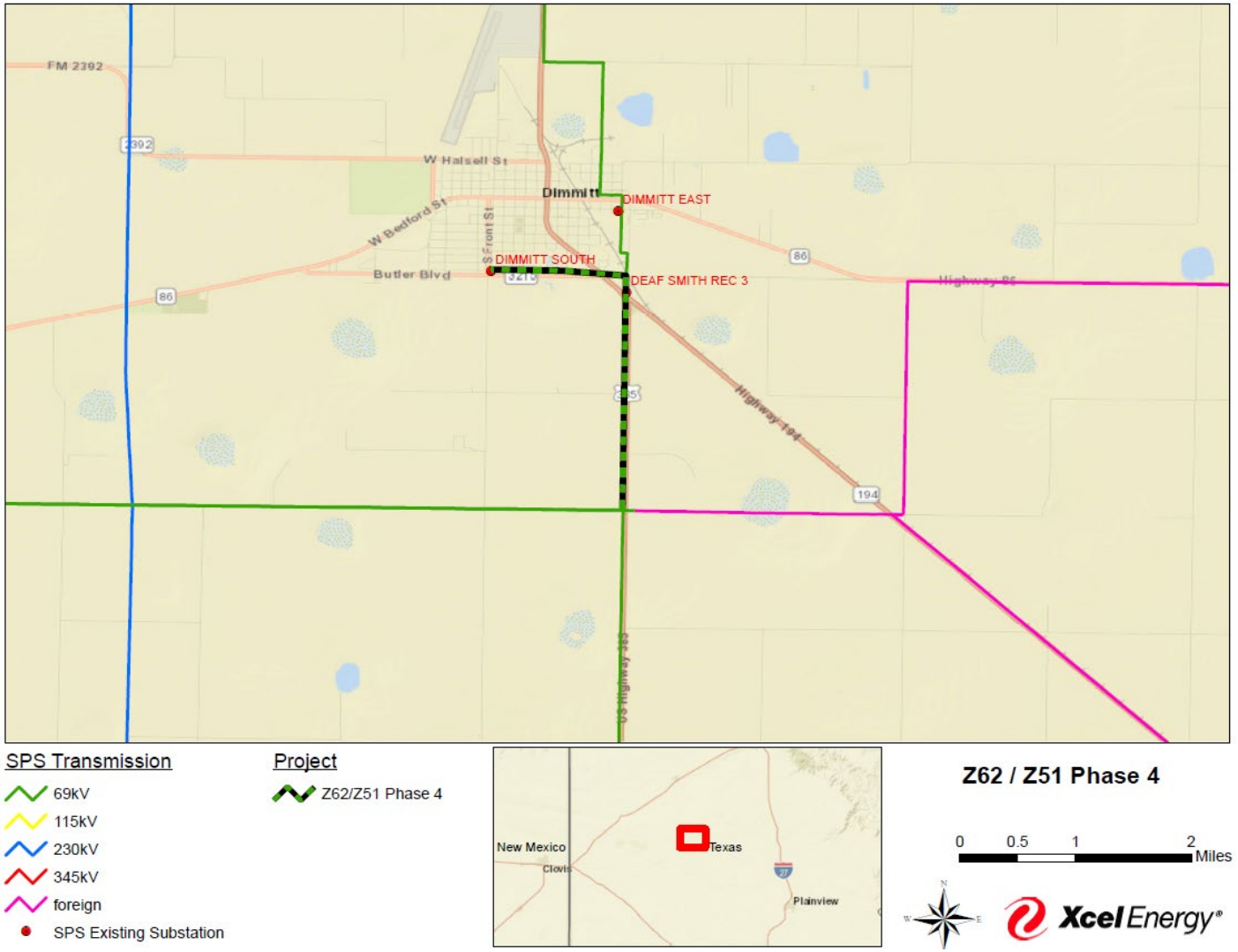
Voltage: 69 kV

ISD: December 2023

NTC: No

Description: Double circuit rebuild

Need: Asset Renewal/Reliability



Ashby Substation

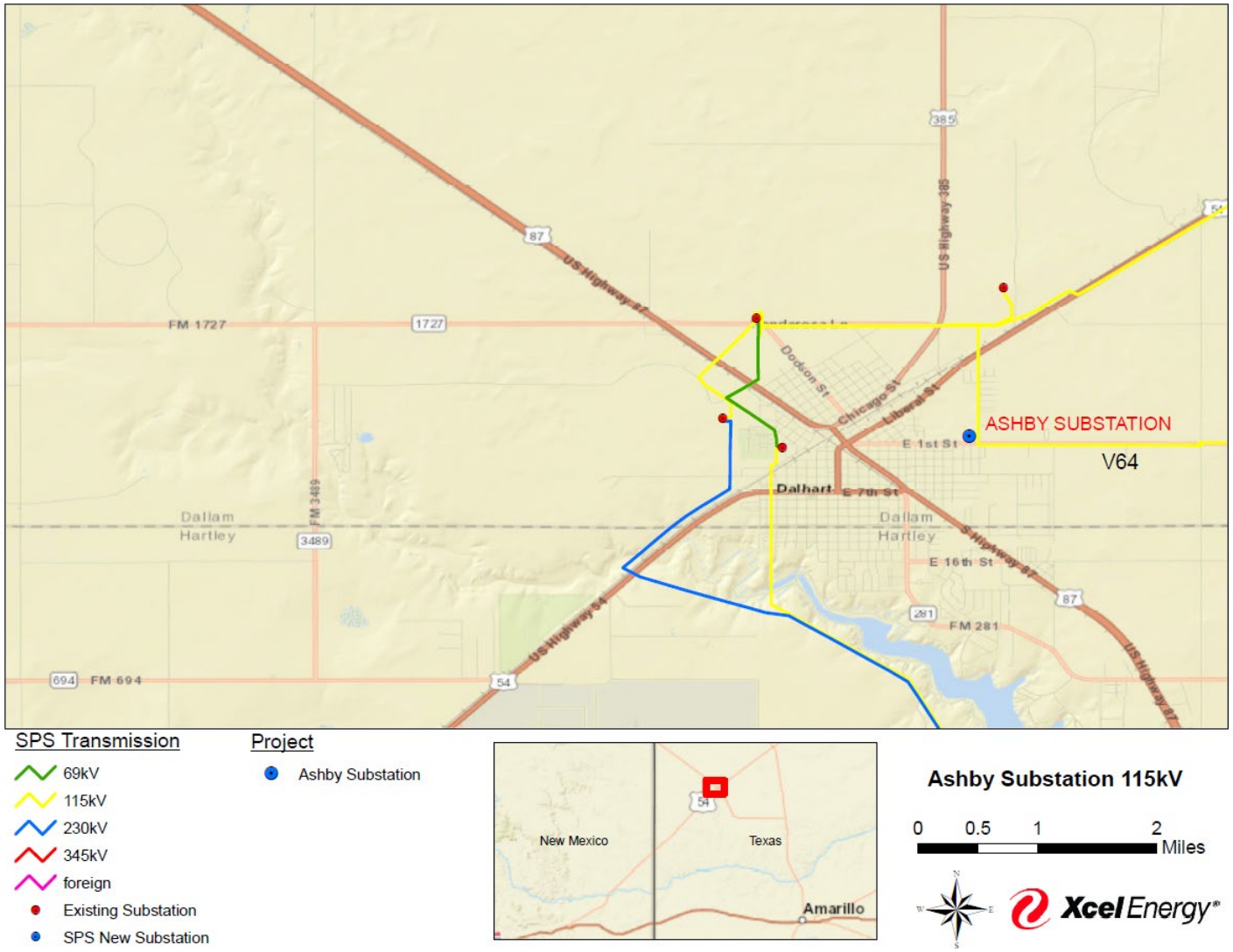
Voltage: 115 kV

ISD: December 2023

NTC: No

Description: V64 Tap, New distribution substation Dalhart, TX

Need: Distribution Driven/Load Growth



Z60 Line Rebuild

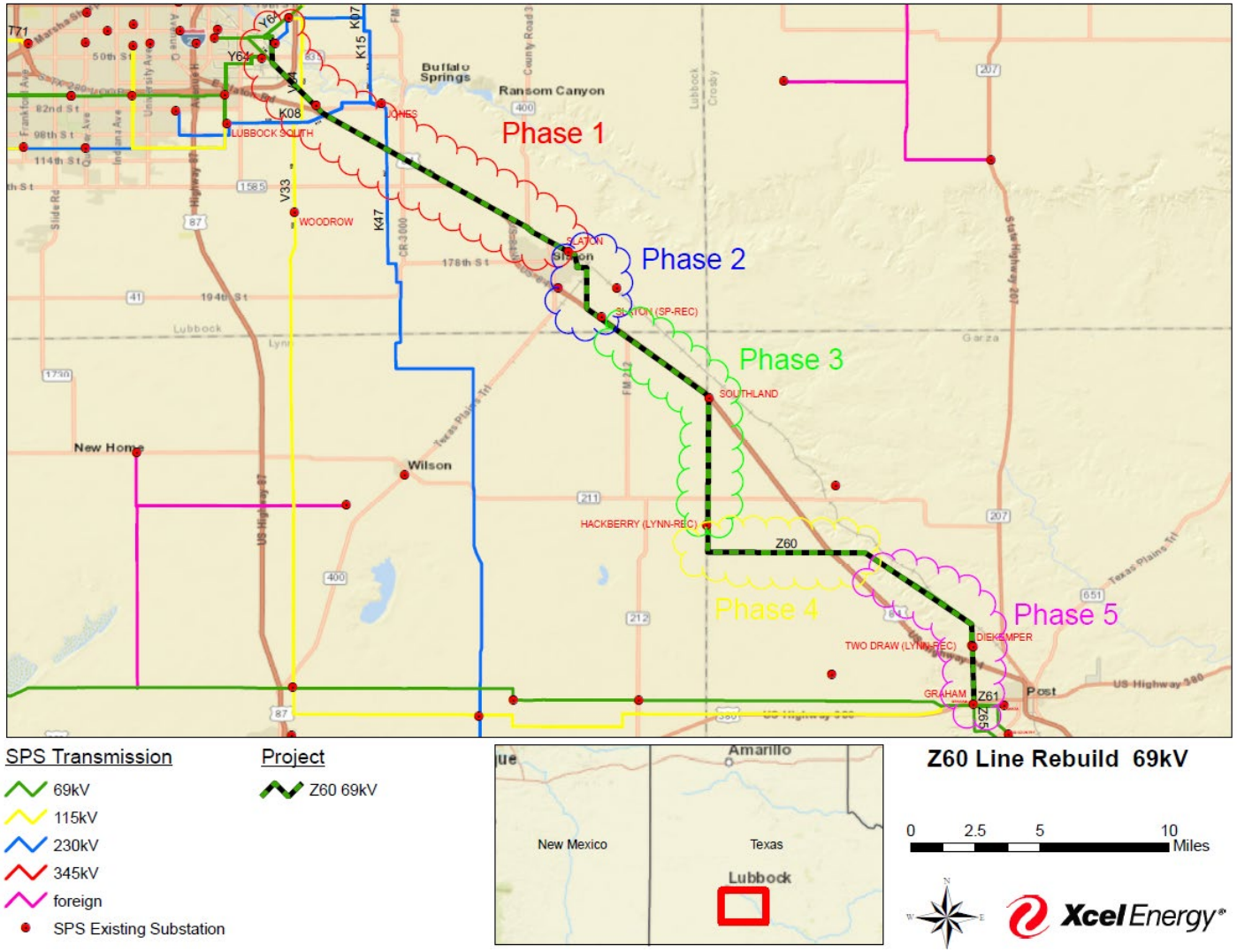
Voltage: 69 kV

ISD: Phase 1: Dec 2025
Phase 2: May 2025
Phase 3: Dec 2024
Phase 4: May 2024
Phase 5: Dec 2023

NTC: No

Description: Built in 1960, the line has had several sustained outages. Line in poor condition.

Need: Asset Renewal



DI08 Substation 115kV Tap

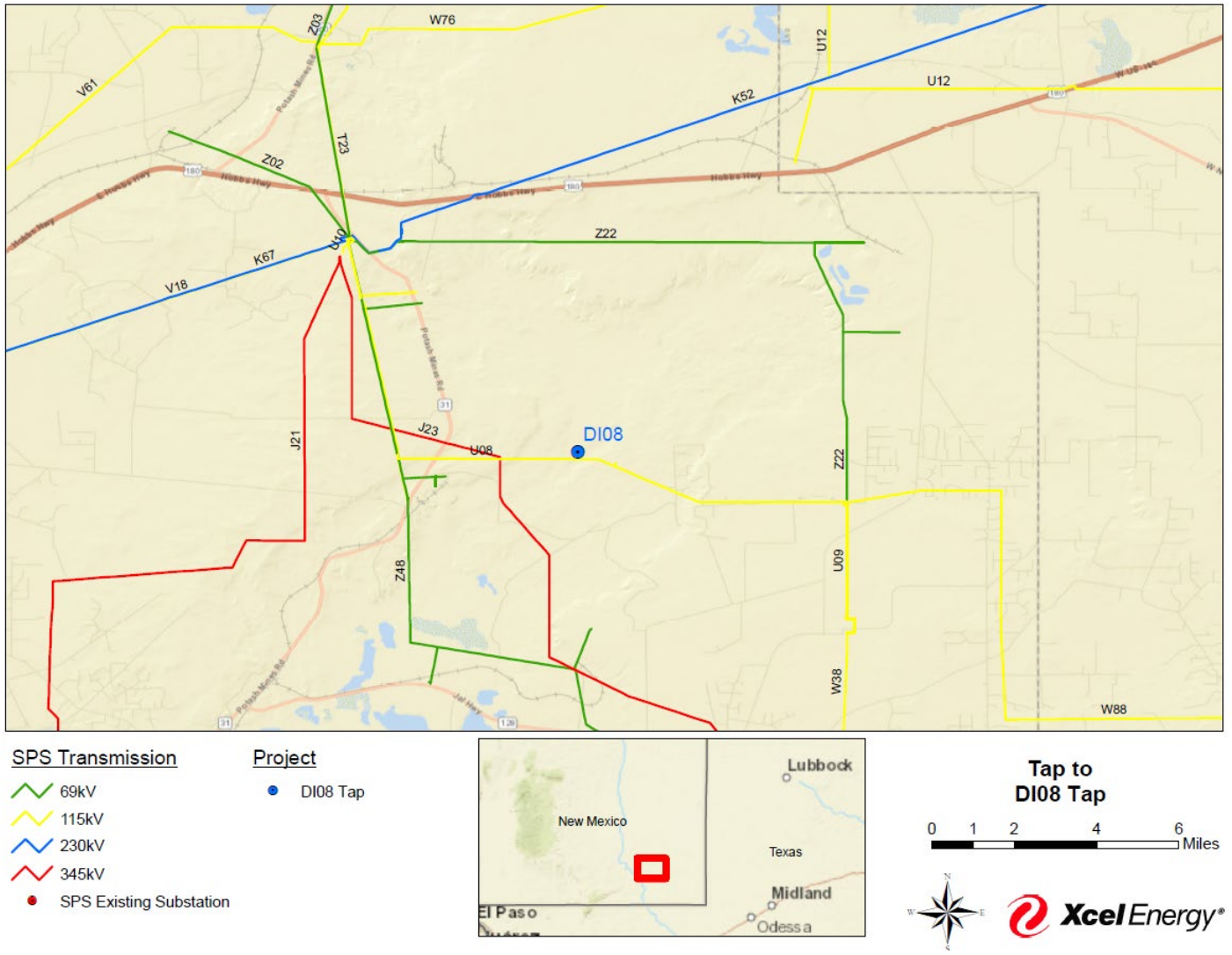
Voltage: 115 kV

ISD: January 2024

NTC: No

Description: Switched Tap on 115kV circuit U08

Need: Load Study



LP&L Removal Projects

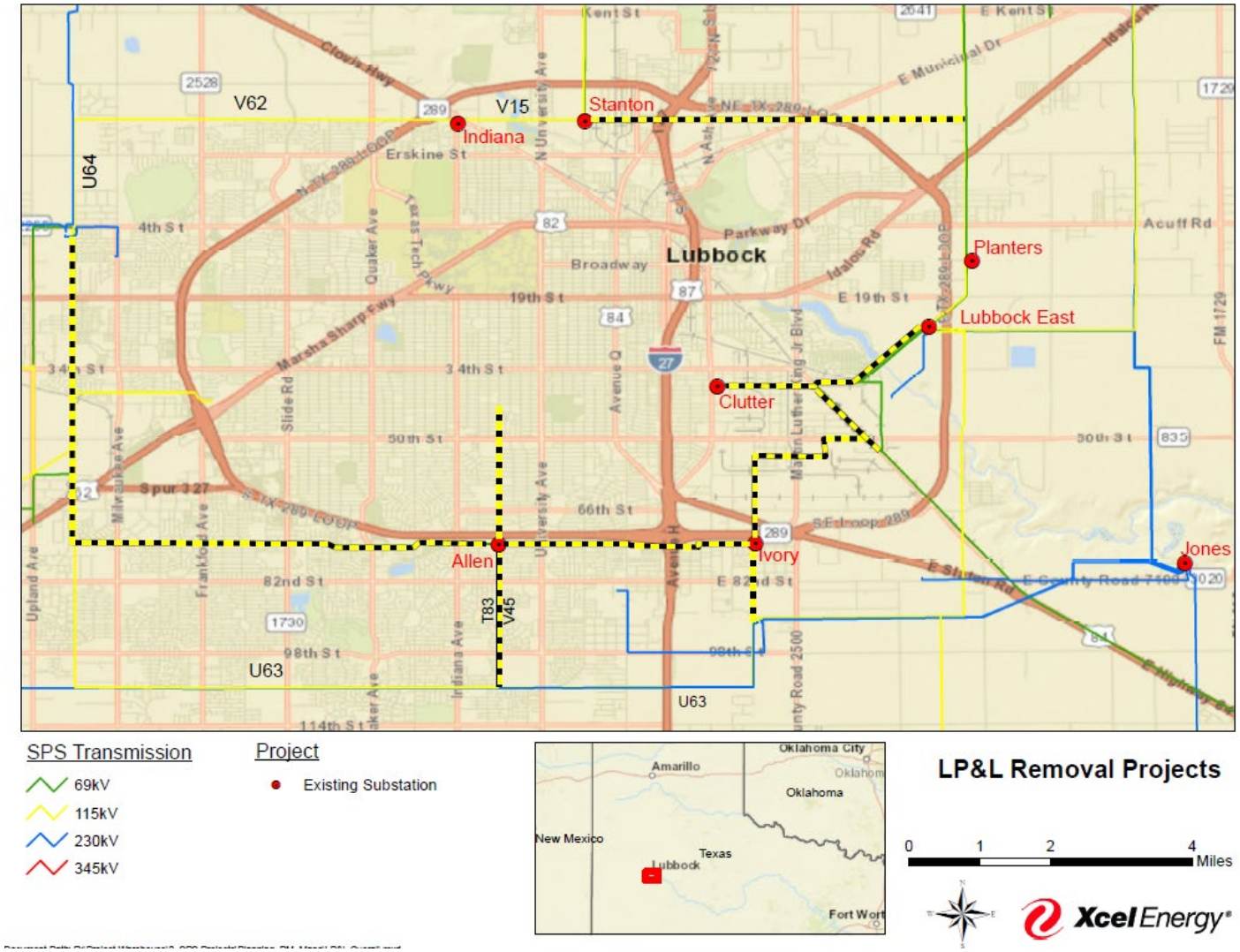
Voltage: 115kV, 69kV

ISD: January 2024

NTC: No

Description: Removals from Southwest Power Pool Region

Need: Lines removed due to Lubbock Power & Light load moving to ERCOT



1st Street Substation 115 kV Tap

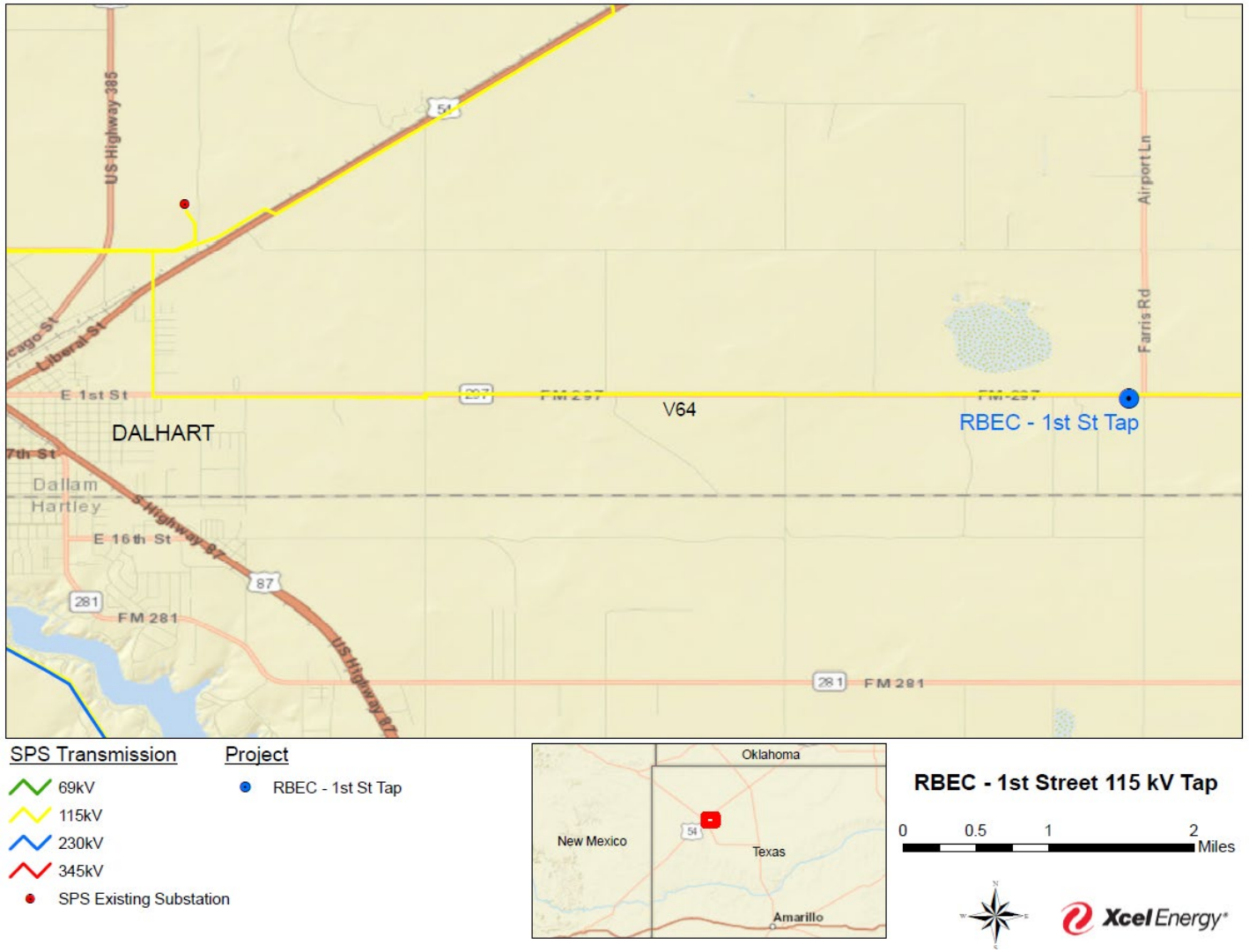
Voltage: 115 kV

ISD: May 2024

NTC: No

Description: New 115kV Tap For Customer Substation, V64

Need: Load Study



Red Bluff Substation Expansion

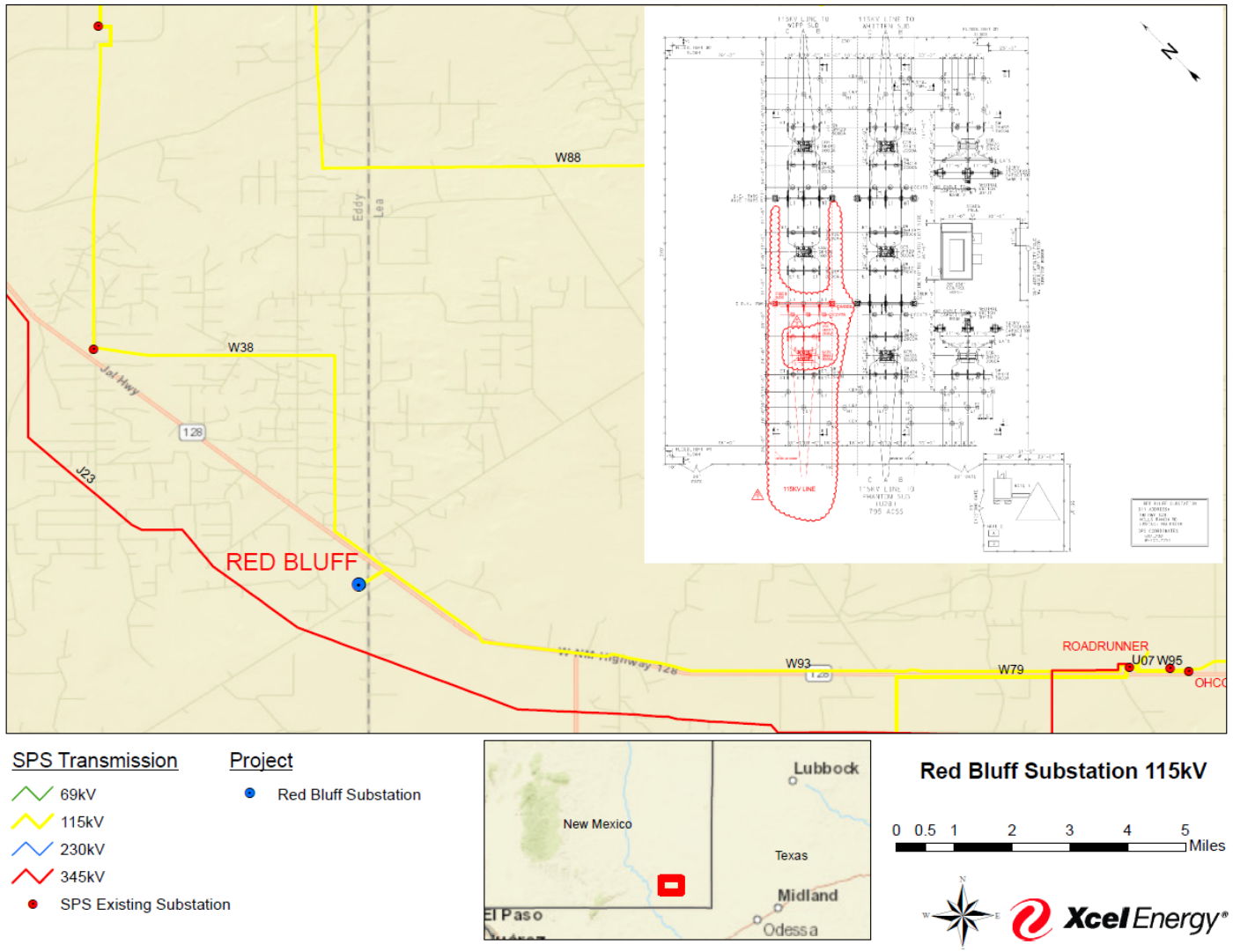
Voltage: 115 kV

ISD: May 2024

NTC: No

Description: Expand substation bus for new 115kV line terminal for customer line

Need: Load Growth



Lubbock South 115 kV Breaker

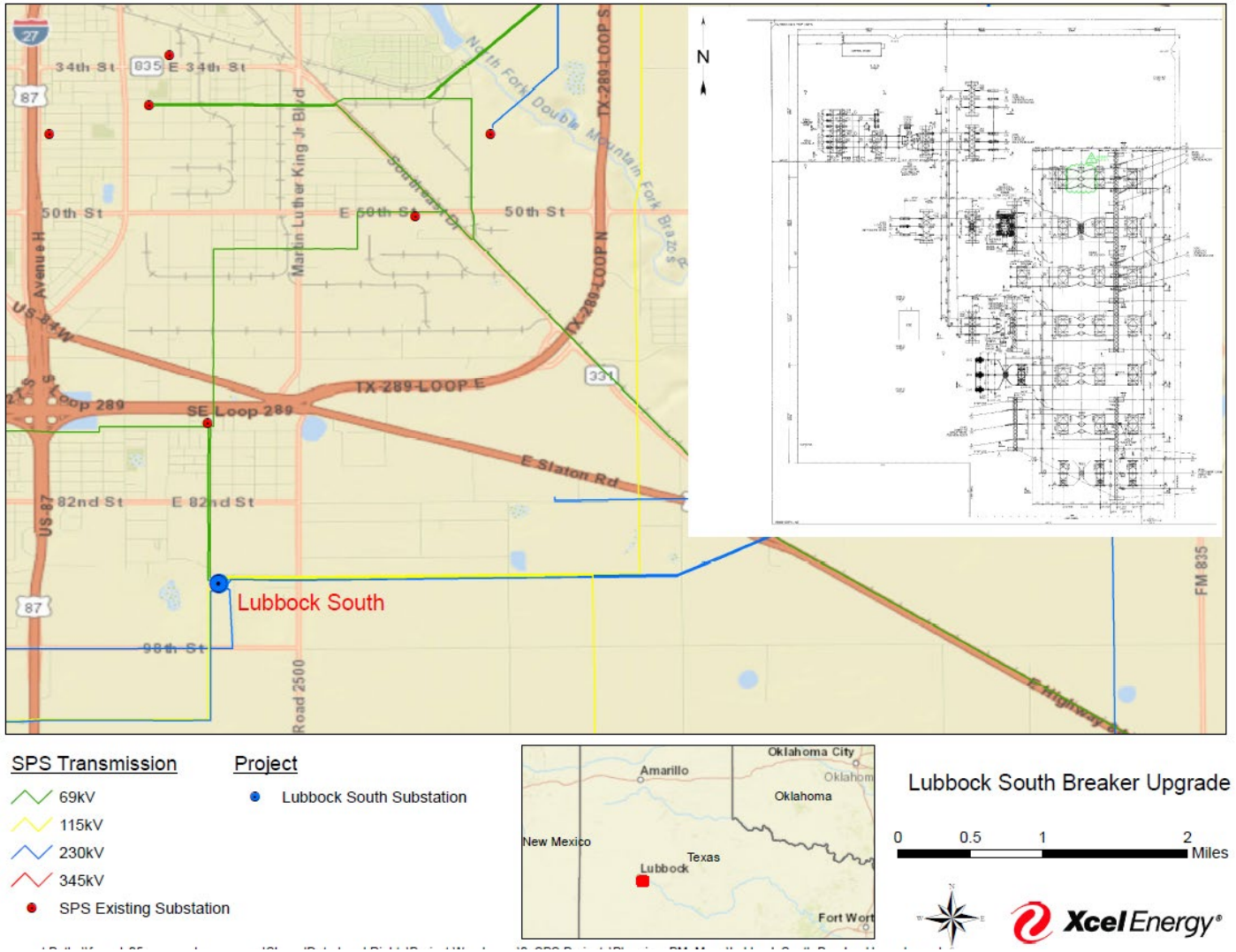
Voltage: 115 kV

ISD: December 2024

NTC: Yes, 2022 ITP

Description: Replace 6940 breaker, fault duty exceeded

Need: Reliability
SPP-NTC-210714



Palindrome Sub Tap W88

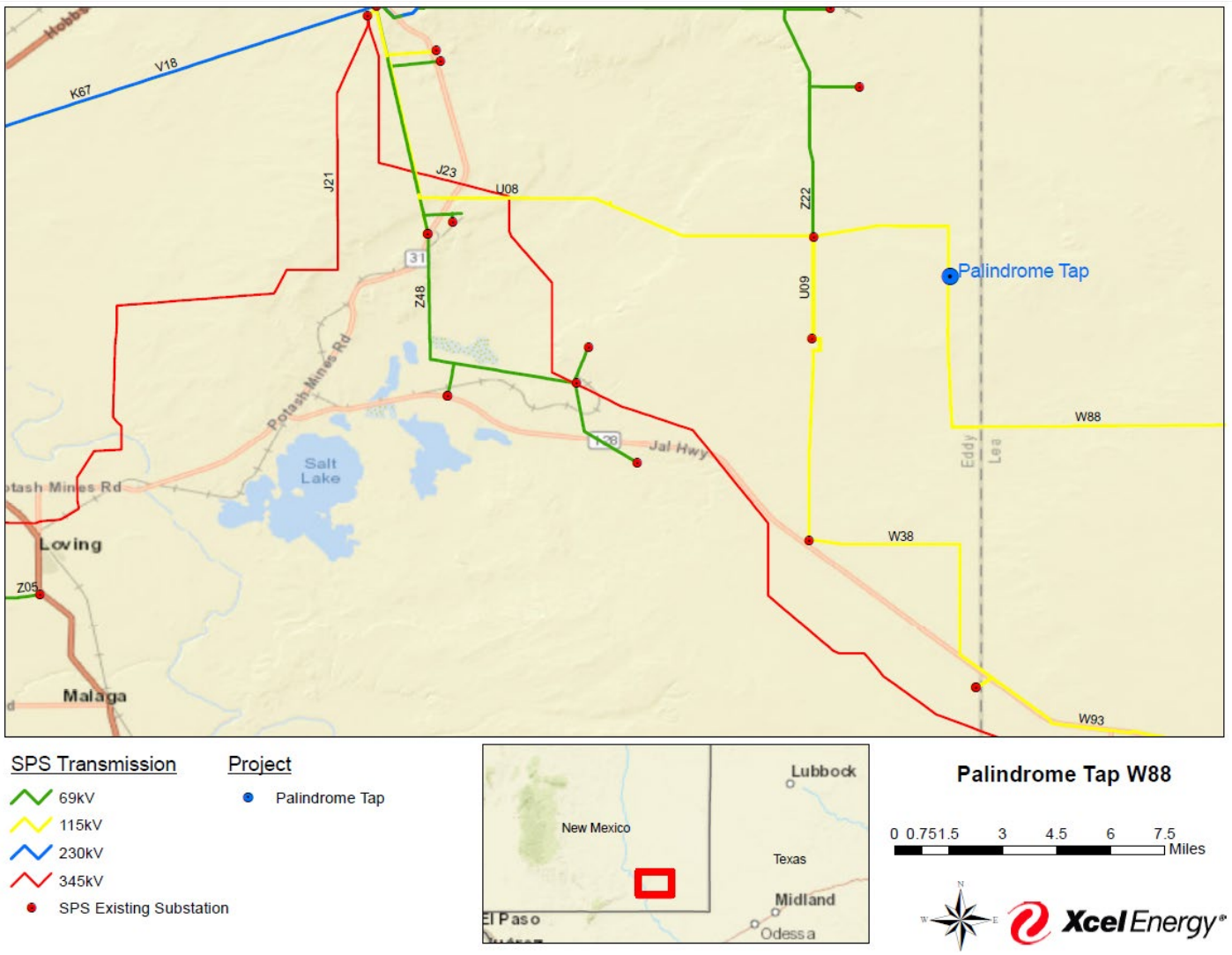
Voltage: 115 kV

ISD: July 2024

NTC: No

Description: New 115kV Tap For Customer Substation, W88

Need: Load Study



Chase Substation

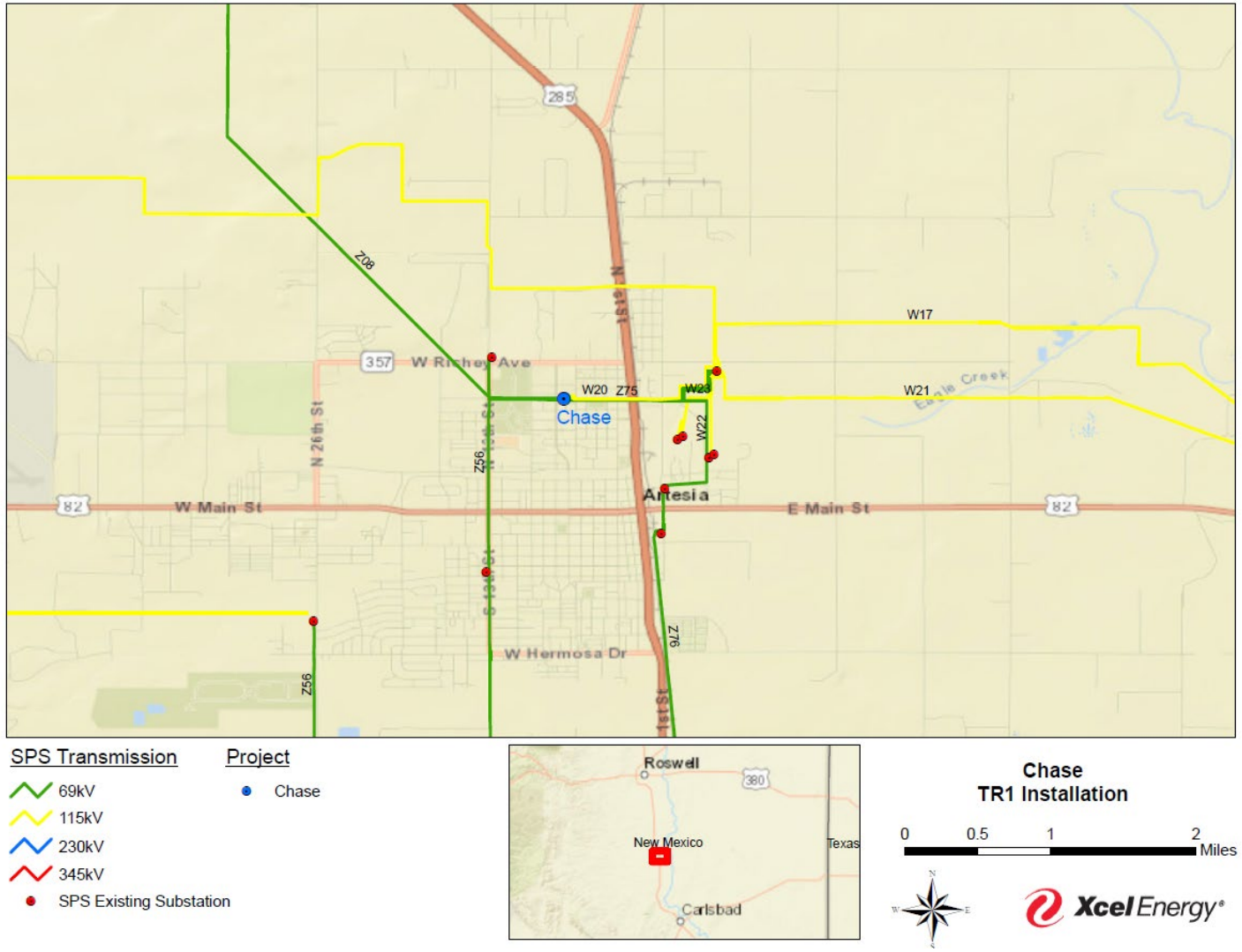
Voltage: 69kV

ISD: November 2024

NTC: No

Description: 69kV Tap, Eagle Creek-Roswell

Need: Distribution Driven



McDowell Creek Substation

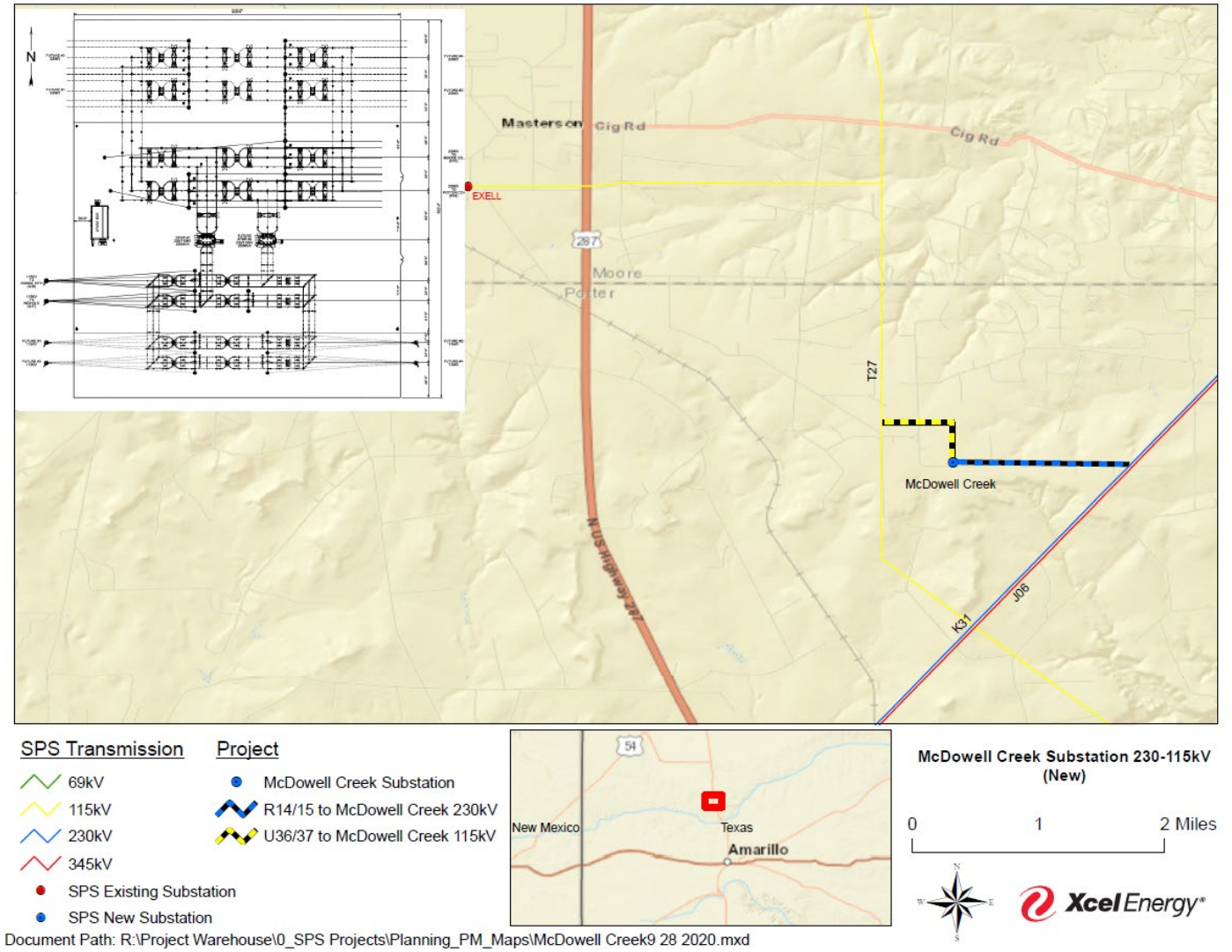
Voltage: 230 kV and 115 kV

ISD: November 2024

NTC: Yes, 2018 ITP

Description: Tap Moore Co – Potter Co 230 kV line and install a 230/115 kV transformer connecting to the 115 kV line from Nichols to Dumas 19th (K31/T27)

Need: Reliability
SPP-NTC-210496



Percy Substation

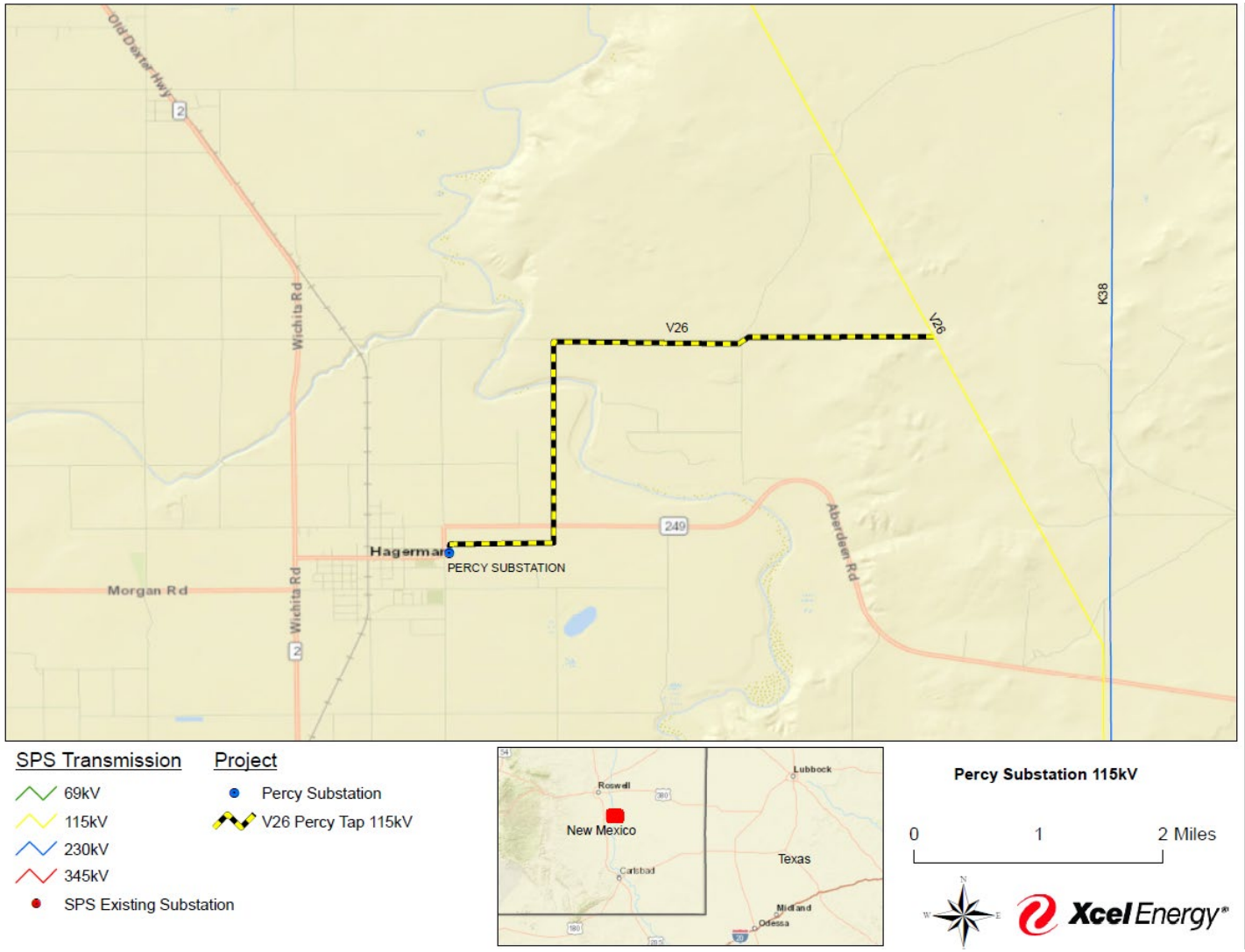
Voltage: 115 kV

ISD: December 2024

NTC: No

Description: 115kV Tap off V26 to new substation

Need: Distribution Driven



Battle Axe Substation

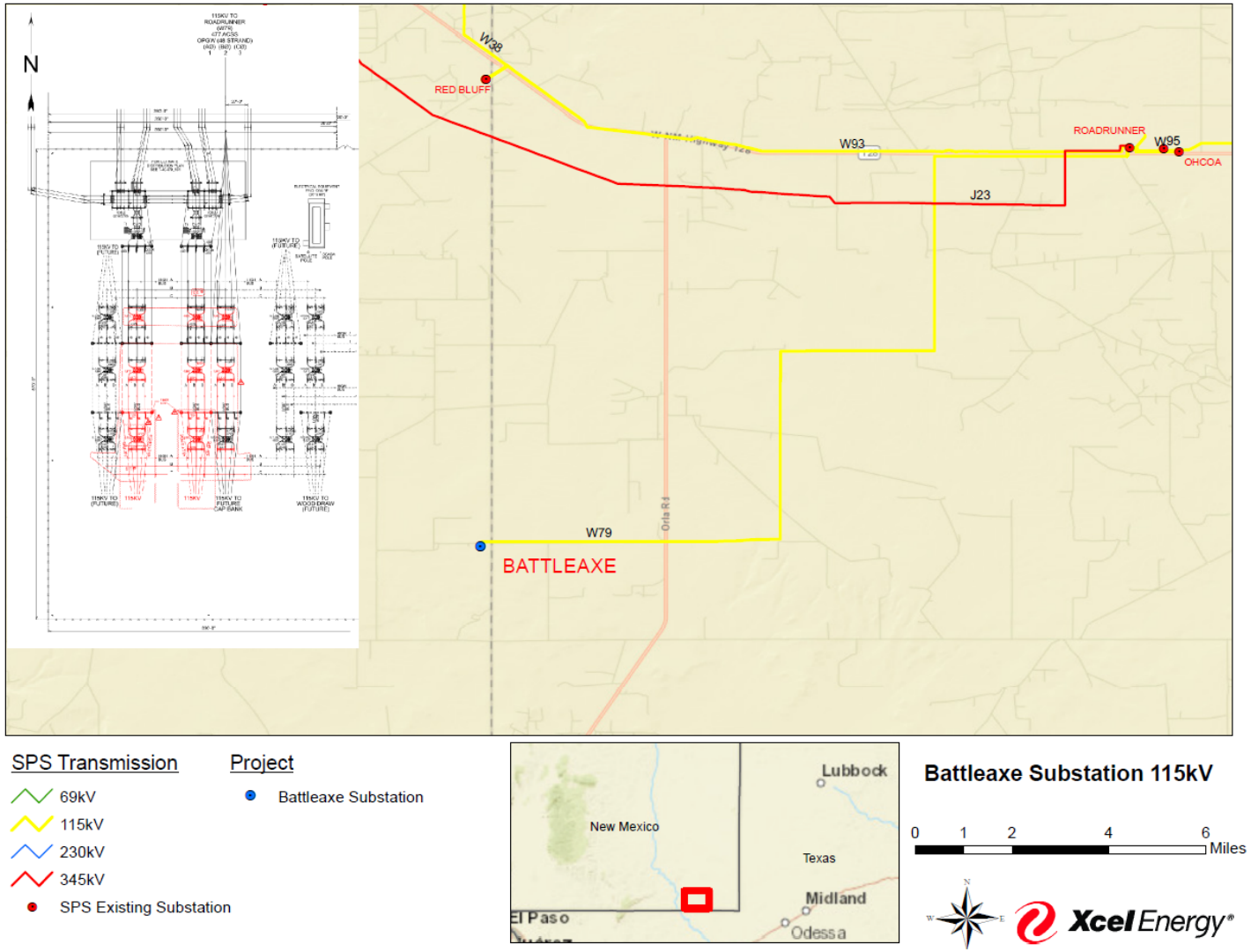
Voltage: 115 kV

ISD: December 2024

NTC: No

Description: Expand substation bus for new 115kV line terminal + Second Distribution Transformer

Need: Load Study addressing load growth



Battle Axe to Zia Hills #1 Substation

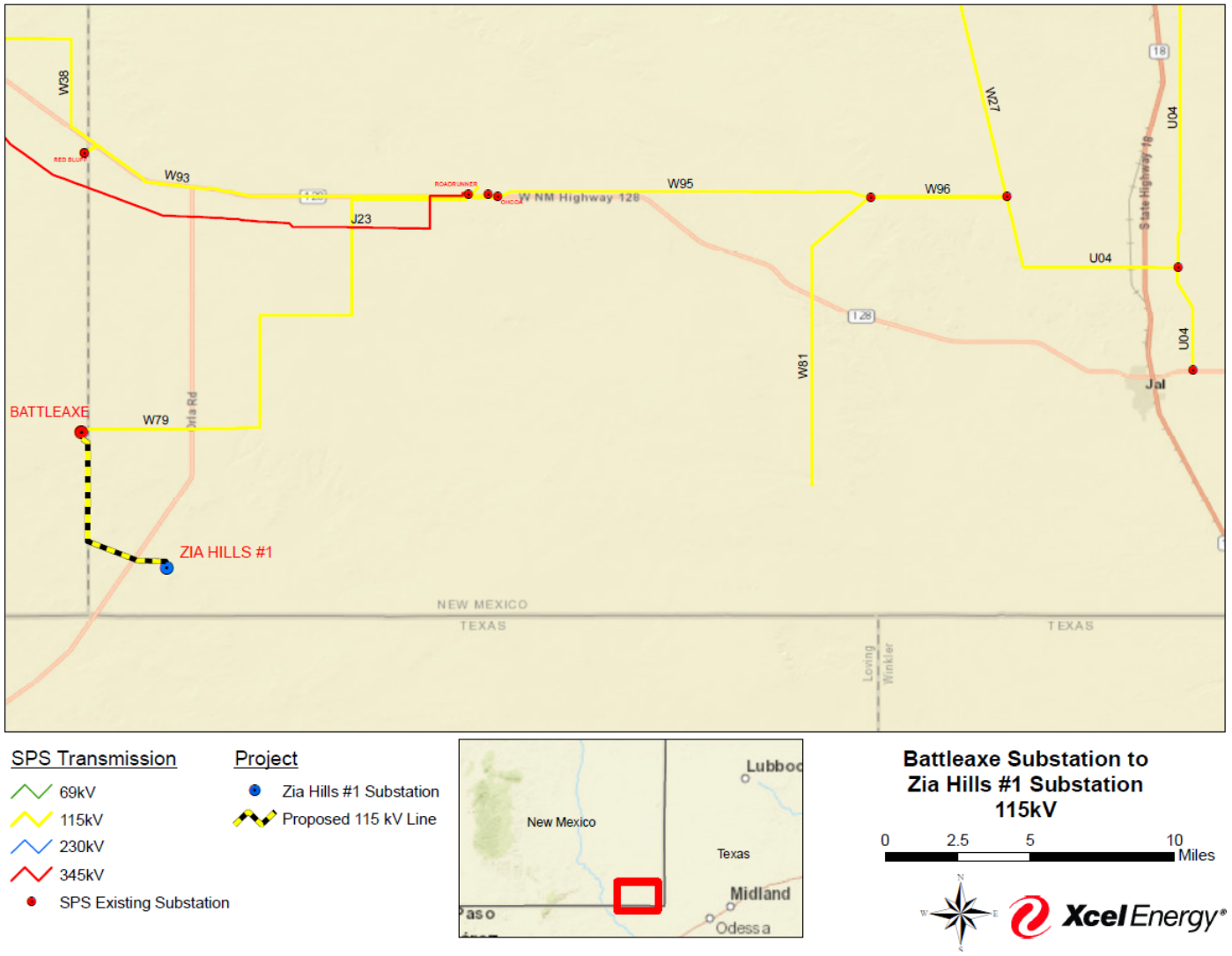
Voltage: 115 kV

ISD: December 2024

NTC: No

Description: New 115kV line to customer owned substation

Need: Load Growth, Customer Funded Line



Crossroads-Hobbs-Roadrunner Line Terminations

Voltage: 345 kV

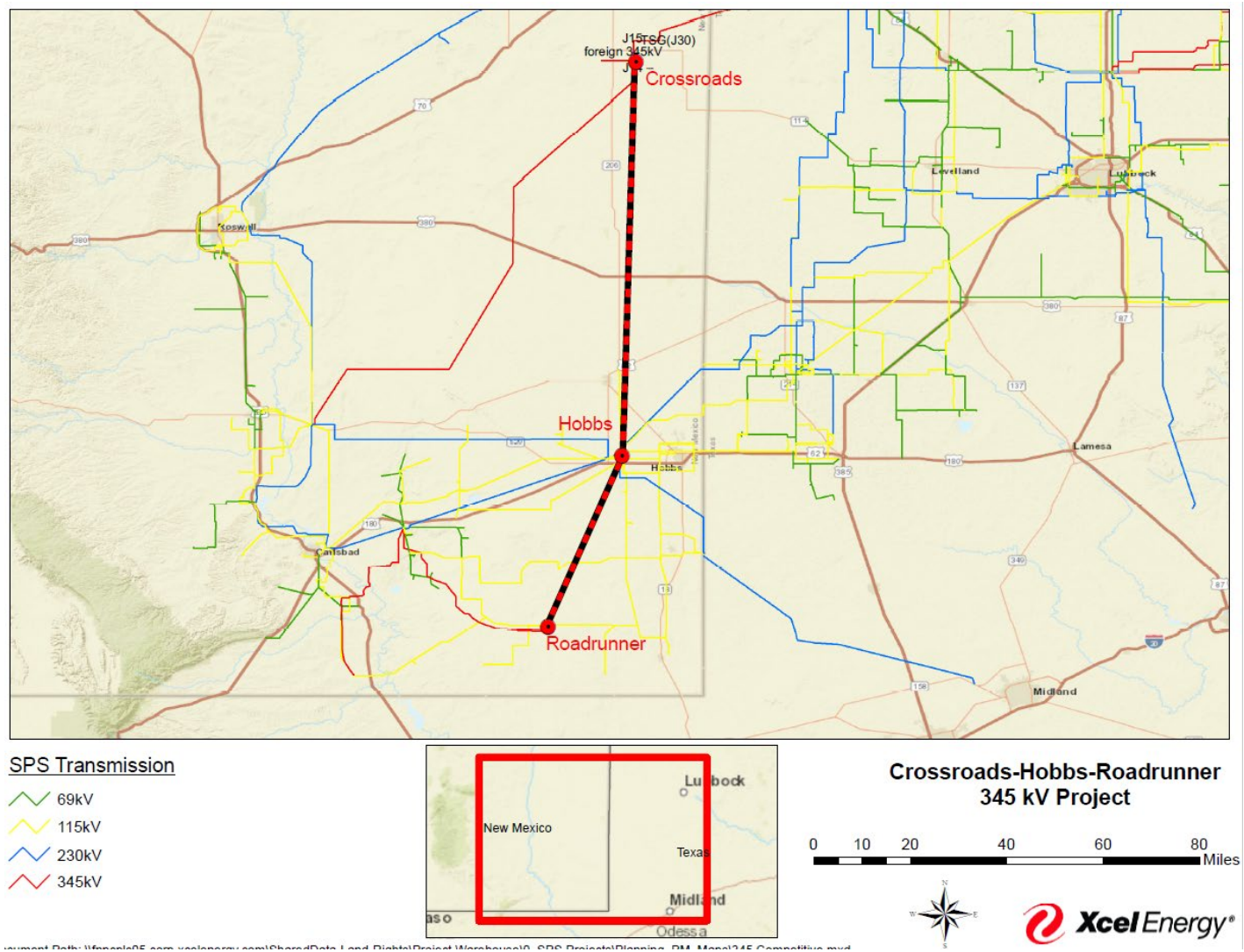
ISD: May 2025

NTC: Yes, 2021 ITP

Description: New 345kV substation expansions for line terminations for double circuit 345kV competitive Project

Need: Reliability

SPP-NTC-210681



Wolverine Substation

Voltage: 115 kV

ISD: May 2025

NTC:

Description: New Substation115kV Tap Circuit T28

Need: Distribution Driven/Load Growth

Jackrabbit Substation

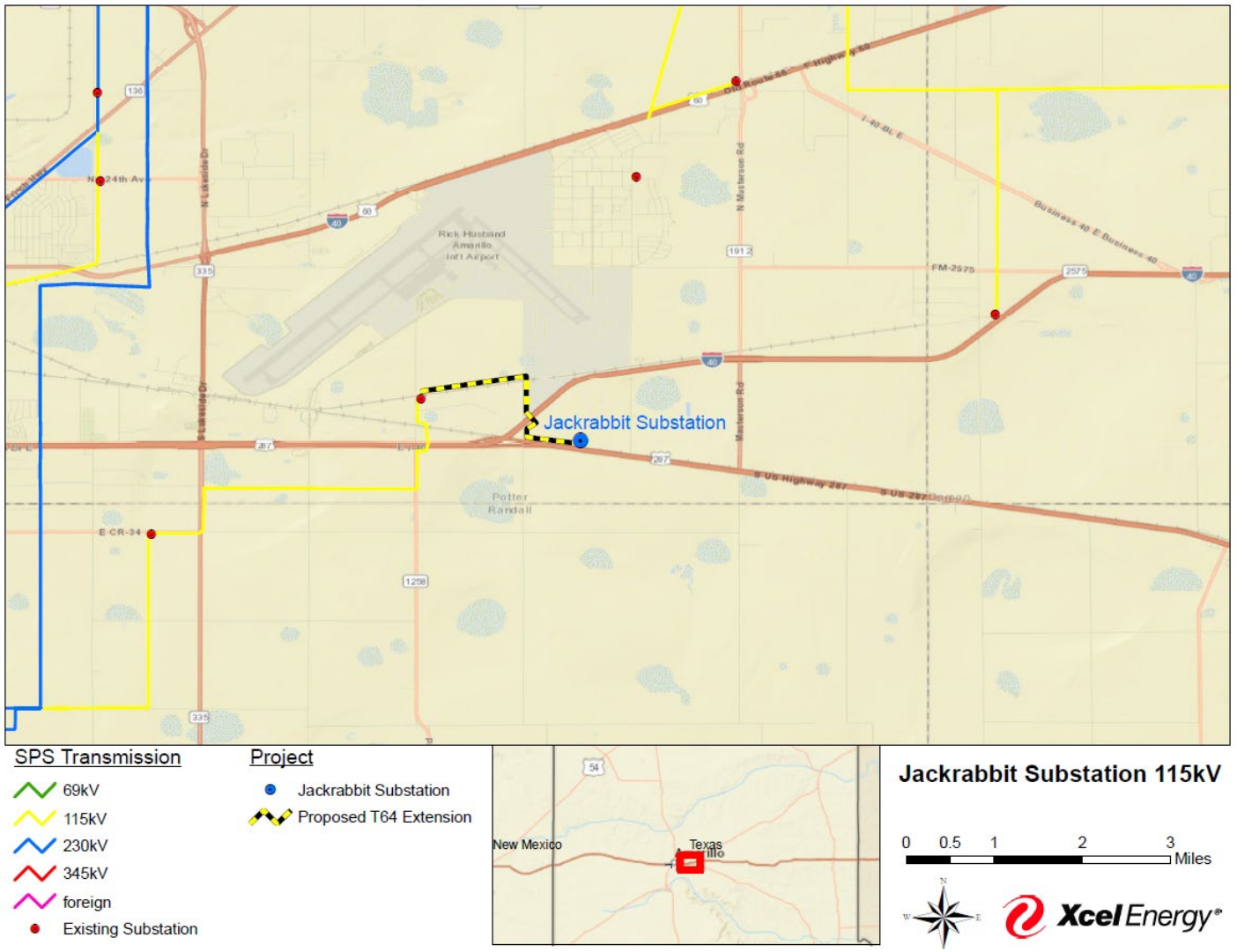
Voltage: 115 kV

ISD: May 2025

NTC: No

Description: Extend 115kV Circuit T64 to new Substation

Need: Distribution Driven/Load Growth



Lubbock South - Allen V45

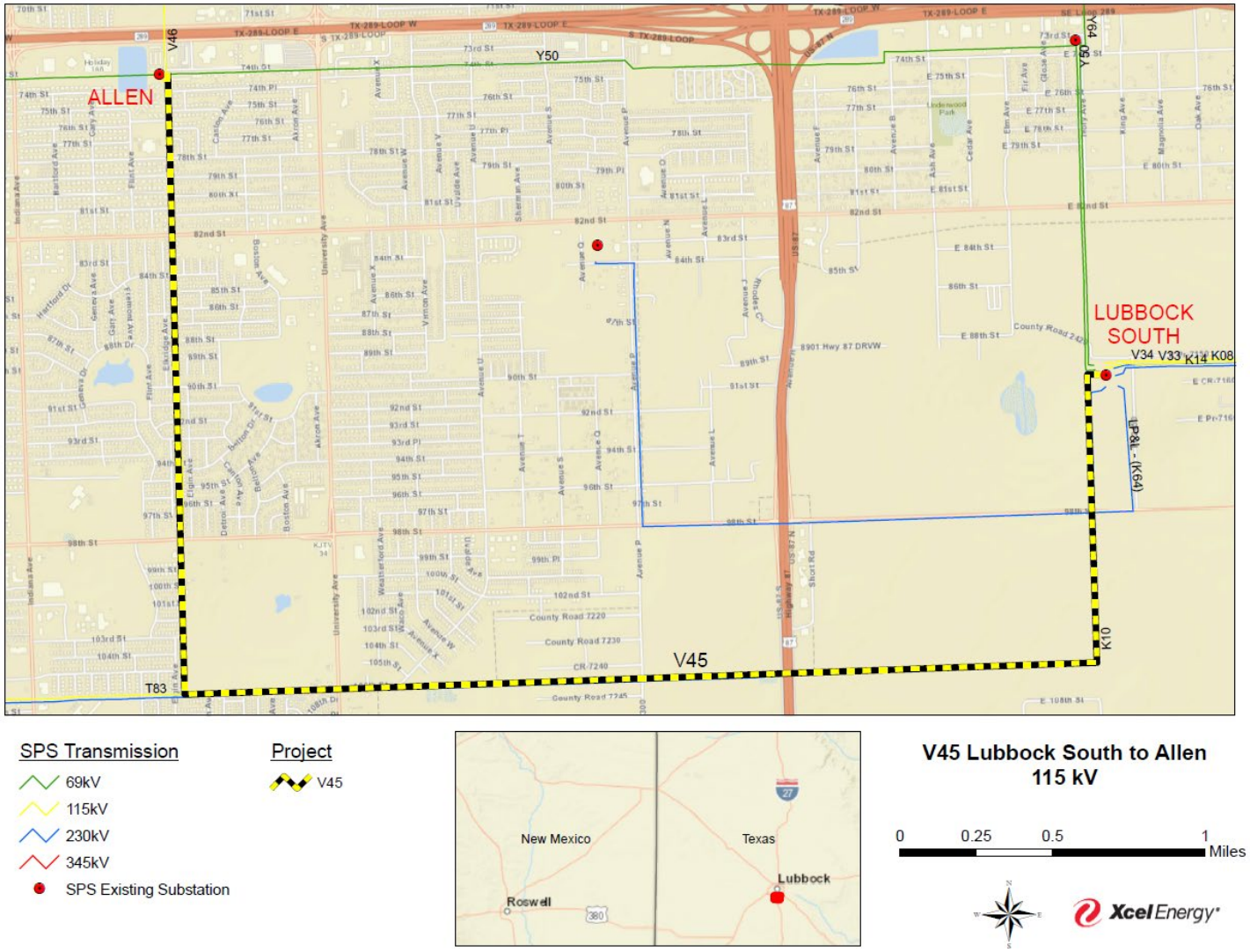
Voltage: 115 kV

ISD: TBD

NTC: Yes, 2020 ITP

Description: Upgrade terminal equipment and rebuild 6 miles of 115 kV line

Need: Reliability
SPP-NTC-210574
NTC Re-evaluation



Carlisle – Murphy V40

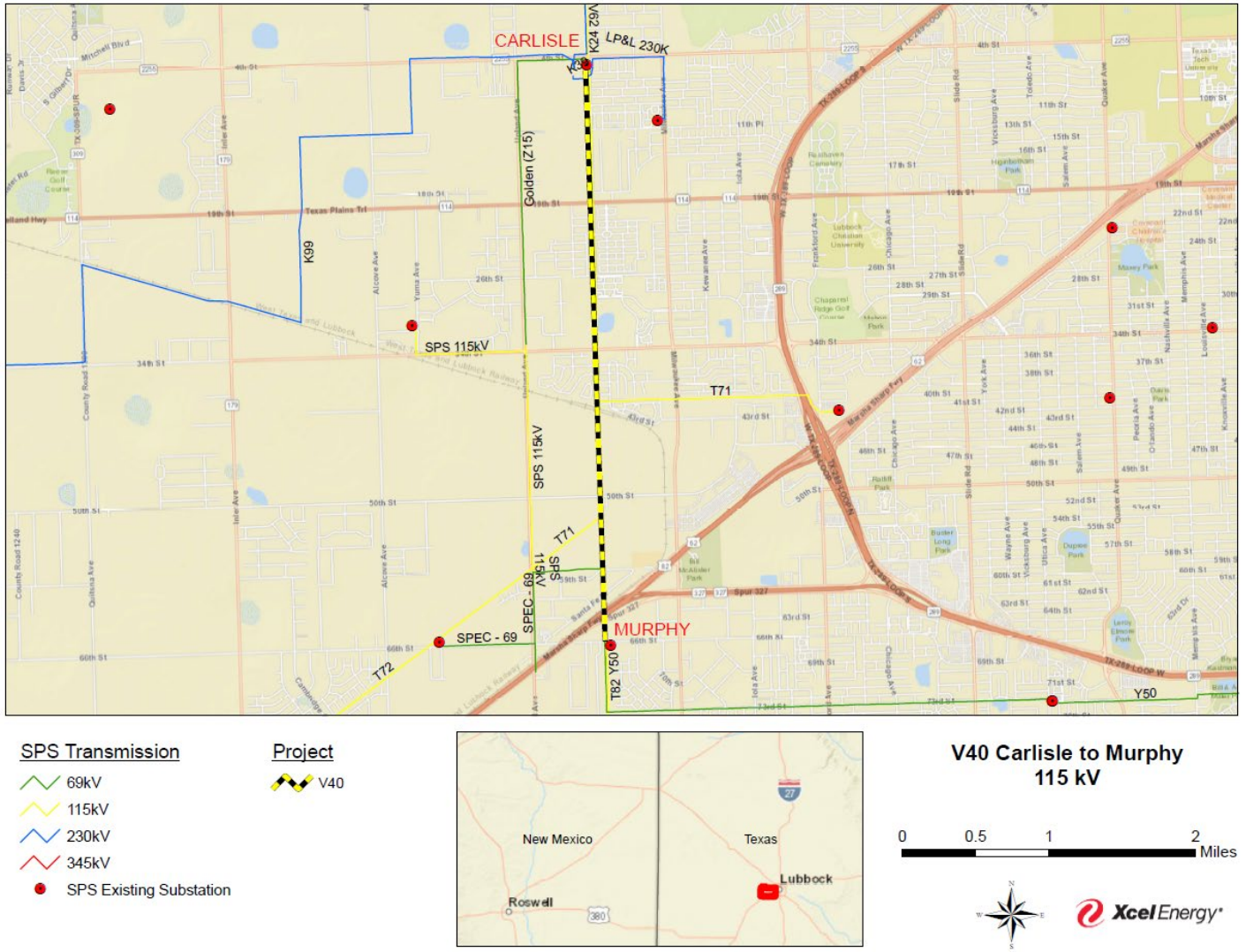
Voltage: 115 kV

ISD: TBD

NTC: Yes, 2020 ITP

Description: Rebuild 4.0 miles of line

Need: Reliability
SPP-NTC-210574
NTC Re-evaluation



Z33 Line Rebuild

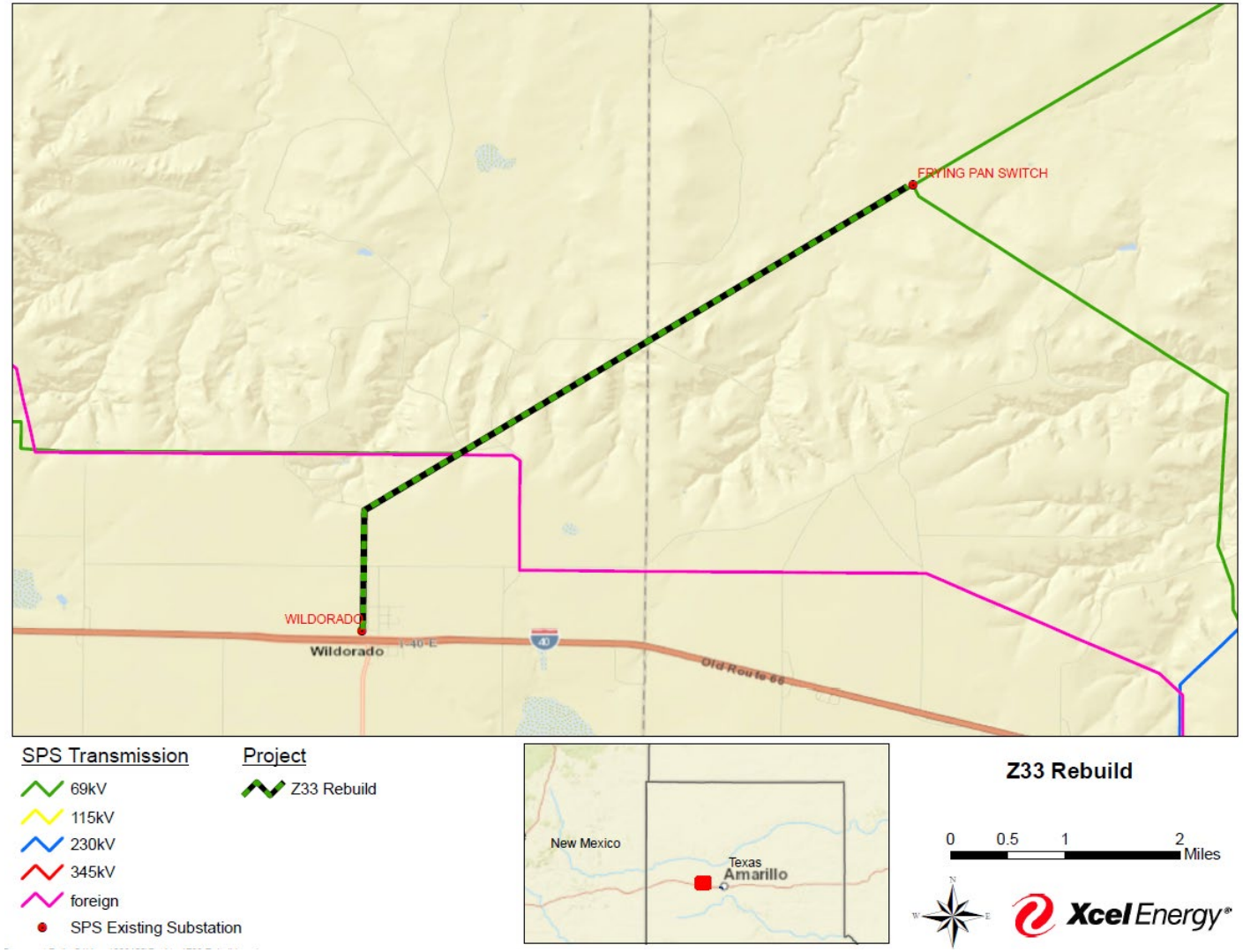
Voltage: 69 kV

ISD: December 2025

NTC: No

Description: Line in poor shape, rebuilt

Need: Asset Renewal/Reliability



Lubbock South – Wolfforth, K10

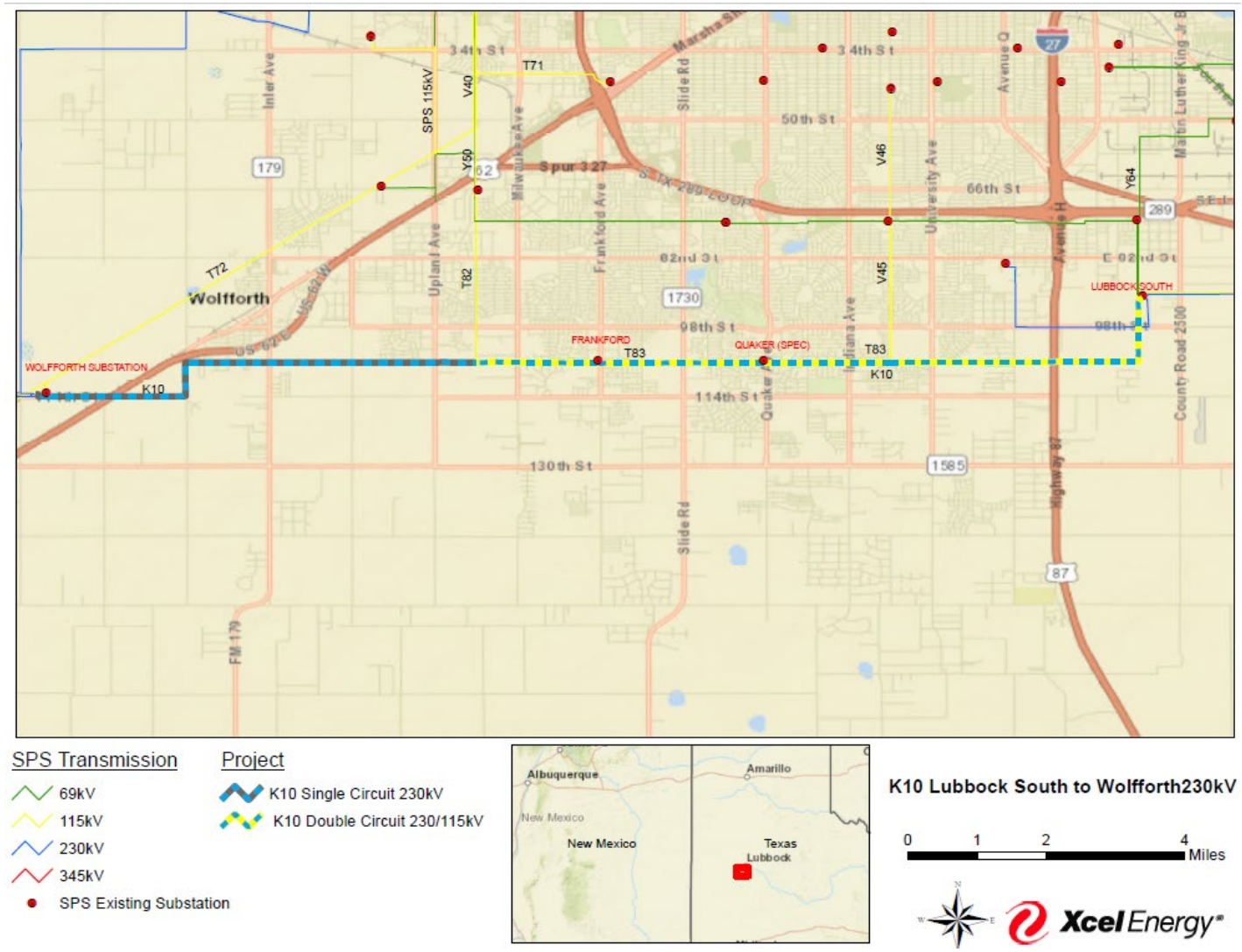
Voltage: 230 kV

ISD: December 2025

NTC: Yes, 2020 ITP

Description: Terminal Upgrades, K10

Need: Reliability
SPP-NTC-210574



Deaf Smith #6 – Friona Rural 115kV

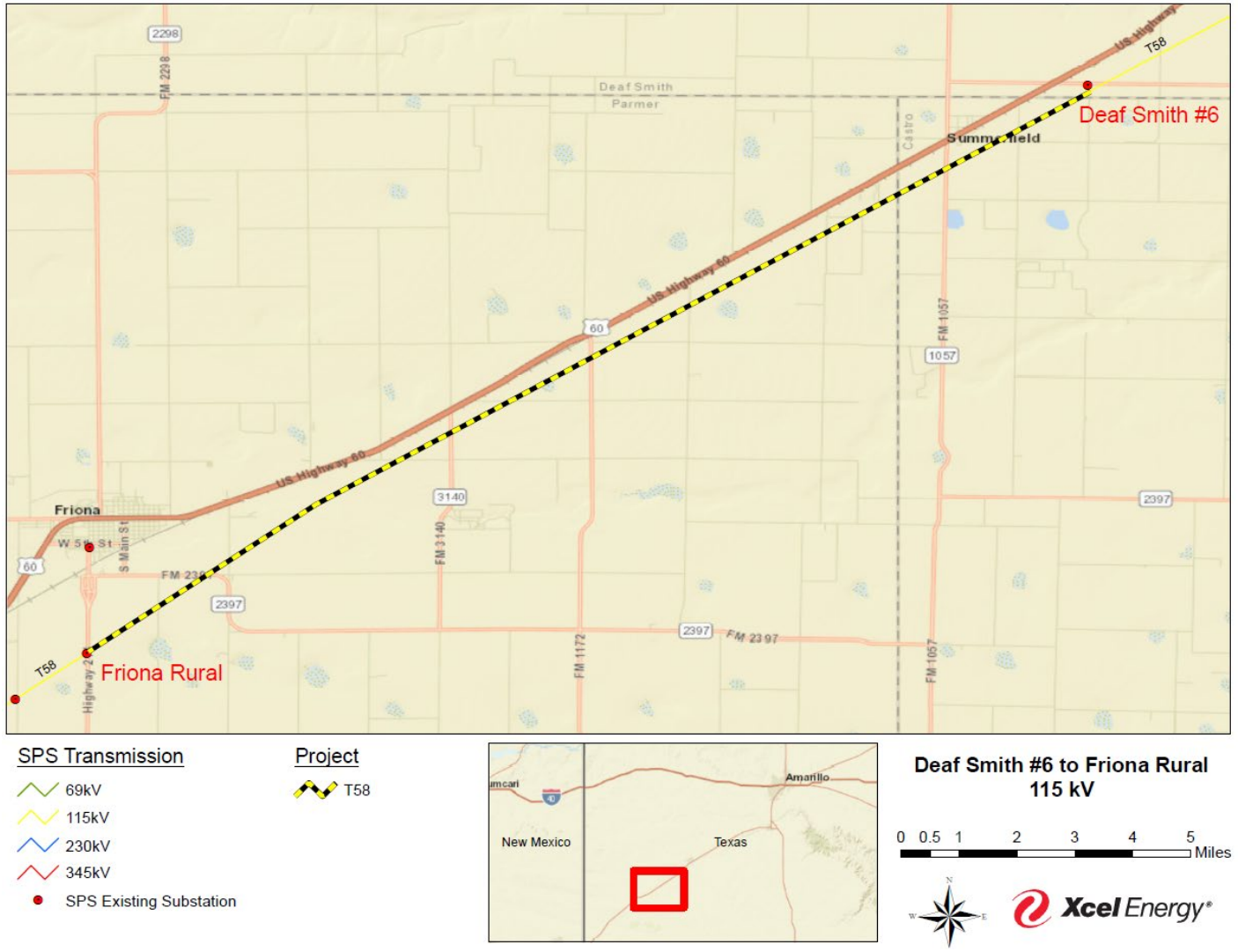
Voltage: 115 kV

ISD: December 2024

NTC: Yes, 2020 ITP

Description: Rebuild approximately 18.9 miles of 115kV, T58

Need: Reliability
SPP-NTC-210574



Friona Rural – Cargill 115kV

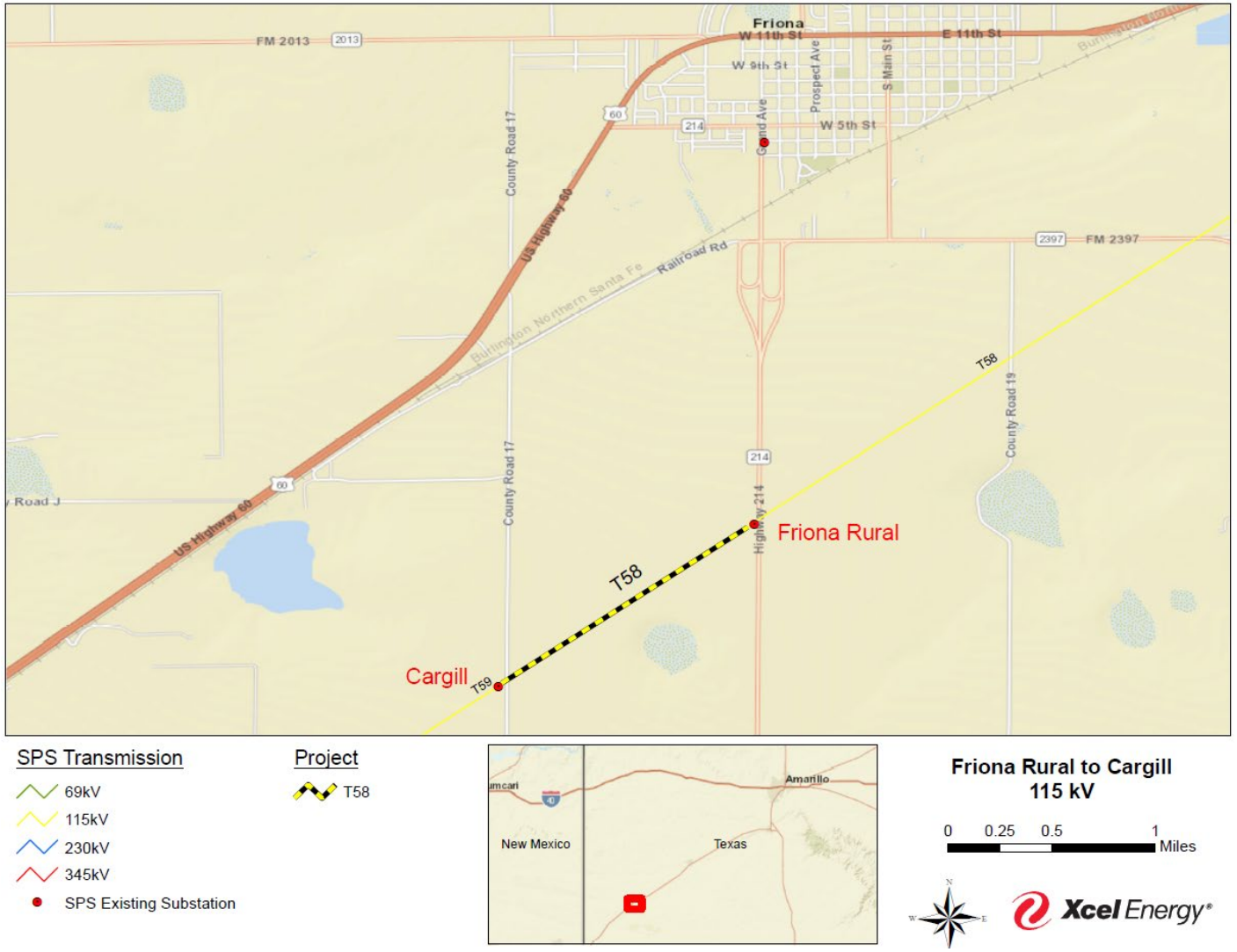
Voltage: 115 kV

ISD: May 2025

NTC: Yes, 2020 ITP

Description: Rebuild approximately 1.15 miles of 115kV, T58

Need: Reliability
SPP-NTC-210574



Hereford South – Deaf Smith #6

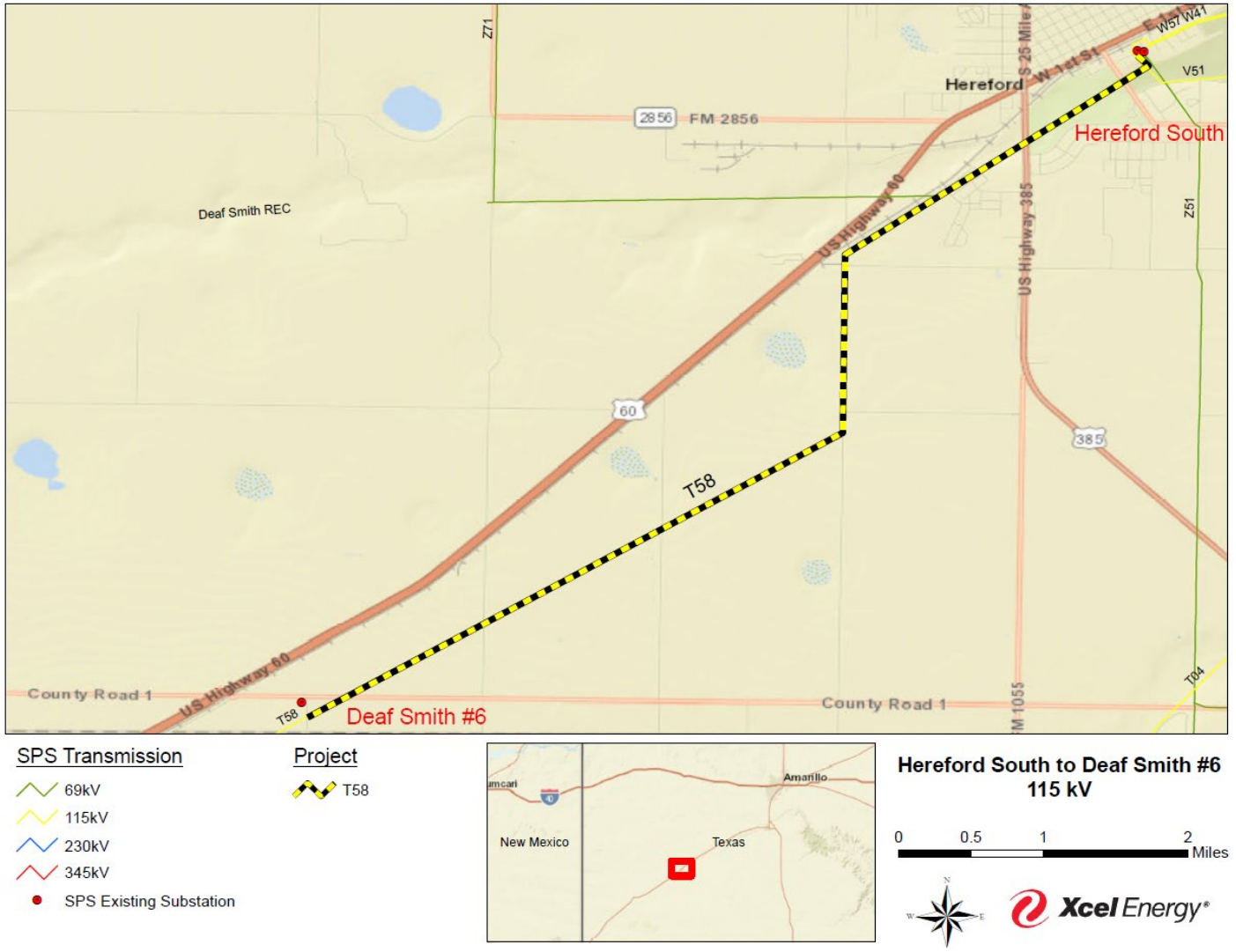
Voltage: 115 kV

ISD: May 2025

NTC: Yes, 2020 ITP

Description: Rebuild approximately 7.12 miles of 115kV, T58

Need: Reliability
SPP-NTC-210574



Allen - Quaker T83

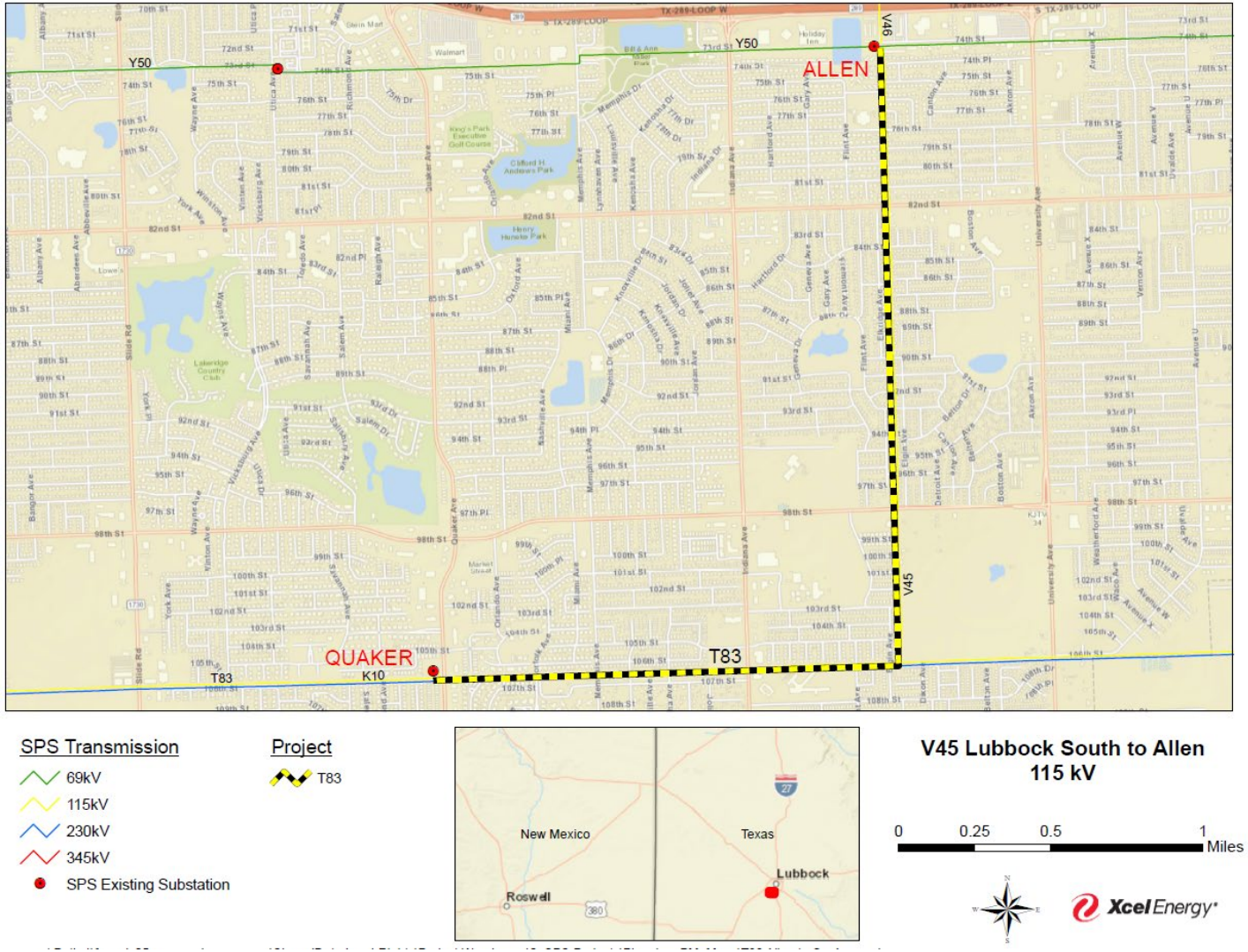
Voltage: 115 kV

ISD: December 2025

NTC: Yes, 2020 ITP

Description: Upgrade terminal equipment and rebuild 3.6 miles of 115 kV line

Need: Reliability
SPP-NTC-210574
NTC Re-evaluation



Lubbock South Breaker Upgrade & Replacement

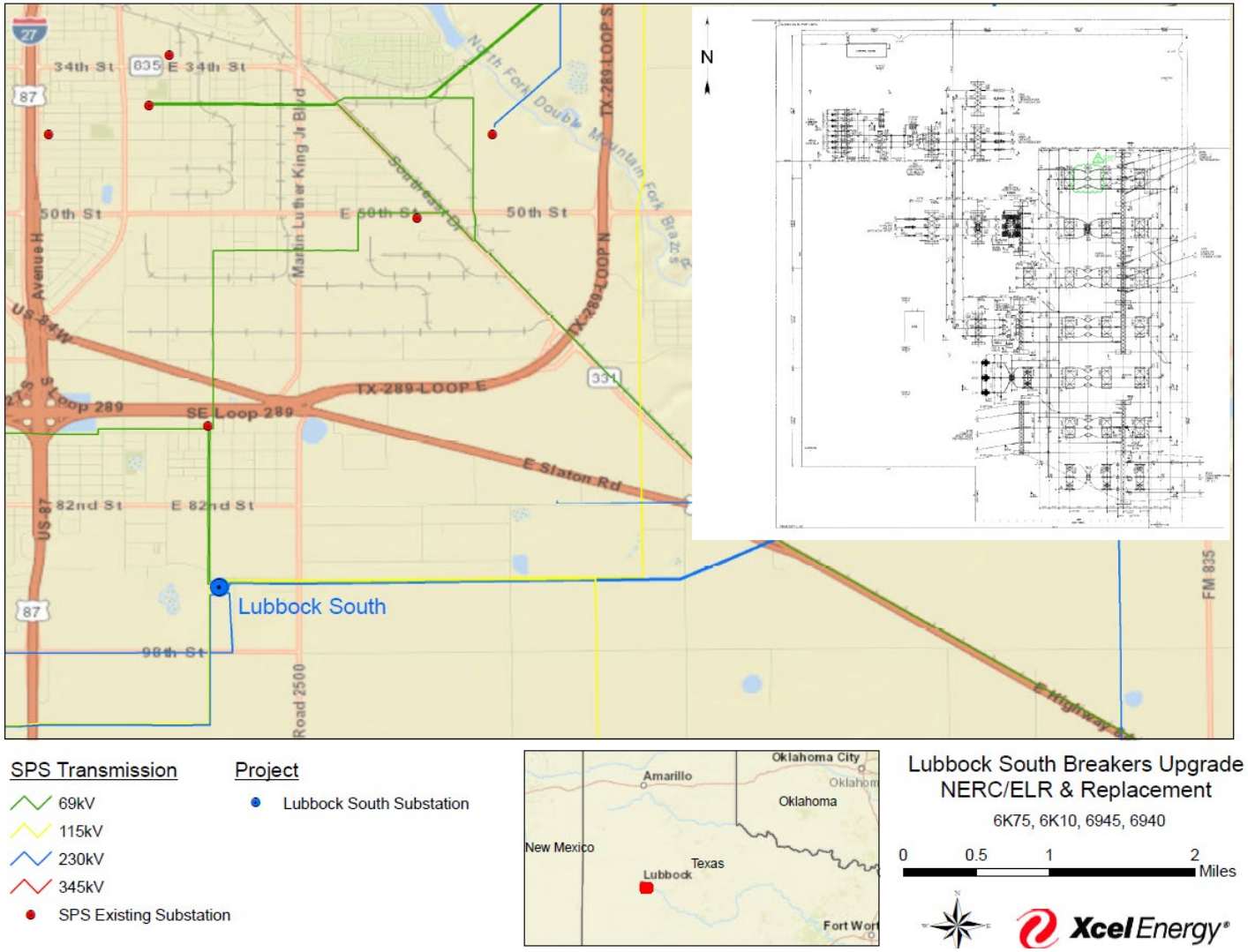
Voltage: 230kV, 115kV

ISD: December 2025

NTC: No

Description: Replace Breakers 6K00, 6K10, 6K75 & 6945

Need: NERC TPL-001-4, Category P5 Single Trip Coil



Zama Substation

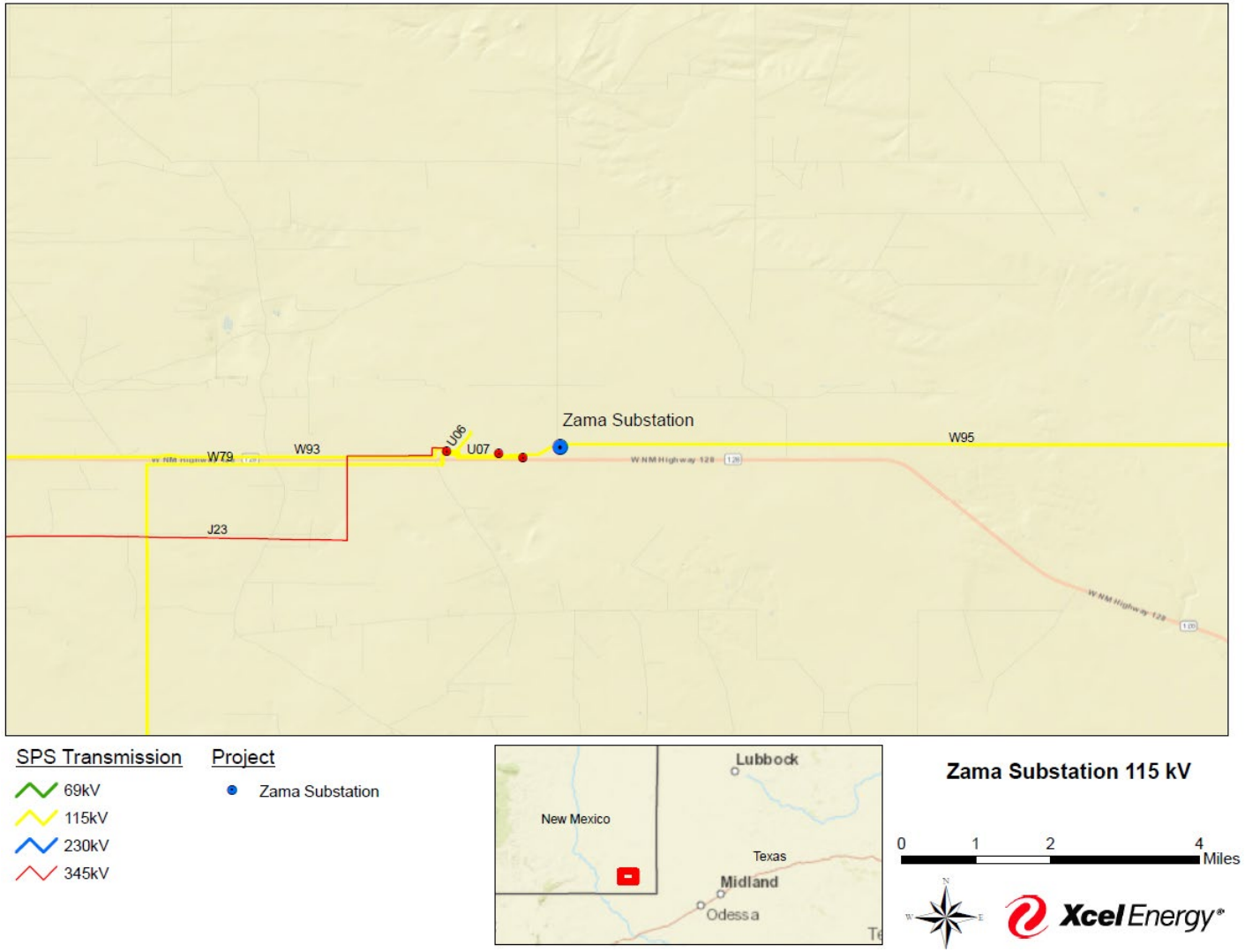
Voltage: 115 kV

ISD: December 2025

NTC:

Description: W95 Tap, New distribution substation Southeast NM

Need: Distribution Driven



Tercio Substation

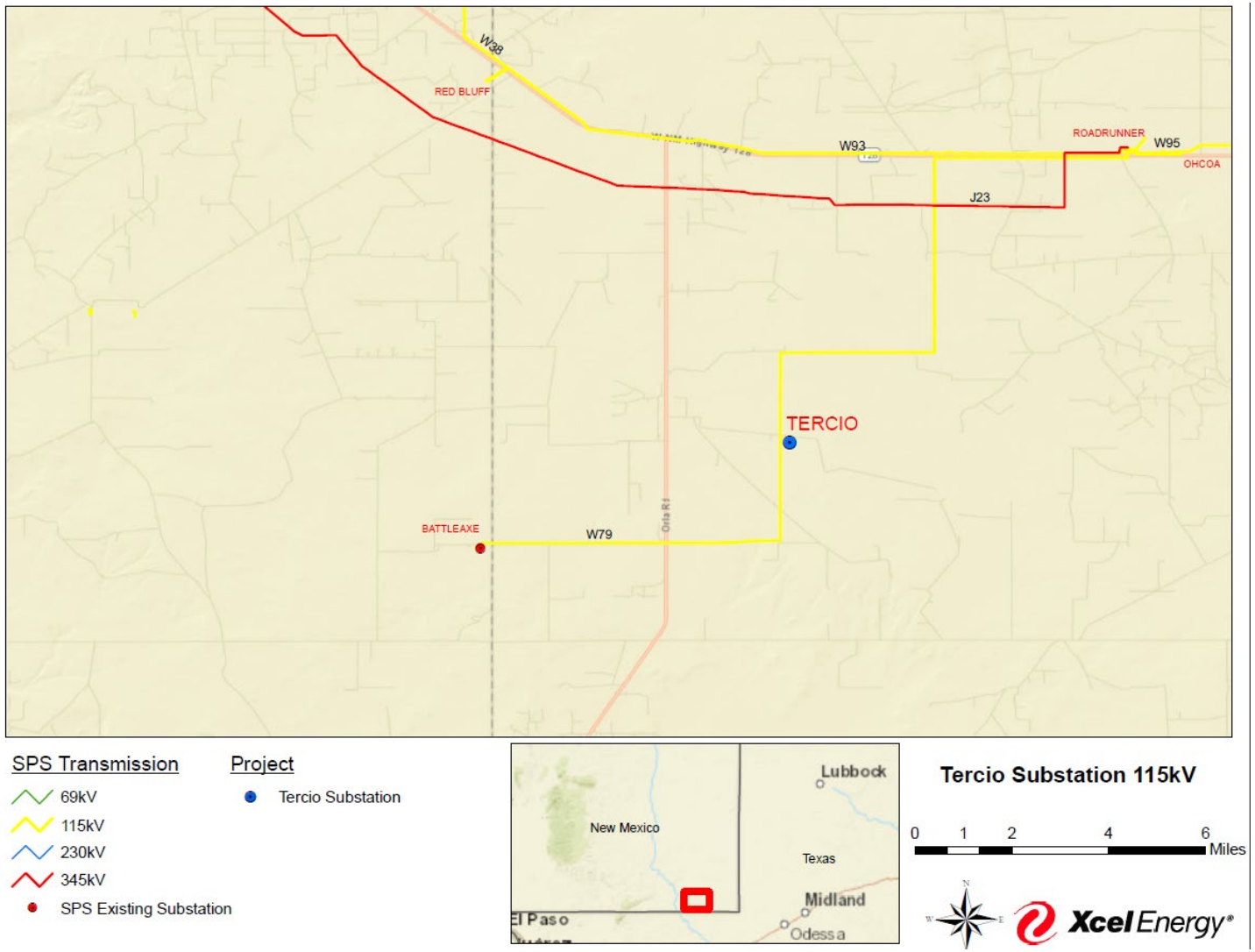
Voltage: 115 kV

ISD: December 2025

NTC: No

Description: W79 tap, New distribution substation Southeast NM

Need: Distribution Driven



Twist Switching Station

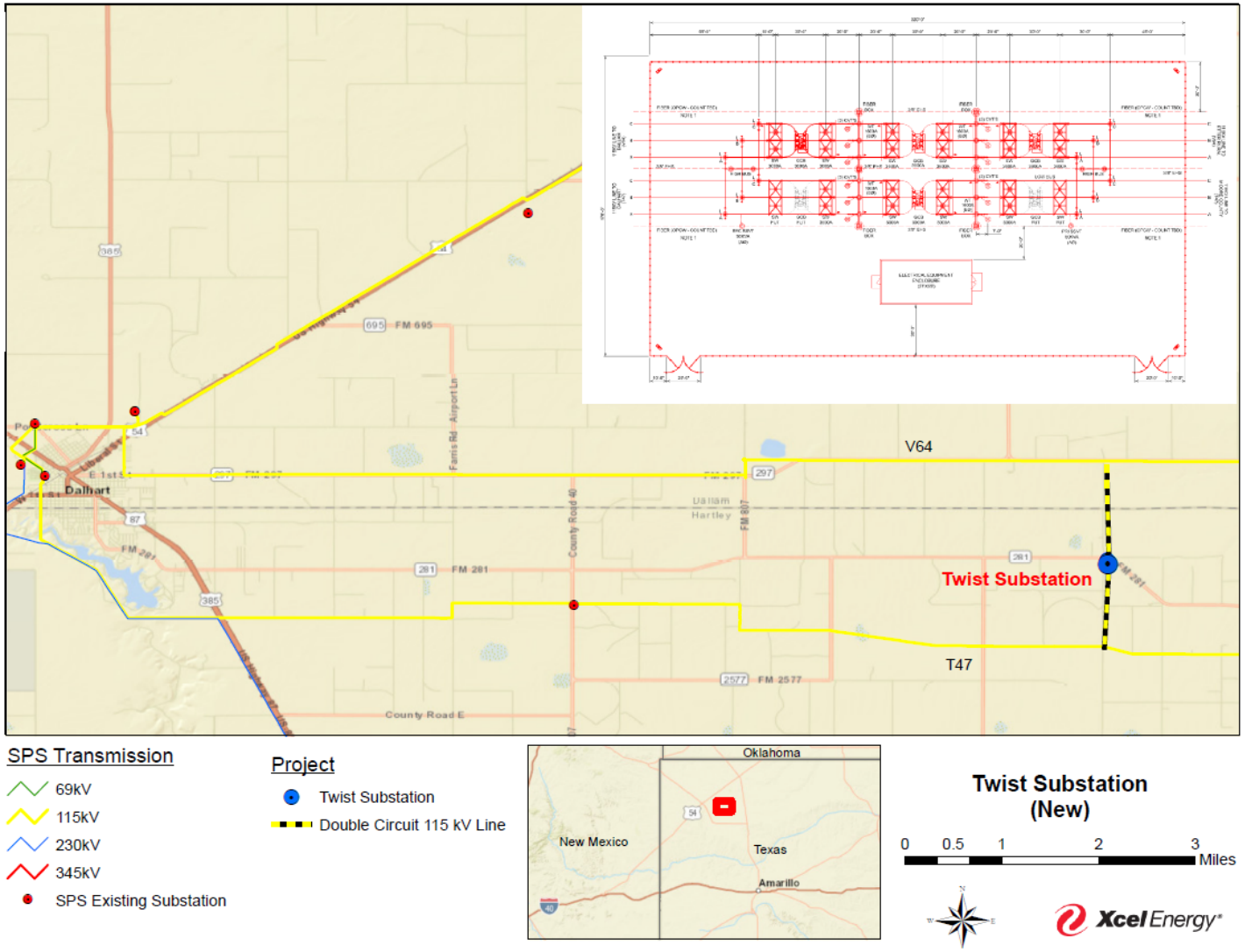
Voltage: 115 kV

ISD: TBD

NTC: Anticipated Modification

Description: New 115kV Switching Station Connecting V64 & T47

Need: Reliability, Load Study



Aztec Substation

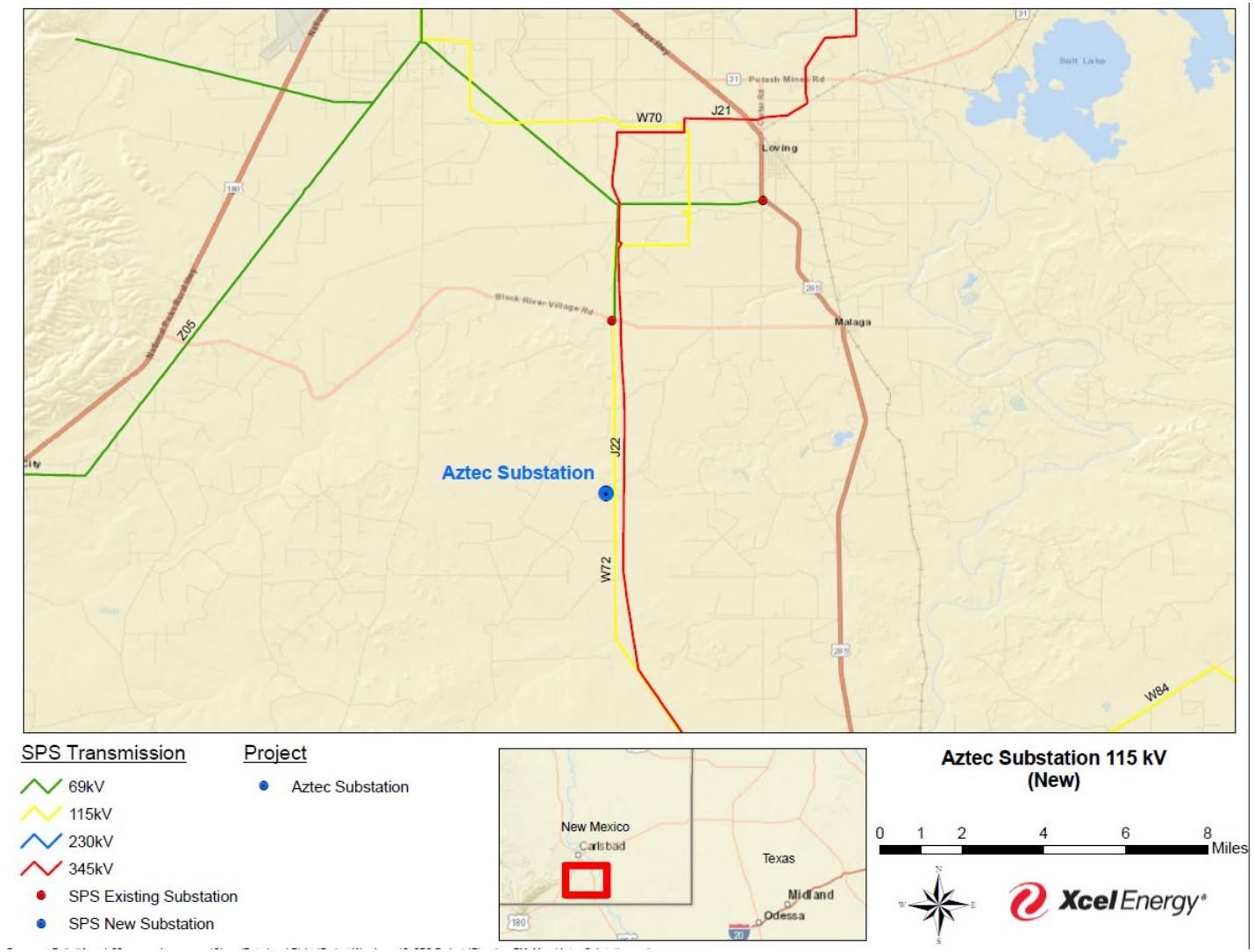
Voltage: 115 kV

ISD: April 2026

NTC: No

Description: W72 tap, New distribution substation south Carlsbad, NM

Need: Distribution Driven



Z53 Line Rebuild

Voltage: 69 kV

ISD: May 2026

NTC: No

Description: Rebuild ~29 miles of 69kV

Need: Asset Renewal/Reliability

Hornet Substation

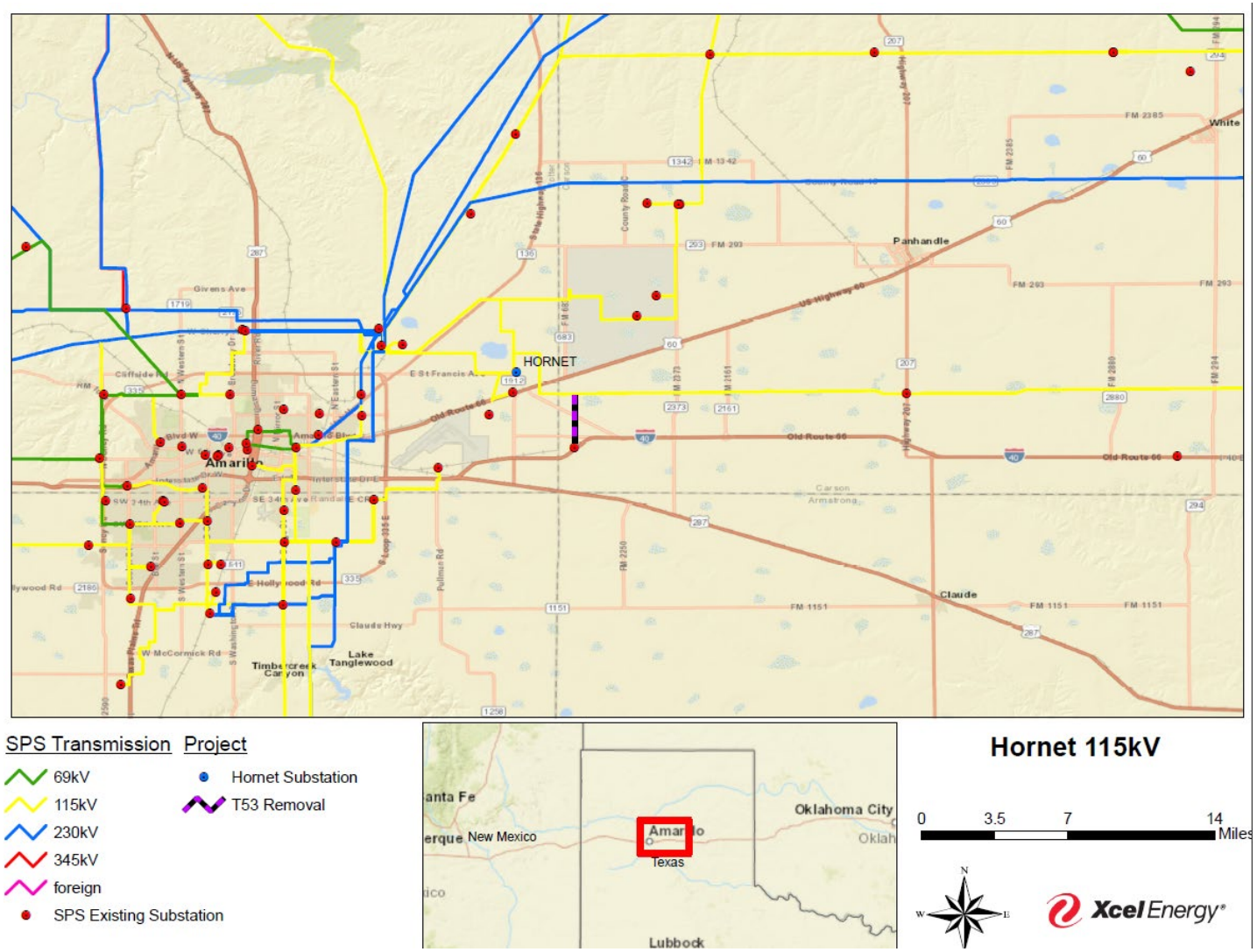
Voltage: 115 kV

ISD: September 2026

NTC: No

Description: T53 Cut-In, New distribution substation Amarillo, TX

Need: Distribution Driven



Capacitor Bank, Lea Road Substation

Voltage: 115 kV

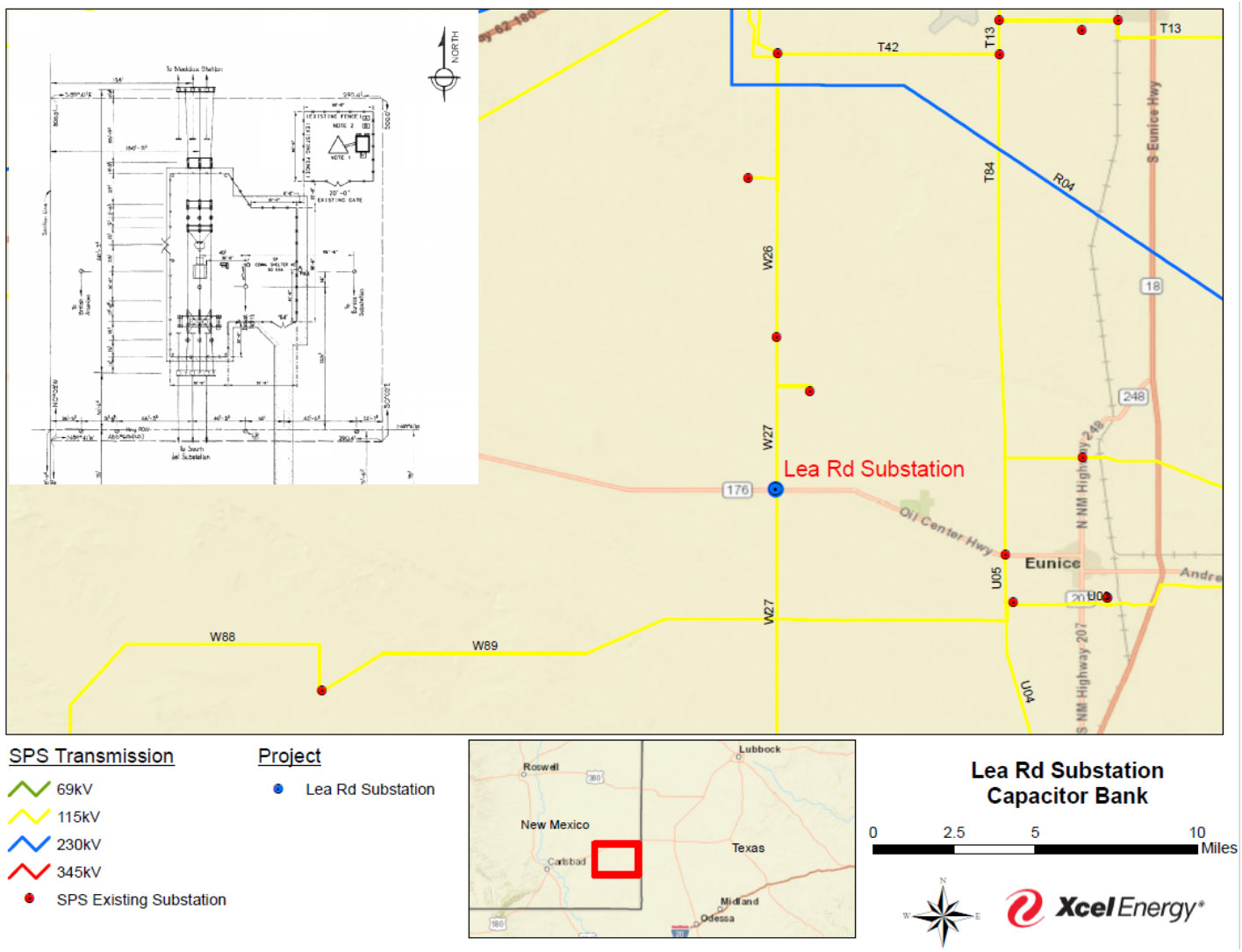
ISD: December 2026

NTC: Yes, 2022 ITP

Description: Adding 2-14.4 MVAr separately switched capacitors

Need: Reliability

SPP-NTC- 210714



Y96 Rebuild

Voltage: 69 kV

ISD: December 2024

NTC: No

Description: Y96 section conductor in poor condition

Need: Asset Renewal

Y79 Line Rebuild

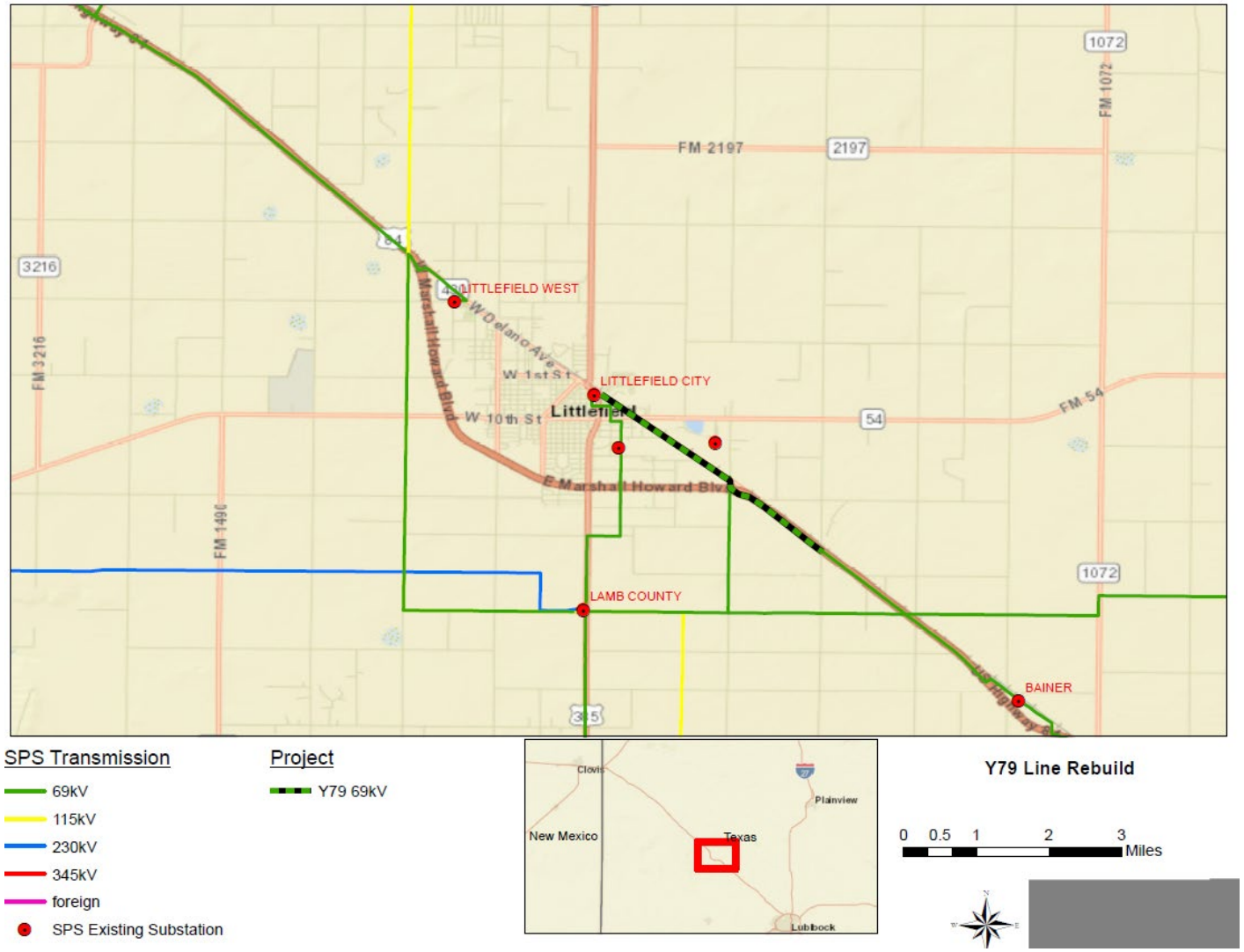
Voltage: 69 kV

ISD: May 2025

NTC: No

Description: Rebuild approximate 2 miles, Clearance problems

Need: Asset Renewal



GENERATION INTERCONNECTION PROJECTS

Bull Creek Switching Station

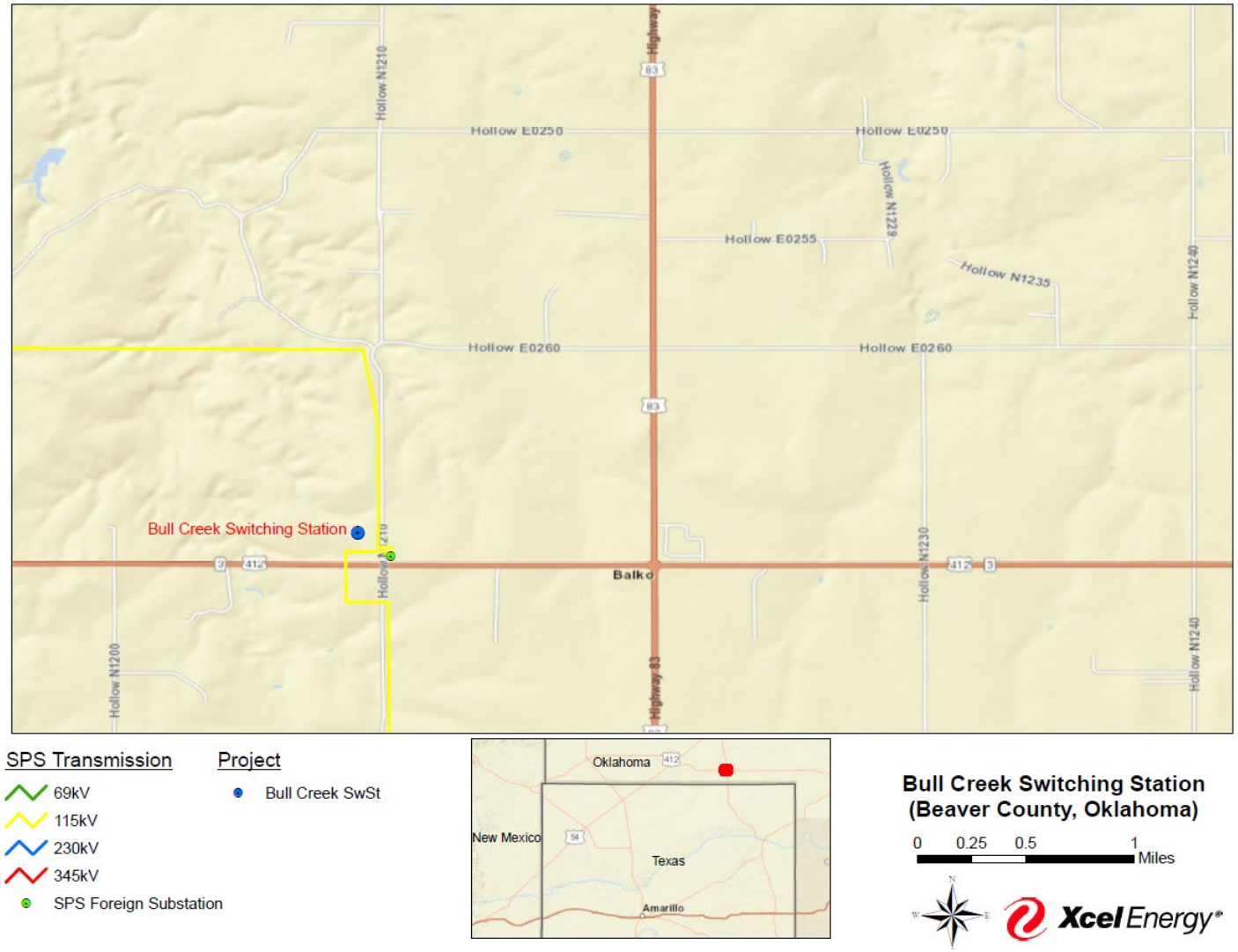
Voltage: 115 kV

ISD: December 2024

NTC: No

Description: New 115kV Switching Station, Beaver County OK

Need: GI Project GEN-2017-047



Sooner Substation

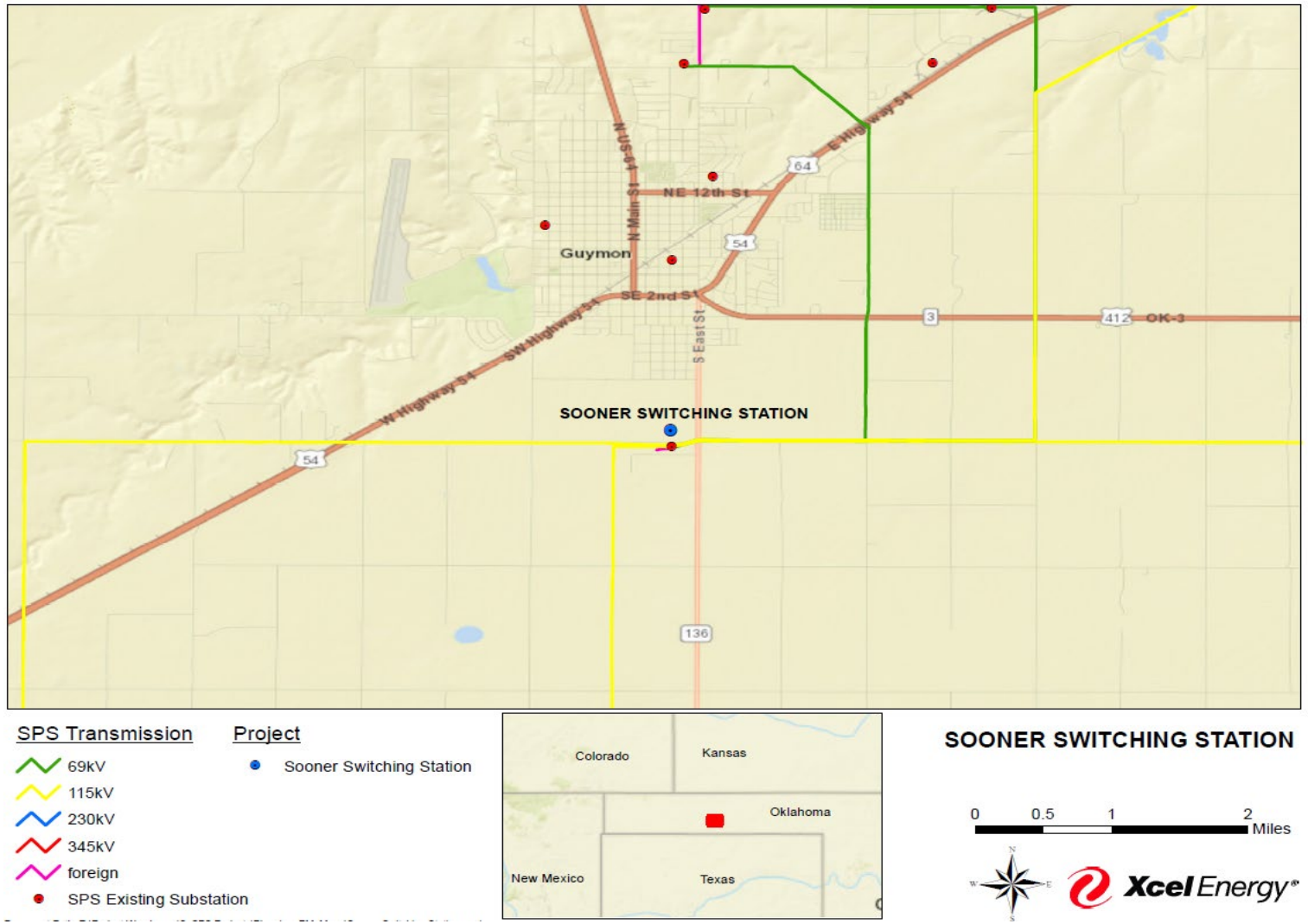
Voltage: 115 kV

ISD: December 2025

NTC: No

Description: New 115kV substation north of existing Texas County

Need: GI Project GEN-2017-100



Tolk Substation 230kV Line Terminal

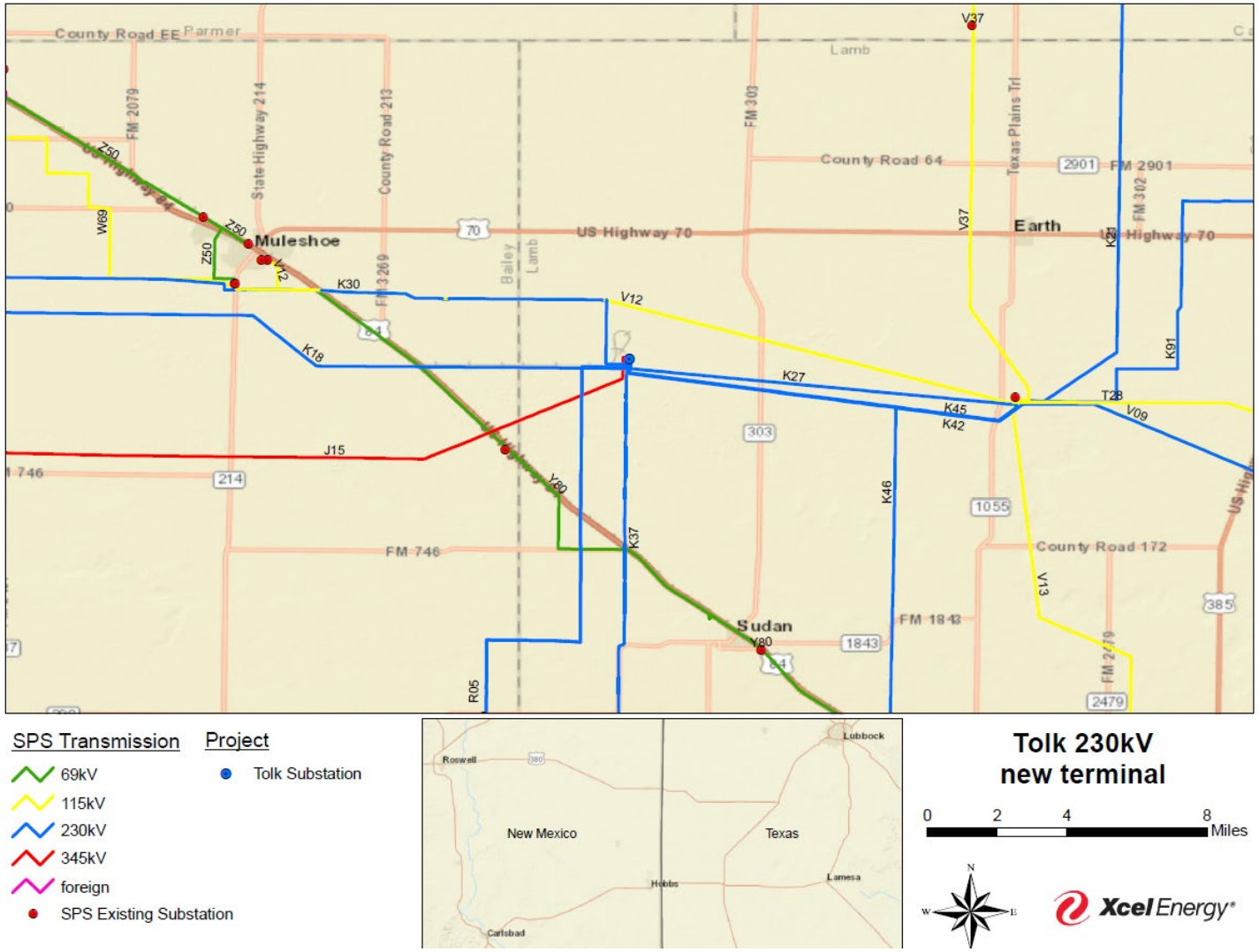
Voltage: 230 kV

ISD: February 2026

NTC: No

Description: New 230kV Line Terminal

Need: GI Project GEN-2017-158



Mahoney Terminal

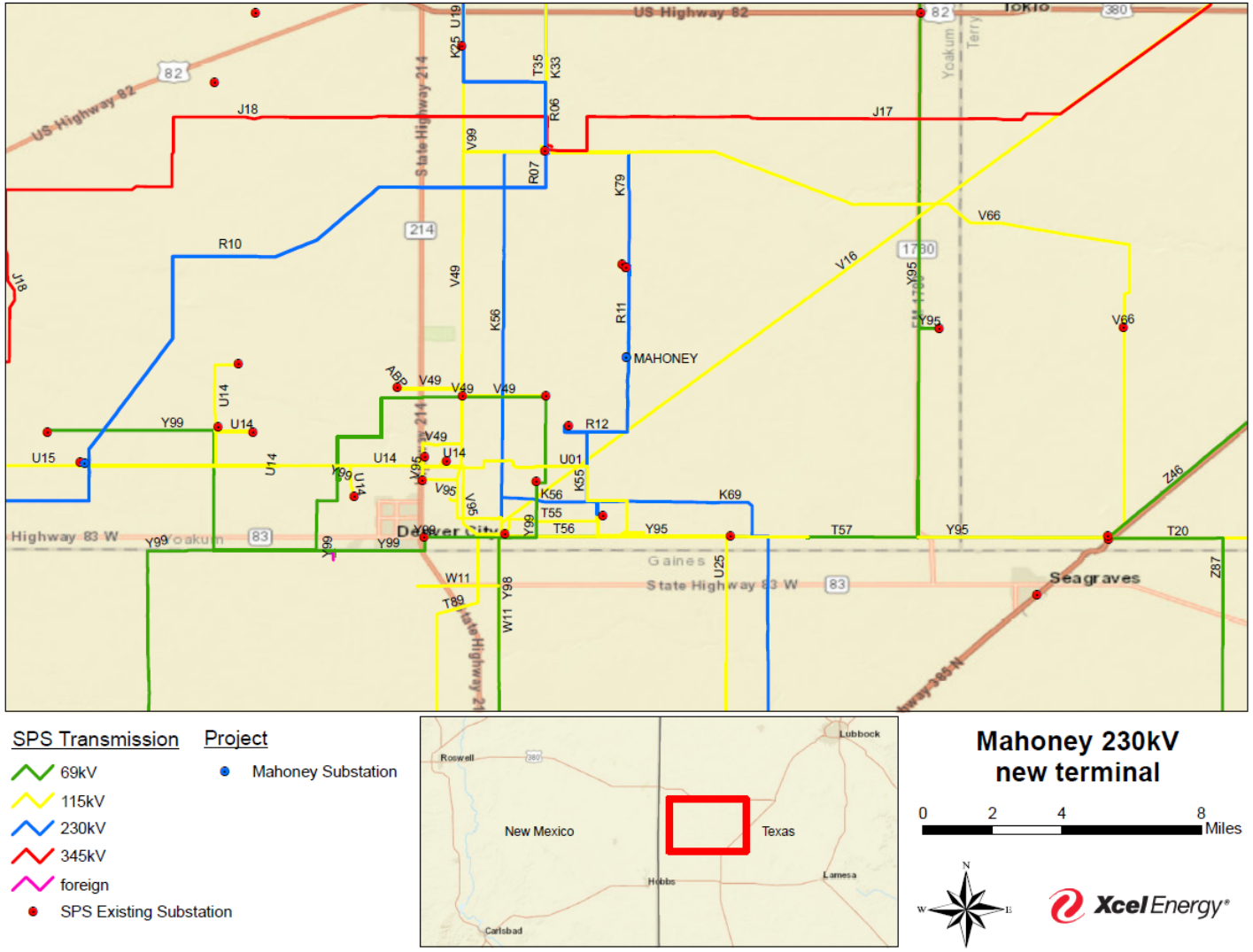
Voltage: 230 kV

ISD: February 2026

NTC: No

Description: New 230kV Line Terminal

Need: GI Project GEN-2017-239



Flatland Substation

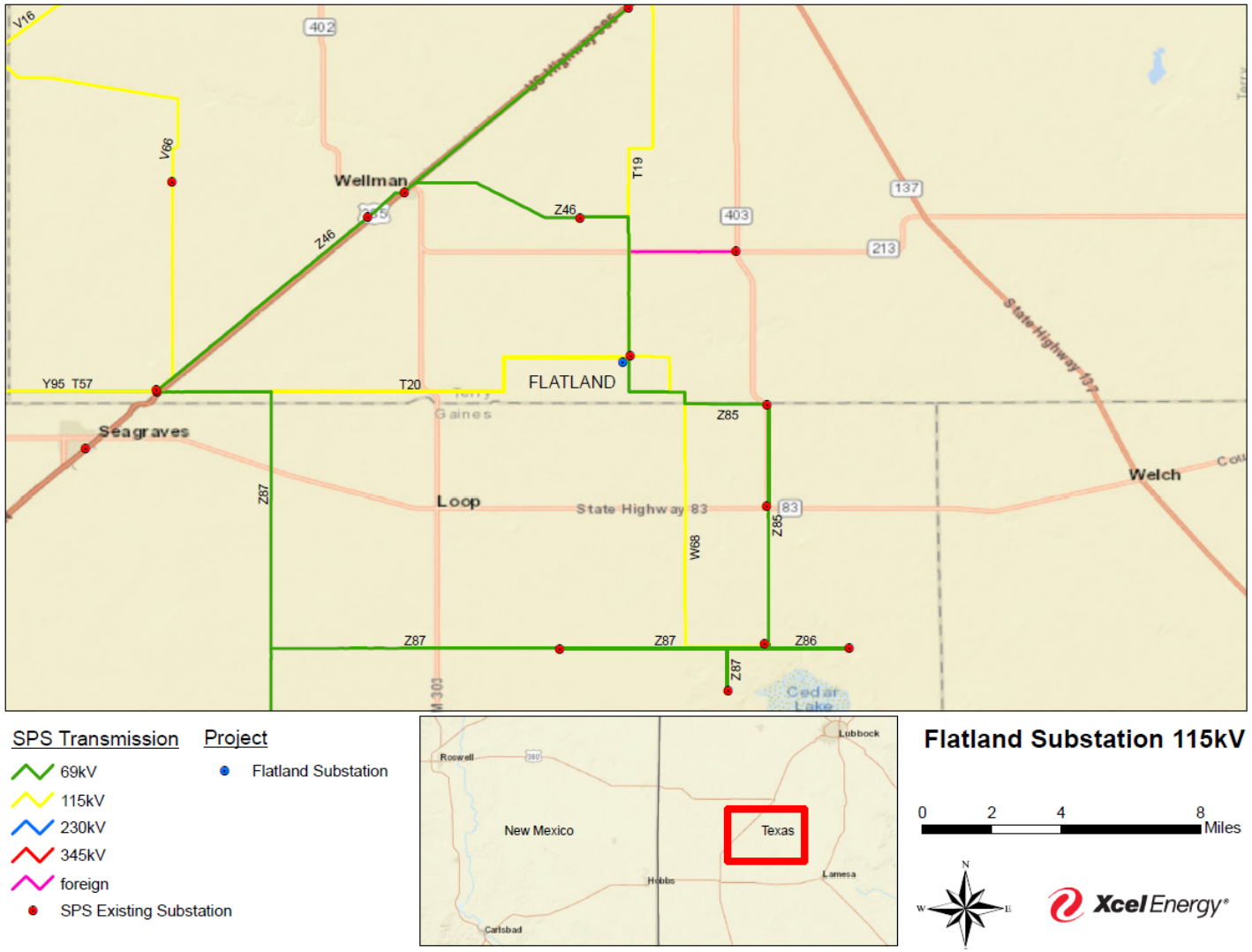
Voltage: 115kV

ISD: February 2026

NTC: No

Description: New 115kV Switching Station, East of Seagraves, TX

Need: GI Project GEN-2017-187



Whirlwind Substation

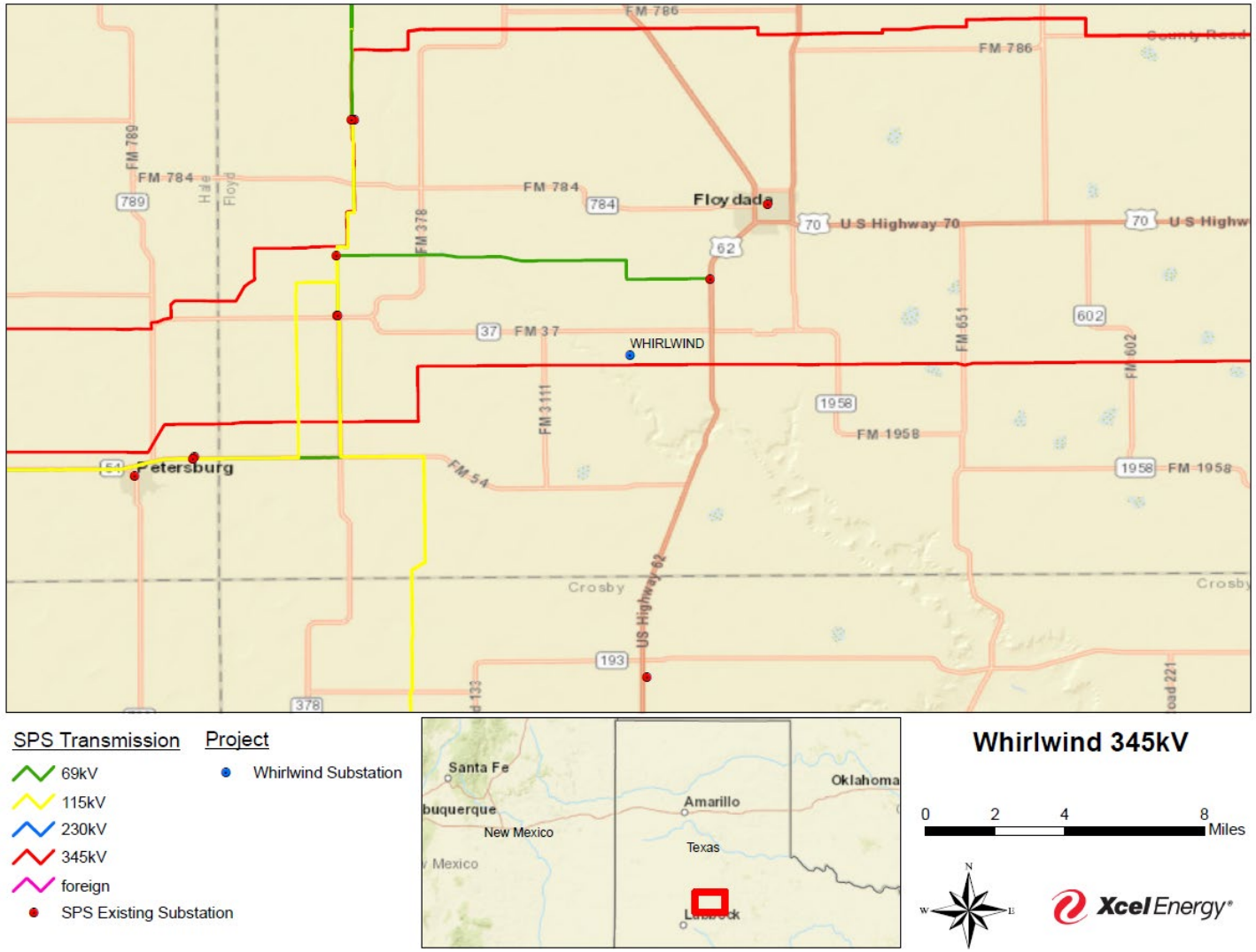
Voltage: 345 kV

ISD: August 2026

NTC: No

Description: New 345kV Switching Station, East of Petersburg, TX

Need: GI Project GEN-2017-151



Olsen Substation

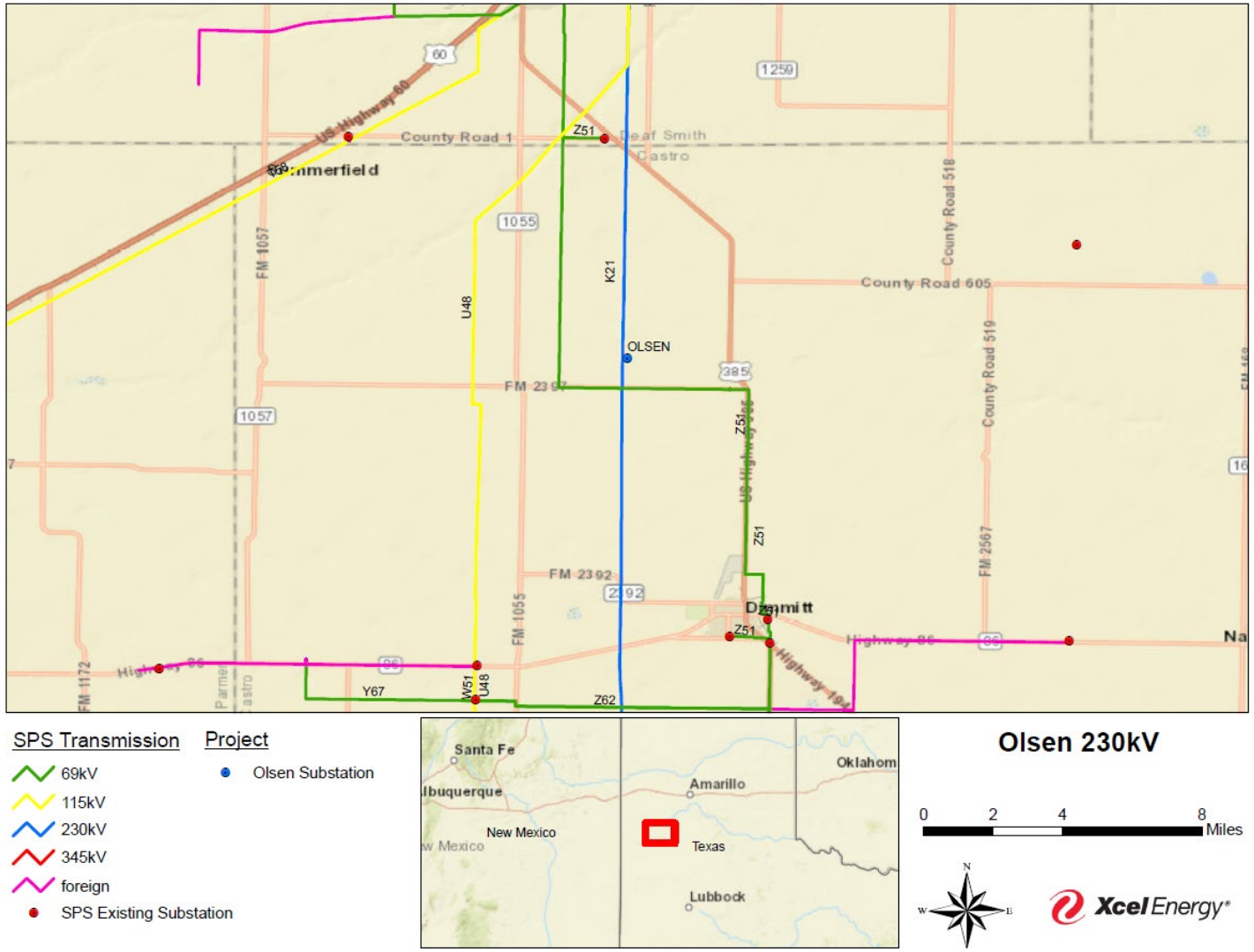
Voltage: 230 kV

ISD: August 2026

NTC: No

Description: New 230kV Switching Station-K21, North of Dimmitt, TX

Need: GI Project
GEN-2017-146



ADDITIONAL INFORMATION

Transformer End Of Life Replacements

- **Cochran County, Replace 115/69kV XFMR**
  - Extreme level of gas
    - ISD: December 2022
- **Cunningham, Replace 230/115 XFMR**
  - Aging infrastructure and in need of replacement
    - ISD: December 2022
- **Bushland, Replace 230/115 XFMR**
  - Asset Renewal, Deterioration of bushings, oil leaks.
    - ISD: April 2023
- **Gaines Co Replace 115/69kV XFMRS**
  - TR01: Bad LTC
    - ISD: April 2023
  - TR02: Aging infrastructure and reduction of fault current rating
    - December 2023
- **Lamb Co Replace 115/69kV XFMR**
  - Aging infrastructure and required replacement
    - ISD: May 2023
- **Riverview Replace 115/69kV XFMR**
  - Aging infrastructure and required replacement
    - ISD: September 2026

Need: Reliability

Anticipated NTC Projects

Project Name	Planned In-Service Date	Upgrade
U38 Maddox – Peral 115kV	December 2024	Terminal Limitations
W93 Red Bluff – Roadrunner 115kV	February 2025	Terminal Limitations
North Loving 115kV	March 2025	Capacitor Bank 1-28.8 MVAR
Malaga Bend 115kV	March 2025	Capacitor Bank 1-28.8 MVAR
Phantom 115kV	May 2025	Capacitor Bank 2-28.8 MVAR
Phantom 115kV	May 2025	Capacitor Bank 1-14.4 MVAR
Phantom 345kV	April 2026	Capacitor Bank 4-50 MVAR
Livingston Ridge 115	May 2025	Capacitor Bank 2-28.8 MVAR
North Loving 345kV	July 2026	Capacitor Bank, 2-50 MVAR
Phantom Sub	November 2026	Transformer 345/115kV 448MVA
2023 Integrated Transmission Plan		
Potter County	TBD	Second 345/230kV Auto
Moore County 115kV	TBD	Terminal Limits, T25
Cunningham/Quahada - Buckeye Tap 115kV	TBD	New 3.2 mile transmission line

Withdrawn/Modified NTC Projects

Project Name	Study Reference	Original NTC	Withdrawal/Modified NTC
Hobbs – Millen 115kV Rebuild	DPA-2018-Mar-854	SPP-NTC-210515	SPP-NTC-220725
Johnson Draw 28.8 MVAr Cap Bank	DPA-2018-Mar-854	SPP-NTC-210515	SPP-NTC-220725
Carlsbad – Pecos 115kV Terminal Upgrades	SPP-2015-AG1-AFS-6	SPP-NTC-200420	Withdrawal, Pending Approval
Customer Tap – Pearl 115kV Terminal Upgrades	DPA-2021-December-1478	SPP-NTC-210718	Withdrawal, Pending Approval
Newhart – Potter County 230kV Terminal Upgrades	2020 SPP ITP	SPP-NTC-210574	SPP-NTC-210705

NERC TPL-001-5

- Approved 2020
- Enforcement Date: July 1, 2023
- Key Changes
  - Single Point of Failure (SPF)
    - Non-redundant components of a Protection System (FERC Order 754)
    - Single protective relay, single communications path, single DC supply, single control circuitry
    - Not mandate of redundancy in components of protection system
    - Upgrades to relaying, DC supply, breakers,
  - Technical Rationale for Selection of Known Outages
    - Outages removed from Model Build (Requirement R1)
    - Added to assessment part of analysis

Power for the Plains Website

http://www.powerfortheplains.com/

- Description for some of the projects
- Routing maps, when available
- General project information

Xcel Energy, Inc. Website

https://www.transmission.xcelenergy.com/Planning/Planning-for-the-Southwestern-Public-Service-Company

Presentation Location

Additional Questions

If you have questions that we were not able to address during this meeting, please email them to:

annette.gallegos@xcelenergy.com

We will take questions until October 31, 2023. The questions and answers will then be communicated out to those that RSVP'd for today's meeting

BUFFET LUNCH

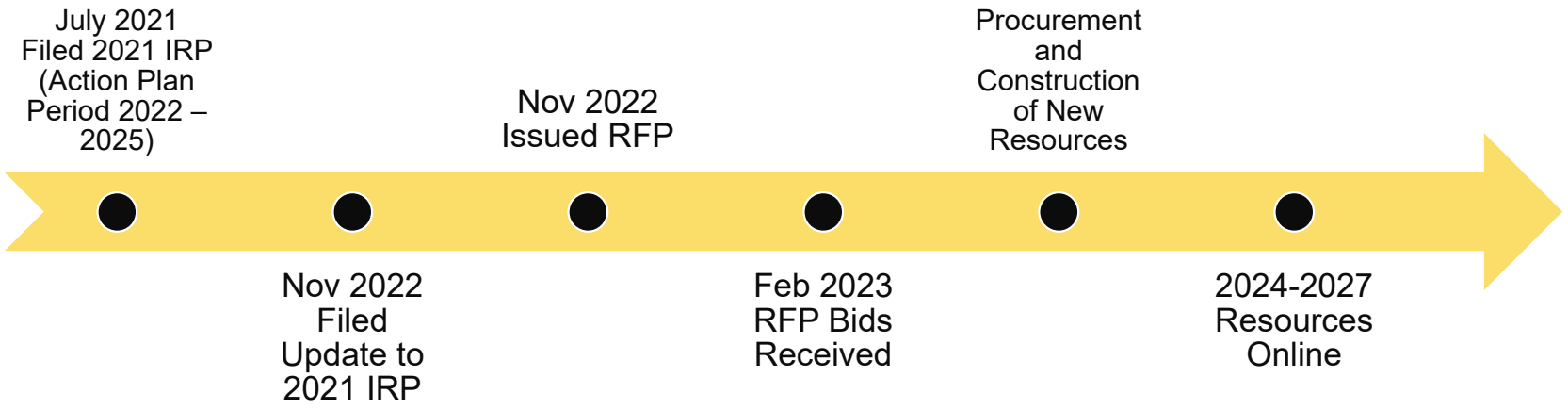
45 Minutes

SOUTHWESTERN PUBLIC SERVICE CO INTEGRATED RESOURCE PLAN

Brooke Trammell | Regional Vice President, Regulatory & Pricing

October 12, 2023

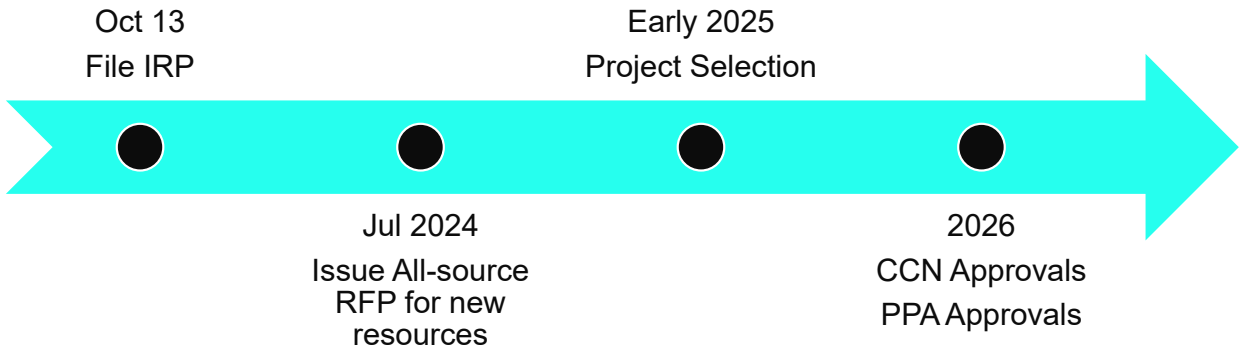
SPS 2021 IRP Overview



Recommended Portfolio from 2022 RFP

- **Plant X1 & X2 150 MW Solar Project**
- **Cunningham 1 72 MW Solar Project**
- **Cunningham 2 196 MW Solar Project**
- **230 MW Purchased Power Agreement**
- **Unit Extensions - Cunningham 2 & Maddox 2**
- **Battery Energy Storage Systems**
  - **36 MW @ Cunningham 1**
  - **48 MW @ existing PPA wind farm in Texas**

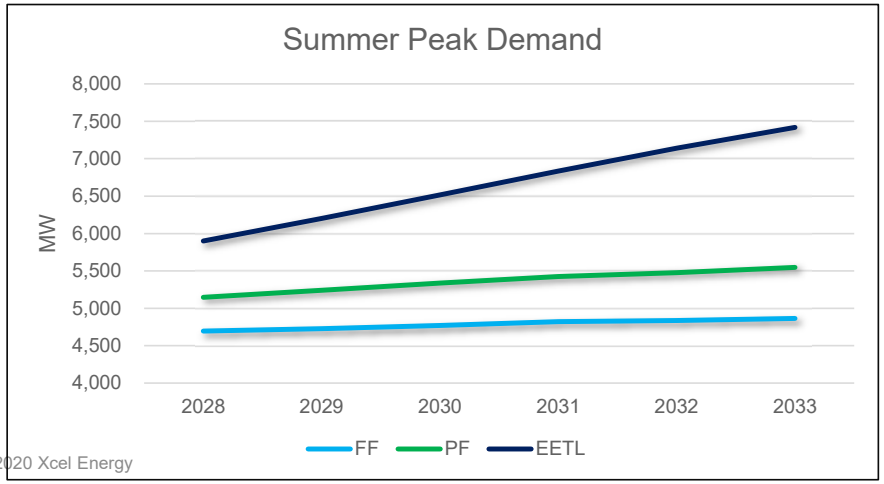
SPS 2023 IRP Overview

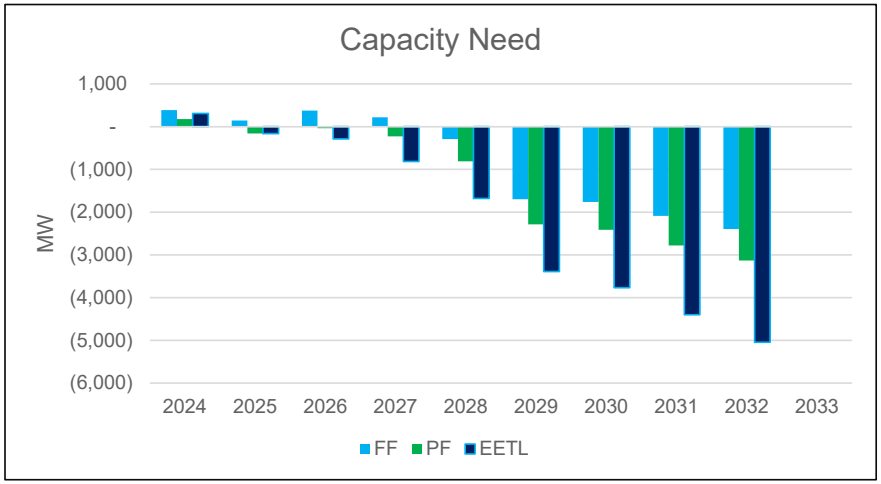


Capacity Need Summary

Load Growth, Retirements, & Resource Adequacy Requirements

- SPS is forecasting a Summer peak demand of between 4,771MW and 6,517MW by 2030
- Assuming the existing Southwest Power Pool PRM of 15%, SPS's capacity need is between 1,760MW and 3,768MW in 2030
- Capacity need increases to 1,903MW and 3,963MW under a hypothetical 18% summer PRM requirement
- Includes retirement of 1,825 MW of thermal retirements by 2030





IRP Modeling Results
Statement of Need Inputs

- All scenarios included a substantial build out of new renewable generation ranging from 4,281MW to 6,631MW of wind and solar generation between 2028 and 2030
- New dispatchable additions ranged from 1,043MW to 4,290MW
- Total resource additions ranged from 5,324MW to 10,211MW
- For context, SPS currently has ~7,500MW of installed capacity with an accredited capacity of 5,400 and a system peak of ~4,200MW

IRP Modeling Results

New Resources Added: 2028 - 2030

1. **All 3,500MW of available wind generation selected in 2028 – 2030 in most scenarios analyzed**

   SPS included an annual cap of 1,000MW of new wind generation per year, plus an additional 500MW of surplus wind generation

   *Wind selection is biased by generic pricing**

2. **Between 1,021MW and of 3,131MW of new solar generation added**

   SPS allowed 1,021 MW of new solar to replace retiring thermal units without incurring transmission network upgrade costs (i.e., replacing retiring existing generation with new solar and utilizing existing interconnection facilities)

3. **Added the following range of dispatchable resources**

   - *Planning Forecast: 1,637MW – 2,530MW (15% PRM, MJB –> 18%, Existing Technologies)*
   - *Electrification Forecast: 3,260MW – 4,290MW (15%, Long-Duration Storage –> 18%, Existing Technologies)*

**Important Note: SPS anticipates actual pricing and availability of resources bid into a competitive RFP will result in a more balanced portfolio of resources*

Key Modeling Takeaways

STRENGTHS

- A continued and substantial need for new, low-cost, renewable generation through the end of the decade and beyond
- The build-out of new renewable generation requires additional dispatchable capacity that conforms with New Mexico's Energy Transition Act

OPPORTUNITIES

- There's an increasing need for alternative, carbon-free, dispatchable, and economic technologies over the 20-year planning period
- SPS's 2023 IRP analysis evaluated long-duration storage and hydrogen-fired combustion turbines technologies, however, alternative, carbon-free, and dispatchable technologies are/will become available and are encouraged to bid into RFP

WEAKNESSES

- Currently, lithium-ion battery energy storage is the predominate, commercially-available carbon-free, dispatchable technology – However, its duration is relatively limited (i.e., 4 – 8 hours)

THREATS

- Relying solely on wind, solar, and short-duration battery energy storage is not economical and presents reliability challenges

IRP Modeling Results

New Resources Added: 2028 - 2030

	PVRR DELTA			Resources Added 2028-2030 (Nameplate Capacity)						
				Dispatchable				Variable Energy Resources		
	2024-2030 NPV $(M)	2024-2040 NPV $(M)	2024-2043 NPV $(M)	Firm Peaking	CC	Storage	Total	Wind	Solar	Total
Financial Forecast										
15% PRM										
Multi-Jurisdictional Baseline*	$0	$0	$0	933	-	130	**1,063**	3,390	1,021	**4,411**
Existing Technologies	$205	$1,829	$2,556	-	-	1,380	**1,380**	3,500	1,021	**4,521**
Long Duration Storage	$186	$1,023	$1,136	-	-	1,280	**1,280**	3,500	1,091	**4,591**
Hydrogen Conversion	$130	$1,292	$1,763	933	-	110	**1,043**	3,260	1,021	**4,281**
18%/20% PRM										
Existing Technologies	$304	$2,169	$2,927	-	-	1,670	**1,670**	3,500	1,021	**4,521**
Long Duration Storage	$279	$1,332	$1,472	-	-	1,540	**1,540**	3,500	1,091	**4,591**
Hydrogen Conversion	$188	$1,571	$2,097	933	-	410	**1,343**	3,500	1,021	**4,521**
Planning Forecast										
15% PRM										
Multi-Jurisdictional Baseline*	$0	$0	$0	700	837	100	**1,637**	3,500	1,301	**4,801**
Existing Technologies	$381	$2,753	$4,149	-	-	2,220	**2,220**	3,500	1,021	**4,521**
Long Duration Storage	$320	$1,348	$1,629	-	-	1,980	**1,980**	3,500	1,831	**5,331**
Hydrogen Conversion	$240	$1,630	$2,255	933	837	170	**1,940**	3,500	1,071	**4,571**
18%/20% PRM										
Existing Technologies	$479	$3,156	$4,577	-	-	2,530	**2,530**	3,500	1,021	**4,521**
Long Duration Storage	$433	$1,709	$2,000	-	-	2,310	**2,310**	3,500	1,771	**5,271**
Hydrogen Conversion	$316	$1,982	$2,667	933	837	360	**2,130**	3,500	1,021	**4,521**
Electrification & Emerging Technologies										
15% PRM										
Multi-Jurisdictional Baseline*	$0	$0	$0	933	2,511	10	**3,454**	3,500	1,211	**4,711**
Existing Technologies	$554	$4,208	$5,066	-	-	3,810	**3,810**	3,500	2,271	**5,771**
Long Duration Storage	$471	$2,125	$2,242	-	-	3,260	**3,260**	3,500	3,011	**6,511**
Hydrogen Conversion	$289	$2,657	$3,185	933	837	1,570	**3,340**	3,500	1,341	**4,841**
18%/20% PRM										
Existing Technologies	$707	$4,849	$5,813	-	-	4,290	**4,290**	3,500	2,371	**5,871**
Long Duration Storage	$674	$2,695	$2,863	-	-	3,580	**3,580**	3,500	3,131	**6,631**
Hydrogen Conversion	$427	$3,228	$3,838	933	837	1,990	**3,760**	3,500	1,021	**4,521**

**Multi-jurisdictional baseline provides information for SPS's other jurisdictions and does not incorporate New Mexico's Energy Transition Act. ET, LDS, HC as shown in this table are all NM ETA compliant.*

Conclusions

- Beyond this IRP, relying *solely* on today's commercially available, carbon-free technologies (i.e., wind, solar and 4-8 hours lithium-ion batteries) is not an economically viable solution
- To be clear, lithium-ion batteries will likely be crucial for achieving New Mexico's ETA, however, alternative emerging technologies are necessary in the future
- The actual cost and capabilities of alternative emerging technologies will become clearer over time and in future IRPs

LOAD SHEDDING – WHY IT'S SOMETIMES NECESSARY

David Wheeler, Manager, System Protection Engineering

XCEL ENERGY-TEXAS AND NEW MEXICO

SUB-REGIONAL TRANSMISSION PLANNING MEETING

October 12, 2023

OUTLINE OF PRESENTATION

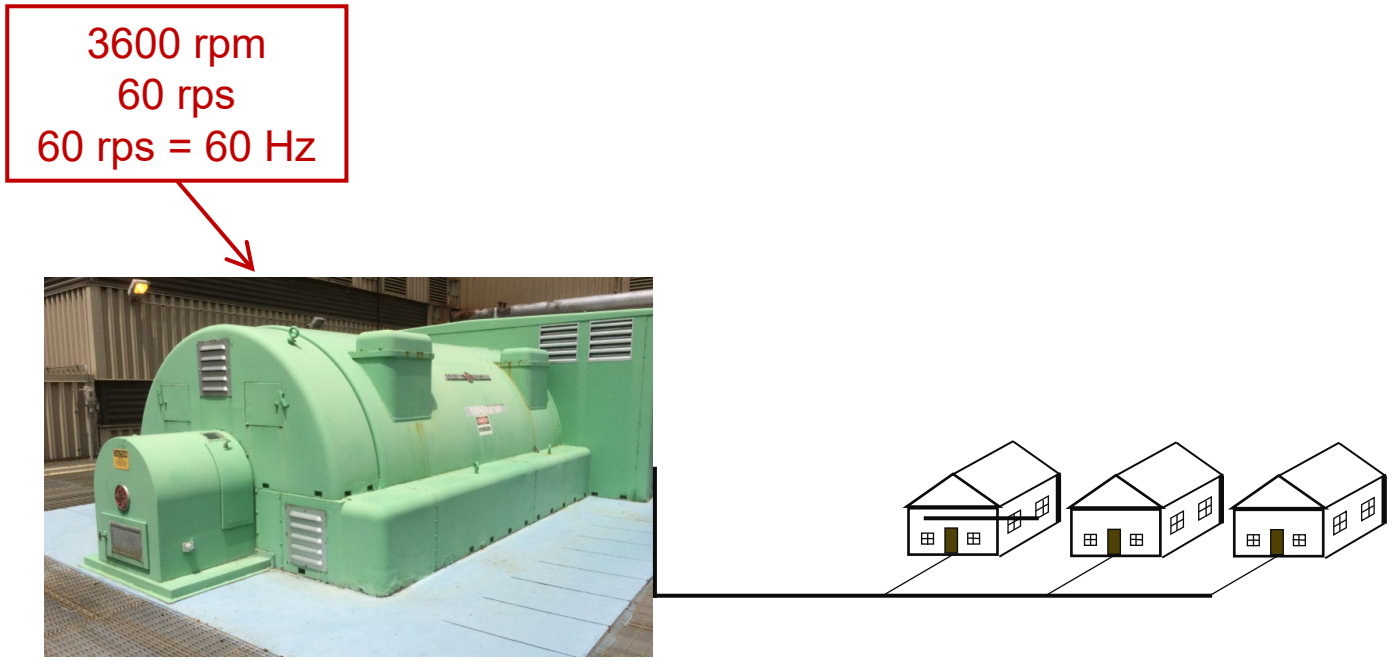
- What is Load Shedding and Why do We Need it?
- What is Underfrequency?
- Manual and Automatic Underfrequency Load Shed (UFLS)
- What is the Purpose of UFLS?
- Xcel Energy New Mexico/Texas Need for UFLS
- UFLS Regional/Local Practices
- Conclusions

What is Load Shedding?

- Manual or automatic removal of blocks of load (MW's) in response to insufficient generation, extremely high load conditions, or sudden loss of significant amounts of generation/import power
- Only non-critical loads are desired to be shed
- Critical loads include hospitals, first responder facilities (i.e., police/fire stations), generator fuel supplies, sewer lift stations, etc.
- Loads are typically shed by opening distribution substation breakers (<15kV)

What is Under Frequency?

- Generators spin at a rate of 3600 revolutions per minute (rpm), or 60 revolutions per second (rps)
- 60 rps is equivalent to 60 electrical cycles per second, which equates to a nominal system frequency of 60 Hertz (Hz)
- When generation = load, frequency is 60 Hz
- When generation < load, frequency drops!



What is Manual Load Shedding?

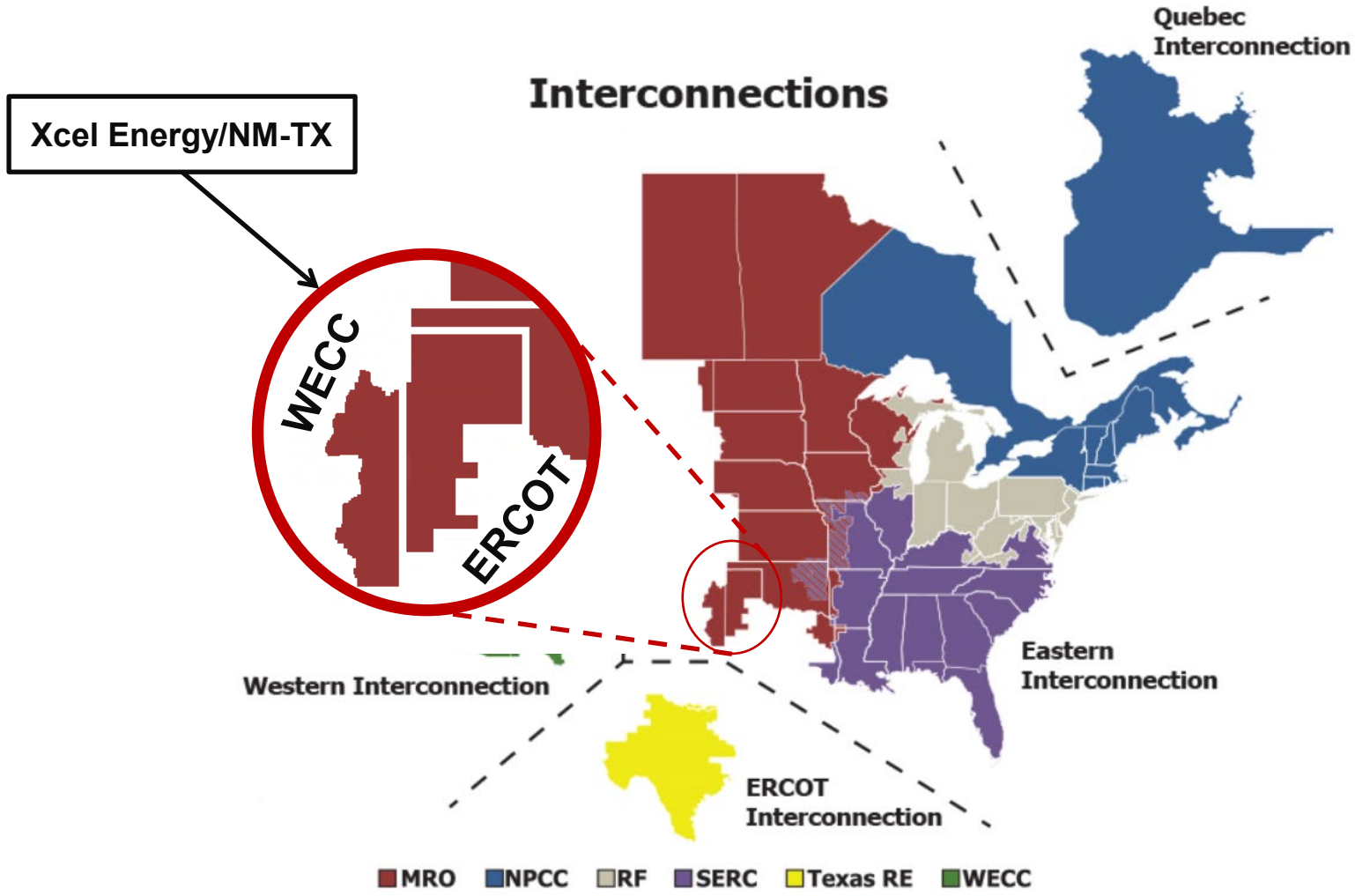
- Controlled, Transmission Operator action performed at the request of Reliability Coordinator, Southwest Power Pool (SPP)
- Substation breakers are queued to be opened to shed load in MW blocks for a minimum time duration (e.g., 1-hour)
- After the next block is shed, previous blocks are restored (rolling blackouts)
- This process continues until the need for load shed no longer exists (e.g., sufficient generation reserves are available, or system load levels have dropped to sustainable levels)
- This is a slow process that can usually be planned, predictable.
- Shed loads are rotated
- Once the load shedding need has passed, normal system operation ensues

When do we need Manual Load Shedding?

- Generation reserves are insufficient to meet forecast load demand
- Greater than expected load due to extreme weather (hot/cold)
- Only necessary if public appeals for load reductions do not achieve desired load levels

Recent Manual Load Shed Examples

- **Winter Storm Uri – Xcel Energy New Mexico/Texas Region**



NERC Map Source: https://www.nerc.com/AboutNERC/keyplayers/PublishingImages/NERC_Interconnections_01JUL19.jpg

Recent Manual Load Shed Examples

- **Winter Storm Uri – Xcel Energy New Mexico/Texas Region**

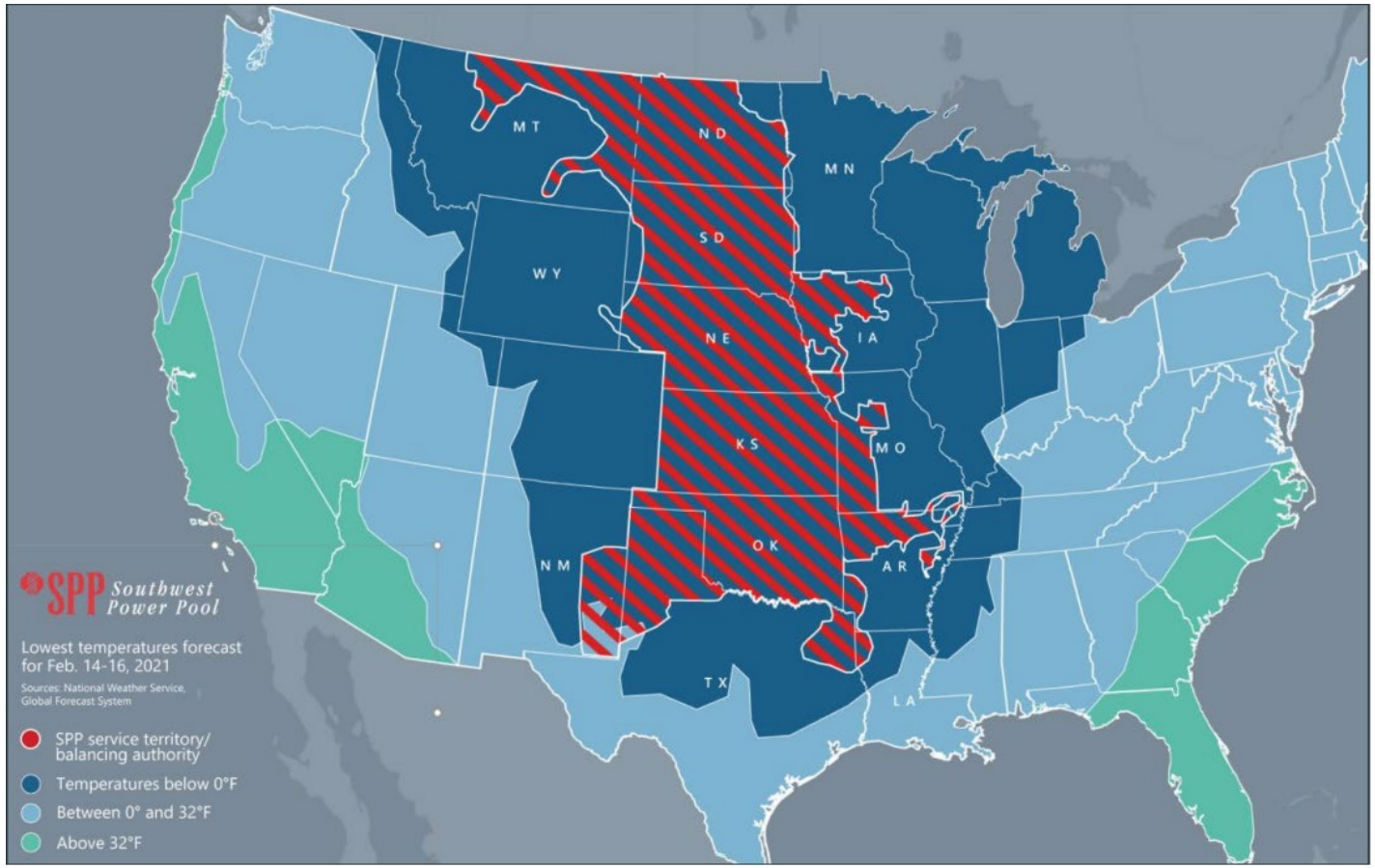


Figure 2: Low-Temperature Map

Map Source: comprehensive review of spp's response to the feb. 2021 winter storm 2021 07 19.pdf

Recent Manual Load Shed Examples

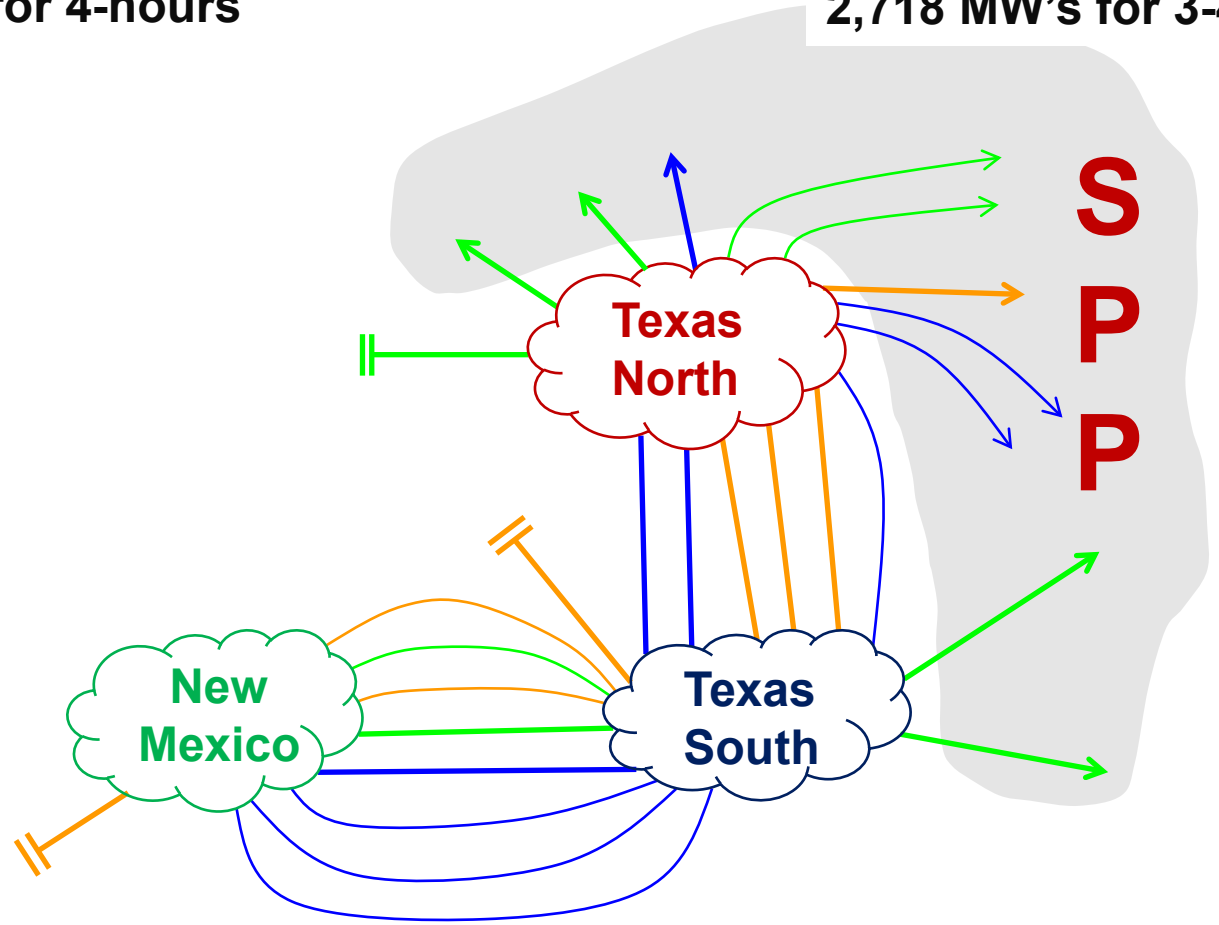
- **Winter Storm Uri – Load Shed Summary, February 16, 2021:**

Xcel Energy NM/TX Load Shed:

336 MW's for 4-hours

SPP Load Shed (Including Xcel):

2,718 MW's for 3-4 hours



Recent Manual Load Shed Examples

- **Winter Storm Uri – ERCOT Region**

Rapid Decrease in Generation Causes Frequency Drop

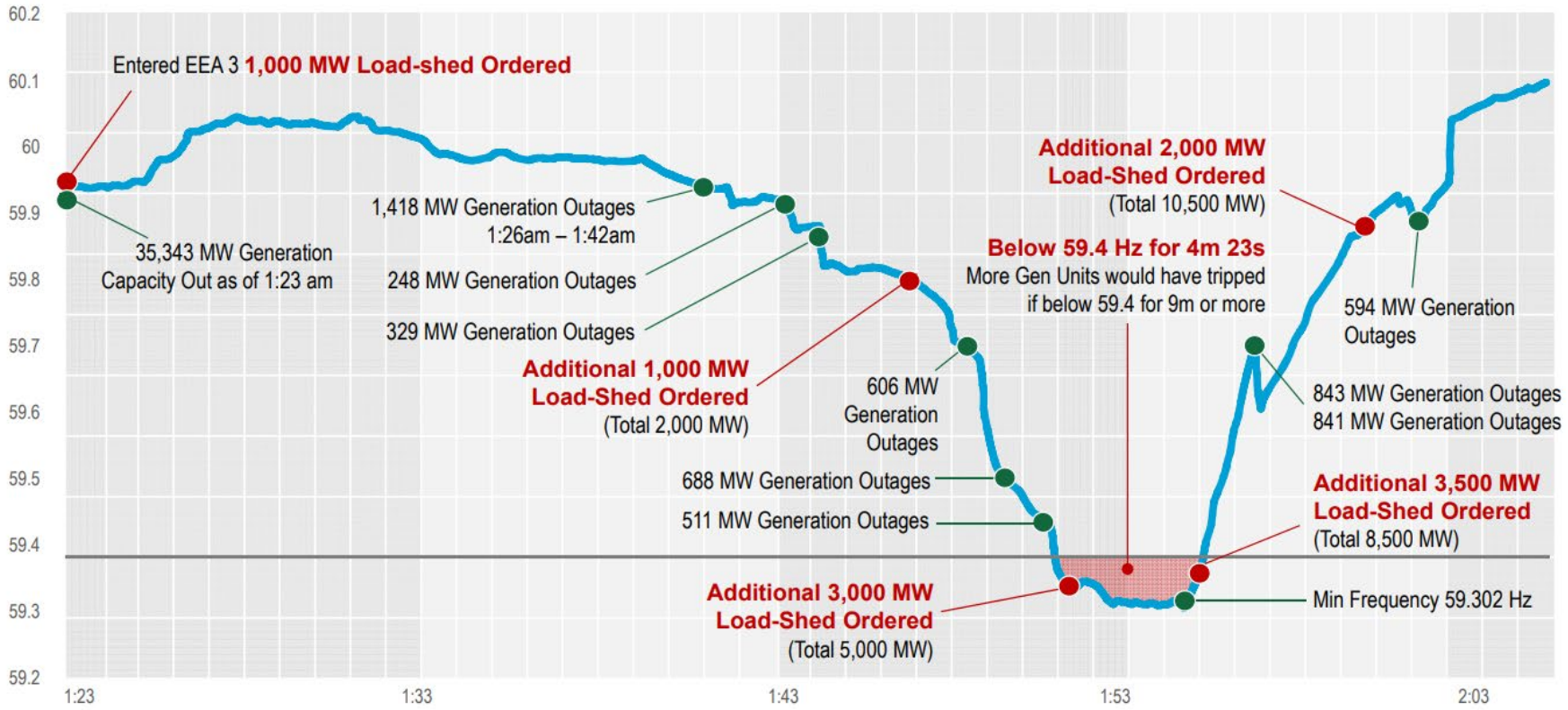


Figure Source: Microsoft PowerPoint - Urgent Board of Directors Meeting_2-24-2021 (ercot.com)

Recent Manual Load Shed Example

- **Winter Storm Uri – ERCOT Load Shed Summary, February 16, 2021:**
  - **ERCOT Load Shed – 10,500 MW's**
  - **Lowest System Frequency – 59.302 Hz!!!**

What is Automatic UFLS?

- Automatic UFLS is a ***last-ditch***, first line of defense to prevent blackouts and generator steam turbine damage
- Underfrequency relays are scattered throughout power system, usually at distribution substations
- Relays monitor voltage frequency
- Relay elements will assert and trip after a short time delay (0.1 – 0.5 seconds) when monitored frequency reaches an underfrequency setpoint
- UFLS programs require tripping for underfrequency conditions below 59.5 Hz
- UFLS programs typically have three or more underfrequency levels, each designed to trip a percentage of total system load
- Much faster than Manual Load Shed – too fast for human intervention
  - Usually in response to loss of generator(s) or Tie Line
- Not Planned or predictable.

What is the Purpose of UFLS?

- **Prevent generator turbine damage**
- **Blackout avoidance**

Steam Turbine Frequency-Time Damage Table

Frequency at Full Load (Hz)	Minimum Time to Damage (Min.)
59.4	-----
58.8	90
58.2	10
57.6	1

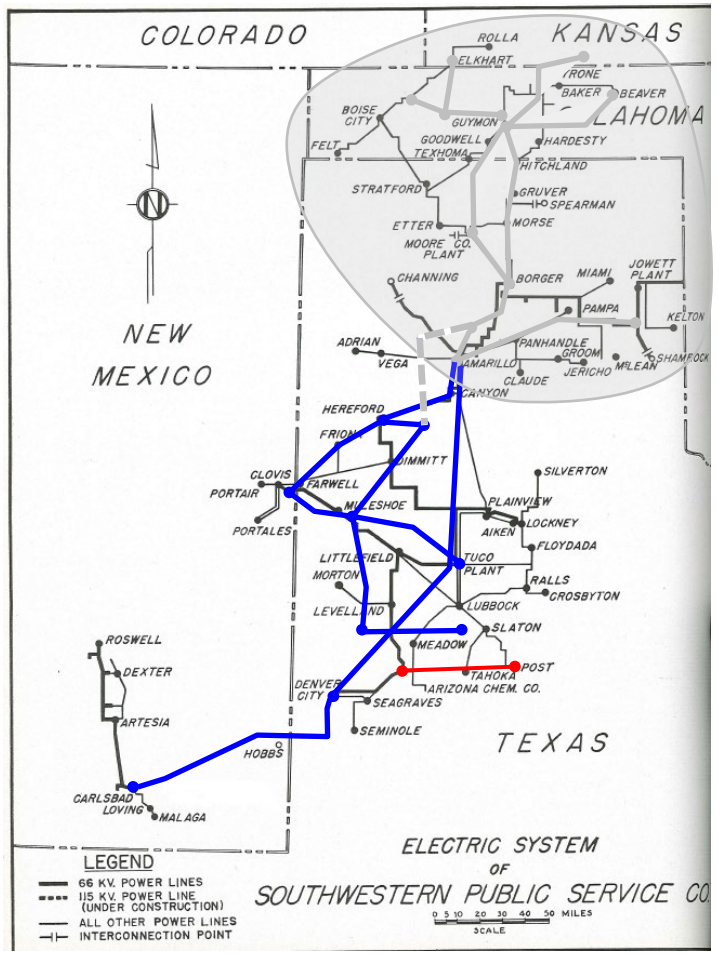
Time is CUMULATIVE over the life of the machine!!

	PRC-024-2 Allowable Low Frequency Tripping Time Delay (Sec.)		
Frequency (Hz)	Eastern Interconnection *	Western Interconnection	ERCOT Interconnection
> 59.5 Hz	Continuous	Continuous	Continuous
≤ 59.5 Hz	1792	Continuous	Continuous
> 59.4 Hz	1201	Continuous	Continuous
≤ 59.4 Hz	1201	180	540
≤ 59.0 Hz	242	180	540
≤ 58.4 Hz	22	30	30
≤ 58.0 Hz	4.44	30	2
≤ 57.8 Hz	0	7.5	2
≤ 57.5 Hz	0	7.5	0
≤ 57.3 Hz	0	0.75	0
≤ 57.0 Hz	0	0	0

* EI tripping times follow the formula $10^{(1.7373*f - 100.116)}$ for frequency values > 57.8 Hz and ≤ 59.5 Hz. This formula was applied to fill in EI values in table at frequency shown.

Xcel Energy NM/TX Need for UFLS

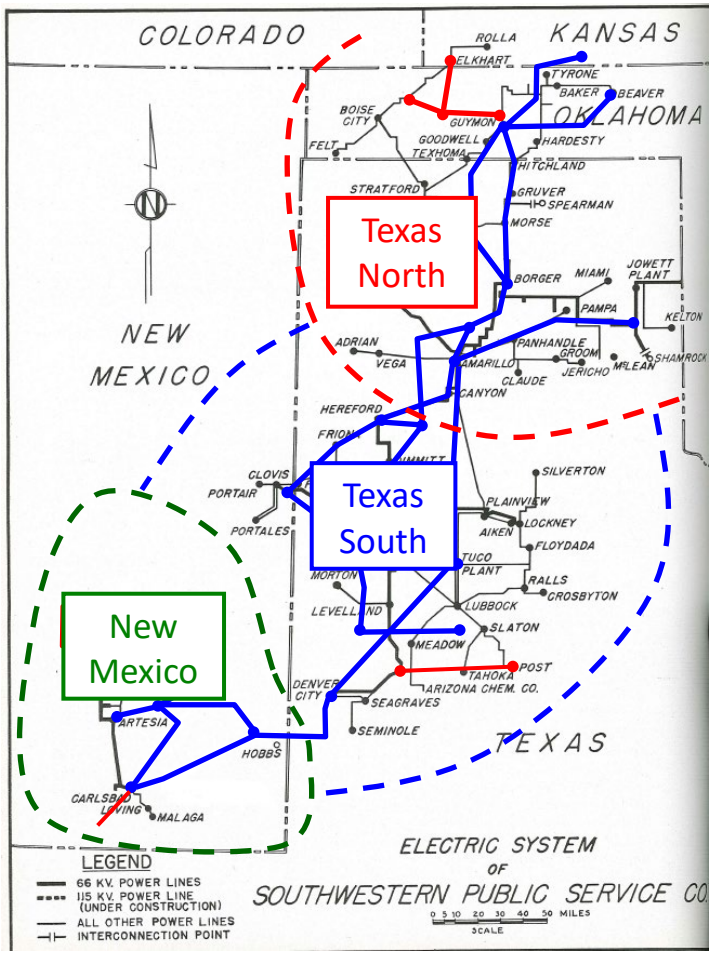
- **Prior to 1964, Xcel Energy NM/TX did not utilize UFLS**
- **In 1964, a major blackout of the Texas North region caused by loss of generation changed that practice!**



Xcel Energy NM/TX Need for UFLS

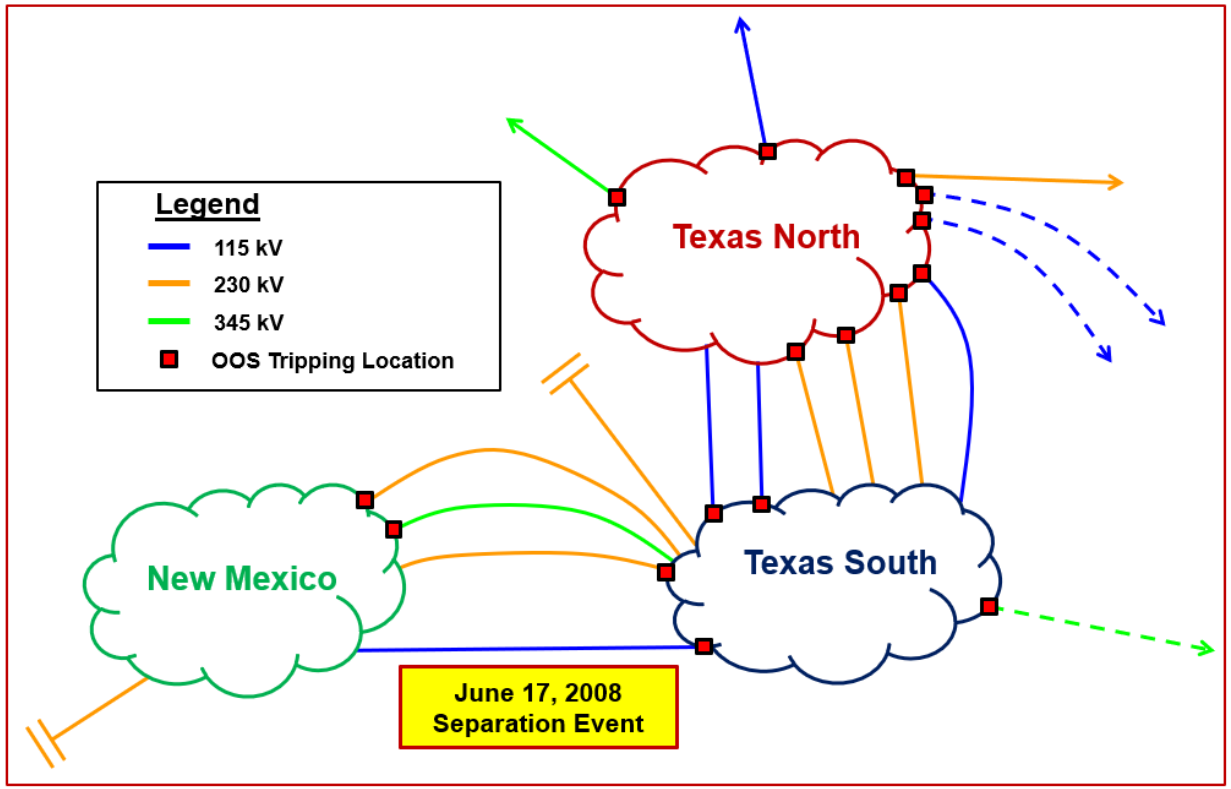
1964 Lessons Learned

- Underfrequency relaying was installed throughout the system at three levels (59.3 Hz, 59.0 Hz, 58.7 Hz)
- About 10% of system load was to be shed at each UF level



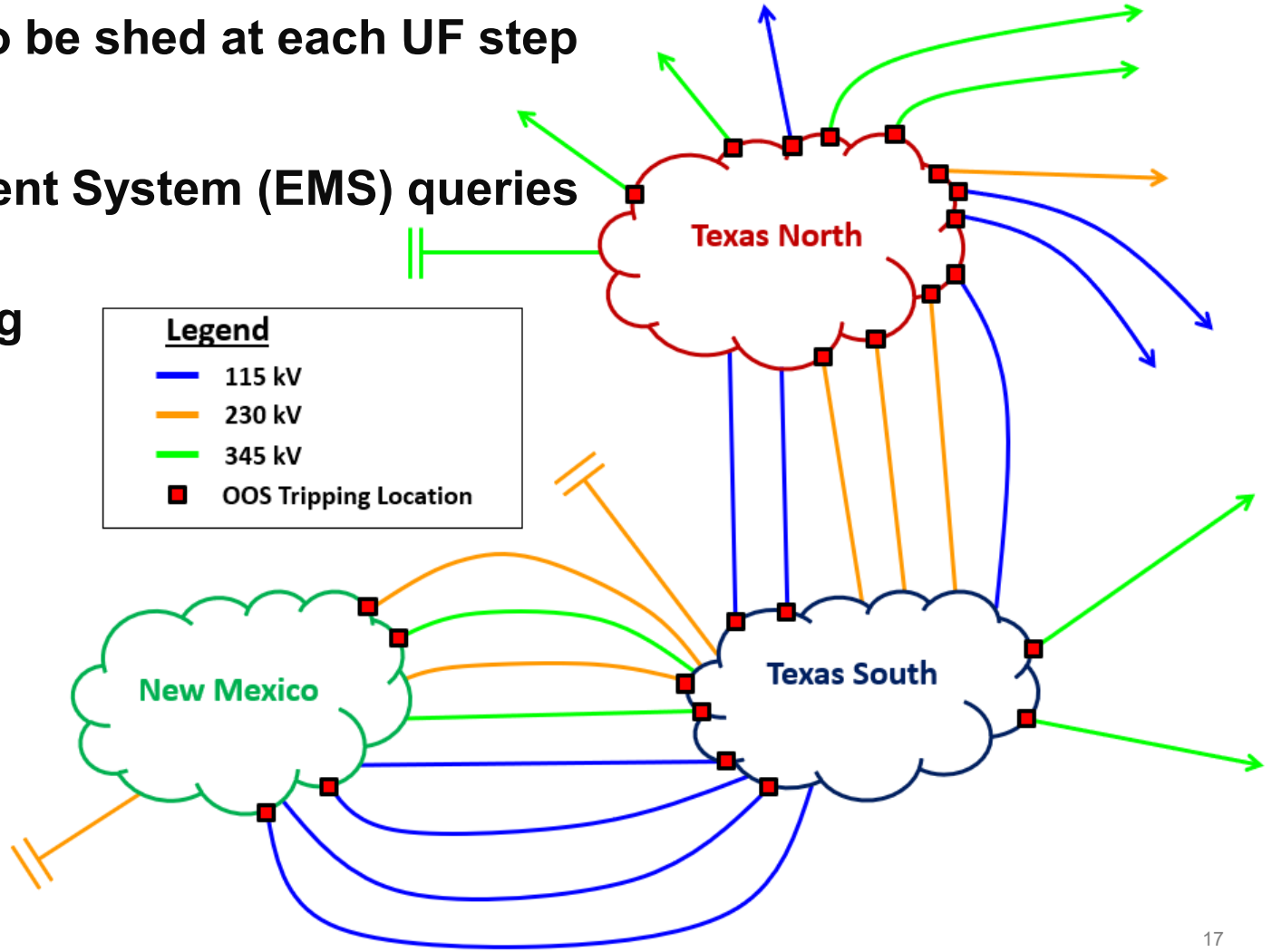
Xcel Energy NM/TX UFLS “Tests”

Separation Event Date(s)	Tie Lines OUT	Tie Lines TRIPPED	Lowest UFLS Level Tripped	UFLS Load Tripped	TOTAL Load Tripped
1983–1985	0	1	59.3 Hz	<350 MW	<350 MW
April 16, 1996	1	4	58.7 Hz	750 MW	2000 MW
June 17, 2008	3	3	59.3 Hz	650 MW	650 MW



UFLS Program Setup and Evaluation

- Identify non-critical loads to be tripped
- Identify at least 10% of system loads to be shed at each UF step
- Balance loads across sub-islands
- Monitor loads using Energy Management System (EMS) queries to ensure shedding required minimum
- Adjust/add loads as necessary ongoing



UFLS Regional/Local Practices

- The planning coordinator for the Xcel Energy NM/TX region is the Southwest Power Pool (SPP)
- Per NERC standard PRC-006, SPP developed a UFLS program summarized below:

UFLS Step	Frequency (Hz)	Minimum Accumulated Load Relief as Percentage of Forecasted Peak Load (%)	Maximum Accumulated Load Relief as Percentage of Forecasted Peak Load (%)
1	**59.3**	10	25
2	**59.0**	20	35
3	**58.7**	30	45

  - Intentional time delay less than or equal to 30 cycles

- Xcel Energy NM/TX uses normal intentional time delays of 6 cycles.

Conclusions

- UFLS (Manual or Automatic) is used to minimize outage time, number of customers affected, and generator damage.
- UFLS targets Non-critical loads whenever possible
- As least 30% and as much as 45% of load must be ready to be shed.
- NERC required load shedding (both manual and automatic UFLS) has proven to be effective in preventing blackouts, or minimizing their extent since the 1965 NE Blackout

Questions?

NERC STANDARD MOD-026-2

Thomas Maldonado – Director, Operations Compliance Programs

October 12, 2023

Verifications of Models and Data for Generators - Background

NERC Standards Affected – MOD-026-1 and MOD-027-1

- The NERC Inverter-based Resource (IBR) Performance Task Force (IRPTF) undertook an effort to perform a comprehensive review of all NERC Reliability Standards to determine if there were any potential gaps or improvements.
- Among the findings noted in the white paper, the IRPTF identified issues with MOD-026-1 and MOD-027-1 that should be addressed.
- SAR endorsed by Reliability and Security Technical Committee on June 10, 2020

Verifications of Models and Data for Generators - Background

NERC Standards Affected – MOD-026-1 and MOD-027-1

- MOD-026-1 and MOD-027- 1 require, among other things, Generator Owners to provide verified dynamic models to their Transmission Planner for the purposes of power system planning studies.
- Both standards contain language that is specific to synchronous generators that is not applicable to IBRs.
- Proposes revisions to MOD-026-1 and MOD-027-1 to clarify requirements related to IBRs and to require sufficient model verification to ensure accurate generator representation in dynamic simulations.

NERC Reliability Standards – New or Modified Term(s)

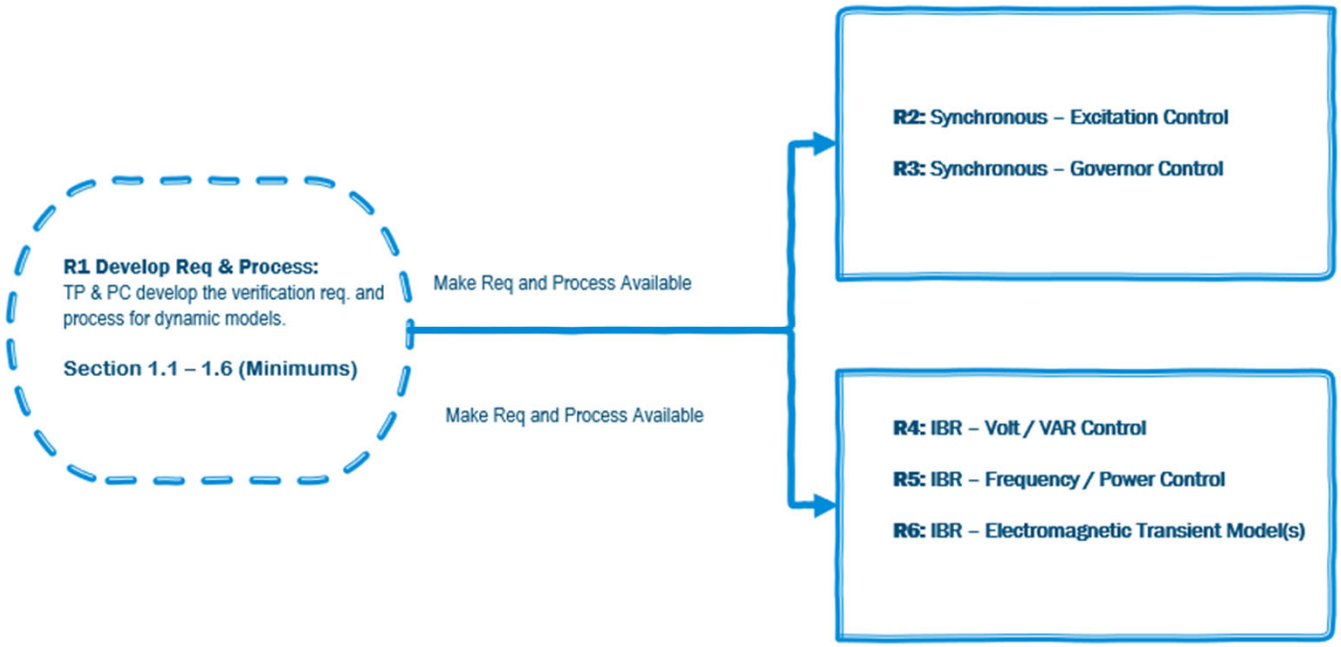
Background:
This section includes all new or modified terms used in the proposed standard that will be included in the *Glossary of Terms Used in NERC Reliability Standards* upon applicable regulatory approval. The terms proposed below are intended to be used in MOD-026-2 and other inverter-based resource related standards.

Term(s):
Power Electronic Device (PED): Any device connected to the ac power system through a power electronic interface that generates or transmits active power or reactive power, or absorbs active power for the purposes of re-injecting it at a later time. This term excludes any load.

Inverter-Based Resource (IBR): Any source of electric power consisting of one or more Power Electronic Devices (PEDs), that operates as a single resource, supplies primarily active power, and connects to the Bulk Power System. An IBR plant/facility includes the Power Electronic Devices, and the equipment designed primarily for delivering the power to a common point of connection (e.g. step-up transformers, collector system(s), main power transformer(s), and power plant controller(s)).

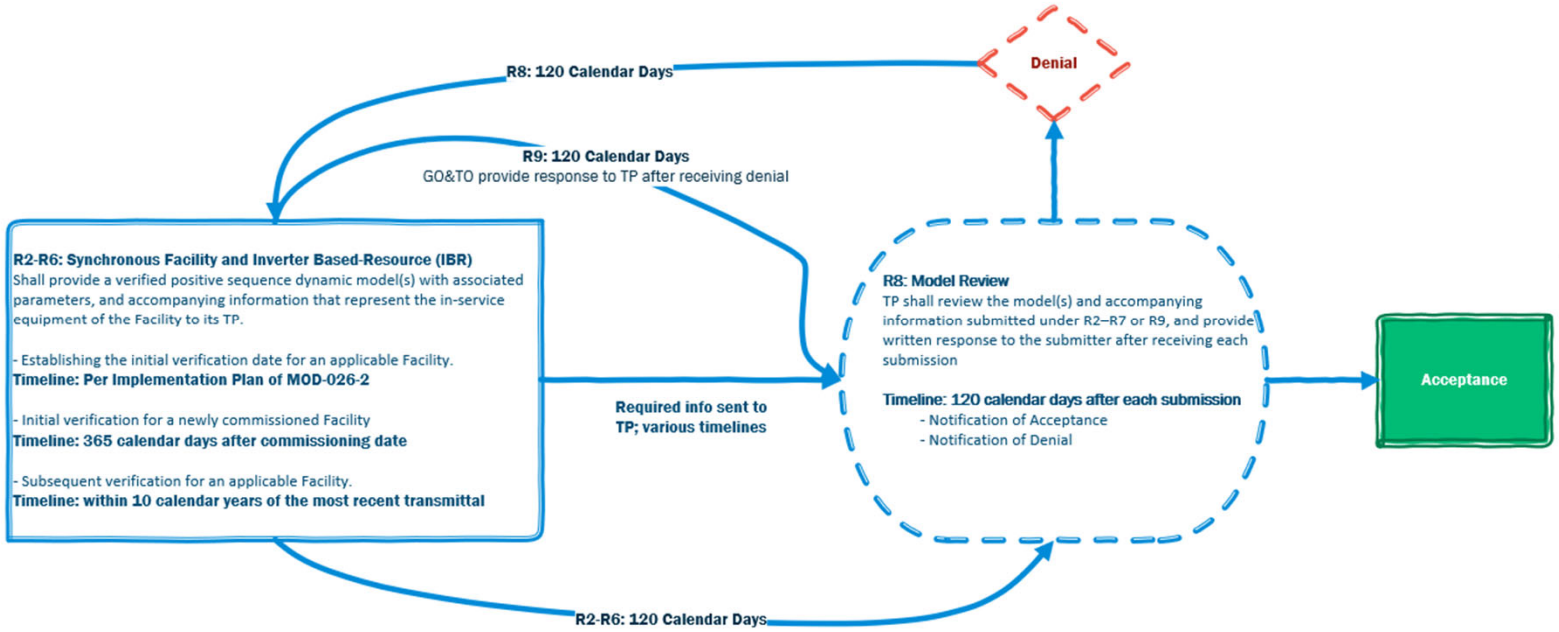
Verifications of Models and Data for Generators – R1 Process

NERC Standard Proposed – MOD-026-2



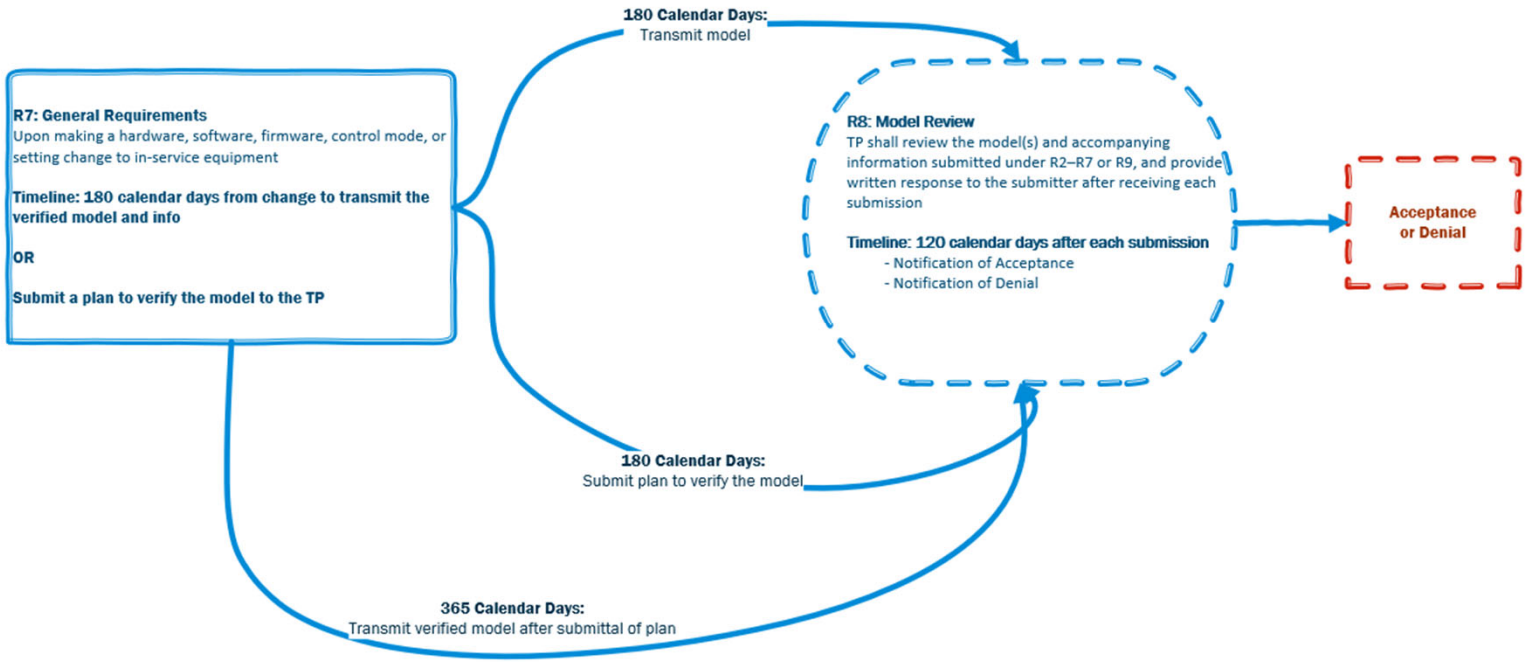
Verifications of Models and Data for Generators – R2-R6, R9 Process

NERC Standard Proposed – MOD-026-2



Verifications of Models and Data for Generators – R7 Process

NERC Standard Proposed – MOD-026-2



Verifications of Models and Data for Generators

NERC Standards MOD-026-2: Project Tracking

Project	2020-06						Home
Scheduling Dates	Projected or Actual Start	Projected or Actual End	Calculated Start	Calculated End	No. of Days Ahead or (Behind) Schedule	Complexity Factor (CF) Impacts to Schedule (Start on 1st Row)	Time Impact
AS1 - Additional SAR 1						Pandemic	90
AS2 - Additional SAR 2						Pandemic	90
QR - Quality Review						Highly Technical	90
SP1 - SAR/PR/WP Posting 1	12/16/2020	1/15/2021	12/16/2020	1/15/2021		Research Required	180
SDT - Dev Time	3/16/2021	7/14/2021	3/16/2021	7/14/2021		SAR - Revised/Additional P	60
CP1 - Comment Period 1						Additional Comment/Ballo	60
CP2 - Comment Period 2						Additional Comment/Ballo	60
CIB - Com/Ballot 1 (Initial)	5/30/2022	7/6/2022	7/14/2021	8/28/2021	(320)	Highly Technical	90
CAB - Com/Add Ballot 2	11/21/2022	1/18/2023	10/27/2021	12/11/2021	(390)	N/A	
CAB - Com/Add Ballot 3	6/7/2023	7/22/2023	2/9/2022	3/26/2022	(483)	N/A	
CAB - Com/Add Ballot 4	10/31/2023	12/15/2023				N/A	
CAB - Com/Add Ballot 5						N/A	
FB - Final Ballot	1/14/2024	1/24/2024	1/10/2022	1/20/2022	(734)	N/A	
PTB - Present to BOT						N/A	
Filing - Filing with Regulators						N/A	
						N/A	
Delta based on Calculated CF Date and Actual Final Ballot:					(14)	Calculated CF Date:	1/10/2024

PTS Change Control

Reason for Update	Date	Notes
SC Action	9/24/2020	SC authorized SAR posting and solicitation of SAR DT.
NERC Standards	3/15/2021	SAR DT will be **presented** at the March 17 SC meeting
NERC Standards	10/18/2021	Updated project **baseline** for March 2022 initial posting
NERC Standards	2/14/2022	Updated initial posting to April 2022
NERC Standards	5/10/2022	Updated initial posting to May 2022
NERC Standards	9/14/2022	Updated additional posting to November 2022
NERC Standards	3/17/2023	Updated additional posting #2 date to June 2023 for additional outreach for EMT models, Protection Settings

IN CLOSING

YOUR XCEL ENERGY POINTS OF CONTACT

Annette Gallegos
Principal Transmission Representative
Transmission Business Relations
806-378-2218
annette.gallegos@xcelenergy.com

Skip Black
Transmission Account Representative
Transmission Business Relations
806-378-2238
Skip.Larry.Black@xcelenergy.com