WEST TEXAS PLANNING UPDATE

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WE DELIVER.

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WEST TEXAS KEY ISSUES AND BACKGROUND

- Obligation to serve load, responsive to all load requests
- Rapid load growth in weak areas with some radial service
- Magnitude of growth exceeds current transmission and distribution limitations
- Transmission limits are resulting in significant congestion
- Congestion is sometimes an early signal of reliability issues
- Construction clearances plus N-1 contingency in SCED are now causing more congestion than normal conditions plus N-1 contingencies
- Distances and type of load complicates operations and solutions
- Continuing need for non-traditional indicators of load growth
- CREZ transmission additions are enabling service and providing additional new options for service however some service areas are away from these recent additions

WEST TEXAS KEY ISSUES AND BACKGROUND

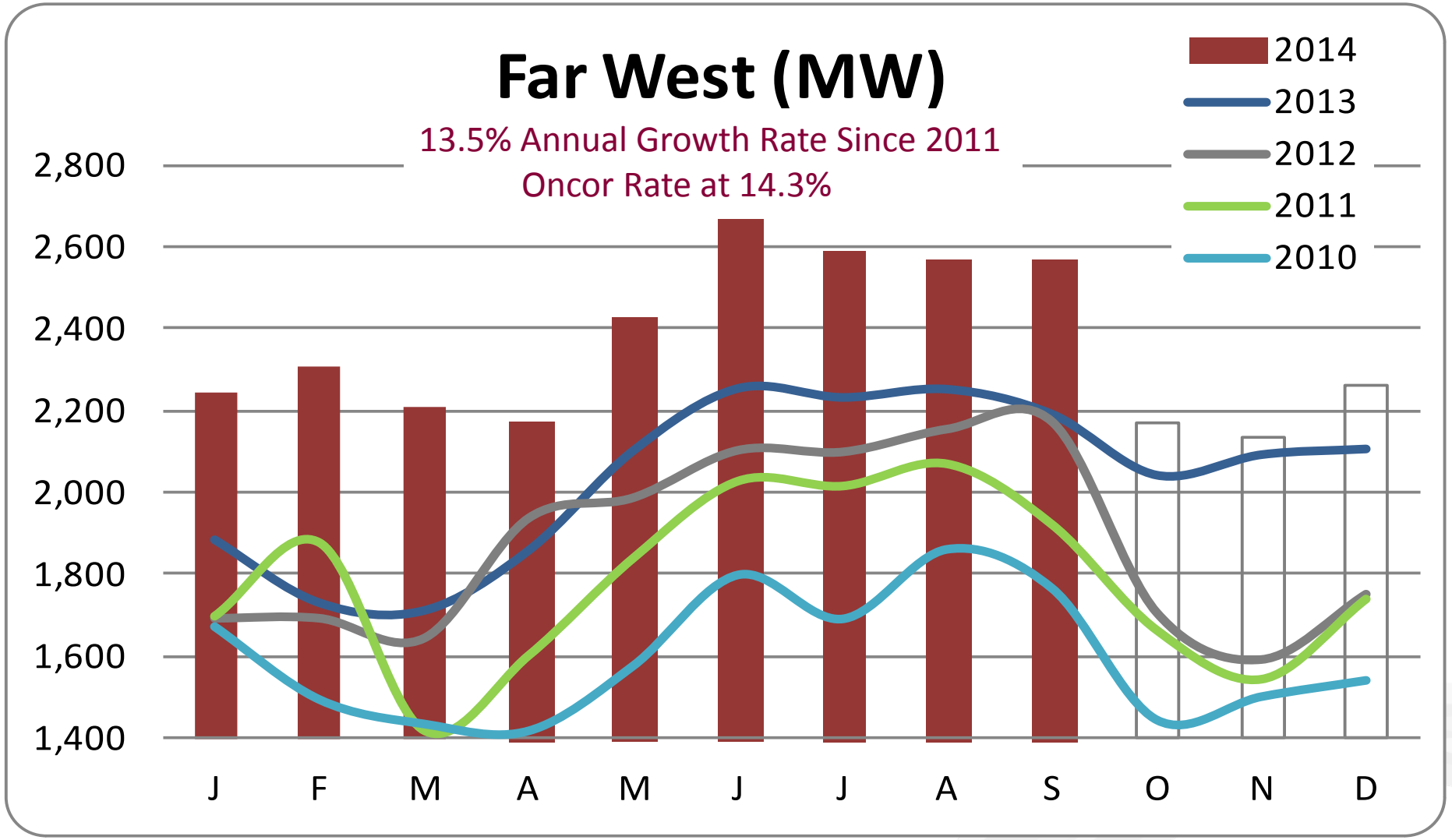
- **Lack of operational flexibility due to transmission limitations, under contingency, is an increasing problem in West Texas**
  - Operational clearances are more difficult to obtain due to increasing load levels and uncertain availability of renewable generation in the area
  - Operational clearances for maintenance, testing and construction are commonly limited due to voltage and thermal limitations brought about under contingency analysis
- **Oncor has undertaken additional techniques to enable construction where clearances are not possible**
  - Temporary paralleling, bypasses and energized (hot) work
  - Increases complexity and cost

- **UNLESS RECENTLY UPGRADED, EXISTING INFRASTRUCTURE IS TYPICALLY NOT CAPABLE OF SERVICING THE INCREASING LOAD**

MEETING CUSTOMER EXPECTATIONS

- Important to meet rapid customer timelines
- Pursue readily available equipment upgrades and operational adjustments to ease congestion
- Collaborate with customers, TSPs and market stakeholders
- Add Special Protection Systems (SPSs) and Constraint Management Plans (CMPs) if necessary
- Reviewing deployment of additional Dynamic Line Rating equipment to maximize operating capabilities enabling clearances and reducing congestion
- Redesign and continual review of new load additions and load forecasting processes for West Texas
- Distribution transformer capacity expansion
  - Plans for 6%, 15% and 30% load growth examined

ACTUAL DEMAND ERCOT FAR WEST WEATHER ZONE ALL TSPs



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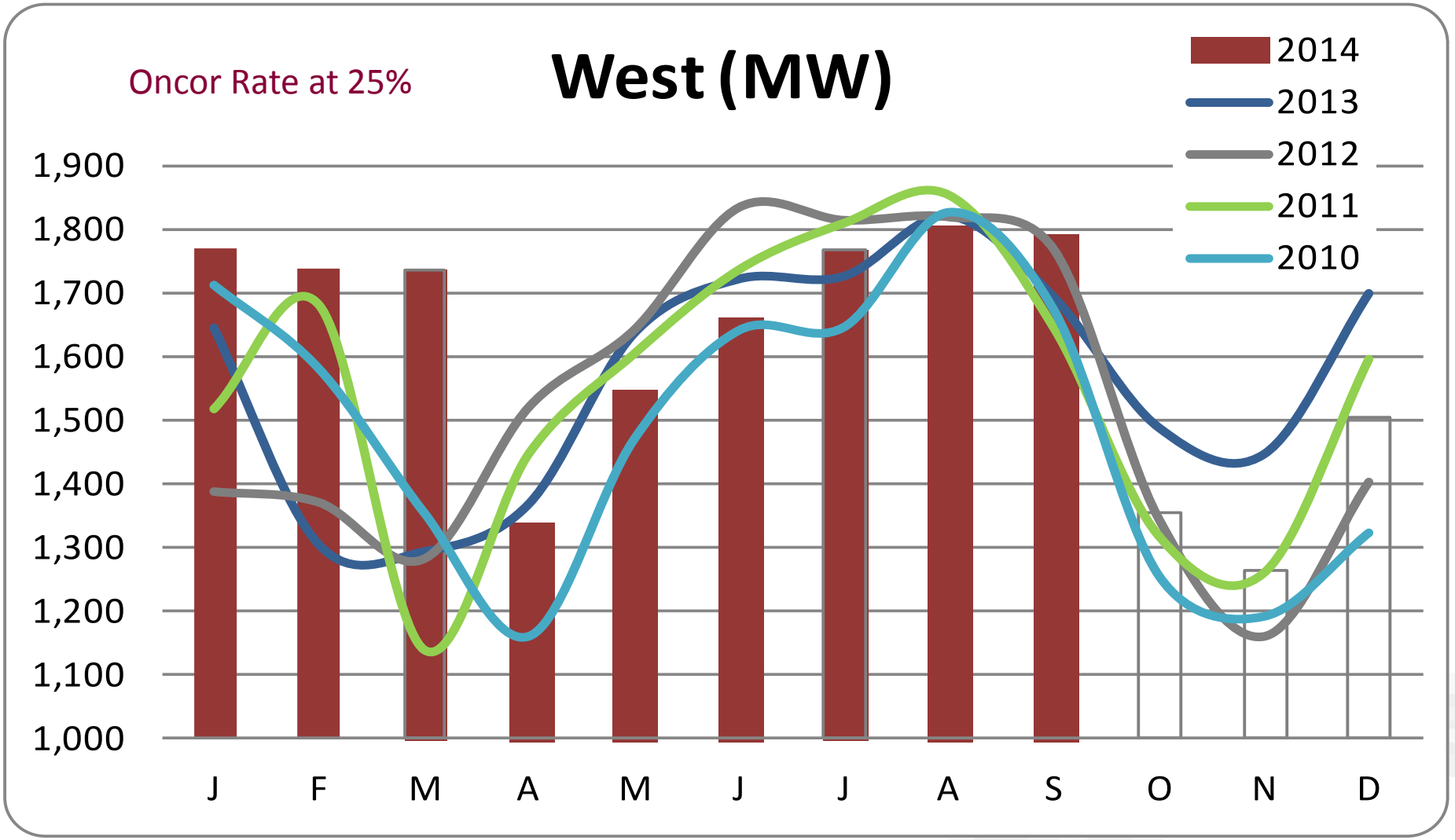
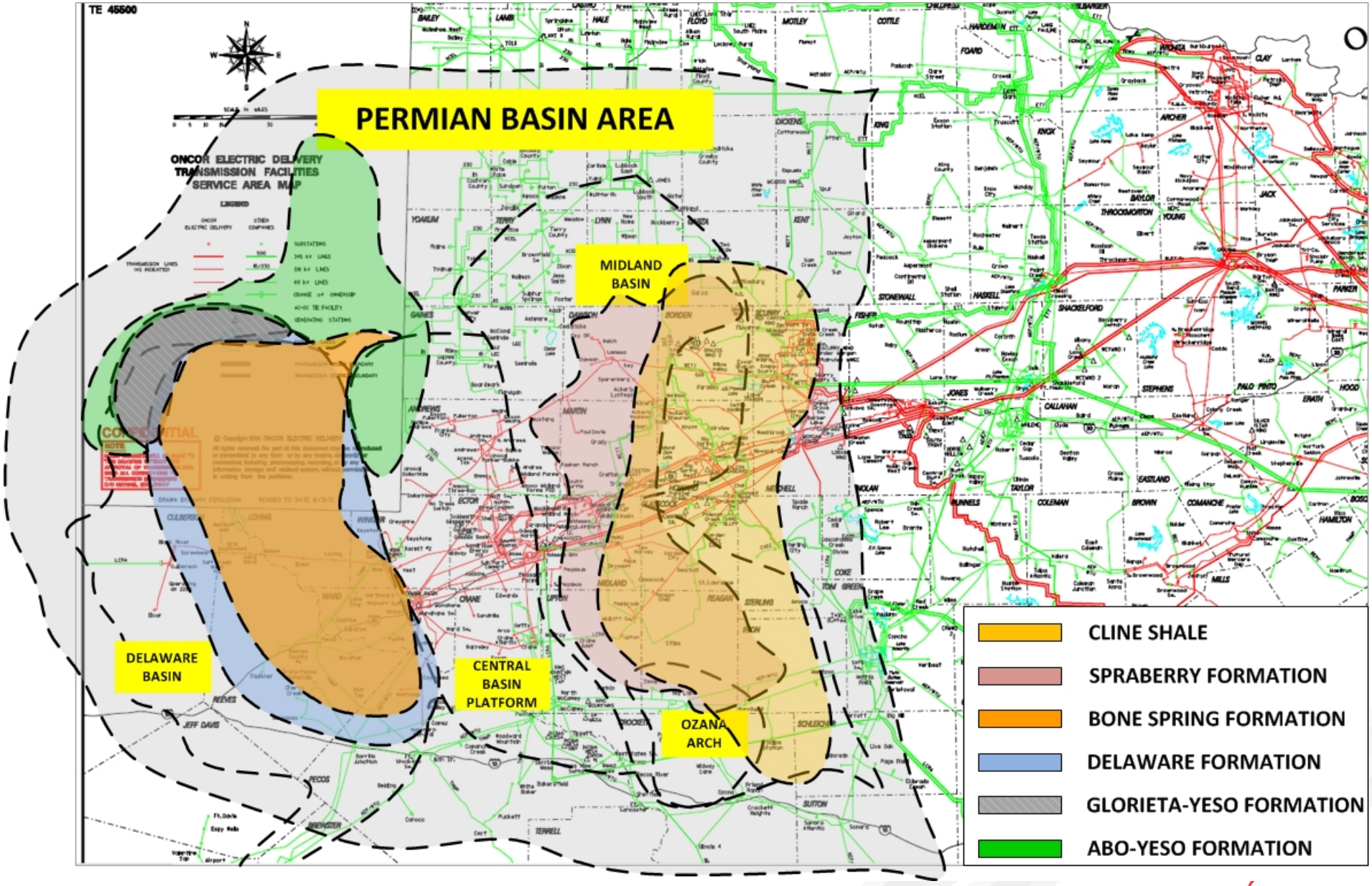


WEST TEXAS WITH BASINS & FORMATIONS



LOAD CHARACTERISTICS

- **Primarily high capacity motor load**
- **Not temperature sensitive**
- **Horizontal recovery techniques require materially more power than traditional vertical recovery (4 to 5 times)**
  - More wells from a single location
  - Higher production than vertical
  - Very high requirement to stay in-service
  - Outages require fast return to service
- **Load very sensitive to voltage fluctuations**
  - Especially during normal and delayed cleared faults
  - Trips offline when voltage dips to 0.90 PU to 0.85 PU
  - Similar to generation voltage ride through issues with wind farms
    - Load voltage ride through requirement does not exist
  - Low system strength aggravates the issues
    - Fault Duty/Short Circuit Ratio
- **Motor starting limits connection distance from substation**
- **Delays in service have resulted in some load (30 MW to +100 MW) being served by onsite generation**

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ERCOT/ONCOR 2013 WTS PROJECT SET

- **ERCOT West Texas Sensitivity (WTS) Study final report was posted on September 16, 2013 and identified 22 projects in the Oncor footprint (total 65 projects all TSPs)**

- **9 WTS projects extend 345 kV from Midland/Odessa to Andrews County and provide additional 345/138 kV autotransformer capacity for 138 kV system**

- **The remaining 13 WTS projects in Oncor's footprint address issues earlier identified by Oncor and those projects are already completed or underway**

WEST TEXAS PLAN KEY ELEMENTS

- Convert 69 kV system to 138 kV
  - Rebuild 69 kV Lines with double-circuit 138 kV construction, one circuit at 69 kV
  - Gradually migrate loads from 69 kV to 138 kV service
- New 138 kV transmission lines
  - Create 138 kV loops to enable clearances and improve system reliability
  - Work closely with Oil & Gas customers to provide expedited service to large single point loads
- Upgrade and add switching stations
  - Increase capacity, modern configurations facilitate greater clearance availability
  - Improved system protection and communications
  - Provisions for future expansion and physical security requirements (CIP)
- Upgrade and add autotransformers with Load Tap Changing (LTC's)
  - Increase capacity and voltage support; operational flexibility for clearances
- Upgrade and add substations with LTC's
  - Increase load serving substation capacity to meet growth plans
  - Increase distribution voltage control capability
- 345 kV Infrastructure
  - Provide backbone support
  - Reach out to areas where there is extreme load and generation growth, but there is a lack of adequate transmission grid infrastructure

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2014 ACTIONS & IMPROVEMENTS

Upgrade Terminal Equipment on Wink (Oncor) – Wink (TNMP) 69 kV Line March

Add 345 kV Breakers at Moss Switching Station May

Convert Midland Farms Substation to 138 kV May

Establish Odessa North 138 kV Switching Station May

Install 69 kV Capacitors at Ennis Creek, Spraberry, & Tex Harvey May

Install 138 kV Capacitors at Mason May

Rebuild Odessa North – Goldsmith Junction 69 kV Line as a Double-Circuit 138 & 69 kV Line (Disconnect from Moss – Ector County North 138 kV Line) May

Upgrade Odessa EHV – Big 3 Tap – Odessa Southwest – Moss 138 kV Line May

Install Morgan Creek SPS #51 May

Install Shunt Reactors at Willow Valley May

Convert Bakke Substation to 138 kV Operation June

Rebuild Stanton East – Buffalo (SU) – Midland East 138 kV Line Dec 2014 and Retire Stanton East SPS Nov

Reconductor Odessa – Odessa EHV 138 kV Line Nov

Construct Buzzard Draw Switching Station Nov

Install 69 kV Capacitors at Midway Dec

Rebuild Wink – Mason 138 kV Line (25-miles up to El Mar complete) Dec

Add Lamesa – Buzzard Draw Second 138 kV Circuit Dec

Rebuild Wink – Permian Basin 138 kV Line Dec

Upgrade Moss – Westover 138 kV Line Dec

Install 138 kV Capacitors at Mockingbird and North Andrews (completed Nov) Dec

Convert Aruba to 138 kV Operation Dec

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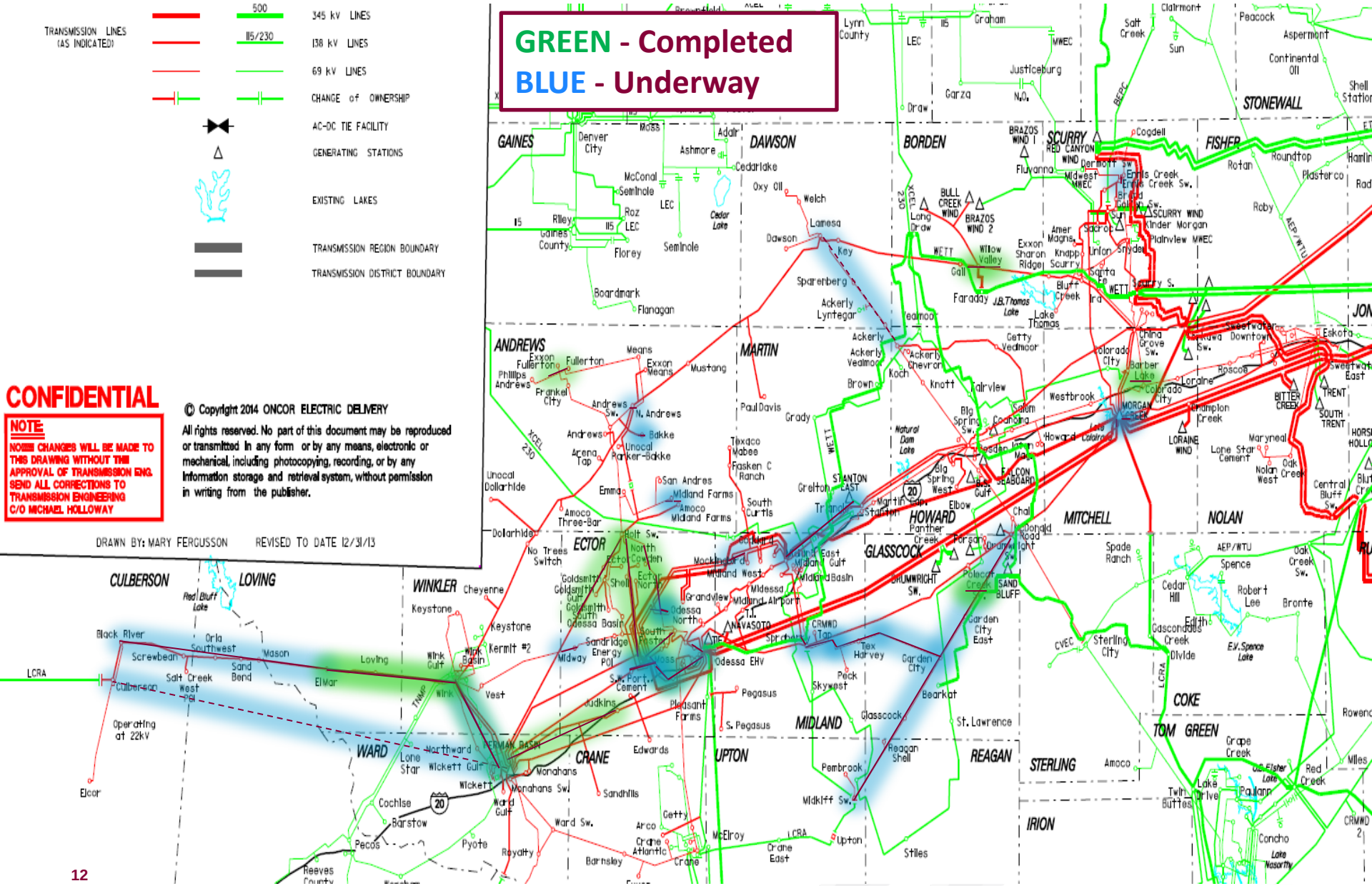
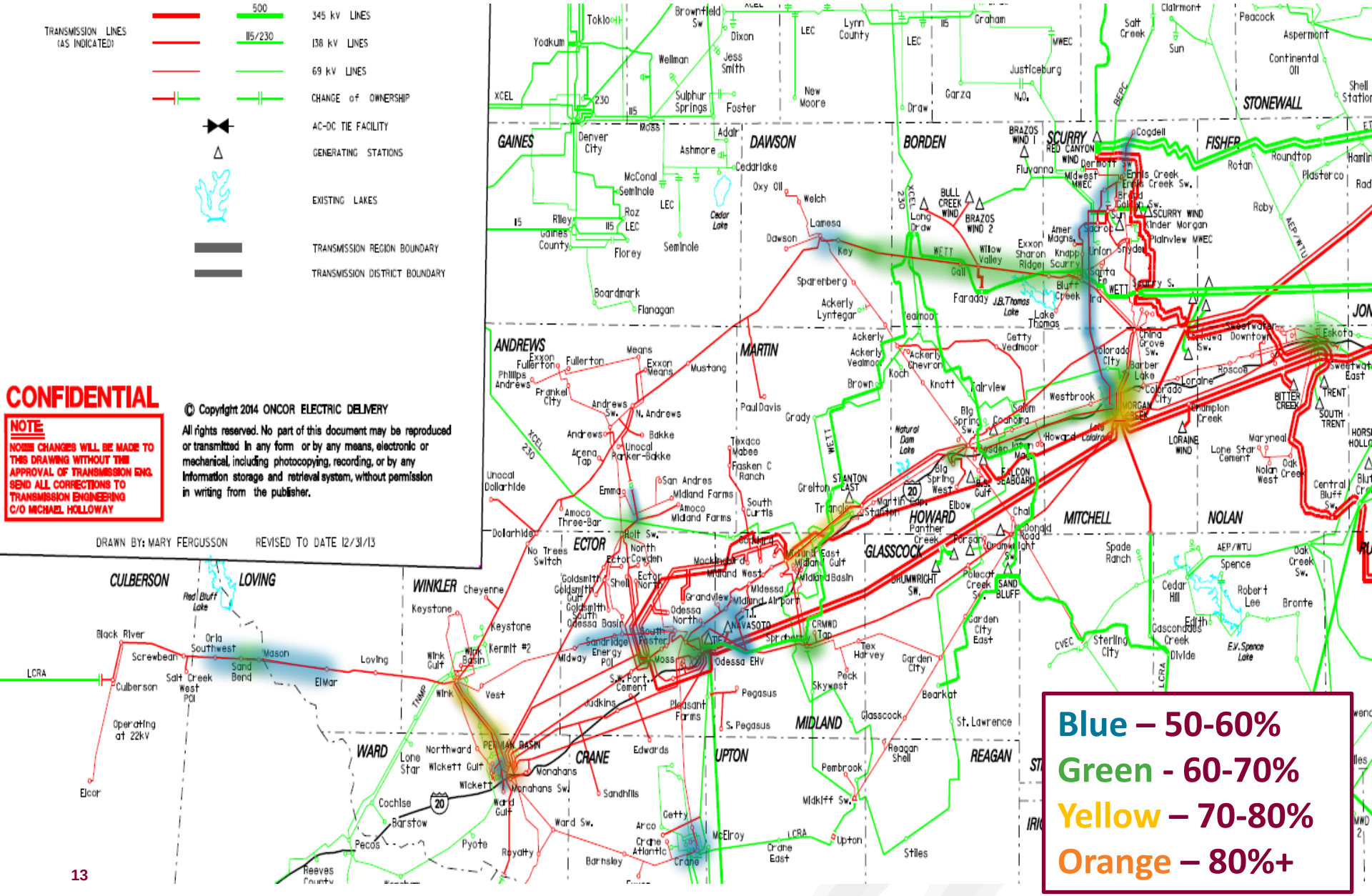
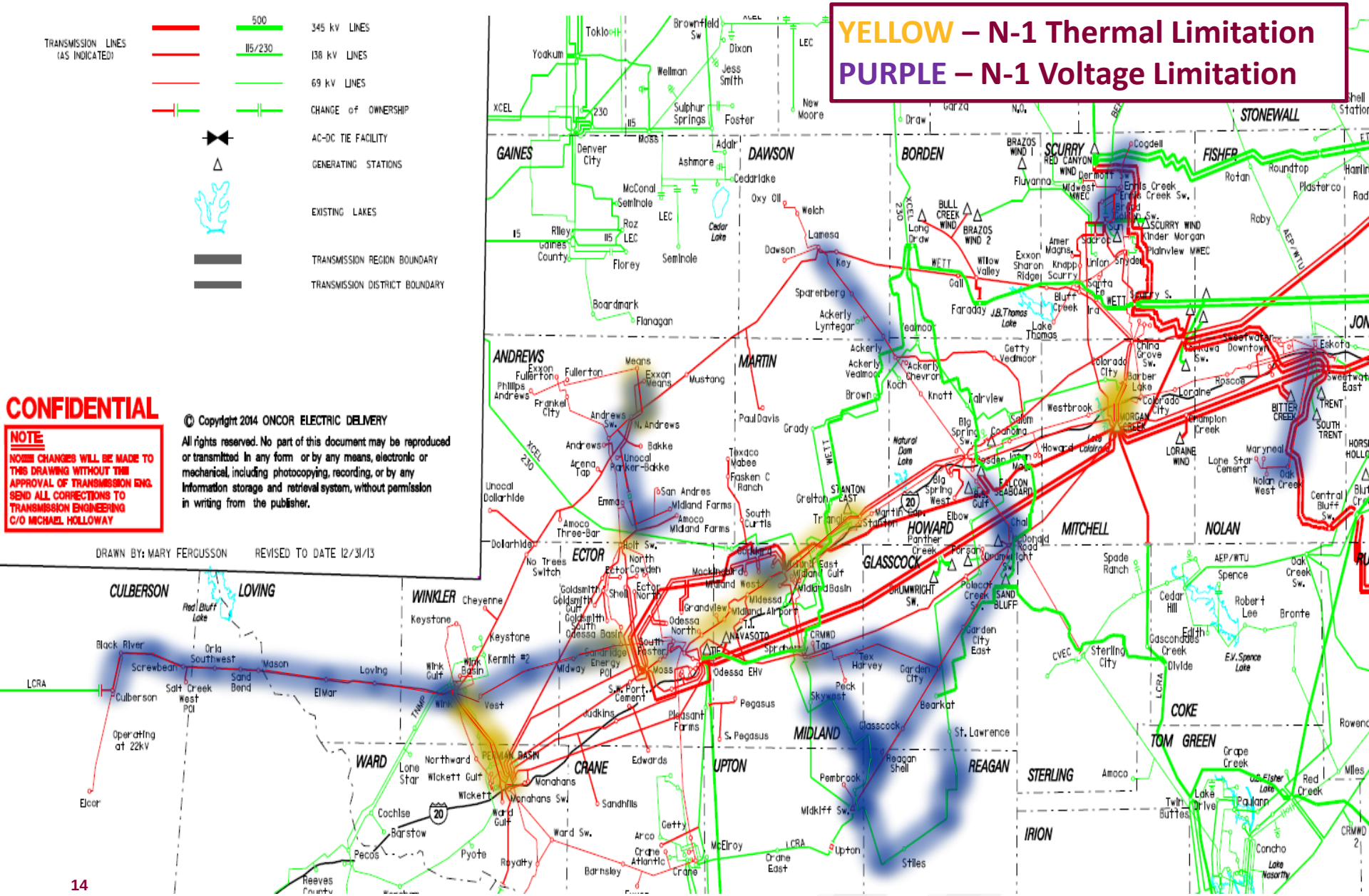
2011 – 2014 ACTIONS & IMPROVEMENTS



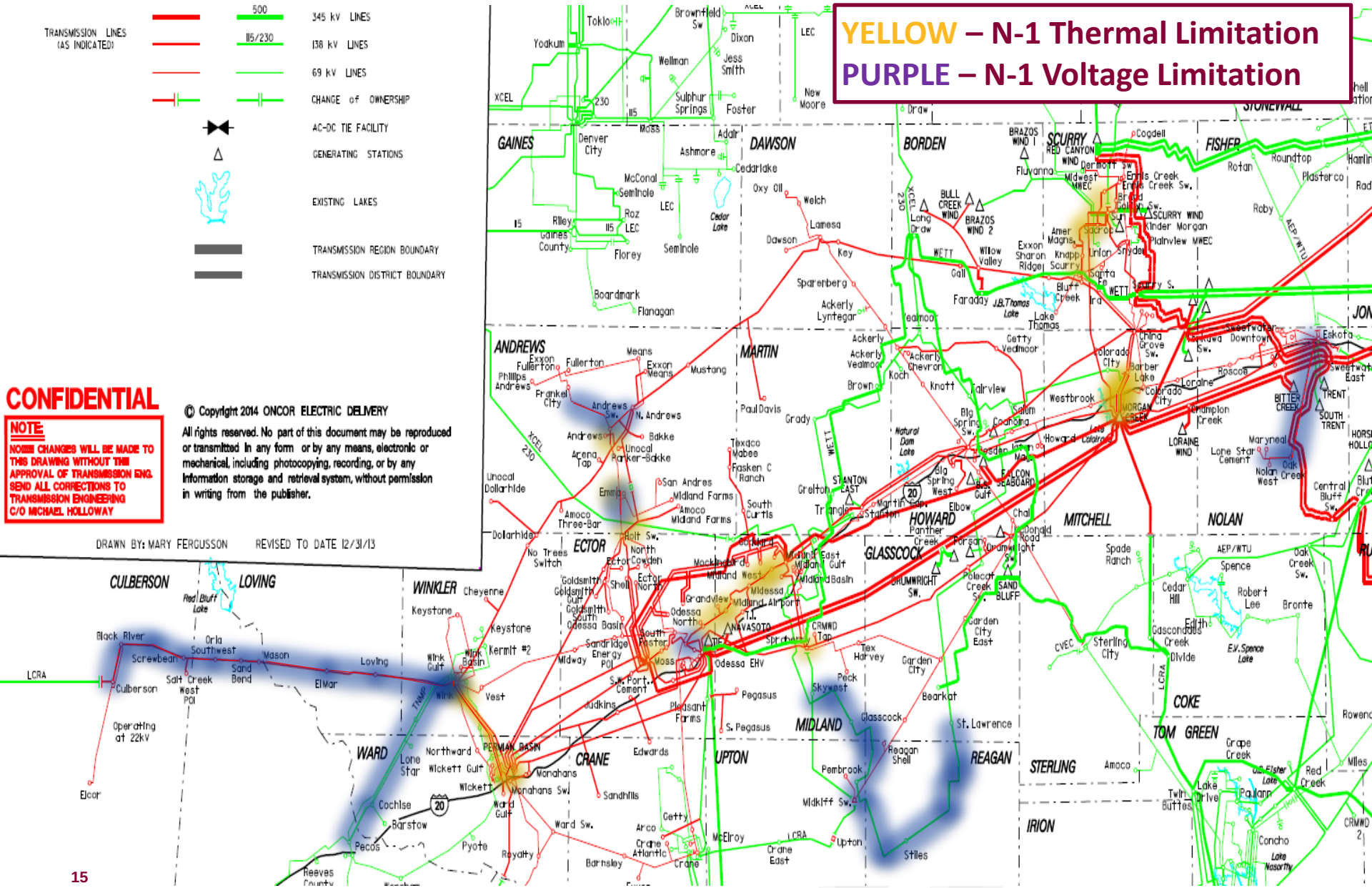
2014 NORMAL CONDITIONS LOADING



2014 SINGLE CONTINGENCY LOADING



2015 SINGLE CONTINGENCY LOADING



2015 IN-SERVICE DATE PROJECTS

Construct New Midland County Northwest 345/138 kV Switching Station May

Add Dermott – Ennis Creek 138 kV Line May

Replace North Andrews 138/69 kV Autotransformers May

Replace Morgan Creek 138/69 kV Autotransformer May

Upgrade Midland Airport – Glenhaven 138 kV Line May

Upgrade North Andrews – Means 69 kV Line May

Upgrade Big Spring Switch – Big Spring West 138 kV Line May

Construct Andrews Cty South 138 kV Switching Sta & 345/138 kV Auto May

Add Breaker at McDonald Road 138 kV Switching Station May

Construct McDonald Road Sw. Sta. – Garden City East 138 kV Line May

Rebuild Lamesa 69 kV Switching Station May

Re-arrange connections for combustion turbines at Morgan Creek May

Rebuild Holt 138 kV Sw. Sta. as a double-bus May

Upgrade Mason – Screwbean 138 kV Line May

Upgrade China Grove Terminal Equipment May

Upgrade Cosden Terminal Equipment May

2015 IN-SERVICE DATE PROJECTS (CONT)

Install second Eskota 138/69 kV Autotransformer Nov

Install 69 kV capacitors at Sweetwater Creek (Lone Star Cement) Nov

Upgrade Spraberry 138 kV Switching Station Dec

Construct Spraberry Sw. Sta. – Garden City East 138 kV Line Dec**

Upgrade Morgan Creek – Cosden 138 kV Line Dec

Upgrade Permian Basin – Ward Gulf Tap – Wink 138 kV Lines Dec

Upgrade Odessa North – Amoco S Foster – Westover 138 kV Line May

Construct Midessa South – Midessa 138 kV Line Dec

Construct Odessa – Midessa South 138 kV Line Dec

Construct Midessa South Switching Station Dec

Construct Odessa Switching Station Dec

Rebuild Wink Switching Station Dec

Rebuild Culberson Switching Station Dec

** Project for Regional Planning Group Review

2016 IN-SERVICE DATE PROJECTS

Construct Permian Basin – Culberson 138 kV Line
Rebuild Culberson Switching Station
Rebuild Odessa EHV – Spraberry 138 kV Line **
Convert Midkiff – Garden City 69 kV Line to 138 kV **
Rebuild Permian Basin Switching Station
Establish Monahans Switching Station
Rebuild Screwbean – Culberson 138 kV Line
Rebuild Midessa – Midland East 138 kV Line
Rebuild Midessa South – Spraberry 138 kV Line
Establish Fullerton Switching Station
Convert North Andrews – Fullerton – Means 69 kV Loop
Establish Midkiff Switching Station
Chalk 69 kV Emergency Capacitors

** Project for Regional Planning Group Review

2017 IN-SERVICE DATE PROJECTS

Convert Holt – Emma Tap 69 kV Line

Rebuild Andrews County South – North Andrews 138 kV Line

Install Midessa South 345/138 kV Autotransfromer

Rebuild Permian Basin – Barilla Junction 138 kV Line (Joint with AEP) **

** Project for Regional Planning Group Review

2018 IN-SERVICE DATE PROJECTS

Rebuild Wink – Odessa Basin 138 kV Line **

Construct Paul Davis – Texaco Mabee 138 kV Line **

Establish Paul Davis Switching Station

Convert Paul Davis – Paul Davis Tap 138 kV Line to Double Circuit

Convert Permian Basin – Crane 69 kV Line

Convert Permian Basin – Northern Natural 69 kV Line

Convert Snyder – Ennis Creek – Cogdell 69 kV Line

Convert China Grove – Amoco 69 kV Line

Convert China Grove – Synder 69 kV Line

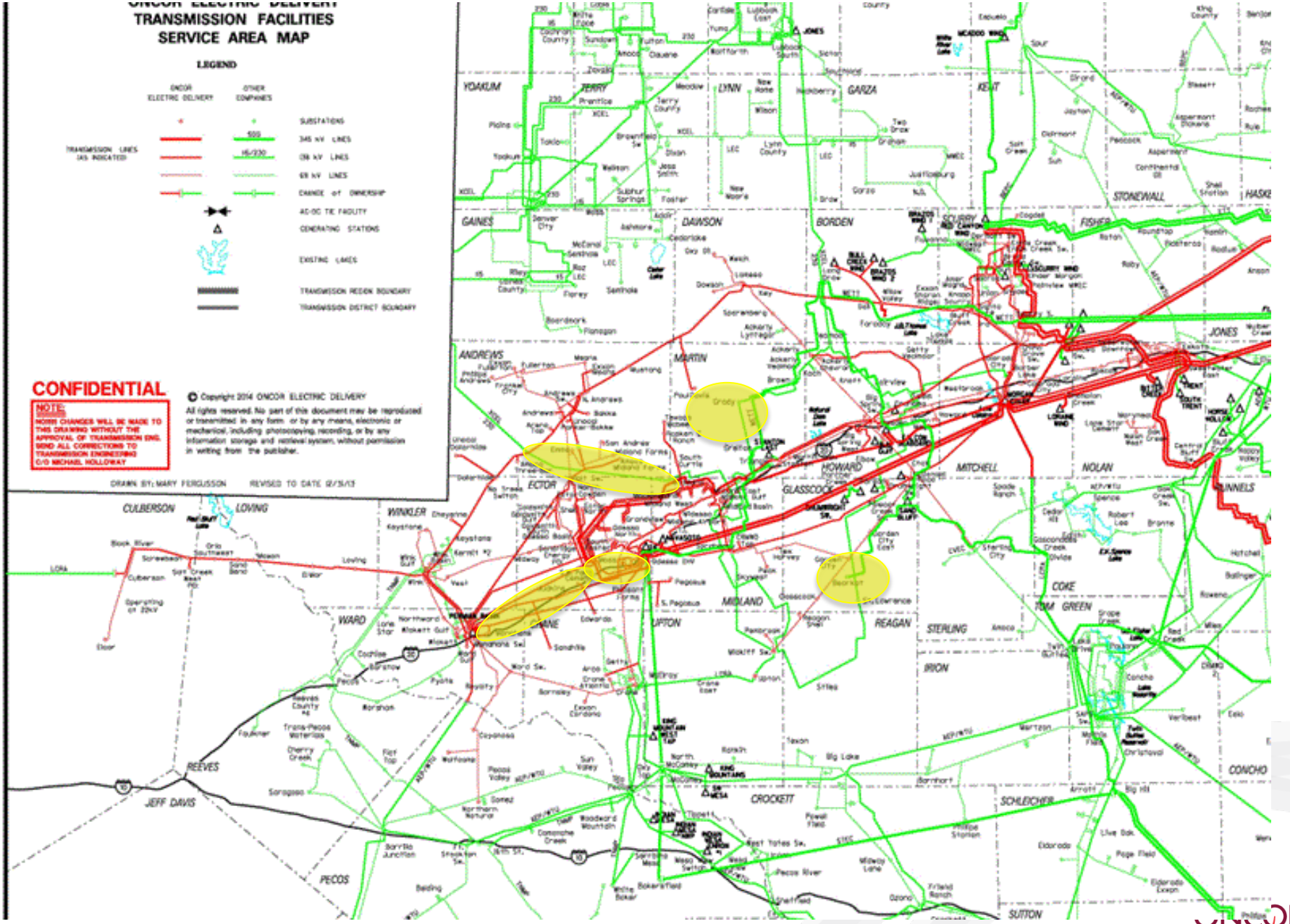
** Project for Regional Planning Group Review

345 kV PROJECTS UNDER CONSIDERATION

- **345/138 kV Switch Stations with Autotransformers at:**
  - **Bearkat**
    - Joint with SU and WETT
  - **Martin County Central**
    - Joint with SU and WETT

- **345 kV Line from Odessa EHV to Moss to Permian Basin/Monahans**
  - Under Study
  - Andrews County South 345/138 kV Station and Midland County NW to Andrews County South 345 kV Line impacts project
  - Resubmit for RPG Review

WEST TEXAS 345 kV UNDERWAY AND BEING CONSIDERED

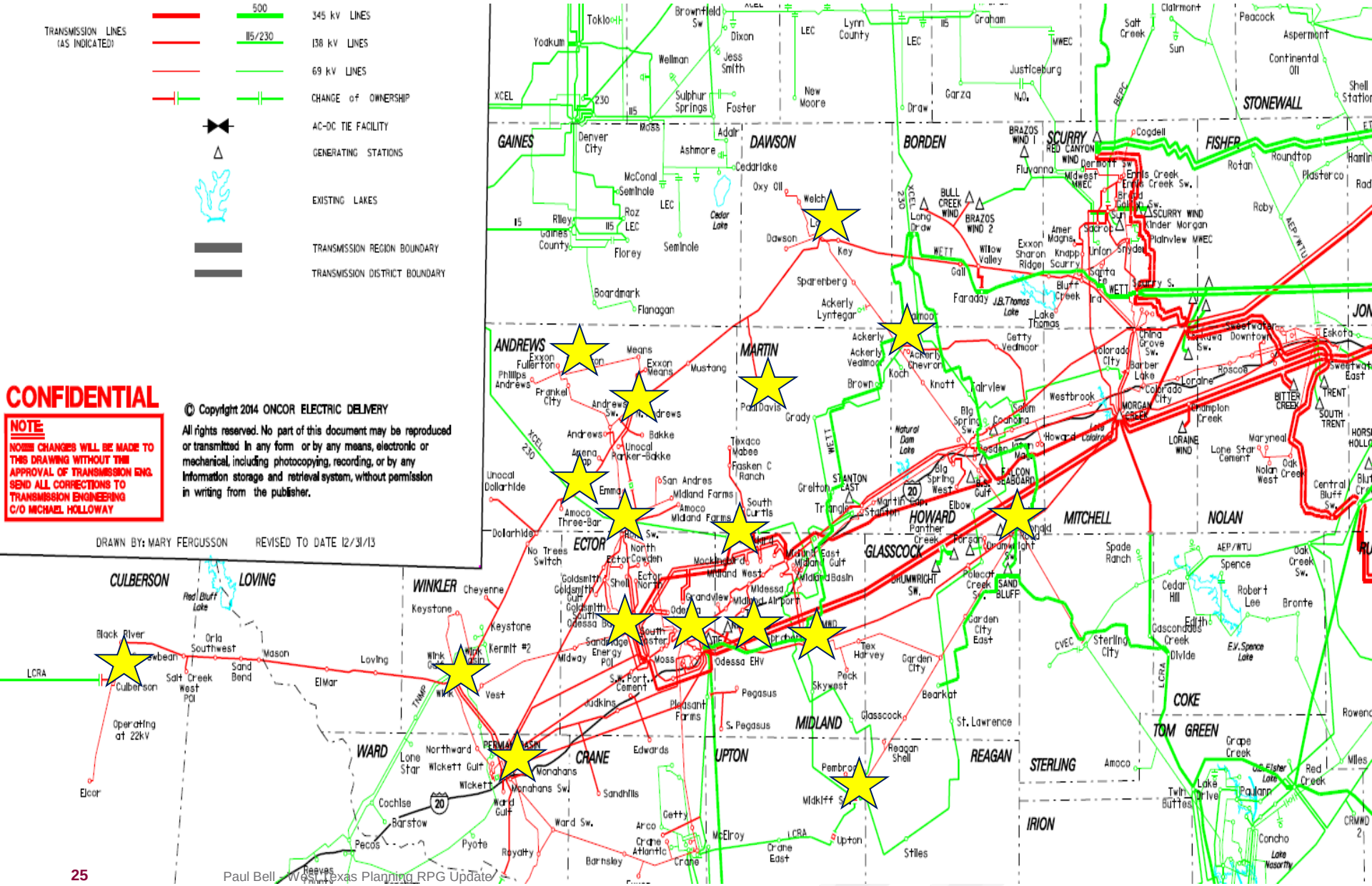


QUESTIONS/DISCUSSION

APPENDIX

Slides included for possible reference

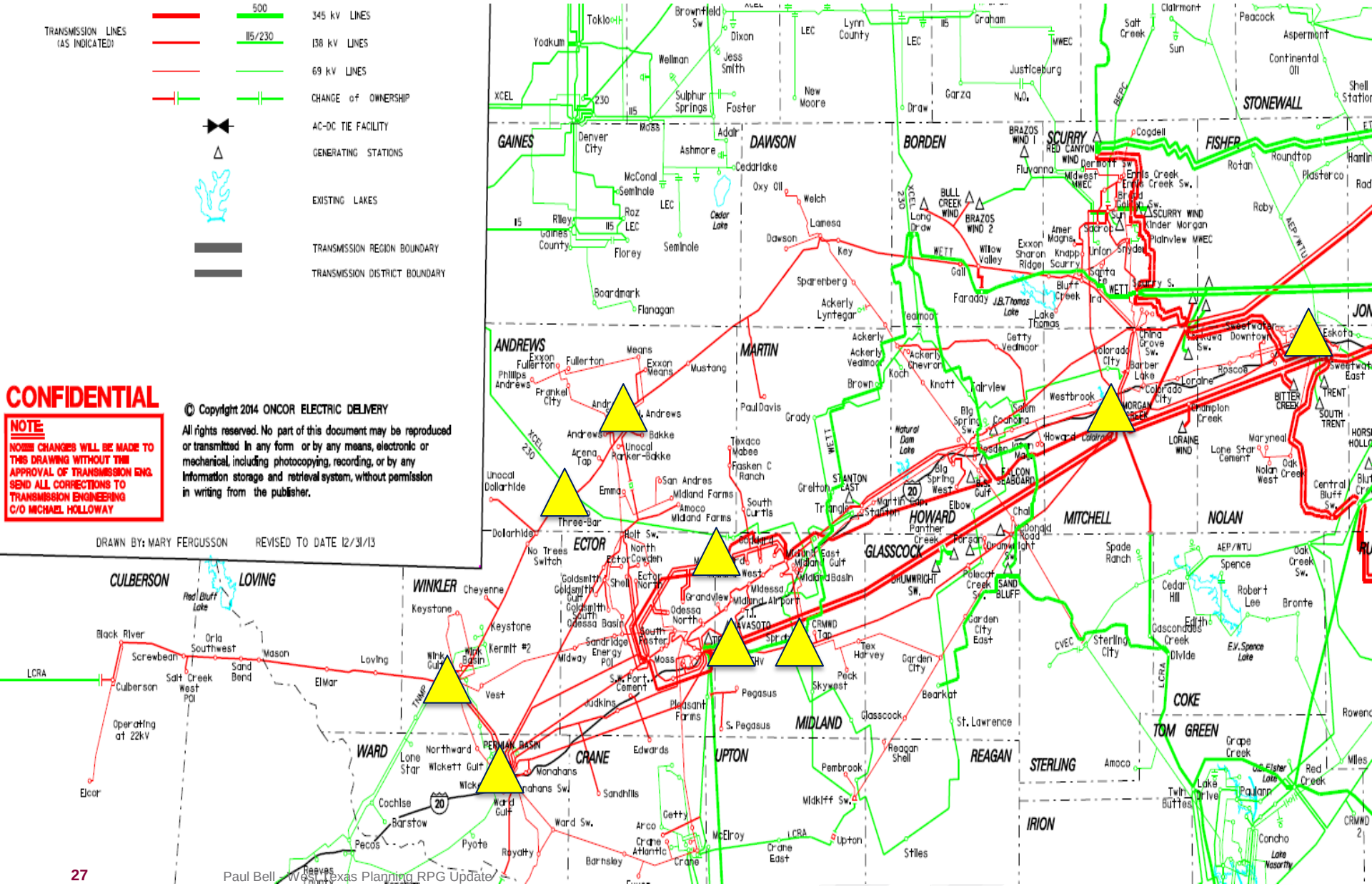
SUMMARY OF TRANSMISSION STATION PROJECTS



SUMMARY OF TRANSMISSION STATION PROJECTS

- **Wink: Rebuild 138 and 69 KV**
- **Permian Basin / Monahans: Establish Monahans Sw. Station and New Permian Basin Station**
- **North Andrews: Rebuild 138 and 69 KV**
- **Lamesa: Rebuild 138 and 69 KV**
- **Spraberry: Rebuild 138 KV**
- **Andrews Co. South: Establish New Switching Station**
- **Midland Co. NW: Establish New Switching Station**
- **Holt: Expand to Double Bus Arrangement on 138 KV**
- **Midessa South: Establish New Switching Station**
- **Buzzard Draw: Establish New Switching Station**
- **McDonald Road: Add Additional Circuit Breakers**
- **Culberson: Convert to Switching Station**
- **Odessa: Rebuild 138 KV**
- **Fullerton: Convert to Switching Station**
- **Midkiff: Rebuild 138 KV**
- **Paul Davis: Establish New Switching Station**
- **Odessa Basin: Station Rebuild**

SUMMARY OF AUTOTRANSFORMER UPGRADES



SUMMARY OF AUTOTRANSFORMER PROJECTS

Autotransformers:

- **Andrews County South: New 345 kV 600 MVA**
- **Midland Co. NW: New 345 kV 600 MVA**
- **Midessa South: New 345 kV 600 MVA**
- **Wink: Add Second 138/69 kV 50 MVA**
- **North Andrews: Upgrade Existing 138/69 kV Autotransformers (2) to 150 MVA**
- **Spraberry: Upgrade Existing 138/69 kV to 150 MVA**
- **Morgan Creek: Upgrade Existing 138/69 kV to 150 MVA**
- **Eskota: Add Second 138/69 kV 150 MVA**