Sub Regional RTEP Committee
PJM West

November 22, 2019

Proposal Window Exclusion Definitions

- The following definitions explain the basis for excluding flowgates and/or projects from the competitive planning process and designating projects to the incumbent Transmission Owner.
- Flowgates/projects excluded from competition will include the underlined language on the corresponding slide.
  - Immediate Need Exclusion: Due to the immediate need of the violation (3 years or less), the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity. - Operating Agreement, Schedule 6 § 1.5.8(m)
  - Below 200kV Exclusion: Due to the lower voltage level of the identified violation(s), the driver(s) for this project are excluded from the competitive proposal window process. As a result, the local Transmission Owner will be the Designated Entity - Operating Agreement, Schedule 6 § 1.5.8(n)
  - Substation Equipment Exclusion: Due to identification of the limiting element(s) as substation equipment, the driver(s) for this project are excluded from the competitive proposal window process. As a result, the local Transmission Owner will be the Designated Entity - Operating Agreement, Schedule 6 § 1.5.8(p)

First Review

Baseline Reliability Projects

AMPT: Baseline Amherst

Process Stage: First Review

Criteria: TO Planning Criteria

Assumption Reference: FERC 715

Model Used for Analysis: RTEP 2024 Summer Base Case

Proposal Window Exclusion: FERC 715 (TO Criteria)

Problem Statement: Amherst #2 – Amherst #1 – Nordson Line Tap topology violates AMPT TO Criteria for Single point radial exposure (Currently 61.72 MW-mile, Limit is set to 30 MW-mile in AMPT TO guidelines).

Existing Facility Rating: N/A

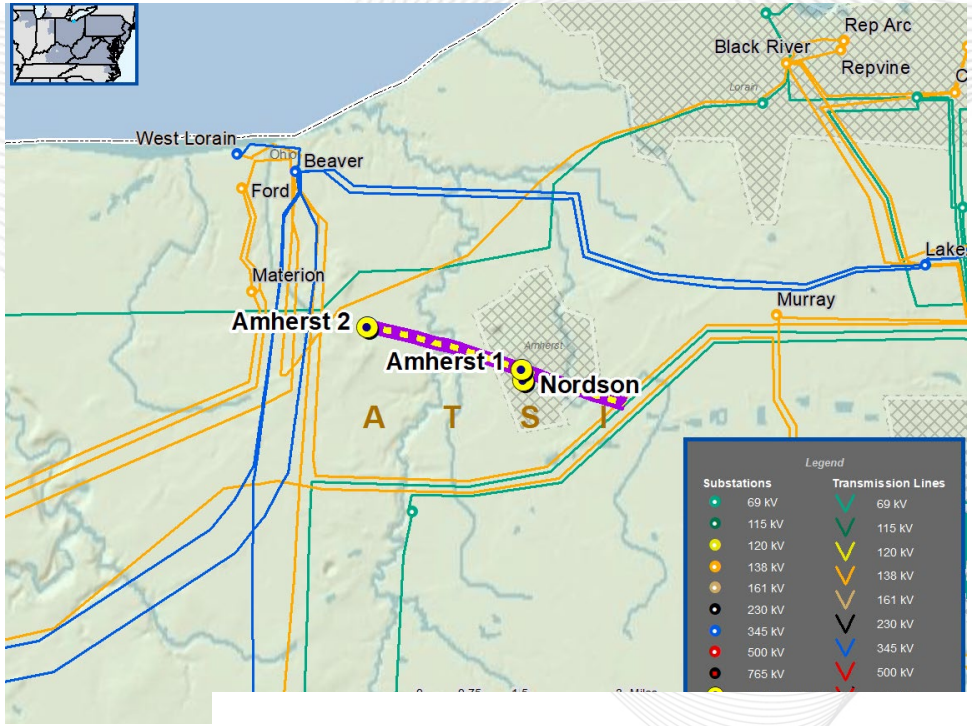
Proposed Solution:

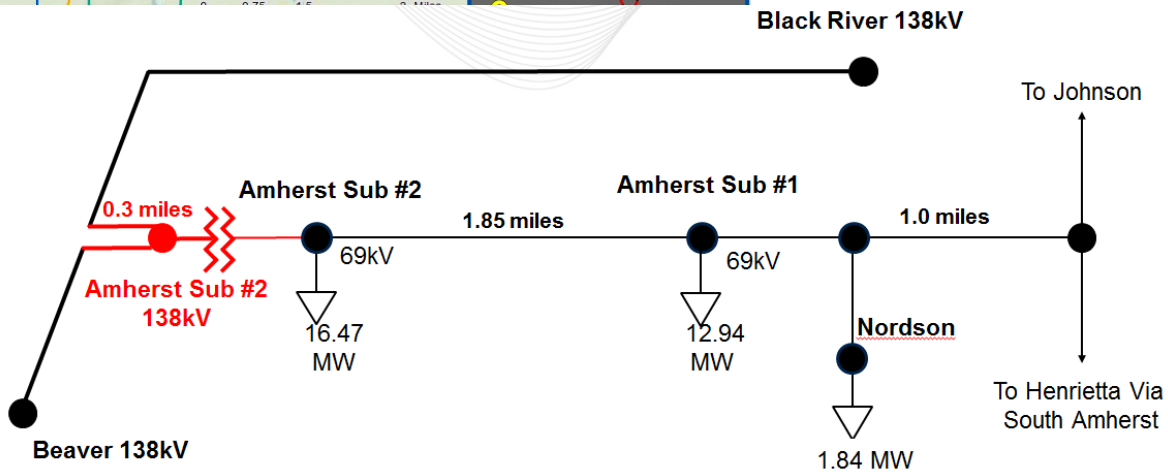
Construct a greenfield 0.3 mile 138kV double circuit line tapping the Beaver-Black River (ATSI) 138 kV line; Install five monopole 138kV double circuit steel structures with concrete foundations and string 1590 ACSR conductor. ($1.3M)
Expand the Amherst #2 Substation with the installation of three 138kV circuit breakers; one138/69/12kV 130 MVA transformers; two 69kV circuit breaker ($5.7M).
Install One 69kV breaker towards Nordson ($0.5M)

Estimated Cost: $ 7.5M

Alternatives:

Required In-Service: 6/1/2020





AEP Transmission Zone: Baseline
Decatur, Indiana

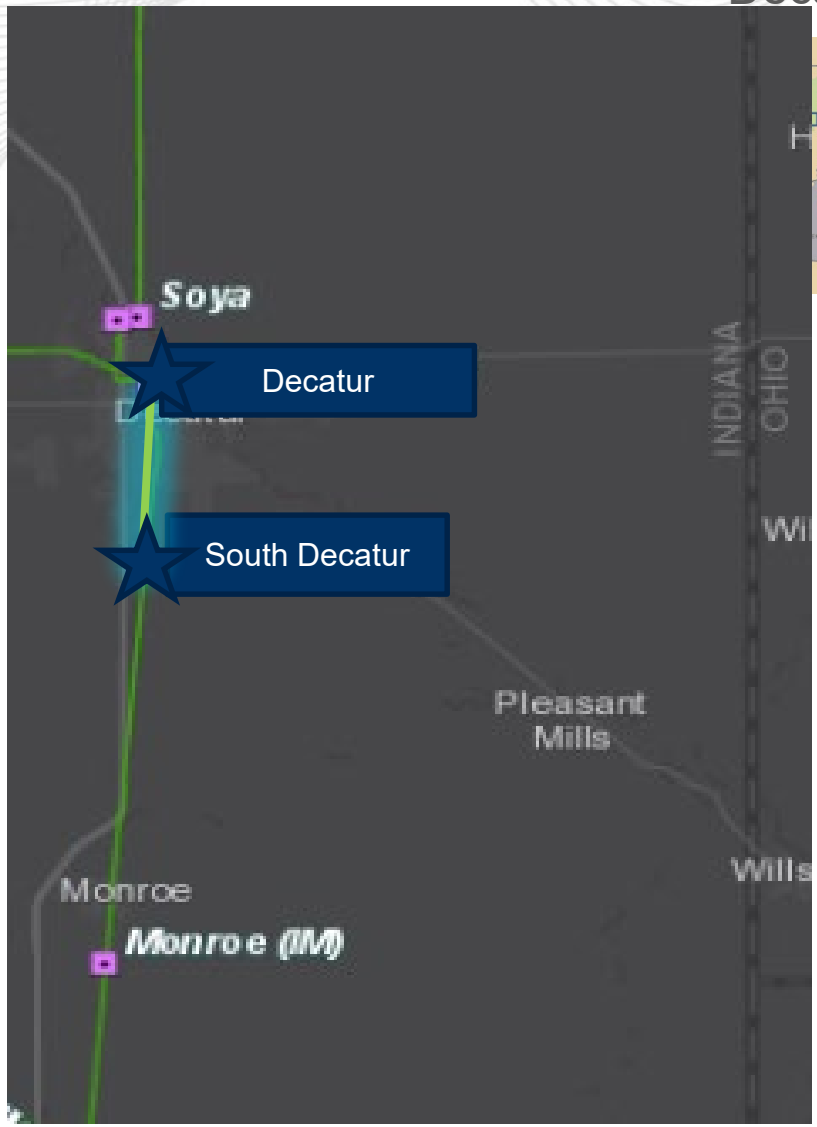
Process Stage: First Review
Criteria: TO Planning Criteria
Assumption Reference: FERC 715
Model Used for Analysis: 2024 RTEP Summer
Proposal Window Exclusion: FERC 715

Problem Statement:
For loss of Marathon – Limberlost 69kV and Adams – Berne 69kV, the Decatur – South Decatur 69kV circuit overloads to 112% of the 50MVA 4/0 ACSR line conductor rating

Proposed Solution:
Decatur – South Decatur 69kV line
Rebuild the 2.3 mile Decatur – South Decatur 69kV line using 556 ACSR in order to alleviate the overload.

Alternatives: None

Total Estimated Transmission Baseline Cost: $9.3M
Required IS Date: 6/1/2024



Process Stage: First Review
Criteria: TO Planning Criteria
Assumption Reference: FERC 715
Model Used for Analysis: 2024 RTEP Summer
Proposal Window Exclusion: FERC 715
Problem Statement:
For loss of Desoto – Jay 138kV and Magley – Allen 138kV, Hillcrest – Ferguson 69kV overloads to 107.7% of the 54MVA 4/0 CU conductor rating. The line is also overloaded for multiple other contingency pairs.

Proposed Solution:
Baer/Ferguson station
Rebuild Ferguson 69/12kV station in the clear as the 138/12kV Bear station and connect it to a ~1 mile double circuit 138kV extension from the Aviation – Ellison Rd 138kV line to remove the load from the 69 kV line.

Alternatives:
Rebuild the line from Hillcrest – Ferguson 69kV.
This line isn't in good shape, but AEP is trying to offload stations from the line so that in the future we can retire it and reroute away from the airport. The line as it exists today is within the FAA glide path as well, portions of it are so close that it was installed without any shield wire. Rebuilding the line instead of relocating Ferguson station would most likely mean underground construction in the future which is a more expensive option.
Estimated Cost: $15M
Total Estimated Transmission Cost: $6.4M
Required IS Date: 6/01/2024

AEP Transmission Zone: Baseline Western Fort Wayne Improvements

Process Stage: First Review

Criteria: TO Planning Criteria

Assumption Reference: FERC 715

Model Used for Analysis: 2024 RTEP Summer

Proposal Window Exclusion: FERC 715

Problem Statement:

For the N-1-1 loss of Saturn – Sorenson 138kV and Columbia XFR 2 the following issues occur:

- 123.6% overload of the Carroll – Churubusco 34.5kV 17MVA limit (1/0 CU conductor)
- The area experiences voltage violations with voltages as low as .839 pu and voltage drops as high as 13% at the Whitley 34.5kV bus and affects the following load serving buses. Whitley 34.5kV, Union 34.5kV, Ummel 69kV, Tri-Lake 69kV, Richland 69kV, Eel River 34.5kV, Cleveland 69kV, Churubusco 34.5kV and Carrol 34.5kV.

For the N-1-1 loss of Saturn – Columbia 138kV and Gateway 69/34kV XFR (knocks out Gateway 69kV bus) the following issues occur:

- 149.3% overload of the Carroll – Wallen 34.5kV 17MVA limit (1/0 CU conductor); 106% overload of Churubusco – Whitley's 34.5kV 17MVA limit (1/0 CU conductor); 167.0% overload of the Carroll – Churubusco 34.5kV 17MVA limit (1/0 CU conductor)
- The area experiences voltage violations with voltages as low as .66 pu and voltage drops as high as 27% at the Whitley 34.5kV bus and affects the following load serving buses. Whitley 34.5kV, Union 34.5kV, Eel River 34.5kV, Churubusco 34.5kV and Carrol 34.5kV.

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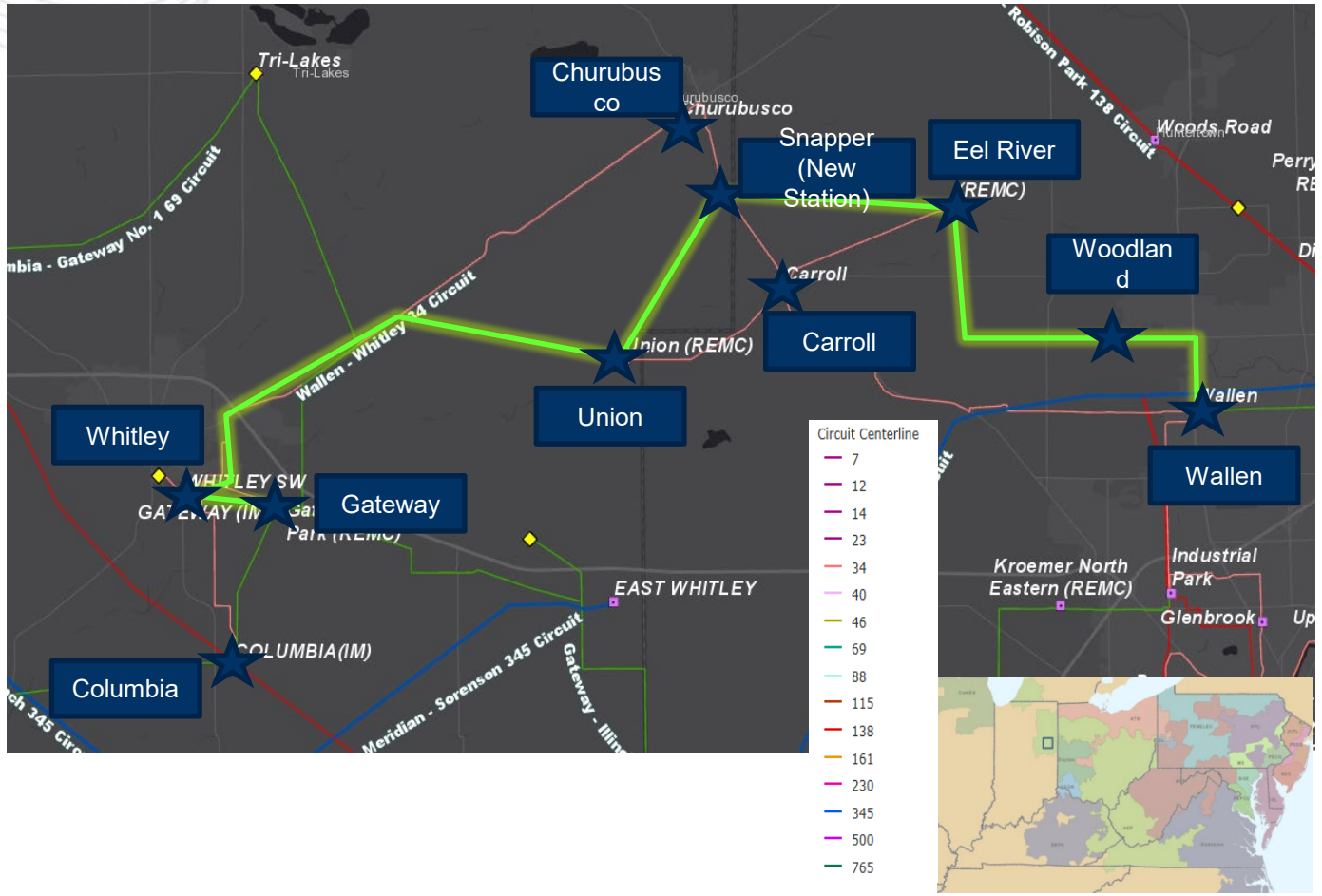

AEP Transmission Zone: Baseline Western Fort Wayne Improvements

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For the N-1-1 loss of Saturn – Columbia 138kV and Illinois Road 138/69 XFR (knocks out Illinois Road 69kV bus) the following issues occur:

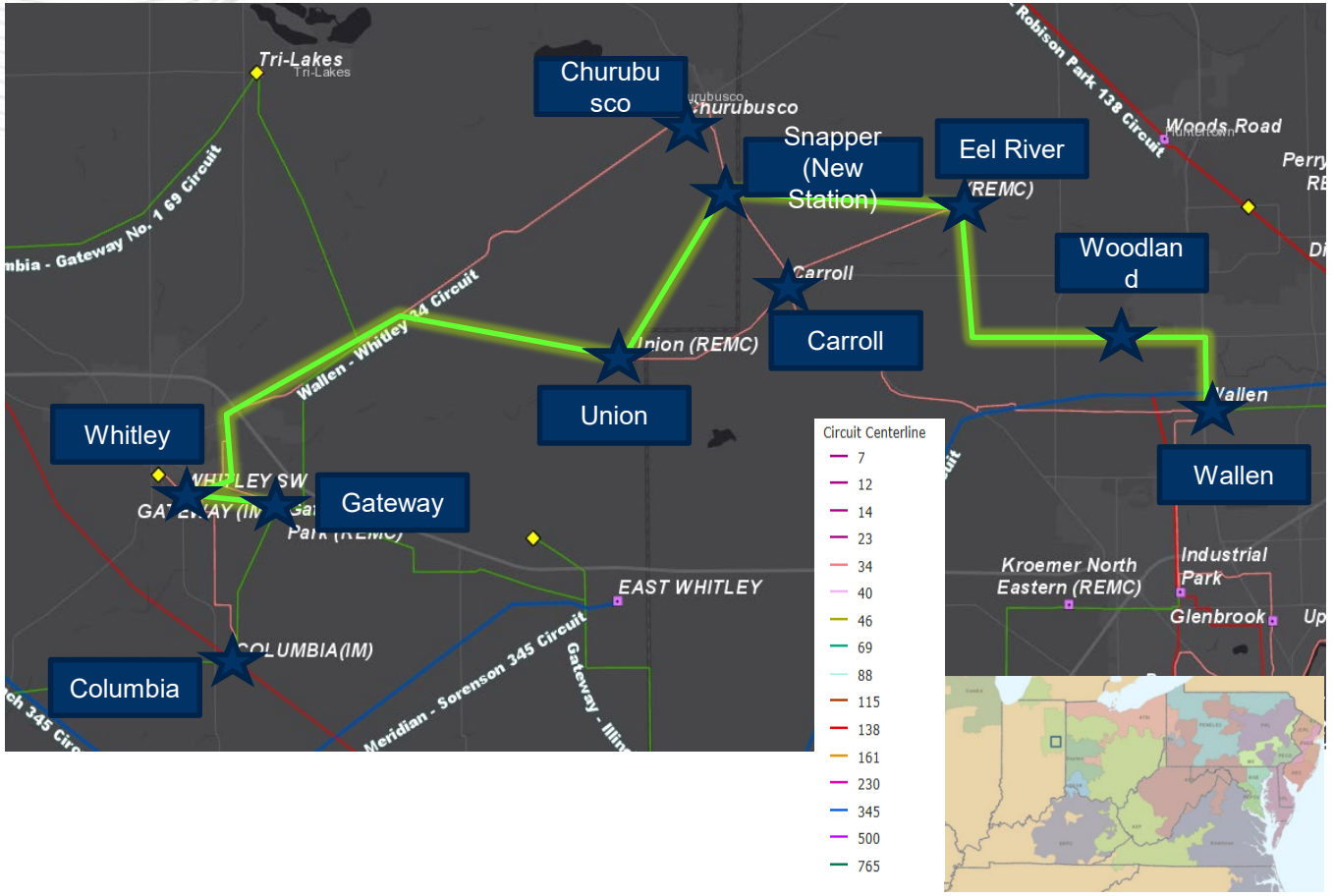
- 108.2% overload of the Carroll – Churubusco 34.5kV 17MVA limit (1/0 CU conductor); 103% overload of the 138/69kV XFR 2 at Columbia station.
- The area experiences voltage violations with voltages as low as .866 pu and voltage drops as high as 8.9% at the Whitley 34.5kV bus and affects the following load serving buses. Whitley 34.5kV, Ummel 69kV, Tri Lake 69kV, Richland 69kV, LincolnWay 69kV, Gateway 69kV, Cleveland 69kV and Churubusco 34.5kV

For the N-1 loss of Columbia 138kV breaker "D":

- 132.4% overload of the Wallen – Carroll 34.5kV 17MVA limit (1/0 CU conductor);
- The Whitley 34.5 experiences a voltage of .906 with a Vdrop of 8.2%

For the N-1-1 loss of Rob Park XFR 4 and Wallen XFR 2 the following issues occur.

- 108.3% overload of the St Joe – Vulcraft 69kV 50MVA limit (4/0 ACSR)
- The area experiences voltage violations with voltages as low as .82 pu and voltage drops as high as 19.2% at the Perry 69kV bus and affects the following load serving buses. Perry 69kV, Woodland 69kV, Harlan 69kV and Diebold 69kV.



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AEP Transmission Zone: Baseline Western Fort Wayne Improvements

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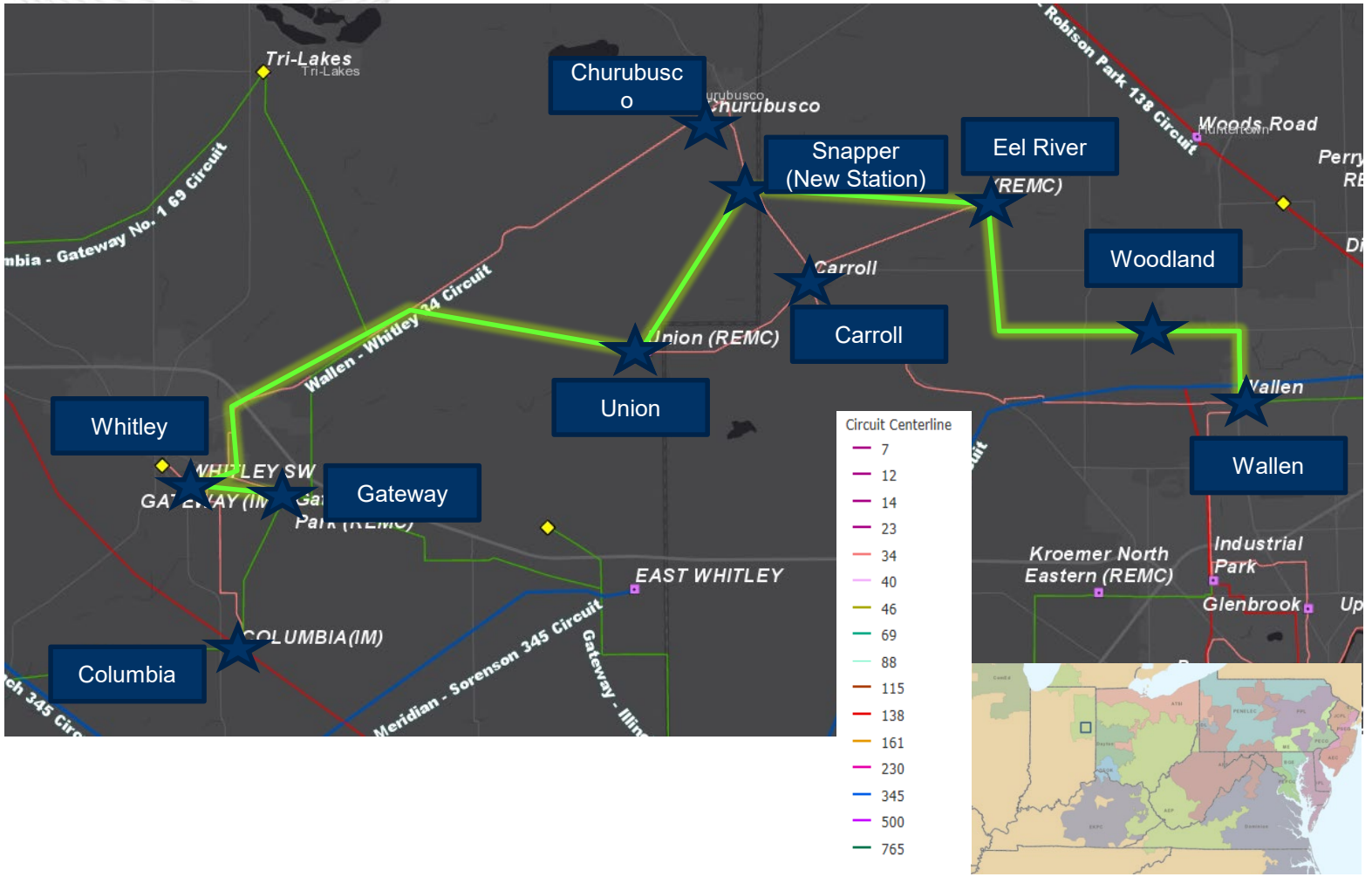
For the N-1-1 loss of Northeast – Columbia 138kV and Illinois Road – Gateway 69kV the following issues occur:

- 134.7% overload of the Carroll – Churubusco 34.5kV 17MVA limit (1/0 CU conductor); 138.6% overload of the 138/34kV XFR 1 at Columbia station; 205.5% overload of the Columbia – Whitley 25MVA limit (4/0 ACSR); 128.9% overload of the Gateway – Whitley 34.5kV 35MVA limit (4/0 CU Riser, 336.4 ACSR is also overloaded); and a 150.2 % overload of the Wallen – Carroll 17MVA limit (1/0 CU conductor)
- The area experiences voltage violations with voltages as low as .597 pu and voltage drops as high as 39.1% at the Richland 69kV bus and affects the following load serving buses. Carroll 34.5kV, Churubusco 34.5kV, Cleveland 69kV, Eel River 34.5kV, Gateway 69kV, Richland 69kV, Tri-Lake 69kV, Ummel 69kV, Union 34.5kV and Whitley 34.5kV.

For the N-1 loss of Wallen – Carroll 34.5kV

- The area experiences voltage violations with voltages as low as .88 pu and voltage drops as high as 10.0% at the Carroll 34.5kV, Churubusco 34.5kV, Eel River 34.5kV and Union 34.5kV busses.



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AEP Transmission Zone: Baseline Western Fort Wayne Improvements

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For the N-1-1 loss of Saturn – Sorenson 138kV and Gateway 69/34.5kV Transformer (knocks out the 69kV bus) the following issues occur:

- The area experiences voltage violations with voltages as low as .897 at Richland 69kV, Tri-Lake 69kV and Ummel 69kV

For the N-1-1 loss of Saturn – Sorenson 138kV and Columbia XFR 2 the following issue occurs:

- The Whitley bus drops to .906 PU

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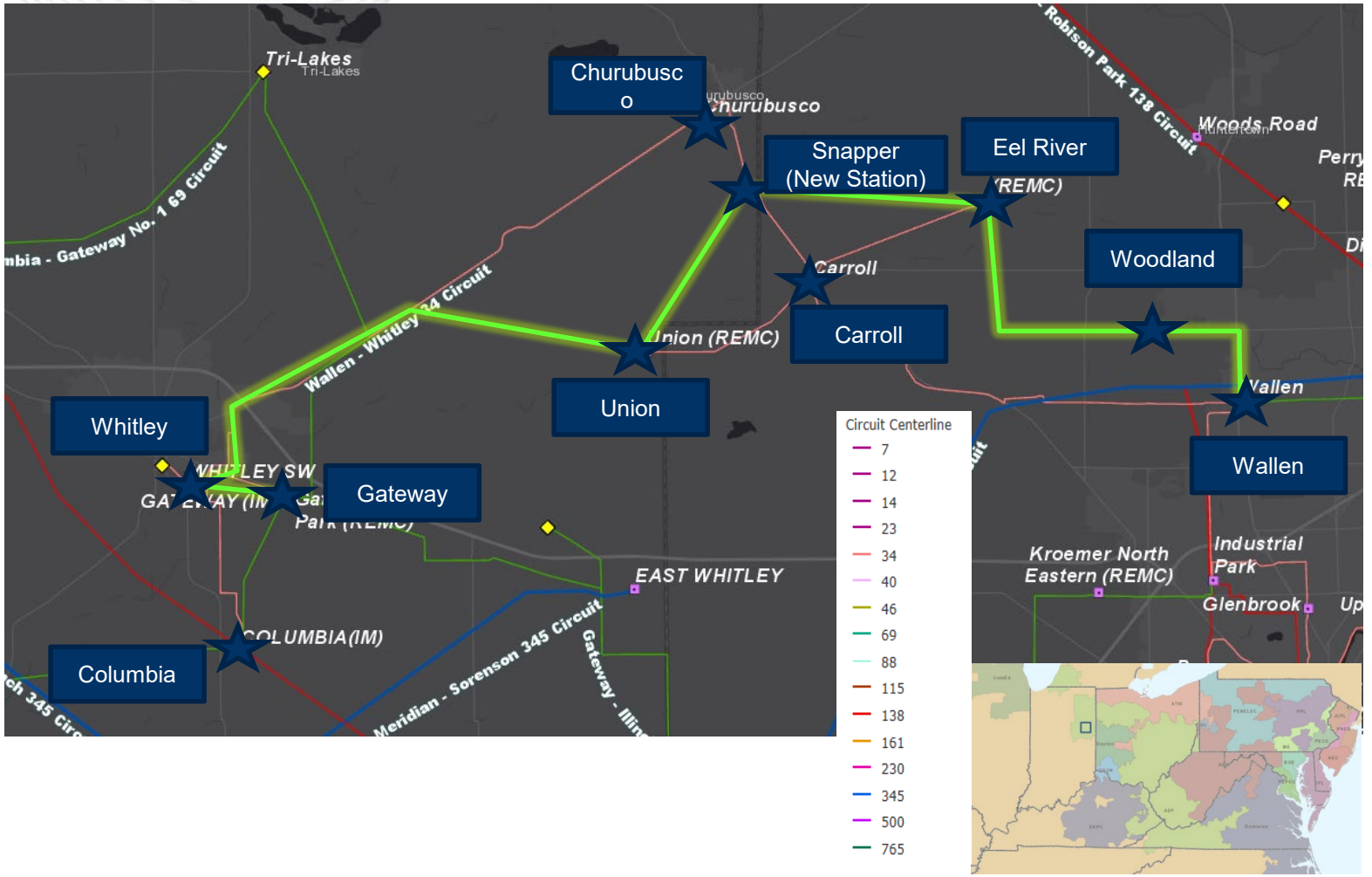

AEP Transmission Zone: Baseline Western Fort Wayne Improvements

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Proposed Solution:

Rebuild the ~30 mile Gateway – Wallen 34.5kV circuit as the ~27 mile Gateway – Wallen 69kV circuit.
Estimated Cost: $43.3M

Retire the ~3 miles Columbia – Whitley 34.5kV line.
Estimated Cost: $0.5M

At Gateway station, remove all 34.5kV equipment and install a 69kV CB for the new Whitley line entrance.
Estimated Cost: $1M

Rebuild Whitley as a 69kV station with 2 line CB's and a bus tie CB.
Estimated Cost: $4.2M

Replace the Union 34.5kV Switch with a 69kV Switch structure. Estimated
Cost: $0.6M

Replace the Eel River 34.5kV Switch with a 69kV Switch structure. Estimated
Cost: $0.6M

Install a 69kV Bobay Sw at Woodland Station.
Estimated Cost: $0.6M

Replace Carroll and Churubusco 34.5kV stations with the 69kV Snapper station. Snapper will have 2 line CB's, a bus tie CB and a 14.4 cap bank.
Estimated Cost: $8.7M

Remove 34.5 kV CB AD at Wallen station.
Estimated Cost: $0.3M

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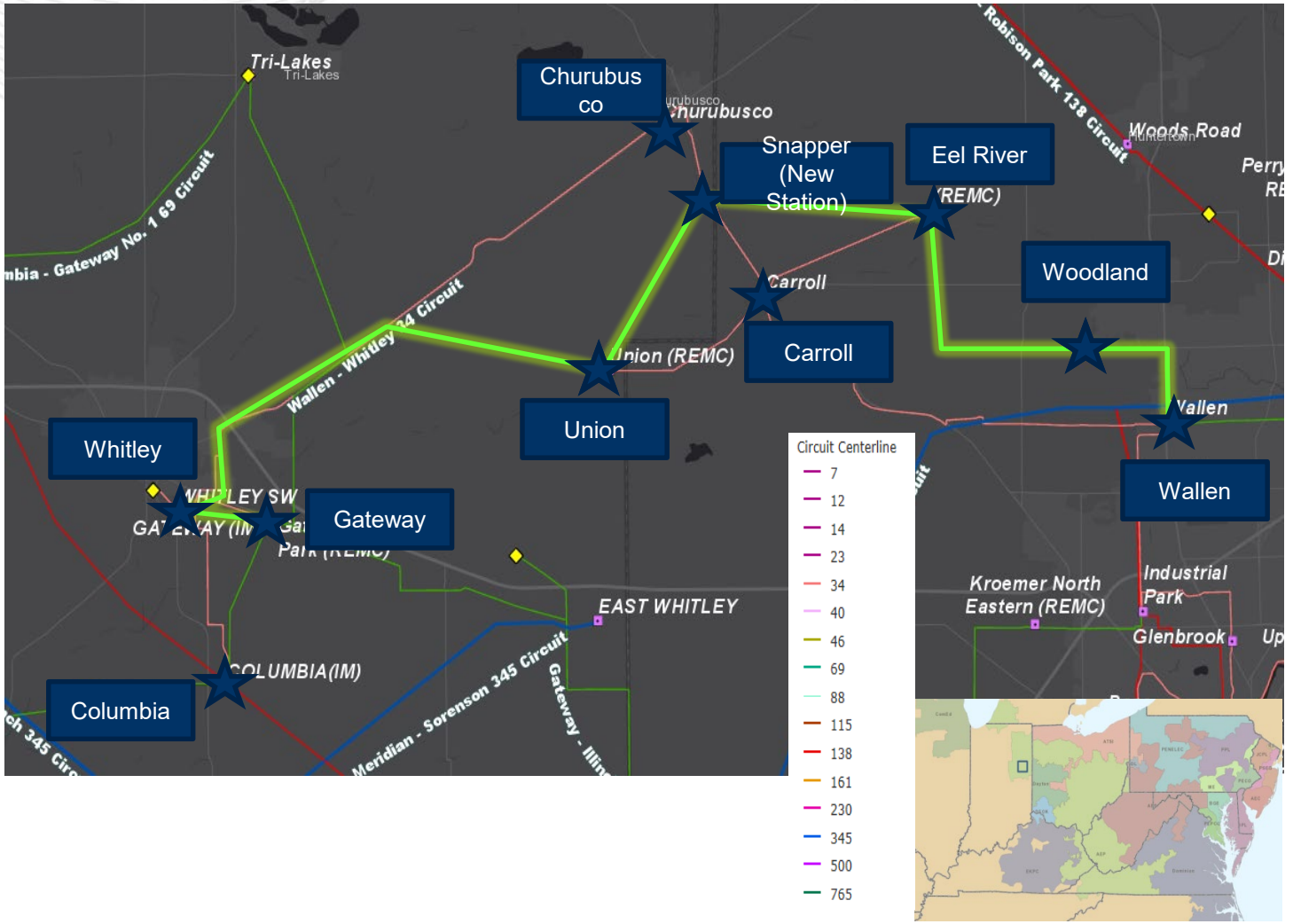

AEP Transmission Zone: Baseline Western Fort Wayne Improvements

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Proposed Solution:

Rebuild the 2.5 mile Columbia – Gateway 69kV line.
Estimated Cost: $6.2M

Rebuild Columbia station in the clear as a 138/69kV station with 2 138/69kV XFR's and a 4 CB ring on the high and low side. Station will re-use breaker's 69kV breakers "J", "K" and 138kV breaker "D".
Estimated Cost: $15M

Rebuild the 13 mile Columbia – Richland 69kV line.
Estimated Cost: $29.3M
Rebuild the .5 mile Whitley – Columbia city line as 69kV.
Estimated Cost: $1.0M
Rebuild the .5 mile Whitley – Columbia city line as 69kV.
Estimated Cost: $0.7M

Rebuild the .6 mile double circuit section of the Rob Park – South Hicksville/Rob Park – Diebold Road as 69kV.
Estimated Cost: $1.0M

Total Estimated Transmission Cost: $113M

Ancillary Benefits: This project addresses the asset renewal needs presented as need number AEP-2019-IM020 presented on 11/22/2019

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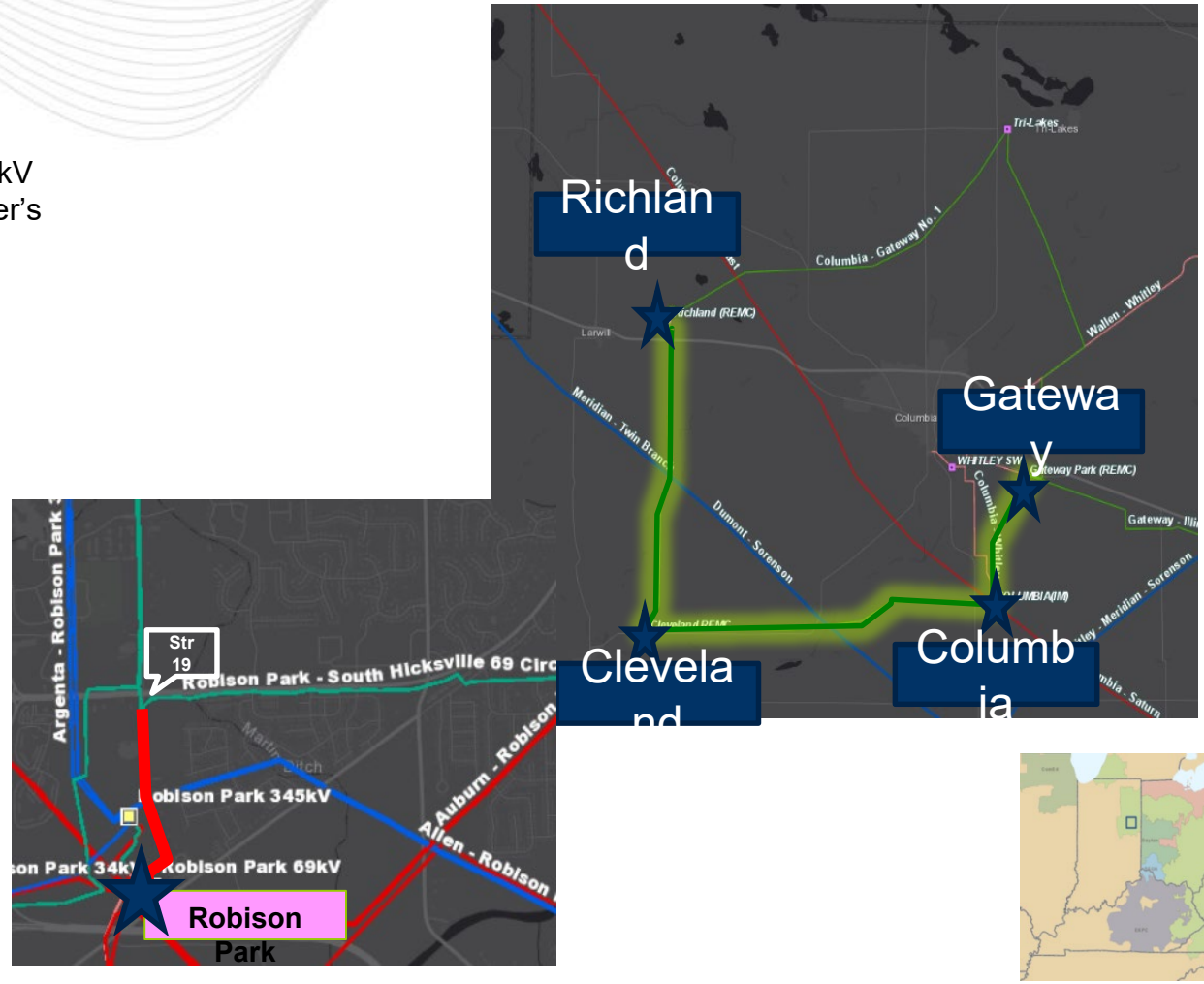

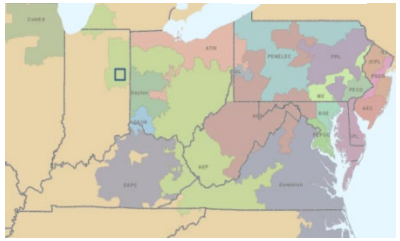

AEP Transmission Zone: Baseline Western Fort Wayne Improvements

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Alternatives:

Alternative #1: Instead of rebuilding the aging 69kV Columbia – Richland & Columbia – Gateway assets, build a drop down station on the nearby Albion – Rob Park 138kV line and cut in the 69kV network with a ~6 mile extension. While this would solve the baseline needs, it wouldn't address some of AEP's aging assets and so wasn't chosen.

Cost: $103M + $29.3M Supplemental needs (AEP-2019-IM020) not addressed.

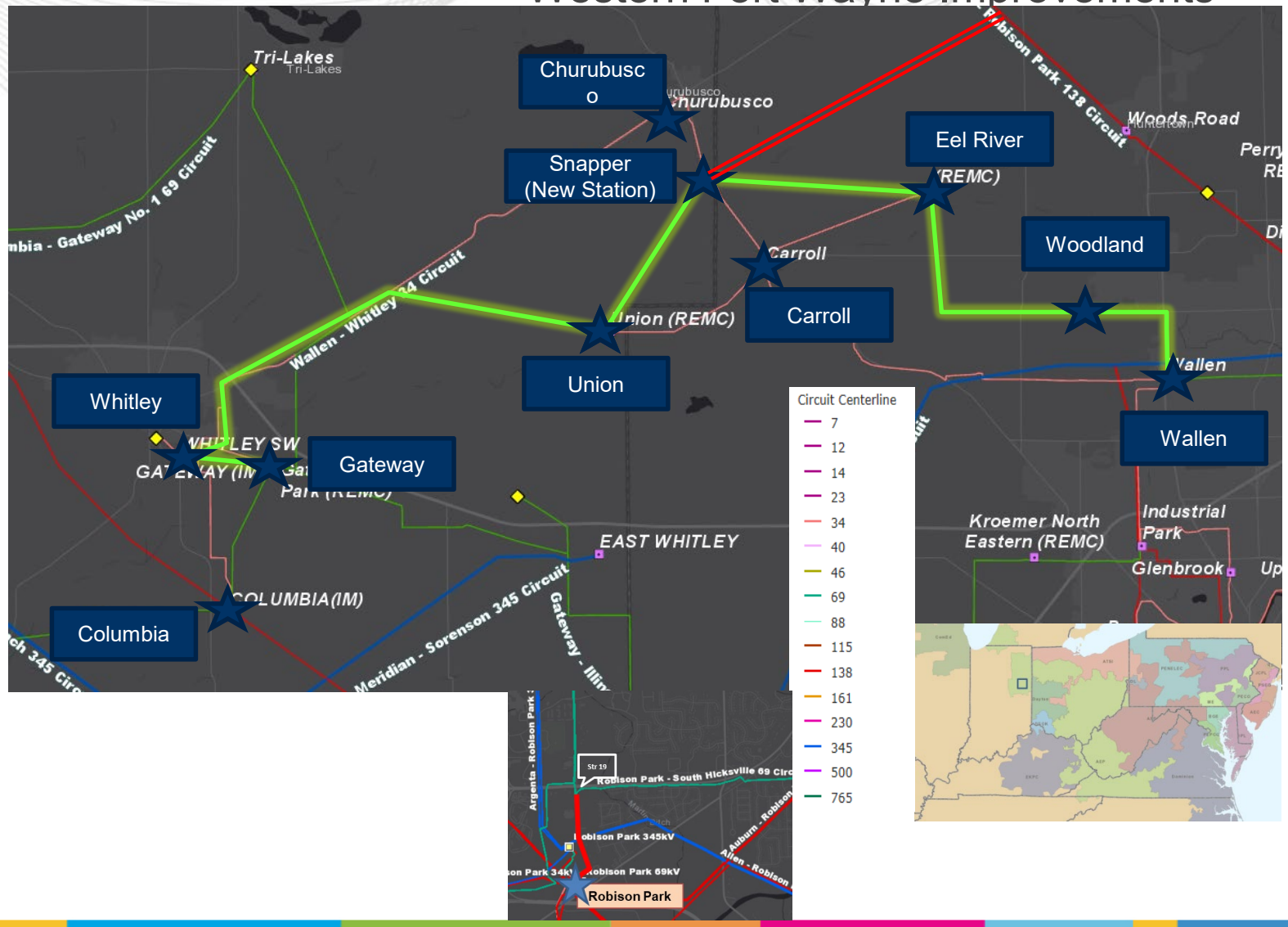
Alternative #2: Instead of rebuilding the aging 69kV Columbia – Richland line, Build the Columbia – Gateway line as double circuit. When taking into account that the Columbia – Richland line is in poor shape and needs to be rebuilt anyway, this alternate becomes unnecessary.

Cost: $86M Baseline + $35.5M Supplemental needs (AEP-2019-IM020) not addressed

Alternative #3: Instead of rebuilding from Columbia – Richland, bring 138kV double circuit from the nearby Columbia – Northeast line to the three stations. This would remove roughly 13.6 miles of 69kV build, but would introduce roughly 13.3 miles of 138kV double circuit and would require significant station investment. For this reason this alternate was not chosen.

Cost: $125M Baseline + $0M Supplemental needs (AEP-2019-IM020) not addressed

Required In Service Date: 6/1/2024



Second Review

Baseline Reliability Projects

ComEd: Baseline Electric Junction

Process Stage: Recommended Solution

Criteria: TO Planning Criteria

Assumption Reference: FERC 715

Model Used for Analysis: RTEP 2020 LL Stability Base Case

Proposal Window Exclusion: FERC 715 (TO Criteria)

Problem Statement:

Three-phase delayed-cleared faults at Electric Junction 138kV blue bus on TSS111 Electric Junction 345/138 kV Transformer 81 or 82, or line 11106 or line 11102, result in instability at TSS 951 Aurora EC units 3 and 4

Existing Facility Rating: N/A

Preliminary Facility Rating: N/A

Recommended Solution:

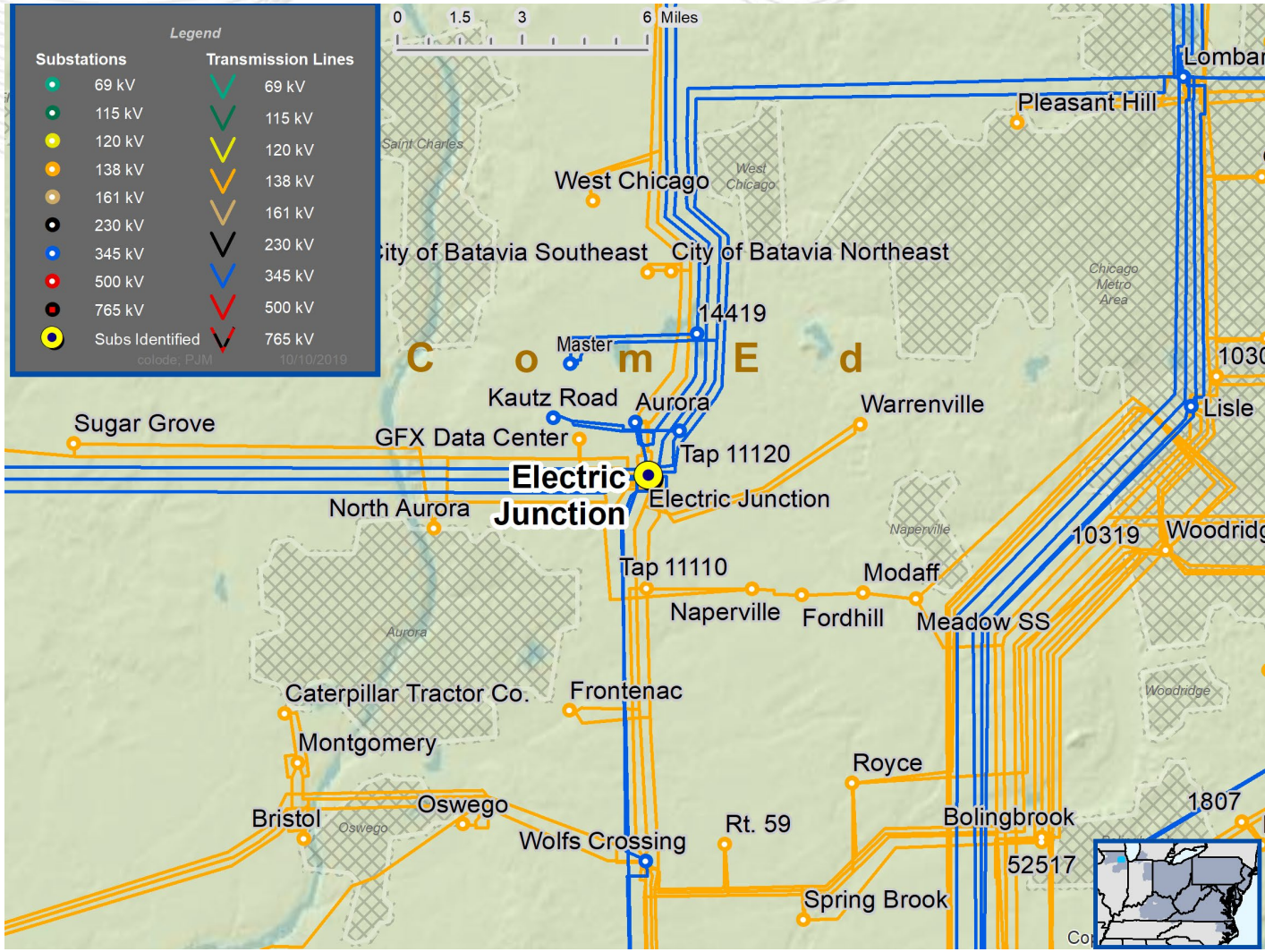
(**B3147**) Modify 138kV blue bus total clearing times at TSS111 Electric Junction to 11 cycles for fault on 345/138kV Transformer 81, and to 13 cycles for faults on 138kV Line 11106, 138kV Line 11102 and 345/138kV Transformer 82

Estimated Cost: $ 0.25M

Required In-Service: 12/31/2020

Projected In-Service: 12/31/2020

Previously Presented: 10/25/2019



AEP Transmission Zone: Baseline
Bradley – Scarbro Rebuild

Process Stage: Recommended Solution

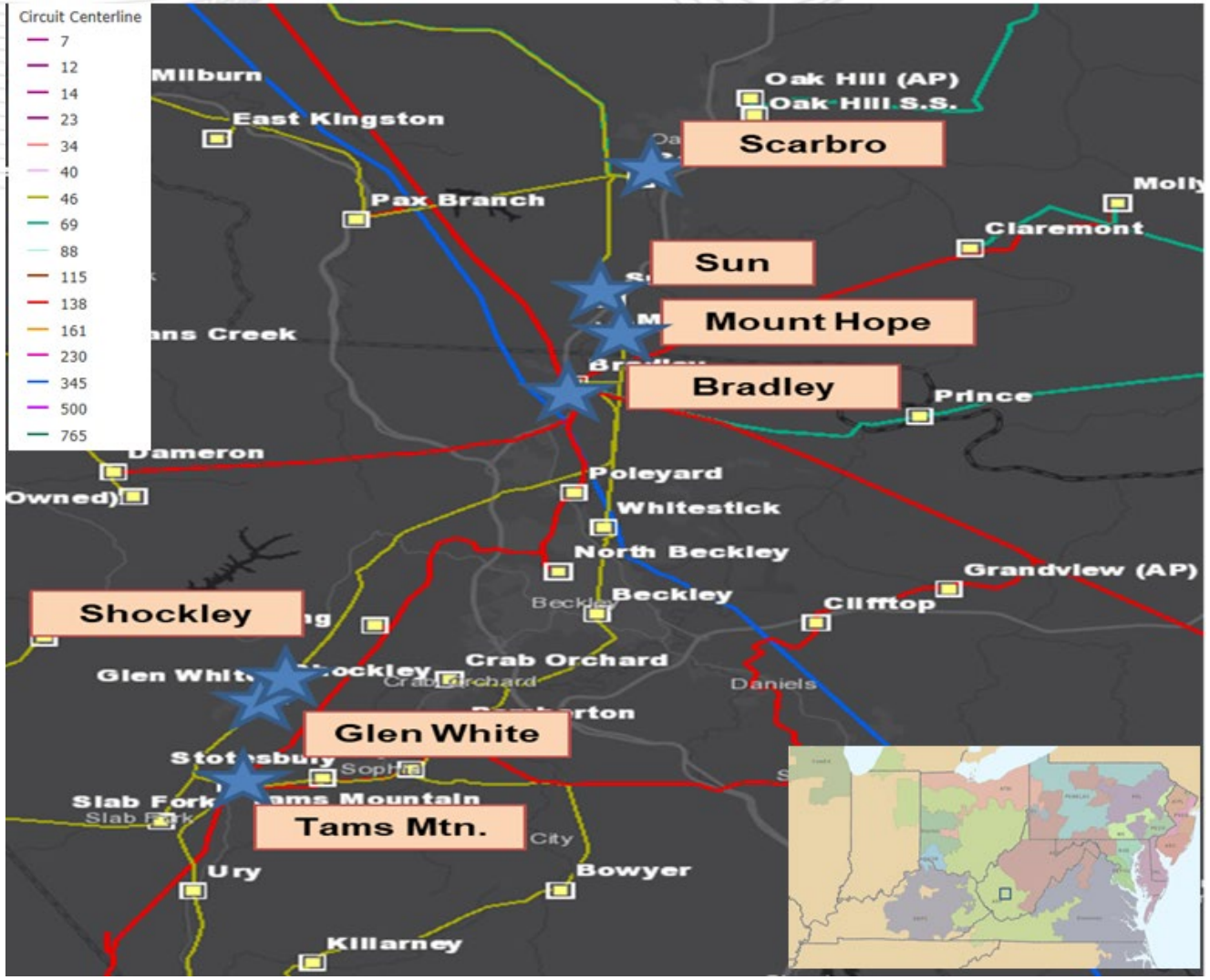
Criteria: TO Criteria Violation
Assumption Reference: FERC 715
Model Used for Analysis: 2021 RTEP Winter
Proposal Window Exclusion: FERC 715 (TO Criteria)
Problem Statement:
TO criteria thermal violations are identified on Bradley – Sun 46kV line section (108% of emergency rating) and Tams Mountain – Glen White 46 kV line section (129% of emergency rating) for N-1-1 contingencies (Bradley 138/69/46 kV XFR outage and Pemberton – Beckley 46 kV line) in the 2021 Winter RTEP Case. For the same contingency pair, voltage magnitudes drop below 0.92pu at Beckley 46 kV (0.86pu), Whitestick 46 kV (0.86pu), Bradley 46 kV (0.88pu), Mt. Hope 46 kV (0.90pu and Sun 46 kV (0.90pu) and voltage deviations are greater than 8% at Sun 46 kV Station, Mt. Hope 46 kV Station, Bradley 46 kV Station, Whitestick 46 kV Station, and Beckley 46 kV Station.
Additionally, Bradley –Scarbro 46 kV Circuit has Equipment material / Condition / Performance / Risk issues shown in Supplemental Need AEP-2019-AP049

Existing Facility Rating:

From Bus #	From Bus Name	To Bus #	To Bus Name	KV	ID	SN/SE/WN/WE
244876	05BRADLEY	244902	05SUN	46	1	31/31/43/43
244899	05SCARBRO	244902	05SUN	46	1	31/31/43/43

Preliminary Facility Rating:

From Bus #	From Bus Name	To Bus #	To Bus Name	KV	ID	SN/SE/WN/WE
244876	05BRADLEY	244902	05SUN	46	1	86/86/108/108
244899	05SCARBRO	244902	05SUN	46	1	86/86/108/108



AEP Transmission Zone: Baseline
Bradley – Scarbro Rebuild

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Recommended Solution:

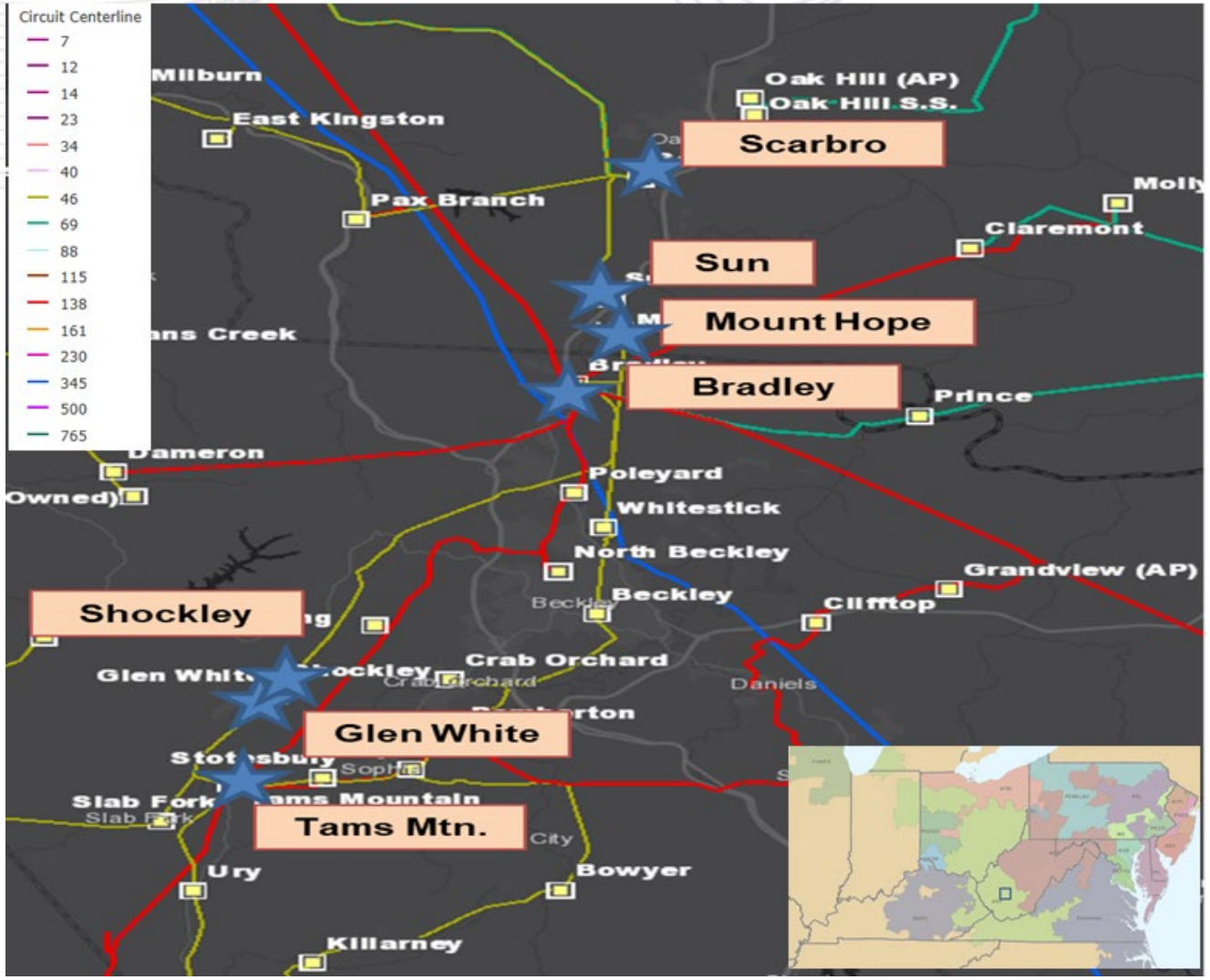
(**B3148.1**) Rebuild the 46 kV Bradley-Scarbro line. The new line will be rebuilt adjacent to the existing one leaving the old line in service until the work is completed. The new 46 kV line will be built with 795 ACSR (120 MVA) and 69 kV standards. **Estimated Cost: $22.2M**
(**B3148.2**) Bradley remote end station work, replace 46 kV bus, install new 12 MVAR capacitor bank. **Estimated Cost: $3.3M**
(**B3148.3**) The switch at Sun Station will be replaced with a 2- way SCADA-controlled MOAB switch. **Estimated Cost: $0.9M**
(**B3148.4**) Remote end work and associated equipment at Scarbro Station. **Estimated Cost: $1.3M**
(**B3148.5**) Retire Mt. Hope Station and transfer load to existing Sun Station. **Estimated Cost: $0.0M**

Total Estimated Transmission Cost: $27.7M

Required In-service: 12/1/2021

Projected In-service: 6/1/2021

Previously Presented: 10/25/2019



Next Steps

Upcoming Western SRRTEP Dates

West	Start	End
12/18/2019	9:00	1:00

Questions?

Revision History

11/19/2019 – V1 – Original version posted to pjm.com