Sub Regional RTEP Committee
PJM West

October 25, 2019

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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)

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First Review

Baseline Reliability Projects

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ComEd: Baseline Electric Junction

Process Stage: First Review

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

Proposed Solution:

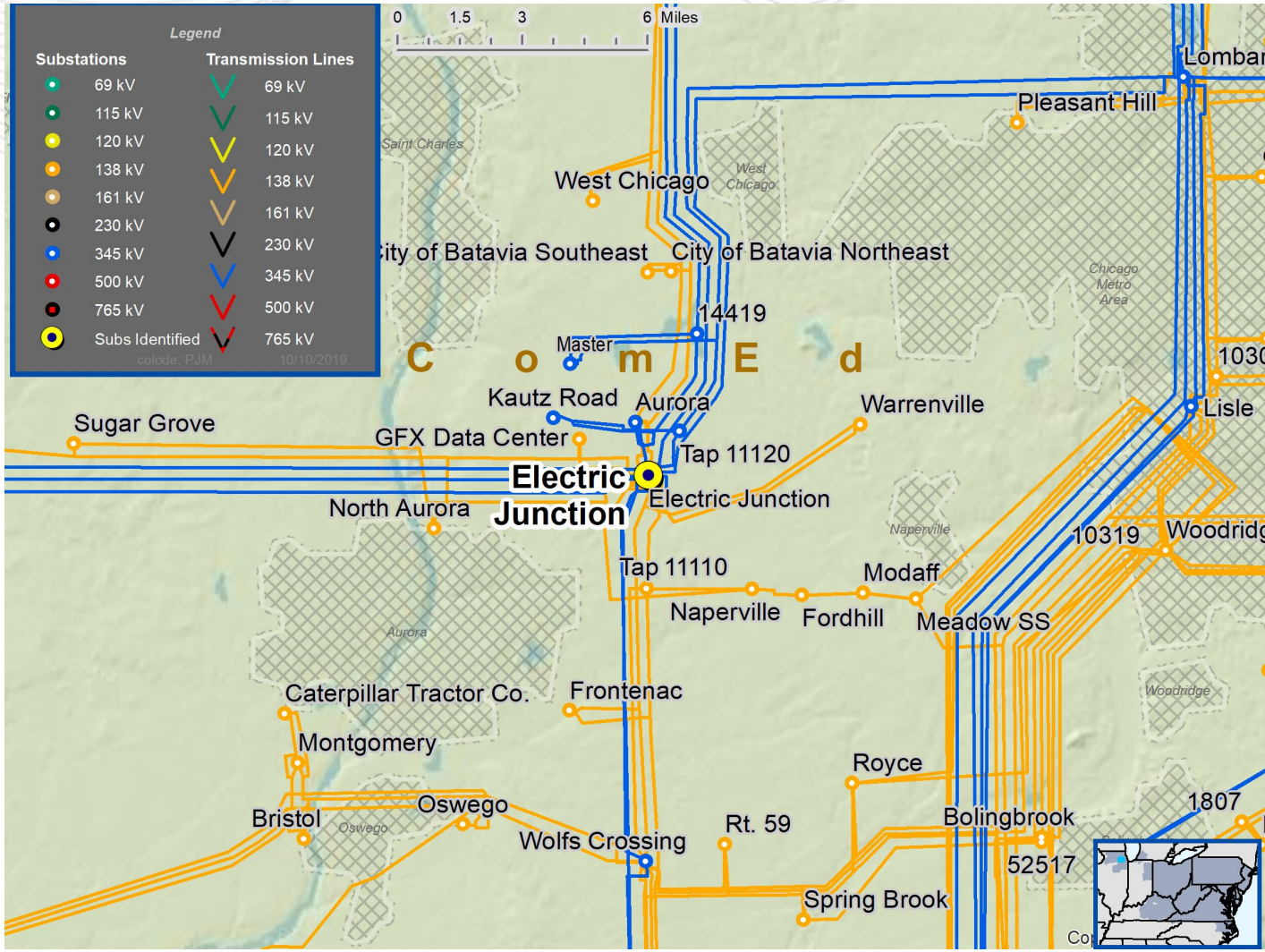
Modify 138kV blue bus total clearing times at TSS111 Electric Junction to 11 cycles for fault on 345/138kV Transformer 81, and to 13 cycles for faults on 138kV Line 11106, 138kV Line 11102 and 345/138kV Transformer 82

Estimated Cost: $ 0.25M

Alternatives:

1. Add high-speed backup clearing at TSS 111 Electric Junction
   - **Estimated Cost:** $ 0.50 M

Required In-Service: 12/31/2020



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AEP Transmission Zone: Baseline
Bradley – Scarbro Rebuild

Process Stage: First Review

Criteria: TO Criteria Violation
Assumption Reference: FERC 715
Model Used for Analysis: 2021 RTEP Winter
Proposal Window Exclusion: FERC 715 (TO Criteria)

Problem Statement:

Planning Criteria Violations:
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.

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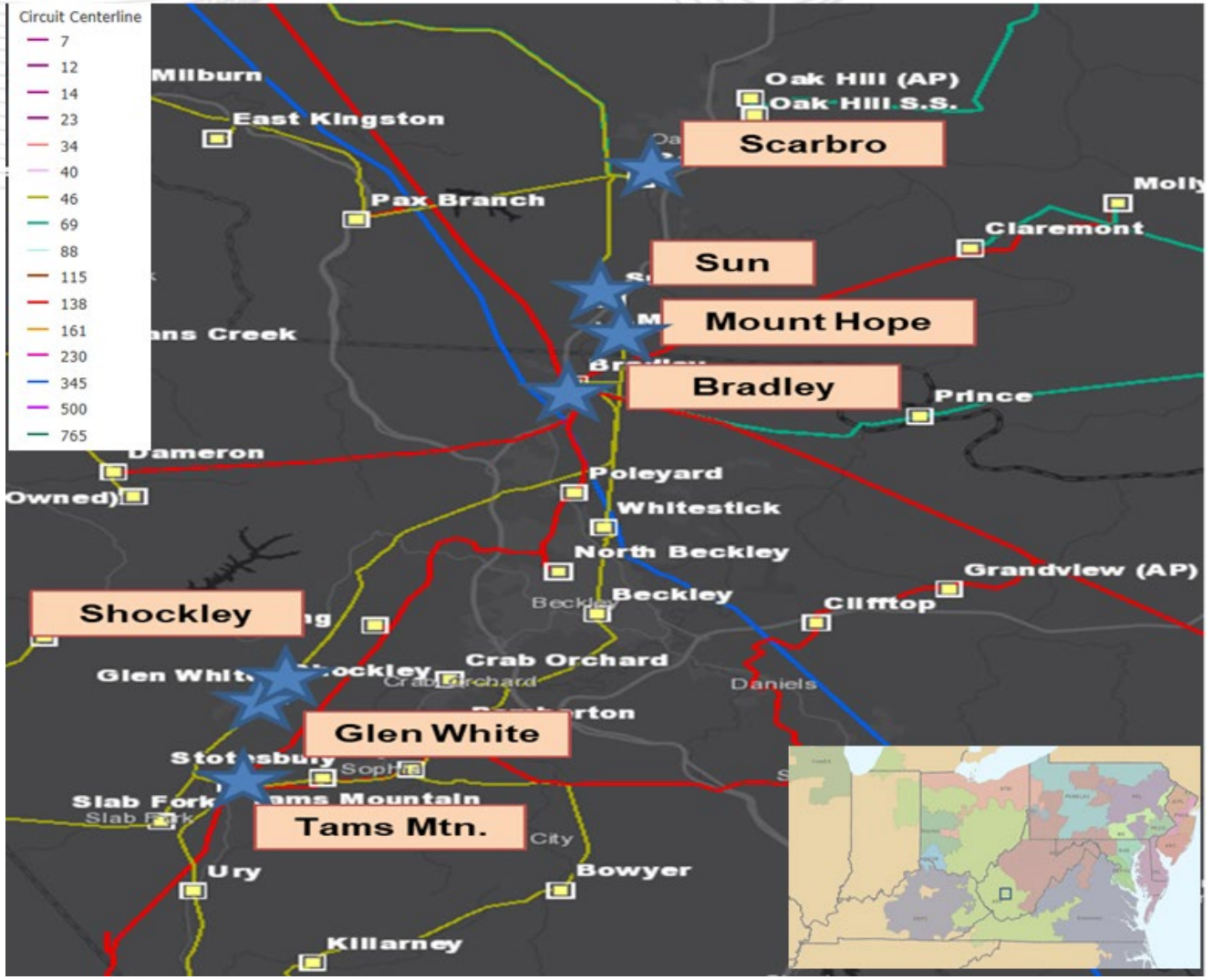

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AEP Transmission Zone: Baseline
Bradley – Scarbro Rebuild

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Potential Solution

Baseline:
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**

Bradley remote end station work, replace 46 kV bus, install new 12 MVAR capacitor bank. **Estimated Cost: $3.3M**

The switch at Sun Station will be replaced with a 2- way SCADA-controlled MOAB switch. **Estimated Cost: $0.9M**

Remote end work and associated equipment at Scarbro Station. **Estimated Cost: $1.3M**

Retire Mt. Hope Station and transfer load to existing Sun Station. **Estimated Cost: $0.0M**

Total Estimated Transmission Cost: $27.7M

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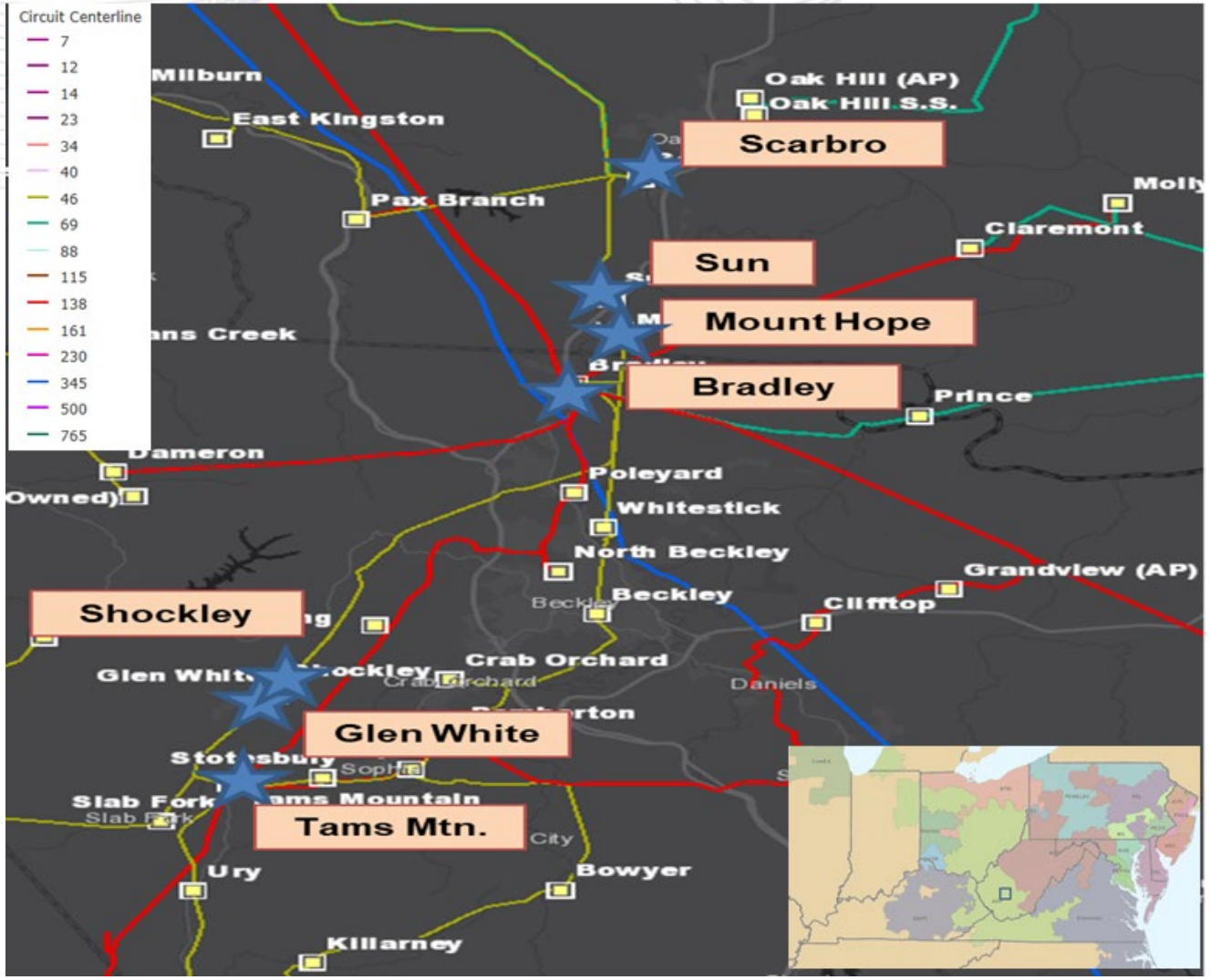

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AEP Transmission Zone: Baseline
Bradley – Scarbro Rebuild

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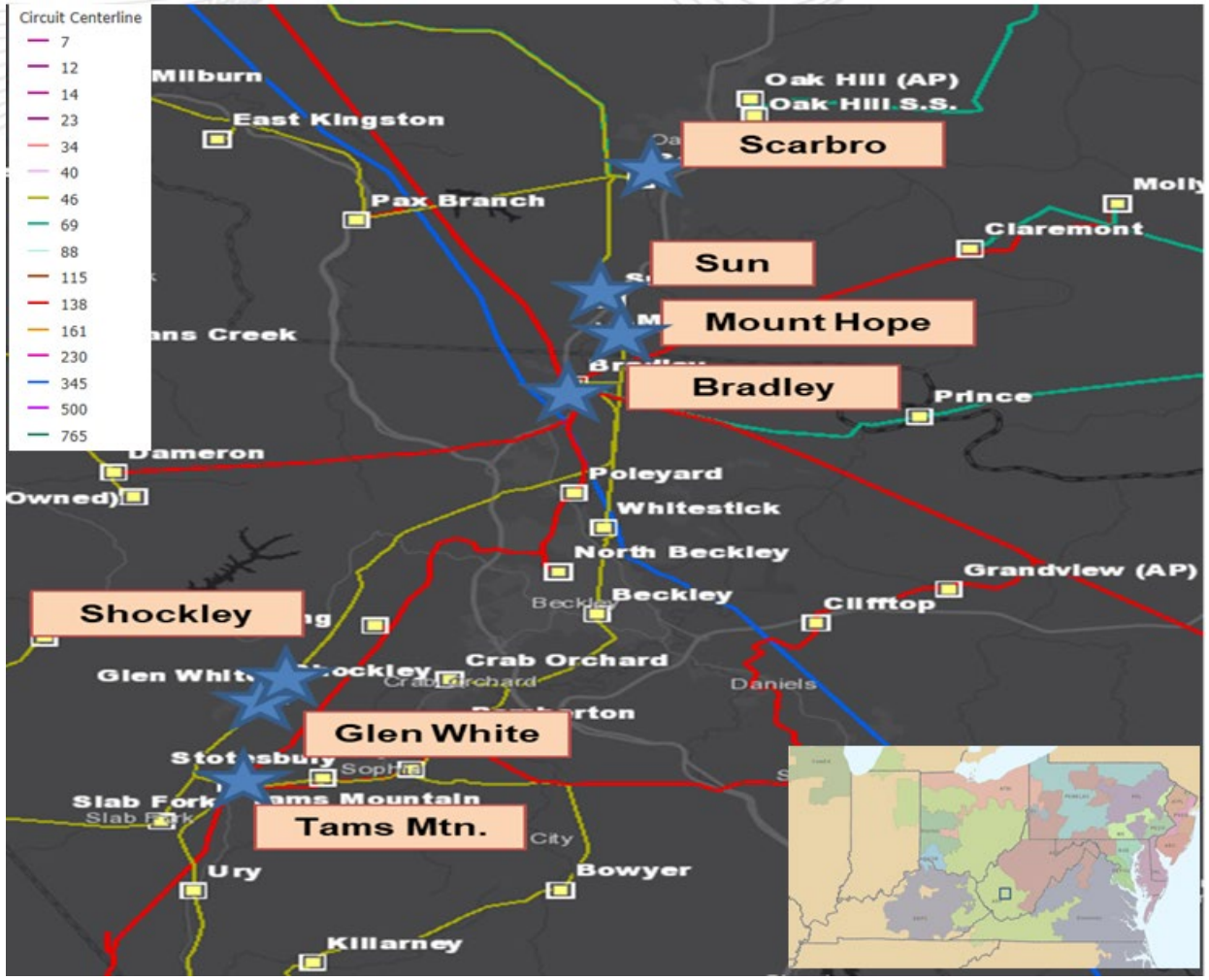
Alternative 1:
Baseline: Establish a new substation where the Bradley – Grandview 138 kV and Beckley – Bradley 46 kV circuits cross. Terminate both of these circuits within the new substation and install a 138/69/46kV XF with a high side circuit switcher. Install two 138 kV circuit breakers and three 69 kV circuit breakers. This project would resolve the N-1-1 conditions causing the thermal/voltage violations by creating a third source to serve the Beckley load pocket.
Supplemental: Rebuild the existing Bradley – Scarbro 46 kV circuit. The majority of the Bradley – Scarbro 46 kV line was built in 1913 (~6.3mi), and consists of wood/lattice structures. There are a total of 22 open conditions on the circuit, including broken conductor strands, heavy rust and woodpecker damage. From 2014-2019.3 the circuit has experienced 6 momentary outages and 4 permanent outages resulting in approximately 900,000 customer minutes of interruption. The proposed baseline solution addresses these needs instead of requiring a separate project.
Estimated Baseline Cost: $17M
Estimated Supplemental Cost: $24.4M
Total Estimated Cost: $41.4M

Alternative 2:
Baseline: Rebuild Tams Mtn. – Glen White 46 kV line section (~3 miles). Rebuild Shockley – Bradley 46 kV line section (~12 miles).
Supplemental: Rebuild the existing Bradley – Scarbro 46 kV circuit. The majority of the Bradley – Scarbro 46 kV line was built in 1913 (~6.3mi), and consists of wood/lattice structures. There are a total of 22 open conditions on the circuit, including broken conductor strands, heavy rust and woodpecker damage. From 2014-2019.3 the circuit has experienced 6 momentary outages and 4 permanent outages resulting in approximately 900,000 customer minutes of interruption. The proposed baseline solution addresses these needs instead of requiring a separate project.
Estimated Baseline Cost: $42M
Estimated Supplemental Cost: $24.4M
Total Estimated Cost: $66.4M

Required In-service: 12/1/2021



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Second Review

Baseline Reliability Projects

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AEP Transmission Zone: Baseline
East Lima and Haviland 138 kV Station Upgrade

Process Stage: Recommended Solution

Criteria: Winter Generator Deliverability and Basecase Analysis

Assumption Reference: PJM RTEP Study

Model Used for Analysis: 2024 RTEP Winter Peak Model

Proposal Window Exclusion: Substation Equipment and Below 200kV

Problem Statement:

The Haviland – East Lima 138kV line is overloaded for multiple contingencies in winter generator deliverability test and basecase analysis test. (N1-WT18, N1-WT19, N1-WT20, N1-WT21, N1-WT22, N1-WT23, N1-WT24, N1-WT25, GD-W244, GD-W3, GD-W4, GD-W5, GD-W7, GD-W8, GD-W19)

~~The Haviland 1 – Haviland 2 138kV bus tie is overloaded for the loss of East Lima – Maddox 345kV line with the stuck break at East Lima. (GD-W272)~~

Existing Facility Ratings:

From Bus ID	From Bus Name	To Bus ID	To Bus Name	Ckt Id	SN	SE	WN	WE
242989	05E LIMA 138.00	243017	05HAVILAND1 138.00	1	143	143	143	143
~~243017~~	~~05HAVILAND1 138.00~~	~~246352~~	~~05HAVILAND2 138.00~~	~~Z1~~	~~187~~	~~240~~	~~247~~	~~285~~

Preliminary Facility Ratings:

From Bus ID	From Bus Name	To Bus ID	To Bus Name	Ckt Id	SN	SE	WN	WE
242989	05E LIMA 138.00	243017	05HAVILAND1 138.00	1	167	245	210	271
~~243017~~	~~05HAVILAND1 138.00~~	~~246352~~	~~05HAVILAND2 138.00~~	~~Z1~~	~~335~~	~~392~~	~~424~~	~~466~~

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AEP Transmission Zone: Baseline
East Lima and Haviland 138 kV Station Upgrade

Proposed Solution:
At East Lima and Haviland 138 kV stations, replace line relays and wavetrap on the East Lima-Haviland 138 kV facility. ~~In addition, at Haviland 138 kV station replace and upgrade bus differential protection on the Haviland 1-Haviland 2 138 kV facility.~~ (**B3131**)

Estimated Cost: ~~$1.5 M~~ $1.35M

Required In-Service: 12/1/2024

Projected In-Service: 12/1/2024

Previously Presented: 9/25/2019 SRRTEP

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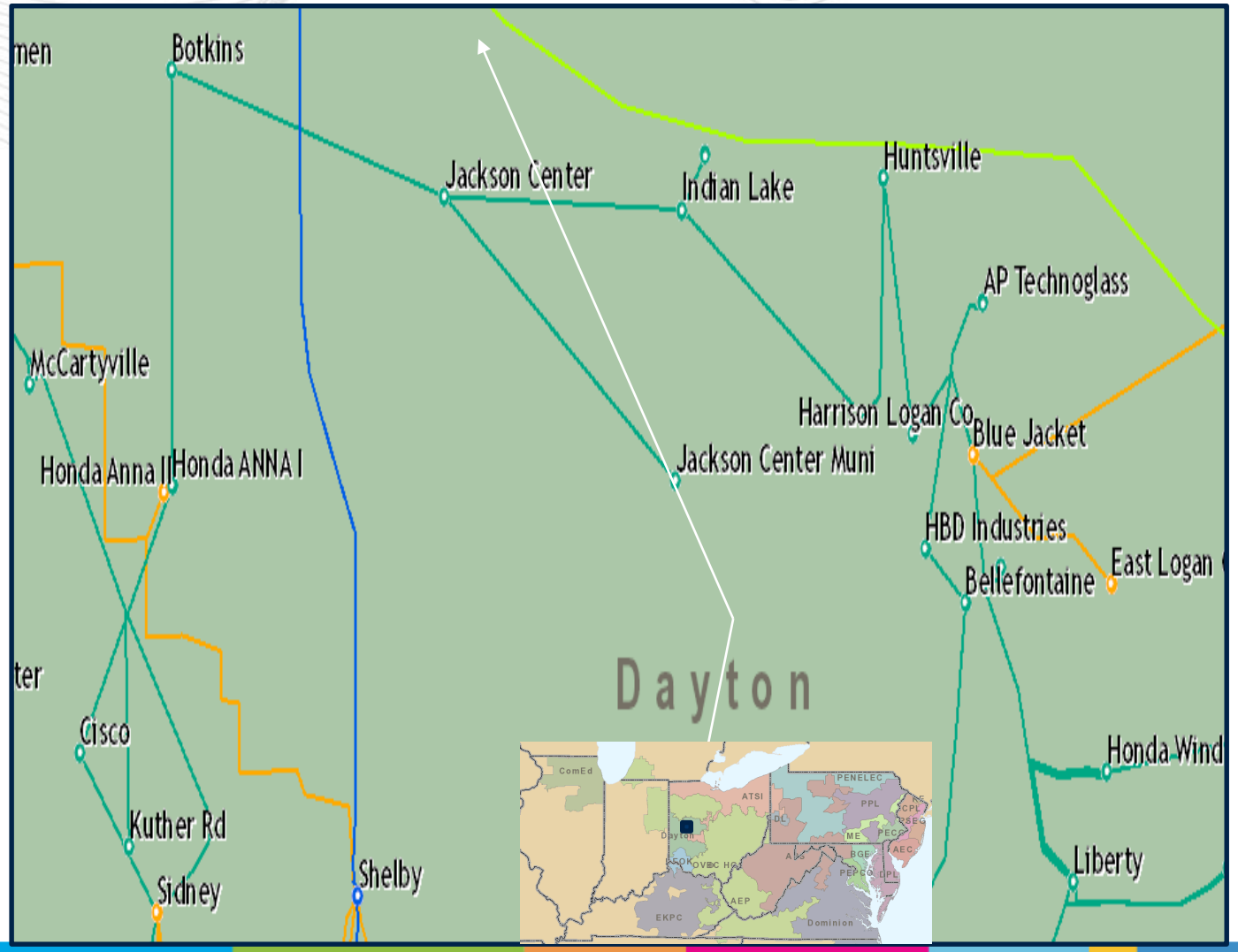
Dayton: Baseline
Blue Jacket Tap-Huntsville 69kV Line & Botkins 69kV Voltage Drop

Process Stage: Recommended Solution

Criteria: TO Criteria Violation
Assumption Reference: FERC 715
Model Used for Analysis: 2024 RTEP Summer & Winter
Proposal Window Exclusion: Below 200kV
Problem Statement:
The Botkins 69kV bus voltage drops 10.6% for the loss of the Sidney-Botkins 69kV transmission line under N-1 analysis in the 2024 RTEP summer case, and the voltage drops 10.4% for the same contingency in the 2024 RTEP winter case. The Sidney-Botkins contingency also causes the Blue Jacket Tap-Huntsville 69kV line to overload to 101% of its summer emergency rating in the 2024 RTEP summer case.
Existing Facility Rating: Blue Jacket Tap-Huntsville SN/SE 80/98
Preliminary Facility Rating: Blue Jacket Tap-Huntsville SN/SE 80/98

Proposed Solution:
Move the existing Botkins 69kV capacitor from the Sidney-Botkins side of the existing breaker at Botkins to the Botkins-Jackson Center side. This will keep the capacitor in-service for the loss of Sidney-Botkins. This reduces the voltage drop to less than 3% and also resolves the overload on the Blue Jacket Tap-Huntsville 69kV line. (**B3133**)
Estimated Cost: $200K
Required In-Service: 6/1/2024
Projected In-Service: 6/1/2024
Previously Presented: 9/25/2019 SRRTEP



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AEP Transmission Zone: Baseline New Buffalo Area Improvements

Previously Presented: 6/17/2019 SRRTEP

Process Stage: Recommended Solution
Criteria: Thermal N-1-1 violation (TO Criteria)
Assumption Reference: FERC 715
Model Used for Analysis: 2022 RTEP Summer
Proposal Window Exclusion: Below 200KV
Problem Statement:
For the N-1-1 loss of

- Derby – Cook Thornton 69kV and Bridgman – Pletcher 69kV
- Bridgman – Cook Thoronton 69kV and Bridgman – Pletcher 69kV
- Derby – Cook Thornton 69kV and Pletcher 138/69kV TR#1
- Bridgman – Cook Thoronton 69kV and Pletcher 138/69kV TR#1

the following violation occurs in the 2022 RTEP case:

- LaPorte Junction – New Buffalo 69 kV line gets loaded to 128%, 124%, 103%, 102% of its SE ratings (4/0 ACSR, 50MVA rating)

Existing Facility Rating:

246335 05LAPORTE – 246472 05N.BUFFAL 50/50/63/63 for SN/SE/WN/WE

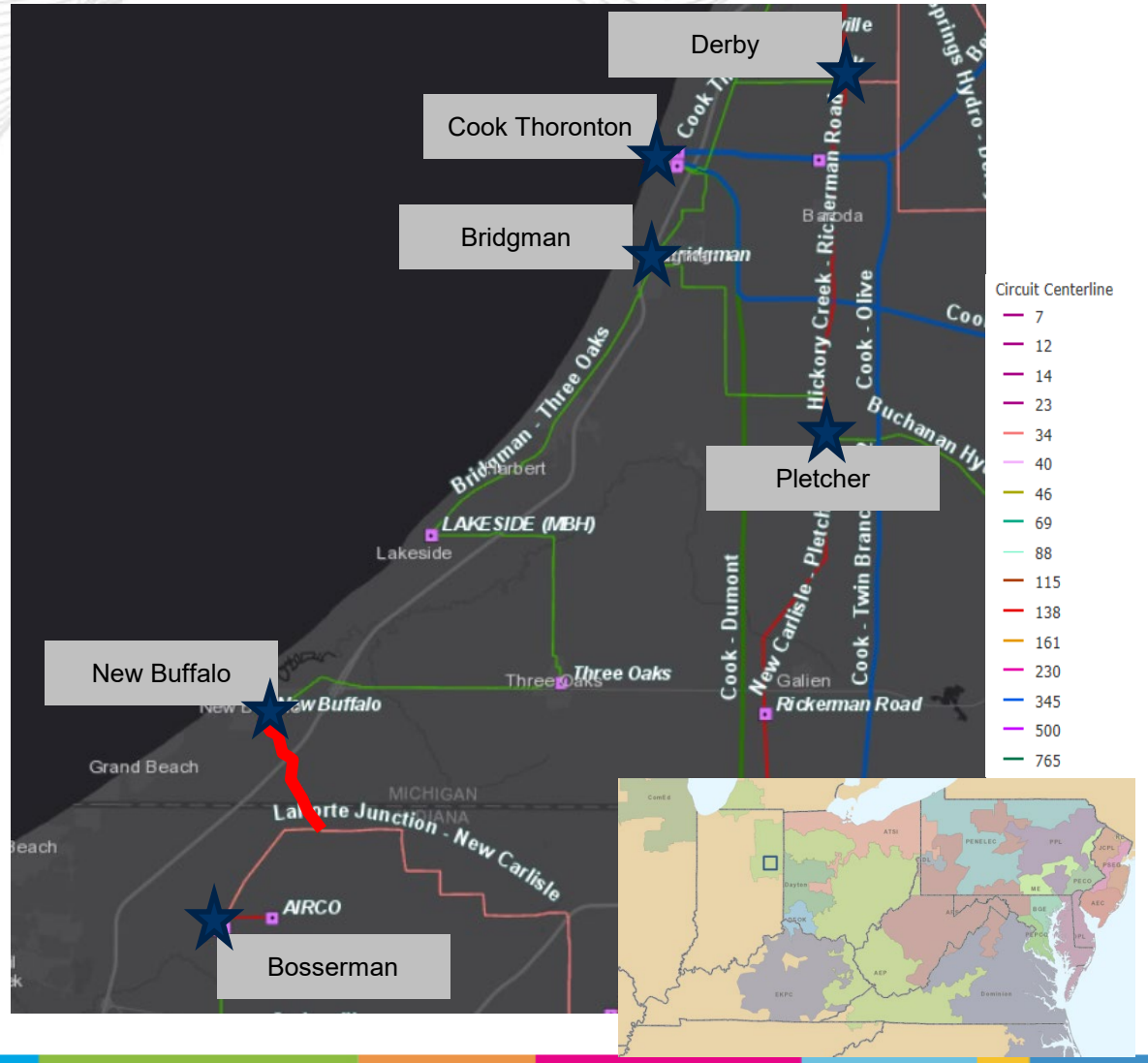
Preliminary Facility Rating:

246335 05LAPORTE – 246472 05N.BUFFAL 64/73/80/87 for SN/SE/WN/WE

Proposed Solution:

Rebuild 3.11 miles of the LaPorte Junction – New Buffalo 69 kV line with 795 ACSR (**B3132**)

Estimated Cost: $12.3M
Required IS Date: 06/01/2022
Project IS Date: 12/15/2020



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Project Updates

Baseline Reliability Projects

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AEP Transmission Zone: Baseline
Pike County, KY

Previously presented: 11/29/2018 SRRTEP
Criteria: Planning Criteria Violation
Assumption Reference: FERC 715
Model Used for Analysis: 2023 Winter RTEP
Proposal Window Exclusion: FERC 715 (TO Criteria)

Problem Statement:
Planning Criteria Violations:

In 2023 RTEP winter case:
For the loss of the Cedar Creek – Fords Branch 46 kV line section or Cedar Creek 138/69/46 kV transformer:
-Voltage Magnitude issues are experienced at Fords Branch (.88pu) station.

For the loss of the Cedar Creek 138/69/46 kV transformer and Beaver Creek – Elwood 46 kV circuit:
-The Dorton 138/46 kV transformer will load to 103% of its winter emergency rating (65 MVA, capabilities study pending)
-The Breaks 69/46 kV transformer will load to 104% of its winter emergency rating (50 MVA, capabilities study pending).
-The Henry Clay – Elwood 46 kV line section (~5.8 mi.) loads to 125% of its conductor's winter emergency rating (63 MVA).
-The Pike 29 S.S – Elwood 46 kV line section (~2.8 mi.) loads to 95% of its conductor's winter emergency rating (61 MVA).
-Voltage Magnitude issues are experienced at Fords Branch(.57 pu), Pike29 (.66 pu), Henry Clay (.80 pu), Draffin (.89 pu.), Burdine (.91pu), and Elwood (.71pu) stations.
-Voltage Deviation issues are experienced at Fords Branch(33%), Pike29 (29%), Elwood (27%), Henry Clay (19%), Burdine (11%), and Draffin(12%) stations.

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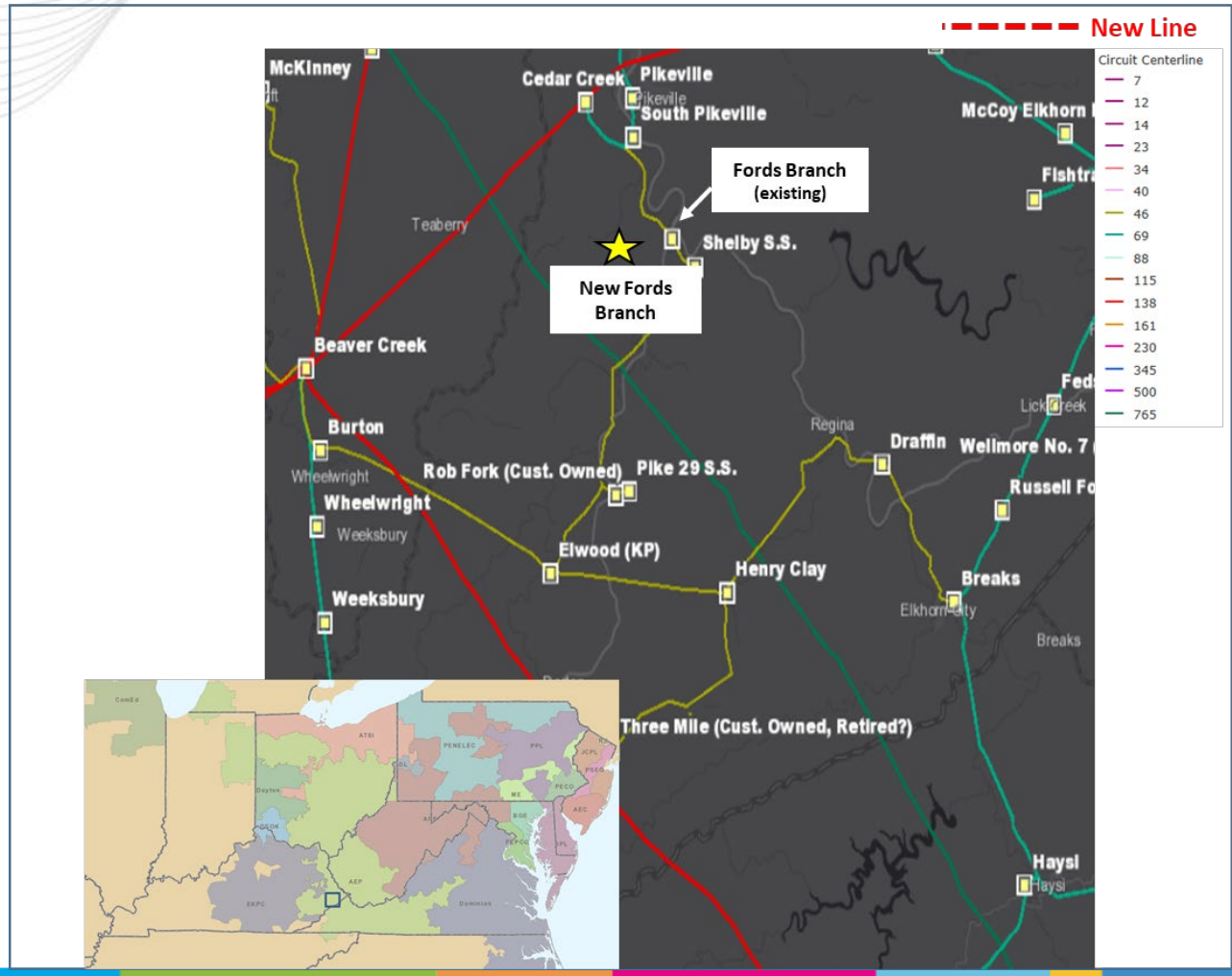

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Planning Criteria Violations:

For the loss of the Cedar Creek 138/69/46 kV transformer and Dorton – 138/46 kV transformer:
-The Burton – Elwood 46 kV line section (~8.3 mi.) loads to 98 % of its winter emergency rating (55 MVA), Voltage Magnitude issues are experienced at Fords Branch(.80pu), Pike29 (.86pu), Henry Clay (.90pu), Burdine (.89pu), and Elwood (.89pu) stations.
-Voltage Deviation issues are experienced at Fords Branch(9%), Pike29 (8% 18%), Elwood (8%), Henry Clay (9%), and Burdine (12%) stations.

For the loss of the Cedar Creek 138/69/46 kV transformer and Dorton – Elwood – Breaks 46 kV circuit:
-The Burton – Elwood 46 kV line section (~8.3 mi.) loads to ~~113%~~ 130% of its ~~conductor's~~ winter emergency rating (~~63 MVA~~ 55MVA).
-The Burton – Beaver Creek 46 kV line section (~2.2 mi.) loads to 119 % of its conductor's winter emergency rating (63 MVA).
-The Beaver Creek 138/69/46 kV transformer #1 will load to 103% of its winter emergency rating (58 MVA) .
-Voltage Magnitude issues are experienced at Fords Branch(.67pu),Pike29 (.75pu), and Elwood (.79pu) stations.
-Voltage Deviation issues are experienced at Fords Branch(25%), Pike29 (21%), Elwood (19%), and Burton (9%) stations.

For loss of the Dorton 138/46 kV and Breaks 69/46 kV transformers:
- Voltage magnitude issues are experienced at Henry Clay (0.89pu), Draffin (0.88pu) and Burdine (0.87) stations.
- Voltage Deviation issues are experienced at Henry Clay (8%), Draffin (%10) and Burdine (9%) stations.

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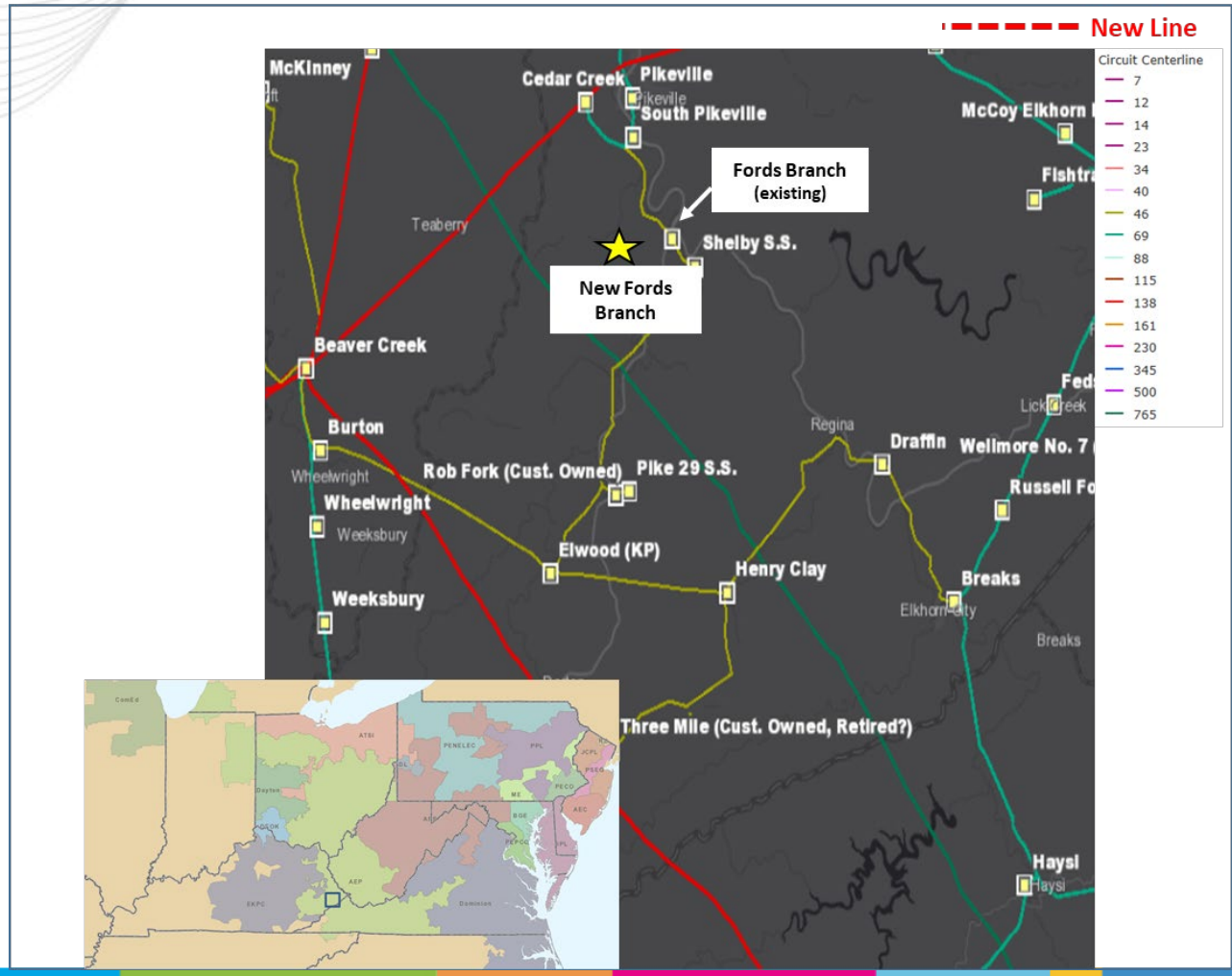

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Customer Service:

~~Kentucky Power Distribution has requested an additional 40 MW of capacity to serve distribution customers at the Kentucky Enterprise Industrial Park, Projected IS date: 12/1/2019~~

~~Planning Criteria Violations with the additional 40MW load:~~

~~Base Case voltage violation (.89pu) at Fords Branch~~

~~For the loss of the Cedar Creek – Fords Branch 46 kV line section or Cedar Creek 138/69/46 kV transformer:~~

~~-The Elwood 46 kV network becomes non convergent due to a voltage collapse.~~

~~For the loss of the Henry Clay – Elwood 46 kV line section:~~

~~-A portion of the Cedar Creek - Fords Branch 46 kV line section (~3 mi.) will load to 103% of its conductor's winter emergency rating (61 MVA)~~

~~-Voltage Magnitude issues are experienced at Fords Branch(.87pu),Pike29 (.90pu), and Elwood (.91pu) stations.~~

~~A bus outage at Elwood Station results in:~~

~~-The Cedar Creek - Fords Branch 46 kV line section (~4.9 mi.) will load to 139% of its largest conductor's winter emergency rating (84 MVA).~~

~~-The Cedar Creek 138/69/46 kV transformer will load to 146% of its 46 windings winter emergency rating (80 MVA)~~

~~-Voltage Magnitude issues are experienced at Fords Branch(.66pu) and Pike29 (.63pu) stations.~~

~~-Voltage Magnitude issues are experienced at Fords Branch(.30%) and Pike29 (37%) stations.~~

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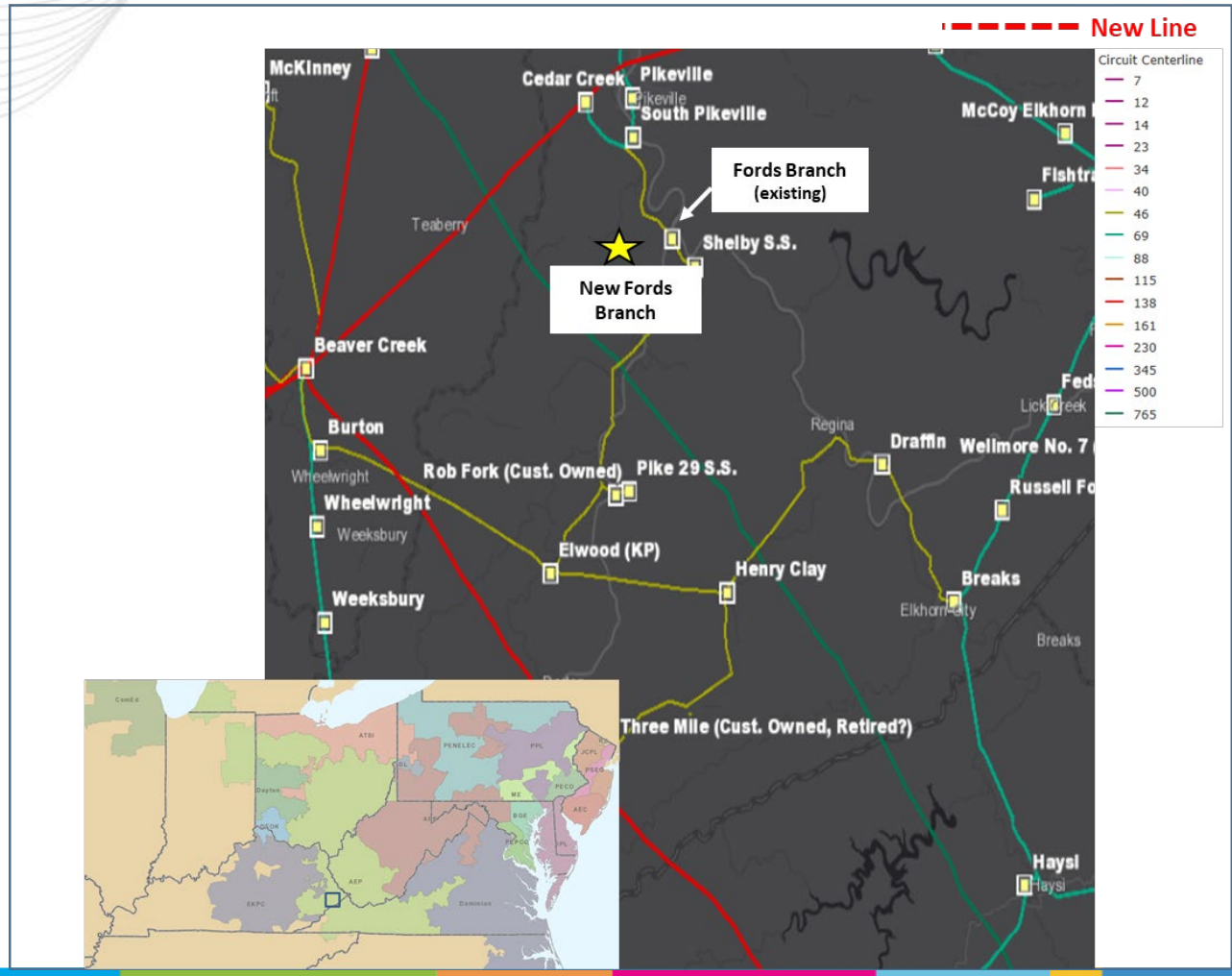

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~~Planning Criteria Violations with the additional 40MW load:~~

~~For the loss of the Beaver Creek – Burton 46 kV line section:~~
~~-A portion of the Cedar Creek - Fords Branch 46 kV line section (~3 mi.) will load to 109% of its conductor's winter emergency rating (61 MVA)~~
~~-Voltage Magnitude issues are experienced at Fords Branch(.88pu) and Pike29 (.91pu) stations.~~

~~For the loss of the Beaver Creek – Elwood 46 kV line circuit:~~
~~-A portion of the Cedar Creek - Fords Branch 46 kV line section (~3 mi.) will load to 105% of its conductor's winter emergency rating (61 MVA)~~
~~-Voltage Magnitude issues are experienced at Fords Branch(.89pu) station~~

~~For the loss of the Dorton 138/46 kV transformer:~~
~~-A portion of the Cedar Creek - Fords Branch 46 kV line section (~3 mi.) will load to 100% of its conductor's winter emergency rating (61 MVA)~~
~~-Voltage Magnitude issues are experienced at Fords Branch(.88pu) and Pike29 (.91pu) stations.~~

~~For the loss of the Breaks 69/46 kV transformer:~~
~~-Voltage Magnitude issues are experienced at Fords Branch(.89pu) station.~~

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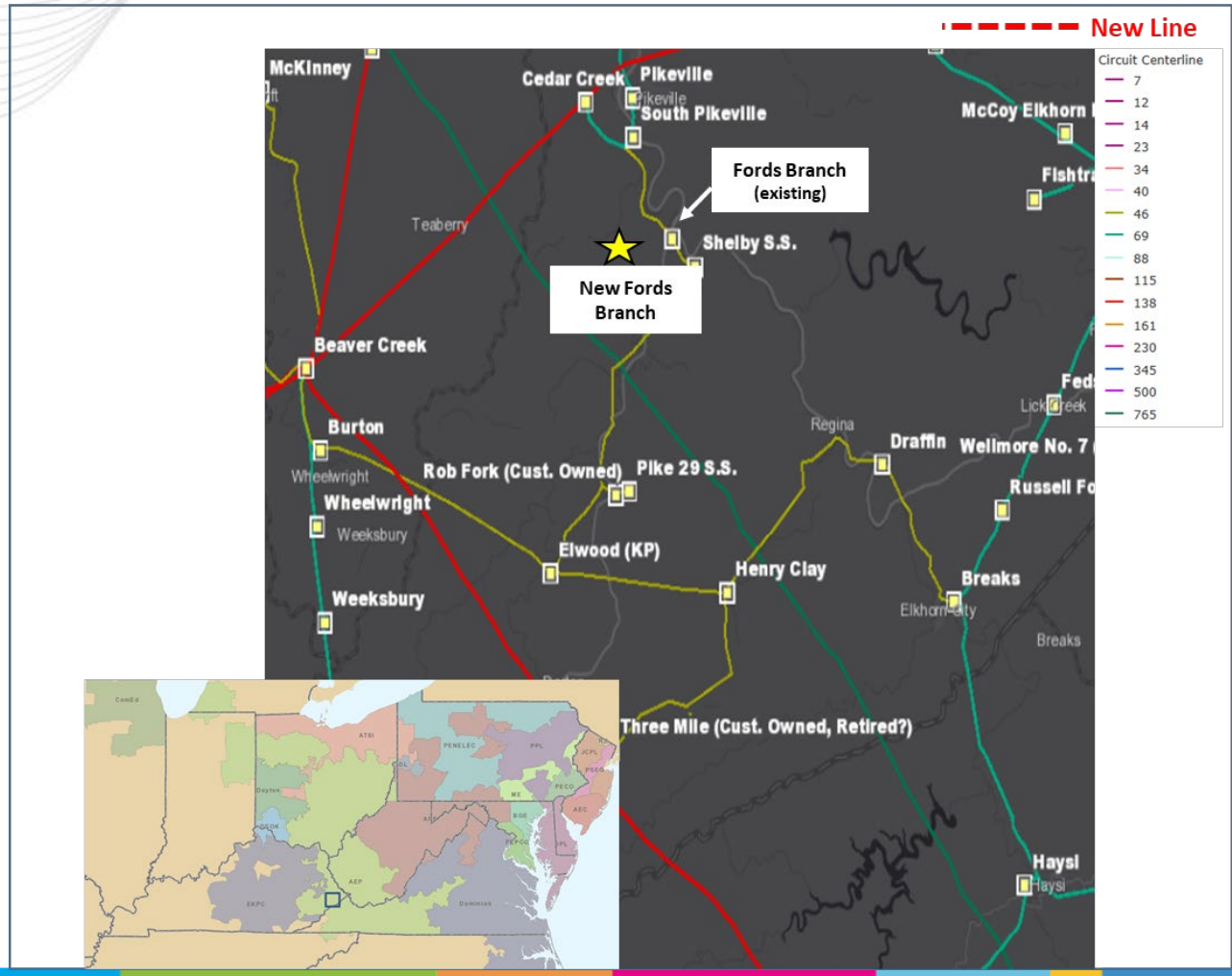

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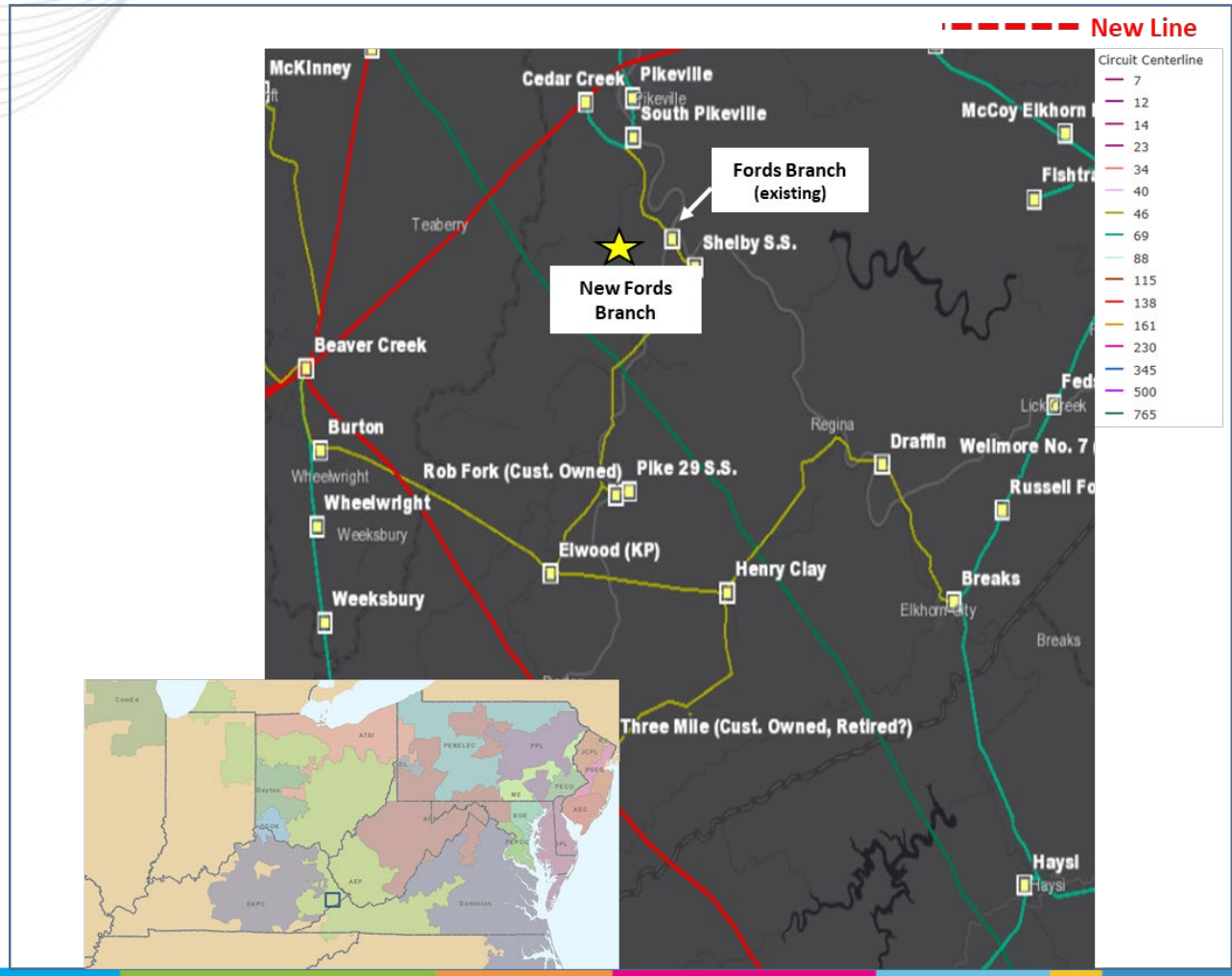
Planning Criteria Violations with the additional 40MW load:

For loss of the Beaver Creek – Elwood 46 kV circuit and Dorton 138/46 kV transformer:
-The Cedar Creek - Fords Branch 46 kV line section (~4.9 mi.) will load to 115% of its largest conductor's winter emergency rating (84 MVA).
-The Cedar Creek 138/69/46 kV transformer will load to 121% of the transformer's 46 kV windings winter emergency rating (80 MVA).
-The Breaks 69/46 kV transformer will load to 134% of the transformers winter emergency rating (50 MVA).
-The Breaks – Draffin 46 kV line section (~4.5 mi.) will load to 102% of its conductor's winter emergency rating (63 MVA).
-The Draffin – Henry Clay 46 kV line section (~7.33 mi.) will load to 105% (92% of its conductor's winter emergency rating (63 MVA)) (55 MVA).
-Voltage magnitude issues are experienced at Fords Branch(.77pu), Pike29 (.77pu), Elwood (.78pu), Henry Clay (.80pu), Draffin (.88pu), and Burdine (.78pu) stations.
-Voltage Deviation issues are experienced at Fords Branch (15%), Pike29 (17%), Elwood (18%), Henry Clay (20%), Draffin (14%), and Burdine (25%) stations.

For loss of the Beaver Creek – Elwood 46 kV circuit and Breaks 69/46 kV transformer:
-A portion of the Cedar Creek - Fords Branch 46 kV line section (~3 mi.) will load to 141% of its conductor's winter emergency rating (61MVA) and 102% of the line's largest conductor winter emergency rating (84 MVA).
-The Cedar Creek 138/69/46 kV transformer will load to 107% of the transformer's 46 kV windings winter emergency rating (80 MVA).
-A portion of the Dorton – Henry Clay 46 kV circuit (~6 mi.) will load to 98% of its conductor's winter emergency rating (63 MVA).
-The Dorton 138/46 kV transformer will load to 110% of its winter emergency rating (65 MVA, capabilities study pending) .
-Voltage magnitude issues are experienced at Fords Branch(.79pu), Pike29 (.80pu), Elwood (.82pu), Henry Clay (.84pu), and Draffin (.83pu) stations.
-Voltage Deviation issues are experienced at Fords Branch (8%), Pike29 (11%), Elwood (11%), Henry Clay (11%),and Draffin (15%) stations.



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~~Planning Criteria Violations with the additional 40MW load:~~

~~For loss of the Dorton 138/46 kV and Breaks 69/46 kV transformers:~~
~~-The Cedar Creek - Fords Branch 46 kV line section (~4.9 mi.) will load to 100% of its largest conductor's winter emergency rating (84 MVA).~~
~~-The Cedar Creek 138/69/46 kV transformer will load to 105% of the transformer's 46 kV windings winter emergency rating (80 MVA).~~
~~-The Beaver Creek – Burton 46 kV line section (~2.2 mi.) will load to 125% of its conductor's winter emergency rating (63 MVA).~~
~~-The Burton – Elwood 46 kV line section (~8.25 mi.) will load to 120% of its conductor's winter emergency rating (63 MVA).~~
~~-The Beaver Creek 138/69/46 kV transformer #1 will load to 105% of its winter emergency rating (58 MVA) .~~
~~-Voltage magnitude issues are experienced at Fords Branch(.79pu), Pike29 (.80pu), Elwood (.81pu), Henry Clay (.77pu), Draffin (.76pu), and Burdine (.75pu) stations.~~
~~-Voltage Deviation issues are experienced at Fords Branch (13%), Pike29 (16%), Elwood (17%), Henry Clay (22%), Burdine (23%), Burton (9%), and Draffin (27%) stations.~~

~~For loss of the Beaver 138/69/46 kV transformer #2 and Dorton 138/46 kV transformer:~~
~~-The Beaver Creek 138/69/46 kV transformer #1 will load to 104% of its winter emergency rating (58 MVA) .~~
~~-A portion of the Cedar Creek - Fords Branch 46 kV line section (~3 mi.) will load to 104% of its conductor's winter emergency rating (61MVA)~~
~~-Voltage magnitude issues are experienced at Fords Branch(.87pu), Pike29 (.90pu), and Burdine (.91pu) stations.~~
~~-Voltage Deviation issues are experienced at Burdine (9%) station.~~

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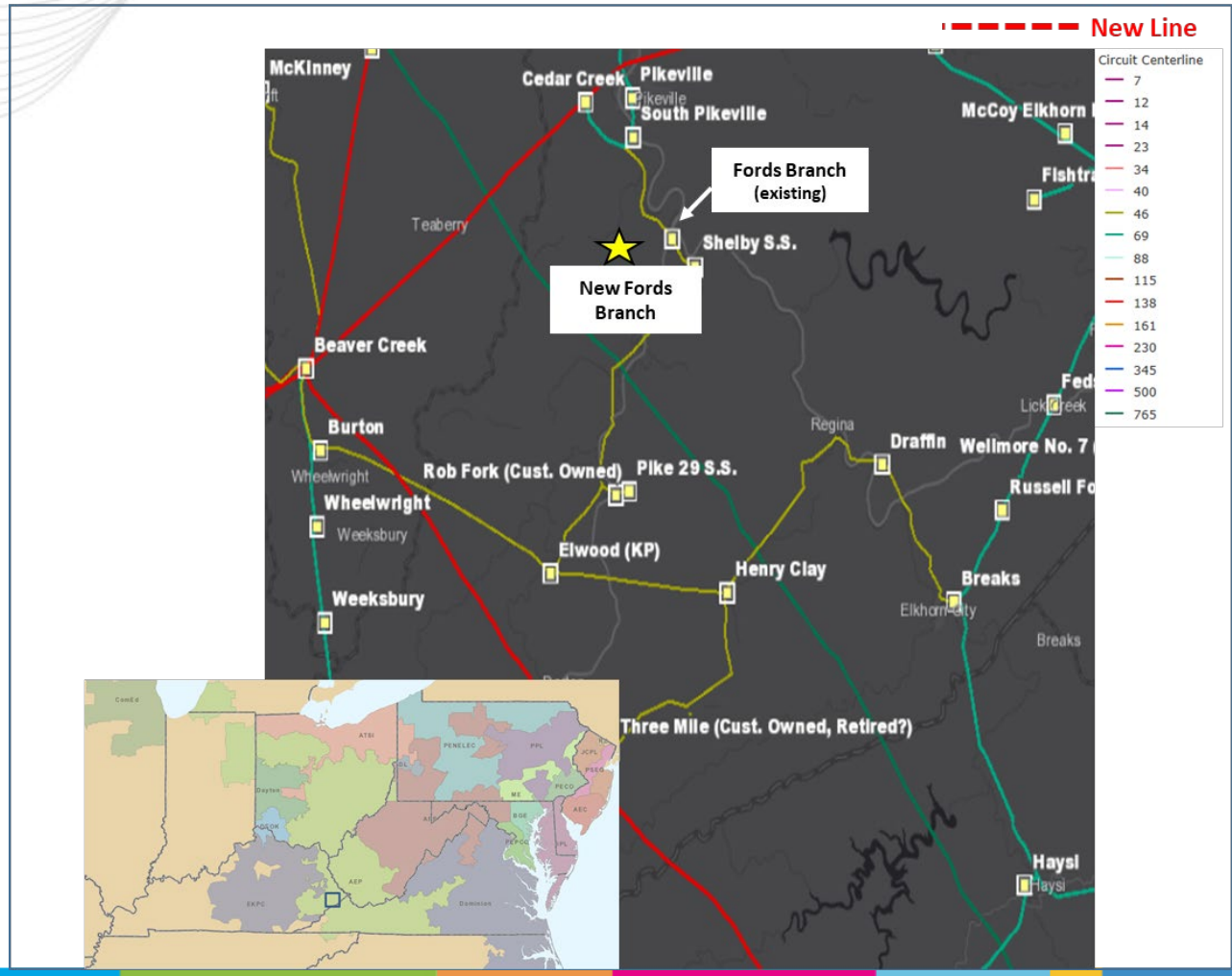

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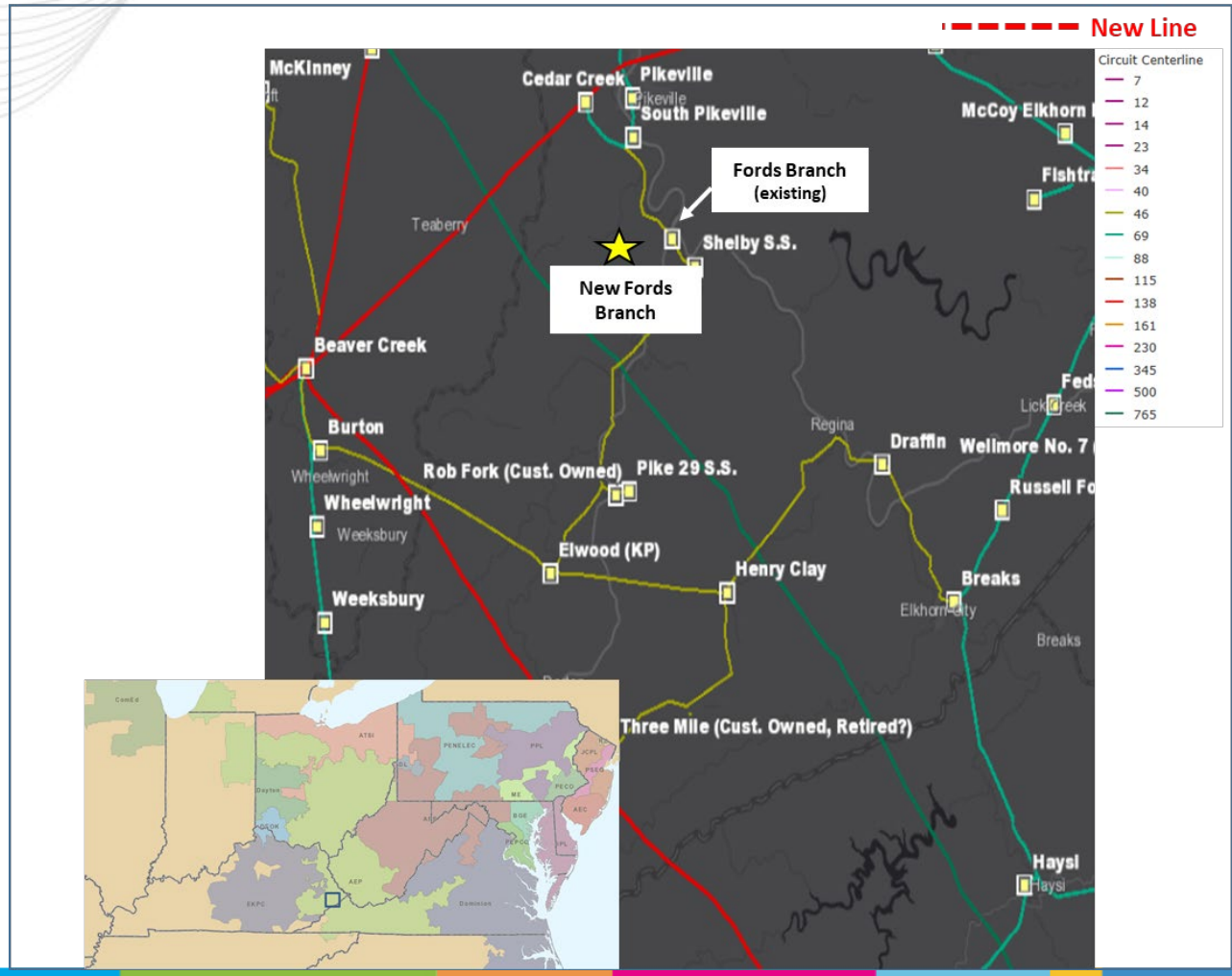
Equipment Material/Condition/Performance/Risk:

- The 46/34.5 kV transformer (vintage 1992) at Fords Branch Station is showing signs of dielectric breakdown (insulation), accessory damage (bushings/windings) and short circuit breakdown (due to amount of through faults).
- The wood pole Phase over Phase switch that currently serves Fords is inoperable and in need of replacement.
- The 34.5 kV circuit breakers "A" & "B" at Fords Branch are ESV type breakers manufactured in 1992, which are an oil type breaker that are being replaced across the AEP footprint due to their history of violent failures. In addition, breakers "A" & "B" have experienced 262 and 333 fault operations, exceeding the manufacturer recommendation of 10.
- The existing station equipment restricts adequate access within the station for normal maintenance activity due to small station footprint, increasing safety risks.
- The small county road needed to access the site has limited room to maneuver a mobile transformer. A mobile must be backed in from highway approximately 0.25mile up county road.

Operational Flexibility and Efficiency

The 46/34.5 kV transformer at Fords Branch Station utilizes a ground switch MOAB scheme as part of the high side transformer protection. ~~The proposed 138/12 kV transformer at Kewanee station will allow for load to be transferred away from the existing Betsy Layne – Cedar Creek 69 kV circuit which has historical seen flows close to its 91 MVA conductor winter emergency rating~~



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Selected Solution

Construct a new greenfield station to the west (~1.5 mi.) of the existing Fords Branch Station, potentially in/near the new Kentucky Enterprise Industrial Park. ~~This station will consist of six 3000A 40kA 138 kV breakers laid out in a ring arrangement, two 30 MVA 138/34.5 kV transformers, and two 30 MVA 138/12 kV transformers.~~ This new station will consist of 4 -138 kV breaker ring bus and two 30 MVA 138/34.5 kV transformers. The existing Fords Branch Station will be retired. (**B3087.1**) **Estimated Cost: ~~$3.4 M~~ $2.8 M**

Construct approximately 5 miles of new double circuit 138 kV line in order to loop the ~~new Kewanee station~~ New Fords Branch station into the existing Beaver Creek – Cedar Creek 138 kV circuit. (**B3087.2**)
Estimated Cost: $ 19.9 M

Remote end work will be required at Cedar Creek Station. (**B3087.3**)
Estimated Cost: $ 0.5 M

Total Estimated Transmission Cost: ~~$23.8M~~ $23.2 M

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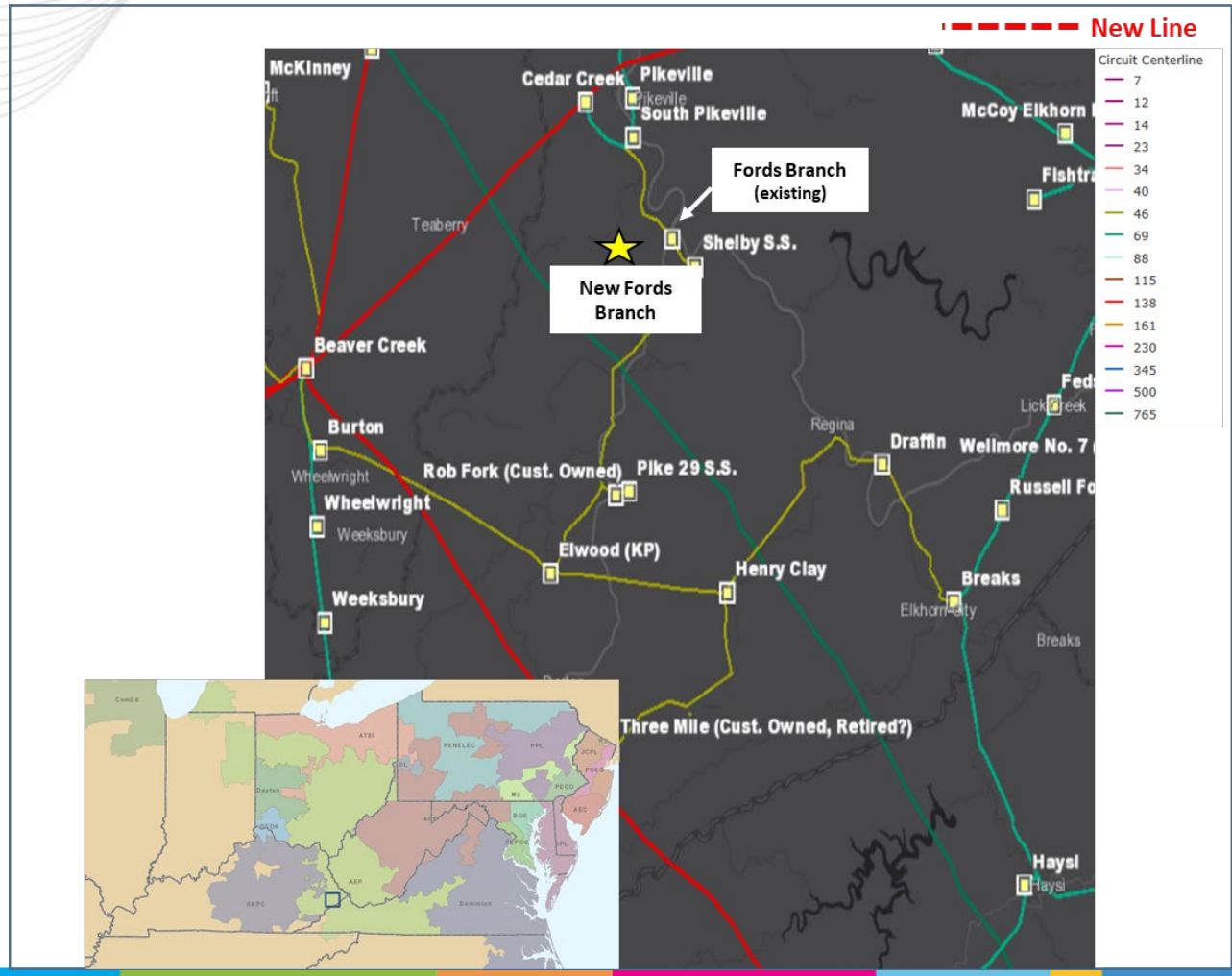

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Alternate #1

Rebuild the overloaded 46 kV circuit sections: Burton – Beaver Creek, Burton – Elwood and Henry Clay – Elwood ~~(~45 miles~~ **~16.3 miles**). Replace the overloaded Beaver Creek 138/69/46 kV and Breaks 69/46 kV transformers. Install ~~total 28.8MVAR~~ an additional 14.4 MVAR cap bank at the Elwood substation (14.4MVAR existing). While this will resolve the identified thermal overloads and ~~this alternative not solve~~ the identified voltage violations, it will create voltage rise issues with an additional cap bank at the Elwood substation due to low short circuit strength on the 46 kV system. Installation of the additional cap bank also increases operational complexity as the new cap bank on the same 46kV bus at Elwood would be switched post contingency whereas the existing 14.4MVAR cap bank is switched normally. There are also existing cap banks at Henry Clay and Fords Branch stations. Coordinating the settings and voltage set points on multiple cap banks in a small area could potentially result in hunting. This alternative would also not address the additional system needs at Fords Branch specified in the Project Justification. **Estimated Cost:** $52 M

~~**This alternative was deemed to not be cost effective.**~~

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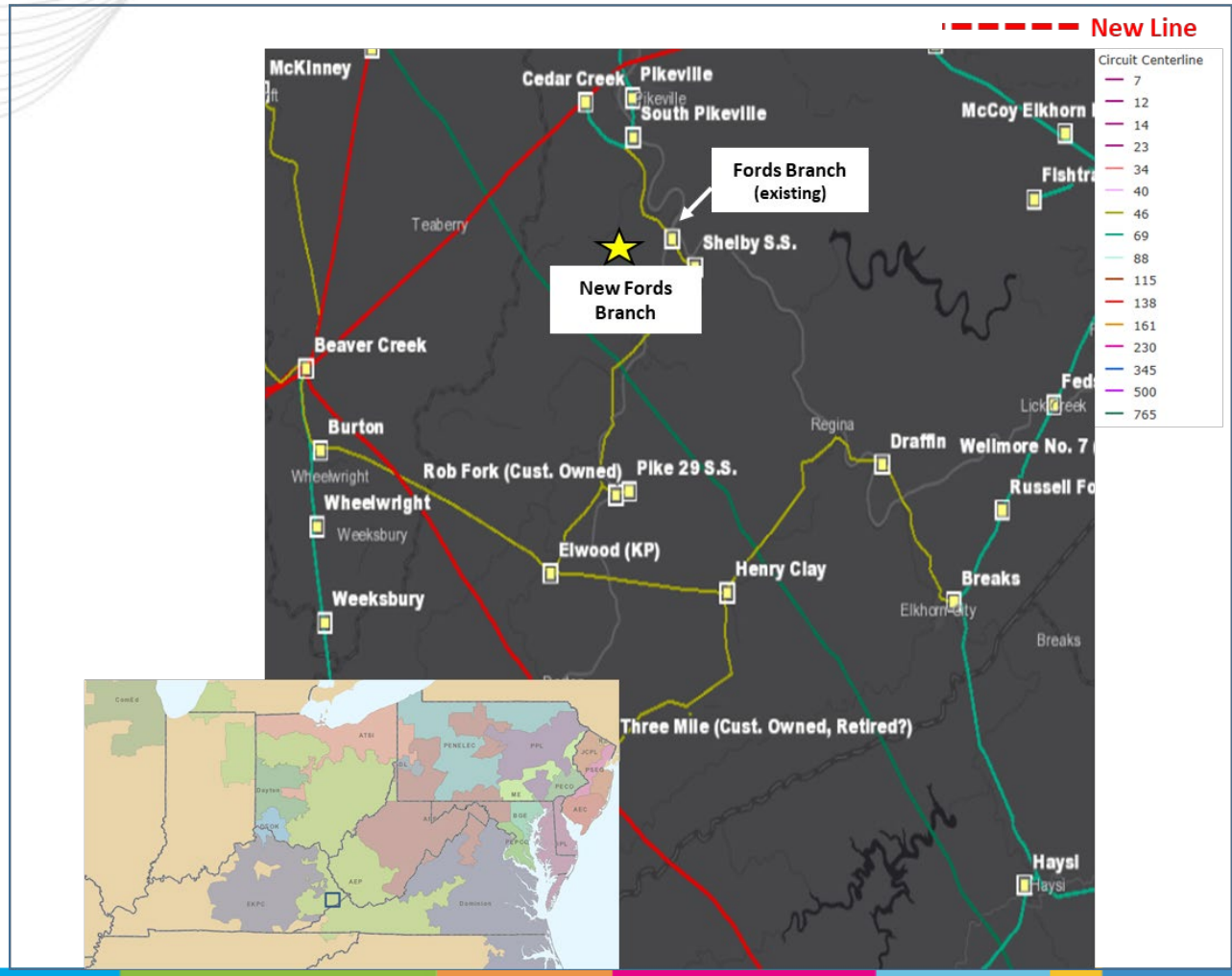

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~~Alternate #2~~

~~Install two additional transformers at Cedar Creek station. This would require an expansion at Cedar Creek station. Construct approximately 5 miles of new double circuit 46 kV line from Cedar Creek to Fords Branch Stations. This would require a significant expansion of Fords Branch station which is not feasible due to the land locked nature of that station being surrounded by residences, mountains, and the flood plain. Because of this, Fords Branch would need to be relocated and constructed as a greenfield station, likely at the Enterprise Industrial Park due to lack of suitable sites nearby. The relocation would require an additional 2 miles of double circuit and single circuit 46 kV line to be constructed to connect the station to the existing 46 kV circuits that currently terminate at Fords Branch. 46 kV circuit breakers would be required at the new Fords Branch station. Estimated Cost: ~$35M~~

Alternate #3

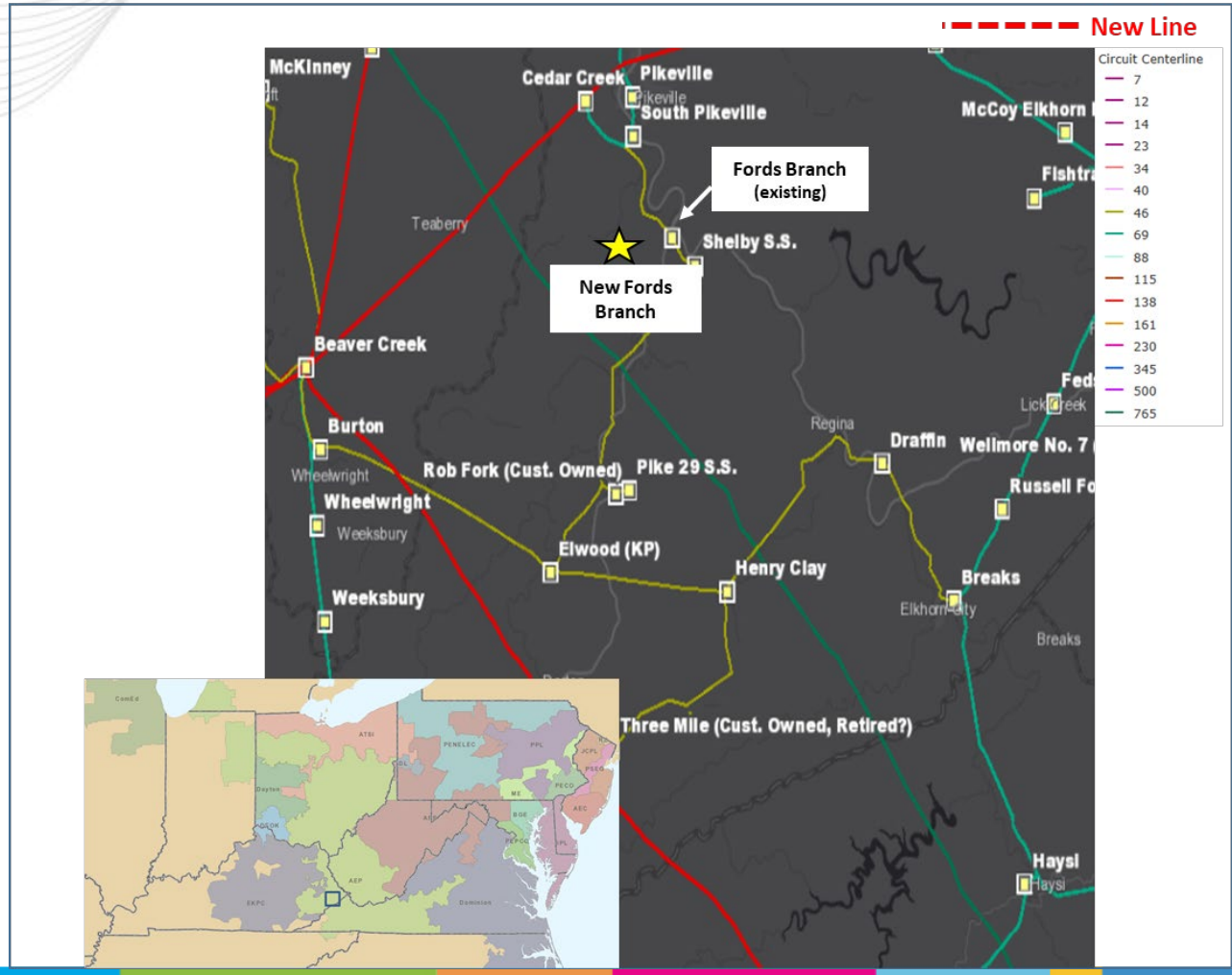
Install a redundant 138/46kV transformer at Cedar Creek station. Reconfigure the existing 138kV bus into a 5 breaker ring bus, Install three new 138kV breakers and install two new 46kV breakers. This would require an expansion and significant station work at Cedar Creek station. Install and additional 14.4 MVAR capacitor bank (14.4 MVAR Existing) at Elwood substation. While this will resolve the low voltage and voltage deviation issues, this alternative will not address voltage rise issue caused by the additional cap bank at the Elwood station. This alternative does not support any future needs at Enterprise Industrial Park. Also, this alternative does not address the additional system needs specified in the Project Justification at Fords Branch and limits the ability to add additional sectionalizing to improve service for the customers served out of the station in the future. The existing station is land locked, surrounded by residences, mountains, and a flood plain. Because of this, Fords Branch would need to be relocated and built in the clear to address the supplemental need, along with new 46 kV line to connect to the new station site. There are also supplemental needs identified on the Cedar Creek – Elwood 46kV circuit, which were presented in the August 2019 SRTEP meeting, need number AEP-2019-AP032. A solution has not been reviewed for this need yet. However, in order to continue to serve Fords Branch at 46 kV, this line would need to be rebuilt at an additional cost of approximately $55M. The selected baseline solution allows AEP to potentially retire the 46 kV line in the future.

Estimated Cost: $70M

Required In-service: ~~12/1/2019~~12/1/2023

Projected In-service: ~~11/30/2019~~09/31/2022

Project Status: Scoping



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Next Steps

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Upcoming Western SRRTEP Dates

West	Start	End
11/22/2019	9:00	1:00

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Questions?

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Revision History

10/18/2019 – V1 – Original version posted to pjm.com

10/22/2019 – V2 – Slides #9 & #10, changes are reflected in the slides

– Slides #7, Added Required IS Date

– Slides #23, Corrected Required IS Date

– Slides #4, Updated problem statement

10/24/2019 – V3 – Slides #7, Replaced the 2014 -2016 CMI with 2014 –2019.3 CMI

11/14/2019 – V4 – Slides #4, Updated Required IS Date

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