



Market Efficiency Update

Transmission Expansion Advisory Committee
November 9, 2017





Addendum 2016-2017 Long Term Proposal Window 1A

- Addendum 2016-2017 Long Term Proposal Window 1A
 - Opened on September 14, 2017
 - Closed on September 28, 2017.
 - Solicited proposals to address the Tanners Creek - Dearborn 345 kV thermal constraint, which is a Reliability Pricing Model (RPM) constraint.
- Target facility Tanners Creek - Dearborn 345 kV was the next limiting element in the 2020/2021 RPM Base Residual Auction CETL study for the DEOK LDA*
- 3 Market Efficiency Proposals
 - 1 Greenfield proposed by Northeast Transmission Development, cost of \$12.7M
 - 2 Upgrades proposed by AEP, costs of \$0.6M respectively \$4.9M
(see Appendix B for full project descriptions)

*After RTEP baseline upgrade b2831 (Upgrade the Tanner Creek - Miami Fort 345 kV circuit) is constructed



Market Efficiency RPM Analysis Completed (LDA DEOK)

- Base Case Update
 - with the portion of the reliability project 2017_1-6A to be recommended in the Reliability Window 1 (see Appendix A)
- Determined CETL impact of proposed projects
- For each proposal, updated the CETL limits in the 2020/2021 RPM Base Residual Auction model and performed simulations for multiple study years
- Determined the RPM and Energy benefits and calculated the B/C Ratios

CETL Analysis	Proposer	Project In-Service Year	Project Cost (\$M)	B/C Ratio	DEOK LDA Price Separation?*
Base Case					Yes
201617_1-1A	NTD	2021	\$12.70	8.88	No
201617_1-2A	AEP	2021	\$0.60	151.61	No
201617_1-2B	AEP	2021	\$4.90	18.6	No

• Results based on 2020/2021 RPM Base Residual Auction model. Future BRA models may yield different results.

- Upgrade 201617_1A-2A, proposed by AEP, has the highest B/C ratio and lowest cost:
 - Upgrade terminal equipment at Tanners Creek 345kV station. Upgrade 345kV Bus and Risers at Tanners Creek for the Dearborn circuit.
 - Cost \$0.6 million
- Additional Projects provide no incremental benefit
- PJM anticipates that the Market Efficiency baseline solution 201617_1A-2A, proposed by AEP, will be presented to the PJM Board in December and recommended for inclusion in the RTEP.

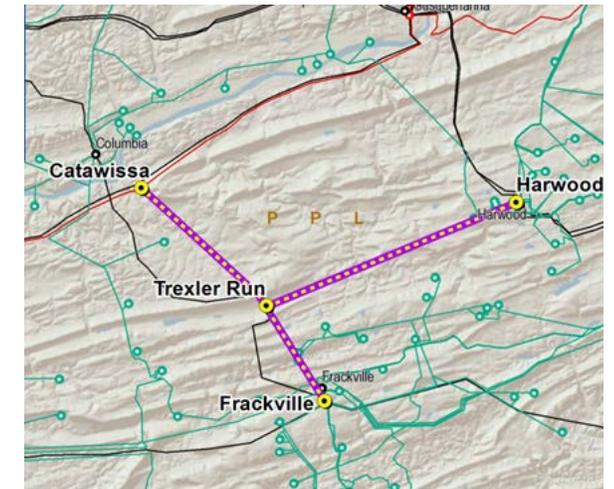
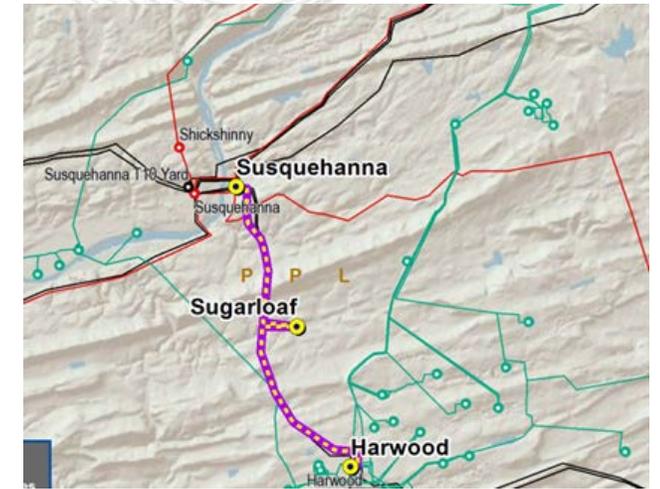
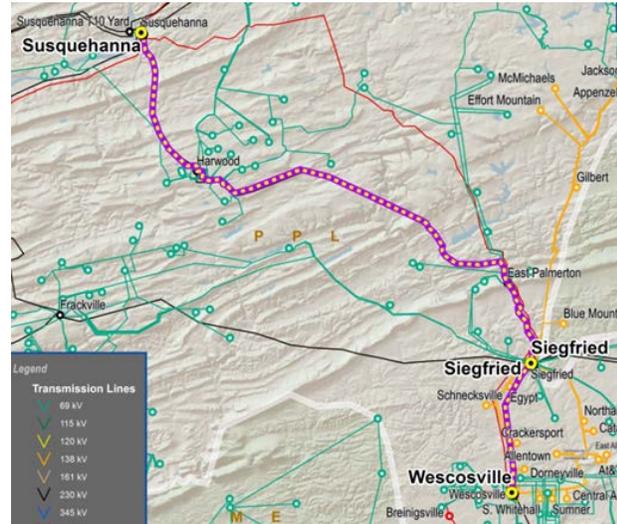
2016-2017 Long Term Window

PPL Group Evaluation

- Reconductor Susquehanna – Harwood 230 kV line:
 - 2A: PPL, \$13.13M
 - 2B: PPL, \$13.01M

- 500/230 kV Transformer At/Near Siegfried:
 - 2C: PPL, \$18.32M
 - 10A: NextEra, \$33.8M
 - 18G: NTD, \$32.9M

- New Harwood – Trexler Run 230 kV line:
 - 18Q: NTD, \$33.7M



Project ID: 201617_1-2A

Proposed by: PPL

Proposed Solution:
 Reconductor the Susquehanna - Harwood and
 Susquehanna-Sugarloaf-Harwood 230 kV DCT lines and
 replace a limited number of structures as necessary to
 accommodate the heavier conductor.

kV Level: 230 kV

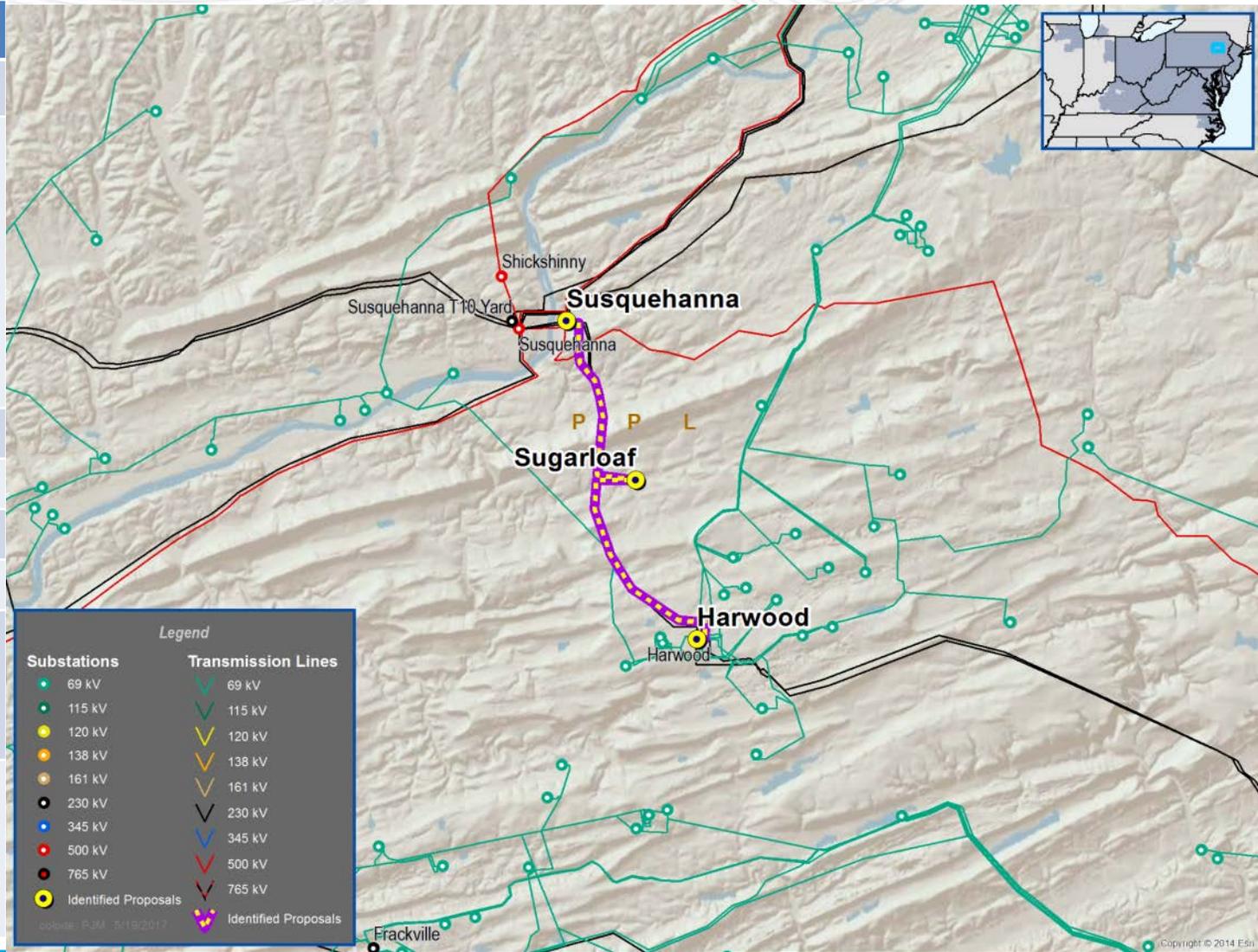
In-Service Cost (\$M): \$13.13

In-Service Date: 2021

Target Zone: PPL

ME Constraints:
 SUSQUEHANNA - HARWOOD 230 kV

- Notes:
- This is an upgrade.
 - Due to different conductor size, 2A has higher ratings than 2B



Project ID: 201617_1-2B

Proposed by: PPL

Proposed Solution:
 Reconductor the Susquehanna - Harwood and
 Susquehanna-Sugarloaf-Harwood 230 kV DCT lines and
 replace a limited number of structures as necessary to
 accommodate the heavier conductor.

kV Level: 230 kV

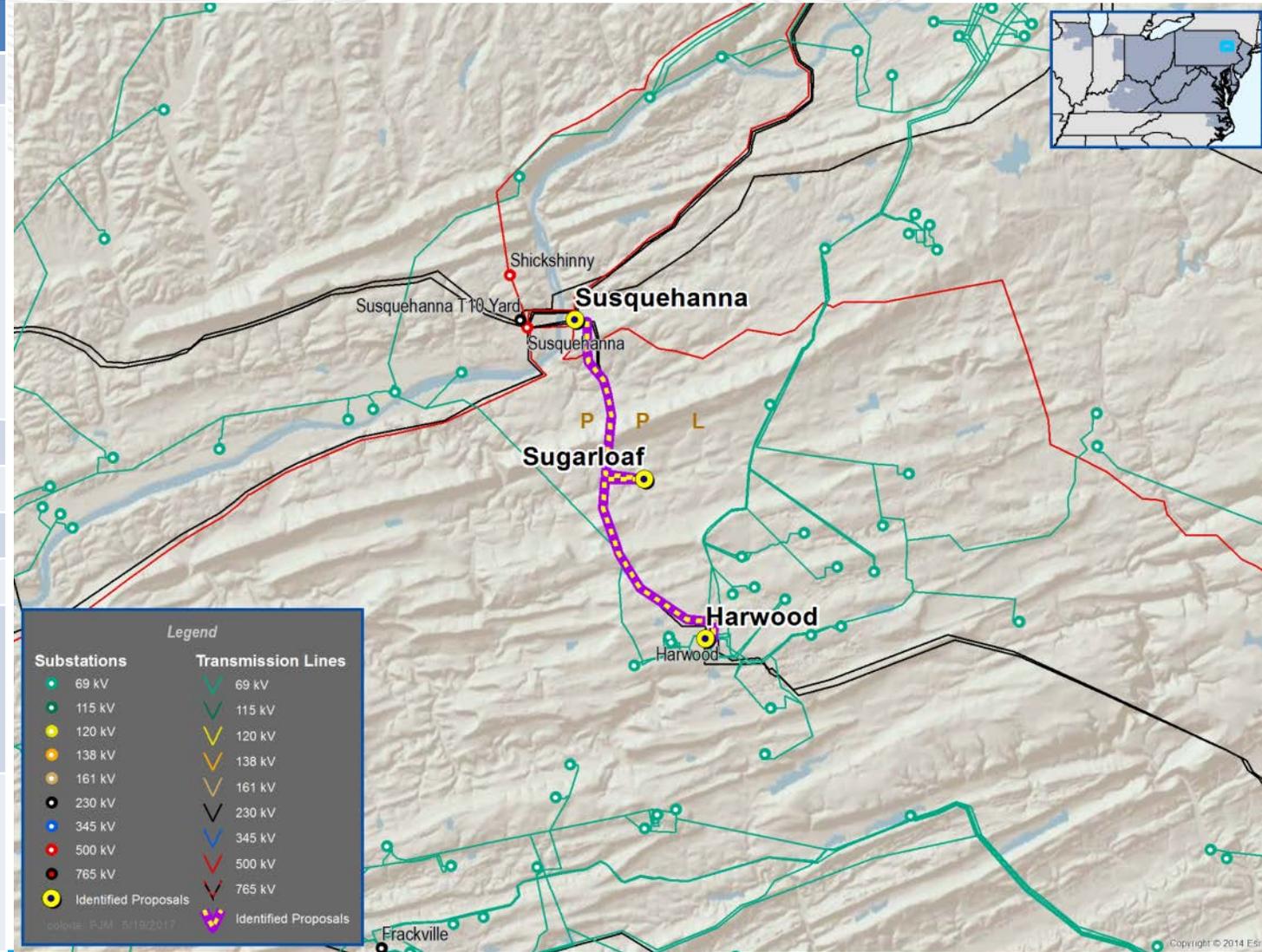
In-Service Cost (\$M): \$13.01

In-Service Date: 2021

Target Zone: PPL

ME Constraints:
 SUSQUEHANNA - HARWOOD 230 kV

- Notes:
- This is an upgrade.
 - Due to different conductor size, 2B has lower ratings than 2A



Project ID: 201617_1-2C

Proposed by: PPL

Proposed Solution:
 Tap the Susquehanna - Wescosville 500 kV line at Siegfried.
 Expand Siegfried to include a 500/230 kV substation.

kV Level: 230/500 kV

In-Service Cost (\$M): \$18.32

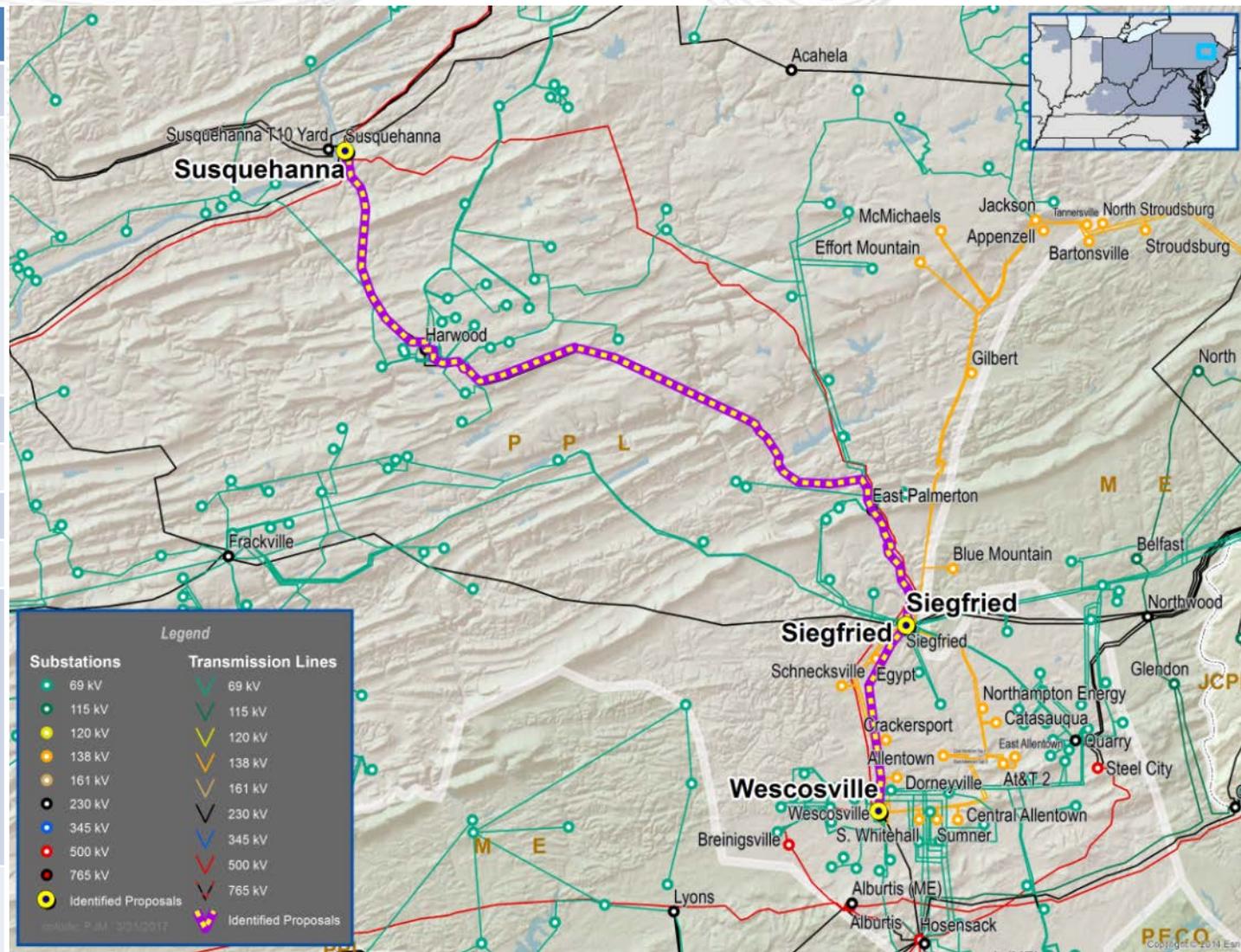
In-Service Date: 2021

Target Zone: PPL

ME Constraints:
 SUSQUEHANNA - HARWOOD 230 kV

Notes:

- This is an upgrade of Siegfried station



Project ID: 201617_1-10A

Proposed by: Nextera

Proposed Solution: Greenfield
 Tap the Susquehanna - Wescosville 500 kV line near Siegfried and build a new 500/230 kV substation (Spring Hill). Tie Spring Hill 230 kV into the existing Siegfried 230 kV substation.

kV Level: 230/500 kV

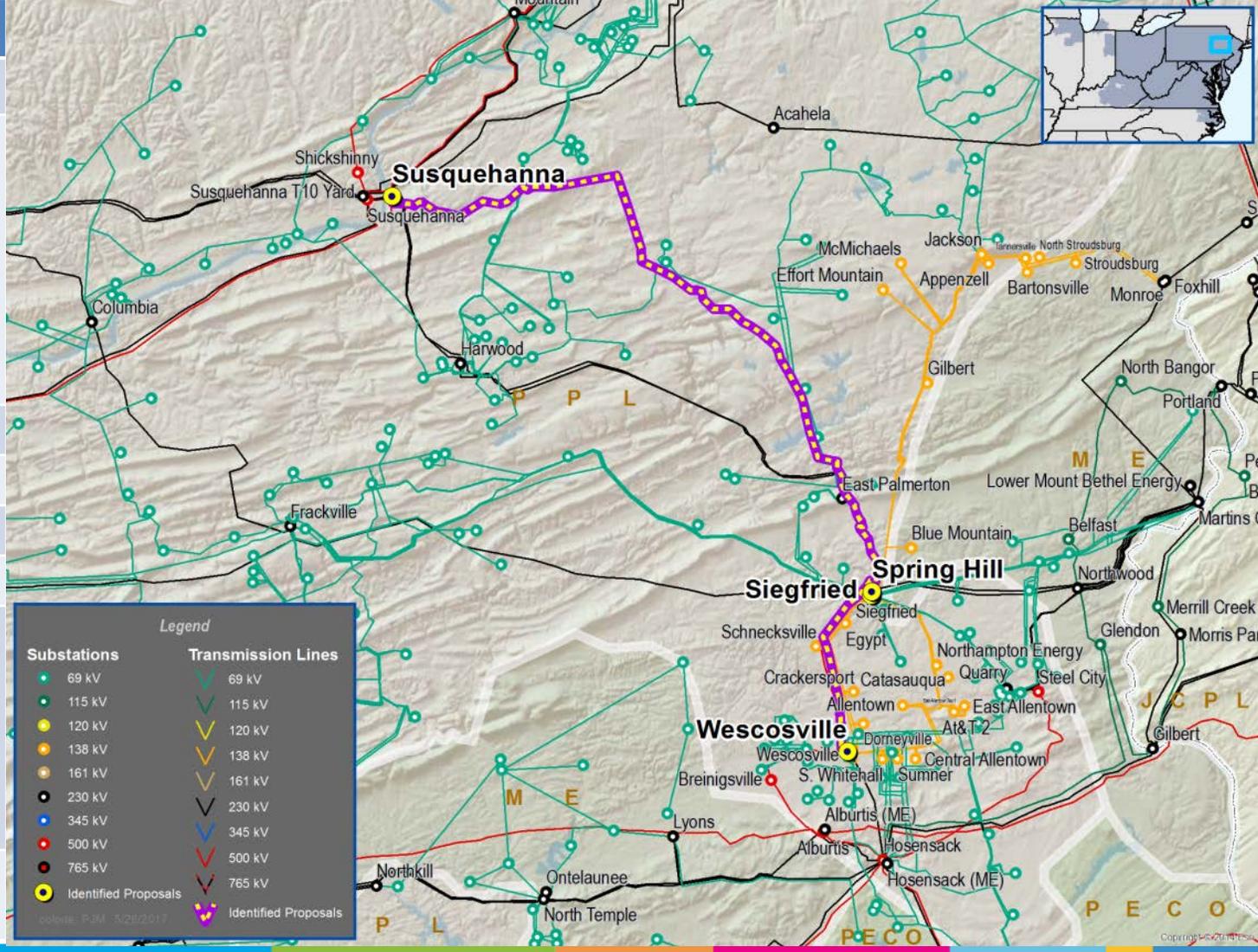
In-Service Cost (\$M): \$33.8

In-Service Date: 2021

Target Zone: PPL

ME Constraints:
 SUSQUEHANNA - HARWOOD 230 kV

Notes:
 • This is a greenfield project



Project ID: 201617_1-18G

Proposed by: Northeast Transmission Development

Proposed Solution: Greenfield
 Tap the Susquehanna - Wescosville 500 kV line near Siegfried and build a new 500/230 kV substation (Fells Creek). Tie the Fells Creek 230 kV into the existing Siegfried 230 kV substation.

kV Level: 230/500 kV

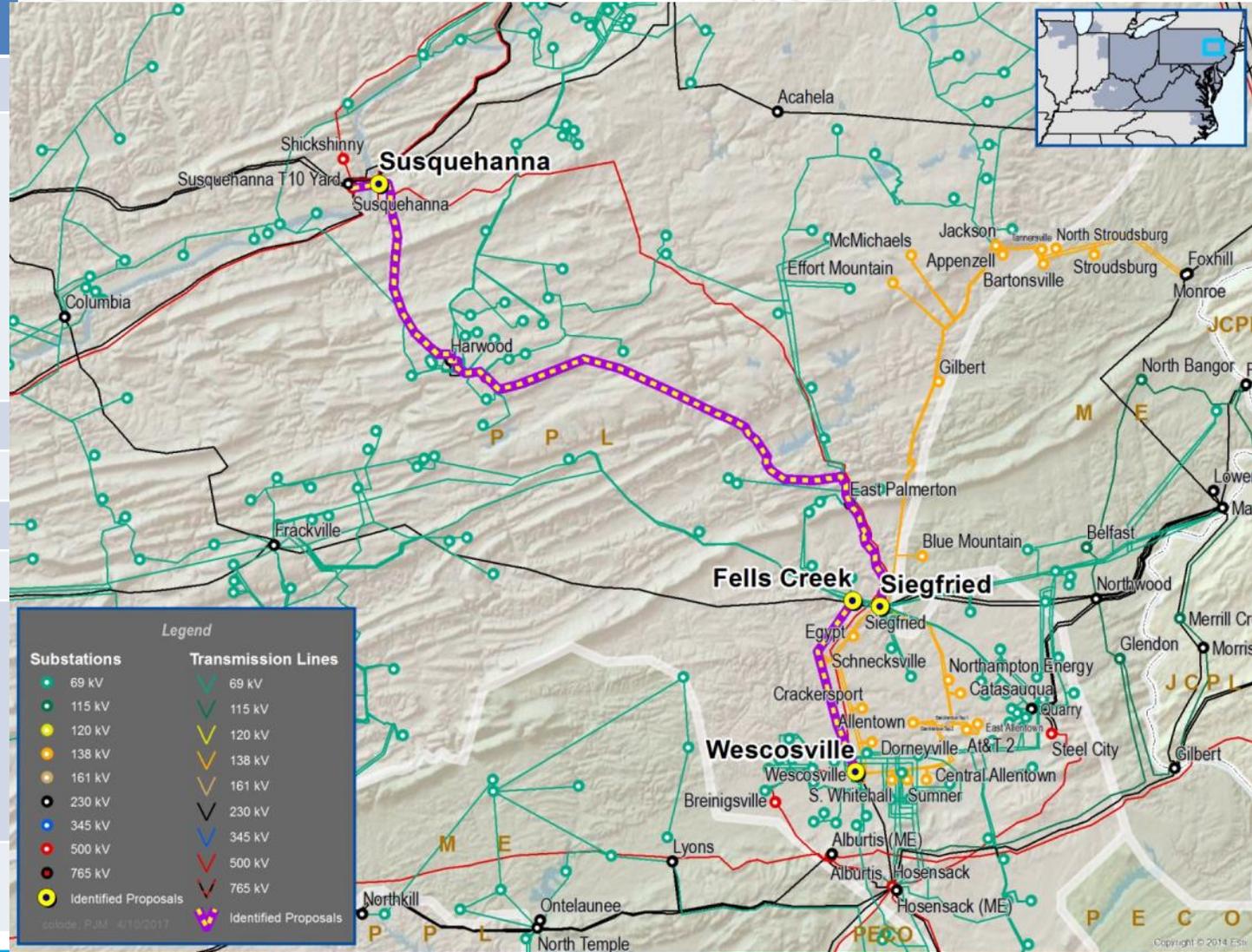
In-Service Cost (\$M): \$32.9

In-Service Date: 2021

Target Zone: PPL

ME Constraints:
 SUSQUEHANNA - HARWOOD 230 kV

Notes:
 • This is a greenfield project



Project ID: 201617_1-18Q

Proposed by: Northeast Transmission Development

Proposed Solution: Greenfield
 Tap the Catawissa - Frackville 230 kV line and build a new 230 kV switchyard (Trexler Run). Build a new Harwood - Trexler Run 230 kV line.

kV Level: 230 kV

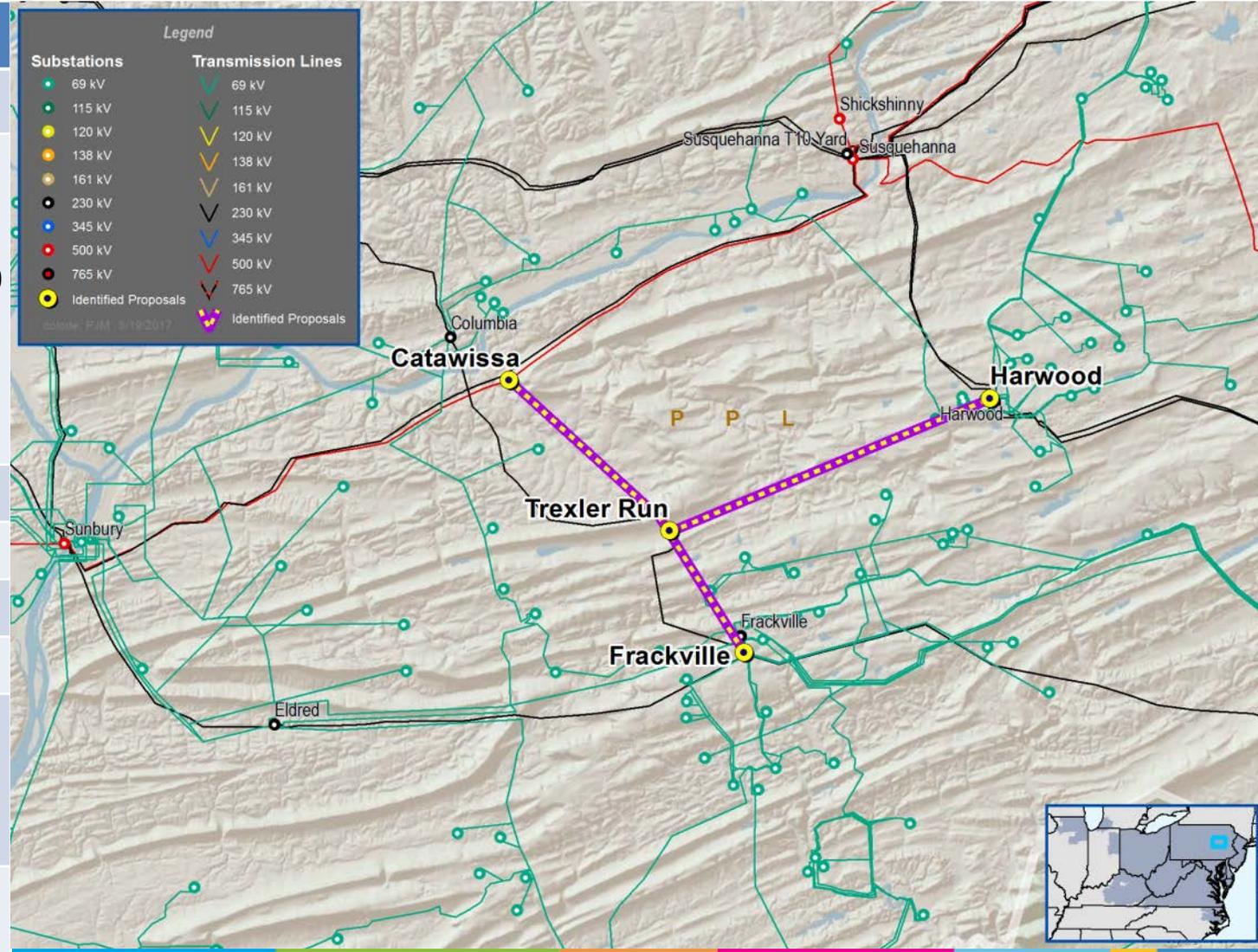
In-Service Cost (\$M): \$33.7

In-Service Date: 2021

Target Zone: PPL

ME Constraints:
 SUSQUEHANNA - HARWOOD 230 kV

- Notes:
- This is a greenfield project



- Base Case Mid-Cycle Update includes monitoring of PPL Wescosville supplemental project (s0864).
- s0864 supplemental project changes operations around Wescosville transformer:
 - New Wescosville 230/138 kV transformer is projected to be operated as normally closed
 - Removes the current Wescosville 230/69 kV #2 transformer (currently operated as normally open)
- The new configuration creates a new flow path
 - from Wescosville 500 kV bus, down through Wescosville 500/138 kV transformer, back up through Wescosville 138/230 kV transformer, toward Hosensack 230 kV bus.
- The new configuration changes congestion pattern
 - Susquehanna – Harwood congestion driver is significantly diminished
 - New congestion around Wescosville 500/138 kV transformer

- Base case configuration assumed operational procedure (WESC OP)
 - Open Wescosville 230/138 kV transformer when Breinigsville – Wescosville 500 kV line in outage
- Sensitivity Scenarios around the Wescosville transformer
 - Wescosville 230/138 kV operated as normally open (WESC OPEN)
 - Wescosville 230/138 kV operated as normally closed without operational procedure (WESC CLOSED noOP)



PPL Group Results – B/C Ratios

				Different Wescosville 230/138 kV Operating Schemes		
Proposal Description	Company	Proposal Id	Proposal Cost* (\$ million)	Base WESC OP	Sensitivity Wesc OPEN	Sensitivity WESC CLOSED noOP
				Wescosville 230/138 kV closed Assumes WESC Operational Procedure active (open Wescosville 230/138 kV flo BREI-WESC)	Wescosville 230/138 kV open	Wesc 230/138 closed WESC Operational Procedure disabled
New 500/230 kV Siegfried Transformer	NextEra	201617_1-10A	\$33.80	0.49	0.42	15.70
	NTD	201617_1-18G	\$32.90	0.75	0.35	16.60
	PPL	201617_1-2C	\$18.32	0.83	0.85	28.67
New Harwood - Trexler Run 230 kV line	NTD	201617_1-18Q	\$33.70	2.70	2.81	2.60
Reconductor Susquehanna - Harwood 230 kV	PPL	201617_1-2A	\$13.13	1.74	0.69	4.22
	PPL	201617_1-2B	\$13.01	0.73	2.10	5.14

* Cost/Constructability analysis in progress

- Challenges
 - Operating mode after PPL supplemental project Wescosville 230/138 kV is in service
 - FSA resources impact

- Further analysis is required
 - Finalize cost/constructability analysis
 - Additional sensitivity analysis
 - FSA
 - Gas - (+/- 20%)
 - Load - (+/- 2%)

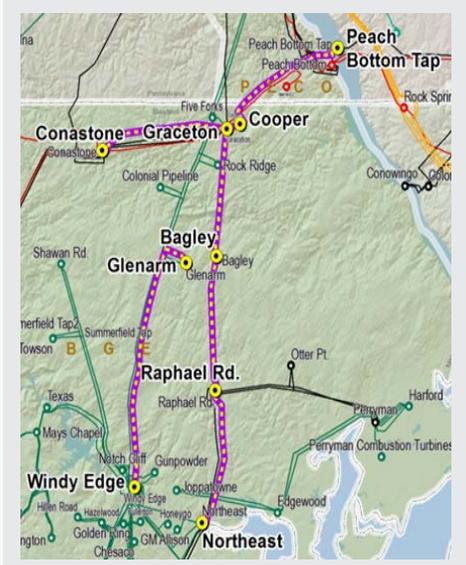
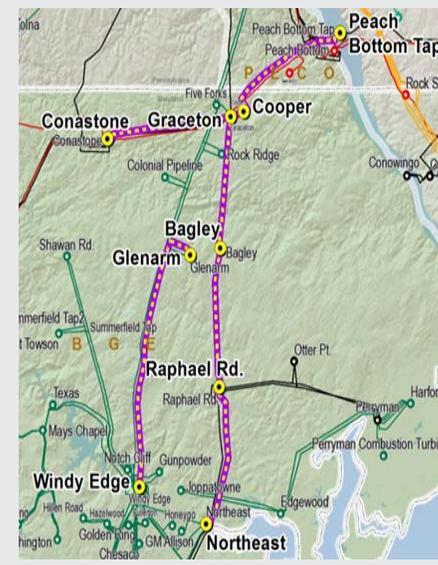
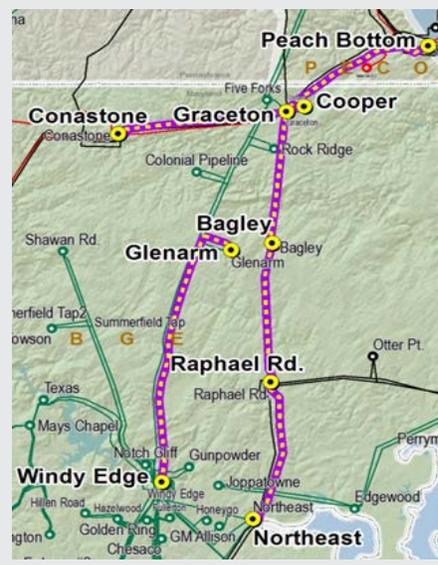
BGE Group Preliminary Results

- Completed the preliminary base runs for 46 proposals received from 9 entities.
- Projects modeled using the submitted assumptions
- B/C ratios computed using the submitted in-service cost of components
- Descriptions of submitted proposals included in Appendix D
- Results presented on the following slides:
 - Projects grouped by proposer
 - Congestion results are based on averages of simulated years 2021 and 2024 (\$ million)
 - Congestion driver is Conastone-Graceton-Bagley 230 kV

Proposal	5A	5B	5C	5D	5E
In-Service cost (\$M)	\$ 5.97	\$ 14.20	\$ 20.30	\$ 20.40	\$ 25.40
In-service Year	2020	2021	2021	2021	2021
B/C Ratio	6.83	5.15	4.91	5.84	5.39
Fully Solves Target Congestion	No	No	Yes	Yes	Yes
Creates Other BGE Congestion	No	Yes	No	No	No
Map					

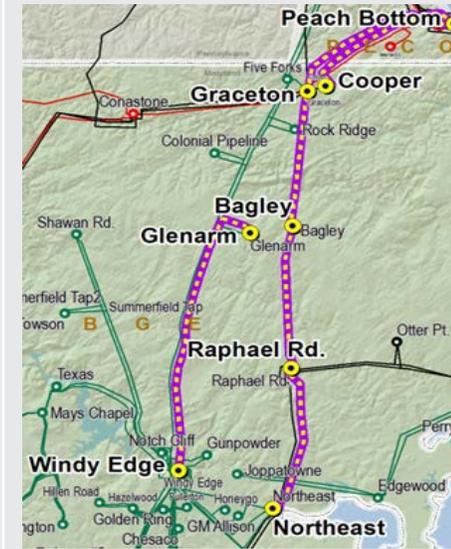
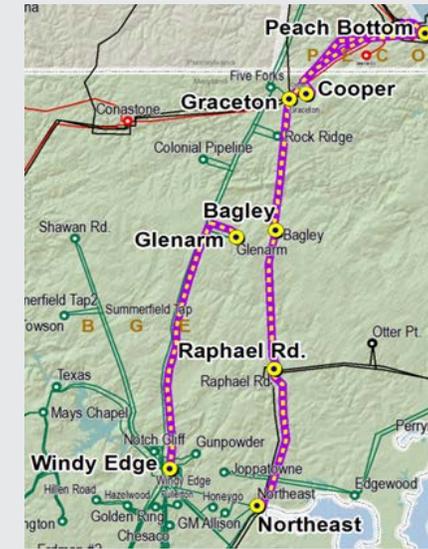
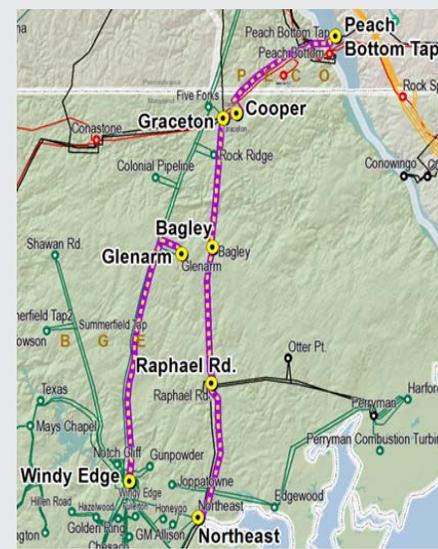
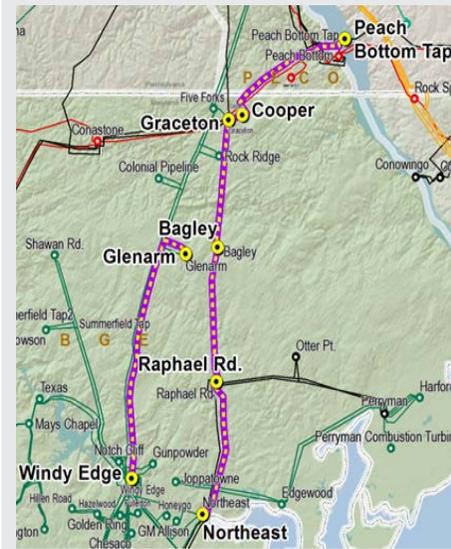
Proposal	6F	6G	6L	6M
In-Service cost (\$M)	\$ 49.20	\$ 56.00	\$ 41.70	\$ 65.49
In-service Year	2021	2021	2021	2021
B/C Ratio	3.58	2.99	4.22	2.43
Fully Solves Target Congestion	Yes	Yes	Yes	Yes
Creates Other BGE Congestion	No	No	No	No

Map



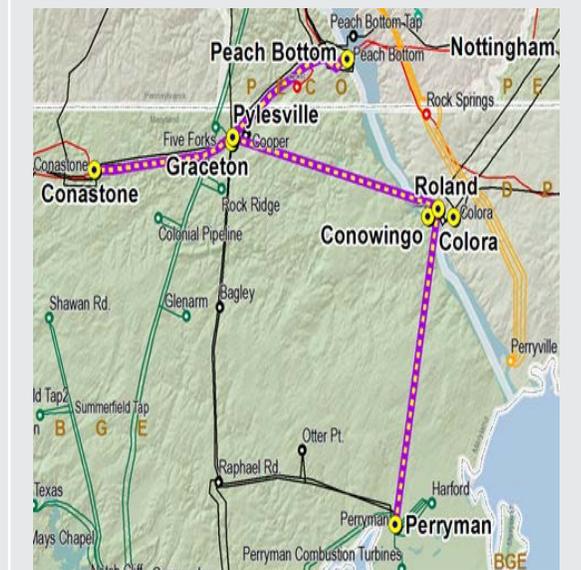
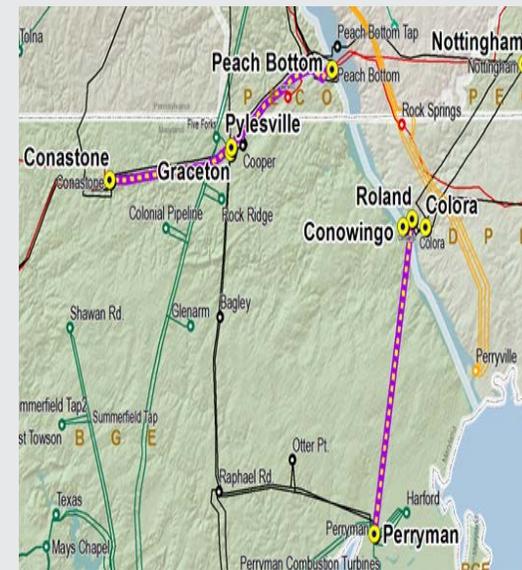
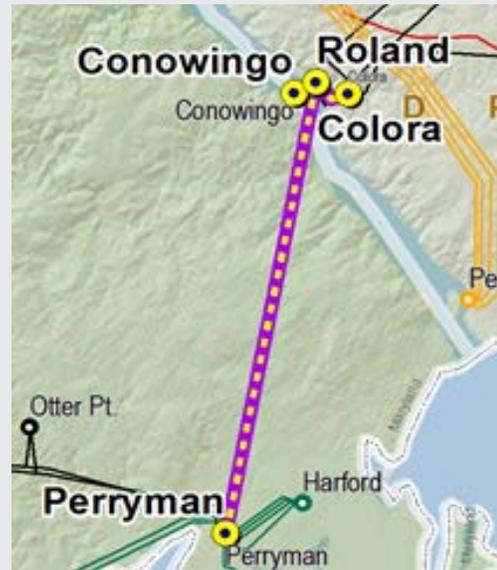
Proposal	7H	7I	7J	7K
In-Service cost (\$M)	\$ 35.60	\$ 59.80	\$ 68.10	\$ 191.40
In-service Year	2021	2021	2022	2022
B/C Ratio	4.86	2.94	2.40	0.93
Fully Solves Target Congestion	No	No	Yes	Yes
Creates Other BGE Congestion	No	No	No	No

Map



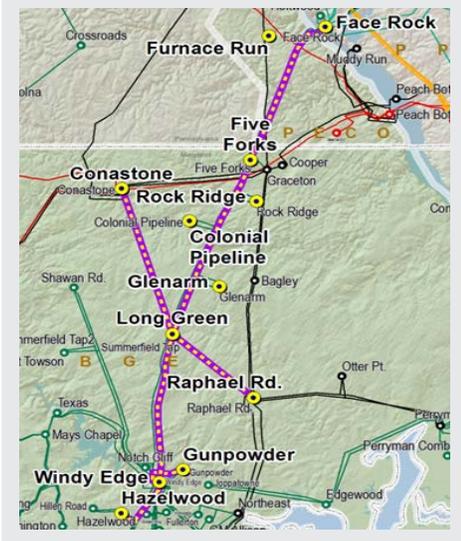
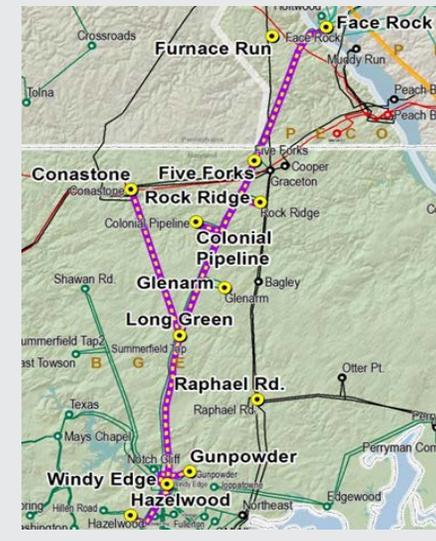
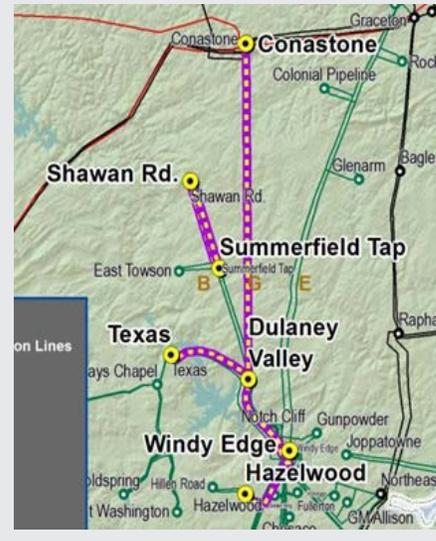
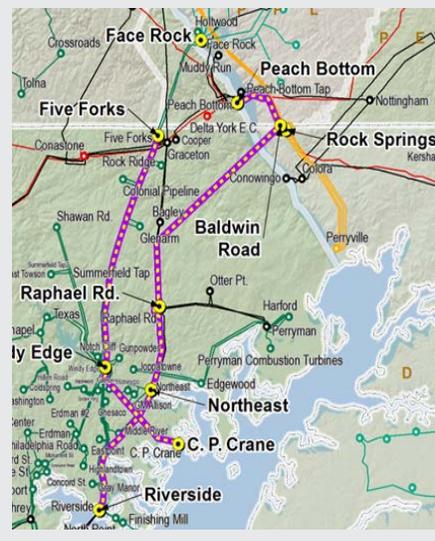
Proposal	10C	10D	10E
In-Service cost (\$M)	\$ 44.40	\$ 93.50	\$ 105.70
In-service Year	2021	2021	2021
B/C Ratio	2.02	0.80	0.74
Fully Solves Target Congestion	No	No	Yes
Creates Other BGE Congestion	No	No	No

Map



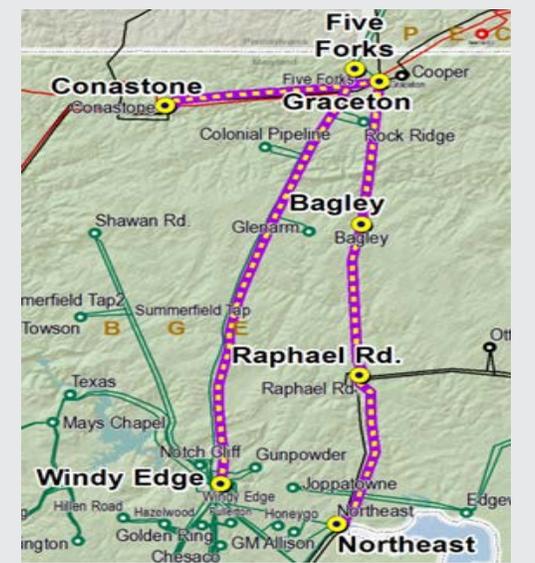
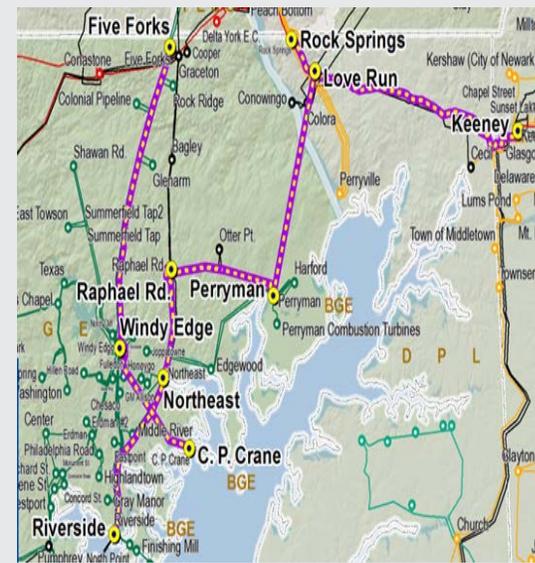
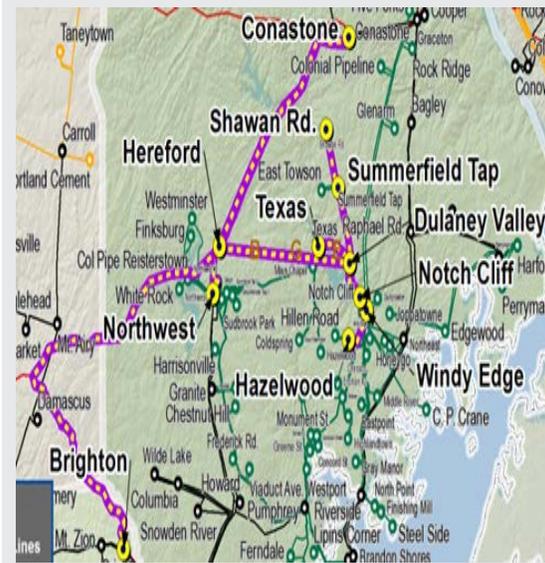
Proposal	13A	13B	13C	13D
In-Service cost (\$M)	\$ 457.80	\$ 107.49	\$ 169.27	\$ 182.99
In-service Year	2024	2022	2022	2022
B/C Ratio	0.46	1.82	1.00	0.92
Fully Solves Target Congestion	Yes	No	No	Yes
Creates Other BGE Congestion	No	No	No	No

Map



Proposal	13E	13F	13G*
In-Service cost (\$M)	\$ 179.22	\$ 483.21	\$ 192.07
In-service Year	2022	2024	2022
B/C Ratio	1.11	0.49	N/A
Fully Solves Target Congestion	No	Yes	N/A
Creates Other BGE Congestion	No	No	N/A

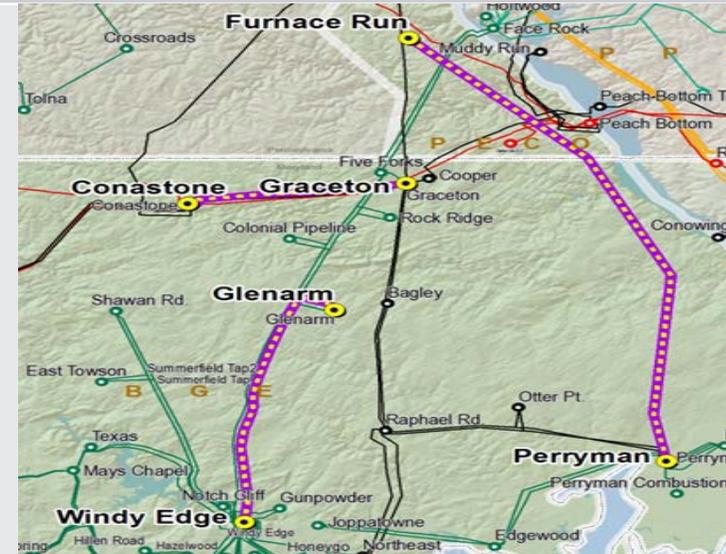
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* 13G Analysis in progress. Results to be posted when completed.

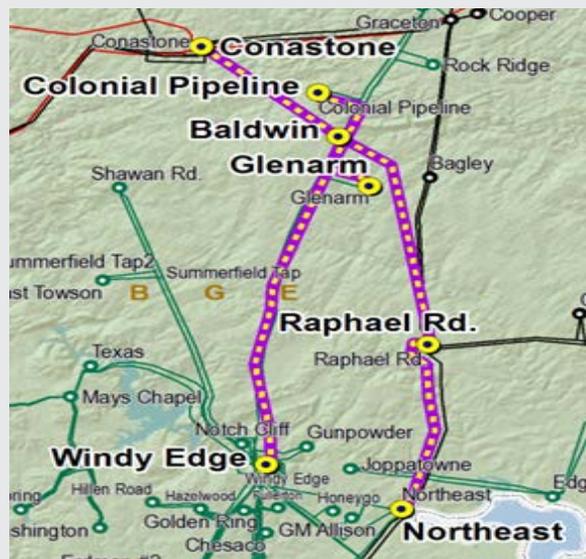
Proposal	14A
In-Service cost (\$M)	\$ 114.80
In-service Year	2023
B/C Ratio	1.12
Fully Solves Target Congestion	Yes
Creates Other BGE Congestion	No

Map



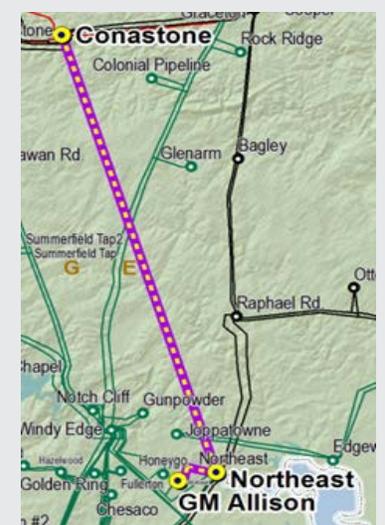
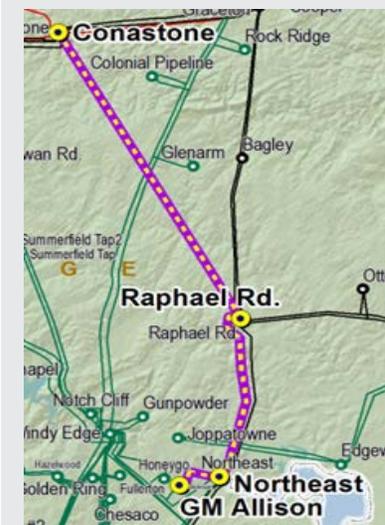
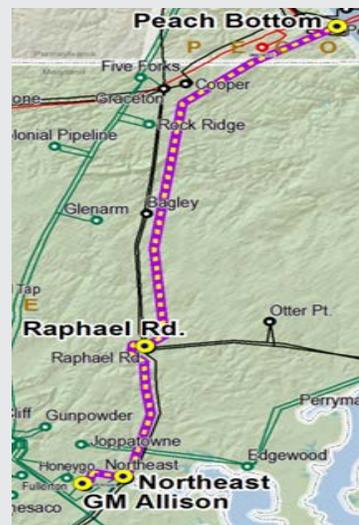
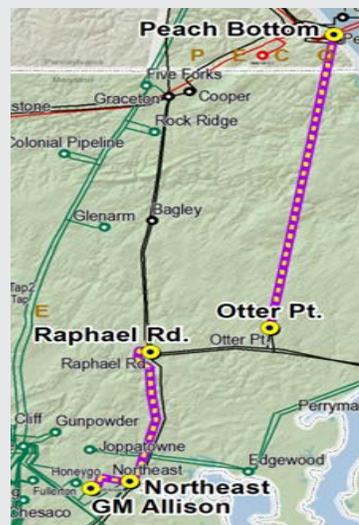
Proposal	15A	15B
In-Service cost (\$M)	\$ 138.50	\$ 178.30
In-service Year	2022	2022
B/C Ratio	3.06	0.92
Fully Solves Target Congestion	Yes	Yes
Creates Other BGE Congestion	Yes	Yes

Map



Proposal	16A	16B	16C	16D	16E
In-Service cost (\$M)	\$ 70.50	\$ 92.20	\$ 87.20	\$ 105.10	\$ 109.30
In-service Year	2021	2021	2021	2021	2021
B/C Ratio	1.73	1.26	1.06	1.10	1.28
Fully Solves Target Congestion	No	No	No	Yes	No
Creates Other BGE Congestion	No	No	No	No	No

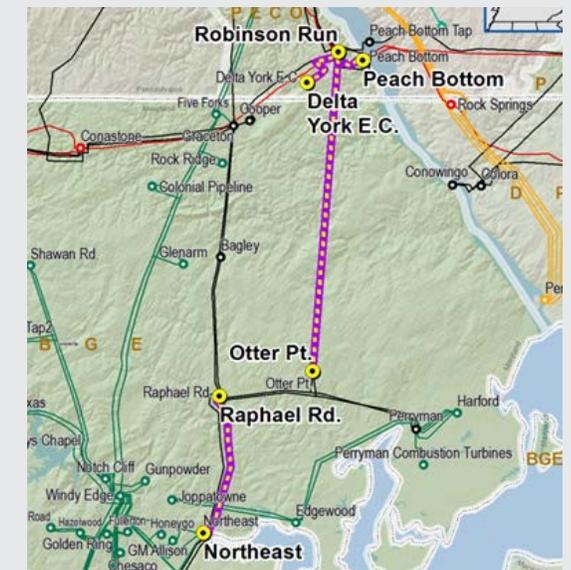
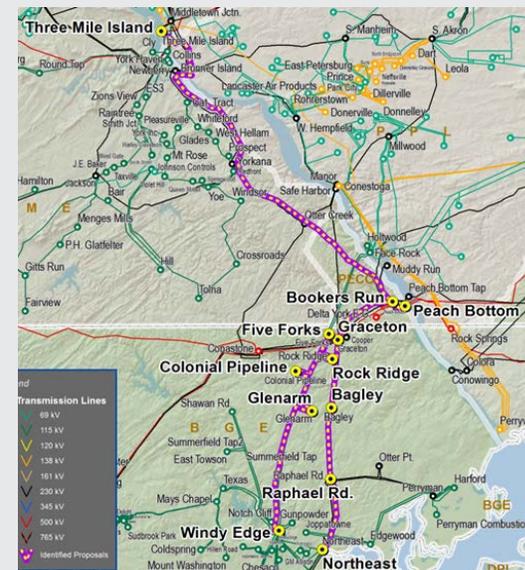
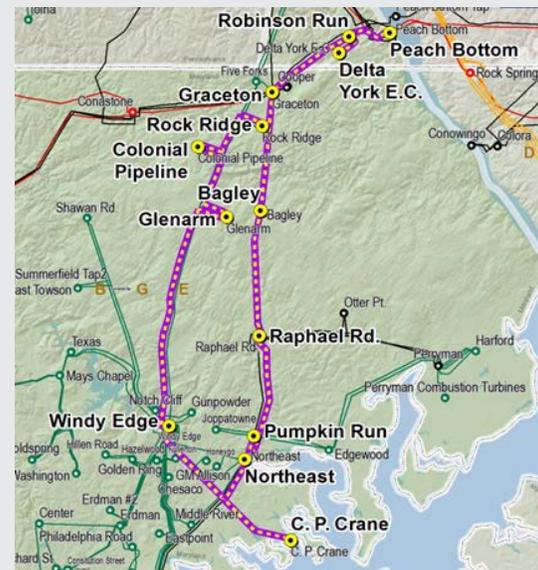
Map



Northeast Transmission Development (6 proposals)

Proposal	18A	18B	18C
In-Service cost (\$M)	\$ 126.20	\$ 132.80	\$ 149.90
In-service Year	2021	2021	2021
B/C Ratio	2.52	2.04	0.96
Fully Solves Target Congestion	No	No	Yes
Creates Other BGE Congestion	Yes	Yes	No

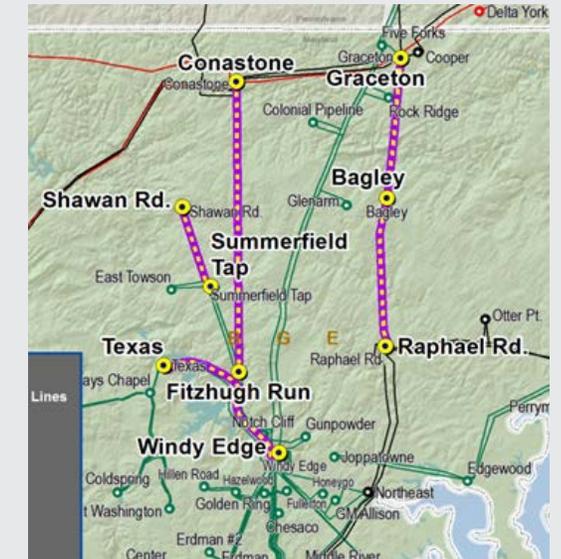
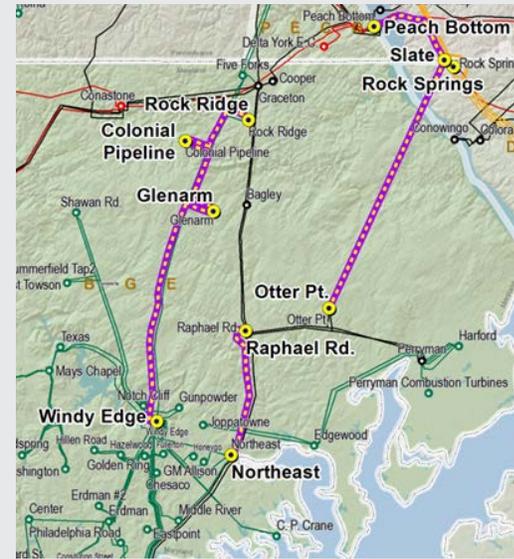
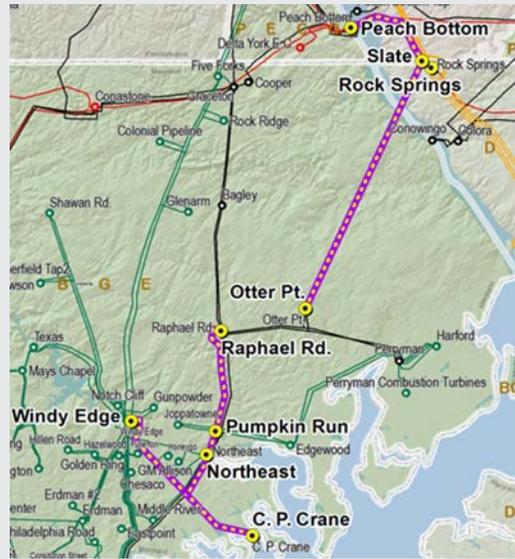
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Northeast Transmission Development (continue)

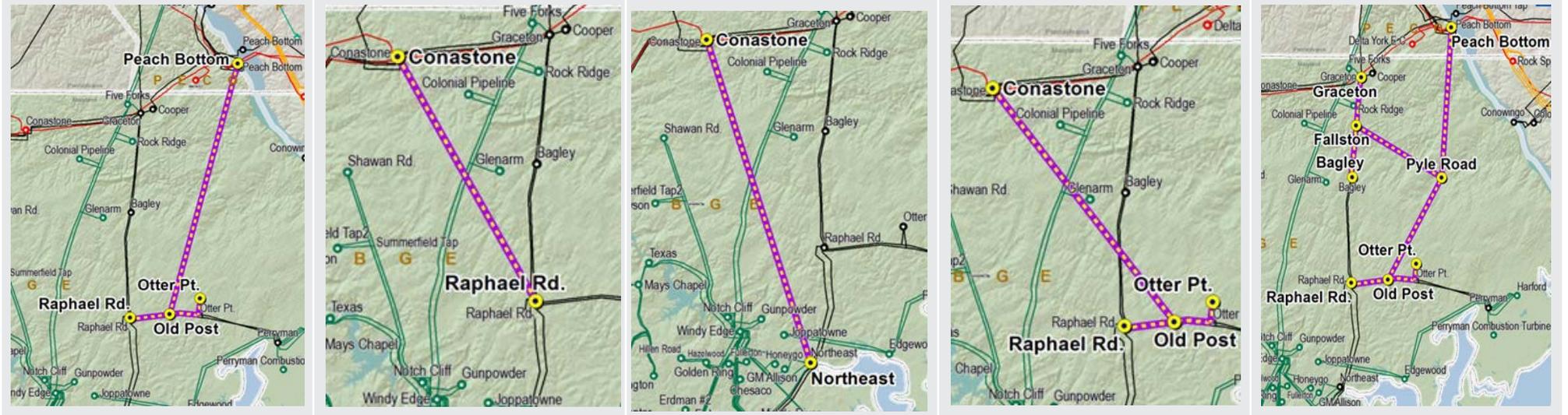
Proposal	18D	18E	18F
In-Service cost (\$M)	\$ 166.00	\$ 152.90	\$ 95.30
In-service Year	2021	2021	2021
B/C Ratio	1.44	1.10	1.94
Fully Solves Target Congestion	Yes	Yes	No
Creates Other BGE Congestion	No	No	No

Map



Proposal	20A	20B	20C	20D	20E
In-Service cost (\$M)	\$ 73.60	\$ 63.00	\$ 135.80	\$ 75.90	\$ 132.20
In-service Year	2021	2021	2021	2021	2021
B/C Ratio	0.67	1.18	0.83	1.05	0.22
Fully Solves Target Congestion	No	Yes	No	No	Yes
Creates Other BGE Congestion	No	No	No	No	No

Map



Proposal	20F	20G	20H	20I
In-Service cost (\$M)	\$ 126.00	\$ 151.50	\$ 107.50	\$ 165.70
In-service Year	2021	2021	2021	2021
B/C Ratio	0.31	0.92	2.13	1.05
Fully Solves Target Congestion	Yes	No	No	Yes
Creates Other BGE Congestion	No	No	No	No
Map				

- Narrow list of potential projects based on additional analysis
- Finalize Cost/Constructability analysis
- Run additional sensitivities on gas and load forecasts:
 - High/Low Gas Price Forecast (+/- 20%)
 - High/Low Load Forecast (+/- 2%)
- Perform reliability analysis

Appendix A

Portion of 2017_1-6A

(Preliminary Reliability Recommendation
DEOK Transmission Zone)



Reliability Recommendation DEOK Transmission Zone

Preliminary Recommendation: (Portion of 2017_1-6A)

Install a new 345kV breaker "1422" so Pierce 345/138kV transformer #18 is now fed in a double breaker, double bus configuration.

Remove X-533 No. 2 to the first tower outside the station. Install a new first tower for X-533 No.2.

Install new 345KV breaker B and move the Buffington-Pierce 345kV feeder to the B-C junction. Install a new tower at the first tower outside the station for Buffington-Pierce 345kV line.

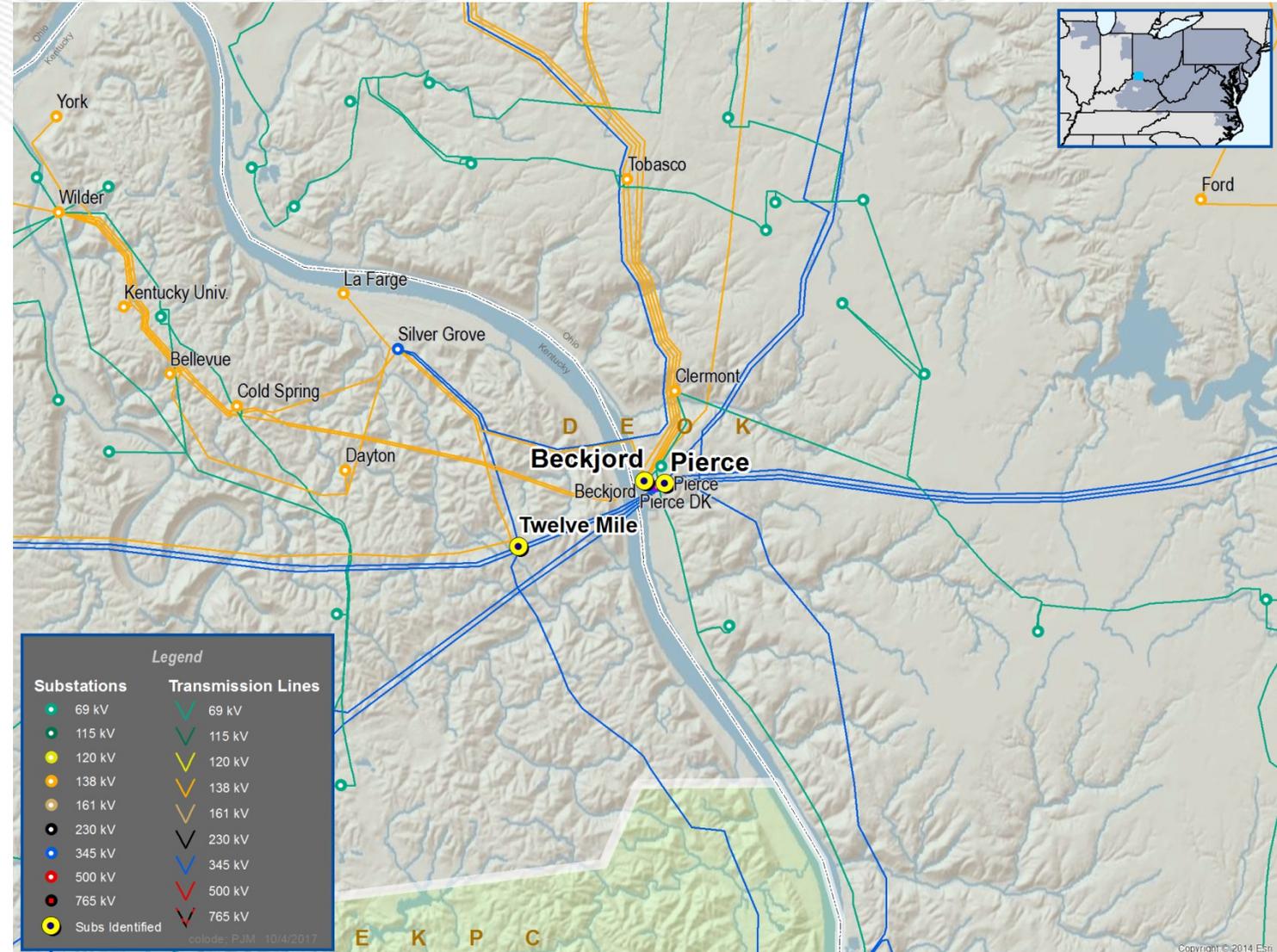
Remove breaker A and move the Pierce 345/138kV transformer #17 feed to the C-D junction.

Replace breaker 822 at Beckjord 138kV substation to increase the rating from Pierce to Beckjord 138kV to 603MVA.

Estimated Project Cost: \$ 9.17 M

Required IS date: 6/1/2021

Project Status: Conceptual



Appendix B

Addendum Window 1A

Projects Received

Project ID: 201617_1A-1A

Proposed by: Northeast Transmission Development (NTD)

Proposed Solution: Greenfield.

New 345 kV switching station ("Twelvemile"). Build a 345 kV switching station ("Twelvemile") interconnecting the existing Silver Grove - Zimmer 345 kV transmission line and the Pierce - Buffington 345 kV transmission line.

kV Level: 345 kV

In-Service Cost (\$M): \$12.7, B/C Ratio = 8.88

In-Service Date: 6/1/2021

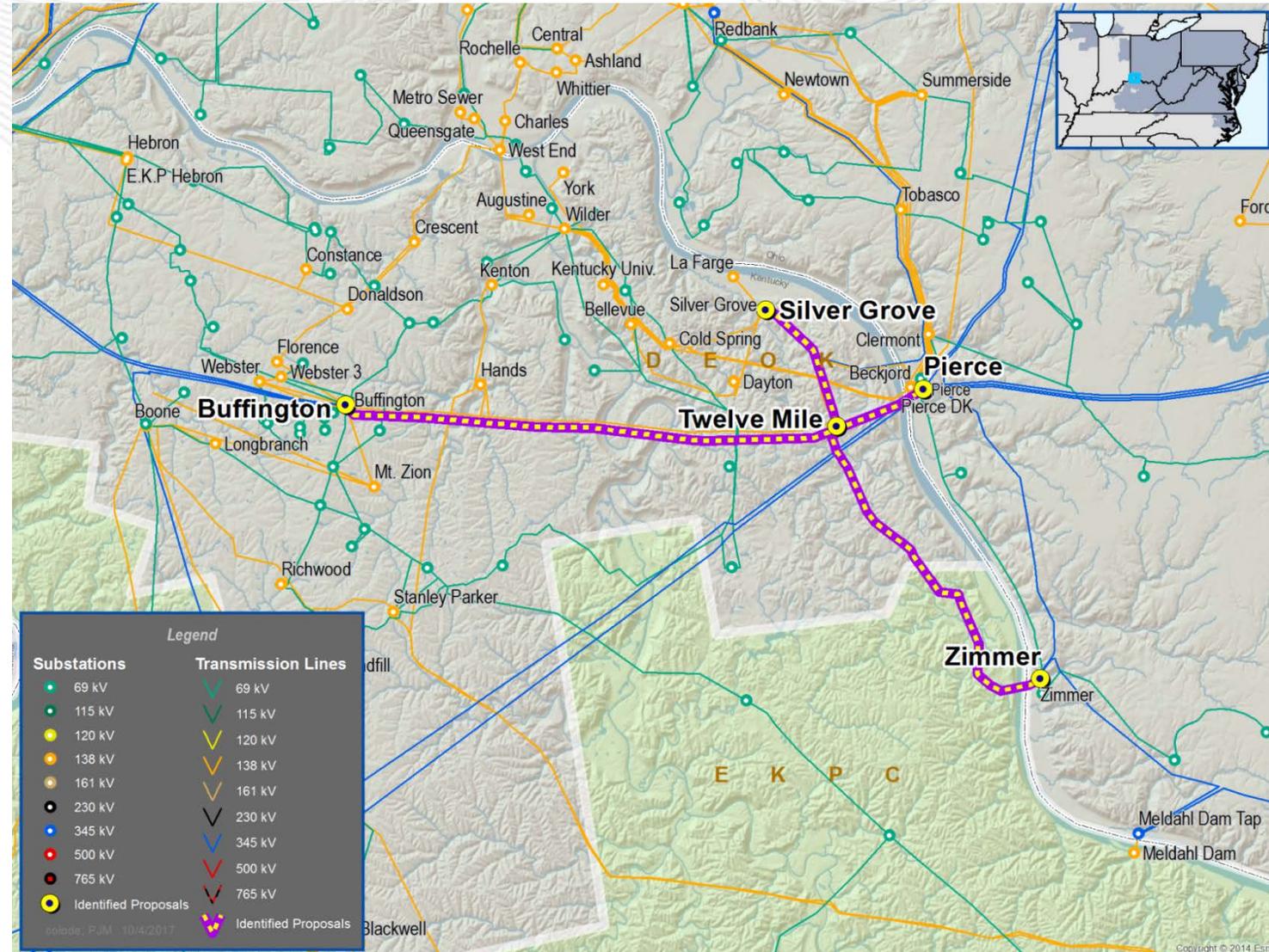
Target Zone: DEOK LDA

ME Constraints:

TANNERS CREEK - MIAMI FORT 345 kV

Notes:

- Same project was submitted as 2017_1-2E to the reliability window, PJM 2017 Proposal Window 1, to address reliability violations.
- This RPM project is not currently recommended.



Project ID: 201617_1A-2A

Proposed by: American Electric Power (AEP)

Proposed Solution: Upgrade
 Upgrade terminal equipment at Tanners Creek 345kV station
 Upgrade 345kV Bus and Risers at Tanners Creek for the Dearborn circuit.

kV Level: 345 kV

In-Service Cost (\$M): \$0.6, B/C Ratio = 151.61

In-Service Date: 6/1/2021

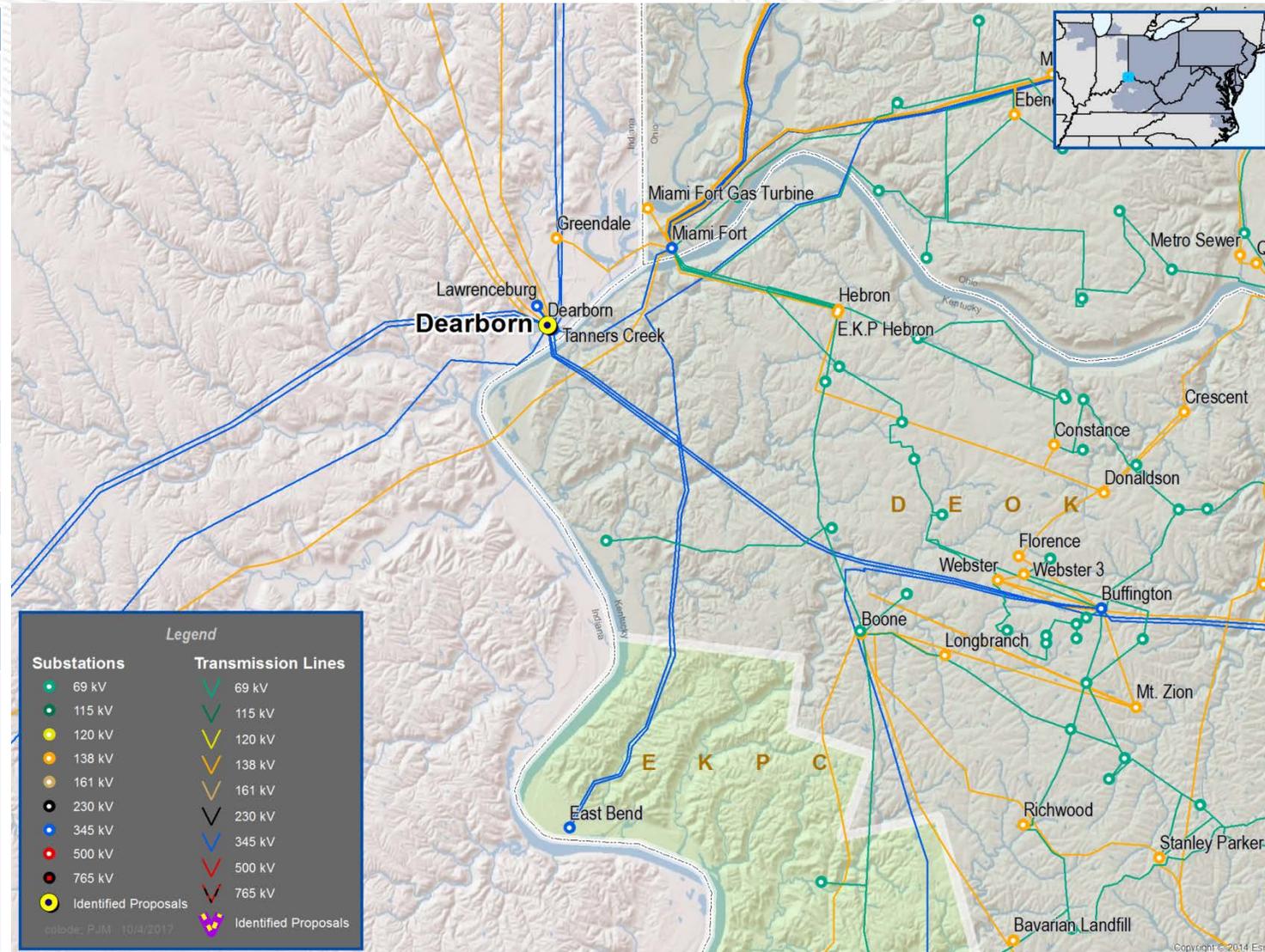
Target Zone: DEOK LDA

ME Constraints:

TANNERS CREEK - MIAMI FORT 345 kV

Notes:

- Very low cost
- Anticipate recommendation for Board approval in December 2017
- Designated Entity: AEP (the local TO)



Project ID: 201617_1A-2B

Proposed by: American Electric Power (AEP)

Proposed Solution: Upgrade
 Establish Tanners Creek - Dearborn 345kV Circuit #2
 Install two 345kV CB at Dearborn station for Tanners Creek Circuits #1 and #2 and one 345kV CB at Tanners Creek for Dearborn Circuit #2.

kV Level: 345 kV

In-Service Cost (\$M): \$4.9, B/C Ratio = 18.6

In-Service Date: 6/1/2021

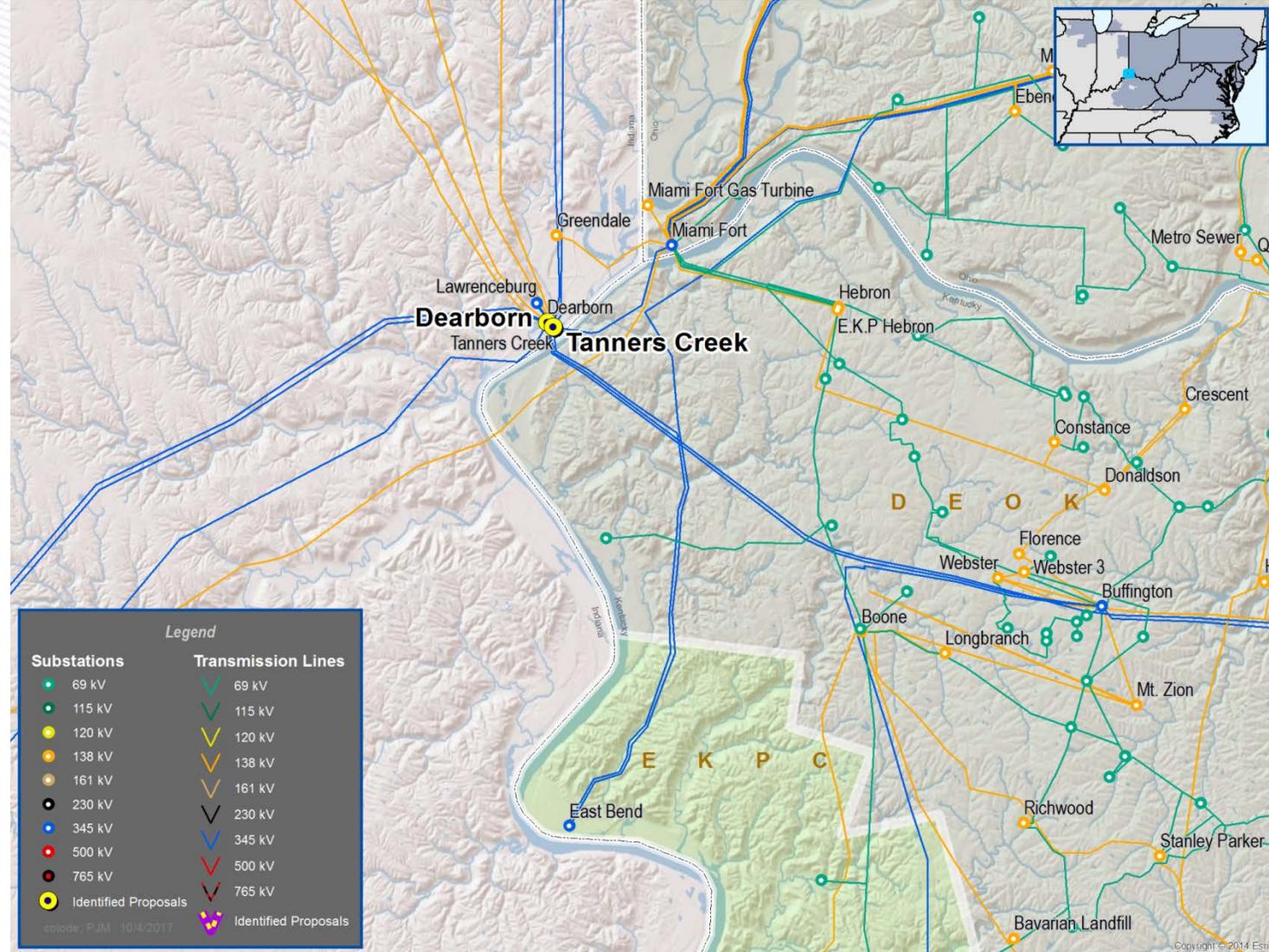
Target Zone: DEOK LDA

ME Constraints:

TANNERS CREEK - MIAMI FORT 345 kV

Notes:

- Cost higher and B/C ratio lower than 201617_1A-2A proposal
- This RPM project is not currently recommended.



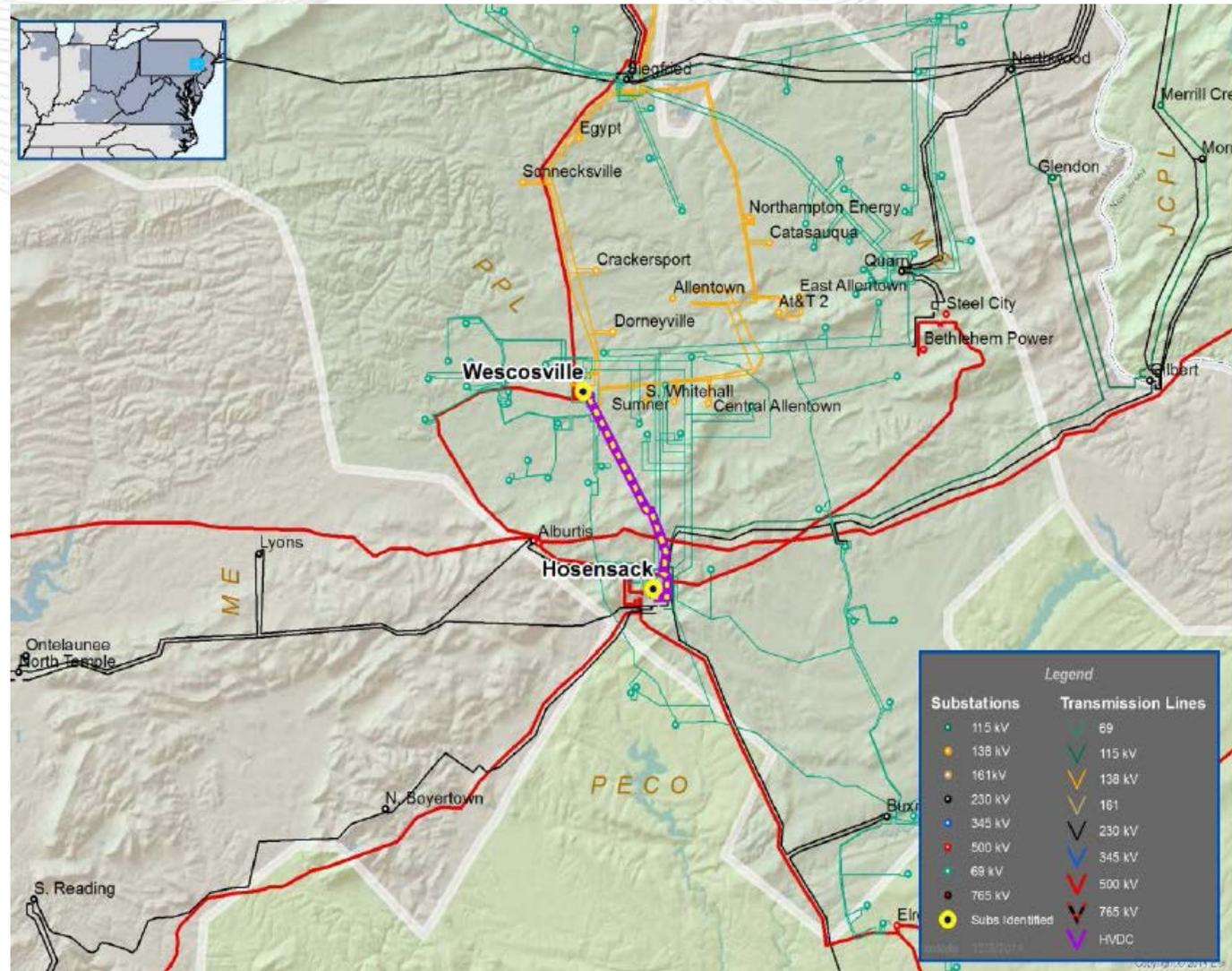
Appendix C – PPL Supplemental Project Wescosville Transformer 230/138 kV



PPL Transmission Zone (presented at TEAC 04/09/2015)

- S0864 Supplemental Upgrade Scope Change:
- Old Scope:
Rebuild approximately 10 miles of the Hosensack-Wescosville 230 kV line to 500 kV and upgrade Wescosville 500-138 kV Substation.
- New Scope:
 - Build approximately 6 miles 500 kV 2nd circuit on the existing Alburdis – Breinigsville.
 - Reconfigure the Wescosville 500 kV station to double breaker arrangement.
 - Install a new Wescosville 230/138 kV transformer.
- Estimated Project Cost:
\$ 58.4 M
- Projected IS Date:
12/31/2017

Note: New Projected IS Date is 3/1/2019



Appendix D – BGE Group Proposed Projects

Project ID: 201617_1-5A

Proposed by: BGE

Proposed Solution:
 Reconductor the Conastone to Graceton 230 kV lines.
 Upgrade substation equipment at Conastone.

kV Level: 230 kV

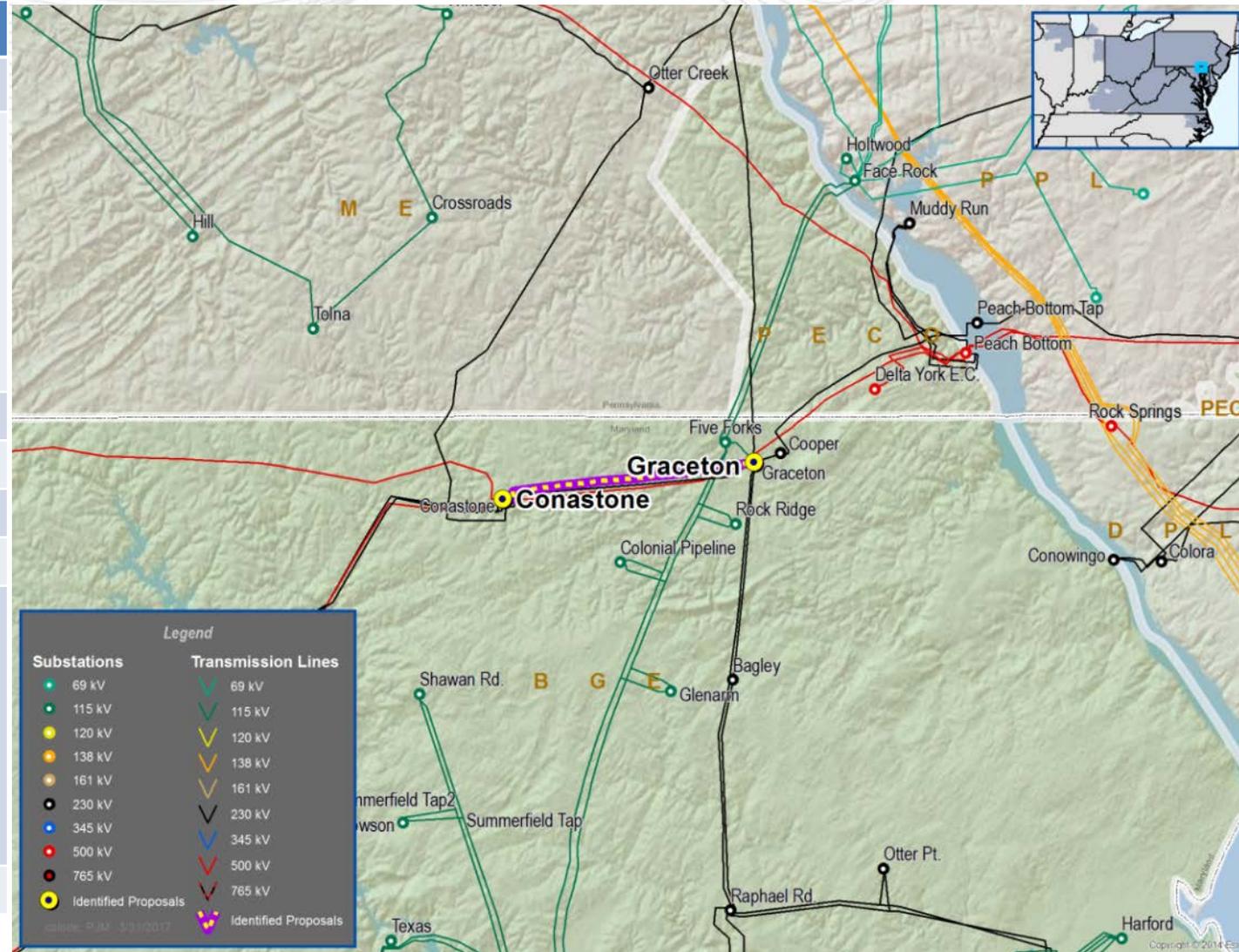
In-Service Cost (\$M): \$5.97

In-Service Date: 2020

Target Zone: BGE

ME Constraints:
 CONASTONE - GRACETON 230 kV

Notes:



Project ID: 201617_1-5C

Proposed by: BGE

Proposed Solution:
 Reconductor the Conastone to Graceton 230 kV lines.
 Upgrade substation equipment at Conastone. Add bundled conductors to the Graceton - Bagley-Raphael Road 230 kV double circuit lines.

kV Level: 230 kV

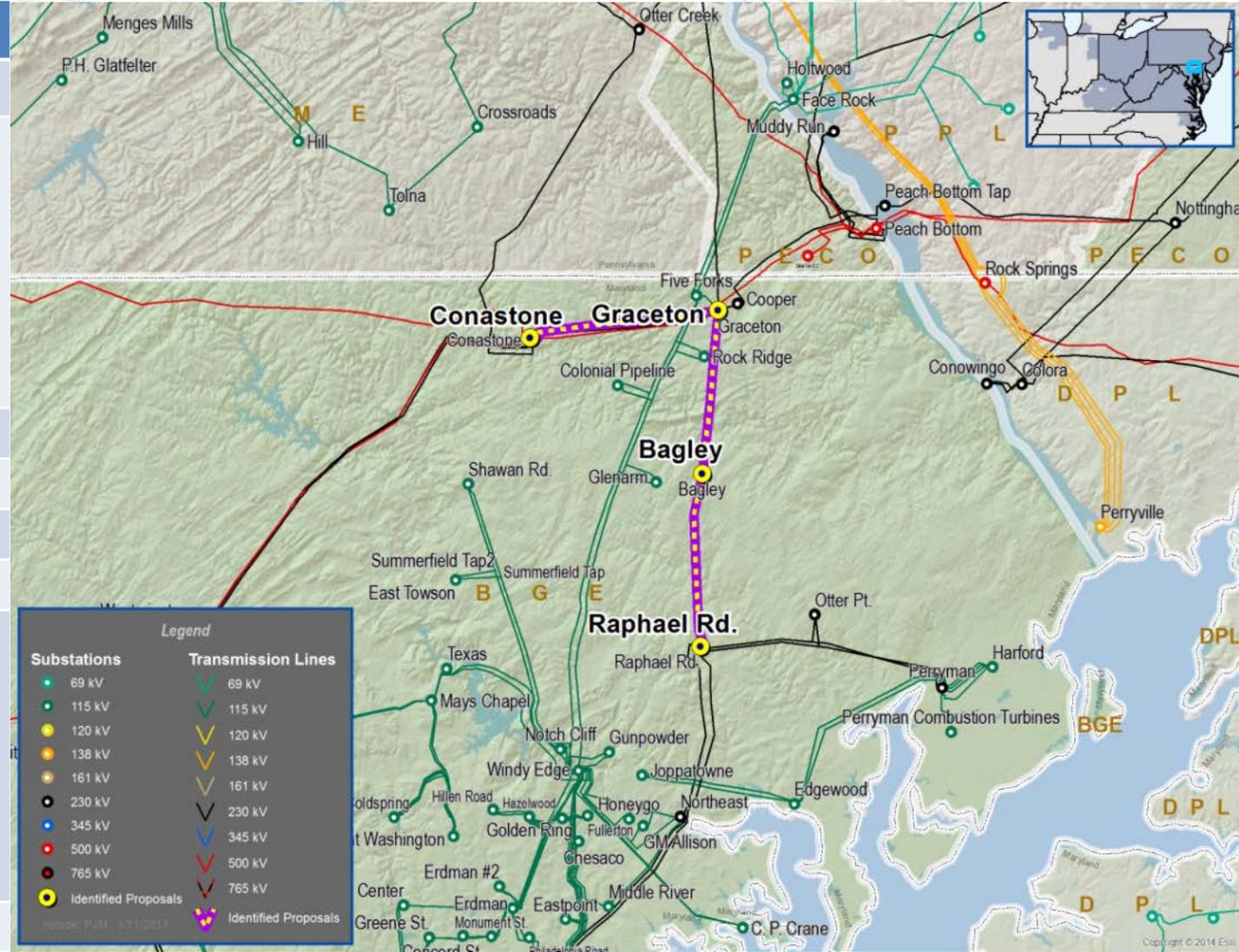
In-Service Cost (\$M): \$20.30

In-Service Date: 2021

Target Zone: BGE

ME Constraints:
 CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-5D

Proposed by: BGE

Proposed Solution:

Reconductor the Conastone to Graceton 230 kV lines. Upgrade substation equipment at Conastone. Add bundled conductors to the Graceton-Bagley-Raphael Road 230kV double circuit lines. Upgrade substation equipment at Windy Edge substation.

kV Level: 115/230 kV

In-Service Cost (\$M): \$20.40

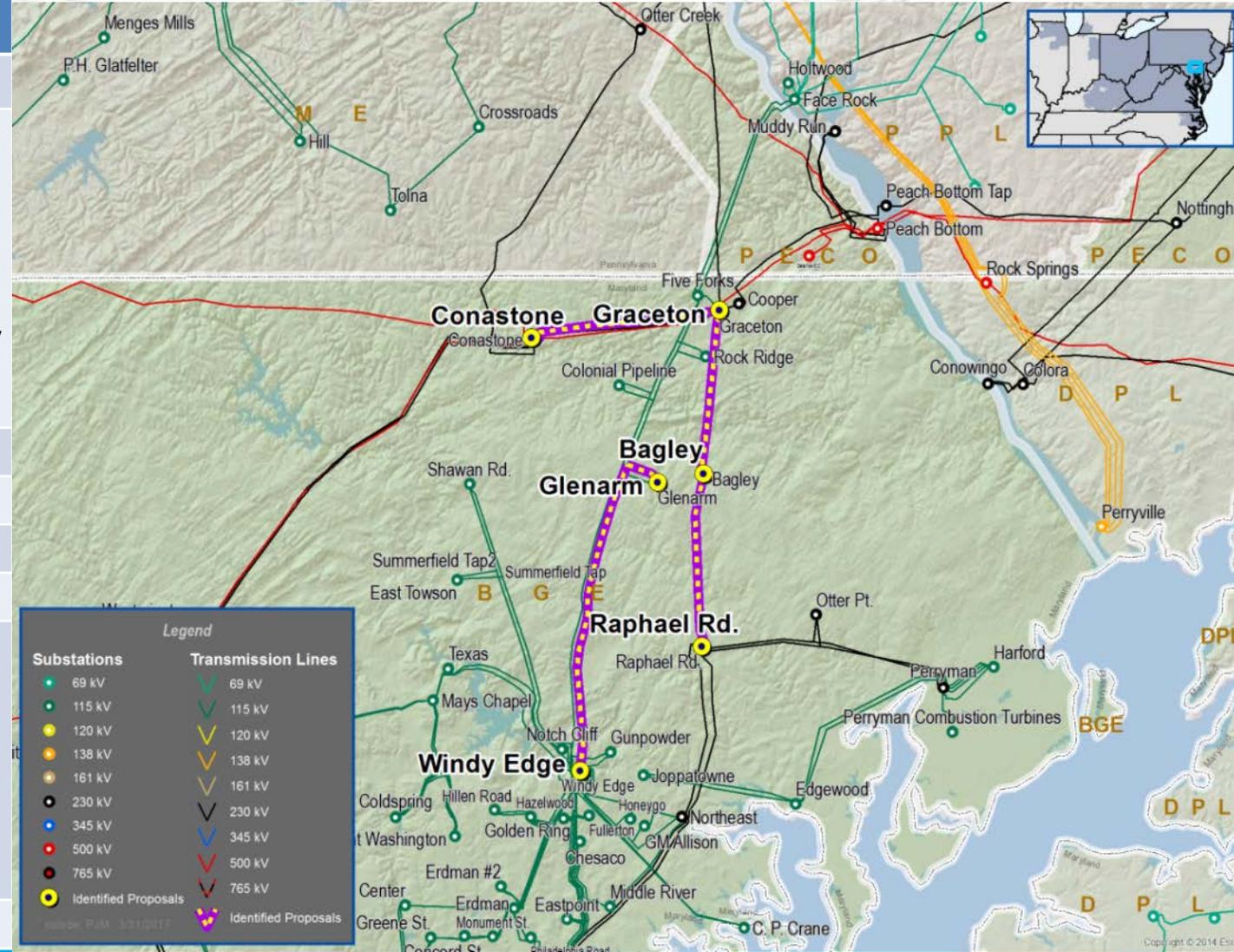
In-Service Date: 2021

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-5E

Proposed by: BGE

Proposed Solution:

Reconductor the Conastone to Graceton 230kV lines. Upgrade substation equipment at Conastone. Add bundled conductors to the Graceton-Bagley-Raphael Road 230kV double circuit lines. Reconductor the Raphael Road to Northeast 230 kV double circuit lines. Upgrade substation equipment at Windy Edge substation.

kV Level: 115/230 kV

In-Service Cost (\$M): \$25.40

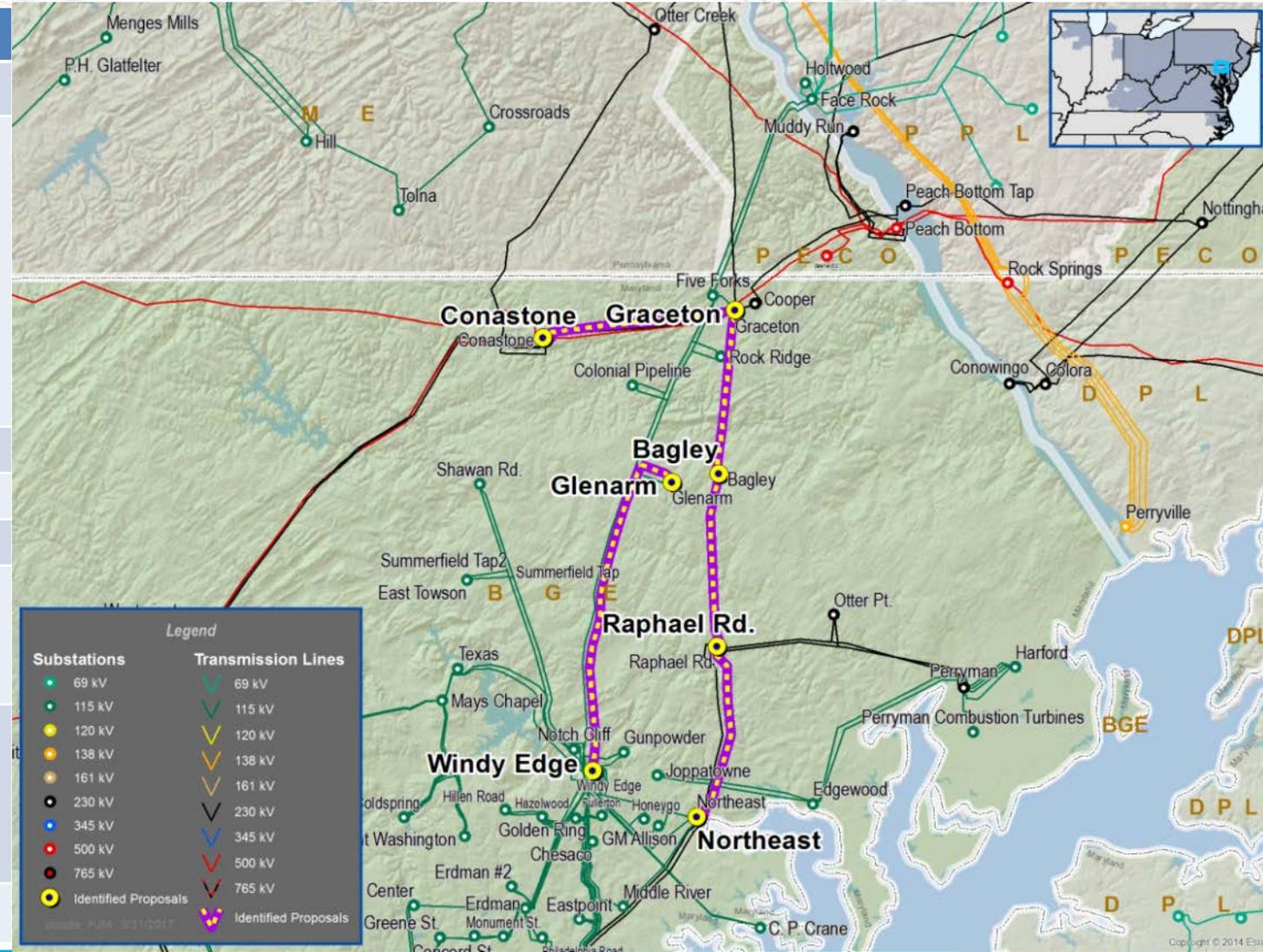
In-Service Date: 2021

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-6F

Proposed by: BGE PECO

Proposed Solution:
 Tap the Peach Bottom-Conastone 500 kV line at Graceton. Expand Graceton to include a 500/230 kV substation. Add bundled conductors to the Graceton-Bagley-Raphael Road 230 kV double circuit lines. Reconductor the Raphael Road to Northeast 230 kV double circuit lines. Upgrade substation equipment at Windy Edge 115 kV substation.

kV Level: 115/230/500 kV

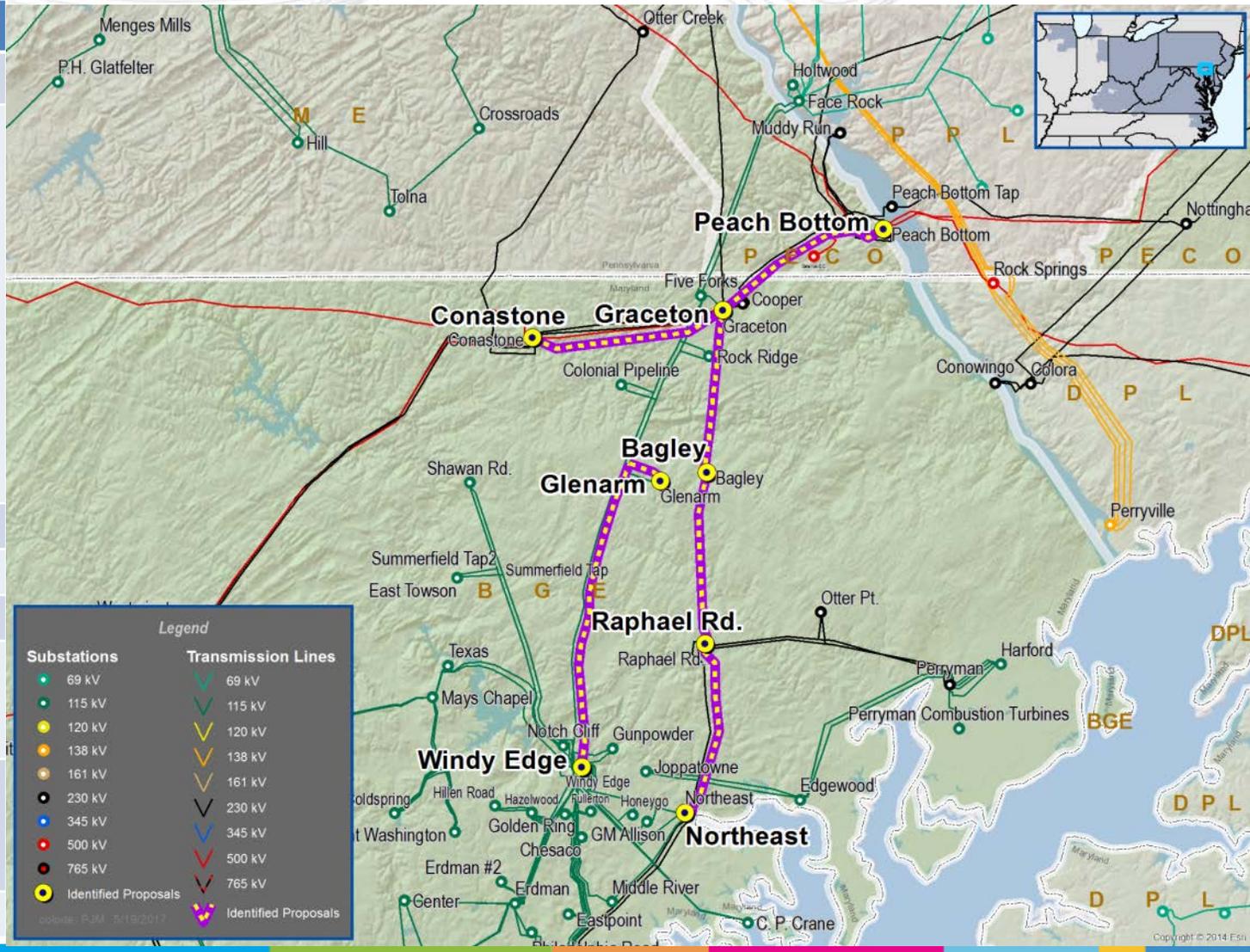
In-Service Cost (\$M): \$49.20

In-Service Date: 2021

Target Zone: BGE

ME Constraints:
 CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-6G

Proposed by: BGE PECO

Proposed Solution:

Tap the Peach Bottom-Conastone 500 kV line at Graceton. Expand Graceton to include a 500/230 kV substation. Add bundled conductors to the Graceton-Bagley-Raphael Road 230 kV double circuit lines. Reconductor the Raphael Road to Northeast 230 kV double circuit lines. Reconductor Graceton – Cooper 230 kV line. Upgrade substation equipment at Cooper 230kV and Windy Edge 115 kV substations.

kV Level: 115/230/500 kV

In-Service Cost (\$M): \$56.00

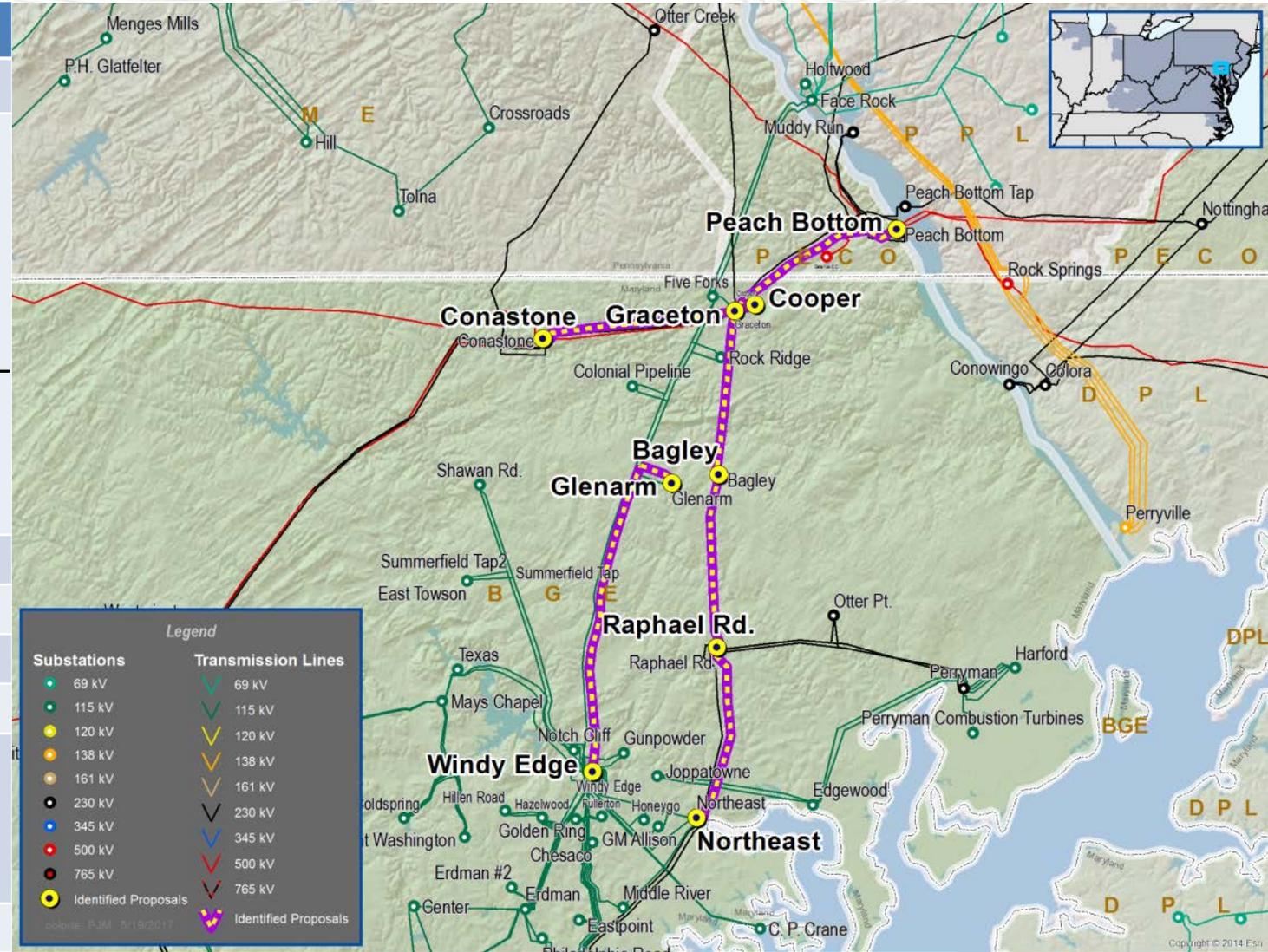
In-Service Date: 2021

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-6M

Proposed by: BGE PECO

Proposed Solution:

Tap the Peach Bottom-Conastone 500 kV line at Graceton. Expand Graceton to include a 500/230 kV substation. New Peach Bottom - Cooper 230 kV line with series reactor; resupply PB Tap. Add bundled conductors to the Graceton – Bagley - Raphael Road 230 kV double circuit lines. Reconductor the Raphael Road to Northeast 230 kV double circuit lines. Reconductor Graceton - Cooper 230kV line. Upgrade substation equipment at Peach Bottom 230 kV, Cooper 230 kV, Conastone 230 kV and Windy Edge 115 kV substations.

kV Level: 115/230/500 kV

In-Service Cost (\$M): \$65.49

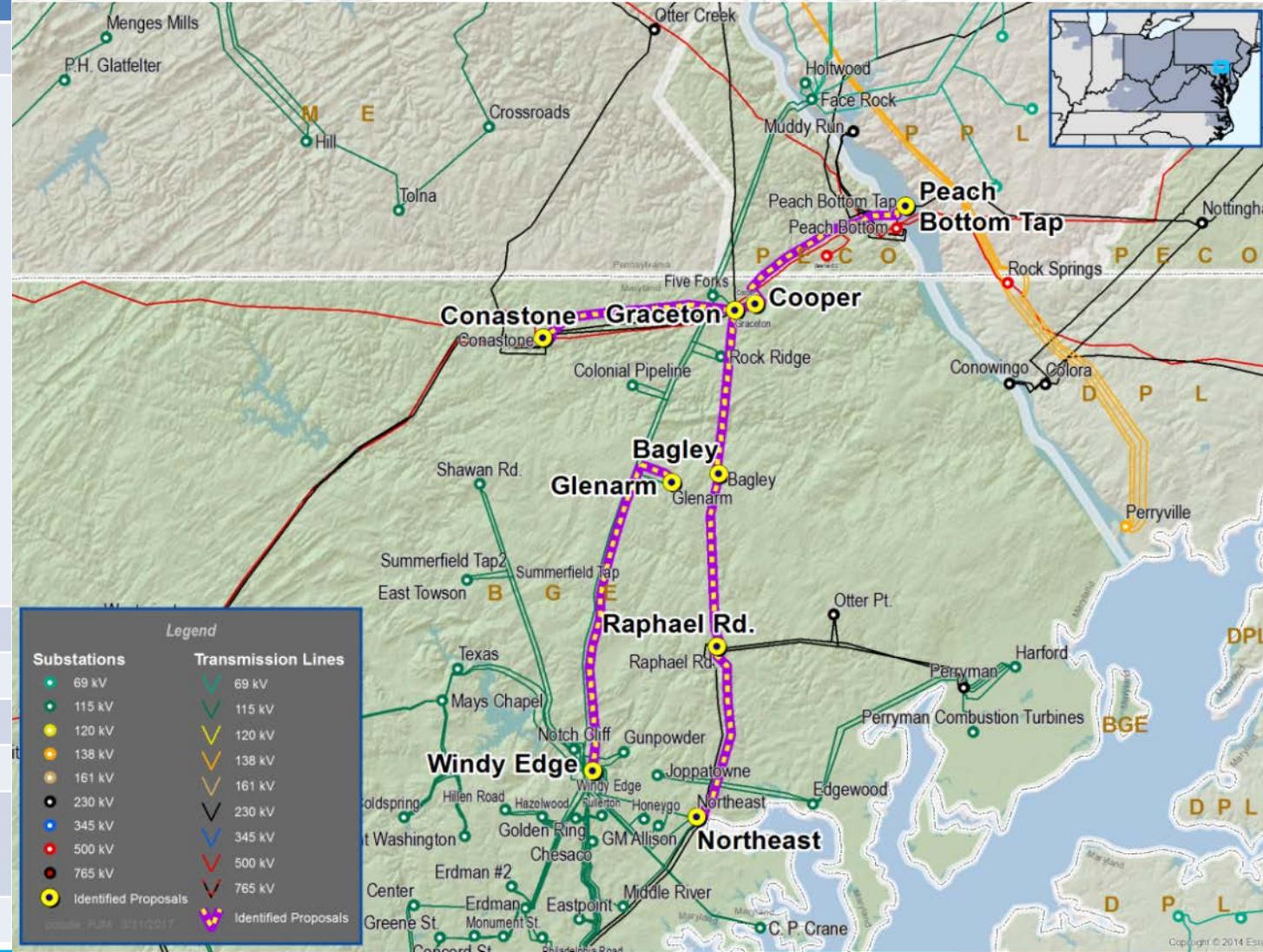
In-Service Date: 2021

Target Zone: BGE PECO

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-7H

Proposed by: PECO

Proposed Solution:

New Peach Bottom - Cooper 230 kV line with series reactor. Add bundled conductors to the Graceton - Bagley - Raphael Road 230 kV double circuit lines. Reconductor the Raphael Road to Northeast 230 kV double circuit lines. Reconductor Graceton - Cooper 230 kV line. Upgrade substation equipment at Peach Bottom 230 kV, Cooper 230 kV and Windy Edge 115 kV substations.

kV Level: 115/230 kV

In-Service Cost (\$M): \$35.60

In-Service Date: 2021

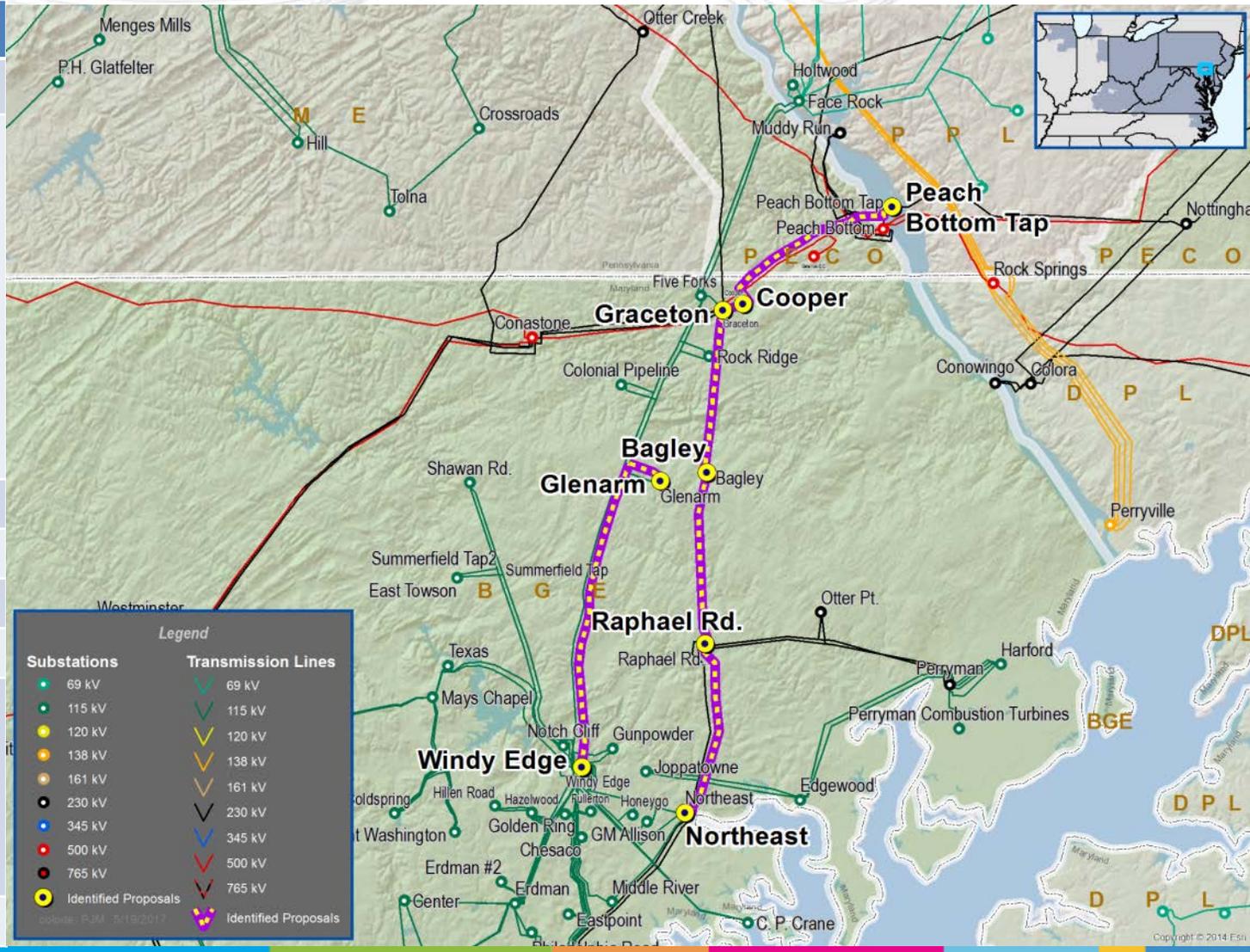
Target Zone: BGE PECO

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

CONASTONE - PEACH BOTTOM 500 kV

Notes:



Project ID: 201617_1-7J

Proposed by: PECO

Proposed Solution:

New Peach Bottom - Graceton 230 kV line with series reactor.
 Reconductor Graceton - Cooper 230 kV line; add reactor.
 Reconductor Peach Bottom - Cooper section of 220-08 line.
 Add bundled conductors to the Graceton - Bagley - Raphael Road 230 kV double circuit lines. Reconductor the Raphael Road to Northeast 230kV double circuit lines. Upgrade substation equipment at Peach Bottom 230 kV, Graceton 230kV, Cooper 230 kV and Windy Edge 115 kV substations.

kV Level: 115/230 kV

In-Service Cost (\$M): \$68.10

In-Service Date: 2022

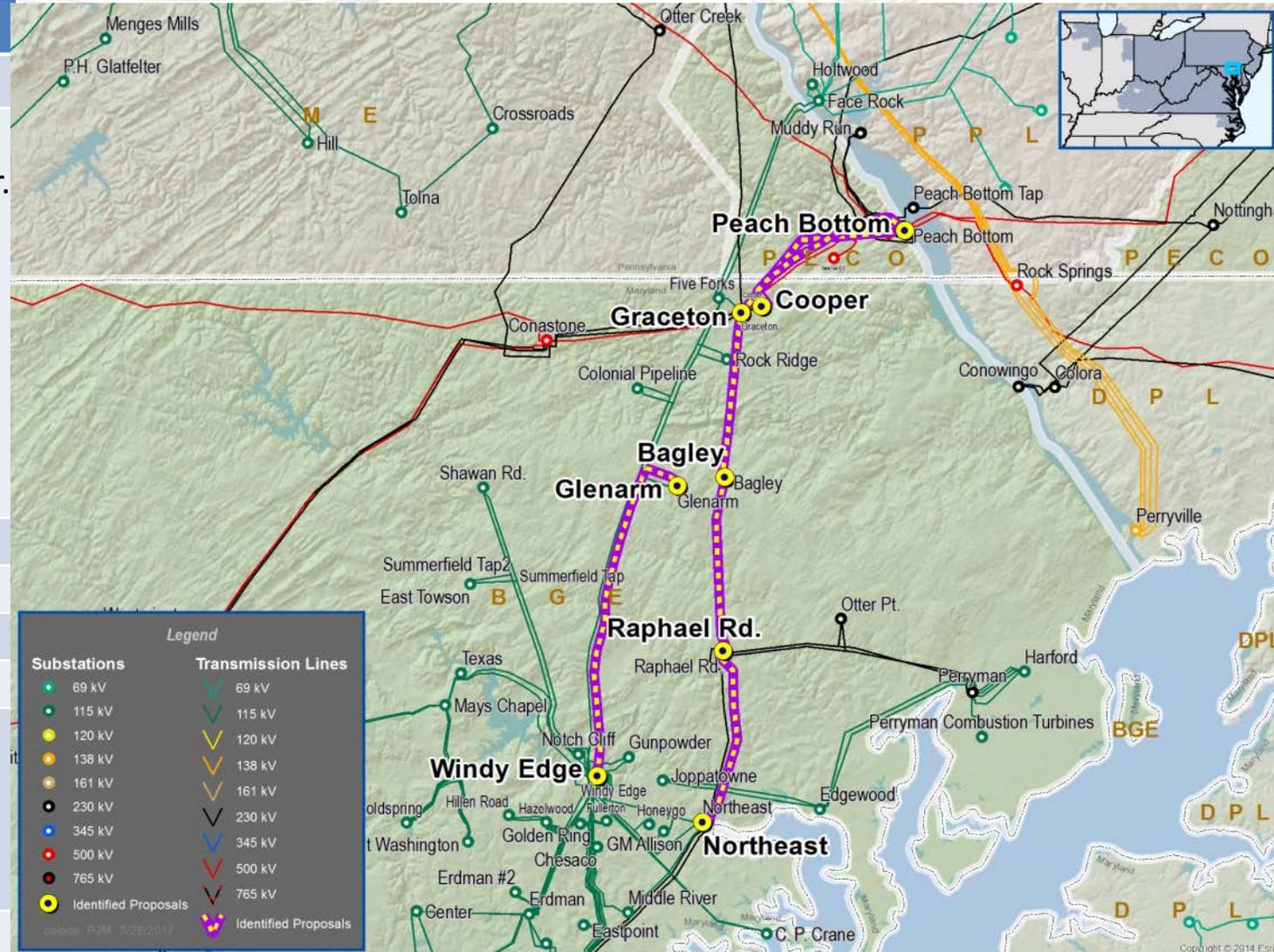
Target Zone: BGE PECO

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

CONASTONE - PEACH BOTTOM 500 kV

Notes:



Project ID: 201617_1-7K

Proposed by: PECO

Proposed Solution:

Add two 500/230 kV transformers at Peach Bottom substation. New Peach Bottom - Graceton 230 kV double circuit line. Replace Graceton - Cooper 230 kV line and Peach Bottom - Cooper section of 220-08 line with underground cable. Add reactor to Graceton - Cooper 230 kV line. Add bundled conductors to the Graceton - Bagley - Raphael Road 230 kV double circuit lines. Reconductor the Raphael Road - Northeast 230 kV double circuit lines. Upgrade substation equipment at Peach Bottom 500/230 kV, Graceton 230 kV, Cooper 230 kV and Windy Edge 115 kV substations.

kV Level: 115/230/500 kV

In-Service Cost (\$M): \$191.40

In-Service Date: 2022

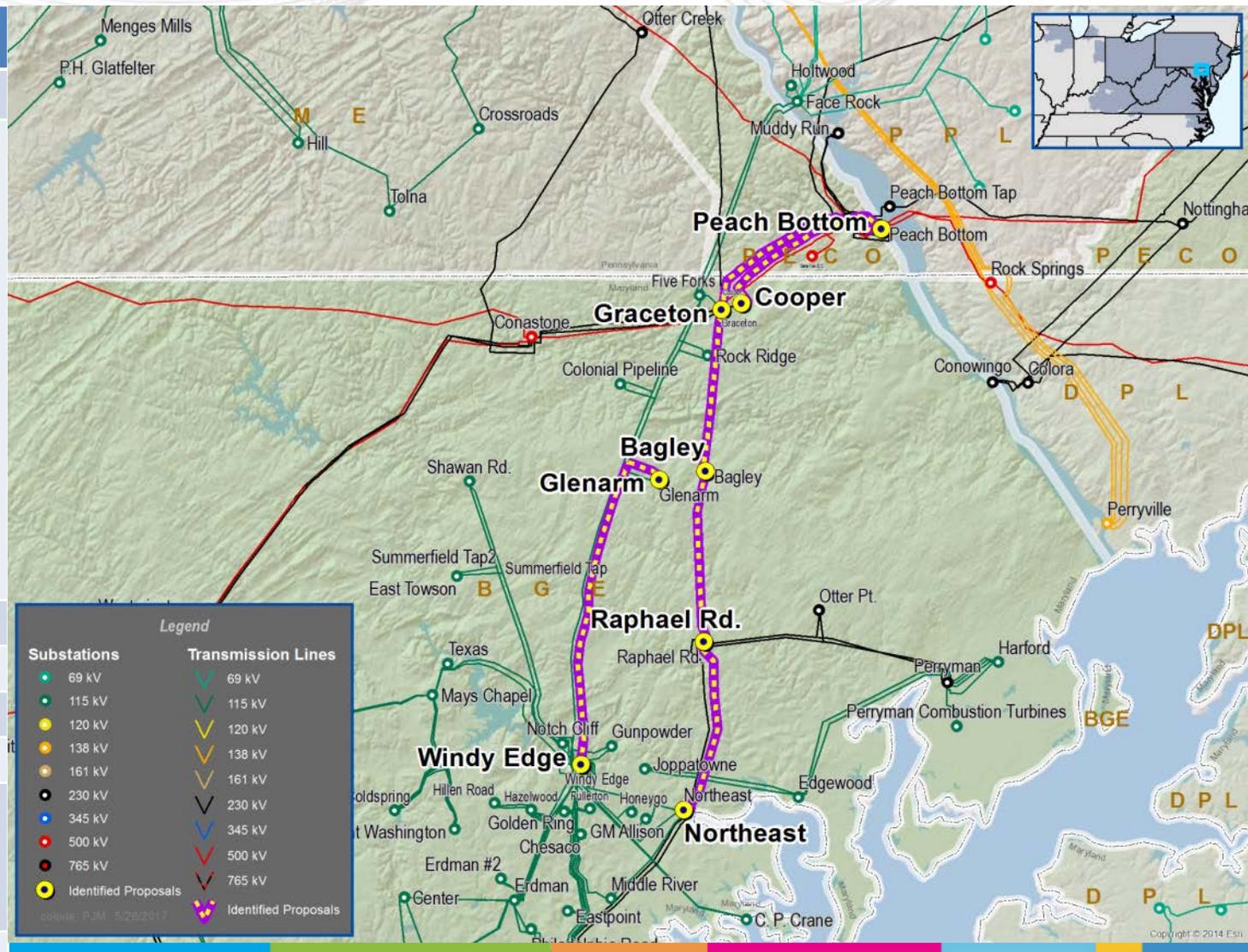
Target Zone: BGE PECO

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

CONASTONE - PEACH BOTTOM 500 kV

Notes:



Project ID: 201617_1-10C

Proposed by: Nextera

Proposed Solution: Greenfield
 Build a new 230 kV switchyard (Rowland) near Conowingo and a new Perryman – Roland 230 kV line. Loop the Conowingo - Colora and Conowingo - Nottingham 230 kV lines into the new switchyard.

kV Level: 230 kV

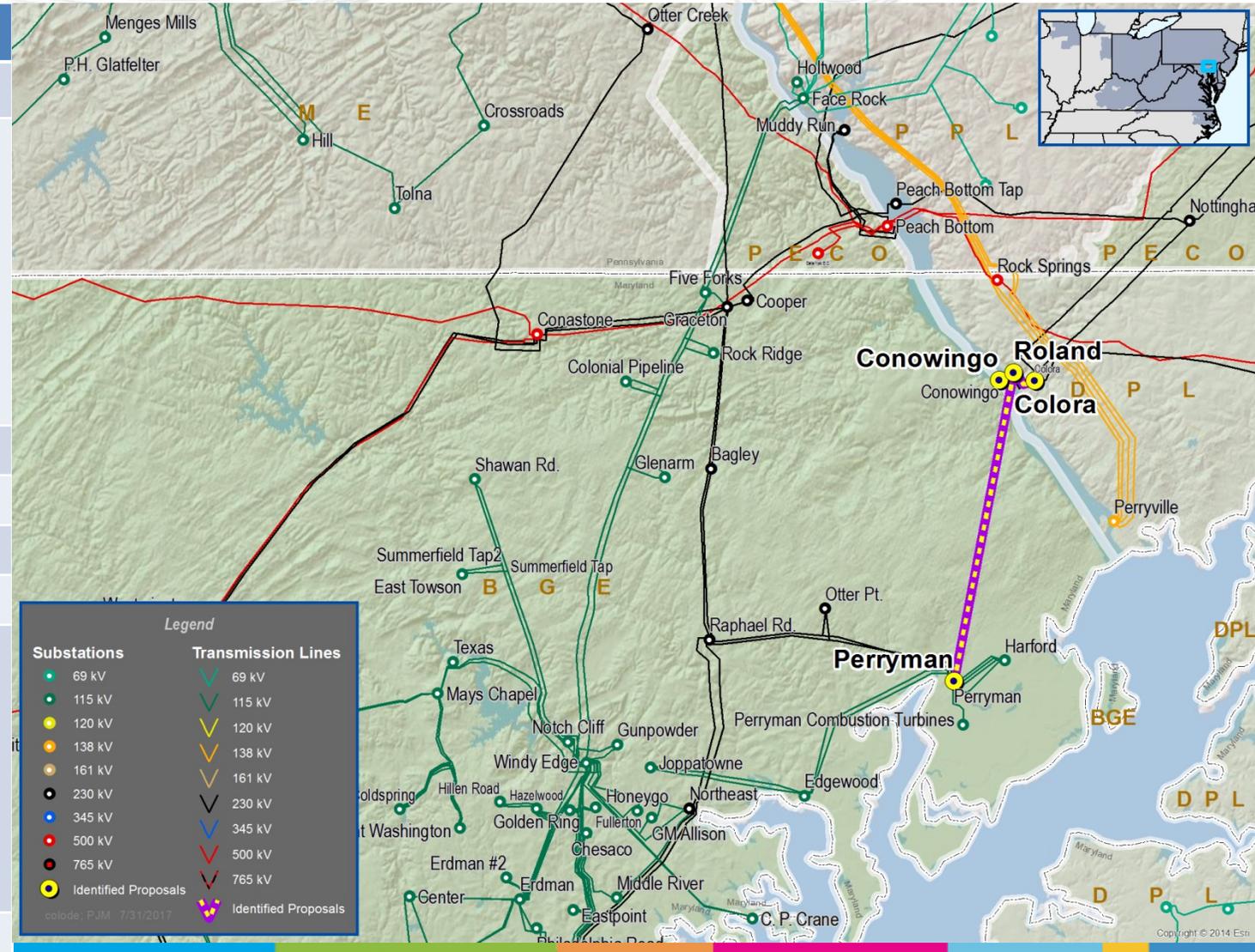
In-Service Cost (\$M): \$44.4

In-Service Date: 2021

Target Zone: BGE

ME Constraints:
 GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-10D

Proposed by: Nextera

Proposed Solution: Greenfield
 Tap the Peach Bottom - Conastone 500 kV line at near Graceton and build a new 500/230 kV substation (Pylesville) tying into Graceton 230 kV. Build a new 230 kV switchyard (Rowland) near Conowingo and a new Perryman – Roland 230 kV line. Loop the Conowingo - Colora and Conowingo - Nottingham 230 kV lines into the new switchyard.

kV Level: 230 kV

In-Service Cost (\$M): \$93.5

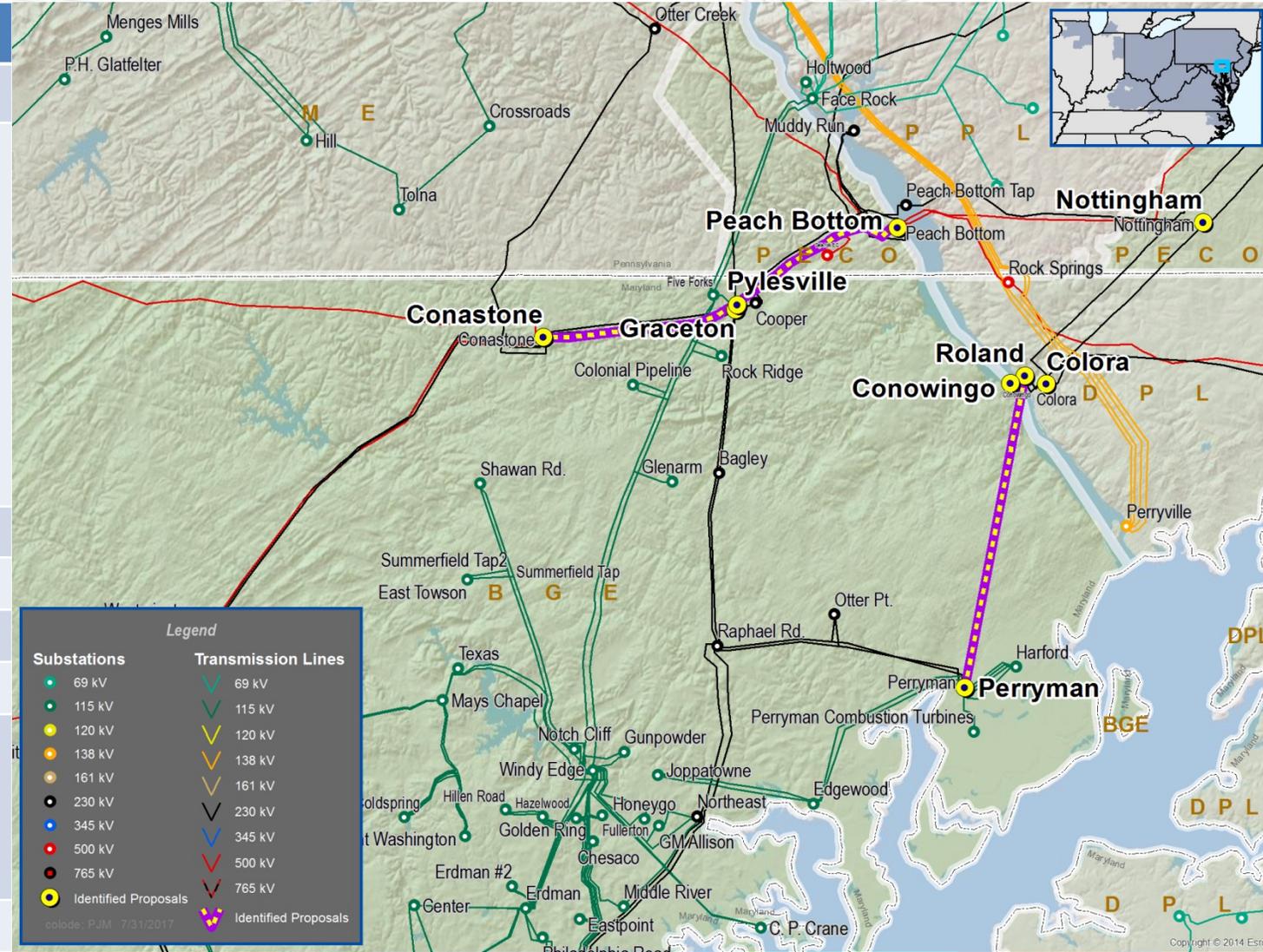
In-Service Date: 2021

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-10E

Proposed by: Nextera

Proposed Solution: Greenfield

Tap the Peach Bottom - Conastone 500 kV line at near Graceton and build a new 500/230 kV substation (Pylesville) tying into Graceton 230 kV. Build a new 230 kV switchyard (Rowland) near Conowingo and a new Perryman – Roland 230kV line. Loop the Conowingo - Colora and Conowingo - Nottingham 230 kV lines into the new switchyard. Build a new 230 kV line from Pylesville 500/230 kV to Rowland 230kV.

kV Level: 230/500 kV

In-Service Cost (\$M): \$105.7

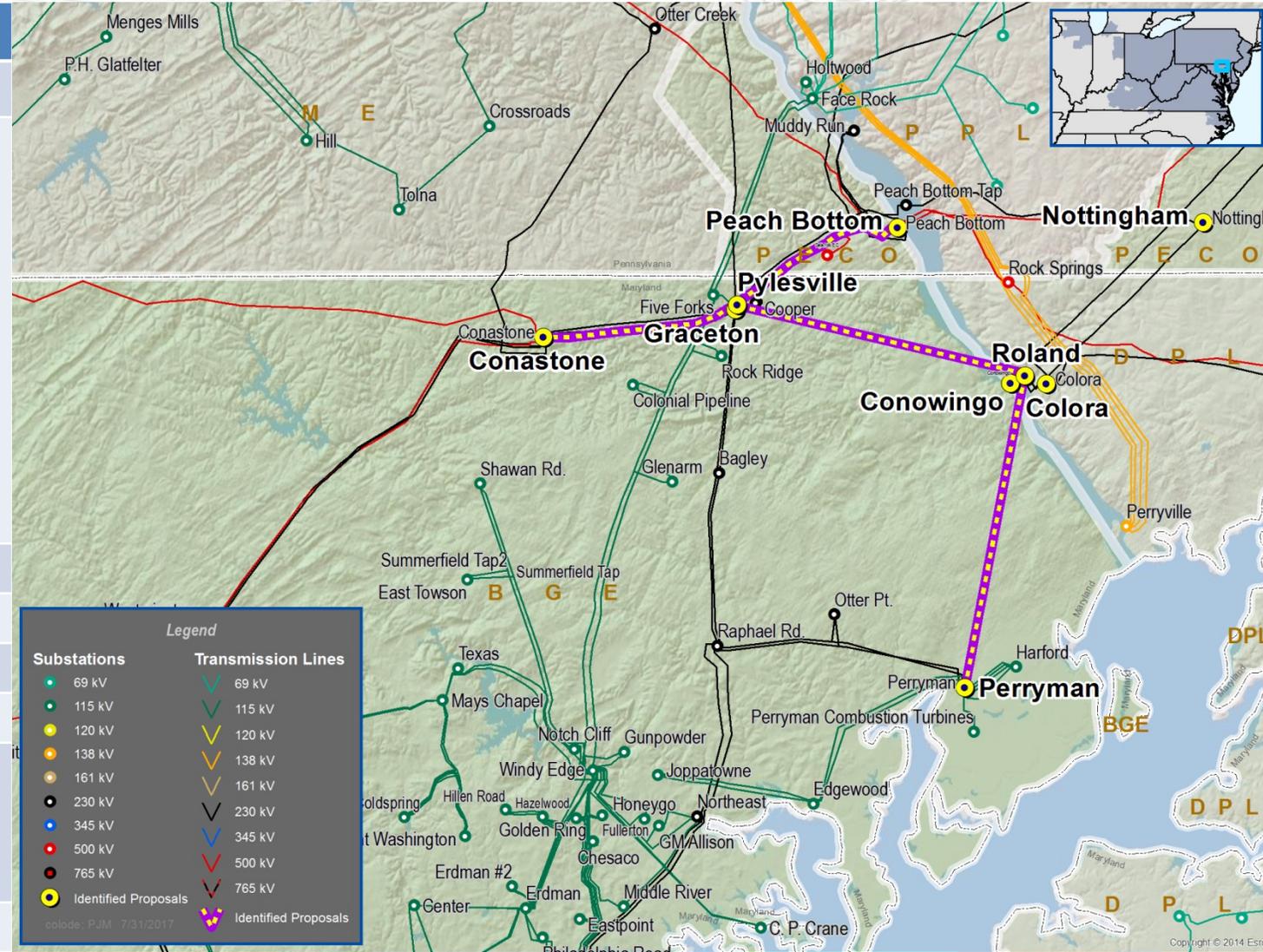
In-Service Date: 2021

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-13A

Proposed by: Transource

Proposed Solution: Greenfield

Tap the Peach Bottom - Rock Springs 500 kV line. Build a new 500/230 kV substation (Baldwin Road). Build a new Baldwin Road - Raphael Road 230 kV line. Rebuild Raphael Road - Northeast 230 kV lines, Northeast - Riverside 230 kV lines and Five Forks - Windy Edge 115 kV DCT lines. Loop Crane - Windy Edge 115 kV lines into Northeast substation. Replace both 115/69 kV transformers at Face Rock.

kV Level: 115/230/500 kV

In-Service Cost (\$M): \$457.83

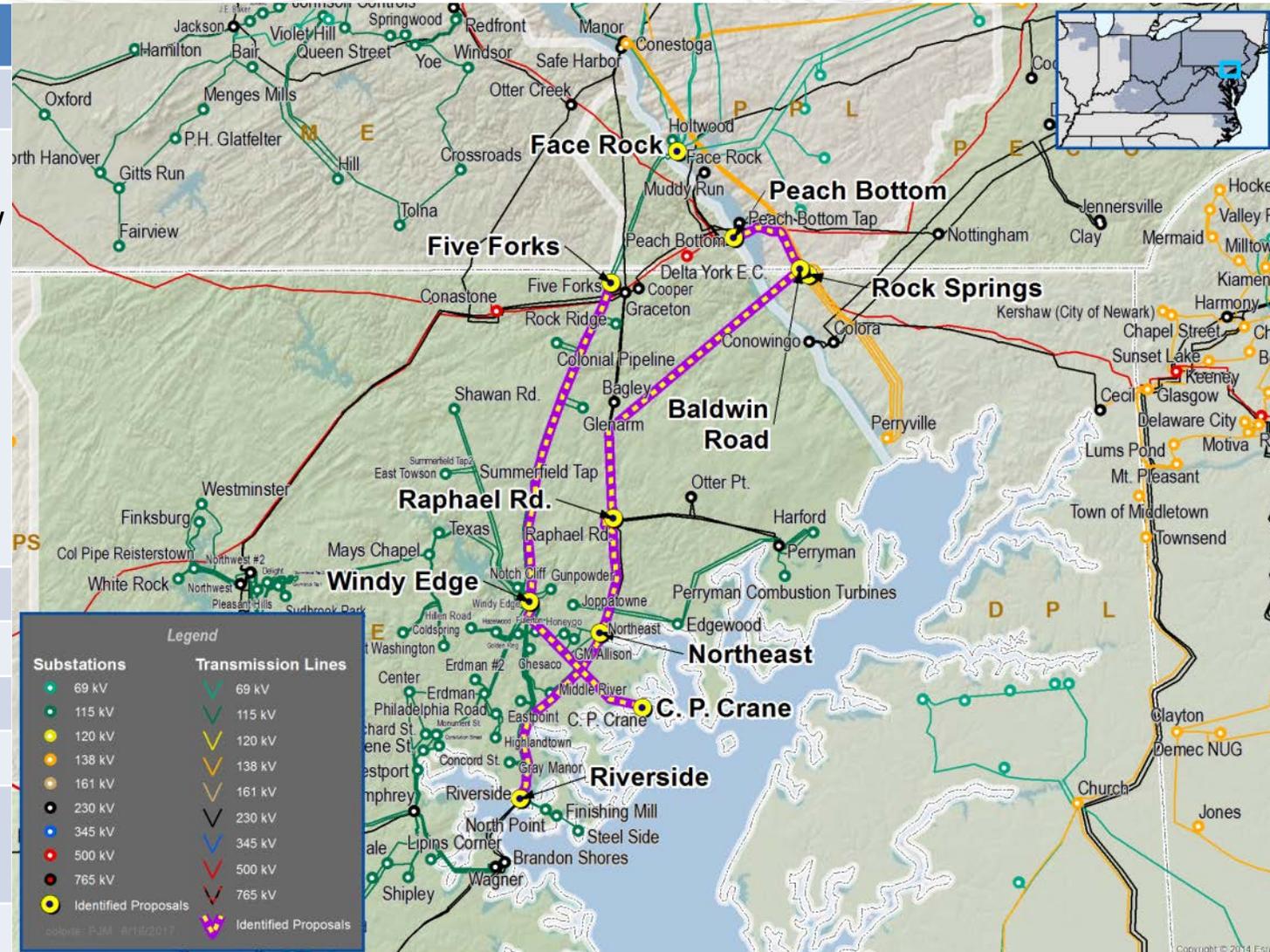
In-Service Date: 2024

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-13B

Proposed by: Transource

Proposed Solution: Greenfield
 Build a new 230/115 kV substation (Dulaney Valley) along the Windy Edge - Texas line. Build a new Conastone - Dulaney Valley 230kV line. Loop Windy Edge - Texas 115 kV and Summerfield - Shawan Road 115 kV lines into Dulaney Valley substation. Reconductor Dulaney Valley - Summerfield 115 kV lines and a section of Windy Edge - Hazelwood 115 kV. Replace transformers at Face Rock and upgrade transformer replacement at Furnace Run.

kV Level: 115/230 kV

In-Service Cost (\$M): \$107.49

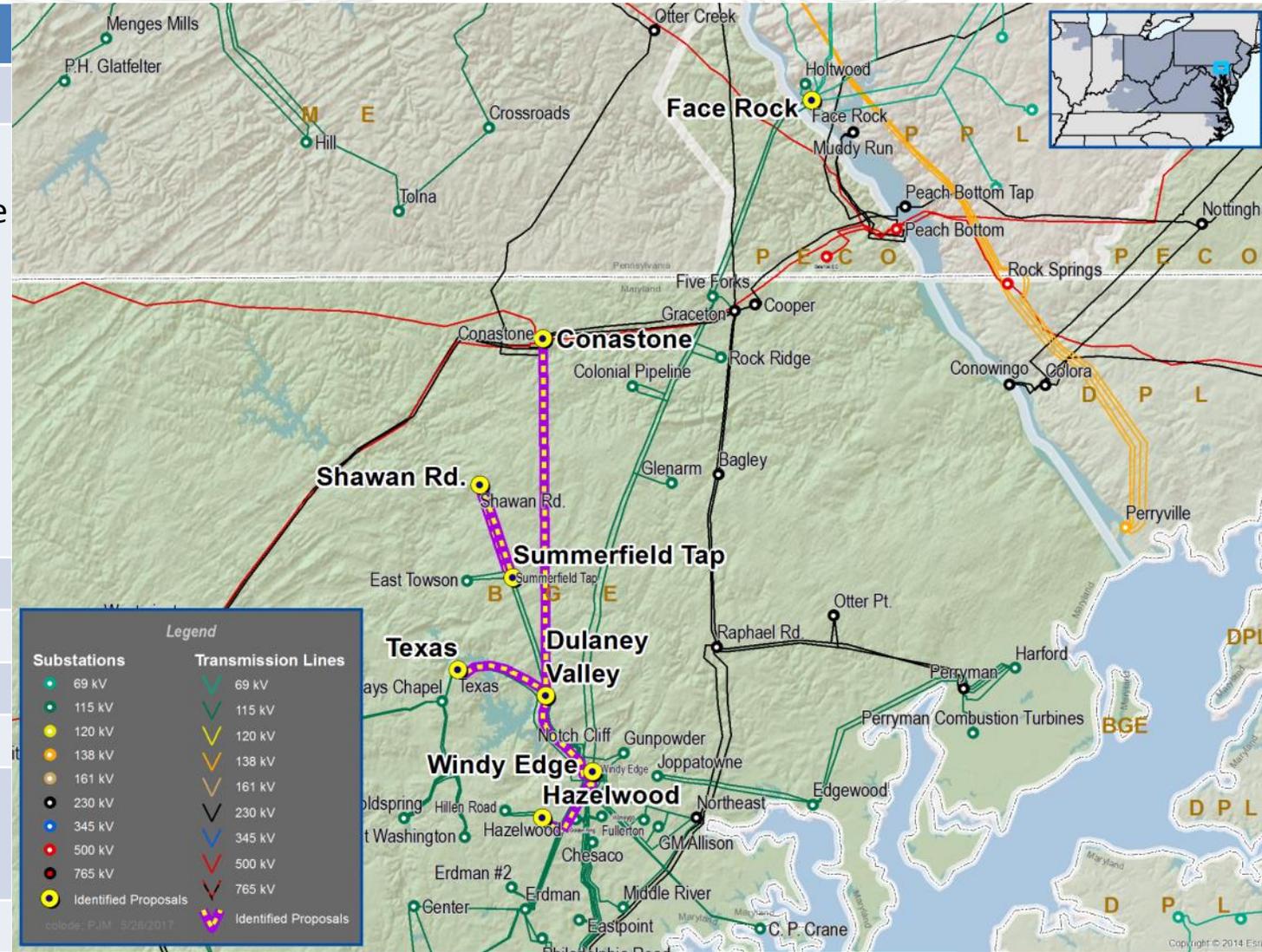
In-Service Date: 2022

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-13C

Proposed by: Transource

Proposed Solution: Greenfield

Build a new 230/115 kV substation (Long Green) south of Glenarm. Build a new Conastone - Long Green 230 kV line. Loop Windy Edge - Glenarm and Windy Edge - Gunpowder 115 kV lines into Long Green substation. Rebuild/upgrade 115 kV lines and substation facilities from Windy Edge to Face Rock and Windy Edge to Gunpowder. Reconductor a section of Windy Edge - Hazelwood 115 kV. Replace transformers at Face Rock and upgrade transformer replacement at Furnace Run.

kV Level: 115/230 kV

In-Service Cost (\$M): \$169.27

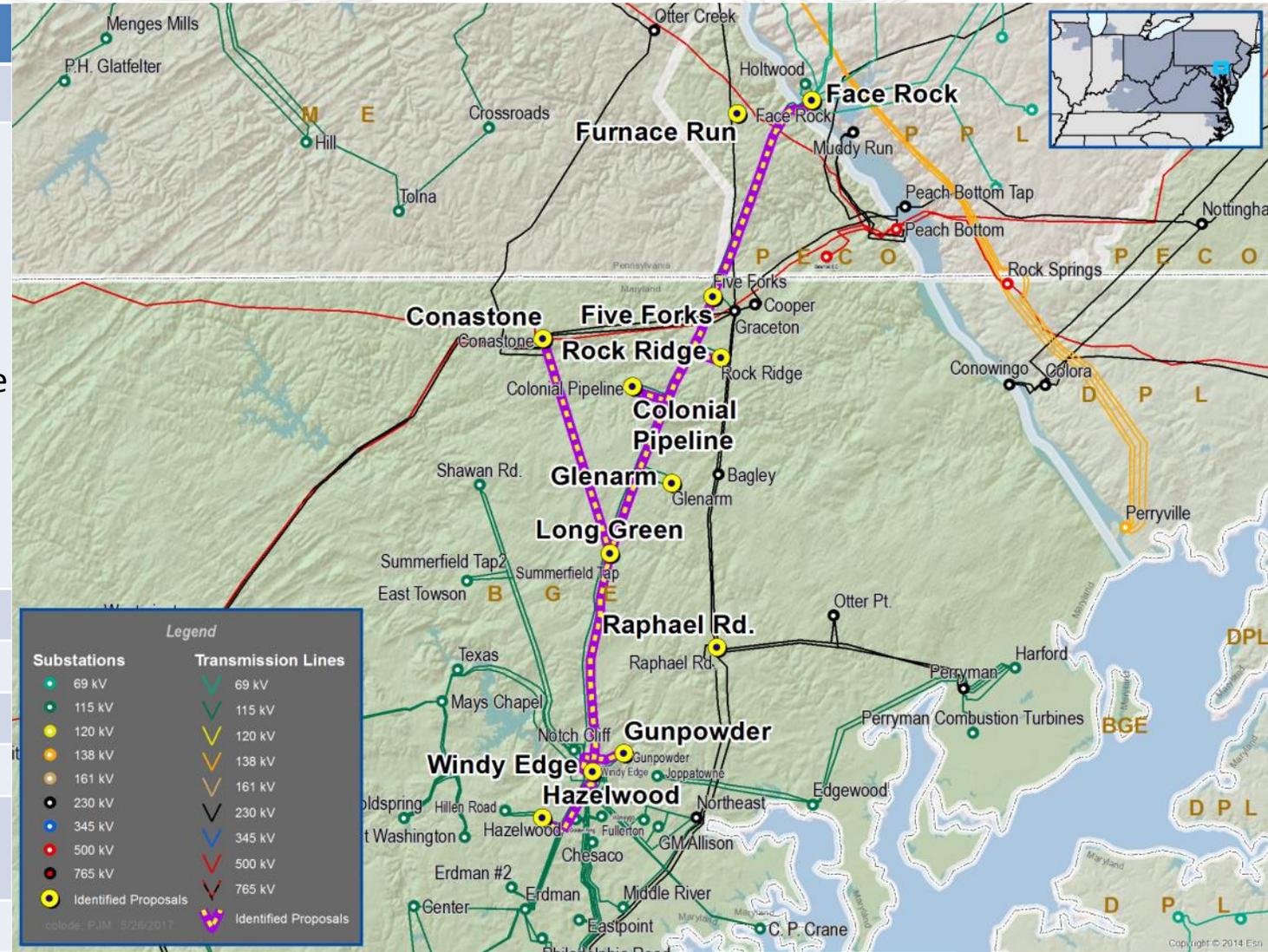
In-Service Date: 2022

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-13D

Proposed by: Transource

Proposed Solution: Greenfield

Build a new 230/115 kV substation (Long Green) south of Glenarm. Build a new Conastone - Long Green 230 kV line and a new Long Green - Raphael Road 230 kV line. Loop Windy Edge - Glenarm and Windy Edge - Gunpowder 115 kV lines into Long Green substation. Rebuild/upgrade 115 kV lines and substation facilities from Windy Edge to Face Rock and Windy Edge to Gunpowder. Reconductor a section of Windy Edge - Hazelwood 115 kV. Replace transformers at Face Rock and upgrade transformer replacement at Furnace Run.

kV Level: 115/230 kV

In-Service Cost (\$M): \$183.00

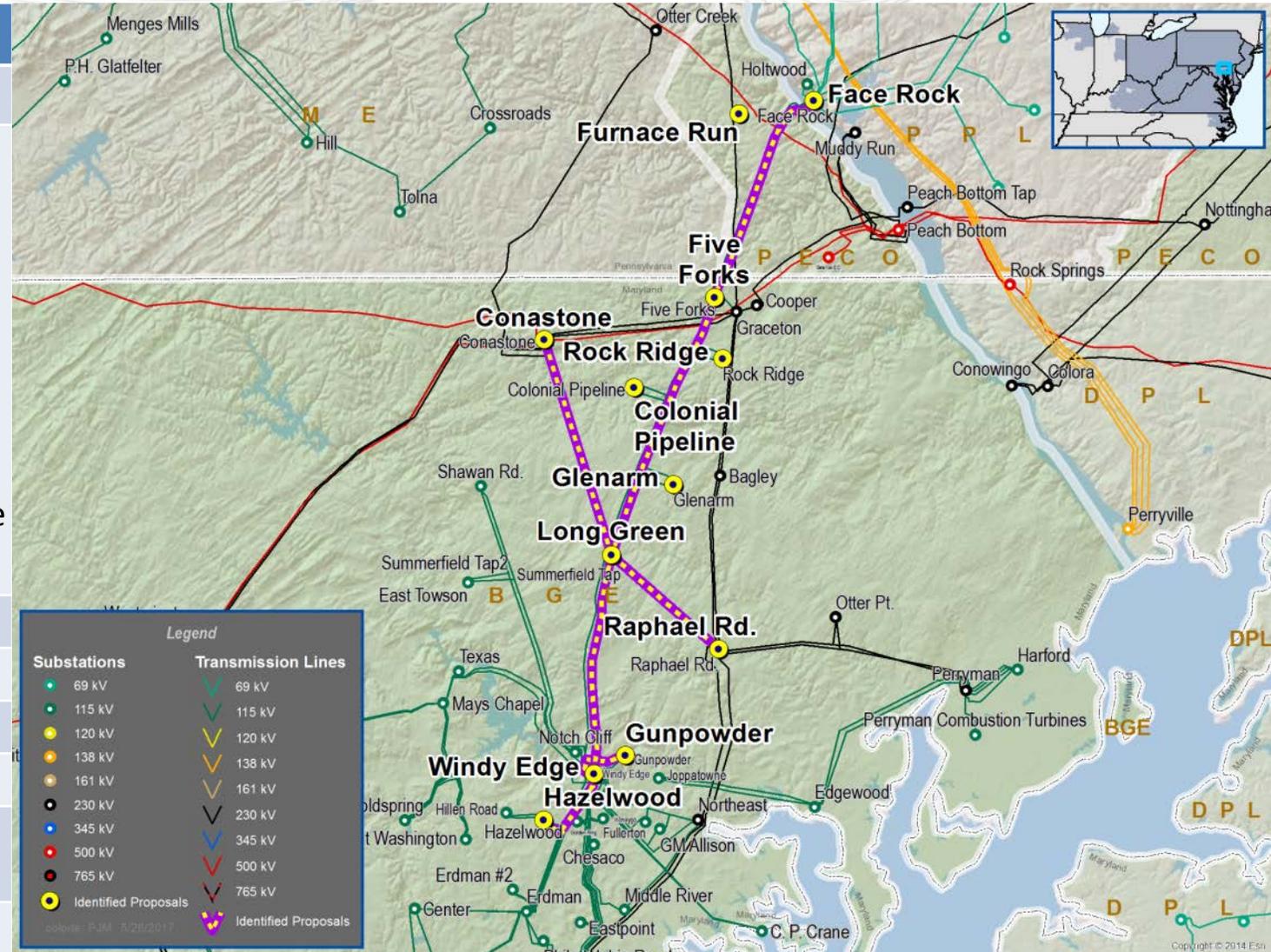
In-Service Date: 2022

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-13E

Proposed by: Transource

Proposed Solution: Greenfield

Tap the Conastone-Brighton 500 kV line and build a new 500/230 kV substation (Hereford). Build a new 230/115 kV substation along the Windy Edge-Texas 115 kV lines (Dulaney Valley). Build a new 230 kV line from Hereford to Dulaney Valley. Loop Conastone-Northwest 230 kV line into Herford and rebuild from Conastone to Herford. Loop Windy Edge - Texas 115 kV and Summerfield - Shawan Road 115 kV lines into Dulaney Valley substation. Reconductor Dulaney Valley - Summerfield 115 kV lines and a section of Windy Edge - Hazelwood 115 kV. Replace transformers at Face Rock and upgrade transformer replacement at Furnace Run.

kV Level: 115/230/500 kV

In-Service Cost (\$M): \$179.22

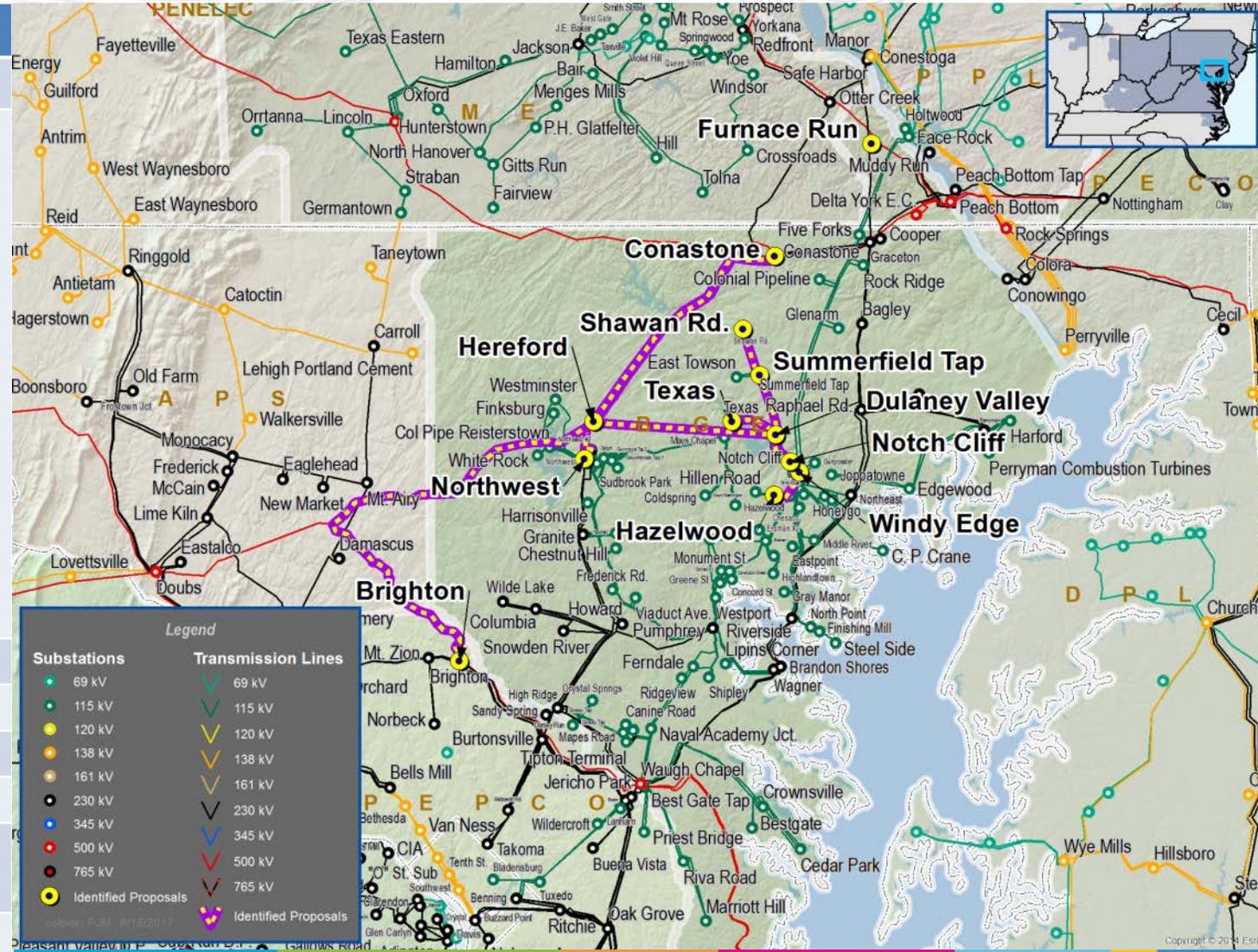
In-Service Date: 2022

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-13F

Proposed by: Transource

Proposed Solution: Greenfield

Tap the Rock Springs - Keeney 500 kV line and build a new 500/230 kV substation (Love Run). Build a new 230 kV line from Love Run to Perryman. Rebuild Perryman-Raphael Road 230 kV lines, Raphael Road-Northeast 230 kV lines, Northeast-Riverside 230 kV lines and Five Forks-Windy Edge 115 kV lines. Loop the Crane - Windy Edge 115 kV lines into Northeast substation. Replace transformers at Face Rock. Substation work at Rock Springs 500 kV station.

kV Level: 230/500 kV

In-Service Cost (\$M): \$483.21

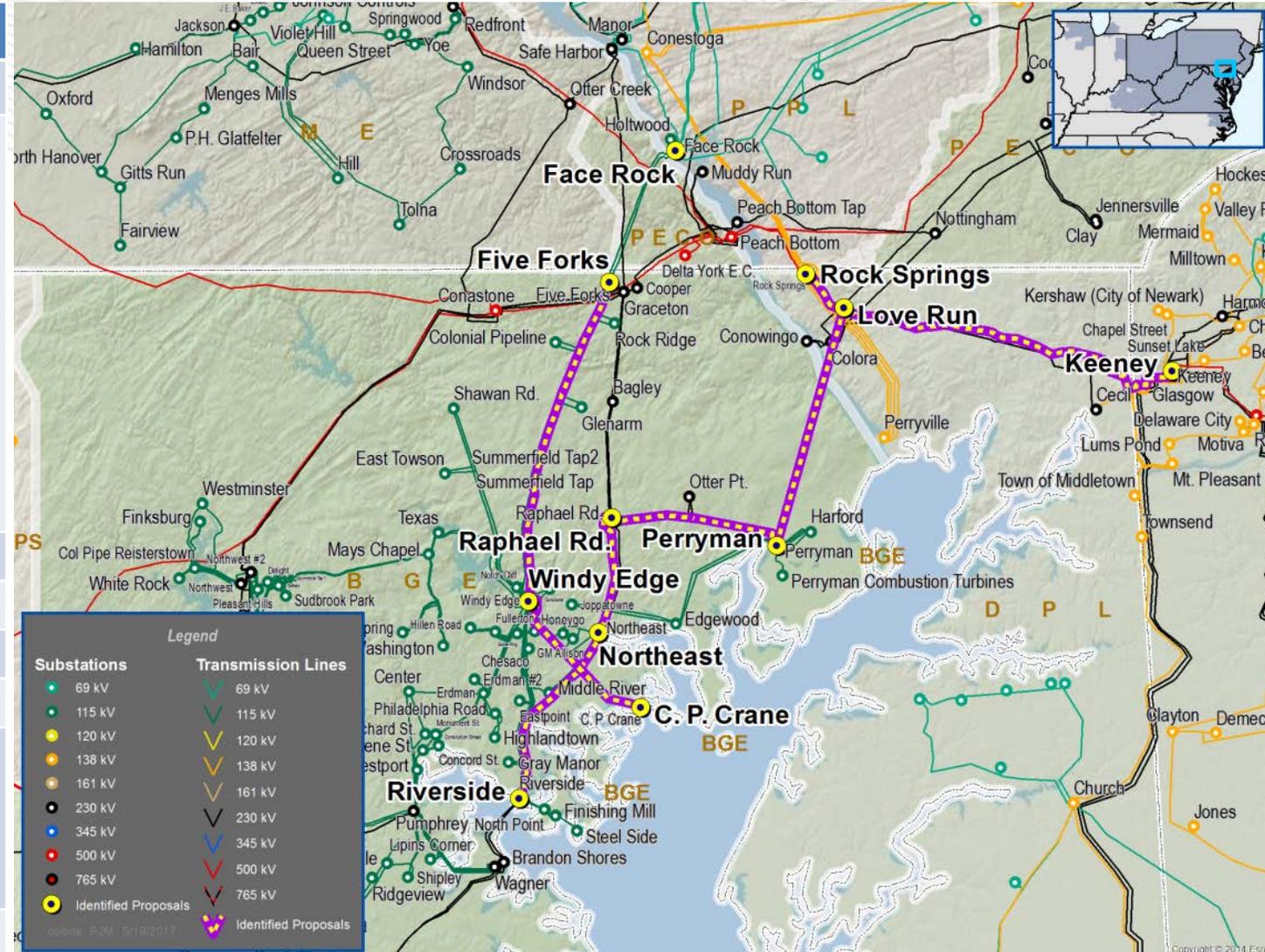
In-Service Date: 2024

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-13G

Proposed by: Transource

Proposed Solution:

Reconductor Conastone - Graceton 230 kV lines.
 Reconductor Graceton - Bagley and Bagley - Raphael Road 230 kV lines. Rebuild Raphael Road - Northeast 230 kV lines and Five Forks - Windy Edge 115 kV lines. Replace transformers at Face Rock and upgrade transformer replacement at Furnace Run.

kV Level: 115/230 kV

In-Service Cost (\$M): \$192.07

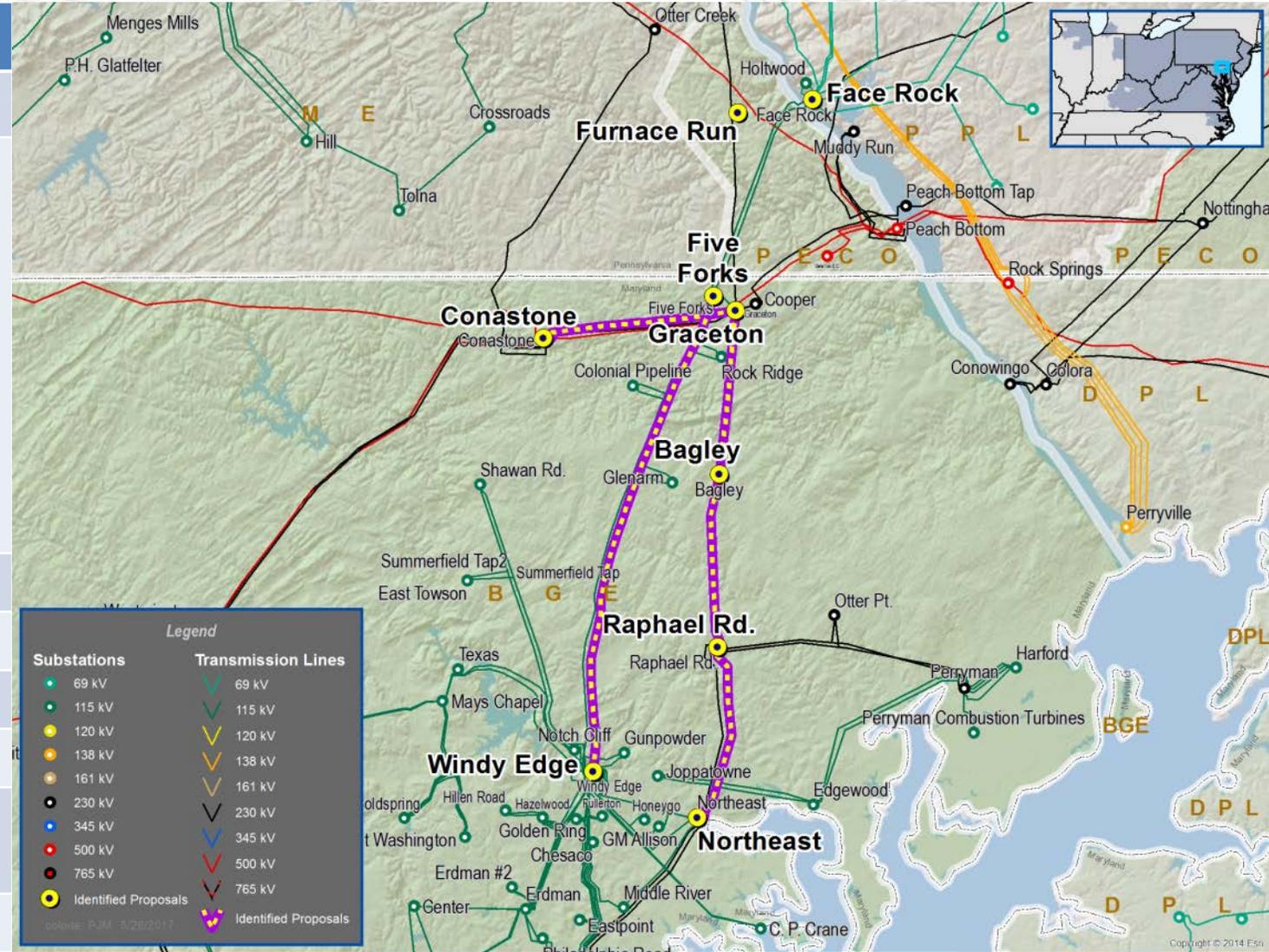
In-Service Date: 2022

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-14A

Proposed by: ATC

Proposed Solution: Greenfield
 Build a new Furnace Run - Perryman 230 kV line. Add series reactors to both Conastone-Graceton 230 kV lines. Rebuild the Glenarm to Windy Edge 115 kV lines.

kV Level: 115/230 kV

In-Service Cost (\$M): \$114.80

In-Service Date: 2023

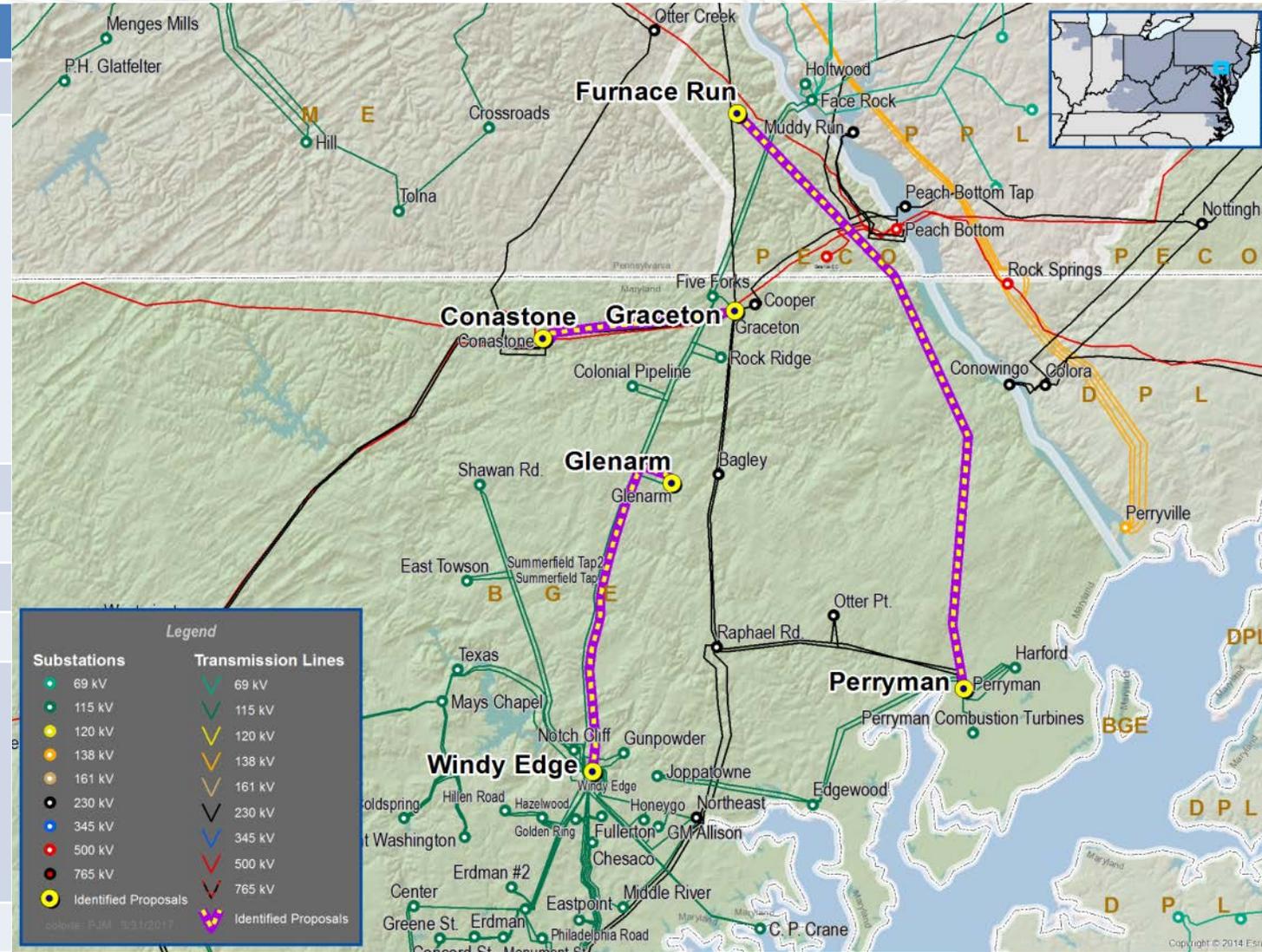
Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

CONASTONE - PEACH BOTTOM 500 kV

Notes:



Project ID: 201617_1-15A

Proposed by: ATXI East PPL

Proposed Solution: Greenfield

Build a new 230/115 kV Substation (Baldwin) north of Glenarm. Build a new Conastone - Baldwin 230 kV double circuit line and a new Baldwin - Raphael Road double circuit 230 kV line. Reconductor the Raphael Road to Northeast 230 kV lines. Loop the Glenarm - Colonial Pipe 115 kV lines into Baldwin. Rebuild the Baldwin to Windy Edge 115 kV lines.

kV Level: 115/230 kV

In-Service Cost (\$M): \$138.53

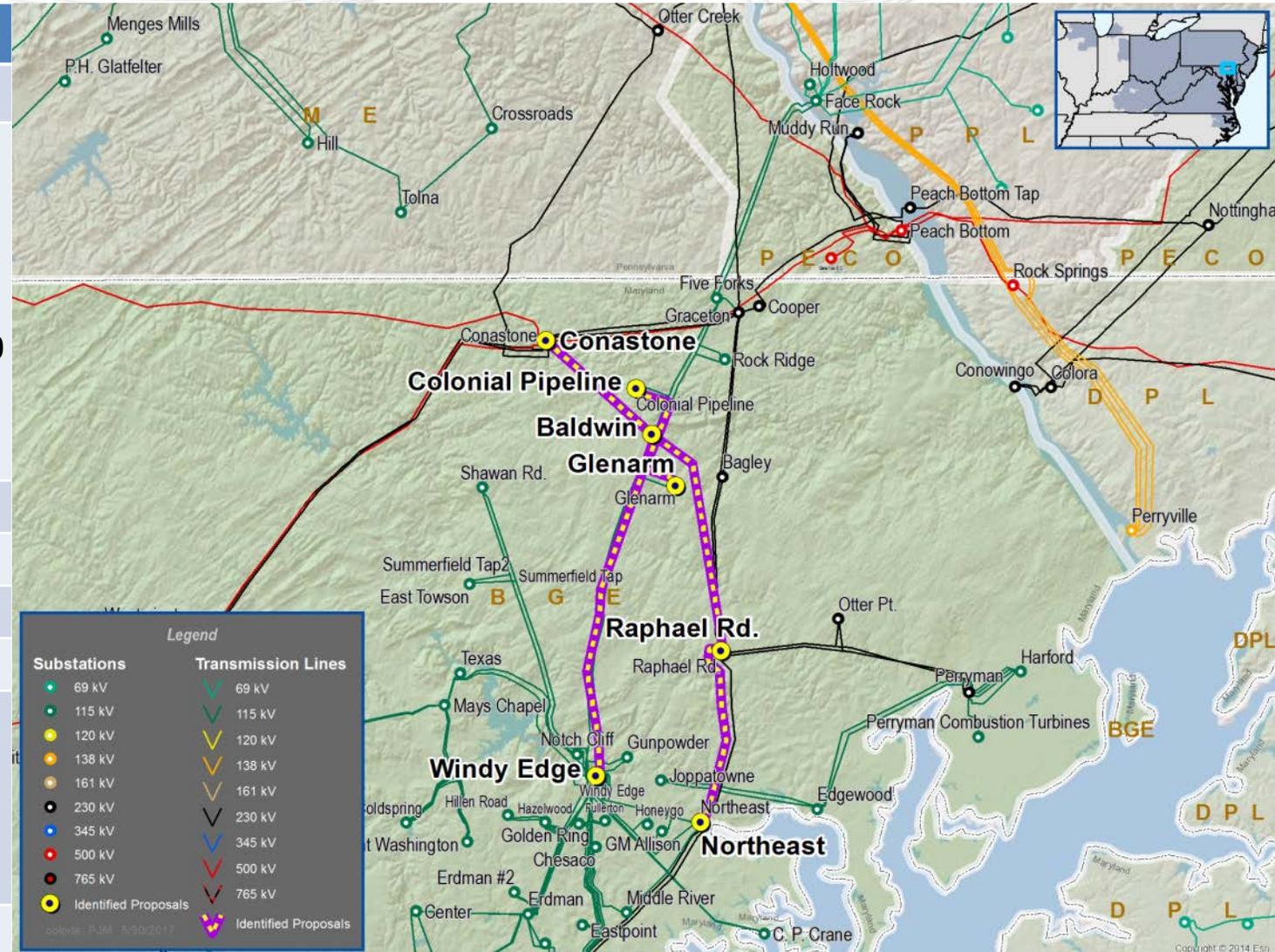
In-Service Date: 2022

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-16A

Proposed by: PSEG

Proposed Solution: Greenfield
 Build a new Peach Bottom - Otter Point 230 kV line.
 Reconductor / Rebuild Raphael Road - Northeast 230 kV lines.
 Reconductor / Rebuild Northeast to General Motors 115 kV lines.

kV Level: 115/230 kV

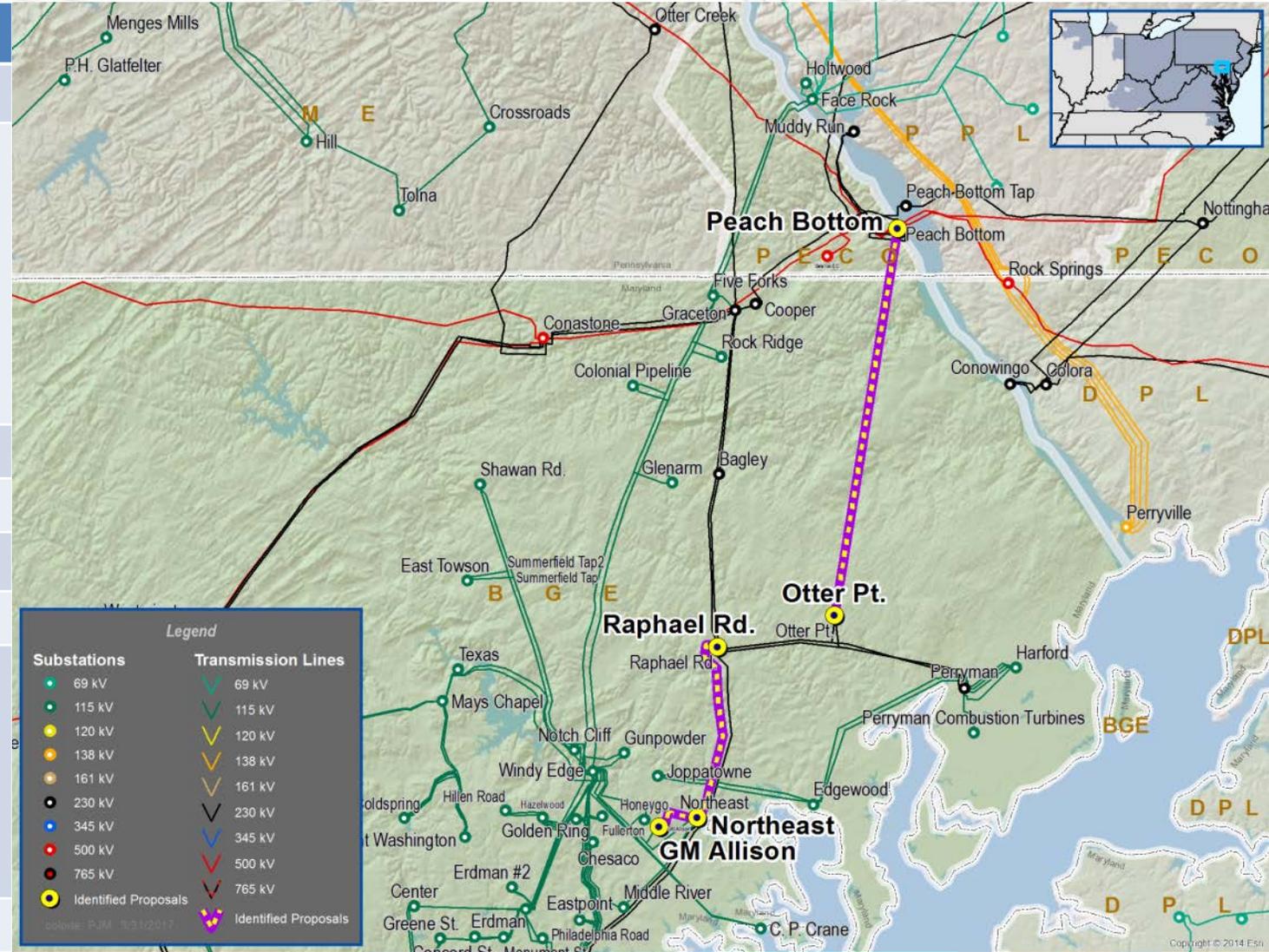
In-Service Cost (\$M): \$70.5

In-Service Date: 2021

Target Zone: BGE

ME Constraints:
 CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-16B

Proposed by: PSEG

Proposed Solution: Greenfield
 Build a new Peach Bottom - Raphael Road 230 kV line.
 Reconductor / Rebuild Raphael Road - Northeast 230 kV lines.
 Reconductor / Rebuild Northeast to General Motors 115 kV lines.

kV Level: 115/230 kV

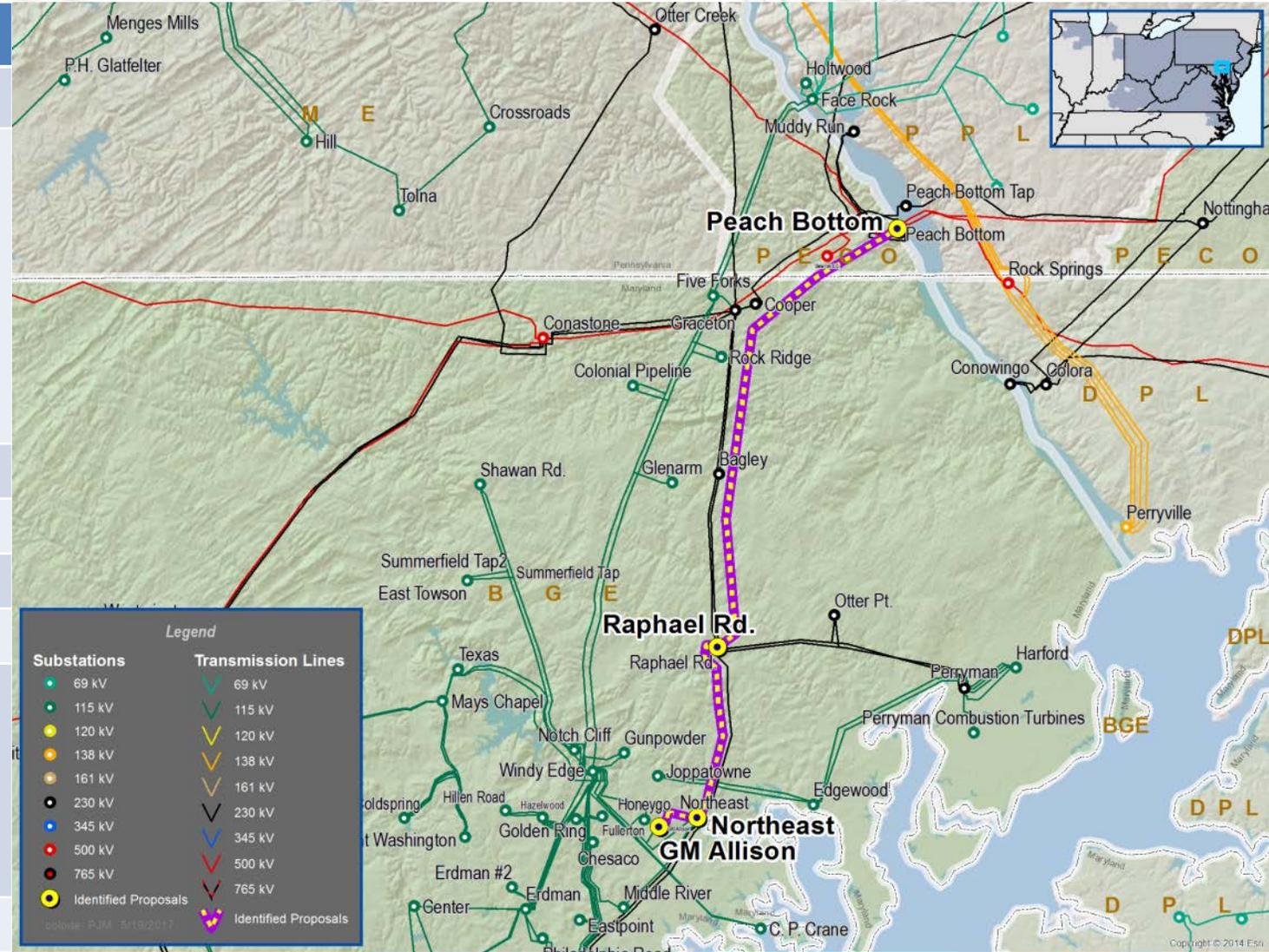
In-Service Cost (\$M): \$92.2

In-Service Date: 2021

Target Zone: BGE

ME Constraints:
 CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-16C

Proposed by: PSEG

Proposed Solution: Greenfield
 Build a new Conastone - Raphael Road 230 kV line.
 Reconductor / Rebuild Raphael Road - Northeast 230 kV lines. Reconductor / Rebuild Northeast to General Motors 115 kV lines.

kV Level: 115/230 kV

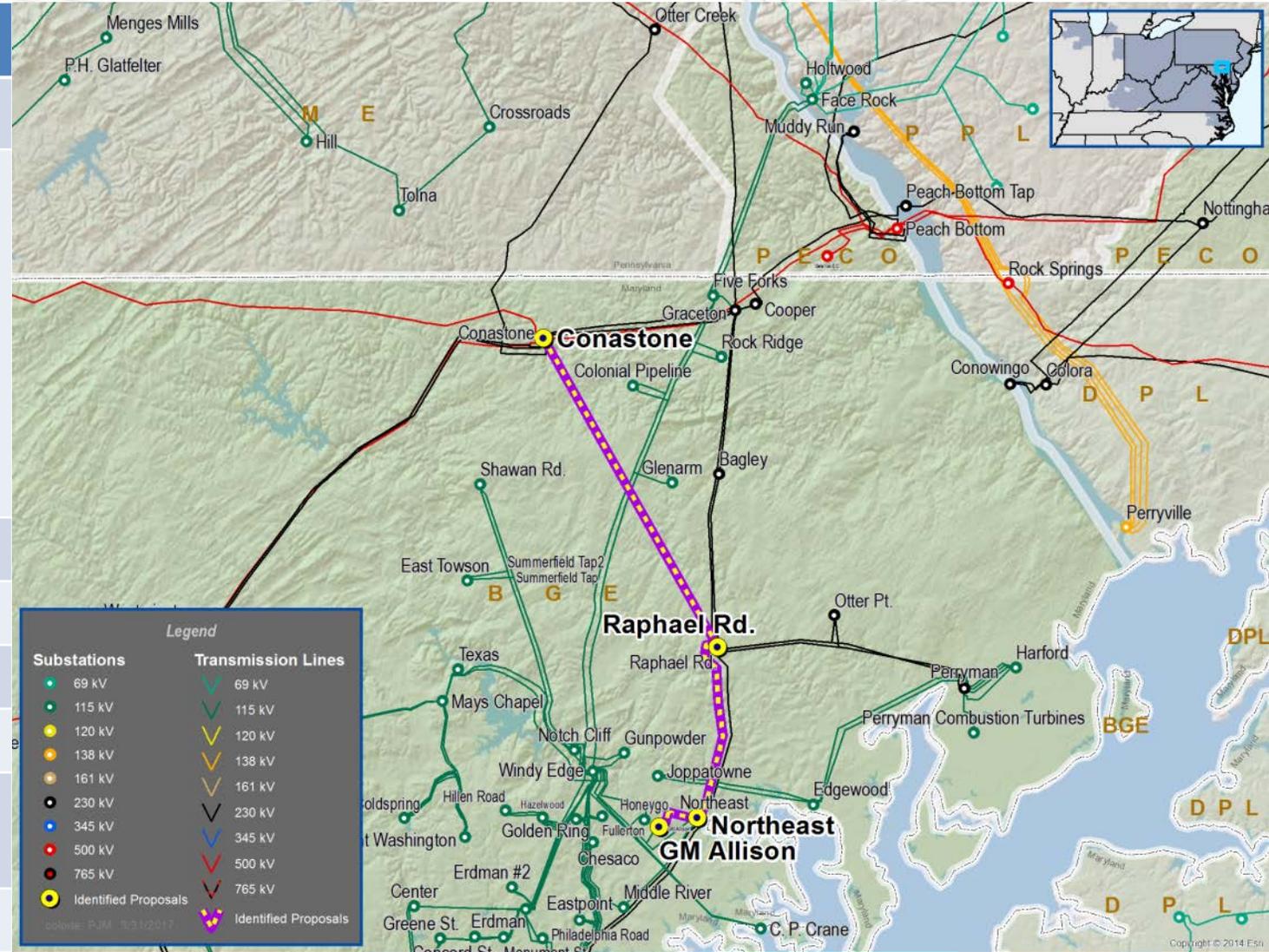
In-Service Cost (\$M): \$87.2

In-Service Date: 2021

Target Zone: BGE

ME Constraints:
 CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-16E

Proposed by: PSEG

Proposed Solution: Greenfield
 Build a new Peach Bottom - Northeast 230 kV line.
 Reconductor / Rebuild Northeast to General Motors 115 kV lines.

kV Level: 115/230 kV

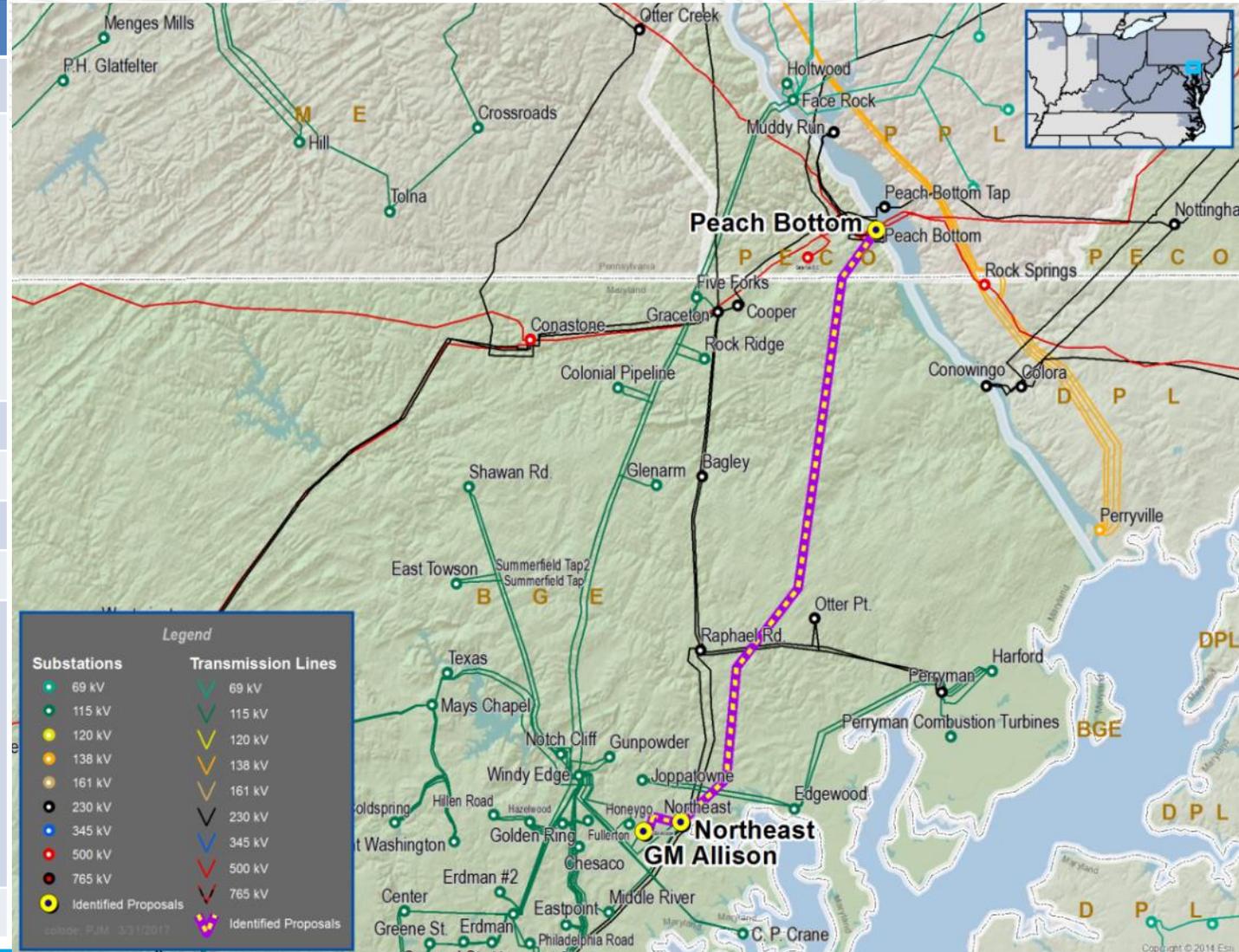
In-Service Cost (\$M): \$109.3

In-Service Date: 2021

Target Zone: BGE

ME Constraints:
 CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-18A

Proposed by: Northeast Transmission Development

Proposed Solution: Greenfield

Tap the Peach Bottom - Delta Power Plant (York) 500 kV line and build a new 500/230 kV substation (Robinson Run). Build a new Robinson Run - Graceton 230 kV double circuit line. Upgrade the Graceton - Bagley - Raphael Road double circuit 230 kV lines. Rebuild the Raphael Road - Northeast 230 kV double circuit lines. Upgrade the Rock Ridge to Windy Edge 115 kV lines. Tap the Raphael Road - Northeast 230 kV lines and build a new 230/115 kV substation (Pumpkin Run). Loop in the Crane - Windy Edge 115 kV lines.

kV Level: 115/230/500 kV

In-Service Cost (\$M): \$126.2

In-Service Date: 2021

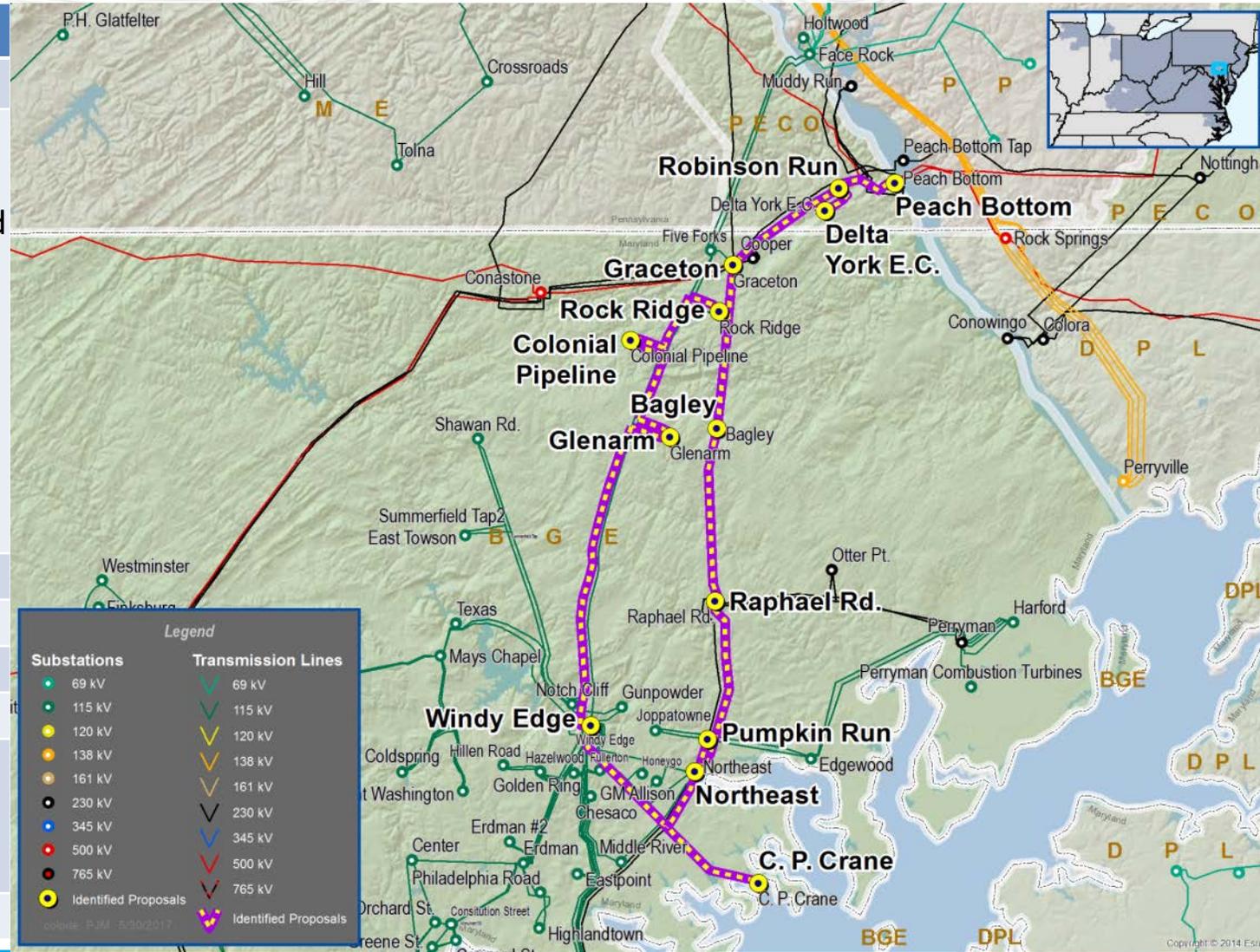
Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

CONASTONE - PEACH BOTTOM 500 kV

Notes:



Project ID: 201617_1-18B

Proposed by: Northeast Transmission Development

Proposed Solution: Greenfield

Tap the Peach Bottom - Three Mile Island 500 kV line and build a new 500/230 kV substation (Bookers Run). Build a new Bookers Run - Graceton 230 kV double circuit line.

Upgrade the Graceton - Bagley - Raphael Road double circuit 230 kV lines. Rebuild the Raphael Road - Northeast 230 kV double circuit lines. Rebuild Five Forks - Rock Ridge 115 kV lines. Upgrade the Rock Ridge to Windy Edge 115 kV lines.

kV Level: 115/230/500 kV

In-Service Cost (\$M): \$132.8

In-Service Date: 2021

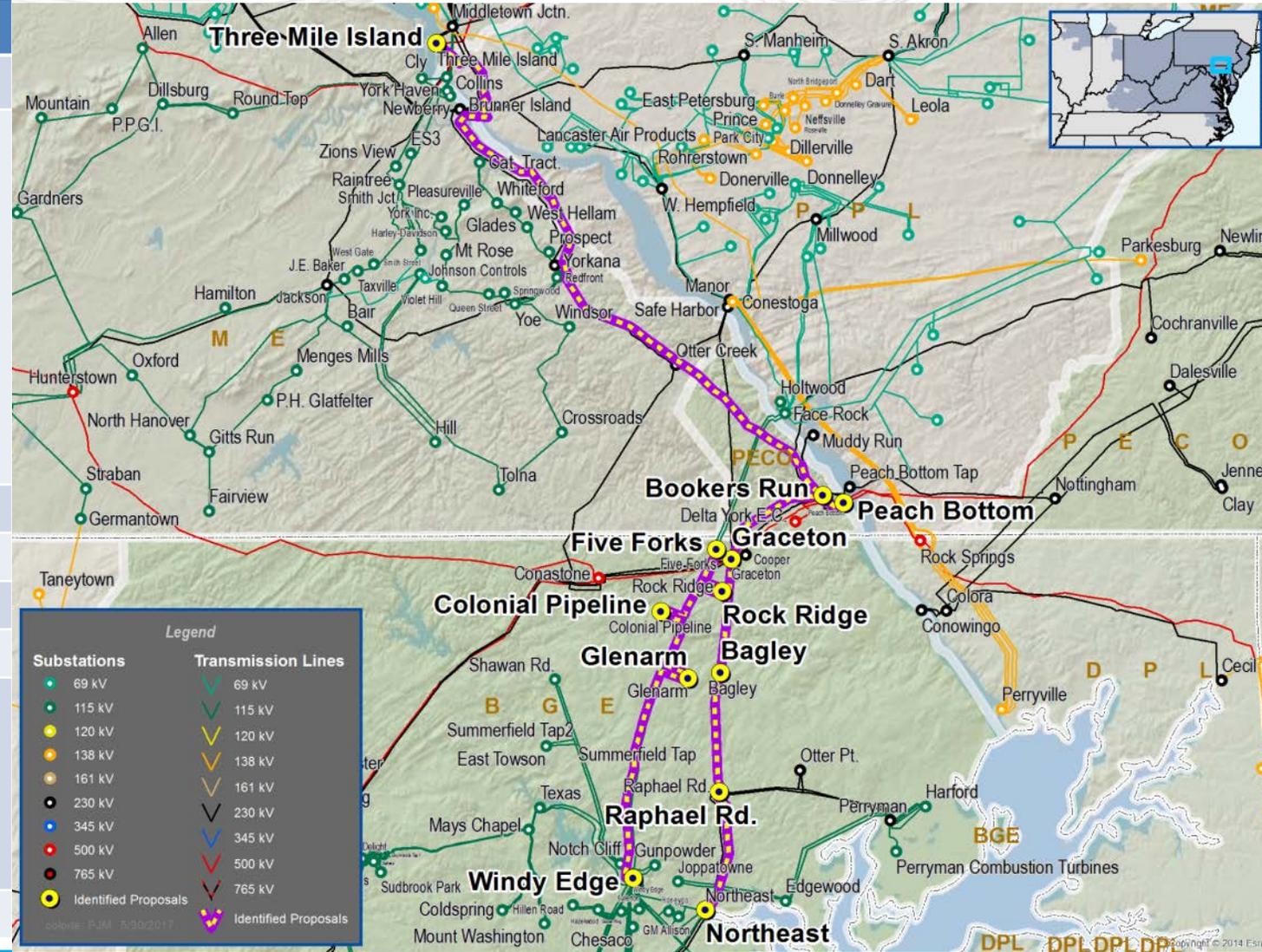
Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

CONASTONE - PEACH BOTTOM 500 kV

Notes:



Project ID: 201617_1-18C

Proposed by: Northeast Transmission Development

Proposed Solution: Greenfield
 Tap the Peach Bottom - Delta Power Plant (York) 500 kV line and build a new 500/230 kV substation (Robinson Run). Build a new Robinson Run - Otter Point 230kV double circuit line. Rebuild the Raphael Road - Northeast 230 kV double circuit lines.

kV Level: 230/500 kV

In-Service Cost (\$M): \$149.9

In-Service Date: 2021

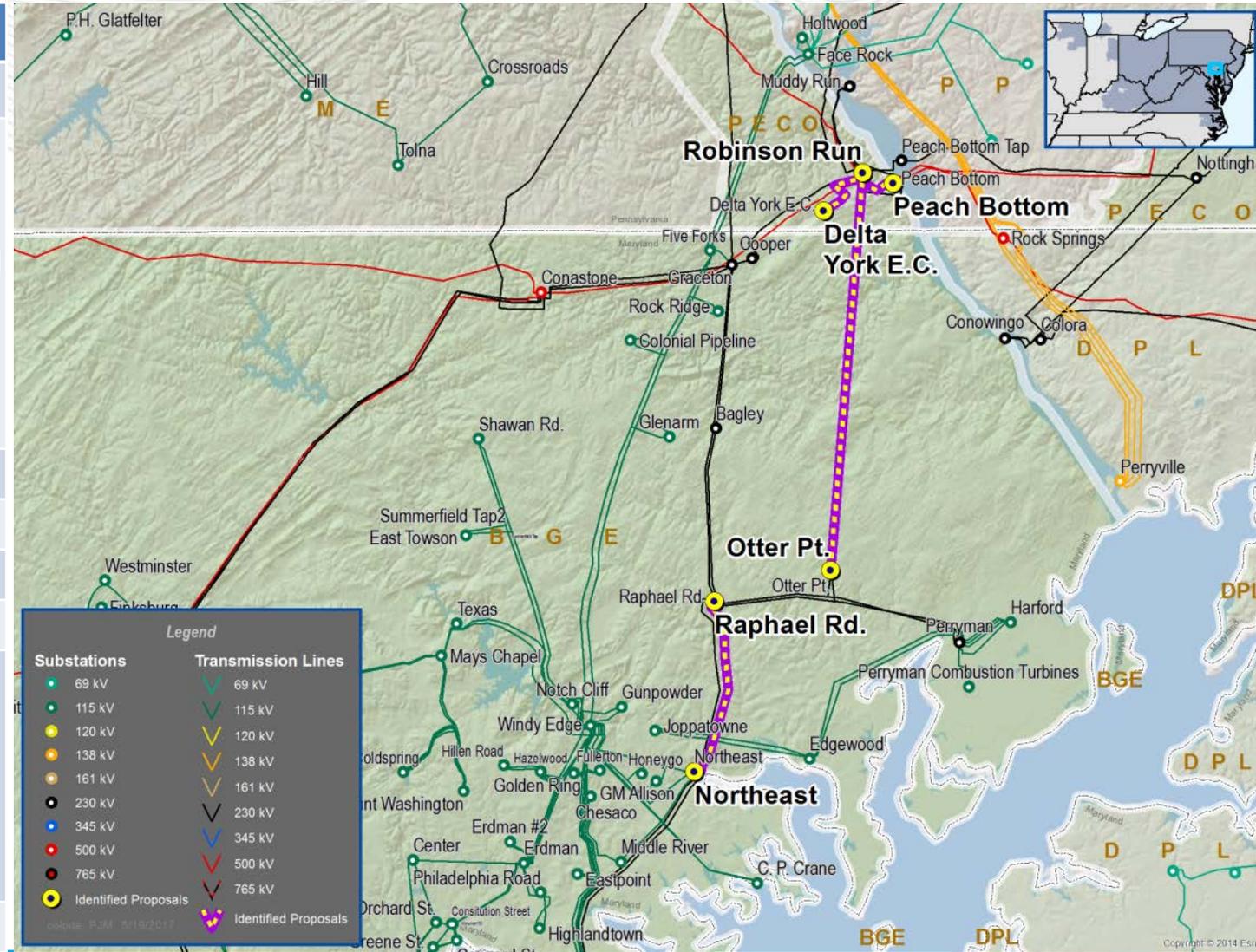
Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

CONASTONE - PEACH BOTTOM 500 kV

Notes:



Project ID: 201617_1-18D

Proposed by: Northeast Transmission Development

Proposed Solution: Greenfield

Tap the Peach Bottom - Rock Springs 500 kV line and build a new 500/230 kV substation (Slate). Build a new Slate - Otter Point 230 kV double circuit line. Rebuild the Raphael Road - Northeast 230 kV double circuit lines. Tap the Raphael Road - Northeast 230 kV lines and build a new 230/115 kV substation (Pumpkin Run). Loop in the Crane - Windy Edge 115 kV lines.

kV Level: 115/230/500 kV

In-Service Cost (\$M): \$166

In-Service Date: 2021

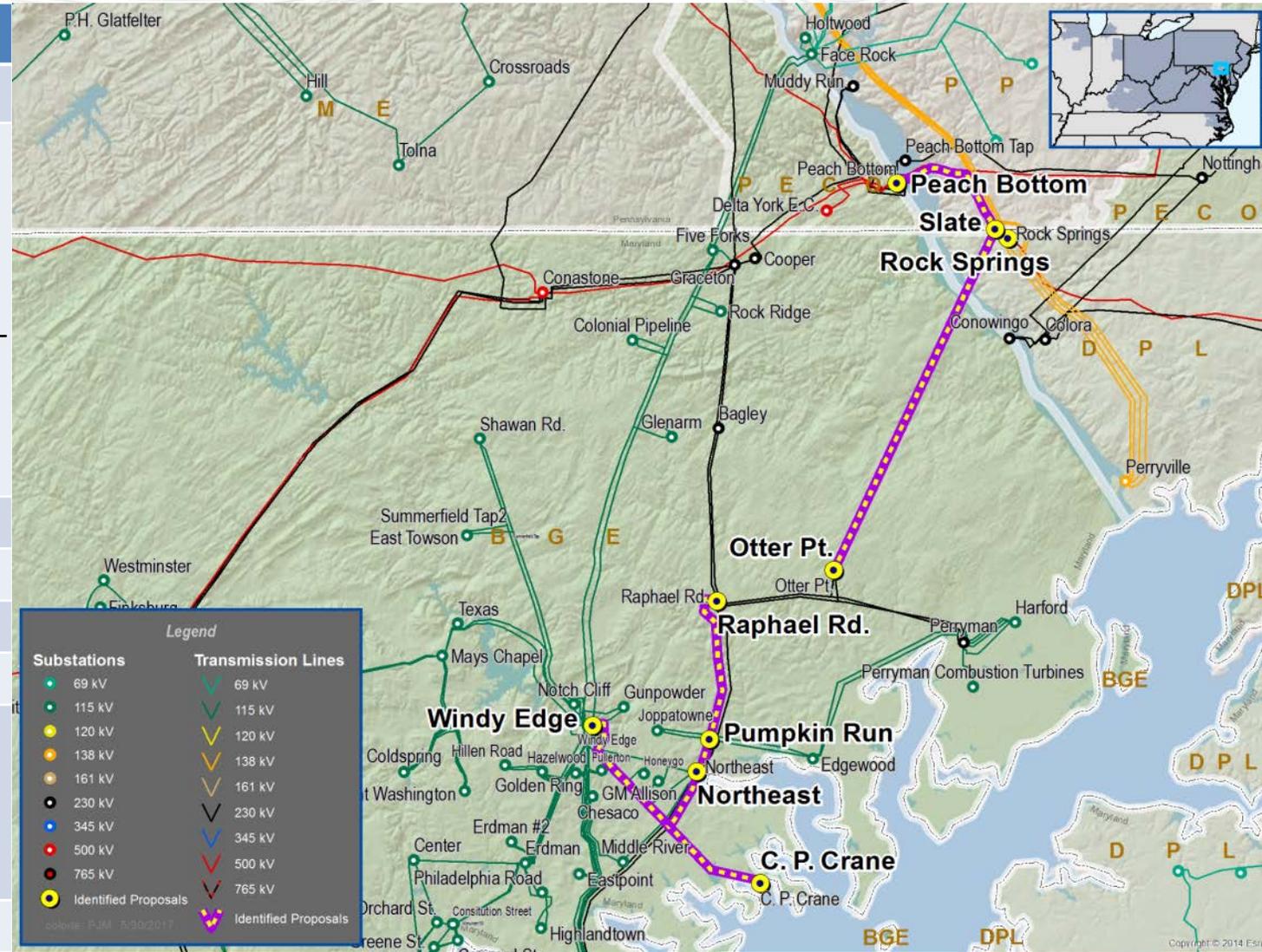
Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

CONASTONE - PEACH BOTTOM 500 kV

Notes:



Project ID: 201617_1-18E

Proposed by: Northeast Transmission Development

Proposed Solution: Greenfield
 Tap the Peach Bottom - Rock Springs 500 kV line and build a new 500/230 kV substation (Slate). Build a new Slate - Otter Point 230kV double circuit line. Rebuild the Raphael Road - Northeast 230 kV double circuit lines. Upgrade the Rock Ridge to Windy Edge 115 kV lines.

kV Level: 115/230/500 kV

In-Service Cost (\$M): \$152.9

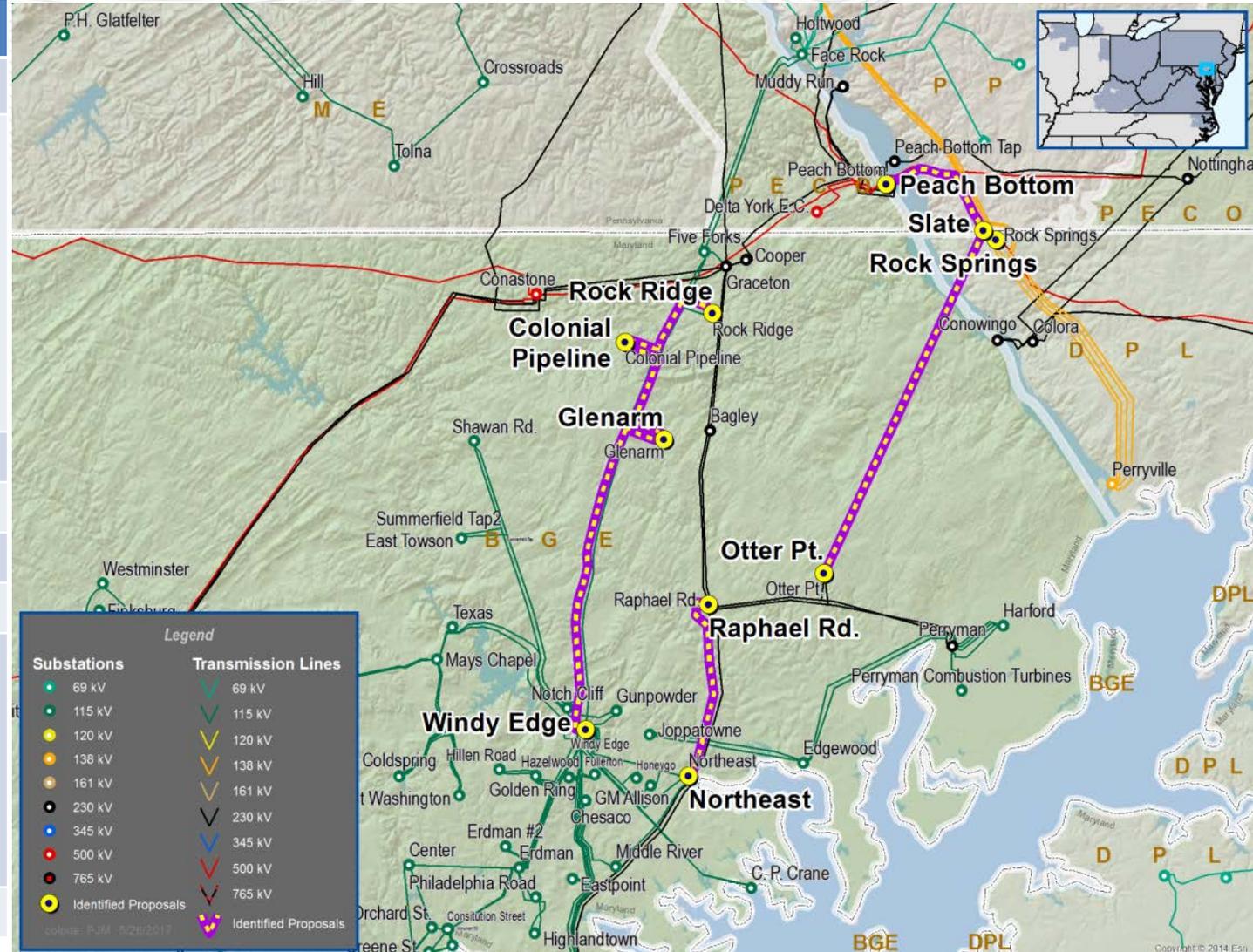
In-Service Date: 2021

Target Zone: BGE

ME Constraints:

- CONASTONE - GRACETON - BAGLEY 230 kV
- CONASTONE - PEACH BOTTOM 500 kV

Notes:



Project ID: 201617_1-18F

Proposed by: Northeast Transmission Development

Proposed Solution: Greenfield
 Build a new 230/115 kV substation (Fitzhugh Run). Build a new Conastone - Fitzhugh Run 230 kV double circuit line. Loop Shawan Road - Summerfield 115 kV lines and Windy Edge - Texas 115 kV lines into Fitzhugh Run substation. Upgrade the Graceton - Bagley - Raphael Road 230 kV double circuit line.

kV Level: 115/230 kV

In-Service Cost (\$M): \$95.3

In-Service Date: 2021

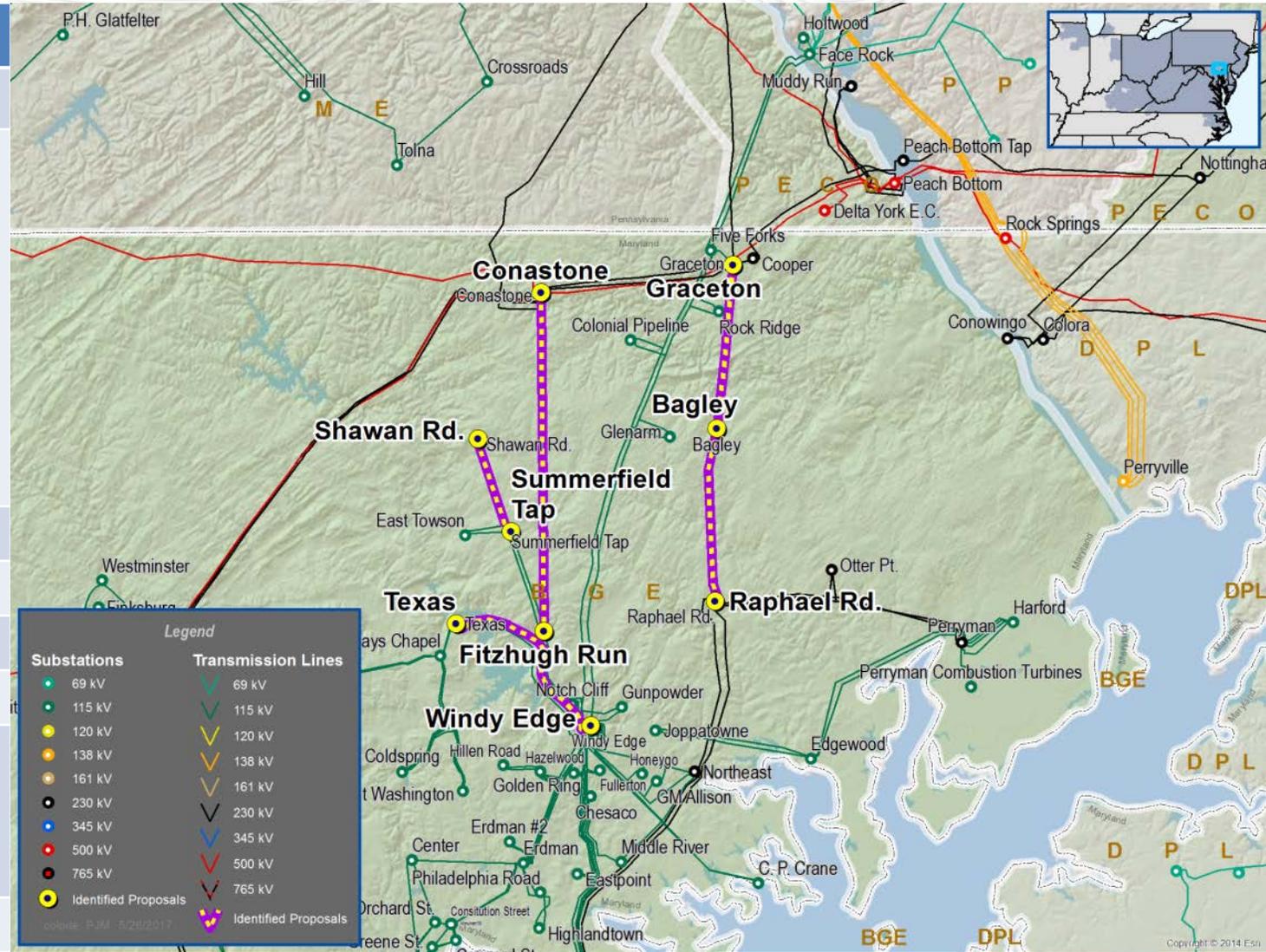
Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

CONASTONE - PEACH BOTTOM 500 kV

Notes:



Project ID: 201617_1-20A

Proposed by: ITC

Proposed Solution: Greenfield
 Tap the Raphael Road - Otter Point 230 kV line and build a new 230 kV switchyard (Old Post). Build a new Peach Bottom - Old Post 230 kV line.

kV Level: 230 kV

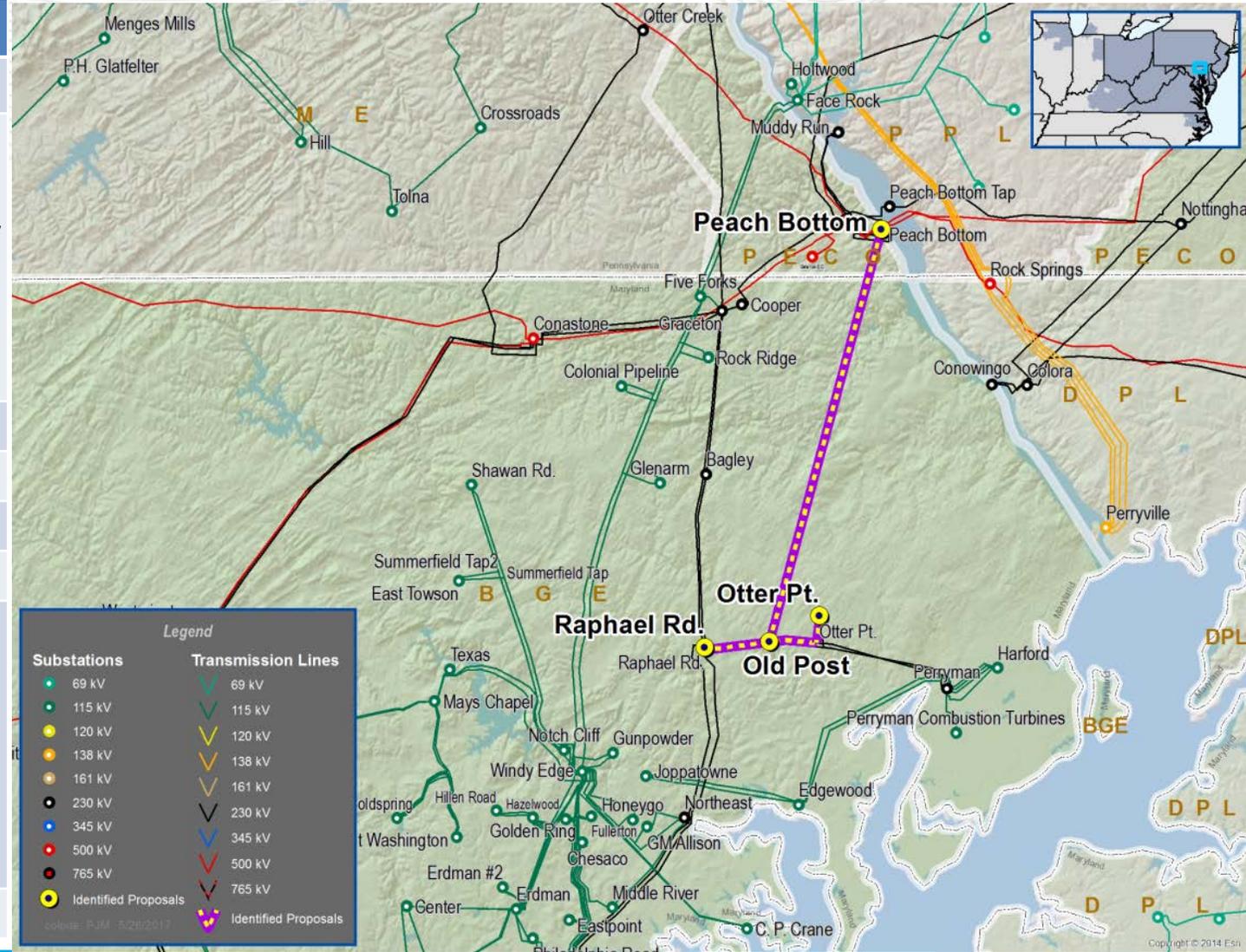
In-Service Cost (\$M): \$73.60

In-Service Date: 2021

Target Zone: BGE

ME Constraints:
 CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-20B

Proposed by: ITC

Proposed Solution: Greenfield
Build a new Conastone - Raphael Road 230 kV line.

kV Level: 230 kV

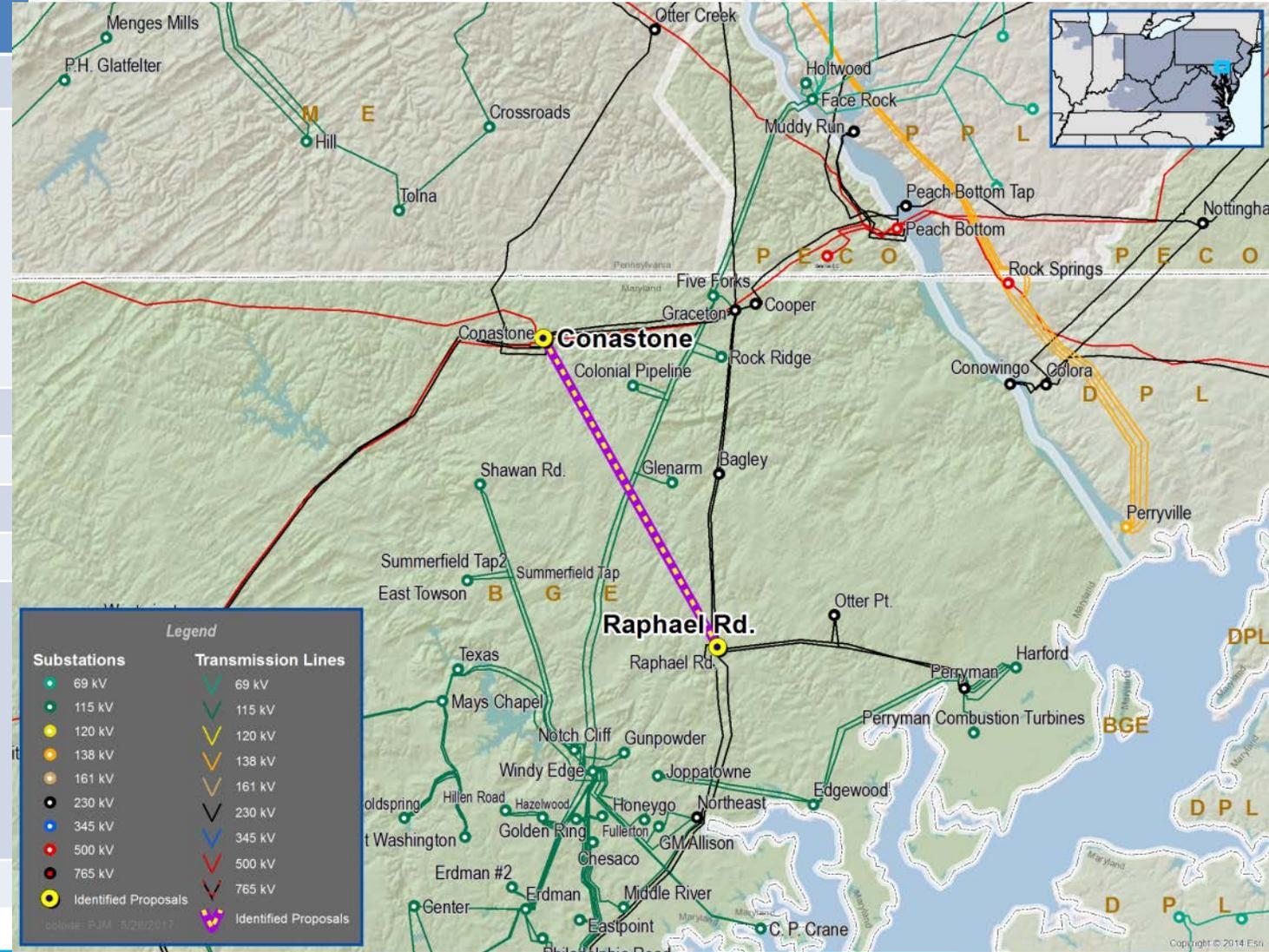
In-Service Cost (\$M): \$63.00

In-Service Date: 2021

Target Zone: BGE

ME Constraints:
CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-20C

Proposed by: ITC

Proposed Solution: Greenfield
Build a new Conastone - Northeast 230 kV line.

kV Level: 230 kV

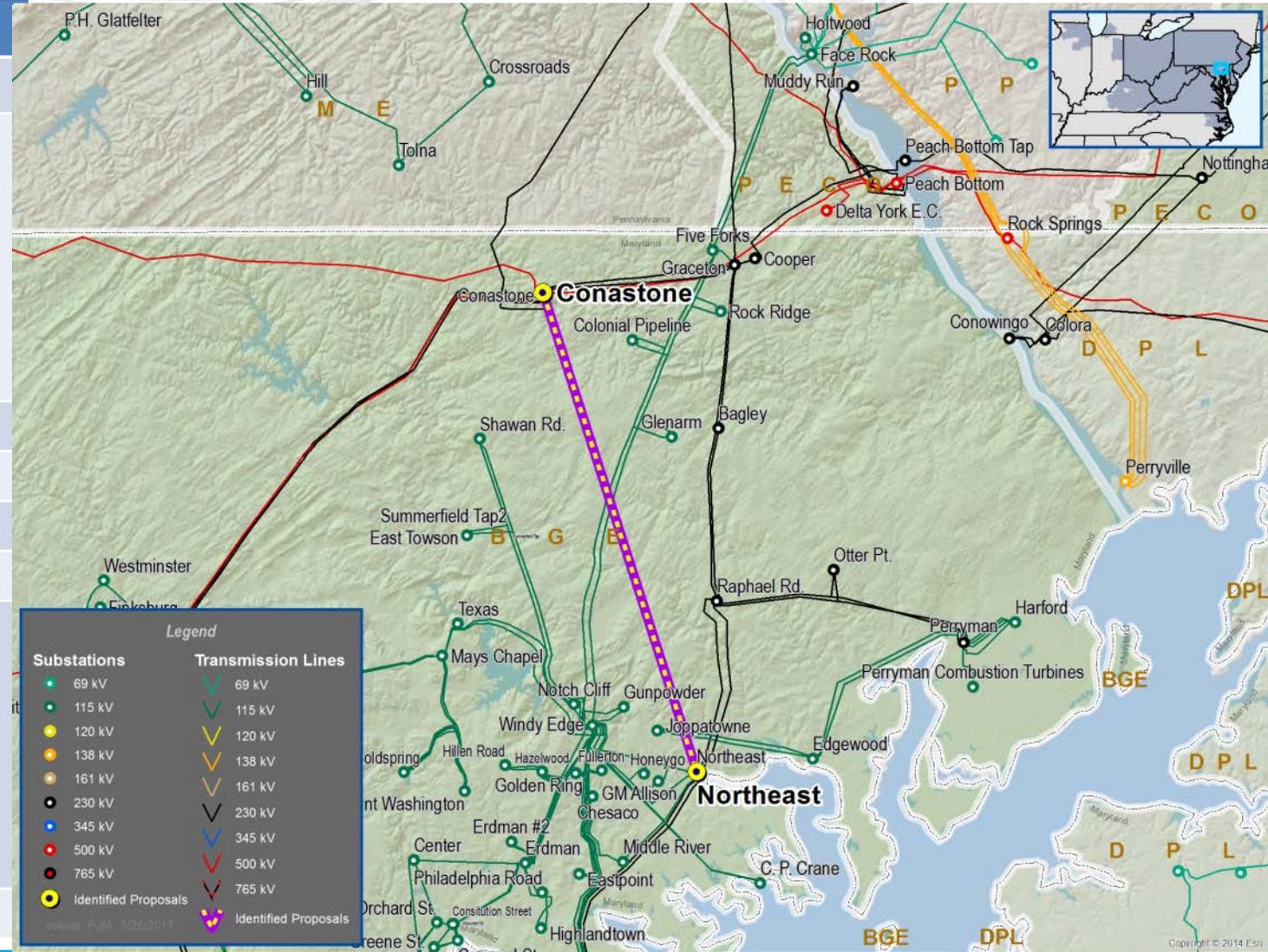
In-Service Cost (\$M): \$135.78

In-Service Date: 2021

Target Zone: BGE

ME Constraints:
CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-20D

Proposed by: ITC

Proposed Solution: Greenfield

Tap the Raphael Road - Otter Point 230 kV line and build a new 230 kV switchyard (Old Post). Build a new Conastone - Old Post 230 kV line.

kV Level: 230 kV

In-Service Cost (\$M): \$75.89

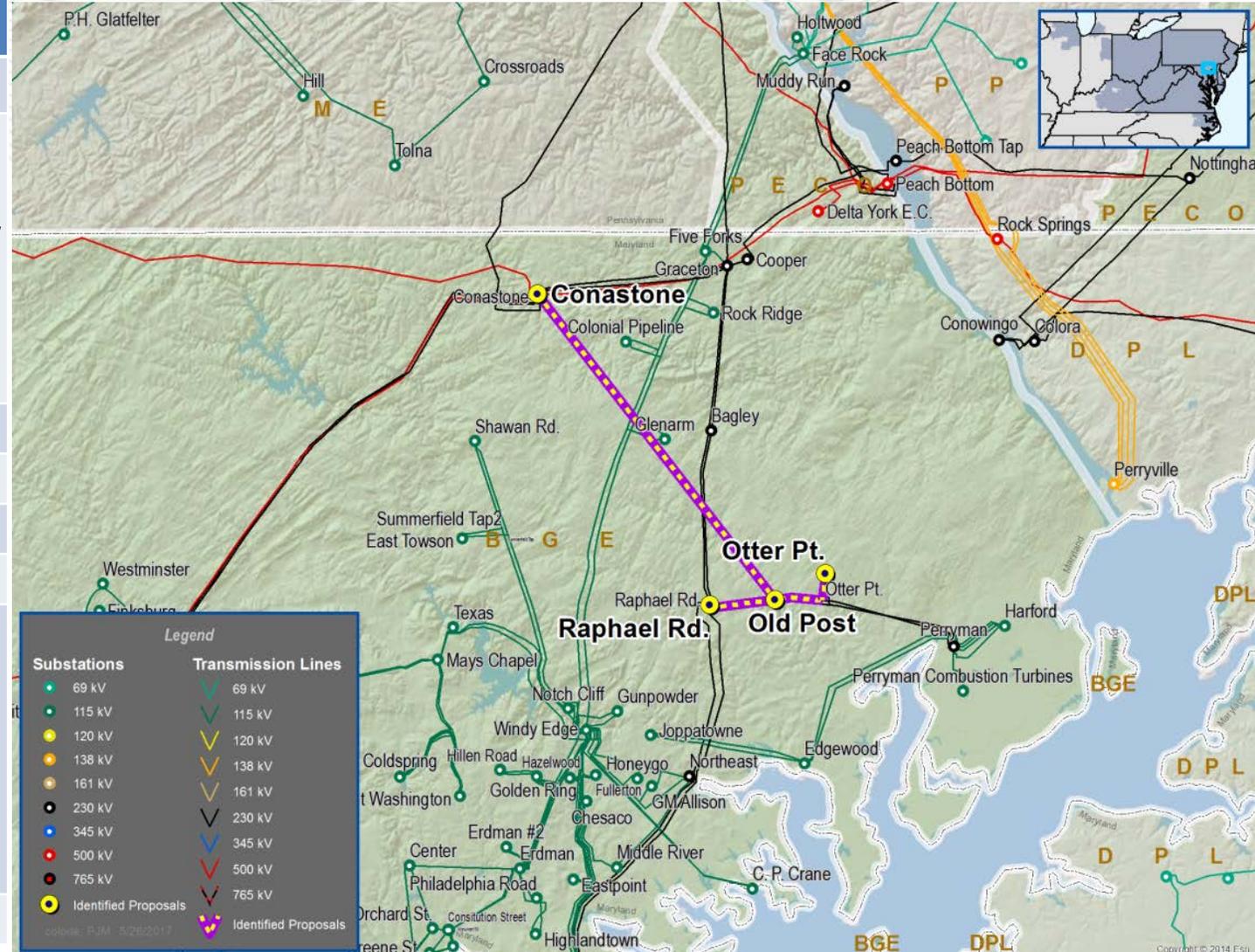
In-Service Date: 2021

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-20E

Proposed by: ITC

Proposed Solution: Greenfield

Tap the Graceton - Bagley 230 kV line and build a new 230 kV switchyard (Fallston Road). Tap the Raphael Road - Otter Point 230 kV line and build a new 230 kV switchyard (Old Post). Build a new 230 kV switchyard (Pyle Road). Build a new Peach Bottom - Pyle Road 230 kV line, a new Pyle Road - Fallston Road 230kV line and a new Pyle Road - Old Post 230 kV line.

kV Level: 230 kV

In-Service Cost (\$M): \$132.24

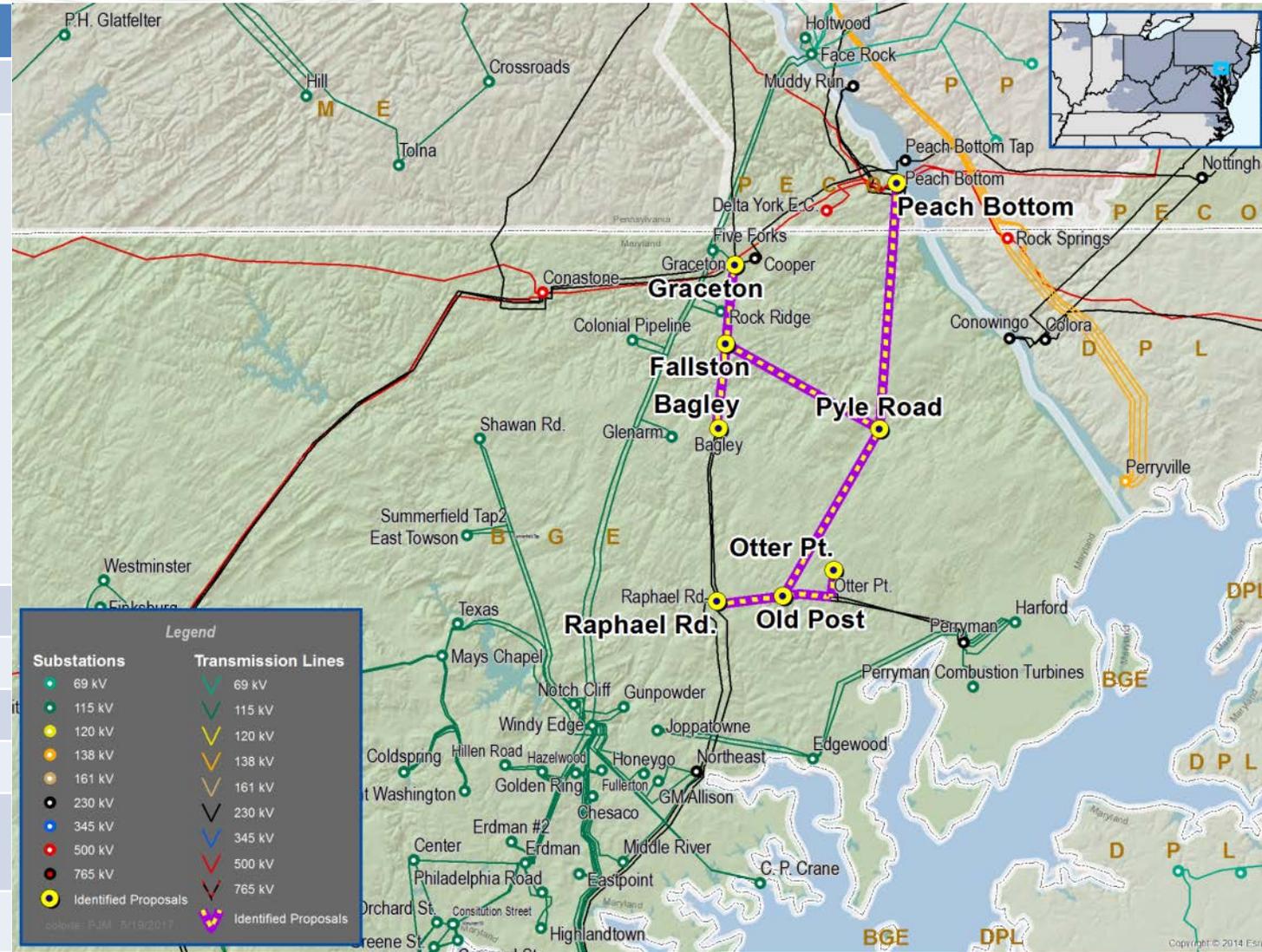
In-Service Date: 2021

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-20F

Proposed by: ITC

Proposed Solution: Greenfield

Tap the Graceton - Bagley 230 kV line and build a new 230 kV switchyard (Fallston Road). Tap the Raphael Road - Otter Point 230 kV line and build a new 230 kV switchyard (Old Post). Build a new 230 kV switchyard (Pyle Road). Build a new Conastone - Pyle Road 230 kV line, a new Pyle Road – Fallston Road 230 kV line and a new Pyle Road – Old Post 230 kV line.

kV Level: 230 kV

In-Service Cost (\$M): \$125.99

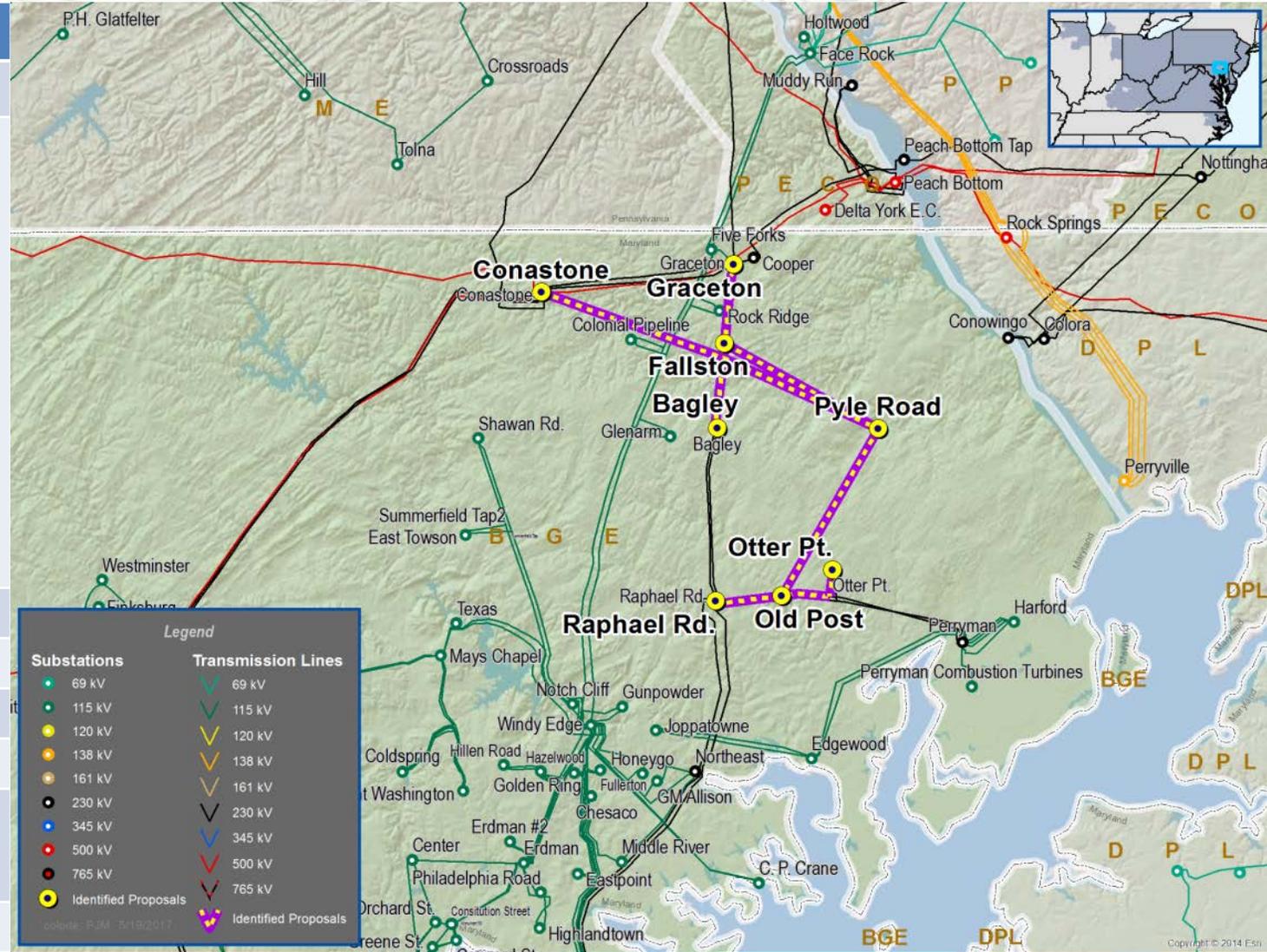
In-Service Date: 2021

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-20G

Proposed by: ITC

Proposed Solution: Greenfield
Build a new Peach Bottom - Northeast 230 kV line.

kV Level: 230 kV

In-Service Cost (\$M): \$151.51

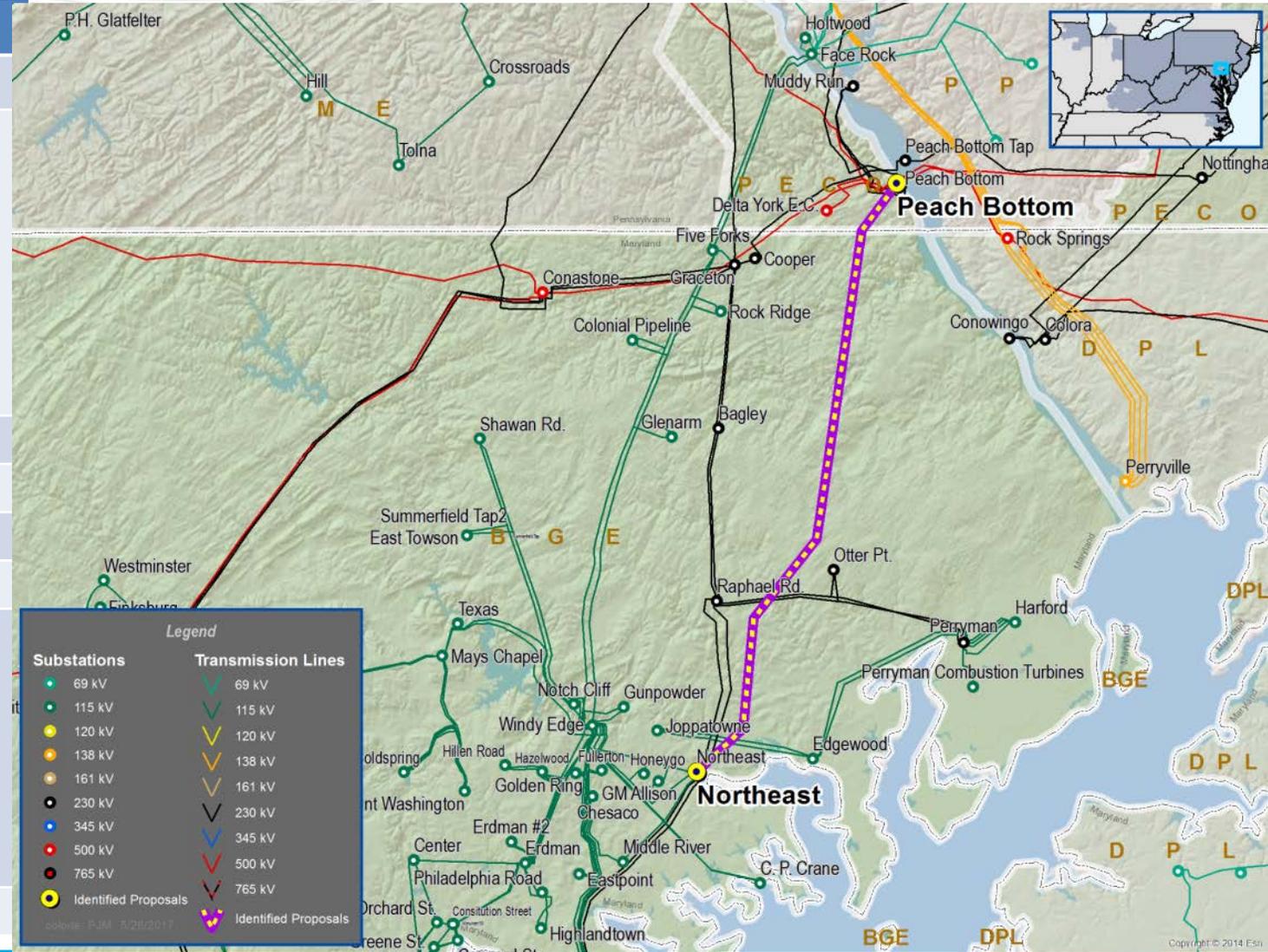
In-Service Date: 2021

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-20H

Proposed by: ITC

Proposed Solution: Greenfield
 Tap the Raphael Road - Otter Point 230 kV line and build a new 230 kV switchyard (Old Post). Build a new Peach Bottom - Old Post 230 kV line. Install a transmission battery energy storage system at the Old Post 230 kV switchyard.

kV Level: 230 kV

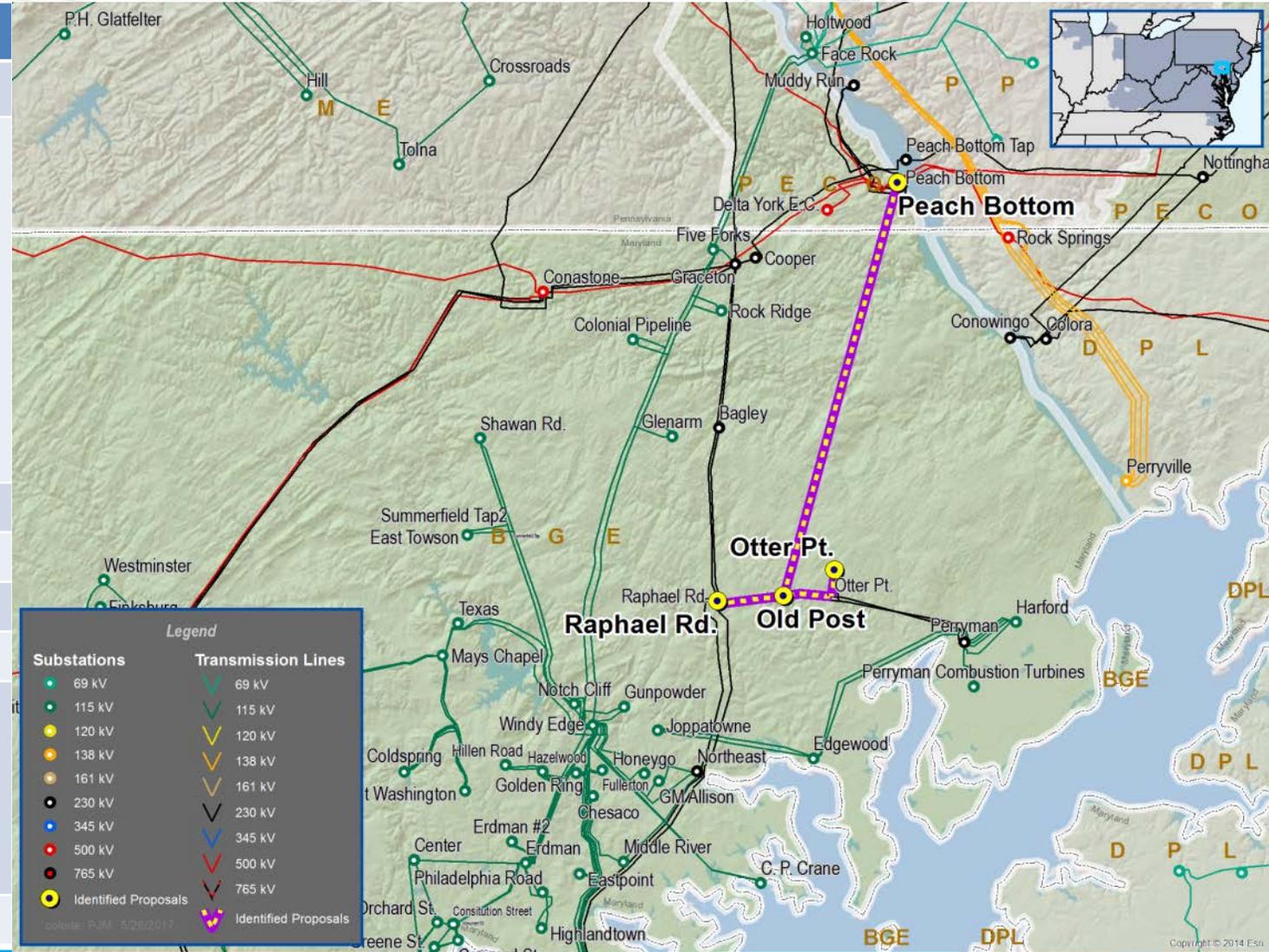
In-Service Cost (\$M): \$107.46

In-Service Date: 2021

Target Zone: BGE

ME Constraints:
 CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



Project ID: 201617_1-201

Proposed by: ITC

Proposed Solution: Greenfield

Tap the Graceton - Bagley 230 kV line and build a new 230 kV switchyard (Fallston Road). Tap the Raphael Road - Otter Point 230 kV line and build a new 230 kV switchyard (Old Post). Build a new 230 kV switchyard (Pyle Road). Build a new Peach Bottom - Pyle Road 230 kV line, a new Pyle Road - Fallston Road 230 kV line and a new Pyle Road - Old Post 230 kV line. Install a transmission battery energy storage system at the Fallston Road 230 kV switchyard.

kV Level: 230 kV

In-Service Cost (\$M): \$165.74

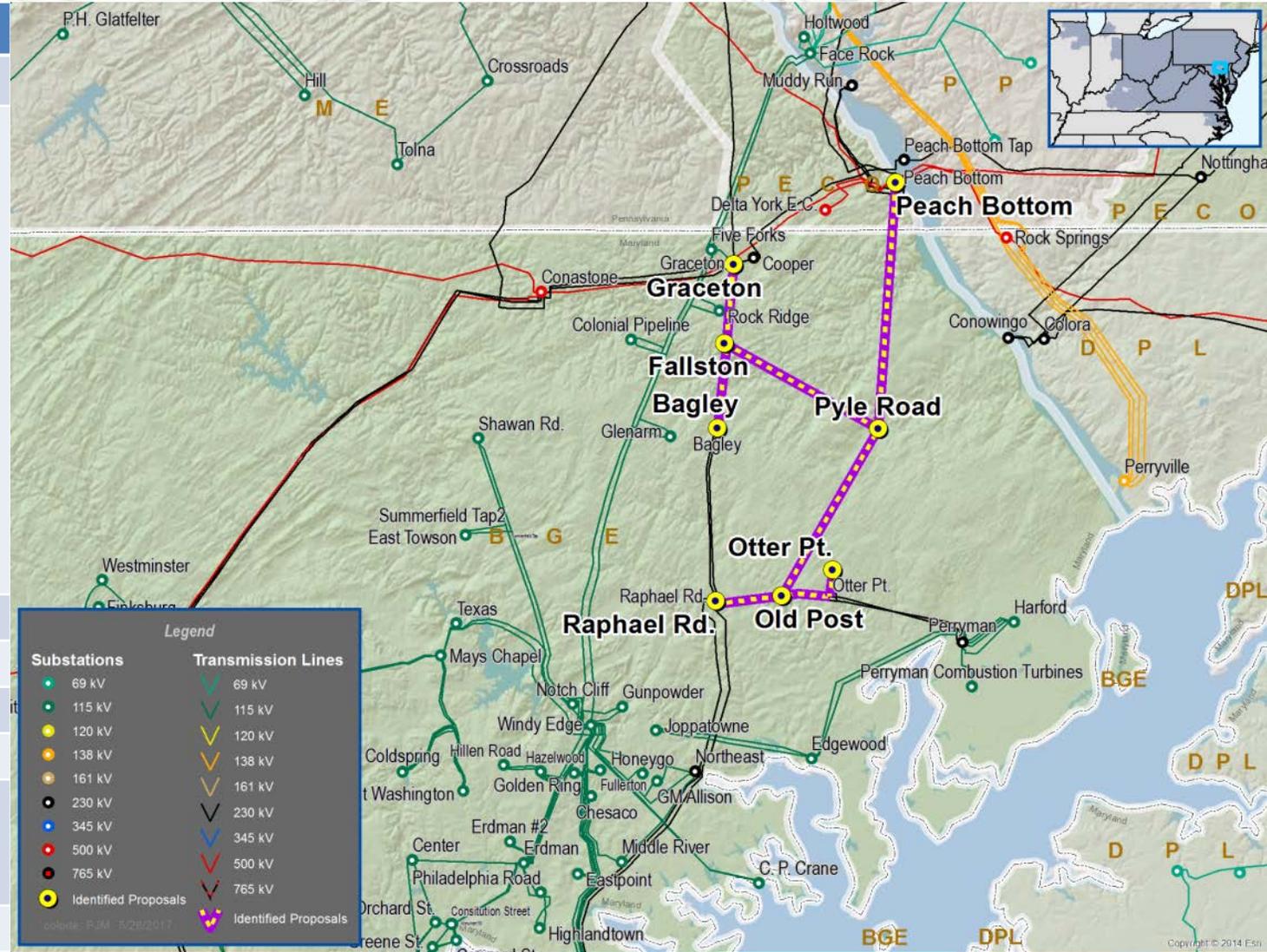
In-Service Date: 2021

Target Zone: BGE

ME Constraints:

CONASTONE - GRACETON - BAGLEY 230 kV

Notes:



- Revision History
 - V1 – 11/XX/2017 – Original Version Posted to PJM.com
 - V2 – 11/09/2017 – Slide 8 – Added \$M to all costs.
 - V2 – 11/09/2017 – Slide 17 – Added more details to column descriptions.
 - V2 – 11/09/2017 – Slide 26 – Updated with “project 13G analysis in progress”.