Market Efficiency Update

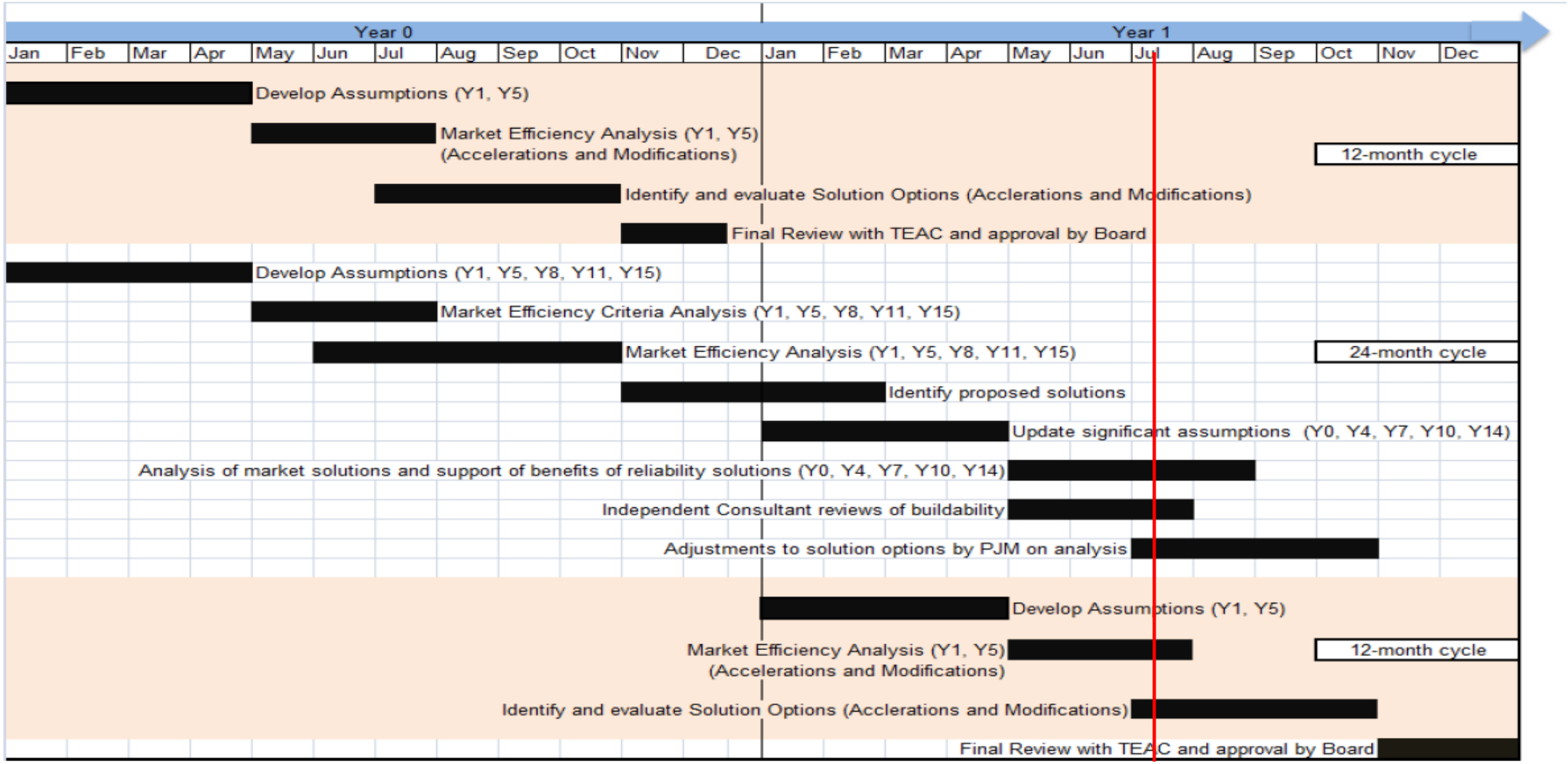
Transmission Expansion Advisory Committee

July 13, 2017

Agenda

- Where we are in the process
- Interregional Projects Status
- RPM Projects Status
- Reevaluation Analysis Status
- Next Steps

Where we are - Market Efficiency Timeline



2016-2017 Window - Overview

- Market Efficiency Base Case Mid-Cycle Update completed and posted

- Analysis of proposed solutions: July 2017 - Oct 2017 (in-progress)
  - Interregional and RPM Projects to be presented at August 2017 TEAC
  - PPL projects will be analyzed next
  - BGE projects will be analyzed after PPL
  - Any high-value low-risk* type projects maybe analyzed in parallel with the above
  - All other regional projects will be analyzed last

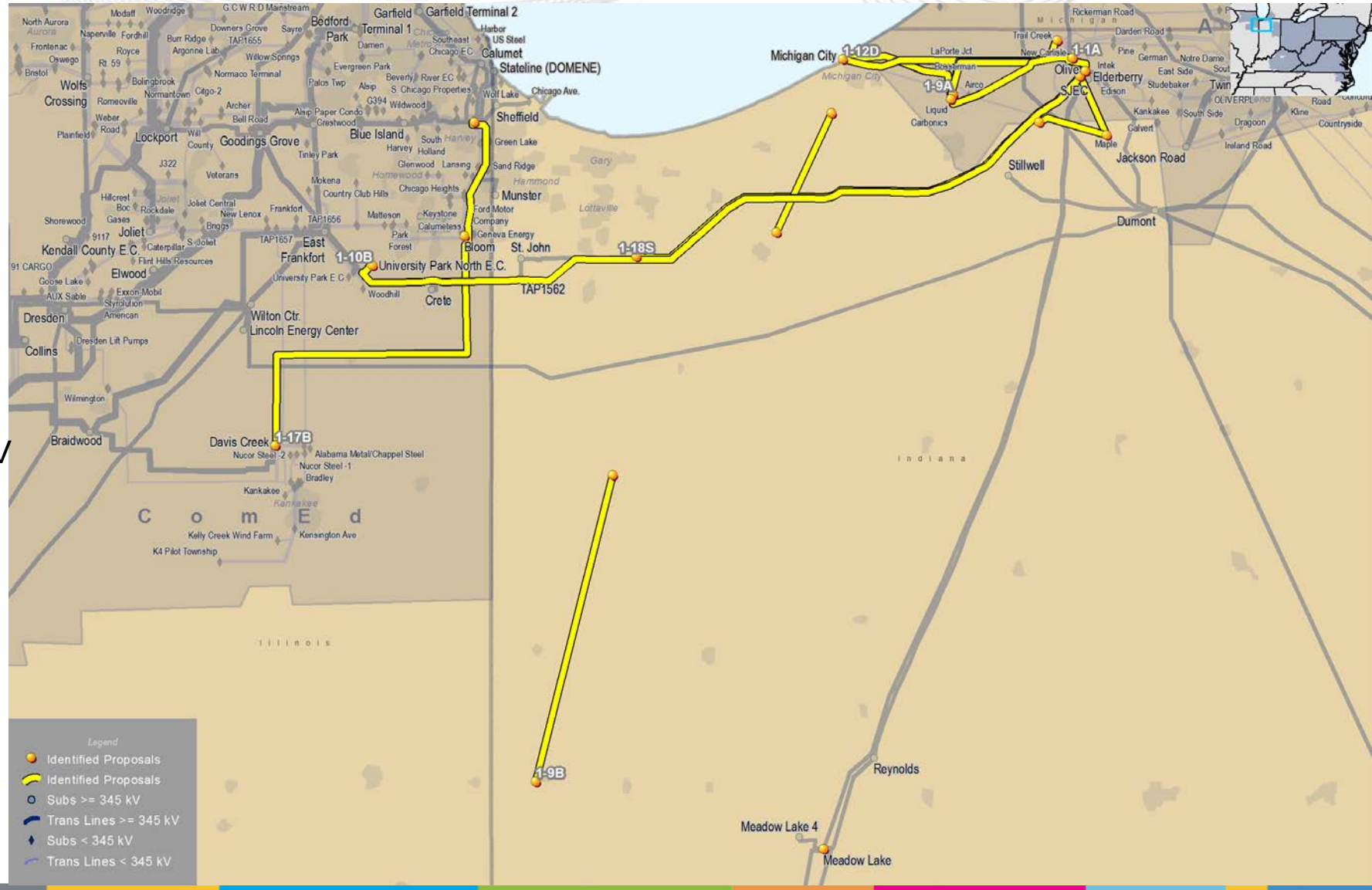
- Target determination of final projects: Dec 2017
  - Interregional, RPM, PPL and high-value low-risk projects to be recommended at Oct, 2017 Board meeting
  - BGE and other projects to be recommended at Dec, 2017 Board meeting

**High-value low-risk projects are generally classified as low cost upgrades, with significant B/C, and with minimum competition.*

Interregional Projects

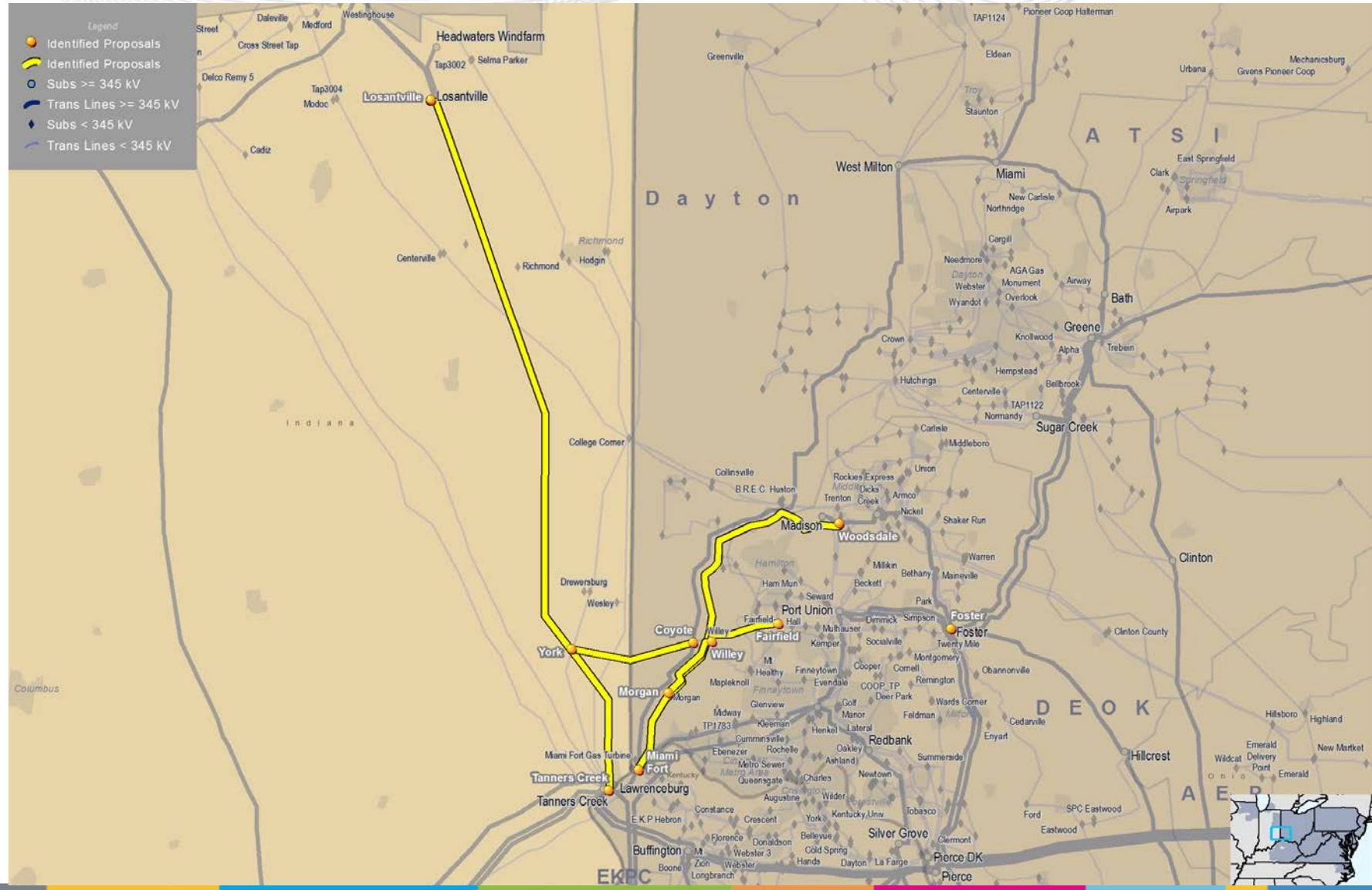
AEP/COMED/NIPSCO Interregional Proposals

- **7 Projects:**
  - 1-1A, 1-9A, 1-9B, 1-10B, 1-12D, 1-17B, 1-18S
- **Cost:**
  - From $1.00 M to $197.97 M
- **ME Constraints:**
  - BOSSERMAN - OLIVE 138 kV
  - PAXTON - GIFFORD 138 kV



DEOK Interregional

- **1 Project:**
  - 1-13H
- **Cost:**
  - $71.88 M
- **ME Constraint:**
  - TANNERS CREEK - MIAMI FORT 345 kV
- **2020/2021 RPM BRA Results**
  - DEOK LDA binding with Tanners Creek - Miami Fort 345KV as limiting CETL constraint



Interregional Evaluation Status

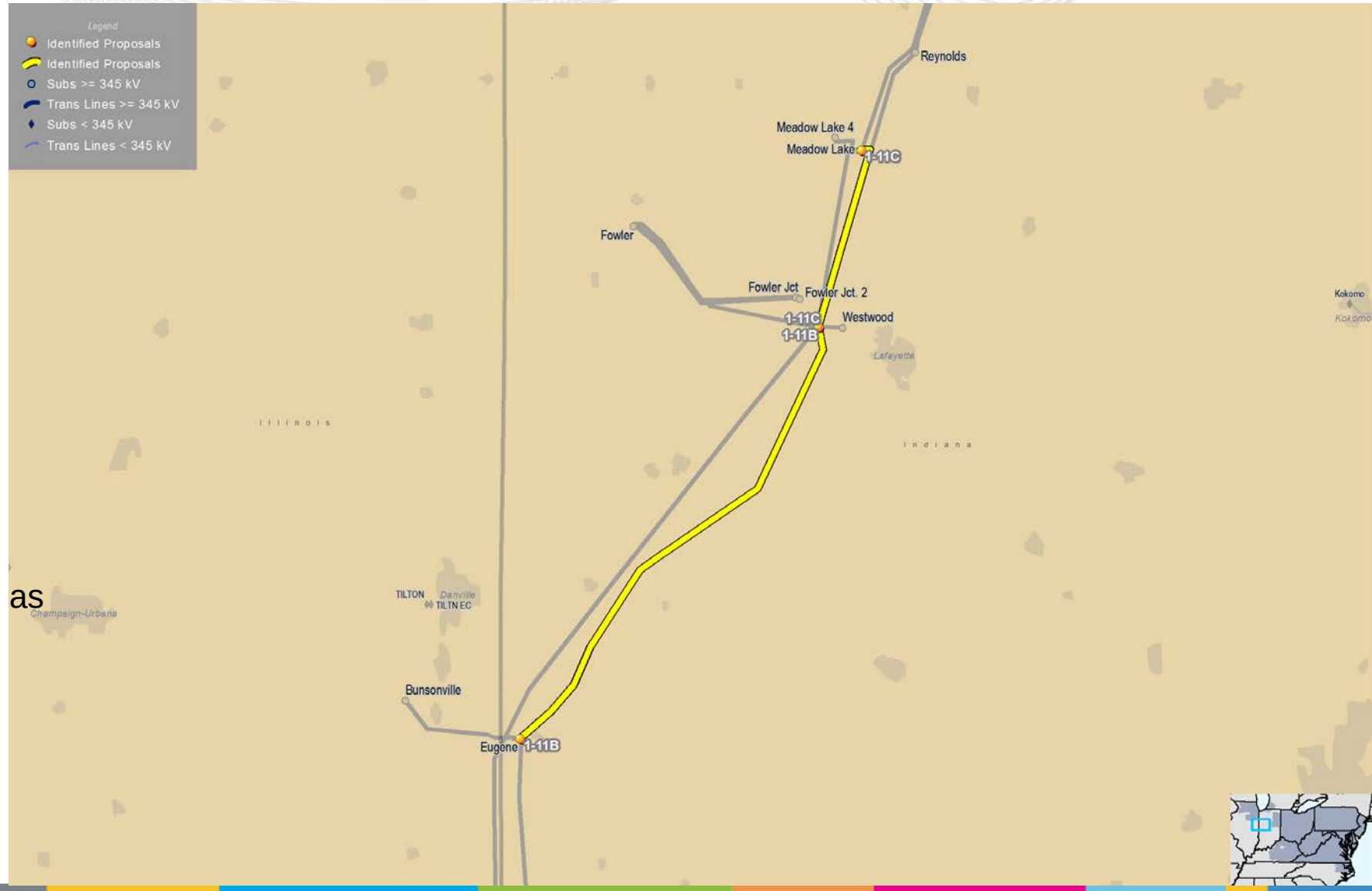
- Mid cycle update removed the interregional congestion driver “Olive – Bosserman”
  - There may be joint RTO benefits that may reveal opportunity for an interregional project
  - Analysis in progress (preliminary results show most of projects don’t pass the B/C threshold when cost is fully allocated to PJM)

- Next steps:
  - PJM to share its results with MISO and vice versa
  - RTOs jointly select the most beneficial project (if any)
  - Inform stakeholders of RTO findings

RPM Projects

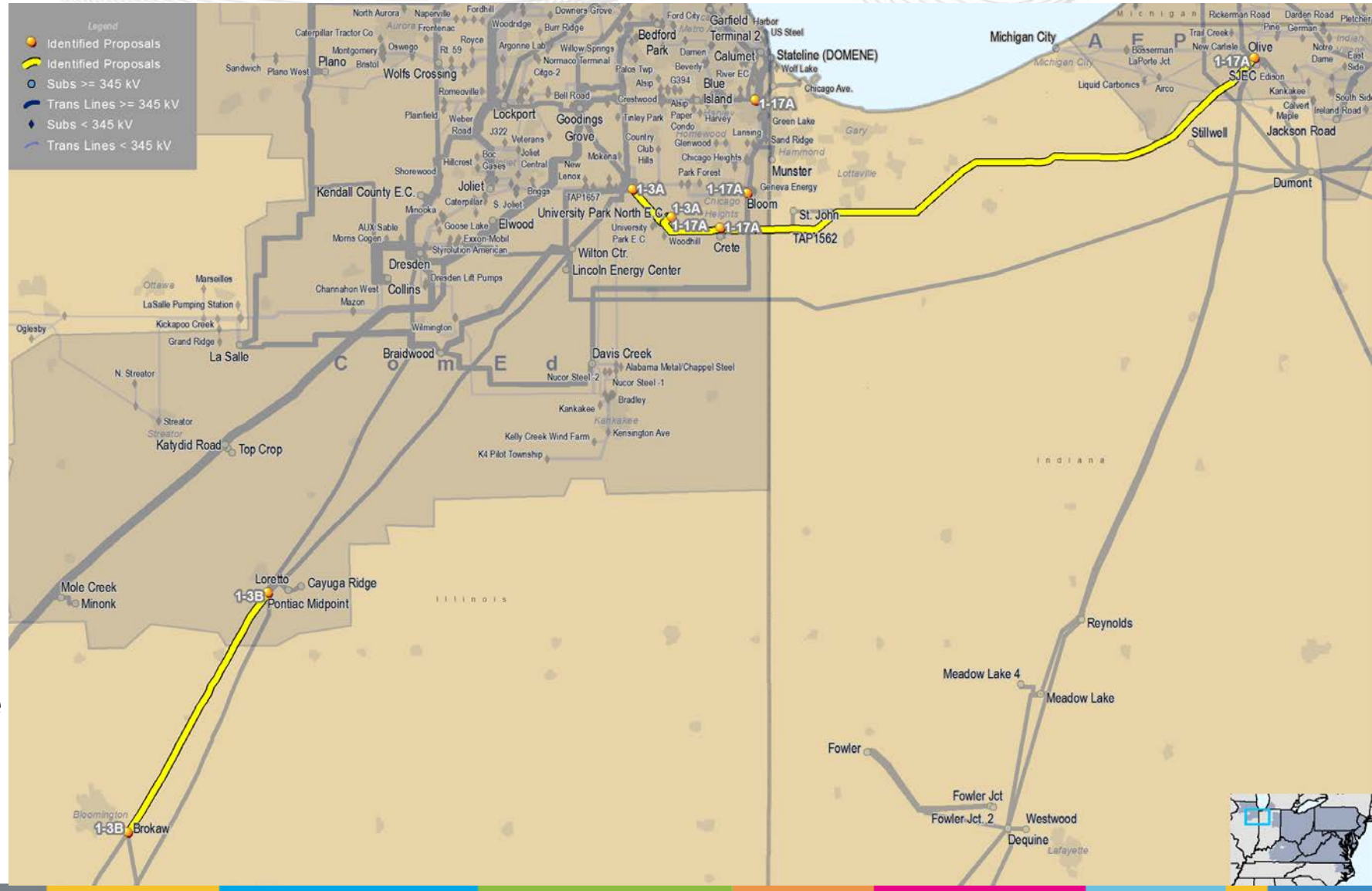
AEP (IN) RPM

- **2 Projects:**
  - 1-11B, 1-11C
- **Cost:**
  - $ 0 Cost
  - Will be included in base case
- **ME Constraints:**
  - EUGENE - DEQUIN 345 kV
  - DEQUIN - MEADOW 345 kV
- **2020/2021 RPM BRA Results**
  - COMED LDA binding with Eugene - Dequine 345 kV line as limiting CETL constraint
- **Note:**
  - These proposals are accelerations the previously approved baseline projects b2776 and b2777



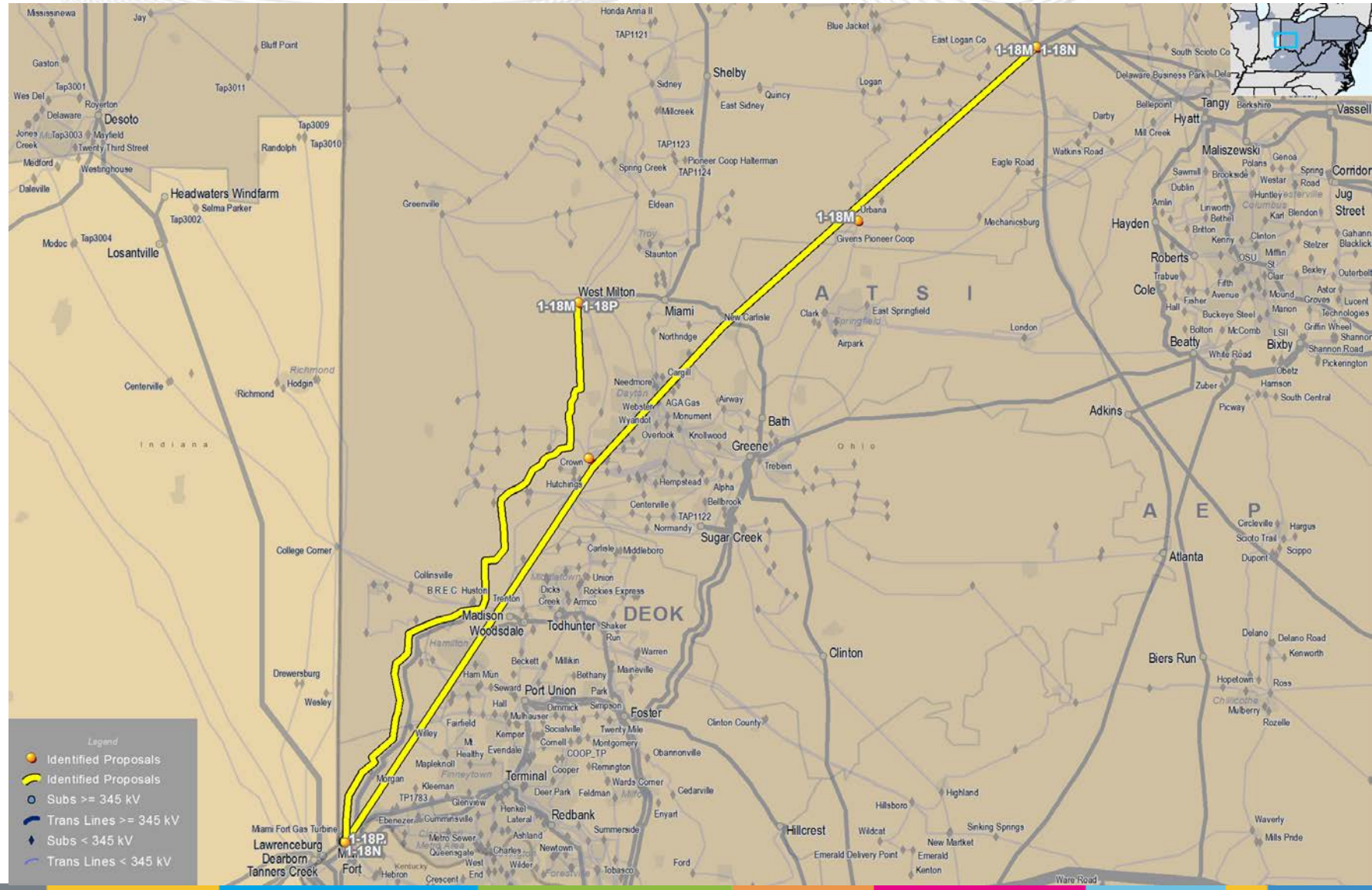
ComEd RPM

- **3 Projects:**
  - 1-3A, 1-3B, 1-17A
- **Cost:**
  - From $0.84 M to $66.90 M
- **RPM Constraints:**
  - E. FRANKFORT - UNIVERSITY PARK 345 kV
  - PONTIAC - BROKAW 345 kV
- **2020/2021 RPM BRA Results**
  - COMED LDA binding with Eugene - Dequine 345 kV line as limiting CETL constraint



Dayton RPM

- **3 Projects:**
  - 1-18M, 1-18N, 1-18P
- **Cost:**
  - From $19.70 M to $117.30 M
- **RPM Constraints:**
  - Dayton LDA RPM
- **No need for analysis**
  - Dayton LDA did not bind



RPM Evaluation Status

- PJM determined CETL impact of proposed projects (completed)
- PJM to run RPM Base Residual Auction model for multiple study years using updated CETL values (in-progress)
- PJM to determine RPM benefits (in-progress)

RPM Evaluation Process – CETL Analysis Results

Project ID	LDA Examined	Proposed Solution	Proposer	Cost Est ($M)	CETL Change	Comment
11B	ComEd	Accelerate the previously approved baseline project to reconductor the Dequine-Eugene 345 kV and substation work at Dequine.	AEP	$0.00	1,253	11B & 11C studied together
11C	ComEd	Accelerate the previously approved baseline project to reconductor the Dequin	AEP	$0.00	1,253	
3A	ComEd	Upgrade capacity on E. Frankfort - University Park 345 kV line.	Comed	$0.84	772	Next limit is voltage collapse
3B	ComEd	Upgrade substation equipment at Pontiac Midpoint station to increase capacity on Pontiac-Brokaw 345 kV line.	Comed	$5.62	339	
17A	ComEd	Build a new 345 kV switchyard (Cottage Grove). Loop in the University Park North EC - Olive 345 kV line, Crete - St. John 345 kV line, Davis Creek - Bloom 345 kV line and Davis Creek - Burnham 345 kV line. Substation upgrades at Bloom and Burnham substations. Upgrade the University Park North-Olive 345 kV line.	AEP Exelon	$66.90	-154	Study included 3A, 3B, 11B and 11C
17B	ComEd	Build a new 345 kV switchyard (Pike Creek). Build a new Meadow Lake - Pike Creek 345 kV double circuit line. Loop the Bloom - Davis Creek 345 kV line and Burnham - Davis Creek 345 kV line into Pike Creek switchyard.	AEP Exelon	$197.97	-435	Study included 3A, 3B, 11B and 11C
13H	DEOK	Tap the Tanners Creek - Losantville 345 kV line and build a new 345 kV switchyard (York). Tap the Miami Fort - Woodsdale 345 kV line and build a new 345/138 kV substation (Coyote) next to Wiley 138kV switchyard. Build a new 345 kV line between York and Coyote stations. Expand Wiley 138 kV switchyard by tying the Coyote 345/138 kV transformer into the Wiley 138 kV yard. Loop the Morgan-Fairfield 138 kV line into Wiley 138 kV station. Install a new 345/138 kV transformer at Foster substation.	Transource	$71.89	-638	

Note: Dayton LDA did not bind in the 2020/2021 BRA Auction, therefore no CETL analysis was performed for Dayton LDA..

Reevaluation of Approved Market Efficiency Projects (2014/15 RTEP Window)

Reevaluation of Market Efficiency Projects - Process

- Applies to market efficiency projects approved during the 2014/15 RTEP Window
- Using the Market Efficiency Base Case Mid-Cycle Update
- Analysis performed individually, one project at a time
- Reevaluation Study Process
  - Create a new base case by removing/reversing the topology related to the approved market efficiency project
  - Measure the impact of adding back the approved market efficiency project
  - Measure benefits for 15-year period starting with the in-service date
  - For RPM projects also measure the capacity benefits
  - Calculate the new B/C ratios
- Projects must meet the B/C criterion of 1.25

Reevaluation Status

- PJM staff is creating reevaluation cases for all projects approved in 2014/15 cycle (80% completed)
- PJM will determine the new B/C ratios for projects
- PJM planning will be reaching out to project owners if the project does not meet reevaluation threshold

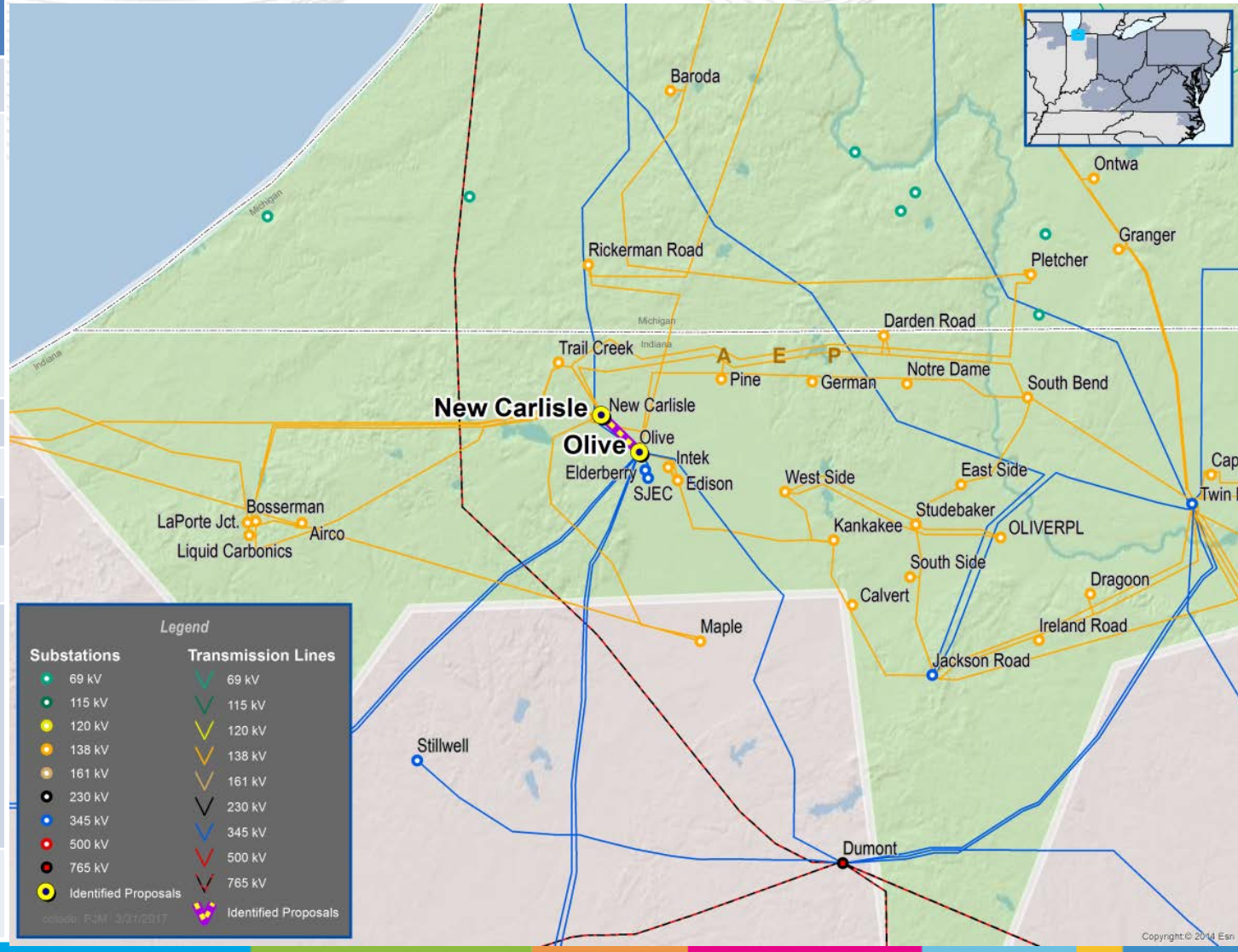
Next Steps

Milestone	Schedule 2016 - 2017
Reevaluation Approved Market Efficiency Projects	July - August 2017
Proposed projects analysis - Interregional, PPL and slam dunks	July – October 2017
Proposed projects analysis - BGE and other	August – December 2017
Acceleration Analysis	July – November 2017
Final TEAC Review and Board Recommendation	December 2017

Appendix A - Interregional Projects Descriptions

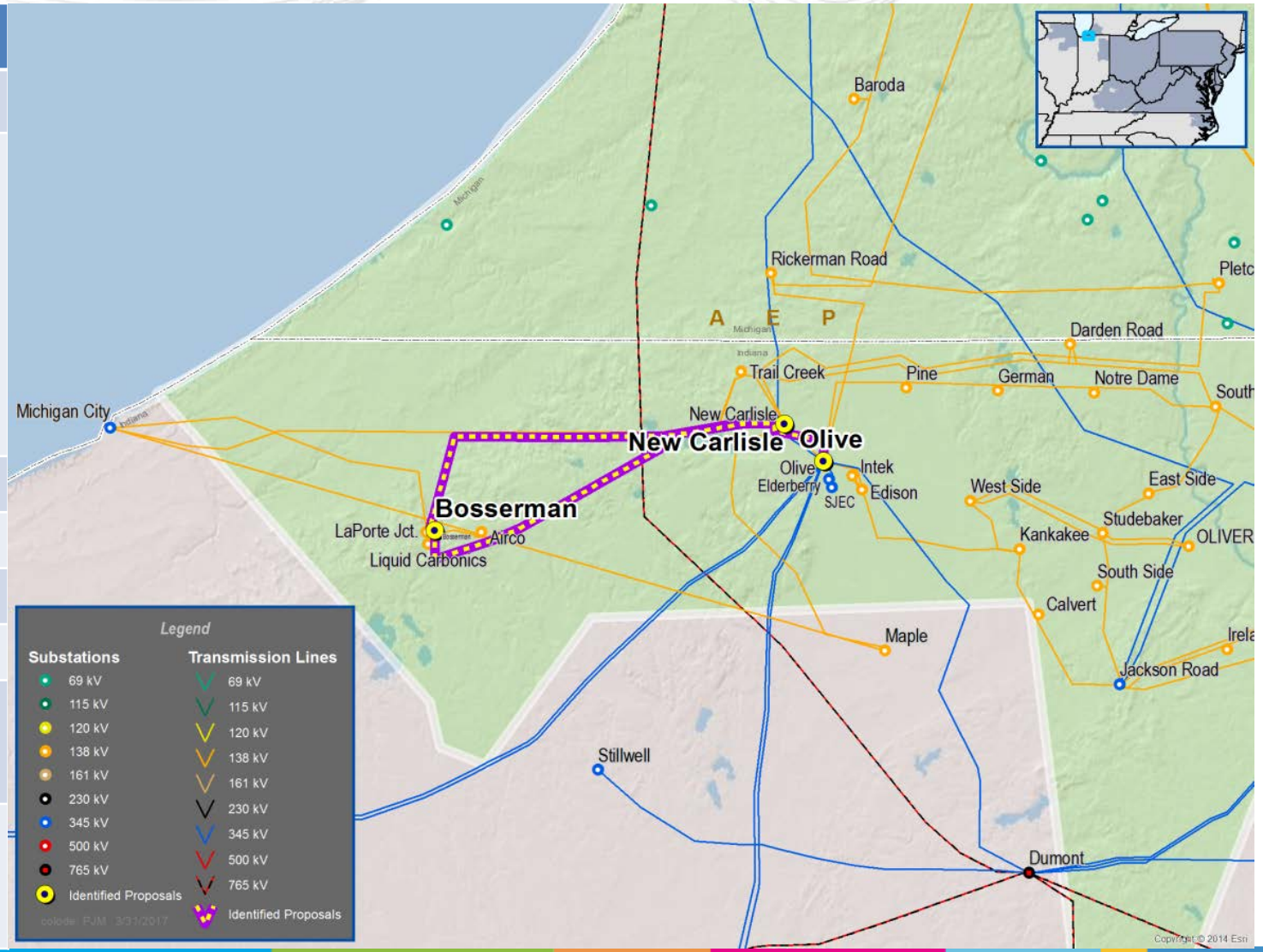
WPPI 1-1A

Project ID: 201617_1-1A
Proposed by: WPPI
Proposed Solution: Interregional Provide a second New Carlisle-Olive 138 kV circuit. Upgrade substation equipment at New Carlisle and Olive substations.
kV Level: 138 kV
In-Service Cost ($M): $2.5
In-Service Date: 2019
Target Zone: AEP
ME Constraints: OLIVE - BOSSERMAN 138 kV
Notes: See supplemental project Olive – Bosserman discussion in the Reliability Update presentation at April TEAC.



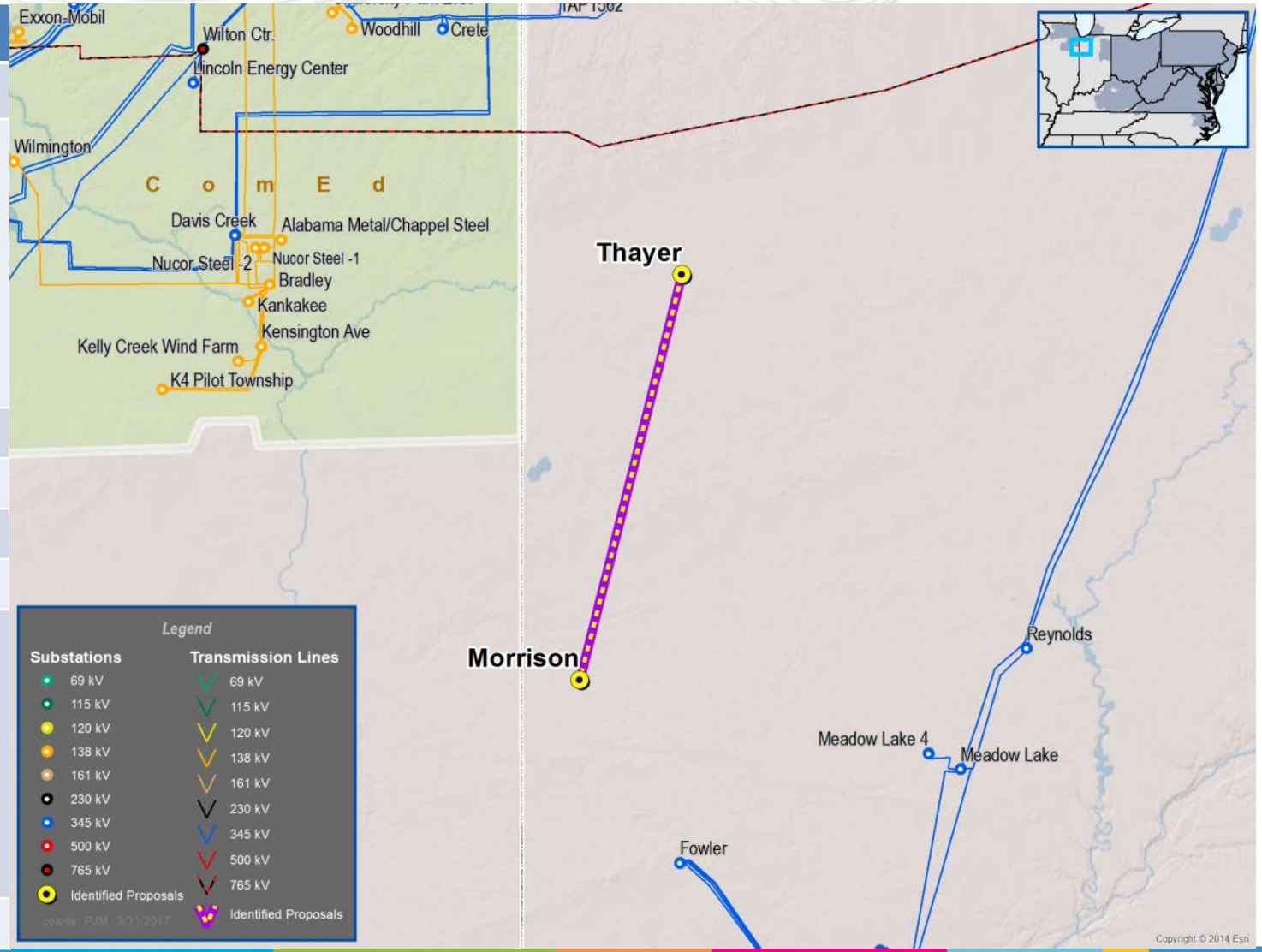
NIPSCO 1-9A

Project ID: NIPSCO 1-9A
Proposed by: NIPSCO
Proposed Solution: Interregional Reconductor existing NIPSCO line section between AEP Bosserman and Olive 138 kV substations. Reconductor existing NIPSCO line section between AEP Bosserman and New Carlisle 138 kV substations.
kV Level: 138 kV
In-Service Cost ($M): $8.00
In-Service Date: 2019
Target Zone: AEP NIPSCO
ME Constraints: OLIVE - BOSSERMAN 138 kV
Notes: See supplemental project Olive – Bosserman discussion in the Reliability Update presentation at April TEAC.



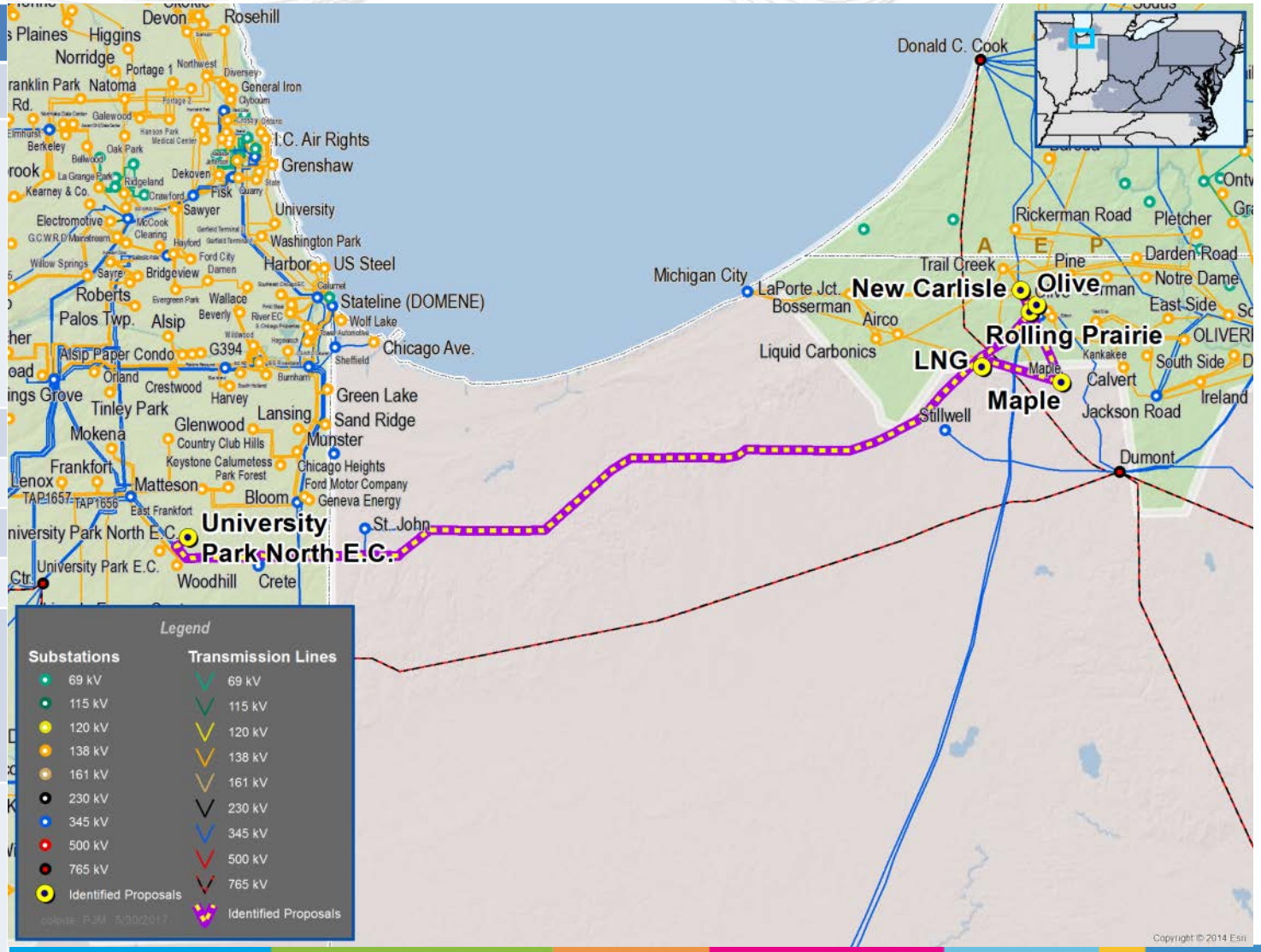
NIPSCO 1-9B

Project ID: 201617_1-9B
Proposed by: NIPSCO
Proposed Solution: Greenfield, Interregional New NIPSCO line section between Thayer and Morrison 138 kV substations.
kV Level: 138 kV
In-Service Cost ($M): $42.50
In-Service Date: 2022
Target Zone: AML ComEd NIPSCO
ME Constraints: PAXTON - GIFFORD 138 kV
Notes:



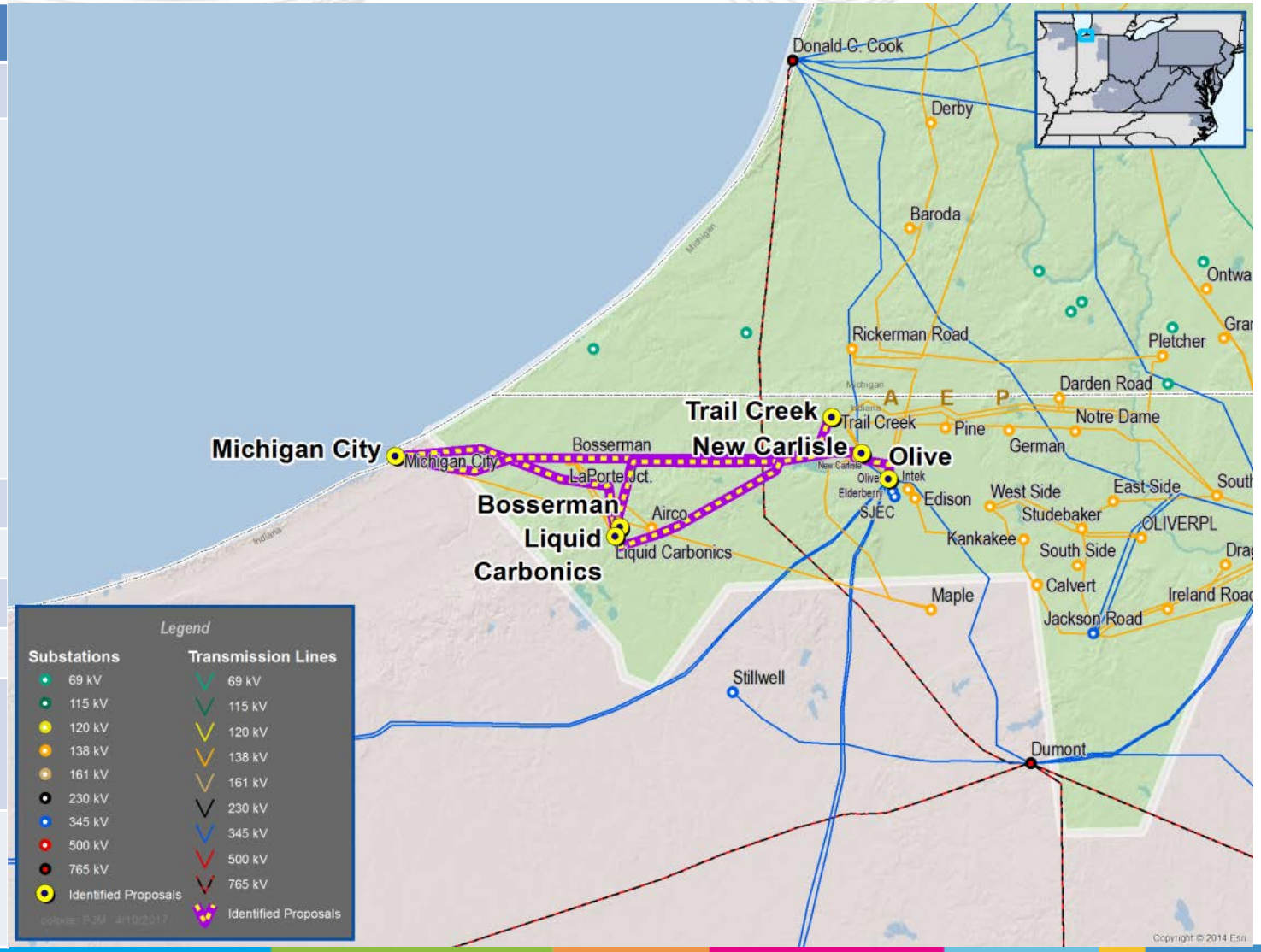
NEXTERA 1-10B

Project ID: 201617_1-10B
Proposed by: Nextera
Proposed Solution: Greenfield, Interregional Cut the University Park - Olive 345 kV and tie into a new 345/138 kV substation (Rolling Prairie). Cut the Maple - New Carlisle 138 kV and Maple - LNG 138 kV lines and tie into the new substation.
kV Level: 138 kV
In-Service Cost ($M): $19.2
In-Service Date: 2021
Target Zone: AEP
ME Constraints: BOSSERMAN - OLIVE 138 kV
Notes: Notes: See supplemental project Olive – Bosserman discussion in the Reliability Update presentation at April TEAC.



AEP NIPSCO 1-12D

Project ID: 201617_1-12D
Proposed by: AEP NIPSCO
Proposed Solution: Interregional Terminate Olive-Bosserman 138 kV line at New Carlisle. Rebuild the 34.5 kV line between New Carlisle and Silver Lake as double circuit 138 kV, operating one circuit as 34.5 kV while extending the other at 138 kV with a new circuit to Liquid Carbonics. Establish an Olive-Liquid Carbonics-Bosserman 138 kV line. Rebuild the Michigan City-Trail Creek-Bosserman 138 kV.
kV Level: 138 kV
In-Service Cost ($M): $41.86
In-Service Date: 2021
Target Zone: AEP
ME Constraints: OLIVE - BOSSERMAN 138 kV
Notes: See supplemental project Olive – Bosserman discussion in the Reliability Update presentation at April TEAC.



TRANSOURCE 1-13H

Project ID: 201617_1-13H

Proposed by: Transource

Proposed Solution: Greenfield, Interregional
Tap the Tanners Creek - Losantville 345 kV line and build a new 345 kV switchyard (York). Tap the Miami Fort - Woodsdale 345 kV line and build a new 345/138 kV substation (Coyote) next to Wiley 138kV switchyard. Build a new 345 kV line between York and Coyote stations. Expand Wiley 138 kV switchyard by tying the Coyote 345/138 kV transformer into the Wiley 138 kV yard. Loop the Morgan-Fairfield 138 kV line into Wiley 138 kV station. Install a new 345/138 kV transformer at Foster substation.

kV Level: 138/345 kV

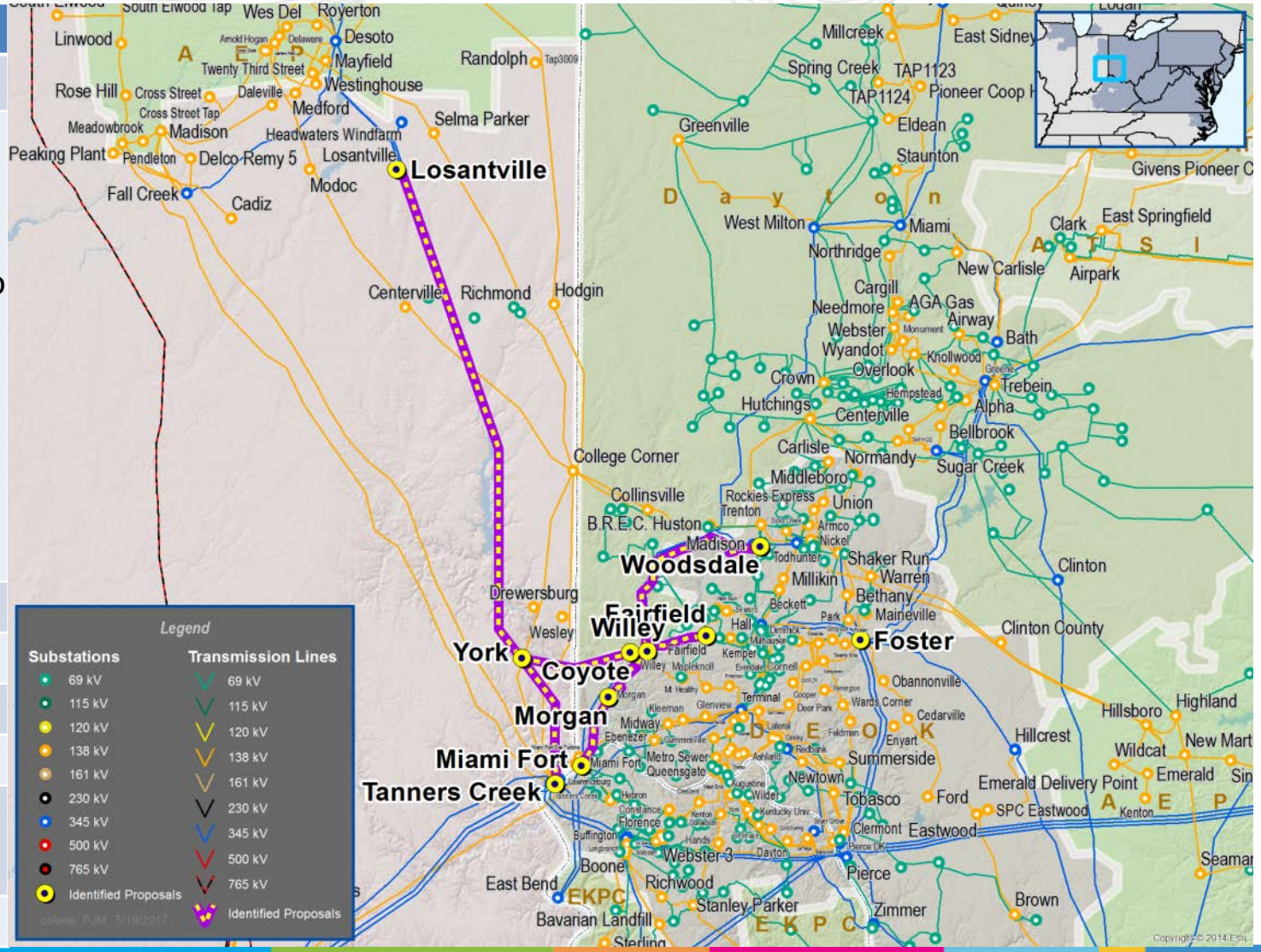
In-Service Cost ($M): $71.89

In-Service Date: 2021

Target Zone: DEOK

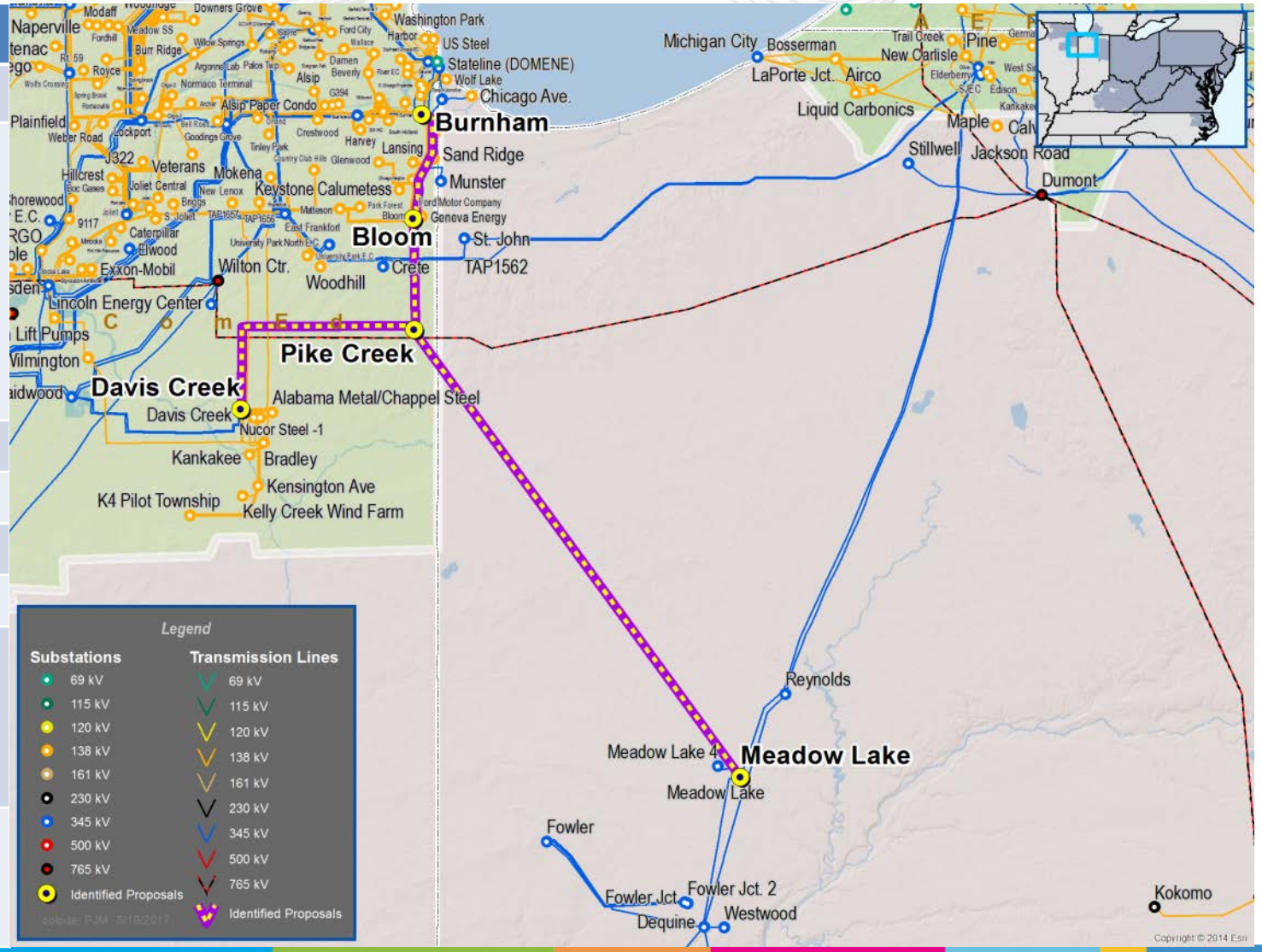
ME Constraints:
TANNERS CREEK - MIAMI FORT 345 kV

Notes:



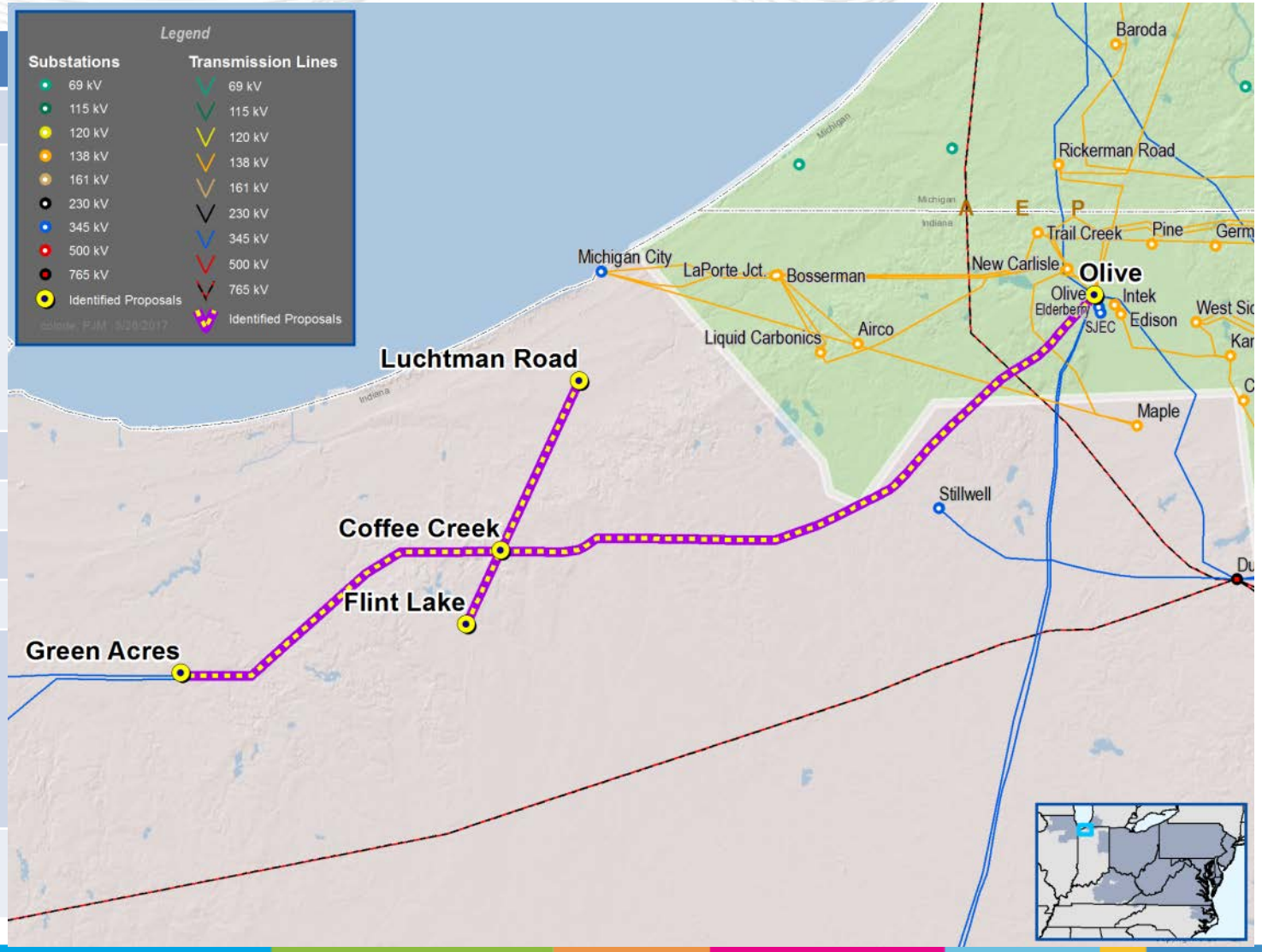
AEP EXELON 1-17B

Project ID: 201617_1-17B
Proposed by: AEP Exelon
Proposed Solution: Greenfield, Interregional Build a new 345 kV switchyard (Pike Creek). Build a new Meadow Lake - Pike Creek 345 kV double circuit line. Loop the Bloom - Davis Creek 345 kV line and Burnham - Davis Creek 345 kV line into Pike Creek switchyard.
kV Level: 345 kV
In-Service Cost ($M): $197.97
In-Service Date: 2021
Target Zone: ComEd
ME Constraints: OLIVE - BOSSERMAN 138 kV + RPM Benefits
Notes: See supplemental project Olive – Bosserman discussion in the Reliability Update presentation at April TEAC.



NTD 1-18S

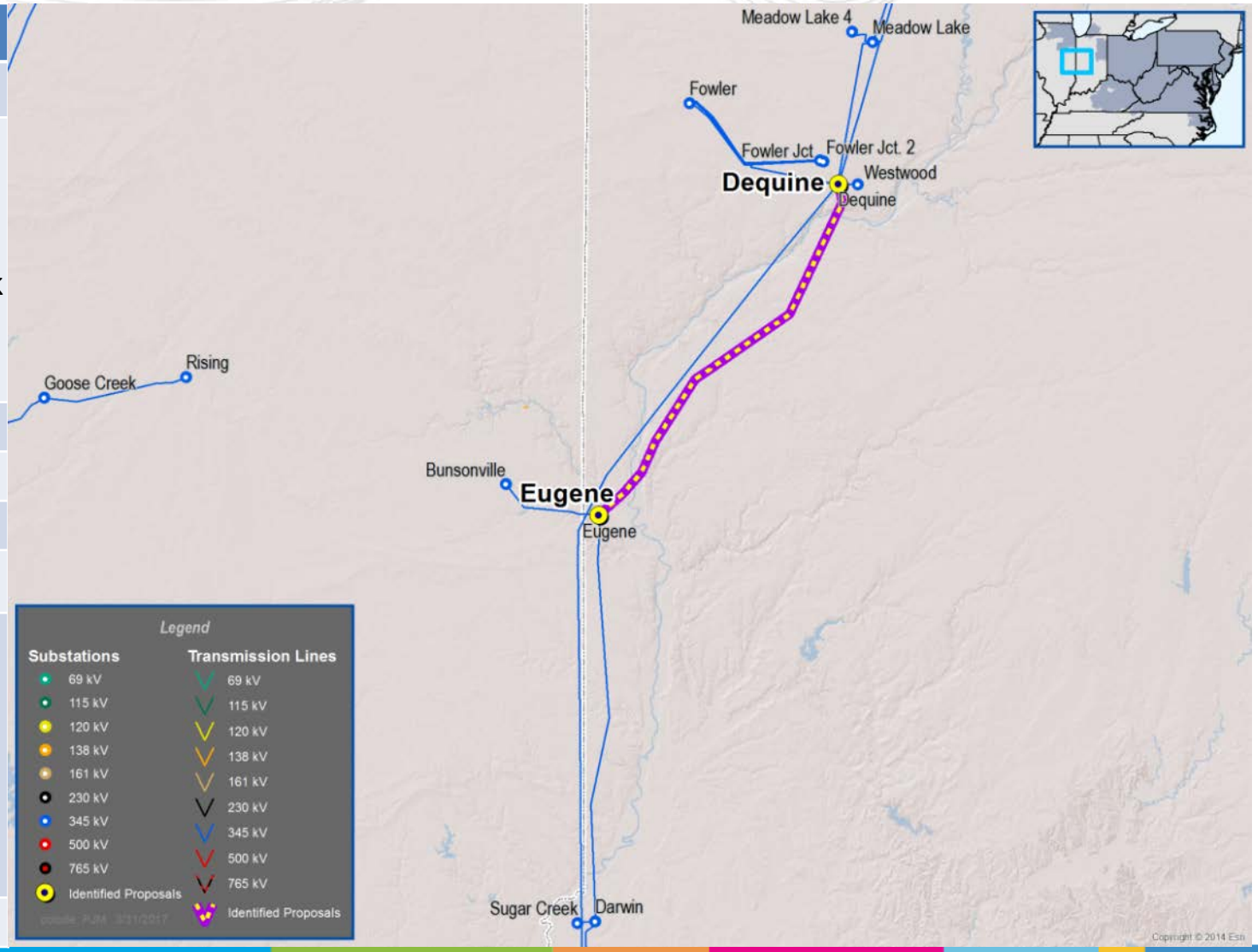
Project ID: 201617_1-18S
Proposed by: Northeast Transmission Development
Proposed Solution: Greenfield, Interregional Tap the Green Acres - Olive 345 kV line and build a new 345/138 kV substation (Coffee Creek). Loop the Flint Lake to Luchtman Road 138 kV line into Coffee Creek.
kV Level: 138/345 kV
In-Service Cost ($M): $17.4
In-Service Date: 2021
Target Zone: AEP
ME Constraints: OLIVE - BOSSERMAN 138 kV
Notes: See supplemental project Olive – Bosserman discussion in the Reliability Update presentation at April TEAC.



Appendix B - RPM Projects Descriptions

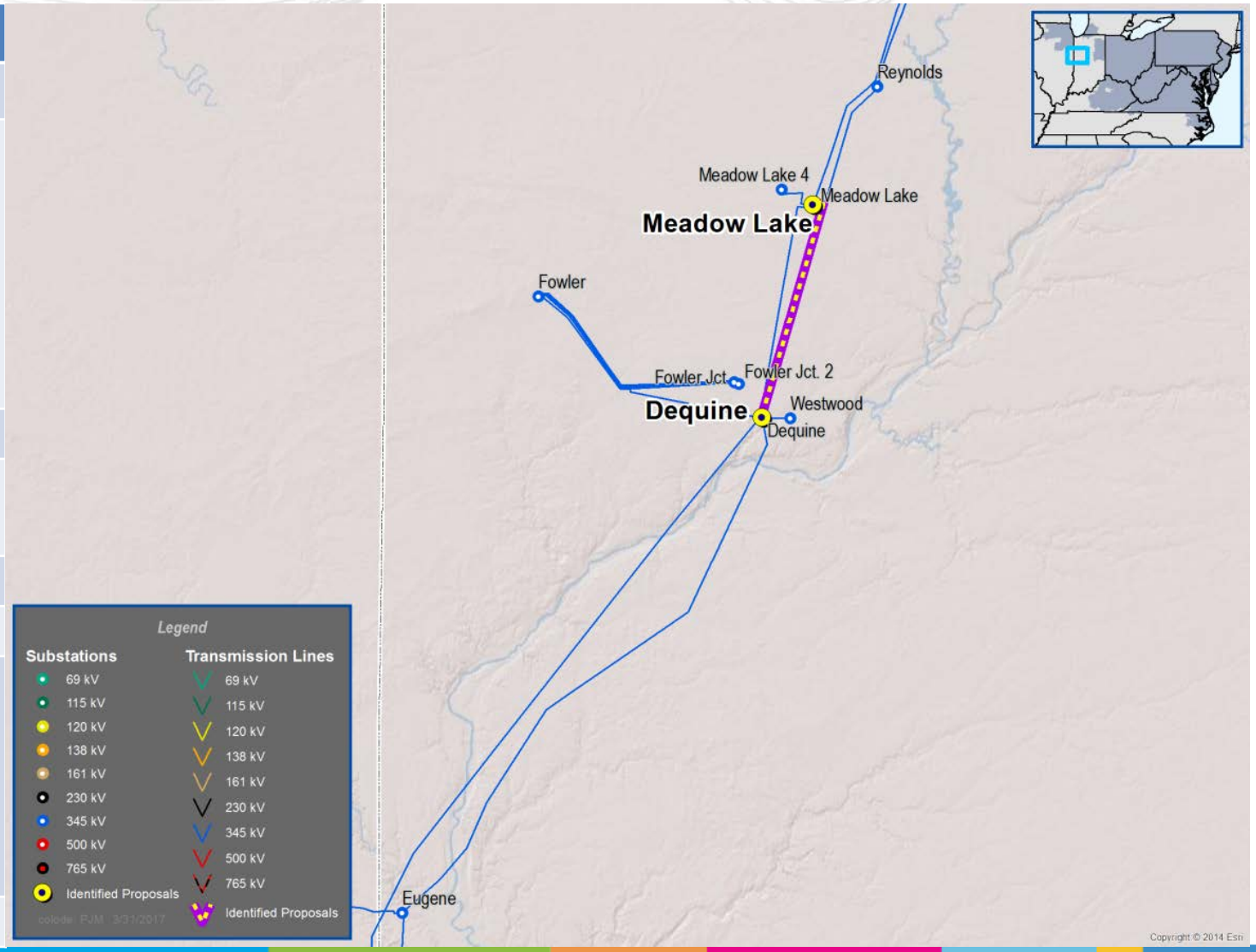
AEP 1-11B

Project ID: 201617_1-11B
Proposed by: AEP
Proposed Solution: Accelerate the previously approved baseline project to reconductor the Dequine-Eugene 345 kV and substation work at Dequine.
kV Level: 345 kV
In-Service Cost ($M): 0
In-Service Date: 2019
Target Zone: AEP
ME Constraints: EUGENE - DEQUIN 345 kV + RPM Benefits
Notes: See approved baseline upgrade b2777



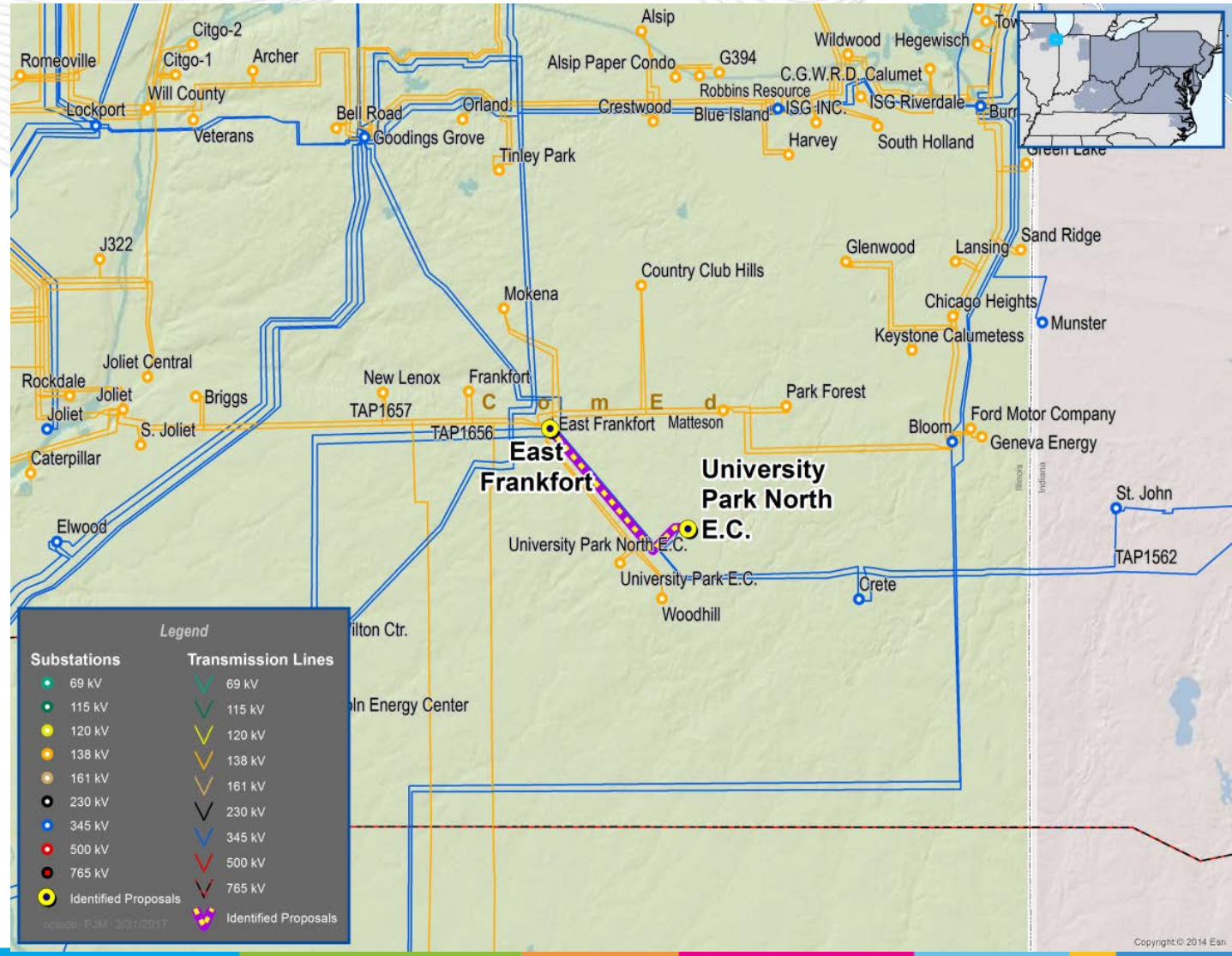
AEP1-11C

Project ID: 201617_1-11C
Proposed by: AEP
Proposed Solution: Accelerate the previously approved baseline project to reconductor the Dequine - Meadow Lake 345 kV #2 line and substation work at Dequine.
kV Level: 345 kV
In-Service Cost ($M): 0
In-Service Date: 2019
Target Zone: AEP
ME Constraints: DEQUIN - MEADOW 345 kV + RPM Benefits
Notes: See approved baseline upgrade b2776



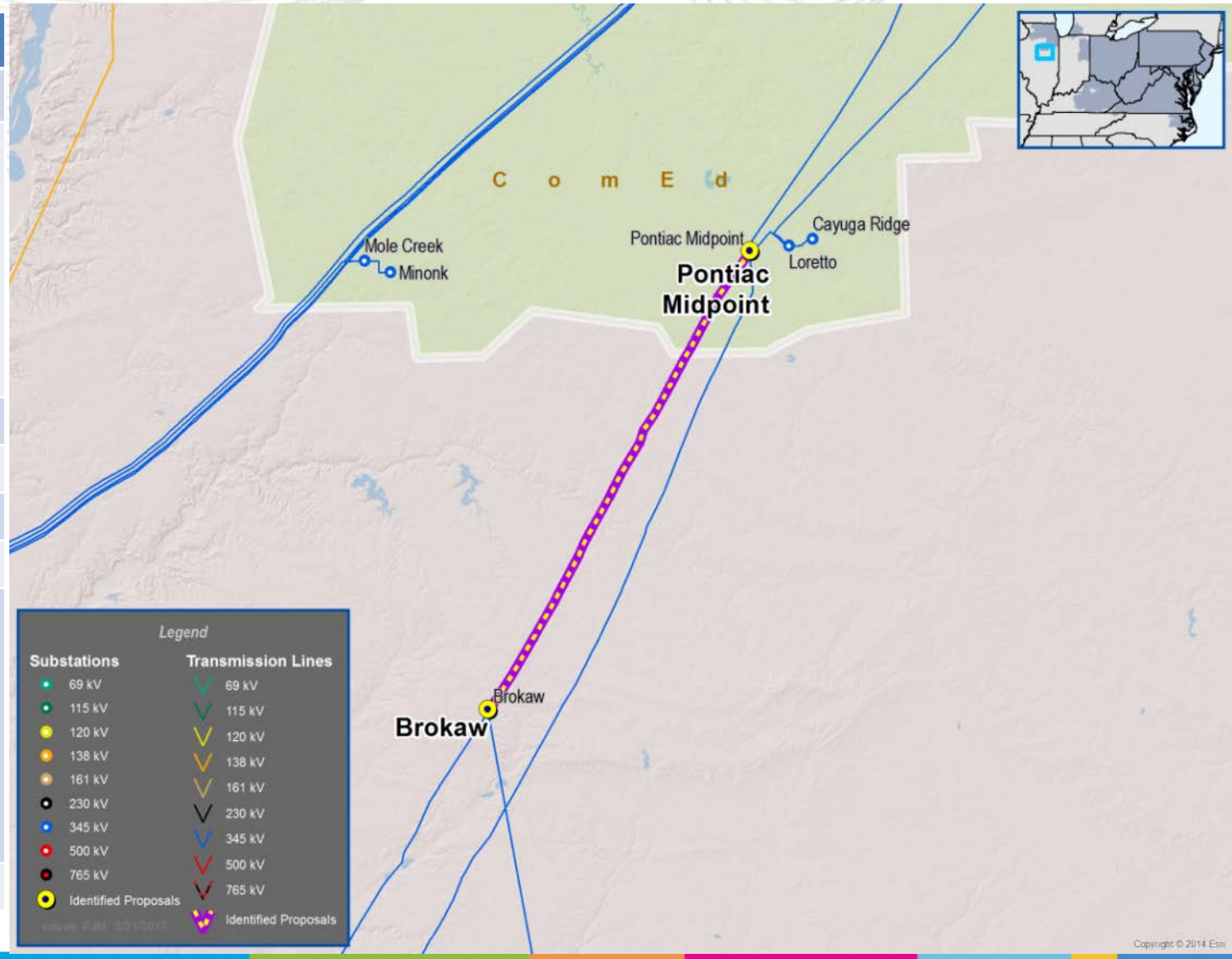
COMED 1-3A

Project ID: 201617_1-3A
Proposed by: ComEd
Proposed Solution: Upgrade capacity on E. Frankfort - University Park 345 kV line.
kV Level: 345 kV
In-Service Cost ($M): $0.84
In-Service Date: 2021
Target Zone: ComEd
ME Constraints: E. FRANKFORT - UNIVERSITY PARK 345 kV + RPM Benefits
Notes:



COMED 1-3B

Project ID: 201617_1-3B
Proposed by: ComEd
Proposed Solution: Upgrade substation equipment at Pontiac Midpoint station to increase capacity on Pontiac-Brokaw 345 kV line.
kV Level: 345 kV
In-Service Cost ($M): $5.62
In-Service Date: 2021
Target Zone: ComEd
ME Constraints: PONTIAC - BROKAW 345 kV + RPM Benefits
Notes:



AEP EXELON 1-17A

Project ID: 201617_1-17A

Proposed by: AEP Exelon

Proposed Solution: Greenfield
Build a new 345 kV switchyard (Cottage Grove). Loop in the University Park North EC - Olive 345 kV line, Crete - St. John 345 kV line, Davis Creek - Bloom 345 kV line and Davis Creek - Burnham 345 kV line. Substation upgrades at Bloom and Burnham substations. Upgrade the University Park North-Olive 345 kV line.

kV Level: 345 kV

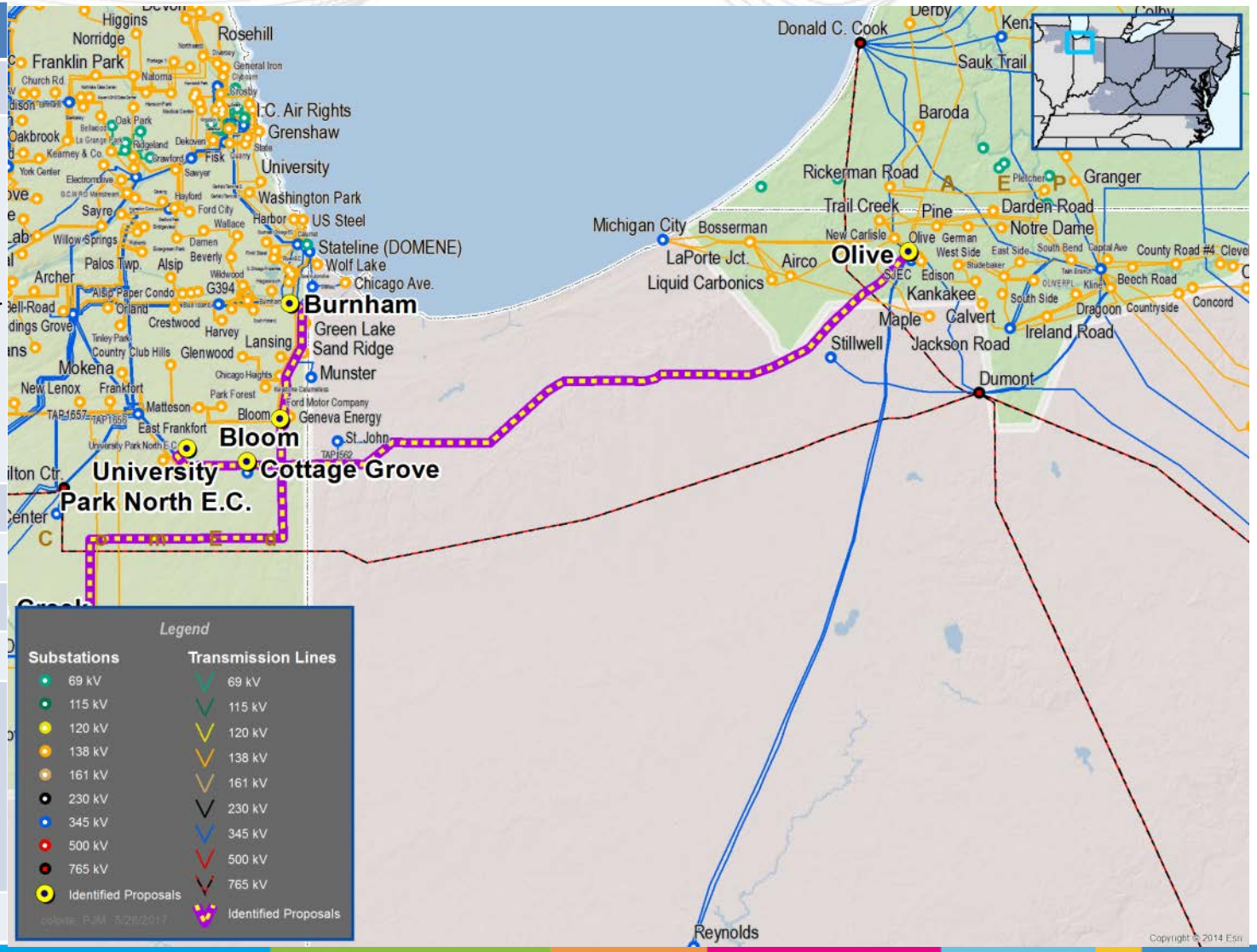
In-Service Cost ($M): $66.90

In-Service Date: 2021

Target Zone: ComEd

ME Constraints:
E. FRANKFORT - UNIVERSITY PARK 345 kV + RPM Benefits

Notes:



NTD 1-18M

Project ID: 201617_1-18M

Proposed by: Northeast Transmission Development

Proposed Solution: Greenfield
Build a new 345/138 kV substation (Bull Branch) near Urbana 138/69 kV substation. Build a new Marysville - Bull Branch 345 kV line and a new Miami - Bull Branch 345 kV line. Connect the Bull Branch 138kV to Urbana 138/69 kV substation. Tap the West Milton - Miami Fort 345 kV line and build a new 345/138 kV substation (Spring Run). Build a new Spring Run - Crown 138 kV line.

kV Level: 138/345 kV

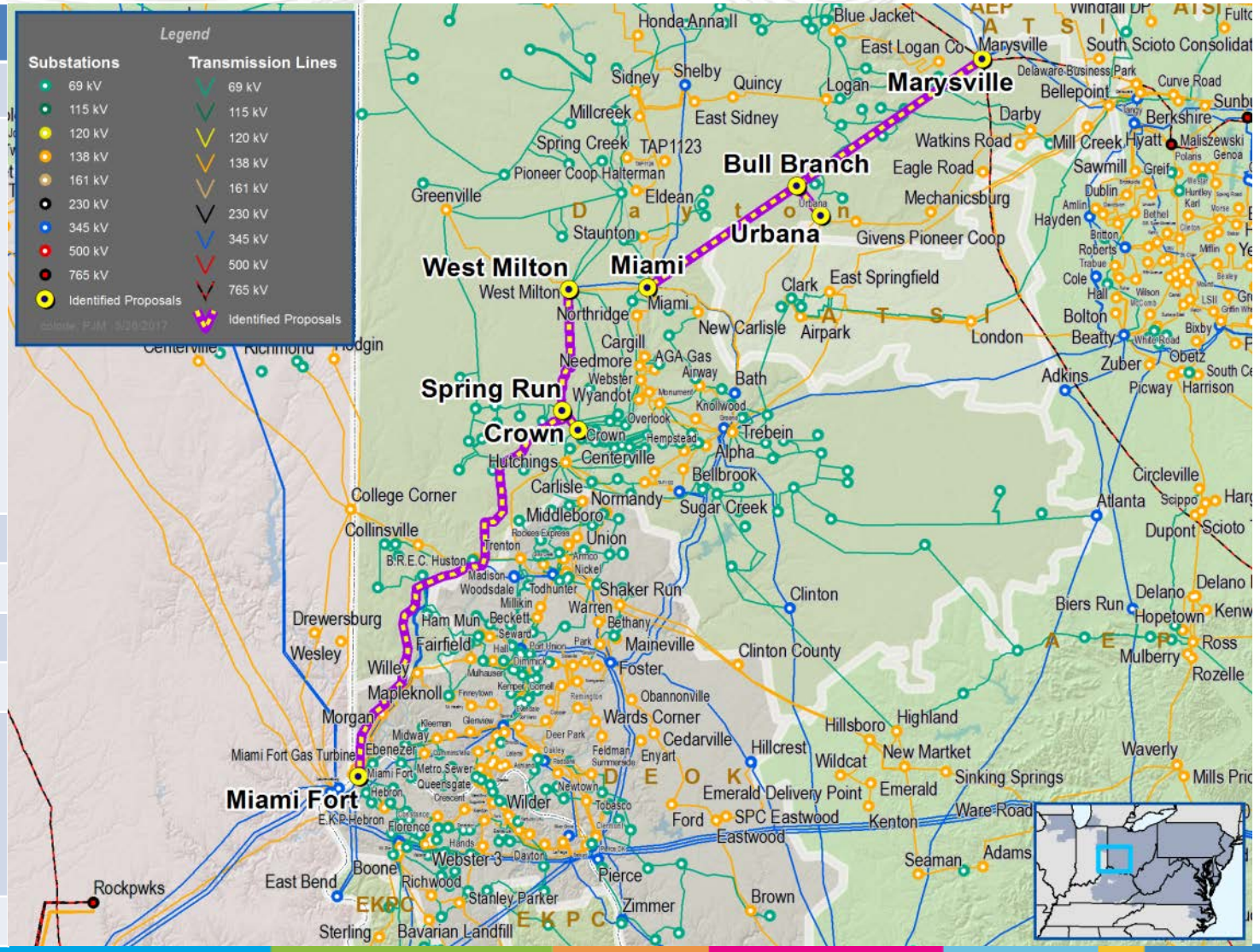
In-Service Cost ($M): $117.30

In-Service Date: 2021

Target Zone: AEP

ME Constraints:
Dayton LDA RPM Benefits

Notes:



NTD1-18N

Project ID: 201617_1-18N

Proposed by: Northeast Transmission Development

Proposed Solution: Greenfield
Build a new 345/138 kV substation (Bull Branch) near Urbana 138/69 kV substation. Build a new Marysville - Bull Branch 345 kV line and a new Miami - Bull Branch 345 kV line. Connect the Bull Branch 138 kV to Urbana 138/69 kV substation.

kV Level: 138/345 kV

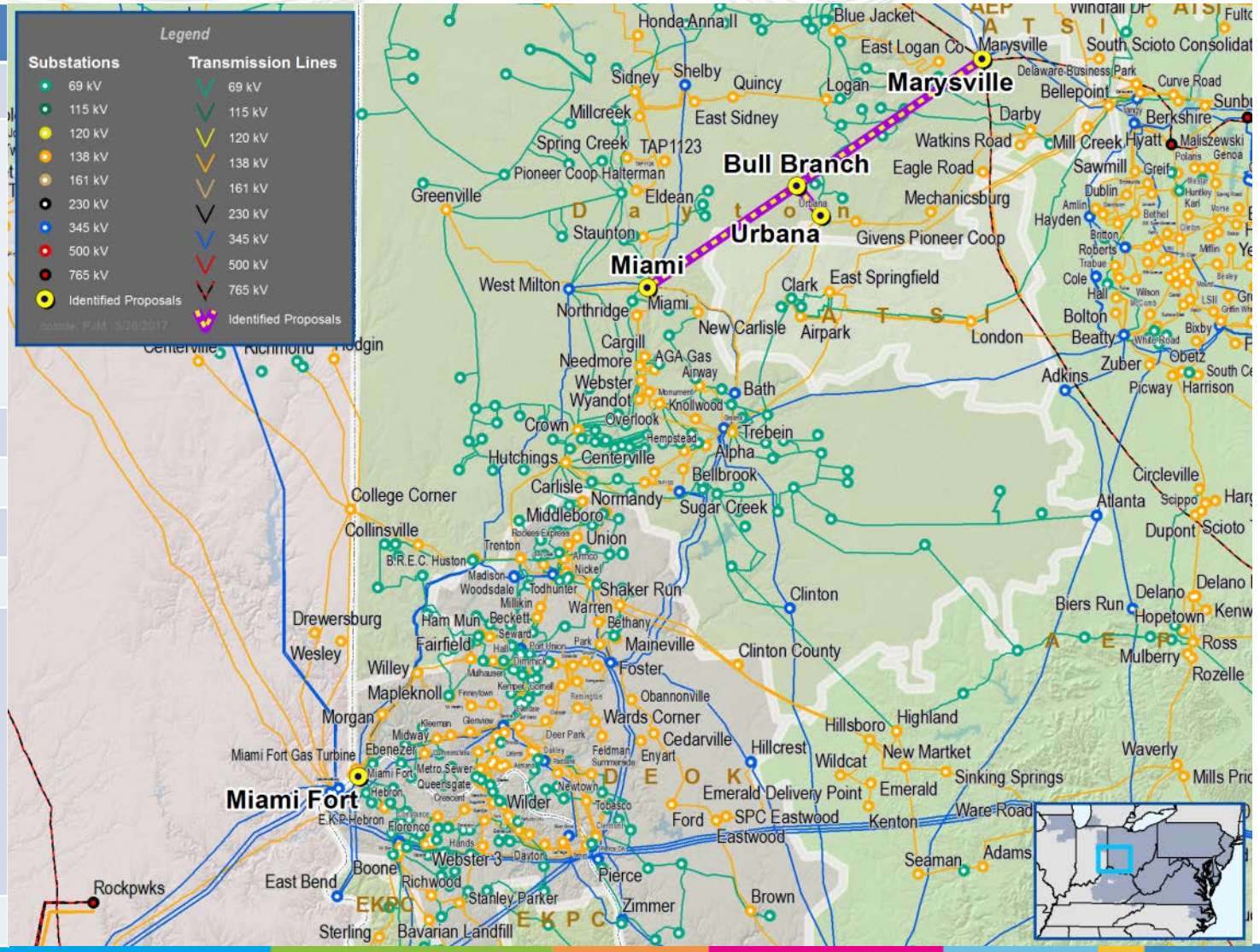
In-Service Cost ($M): $97.70

In-Service Date: 2021

Target Zone: AEP

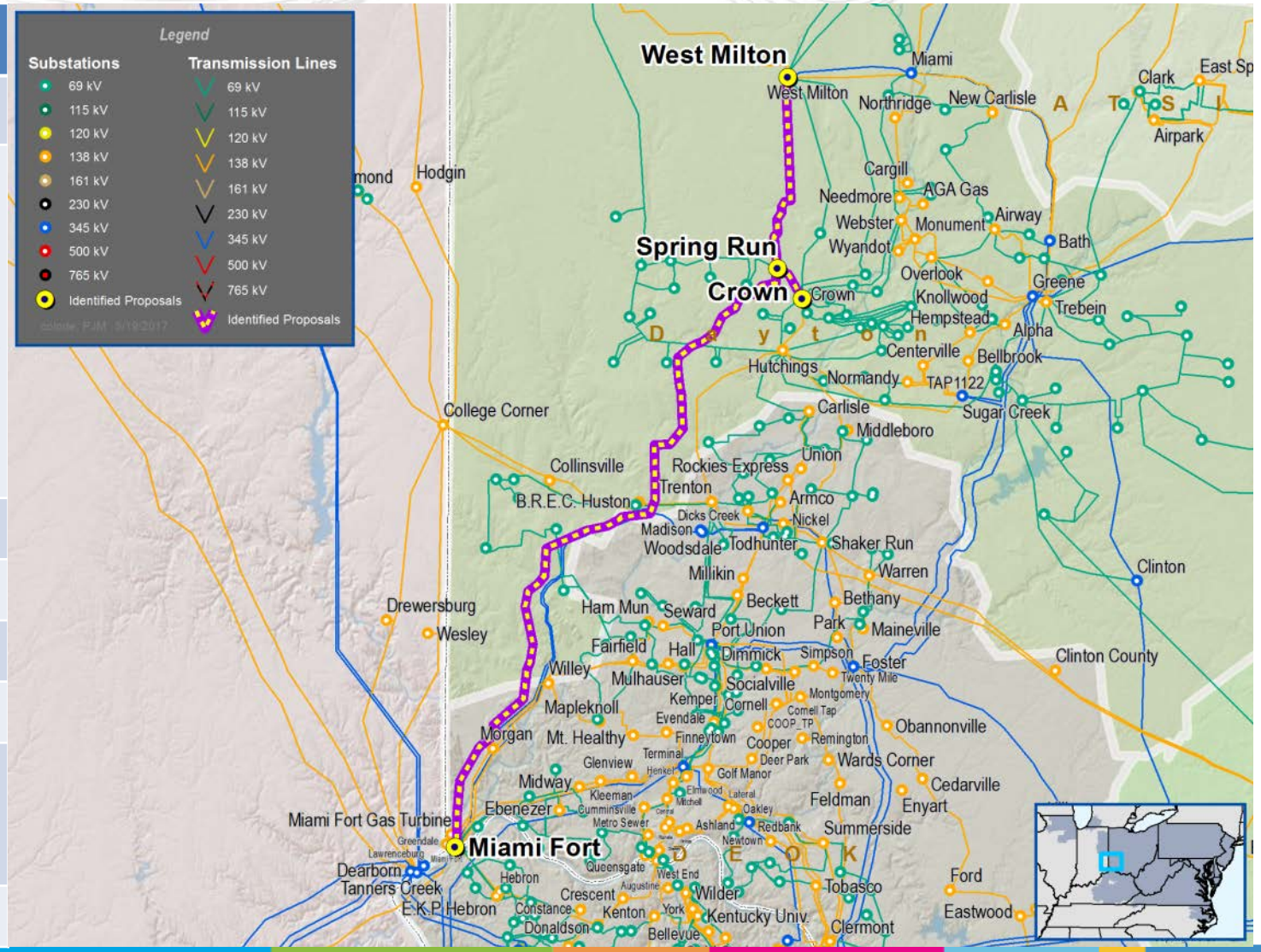
ME Constraints:
Dayton LDA RPM Benefits

Notes:



NTD 1-18P

Project ID: 201617_1-18P
Proposed by: Northeast Transmission Development
Proposed Solution: Greenfield Tap the West Milton - Miami Fort 345 kV line and build a new 345/138 kV substation (Spring Run). Build a new Spring Run - Crown 138 kV line.
kV Level: 138/345 kV
In-Service Cost ($M): $19.70
In-Service Date: 2021
Target Zone: Dayton
ME Constraints: Dayton LDA RPM Benefits
Notes:



Appendix C - AEP Supplemental Project Olive – Bosserman 138 kV

AEP Supplemental Project

- AEP has planned a supplemental project that impacts the Olive – Bosserman market efficiency constraint

- Supplemental projects are:
  - Not needed for reliability criteria, market efficiency, or operational performance
  - Funded wholly by Transmission Owner
  - No PJM approval needed

- This supplemental project is included in the Market Efficiency base case and all submitted projects to address Olive-Bosserman constraint will be evaluated under this assumption

AEP Transmission Zone

Supplemental Project: Olive-Bosserman 138 kV
Previously Presented at 4/13/2017 TEAC and 4/21/2017 Western SRTEAC

Problem Statement/Driver:

The LaPorte Junction - New Carlisle 34.5 kV circuit has a vintage from 1930s and is wood pole construction. Between 2010-2015, ~2 million customer minutes of interruption (CMI) were recorded at Silver Lakes station. There are 183 open conditions, 95 of which are category A conditions on the ~20 mile long line.

Indiana and Michigan Power Company has requested to convert Silver Lake and Springville to 138 kV operation.

This project would also resolve congestion on the Olive-Bosserman 138 kV identified during MISO-PJM JOA market efficiency studies in addition to addressing the a potential overload identified on this facility during the PJM 2021 RTEP. It was submitted (without the new distribution station additions) to the PJM reliability and market efficiency windows.

Recommended Solution:

Construct two 138/12 kV distribution stations, Bootjack and Marquette, to replace Silver Lake 34.5 kV and Springville 69 kV stations.(S1279.1)

Cut the existing Olive – Bosserman line into New Carlisle station. (S1279.2)

Rebuild sections of the LaPorte Junction-New Carlisle/New Buffalo 34.5 kV line to 138 kV to establish Bootjack-Olive 138 kV circuit. (S1279.3)

Install a three way phase over phase switch, called Kuchar, near Liquid Carbonics station and construct a new 138 kV line between Bootjack and Kuchar. (S1279.4)

Construct a 138 kV extension to Marquette station by tapping the Bosserman-Liquid Carbonics 138 kV line. (S1279.5)

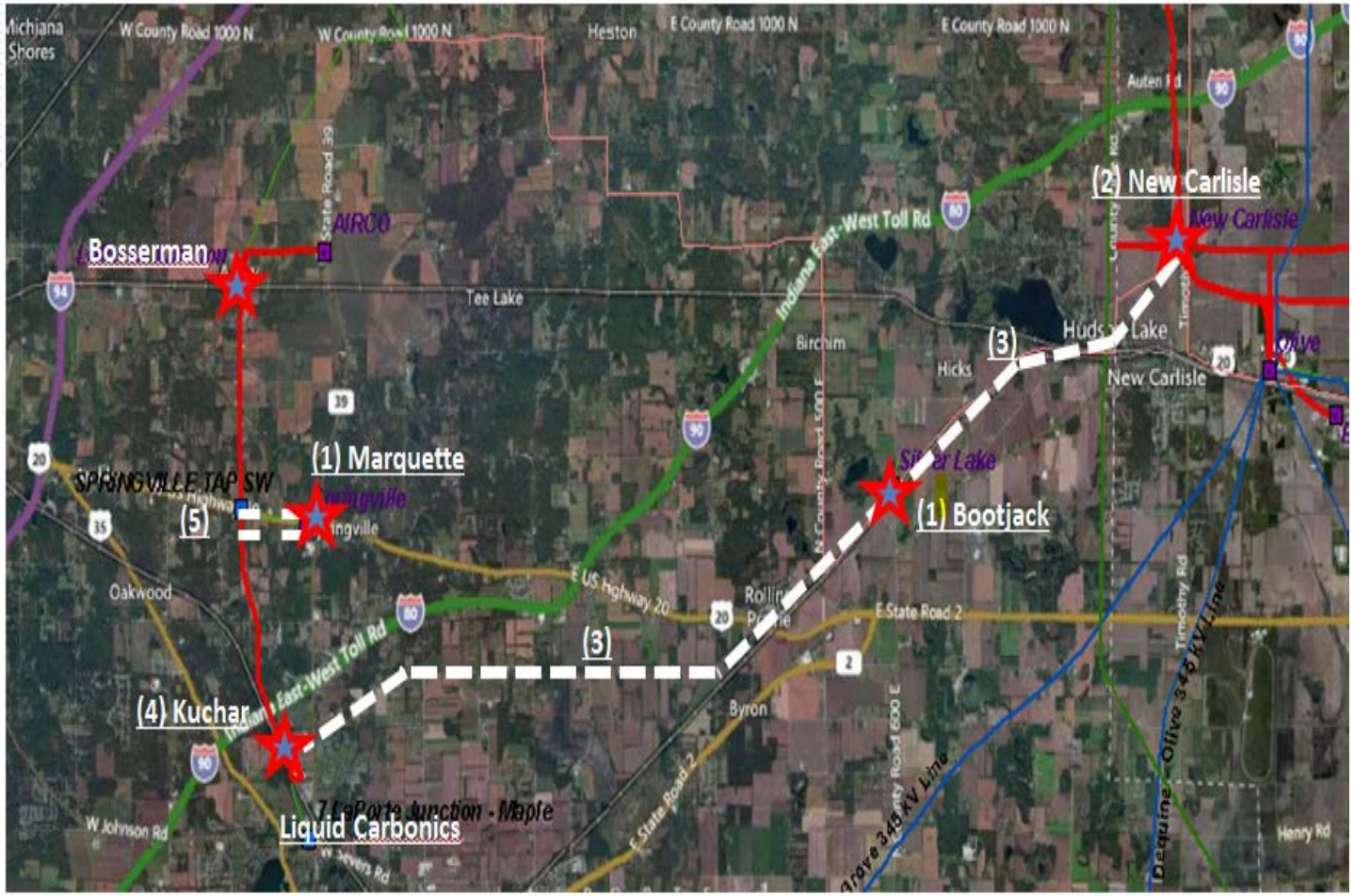
Alternatives:

Rebuild ~20 mile long New Carlisle – LaPorte Junction 34.5 kV utilizing existing line ROW corridor. This alternative was not selected because it did not provide the operational flexibility & efficiency and customer service benefits provided by the preferred option. Estimated cost: ~$32M

Cost Estimate: $36.786M

Projected IS date: 12/1/2019

Status: Conceptual



Revision History

- Revision History
  - V1 – 7/10/2017 – Original Version Posted to PJM.com