Reliability Analysis Update

Transmission Expansion Advisory Committee

May 12, 2016

2016 RTEP Timeline

2016 RTEP Timeline

- Cases
  - 2016 RTEP summer case finalized
  - 2016 RTEP winter case sent to TO for modeling updates
  - 2016 RTEP light load case sent to TO for modeling updates

- Analysis
  - Completed and validated the N-1, generation deliverability analysis and common mode outage analysis, preliminary results are posted.
  - Currently working to complete the preliminary load deliverability and N-1-1 analysis

- Windows
  - 2016 RTEP Window #2 anticipated opening date at the end of June 2016

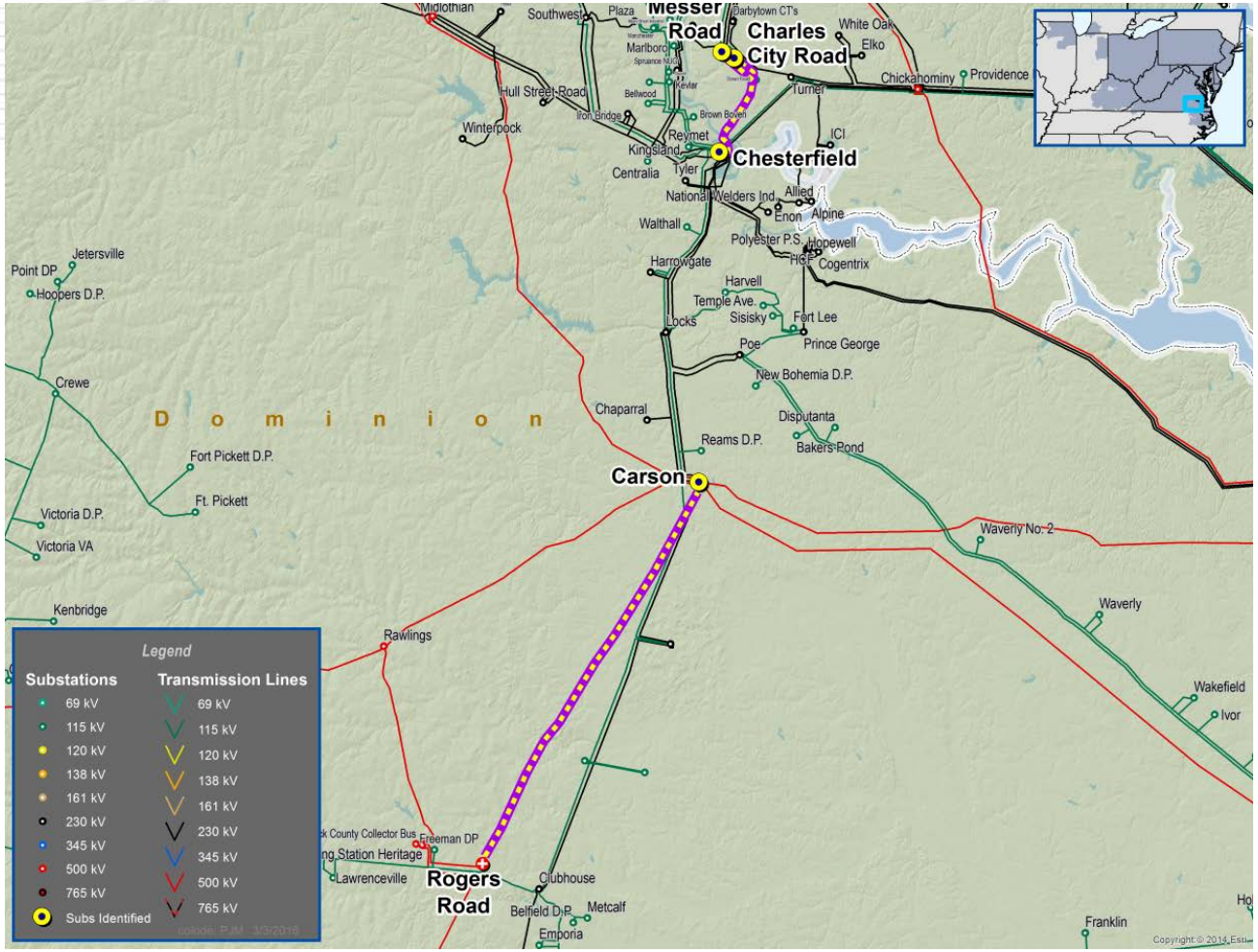
2016 RTEP Proposal Window #1
Proposal Review and Recommendations

2016 RTEP Proposal Window #1 Timeline

- February 2016
  - Preliminary violations reviewed with the PJM TEAC
- March - April 2016
  - 2016 RTEP Window 1 Proposal evaluations
- April 20, 2016
  - Preliminary 2016 RTEP Proposal Window #1 Webcast posted to PJM.com
- May 12, 2016
  - Recommendation to PJM TEAC
- July 2016
  - Seek PJM Board Approval

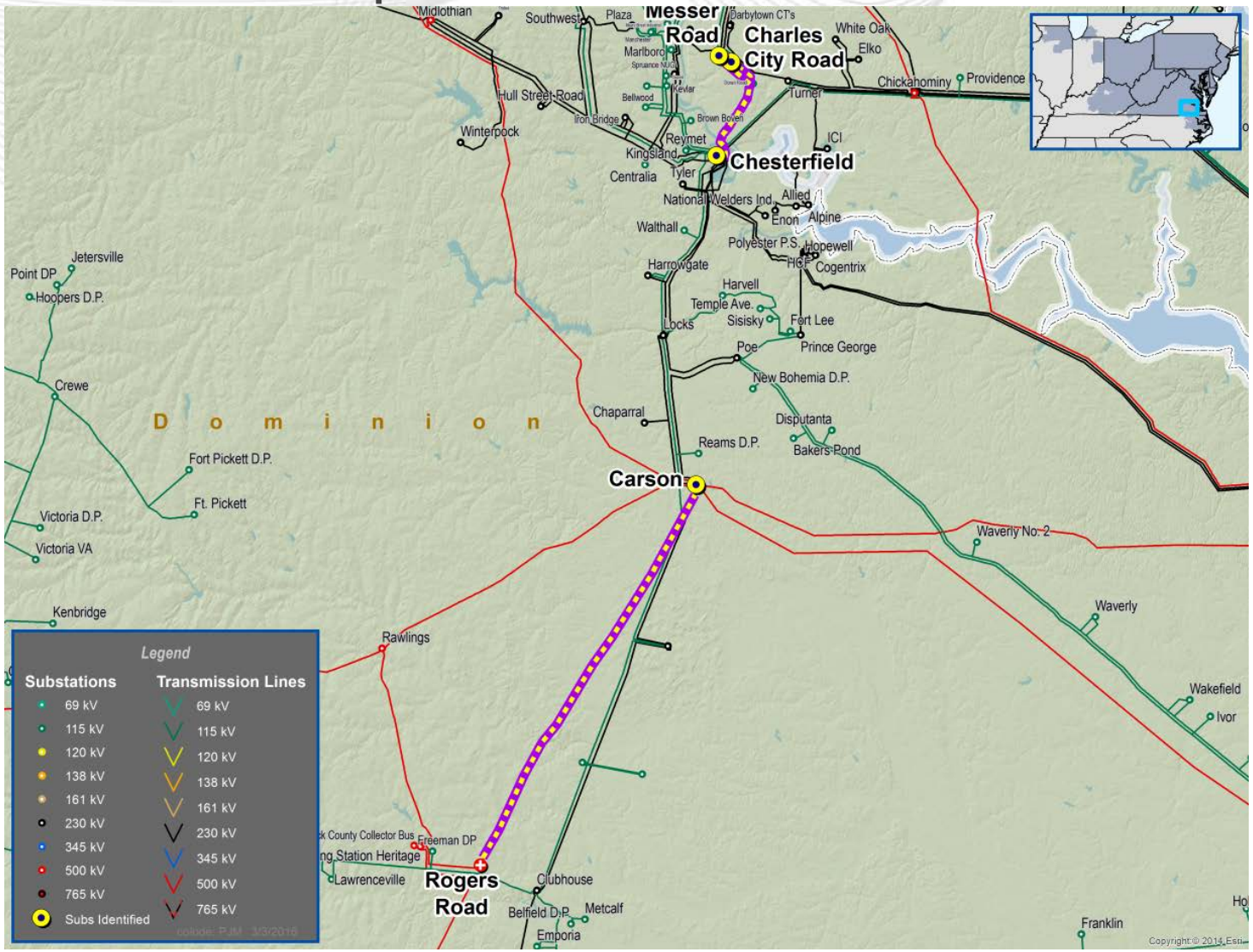
2016 RTEP Proposal Window #1

- Scope
  - Generator Deliverability and Common Mode Outage Violations
  - End of life facilities
- Preliminary Files Released: 2/5/2016
- Window Opened: 2/16/2016
- Window Closed: 3/17/2016 – Proposal definitions, simulation data and planning cost estimate due
- Detailed Project Costs due: 4/1/2016 – Additional 15 days to develop and provide detailed cost data – See the window documentation for additional information



2016 RTEP Proposal Window #1 Statistics

- 13 flow gates addressed
- 25 Proposals from 7 entities
  - 3 Transmission Owner Upgrades
    - Cost range of $7.7M to $48.5M
  - 21 Greenfield Projects
    - Cost range of $15.6M - $111.5 M



Evaluation Considerations

- Factors considered when selecting a proposal
  - Performance
  - Mitigation of applicable criteria violations
    - End of Life
  - Cost
  - Risk

Chesterfield – Messer Road – Charles City Road 230kV

2016 RTEP Proposals Submitted for Window #1

- **Generation Deliverability and Common Mode Outage (FG# 60, 61, 62, 66, 68, 70, 71, 72, 76, 78, 248, 249)**
- The Chesterfield – Messer Road – Charles City Road 230kV circuit is overloaded for several contingencies
  - This facility is also a Dominion local transmission owner End of Life criterion violation in the near term planning horizon
- Proposals Considered

Proposal Id	Cost Estimate
2016_1-3B	$22 M
2016_1-3F*	$58.8 M
2016_1-3G	$7.7 M
2016_1-5A	$41.7 M
2016_1-5B	$15.6 M
2016_1-5C	$26 M

2016 RTEP Proposals Submitted for Window #1

New 500/230kV Facilities	230kV Upgrade	Rebuild of Existing Infrastructure
2016_1-5A, 2016_1-5B, 2016_1-5C, 2016_1-3F	2016_1-3G	2016_1-3B
• Doesn't address End of Life facility • New ROW	• Caused additional violations in combination with 500kV solutions	• The proposed rebuild of existing infrastructure fixes the reliability criteria violation • Significant Margin • Existing ROW • Addresses End of Life

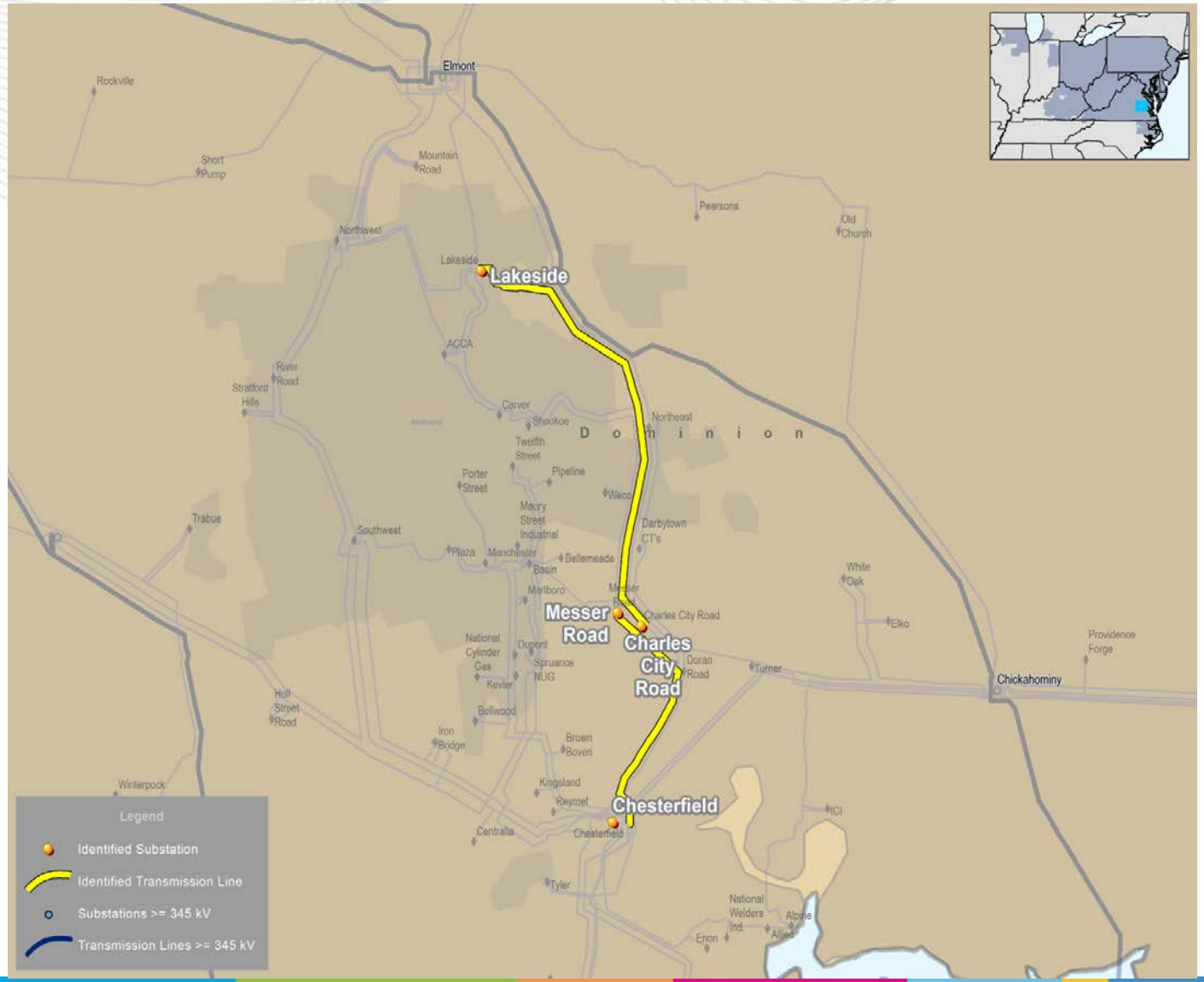
Dominion Transmission Zone

- **Generation Deliverability and Common Mode Outage (FG# 60, 61, 62, 66, 68, 70, 71, 72, 76, 78, 248, 249) & DOM End of Life Facility**
  - The Chesterfield – Messer Road – Charles City Road 230kV circuit

- **Recommended Solution:**
  - Rebuild 21.32 miles of existing line between Chesterfield and Lakeside 230 kV. (B2745)

- **Estimated Project Cost:** $ 22 M

- **Required IS Date:** 6/1/2020



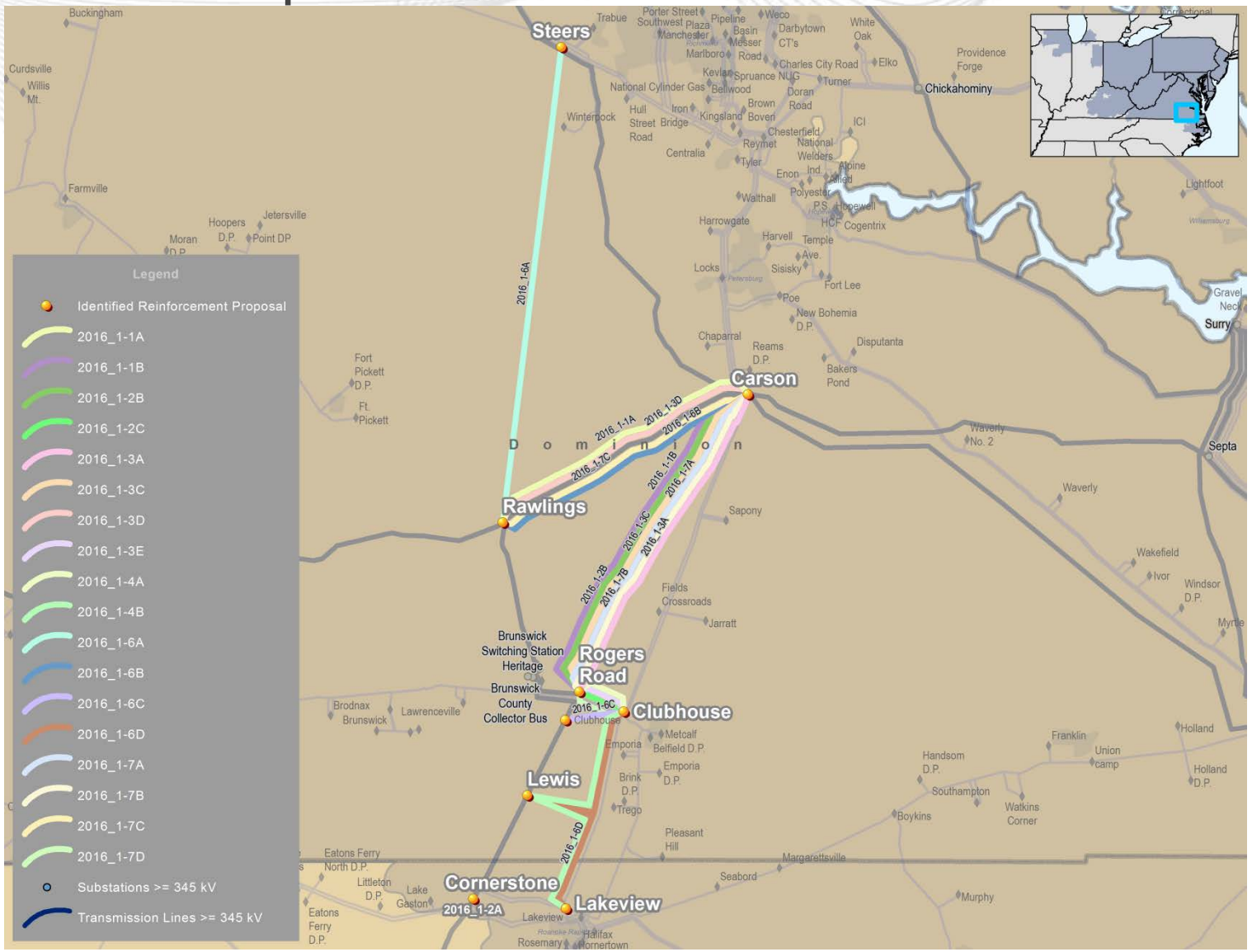
Carson – Rogers Road 500 kV

2016 RTEP Proposals Submitted for Window #1

- **Generation Deliverability (FG# 102)**
- The Carson – Rogers Rd 500 kV circuit is overloaded for single contingency loss of the Carson – Rawlings 500 kV circuit.
- Proposals Considered

2016_1-1A	2016_1-1B	2016_1-2A	2016_1-2B
2016_1-2C	2016_1-3A	2016_1-3C	2016_1-3D*
2016_1-3E	2016_1-4A	2016_1-4B*	2016_1-6A
2016_1-6B	2016_1-6C	2016_1-6D	2016_1-7A
2016_1-7B	2016_1-7C	2016_1-7D	

- Cost Estimates: ($24 M to $115 M)

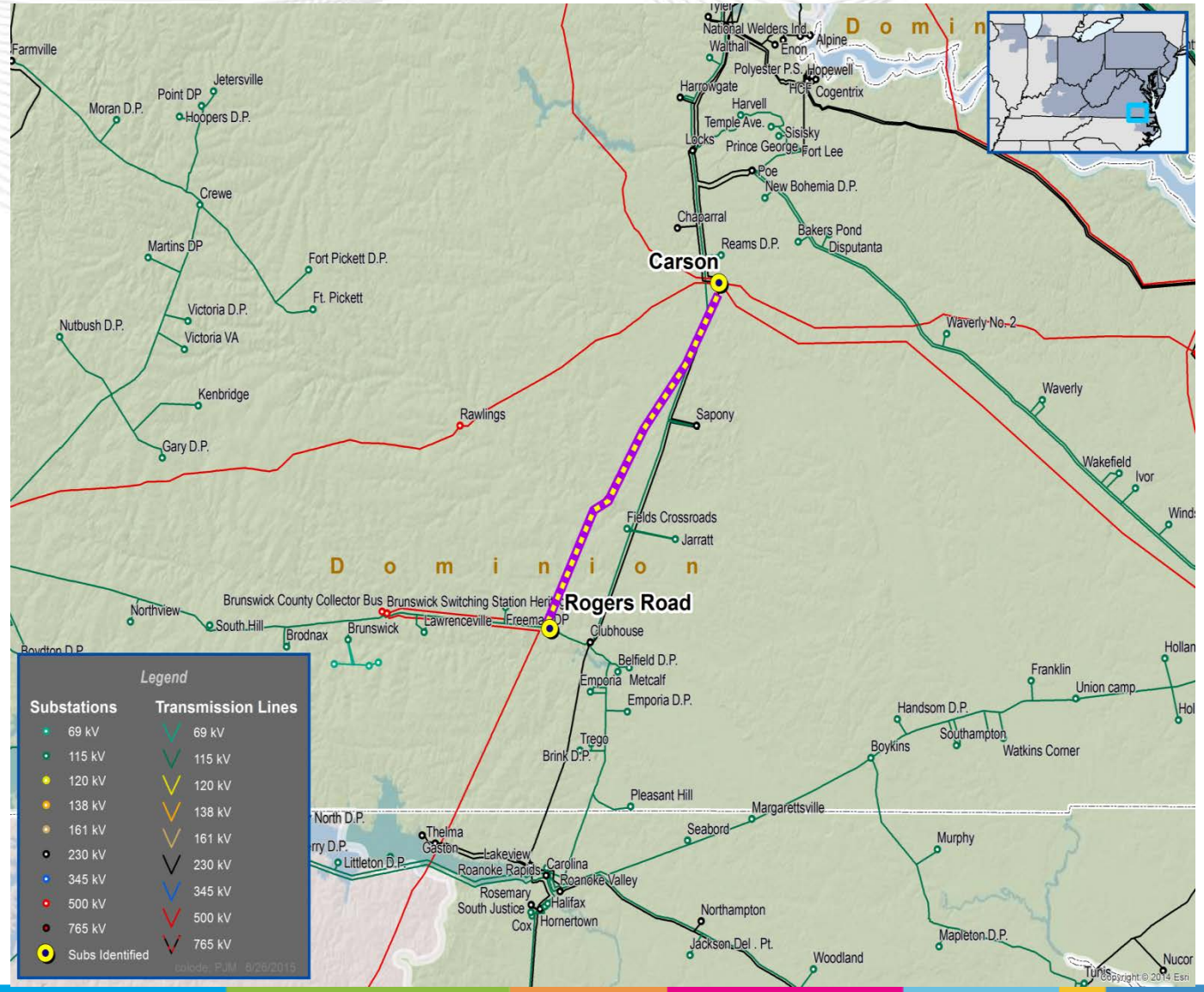


2016 RTEP Proposals Submitted for Window #1

2nd 500kV Circuit	230kV Clubhouse Option	Rebuild of Existing Infrastructure
2016_1-1A, 2016_1-3D, 2016_1-7C, 2016_1-6B, 2016_1-1B, 2016_1-2B, 2016_1-3C, 2016_1-7A, 2016_1-7B, 2016_1-2A, 2016_1-6A, 2016_1-6C	**2016_1-2C, 2016_1-3E, 2016_1-4A, 2016_1-7D, 2016_1-4B, 2016_1-6D**	**2016_1-3A**
• All 2nd 500 kV Proposals mitigated the 500 kV reliability criteria violation • Caused additional violations in 2021 analysis • Significant New ROW	• All 230 kV Clubhouse Proposals mitigated the 500 kV reliability criteria violation • Line loading exceeds 90% for all Clubhouse Proposals in the year 2020 analysis	• The proposed rebuild of existing infrastructure fixes the reliability criteria violation • Significant Margin • Existing ROW • Addresses long-term End of Life need

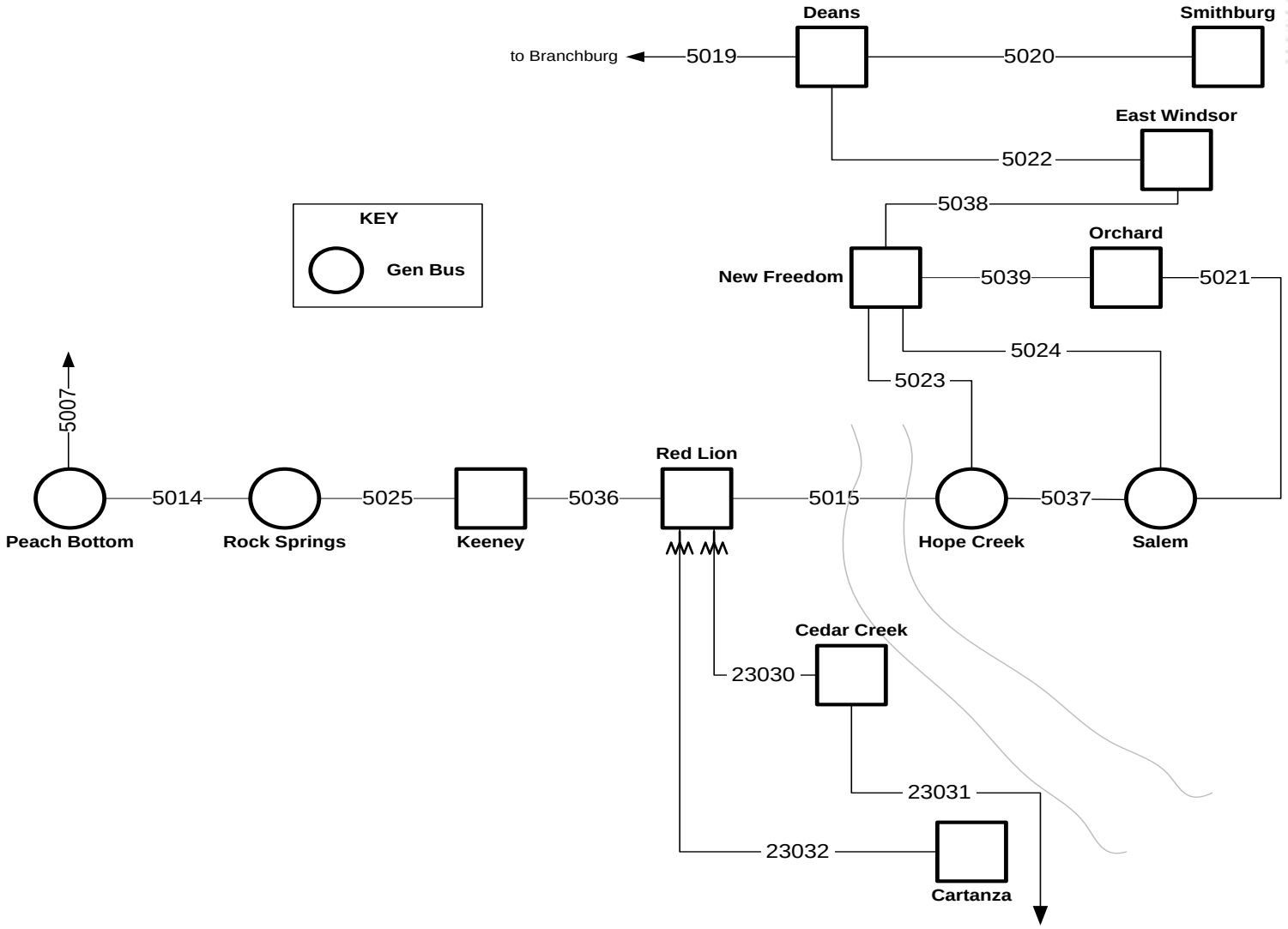
Dominion Transmission Zone

- **Generation Deliverability Violation (FG# 102)**
  - The Carson – Rogers Rd 500 kV circuit.
- **Recommended Solution:**
  - Rebuild the Carson – Rogers Rd 500kV circuit. (B2744)
- **Estimated Project Cost:** $ 48.5 M
- **Required IS Date:** 6/1/2020



Artificial Island Update

Artificial Island Area Network



Artificial Island Update

- Consideration of increased cost estimates for the current approved scope of work
- Examining configuration changes to terminate the planned Silver Run – Salem 230 kV transmission line at Hope Creek
- Continue to develop current design in parallel with the investigation into alternative configurations

Artificial Island Update

- Ongoing Activities
- Conducted discussions with PSE&G and LS Power and identified several alternative line routing and substation location options for interconnection at Hope Creek
  - Considerations for options being reviewed
    - Electrical performance
    - ROW – use of existing easements or obtaining new easements
    - Impacts to Artificial Island plans for site
    - Permitting Impacts in vicinity of AI site
    - Physical Site constraints
    - Cost
    - Schedule

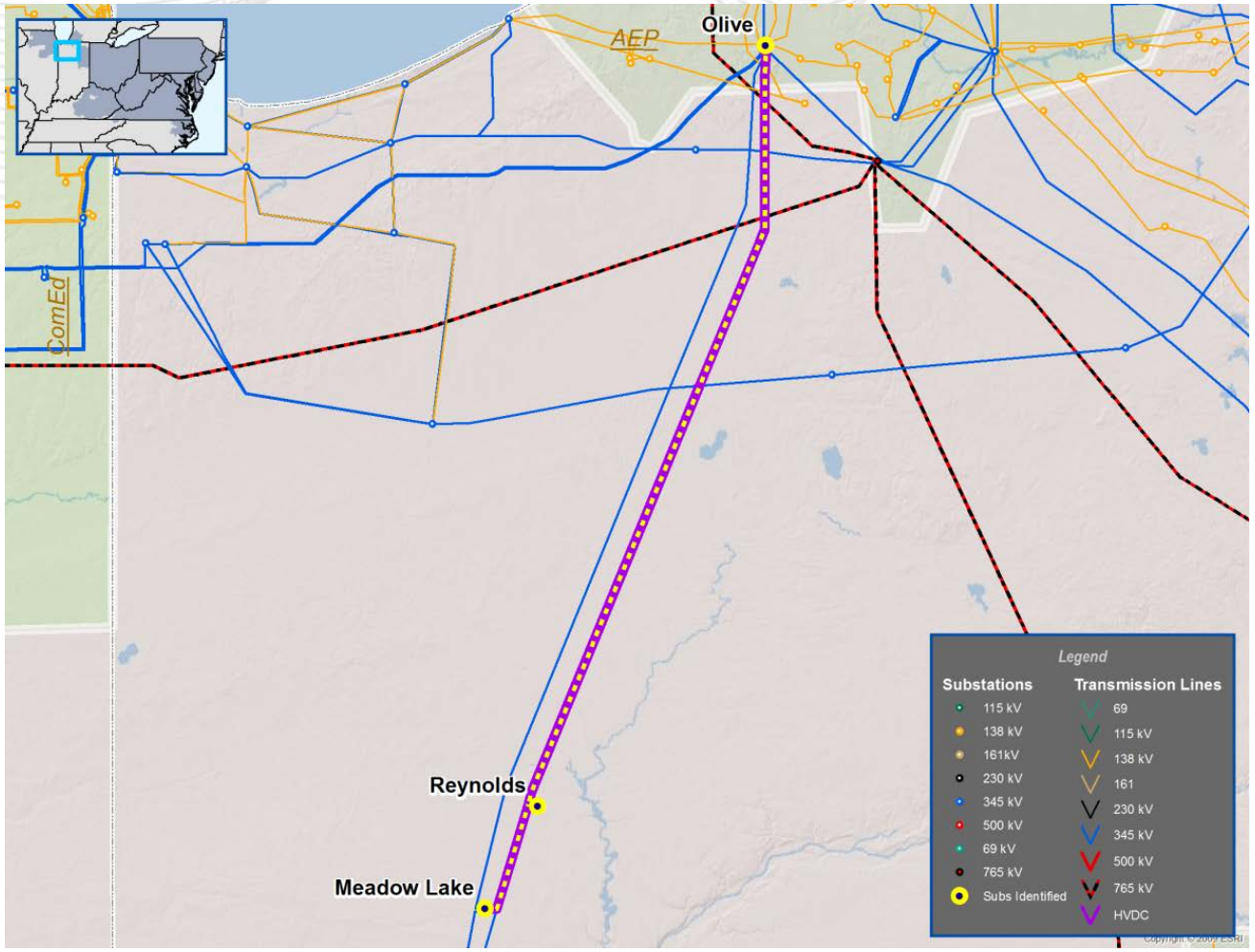
Artificial Island Update

- Complete work to identify viable alternatives to interconnect at Hope Creek
  - Determine if alternate routes/substation locations are viable
  - Complete analysis of electrical performance
  - Develop cost estimate(s)
  - Asses constructability impacts
- Provide recommendation for AI interconnection
- Process scope change to project if appropriate

Supplemental Projects

AEP Transmission Zone

- Supplemental Project
- Loop in the Meadow Lake - Olive 345 kV circuit into NIPSCo's Reynolds 765/345kV station (S1141)
- Part of MISO MVP project
- Estimated Project Cost: $2M
- Projected IS Date: 5/1/2017



Questions?

Email: RTEP@pjm.com

Revision History

- Revision History
  - V1 - Original version posted to PJM.com – 5/10/2016
  - V2 – Added baseline upgrade ID #’s and removed slide– 5/11/2016
  - V3 Removed slide from supplemental projects section – 5/11/2016