Sub Regional RTEP Committee PJM South

March 9, 2015

Reliability Analysis Update

Dominion Local TO Criteria - End Of Life Criteria

Dominion End of Life Criteria

Dominion End of Life Criteria decision point metrics:

1) Facility is nearing, or has already passed, its end of life, and

2) Continued operation risks negatively impacting reliability of the transmission system.

Dominion End of Life Criteria

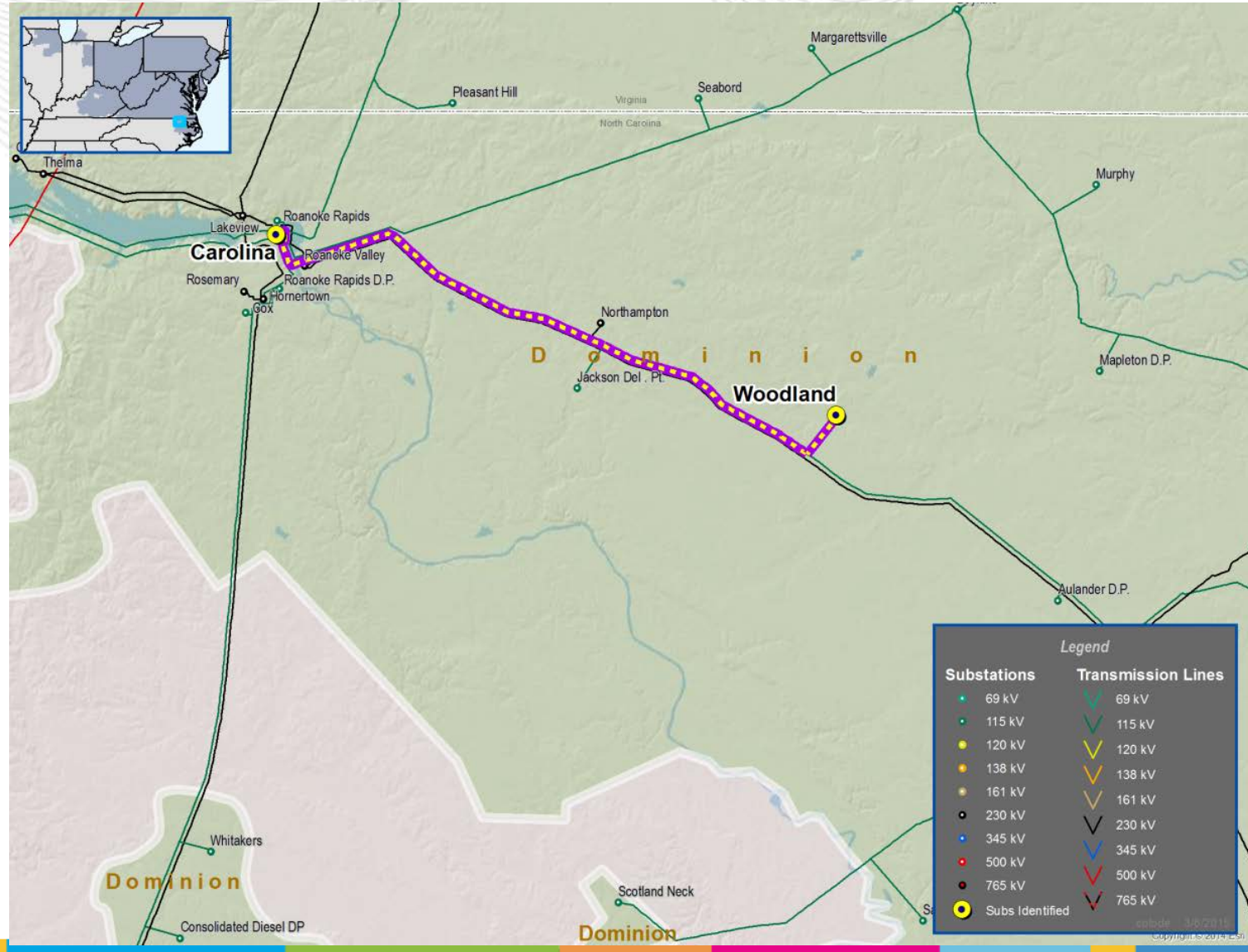
- Dominion Local TO Criteria
  - End of Life Criteria
    1. End of Life Assessment
       - Industry guidelines indicate equipment life standards
         - Wood structures - 35-55 years,
         - Conductor and connectors - 40-60 years
         - Porcelain insulators - 50 years.
    2. Reliability and System Impact

Dominion Transmission Zone

B2458.1 - B2458.4 Cost Increase

Existing Project Scope:

- Uprate Line #54 (Carolina – Woodland 115kV), 27 miles. Replace 14 wood H-frame structures with steel H-frame structures that are in the same line section. Replace 2.5 miles of static wire. Remove the Carolina 54 SPS to include relay logic changes, minor control wiring, relay resets and SCADA programming.



Proposed Addition to Existing Project Scope

- Dominion End of Life Criteria
- End of Life
  - 4.5 miles of conductor between Carolina 115kV and Jackson DP 115kV has a 60 year old conductor and the structures are between 43 and 60 years old.
- System Impact
  - Failure of the Carolina – Jackson facility would permanently drop 27.6 MW of load
- Addition to project scope due to End of Life criteria: Replace 4.5 miles of conductor between Carolina 115kV and Jackson DP 115kV with a minimum of 300 MVA summer STE rating and replace 8 wood H-frame structures located between Carolina and Jackson DP with steel H-frames. (B2458.5)

Previous Estimated Cost: $ 4.9 M

Revised Estimated Cost : $ 6.9 M

Projected IS Date: May 2016

Dominion Transmission Zone

Problem:

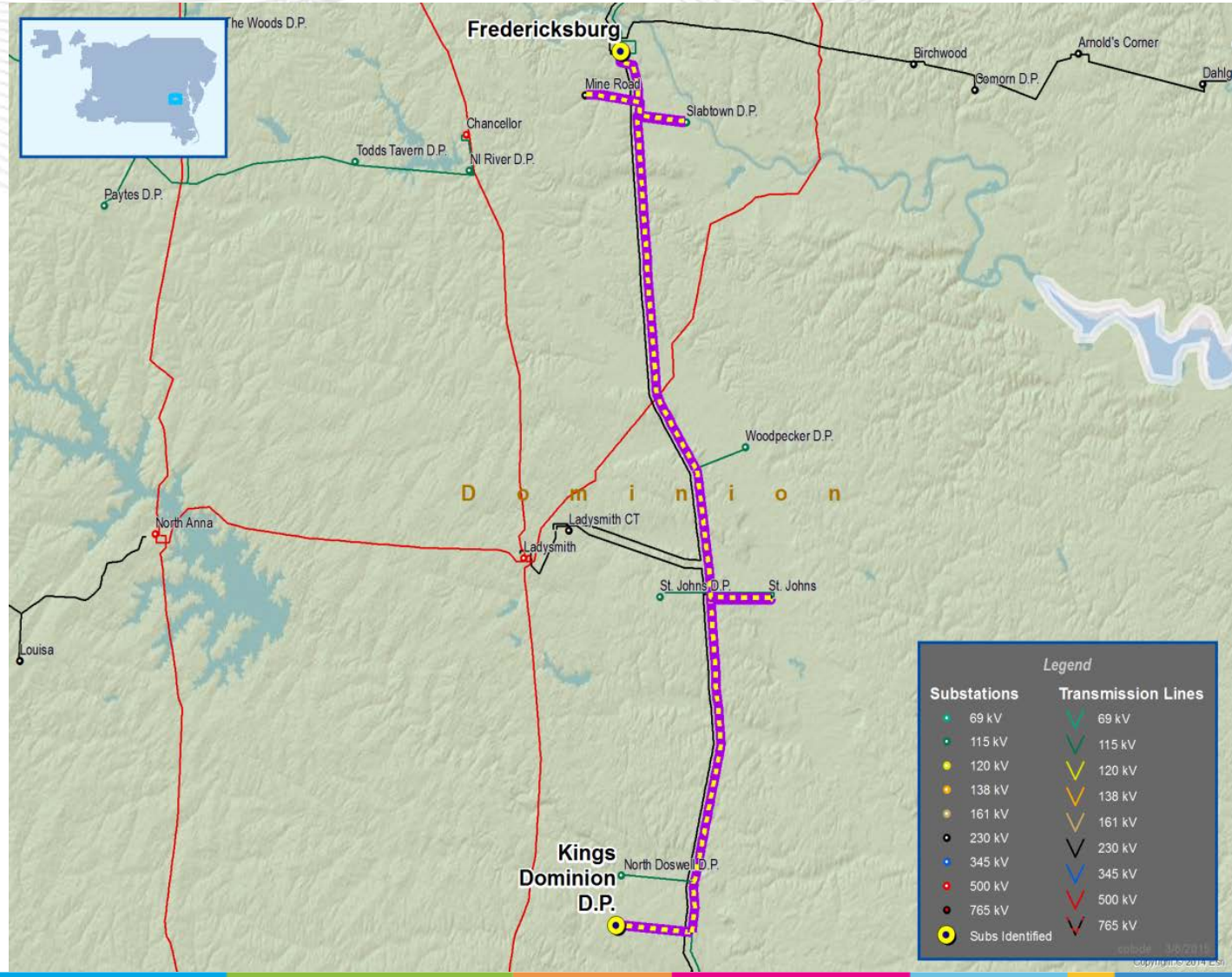
- End of Life Criteria -The 34 mile section of the Line #47 between Kings Dominion 115kV and Fredericksburg 115kV was constructed on wood H-frames in 1957 and has 795 ACSR conductor with a 3/8” steel static wire.
- System Impact Assessment - Failure of Line #47 would permanently drop 96 MW of load

Proposed Solution:

- Rebuild Line #47 between Kings Dominion 115kV and Fredericksburg 115kV to current standards with a summer emergency rating of 353 MVA at 115kV. (B2622)

Estimated Project Cost: $51.0 M

Projected IS Date: 12/31/2017



Dominion Transmission Zone

Problem:

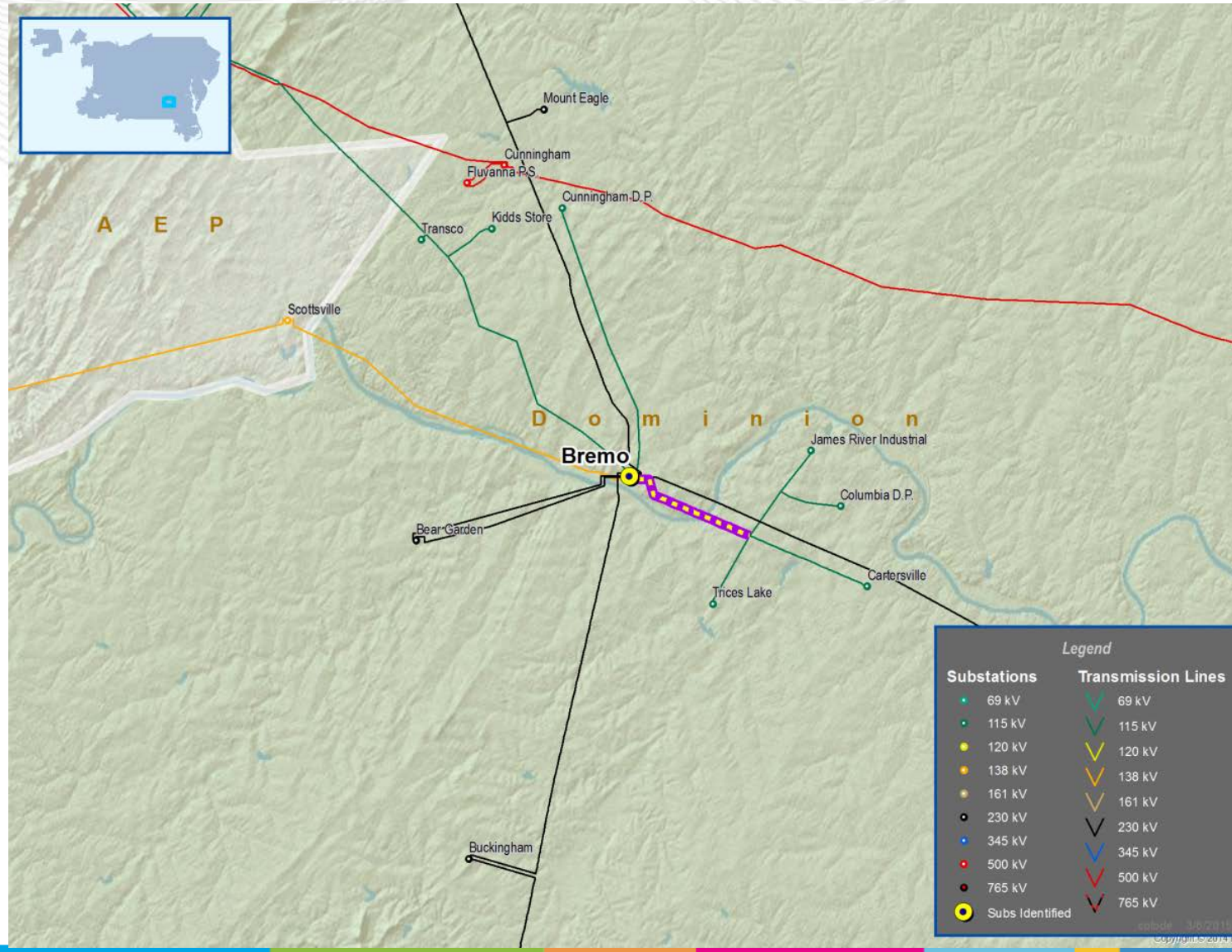
- End of Life Criteria - Line #4 between Bremo 115kV and Structure 8474 115kV was constructed on wood H-frame structures in 1947. This line has copper conductor and 3/8" steel static.
- System Impact Assessment - Failure of Line #4 would permanently drop 86.7 MW of load

Proposed Solution:

- Rebuild Line #4 between Bremo and Structure 8474 (4.5 miles) to current standards with a summer emergency rating of 261 MVA at 115kV. (B2623)

Estimated Project Cost: $6.8 M

Projected IS Date: 12/31/2016



Dominion Transmission Zone

Problem:

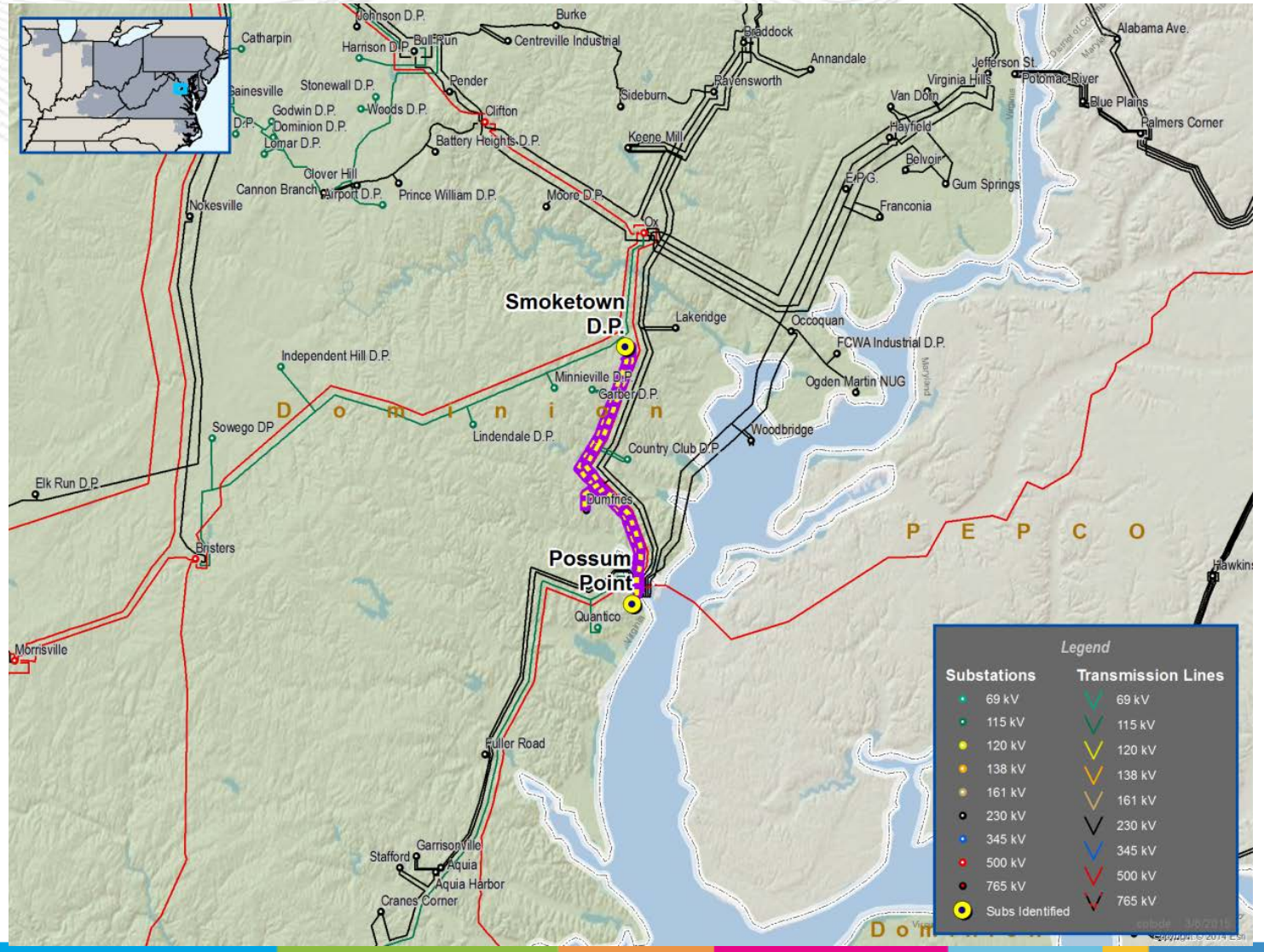
- End of Life Criteria - 115kV Lines #18 and #145 are approximately 8.35 miles long and were constructed on double-circuit, 3-pole wood H-frame structures in the timeframe between 1948 and 1954..
- System Impact Assessment - Failure of Lines #18 & #145 would permanently drop 68.5 MW of load

Proposed Solution:

- Rebuild 115kV Lines #18 and #145 between Possum Point Generating Station and NOVEC's Smoketown DP (approx. 8.35 miles) to current 230kV standards with a normal continuous summer rating of 524 MVA at 115kV (1047 MVA at 230kV) (B2624)

Estimated Project Cost: $24.7 M

Projected IS Date: 12/31/2016



Dominion Transmission Zone

Problem:

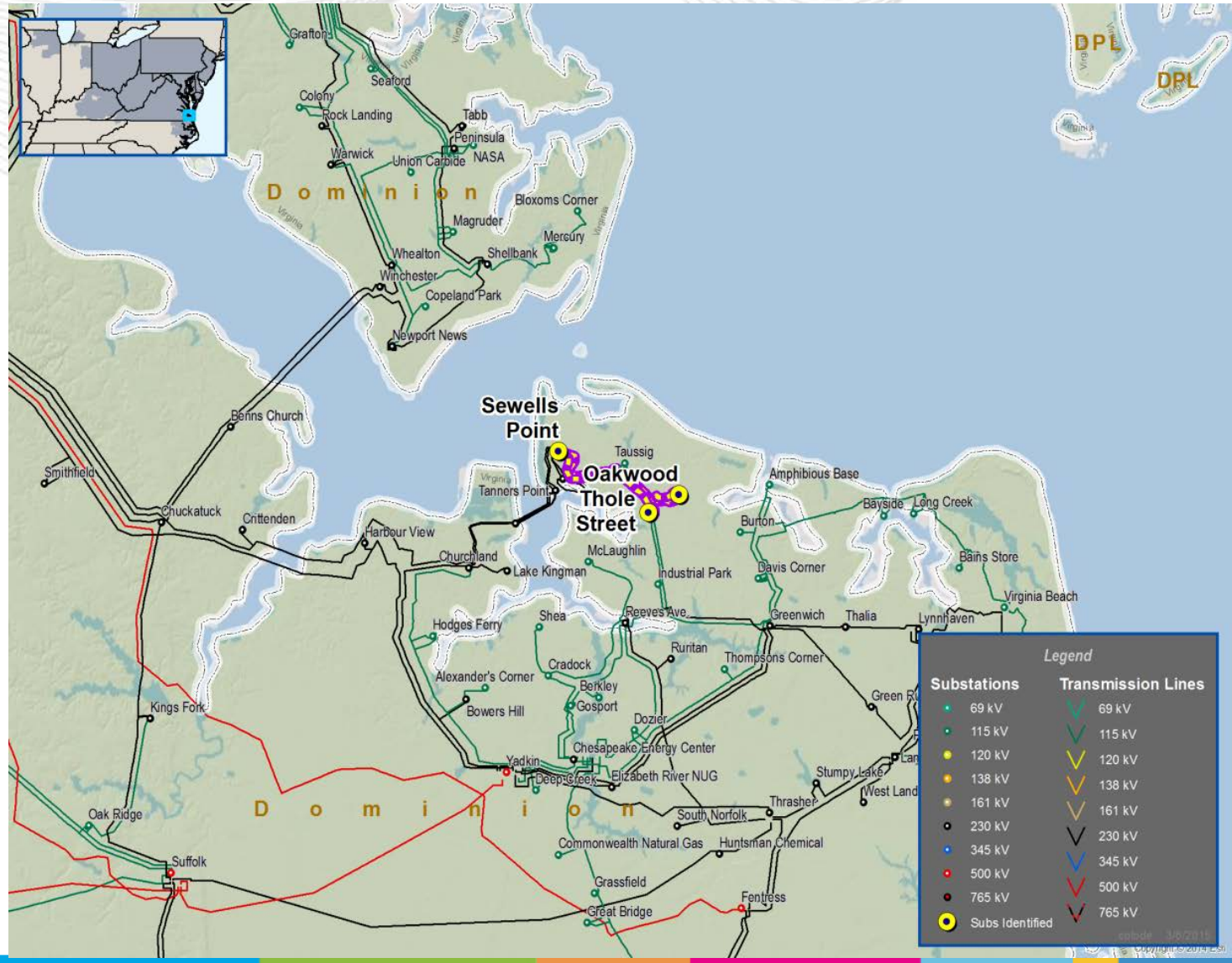
- End of Life Criteria - The 115kV Lines #48 (Sewells Point to Thole Street) and #107 (Sewells Point to Oakwood) were built on double circuit weathering steel (corten) towers in 1965. Field reports and condition assessment indicate the corten structures are in poor condition and additional structure loading will be required due to a need for fiber to be installed on these structures
- System Impact Assessment - Failure of Lines #48 & #107 would permanently drop 27 MW of load

Proposed Solution:

- Rebuild 115kV Line #48 between Thole Street and structure 48/71 to current standard. The remaining line to Sewells Point is 2007 vintage. Rebuild 115kV Line #107 line between structure 107/17 and 107/56 to current standard (B2625)

Estimated Project Cost: $15.3 M

Projected IS Date: 12/31/2018



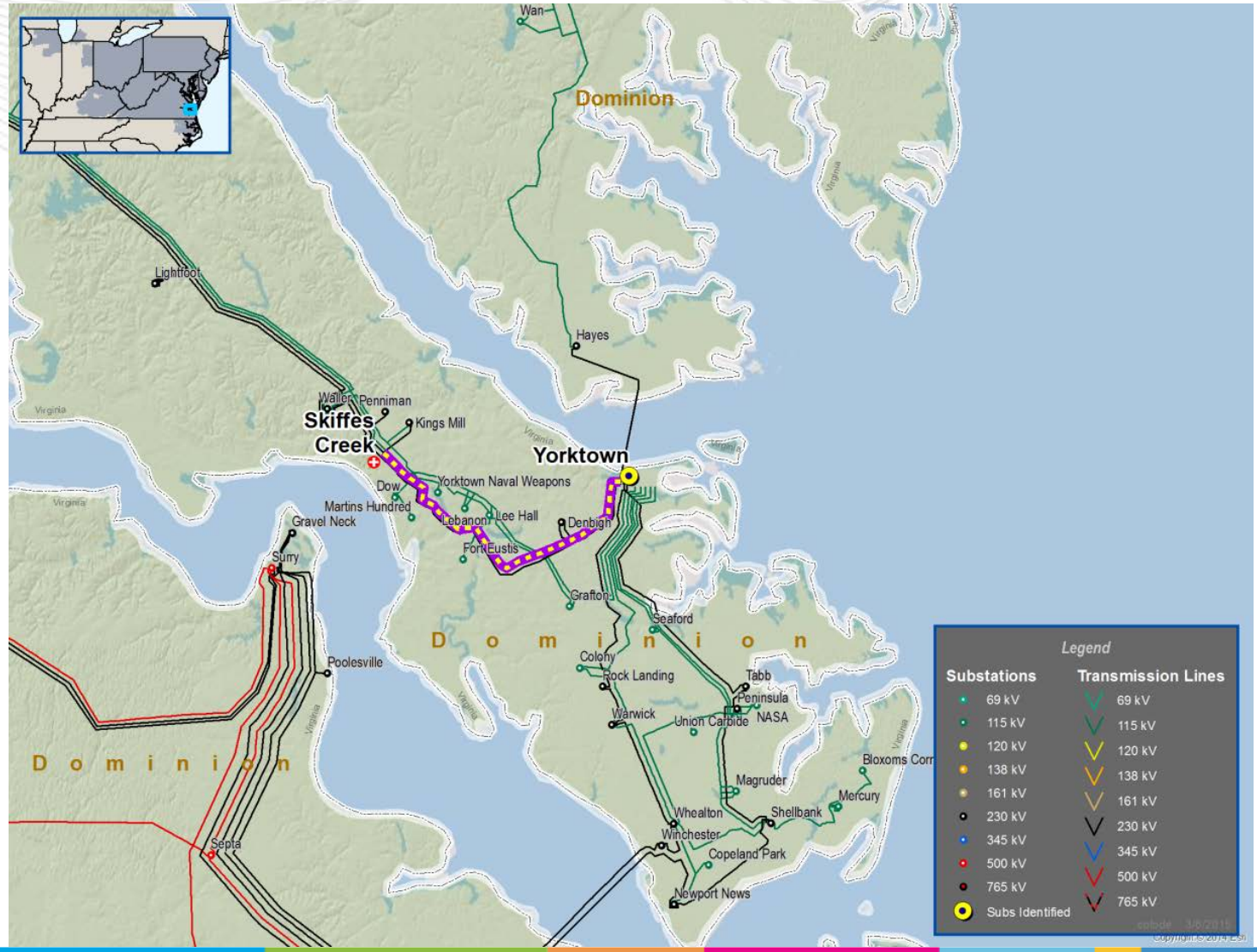
Dominion Transmission Zone

Problem:

- End of Life Criteria - The 13 mile 115kV Line #34 from Skiffes Creek – Yorktown was built on wood H-frames in the 1940's and 1950's. This line has sections of 4/0 copper conductor and 3/8" steel static. The first 4.5 miles out of Yorktown is on 3 pole double circuit wood H-frames with the Line #61 line.
- System Impact Assessment - Failure of Lines #34 & #61 would permanently drop 198 MW of load

Proposed Solution:

- Rebuild the 115kV Line #34 and the double circuit portion of 115kV Line # 61 to current standards with a summer emergency rating of 353 MVA at 115kV. (B2626)
- **Estimated Project Cost:** $24 M
- **Projected IS Date:** 12/31/2018



Dominion Transmission Zone

Problem:

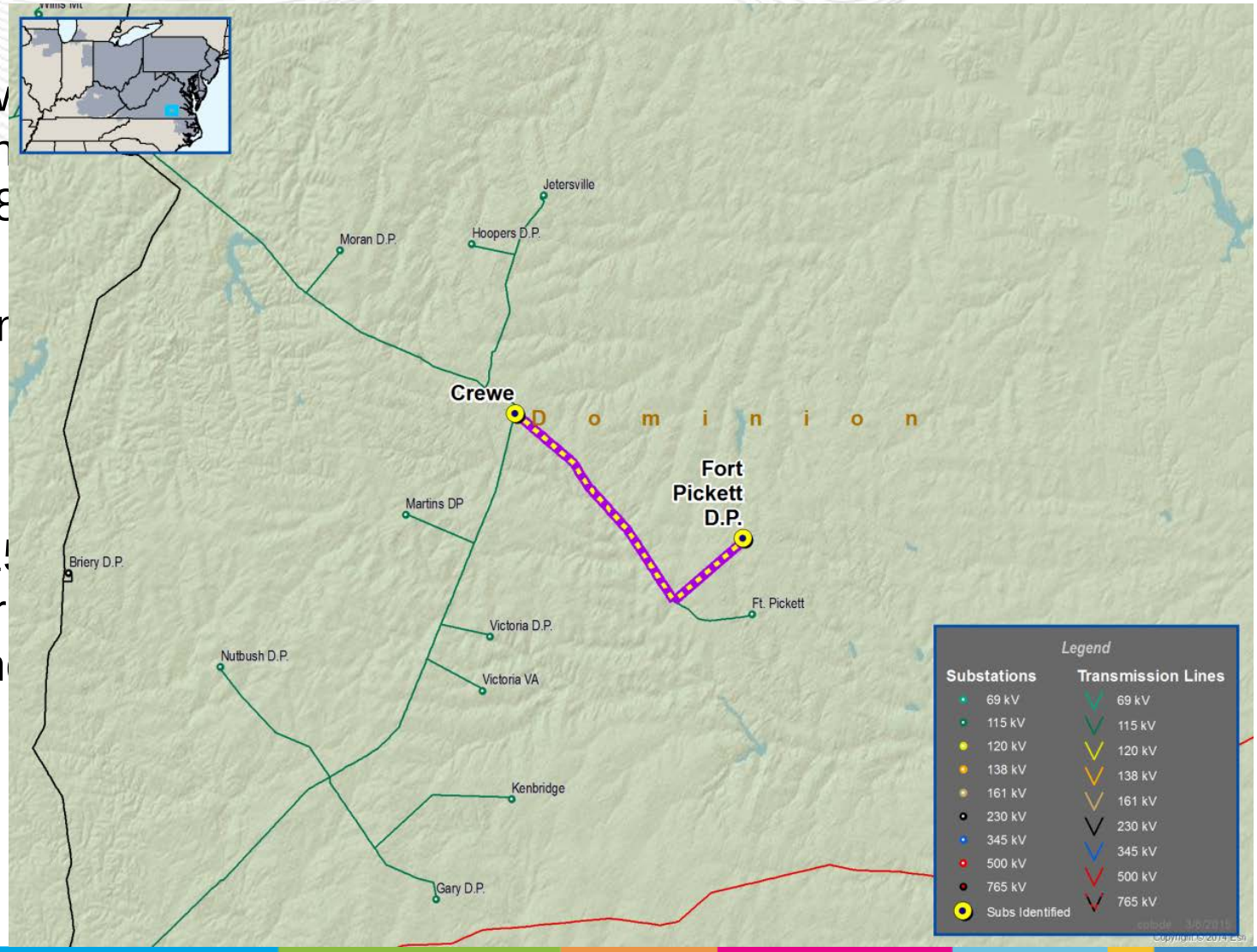
- End of Life Criteria - The 115kV Line # 1 w
  constructed on wood H-frame structures in
  This line has 2/0 copper conductor and 3/8
  static.
- System Impact Assessment - Failure of Lir
  permanently drop 31 MW of load

Proposed Solution:

- Rebuild 115kV Line #1 between Crewe 11
  Fort Pickett DP 115kV (12.2 miles) to curr
  standards with a summer emergency ratin
  MVA at 115kV. (B2627)

Estimated Project Cost: $18.3 M

Projected IS Date: 12/31/2016



Dominion Transmission Zone

Problem:

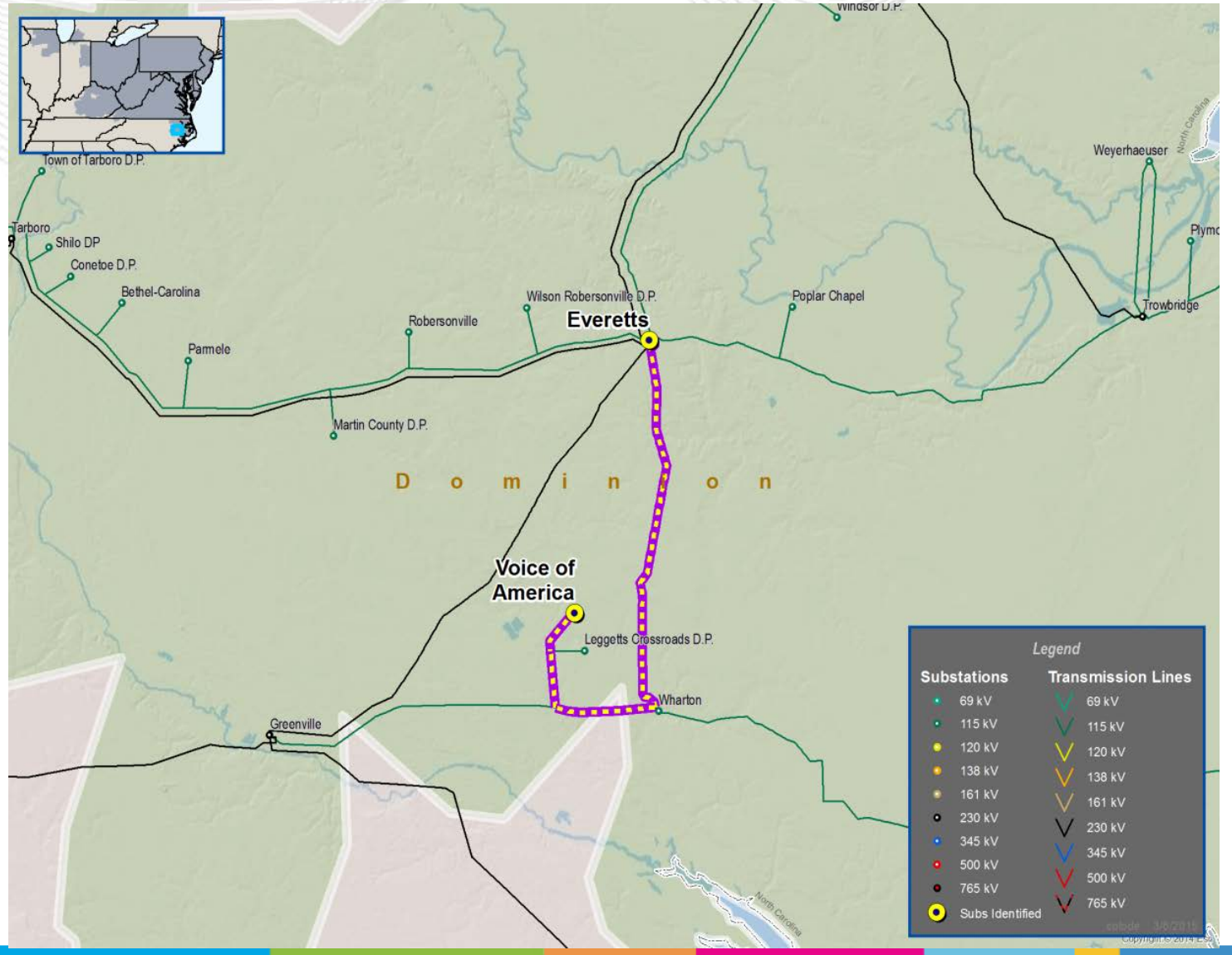
- End of Life Criteria - The Line #82 line was constructed on wood H-frame structures in 1953. This line has ACSR conductor and 3/8 inch steel static.
- System Impact Assessment - Failure of Line #82 would permanently drop 49 MW of load

Proposed Solution:

- Rebuild 115kV Line #82 Everetts – Voice of America (20.8 miles) to current standards with a summer emergency rating of 261 MVA at 115kV (B2628)

Estimated Project Cost: $24 M

Projected IS Date: 12/31/2017



Dominion Transmission Zone

Problem:

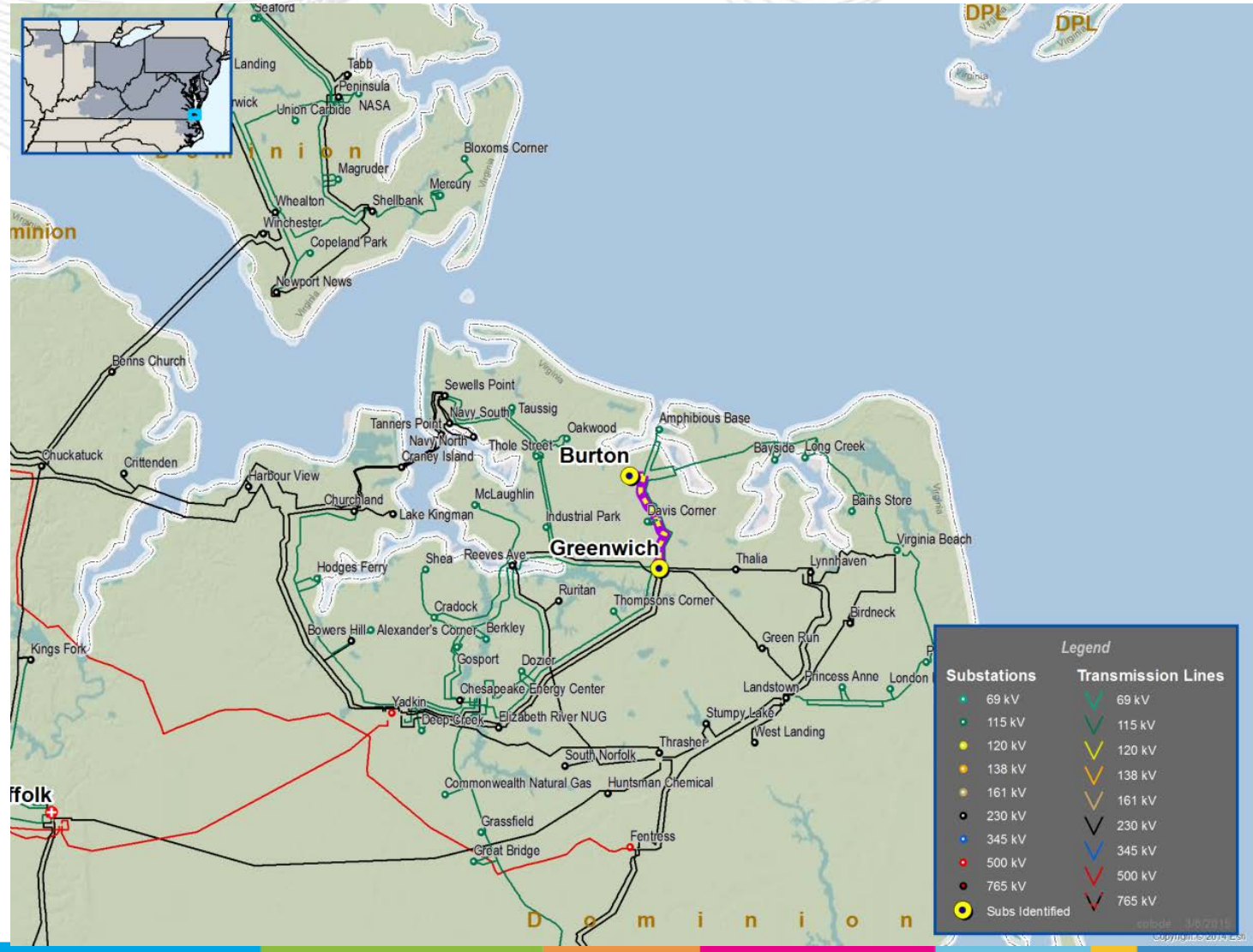
- End of Life Criteria - The 115kV Lines #27 (new line 166) and # 67 lines from Greenwich to Burton were built on double circuit weathering steel (Corten) towers in 1964. The corten structures are in poor condition and additional structure loading will be required due to a need for fiber to be installed on these structures.
- System Impact Assessment - Failure of Lines #27 & #67 would permanently drop 90 MW of load

Proposed Solution:

- Rebuild the 115kV Lines #27 & #67 lines from Greenwich 115kV to Burton 115kV Structure 27/280 to current standard with a summer emergency rating of 262 MVA at 115kV (B2629)

Estimated Project Cost: $8.85 M

Projected IS Date: 12/31/2019



Dominion Transmission Zone

Driver:

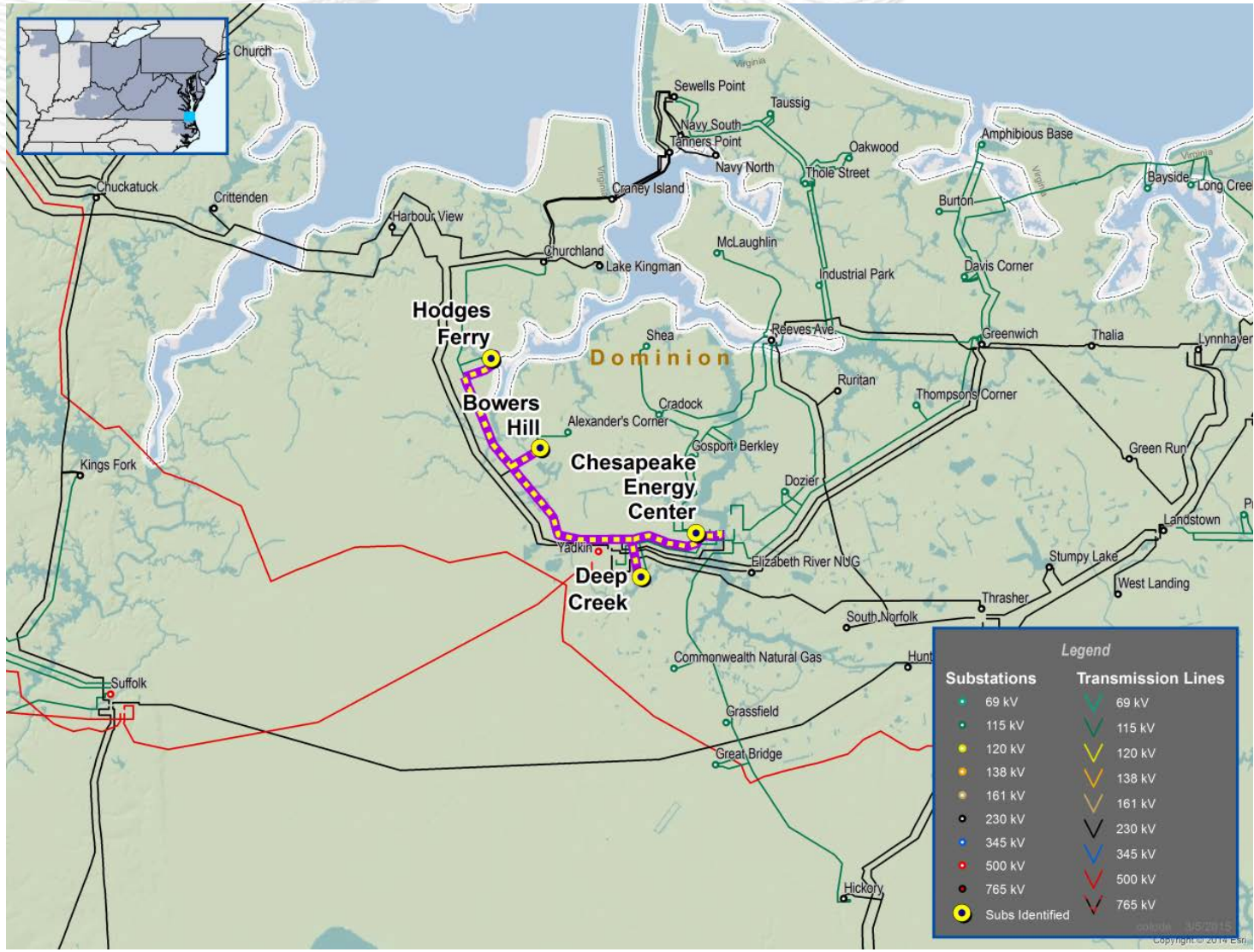
- The Chesapeake - Deepcreek - Bowers Hill - Hodges Ferry 115 kV line is overloaded for various GenDeliv and N-1-1 contingencies

Proposed Solution:

- Wreck and rebuild the Chesapeake - Deepcreek - Bowers Hill - Hodges Ferry 115 kV line; minimum rating 239 MVA normal/emergency, 275 MVA load dump rating (b2620)

Estimated Project Cost: $10 M

Required IS Date: 6/1/2016



Dominion Transmission Zone

Problem:

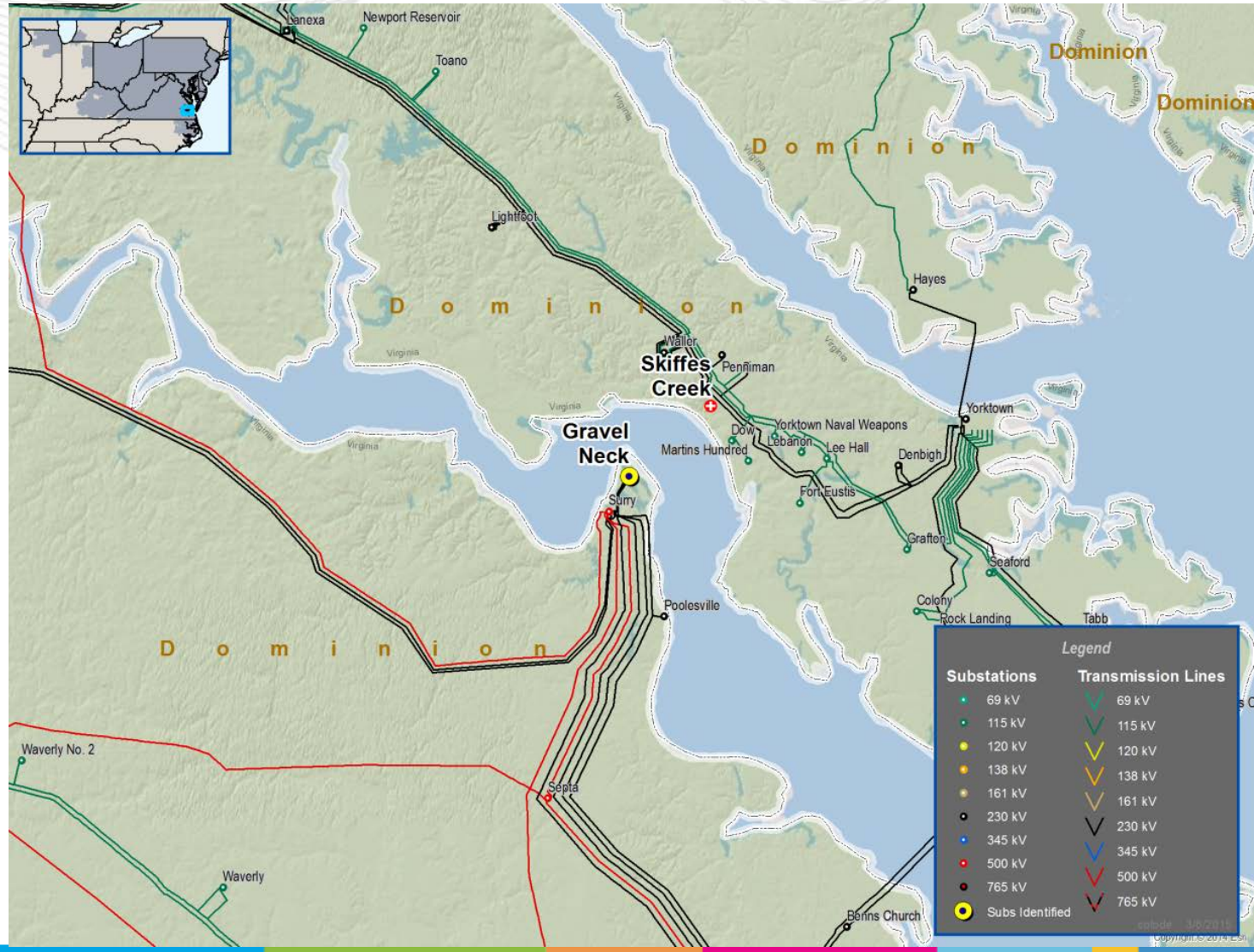
- Transmission upgrades are needed on GSU units #4 and #5 for Operational Performace.

Proposed Solution:

- Install circuit switchers on GSU units #4 and #5. Install two 230kV CCVT's on Lines #2407 and #2408 for loss of source sensing (B2630)

Estimated Project Cost: $662 K

Projected IS Date: 5/31/2015



Supplemental Projects

Dominion Transmission Zone

Existing Project S0610

Problem

- Transferring 6 MW from Halifax DP to new DP for reliability and anticipated industrial park development (no new load initially). Projected load 15 MW by 2024.

Previous Solution

- Split Line 81, build 4 miles of double circuit 115kV and a 115kV breaker station with a tap to serve Roanoke Industrial Park 115kV DP (REC). REC cancelled their request for a 115kV DP at Roanoke Industrial Park.

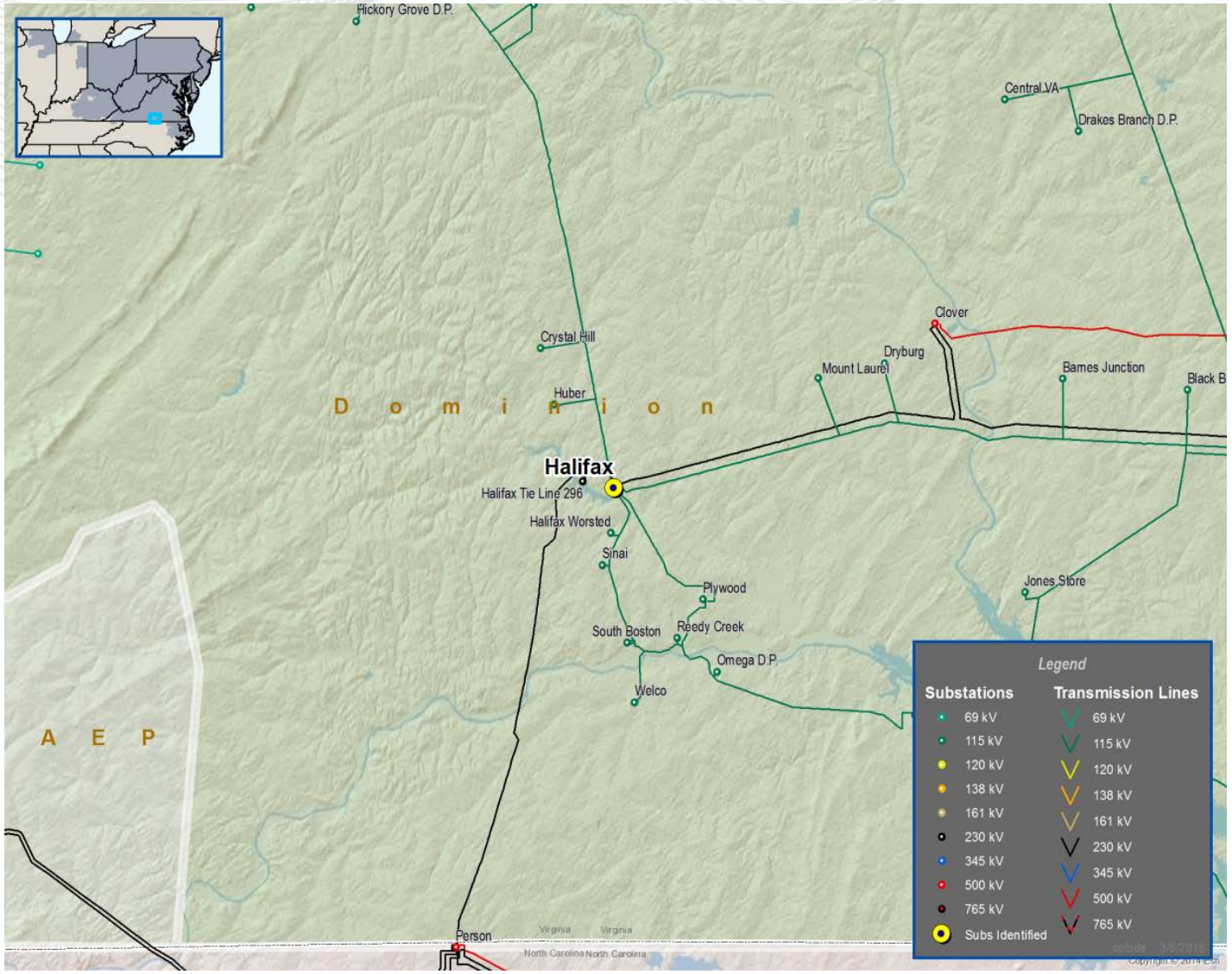
Revised Solution:

- Install 2 switches on Line 81 and provide 115kV tap for new 115kV DP.

Previous Estimated Cost: $12.9 M

Revised Estimated Cost: $600 K

Projected IS Date: 10/31/2015



Dominion Transmission Zone

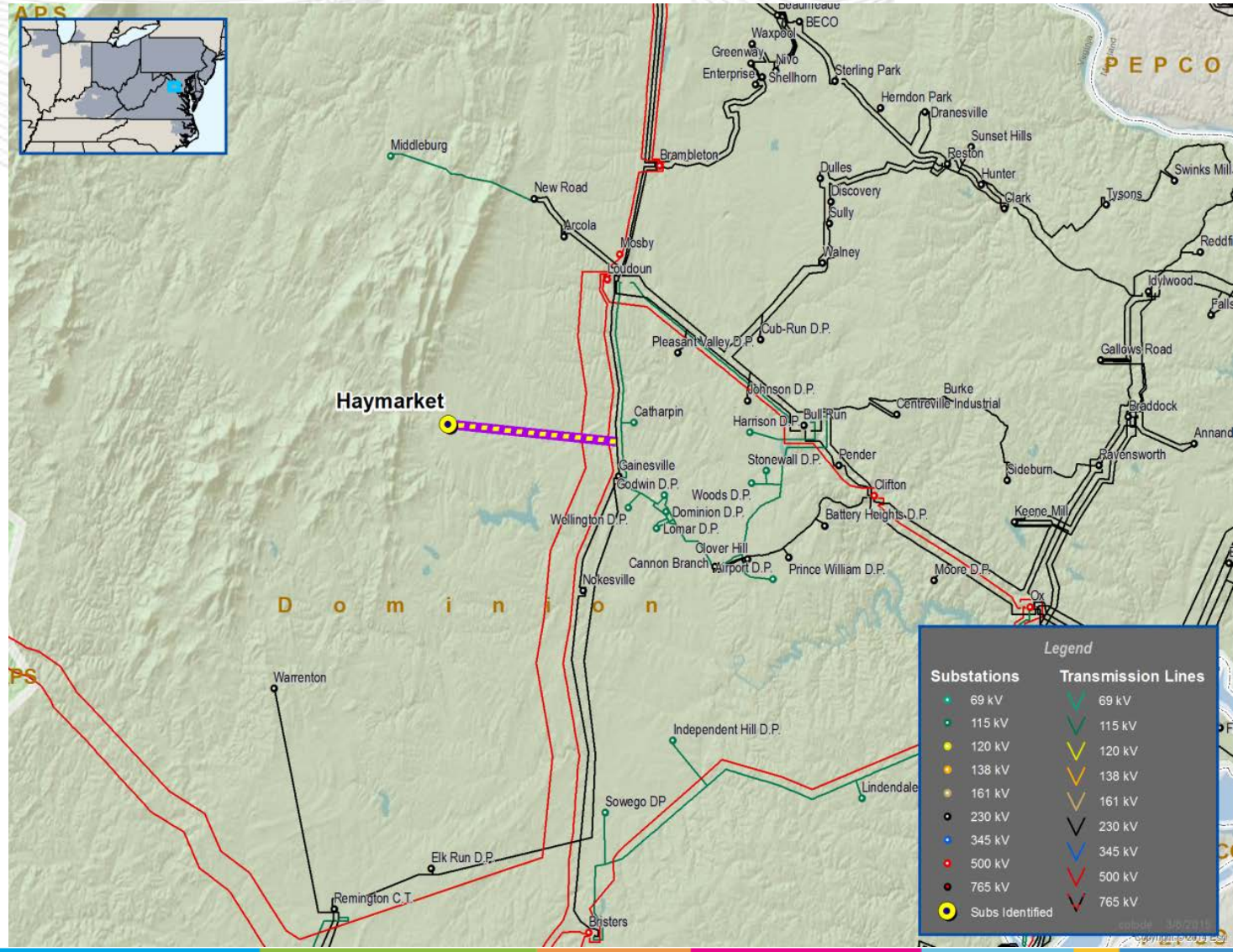
Problem:

- Dominion Distribution (DVP) has submitted a Delivery Point (DP) Request for a proposed Haymarket Substation (site to be acquired) with an energization date of 01/31/2018 (energization likely will be summer 2018). The main driver for the new substation is a block load addition. Initial load will be approximately 80 MVA, growing to over 100 MVA by 2019.

Proposed Solution:

- Loop (in-and-out) an overhead, double-circuit, 230kV transmission line extension approximately 6 miles (along new right-of-way) from a point in the corridor north of Gainesville to the proposed Haymarket Substation site **(s0918.1)**. Install four 230kV breakers in a ring arrangement to accommodate the connection of DVP's 84 MVA ,230-34.5kV transformers (two initial, three ultimate) **(s0918.2)**
- **Estimated Project Cost:** $45-57 M

Projected IS Date: 5/1/2018



Dominion Transmission Zone

Problem:

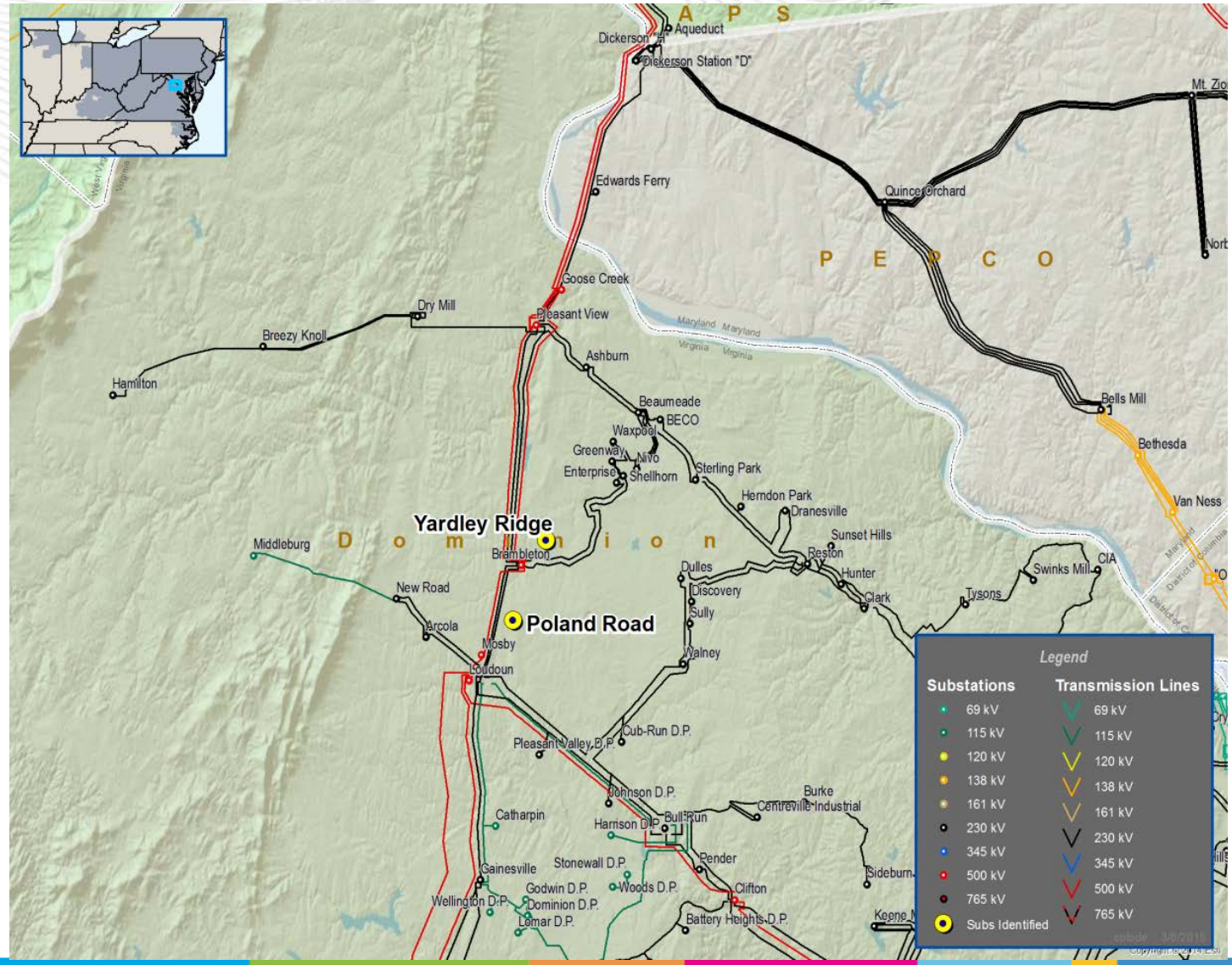
- Dominion Distribution (DVP) has submitted a Delivery Point (DP) Request for a proposed Poland Road Substation with an energization date of 04/30/2017. NOVEC has also submitted a DP Request for a proposed Yardley Ridge Substation with an energization date of 12/01/2017. The driver for each new substation is a block load addition (approx. 110 MVA at Poland Road and approx 150 MVA at Yardley Ridge).

Proposed Solution:

- Poland Road – Cut Line #2094 (Loudoun-Brambleton) and extend a double-circuit 230kV line approximately 4.0 mile to Poland Road Substation **(S0919.1)**. At Poland Road Sub, install two backbone structures and a four-breaker 230kV ring bus. **(S0919.3)**
- Yardley Ridge – Cut Line #2137 (Brambleton-BECO) and extend a double-circuit 230kV line approximately 0.5 miles to Yardley Ridge Substation **(S0919.2)**. At Yardley Ridge Sub, install two backbone structures and a four-breaker 230kV ring bus **(S0919.4)**

Estimated Project Cost: $35 M

Projected IS Date: 5/1/2018



Dominion Transmission Zone

Problem:

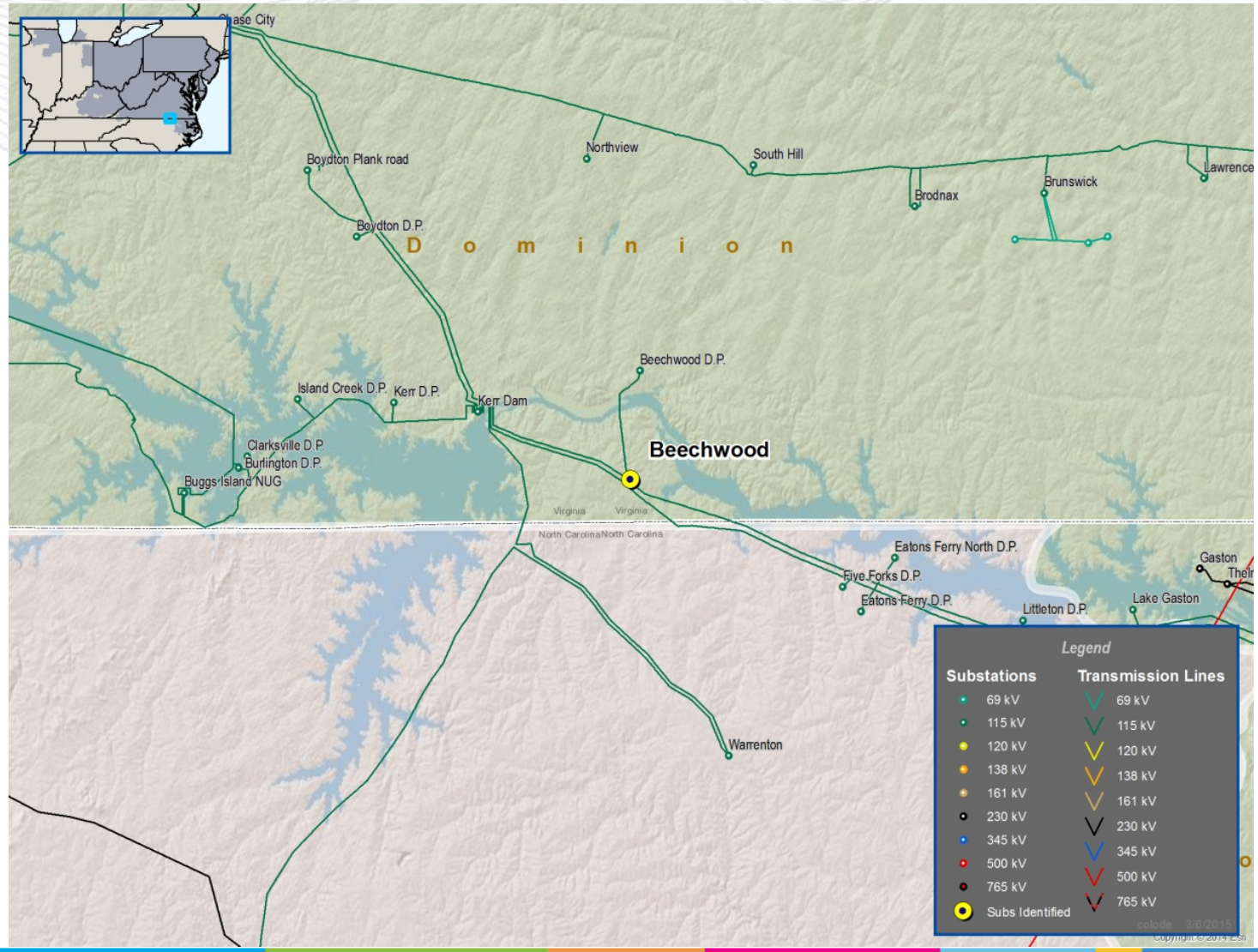
- 115 kV Line #90 (Carolina – Kerr Dam) has a 4.5 mile long radial tap that serves Beechwood DP. The need to remove this long tap exposure from the main line was identified for reliability. Line #90 is a 39 mile long 115kV line, also serving Five Forks DP, Littleton DP and Lake Gaston.

Proposed Solution:

- Build a new substation at the tap serving Beechwood DP with a 115kV three breaker ring to split Line #90 and terminate the end points. Terminate the Beechwood tap into the ring. (S0920)

Estimated Project Cost: $4 M

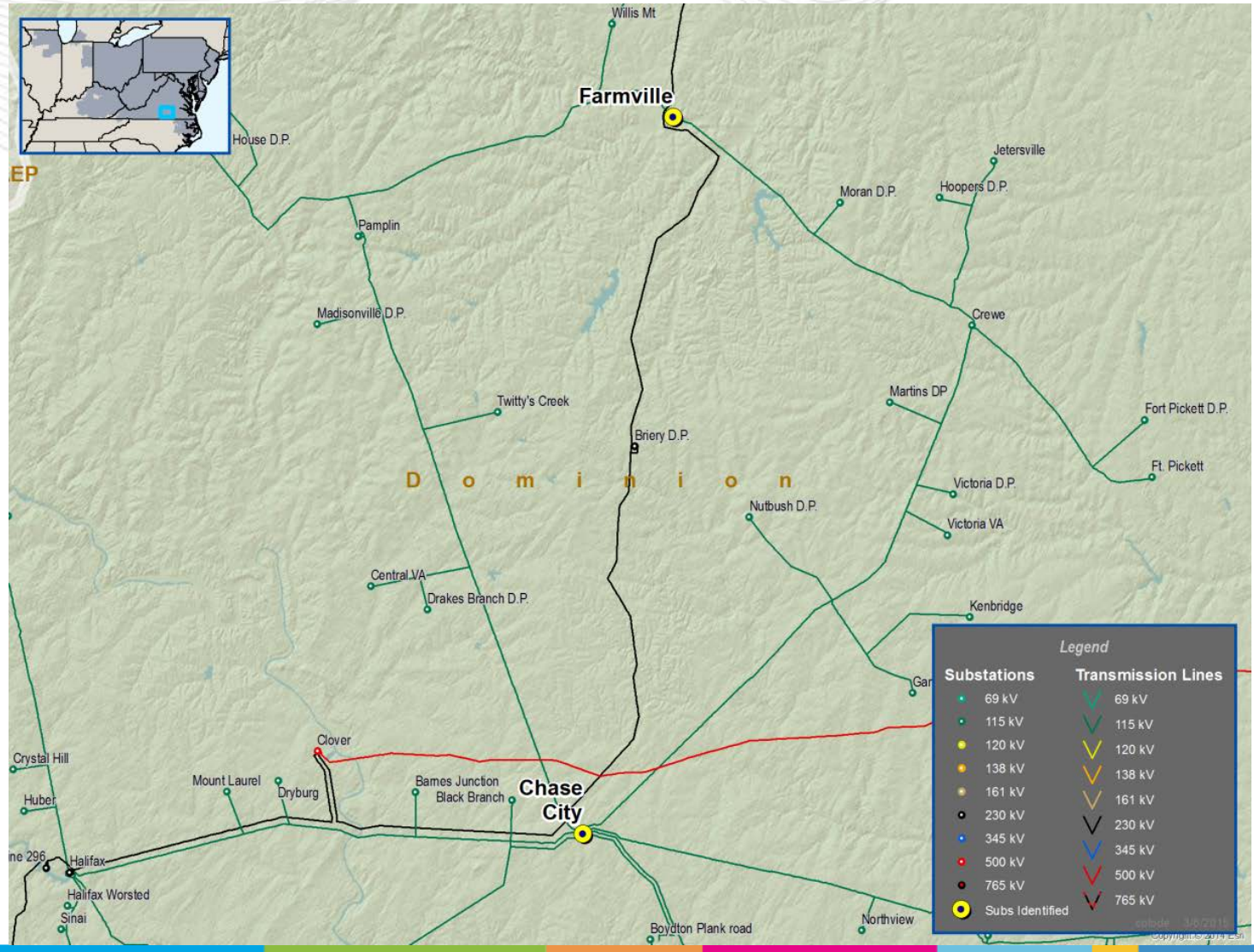
Projected IS Date: 12/31/2017



Dominion Transmission Zone

Problem:

- The Dominion Facility Connection Requirement states that transmission tap lines greater than a mile should be protected by a breaker to improve the reliability of the line
- These lines also have increased exposure due to several long taps:
  - Jetersville tap is 8 miles increasing to 16 miles with the new Ponton DP in 201
  - Nutbush DP tap is 5.4 miles
  - Gary DP tap is 7.9 miles
  - Redhouse DP tap is 17 miles



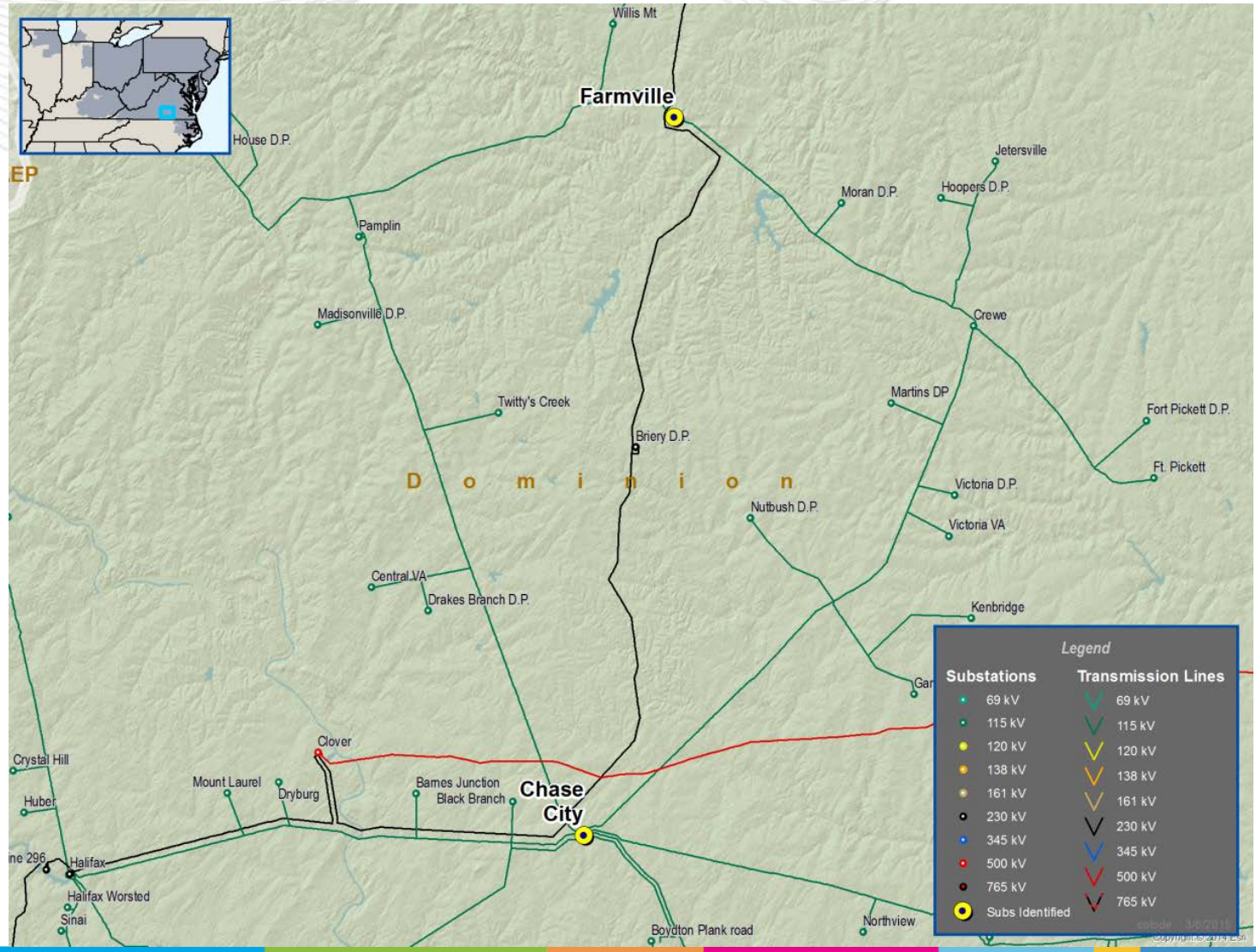
Dominion Transmission Zone

Proposed Solution:

- Network 115kV Lines #98 and #158 by splitting Line #158 between Crewe and the Jetersville tap and building a 4 breaker ring switching station **(S0921.1)**. Double build the Jetersville tap 0.6 miles back to the new station. Double build Line #1 for 0.6 miles from Crewe back to the new station. Terminate the lines into the ring. **(S0921.5)**
- Network Lines #84 and 154 by expanding Pamplin Substation and building a 4 breaker ring. Terminate lines 84, 154 and the Redhouse DP tap into the ring bus. **(S0921.2)**
- Purchase land and build a new station in the vicinity of the taps to Gary and Nutbush delivery points **(S0921.3)**. Install a 4 breaker ring, split line 98 and terminate into the ring. Terminate the Gary and Nutbush DP taps into the ring. Splitting the 98 line is necessary for protection. **(S0921.6)**
- Add a 115kV breaker at Twittys Creek. Splitting the 154 line at Twittys Creek is necessary for protection. **(S0921.4)**

Projected IS Date: 12/31/2017

Estimated cost: $ 25 M



Dominion Transmission Zone

Problem:

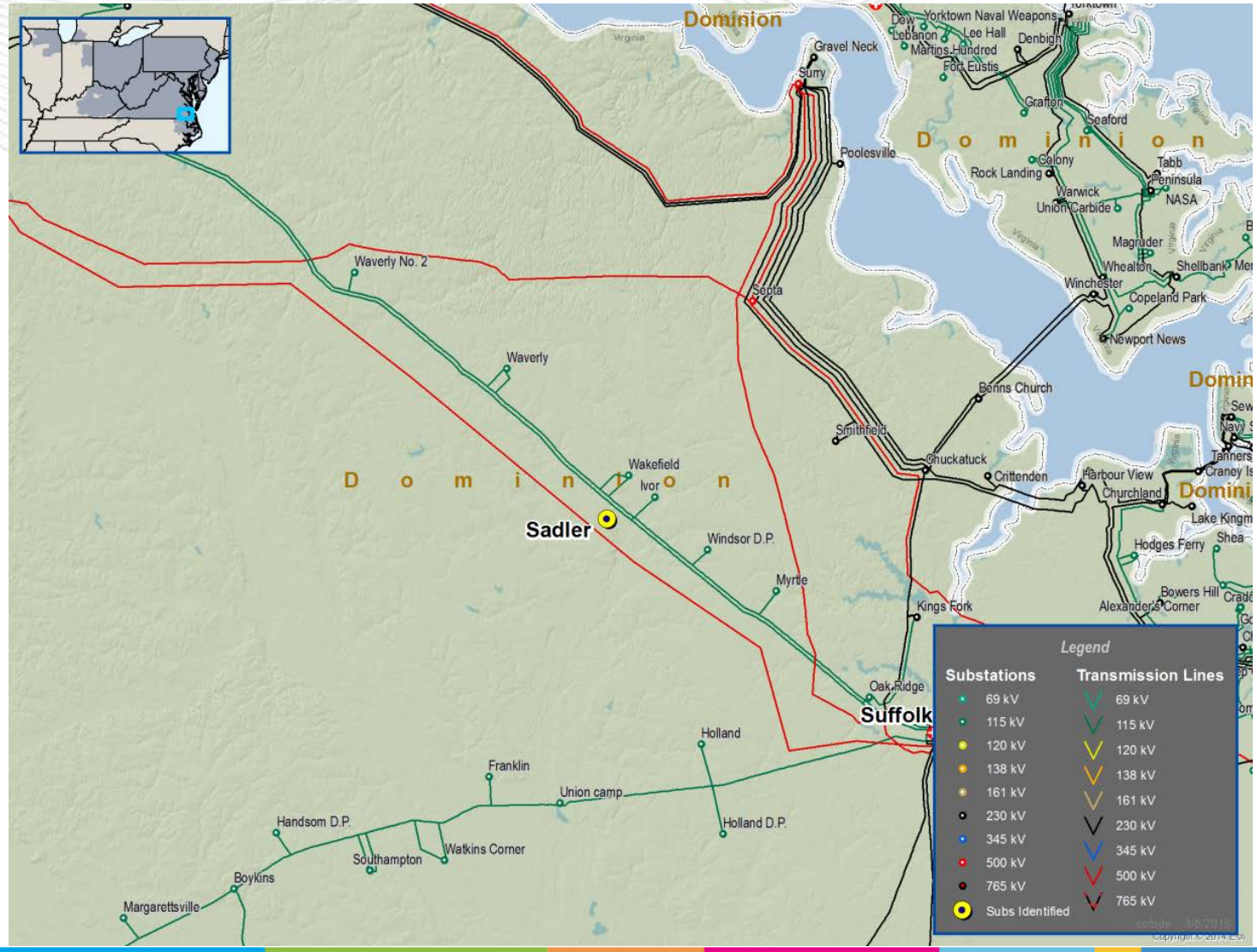
- There are two 115kV lines between Poe and Suffolk substations. To serve the delivery points with better reliability the normally open switches will be closed therefore these lines become networked lines. Due to the 56-mile long length of the networked lines, breakers are needed to sectionalize both lines for protection and reliability consideration.

Proposed Solution:

- Build a new switching station, Sadler, between Ivor and Wakefield substations. New station will build two new 115kV breakers to break existing 115kV lines #44 and #106. (S0922)

Estimated Project Cost: $2.8 M

Projected IS Date: 5/31/2017



Dominion Transmission Zone

Problem:

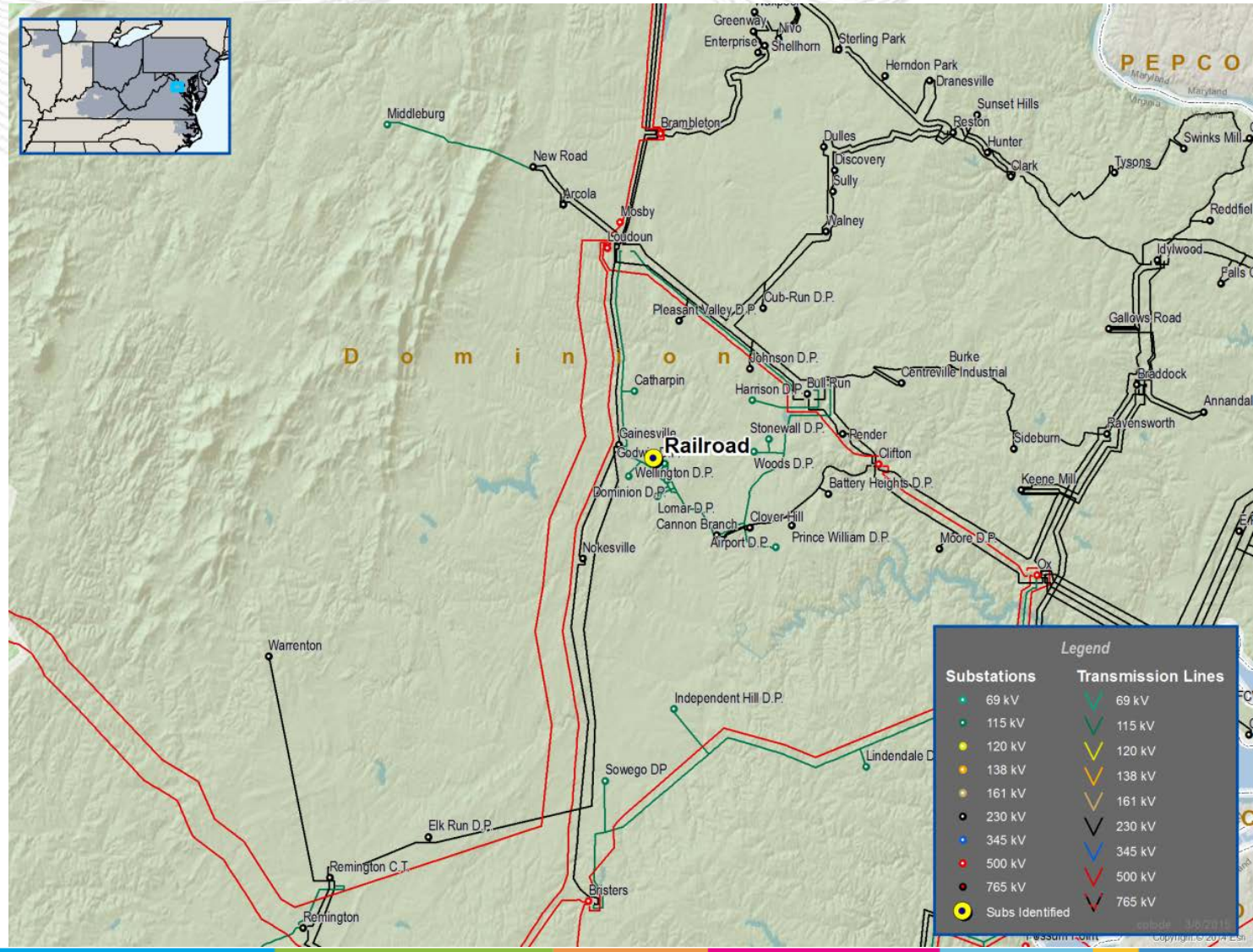
- NOVEC has submitted a Delivery Point (DP) Request for a proposed Railroad Substation with an energization date of 12/01/2015. The driver for the new substation is a large (76 MVA) data center load that cannot be fed by expansion of existing NOVEC substation.

Proposed Solution:

- Cut 230kV Line #2151 (Liberty-Gainesville) and loop approximately one span (in-and-out) to the proposed Railroad Substation. (S0923.1)
- Install two single-circuit 230kV backbones, four 230kV breakers in a ring arrangement, control enclosure, and protective relaying (S0923.2)

Estimated Project Cost: $3 M

Projected IS Date: 12/1/2015



Dominion Transmission Zone

Problem:

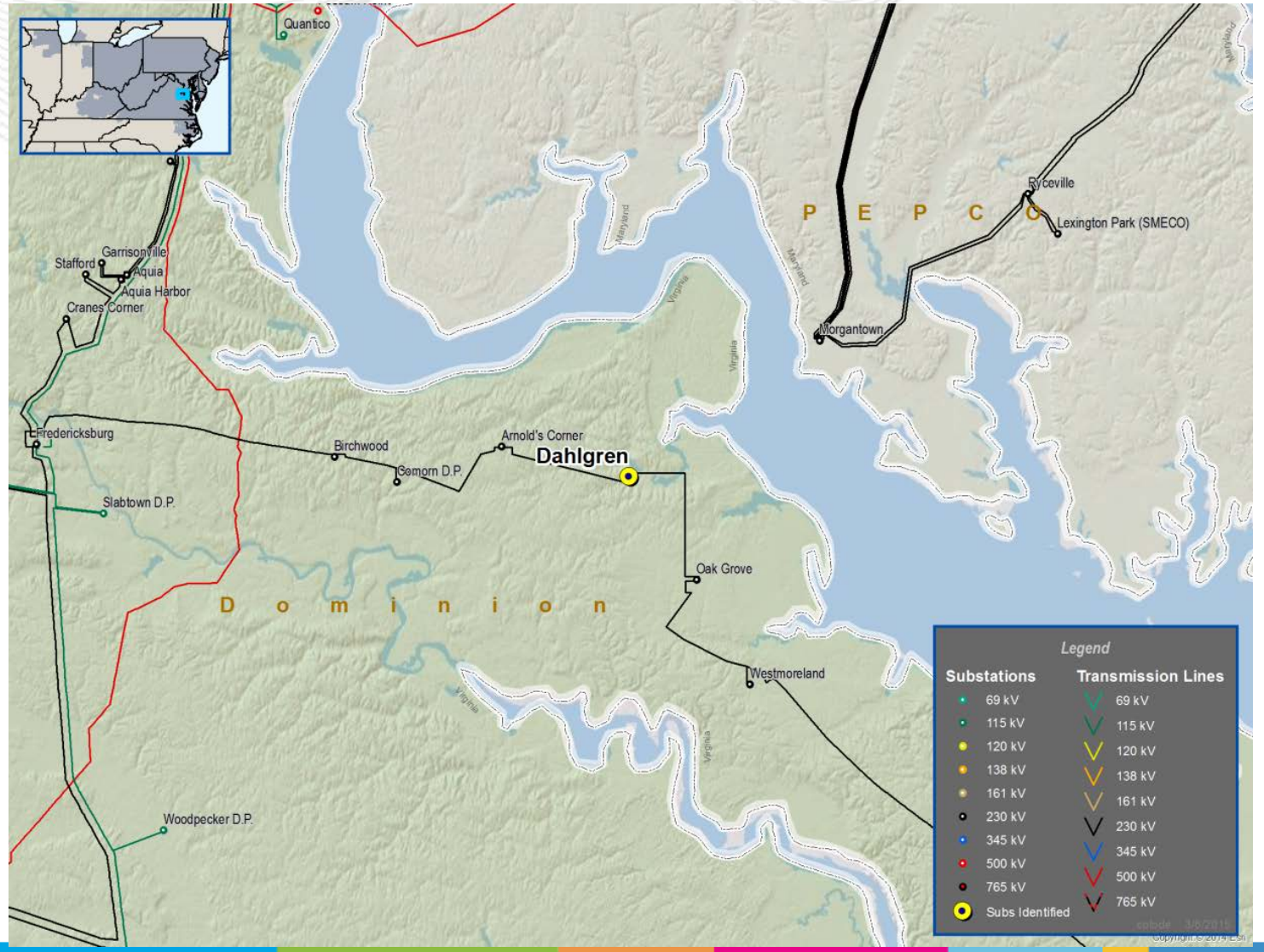
- Breaker maintenance on the 230kV breaker requires that the two 230kV lines be operated radial while maintenance is performed. The existing arrangement also creates an operational hazard where the 230kV breaker can be inadvertently bypassed during switching which could result in outages to the 230kV lines and generation at Birchwood NUG. This area has also been experiencing high voltage on the 230kV system in the area during light load conditions

Proposed Solution:

- Install three 230kV bus breakers and a 230kV, 100MVAR Variable Shunt Reactor to provide line protection during maintenance, remove the operational hazard and provide voltage reduction during light load conditions (S0924)

Estimated Project Cost: $6.7 M

Projected IS Date: 5/1/2016



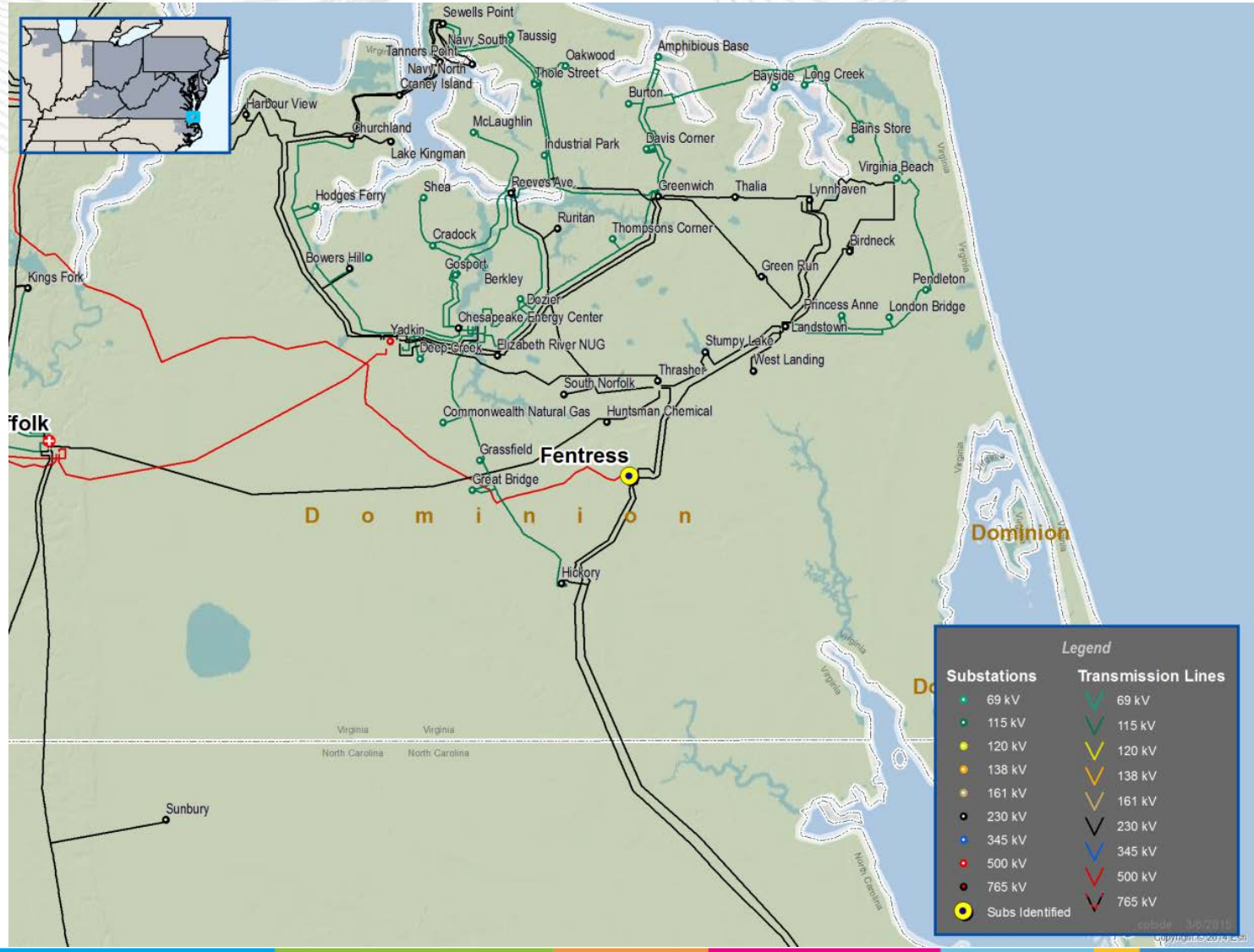
Dominion Transmission Zone

Supplemental Project:

- Dominion Distribution has identified the need to install a 2nd 230/34.5kV MVA LTC transformer at Fentress substation. Transmission will need to support Dominion Distribution's effort with the installation of a 230kV circuit switcher on high side of this transformer and perform other associated work (S0926)

Estimated Project Cost: $400 K

Projected IS Date: 5/31/2017



Questions?

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