



Transmission Expansion Advisory Committee

December 16, 2009



MAAC Stability Analysis

- Objectives

- To ensure that the PJM system meets stability criteria under the Capacity Emergency Transfer Objective (CETO), a critical stressed power transfer scenario.

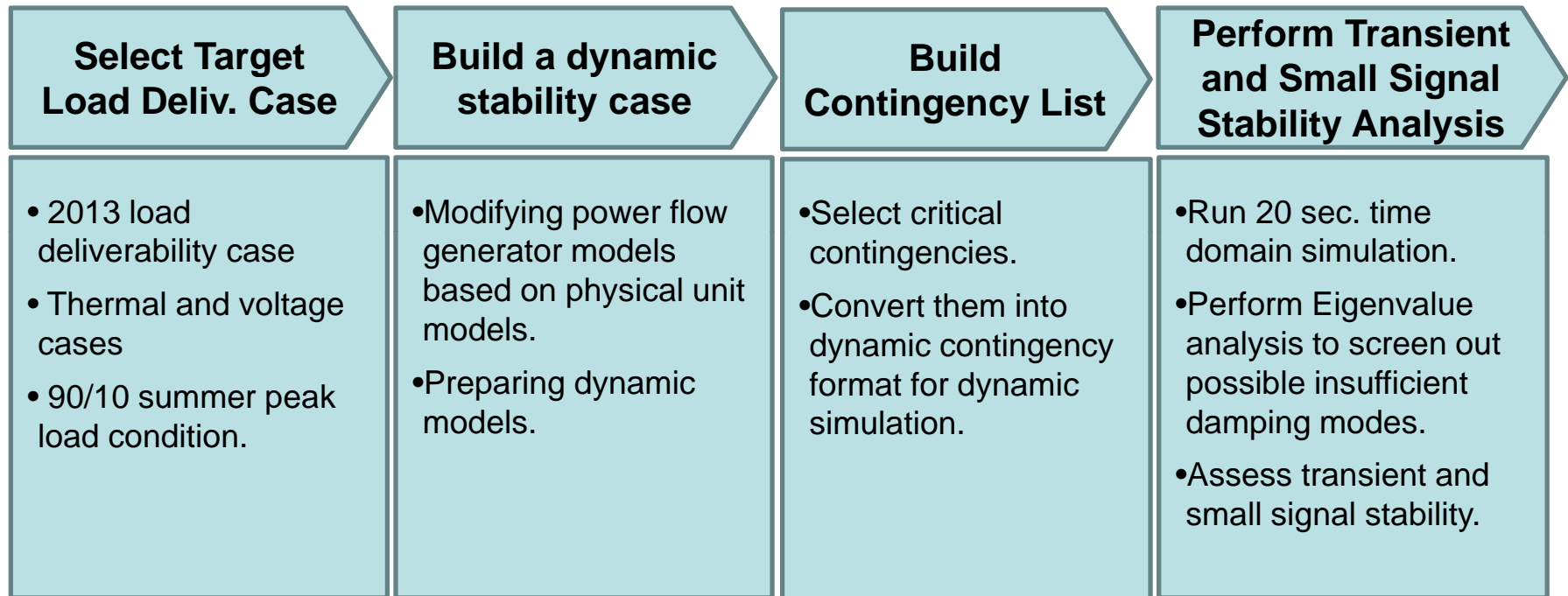
- Study Case

- 2013 load deliverability case (a 90/10 Summer Peak load condition).
- Both thermal and voltage sample cases were studied.

- Tested Stability Criteria

- Transient stability (angular stability).
- Damping (positive damping).

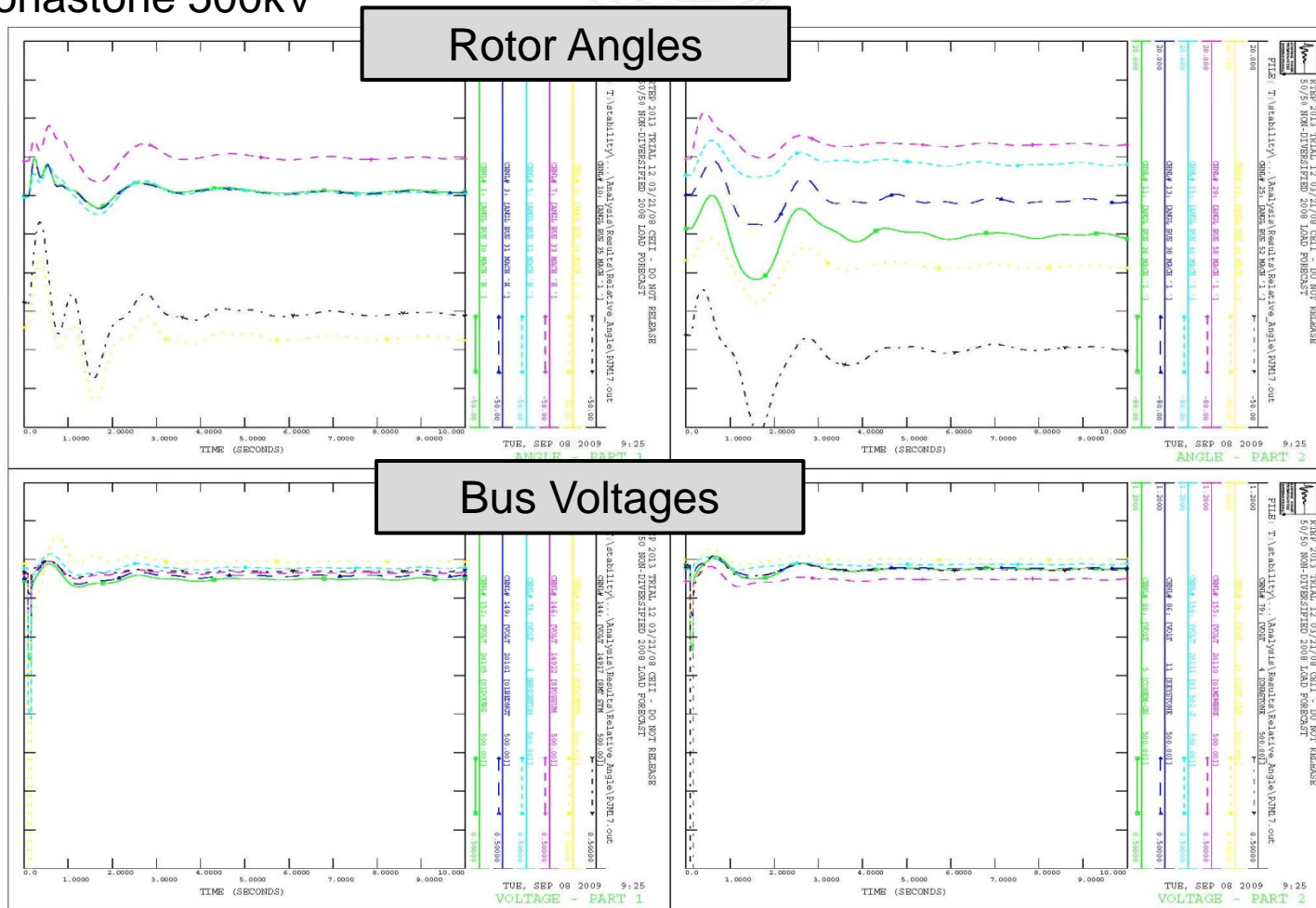
- Procedure



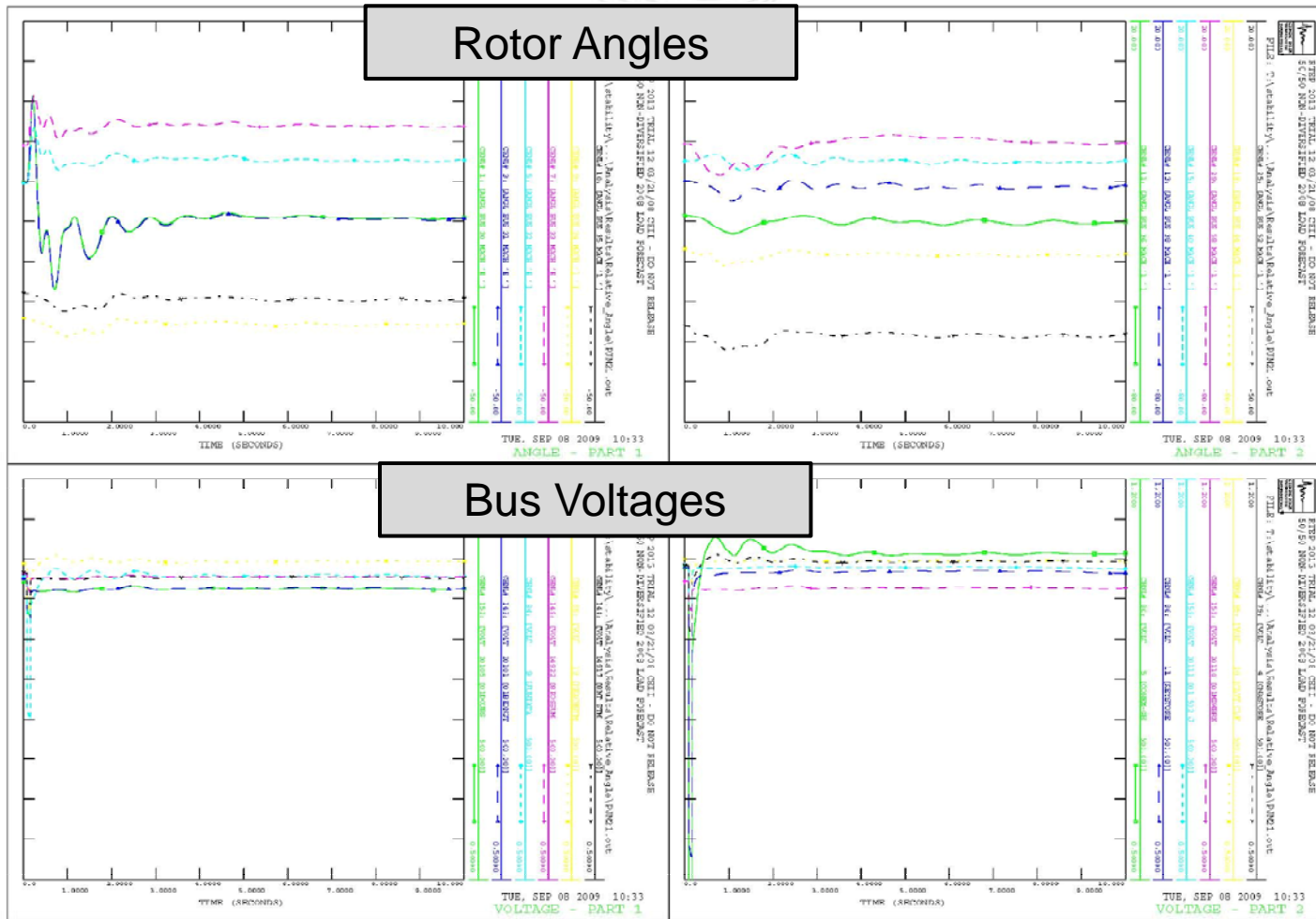
- Analysis Tools
 - PSSE, SSAT.

- **Studied Contingencies**
 - Critical single contingencies (PJM 500kV lines) involving a 3-ph fault with normal clearing and several machine outage contingencies.
- **Analysis Results**
 - No transient stability issues have been identified.
 - All transient oscillations damp out within 10~20 seconds.

- Example: PJM17: 3ph fault @ Peach Bottom 500kV on Peach Bottom - Conastone 500kV



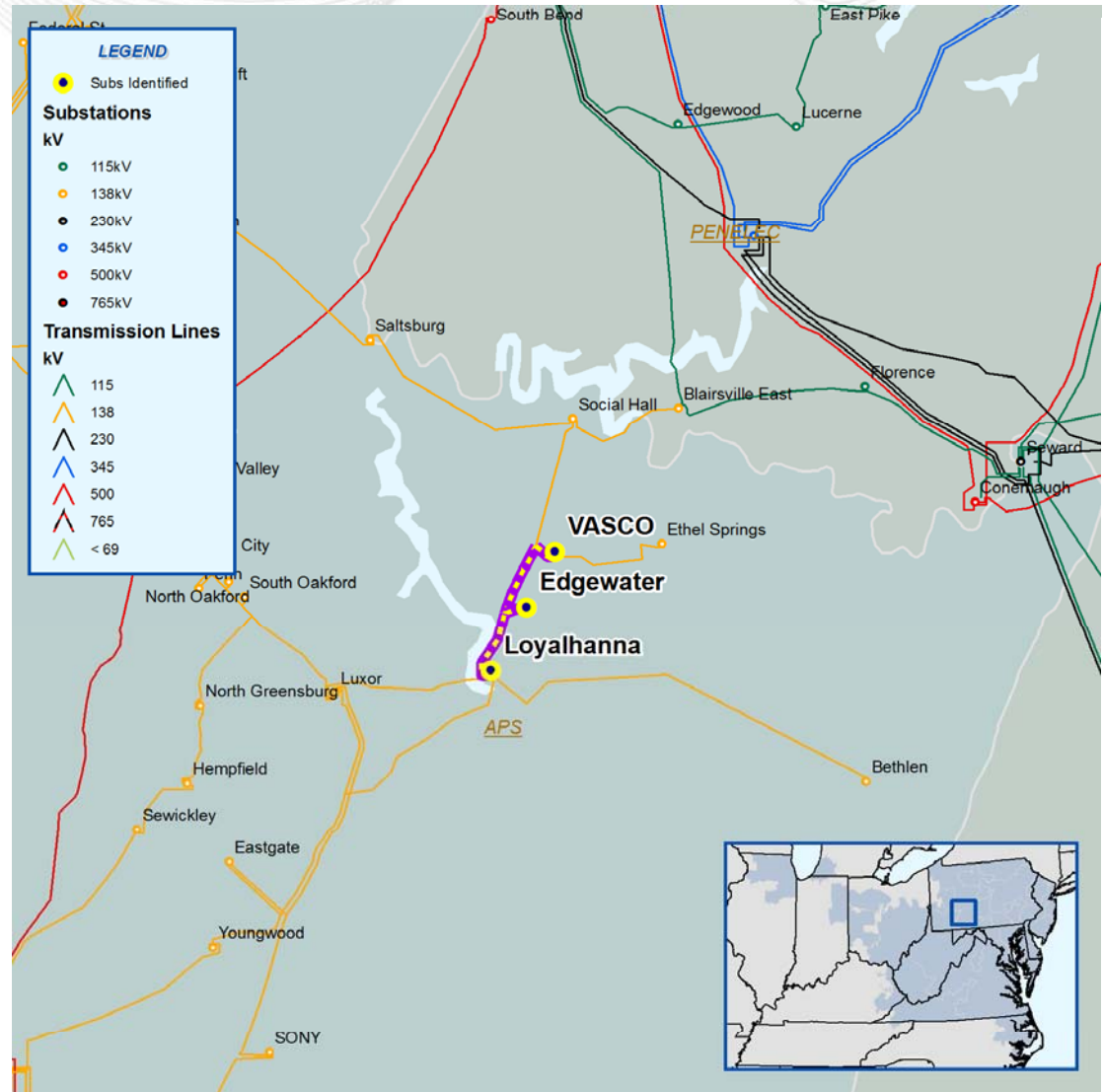
- PJM21: 3ph fault @ Conemaugh 500kV on Conemaugh - Keystone 500kV.



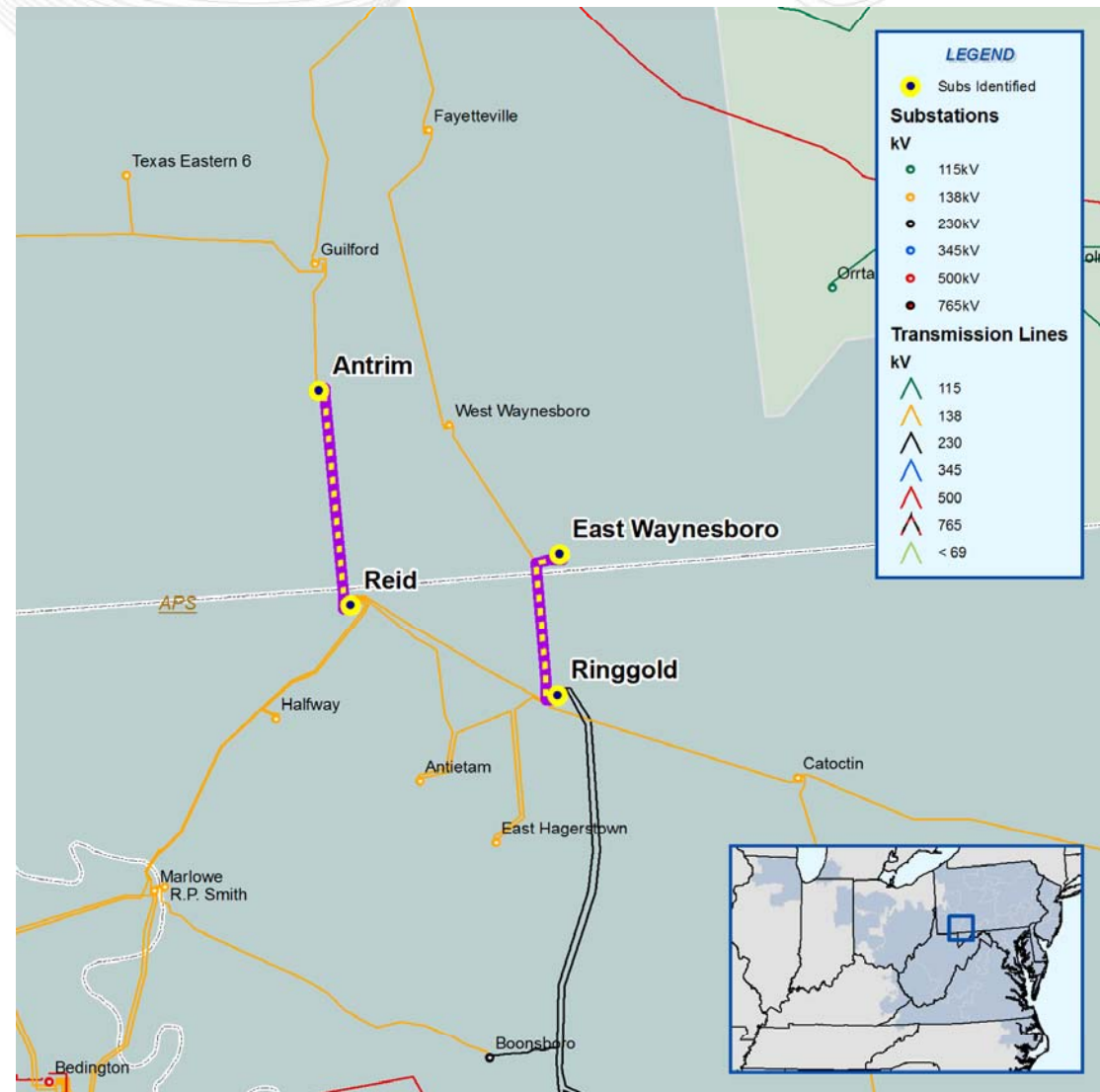


Baseline Reliability Update

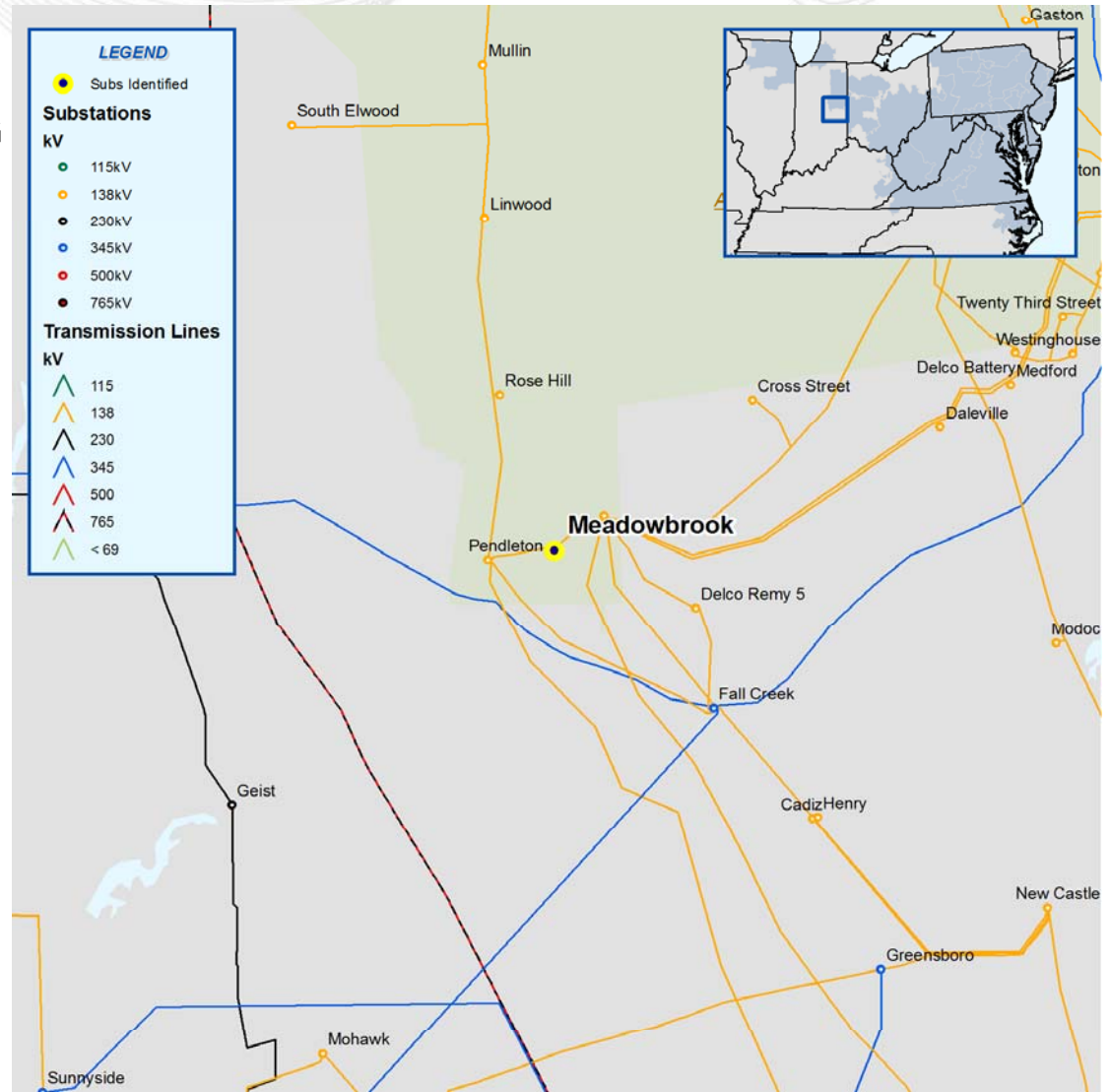
- **N-1-1 thermal overloads** of Edgewater – Vasco Tap 138 kV line; Edgewater – Loyalhanna 138 kV line for Loss of STNYSP 138 kV, SOAKFD kV bus, and NOAKFD 138 kV busses; and Loss of Youngwood – Yukon 138 kV line
- **Proposed Solution:**
 - Reconductor the Edgewater – Vasco Tap; Edgewater – Loyalhanna 138 kV lines with 954 ACSR (b1128)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



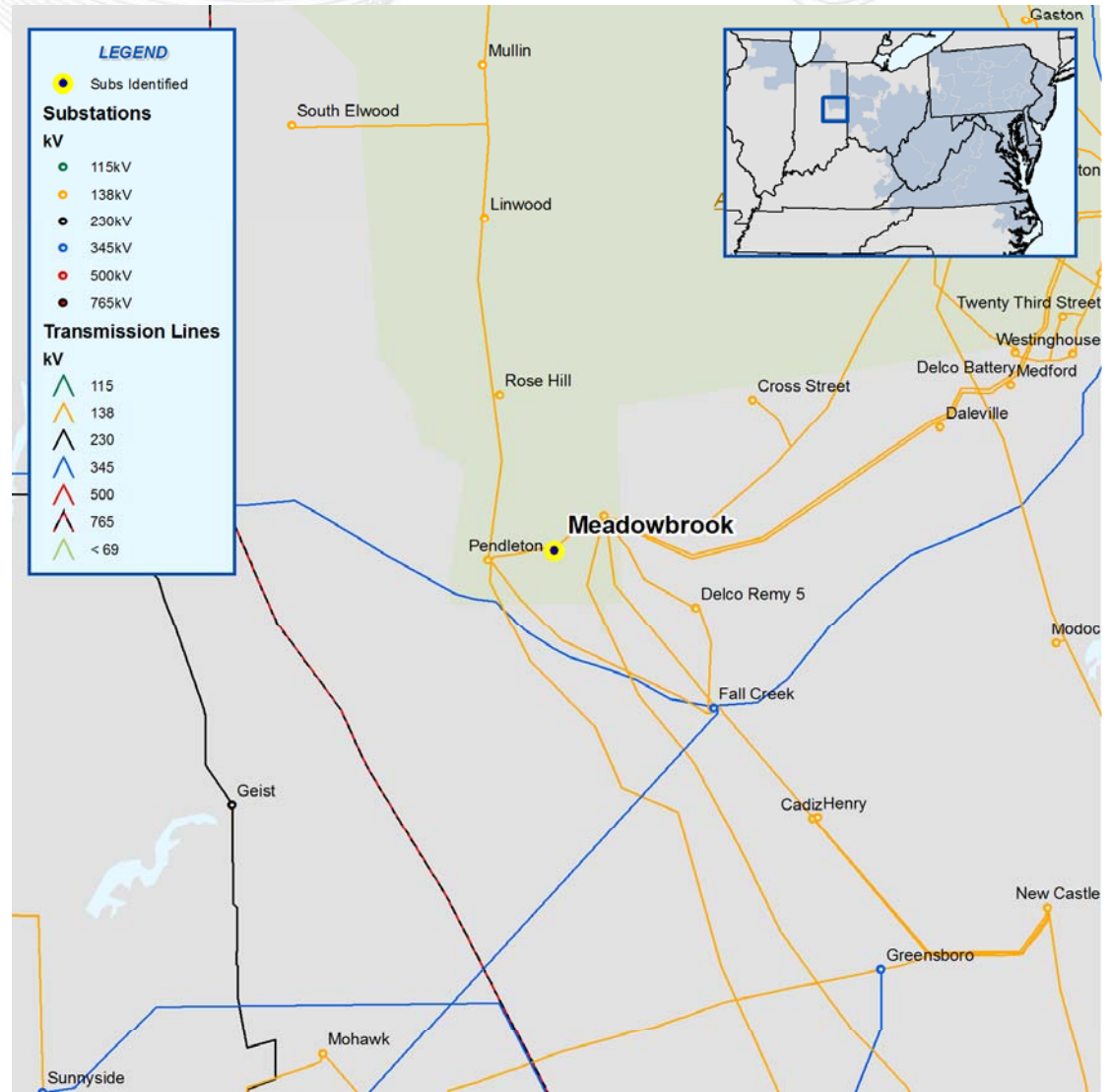
- **N-1-1 thermal overload** of East Waynesboro – Ringgold 138 kV line for Loss of Antrim – Reid 138 kV; and Loss of Harmony 138 kV Bus
- **Proposed Solution:**
 - Reconductor the East Waynesboro – Ringgold 138 kV line with 954 ACSR (b1129).
- **Estimated Cost:** \$3 M
- **Expected IS Date:** 6/01/2014



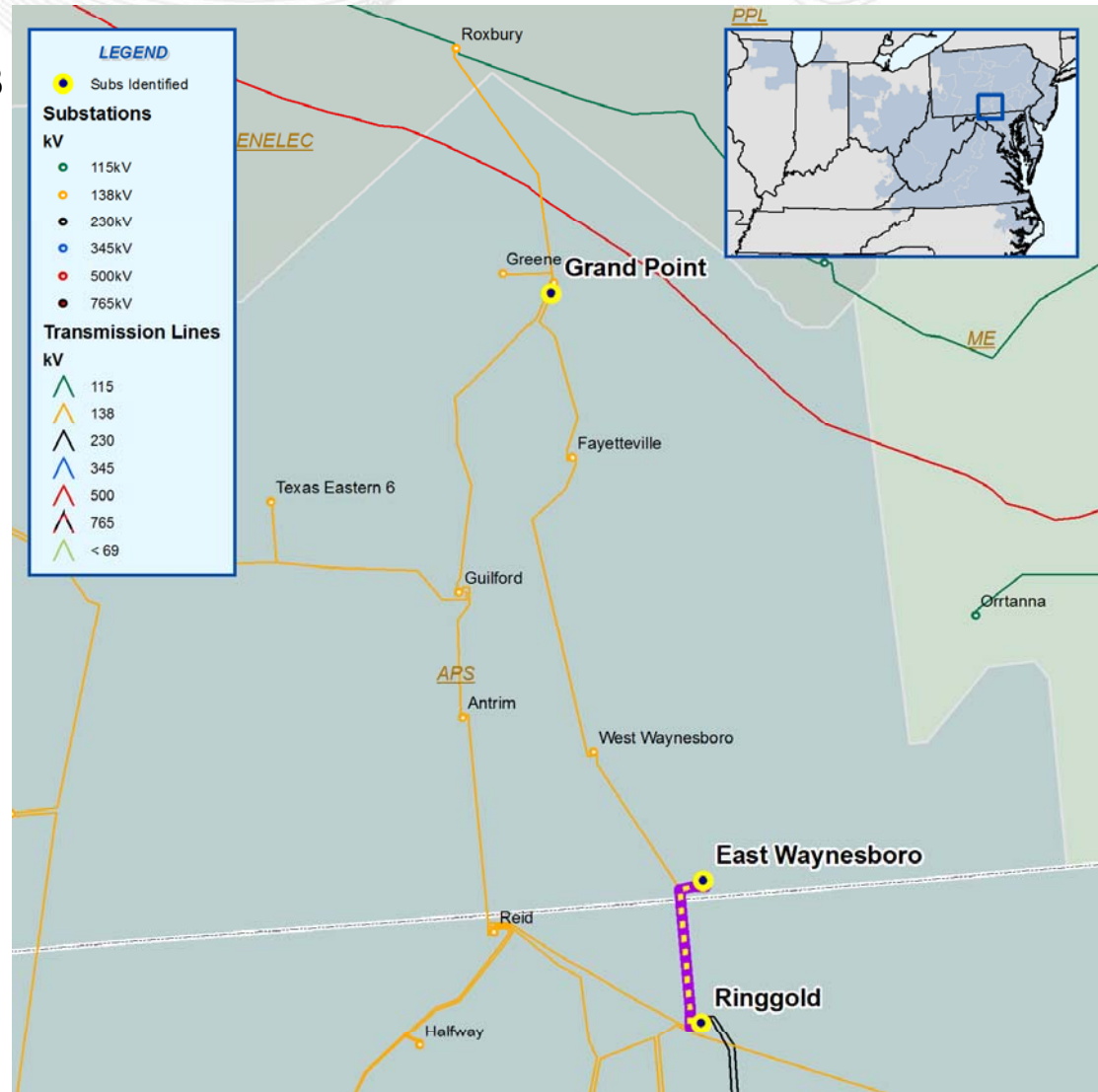
- **N-1-1 thermal overloads** of Double Tollgate – Meadowbrook CKT 1 138 kV line for Loss of DTG – Meadowbrook CKT 2 138 kV; and Loss of Meadowbrook – W Winchester 138 kV line
- **Proposed Solution:**
 - Upgrade Double Tollgate-Meadowbrook MDT Terminal Equipment (b1131)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



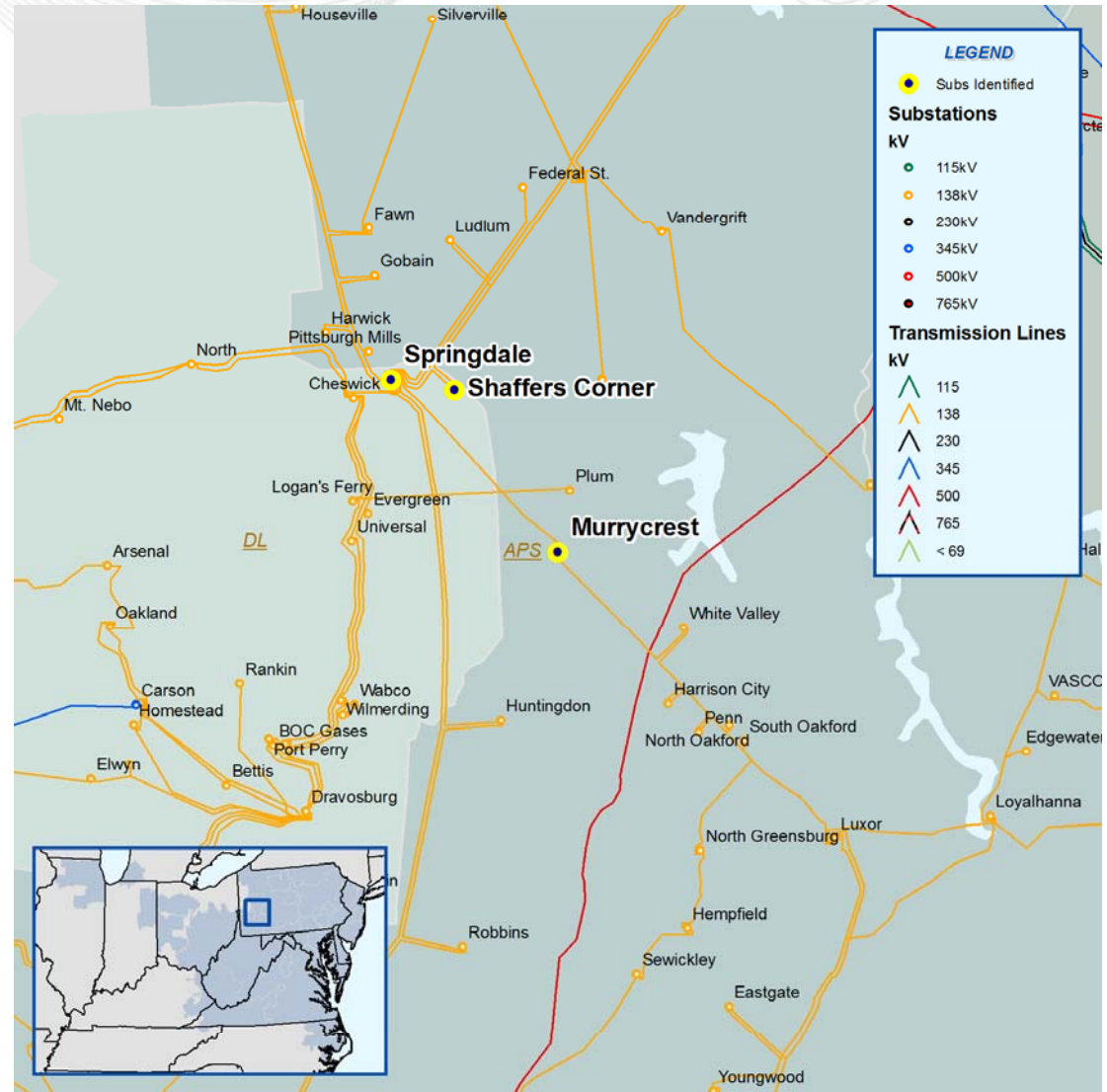
- **N-1-1 thermal overloads** of Double Tollgate – Meadowbrook CKT 2 138 kV line fir Loss of DTG – Meadowbrook CKT 1 138 kV; and Loss of Meadowbrook – W Winchester 138 kV line
- **Proposed Solution:**
 - Upgrade Double Tollgate-Meadowbrook MBG terminal equipment (b1132)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



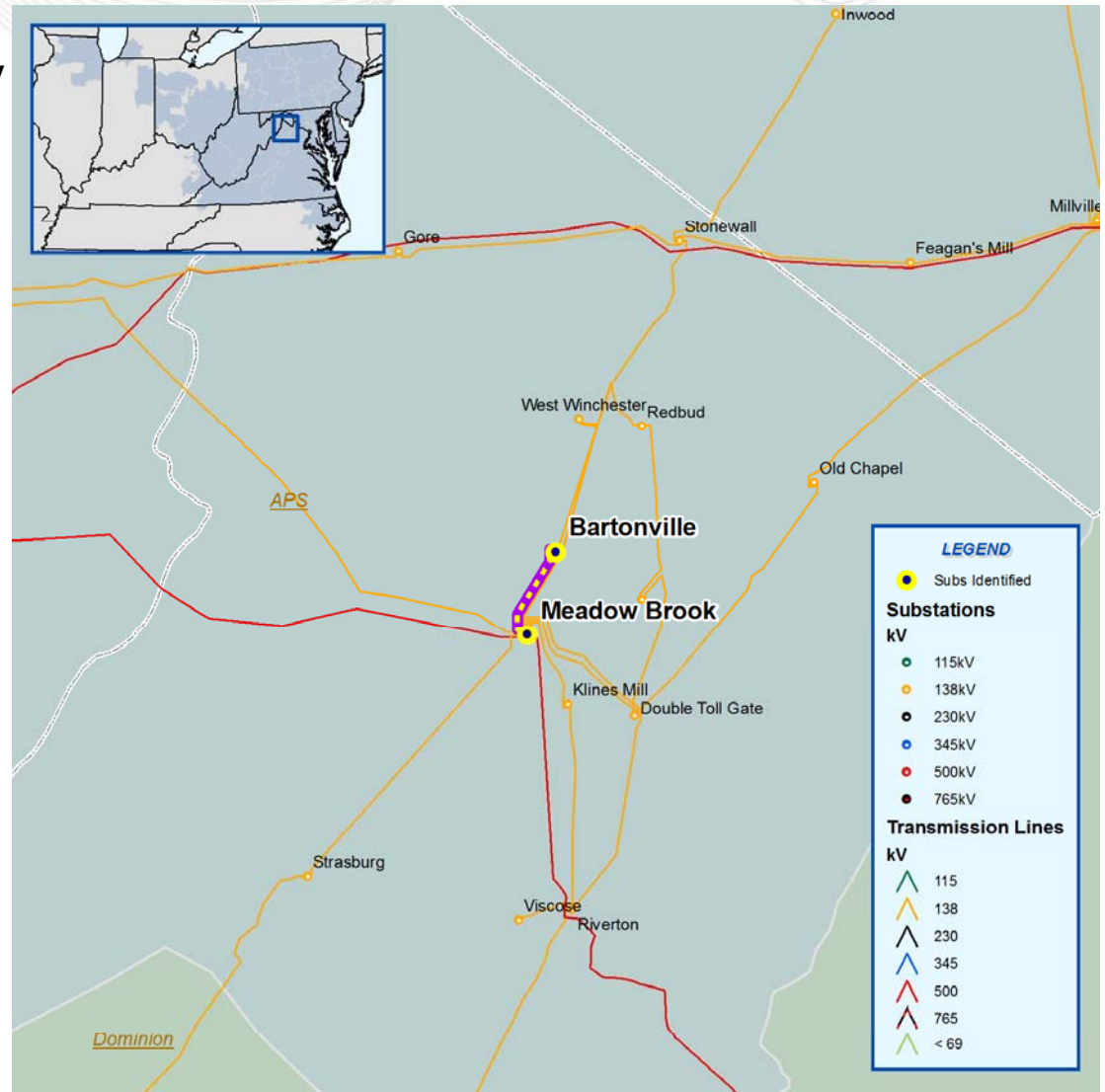
- **N-1-1 thermal overloads** of Grand Point – South Chamber 138 kV line for Loss of E Waynesboro – Ringgold 138 kV line; and Loss of Lewistown 230/115 kV Transformer # 3, Lewistown – Raystown 230 kV line, Lewistown – Shingletown 230 kV line, Lewistown – Yeagerstown 230 kV CKT 2, Lewistown Transformer #2
- **Proposed Solution:**
 - B0684 can be revised to reconductor Grand Point – South Chambersburg – Guliford. (B1152)
- **Estimated Cost:** \$2.9 M
- **Expected IS Date:** 6/01/2014



- **N-1-1 thermal overloads** of Allegheny Ludlum 4 Junction – Springdale 138 kV line for Loss of Murrycrest 138 kV – Wallace 138 kV; and Loss of Shaffers Corner – Springdale 138 kV line
- **Proposed Solution:**
 - Upgrade terminal equipment at Springdale. (B1133)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



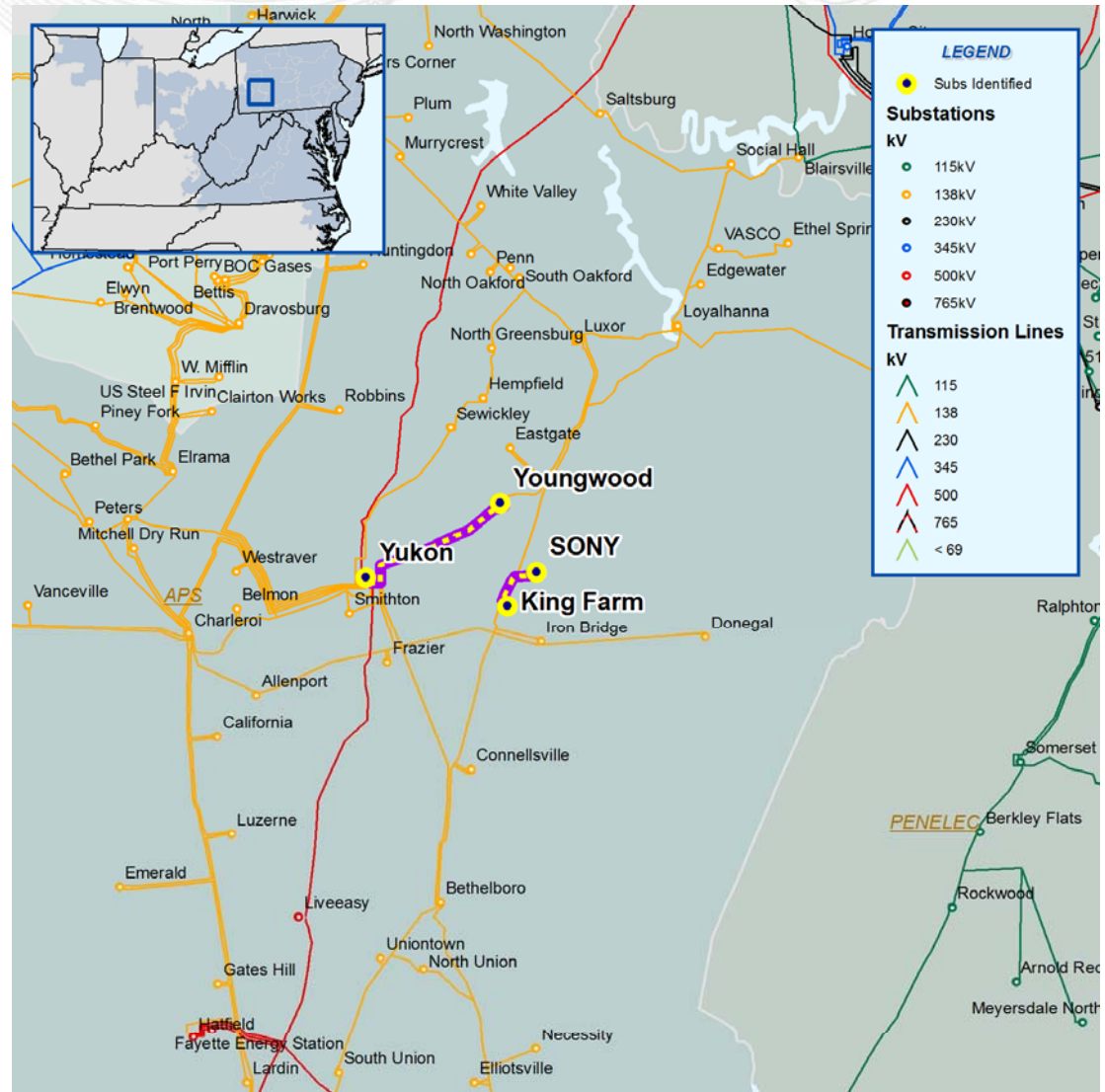
- **N-1-1 thermal overloads** of Bartonville – Meadowbrook 138 kV line for loss of Bedington – Black Oak 500 kV line; and Loss of Bedington – Doubs 500 kV line
- **Proposed Solution:**
 - Reconductor the Bartonville – Meadowbrook 138 kV line with high temperature conductor. (B1135)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



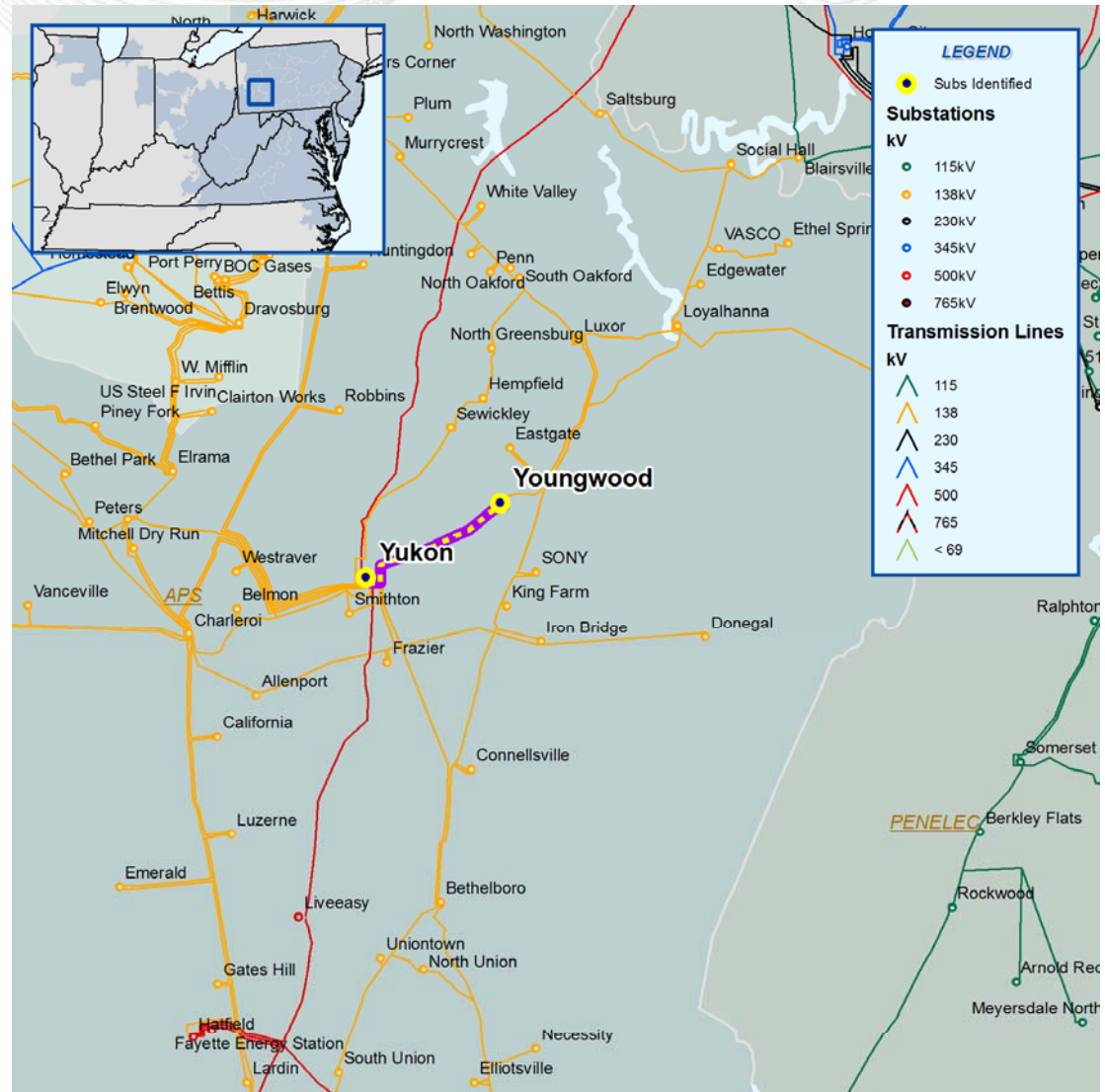
- **N-1-1 thermal overloads** of Eastgate 2 – Luxor 138 kV line; Eastgate – Sony 138 kV line for loss of Youngwood – Yukon 138 kV line; and Loss of Waltz T 138 kV and Waltz Mills 138 kV busses
- **Proposed Solution:**
 - Reconductor the Eastgate – Luxor 138 kV; Eastgate – Sony 138 kV line with 954 ACSR. (B1137)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



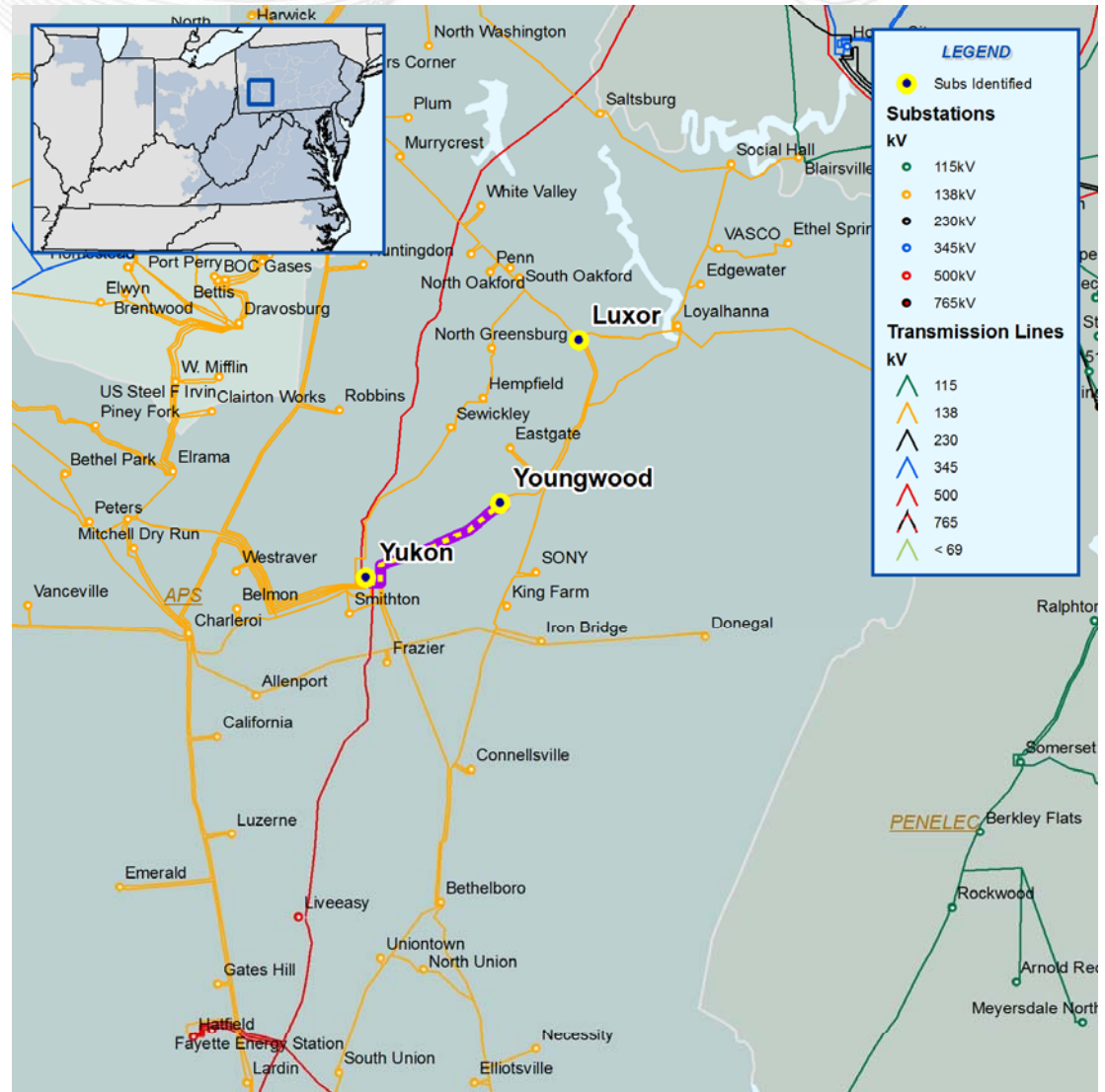
- **N-1-1 thermal overloads** of King Farm – Sony 138 kV line for loss of Youngwood – Yukon 138 kV line; and Loss of Waltz T 138 kV and Waltz Mills 138 kV busses
- **Proposed Solution:**
 - Reconductor the King Farm – Sony 138 kV line with 954 ACSR. (B1138)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



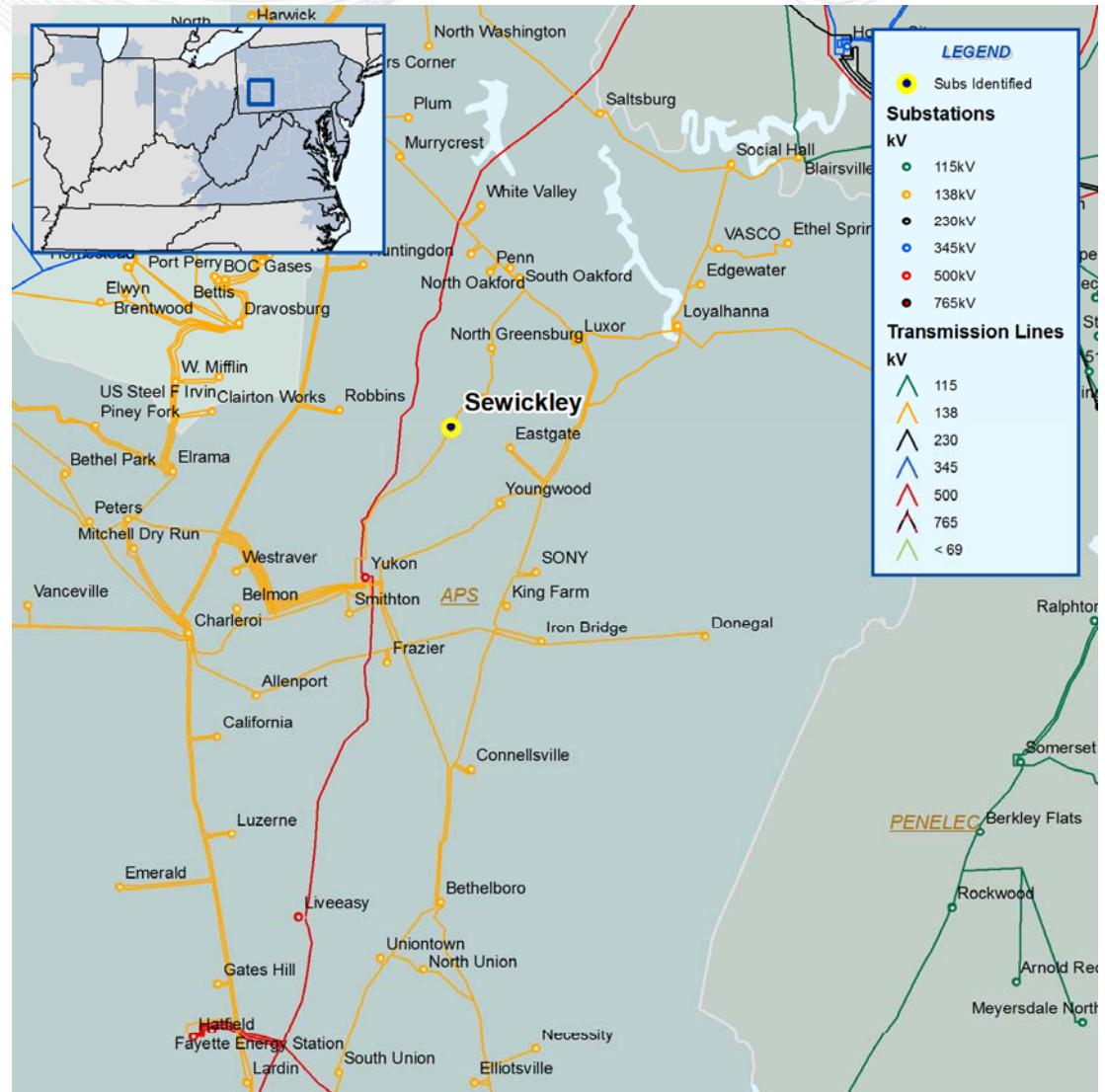
- **N-1-1 thermal overloads** of Yukon – Waltz T 138 kV line for loss of Youngwood – Yukon 138 kV line; and Loss of Springdale – Wallace 138 kV line
- **Proposed Solution:**
 - Reconductor the Yukon – Waltz Mills 138 kV line with high temperature conductor. (B1139)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



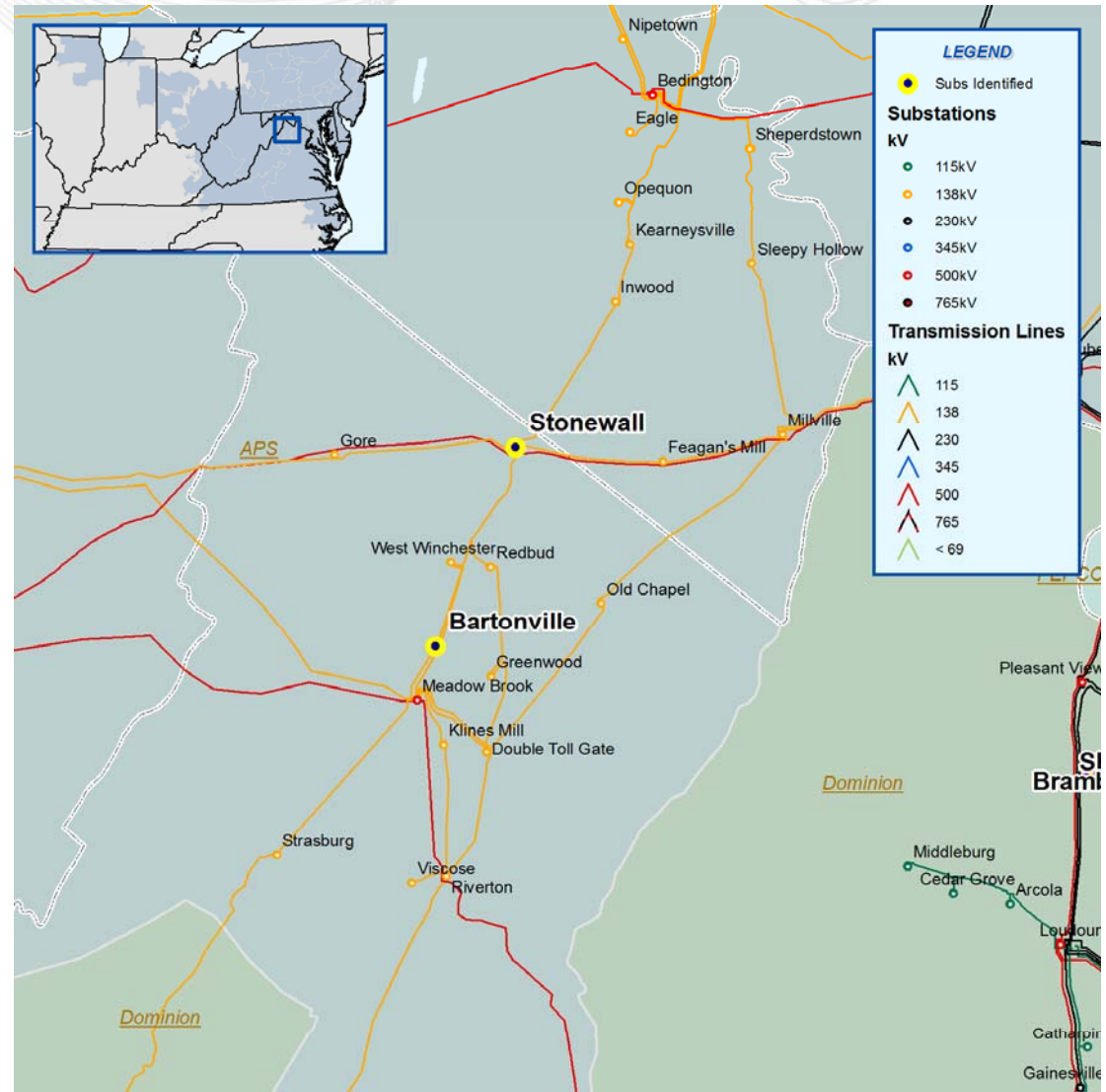
- **N-1-1 thermal overloads** of Bracken Junction – Luxor 138 kV line for loss of Youngwood – Yukon 138 kV line; and Loss of Loyalhanna – Luxor 138 kV line
- **Proposed Solution:**
 - Reconductor the Bracken Junction – Luxor 138 kV line with 954 ACSR. (B1140)
- **Estimated Cost:** \$0.8 M
- **Expected IS Date:** 6/01/2014



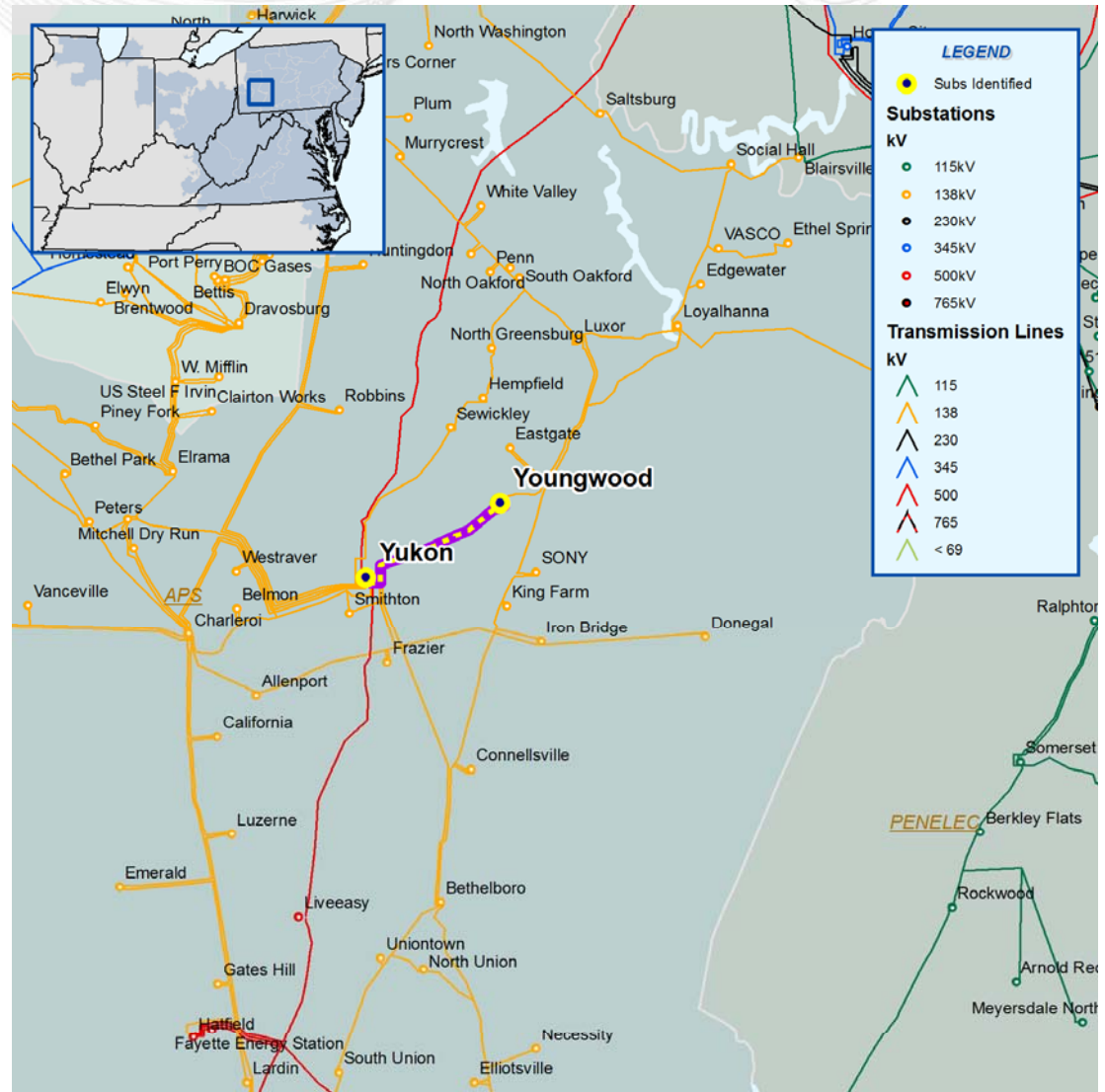
- **N-1-1 thermal overloads** of Sewickley – Waltz T 138 kV line for loss of Bedington – Doubs 500 kV line; and Loss of Springdale – Wallace 138 kV line
- **Proposed Solution:**
 - Reconductor the Sewickley – Waltz Mills Tap 138 kV line with high temperature conductor. (B1141)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



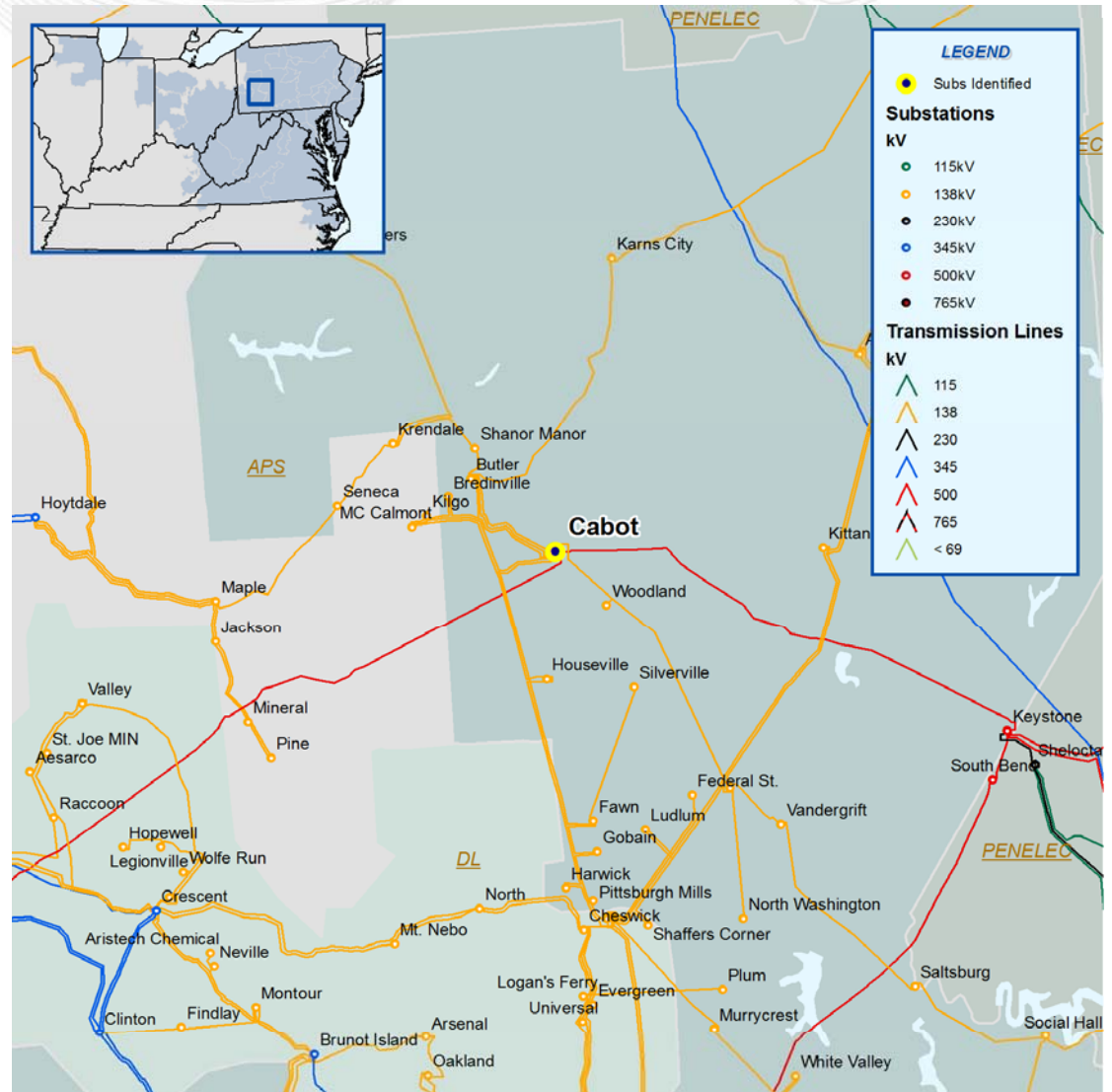
- **N-1-1 thermal overloads** of Bartonville – Stephenson 138 kV line; Stonewall – Stephenson 138 kV line for loss of Bedington – Doubs 500 kV line; and Loss of Black Oak – Hatfield 500 kV
- **Proposed Solution:**
 - Reconductor the Bartonville – Stephenson 138 kV; Stonewall – Stephenson 138 kV line with 954 ACSR. (B1142)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



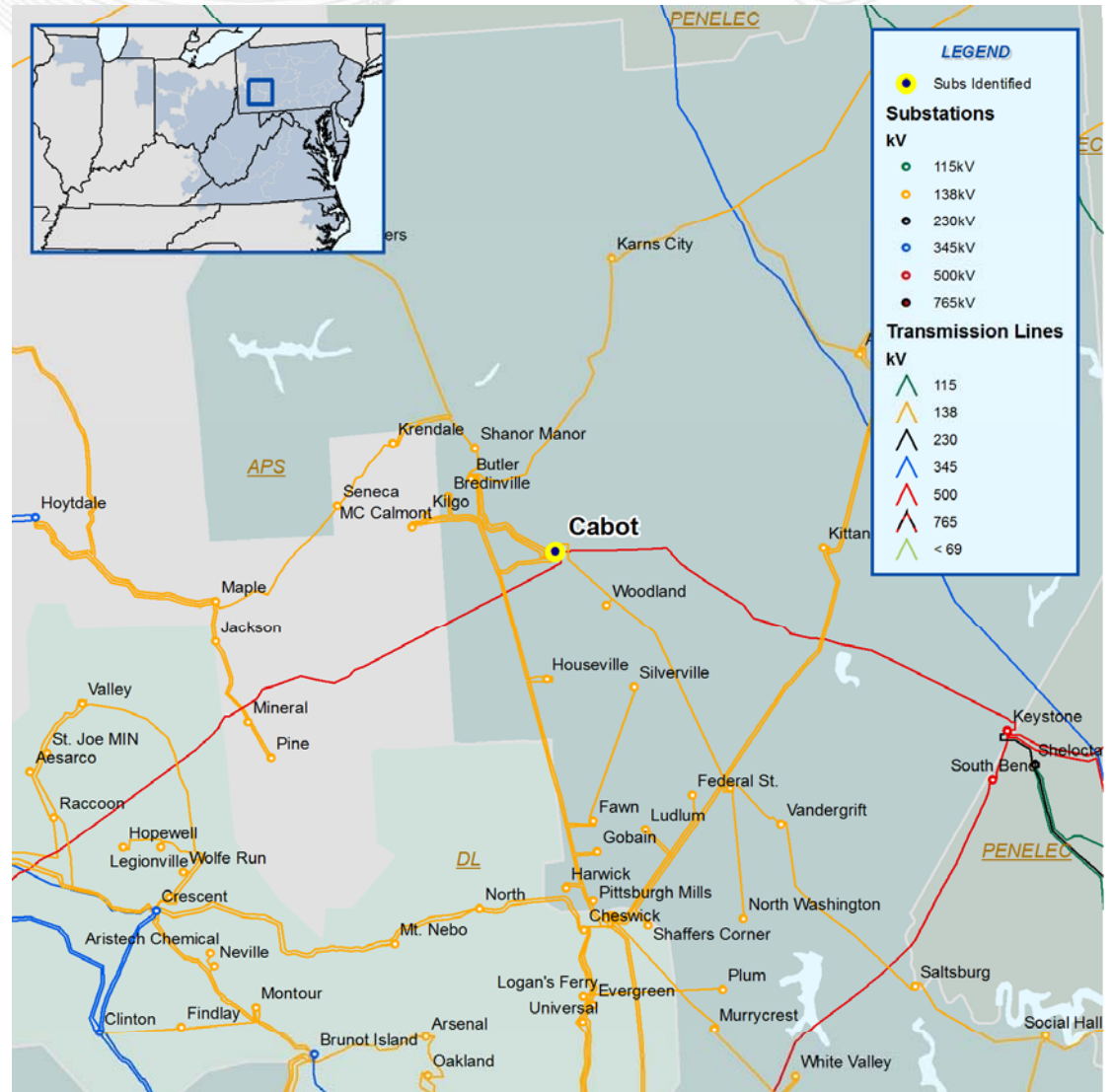
- **N-1-1 thermal overloads** of Youngwood – Yukon 138 kV line for loss of Hempfield – Sewickley 138 kV line; and Loss of Springdale – Wallace 138 kV line
- **Proposed Solution:**
 - Reconductor the Youngwood – Yukon 138 kV line with high temperature conductor. (B1143)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



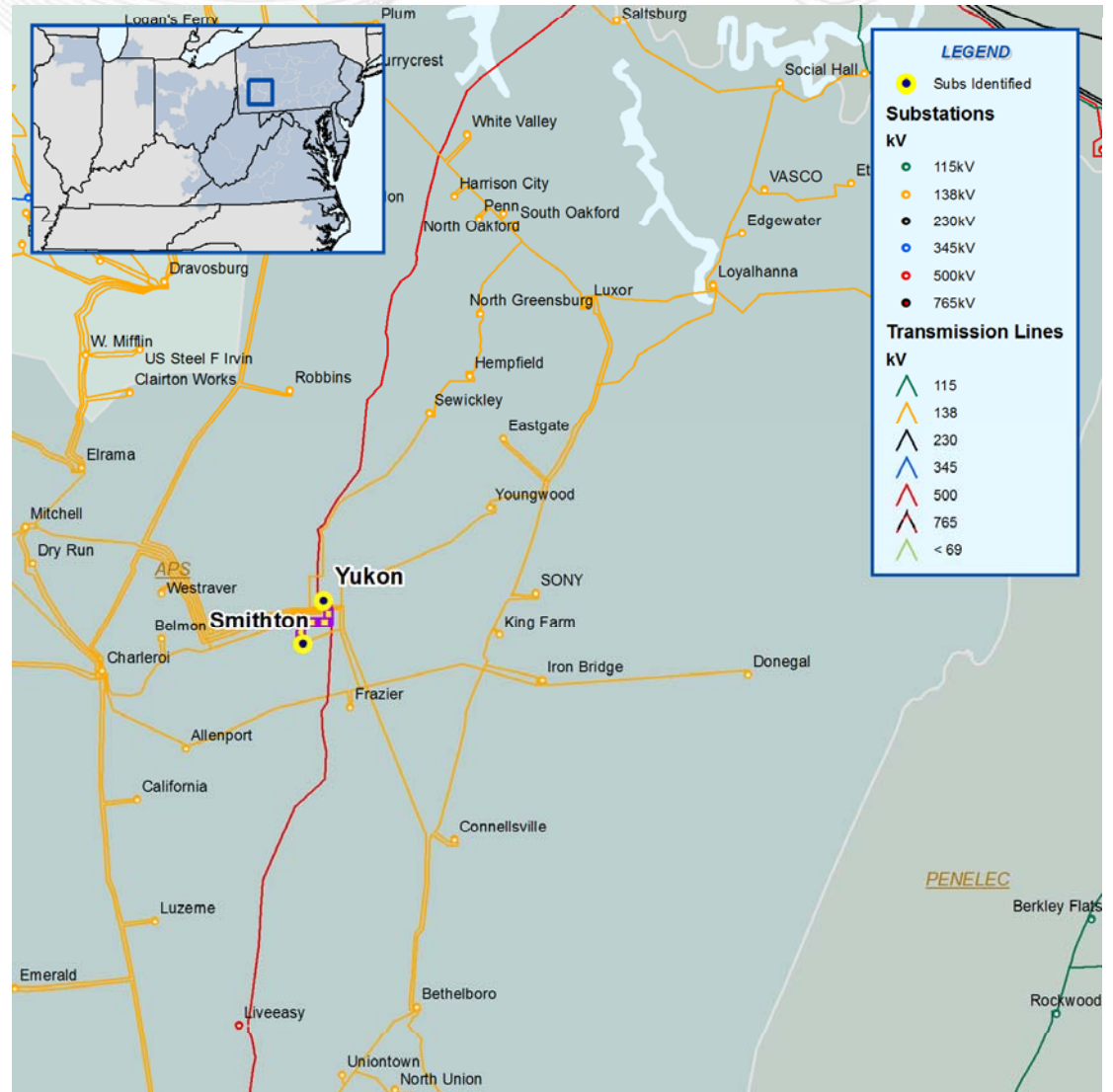
- **N-1-1 thermal overloads** of Bull Creek Junction – Cabot 138 kV line for loss of Cabrey 138 kV bus; and loss of Lawson 138 kV bus
- **Proposed Solution:**
 - Reconductor the Bull Creek Junction – Cabot 138 kV line with high temperature conductor. (B1144)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



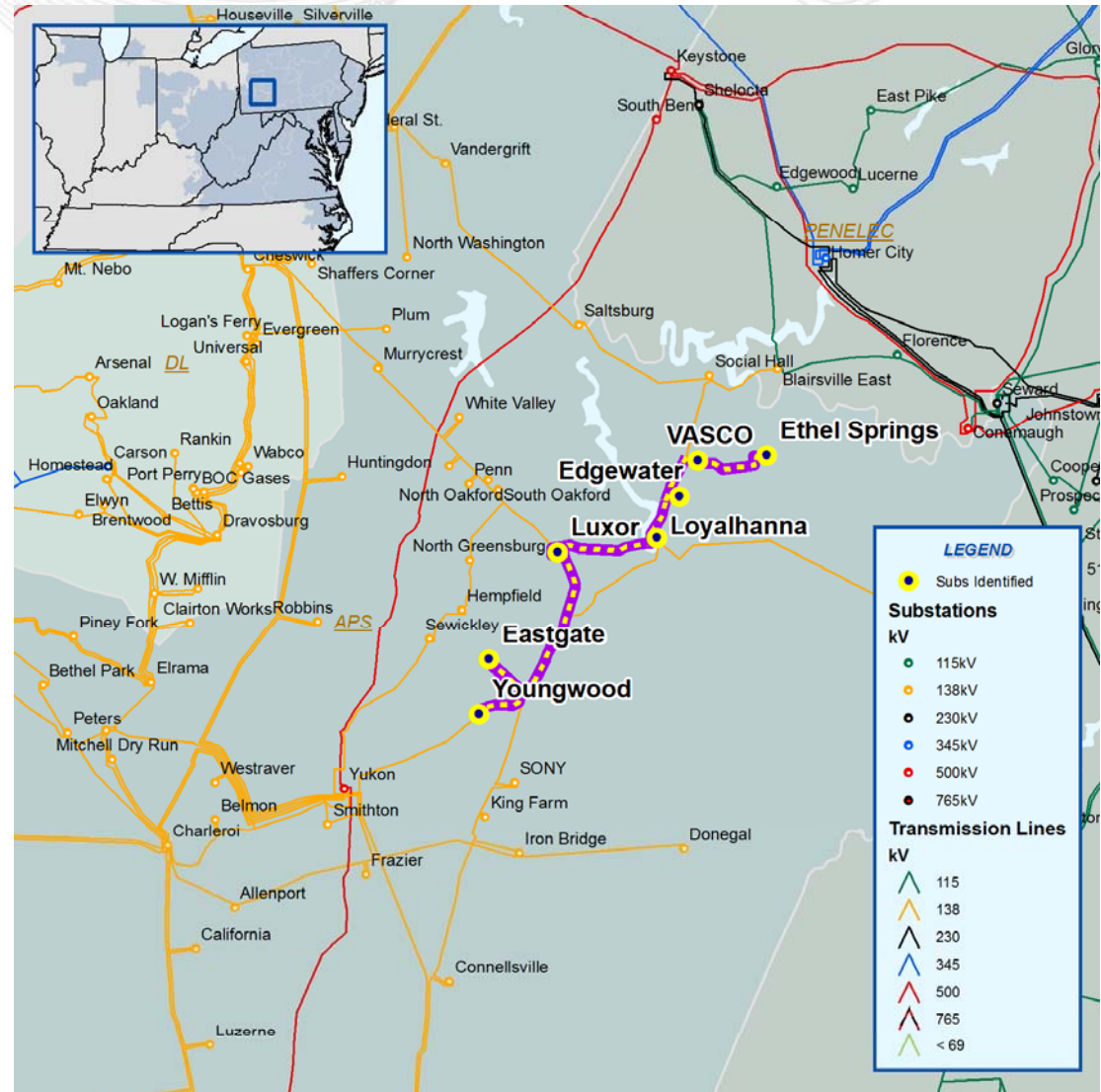
- **N-1-1 thermal overloads** of Cabot – Lawson 138 kV line for loss of Bull Creek Junction 138 kV bus; and Loss of Cabrey 138 kV bus
- **Proposed Solution:**
 - Reconductor the Lawson Junction – Cabot 138 kV line with high temperature conductor. (B1145)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



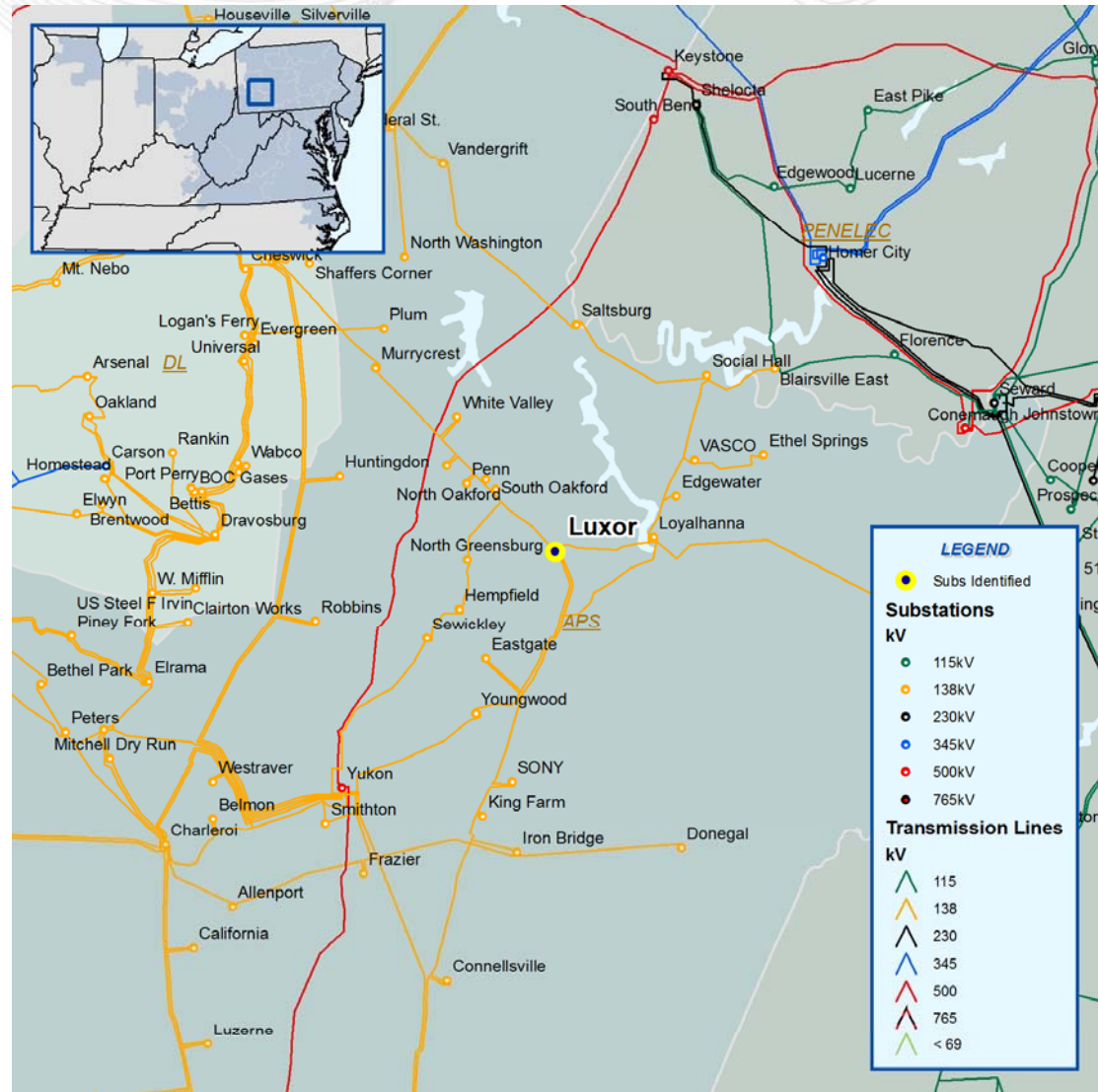
- **N-1-1 thermal overloads** of Smith – Yukon 138 kV line for Loss of Waltz T 138 kV Bus and Waltz Mills 138 kV bus; and Loss of Youngwood – Yukon 138 kV line
- **Proposed Solution:**
 - Replace structures along Smith – Yukon 138 kV to increase line rating. (B1147)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



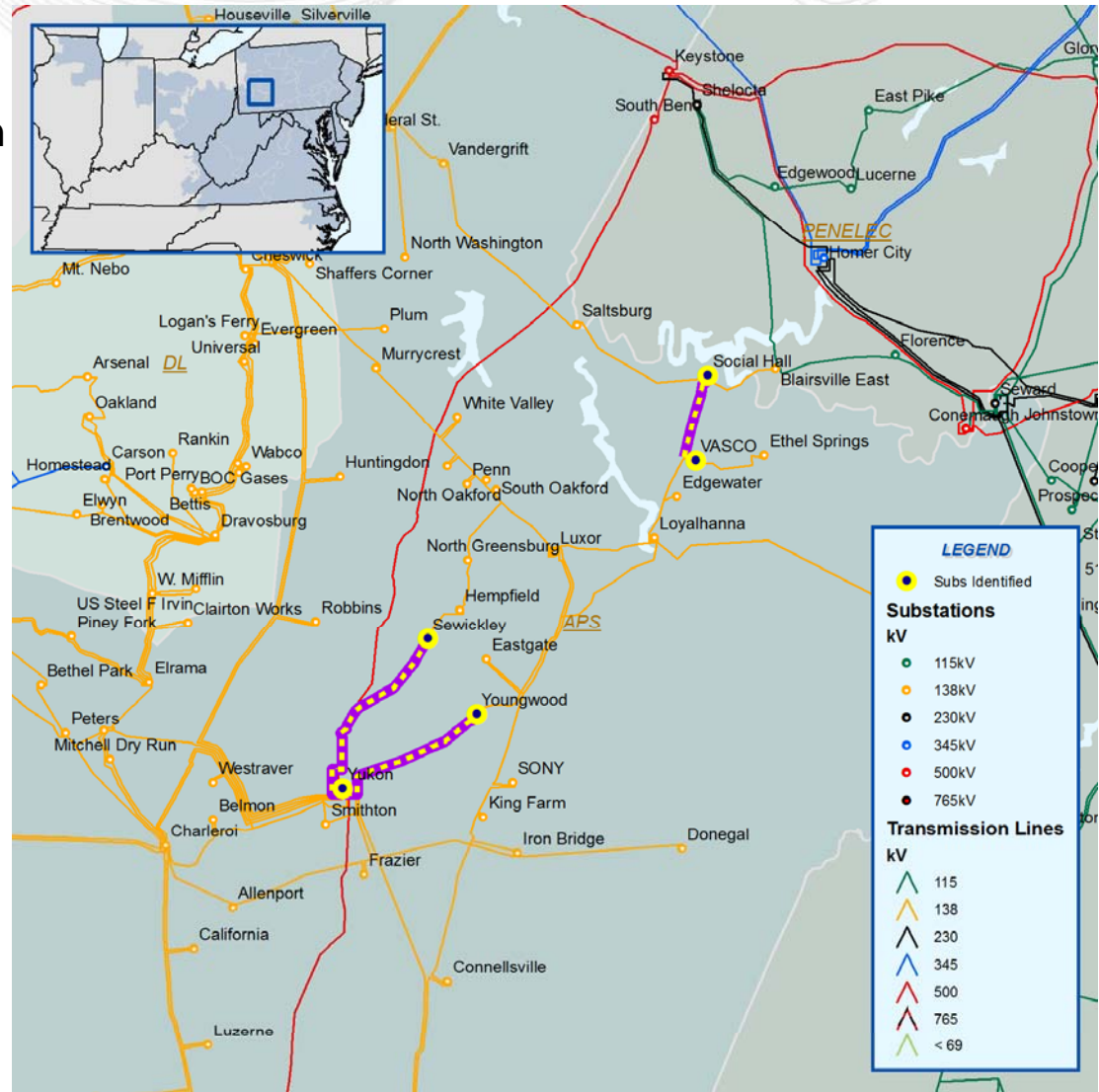
- **N-1-1 thermal overloads** of Loyalhanna - Luxor 138 kV line for Loss of Bracken Junction - Eastgate 138 kV line, Eastgate - Youngwood 138 kV, Bracken Junction - Luxor 138 kV line, Bracken Junction - Unity 138 kV + Vasco - Vasco Tap 138 kV line, Vasco - Ethel Springs 138 kV line, Vasco Tap - Edgewater - Loyalhanna 138 kV line, Vasco Tap - Social Hall 138 kV line
- **Proposed Solution:**
 - Reconductor the Loyalhanna – Luxor 138 kV line with 954 ACSR. (B1148)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



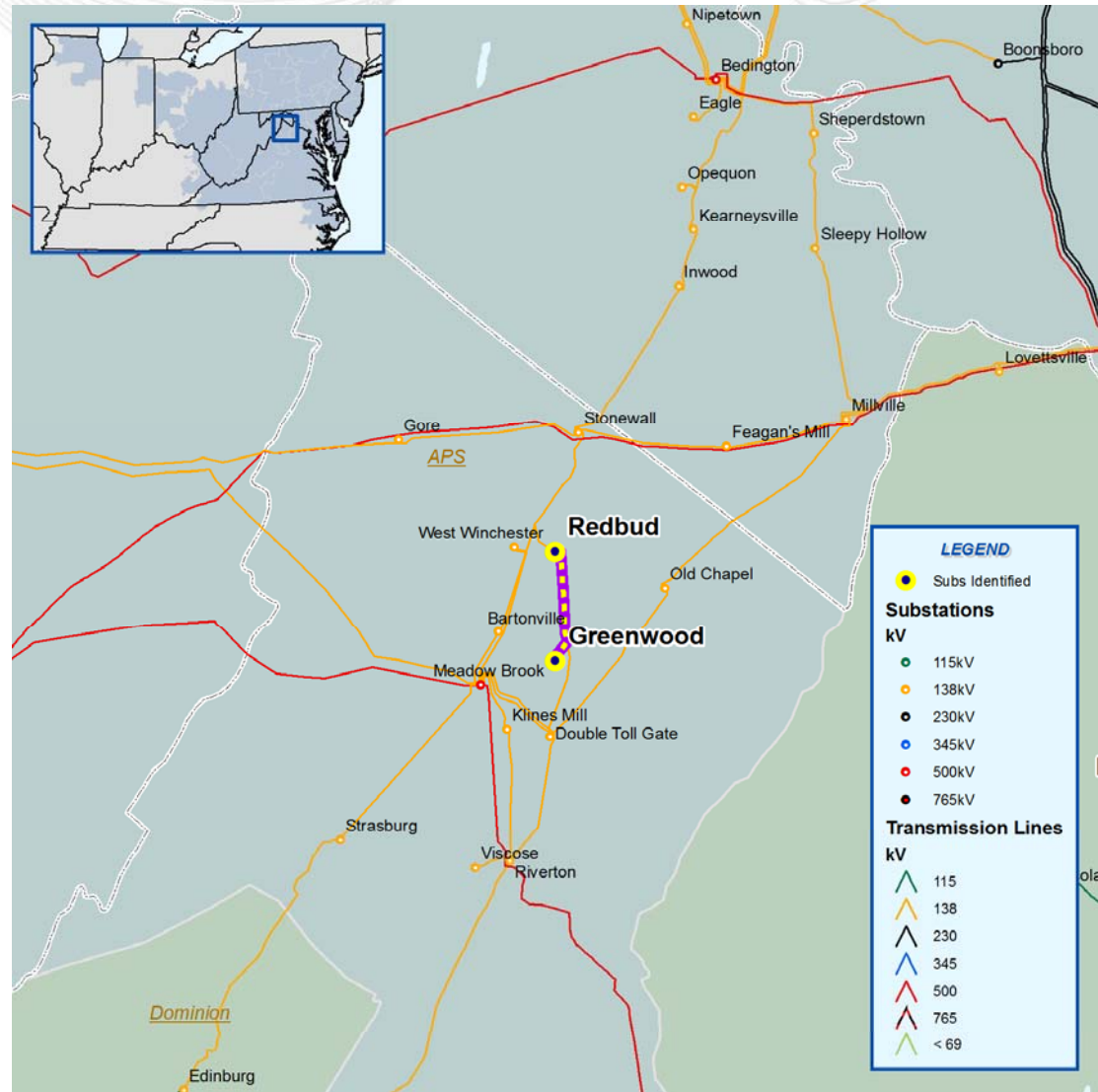
- **N-1-1 thermal overloads** of Luxor - Stony Springs Junction 138 kV line for Loss of Yukon - Waltz Mills - Sewickley 138 kV line + Springdale - Wallace 138 kV line
- **Proposed Solution:**
 - Reconductor the Luxor – Stony Springs Junction 138 kV line with 954 ACSR. (B1149)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



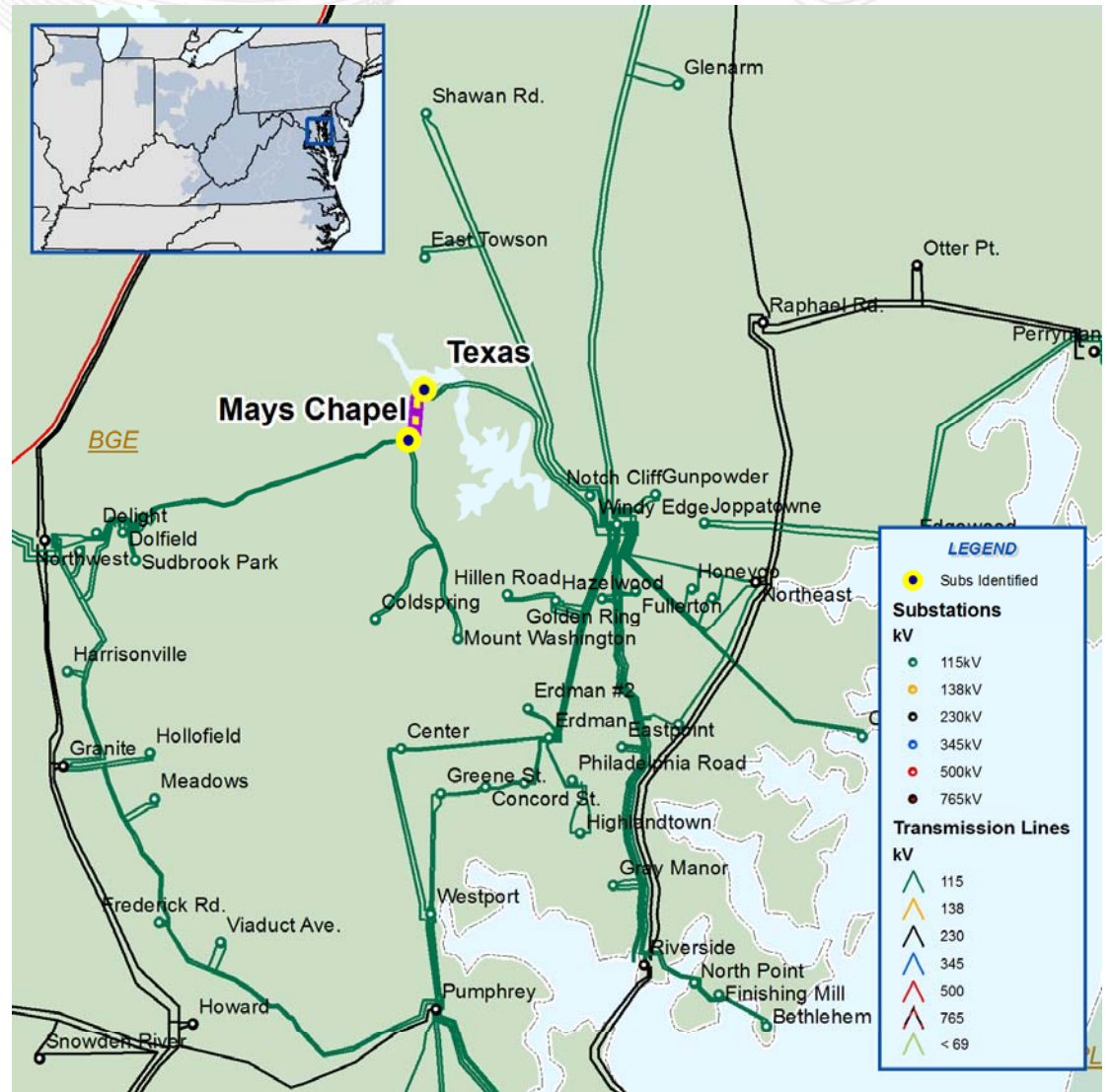
- **N-1-1 thermal overloads** of Social Hall - Vasco Tap 138 kV line for loss of Youngwood - Yukon 138 kV line + Yukon - Waltz Mills - Sewickley 138 kV line
- **Proposed Solution:**
 - Upgrade terminal equipment at Social Hall. (B1150)
- **Estimated Cost:** TBD
- **Expected IS Date:** 6/01/2014



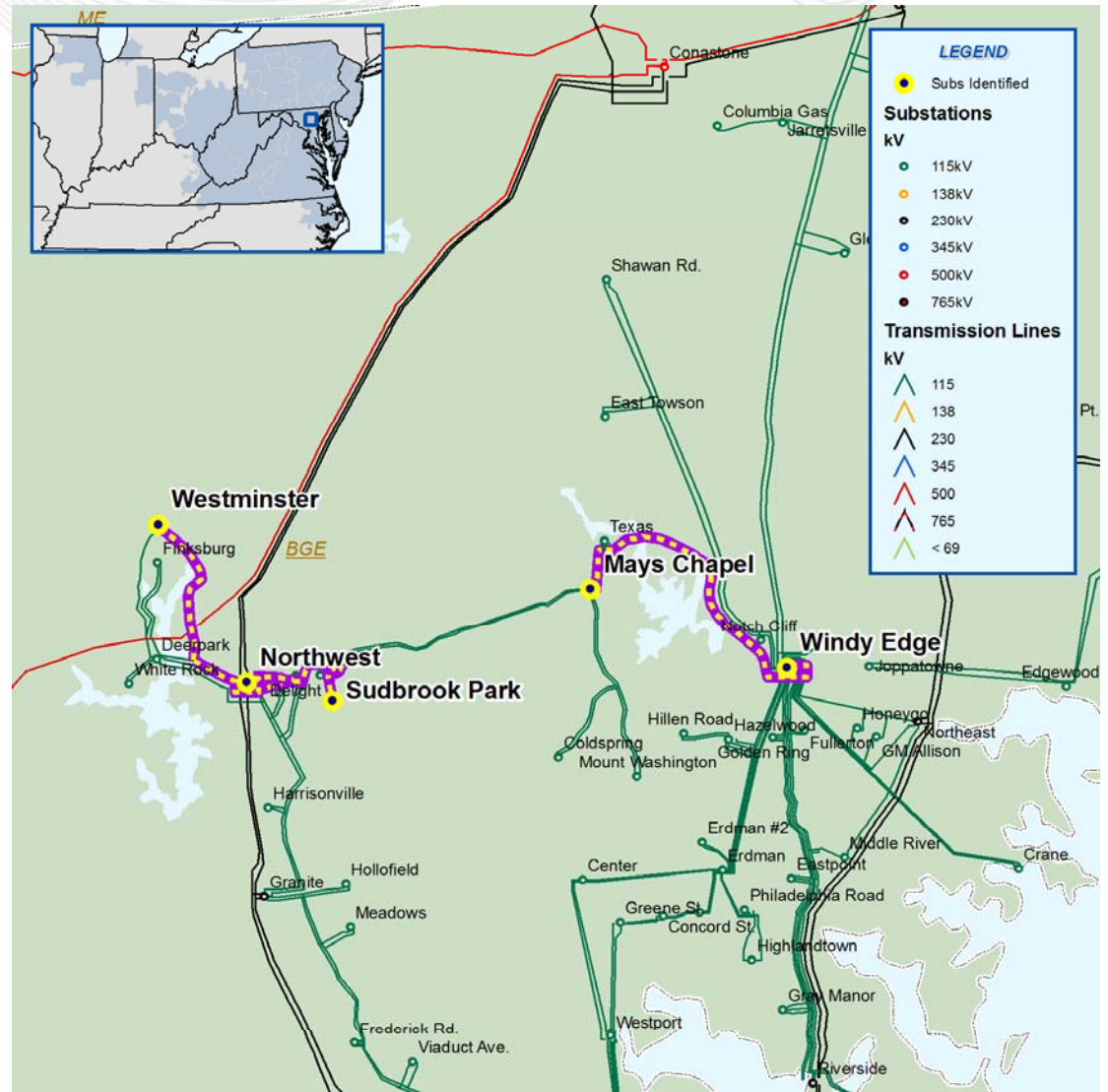
- **N-1-1 thermal overloads** of Greenwood - Redbud 138 kV line for Loss of Meadow Brook - West Winchester 138 kV line + Base Case
- **Proposed Solution:**
 - Reconductor the Greenwood – Redbud 138 kV line with 954 ACSR. (B1151)
- **Estimated Cost:** \$2.7 M
- **Expected IS Date:** 6/01/2014



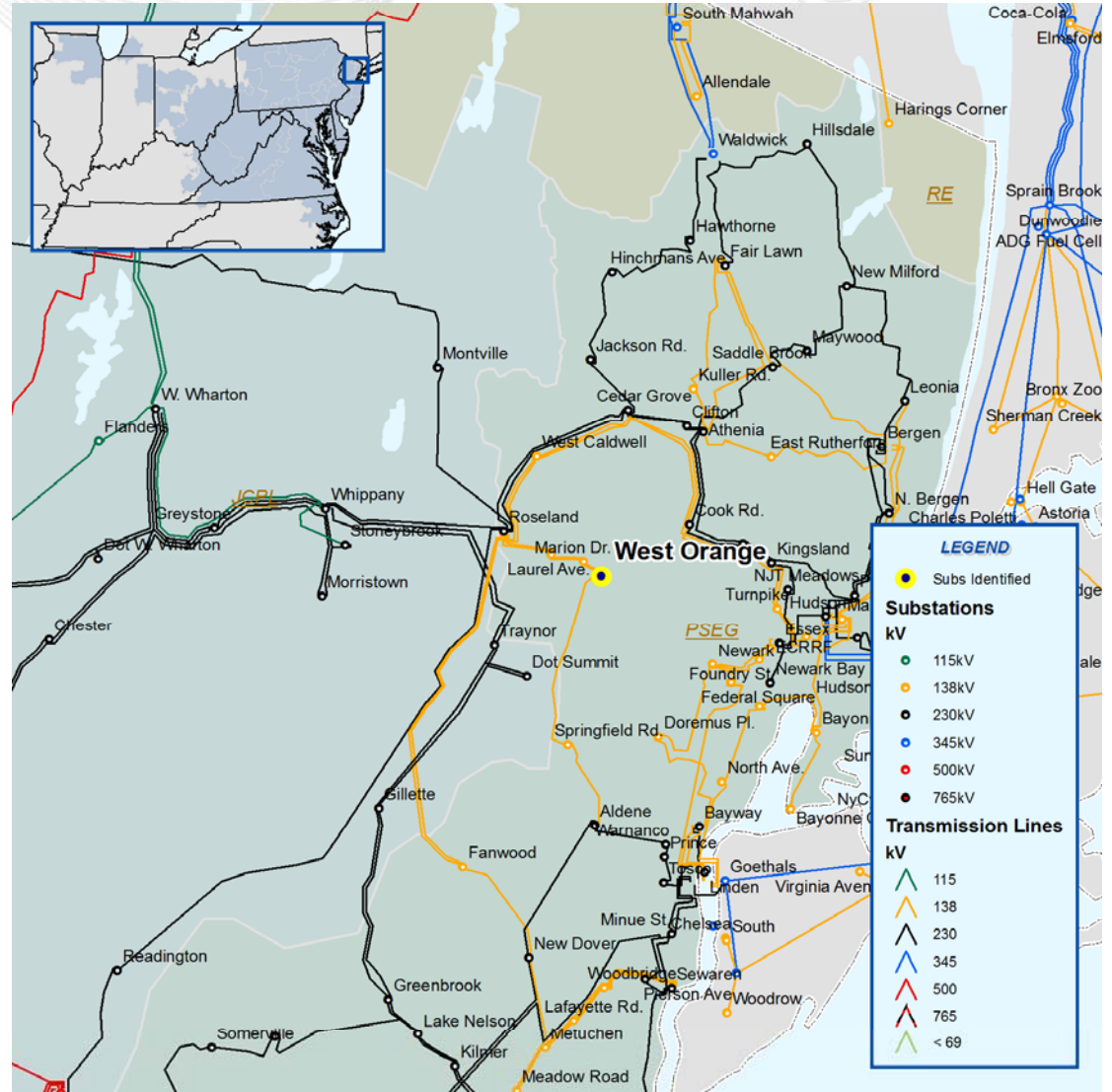
- N-1-1 thermal overload of Mays Chapel – Texas 115kV line for the loss of Mays Chapel – Mt. Washington CKT 110702 + loss of Northwest – Delight - Gwynnbrook - Mays Chapel CKT 110579 115kV line
- Proposed Solution:
 - Transfer 6 MW of load s from Mt. Washington to East Towson.
- Estimated Cost: \$ 0.0 M
- Expected IS Date: 6/01/2014



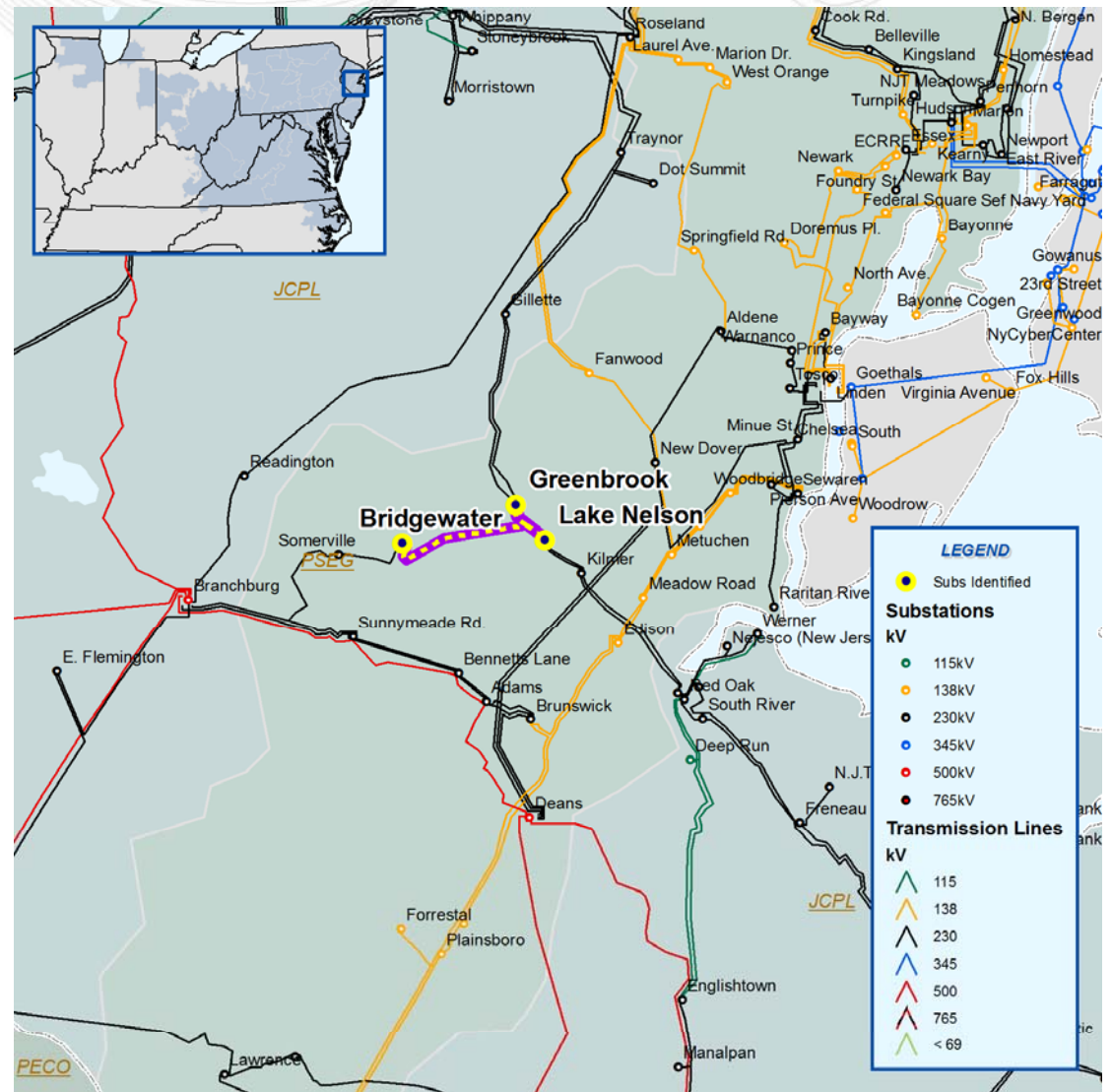
- N-1-1 voltage drop violations in Texas, Delight, Notch Cliff, Shawn Rd. vicinity for the following contingencies :
 - Loss of Northwest – Sudbrook CKT 110578 + loss of Mays Chapel – MT. Washington CKT 110701.
 - Loss of Northwest – Westminster CKT 110579 + loss of Mays Chapel – MT. Washington CKT 110702.
 - Loss of Windy Edge – Mays Chapel CKT 110509 + loss of Mays Chapel – MT. Washington CKT 110702.
- Proposed Temporary Solution in 2014 (permanent solution to be determined):
 - Apply a special protection scheme (load drop and H/S switching removal at Mt. Washington)
- Estimated Cost: \$ 0.1 M
- Expected IS Date: 6/01/2014



- N-1-1 Voltage Violation
- Voltage drop and voltage magnitude violation in the West Orange 138 kV vicinity for several contingencies.
- Proposed Solution:
 Convert the following facilities from 138 kV to 230 kV. (B1154)
 - >West Orange 138 kV substation
 - >The Roseland – West Orange two 138 kV circuits (S-1319 & T-1320).
 - >The Roseland – Sewaren 138 kV circuit (O-1315).
- Estimated Cost:
\$200 M
- Expected IS Date:
06/01/2014



- N-1-1 Voltage Violation
- Voltage drop and voltage magnitude violation in the Bridgewater, Greenbrook and Lake Nelson 230 kV vicinity for several contingencies.
- Proposed Solution:
Build a new 230 kV circuit from Branchburg to Middlesex Sw. Rack.
Build a new 230 kV substation at Middlesex by connecting the new and the existing circuits from Branchburg, plus the two 230 kV parallel circuits from Raritan River to Gillette (I-1023 and W-1037). (B1155)
- Estimated Cost:
\$125 M
- Expected IS Date:
06/01/2014



- N-1-1 Voltage Violation
- Voltage drop and voltage magnitude violation in the Burlington 138 kV vicinity for several contingencies.
- Proposed Solution:
Convert the following facilities from 138 kV to 230 kV (B1156).
 - >The Burlington 138 kV substation.
 - >The Camden 138 kV substation.
 - >The 138 kV circuits from Burlington to Camden (I-1309 and J-1310).
 - >The 138 kV circuit from Camden to Cuthbert Blvd. and the Cuthbert Blvd 138 kV substation
- Estimated Cost:
\$150 M
- Expected IS Date:
06/01/2014

