Market Resource Alternatives (MRA): SEMA-RI

Planning Advisory Committee

(Non-CEII version)

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RESOURCE ANALYSIS & INTEGRATION

Topics for Today's Discussion

- Objective of this study
- Evolution of MRA studies in New England
- Study Area
- Needs Assessment & Thermal Violations
- SEMA-RI MRA Analysis Overview & Illustration
- Sub-Area walk-through
- SEMA-RI MRA Analysis Hybrid Solution
- Conclusion

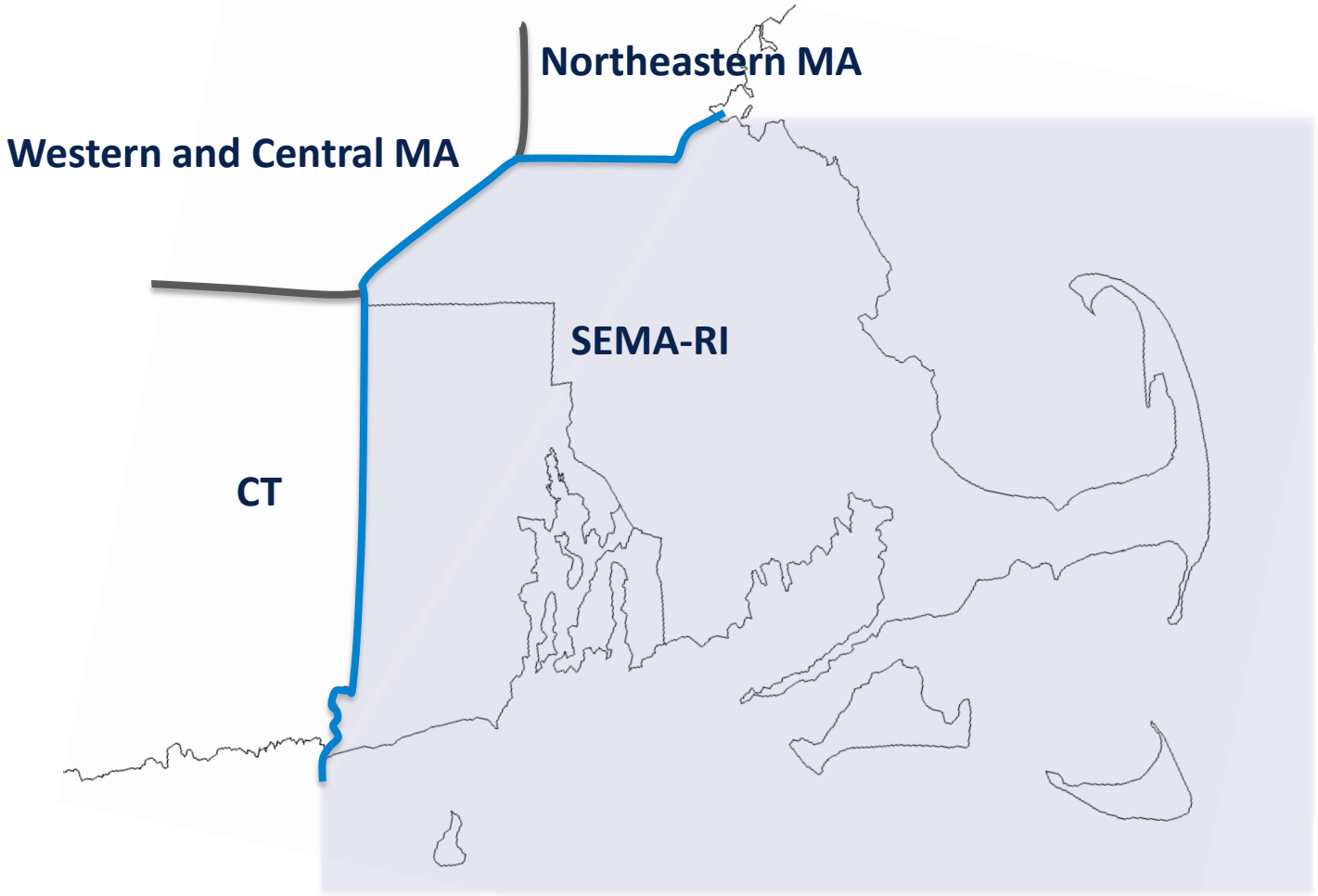
Objective of this MRA study

- Provide theoretical signals to developers and stakeholders on the appropriate and desirable electrical locations in the SEMA-RI system purely based on reliability to help remove some of the constraints identified in the SEMA-RI Transmission Needs Assessment
- Highlight the importance of a hybrid solution involving both Generation and Demand Side Management to reduce the number of thermal violations identified for the SEMA-RI region
- Emphasize that the alternatives proposed in this study cannot replace transmission but may complement them instead

Evolution of MRA studies in New England

- In 2010, PAC suggested MRAs as a supplement to Needs Assessments in the regional planning process
- April 2011 – ISO-NE presented preliminary results for MRAs in NH/VT study region (requires CEII access)
  - Identified Gen Injection or independently, Load Reduction to remove all constraints in 6 sub-areas
- December 2012 – ISO-NE presented preliminary results for MRAs in GHCC study region (requires CEII access)
  - Identified approximately 900 MW of Gen Injection or independently, 1350 MW of Load Reduction to remove all constraints in 4 sub-areas
- Why pick SEMA-RI region?
  - Significant retirement (Brayton Pt. station) in the region
  - SEMA-RI Needs Assessment presented at PAC in February 2014, July 2014 and November 2014 and solutions are currently being assessed
- What are the changes in this assessment?
  - A hybrid approach of incorporating both Generation Injection as well as Demand Side Management into a combined MRA solution
  - Reduce the number of identified transmission needs to a smaller subset with the help of the proposed alternatives
  - Load reduction as a smaller, optimistic fraction of the actual load at a location and not the entire load itself

Study Area : SEMA-RI
(South Eastern Massachusetts – Rhode Island)



SEMA-RI Needs Assessment

- PAC presentations:
  - N-1 presented at PAC in February 2014 (requires CEII access)
  - N-1-1 presented in July 2014 and November 2014 (requires CEII access)
- Summary of Violations:
  - 22 N-1 thermal violations
  - 52 N-1-1 thermal violations
- Study assumptions for the SEMA-RI Needs Assessment are available in the Appendix (slide #31) of this presentation
- Needs Assessment Violation Summaries are available in the Appendix of the CEII version of this presentation (requires CEII access)

SEMA-RI MRA Analysis Overview

- The 2022 N-1 and N-1-1 Needs Assessments were used as the basis for the MRA study
- Two Step Approach:
  - Using N-1 Needs, a best-fit hybrid MRA solution (Gen Injection & Demand Side Management) was determined for the SEMA-RI region to remove some of the 22 identified violations (Apr 2014 PAC – requires CEII access)

Step 1 (N-1)

    - **6 MRA locations** (Gen and Demand Side Management) were suggested
      - Under one test scenario, approximately 940 MW of injection was suggested among these 6 locations
        - » 22 thermal needs were reduced to 5 thermal needs as a result of the addition of these alternatives

  - Using Step 1's hybrid MRA solution as a basis, the N-1-1 constrained elements were addressed

Step 2 (N-1-1)

    - **9 MRA locations** (Gen and Demand Side Management) were suggested (Six from Step 1 and three newly suggested)
      - Under one test scenario, approximately 1540 MW of injection was suggested among these 9 locations
        - » 74 thermal needs were reduced to 19 thermal needs as a result of the addition of these alternatives

SEMA-RI MRA Analysis In-Depth – *Step 1 (N-1)*

* Refer to Appendix Slide #32 for Cluster Optimization Illustration

SEMA-RI 2022 N-1 Needs Assessment Summer 90/10 Cases

Generate 'Best-Fit' MRA locations using Cluster Optimization* for each Sub-Area

- Identified based on all N-0, N-1 thermal constraints and distribution factors

Identify multiple MRA Combinations for all Sub-Areas

Perform Security-Constrained dispatch (SCD) for a 'Best-Fit' Combination

- Optimization performed based on all N-0 and N-1 Thermal Needs Assessment constraints to generate minimum Gen/ Demand Side Mgmt requirements

Identify ***hybrid* MRA solution** (Includes Gen, Demand Side Mgmt)

- This *hybrid* MRA solution aims to remove some thermal violations identified as N-1 Needs

Step 2 (N-1-1)

SEMA-RI MRA Analysis In-Depth – *Step 2 (N-1-1)*

Step 1 (N-1)

* Refer to Appendix Slide #32 for Cluster Optimization Illustration

Include the *hybrid* MRA solution from N-1 analysis in all N-1-1 Needs Assessment cases

Increase injection, if needed, at each existing location <u>without identifying new MRA locations</u>

→ For generating units, limit the size of injection to comparable generators in the Interconnection Queue

Generate <u>new</u> 'Best-Fit' MRA locations in <u>new sub-areas</u> using Cluster Optimization*

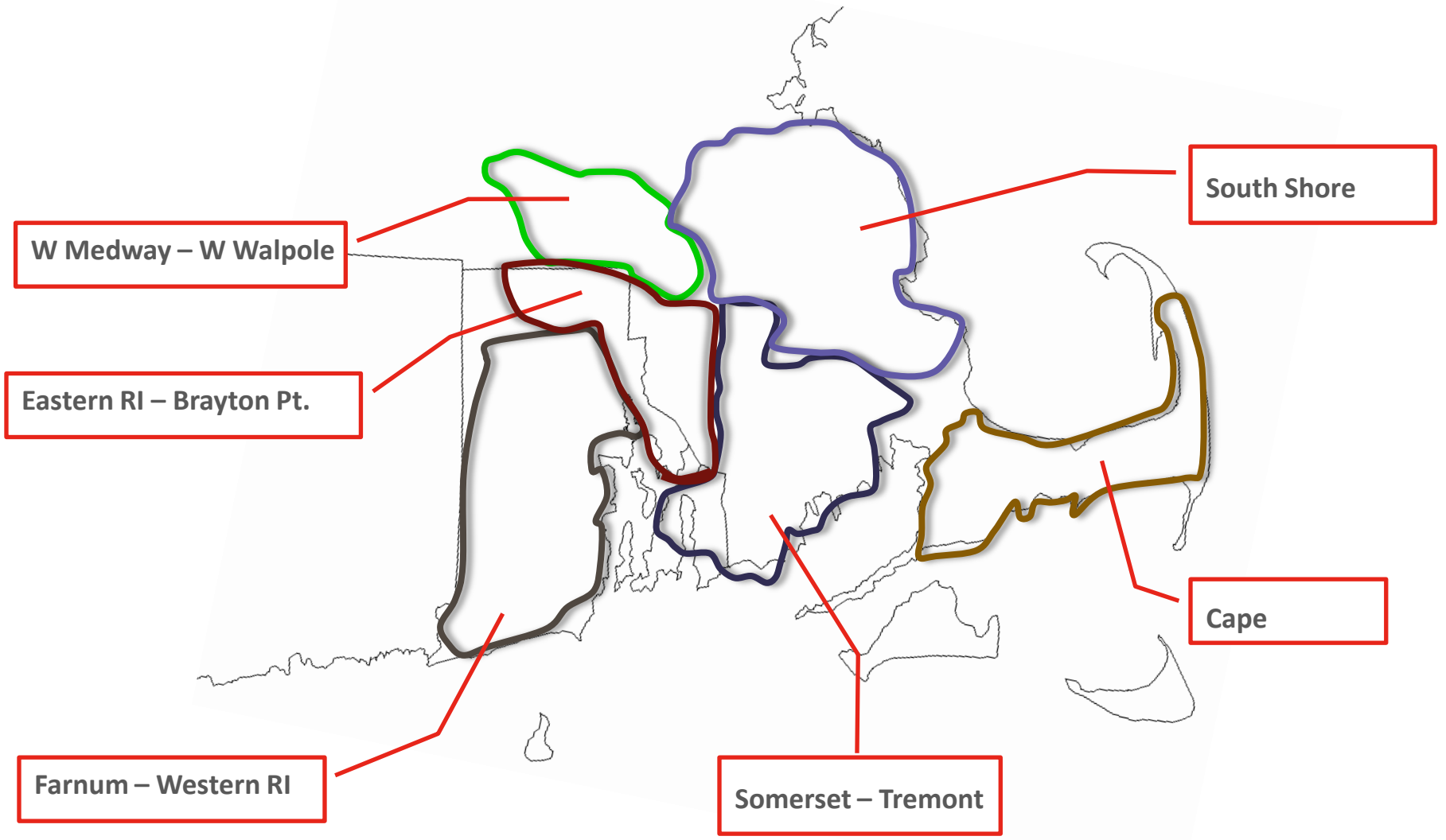
Perform Security-Constrained dispatch (SCD) to identify unresolved constraints

→ The remaining overloaded transmission elements might require a pure transmission upgrade

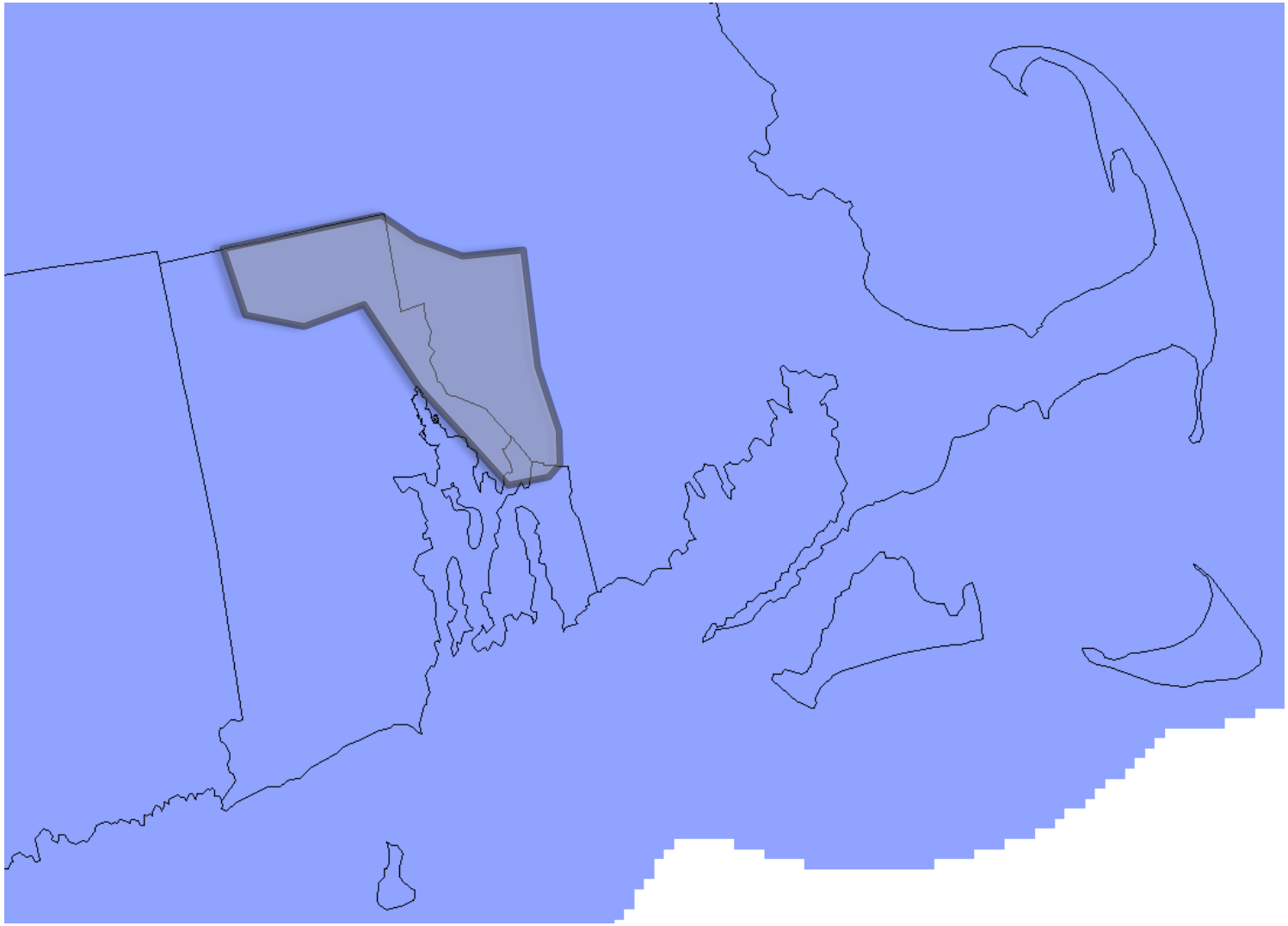
Identify ***hybrid* MRA solution** (Includes Gen, Demand Side Mgmt)

→ This *hybrid* MRA solution aims to remove some thermal violations identified as N-1 and N-1-1 Needs

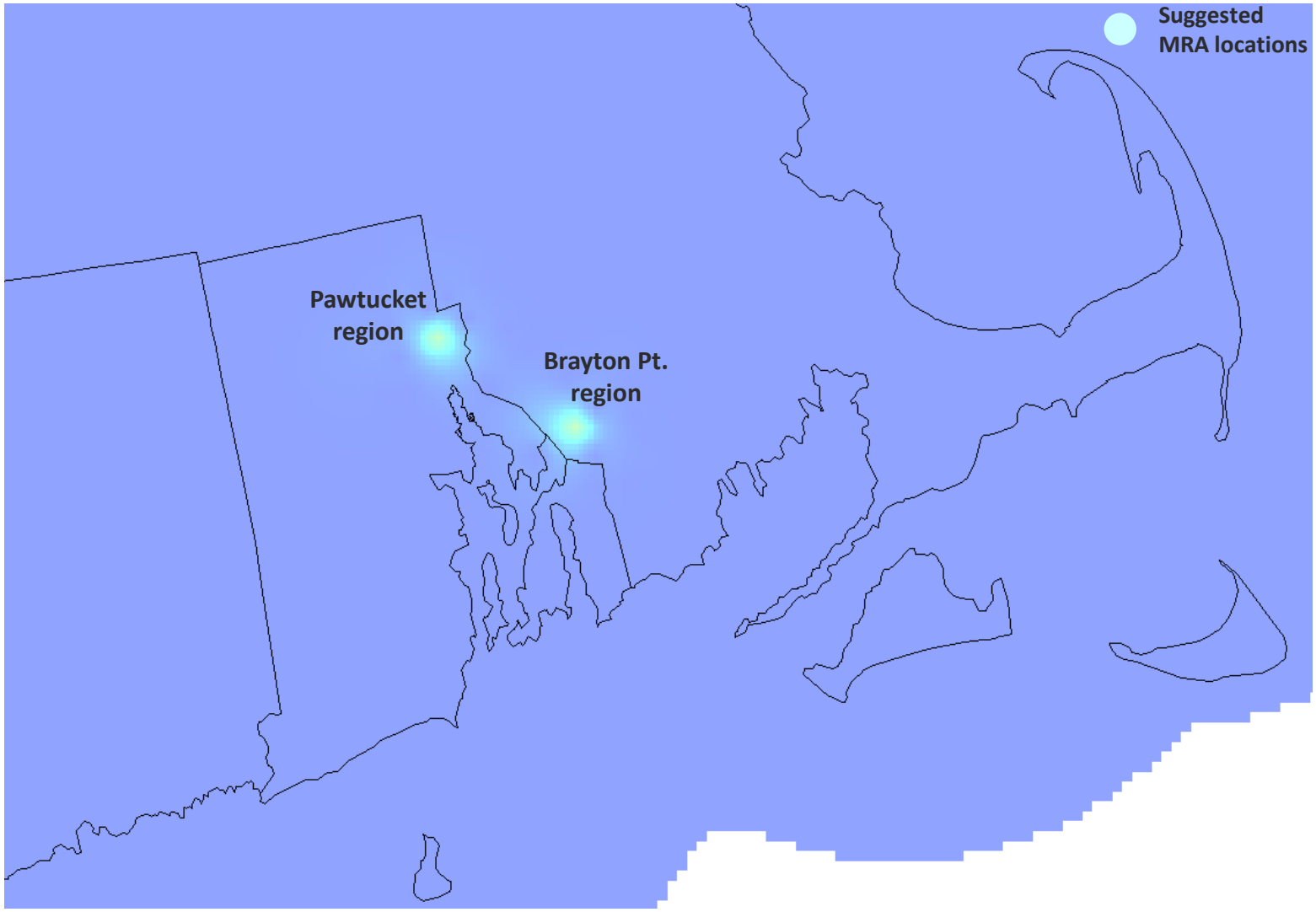
SEMA-RI MRA Analysis Sub-Areas



Eastern RI – Brayton Pt. Sub-Area



Eastern RI – Brayton Pt. Sub-Area *(contd.)*



Eastern RI – Brayton Pt. Sub-Area *(contd.)*

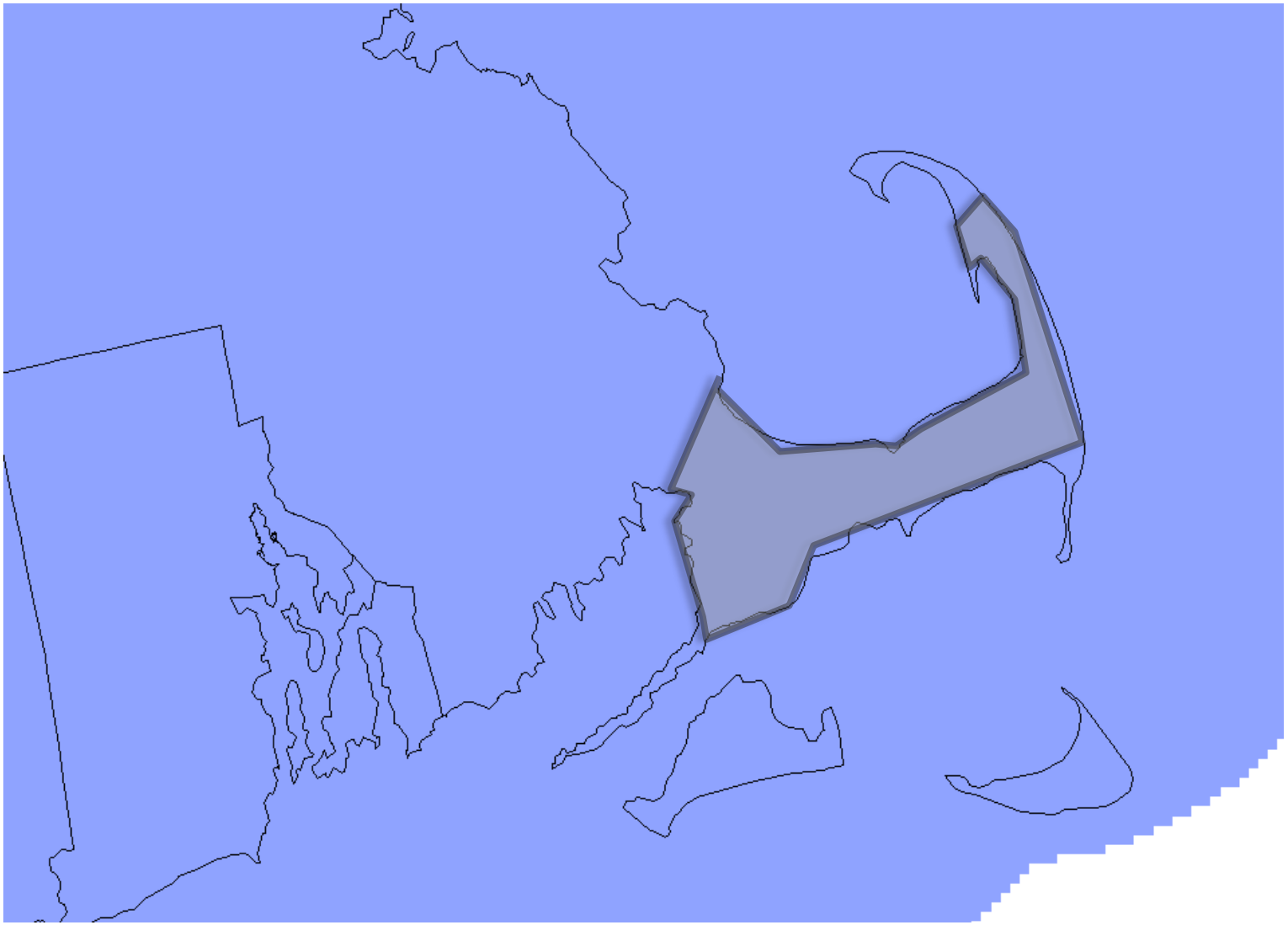
By placing injections at the following suggested MRA locations, 9 of the 11 thermal constraints (N-1 and N-1-1) in the Eastern RI – Brayton Pt. sub-area could be removed:

Brayton Pt. region (possible Generating Unit) and

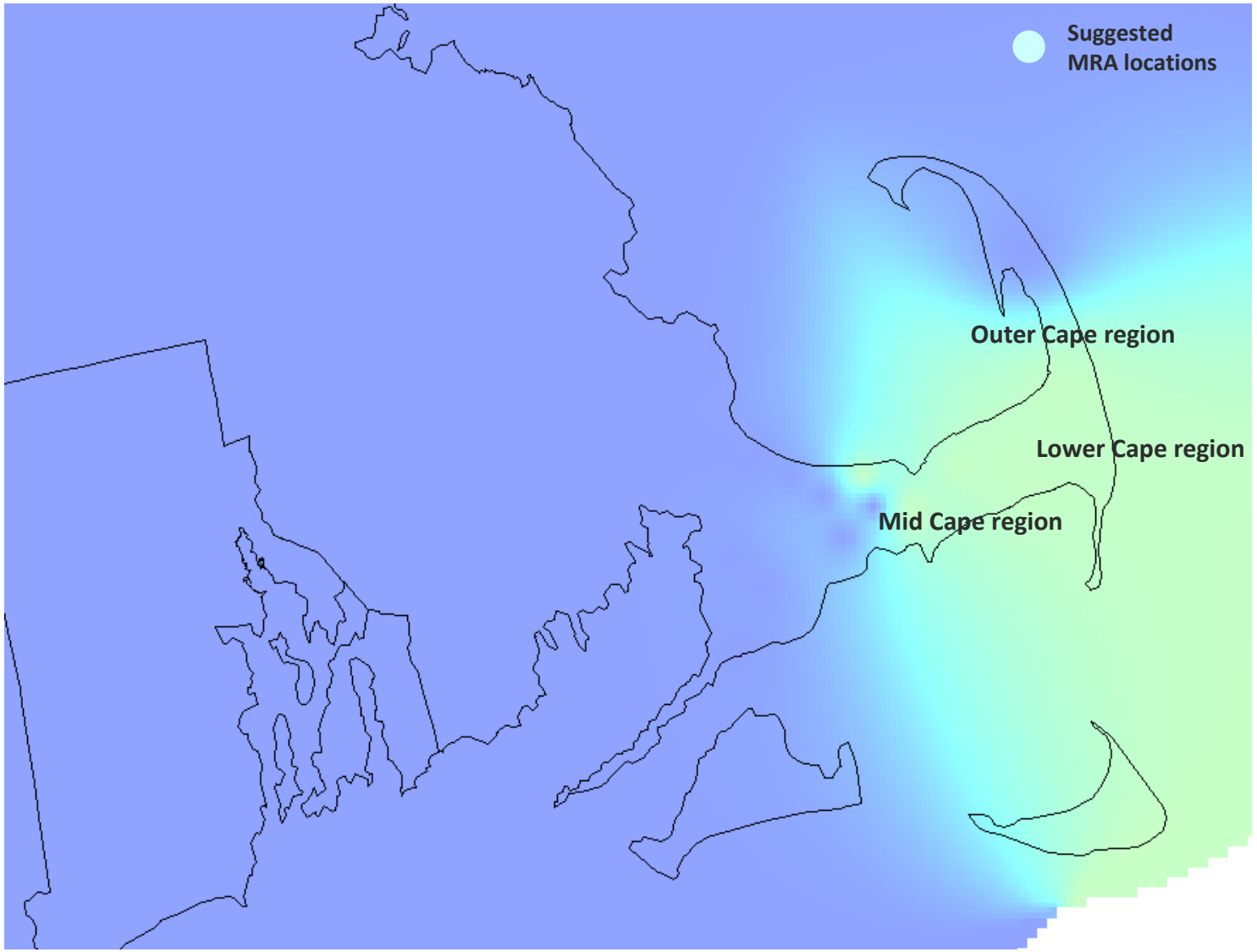
Pawtucket region (possible Demand Side Management or small Generating Unit)

The above-suggested MRA locations would work along with the other sub-areas' suggested MRA locations to remove some of the N-1 and N-1-1 thermal constraints identified through the SEMA-RI Needs Assessment

Cape Sub-Area



Cape Sub-Area *(contd.)*



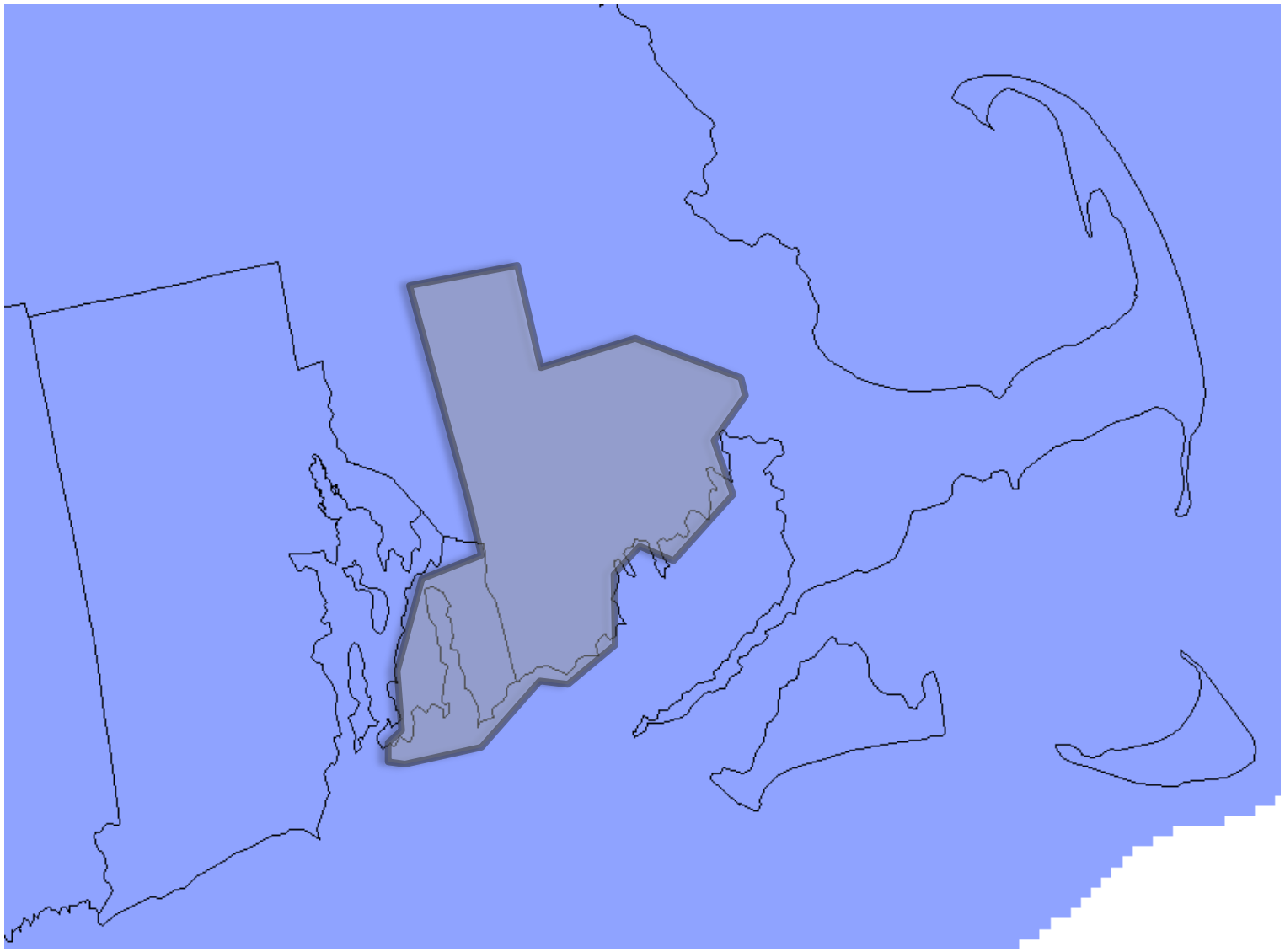
Cape Sub-Area *(contd.)*

By placing injections at the following suggested MRA locations, 12 of the 17 thermal constraints (N-1 and N-1-1) in the Cape sub-area could be removed:

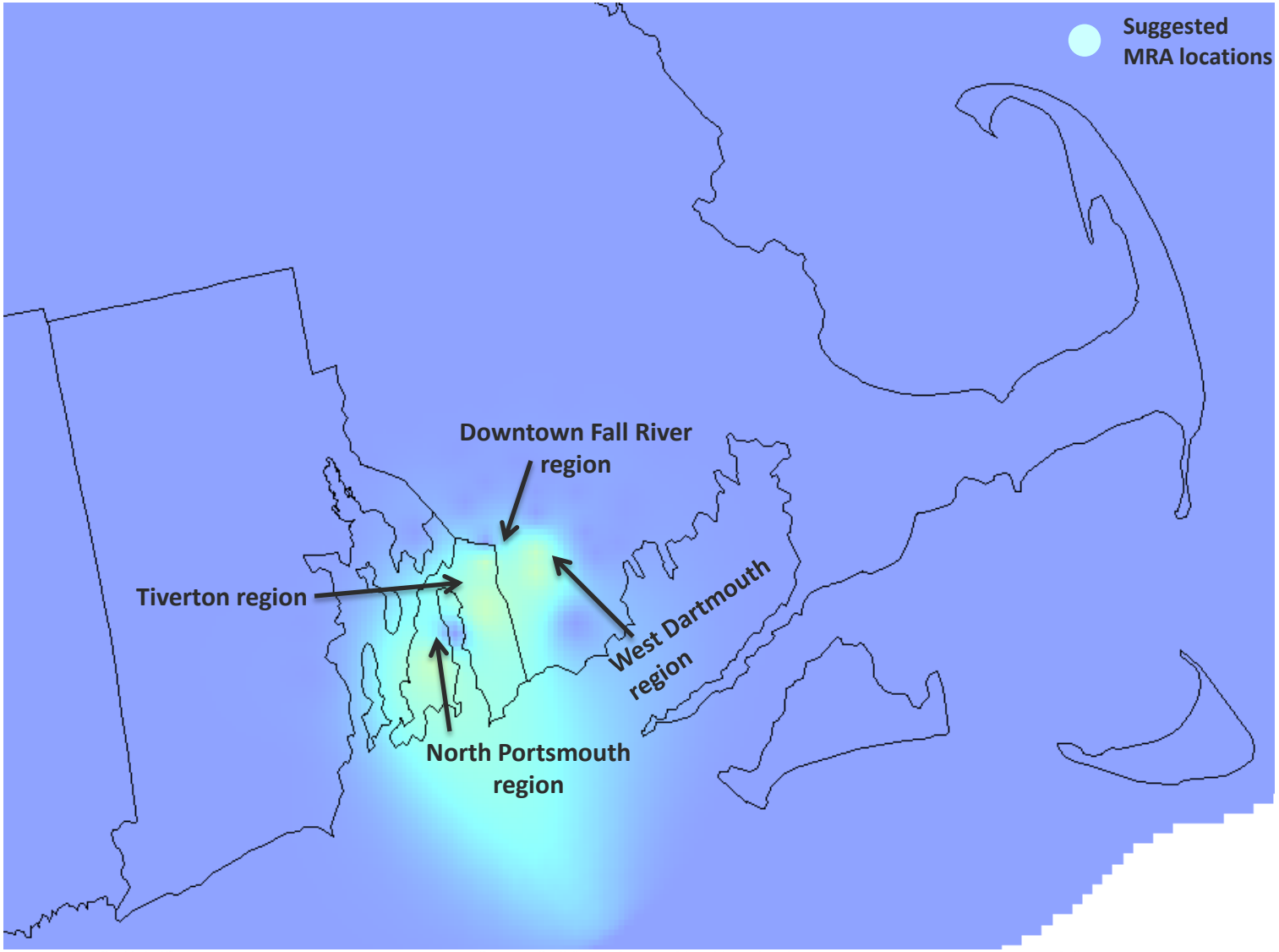
Mid-Lower-Outer Cape regions (possible Generating Unit)

The above-suggested MRA location would work along with the other sub-areas' suggested MRA locations to remove some of the N-1 and N-1-1 thermal constraints identified through the SEMA-RI Needs Assessment

Somerset – Tremont Sub-Area



Somerset – Tremont Sub-Area *(contd.)*



Somerset – Tremont Sub-Area *(contd.)*

By placing injections at the following suggested MRA locations, 17 of the 21 thermal 115 kV constraints (N-1 and N-1-1) in the Somerset – Tremont sub-area could be removed:

Tiverton region (possible Generating Unit) and

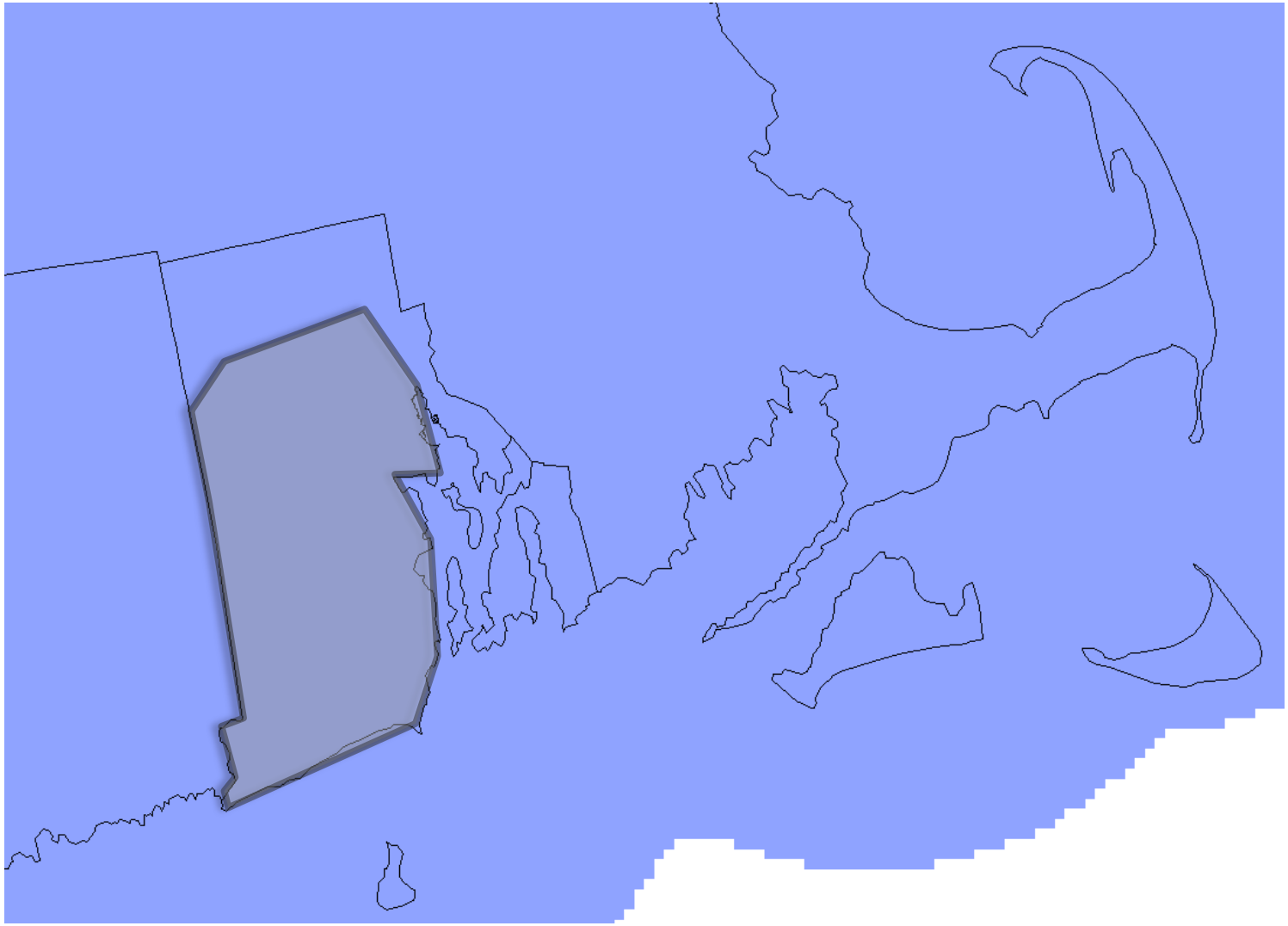
North Portsmouth (possible Generating Unit) and

Downtown Fall River (possible Demand Side Management or small Generating Unit) and

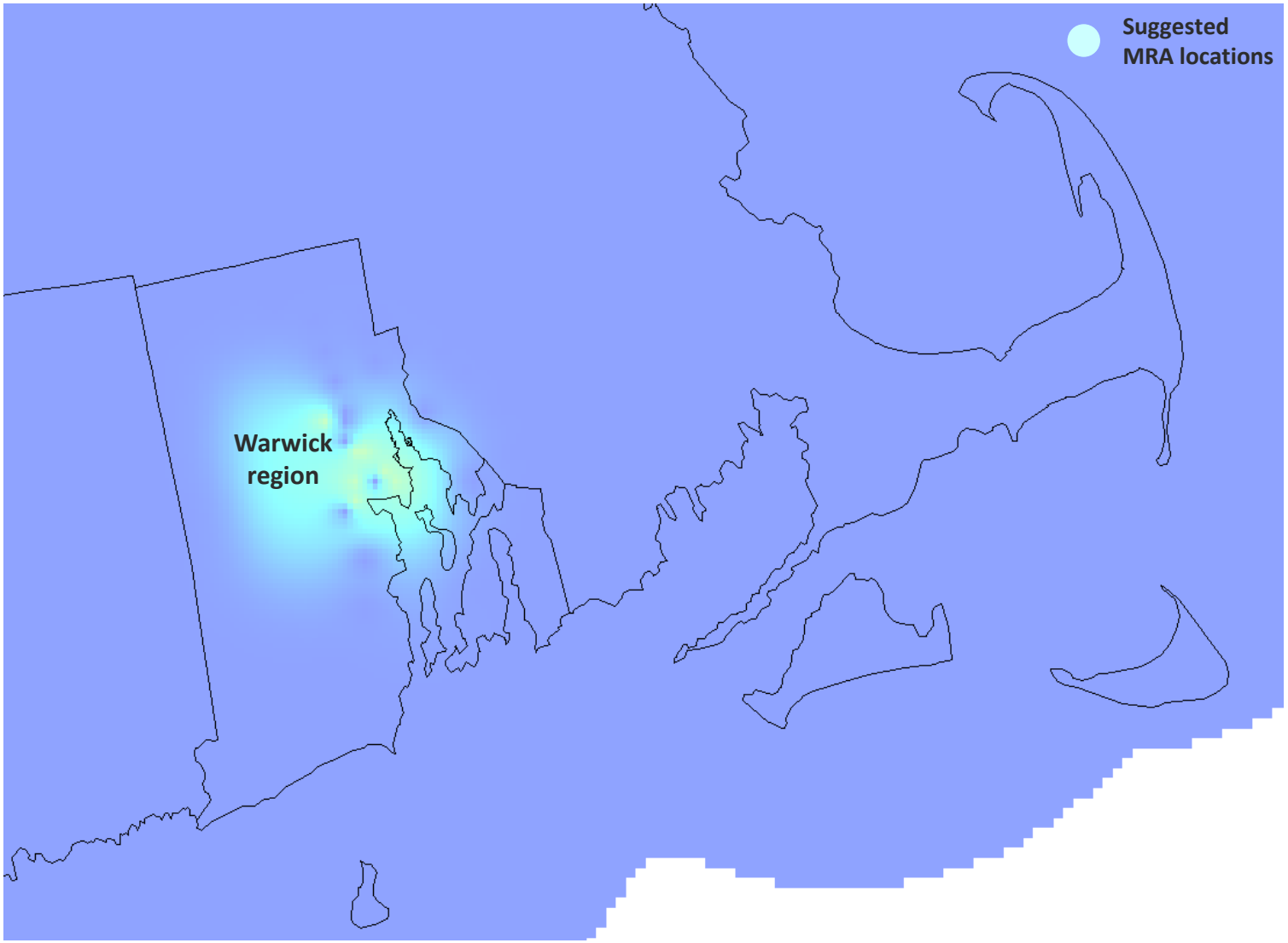
West Dartmouth (possible Demand Side Management or small Generating Unit)

The above-suggested MRA locations would work along with the other sub-areas' suggested MRA locations to remove some of the N-1 and N-1-1 thermal constraints identified through the SEMA-RI Needs Assessment

Farnum – Western RI Sub-Area



Farnum – Western RI Sub-Area *(contd.)*



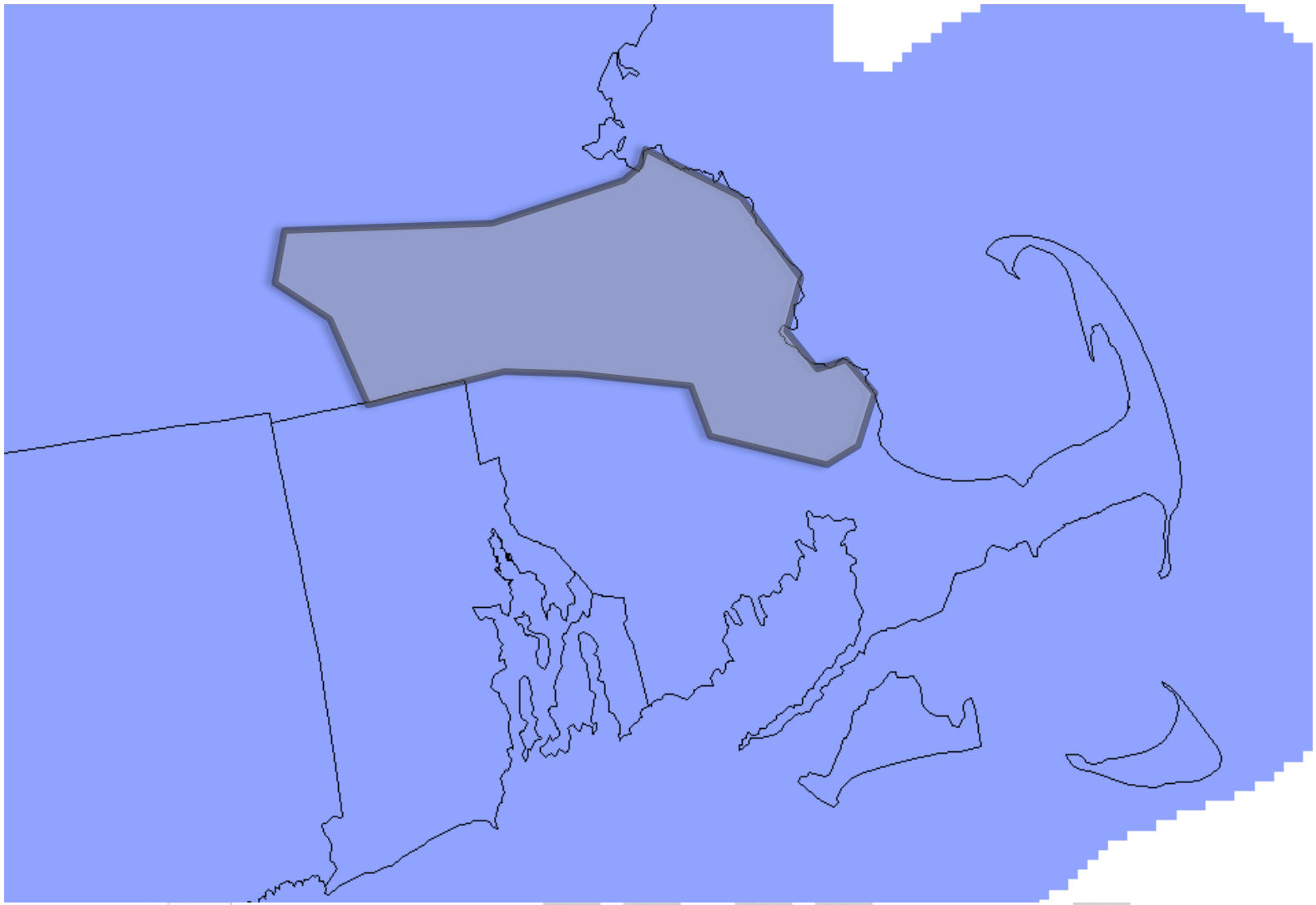
Farnum – Western RI Sub-Area *(contd.)*

By placing injections at the following suggested MRA locations, 4 of the 5 thermal constraints (N-1 and N-1-1) in the Farnum – Western RI sub-area could be removed:

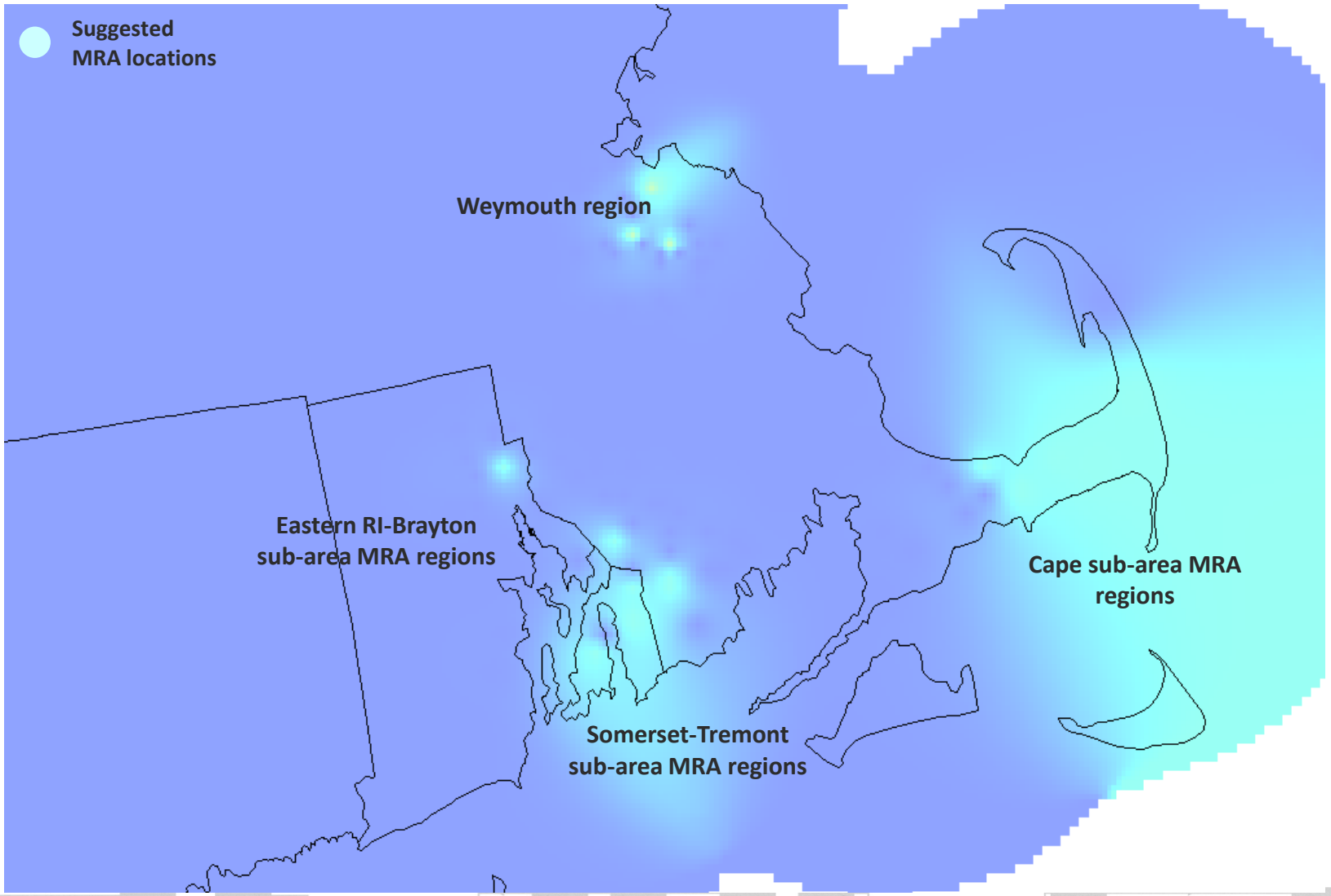
Warwick region (possible Demand Side Management or small Generating Unit)

The above-suggested MRA locations would work along with the other sub-areas' suggested MRA locations to remove some of the N-1 and N-1-1 thermal constraints identified through the SEMA-RI Needs Assessment

W. Medway – W. Walpole – South Shore Sub-Areas



W. Medway – W. Walpole – South Shore Sub-Areas *(contd.)*



W. Medway – W. Walpole – South Shore Sub-Areas *(contd.)*

By placing injections at the following suggested MRA location along with placement of injections in other sub-areas, 13 of the 15 thermal constraints (N-1 and N-1-1) in the W. Medway – W. Walpole – South Shore sub-areas could be removed:

Weymouth region (possible Demand Side Management or small Generating Unit)

Again, the above-suggested MRA location would work along with the other sub-areas' suggested MRA locations to remove some of the N-1 and N-1-1 thermal constraints identified through the SEMA-RI Needs Assessment

SEMA-RI MRA Analysis Hybrid Solution

* Large Generating Unit (LGIP) >=20
* Small Generating Unit (SGIP) <20
* DSM = Demand Side Management

MRA Sub-Area	Suggested MRA locations	Suggested type of Injection*	Test Scenario	
			Injection (MW)	Lingering Transmission Needs after the Test Injection
Eastern RI – Brayton Pt.	**Pawtucket region**	Small Gen / DSM	10	2 Transmission Needs (Cumberland RI region lines)
	Brayton Pt region	Large Gen	800	
Somerset – Tremont	**Tiverton region**	Large Gen	350	9 Transmission Needs (Swansea region line, Tremont region line, Acushnet region line, Portsmouth region 69 kV lines and transformers)
	North Portsmouth region	Large Gen	200	
	West Dartmouth region	Small Gen / DSM	10	
	Downtown Fall River region	Small Gen / DSM	25	
Cape	**Mid-Lower-Outer Cape regions**	Large Gen	100	5 Transmission Needs (Upper-Cape region lines)
Farnum – Western RI	**Warwick region**	Small Gen	20	1 Transmission Needs (North Kingstown region line)
W. Walpole – South Shore	**Weymouth region**	Small Gen	25	2 Transmission Needs (Millbury region line, Holbrook region transformer)

9 Suggested MRA locations in the SEMA-RI region

SEMA-RI MRA Analysis Conclusion

- This N-1-1 *hybrid* MRA solution provides theoretical signals to developers and stakeholders on desirable electrical injection locations in the SEMA-RI system purely based on reliability

- This analysis determines 9 suggested injection locations in the SEMA-RI region to remove some of the thermal violations identified in the Needs Assessments

- One test scenario shows that a combination of approximately 1540 MW of Generation Injection and Demand Side Management around the region helps to remove all but 19 thermal violations out of the 74 violations identified in the Needs Assessments

SEMA-RI MRA Analysis Conclusion *(contd.)*

Due to it's theoretical nature, this MRA solution faces a number of limitations as shown below:

- Cost-Benefit comparison between a pure transmission solution and this hybrid MRA solution was not performed
- The placement of these injections does not factor-in the 'out-of-service' effect of these injections in the test scenario
- This analysis does not consider the additional transmission upgrades and investments that might arise as part of the FCM qualification process for the test scenario

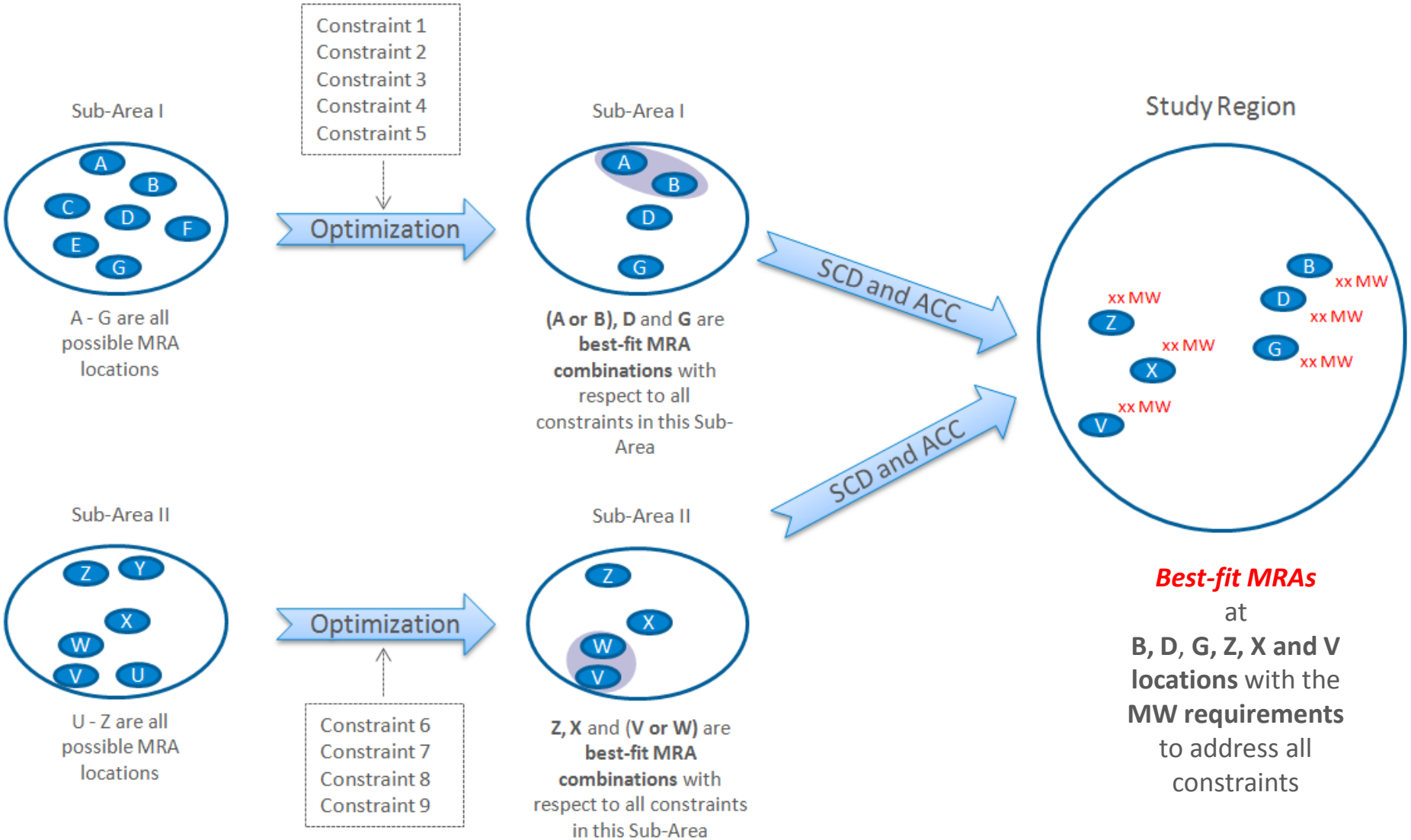
Questions

APPENDIX

SEMA-RI Needs Assessment

- N-1 presented at PAC in February 2014, N-1-1 presented in July 2014 and November 2014 (all require CEII clearance)
- Study assumptions:
  - Study included all generation up to FCA #7
  - 2022 90/10 Summer Peak load level studied
    - SEMA-RI load
    - Active DR, Passive DR and EE
  - Transmission projects included:
    - GSRP, RIRP and IRP components of NEEWS and Greater Boston Working Group solutions (March 2012 PAC)
    - Two proposed Brayton Point region 115 kV projects not included in the study
  - Brayton Point along with other resources that submitted Non-Price Retirement requests were removed from the study

SEMA-RI MRA Cluster Optimization - Illustration



Best-fit MRAs at **B, D, G, Z, X and V locations** with the **MW requirements** to address all constraints