# Interactive Map Project

User Guide

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## Introduction

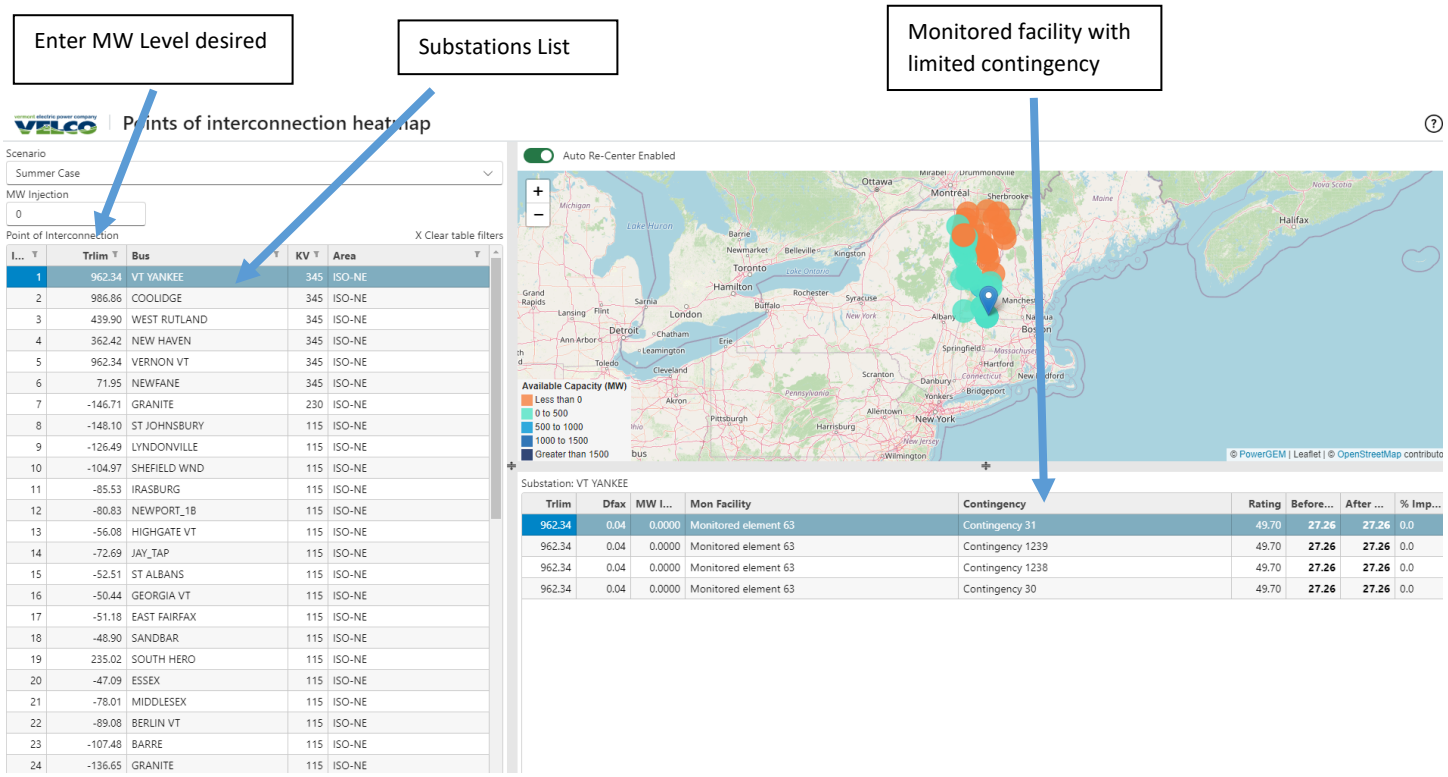
VELCO planning team has been working to implement an interactive map to satisfy FERC order 2023 requirement. The FERC order aimed at the Improvements to Generator Interconnection Procedures and Agreements (GIPA). The goal of this project was to provide an interactive map to potential energy developers to show the ability of VELCO transmission lines to handle potential additional MWs injection points based on the current topology of VELCO system. The development of the map has also considered N-1 scenarios including potential contingencies inside VELCO .

## Map Limitation

The interactive map must be viewed as a source for information to understand the best candidates' locations to handle additional MW injection load such as solar PV and other renewable resources, however additional studies may be required to provide the needed level of accuracy as dedicated by ISO-NE planning procedures, NPCC and NERC standards. The current map uses a single summer case to estimate additional line capacities, so Shoulder and spring like conditions are not currently modeled. To stress the limitation of the map, the following disclaimer statements were added: "**This map should be used for information purposes only as it provides general guidelines for transmission capacity. The map does not represent all expected system conditions nor includes voltage or stability constraints. Users are encouraged to follow all NERC and ISO-NE requirements regarding the interconnection process as referenced by ISO-NE and NERC**.

## Viewing the Map

The map is available on the VELCO website under the planning section at the following link:
https://www.velco.com/heatmap/



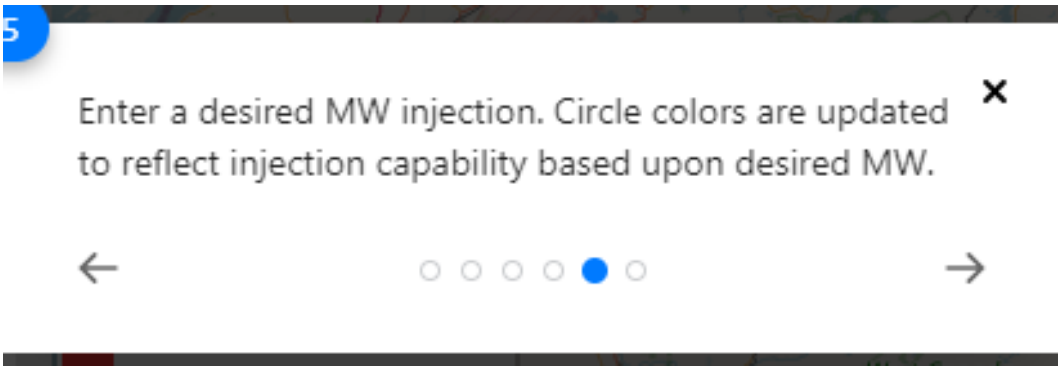

| I... | Trlim | Bus | KV | Area |
|---|---|---|---|---|
| 1 | 962.34 | VT YANKEE | 345 | ISO-NE |
| 2 | 986.86 | COOLIDGE | 345 | ISO-NE |
| 3 | 439.90 | WEST RUTLAND | 345 | ISO-NE |
| 4 | 362.42 | NEW HAVEN | 345 | ISO-NE |
| 5 | 962.34 | VERNON VT | 345 | ISO-NE |
| 6 | 71.95 | NEWFANE | 345 | ISO-NE |
| 7 | -146.71 | GRANITE | 230 | ISO-NE |
| 8 | -148.10 | ST JOHNSBURY | 115 | ISO-NE |
| 9 | -126.49 | LYNDONVILLE | 115 | ISO-NE |
| 10 | -104.97 | SHEFIELD WND | 115 | ISO-NE |
| 11 | -85.53 | IRASBURG | 115 | ISO-NE |
| 12 | -80.83 | NEWPORT_1B | 115 | ISO-NE |
| 13 | -56.08 | HIGHGATE VT | 115 | ISO-NE |
| 14 | -72.69 | JAY_TAP | 115 | ISO-NE |
| 15 | -52.51 | ST ALBANS | 115 | ISO-NE |
| 16 | -50.44 | GEORGIA VT | 115 | ISO-NE |
| 17 | -51.18 | EAST FAIRFAX | 115 | ISO-NE |
| 18 | -48.90 | SANDBAR | 115 | ISO-NE |
| 19 | 235.02 | SOUTH HERO | 115 | ISO-NE |
| 20 | -47.09 | ESSEX | 115 | ISO-NE |
| 21 | -78.01 | MIDDLESEX | 115 | ISO-NE |
| 22 | -89.08 | BERLIN VT | 115 | ISO-NE |
| 23 | -107.48 | BARRE | 115 | ISO-NE |
| 24 | -136.65 | GRANITE | 115 | ISO-NE |

| Trlim | Dfax | MW I... | Mon Facility | Contingency | Rating | Before... | After ... | % Imp... |
|---|---|---|---|---|---|---|---|---|
| 962.34 | 0.04 | 0.0000 | Monitored element 63 | Contingency 31 | 49.70 | 27.26 | 27.26 | 0.0 |
| 962.34 | 0.04 | 0.0000 | Monitored element 63 | Contingency 1239 | 49.70 | 27.26 | 27.26 | 0.0 |
| 962.34 | 0.04 | 0.0000 | Monitored element 63 | Contingency 1238 | 49.70 | 27.26 | 27.26 | 0.0 |
| 962.34 | 0.04 | 0.0000 | Monitored element 63 | Contingency 30 | 49.70 | 27.26 | 27.26 | 0.0 |

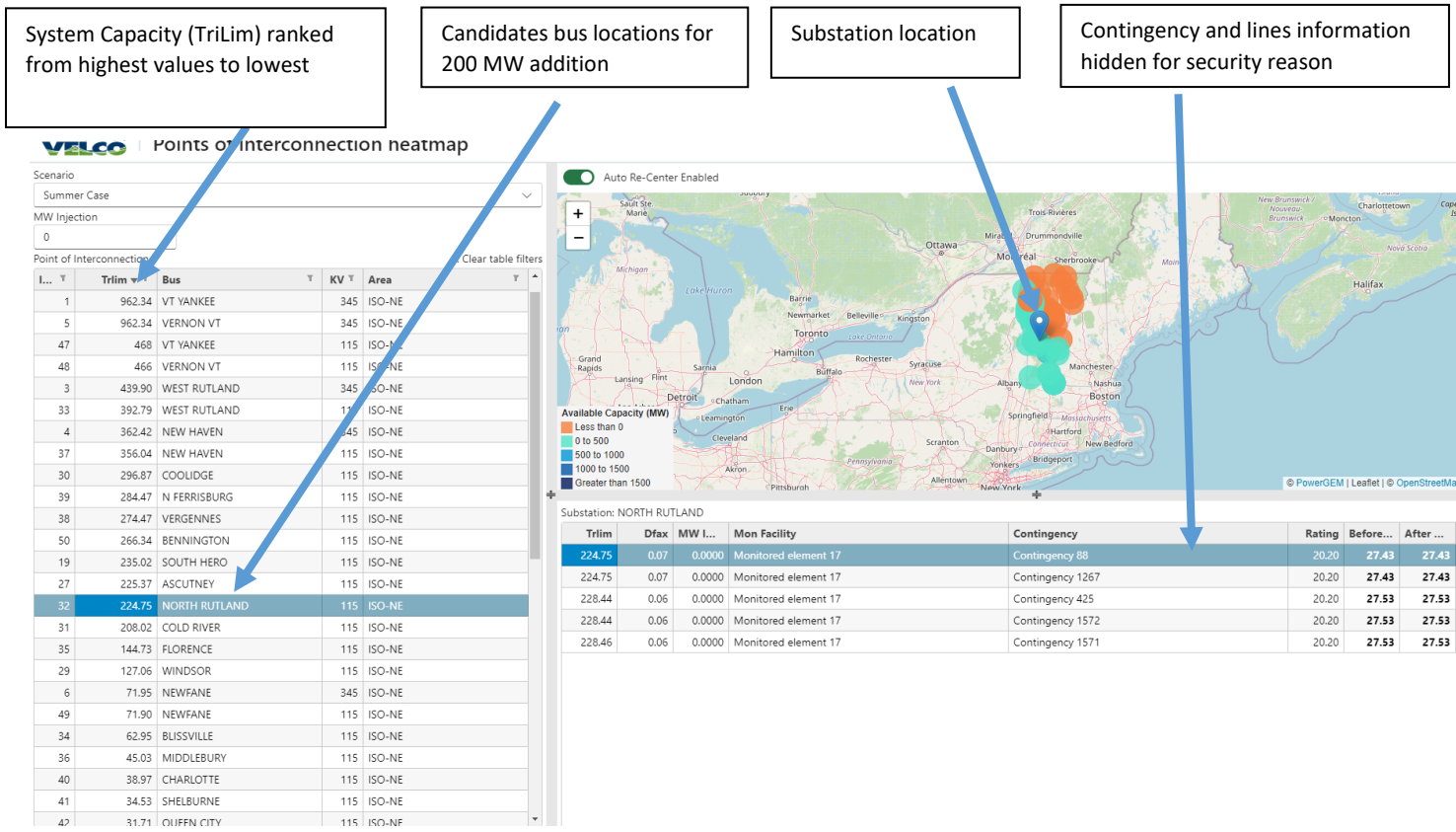
## Using the Map

Users can enter the amount of MW needed under the MW injection option, the map shows the limited amount of power that can be injected for each bus, buses with positive TriLim values are good candidates for additional power while buses with negative TriLim values are indication of overload at these buses before adding new power to the system. The example below shows 200 MW injection into the VELCO system. The Trilim column can be filtered to show

the largest values or the smallest values. It is recommended that users filter this column using the largest Trilim values to show the best candidates location for adding more MW. In the example below, the North Rutland bus has a capacity of 233 MW so it could be a good candidate for the 200 MW addition.




Distribution Factors, montiored elements and contingencies affecting the new MW addittion is shown on more detail on the map




| I... | Trlim | Bus | KV | Area |
|---|---|---|---|---|
| 1 | 962.34 | VT YANKEE | 345 | ISO-NE |
| 5 | 962.34 | VERNON VT | 345 | ISO-NE |
| 47 | 468 | VT YANKEE | 115 | ISO-NE |
| 48 | 466 | VERNON VT | 115 | ISO-NE |
| 3 | 439.90 | WEST RUTLAND | 345 | ISO-NE |
| 33 | 392.79 | WEST RUTLAND | 115 | ISO-NE |
| 4 | 362.42 | NEW HAVEN | 345 | ISO-NE |
| 37 | 356.04 | NEW HAVEN | 115 | ISO-NE |
| 30 | 296.87 | COOLIDGE | 115 | ISO-NE |
| 39 | 284.47 | N FERRISBURG | 115 | ISO-NE |
| 38 | 274.47 | VERGENNES | 115 | ISO-NE |
| 50 | 266.34 | BENNINGTON | 115 | ISO-NE |
| 19 | 235.02 | SOUTH HERO | 115 | ISO-NE |
| 27 | 225.37 | ASCUTNEY | 115 | ISO-NE |
| 32 | 224.75 | NORTH RUTLAND | 115 | ISO-NE |
| 31 | 208.02 | COLD RIVER | 115 | ISO-NE |
| 35 | 144.73 | FLORENCE | 115 | ISO-NE |
| 29 | 127.06 | WINDSOR | 115 | ISO-NE |
| 6 | 71.95 | NEWFANE | 345 | ISO-NE |
| 49 | 71.90 | NEWFANE | 115 | ISO-NE |
| 34 | 62.95 | BLISSVILLE | 115 | ISO-NE |
| 36 | 45.03 | MIDDLEBURY | 115 | ISO-NE |
| 40 | 38.97 | CHARLOTTE | 115 | ISO-NE |
| 41 | 34.53 | SHELBURNE | 115 | ISO-NE |
| 42 | 31.71 | QUEEN CITY | 115 | ISO-NE |

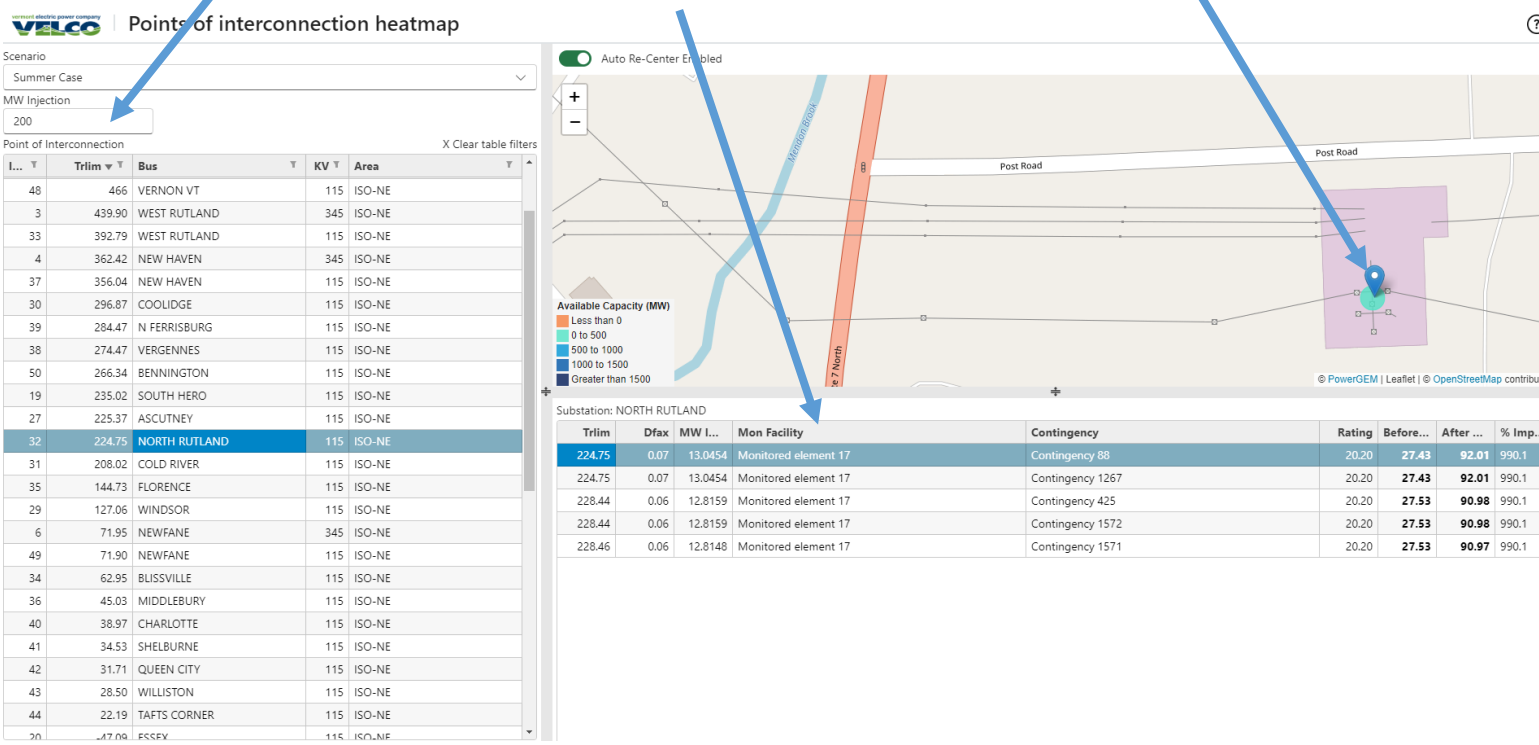
| Trlim | Dfax | MW I... | Mon Facility | Contingency | Rating | Before... | After ... | % Imp... |
|---|---|---|---|---|---|---|---|---|
| 224.75 | 0.07 | 0.0000 | Monitored element 17 | Contingency 88 | 20.20 | 27.43 | 27.43 | 0.0 |
| 224.75 | 0.07 | 0.0000 | Monitored element 17 | Contingency 1267 | 20.20 | 27.43 | 27.43 | 0.0 |
| 228.44 | 0.06 | 0.0000 | Monitored element 17 | Contingency 425 | 20.20 | 27.53 | 27.53 | 0.0 |
| 228.44 | 0.06 | 0.0000 | Monitored element 17 | Contingency 1572 | 20.20 | 27.53 | 27.53 | 0.0 |
| 228.46 | 0.06 | 0.0000 | Monitored element 17 | Contingency 1571 | 20.20 | 27.53 | 27.53 | 0.0 |

The map provides the ability to show the loading of the transmission line before and after adding the new MW as shown on the previous example: the loading before adding the new MW was 27.43% compared to 92.01% after adding the 200 MW.

Key information for 200 MW addition at the North Rutland Bus

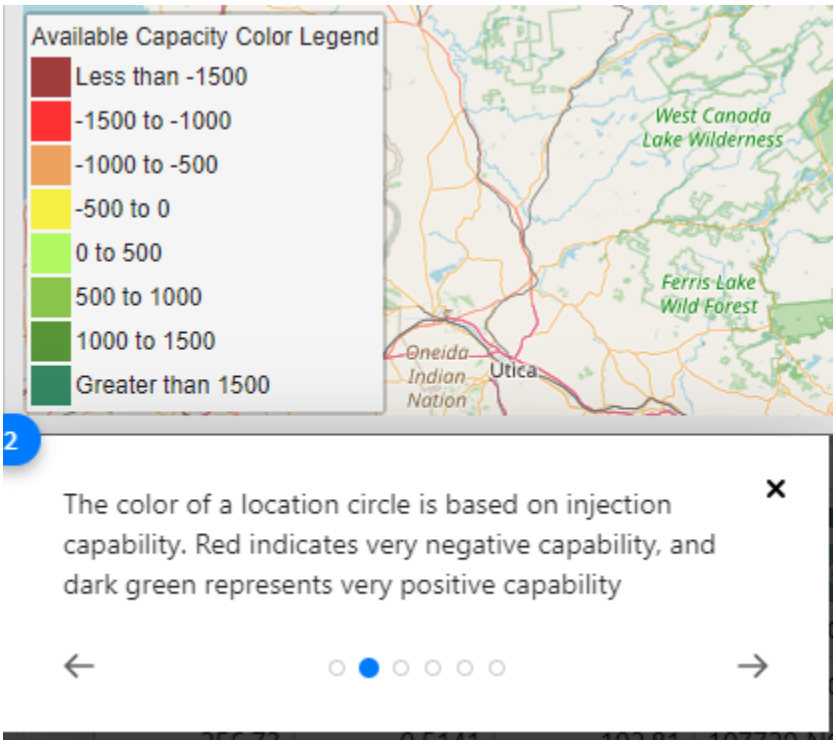
Overloaded lines and contingencies are hidden due to security constraints

Bus Location, zoom in to see substation location




| I... | Trlim | Bus | KV | Area |
|---|---|---|---|---|
| 48 | 466 | VERNON VT | 115 | ISO-NE |
| 3 | 439.90 | WEST RUTLAND | 345 | ISO-NE |
| 33 | 392.79 | WEST RUTLAND | 115 | ISO-NE |
| 4 | 362.42 | NEW HAVEN | 345 | ISO-NE |
| 37 | 356.04 | NEW HAVEN | 115 | ISO-NE |
| 30 | 296.87 | COOLIDGE | 115 | ISO-NE |
| 39 | 284.47 | N FERRISBURG | 115 | ISO-NE |
| 38 | 274.47 | VERGENNES | 115 | ISO-NE |
| 50 | 266.34 | BENNINGTON | 115 | ISO-NE |
| 19 | 235.02 | SOUTH HERO | 115 | ISO-NE |
| 27 | 225.37 | ASCUTNEY | 115 | ISO-NE |
| 32 | 224.75 | NORTH RUTLAND | 115 | ISO-NE |
| 31 | 208.02 | COLD RIVER | 115 | ISO-NE |
| 35 | 144.73 | FLORENCE | 115 | ISO-NE |
| 29 | 127.06 | WINDSOR | 115 | ISO-NE |
| 6 | 71.95 | NEWFANE | 345 | ISO-NE |
| 49 | 71.90 | NEWFANE | 115 | ISO-NE |
| 34 | 62.95 | BLISSVILLE | 115 | ISO-NE |
| 36 | 45.03 | MIDDLEBURY | 115 | ISO-NE |
| 40 | 38.97 | CHARLOTTE | 115 | ISO-NE |
| 41 | 34.53 | SHELBURNE | 115 | ISO-NE |
| 42 | 31.71 | QUEEN CITY | 115 | ISO-NE |
| 43 | 28.50 | WILLISTON | 115 | ISO-NE |
| 44 | 22.19 | TAFTS CORNER | 115 | ISO-NE |
| 20 | -47.09 | ESSEX | 115 | ISO-NE |

| Trlim | Dfax | MW I... | Mon Facility | Contingency | Rating | Before... | After ... | % Imp. |
|---|---|---|---|---|---|---|---|---|
| 224.75 | 0.07 | 13.0454 | Monitored element 17 | Contingency 88 | 20.20 | **27.43** | **92.01** | 990.1 |
| 224.75 | 0.07 | 13.0454 | Monitored element 17 | Contingency 1267 | 20.20 | **27.43** | **92.01** | 990.1 |
| 228.44 | 0.06 | 12.8159 | Monitored element 17 | Contingency 425 | 20.20 | **27.53** | **90.98** | 990.1 |
| 228.44 | 0.06 | 12.8159 | Monitored element 17 | Contingency 1572 | 20.20 | **27.53** | **90.98** | 990.1 |
| 228.46 | 0.06 | 12.8148 | Monitored element 17 | Contingency 1571 | 20.20 | **27.53** | **90.97** | 990.1 |


Available Capacity Color Legend
Less than -1500
-1500 to -1000
-1000 to -500
-500 to 0
0 to 500
500 to 1000
1000 to 1500
Greater than 1500
West Canada Lake Wilderness
Ferris Lake Wild Forest
Oneida Indian Nation
Utica
2
The color of a location circle is based on injection capability. Red indicates very negative capability, and dark green represents very positive capability