Connecticut River Valley Project Update

vermont electric power company

VELCO

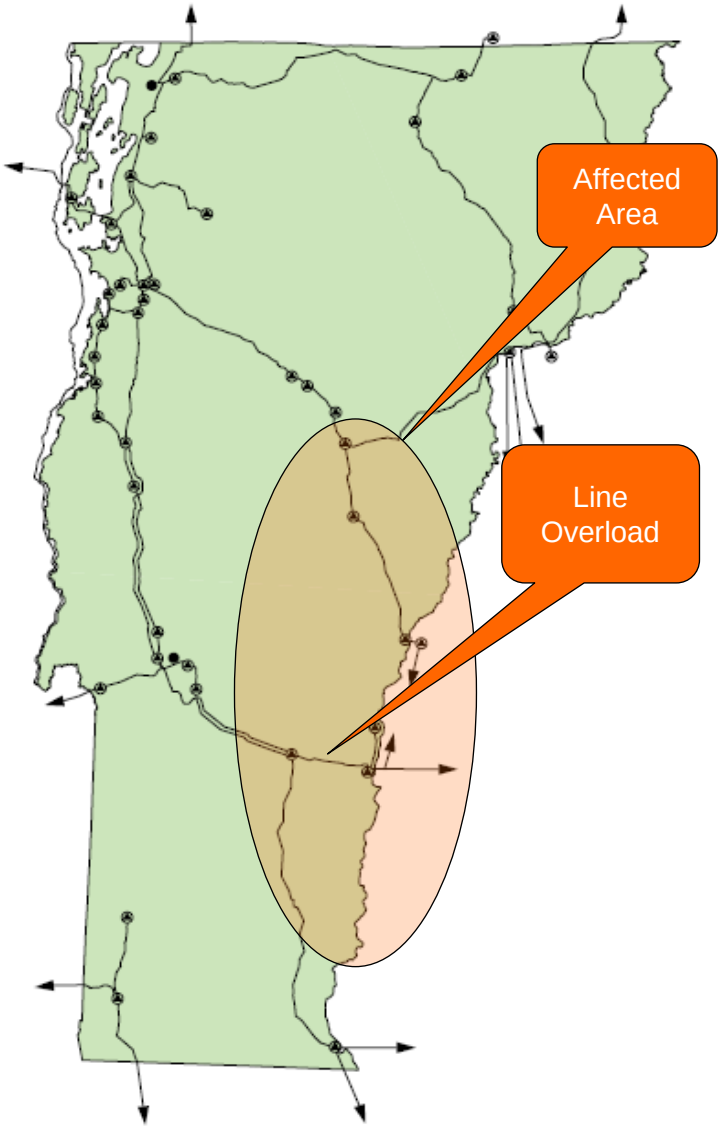
Operating Committee

March 16, 2017

The Problem

The ISO-NE NH/VT 2023 Needs Assessment (completed fall of 2014) identified the following reliability deficiencies:

- High voltages near the Hartford 115kV substation for a single element outage event
- Overloads on the Coolidge to Ascutney, 115kV, K31 line during N-1-1 contingency events
- High and low voltages near the Hartford 115kV substation during N-1-1 events
- Voltage collapse in the Connecticut River Valley during N-1-1 contingency events
- Breaker Failure at Hartford substation results in loss of 46kV service at Chelsea and Hartford substations



The Solution

- **Transmission Line** – Reconductor the existing K31 Line, which is a 15 mile, 115 kV line that runs from the Coolidge substation to the Ascutney substation
  - Addresses thermal overload
  - Replaces existing conductor with 1351.5 ACSS (Aluminum Conductor Steel Supported) – allows operation at a higher temperature
  - 1351.5 ACSS has nearly identical cross section as VELCO's standard 1272 ACSR (Aluminum Conductor Steel Reinforced)
  - Allows VELCO to use its115 kV line design standard
  - Requires reconductoring of several GMP subtransmission lines
  - Numerous alternatives considered, including design and routing alternatives

The Solution (continued)

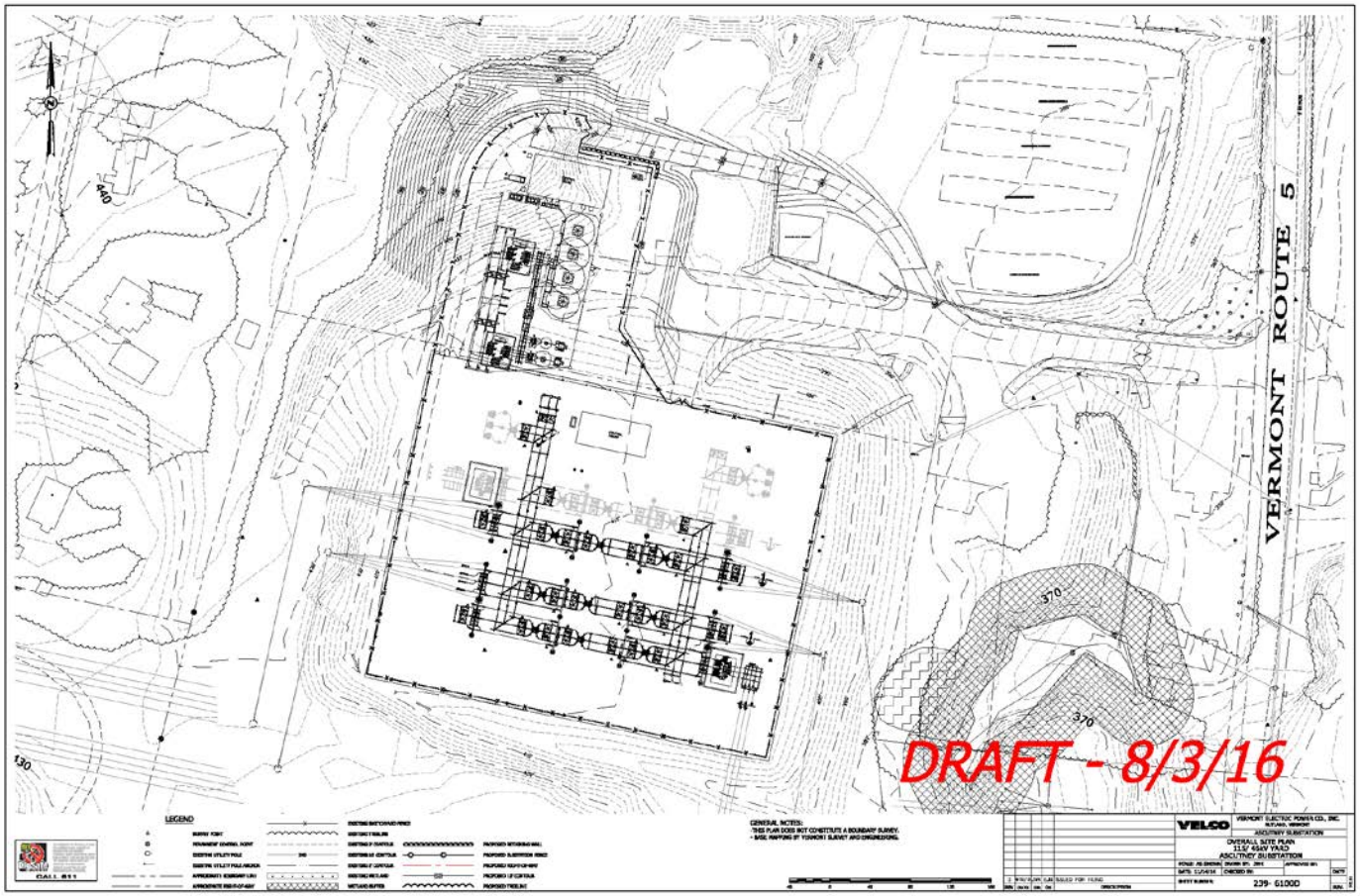
- **Voltage Control** – Installation of a Static VAr Compensator (SVC), at the Ascutney 115 kV substation

  – SVC is a transmission apparatus that uses power electronics technology to regulate or control system voltage
  – The SVC will have a capacity range of +50 MVAr power injection capability to -25 MVAr power absorption capability
  – Addresses the voltage violations and voltage collapse concerns

  Evaluated and considered alternative solutions, including Statcom, SC, SVC designs (TSC/TSR and SVC-TCR/FC)

Ascutney Substation

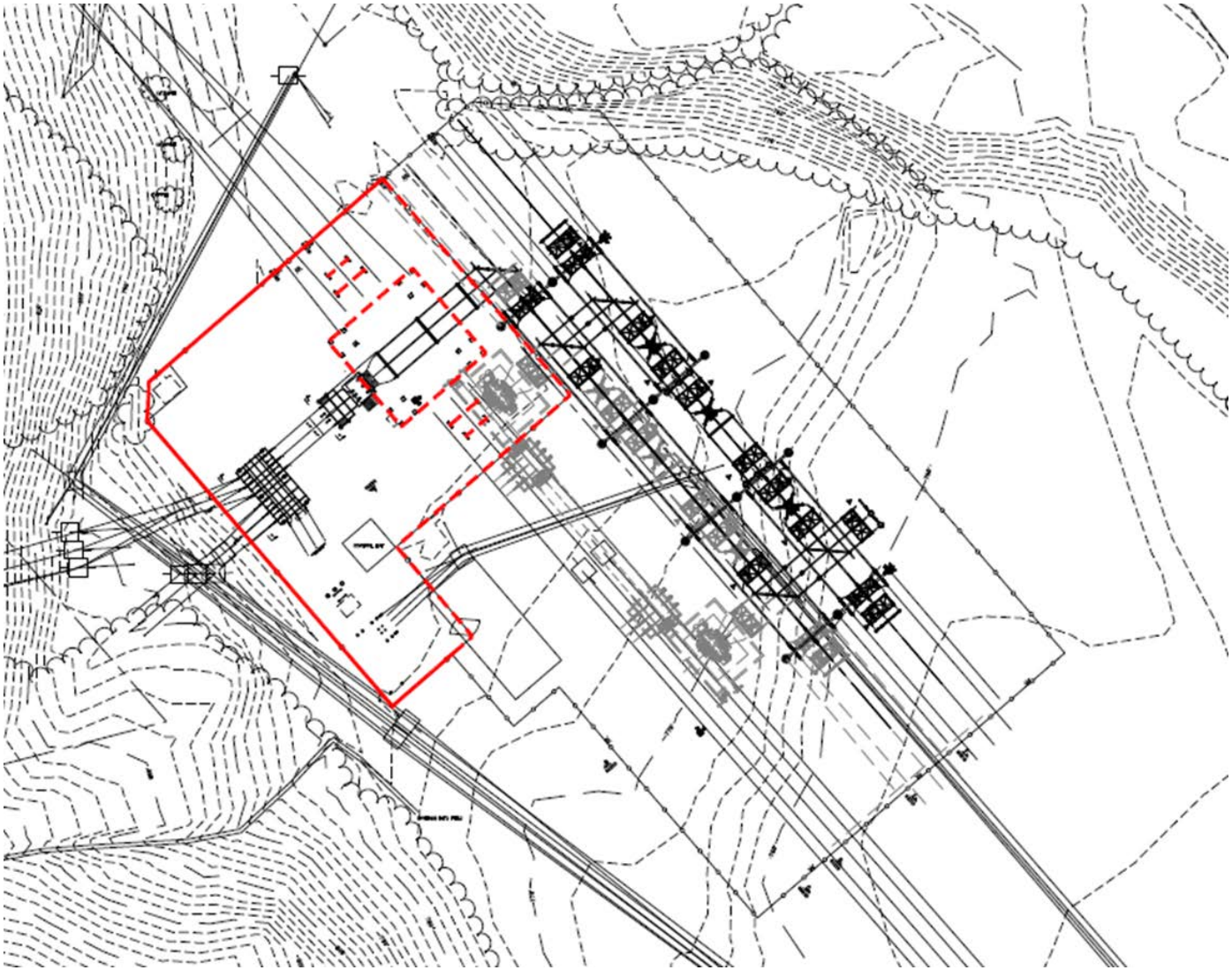
The installation of a third bay at the Ascutney, 115kV substation will be needed to accommodate the Static VAr Compensator



The Solution (continued)

- **Chelsea Substation Upgrade** – Rebuild the Chelsea 115 kV substation from a straight bus configuration to a three-breaker ring substation
  - Allows continued service to the 46 kV system following a transmission outage event that can cause voltage collapse
  - VELCO and Green Mountain Power intend to replace their respective 46kV oil breakers and Washington Electric Cooperative intends to replace their 46kV relays
  - Maintenance on the transformer bushing will be performed and an oil containment system will be installed for the transformer
  - Security equipment and an emergency generator will be installed

Chelsea Substation General Arrangement

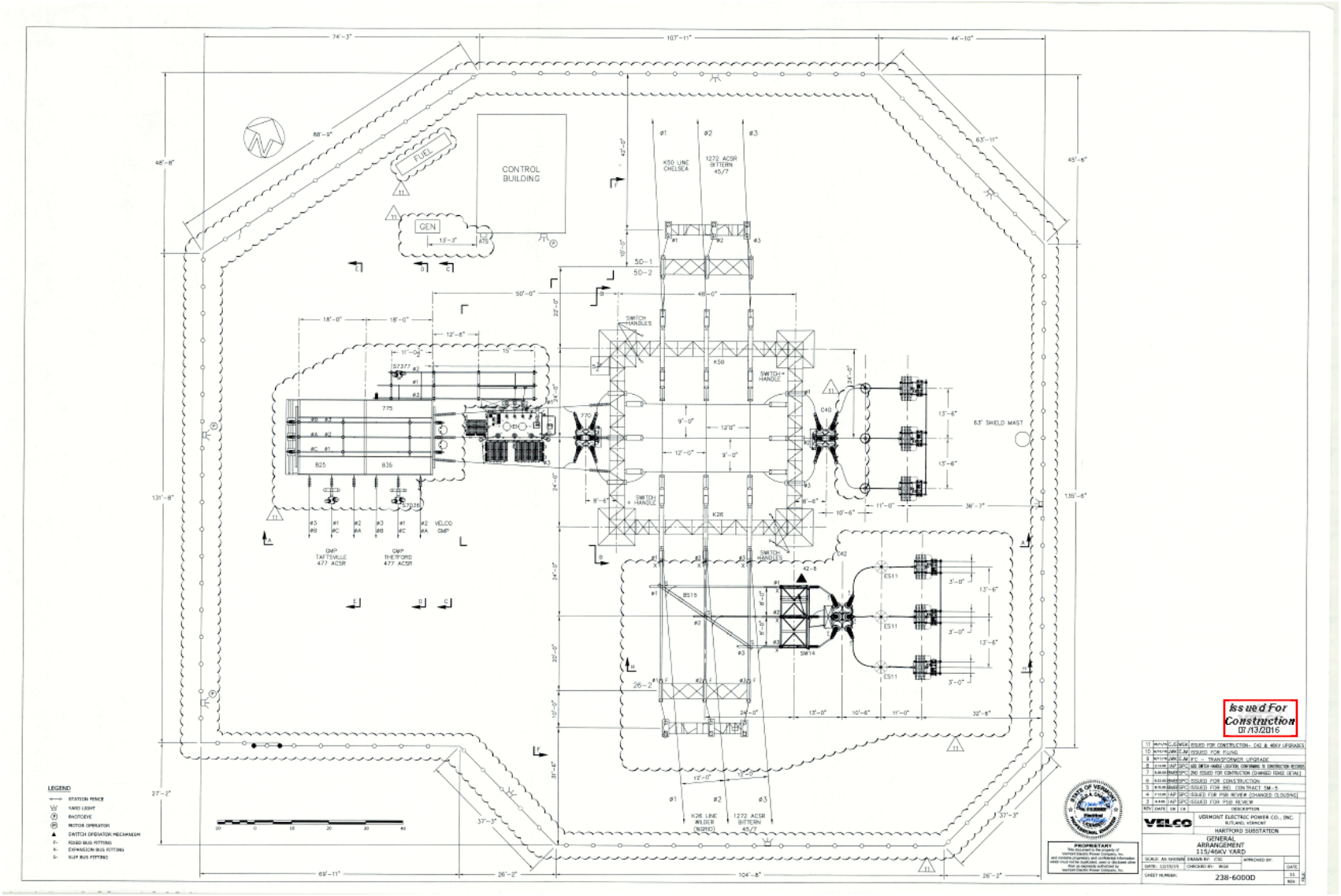


The Solution (continued)

- **Hartford Substation** - Reduce the existing 25 MVAr capacitor bank at Hartford substation to a 12.5 MVAr bank and add a new 12.5 MVAr capacitor bank to the Hartford-Wilder K26 line terminal at Hartford substation

  – Addresses high voltage concerns following a transmission outage event
  – Provides improved operational flexibility
  – VELCO and Green Mountain Power will replace their respective 46kV oil breakers
  – An oil containment system will be installed for the transformer

Hartford Substation General Arrangement



Project Status

- Total project TCA estimate is $106,526,552 (excluding contingency)
- ISO-NE issued a letter in 2015 pursuant to Section I.3.9 of the ISO Tariff stating that no significant adverse affect has been identified regarding the Project
- Filed for Certificate of Public Good (CPG) on September 24, 2015
- Received CPG on June 9, 2016
- Held numerous public meetings in the towns of Chelsea, Hartford, Weathersfield and Cavendish
- The ISO-NE Reliability Committee approved the TCA Estimate on 2/15/17
- All aspects of the Project (including closeout) are expect to be competed by Q4 2019

Hartford Substation

- Engineers Construction Inc. (ECI) was awarded the above and below grade construction contract
- Construction began in September 2016
- The 115kV Breaker and 12.5 MVAr Capacitor bank was commissioned in November of 2016
- An outage to replace and commission the 46kV breakers is scheduled for April 10-28, 2017

K31 Line Rebuild / Reconductoring

Material

- Utilizing Cor-Ten, direct imbedded steel poles fabricated from Corolina High Mast (CHM)
- All Poles delivered to the laydown yard in November 2016
- All line material (insulators and hardware) delivered to the laydown yard in December 2016
- All conductor delivered to the laydown yard in January 2017

Access Construction

- Awarded access construction contracts to Markowski Excavating and Casella Construction
- Access construction began in September 2016
- Access road construction completed in December 2016

Line Construction

- Awarded line construction contract to JCR Construction Company
- Line construction (hole drilling) began in December 2016
- K31 Line outage began on January 23, 2017
- Line construction is on-schedule to be completed by September 15, 2017

K31 Line Rebuild / Reconductoring

Access Road Construction

K31 Line Rebuild / Reconductoring

Rock Drilling and Pole Setting

K31 Line Rebuild / Reconductoring

Backfilling and Framing

Ascutney Bay Addition

- Awarded below grade construction contract to Daniels Construction
- Below grade construction began on September
- Below grade construction completed on December
- Awarded above grade construction contract to Cianbro
- Above grade construction to begin March 13, 2017
- Above grade construction expected to be complete by August 2017

Ascutney SVC

- Awarded EPC contract to GE Grid Solutions in May 2016
- Awarded site preparation contract to Daniels Construction
- Site construction began in September 2016
- Site construction to be completed by May 1, 2017
- GE to mobilize to site on May 1, 2017
- SVC scheduled to be commissioned in April 2018

Chelsea Substation

- Awarded below and above grade contracts to Naylor and Breen in February 2017
- Below grade construction to begin April 12, 2017
- Scheduled to be commissioned in April 2018

Project Schedule

- **Commissioning Dates:**
  - Hartford Capacitor Banks – December 2016
  - Ascutney Bay Addition – May 2017
  - K31 Line – October 2017
  - Chelsea Rebuild – January 2018
  - Ascutney SVC – April 2018