PG&E's 2021 Request Window Proposals

CAISO 2021-2022 Transmission Planning Process

September 28, 2021

Together, Building a Better California

Transmission Project Proposals Overview

Six Reliability Driven Projects Seeking CAISO Approval and One Conceptual Project:

Stockton

- Weber-Mormon Jct Line Section Reconductoring
- Manteca-Ripon-Riverbank-Melones Area 115 kV Line Reconductoring

Sacramento

- Cortina 230/115/60 kV Transformer Bank #1 Replacement

Greater Fresno Area

- Coppermine 70 kV Reinforcement

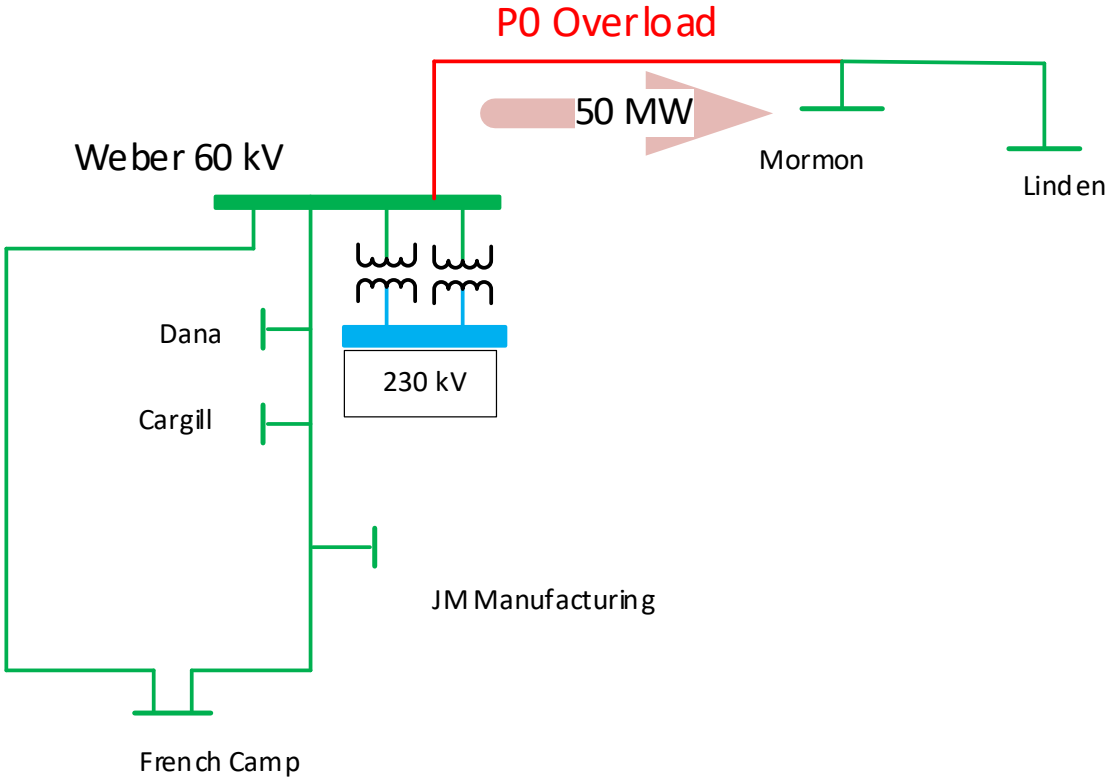
Greater Bay Area

- Vasona-Metcalf 230 kV Line Limiting Elements Removal
- Contra Costa PP 230 kV Line Terminals Reconfiguration
- South Bay 115 kV Reinforcement Conceptual Project

WEBER – MORMON JCT 60KV LINE SECTION RECONDUCTORING

Area Background

- Local Weber 60 kV pocket is located in San Joaquin County and serves about 20,000 customers.
- Within the pocket, Weber Substation serves as the source to Mormon and Linden Substations.
- A total of 50 MW load (about 6,500 customers) is served via these two substations in a radial configuration



Assessment Results

- **Contingency Description:**
  - **P0:** Normal thermal overload on 6.2 miles of Weber – Mormon Jct 60 kV Line (Weber to Mormon)
- **Power Flow Results:**

CVLY Peak		Pre-Project			Post-Project	Contingency	
Facility	Rating* & Length	2023	2026	2031	2031	Category	Contingency Name
From Weber (000/004) to Mormon (006/103)	397 A 6.2 mi	123.6%	124.9%	124.8%	77.5%	P0	(None)

*Existing Summer Normal Rating

Proposed Project

- **Project Objectives:** Increase Weber – Mormon Jct 60 kV line capacity to address NERC TPL-001-4 P0 thermal overload issue
- **Preferred Scope**
  - Reconductor 6.2 circuit miles between Weber (000/004) and Mormon (006/103) of the Weber - Mormon Jct 60 kV Line with larger conductor to achieve at least 631 Amps of summer normal rating.
  - Remove any limiting components as necessary to achieve full conductor capacity

Line Section	Current Conductor Type and Size	Length (miles)	Official Line Section Ratings (Amps, Summer Normal)	Minimum Required Normal Rating (Amps)
From Weber (000/004) to Mormon (006/103)	336.4-19, AAC	6.2	397	631

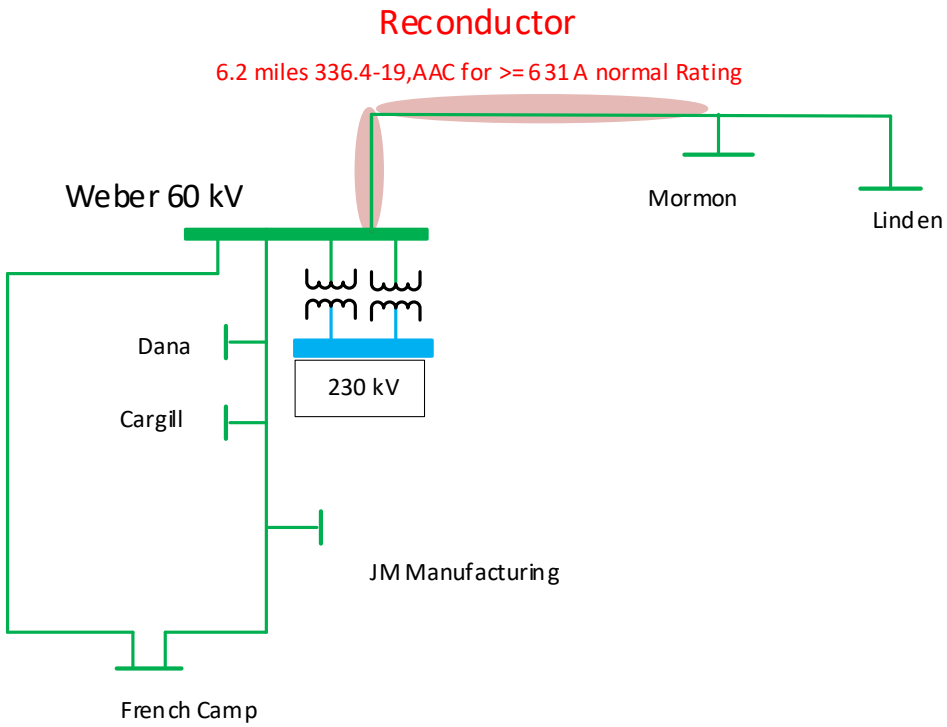
Proposed Project (cont.)

- **Proposed In-Service Date**

  May 2027 or earlier

- **Estimated Cost**

  $9.3M - $18.6M*



- **Other Alternatives Considered**
  - Alternative 1: Rerate

    is not feasible per PG&E re-rate methodology as the line overloads can occur outside of the allowed rerate time period of 10 AM to 7 PM.

  - Alternative 2: Energy storage

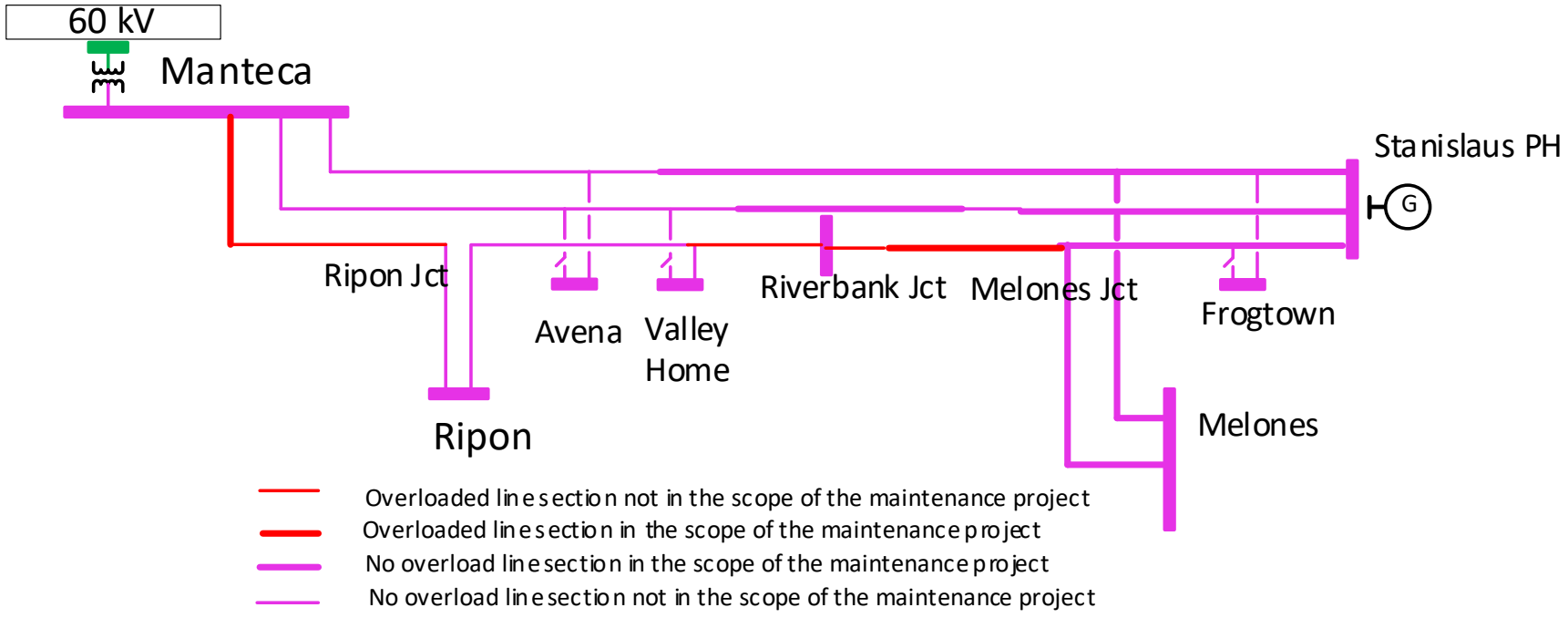
    is not as cost-effective as a reconductoring project. The interconnection cost estimate is $13M - $26M (AACE Level 5) without including the energy storage cost.

*AACE Level 5 quality estimates includes a +100% contingency

MANTECA-RIPON-RIVERBANK JCT-MELONES AREA 115 KV LINE RECONDUCTORING

Area Background

- The Ripon - Manteca 115 kV and Stanislaus-Melones SW STA - Riverbank Jct SW STA 115 kV, Riverbank Jct SW STA - Ripon 115 kV are the sources to serve Ripon and Valley Home Substations in San Joaquin County from both Manteca and Stanislaus Substations.
- There is an existing PG&E maintenance project, which will replace the 2/0 7-strand CU conductor with 715 All Aluminum Conductor (AAC).



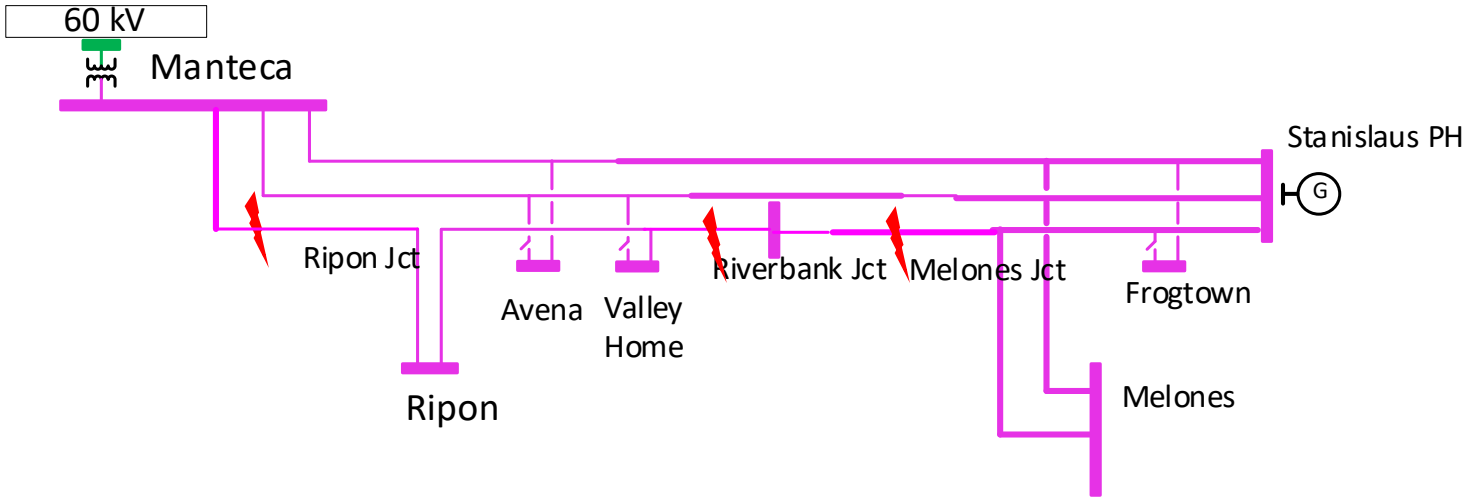
Assessment Results

- **Contingency Description:**
  - P1 and P2-1 category events that cause loss of

1. Ripon - Manteca 115 kV line (overload #2 and #3 lines)

2. Riverbank Jct SW STA - Ripon 115 kV line (overload #1 line)

3. Stanislaus-Melones SW STA - Riverbank Jct SW STA 115 kV line (overload #1 line)



Assessment Results

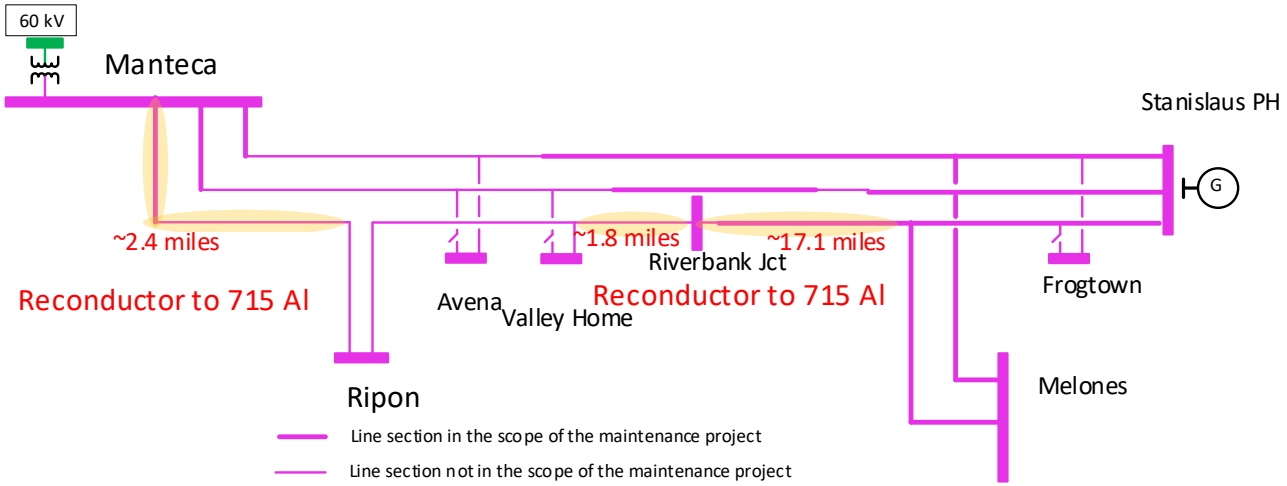
- **Power Flow Results**

Stockton Peak		Pre-Project			Post-Project			Contingency	
Facility	Rating* (A)	2023	2026	2031	2023	2026	2031	Category	Contingency Name
Ripon - Manteca	326	100.8%	109.3%	107.9%	43.4%	47.7 %	47.2%	P1	Stanislaus-Melones-Riverbank Jct SW STA115kV
		100.8%	109.3%	107.9%	43.4%	47.7 %	47.2%	P2	Riverbank JCT SW STA-Ripon 115kV (RIVRBKJT-VLYHMTP1) (MELNS JB-RIVRBKJT)
Riverbank Jct SW STA - Ripon	340	108.2%	119.2%	116.9%	46.4%	51.4 %	50.5%	P1	Ripon - Manteca
		108.2%	119.2%	116.9%	46.4%	51.4 %	50.5%	P2	Ripon – Manteca (RPNJ2-MANTECA) (RPNJ2-Ripon)
Stanislaus - Melones SW STA - Riverbank Jct SW STA	326	112.8%	124.2%	121.9%	46.4%	51.4 %	50.5%	P1	Ripon - Manteca
		112.8%	124.2%	121.9%	46.4%	51.4 %	50.5%	P2	Ripon – Manteca (RPNJ2-MANTECA) (RPNJ2-Ripon)

*Summer Emergency

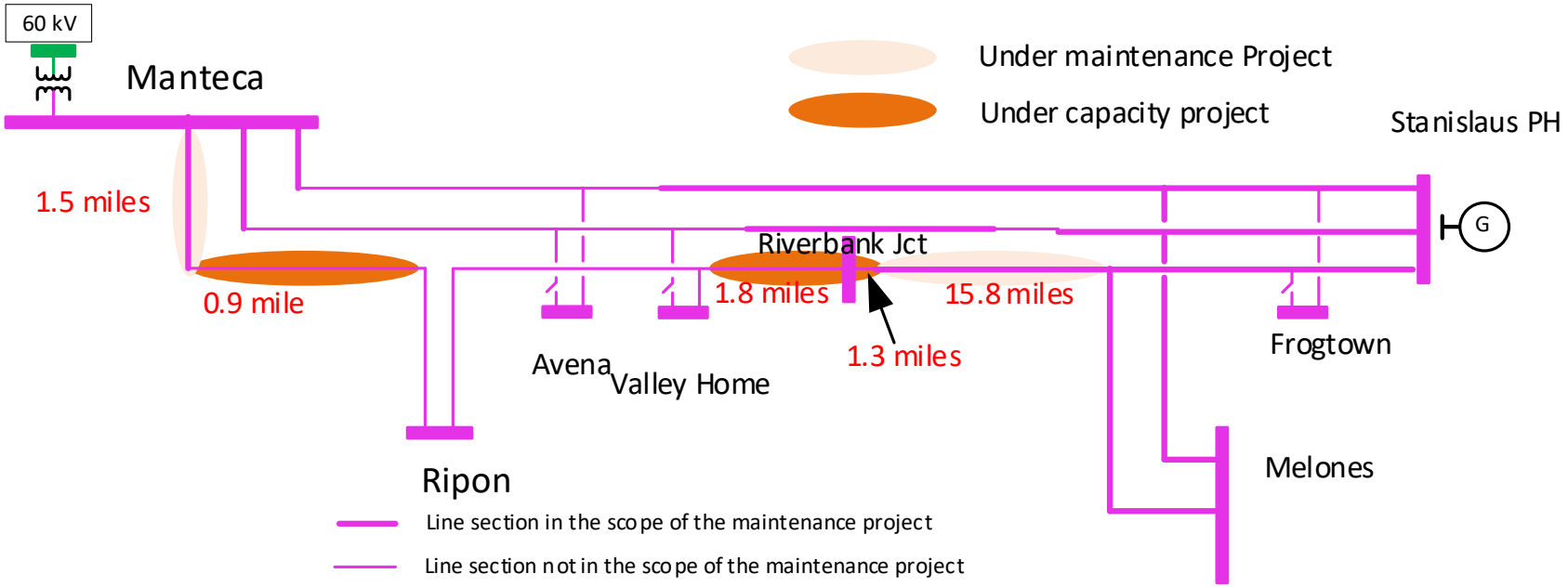
Proposed Project

- **Project Objectives:** Increase Manteca-Ripon-Riverbank-Melones area 115 kV line capacity to address NERC TPL-001-4 P1 thermal overload issue
- **Preferred Scope:**
  - Reconductor 2.4 miles between Manteca and Ripon Jct (051/323B), 1.8 miles between Riverbank SW STA and Valley Home Tap (038/233), and 17.1 miles between Riverbank Jct and Melones Jct (018/108), for a total of 21.3 miles with 715 AAC conductor
  - Remove any limiting components as necessary to achieve full conductor



Proposed Project (cont.)

- There are 17.3 miles in the proposed project scope which will be implemented under the maintenance project.
- The remaining 4.0 miles will be implemented under this capacity project.



Proposed Project (cont.)

- **Proposed In-Service Date:**
  - May 2028 or earlier
- **Estimated Cost:**
  - $36.3M - $72.6M* (for entire 21.3 miles)
    - **$6.8M - $13.6M** (for 4 miles under this capacity project)
    - $29.5M - $59.0M (for 17.3 miles under the existing maintenance project)
- **Other Alternatives Considered**
  - Alternative 1: Rerate

    is not feasible per PG&E re-rate methodology as the line overloads can occur outside of the allowed rerate time period of 10 AM to 7 PM

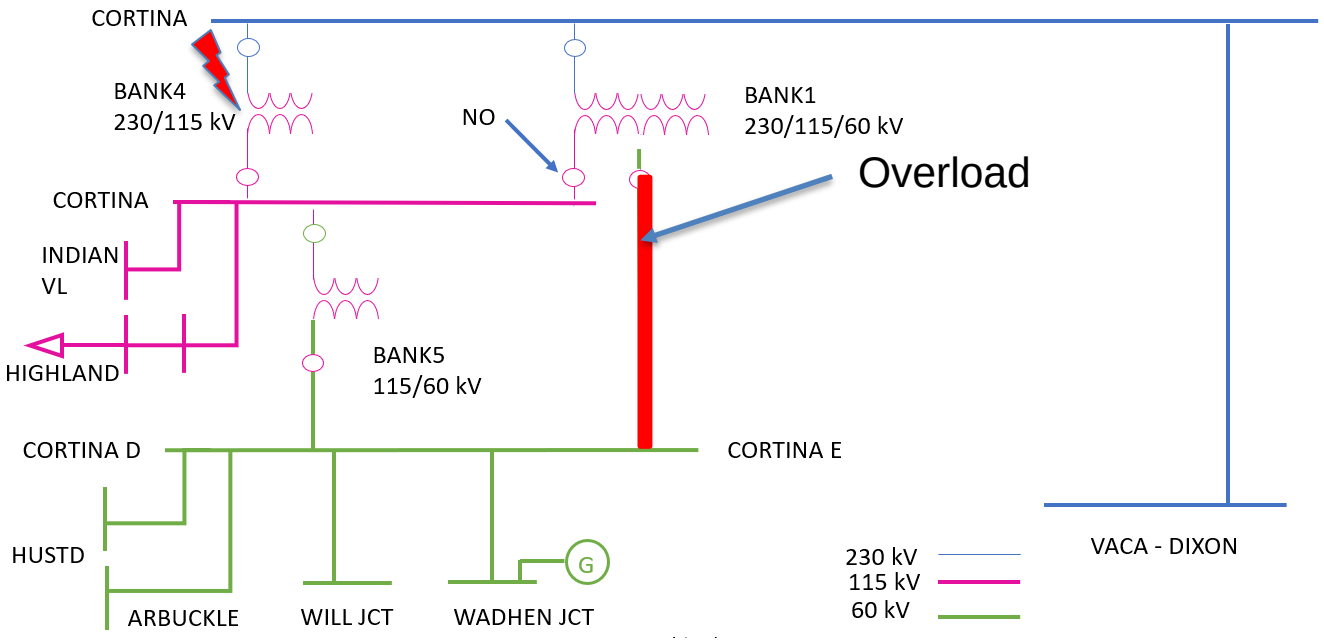
*AACE Level 5 quality estimates includes a +100% contingency

CORTINA 230/115/60 KV BANK #1 REPLACEMENT PROJECT

Area Background

- Cortina Substation is located in Colusa County and serves about 14,824 customers.
- Cortina substation has three transformer banks. Cortina 230/115/60 kV Bank #1 has the lowest rating among the three banks.
- Cortina 230/115/60 kV Bank #1 is currently being operated as a 230/60 kV Bank with the 115 kV operated open.
- There is an existing Operating Procedure to mitigate Cortina 230/115/60 kV Bank #1 overload due to loss of Cortina 230/115 kV Bank #4.

EXISTING SINGLE LINE



Assessment Results - without Operating Procedure

- **Contingency Description:**
  - P1 and P3 category events that cause loss of Cortina 230/115 kV Bank #4 or combined with Wadham 13.8 kV Gen Unit 1

- **Power Flow Results:**

Without Operating Procedure

Monitored		Pre-Project			Post-Project	Contingency	
Facility	Rating* (MVA)	2023	2026	2031	2031	Category	Contingency Name
Cortina 230/115/ 60 kV Bank #1	84	137.5%	123.5%	126.2%	<70%	P1	P1-3: CORTINA 230/115KV TB 4
Cortina 230/115/ 60 kV Bank #1	84	146.6%	126.8%	127.3%	<70%	P3	P3: CORTINA 230/115KV TB 4 & WADHAM 13.80KV GEN UNIT 1

*Existing Summer Emergency Rating

Assessment Results - with Operating Procedure

- **Contingency Description:**
  - P1 and P3 category events that cause loss of Wadham 13.8 kV Gen Unit 1 or combined with Cortina 230/115 kV Bank #4.

- **Power Flow Results:**

With Operating Procedure

Monitored		Pre-Project			Post-Project	Contingency	
Facility	Rating* (MVA)	2023	2026	2031	2031	Category	Contingency Name
Cortina 230/115/60 kV Bank #1	84	102.2	100.6	106.2	<70%	P1	P1-1: WADHAM 13.8 KV GEN UNIT 1
Cortina 230/115/60 kV Bank #1	84	99.2	97.7	104.7	<70%	P3	P3: WADHAM 13.8 KV UNIT 1 & CORTINA #4 60 KV

*Existing Summer Emergency Rating

Proposed Project

Preferred Scope

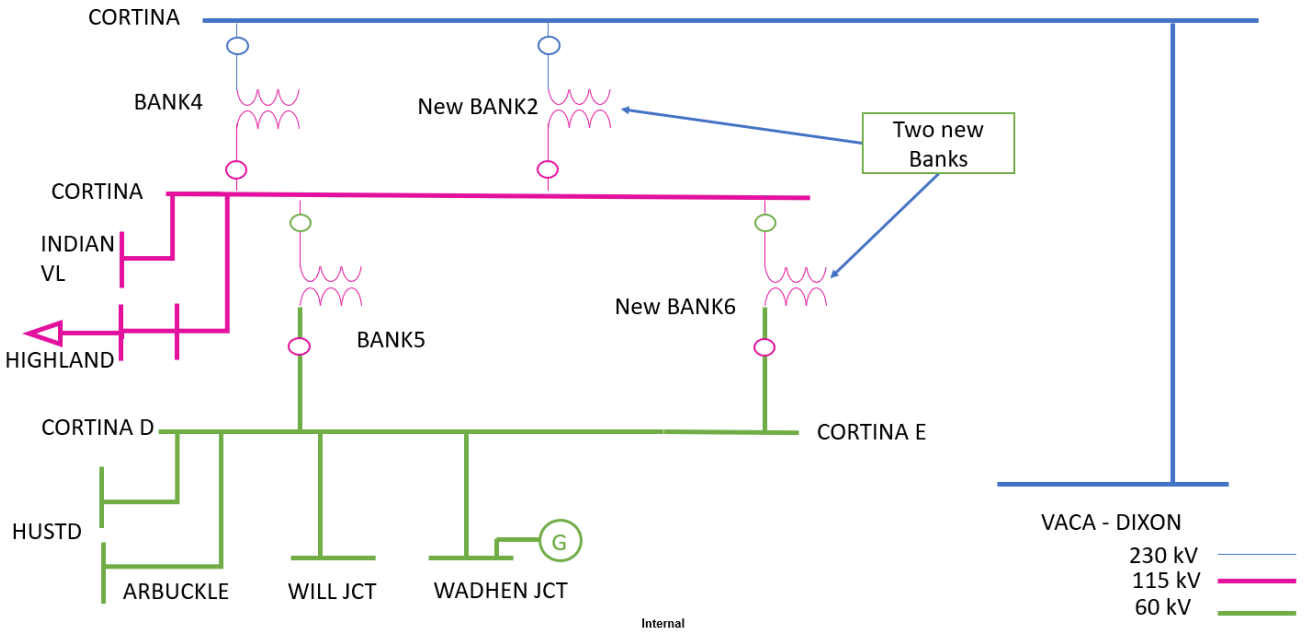
- Replace the existing Cortina 230/115/60 kV Bank #1 with one 230/115 kV and one 115/60 kV transformer banks.

Proposed In-Service Date

- May 2027 or earlier

Estimated Cost

- $21M - 42M*



*AACE Level 5 quality estimates includes a +100% contingency

Alternatives

- **Other Alternatives Considered**

– Alternative 1: Operation Procedure to open Cortina 115/60 kV Bank #5 under normal condition

It could cause G-1 violations. Therefore, it is not recommended to rely on this Operation Procedure as a long-term solution.

– Alternative 2: Converting Existing Cortina 230/115/60 kV Bank #1 to 115/60 kV and adding one new 230/115 kV transformer.

The cost for this alternative is $25M - $50M* which is higher in comparison to the recommended scope.

– Alternative 3: Keeping existing Cortina 230/115/60 kV bank #1 and add one new 230/115 kV bank.

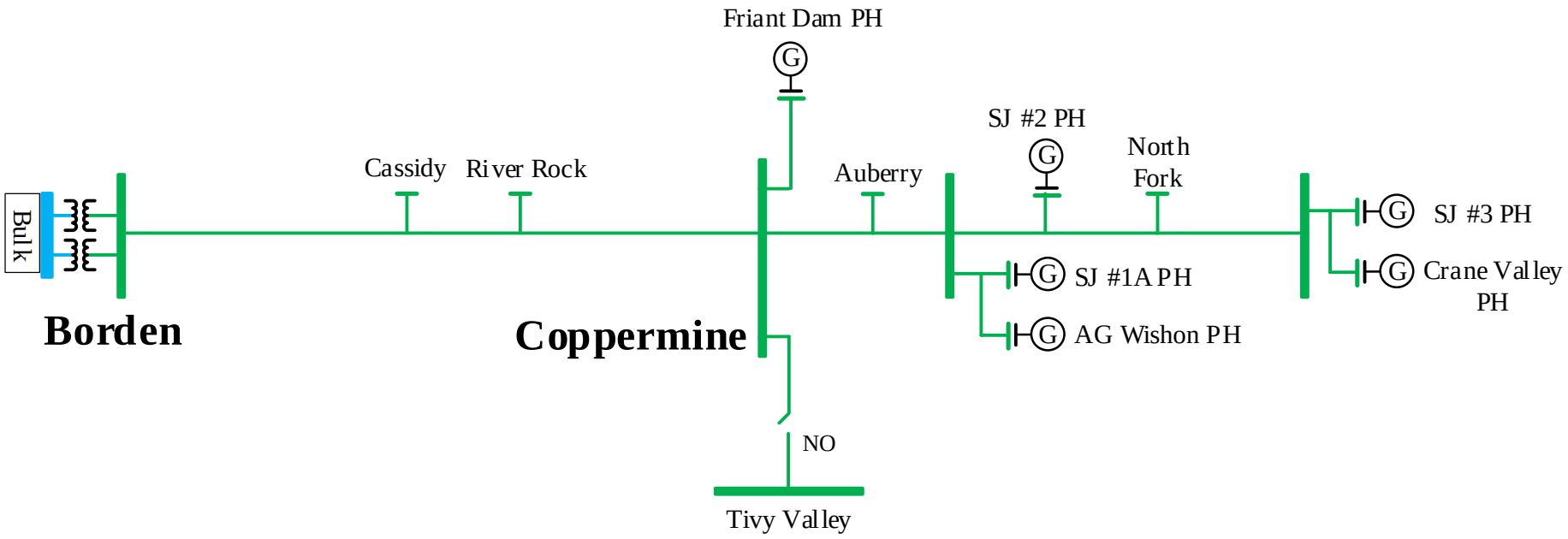
The cost for this alternative is $22M - $44M* which is higher in comparison to the recommended scope.

*AACE Level 5 quality estimates includes a +100% contingency

COPPERMINE 70 KV REINFORCEMENT PROJECT

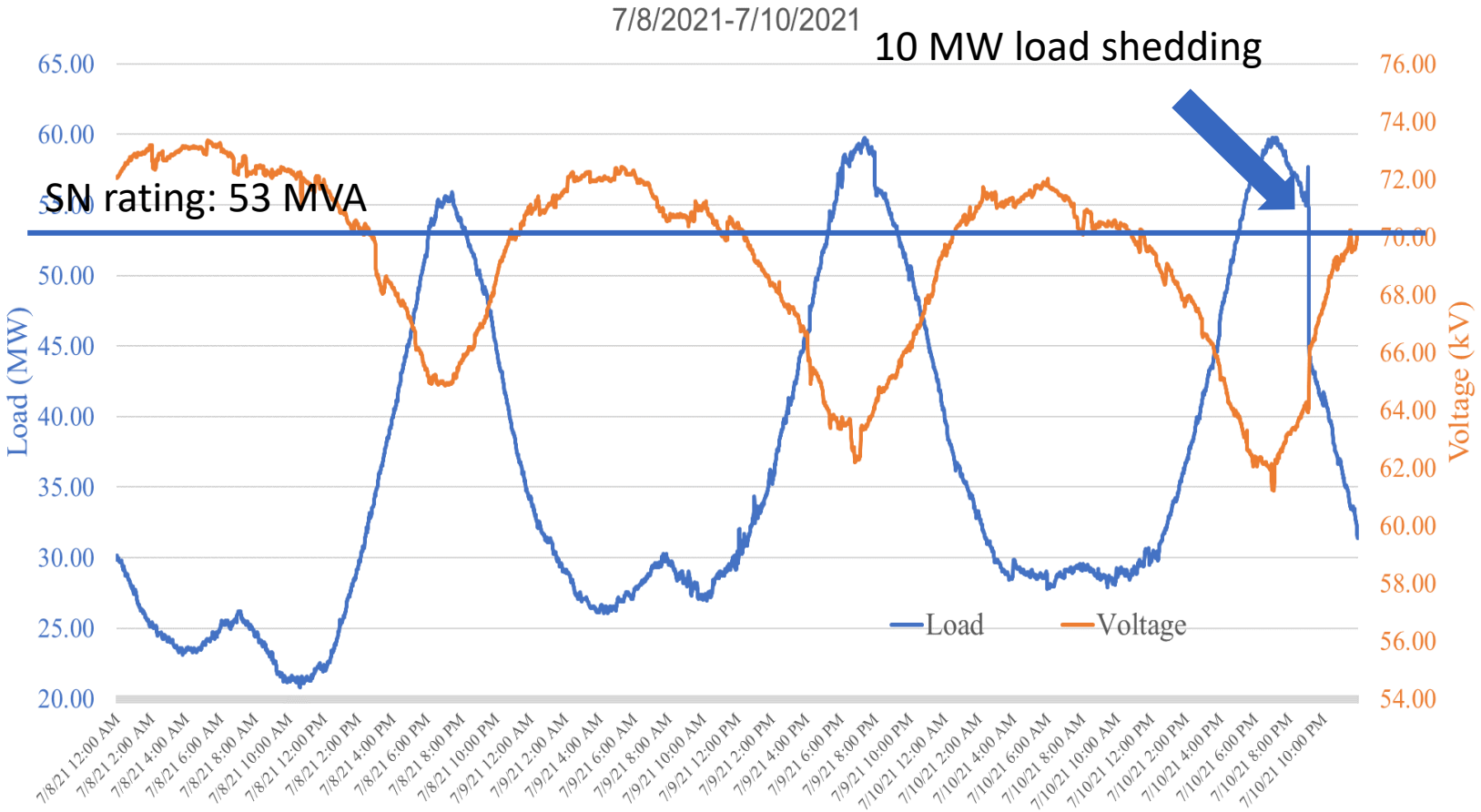
Area Background

- Borden-Coppermine 70 kV line is the only source feeding this pocket from the bulk system in the summer.
- Most of the hydro powerhouses (PHs) do not operate in the summer while Friant Dam PH's generation has decreased to a minimum level in the past three years.



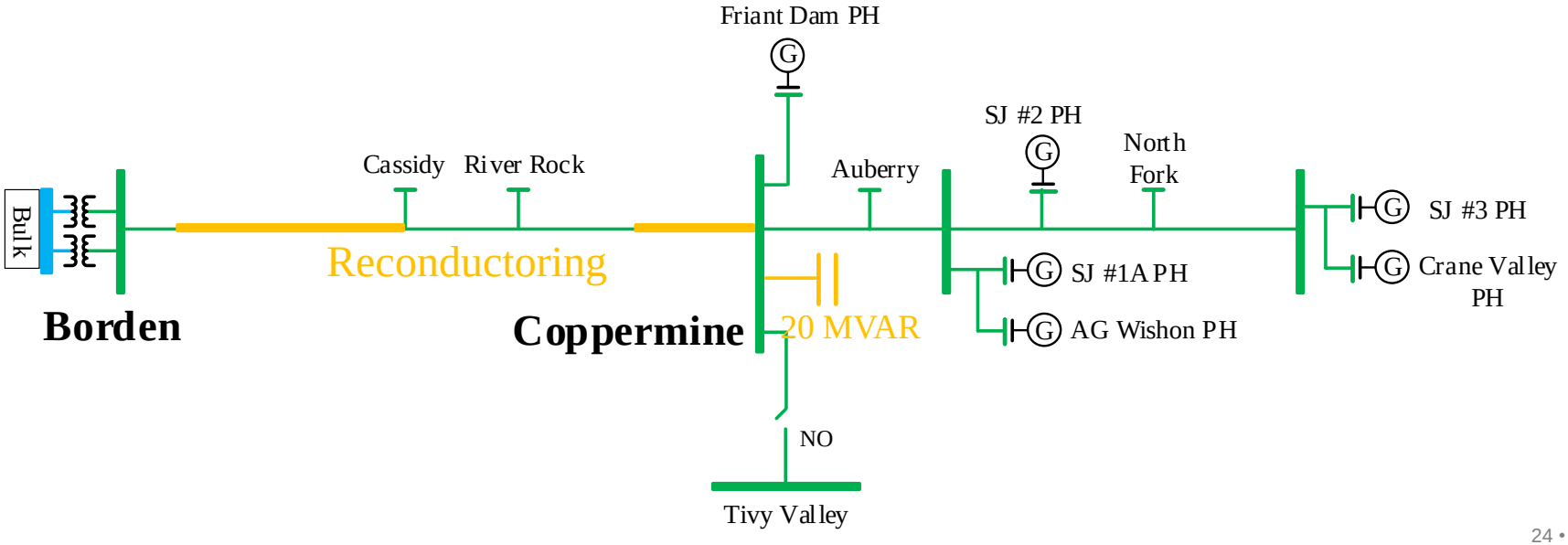
Assessment Results-Real Time

- PG&E witnessed normal overloads up to 119% on Borden-Coppermine 70 kV line and low voltages such as 0.88 p.u. in this pocket in real time operation.



Proposed Project

- **Project Objectives:** Increase Borden-Coppermine 70 kV line capacity and install voltage support to address NERC TPL-001-4 P0 thermal overload and low voltage issue
- **Preferred Scope**
  - Reconductor ~9.45 circuit miles between Borden and Cassidy Substations (from 19/10A to Cassidy Sub section) with a larger conductor
  - Reconductor ~3.57 circuit miles between Cassidy and Coppermine Substations (from 3/7 to Coppermine Sub section) with a larger conductor
  - Remove any limiting components to achieve the full conductor capacity
  - Install 20 MVAR voltage support at Coppermine Substation



Proposed Project (cont.)

- **Proposed In-Service Date**
  - May 2027 or earlier
- **Estimated Cost**
  - $21.8M - $43.6M*
- **Other Alternatives Considered**
  - Alternative 1: Energy storage + voltage support

    It triggers Coppermine 70 kV bus upgrade that costs around $35M - $70M* without the energy storage and voltage support cost
  - Alternative 2: Introduction of 115 kV source

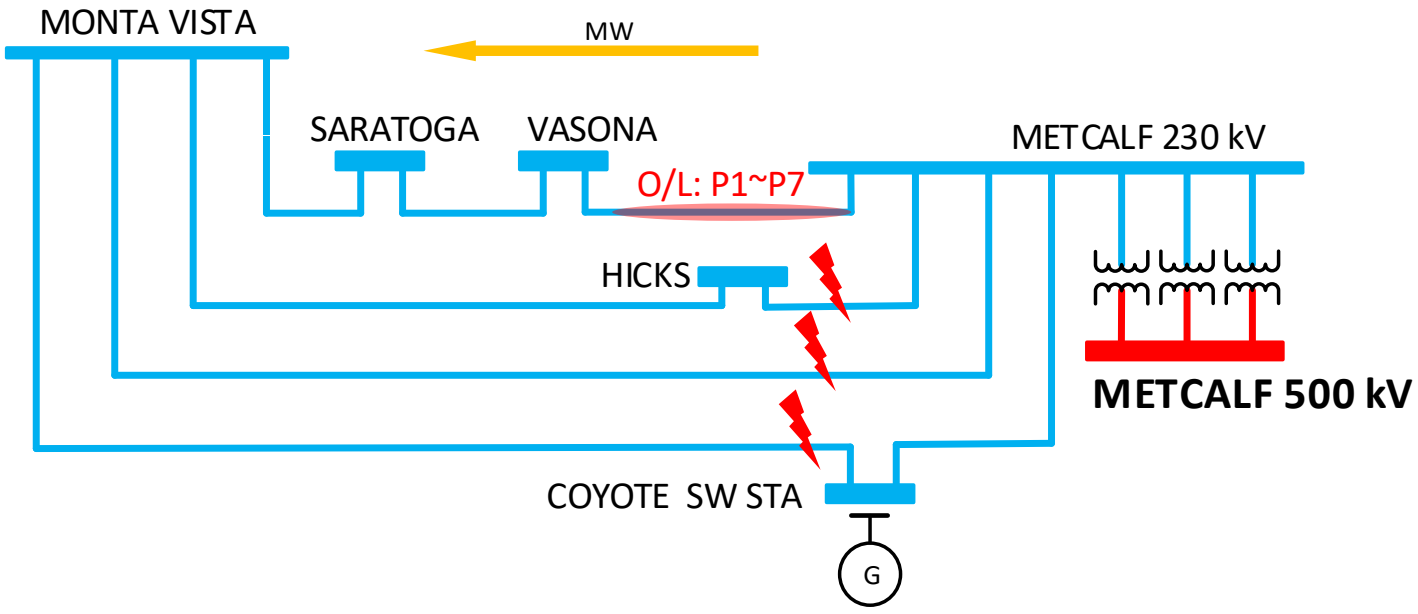
    It is not cost-effective.

*AACE Level 5 quality estimates includes a +100% contingency

VASONA-METCALF 230 KV LINE LIMITING ELEMENTS REMOVAL

Area Background

- In Santa Clara County, four 230 kV paths transmit power from Metcalf 500-230 kV substation to Monta Vista 230 kV Substation which help supply loads in Peninsula and SF areas.
- One portion of the four paths, the Vasona-Metcalf 230 kV Line, was derated from 1600 to 1055 Amps due to limiting elements at substations.



Assessment Results

- **Contingency Description:**
  - P1, P2, P3, P6 or P7 category events that cause loss of one or two paths among the total four paths between Metcalf and Monta Vista

- **Power Flow Results:**

Summer Peak		Pre-Project			Post-Project	Contingency	
Facility	Rating* (Amps)	2023	2026	2031	2031	Category	Contingency Name
Vasona-Metcalf 230 kV Line	Pre-Project: 1055; Post-Project: 1673	94%	100%	102%	62%	P1	HICKS-METCALF 230KV
		103%	111%	114%	69%	P2	MONTAVIS 230KV - SECTION 1E & 2E
		123%	131%	136%	82%	P6	HICKS-METCALF & CAL MEC-MONTAVIS
		114%	120%	125%	76%		MONTA VISTA-COYOTE & MONTAVIS-HICKS
		107%	115%	121%	73%	P7	METCALF-MONTA-VISTA & MONTA VISTA-COYOTE

*Summer Emergency Rating

Proposed Project

- **Project Objectives:** Remove Vasona-Metcalf 230 kV line limiting elements to achieve the full conductor rating of the line
- **Preferred Scope**
  - At Metcalf Substation, upgrade Vasona-Metcalf 230 kV Line terminal conductors from single 1113 conductor into bundled 1113 conductors.
  - At both Metcalf Substation and Vasona Substation, replace the wave traps and any other terminal conductors that limit the line summer rating below 1743 Amps.

Location	Elements to Be Upgraded	Pre-Project Rating (Amps)	Post-Project Line Rating (Amps)
Metcalf	Line Terminal Conductors	1099 (Emergency)	1743
Metcalf and Vasona	Wave traps	1600	

Proposed Project (cont.)

- **Proposed In-Service Date**

  May 2025 or earlier

- **Estimated Cost**

  $0.6 M - $1.2 M*

- **Other Alternatives Considered**
  - Alternative 1: Energy storage

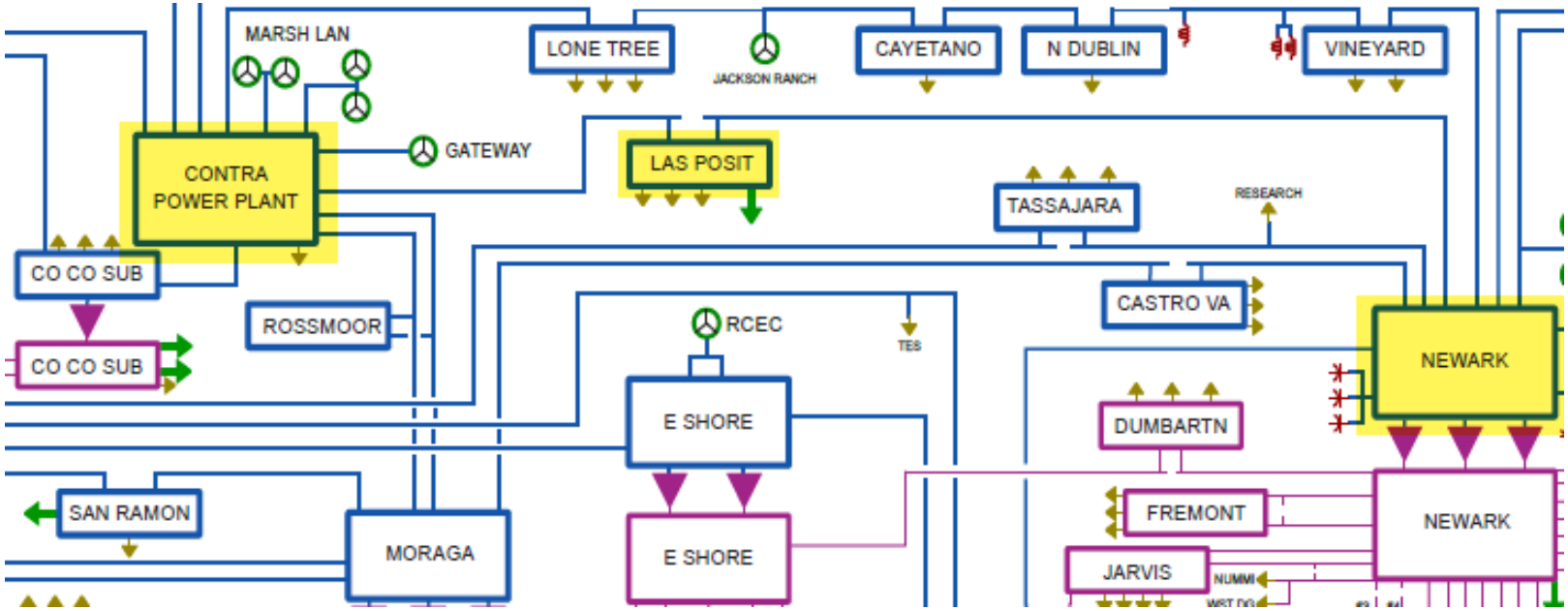
    Not as cost-effective as limiting elements removal project

*AACE Level 5 quality estimates includes a +100% contingency

CONTRA COSTA PP 230 KV LINE TERMINAL RECONFIGURATION

Area Background

- Contra Costa PP 230 kV Substation is located in the City of Antioch within the northern Contra Costa County area.
- It serves as a 230 kV source for the local 115 kV system and surrounding 230 kV system, including Moraga, Newark, and Las Positas 230 kV Substations.
- Gateway and Marsh Landing generating stations are connected at the Contra Costa PP 230 kV Substation and supply power to the Greater Bay Area.



Assessment Results

- **Contingency Description:**
  - P2-4 events that cause loss of Contra Costa PP 230 kV Bus Section 1E + 2E (overload the Las Positas – Newark 230 kV Line)
  - P2-2 events that cause loss of Contra Costa PP 230 kV Bus Section 1E (overload the Bus Section 2F, 1D, CB820, and SW 601)
- **Power Flow Results:**

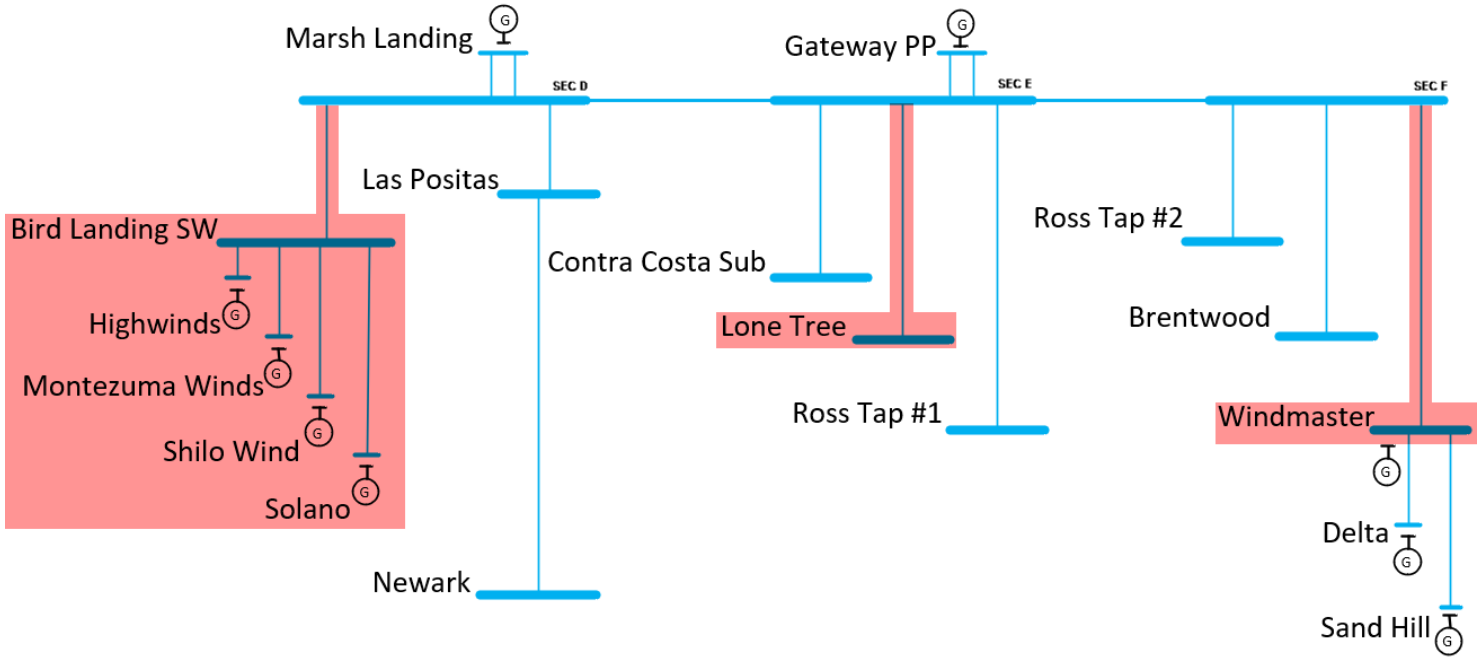
#	Facility	Facility* Rating (MVA)	Pre Project			Post Project		Contingency	
			2023	2026	2031	2026	2031	Category	Contingency Name
1	Las Positas – Newark 230 kV line	338.6	143.5%	147.7%	167.2%	N/A	66.0%	P2-4	P2-4: C.COSTAPPE 230KV - SECTION 2E & 1E
2	Bus 2F	777	103%	N/A	N/A	80.2%	N/A	P2-2	P2-2: C.COSTAPPE 230KV - SECTION 1E
3	CB820	797	101%	N/A	N/A	80.8%	N/A		
4	SW 601	478	123%	N/A	N/A	94%	N/A		
5	Sec 1D	777	127%	N/A	N/A	52.3%	N/A		

*Existing Summer Emergency Rating

Proposed Project

- **Project Objectives:** Optimize line terminal configuration at Contra Costa PP 230 kV Bus to address P2 thermal overloads
- **Preferred Scope**
  - Move Lone Tree to SEC 2D and Birds Landing to SEC 2E at Contra Costa PP 230 kV Substation
  - Relocate Windmaster from Section F to Section E

Contra Costa PP 230 kV Substation



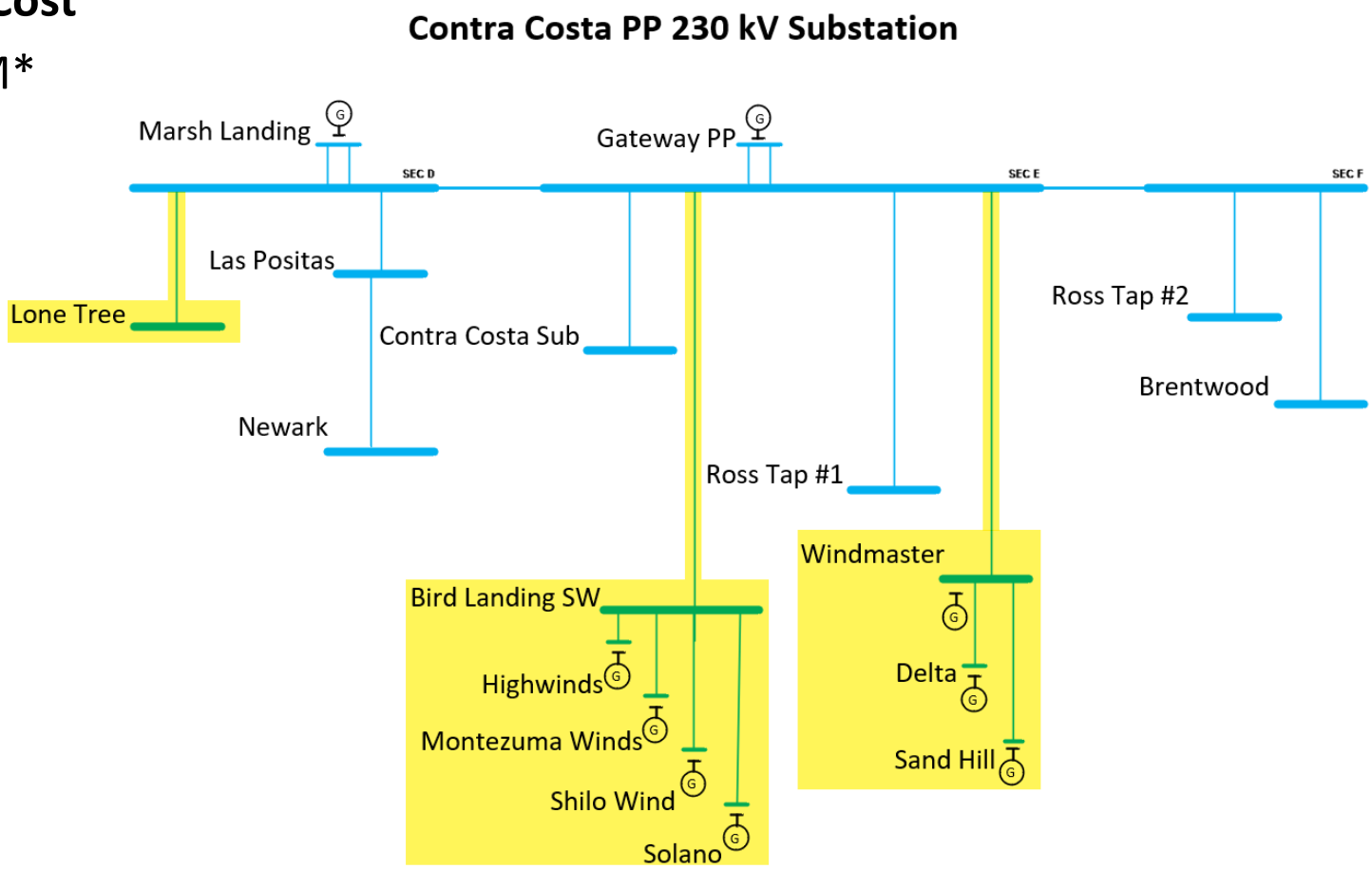
Proposed Project (cont.)

- **Proposed In-Service Date**

  August 2025 or earlier

- **Estimated Cost**

  $5M - $10M*



*AACE Level 5 quality estimates includes a +100% contingency

Proposed Project (cont.)

- **Other Alternatives Considered**

  – Alternative 1: Convert to BAAH

  Due to the space limitation, the only feasible option is to convert Contra Costa PP 230 kV Substation to GIS BAAH. However, the cost of GIS BAAH to accommodate 16 elements is about $160M, which is much more expensive than the recommended line swapping solution.

  – Alternative 2: Add sectionalizing breaker

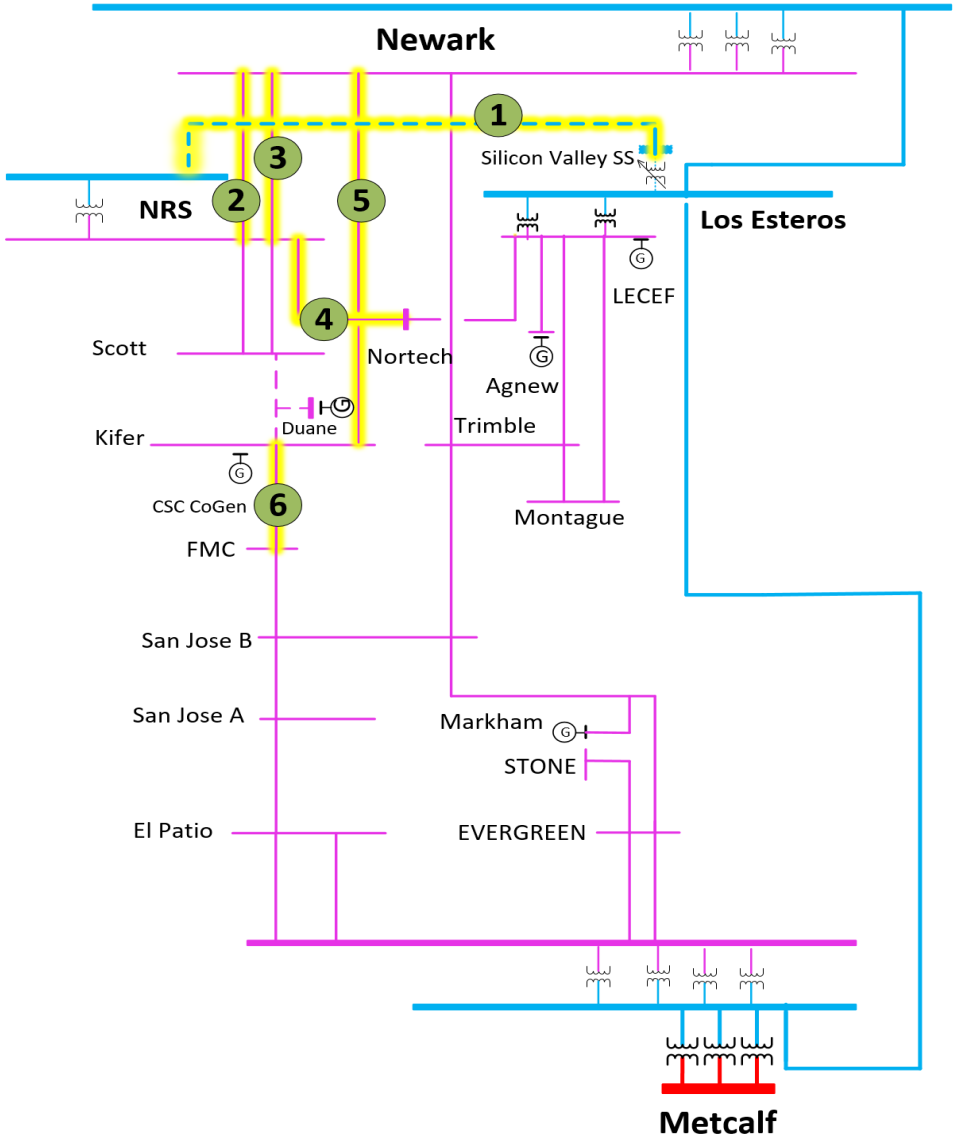
  Contra Costa PP 230 kV Substation currently has three sections. However, PG&E standard does not allow more than three sections, so this alternative is not feasible.

SOUTH BAY 115 KV REINFORCEMENT CONCEPTUAL PROJECT

South Bay-SVP Area Overview

- Silicon Valley Power (SVP) is an electric utility located in the City of Santa Clara serving around 50,000 residential and over 8,500 commercial and industrial customers

- PG&E serves SVP through following transmission lines:
  1) Silicon Valley SW STA - NRS 230 kV
  2) Newark - NRS #1 115 kV
  3) Newark - NRS #2 115 kV
  4) Nortech – NRS 115 kV
  5) Newark - Kifer 115 kV
  6) Kifer - FMC 115 KV



South Bay-SVP Area Overview

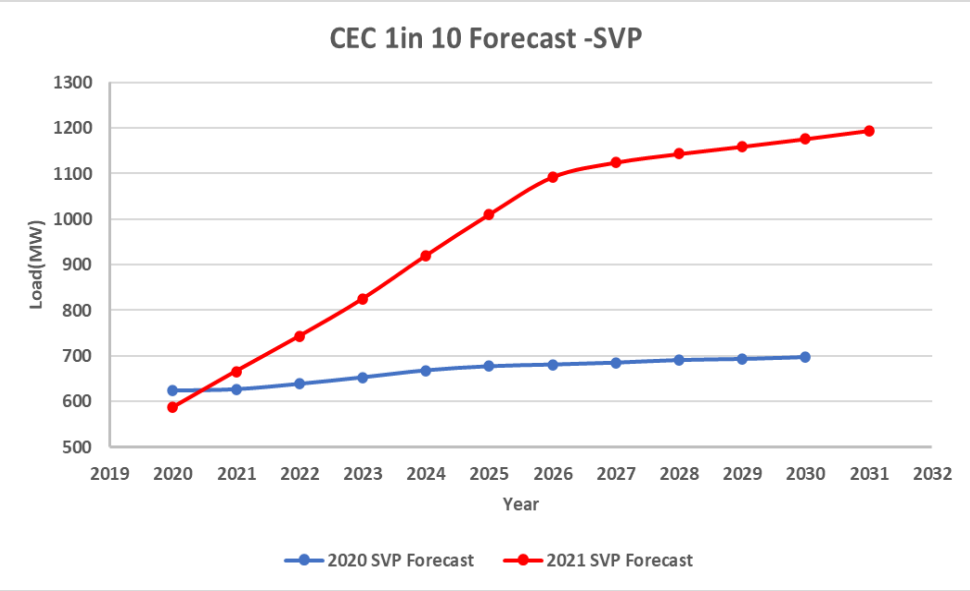
- Existing Maximum Transmission Capability from PG&E to SVP:
  - 900 MVA under normal system conditions
  - 472 MVA under worst N-1-1 condition

- SVP owns two natural gas generation:
  1) DVR Power Plant connected to DUANE with a maximum power output of 147 MW
  2) Gianera Generating Station connected to NRS with a maximum power output of 49.5 MW

- SVP's reported peak demand in year 2020 was 586.3 MW

SVP High Load Forecast in 2021-2022 TPP

- SVP load forecast has significantly increased due to several load interconnection requests to their system
- SVP demand is expected to increase about 80% by year 2031

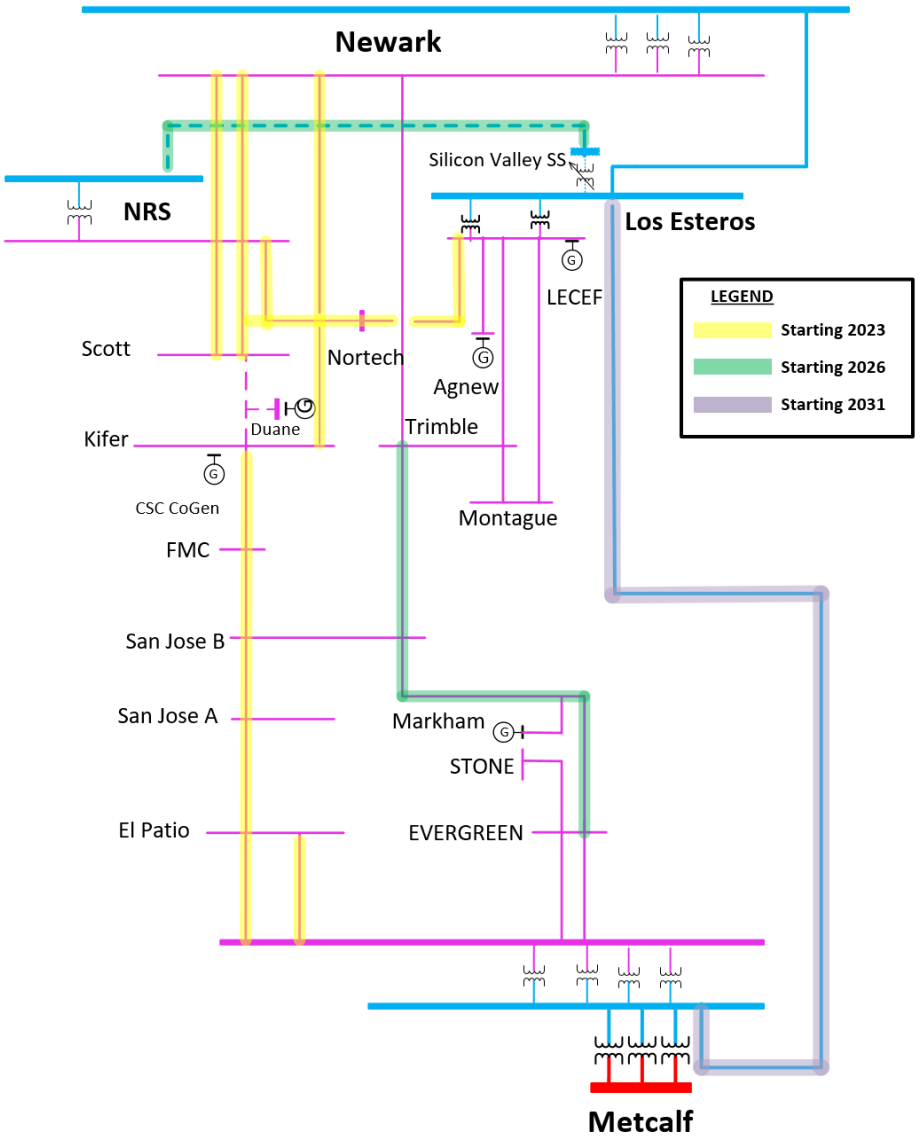


2021-2022 SVP Load Forecast											
Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Load (MW)	666	743	825	920	1010	1092	1124	1143	1159	1176	1194

Assessment Results

- **Contingency Description:**

  Due to high SVP load increase, contingency categories P0- P1 will cause thermal overloads on several South Bay 115 kV lines and low voltage issues in San Jose Area starting 2023



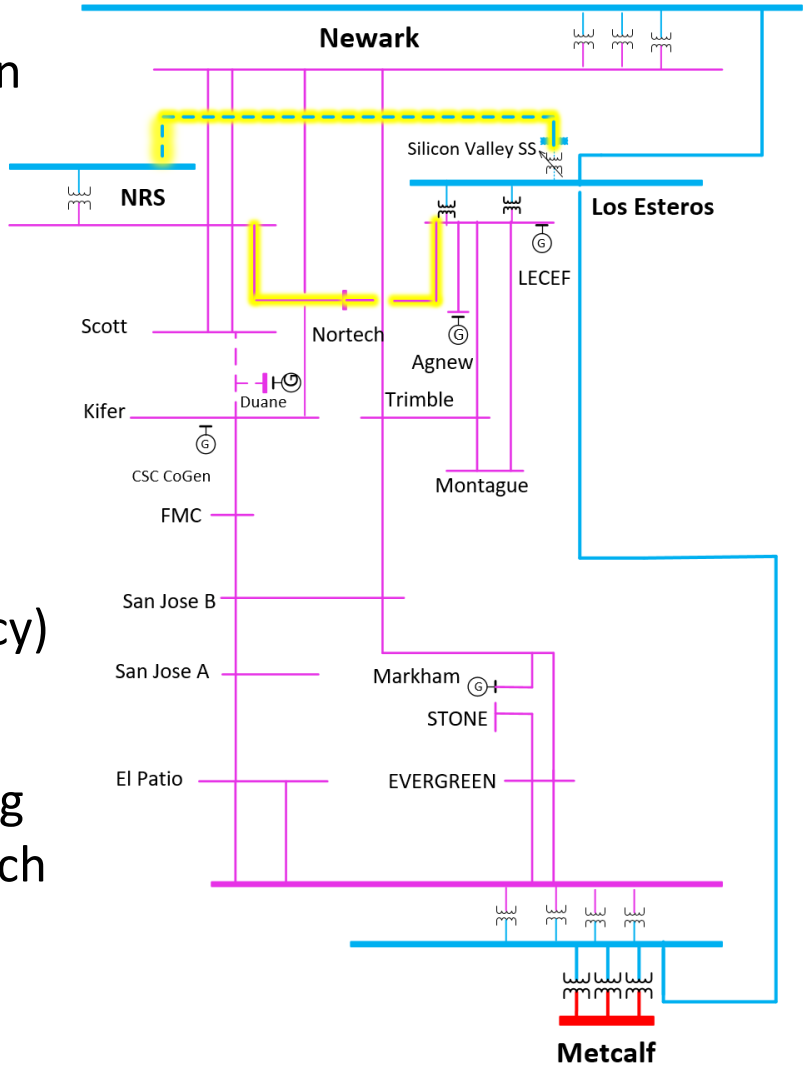
Most Limiting Path

- Over 60% of the power delivered to SVP from PG&E is from Los Esteros Substation through the following two paths:

  1) Silicon Valley SW STA - NRS 230 kV
  2) Los Esteros - Nortech 115 kV & Nortech – NRS 115 kV

- Los Esteros - Nortech 115 kV line will have thermal overloads during normal conditions (Category P0: No Contingency) starting year 2026

- There are N-1 contingencies overloading Los Esteros - Nortech 115 kV and Nortech – NRS 115 kV lines starting year 2023

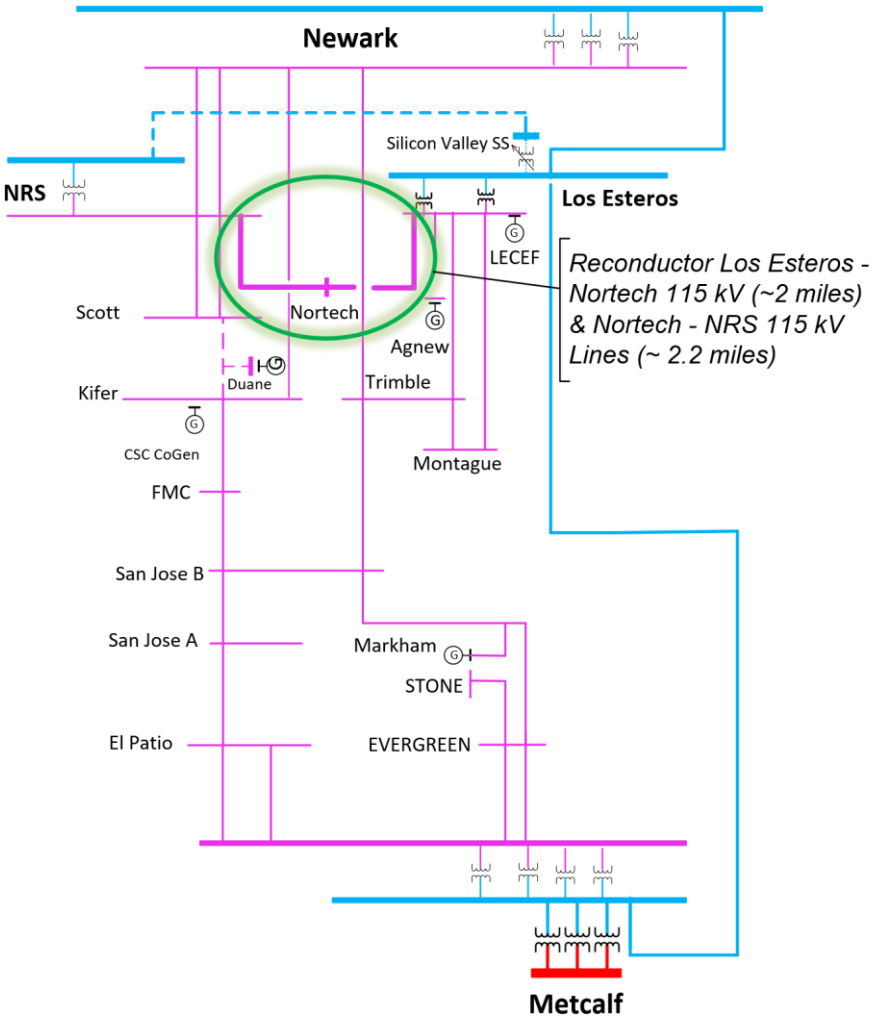


Upgrading the Most Limiting Path

- **Project Scope**
  - Reconductor Los Esteros - Nortech 115 kV with conductor rated for 2300 Amps or higher
  - Reconductor Nortech - NRS 115 kV with conductor rated for 2000 Amps or higher
- **Estimated Cost**
  - Los Esteros - Nortech 115 kV Reconductoring ~ 2 miles

    $16M - $32M*
  - Nortech - NRS 115 kV Reconductoring ~ 2.2 miles

    $18M - $36M*

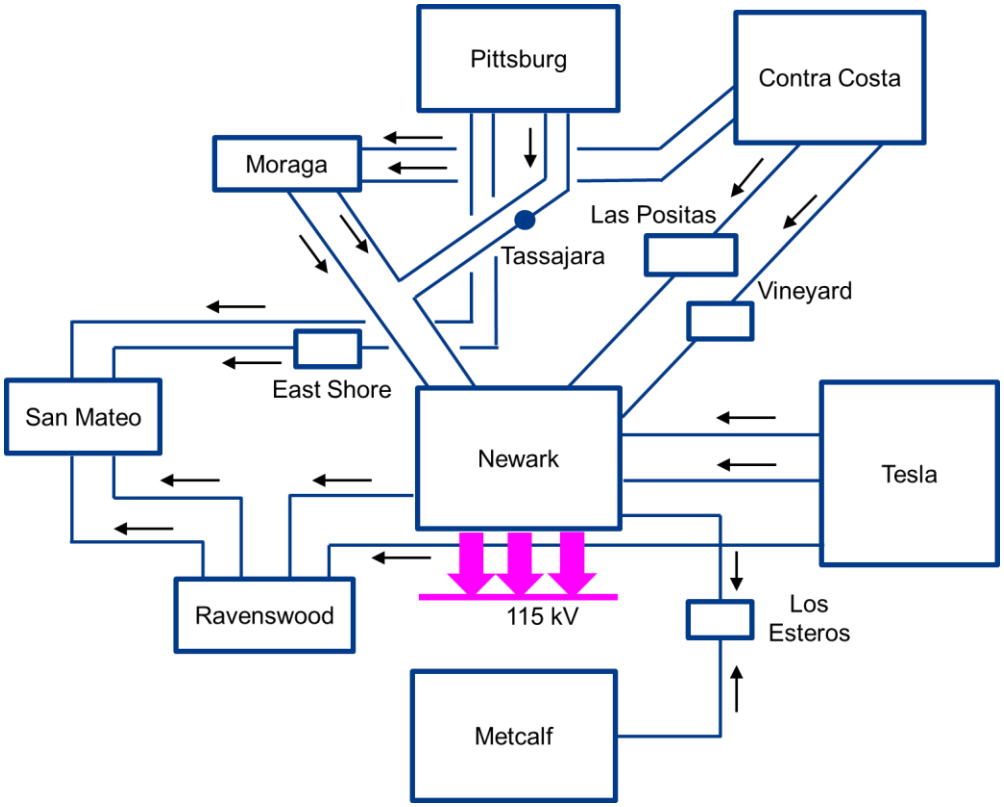


*AACE Level 5 quality estimates includes a +100% contingency

NEWARK Substation: A Strong Source for Meeting Increased SVP Demand

- Newark Substation serves as a critical substation which transfers power from Pittsburg, Contra Costa and Tesla 230 kV Substations to the South Bay, San Francisco and Peninsula

- Newark Substation is a strong source that can accommodate the increased SVP demand and the most feasible option considering geographic location and the existing connections to SVP system



PG&E explored different alternatives to increase power transfer capability from Newark to SVP to meet the expected load growth

Project Alternative 1

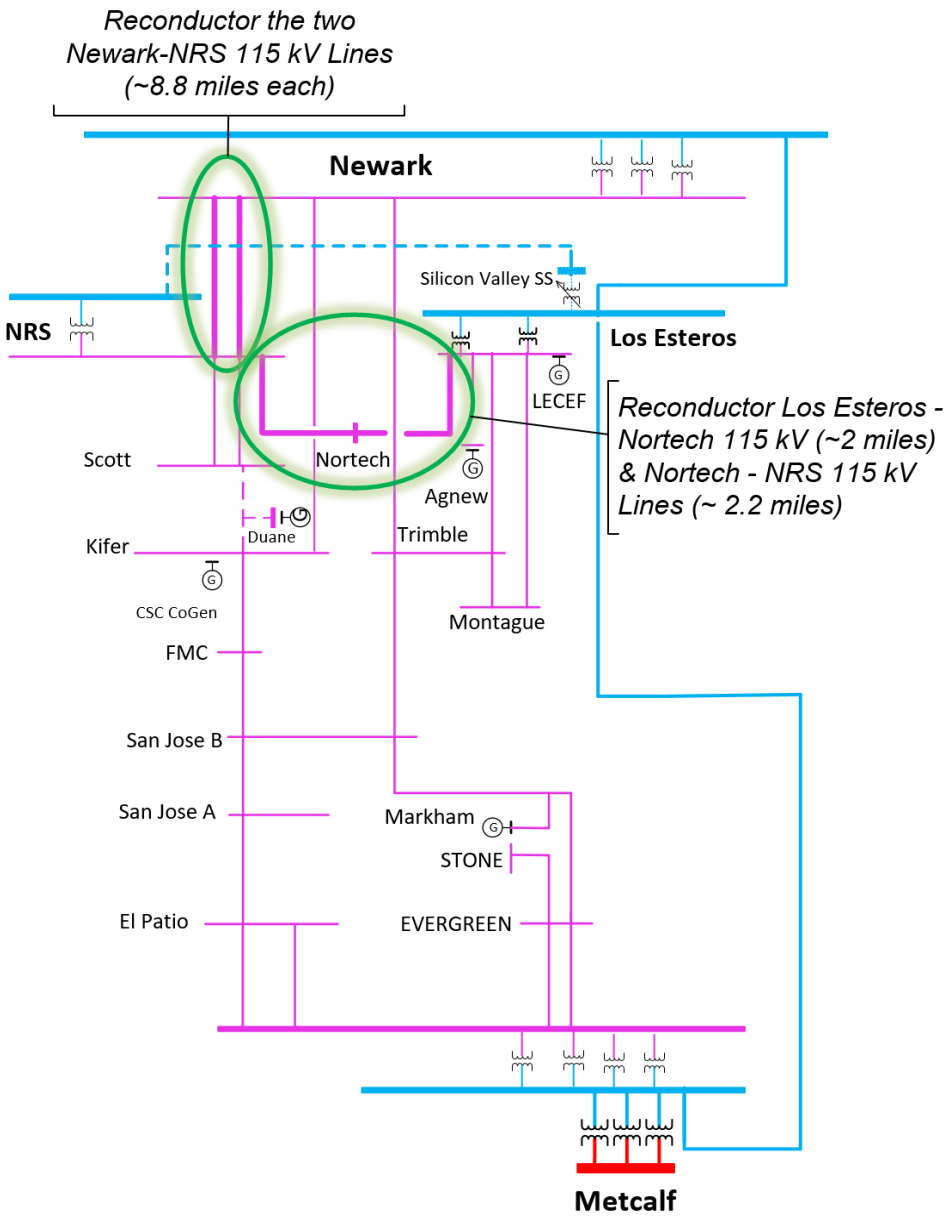
- **Project Scope**

  Reconductor the two existing Newark-NRS 115 kV lines with conductor rated for 1500 Amps or higher

  – Each line is about 8.8 miles

- **Estimated Cost**

  $44M - $88M*



*AACE Level 5 quality estimates includes a +100% contingency

Project Alternative 2

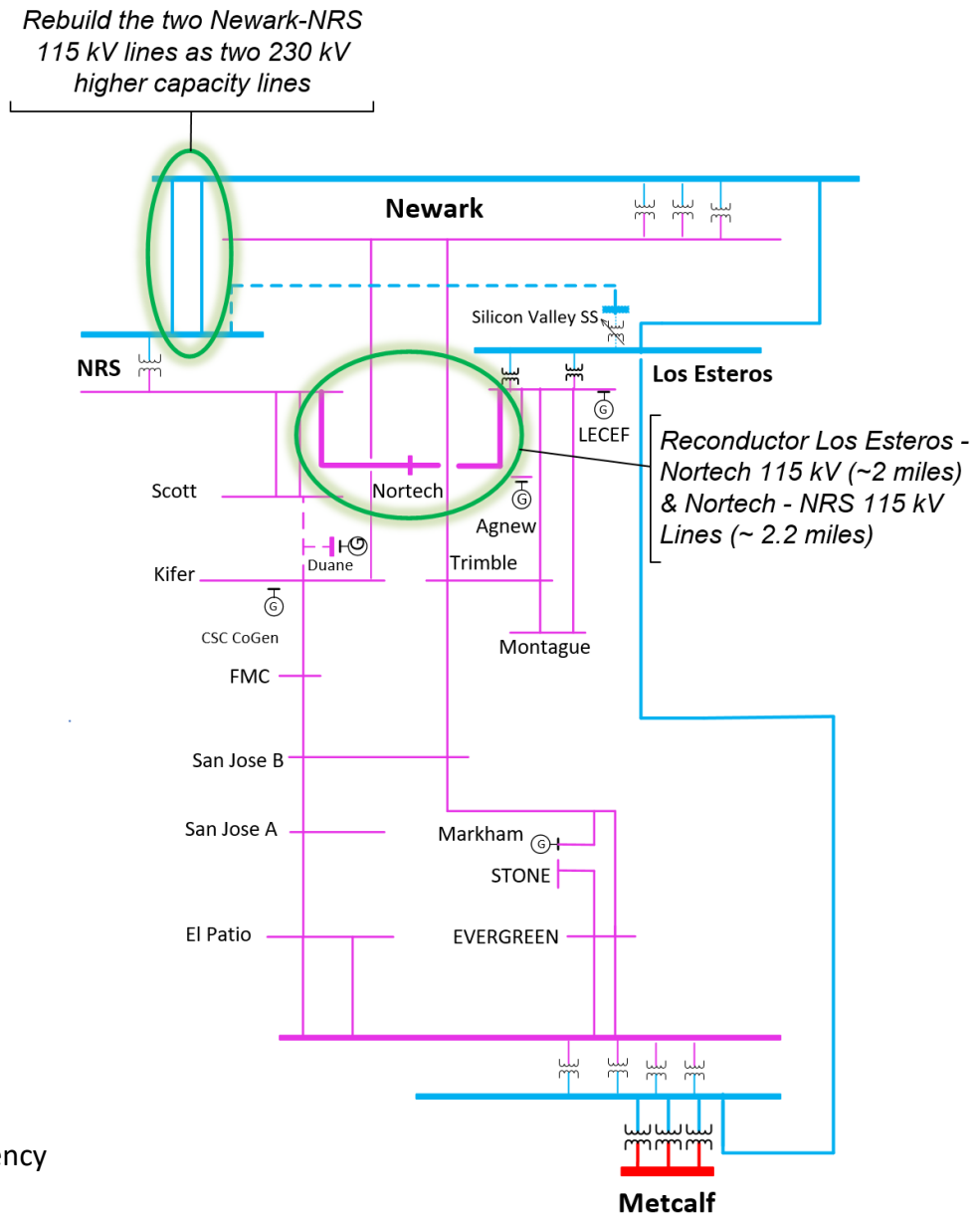
- **Project Scope**

  Rebuild the two Newark-NRS 115 kV lines as two 230 kV with conductor rated for 1144 Amps or higher

  – The two lines will use a routing similar to the existing 115 kV lines to the extent possible but need to be undergrounded for a small portion

- **Estimated Cost**

  $105M - $210 M*



*AACE Level 5 quality estimates includes a +100% contingency

Project Alternative 3

- **Project Scope**

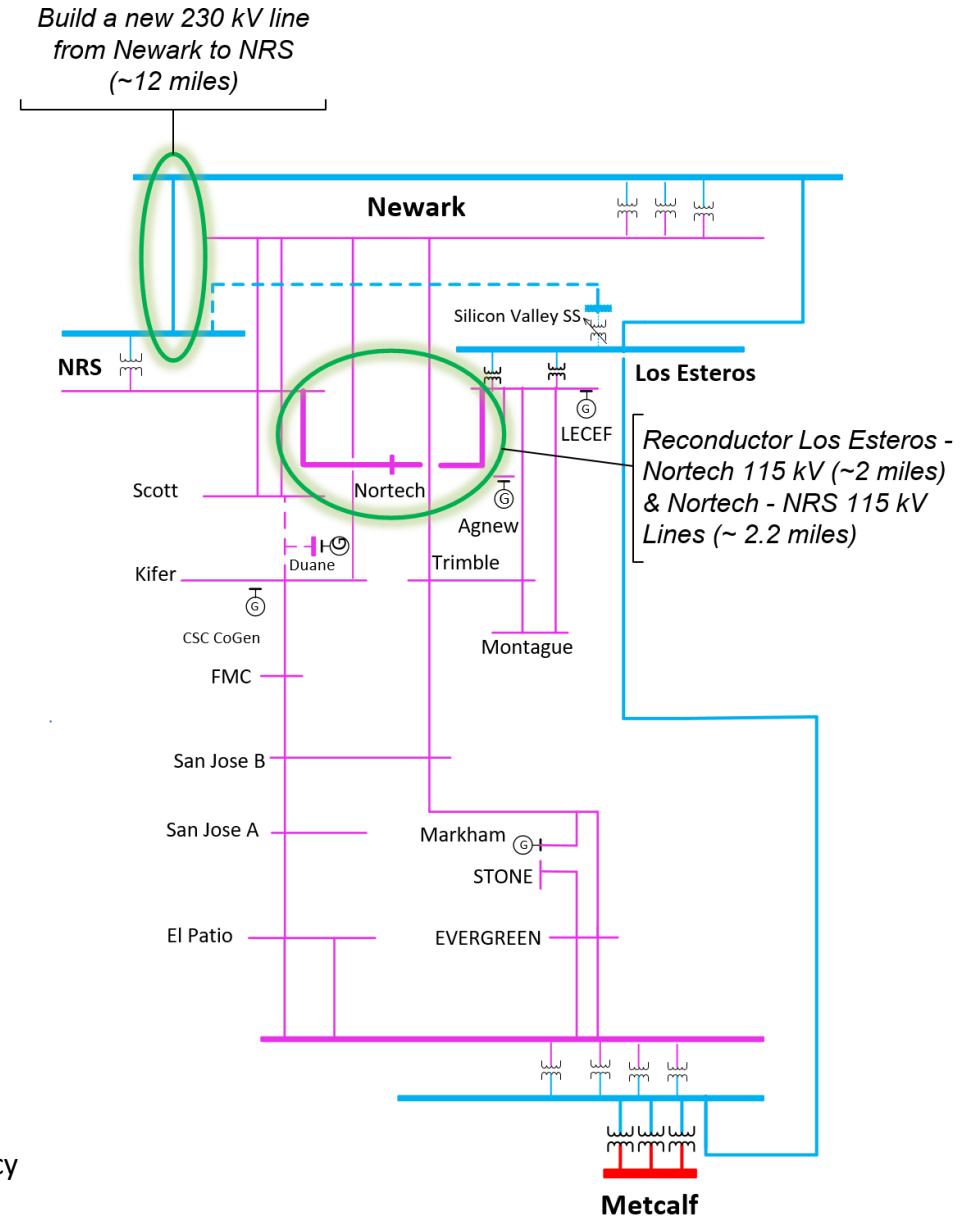
  Build a new 230 kV line from Newark to NRS with conductor rated for 2200 Amps or higher

  – The new line will have a different routing compared to the existing Newark - NRS #1 & #2 115 kV lines

  – The line is estimated to be about 12 miles with about 9 miles of underground

- **Estimated Cost**

  $232M - $464M*



*AACE Level 5 quality estimates includes a +100% contingency

Project Challenges and Considerations

- Alternative studies are still ongoing to determine the most cost effective, feasible solution to mitigate all the overloads caused by the SVP load increase for all contingency
- Based on the power flow studies, upgrading the PG&E system alone cannot mitigate all the overloads and notable upgrades are needed in SVP system
- The feasibility and cost evaluation of the alternatives are very complex due to routing limitations caused by proximity to environmentally sensitive locations and high population density areas
- PG&E is observing high reactive flows to SVP system due to the significant load increase which further limits the transfer capability. There is a need for reactive support devices in SVP system to address this issue
- The two Newark – NRS #1 & #2 115 kV lines are a critical power source into SVP. The clearance windows for these lines will be limited and should be coordinated to avoid any conflicts with SVP's planned upgrades