Application No.: A.23-05-010
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Witnesses: R. Fugere

(U 338-E)

2025 General Rate Case

Wildfire Management
Part 1: Overview

Before the

Public Utilities Commission of the State of California

Rosemead, California
May 12, 2023

SCE-04 Vol. 05 Pt. 1: Wildfire Management Overview

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I.

INTRODUCTION

A. Content and Organization of Volume

This volume, which includes Parts 1 through 4, presents Southern California Edison Company's (SCE) forecast of 2025-2028 operations and maintenance (O&M) expenses and 2023-2028 capital expenditures to implement measures directed at reducing wildfire and PSPS risks. The funding request presented in this volume is necessary for SCE to continue its efforts to enhance the safety of the electrical system and to increase public safety by minimizing the risk of significant wildfires associated with SCE equipment, consistent with state policy.

The testimony in this volume will explain the scope and cost forecasts of planned work activities, including identifying key regulatory requirements and other drivers for the planned work. It will also explain the important role these activities play in wildfire prevention (i.e., reducing potential ignitions) and reduce the impact should an ignition event occur, as well as enhancing system resiliency.

B. Summary of O&M and Capital Request

This volume[1] presents SCE's requests for $269.527 million (constant 2022 dollars) in O&M expenses for the 2025 Test Year and $7,310 million in capital expenditures for 2023-2028 to effectively address wildfire and PSPS risks. SCE's total requests for Wildfire Management are presented in Table I-1 and Table I-2. This funding is crucial to implement effective wildfire mitigation programs and activities designed to reduce the number and likelihood of ignitions associated with SCE equipment as well as to increase resiliency of SCE infrastructure to wildfires.

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[1] SCE is referring to SCE-04 Vol. 05 Parts 1, 2, 3, and 4.

Table I-1
Wildfire Management O&M Expenses
(Constant 2022 $000)[2]

GRC Activity	Testimony Location	TY 2025 O&M
Grid Hardening	SCE-04 Vol. 05 Part 2	$501
HFRA Sectionalizing Devices	SCE-04 Vol. 05 Part 2	$1,515
Supplemental System Hardening Activities	SCE-04 Vol. 05 Part 2	$4,963
Alternative Technologies	SCE-04 Vol. 05 Part 3	$942
High Fire Risk Inspections and Remediations	SCE-04 Vol. 05 Part 3	$134,482
Infrared Inspection Program	SCE-04 Vol. 05 Part 3	$583
Wildfire Mitigation and Vegetation Management Technology Solutions	SCE-04 Vol. 05 Part 3	$6,741
PSPS Execution	SCE-04 Vol. 05 Part 4	$20,941
PSPS Customer Support	SCE-04 Vol. 05 Part 4	$36,971
Organizational Support	SCE-04 Vol. 05 Part 3	$3,173
Aerial Suppression	SCE-04 Vol. 05 Part 4	$32,981
Enhanced Situational Awareness	SCE-04 Vol. 05 Part 4	$10,934
Fire Science and Advanced Modeling	SCE-04 Vol. 05 Part 4	$8,815
Wildfire Mitigation and Vegetation Management Technology Solutions	SCE-04 Vol. 05 Part 4	$5,364
Environmental Programs	SCE-04 Vol. 05 Part 4	$621
Totals		**$269,527**

2 There are additional dollars in SCE-02 Vol. 10 associated with vegetation management activities, SCE-06 Vol. 04 for wildfire related training, SCE-02 Vol. 11 for wildfire-related work order expenses and SCE-06 Vol. 06 for wildfire compliance related work activities.

Table I-2
Wildfire Management Capital Expenditures 2023 – 2028
(Total Company Nominal $000)[3]

GRC Activity	Testimony Location	2023 - 2028 Capital Expenditure Forecst
Grid Hardening	SCE-04 Vol. 05 Part 2	$6,292,074
High Fire Risk Inspections and Remediations	SCE-04 Vol. 05 Part 2	$11,177
HFRA Sectionalizing Devices	SCE-04 Vol. 05 Part 2	$33,100
Supplemental System Hardening Activities	SCE-04 Vol. 05 Part 2	$1,249
Alternative Technologies	SCE-04 Vol. 05 Part 3	$63,063
High Fire Risk Inspections and Remediations	SCE-04 Vol. 05 Part 3	$798,985
Wildfire Mitigation and Vegetation Management Technology Solutions	SCE-04 Vol. 05 Part 3	$48,771
Fire Science and Advanced Modeling	SCE-04 Vol. 05 Part 4	$6,714
Enhanced Situational Awareness	SCE-04 Vol. 05 Part 4	$6,035
Wildfire Mitigation and Vegetation Management Technology Solutions	SCE-04 Vol. 05 Part 4	$49,143
Totals		**$7,310,311**

[3] *See* SCE-02 Vol. 10. There are additional capital dollars associated with wildfire Vegetation Management activities.

II.

WILDFIRE MANAGEMENT

A. Overview

1. Wildfires Continue to Be a Top Safety Risk for California

This volume provides detailed risk discussion and analysis concerning SCE's efforts to mitigate the risk of wildfires associated with SCE equipment, to help protect the safety and well-being of our customers and the communities that we serve. Our risk reporting encompasses several mitigations and focuses most prominently on our principal programs to address wildfire risk: our Wildfire Covered Conductor Program (WCCP) and undergrounding of existing overhead lines through our Targeted Undergrounding Program (TUG). These principal mitigations are complemented by a suite of other mitigations carefully designed to address the risks inherent at each location of SCE's High Fire Risk Area (HFRA).[4]

SCE provides electric service to more than 15 million people[5] in a 50,000 square-mile service territory across California's southern, central, and coastal areas. Our service area is comprised of nine regions[6] with a diverse topography, from heavily forested mountainous areas to large swaths of chaparral grassland and desert biomes. Fuel and weather conditions in these regions play a significant role in the initiation, spread, and intensity of wildfires. Fuel conditions (such as the age, health, volume, and type of fuel) are localized and dynamically impact wildfire risk. Similarly, weather conditions such as wind speed and relative humidity play a significant role in the initiation, spread, and intensity of wildfires. These factors are generally unique to a particular region.

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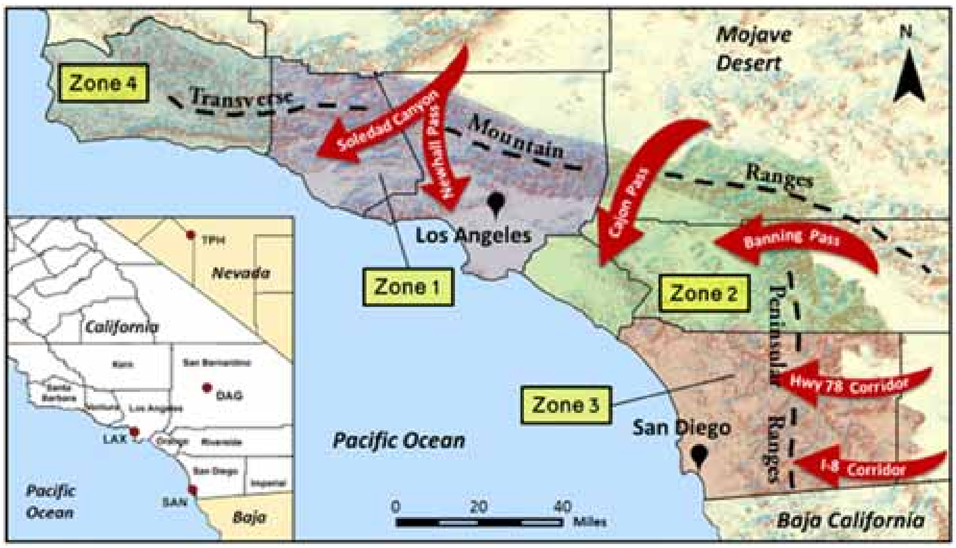
4 SCE's HFRA is based on a combination of historical map boundaries (based on past fire management and response experiences), California Department of Forestry and Fire Protection's (CALFIRE) Fire Hazard Severity Zone maps, and the California Public Utility Commission's approved statewide HFTD maps. Collectively, SCE has considered Zone 1, Tier 2, and Tier 3 (collectively, the HFTD) and non-CPUC historical high fire risk areas to collectively be the HFRA. Zone 1 consists of Tier 1 High Hazard Zones (HHZ) on the map of Tree Mortality HHZs prepared jointly by the United States Forest Service and CALFIRE. Tier 1 HHZs are in direct proximity to communities, roads, and utility lines, and represent a direct threat to public safety. Tier 2 consists of areas on the CPUC's Fire Threat Map where there is an "elevated" risk for destructive utility-associated wildfires. Tier 3 consists of areas on the CPUC's Fire Threat Map where there is an "extreme" risk for destructive utility-associated wildfires.

5 SCE provides this service through over 5 million customer accounts.

6 SCE's nine regions are North Coast, Metro East, Metro West, San Joaquin, Orange, Rural, North Valley, Desert, and San Jacinto.

Many of these regions experience sporadically rainy winters and dry, hot summers. Additionally, the North Coast region experiences Sundowner winds in the late Spring/early Summer, while mountain passes are subject to Santa Ana winds in the late Fall through late Winter as shown in Figure II-1.[7] This unique combination of diverse vegetation types, topography, terrain, weather, and wind patterns create conditions conducive to significant wildfire events.

Figure II-1
Map of Santa Ana Wind Zones and Associated Passes



This risk of significant wildfire events continues to exist due to a range of changing climatic conditions that foster the initiation, spread, and intensity of wildfires; these developments in turn escalate the consequences of wildfires. Extreme multi-year droughts, combined with increasing temperatures, can lead to greater amounts of dead vegetation, while increases in the frequency and/or magnitude of wind events can compound any resulting fires. Moreover, it is now beyond reasonable dispute that climate change is dramatically increasing the severity of wildfires in California. As shown in Figure II-2 below, although the number of fire events has generally declined since the late 1980s, the number of total acres burned has increased almost seven-fold. Accordingly, it has become even more imperative that the utilities harden their systems to prevent this kind of devastation.

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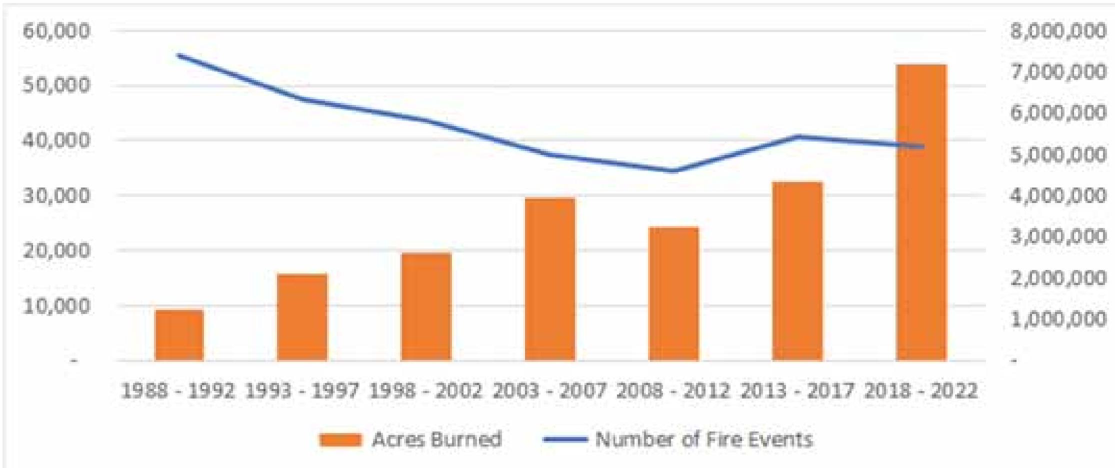
[7] Rolinski, T., Capps, S., Fovell, R., Cao, Y., D'Agostino, B., Vanderburg, S., *The Santa Ana Wildfire Threat Index: Methodology and Operational Implementation. Weather and Forecasting*, (2016). 31. 10.1175/WAF-D-15-0141.1. Accessible at https://journals.ametsoc.org/configurable/content/journals$002fwefo$002f31$002f6$002fwaf-d-15-0141_1.xml?t:ac=journals%24002fwefo%24002f31%24002f6%24002fwaf-d-15-0141_1.xml.

Figure II-2
Number of Wildfires and Acres Burned in California[8]



Projections by Westerling (2018) point to a future defined by intensifying and, at times, expanding areas of elevated wildfire risk, strongly driven by changes to underlying climate conditions.[9] Other research, notably Williams, *et al*. (2019), further strengthens the primary link between climate change and wildfire activity in California.[10] As such, the consequences of resulting ignitions could increase as climate change makes the underlying and surrounding landscape more receptive to ignitions.

Since the 1960s, new housing patterns in California have been largely characterized by development in areas adjacent to forests, public lands, and the unbuilt environment.[11] Attracted by the appeal of enjoying open scenery and suburban living, while still being within driving distance of major

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8 *See* https://34c031f8-c9fd-4018-8c5a-4159cdff6b0d-cdn-endpoint.azureedge.net/-/media/calfire-website/our-impact/fire-statistics/featured-items/top20_acres.pdf?rev=be2a6ff85932475e99d70fa9458dca79&hash=A355A978818640DFACE7993C432ABF81.

9 Westerling, A. L., (2018). *Wildfire Simulations for California's Fourth Climate Change Assessment: Projecting Changes in Extreme Wildfire Events with a Warming Climate. California's Fourth Climate Change Assessment, California Energy Commission*. Publication Number: CCCA4-CEC-2018- 014.

10 Williams, A. P., Abatzoglou, J. T., Gershunov, A., Guzman-Morales, J., Bishop, D. A., Balch, J. K., & Lettenmaier, D. P. (2019). *Observed impacts of anthropogenic climate change on wildfire in California*. Earth's Future, 7, pp. 892–910. Accessed at https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019EF001210.

11 Barrett, K., (2019). *Reducing Wildfire Risk in the Wildland-Urban Interface: Policy, Trends, and Solutions.* 55 Idaho L. Rev., 3.

economic centers of activity, people in California are moving to locations in the wildland urban interface (WUI) faster than in other parts of the country, despite the known wildfire history in these areas.[12]

SCE maintains a total of approximately 1.4 million structures and 51,000 circuit miles of overhead conductor. Of those, approximately 310,000 structures[13] and 14,000 circuit miles[14] (27%) of overhead conductor are in High Fire Risk Areas (HFRA). Given the threat posed by wildfires, SCE proposes a suite of mitigations to reduce the probability of an ignition, reduce the impact should an ignition event occur, reduce the need for PSPS, as well as lessen the impact of PSPS on customers and communities. SCE and the Commission are aligned that PSPS is a mitigation measure of last resort, and SCE recognizes the impacts that these events have on our customers and communities.

2. <u>Compliance Requirements</u>

D.21-08-036 identified various compliance requirements related to the activities included in this volume of testimony. SCE identifies those requirements in Table II-3 and indicates where in this testimony those requirements are satisfied.

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[12] Radeloff, V. C., et al. (2018). *Rapid Growth of the U.S. Wildland-Urban Interface Raises Wildfire Risk*, Proc. Nat'l. Acad. Sci. 115:3314 (2018). Accessed at https://www.pnas.org/doi/full/10.1073/pnas.1718850115 on April 17, 2023.

[13] The approximately 310,000 structures include distribution, transmission, and combo poles.

[14] This consists of approximately 9,600 overhead distribution primary conductor miles and 4,400 overhead transmission conductor miles in High Fire Threat Districts (HFTD).

Table II-3
Compliance Requirements

GRC Reference	Requirement	Location Addressed in SCE-4, Volume 5
D. 21-08-036, p. 203	"Therefore, as part of its next GRC filing, we direct SCE to further evaluate the interaction between its proposed wildfire mitigations, and whether costs can be reduced for ratepayers while still maintaining a consistent level of safety."	Part 1, Section II. A. 5 – Risk-Informed Approach to Wildfire Mitigations
D. 21-08-036, Ordering Paragraph 16	"Southern California Edison Company (SCE) shall include in its next General Rate Case filing a presentation of how it leveraged the implementation of the grid hardening and modeling tools approved in this decision to better assess thresholds for initiating a Public Safety Power Shutoff (PSPS) event, including a quantitative evaluation of how covered conductor has resulted in higher thresholds for initiating a PSPS event, broken down by Tier 2 and Tier 3 High Fire-Threat Districts, as well as an evaluation of how covered conductor has contributed to reductions in SCE's historic PSPS frequency, scope, or duration."	Part 2, Section I. A. 2. (d) – Wildfire Covered Conductor Program (WCCP)
GRC Track 3 Decision – D.22-06-032, p. 33	"SCE shall in its next GRC provide an accounting of the amounts of the recovery, as well as the number and costs of the defective units. To the extent ratepayers have funded some of these fuses, ratepayers should be credited their fair share of any recovery"	Part 2, Section I. A. 3. – Fusing Mitigation
D. 21-08-036, p.37	While we appreciate the models serve different purposes, to the extent different models are used to evaluate the same risk and associated impact of various mitigation measures, SCE should include a qualitative explanation for any divergence between the model results and how the results support the proposed mitigations programs. Similarly, TURN's recommendation to include egress in the calculation of wildfire risk consequence would improve SCE's Risk management approach and is generally uncontested. To the extent this issue is not addressed in R.20-07-013, we direct SCE to incorporate egress, and other conditional risks as appropriate, in future RAMP and GRC risk modeling.	Part I, Section II. A. 5 – Risk-Informed Approach to Wildfire Mitigations
D.22-10-002 Decision Addressing Phase 1, Tracks 3 and 4 Issues	The IOUs shall identify capital expenditures and operating costs stemming from an approved WMP as such in the GRC or other applications for cost recovery. Each WMP mitigation shall be mapped to at least one GRC cost category, or to a cost category in a separate WMP cost recovery application if applicable and tracked in the RSAR.	Included in workpaper[1]

[1] WP SCE-04 Vol. 05 Part 1, pp. 1 - 3, WMP to GRC Mapping.

3. Regulatory Background/Policies Driving SCE's Request

SCE's request in this GRC builds upon several years of efforts by the State to understand and mitigate the impacts of wildfires. SCE summarizes many of these efforts here, particularly those pertaining to utilities.

Fire Safety Regulations: In D.17-12-024, the Commission adopted regulations to enhance wildfire safety in the statewide High Fire Threat Districts (HFTD).[15] These fire-safety regulations aim to reduce the fire hazards associated with overhead power-line facilities in elevated and extreme areas throughout the State. The regulations are contained in the Commission's General Orders (GO) 95, 165 and 166; and in Rule 11 of each of the electric Investor-Owned Utilities' (IOU) electric tariff rules. The HFTD tiers were determined based on elevated hazards for the ignition and rapid spread of power-line fires due to strong winds, abundant dry vegetation, and other environmental conditions. Since adoption of the HFTD maps in 2018, SCE has complied with new construction standards, enhanced vegetation clearances, increased asset inspections, and shortened remediation timelines, consistent with applicable Commission General Orders (GO) designed to reduce fire risk.

Grid Safety and Resiliency Program (GSRP): SCE filed its Grid Safety and Resiliency Program (GSRP) Application (A.18-09-002) in September 2018 seeking approval of, and cost recovery for, incremental costs to implement the program over the 2018 to 2020 period. The GSRP filing was designed to bridge the gap between the 2018 and 2021 GRC cycles. SCE's proposed GSRP was a portfolio of mitigation measures primarily focused on preventing wildfire ignitions associated with electrical distribution infrastructure in High Fire Risk Areas (HFRA). GSRP's focus areas were: (1) further grid hardening; (2) enhanced situational awareness; and (3) enhanced operational practices. Given the increased wildfire risk, SCE began implementing GSRP in 2018.

Wildfire Mitigation Plans (WMP): Since filing its GSRP Application, SCE has continued to review and refine the strategies and programs described in that filing. California Senate Bill 901 (SB 901) was also enacted in 2018 and required electric utilities to prepare and submit WMPs that describe the utilities' plans to prevent, combat, and respond to wildfires affecting their service territories, and to detail efforts to reduce the use and customer impacts of PSPS. SB 901 also allowed utilities to track costs to implement their WMPs in a wildfire memorandum account. Through a proceeding it opened on October 25, 2018 (R.18-10-007), the CPUC reviewed and approved SCE's

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[15] The Commission designates these districts, as shown in the Fire Threat map issued by the State.

initial 2019 WMPs. Since then, the CPUC's Wildfire Safety Division[16] has enacted increasingly comprehensive requirements for utility WMPs. SCE's WMPs were approved in 2020, 2021, and 2022, and SCE submitted its 2023 – 2025 WMP on March 27, 2023. This testimony builds upon the risk modeling and mitigation strategies detailed in that WMP filing.

General Rate Case: In Track 1 of SCE's 2021 GRC, SCE requested funding to implement a portfolio of wildfire mitigations over the 2021 – 2023 period. CPUC Decision D.21-08-036 authorized funding for wildfire mitigations over this timeframe. In addition, SCE has tracked and sought cost recovery for costs incurred beyond those authorized in its General Rate Cases to implement its approved WMPs, through Tracks 2 and 3 of SCE's 2021 GRC. SCE is also seeking recovery of incremental costs incurred in 2021 through its Wildfire Mitigation and Vegetation Management application, filed in June 2022. SCE submitted its 2021 GRC Track 4 proposal in May of 2022, which seeks to establish an authorized revenue requirement for 2024, including specific forecasts for wildfire and PSPS risk mitigation activities.

Risk Assessment Mitigation Phase (RAMP): As discussed above, SCE submitted its 2022 RAMP report in May of 2022, which presented SCE's risk-informed plans to address wildfire and PSPS risks over the 2025 – 2028 GRC period. SCE's request in this GRC is based on the robust risk analysis performed through the RAMP process. SCE has modified, where appropriate, the scope and costs for the mitigations identified in RAMP to incorporate updated risk analysis, lessons learned, cost and resource information, and other factors.

Risk OIR: Through R.20-07-013 – Order Instituting Rulemaking to Further Develop A Risk-Based Decision-Making Framework for Electric and Gas Utilities – the CPUC has implemented certain requirements related to risk modeling and integration into the GRC. First, PSPS must be modeled as its own standalone risk. SCE complied by modeling PSPS as its own risk with controls and mitigations in both the RAMP and this rate case request. Second, the IOUs are required to explicitly map costs and comments between the RAMP and GRC filings. The cost mapping must identify expenses as either capital or operating expenses. SCE has provided testimony and workpapers that provide this information.[17] Third, the IOUs are required to identify capital expenditures and operating

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[16] Pursuant to Assembly Bill 1054, beginning in July 2021, the CPUC's Wildfire Safety Division was moved to the California Natural Resources Agency and renamed the Office of Energy Infrastructure Safety (Energy Safety or OEIS).

[17] WP SCE-01 Vol. 2, pp. 1 - 6, RAMP to GRC Recommendations.

costs stemming from an approved WMP as such in the GRC or other applications for cost recovery. Each WMP mitigation shall be mapped to at least one GRC cost category, or to a cost category in a separate WMP cost recovery application if applicable and tracked in the RSAR. SCE provided a workpaper that provides this information.[18] Fourth, the IOU's GRC Application shall contain GRC Workpapers with chapter or risk information, RAMP mitigation cost estimates, proposed GRC cost estimates and the difference from RAMP estimates. As noted above, SCE has provided workpapers with this information.

PSPS Rulemaking: Through R.18-12-005 – Order Instituting Rulemaking to Examine Electric Utility De-Energization of Power Lines in Dangerous Conditions – the CPUC has outlined various requirements pertaining to the use of PSPS, including stakeholder engagement, customer and public safety partner notifications, customer care options, and risk evaluation. SCE has partnered with the CPUC and stakeholders throughout this rulemaking and accompanying phases to build a PSPS approach that seeks to minimize wildfire and PSPS risks to our customers. Further, in 2021, SCE implemented its PSPS Action Plan, which outlined over 130 discrete items intended to reduce the use of PSPS, execute PSPS events more effectively with transparency into the decision-making process, mitigate the impacts of PSPS events, keep partners and customers clearly and consistently informed, and enhance and improve post-event reporting. As of Spring 2022, SCE had substantially completed execution of all but one of these items.[19] The PSPS-related activities in this testimony continue and build upon the progress made through this rulemaking and SCE's PSPS Action Plan.

4. Risk-Informed Approach to Wildfire Mitigations Presented in This Testimony

a) Advances in SCE's Wildfire and PSPS Risk Modeling

Risk modeling and analysis have been cornerstones in developing and executing our Wildfire Mitigation Plans (WMPs) and the annual updates to those Plans. At the inception of its wildfire mitigation program, SCE utilized portfolio level risk-spend efficiencies and operational considerations to determine the appropriate scope of the program. From there, SCE used several iterations of risk-prioritization models for covered conductor deployment to inform prioritization of work from 2018 through 2024. SCE's risk-prioritization models inform, but do not determine on their

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[18] WP SCE-04 Vol. 05 Part 1, pp. 1 - 3, WMP to GRC Mapping.

[19] The only remaining Action Plan milestone is a joint effort with the Rialto Unified School District (Rialto USD) to facilitate development of a behind the-meter microgrid project for a school in Fontana as part of SCE's Community Resiliency Pilot. This project has been delayed due to circumstances beyond SCE's control.

own the appropriate order of work to be performed, nor the total amount or scope of work that should be done. Risk prioritization models estimate both the probability of ignition (POI) and their likely consequences, such as acres and structures burned. The outputs of those risk-prioritization models appropriately guided SCE's wildfire mitigation efforts regarding where to begin grid hardening deployment (*i.e.*, how to address the highest relatively risky areas first (when operationally feasible and efficient)). Since the 2018 RAMP, our approach has matured over time, resulting in significant progress in SCE's wildfire and PSPS risk modeling capabilities.

For our 2018 RAMP, SCE developed a RAMP risk model and MARS framework (SCE's version of a Multi-Attribute Value Function (MAVF)) to quantify our enterprise-level risks and evaluate mitigation options. SCE's MARS model aligns with the methodology approved in the S-MAP Settlement. This analysis informed SCE's wildfire mitigation work set forth in SCE's Grid Safety and Resiliency Program (GSRP) and 2019 WMP. In parallel, at that time we developed the Wildfire Risk Model (WRM), which was used to determine probability and consequence of ignitions at the asset level.

For the 2021 GRC and 2020 WMP, we developed asset-specific Probability of Ignition (POI) databases and contracted with a recognized expert third party to develop wildfire consequence information. SCE used these improvements along with the 2018 RAMP model and MARS framework to assess system- or High Fire Risk Area (HFRA)-level wildfire risks and risk mitigation using HFRA-level "top down" averages for probability and consequence of ignitions, and a "bottoms-up" approach for circuit segment mitigation prioritization, in conjunction with other operational considerations.

For our 2022 RAMP, we further updated our models by using the latest asset, fire consequence, weather, fuel, and burn scar data. In addition, we updated algorithms and utilized a more refined fire consequence modeling tool. We also developed a method to translate the risk scores produced by our POI and consequence models into unitless values consistent with the RAMP framework, using the MARS approach at the structure (pole or tower) level. In addition, SCE has developed a PSPS risk calculation at the circuit-segment level to more comprehensively account for wildfire risk reduction benefits, as well as the customer impacts associated with using PSPS as a necessary measure of last resort against wildfire ignition risk. All these improvements and additions are integrated into the overarching model referred to as the Wildfire Risk Reduction Model (WRRM).

Finally, as discussed at length in SCE's 2022 RAMP Wildfire and PSPS Chapter and in SCE's 2022 WMP Update, in 2022, SCE developed an Integrated Wildfire Mitigation Strategy

(IWMS – Formerly referred to as the Integrated Grid Hardening Strategy (IHGS)) Risk Framework, which takes into account risk factors not currently considered by MARS, such as Communities of Elevated Fire Concern (CEFC). CEFC is one important factor that SCE uses to determine whether to deploy targeted undergrounding as a replacement of existing overhead conductor. As discussed in SCE's 2023-2025 WMP, SCE has leveraged IWMS in concert with the MARS Framework to evaluate wildfire risk and identify the appropriate set of mitigations to deploy. SCE summarizes this below and provides more detail in the following section.

The MARS Framework is used to calculate overall utility risk from both wildfire and PSPS. The MARS Framework converts PSPS risk and Wildfire risk into a unitless risk score based on the principles in the S-MAP Settlement. The MARS Framework allows SCE to define and evaluate overall utility risk, and to compare mitigations and alternatives to each ignition driver and sub-driver on the basis of risk reduction and cost effectiveness.

The IWMS Risk Framework defines three risk tranches within SCE's HFRA based on potential consequences should an ignition occur at a specific utility asset location. This analysis includes elements such as potential egress constraints and CEFC. The IWMS Risk Framework is anchored on wildfire consequence should an ignition occur and does not adjust consequences based on the probability of ignition. SCE takes this approach because probability of ignition changes over time due to many variables such as age, loading, etc. Furthermore, in some locations the consequences of an ignition that leads to a wildfire may be so extreme that it is prudent to mitigate ignition risk regardless of probability.

After mitigations have been evaluated and selected under the MARS Framework, SCE uses this preferred list of mitigations in combination with the IWMS Risk Framework as a key input to determine the location, scale, scope, and frequency for each mitigation based on the three tranches of forecasted wildfire consequence severity. The IWMS Risk Framework supports SCE's strategy to deploy mitigations commensurate with the level of consequence from a safety, financial, and reliability perspective within each location of its high fire risk area.

b) Updates to Risk Modeling Since 2022 RAMP Report

SCE has continued to advance our wildfire and PSPS risk modeling methodology since filing our 2022 RAMP report including incorporation of recommendations made by parties in their evaluation of our RAMP report. The updates include systemic updates that are applicable to all RAMP controls and mitigations and control/mitigation specific updates.

The key systemic updates include moving to the Weighted Average Cost of Capital (WACC) for future cash discounting,[20] incorporation of egress, inclusion of Fire Investigation Preliminary Analysis (FIPA) ignitions into the risk drivers, updating with 2022 actuals for risk drivers, general modeling updates and updated mapping of foundational costs to controls and mitigations.

As noted above in Section II.A.2a), SCE incorporated egress into the RSE calculations. SCE divided its service area into hexagons approximately 214 acres in size. SCE used hexagons because the distance from the center of a hexagon to all adjacent hexagons is the same distance (1,000 meters) and it enabled SCE to compare variables across similar-sized polygons. SCE determined which hexagons in its HFRA have substantial road availability concerns using a ratio of roads to population in each hexagon. A lower score indicates 0.5 or fewer miles of roads available per person in a given hexagon, creating a potential egress concern should everyone in the polygon need to evacuate the area simultaneously. These locations were indexed on a one to nine scale, where a score of nine represents locations that are the most relatively egress constrained. SCE determined which hexagons in its HFRA that have a high frequency of historical fires, using fire scars, from 1970 to 2020. A higher score indicates a higher likelihood that a given hexagon will burn, meaning fires either originated from or travel into these hexagons. These locations were indexed on a one to nine scale, where a score of nine represents locations with the highest relative fire frequency. SCE then overlaid the egress-constrained areas with regions that have a high historical fire frequency. SCE flagged hexagons with both limited road availability and a high burn frequency as potential Fire Risk Egress Constrained Areas. For all locations in proximity to SCE’s overhead assets in HFTD, each location has been ascribed a score of one to eighty-one, which is the product of the resulting egress and fire frequency score.

In order to incorporate egress into our existing framework in a consistent fashion as the one used in our Severe Risk Area (SRA) methodology described above, SCE utilized the Fire Risk Egress score for each location as a multiplier on the safety component of its MAVF. For instance, in location “x” with a Fire Risk Egress score of 45, the resulting egress multiplier for all circuit segments in those locations would be calculated as follows:

$$\text{Fire Risk Egress}_X = 1 + (45/81)$$

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[20] *See* SCE-01 Vol. 02, for a further discussion on discounting.

In line with the 2023 WMP, in this GRC SCE has enhanced its POI model to include FIPA ignitions in its calibration process. SCE's 2022 RAMP solely used CPUC reportable ignitions as part of its calibration of probability of ignitions to forecast ignition frequencies. Including FIPA ignitions, which captures ignitions beyond CPUC reportable ignitions, along with separating primary and secondary ignitions, allows for more granular forecasts and application of POI to specific ignition events. In 2022, SCE engaged a third-party independent evaluator to review its RSE development process for the 2023 WMP and the accuracy of its RSE. SCE leveraged the lessons learned from the third-party independent evaluator's review of its WMP RSE results for this GRC as well.[21] Lastly, SCE also updated the Quality Control (QC) Factor for groups of controls and mitigations.[22]

In addition to the updates discussed above that may impact all controls and mitigations there were specific updates to assumptions and/or modeling of certain controls and mitigations. These updates include the revisiting of all RSE inputs such as financials, scope (overall scope and locational specific scope), mitigation effectiveness values and useful life. SCE also revisited modeling methodology such as whether to use the median or riskiest segments for RSE calculations.

c) Integrated Wildfire Mitigation Strategy

(1) Background

Since the devastating California wildfires that occurred in the last half of 2017, SCE has been enhancing and advancing its approach to reducing the risk of ignitions associated with utility equipment. Over the last several years, it has become apparent that the magnitude of wildfire risk associated with significant portions of SCE's service areas is unacceptable and continuing to grow. Accelerating climate change, with associated extreme weather events, as well as the continued expansion and migration of Californians into the wildland-urban interface,[23] has made it imperative that

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[21] *See* SCE's 2023 WMP Section ACI SCE-22-22 Third Party Confirmation of RSE Estimates in Appendix D: Areas for Continued Improvement for additional information on the results and recommendations.

[22] The QC Factor is based on data collected from SCE's Transmission and Distribution Construction Inspection Programs to adjust for any potential discrepancies. SCE compares the structures with construction deficiencies to the sample of structures inspected to determine a percent error that would apply to our wildfire mitigation activities. This helps account for inherent rate of error in installation, etc. The QC Factor is applied to Vegetation Management, Inspection, and System hardening activities. The QC factor was updated using more recent data resulting in higher QC% applied to Inspections and System Hardening in particular (~3% to 8%). SCE also removed the REFCL QC factor (i.e., set to 0%) since there is no currently identified rate of error in installations due to the relatively new nature of the technology.

[23] *See* https://frap.fire.ca.gov/media/10300/wui_19_ada.pdf. Wildland-urban interface is dense housing adjacent to vegetation that can burn in a wildfire.

SCE prioritize mitigation of the risk of catastrophic wildfires associated with its overhead lines; historically, these assets are linked to the majority of ignitions and ignition risk associated with SCE's utility equipment.

Wildfires over the last five year-period have demonstrated that the level of absolute risk across California and the West may require actions beyond the utilities' short- and medium-term risk mitigation plans, which is the focus of this testimony. The California Department of Forestry and Fire Protection's (CAL FIRE) data indicates that nearly half of the 20 largest wildfires since 1932 have occurred in the past three years. Burning for months in 2021, the Dixie Fire became the largest single wildfire in California history, burning almost a million acres – an area larger than the state of Rhode Island – and across the crest of the Sierra Nevada mountains. On December 30, 2021, an unprecedented wildfire broke out in suburban Boulder, Colorado, spreading with devastating speed and destroying more than 1,000 structures. These events demonstrate the level of absolute wildfire risk in the western United States. And accordingly, the wildfire risk in SCE's service area is beyond what can be mitigated and addressed in a single GRC cycle. Given finite resources and other constraints, SCE uses a risk-prioritization methodology to sequence the deployment of mitigations in the riskiest parts of its service area, as defined by the Commission's HFTD maps. Our risk prioritization methodology helps us determine the relative ranking of locations from a risk perspective, to help prioritize work in the very riskiest areas using the most effective and expeditious mitigations.

To address the unacceptable level of absolute risk facing our customers and communities associated with wildfires, beginning in 2018 SCE initiated an ambitious plan to significantly and materially harden our overhead electrical infrastructure to reduce ignitions associated with that infrastructure. Those efforts – largely effectuated through SCE's Wildfire Covered Conductor Program (WCCP) – focused on replacing existing overhead bare wires with wires covered by insulating materials, also known as "covered conductor." In Tracks 1 and 4 of SCE's 2021 GRC, SCE established a plan to install covered conductor on ~6,200 circuit miles of overhead distribution lines through 2024. SCE is effectively executing on that plan, and SCE's covered conductor installations to date have materially reduced ignition risk across the HFRA. However, as discussed further below, the circuit-by-circuit analysis that led to SCE's IWMS demonstrates that substantial and unacceptable ignition risk remains on portions of the HFRA that will not have been hardened as part of this effort.

(2) Overview of IWMS

IWMS is SCE's holistic approach to developing portfolios of effective and complementary mitigations and deploying them in a manner that focuses on the areas of greatest risk. IWMS incorporates additional factors not currently present in the MARS Framework (e.g., CEFC, extremely high windspeeds, and analysis of local conditions based on inspection photographs and/or satellite imagery), which help augment SCE's analysis of risk impacts from these factors at local levels. By following its IWMS, SCE has a more complete depiction of the full impacts of a wildfire in certain locations and thus can better prioritize and scope mitigations to areas where ignitions can have the greatest impact.

The first stage (Initial Risk Categorization) of IWMS is to categorize all of SCE's overhead distribution circuit segments in HFRA into one of three tranches utilizing various data sources and fire science: Severe Risk Area, High Consequence Area, and Other HFRA.

The next stage (Review and Revise) involves a team of SMEs from SCE's Wildfire Safety, Fire Science, Enterprise Risk Management, and Engineering groups reviewing, refining, and revising the initial output from the previous step using inspection photographs, satellite imagery, maps, and other data sources to consider local conditions and features that may alter the initial designation.

After each overhead distribution circuit segment has a risk tranche designation, SCE assigns to it the corresponding portfolio of mitigations. For each risk tranche, SCE has determined a portfolio of complementary mitigations appropriate for its risk level. In Severe Risk Areas, the threat to lives and property is elevated to such an extent that SCE has determined that for public safety reasons it is prudent to not just significantly reduce ignition risk expeditiously but minimize it in the long term to the extent practicable. In High Consequence Areas, SCE's strategy focuses on mitigating the majority of significant ignition risk drivers. In Other HFRA, SCE will replace retired or damaged bare wires naturally over time with covered conductor and continue mitigations that have relatively low incremental costs or are dictated by compliance requirements or local conditions. During the Review and Revise stage, the team of SMEs will make individualized adjustments to portfolios for specific segments if local conditions favor doing so.

Mitigations for each portfolio are selected based on a variety of factors, including effectiveness, risk drivers they mitigate, cost, and time to deploy. SCE uses the MARS

Framework to help it compare mitigations and alternatives to each ignition driver and sub-driver on the basis of risk reduction and cost effectiveness.

Some mitigations are deployed only where certain conditions exist, such as tree attachment removals or Long Span Initiative (LSI) remediations.[24] Other mitigations, such as undergrounding, require a separate feasibility review, which is conducted by a team of planners and engineers. This feasibility review considers issues impacting constructability, such as local terrain and accessibility. If a mitigation is found to be infeasible, the Review and Revise team will recommend an alternative mitigation taking into account local conditions.

Once segments are assigned a portfolio of mitigations, the deployment of each individual mitigation is prioritized using a combination of risk and operational factors. Generally, mitigations do not have to be prioritized against each other, as they utilize different resources (e.g., hardening uses different resources than inspections, which use different resources than vegetation management) or have different timelines that can run in parallel (e.g., TUG and CC projects have long timelines and SCE can deploy other projects concurrently, such as fast-acting fuses or Fast Curve-capable hardware). Figure II-3 illustrates how the key steps of the IWMS Risk Framework.

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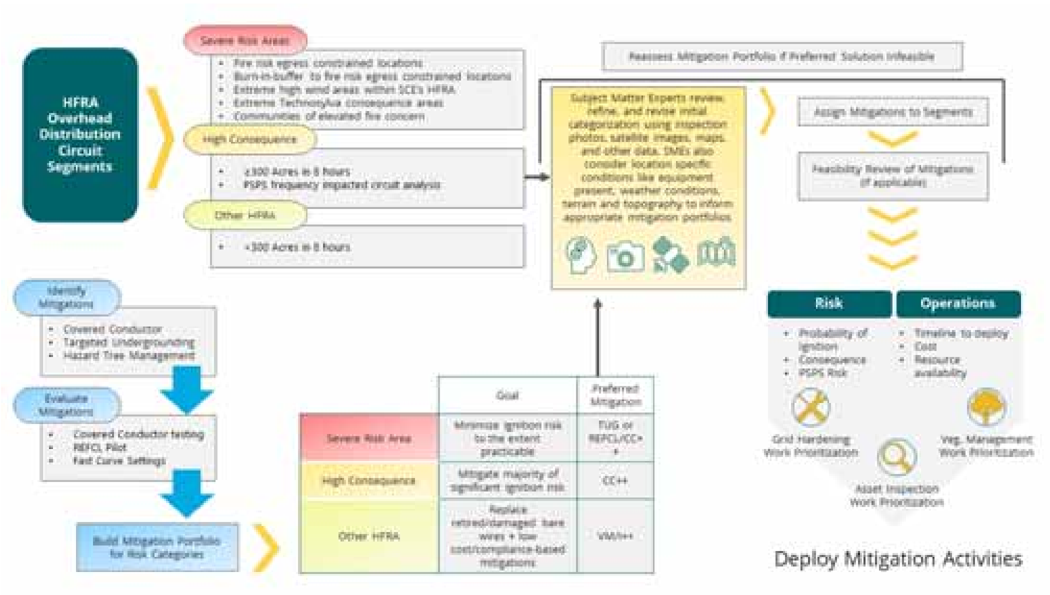
[24] Tree attachment removals involve transferring electrical equipment from a live tree to an SCE pole to reduce wildfire risks. LSI remediation involves installing line spacers on segments that are at heightened risk of wire-to-wire contact. SCE can implement this remediation relatively quickly, making it an effective interim mitigation option to reduce risk on overhead lines that are especially subject to this risk driver.

Figure II-3
IWMS Schematic



(3) Expansion of IWMS to Additional Mitigations

In 2022, SCE started using the IWMS Risk Framework to prioritize mitigation selection and scope for grid hardening activities, inspection programs, and vegetation management activities. Due to the long lead time for planning and construction for covered conductor and undergrounding, the earliest that these mitigations scoped with the IWMS Risk Framework will be placed in-service is 2023.

In early 2022, SCE reviewed in-flight covered conductor scope for 2022 and 2023 that was still in earlier stages for alignment to the IWMS Risk Framework. Based on those reviews, SCE made decisions to either continue the mitigation as-is, target for higher risk mitigation activity, or stop scope completely.

SCE also evaluated the alignment of IWMS with the High-Fire Risk Informed (HFRI) detailed inspection scope strategy and has prioritized structures in Severe Risk Areas and High Consequence Areas to be inspected more frequently starting with 2023 inspections.

Similar alignment was also assessed in 2022 for vegetation management program strategy, such as with the Heavy Tree Mitigation Program (HTMP), where the risk methodology utilized assigned vegetation grids that had higher proportions in Severe Risk Areas to be placed on annual inspection cycles starting in 2023.

(4) IWMS Risk Assessment Stages

The risk assessment portion of the IWMS features two major stages (Initial Risk Categorization and then Review & Revision) which are described in more detail below.

(a) Stage 1: Initial Risk Categorization

The first stage of IWMS uses quantitative risk analysis that incorporates several factors to deliver an initial output that categorizes all of SCE's HFRA circuit segments into risk tranches defined as Severe Risk Areas, High Consequence Areas, and Other HFRA.

- **Severe Risk Areas (SRA)** are locations that are characterized by elevated population risk factors such as heightened egress risk, significant wildfire risk, communities of elevated fire concern, and/or heightened risk of high wind events.
- **High Consequence Areas (HCA)** are segments where simulated fires exceed 300 acres in eight hours and do not have the same level of population risk as the Severe Risk Areas.
- **Other HFRA** encompasses locations within HFRA that do not meet either of the previous criteria.

A detailed description of these three risk tranches, including all factors currently used, is provided below.

(i) Severe Risk Areas

The CPUC has already defined[25] all areas in HFTD as inherently being at elevated or extreme risk of wildfire. SCE has determined a subset of those regions are "Severe Risk Areas" as they have attributes that further elevate the risk levels to populations residing, working in, or visiting these locations.

SCE uses the following four criteria to determine Severe Risk Areas:

1. Population egress constraints, high fire frequency, and burn-in buffer into egress locations.

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[25] D.17-12-024, Decision Adopting Regulations to Enhance Fire Safety in the High Fire-Threat District (Dec. 21, 2017).

2. Significant fire consequence – Acres burned consequence greater than 10,000 over an 8-hour unsuppressed model simulation.
3. High winds – Locations, which if fully covered with covered conductor, would still be subject to high PSPS likelihood.
4. Communities of Elevated Fire Concern (CEFCs) – Smaller geographic areas where terrain, construction, and other factors could lead to smaller, fast-moving fires threatening populated locations under benign (normal) weather conditions.

SCE notes that a circuit mile may meet multiple SRA criteria.

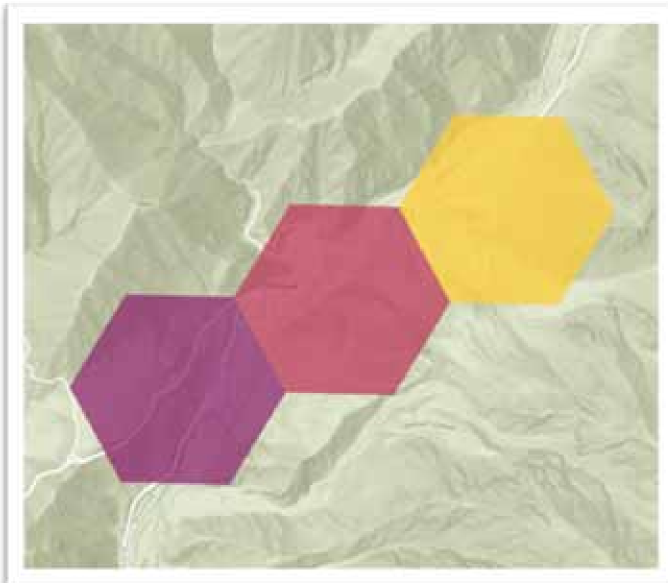
a. <u>SRA Criteria #1: Egress Constraints, High Fire Frequency & Burn-In Buffer</u>

This criterion includes five steps:

1. Divide SCE's HFRA into equally sized polygons.
2. Identify egress-constrained locations.
3. Determine locations that have experienced high fire frequency historically.
4. Overlay the egress-constrained locations with historical high fire frequency locations to determine Fire Risk Egress Constrained Areas.
5. Add a burn-in buffer to Fire Risk Egress Constrained Areas.

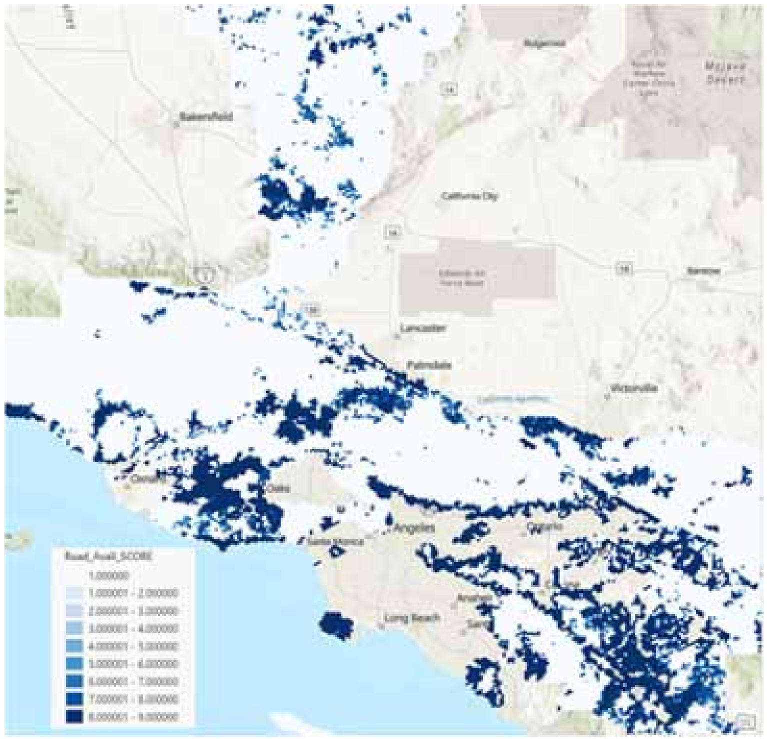
SCE divided its service area into hexagons approximately 214 acres in size. SCE used hexagons because the distance from the center of a hexagon to all adjacent hexagons is the same distance (1,000 meters) and it enabled SCE to compare variables across similar-sized polygons as shown in Figure II-4.

Figure II-4
Polygon Assignment



SCE determined which hexagons in its HFRA have substantial road availability concerns using a ratio of roads to population in each hexagon. A lower score indicates fewer miles of roads available per person in a given hexagon, creating a potential egress concern should everyone in the polygon need to evacuate the area simultaneously as shown in Figure II-5.

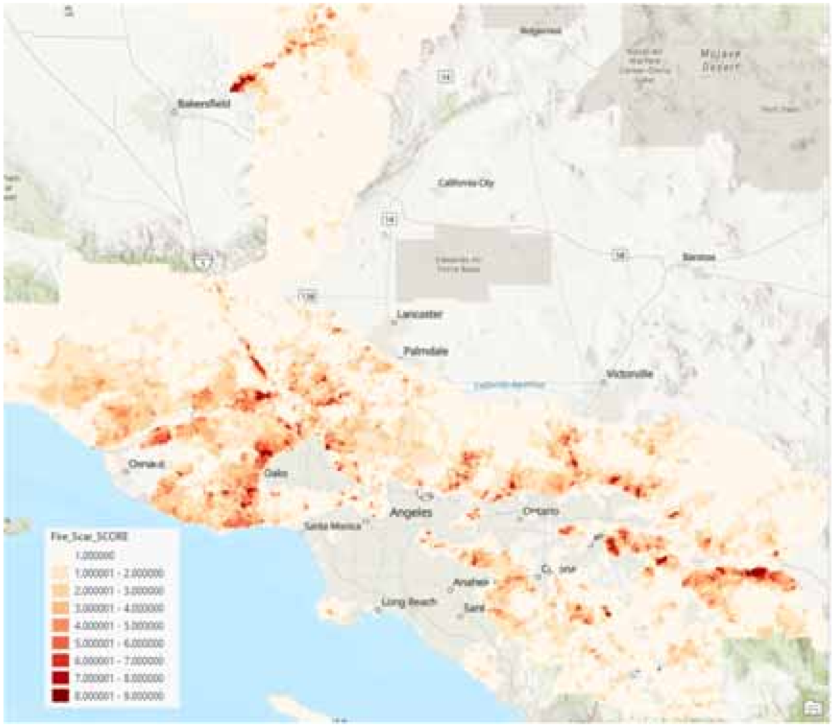
Figure II-5
Identify Egress-Constrained Areas



SCE determined the hexagons in its HFRA that have a high frequency of historical fires as shown in Figure II-6, using fire scars, from 1970 to 2020.[26] A higher score indicates a higher likelihood that a given hexagon will burn, meaning fires either originated from or travel into these hexagons.

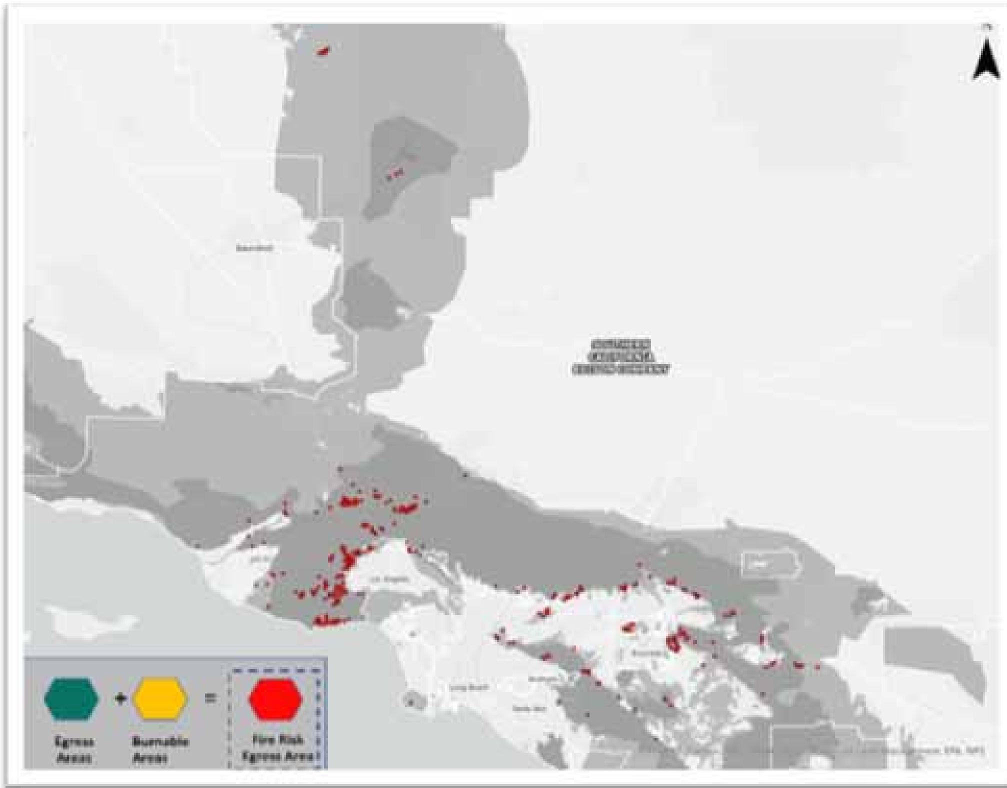
[26] Data from CalFire FRAP database.

Figure II-6
Identify Areas with a High Frequency of Fires



SCE then overlaid the egress-constrained areas with regions that have a high historical fire frequency. SCE flagged hexagons with both limited road availability and a high burn frequency as potential Fire Risk Egress Constrained Areas, as shown in Figure II-7.

Figure II-7
Overlay Areas with a High Frequency of Fires with Egress-Constrained Areas



Next, utilizing Technosylva ignition simulation data, SCE determined which of SCE's overhead structures could result in fires burning into Fire Risk Egress Constrained Areas. SCE performed a calculation to identify which structures could potentially result in a fire trapping the public.

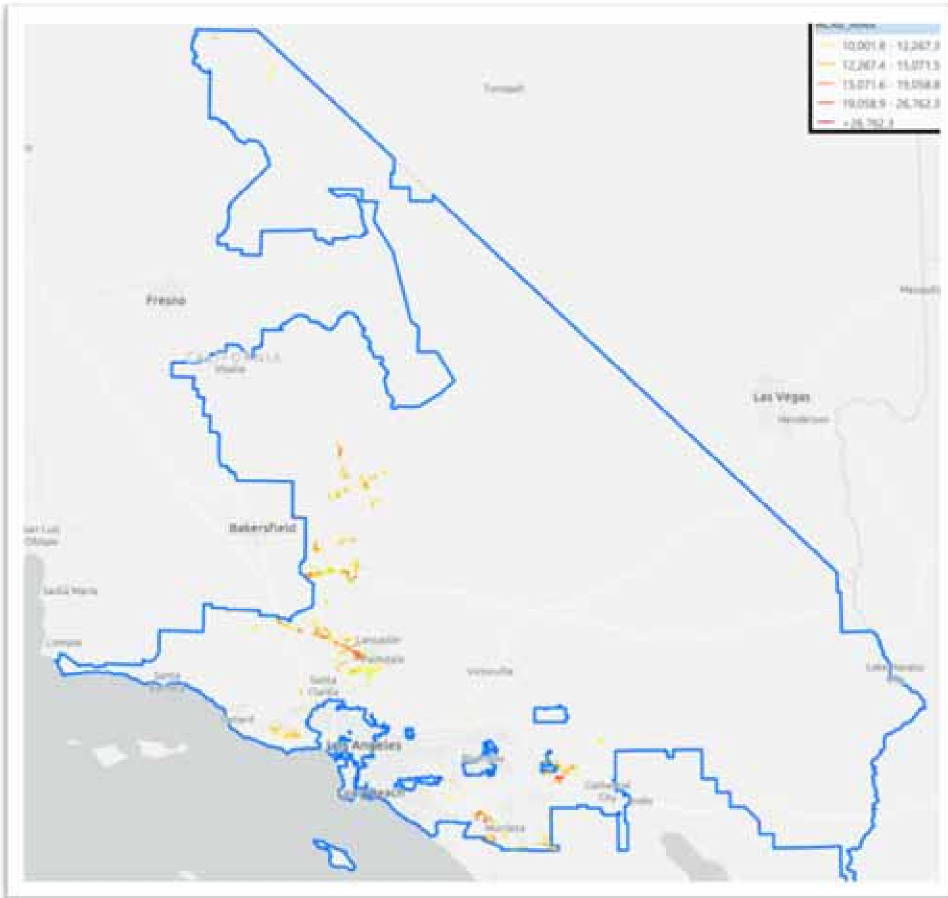
Figure II-8
Delineate Burn in Buffer

Below are the steps to calculate the "Burn in Buffer" as shown in Figure II-8.

1. Identify all structures within 25 miles of a Fire Risk Egress Constrained Area.
2. Calculate the time needed for the population to exit the polygon using population size, travel speed, and distance to safety.
3. Considering terrain and other factors, calculate the distance the fire could travel from each SCE distribution overhead structure within 25 miles, in the time needed to evacuate the Fire Risk Egress Constrained Area.
4. Flag the structure as a potential burn in buffer structure if the fire originating there could enter the Fire Risk Egress Constrained Area.
5. Assess identified locations to determine if the fire will actually burn into a Fire Risk Egress Constrained Area, when accounting for wind direction, topography, and physical barriers (e.g., lakes).

b. SRA Criteria #2: Significant Fire Consequence

Figure II-9
Identify Areas with Exceptionally High Technosylva Consequence Scores



To estimate the consequence of an ignition, SCE leverages the fire propagation algorithm within the Technosylva consequence module, as shown in Figure II-9, to estimate the natural unit consequences (e.g., acres burned, structure burned, and population impacted) from individual ignition simulations for eight hours along SCE's overhead assets within HFRA.[27] Analysis of recent fires in California regardless of cause between 2018 and 2022 shows

[27] In 2021 SCE updated this consequence model to include additional historical weather scenarios and incorporated the most up-to-date fuel information, including the recent burn scars. To account for a wide range of historical climate scenarios, SCE uses 444 weather scenarios across a 20-year historical climatology in its consequence model. By using a wide range of models, SCE can determine the relative risk of wildfire consequence for each location under the maximum likely weather conditions, based on a historic climatology for any given location.

that 70% of fires that burn over 10,000 acres in the first eight hours ultimately burned more than 50,000 acres, and 35% of fires that burn over 10,000 acres in the first eight hours ultimately burned more than 100,000 acres.[28] According to the California Department of Forestry and Fire Protection, the number of acres burned in the top 20 largest wildfires in California ranges from approximately 177,000 to 1,000,000 acres.[29] To prevent a fire from becoming the next largest fire, SCE identified segments in its HFRA as Severe Risk Areas if it has a consequence score of 10,000 or more acres burned at eight hours and proposed to use its most effective mitigation which is undergrounding to combat this risk in these areas.

c. SRA Criteria #3: High Wind Locations

SCE examined historical wind data from 2017 to determine which areas, as shown in Figure II-10, have experienced high sustained wind speeds above 40 mph and wind gusts above 58 mph (current PSPS[30] de-energization threshold for fully covered isolatable conductor segments).[31] SCE identified a number of miles in its HFRA that have frequently experienced extremely high winds. This means that even if these areas are equipped with covered conductor, the likelihood of continued PSPS events occurring is still high.

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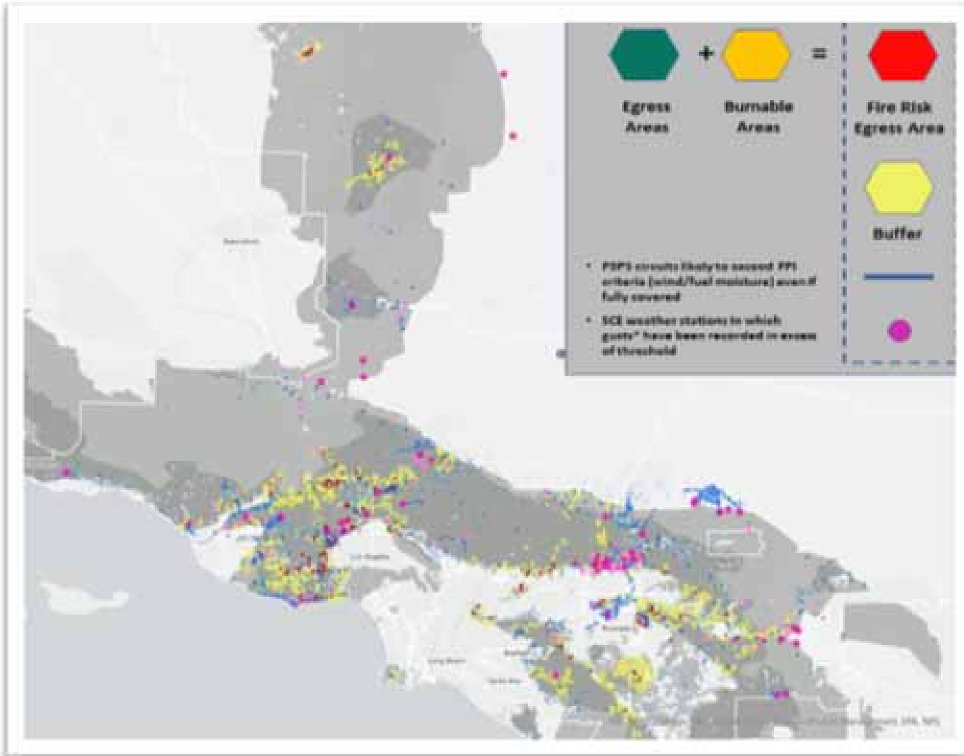
28 SCE used the following link, https://www.simtable.com/apps/fireProgression/, to analyze actual fires that occurred in California regardless of cause between 2018 to 2022. SCE estimates the fire size at 8 hours and compared it to the final fire size. Fourteen of the 20 fires (or 70% of these fires) that burn over 10,000 acres in the first eight hours burned over 50,000 acres in the end. Or seven of the 20 fires (or 35% of these fires) that burn over 10,000 acres in the first eight hours burned over 100,000 acres in the end.

29 *See* https://www.fire.ca.gov/media/4jandlhh/top20_acres.pdf.

30 When there are potentially dangerous weather conditions in fire-prone areas, SCE may temporarily shut off power in these areas to prevent our electric system from becoming the source of ignition. These outages are called Public Safety Power Shutoffs (PSPS).

31 This may change as SCE modifies thresholds based on further analyses and data over time.

Figure II-10
Identify Areas with Extremely High Wind Speeds



d. <u>SRA Criteria #4: Communities of Elevated Fire Concern (CEFC)[32]</u>

In 2022, based on recorded fires and lessons learned, SCE identified Communities of Elevated Fire Concern (CEFCs). CEFCs are smaller geographic areas where terrain and other factors could lead to smaller, fast-moving fires threatening populated locations under benign (normal) weather conditions. Examples of these types of communities are those on the edge of a hill, where if an ignition were to occur downhill from that community, the ignition could immediately impact those population centers, even under low to no wind conditions. CEFCs are communities that meet the following criteria: (1) communities/subdivisions situated on hilltops with powerlines located in valleys below where fires could run uphill, impacting the local region; and (2)

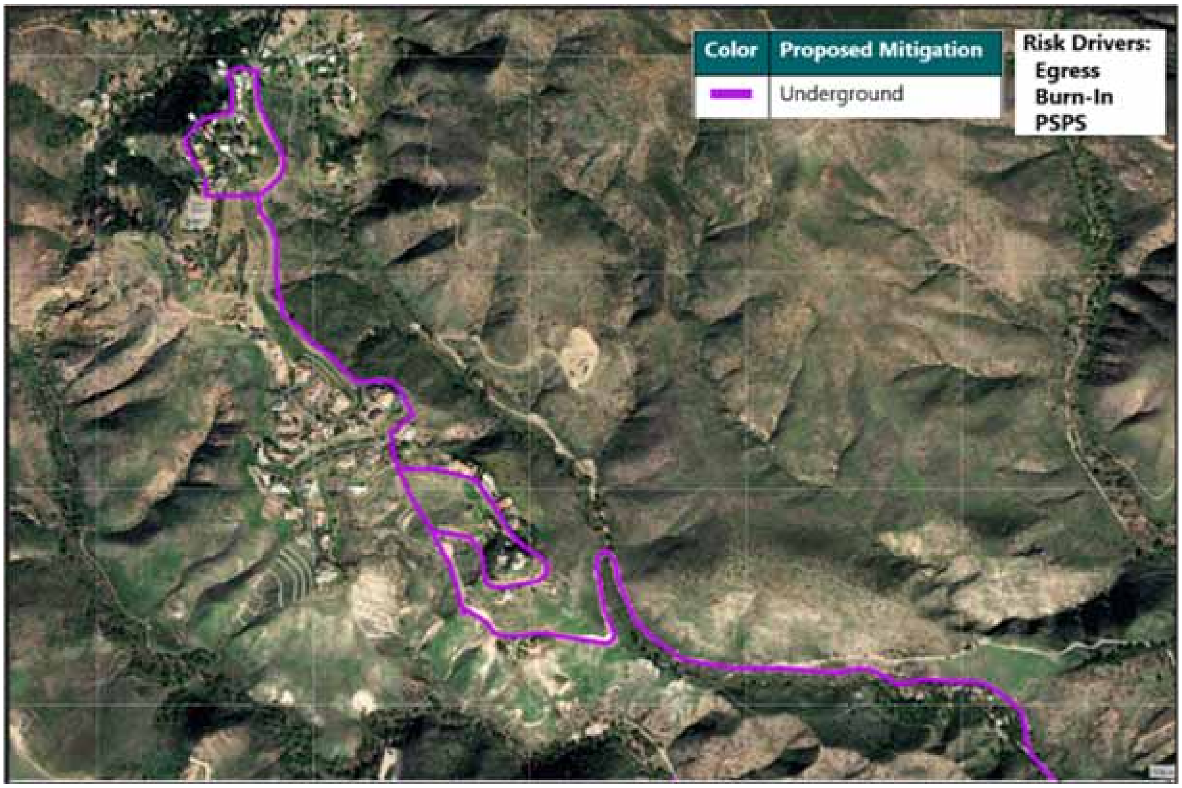
[32] CEFCs is a new risk sub-category that was added to Severe Risk Areas after SCE has filed its approved 2022 WMP and pending 2022 RAMP. Some of the CEFC miles overlapped with the other 3 risk sub-categories. That is, some of the CEFC miles are already classified as either in egress/burn-in, 10,000+ acres burned, or high wind. The inclusion of CEFCs essentially added 615 unique miles to the Severe Risk Areas.

rural communities in locations with limited escape routes that could become encapsulated by fire and thus trap residents. SCE's fire science team reviewed SCE's service area and identified the CEFCs, which were then reviewed by SCE SMEs and modified based on known local fuel conditions. Given that fires in CEFCs can result in devastating impacts to SCE's customers, SCE is adding these locations to its Severe Risk Areas. The number of miles in Severe Risk Areas is 2,950. Figure II-11 illustrates a CEFC, showing a subdivision on multiple hilltops surrounded by dense vegetation. Fires that start in the canyons will burn rapidly uphill towards populated areas.

Figure II-11
Communities of Elevated Fire Concern

Figure II-12 below shows an example of a Severe Risk Area in Los Angeles County. This isolated community is faced with egress/burn-in and PSPS risks. If a fire were to occur in this area or locations nearby, the customers may not have sufficient time to evacuate. Furthermore, customers may continue to experience extremely high wind events, which may be subject to proactive power outages as wind speeds will likely exceed even covered conductor wind speed thresholds.

Figure II-12
Example of a Community Facing Egress/Burn-in and PSPS Risks



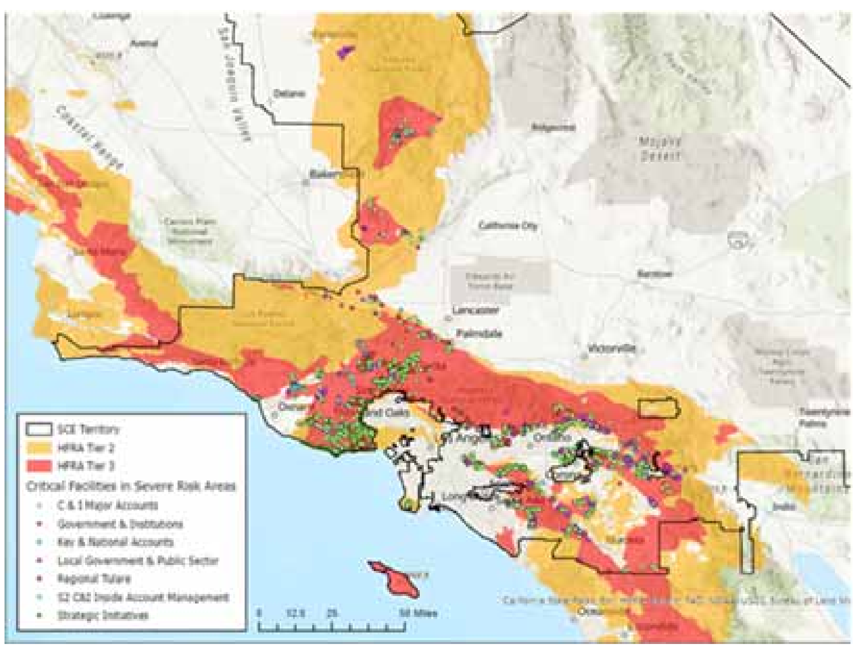
As noted above and shown below in Table II-4, there are 2,950 total miles in Severe Risk Areas. A significant portion of the unhardened miles by the end of 2022 form the basis of SCE's TUG forecast scope of work in 2023-2028. As described above, the evolution of SCE's risk methodology in the past two years identified these miles as being in areas where risk must be reduced to the extent practicable. The remaining miles in Severe Risk Areas will be considered for covered conductor or other alternative mitigation if TUG is deemed infeasible.

Table II-4
Total Miles in Severe Risk Areas

Severe Risk Areas	Total Miles
Egress-Constrained + Burn-in Buffer	1,284
10,000+ Acres Burned at 8 hours	749
Extreme Wind Areas (Frequent PSPS)	302
Communities of Elevated Fire Concern (CEFCs)	615
Total Miles	**2,950**

In addition to the consequence risks shown in the four criteria that define the Severe Risk Areas above, there are other tangible consequences associated with these Severe Risk Areas in which SCE deems as the absolute risks. Particularly, there are a significant number of homes and businesses, critical care customers, and critical infrastructure located in these areas (see Figure II-13). Many customers who live in these high wildfire risk areas are also the constituencies that the Commission and SCE are proactively trying to assist with various customer care programs.

Figure II-13
Locations of Critical Facilities in Severe Risk Areas



(ii) High Consequence Areas

SCE uses the following three criteria to determine High Consequence Areas:

1. Not identified in meeting Severe Risk Area criteria.
2. Destructive fire consequence – Acres burned consequence between 300 and 10,000 after an 8-hour unsuppressed model simulation.
3. Locations subject to PSPS events due to high winds in which covered conductor has not been fully deployed.

a. Destructive Fire Consequence

SCE has identified additional locations where a wildfire can propagate over large areas (between 300 and 10,000 acres) in a relatively short period of time and/or have the potential to be frequently impacted by PSPS. SCE has categorized these as "High Consequence Areas."

SCE determined an ignition that can become a 300-acre-or-greater sized fire within the first eight hours has a high probability of eventually becoming very large, thereby posing significant risks to life, health and property. SCE provides further explanation for this threshold below. SCE selected the 300 acres burned and 10,000 acres burned thresholds at 8-hours as the lower and upper limits for High Consequence Areas based on the following analysis.

As indicated in Table II-5, number of acres burned is a reasonable and reliable correlated proxy for buildings destroyed:

Table II-5
2015-2019 Fire Size and Buildings Destroyed

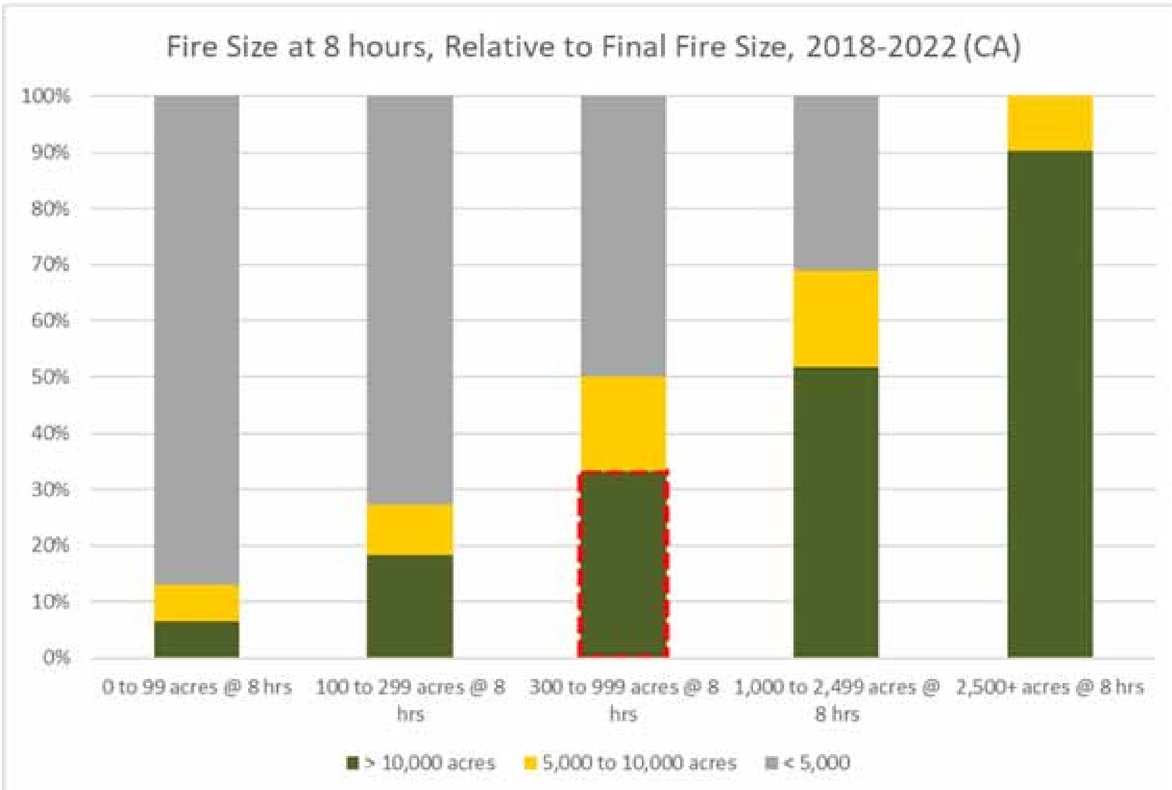
Final Fire Size (Acres)	Average Buildings Destroyed
300-1k	~2
1k-5k	~7
5k-10k	~15
10k-50k	~200
50k+	~1,250

A fire of 10,000 acres or more destroys approximately 200 buildings, on average.

As indicated in Figure II-14 below, of the fires that had burned between 300 and 999 acres after 8 hours, 33% eventually burned more than 10,000 acres. In contrast, fires that burned less than 300 acres after 8 hours are much less likely to eventually burn more than 10,000 acres. Of the fires that burned less than 300 acres, only 10% eventually burned more than 10,000 acres. Based on this analysis, SCE selected 300 acres as the lower threshold for modeled fire consequence for High Consequence Areas.[33]

[33] Similarly, if we were to use the definition of catastrophic wildfires as defined by OEIS (>5,000 acres), 64 of the 96 (or 67%) catastrophic fires started with a 300-9,999 acre burn at 8 hours.

Figure II-14
Fire Size at 8 Hours Relative to Final Fire Size



b. <u>High Winds</u>

SCE also conducts an analysis each year that identified circuits that have experienced or are expected to experience high customer minutes of interruption from PSPS de-energizations due to high wind speeds absent appropriate grid hardening. SCE has included those circuits that meet the criteria described above but were not already identified as Severe Risk Areas. The number of miles in High Consequence Area is 4,400.

(iii) <u>Other HFRA</u>

SCE defines "Other HFRA" as areas that are located in SCE's HFRA that are neither Severe Risk nor High Consequence but are identified by the Commission as areas of "extreme" and "elevated" wildfire risk in the current CPUC Fire Threat Map (See Section 6.1.4.2).

These locations are still subject to regulatory and compliance requirements for enhanced mitigation activity, such as increased inspections and/or vegetation management, and will be hardened over time as SCE replaces existing infrastructure, etc. The number of miles in Other HFRA is 2,250.

(iv) Summary of IWMS Risk Tranches

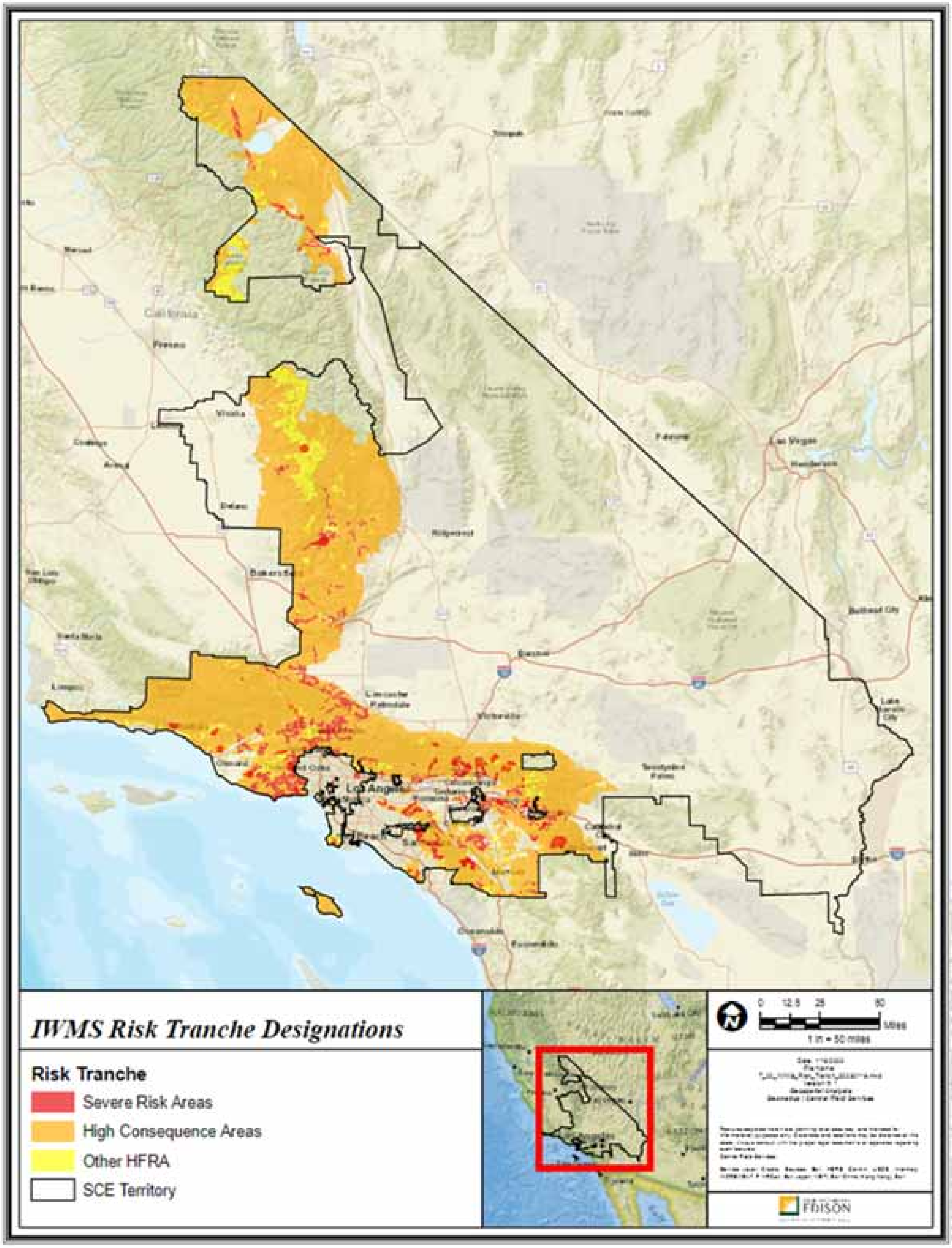
Table II-6 below summarizes the risk characteristics of each risk tranche.

Table II-6
IWMS Risk Framework Risk Tranches (Mutually Exclusive)

Severe Risk Area Criteria
o Population egress, high fire frequency location, and burn-in buffer into egress locations. o Significant fire consequence – Acres burned consequence greater than 10,000 over an 8-hour unsuppressed model simulation. o High winds – Locations, which if fully covered with covered conductor, would still be subject to high PSPS likelihood. o Communities of Elevated Fire Concern (CEFCs) – smaller geographic areas where terrain and other factors could lead to smaller, fast-moving fires threatening populated locations under benign (normal) weather conditions.
High Consequence Area Criteria
o Not identified in meeting Severe Risk Area criteria. o Destructive fire consequence – Acres burned consequence between 300 and 10,000 over an 8-hour unsuppressed model simulation. o Locations subject to PSPS events in which covered conductor has not been fully deployed.
Other HFRA Criteria
o Not identified in meeting Severe Risk Area or High Consequence criteria. o Small fire consequence - Acres burned consequence less than 300 over an 8-hour unsuppressed model simulation.

The following map, as shown in Figure II-15, illustrates the locations of the Severe Risk, High Consequence, and Other HFRA areas.

Figure II-15
IWMS Risk Tranche Designations[34]



(b) Stage 2: Review & Revise

With exception of CEFC identification, the first stage of IWMS is automated and reliant upon the completeness, granularity, and accuracy of data sources. While valuable as a directional starting point, the judgment of subject matter experts (SME) is needed to evaluate the results of the risk analysis.

Accordingly, SCE performs further due diligence by reviewing the output using SCE's inspection photos, geographic information system (GIS), and Google Maps or Street Views with subject matter experts such as engineers and fire science specialists. These deep dives allow SCE's employees to virtually "walk the line" to determine whether a segment is appropriately categorized.

This stage of the IWMS is time-consuming and labor intensive, as SCE personnel review hundreds of circuit miles of overhead distribution lines. SCE has already started scoping mitigations for areas that have undergone Review & Revise and expects to complete this stage for all HFRA by the first quarter of 2024.

During these reviews, SCE looks for the presence of risk drivers, including but not limited to, heavy trees, long span, local fuel regime, prevailing wind direction and intensity, topography (slope and terrain complexity), local fire ecology, local road accessibility, and existing mitigations (e.g., covered conductor). SCE then makes the determination to either keep the designation as prescribed by the model or recommend an alternate designation as appropriate.

Figure II-16 shows one of many Google Maps screenshots of one location that SMEs reviewed, where there is a 100% match between the model and detailed SME review. This location was identified a Severe Risk Area due to the exceptionally high Technosylva wildfire consequence. A fire starting in this location has the potential to grow larger than 10,000 acres in size in the first eight hours. SME review confirmed the location of the overhead lines in relation to the dry, heavy vegetation in the area, topography, and potential winds could lead to a fire of this size.

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[34] Map as of January 18, 2023.

Figure II-16
Photo of Location Confirms Severe Risk Area Designation

Figure II-17 below shows an example of a deviation between the initial output (left picture) and detailed SME review (right picture). The initial output flagged these circuit segments as Severe Risk Areas because they fit the criteria of egress constrained and burn-in buffer.

However, during SME review, it became apparent that the overhead lines mainly run over dirt, roads, and light brush and relatively fewer structures in the area would be threatened by a wildfire. Taking into consideration other factors, including the fact that the Technosylva estimate for acres burned in 8-hours for this segment of overhead distribution wire was 1,424, the recommendation from the detailed SME review for this location was to convert the designation to High Consequence. Figure II-18 shows one of many Google Maps screenshots of the location that SMEs reviewed, confirming the need to convert the designation from Severe Risk Area to High Consequence Area.[35]

[35] Figure II-18 is a screenshot of the location marked with a teal circle in Figure II-17.

Figure II-17
Example of a Deviation Between Risk Model and SME Review

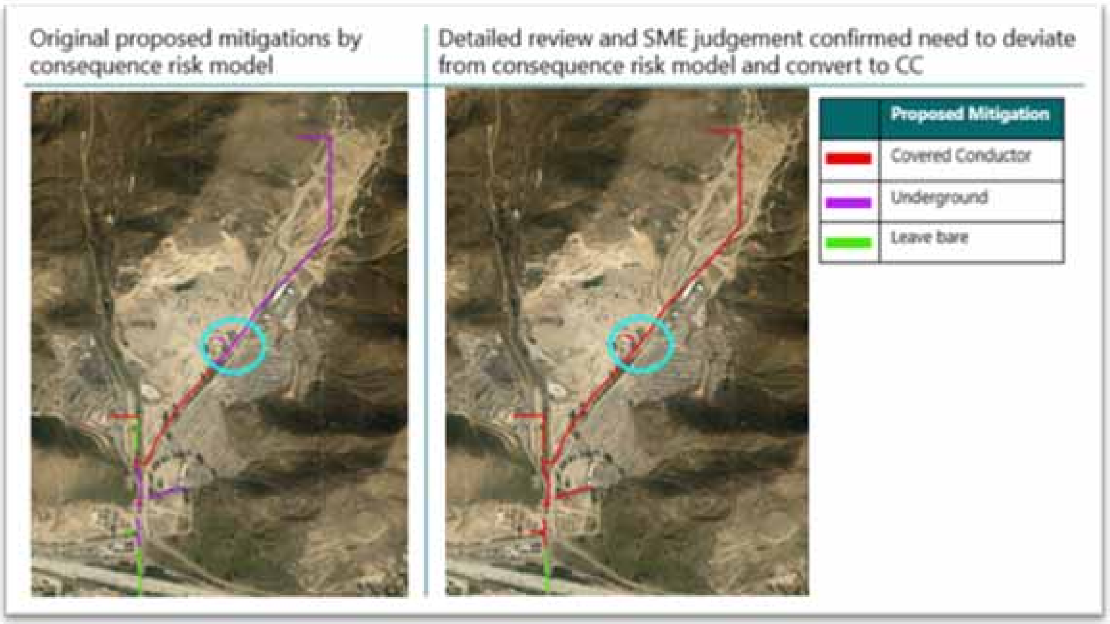


Figure II-18
Photo of Location Confirms Need to Convert Designation from Severe Risk to High Consequence

Based on the results of the IWMS Review and Revise stage, SCE selects the appropriate mitigation(s) to deploy to each area. Table II-7 shows the scope planned for grid hardening work between 2025-2028.

Table II-7
Planned Grid Hardening Scope from 2025-2028

IWMS Risk Tranche	Approximate Circuit Miles	Expected to be Hardened by end of 2024	Planned to Harden with CC + TUG from 2025-2028	To Be Addressed as Applicable
Severe Risk Areas	2,950	2,398	552	-
High Consequence Areas	4,400	4,081	319	-
Other HFRA	2,250	367	959	924
Total	**9,600**	**6,846**	**1,830**	**924**

(5) Mitigation Selection

SCE utilized the decision tree in Figure II-19 below to determine the appropriate mitigation strategy for each circuit segment location, which informed this GRC's proposed scope. Per the decision tree, if the circuit segments are located in a Severe Risk Area and are not already hardened, then SCE determines whether it is feasible to underground. If feasible, SCE will underground those segments.[36] Similar to the operational buffer adopted for WCCP in SCE's 2021 GRC Track 1 Final Decision, the final scope for undergrounding will also include any miles necessary to account for operational realities.[37] If not, SCE will harden with covered conductor and perform additional mitigations, such as asset and vegetation management (*e.g.*, CC++).[38] For segments already hardened that are in Severe Risk Areas, SCE will add additional mitigations. If the circuit segments are not in Severe Risk Areas but are in High Consequence Segments, and are also not already hardened, SCE will install covered conductor. All segments in this case will also receive additional mitigations (*e.g.*, CC++). If circuit segments are not located in a Severe Risk Area or do not meet the High Consequence criteria, then they are considered as "Other HFRA" and will be hardened over time through other replacement programs (including storm rebuilding work as necessary) since the standard in HFRA is covered conductor.

Under this integrated wildfire mitigation strategy, SCE proposes to harden a total of approximately 4,261 circuit miles (i.e., 2,431 miles in 2023 – 2024 and 1,830 miles in 2025 –

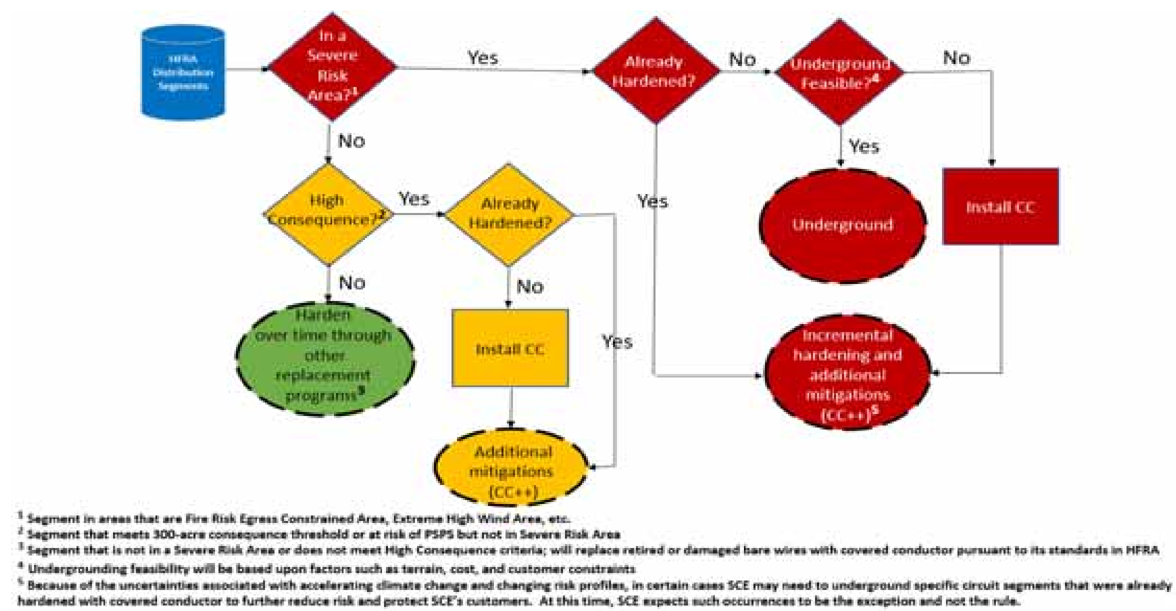
[36] *See* SCE-04, Vol. 05, Part 2. The final selection of underground scope is determined through a feasibility analysis to determine the level of difficulty.

[37] Undergrounding lines often requires re-routing that results in more circuit miles constructed than if the structures were left overhead.

[38] *See* Section II.A.4.c)(6) of this volume for a definition of CC++.

2028) of riskiest areas in the 2023-2028 period for the reasons stated above. Specifically, for 2025-2028, SCE proposes to install 1,250 circuit miles of covered conductor, 580 circuit miles of undergrounding, and various other grid hardening activities that would address risks in the Severe Risk Areas, High Consequence Areas, and some Other HFRA to account for buffer miles. Given the ignition risk associated with secondary conductor, the scope of TUG has been expanded to include not only the primary conductor but also secondaries and services, if needed.[39] Where applicable, SCE will remove overhead electrical conductor and wires to virtually eliminate the risk of overhead equipment failure and contact-from-object-related faults/ignitions.[40]

Figure II-19
Decision Tree for Evaluating Undergrounding and other Mitigations



(6) <u>Mitigations Identification</u>

SCE designs portfolios of complementary mitigations tailored to each of the three risk tranches. These include the following:

- TUG: This portfolio is anchored on the undergrounding of overhead lines to mitigate all risk drivers to the extent reasonably possible.

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39 *See* SCE-04, Vol. 05, Part 2.

40 Underground electric services will still have some above-ground equipment, such as pad-mount transformers. As such, some residual risks still remain with undergrounding, but it significantly reduces the risk for these Severe Risk Areas.

- REFCL/CC++: Similar to TUG, this portfolio targeted to SRA to also mitigate all risk drivers to the extent reasonably possible, particularly when the locations are not conducive to undergrounding. REFCL/CC++ includes covered conductor, fast curve, vegetation management, and fusing to address contact from object; REFCL, asset inspections, and covered conductor to address equipment failure; and covered conductor to address wire to wire contact.
- CC++: This portfolio is targeted to High Consequence areas and is anchored on installing covered conductor to address all significant ignition risk drivers associated with overhead conductor.
- VM/I++: This portfolio continues wildfire mitigation initiatives such as asset inspections, Fast Curve settings, and vegetation management that have relatively low incremental costs or are dictated by compliance requirements or local conditions. Additionally, the deployment of technology like EFD may provide some monitoring benefit on these unmitigated aging assets (e.g., detect issues on the electric line before failure). Accordingly, Other HFRAs are targeted for the VM/I++ portfolio of mitigations.
- TVM/I: Similar to SCE's overhead distribution lines, SCE's overhead transmission lines traverse Severe Risk Areas, High Consequence Areas and Other HFRAs. However, due to taller structures and greater space between phases, SCE's transmission lines generally have a lower risk of ignition than its overhead distribution lines and thus have its own portfolio of mitigations assigned to it, TVM/I. This portfolio includes inspections, vegetation managements, emerging technologies, and other programs. SCE will perform additional review and analysis of possible mitigations for transmission lines in 2023 beyond what is currently included in the TVM/I portfolio.

Table II-8 below summarizes the components of each portfolio and potential alternatives for each mitigation.

Table II-8
Mitigation Portfolios

Mitigation	Portfolio Including Mitigation
Covered Conductor	CC++, REFCL/CC++
Undergrounding Overhead Conductor	TUG
Branch Line Protection Strategy	TUG, CC++, REFCL/CC++, VM/I++
Remote Controlled Automatic Reclosers Settings Update	TUG, CC++, REFCL/CC++, VM/I++
Circuit Breaker Relay Hardware for Fast Curve	TUG, CC++, REFCL/CC++, VM/I++
Transmission Open Phase Detection	TVM/I
Tree Attachments Remediation	Deployed to address specific known issue
Long Span Initiative (LSI)	Deployed to address specific known issue
Vertical Switches	Deployed to address specific known issue
Vibration Damper Retrofit	Deployed to address specific known issue
Rapid Earth Fault Current Limiters (REFCL) - Ground Fault Neutralizer	REFCL/CC++
REFCL (Grounding Conversion)	REFCL/CC++
Early Fault Detection	CC++, REFCL/CC++, VM/I++
Distribution High Fire Risk-Informed Inspections & Remediations	TUG, CC++, REFCL/CC++, VM/I++
Transmission Risk-Informed Inspections & Remediations	TVM/I
Infrared of Distribution electrical lines & equipment	TUG, CC++, REFCL/CC++, VM/I++
Infrared of Transmission electrical lines & equipment	TVM/I
Generation High Risk Informed Inspections & Remediations	Legacy facilities only
Transmission Conductor & Splice	TVM/I
Hazard Tree Mitigation Program	TUG, CC++, REFCL/CC++, VM/I++
Structure Brushing	TUG, CC++, REFCL/CC++
Expanded Clearances for Legacy Facilities	Legacy facilities only
Dead and Dying Tree Removal	TUG, CC++, REFCL/CC++, VM/I++
Distribution Line Clearances	TUG, CC++, REFCL/CC++, VM/I++
Transmission Line Clearances	TVM/I

Table II-9
Preferred Mitigation Portfolio per Risk Tranche - Distribution

Risk Tranche	Preferred Mitigation Portfolio
Severe Risk Areas	TUG or REFCL/CC++
High Consequence Areas	CC++
Other HFRA	VM/I++

(a) Severe Risk Areas

For Severe Risk Area locations, the threat to lives and property is elevated to such an extent that SCE has determined that for public safety reasons it is prudent to not just significantly reduce ignition risk expeditiously but minimize it in the long term to the extent practicable. Therefore, undergrounding is preferred unless covered conductor has already been installed or specific terrain or local issues require alternatives such as covered conductor with supplementary mitigations.

For example, mountainous regions with winding rights-of-way and rocky soil may not be conducive to undergrounding. In those situations, SCE would examine alternatives such as covered conductor paired with REFCL. On the other hand, undergrounding may be more feasible in flat areas with silty clay soil, making that the preferred option. Accordingly, Severe Risk Areas are assigned either the portfolio known as TUG or REFCL/CC++.

Due to the potential impacts that a wildfire would have in these areas, when designing REFCL/CC++, SCE looked to mitigate all risk drivers to the extent reasonably possible. This necessarily means some cost-efficient redundancy, which is desirable since no mitigation matches undergrounding on its own. Thus REFCL/CC++ includes covered conductor, fast curve, vegetation management, and fusing to address contact from object; REFCL, asset inspections, and covered conductor to address equipment failure; and covered conductor to address wire to wire contact.

As all options have implementation times of multiple months, up to as much as four years or more, SCE will continue to use initiatives such as Fast Curve (FC) settings, asset inspections on the most frequent basis, and, as a tool of last resort, PSPS to mitigate the risk of ignitions while the selected initiative is designed, permitted, and constructed.

(b) High Consequence Areas

For High Consequence Area locations, SCE's strategy focuses on mitigating the majority of significant ignition risk drivers. SCE has selected CC++ for most of the High Consequence Areas that are still unmitigated, as it addresses all significant ignition risk drivers associated with overhead conductor, reduces more risk per dollar spent, and is faster and easier to deploy.

(c) Other HFRA

For areas classified as Other HFRA, SCE will harden overhead distribution circuits over time, as it replaces retired or damaged bare wires with covered conductor pursuant to its standards in HFRA.[41] SCE will continue wildfire mitigation initiatives such as asset inspections, Fast Curve settings, and vegetation management that have relatively low incremental costs or are dictated by compliance requirements or local conditions. Additionally, the deployment of technology like EFD may provide some monitoring benefit on these unmitigated aging assets (e.g., detect issues on the electric line before failure). Accordingly, Other HFRAs are assigned the VM/I++ portfolio of mitigations.

5. Risk factors, Safety, Reliability and Connection with RAMP

Wildfire is SCE's top public safety risk. In Chapter 4 of SCE's 2022 RAMP report, SCE provided a detailed account of wildfire and PSPS risks, mitigations available to address these risks, and potential portfolios of mitigations to reduce these risks. In SCE's RAMP report, we separately assessed both wildfire and PSPS risk in HFRA. SCE constructed a portfolio of wildfire mitigations to address the components of wildfire and PSPS risks. These mitigations largely focused on reducing the frequency of occurrence for the Drivers of ignitions (left side of the bowtie).[42] The wildfire and PSPS risk mitigations presented in this testimony, as well as the Vegetation Management activities presented in SCE-02, Volume 10, represent SCE's continued efforts to refine and improve upon the portfolio of activities previously presented in SCE's RAMP, WMP, and GRC filings, to most effectively and expeditiously mitigate the wildfire risk. Table II-10 maps the GRC activities presented in this testimony to the corresponding risk mitigation activity presented in SCE's 2022 RAMP report.

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[41] Other HFRA areas are undergoing SME review against initial model output. This review is expected to be completed in Q1 2024.

[42] *See* Chapter 4 of SCE's RAMP report for a detailed discussion of the wildfire risk bowtie and its components.

Table II-10[43]
Wildfire and PSPS Controls, Mitigations and Foundational Activities Included in SCE's 2022 RAMP Filing[44]

RAMP Risk	GRC Activity	GRC Testimony Section	RAMP ID	RAMP Control / Mitigation Name
Wildfire	Grid Hardening	SCE-04 Vol. 05 Part 2	C1	WCCP
Wildfire	Grid Hardening	SCE-04 Vol. 05 Part 2	C1a	FR Poles
Wildfire	Fusing Mitigation	SCE-04 Vol. 05 Part 2	C2	Branch Line (Fuses)
Wildfire	HFRA Sectionalizing Devices	SCE-04 Vol. 05 Part 2	C3	RAR
Wildfire	HFRA Sectionalizing Devices	SCE-04 Vol. 05 Part 2	C4	Circuit Breaker (CB) with Fast Curve Settings
Wildfire	Alternative Technologies	SCE-04 Vol. 05 Part 3	C5	Transmission Open Phase Detection (T-OPD)
Wildfire	Grid Hardening	SCE-04 Vol. 05 Part 2	C6	Tree Attachment Remediation
Wildfire	Grid Hardening	SCE-04 Vol. 05 Part 2	C8	Long Span Initiative
Wildfire	High Fire Inspections and Remediations	SCE-04 Vol. 05 Part 3	C10	Distribution Ground
Wildfire	High Fire Inspections and Remediations	SCE-04 Vol. 05 Part 3	C11	Distribution Aerial
Wildfire	High Fire Inspections and Remediations	SCE-04 Vol. 05 Part 3	C12	Transmission Ground
Wildfire	High Fire Inspections and Remediations	SCE-04 Vol. 05 Part 3	C13	Transmission Aerial
Wildfire	Infrared Inspection Program	SCE-04 Vol. 05 Part 3	C14	Distribution Infrared
Wildfire	Infrared Inspection Program	SCE-04 Vol. 05 Part 3	C15	Transmission Infrared
Wildfire	Wildfire Vegetation Management	SCE-02 Vol. 10	C16	Hazard Tree Mitigation Program
Wildfire	Routine Vegetation Management	SCE-02 Vol. 10	C17	Expanded Pole Brushing
Wildfire	Dead, Dying and Diseased Tree Removal	SCE-02 Vol. 10	C18	Dead and Dying Tree Removal Program
Wildfire	Routine Vegetation Management	SCE-02 Vol. 10	C19	Expanded Line Clearing
Wildfire	Enhanced Situational Awareness	SCE-04 Vol. 05 Part 4	C20	HD Cameras
Wildfire	Aerial Suppression	SCE-04 Vol. 05 Part 4	C21	Aerial Suppression
Wildfire	Grid Hardening	SCE-04 Vol. 05 Part 2	M1	Targeted Undergrounding
Wildfire	Grid Hardening	SCE-04 Vol. 05 Part 2	M2	REFCL (Total)
Wildfire	Grid Hardening	SCE-04 Vol. 05 Part 2	M3	Vibration Damper
Wildfire	Alternative Technologies	SCE-04 Vol. 05 Part 3	M4	DOPD
Wildfire	Alternative Technologies	SCE-04 Vol. 05 Part 3	M5	EFD
Wildfire	Alternative Technologies	SCE-04 Vol. 05 Part 3	M6	Hi-Z
PSPS	Enhanced Situational Awareness	SCE-04 Vol. 05 Part 4	C22	Weather Stations
PSPS	PSPS Execution	SCE-04 Vol. 05 Part 4	C23	CRC/CCV
PSPS	PSPS Customer Support	SCE-04 Vol. 05 Part 4	C24	CCBB
PSPS	PSPS Customer Support	SCE-04 Vol. 05 Part 4	C25	Customer Resiliency Equipment Rebates
PSPS	PSPS Customer Support	SCE-04 Vol. 05 Part 4	C26	211 Partnerships
PSPS	Fire Science and Advanced Modeling	SCE-04 Vol. 05 Part 4	C27	Weather and Fuel Modeling
PSPS	Fire Science and Advanced Modeling	SCE-04 Vol. 05 Part 4	C28	Fire Science
Wildfire	Wildfire Mitigation and Vegetation Management Technology Solutions	SCE-04 Vol. 05 Part 3	F1	Inspection WM Tools
Wildfire	Wildfire Mitigation and Vegetation Management Technology Solutions	SCE-02 Vol. 10	F2	Arbora
PSPS	PSPS Customer Support	SCE-04 Vol. 05 Part 4	F3	Community Meetings
PSPS	PSPS Customer Support	SCE-04 Vol. 05 Part 4	F4	Marketing
PSPS	PSPS Customer Support	SCE-04 Vol. 05 Part 4	F5	PSPS Research & Education
Wildfire	Wildfire Mitigation and Vegetation Management Technology Solutions	SCE-04 Vol. 05 Part 3	F6	WiSDM
Wildfire	Wildfire Mitigation and Vegetation Management Technology Solutions	SCE-04 Vol. 05 Part 3	F7	Ezy

In recognition of the long-term stakes that exist with respect to climate change, the Commission has directed the utilities to file long-term Climate Adaptation and Vulnerability Assessments (CAVAs). SCE's first CAVA was filed in May of 2022. As it relates to wildfire risk, there is an important contrast between what the Commission asked for in the RAMP and what the

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43 *See* SCE-02, Vol. 10 (Vegetation Management).
44 *See* WP SCE-04 Vol. 04 Part 1, pp. 4 – 54, WF/PSPS RAMP to GRC Integration.

Commission asked for in the CAVA. RAMP must identify and examine the wildfire risks that are implicated in the utility's activities and delivery of electricity to its customers. In assessing assets, operations and services, the CAVA must assess the vulnerability of the utility to the damaging effects of climate change on utility assets, operations, and services. Therefore, the wildfire and PSPS risk mitigations that were evaluated in SCE's 2022 RAMP, and that are presented in this testimony, necessarily focus on the reduction of risk associated with SCE's equipment and the ability to reduce the risks associated with PSPS. Other areas of SCE's 2025 GRC discuss the mitigations associated with the risks that CAVA has identified.

a) SPD / Intervenor Comments

SCE received comments and recommendations from Safety Policy Division, TURN, and MGRA related to our Wildfire and PSPS risk analysis from our 2022 RAMP report. SCE addresses some of these recommendations directly below. However, some recommendations that were specific to certain controls/mitigations are addressed in the sections of testimony describing the specific GRC activity. In addition, there were certain recommendations related to risk modeling that are addressed in SCE-01 Vol. 02.[45]

SPD and MGRA Recommendation: MGRA has noted that while Fast Curve settings are highly effective at preventing ignitions, they can lead to localized de-energization without advanced warning. This leads to impacts on AFN customers who would benefit from certain PSPS Controls under a PSPS de-energization but would be left unprepared during a Fast Curve de-energization. SPD agrees with MGRA and recommends that SCE should provide details regarding how they address the impact of a Fast Curve de-energization on AFN and MBL customers.[46]

SCE Response: Unplanned outages as a result of the detection and response to line faults by fast curve protection technology are distinct from PSPS events that are proactively initiated in a planned manner. Fast Curve is an advanced iteration of protective devices that utilities have used for decades, such as fuses, and are installed throughout utility service areas across the country. SCE enables Fast Curve settings during elevated fire conditions; however, enablement of settings does not guarantee a fault or outage will occur and thus outages triggered by Fast Curve settings are considered unplanned and SCE cannot predict such outages or warn customers prior to the outage. By contrast,

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[45] *See* SCE-01 Vol. 02 Part 2 and WP SCE-01 Vol. 02, pp. 7 – 14, RAMP Recommendation Responses.

[46] A.22-05-013, p. 41. Safety Policy Division Staff Evaluation Report on the Southern California Edison Company's 2022 Risk Assessment and Mitigation Phase (RAMP).

PSPS events are proactive, and are generally preceded by some period of forewarning, enabling the IOUs to provide advance notifications to customers and stakeholders, and to mobilize customer support resources. There is no such forewarning with Fast Curve settings due to their reactive response to faults, and thus no opportunity to implement the types of notification and other measures associated with proactive de-energizations.

SPD and TURN Recommendations: SPD noted that SCE should revise its risk modeling to include all risk element factors, such as egress, into the risk reduction and RSE calculations. TURN further noted that as a matter of compliance with D.18-12-014, SCE's re-calculation of RSEs for its GRC must include egress benefits and all other considerations that materially affect its RSE calculations for any risk.

SCE Response: SCE disagrees that D.18-12-014 mandates that SCE include egress benefits and all other considerations that materially affect its RSE calculations for any risk. SCE's RSE calculations were in full compliance of the SMAP settlement. In this GRC, SCE has included the following additional risk benefits from egress. Further, SCE has developed a methodology to incorporate egress directly into its MAVF that is discussed below in Section II.A.4.b).

SPD and TURN Recommendation: SCE should utilize isolatable circuit segments for tranches to align more closely with how projects would be implemented on the ground. SCE should aggregate these circuit-level segments into isolatable, project-level circuit segments and present risk reduction and RSE calculations at this level of tranche granularity. TURN recommends that SCE's upcoming GRC also present RSEs and risk reduction calculations for its wildfire mitigations using SPD's quintile approach.

TURN and SPD also note that additional tranche classifications should focus on using combinations of quintiles of Likelihood of a Risk Event (LoRE) and Consequences of a Risk Event (CoRE), so that the isolatable circuit segments with the highest 20 percent of LoRE and the highest 20 percent of CoRE would be grouped together. This would support a more logical calculation of RSEs. TURN recommends that SCE's upcoming GRC also present RSEs and risk reduction calculations for its Wildfire mitigations using SPD's quintile approach, which would create a total of 25 LoRE/CoRE tranches. TURN agrees with SPD that this level of granularity would be much more meaningful than SCE's three HFRA-based tranches.

SCE Response: SCE appreciates SPD's and TURN's feedback regarding the presentation of data. SCE is providing excel based sheets for WCCP and TUG that will allow parties to analyze the data at the circuit level, isolatable circuit level and segment level. The data could also be grouped into quartiles, quintiles or any other delineation by parties. Additional detailed calculation sheets are available upon request including a file that incorporates all segment level data for all mitigations.

SPD Recommendation: SCE should remove the additional 173.4 circuit miles (30 percent) in the most recent proposed TUG scope (as set forth in RAMP), as SCE included these to replace duplicated circuit miles without adequate justification.

SCE Response: This is addressed in SCE-04 Vol. 05 Part 2 under the Targeted Undergrounding section.

SPD Recommendation: SCE should consider expanding both BLF and RAR due to the high RSEs associated with these technologies.

SCE Response: Please see SCE's request to expand sectionalizing devices and associated settings in SCE-04, Vol. 05 Part 2 under the HFRA Sectionalizing Devices section.

SPD Recommendation: Given the lower RSE, SPD staff question the appropriateness of substantial investment of ratepayer funds for TUG after the large-scale implementation of the CC program has been underway for years. The WCCP was supposed to prioritize and install CC on the highest-risk circuit segments in the program's early years. Hence, there is no widespread need for TUG since the highest-risk circuit segments already have CC installed.

SCE Response: While undergrounding may be more costly than other wildfire mitigations, such as covered conductor on a per-mile basis, it is the only option that essentially eliminates wildfire risk. It is not a question of being "cost effective," but rather is an option used in the highest-risk areas where it is prudent to virtually eliminate fire risk. Due to it having the highest mitigation effectiveness value, SCE selects undergrounding as a wildfire mitigation only in the most risky locations, with one or more of the following characteristics: 1) population egress constraints,[47] high fire frequency, and burn-in buffer[48] into egress locations; 2) 10,000+ acres burned at 8 hours - areas that have the potential to burn into catastrophic fires; 3) extreme high wind areas – areas in which covered conductor is not sufficient in preventing PSPS de-energization; that is, locations that have

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[47] Egress constrained areas are locations that lack available road capacity that could prevent people from effectively evacuating in the event of an approaching wildfire.

[48] Burn-in buffers are areas adjacent to the egress constrained areas such that if the fire originated there, could enter the egress constrained area.

experienced high sustained wind speeds and wind gusts of 40 mph and 58 mph, respectively, which is above the current PSPS de-energization threshold for fully covered isolatable conductor segments; and 4) communities of elevated fire concerns – smaller geographic areas where terrain, construction, and other factors could lead to smaller, fast-moving fires threatening populated locations under benign (normal) weather conditions. It is prudent to deploy the most effective solution, i.e., undergrounding, in these very highest-risk areas to protect the communities and customers we are privileged to serve, as well as critical infrastructure facilities.

SPD Recommendation: SPD recommends that SCE consider a third alternative to their wildfire plans discussed below. The third alternative would focus on TUG and WCCP proposals for the 67th percentile based on risk reduction. This sub-sample of circuit segments would be less than 40 percent of the proposed spending for both programs but would focus on about 85 percent of the risk reduction. SPD recommends SCE narrow this by selecting circuit segments that have RSEs below the total sample RSE median for each program. Using the RSE median is a generous cutoff due to the wide range and high standard deviation of the RSEs. This would narrow the programs further and focus on the highest-risk segments and the most cost-effective segments based on Risk Spend Efficiencies.

SCE Response: One of the primary observations in the SPD Report is that SCE can "buy down" 85% of the ignition risk associated with its infrastructure in its WCCP and TUG proposals by spending 40% of the money SCE proposes to invest in grid hardening mitigations. Setting aside whether those particular calculations are accurate, SPD's conclusion fundamentally misses the point. In its Test Year 2021 GRC, SCE explained at length the dangers of the logical fallacy of conflating the concepts of relative and absolute risk. Because certain circuit segments in the High Fire-Threat Districts (HFTD) are relatively riskier than other certain circuit segments in the HFTD by orders of magnitude (at least from a modelling perspective), they unsurprisingly constitute the majority of the relative risk on the system.

But that is ultimately irrelevant: the important question is how much absolute risk would remain if SPD's recommendation is accepted and SCE does not harden those remaining areas—areas that the Commission has already deemed inherently risky by designating them as part of the HFTD. It is the remaining (i.e., residual) absolute risk that is relevant, not the amount of relative risk that can be bought down by making the limited investments SPD recommends. This is an important distinction with potentially critical safety implications. Indeed, accepting SPD's recommendation would leave an unacceptably high amount of total risk – potential for thousands of customer homes and acres burned – unmitigated by system hardening.

Additionally, SPD recommends that SCE narrow the scope of WCCP and TUG by selecting circuit segments that have RSEs above the total sample RSE median for each program. SPD claims that using the RSE median is a generous cutoff due to the wide range and high standard deviation of the RSEs, and that this would narrow the programs further and focus on the highest-risk segments and the most cost-effective segments based on RSEs. While this analysis may appear to make sense on paper, it does not take into account the real-world implications of the way that work is bundled and executed. Selecting only circuit segments above the median value could result in inefficiencies if crews are undergrounding every other circuit segment. The Staff Report also provides no compelling reason why it is logical and in the interest of customer safety for SCE to harden the 51st percentile riskiest circuit but not the 49th percentile riskiest circuit.

SPA and MGRA Recommendation: SPD noted that SCE should revise its risk modeling to reflect the more accurate risk reduction from covered conductor based on SCE's fault and wire-down data. MGRA similarly noted that SCE should provide any additional results from the continued joint IOU covered conductor working group as soon as they are available, making a supplemental filing.

SCE Response: SCE's mitigation effective values for covered conductor reflect SCE's fault and wire-down data as well as laboratory testing performed in 2022. SCE is also leading the Joint IOU Covered Conductor Effectiveness Working Group and the utilities continue to make progress on the objectives. Progress on these efforts is described in Appendix F of SCE's 2023 – 2025 WMP, which can be found on SCE's website.[49] The utilities have set forth a plan for 2023 to conduct several workshops to assess covered conductor testing results, maintenance and inspection practices, new technologies, and other items. The primary lessons learned resulting from the study thus far has been the increase in effectiveness of covered conductor as compared to earlier assumptions, which SCE has incorporated into its risk analysis for this GRC.

MGRA Recommendation: SCE should provide an alternative that includes advanced technologies such as REFCL in combination with covered conductor, including projected cost and mitigation effectiveness.

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[49] *See* https://www.sce.com/safety/wild-fire-mitigation.

SCE Response: SCE did include REFCL and other advanced technologies in the proposed and alternative RAMP plans. As discussed further in this testimony, SCE's IWMS presents options for using REFCL in combination with covered conductor to achieve risk reduction in severe risk areas. SCE continues to understand the feasibility, compatibility, and performance of REFCL and will continue to include it as an option for reducing risk in HFRA.

SPD and MGRA Recommendation: As MGRA points out in their informal comments, because SCE does not include PSPS damage events in its ignition risk model, this will bias the likelihood model (which is dependent on historical data), and result in underestimating the ignition risk in areas with frequent PSPS. SPD agrees with MGRA and recommends that SCE integrate PSPS damage and hazard reports into their likelihood calculations.

SCE Response: SCE is not using PSPS damage reports in its probability of ignition models because those reports are biased in two directions: first, the existence of damage does not mean an ignition would have occurred (over-indexing), and second, the absence of damage does not mean an ignition would not have occurred in the absence of PSPS (under-indexing). SCE notes that damage discovered following PSPS events is valuable information that SCE considers in system hardening and PSPS threshold decisions even though the data does not have sufficient fidelity to be used in its models.

SPD Recommendation: Lack of transparency related to models using machine learning techniques. On the wildfire risk modeling, the machine learning techniques also contributed to this lack of transparency. Despite SCE's efforts to show the inner workings of the machine learning approach, it remains very much an opaque "black box" to SPD staff. This is not a criticism of SCE's initiative to apply machine learning techniques to model wildfire risk. Far from it, SPD supports its continued and broader use. It's simply an acknowledgment that there are challenges that SCE will have to overcome in the GRC and future RAMPs to provide greater transparency within the confines of the machine learning approach.

SCE Response: SCE appreciates the feedback from SPD and other intervenors in our RAMP filing. SCE has strived to include additional workpapers describing the machine learning models. In addition, SCE would be amenable to having further discussions or workshops with parties to provide additional details or answer any questions parties may have on our machine learning models.

SPD Recommendation: SCE argues that the operating cost savings from using a higher FPI threshold found in Alternative Plan #1 would likely be more than offset by costs and impacts to the customers from the greater wildfire risk. However, SCE's RAMP lacks a comparative analysis to justify this explanation. SCE could utilize a Cost-Benefit Approach to compare the costs and impacts to customers from the increase or decrease of wildfire ignition risk caused by using the different FPI thresholds found in the Proposed Plan and the Alternative Plan #1.

SCE Response: SCE acknowledges that we did not provide a full quantitative analysis on Alternative Plan #1 addressing PSPS risk. However, the potential relatively small PSPS savings from Alternative Plan #1 due to fewer line patrols and less IMT activity would clearly be offset by the impacts of one large fire event that destroyed 10,000 acres and/or destroyed 20 buildings. For instance, using SCE's wildfire model and consequence assumptions, a 10,000-acre fire or a fire that destroyed 20+ buildings would have a financial impact of ~$20 million not taking into consideration any safety or reliability consequences.[50]

[50] Assumes $305/acre fire suppression costs, $1,460 land restoration costs and $940,337 per structure destroyed. In comparison, the amounts SCE spends *per year* on PSPS IMT and Line Patrols is far less, and can be found in SCE-04, Vol. 05, Part 4.