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REVISION ~~2~~3
March ~~9~~18, 2020

Southern California Edison

2020-2022 Wildfire Mitigation Plan

Rosemead CA
February 7, 2020

CONTENTS

EXECUTIVE SUMMARY

Southern California Edison (SCE)[1] is dedicated to the safety of the communities we serve. In this filing, we set forth our second comprehensive Wildfire Mitigation Plan (WMP) covering the years 2020 through 2022. This WMP builds on SCE's 2019 WMP, its successes, and lessons learned.

As in SCE's 2019 WMP, the 2020-2022 plan includes infrastructure hardening, vegetation management, detailed inspections and remediations, and situational awareness. SCE's WMP also emphasizes Public Safety Power Shutoff (PSPS) resilience and community engagement, particularly for under-represented groups and our access and functional needs (AFN) customers.

The 2020-2022 plan increases the use of data, advanced risk analytics and innovative technologies to help the company prioritize the activities with the greatest potential to mitigate wildfire risks and improve public safety. While SCE has considerably matured in our wildfire mitigation capabilities, we will continue to look for opportunities to improve.

We want to thank California's leadership — lawmakers and various agency personnel — for addressing this critically important public safety issue. SCE is proud of our partnership with local governments, first responders and the general public, in reducing the risk of potentially devastating wildfires.

SCE'S FOUNDATIONAL STRATEGY FOR WILDFIRE MITIGATION REMAINS SOUND

The primary objective of SCE's WMP is to protect public safety, and includes an actionable, measurable, and adaptive plan for 2020 through 2022 to reduce the risk of potential wildfire-causing ignitions associated with SCE's electrical infrastructure in High Fire Risk Areas (HFRA) through enhanced system hardening, situational awareness, and operational practices.

Additional key objectives include reducing the customer impact of PSPS; implementing measures that increase resiliency and safeguard SCE's electric system against wildfires irrespective of ignition source; improving fire agencies' ability to detect and respond to emerging fires; improving coordination between utility, state, and local emergency management personnel; reducing the impact of wildfires and wildfire mitigation efforts on the public; and effectively engaging the public about how to prepare for, prevent, and mitigate wildfires in SCE's HFRA.

[1] *See* Appendix A for a list of acronyms.

The 2020-2022 WMP represents a natural extension and refinement of the 2019 WMP. SCE's analysis of 2019 ignitions within our service area reaffirmed the foundational strategy that SCE developed in our Grid Safety and Resiliency Program (GSRP) Application (A.18-09-002) in 2018, as noted in our Assembly Bill (AB) 1054 Advice Letter filing to the California Public Utilities Commission (CPUC or Commission) on January 31, 2020.

SCE's 2020-2022 WMP includes 69 specific activities, a net increase of 11 since our 2019 WMP, targeting further improvements in several areas. SCE has put forward a comprehensive and detailed WMP and we are committing and reallocating significant resources to further reduce the risk of wildfires. Each of these activities in our plan plays a critical role in our wildfire mitigation portfolio and they are designed to work hand-in-hand to mitigate wildfire risks and improve community resilience. Highlights include:

- Infrastructure Hardening: Covered conductor deployment represents the bulk of SCE's infrastructure-hardening effort. We are planning to deploy at least 700 circuit miles of covered conductor in 2020, a ramp-up from 151 circuit miles achieved in 2018 and 372 circuit miles achieved in 2019 (original target in 2019 was 96 circuit miles). We have an aggressive plan to deploy up to 4,500 circuit miles of covered conductor by the end of 2022. We continue to target deployment in the highest-risk areas based on continual improvements to our risk-informed analyses, and will also consider areas where covered conductor can mitigate the need for PSPS events in the near-term. We are including selective undergrounding in areas that meet specific criteria (e.g., PSPS-impacted circuits and areas with limited egress routes), and installation is expected to commence in 2021 after completing design, engineering, and permitting requirements. The 2020-2022 WMP will also continue efforts on resiliency hardening with application of fire-resistant wrap to protect existing wood poles, installation of additional composite poles, and further expansion of fusing and sectionalization.

- Vegetation Management: Vegetation management programs will largely continue our 2019 efforts. We will expand brush clearing around poles to reduce fire spread risk, target overhangs, and continue tree removals under the Hazard Tree Management Program (HTMP) to mitigate risk of ignition from vegetation and trees that could fall into our lines. We will also continue our work on increasing and maintaining clearance distances to prevent tree-line contact.

- Inspections and Remediation: In 2019, we inspected 100% of the overhead assets in our HFRA. In the 2020-2022 WMP, our objective is to prioritize the re-inspection of structures that represent the highest risk based on the probability of ignition and consequence. These structures will be inspected annually, going beyond the current regulatory requirement of five-year inspection cycles for distribution assets and three-year inspection cycles for transmission assets until other mitigation measures are in place to warrant further adjustments. We will utilize both ground and aerial inspections for such transmission and distribution assets to obtain 360-degree views of our structures and equipment. For remediations, SCE today follows pre-established regulatory compliance timelines based on inspection results. A more impactful and effective approach would be to use a more granular risk-informed prioritization method, which SCE has proposed in this WMP. The current regulatory construct does not accommodate this level of discretion, but we strongly believe that this shift will provide SCE the flexibility needed to appropriately allocate resources to activities that have higher wildfire risk reduction potential. We will work with the CPUC and Wildfire Safety Division (WSD) on this proposal for the ability to make these risk-informed trade-offs.

- Situational Awareness: The deployment of high-definition (HD) cameras is considered complete. The 161 HD cameras installed to date provide visual coverage of more than 90% of our HFRA, reaching a practical saturation point given the terrain and topography in these areas. SCE has also completed installing 482 weather stations. Weather stations have proven critical for weather modeling and forecasting, particularly to inform our PSPS program and allow more targeted de-energizations. We will expand the program and install additional weather stations, to reach an average of two weather stations per circuit in our HFRA by 2024, at a pace of 375 weather stations annually.

- PSPS: We recognize and appreciate the impact of PSPS events on our customers, and we do not take lightly any decision to proactively de-energize portions of the grid. Though the frequency and scope of PSPS events are expected to lessen as we deploy more of our WMP activities, PSPS will have to remain available as a tool to mitigate wildfire risk during severe weather and high Fire Potential Index (FPI) events.

SCE's sectionalization capability to isolate circuit segments, and our reliance on real-time weather data and field conditions prior to activating PSPS events have helped us reduce the number of customers impacted by PSPS in our service area. For example, during the statewide October 2019 PSPS events, SCE was able to limit the cumulative impact to approximately 2% of our customers. Though a longer or more intense fire season could potentially increase PSPS frequency, scale, and duration, we are rapidly developing circuit-specific plans to reduce the impacts we observed in 2019. We are expanding this planning to circuits that may be subject to PSPS based on historical weather scenarios. For each circuit, we apply a multipronged approach that includes:

- consideration of system hardening and more granular situational awareness that will potentially reduce the frequency of PSPS events (for example, targeted covered conductor installations may allow for a risk-informed increase in wind thresholds on heavily impacted circuits);
- using existing isolation equipment and/or installing additional sectionalization equipment to reduce the scope of PSPS events (number of customers de-energized); and
- providing solutions to reduce the impact of PSPS events on our customers, such as additional Community Resource Centers (CRCs) and assistance with backup generation. We are also actively pursuing microgrid opportunities where they are technologically and economically feasible. Moreover, we have increased community outreach, communications, and education.

SCE continues to reassess its performance as it gains new and additional information about factors affecting the nature of wildfire and related risks. This WMP will not be static and will be adjusted and improved as necessary and appropriate. Any modification will be communicated transparently through AB 1054 quarterly filings, annual updates, and any WMP Off-Ramp Reports.

More than a Sequel: SCE is Advancing New Technologies and Data Analytics Capabilities

Data capture, data analysis, technology, and automation are increasingly part of SCE's wildfire mitigation planning and implementation, as well as our broader operations. New wildfire initiatives launched in 2018 and 2019 captured additional data that has been used to improve analyses at more granular levels and inform our WMP.

SCE also launched new tools, machine learning capabilities, and new technology — some have reached operational maturity while others present promising opportunities. In 2019, Light Detection and Ranging technology (LiDAR) proved to be a useful tool for vegetation inspections and has since become a standard component of the vegetation management toolset. We also completed a pilot to evaluate fire-retardant wraps around poles and are currently implementing this initiative.

Going forward, SCE is evaluating several technology solutions for early or advance detection of fault conditions. Distribution Fault Anticipation (DFA) technology evaluation has produced encouraging results for advance detection of incipient fault conditions and hard-to-detect system anomalies. An Open Phase Detection (OPD) Pilot has been initiated and could yield a potential solution to reliably and efficiently sense open phase conditions and de-energize a line prior to a severed conductor hitting the ground. SCE is also evaluating Early Fault Detection (EFD) technology that uses radio frequency emitted from equipment to not only detect, but also pin-point locations of emerging issues.

SCE is commissioning a new state-of-the-art technology using a HD/Radiometric Helicopter-Mounted Imager — an infrared technology — for real-time or post-flight inspections. The technology picks up heat signatures that indicate damaged equipment. In addition, SCE is investing in machine learning and artificial intelligence capabilities for inspections to automatically identify and flag equipment deviations and anomalies to qualified personnel based on visual imagery.

To further inform PSPS activations, SCE has expanded and improved its FPI by incorporating weather forecasts and fuel loading to account for the large and diverse geographic area of our service area. The FPI is used in conjunction with wind thresholds to identify areas that are likely to have significant fire activity that could threaten communities and SCE infrastructure. SCE will refine its FPI models by including historical weather and vegetation data, fuel types, and a precipitation decay function to account for different fuel scenario and seasonality effects.

Risk Analysis Guides SCE's Planning and Prioritization

Another significant advancement has been moving beyond enterprise-level risk models to asset-level risk models. By targeting specific assets and locations with higher risk profiles, we can more effectively allocate constrained labor resources to reduce risk beyond what is expected from system level averages. We are also incorporating risk analysis in our approach to PSPS events and resilience.

In 2018, SCE utilized its enterprise-level risk model to determine the large-scale programs that we need to undertake across our service area. For example, based partly on system-level risk spend efficiency (RSE) estimates, we determined that in general, the Wildfire Covered Conductor Program (WCCP) would reduce wildfire risks at a lower cost compared to other measures such as undergrounding, and that shifting resources to WCCP from traditional infrastructure replacement programs in the near term was warranted.

Deployed in 2019, the asset-level Wildfire Risk Model (WRM) estimates probability and consequence of ignitions using advanced analytics. The WRM's probability module uses machine learning capability to estimate the probability of an ignition from inherent equipment failure, current asset characteristics, or contact from a foreign object. The WRM's consequence module uses a fire propagation model that incorporates weather and fuel conditions along with other factors such as topography and housing and population density. The resulting ignition risk scores for each asset or circuit-segment location are used to target WCCP deployment, prioritize remediation of inspection findings, and guide our vegetation clearing activities.

In 2020, we are transitioning to risk modeling that integrates wildfire ignition probability and fire spread prediction calculations, incorporates more granular weather forecasts along with detailed vegetation, population and structure data, and accommodates dynamic updates. Over the 2020-2022 WMP period, we expect to expand wildfire mitigation prioritization to equipment, structures, and vegetation inspections along with weather station installations.

SCE's 2020-2022 WMP includes RSEs for our proposed wildfire mitigation activities calculated using our enterprise-level risk model. SCE notes that while an RSE is a valuable contributing metric to inform the development of the overall WMP, it is important to recognize that RSEs are not, and should not, be the only factors used to develop a risk mitigation plan. The RSE metric does not take into account certain operational realities, including planning and execution lead times, resource constraints, work management efficiencies, an activity's total risk reduction potential on targeted areas of the system, and regulatory compliance requirements. SCE considers these additional factors while determining the type and volume of work undertaken to reduce wildfire risks in a timely manner, while managing customer impact of mitigation measures.

Our risk analysis mindset extends beyond ignition and fire consequence risk associated with electric infrastructure. For example, in undertaking PSPS resilience, we are prioritizing circuits and circuit-segments based on risk analysis that accounts for frequency of PSPS events, total number of customers, types of customer (for example, critical care, medical baseline, low income), critical facilities, and sectionalizing ability, among other things.

SCE Supports A Capability Maturity Model with Modifications

SCE has made great strides in developing our wildfire mitigation capabilities, going beyond minimum regulatory requirements in several key areas, increasingly relying on data and advanced analytics to plan and prioritize resource allocation for wildfire risk mitigation, and establishing robust operational processes for planning, preparedness and customer/stakeholder engagement.

The requirements outlined in the Dec. 16, 2019 Administrative Law Judge's Ruling on WMP Templates and Related Material and Allowing Comment (ALJ Ruling)[2] included a survey comprised of nearly 250 questions, spanning 52 capabilities grouped into 10 categories as part of the first Wildfire Mitigation Capability Maturity Model. SCE supports the development and utilization of a wildfire mitigation capability maturity model to "help to identify and share best practices amongst the utilities and to establish a continually improving suite of best practices and lessons learned to combat the growing risk of utility-caused wildfires."[3]

[2] Order Instituting Rulemaking (R.)18-10-007.

[3] ALJ Ruling, Attachment 3 (Utility Wildfire Mitigation Maturity Model), p. 2.

Our responses to these questions for 2020 maturity reflect the enhancements we made in 2019. We recognize that there are always opportunities to improve and we will continue to focus on those opportunities. SCE's assessment of our expected 2023 capability maturity assumes full deployment of the proposed 2020-2022 WMP. SCE anticipates improvements in our capabilities in several areas such as risk mapping, grid design, system hardening, and resource allocation with incorporation of the dynamic asset level risk modeling capability.

In some areas, we do not show a change in a survey score between 2020 and 2022. This is partly a function of a 2020 measurement baseline that already includes recent capability improvements achieved by SCE. For example, we have made considerable progress in inspections and maintenance, vegetation management, emergency planning and preparedness, and stakeholder cooperation and community engagement capabilities. Though we continually look for ways to refine and improve, we will be prioritizing other areas for increased maturity. Moreover, in some capability dimensions, the mechanics of the scoring system require relatively large steps, and longer timelines are needed to improve along the current maturity model scales.

In addition, we do not believe some of the higher levels of capabilities provided in the maturity model survey should be the highest priority for advancing wildfire safety. For example, there is limited value in increasing the frequency of weather data update from every 10 minutes to at least every minute. As another example, SCE manually patrols de-energized lines after PSPS events before deciding to re-energize. This systematically helps ensure the greatest degree of public safety and, therefore, should not be automated for the foreseeable future.

It is unclear at this point how the survey results will be aggregated to determine overall maturity for any utility and in turn, how these scores will inform improvements to future WMPs. SCE agrees however, that "the maturity assessment is not designed to assess performance or regulatory compliance, which should be conducted separately."[4]

We understand and appreciate that the maturity model was developed under a compressed time constraint for the purpose of including in the ALJ Ruling to evaluate utilities' wildfire mitigation capabilities. The inaugural process with shortened timelines did not allow for incorporation of participant comments or the benefit of receiving detailed clarifications from the WSD. This posed significant challenges as many questions in the survey are either subject to interpretation or did not align with how SCE approaches wildfire mitigation specifically, and grid design and operations broadly. Regardless, SCE has put in significant effort to accurately respond to the maturity model survey and is providing an accompanying document with comments about our interpretation and the basis of our response to each question.

[4] ALJ Ruling, Attachment 3 (Utility Wildfire Mitigation Maturity Model), p. 2.

SCE looks forward to a public process working with the WSD to modify and refine this survey and the scoring mechanism for subsequent cycles to better align with a shared understanding of the necessary evolution of wildfire mitigation capabilities in California. Greater clarity about the survey purpose and application over time will be essential as SCE continues to look for ways to improve its own wildfire mitigation and PSPS resilience capabilities.

It is also critically important to note that the maturity model assumes moving beyond minimum regulatory requirements. An assessment of the current regulatory structure and processes for scope and funding approval of risk mitigation activities to achieve higher levels of maturity is necessary as well.

SCE Drives Improvements Through Appropriate Use of Metrics

Metrics and underlying data are critical components to evaluate the effectiveness and compliance of the WMP programs. The ALJ Ruling defines three sets of metrics: Progress Metrics, Outcome Metrics, and Program Targets, and requires utilities to report performance on specific metrics over the past five years. SCE strongly supports collecting, monitoring, and analyzing metrics information. The emphasis should be on short- and long-term metrics that are relevant to the key objectives of wildfire risk mitigation, and there should be a clear distinction between metrics that can help inform future wildfire mitigation plans, and metrics that can help monitor progress per approved WMPs.

In its 2019 WMP, SCE established activity and metric goals to evaluate compliance and the efficacy of its WMP. As SCE has stated in previous filings and submittals, tracking Program Targets for approved WMPs are the best means of determining progress, and these are the only metrics that can help assess WMP compliance in the near-term. Progress and Outcome metrics, on the other hand, should help inform the effectiveness of wildfire mitigation activities and identify improvements and changes necessary, but should not be used to measure progress per approved plans. Prudent grid operations, maintenance, and upgrades will not eliminate risk entirely; but over time and cumulatively, will result in an overall reduction of Progress and Outcome Metrics, such as fire ignition events associated with SCE's electrical infrastructure.

SCE Worked Diligently To Respond To The New WMP Guidelines

The ALJ Ruling resulted in sweeping new WMP Guidelines (Guidelines) spanning operational, business, and system processes. The Guidelines require significant amounts of data and new information that were not part of the 2019 WMP process.

SCE's objective is to fulfill all the requirements if the data and information can be obtained, and to provide notice of availability in iterations once the remaining data is able to be gathered. The timeline of less than eight weeks and the breadth and depth of requested information necessitated this approach. In our filing, SCE has clearly indicated the data provided, any data we are unable to provide at this time and when that data is expected to be available. In addition, some of the requested Geographic Information System (GIS) data is sensitive and will be submitted as confidential to the WSD. In some instances, where SCE does not typically collect and compile data consistent with the new requirements or specified formats, we have provided relevant information related to the requirement and clearly identified any deviation.

The data SCE provided to meet the compressed schedule of the ALJ Ruling should be considered preliminary. If there are any changes based on further review, SCE will promptly notify the Commission of these changes.

SCE notes that our recorded and forecast capital expenditures and Operations and Maintenance (O&M) expenses included in its 2020-2022 WMP are different from the capital expenditures and O&M expenses set forth in direct testimony supporting its 2021 General Rate Case (GRC) and the 2019 WMP. They reflect the latest available information on SCE's historical costs, updated forecasts since previous filings, and updated or new wildfire mitigations activities based on lessons learned after the GRC was filed (e.g., October PSPS events).[5]

CONCLUSION

SCE looks forward to working with the Commission to better understand and help refine the requirements for future WMP and WMP-related filings so as to focus our collective efforts on data and analyses that improve the effectiveness of wildfire risk mitigation, reduce the impact of wildfires and PSPS events on customers, and support a transparent and practical process for WMP approvals and evaluation.

Last year, we made significant progress through implementation of our aggressive 2019 WMP, including hardening of the grid, increasing inspections and repairs, improving our ability to monitor our system and the weather, trimming and removing hazardous trees, expanding public engagement and communication, and utilizing big data to improve the automated sensing of our system and equipment.

SCE's 2020-2022 WMP builds on the success of our 2019 efforts and expands current programs, including the application and exploration of a variety of innovative, new technologies. We are committed to preventing devastating wildfires and protecting the safety of our customers and communities.

[5] *See* Section 5.1.14 for a comparison of our 2021 GRC and 2020-2022 WMP forecast costs for years 2020-2022.

1 PERSONS RESPONSIBLE FOR EXECUTING THE WMP

Provide an accounting of the responsibilities of the responsible person(s) executing the plan, including:
1. Executive level with overall responsibility
2. Program owners specific to each component of the plan
Ensure that the plan components described in (2) include an accounting for each of the WMP sections and subsections 6

Due to the broad nature of the work being outlined in this WMP, multiple Organizational Units within SCE are responsible for executing some of the specific wildfire activities. The accountable areas include Transmission & Distribution (T&D), Customer Service, Safety, Security, & Business Resiliency, and Generation. Overarching execution and oversight of this WMP will be overseen by the Grid Resiliency & Public Safety Program Management Office (PMO) under the direction of Phil Herrington, Senior Vice President of the T&D Organizational Unit.

The program owners of the components of SCE's wildfire mitigation strategies and programs are outlined below by the WMP initiatives and subsections in Section 5.3. SCE's wildfire mitigation programs are described in detail in Section 5.3, so these sections are the key focal areas that, for example, the data and descriptions included in Chapters 2 through 4 support. Certain subsections in Section 5.3 do not have specific wildfire activities but also have important supporting roles and are included in Table SCE 1-1.7 below and reference multiple organizational units due to the cross-functional nature of several of those sections.

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[6] At the beginning of most chapters and in various sections of this WMP, SCE has included the Guidelines instructions given that they are expansive and duplicative in certain areas. Not all Guidelines instructions are included as some, such as those in Chapter 3, only instruct on how to fill out the tables without requiring additional information. In these instances, SCE includes an overview of the table information. All Guidelines instructions are italicized to differentiate and for ease of reference. Also, in some instances, for example Chapter 4, SCE provides a complete description of a subject area that has related requirements throughout the Guidelines. Instead of explaining a common subject area in pieces, SCE has included them together at their first instance to provide a complete and understandable description of that subject area, and refers to those sections where the Guidelines instruct to include related and, in many instances, duplicative information.

[7] In this WMP, SCE has included several of its own tables and figures separate from Tables 1-31 included in the Guidelines. Because the Guidelines tables are numbered in sequence without regard to the WMP numerical sections, SCE's tables and figures are labeled Table SCE and Figure SCE and then the first number in the section they appear, i.e., Table SCE-1, Table SCE-5, etc., in order to differentiate between the tables required in the Guidelines and SCE's tables and for consistency regarding figures.

Table SCE 1-1
2020 Wildfire Mitigation Initiatives by Operating Unit and Department

Wildfire Mitigation Initiatives	Program Owner(s)
5.3.1 – Risk Assessment and Mapping	• Robert LeMoine, Director (Enterprise Risk Management & Insurance) • Jose Goizueta, Director (T&D-Asset Management, Strategy & Engineering)
5.3.2 – Situational Awareness and Forecasting • Weather Stations (SA-1) • Distribution Fault Anticipation (DFA) (AT-2.1) • Early Fault Detection (EFD) Evaluation (AT-7) • Transmission Open Phase Detection (SH-8) • Fire Potential Index (FPI) Phase II (SA-2) • Fuel Sampling Program (SA-5) • Surface and Canopy Fuels Mapping (SA-6) • Remote Sensing / Satellite Fuel Moisture (SA-7) • Fire Science Enhancements (SA-8) • High-Performing Computer Cluster (HPCC) Weather Modeling System (SA-3) • Asset Reliability & Risk Analytics Capability (SA-4) • Expansion of Risk Analysis (RA-1)	• Donald Daigler, Director (Safety, Security & Business Resiliency) • Russell Ragsdale, Director (T&D-Asset Management, Strategy & Engineering)
5.3.3 – Grid Design and System Hardening • Alternative Technology Pilots – Meter Alarming for Down Energized Conductor (MADEC) (AT-1) • Alternative Technology Evaluations – Rapid Earth Fault Current Limiter – Ground Fault Neutralizer (GFN) (AT-3.1) • Alternative Technology Evaluations – Rapid Earth Fault Current Limiter – Resonance Grounded Substation with Arc Suppression Coil (AT-3.2) • Alternative Technology Evaluations – Rapid Earth Fault Current Limiter – Isolation Transformer Coil (AT-3.3) • Alternative Technology Evaluations – Distribution Open Phase Detection (AT-3.4) • High Impedance Relay Evaluations (AT-8) • Circuit Breaker Relay Hardware for Fast Curve (SH-6) • Covered Conductor (SH-1) • Tree Attachment Remediation (SH-10)	• Russell Ragsdale, Director (T&D-Asset Management, Strategy & Engineering) • Jim Buerkle, Director (Generation)

Wildfire Mitigation Initiatives	Program Owner(s)
• Alternative Technology Implementation – Vibration Dampers (AT-4) • Fire Resistant Poles (SH-3) • Branch Line Protection Strategy (SH-4) • PSPS-Driven Grid Hardening Work (SH-7) • Microgrid Assessment (PSPS-8) • Installation of System Automation Equipment – RAR/RCS (SH-5) • Remediations – Distribution (SH-12.1) • Remediations – Transmission (SH-12.2) • Remediations – Generation (SH-12.3) • Undergrounding Overhead Conductor (SH-2) • Transmission Overhead Standards (TOH) Review (SH-9) • Legacy Facilities (SH-11)	
5.3.4 – Asset Management and Inspections • Infrared Inspection of Energized Overhead Distribution Facilities and Equipment (IN-3) • Infrared Inspection, Corona Scanning, and High Definition Imagery of Energized Overhead Transmission Facilities and Equipment (IN-4) • Distribution High Fire Risk Informed Inspections in HFRA (IN-1.1) • Asset Defect Detection Using Machine Learning Object Detection (AT-5) • Aerial Inspections – Distribution (IN-6.1) • Advanced Unmanned Aerial System Study (AT-2.2) • Unmanned Aerial (UAS) Operations Training (OP-3) • Transmission High Fire Risk Informed Inspections in HFRA (IN-1.2) • Aerial Inspections – Transmission (IN-6.2) • Assessment of Partial Discharge for Transmission Facilities (AT-6) • Quality Oversight / Quality Control (IN-2) • Failure Modes and Effects Analysis (FMEA) (IN-7) • Generation High Fire Risk Informed Inspections in HFRA (IN-5)	• Ray Fugere, Principal Manager (T&D-Asset Management, Strategy & Engineering) • Melvin Stark, Principal Manager (T&D-Compliance & Operational Support) • Jim Buerkle, Director (Generation)
5.3.5 – Vegetation Management and Inspections Expanded Pole Brushing (VM-2) Expanded Clearances for Legacy Facilities (VM-3) Vegetation Management Quality Control (VM-5) Hazard Tree Management Program (VM-1) Drought Relief Initiative (DRI) Inspections and	• Melanie Jocelyn, Principal Manager (T&D-Compliance & Operational Support) • James Buerkle, Director (Generation)

Wildfire Mitigation Initiatives	Program Owner(s)
Mitigations (VM-4) •	
5.3.6 – Grid Operations and Protocols • Annual SOB 322 Review (OP-1) • Community Resource Centers (PSPS-2) • Customer Resiliency Equipment Incentives (PSPS-3) • Income Qualified Critical Care (IQCC) Customer Battery Backup Incentive Program (PSPS-4) • MICOP Partnership (PSPS-5) • Independent Living Centers Partnership (PSPS-6) • Community Outreach (PSPS-7) • Wildfire Infrastructure Protection Team Additional Staffing (OP-2) • De-Energization Notifications (PSPS-1.1 – 1.4)	• Donald Daigler, Director (Safety, Security & Business Resiliency) • Kari Gardner, Senior Manager (Customer Service-Customer Service Operations)
5.3.7 – Data Governance	• Ranbir Sekhon, Director (Business Transformation • Donald Daigler, Director (Safety, Security & Business Resiliency) • Russell Ragsdale, Director (T&D-Asset Management, Strategy & Engineering) • William Chiu, Managing Director (T&D-Grid Resiliency & Public Safety PMO) • Jose Goizueta, Director (T&D-Asset Management, Strategy & Engineering) • Ray Fugere, Principal Manager (T&D-Asset Management, Strategy & Engineering)
5.3.8 – Resource Allocation Methodology	• Robert LeMoine, Director (Enterprise Risk Management & Insurance) • William Chiu, Managing Director (T&D-Grid Resiliency & Public Safety PMO)

Wildfire Mitigation Initiatives	Program Owner(s)
5.3.9 – Emergency Planning and Preparedness • SCE Emergency Response Training (DEP-2) • Customer Education and Engagement (DEP-1.1-1.3) • IOU Customer Engagement (DEP-3) • Customer Research and Education (DEP-4)	• Donald Daigler, Director (Safety, Security & Business Resiliency) • Kari Gardner, Senior Manager (Customer Service-Customer Service Operations)
5.3.10 – Stakeholder Cooperation and Community Engagement	• Donald Daigler, Director (Safety, Security & Business Resiliency) • Kari Gardner, Senior Manager (Customer Service-Customer Service Operations)

1.1 VERIFICATION

Complete the following verification for the WMP submission:

RULE 1.11 VERIFICATION

I am an officer of the applicant corporation herein, and am authorized to make this verification on its behalf. The statements in the foregoing document are true of my own knowledge, except as to matters which are therein stated on information or belief, and as to those matters I believe them to be true.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 7th day of February, 2020 at Rosemead, California.

Phil Herrington
Senior Vice President, Transmission & Distribution
SOUTHERN CALIFORNIA EDISON COMPANY
2244 Walnut Grove Avenue
Rosemead, CA 91770

2 Metrics and Underlying Data

Instructions: Report performance on the following progress and outcome metrics within the utility's service territory over the past five years. Where a utility does not collect its own data for a given metric, that utility shall work with the relevant sources to collect the information for its service territory, and clearly identify the owner and dataset used to provide the response in "Comments" column.

Progress metrics, listed below, track how much utility wildfire mitigation activity has managed to change the conditions of utility wildfire risk exposure in terms of drivers of ignition probability.

Outcome metrics measure the performance of a utility and its service territory in terms of both leading and lagging indicators of wildfire risk, PSPS risk, and other direct and indirect consequences of wildfire and PSPS, including the potential unintended consequences of wildfire mitigation work.

In the 2019 WMPs, utilities proposed sets of "program targets" that enable tracking implementation of proposed wildfire mitigation activities against the scope of those activities as laid out in the WMPs but do not track the efficacy of those activities. Utilities shall continue to report program targets, however, the primary use of these will be to gauge follow-through on WMPs while recognizing that some WMP initiatives should be adjusted after plan submittal based on new information and lessons learned.

2.1 Lessons Learned: How Tracking Metrics on the 2019 Plan has Informed the 2020 Plan

Describe how the utility's plan has evolved since the 2019 WMP submission. Outline any major themes and lessons learned from the 2019 plan and subsequent implementation of the initiatives. In particular, focus on how utility performance against the metrics used has informed the utility's 2020 WMP.

SCE has put forward a comprehensive WMP for 2020 through 2022 that builds on its 2019 successes, lessons learned, and community needs. Since submitting the 2019 WMP, metrics have proven valuable as a formal mechanism to develop goals, track performance trends, demonstrate the efficacy of mitigation activities, and inform the Commission, stakeholders, and the public of SCE's wildfire strategies and programs. Lessons learned from tracking metrics in 2019 are further described in the subsections below.

2.1.1 2019 WMP Metrics: Tracking Mitigation Activities

In its 2019 WMP, SCE defined 58 performance activities and metrics to track the progress of its five wildfire mitigation work streams and demonstrate its compliance with the plan. The 58 activity and metric goals represent the Program Targets for each wildfire mitigation initiative using the updated definitions in the WMP Guidelines. SCE used controllable and quantifiable metrics to inform substantial compliance with its 2019 WMP. These metrics provided internal and external value by clearly establishing performance thresholds. For activities that were newly established in 2019, demonstration of a process to complete the work stream was determined as an effective measure for tracking performance. Capturing and compiling the data to track these mitigation measures has been primarily a manual process to date, but SCE is implementing new tools and technologies to assist with data capture and tracking of mitigation activities. SCE plans to further automate its tracking processes over this WMP period. One of the key lessons learned from tracking metrics is the importance of providing the Commission, stakeholders, and the public an understanding of SCE's ability to effectively execute wildfire mitigation work, adjust plans due to challenges, and inform of modifications to its wildfire programs. As shown in Table 4,[8] SCE substantially met and, in many cases, exceeded its 2019 Program Targets. Using 2019 as a baseline year, SCE has established similar Program Targets to track performance and compliance with this WMP for 2020 as outlined in Section 5.1.13 (Table SCE 5-1). SCE completed various pilot programs as part of the 2019 WMP and has utilized the observations and results from these to inform the 2020-2022 WMP. As further described in Chapter 5, SCE modified and refined several wildfire mitigation activities based on the results and findings of tracking 2019 WMP Program Targets.

In the 2019 WMP, in addition to the Program Targets that demonstrate compliance, SCE also identified leading and lagging indicators to track trends that could provide valuable insights to develop future mitigation strategies. SCE described three indicators: (1) wire down on circuits in HFRA (lagging indicator); (2) ignitions on circuits in HFRA (lagging indicator); and (3) counts of all faults on circuits in HFRA (leading indicator). Pursuant to the Guidelines, these indicators would now be classified as Progress and Outcome Metrics. These indicators or metrics were not new measures SCE collected specifically for the 2019 WMP. For example, SCE has collected ignition data since May 2014 and fault data since 2006 and the combination of these two data sources is informative in establishing a baseline that ultimately should show a decline over time as wildfire mitigations are deployed in SCE's HFRA.

In 2019, SCE completed several risk mitigation activities such as inspecting all assets in the HFRA and installing 372 miles of covered conductor that are expected to reduce these three indicators and ignition risks. But as explained in SCE's previous filings and comments, year-to-year fluctuations in these indicators can be caused by many factors including adverse weather conditions and other factors outside SCE's control. Therefore, these are key indictors to measure the effectiveness of SCE's wildfire mitigation programs over longer-term horizons and inform future WMPs.

[8] The Guidelines include 31 tables that are required to be populated. Due to the size of these tables, SCE has included them in Excel on its WMP website. All references to Tables 1-31 should be directed to the Excel file labeled "SCE 2020-2022 WMP Tables 1-31.xlsx" on SCE's WMP website. In this Excel file, SCE has included a tab with its major assumptions. For example, all data being provided, unless otherwise stated in the Comment column of the tables, are data for SCE's HFRA.

2.1.2 Moving from Tracking Mitigation Activities to Measuring Effectiveness

The 2019 WMP metrics have provided a valuable mechanism to 1) develop goals that help prioritize wildfire work and 2) establish databases to track performance trends and demonstrate the efficacy of mitigation activities.

Program Targets are useful to set performance targets and track the progress of newly developed wildfire mitigation activities for planning and prioritization. As many of the wildfire activities were new and above what is typically planned for routine utility operations, having awareness across the company of the additional wildfire activities has helped to plan comprehensively, allocate resources efficiently, and make timely decisions. Monitoring and reporting Program Targets and lessons learned at SCE's operational and senior leadership levels on a regular basis has helped escalate and resolve issues, re-allocate resources, and provide overall support for managing all wildfire mitigation work.

Data that demonstrates the efficacy of wildfire mitigation activities such as ignitions, faults and wire down events proposed by SCE, are very important, and as noted previously, observations and analyses over time will help SCE better correlate mitigations with actual outcomes. SCE's operational and senior management routinely review and discuss data related to ignition, fault, and wire down events in SCE's service territory, along with events outside SCE territory, that guides improved data collection, root cause assessments, and ultimately refinements to its wildfire mitigation strategies and programs.

Phase 2 of R.18-10-007 (Phase 2) provided an opportunity to explore and further refine what was initially identified in SCE's 2019 WMP as indicators. It also helped identify additional relevant and available data that could be useful for tracking trends and the efficacy of wildfire mitigation activities over the long term. SCE recognizes and supports the Commission's desire to move towards outcome-based metrics to assess effectiveness of the mitigation efforts, and accordingly proposed six discrete and focused metrics in its July 30, 2019 Report on Data Collection for WMP Report (July 30, 2019 Data Report). These metrics were:

- Wire down events within HFTD Areas
- Equipment caused ignitions in HFTD Areas
- Vegetation caused ignitions in HFTD Areas
- Faults on Circuits in HFTD Areas
- Number of Conventional Blown Fuse Events
- Number of National Fire Danger Rating System (NFDRS) "Very Dry" and "Dry" days

SCE's proposed metrics, above, can drive effective, feasible trend analyses and root cause assessments utilizing available systems and data to reduce wildfire risk, assess SCE's wildfire mitigation strategies and programs, and improve future WMPs. SCE also provided datasets for its proposed metrics to further inform the Commission and stakeholders of available information.

The Guidelines, WMP Metrics attachment, and Supplemental Data Request (SDR), which includes outcomes associated with wildfires, introduced a diverse and large set of performance metrics. SCE is committed to reporting and analyzing Progress and Outcome Metrics over the long term and meeting all requirements. SCE will proactively coordinate with external agencies to develop methods to allow timely and efficient access to information SCE does not manage, to the extent feasible. SCE posits that some of these metrics do not align with advancing wildfire safety. SCE looks forward to collaborating with the WSD and stakeholders to evolve the metrics that focus on rapidly advancing wildfire safety and demonstrating the effectiveness of its wildfire mitigation strategies and programs.

2.2 Recent Performance on Progress Metrics, Last 5 Years

Table 1 provides a five-year history, where applicable, of Progress Metrics as defined by the Guidelines. The comment section for each metric in the table provides details of the source and data that was used or explanations for why certain data is not available.

See Table 1 "Recent performance on progress metrics, last 5 years" for more detail.

2.3 Recent Performance on Outcome Metrics, Annual and Normalized for Weather, Last 5 Years

Table 2 provides a five-year history, where applicable, of Outcome Metrics as defined by the Guidelines. Comments are included in the table to provide additional details about the data provided or indicate if the data is not available or not applicable for the past 5 years. By providing the information that contains the term "utility-ignited" in this table regarding wildfire statistics, SCE is not admitting that: 1) the provided numbers are the actual number of deaths caused, structures destroyed, acres burned, or value of assets destroyed; 2) SCE's facilities caused any of these wildfires, or; 3) SCE has any responsibility for any damage, loss, fatality, or injury caused by these wildfires. In many instances, the cause of wildfires is still under investigation and even where an Authority Having Jurisdiction (AHJ) has issued a report on the cause, SCE may dispute the conclusions of such a report.

See Table 2 "Recent performance on outcome metrics, last 5 years" for more detail.

2.4 Description of Additional Metrics

Table 3 provides additional Progress and Outcome Metrics not requested through the WMP data templates that SCE has historically tracked or has begun to track as of 2019. Included in this section are further extrapolations of fault data quantified by frequency of such occurrences. These metrics provide SCE with additional data associated with internal or external risk factors (i.e., different causes for faults) that could lead to ignitions. These additional measurements enhance SCE's ability to plan, assess, prioritize, and refine ignition risk mitigation initiatives.

See Table 3 "Recent performance on additional metrics, last 5 years" for more detail.

2.5 Description of Program Targets

Table 4 provides details of wildfire mitigation activity and metric goals (or Program Targets) included in its 2019 WMP. In the table, the 2019 Program Targets are identified according to the identification numbers defined in SCE's 2019 WMP (which could be different from the 2020 Program Target identification number). Table 4 includes the previously submitted Program Targets and the 2019 performance including the variance against planned completion.

Of the 58 activities for which performance was measured based on 2019 WMP targets, SCE exceeded its target in 29% and reached the target in 64% of the initiatives. For the remaining 7%, or four programs, SCE did not meet its initial 2019 plans due to resource constraints, operational challenges and reprioritization of activities to address emergent issues such as PSPS events, and in some instances missed the year-end due date by only a few days. SCE has and is continuing to analyze operational data and modify its planning and deployment approaches to help improve performance in 2020 and beyond. SCE has prioritized completing the previously targeted work that is not yet complete.

See Table 4 "List and description of program targets, last 5 years" for more detail.

2.6 Detailed Information Supporting Outcome Metrics

In Tables 5 and 6, SCE provides the requested data related to accidental deaths and OSHA-reportable injuries, respectively, due to utility wildfire activities. SCE notes the following related to the data provided in these tables:

- SCE does not track OSHA-reportable contractor and public incidents, as there is no direct employment relationship and no requirement to report to OSHA. However, SCE does track CPUC-reportable incidents, which have similar thresholds for identification and reporting (i.e., fatality or personal injury rising to the level of in-patient hospitalization, and in connection with utility assets). To provide a more complete data set, SCE provides data in Table 6 related to the "Contractor" and "Member of the Public" columns that correspond to CPUC-reportable incidents.

- Historically, SCE has not tracked reportable incidents separately by wildfire mitigation-related work and non-wildfire work. Therefore, to provide the requested data, SCE assessed each OSHA-reportable employee incident and each CPUC-reportable contractor and public incident over the historical period and determined that the work activities that had reportable incidents were not related to wildfire mitigation efforts.[9]

Going forward, SCE will create a process to flag applicable wildfire work-related incidents as part of its ongoing safety reporting efforts.

See Table 5 "Accidental deaths due to utility wildfire mitigation initiatives, last 5 years" and Table

[9] In late 2018, when SCE initiated its Enhanced Overhead Inspection (EOI) effort to support wildfire mitigation, some employee and contractor incident tracking was captured as related to EOI work; however, none of those incidents rose to the level of an OSHA- or CPUC-reportable event and, therefore, were not included in Tables 5 and 6.

6 “OSHA-reportable injuries due to utility wildfire mitigation initiatives, last 5 years” for more detail.

Table 7 provides details of the current methods used to estimate impact of potential ignitions. The data and methods are reflective of the Reax Engineering (Reax) fire-modeling methodology further described in Section 5.3.1.

See Table 7 “Methodology for potential impact of ignitions” for more detail.

2.7 Mapping Recent, Modelled, and Baseline Conditions

SCE is providing non-confidential and confidential modeled and asset data in GIS shapefiles to the WSD.[10] Below, SCE describes the data it is providing, what data is not currently available but will be provided at a later time, and what data SCE believes it will be unable to provide.

See Table 8 “Map file requirements for recent and modelled conditions of utility service territory, last 5 years” and Attachments 6.1 through 6.3 for more detail.

Attachment 6.1 - Recent weather patterns (non-confidential)

- Average annual number of Red Flag Warning (RFW) days per square mile across service territory
- Average 95th and 99th percentile wind speed and prevailing direction (modeled)

Attachment 6.2 - Recent drivers of ignition probability (non-confidential)

- Date of recent ignitions categorized by ignition probability driver

Attachment 6.3 - Recent use of PSPS (non-confidential)

- Duration of PSPS events and area of the grid affected in customer hours per year

See Table 9 “Map file requirements for baseline condition of utility service territory projected for 2020” and Attachments 6.4 through 6.6 for more detail.
Attachment 6.4 - Current baseline state of service territory and utility equipment

- Non-HFTD vs HFTD (Zone 1, Tier 2, Tier 3) regions of utility service territory (non-confidential)
- Urban vs. rural vs. highly rural regions of utility service territory (non-confidential)
- Wildland Urban Interface (WUI) regions of utility service territory (non-confidential)
- Number and location of critical facilities (confidential)
- Number and location of customers (non-confidential)
- Number and location of customers belonging to access and functional needs populations (non-confidential)

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[10] The GIS shapefiles that are non-confidential can be found on SCE’s WMP website.

- Overhead transmission lines (confidential)
- Overhead distribution lines (non-confidential)
- Location of substations (confidential)
- Location of weather stations (non-confidential)
- All utility assets by asset type, model, age, specifications, and condition (confidential)

SCE is providing the WSD confidential geospatial location data for the following assets for which it regularly tracks in its asset management databases and GIS tools: substations, conductors, structures (towers, poles, vaults, padmounts, etc.), transformers, switches (Remote Automatic Reclosers (RARs), Pole Switches, Remote Control Switches (RCSs), etc.), fuses, and distribution line capacitor banks. SCE needs additional time to gather and correlate confidential information about model, age, and specifications and will supplement with additional information at a later time. Currently, asset condition data is generally limited to inspection and remediation activities related to the asset types noted above but are tracked in multiple systems depending on operational area of responsibility. Additional time is also necessary to merge and correlate these data sources and provide the most recent inspection and remediation data. SCE anticipates these confidential datasets will be provided to WSD by the end of March 2020.[11]

The following equipment are not currently tracked in SCE's asset management database or GIS applications: crossarms, insulators, arresters, guy wires, splices, clamps, and connectors. However, as part of SCE's Pole Loading Program (PLP), SCE has captured data for crossarms, insulators, and guy wires (both down and span) in its SPIDA software application, for poles that have been pole loaded. Additionally, SCE collected data on splices through its EOI effort and the PLP but notes these are currently not systematically updated after overhead lines are reconductored. SCE anticipates this confidential data will be provided to WSD by the end of March 2020.

Attachment 6.5 - Location of planned utility equipment additions or removal (confidential)

- Non-HFTD vs HFTD (Zone 1, Tier 2, Tier 3) regions of utility service territory
- Urban vs. rural vs. highly rural regions of utility service territory
- WUI regions of utility service territory
- Circuit miles of overhead transmission lines
- Circuit miles of overhead distribution lines

[11] Confidential data that SCE has but is not able to gather, compile and organize by February 7, 2020, will be submitted in iterations to WSD as the data becomes available. SCE will inform the WSD when the remaining confidential data will be available. SCE also plans to use the WSD's instructions in Resolution WSD-001 for Discovery and Document Maintenance to inform when remaining non-confidential data is available on SCE's WMP website.

- Location of substations

SCE does not routinely track planned additions, removals, or upgrades by circuit mile, population density, or WUI. While SCE has a number of planned distribution projects over the next few years, they are not far enough along in the project lifecycle to have a complete list of affected structures (new or existing), circuit path/route geometries, and/or geospatial coordinates. Therefore, SCE is unable to map the distribution projects in GIS and subdivide as requested.

The planned work with a well-developed scope and geospatial properties are typically major, longer lifecycle transmission and substation projects that have detailed engineering and/or a Certificate of Public Convenience and Necessity (CPCN) or Permit To Construct (PTC) from the Commission. Therefore, the only planned work that SCE included here are (1) transmission projects that have known, planned geospatial geometries (circuit path/route) that can be uploaded to GIS tools and then divided by population density, WUI, and HFTD Tier/Zone and (2) known, planned substation projects (of which SCE has one in the next three years, Safari Substation).

Although SCE plans to install at least 1,125 weather stations and will strive for approximately 1,425 additional weather stations between 2020 and 2022, actual site/structure locations have not yet been determined and SCE is therefore unable to provide the locational attributes as requested.

Attachment 6.6 - Planned 2020-2022 WMP initiative activity per year (confidential)

- This confidential shapefile provides the location of 2020-2022 WMP wildfire mitigation activities planned to be completed by the end of each year of the plan term

The wildfire mitigation activities included in Attachment 6.6 GIS files are not exhaustive (see Section 5.1 for a more detailed list of WMP activities). Rather, the activities identified in Attachment 6.6 are select planned infrastructure hardening activities that are far enough into the planning/scoping process such that SCE has enough known structure/geospatial data to process them in GIS and provide an output by population density, WUI, and HFTD tier/zone by circuit mile or, where noted, by individual structure/location as requested. Importantly, these planned wildfire mitigation projects can change in scope, schedule, and priority due to a number of factors, including, but not limited to, improvements to risk modeling, scope/duration/frequency of PSPS events, emergency repairs/upgrades, permitting, environmental constraints, and other factors. The planned hardening activities included are installation of covered conductor, current limiting fuses (CLFs), RARs, and tree attachment (TA) remediation.

The planned covered conductor deployment for 2020-2022 (included in the Attachment 6.6 shapefile) is based on a risk-informed priority methodology conducted in late 2019 and subject to change based on continuous improvements to SCE’s risk modeling methods, as further described in Chapter 4. The covered conductor is noted by circuit miles of overhead distribution. The planned CLFs installations only reflect those scoped for 2020 for which SCE has known structure locations and geospatial coordinates at this time. CLF activities are noted by unit and location, not by circuit mile. Additional CLF upgrades will occur later in 2020 and possibly in 2021, but those locations are not known at this time. SCE has scoped all planned RARs installations and have planned locations for all devices, currently being installed through 2020. RARs are noted by unit and location, not by circuit mile. The TA remediation work only reflects scoped locations through 2020 for which SCE has known structure locations and/or geospatial coordinates. Additional TA work for 2021-2022 has not been scoped yet. TA remediation is noted by structure and location of overhead distribution, not by circuit mile.

3 BASELINE IGNITION PROBABILITY AND WILDFIRE RISK EXPOSURE

As California's wildfire risk has grown in recent years, so have SCE's efforts in improving ignition risk analysis capability and wildfire risk mitigation by investing in targeted activities to reduce risk exposure. In 2019, SCE rolled out operational FPI datasets that consider current circuit configurations (wildfire risk exposure) for all its HFRA. Additionally, SCE has taken steps to analyze five-year ignition data to calculate and forecast ignition probability based on specific drivers. Collectively, these two measures enable SCE to more accurately estimate wildfire risk exposure and identify the sources of such risk. SCE has also matured its wildfire mitigation tools such as PSPS and grid hardening initiatives that help California reduce its overall wildfire risk. SCE plans on continuing to refine and expand its wildfire fire mitigation activities through this WMP period and beyond.

3.1 RECENT WEATHER PATTERNS, LAST 5 YEARS

In Table 10, SCE provides data on weather patterns over the last five years based on the descriptions in the Guidelines and SCE's interpretation of them along with other related information described below.

The first row in Table 10 is populated with historical data on Red Flag Warnings (RFW) by circuit mile days per year. The RFW circuit-mile days are based on all overhead distribution and transmission circuits that traverse through the National Weather Service (NWS) Fire Weather Zone (FWZ)[12] from a 2015-2019 historical database of RFW events from the NWS. The overhead lengths of distribution and transmission circuits are calculated within each FWZ polygon (area divided geospatially into over approximately 1,000 space areas). All circuit lengths within that FWZ polygon are then multiplied by the number of days (or fraction of days) that a particular polygon had an RFW in effect.

The Guidelines require that SCE use RFW circuit mile days per year data to normalize data required in other tables. SCE recommends the Commission consider using the National Fire Danger Rating System (NFDRS), which all fire agencies use to determine daily fire danger risk, instead of RFW data. NFDRS is a system that allows fire managers to estimate today's or tomorrow's fire danger for a given area. It combines existing and expected states of selected fire danger factors into one or more qualitative or numeric indices that reflect an area's protection needs. Fire danger ratings are typically reflective of the general conditions over an extended area, often tens of thousands of acres, where a possible wildfire could start. Fire danger ratings describe conditions that reflect the potential, over a large area, for a fire to ignite, spread and require suppression action.

The Guidelines also require SCE provide days rated as "Extreme" on SCE's proprietary FPI, which is the number of days (or fraction of days) that an overhead distribution or transmission line

[12] https://www.weather.gov/gis/FireZones

within SCE's HFRA had an FPI of 15 or higher, where 15 represents SCE's lower boundary for an extreme indicator of fire potential. The number of days is multiplied by the length of the associated HFRA overhead circuit. SCE's FPI calculation capability was initiated in late 2018 and was not implemented across SCE's HFRA until March 2019, and therefore the information in Table 10 for 2019 uses FPI data from March to December 2019.

The WMP Guidelines also require SCE to provide the 95th and 99th percentile wind conditions in circuit mile days. SCE's 95th and 99th percentile values were calculated using 5-year averages (2009 to 2014) of historical modeled wind gust data taken at the centroid of each circuit because relevant data prior to 2008 is unavailable. Further, the values in the column marked "5-year historical average" were calculated using 5-year averages from a different range (2015-2019) than was used for the 95th and 99th percentile values. SCE determined the number of days that an overhead distribution and transmission circuit in HFRA reached or exceeded its 95th or 99th percentile wind gust speed. The number of days is multiplied by the length of the associated HFRA overhead circuit to get 95th and 99th percentile wind conditions in circuit mile days.

See Table 10 "Weather patterns, last 5 years" for more detail.

3.2 Recent Drivers of Ignition Probability, Last 5 Years

To calculate the recent drivers of ignition probability, SCE utilized the following data sources:

- SCE's Outage Management System (OMS) and Outage Database and Reliability Metrics (ODRM)
- Wire down data to determine if the conductor failure led to a wire down event
- Repair work records (from SCE's asset data in SAP) to identify failures
- CPUC reportable fire data

The data from these sources was aggregated to populate Table 11. Pursuant to the WMP Clarification Document issued on January 15, 2020, SCE partitioned Table 11 into distribution (Table 11a) and transmission (Table 11b). Tables 11a and 11b reflect incident type data across SCE's system-wide territory, and not limited to SCE's HFRA. For purposes of this WMP, SCE defines distribution as voltage below 50 kV and transmission as voltage above 50 kV.

To populate the "number of ignitions per year from this driver" in Tables 11a and 11b, SCE used CPUC reportable data filed for 2015 through 2018, and preliminary data for 2019.[13] The CPUC reportable data contains date and time, latitude and longitude, voltage, location, suspected initiating event, and driver and sub-driver (e.g., animal contact, balloon contact, and transformer failure) categories. SCE mapped the suspected initiating event to the driver and sub-driver categories for 2015 through 2019.

See Tables 11a and 11b "Key recent drivers of ignition probability, last 5 years" for more detail.

[13] 2019 data is preliminary because it has not yet been reviewed through SCE's data quality review process.

3.3 Recent Use of PSPS, Last 5 Years

During high-risk fire weather conditions that pose unacceptable levels of wildfire risk to the public based on wind, temperature, humidity levels, ground fuel capacity and the state of the grid, SCE initiates PSPS as a proactive measure to mitigate the risk. There are various initiatives listed throughout SCE's 2020-2022 WMP which target the reduction in frequency of PSPS and mitigate the customer impact during a PSPS event. These initiatives include, but are not limited to, SCE continuing to conduct high fire risk-informed inspections (HFRI), prioritizing maintenance and remediation efforts, installing covered conductor, augmenting weather forecasting and modeling, using advanced risk modelling and ignition probability tracking, conducting vegetation management, updating circuit breaker and relay settings, upgrading remote switching and sectionalizing capabilities, deploying trained and qualified personnel to monitor field conditions as well as other operationalized initiatives in HFRA. Notwithstanding these significant undertakings to help ensure public and employee safety, extreme weather events can pose high ignition and public safety risks, necessitating PSPS. Sections 4.4, 5.3.6, 5.3.9, and 5.6.2 provide more detail on SCE's PSPS protocols and thresholds, mitigation activities to reduce the impact of PSPS events, customer wildfire preparedness communication and education, and SCE's long-term PSPS strategy.

Table 12 represents the frequency, scope, and duration of PSPS events in total and normalized by year (by dividing by the number of RFW circuit-mile days and as further clarified above in Section 3.1). A combination of data from SCE's OMS and data recorded by documentation specialists during actual PSPS events was used. SCE did not execute any preemptive power shutoffs in 2015 and 2016. Over the past five years, SCE first exercised PSPS as a mean of mitigating wildfire risk on December 7, 2017. PSPS activity was minimal in 2017 and 2018, with an increase in 2019 resulting from the implementation of a more robust PSPS program as part of SCE's 2019 WMP.

See Table 12 "Recent use of PSPS, last 5 years" for more detail.

3.4 Baseline State of Equipment and Wildfire and PSPS Event Risk Reduction Plans

3.4.1 Current Baseline State of Service Territory and Utility Equipment

Table 13 lists the current baseline state of SCE's service territory in terms of overhead circuit miles for distribution and transmission lines, substations (only in-service, not including third-party owned), and critical facilities. The table also lists the number of customers in WUI zones and by HFRA tier/zone. SCE retains a small portion of HFRA located outside of the CPUC's HFTD (SCE's non-CPUC HFRA), and operationally treats these areas as Tier 2. These areas have been added to the HFTD Tier 2 populations.[14] HFTD Zone 1 cells only reflect values found outside of HFTD Tier 2 and Tier 3 areas. Zone 1 areas that are wholly contained within Tier 2 and Tier 3 areas are reflected in those respective tiers. The WUI area delineation is based on a GIS layer published by the University of Wisconsin-Madison.

[14] *See* Section 4.2.1 for SCE's description and analysis supporting its HFRA.

SCE does not track all customers that are designated as AFN customers. As such, data provided for the AFN population only includes SCE customers enrolled in the California Alternate Rates for Energy (CARE) / Family Electric Rate Assistance Program (FERA)[15] and/or Medical Baseline[16] programs.

See Table 13 "Current baseline state of service territory and utility equipment" for more detail.

Table 14 provides the number of utility weather stations located in SCE's service territory. Weather stations are equipment containing sensors that capture and transmit weather data, including wind speed and direction, temperature, relative humidity, and solar irradiance. Real-time weather information is used to monitor weather and improve/validate weather models. This information is also used to implement SCE's PSPS protocols and in certain situations will allow SCE to be more surgical in PSPS de-energizations. All weather stations listed in Table 14 are in SCE's service territory and are operated by SCE. The number of units listed is categorized by HFTD tier and normalized by dividing the number of units by the number of circuit miles in overhead primary circuits for both transmission and distribution lines. Weather stations located in SCE's non-CPUC HFRA are included in the HFTD Tier 2 populations. HFTD Zone 1 cells only reflect values found outside of HFTD Tier 2 and Tier 3 (there are no weather stations in Zone 1). Zone 1 areas that are wholly contained within Tier 2 and Tier 3 areas are reflected in those respective tiers.

See Table 14 "Summary data of weather station count" for more detail.

Table 15 summarizes data for fault indicators for overhead distribution circuits and the categorization of installations by tier/zone, including fault indicators in non-HFTD areas. The fault indicators included in this table are either mechanical (i.e., they provide a visual cue to the Troubleman trying to locate the fault) or remote-electronic (i.e., provide presence of fault current remotely via a field computer application). As noted above, fault indicators located in SCE's non-CPUC HFRA are included in the HFTD Tier 2 populations. HFTD Zone 1 cells only reflect values found outside of HFTD Tier 2 and Tier 3 (there are no fault indicators in Zone 1); Zone 1 areas that are wholly contained within Tier 2 and Tier 3 areas are reflected in those respective tiers. For the normalization calculations, the denominators include the mileage of overhead primary circuits at distribution voltages in the corresponding HFTD areas.

See Table 15 "Summary data on fault indicator count" for more detail.

3.4.2 Planned Additions, Removal, and Upgrade of Utility Equipment by End of 3-Year Plan Term

Table 16 provides planned additions, removals, and upgrades of utility equipment by the end of the three-year plan term. For the reasons explained in Section 2.7, the only planned work

[15] https://www.sce.com/residential/assistance/care-fera
[16] https://www.sce.com/residential/assistance/medical-baseline

included in Table 16 are transmission and substation projects that have known, planned geospatial geometries.

As noted above, planned additions, removals, and upgrades located in SCE's non-CPUC HFRA are included in the HFTD Tier 2 populations. HFTD Zone 1 cells only reflect values found outside of HFTD Tier 2 and Tier 3. Zone 1 areas that are wholly contained within Tier 2 and Tier 3 areas are reflected in those respective Tiers.

See Table 16 "Location of planned utility equipment additions or removal by end of 3-year plan term" for more detail.

SCE interprets the requirements for Table 17 to include all SCE's wildfire mitigation activities. SCE does not have geospatial information for all its wildfire hardening efforts. As such, Table 17 includes select planned infrastructure hardening activities with known geospatial properties that enable processing in GIS tools. These properties enable SCE to produce the results as requested by circuit mile or, where noted, by individual structure/location. As noted above, mitigation activities located in SCE's non-CPUC HFRA are included in the HFTD Tier 2 populations. HFTD Zone 1 cells only reflect values found outside of HFTD Tier 2 and Tier 3. Zone 1 areas that are wholly contained within Tier 2 and Tier 3 areas are reflected in those respective Tiers. The following planned hardening activities are included in Table 17: covered conductor, CLFs, RARs, and TA remediation.

Covered conductor deployment plans are based on SCE's current risk-informed priority methodology, further described in Section 5.3.3.3 for 2020-2022. Covered conductor scope is measured as circuit miles of overhead distribution. A relatively small amount of covered conductor scope is in non-HFTD areas. These are typically sections that meet one of the following criteria: (1) small circuit segments or spans that extend from Tier 2 or Tier 3 into non-HFTD areas due to engineering or constructability requirements unique to that location or (2) possess other drivers that warrant the installation of covered conductor (e.g., an area with high winds and high tree count in vegetation management inventory).

CLF installations only reflect those scoped for 2020, for which SCE has known structure locations and geospatial coordinates. Additional CLF upgrades are likely to occur later in 2020 and possibly into 2021, but those locations are not known at this time. CLFs are noted by unit and location, not by circuit mile. CLFs scoped in non-HFTD protect the downstream portion of the lines that traverse HFRA.

SCE has scoped all planned RARs installations and have planned locations for all devices currently being installed through 2020. RARs are noted by unit and location, not by circuit mile. RARs scoped in non-HFTD protect lines that traverse HFRA and are often placed strategically there to isolate communities in HFRA from those that are not (which may limit PSPS impacts) while helping ensure the entire line traversing HFRA is protected.

The planned TA remediation work only reflects scoped locations through 2020 for which SCE has known structure locations and/or geospatial coordinates. Additional TA remediation work may be scoped for 2021 and 2022, depending on where covered conductor is installed. TA remediation is noted by structure/location, not by circuit mile. There are a relatively small amount of TA structures located in non-HFTD areas.

The wildfire mitigation activities included in this table are not exhaustive (see Section 5.1.13 for a complete list of SCE's WMP activities). Rather, they are activities far enough in the planning/scoping process where SCE has enough known structure/geospatial data to process in GIS and organize by population density, WUI, and HFTD tier/zone, as requested. Planned wildfire mitigation projects can change in scope, schedule, and priority at any time due to several factors, including, but not limited to, risk methodology improvements, weather, emergency repairs/upgrades, safety concerns, permit requirements, environmental requirements, and other factors.

See Table 17 "Location of planned utility infrastructure upgrades" for more detail.

3.4.3 Status Quo Ignition Probability Drivers by Service Territory

For Tables 18a and 18b, SCE used the ignition probability driver data populated in Tables 11a and 11b. This data was averaged and organized into the different HFTD tiers/zones. As in Tables 11a and 11b, SCE separated distribution and transmission data into Tables 18a and 18b, respectively. The data sources are the same as those used for Tables 11a and 11b.

See Tables 18a and 18b "Key drivers of ignition probability" for more detail.

4 INPUTS TO THE PLAN AND DIRECTIONAL VISION FOR WILDFIRE RISK EXPOSURE

SCE's 2020-2022 WMP strategies and programs are based on several inputs, not the least of which are the improvements driven by the successes and challenges of SCE's 2019 wildfire mitigation efforts. In fact, and as described in Advice Letter 4120-E, SCE modified some of its wildfire mitigation programs in 2019 as well. SCE expects to continue to make necessary changes as it learns from implementing its wildfire programs, new research, benchmarking, collaboration with other utilities, its customers, first responders, government agencies, and other stakeholders. These inputs and other important factors such as management and subject matter expert (SME) judgment and risk analysis, informed SCE's wildfire strategies and programs presented in this WMP. As further explained below and in subsequent chapters, SCE expects to reduce ignitions in its HFRA, reduce the impact of PSPS, and increase public safety over this WMP period.

SCE's long-term vision is to significantly reduce ignitions that could lead to devastating wildfires, and substantially mitigate impacts related to implementing its wildfire programs including PSPS. We also strive to safeguard SCE's electric system against wildfires irrespective of ignition source and improve system resiliency where operationally feasible. In subsequent chapters, SCE describes how it will reduce wildfire risk exposure and take measurable steps to reduce the impact of PSPS.

4.1 THE OBJECTIVES OF THE PLAN

The objectives of the plan shall, at a minimum, be consistent with the requirements of California Public Utilities Code §8386(a). Describe utility WMP objectives, categorized by each of the following timeframes:

1. *Before the upcoming wildfire season, as defined by the California Department of Forestry and Fire Protection (CAL FIRE)*
2. *Before the next annual update*
3. *Within the next 3 years, and*
4. *Within the next 10 years.*

Safety is the first of SCE's core values and this is demonstrated through its commitment to creating and maintaining a safe environment for its customers, workforce and the communities it serves. SCE's primary objective in this WMP is to set forth an actionable, measurable, and adaptive plan for 2020 to 2022 to reduce the risk of potential wildfire-causing ignitions associated with SCE's electrical equipment within SCE's HFRA. This and the following additional objectives of this WMP reflects SCE's commitment to protect public safety and are consistent with the requirements of California Public Utilities (PU) Code Section 8386(a) to construct, maintain, and operate its electrical lines and equipment in a manner that will minimize the risk of catastrophic wildfire posed by those electrical lines and equipment:

- Implementing measures that safeguard SCE's electric system against wildfires and improve system resiliency;

- Minimizing PSPS impact to its customers and communities;
- Improving fire agencies' ability to detect and respond to emerging fires;
- Improving coordination with utility emergency management personnel;
- Reducing the impact of wildfires and wildfire mitigation efforts on the public; and
- Engaging the public about how to prepare for, prevent, and mitigate wildfires in SCE's HFRA

According to CAL FIRE, the 2020 fire season may start earlier as the outlook estimates that the large-fire potential may increase to "above normal" this spring across Southern California due to the possibility of near to above normal numbers of offshore wind events.[17] The "Grassfire Season" may be a few weeks earlier than usual and begin in April 2020 with resource demand likely centered on foothill and urban interface regions. While the historical wildfire season typically begins in the May/June time period, CAL FIRE has also previously acknowledged that climate change is rendering the term "fire season" obsolete as wildfires now burn on a year-round basis across the state of California.[18] In Chapter 5, SCE provides more details on the WMP Program Targets that will be pursued by SCE in the upcoming wildfire season. SCE's hardening initiatives are being prioritized based on risk analyses which will enable SCE to complete more work in the higher-risk areas prior to the traditional start of the fire season. Similarly, SCE is prioritizing certain situational awareness and operational enhancements in preparation for the 2020 wildfire season. This includes implementing several initiatives to reduce the impact of PSPS, prior to the peak fire season. Likewise, SCE's expansion of its weather station network will prioritize circuits that do not have weather stations in addition to circuits on PSPS monitoring and de-energization lists to enable further granular weather forecasting in areas more susceptible to de-energization.

Chapter 5 of this WMP also describes the programs and activities SCE intends to complete by year-end 2020. SCE's objective is to meet or exceed its wildfire mitigation initiatives' 2020 Program Targets including, but not limited to, operational practices, inspections, system hardening, vegetation management, situational awareness, new technologies, PSPS, and post-incident recovery, restoration, and remediation strategies and programs. SCE also includes forecasts of its programs and activities it intends to complete over the 3-year period of this WMP. SCE's covered conductor deployment will go beyond 2022 and is expected to reach substantial completion by 2024, subject to supply chain and skilled labor resource availability. SCE is attempting to accelerate and expand this program to install more covered conductor in HFRA, this year and within the next four years, beyond the amount originally contemplated in SCE's GSRP. SCE is targeting the proactive replacement of up to approximately 7,500 circuit miles of

[17] The United States Forest Service (USFS) (Predictive Services), that issues the rolling four-month Fire Season Outlook prediction, also describes, in its February 1, 2020 issuance for Southern and Central California, the expected "below normal" winter precipitation as another factor in predicting a potentially earlier start to the 2020 fire season in Southern California.

[18] *See* CAL FIRE 2018 Strategic Fire Plan, p. 10.

existing bare distribution primary overhead conductor in HFRA by 2024.

A summary of SCE's short-term and long-term objectives are detailed in Table SCE 4-1. For more detailed information on SCE's specific strategies and goals for each wildfire mitigation program initiative by the following timeframes: Before 2020 Wildfire Season, Before Next Annual Update, Short-Term (2020-2022) and Long-Term (2023-2030), see Tables SCE 5-0-1 through 5-0-10 in Section 5.1.

Table SCE 4-1
2020-2022 Wildfire Mitigation Plan Objectives

Before 2020 Wildfire Season	**Before Next Annual Update**	**Short-Term (2020-2022)**	**Long-Term (2023-2030)**
• Prioritize hardening initiatives based on existing locational risk analyses to complete more work in the higher-risk areas • Prioritize operational enhancements that aim to reduce the impact of PSPS • Complete 360-degree (aerial & ground) inspections on the highest-risk structures within HFRA	Complete all 2020 Program Targets outlined in Table SCE 5-1	• Incorporate lessons learned from initial wildfire mitigation deployment and identify operational efficiencies to execute more effectively • Minimize PSPS impact to its customers and communities while continuing to harden the grid for improved resiliency • Refine and improve mitigation effectiveness and RSE methodology • Improve fire agencies' ability to detect and respond to emerging fires and further partner with governments, academia, the private sector and communities	• Minimize the operational need for PSPS by deploying grid hardening system-wide • Transition to operating and maintaining wildfire mitigation activities already deployed • Monitor and evaluate new technological advances that can further SCE's wildfire mitigation effectiveness

4.2 Understanding Major Trends Impacting Ignition Probability and Wildfire Consequence

Describe how the utility assesses wildfire risk in terms of ignition probability and estimated wildfire consequence, including use of Multi-Attribute Risk Score (MARS) and Multi-Attribute Value Function (MAVF) as in the Safety Model and Assessment Proceeding (S-MAP) and Risk Assessment Mitigation Phase (RAMP). Include description of how the utility distinguishes between these risks and the risks to safety and reliability. List and describe each "known local condition" that the utility monitors per GO 95, Rule 31.1, including how the condition is monitored and evaluated. In addition:

A. Describe how the utility monitors and accounts for the contribution of weather to ignition probability and estimated wildfire consequence in its decision-making, including describing any *utility-generated Fire Potential Index or other measure (including input variables, equations, the scale or rating system, an explanation of how uncertainties are accounted for, an explanation of how this index is used to inform operational decisions, and an explanation of how trends in index ratings impact medium-term decisions such as maintenance and longer-term decisions such as capital investments, etc.).*

B. Describe how the utility monitors and accounts for the contribution of fuel conditions to ignition probability and estimated wildfire consequence in its decision-making, including describing any proprietary fuel condition index (or other measures tracked), the outputs of said index or other measures, and the methodology used for projecting future fuel conditions. Include discussion of measurements and units for live fuel moisture content, dead fuel moisture content, density of each fuel type, and any other variables tracked. Describe the measures and thresholds the utility uses to determine extreme fuel conditions, including what fuel moisture measurements and threshold values the utility considers "extreme" and its strategy for how fuel conditions inform operational decision-making.

Enterprise-Wide Safety and Wildfire Risk

SCE follows a comprehensive risk management evaluation protocol to assess and mitigate enterprise-wide safety risks. This process includes the CPUC's adopted risk-mitigation procedures: the S-MAP and RAMP. The purpose of the S-MAP is to: (1) allow parties to understand the models the utilities propose to use to prioritize programs and projects intended to mitigate risks and (2) allow the CPUC to establish standards and requirements for those models. In each utility's RAMP report, the utility describes how it plans to assess its risks, and to mitigate and minimize such risks. Each utility's RAMP report should be consistent with the direction provided in the S-MAP. The RAMP submission, as clarified or modified in the RAMP proceeding, is then incorporated into the large IOU's GRC filings.

Pursuant to SCE's 2018 RAMP, SCE deployed a multi-attribute probabilistic risk evaluation model to assess safety risks (including safety-related risks and the associated probability and consequences of potential events). As part of this process, SCE utilized a risk-informed decision-making process to identify, evaluate, mitigate, and monitor enterprise risks, including risks associated with wildfires. This process enables SCE to explicitly include risk considerations in its decision-making for work identification, prioritization, and funding and resource allocation. Senior leaders employ the framework to review the risk analyses and mitigation plans in place to manage enterprise risks. Though risk management has always been an essential part of the management toolkit for strategic, business, and operational planning, over the last few years, risk-informed planning has become a much more explicit and essential component of decision-making.

In its 2018 RAMP report, SCE identified nine top safety risks, wildfire being one among them. For each risk, SCE analyzed existing controls and identified potential mitigations. As described below, some of the identified mitigations for wildfire risk drivers may also mitigate other safety risks such as contact with energized equipment. In those cases where a wildfire-related mitigation also addresses a different safety risk, the deployment of a mitigation primarily for wildfire purposes will be taken into consideration in the future planning of what is needed to address the other non-wildfire safety risks.

Based on feedback received from parties in response to SCE's 2018 RAMP and its 2019 WMP, SCE incorporated a number of improvements to its wildfire risk modeling framework in this 2020-2022 WMP filing. In terms of risk assessment, this feedback included (1) accounting for wildfire risk associated with transmission assets; (2) a re-evaluation of the methodology used for calculating risk spend efficiency for projects to normalize the benefits between mitigations with longer and shorter term effective useful lives; and (3) to refine the granularity of the risk analysis by circuit or line segment to improve an assessment of the performance of SCE's WCCP. SCE has worked diligently to address all of these concerns. Consistent with the S-MAP framework, SCE's 2020-2022 WMP employs a MAVF and a risk bowtie approach, which links mitigations to drivers and/or outcomes for safety, reliability, and financial dimensions for enterprise level risk analysis, and as discussed below, more granular asset level models for deploying mitigations within programs.

SCE annually identifies and evaluates the key risks that the enterprise and its customers face, with a focus on safety risks, such as wildfire risk, utilizing a multi-step process from both a top-down and bottoms-up approach, as described below:

- Top-down review of enterprise-level risks: This effort is aimed at assessing the breadth of activities ongoing at SCE, in the state, and in the utility industry to identify key risks. It includes a review of industry trends and research, public policy efforts, legislative activities, key CPUC and other regulatory proceedings, major SCE initiatives, and critical business functions. The team also compiles feedback on current and emerging enterprise-level risks through company-wide surveys and direct discussions with SCE leadership.
- Bottom-up review of SCE Enterprise Risk Register: SCE maintains an enterprise risk register that captures and assesses risks from across the enterprise, based on interviews and feedback from working groups throughout the organization.
- Consolidation and aggregation: SCE aggregates the risks identified through the above processes to evaluate which risks have potential major safety consequences, including consolidation of duplicate and similar risks.
- Review and refinement with senior leadership: Through leadership review and assessment, further refinements are made as appropriate.

Known Local Conditions

SCE does account for known local conditions in its service territory in developing work scope. As described in Section 4.3.1 below, SCE conducted a detailed analysis of its historical non-CPUC designated HFRA in 2019 and determined that a small portion of this area has similar wildfire risk profile as the High Fire Threat District (HFTD) Tier 2 area. As such, SCE currently treats this portion of non-CPUC HFRAs as a Tier 2 HFTD. In addition, in 2013, SCE completed a territory-wide wind study, which was used to define high wind areas (above the 8 pounds per square foot specified in GO 95) as known local conditions for use in pole loading calculations. SCE implemented the results of this wind study in 2014.

SCE also uses the Santa Ana Winds Threat Index (SAWTi) issued by United States Forest Service (USFS), which categorizes Santa Ana wind severity with respect to the potential for large fires to occur. The SAWTi assesses weather and fuel conditions to generate a threat level associated with Santa Ana wind events and extends out six days showing four threat levels that range from Marginal to Extreme. The SAWTi covers much of the southern portion of SCE's service territory. SCE uses it to gauge the overall severity of forecasted or ongoing Santa Ana wind events across affected SCE districts and as additional validation of the Fire Weather Watches and RFW provided by the National Weather Service.

Weather Conditions

Weather conditions play a significant role in the initiation, spread, and intensity of wildfires. Therefore, weather data serve as key inputs into fire spread modeling to calculate probability and consequence of ignitions. See Section 4.3 for more details. In addition, SCE calculates an FPI based on weather and fuel condition forecasts to assess the likelihood of significant fire activity occurring within the service territory. See Section 5.3.2.4 for more details.

Fuel Conditions

Fuel conditions also play a critical role in the initiation, spread, and intensity of wildfires. Currently, SCE has several methods and tools to monitor and track moisture amounts in the vegetation that contributes most to significant wildfire activity. Fuel moisture (dead and live vegetation) is expressed as a percentage of the water amount compared to the dry weight of the vegetation. For dead vegetation, less than 10% moisture represents fuels that will burn actively whereas moisture for live vegetation that is less prone to burning is generally 80% or more. In 2019, SCE launched a fuels sampling program to fill in known gaps in live fuel moisture observational data. Physical samples of native living plants are collected bi-weekly to determine the dryness and ultimately the combustibility of the vegetation. This data is tracked to determine moistening/drying trends that affect wildfire activity. In addition, SCE has several models that project moisture amounts in dead vegetation. This information is combined with the bi-weekly live fuel sampling to provide a holistic understanding of the fuels environment and serve as inputs into the FPI.

4.2.1 Service Territory Fire Threat Evaluation and Ignition Risk Trends

Discuss fire-threat evaluation of the service territory to determine whether an expanded High Fire Threat District (HFTD) is warranted (i.e., beyond existing Tier 2 and Tier 3 areas). This section shall include a discussion of any fire threat assessment of its service territory performed by the electrical corporation. In the event that the electrical corporation's assessment determines the fire threat rating for any part of its service territory is insufficient (i.e., the actual fire threat is greater than what is indicated in the CPUC Fire Threat Map and High Fire Threat District designations), the corporation shall identify those areas for consideration of HFTD modification, based on the new information or environmental changes. To the extent this identification relies upon a meteorological or climatological study, a thorough explanation and copy of the study shall be included.

4.2.2 Evolution of SCE's Historical High Fire Risk Areas

SCE has maintained HFRA designations that were based on a combination of its historical map boundaries (based on past fire management and response experiences), CAL FIRE's Fire Hazard Severity Zone (FHSZ) maps, and most recently, the CPUC's HFTD maps released in January 2018. SCE has since considered Zone 1, Tier 2 and Tier 3 (collectively, the HFTD), and non-CPUC historical high fire risk areas, to collectively be "HFRA." In the fall of 2018, SCE filed its Grid Safety & Resiliency Program (GSRP) application and in February of 2019, SCE submitted its 2019 Wildfire Mitigation Plan (WMP). Both SCE's GSRP and 2019 WMP made explicit that from an operational perspective, SCE's internally-designated HFRA consisted of (1) Zone 1, (2) CPUC-designated Tier 2 and Tier 3 HFTD maps (27% of SCE's service territory), and (3) various areas outside of the HFTD that SCE traditionally considered to be at elevated risk of wildfires (8% of SCE's service territory; cumulatively 35%). As discussed in those proceedings, SCE initially included both areas as a prudent approach from a risk perspective while a thorough analysis of the non-HFTD HRFA was pending.

SCE's 2019 WMP described how SCE has historically defined those areas collectively as its "HFRA," and how it has generally employed the same elevated wildfire threat mitigation strategies, standards, programs and activities in both CPUC-designated HFTD and non-CPUC HFRA. In other words, SCE has generally treated all its designated HFRA consistently, with appropriate risk-based prioritization of some areas over others for certain programs and activities. SCE's 2019 WMP also described that, at the time of its submittal, SCE was in the process of conducting a rigorous review of its non-CPUC HFRA areas to assess whether it was appropriate to either continue to classify each of those 1,141 granular subareas as HFRA. That analysis (i.e., whether to "remove" or "retain" each non-CPUC-HFTD HFRA polygon) is now complete. From an operational perspective, SCE will treat "removed" areas as non-high-fire risk areas (i.e., all the inspection and maintenance schedules and other programs aimed at HFRA will not apply to these areas). "Retained" areas will be treated as HFRA (i.e., all the inspection and maintenance schedules and other programs aimed at HFRA will apply to these areas).

In August 2019, SCE filed a Petition for Modification (PFM) of D.17-12-024, in which SCE proposed retaining less than 1% of the non-CPUC HFRA to be treated as CPUC HFTD Tier 2 and requested the Commission formally include these areas in its HFTD. Included with the PFM is the detailed report on the results of SCE's HFRA Evaluation. SCE is currently awaiting the Commission's decision on this PFM and respectfully requests the Commission issue a decision before or in concert with this 2020-2022 WMP process. In this WMP, and as noted previously, SCE has included the retained portion in its HFRA and is treating these areas as Tier 2.

4.2.3 Evaluation of SCE's Non-CPUC High Fire Risk Areas

In the fall of 2018, a team consisting of SCE employees with subject matter expertise in fire management/response, fire behavior/fuels, meteorology, maintenance/inspection, grid operations, vegetation management, and geospatial analysis began a project to evaluate SCE's non-CPUC HFRA polygons. The following summarizes the results of the comprehensive evaluation performed by this team.

As detailed in SCE's HFRA Evaluation, Retained Non-CPUC HFRA Final Report (HFRA Report),[19] SCE proposes to retain less than 1% of its non-CPUC-HFRA polygons and treat them as HFTD Tier 2 areas. This percentage includes 40 polygons in SCE's service territory and 3 polygons outside of SCE's service territory, as set forth in the HFRA Report. Specifically, the HFRA Report includes, for each of these 43 polygons:

- A satellite-based GIS geospatial map – the map shows, in color, an overlay of overhead electrical equipment, HFTD areas (e.g., orange is Tier 2 and red is Tier 3), non-HFTD areas (i.e., the polygon at issue), and historical fires.
- Results of wildfire simulations – SCE hired Reax to run a fire-risk simulation in the vicinity of overhead lines that run through SCE's previous non-CPUC HFRA. The Monte Carlo-based modeling simulated fire ignition points randomly selected within 100 meters of overhead electric facilities, and relied on several inputs including fuel, topography, housing density, historical fires, and extreme fire weather conditions (weather scenarios) over the last 20 years.

The HFRA Report also includes the following information for each retained polygon, all of which is relevant to the risk analysis:

- Electrical facilities description – contains an accounting of the length of overhead and underground circuit miles for both transmission and distribution level equipment for each of the retained polygons.
- Historical fire information – enumerates the previous fires experienced in each of the retained polygons since 2000 and their most recent fires, if applicable.
- Vegetation management activity – sets forth the number of identified trees needing trimming in the area (which indicates how active the vegetation management is in the area).
- Tree mortality area designation – identifies whether or not the retained polygon contains tree mortality areas.
- Fuel sources – contains a list of vegetation fuel types within each retained polygon.
- Conclusions – sets forth clear justifications for SCE's HFRA retention decision for each retained polygon.

SCE proposed excluding greater than 99% of the service territory contained within non-CPUC HFRA polygons from SCE's previous HFRA (i.e., greater than 99% of the 8% previously constituting SCE's non-CPUC HFRA service territory). Therefore, with the inclusion of the less than 1% of its service territory, SCE's HFRA will now be in very close alignment with that of the CPUC HFTD maps.

[19] See Appendix C in SCE's PFM of Decision 17-12-024.

4.2.4 Impacts of HFRA Boundary Changes

Figure SCE 4-2~~Figure SCE 4-2~~ provides a before and after snapshot of the HFRA boundary change.

Figure SCE 4-2
Impacts of HFRA Boundary Changes

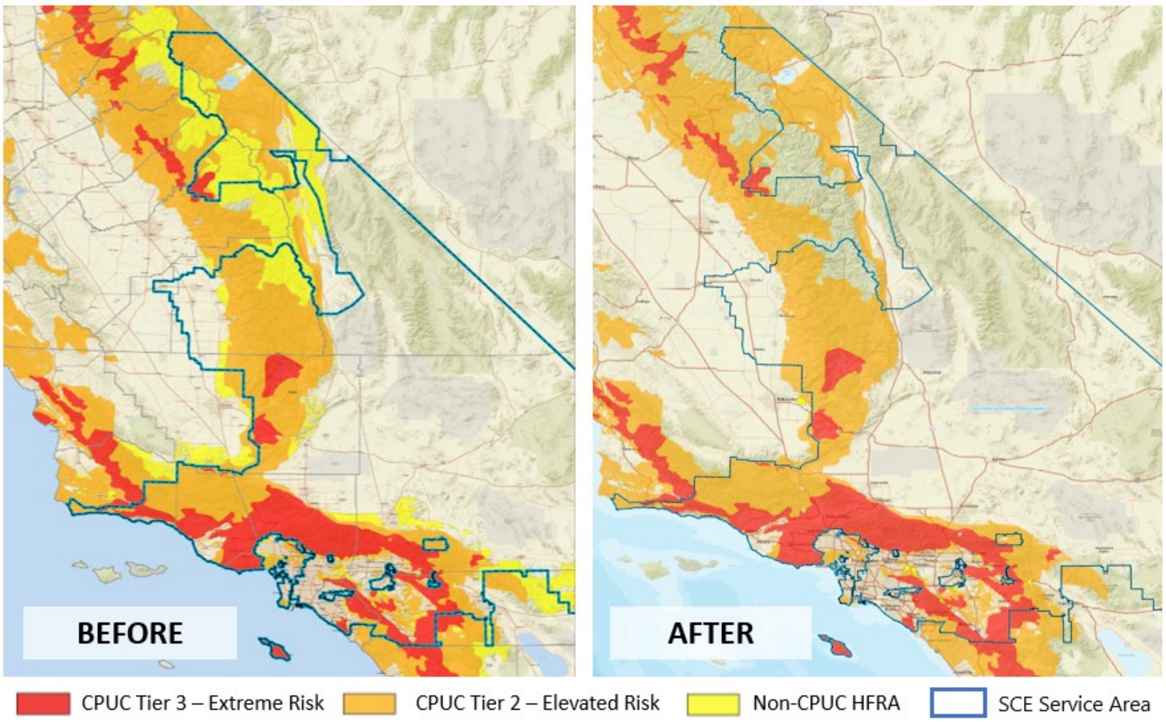


Table SCE 4-2 summarizes the impacts of the HFRA boundary change by area. For a description of the boundary change impact on individual mitigations or hardening activities, please refer to Advice Letter 4030-E filed on July 5, 2019.

Table SCE 4-2
Impacts of the HFRA Boundary Change by Area

	Before HFRA Evaluation		After HFRA Evaluation	
	Area (Square Miles)	Percent of Service Territory	Area (Square Miles)	Percent of Service Territory
Tier 3 of the HFTD-- Extreme Risk	4,708	9%	4,708	9%
Tier 2 of the HFTD -- Elevated Risk	9,571	18%	9,571	18%
SCE HFRA Not in HFTD	4,212	8%	124	<1%
Total	18,493	35%	14,403	27%

4.2.5 Macro Trends Impacting Utility Ignited Ignition Probability and Estimated Wildfire Consequence by Year 10

In the "Rank" column, numerically rank the trends anticipated to exhibit the greatest change and have the greatest impact on ignition probability and estimated wildfire consequence (be it to increase or decrease ignition probability and estimated wildfire consequence) in ten years. Rank in order from 1 to 8, where 1 represents the greatest anticipated change or impact on ignition probability and estimated wildfire consequence and is the least anticipated change or impact.

In the "Comments" column, provide a narrative to describe the expected change and expected impact on the utility's network, including whether the trend is expected to significantly increase risk, moderately increase risk, have limited or no impact, moderately decrease risk, or significantly decrease risk. Use quantitative estimates wherever possible. Also outline any programs being implemented to specifically address this trend.

In Table 19, SCE ranked the macro trends largely based on the fire triangle (i.e., heat, fuel and oxygen), as these factors have the largest impact on ignition probability and wildfire consequence. In the Comments column, SCE describes the science and assumptions it used in its ranking. SCE had not previously projected these macro trends out ten years as it relates to wildfire safety and has based its responses on high-level SME judgment. SCE believes climate change would have the largest impact on ignition probability and wildfire consequence as it is a main driver of fuel density and moisture.

List and describe any additional macro trends impacting ignition probability and estimated wildfire consequence within utility service territory, including trends within the control of the utility, trends within the utility's ability to influence, and externalities (i.e., trends beyond the utility's control, such as population changes within the utility's territory).

List and describe all relevant drivers of ignition probability and estimated wildfire consequences and the mitigations that are identified in the Risk Assessment Mitigation Phase (RAMP) and not included in the above, including how these are expected to evolve. Rank these drivers from highest to lowest risk and describe how they are expected to evolve

SCE used the bowtie framework (included in SCE's RAMP report) to model wildfire risk, which included describing and quantifying the various direct drivers and sub-drivers of ignition. Chapter 12 of SCE's RAMP report refers to the impact of more extreme wildfire events as well as other catastrophic events such as extreme rain events and/or heat events. As SCE's modelling capabilities and understanding of the wildfire risk matures, more scenario analysis can be utilized to further understand the different macro trends impacting ignition probability and wildfire consequence.

See Table 19: "Macro trends impacting ignition probability and/or wildfire consequence" for more details.

4.3 CHANGE IN IGNITION PROBABILITY DRIVERS

Based on the implementation of the above wildfire mitigation initiatives, explain how the utility sees its ignition probability drivers evolving over the 3 year term of the WMP. Focus on ignition probability and estimated wildfire consequence reduction by ignition probability driver, detailed risk driver, and include a description of how the utility expects to see incidents evolve over the same period, both in total number (of occurrence of a given incident type, whether resulting in a near miss or in an ignition) and in likelihood of causing an ignition by type. Outline methodology for determining ignition probability from events, including data used to determine likelihood of ignition probability, such as past ignition events,
number of near misses, and description of events (including vegetation and equipment condition).

In 2019, SCE deployed the Wildfire Risk Model (WRM) to estimate the amount of risk expected at individual locations. As described in Section 4.2, SCE used the RAMP methodology to perform overall portfolio system-wide risk analysis, while the more granular WRM helped SCE prioritize the deployment of wildfire mitigation to areas in order of the highest risk. The WRM utilizes a similar risk bowtie approach as described in RAMP, but builds upon that approach by localizing the drivers, outcomes, and consequences to specific circuit and circuit segments. The output of this model is a risk score that identifies high risk locations where specified, targeted mitigations could be considered. In 2019, SCE used the WRM to re-prioritize the deployment of covered conductor to higher risk locations. Over the next three years, covered conductor deployment will increase from 151 circuit miles in 2018 and 372 circuit miles in 2019, to 700-1000 circuit miles in 2020, 1,400 circuit miles in 2021, and 1,600 circuit miles in 2022, ultimately reducing system risk between 45% to 65%. SCE also used the WRM to inform SCE's HFRI Program. Once operational, this program will utilize WRM outputs to inspect higher risk areas more frequently.

The WRM is comprised of three components: a Probability of Failure/Ignition Likelihood module, a Fire Propagation module, and an Impact module. The propagation and impact modules are integrated to produce a single consequence variable used by the WRM.

4.3.1 Probability of Ignition Module

The Probability of Failure/Ignition Likelihood module uses predictive models developed by SCE to identify assets most likely to be associated with an ignition. The probability of an ignition is the combined probability of spark with probability of fire.

4.3.1.1 Probability of a Spark

SCE's probability of a spark model has three primary components: probability of a spark caused by an equipment failure (EFF), probability of a spark caused by contact from a foreign object (CFO), and the probability of a spark caused by an identified maintenance item (e.g., a Priority 2 notification).

SCE used machine learning algorithms to assess the likelihood or probability that a piece of equipment will experience a fault resulting in a spark from either an EFF or a CFO, and the probability that fault will result in an ignition event. SCE used an extensive series of input variables including historical asset performance, weather, environmental, and geographical data to develop the predictive models. The Probability of Failure/Ignition Likelihood module contains individual sub-models for each type of asset (wire, transformer, etc.), and thus total ignition probability at a structure (pole or tower) is calculated as the sum of the probabilities of ignition across the assets at that location.

SCE calculated the probability of a spark caused by an identified maintenance item (e.g., Priority 2) using a failure modes and effects analysis as the number of equipment failures that occur specifically on equipment that had a previously identified maintenance item is very limited. Moreover, because maintenance items are typically repaired before failure, the inherent risk of failure before replacement must be estimated theoretically.

4.3.1.2 Probability of a Spark Turning into a Fire

The probability of a spark resulting in a fire is a function of the FPI. FPI is an internal tool used to estimate wildfire potential based on forecasted weather and fuel conditions. For more details on SCE's FPI, see Section 5.3.2.4. In 2020, SCE will begin refining its current FPI by integrating historical weather and vegetation data into the index. In parallel, SCE will work on the development and testing of a new FPI which will incorporate more information about fuel conditions. As SCE is still advancing its FPI, currently and for 2020, SCE assumes a 100% conversion rate from spark to fire.

4.3.2 Fire Propagation Module

The fire propagation module of the WRM replaces the broader "outcome" scenarios presented in SCE's GSRP, RAMP and 2019 WMP filings by forecasting specific fire attributes, namely:

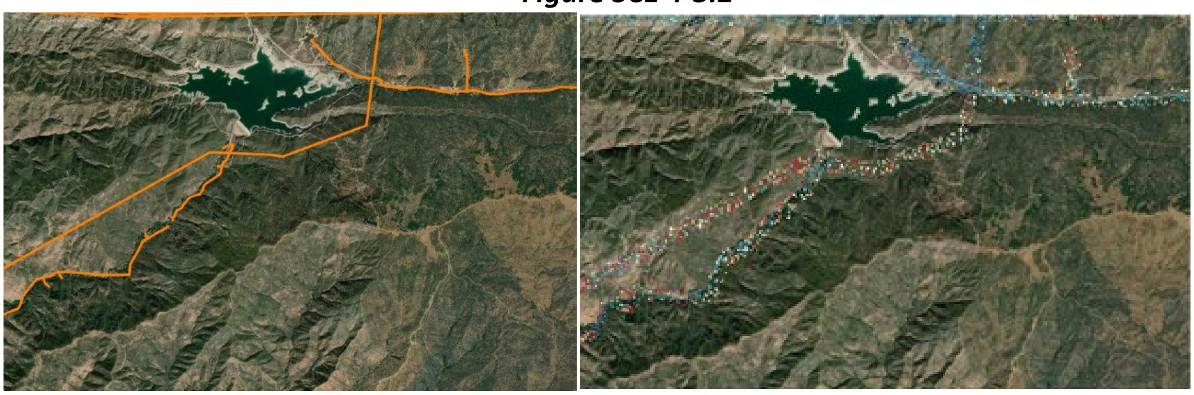
- Fire volume and flame length
- Fire progression, area, and direction
- Potential structures impacted by a fire based on the sample fire scars

In early 2019, SCE contracted with Reax, a recognized expert in areas ranging from fire investigation and building code fire to wildfire computer modeling, to develop improved wildfire consequence information using the firm's wildfire simulation tools. Fire propagation characteristics are provided by Reax using its ELMFIRE fire modeling technology. This technology utilized a twenty-year fire weather climatology to develop historical fire-weather days across SCE's service territory. The model includes high resolution, hourly gridded fields of relative humidity, temperature, dead fuel moisture, and wind speed/direction (weather scenarios) as inputs to a Monte Carlo simulation using hundreds of thousands of ignition locations distributed randomly within an extended perimeter, or "buffer" surround SCE overhead facilities in HFRA.

Based on these simulations, fire volume – the spatial integration of fire area and flame length – were tabulated and recorded to develop sample fire scars. This process was repeated across SCE's service territory for hundreds of thousands of combinations of ignition location and ignition time. Outputs of these simulations were used to quantify the consequence as the product of fire volume and the number of impacted structures within the weighted average overlay of simulated fire scars localized to 300 meter by 300 meter Reax grid squares.

The figures below illustrate an example. The figure on the left illustrates SCE overhead facilities. The figure on the right illustrates match-drop ignition locations randomly distributed within a buffer surrounding SCE overhead facilities.

Figure SCE 4-3.2

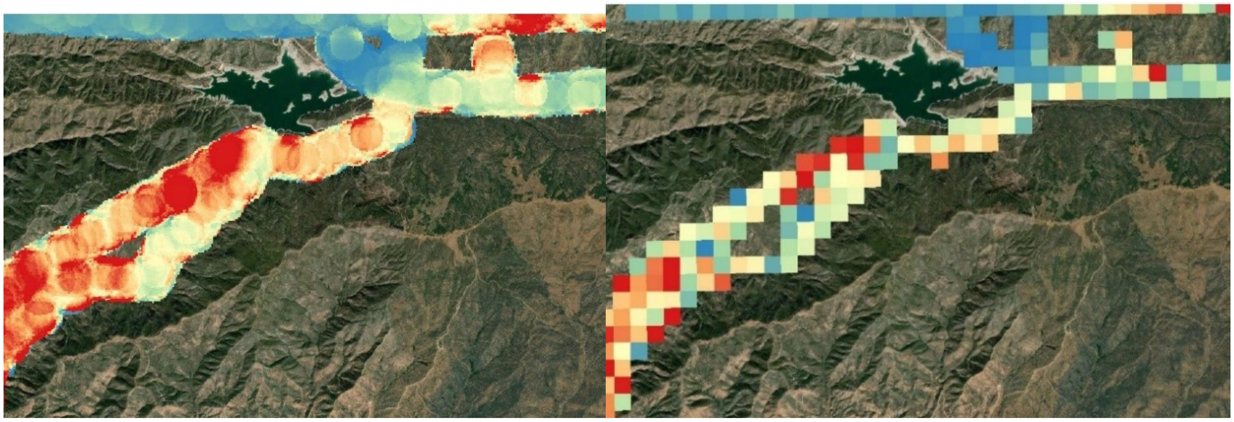


4.3.3 Fire Impact Module

For the Fire Impact module, SCE enhanced the Reax consequence output to consider not only the number of structures impacted, but also impacts to safety, such as serious injuries and fatalities, acres of property burned, as well as suppression and restoration costs. Reax uses the weighted average of the fire propagation simulations spreading from each of the points to estimate the number of structures and population that could be impacted for each simulated fire. Using U.S. Census housing density data, the six-hour fire simulation estimates the structure density for each pixel within the perimeter of the simulation. The granularity of this model enables SCE to estimate the scope of the potentially impacted structures based on the specific burn area simulated, instead of relying on higher level housing density information. SCE has continued to refine the consequence module to create risk flags to assess population egress – the ability of a population to evacuate an area – and social vulnerability – the ability of a population to withstand the economic impacts associated with a fire event. These risk flags are estimated outside of the Reax fire propagation module.

The model outputs are generated as raster files with a resolution of 30 meters. These raster files depict fire area, volume, number of structures impacted, and risk surrounding the modeled ignition point (see the figures below). In order to simplify the analysis, these risk boundaries are smoothed using a kernel density interpolation technique to create 300-meter by 300-meter average “Reax squares.”

Figure SCE 4-3.3



In 2020, SCE is adopting a GIS-enabled software platform known as Technosylva to enhance SCE’s ability to model wildfire risk. One of the tools provided by Technosylva is the Wildfire Risk Reduction Model (WRRM)[20] which integrates wildfire ignition probability developed for the WRM with Technosylva fire spread predictions to calculate the expected risk. Similar to the methodology employed by Reax, the WRRM will conduct Monte Carlo simulations to estimate the potential impact of fire ignition and propagation to structures, population, utility assets, and critical facilities using a set of historical and projected fire weather data. However, WRRM improves upon Reax in several ways. This tool will integrate with SCE’s weather forecast model, using a customized version of the Weather Research and Forecasting model calibrated to two-kilometer by two-kilometer wind and weather conditions SCE’s service territory granular two-kilometer by two-kilometer wind and weather conditions. This analysis will use a pre-defined set of weather scenarios, reflecting the most common conditions for fire ignition and propagation and will run multiple simulations for each asset. SCE expects to run several scenarios for each ignition point using different fire propagation and weather scenarios simulations, resulting in hundreds of millions of simulations throughout SCE’s service territory. SCE intends to re-run this simulation on an annual, or semi-annual basis based on updated and calibrated information from previous fire weather seasons. The WRRM will also rely on more granular vegetation, structure, and population data than currently used in Reax to estimate potential consequences. The ability to run multiple scenarios in a myriad of weather and wind conditions along with improved population, structure, weather, and vegetation datasets will vastly improve SCE’s ability to design and target mitigations to high risk areas.

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[20] For clarity, SCE’s current WRM is different than Technosylva’s WRRM despite similar names and acronyms.

In addition to developing risk scores for known current weather conditions, SCE plans to enhance the WRRM to develop future-facing "what if" climate scenarios based on future projected climate conditions. SCE intends to work with the California Energy Commission (CEC) and stakeholders in other proceedings, such as the Commission's Climate Change Adaptation Order Instituting Ratemaking (R.18-04-019), to better understand climate models that may need to be developed through an iterative working process. These longer-term future-facing models are anticipated to be used to inform SCE's wildfire mitigation strategies and programs. SCE is also working to further develop additional risk flags in the WRRM to identify quantitative and qualitative considerations to improve the risk model including, for example, developing improved assessments of population egress and fire suppression capabilities in local areas.

The WRRM will integrate with two other Technosylva tools that SCE is employing, FireSim and FireCast that are further discussed in Section 5.3.2. WRRM will share weather and vegetation data with FireCast and FireSim to ensure consistency between real-time operational planning and system-wide mitigation deployment.

4.4 Directional Vision for Necessity of PSPS

Describe any lessons learned from PSPS since the utility's last WMP submission and expectations for how the utility's PSPS program will evolve over the coming 1, 3, and 10 years. Be specific by including a description of the utility's protocols and thresholds for PSPS implementation. Include a quantitative description of how the circuits and numbers of customers that the utility expects will be impacted by any necessary PSPS events is expected to evolve over time. The description of protocols must be sufficiently detailed and clear to enable a skilled operator to follow the same protocols.

SCE has defined protocols that dictate the need for activation of a PSPS Incident Management Team (IMT). When wind and fire potential (quantified by SCE's FPI) forecasts are at or above Elevated Fire Weather Threat levels, SCE activates IMTs to report to its Emergency Operations Center. Each team is trained and qualified on the Incident Command System (ICS), the federally recognized emergency response methodology. SCE has teams on-call 24 hours a day, 7 days a week, 365 days a year.

Three days ahead of a forecasted PSPS event, SCE's PSPS IMT initiates notifications, if weather conditions can be predicted this far in advance, to public safety partners and city/state agencies in the potentially impacted area. Two days before forecast conditions are expected to impact a specific circuit, SCE's protocol dictates the initiation of notification to customers on that circuit via their preferred method of communication (e.g., text, e-mail, or phone). They are again scheduled to be notified one day before the forecasted conditions.

During this time, SCE also deploys field resources to pre-patrol each circuit that is forecasted to be in scope for PSPS de-energization consideration. This requires a qualified electrical worker

(QEW) to visually inspect the entire length of the overhead circuit that traverses HFRA to verify if the circuit can withstand incoming weather and to provide other up-to-date intelligence on field conditions to SCE's IMT. If concerning maintenance items are discovered on a circuit in scope, repairs are expedited (if possible) before the impending wind event. Where possible, every circuit that is in scope for the upcoming event should have a pre-patrol performed, unless it was already patrolled within the last seven days.

Prior to each PSPS event, SCE implements required modified operational procedures that minimize or eliminate the potential for a spark to occur. When circuits are forecasted to exceed pre-determined thresholds, SCE implements fast curve settings protective relays, which are designed to limit the fault energy and more quickly de-energize the line should a fault occur. SCE also implements operating restrictions and blocks reclosers on these lines so that if a line relays, it cannot automatically reclose. In this situation, the line has to be patrolled and the potential safety hazard removed before the circuit can be re-energized.

Two hours before the start of the event, SCE's IMT coordinates with field resources to ensure that a QEW is physically present for live field observation (LFO). The purpose of this LFO is to monitor a circuit for any possible signs of failure or prevailing environmental conditions such as potential damage from wind gusts, airborne vegetation, or flying debris. If observed conditions are concerning enough, QEWs are empowered to recommend immediate de-energization to the Incident Commander.

LFOs are just one of many inputs that SCE's IMT considers, while evaluating the potential for PSPS de-energization of a circuit. Other inputs include specific concerns from state and local fire authorities, emergency management personnel, and law enforcement regarding public safety issues. The expected impact that de-energizing circuits will have on public safety (through impacts on essential services such as public safety agencies, water pumps, traffic controls, etc.) is also an input to the final recommendation by the PSPS IMT. The decision to de-energize must be authorized by the IMT's Incident Commander.

SCE's de-energization decisions are made on a circuit-by-circuit basis, often on a sub-circuit level, and are taken only when current conditions in the immediate area warrant action. De-energization wind speed triggers are unique to each circuit and are dynamic based on evolving environmental and circuit-specific characteristics. Some factors that are taken into consideration when setting de-energization triggers include wind speed, FPI, ignition consequence modeling, circuit conditions, length of conductor, and other technical characteristics for the applicable circuit. The IMT takes characteristics such as a higher FPI, multiple historical outages or outstanding maintenance items into account when determining if wind speed thresholds for recommending de-energization should be lowered.

Lessons learned from PSPS events and SCE's protocols for PSPS implementation are captured in SCE's required ESRB-8 filings after each PSPS event. These reports can be found on SCE's website at www.sce.com/wildfire under "Reports to the CPUC." Recent lessons learned focus on the need for greater stakeholder communications during PSPS events to include coordination with public safety partners and local governments, and the need for greater understanding of impacts from a PSPS event to include enhanced outage notification during PSPS events.

Setting aside variability in weather conditions, SCE anticipates de-energization events to decrease in coming years. However, PSPS events will still be required in some cases for the safety of customers and communities. SCE is targeting ignition risk mitigation efforts on circuits most impacted by PSPS in 2018 and 2019. Continuous improvement in operational practices (e.g., optimizing circuit-specific activation and de-energization thresholds), expanded grid hardening activities (e.g., targeted installation of covered conductor and additional automated sectionalizing devices), and enhanced situational awareness capabilities through expansion of SCE’s network of weather stations will also facilitate reducing PSPS events over time.

In parallel, SCE is actively pursuing customer care initiatives to help decrease the impact of PSPS events on its customers. Examples of these initiatives include deployment of Community Crew Vehicles (CCVs), activation of Community Resource Centers (CRCs) and engagement with impacted communities to help bolster preparedness. The mitigations SCE is undertaking are discussed in more detail in Section 5.3.6.

Table 20 provides SCE's estimates about the use of PSPS protocols and specific impacts to the public over the coming decade. Forecasts in this table assume unchanged Tier 2 and Tier 3 areas, low population and load growth, and undetermined climate change on fire weather in SCE's service territory.

SCE's forecasts also assume that 2019 represents an average year for future fire-weather threats. If fire weather threats worsen in frequency and intensity compared to 2019, the expected frequency and impact of PSPS events in SCE’s HFRA may be adversely impacted.

See Table 20: “Anticipated characteristics of PSPS use over next 10 years” for more details.

5 Wildfire Mitigation Strategy and Programs for 2019 and for Each Year of the 3-Year WMP Term

5.1 Wildfire Mitigation Strategy

Describe organization-wide wildfire mitigation strategy and goals for each of the following time periods:

- Before the upcoming wildfire season, as defined by the California Department of Forestry and Fire Protection (CAL FIRE),
- Before the next annual update,
- Within the next 3 years, and
- Within the next 10 years.

The description of utility wildfire mitigation strategy shall:

A. Discuss the utility's approach to determining how to manage wildfire risk (in terms of ignition probability and estimated wildfire consequence) as distinct from managing risks to safety and/or reliability. Describe how this determination is made both for (1) the types of activities needed and (2) the extent of those activities needed to mitigate these two different groups of risks. Describe to what degree the activities needed to manage wildfire risk may be incremental to those needed to address safety and/or reliability risks.

B. Include a summary of what major investments and implementation of wildfire mitigation initiatives achieved over the past year, any lessons learned, any changed circumstances for the 2020 WMP term (i.e., 2020-2022), and any corresponding adjustment in priorities for the upcoming plan term. Organize summaries of initiatives by the wildfire mitigation categories listed in Section 5.3.

C. List and describe all challenges associated with limited resources and how these challenges are expected to evolve over the next 3 years.

D. Outline how the utility expects new technologies and innovations to impact the utility's strategy and implementation approach over the next 3 years, including the utility's program for integrating new technologies into the utility's grid.

A. SCE's Approach to Managing Wildfire Risk:
Fire risk management and mitigation has been an integral part of SCE's operational practices for years. Since 2017, however, large catastrophic fires have emphasized that the safety of SCE's communities requires additional measures to address a higher level of wildfire risk not contemplated by existing state standards or traditional utility fire mitigation practices. Accordingly, SCE undertook a large effort starting in late 2017 to assess, test, and benchmark

several enhanced wildfire mitigation measures and approaches and began deploying these in 2018. In 2019, as described in SCE's 2019 WMP and subsequent December 2, 2019 Reports on Possible Off Ramps Advice Letter (Advice 4120-E or Off Ramp Report), SCE accelerated and expanded its wildfire mitigation activities, making modifications and refinements based on emergent events, additional analysis, and lessons learned from its successes and trials during implementation. These efforts were challenging as SCE established new processes, tools, and protocols to implement its wildfire mitigation strategies and programs. SCE was largely successful in meeting the goals for the 58 activities in its 2019 WMP. SCE continued to improve many facets of its wildfire programs in 2019, including more granular risk analyses and modifications to its PSPS program to reduce the frequency and impact of de-energization.

The primary objective of this WMP is to set forth an actionable, measurable, and adaptive plan for 2020 to 2022 to reduce the risk of ignitions associated with SCE's electrical infrastructure in HFRA. Consistent with SCE's first WMP, this WMP's fundamental underlying objective is protecting public safety by, among other things, further hardening SCE's electric system against wildfires and improve system resiliency, minimizing the customer impact of PSPS, improving fire agencies' ability to detect and respond to emerging fires in coordination with utility emergency management personnel, and effectively communicating with customers, community groups, and other stakeholders about how to prepare for, prevent, and mitigate wildfires in SCE's HFRA.

SCE's 2020-2022 WMP is not static. As SCE learns from its experiences and gains new information about factors affecting wildfire risk, SCE will reassess its wildfire mitigation strategy to continually focus on improved ways to mitigate the highest wildfire risks. Accordingly, consistent with the requirements in PU Code Section 8386, this WMP sets forth SCE's 2020-2022 plan to minimize wildfire risk by prudently operating and maintaining its grid. While these collective efforts are designed to mitigate the risk of fire ignition events associated with SCE's electrical infrastructure, the risk of ignition will not be eliminated. Over time and cumulatively, the success of the individual programs and activities in this WMP are expected to result in an overall reduction of controllable fire ignition events associated with SCE's electrical infrastructure.

B. Summary of Major Investments And Implementation Of Wildfire Mitigation Initiatives:
Below are summaries of SCE's initiatives organized by the wildfire mitigation categories listed in Section 5.3, including goals achieved and lessons learned. For more details, see the associated sections in this WMP, SCE's most recent 2019 WMP progress update filed in the Senate Bill (SB) 901 OIR and SCE's Off Ramp Report.

5.1.1 Risk Assessment and Mapping

In its 2019 WMP, SCE committed to evolving its risk modeling beyond the portfolio level analysis described in GSRP and RAMP to better inform decisions to target the deployment of wildfire mitigation on a more granular level. Thus, as described in Chapter 4, SCE has progressed its modeling capabilities beyond the analysis of historical ignition data to a more dynamic approach with its WRM and will further advance with the implementation of the WRRM.

Table SCE 5-0-1

5.3.1 Risk Assessment and Mapping Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
Aim to deploy the Technosylva Fire Sim/Fire Cast Modules and the Technosylva Wildfire Risk Reduction Model (WRRM)	See Table SCE 5-1 2020 Program Targets for 2020 activities	• Refine and improve mitigation effectiveness and Risk Spend Efficiency (RSE) methodology • Within the WRRM, analyze how wildfire patterns may change under forward-looking climate change scenarios • Integrate WRRM's fire spread modeling capabilities with SCE's asset predictive models • Utilize WRRM scenarios to inform 2022 RAMP filing	• Utilize integrated WRRM and asset condition data to predict asset health condition and wildfire-related risk values • Use WRRM climate change scenarios to: (1) inform how HFRA boundaries may evolve over time; (2) consider where mitigations may need to be deployed in the future; and (3) proactively engage communities and local governments in climate adaptation decision-making

SCE's wildfire mitigation programs for risk assessment and mapping are further described in Section 5.3.1.

5.1.2 Situational Awareness and Forecasting

A key component of SCE's wildfire mitigation strategy is to enhance situational awareness capabilities regarding potential wildfire conditions and develop appropriate operational plans, including minimizing the use of PSPS to mitigate wildfire risk. Importantly, these efforts help both fire agencies and SCE emergency management staff in assessing and responding to wildfires. SCE has installed 161 HD cameras, reaching 90% coverage of its Tier 2 and Tier 3 HFRA. The deployment of HD cameras has reached a saturation point and due to geographical limitations, additional cameras will not provide any additional benefits. SCE has also completed the deployment of 482 weather stations and will continue to deploy more, primarily in HFRA to enable more targeted PSPS and improve its weather modeling capabilities. Furthermore, SCE is increasing staffing of fire management personnel and meteorologists to improve situational awareness, and support planning and operational decisions to reduce wildfire risk.

Partnering with the University of California San Diego (UCSD) and coordinating with state, county and local fire agencies to identify optimal placement of HD cameras was valuable and effective. In addition, encouraging vendors to negotiate tower agreements early helped avoid schedule delays. Among the lessons learned was the need to consider inclement weather, remote terrain, and accessibility issues (e.g., snow, mud, etc.) when establishing the schedule for weather station installations.

Table SCE 5-0-2
5.3.2 Situational Awareness and Forecasting Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
Operationalize an additional HPCC which will support a proprietary and specialized high-resolution weather model specific to SCE's service territory	See Table SCE 5-1 2020 Program Targets for 2020 activities	• Expand installation of weather stations • Use HPCC to develop a 40-year historical weather and fuels dataset • Implement new FPI to include more information about fuel conditions • Improve SCE's modeling capabilities, fuels sampling and fire spread modeling by adding data inputs and by incorporating technologies such as machine learning and remote sensing • Expand the exploration and deployment of technologies that advance the real-time monitoring of system health (such as DFA, EFD, or similar technology) • Build new partnerships and leverage existing relationships with government, academia and the private sector to further the understanding of wildfires • Enable proactive maintenance to prevent degrading equipment conditions from evolving into an actual failure • Explore use of remote sensing technology such as satellite imagery combined with advanced data analytics • Increase staffing of fire management personnel and meteorologists to improve situational awareness, and support planning and operational decisions to reduce wildfire risk	• Continue deployment of weather stations to achieve approximately 2 weather stations per HFRA circuit • Implement advanced tools and technology to inform mitigation initiatives for all-hazard threats and to aggregate and synthesize data and perform predictive analyses • Integrate environmental science to further understand conditions that lead to the initiation, spread, and intensity of wildfire activity • Improve modeling capabilities by incorporating technologies such as machine learning and remote sensing • Develop and mature fire and environmental science capability to support climate change and severe weather analysis and adaptation planning • Leverage weather stations to provide input into predictive weather modeling

Situational Awareness and Forecasting are further described in Section 5.3.2

5.1.3 Grid Design and System Hardening

In 2019, SCE continued to make significant investments in grid hardening including replacing hundreds of miles of bare conductor with covered conductor, replacing wood poles with fire resistant poles where appropriate, installing more fast-acting fuses, and remote controlled sectionalizing devices in HFRA. These grid hardening measures that focus on reducing ignition risk also improve reliability by reducing the frequency and impact of faults resulting from contact from objects. The increased resistance to faults and conductor insulation may also reduce the frequency of wire down, wire-to-wire contact, and wire contact with energized equipment incidents.

Installing covered conductor on its overhead lines in HFRA continues to be one of the major wildfire risk mitigation activities in this WMP given its risk reduction potential and cost effectiveness compared to other measures such as undergrounding. As mentioned previously, SCE is prioritizing and targeting system hardening mitigations in higher risk areas within HFRA.

SCE is also refining its strategy for deploying sectionalizing devices. In 2019, RARs were installed and/or relocated around the HFRA boundary to improve electric service for customers located outside of HFRA during PSPS or other outage events. Further analysis showed that sectionalizing devices, including Remote Controlled Switches (RCS), in certain locations are a more cost-effective and feasible alternative to RARs to achieve the same granular sectionalizing capability. In this WMP period, SCE will continue to install remote controlled switches to further sectionalize its circuitry in HFRA.

Based on analysis of recent PSPS events, SCE has identified opportunities to reassess, and potentially modify circuit designs and configurations to reduce the number of customers affected during a PSPS event. This includes replacing small segments of bare conductor with covered conductor, targeted undergrounding projects, and/or adding switching devices (and potentially circuit ties) to improve flexibility for circuit reconfigurations and load transfers. These circuit modifications help minimize the impact to customers who are located in 1) non-HFRA that are fed from circuits that also serve HFRA and 2) underground circuits within HFRA that are fed from circuitry that also contains overhead facilities within HFRA.

Through fire testing and technical evaluations in 2019, SCE learned that a fire-resistant wrap/barrier is capable of withstanding temperatures exceeding 2,100 degrees Fahrenheit. Applying a protective layer to new wood poles has proved to be an effective measure to protect them from the typical conditions a wood pole may be subjected to during a passing wildfire (after an ignition has occurred). This fire-resistant pole-wrapping technology is a cost-effective alternative to installing fire-resistant composite poles when the probability of an ignition at the pole is low (i.e., no electrical equipment on the pole and/or not a woodpecker area). In 2020, SCE will continue installing the fire-resistant wrap/barrier on new treated wood poles in HFRA when these criteria are met. Installation of this fire-resistant protective wrap/barrier to wood poles in combination with fire-resistant composite poles will allow SCE to lower costs while meeting the need of hardening its grid.

Also in 2019, SCE completed technology pilots or evaluations of ridge pin construction (used only in limited scenarios), bolted wedge connectors (implemented into standards for new construction and rebuilds), substation class electronic fuses (will not expand their use at this time), single phase reclosers (will continue to evaluate), and CAL FIRE exempt surge arresters (incorporated into standards for new arrestor applications in HFRA).

SCE is continuing to explore other advanced or alternative technologies such as infrared technology, machine learning and artificial intelligence to complement grid hardening activities. SCE is using infrared technology to scan circuitry and connectors to detect anomalies for targeting replacements. SCE has also identified a potential opportunity to leverage machine learning object detection on equipment inspection photos to help detect conditions requiring remediation and streamline inspection processes (Section 5.3.4.9.1.1 further describes asset defect detection using machine learning). SCE is exploring the use of artificial intelligence/machine learning to identify patterns and support future predictive maintenance. SCE expects to advance these technologies over this WMP period.

Table SCE 5-0-3

5.3.3 Grid Design and System Hardening Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
• Continue to deploy covered conductor • Continue to install fast-acting fuses to help interrupt electric current more quickly and reduce the risk of ignitions • Continue to replace poles with fire resistant poles in HFRA	See Table SCE 5-1 2020 Program Targets for 2020 activities	• Refine and expand system hardening activities, with extensive plans to replace bare overhead conductor with covered conductor and increase its installation of fire-resistant poles in HFRA • Continue to assess and develop undergrounding plan to not only reduce PSPS impacts and ignition risk but also address potential egress/ingress issues in HFRA • The use of FR poles will enhance the resiliency of SCE's infrastructure in HFRA and help with rapid restoration • Evaluate and update engineering design standards, as needed, to improve the performance of sub-transmission and transmission linear and structural assets under extreme wind events • Evaluate technologies such as Rapid Earth Fault Current Limiter (REFCL), Open Phase Detection (OPD), Early Fault	• System hardening activities will be shaped by successes in advanced technology and informed by changes to wildfire risk factors, such as climate change, land use changes, fuel management, and other environmental considerations • Covered conductor and fire-resistant poles to be program mainstays for years to come; Undergrounding efforts are also expected to expand • Advancements in material science, construction methods, and improvements in the way SCE designs its system are also expected to increase system resiliency • Continue exploring emerging technologies that can reduce the probability of an ignition event and/or reduce public exposure to a hazardous condition during periods of high fire risk • Systems like DFA, or other new technologies, may

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
		Detection (EFD) and other alternative technologies for studies and pilots	offer improvements for detecting and locating incipient system failures with potential ignitions risks and allow SCE to take action to mitigate these ignition drivers

Grid Design and System Hardening activities are further described in Section 5.3.3.

5.1.4 Asset Management and Inspections

SCE's inspection and maintenance programs are foundational to help ensure safety and reliability of its grid. Historically, SCE inspected and maintained electrical equipment and structures regularly to reduce safety and reliability risks, but these programs were designed to meet compliance requirements. Given the increased wildfire risk, SCE developed and implemented new inspection and maintenance initiatives to combat this heightened threat. In 2019, SCE inspected all distribution, transmission, and generation assets located in HFRA, and developed new wildfire risk criteria as part of its Enhanced Overhead Inspection (EOI) initiative. Acceleration of approximately 450,000 ground-based inspections (all structures in SCE's original HFRA), typically performed over a 5-year cycle, were completed in approximately five months. This schedule helped identify structure and equipment conditions that could lead to faults faster, but also created challenges for remediating these findings within compliance timeframes. The regulatory requirements for remediation are time-based and limited in ability to distinguish between the different levels of risks posed by different types and locations of the findings. In 2020, SCE plans to make two further modifications to its inspection and maintenance programs informed by risk analysis. First, assets that pose higher risks (for both probability of ignition and fire consequence) will be inspected more frequently. Second, SCE wants to set remediation schedules based on risk assessment of the finding. SCE looks forward to working with the CPUC and the WSD on these changes that would mature its asset management capability beyond minimum regulatory requirements and help SCE allocate constrained resources to maximize risk reduction.

SCE has learned some valuable lessons from its 2019 inspection programs. For example, in March 2019, a crossarm failed resulting in a downed powerline which appears to have caused a small fire. Upon further inspection, it was determined that the bottom of the crossarm as viewed from the ground in a recent ground-based inspection was in good condition, but the top of the crossarm showed significant deterioration. SCE expeditiously modified its inspection strategy and deployed aerial inspections to complement ground inspections on all transmission and distribution assets in its HFRA to inspect pole tops, wooden crossarms, steel structures, and all conductor/hardware. Aerial inspections paired with ground inspections offer a more comprehensive 360-degree perspective of the structures and equipment that may not be easily visible from the ground. The aerial inspections program deploys various types of sensors and collects different types of information, including HD photos, videos, LiDAR data, infrared data, and corona data which are used to identify issues, analyze risks, prioritize and ultimately remediate the findings. Given the urgency of completing aerial inspections under compressed timeframes, the supporting business processes used quick-to-deploy technology solutions. SCE is building comprehensive technology and data management solutions to support the aerial inspections business processes as it transitions from a quick-launch initiative to a steady-state activity.

When the 2019 WMP was submitted, SCE included a plan to scan its transmission assets in HFRA using infrared technology when they were operating at or above 40% of their rated line capacity to adequately identify anomalies. However, such operating conditions are intermittent and are often correlated with hot weather, when the ambient conditions can mask equipment-related data. After evaluating additional data, SCE identified that due to NERC/FERC reliability standards and because of seasonal loading variations, most of the transmission system operates well below 40% of rated line capacity for much of the year. Accordingly, SCE evaluated the ability to take infrared images on lines operating at lower rating capacities and discovered that such images effectively captured anomalies on lines operating well below the initially set 40% load threshold.[21]

Table SCE 5-0-4

5.3.4 Asset Management and Inspections Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
• Continue to perform aerial and ground based inspections of higher fire-risk assets • Begin QC of completed inspections in the HFRA	See Table SCE 5-1 2020 Program Targets for 2020 activities	• Prioritize the re-inspection of structures that represent the highest risk, based on the probability of ignition and consequence in the HFRA as a part of the High Fire Risk Informed Inspection Program • Utilize both ground and aerial inspections for transmission and distribution assets to obtain 360-degree views of SCE's structures and equipment • Continue traditional inspection programs outside of HFRA	• Integrate inspection activities with asset management strategies to help ensure that individual asset strategies and inspection activities work cohesively to promote reliability, affordability and safety, including fire safety • Advance Inspection Redesign initiative to support the SCE's continuing transition from a compliance-focused inspection approach to a more risk-informed approach • Focus on increasing data collection and data analytics to inform and

[21] *See* SCE's Advice Letter 4120-E (submitted in conformance with D.19-05-036), pp. 11-12 (December 2, 2019), https://library.sce.com/content/dam/sce-doclib/public/regulatory/filings/pending/electric/ELECTRIC_4120-E.pdf.

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
			improve SCE's inspection programs

Asset Management & Inspections are further described in Section 5.3.4.

5.1.5 Vegetation Management and Inspections

SCE's Vegetation Management Program has been in place for many years conducted in accordance with General Order (GO) 95 compliance requirements. This program emphasizes inspection and maintenance of vegetation clearance near electrical facilities to help reduce ignitions and outages stemming from vegetation contact with energized electrical infrastructure. SCE's vegetation management strategy addresses potential ignition risk by preventing fall-ins, grown-ins and blow-ins. SCE's vegetation management programs include tree removals, maintaining clearance distances, pole brush clearing, and, in more recent years, weed abatement.

In response to California's increased wildfire risks, SCE's Vegetation Management Program was modified to include supplemental vegetation inspections during the summer growth season in HFRA through Operation Santa Ana and the Drought Relief Initiative (DRI) as described in Section 5.3.5. In 2018, SCE expanded the program even further by adding SCE's Hazard Tree Management Program (HTMP), expanded clearances at time of maintenance, and pole brush clearing. In 2020, SCE is focusing on improving and strengthening its vegetation management work scheduling, crew management, and will strengthen its quality control and quality assurance activities.

SCE also plans to deploy an Integrated Vegetation Management (IVM) platform that will facilitate better collaboration with arborists, environmental and utility regulators, and customers to achieve the right trim at the right time. This platform will integrate disparate vegetation management tools and systems to improve work planning and scheduling, notification of work, and reporting. Additional benefits include improved risk-informed allocation of resources that should lead to reduced time between target trim date and actual trim date and a reduced number of visits per site. The integrated program will initially focus on DRI and HTMP and then be rolled out across all wildfire related vegetation activities by 2022.

In 2019, SCE faced resource challenges in a tight labor market and increased costs caused in part by growing demand across the state for new vegetation clearance requirements. Statutes requiring increased wages for qualified line clearance trimmers, which became effective in 2020, will also create upward cost pressure. SCE also experienced and continues to experience challenges with gaining support from property owners and agencies that do not agree with the value and efficacy of vegetation management for wildfire mitigation or perceive potential environmental and aesthetic impacts as outweighing that value.

Table SCE 5-0-5

5.3.5 Vegetation Management and Inspections Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
• Perform supplemental inspections in HFRA, such as Canyon Patrols, At-Risk Circuit Patrols and Operation Santa Ana • Continue to actively identify and trim or remove trees that may pose a risk of falling into power lines	See Table SCE 5-1 2020 Program Targets for 2020 activities	• Expand brush clearing around poles to reduce fire spread risk • Continue tree removals under the Hazard Tree Management Program to mitigate risk of ignition from vegetation and trees that could fall into our lines • Continue increasing and maintaining clearance distances to prevent tree-line contact • Deploy an integrated vegetation management software solution	• Implement more comprehensive use of technology to add efficiency or replace/compliment current foot patrols • Utilize more predictive analytics capability such as artificial intelligence to improve risk prioritization and resource allocation methods • Further integrate programs across and potentially outside the organization to minimize vegetation-related work that can overlap across large geographic areas • Continually implement enhancements to how SCE identifies, tracks, and remediates fast-growing tree species

Vegetation Management and Inspections are further described in Section 5.3.5.

5.1.6 Grid Operations and Protocols

SCE's grid hardening and other wildfire mitigation activities should, over time, reduce the need for PSPS. Hardening the grid in SCE's HFRA is a multi-year effort and PSPS events may still occur (during transition and possibly even later depending on climate and weather changes). Thus, SCE is committed to aggressively pursuing mitigations to minimize the impacts of PSPS on communities.

SCE considers initiating PSPS events based on several factors including but not limited to QEW observations in the field; specific concerns from state and local fire authorities, emergency management personnel, and law enforcement regarding public safety issues; the expected public safety impact of de-energizing circuits (such as impacts on essential services such as public safety agencies, water pumps, traffic controls, etc.); and extreme weather conditions such as when wind speeds and the FPI exceed certain threshold values. These thresholds are based upon a number of risk factors, such as the condition of physical assets that comprise a given circuit and historical wind speeds.

Beginning in 2020, SCE plans to implement additional and expanded initiatives to further reduce impacts to customers.

Table SCE 5-0-6

5.3.6 Grid Operations and Protocols Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
• Complete circuit de-energization plans for all HFRA circuits. These plans will identify steps to surgically de-energize PSPS circuits based on a number of different conditions, with the aim of de-energizing the fewest customers possible. • Increase the number of customer care products and services provided before, during and after an event. These products (e.g., potable water, blankets, ice, power banks, battery backup rebates, etc.) are intended to reduce the burden of power outages. • Continue to employ a variety of targeted communication channels to ensure that customers are notified in a timely manner (e.g., Outage Map Improvements, Geo Alerts, Nextdoor Alerts)	See Table SCE 5-1 2020 Program Targets for 2020 activities	• Continue installation of reclosers to add additional "sectionalization," to minimize potential ignitions and decrease scope of PSPS events • Continue mitigations to minimize PSPS impacts on customers before, during and after a PSPS event • Deploy mobile generators to critical infrastructure, public safety partners / customers as needed, and pursue microgrid opportunities that are cost-effective • Deliver in-language outreach to educate various communities in emergency preparedness and PSPS • Employ a variety of targeted communication channels to ensure that customers are notified in a timely manner (e.g., Nextdoor) • Continue partnerships with 2-1-1 service providers and designated independent living centers to prepare AFN communities for PSPS • Continue deployment of Community Resource Centers and Community Response Vehicles	• Enhance automation capabilities across the grid • Decrease frequency and scope of PSPS events as more WMP activities are deployed • Continually improve SCE's community outreach, communications, and education

Grid Operations and Protocols are further described in Section 5.3.6.

5.1.7 Data Governance

Traditionally organizations across SCE have addressed data governance at the system and initiative level, largely focused on data quality, security, and compliance. While these programs and processes have been largely successful, in 2019, SCE established new processes and tools to help manage large datasets associated with its wildfire mitigation initiatives including, for example, inspection data (including aerial images), remediation data, and risk information critical to effectively plan, prioritize, and manage work. SCE plans to invest in automation, machine learning, and artificial intelligence over this WMP period, focusing on data architecture, management, and stewardship. These refinements will help integrate wildfire data in areas including vegetation management, asset inspections, and PSPS. Ultimately, the integration of these datasets will allow for greater insights from advanced analytics of asset health for improved risk modeling and prediction.

In 2020, SCE will continue developing its foundational data governance strategy and will also develop a data quality framework and methodology for measuring and managing master data quality. Ongoing development of SCE's data governance strategy and its implementation will continue for a number of years until it is fully realized.

Table SCE 5-0-7

5.3.7 Data Governance Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
• Modify data collection standards based on lessons learned from 2019 • Assess use case areas to determine breadth of scope for data governance enablement • Explore the use of AI/ML for data quality • Initiate design of integrated wildfire data management and governance process	• Develop integrated data governance strategy and governance structure for wildfire related data management • Design data quality processes and support technology solutions • Design enterprise data solutions in support of managing wildfire related data – to include data intake, organization, analysis, visualization, reporting, and integration • Enable technology and process improvements to wildfire mitigation related reporting and data request handling	• Continue to develop foundational data governance strategy and a data quality framework and methodology for measuring and managing master data quality • Develop an integrated wildfire data management and governance process to ensure consistent processes and tools across wildfire-related initiatives • Implement integrated data platform to share data across programs / activities, facilitating more advanced analytics and data visualizations	• Reach full realization of SCE's data governance strategy • Have integrated view of wildfire mitigation activities by 2023 and continue to enhance view as different sets of activities emerge and are utilized in future WMPs • Continue to evolve the integrated data platform capability and data governance capability based on emerging needs, solutions, and requirements

Data Governance is further described in Section 5.3.7.

5.1.8 Resource Allocation Methodology

Wildfire mitigation activities have considerably increased the overall scope of utility work and pose challenges to resource allocation. In many cases, the same crews that support wildfire mitigation activities are responsible for executing SCE's traditional infrastructure replacement work. Despite the importance of traditional infrastructure replacement work, SCE will pursue them at a slower pace in order to accomplish crucial wildfire mitigation work.

Table SCE 5-0-8

5.3.8 Resource Allocation Methodology Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
See sections 5.3.8.1 to 5.3.8.4	See sections 5.3.8.1 to 5.3.8.4	See sections 5.3.8.1 to 5.3.8.4	See sections 5.3.8.1 to 5.3.8.4

Resource Allocation Methodology is further described in Section 5.3.8.

5.1.9 Emergency Planning and Preparedness

SCE has a robust emergency management structure for hazards, including wildfires. Its emergency preparedness and response plans consider numerous hazards that potentially impact SCE's service territory and/or the electric grid, including earthquakes, cybersecurity, and wildfires. Further, SCE delivers a robust FEMA-based ICS (Incident Command System) training program that follows the National Incident Management System (NIMS) model for employees identified as IMT members and has trained over 600 employees to-date.

Table SCE 5-0-9
5.3.9 Emergency Planning and Preparedness Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)

• Continue regular bi-weekly call with emergency officials through Operational Area calls
• Continue stakeholder outreach:
  • Local government/public safety officials meetings and presentations
  • Start conducting community meetings
  • Community meetings in areas highly impacted by PSPS events
  • Meetings (in-person and virtual) for general customers and/or specific customer segments
  • Engage with CBOs and other stakeholders– including representatives of the AFN community
  • Send annual WMP/PSPS update to local governments and tribes
  • Request update of contact information for emergency officials
  • SCE Emergency Operations Tours for government, business, and community stakeholders
  • Post-community meeting, stakeholder/customer engagement surveys
  • Promote WMP, PSPS, and community-specific wildfire mitigation measures through social media channels
• Continue to train SCE Emergency Response
	See Table SCE 5-1 2020 Program Targets for 2020 activities	• Hold community meetings primarily in areas impacted by PSPS de-energization events to share information about PSPS, emergency preparedness, and SCE's WMP
		• Promote wildfire and resiliency awareness through several channels including direct mail, web-based messaging, and digital media
		• Continue training existing and new IMT members and evaluate staffing levels and needs
		• Implement research activities gauging customer awareness, preparedness for, and satisfaction with outage experiences
		• Develop and socialize outreach to master meter customers for cascading SCE education materials to tenants and promote PSPS alerts and notification enrollments
			• Continue to refine key message points to customers about wildfire activities, emergency preparedness and PSPS events based on research findings
			• Update training protocols based on changes to National Incident Management System and lessons learned

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
Teams on PSPS Response Plan • Conduct PSPS functional exercises • Continue to improve navigation and accessibility to wildfire information and resources on SCE website			

SCE's wildfire mitigation programs for Emergency Planning and Preparedness are further described in Section 5.3.9.

5.1.10 Stakeholder Cooperation and Community Engagement

SCE is committed to keeping its customer and key stakeholders informed on the company's WMP activities, PSPS protocols, and general emergency preparedness. In 2019, SCE conducted over 350 meetings and presentations with local government and tribal officials, community organizations, and the general public. In 2020, SCE will concentrate its efforts on communities that were impacted by multiple PSPS de-energizations.

Table SCE 5-0-10

5.3.10 Stakeholder Cooperation and Community Engagement Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
• Establish international, joint IOU wildfire committee with two of the major Australian electric utilities, AusNet Services and Powercor Australia • County and state emergency (including CPUC) and tribal emergency management agencies to attend and observe SCEs PSPS exercises • Continue to pursue non-disclosure agreements with county emergency management representatives to facilitate sharing customer information (Critical Care) in advance of emergency situations	See Table SCE 5-1 2020 Program Targets for 2020 activities	• Continue to conduct meetings and presentations with local government and tribal officials, community organizations, and the general public to inform on SCE's WMP activities, PSPS protocols, and general emergency preparedness • Collaborate and share best practices with trade associations, technical organizations, and establish an international wildfire committee with national and international agencies • Continue to partner with all wildland fire suppression agencies as	Continue meetings with local government and tribal officials, community organizations, and the general public to further enhance partnerships, increase awareness, and discuss lessons learned

Before 2020 Wildfire Season	Before Next Annual Update	Short-Term (2020-2022)	Long-Term (2023-2030)
• Continue outreach and coordination efforts with emergency management representatives of water, cable and telecommunications providers through The California Utilities Emergency Association. • Participate in preparedness and coordination meetings hosted by CalOES		part of SCE's overall fire mitigation efforts • Explore virtual community meetings to increase the reach of the meetings	

SCE's wildfire mitigation programs for Stakeholder Cooperation and Community Engagement are further described in Section 5.3.10.

C. Challenges Associated with Limited Resources

Wildfire mitigation activities have considerably increased the overall scope of utility work and pose challenges to resource allocation. In many cases, the same crews that support wildfire mitigation activities are responsible for executing SCE's traditional infrastructure replacement work. SCE will monitor and, if necessary, adjust its short- and long-term plans for resource allocation and prioritization of work across its portfolio of both wildfire and traditional infrastructure replacement work, with a focus on identifying, prioritizing and allocating resources to reduce the greatest wildfire risk.

Resource Allocation Methodology is further described in Section 5.3.8.

D. New Technologies and Innovations

5.1.11 New Technologies and Innovations

SCE actively monitors advancements by partner utilities, academia, and industry to incorporate new technologies and asset management strategies into its standards. SCE pilots new technologies on a limited scale to gain an understanding of the technical and construction requirements and, if successful, works to deploy these technologies on a wider scale across the HFRA or service territory. For example, SCE is currently exploring the use of unmanned aerial systems (drones) and, as mentioned earlier, detection technologies using artificial intelligence and machine learning to compliment SCE's manual inspection process (Section 5.3.4.9.1.1 further describes asset defect detection using machine learning).

SCE evaluates pre-commercial technologies through its Electric Program Investment Charge (EPIC) projects. When preparing an EPIC investment plan, SCE begins by reviewing near-, medium-, and long-term grid challenges to help define its strategic priorities. Based on these priorities, SCE includes proposals for potential projects in its investment plan, which are then screened to ensure alignment with EPIC's guiding principles and investment planning framework, and to assess their potential to create customer benefits. These projects then proceed through SCE's governance process that oversees projects as they move through each phase of the technology lifecycle—from conception of a technology use-case through demonstration, pilot and full deployment. In the Research Administration Plan (RAP) application filed April 23, 2019, SCE proposed a new project— Wildfire Prevention & Resiliency Technology Demonstration, which is intended to expand upon SCE's existing wildfire mitigation efforts, as outlined in its 2019 Wildfire Mitigation Plan by facilitating the demonstration of promising new pre-commercial technologies that could potentially be deployed at scale in the future.

SCE's wildfire mitigation programs for New Technologies and Innovations are further described throughout the WMP. However, one initiative to improve SCE's existing grid communication infrastructure and technology, described below, provides expanded grid resiliency benefits to existing initiatives described in the WMP.

Field Area Network (Private LTE Network):
The Field Area Network (FAN) is a resilient network that provides secure, wireless communication for mission-critical field devices. Once deployed, the network will provide greater coverage in HFRA enabling connectivity to over 250,000 devices with sub-second latency and bandwidth of approximately 10 Mbps. As such it is a key enhancement to enable or scale specific wildfire mitigation use cases that require high-bandwidth, low-latency, reliability, scalability, and security of a modern wireless network. As an example, the FAN is foundational to scale weather station deployment by providing connectivity to remote areas while providing low-latency communication for near real-time data polling during PSPS events. Additionally, it provides the coverage and bandwidth to backhaul the large data streams required for certain early fault detection technology. The communication system will also provide the cybersecurity controls necessary to better secure field operations during PSPS, including circuit protection, switching, and sectionalization.

The table below depicts the mitigation strategies the FAN will enable SCE to scale:

Mitigation Strategy	Pilot	Deploy	Enabling FAN Capability
Open Phase Detection	X		Low Latency
Weather Stations Supporting PSPS	X	X	Low Latency, Remote Coverage
REFCL Device Deployment	X		Low Latency
Early Fault Detection	X		Bandwidth, Remote Coverage
Improved DMS Command Response (<1 Sec)	X	X	Low Latency

In addition to the use cases above, the FAN also enables operational device management allowing firmware updates with new feature sets, configuration changes, and security patches be deployed remotely. This improves our agility to reconfigure remote field devices as the wildfire threat evolves. It also improves the ability to collect post-fault analytics to study system events, understand underlying causes, and implement preventative measures.

5.1.12 Alternative Mitigations Considered

In the spirit of continuous improvement, SCE routinely evaluates its wildfire mitigation strategies and programs and considers alternative mitigations with improving data, data models, other analytical tools, and guidance from the Commission. Brief summaries of alternative mitigations for certain wildfire initiatives are described below.

Covered Conductor:
SCE's risk analysis showed that installation of covered conductor, in most cases, provides greater overall risk reduction value than underground conversion. Covered conductor achieves many of the same fire mitigation benefits as converting overhead wire to underground cable, but at a fraction of the time and cost to implement. It also has similar public safety benefits but does not suffer from the troubleshooting and restoration delays associated with underground systems, meaning faster repairs and shorter outage times for customers. SCE is planning, however, to implement underground conversion of overhead wire in select areas over this WMP period as further described in Section 5.3.3.

High Definition (HD) Cameras:
Though SCE has access to fire progression images through other public means (e.g., monitoring news channels and 911 calls) and can dispatch fire crews to determine fire severity, SCE selected to deploy HD cameras to expedite obtain information gathering regarding fire progression. Moreover, SCE understands from SDG&E's experience that the fire agencies also find the HD cameras beneficial for their fire containment and public protection efforts since no other agency or public entity has installed such devices.

Weather Stations:
Weather forecasting information is available through public information such as the Remote Automatic Weather Stations, National Weather Service, and the Federal Aviation Administration. However, these alternatives are less accurate than SCE's own weather stations and would limit SCE's ability to make better informed operational decisions using more granular and real-time weather information in today's higher-risk fire environment.

Sectionalizing Devices:
SCE does not underestimate the impact PSPS events have on its customers. As such it considers methods and technologies that could reduce the number of impacted customers. The deployment of RARs and RCSs are good examples of technologies that are being used to sectionalize the grid and allow load to remain energized, this leverages existing infrastructure and is, in most cases, more cost effective than a microgrid.

Pole Replacements:
Wildfires are a major threat to the integrity of traditional wooden poles. SCE has evaluated alternative pole materials such as composite and steel in addition to fire resistant wraps. As

mentioned earlier, SCE determined a combination of these pole types provides the most cost-effective way to harden the grid.

5.1.13 2020 Program Targets

In Table SCE 5-1~~Table SCE 5-1~~, SCE includes its 2020 Program Targets for its 2020-2022 WMP initiatives. SCE set program targets after accounting for potential resource constraints and other execution risks identified in 2019. However, SCE will strive to complete additional work in certain areas to mitigate wildfire risk as quickly as possible. For these areas, as noted in the table below, SCE has included upper ranges beyond the Program Target and only 2020 Program Targets are included in the table below. SCE has provided its current forecasts of wildfire mitigation work scope for 2021 and 2022 in the relevant tables and will assign Programs Targets for these years during the annual WMP updates process based on lessons learned and progress made in the previous year.

All WMP initiatives are further described throughout Section 5.3.

Table SCE 5-1
2020 Program Targets

Program Category	2020-2022 WMP Identifier	Initiative/Activity	2020 Program Target
Risk Analysis	RA-1	Expansion of Risk Analysis Section 5.3.2.7	Implement Wildfire Risk Reduction Model (WRRM) module of Technosylva
Operational Practices	OP-1	Annual SOB 322 Review Section 5.3.6.1.1	Review and update SOB 322 to reflect lessons learned from past elevated fire weather threats/PSPS events and integrate, where applicable, new and improved situational awareness data, improved threat indicators, and applicable regulatory requirements in an effort to reduce wildfire risk and the impact of outages on customers.
	OP-2	Wildfire Infrastructure Protection Team Additional Staffing Section 5.3.6.5.7	Hire additional resources including: a senior compliance manager, two compliance advisors, a project/program advisor, a data specialist and a fire-weather meteorologist. PSPS Operations will also be staffed to provide dedicated operational, project management, and compliance capabilities.
	OP-3	Unmanned Aerial (UAS) Operations Training	Increase the number of UAS operators by an additional 50 crews

Program Category	2020-2022 WMP Identifier	Initiative/Activity	2020 Program Target
		Section 5.3.4.9.2.2	
Inspections	IN-1.1	Distribution High Fire Risk Informed Inspections in HFRA Section 5.3.4.9.1	Inspect 105,000 structures in HFRA
	IN-1.2	Transmission High Fire Risk Informed Inspections in HFRA Section 5.3.4.10.1	Inspect 22,500 structures in HFRA
	IN-2	Quality Oversight / Quality Control Section 5.3.4.14	Perform quality control and oversight of inspections of 15,000 transmission, distribution, and generation structures in HFRA
	IN-3	Infrared Inspection of Energized Overhead Distribution Facilities and Equipment Section 5.3.4.4	Inspect 50% of distribution circuits in HFRA
	IN-4	Infrared Inspection, Corona Scanning, and High-Definition Imagery of Energized Overhead Transmission facilities and Equipment Section 5.3.4.5	Inspect 1,000 transmission circuit miles in HFRA
	IN-5	Generation High Fire Risk Informed Inspections in HFRA Section 5.3.4.16	Perform inspection of 200 generation-related assets
	IN-6.1	Aerial Inspections – Distribution Section 5.3.4.9.2	Inspect 165,000 structures in HFRA
	IN-6.2	Aerial Inspections – Transmission Section 5.3.4.10.2	Inspect 33,500 structures in HFRA
	IN-7	Failure Modes and Effects Analysis (FMEA) Section 5.3.4.15.1	Complete FMEA study for substation assets in HFRA and prepare final report
System Hardening	SH-1	Covered Conductor Section 5.3.3.3.1	Install 700 circuit miles of covered conductor in HFRA. 700 circuit miles is SCE’s program target. SCE will strive to complete 1,000 circuit miles subject to resource constraints and other execution risks

Program Category	2020-2022 WMP Identifier	Initiative/Activity	2020 Program Target
	SH-2	Undergrounding Overhead Conductor Section 5.3.3.16	Refine evaluation methodology for targeted undergrounding as a wildfire mitigation activity
	SH-3	Fire Resistant Poles Section 5.3.3.6.1 and 5.3.3.6.2	Replace 5,200 poles with fire resistant poles in HFRA SCE will strive to replace 11,700 poles with fire resistant poles in HFRA subject to pole loading assessment results, resource constraints and other execution risks
	SH-4	Branch Line Protection Strategy Section 5.3.3.7	Install/replace fuses at 3,025 locations
	SH-5	Installation of System Automation Equipment – RAR/RCS Section 5.3.3.9	Install 45 RARs/RCSs
	SH-6	Circuit Breaker Relay Hardware for Fast Curve Section 5.3.3.2.7	Replace/upgrade 55 relay units in HFRA SCE will strive to replace up to 110 relay units in HFRA. These targets are subject to resource constraints and other execution risks
	SH-7	PSPS-Driven Grid Hardening Work Section 5.3.3.8.1	Review 50% of all distribution circuits within HFRA to determine if modifications may improve sectionalizing capability within HFRA
	SH-8	Transmission Open Phase Detection Section 5.3.2.2.3	Continue deployment of transmission open phase detection on six additional transmission/sub-transmission circuits
	SH-9	Transmission Overhead Standards (TOH) Review Section 5.3.3.18	Review transmission standards to determine if there are any changes that can be made to help reduce wildfire threats, especially during extreme wind events
	SH-10	Tree Attachment Remediation Section 5.3.3.3.2	Remediate 325 tree attachments SCE will strive to complete 481 tree attachment remediations subject to resource constraints and other execution risks

Program Category	2020-2022 WMP Identifier	Initiative/Activity	2020 Program Target
	SH-11	Legacy Facilities Section 5.3.3.19	Evaluate risk, scope, and alternatives for identified circuits; evaluation of additional system hardening mitigation for wildlife fault protection and grounding/lightning arresters
	SH-12.1	Remediations – Distribution Section 5.3.3.12.1	Remediate 100% of notifications with ignition risk in accordance with CPUC requirements, non-inclusive of notifications which meet the criteria of a valid exception
	SH-12.2	Remediations – Transmission Section 5.3.3.12.2.	Remediate 100% of notifications with ignition risk in accordance with CPUC requirements, non-inclusive of notifications which meet the criteria of a valid exception
	SH-12.3	Remediations – Generation Section 5.3.3.12.3	Remediate 100% of notifications with ignition risk in accordance with CPUC requirements, non-inclusive of notifications which meet the criteria of a valid exception
Vegetation Management	VM-1	Hazard Tree Management Program Section 5.3.5.16.1	Assess 75,000 trees for hazardous conditions and perform prescribed mitigations in accordance with program guidelines and schedules
	VM-2	Expanded Pole Brushing Section 5.3.5.5.1	Perform brush clearance of 200,000 poles SCE will strive to perform brush clearance for 300,000 poles subject to resource constraints and other execution risks
	VM-3	Expanded Clearances for Legacy Facilities Section 5.3.5.5.2	Perform assessments of all identified facilities in HFRA. Establish enhanced buffers at 30% of identified facilities
	VM-4	Drought Relief Initiative (DRI) Inspections and Mitigations Section 5.3.5.16.2	Perform DRI annual inspection scope and complete prescribed mitigations in accordance with internal DRI program guidelines
	VM-5	Vegetation Management Quality Control Section 5.3.5.13	Perform 3,000 risk-based HFRA circuit mile vegetation management Quality Control inspections
Situational	SA-1	Weather Stations Section 5.3.2.1	Install 375 Weather Stations

Program Category	2020-2022 WMP Identifier	Initiative/Activity	2020 Program Target
Awareness			SCE will strive for installation of 475 Weather Stations subject to resource constraints and other execution risks
	SA-2	Fire Potential Index (FPI) Phase II Section 5.3.2.4.1	Refine the current FPI by integrating historical weather and vegetation data into the index
	SA-3	High-Performing Computer Cluster (HPCC) Weather Modeling System Section 5.3.2.6.	Complete installation of second HPCC
	SA-4	Asset Reliability & Risk Analytics Capability Section 5.3.2.7	Implement FireCast and FireSim modules of Technosylva
	SA-5	Fuel Sampling Program Section 5.3.2.4.2	Perform updated fuel sampling in HFRA in areas deemed appropriate once every two weeks (weather permitting)
	SA-6	Surface and Canopy Fuels Mapping Section 5.3.2.4.3	Initiate surface and canopy fuels mapping across HFRA
	SA-7	Remote Sensing / Satellite Fuel Moisture Section 5.3.2.4.4	Initiate procurement process for remote sensing technology for future implementation
	SA-8	Fire Science Enhancements Section 5.3.2.4.5	Implement enhanced forecasting capability and improved fuel modeling
Public Safety Power Shutoff	PSPS-1.1	De-Energization Notifications Section 5.3.6.7	Notify applicable public safety agencies and local governments of possible de-energization
	PSPS-1.2	De-Energization Notifications Section 5.3.6.7	Notify Cal OES through the State Warning Center of possible de-energization
	PSPS-1.3	De-Energization Notifications Section 5.3.6.7	Notify the CPUC of possible de-energization
	PSPS-1.4	De-Energization Notifications Section 5.3.6.7	Enhance Emergency Outage Notification System (EONS) to include Zip Code level alerting to include in-language notifications to align with its existing notification abilities for SCE customers
	PSPS-2	Community Resource Centers Section 5.3.6.5.1	Have 23 sites available across SCE service territory for customers impacted by a PSPS

Program Category	2020-2022 WMP Identifier	Initiative/Activity	2020 Program Target
	PSPS-3	Customer Resiliency Equipment Incentives Section 5.3.6.5.2	Develop a customer resiliency equipment incentive pilot program that provides financial support to customers willing to increase resiliency within its HFRA One customer will be implemented for this pilot in 2020.
	PSPS-4	Income Qualified Critical Care (IQCC) Customer Battery Backup Incentive Program Section 5.3.6.5.3	Outreach to eligible customers (low income, critical care, Tier 2/3) to provide portable battery back-up solution. SCE has identified approximately 2,500 customers that it will target for the program in 2020 with efforts to begin second quarter.
	PSPS-5	MICOP Partnership Section 5.3.6.5.4	Enable communications with indigenous populations and measure the number of customers contacted
	PSPS-6	Independent Living Centers Partnership Section 5.3.6.5.5	Conduct outreach activities and workshops/trainings to provide preparedness education and assistance in applying for the Medical Baseline Program and measure the number of customers contacted
	PSPS-7	Community Outreach Section 5.3.6.5.6	Minimum of five Community Crew Vehicles (CCVs) ready to be deployed during times when weather and fuel conditions are at critical levels. Communicate with customers in a local targeted way using a variety of channels to ensure timely delivery of notifications
	PSPS-8	Microgrid Assessment Section 5.3.3.8.2	1) Execute RFP for six resiliency microgrid projects 2) Depending on RFP results, implementation of up to 6 resiliency microgrid projects shown to be technically feasible and cost-effective
Emergency Preparedness	DEP-1.1	Customer Education and Engagement – Dear Neighbor Letter Section 5.3.9.2	Send ~915,000 letters with information about PSPS, emergency preparedness, and SCE's wildfire mitigation plan to customer accounts in HFRA and ~3,200,000 letters to

Program Category	2020-2022 WMP Identifier	Initiative/Activity	2020 Program Target
			customer accounts in non-HFRA
	DEP-1.2	Customer Education and Engagement – Community Meetings Section 5.3.9.2	Host 8-12 community meetings in areas impacted by 2019 PSPS plus other meetings including online as determined to share information about PSPS, emergency preparedness, and SCE's wildfire mitigation plan
	DEP-1.3	Customer Education and Engagement – Marketing Campaign Section 5.3.9.2	Marketing campaign to reach 5,000,000 Customer Accounts (goal of 40% awareness about the purpose of PSPS, emergency preparedness, and SCE's wildfire mitigation plan)
	DEP-2	SCE Emergency Response Training Section 5.3.9.1	Hold SCE IMT member training on de-energization protocols, determine additional staffing needs and train, exercise and qualify new staff
	DEP-3	IOU Customer Engagement Section Section 5.3.9.2	Participate in statewide multi-channel and multi-lingual campaign using digital ads, social media ads, and radio ads to provide customers with important and consistent messaging about wildfire mitigation activities happening across the state
	DEP-4	Customer Research and Education Section 5.3.9.2	Develop/implement various research activities that gauge customer awareness, preparedness for, and satisfaction with outage experiences; to include but not be limited to: town hall meetings, online & telephone surveys, focus groups, and assessments of programs & services to prepare customers before and after PSPS outages
Alternative Technology	AT-1	Alternative Technology Pilots – Meter Alarming for Down Energized Conductor (MADEC) Section 5.3.3.2.2	Evaluating algorithm improvements specific to the detection of downed energized covered conductor, which may behave differently than bare conductor

Program Category	2020-2022 WMP Identifier	Initiative/Activity	2020 Program Target
	AT-2.1	Distribution Fault Anticipation (DFA) Section 5.3.2.2.1	Evaluate technology performance on fault anticipation technology and future deployment
	AT-2.2	Advanced Unmanned Aerial Systems Study Section 5.3.4.9.2.1	Conduct additional EVLOS demonstration UAS flights using lessons learned from 2019 study and validate aerial patrol findings via truck, foot, or helicopter
	AT-3.1	Alternative Technology Evaluations: Rapid Earth Fault Current Limiter - Ground Fault Neutralizer (GFN) Section 5.3.3.2.3.1	Initiate engineering design and order equipment for a GFN field installation
	AT-3.2	Alternative Technology Evaluations: Rapid Earth Fault Current Limiter – Resonant Grounding with Arc Suppression Coil Section 5.3.3.2.3.2	Initiate engineering design to convert a typical substation to resonant grounding
	AT-3.3	Alternative Technology Evaluations: Rapid Earth Fault Current Limiter - Isolation Transformer Section 5.3.3.2.3.3	Install one Rapid Earth Fault Current Limiter - Isolation Transformer
	AT-3.4	Alternative Technology Evaluations – Distribution Open Phase Detection Section 5.3.3.2.4	Complete pilot installation for five circuit locations
	AT-4	Alternative Technology Implementation – Vibration Dampers Section 5.3.3.3.3	Evaluate damper technologies for both small and large diameter covered conductor applications and develop standards for small and large diameter covered conductors
	AT-5	Asset Defect Detection Using Machine Learning Object Detection Section 5.3.4.9.1.1	Begin standardization of data collection for Machine Learning (ML) by cataloging and tagging inspection imagery metadata for ML. Investigate SCE use cases and evaluate feasibility of ML to support objective evaluation of assets.
	AT-6	Assessment of Partial Discharge for Transmission Facilities Section 5.3.4.10.2.1	Evaluate use of a Partial Discharge assessment technology to assess the health of in-service transmission assets

Program Category	2020-2022 WMP Identifier	Initiative/Activity	2020 Program Target
	AT-7	Early Fault Detection (EFD) Evaluation Section 5.3.2.2.2	Develop installation standards, install, and commission at least 10 EFD sensors. Gather data to determine requirements to support the potential for larger system deployments. SCE will strive to complete an additional 90 sensors for evaluation subject to resource constraints and other execution risks
	AT-8	High Impedance Relay Evaluations Section 5.3.3.2.5	Investigate and deploy two controllers/relays with a High Impedance (Hi-Z) element in HFRA

5.1.14 2020-2022 WMP Costs Summary

SCE's recorded and forecast capital expenditures and O&M expenses included in its 2020-2022 WMP are different from the capital expenditures and O&M expenses set forth in direct testimony supporting its 2021 GRC and the 2019 WMP. This is because the expenditures reflect the latest available information on SCE's historical costs, updated forecasts since previous filings, and updated or new wildfire mitigations activities based on lessons learned after the 2021 GRC was filed (e.g., October PSPS events).[22] The WMP cost forecasts represent SCE's best estimates of scope and costs at the time of filing and are subject to change. As an example, for vegetation management, there are considerable uncertainties associated with the scope of work in HFRA (number of trees trimmed or removed to increase line clearance distances). Moreover, SCE's cost estimates for this activity has not yet accounted for the impacts of SB 247.

[22] SCE's 2021 GRC was filed in August 2019, and SCE submitted supplemental wildfire mitigation-related testimony in November 2019. The cost forecasts supporting those submissions pre-date, by definition, the cost forecast set forth herein. SCE is committed to transparency on any potential forecast discrepancies (as shown in Table SCE 5-2) but notes that no formal "update" is required in the 2021 GRC (which is the operative CPUC cost recovery proceeding). For 2020 wildfire mitigation plan-related costs, the Commission has authorized SCE to track those costs in various memorandum accounts, and they will be examined on a recorded basis for reasonableness and cost recovery in "Track 3" of SCE's 2021 GRC, pursuant to the November 25, 2019 Scoping Memorandum in A.19-08-013. 2021-2022 wildfire mitigation forecast costs will be examined for reasonableness and cost recovery in "Track 1" of SCE's 2021 GRC, pursuant to that that same Scoping Memorandum. It is important to note that in the pending 2021 GRC, SCE has proposed a "Wildfire Risk Reduction Memorandum Balancing Account," which, if adopted, for rate setting purposes would "true-up" relevant recorded costs as compared to forecast approved costs. AB 1054 includes a CapEx exclusion of $1.6575 billion from equity rate base.

Table SCE 5-2 provides a summary of forecast changes between wildfire mitigation activities described in the 2020-2022 WMP and those outlined in SCE's 2021 GRC.[23]

Table SCE 5-2

2021 GRC and 2020-2022 WMP Cost Comparison for Years 2020-2022

GRC/WMP (Nominal Dollars, in Millions)	Capital	O&M
2021 GRC (Amended Nov 2019)	$ 2,607.6	$ 894.0
2020-2022 WMP	$ 2,652.3	$ 1,170.9

In addition to the 2020-2022 WMP forecast costs in Table SCE 5-2~~Table SCE 5-2~~, SCE has recently been made aware of cost pressures from its contractors due to higher wildfire liability insurance costs. While SCE is still gaining clarity on the potential magnitude of this incremental cost, it anticipates this cost pressure could be in the range of multiple tens of millions of dollars per year on top of the cost summarized in cost summarized in the table above. SCE is actively working with its contracted service partners to gain clarity and transparency on this emerging cost pressure.

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23 Costs in Tables 21-30 include SCE activities in HFRA that are not considered specific wildfire mitigation activities. Accordingly, the summed costs in Tables 21-30 will not match with the forecast costs of wildfire mitigation activities in Table SCE 5-2.

5.2 Wildfire Mitigation Plan Implementation

Describe the processes and procedures the electrical corporation will use to do all the following:

A. Monitor and audit the implementation of the plan. Include what is being audited, who conducts the audits, what type of data is being collected, and how the data undergoes quality assurance and quality control.
B. Identify any deficiencies in the plan or the plan's implementation and correct those deficiencies.
C. Monitor and audit the effectiveness of inspections, including inspections performed by contractors, carried out under the plan and other applicable statutes and commission rules.
D. For all data that is used to drive wildfire-related decisions, including grid operations, capital allocation, community engagement, and other areas, provide a thorough description of the utility's data architecture and flows. List and describe 1) all dashboards and reports directly or indirectly related to ignition probability and estimated wildfire consequences and reduction, and 2) all available GIS data and products. For data, including a list of all wildfire-related data elements, where it is stored, how it is accessed, and by whom. Explain processes for QA/QC, cleaning and analyzing, normalizing, and utilizing data to drive internal decisions. Include list of internal data standards and cross-reference for they datasets or map products to which the standards apply.

5.2.1 Monitor and Audit the Implementation of the Plan and Effectiveness of Inspections

SCE exercises comprehensive and rigorous oversight of its WMP through programmatic processes that monitor and audit the implementation of the plan and the effectiveness of inspections.

SCE developed a performance dashboard to track progress of wildfire mitigation metrics and activities discussed in its 2019 WMP. SCE collects data regularly from existing data repositories throughout the organization (e.g., number of weather stations and HD cameras installed, circuit miles of covered conductor deployed) and displays the data as a heat map in the performance dashboard indicating implementation status as Complete, Ahead of Plan, On Track, At Risk, or Off Track. SCE SMEs assist with performing quality control checks to validate the data. The performance dashboard is updated regularly and sent to SCE senior leadership for awareness and review. Items that are Off Track or trending negatively, will be brought to the attention of senior management to discuss implementation risks, ways to improve performance, and/or plans to get back on track.

SCE's Transmission and Distribution (T&D) organization unit has a Compliance and Quality (C&Q) group that develops quality control (QC) and quality assurance (QA) processes to ensure that mitigation activities are proceeding as planned. C&Q performs independent testing and assessment of wildfire and non-wildfire activities to drive continuous improvement throughout the organization. In 2019, line/equipment inspections in the HFRA were performed exclusively by SCE employees. The quality reviews to monitor and audit effectiveness of these programs will include oversight of both SCE and contract employees, if contractors are being utilized to supplement the SCE workforce. Section 5.3.4.14 Quality Assurance/Quality Control of Inspections further describes the monitoring and quality assurance program for line/equipment inspections. As described in Section 5.3.4.14, this group performs field validations of inspections completed by T&D work crews under the WMP. SCE QC inspectors conduct the reviews by performing independent field inspections, essentially performing the same inspection activity, and comparing the results. The QC process for completed inspections would be the same for SCE and contract employees, if contract employees are utilized. C&Q will perform QC inspections of completed inspections for approximately 15,000 transmission, distribution, and generation structures in HFRA. The QC inspection scope will be based on risk-stratified sampling to assess the accuracy of the overhead inspections. SCE's Vegetation Management uses external resources to perform QC (e.g., review if a tree trim met the correct clearance distance).

SCE's Audit Services Department (ASD) assesses WMP implementation independently of the responsible operating unit. Audits are determined via a risk assessment informed by SCE's Board of Directors (Board), senior management and regulatory requirements. ASD conducts risk-informed audits of SCE's electrical line and equipment inspection program to provide reasonable assurance that SCE facilities are being appropriately inspected and identified conditions are timely remediated according to applicable requirements. ASD includes field inspection reviews of structures inspected, a desktop review of inspection processes and procedures, and a review of inspections evaluated under C&Q processes. ASD also assesses whether any potentially significant issues observed in the field are timely communicated to T&D operations and appropriately remediated. ASD tracks corrective actions using industry standard auditing software in accordance with the International Standards for the Professional Practice of Internal Auditing.

Ultimately, the Board provides oversight for all aspects of SCE's business including safety, and Board committees have responsibility for oversight of specific areas. The Board's Safety and Operations Committee (Committee) oversees SCE's safety performance, culture, goals, risks and significant safety-related incidents involving employees, contractors, or members of the public. The Committee members take an active role in overseeing SCE's safety and operational practices, including oversight of SCE's WMP.

5.2.2 Identify and Correct Deficiencies

SCE field crews (SCE & contract) executing work in HFRA, management reviewing results or trends, and internal auditors are empowered to suggest improvement opportunities. Field crews and grid operations staff are closest to the work and play an instrumental role in implementing SCE's wildfire mitigation programs and ensuring that work is safely executed, data is captured correctly, concerns are reported, and work methods and analyses are continually improved.

Program and mitigation activity owners, and the Program Management Office (PMO), monitor leading and lagging metrics to track progress, review the concerns raised by stakeholders, or issues identified through QA/QC processes and audits, and recommend appropriate corrective actions to the responsible organizations. The responsible organization for each mitigation activity is accountable for implementing these corrective actions. These organizations work with the PMO to report out progress and corrective actions to executive leadership.

5.2.3 Data Architecture and Flows

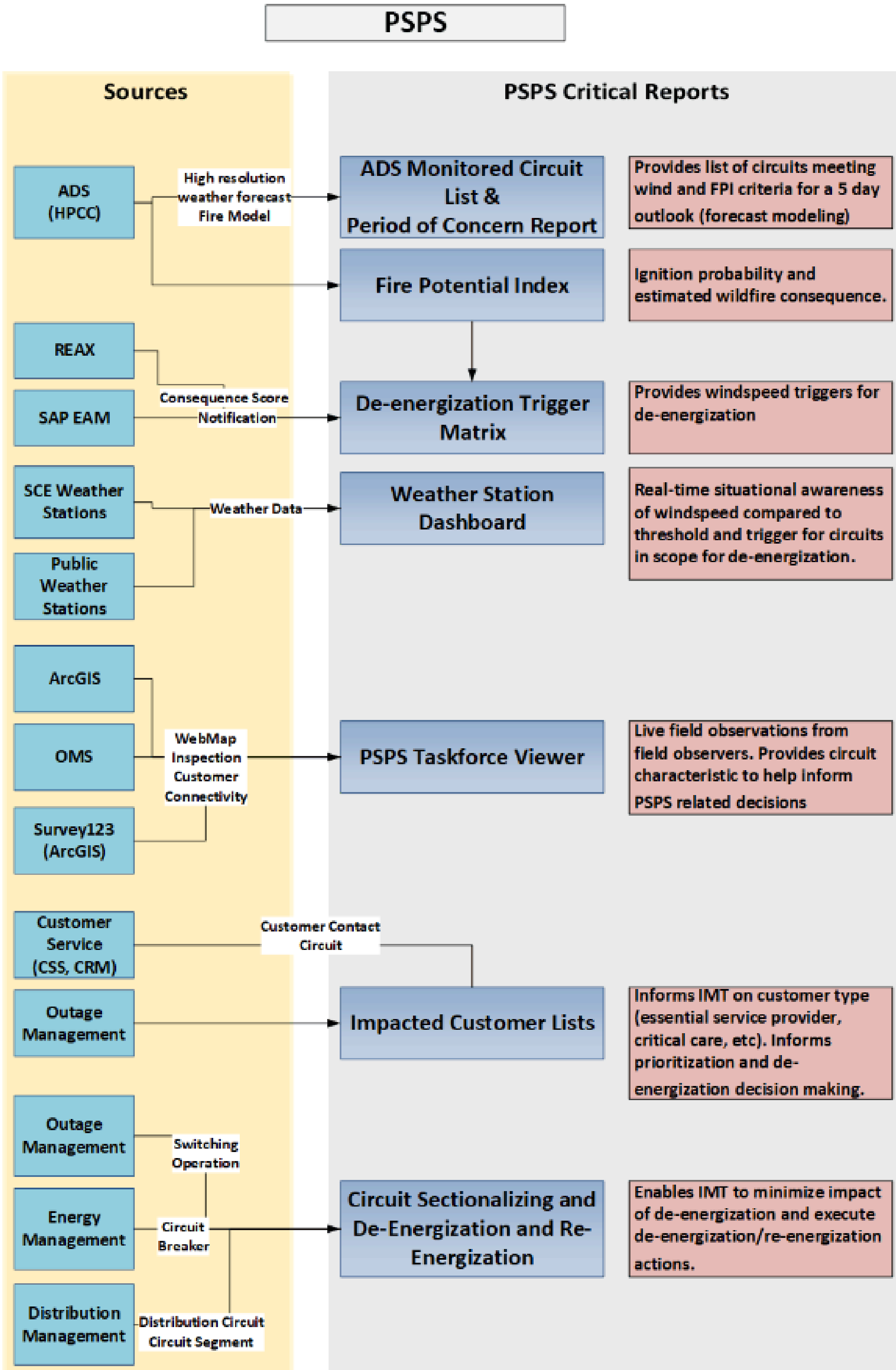
SCE uses multiple systems to drive wildfire-related decisions and operations. Systems that support key functions such as grid operations, community engagement, inspections and maintenance, vegetation management, and asset risk management are listed below with their associated data architectures and flows.

Grid Operations and Community Engagement (Data Flows Supporting PSPS)

SCE's Grid Operations' systems (e.g., Distribution Management System, Energy Management System, Outage Management System Weather Stations) are used for circuit monitoring, switching, and executing de-energization and re-energization of circuits to support the overall PSPS data flow.

Community engagement is managed using SCE's Customer Service System (CSS), Customer Relationship Systems (CRM), and OMS. These systems are also part of the PSPS data flow. The data architecture and flows that support SCE's community engagement processes are depicted below in Figure SCE 5-1:

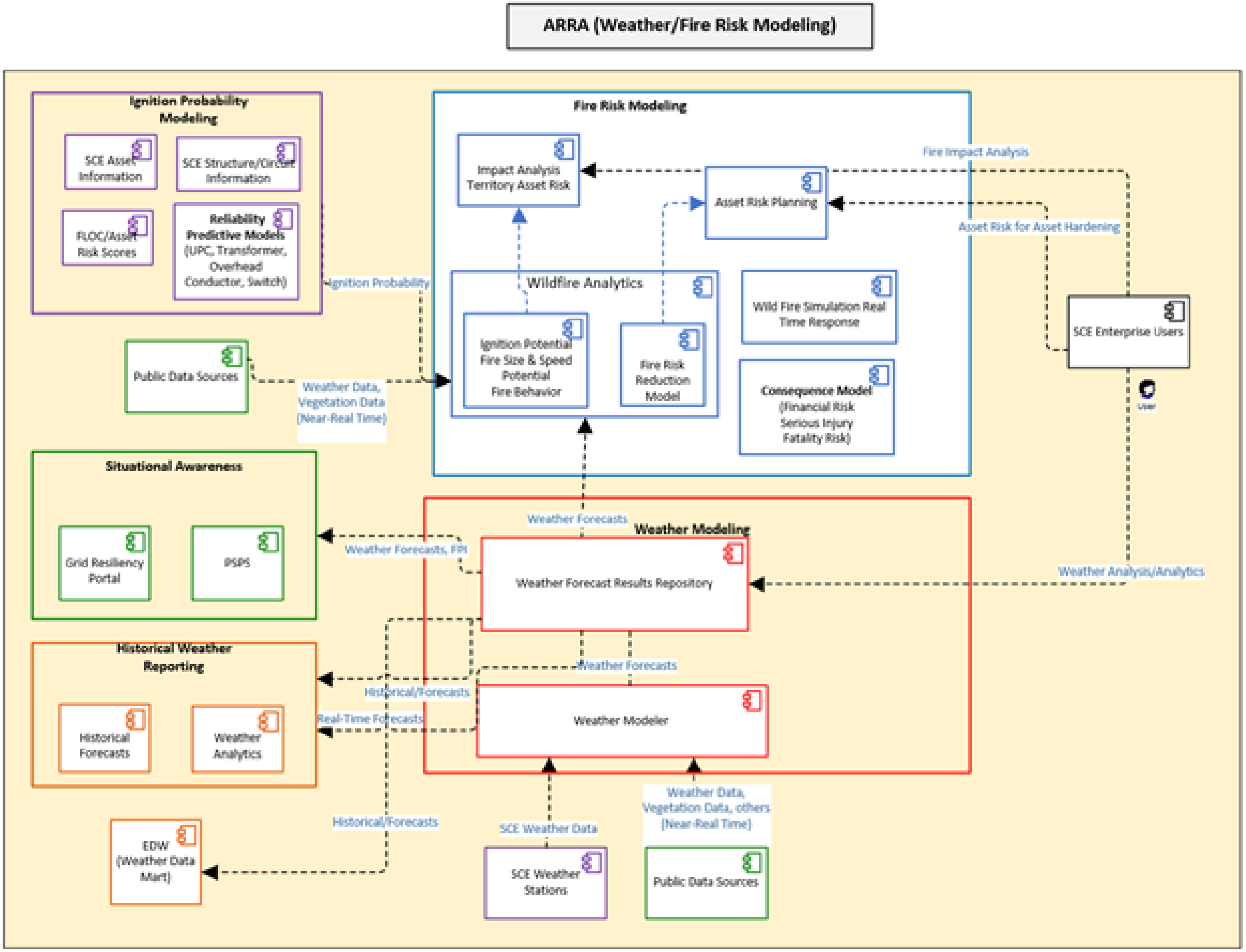
Figure SCE 5-1
PSPS Data Architecture Flow



SCE plans on deploying process orchestration, automation and data pipelines to enable faster decision making and less manual reporting during PSPS events. Data is critical to decision making during PSPS events and this program will focus on developing automated date pipelines to critical data across the system. Connecting data across key PSPS activities currently requires manual effort and manual QC as managing a PSPS event requires data from across multiple systems that are not currently integrated. This program will focus on creating automated data pipelines and enhance dashboards to inform PSPS decision making. The initial focus will be on improving the communication pipeline to ensure SCE can accelerate its ability to inform customers of potential events with a goal to deliver necessary automation before the 2020 PSPS season.
For PSPS protocols, refer to Section 5.3.6.

Risk-Informed Work Prioritization
Currently, SCE uses a variety of resources to forecast weather and fire occurrences, including the use of third-party data by SCE meteorologists. SCE also has an advance analytics group to derive an asset risk score that serves as a key driver for determining where to prioritize execution of wildfire mitigations. The asset risk score is based on outputs from weather models (currently generated by Atmospheric Data Solution for SCE), ignition probability models (generated in-house) and the fire-risk models (generated in-house currently using Reax). The data architecture and flow to support SCE's current processes for modeling weather, ignition probability, and fire consequence are depicted below in Figure SCE 5-2~~Figure SCE 5-2~~.

Figure SCE 5-2
Data Architecture Flow for Modeling Weather, Ignition Probability, and Fire Consequence



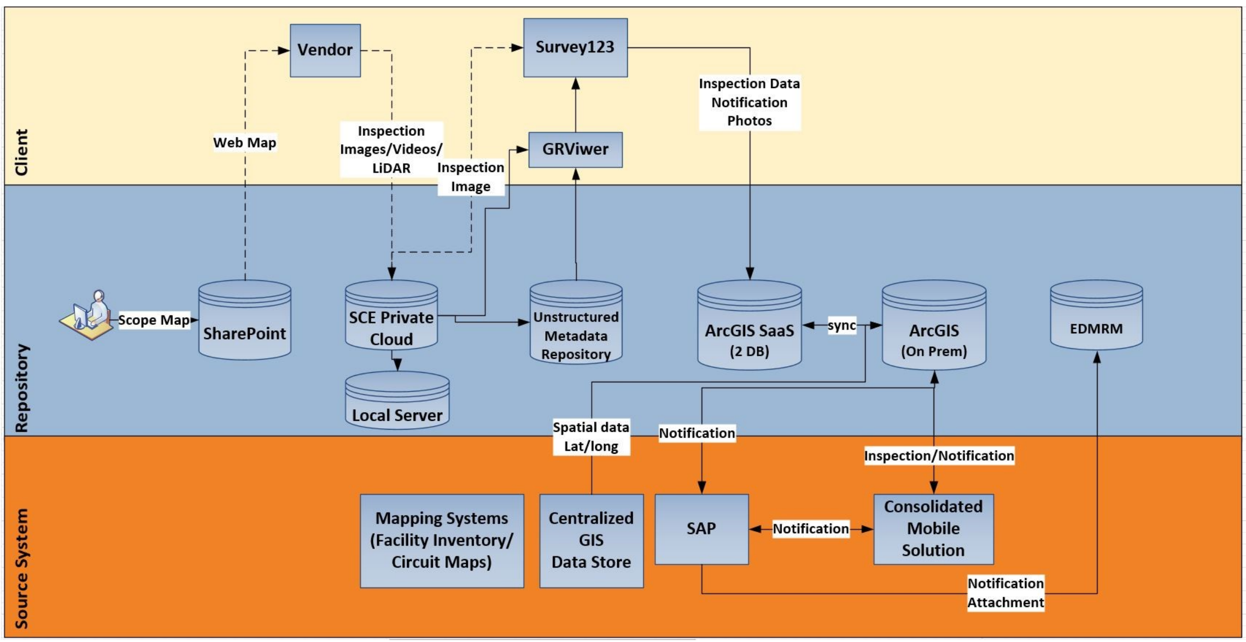
For a description of SCE’s capital (resource) allocation methodology, refer to Section5.3.8.

Aerial Inspections

SCE assigns inspection work to aerial vendors using SCE’s main asset source system (i.e. SAP) and mapping systems. Aerial vendors fly the lines and capture aerial imagery. This data is stored in SCE’s private Azure cloud and is also synced to SCE’s source systems on local servers. SCE’s inspectors use ArcGIS web applications (e.g., Client-Survey123) to access images in performing their inspections and recommend necessary remediations that are automatically integrated into SAP. The data architecture and flows to support this are depicted below in Figure SCE 5-3:

Figure SCE 5-3

Data Architecture Flow for Aerial Inspections



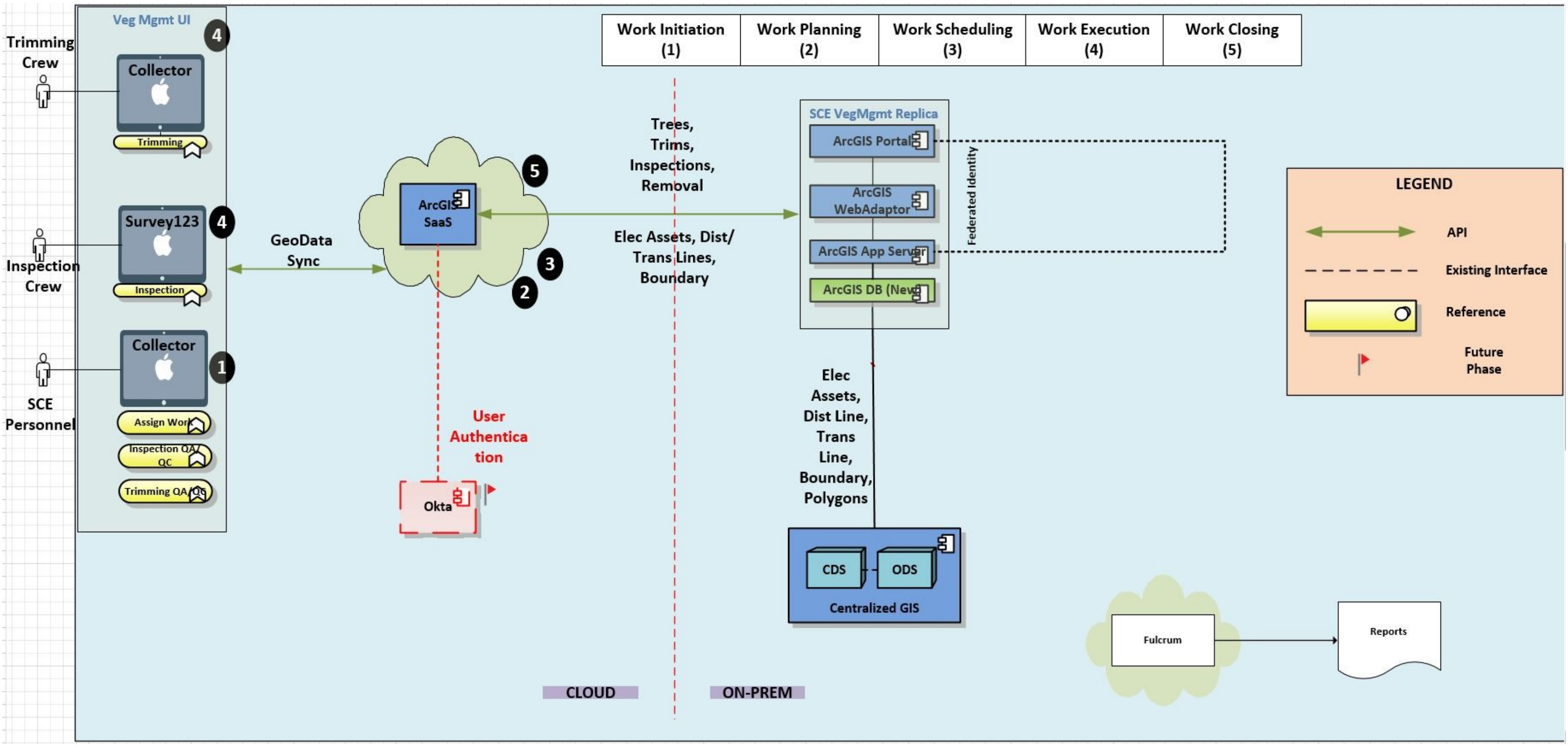
For a description of SCE’s Distribution Aerial Inspections Program, refer to Section 5.3.4.9.2.

Vegetation Management

SCE has multiple databases that support SCE’s vegetation management operations. Below is a brief description of these databases and Figure SCE 5-4~~Figure SCE 5-4~~ displays the data architecture and flows.

1. For SCE’s routine vegetation management, SCE uses mobile apps on ArcGIS Online (AGOL)
2. For SCE’s HTMP, LiDAR Program, Power Delivery Program, Distribution Pole Brushing Program, and Supplemental Patrols, SCE uses Fulcrum, a software as a service (SaaS) platform
3. For SCE’s DRI, Weed Abatement Program, and its storm emergency programs, SCE uses different databases

Figure SCE 5-4
Data Architecture Flow for Vegetation Management



SCE intends to deploy an IVM platform that includes process orchestration, automation, mobile tools and an integrated repository across all vegetation management programs. This system integration will improve data accuracy by: 1) assisting with maintaining updated vegetation management data, without a large backlog of paperwork to process; 2) eliminating data errors from manual data entry; 3) obtaining real-time information on work task items such as status, crew assignment, work dates; and 4) reducing manual intervention in overseeing vegetation management work and obtain visibility into the individual tasks. As mentioned earlier, this program will initially focus on hazard tree and DRI activities, with an expected goal to extend to all wildfire-related vegetation activities through this WMP period.

Vegetation Management – Trims Completed Dashboard

A snapshot of the Trims Completed dashboard, shown below in Table SCE 5-7, illustrates how SCE informs the development of the status, expectations, and results of its vegetation work. Vegetation management and resource planners use this dashboard to help plan and monitor work and take corrective actions when necessary. Key columns are captured in Table SCE 5-3.

Figure SCE 5-5
Vegetation Management Trims Completed Dashboard

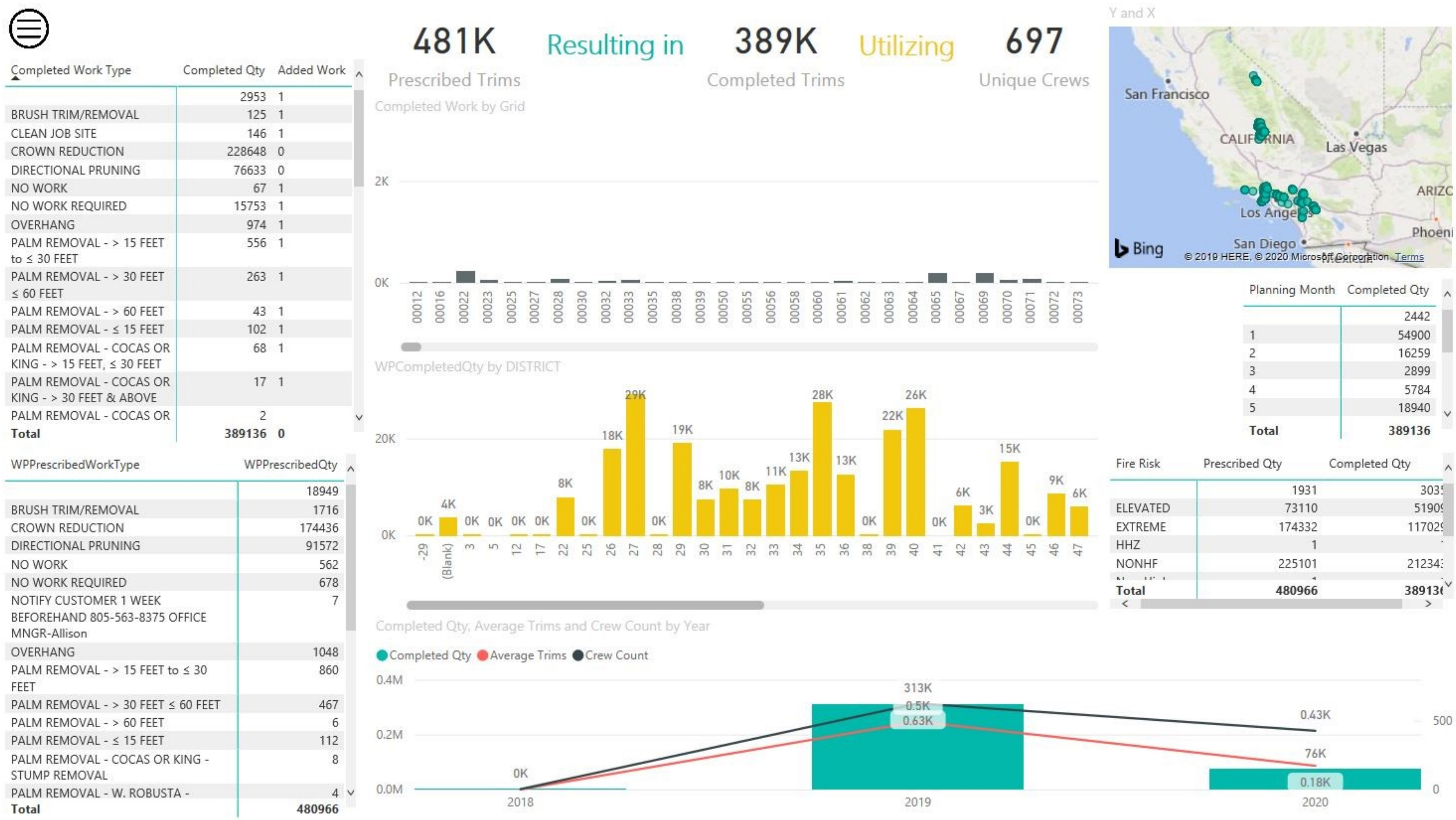


Table SCE 5-3
Vegetation Management Trims Completed Dashboard Key Columns

Column Name	Column Description
Prescribed Trims	Quantity of identified incoming work units for vegetation trimming
Completed Trims	Quantity of completed work units for vegetation trimming
Crews	SCE tree trimming contractors/crews
Work Type	Type of work performed during trimming (e.g., brush trim, crown reduction, pruning)
Fire Risk	Fire risk type (e.g., Elevated, Extreme, etc.)
District	District Number
Prescribed Quantity	Incoming trimming work grouped by fire risk type
Trimmer Assigned Work	Trimming work assigned to SCE contractors
Inspections	Inspection activity undertaken by SCE arborists/contractors
Clearance Type	Clearance type
Inspector	Person performing the inspection
Species	Type of tree species

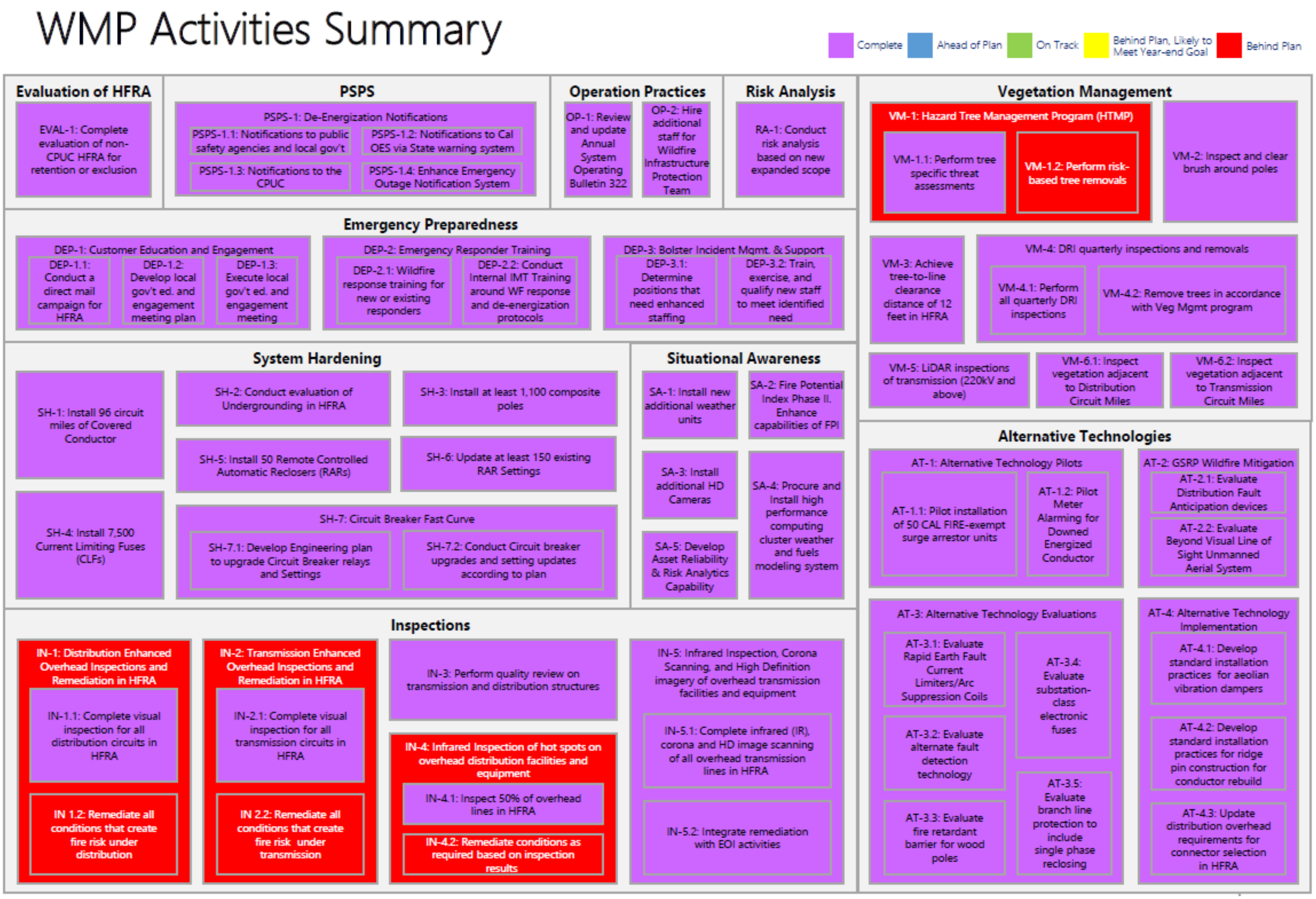
For a description of SCE's Vegetation Management program, refer to Section 5.3.5.

Dashboards and Reports
SCE has various reports and dashboards directly or indirectly related to ignition probability and estimated wildfire consequences and reduction. Ad hoc dashboards and reports are also created to support the program. Below are some of the key dashboards that are used:

Wildfire Mitigation Status Executive Dashboard
Below in Figure SCE 5-6~~Figure SCE 5-6~~ is the executive dashboard SCE used to track and report wildfire mitigation activities from SCE's 2019 WMP. SCE's most recent status update of its 2019 WMP was filed January 31, 2020.[24]

[24] Advice Letter 4153-E: Southern California Edison Company's Quarterly Advice Letter Pursuant to Assembly Bill 1054 Regarding the Implementation of Its Approved Wildfire Mitigation Plan and Its Safety Recommendations (January 31, 2020), https://library.sce.com/content/dam/sce-doclib/public/regulatory/filings/pending/electric/ELECTRIC_4153-E.pdf

Figure SCE 5-6
Wildfire Mitigation Executive Dashboard



Consequence Score Dataset

In lieu of a report, a consequence score dataset is used to calculate Asset Risk Score. Table SCE 5-4~~Table SCE 5-4~~ is provided below:

Table SCE 5-4
Consequence Score Dataset

GESW_ID	CIRCT_NAME	COND_TYPE	VOLTAGE	FinancialImpact	Serious Injury	Fatality	Mars Financial	MARS Injury	MARS Fatality	AnimalFire	BalloonFire	CFO_OtherFire	VegFire	VehicleHit Fire	Capacitor Fire	Conductor Fire	Crossarm Fire	EFF_OtherFires	InsulatorFire	Slice/Clamp/ConnectorFire	TransformerFire	Unknown Fire	TotalFireFrequency	Total MARS Score
45388003	RIM	Overhead Primary Conductor	12	667343.6996	6.25E-03	7.53E-04	1.33E-02	6.16E-03	4.78E-03	4.56E-05	9.78E-05	4.42E-05	2.25E-04	1.00E-04	1.15E-05	5.77E-05	5.13E-06	4.77E-05	2.87E-05	3.10E-05	7.11E-06	1.24E-04	8.26E-04	6.07E-03
25012786	ALPINE	Overhead Primary Conductor	2.4	667028.9841	6.21E-03	7.48E-04	0.01334	6.12E-03	4.75E-03	4.65E-05	9.98E-05	4.51E-05	2.46E-04	4.70E-05	7.32E-05	5.88E-05	5.24E-06	4.87E-05	2.93E-05	3.17E-05	7.26E-06	1.42E-04	8.81E-04	6.05E-03
45388676	RIM	Overhead Primary Conductor	12	659469.709	6.18E-03	7.44E-04	1.32E-02	6.09E-03	4.72E-03	4.50E-05	9.67E-05	4.37E-05	2.22E-04	9.91E-05	1.13E-05	5.70E-05	5.07E-06	4.72E-05	2.83E-05	3.07E-05	7.03E-06	1.22E-04	8.16E-04	6.00E-03
45388645	RIM	Overhead Primary Conductor	12	612145.8637	5.73E-03	6.91E-04	1.22E-02	5.65E-03	4.38E-03	4.18E-05	8.97E-05	4.06E-05	2.06E-04	9.20E-05	1.05E-05	5.29E-05	4.71E-06	4.38E-05	2.63E-05	2.85E-05	6.52E-06	1.14E-04	7.57E-04	5.57E-03
144008761	RIM	Overhead Primary Conductor	12	572989.2342	5.37E-03	6.47E-04	1.15E-02	5.29E-03	4.10E-03	3.91E-05	8.40E-05	3.80E-05	1.93E-04	8.61E-05	9.84E-06	4.95E-05	4.41E-06	4.10E-05	2.46E-05	2.66E-05	6.11E-06	1.06E-04	7.09E-04	5.21E-03
45389208	RIM	Overhead Primary Conductor	12	541407.8421	5.07E-03	6.11E-04	1.08E-02	5.00E-03	3.88E-03	3.70E-05	7.94E-05	3.59E-05	1.83E-04	8.14E-05	9.29E-06	4.68E-05	4.16E-06	3.87E-05	2.33E-05	2.52E-05	5.77E-06	1.00E-04	6.70E-04	4.93E-03
15420663	BOUQUET	Overhead Primary Conductor	16	128019.7767	9.28E-03	1.12E-03	2.56E-03	9.14E-03	7.10E-03	4.75E-05	1.02E-04	4.61E-05	8.99E-05	4.80E-05	1.19E-05	1.08E-04	1.40E-05	4.98E-05	2.99E-05	3.24E-05	7.42E-06	7.58E-05	6.63E-04	4.70E-03
164249625	ALPINE	Overhead Primary Conductor	2.4	486593.8844	4.78E-03	5.75E-04	9.73E-03	4.71E-03	3.65E-03	4.26E-05	9.13E-05	4.13E-05	2.25E-04	4.30E-05	6.70E-05	5.38E-05	4.79E-06	4.46E-05	2.68E-05	2.90E-05	6.64E-06	1.30E-04	8.06E-04	4.52E-03
25012848	ALPINE	Overhead Primary Conductor	2.4	474895.5706	4.56E-03	5.50E-04	9.50E-03	4.49E-03	3.49E-03	5.32E-05	1.14E-04	5.17E-05	2.81E-04	5.38E-05	8.38E-05	6.73E-05	5.99E-06	5.57E-05	3.35E-05	3.62E-05	8.30E-06	1.63E-04	1.01E-03	4.37E-03
15423148	BOUQUET	Overhead Primary Conductor	16	125456.9242	8.36E-03	1.01E-03	2.51E-03	8.24E-03	6.40E-03	4.41E-05	9.47E-05	4.28E-05	8.35E-05	4.46E-05	1.11E-05	1.00E-04	1.30E-05	4.62E-05	2.78E-05	3.00E-05	6.89E-06	7.04E-05	6.15E-04	4.29E-03
53307510	HIGH SCHOOL	Overhead Primary Conductor	2.4	479991.055	4.25E-03	5.12E-04	9.60E-03	4.19E-03	3.25E-03	4.03E-05	8.66E-05	3.92E-05	2.71E-04	4.07E-05	1.01E-05	5.10E-05	4.54E-06	4.22E-05	2.54E-05	2.75E-05	6.29E-06	1.28E-04	7.72E-04	4.26E-03
45390059	RIM	Overhead Primary Conductor	12	468564.3275	4.07E-03	4.91E-04	9.37E-03	4.01E-03	3.12E-03	3.51E-05	7.53E-05	3.41E-05	1.73E-04	7.72E-05	8.82E-06	4.44E-05	3.95E-06	3.68E-05	2.21E-05	2.39E-05	5.48E-06	9.53E-05	6.36E-04	4.12E-03
53307544	HIGH SCHOOL	Overhead Primary Conductor	2.4	461950.06	4.07E-03	4.91E-04	9.24E-03	4.01E-03	3.11E-03	3.88E-05	8.33E-05	3.77E-05	2.61E-04	3.92E-05	9.76E-06	4.91E-05	4.37E-06	4.07E-05	2.44E-05	2.64E-05	6.06E-06	1.23E-04	7.43E-04	4.09E-03
15421544	BOUQUET	Overhead Primary Conductor	16	114642.2386	7.95E-03	9.58E-04	2.29E-03	7.83E-03	6.08E-03	4.79E-05	1.03E-04	4.65E-05	9.07E-05	4.84E-05	1.20E-05	1.09E-04	1.41E-05	5.02E-05	3.02E-05	3.26E-05	7.48E-06	7.65E-05	6.68E-04	4.05E-03
15422868	BOUQUET	Overhead Primary Conductor	16	119250.5673	7.87E-03	9.48E-04	2.39E-03	7.75E-03	6.02E-03	5.03E-05	1.08E-04	4.89E-05	9.52E-05	5.08E-05	1.26E-05	1.14E-04	1.48E-05	5.27E-05	3.17E-05	3.43E-05	7.85E-06	8.03E-05	7.02E-04	4.04E-03
45388937	RIM	Overhead Primary Conductor	12	448464.8841	3.99E-03	4.81E-04	8.97E-03	3.93E-03	3.05E-03	5.20E-05	1.12E-04	5.05E-05	2.57E-04	1.14E-04	1.31E-05	6.58E-05	5.86E-06	5.45E-05	3.27E-05	3.54E-05	8.12E-06	1.41E-04	9.42E-04	3.99E-03
53308128	HIGH SCHOOL	Overhead Primary Conductor	2.4	450978.9148	3.95E-03	4.76E-04	9.02E-03	3.90E-03	3.02E-03	3.94E-05	8.46E-05	3.83E-05	2.65E-04	3.98E-05	9.91E-06	4.99E-05	4.44E-06	4.13E-05	2.48E-05	2.68E-05	6.15E-06	1.25E-04	7.55E-04	3.98E-03
21871191	DAVENPORT	Overhead Primary Conductor	16	185602.1026	6.97E-03	8.40E-04	3.71E-03	6.87E-03	5.33E-03	9.05E-05	1.23E-04	5.57E-05	1.08E-04	9.86E-05	1.44E-05	7.25E-05	1.69E-05	8.35E-05	3.61E-05	3.90E-05	1.43E-05	9.15E-05	8.44E-04	3.98E-03
45389997	RIM	Overhead Primary Conductor	12	454335.8787	3.88E-03	4.68E-04	9.09E-03	3.83E-03	2.97E-03	3.06E-05	6.56E-05	2.97E-05	1.51E-04	6.73E-05	7.69E-06	3.87E-05	3.44E-06	3.20E-05	1.92E-05	2.08E-05	4.77E-06	8.31E-05	5.54E-04	3.97E-03
15422477	BOUQUET	Overhead Primary Conductor	16	119535.1291	7.61E-03	9.16E-04	2.39E-03	7.50E-03	5.82E-03	5.49E-05	1.18E-04	5.33E-05	1.04E-04	5.55E-05	1.38E-05	1.25E-04	1.62E-05	5.75E-05	3.46E-05	3.74E-05	8.57E-06	8.76E-05	7.66E-04	3.93E-03
21284600	RICARDO	Overhead Primary Conductor	16	128574.7516	7.46E-03	8.98E-04	2.57E-03	7.35E-03	5.70E-03	5.84E-05	1.25E-04	5.67E-05	1.79E-04	5.90E-05	1.47E-05	7.38E-05	6.57E-06	1.18E-04	1.29E-04	3.97E-05	9.11E-06	9.31E-05	9.62E-04	3.91E-03
13041453	ARLENE	Overhead Primary Conductor	16	102404.9493	7.55E-03	9.10E-04	2.05E-03	7.44E-03	5.77E-03	4.39E-05	9.42E-05	4.26E-05	8.31E-05	4.44E-05	1.10E-05	1.90E-04	4.95E-06	4.60E-05	1.12E-04	2.99E-05	6.85E-06	7.01E-05	7.79E-04	3.82E-03
25013008	ALPINE	Overhead Primary Conductor	2.4	388802.1734	4.24E-03	5.11E-04	7.78E-03	4.18E-03	3.24E-03	4.49E-05	9.64E-05	4.36E-05	2.37E-04	4.54E-05	7.07E-05	5.68E-05	5.06E-06	4.70E-05	2.83E-05	3.06E-05	7.01E-06	1.37E-04	8.50E-04	3.80E-03
13027570	ARLENE	Overhead Primary Conductor	16	100420.7124	7.53E-03	9.08E-04	2.01E-03	7.42E-03	5.76E-03	4.34E-05	9.32E-05	4.22E-05	8.22E-05	4.39E-05	1.09E-05	1.88E-04	4.89E-06	4.55E-05	1.11E-04	2.96E-05	6.78E-06	6.93E-05	7.70E-04	3.80E-03
35996776	MACIEL	Overhead Primary Conductor	12	65739.62276	7.91E-03	9.53E-04	1.31E-03	7.79E-03	6.05E-03	3.11E-05	6.66E-05	1.67E-04	5.87E-05	3.14E-05	7.80E-06	1.28E-04	3.50E-06	3.25E-05	1.95E-05	2.11E-05	4.84E-06	4.95E-05	6.21E-04	3.79E-03
25012605	ALPINE	Overhead Primary Conductor	2.4	395652.8436	4.09E-03	4.93E-04	7.91E-03	4.03E-03	3.13E-03	3.45E-05	7.41E-05	3.35E-05	1.82E-04	3.49E-05	5.44E-05	4.37E-05	3.89E-06	3.62E-05	2.17E-05	2.35E-05	5.39E-06	1.06E-04	6.54E-04	3.77E-03
43730587	CONINE	Overhead Primary Conductor	12	127931.2529	7.13E-03	8.59E-04	2.56E-03	7.03E-03	5.46E-03	3.17E-05	6.81E-05	3.08E-05	1.61E-04	1.02E-04	7.98E-06	4.01E-05	3.57E-06	3.32E-05	2.00E-05	2.16E-05	4.95E-06	5.06E-05	5.75E-04	3.76E-03
25013229	ALPINE	Overhead Primary Conductor	2.4	391653.2296	4.11E-03	4.95E-04	7.83E-03	4.05E-03	3.14E-03	4.00E-05	8.59E-05	3.89E-05	2.11E-04	4.04E-05	6.30E-05	5.06E-05	4.51E-06	4.19E-05	2.52E-05	2.72E-05	6.24E-06	1.23E-04	7.58E-04	3.76E-03
15420190	BOUQUET	Overhead Primary Conductor	16	113477.3832	7.21E-03	8.68E-04	2.27E-03	7.10E-03	5.51E-03	4.31E-05	9.24E-05	4.18E-05	8.15E-05	4.35E-05	1.08E-05	9.76E-05	1.27E-05	4.51E-05	2.71E-05	2.93E-05	6.72E-06	6.87E-05	6.00E-04	3.72E-03

The Asset Risk Score is based on factors that include Circuit Voltage, Fatality Consequence, Injury Consequence Financial Consequence and frequency of causes such as vehicle hit, conductor and crossarm. The key columns in the consequence score dataset are listed below in Table SCE 5-5:

Table SCE 5-5
Consequence Score Dataset Key Columns

Column Name	Column Description
GESW_ID	GE Small World Id
CIRCT_NAME	Circuit name
COND_TYPE	Conductor Type
VOLTAGE	Circuit Voltage
Financial Impact	Financial consequence
Serious Injury	Serious Injury Consequence
Fatality	Fatality Consequence
Mars Financial	Financial consequence conversion to multi attribute risk score
MARS Injury	Injury consequence conversion to multi attribute risk score
MARS Fatality	Fatality consequence conversion to multi attribute risk score
AnimalFire	Frequency of fire caused by animal contact
BalloonFire	Frequency of fire caused by balloon contact
CFO_OtherFire	Frequency of fire caused by contact from object
VegFire	Frequency of fire caused by vegetation contact
VehicleHitFire	Frequency of fire caused by car collisions
CapacitorFire	Frequency of fire caused by capacitor fault
ConductorFire	Frequency of fire caused by conductor fault
CrossarmFire	Frequency of fire caused by crossarm failure
EFF_OtherFires	Frequency of fire caused by other
InsulatorFire	Frequency of fire caused by insulator failure
Slice/Clamp/ConnectorFire	Frequency of fire caused by slice, clamp or connector fault
TransformerFire	Frequency of fire caused by transformer fault
UnknownFire	Frequency of fire by unknown causes
Total Fire Frequency	Total frequency of fire
Total MARS Score	All consequences aggregated into a multi attribute risk score

PSPS Monitored Circuit List

The monitored circuit list report is used to identify the list of circuits that are being considered for PSPS and the circuits that are approaching PSPS criteria (below the orange line). PSPS criteria is based on a number of factors, including weather and Fire Potential Index (FPI). This report is developed by SCE's expert meteorology staff using the weather and fuel forecast and circuit spatial data. The red highlights indicate circuit specific wind and FPI values that are exceeding established thresholds. A snapshot of this is provided below in Table SCE 5-6~~Table SCE 5-6~~:

This report is used to inform the decision to activate an Incident Management Team (IMT) and to initiate notifications. These thresholds do not determine if a circuit should be de-energized. For a detailed description of SCE's de-energization protocol, please refer to Section 4.4.

Table SCE 5-6
PSPS Monitored Circuit List Template

Monitored Circuit List Template

Circuit	Downstream Circuits	Shared Structures	D_S_T	Date_Time Starting	Date_Time Ending	Switching Center	Substation	County	District	Weather Stations		Sustained Wind Threshold	Gust Threshold	99th pct Sustained	99th pct Gust	Peak Wind Forecast	Peak Gust Forecast	Peak FPI
Circuit 1	Insert Downstream Circuits	Insert Shared Structures	D_S_T	mm/dd/yy 00:00	mm/dd/yy 00:00	Insert SC	Insert Substation	Insert County	District	Insert Applicable WS	Insert Applicable WS	Value	Value	Value	Value	Value	Value	Value
Circuit 2	Insert Downstream Circuits	Insert Shared Structures	D_S_T	mm/dd/yy 00:00	mm/dd/yy 00:00	Insert SC	Insert Substation	Insert County	District	Insert Applicable WS	Insert Applicable WS	Value	Value	Value	Value	Value	Value	Value
Circuit 3	Insert Downstream Circuits	Insert Shared Structures	D_S_T	mm/dd/yy 00:00	mm/dd/yy 00:00	Insert SC	Insert Substation	Insert County	District	Insert Applicable WS	Insert Applicable WS	Value	Value	Value	Value	Value	Value	Value
Circuit 1	Insert Downstream Circuits	Insert Shared Structures	D_S_T	mm/dd/yy 00:00	mm/dd/yy 00:00	Insert SC	Insert Substation	Insert County	District	Insert Applicable WS	Insert Applicable WS	Value	Value	Value	Value	Value	Value	Value
Circuit 2	Insert Downstream Circuits	Insert Shared Structures	D_S_T	mm/dd/yy 00:00	mm/dd/yy 00:00	Insert SC	Insert Substation	Insert County	District	Insert Applicable WS	Insert Applicable WS	Value	Value	Value	Value	Value	Value	Value
Circuit 3	Insert Downstream Circuits	Insert Shared Structures	D_S_T	mm/dd/yy 00:00	mm/dd/yy 00:00	Insert SC	Insert Substation	Insert County	District	Insert Applicable WS	Insert Applicable WS	Value	Value	Value	Value	Value	Value	Value

The key fields used for this list are listed below in Table SCE 5-7:

Table SCE 5-7
PSPS Monitored Circuit List Key Fields

Column Name	Column Description
Circuit	Impacted Circuit Name
Downstream Circuits	Impacted Downstream Circuits
D_ST_T	Circuit Type (Distribution/Subtrans/Trans)
Date Time Starting	Period Of concern start time
Date Time Ending	Period Of concern end time
Switching Center	Switching Center for the impacted circuit
Substation	Feeder Substation
County	County Name
District	District Number
Weather Stations	Weather station Structure Location
Sustained Wind Threshold	Sustained Wind Threshold
Gust Threshold	Gust Threshold
99th pct Sustained	99^{th} pct Sustained Wind Threshold (Top 1% of historical values)
99th pct Gust	99^{th} pct Gust Threshold (Top 1% of historical values)
Peak Wind Forecast	Peak Wind Forecast
Peak Gust Forecast	Peak Gust Forecast
Peak FPI	Peak Fire Potential Index

All available GIS data and products
SCE uses internal and external GIS layers in AGOL to support situational awareness and communications during PSPS events or other hazardous events. These layers allow SCE to build tools such as REST services, web maps, survey forms, and dashboards to inform internal and external stakeholders as the event unfolds. Additionally, SCE uses these GIS layers to conduct spatial analysis to calculate impacts to SCE's asset during and after event.

For a relevant data dictionary, see SCE's Report on Data Collection for Wildfire Mitigation Plans Report filed on July 30, 2019 in docket R.18-10-007. Further details of key wildfire related data elements used to support the Wildfire Mitigation Program, where it is stored, how it is accessed, and by whom is referenced in Section 5.3.7.

For more details on SCE's Arc GIS layers, see Appendices D and D and refer to Section 2.7 and Chapter 6 regarding GIS files SCE is providing as part of this WMP.

Data QA/QC Process
To maintain data integrity, SCE currently uses a combination of automation and manual checks within its existing processes. Corrections to asset and location data in the HFRA, resulting from EOI, are analyzed with available datasets and prioritized for remediation in SCE's asset correction processes. The exceptions from the automated interfaces are reviewed and addressed

periodically depending on the criticality of the record involved.

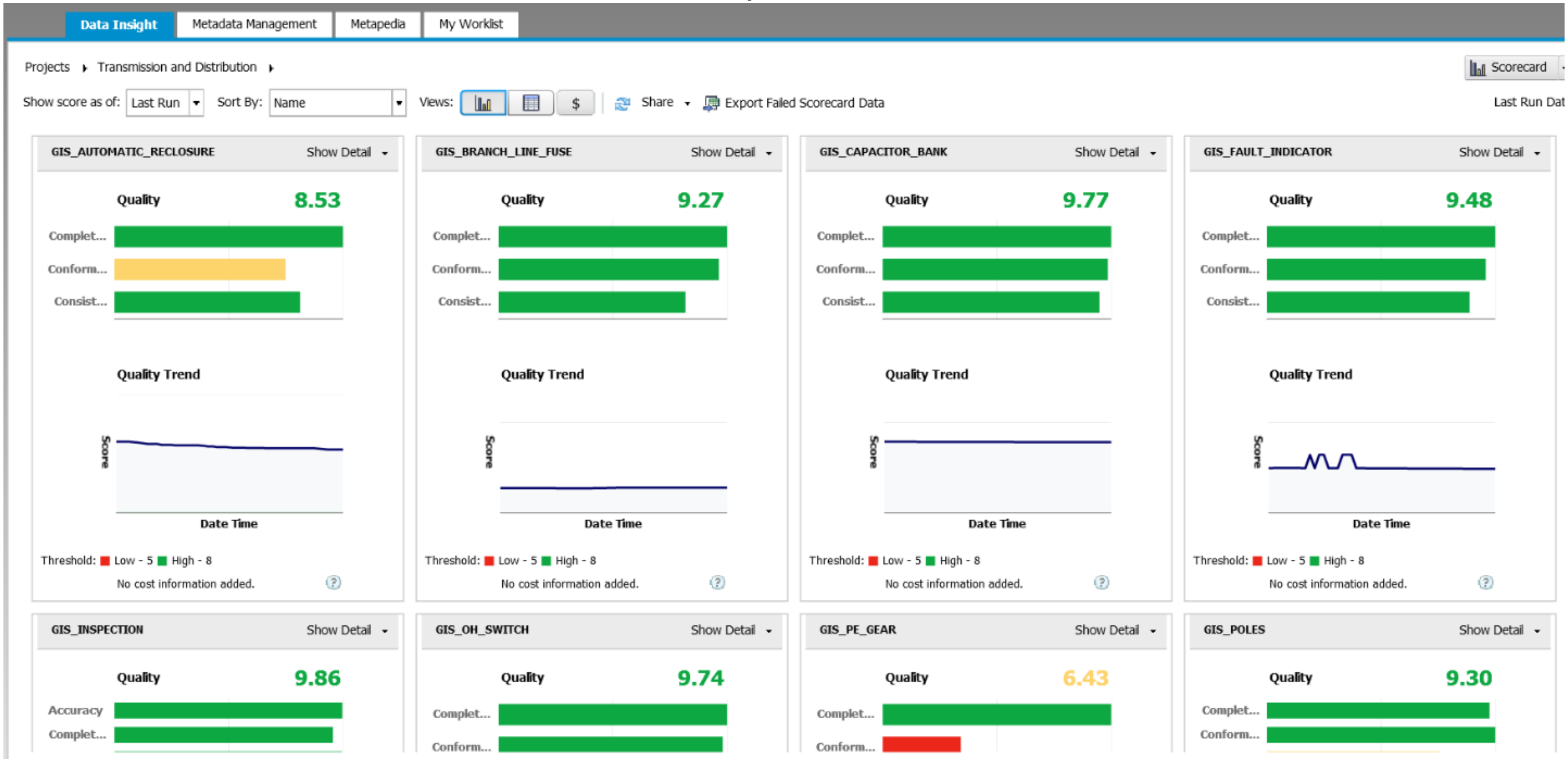
SCE is implementing a Data Quality Remediation framework for key master data and transactional datasets. This framework includes data quality remediation dashboards to monitor and address data quality issues, by enriching and reconciling information flows from business transactions for auditability and data sharing. Data quality is measured based on business capability rules, which are used to validate the completeness and accuracy of data in a system, and the consistency and integrity of data between systems, which are used for reconciliation processes.

SCE's critical business functions rely on electrical assets and their connectivity. To ensure accuracy of the connectivity in the transmission and distribution network, it is important to ensure integrity of the data between the systems. Every asset has an identifier that is referenced in consuming applications, and any discrepancy in data creation or modification can result in data quality issues.

The Data Quality Remediation framework builds on an understanding of SCE's business processes on data creation and data management. In the initial assessment stage, the current state of data quality is evaluated based on rules and tolerance limits set by business SMEs. Once the data quality score is determined, a gap analysis is performed to find the root causes of any data quality issue as part of the design remediation phase. Causes can range from business process failure to system-related issues, such as when there are inconsistencies between data entry practices across different systems for the same types of records. SCE then plans and implements corrective actions based on discussions with business stakeholders.

The scorecard below in Figure SCE 5-7~~Figure SCE 5-7~~ shows aspects of the data quality state of electrical assets. This score card is generated at the assessment stage and monitored through the design and remediation stages to track the data quality improvement.

Figure SCE 5-7
Data Quality Scorecard



The key factors that contribute to the Data Quality Score are Completeness (all the fields that define the record are completed), Conformity (aligns with the business rules for the data) and Consistency (how often the records meet completeness and conformity standards).

This framework has been implemented for some, but not all, data areas. Going forward, SCE is working toward a standardized process to monitor the data quality and increase awareness of data quality issues across the enterprise. SCE plans to incrementally expand the use of this framework and the related dashboards for other key datasets over the next 3 years.

5.3 Detailed Wildfire Mitigation Programs

In this section, describe how the utility's specific programs and initiatives plan to execute the strategy set out in Section 5.1. The specific programs and initiatives are divided into 10 categories, with each providing a space for a narrative description of the utility's initiatives and a summary table for numeric input in the subsequent tables in this section. The initiatives are organized by the following categories provided in this section:

1. Risk assessment and mapping
2. Situational awareness and forecasting
3. Grid design and system hardening
4. Asset management and inspections
5. Vegetation management and inspections
6. Grid operations and protocols
7. Data governance
8. Resource allocation methodology
9. Emergency planning and preparedness
10. Stakeholder cooperation and community engagement

To the extent applicable and relevant, if an electric utility has completed a Safety Model and Assessment Proceeding (S-MAP) and Risk Assessment Mitigation Phase (RAMP) as part of its General Rate Case that identifies safety models or programs the electrical corporation has implemented to mitigate ignition probability and estimated wildfire consequence, then the models or programs identified pursuant to this section must comport with those identified in the S-MAP proceeding. Describe any differences with S-MAP and RAMP and provide rationale.

SCE's wildfire risk models have evolved significantly over the past two years. Detailed descriptions of these models can be found elsewhere in this WMP (for the asset level wildfire risk model, see Section 4.3 for the RAMP, GSRP, 2021 GRC, and 2019 WMP models).

Both the RAMP model and the asset level wildfire risk model (WRM) are used in this 2020-2022 WMP. SCE intends to improve both models in the coming year. As required by the ALJ Ruling, the RSEs presented throughout this WMP are calculated using a modified RAMP MAVF (SCE's MARS), as described in the next section. The WRM is currently being used to target mitigation deployment to higher risk locations based on structure level ignition risk and circuit segment level consequence risk. Thus, the RSE calculation relies on a system average risk reduction, which, in the first few years, understates the risk reduction benefits of the scope of work actually deployed.

SCE's goal is to deploy system hardening measures that reduce the risk of ignitions associated electrical infrastructure as quickly as possible. As further explained in the Risk Spend Efficiency Analysis in Section 5.3.8 Resource Allocation Methodology, RSEs are not, and should not be, the only factor used to develop a risk mitigation plan. The RSE metric does not take into account certain operational realities that SCE must consider in its WMP. As described in SCE's 2021 GRC, the scope of work proposed in this WMP takes expected resource constraints into account even after planning to reallocate resources from other areas (e.g., moving resources away from traditional reliability-focused infrastructure replacement, especially in non-high fire areas, and into wildfire mitigation programs). Moreover, programs with higher RSEs such as PSPS are not necessarily the preferred long-term solution over covered conductor installation with comparatively lower RSEs. SCE did, however, consider RSEs, the overall expected risk reduction, planning and execution lead times, resource availability, customer impact, and other operational factors in developing its WMP.

SCE plans to revise and improve its MAVF in 2020 for use in its 2021 WMP update, and in its 2022 RAMP (MARS 2.0). Feedback received for SCE's 2018 RAMP Report, 2021 GRC, 2020-2022 WMP, along with any developments in the S-MAP proceedings will guide these revisions and improvements. Additionally, SCE will also consider feedback given to PG&E and SDG&E for their RAMP Reports. SCE is improving its asset level risk model by adding asset types, and a new fire propagation and consequence module with its implementation of an enhanced GIS enabled risk modeling. Sections 4.3, 5.3.1 and 5.3.2 further describe enhancements SCE is adopting to model wildfire risk.

As resources become available and wildfire risks are sufficiently mitigated, SCE will consider shifting resources back to traditional infrastructure replacement programs. SCE will assess portfolio level options using risk-informed analyses (including MARS 2.0) that considers safety (including but not limited to wildfire), reliability, and cost. Once the portfolio-level decisions are made, the improved asset level risk model will be used to target where each risk mitigation activity (including reliability and safety including wildfire) should be deployed.

5.3.1 Risk Assessment Mapping

Description of programs to reduce ignition probability and wildfire consequence

For each of the below initiatives, provide a detailed description and approximate timeline of each, whether already implemented or planned, to minimize the risk of its equipment or facilities causing wildfires. Include a description for the utility's programs, the utility's rationale behind each of the elements of this program, the utility's prioritization approach/methodology to determine spending and deployment of human and other resources, how the utility will conduct audits or other quality checks on each program, how the utility plans to demonstrate over time whether each component is effective and, if not, how the utility plans to evolve each component to ensure effective spend of ratepayer funds. Include descriptions across each of the following initiatives. Input the following initiative names into a spreadsheet formatted according to the template below and input information for each cell in the row.

1. *A summarized risk map showing the overall ignition probability and estimated wildfire consequence along electric lines and equipment*
2. *Climate-driven risk map and modelling based on various relevant weather scenarios*
3. *Ignition probability mapping showing the probability of ignition along the electric lines and equipment*
4. *Initiative mapping and estimation of wildfire and PSPS risk-reduction impact*
5. *Match drop simulations showing the potential wildfire consequence of ignitions that occur*

along the electric lines and equipment

6. *Weather-driven risk map and modelling based on various relevant weather scenarios*
7. *Other / not listed [only if an initiative cannot feasibly be classified within those listed above*

For each of the above initiatives, describe the utility's current program and provide an explanation of how the utility expects to evolve the utility's program over each of the following time periods:

1. *Before the upcoming wildfire season,*
2. *Before the next annual update,*
3. *Within the next 3 years, and*
4. *Within the next 10 years*

5.3.1.1 A summarized risk map showing the overall ignition probability and estimated wildfire consequence along electric lines and equipment

SCE has developed a method to visually display the highest priority work based on wildfire ignition risk along SCE electrical lines and equipment within HFRA using a number of geospatial resources (see examples in Chapter 4). One of SCE's primary resources used to display this project data in a geospatial format is known as the "Scope Mapping Tool." Risk data can be displayed along with inspection results and maintenance notifications in these geospatial layers to inform the prioritization of asset maintenance, upgrades, and equipment replacement. While the Scope Mapping Tool is used to streamline asset and work management activities across SCE's service territory, SCE does not have plans at this time to expand the ignition probability and estimate beyond HFRA boundaries.

5.3.1.2 Climate-driven risk map and modelling based on various relevant weather scenarios

In 2020, SCE will implement the WRRM, which will run multiple simulations based on different weather scenarios. The WRRM is discussed in depth in Section 4.3.3.

5.3.1.3 Ignition probability mapping showing the probability of ignition along the electric lines and equipment

In 2019, SCE developed the WRM, which assesses the risk of ignition at the circuit and circuit segment level. See Section 4.3 for a detailed description of SCE's WRM.

5.3.1.4 Initiative mapping and estimation of wildfire and PSPS risk-reduction impact

SCE utilized an Excel-based tool to estimate the relative risk reduction impact for each applicable mitigation (see Sections 5.3.2 through 5.3.10, Tables 21-30 for details on each activity and results from the risk reduction tool, where applicable). The methodology used in the 2020-2022 WMP is similar to that used in SCE's 2018 RAMP report and the 2021 GRC to assess the risk reduction attributed to the wildfire mitigation portfolio.

Based on the Guidelines, SCE adjusted its RAMP model by adding: (1) useful life; and (2) incremental RSE by year. SCE assessed the useful life of each of the scored mitigations by taking into account the full benefit stream of the mitigation into the future. This is different from the 2018 RAMP model calculation, which only focused on the years 2018-2023, and differentiates expected risk reduction benefit from different activities. As an example, capital-intensive mitigations such as covered conductor or undergrounding may have useful lives of 40+ years.

Instead of calculating the cumulative RSE by year, SCE has adjusted its model to calculate the RSE by the year's incremental deployment. The impact is that there will be no co-mingling or stacking of mitigation benefits for each deployment year from the previous year.

SCE used data, analysis, and subject matter expertise to determine mitigation effectiveness at the risk driver or consequence level and useful life of the programs and exposure (e.g., the total number of overhead circuit miles in HFRA).

In this WMP period, SCE plans to further refine its risk-informed planning processes by developing the capability to assess the relative RSE of mitigation portfolios under various scenarios. The results if such analyses can be used in conjunction with other operational considerations to drive decisions on activity scope determination and resource allocation. Additionally, SCE intends to expand its analysis to understand the impact of multiple mitigations in the same location.

5.3.1.5 Match drop simulations showing the potential wildfire consequence of ignitions that occur along the electric lines and equipment

Fire simulations near each HFRA circuit and segment are currently provided by Reax. In 2020 and for the foreseeable future, the fire simulations will be provided by the WRRM. See Section 4.3 for a description of Reax's and the WRRM's fire simulations.

5.3.1.6 Weather-driven risk map and modelling based on various relevant weather scenarios

The Reax analysis uses a pre-defined set of weather scenarios reflecting the most common conditions of fire ignition and propagation while running multiple simulations for each location. In transitioning to the WRRM, SCE will develop weather scenario simulations based on historical analysis of fire and climatology for SCE's service territory.

See Section 5.3.2 for additional detail on fuels sampling and WRRM implementation.

See Table 21 "Risk assessment and mapping" for more detail on the initiatives above.

5.3.2 Situational Awareness and Forecasting

Description of programs to reduce ignition probability and wildfire consequence
For each of the below initiatives, provide a detailed description and approximate timeline of each, whether already implemented or planned, to minimize the risk of the utility's equipment or facilities causing wildfires. Include a description of its initiatives, the utility's rationale behind each of the elements of the initiatives, the utility's prioritization approach/methodology to determine spending and deployment of human and other resources, how the utility will conduct audits or other quality checks on each initiative, how the utility plans to demonstrate over time whether each component of the initiatives is effective and, if not, how the utility plans to evolve each component to ensure effective spend of ratepayer funds.
Include descriptions across each of the following initiatives. Input the following initiative names into a spreadsheet formatted according to the template below and input information for each cell in the row.

1. *Advanced weather monitoring and weather stations*
2. *monitoring sensors*
3. *Fault indicators for detecting faults on electric lines and equipment*
4. *Forecast of a fire risk index, fire potential index, or similar*
5. *Personnel monitoring areas of electric lines and equipment in elevated fire risk conditions*
6. *Weather forecasting and estimating impacts on electric lines and equipment*
7. *Other / not listed [only if an initiative cannot feasibly be classified within those listed above]*

For each of the above initiatives, describe the utility's current program and provide an explanation of how the utility expects to evolve the utility's program over each of the following time periods:

1. *Before the upcoming wildfire season,*
2. *Before the next annual update,*
3. *Within the next 3 years, and*
4. *Within the next 10 years*

Program Overview:
Situational awareness is essential for SCE's operational decision-making and service delivery, enabling it to plan proactively and appropriately modify work procedures to improve the safety of its workers and the communities it serves. It gives SCE visibility to critical system operations, weather and hazardous conditions across the service territory at higher levels of granularity, and other externalities that affect the daily operation of the grid. Situational awareness also enables SCE to improve response time before and during emergencies such as wildfires, which reduces impacts to customers.

Additionally, situational awareness is an integral part of emergency management, and it is imperative that SCE has a detailed understanding of current conditions across its service territory prior to and during emergency events.

By the end of 2019, SCE completed installation of 161 HD cameras, providing 90% coverage of its Tier 2 and Tier 3 HFRA. This enables fire agencies and SCE fire management personnel with early detection, confirmation and situational awareness of wildfire activity. These cameras also enable first responder agencies to assess emerging wildfire threats more quickly, helping to mitigate potential safety risk to the public. In SCE's assessment, due to geographical limitations, the deployment of HD cameras has reached a saturation point. SCE does not currently have plans to install more HD cameras as installing more cameras will not provide additional benefits. Work associated with HD cameras in 2020-2022 will focus on data storage and access and routine operations and maintenance.

SCE's Watch Office monitors activities on a 24/7 basis, notifies response teams when action is needed and updates SCE's management on evolving events. The Watch Office is co-located within the Emergency Operations Center (EOC), which was upgraded in 2016 and serves as the training center for SCE's Incident Management Teams. Meteorologists and Geographic and Information System (GIS) specialists at the newly established Situational Awareness Center, monitor evolving weather and other conditions that might lead to fire events or other hazardous conditions.

SCE is using more detailed circuit-level information to enhance its situational awareness capabilities to better assess how weather conditions might impact public safety and utility infrastructure in HFRA. One high performance computing cluster (HPPC) was operationalized in 2019 and an additional HPCC will be operationalized in 2020 which support a proprietary and specialized high-resolution weather model specific to SCE's service territory. SCE is also significantly expanding its deployment of weather stations to enhance the high-resolution weather model and provide real-time data near circuits in HFRA. This data will be collected and analyzed for potential weather impacts to PSPS circuits.

Situational Awareness Long-Term Strategy:
The ability to convert raw environmental data into actionable intelligence is critical for strategic planning, operational response, mitigation practices and other efforts across the company. SCE will continue to advance its situational awareness program by implementing advanced tools and technology that will not only inform PSPS decisions and wildfire response, but also drive other risk reduction and mitigation initiatives for all-hazard threats such as climate change. As SCE continues to add data collection points, it will rely on tools and technology to help aggregate and synthesize this data and perform predictive analyses to inform planning and operational decisions.

Fire science is a critical component of SCE's situational awareness program. SCE is integrating environmental science and technology to help understand antecedent conditions that lead to the initiation, spread and intensity of wildfire activity. In addition, the fire science team will build new partnerships and leverage existing relationships with government, academia and the private sector to further the understanding of wildfires.

In the long-term, the fire science team will seek to make improvements to SCE's modeling capabilities, fuels sampling and fire spread modeling by adding data inputs and by incorporating technologies such as machine learning and remote sensing. For example, in order to increase the resolution of existing weather forecast and fire spread modeling, inputs such as vegetation moisture and weather data must be constantly evaluated and adapted. The increased number of weather stations and fuel sampling locations (as referenced below in Sections 5.3.2.1 and 5.3.2.4.2, respectively) will help improve trend analytics and long-term forecasting techniques, which would include 3-6 months of advance forecasting to determine the start and end of fire season. Developing and maturing SCE's fire and environmental science capability will also help support climate change and severe weather analysis and adaptation planning.

Meteorological Resources:
SCE meteorologists are trained professionals with specialization in critical fire-weather conditions. This team uses the aforementioned forecasting tools and weather station data to develop comprehensive weather forecasts starting four to seven days in advance of any predicted severe weather event. This information is provided to impacted departments and incident management personnel and is critical in shaping response and mitigation activities for potential wildfire events. Given the importance of this information for identifying circuits and locations that can be potentially impacted so that field personnel can be dispatched to at-risk locations to monitor real-time conditions, SCE continues to refine its forecasting capability.

5.3.2.1 Advanced weather monitoring and weather stations (SA-1)

The size of SCE's service territory in HFRA and its diverse topography necessitate granular weather data, which requires a dense network of weather stations to monitor location-specific, real-time conditions in HFRA to enable operational decision making. For example, Southern California's mountains have rapid elevation changes and differing canyon orientations, which create localized weather zones.

Additional weather station data help enhance the resolution of existing weather models and provide real-time information to assist in making key operational decisions during wildfire risk conditions. The data provided by the weather stations allows SCE to effectively monitor weather conditions at the circuit level and inform critical operational decisions during elevated weather conditions, such as deploying the PSPS protocol. For this reason, SCE intends to accelerate additional weather station installations across HFRA.

While there are numerous public weather stations, SCE utilizes data from trusted and validated sources to determine where to site additional weather stations. Weather stations are placed in locations with varied elevations (e.g., on ridge or hill tops and valley or canyon locations). Circuits that have longer length, diverse topography and varied weather characteristics will require more weather stations. Section 5.3.6.5 describes SCE's methodology for identifying circuits most frequently impacted by PSPS which could be candidates for additional weather stations.

These additional weather stations will also provide data that will be used to optimize SCE's weather models. Statistical analyses that uses historical weather data can be used in post-processing to deliver increasingly accurate wind forecasts.

SCE installed 125 weather stations in 2018 to enhance existing weather models in key HFRA locations. In 2019, SCE installed an additional 357 weather stations focusing primarily on circuits that are in HFRA.

SCE plans to install a minimum of 375 weather stations in HFRA in 2020. Circuits that do not have a weather station currently installed will be prioritized first. Next, SCE will prioritize circuits that most frequently reached PSPS monitoring thresholds which may result in some circuits having more than one weather station. This will enable SCE to potentially be more granular in PSPS de-energization decisions when only portions of circuits with sectionalizing devices are experiencing high FPI conditions.

In addition, SCE will be developing and implementing a new robust software to manage new installations, fixes, and maintenance of its weather stations. This software application will move the utility from a manual paper process to a digital solution with the ability to retrieve, store, and access information more efficiently.

SCE will be piloting vehicle-mounted weather stations to provide real time observations in locations where pole-mounted weather stations do not yet exist. Utilizing vehicle-mounted weather stations will improve the precision of de-energization and limit associated customer impacts.

In the long term, SCE's intent is to ensure all circuits in HFRA have one or more weather stations that will provide input to predictive weather modeling. SCE will be analyzing the coverage of weather stations each year to determine if more are needed in specific areas. In addition, previously installed weather stations will continue to be monitored and maintained to ensure they are working and providing accurate data.

5.3.2.2 Continuous monitoring sensors

SCE traditionally utilizes protective relays to detect and isolate abnormal events such as faults. Relays are set to continuously monitor the operating conditions of the protected system or equipment by taking real time currents and/or voltages information to detect abnormal system conditions such as overload, under voltage, and under frequency. If the real time quantities are outside of the relay set parameters, the protective relay will initiate tripping of the power circuit breakers to isolate the abnormalities in a timely manner. However, the complexity of the power grid means there are many pre-fault conditions that are below the trigger of the conventional power system relays. Accordingly, SCE is expanding the exploration and deployment of technologies that will advance the real-time monitoring of the system health and enable proactive maintenance to prevent degrading equipment conditions from evolving into an actual failure with a risk of potential ignitions that can cause a wildfire. In the paragraphs below, SCE will provide brief descriptions of these technologies.

5.3.2.2.1 Distributed Fault Anticipation (DFA) pilot study (AT-2.1):

DFA is a predictive algorithm that uses electrical system measurements to recognize current and voltage signatures indicative of pending equipment failures.

In 2019, SCE developed a plan to engineer, design, and commission 60 DFA units monitoring HFRA circuits as part of a pilot program. 24 DFA units were fully operational by the end of 2019, with the remaining 36 units fully installed, commissioned and operational by January 31, 2020.

The next phase of the pilot will include the analysis of DFA data in conjunction with existing software/tools to identify maintenance, inspection, patrol, and operational impacts for these piloted circuits. SCE intends to perform an in-depth performance evaluation to determine the effectiveness of DFA technology.

Depending on the pilot evaluation, and possibly new technologies, deployments of DFA or similar technology may be adopted as a program in the near future. As planned, deployment activities are targeted to ramp up in 2021, though this may be accelerated, delayed, or terminated based on other factors such as pilot performance, competing technology options and prioritization of work efforts.

5.3.2.2.2 Early Fault Detection (EFD) Evaluation (AT-7):

EFD systems are capable of detecting conditions on the electric system which may cause a fault or possibly increase the collateral damage associated with a fault event. This type of technology provides complementary benefits to the DFA systems and could work in concert with the DFA to not only detect potential system anomalies, but to more accurately pinpoint the source of the potential defects. EFD hardware is installed on poles whereas the DFA hardware is installed inside the substation.

In 2020, SCE plans to develop installation standards, install and commission at least 10 EFD sensors with up to an additional 90 sensors in scope for evaluation depending on lessons learned, costs and material availability. During the assessment period, SCE will gather performance data on EFD and determine requirements for potential larger system deployments. SCE's current plan is to complete installation and commissioning for the pilot devices by the end of 2021 and allow sufficient time in 2022 for evaluation and development of potential next steps for this emerging technology.

Similarly, as in the DFA technology evaluation, the deployments of EFD or similar technology may be accelerated, delayed or even terminated based on other factors such as pilot performance, competing technology options and prioritization of work efforts.

5.3.2.2.3 Transmission Open Phase Detection (SH-8)

In 2019, SCE evaluated and deployed a protection scheme to detect an open phase (broken conductor) condition on its transmission system. SCE validated the open phase detection scheme by utilizing RSCAD (a power system simulations software) to model a transmission line and replicate an open phase condition. Through simulations testing, SCE optimized the open phase detection scheme and successfully detected an open phase condition, allowing de-energization of the line before it could contact a grounded object resulting in a fault event.

In 2020, SCE plans to continue the deployment of transmission open phase detection on six more transmission and sub-transmission lines. The open phase detection element is currently in the "alarm only" mode; however, SCE plans to transition to "trip" mode once the protection scheme has been fully validated. Beyond 2020, SCE intends to evaluate the feasibility of deploying open phase detection on lines with three or more terminals.

5.3.2.3 Fault indicators for detecting faults on electric lines and equipment

Fault indicators have historically been installed to assist in locating faulted circuit conditions. SCE is leveraging the advances in fault indicator technology to provide better intelligence of its grid operations. Remote fault indicators have been deployed as part of SCE's Grid Modernization program to provide line current measurement at device locations are not included in this WMP. As with other new smart grid devices, these new technologies will continue to evolve in the coming years and SCE will continue to track these improvements and adjust its application of these technologies to maximize their wildfire risk reduction benefits.

5.3.2.4 Forecast of a fire risk index, fire potential index, or similar

5.3.2.4.1 Fire Potential Index Phase II (SA-2)

FPI is an internal tool used to estimate wildfire potential based on actual weather and fuel conditions. Inputs include wind speed, the dryness of the air near the ground, and vegetation moisture. The FPI is used in conjunction with wind thresholds to identify areas that are likely to have significant fire activity which could threaten communities and SCE infrastructure. The FPI is currently the best method for assessing fire potential across SCE's extensive service territory due to its customization options for addressing specific fire thresholds across different weather climates.

In 2019, SCE began Phase II of the FPI project to increase capabilities by adding more granular weather data and expanding coverage to all of SCE's service territory. FPI went from being calculated at the district level to being calculated at the circuit level at a three-hour temporal resolution out to five days. This level of data helped to identify circuits that could be impacted the most during critical weather events, reducing the number of customers affected by possible de-energization.

In 2020, SCE will begin refining the current FPI by integrating historical weather and vegetation data into the index. This will facilitate better calibration and evaluation of current events in historical context for better-informed decision making. In parallel, SCE will work on the development and testing of a new FPI which will incorporate more information about fuel conditions such as quantities and types of fuels (e.g., brush, grass, timber). Implementation and verification of this new FPI will occur in the 2021-2022 time period.

In parallel with using the current FPI, SCE will seek to identify and correct any potential weaknesses in the newly developed FPI. New FPIs will only be installed after testing and verification are completed.

5.3.2.4.2 Fuel Sampling Program (SA-5)

Physical samples of living vegetation in SCE's service territory are collected by various fire agencies to determine the degree of fuel combustibility. Due to the sporadic nature of that sampling, both spatially and temporally, SCE initiated its own fuel sampling program as part of its enhanced situational awareness capabilities described in the 2019 WMP to fill in existing data gaps to help inform PSPS decision-making.

With the help of the Los Angeles County Fire Department (LACFD), SCE conducted a three-month pilot study to determine the feasibility of modifying its enhanced situational awareness capabilities to include a fuel sampling program. The study consisted of a vendor physically sampling native vegetation at three locations across Los Angeles County. The sampling and lab methodologies were refined throughout the study period so that the results matched those from the LACFD. The pilot study produced improved vegetation condition data and SCE subsequently launched its fuel sampling program.

SCE will continue to expand (2020) and mature (2021-2022) its fuel sampling program to better understand vegetation conditions that can potentially turn a spark into a catastrophic wildfire. Collected vegetation samples will help SCE improve its situational awareness and its in-house wildfire risk models. Fuel sampling will occur every two weeks (weather permitting) across multiple locations within four major regions of the SCE service territory. These regions include: The Inland Empire, Northern Los Angeles County, Eastern Sierra, and the Western Sierra. Sampling will include collecting portions of the native vegetation such as chamise and sagebrush. The vegetation will be weighed, dried, and weighed again to determine moisture content. Results will be posted in the National Fuel Moisture Database, which is available to the public.

The fuels sampling program will continue to mature over the next 10 years, but it is unlikely to expand unless other data gaps are identified. Maturity of the program will come in the form of an increasing dataset. This will allow for the development of trends and statistics which will be useful in better analyzing historical wildfires and develop three to six months ahead fire season outlooks.

5.3.2.4.3 Surface and Canopy Fuels Mapping (SA-6)

Accurate assessments of vegetation conditions including details about surface and canopy fuels are vital to the success of fire spread modeling. Currently, a basic generic dataset called LandFire is being used, but this dataset has certain limitations that affect model outputs. SCE will work to make improvements to this dataset by means of remote sensing and on-site validation of fuel conditions. Updates will include more precise vegetation mapping and updated land disturbances.

Currently, SCE is using its vendor's most up-to-date land surface data which is coarse in resolution and does not include recent landscape disturbances. Therefore, in order to improve SCE's fire spread modeling results, SCE plans to have vendors perform an extensive and detailed mapping of surface and canopy fuels in its HFRA during the 2020-2022 time period using a blend of LiDAR and non-LiDAR technology. In addition, careful attention will be paid to address fuel conditions around powerlines and to more accurately map the urban wildland interface regions, which will help with risk analysis.

Vegetation and fuels mapping will need to occur periodically over the next 10 years. This will likely involve some of the same methodologies and technologies that are used in the 2020-2022 time period. However, SCE will explore new emerging technologies that could be implemented during this period.

5.3.2.4.4 Remote Sensing (SA-7)

For the purpose of increasing situational awareness specifically related to wildfires, SCE is pursuing the use of remote sensing technology using satellite imagery, wildfire detection and HPCC model improvement between 2020-2022. Remote sensing technology can also provide processing of imagery into vegetation indexes specifically designed for SCE territory to monitor the health of the environment. In addition, this information will provide imagery that is frequently updated as compared to current imagery datasets. This will provide SCE the ability to see changes in the territory over a weekly basis, which will assist with restoration efforts in areas affected by fires/natural events.

Activities in 2020 include solidifying use cases such as lower atmospheric profiling and identifying vendors who can perform the necessary functions to support this and other defined projects. 2021 and 2022 activities will be centered on data collection, data processing and data analytics.

5.3.2.4.5 Fire Science Enhancements (SA-8)

Enhancements to the Fire Science program are critical to wildfire mitigation. Most of these enhancements are centered around weather and fuel modeling capabilities such as ensemble forecasting and the move toward sub-kilometer output. These enhancements will enable SCE to make more precise decisions regarding proactive de-energizations as well as in assessing priorities for grid hardening.

2019 activities included the development of FPI output, initially at the district level and then at circuit level, which was used to help identify areas that could be impacted by potential proactive de-energization decisions.

2020 activities will include working on a new FPI as well as on ensemble forecasting methods. 2021-2022 activities will consist of developing sub-kilometer weather and fuels output across the region.

Activities over the long term will include continued refinement of weather and fuel modeling. The current historical data set of 40 years will be expanded to include additional years, making the model more robust. Forecasts will also be produced at a higher resolution (less than 2km). SCE will also continue partnerships with academia, government, and with other private industry stakeholders to monitor scientific progress that can potentially be incorporated into its processes.

5.3.2.5 Personnel monitoring areas of electric lines and equipment in elevated fire risk conditions

A critical component of SCE's PSPS protocol is to assess the potential for extreme fire risk conditions with the help of line patrols and live field observations (monitoring). Monitoring activities are performed by troublemen, senior patrolman, line crews and other supporting resources. Operationally, SCE deploys line patrol crews to assess circuit conditions prior to de-energization and before restoring service to confirm it is safe to re-energize.

In 2019, SCE deployed resources to perform live field observations (monitoring) on 390 unique distribution circuits and 128 unique sub-transmission circuits during activations. Many of these circuits were monitored multiple times during the various activations.

SCE will continue to deploy resources to perform live field observations (monitoring) for future events. The use of additional situational awareness devices (weather stations and HD cameras) may further influence where resources are stationed. As processes, procedures and technology evolve, they will be considered to determine when and where personnel performing live field observations are necessary.

5.3.2.6 Weather forecasting and estimating impacts on electric lines and equipment (SA-3)

High resolution weather and fuel modeling provides vital information for daily grid operations and PSPS activations. This information includes variables such as wind speed, humidity, precipitation and various vegetation moisture parameters, some of which are critical inputs into the FPI. This data helps determine circuits that are at risk for potential proactive de-energization and serves as inputs into fire spread modeling applications.

SCE purchased two High-Performance Computing Clusters (HPCCs) in 2019 for the purpose of producing high resolution weather and fuels information for meteorology and fire science, along with installing the Weather Research and Forecasting model (WRF) and housing the associated hardware at the Irvine and Alhambra datacenters. One HPCC was moved to SCE's Irvine datacenter and the second HPCC is scheduled to be moved to SCE's Alhambra datacenter and operationalized in 2020.

SCE's HPCCs will support full integration of all weather and fuel model products, full redundancy capability, and the development of a 40-year historical weather and fuels dataset. This historical data will provide valuable insight into the nature of wildfire behavior and will allow SCE to relate weather and fuel parameters to fire occurrences. In addition, weather and fuel model output will be used to run fire spread models which will determine potential risks of past, current and future event scenarios.

Between 2021-2022, SCE plans to procure and install a third HPCC to run customized climate models as well as make significant improvements to current modeling capabilities. Specifically, this HPCC will be used to test and train models to improve forecasts of vegetation conditions and forecast weather at a sub-kilometer level. Stochastic ensemble forecasting and machine learning techniques will also be incorporated to improve the current weather and fuel models. These improvements will help to produce more accurate weather and fire potential forecasts which will allow SCE to make better informed operational decisions.

As datasets from sources such as weather stations and historical model runs expand, SCE plans to further refine its modeling capabilities, both in terms of accuracy and granularity, utilizing the expanded data and information. In addition, downstream models such as fuel models and long-range forecasts of Santa Ana winds and fire seasons will become more reliable and subsequently, more effective in reducing wildfire risk.

5.3.2.7 Asset and Reliability & Risk Analytics Capability (RA-1, SA-4)

Expansion of Risk Analysis and Wildfire Risk Reduction Model (RA-1):
As discussed in Sections 4.3 and 5.3.1, in 2020, SCE expects to implement the WRRM. SCE will integrate the WRRM's fire spread modeling capabilities with SCE's asset predictive models to enhance SCE's ability to model wildfire risk. In the long term, SCE will integrate asset condition data and daily weather data into its predictive models to provide near-real-time forecast and prediction of asset health condition and wildfire-related risk values.

FireCast, and FireSim (SA-4):
FireCast: FireCast is an application that provides a 3-day forecast of potential fire ignitions across the SCE service territory by using weather forecasts to run millions of simulations daily to derive both territory wide and utility asset risk forecasts as well as fire potential. The forecasts are embodied in a 4-D mapping application that facilitates review and analysis of risk metrics.

FireSim: FireSim provides real-time simulation modeling to derive potential fire impacts for active suppression response or weather event planning. This application leverages available weather and risk forecasts with real-time capabilities.

2019 activities included the development of various use-cases which included several on-site meetings with the vendor. In addition, FireCast and FireSim applications were customized specifically for the SCE service territory (defining domain, incorporating SCE assets, etc.) and provided to the SCE Fire Scientist.

SCE will test and validate FireCast and FireSim using any future fire events and move towards integrating these components as a tool for PSPS activation decision making. Eventually FireCast and FireSim will become fully integrated into the decision-making process during PSPS proactive de-energization events.

See Table 22 "Situational awareness and forecasting" for more details on the initiatives above.

5.3.3. Grid Design and System Hardening

Overview of System Hardening and Operational Practices:
SCE has developed a robust system hardening program to reduce wildfire risks (i.e., reduce the number of ignitions) and enhance system resiliency (i.e., reduce electrical infrastructure damage and improve power restoration time during and after a fire event) in its service territory. SCE conducts ongoing assessment and refinement of its grid hardening programs to identify technologies and protocols that may reduce the probability of an ignition event or reduce public exposure to hazardous conditions during periods of high fire risk. When SCE identifies a potential grid hardening alternative, it will pilot limited deployments to validate the effectiveness of new technology in mitigating wildfire ignitions in its service territory. PSPS, however, will still remain an available tool in the long term for extreme conditions.

Significant investments in system hardening require a commensurate evolution of operational practices. SCE has established operational protocols specifically for wildfire risk reduction, and intends to adapt them to ensure safe, reliable, and effective grid operation as the wildfire threat evolves. The use of operational protocols that mitigate wildfire risk, such as PSPS, are required to bridge the longer-lead time of completing system hardening across HFRA in SCE's service territory.

The following sections detail SCE's commitment and approach to system hardening and advancing new technologies and operational practices to meet today's needs and plan for the future.

Short-term Strategy (2020-2022):
In the coming years, SCE will continue to refine and expand its system hardening activities outlined in its 2019 WMP. SCE has extensive plans to replace bare overhead conductor with covered conductor and increase its installation of fire-resistant poles in HFRA (for example, see Table 23 "Grid Design and System Hardening" for planned number of covered conductor line miles to be installed).

To help reduce the PSPS impact on customers, SCE identified overhead circuits in HFRA portions of which could potentially be undergrounded. SCE's undergrounding program will be a multi-year effort with a target construction start in 2021 for the first six miles of the plan. SCE will continue to assess and develop its undergrounding plan to not only reduce PSPS impacts and ignition risk but also address potential egress issues in HFRA.

In 2019, SCE evaluated a fire-resistant (FR) wrap for wood poles. The evaluation successfully showed through various fire scenarios that FR wrap protected the wood from structural damage. A FR wrapped wood pole is created by applying surface treatments, such as wrapping an intumescent shield around the pole. The use of FR poles will enhance the resiliency of SCE's infrastructure in HFRA and help with rapid restoration. SCE is confident in the product's ability to significantly increase the likelihood of a wood pole surviving a wildfire. In 2020, SCE will deploy

FR wrap wood poles in HFRA in combination with FR composite poles based on material availability. Further, in 2020, SCE will continue to investigate this technology for improvement and to identify what activities need to take place post fire exposure to these poles.

While the primary focus of the 2019 WMP was on SCE's distribution system, the 2020-2022 WMP will incorporate additional activities focused on the sub-transmission and transmission systems. Learning from recent California fire ignitions that were attributed to utility equipment, SCE plans to evaluate and update its engineering design standards, as needed, to improve the performance of sub-transmission and transmission linear and structural assets under extreme wind events. Additionally, SCE plans to further pilot a transmission, open phase detection system that aims to detect and de-energize a detached transmission line before it hits the ground.

SCE also evaluates emergent technologies for system hardening. In the 2019 WMP, SCE described emergent technologies it was evaluating in the AT-1 to AT-4 activities.[25] SCE expects some of these evaluations, pilots, and studies to transition to implementation efforts during the 2020-2022 WMP cycle. For example, in 2019, SCE piloted CAL FIRE exempt spark prevention surge arresters at target locations. Based on its evaluation of the successful performance of these pilot units, SCE revised its Distribution Design Standards (DDS) and Distribution Overhead (DOH) construction standard manuals to include the CAL FIRE exempt spark prevention surge arresters. Inventory levels of the new arresters are being created for future work efforts and SCE intends to standardize on the use of the exempt arrests in HFRA applications for new or replace arrester installations.

In 2020, SCE plans to evaluate technologies such as Rapid Earth Fault Current Limiter (REFCL), Open Phase Detection (OPD), Early Fault Detection (EFD) and other alternative technologies for studies and pilots. To the extent that SCE pursues such programs and activities at larger scale, they will be set forth in future years' annual updates.

Long-term Strategy (2023-2030):
Future system hardening activities will be shaped by successes in advanced technology and informed by changes to wildfire risk factors, such as climate change, land use changes, fuel management, and other environmental considerations. While SCE expects covered conductor and fire-resistant poles to be program mainstays for years to come, undergrounding efforts are also expected to expand. Advancements in material science, construction methods, and improvements in the way SCE designs its system are also expected to increase system resiliency. Using its Asset Risk and Reliability Analytics framework and planned improvements in its asset management systems, SCE aspires to have a balanced mix of hardening activities that can be targeted to specific applications and based on unique locational risks.

In addition to carrying out existing system hardening programs, SCE plans to continue evaluating emerging technologies that can reduce the probability of an ignition event and/or reduce public

25 Southern California Edison Company's 2019 WMP, Section 4.7, Alternative Technologies, pp. 71-74 (February 6, 2019), http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M263/K645/263645320.PDF.

exposure to a hazardous condition during periods of high fire risk. SCE hopes that technologies currently under evaluation, as outlined in the Alternative Technology section in this chapter, can pass rigorous pilot testing to become new deployable system hardening programs. Given SCE's past success with emerging technologies, SCE is committed to continually evaluating potential wildfire mitigation programs and activities to further improve its grid design and system hardening well into the future.

The longer 10-year plan will be further solidified as the effectiveness of the current mitigation strategy is evaluated over the next few years. During the next decade, systems like DFA, or other new technologies, may offer improvements for detecting and locating incipient system failures with potential ignitions risks and allow SCE to take action to mitigate these ignition drivers.

5.3.3.1 Capacitor Maintenance and Replacement Program

SCE's historic capacitor bank maintenance program is primarily focused on helping with voltage support provided by the capacitor installations and the related system reactive power compensation. In addition to voltage support, during times of high electricity demand, capacitors can play a critical role in helping avoid or limit overload conditions on distribution circuits.

As part of inspections, capacitor banks requiring replacement or repair are recorded and prioritized for follow-up work. Aging increases the potential for capacitor bank equipment failures. This program targets updating capacitor bank hardware based on field inspections to help avoid failure events, an important secondary benefit related to wildfire risks.

In 2019, SCE continued to develop a monitoring system to help detect capacitor bank issues, such as failed capacitor switches and blown fuses, to improve capacitor bank maintenance and inspection efforts. This monitoring system will continue to be refined in 2020 to aid with maintenance and inspections of capacitor applications. Over the coming three years, SCE expects to refine its ability to remotely monitor capacitor performance to improve its inspection and maintenance efforts. The industry has developed guidance for fusing to minimize the impacts of capacitor unit failure modes. SCE uses this guidance to select fuses for its capacitor banks. SCE engineers will continue to work with industry leading manufacturers to identify options that minimize ignition risks from capacitor equipment failures. As such, SCE does not view this activity as a wildfire mitigation effort but will continue to operate maintenance plans as described in further detail in SCE's 2021 GRC (Exhibit SCE-02, Vol. 3).

5.3.3.2 Circuit Breaker Maintenance and Installation to De-energize Lines Upon Detecting a Fault

5.3.3.2.1 Circuit Breaker Maintenance

SCE believes through its experience that its existing circuit breaker maintenance plans have been effective at providing reliable circuit breaker operation. As such, SCE does not view this activity as a wildfire mitigation effort but will continue to operate maintenance plans as described in further detail in SCE's 2021 GRC (Exhibit SCE-02, Vol. 3).

Because SCE's circuit breaker maintenance program covers its entire territory, SCE used an average maintenance cost per distribution voltage circuit breaker along with typical maintenance cycle times to develop estimates associated to circuit breakers with feeder circuits in HFRA (values provided in Table 23).

5.3.3.2.2 Meter Alarming for Down Energized Conductor (MADEC) Pilot (AT-1)

In 2019, SCE implemented a machine learning algorithm and a process, MADEC, for identifying and isolating distribution circuits when hazardous downed energized conductors are identified. The MADEC system has been activated for full operations across SCE's system for both HFRA and non-HFRA circuitry and is intended to minimize public exposure to potentially energized conductors and related wildfire ignitions events.

In 2020, SCE intends to further advance the detection algorithm for faster identification of downed energized covered conductors and explore other possible algorithm advancements. The detection algorithm can be improved as events are captured and included into the detection model.

5.3.3.2.3 Rapid Earth Fault Current Limiter (REFCL)

Through the past decade, research in Australia has led to the development of special protective technology for distribution system ground faults that are expected to greatly reduce the ignition probability. This technology is known as Rapid Earth Fault Current Limiters (REFCLs).

REFCL is a system that quickly detects a ground fault (does not work for phase faults) and reduces the fault current to a level that would prevent an ignition even if there is direct contact of energized conductor with dry grass.

In 2019, SCE performed a detailed technology feasibility assessment on how REFCL could be applied to its distribution systems. The assessment indicated that a large portion of SCE's distribution electric system can accommodate system and protection design changes that could allow the implementation of this technology. REFCL offers improvements for minimizing ignition events from single line to ground faults. Additional system grounding changes may impact primary connected customers and would require a collection of electric system modifications. Based on the findings of the feasibility assessment, SCE concluded that this technology has enough wildfire mitigation benefit to justify REFCL pilot projects.

In general, there are three variants of this technology application to rapidly reduced the fault current to a very low level where ignition would not occur. These three variants are Ground Fault Neutralizer, Arc Suppression Coil, and Isolation Transformers. This system can also be tied to a CB/RAR to isolate the fault.

5.3.3.2.3.1 REFCL - Ground Fault Neutralizer (AT-3.1)

One of the more robust variants of this technology is the application of a Ground Fault Neutralizer (GFN), which consists of an arc suppression coil in parallel with an inverter to cancel out the residual fault current. This type of REFCL application is the dominant technology applied by Australian utilities to comply with their operating requirements.

Australian utilities commonly have 3-wire distribution systems whereas SCE has a mixture of 3-wire and 4-wire systems. REFCL technologies are presently only available for 3-wire systems. Initial review of this technology shows benefits for ignition prevention are possible for some of SCE's circuitry in HFRA.

In 2019, SCE performed a detailed technology feasibility assessment on whether and how REFCL could be applied to its distribution systems. The assessment indicated that a large portion of SCE's distribution electric system can have system and protection changes that could allow the implementation of this technology. REFCL offers improvements for minimizing ignition events from single line to ground faults. System grounding changes may impact primary connected customers and would require a collection of electric system modifications. Based on the findings of the feasibility assessment, SCE concluded that this technology has enough wildfire mitigation benefit to justify REFCL pilot projects.

For 2020, SCE plans to initiate design for a GFN field installation that would include site selection, material specifications, development of operating policies, development of engineering design documents and construction requirements, identification of industry vendors for GFN devices and development of remediations for expected challenges learned from Australian utility installations. SCE is targeting construction in 2021 for GFN.

5.3.3.2.3.2 REFCL – Resonant Grounding with Arc Suppression Coil (AT-3.2)

Arc Suppression Coil (ASC) offers a simpler alternative for ignition reduction in smaller systems when compared with a GFN. In the ASC application of REFCL technology, one takes advantage of a resonant grounding design that has been used by European utilities for reliability benefits for many years. In this application, there are less equipment and complexities with installation of ASC compared to GFN.

For 2020, SCE plans to initiate design for an ASC field installation to convert a typical substation to resonant grounding. This design will include substation site selection, material specifications, development of operating policies, development of engineering design documents and construction requirements, identification of industry vendors for ASC devices, and development of remediations to expected challenges learned from Australian utility installations. SCE is targeting construction in 2021 for the ASC installation.

5.3.3.2.3.3 REFCL - Isolation Transformer (AT-3.3)

In addition to application of the GFN or ASC devices at substations, SCE is also exploring the use of isolation transformer equipment on distribution circuits to achieve the desired rapid fault current reduction operating requirements. The use of ungrounded or isolation transformers in small overhead systems has been shown to meet these requirements.

For 2020, SCE intends to initiate a pilot installation at one location and develop the operating practices and construction requirements associated with application of these systems. SCE's evaluation of its existing system shows that development of a small distribution class ASC or similar device may be required for widespread application of isolation transformer technology in order to align with REFCL operating limits. Efforts in 2020 and 2021 will focus on possible development of a distribution class ASC for this application.

5.3.3.2.4 Distribution Open Phase Detection (AT-3.4)

SCE is investigating a distribution Open Phase Detection (OPD) scheme to determine open conductor conditions. This will allow the protection system to isolate a separated conductor prior to the wire contacting the ground, while leveraging existing distribution hardware in HFRA.

In 2019, SCE evaluated the feasibility of performing a Distribution OPD pilot. In addition, SCE installed devices called Remote Sectionalizing Reclosers (RSRs), which include three phase voltage sensing and relaying capabilities that can be leveraged for detecting open conductor conditions. The circuitry between an interrupting device, like an RAR, and the end point RSR is monitored by the OPD scheme. Site reviews of five RARs were performed where RSR devices had been previously applied as circuit ties. These five locations were selected for 2020 pilot installation efforts for advancing the distribution OPD scheme.

In 2020, SCE will perform a pilot focused on determining the effectiveness of the Distribution OPD scheme and anticipated costs with potential larger deployment for five circuit locations. These pilot installations will focus on locations utilizing existing RAR and RSR devices to provide telemetry monitoring and interrupting capability. SCE expects to configure the equipment for alarming, rather than tripping, for at least the initial portion of the pilot. The pilot project installations will be monitored to determine effectiveness and inform further development and deployment actions for subsequent years.

5.3.3.2.5 High Impedance Relay Evaluations (AT-8)

SCE aims to develop a layered protection scheme to minimize wildfire ignition risks. Today, SCE deploys legacy protection schemes (phase and ground overcurrent) which are extremely effective in clearing faults in non-HFRA. In 2018 and 2019, SCE incorporated the addition of Fast Curve settings onto the existing protection scheme for circuits in HFRA, enhancing the ability to isolate faults quickly.

In 2020, SCE plans to investigate and deploy two controllers/relays with a High Impedance (Hi-Z) element in HFRA. The Hi-Z protection element will be monitored and evaluated for desired and non-desired operations, and a performance report shall be developed. In 2021 and beyond, SCE envisions leveraging an array of distribution protection schemes to detect and isolate faulted conditions in HFRA.

5.3.3.2.6 Circuit Breaker Replacements

SCE replaces circuit breakers on its distribution and transmission system through the substation Infrastructure Replacement (IR) program at a rate of approximately 220 circuit breakers per year, as detailed in SCE’s 2021 GRC (SCE-02, Vol. 3). The circuit breakers are replaced to maintain system reliability by reducing the probability of a circuit breaker failure due to age.

SCE's existing circuit breaker replacement plans have been effective to date in providing reliable circuit breaker operation. As such, SCE does not view this activity as a wildfire mitigation effort but will continue to execute replacement plans as outlined in its 2021 GRC. SCE has provided substation IR circuit breaker plan data for feeder circuits in HFRA (Table 23). It is important to note that circuit breaker replacement plans are subject to change for various reasons including, for example, outage coordination schedules, resource constraints, reprioritization of projects, and project bundling.

5.3.3.2.7 Circuit Breaker Relay Installs (CB Fast Curve Settings SH-6)

An activity that SCE considers to be a wildfire mitigation activity is deployment of Fast Curve settings at the substation circuit breaker (CB) relay. Fast Curve settings for CB relays are intended to provide quicker fault detection and clearing of HFRA circuits. Fast Curve settings reduce fault energy by increasing the speed with which a relay reacts to most fault currents. Compared to conventional settings, SCE believes reducing fault durations anticipated with Fast Curve operating settings is expected to reduce heating, arcing, and sparking for many faults. To allow SCE the capability to toggle between normal and Fast Curve operating setting during high fire threat weather requires CB relays to be newer microprocessor-type relays. Further details on this activity can be found in SCE's 2018 GSRP filing.

SCE met its 2019 WMP goal of updating settings for existing, compatible microprocessor CB relays, as well as developed a 2020-2022 plan to upgrade non-compatible and/or older vintage electromechanical and microprocessor CB relays for HFRA feeder circuits.

SCE intends to execute the CB relay Fast Curve plan it developed in 2019 and complete deployment by year-end 2022, which includes a total of 210 relay upgrades. In 2020, SCE plans to replace/upgrade 55 relay units in HFRA. SCE has already identified additional relays targeted by the activity and planned for their replacement under the Substation Infrastructure Replacement (Substation IR) program (SCE's 2021 GRC Exhibit SCE-02, Volume 3). For these planned Substation IR-driven relay replacement projects, SCE will include Fast Curve settings on targeted CB relays for HFRA feeder circuits.

5.3.3.3 Covered Conductor Installation

5.3.3.3.1 Covered Conductor Installation (SH-1)

Installation of covered conductor is mainly driven by SCE's WCCP, which is a multi-year program started in 2018 as part of GSRP. This program is aimed at reducing the risk of fire ignitions by replacing bare overhead conductor with covered conductor in HFRA. The increased use of covered conductor is anticipated to significantly reduce contact-from-object and wire-to-wire ignition risks as well as indirectly reduce the frequency of wire down events by reducing the number of faults. SCE's analysis of its historical fire data indicated that contact-from-object and wire-to-wire faults in SCE's HFRA were associated with approximately 60% of suspected wildfire-initiating events. SCE's risk analysis demonstrates that application of covered conductor continues to be an effective approach to reduce ignitions associated with these two ignition drivers in HFRA.

The benefits of utilizing covered conductor to reduce the wildfire ignition risk, in combination with other mitigation measures, such as advanced protective relays, and automatic reclosers with Fast Curve settings, and CLFs, significantly outweigh the increased cost of installing covered conductor over bare conductor. Covered conductor also offers significantly better safety protection for the public in the limited cases of high impedance faults, as tests and studies have demonstrated that incidental contacts with energized conductor that is covered do not result in injuries.

In addition to replacing bare conductor with covered conductor, the WCCP will allow SCE to complete a number of system hardening improvements on the distribution system. Where appropriate, pole replacements and transformer replacements driven by this reconductoring program will be replaced with fire-resistant poles and ester fluid transformers, respectively. Additionally, SCE will install wildlife protection, such as protective covering for dead-end, termination, fuse, arrester, and transformer bushing to combat contact-related faults. Another benefit of WCCP is removing vintage splices, such as automatic and pre-formed types, which are more likely to fail under mechanical or electrical high stress events.

In addition to WCCP-driven covered conductor installations, SCE's standards require bare conductor it identifies for replacement, as well as any new construction, in HFRA to be replaced with covered conductor. Typically, SCE identifies bare conductor requiring replacement outside of the WCCP through its existing inspection programs.

In 2019, SCE installed 372 circuit miles of covered conductor, exceeding its 2019 WMP goal of installing at least 96 circuit miles in HFRA. Some of the key lessons learned from this were related to weather, permitting, and material availability, among other constraints on the speed of installation. In 2020, SCE plans to install 700 circuit miles of covered conductor in HFRA. SCE plans to further coordinate construction windows in areas prone to winter weather events, communicate with internal and external stakeholders during the early design phase to attain permits in a timely manner, and closely monitor material availability to identify any shortages or surplus at sites where work is planned. SCE will strive to install up to 1,000 circuit miles of covered conductor in 2020 in HFRA.

Given the significant wildfire mitigation benefits, SCE is targeting the proactive replacement of up to approximately 4,000 circuit miles of existing, bare, distribution primary overhead conductor in HFRA between 2020 and the end of 2022 as shown in Table 23. This accelerated deployment will help to significantly reduce the fire-ignition risk more expeditiously. The scoping and design work conducted in 2019 has enabled SCE to significantly ramp-up the covered conductor installations targeted for 2020 to 2022.

To prioritize the covered conductor installations, SCE is developing predictive models at the asset level to quantify the probability of an ignition, together with the HFRA wildfire consequence, to calculate the risk of wildfire at the circuit segment level. This level of understanding of wildfire risk will help SCE prioritize the highest risk circuit segments in HFRA.

SCE plans to complete its covered conductor installations under the WCCP by the end of 2024, at which point 70% of the overhead wire originally in scope, as part of the 2018 GSRP, is anticipated to be replaced with covered conductor. SCE expects to replace the remaining 30% of overhead wire in HFRA through existing SCE programs, as needed by program tenets, in the years to come.

5.3.3.3.2 Tree Attachment Remediation (SH-10)

Older construction in SCE's forested service area made use of existing trees to carry conductor rather than a separate utility pole. These are called "tree attachments." SCE's observations in regions with a high concentration of tree attachments indicate faults and damages are related to branches falling from the tree to which utility equipment is attached. Consequently, SCE believes it is prudent to remove tree attachments. In 2019, SCE remediated 101 tree attachments and plans to remediate a minimum of 325 tree attachments in 2020 and will strive to complete 481. Beyond 2020, SCE plans to remediate 689 tree attachments in 2021, and 788 tree attachments in 2022. SCE will remediate these tree attachments by relocating them to a pole typically in concert with covered conductor deployment (i.e., WCCP).

Other considerations for heavily forested areas:
In forested areas with dense vegetation, SCE may use spacer cable system construction in conjunction with covered conductor. Spacer cable is a more compact construction and has a steel messenger wire that supports the weight of the covered conductor. This design can generally, within reason, withstand falling tree branches without damaging the covered conductor.

SCE may use aerial bundled cable in limited areas as an alternative to covered conductor, likely in areas with narrower spaces and areas with dense vegetation that cannot be trimmed. Aerial bundled cable is more complicated to make connections with, making it more suited for long runs with few equipment and tap lines. Additionally, the increased weight of aerial bundled cable will lead to shorter spans and more pole replacements. Both covered conductor and aerial bundled cable have comparable benefits regarding preventing contact from objects; however, covered conductor is more economical for most applications.

5.3.3.3.3 Vibration Dampers (AT-4)

Vibration dampers are hardware attached to conductors (usually near insulators) to inhibit conductor abrasion and fatigue from vibration. Vibration dampers are specifically meant to reduce Aeolian vibration, which manifests with non-turbulent winds, where wind speeds are below 15 mph. The use of dampers can prevent the conductor, conductor connections and attachments from degrading due to vibration.

In 2019, SCE met the 2019 WMP goal of developing standard installation practices for Aeolian vibration dampers. SCE expanded its conductor resiliency effort with vibration damper applications for existing conductors by developing standard installation practices for bare conductors. This standard was published in SCE's Distribution Overhead Construction Standard.

This improvement is anticipated to help in the long term integrity of some electric system components.

While damper applications for bare wire have been heavily studied by the industry, damper applications for covered conductor have not. For this reason, dampers are not readily available for covered conductor. Current designs of damper technologies, such as spiral vibration dampers and Stockbridge dampers have the following limitations:

- Spiral vibration dampers are only effective for small diameter conductors (less than 0.76 inches). Because the covering increases the diameter of the covered conductors, a very limited number of covered conductor sizes meet this criterion; and
- Stockbridge dampers are not well suited to distribution applications due to the need to analyze every span for effective damper placement. The design of the clamping mechanism on current Stockbridge dampers may also damage the covered conductor's covering.

Due to these limitations, further assessment of vibration dampers for covered conductor applications is required in 2020 and may extend into future years.

5.3.3.4 Covered Conductor Maintenance

SCE largely uses the same inspection and maintenance process for covered conductor as used for bare conductor. The inspection schedule is the same and the visual check is similar. The additional inspection requirements for covered conductor include verifying that the proper covering for exposed conductor is installed and inspecting the condition of the insulation material on the covered conductor. These requirements are necessary since installing covered conductor first requires stripping the covered conductor to make connections and then re-covering any exposed portion of the conductor.

5.3.3.5 Crossarm Maintenance, Repair, and Replacement

SCE does not have a dedicated crossarm maintenance program. However, most, if not all, existing crossarms will be replaced with composite crossarms as part of SCE's WCCP efforts since insulators need to be replaced when reconductoring to covered conductor. In addition, SCE will continue to inspect crossarms through its High Fire Risk Informed inspections and aerial inspection programs in HFRA to identify damaged or deteriorated crossarms requiring replacement. Per its standards, SCE will replace wood crossarms identified by these inspections with composite crossarms. Details about SCE's inspection programs can be found in Section 5.3.4.

5.3.3.6 Distribution Pole Replacement and Reinforcement, Including Composite Poles

5.3.3.6.1 WCCP Fire Resistant Poles (SH-3)

As described in SCE's 2021 GRC (SCE-04, Vol. 5A), WCCP will require pole upgrades in certain circumstances. Covered conductor is heavier and has a larger cross-sectional area than bare conductor. Accordingly, implementing WCCP will require SCE to determine the adequacy of existing poles to support this extra weight and associated wind loading due to the larger cross-sectional area. As part of this re-conductoring work, SCE will conduct a pole loading assessment on existing poles where covered conductor is to be installed to determine if pole replacement is required. If the pole loading analysis shows that GO 95-mandated minimum safety factors would not be maintained after installing covered conductor, SCE will install new fire-resistant poles (e.g., a FR composite pole or FR wrapped wood pole) to support the new covered conductor. A fire-resistant pole is either a composite pole with a fire-protective shield or a treated wood pole with a fire-retardant intumescent wrap.

In 2019, SCE installed 1,421 FR poles as part of the WCCP, meeting its 2019 WMP goal of installing at least 1,100 FR poles in HFRA. In 2020, SCE is targeting to replace 5,200 poles and will strive to replace 11,700 poles with fire resistant poles in HFRA, subject to pole loading assessment results, resource constraints and other execution risks.

As part of the WCCP, SCE anticipates it will replace approximately up to 47,000 existing wood poles in HFRA from 2020 to 2022. At locations with pole-top electrical equipment or known woodpecker problem areas, SCE will apply FR composite poles subject to material availability. In all other applications, SCE plans to use FR wrapped wood poles subject to material availability.

SCE plans to complete its FR pole installations under the WCCP by the end of 2024. Thereafter, SCE will replace wood poles with FR poles in HFRA through other existing programs.

5.3.3.6.2 Deteriorated Pole Program (SH-3)

As discussed later in Section 5.3.4.6, GO 165 requires intrusive inspections on all poles by the time they are 25 years old and then re-inspected at least once every 20 years. SCE completed its first cycle of intrusive inspections in 2009 and continues intrusive inspections through this program.

SCE's Deteriorated Pole Program, which was established pursuant to the distribution pole inspection program in compliance with GO 165, replaces poles throughout SCE's service territory based on the results of these inspections. It also replaces deteriorated poles identified in the normal course of business based on their external condition. The Deteriorated Pole Program prioritizes these poles according to the nature and extent of degradation.

The Deteriorated Pole Program pole replacements are considered part of SCE's normal maintenance program and are not considered a WMP initiative. However, in HFRA, degraded poles will be replaced with FR poles using the same strategy as WCCP (i.e., combination of FR composite and FR wraps). All FR poles in HFRA will be tracked as part of the SH-3 Program Target.

5.3.3.6.3. Poles Identified During Inspections

SCE's inspection programs outlined in Chapter 5.3.4 can result in pole replacements for various reasons, including safety, reliability, and compliance. Values in Table 23 are provided using open notifications and work orders initiated by the inspection programs and planned for replacement based on their respective priority levels. The number of poles replaced each year can change based on inspection determinations made on the field. SCE does not consider pole replacements to be a WMP initiative but will continue to do this as part of SCE's compliance obligation and system hardening goals.

5.3.3.7 Expulsion Fuse Replacement (Branch Line Protection Strategy SH-4)

In 2018, SCE focused its efforts on a branch line protection strategy in HFRA to minimize fault energy using CLFs. Its initial efforts focused on circuit topology updates with the installation of branch line protection where fuses did not already exist. SCE’s 2020 efforts will now focus on updating existing conventional fuses to CLF designs after the pending completion of the project for new fusing installations. The fuse replacements will predominantly target expulsion type fuses and fuses with historical performance issues, such as vintage liquid fuses. Liquid fuses are generally not considered expulsion fuses, though the activity is similar in nature and planned to be grouped into this category.

In 2019, SCE met its goal of installing CLFs for at least 7,500 locations for HFRA circuitry. SCE installed CLFs at 7,765 locations as part of a targeted fuse installation effort.

In 2020, SCE plans to install/replace fuses at 3,025 locations. Over the next 3 years, SCE expects to replace existing conventional branch line fusing with updated protective devices in its HFRA, namely either CLFs or branch line reclosers. In some cases, CAL FIRE exempt classified expulsion fuses may be used in circuit designs, such as conditions with higher circuit loading where higher amperage CLFs are either not available or does not offer a greater technical advantage.

Additionally, branch line recloser technology or application criteria may evolve in future years, potentially replacing or working in conjunction with the branch line fusing applied as part of these efforts.

5.3.3.8 Grid Topology Improvements to Mitigate or Reduce PSPS Events

5.3.3.8.1 PSPS-Driven Grid Hardening Work (SH-7)

As a result of PSPS events in 2019, SCE identified opportunities to reassess and potentially modify configurations on circuits that have experienced multiple PSPS events to reduce the number of affected customers. SCE plans to accomplish this by replacing targeted segments of bare conductor with covered conductor, installing small undergrounding projects, and/or adding switching devices to allow for circuit reconfigurations/load transfers or further minimize the circuitry that needs to be de-energized. These circuit modifications will minimize the impact to its customers located in 1) non-HFRA that are fed from circuits that traverse HFRA and 2) certain underground areas within HFRA that are fed from overhead circuitry within HFRA.

SCE is continuing its scoping efforts to identify locations that can benefit from circuit modifications and will continue to design and execute these projects as they are identified. To date, SCE has identified approximately 30 potential locations where additional circuit modifications may improve sectionalizing capability within HFRA. Design and execution of this work was initiated in late November 2019.

SCE is currently using super-computing capabilities to develop a 40-year data set of historical high-resolution weather and fuel forecast models for HFRA. In future years, SCE plans to use this data set to help prioritize circuits for wildfire mitigation activities by examining the number of times each circuit breached PSPS criteria over a given historical period. This will help SCE forecast which circuits may be most likely to exceed PSPS criteria. Using this output, in combination with the most recent PSPS de-energization data, SCE will identify opportunities to reduce PSPS impacts through operational practices, grid hardening techniques, or microgrids, where appropriate. In 2020, SCE plans to review 50% of all distribution circuits within HFRA to determine if modifications may improve sectionalizing capability.

5.3.3.8.2 Microgrids (PSPS-8)

The CPUC opened the Microgrids and Resiliency Strategies OIR (R.19-09-009) proceeding to comply with the statutory mandates of SB 1339 to facilitate the commercialization of microgrids for distribution customers of large electrical corporations and to address the CPUC's goal of deploying resiliency planning in areas that are prone to outage events and wildfires.[26] The CPUC has adopted the U.S. Department of Energy's definition of a microgrid in this proceeding, which is "a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode."[27] When properly designed and located, microgrids open up the possibility of continuing electrical service in lower-risk fire areas that would otherwise be affected by PSPS events that are targeting adjacent or nearby HFRA.

Microgrids may serve a single customer behind-the-meter (BTM) or multiple customers in-front-of-the-meter (FTM). The former is more common today given fewer regulatory barriers and technical complexities relative to the latter. In the long term, as these barriers and complexities are addressed, the FTM microgrids may prove, in certain instances, to be a valuable resiliency tool. The CPUC aims to address barriers to deploying FTM microgrids through the Microgrid OIR. SCE is in the process of determining where such microgrids and to what scale could be deployed on a pilot basis and how to compare microgrid effectiveness with other mitigation options. As further detailed in its proposals in the Microgrid OIR, SCE plans to conduct microgrid pilots in 2020. As SCE gains experience and lessons learned from its 2020 pilots, SCE expects to update, modify, and refine the microgrid candidate selection approach. Details on SCE's PSPS Microgrid Pilot may be found in SCE's filing for Rulemaking 19-09-009.[28]

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26 Genevieve Shiroma, *Assigned Commissioner's Scoping Memo and Ruling for Track 1* (December 20, 2019), http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M322/K210/322210423.PDF.

27 Dan T. Ton and Merrill A. Smith, *The U.S. Department of Energy's Microgrid Initiative,* pp. 84-94 (The Electricity Journal, Volume 25, Issue 8, October 2012), https://www.energy.gov/sites/prod/files/2016/06/f32/The%20US%20Department%20of%20Energy's%20Microgrid%20Initiative.pdf.

28 Southern California Edison Company's (U 338-E) Comments on Track 1 Microgrid and Resiliency Strategies Staff Proposal (January 30, 2020), http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M325/K544/325544944.PDF

SCE summarizes its microgrid approach in this WMP because it essentially is a wildfire-focused initiative. Similar to how PSPS-specific policy issues should be resolved in the PSPS OIR, microgrid-specific policy issues should be resolved in the Microgrids OIR. Developing and installing microgrid solutions is complex, requires a detailed understanding of local system configurations, air quality requirements, policy objectives, regulatory requirements, etc., all of which are better suited to be addressed in the separate Microgrid OIR. SCE anticipates microgrid solutions can help improve grid resiliency and reduce the impacts of de-energization, making it a part of SCE's overall wildfire strategy. To the extent that SCE determines alternative solutions are more cost effective or the CPUC enacts policy changes that impact SCE's Microgrid Pilot, SCE will inform the WSD and those changes and requirements will automatically apply to this WMP once adopted.

In addition to microgrids, SCE is exploring options to further expand the "Resiliency Zone" concept. As some mitigations (including the expansion of microgrids) may take time, SCE is in the early stages of assessing opportunities to provide electricity to centrally located community resources serving local customers during a PSPS event. SCE is developing criteria to explore where such resiliency zones would be best located and what types of technology or operational strategies would best support this effort. For example, energizing a remote area in SCE's HFRA that has limited egress routes where customers may need to obtain access to basic services (e.g. fuel, groceries, food), Resiliency Zone solutions may reduce impacts to customers. A small, centralized area of the community may be energized during a PSPS event, only where it is safe to do so, and connected to electrical services that are fed from underground infrastructure. This strategy does not supersede any other program or SCE's generator policy but is intended to be an incremental step to longer-term strategies.

5.3.3.9 Installation of System Automation Equipment (Remote Controlled Automatic Reclosers Settings Update SH-5)

For the 2020-2022 WMP, SCE is expanding its system automation equipment strategy to target both RARs and additional sectionalizing devices to provide important isolating capabilities that could minimize the frequency of customer outages during PSPS and other outage events. In certain cases, these other sectionalizing devices, including RCSs, can be a cost-effective alternative, in certain situations, to RARs for more granular sectionalizing than previously anticipated.

SCE successfully met its 2019 WMP target of at least 50 RAR installations for HFRA circuitry with benefits for further circuit segmentation and energy reductions detailed in the GSRP filing by installing 55 RARs in 2019. During scoping of RAR projects, however, SCE identified additional scenarios where RARs are not the best devices to achieve the desired outcomes. In particular, to improve sectionalizing capabilities related to PSPS events, SCE plans to apply RCSs and other sectionalizing devices, such as manually operated switches, instead of RARs in certain situations. For example, situations with small overhead line sections served from underground sources may benefit from the application of an underground RCS installation to segment the overhead line based on operating conditions. SCE will continue to install RARs for mainline circuit protection and reliability improvements, as appropriate.

In 2020, SCE plans to install 45 devices consisting of both RARs and RCSs. Note that SCE's 2020 RAR installation program will complete the original target as defined in its GSRP filing. For 2021 SCE intends to transition sectionalizing device installations into normal work processes instead of a dedicated program.

5.3.3.10 Maintenance, Repair, and Replacement of Connectors, Including Hotline Clamps

SCE does not have a program explicitly to target connector maintenance, repair and replacement, but rather identifies scope through other work activities. Connector replacement can be identified during repair work, traditional inspections, or other means such as infrared scanning. SCE is piloting Distribution Fault Anticipation (DFA) and Early Fault Detection (EFD) technologies to improve its identification and alerting of its maintenance crews when connector maintenance, repair, or replacement is needed. SCE is using infrared to scan circuitry and connectors and identify those that need maintenance, repair, or replacement. These efforts will continue through 2020. Over the short (3 years) and long term (10 years), SCE will replace vintage connectors during its re-conductoring efforts, such as its covered conductor installation.

5.3.3.11 Mitigation of Impact on Customers and Other Residents Affected During PSPS Event

A few of the grid design and system hardening initiatives that SCE is undertaking to reduce the impact of PSPS events are described in the preceding sub-sections of Section 5.3.3. Many of these activities contribute to reducing the number and duration of PSPS de-energizations. In Section 5.3.6, SCE describes the various operational response practices it is using to mitigate PSPS impacts during these events. These include but are not limited to SCE's exploration into using microgrids and incentive programs to encourage customers to use their existing or planned solar installations to provide supplemental power. Programs like these can help with system hardening and mitigating the impact of PSPS events on customers and other residents by offering localized energy redundancy.

5.3.3.12 Other Corrective Action

SCE historically conducts maintenance based on findings from its inspection programs. SCE performs "other corrective actions" for various reasons, including safety, reliability, and compliance. SCE does not consider other corrective actions to be a WMP initiative but will continue to do this as part of SCE's role as a prudent operator of the grid.

Planned maintenance work identified through HFRA inspections is comprised of repairs to SCE's equipment and structures recorded as Priority 2 and Priority 3 items (i.e., level 2 and level 3). These repairs can be performed by inspectors or qualified electrical workers and are prioritized based on the established due date. Unplanned activities, also referred to as breakdown maintenance, include the repair of SCE equipment and structures that are damaged, compromised, or have failed in service. These items are typically identified as Priority 1 conditions and are usually performed in response to damage caused by equipment failures, degradation, metallic balloons, animals, or other causes. Repairs to these conditions are either completed or made safe to the public within 24 hours of identification. SCE considers opportunities to use more fire-resistant materials in HFRA, such as composite poles and crossarms, and its latest engineering standards, which have higher fault resistance, when performing these remediations while also focused on safety and reliability for customers.

Current programs use compliance dates and three-tier maintenance prioritization that is assigned by inspector and approved by a separate gatekeeper with additional validation. Once approved by a gatekeeper, SCE remediates items by due date and risk analyses unless constrained.

In, 2019 SCE's ground-based EOI effort was designed to identify and remediate immediate or probable wildfire risk, and involved the inspection of over approximately 385,000 distribution structures and approximately 41,000 transmission and transmission-telecommunications structures within SCE's HFRA. It was implemented through a phased approach based on a historical data-driven probability risk analysis. SCE's EOI effort was designed to be executed in two phases, with priority placed on the highest risk assets in SCE's HFRA. The first phase of inspections was substantially completed by January 31, 2019 and addressed approximately 109,000 structures with higher risk ranking based on historical system events. The second phase was substantially completed by May 31, 2019 and addressed the remaining 277,000 structures within 1,315 circuits in SCE's HFRA. Also, as part of its EOI effort in 2019, SCE identified certain-span conditions that pose a fire risk. These span conditions included, for example, long spans, angled spans, and spans that transition from vertical to horizontal configurations.

While this approach has served its purpose on meeting the strict compliance requirements, it is not effective in allocating the limited resources to address the risks to the public. Going forward, SCE believes the Commission should direct utilities to switch to a program that prioritizes risks rather than compliance due dates, focusing on items that have higher fire risk.

5.3.3.12.1 Distribution Remediation (SH-12.1)

The primary activities involved in SCE's distribution EOI effort included inspecting all distribution primary voltage-level structures based on identified ignition risk reduction criteria. During an EOI inspection, there was a physical visit to the structure being inspected and then a thorough visual inspection from the ground occurs at the actual location. SCE also identified certain overhead conductor span conditions – such as sagging lines or spans that made directional changes[29] that could pose a greater fire risk.

As a result of ground-based inspections on over 385,000 structures, approximately 96,000 notifications were generated to address issues on distribution assets. The breakdown of those findings by priority category is as follows:

- 606 Priority 1 notifications
- 55,180 Priority 2 notifications
- 40,056 Priority 3 notifications

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[29] These are spans that deviated from tangent line construction

The identified repairs were assigned due dates consistent with the high-fire tiered area and prioritized based on earliest compliance date. Of the approximate 96,000 notifications, 10,000 were for vegetation trimming and the majority (83,000) are associated with electrical assets that required repair or replacement. In 2019, all Priority 1 notifications were completed and the great majority of Priority 2 notifications that were due in 2019 and not encumbered by access restriction and/or permitting requirement were completed with the exception of 282 notifications that were subject to delays caused by inclement weather and other factors. SCE will continue to work towards remediating the issues identified through the 2018-2019 ground-based EOI inspections in HFRA. In 2020, SCE plans to remediate 100% of notifications with ignition risk in accordance with CPUC requirements, non-inclusive of notifications which meet the criteria of a valid exception. Additionally, SCE is evaluating assets for inclusion in its risk modeling efforts to determine a risk-informed approach for this work.

5.3.3.12.2 Transmission Remediations (SH-12.2)

Similar to distribution remediations, planned maintenance work identified through HFRA inspections is comprised of repairs to SCE's equipment and structures recorded as Priority 2 and Priority 3 items (i.e., level 2 and level 3). These repairs can be performed by inspectors or qualified electrical workers for electrical assets and cable splicers for telecom assets and prioritized based on the established due date. Unplanned activities, also referred to as breakdown maintenance, include the repair of SCE equipment and structures that are damaged, compromised, or have failed in service. These items are typically identified as Priority 1 conditions and are performed in response to damage caused by equipment failures, degradation, metallic balloons, animals, or other causes. Repairs to these conditions are either completed or made safe to the public within 24 hours of identification.

SCE performed inspections of all relevant transmission and transmission-telecommunications assets in HFRA for a total of over approximately 41,000 inspections in 2019. Items requiring remediation were documented and scheduled for maintenance or repair, based upon the risk of the condition. After the gatekeeping process, over 3,000 electrical notifications and over 9,500 vegetation related notifications requiring remediation were identified including:

- 48 Priority 1 notifications
- 12,000 Priority 2 notifications
- 1,700 Priority 3 notifications

Most of the notifications were tied to vegetation issues (due to their location in heavily vegetated areas) with a small percentage, about 10% tied to asset issues that required repair/replacement. All Priority 1 and over 9,000 Priority 2 notifications were completed in 2019.

SCE has 3,400 P2 notifications remaining to be completed. SCE is prioritizing the P2 notifications that were due in 2019 but not completed. Most of the P2 notifications are due in 2020 as they occurred in Tier 2 areas. Priority 3 notifications have been rolled into other programs, including routine vegetation management or targeted programs to address within their compliance due dates and to improve productivity.

SCE plans to remediate 100% of notifications with ignition risk in accordance with CPUC requirements, non-inclusive of notifications which meet the criteria of a valid exception. SCE will work towards integrating this inspection program into current inspection routines at these facilities to ensure consistent practices across the organization, following improvements from its transmission and distribution programs. Additionally, SCE is evaluating different assets for inclusion in risk modeling efforts to determine a risk-informed approach for this work.

5.3.3.12.3 Generation Remediations (SH-12.3)

In March 2019, SCE began inspecting generation assets in HFRA. These inspections included ignition-focused assessments of low-voltage ancillary assets and their associated overhead lines, supporting structures, and any exposed wiring or threats from vegetation that required additional mitigation. In addition, high-voltage facilities were inspected to ensure that all overhead connections from the last inspection of these structures had been evaluated and assessed for vegetation clearance buffers, using relevant criteria from transmission and distribution inspections. Remediation work stemming from these inspection efforts was prioritized according to the risk/severity of the identified condition including, for example, asset corrections and infrastructure repairs or replacement, as well as vegetation management, and in some cases civil repairs to critical assets that cannot be accessed.

SCE performed inspections of all relevant generation assets in HFRA for a total of 449 inspections in 2019. Items requiring remediation were documented and scheduled for maintenance or repair, based upon the risk of the condition. After the gatekeeping process, a total of 243 notifications requiring remediation were identified including:

- 1 Priority 1 notification
- 88 Priority 2 notifications
- 154 Priority 3 notifications

Most of the notifications were tied to vegetation issues (due to their location in heavily vegetated areas) with a small percentage, about 10%, tied to asset issues that required repair or replacement. All Priority 1 and 2 notifications that were due in 2019 and did not have a GO 95 exception due to permitting or other constraints were completed in 2019.

A small number of P2 notifications remain to be completed in 2020. The maintenance notifications (Priority 3) are being rolled into other programs, including routine vegetation management or targeted programs to address their issues. In 2020, SCE plans to remediate 100% of notifications with ignition risk in accordance with CPUC requirements, non-inclusive of notifications which meet the criteria of a valid exception. SCE will work towards integrating this inspection program into the current inspection routines at these facilities to ensure consistent practices across the organization, following improvements from transmission and distribution programs. Additionally, SCE is evaluating different assets for inclusion in risk modeling efforts to determine a risk-informed approach for this work. This activity will continue through at least another full inspection cycle to determine trends, assess risks, and evaluate the need for further inspections and their frequency.

As SCE improves the quality of its data and the quality of its risk-informed analyses, the program will be re-evaluated to determine the appropriate inspection frequency for the long-term.

5.3.3.13 Pole Loading Infrastructure Hardening and Replacement Program Based on Pole Loading Assessment Program

As described further in Section 5.3.4.13, the Pole Loading Program (PLP) is an assessment and remediation program identifying poles that do not meet the safety factor requirements of GO 95 and SCE's internal design and construction standards for repair or replacement. PLP's goal is to assess the structural loading capabilities of the approximately 1.4 million wood, composite, and lightweight steel poles in SCE's service territory to meet current design standards by 2021, and to continue remediating pole overloading issues by 2025.

All poles that require replacement are prioritized based on their safety factor and on whether the pole is in HFRA. In HFRA, pole loading program poles will be replaced with FR poles. PLP is not a WMP initiative but will continue as part of SCE's role as the prudent operator of the grid.

5.3.3.14 Transformers Maintenance and Replacement

Through the WCCP program, SCE will include a number of complementary system hardening improvements on the distribution system. SCE will replace existing overhead distribution transformers that are filled with mineral oil to new transformers filled with ester fluid, thus reducing the flammability and the environmental impact in case of spillage. At the same time, SCE will also install transformer bushing covers where appropriate. These system hardening measures are intended to reduce certain equipment and contact from object ignition drivers, respectively. Otherwise, SCE does not currently consider transformer maintenance to be a WMP initiative but will continue to do this as part of SCE's role as the prudent operator of the grid and evaluate whether any other targeted transformer maintenance or replacement is needed to mitigate wildfire risk.

5.3.3.15 Transmission Structure Maintenance and Replacement

SCE's historic transmission maintenance program, which includes towers, poles, conductor, and other transmission assets, is informed by compliance programs that help ensure safety and reliability. As part of SCE's inspections programs, transmission structures requiring maintenance are recorded and scheduled for follow-up work. SCE does not consider its structure maintenance programs to be a WMP initiative but will continue to do this as part of SCE's role as the prudent operator of the grid.

5.3.3.16 Undergrounding of Electric Lines and/or Equipment (SH-2)

In 2019, SCE evaluated undergrounding as a potential wildfire mitigation in its HFRA. SCE evaluated circuit segments on the basis of multiple criteria including wildfire risk scoring, PSPS impacts, and local SCE knowledge of terrain and topography to identify potential undergrounding candidates. SCE also reviewed egress in areas that may be challenging to evacuate should a fire occur as well as areas where customers may require electric service to provide essential public health and safety services.

SCE's first step in its 2019 undergrounding evaluation utilized wildfire risk scores at a circuit segment level to rank all the circuit segments in HFRA based on the risk mitigation effectiveness of targeted undergrounding. Through discussion with SCE's Field Engineering and Planning groups, SCE identified four districts to further analyze, each containing a relatively high concentration of high-ranking segments.

Once these districts were selected for analysis, SCE assembled a cross-functional working team with experts from Enterprise Risk Management, Asset Management & Strategy, Field Engineering, Distribution Planning, and local District personnel. Each of these working teams reviewed the feasibility of undergrounding and compared it with the effectiveness of other mitigations. After collecting input from these cross-functional working teams, SCE's Field Engineering personnel completed additional analysis of undergrounding constructability and cost. SCE also considered the possible mitigation of PSPS impacts on customers. It evaluated opportunities to modify circuit configurations, including the use of targeted undergrounding, on circuits that have experienced multiple PSPS events to reduce the number of customers affected. At the conclusion of this process, SCE identified a short list of potentially feasible undergrounding projects for 2021.

SCE met its 2019 WMP goal to conduct an undergrounding evaluation in HFRA and identified scope to support the installation of at least six miles of targeted undergrounding in 2021. In 2019, SCE also completed approximately 0.3 miles of undergrounding in HFRA using the Rule 20 Tariff.

In 2020, SCE will continue to refine its evaluation methodology for undergrounding in addition to working with local communities to pursue undergrounding in HFRA using Tariff Rule 20. The evaluation methodology is anticipated to incorporate factors such as wildfire risk reduction by removing overhead primary conductors, mitigation of PSPS frequency and impacts, and further consideration of pole removal from egress routes. Beyond 2020, SCE intends to complete the six miles of undergrounding scope in 2021 and eleven miles in 2022.

5.3.3.17 Updates to Grid Topology to Minimize Risk of Ignition in HFTDs

As described in Sections 5.3.3.8.1 and 5.3.3.9, SCE is pursuing various steps to further sectionalize portions of the grid to mitigate the impact of faults on SCE's ignition risk as well as PSPS and other outage events on customers. Separately, the fusing program is intended to reduce the risk of fire ignitions associated with SCE's distribution lines and equipment by reducing fault energy. Typically, CLFs are selected for this application because they can provide faster fault clearing for most faults and a reduced fault energy, compared conventional fuses. However, in rare instances, fault current levels and device coordination may require the application of conventional fuses or Branch Line Fuses (BLFs). In addition to the fault energy reduction, the placement of BLFs is expected to improve electric circuit reliability by segmenting faulted circuits to smaller line sections.

SCE expects to complete its BLF installations in 2020. Thereafter, installation of BLFs would follow normal work scope as new branch circuits are created or where grid improvements are identified. For more information on BLF see Section 5.3.3.7.

5.3.3.18 TOH Review (SH-9)

While SCE's 2019 wildfire mitigation strategies and programs included initiatives for its distribution and transmission systems, SCE's distribution system received greater focus largely because of historical ignition sources being predominately from its distribution system. In 2020, SCE will proactively review its transmission and sub-transmission construction and design standards for opportunities to further reduce the likelihood of electric system-related ignitions and identify potential improvements to help reduce wildfire threats, especially during extreme wind events. Example topics of this review include grounding and clearances for transmission and sub-transmission facilities, and closer examination of switch configurations, insulated guy wires, and avian protection. Findings from this review may increase the insulation effectiveness between energized and grounded sub-transmission equipment, reducing the likelihood of generating an arc. SCE will develop a report of its findings along with any identified actions for design improvements. If SCE's findings determine that modifications are needed in 2020 it will inform the Commission through any required filings such as the Off Ramp Report. SCE expects to continue to review and assess them throughout this WMP period and beyond.

5.3.3.19 Legacy Facilities (SH-11)

Findings from the 2019 EOI effort on distribution and generation assets uncovered areas to explore further for legacy facilities, many in proximity to historic hydroelectric generation facilities in HFRA. The age of these facilities, proximity to densely forested areas, and their unique configuration pose challenges to address additional mitigation opportunities. In one such case, the 2019 inspection findings required immediate measures to de-energize a line and seek an alternate source to provide reliable power to a high hazard dam facility and a small (<10 kW) microgrid, solar plus storage solution was deployed. Other facilities and circuits have been identified for further evaluation. SCE plans to conduct a risk-based analysis of these lines and develop site-specific remediation options to either mitigate in place (potentially with covered conductor), reconfigure, rebuild, or provide alternative means of power supply where feasible.

Other system hardening activities that may provide additional wildfire risk reduction benefits for these legacy facilities will also be explored. These include, but are not limited to, evaluation and possible deployment of additional avian and wildlife protection measures, assessment of existing grounding grids and lightning arrester systems to ensure their adequacy, and incorporation of these facilities into existing programs moving forward.

In 2020, SCE plans to evaluate certain legacy facilities including substations and Generation facilities to assess any potential fire risks and develop an execution strategy to mitigate any findings.

See Table 23 "Grid design and system hardening" for more detail on the initiatives above.

5.3.4 Asset Management and Inspections

Explain the rationale for any utility ignition probability-specific inspections (e.g., "enhanced inspections") within the HFTD as deemed necessary over and above the standard inspections. This shall include information about how (i.e., criteria, protocols, etc.) the electrical corporation determines additional inspections are necessary.

Describe the utility's maintenance protocols relating to maintenance of any electric lines or equipment that could, directly or indirectly, relate to wildfire ignition. Include in the description the threshold by which the utility makes decisions of whether to (1) repair, or (2) replace electric lines and equipment. Describe all electric lines and equipment that the utility "runs-to-failure", those that the utility maintains on a risk-based maintenance plan, and those that are managed by other approaches; describe each approach. Explain the maintenance program that the utility follows and rationale for all lines and equipment.

Description of programs to reduce ignition probability and wildfire consequence
For each of the below initiatives, provide a detailed description and approximate timeline of each, whether already implemented or planned, to minimize the risk of its equipment or facilities causing wildfires. Include a description for the utility's programs, the utility's rationale behind each of the elements of this program, the utility's prioritization approach/methodology to determine spending and deployment of human and other resources, how the utility will conduct audits or other quality checks on each program, how the utility plans to demonstrate over time whether each component is effective and, if not, how the utility plans to evolve each component to ensure effective spend of ratepayer funds.

Include descriptions across each of the following initiatives. Input the following initiative names into a spreadsheet formatted according to the template below and input information for each cell in the row.

1. Detailed inspections of distribution electric lines and equipment
2. Detailed inspections of transmission electric lines and equipment
3. Improvement of inspections
4. Infrared inspections of distribution electric lines and equipment
5. Infrared inspections of transmission electric lines and equipment
6. Intrusive pole inspections
7. LiDAR inspections of distribution electric lines and equipment
8. LiDAR inspections of transmission electric lines and equipment
9. Other discretionary inspection of distribution electric lines and equipment, beyond inspections mandated by rules and regulations
10. Other discretionary inspection of transmission electric lines and equipment, beyond inspections mandated by rules and regulations
11. Patrol inspections of distribution electric lines and equipment
12. Patrol inspections of transmission electric lines and equipment
13. Pole loading assessment program to determine safety factor

14. Quality assurance / quality control of inspections
15. Substation inspections
16. Other / not listed [only if an initiative cannot feasibly be classified within those listed above]

Inspecting electrical equipment is a critical component of asset management and delivery of safe and reliable power. SCE has established various inspection and maintenance programs to not only meet compliance requirements but go beyond minimum requirements when deemed appropriate to help reduce fire risks. These programs are listed below and explained in more detail in subsequent sections.

SCE has system-wide inspection programs that include HFRA in SCE's service territory and help reduce wildfire risks. These programs include:

- Detailed Inspections of distribution electric lines and equipment
- Detailed inspections of transmission electric lines and equipment
- Intrusive pole inspections
- Patrol inspections of distribution electric lines and equipment
- Patrol inspections of transmission electric lines and equipment
- Pole loading assessment program to determine safety factor
- Quality assurance/quality control of inspections
- Substation inspections
- Remediation protocol

SCE has also established several inspection programs which are specific to reducing wildfire risk and which go beyond mandated rules and regulations. These programs include:

- Infrared inspections of distribution electric lines and equipment
- Infrared inspections of transmission electric lines and equipment
- HFRI of distribution electric lines and equipment
- Distribution aerial inspections
- HFRI of transmission electric lines and equipment
- Transmission aerial inspections
- Substation Failure Modes and Effects Analysis
- HFRI of generation assets

More information about these activities is specified below in Sections 5.3.4.1 through 5.3.4.16. Overall, SCE's inspections and maintenance strategy in the next 10 years (2020-2030) is to integrate its inspection activities with its asset management strategies to help ensure that individual asset strategies and inspection activities work cohesively to promote reliability, affordability and safety, including fire safety.

Given the significant risk of wildfires potentially associated with electrical infrastructure, in late

2018, SCE considered it prudent to inspect all of its distribution and transmission structures in HFRA as quickly as feasible with the specific intent of finding asset conditions that could potentially cause a spark or ignition. Asset conditions can change after an inspection for several reasons, many outside the utility's control. Instead of waiting five years (for distribution) and three years (for transmission) to complete the cycle per regulatory requirements, SCE, through its EOI effort in 2018 and 2019, inspected all of its distribution and transmission structures within HFRA in a matter of months and prior to the start of the 2019 wildfire season.

SCE launched its Inspection Redesign initiative following its EOI effort to examine its current inspection programs and find ways to improve SCE's approach. The Inspection Redesign is focused on detailed distribution and aerial inspection programs; however, the effort will evolve to cover additional inspection programs.

Through the Inspection Redesign initiative, SCE developed new training and a custom mobile inspection application that uses intelligent guided surveys to enable Electrical Service Inspectors (ESIs) to perform risk-informed inspections in HFRA beginning in 2020 that meet the requirements for both wildfire-focused inspections (formerly known as EOI), distribution Overhead Detail Inspections (ODI), transmission inspections, and generation inspections. This new program is referred to as SCE's High Fire Risk Informed Inspection (or HFRI) Program and is focused on inspections in HFRA. SCE will continue its traditional inspection programs outside of HFRA. The custom mobile inspection application enables ESIs to conduct a single inspection in a HFRA or non-HFRA that assesses ignition risk and meets all compliance obligations. Further, the tool features a data capture element that will provide high-quality information about asset conditions which will subsequently be processed and analyzed by SCE's data scientists. In the future, artificial intelligence and machine learning technologies will use this information for improved risk modeling. In 2020, the new application will further allow SCE to, among other things, achieve a steady-state, risk-informed scheduling process, and implement assisted photo capture tools and data quality metrics.

The long-term vision of the Inspection Redesign initiative is to support the company's continuing transition from a compliance-focused inspection approach to a more risk-informed approach. Thus, the initiative will focus on finding ways for SCE to both increase data collection and data analytics to inform and improve SCE's inspection programs.

5.3.4.1 Detailed Inspections of Distribution Electric Lines and Equipment

SCE performs routine inspections of SCE's overhead distribution electric system in compliance with GO 165. GO 165 requires SCE to perform a visual detail inspection of all overhead distribution electric assets every five-years. To achieve this, the ODI program inspects approximately one-fifth of SCE's service territory annually, including high fire and non-high fire assets. Since the program is run system-wide, however, the number of inspections of assets in HFRA shifts slightly each year. SCE prioritizes the ODI program and has dedicated resources and funds to the program to help ensure compliance with GO 165. This program is part of SCE's portfolio of standard inspection activities.

SCE monitors the compliance and effectiveness of the program through several means, which include reports measuring inspection rates, reports tracking compliance, and QA and QC inspections. This inspection activity documents and records items that require repair or replacement. Furthermore, the inspectors prioritize maintenance in accordance with applicable GOs.

SCE's ODI program in 2019 conducted 50,577 inspections within HFRA, and discovered:

- Over 19,000 Priority 2 conditions requiring remediation
- Over 2,000 vegetation-related issues
- Over 1,800 customer-related issues, such as:
  - Customers attaching facilities on utility poles
  - Customers restricting access to utility facilities
- Over 6,600 issues created by communications companies, which include, but are not limited to:
  - Communication wires touching or near electric facilities
  - Slack guy wire
  - Low service drops

Starting in 2020, SCE will re-inspect approximately 37% of its HFRA distribution assets annually through the new HFRI program to help ensure that any deterioration in asset condition in higher risk areas are promptly identified for timely remediation. These inspections are discussed in more detail in Section 5.3.4.9.1 of this chapter. Some near-term activities that SCE is looking at revising in its inspection programs are:

- Developing risk-informed inspection programs, where certain assets would be inspected at more frequent intervals than those required by GO 165, such as performing ODI once every three years for higher risk assets instead of once every five years
- Developing response inspection programs, which are inspections initiated in response to outside forces, such as an earthquake, or winter storm
- Deploying two-person find and fix inspection crews to remediate high-priority work in an accelerated timeframe

5.3.4.2 Detailed Inspections of Transmission Electric Lines and Equipment

SCE performs detailed routine inspections of SCE's overhead transmission electric system in compliance with GO 165, the North American Electric Reliability Corporation (NERC), Western Electricity Coordinating Council (WECC) and California Independent System Operator (CAISO) rules and regulations. SCE's Transmission Inspection and Maintenance Program (TIMP) requires a visual detail inspection every three years of all overhead transmission and sub-transmission electric assets. To achieve this goal, SCE inspects approximately one-third of its service territory annually, including HFRA and non-HFRA assets. Given that SCE performs inspections systemwide each year, the number of inspections of assets in high fire areas shifts slightly each year. Resource allocation and work prioritization is driven by GO 165 compliance requirements. SCE monitors the compliance and effectiveness of the program through several means, including reports measuring inspection rates, reports tracking compliance, and QA/QC inspections.

SCE's TIMP program in 2019 conducted 41,952 inspections within HFRA, and identified:

- 48 Priority 1 notifications that have been remediated
- Over 3,000 Priority 2 conditions, which required electrical crews to remediate
- Over 9,500 vegetation-related issues

The difference between the planned inspections and the actual inspections in 2019 shown on Table 24, initiative activity 10.1, was caused by assets incorrectly identified as distribution only, non-SCE structures, or structures not located in HFRA.

SCE will ensure that all TIMP compliance-due date inspections in 2020-2022 are performed per applicable rules and regulations and SCE's internal standards. SCE modified the inspection cycles for some of its transmission overhead inspection assets to exceed compliance requirements such that, in 2020 and beyond, SCE will annually inspect approximately 47% of its HFRA transmission assets. These inspections are discussed in more detail in Section 5.3.4.10.1. Some near-term work in the TIMP that SCE is looking at revising includes:

- Developing a risk-informed inspection program, where certain assets would be inspected at more frequent intervals than required currently by SCE's program
- Developing response inspection programs, which are inspections initiated in response to outside forces, such as an earthquake or a winter storm

5.3.4.3 Improvement of Inspections

In order to continually improve, after the 2019 EOI effort, SCE decided to diversify its training activities in order to include a greater focus on classroom training and job shadowing. For example, in 2019, SCE conducted classroom training for ODI inspectors to ensure that the inspectors understood the new inspection requirements and tools. SCE is continuing to refine its training programs based on feedback from the field and its QC program. Further, T&D's C&Q evaluates inspection approaches and procedures periodically for potential improvements.

5.3.4.4 Infrared Inspections of Distribution Electric Lines and Equipment (IN-3)

SCE conducts infrared inspections of SCE's overhead distribution electric system in HFRA, annually inspecting approximately 50% of the circuit miles in these locations. SCE performs these inspections to detect conditions that pose a fire, safety, and reliability risk but may not be visible to the human eye. SCE monitors internal compliance and effectiveness of the program through reports tracking progress and inspection findings.

In 2016, SCE conducted a small pilot study to determine the usefulness of infrared inspections, that was inconclusive due to the limited sample size. In 2017, SCE conducted a larger, more detailed and statistical study of infrared inspections. This study revealed that infrared inspections can detect degraded conditions not visible to the naked eye. After the 2017 pilot, SCE inspected all high fire miles that were not inspected as part of the pilot. Based upon the data from those inspections in 2017 and 2018, SCE made the decision in 2019 to begin performing infrared inspections for 50% of HFRA circuit miles every year, so that each HFRA circuit mile receives an infrared inspection every other year.

SCE's distribution infrared inspection program inspected 4,962 circuit miles in SCE's HFRA in 2019 and identified:

- 23 Priority 1 conditions, which have been remediated
- Over 58 Priority 2 conditions, which have been remediated

In 2020 and beyond, SCE plans to inspect lines on the HFRA on a two-year cycle. SCE will also use the information learned from the 2017 to 2019 infrared inspections to determine whether future refinements to the infrared inspection cycles or criteria are appropriate.

5.3.4.5 Infrared Inspections of Transmission Electric Lines and Equipment (IN-4)

In 2019, SCE started a program to perform infrared and corona inspections of its overhead transmission system. SCE performed these inspections to detect conditions that pose a fire, safety, and reliability risk, but are not visible to the human eye. SCE monitors internal compliance and effectiveness through reports tracking progress and inspection findings.

In 2019, SCE's transmission infrared and corona inspection program inspected 6,700 circuit miles in SCE's HFRA and found approximately 200 conditions that required electrical crews to remediate:

- 22 Priority 1 conditions, which have been remediated
- 55 Priority 2 conditions, to be scheduled based upon priority and compliance requirements
- 127 Priority 3 conditions, to be scheduled based upon priority and compliance requirements

In 2020, SCE will perform infrared and corona scans on approximately 1,000 HFRA circuit miles (approximately 20% of its transmission HFRA circuits). SCE will use the information learned from the 2019 and 2020 infrared and corona inspections to determine the inspection volume and cadence for these Transmission aerial inspections in future years.

5.3.4.6 Intrusive Pole Inspections (IPI)

In 1997, the IPI program was established in accordance with GO 165, to evaluate SCE's wood poles using visual and internal examination of the poles to identify and document damage or decay requiring remediation. GO 165 requires intrusive inspections for all poles at least 15-years in service or older, to be completed using a 10-year cycle from the initial intrusive inspection. If the pole has passed the initial intrusive inspection within the first 25-years of age, GO 165 requires subsequent intrusive inspections on a 20-year cycle. SCE completes intrusive inspections on a 10-year cycle, which is in line with industry benchmarking and is approved by the Commission.

Intrusive inspections involve drilling into the pole's interior to identify and measure the extent of internal decay, if any. The result is recorded as the Remaining Section Modulus (RSM) and is utilized in pole loading calculations in compliance with GO 95, Rule 44.2. Inspectors will apply a preservative to poles that pass the intrusive inspection to reduce the likelihood of future decay when the conditions warrant it. Inspectors may also perform a visual inspection on poles that are in the inspection grid but that are younger than 10 years old to look for signs of obvious external damage or high priority conditions that warrant immediate attention. The inspector analyzes the integrity of the pole and classifies it for repair or replacement, as necessary. Approximately 10,000 poles are identified for repair or replacement each year through this program across SCE's service territory. SCE monitors the compliance and effectiveness of this program through reports measuring inspection rates, tracking compliance, and measuring the results of inspections.

SCE's IPI program intrusively inspected over 21,000 poles in 2019 in HFRA and discovered:

- Approximately 5 Priority 1 pole replacements (all completed)
- Over 2,000 Priority 2 pole replacements

SCE will continue to perform intrusive inspections on a ten-year cycle.

5.3.4.7 LiDAR Inspections of Distribution Electric Lines and Equipment

LiDAR is conducted under the Aerial Inspection program; refer to Section 5.3.4.9.2 (Aerial Inspections).

5.3.4.8 LiDAR Inspections of Transmission Electric Lines and Equipment

LiDAR is conducted under the Aerial Inspection program; refer to Section 5.3.4.10.2 (Aerial Inspections).

5.3.4.9 Other Discretionary Inspection of Distribution Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

5.3.4.9.1 High Fire Risk Informed Inspections of Distribution Electric Lines and Equipment (IN-1.1)

As noted in Section 5.3.4.1 Detailed Inspections of Distribution Electric Lines and Equipment~~5.3.4.1 Detailed Inspections of Distribution Electric Lines and Equipment~~, SCE performs routine inspections of SCE's overhead distribution electric system in compliance with GO 165. In 2019, SCE laid the groundwork to incorporate risk into its ODI program starting in 2020 by increasing the annual inspection population in HFRA from approximately 20% to 37%. The additional 17% goes above and beyond the requirements of GO 165. The population for the extra inspections was determined using a risk framework to help ensure that any deterioration in asset condition in higher risk areas are promptly identified for timely remediation. SCE has allocated additional resources to the ODI program to perform this incremental work. The monitoring performed for routine ODI inspections will extend to these additional inspections.

In 2019, SCE performed additional detailed ground-based inspection of its electric distribution assets through its EOI effort.

SCE completed 455,515 additional detailed ground-based inspections of its electric distribution assets primarily in its HFRA in 2019 and identified:

- Over 600 Priority 1 conditions, that required electrical crews to remediate
- Over 65,000 Priority 2 conditions, that required electrical crews to remediate

- Over 16,000 vegetation-related issues

SCE took away several lessons from its 2019 EOI effort, including:

- Moving from a compliance-based to risk-informed approach enhances SCE's ability to identify and remediate conditions that could lead to high fire risk ignitions
- Adopting digital tools (iPads, electronic reporting dashboards, etc.), in conjunction with an expedited software development approach and close partnership with end users, enabled speedy and effective implementation
- Initiating aerial inspections to identify conditions not visible from the ground improved inspections

SCE will conduct at least 50,000 HFRI in 2020. Also, as noted above, SCE is continuing to improve its inspection programs to incorporate more risk-informed approaches and lessons learned from the 2019 and 2020 inspections. This may result in SCE conducting additional HFRI in 2020 and modifying the number of additional inspections in 2021 and 2022.

5.3.4.9.1.1 Asset Defect Detection Using Machine Learning Object Detection (AT-5)

SCE has identified a potential opportunity to use ML object detection to help detect defects from equipment inspection photos and streamline inspection processes. For example, in 2019, EOI produced large quantities of high-resolution images that are currently being reviewed and processed by QEWs. ML can help reduce image processing times, and SCE is currently deploying a cloud-based analytics platform to support ML model development. One potential use case is object and defect detection from inspection photos to help streamline inspection processes. SCE is expanding its capability and exploring the use of artificial intelligence (AI) and ML to identify patterns and support future predictive maintenance.

In 2020, SCE will standardize data collection in its inspection programs for future ML. SCE is developing various tools and processes in its ML efforts to evaluate the feasibility of supporting objective evaluation of inspection assets. As part of its effort, SCE has identified several potential ML vendors and will evaluate their immediate capabilities as it also develops in-house capabilities. The primary goal will be to prioritize inspection resources and improve defect identification rates.

For 2021, SCE plans to demonstrate in-house developed models that identify assets from inspection imagery and explore the identification of defects within these detected assets. Partnering with industry vendors, such as EPRI, will also be a key activity.

SCE will also explore additional data sources such as LiDAR and Remote Sensing to improve its ML models for defect identification. Depending on the success of ML, SCE plans to pilot the defect detection capabilities during its 2022 inspection efforts. SCE will continue to develop ML models to see if it is possible to determine the severity of a defect and classify its risk. Lastly, SCE aims to utilize the collected, image meta-data to provide a holistic 360-degree view of an asset for additional analytics as integration into future inspection processes.

5.3.4.9.2 Distribution Aerial Inspections (IN-6.1)

SCE launched a robust aerial inspection effort in April 2019, which supplements SCE's ground-based inspections. Aerial inspections offer a more comprehensive inspection of SCE's infrastructure, including a different perspective of the pole top, the wooden crossarms, the steel structures, and all conductor/hardware that may not be easily visible from the ground. These inspections have resulted in the accumulation of vast amounts of remote sensing data that SCE analyzes for risk/issue identification, prioritization, and subsequent remediation. The program deploys various types of sensors and collects different types of data across the initiatives, including, for example, HD photos, videos, and LiDAR.

Given the urgency, in 2019, of completing aerial inspections under compressed timeframes, the supporting business processes used quick-to-deploy technology solutions. SCE plans to build comprehensive technology and data management solutions to support the aerial inspections processes as they transition from using the quick-launch initiatives of today to steady-state functions going forward. SCE expects the following benefits from building out comprehensive technology and data management solutions:

- Ability to live-stream high-definition (HD) video
- Geo-tagging of image frames with UAS location
- Storage of high-volume video and HD imagery data
- Ability to receive and display HD video content with minimal lag
- Support hazard/defect identification with ML and AI
- Enable search and access to video content based on location and asset attributes

SCE completed 113,900 aerial-based inspections of its electric distribution assets primarily in its HFRA in 2019 and identified:

- Over 100 Priority 1 conditions, which have been remediated.
- Over 7,000 Priority 2 conditions, which required electrical crews to remediate
- Over 6,000 vegetation related issues

SCE plans to perform approximately 165,000 distribution aerial inspections in 2020. Additionally, SCE plans to incorporate lessons learned from 2019 and 2020 to determine the appropriate size, scope, and frequency of aerial inspections moving forward. The inspections in 2019 were instructive in identifying an opportunity to implement a consistent storage mechanism that would, for example, in the future, give SCE the ability to quickly tag photos for processing by ML technologies. Also, SCE identified the opportunity to store data in a way that is useful for other users and use cases (e.g., LiDAR data has multiple uses including for inspection programs and vegetation management programs.).

SCE will focus on developing advanced analytics capabilities to improve its aerial inspection programs. To do this, SCE plans to develop stronger data governance standards and data platforms to ensure the data quality necessary to support advanced data processing and analytics by its ML and AI technologies. Specifically, SCE is focused on deploying a suite of technology services and a data repository for image data collected from aerial programs that will enable ML and AI to perform image processing and notification generation. This effort will focus on deploying a repository for image data based on established specifications with automated rules for rejection and acceptance. Labeling tools will be deployed to both identify assets on structures and discrepant conditions requiring notifications. This will enable the training of ML algorithms for asset identification, asset degradation condition, and the development of AI to perform inspections from image data for further review by qualified personnel. This will speed up the time it takes to process and review the vast amounts of image data being collected from aerial programs. This effort will also focus on the infrastructure needs to retrieve data from the field in an expedited manner. Finally, this effort will build the necessary ML and AI algorithms to process the images automatically. The initial focus will be to build the image standards and rules for labeling with a goal to deliver the ML and AI capabilities by end of 2022.

5.3.4.9.2.1 Advanced Unmanned Aerial Systems Study (AT-2.2)

SCE developed a demonstration project to study the efficacy of using aerial drones to patrol overhead lines associated with PSPS events. The focus was on augmenting traditional patrol methods via truck, foot, or helicopter, to further reduce wildfire risk by detecting equipment risks that are more difficult to find by these other means and expedite power restoration to minimize the impact of outages on customers.

In 2019, SCE completed its initial evaluation of Beyond Visual Line of Sight (BVLOS) Unmanned Aerial System (UAS a.k.a. 'drone') capabilities by conducting demonstration flights utilizing Extended Visual Line of Sight (EVLOS), a precursor to BVLOS that utilizes multiple visual observers along the vehicle's path to maintain visual contact with the drone. The study was successful in that all planned circuit segments were flown and yielded abundant data and learning that serve as a springboard for the next phase of the study.

First, significant regulatory barriers exist that make BVLOS drone flights difficult to achieve in the commercial environment, particularly in areas with congested and restricted airspace—a hallmark of SCE's service territory.

Second, Southern California—and California is general—has some of the most diverse geography and landscape in the United States, much of which is served by SCE. This diversity, particularly extreme elevation changes and heavily forested areas, present challenges for live streaming data and aircraft control. Drone endurance—the amount of time a vehicle can stay airborne to achieve its mission—needs to improve for UAS patrols to be conducted effectively and efficiently. Video quality and zoom, combined with shooting angles and distance above structures, need to be improved for Troublemen and Patrolmen to feel confident to make an 'all-clear' decision from a desktop vantage point.

Third, UAS operations at SCE quickly evolved in 2019 with the introduction of aerial inspections to augment its EOI effort. Therefore, there is additional momentum to further accelerate the state of UAS operations at SCE for wildfire prevention, mitigation and response efforts. Much was learned in the first phase of the Advanced UAS Study, and it is clear that additional demonstration flights are needed to not only prove the viability and effectiveness of using UAS compared to traditional patrolling methods, but also to advance aircraft detect-and-avoid and communication technologies that are prerequisites for BVLOS.

To address these challenges and prepare SCE's operations and workforce for such advanced UAS operations, SCE is planning to conduct additional demonstration flights in 2020. In 2021 and beyond, subject to lessons learned in 2020, SCE plans to evaluate communication technologies that advance aircraft detect-and-avoid and control capabilities that will mitigate vehicle communication challenges, improve video streaming capabilities, and improve airspace safety. Once these technologies are proven, SCE would like to obtain a BVLOS waiver on a limited number of circuit miles, leveraging the technologies noted above and using these as test cases to advance BVLOS across the company—to more circuits across diverse voltages, construction types, altitudes, and geographies.

5.3.4.9.2.2 UAS Operations Training (OP-3)

UAS are an important tool SCE utilizes to perform remote sensing activities related to wildfire mitigation. As use cases for UAS increase across the enterprise, it is imperative that SCE maintain a baseline level of frontline employees who can quickly respond to emergent and ongoing mitigation activities. SCE plans to create a formal training and certification process for select employees across multiple organizational units to ensure skilled UAS operators with knowledge of the wires-environment that can be rapidly deployed across the service territory in response to wildfire prevention, mitigation, and response activities. While SCE anticipates the need for both internal and external UAS resources for the period of this WMP, SCE intends to increase the number SCE employees who are FAA-certified UAS operators. SCE intends to increase its internal workforce of UAS operators in 2020 by 50.

5.3.4.10 Other Discretionary Inspection of Transmission Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

5.3.4.10.1 High Fire Risk Informed Inspections of Transmission Electric Lines and Equipment Overview (IN-1.2)

As noted in Section 5.3.4.2, SCE performs routine inspections of SCE's overhead transmission electric system in compliance with GO 165. In 2019, as SCE realized the need to shift towards more risk-informed inspections, SCE increased its normal inspection population in HFRA from approximately 33% annually to 47% for 2020. The additional 20% is above and beyond the requirement for SCE's typical inspection procedures and GO 165. The population for the extra inspections was determined using a risk-informed framework. SCE has prioritized these inspections and is working to increase the staffing and secure the funds needed to run the program. The monitoring performed for routine TIMP inspections will extend to these additional inspections. In 2019, SCE performed additional detail ground-based inspection of its electric transmission assets through its EOI effort.

SCE's additional detail ground-based inspections of its electric transmission assets for 2019 included approximately 42,000 inspections primarily in its HFRA and identified:

- Over 40 Priority 1 conditions, which have been remediated

- Over 3,000 Priority 2 conditions, that required electrical crews to remediate
- Over 9,500 vegetation-related issues

SCE will conduct at least 22,500 HFRI in 2020. Also, as noted above, SCE is continuing to improve its inspection programs to incorporate more risk-informed approaches and lessons learned from the 2019 and 2020 inspections. This may result in SCE conducting additional High-Fire Risk Informed inspections in 2020 and modifying the number of additional inspections in 2021 and 2022.

5.3.4.10.2 Transmission Aerial Inspections (IN-6.2)

The background on SCE's aerial inspection program, lessons learned from 2019, and how the program will evolve over time is described in Section 5.3.4.9.2. Below is a high-level overview of SCE's transmission aerial inspections performed in 2019:

SCE completed 38,998 aerial-based inspections of its electric transmission assets primarily in its HFRA in 2019 and identified:

- 59 Priority 1 conditions, which have been remediated
- Over 6,607 Priority 2 conditions, that required electrical crews to remediate
- Over 2,322 vegetation related issues

SCE plans to conduct approximately 33,500 transmission aerial inspections in 2020 and intends to incorporate lessons learned from 2019 and 2020 to determine the appropriate size, scope, and frequency of aerial inspections moving forward.

5.3.4.10.2.1 Assessment of Partial Discharge Transmission Facilities (AT-6)

SCE has identified a radio frequency (RF) detection technology that has the potential to determine the health of transmission assets by remotely detecting partial discharge. As equipment deteriorates, it may produce more and more partial discharge either in the form of arcing, leaking, or tracking. The partial discharge can be detected via RF emissions allowing SCE to investigate and respond to failing equipment prior to an in-service failure.

In 2020, SCE will assess this technology to determine if it can effectively detect partial discharge leading to reduced in-service failures. The assessment may lead to a pilot program and potentially broader use for asset health assessment.

5.3.4.11 Patrol Inspections of Distribution Electric Lines and Equipment

SCE performs routine patrols of SCE's overhead distribution electric system in compliance with GO 165. GO 165 requires SCE to perform an annual patrol inspection of all overhead distribution electric assets that are located in SCE's HFRA. Patrols are performed within specified grids and qualified inspectors visually inspect SCE's overhead and above-ground underground electrical distribution facilities to identify and document obvious safety and reliability conditions that require corrective action. Annual patrols are performed primarily from ground vehicles but can also be completed by foot or aircraft. Like other inspection programs, these inspectors document and prioritize items for follow-up corrective action. If an inspector notices a Priority 1 condition, as defined by GO 95 Rule 18, the inspector will request for a Troubleman to come to the site, assess the condition, and ensure the safety of the site. The Troubleman will record and document the condition(s) observed.

In 2019, SCE performed over 7,000 distribution patrol inspections of grids (blocks of area) containing assets within SCE's HFRA.

SCE plans to conduct all required patrol inspections in 2020 and beyond. SCE is also looking at making near-term changes to its distribution patrol program by:

- Moving towards a risk-informed inspection program based upon lessons learned from 2019 and 2020 inspections, such that certain inspections could be performed at more frequent intervals than those required by GO 165
- Revising the inspection tool utilized by the inspectors

5.3.4.12 Patrol Inspections of Transmission Electric Lines and Equipment

SCE performs routine patrol inspections of SCE's overhead transmission electric system in compliance with GO 165, NERC, WECC and CAISO rules and regulations. SCE's TIMP inspectors perform patrol inspections of approximately two-thirds of SCE's service territory annually, including high fire and non-high fire assets. The number of inspections of assets in HFRA shifts each year slightly as this program is run systemwide. Inspections are also performed after unplanned events, such as extreme weather, fires, and equipment malfunctions. Resource allocation and work prioritization is driven by compliance requirements. This program is part of SCE's general portfolio of inspection activities. To track the compliance and effectiveness of the program, SCE produces reports measuring inspection rates, tracks compliance and conducts QA/QC inspections. During 2019, patrol inspections that were due for compliance inspections, were performed at the same time as the high fire inspections and the findings are captured in section 5.3.4.2. For circuits that traversed both in and out of the HFRA, SCE separately inspected the assets of the circuits outside of the HFRA to complete the detailed circuit inspection.

SCE plans to conduct all required patrol inspections in 2020 and beyond. SCE is also looking at making near-term changes to its distribution patrol program by:

- Moving towards a risk-informed inspection program based upon lessons learned from 2019 and 2020 inspections, such that certain inspections could be performed at more frequent intervals than those required
- Revising the inspection tool utilized by the inspectors

5.3.4.13 Pole Loading Assessment Program to Determine Safety Factor

The PLP is an assessment and remediation program to identify poles that do not meet the safety factor requirements of GO 95 and SCE's internal design and construction standards for repair or replacement. The PLP's goal is to assess the structural loading capabilities of the approximately 1.4 million wood, composite, and light-weight steel poles in SCE's service territory to meet current design standards by 2021, and to continue remediating pole overloading issues by 2025. This program is designed to verify that the structural integrity of existing poles is sufficient to withstand anticipated wind loads acting on poles, including wind loading in high wind areas within SCE's service territory. The PLP prioritized assessment of poles in HFRA. Although the Commission requires a design wind pressure of 6 pounds per square foot (with 0.5 inches of radial ice) or 8 pounds per square foot (no ice), SCE adopted higher wind loading design standards of 12, 18, and 24 pounds per square foot in addition to the standards for 6 and 8 pounds. SCE made these determinations based on meteorological studies in areas with higher wind velocities. The wind-loading criteria employed by SCE is based on specific line locations and potential wind speeds at those locations. SCE will continue to assess pole conditions and replace poles, and where applicable, utilize the higher wind loading criteria outlined above. See Section 5.3.3.13 for a description of pole replacements resulting from Pole Loading Program assessments.

In 2019, SCE performed 15,902 pole loading assessments in high fire areas. The remaining 2020 high fire area scope consists of approximately 2,400 poles that are difficult to access. The PLP is a one-time assessment of poles in SCE's service territory targeted for completion in 2021. After 2021, when designing to add facilities to a pole, a pole loading calculation will occur at that time to ensure the pole does not get overloaded.

5.3.4.14 Quality Assurance/Quality Control of Inspections (IN-2)

SCE's C&Q group performs an independent evaluation of activities that impact the safe, reliable, and affordable delivery of electricity. The group partners with organizations throughout the T&D organizational unit to correct quality gaps. The C&Q group assesses compliance with GO 95/128/165/174 and various SCE maintenance, inspection, and construction standards. This group typically performs over 25,000 inspections per year.

Current QC programs include inspection of distribution overhead and underground construction by SCE and contract crews. Any conditions identified by the QC program as requiring remediation will be remediated per compliance requirements or SCE internal standards. C&Q also assesses the performance quality of compliance-driven inspections programs such as ODI, Underground Detail Inspection (UDI), and IPI. In addition, the group performs quality assessments of vendor-performed pole loading calculations and assesses the performance quality of vendor-performed steel stub pole repairs.

In 2019, C&Q performed field validations of approximately 17,000 EOI inspections that were completed as part of the EOI effort in HFRA. SCE surpassed the initial goal of 7,500 due to its decision to perform additional quality reviews in areas considered to have high risk attributes. The QC inspections exceeded the requirements of GO 165.

In 2020, C&Q is finalizing and implementing a new risk-informed quality program, which will include QC assessments for inspections of distribution, transmission, and generation-related facilities in HFRA. C&Q will perform QC inspections of completed inspections for approximately 15,000 transmission, distribution, and generation structures in HFRA. The QC inspection scope will be based on risk-stratified sampling to assess the accuracy of the overhead inspections.

5.3.4.15 Substation Inspections

SCE maintains public and worker safety, and regulatory compliance, by completing scheduled inspections of its substations through its Substation Inspection & Maintenance Program (SIMP) in conformance to GO 174 and NERC reliability standards. For substation inspections per GO 174, SCE visually inspects the substation equipment and facility conditions, and documents anomalies as notifications. These notifications may or may not result in additional work.

SCE also performs maintenance and equipment testing as part of the SIMP in line with prudent utility practices. In 2019, SCE increased its inspection frequency on distribution relays in SCE's HFRA (aligning with Bulk Electric System (BES) compliance relays) by reducing the time between inspections from 12 years to six years. Additionally, SCE performed circuit breaker, relay, and battery inspections due in 2019 at the beginning of the year.

In 2019, SCE conducted 5,591 Substation inspections in accordance with the requirements of GO 174, as well as approximately 12,000 circuit breaker inspections and approximately 16,000 relay inspections as a part of regular maintenance programs. SCE will continue to perform Substation inspections in 2020 and through this WMP period.

5.3.4.15.1 Substation Failure Modes and Effects Analysis (FMEA) (IN-7)

In 2020, SCE plans to complete the FMEA study for substation assets in HFRA. The objectives of the FMEA are to:

- Identify risks associated with substation assets that could potentially ignite a wildfire (e.g., catastrophic equipment failure, vegetation or animal contact with substation equipment)
- Critically assess the adequacy of SCE's SIMP in mitigating these risks
- Determine if additional inspection and/or maintenance activities are warranted from a wildfire risk mitigation perspective

The results of the FMEA study will be used to inform potential plans for incremental substation-related work activities in 2021 and beyond, and potentially drive additional substation inspection and/or maintenance activities beyond SIMP that need to be completed in 2021 and 2022.

5.3.4.16 Generation High Fire Risk Informed Inspections in HFRA (IN-5)

In March 2019, SCE began implementing inspections of relevant generation-related assets in HFRA. These inspections included ignition-focused assessments of low-voltage ancillary assets and their associated overhead lines, supporting structures, and any exposed wiring and/or threats from vegetation that require additional mitigation. In addition, high-voltage facilities were inspected to ensure that all overhead connections from the last inspection(s) of transmission and distribution structures had been evaluated and assessed for vegetation clearance buffers, using relevant criteria from transmission and distribution inspections.

SCE performed inspections of all relevant generation assets in HFRA for a total of 449 inspections in 2019. Items requiring remediation were documented and scheduled for maintenance or repair, based upon the risk of the condition. After the gatekeeping process, a total of 243 notifications requiring remediation were identified including:

- 1 Priority 1 notification
- 88 Priority 2 notifications

- 154 Priority 3 notifications

In 2020, SCE will inspect at least 200 Generation-related assets. SCE will also work towards integrating this inspection program into the current inspection routines at these facilities to streamline field efforts. In addition, any improvements made to transmission and distribution inspection efforts will be incorporated, as applicable, to ensure consistent practices across the organization. SCE is also evaluating incorporating these assets into risk modeling efforts to determine a risk-informed approach for this work. The activity will continue through at least another full inspection cycle (currently proposed as a two-year cycle) to determine trends, assess risks, and evaluate the need for further inspections and their frequency for the long-term.

See Table 24 “Asset management and inspections” for more details on the initiatives above.

5.3.5 Vegetation Management and Inspections

Explain the rationale for any utility ignition probability-specific inspections (e.g., "enhanced inspections") within the HFTD as deemed necessary over and above the standard inspections. This shall include information about how (i.e., criteria, protocols, etc.) the electrical corporation determines additional inspections are necessary.

Describe the utility's vegetation treatment protocols relating to treatment of any vegetation that could pose a grow-in or fall-in risk to utility equipment. Include in the description the threshold by which the utility makes decisions of whether to (1) treat, or (2) remove vegetation.
Discuss the overall objectives, strategies, and tactics of the electrical corporation for vegetation management. In the discussion,

1. *Address how the electrical corporation has collaborated with local land managers to leverage opportunities for fuel treatment activities and fire break creation, and compliance with other local, state, and federal forestry and timber regulations.*
2. *Discuss how the electrical corporation identifies and determines which vegetation is at risk of ignition from utility electric lines and equipment.*
3. *Describe how (i.e., criteria, data, protocols, studies, etc.) the utility made the determination to trim any vegetation beyond required clearances in GO 95.*
4. *Describe utility plan to mitigate identified trees with strike potential, including information about how (i.e., criteria, protocols, data, statutes, etc.) the electrical corporation identifies and defines "hazard trees" and "trees with strike potential" based on height and feasible path to strike powerlines or equipment. Describe utility plan to identify reliability/at-risk tree species to trim or remove, where feasible, per location-specific criteria.*
5. *Include a discussion of how the utility's overall vegetation management initiatives address risks that may arise from trimming or removing trees, including but not limited to erosion, wind, flooding, etc.*

A full description of enhanced inspections is located in Section 5.3.4. This section will focus on SCE's Vegetation Management Program.

SCE's Vegetation Management Program has been in place for many years with the objective of meeting the requirements of GO 95, as well as other compliance requirements. These activities help minimize faults arising from vegetation contact with energized electrical facilities that result in ignitions and outages. The program includes pre-inspection and pruning that emphasize maintaining clearance compliance on trees located in proximity to SCE's electric facilities. In addition, the program performs activities such as tree removal, pole clearing, and in more recent years, weed abatement. In response to recent regulatory direction and the increased wildfire risk that California is currently experiencing, SCE's Vegetation Management Program expanded to include additional mitigation activities to reduce ignition risk that may result in wildfires.

SCE expanded its vegetation management activities within HFRA as the ignition probability increases when vegetation makes contact with utility equipment, and the probability for ignition events are expected to be higher in HFRA than in non-HFRA.

SCE's distribution and transmission lines are inspected annually for compliance with internal, state, and federal vegetation management requirements, during which vegetation may be scheduled for pruning or removal to maintain compliance. The pruning takes into consideration a tree's anticipated growth over twelve months and clearance distance are greater in HFRA than in non-HRFA. Fast-growing species, or trees in HFRA, may need additional inspections or removal to maintain compliance. Supplemental inspections and patrols target the areas of highest risk, typically during the summer growth season. SCE engages contractors to inspect, prune, and remove trees, and to abate weeds. SCE has implemented new processes, procedures, and guidelines, including technological advances and operational improvements, to respond to changes in vegetation management-related regulatory direction and increasing wildfire risk and increase the effectiveness of vegetation management activities. In addition, SCE has implemented evaluation methods that assess the risks of individual trees in order to prioritize work based on relative risk. These are described in greater detail below.

Vegetation Grow-In and Fall-In Risks

Vegetation grow-in and fall-in risks are mitigated by SCE's Transmission Vegetation Management Plan (TVMP), Distribution Vegetation Management Plan (DVMP) and HTMP. These vegetation risks will also be mitigated by SCE's Integrated Vegetation Management Plan (IVM), which is still in its early stages of development.

For distribution line voltages between 2.4 kV to 69 kV, vegetation in grow-in zones (i.e., beneath the conductors), blow-in zones (i.e., within general blow-in proximity to conductors), and side grow-in zones (i.e., adjacent to conductors) is cleared to maintain the clearance distances required by regulations. This includes, where achievable, the CPUC-recommended expanded clearances at the time of maintenance as described in Section 5.3.5.20. All fast-growing species in grow-in zones are removed if the species has the capacity to encroach into the clearance distance at the time of tree maturity; SCE has identified trees species in its service territory as either fast, medium or slow growing. Additionally, where practical and achievable, SCE removes vegetation in the drop-in zone (e.g., overhangs) within HFRA and removes or makes safe palms that have the potential to dislodge fronds.

For transmission line voltages greater than 115 kV, SCE has a "wire-zone" which is defined as the area directly beneath the conductors and includes the distance of the conductors at maximum sway condition (line dynamics). Within this zone, fast-growing species are removed if the species has the capability to encroach into the clearance distance at tree maturity. Additionally, SCE will allow only low-growing trees, shrubs and grasses within wire-zones in Tier 2 and Tier 3 HFRA. SCE is still in the process of implementing this internal standard.

For SCE's transmission and distribution vegetation management programs related to regulatory compliance (e.g., GO 95 Rule 35, CAL FIRE PRC 4293 and NERC Reliability Standard FAC-003), SCE primarily manages vegetation through pruning. SCE performs removals for fast-growing species that meet specific criteria, trees that are identified as dead, rotten, diseased, etc., trees within the compliance clearance zones in accordance with GO95 Rule 35, or if brought to the attention of SCE.

SCE is in the early stages of developing its Integrated Vegetation Management Plan (IVM). The goal of IVM is to develop sustainable shrub or grassy areas that do not interfere with overhead power lines, pose a fire hazard, or restrict access on SCE transmission rights-of-way (ROW) or applicable distribution easements. IVM promotes desirable, stable, low-growing plant habitat that will resist invasion from tall growing tree species through appropriate, environmentally sound, and cost-effective control methods. These methods can include a combination of chemical, biological, cultural, mechanical, and/or manual treatments. This approach can reduce costs over the long term and reduce the risk of outages and fires, while improving wildlife habitat.

SCE's HTMP identifies and defines "hazard trees" and "reliability trees" as trees with strike potential based on height and feasible path to strike powerlines or equipment. The HTMP assesses any tree in the HFRA utility strike zone (USZ) with the potential to strike the conductors should the tree or portion of the tree fail (e.g., any tree in the USZ that is taller than it is closer). Trees that are determined to potentially threaten electrical facilities and require management are included in SCE's tree inventory for tracking purposes. Tree management may include heavy topping, removal of limbs, or the removal of the entire tree. Evaluation and management of any potential risks that may arise from the work, such as erosion and wind shear, are included with post tree removal, inspection, and quality reviews.

Objectives, Strategies, and Tactics for Vegetation Management

The Vegetation Management Program strategy is to remove fast-growing species, as applicable, and maintain vegetation in accordance with regulation clearance distances, in addition to preventing grow-ins, blow-ins and side grow-ins. SCE's trim distances are based on the CPUC's recommended clearance distances. The Vegetation Management Program has evolved steadily from a compliance-oriented operation to one that increasingly incorporates risk management practices to evaluate vegetation management issues and prioritize work. In 2018, SCE initiated a comprehensive redesign of its Vegetation Management Department to enhance oversight and improve reporting capabilities. From 2018 to 2019, SCE improved governance plans and management oversight of vegetation management practices and the functions necessary to support the processes defined in these plans. These processes include the protocols and requirements for pre-inspections, contract management, public outreach, safety, post-work verification, and managing events. As part of this redesign, SCE, in 2020, will add staffing, implement program enhancements in areas such as work scheduling and issue management, and emphasize quality control and quality assurance activities.

SCE collaborates with local land managers in forested areas through regular discussions that take place prior to, and at the start of pruning and removal activities. These collaborative efforts allow SCE to educate land managers about its wildfire mitigation efforts and in turn SCE understands local timber disposal and sale regulations for that area. Additional efforts may be needed, however, to obtain advanced commitment from land managers. For example, SCE conducted educational presentations in 2019 to local representatives of the United States Forest Service (USFS). At a location in Inyo National Forest that was targeted for an HTMP assessment based on a concurrent fuel reduction project undertaken by USFS, the proposed measures met with resistance due to the volume of trees requiring remediation. SCE has observed similar resistance to DRI removals and deeper pruning distances in Los Angeles County areas subject to Coastal Commission regulations, including an area that had recently been through a wildfire.

SCE communicates with local communities and residents about its vegetation management plans. SCE will continue to inform communities about its vegetation management activities that will occur in local areas through the distribution of printed materials, attendance at community outreach meetings, and meetings with local officials.

Initiative Description and Implementation Overview

The following are descriptions and implementation overviews for Vegetation Management initiatives, which are summarized in Table 25.

5.3.5.1 Additional Efforts to Manage Community and Environmental Impacts

Additional efforts to manage community and environmental impacts include meeting with the city and/or the homeowner associations, scheduling and staffing public meetings, and preparing and distributing educational materials. These activities are based on the specific needs and demands of a community and may also include the use of targeted social media campaigns to increase the local public's awareness of vegetation management work taking place in the community. Finally, SCE manages impacts to the community by adjusting the pace of vegetation work to limit the number of pruning crews or the hours worked; however, these localized demands increasingly inhibit SCE's ability to keep pace with its schedule. Beginning in 2020, SCE will work with individual communities to identify how to reduce or eliminate these barriers in a way that satisfies both parties.

5.3.5.2 Detailed inspections of vegetation around distribution electric lines and equipment

SCE annually inspects for clearance around distribution conductors. These inspections are performed in accordance with SCE's DVMP, which conforms to regulatory requirements of the CPUC's GO 95 Rule 35, Rule 35 Appendix E, PRC 4292 and PRC 4293. Pre-inspections are performed to verify that clearance requirements are in accordance with regulatory requirements and program standards, and that clearance will be maintained through the annual inspection cycle. Independent quality assurance reviews and quality control inspections are performed to validate work quality and program effectiveness and to drive continuous improvement. In addition to annual inspections, for certain fast-growing species, SCE conducts additional inspections as needed to verify that there is no encroachment into the required clearance distance. For these compliance inspections, only trees that require trimming, or have been trimmed in the past, are added or maintained in the vegetation management inventory as described in 5.3.5.19.

5.3.5.3 Detailed inspections of vegetation around transmission electric lines and equipment

SCE annually inspects for clearance around transmission conductors. These inspections are performed in accordance with SCE's TVMP, which conforms to regulatory requirements of the CPUC's GO 95 Rule 35, Rule 35 Appendix E, PRC 4292, PRC 4293 and FAC-003-4, as applicable.

Pre-inspections are performed to verify that clearance requirements are in accordance with regulatory requirements and program standards, and that clearance will be maintained through the appropriate inspection cycle. Independent quality assurance reviews and quality control inspections are performed to validate work quality and program effectiveness and to drive continuous improvement (in Section 5.2, SCE describes its monitor and audit process for the WMP). For these compliance inspections, only trees that require trimming, or have been trimmed in the past, are added or maintained in the vegetation management inventory as described in 5.3.5.19.

5.3.5.4 Emergency response vegetation management due to red flag warning or other urgent conditions

Red flag warnings and conditions do not typically drive additional vegetation scope, as the impacted locations are typically too vast for a targeted response to be practical or of value. PSPS monitoring triggers general inspections of SCE facilities or assets. To the extent a vegetation hazard is identified during these inspections, crews may be called out to perform necessary pruning and/or removals. For scheduled work, a red flag warning may trigger additional steps or limitations beyond the use of fire suppression materials that are always required in HFRA. For example, during a PSPS "period of concern", all non-emergency work that may cause sparks, such as pruning, is ceased until the period is over.

5.3.5.5 Fuel management and reduction of "slash" from vegetation management activities

SCE reduces slash (e.g., cut limbs and other woody debris) from vegetation management activities by chipping and then hauling the material away to be disposed or recycled by pruning/removal contractors. Some of SCE's vegetation programs, such as DRI, send its debris to a biomass plant.

SCE's weed abatement program focuses on SCE-owned property and transmission ROWs, keeping them clear of brush and other live fuel plants.

5.3.5.5.1 Expanded Pole Brushing (VM-2)

SCE continues to expand its pole brushing (pole brush clearance around poles) activities to inspect and clear brush to a 10-foot radial clearance on distribution poles in HFRA, beyond those requiring brushing per PRC Section 4292.

Expanded pole brushing was a goal in the 2019 WMP. SCE's goal was to perform 25,000 additional pole brushes beyond the quantity required for its PRC 4292 pole population. SCE exceeded its 2019 pole brushing goal by performing 89,236 pole brushes beyond those required by PRC 4292. SCE estimates that the quantity of distribution poles that will be brushed in 2020 and subsequent years will be between 200,000 to 300,000 each year.

5.3.5.5.2 Expanded Clearances for Legacy Facilities: (VM-3)

In addition, SCE is evaluating several legacy facilities, many in proximity to historic hydroelectric generation facilities, as recommended in findings from the 2019 inspection efforts. The age of these facilities, proximity to densely forested areas, and (as designed at the time) the smaller setback distances and easements pose challenges to address additional mitigation opportunities. Addressing the State's recommended CAL FIRE clearances pursuant to PRC 4291 and PRC 4293 at these facilities will require a multi-year program of assessments, seeking agency approvals, and remediation. In 2020, SCE plans to perform assessments of all identified facilities in HFRA and establish enhanced buffers at 30% of identified facilities.

5.3.5.6 Improvement of inspections

SCE's TVMP and DVMP are developed to meet and often exceed the regulation requirements. SCE's QC Program performs inspection sampling to determine the overall effectiveness of the vegetation management program and the effectiveness and performance of SCE's vegetation contract workforce. Based on the results of QC inspections, SCE provides timely feedback to contractors in order to drive continuous improvement. SCE delivers annual training to SCE Vegetation Operations personnel and contractors (typically the lead personnel). SCE will evaluate the performance of the inspectors used for HTMP as part of its QC process in 2020 and beyond. See also QA/QC process in 5.3.5.13.

5.3.5.7 LiDAR inspections of vegetation around distribution electric lines and equipment

LiDAR vegetation inspections are typically not performed around distribution electric lines and equipment, but SCE completed some LiDAR data capture around distribution facilities in 2019 for the purpose of determining geospatial locations and long spans. SCE is evaluating whether this data can be incorporated into its routine vegetation management inspection process.

5.3.5.8 LiDAR inspections of vegetation around transmission electric lines and equipment

SCE utilizes LiDAR technology to inspect select transmission and sub-transmission lines with respect to FAC 003-4, GO 95-Rule 35 and PRC Section 4293, to maintain appropriate clearances between SCE's lines and vegetation. LiDAR technology measures the distance to a target by illuminating the target with pulsed laser light and measuring the reflected pulses with a sensor. Differences in laser return times can then be used to make digital three-dimensional representations of the target. LiDAR technology is effective at assessing vegetation clearances, particularly in rugged and hard-to-access areas where foot patrols may not be feasible.

LiDAR technology was successfully implemented and operationalized in 2019. SCE had a goal in its 2019 WMP to perform LiDAR on 1,000 HFRA circuit miles, which SCE exceeded by performing LiDAR on 1,559 circuit miles. The data acquired from the 2019 LiDAR inspections will be used to determine when future LiDAR flights may be required based on vegetation density. SCE will continue using LiDAR technology as needed for vegetation management.

5.3.5.9 Other Discretionary Inspections of Vegetation Around Distribution Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

See Sections 5.3.5.16.1 and 5.3.5.16.2 for inspections related to HTMP and DRI.

5.3.5.10 Other Discretionary Inspections of Vegetation Around Transmission Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

See Sections 5.3.5.16.1 and 5.3.5.16.2 for other discretionary vegetation inspections.

5.3.5.11 Patrol Inspections of Vegetation Around Distribution Electric Lines and Equipment

SCE performs supplemental vegetation inspections in HFRA, such as Canyon Patrols, At-Risk Circuit Patrols, and Operation Santa Ana. Canyon Patrols are performed annually to verify that certain circuits located in canyons are free from vegetation encroachments into the minimum vegetation clearance distance. At-Risk Patrols are performed on circuits that have a history of multiple vegetation-caused circuit interruptions. Operation Santa Ana is a joint patrol effort with state and local fire authorities to perform patrols of overhead powerlines in the HFRA. These patrols focus on electrical facilities and adherence to PRC Section 4292 and 4293 vegetation-related requirements.

5.3.5.12 Patrol Inspections of Vegetation Around Transmission Electric Lines and Equipment

See Section 5.3.5.11, above.

5.3.5.13 Quality Assurance / Quality Control of Inspections (VM-5)

SCE has a three-tiered, in-depth, oversight strategy to assess program effectiveness, contractor and subcontractor performance, and to drive continuous improvement on both the program and individual performance levels. The approach includes activities such as comprehensive internal work verification, independent QC and several QA assessments.

QC of HFRA circuit miles was a performance metric in the 2019 WMP. SCE's 2019 goal was to perform QC of 450 Distribution circuit miles and 400 Transmission circuit miles. SCE exceeded its 2019 assessment goal by performing QC of 2,155 Distribution circuit miles and 870 Transmission circuit miles. SCE plans to perform QC of 3,000 risk-informed HFRA circuit mile inspections per year in years 2020 to 2022.

5.3.5.14 Recruiting and Training of Vegetation Management Personnel

SCE continues to expand its vegetation management workforce. Historically, Vegetation Management has been an operational activity. In 2019, a "Compliance and Operational Support" department was added to Vegetation Management to drive program enhancements and efficiencies. In late 2019, the Program was reorganized into four distinct departments: Operations; Resource Planning and Performance Management; Long Range and Strategic Planning; and Compliance. The reorganization also generated new positions and vacancies for which SCE is now actively recruiting and staffing. SCE will continue to evaluate the effectiveness of the reorganization and adjust as needed. SCE provides annual training to all Vegetation Management operations personnel and contractors, where participants acquire a better understanding of the regulations, how to implement any SCE-specific requirements, and additional efforts and commitments made by SCE for vegetation management through programs such as the WMP.

5.3.5.15 Remediation of At-Risk Species

In addition to its criteria for mitigating trees that are at risk of striking SCE's facilities, SCE's HTMP has a separate set of criteria for mitigating palms that have the potential to strike SCE's facilities. SCE's vegetation management program manages work based on regulatory clearance requirements and growth-rates (fast, medium and slow) where additional measures are needed for fast-growing species, as applicable. All fast-growing species in grow-in zones (area directly beneath the line) are removed, if possible, if the species has the capacity to encroach into the clearance distance at the time of tree maturity. Where practical and achievable, SCE removes vegetation in the drop-in zone (e.g., overhangs) within HFRA and removes or makes safe palms that have the potential to dislodge fronds; however, SCE is still in the process of implementing these activities.

5.3.5.16 Removal and remediation of trees with strike potential to electric lines and equipment

5.3.5.16.1 Hazard Tree (VM-1)

The decision to recommend removal of trees that are not dead or dying is based on the professional opinion of a certified arborist. SCE's hazard tree risk assessment methodology is based upon the American National Standards Institute (ANSI) standard A300 for tree care operations and the International Society of Arboriculture (ISA) Tree Risk Assessment Qualification Training Manual, which provides more hazard tree detail than contained in the CAL FIRE Powerline Fire Prevention Field Guide. SCE's assessment methodology considers the tree attributes, the site conditions, impact to the infrastructure, and the likelihood of failure.

HTMP assessments are performed by trained and knowledgeable individuals. In HFRA, SCE defines all trees within the USZ that have the potential to strike the conductors or fall within the Minimum Violation Clearance Distance (MVCD) as "subject trees". After assessment, a subject tree can remain a "subject tree" or be classified as a "hazard tree" or "reliability tree". A hazard tree has conditions within the tree that poses an expected risk to electrical facilities. A reliability tree is considered a healthy tree but is located in an area where site conditions pose an expected risk. Both hazard and reliability trees are risk-ranked and removed based on expected risk to the infrastructure. SCE utilizes a HTMP Tree Risk Calculator developed using industry methodology to determine a risk score for each tree assessed (variables included in risk score discussed below). SCE then prioritizes the appropriate management based on the risk score of each individual tree. Tree management may include heavy topping, removal of limbs, or the removal of the entire tree. Post-inspection of all work prescribed by a tree assessment inspector is performed by an independent quality control contractor. Evaluation and management of any potential risks that may arise from the work, such as erosion and wind shear, are included with post tree removal, inspection, and quality reviews.

CAL FIRE's Powerline Fire Prevention Field Guide (CAL FIRE Field Guide) discusses tree defect attributes for root rot, leaning trees, exposed root systems and heart rot. SCE's HTMP tree-risk calculator includes criteria for leaning trees and the same tree defects contained in the CAL FIRE Field Guide, yet contains a more comprehensive list of tree defects that includes, but is not limited to: codominant tops (small, moderate, large); insect or mistletoe infestation (nuisance, moderate, severe); rot (minor, moderate, prevalent, major); and, exposed or girdling roots (minor, moderate, serious).

The certified arborist evaluates these site conditions and tree defects in proximity to the target and SCE's infrastructure and derives a "likelihood of failure" and "likelihood of impact." Likelihood of failure includes attributes for tree height, tree age, site conditions, tree lean, and tree defects. Likelihood of impact includes attributes for line voltage impact and fire impact. SCE will continue assessing the structural condition of trees in HFRA that are not dead or dying but could nevertheless fall into, or otherwise impact, electrical facilities and potentially lead to ignitions and outages.

Hazard tree assessments and removals were a goal in the 2019 WMP. SCE's goal was to perform 125,000 assessments and to perform 7,500 removals. SCE achieved its 2019 assessment goal by performing 129,485 risk-based tree assessments. Of the 129,485 assessments performed, 16,078 trees (12.4%) were prescribed for removal which exceeded SCEs target removal quantity of 7,500 trees. However, despite identifying 16,078 trees for removal, SCE was unable to achieve its removal targets due to the inability to gain timely permission to perform the removals and slower-than-expected onboarding of contractors needed to perform the required removals. SCE was able to remove 5,917 (4.6%) trees in 2019. For 2020, the HTMP assessment volume targets decreased from 125,000 in the 2019 WMP to 75,000 in the 2020-2022 WMP, primarily due to the following three reasons:

1. In 2019, SCE faced significant challenges with attracting and retaining ISA-certified professionals to perform assessments, given the high demand for arborists in California and nationally.
2. Additionally, the productivity rate of trees assessed per day varied greatly due to differences in terrain and tree density. Although SCE was able to achieve its 2019 goal of 125,000 assessments, it required regularly relocating assessors from lower productivity areas to forested areas where higher productivity could be achieved. While all areas assessed included circuits that represented significant wildfire risk, there will be less flexibility with locations as areas are completed.
3. Finally, the delays in tree removal in 2019 have resulted in an inventory of over 10,000 trees that now require management. Tree pruning/removal crews are also in high demand across the state and draw from the same pool as those who perform compliance distance trimming, creating labor constraints. Given the limitations on the actual mitigation, there is no benefit in pursuing higher volumes through increased resources.

The 2020-2022 target of 75,000 assessments per year was set based on the average number of assessors with established availability and achievable assessment productivity.

The tree-specific risk assessment identifies if the tree should be mitigated to remove an expected risk. SCE will include, for tracking purposes, trees in its tree inventory that are considered potentially threatening to electrical facilities and require management such as heavy topping, removal of limbs, or the removal of the entire tree. An independent QC contractor performs post-inspection of all work prescribed by a tree assessment inspector. Post-tree removal, inspection and quality review includes evaluation and management of any potential risks that may arise from the work, such as erosion and wind shear.

5.3.5.16.2 Drought Relief Initiative (DRI) (VM-4)

SCE established this initiative due to an epidemic of dead and dying trees brought on by climate change and years of drought. Under its DRI, SCE conducts periodic inspections in Tier 2 and Tier 3 HFRA for tree mortality to identify and remove dead, dying, or diseased trees affected by drought conditions. As part of SCE's ongoing DRI program, SCE performs all annual inspections in accordance with program requirements and removes 94% of active inventory within six months. Active inventory reflect trees for which SCE has both access and authorization to perform the removal. DRI assessments and removals was a goal in the 2019 WMP, and SCE performed all required assessments and completed 13,347 removals.

5.3.5.17 Substation inspections

SCE performs substation inspections in accordance with CPUC GO 174 requirements. Although not specifically referenced in GO 174, SCE monitors substations for vegetation management and conducts inspections of substation perimeter fencing for encroachment.

5.3.5.18 Substation vegetation management

SCE manages vegetation in proximity to substation equipment, as well as outside the fence line for encroachment or fall in risk by performing pruning, removal, and weed abatement

5.3.5.19 Vegetation inventory system

SCE maintains several digital tools for Vegetation Management, including Collector/Survey 123 for compliance inspections and FULCRUM for HTMP. These digital tools are centralized and updated daily with inspection results. The digital tools for compliance, at a minimum, keeps inventory of the species, GPS location, species growth rates (slow, medium, fast), and inspection/trim history. The digital tools for HTMP keeps inventory of the species, GPS location, tree identification (i.e., subject, hazard, reliability tree) and applicable documentation on the assessment performed by the qualified tree-risk assessor.

SCE is focused on deploying an integrated vegetation management platform that includes process orchestration, automation, mobile tools and an integrated repository across all programs that will allow for collaboration with customers, arborists, environmental regulators, and utility regulators to achieve the right trim at the right time. Integrating programs onto a single platform will enhance efficiency, risk modeling, communication, reporting, planning and scheduling. The program will be initially focus on hazard tree and DRI with an expected goal of delivering across all wildfire related vegetation activities by end of 2022.

5.3.5.20 Vegetation management to achieve clearances around electric lines and equipment

Vegetation management activities to maintain clearance distances from transmission and distribution lines and equipment are conducted in HFRA and non-HFRA. In HFRA, this work includes three distinct activities:

1. Expanding clearances, where achievable, to 12 feet for lines under 72 kV, 20 feet for lines under 110 kV, and 30 feet for lines over 110 kV (initial deeper trim for any

particular tree). SCE has adopted this standard in HFRA based on recommended clearances in D.17-12-024. This activity not only increases the amount of trimming on trees that were previously trimmed, but increases the number of trees that need to be trimmed or removed.

2. Maintaining 12, 20, or 30 feet clearances from SCE's lines for trees that have previously been trimmed to these distances, and
3. Maintaining 4 feet clearances per D.17-12-024 minimum requirements where SCE cannot achieve deeper trims due to operational constraints.

All three of these activities in HFRA are for wildfire mitigation and reducing the probability and consequence of potential ignitions. SCE's line clearance forecasts include these three activities in HFRA. The forecasts included are subject to change as there are considerable uncertainties associated with the scope of work (number of trees trimmed or removed). Although risk analysis is guiding some line clearance activities, the line clearance scope in HFRA is driven by Commission requirement and recommendations to mitigate wildfire risks and not informed by RSE estimates.

As discussed earlier, SCE performs annual inspections for clearance around conductors in accordance with applicable regulations such as GO 95 and SCE's TVMP and DVMP. Independent parties perform QA reviews and QC inspections to validate work quality and adherence to internal program and regulatory requirements.

Vegetation Management Long-Term Strategy

SCE's Vegetation Management Program will continue to evolve over the next 10 years and many factors will be considered, such as enhancing work practices from lessons learned and exploring new technologies and methods. These improvements will be focused on reducing ignition risk related to vegetation near SCE's facilities in HFRA. SCE anticipates that over time it will:

1) consider and likely adopt more comprehensive use of technology such as LiDAR to add efficiency or replace current foot patrols and more predictive analytics capability such as artificial intelligence to improve its risk prioritization and resource allocation methods;
2) further integrate programs across and potentially outside the organization to minimize vegetation-related work that can overlap across large geographic areas;
3) continually implement enhancements to how SCE identifies, tracks, and remediates fast-growing tree species; and
4) likely implement an integrated vegetation management software solution.

SCE also anticipates continued resource challenges for certified arborists and tree crews and is developing programs, collaborations, and partnerships to help reduce these constraints.

See Table 25 "Vegetation management and inspections" for more details on the initiatives above.

5.3.6 Grid Operations and Protocols

For each of the below initiatives, provide a detailed description and approximate timeline of each, whether already implemented or planned, to minimize the risk of its equipment or facilities causing wildfires. Include a description of the utility's initiatives, the utility's rationale behind each 5-106 of the elements of the initiatives, the utility's prioritization approach/methodology to *determine spending and deployment of human and other resources, how the utility will conduct audits or other quality checks on each initiative, how the utility plans to demonstrate over time whether each component of the initiatives is effective and, if not, how the utility plans to evolve each component to ensure effective spend of ratepayer funds.*

Grid Operations is responsible for monitoring and operating SCE's electric system. During significant events, Grid Operations personnel are responsible for the real-time operation of the system and coordinating activities with external agencies such as fire agencies and emergency response personnel. Grid Operations is also responsible for applying System Operating Bulletins (SOB), which encompass operating protocols, remedial actions, communication and notification protocols, ratings and limits of lines and equipment, and system protection schemes. Qualified employees (e.g., Troublemen, Senior Patrolmen, Foremen, or Field Supervisors) may contact Grid Operations at any time to request a line or line segment be temporarily de-energized or place sectionalizing equipment into "non-automatic" recloser settings to promote public and employee/contractor safety. To reduce power line ignitions during extreme weather conditions, overhead transmission, sub-transmission, and distribution lines and line sections are subject to operating restrictions described in Section 5.3.3.

5.3.6.1 Automatic recloser operations

SCE deploys certain protective devices, such as remote-controlled automatic reclosers (RAR) and circuit breaker (CB) relays, on overhead systems in HFRA to enable recloser relay blocking and Fast Curve settings in response to weather events. These deployments are conducted in accordance with SCE's SOB 322 and the protective devices are configured in response to weather events such as RFWs declared by the National Weather Service, as well as Fire Weather Threat (FWT) and Thunderstorm Threat (TT) declared by SCE's Incident Commander, and other high wildfire risk conditions.

At the onset of SCE's system hardening efforts, as described in Section 5.3.3, SCE's goal was to maintain reclose functionality for portions of circuits outside of the HFRA by installing RARs, where feasible, just outside the HFRA boundaries to provide Fast Curve setting capabilities. This would reduce fault energy, strengthen reliability benefits, and increase PSPS sectionalizing abilities by providing the capability to de-energize the circuitry within the HFRA independently from non-HFRA circuitry.

During the scoping effort, SCE identified several scenarios where overhead RARs do not completely eliminate exposed energized conductors in SCE's HFRA during a PSPS event. For example, in situations where a line is first underground when entering into the HFRA and then rises to overhead, an overhead RAR mitigates fire risk for the overhead line downstream from the RAR, but would not effectively mitigate fire risk associated with upstream overhead equipment, such as disconnect switches, jumpers and overhead conductor. Additionally, many circuits that were primarily located outside of HFRA only crossed into HFRA for a handful of spans. In these cases, the RAR would provide limited or no ability to de-energize conductors on portions of the circuits traversing HFRA during a PSPS event. To overcome these barriers in using RARs, SCE installed a mix of overhead and underground RCSs and applied Fast Curve settings at the substation CB to provide fault energy reduction. These actions facilitated additional "sectionalization," which is key to eliminating all energized conductors within impacted HFRA during a PSPS event.

5.3.6.1.1 Annual SOB 322 Review (OP-1)

Historically, Grid Operations performed an annual review of SOB 322 and made updates as needed to provide better guidance to system operators, substation operators, and field line employees on the safe operation of circuits that traverse HFRA during an elevated weather threat. However, over the past few years, it became clear that SOB 322 needed to be updated more frequently. The evolving wildfire threat, together with lessons learned from actual weather threats and PSPS events and its desire to integrate more risk-based operational protocols, led SCE to take a continuous improvement approach to revising SOB 322. In 2019, SOB 322 became more of a living document, which was reviewed on a continuous basis through the year and revised (published) several times to increase operational effectiveness and safety while also minimizing the impact of outages on SCE customers. Although a significant amount of organizational change management support was needed to ensure the understanding, adoption, and execution of the new or modified operating procedures, SCE feels this is the best approach given the current environment.

SCE completed the 2019 WMP goal of reviewing and updating SOB 322 to reflect lessons learned from past elevated fire weather threats and integrate, where applicable, new and improved data from its situational awareness resources. Table SCE 5-8 summarizes the SOB 322 revisions.

Table SCE 5-8
SOB 322 Revisions

Revision Category	Revision Description
Fire Weather Threat Declarations and Definitions	• Created an Elevated Fire Weather Threat (EFWT), enabling operating restrictions prior to issuance of a Red Flag Warning • Changed declaration of an EFWT to be by switching center and county (not across the entire county) • Created protocol around using a PSPS Watch List during EFWT declaration, which would place operating restrictions on only the lines listed rather than the switching center and county as a whole, thereby reducing outage impacts on customers not impacted by identified weather threats • Replaced Elevated Fire Weather Threat (EFWT) with FWT to disassociate the general threat declaration from varying wildfire/storm threat levels • Created a new TT which will be treated similarly to an RFW
Operational Enhancements and Clarifications	• For safety purposes, clarified that only certain devices shall be operated to de-energize lines or line segments for PSPS • Clarified when single-phase switching and normal switching protocols are allowed

Revision Category	Revision Description
	• Added additional process flow diagrams that clarify the operation of reclosers and outage management procedures • Added new requirement to open all downstream RARs during extended PSPS outages
Transmission Protocols	• Added transmission lines as being in scope and subject to operating restrictions, including considerations for PSPS • Revised the list of transmission circuits that traverse HFRA • Added that operating restrictions on transmission circuits would not be automatic when an RFW or FWT has been declared, and requires a more detailed assessment • Provided guidance on manually blocking non-automated transmission reclosers • Added new protocol for PSPS proximity threat, which places operating restrictions on transmission lines that are in proximity to distribution lines listed on the PSPS monitor list • Added that transmission line operating restrictions could be included under a TT • Expanded to include blocking transmission reclosers for the Switching Center/county affected during an FWT declaration
Roles and Responsibilities	• Added requirement for Grid Control Center (GCC) manager to review transmission lines subject to SOB 322 • Added new role to IMT to focus on transmission reliability during events • Added step for GCC transmission dispatcher to notify the reliability coordinator, CAISO and neighboring entities when PSPS has been initiated for transmission lines • Shifted some GCC manager duties to the IMT Incident Commander
Miscellaneous Updates, Clarifications, Resources	• Changed reference of PSPS monitoring to PSPS live field observations • Added PSPS circuit watch list to SharePoint for easy reference • Added language on the PSPS proximity tool, responsibility for updating the tool, and overall use of the tool during real time operations • Changed Red Flag Fire Prevention Program to Work Restrictions During Fire Weather Conditions Program • Added clarity on default resources if online versions are unavailable • Moved, expanded, or retitled various sections to improve flow and/or organization

Every weather threat event, whether SCE proactively de-energizes lines or not, is an opportunity to learn and improve the protocol. SCE desires to learn from these events, while also formalizing and standardizing protocols, where possible, to gain as much consistency and rigor in its operational protocols, knowing that every event is different and, at times, requires flexibility for unforeseen conditions to ensure safe operation. SCE will continue to revise the protocol to include, as applicable, new and improved situational awareness data, improved threat indicators, and applicable regulatory requirements.

5.3.6.2 Crew-accompanying ignition prevention and suppression resources and services

Except in limited cases where required for planned project work operating under a federal or state license or permit (e.g., USFS Master Special Use Permit), SCE does not utilize crew-accompanying ignition prevention and suppression resources and services. In all other instances, SCE mitigates the risk for crew-caused ignitions by employing the work restrictions protocol described in this section.

Under the prior work methods, emergency and non-emergency work could proceed during all fire weather conditions, including extreme as long as the crews had mitigations (water backpack, shovel, etc.) in place. The requirement to carry this mitigation equipment was triggered by the RFW.

In the new protocol, mitigations (water backpack, shovel, etc.) are still required when working on impacted circuits during moderate fire level threat (earlier trigger than RFW). Additionally, all work must be cancelled and rescheduled for impacted circuits under elevated fire weather threat. Mitigations are no longer tied to RFW and are aligned with FWT. This allows SCE to be more precise and focused on where restrictions are applied.

5.3.6.3 Personnel work procedures and training in conditions of elevated fire risk

During significant events, Grid Operations personnel act as SCE’s accountable representatives in matters concerning the real-time operation of the system and coordinate activities with external agencies such as emergency response personnel. Grid Operations is also responsible for applying System Operating Bulletins (SOB), which encompass operating protocols, remedial actions, communication and notification protocols, ratings and limits of lines and equipment, and system protection schemes. Qualified employees (e.g., Troublemen, Senior Patrolmen, Foremen, or Field Supervisors) may contact Grid Operations at any time to request a line or line segment be temporarily de-energized or place sectionalizing equipment into “non-automatic” recloser settings to promote public and employee/contractor safety.

SCE also developed the Work Restrictions During Elevated Fire Conditions Program, (formerly known as the Red Flag Fire Prevention Program), to restrict or delay field work. This program applies to both SCE employees and contractors and is intended to reduce their risk of causing an ignition during the normal course of work in HRFA when the weather and fuel conditions are more susceptible to fire ignitions.

5.3.6.4 Protocols for PSPS re-energization

When fire risk conditions subside to safe levels and safe conditions are validated by field resources, SCE will begin patrolling impacted circuits to check for any condition that could potentially present a public safety hazard when re-energizing circuits. Once field resources confirm that it is safe to re-energize the circuit(s), power will be restored, and public safety partners and customers will be notified of re-energization. The order in which circuits are re-energized will depend on many factors including, but not limited to, customer safety and well-being, consideration of affected essential services, damage to electrical and other infrastructure, and circuit design/topology.

5.3.6.5 PSPS Events and Mitigation of PSPS impacts

SCE's trained and qualified IMTs manage PSPS events out of SCE's Emergency Operations Center (EOC). SCE also utilizes operational resources to plan, oversee and execute field deployments in support of PSPS protocols (*e.g.,* pre-patrols, live field observations and re-energization patrols) and may deploy mobile generators to critical infrastructure, public safety partners or customer locations during an event.

SCE is committed to aggressively pursuing mitigations to minimize the PSPS impacts felt by the public. For example, SCE will utilize engineering analysis to identify opportunities, such as installing additional sectionalizing devices or automating existing ones, that will keep customers energized during PSPS events, wherever possible. SCE is also exploring a microgrid pilot program (see Section 5.3.3.8.2). In locations where customers are directly fed by overhead circuits in HFRA and cannot be isolated, SCE will continue raising risk tolerance by performing grid hardening activities that increase de-energization wind speed triggers. Examples of these grid hardening efforts include targeted installation of covered conductor and circuit undergrounding, which are described in greater detail below. Although PSPS events may be less frequent over time as SCE increases its system hardening, PSPS will have to remain available as a tool for wildfire mitigation.

New PSPS Mitigation Approach: Circuit-specific Evaluation and Planning

Beginning in 2020, SCE plans to implement a circuit-specific evaluation and planning that would result in the development of a circuit-specific mitigation plan for each circuit impacted by PSPS. This approach would first prioritize circuits for mitigation by considering factors such as the nature of the PSPS outages and the types of customers impacted. Secondly, each circuit would be individually evaluated for potential mitigations. The circuit evaluation process involves the evaluation of grid hardening mitigations to reduce the frequency of PSPS events, the evaluation of solutions to keep certain locations energized during PSPS events, with the ultimate goal to reduce the impact of PSPS on as many customers as possible.

For all PSPS-impacted circuits: Evaluation of grid hardening mitigations to reduce the frequency of PSPS events

SCE initiates PSPS events when wind speeds exceed certain threshold values. Thresholds are based upon a number of risk factors, such as the condition of the physical assets that comprise a given circuit. To reduce the expected likelihood of PSPS events, SCE will evaluate whether a given circuit has opportunities to replace or repair particular assets to improve the overall integrity of the circuit and raise the trigger for the circuit. The specific mitigations deployed to reduce PSPS events are generally the same mitigations deployed to reduce wildfire ignition risk and may include the following: accelerating minor repairs that would otherwise be scheduled according to a 6-month or 12-month compliance obligation, replacing/upgrading assets to improve resiliency, remediating long spans, and deploying covered conductor. In the long-term, SCE plans to deploy such grid hardening technologies throughout the system. For this effort, deployment is prioritized to specifically target communities most impacted by PSPS. The specific types of mitigations may evolve as SCE's risk models evolve and are updated to improve the PSPS trigger calculations.

For select locations: Evaluation of solutions to keep certain locations energized during PSPS events.

This evaluation applies to the same two specific types of locations discussed in the PSPS Resiliency Microgrid Pilot[30] namely: (1) a location within the HFRA that has underground service, or (2) a location outside of the HFRA that is served by an overhead line running through HFRA. SCE will evaluate each PSPS-impacted circuit for such locations. When locations are identified, SCE will evaluate a range of potential options, including the following:

- Evaluate opportunities for switching procedures using the existing system. Such procedures will reduce the number of customers impacted by PSPS events.
- Evaluate opportunities to deploy lower cost projects to reduce customers impacted. For many circuits, SCE can reduce the number of customers that must be de-energized during an event by increasing the sectionalization of the circuit. SCE will evaluate each PSPSimpacted circuit for such opportunities and has already deployed a number of assets to increase sectionalization.
- Evaluate higher-cost capital projects. Such projects could include deploying a microgrid, deploying temporary backup generation (to provide power to the entire circuit segment),or deploying a new underground circuit. SCE will evaluate the cost-effectiveness of such projects. Given their higher capital cost, SCE expects that a small number of such projects will be deployed.
- Evaluate customer-side solutions. SCE is exploring additional customer programs, including programs designed to provide generation to targeted facilities that provide support for a community. In particular, SCE is exploring the potential to provide back-up generation, to not only designated Community Resource Centers, described below, but also for certain commercial and government customers that provide important services to the community. To the extent the grid-side mitigations described above are not feasible, SCE intends to deploy customer-side solutions, where possible, to benefit those communities.

5.3.6.5.1 Community Resource Centers (PSPS-2)

SCE has augmented its mobile Community Crew Vehicles by partnering with facilities around the territory and establishing Community Resource Centers (CRCs). These CRCs are located both outside the HFRA (urban), and within the HFRA (remote), with the main difference being that the urban sites will not be impacted by the de-energized circuit, while the remote CRC would be impacted and rely on site resiliency (backup generation capability). SCE is currently under contract with Transform Holdco LLC (THC), parent company for Sears and Kmart stores, to utilize designated stores (urban) as CRCs during PSPS events. In addition to the retail stores, SCE will continue to onboard new CRCs (remote) in HFRA (Tier 2 & 3), including sites with backup generation capability.

[30] *See* SCE's Resiliency Proposal and Response to ALJ Ruling, filed January 21, 2020, p. 6, http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M325/K544/325544944.PDF

SCE's original CRC strategy included a total of 15 urban and 35 remote CRCs by 2021. In 2020, SCE plans to have 23 sites available across SCE's service territory for customers impacted by a PSPS. SCE is reassessing this strategy to include improved coverage based on weather and circuit data history. SCE anticipates that the final CRC recommendation will be approved in early 2020 (post-2020-2022 WMP submission) followed by activities to establish the CRCs.

SCE's CRC refresh strategy will include "pop-ups." Pop-up sites are locations that become available through communities and agencies, often on an as-needed basis with limited pre-planning. These sites could be indoor facilities not under contract between SCE and the third party, offered to SCE for PSPS use, and can include parking lots, as well as established indoor facilities.

SCE has enabled (ready for activation) 13 CRCs and is continuing to expand the list. SCE continues to learn from the 2019 wildfire season and related PSPS activity, including identifying the need for improved external coordination and additional resources, such as, but not limited to, blankets, bulk water, ice, etc. SCE will incorporate these lessons learned into its CRCs that get rolled out in 2020.

5.3.6.5.2 Customer Resiliency Equipment Incentives (PSPS-3)

SCE is developing a customer resiliency equipment incentive program that provides financial support to customers willing to increase resiliency within HFRA. This program targets customers who already have solar and storage, or will be adding such capabilities to their sites, and are willing to island and redirect the energy in the storage battery to a designated building on site for use during PSPS or other emergencies. These facilities are required to be open to the public during PSPS events or other emergencies. The majority of customers that have these features at their sites are larger entities such as schools, local government facilities, and large retailers. The islanding allows the use of the designated building as a powered CRC in HFRA. SCE is currently in the process of setting up a pilot for this program based on two types of customers: 1) customers that already installed solar and storage capabilities (retrofit design) and 2) customers that have solar and are in the process of adding storage (upfront design). The purpose for the two configurations is to learn about the complexity of the islanding design, costs, and customer participation. SCE plans to learn from its pilots in 2020 to determine what modifications may be needed in 2021 and beyond. In 2020, SCE plans to implement one pilot.

5.3.6.5.3 Income Qualified Critical Care (IQCC) Customer Battery Backup Incentive Program (PSPS-4)

In 2019, SCE began developing an incentive program for its IQCC Medical Baseline customers that would fully fund the cost of a battery-powered portable backup solution to operate critical medical equipment for up to 24 hours during power outages due to PSPS events or other emergencies. Subsequently, in October 2019, Governor Newsom signed SB 167 into law, which authorizes electrical corporations to deploy backup electrical resources or provide financial assistance for backup electrical resources to those customers receiving medical baseline allowances and who meet specified requirements. Given the emphasis on assisting these customers during a PSPS event, priority will be given to income qualified critical care customers living in SCE's HFRA. In 2020, SCE plans to identify approximately 2,500 customers that it will target for this program.

5.3.6.5.4 MICOP Partnership (PSPS-5)

In 2019, SCE expanded its partnership with the nonprofit organization Mixteco/Indigena Community Organizing Project (MICOP) to develop and conduct culturally appropriate and in-language outreach to educate indigenous communities in Ventura County about emergency preparedness and PSPS.

MICOP will utilize its local radio station, Radio Indigena 94.1 FM, to broadcast public service announcements (PSAs) and informative segments to educate indigenous individuals who have limited English proficiency and are living and working in the Oxnard area on how to prepare for emergencies and potential PSPS events. On-air content will be delivered in three indigenous languages: Mixteco, Purapecha, and Zapoteco. MICOP will also coordinate direct education and outreach with community members including agricultural farm workers, and through MICOP-hosted community meetings, health fairs and local school events. Direct outreach began in the fourth quarter of 2019. SCE expects this partnership to improve its ability to provide important wildfire safety information to this population. SCE will evaluate and assess the effectiveness of this partnership in reaching and informing the growing indigenous population in its HFRA to determine if any modifications are needed and (although SCE anticipates it will) whether to continue it into 2021 and beyond. The planned Access and Functional Needs (AFN) outreach activities will be closely monitored and adjusted as needed through regular meetings with the nonprofit. Progress reports will help to determine sustained and future outreach efforts beyond 2020.

5.3.6.5.5 Independent Living Centers Partnership (PSPS-6)

In 2019, SCE established partnerships with seven 2-1-1 service providers[31] and eight designated independent living centers (ILC) across the service territory to prepare access and functional needs (AFN) communities for PSPS. The ILCs are dedicated to increasing independence, access and equal opportunity for people with disabilities. Collectively, they provide direct services to Inyo, Kern, Los Angeles, Mono, Orange, Riverside, San Bernardino, Santa Barbara and Ventura Counties.

These partnerships will incorporate and leverage the subject matter expertise of AFN advocates and members of the AFN community to ensure education and outreach are appropriate, accessible and impactful. Outreach will promote enrollment of medical baseline and critical care customers to augment advance notifications for PSPS events and will include at least 10 workshops/trainings to provide preparedness education and assistance in applying for the Medical Baseline Program.

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[31] 211.org is a free and confidential service (with 180 languages supported) that helps people across North America find local resources they need 24 hours a day, seven days a week, http://211.org/

The planned AFN outreach activities will be closely monitored and adjusted as needed through regular meetings with individual ILCs, as well as larger convenings with all eight ILCs. These monitoring activities, along with progress reports submitted by each nonprofit, will help to determine sustained and future outreach efforts beyond 2020.

5.3.6.5.6 Community Outreach (PSPS-7)

To minimize the impacts to customers that are affected by PSPS activations, SCE will coordinate with local emergency management agencies (when possible) to deploy community response vehicles to affected communities. These vehicles provide customers access to basic amenities such as water, snacks and portable charging devices along with trained staff that can provide real-time information on PSPS events. SCE has designed and outfitted five cargo transit vans as Community Crew Vehicles (CCVs) with the required equipment and technology to enable SCE staff to transport water, snacks, portable charging devices, lights, and other amenities.

SCE is also employing a variety of targeted communication channels to ensure that customers are notified in a timely manner. For example, Nextdoor, a neighborhood online forum to exchange helpful information, goods, and services has 2.5 to 3.0 million verified users in SCE's service territory that can be targeted by region, county, city, circuit, or neighborhood. The Nextdoor platform allows city, county, state and now, private utility organizations to build strong ties with the neighborhoods they serve, improving service delivery and civic engagement. With unique mapping and targeting features, public agencies can effectively communicate with real residents. SCE made its first Nextdoor post in December 2019 and will continue to work on refining its customer notification strategy in 2020 and through this WMP period.

5.3.6.5.7 Wildfire Infrastructure Protection Team Additional Staffing (OP-2)

In 2018, due to SCE's newly established protocols that introduced more rigorous requirements related to PSPS activations, SCE added specialized fire science and meteorology staff to augment existing Business Resiliency resources and response efforts. These fire science and meteorology staff develop and implement critical wildfire mitigation programs and initiatives, including applying the latest research, science, and technology to help minimize the risk of utility-caused ignitions across SCE's service territory. Meteorologists previously maintained collateral responsibilities to support other areas of the company but due to emerging threats and conditions related to wildfire, it became evident that staff size needed to be increased and dedicated to solely 24-hour wildfire response activity.

SCE met the 2019 WMP goal of hiring one additional meteorologist to assist with the increased demand for weather monitoring and forecasting in response to PSPS conditions. Due to the frequency and magnitude of PSPS activity in 2019, SCE hired two additional meteorologists, one fire scientist and one fire management officer to support SCE's situational awareness capabilities. Meteorology staff play a critical role in forecasting PSPS events which ultimately determines the activation of PSPS IMTs and significant mobilization of SCE staff and resources. Many external agencies including cities, counties and public safety agencies make staffing decisions and mobilize resources based on SCE's weather forecasting and PSPS decisions. Due to the high-stakes nature of PSPS protocols and the potentially impacted customers, it is imperative that SCE maintain a team of qualified meteorology and fire science staff who are providing accurate and reliable data that drive the PSPS decision making process.

In 2019, to further support the execution and efficiency of PSPS, an Advanced Circuit Evaluation (ACE) team, staffed by six technical specialists, was established to aid in monitoring real-time conditions to develop ongoing circuit-specific switching plans. These switching plans are used to help mitigate impact to customers during PSPS events. To organize work streams and provide tracking and reporting of initiative requirements, a Project Manager was added to the team. This team will also directly support the PSPS IMT and task forces during activation to drive continuity of operations event management during events.

In December of 2019, SCE established a dedicated Wildfire/PSPS Response group within the Business Resiliency Department to provide direct support for PSPS and wildfire mitigation efforts. This includes supporting high impact work activities for advancing the PSPS protocol, supporting implementation of enhanced situational awareness tools such as super computers, high-resolution forecasting, HD cameras, weather stations and developing processes and procedures in alignment with company standards and best practices. To support this new group, SCE will onboard additional resources including: a senior compliance manager, two compliance advisors, a data specialist and a fire meteorologist. These resources will develop several additional capabilities around PSPS IMT programs and processes, enhancing situational awareness tools and technologies, and building external engagement and compliance.

To enhance existing operational practices, a new PSPS Operations Department will be staffed in 2020. This department will be led by a principal manager and staffed with functional area managers, technical specialists, advisors, and support staff that will have responsibility for: executive engagement, cross-organizational coordination, circuit switching plan development, operational compliance, training, continuous improvement, project management, and related initiatives. The ACE Team, described above, will report to this new department.

5.3.6.5.8 Self-Generation Incentive Program (SGIP) Resiliency

The Self-Generation Incentive Program (SGIP) provides incentives to support existing, new, and emerging distributed energy resources, by providing rebates for qualifying distributed energy systems, such as renewable generation and energy storage, that are installed on the customer's side of the utility meter. Updates to the SGIP can provide assistance to enhance the resiliency of eligible customers affected by PSPS events by providing backup power. Commission Decision (D.)19-09-027 established a new “equity resiliency budget” set-aside for customers participating in one of two low-income solar generation programs or vulnerable households that are located in Tier 2 and Tier 3 HFRA, as well as for critical service facilities serving those areas. Customers eligible for the equity resiliency incentive will receive a $1 per-Watt-hour incentive for energy storage projects. As part of D.19-09-027, SCE will transfer $34 million of its total SGIP budget to the new equity resiliency budget and will begin accepting customer applications for equity resiliency incentives in 2020.[32]

On January 16, 2020, the Commission adopted D.20-01-021 that authorized statewide annual ratepayer collections of $166 million annually through 2024 for the SGIP program. This decision prioritized allocation of funds to benefit customers affected by PSPS events or located in areas with extreme wildfire risk, including adopting a resiliency adder and a renewable generation adder to promote critical resiliency needs during PSPS events. The Commission also directed utilities to prioritize customer applications for the equity resiliency budget in order to further expedite support for customers affected by wildfire and PSPS-related outages.

5.3.6.5.9 Mobile Generator Deployment

SCE continues to work collaboratively with local governments, first responders and essential service providers to provide awareness of PSPS and to educate them on the importance of developing a resiliency plan that addresses back-up power needs for their facilities which provide critical life and safety functions. Many of these customers are required by law or industry standard to have back-up generation in place to sustain critical operations in the event of a power outage, regardless of outage type. Other customers not required to have back-up generation are encouraged to consider adding this capability if they feel they have critical needs that must continue in a power outage.

However, if essential service providers are unable to sustain critical life/safety operations during an extended power outage, SCE will consider requests to provide temporary mobile backup generation. Through the existing PSPS communication plan, SCE will coordinate closely with the emergency management community at the county level to identify and prioritize back-up generation needs requested by the county. Absent prioritization from the County, SCE will generally prioritize requests in the following categories as shown in Table SCE 5-9:

Table SCE 5-9

Prioritization of Mobile Generator Deployment

Priority Order	Essential Service Provider Category
1. Life Safety Emergencies	Hospitals Skilled Nursing Facilities Public Safety Agencies
2. Public Health Emergencies	Water/Wastewater
3. Communication Failures	Telecommunications

Other community needs (e.g., warming/cooling centers, community centers, etc.) that may impact the public health and safety may be considered for back up generation at the request of the County.

32 For more information, see SCE's Advice Letter AL 4127-E (December 17, 2019), https://library.sce.com/content/dam/sce-doclib/public/regulatory/filings/pending/electric/ELECTRIC_4127-E.pdf

If the Incident Commander determines there is a critical need for temporary back-up generation for one of the essential service providers noted above, the PSPS Task Force, which resides under the Operations Section of the Incident Command Structure, will be responsible for determining the appropriate sizing and installation requirements, and work with the Logistics Section of the IMT, contract partners, vendors and the appropriate internal T&D field crews to coordinate deployment and installation. Once the event has concluded and power has been restored, this same task force will confirm the generator is removed and returned to the vendor.

5.3.6.6 Stationed and on-call ignition prevention and suppression resources and services

SCE does not utilize stationed and on-call ignition prevention and suppression resources and services. As stated previously, SCE provides workers with basic fire suppression equipment and training to extinguish incipient-stage ignitions. SCE also restricts work during elevated fire weather conditions and relies on the expertise of its fire agency partners to support fire suppression activities throughout its service territory.

5.3.6.7 De-Energization Notifications (PSPS 1.1 – 1.4)

SCE is committed to full compliance of all notification requirements as outlined by the Commission in Rulemaking 18-12-005. SCE understands its stakeholders have different needs and require varying methods of alerting and warning to ensure proper notification. For example, first responders, public safety partners, and local governments require as much lead time as practical to begin contacting constituents and preparing to respond to potential de-energization. To support this need, SCE generally provides priority notification to these agencies upon activation of the EOC, typically 72 hours before a potential PSPS event. Additional alerting and warning update notifications are made again at 24-hour intervals with these agencies to maintain operational coordination. SCE begins initial alerting and warning messaging to remaining customers up to 48 hours in advance of a potential PSPS event. Notifications are then made to these customers in 24-hour intervals to maintain situational awareness and provide updated information regarding the ongoing potential PSPS event. All PSPS event notifications to key stakeholders, including public safety partners and customers, are delivered via voice, email, and TTY (telecommunication device for the hearing impaired) formats as per the preference of the recipient. Notifications are offered in multiple languages.

Requirements are summarized below in Table SCE 5-10.

Table SCE 5-10
De-Energization Notification Requirements

Stakeholder	Initial Notification (Alert)	Update Notification (Alert)	Imminent Shut down (Warning) [33]	De-Energized (Statement)	Preparing for Re-Energization (Statement)[34]	Re-Energized (Statement)	PSPS Averted (Statement)
First/Emergency Responders/Public Safety Partners	72 hours before	48 & 24 hours before	1-4 hours	When De-Energization Occurs	Before Re-energization Occurs	When Re-Energization Occurs	When circuits are no longer being considered for PSPS
Critical Infrastructure Providers	72 hours before	48 & 24 hours before	1-4 hours	When De-Energization Occurs	Before Re-energization Occurs	When Re-Energization Occurs	When circuits are no longer being considered for PSPS
Customers	48 hours before	24 hours before	1-4 hours	When De-Energization Occurs	Before Re-energization Occurs	When Re-Energization Occurs	When circuits are no longer being considered for PSPS
*SCE will target the schedule above to notify customers. Erratic or sudden onset of hazardous conditions that jeopardize public safety may impact SCE's ability to provide advanced notice to customers.							

In late 2019, SCE enhanced its notifications in EONS by implementing Zip Code-level alerting for PSPS events. Zip Code alerting enables non-SCE accountholder populations residing within SCE's service territory the ability to enroll to receive PSPS notifications based on their preferred zip code(s). In 2020, SCE will further enhance Zip Code-level alerting to include in-language notifications in alignment with its existing notification abilities for SCE customers. Furthermore, in 2020, SCE is deploying a new public alert messaging channel to notify anyone in an area affected by an active PSPS without signing up on SCE.com. This capability is similar to "Amber Alerts" and leverages industry-leading web-based public alerting technologies.

See Table 26 "Grid operations and protocols" for more detail on the initiatives above.

5.3.7 Data Governance

Description of programs to reduce ignition probability and wildfire consequence
For each of the below initiatives, provide a detailed description and approximate timeline of each, whether already implemented or planned, to minimize the risk of its equipment or facilities causing wildfires. Include a description of the utility's initiatives, the utility's rationale behind each of the elements of the initiatives, the utility's prioritization approach/methodology to determine

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[33] SCE will make every attempt to notify customers at the 1-4 hour warning stage. Given the unpredictability of shifting weather during PSPS events, implementation of this timeframe may vary.
[34] SCE will attempt to notify customers before re-energization when possible.

spending and deployment of human and other resources, how the utility will conduct audits or other quality checks on each initiative, how the utility plans to demonstrate over time whether each component of the initiatives is effective and, if not, how the utility plans to evolve each component to ensure effective spend of ratepayer funds.

Include descriptions across each of the following initiatives. Input the following initiative names into a spreadsheet formatted according to the template below and input information for each cell in the row.

1. *Centralized repository for data: Designing, maintaining, hosting, and upgrading a platform that supports storage, processing, and utilization of all utility proprietary data and data compiled by the utility from other sources.*
2. *Collaborative research on utility ignition and/or wildfire: Developing and executing research work on utility ignition and/or wildfire topics in collaboration with other non-utility partners, such as academic institutions and research groups, to include data-sharing and funding as applicable.*
3. *Documentation and disclosure of wildfire-related data and algorithms: Design and execution of processes to document and disclose wildfire-related data and algorithms to accord with rules and regulations, including use of scenarios for forecasting and stress testing.*
4. *Tracking and analysis of near miss data: Tools and procedures to monitor, record, and conduct analysis of data on near miss events.*
5. *Other / not listed [only if an initiative cannot feasibly be classified within those listed above]*

Data capture, data analysis, technology, and automation are increasingly a part of SCE's wildfire mitigation planning and implementation, as well as for its broader operations. Data quality and governance has been an instrumental part of SCE's values for many years. To date, organizations across SCE have addressed data governance at the system and initiative level largely focused on data quality, security, and compliance. While these programs and processes have been largely successful, moving forward, SCE is rethinking how it is using data for analysis, insights, and decision making. The volume of data SCE is collecting grows daily due to emerging new activities such as aerial imagery and videos as well as the need to integrate more information. These increased data requirements are vast and need to be stored, analyzed, and managed. SCE plans to invest in automation, machine learning and artificial intelligence over this WMP period, focusing on data architecture, management, and stewardship. Existing data governance processes and structures were developed within the scope of each initiative with the intent of transitioning activities to operational groups after the processes are established. As an example, in the distribution and transmission area, SCE has initiated a series of initiatives to enhance and improve areas such as vegetation management, asset inspections, and PSPS. The accelerated nature of these initiatives resulted in the creation of some data silos (discussed below) that require manual activities to interconnect data to perform analysis.

To improve this, SCE is working to develop an integrated wildfire data management and governance process. One of the steps involves SCE investing in process (data governance, stewardship) and technology (integrated data platforms, data management, data pipelines) to enable comprehensive decision making across initiatives, activities and processes. SCE's Enterprise Information Governance (EIG) and Information Technology (IT) groups are collaborating with various organizational units to coordinate and formalize these data governance efforts. SCE will develop and implement consistent processes and tools across the wildfire related initiatives. This is SCE's primary focus and foundational structure for managing its wildfire related data and facilitating the items below.

The scope of the data management and governance process includes establishing new data roles and responsibilities (data stewards, data custodians, data subject matter experts, etc.), and capabilities in master data management, metadata management, data quality and integrity, data lifecycle management, and data security and privacy. SCE's approach is to implement these capabilities in smaller tangible pilots, prioritized based on impact of the data area and data elements. For example, creating a 360 view of an asset that integrates aerial and ground imagery with inspection and remediation data for both asset and vegetation programs. This will allow for greater insights from advanced analytics and for a single view of asset heath for better risk modeling and prediction. The initial focus will be on linking key data sets to support automated integration of data for risk modeling with a goal to have a fully integrated view of wildfire mitigation activities by 2023.

5.3.7.1 Centralized Repository for Data

SCE has several systems in place to support day-to-day operations. SCE is currently implementing an integrated data platform that allows for data to be shared and utilized across programs and activities. This will facilitate more advanced analytics, visualization of data, and management of discrepant issues across the territory. SCE expects that it will steadily progress this capability over the next three years based on evolving needs and requirements. See Table SCE 5-11~~Table SCE 5-11~~ for the current set of databases directly or indirectly in use that support the applications supporting the wildfire mitigation activities.

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Table SCE 5-11
Databases Supporting Wildfire Activities

Database Name	Database Description	Access	Governance	Existing/New
SAP – EAM	Master Datastore for all SCE Assets and work management transactions.	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes	Existing
Outage Management System (OMS)	SCE's system to manage planned and unplanned outages to SCE's electrical grid.	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes	Existing
Outage Database and Reliability Metrics System (ODRM)	Tracks distribution, substation, and transmission unplanned outages that affect a single line transformer or more on SCE's grid.	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes	Existing
Operational Data Store (ODS) – Comprehensive Geographic information	The ODS is a data store model which contains spatial, non-spatial data from the various	Authentication and Authorization access is managed using SCE's enterprise	Any changes to this system are done by authorized users only and audited and tracked	Existing

Database Name	Database Description	Access	Governance	Existing/New
System (CGIS) Applications	source systems like map3d, GESW, SAP, CS	ticketing system and implemented based on roles-based access.	using in-built data base features and /or supporting processes.	
Distribution Circuit Mapping Application - GE Small World	The GE Smallworld application is currently used to maintain circuit schematic information of the distribution system and support SCE's OMS	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes.	Existing
Atmospheric Data Solutions Weather Database (ADS)	High Performance Computing Clusters (HPCCs) are used to help model the atmosphere and fuel conditions across SCE's HFRA for PSPS and other applications.	Authentication and Authorization access is managed using SCE's enterprise ticketing system.	This system is maintained by ADS and SCE business teams have access to reports generated by ADS.	New
Consolidated Mobile Solutions	CMS is an integrated mobile work management system with mobile GIS mapping, Global Positioning System guided navigation and automated vehicle location/ tracking.	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes	Existing/ Enhancements

Database Name	Database Description	Access	Governance	Existing/New
AGOL – High Fire Risk Informed Inspections (HFRI)	Mobile apps and web apps and dashboard developed on AGOL to support HFRI for identified assets in SCE's HFRA.	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes	New
AGOL – Vegetation Management	Mobile Apps and Web apps and dashboard developed on AGOL to support Vegetation Management.	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes	New
AGOL – PSPS Applications	Mobile Apps and Web apps and dashboard developed on AGOL to support PSPS Activities.	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes	New
MS – Azure Aerial Inspections Database	Azure data store is being used to store all the images/videos captured as part of Aerial Inspections.	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented	Any changes to this system are done by authorized users only and audited and tracked using in-built data base	New

Database Name	Database Description	Access	Governance	Existing/New
		based on roles-based access.	features and /or supporting processes	
Local on-prem Image Storage	Local servers are being used to carry out inspections of all the images captured.	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes	New
SharePoint Repository	Repository for documentation, processes and procedures storage.	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes.	Existing/ Enhancements
Weather Data Mart - Enterprise Data Warehouse (Hadoop)	Weather data mart is being used to store all weather datasets procured for forecasting purposes; weather forecasts are also stored in this data mart.	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on access-based roles.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes	Existing / Enhancements
Electronic Data Management / Record System (EDMRM)	Storage for records and documents associated with	Authentication and Authorization access is	Any changes to this system are done by authorized users	Existing

Database Name	Database Description	Access	Governance	Existing/New
	notifications / work orders and assets.	managed using SCE's enterprise ticketing system and implemented based on roles-based access.	only and audited and tracked using in-built data base features and /or supporting processes	

5.3.7.2 Collaborative Research on Utility Ignition and/or Wildfire

SCE seeks to leverage all resources and innovations available to support the WMP. This includes collaborating with academic institutions and benefitting from their knowledge and resources. The following are examples:

Distribution Fault Anticipation: In collaboration with Texas A&M, SCE installed distribution fault anticipation (DFA) devices in substations, which then transmit circuit data, specifically voltage and current, in the form of grid events through the LTE network (wireless communications network). The transmitted information is stored on a secure server which is accessible to both SCE and Texas A&M authorized personnel. Texas A&M assists SCE in performing an initial evaluation of grid events captured by DFA devices, as well as providing recommendations if the DFA devices do not provide a clear diagnostic of the grid event. SCE would then validate, perform field inspections and provide remediation recommendations. For more information on DFA, see Section 5.3.2.2.1.

High Definition Cameras: SCE partnered with the University of California, San Diego (UCSD) and the University of Nevada, Reno (UNR) to procure, install and maintain pan-tilt-zoom HD cameras at up to 80 locations. UCSD and UNR served as technical, research, and execution partners for the deployment of the HD cameras. SCE also worked with local and state fire agency personnel to support deployment and will continue to incorporate impacted fire agencies throughout SCE's HFRA to provide HD camera live feeds. This information is critical to fire agencies for effectively deploying air and ground resources to limit and contain fires in the early stages. SCE will continue to collaborate with UCSD on an ongoing basis. For more information on HD Cameras, see Section 5.1.2.

5.3.7.3 Documentation and Disclosure of Wildfire-Related Data and Algorithms

Ignition Probability Models:
SCE has developed predictive reliability models for selected major distribution system assets, including transformers, poles, overhead conductors, underground primary cables and overhead and underground switches. The process of proactively replacing equipment that is most likely to fail in-service is referred to as predictive maintenance. The objective of predictive reliability analysis is to improve system reliability performance by applying analytics to better identify and

predict equipment failures at an individual asset-basis and partner with execution organizations in creating processes to cost-effectively and strategically implement these benefits.

An extensive series of input variables was used to develop predictive models. Table SCE 5-12 shows the sources used for generation of the Ignition Probability Model. The output from the Ignition Probability model(s) is stored in the Critical Business Folder in a cloud-based repository. Authentication and authorization access to this store is managed using a standard defined approval process, and changes and updates to these are tracked using standard SharePoint tracking features.

Table SCE 5-12
Ignition Probability Model Data Sources

Database Name	Database Description
Repair Orders (RO)	Detail incident description. Material list, incident site picture, incident date, “from” and “to” structure, load off/on, crew type.
EMap/Eworld Database	This database has SCE circuit map information.
Facilities Inventory Mapping (FIM) Database	This database has map-based inventory of SCE assets.
Environmental Data. (California Department of Water Resources.)	Soil chemistry, soil composition, water table and groundwater data.
Enterprise Data Warehouse (Hadoop)	This database is used to store the usage data collected from all the meters.
SAP – EAM/HCM	Master datastore for all SCE assets and work management transactions.
OMS - Outage Management System	SCE’s system to manage planned and unplanned outages on SCE’s electrical grid.
ODRM - Outage Database and Reliability Metrics System	Tracks distribution, substation, and transmission unplanned outages that affect one or more line transformers on SCE’s grid.
ODS - CGIS Applications	The ODS (Operational Data Store) is a data store model which contains spatial, non-spatial data from the various source systems like Map3D, GESW, SAP, CS
Distribution Circuit Mapping Application - GE Smallworld	The GE Smallworld application is currently used to maintain circuit schematic information of the distribution system and support SCE’s Outage Management System

Consequence Model:
Table SCE 5-13 contains the different data sources used to generate the consequence models that are used in addition to the Ignition Probability to arrive at the overall asset risk score. The

output from the consequence models are stored in SharePoint. Authentication and authorization access to this store is managed using a standard defined approval process, and changes and updates to these are tracked using standard SharePoint tracking features.

Table SCE 5-13
Consequence Model Data Sources

Database Name	Database Description
CPAD_2018a_Units.shp - All parks (National, State, Local) in California, California Department of Conservation	This dataset provides polygon locations of all registered parks and recreation zones in Ca, listed by description of park name and agency supervising the parcel.
Formulas_PopData.xlsx	This dataset provides latitude and longitude coordinates of manholes and vaults under SCE control, with corresponding census demographic information and description of the location.
Wells_All.shp - Oil/Natural Gas wells in Ca, California Department of Conservation	This dataset provides point location and other data (Operator, lease, well number, etc.) for nearly 200,000 oil and gas wells in California.
Home Prices - Zip code averages of Zillow, Realtor.com & Redfin median house price databases	This dataset provides the list of median home prices by zip code according to three different comprehensive real estate databases (highlight the challenge of the county assessor's offices).
CA schools - List of all public and private schools in Ca, California Dept. of Education's Public Schools	This dataset provides the locations of public and private schools in California. The data comes from the California Dept. of Education's Public Schools.
Census Data 2017 Med HH Income - US Census Bureau	This dataset contains the median household income for all counties in the state of California.
300m x 300m grid squares developed from Reax fire perimeter grid	This dataset has the fire perimeter grids for SCE territory.
California_BlockGroup_Pop_Households_2018 - US Census Bureau	This dataset contains the List of all California Census Block populations & corresponding number of households.
Fire stations - Lighthouse Database, US Department of Homeland Security, California	This data set contains the Fire Stations in the United States. Any location where fire fighters are stationed or based out of, or where equipment that such personnel use in carrying out their jobs is stored for ready use.

Database Name	Database Description
	Fire Departments not having a permanent location are included, in which case their location has been depicted at the city/town hall or at the center of their service area if a city/town hall does not exist. This dataset includes those locations primarily engaged in forest or grasslands firefighting, including fire lookout towers if the towers are in current use for fire protection purposes.
Active Business Dataset Listing of Active Businesses, City of Los Angeles	This dataset Contains the listing of all active businesses currently registered with the Office of Finance. An "active" business is defined as a registered business whose owner has not notified the Office of Finance of a cease of business operations.
Hospitals Dataset California Health and Human Services ca-oshpd-gachospital-building-05022019 (Hospitals)	This dataset contains the list of all hospital GIS locations in the state of California.
Buildings Dataset List Buildings2_cleaned.csv Buildings_Cleaned_Parsed_3	This dataset contains the 125,192,184 building footprint polygon geometries in all 50 US States in GeoJSON format.
Social Vulnerability Index SoVI_2010_CA - Social Vulnerability Index	This dataset contains the Social Vulnerability Index (SoVI®) 2010-14 measures the social vulnerability of U.S. counties to environmental hazards.
EGRESS (From workflow EGRESSV3_AVGfirearea - Reax & Tom-Tom GPS	This dataset has the Tom-Tom drive times measured from the center of grid blocks to create 30-minute drive time areas in square kilometers that showed, during peak hours, the max distance a population would be able to drive in every direction.

5.3.7.4 Tracking and Analysis of Near Miss Data

Table SCE 5-14 contains the different data sources used to track and analyze near miss data. SCE tracks all outages and causes based on information provided from the field and stores that data in its outage management database. SCE cross references these outages with operational data from system events such as relay operations to determine which conductor failures led to a wire down event. SCE used these data sources along with SAP CPUC reportable ignition data to populate and track the "Number of incidents per year (faults)" and near misses.

Table SCE 5-14

Data Sources to Track and Analyze Near Miss Data

Database Name	Database Description	Access	Governance	Existing/New
Wire Down Database	Wire downs are based on wire down calls and repair orders across the entire SCE service territory where the following types of wire are reported down: – Primary – Secondary – Service drop – Transmission – Sub-transmission Any wire that is considered a risk to the public due to being on the ground or within eight feet of the ground is considered a wire down	Authentication and Authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access.	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes	Existing
CPUC Reportable Initiations	Excel file for reporting Fire events meeting the CPUC Reportable criteria	Access granted by SharePoint Site owners	Any changes to this SharePoint / Folders are done by authorized users only	Existing
ODRM	Tracks distribution, substation, and transmission unplanned outages that affect a single line transformer or more on SCE's grid	Authentication and authorization access is managed using SCE's enterprise ticketing system and implemented based on roles-based access	Any changes to this system are done by authorized users only and audited and tracked using in-built data base features and /or supporting processes	Existing

See Table 27 "Data governance" for more detail on the initiatives above.

5.3.8 Resource Allocation Methodology

Description of programs to reduce ignition probability and wildfire consequence
For each of the below initiatives, provide a detailed description and approximate timeline of each, whether already implemented or planned, to minimize the risk of its equipment or facilities causing wildfires. Include a description of the utility's initiatives, the utility's rationale behind each of the elements of the initiatives, the utility's prioritization approach/methodology to determine spending and deployment of human and other resources, how the utility will conduct audits or other quality checks on each initiative, how the utility plans to demonstrate over time whether each component of the initiatives is effective and, if not, how the utility plans to evolve each component to ensure effective spend of ratepayer funds.

Include descriptions across each of the following resource allocation methodology and sensitivities initiatives, including a description of the data flow into the calculations involved in each. Input the following initiative names into a spreadsheet formatted according to the template below and input information for each cell in the row.

1. Allocation methodology development and application
2. Risk reduction scenario development and analysis
3. Risk spend efficiency analysis
4. Other / not listed [only if an initiative cannot feasibly be classified within those listed above]

The list provided is non-exhaustive and utilities shall add additional initiatives to this table as their individual programs are designed and structured. Do not create a new initiative if the utility's initiatives can be classified under a provided initiative

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5.3.8.1 Allocation methodology development and application

Resource allocation involves careful consideration and distribution of both human and financial resources across SCE's efforts towards minimizing the risk of its equipment or facilities causing wildfires. SCE has an internal allocation and planning process that governs and allocates capital across the various organizational units. This process is continuous and requires input and development at all levels of the company, including organizational unit management, SCE senior management, and the Board of Directors. In addition, key projects and programs are reviewed with senior leadership before funds are budgeted or spent. SCE undertakes these efforts to prudently distribute resources to address the safety, reliability and affordability of electric services and minimize the risks inherent in its business. Through the capital allocation process, SCE strives to make sure that customer dollars are spent effectively and efficiently and that its rates do not become unaffordable for customers, taking into consideration the value that SCE's work and investments provide to them. SCE typically develops forecasts for the prospective five-year period. The most granularity and confidence in this forecast exists in the next year's plan, while the outer years (years 2-5) provide directional guidance based on what is known at the time of the plan's development.

SCE continually monitors and, where necessary, adjusts short- and long-term plans for resource allocation and prioritization of work. SCE reviews whether resource plans are working effectively, and whether any adjustments to the plans are needed to improve the overall allocation methodologies used. As labor markets, environmental conditions, and other externalities change over time, and as SCE continues to refine its understanding of mitigation effectiveness, SCE will continue to adjust resourcing plans to help ensure effective allocation of human and financial resources.

There are constraints on how the amount of work that can be performed based on the availability of SCE workers (both SCE employees and contractors) to plan, design, engineer, and implement this work. In allocating resources, SCE must consider both the availability of and impacts to both financial and human resources. SCE also considers risk reduction, other execution constraints, and customer impacts while allocating financial resources. Execution capacity is constrained by mitigation cycle times, permit approvals, extreme weather, and other factors. SCE also considers customer fatigue, with respect to outages, and its impacts when allocating work.

Considering the work required to maintain and operate the electric system, and the need to immediately and substantially address wildfire risk, SCE undertook an effort to examine how SCE could modify the allocation of resources to rapidly and effectively deploy wildfire mitigation programs. SCE found that, in many cases, the same resources that are required to support wildfire mitigation activities are responsible for implementing SCE's traditional infrastructure replacement work. These resources are finite, and SCE faces real resource constraints. After assessing overall grid and societal needs, and in light of resource constraints, SCE made a conscious decision to pursue important system augmentation, infrastructure replacement, and load growth activities[35] at a slower pace for the near future during the next few years in order to divert necessary resources to implement higher safety risk reduction wildfire mitigation work. SCE is mindful of its responsibility as stewards of customer funding and has put forward a request in its 2021 GRC that provides significant immediate and longer-term value while maintaining affordability for customers.[36] SCE performed a risk analysis to evaluate the public safety impacts of shifting resources from traditional infrastructure replacement programs to wildfire mitigation work. This analysis shows that the safety benefit gained through the enhanced portfolio of wildfire mitigations exceeds the safety reduction in other risk initiatives, specifically contact with overhead conductor and underground equipment failure risks (which are further described in SCE's 2018 RAMP Report). The methodology and summary of results can be found in SCE's 2021

[35] Programs pursued at a slower pace (or deferred) to allow SCE to complete wildfire mitigation activities include, but are not limited to, Distribution Automation, 4 kV Cutovers, and Worst Circuit Rehabilitation.

[36] SCE discusses this resource re-allocation effort in its 2021 GRC Application and testimonies. *See* generally, *Test Year 2021 General Rate Case Amended Application of Southern California Edison Company* (U 338-E) (November 7, 2019), http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M319/K752/319752951.PDF.

GRC.[37]

Table SCE 5-14-1
Allocation Methodology Development and Application Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next WMP Annual Update	Short Term (2020-2022)	Long Term (2023-2030)
SCE will continue to refine its enterprise level and asset level risk modeling methodology and monitor its wildfire risks. If necessary, SCE will adjust its short-term and long-term plans for resource allocation and prioritization of work.	SCE will begin transitioning from its current asset level Wildfire Risk Model (WRM) to the Wildfire Risk Reduction Model (WRRM) to provide both weather and wildfire risk forecasts to identify areas and assets of greatest risk. This system will enable SCE to better target resources to high risk areas.	SCE expects to refine its resources prioritization and allocation methodology with the incorporation of the dynamic asset level risk modeling capability. SCE is also planning on incorporating advanced technologies with predictive analytics capability such as AI to further improve its resource allocation methods.	SCE plans to improve its resource allocation methodology by enhancing its models to address different climate scenarios as well refining its models at a more granular level.

5.3.8.2 Risk Reduction Scenario Development and Analysis

As discussed in Section 4.3, SCE's WRM quantifies wildfire risk at a granular level (i.e., down to specific circuits and circuit segments across the HFRA). It enables SCE to identify potential high-risk circuits and segments where mitigation considerations, such as covered conductor, targeted undergrounding, equipment replacement, or other strategies may be considered. At this point in time, while the wildfire risk model is effective for identifying granular risk scores across circuits and segments to assist in mitigation selection, it is not being used to generate mitigation effectiveness or financial scores. It is important to note that the relative risk ranking of circuits can and probably will change over time as SCE continues to evolve its risk modeling capabilities.

In general, SCE looks to first address those circuit segments and circuits which present the greatest risk. However, SCE will often bundle work related to multiple and/or contiguous circuit

[37] *See Workpapers, SCE-01, Vol. 02, General Rate Case, Risk Informed Strategy & Business Plan*, Wildfire Tradeoff Risk Analysis, pp. 44-46 (August 2019), http://www3.sce.com/sscc/law/dis/dbattach5e.nsf/0/4BAB5842B1920B888825846600789252/$FILE/WPSCE01V02.pdf.

segments together to achieve operational efficiencies. For example, the risk associated with each circuit may not be uniform along its length: the risk can vary between a specific mile or segment within a circuit, especially if that circuit traverses various HFTD Tiers and is exposed to different probabilities of ignition by contact from objects, or varying topography and vegetation that can influence fire propagation and consequence. In some cases, it may be operationally efficient and prudent to remediate relatively lower risk segments of a circuit at the same time relatively higher risk segments of the same circuit are addressed, instead of sending multiple crews out at multiple different times, requiring the development of separate work scope packages.

Table SCE 5-14-2
Risk Reduction Scenario Development and Analysis Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next WMP Annual Update	Short Term (2020-2022)	Long Term (2023-2030)
SCE will perform the described risk scenarios to identify highest risk segments to scope the locations for deployment of the mitigations identified in this WMP	SCE will perform the described risk scenarios to identify highest risk segments to scope the locations for deployment of the mitigations identified in this WMP	SCE will enhance and implement its risk scenarios using updated models with refreshed information	SCE will improve its risk models to address different climate scenarios

5.3.8.3 Risk Spend Efficiency Analysis

SCE's Enterprise Risk Management group develops RSEs in conjunction with the SCE business units that will implement the mitigations. For a description of how RSEs are developed, please see Section 5.3.1.4. In the near and long term, SCE will look for ways to refine and improve its RSE development process.

Although included in SCE's 2020-2022 WMP, RSEs are not, and should not, be the only factor used to develop a risk mitigation plan. The RSE metric does not take into account certain operational realities, resource constraints, and other factors that SCE must consider in the development of its plan. For example, while PSPS has a relatively high RSE, there are regulatory and practical limits to how much PSPS can be deployed. Indeed, the Commission prescribes that PSPS should be used "as a last resort" despite its relatively high RSE. The same is true for other mitigations presented in this testimony. As another example, while undergrounding overhead power lines may present a relatively high risk-reduction opportunity, it requires considerably more planning and lead time to implement than reconductoring using covered conductor. If SCE focused only on undergrounding its overhead system in HFRA, its ability to immediately reduce risk would be significantly delayed. In addition, for various operational and financial reasons, it is not practical to underground the entire transmission and distribution system in HFRA. Accordingly, SCE developed a comprehensive and balanced mitigation plan with activities that will collectively reduce the greatest amount of risk in the shortest amount of time, considering RSE as well as various regulatory, operational, resource, and cost constraints. It would be inappropriate to implement a comprehensive wildfire risk mitigation plan based solely on RSEs, which would likely lead to significant parts of the system and potentially significant risk issues left unaddressed.

Indeed, the Commission's SED agrees that focusing solely on RSEs in selecting mitigations could be "suboptimal from an aggregate risk portfolio standpoint"[38] in its comments relating to PG&E's 2017 RAMP Report. SED acknowledged that "mitigations are usually selected based on the highest RSE score unless there may be some identified resource constraints, compliance constraints, or operational constraints that may favor another candidate measure with a lower RSE."[39]

Table SCE 5-14-3
Risk Spend Efficiency Analysis Strategy & Goals Roadmap

Before 2020 Wildfire Season	Before Next WMP Annual Update	Short Term (2020-2022)	Long Term (2023-2030)
SCE will revise and improve MAVF methodology, the framework to evaluate risk reduction	SCE plans to incorporate the updated MAVF into its WMP Annual Update	SCE will incorporate learnings and feedback from other IOU RAMP reports on their MAVF framework and incorporate into 2022 RAMP and subsequent WMP filings	SCE will continue to refine modeling and analysis to a more granular level

5.3.8.4 Organizational Support - PMO and OCM

Program Management Office

38 California Public Utilities Commission, *Risk and Safety Aspects of Risk Assessment and Mitigation Phase Report of Pacific Gas and Electric Company, Investigation 17-11-003,* p. 18 (March 30, 2018), https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/Safety/Risk_Assessment/RCR/SED_RAMP_Evaluation_PGE_033018a.pdf

39 *Ibid.*

The PMO provides oversight for all wildfire mitigation activities. It is responsible for: (1) executing near-term actions to further mitigate increased wildfire risk; (2) developing enhancements to its operational plans for long-term wildfire, public safety, and related resiliency strategies; and (3) integrating SCE's wildfire mitigation strategies with existing programs, such as long-term capital planning, RAMP, GRC, and WMP In order to support these objectives, SCE augments its current staff to provide additional overall PMO support. Additionally, SCE will focus on risk analysis to provide additional analysis and expertise regarding program selection, sizing and prioritization.

The recent increase in wildfire risk drives an even stronger need to find means to reduce the cause of wildfires and enhance methods to detect and suppress them more quickly. In order to operationalize the most effective suite of mitigations, SCE is contracting with vendors that have specific expertise. The PMO requires additional skills and resources that are responsible for oversight of the entire portfolio. These resources ensure the overall strategy gets integrated into the global company's long-term plans, drive completion of regulatory requirements, and report on the overall status of the program.

Organizational Change Management

Organizational Change Management (OCM) is a program focused on helping to identify and manage the effect of necessary changes to business processes, systems and tools, job roles, policies and procedures, and other areas that may have a corresponding impact to resources.

SCE's OCM efforts primarily support its wildfire mitigation programs and is embedded both at the program level to oversee and coordinate across work streams, and at the work stream level to address more targeted/localized OCM efforts. OCM efforts include employee and other stakeholder communications, engagement, training, coaching, development, feedback, monitoring, and advocacy.

For SCE's wildfire mitigation efforts, the OCM work is needed to facilitate internal and external awareness, understanding, and knowledge of the many and varied changes resulting from the increased hardening and resiliency of the Company's grid and the safety of its employees, customers, and communities. Given the scope, scale, and complexity of change inherent in the wildfire mitigation programs, it is critical to embed OCM efforts into these activities and solutions to increase the likelihood of success of the programs' intended outcomes.

Table SCE 5-14-4
Organizational Support Strategy & Goals Roadmap

Before 2020 Wildfire Season	**Before Next WMP Annual Update**	**Short Term (2020-2022)**	**Long Term (2023-2030)**
SCE will: Perform a 2019 post evaluation of key programs such as PSPS and capture lessons learned toward improving the program Based on 2019 lessons learned refine the framework for tracking and evaluating the performance of the WMP execution Develop (based on past successes and lessons learned) a stakeholder outreach plan and host town-hall style sessions in key HFRA regions Conduct internal training and awareness activities for impacted organizations	SCE will: Perform a comprehensive review of SCE's WMP 2020 execution, record lessons learned and identify potential areas for continuous improvement Perform a resource analysis and determine if they are "right sized" for future work Evaluate SCE's stakeholder outreach and communications effectiveness Identify successes in WMP program implementation and possible areas of improvements Perform training refresh and modify training program as needed	SCE will: Establish a robust and sustainable process for collecting and reporting WMP execution performance data Develop a plan for integrating Wildfire PMO functions into the tactical elements of the organization Establish a system to continuously evaluate WMP implementation processes and recommend methods of improving them or further integrating them in the "normal" operations of the organization Establish a formal cadence and methodology for stakeholder outreach, internal communications, and training	SCE will: Fully automate the tracking and reporting functions of WMP execution performance Fully integrate wildfire PMO functions into the organization's normal operations Operate a robust set of performance evaluation and compliance processes Operate a mature system of outreach activities, employee awareness, and employee change readiness

See Table 28 "Resource allocation methodology" for more detail on Section 5.3.8..

5.3.9 Emergency Preparedness and Planning

Include a general description of the overall emergency preparedness and response plan, and detail:

1. A description of how plan is consistent with disaster and emergency preparedness plan prepared pursuant to Public Utilities Code Section 768.6, including:
a. Plans to prepare for and restore service, including workforce mobilization (including mutual aid and contractors) and prepositioning equipment and employees
b. Emergency communications, including community outreach, public awareness, and communications efforts before, during, and after a wildfire in English, Spanish, and the top three primary languages used in California other than English or Spanish, as determined by United States Census data
c. Showing that the utility has an adequate and trained workforce to promptly restore service after a major event, taking into account mutual aid and contractors

2. Customer support in emergencies, including protocols for compliance with requirements adopted by the CPUC regarding activities to support customers during and after a wildfire, including:
a. Outage reporting
b. Support for low income customers
c. Billing adjustments
d. Deposit waivers
e. Extended payment plans
f. Suspension of disconnection and nonpayment fees
g. Repair processing and timing
h. Access to utility representatives
3. Coordination with Public Safety Partners, such as stationing utility personnel in county Emergency Operations Centers

Describe utility efforts to identify which additional languages are in use within the utility's service territory, including plan to identify and mitigate language access challenges.

Description of programs to reduce ignition probability and wildfire consequence
For each of the below initiatives, provide a detailed description and approximate timeline of each, whether already implemented or planned, to minimize the risk of its equipment or facilities causing wildfires. Include a description of the utility's initiatives, the utility's rationale behind each of the elements of the initiatives, the utility's prioritization approach/methodology to determine spending and deployment of human and other resources, how the utility will conduct audits or other quality checks on each initiative, how the utility plans to demonstrate over time whether each component of the initiatives is effective and, if not, how the utility plans to evolve each component to ensure effective spend of ratepayer funds.

Include descriptions across each of the following initiatives. Input the following initiative names

into a spreadsheet formatted according to the template below and input information for each cell in the row.
1. Adequate and trained workforce for service restoration
2. Community outreach, public awareness, and communications efforts
3. Customer support in emergencies
4. Disaster and emergency preparedness plan
5. Preparedness and planning for service restoration
6. Protocols in place to learn from wildfire events
7. Other / not listed [only if an initiative cannot feasibly be classified within those listed above]
The list provided is non-exhaustive and utilities shall add additional initiatives to this table as their individual programs are designed and structured. Do not create a new initiative if the utility's initiatives can be classified under a provided initiative.

By undertaking comprehensive planning efforts, SCE aims to minimize the impacts of emergencies on customers and communities. SCE's emergency preparedness and response plans are developed to streamline SCE's response efforts, inform critical actions and decision-making, determine roles and responsibilities of SCE IMT members, and maximize SCE's ability to respond and recover following any type of disruptive incident. They are based on both the National Incident Management System (NIMS) and the California-specific Standardized Emergency Management System (SEMS); as well as the ICS principles and protocols developed by the Federal Emergency Management Agency (FEMA). Plans are regularly reviewed, evaluated, and updated to maintain public and employee health and safety and to minimize damage to public property, private property, and SCE infrastructure.

Emergency communications, including community outreach, public awareness, and communications efforts before, during, and after a wildfire in English, Spanish, and the top three primary languages used in California other than English or Spanish, as determined by United States Census data:
SCE has a comprehensive plan for communicating with its customers during emergencies, especially during outages, which includes a schedule of notifications for repair (unplanned) outages and maintenance (scheduled) outages. Automated outbound notifications are sent to customers via the customer's preferred method of contact (such as email and text message) when an outage occurs, as outage restoration times are determined or shifted, and upon conclusion of the outage. For maintenance outages, SCE provides advanced notice to customers at least three days prior to the outage, but usually up to two weeks prior. SCE provides an automated reminder call twenty-four hours ahead of the scheduled outage and SCE's Outage Map on SCE.com provides customers with outage information in their service location.

SCE enhanced its emergency communication plans following the 2017 wildfires to build awareness about the importance of wildfire mitigation and provide information about the critical work that SCE is undertaking in HFRA. SCE added proactive communications and education about wildfire and emergency preparedness as well as communications and awareness during and following wildfire events. For example, as part of its Grid Safety and Resiliency Program (GSRP), SCE implemented Phase One of its new Emergency Outage Notification System (EONS) in Fall 2018. This new system has the capability to execute high-volume notifications within very short timeframes, enabling SCE to reach a large number of customers in areas potentially subject to PSPS. SCE also added options for those who are not an SCE account holder or a customer of record to receive outage notifications by registering for alerts and notifications at a zip code level for PSPS events. Residents who are not the customer of record, such as those in a master-metered community, but who may know the name on the SCE account and the service address, can sign up for alerts and notifications (related to pre-planned maintenance and emergency outages) for that specific address on SCE's website. In 2020, SCE will launch a targeted campaign to its master-metered properties that will provide information about PSPS events and how to sign up for alerts and notifications and will direct customers to SCE's website to learn more about SCE's wildfire mitigation activities, PSPS and consumer protections from disasters.

On SCE's website (SCE.com), customers can find content about SCE's wildfire mitigation efforts, learn tips for how to become more resilient during major events and receive up-to-date information regarding PSPS in their area. Radio, digital banners/videos and social media ads also drive visitors to SCE.com for more information. SCE also maintains a toll-free (1-800) phone line staffed with trained personnel in SCE's customer contact center who receive calls from impacted customers as a priority.

Showing that the utility has an adequate and trained workforce to promptly restore service after a major event, taking into account both mutual aid and contractors

SCE maintains an adequate and trained workforce to assist during emergencies. In addition to the Storm Plan, which guides SCE's response to emergencies of varying scopes and sizes, SCE delivers a robust ICS training FEMA-based program that follows the NIMS model for employees identified as IMT members. SCE has trained over 600 employees to-date. SCE maintains a large, highly skilled field workforce (both employees and contractors) to provide effective emergency response and restore service during and after a major event. SCE also uses contract resources that can be reassigned to assist with a major event. SCE's existing mutual assistance agreements are activated in situations where the response exceeds the capacity of SCE's crews and emergency contracting capabilities.

Trained employees are placed into Incident Management Teams (IMTs). While on-call, they are required to report to the Emergency Operations Center (EOC) to coordinate incident response within two hours, with limited exceptions. IMTs are rotated and are specifically designed to have multiple back-ups, so that response and recovery efforts can be conducted 24 hours a day for several days or even weeks. The IMT maintains visibility into any staffing shortages or workforce incidents during these events and may request appropriate support via additional internal staffing, emergency contracts, or mutual assistance. These requirements are captured in SCE's Storm Plan.

IMT and EOC capabilities are tested regularly through real-world incidents—such as windstorms, wildfires, and PSPS—and exercises and drills. During exercises and drills, team members are evaluated on their performance and given real-time feedback on areas for improvement and best practices.

Customer support in emergencies, including protocols for compliance with requirements adopted by the CPUC regarding activities to support customers during and after a wildfire:
SCE makes every effort to raise customer awareness about the protections SCE can offer them should they be impacted by wildfires and other disasters as detailed below:

- Access to outage reporting and emergency communications
  - SCE uses best practices to ensure all customer information is current so that customers can receive the most up-to-date information regarding outage and emergency communications and to ensure that resources are available for reporting outages.
- Support for low-income customers
  - Ensuring all impacted customers enrolled in CARE/FERA have their accounts flagged as impacted to automatically prevent annual verifications and high usage verifications from executing.
- Billing adjustments
  - Ensuring all identified impacted customer accounts do not receive estimations and daily minimum charges are halted/adjusted
- Deposit waivers
  - Ensuring all impacted customer accounts do not automatically, or manually, receive deposit requirements
- Extended payment plans
  - Working with impacted customers to provide extended payment plans through recovery from incident
- Suspension of disconnection and nonpayment fees
  - Ensuring all impacted customer accounts are not sent for disconnection due to non-payment, eliminating assessment of non-payment fees
- Repair processing and timing
  - Ensuring access to local planning resources to assist with expediting SCE support for rebuilding and providing up to date information about restoration timing both through contact center and web for impacted customers
- Access to utility representatives
  - Directing resources to local assistance centers and other events to provide in-person support following events to assist with information and consumer protections

5.3.9.1 Adequate and trained workforce for service restoration: SCE Emergency Responder Training (DEP-2)

SCE maintains a large, highly skilled field workforce (both employees and contractors) to restore service during and after a major event. All of SCE's Troublemen, Senior Patrolmen and Journeyman Lineman received training on SCE's 2019 Wildfire Mitigation Plan, changes to SOB 322 in 2019, roles and responsibilities of IMT team and PSPS activation criteria. In addition to the

background information, the training covered T&D field personnel's involvement in the PSPS process which included specific patrolling scenarios and responsibilities. Field personnel with wildfire response and de-energization responsibilities were required to undertake additional training on their roles and responsibilities as they relate specifically to PSPS.
Newly identified field personnel will be required to complete trainings in PSPS protocols. Existing QEWs will be required to participate in updated PSPS trainings to keep apprised of any changes to plans and protocols.

SCE continues to evaluate its emergency response staffing capabilities and may continue to identify and train more personnel to help support company efforts during and after an incident. SCE also utilizes a mutual assistance program to help effectively respond to and restore power following complex and/or large incidents. Assistance can be received or supplied in the form of personnel, equipment, materials, and other associated services. SCE is currently a party to the following mutual assistance agreements, which provide a mechanism to quickly obtain or supply emergency assistance prior to, during, or after an incident that affects SCE facilities:

- California Utilities Emergency Association (CUEA) among California utilities
- Western Region Mutual Assistance Agreement for Electric Utilities (WRMAG), a regional agreement
- Edison Electric Institute (EEI), a national mutual assistance program

These mutual assistance agreements are standardized across utilities and articulate specific requirements and authorizations to receive or deploy crews. SCE regularly participates in mutual assistance calls, planning efforts, and coordinating body meetings, and has provided mutual assistance to other utilities in large-scale emergencies.

In addition to a trained SCE workforce and mutual assistance agreements, SCE can utilize contractors to assist in restoring service following a major incident, including wildfires. Additional contractor resources can be quickly on-boarded if required. All contracts have provisions to facilitate requests for immediate emergent support to restore power following complex and/or large incidents throughout SCE's service territory. Many of SCE's contractor partners have a national and international presence and can bring in additional resources and support from their other operating areas upon request.

SCE also maintains a trained workforce to assist during emergencies. SCE delivers a training FEMA-based program that follows the NIMS model for employees identified as IMT members. Trained employees are placed into IMTs and while on-call, they are required to report to the Emergency Operations Center (EOC) to coordinate incident response within two hours, with limited exceptions. IMTs are rotated and are specifically designed to have multiple back-ups, so that response and recovery efforts can be conducted 24 hours a day for several days or even weeks. The IMT maintains visibility into any staffing shortages or workforce incidents during these events and may request appropriate support via additional internal staffing, emergency contracts, or mutual assistance. These requirements are captured in SCE's Storm Plan.
IMT and EOC capabilities are tested regularly through real-world incidents—such as windstorms,

wildfires, and PSPS—and exercises and drills. During exercises and drills, team members are evaluated on their performance and given real-time feedback on areas for improvement and best practices. In 2020 through 2022, SCE will continue training existing and new IMT members and evaluate staffing levels and needs.

5.3.9.2 Community outreach, public awareness, and communications efforts (DEP-1.1, DEP-1.2, DEP-1.3, DEP-3, DEP-4)

SCE conducted extensive community outreach to increase public awareness of emergency planning and preparedness information in 2019. For example, SCE sent over one million letters to customer accounts targeting customers residing in HFRA. The focus of the letter included details on SCE's wildfire mitigation efforts, PSPS protocols, emergency preparedness tips, and guidance on where to go for more information. SCE also conducted a digital and radio campaign to inform all customers about PSPS, SCE's wildfire mitigation work and how customers can enhance their emergency preparedness. In 2020, SCE plans to send approximately 915,000 letters with information about PSPS, emergency preparedness, and SCE's wildfire mitigation plan to customer accounts in HFRA and approximately 3,200,000 letters to customer accounts in non-HFRA.

In 2019, SCE met with cities, counties, and tribes to review SCE's 2019 WMP and PSPS protocols. SCE also made presentations to city councils, boards of supervisors, community-based organizations, and other forums. SCE hosted community meetings throughout the its service territory from June through November 2019 to raise awareness of SCE's 2019 WMP and PSPS protocols. SCE mailed invitations to nearly 260,000 customers in SCE's HFRA and sent emails or utilized social media to invite customers to attend the community meetings.

In 2020, SCE plans to hold 8-12 community meetings primarily in areas that were impacted by multiple PSPS de-energization events in 2019 to share information about PSPS, emergency preparedness, and SCE's wildfire mitigation plan. SCE will also participate in community-based organization and other third-party meetings. To help evaluate the success of these meetings, SCE employees will provide a post-meeting questionnaire for attendees requesting feedback. In addition, SCE staff immediately debriefs for lessons learned and corrective actions after the meetings. The input from the surveys and debrief meetings are used to improve community engagement and outreach efforts going forward.

SCE will also host resiliency workshops to assist non-residential customers in making their facilities more resilient. Initial workshops will be held with small water agencies and then other customer segments to follow. The workshops highlight lessons learned from other customers and highlight resources that would be available to assist customers in their resiliency efforts.

SCE's customer research and education strategy, which aligns with the statewide campaign mentioned in the IOU Customer Engagement discussion under customer outreach, includes focus groups and customer surveys that inform SCE's approach to educating and supporting customers around wildfire mitigation activities and PSPS events.

During 2020-2022, SCE will continue to promote wildfire and resiliency awareness through several channels including direct mail, web-based messaging, and digital media. In 2020, SCE's marketing campaign expects to reach approximately 5,000,000 customer accounts to inform about the purpose of PSPS, emergency preparedness, and SCE's wildfire mitigation plan. The company will regularly engage local governments, tribal staff and first responders about SCE's WMP, the PSPS de-energization process, and how SCE will communicate and work with government agencies, public safety partners and emergency responders during outages. Members of SCE's HFRA communities will hear firsthand at these meetings from SCE staff and other community leaders or agencies about fire risk in California and the implications for them, how to be prepared and remain resilient, and information about SCE's wildfire mitigation efforts. Community members will also have an opportunity to share their questions and concerns. SCE is exploring virtual community meetings to increase the reach of these discussions. SCE will continue to participate in meetings hosted by third parties, such as local governments, to discuss its WMP and PSPS protocol. SCE will also engage with county emergency managers to prepare for the fire season, and review PSPS activations for opportunities to improve its PSPS protocols.

To ensure that messages do not conflict and attention is focused appropriately on safety imperatives, information and resources, SCE will align its local outreach campaign with PSPS education campaigns airing statewide in conjunction with the other two large electric Investor-Owned Utilities (IOUs) and California Governor's Office of Emergency Services (Cal OES). The IOU Customer Engagement effort is a multi-channel, multi-lingual campaign using digital ads, social media ads and radio ads to provide customers with important and consistent messaging about wildfire mitigation activities happening across the state.

In addition to community outreach efforts to inform its customers, SCE increased efforts to obtain direct feedback from customers about their outage experiences and their recommendations to better prepare customers for such events. The information gathered from these activities have led to focused efforts to address customer needs based on unique usage profiles. The information is also used in the implementation of long-term solutions that promote self-sufficiency and resiliency. In 2020-2022, SCE will continue to develop and implement various research activities that gauge customer awareness, preparedness for, and satisfaction with outage experiences. These activities include, but are not limited to:

1. Town hall meetings in areas that have been highly impacted by WMP/PSPS outages
2. On-line and telephone surveys of both residential and business customers who have had WMP/PSPS outages
3. Focus groups with key populations to identify how outages impact their day-to-day functionality and how they manage during outages
4. Assessments of programs and services that have been designed to better prepare customers before outages, and provide support during these outage events

During this period, SCE will use year-over-year performance data to establish a benchmark of current activities and long-term goals for facilitating customer preparedness. SCE will use the data to explore additional programs and services that support customer resiliency. SCE will monitor the performance of the programs and services that result from its research and education activities by using performance metrics for outage satisfaction and tracking the changes in outage awareness and customer satisfaction with implemented support services.

Longer term, SCE will employ a similar strategy to the one described above, reaching out to all local governments and tribes in SCE's HFRA to provide updates on the WMP and updates to its PSPS protocols. The meetings provide an opportunity for SCE to learn about ways to improve how the company interacts with local governments and tribes during PSPS and other emergency incidents. SCE will continue its engagement with County Emergency Operational Areas so that local government emergency response officials are aware of the PSPS protocol and can continue to work together with SCE to improving collaboration during PSPS events and other emergencies.

5.3.9.3 Customer support in emergencies

As described earlier in this section and in Section 5.3.6.7, SCE implemented EONS in 2019 to execute high-volume targeted notifications within very short timeframes, enabling SCE to reach a large number of customers in areas potentially subject to PSPS. SCE also developed a process to utilize this technology for customers impacted by disasters and inform of SCE's offerings and provide recovery support. In the fourth quarter of 2019, SCE enhanced EONS' capabilities to expand in-language notifications based on customer preference including, but not limited to, Spanish, Tagalog and Chinese.

SCE also enhanced notification plans to include options for those who are not an SCE account holder or customer of record to receive outage notifications, by implementing a registration for alerts and notifications at a zip code level. Also, residents who are not the customer of record (such as those in a master-metered community) but know the name on the SCE account and the service address for their specific address can sign up for emergency SCE alerts and notifications. SCE updated its annual master-metered letter to inform property owners (i.e., SCE account holders) of the options available to their tenants, which can be posted in community areas for awareness to these populations of customers.

SCE's long-term strategy will focus on continual improvement in areas that aim to increase customers' awareness before, during and following emergencies. SCE will work to improve customers' knowledge of the program offerings available and ensure customers receive critical notifications when emergencies arise. SCE will also emphasize reaching customers throughout the service territory. SCE is launching a targeted campaign to its master-metered properties that will provide information regarding PSPS events, instruct on how to sign up for alerts and notifications and direct customers to SCE's website to learn more about SCE's activities, PSPS and consumer protections from disasters.

5.3.9.4 Disaster and emergency preparedness plan

SCE regularly maintains disaster and emergency preparedness plans, which serve as the foundation for IMT training, exercise and response activities designed to facilitate a rapid return to continuity of operations. Among these plans are the Wildfire Response Plan that contains PSPS protocols and the tasks associated with execution in the IMT structure. Plans are regularly tested via simulation exercises and real-world events to ensure IMT members' proficiency in roles and responsibilities. These events also allow SCE to better understand resource needs during response operations, such as the number of personnel needed to execute emergency functions and restoration during PSPS events.

The Storm Plan articulates the operations and policies that guide how the company plans for, addresses and responds to emergency electrical incidents using the utility-specific ICS structure. It is designed to facilitate safe and efficient restoration of outages caused by outside forces, through the development of accurate situational awareness and the sharing of critical information during an incident. The Storm Plan outlines the communications strategy and notification procedures by which SCE will communicate with its customers, the public, appropriate government agencies, essential service providers, critical care customers, and other important stakeholders in the restoration process. It also outlines how SCE will collaborate with the communities it serves in preparing for and responding to emergency events, which may include activities such as pre-positioning of field resources or equipment in advance of forecasted weather events.

The Wildfire Response Plan outlines a threat specific strategy aimed at mitigating, planning for, responding to and recovering from an actual wildfire event, as well as a potential fire event with the possible need for proactive de-energization through use of the PSPS protocol. It outlines the roles and responsibilities for the company leadership and incident response personnel across the enterprise during response operations.

To ensure effectiveness, components of SCE's disaster and emergency plans are regularly quality checked and periodically audited. For example, each real-world and simulation exercise is required to have an After Action/Corrective Action plan for all issues identified over the course of the incident. SCE tracks these for completion and incorporates all lessons learned into existing plans and protocols through regular updates to its disaster and emergency plans. SCE maintains both an annual plans maintenance schedule and a training/exercise calendar to facilitate syncing plan updates with lessons learned from existing trainings and exercises. SCE's long term disaster and emergency plans will continue to be regularly updated to incorporate additional regulations and identified corrective actions and maturity models.

SCE also actively engages key stakeholders in conjunction with maintaining its disaster and emergency preparedness plans. As previously described in Section 5.3.6 Grid Operations and Protocols, in the event of a PSPS activation, SCE will coordinate with local emergency management agencies and employ a variety of targeted communication channels to ensure customers are notified in a timely manner. Also, in Section 5.6.2, SCE describes engagement with public safety partners, including fire and law enforcement agencies, to collaborate on mitigation strategies and event protocols, as well as outreach efforts to water agencies, telecommunications companies, and healthcare providers to educate them on PSPS protocols and potential impacts.

5.3.9.5 Preparedness and planning for service restoration

SCE provides its employees with the tools, plans, guidelines, and strategies to help ensure smooth and rapid re-energization. SCE increases resiliency by training employees to handle PSPS events weeks and even months in advance. During and before an event, the IMT briefs local field personnel on circuits that have a potential of being de-energized for PSPS. Existing SAP repair notifications are given to the local field personnel ahead of the activation to help remediate on those circuits before the wind event begins. If a circuit is nearing the de-energization criteria, SCE reviews switching plans to assess how the de-energizations can be the least impactful to the customers, while still isolating the area of concern. These switching plans are also used when the circuits are being re-energized. Once circuits have de-escalated from PSPS criteria, the circuits are prioritized by the restoration teams to be patrolled and re-energized in a strategic fashion. Restoration teams have the expertise to assess whether additional resources are needed to re-energize a circuit faster, especially in the hard-to-reach circuits, by proactively requesting air operations to aid in the patrolling of de-energized lines. As the lines are being patrolled and monitored for re-energization, SCE maintains clear communications with all the affected departments.

In 2019, SCE significantly improved the consistency, rapidity, and reliability of the re-energization process, by developing De-energization and Re-energization protocols specific to use of the PSPS. De-energization protocols ensure that all groups are notified of the pending de-energization, that steps are documented and verified and that the proper managerial approvals have been obtained. Similarly, re-energization protocols ensure that all those affected are notified that a circuit is in the process of being restored, as well as having the steps documented, verified and approved by management. These protocols include circuit-specific switching plans created prior to the event, which save the teams time in both de-energizing circuits and re-energizing them. For 2020 to 2022, and in the longer term, SCE will continue to focus on opportunities to improve restoration by exploring new tools and technologies that support the IMT and field staff with restoration efforts.

To ensure compliance, SCE will establish the following audit measures. SCE plans on performing a quarterly audit to confirm Consolidated Mobile Solution (CMS), Circuit Maps, and Geographical Information System (GIS) Circuit Geometries match. SCE also plans on reviewing the de-energization and re-energization forms after an event to ensure that they are being completed correctly and to identify any potential areas of improvement to the form or personnel training.

5.3.9.6 Protocols in place to learn from wildfire events

Following every wildfire or PSPS EOC activation, SCE conducts a debriefing of response participants to solicit feedback and lessons learned. This feedback is incorporated into an After-Action Report (AAR), which includes an Improvement Plan or a Corrective Action Plan. SCE maintains a robust after-action process for all IMT activations, regardless of hazard. These protocols have been successful in ensuring that strengths and successes during activations are replicated across future incidents. SCE will use AARs to assess areas for improvement, turn these areas into corrective actions, and assign actions to personnel to remediate.

In 2019, AARs were completed for all IMT activations, including those related to wildfires or PSPS. These AARs have been successfully utilized to describe and assign necessary corrective actions and ensure the continuous improvement of SCE preparedness and response efforts.

SCE plans to continue utilizing these protocols and processes in order to assign corrective actions and continuously improve. Currently, there are no plans to change the processes or procedures for developing AARs or corrective actions.

See Table 29 “Emergency planning and preparedness” for more detail on the initiatives above.

5.3.10 Stakeholder Cooperation and Community Engagement

Description of programs to reduce ignition probability and wildfire consequence

For each of the below initiatives, provide a detailed description and approximate timeline of each, whether already implemented or planned, to minimize the risk of its equipment or facilities causing wildfires. Include a description of the utility's initiatives, the utility's rationale behind each of the elements of the initiatives, the utility's prioritization approach/methodology to determine spending and deployment of human and other resources, how the utility will conduct audits or other quality checks on each initiative, how the utility plans to demonstrate over time whether each component of the initiatives is effective and, if not, how the utility plans to evolve each component to ensure effective spend of ratepayer funds. Include descriptions across each of the following initiatives. Input the following initiative names into a spreadsheet formatted according to the template below and input information for each cell in the row.

1. *Community engagement*
2. *Cooperation and best practice sharing with agencies outside CA*
3. *Cooperation with suppression agencies*
4. *Forest service and fuel reduction cooperation and joint roadmap*
5. *Other / not listed [only if an initiative cannot feasibly be classified within those listed above]*

The list provided is non-exhaustive and utilities shall add additional initiatives to this table as their individual programs are designed and structured. Do not create a new initiative if the utility's initiatives can be classified under a provided initiative.

SCE is committed to keeping its customer and key stakeholders informed on the company's WMP activities, PSPS protocols, and general emergency preparedness. In 2019, SCE conducted over 350 meetings and presentations with local government and tribal officials, community organizations, and the general public. In 2020, SCE will continue to inform its customers on wildfire mitigation strategies and concentrate its efforts on communities that were impacted by multiple PSPS de-energizations in the past.

5.3.10.1 Community engagement

In 2020, SCE will continue to regularly engage with local government officials, tribal staff and first responders to educate stakeholders on SCE's 2020-2022 WMP and its potential impact on their community. These meetings will focus on educating local and tribal governments about the PSPS de-energization process and how the company will communicate and work with government agencies and emergency operations during outages. In the past, SCE received input from these meetings and other discussions with local government officials and incorporated them in its PSPS notifications. For example, when SCE expects conditions to meet the criteria for potential PSPS, "Periods of Concern" notifications are sent to local government officials so they are better able to plan for potential PSPS events. SCE will continue these meetings to further enhance partnerships, increase awareness, and discuss lessons learned.

SCE will also continue to conduct meetings in HFRA communities to engage SCE customers, community leaders, and other stakeholders to understand their questions and concerns, as well as to increase awareness about the fire risk in California and what that means to them; how to be prepared and remain resilient; and SCE's wildfire mitigation efforts. These forums allow SCE to obtain up-to-date customer information that is critical for outreach and notification during events. SCE will invite local first responders, emergency personnel and the Red Cross to educate the community members on emergency preparedness. SCE is also exploring virtual community meetings to increase the reach of the meetings. SCE's community outreach, public awareness, and communications efforts are further described in Section 5.3.9.2.

5.3.10.2 Cooperation and best practice sharing with agencies outside CA

SCE believes in the value of cooperating and sharing best practices with agencies outside of California to help educate and learn from other organizations that may be facing similar challenges. SCE will continue to engage and share best practices with industry trade associations, including but not limited to, Electric Power Research Institute, Western Energy Institute, and Edison Electric Institute. Additionally, SCE will continue to share expertise and insights with technical organizations including the Institute of Electrical and Electronic Engineers and the National Fire Protection Association.

SCE is currently working with the UMS Group to establish an International Joint Investor-Owned Utility wildfire committee with two of the major Australian electric utilities, AusNet Services and Powercor Australia. This planned committee would include the three large investor-owned utilities (IOUs) in California and the two Australian utilities with the intent of sharing best practices and lessons learned.

The comprehensive approach to sharing with trade associations, technical organizations and establishing an international wildfire committee gives SCE the ability to collaborate and share best practices with a vast of array of agencies both nationally and internationally.

5.3.10.3 Cooperation with suppression agencies

SCE develops and maintains excellent long-term working relationships with fire suppression agencies in order to become a trusted partner in all aspects of fire risk mitigation, training and emergency response. SCE's internal Fire Management team is responsible for maintaining situational awareness of fire threats and fire activity affecting or having the potential to affect the electric grid; reporting on fires; responding in person to fires threatening SCE infrastructure; and representing SCE and acting as a liaison with public agencies and affected SCE organizational units. They are required to serve as SCE's technical representative and subject matter experts to fire agency incident commanders, senior staff, and fire agency executives, and they must possess a good working knowledge of the ICS and SCE's transmission and distribution power delivery systems, including construction and protection. The Fire Management team also ensures that critical information is shared between SCE organizational units and public agencies and resolves conflicts. They also provide Electrical Safety for First Responders training to suppression agencies, organizations and conferences. SCE Fire Management is the point of contact and coordinator of fire agency access to SCE's HD cameras throughout its 50,000-mile service territory (see 5.3.2 Situational Awareness and Forecasting). SCE will continue to partner with all wildland fire suppression agencies as part of SCE's overall fire mitigation efforts.

5.3.10.4 Forest service and fuel reduction cooperation and joint roadmap

Cooperation with the U.S. Forest Service (USFS) on fuels reduction is ongoing. To be clear, these are not independent fuel reduction activities, but rather mechanisms and agreements through which SCE is able to execute its vegetation management work. In March 2019, SCE completed a two-year effort with Region V of the USFS where SCE obtained new 30 year master permits and easements (MPEs) for its facilities on USFS lands and developed an O&M Plan that contains a framework to allow for streamlined approvals when completing O&M work, including fuel reduction activities. At a minimum, SCE holds annual meetings with each of the seven forests covered under the MPEs. There are three forests where SCE holds quarterly meetings to discuss a variety of projects including efforts that are under way to reduce fuels that have the risk of impacting SCE powerlines and facilities.

SCE has been collaborating with Sierra National Forest over the past year and a half to significantly reduce fuels in and around its powerlines. SCE has also been working closely with Inyo National Forest over the past several months to reduce fuel hazards. SCE has well established relationships with the USFS and regularly interacts with its staff and leadership (at the Forest and Region V level).

The MPEs and associated O&M Plan constitutes formal agreements with the USFS covering fuel reduction activities among other things. The O&M Plan also calls out fuel reduction activities as a Class III activity, meaning that in the event we have a large fuel reduction project, SCE would submit the request to the USFS. The USFS then has 30 days to get back to us to determine next steps. However, even with the MPEs in place, there is the potential for delays in the event the USFS requires additional environmental analysis under the National Environmental Policy Act (NEPA).

See Table 30 "Stakeholder Cooperation and Community Engagement" for more information on the initiatives above.

5.4 Methodology for Enterprise-Wide Safety Risk and Wildfire-Related Risk Assessment

Describe methodology for identifying and evaluating enterprise wide safety risk and wildfire related risk, and how that methodology is consistent with the methodology used by other electric utilities or electrical corporations. If the risk identification and evaluation methodology is different, the utility shall explain why in this section.

Similar to the other California investor-owned utilities, SCE followed the CPUC's adopted risk-mitigation procedures in the S-MAP and RAMP[40] in developing its methodology for identifying and evaluating enterprise wide safety risk and wildfire risk. See Section 4.2 for more detail.

[40] For more details on SCE's RAMP methodology, please see Southern California Edison Company's *2018 Risk Assessment And Mitigation Phase Report*, http://www3.sce.com/sscc/law/dis/dbattach5e.nsf/0/B2ADFEF6506791E9882583460074389A/$FILE/I.18-11-006%20SCE%202018%20RAMP%20Report.pdf

5.5 PLANNING FOR WORKFORCE AND OTHER LIMITED RESOURCES

Include a showing that the utility has an adequately sized and trained workforce to promptly restore service after a major event, taking into account employees of other utilities pursuant to mutual aid agreements and employees of entities that have entered into contracts with the utility.

SCE maintains an adequate and trained workforce ready to provide assistance during emergencies. SCE has a Storm Plan to respond to emergencies that can vary in scope and size and which may require the activation of mutual assistance to restore power in a safe and timely manner. SCE also has a robust ICS training program for employees identified as emergency responders. In 2019, SCE had 655 rostered members, all of whom received either initial qualification or re-qualification training.[41] All of these members were trained for activations, and these personnel are now all rostered to an IMT, IST (Incident Support Team), or PSPS Task Force. Many of these positions received multiple trainings from BR (such as ICS 300, position specific, and PSPS specific trainings).

IMTs are placed on rotations, and on-call teams are required to respond to the EOC within two hours, with limited exceptions. These teams are specifically structured to have multiple back-ups available, so that response and recovery efforts can be conducted 24 hours-a-day for several days or even weeks. Moreover, SCE has a large field workforce (both employees and contractors) that is highly skilled and able to restore service during and after a major event (see Table SCE 5-15 and Table SCE 5-16). SCE's field workforce has many years of experience, on average, which allows it to effectively respond to major events. SCE also employs contract resources that can be reassigned to assist with a major event.

Due to the frequency and duration of PSPS activity in 2019, SCE expanded the number of PSPS IMTs from four to six teams and expanded the number of positions on each team to improve overall operations and balance workload and fatigue. SCE also put in place a dedicated Advanced Circuit Evaluation (ACE) team to continually monitor, assess, track and report out on circuit integrity and environmental conditions to inform PSPS decision making. Over this WMP period, SCE will continue to refine and enhance its PSPS program based on lessons learned, community feedback, and WSD and Commission guidance. For example, as further described in Section 5.3.6.5.7, SCE is setting up a new, dedicated PSPS Operations Team.

IMT and EOC capabilities are tested regularly both by actual incidents such as windstorms, wildfires, and PSPS, and through exercises and drills that all team members are required to participate in annually. These exercises, drills, and actual activations provide an opportunity for team members to utilize their training, refresh their skills, and learn on the job. During exercises and drills, team members are also evaluated on their performance and given feedback on areas for improvement and best practices.

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[41] This number excludes 'non-rostered' positions (e.g., assistants, analysts, and customer service representatives) that assist in activations in an ad-hoc manner but are not considered ICS trained.

In addition to SCE's internal response and recovery capabilities, SCE maintains existing mutual assistance agreements with outside providers to meet restoration objectives. These mutual assistance agreements are activated in incidents which exceed the capacity of SCE's crews and emergency contracting capabilities. The IMT and EOC maintain visibility on the workforce and incidents, maintaining situational awareness of any staffing shortages or other potential shortages, looking ahead at potential needs and requesting appropriate support via additional internal staffing, emergency contracts, or mutual assistance. These requirements are captured in SCE's Storm Plan detailed in Section 5.3.9, Emergency Preparedness and Planning.

Recognizing the impacts of climate change, the increasing wildfire risk within SCE's HFRA service territory, and the potential for numerous PSPS related activations, SCE added approximately 75 additional contract crews and approximately 180 additional contract planners in 2019 to help design and execute all its work including the critical wildfire mitigation efforts described in its 2019 WMP. SCE continues to evaluate the need for additional field resources and trained staff members. In 2020, SCE plans to continue to add contract crews and professional staff including planners, engineers, and other resources to continue to build out its workforce to execute critical wildfire initiatives amongst other work. SCE will also continue to implement training and exercise opportunities in 2020 to increase team capacity and will continue to do so through this WMP period. In Table SCE 5-15, SCE provides a detailed breakdown of its Distribution Field Workforce and supporting personnel through 2019. In Table SCE 5-16 below, SCE provides a similar detailed breakdown of its Transmission, Substations & Operations Field Workforce and supporting personnel through 2019. These tables show that SCE grew its field workforce by approximately 700 resources (SCE and contract) compared to January 2019 counts provided in the 2019 WMP. [42]

[42] In the 2019 WMP, SCE mistakenly did not include distribution contract planners of approximately 520.

Table SCE 5-15
Distribution Field Workforce

Distribution - Resources	As of Year End 2019 (FTE only) 5,159	Supporting
Foreman Electl Crew	166	Trained resources to work on SCE's high voltage, overhead and underground distribution system. They perform inspections and maintenance, assess system damages, make repairs to restore service, and serve as SCE's first responders.
Journeyman Lineman	572	
Troubleman	205	
Splcr Sr Cble	23	
Streetlight Repairman	27	
Lineman, Apprentice	201	Serve as compliments to field crews, training under the direct supervision of Journeyman Lineman and Foreman.
Groundman	333	Compliments the field crews as part of their training, working in direct supervision of the Journeyman Lineman and Foreman.
Sup, Field	82	Provides management, field safety, and operational oversight and technical support for field crews in each of the SCE's district locations.
Sup, General Foreman	73	
Form Troubleman Training	4	
PSPECs	107	Coordinates outages, laying out jobs and customer contacts
Sup, Project General Sup	41	Oversees contract crews site training, safety
Field Service Rep	144	1st responders - identify problems and stand by to ensure site is secure
Meter Technicians	97	
MGR - Metering Field Ops	3	
Sr Sup, Ops	28	
Sr Sup, Engy Del / Distrib	17	
Planners/Designers	769	Damage assessments - support the field crews by conducting assessments, order material, and other admin support
Materials Mgmt, Sr Specialist	17	
Construction/Maintenance Clerk/Special	215	
Supervise Construct/Maint Acct	50	
Meter Support Specialist	7	
Spclst Fld Svcs Support	4	
Inspectors	175	
Contractors - 4-Man Crew	1,100	Avg 275 crew (4-Man Crew)
Contractor - Planner/Designer	699	

Table SCE 5-16
Transmission, Substations & Operations Field Workforce

Transmission, Substations & Operations - Field Crews	2019 Year-End 1,318	Supporting
Transmission		Trained resources to work on SCE's high voltage, overhead and underground distribution system. They perform inspections and maintenance, assess system damages, make repairs to restore service, and serve as SCE's first responders.
Journeyman Lineman	133	
Splcr Sr Cble	20	
Patrolman Sr	38	
Right of Way Equipment Operator	5	
Transmission		Compliments to field crews, training under the direct supervision of Journeyman Lineman (i.e. JM Battery Electricians, Construction Electricians, Substation Cable Splicers) and Foreman.
Groundman	30	
Lineman, Apprentice	62	
SC&M		
Apprentice Substn Elctrcn	35	
Electn Appr Battry	4	
Electn Appr Cnstrn	14	
Hlpr Electl Constr	5	
Splcr Appr Subs Cable	3	
Transmission		Provides management, field safety, and operational oversight and technical support for maintenance & test crews.
Sup, General Foreman	14	
Supr Road R/W	4	
SC&M		
Substation Electrician	129	
Sup, Apparatus	5	
Sup, Cnstrn	4	
Sup, Tech Spec	1	
Sr Sup, Maint / Test	44	
Grid Ops		
Sup, Substn Ops	5	
Transmission		Coordinates outages, laying out jobs and customer contacts
PSPECs	10	
SC&M		1st responders - identify problems, stand by to ensure site is secure, analyze grid flow, and support construction (i.e. civil)
Electn Battry	8	
Electn Constrn	45	
Form Dstrbn Aprts	16	
Mech Structural	17	
Splcr Subs Cable	7	
Techn Dstrbn Aprts	42	
Techn Electl Aprats Test/Test A	4	
Technician, Test	79	
Technician, Test Supervising	54	
Transformer Helper	4	
Transformer Specialist	15	
Transformer Specialist Foreman	4	
Utilityman Terrtrl	16	
Welder Cnstrn	4	
Working Foreman - CFF	6	
Working Form CFF Elect Const	3	
Grid Ops		
Operator, System	136	
Opr Substation	111	
Opr Trainee	6	
Power Sys Ops Specialist	46	
Power Systems Planner 3	4	
SC&M		Damage assessments - support the field crews by conducting assessments, order material, and other admin support
Materials Mgmt, Advisor	11	
Transmission		
Planners	51	
Contractors	64	Avg 16 crews (4-Man Crew)
Telecom	13	
Form Cable	9	1st responders - identify problems, stand by to ensure site is secure, analyze grid flow, and construction
Planner	1	
Trans Telecom PSPEC	3	
Total	**1,331**	

5.6 Expected Outcomes of 3-Year Plan

5.6.1 Planned Utility Infrastructure Construction and Upgrades

Explain how the utility expects the geographic location of transmission and distribution lines to shift over the three-year plan period and discuss its impact on 1) the utility's risk exposure and 2) the utility's wildfire mitigation strategy. Outline portions of grid within HFTD that are highest cost to serve, by highlighting circuits or portions of circuits that exceed $0.5M per customer in capital cost required to harden. Provide justification for the level of hardening required and why the lowest cost path to harden this equipment exceeds $0.5M per customer, including by describing the various alternatives that were considered to reduce ignition probability and estimated wildfire consequence. For each of these sections of the grid, outline any analysis that was conducted around islanding, serving with microgrids, or providing backup generation, all to reduce the impact of PSPS events and reduce ignition probability and estimated wildfire consequence at the lowest possible cost.

Discuss how the utility wildfire mitigation strategy influenced its plan for infrastructure construction (in terms of additions or removal of overhead lines, including undergrounding of overhead lines) as detailed in Section 3.4.2. Discuss how the utility wildfire mitigation strategy influenced its plan for upgrades to overhead lines and substations as detailed in the Section 3.4.2.

How Transmission and Distributions Lines are Expected to Shift and Their Impact on Risk and WMP Strategy Over the 3-year Period

Distribution and transmission lines in SCE's service territory are expected to incrementally grow and shift over the three-year WMP period due to additions and removals of lines. Additions and removals of lines occur for various reasons including, but not limited to, new circuitry to accommodate customer load growth and Distributed Energy Resources (DER), line extensions, removal of facilities, generator interconnections, new substations, and undergrounding of existing overhead lines. While there are various drivers that result in changes and additions to SCE's lines, SCE designs and constructs lines in accordance with standards to minimize risk exposure in support of its wildfire mitigation strategy. Therefore, new infrastructure will be designed and constructed utilizing the latest wildfire mitigation strategies, current risk analyses, and determination of a solution to reduce the risk at that location. For example, all new distribution circuits and poles in HFRA will be constructed with at least insulated conductors and fire-resistant poles. Further details on changes to SCE's design and construction standards are described below. These standards and continual risk analyses, coupled with SCE's wildfire initiatives (including PSPS) in HFRA through this WMP period, are anticipated to help decrease ignitions in HFRA thus reducing wildfire risk and increasing public safety.

Current plans[43] over the three-year WMP period demonstrate the following net changes[44] in

[43] Current plans account for known transmission, substation and distribution projects that are far along the planning and engineering phase and SCE has geospatial data for.

[44] Positive change is a net addition, and a negative change is a net removal.

terms of geographic location of transmission overhead lines in SCE's service territory:

- In non-HFTD, a net change of approximately 18.9 circuit miles of transmission lines
- In HFTD Zone 1, a net change of 0.0 circuit miles of transmission lines
- In HFTD Tier 2, a net change of approximately 14.9 circuit miles of transmission lines
- In HFTD Tier 3, a net change of approximately 25.5 circuit miles of transmission lines

The land use breakdown of these net changes in HFRA are 14.0% in urban areas, 21.8% in rural areas, and 64.2% in highly rural areas. The percentages provided represent known quantifiable changes for overhead transmission circuit miles. Additional circuit mile changes may be planned and implemented between 2020 and 2022.

The information listed above and within Table 16 does not include distribution primary overhead line removals due to targeted undergrounding. As a result, the total primary overhead line removals that are anticipated through 2022 are not fully reflected within the net changes provided above. While a list of potential targeted undergrounding projects has been identified, SCE will continue to refine its evaluation methodology and determine the areas to execute targeted undergrounding work in support of its wildfire mitigation strategy. In addition, as noted in Section 2.7, SCE does not routinely track planned additions, removals, or upgrades by circuit mile, population density, or WUI. While SCE has a number of planned distribution projects over the next few years, they are not far along enough in the project lifecycle to have a complete list of affected structures (new or existing), circuit path/route geometries, and/or geospatial coordinates. Therefore, SCE is unable to map the distribution projects in GIS and subdivide as requested to summarize net changes to distribution overhead lines.

See Table 16 "Location of Planned Utility Equipment Additions or Removal by End of 3-year Plan Term" for more detailed information highlighting changes in transmission overhead lines over the three-year WMP period.

Highest Cost to Serve Portions of the Grid within HFTD

A circuit level review was completed to determine the cost per metered customer for capital expenditures (non-maintenance or compliance-related activities) currently planned related to grid hardening projects. The list of grid hardening activities considered for this analysis are listed below.

- Wildfire Covered Conductor Program (WCCP)
- High Fire Risk Area (HFRA) Sectionalizing Devices and PSPS mitigation
- Fusing Mitigation
- Targeted Undergrounding Program

Where scope identified was currently available, a cost required to harden per metered customer was found by aggregating all hardening activity costs for a targeted circuit, and then evaluating whether the ratio of cost per metered customers exceeded a threshold of $0.5 million. The outcome of the above described review demonstrated that zero circuits currently exceeded the threshold of $0.5 million per metered customer.

Wildfire Mitigation Strategy Influence on Construction and Upgrades
SCE's 2019 wildfire mitigation strategy included updating distribution design and construction standard manuals to expand the use of wildfire mitigating measures in HFRA. For example, standards were refined for connector selection in HFRA application to prioritize the use of CAL FIRE-exempt connectors, such as bolted wedges. SCE also completed the publication of the CAL FIRE-exempt spark prevention surge arrestor after a successful pilot evaluation (as a result of 2019 WMP AT-1 and AT-4 activities). These surge arresters are now required with all HFRA applications. Additionally, SCE issued standards on increased usage of vibration dampers on bare conductor for mitigating the Aeolian vibration effect (as a result of 2019 WMP AT-4 activity). Furthermore, SCE published standards for ridge-pin construction which is an alternative construction method increasing the vertical separation between the center phase conductor and the two other phases and reducing the potential for conductor slapping (as a result of 2019 WMP AT-4 activity). Finally, SCE updated its design and construction standards to include fire-resistant wrap on new treated wood poles for use in HFRA, an alternative to fire-resistant composite poles (as a result of 2019 WMP RAMP Mitigation M9 activity). SCE frequently reviews and updates these standards to reflect regulatory requirement changes, new or revised construction methods, and new technologies to help mitigate wildfire risk. Over this WMP period, SCE plans to continue improving its wildfire mitigation transmission design and construction strategies as well as expanding its efforts to the transmission system. See Section 5.3.3.18, TOH Review for more details.

Change In Drivers Of Ignition Probability Taking Into Account Planned Initiatives For Each Year Of The Plan
Tables 31a and 31b include estimates of changes in drivers of ignition probability considering planned wildfire mitigation initiatives for each year of the plan for distribution and transmission equipment, respectively. Estimates were provided for drivers where SCE tracks near misses. As such, there are a few drivers SCE does not track and these are coded NA in the tables. SCE assumed constant weather patterns consistent with its historical weather data.

The calculations for projected ignitions in Tables 31a and 31b are primarily driven by the cumulative propagation of mitigation effectiveness for each of the mitigation initiatives. Although the numbers provided in the table reflect an expected value, the uncertainty inherent in each mitigation effectiveness estimate, especially when compounded with the other mitigations, leads to a significant range of uncertainty around the expected value calculation.
See Tables 31a and 31b "Change in Drivers of Ignition Probability Taking into Account Planned Initiatives, for Each Year of Plan" for more detail.

5.6.2 Protocols on Public Safety Power Shut-off

Describe protocols on Public Safety Power Shut-off (PSPS or de-energization), to include (See 1 through 5 in italics below):
1. Strategy to minimize public safety risk during high wildfire risk conditions and details of the considerations, including but not limited to list and description of community assistance locations

and services provided during a de-energization event.
2. Outline of tactical and strategic decision-making protocol for initiating a PSPS/de-energization (e.g., decision tree).
3. Strategy to provide for safe and effective re-energization of any area that was de-energized due to PSPS protocol.
4. Company standards relative to customer communications, including consideration for the need to notify priority essential services – critical first responders, public safety partners, critical facilities and infrastructure, operators of telecommunications infrastructure, and water utilities/agencies. This section, or an appendix to this section, shall include a complete listing of which entities the electrical corporation considers to be priority essential services. This section shall also include description of strategy and protocols to ensure timely notifications to customers, including access and functional needs populations, in the languages prevalent within the utility's service territory.
5. Protocols for mitigating the public safety impacts of these protocols, including impacts on first responders, health care facilities, operators of telecommunications infrastructure, and water utilities/agencies.

5.6.2.1 Strategy to Minimize Public Safety Risk During High Wildfire Risk Conditions

SCE's wildfire mitigation plan strategy is designed to prevent, combat and respond to the threat of wildfires and consists of three main pillars: enhancing operational practices, bolstering situational awareness, and hardening the grid. Each of these wildfire mitigation focus areas include initiatives designed to minimize public safety risks during high wildfire risk conditions. Operational practices, for example, include vegetation management, implementation of system operating restrictions and PSPS response protocols. During elevated fire weather conditions, SCE proactively employs a number of operational practices to mitigate against the threat of wildfires, reserving PSPS for extreme weather conditions. These other operational practices include, but are not limited to, blocking reclosers to prevent automated reclosing devices from re-energizing circuits when conditions may be hazardous and implementing Fast Curve settings to reduce the fault energy to more quickly de-energize when a short circuit has been detected, as described in Section 5.3.3.

In the area of situational awareness, SCE has invested in tools, technologies, and practices to better forecast potential wildfire conditions and be more effective in responding to fire events when they occur. These include: a Situational Awareness Center that during emergencies and incidents is staffed around the clock with meteorologists and Geographic Information System (GIS) professionals, additional weather stations that provide real-time information about wind, temperature, and humidity to help SCE make decisions during potential fire conditions, and live fire-monitoring cameras to help IMTs and first responders more quickly assess and respond to reported fires. Additionally, in 2020, SCE will have installed two super computers (one at the primary location and one at the backup location) that help produce high-resolution weather and fuel modeling forecasts to provide IMTs with precision and granularity.

In the area of grid hardening, mitigations to reduce the risk of ignition include: Installation of insulated wires that lower the chance of faults or short circuits that can create ignitions, fire resistant pole wraps that are more resilient than wood poles, and fast-acting fuses that can react more quickly to minimize fire risks. All of these efforts help reduce the public safety risk during high wildfire risk conditions.

5.6.2.2 Tactical and Strategic Decision-Making Protocol for Initiating a PSPS

The decision to preemptively de-energize a circuit requires consideration of many complex factors. Execution of de-energization protocols is managed by the Incident Management Team (IMT) in alignment with nationally recognized Incident Command System principals. The following considerations are intended to provide a framework to assist the IMT in exercising this discretion:

- National Weather Service alerts or warnings for counties that contain SCE circuits in high fire risk areas;
- Ongoing assessments from SCE's in-house meteorologists informed by high resolution weather models, data from strategically deployed SCE weather stations (e.g., wind speeds, humidity levels, and temperature), and publicly available weather stations;
- The SCE Fire Potential Index (FPI), an internal tool that utilizes both modeled weather and fuel conditions;
- Real-time situational awareness information obtained from weather station data and in some instances, field observers positioned locally in high fire risk areas identified as at risk for extreme fire weather conditions
- Specific concerns from state and local fire authorities, emergency management personnel, and law enforcement regarding public safety issues;
- Expected impact of de-energizing circuits on essential services such as public safety agencies, water pumps, traffic controls, etc.; and
- Other operational considerations to minimize potential wildfire ignitions including current known state of circuit conditions.

SCE will continue to improve its ability to gather improved and real-time information that better informs PSPS decisions. For a more detailed narrative on SCE's process for de-energization and lessons learned, refer to Section 4.4.

5.6.2.3 Protocols for mitigating the public safety impacts of these protocols

SCE continues to host meetings and provide information to county Offices of Emergency Management (OEM), local and tribal governments, public safety agencies and community members (including selected groups through specialized workshops) that may be impacted by circuits that traverse HFRA. These meetings enable SCE to provide information regarding its PSPS protocol, explain its wildfire mitigation efforts, and encourage emergency preparedness. SCE uses these opportunities to convey the importance of community resiliency in the event of any outage, irrespective of cause, and to receive important feedback from its customers so SCE may incorporate this feedback into its planning process and PSPS protocol. These meetings, and SCE's wildfire planning efforts (including PSPS), are conducted in compliance with PU Code Section 768.6.

SCE continues to hold regular meetings with public safety partners including fire agencies, law enforcement agencies and emergency management agencies to continue dialogue regarding PSPS and to collaborate on mitigation strategies and event protocols. Meeting topics include, but are not limited to, how circuits are identified as being subject to PSPS, overview of SCE's de-energization criteria, notification process throughout an event, information on SCE's ICS structure, how SCE handles emergent requests from public safety partners during events, and information sharing (e.g., GIS boundaries, critical care and medical baseline customer information, period of concern data, etc.).

SCE's engagement with local governments includes the following: information (via email) on its PSPS protocol and its wildfire mitigation efforts to representatives of cities, counties, tribes, and unincorporated communities (unincorporated communities are included in outreach to counties) with HFRA circuits; proposals to meet and meetings with key city and county personnel to further review and discuss any of the topics presented; proposals to provide maps of HFRA circuits (both PDF and GIS layers); requests for local governments and other agencies to provide SCE information on critical facilities/essential service providers and other concerns resulting from de-energizing particular circuits. Additionally, and upon request, SCE has presented at city council and local public safety commission meetings and solicited feedback on the company's WMP from fire officials in its service territory.

SCE also conducts outage education meetings (Outage Schools) throughout the year for business and residential customers. These meetings are designed to help customers understand what to expect during an outage, including an outage related to PSPS. Outage Schools will continue annually throughout SCE's service territory. Topics include the process for determining the extent of an outage (damage assessment), information on notification process during an outage, details on SCE's PSPS, and, outage restoration information.

SCE hosts targeted workshops and presentations with public safety partners including water agencies, telecommunications companies, and healthcare providers to educate them on PSPS protocols and potential impacts. These workshops allow for two-way communication to better understand customer concerns, including resiliency, and for customers to share best practices with one another. By partnering with industry associations, SCE is better able to discuss resiliency efforts with their members and gain assistance in expanding the reach of PSPS education.

Building off feedback received from impacted stakeholders, SCE formed an internal task force to address customer care solutions. The objective of this task force is to identify near-term and long-term customer care solutions to support customers potentially impacted by PSPS events. The task force develops solutions, educates customers on existing resources, and resolves issues for identified and emerging customer care initiatives. Such work includes:

- Response IMT: Response activities including deploying customer care assets to the field such as community resource centers, ice trucks, blankets, potable water, etc.
- Business, government and agency coordination, education and outreach: Outreach and support for affected business customers including telecommunication companies,

water entities, healthcare, and education. Initiatives for government agencies include rural and tribe-specific needs.

- Access and functional needs (AFN) and community-based organization (CBO) coordination: Outreach initiatives for AFN customers and CBO coordination to assist customers such as seniors, people with limited English proficiency, and customers with disabilities, and/or those who are transportation disadvantaged.
- Customer contact effectiveness: Continue to explore more effective information and resources to customers who call into the SCE call center. Partner with public agencies or non-profit organizations that can serve non-electrical needs.
- Products and programs: Explore and define new programs to support electric resiliency of customers including rebates for equipment such as back-up power and distributed energy resources and other programs for all classes of customers.
- Customer care feedback: Implement formal pipelines for PSPS-specific customer feedback. Execute PSPS research to determine customer needs and impact and/or test new materials.
- SCE.com/Digital/Notifications: Improvements to SCE.com information including maps and public alerts, including new methods of notifying customers.

5.6.2.4 Critical and Essential services

SCE considers the following customer categories as critical infrastructure providers:

- Emergency Services Sector, including:
    - Fire Stations (Federal/State/Local)
    - Police Stations (Federal/State/Local)
    - Emergency Operations Centers (EOCs)
    - Emergency Dispatch Centers*
    - Communications Sites Supporting Emergency Operations*
- Government Facilities, including:
    - Schools
    - Jails and Prisons
    - Gov't agencies essential to national defense
- Healthcare and Public Health Sector, including:
    - Public Health Departments
- Hospitals and Medical Facilities, including:
- Skilled Nursing Facilities
- Nursing Homes
- Blood Banks
- Dialysis Centers
- Hospice Facilities
- Energy Sector, including:
- Public and Private Utility Facilities
- Inter-connected Publicly Owned Utilities
- Electric Cooperatives
- Community Choice Aggregators (CCA)

- Water and Wastewater Systems Sector, including:
- Pumping Stations
- Well Sites
- Lift Stations
- Wastewater Treatment Plants
- Flood Control Gates*
- Communications Sector, including:
- Radio and Television Broadcasting Stations
- Communication Carrier Infrastructure:
- Routers
- Central Offices
- Head Ends
- Cellular Switches
- Cellular Sites
- Remote Switches
- Radio Repeaters Utilized by Emergency Responders*
- Chemical Sector, including:
- Chemical Plants
- Chemical Storage Facilities
- Chemical Distribution Centers
- Transportation Sector, including:
- CalTrans Operations Centers*
- Transportation Management Centers*
- Airports*
- Mass Transit Stations*

* Represents County request as Critical Infrastructure/Facilities

6 UTILITY GIS ATTACHMENTS

As explained in Section 2.7, SCE is providing the WSD with both confidential and non-confidential GIS files. The non-confidential GIS files are available on SCE's website. SCE has used the following method to name its GIS files, consistent with the naming conventions in Chapter 6 of the Guidelines (i.e., 6.1 – Recent weather patterns; 6.2 – Recent drivers of ignition probability; 6.3 – Recent use of PSPS; 6.4 – Current baseline state of service territory and utility equipment; 6.5 – Location of planned equipment additions or removal; and 6.6 – Planned 2020 WMP initiative activity by end-2022):

- All GIS files are related to the layers listed in Tables 8 and 9 and follow the attachment locations described on those tables.
- The GIS files' names will include the Table (8 or 9), the specific attachment (i.e., 6.1 to 6.6) and the specific row in the table (i.e., A-Z, with A being the first row).
- As an example, for the "6.4 – Current baseline state of service territory and utility equipment" in Table 9, the GIS file showing the location of substations will be named, "Table9_Attachment6_4_I."

As part of its GIS submission, SCE is also providing a table that will list the GIS layer name with the table and attachment references included in the Guidelines.

Appendix A
List of Acronyms

Appendix B
WMP Tables

Appendix C
WMP GIS Dashboard Descriptions

Appendix D
WMP GIS Dataset Descriptions