Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-1)
Wildfire Involving SDG&E Equipment

May 17, 2021

TABLE OF CONTENTS

RISK: WILDFIRE INVOLVING SDG&E EQUIPMENT

I. INTRODUCTION

The purpose of this chapter is to present San Diego Gas & Electric Company's (SDG&E or Company) risk control and mitigation plan for risk of wildfire involving SDG&E equipment, including third party pole attachments (Wildfire). Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein (the Settlement Decision).[1]

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter SDG&E-RAMP-B of this RAMP Report. On an annual basis, SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process. The ERR process influenced how risks were selected for inclusion in this 2021 RAMP Report, consistent with the Settlement Decision's directives, as discussed in Chapter SCG/SDG&E RAMP-C.

The RAMP Report's purpose is to present a current assessment of key safety risks and the proposed activities for mitigating those risks. The RAMP Report does not request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC) application. The costs presented in this 2021 RAMP Report are those costs for which SDG&E anticipates requesting recovery in its Test Year (TY) 2024 GRC. SDG&E's TY 2024 GRC presentation will integrate developed and updated funding requests from the 2021 RAMP Report, supported by witness testimony.[2] This 2021 RAMP Report is presented consistent with SDG&E's GRC presentation, in that the last year of recorded data (2020) provides baseline costs, and cost estimates are provided for years 2022-2024, as further discussed in Chapter SCG/SDG&E RAMP-A. This 2021 RAMP Report presents capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total; operations and maintenance (O&M) costs are only presented for TY 2024 (consistent with the GRC). Costs for each activity that directly address each risk are

---

[1] D.16-08-018 also adopted the requirements previously set forth in D.14-12-025. D.18-12-014 adopted the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with modifications and contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and General Rate Case.

[2] *See* D.18-12-014 at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

provided where those costs are available and within the scope of the analysis required in this RAMP Report.

Throughout this 2021 RAMP Report, activities are delineated between controls and mitigations, consistent with the definitions adopted in the Settlement Decision's Revised Lexicon. A "control" is defined as a "[c]urrently established measure that is modifying risk."[3] A "mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[4] Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E's Wildfire risk; however, many of the activities presented herein also help mitigate other areas.

As discussed in Chapters SCG/SDG&E RAMP-A and SDG&E RAMP-C, SDG&E has endeavored to calculate a Risk Spend Efficiency (RSE) for all controls and mitigations presented in this risk chapter. However, for controls and mitigations where no meaningful data or Subject Matter Expert (SME) opinion exists to calculate the RSE, SDG&E has included an explanation why no RSE can be provided, in accordance with California Public Utilities Commission (CPUC or Commission) Safety Policy Division (SPD) staff guidance.[5] Activities with no RSE value presented in this 2021 RAMP Report are identified in Section V below.

SDG&E has also included a qualitative narrative discussion of certain risk mitigation activities that would otherwise fall outside of the RAMP Report's requirements, to aid the CPUC and stakeholders in developing a more complete understanding of the breadth and quality of the Company's mitigation activities. These distinctions are discussed in the applicable control and mitigation narratives in Section III and/or IV.

A. Risk Overview

SDG&E's service territory experiences Santa Ana winds, which have been directly linked to some of the largest and most destructive wildfires in Southern California. These Santa Ana winds, coupled with other weather conditions, dry fuels, and the impacts of climate change, have resulted in an increased risk of catastrophic wildfires. The California Legislature found that

---

3 *Id.* at 16.

4 *Id.* at 17.

5 *See* Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 (November 25, 2020) at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.").

"[t]he increased risk of catastrophic wildfires poses an immediate threat to communities and properties throughout the state,"[6] "[w]ith increased risk of catastrophic wildfires, the electrical corporations' exposure to financial liability resulting from wildfires that were caused by utility equipment has created increased costs to ratepayers,"[7] and "[t]he state has dramatically increased investment in wildfire prevention and response, which must be matched by increased efforts of the electrical corporations."[8]

In 2020, the scale and scope of California wildfires occurred at an unprecedented level. The California Department of Forestry and Fire Protection's (CAL FIRE) website reports that the 2020 August Complex Fire burned over one million acres, making it the largest wildfire in California history. Indeed, five of the six largest fires in California history occurred in 2020. Unfortunately, these wildfires caused deaths and the destruction of property and natural resources.

In SDG&E's service territory, the most significant fire of 2020 was the Valley Fire, burning 16,390 acres and causing significant property damage, as well as the interruption of electric service after burning 119 wood poles. While the ignition of the Valley Fire, and many of the other major fires of 2020, were not linked to utility equipment, these fires and their consequences nevertheless reinforce the continued importance of taking dramatic action to mitigate the risk of climate change-driven catastrophic wildfires in California, including potential utility-caused wildfires.

The Valley Fire occurred in SDG&E's High Fire-Threat District (HFTD). The HFTD, as established by D.17-12-024, is an area within SDG&E's service territory that has a greater potential for wildfires. The HFTD represents approximately 64% of SDG&E's service territory. The HFTD consists of Tier 2 areas, "where there is an elevated risk for destructive utility-associated wildfires," and Tier 3 areas, "where there is an extreme risk for destructive utility-associated wildfires."[9] Although wildfire risk is not limited to the HFTD, the majority of the risk is primarily within Tier 2 and Tier 3 areas. Roughly 61% of the ignition consequences are estimated to be in Tier 3, 36% in Tier 2, and 3% in non-HFTD. This is why the majority of

---

6 Assembly Bill (AB) 1054 (2019-2020), Section 1(a)(1).

7 AB 1054, Section 1(a)(2).

8 AB 1054, Section 2(a).

9 D.17-12-024 at 2.

SDG&E's wildfire mitigation initiatives are targeted and prioritized in the HFTD, and thus, this Wildfire RAMP Chapter is focused on the HFTD.

Safety is SDG&E's top value, and virtually no activity implicates safety more than wildfire prevention. SDG&E has focused on wildfire prevention and mitigation activities for more than a decade, and it strives to be the industry leader in this area. In the aftermath of the catastrophic October 2007 wildfires in SDG&E's service territory and across Southern California, SDG&E dedicated itself to revamping and enhancing its wildfire prevention and mitigation measures across a wide spectrum of disciplines and activities.

A prime example is SDG&E's ability to forecast fire danger and to use such information to adapt the Company's behavior. SDG&E developed an in-house meteorology team to forecast fire danger throughout its service territory and enable the Company to undertake advanced preparations for severe weather events. SDG&E built the first of its kind network of dense, utility-owned weather stations to provide detailed weather data across the service territory, which informs day-to-day operational decision-making at all levels of the Company. Additionally – and as a last resort when conditions warrant – SDG&E pioneered the use of de-energization (*i.e.*, Public Safety Power Shutoffs or PSPS) for public safety from major wildfires. While SDG&E uses PSPS as a last resort tool, it also recognizes that PSPS itself can impact customers and communities. Accordingly, the risk presented herein is comprised of two components: the risk of wildfire and PSPS impacts.

SDG&E continues to innovate and improve its wildfire mitigation initiatives to keep its communities safe through situational awareness, prevention, communication, and collaboration. SDG&E openly shares its experience, lessons learned, and technological advancements in weather and wildfire mitigation with other investor-owned utilities (IOUs), state agencies, and stakeholders in the fire community, with the objective of improving wildfire prevention across California and the West. Despite an unusually challenging year, SDG&E advanced its wildfire mitigation initiatives in 2020 and will continue to do so in 2021.

B. Risk Definition

For purposes of this RAMP Report, SDG&E's Wildfire risk is defined as the risk of catastrophic wildfire, especially those initiated by SDG&E equipment, resulting in fatalities, widespread property destruction, and multi-billion-dollar liability. Because PSPS as a mitigation

has an impact on customers, the overall risk assessment is comprised of two components: the risk of a catastrophic wildfire and the PSPS impacts to customers.

C. Scope

This Wildfire RAMP Chapter is focused on the HFTD; programs outside of the HFTD are addressed in the RAMP risk of Electric Infrastructure Integrity (SDG&E-Risk-2). Table 1 below provides what is considered in scope for the Wildfire risk in this RAMP Report.

Table 1: Risk Scope

In-Scope:	Wildfires that meet the CPUC Fire Incident Data Collection requirements for reporting.[10] In accordance with D.14-02-015, a wildfire must be reported if all three of the following criteria are met: • A self-propagating fire of material other than electrical and/or communication facilities; • The resulting fire traveled greater than one linear meter from the ignition point; and • The utility has knowledge that the fire occurred. The impacts of PSPS to customers are also included in the scope of the overall risk assessment.
Data Quantification Sources:	SDG&E ignition-related historical data that was adjusted by Subject Matter Experts for operational and environmental changes. *See* Appendix B for additional information.

II. RISK ASSESSMENT

In accordance with the Settlement Decision,[11] this section describes the risk bow tie, possible Drivers, potential Consequences, and the risk score for the Wildfire risk.

SDG&E considers risk-related differences in its analysis of the Wildfire risk. The Settlement Decision requires "[f]or each Risk Event, the utility will subdivide the group of assets or the system associated with the risk into Tranches…The determination of Tranches will be based on how the risks and assets are managed by each utility, data availability and model maturity, and strive to achieve as deep a level of granularity as reasonably possible."[12] As discussed in Section I above, pursuant to D.17-12-024, SDG&E's HFTD consists of Tiers 3 and

[10] D.14-02-015 at Appendix C, C-3.

[11] D.18-12-014 at 33 and Attachment A, A-11 ("Bow Tie").

[12] D.18-12-014 at Attachment A, A-11 ("Definition of Risk Events and Tranches").

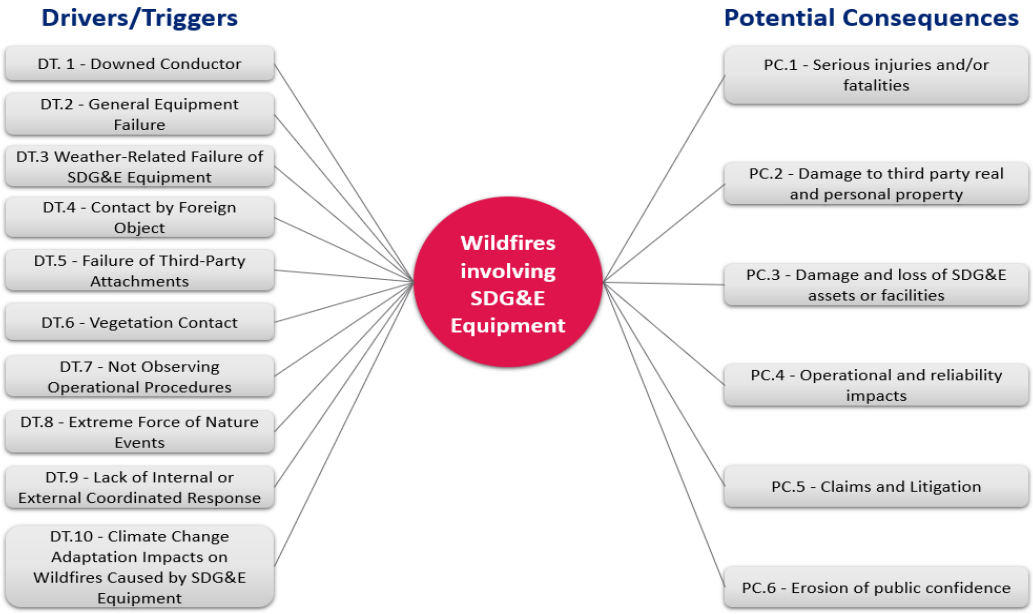
2 consistent with the Commission's Fire-Threat Map. In defining HFTD Tiers 3 and 2, the Commission recognized the difference in risk profiles between HFTD Tiers 3 and 2 with Tier 3 being deemed as "extreme risk" and Tier 2 as "elevated risk." SDG&E also recognizes the different risk profiles in HFTD Tiers 3 and 2 and therefore plans, manages, and prioritizes most its wildfire mitigation work based on the location (HFTD, non-HFTD) and the associated risk within (Tiers 3 and 2). Given this, SDG&E tranched a majority of the controls and mitigations herein into HFTD Tiers 3 and 2. In addition to assessing Wildfire risk by location (HFTD) and Tier (Tier 3 vs. Tier 2), SDG&E further distinguishes its asset-specific differences through the creation and scoping of its programs. This is provided in more detail in Section III below.

A. Risk Bow Tie and Risk Event Associated with the Risk

The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision[13] instructs the utility to include a risk bow tie illustration for each risk included in RAMP. As illustrated in the risk bow tie shown below in Figure 1, the risk event (center of the bow tie) is a wildfire involving SDG&E equipment, the left side of the bow tie illustrates drivers/triggers that could lead to the risk event occurring, and the right side shows the potential consequences of the risk event occurring. SDG&E applied this framework to identify and summarize the information provided in Figure 1. A mapping of each mitigation to the element(s) of the risk bow tie addressed is provided in Appendix A.

[13] *Id.* at Attachment A, A-11 ("Bow Tie").

Figure 1: Risk Bow Tie



B. Cross-Functional Factors

SDG&E identified the following cross-functional factors (CFF) that are associated with wildfire risk. These include:

- **Asset Management (SDG&E-CFF-1):** To prevent wildfires and safely operate its grid, SDG&E conducts various asset management and inspection programs to enable identification and repair of equipment conditions. These programs include detailed cyclical inspections, infrared inspections, intrusive wood pole inspections, light detection and ranging (LiDAR) surveys, additional HFTD Tier 3 focused inspections, drone inspections, annual aerial and ground patrols, and quality assurance of inspections. Asset Management is also discussed below in Section III as C39.
- **Climate Change Adaptation, Energy System Resilience, and GHG Emissions (SDG&E-CFF-2):** In the years prior to 2018, there was growing evidence that changing climate conditions were contributing to an increase in wildfire potential throughout California. As a result, and to prepare the Company to adapt to climate change, SDG&E established a Fire Science and Climate Adaption (FS&CA) department in 2018, which

continues to expand and grow to meet the needs of increasing wildfire and climate-related risks. Climate change adaptation is listed as one of the drivers/triggers (DT.10) that impacts wildfire risk and is discussed in Section II.C. Details regarding the FS&CA department are provided in Section III below as C4.

- **Emergency Preparedness and Response (SDG&E-CFF-3):** A major focus of SDG&E's emergency preparedness and response activities is to reduce the likelihood of a wildfire occurring and to mitigate the impacts associated with PSPS. This is demonstrated by the number of Emergency Operations Center (EOC) activations associated with wildfire risk, which is further demonstrated below in Section III below as C41. In addition to the EOC activations, SDG&E's Emergency Management department conducts a facilitated de-brief of all major fire and PSPS-related incidents and activations as an essential part of the after-action review program, where opportunities for improved safety, scene management, communications, and/or training are identified.
- **Foundational Technology Systems (SDG&E-CFF-4):** Many of SDG&E's wildfire mitigation activities rely on foundational technology systems. For example, advanced technologies are used to monitor weather conditions to evaluate the fire potential in SDG&E's service territory, track vegetation growth, review outage and fault information, and more. The health of SDG&E's foundational technology systems, therefore, impacts wildfire mitigation.
- **Records Management (SDG&E-CFF-6):** SDG&E implemented various recordkeeping controls for its system in accordance with CPUC regulations, decisions and directives. For wildfire, this includes compliance with the D.14-02-015, Wildfire Safety Division resolutions, and the General Orders (*e.g.*, G.O. 95 Rules For Overhead Electric Line Construction).
- **Safety Management Systems (SDG&E-CFF-7):** SDG&E's Safety Management System (SMS) provides a systematic, cohesive framework

which builds upon SDG&E's strong safety culture and integrates new and existing processes. By taking an integrated, systematic approach to safety, SDG&E is better able to assess and manage risk across the entire organization. Enhancing our communication, collaboration, feedback and documentation and using data and analytics to regularly measure our effectiveness and make continuous improvements will help make each of our current and future safety programs more effective. SDG&E's SMS framework, as referenced in the SMS Cross Functional Factor Chapter, includes the Five Pillars of Safety, to focus on both individual safety behaviors and process safety management. Activities to effectively manage the risks SDG&E faces, including wildfire mitigation and prevention activities, are integrated throughout the Five Pillars of Safety and the SMS Framework.

- **Workforce Planning / Qualified Workforce (SDG&E-CFF-8):** A highly qualified workforce positions a utility to efficiently and effectively manage operations to ensure safety, compliance, and reliability, and fosters confidence in those who regulate these activities. SDG&E requires workers in the below roles to meet minimum qualifications of degree, experience, and/or time-in-service. Additionally, workers are provided training to gain knowledge to perform their roles safely, effectively, and efficiently. In its 2021 Wildfire Mitigation Plan (Wildfire Mitigation Plan or WMP) update, SDG&E reported on worker qualifications and training practices regarding wildfire and PSPS mitigation for workers in the following target roles:
    - Vegetation inspections and projects
    - Asset inspections
    - Grid hardening
    - Event-related inspections

C. Potential Drivers/Triggers

The Settlement Decision[14] instructs the utility to identify which element(s) of the associated risk bow tie each mitigation addresses. When performing the risk assessment for Wildfire, SDG&E identified potential leading indicators, referred to as drivers or triggers.[15] These include, but are not limited to:

DT.1 – Downed Conductor: A downed conductor (or "wire down") occurs when a conductor drops or breaks from its designed location on a pole and cross arm and ends up on the ground, sometimes in an energized mode. A wire down can result from a variety of factors, many of which are outside of SDG&E's control.

DT.2 – General Equipment Failure: Electric equipment failure can be a source of ignition. Failure of components such as connectors, hot line clamps, and insulators can result in wire failure and end up in a wire down situation, sometimes in the energized mode. Other equipment failures can also spark ignitions regardless of whether they lead to wire down situations.

DT.3 – Weather-Related Failure of SDG&E Equipment: Weather plays a large part in the potential failure of SDG&E equipment. Excessive wind, lightning, and exposure to weather over time can degrade the integrity of the electrical components and lead to failure of one or more of the electrical parts, causing a failure of the conductor.

DT.4 – Contact by Foreign Object: Foreign objects coming into contact with SDG&E's facilities can also present sources of ignition. For example, Mylar balloons are highly conductive and can cause phase-to-phase faulting, on contact. In the worst case this can cause the conductor to fail and land in an energized mode, causing arcing and sparking in dry conditions. In addition, vehicular contact can bring down conductors and

[14] D.18-12-014 at Attachment A, A-11 ("Bow Tie").

[15] Potential Drivers/Triggers serve as an indication that a risk could occur. They do not reflect actual or threatened conditions.

sometimes the entire pole, resulting in conductors laying on the ground in an energized mode.

DT.5 – Failure of Third-Party Attachments: As mandated by the CPUC, SDG&E must allow communication infrastructure providers to attach to utility poles when space is available. These providers might not properly install or inspect their equipment. This has led to contact of these attachments with the electrical facilities, leading to fire-related incidents.

DT.6 – Vegetation Contact: During storms and severe wind events, branches are shed by trees in the vicinity of SDG&E facilities. These can fall on conductors, leading to conductor failure or, in the case of palm fronds, phase-to-phase contact and a cascade of sparks. In addition, trees that are many feet away from an energized conductor sometimes uproot and fall on the conductor, causing pole and equipment damage, line failure, or sparking.

DT.7 – Not Observing Operational Procedures: SDG&E revises its protocols and procedures based on certain conditions. For example, during fire weather watch or red flag warnings, SDG&E and its contractors may not perform welding or other activities that may generate potential ignition sources. If an employee or contractor does not adhere to the operational procedure, it may cause an adverse consequence.

DT.8 – Extreme Force of Nature Events: SDG&E's overhead electrical facilities are fully exposed to the elements. Significant weather and wind-related events can cause a variety of problems related to equipment failure and downed conductors. Also, continual exposure to natural elements can degrade or weaken key components, conditions that may not be found until the following scheduled inspection and repair cycle.

DT.9 – Lack of Internal or External Coordinated Response: A well-coordinated response to a downed conductor aids in the suppression of a fire as well as the de-energization of the conductor in a safe manner. Lack of coordination could lead to uncontrolled fire, electrical exposure to first responders, and possibly injury or death.

DT.10 – Climate Change Adaptation Impacts on Wildfires Caused By SDG&E Equipment: Despite SDG&E's proactive approach to mitigating fire risk, increases in temperature and prolonged periods of drought in the decades to come will likely lead to high-risk fire areas expanding from the foothills and mountains into the lower elevation coastal canyons and wildland interfaces that were previously considered at lower risk for fire ignition and propagation. Prolonged periods of drought will also likely result in a longer wildfire season, potentially extending the focus of our threat monitoring and potential response from the fall months to year-round – with the greatest increased threat in the spring and summer months. These climate trends have already been realized across the region, culminating in a previously unseen wildfire outbreak across coastal San Diego County in May of 2014. Based upon the most recent climate science, these trends are likely to continue and worsen into the future.

D. Potential Consequences of Risk Event

Potential consequences[16] are listed to the right side of the risk bow tie illustration provided above. If one or more of the drivers/triggers listed above were to result in an incident, the potential consequences, in a reasonable worst-case scenario, could include:

PC.1 – Serious injuries and/or fatalities;

PC.2 – Damage to third party real and personal property;

PC.3 – Damage and loss of SDG&E assets or facilities;

PC.4 – Operational and reliability impacts;

PC.5 – Claims and litigation; and

PC.6 – Erosion of public confidence.

These potential consequences were used in the scoring of Wildfire that occurred during the development of SDG&E's 2020 Enterprise Risk Registry.

[16] D.18-12-014 at 16 and Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

E. Risk Score

The Settlement Decision requires a pre and post-mitigation risk calculation.[17] Chapter SCG/SDG&E RAMP-C of this RAMP Report explains the Risk Quantitative Framework, which underlies this Chapter, including how the pre-mitigation risk score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.[18]

SDG&E continually evaluates its wildfire risk assessments regarding the probability of ignitions and the consequences of wildfires. This wildfire risk assessment is an ongoing effort that is updated as new data is collected and when new studies are undertaken. In accordance with the Settlement Decision,[19] Table 2 below provides risk scores that take into account the benefits of any mitigations that have been implemented as of the end of 2020. Table 2 also provides the risk score for the wildfire risk, PSPS impact and Total Wildfire Risk Score (TWRS).

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[20]

	Wildfire Risk	**PSPS Impact**	**Total Wildfire Risk Score (TWRS)**
Pre-Mitigation Risk Score	11,768	4,691	16,459
LoRE	21.2	4	N/A
CoRE	556	1,173	N/A

Pursuant to Step 2A of the Settlement Decision, the utility is instructed to use actual results, available and appropriate data.[21] The general approach to quantifying Wildfire risk is a hybrid approach – "top down," coupled with "bottoms up." The "top down" approach refers to the assessment across the entire risk, namely the total wildfire risk across SDG&E's entire

---

17 D.18-12-014 at Attachment A, A-11 ("Calculation of Risk").

18 *See infra,* n. 20.

19 D.18-12-014 at Attachment A, A-8 – A-9 ("Identification of Potential Consequences of Risk Event" and "Identification of the Frequency of the Risk Event").

20 The term "pre-mitigation analysis," in the language of the Settlement Decision refers to required pre-activity analysis conducted prior to implementing control or mitigation activity. (D.18-12-014 at Attachment A, A-12 ("Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," "Measurement of Pre-Mitigation Risk Score")).

21 *Id.* at Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

service territory, using global concepts of ignitions, relevant outages, potential damage, and so forth. The "bottoms up" approach is undertaken by analyzing granular aspects of Wildfire risk, such as the amount of risk (likelihood of ignition and consequence if an ignition occurs) from specific assets or locations. Together these two methods help calibrate each other to provide a more robust risk picture than only reviewing one method (global or granular).

The global "top down" assessment is based on a model that was built using stochastic methods (*e.g.*, Monte Carlo), which allows for uncertainty to be incorporated into the modeling. The inputs related to the likelihood of ignition involve information related to historical large fires, annual ignitions, accommodations to climate change, accommodations to system hardening, and accommodations from operational changes such as system protection settings and PSPS. The inputs related to the consequence of ignitions involve information related to SDG&E's wildfire behavior modeling, accommodations due to climate change, and applying financial treatments to consequences to adjust to the current year's financial considerations (*e.g.*, real estate prices). The output of the model is two probability distributions, one for ignition likelihoods and another financial consequence. Currently, the financial consequence is used as a proxy for human safety, due to the strong connection between safety and homes destroyed and because large fires are rare, giving a small sample size to find correlations between location and safety implications.

The granular "bottoms up" approach attempts to find failure and ignition rates for specific scenarios, starting with equipment types and sub-types, but also by location and environmentally focused conditions such as vegetation and wind. Bear in mind that the sample size of ignitions is relatively small from a statistical standpoint when considering all of the situational characteristics. For example, there are fewer than 10 ignitions recorded for certain equipment types, over the past five years, and those ignitions occurred under various conditions with varying weather, vegetation, and asset-specific characteristics such as age or manufacturer. Although it is a positive situation to have small sampling of ignitions, it leads to the need to generalize much of the information. As an example, there have been a total of four ignitions due to distribution fuses in the past five years. There are thousands of distribution fuses in SDG&E's distribution system, and each of these ignitions occurred under their own unique circumstances when one considers the weather, vegetation, fuse type, and so forth. Therefore, one should not

expect SDG&E to have extremely granular ignition rates for all fuse-related situations, but rather it will be generalized to a few fuse categories and broken out by Tier 2 and Tier 3 of the HFTD.

Finally, an important notion regarding wildfire risk is the connection between ignitions and risk. Over the past 10 years, there have been approximately 300 CPUC reportable ignitions[22] associated with SDG&E equipment. Of those 300, only one of them is associated with the destruction of property – which was a single structure. For the most part, each of these 300 ignitions did not require significant fire suppression activity and burned less than one acre. In other words, preventing any one of those 300 ignitions would not have provided significant risk reduction. However, one large fire at the wrong time and place could have a larger impact than those 300 ignitions combined. Because wildfire risk is very situationally dependent, and many of SDG&E's mitigations involve long-term improvements such as equipment change-outs, it is very difficult to confidently attribute risk reduction for each equipment change-out. Because of this, SDG&E has chosen to largely use all reportable ignitions as the measure to quantify risk reduction, while understanding that an ignition that was prevented was not necessarily going to be a catastrophic wildfire. Put another way, SDG&E's global modeling suggests that approximately one in 500 ignitions will be catastrophic (*e.g.*, damage resulting in over $100 million; significant damage and potential safety consequences), and therefore, if a mitigation prevents one ignition in the High Fire Threat District, it is preventing 1/500th of a catastrophic fire.

Additionally, when evaluating the current level of wildfire risk, SDG&E incorporated PSPS impacts. While PSPS could be considered a separate risk, it is directly tied to wildfire mitigation and would not exist otherwise. Without PSPS, the wildfire risk would be significantly higher.

Therefore, as shown in Table 2, there are two separate risk scores that SDG&E measures for this Wildfire risk: (1) wildfire risk, and (2) PSPS impacts. The overall risk evaluation, referred to as the TWRS, is the sum of the risk scores for wildfire risk and PSPS impact. All RSE scores presented in this RAMP chapter use the TWRS as their basis. Some mitigations in SDG&E's RAMP Wildfire chapter reduce the wildfire risk, while other mitigations reduce the PSPS impacts, and some mitigations lower the risk for both wildfire risk and PSPS impacts.

[22] As defined by D.14-02-015.

The evaluation of PSPS impacts is still in the early stages of development, and SDG&E's framework will continue to evolve in quantifying and understanding the impacts of PSPS to inform strategies for wildfire mitigation.

III. 2020 CONTROLS

This section "[d]escribe[s] the controls or mitigations currently in place" as required by the Settlement Decision.[23] The activities in this section were in place as of December 31, 2020. Controls that will continue as part of the control and mitigation plan are addressed in Section IV.

To mitigate, minimize, and manage the Wildfire risk, SDG&E uses a multi-layered approach designed to defend against single points of failure. SDG&E strategically performs a variety of activities to prevent wildfires and reduce PSPS impacts. For example, SDG&E inspects and remediates vulnerabilities on its system while at the same time performing vegetation management activities, hardening infrastructure, and as a last resort, a PSPS when deemed necessary.

As described in Section II above, SDG&E tranched a majority of the controls and mitigations into HFTD Tiers 3 and 2. Moreover, SDG&E recognizes asset-specific characteristics through the creation and scoping of its programs. For example, bare conductor and covered conductor could be considered different tranches of conductor. Rather than treating these as separate tranches, SDG&E developed unique programs to identify and evaluate these assets. Other examples of assets being further broken down into distinct programs include:

- Multiple resiliency programs (*i.e.*, Microgrids, Resiliency Grant Programs, Standby Power Programs, and Resiliency Assistance Programs) that have different goals and targeted customers
- Separate asset-specific programs (*e.g.*, SCADA Capacitors, Hotline Clamps, Lightning Arresters)
- Multiple inspection programs, which are separated by the duration of inspection cycles (*e.g.*, annual, 5-years, 10-years) and the inspection method (*e.g*., patrols, drones, IR/Corona)

These identified tranches and program designations represent how SDG&E currently manages its wildfire mitigation portfolio. As described in Section III.A below, SDG&E's wildfire modeling

[23] Settlement Decision at 33.

continues to mature and develop. SDG&E is working toward evaluating programs at a more granular level beyond HFTD Tiers 3 and 2 and is beginning to do so in certain programs, including the Strategic Undergrounding and Covered Conductor Grid Hardening programs.

SDG&E notes that for the majority of the controls and mitigations subject to the HFTD Tiers 3 and 2 tranching, the activity performed in Tier 3 is the same as in Tier 2. Accordingly, in the presentation below, there is a single description of the control and mitigation. After the control name, SDG&E has identified the tranche in the following sections by the nomenclature C#-T1: HFTD Tier 3; C#-T2: HFTD Tier 2. The same nomenclature is used for mitigations with an "M" instead of a "C" in the identifier. Costs, units, and RSEs are provided at the tranche level (*i.e.*, Tiers 3 and 2) using these identifiers. Because SDG&E does not track costs by HFTD Tiers 3 and 2, an approximation was applied per program based on the forecasted units per tranche.

Consistent with its Wildfire Mitigation Plan 2021 Update, SDG&E presents this RAMP Chapter in the following categories, each of which is further described below:

- Risk Assessment and Mapping
- Situational Awareness and Forecasting
- Grid Design and System Hardening
- Asset Management and Inspections
- Vegetation Management and Inspections
- Grid Operations and Protocols
- Data Governance
- Resource Allocation Methodology
- Emergency Planning and Preparedness
- Stakeholder Cooperation and Community Engagement

A. Risk Assessment and Mapping

SDG&E has remained committed to the ongoing development and implementation of its wildfire modeling and continues to refine a primarily automated risk assessment and mapping methodology. At the same time, SDG&E's engineers and emergency operations personnel continue to analytically evaluate and prioritize proposed grid hardening projects and emergency actions from the standpoint of reducing or eliminating fire risk potential from overhead electric facilities.

SDG&E continues to work to implement innovative approaches to enhance and leverage this modeling and learn from efforts undertaken across the state. The Wildfire Risk Reduction Model (WRRM) and WRRM-Operational System (WRRM-Ops) have and will continue to serve the need to understand the wildfire risk from electric grid assets and fire propagation. These models represent SDG&E's continued commitment to the ongoing development and further refinement of risk-related models for the evaluation of hardening projects and the safe operation of the SDG&E system. To date, SDG&E subject matter experts, including fire coordinators and fire scientists, analyze the model's performance for all wildfires on the landscape, identifying deviations from the risk and propagation modeling. These findings help drive the future development of the model, and refining the model will result in improved and more specific quantifiable outcomes allowing for better decision making in the overall hardening effort.

While WRRM and WRRM-Ops continue to play a critical role in understanding the fire risk, SDG&E recognized a need for a model with the capability to analyze circuit segments for risk of wildfire and PSPS impacts, as well as calculate RSE scores for mitigation initiatives. To meet that need, SDG&E developed a new model in 2020 named Wildfire Next Generation System (WiNGS). While it is in the first year of development, WiNGS is expected to help prioritize SDG&E's grid hardening mitigations in the coming years.

1. C1: Wildfire Risk Reduction Model – Operational System

SDG&E's WRRM prioritizes long-term system hardening efforts to target the areas of greatest wildfire risk. This model was developed in collaboration with fire behavior experts and leverages 30 years of high-resolution weather data to establish a climate scenario and failure rates of SDG&E's assets, establishing risk maps showing the overall ignition probability and estimated wildfire consequence along electric lines and equipment. SDG&E has further enhanced this model into an operational system (WRRM-Ops) by developing a fully automated process to ingest daily weather and fuel moisture data from its supercomputers, and to re-calculate risk levels to support emergency operations. This information is now leveraged by SDG&E's subject matter experts to gather intelligence and communicate potential impacts and risk for every potential fire of consequence that occurs in SDG&E's service territory.

This initiative enhances SDG&E's awareness of wildfire risk by deploying science-based technologies and implementing solutions to inform SDG&E's operations. Lessons learned from

this process inform the ongoing development of the modeling system, which supports short, mid, and long term operational and system hardening decisions.

Enhancements and progress that have been made in 2020 include:

- ALERTWildfire viewer cameras,[24] mountain top camera network used to spot fires, are located on the map with a camera icon and improved integration with Application Programming Interfaces (APIs)
- Weather stations integration using observed weather data
- Delta Wind field inclusion – the difference between Forecasted and Observed wind
- Simulations are automatically run for all incidents in the Integrated Reporting of Wildland-Fire Information (IRWIN) database

Additionally, improved performance for fire behavior calculations were updated and included:

- herbaceous content
- urban density (isolated, scattered, dense)
- vegetation type (high and low intensity fire behavior fuels)
- A surface spotting model has been implemented
- Rate of Spread (ROS) adjustments have been made
- Complex ignitions: the API allows ignitions from hexagons

Enhancements to the tool planned for 2021 include upgrading fuel moisture inputs into the fire behavior modeling, upgrading the forecaster interface, and incorporating the data into a PSPS decision support tool. Fuel moisture improvements are ongoing with leading post-doctoral experts from San Jose State University Wildfire Interdisciplinary Research Center (WIRC) working in conjunction with SDG&E Meteorology and WRRM-Ops software vendor Technosylva.

B. Situational Awareness and Forecasting

Weather continues to have a significant impact on utility operations. SDG&E is an industry leader in the development and implementation of utility-specific meteorological technology to anticipate, prepare for, respond to, and recover from severe weather and wildfire

[24] *http://www.alertwildfire.org/sdge/*.

events. Utilization of situational awareness tools, further described in this Section, has proven successful historically and continues to be beneficial to system planning, emergency operations, and the safe implementation of PSPS. Based on these successes, SDG&E situational awareness networks will be expanded into areas where they can be used to minimize the impacts of PSPS and make communities safer.

1. C2: Advanced Weather Station Integration

This initiative provides more specific information regarding the location and severity of weather events that may impact SDG&E's system. Weather events have the potential to cause damage to the electric system, which may lead to an ignition. Advanced weather stations provide important information that enables safer and more informed operation of SDG&E's electric system during extreme weather events. SDG&E will continue the strategic rebuild of the weather station network through 2021 as the original equipment is reaching the end of its usable life. This is critical because the information from this weather network provides the foundational data for mission-critical activities such as the Fire Potential Index (FPI) and PSPS activities.

SDG&E will focus this activity on regions that have old weather monitoring equipment that has reached the end of life. This activity will also be engaged in areas where additional sensors can be installed to acquire data on fuel moisture conditions as an enhancement to the weather station capability. Region prioritization can also be influenced by an assessment of PSPS impacts and identification of areas where additional weather stations can support enhanced isolation strategies during PSPS events. There are multiple methods that are used to prioritize regions. These methods include the integration of high-resolution modeling to determine where unmeasured strong winds may be occurring, subject matter expert input from weather and fire experts, and input from community partners sharing local knowledge.

In 2020, SDG&E had the largest expansion to its weather station network since 2011 with the addition of over 30 new stations and a rebuild of about 50 additional weather stations that were at the end of their usable lives.

Regarding regions covered, these stations were selected in locations where it was determined that when coupled with additional sectionalizing, this weather information could help mitigate the impact of PSPS by better representing localized neighborhoods and increasingly isolating PSPS when possible. Additionally, SDG&E rebuilt some stations that were some of the

oldest on SDG&E's network (originally installed in 2010 and 2011) and covered the highest risk regions across HFTD Tier 3 locations.

In 2021, SDG&E plans to rebuild approximately 30% of the existing network, which is at end-of-life and install new sensor technology to measure fuel moisture where available. As technological advancements permit, SDG&E plans to install sensors to better measure and validate fuel moisture conditions across the region to better understand the effects on the wildfire ignition and spread.

2. C3: Wireless Fault Indicators

- **C3-T1: Tier 3; C3-T2: Tier 2; C3-T3: Non-HFTD**

SDG&E initiates operational measures during times of elevated or extreme wildfire risk to improve public safety, such as the disabling of automatic reclosing and the use of sensitive and fast protection settings that limit the heat energy produced by a fault reducing the chance of ignition. These operational practices increase the duration of outages for SDG&E's customers as a lack of circuit coordination caused by these mitigations makes faults and damaged assets more difficult to locate. Wireless fault indicators are a proven technology that helps narrow the search area to determine where a system failure has occurred, so SDG&E can quickly identify a search area and dispatch crews to find system failures. This technology is important to SDG&E's operational mitigation measures that decrease wildfire ignition risk.

During times of heightened wildfire risk, SDG&E patrols all infrastructure for damage prior to restoring power. In instances where large areas are de-energized due to sensitive protective relay settings, wireless fault indicators are used to concentrate focus to a much smaller portion of the electric circuit, which allows for: a faster response to the site if an ignition exists; a greater chance of determining and correcting a fault cause (when damage on the overhead electric system is not immediately obvious); and, potentially, faster customer restoration (which could offset customer reliability impacts caused by wildfire mitigation measures).

SDG&E routinely reviews results of sensitive relay outages to identify the need and locations for new wireless fault indicator locations. Locations may change based on new information and past findings. Wireless fault indicators are typically placed on bifurcations in SDG&E's system or midway on a section of conductor that does not have SCADA devices to provide real-time notification of loss of current or faults downstream. Examples include a location where a feeder splits but only has a SCADA switch in one direction downstream.

Adding a wireless fault indicator to the other direction will provide complete information on the status of all conductors downstream. Other applications of wireless fault indicators are at locations where facilities enter areas of high fuel concentrations, areas that are difficult to patrol, or transitions between HFTD tiers. Overhead to underground and underground to overhead unfused transitions and downstream of non-SCADA substations are also valuable applications.

In 2020, SDG&E installed 502 wireless fault indicators in the HFTD. In 2021, SDG&E plans to maintain the current rate of installations of wireless fault indicators finishing the Tier 2 and expanding into the wildland urban interface, another fire heightened area in SDG&E's service territory.

3. C4: Fire Science and Climate Adaptation Department

This initiative addresses understanding of wildfire risk and impacts of climate change on the risk. In the years prior to 2018, there was growing evidence that changing climate conditions were contributing to an increase in wildfire potential throughout California. As a result, SDG&E established a Fire Science and Climate Adaption (FS&CA) department in 2018, which continues to expand and grow to meet the needs of increasing wildfire and climate-related risks. The department is comprised of meteorologists, community resiliency experts, fire coordinators, and project management personnel. This department's purpose is responding to and strategizing for SDG&E's fire preparedness activities and programs.

One of the programs managed by the FS&CA department is the Ignition Management program. The purpose of the Ignition Management program is to track and perform root cause analyses on ignitions and potential ignitions to detect patterns or correlations. When patterns or correlations are identified, the outcomes are communicated and assigned to mitigation owners from the business unit most logically positioned to eliminate or reduce future events of a similar nature. The value of this program is in understanding and preventing ignitions. The ignition management program has enabled SDG&E to gather focused data on near ignition events and analysis of this data has helped educate fire prevention decisions.

In addition to providing SDG&E with subject matter expertise in meteorology, wildland fire coordination and response, and community resiliency, this department is building and leading the creation of a Fire Science and Innovation Lab (FSI Lab). The FSI Lab brings together leading thinkers and problem solvers in academia, government, and the community to create forward-looking solutions to help prevent ignitions, mitigate the impacts of fires, and

ultimately help build a more resilient region. Due to the COVID-19 pandemic in 2020, SDG&E established a virtual FSI Lab to move forward in a remote environment, engaging expanded partnerships with San Jose State University, the San Diego Supercomputer Center, University of Wisconsin, and Scripps Institution of Oceanography. With this FSI Lab, SDG&E aims to lead the development of the next generation of fire science and wildfire innovation; this data would then feed into SDG&E's risk models to prioritize work. Additionally, numerous community resilience events were targeted to SDG&E's service territory and conducted both online and in socially distant outreach events. Three new academic partnerships were established in 2020 for the purpose of advancing wildfire science. Below are additional details regarding these partnerships:

- SDG&E has established a 3-year strategic partnership with leading experts in climate at Scripps Institute of Oceanography to study the onset of wildfire suppressing precipitation in San Diego County, with attention paid to impacts on wildfire and subsequent later autumn and winter season hydrological measures. Scripps will examine the variability from year to year, documenting the types of storms that produce the precipitation, quantifying the current lead time in predicting these events, and identifying potential approaches to display and to predict these important storms. These late season storms and the impact on the wildfire environment could have an impact on PSPS frequency in the future.
- The San Jose State University project will develop new Live Fuel Moisture Content (LFMC) tools to better assess fire danger in the SDG&E service territory using state-of-the-science remote sensing data sets. These tools will be developed using the new high-resolution data from various satellite products eventually leading to a dataset and methodology to incorporate these tools into the Technosylva FireCast fire behavior modeling platform. Additional output from the project will include two peer-reviewed publications and one M.S. thesis which have yet to be finalized.
- SDG&E is also working with the San Diego Supercomputer Center (SDSC) to ingest and store SDG&E datasets for weather forecast, fire

potential index and fuels to enable publicly available findability and accessibility of these datasets for various stakeholders and all researchers through web services and visual maps. Application Programming Interfaces will enable time range or geolocation and tagged metadata-based querying as well as grouping and sub-setting of datasets for context-driven use. The map services will enable layering of these datasets for use in fire modeling. The project will maintain a server at SDSC for data access along with data storage capabilities stored at SDSC and back up storage on Amazon Cloud.

The FS&CA department will continue to focus on collaborations with stakeholders in the community and will continue to evolve the FSI Lab. Specific enhancements and improvements in 2021 will be further enhancing academic partnerships through broader data sharing and sponsoring specific utility focused projects through the FSI Lab. The FS&CA department envisions establishing long-lasting partnerships with academia to create opportunities to educate the next generation of utility wildfire subject matter expertise.

4. C5: High-Performance Computing Infrastructure

This initiative provides tools to process big data that is key to understanding the fire risk. Wildfire risk mitigation requires the development of high-quality weather information to support daily decision-making. To that end, SDG&E utilizes three high-performance computing clusters to generate high quality weather data that is incorporated directly into operations. Collectively, nearly 2,000 compute core hours of high-performance computing are used per day to generate operational products, including WRRM-Ops.

The weather-related forecast data generated by these supercomputers is shared with several partners, including the U.S. Forest Service, which disseminates the data through their public website, and the National Weather Service.

SDG&E plans to continue the production and sharing of forecast products as well as prioritize data analytics and modeling for the foreseeable future.

SDG&E intends to maintain and update this program to stay aligned with the latest computing technology and intends to share all the data that is generated with the wildfire community. This will include acquiring a new high-performance computing platform in 2022, at which point SDG&E's existing computing infrastructure will be at the end of its useful life. The

new high-performance computing infrastructure is essential to the ongoing development of fire science and big data analytics. SDG&E intends to work closely with the San Diego Supercomputer Center to closely monitor data science advancements to ensure that this program remains highly capable of providing the advanced analytics required to operate the utility of today and of the future.

C. Grid Design and System Hardening

SDG&E's grid hardening programs are a set of controls and mitigations that directly address the goal of reducing wildfires caused by utility equipment and minimizing the societal impacts to customers from mitigations such as PSPS. SDG&E has a number of controls and mitigations including overhead hardening and strategic undergrounding that have demonstrated a measured reduction in risk events on utility equipment, reducing the opportunities for ignition. SDG&E has a number of protection and equipment programs such as advanced protection, expulsion fuse replacement program, and the lightning arrestor program. These programs reduce the chance that a risk event results in an ignition by utilizing protection settings and/or equipment that address a specific failure mode known to lead to the ignition. These result in measured reductions in ignition percentage from risk events. Finally, SDG&E has a number of programs with the purpose of reducing PSPS impacts to customers including the PSPS sectionalizing program, microgrid and generator programs, as well as strategic undergrounding. The impacts of these programs are measured in the number of customers who will no longer be impacted by a PSPS event assuming weather conditions similar to previous events.

1. C6: SCADA Capacitors

- **C6-T1: Tier 3; C6-T2: Tier 2**

This initiative mitigates the risk of a capacitor being an ignition source. The supervisory control and data acquisition (SCADA) capacitors program will replace existing non-SCADA capacitors with a more modern SCADA switchable capacitor. The current capacitors are designed to provide continuous voltage and power factor corregction for the distribution system. During a failure of a capacitor from either mechanical, electrical, or environmental overstress, an internal fault is created resulting in internal pressure and the potential to rupture the casing. This rupture of molted metal has the potential to be an ignition source. These capacitor faults are currently protected through fusing, which is not always effective at preventing the high-risk failure mode described.

The SCADA capacitors program will replace existing non-SCADA capacitors with a more modern SCADA switchable capacitor. The modernization of these capacitors will introduce a monitoring system to check for imbalances and internal faults and open based on the protection settings. In addition, the SCADA capacitor will provide a method for remote isolation and monitoring of the system providing additional situational awareness during extreme weather conditions. The program will first prioritize replacing or removing from service fixed capacitors within the system and then addressing capacitors with switches. Both types of capacitors will be modernized to a SCADA switchable capacitor. The new protection equipment built within these capacitors is designed to detect and isolate issues on capacitors before the capacitor rupture occurs, reducing or eliminating the failure mode most likely to lead to an ignition, and providing improvement over the current protection which utilizes analog fuses.

SDG&E plans to replace all capacitors within the HFTD, prioritizing Tier 3 and then proceeding to Tier 2. SDG&E is modernizing approximately 100 capacitors in the HFTD. In 2020, SDG&E completed 30 and plans to complete 32 in 2021, and approximately 40 in 2022, completing the program.

SDG&E plans to monitor the SCADA capacitors to ensure effectiveness of reducing ignition risk and improve equipment as necessary if there are any issues. As more work is done to understand the risk in the wildland urban interface, the program could potentially expand to those areas as well.

2. C7: Overhead Distribution Fire Hardening – Covered Conductor

- **C7-T1: Tier 3; C7-T2: Tier 2**

Covered conductor was studied by SDG&E beginning in 2019 to determine where it should be applied in SDG&E's service territory, with the first installation of covered conductor in the service territory occurring in 2020.

While SDG&E has not conducted studies to measure the effectiveness of covered conductor, it estimates it to be 70% effective, assuming it will be equally effective as bare conductor hardening at preventing equipment failures and better than bare conductor hardening at preventing foreign object in line contacts. In addition to its wildfire mitigation benefits, covered conductor has some PSPS benefits as well, raising the threshold for PSPS to higher wind speeds than bare conductor hardening.

SDG&E intends to install covered conductor in the HFTD, however, given the significant unhardened mileage that exists, risk-based prioritization of the deployment of these hardening initiatives remains very important. SDG&E utilized an early version of WiNGS to identify some circuit segments to pivot from bare conductor hardening to covered conductor hardening based on the risk analysis conducted in the model. As it continues to scope specific covered conductor projects, SDG&E plans to utilize its WiNGS model to both evaluate mitigation alternatives and prioritize the deployment of mitigations at the circuit segment level. The scope of covered conductor work identified in 2023-2024 was informed by the segment-level analysis conducted in WiNGS.

In 2020, SDG&E completed its first covered conductor installation, hardening approximately 1.9 miles of line. Given the success of the pilot installation, SDG&E is moving forward with the program and has plans to significantly increase the amount of covered conductor installed over the next several years ramping up to approximately 100 miles per year.

As covered conductor becomes a larger part of SDG&E's system, SDG&E will continue to monitor and measure all performance indicators that impact the efficiency of this mitigation, including a study of the measured effectiveness, and the cost per mile.

3. C8: Expulsion Fuse Replacement

- **C8-T1: Tier 3; C8-T2: Tier 2**

SDG&E's distribution system is dynamic and can experience events that result in a fault, which may serve as an ignition source. When the distribution system experiences a fault or overcurrent, there are fuses connected to the system to protect its integrity and isolate the fault. These expulsion fuses are designed to operate by creating a significant expulsion within the fuse, resulting in the fuse opening and isolating the fault, and in turn limiting further damage to other equipment. Because of this internal expulsion, the fuses are equipped with a venting system that sends a discharge of energy out of the fuse and into the atmosphere. This external discharge has the potential to ignite flammable vegetation.

SDG&E's fuse replacement program replaces existing expulsion fuses that operate as described above with new more fire safe expulsion fuses that are approved by CAL FIRE and reduce the discharge expelled into the atmosphere, reducing the chance of a fuse operation leading to an ignition. Since the program began in 2019, SDG&E has measured the fuse operations of the new CAL FIRE approved fuses. SDG&E's research has shown 139 fuse

operations with zero ignitions. While there are currently not enough samples relative to historical fuse operations to demonstrate statistical significance, the early effectiveness results are promising and in alignment with SDG&E expectations for this program.

It is SDG&E's intention to replace a total of 11,000 fuses throughout the HFTD. Prioritization started with Tier 3 and moved to Tier 2. Due the high volume of replacements, projects are bundled based on geographic proximity for construction efficiency and to reduce outages when required.

In 2020, SDG&E has replaced 5,669 fuses out of the 11,000 expulsion fuses in the HFTD. The target for 2021 is 4,000 fuses, which will be primarily in Tier 2 of the HFTD with minor work remaining in Tier 3. While Tier 3 remains the priority, the remaining work in Tier 3 are jobs that are more difficult to execute due to access or permitting issues. SDG&E continues to work through these jobs to see them to completion, however, work on the Tier 2 jobs will continue in parallel to maximize productivity and make progress to the final goal of replacing all expulsion fuses within the HFTD.

4. C9: PSPS Sectionalizing

- **C9-T1: Tier 3; C9-T2: Tier 2; C9-T3: Non-HFTD**

SDG&E utilizes Public Safety Power Shutoffs as a last resort mitigation during extreme weather conditions where the probability of ignition is much higher than normal and the consequences of ignitions due to high winds and dry conditions can and have been catastrophic. While SDG&E believes the last resort utilization of this activity is necessary and the right thing to do for the safety of SDG&E's customers and communities, SDG&E also understands that power outages can have negative economic and societal impacts and should be limited as much as feasible to the specific areas that are experiencing the extreme risk.

To that end, SDG&E's PSPS sectionalizing enhancement program strategically installs switches in locations that allow for more customers to remain energized during PSPS by improving the ability to isolate high-risk locations. Examples of this include installing switches on circuits that have significant portions of the circuit undergrounded, allowing the customers with the lower risk underground infrastructure to remain energized while the switch isolates the high-risk overhead portion of the circuit. In other cases, certain portion of circuits are more susceptible to experiencing extreme wind than other parts of the circuit, thus combining weather stations with sectionalizing devices enables SDG&E to de-energize only the sections of circuits

that are actually experiencing the extreme wind, rather than the entire circuit. The effectiveness of these mitigations is measured in customers who will no longer experience a PSPS event assuming weather conditions similar to prior PSPS events. By adding in remote sectionalizing devices within the HFTD, SDG&E is able to reduce the number of impacted customers based on past weather events, and improve the restoration times for the smaller circuit segments that will still be impacted.

SDG&E utilizes lessons learned from historical PSPS events to identify and prioritize locations for switches. This typically means installing switches in the HFTD, and SDG&E has made significant progress in this area. But as recent weather patterns have become more extreme and widespread as experienced in October 2019 and December 2020, SDG&E is utilizing the lessons learned from those events to place switches with the goal of limiting PSPS exposure in future years, which includes locations in the HFTD and wildland urban interface.

SDG&E has installed approximately 303 remote sectionalizing devices combined with over 214 weather stations, which typically allows SDG&E to execute PSPS events at a circuit segment level rather than utilizing whole circuits or substations. In 2019, SDG&E installed 7 switches and in 2020, 23 were installed. SDG&E was able to exceed its target in 2020 by aggressively replacing the highest impact switches before the 2020 fire season. The target for the next several years will be 10 PSPS sectionalizing devices per year.

Through the PSPS events which have occurred in SDG&E's service territory since 2013, SDG&E demonstrated how remote sectionalizing devices combined with a dense weather station network can limit the impacts of PSPS only towards those customers with the highest risk. SDG&E has over 183,000 customers located within its HFTD, but because of SDG&E's hardened transmission system, weather station network, and remote sectionalizing devices, only a small percentage of those customers are exposed to PSPS events during the highest risk system conditions, and only if they are the customers exposed to the risk on a particular high wildfire threat day. Going forward, SDG&E will continue this program as a last resort with the goal of reducing PSPS impacts using the most relevant data, including the recent PSPS events of December 2020.

5. C10: Microgrids

- **C10-T1: Tier 3; C10-T2: Tier 2**

Microgrids provide power continuity to customers during both planned and unplanned outages. Specifically, during PSPS events, this results in reduced duration and severity of disruption to customers' electric service. The reduction of PSPS impacts is key to increasing resiliency and reliability to customers. This is especially important for critical facilities, as they may provide firefighting resources and life-saving services among other things. Another segment of customers who benefit greatly from reduced PSPS duration are the Access and Functional Needs (AFN) community. AFN customers are deemed by the CPUC to be the most vulnerable during PSPS outages and are defined in D.19-05-042 to include individuals who have developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries, limited English proficiency or who are non-English speaking, and transportation disadvantaged, among others.

Historical analysis of areas impacted by PSPS events highlight specific communities which are compared against the grid hardening strategy. SDG&E evaluates these communities against recent or future grid hardening strategies to determine if additional mitigations should be considered to reduce PSPS impacts to customers. Specific customer information, such as classification as a critical facility, is used to appropriately determine the need to install additional resiliency tools to reduce PSPS impacts to customers.

Microgrids are designed to meet the identified customers' load needs for the duration of a PSPS event. While other solutions may be the preferred approach from a wildfire risk reduction perspective (*e.g.*, undergrounding), those options may not be technically feasible or the most cost-effective solution. For instance, customers who are located far away from a substation or central source of generation would require additional mileage of undergrounding that can be cost-prohibitive.

Additionally, customers may be located in a geographical area that makes digging for undergrounding infeasible, whether from hard rock or from an environmental or cultural perspective. When these situations arise, SDG&E evaluates other solutions to reducing the PSPS impacts to customers, which can include designing and building a microgrid that can be electrically isolated during a PSPS event and offer reliable electric service to customers and allow SDG&E to use de-energization of power lines as a wildfire risk mitigation solution.

By 2022, microgrids are expected to reduce PSPS impacts to a total of 662 customers. This number is calculated based on the locations of microgrids and the customers they serve and is used to estimate the reduction in PSPS impact to calculate the RSE. Sites for 2023 and 2024 are still being scoped and actual customer counts are not yet available. Because microgrids are designed to keep those customers energized throughout the duration of a PSPS event, the effectiveness of the mitigation is estimated to be 100%.

SDG&E uses a combination of data including, but not limited to, the risk of wildfire from overhead infrastructure, feasibility of alternative solutions such as undergrounding distribution infrastructure, and historical PSPS impact data to guide the targeted customers. This analysis is performed in concert with determining if a traditional overhead hardening or undergrounding solution could mitigate both the wildfire and PSPS impact risks. Additional information such as identification of critical facilities or AFN customers is incorporated into prioritizing targeted locations for a potential microgrid project.

In 2020, four microgrids sites were deployed at the following locations: Ramona Air Attack Base, Cameron Corners, Shelter Valley, and Butterfield Ranch. SDG&E has completed the temporary configuration (conventional generators) for these microgrids and plans to have the permanent renewable solution in service as soon as 2022. For 2021, SDG&E has identified an additional location for further evaluation in coordination with the other grid hardening efforts discussed herein. The community of Sherilton Valley is a low-income community, including medical baseline customers, located in Tier 3 of the HFTD, and was consistently impacted by PSPS events due to overhead distribution line exposure to extreme weather conditions. While SDG&E's 2021 WMP indicated Campo as a second location for a future microgrid, upon further evaluation, this location has been identified as suitable for traditional grid hardening solution instead of a microgrid. SDG&E will deploy temporary generation to the Feeding America location to provide power continuity during PSPS events. SDG&E continues to evaluate additional locations for microgrid solutions such as Warner Springs. Dependent upon final engineering and design of the microgrids, additional locations would include either a single battery energy storage solution or combination of solar plus battery energy storage to provide power continuity to customers during the PSPS events.

6. C11: Advanced Protection

- **C11-T1: Tier 3; C11-T2: Tier 2**

SDG&E's Advanced Protection (AP) program develops and implements advanced protection technologies within electric substations and on the electric distribution system. AP aims to prevent and mitigate the risks of fire incidents, create higher visibility and situational awareness in fire-prone areas, and allow for the implementation of new relay standards in locations where protection coordination is difficult due to lower fault currents attributed to high impedance faults. SDG&E's advanced protection program is designed to reduce the risk of transmission or distribution risk events leading to an ignition.

More advanced technologies, such as microprocessor-based relays with synchrophasor/phasor measurement unit (PMU) capabilities, real-time automation controllers, auto-sectionalizing equipment, line monitors, direct fiber lines, and wireless communication radios comprise the portfolio of devices that SDG&E installs in substations and on distribution circuits to allow for a more comprehensive protection system along with greater situational awareness via SCADA in the fire-prone areas of the HFTD. This portfolio of advanced technology allows SDG&E to implement new protection systems, such as:

- **Falling Conductor Protection (FCP)** designed to trip distribution overhead circuits before broken conductors can reach the ground energized;
- **Sensitive Ground Fault Protection** for detecting high impedance faults resulting from downed overhead conductors that result in very low fault currents;
- **Sensitive Profile Relay Settings** enabled remotely on distribution equipment during red flag events to reduce fault energy and fire risk;
- **High Accuracy Fault Location** for improved response time to any incident on the system;
- **Remote Event Retrieval and Reporting** for real-time and post-event analysis of system disturbances or outages;
- **SCADA Communication** to all field devices being installed for added situational awareness; and

- **Increased Sensitivity and Speed of Transmission Protection Systems** to reduce fault energies and provide swifter isolation of transmission system faults.

Specifically, AP aims to replace aging substation infrastructure such as obsolete 12 kV substation circuit breakers, electro-mechanical relays, and Remote Terminal Units (RTUs). New circuit breakers incorporating microprocessor-based relays, RTUs, and the latest in communication equipment facilitating the requirements of SDG&E's advanced protection systems will be installed in SDG&E substations within the HFTD. On distribution circuits within the HFTD, AP coordinates with the overhead system hardening programs to strategically install or replace sectionalizing devices, line monitors, direct fiber lines, and communication radios to facilitate the requirements of SDG&E's advanced protection systems.

In 2020, the AP program focused on hardening projects in HFTD Tier 3 and 2 areas. Accomplishments in 2020 include design initiation of 7 substations and 6 circuits, with 8 substations and 6 circuits energized. Equipment replaced totaled 13 circuit breakers, 13 electro-mechanical or incompatible relays, and 2 RTUs. 7 new distribution reclosers were installed to increase sectionalizing in support of falling conduction protection and PSPS.

Over the next several years, the program is targeting enabling AP on 8 circuits per year with a goal of completing all 76 HFTD Tier 3 circuits by 2026.

Improvements to AP technology include expanding FCP to include two-phase and single-phase distribution circuits, further extending branch circuit protection. The program will also begin migrating new FCP communication designs to leverage the Company's private LTE communication initiative to improve wireless network coverage, increase path resiliency and optimize deployment cost.

7. C12: Hotline Clamps

- **C12-T1: Tier 3; C12-T2: Tier 2**

Through equipment failure analysis related to wire down outages, SDG&E has identified high risk connectors known as "hotline clamps" that SDG&E intends to replace as part of this program. These hotline clamps have been identified because they have been associated with creating a weak connection that can fail during a fault on the system, resulting in a wire down event. This wire down event can lead to an energized wire on the ground or coming into contact with a foreign object, thus becoming an ignition source.

This initiative replaces these hotline clamp connections with compression connections to eliminate the risk of the wire down failure associated with hotline clamps, which in turn will reduce wire down events and ignitions associated with connection failures.

SDG&E is focusing this initiative on the HFTD portion of its service territory. Tier 3 of the HFTD is prioritized over Tier 2 areas. Due to the high volume of replacements, projects are bundled based on geographic proximity for construction efficiency and to reduce outages when required.

To date, SDG&E has replaced 2,758 hotline clamps of the 8,500 identified in the HFTD, approximately 32%. SDG&E plans to replace 1,650 clamps in 2021. At the current pace, SDG&E will complete this program by the year 2024.

8. C13: Resiliency Grant Programs

- **C13-T1: Tier 3; C13-T2: Tier 2**

SDG&E's Resiliency Grant Programs focus on enhancing resiliency among vulnerable customer segments in the SDG&E territory. This program consists of several projects that all aim to provide customers renewable backup power options during PSPS events. The primary initiative in this category is the Generator Grant Program (GGP), which was launched in 2019 and continued in 2020. To optimize available program resources to vulnerable customers, the GGP targeted Medical Baseline (MBL) customers who have experienced a previous PSPS outage. Medical Baseline customers are those have a qualifying medical condition or have certain medical devices such as a dialysis machine, electric wheelchair, or pacemaker. Because these customers have experienced at least one PSPS event, it is considered one of the best indicators of propensity of future outage, thus contributing efficiently to improving overall customer resilience. The objective of the GGP is to provide backup power sources that can both mitigate safety and health risks, as well as overall impacts experienced during de-energization incidents.

In both 2019 and 2020, MBL customers were offered a portable battery unit with a solar charging capability under the GGP, to achieve additional resiliency during PSPS events. Portable battery units delivered to customers through GGP demonstrate SDG&E's desire to leverage cleaner, renewable generator options that enable vulnerable customers to enhance their personal emergency plans with a means to keep small devices and appliances charged and powered during PSPS events.

In 2020, approximately 1,864 MBL customers with a previous 2019 PSPS outage were invited to participate in the program, and 1,409 portable battery units were delivered to customers between May and October 2020 under the GGP. This high customer response rate of roughly 76% for the 2020 program was borne out in post-program surveys for the program that validated the high customer satisfaction with this program.

For customers who accepted participation in the 2020 GGP program, 81% were able to use the battery during a PSPS event, and 96% of customers state that they now feel "very" or "extremely" prepared for a future PSPS event. This population included every customer who experienced a PSPS while being enrolled as an MBL customer in 2019. Of the delivered units, 75 units were provided specifically to master-metered MBL customers who lived in Mobile Home Parks, which were impacted by PSPS in 2019. Additionally, 20 battery units were made available for "emergency" delivery during larger PSPS events in November and December 2020, for customers experiencing severe medical challenges due to power outages.

Through 2024, the Resiliency Grant Program is expected to reduce PSPS impacts to over 8,000 customers. This number is calculated based on the count of customers that would receive the generator and is used to estimate the reduction in PSPS impact to calculate the RSE. Because the generators provided to customers as a part of this program are not whole-facility solutions but rather smaller units that keep specific equipment energized, the effectiveness of the mitigation is estimated to be 40%. Of the more than 66,000 currently active participants in SDG&E's MBL program at this time, over 11,000 of these households are in the HFTD. While the 2020 program was able to target all MBL customers impacted by a 2019 PSPS event, large scale PSPS events occurring late in 2020 have expanded the number of MBL customers with a previous PSPS outage. A majority of this newly identified vulnerable population will still be within the HFTD, however, additional eligibility criteria are likely to come into play for the 2021 season, such as HFTD level, as well as the number and length of outages in specific communities. Additionally, SDG&E will explore offering this program to certain eligible utility-identified AFN customers outside of just the MBL program.

The GGP for 2020 concluded with a total of 1,420 battery deliveries made, including the additional emergency units delivered during the November and December 2020 PSPS events. The GGP program served over 30 communities with eligible customers concentrated primarily in HFTD Tier 3 and Tier 2. The three largest communities served (Alpine, Ramona, and Valley

Center) comprised about 55% of all customers in 2020 benefitting from GGP. Based on the large PSPS events in late 2020, the program is scheduled to target roughly 3,200 customers for battery units in 2021. Invitations for the 2021 GGP are on track to begin reaching eligible customers by May 2021.

For 2021, SDG&E is looking to expand Resiliency Grant Programs to accommodate both the increased number of MBL customers impacted by 2020 PSPS outages, and to include other customers with access and functional needs who may not be currently enrolled in the MBL program. This includes those that have "self- reported" disabilities or vulnerabilities to SDG&E. Another potential expansion for the AFN population is the development of emergency or "real-time" response programs that can address needs for customers in the short time leading up to and during PSPS events. In late 2020, during PSPS outages, two new enhancements to this program were tested: (1) emergency delivery, and (2) resiliency item delivery. While the core GGP program focuses on proactive empowerment of known vulnerable customers, there is also an opportunity to develop some reactive services that are triggered around actual PSPS events. The newly tested enhancements involved delivery of charged GGP batteries to customers who called into the SDG&E Customer Care Centers or 2-1-1 in need of emergency power backup needs that could not be met through other AFN services such as hotel stays and accessible transportation. In two late 2020 PSPS outages, the SDG&E Emergency Operations Center was able to leverage a real-time delivery of a portable battery backup to eight customers in need. There is potential to expand this program further through a partnership with 2-1-1 to identify and support severely at-risk customers with these deliveries.

9. C14: Standby Power Programs

- **C14-T1: Tier 3; C14-T2: Tier 2**

SDG&E's Standby Power Programs provide alternative energy solutions aimed at providing the participating customer a comprehensive source of power to energize their entire home or business. Targeted customers – residential, small commercial, critical facilities, and mobile home park clubhouses – will see their risk of PSPS events mitigated through Standby Power Programs.

The first of its Standby Power Programs, SDG&E introduced what is now known as the Fixed Backup Power (FBP) Program. Customers who will not directly benefit from SDG&E's grid hardening programs in the near future, and who reside in the HFTD, are considered for

participation in the Fixed Backup Power Program. Specifically, this program assists backcountry residences, businesses, and local communities in the HFTD that may not benefit from a near or long-term traditional hardening initiatives. Since these customers reside in the backcountry and are so widely distanced from one another, SDG&E's grid hardening initiatives will not reduce the PSPS impacts to this subset of customers. The intention is to help certain customers who have experienced a PSPS event in the past and reside in the HFTD in becoming more resilient to PSPS events, while also reducing wildfire risk.

The Fixed Backup Power Program is designed to offer a fixed installation backup generator, while community businesses and organizations may receive a critical facility generator on a temporary basis during an active PSPS,[25] and clubhouse or central community building at mobile home parks may receive a solar panel and battery backup system.

Analyzing RSE and cost-effectiveness, installing fixed standby generators is the most efficient option for these customers. Undergrounding and hardening overhead power-line installations could potentially prove to be ineffective, considering there is no guarantee that these powerlines would stay energized during a PSPS event. Providing standby generators is the most efficient remedy for customers likely to experience PSPS events, as identified by this program.

Through 2024, the Standby Power Program is expected to reduce PSPS impacts to approximately 1,200 customers. This number is calculated based on the count of customers that would receive the generator and is used to estimate the reduction in PSPS impact to calculate the RSE. Because the generators provided to customers as a part of this program are whole-facility solutions that are expected to keep the customers energized throughout a PSPS event, the effectiveness of the mitigation is estimated to be 100%.

In assessing which communities would benefit most from these programs, SDG&E reviewed areas in the HFTD that have been highly impacted by frequent PSPS events in the past. Based on this review, SDG&E found that Julian, Santa Ysabel, Descanso, Potrero, and Ramona communities were the highest impacted, and therefore, could benefit most from this resiliency program.

The intention is to target customers within these high-risk communities where there is a historical risk of PSPS events. SDG&E intends to complete installations in one community

[25] This program was previously known as the Critical Facility Generator Program in SDG&E's 2020 WMP.

before moving to the next, hoping this will build resilience across the most vulnerable populations and customer segments.

The Standby Power Programs are relatively new initiatives, and as such, SDG&E is tracking all aspects of the program to effectively document lessons learned, which will be incorporated in subsequent program years. Currently, 75 residences are confirmed to have installed generators as of the end of 2020, including one commercial site. The targeted residences, communities, and commercial buildings reside in Julian, Santa Ysabel, Descanso, Potrero, and Ramona.

For 2021, SDG&E plans on increasing the goal of 2020 from 300 generator installations to 413. SDG&E anticipates the 2021 program year to incorporate a portion of the remaining 2020 sites that will not complete construction by end of year 2020 and the full target of approximately 300 additional sites in 2021.

SDG&E plans to extend its Standby Power Programs at least through 2024. SDG&E has established a streamlined process and plans to maintain and improve it going forward. Specifically, SDG&E has collaborated with the County of San Diego (and the third-party contracting company involved with these programs) to streamline residential permitting—a process that used to take anywhere from four to eight weeks, reducing it down to a two- to three-week process. Also, in discovering the extended permitting and installation processes involved with specific commercial/community buildings (like schools and mobile home parks), SDG&E intends to start these projects earlier in the year in preparation for the timelier site assessments, permitting, and installations. SDG&E will continue to explore enhancements to this category of customer initiatives through evaluation of customer feedback and lessons learned.

10. C15: Resiliency Assistance Programs

- **C15-T1: Tier 3; C15-T2: Tier 2**

The final area in which SDG&E is minimizing risk by increasing customer resilience is through its Resiliency Assistance Programs, aimed at providing eligible customers point-of-sale rebates for generators purchased through traditional retailers. The Generator Assistance Program (GAP) is SDG&E's most prominent program under the Resiliency Assistance umbrella. The objective of these customer offerings is to expand the focus to the greater market of SDG&E customers who have recently been impacted or may be impacted by PSPS outages in years to come. While the Resiliency Grant Programs, outlined above, address the needs of the most

medically vulnerable, and Standby Power Programs focus on customers that are not yet planned to benefit from SDG&E grid hardening initiatives to mitigate impact of PSPS outages, the GAP expands resilience opportunities to the general market in SDG&E's HFTD boundaries and beyond.

In July 2020, SDG&E launched the GAP, marketing to customers in the HFTD who had experienced a 2019 PSPS outage with an offer to download a rebate on a portable generator. The intent was to engage, educate and offer customers new options to enhance their own personal emergency preparedness plans for PSPS events through a dedicated rebate program. Using a similar model to Energy Efficiency rebates offered on customer programs promoting products like programmable thermostats, GAP was launched to offer rebates for a wide array of dual-fuel (gas-propane) portable generators that are available in local "big box" stores. To streamline the process for customers during a year where COVID-19 protection measures were critical, a customer who was invited to the program could download a coupon online, choose a retailer, then choose between the delivery channel of their choice: direct delivery to their home, order with store pickup, or in standard in-store shop and purchase.

Through 2024, Resiliency Assistance Programs are expected to reduce PSPS impacts to approximately 5,000 customers. This number is calculated based on the count of customers that are expected to purchase generators through the rebate program and is used to estimate the reduction in PSPS impact to calculate the RSE. Because the generators purchased through this program vary depending on the customer's preferences, the effectiveness of the mitigation is estimated to be 75%.

The 2020 GAP program focused on a broad market of residential and small business customers impacted by recent PSPS events across the HFTD. This being SDG&E's first generator rebate program, the objective was to cast a wide net to those with the highest propensity for a future outage while offering a generous rebate as an incentive for customers to prepare themselves with backup power sources. The program offered a $300 rebate to customers who met the basic eligibility criteria of residing in the HFTD and having experienced a recent outage. In addition, for California Alternative Rates for Energy (CARE) customers meeting these criteria, a larger rebate of $450 was made available. For lower income customers, this enhanced rebate provided roughly a 70-90% discount on an average portable generator. The 2021 GAP program will continue to target low-income customers with enhanced rebates.

Final 2020 program participation included 2,661 coupons downloaded, including 483 by CARE customers. Of the coupons downloaded, 1,305 total customers redeemed the rebate and purchased a portable generator, 271 of which were CARE customers. The program was designed to offer a customer resiliency power backup option to the highest PSPS event propensity customers across the HFTD. Customers in 34 communities across the HFTD have participated so far in this program, with about 60% of customers concentrated in larger communities of Valley Center, Ramona, Alpine and Campo. Based on the large PSPS events in late 2020, the program will expand eligibility in 2021 to roughly 59,000 customers, well beyond the 28,256 customers targeted in 2020. The 2021 Generator Assistance Program is expected to begin offering eligible customers invitations to participate in the expanded rebate program by May of 2021.

The Resiliency Assistance Programs in 2021 are expected to be enhanced in several ways. First, based on limited availability of certain generator models in local retailers during 2020 due to nationwide shortages from major weather events, SDG&E will pursue expansion of the type of rebates offered to include additional downstream rebate options to customers. This will allow customers more choice and will also open supply chain options to additional local and national retailers by allowing customers to purchase at their favorite stores and then redeem coupons post purchase. In an effort to provide new options for customers, SDG&E also plans to add new portable batteries and power station options to the rebate program, following demonstrated demand for these products at other utilities in California and beyond. Finally, GAP will also include an expanded focus on well pump customers in SDG&E's territory with need for backup power capability during PSPS outages. A partnership with the County of San Diego to identify these customers has been completed and will target these homes and small businesses. Finally, SDG&E is pursuing new ways to educate and inform customers about smart customer resiliency tips and recommendations. An approach to offering "Resiliency Audits" to customers to self-evaluate PSPS preparedness is also underway and could be offered to both residential and critical facilities customers in 2021. These audit/surveys will inform customers about programs available to solve their unique resiliency gaps while also gathering critical information from customers on new ways to help prepare them even better in future years.

11. C16: Strategic Undergrounding

- **C16-T1: Tier 3; C16-T2: Tier 2**

Strategic undergrounding provides the dual benefits of nearly eliminating wildfire risk for the areas where overhead system is converted to underground and eliminating the need and impacts of PSPS for customers fed by underground systems. Undergrounding is, however, often the most expensive major hardening alternative on a per-mile basis, and is thus being deployed strategically. SDG&E seeks to deploy undergrounding in areas where wildfire risk is very high as well as in areas where substantial PSPS reductions can be gained through a minimal installation of underground electric system. The scope of undergrounding work identified in 2023 - 2024 is informed by the WiNGS model.

In 2020, SDG&E installed 29.1 miles of underground cable (including 13.3 miles from the Cleveland National Forest (CNF) project) and intends to install approximately 25 miles of underground within the HFTD in 2021. Over the next several years, SDG&E plans to significantly increase its strategic undergrounding scope to over 100 miles per year to reduce wildfire risk and PSPS event impacts. Another benefit of undergrounding that is yet to be quantified is the reduced scope of vegetation management required in areas that are undergrounded. The strategic underground initiative will continue to evolve as SDG&E gains a better understanding of the costs and constraints involved. Although SDG&E has extensive experience in installation of underground cable, performing undergrounding within the HFTD makes this initiative challenging to implement. Some challenges include difficult terrain, environmental constraints, permitting timelines, and acquisition of easements. Lessons learned from each year's undergrounding accomplishments will help to alleviate some of these constraints through process improvements and stakeholder engagement.

12. C17: Overhead Distribution Fire Hardening – Bare Conductors

- **C17-T1: Tier 3; C17-T2: Tier 2; C17-T3: Non-HFTD**

SDG&E's Distribution Overhead System Hardening program combines SDG&E's overhead hardening programs, formerly known as Fire Risk Mitigation (FiRM), Pole Risk Mitigation Engineering (PRiME), and Wire Safety Enhancement (WiSE) into one program. The one exception to the consolidation of work under this initiative is the distribution hardening component of the CNF project. CNF will continue to be managed separately from the work formerly known as FiRM, PRiME, and WiSE as all distribution CNF work is expected to be

completed in 2021. The consolidation of these hardening programs involves the strategy evolution described in SDG&E's 2020 WMP and will result in the execution of projects based on a circuit-by-circuit approach that weighs risk inputs alongside the need to reduce PSPS impacts, rather than scoping projects based on specific wire or at-risk poles. Ultimately combining overhead distribution hardening programs into one program has made the engineering, design, construction, and management of the projects more efficient and has minimized impacts to customers during job walks, construction and post-construction close-out activities. The overhead scope includes the replacement of wood with steel poles and replacement of conductor with high strength conductor.

In 2020, SDG&E conducted a research study that measured the effectiveness of bare conductor hardening and found that it reduced risk events by 47%. Given this is the lowest cost of its major hardening mitigation programs, SDG&E continues to leverage this program as an efficient method to reduce risk for the near future. This will allow for additional time to gain more experience with covered conductor and to transition from bare conductor scope of work to covered conductor or strategic undergrounding.

One of the biggest challenges with SDG&E's projects and execution schedules is the various land and environmental constraints imposed on projects. A single distribution circuit can traverse over multiple landowners, including federal, state, and local agencies (*i.e.*, Cleveland National Forest, Camp Pendleton, Bureau of Land Management (BLM)), California State Park, County of San Diego, Caltrans, Indian Tribal Lands, irrigation districts), private properties, and conservation easements. SDG&E often faces environmental constraints that require detailed review and approval processes that can limit the time of year it can operate, dictate the means and methods for construction, or cause re-routing of a section of circuit due to cultural or other environmental concerns. The federal, state, and local agencies often have specific and unique permitting requirements and environmental review and mitigation requirements and often require near final designs before the permitting process can start. In many cases, SDG&E must acquire new land rights or amend existing land rights. These land and environmental activities can impose long durations and uncertainty in our project schedules, but SDG&E leverages previous experience to build accurate schedules and thus forecasts. Efforts will be made to try to complete the highest risk reduction projects first, but this may not always be possible given the land and environmental constraints noted above.

SDG&E completed nearly 100 miles of bare conductor overhead system hardening in 2020, with 42 miles in Tier 3 of the HFTD, 54 miles in Tier 2 of the HFTD, and 4 miles in the wildland urban interface. SDG&E plans to execute an additional 100 miles of bare conductor in 2021 and will begin ramping down bare conductor mileage in 2022. SDG&E is transitioning to the other hardening alternatives beginning in 2022 to mitigate both wildfire risk reduction and PSPS impact reduction.

13. C18: Overhead Transmission Fire Hardening – Distribution Underbuilt

- **C18-T1: Tier 3; C18-T2: Tier 2**

SDG&E has been hardening its transmission system within the HFTD since the wildfires that impacted Southern California in 2007. SDG&E has nearly 1,000 circuit miles of overhead transmission that traverse the HFTD. SDG&E has generally prioritized this overhead transmission hardening by focusing on the areas with the highest risk, starting with Tier 3 and moving then into Tier 2. Approximately 800 miles, or 80% of the transmission system within the HFTD, currently meets SDG&E's hardened design and construction standards. There are still 200 miles of transmission infrastructure that remains to be fully hardened

To address the remaining infrastructure, SDG&E's overhead transmission hardening program utilizes enhanced design criteria, steel poles over wood poles, high strength conductor, and increased conductor spacing in the HFTD to reduce the chance of risk events and ignitions. In 2020, SDG&E performed a study on 17 transmission lines totaling 190 miles in the HFTD. SDG&E reviewed 20 years of reliability performance from 2000 to 2019. SDG&E compared overhead risk events per operating year per 100 miles before and after overhead transmission hardening and found an 83% reduction in risk events on hardened infrastructure.

Now that the transmission portion of the Cleveland National Forest project is completed, SDG&E has at least one hardened transmission line into every substation within the HFTD. This not only reduces the risk of ignitions caused by SDG&E's transmission system in the areas of greatest consequence, but it also significantly reduces the risk of transmission-related PSPS events impacting customers at the substation level. SDG&E's hardened transmission system allows SDG&E to take a targeted approach to PSPS decisions utilizing remote sectionalizing on the distribution system, thereby significantly reducing the number of customers impacted by further limiting the need to de-energize transmission lines or entire substations for public safety.

In 2020, SDG&E completed construction on approximately 21.6 miles of transmission and 9.4 miles of distribution underbuilt on transmission lines (in addition to the transmission hardening performed by the CNF project) in 2020. These projects were completed in the communities of Kearny Mesa, Otay Mesa, and portions of lines located on Camp Pendleton.

In 2021 and 2022, SDG&E plans to harden additional transmission mileage within the HFTD, including its last remaining miles in Tier 3 of the HFTD. SDG&E notes that the tie lines hardened in accordance with this strategy are driven by Federal Energy Regulatory Commission (FERC)-jurisdictional projects, given that hardening efforts address the 69 kV transmission system and the associated 12 kV distribution system located in the HFTD. The costs associated with this initiative include only the CPUC-jurisdictional elements related to this strategy.

By the end of 2022, SDG&E plans to have hardened 100% of transmission lines traversing the Tier 3 HFTD, and approximately 85% of the HFTD overall. SDG&E intends to complete this long-term strategy of grid hardening its transmission system within the HFTD by 2026. Projects for the remaining unhardened lines have been identified and have started the process of being scoped and approved.

14. C19: Cleveland National Forest Fire Hardening

- **C19-T1: Tier 3; C19-T2: Tier 2**

The CNF project design was based on various recommendations addressing fire prevention and the U.S. Forest Service's environmental requests. Using an analytical matrix reflecting elements of fire risks and environmental concerns, SDG&E and the U.S. Forest Service collaborated to determine which sections of the electric system should be upgraded. Each segment required a custom solution based on many factors, including the location of the customer being served by the distribution system, the topography of the land, and various biological, cultural, and environmental factors. Similar to overhead transmission hardening, because of the known local wind conditions, the grid hardening activities were designed to handle the higher wind speeds and utilize increased wire spacing to decrease the likelihood of wire-to-wire contact or arcing as the result of contact by flying debris.

The CNF projects include the hardening of facilities and select undergrounding of several existing 12 kV and 69 kV electric facilities spread throughout an approximately 880 square-mile area in the eastern portion of San Diego County located in the HFTD. The existing electric lines located within CNF also extend outside of CNF boundaries. Generally, the CNF program will

increase the safety and reliability of SDG&E's system by hardening existing electric infrastructure that currently serves the U.S. Forest Service, emergency service facilities (*i.e.*, fire, communication, and other), campgrounds, homes, businesses, and other customers with the CNF and surrounding areas.

Construction commenced on the CNF program in late 2016 and is planned to be completed in 2021. At the end of 2020, SDG&E has hardened a total of 98 miles of transmission, 107 miles of overhead distribution and has installed 16.6 miles of distribution underground. In 2020 specifically, the CNF project converted 12.5 miles of existing overhead distribution to 14.3 miles of underground cable, hardened 29 miles of electric transmission, and 45.5 miles of overhead distribution. All of the transmission lines that were identified on this project have been completed and can withstand winds of either 85 mph or 111 mph based upon the known local wind conditions. Less than 10 miles of overhead distribution remains to be fire-hardened within CNF and is expected to be completed in 2021. All construction and close-out activities, such as QA/QC reviews, are planned to occur within 2021.

SDG&E notes that the tie lines hardened in accordance with this strategy are driven by FERC-jurisdictional projects, given that hardening efforts address the 69 kV transmission system and the associated 12 kV distribution system located in the HFTD. The costs presented include only the CPUC-jurisdictional elements related to this strategy.

15. C20: LTE Communication Network

This initiative enables SDG&E's other mitigation activities, such as the Advanced Protection program, and contributes to addressing the risk of equipment failures or foreign objects in lines that could lead to ignitions. SDG&E's existing communication system within the HFTD does not have the bandwidth to support some of the technologies SDG&E is currently deploying as wildfire mitigations including its Advanced Protection program and specifically the Falling Conductor Protection initiative. In addition, there are gaps in coverage of third-party communication providers in the rural areas of eastern San Diego County that limit SDG&E's ability to communicate with field personnel during Red Flag Crew deployments and Emergency Operations Center activations.

SDG&E is deploying a privately-owned LTE network using licensed radio frequency (RF) spectrum by means of the Distribution Communications Reliability Improvements (DCRI) program. This will enhance the overall reliability of SDG&E's communication network, which

is critical for enabling fire prevention and public safety programs. SDG&E's communication network is foundational to many initiatives that demand reliable communication. The ability to reliably enable and disable sensitive settings, enable or disable reclosing, or even remotely operating a switch during a high-risk weather event demands reliable communication that the LTE network will provide. SDG&E's Falling Conductor Protection, in particular, relies on a robust communications network to operate successfully and falling conductor circuits will continue to be enabled as SDG&E's communication network comes online.

SDG&E is prioritizing installations in the HFTD and is working closely with the Advanced Protection team to coordinate the installation of protection and communications equipment.

In 2020, the DCRI program completed a large number of accomplishments foundational to advancing communications coverage and reliability in the HFTD. Accomplishments include: acquisition of spectrum licensing; single spectrum RF design for 50% of service territory; site design standards for attachment to distribution assets; integrated LTE/Distribution build process; siting surveys, land rights and environmental analysis; community outreach and communications planning; 15 base stations completed; georedundant production core; QA/test core; use case testing lab environment built; and further use case testing and validation.

The active development of distribution standards and as well as the associated integrated LTE/Distribution build process has delayed the installation of additional base stations this year. The integrated LTE/Distribution build process is a new unique process that integrates numerous departments and various safety and regulatory requirements into new distribution standards that drive design. Site-specific designs must be fully completed prior to initiating procurement of the engineered steel poles used in the designs. Over the next several years, SDG&E plans to ramp up installations of base stations to create the required communication network necessary to implement the AP initiatives.

The program is continually progressing and there are many facets to define success with a program of this nature. Efforts are being taken to increase efficiency of the buildout, such as potential acquisition of a second spectrum type, as well as analyzing initial build sites and adjusting deployment strategies to meet build-out timelines.

16. C21: Lightning Arrester Removal / Replacement Program

- **C21-T1: Tier 3; C21-T2: Tier 2**

Lightning arrestors are a piece of electrical equipment designed to mitigate the impact of transient overvoltages on the electric system. Overvoltage can cause damage to more expensive distribution equipment such as transformers and underground cables, so lightning arrestors are used as protection devices. Overvoltage can be caused by switching surges, faults, or lightning strikes. When the arrestor senses an overvoltage on the system, the device activates, stabilizing the voltage on the system while passing excess current to ground. If the overvoltage duration is too long, or the overvoltage too high, the arrestor can become thermally overloaded, causing these units to fail in a way where they can become an ignition source.

Through SDG&E's effort to improve and explore alternate solutions and evaluate new technology, a new product was introduced that received CAL FIRE approval. Utilizing this new product, SDG&E plans to replace these arrestors in strategic locations within the HFTD with a CAL FIRE approved lightning arrestor. The CAL FIRE approved device comes with an external device that operates prior to the arrestor overloading, dramatically reducing the potential of becoming an ignition source.

SDG&E will be installing the first of these units in 2021, so no studies have been completed on the effectiveness of this mitigation. SDG&E estimates the program will have an 80% reduction in ignitions, based on the technology and what the product is designed to accomplish. Like all of its equipment programs, SDG&E will be installing these new assets in a way where they can be queried for later reporting, so SDG&E can evaluate the effectiveness of these mitigations as new lightning arrestors begin to protect the electric system under overvoltage conditions.

In 2020, SDG&E's plan for this program was to finalize its construction standards and constructing at test sites for successful installation of these lightning arrestors in 2021. Thus, no major installations occurred in 2020. Construction standards were finalized, and major construction will begin in 2021 with a target of installing 924 lightning arrestors. Over the next several years, the program will ramp up to begin replacing approximately 1,800 arrestors per year. This pace would replace all at-risk arrestors within a ten-year period.

D. Asset Management and Inspections

The purpose of SDG&E's asset management and inspection programs are to promote safety for the general public, SDG&E personnel, and contractors by providing a safe operating and construction environment while maintaining system reliability. SDG&E's established inspection and maintenance programs enable SDG&E to identify and repair conditions and components to reduce potentially defective equipment on SDG&E's electric system to minimize hazards and maintain system reliability. To accomplish this, SDG&E meets or exceeds the requirements of the inspections mandated by Public Resource Code Sections 4292 and 4293 as well as G.O. 95, G.O. 128, G.O. 165, and G.O. 174.

As discussed in the sections below, SDG&E is continually working to find ways to improve the safety of its system through its asset management and inspection programs. This includes development of new programs such as the distribution and transmission drone programs with a continued focus on existing programs such as the routine and detailed inspections performed for substation, distribution and transmission assets.

1. C22: Distribution System Inspection – CMP – 5 Year Detailed Inspections

- **C22-T1: Tier 3; C22-T2: Tier 2**

Commission G.O. 165 requires SDG&E to perform a service territory-wide inspection of its electric distribution system, which is referred to as the Corrective Maintenance Program (CMP). This inspection program mitigates the risk of equipment failure by identifying equipment deterioration and making the repair and/or replacement before failures occur. Equipment failure can lead to electrical faults, which can lead to ignitions. G.O. 165 establishes inspection cycles and record-keeping requirements for utility distribution equipment. Utilities must conduct detailed inspections at a minimum every three to five years, depending on the type of equipment. For detailed inspections, the utilities' records must specify the condition of inspected equipment, any problems found, and a scheduled date for corrective action. Utilities are also required to perform intrusive inspections of distribution wood poles depending on the age and condition of the pole and prior inspection history.

The CMP helps to mitigate wildfire risk by providing SDG&E additional information about its electric distribution system, including in the HFTD. With this information, SDG&E's corrective actions address infractions before a potential issue can occur.

The five-year detailed inspections are mandated by G.O. 165. These inspections are performed throughout SDG&E's entire service territory, including the HFTD. SDG&E conducts an audit to ascertain the effectiveness of the inspections. This audit is managed by SDG&E's operational and engineering managers, who are responsible for certain districts. They typically select about 1.5% of the combined (overhead and underground) territories and assess their conditions to see if the appropriate improvements have been properly carried out. SDG&E tracks the issues identified through this inspection method. These records can be evaluated to identify the quantity and types of issues found that demonstrate the effectiveness of the program.

In 2020 and future years, SDG&E will continue to comply with G.O. 165. SDG&E plans to review the results and high-definition imagery from its drone inspections to provide feedback and enhance its ground G.O. 165 detailed overhead visual inspections and patrols. The following table summarizes the top five conditions found on overhead detailed inspections within the HFTD in 2020 from the CMP.

Table 3: Top Five Conditions During Overhead Detailed Inspections in 2020

OHVI Conditions - HFTD	Count
Damaged/Missing High Volt Signs - 2	333
SDGE/Cust Pole or Stub Pole Dmged/B	280
Damaged Ground Molding	252
CIP Not Transferred- Non-Immediate	198
Overhead connectors Directly on Lin	182

2. C23: Transmission System Inspection

SDG&E utilizes a comprehensive, multi-faceted inspection and patrol program for its electric transmission system which consists of visual patrols, infrared patrols, detailed patrols, as well as other various specialty patrols, inspections, and assessments. Inspections and patrols of all structures, attachments, and conductor spans are performed to identify facilities and equipment that may not meet Public Resources Code §§ 4292 and 4293 or G.O. 95 and G.O. 128 rules.

When non-conformances are identified through these inspections, secondary assessments are performed based on severity levels assigned. These assessments inform what mitigation measures are needed and the timelines for corrective action. This inspection program mitigates the risk of equipment failure by identifying equipment deterioration and making the repair and/or

replacement before failures occur. Equipment failure can lead to electrical faults, which can lead to ignitions.

For detailed inspections, experienced, internal lineman (patrollers) physically visit every structure scheduled for the year to perform the inspections, looking at all components of the structure and conductor. By physically visiting the structures, patrollers are able to look the structure and also access to the structure for current and future maintenance requirements. Detailed inspections result in the largest number of G.O. 95 findings for corrections showing the benefit of this specific activity.

Detailed inspections are currently completed on a three-year cycle for all structures in the HFTD. As conditions are identified during these detailed patrols, internal severity codes are established to properly prioritize corrections. This also is so that conditions are corrected in timeframes which meet or exceed G.O. 95 requirements.

In addition, prior to the first event of the current year's wildfire season as conditions allow, SDG&E plans to complete an additional set of visual transmission inspections on tie lines located within Tier 3 of the HFTD which are likely to be impacted by high winds. This additional patrol is looking for potential fire conditions within the high-risk Tier 3 HFTD environment which take immediate prioritization.

SDG&E currently plans on continuing its historical practice in the subsequent years. With the continuation of this program and interval, SDG&E plans to complete inspections of approximately 2,700 structures in 2021. SDG&E notes that the transmission line inspection programs are driven by FERC-jurisdictional projects. This filing provides only the CPUC-jurisdictional elements related to this strategy.

SDG&E annually evaluates its maintenance practice to confirm inspection and repair intervals meet or exceed regulatory requirements. SDG&E regularly monitors all its inspection programs and ensures all inspection goals are met. Yearly inspections and patrols are performed simultaneously with multiple inspectors and inspection types, validating the quality of the patrols performed. In addition, every quarter, transmission supervisors randomly select 1% of the structures with conditions identified and mitigation measures completed, to field verify the reported conditions have been appropriately addressed. The table below summarizes the top five corrective transmission maintenance orders for 2020.

Table 4: Top Five Corrective Transmission Maintenance Orders for 2020[1]

Maintenance Order	Qty
Ceramic Insulators - Rust	77
Cotter Key(s) – Missing	23
Foundations – Covered/Washed Out	15
Conductor Strands – Broken	14
Complete Wood Pole – Replacement Required	10

[1] Represents only maintenance orders created based on findings from 2020 transmission detailed inspections.

3. C24: Distribution System Inspection – IR/Corona

- **C24-T1: Tier 3; C24-T2: Tier 2**

Infrared distribution inspections mitigate the risk of issues with electrical connections and equipment that cannot be seen during SDG&E's traditional visual inspections. Left undetected, these issues could cause an equipment failure that could lead to an ignition. Connections are difficult to fully assess from the ground or air as it is not possible to visually see the electrical flow. If connections look secure but are not truly tight, the electrical flow may all follow one path resulting in potential premature failure of a connection. Thermographers utilize infrared technology which looks at the radiation emitted by the connections to determine if there are potential issues with a connection prior to failure.

Issues identified through the infrared program are often issues that would not have been identified through current visual or detailed inspections. SDG&E plans to track the infrared inspection findings to evaluate the risk reduction potential. At this time, only a few inspection findings have been discovered utilizing the infrared technology that would not have been seen through traditional visual inspections. The issues identified to date are conditions that could pose a fire or public safety risk.

SDG&E began this program on a pilot basis. The initial focus of the pilot program was on distribution circuits located within Tier 3 of the HFTD. Circuits were initially selected within Tier 3 based on the historical fault counts. Based on the results from the initial pilot program and a comparison to visual findings for a similar region, the prioritization of the pilot program has been changed. Due to the low current running through the lines in the more rural areas, it is thought this may have an impact on the effectiveness of the technology in determining potential connection issues. Based on the risk avoided and cost, the program did return value in the Tier 3

HFTD, but SDG&E plans to continue the pilot program on more urban circuits within Tier 2 of the HFTD and assess the effectiveness.

In 2020, SDG&E completed infrared inspections on the structures and adjacent conductors on approximately 13,000 distribution structures within Tier 3 of the HFTD. As noted above, moving into 2021, the scope of this program will change in order to determine the effectiveness of the program within the higher loaded circuits within Tier 2 of the HFTD.

SDG&E plans to continue the pilot program in 2021 to analyze the effectiveness on higher loaded circuits. As data is collected through these infrared inspections, the results can be analyzed as they were with the Tier 3 study. Depending on the results, the program with be re-evaluated to analyze potential modification or improvements such as frequency, quantity per year, or new features to increase the effectiveness of the program.

4. C25: Distribution System Inspection – CMP – 10 Year Intrusive

- **C25-T1: Tier 3; C25-T2: Tier 2**

SDG&E performs wood pole intrusive inspections on a 10-year (average) cycle on all wood poles throughout SDG&E's service territory. This program mitigates the risk of a pole failing due to internal degradation prior to SDG&E identifying the issue and replacing the pole. A pole failure can lead to a fault on the system and a potential ignition. Each pole is inspected visually and if conditions warrant, intrusively. G.O. 165 requires that any pole 15 years of age or older is inspected intrusively. The form of the intrusive inspection is normally an excavation about the pole base and/or a sound and bore of the pole at ground-line. Treatment is applied at this time in the form of ground-line pastes and/or internal pastes. The 10-year cycle fulfills the requirements of G.O. 165: (1) all wood poles over 15 years of age are intrusively inspected within 10 years, and (2) all poles which previously passed intrusive inspection are to be inspected intrusively again on a 20-year cycle.

Depending on the cavities found, or the amount of rot found, an estimate of the remaining pole strength is determined utilizing industry-wide standards. Depending on the severity of the deterioration, the pole either passes, must be reinforced with a steel truss to provide it another five to ten years of useful life or replaced.

In 2020, SDG&E performed approximately 14,000 wood pole intrusive inspections in the HFTD. The number of poles inspected in the HFTD will slightly vary year-to-year, as the inspection cycle begins to move in other areas of the service territory.

SDG&E does not currently plan on modifying or enhancing this program. Consistent with the Commission's requirements, all wood poles will continue to be intrusively inspected on a 10-year cycle. The following table summarizes the top conditions found during intrusive inspections on distribution poles within the HFTD in 2020.

Table 5: Top Conditions Found on Intrusive Inspections on Distribution Poles in 2020

Wood Pole Intrusive Conditions - HFTD	Count
Climbing Inspection Recommended	548
Restoration Recommended, Steel Rein	50
Restoration Rejected, Replace	43
Restoration Recommended, C-Truss	19
Pole Leaning Badly	10

5. C26: LiDAR Flights

Accurate surveys of the electric distribution right of ways, including existing distribution lines, telecommunication lines, structures, crossings, vegetation, and other potential hazards, are critical to effective and accurate electric line design. While previous design methods relied upon standard structure heights, span lengths, and sag and tension charts, enhanced design tools and survey methods are required to mitigate the risk of wildfires.

LiDAR surveys have evolved into a foundational component for SDG&E's overhead transmission and distribution line engineering analysis and design. The transmission department was the early adopter of utilizing LiDAR into their designs. In 2013 with the start of the FiRM program, SDG&E began utilizing LiDAR for the distribution system for clearance and structural adequacy prior to implementation of the grid hardening program. LiDAR surveys provide the most cost-effective, scalable, and accurate solution for overhead power line analysis increasing both system reliability and safety.

Ideally, a transmission or distribution line can be modeled with a single deployment of LiDAR and subsequent modeling. But transmission and distribution systems are often changing with joint use additions, customer relocations, compliance, reliability and maintenance modifications, conductor creep and pole settling, and external development. Rural transmission lines, particularly in HFTD, require attentive vegetation analysis. As such, it is important that LiDAR is field verified. Priority for LiDAR spend follows post-construction survey, pre-construction design, and vegetation analysis.

LiDAR is and has been essential for SDG&E's design projects, vegetation analysis, and post-construction assessment. In 2020, SDG&E captured LiDAR for approximately 5,700 distribution structures. As SDG&E's system hardening projects continue to roll out, additional pre-LiDAR and post-LiDAR design and analysis will follow.

LiDAR acquisition and inspections will continue to support the transmission and distribution fire hardening efforts. SDG&E plans to assess transmission lines for vegetation and clearance compliance with a targeted completion of all HFTD Tier 3 projects by the end of 2021. Section and structural usage analysis based on the same LiDAR set will follow in 2022 and beyond.

LiDAR inspections will continue to supplement the grid hardening efforts and post-construction analysis. Vegetation and clearance checks will be fully implemented within the HFTD and potentially expand into non-HFTD projects. Results of these analyses will also be used for emergency operations during red flag and other extreme events.

6. C27: Distribution System Inspection – HFTD Tier 3 Inspections

- **C27-T1: Tier 3; C27-T2: Tier 2**

SDG&E has implemented an HFTD Tier 3 Inspection program to perform Quality Assurance/Quality Control (QA/QC) inspections within the HFTD Tier 3 prior to fire season. These additional proactive inspections are scheduled on a three-year cycle, in addition to the G.O. 165 five-year detailed inspections, exceeding the requirements of G.O. 165. These additional inspections are designed to identify potential structural and mechanical problems before they fail. SDG&E has performed HFTD Tier 3 Inspections of its overhead electric distribution poles in high-risk fire areas with a focus on identifying areas where maintenance would improve fire safety and reliability, with a goal of mitigating the probability that SDG&E's overhead electric system, facilities, and equipment would be the source of ignition for a fire.

These inspections were conducted from 2010 through 2016 as a result of a settlement agreement adopted in D.10-04-047. In 2017, SDG&E decided to proactively continue the HFTD Tier 3 Inspections as part of its normal program. In 2018, when the CPUC adopted the current statewide fire threat map, SDG&E began applying the QA/QC three-year inspection cycle to the newly defined HFTD Tier 3. From 2016 to 2018, SDG&E performed HFTD Tier 3 Inspections on an average of 15,000 poles annually (approximately one-third of the distribution poles in the HFTD Tier 3) in its then-existing "extreme" and "very high" fire threat areas. In addition to the

inspections, SDG&E performs a system maintenance patrol (as specified by G.O. 165) for the entire overhead electric distribution system in the HFTD on an annual basis. Safety-related issues identified on those patrols are scheduled for follow-up repair.

For HFTD Tier 3 Inspections, the main purpose is to identify fire safety conditions in the HFTD Tier 3. SDG&E performed 11,864 inspections in the HFTD Tier 3 in 2020. All of these inspections were completed by March 2020. In 2021, SDG&E plans to complete 10,815 HFTD Tier 3 inspections.

In addition, SDG&E intends to accelerate repairs of these types of conditions found in Tier 2 and 3 of the HFTD (including the design, engineering, and construction of the new structures) faster than the six-month or twelve-month time frame required by the Commission's General Orders. This will reduce the risk of wildfire on an accelerated schedule within the highest risk areas. The table below shows the top five conditions found on HFTD Tier 3 inspections for 2020.

Table 6: Top Five Conditions Found on HFTD Tier 3 Inspections for 2020

HFTD Tier 3 Conditions	Count
SDGE/Cust Pole or Stub Pole Dmged/B	99
Damaged Cross-Arm	52
Other - Infraction - No Applicable	47
Damaged Ground Molding	40
Damaged/Missing High Volt Signs - 2	39

7. C28: Distribution System Inspection – Drone Inspections

- **C28-T1: Tier 3; C28-T2: Tier 2**

SDG&E began a pilot program at the end of 2019 to determine whether the use of drone technology could help improve or enhance its existing inspection efforts in the HFTD. Specifically, SDG&E was interested in determining whether drones and the high-resolution imagery captured by the drones could be used to identify issues that could not be or were difficult to identify from the ground using traditional inspection methods. Improved identification methods for potential fire hazards on distribution facilities would minimize the risk of wildfire ignition and faults that cause outages.

Further, the number of images (over 1 million) being captured during the pilot drone program put a spotlight on how SDG&E could review the data from the drones more efficiently in the future and address a situation where SDG&E would be consuming image data from other

sources, such as cameras mounted on fleet vehicles or photos submitted by customers. As the amount of data coming into SDG&E's system increases, the ability for humans to review all the data would become impossible, costly, and burdensome. Therefore, SDG&E began using intelligent image processing (*i.e.*, machine learning or artificial intelligence) technology to process large amounts of data and focus human resources on potential issues.

In 2020, SDG&E concluded assessments for 37,310 distribution poles in the Tier 3 HFTD. An analysis of the data collected by the drone program concluded that the program found a higher percentage of total issues than current inspection programs; however, the timing of the inspections or other efforts, such as vegetation management schedules, can influence a straight comparison between programs. Accordingly, SDG&E focused its analysis on the 8,149 poles that were reviewed using ground-based inspectors and the drone teams. For poles with overlapping inspection dates within 0-180 days, the drone program found, on average, 51% more issues. The top issues that were found significantly more by the drone program included: damaged arrestors, damaged insulators, issues with pole top work, issues with armor rods, crossarm or pole top damage, exposed connections, loose hardware, improper splices, and damaged conductor, damaged transformer and CIP connection issues. With that said, the types of issues identified between the two programs with vegetation issues, grounding problems, and other damage were identified more by the ground-based inspectors.

While further analysis would help determine the exact reasons for the discrepancy in findings between the different types of assessments, it is apparent that the imagery collected by the drones does allow for improved identification of potential fire hazards for certain types of issues or where conditions such as terrain and vegetation density present difficulties in completing full detailed inspections. The drone program also provided SDG&E with an opportunity to leverage the influx of images captured by the drones as well as build intelligent image processing models to identify assets and detect potential damage to its electric facilities. Once the models are developed and tested, SDG&E would potentially be able to process thousands of images in real-time or in a fraction of what it would take for a qualified electrical worker to review.

SDG&E targeted its initial efforts in Tier 3 of the HFTD, as this is the area with the highest risk for wildfire. Next, SDG&E plans to expand the program into Tier 2 of the HFTD and complete assessments on its distribution facilities in that area over the next two years.

Prioritization will be completed by reviewing circuit risk indexes that are built considering pole age, pole material type, local weather conditions, and vegetation communities. SDG&E will also review its efforts on other programs and remove facilities that are being upgraded or otherwise affected by its other Wildfire initiatives from the scope of its drone assessments.

SDG&E did encounter constraints in performing drone assessments for all its distribution facilities primarily related to government agency authorizations from California State Parks and U.S. Forest Service, as well as coordination with certain customers. Additional efforts will be made to gain approvals from these agencies and perform drone inspections on those distribution facilities beginning in 2021.

For the intelligent image processing effort, SDG&E prioritized the types of models it developed to focus on the highest risk items and highest frequency issues. As SDG&E gained experience through the pilot program, efficiencies in flight planning, customer outreach, and image collection and review were gained over the approximate 15-month schedule for completion of flights. These efficiencies were able to reduce costs by 50% from an average of $1,000/pole to $500/pole. With further modifications to the program, SDG&E is working to decrease cost impacts as it expands the program to Tier 2 of the HFTD. There are approximately 44,000 distribution facilities in Tier 2 of the HFTD and SDG&E plans to perform flights and assessments on half of those facilities in 2021 and the remainder in 2022 based on the prioritization discussed above. The program will then transition to completing inspections within the HFTD on a five-year cycle.

SDG&E's intelligent image processing models now in development include 25 models detecting 15 asset variations and 12 damage conditions within a range of 65-97% accuracy. These models are generally associated with the pole, crossarm, insulator, and transformer. SDG&E has invested approximately $2 million in the development of these models and intends to continue refining the current models and building additional models in 2021 to eventually allow for a full evaluation of the pole, depending on the images provided. For example, a certain number of different types of conditions are necessary in order to build an effective model, and if those conditions do not exist, then the model's accuracy will be affected.

To help decrease the costs for flight and assessments while maintaining quality and effectiveness of the drone program, SDG&E plans on implementing two significant changes in

the next phase: (1) reducing the number of images taken by the drone, and (2) deploying a qualified electric worker (QEW) to act as the visual observer with the drone pilot.

Reducing the number of images taken will allow the field teams to complete flights on more poles per day and decrease the time it takes the QEW to review all images and perform the assessment. This will ultimately reduce the cost to perform the flights and assessments on a per pole basis. SDG&E based this change on an analysis of which images were used by the assessment team to identify most issues. The results indicated that more than 65% of the issues were identified using the level 2 image, which is taken from an angle above the pole and at a close distance from the pole. While only approximately 13% of issues were identified using the level 1 image, this photograph was useful in executing the repair and providing context to the assessment team when performing their reviews. Thus, SDG&E will be eliminating the level 3 image capture, which is taken below the crossarm and presents the highest risk of collision when flying the drone and, while it offers additional angles and views of hardware and connections, it represents what can generally be seen from the ground.

Next, the drone teams consisted of a two-person crew with a drone pilot and the visual observer, both of which are not QEWs. By pairing the drone pilot with a QEW, SDG&E would get the cost savings of reducing manpower and the benefit of having a trained and qualified individual to observe the pole in the field. This change will help better determine the advantages and disadvantages between ground-based and drone-based inspections and make a more informed decisions about how to incorporate drone technology into its inspection programs in the future.

Finally, the intelligent image processing models will continue to be enhanced and expanded to reduce future costs associated with inspections and provide the means necessary to address the increasing need to consume and process data.

8. C29: Distribution System Inspection – Circuit Ownership

- **C29-T1: Tier 3; C29-T2: Tier 2**

The Circuit Ownership platform relies upon field personnel expertise to identify potential hazards that could lead to a wildfire. This initiative helps to reduce the risk of potential fire hazards turning into ignitions by identifying concerns and mitigating them before they fail. This platform gives SDG&E's field personnel another avenue to submit these concerns via a Mobile Data Terminal (MDT) program or mobile application (both iOS and Android). Specifically, this

program facilitates supplemental submission of circuit vulnerabilities (in addition to the existing inspection programs) so that they can be timely repaired, to prevent a potential ignition and minimize the risk of wildfire. In essence, this program provides field personnel a platform for "if you see something, say something." This program focuses on regions where there could potentially be a wildfire concern. This includes Tier 2 and Tier 3 of the HFTD and coastal canyons where simulations have indicated a wildfire risk exists.

SDG&E's mobile application enables all employees to submit supplemental inspections if they see an issue with SDG&E assets that needs to be addressed. When issues are identified through the mobile application, they are categorized within two days (unless identified as an imminent danger or hazard) as either a priority, emergency, or non-emergency. This prioritizes the prompt follow-up of those priority and emergency submissions. For example, a submission through this program identified a long stretch of overhead wire (sized #6 bare stranded copper) that runs through a dry brush canyon near an urban development. This branch line feeds a small transformer that is used for monitoring. Once the issue was identified, the Circuit Ownership program developed a plan to isolate the transformer "off grid" with solar and batteries, and then remove the 22-span section of overhead small conductor that has a higher risk of failure.

SDG&E deployed this program in 2020, and there are have been four submissions to date. Plans for 2021 include providing refresher training to field personnel that could use this tool to identify potential hazards. This initiative has the potential to expand to all users in SDG&E's Electric Regional Operations department or even outside departments to submit concerns. Other discretionary inspection of transmission electric lines and equipment, beyond inspections mandated by rules and regulations.

9. C30: Distribution System Inspection – CMP – Annual Patrol

- **C30-T1: Tier 3; C30-T2: Tier 2**

In general, utilities must patrol their systems once a year in urban areas and in Tier 2 and Tier 3 of the HFTD. Patrols in rural areas outside of the HFTD are required to be performed once every two years. As a long-standing practice, however, SDG&E performs patrols in all areas on an annual basis as part of the CMP. In addition to the patrols, utilities must conduct detailed inspections at a minimum every three to five years, depending on the type of equipment. SDG&E's inspection and repair programs mitigate wildfire risk by identifying and repairing or

replacing deteriorated equipment before the failures occur, including in the HFTD. This program reduces faults due to equipment failure, which reduces the probability of ignitions.

The patrol inspections are mandated by G.O. 165. Upon completion of prescribed actions necessitated by the detailed CMP inspections, SDG&E conducts an audit to ascertain the effectiveness of the inspections. This audit is managed by SDG&E's operational and engineering managers, who are responsible for certain districts. The managers typically select about 1.5% of the combined (overhead and underground) territories and assess their conditions to see if the appropriate improvements have been properly carried out.

SDG&E performs inspections throughout its service territory. SDG&E tracks the issues identified through this inspection method. These records can be evaluated to identify the quantity and types of issues found that demonstrate the effectiveness of the program.

In 2020, all patrols on the electric distribution system have been completed in SDG&E's service territory. In 2021 and future years, SDG&E will continue to comply with G.O. 165 and conduct the required inspections.

SDG&E tracks the issues identified through this inspection method. These records can be evaluated to identify the quantity and types of issues found that demonstrate the effectiveness of the program. The table below summarizes the top five conditions found on patrols of distribution poles within the HFTD in 2020.

Table 7: Top Five Conditions Found on Patrols in 2020

Patrol Conditions - HFTD	Count
Damaged/Missing High Volt Signs - 2	333
SDGE Leaning Pole or Potential Over	64
SDGE/Cust Pole or Stub Pole Dmged/B	46
Damaged Cross-Arm	32
Damaged / Missing Pole Hardware	17

E. Vegetation Management and Inspections

Vegetation around electric distribution lines and equipment poses potential risks for safety, wildfire, compliance, and reliability. To address these risks, SDG&E developed and executes a robust and detailed schedule and scope for its vegetation inspection activities. While tree trimming is a mandated activity pursuant to CPUC G.O. 95, Rule 35, Public Resources Code 4293, and NERC FAC003-4, SDG&E's program goes beyond these minimum requirements to further enhance safety, especially in the HFTD.

SDG&E's vegetation management program involves several components including: tracking and maintaining a database of inventory trees and poles, routine and enhanced patrolling, pruning and removing hazardous trees, replacing unsafe trees with more situationally compatible species, pole brushing, and training first responders in electrical and fire awareness. These program components are discussed in detail in the Sections below.

SDG&E divides its service territory into 133 distinct zones known as Vegetation Management Areas (VMA). SDG&E's activities in each VMA are driven by a master schedule that identifies specific activities that are calendared to take place in each VMA every year. The activities include: pre- inspection, audit of pre-inspection work, tree pruning and removal, pole brushing, post-trim, and brushing audits. Patrol activities are generally termed to include routine inspections and off-cycle, incremental/enhanced inspections throughout the service territory. During the pre-inspection activity, trees in proximity to SDG&E's power lines are inspected and evaluated and the tree condition in the database is updated accordingly. Each tree is visited and inspected annually. The annual inspections include routine maintenance and hazard tree assessments to verify that trees will remain compliant for the duration of the cycle and/or pruned according to standards and clearances. Trees that will not maintain compliance, or that have the potential to impact power lines within the annual pruning cycle, are identified and assigned to the tree contractor to work. If a tree requires urgent work, the inspector has the discretion to issue the job to the tree contractor for priority completion. Emergency pruning may occur where a tree requires immediate attention to clear an infraction, or if it poses an imminent threat to the electrical facilities.

The aim of SDG&E's enhanced vegetation management strategy is to minimize or eliminate the likelihood of vegetation encroachment near power lines or tree-line contact as a result of by wind sway, branch breakout, or tree/root failure. SDG&E follows the industry standard of directional pruning to achieve this goal. If a tree cannot be mitigated by pruning, SDG&E may determine that complete removal is necessary. This course may be followed in situations where continued pruning is detrimental to the tree, the remaining tree poses a threat, or its growth potential cannot be managed for the duration of the annual cycle.

1. C31: Tree Trimming

- **C31-T1: Tier 3; C31-T2: Tier 2**

SDG&E maintains an electronic tree database that tracks the inspection, trimming, and auditing activity of its nearly 457,000 inventory trees. SDG&E defines an inventory tree as one that could encroach the minimum required clearance or otherwise impact the electrical facilities within three -years of the inspection date. The database includes tree information including species, height, diameter, growth rate, clearance, and other characteristics. This history provides tree inspectors with relevant information to determine which trees require work for the annual cycle. The tree inventory database is updated daily, reflecting trees that are added to or removed from the system. SDG&E employs a contracted workforce of ISA-Certified Arborists trained in species identification, characteristics, and hazard assessment.

SDG&E's vegetation management program strategy and schedule are centered around annual routine and enhanced inspections. Routine operations are driven by regulatory requirements by following an annual master schedule that includes pre-inspection activities, trimming, auditing, and pole brushing. Within the HFTD, SDG&E performs separately scheduled routine and non-routine hazard tree inspections annually. These off-cycle inspections provide a second assessment of all trees during the annual cycle. The inspections are performed by International Society of Arboriculture (ISA) Certified Arborists and include a 360-degree assessment of every tree within the "strike zone" of the conductors. The strike zone includes the area adjacent to power lines both inside and outside the rights-of-way for trees that are tall enough to potentially strike the overhead facilities. SDG&E completes work identified during the non-routine inspections prior to the start of the peak fire season (September 1).

During routine and off-cycle inspections in the HFTD, SDG&E also pursues enhanced clearances on its targeted species, including eucalyptus, palm, oak, pine, and sycamore. When determining targeted species, SDG&E considered factors such as growth rate and characteristics, failure potential, outage frequency history, and other environmental factors. Species alone does not necessarily trigger the need for enhanced trimming. As with any living organism in a changing environment, risk assessments are based on multiple site-specific conditions. Many of these trees, such as eucalyptus and sycamore, are fast-growing and have the propensity to shed branches during windy conditions.

SDG&E schedules its enhanced tree inspections within the HFTD to coincide with the post-trim QA/QC activity. The enhanced inspection activity occurs approximately six months after the routine inspection activity. This inspection frequency enables a second look at trees within the annual cycle to ensure conditions have not changed that may result in a tree/line conflict. In areas of the HFTD where the annual, routine pre-inspection activity occurs in the Fall (September-December), SDG&E performs the enhanced tree inspection activity in the Spring and Summer, in advance of seasonal Santa Ana wind conditions. The protocol and scope for both routine and enhanced inspections within the HFTD includes a visual inspection of all trees that have the potential to strike the electrical facilities if the tree were to fail at ground level. The visual inspection includes a 360-degree hazard assessment of trees from ground level to canopy height to determine tree health, structural integrity, and environmental conditions. Where appropriate, sounding techniques or root examination may also be conducted.

In 2021, SDG&E created four new internal SDG&E Forester Patroller positions to perform the off-cycle, enhanced tree inspections within the HFTD. These patrollers are ISA-Certified Arborists and highly qualified to perform hazard tree risk assessments. This team will also be engaged to perform customer refusal resolution within the HFTD.

Also, in 2021 SDG&E is implementing its next-generation database and work management system. Vegetation management and inspection activities were previously managed within a work management system currently called PowerWorkz. An enhancement to this system called EPOCH is scheduled to roll out in early 2021. This new system will include upgraded computer field hardware and software which will create improvements in data entry, accuracy, and reporting and should increase efficiencies in tree-trimming activities.

SDG&E tree contractors follow American National Standards Institute (ANSI) A300 industry tree standards and “directional pruning” techniques which foster the health of a tree while maximizing clearance and extending the pruning cycle. Tree branches that overhang electrical conductors may be considered a risk. SDG&E removes all overhanging branches on its distribution and transmission lines. Once the work is completed, the tree crew updates the tree information and records the work performed in a MDT, then uploads this information into the Vegetation Work Management System. Where achievable, SDG&E prunes trees to a clearance of 12 feet (or greater) from power lines. The post-pruning clearances obtained by the tree contractor are determined by factors such as species, tree growth, wind sway, and proper

pruning practices. On average, SDG&E prunes approximately 175,000 trees each year and removes approximately 8,500 non-compatible trees. In 2020 SDG&E pruned 221,500 trees and removed 12,985 trees. By comparison, in 2019, SDG&E pruned 167,588 trees and 9,936 removed trees.

In 2020, SDG&E experienced a significant cost increase in the tree trim and removal contract rates due to Senate Bill (SB) 247. This legislation resulted in an average contract rate increase of 48% for Davey Tree rates and 63% for Utility Tree Service rates. These cost increases, coupled with a higher overall volume of tree trimming and removals, resulted in a substantial portion of the increased Tree Trimming Balancing Account (TTBA) spending in 2020.

Tree removal includes the chipping of all material and removal of debris. Large wood (> 6-8-inch diameter) generated from tree removal work is generally left onsite with the property owner's acknowledgment on the signed tree removal authorization document. Any large debris left on slopes is positioned to prevent movement of the material by gravity. All debris associated with pruning and removal operations is removed from watercourses to prevent flooding or degradation of water quality. Tree removal operations that may occur in sensitive environmental areas are reviewed to determine protocols that must be followed to protect species and habitat.

As part of its sustainability measures, SDG&E supports and follows its "Right Tree-Right Place" initiative to replace incompatible trees with trees that are safe to grow near power lines. This program supports tree health, prevents outages and ignitions, and minimizes customer impact as a result of frequent tree trimming. SDG&E's sustainability initiative also includes the effort to divert a greater volume of the green waste associated with vegetation activities from landfills to recycling in an effort to reduce the carbon footprint. In late 2020, SDG&E initiated a new service agreement with a second recycling vendor to increase the amount of green waste debris diverted from landfills.

Documented QA/QC activities are a critical component of a utility's vegetation management program to measure contractor performance and further safety, compliance, and reliability.

SDG&E utilizes a third-party contractor to perform quality assurance audits of all its vegetation management activities to measure work quality, contractual adherence, compliance, and to determine the effectiveness of each component of the program. These audits include a

statistical analysis of a representative sample of all completed work. Auditing is performed by Certified Arborists. A minimum random sampling of 15% of completed work is audited to determine compliance with scoping requirements. Safety, regulatory requirements, and service reliability dictate the vegetation management methodology of spend and resource allocation. SDG&E works with the audit contractor to determine the scope, frequency, and number of resources needed to complete all audit activities. During the post-trim audit, the Certified Arborist also performs an inspection of all the power lines within the VMA for any trees that will not remain compliant with applicable regulatory requirements for the duration of the annual cycle. SDG&E and the contractor review the results to determine if any additional work is required.

In 2020, SDG&E expanded its audit program by integrating "level 2" hazard tree assessments during the post-trim audit. These assessments are performed by the same Certified Arborists performing the audit. In 2020, SDG&E also began auditing 100% of all completed reliability trimming and removals performed within the HFTD. Lastly, Vegetation Management increased the audit sampling for all other activities from 10-15%. Within the next two years, SDG&E hopes to expand and integrate the use of LiDAR as an additional tool for QA/QC.

SDG&E plans to explore the use of WiNGS to evaluate vegetation management prioritization in the near future. This will determine future refinements for risk models to support future prioritization and implementation of tree trimming. Over the next 5 years, SDG&E will work to develop a comprehensive audit program to continue to assess and quantify the state of compliance of the Vegetation Management program with regulatory requirements. These audits will inform on the overall success of the program, state of compliance, and procedural integrity.

2. C32: Fuel Management Program

- **C32-T1: Tier 3; C32-T2: Tier 2**

The Fuel Management Program aims to mitigate the following:

- Accumulation of wildland fuels in proximity to electrical infrastructure (wires, poles, equipment) poses a risk of damage to these facilities during wildland fires.
- Firefighting activities, firefighter safety, and faults resulting from smoke columns in proximity to electric facilities can cause power interruption.

- Wildland fuels pose a risk of ignition resulting from electric equipment failure if left unabated.

Wildland fuel reduction involves the thinning, pruning, and in some cases, removal of vegetation for the purpose of minimizing source material that could ignite and propagate a wildfire. The program consists of three activities:

- **Fuels Treatment activity** - Increased clearances around select structures (*e.g.*, poles). The Fuels Treatment activity was developed in 2019 to reduce the risk of ignition that could occur from equipment or pole failure or a wire-down event and propagate fire. This activity is also intended to protect Company infrastructure in the event of a wildfire that originates beyond SDG&E facilities.

  The Fuels Treatment activity has been implemented primarily within the Tier 3 High Fire Threat District on select poles which carry hardware that could possibly spark and ignite a fire. The scope of this activity entailed the removal of dead or dying fine fuels at ground level within a 50-foot radius of the poles. Some of these poles are those that are already subject to clearing requirements of Public Resources Code Section 4292. However, that requirement only requires a radius clearing of 10 feet.

  For this activity, SDG&E also included the use of a chemical fire retardant as an alternative to mechanical brush clearing. The fire retardant was applied around poles, and in some areas, in a linear application between structures within an easement. Landowner approval was secured for all work associated with the Fuels Modification activities.
  In 2020, SDG&E implemented the Fuels Treatment activity for pole brushing and fire-retardant activities where the total treatment of pole brushing in 2020 was 304 acres, and the total treatment using fire retardant was 25 acres, including 38 poles and roadside application.
- **Vegetation Abatement activity** - Vegetation clearing within transmission rights-of-way. This activity primarily consists of the removal of ground level, non-native flashy fuels, and the thinning of tree branches (to 6-8

feet) above ground. Brush abatement activities are planned and scheduled in late February/early March each year near the end of the normal rain season and before the flush spring growth occurs so that activities are efficiently managed in the appropriate regions.

In 2020 a total of 1,352 acres were abated on fee-owned power line corridors, and 300 acres of fee-owned properties were abated. SDG&E will continue these abatement activities following the same scheduled frequency.

- **Fuels Reduction Grant activity** - SDG&E-sponsored funding grants to third parties for the creation of fuel breaks. The Fuels Reduction Grant Activity was implemented to provide funds to third parties (*e.g.*, community organizations) targeted at reducing the risk of a fire of consequence igniting in a project area and strengthening the resiliency of the project areas.

  Fire Coordination fuels treatment projects will be identified using GIS analysis of Tier 2 and 3 areas of the service territory that meet certain criteria. The analysis will focus on areas impacted by significant wind events (PSPS). The analysis will then overlay areas where electric facilities, fuels, and topography have a direct association to fire ignition potential and growth and community protection.

  SDG&E awarded a $500,000 fuels treatment grant to Fire Safe Council of San Diego County for 2020-2021. This grant will be used to treat wildland fuels in proximity to electric facilities with potential to impact communities during a wildland fire.

SDG&E developed the Fuels Treatment activity as a proactive program intended to reduce wildfire fuel loads in high fire risk areas outside the areas already addressed by traditional pole brushing and other Company wildfire mitigation-related activities. The goal is to implement and assess new fire reduction practices so the Company can minimize the chances of an ignition event in high fire threat areas. SDG&E is gathering data on this program to determine the best methods to reduce fire threat.

SDG&E will continue to monitor the success of the program and adjust funding accordingly. Where appropriate, SDG&E will also continue to engage fire agencies, local/state/federal governments, and community groups to coordinate and maximize all stakeholder efforts. For the Vegetation Abatement activity specifically, anticipated improvements and innovations include enhanced reporting methods, pictorial documentation of brushing activities, successional training opportunities, efficient/improved sustainable brush abatement machinery technology (lower emissions & finely ground deck mulching spoils), and the possible utilization of prescribed grazing using goats.

3. C33: Enhanced Vegetation Management

- **C33-T1: Tier 3; C33-T2: Tier 2**

SDG&E's Vegetation Management program strives to be best-in-class through innovative approaches to further reduce risks associated with vegetation and power lines. In the HFTD, vegetation-related risks include the potential for vegetation contacts, vegetation-related ignitions, and catastrophic wildfire. Increased activity frequency and enhanced post-trim clearances are two elements of SDG&E's effort to mitigate these risks.

Trees are dynamic, living organisms. As such, the vegetation/powerline environment is in continual flux as clearances change due tree growth, tree health, and external forces. Additional and discretionary inspections and trimming beyond currently mandated requirements reduce the risk of non-compliant or high-risk conditions that may lead to wildfire. To that end, in 2020, SDG&E continued broader application of its vegetation management activities in the HFTD related to routine inspection, enhanced patrols, and trimming. SDG&E also continued its enhanced vegetation management activities, including trimming identified high-risk species in the HFTD to an approximately 25-foot clearance from electrical facilities, where achievable.

Enhanced vegetation management activities are targeted in the HFTD. During the annually scheduled routine inspection and enhanced patrol activities, all trees within the strike zone of the transmission and distribution lines receive a "level 2" hazard evaluation. These inspections are performed by ISA-Certified Arborists. Trees tall enough to strike overhead electric lines are assessed for trimming or removal. These efforts would include identification of dead, dying, and diseased trees, live trees with a structural defect, and conditions such as wind sway and line sag. Where required, trees are trimmed or removed to prevent line strike from either whole tree failure or limb break out. The enhanced patrols are timed to occur mid-cycle

with the routine scheduled inspection resulting in inspections occurring within the HFTD twice annually. Approximately 240,000 of SDG&E's 455,000 inventory trees are located within the HFTD.

SDG&E's tree trimming operations follow the concept of directional pruning, where all branches growing towards the lines are rolled back to direct the growth away from the lines and to increase the post-trim clearance. This practice decreases the risk of tree branches contacting electric facilities, whether by growth encroachment, limb failure, or complete tree failure.

SDG&E continues to focus on applying expanded post-trim clearances on targeted species identified as a higher risk due to growth potential, failure characteristics, and relative outage frequency. These species include eucalyptus, sycamore, oak, pine, and palm.

During elevated or extreme weather events, SDG&E's vegetation management contractors are kept informed of conditions in advance, allowing them time to relocate crews into safe work areas or to cease operations if required. In instances of emergency tree trimming during elevated fire conditions, additional fire equipment or support from contracted, professional fire resources may be utilized. In advance of a forecasted Red Flag Warning or Santa Ana conditions, SDG&E will determine if vegetation management patrols are warranted to assess tree conditions. SDG&E's internal Meteorology department confers with our Fire Coordination and Vegetation Management organizations to determine where this activity should occur.

SDG&E provides electrical equipment training to CAL FIRE representatives in conjunction with joint utility inspections. This training is intended to provide CAL FIRE awareness of electrical equipment, and to build a collaborative and positive working relationship between utility and regulator. CAL FIRE can then use this training to perform regularly scheduled inspections. CAL FIRE was unavailable to participate in joint inspections with SDG&E in 2020 due to fire response throughout the state. However, they have committed to resuming these activities in 2021 and future years.

In 2020, SDG&E continued to apply its enhanced vegetation management program, including achieving an approximate 25-foot clearance, where feasible, between trees and electric distribution facilities within the HFTD. This is a significant increase over the average 12-foot post-trim clearance SDG&E typically achieves and goes beyond the legal and regulatory requirements that apply throughout SDG&E's service territory. In 2020, SDG&E trimmed

approximately 13,000 targeted trees to the expanded 20 to 30-foot clearance range. As stated in section 4.4.2.9 of the 2021 WMP Update SDG&E can reduce vegetation contacts by 6.3 per year, and the associated ignitions by 0.19 per year by completing these clearances throughout the HFTD.

As SDG&E has implemented enhanced inspections, patrols, and trimming, it has identified that additional tools, fleet, and crews are needed to support this program. SDG&E also hired four internal SDG&E inspectors to augment its contractor workforce to perform the off-cycle HFTD and additional patrol activities for target species, such as Century plant and bamboo. Tree contractors are adding to their workforce to meet the demand of the increased workload associated with enhanced scoping.

Over the next 3 years, SDG&E will continue to refine and expand the use of its Vegetation Risk Index over the next three years to identify where to target additional trimming and removal activities. SDG&E will work with CAL FIRE to schedule annual training and joint inspection activities. SDG&E will continue to partner and collaborate with fire agencies and stakeholders on fire avoidance and fuel reduction initiatives.

4. C34: Pole Brushing

- **C34-T1: Tier 3; C34-T2: Tier 2**

Pole brushing is a fire prevention measure involving the removal of vegetation at the base of poles that carry specific types of electrical hardware that could cause sparking or molten material to fall to the ground. The clearance requirements in Public Resources Code Section 4292 require the removal of all vegetation down to bare mineral soil within a 10-foot radius from the outer circumference of subject poles located within the boundary of the State Responsibility Area (SRA). The requirement also includes the removal of live vegetation up to eight vertical feet, and the removal of dead vegetation up to conductor level within the clearance cylinder.

Pole brushing follows a specific multi-activity, annual schedule in order to remain compliant year-round. The number of subject-poles fluctuates minimally year-to-year, so scheduling, spend, and resource allocation remain fairly constant. SDG&E performs an environmental review in advance of all new pole brushing activities to assess impacts to protected species and habitat. Like all other vegetation management activities, a QA/QC audit is performed on a random, representative sample of all completed pole-brush work. Additionally, SDG&E conducts internal compliance audits for vegetation management on an annual basis.

In 2020, SDG&E replaced approximately 3,176 fuses and 1,857 hot line clamps attached to poles within the HFTD. This will reduce the risk of equipment-related ignitions and will potentially reduce the number of poles that are subject to pole brushing requirements in Public Resources Code Section 4292. In 2021 SDG&E plans to continue the effort of replacing fuses and hot line clamps attached to poles within the HFTD. This will continue to reduce the risk of equipment-related ignitions and will potentially reduce the number of poles that are subject to pole brushing requirements in Public Resources Code Section.

Pole brush inspection occurs in conjunction with the tree inspection activity. There are opportunities for redundancy and data discrepancy between this and the pole brushing activity which is performed on a different schedule. Within the next two years, SDG&E is planning to revise its procedure to integrate pole brush inspection within the pole brush activity. This will help reduce property visits and customer contacts and improve contractor work efficiency and data integrity. Over the next 10 years, SDG&E will develop the use of LiDAR to help with equipment change detection and auditing of pole brushing. SDG&E is also investigating inter-departmental processes that could automate notification when equipment is changed out that makes a pole subject to brushing.

SDG&E performs required pole brushing activities on subject poles located within the State Responsibility Area (SRA) per Public Resources Code Section 4292. The State Responsibility Area where Public Resources Code Section 4292 applies does not align completely with the HFTD boundary. As an extra precautionary measure, SDG&E brushes about 2,000 additional poles located outside SRA where Public Resources Code Section 4292 does not apply. These poles exist in areas of potentially flammable vegetation, on steep slopes, and/or adjacent to areas where a fire may propagate.

SDG&E's Vegetation Management department works with internal Meteorology and Fire Coordination departments to determine where it may be prudent to expand vegetation clearances around subject poles within high fire areas to mitigate the risk of ignitions that could occur outside the required clearances of Public Resources Code Section 4293.

SDG&E utilizes the same work management system to manage and track the inventory of all subject poles that require clearing. SDG&E brushes approximately 34,000 distribution poles that have non-exempt subject hardware attached. Inspectors determine which poles required

work and update the records in the database. SDG&E performs three separately scheduled pole brush activities annually including mechanical brushing, chemical application, and re-clearing.

Mechanical pole brushing includes clearing all vegetation around the base of the pole down to bare mineral soil for a radius of ten feet from the outer circumference of the pole; removing all live vegetation within the cylinder up to a height of eight feet above ground; removing all dead vegetation up to the height of the conductors. Mechanical brushing is typically performed in the spring months.

On poles where environmentally safe and with customer consent, contractors will apply an Environmental Protection Agency (EPA) approved herbicide, the chemical application. SDG&E treats approximately 10,000 poles with the pre-emergent herbicide to minimize vegetative re-growth and reduce overall maintenance costs. The chemical application is typically done just before the rain season (during the fall and winter months) so the chemical is activated and effective. Not all subject poles can be treated with herbicide due to environmental constraints which include species/habitat protection, site slope, proximity to water, proximity to trees, etc.

Reclearing, a second mechanical activity, is performed on poles that do not allow chemical application to remove vegetation that has grown into, or blown into, the required clearance area since the last maintenance activity. The need to revisit a subject pole multiple times is not uncommon due to leaf litter cast or blown into the cleared area and vegetation regrowth that cannot controlled by mechanical or herbicide treatments.

F. Grid Operations and Protocols

SDG&E's grid operations and protocols consist of mitigations that reduce risk through changing the way SDG&E operates during periods of elevated and extreme wildfire risk. This includes the disabling of reclosing in the HFTD, the enabling of fast recloser settings, restricting work in the HFTD during extreme fire potential and Red Flag Warnings, and sending contract fire resources into the field during elevated days in the HFTD. These operational decisions strive to reduce ignitions on the electric system. It is important to note that these protocols are now part of how SDG&E operates and is embedded into what we do. Accordingly, no costs are identified as costs are not separated for operating in such a manner.

In the research study detailed in the 2021 Wildfire Mitigation Plan, SDG&E shows that the chance of an ignition is highest during extreme FPI days for circuits located within the

HFTD. A risk event occurring during those weather conditions within the HFTD is more likely than normal and elevated FPI days. Sensitive and fast protection settings help reduce fault energy from causing an ignition.

To mitigate the high ignition percentages that may occur on extreme FPI days within the HFTD, SDG&E has developed a protective relay setting focused on detecting and isolating faults as quickly as possible. This protection settings profile is designed to operate as fast as possible, ignoring traditional protective coordination. SDG&E enables this setting profile on dynamic protective devices such as reclosers and circuit breakers when the FPI indicates an extreme risk. By reducing the resultant energy of a fault, the probability of causing significant damage to the surrounding area is reduced by limiting additional sparks resulting from less sensitive relay settings. These sensitive relay settings improve both the sensitivity of fault detection and the speed at which faults are cleared.

Sensitive and fast protection settings are part of SDG&E's operating standards to enable these setting on remote sectionalizing devices located within the HFTD on days where the fire potential is extreme. SDG&E developed the settings and the operating standard around these settings in 2015 and have been utilizing them since. Specifically, SDG&E operated these settings in 2020 and will use them again in the future.

SDG&E previously completed a large deployment of overhead distribution reclosers, focusing heavily on the HFTD. A recloser is a switching device that is designed to detect and interrupt momentary faults. The device can reclose automatically and open back up if a fault is still detected. The automated reclosing feature can be disabled, so if a device detects a fault it will trip open and remain open and minimize the potential for an ignition.

These overhead distribution reclosers allow SDG&E to operate its system in a variety of configurations depending on input from its meteorologists, known localized conditions, and its declared Operating Condition. They also provide SDG&E the ability to sectionalize various elements of its distribution system to efficiently manage system operations and reliability, which results in quicker restoration times for customers. Additionally, SDG&E has associated these remote SCADA-controlled sectionalizing devices with specific wind anemometer locations, allowing for targeted applications of PSPS to the areas that pose the most significant real-time system condition risk of wildfire.

Under Normal Conditions, overhead distribution reclosers operate to clear faults by isolating the fewest number of customers while reducing overall exposure to the electric system. Under Elevated Conditions or higher and now most of the year, all distribution reclosing functions are disabled on circuits located within the HFTD but may include other circuits if the burn environment is conducive to large wildfires. This is done so that if a fault occurs on the system, the recloser automatically opens and stays open so the fault only occurs once and is not closed, creating another opportunity for a potential ignition. Disabling reclosing functions is not optimal for reliability, but is performed for public safety and wildfire risk reduction when weather conditions are elevated or higher.

SDG&E's internal operating procedure for reclosing protocols is validated annually prior to fire season. SCADA-controlled sectionalizing devices with specific anemometer locations are validated yearly to ensure all newly installed devices are updated on the procedure, along with the SCADA summary screen. SDG&E's recloser protocols are intended to reduce the chance of a fault leading to an ignition. This includes disabling reclosing and the enabling sensitive settings described in the narrative above. SDG&E would expect the ratio of ignitions/faults to rise over time if SDG&E were to stop following these procedures.

The disabling of reclosing and the enabling of sensitive settings were among the first mitigations SDG&E initiated after the lessons learned from the 2007 fires. These innovative mitigations represented a shift in priority from electric reliability in favor of public safety and wildfire risk reduction. Today, these procedures represent a standard best practice for California utilities.

SDG&E has designated the type of work activity that can be performed for each of the Operating Conditions. As conditions increase in severity, activities that present an increased risk of ignition have additional mitigation requirements. Where risk cannot be mitigated, work activity might cease. The following summarizes the work activity guidelines for each Operating Condition:

- **Normal Condition:** normal operating procedures are followed with baseline tools and equipment.
- **Elevated Condition:** certain at-risk work activities may require additional mitigation measures in order to proceed with work. The additional mitigation measures will be documented.

- **Extreme or RFW Condition:** most overhead work activities will cease, except where not performing the work would create a greater risk than doing so. In those cases where at-risk work needs to be performed, an SDG&E Fire Coordinator is consulted, and additional mitigation steps are implemented. Status of work, ceased or continued, will be documented.

These guidelines suffice for most routine types of activities performed in the wildland areas, which consist of undeveloped areas with vegetation. For non-routine, or especially hazardous work, SDG&E's Fire Coordination group is consulted to determine whether additional mitigation requirements are needed.

SDG&E intends to continue to prioritize the integration of the Fire Potential Index into operational practices to promote safety. The FPI classifies the fire potential based on weather and fuel conditions and historical fire occurrences within SDG&E's service territory. SDG&E conducts annual reviews of these procedures and makes updates as necessary. Other special work procedures restrict work activities on elevated and extreme FPI days. Because of these procedures, SDG&E would expect crew related ignitions to decrease on elevated or higher FPI days.

In addition to operating procedures, SDG&E has protocols for maintaining public safety during high wildfire conditions, PSPS and re-energization events. SDG&E has experienced that while power lines are de-energized, they are still exposed to extreme winds and weather, and the potential for damage. Once the wind has passed, the conditions are typically still extremely dry and dangerous. Before re-energizing a line at the conclusion of a weather event, to confirm no damage has occurred to the line and ignitions will not occur upon re-energization, post-event patrols must be completed. SDG&E patrols 100% of lines that were proactively de-energized as part of a PSPS event. To perform these post-event patrols of de-energized lines, SDG&E utilizes both ground and aerial resources once a weather event concludes. While aerial resources are much faster at completing patrols, they cannot fly in elevated wind conditions, which often still exist when extreme wind events are determined to be over. SDG&E strives to complete post-event patrols and restoring service within 24 hours from when the Utility Incident Commander gives the okay to patrol, which signals the end of the weather event for that circuit. While SDG&E has been generally successful in restoring service within 24 hours, challenges such as

damage found on lines, a lack of daylight hours, or high winds impacting deployment of aerial resources may cause delays.

1. C35: Aviation Firefighting Program

- **C35-T1: Tier 3; C35-T2: Tier 2; C35-T3: Non-HFTD**

Under certain conditions, a wildfire that is not suppressed may grow rapidly and uncontrollably, endangering public safety. SDG&E's Aviation Firefighting Program mitigates this risk by serving as a wildfire suppression resource. If fire agencies divert aerial resources to fight wildfires outside of SDG&E's service territory, this program allows aerial firefighting resources to remain available in the region.

SDG&E has two firefighting helicopters available. SDG&E leases an Erickson S-64 helitanker (Air Crane) and a Sikorsky UH-60 Blackhawk helitanker (Blackhawk). Both firefighting assets are Type 1 firefighting helicopters, which are defined as carrying over 700 gallons of water to fight fires. The Air Crane has the capability of dropping up to 2,650 gallons of water, and the Blackhawk has the capability of dropping up to 850 gallons of water. Additionally, the Blackhawk is configured for night vision device flight and is capable of night firefighting with the appropriate crew and training.

SDG&E based its decision for these two resources on two missions. First, both resources provide very good fire suppression capability to SDG&E's service territory. They have both been successfully utilized in many instances, preventing fires from burning out of control in San Diego County. Second, SDG&E performs capital work in the more rural areas with accessibility issues. In areas of difficult access, aerial resources are a necessary construction tool to be able to set structures. Both assets currently under lease fit the requirements for SDG&E.

SDG&E's Aviation Firefighting Program provides risk reduction not only to fires associated with SDG&E equipment but also to the entire community for all causes of wildfire. However, the risk reduction discussed in this Chapter, and the RSE for the program, only focuses on Wildfire risk associated with the utility. Similar to other risk-reducing programs, quantifying aviation risk reduction is complex. The goal is to understand how the Aviation Firefighting program reduces wildfire likelihoods and consequences.

From a likelihood standpoint, the Aviation Firefighting Program is not focused on preventing CPUC reportable ignitions. As defined by D.14-02-015, a reportable ignition is one that starts at utility equipment and travels a meter in vegetation. The helicopters are not

dispatched to an ignition site before the fire spreads one meter. As such, the ignition count will not be decreased.

The Aviation Firefighting Program focuses on reducing the consequences of wildfires through suppression of fire spread and protection of assets. Thus, the risk reduction can be found in the CoRE portion of the risk score assessment.

The risk assessment asks the question of "how much less impact do wildfires have with its Aviation Firefighting Program versus without one." This is a complex question to solve. Each fire is different, and there is no known general rule to apply to SDG&E's specific program. Fire behavior modeling is not accurate enough to compare what would have happened without suppression activities. There is, however, anecdotal evidence that recent non-utility wildfires benefitted from aviation resources. Strong evidence of the benefit is reflected in the regularity that local fire agencies use the resource.

What follows is a brief discussion on how the Aviation Firefighting Program is effective against wildfires in different types of weather. It is known that on low wind days, aviation resources are excellent tools to prevent prolonged spread; and SDG&E's aviation resources are regularly dispatched in these situations. The effectiveness of aviation resources to assist general fire suppression activities is significant in these situations. However, most wildfire risk that exists to the community is not due to these types of calmer low wind weather days. On the other end of the weather perspective, *i.e.*, high wind weather conditions, the benefit of aviation resources is likely to have more constraints. On extremely windy days, wildfires can grow in size even in the first 10 minutes, and although aerial firefighting resources can arrive very quickly, the spread can become too great to overcome. Additionally, on extremely windy days, there are situations and locations when helicopters are not safe to operate. Generally, helicopters that drop water need to be relatively close to their target, and the stronger the wind, the more dangerous it becomes to fly close to the ground. Importantly, strong winds can help dissipate the water from the aircraft and lead to ineffective water drops.

SDG&E will continue to analyze the most effective way to run its Aviation Firefighting Program, and to determine the effectiveness of that program, using internal and external data to assist in the analysis. For the time being, subject matter experts believe that the program reduces overall wildfire consequence, and therefore wildfire risk, by approximately 4% based solely on the knowledge of the equipment and operations, coupled with anecdotal evidence of recent

history. Notably, this 4% is only the measure of utility-associated wildfires and the overall benefit of the program is much larger than what that 4% represents.

SDG&E has agreements with the County of San Diego, CAL FIRE, and the Orange County Fire Authority for aerial firefighting within SDG&E's service territory. Dispatch of SDG&E's aviation firefighting assets is performed through CAL FIRE and these assets support their initial attack strategy to contain wildfires to less than 10 acres. SDG&E employs flight operations staff to assist in dispatching SDG&E aerial assets 365 days per year. This allows the assets to be launched rapidly once dispatched by CAL FIRE.

When wildfires occur outside of SDG&E's service territory, CAL FIRE may divert aerial firefighting resources to those emerging wildfires, which reduces the aerial firefighting capability in the San Diego region. Accordingly, SDG&E has developed and implemented an effective, year-round aerial firefighting program to support the fire agencies in its service territory.

SDG&E is pursuing a partnership with CAL FIRE for night firefighting. While the demands of this mission and requirements are determined by CAL FIRE, SDG&E has started night currency and proficiency flights for pilots to gain confidence and familiarity with night operations. SDG&E is also increasing the hangar space for maintenance and security of these aerial firefighting assets. Expanding the current hangar space will allow robust maintenance of the helicopters to be performed indoors, as well as provide secure indoor storage for when the helicopters are not in use.

SDG&E will maintain its leases for the Air Crane and the Blackhawk. In 2021, SDG&E will take ownership of a Sikorsky S-70M (Firehawk), which will serve as one of SDG&E's lead aerial firefighting resources once it is outfitted with firefighting capability. Once the Firehawk is in service, which is expected to be in 2022, the Blackhawk will be available as a backup if needed. Operations with the Firehawk will be more capable and safer for firefighting than the current Blackhawk due to the platform's advanced safety systems and enhanced performance characteristics. The Firehawk will be maintained and operated by Helistream. Over the next three to ten years, SDG&E will continue to assess the effectiveness of its Aviation Firefighting Program and will work with CAL FIRE on any changes for improved firefighting effectiveness.

2. C36: Wildfire Infrastructure Protection Teams

- **C36-T1: Tier 3; C36-T2: Tier 2**

Contract Fire Resources are utilized to mitigate the fire risks associated with at-risk work activities performed in areas that are adjacent to wildland fuels. The primary objective is preventing ignitions from utility activities. In addition, the Contract Fire Resources are trained and equipped to notify the agency having jurisdiction of an ignition and are able to safely mitigate the impact of an ignition through suppressive action until first responders arrive.

SDG&E's service territory has a large percentage of its infrastructure in the HFTD. While all SDG&E field personnel attend annual fire prevention training, the use of Contract Fire Resources during times of increased fire risk (*e.g.*, during Extreme or Red Flag Warning FPI days) enables SDG&E to perform necessary activities while reducing the risk of an ignition or of a fire growing into a fire of consequence.

In 2020, SDG&E utilized these Contract Fire Resources to prevent fires and reduce the consequence of ignitions associated with utility activities during Extreme or higher FPI days. SDG&E will continue to use them in the future. The utilization of Contract Fire Resources may increase/decrease with the severity of the fire conditions in the region. Factors such as fuel moisture, weather, work activities, and fire activities in the region all play a role in determining the need for these prevention resources. This program is regularly refined with the training qualifications of personnel serving on Contract Fire Resources and utility activities are being reviewed annually.

3. C37: PSPS Events and Mitigation of PSPS Impacts

- **C37-T1: Tier 3; C37-T2: Tier 2**

SDG&E has a statutory obligation to operate its system safely, and as part of that obligation, SDG&E may de-energize circuits (*i.e.*, turn off power) when necessary to protect public safety (Public Safety Power Shutoff or PSPS). Any decision to de-energize circuits for public safety is made in consultation with SDG&E's Emergency Operations Center (EOC), Meteorology, and SDG&E leadership. Typically, it is expected, but not required, that the FPI would be "extreme" or that there would be a Red Flag Warning in effect when a PSPS decision is made.

A PSPS is a last resort measure to reduce wildfire risk. SDG&E leverages a multitude of situational awareness data and input from its subject matter experts when considering the need

for a PSPS event. In determining whether to employ a PSPS in any area of its service territory, SDG&E considers a variety of factors such as:

- Weather conditions
- Vegetation conditions
- Field observations
- Information from first responders
- Flying debris
- Meteorology
- Expected duration of conditions
- Location of any existing fires
- Wildfire activity in other parts of the state affecting resource availability.

Utility operating experience is required to analyze all the various inputs and decide how to manage risk to the communities affected.

If SDG&E determines it is necessary to employ a PSPS for portions of its system, re-energization will take place after the SDG&E weather network shows that wind speeds have decreased and SDG&E weather forecasts indicate that winds will not re-accelerate at or above dangerous levels. All lines that have been de-energized are inspected for damage before re-energization may occur. Once a line is patrolled and any needed repairs are made, the area will be patrolled again and then re-energized.

G. Data Governance

In 2020, SDG&E began centralizing its measures and metrics put forth in Wildfire Mitigation Plans in a central repository to gain insights and assess progress on programs and initiatives.

During the establishment of the centralized measures and metrics reporting process, SDG&E inventoried required data metrics and identified data owners and data sources. Through subsequent interviews of data owners, SDG&E determined that each specific data metric would need to be clearly defined and a repeatable and verifiable process established to accumulate and track the data to ensure its integrity and auditability.

Initially, SDG&E almost exclusively collected data metrics and measures manually. In addition, data definitions were inconsistent, some data was untimely, and preliminary and final data metrics could vary. To enhance data quality and improve the efficiency of the data

gathering process, SDG&E began developing a WMP Data Governance Framework (DGF) and an automated Central Data Repository (CDR) for wildfire-related data, which can be used by multiple internal and external stakeholders in the future. These changes will improve data collection by moving away from manual collection to a more uniform, electronic format that will provide data metrics in a searchable format, similar to a GIS data structure.

The DGF will define a set of repeatable standards, policies, processes and controls for wildfire- related data. Similar to the Wildfire Safety Division's GIS Data Standards, the vision of SDG&E's DGF is to make its wildfire-related data actionable, accessible, aligned, and auditable.

1. C38: Centralized Repository for Data

Development of an Enterprise Asset Management Platform (EAMP) will build a central data repository to house all required metrics specific to SDG&E's wildfire mitigation efforts and establish an asset data foundation integrating key asset-related attributes to enable predictive asset health analyses and risk modeling and improve inspection/assessment strategies and prioritization. Integrating this asset risk information with other inputs, such as Circuit Risk Index for situational awareness, will inform the appropriate asset-related operational decision-making and strategy for enhanced reliability and safe operation of assets. SDG&E believes this will provide a means to optimize the risk, performance, and investments while meeting or exceeding safety and regulatory objectives.

SDG&E envisions that the CDR will eventually provide a "single source of truth" for SDG&E's wildfire-related data for use by multiple internal and external stakeholders in the future. This program will work to pull data from over ten business units and data sources into the CDR. This data will be leveraged to automate the population of the required metrics in the schema required by the WSD. The costs included are primarily related to services required to connect up to a dozen different company systems into the CDR. The data, including both spatial and non-spatial data, will need to be placed into the data schema required by the WSD to meet the standardized reporting requirements given to all electric utilities. This includes licenses and hardware to support the increased capacity required to house the additional data and automation of the data gathering. This will allow for consistent, accurate reporting of all required WMP data.

In 2021 and beyond, the EAMP program will continue to integrate disparate asset data across SDG&E's Electric Distribution, Transmission, and Substation into the centralized repository. Further asset health indexes, asset risk calculations, and advanced analytics will be developed as well. Assets to be integrated as part of EAMP will be prioritized through analysis of ignition and reliability data. SDG&E has completed approximately 25% of the effort needed to implement the DGF and CDR and anticipates the completion of data related to the all the metrics tables contained in the WMP by the end of 2021. SDG&E expects that the development of the centralized repository along with the supporting documentation will continue through 2024**.**

H. Resource Allocation Methodology

SDG&E's enterprise risk management process, discussed in Chapter RAMP-B, includes a focus on risk-informed investment decision-making. The programs provided in this Section are tools to help prioritize Wildfire-related investments.

1. C39: Asset Management

Asset Management provides a consistent framework that is based on risk to evaluate various projects and allocate resources to different areas. SDG&E's Asset Management organization, under the Investment Prioritization workstream, has been working on building the governance process, resource allocation methodology and enabling tool to support the creation of long-term and short-term plans for capital investment, operation & maintenance and asset retirement. Asset Management is discussed in more detail in RAMP Chapter CFF-1.

While the Asset Management initiative focuses on enterprise-wide resource allocation, there was a need to develop a more granular application of the same type of modeling to tackle specific wildfire-related issues such as targeted grid hardening to reduce PSPS. To do that, SDG&E's wildfire mitigation team developed the WiNGS model to specifically tackle the issue of quantifying the impacts of PSPS and identifying more optimal solutions to target both wildfire risk reduction as well as PSPS reduction. The WiNGS model, further described above, was developed internally with the support of third-party consultants to validate the methodology and provide external proxies to improve data used in the model.

2. C40: Wildfire Mitigation Personnel

In July 2019, SDG&E established the Wildfire Mitigation and Vegetation Management department with existing management personnel already deeply familiar with SDG&E's wildfire

mitigation portfolio. This new department is overseen by the Director of the Wildfire Mitigation and Vegetation Management and contains four groups to address aspects of the overall wildfire mitigation effort:

- The Wildfire Mitigation Programs group is involved with the various regulatory proceedings that address wildfire and de-energization as well as legislative and media inquiries.
- The Vegetation Management group manages the current tree and vegetation management inspection and trim program and will begin to address SDG&E's newly formed fuels management program.
- The Wildfire Mitigation Plan Strategic group develops metrics, leads vision projects, promotes new ways to enhance fire safety, and explores advancements to further drive improvement and change including risk modeling capabilities.
- The Wildfire Mitigation Plan Accountability group is responsible for monitoring fire-related metrics, tracking WMP activities, complying with reporting requirements, provide for governance specifications and procedures, and act in a lead capacity on audits of the WMP programs.

The department structure is integrated across the entire SDG&E organization as well as through its reporting hierarchy. With regular monthly meetings of each group, this structure allows for wide collaboration and information gathering, as well as the ability to inform, plan, act, and improve within a compressed timeline, when needed. This structure also allows any operational or strategic changes to be communicated and captured within SDG&E's approach to wildfire mitigation and response.

The Wildfire Mitigation and Vegetation Management department will continue to play a critical role in monitoring and reporting on the Company's overall wildfire mitigation efforts and continuing to advance and mature SDG&E's wildfire mitigation capabilities.

I. Emergency Planning and Preparedness

As discussed in RAMP Chapter CFF-3, the mission of the SDG&E Emergency Management department is to coordinate safe and effective emergency preparedness for the Company, SDG&E's customers, and emergency response personnel. That mission extends to safely and efficiently preparing for, responding to, and recovering from all threats and hazards

through strategic planning, training and exercising, and a sustained Quality Assurance and Improvement process.

1. C41: Emergency Management Operations

SDG&E manages emergencies in alignment with the state Standardized Emergency Management System (SEMS) and federal National Incident Management System (NIMS), to coordinate across all levels of utility, government, and agency activity. The Company utilizes a utility-compatible Incident Command System (ICS) structure as an all-hazards framework to manage emergency incidents and events. ICS is the combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure and serves as the mechanism to direct those functions during an emergency response.

The SDG&E Emergency Management department is responsible for coordinating emergency management activities and activation of the EOC. SDG&E's EOC serves as the location from which centralized emergency management is coordinated. To respond and recover effectively from all hazards and threats, like wildfires, SDG&E established an EOC with cross-functional teams representing every major business line within the Company and functioning within a utility-compatible ICS.

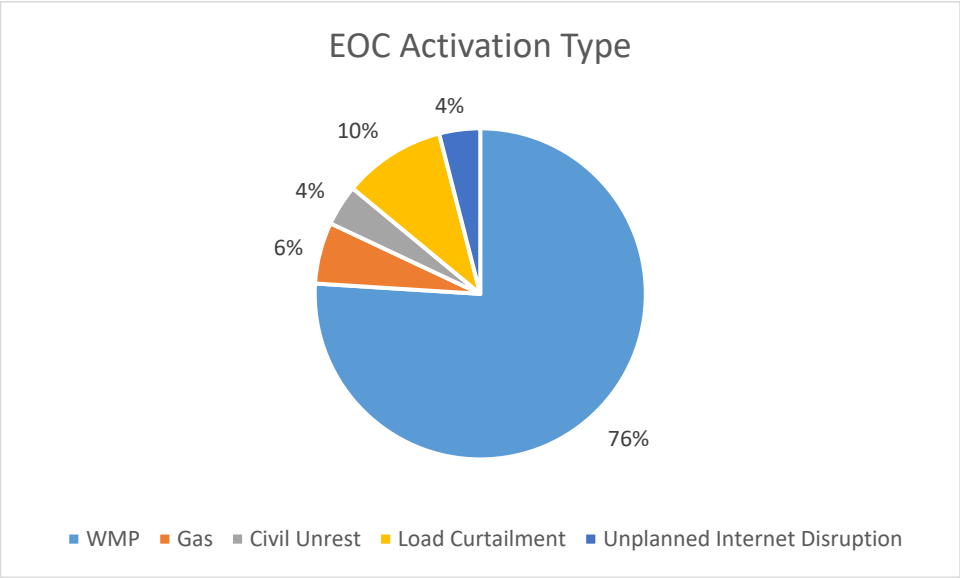
SDG&E's EOC was activated numerous times in 2020. The following table summarizes SDG&E's 2020 EOC activations with numbers of days activated.

Table 8: Summary of 2020 EOC Activations

Event / Incident Name	# of Days Activated	Start Date
COVID-19 Pandemic	299	March 7, 2020
Civil Unrest	2	May 30, 2020
Orange Ave Gas Incident	3	July 16, 2020
Electric Load Curtailment	5	August 14, 2020
Extreme Weather (Load Curtailment, Valley Fire, PSPS)	6	September 3, 2020
PSPS	5	September 25, 2020
PSPS	6	October 23, 2020
Unplanned Internet Disruption	2	November 16, 2020
PSPS	16	November 24, 2020
PSPS, Creek Fire	5	December 20, 2020
2020 Total	**353**	

Not including the activation for the COVID-19 pandemic, 76% of SDG&E's EOC activations were Wildfire related (as shown in the figure below).

Figure 2: 2020 EOC Activation Types



While additional details regarding SDG&E's Emergency Preparedness and Response activities are provided in RAMP Chapter CFF-3, the costs for such activities are included in this RAMP chapter, consistent with WMP presentations, and are duplicated in CFF-3. SDG&E took this approach because many of these emergency preparedness and response activities were initiated and developed to respond to wildfire and PSPS events. Furthermore: (1) the majority of EOC activations are typically wildfire or PSPS related, (2) SDG&E's Aviation Services program (another Wildfire mitigation) is part of the Emergency Management organization, and (3) other wildfire supportive departments (*e.g.*, FS&CA) are physically located in the EOC.

J. Stakeholder Cooperation and Community Engagement

Engagement and cooperation among all wildfire stakeholders are extremely important to SDG&E, as it endeavors to fulfill its commitment to mitigating the risk of wildfires and adverse impacts of PSPS events. SDG&E remains dedicated to partnering with utility customers, elected officials, nonprofit support organizations, first responders and all other public safety and community partners, understanding they all play a unique and important role in achieving wildfire prevention and mitigation in SDG&E's service territory. SDG&E provides an essential service, and it takes its role within the communities it serves very seriously. This is especially true during times of PSPS events, when communities – neighborhoods in which SDG&E's

employees, families and friends live – depend on complete, accurate, and timely information for their well-being.

SDG&E will continue to strive to provide all stakeholders with awareness and information, doing everything in its power to educate the public on wildfire preparedness, including PSPS events. It is SDG&E's goal to equip those it serves with information and resources to navigate the adversity of an emergency, wildfire or PSPS event. Through thoughtful education campaigns and strategic partnerships, SDG&E has implemented a robust, external communication strategy, which is continuously analyzed to identify areas of improvement. SDG&E also leverages its broadened and increased relationships with community-based organizations (CBOs) and stakeholders to amplify and disseminate critical, sometimes life-saving information. These year-round efforts and partnerships are further explained below.

SDG&E remains committed to fostering productive collaboration and engaging the communities it serves. Endeavoring to collaboratively identify fresh ways to better serve our communities will remain a top priority in 2021 and beyond. As outlined below, SDG&E will continue to leverage its partner network, agency relationships and strive for clear, concise education and messaging.

1. C42: Communication Practices

The nearly year-round threat of wildfire risk in California and changing conditions illustrates the need for SDG&E to continually educate customers and the general public about wildfire safety, resiliency and emergency preparedness. Thus, a comprehensive wildfire safety communications and outreach plan has been developed with the intent of increasing community resiliency to wildfires and PSPS impacts.

The importance of providing accurate, timely information to increase public awareness cannot be understated. By educating communities before an emergency, wildfire, or PSPS event occurs, customers can take the necessary steps to prepare for and navigate the inherent difficulties these events bring. Additionally, SDG&E leverages channels outside of its internal outreach campaigns, in the form of partnerships and external events. These provide additional avenues for SDG&E to interact with the public. Providing myriad outreach and engagement channels increases public touchpoints and leads to increased awareness.

SDG&E has a team of outreach advisors that work with community organizations to provide education, programs and services beneficial to customers, with a key focus on wildfire

preparedness, PSPS notifications and support services. A key channel and support network utilized by outreach advisors to promote wildfire preparedness information, PSPS notifications, and available support services during PSPS events is SDG&E's Energy Solutions Partner network. This network is comprised of nearly 200 CBOs who serve a critical role in connecting SDG&E with their constituencies. Through this Partner Network, SDG&E is able to reach diverse, multicultural, multilingual, senior, special needs, disadvantaged and AFN communities. In many cases they are considered trusted partners and experts by the communities they serve, and are able to provide valuable feedback to SDG&E on the needs of their constituents, as well as amplify SDG&E's wildfire preparedness and notification messaging to hard-to-reach customers.

As part of its ongoing efforts to support wildfire mitigation and community fire safety, the SDG&E Wildfire Safety Community Advisory Council (WSCAC) is a forum allowing community leaders to provide direct and constructive input, feedback, recommendations, and support to SDG&E senior management and the Safety Committee of SDG&E's Board of Directors. SDG&E takes the information discussed during these meetings very seriously, as the council members provide useful insight into how SDG&E can continue to help protect the region from wildfires.

Wildfire Safety Fairs will also continue to serve the communities with information, education, resiliency and opportunities to help before, during and after a PSPS activation and/or any other emergency situation. The Company will also review and assess the prevalent languages identified. The expanded CBO collaboration will help with this effort.

SDG&E plans to continue strategically enhancing collaboration with community partners, including Fire Safe Councils, local Fire Departments, CERT, local town organizations and other CBOs to educate on PSPS, emergency response and programs available to all communities.

Additionally, SDG&E will continue to partner with CBOs, and will be focusing on building new partnerships with organizations that represent the needs of customers with AFN in the future.

In addition to and in coordination with its wildfire safety communications discussed above, SDG&E conducts PSPS-specific communications in three phases: prior to, during, and following a PSPS event. Efforts before a PSPS focus on educating customers and the public about what a PSPS is and tactics they can employ to remain safe, resilient, and updated during a

PSPS occurrence. In 2020, SDG&E expanded its public education and outreach efforts associated with its PSPS Communications Plan. In light of COVID-19 considerations, special emphasis was placed on reaching and educating customers and the public in new and novel manners. For example, in September 2020, the Company launched its novel PSPS Mobile App (Alerts by SDG&E). This new tool enables customers to receive information including, but not limited to, notifications, Community Resource Center information with GPS directions, and other real-time updates and safety information related to PSPS activities. During a PSPS, the company focuses on providing real-time awareness and updates about the event and how to remain safe. For instance, SDG&E assigns a dedicated 2-1-1 organization liaison who is responsible for conveying real-time updates and talking points. The Company will also employ standard communication channels to promote 2-1-1 service resources including, but not limited to social media channels, broadcast and print media, and the SDG&E NewsCenter and website. Lastly, following a PSPS, the Company examines communications and solicits customer feedback with the intent of refining and improving communication efforts for the following year. Specifically, SDG&E reaches out to customers, through formal surveys, to establish a baseline awareness of PSPS-related messaging and communications at the beginning of wildfire season. At the end of wildfire season, customers will again be surveyed to measure the effectiveness of public education efforts and communications.

SDG&E assigns a dedicated 2-1-1 organization liaison who is responsible for conveying real-time updates and talking points. SDG&E will be investing in improvements that enhance both the wildfire safety and PSPS communications. The public education campaign will start sooner in the year and will work to expand the reach of communications within the service territory. Also, the formal CBO contract established in 2020 will continue, and the lessons learned during the 2020 wildfire season will be applied to future campaigns. The Company will also review and assess the prevalent languages identified. The expanded CBO collaboration will help with this effort. Additionally, the Company is considering and evaluating additional efforts including, but not limited to, working with local school districts to enhance public education efforts. Considerations include school newsletters, communications to parents as well as leveraging established school communication platforms (emails, text messages, and collateral materials). SDG&E is also examining new opportunities within its established partnerships with local Tribal Councils and other resources that serve Native American communities. Along with

the expanded communication efforts, SDG&E is working to develop new communications in a culturally appropriate and relevant manner.

2. C43: Non-Conductive Balloon Alternatives

Metallic foil balloons continue to disrupt the reliability of the electric grid and are a source of reportable ignitions. In 2020, SDG&E attributed two CPUC reportable ignitions to balloons, and according to SDG&E's 2020 Wildfire Mitigation Plan (Table 11a), SDG&E reported an average of 3.6 ignitions per year caused by balloons from 2015 to 2019.

As a potential solution, SDG&E is pursuing the development of a non-conductive balloon with a major manufacturer in the balloon industry. SDG&E brings expertise in electrical engineering and the distribution power grid, and the balloon manufacturer brings expertise in manufacturing processes and retail commercialization. Both companies are working collaboratively to develop a prototype non-conductive balloon, which will not cause an electrical fault when it comes in contact with overhead distribution power lines. Both companies are also involved in drafting an industry standard to test balloons in distribution power lines to identify whether a balloon will cause a fault to overhead distribution power lines. Such a test standard might be adopted by local authorities to limit the sale of balloons that do not pass the test.

The non-conductive balloons are being tested according to distribution power voltages, rather than geographic areas. The balloons so far have passed tests at 12 kV and 21 kV, in conditions that represent the highest distribution voltages in SDG&E's territory and PG&E's territory. Currently, tests are underway to test higher distribution voltages in use within SCE's territory and some municipal electric utilities in the State.

The next high-voltage tests will address 33 kV to model distribution voltages used across other Californian electric utilities. The work will also clarify what standard test conditions should apply to an industry-wide standard test.

The test standard is being developed within the Institute of Electrical and Electronic Engineers (IEEE, ieee.org). The trial-use standard is in the drafting stage, and is being developed by a task force within the Distribution Reliability Working Group of IEEE. The task force is made up of representatives from electric utilities across the U.S., a high voltage test lab, a balloon manufacturer, and other consultants and experts. The draft standard is titled "Trial Use Standard for Testing and Evaluating the Dielectric Performance of Celebratory Balloons in Contact with Overhead Power Distribution Lines Rated up to 38 kV System Voltage." The goal

is to have a standard test that could be performed by any high-voltage lab to determine if a celebratory foil balloon will cause a fault in overhead distribution lines or not. According to the IEEE process for developing draft standards, the expected date of submitting the draft for initial sponsor ballot is December 2022.

If the prototypes continue to have success in the high voltage tests, the balloon manufacturer may seek improvements to lower the production costs and apply the technology to complex balloon designs. SDG&E does not anticipate it will fund any of those product improvements but may participate in ensuring the industry-standard test applies to any new product developments.

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.[26] As described in Section II above, SDG&E tranched a majority of the activities by Tiers 3 and 2 of the HFTD given that each Tier has a different risk profile. Accordingly, the costs, units and RSEs are provided for each program by Tiers 3 and 2 of the HFTD.

All of the activities discussed in Section III above, with the exception of C19: Cleveland National Forest Fire Hardening, are expected to continue during the 2022 through 2024 time period. SDG&E's control and mitigation plan herein differs from SDG&E's 2021 WMP because the years covered in each filing are different. For clarity, a current activity that is included in the control and mitigation plan may be referred to as either a control and/or a mitigation. For purposes of this RAMP, a control that will continue as a Mitigation will retains its control ID unless that the size and/or scope of that activity will be modified, in which case that activity's control ID will be replaced with a mitigation ID. The table below shows which activities are expected to continue.

[26] *See* D.18-12-014, Attachment A at A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Table 9: Control and Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	WRRM-Ops	X	X
2	C2	Advanced Weather Station Integration	X	X
3	C3	Wireless Fault Indicators	X	X
4	C4	Fire Science and Climate Adaptation Department	X	X
5	C5	High Performance Computing Infrastructure	X	X
6	C6 / M1	SCADA Capacitors	X	X
7	C7 / M2	Overhead Distribution Fire Hardening – Covered Conductor	X	X
8	C8 / M3	Expulsion Fuse Replacement	X	X
9	C9 / M4	PSPS Sectionalizing	X	X
10	C10 / M5	Microgrids	X	X
11	C11 / M6	Advanced Protection	X	X
12	C12 / M7	Hotline Clamps	X	X
13	C13 / M8	Resiliency Grant Programs	X	X
14	C14 / M9	Standby Power Programs	X	X
15	C15 / M10	Resiliency Assistance Programs	X	X
16	C16 / M11	Strategic Undergrounding	X	X
17	C17 / M12	Overhead Distribution Fire Hardening – Bare Conductor	X	X
18	C18 / M13	Overhead Transmission Fire Hardening – Distribution Underbuilt	X	X
19	C19	Cleveland National Forest Fire Hardening	X	-
20	C20	LTE Communication Network	X	X
21	C21 / M14	Lightning Arrestor Removal/Replacement Program	X	X
22	C22	Distribution System Inspection – CMP – 5 Year Detailed Inspections	X	X
23	C23	Transmission System Inspection	X	X

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
24	C24	Distribution System Inspection – IR/Corona	X	X
25	C25	Distribution System Inspection – CMP – 10 Year Intrusive	X	X
26	C26	LiDAR Flights	X	X
27	C27	Distribution System Inspection – HFTD Tier 3 Inspections	X	X
28	C28	Distribution System Inspection – Drone Inspections	X	X
29	C29	Distribution System Inspection – Circuit Ownership	X	X
30	C30	Distribution System Inspection – CMP – Annual Patrol	X	X
31	C31	Tree Trimming	X	X
32	C32 / M15	Fuels Management Program	X	X
33	C33 / M16	Enhanced Vegetation Management	X	X
34	C34	Pole Brushing	X	X
35	C35	Aviation Firefighting Program	X	X
36	C36	Wildfire Infrastructure Protection Teams	X	X
37	C37	PSPS Events and Mitigation of PSPS Impacts	X	X
38	C38	Centralized Repository for Data	X	X
39	C39	Asset Management	X	X
40	C40	Wildfire Mitigation Personnel	X	X
41	C41	Emergency Management Operations	X	X
42	C42	Communication Practices	X	X
43	C43	Non-Conductive Balloon Alternatives	X	X

As shown in Table 9 above, almost all of the Wildfire mitigation activities are expected to continue, and no completely new programs are included in SDG&E's control and mitigation

plan. For activities that SDG&E plans to perform that remain unchanged, please refer to the description in Section III. If changes to the various activities are anticipated, such modifications are further described in this section below. Some of the programs in Table 9 above, such as C8: Expulsion Fuse Replacement, include a Mitigation ID that are not addressed in Section IV.A below. SDG&E considers these mitigations to be fundamentally unchanged but addresses assets in additional portions of the service territory in the future years. These differ from programs such as inspections where SDG&E is visiting the same assets on a given cycle.

A. Changes to 2020 Controls

The following describes planned changes to the existing activities discussed above in Section III. Given the objectives to minimize the Wildfire risk (wildfire and PSPS impacts), SDG&E's control and mitigation plan differs from the activities performed in 2020 by significantly increasing grid hardening investments in both Covered Conductor and Strategic Undergrounding and decreasing the traditional, bare conductor programs including FiRM, PRiME, and WiSE. These substantial grid hardening changes as well as other changes from the 2020 controls are described below.

1. C1: WRRM-Ops

SDG&E's Wildfire Risk Reduction Modeling Program will see improvements and cost increases through 2024. SDG&E's continued investment will enable the development of new fire science technologies and will increase the effectiveness of existing tools such as the Fire Potential Index. SDG&E has partnered with the San Diego Super Computing Center to re-evaluate the inputs into the FPI by incorporating higher fidelity data sets and examining the influence of additional data to obtain a more representative fire potential prediction. Modernizing existing tools is critical to daily operations to greatly enhance efficiencies and increase reliability by reducing the number of required patrols following outages. In addition, WRRM-Ops will be further enhanced the development of the physical Fire Science and Innovation lab pending a return to the Emergency Operations Center.

2. Grid Hardening Changes

SDG&E's WiNGS tool, used for risk-based prioritization, now takes into account both Wildfire risk reduction and PSPS impact reduction when analyzing projects. Prior to the development of this tool, only the risk reduction related to wildfire was considered, so the programs of Covered Conductor and Strategic Undergrounding, which are costly and have

limited wildfire risk reduction, had lower RSEs than the traditional hardening. With the inclusion of PSPS impact reductions factored into the RSE, the RSEs for these programs can now compete with traditional hardening due to the additional benefits they bring with respect to PSPS impacts.

a. C7 / M2: Overhead Distribution Fire Hardening – Covered Conductor

- **M2-T1: Tier 3; M2-T2: Tier 2**

SDG&E now has the personnel and standards in place to ramp up these programs significantly over the next several years while phasing out traditional hardening. SDG&E completed 1.9 miles of covered conductor in 2020 and plans to increase that amount to 20 miles in 2021, 60 miles in 2022, and 100 miles in 2023 and 2024. The associated costs increase from approximately $1.7 million in 2020 to $160 million per year in 2023 and 2024.

b. C16 / M11: Strategic Undergrounding

- **M11-T1: Tier 3; M11-T2: Tier 2**

SDG&E completed 16 miles of strategic undergrounding in 2020 and plans to increase that amount to 25 miles in 2021, 80 miles in 2022, 125 miles in 2023, and 150 miles in 2024. The associated costs increase from approximately $39 million in 2020 to $420 million in 2024.

c. C17 / M12: Overhead Distribution Fire Hardening – Bare Conductor

- **M12-T1: Tier 3; M12-T2: Tier 2; M12-T3: Non-HFTD**

SDG&E completed 100 miles of bare conductor hardening in 2020 at a cost of approximately $140 million. SDG&E plans for another 100 miles of bare conductor hardening in 2021, but only 5 miles in 2022 at a cost of approximately $5 million and no future work in 2023 or 2024.

3. C22: Distribution System Inspection – CMP – 5 Year Detailed Inspections

- **C22-T1: Tier 3; C22-T2: Tier 2**

SDG&E's CMP detailed inspections are expected to increase O&M costs in 2021 and 2022 as the program adds a crossarm remediation component in these years. The crossarm remediation initiative will investigate and remediate crossarms that do not meet the required loading criteria. This initiative involves fielding and performing pole loading calculations for each location to verify that the crossarm needs to be remediated. This program will add

approximately two million dollars per year in order to investigate roughly 4,000 crossarms. Current estimates show that the failure rate is expected to be ten percent. SDG&E will first target high-risk crossarms in Tier 3, then proceed to medium-risk crossarms in Tier 3 and high-risk crossarms in Tier 2. All remediations are expected to be completed in 2024.

4. C28: Distribution System Inspection – Drone Inspections

- **C28-T1: Tier 3; C28-T2: Tier 2**

The Drone Inspection program will begin to ramp down and level out its inspections and costs after 2022. The Drone Inspection program started with the goal of inspecting every structure within the HFTD in a three-year period. This program was successful in identifying items that were not able to be discovered with traditional ground inspections. This led to extra work in order to remedy the items found during the inspections. Once the initial inspections and repairs have been completed in 2022, the program will transition to a five-year inspection cycle. SDG&E expects that during this future five-year cycle, fewer concerns requiring follow-up construction will be identified, stabilizing the future costs.

5. C35: Aviation Firefighting Program

- **C35-T1: Tier 3; C35-T2: Tier 2; C35-T3: Non-HFTD**

SDG&E's Aviation Firefighting Program sees increases in costs during the period of 2022-2024. These increases are related to the ownership of a new Sikorsky S-70M (Firehawk). The Firehawk will serve as one of SDG&E's lead aerial firefighting resources once it is outfitted with firefighting capability. The Firehawk is expected to be ready for service in 2022, leaving the Blackhawk available as a backup if needed. Operations with the Firehawk will be more capable and safer for firefighting compared to the current Blackhawk due to the platform's advanced safety systems and enhanced performance characteristics.

6. C38: Centralized Repository for Data

Data Governance will involve a substantial increase to address the Centralized Data Repository and automation of new reporting required by the WSD. These costs are primarily related to the services required to automate the data gathering across up to a dozen different company systems into the CDR and develop further automation to calculate required metrics and report on these items in the schema required by the WSD. This also includes licenses and hardware to support the increased capacity required to house the additional data and automation

of the data gathering. This will allow for consistent, accurate reporting of all required WMP data.

7. C40: Wildfire Mitigation Personnel

SDG&E's Wildfire Mitigation department is hiring four new FTEs in Data Analyst roles to assist with the expanded data requirements from the Wildfire Safety Division (WSD). Additional reporting around the Quarterly Initiative Updates and Quarterly Data Reports has driven the need for these additional FTEs. The WSD also began compliance inspections related to SDG&E's WMP Programs in 2020 that necessitate additional reporting. This led to the creation of a dashboard that allows the WSD to view and download information on the various WMP Programs required to perform inspections. The additional costs in this group are also attributed to IT projects to modify and improve existing tools to support streamlined data gathering to support several new reporting requirements.

V. COSTS, UNITS, AND QUANTITATIVE SUMMARY TABLES

SDG&E's risk control and mitigation plan takes into account recent data and trends related to Wildfire, affordability impacts, possible labor constraints and the feasibility of mitigations. SDG&E has performed RSEs, in compliance with the Settlement Decision, but ultimate mitigation selection can be influenced by other factors, including funding, labor resources, technology, planning, compliance requirements, and operational and execution considerations.

The following tables in this section provide a summary of the risk control and mitigation plan, including the associated costs, units, and the RSEs, by tranche. When an RSE could not be performed, an explanation is provided.

SDG&E does not account for and track costs by activity or tranche; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by SMEs and available accounting data. Certain programs, as shown in Table 10 below, include both O&M and capital cost components. In those instances, SDG&E provided units for the programs in its control and mitigation plan in either the O&M or capital columns in Table 11 consistent with the program's primary activity. For example, as illustrated in Table 10, Strategic Undergrounding (C16/M11) is largely a capital program that also has an O&M component. The associated units are, therefore, shown in Table 11 in the capital column.

Table 10: Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[27]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[28]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	WRRM - Ops	$1,385	-	$6,456	$7,890	-	-
C2	Advanced Weather Station Integration	$1,032	-	$1,625	$1,986	-	-
C3-T1	Wireless Fault Indicators (HFTD Tier 3)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C3-T2	Wireless Fault Indicators (HFTD Tier 2)	$838	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C3-T3	Wireless Fault Indicators (Non-HFTD)	-	-	$590	$722	-	-
C4	Fire Science and Climate Adaptation Department	$424	$3,363	$272	$333	$3,700	$4,523
C5	High Performance Computing Infrastructure	-	-	$6,579	$8,041	-	-
C6/M1-T1	SCADA Capacitors (HFTD Tier 3)	$406	-	$0	$0	-	-
C6/M1-T2	SCADA Capacitors (HFTD Tier 2)	$625	-	$1,612	$1,970	-	-
C7/M2-T1	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 3)	$1,101	-	$298,691	$365,066	$2,962	$3,620
C7/M2-T2	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 2)	$593	-	$65,566	$80,137	$650	$795
C8/M3-T1	Expulsion Fuse Replacement (HFTD Tier 3)	$2,081	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			

[27] Recorded costs and forecast ranges are rounded. Additional cost-related information is provided in workpapers. Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar amounts and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

[28] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2020 "baseline" capital costs associated with Controls. The 2020 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[28]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C8/M3-T2	Expulsion Fuse Replacement (HFTD Tier 2)	$4,210	-	$2,771	$3,387	-	-
C9/M4-T1	PSPS Sectionalizing (HFTD Tier 3)	$588	-	$482	$589	-	-
C9/M4-T2	PSPS Sectionalizing (HFTD Tier 2)	$3,203	-	$2,628	$3,213	-	-
C9/M4-T3	PSPS Sectionalizing (Non-HFTD)	$1,282	-	$1,052	$1,285	-	-
C10/M5-T1	Microgrids (HFTD Tier 3)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C10/M5-T2	Microgrids (HFTD Tier 2)	$3,608	$371	$34,301	$41,924	$1,284	$1,570
C11/M6-T1	Advanced Protection (HFTD Tier 3)	$9,164	-	$27,564	$33,689	-	-
C11/M6-T2	Advanced Protection (HFTD Tier 2)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C12/M7-T1	Hotline Clamps (HFTD Tier 3)	-	$956	-	-	$164	$201
C12/M7-T2	Hotline Clamps (HFTD Tier 2)	-	$2,343	-	-	$164	$201
C13/M8-T1	Resiliency Grant Programs (HFTD Tier 3)	-	$1,692	-	-	$2,370	$2,897
C13/M8-T2	Resiliency Grant Programs (HFTD Tier 2)	-	$3,384	-	-	$4,740	$5,793
C14/M9-T1	Standby Power Programs (HFTD Tier 3)	-	$1,754	-	-	$4,163	$5,088
C14/M9-T2	Standby Power Programs (HFTD Tier 2)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C15/M10-T1	Resiliency Assistance Programs (HFTD Tier 3)	-	$304	-	-	$324	$396
C15/M10-T2	Resiliency Assistance Programs (HFTD Tier 2)	-	$456	-	-	$486	$594
C16/M11-T1	Strategic Undergrounding (HFTD Tier 3)	$27,512	-	$552,350	$675,095	$5,993	$7,324
C16/M11-T2	Strategic Undergrounding (HFTD Tier 2)	$11,384	-	$331,410	$405,057	$3,596	$4,395
C17/M12-T1	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 3)	$57,969	$1,447	$4,500	$5,500	-	-
C17/M12-T2	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 2)	$74,531	$1,861	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C17/M12-T3	Overhead Distribution Fire Hardening – Bare Conductor (Non-HFTD)	$5,521	$138	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[28]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C18/M13-T1	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 3)	-	-	$2,809	$3,433	-	-
C18/M13-T2	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 2)	$5,038	-	$37,604	$45,960	-	-
C19-T1	Cleveland National Forest Fire Hardening (HFTD Tier 3)	$84,044	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C19-T2	Cleveland National Forest Fire Hardening (HFTD Tier 2)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C20	LTE Communication Network	$40,647	-	$181,103	$221,348	-	-
C21/M14-T1	Lightning Arrestor Removal/Replacement Program (HFTD Tier 3)	$20	-	$7,051	$8,618	-	-
C21/M14-T2	Lightning Arrestor Removal/Replacement Program (HFTD Tier 2)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C22-T1	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 3)	$3,866	$90	$9,325	$11,398	$185	$226
C22-T2	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 2)	$3,790	$89	$12,093	$14,780	$109	$133
C23	Transmission System Inspection	$838	-	$ 1,957	$ 2,392	-	-
C24-T1	Distribution System Inspection – IR/Corona (HFTD Tier 3)	-	$175	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C24-T2	Distribution System Inspection – IR/Corona (HFTD Tier 2)	-	-	-	-	$157	$192
C25-T1	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 3)	$344	$584	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C25-T2	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 2)	$177	$300	$2,266	$2,770	-	-
C26	LiDAR Flights	-	-	-	-	$1,620	$1,980
C27-T1	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 3)	$1,147	$399	$7,191	$8,789	$282	$344
C27-T2	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 2)	$2	$1	$8	$10	-	-

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[28]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C28-T1	Distribution System Inspection – Drone Inspections (HFTD Tier 3)	$15,899	$51,953	-	-	$2,025	$2,475
C28-T2	Distribution System Inspection – Drone Inspections (HFTD Tier 2)	-	-	$10,085	$12,326	-	-
C29-T1	Distribution System Inspection – Circuit Ownership (HFTD Tier 3)	-	-	-	-	$38	$46
C29-T2	Distribution System Inspection – Circuit Ownership (HFTD Tier 2)	$48	-	-	-	$75	$92
C30-T1	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 3)	$332	$135	$1,210	$1,479	$10	$13
C30-T2	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 2)	$394	$160	$1,437	$1,756	$12	$15
C31-T1	Tree Trimming (HFTD Tier 3)	-	$15,721	-	-	$14,521	$17,748
C31-T2	Tree Trimming (HFTD Tier 2)	-	$18,954	-	-	$17,508	$21,398
C32/M15-T1	Fuels Management Program (HFTD Tier 3)	-	$5,805	-	-	$5,586	$6,827
C32/M15-T2	Fuels Management Program (HFTD Tier 2)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C33/M16-T1	Enhanced Vegetation Management (HFTD Tier 3)	-	$4,687	-	-	$4,637	$5,668
C33/M16-T2	Enhanced Vegetation Management (HFTD Tier 2)	-	$5,548	-	-	$5,489	$6,708
C34-T1	Pole Brushing (HFTD Tier 3)	-	$2,549	-	-	$2,450	$2,995
C34-T2	Pole Brushing (HFTD Tier 2)	-	$2,885	-	-	$2,773	$3,390
C35-T1	Aviation Firefighting Program (HFTD Tier 3)	$5,054	$4,146	$1,358	$1,660	$5,691	$6,956
C35-T2	Aviation Firefighting Program (HFTD Tier 2)	$2,980	$2,445	$801	$979	$3,356	$4,101
C35-T3	Aviation Firefighting Program (Non-HFTD)	$214	$176	$58	$70	$241	$295

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[28]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C36-T1	Wildfire Infrastructure Protection Teams (HFTD Tier 3)	-	$1,816	-	-	$1,855	$2,267
C36-T2	Wildfire Infrastructure Protection Teams (HFTD Tier 2)	-	$771	-	-	$788	$963
C37-T1	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 3)	There are no recorded or forecasted cost estimates for these tranches during the TY 2024 GRC's 2022 – 2024 forecast period					
C37-T2	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 2)						
C38	Centralized Repository for Data	$10,214	-	$56,578	$69,150	-	-
C39	Asset Management	$444	$329	-	-	$349	$426
C40	Wildfire Mitigation Personnel	-	$3,389	-	-	$5,224	$6,385
C41	Emergency Management Operations	$2,846	$12,214	$10,101	$12,346	$10,938	$13,369
C42	Communication Practices	$5,224	$8,675	$2,781	$3,399	$5,996	$7,328
C43	Non-Conductive Balloon Alternatives	-	$86	-	-	$68	$83

Table 11: Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C1	WRRM - Ops	A risk model that estimates wildfire consequence along electric lines and equipment. One unit of measure would not accurately represent the program.							
C2	Advanced Weather Station Integration	# weather stations rebuilt		30	-	135	165	-	-
C3-T1	Wireless Fault Indicators (HFTD Tier 3)	# wireless fault indicators installed		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C3-T2	Wireless Fault Indicators (HFTD Tier 2)	# wireless fault indicators installed		502	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C3-T3	Wireless Fault Indicators (Non-HFTD)	# wireless fault indicators installed		-	-	450	550	-	-
C4	Fire Science and Climate Adaptation Department	A department that creates weather forecasts, including FPI forecasts. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							
C5	High Performance Computing Infrastructure	Infrastructure that allows SDG&E to run simulations foundational to understanding wildfire risk. One unit of measure would not accurately represent the program.							
C6/M1-T1	SCADA Capacitors (HFTD Tier 3)	# of capacitors replaced		10	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C6/M1-T2	SCADA Capacitors (HFTD Tier 2)	# of capacitors replaced		20	-	36	44	-	-
C7/M2-T1	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 3)	# of miles hardened		1	-	192	235	-	-
C7/M2-T2	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 2)	# of miles hardened		1	-	42	51	-	-
C8/M3-T1	Expulsion Fuse Replacement (HFTD Tier 3)	# of fuses replaced		1,052	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C8/M3-T2	Expulsion Fuse Replacement (HFTD Tier 2)	# of fuses replaced		2,128	-	815	997	-	-
C9/M4-T1	PSPS Sectionalizing (HFTD Tier 3)	# of switches installed		6	-	3	3	-	-

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C9/M4-T2	PSPS Sectionalizing (HFTD Tier 2)	# of switches installed		13	-	18	21	-	-
C9/M4-T3	PSPS Sectionalizing (Non-HFTD)	# of switches installed		4	-	6	9	-	-
C10/M5-T1	Microgrids (HFTD Tier 3)	# of microgrids		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C10/M5-T2	Microgrids (HFTD Tier 2)	# of microgrids		4	-	3	3	-	-
C11/M6-T1	Advanced Protection (HFTD Tier 3)	# of circuits enabled		6	-	22	26	-	-
C11/M6-T2	Advanced Protection (HFTD Tier 2)	# of circuits enabled		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C12/M7-T1	Hotline Clamps (HFTD Tier 3)	# of hotline clamps removed		-	598	-	-	86	106
C12/M7-T2	Hotline Clamps (HFTD Tier 2)	# of hotline clamps removed		-	1,466	-	-	86	106
C13/M8-T1	Resiliency Grant Programs (HFTD Tier 3)	# of generators		-	473	-	-	600	733
C13/M8-T2	Resiliency Grant Programs (HFTD Tier 2)	# of generators		-	947	-	-	1,200	1,467
C14/M9-T1	Standby Power Programs (HFTD Tier 3)	# of generators		-	74	-	-	166	202
C14/M9-T2	Standby Power Programs (HFTD Tier 2)	# of generators		-	1	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C15/M10-T1	Resiliency Assistance Programs (HFTD Tier 3)	# of generators		-	510	-	-	221	271
C15/M10-T2	Resiliency Assistance Programs (HFTD Tier 2)	# of generators		-	764	-	-	332	406
C16/M11-T1	Strategic Undergrounding (HFTD Tier 3)	# of miles UG		11	-	200	244	-	-
C16/M11-T2	Strategic Undergrounding (HFTD Tier 2)	# of miles UG		5	-	120	146	-	-
C17/M12-T1	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 3)	# of miles hardened		42	-	5	6	-	-
C17/M12-T2	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 2)	# of miles hardened		54	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C17/M12-T3	Overhead Distribution Fire Hardening – Bare Conductor (Non-HFTD)	# of miles hardened		4	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C18/M13-T1	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 3)	# of miles hardened		-	-	3	4	-	-
C18/M13-T2	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 2)	# of miles hardened		9	-	41	50	-	-

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C19-T1	Cleveland National Forest Fire Hardening (HFTD Tier 3)	# of miles hardened		61	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C19-T2	Cleveland National Forest Fire Hardening (HFTD Tier 2)	# of miles hardened		-	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C20	LTE Communication Network	# of base stations		15	-	128	156	-	-
C21/M14-T1	Lightning Arrestor Removal/Replacement Program (HFTD Tier 3)	# of lightning arrestors replaced		30	-	4,990	6,098	-	-
C21/M14-T2	Lightning Arrestor Removal/Replacement Program (HFTD Tier 2)	# of lightning arrestors replaced		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C22-T1	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 3)	# of HFTD inspections		-	9,055	-	-	9,266	11,326
C22-T2	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 2)	# of HFTD inspections		-	8,877	-	-	5,450	6,662
C23	Transmission System Inspection	# of HFTD inspections		2,679	-	7,331	8,661	-	-
C24-T1	Distribution System Inspection – IR/Corona (HFTD Tier 3)	# of HFTD inspections		-	13,077	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C24-T2	Distribution System Inspection – IR/Corona (HFTD Tier 2)	# of HFTD inspections		-	-	-	-	16,200	19,800
C25-T1	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 3)	# of HFTD inspections		-	10,368	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C25-T2	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 2)	# of HFTD inspections		-	5,330	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C26	LiDAR Flights	Program to create accurate surveys of electric distribution lines, structures, vegetation, and other potential hazards critical to design. One unit of measure would not accurately represent the program.							
C27-T1	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 3)	# of HFTD inspections		-	10,993	-	-	9,734	11,897
C27-T2	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 2)	# of HFTD inspections		-	19	-	-	3	3
C28-T1	Distribution System Inspection – Drone Inspections (HFTD Tier 3)	# of HFTD inspections		-	37,310	-	-	13,320	16,280
C28-T2	Distribution System Inspection – Drone Inspections (HFTD Tier 2)	# of HFTD inspections		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C29-T1	Distribution System Inspection – Circuit	Submissions made to the Circuit Ownership program		-	-	-	-	5	6

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
	Ownership (HFTD Tier 3)								
C29-T2	Distribution System Inspection – Circuit Ownership (HFTD Tier 2)	Submissions made to the Circuit Ownership program		-	2	-	-	9	11
C30-T1	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 3)	# of HFTD patrols		-	39,371	-	-	35,434	43,308
C30-T2	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 2)	# of HFTD patrols		-	46,751	-	-	42,076	51,426
C31-T1	Tree Trimming (HFTD Tier 3)	# of trees inspected		-	122,740	-	-	41,294	50,470
C31-T2	Tree Trimming (HFTD Tier 2)	# of trees inspected		-	147,984	-	-	49,787	60,850
C32/M15-T1	Fuels Management Program (HFTD Tier 3)	# of structures cleared		-	324	-	-	450	550
C32/M15-T2	Fuels Management Program (HFTD Tier 2)	# of structures cleared		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C33/M16-T1	Enhanced Vegetation Management (HFTD Tier 3)	# of trees trimmed		-	7,829	-	-	7,007	8,564
C33/M16-T2	Enhanced Vegetation Management (HFTD Tier 2)	# of trees trimmed		-	9,266	-	-	8,293	10,136
C34-T1	Pole Brushing (HFTD Tier 3)	# of poles brushed		-	17,151	-	-	14,101	17,234

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C34-T2	Pole Brushing (HFTD Tier 2)	# of poles brushed		-	19,412	-	-	15,959	19,506
C35-T1	Aviation Firefighting Program (HFTD Tier 3)	Helicopters available for use by CalFire to respond to active fires. One unit of measure would not accurately represent the program.							
C35-T2	Aviation Firefighting Program (HFTD Tier 2)								
C35-T3	Aviation Firefighting Program (Non-HFTD)								
C36-T1	Wildfire Infrastructure Protection Teams (HFTD Tier 3)	Qualified firefighters join electric crews to serve in a prevention and ignition mitigation role. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							
C36-T2	Wildfire Infrastructure Protection Teams (HFTD Tier 2)								
C37-T1	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 3)	De-energizing power lines for public safety. One unit of measure would not accurately represent the program.							
C37-T2	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 2)								
C38	Centralized Repository for Data	Centralized repository to integrate asset data across distribution, transmission, and substation. One unit of measure would not accurately represent the program.							
C39	Asset Management	Initiative that develops proactive asset replacement, inspection, and repair programs based on risk. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							
C40	Wildfire Mitigation Personnel	A department that tracks and reports on wildfire mitigation programs through quarterly reports and annual WMP. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C41	Emergency Management Operations	A department that reduces risk by effectively responding to fires or extreme fire potential events. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							
C42	Communication Practices	Program that improves coordination and customer awareness during fires or PSPS events. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							
C43	Non-Conductive Balloon Alternatives	Program to develop a non-conductive balloon that will not cause an electrical fault when it comes in contact with overhead distribution power lines. One unit of measure would not accurately represent the program.							

Table 12: Risk Control & Mitigation Plan - Quantitative Analysis Summary[29]

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C1	WRRM - Ops	*See* Table 13 below					
C2	Advanced Weather Station Integration	*See* Table 13 below					
C3-T1	Wireless Fault Indicators (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C3-T2	Wireless Fault Indicators (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C3-T3	Wireless Fault Indicators (Non-HFTD)	-	-	9.20	24.01	220.87	1,516.03
C4	Fire Science and Climate Adaptation Department	*See* Table 13 below					
C5	High Performance Computing Infrastructure	*See* Table 13 below					
C6/M1-T1	SCADA Capacitors (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C6/M1-T2	SCADA Capacitors (HFTD Tier 2)	4	351.80	6.78	622.91	5,628.63	381.49
C7/M2-T1	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 3)	4	820.76	4.79	1,409.28	10,034.69	32.47
C7/M2-T2	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 2)	4	351.80	6.77	622.91	5,623.76	13.64
C8/M3-T1	Expulsion Fuse Replacement (HFTD Tier 3)	-	-	-	-	-	-

[29] It should be noted that the RSE provided in Table 12 represents the combination of C37: PSPS Events and Mitigation of PSPS Impacts, C42: Emergency Management Operations, and C43: Communication Practices. This is because PSPS events (C37) cannot be performed without Emergency Management Operations (*i.e.*, EOC activations) and Communication Practices (*i.e.*, communicated with our customers).

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C8/M3-T2	Expulsion Fuse Replacement (HFTD Tier 2)	4	351.80	6.79	622.91	5,634.86	186.71
C9/M4-T1	PSPS Sectionalizing (HFTD Tier 3)	4	801.85	5.13	1,409.28	10,436.99	2,112.33
C9/M4-T2	PSPS Sectionalizing (HFTD Tier 2)	4	278.78	6.84	622.91	5,375.80	1,062.66
C9/M4-T3	PSPS Sectionalizing (Non-HFTD)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C10/M5-T1	Microgrids (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C10/M5-T2	Microgrids (HFTD Tier 2)	4	330.32	6.84	622.91	5,581.97	30.15
C11/M6-T1	Advanced Protection (HFTD Tier 3)	4	820.87	4.74	1,409.28	9,968.82	309.45
C11/M6-T2	Advanced Protection (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C12/M7-T1	Hotline Clamps (HFTD Tier 3)	4	820.87	5.11	1,409.28	10,489.12	92.64
C12/M7-T2	Hotline Clamps (HFTD Tier 2)	4	351.80	6.83	622.91	5,658.53	36.13
C13/M8-T1	Resiliency Grant Programs (HFTD Tier 3)	4	803.20	5.13	1,409.28	10,442.42	76.30
C13/M8-T2	Resiliency Grant Programs (HFTD Tier 2)	4	334.13	6.84	622.91	5,597.21	38.15
C14/M9-T1	Standby Power Programs (HFTD Tier 3)	4	771.64	5.13	1,409.28	10,316.19	119.92
C14/M9-T2	Standby Power Programs (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C15/M10-T1	Resiliency Assistance Programs (HFTD Tier 3)	4	796.67	5.13	1,409.28	10,416.30	568.86
C15/M10-T2	Resiliency Assistance Programs (HFTD Tier 2)	4	333.65	6.84	622.91	5,595.29	284.43

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C16/M11-T1	Strategic Undergrounding (HFTD Tier 3)	4	800.44	2.17	1,409.28	6,266.93	155.87
C16/M11-T2	Strategic Undergrounding (HFTD Tier 2)	4	333.20	5.55	622.91	4,789.38	53.75
C17/M12-T1	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 3)	4	820.87	5.12	1,409.28	10,501.38	52.70
C17/M12-T2	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C17/M12-T3	Overhead Distribution Fire Hardening – Bare Conductor (Non-HFTD)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C18/M13-T1	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 3)	4	820.87	5.12	1,409.28	10,504.62	62.62
C18/M13-T2	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 2)	4	351.80	6.75	622.91	5,610.50	31.74
C19-T1	Cleveland National Forest Fire Hardening (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C19-T2	Cleveland National Forest Fire Hardening (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C20	LTE Communication Network	*See* Table 13 below					
C21/M14-T1	Lightning Arrestor Removal/Replacement Program (HFTD Tier 3)	4	820.87	5.09	1,409.28	10,462.35	112.77
C21/M14-T2	Lightning Arrestor Removal/Replacement Program (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C22-T1	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 3)	4	820.87	5.67	1,409.28	11,278.32	65.03
C22-T2	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 2)	4	351.80	7.66	622.91	6,181.14	32.95
C23	Transmission System Inspection	*See* Table 13 below					
C24-T1	Distribution System Inspection – IR/Corona (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C24-T2	Distribution System Inspection – IR/Corona (HFTD Tier 2)	4	351.80	7.12	622.91	5,841.66	322.17
C25-T1	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C25-T2	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 2)	4	351.80	6.85	622.91	5,674.72	1.98
C26	LiDAR Flights	*See* Table 13 below					
C27-T1	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 3)	4	820.87	5.86	1,409.28	11,543.27	111.05
C27-T2	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 2)	4	351.80	6.84	622.91	5,668.49	57.46
C28-T1	Distribution System Inspection – Drone Inspections (HFTD Tier 3)	4	820.87	5.77	1,409.28	11,412.20	193.99
C28-T2	Distribution System Inspection – Drone Inspections (HFTD Tier 2)	4	351.80	7.42	622.91	6,031.65	8.86

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C29-T1	Distribution System Inspection – Circuit Ownership (HFTD Tier 3)	4	820.87	5.13	1,409.28	10,511.39	13.14
C29-T2	Distribution System Inspection – Circuit Ownership (HFTD Tier 2)	4	351.80	6.84	622.91	5,666.00	7.26
C30-T1	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 3)	4	820.87	5.88	1,409.28	11,565.81	683.68
C30-T2	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 2)	4	351.80	7.94	622.91	6,349.95	373.04
C31-T1	Tree Trimming (HFTD Tier 3)	4	820.87	11.41	1,409.28	19,364.02	191.61
C31-T2	Tree Trimming (HFTD Tier 2)	4	351.80	16.18	622.91	11,485.31	104.45
C32/M15-T1	Fuels Management Program (HFTD Tier 3)	4	820.87	5.10	1,391.02	10,382.39	6.83
C32/M15-T2	Fuels Management Program (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C33/M16-T1	Enhanced Vegetation Management (HFTD Tier 3)	4	820.87	5.08	1,409.28	10,440.78	111.32
C33/M16-T2	Enhanced Vegetation Management (HFTD Tier 2)	4	351.80	6.77	622.91	5,621.15	60.78
C34-T1	Pole Brushing (HFTD Tier 3)	4	820.87	6.64	1,409.28	12,641.14	261.05
C34-T2	Pole Brushing (HFTD Tier 2)	4	351.80	9.09	622.91	7,071.77	152.16
C35-T1	Aviation Firefighting Program (HFTD Tier 3)	4	820.87	5.13	1,443.91	10,690.74	23.79
C35-T2	Aviation Firefighting Program (HFTD Tier 2)	4	351.80	6.84	631.93	5,729.57	14.02
C35-T3	Aviation Firefighting Program (Non-HFTD)	-	-	9.20	30.25	278.29	0.91

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C36-T1	Wildfire Infrastructure Protection Teams (HFTD Tier 3)	4	820.87	5.41	1,409.28	10,913.88	62.94
C36-T2	Wildfire Infrastructure Protection Teams (HFTD Tier 2)	4	351.80	7.08	622.91	5,819.42	56.03
C37-T1	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 3)	4	820.87	8.39	1,409.28	15,107.453	145.06
C37-T2	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 2)	4	351.80	13.73	622.91	9,959.09	119.71
C38	Centralized Repository for Data	*See* Table 13 below					
C39	Asset Management	*See* Table 13 below					
C40	Wildfire Mitigation Personnel	*See* Table 13 below					
C41	Emergency Management Operations	*See* information for control C37-T1 and C37-T2					
C42	Communication Practices	*See* information for control C37-T1 and C37-T2					
C43	Non-Conductive Balloon Alternatives	*See* Table 13 below					

It should be noted that the RSE provided in Table 12 above represents the combination of C37: PSPS Events and Mitigation of PSPS Impacts, C42: Emergency Management Operations, and C43: Communication Practices. This is because PSPS events (C37) cannot be performed without Emergency Management Operations (*i.e.*, EOC activations) and Communication Practices (*i.e.*, communicated with our customers).

Table 13: Risk Control & Mitigation Plan - Quantitative Analysis Summary for RSE Unavailability

ID	Control/Mitigation Name	RSE Unavailability Rationale
C1	WRRM-Ops	This initiative does not have an RSE because it is considered foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C2	Advanced Weather Station Integration	This does not have an RSE because it is considered foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C4	Fire Science and Climate Adaptation Department	This is considered foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C5	High Performing Computing Infrastructure	This does not have an RSE because it is considered foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C20	LTE Communication Network	This does not have its own RSE because it is foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction.

ID	Control/Mitigation Name	RSE Unavailability Rationale
C23	Transmission System Inspection	This does not have an RSE because a majority of the costs for this program are FERC related. Only a portion of these costs are related to distribution equipment on the transmission structures.
C26	LiDAR Flights	This does not have an RSE because it does not directly reduce wildfire risk. As described above, LiDAR inspections on distribution and transmission lines are primarily used for grid hardening design efforts rather than for identifying issues like the other inspection programs. As such, quantifying a reduction in ignition risk for these inspections is not applicable. LiDAR is utilized for distribution hardening programs, which are primarily being designed and constructed in the HFTD.
C38	Centralized Repository for Data	This initiative is foundational to supporting wildfire mitigation efforts. Centralizing data does not by itself reduce Wildfire risk, but provides tools to allow SDG&E to further reduce Wildfire risk. Quantifying an RSE for such a mitigation would be impractical because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. It supports various initiatives by providing better information to make risk informed mitigation decisions.
C39	Asset Management	SDG&E has categorized this workgroup and activity as foundational, in which this activity alone does not mitigate the risk of wildfire but is critical in understanding the wildfire risk in general in relation to SDG&E equipment assets. This activity, in conjunction with the other foundational activities, allows for mitigation prioritization; the calculation of RSEs; and aids to effectively select and implement the right mitigations and controls to reduce the risk of wildfires. Initiatives included in this category cover both an enterprise-wide initiative (Investment Prioritization) lead by the Asset Management organization as well as a more focused initiative (WiNGS) lead by the wildfire mitigation team to apply more granular analytics to grid hardening projects.
C40	Wildfire Mitigation Personnel	This initiative does not have an RSE because it is foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C43	Non-Conductive Balloon Alternatives	This does not have an RSE because the current scope of this initiative is focused on outreach efforts to drive adoption of the alternative technology for metallic foil balloons. No current deployment of this

ID	Control/Mitigation Name	RSE Unavailability Rationale
		technology is in place to allow for a calculation of RSEs based on measurable indicators of effectiveness.

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the risk control and mitigation plan for the Wildfire risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this control and mitigation plan also took into account modifications to the plan and constraints, such as budget and resources.

In considering alternatives to the control and mitigation plan, SDG&E utilized a segment-level analysis to examine different grid hardening strategies evaluating the combined effect of the hardening options in a small portfolio-level analysis.[30] With a long-term objective of significantly reducing the risk of wildfires over a multi-year timeframe that extends beyond this RAMP, SDG&E selected the portfolio of grid hardening strategies set forth in the control and mitigation plan that includes a mix of undergrounding and covered conductor implementation. The proposed scope included in this RAMP is part of a long-term effort that is aimed at reducing the Wildfire risk by approximately 80% and reducing impacts of PSPS to approximately 18K customers. The total risk[31] reduction estimated from this strategy is ~70% over a period of ~10 years.

Identifying the long-term objectives for grid hardening is critical to selecting the mitigation strategies. For instance, if SDG&E had selected an objective of reducing Wildfire risk by 60%, the mitigations selected for the segments in scope of this strategy will differ from those that would be selected under a different objective of reducing 80%. This is because each segment has a certain level of risk and depending on which mitigation is selected, the risk reduction achieved will vary. For example, if a segment is selected for the implementation of

[30] A portfolio-level analysis refers to the analysis done when combining multiple mitigations to assess combined effect of the mitigations. In this context, a 'small' portfolio refers to the combination of a couple of mitigations that are complementary in nature.

[31] Total risk combines both wildfire and PSPS impacts.

covered conductor, the risk reduction that could be achieved on that segment will be roughly around 60%. On the other hand, if the same segment is selected for undergrounding, the risk reduction that could be achieved on that segment would be closer to 100%. As such, the selection of hardening strategies for each segment in the near term affects the long-term potential for risk reduction.

The alternatives analysis conducted for grid hardening includes the scope of work planned for 2023 and 2024. 2022 is held constant for a couple of reasons; first, hardening projects planned for 2022 are already underway making it infeasible and overly burdensome to switch to other types of mitigations and second, the segment-level analysis that SDG&E recently developed (using the WiNGS model) is influencing the scope of hardening work starting in 2023 making it more comparable from a segment alternatives analysis standpoint.

The analysis of annual targets took into consideration constraints, including affordability as well as resources. This analysis is considered preliminary and may change as a result of updating our models. Additionally, the mitigations that ultimately get implemented may differ from the mitigations that the model proposes as SDG&E's engineering teams begin to scope the proposed solutions and evaluate additional constraints such as environmental and land permitting as well as other feasibility factors.

The grid hardening strategies analyzed as a part of this alternative analysis are summarized in the table below. Underground is referred to as 'UG' and Covered Conductor is referred to as 'CC'.

Table 14: Grid Hardening Alternative Analysis

	2023 - 2024			2023 - 2030		
Alternatives	**2023 -2024 Scope**	**2023 - 2024 Total Risk Reduction**	**2023 - 2024 RSE**	**Long-term Scope**	**Long-term Total Risk Reduction**	**Long-term RSE**
Proposed	275 miles of UG 200 miles of CC	32.8%	100.35	584 miles of UG 865 miles of CC	62.7%	69.35
Alternative 1	475 miles of UG	34.1%	85.11	1,449 miles of UG	70.9%	58.04
Alternative 2	475 miles of CC	21.1%	93.36	1,449 miles of CC	46.0%	66.58

A. Alternative 1

As shown in the summary table above, the SDG&E's control and mitigation plan includes a total of ~475 miles over 2023 – 2024. While the control and mitigation plan includes a mix of undergrounding as well as implementation of covered conductor, Alternative 1

considers the scenario of undergrounding the ~475 miles instead of implementing the proposed mix of mitigations. While Alternative 1 offers greater risk reduction, it comes with higher costs that result in a lower RSE. SDG&E's control and mitigation plan offers a tangible risk reduction at a much lower cost. Additionally, taking an all-underground approach may not be feasible due to permitting, terrain constraints as well as resource availability.

B. Alternative 2

Alternative 2 considers the scenario of implementing covered conductor across the ~475 miles and eliminates the option of undergrounding. While it has a comparatively close RSE due its lower costs, its risk reduction potential, particularly in the long run, is capped at ~50%. Because of SDG&E's desire to go beyond the 50% reduction while considering cost impacts, deploying a mixed strategy as proposed meets those objectives.

Table 15: Alternate Mitigation Plan - Recorded and Forecast Dollars Summary[32] (Direct After Allocations, In 2020 $000)

ID	Alternative Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Alterative 1	$ 1,436,587	$ 1,755,828	$ 19,575	$ 23,925
A2	Alterative 2	$ 787,500	$ 962,500	$ 11,070	$ 13,530

Table 16: Alternate Mitigation Plan - Units Summary

ID	Alternative Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Alterative 1	# of UG miles		500	611	225	275
A2	Alterative 2	# of CC miles		482	589	225	275

[32] Recorded costs and forecast ranges are rounded. Additional cost-related information is provided in workpapers. Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar amounts and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

Table 17: Alternate Mitigation Plan - Quantitative Analysis Summary

ID	Control/Mitigation Name	Forecast (2022 – 2024)					
		PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	TWRS	RSE
A1	Alterative 1	4.00	1,133.53	11.29	556	10,812	79
A2	Alterative 2	4.00	1,172	15.00	556	13,026	88

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

ID	Control/Mitigation Name	Drivers/Triggers/Potential Consequences Addressed
C1	WRRM-Ops	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C2	Advanced Weather Station Integration	DT.9, DT.10, PC.1, PC.2, PC.3, PC.5, PC.6
C3	Wireless Fault Indicators	DT.9, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C4	Fire Science and Climate Adaptation Department	DT.7, DT.8, DT.9, DT.10, PC.1, PC.2, PC.3, PC.5, PC.6
C5	High Performance Computing Infrastructure	DT.9, DT.10, PC.1, PC.2, PC.3, PC.5, PC.6
C6 / M1	SCADA Capacitors	DT.2, PC.1, PC.2, PC.3, PC.5, PC.6
C7 / M2	Overhead Distribution Fire Hardening – Covered Conductor	DT.1, DT.2 DT.3, DT.4, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C8 / M3	Expulsion Fuse Replacement	PC.1, PC.2, PC.3, PC.5, PC.6
C9 / M4	PSPS Sectionalizing	PC.4, PC.6
C10 / M5	Microgrids	PC.4, PC.6
C11 / M6	Advanced Protection	PC.1, PC.2, PC.3, PC.5, PC.6
C12 / M7	Hotline Clamps	DT.1, DT.2, PC.1, PC.2, PC.3, PC.5, PC.6
C13 / M8	Resiliency Grant Programs	PC.4, PC.6
C14 / M9	Standby Power Programs	PC.4, PC.6
C15 / M10	Resiliency Assistance Programs	PC.4, PC.6
C16 / M11	Strategic Undergrounding	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C17 / M12	Overhead Distribution Fire Hardening – Bare Conductor	DT.1, DT.2, DT.3, DT.5, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C18 / M13	Overhead Transmission Fire Hardening – Distribution Underbuilt	DT.1, DT.2, DT.3, DT.5, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C19	Cleveland National Forest Fire Hardening	DT.1, DT.2, DT.3, DT.5, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C20	LTE Communication Network	PC.1, PC.2, PC.3, PC.5, PC.6
C21 / M14	Lightning Arrestor Removal/Replacement Program	DT.2, PC.1, PC.2, PC.3, PC.5, PC.6
C22	Distribution System Inspection – CMP – 5 Year Detailed Inspections	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10

ID	Control/Mitigation Name	Drivers/Triggers/Potential Consequences Addressed
C23	Transmission System Inspection	DT.1, DT.2, DT.3, DT.4, DT.6, DT.8, DT.10
C24	Distribution System Inspection – IR/Corona	DT.1, DT.2, DT.3
C25	Distribution System Inspection – CMP – 10 Year Intrusive	DT.1, DT.2, DT.3, DT.8, DT.10
C26	LiDAR Flights	DT.2, DT.3, DT.4, DT.6
C27	Distribution System Inspection – HFTD Tier 3 Inspections	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
C28	Distribution System Inspection – Drone Inspections	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
C29	Distribution System Inspection – Circuit Ownership	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
C30	Distribution System Inspection – CMP – Annual Patrol	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
C31	Tree Trimming	DT.1, DT.2, DT.3, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C32 / M15	Fuels Management Program	DT.6, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C33 / M16	Enhanced Vegetation Management	DT.1, DT.2, DT.3, DT.6, DT.8, PC.1, PC.2, PC.3, PC.5, PC.6
C34	Pole Brushing	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C35	Aviation Firefighting Program	DT.9, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C36	Wildfire Infrastructure Protection Teams	DT.9, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C37	PSPS Events and Mitigation of PSPS Impacts	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C38	Centralized Repository for Data	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C39	Asset Management	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C40	Wildfire Mitigation Personnel	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C41	Emergency Management Operations	DT.9, PC.1, PC.2, PC.3, PC.5, PC.6
C42	Communication Practices	DT.7, DT.9, PC.5, PC.6
C43	Non-Conductive Balloon Alternatives	DT.4

APPENDIX B: QUANTITATIVE ANALYSIS SOURCE DATA REFERENCES

Appendix B: Quantitative Analysis Source Data References

The Settlement Decision directs the utility to identify potential consequences of a risk event using available and appropriate data.[33] The list below provides the inputs used as part of this assessment.

San Diego Gas & Electric, CPUC Reportable Fire Database

- 2014 –2020 ignition reporting (pursuant to D14-02-015, Ordering Paragraph 9 and Appendix C)

San Diego Gas & Electric, Electric Reliability Database

- 2010 –2020 internal reliability data

San Diego Gas & Electric, Asset Management data

- Various asset information, such as the count and type of assets, by HFTD tier

CALFIRE, Wildfire Activity Statistics (also known as Redbooks)

https://www.fire.ca.gov/stats-events

- Annual record of wildfire statistics such as location, size, and damage

Technosylva (internal consultant who performs wildfire modeling)

WRRM consequence data

[33] D.18-12-024, Attachment A at A-8 (Identification of Potential Consequences of Risk Event).