

**BEFORE THE PUBLIC UTILITY COMMISSION
OF OREGON**

UM 2340

In the Matter of

PUBLIC UTILITY COMMISSION OF
OREGON,

Investigation Into Guidelines for Wildfire
Mitigation Plans.

ORDER

DISPOSITION: STAFF'S RECOMMENDATION ADOPTED

At its Special Public Meeting on October 30, 2025, the Public Utility Commission of Oregon adopted Staff's recommendation in this matter. The Staff Report with the recommendation is attached as Appendix A.

BY THE COMMISSION:



Alison Lackey

Chief Administrative Law Judge



A party may request rehearing or reconsideration of this order under ORS 756.561. A request for rehearing or reconsideration must be filed with the Commission within 60 days of the date of service of this order. The request must comply with the requirements in OAR 860-001-0720. A copy of the request must also be served on each party to the proceedings as provided in OAR 860-001-0180(2). A party may appeal this order by filing a petition for review with the Circuit Court for Marion County in compliance with ORS 183.484.

**PUBLIC UTILITY COMMISSION OF OREGON
STAFF REPORT
SPECIAL PUBLIC MEETING DATE: October 30, 2025**

REGULAR X CONSENT _____ EFFECTIVE DATE _____ N/A _____

DATE: October 23, 2025

TO: Public Utility Commission

FROM: Heide Caswell

THROUGH: Bryan Conway **SIGNED**

SUBJECT: OREGON PUBLIC UTILITY COMMISSION STAFF:
(Docket No. UM 2340)
WMP Risk Spent Efficiency Workbook and Guidelines

STAFF RECOMMENDATION:

The Public Utility Commission of Oregon (Commission) should approve the Wildfire Mitigation Plan (WMP) Risk Spent Efficiency (RSE) Workbook and corresponding Guidelines for use and submission by investor-owned electric utilities.

DISCUSSION:

Issue

Whether the Commission should approve and direct the utilities to utilize the proposed WMP RSE Workbook and Guidelines.

Applicable Rule or Law

ORS 756.040 describes the general powers of the Commission to supervise and regulate every public utility, and to do all things necessary and convenient in the exercise of that authority.

ORS 757.960 through 757.969, established standards for electric utility’s Wildfire Mitigation Plans and directs the Commission to evaluate electric companies’ risk-based wildfire mitigation plans and planned activities to protect public safety, reduce risk to utility customers, and promote electrical system resilience to wildfire damage.

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In Order No. 24-326¹ the Commission has adopted guidelines for Wildfire Mitigation Plans, including Planning Cycle Guidelines, Update Guidelines, and Data Guidelines. The Commission subsequently adopted a Glossary of Shared Terminology and Multi-Year Plan Standardized Format in Order No. 25-326.²

Analysis

Background

The Commission established Docket No. UM 2340, based on recognition that a Commission-led evolution of wildfire mitigation plans was necessary.³ The identified elements for improvement were divided into two phases, with specific content for each. Table 1 outlines the recommendations for each phase and the current status.

Table 1: Summary of Joint Recommendations Adopted in July 2024

	Effort Areas	Recommendation	Outcome	Leading	Status
Phase 1	Process and Planning Cycle	Updated Process	Guidance for procedural steps WMP evaluation.	Staff	Approved
		Updated Planning Cycle	Guidance on how to transition to multi-year planning.	Staff	Approved
	Standardization of Elements	Data Templates	Template which identifies the appropriate information and level of granularity for data required in the WMP.	Staff	Approved
Phase 2	Standardization of Elements	Shared Terminology	Glossary of shared terminology that can be used across WMPs.	Utilities	Approved
		Shared Format	A format guide which adopts uniform chapter and section headings, as well as other agreed upon organizational features.	Utilities	Approved
	Working Group	Risk Quantification & Risk-Spend Efficiency	Guidance on risk quantification and a uniform risk-spend valuation methodology.	Staff	In Progress

¹ *In re Public Utility Commission of Oregon, Investigation into Guidelines for Wildfire Mitigation Plans*, Order No. 24-326 (Sept. 23, 2024).

² *In re Public Utility Commission of Oregon, Investigation into Guidelines for Wildfire Mitigation Plans*, Order No. 25-326 (Aug. 20, 2025).

³ See *In re Pacific Power 2024 Wildfire Mitigation Plan*, Docket No. UM 2207, Order No. 24-230 (July 10, 2024); *In re Portland General Electric 2024 Wildfire Mitigation Plan*, Docket No. UM 2208, Order No. 24-232, (July 10, 2024); *In re Idaho Power 2024 Wildfire Mitigation Plan*, Docket No. UM 2209, Order No. 24-231 (July 10, 2024).

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From April through August of 2025, Staff met with the utilities to gather input into the elements used in risk modeling assessment and current cost effectiveness calculations, which informed Staff's proposal.

On September 4, 2025, Staff began stakeholder engagement on the RSE proposal.⁴ These efforts included a public workshop held on September 17, 2025, where Staff reviewed the progress and process for its proposed guidelines RSE workbook. Stakeholders were given the opportunity to ask questions and provide feedback. Staff additionally solicited stakeholder comments in the UM 2340 docket.

Guideline Objectives and Implementation

The proposed guidelines stem from the work of the UM 2340 Working Group, who has been focused on risk quantification and risk-spend efficiency guidelines. The proposed Risk Spend Efficiency (RSE) workbook and guidelines (Guidelines) provide a single proposal to calibrate utility methodologies for risk modeling and risk-spend efficiency.

Staff notes that implementation of the guidelines will not direct specific outcomes and is not a substitute for a utility's judgement. Instead, the guidelines provide a shared framework for discussion and a method for comparison of risks and mitigations across utilities. Additionally, the proposed guidelines do not alleviate the utility from the requirement to demonstrate prudence of their investments for cost recovery.

The Guidelines are informed by Staff review of work done by others to develop risk quantification, including efforts made by the California Public Utility Commission, practices of Oregon and California Investor-Owned Utilities, and other industry related published studies. Consideration needed to be given to the complex variations that are unique to each of the IOUs (such as landscape, weather, vegetation, and mitigation effectiveness), while balancing a need to ensure that each RSE weighting remained generally consistent. Staff is also cognizant of the need to carefully and consistently create boundaries around ignition risk, mitigation effectiveness, and costs as to not inadvertently influence the result of one specific mitigation over another. It quickly became clear that given its complexity, this process needed to be developed in stages. Specifics outlining the current RSE Worksheet are provided in the RSE Workbook Details section of this memo.

Staff's proposal allows for cross-walking of utility risk modeling methodologies and establishes the foundation of risk-spend efficiency calculations. Staff recognizes the

⁴ <https://edocs.puc.state.or.us/efdocs/HAH/um2340hah339624114.pdf>

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challenges involved in developing a model to capture risk quantification, which is why Staff chose to approach this process in stages.

If adopted, the utilities would complete the RSE Workbook included in Attachment B as part of the 2026-2028 WMPs. Staff believes this to be feasible, since the utilities have provided much of this information during the Guideline development process. Staff is committed to assisting with the development of any proxy values, as needed, to aid in completion of the RSE Workbook.

Staff anticipates continuing the next stage of development based upon the experience it and the utilities gain in the 2026-2028 WMP review cycle, targeting further development during 2026.

Utility Coordination

In March 2025, Staff and the IE organized the RSE development process, including creating a schedule for a series of topical meetings with the IOUs, focused on key topics advancing the development of the RSE Model. Table 2 outlines the RSE development meetings that were held.

Table 2 Risk Spend Efficiency IOU meetings

Date	Topic	Details
4/2/2025	Fire Risk Data	<u>Joint IOU RSE Development Meeting 1.</u> Terrain, land-use, canopy fuels, surface fuels, short-term (fuels) and other physical data sets used in fire risk modeling.
4/9/2025	Weather Modeling	<u>Joint IOU RSE Development Meeting 2.</u> Short-term fuels (cont.) short-term (wind, weather, and derived variables), weather models, seasonal (weather), climatology, and other weather data sets used in fire risk modeling.
4/16/2025	Seasonal and Future State	<u>Joint IOU RSE Development Meeting 3.</u> Seasonality (drought severity, weather patterns, fuel loads, disturbances), climatology (historical and projections), future state data (land use, population, Structures and wildfire consequence), and other seasonal data sets used in fire risk modeling.
4/23/2025	Ignition Probability and Future State	<u>Joint IOU RSE Development Meeting 4.</u> Risk event data (outages, wire down events, and ignitions), probability of ignitions (fuels, terrain, canopy, wind, aridity derived indices, asset characteristics, methods, and others), and fire potential index (fuels, terrain, wind, aridity, derived indices, wildfire consequences, planning horizon, categories/levels, and other) data sets used in fire risk modeling.
4/30/2025	Ignition Drivers	<u>Joint IOU RSE Development Meeting 5.</u> Reviewing risk event drivers (contamination, equipment deterioration, equipment error, equipment environmental, equipment other, fire, public contact, wildlife contact, vegetation, wire-to-wire, unknown, and other), and relative sub-drivers associated with ignition risks.

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Date	Topic	Details
5/7/2025	Wildfire Consequences	<u>Joint IOU RSE Development Meeting 6.</u> Wildfire spread (data inputs and methods) and wildfire consequences outputs.
5/21/2025	Mitigation Effectiveness	<u>Joint IOU RSE Development Meeting 7.</u> Reviewed various system hardening options such as; undergrounding, covered conductor, pole replacements, equipment updates, vegetation management, operational practices (such as sensitive settings, installation of camera detection and weather stations), transmission system improvements, and other mitigations options.
5/28/2025	Mitigation Selection and Costs	<u>Joint IOU RSE Development Meeting 8.</u> Utilities current methods identifying how mitigation programs and projects are selected. What are the utilities current RSE calculations. Average mitigation cost based on the type of mitigation.
7/23/2025	Introduction of RSE workbook to Utilities	<u>Joint IOU RSE Development Meeting 9.</u> Staff introduced the first draft of the RSE Workbook. Staff outlined sections one and two worksheets to IOUs.
7/30/2025	RSE Data Discussion	<u>Joint IOU RSE Development Meeting 10.</u> Staff began discussions with IOUs to work to develop average values for ignition probability by fault type and mitigation ignition risk reductions by risk event drivers.
8/6/2025	IOU RSE Discussion	<u>Joint IOU RSE Development Meeting 11.</u> Continued discussion on values for ignition risk, mitigation effectiveness and costs.
8/13/2025	PacifiCorp RSE Review	<u>IOU RSE Development Meeting 12 PAC.</u> Focused discussion with PacifiCorp internal data for the development of average values for ignition probability by fault type, mitigation ignition risk reductions by risk event drivers and the mitigation costs, saving and lifespan.
8/25/2025	Idaho Power RSE Review	<u>IOU RSE Development Meeting 12 IPC.</u> Focused discussion with Idaho Power internal data for the development of average values for ignition probability by fault type, mitigation ignition risk reductions by risk event drivers and the mitigation costs, saving and lifespan.
8/27/2025	Portland General Electric RSE Review	<u>IOU RSE Development Meeting 12 PGE.</u> Focused discussion with Portland General Electric internal data for the development of average values for ignition probability by fault type, mitigation ignition risk reductions by risk event drivers and the mitigation costs, saving and lifespan.

Staff engaged in an iterative process with the utilities to ensure that the RSE Workbook allowed sufficient flexibility for each utility to capture the details of its systems as well as model input and throughputs. While eventually resolved, utility concerns around information being requested by Staff led to delays and created an initial obstacle to development of a proposal that reflected the needs of each utility.

Staff held a total of twelve meetings with the utilities, with the first 8 focused on inputs into the elements used in risk modeling assessment and current RSE calculations.

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The first draft of the RSE Workbook, containing sections 1 (Exposure Risk) and 2 (Outage/Fault Ignition Risk), was introduced to utilities at the July 23 meeting. Staff provided a revised draft of the RSE Workbook, including the addition of section 5 (Mitigation Cost) on July 31. On August 20, Staff provided a third draft of the RSE Workbook.

Staff then held a series of individual meetings to provide further clarity and review responses for the three worksheets (*Worksheet 2c – Outage to Ignition Mapping*, *Worksheet 2e – Outage Mitigation Effectiveness*, and *Worksheet 5a – Mitigation Cost Inputs*). During these meetings the utilities requested additional time to prepare their worksheet results. Once Staff received the inputs, average results were updated for the three worksheets in the RSE workbook.

On September 5, 2025, the RSE workbook and Stakeholder presentation was filed to the docket.⁵

RSE Workbook and Guidelines

For stage one of the development of the RSE workbook Staff focused on how utilities establish the physical risks across their service territories by establishing an HFRZ model (section 1) and how the analysis of outage history can identify the unique risks experienced on circuits (section 2). This information in combination with the average outage probability of ignition occurrence, mitigation effectiveness, and cost is then calculated to establish a risk value and mitigation effectiveness for each circuit segment.

The RSE Workbook is currently broken into 6 sections. These sections are:

- **Section 1:** HFRZ Exposure Risk Modeling
- **Section 2:** Outage/Fault Ignition Risk
- **Section 3:** Asset Health Risk (to be developed in Stage 2)
- **Section 4:** Qualitative Risk Analysis (to be developed in Stage 2)
- **Risk Summary:** summarized the base risk from sections 1 – 4 and highlight the highest risk
- **Section 5:** Mitigation Cost
- **Section 6:** Risk Spent Efficiency

Within each section are several worksheets which evaluate the data for each section. The corresponding section for each of the worksheets is denoted with a number that is followed by a letter to distinguish the differing data and analysis that each section worksheet produces. Details about each worksheet are summarized below.

⁵ Docket No. UM 2340.

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- **RSE Workbook Overview** provides a general report overview, outlining each section, and the corresponding worksheets.
- **1a - Exposure Risk Model** provides electric utilities with a model diagram to outline data, processes and outputs used to develop the High Fire Risk Zone.
- **1b - Exposure Risk Data** provides a general outline of the underlying data that is being used to develop the HFRZ model. Data types include, but are not limited to, the underlying risk of the landscape, populations, weather, and fire spread scenario modeling.
- **1c - Exposure Risk Intermediate** complements worksheet 1b which summarizes the electric utilities results of any intermediate result outputs from modeled data sources note in worksheet 1b-Exposure Risk Data.
- **1d - Segment Exposure Results** provides the foundation for evaluating RSE by connecting the results from the HFRZs model to circuit segments⁶ identified by the electric utilities. Staff requested the utilities provide an HFRZ risk score for each circuit segment, as well as a statistical summary of the HFRZ model intersection results.
- **2a - Ignition Risk Grouping** provides a diagram for how the utility maps internal fault codes to the classification provided in the Data Templates⁷. The data is then subclassified into RSE Ignition Risk Grouping.
- **2b - Outage History** utilities report historical outages over a 12-month period by the Ignition Risk Groupings (as classified in worksheet 2a) and if the event occurred during fire season or non-fire season for each circuit segment defined in worksheet 1d. Utilities are also asked to report the number of PSPS events which occurred and the number outages that resulted in a sustained outage while the circuit segment was in sensitive settings.
- **2c - Outage to Ignition Mapping** outlines the probability of an outage becoming an ignition using the Ignition Risk Groupings during fire season and non-fire season⁸. These values are the basis for calculating base ignition risk and the ignition mitigation effectiveness for section 2. This worksheet does not require any utility data entry.

⁶ Staff believes the best approach to developing circuit segments is to use zones of protection. The zone of protection is the area or segment of an electrical power system usually distinguished by particular protective devices. The creation of circuit segments allows utilities to focus their risk analysis to tangible mitigation approaches addressing the distinct risk factors for a circuit segment as opposed to the entire circuit.

⁷ The risk event categories, types, and drivers within the table are aligned to IEEE 1782-2022 and were established in 2024 upon the development and approval of the Data Template Guidelines.

⁸ Current percent probability values are based on Staff ignition rank order, subject matter expertise, and utility provided historical results. As historical utility tracking of ignition events develops these probabilities will continue to be refined and updated.

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- **2d - Ignition risk** utilizes the circuit segment outage results from worksheet 2b and the percentage probability of an ignition occurrence by Ignition Risk Grouping from worksheet 2c to determine the probability of an ignition occurring on the circuit segment. The data calculated within the table establishes the base outage/fault ignition risk on each of the circuit segments. This worksheet does not require any utility data entry.
- **2e - Ignition Mitigation Effectiveness** defines the percent effectiveness of reducing an ignition for the mitigation option based on the Ignition Risk Grouping⁹. These values are the basis for calculating the ignition mitigation effectiveness in section 2. This worksheet does not require any utility data entry.
- **2f - Ignition Mitigation Reduction** utilizes ignition results from worksheet 2d and the percentage probability of mitigation effectiveness by Ignition Risk Grouping from worksheet 2e to determine the probability of an ignition occurring after mitigation on the circuit segment. The data calculated within the table produces the mitigation ignition risk reduction on each of the previously provided circuit segments. This worksheet does not require any utility data entry.
- **2g - Segment Ignition Reduction** summarizes the result of section 2. Circuit segments are ranked by highest HFRZ score with pre-mitigation risk with the post mitigation risk results for each of the mitigation types. Additionally, risk and reductions are broken into fire season, non-fire season, and annual results. This worksheet does not require any utility data entry.
- **3 - Asset Risk** to be developed.
- **4 - Qualitative Risk** to be developed.
- **Risk Summary** The risk summary worksheet compiles circuit segment pre-mitigated risk results from sections 1 – 4. This worksheet compiles all pre-mitigation risks to develop an aggregated risk score and rank. The intent is to highlight areas that have been designated with the highest ignition risk potential, therefore concentrating on mitigation efforts and investments where the need is greatest.
- **5a - Mitigation Cost Inputs** defines the average mitigation costs for capital and O&M for each mitigation type. The worksheet takes into account the lifetime of the mitigation and any capital interest rates or financing costs or depreciation rates and evaluates the any O&M savings from the mitigation.
- **5b – Circuit Mitigation Cost** utilizes the information provided in worksheets 1d, 2b, and 5a to calculate the average cost of each mitigation option per circuit segment. The worksheet calculates the total costs of the mitigation over its lifetime as well as the annual cost of the mitigation spread across the total lifetime. These calculations

⁹ Current values are based on an average of the mitigation effectiveness assessments and data analysis from Staff, the WMP Independent Evaluator, and the three Oregon Investor Owner Utilities. Staff will continue to evaluate and update effectiveness, using results provided by the industry of ignition event occurrences prior to and after the mitigation.

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are a high-level view of mitigation costs and will continue to be refined as RSE work continues.

- **6a - RSE Details** compiles all the relevant data to calculate the RSE values for each mitigation type
- **6b - RSE Summary** compiles the results of data from worksheet 6a and highlights the highest RSE results by circuit segment for long-term and short-term mitigation types

Stakeholder Comments

Comments from stakeholders were generally supportive of the proposed RSE approach and provided further suggestions on areas of interest, including co-benefits quantification. In addition, the Joint Utilities expressed the need for greater clarification and awareness of how this work will be used with WMPs. Staff heard those comments and developed a guidelines document to assist in the completion of the workbook. Further, Staff remains committed to the continued collaboration with the IOUs to mature this product and intends to organize additional meetings to ensure alignment.

Conclusion

The proposed RSE Workbook and Guidelines are the result of 12 meetings with the IOUs, extensive research, and development by Staff and the Independent Evaluator. The result will enable the Commission, Staff, and Stakeholders to better understand the work and investments from the IOUs. Using a data driven approach that complements the WMP written content will ensure that communities are better able to understand the utilities project selection and add clarity on rate payer cost recovery issues.

Staff acknowledges that utility efforts around reducing wildfire risk have advanced substantially over the last few years and also recognizes the need for further evolution and refinement in the future as the tracking and reporting of utility data improves.

Staff's proposed UM 2340 RSE Workbook Guidelines can be found in Attachment A and Staff's proposed UM 2340 RSE Workbook is provided in Attachment B.

PROPOSED COMMISSION MOTION:

Approve the following proposed WMP RSE Workbook and Guidelines and direct the utilities to use them in the 2026-2028 WMP review cycle.

Wildfire Mitigation Plan (WMP) – Risk Spend Efficiency (RSE) Workbook Guidelines

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Overview

This document is the Oregon Public Utility Commission’s (OPUC) Wildfire Mitigation Plan (WMP) Risk Spend Efficiency (RSE) Guidelines for electric utilities submitting the WMP RSE Workbook. This includes tabular wildfire mitigation data to support the OPUC review of compliance with ORS 757.963 and Oregon Administrative Rule (OAR) 860-300-0020(1)(b), OAR 860-300-0020(2) and OAR 860-300-0030.

These guidelines set forth the required standards, schemas, and schedule for the submission of WMP RSE Workbook. The OPUC will provide the WMP RSE Workbook to each investor-owned electric utility (IOU), and new workbooks will be made available if future changes to these guidelines are made.

The implementation of the guidelines will not direct specific outcomes and is not a substitute for a utility’s judgement. Instead, the guidelines provide a shared framework for discussion and a method for comparison of risks and mitigations across utilities. Additionally, the proposed guidelines do not alleviate the utility from the requirement to demonstrate prudence of their investments for cost recovery.

Submission Details

The WMP RSE Workbook shall be submitted on December 31 each year.¹ The submission shall contain data results relevant to the reporting period year.

Submission Naming Convention

When submitting the WMP RSE Workbook, the file name shall include the filing year, utility abbreviation shown in Table 1.

Table 1 RSE Workbook File Submission Name

Electric Company	RSE File Name
PacifiCorp	YYYY_PAC_WMP_RSE_Workbook.xlsx
Portland General Electric	YYYY_PGE_WMP_RSE_Workbook.xlsx
Idaho Power Company	YYYY_IPC_WMP_RSE_Workbook.xlsx

¹ OAR 860-300-0020(2).

Designation of Confidential Information

An electric company may request a confidential designation consistent with Ch. 860 Division 1 of the Oregon Administrative Rules. Any confidential information should be identified at the same time the data is submitted. Designation of confidential information should clearly note the cells, files, or schema containing confidential information. A designation of confidentiality should be provided at the most granular level possible. In other words, an electric company should not broadly designate a worksheet as confidential if only portions of the worksheet meet the requirements of Division 1.

Filing Errata, Revisions, and Versions

If revision of a WMP RSE Workbook submission is needed, an electric company shall incorporate the revisions into its WMP RSE Workbook and resubmit the workbook in its entirety with other fields unchanged.

When a data submission includes revisions to previously submitted data, the electric company must provide a cover letter containing the following information for each record being revised:

- Description
- Explanation for each revision
- Table name and cell reference

All data submissions, including errata or revisions, must comply with guidelines when the submission is made.

Completing the WMP RSE Workbook

Within each worksheet, where appropriate, fields contain specific values identified, pre-populated, calculated or requiring electric utility completion. Please use these to guide your submittals.

Requirements for Data

The data submitted by an electric utility shall comply with each of the following requirements:

- **Completeness:** The electric utility shall report data sources, model outputs, results, and performance on each worksheet of the WMP RSE Workbook where applicable except where a section pertaining to a given worksheet is a calculated field or specifies otherwise.
- **Comparability:** For fields where acceptable values are defined, an electric utility shall adhere to the acceptable values provided in these guidelines. Do not add any extraneous characters or white spaces.
- **Empty:** Data which are “zero,” “missing,” or “not applicable” must be filled in as “0”.
- **Internal Consistency:** The RSE data submitted by the electric company should be internally consistent with any geospatial data submitted by the electric company.
- **Circuit Segment:** The zone of protection is the area or segment of an electrical power system usually distinguished by particular protective devices. The creation of circuit

segments allows utilities to focus their risk analysis on tangible mitigation approaches addressing the distinct risk factors for a circuit segment as opposed to the entire circuit.

- Fire Season Start Date²: Electric utility specified reporting period date for the start of fire season for the circuit segment.
- Fire Season End Date: Electric utility specified reporting period date for the end of fire season for the circuit segment.

OPUC may reject data submissions that do not comply with the above requirements or the required schema and direct an electric company to file corrected data or a resubmission.

Risk Spend Efficiency Model Framework

The RSE Workbook is currently in development. Stage one of the RSE workbook is focused on how utilities establish the environmental risks across their service territories through the development of an HFRZ model (section 1) and how the analysis of outage history can identify the unique risks experienced on circuits (section 2). This information— in combination with the conditional probability of an ignition given that an outage has occurred, mitigation effectiveness, and cost—is then calculated to establish risk value and mitigation effectiveness for circuit segments. Table 2 below outlines the focused sections within the RSE framework.

² To the extent that the utility has differing fire season start and end dates they can accommodate that variation by associating the appropriate dates to each geographic areas they have identified in their Plans and coversheet of the data template. These designations and the start and end dates shall be consistent throughout all WMP reporting elements for the reporting year. For instance, if one HFRZ geographic designated area's fire season was initiated on May 15 and terminated on October 10, yet another HFRZ area began on June 1 and terminated on October 20, such shall be noted. If the operator, however, identifies one system-wide start and end date they can so note that it is associated with all HFRZ areas.

Table 2 RSE Section Details and Development Status

Section	Summary	Status
Section 1: HFRZ Exposure Risk Modeling	Outlines the utilities environmental HFRZ exposure risk and applies the data to circuit segments	Developed
Section 2: Outage/Fault Ignition Risk	Tabulates historical outage/fault history for each circuit segment by risk driver. Determines the conditional probability of an ignition given an outage has occurred. Outlines mitigation effectiveness based on Ignition Risk Grouping categories. Applies these results to historical outage events by circuit segment to determine ignition risk prior to and post mitigation	Developed
Section 3: Asset Health Risk	Reviews the type and age of equipment to measure ignition risk prior to and post mitigation for the circuit segment.	To be developed
Section 4: Qualitative Risk Analysis	Additional utility assessment of risk based on utility defined and measured qualitative analysis of the circuit segment. Allows the utility to note completed mitigation work for a circuit segment with little to no post mitigation outage data.	To be developed
Risk Summary: Base Risk Summary	Summarizes the base risk from section 1-4 highlighting areas with the high risk.	Developed
Section 5: Mitigation Cost	Uses average cost per mitigation type to determine the lifetime cost of the mitigation and annual cost of the mitigation over its lifetime.	Developed
Section 6: Risk Spend Efficiency	Calculates risk prior to and post mitigation and the annual cost of the mitigation to develop RSE values for each mitigation type by circuit segment.	Developed
Section 7: Co-Benefits	Measures key co-benefits of wildfire mitigation measures such as reliability impacts.	To be developed

Figure 1 below outlines the framework of information used to evaluate the various mitigation options. Figure 2 shows the elements and calculation used for the RSE. Note the annual mitigation effectiveness and mitigation costs are calculated for the lifetime of the mitigation, to assess the cost spread, including financing costs and depreciation rates, and then divided by lifetime of the mitigation to evaluate the annual risk reductions to the annual cost of the mitigation.

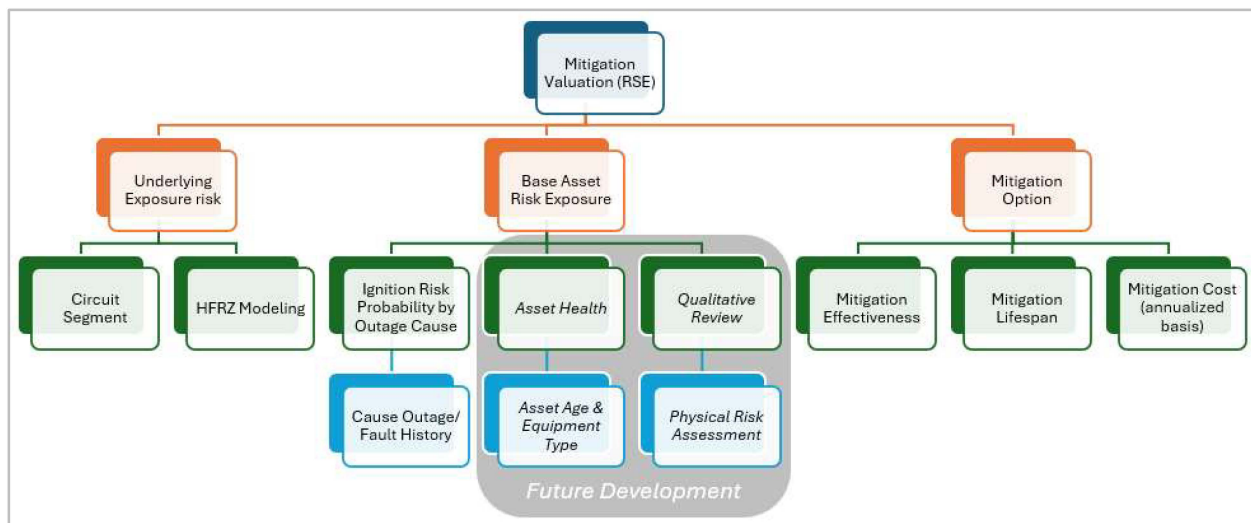


Figure 1 RSE Framework

$$\text{Mitigation Valuation (RSE)} = \frac{\text{Underlying Environmental Exposure Risk} \times \left[\text{Annual Risk Pre-Mitigation} - \text{Annual Risk Post-Mitigation} \right]}{\text{Annual Mitigation Cost}}$$

Figure 2 RSE Calculation

1 HFRZ Exposure Risk Modeling

The HFRZ Exposure Risk Model models ignition and fire spread risk within the electric utilities’ service territory (regardless of where the electric utility equipment currently exists) and a reasonable distance from the utility’s generation or transmission assets.³ Examples of data types included in the model could include, terrain, landscape, vegetation types (also known as fuels), populations, weather history and modeled scenarios, and historical fire spread scenarios. The modeled analysis is performed exclusive of the location and existence of electrical equipment. This ensures that risk is identified if electrical services are expanded into new areas within the utilities service territory. Once the analysis of the base environmental exposure model is produced the electric utilities determine threshold values within the modeled results to define the High Fire Risk Zone (HFRZ).

³ OAR 860-300-0020 (A)(B).

As a final step in this section of the RSE workbook electric utilities are asked to overlay existing circuit segments onto the modeled environmental exposure risk assessment results to develop a circuit segment risk score.

1.a Exposure Risk Model

Worksheet 1a Exposure Risk Model provides electric utilities with a model diagram to outline data, processes, and outputs used to develop the High Fire Risk Zone.

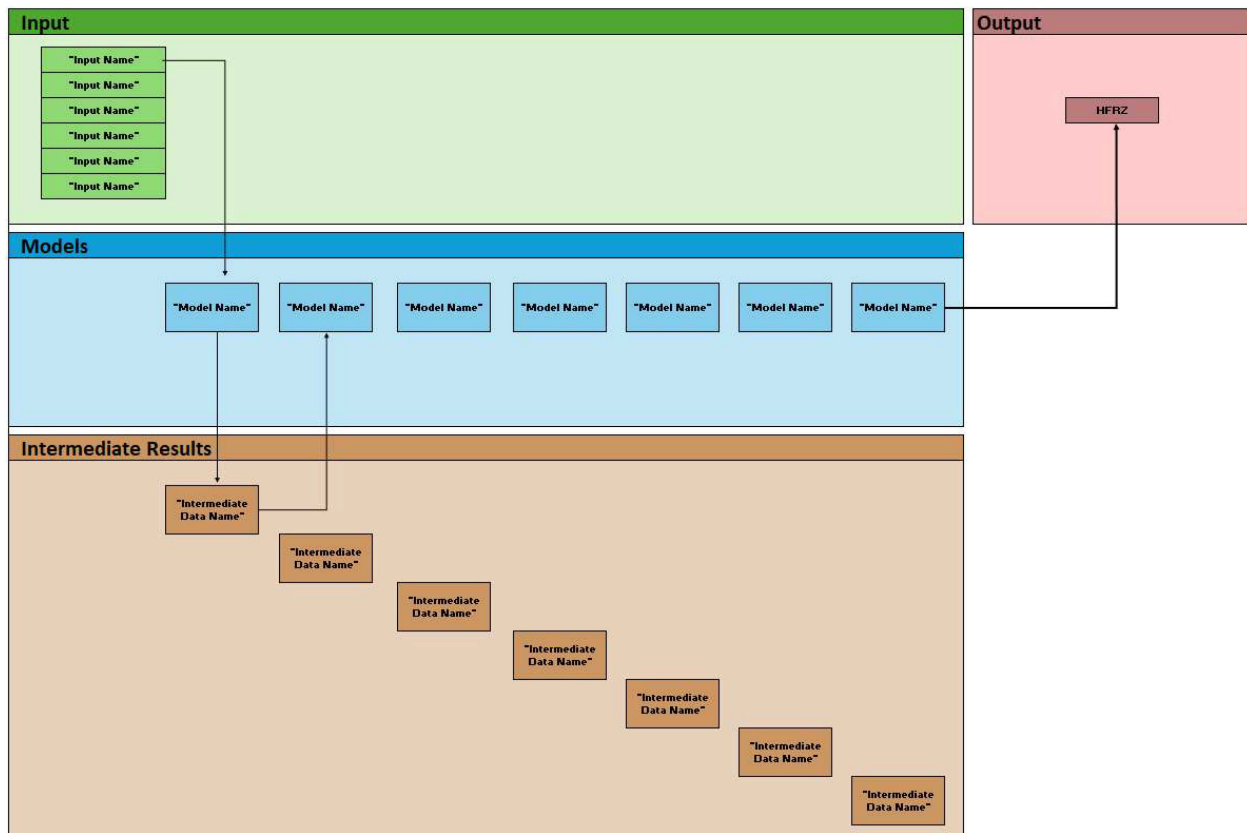


Figure 3: Exposure Risk Model Diagram

Input

The input section of the exposure risk model diagram provides a location for the electric utilities to list and/or categorize the type of data source used in the HFRZ models to determine the areas of fire risk. Detailed information about each input shall be provided in worksheet 1b-Exposure Risk Data. Connection arrows should be used to map the connecting datasets to the modeled analysis.

Models

The model section of the exposure risk model diagram provides a location for electric utilities to outline how the data inputs feed into each model. Examples of these model stages previously provided by the electric utilities include the fire growth models, ignition potential index, risk

associated with ignition locations, and wildfire threat index. Detailed model data inputs and outputs can be in worksheet 1b-Exposure Risk Data. Additionally, any intermediate output from the models shall be included in worksheet 1c-Exposure Risk Intermediate. Connection arrows should be used to show how datasets, models, and intermediate results connect.

Intermediate Results

The intermediate results section of the exposure risk model diagram outlines a location for electric utilities to provide the results of any modeled analysis from the input datasets. Additionally, intermediate results may also feedback into models producing additional intermediate results or the HFRZ output. Detailed information about each intermediate result and the connecting model shall be provided in worksheet 1c-Exposure Risk Intermediate. Connection arrows should be used to show how models and intermediate results connect.

Output

The output section of the exposure risk model diagram shall indicate the final datasets and models used to develop the High Fire Risk Zones (HFRZ) for each of the electric utilities. Connection arrows should be used to show how the exposure elements combine to develop the HRFZ.

1.b Exposure Risk Data

Within the RSE workbook the IOUs shall provide detailed information on the datasets and transformations used to develop their fire risk models. The “Exposure Risk Data” worksheet is used to provide a general outline of the underlying data that is being used to develop the HFRZ model. The table is broken into the Field Name, Field Descriptions, and Field Entry Value Type Constraints. These details provide a general outline of the underlying data that is being used to develop the HFRZ model. Data types include, but are not limited to, the underlying risk of the landscape, populations, weather, and fire spread scenario modeling. These items can be grouped as an input category with data specific details outline in the Utility Input File Name or Data Source Name. The data table shall not include any blanks for rows where data is added. If a metric is not applicable or unknown enter this into the results column and provide a comment if needed. If additional details are provided within the utilities Wildfire Mitigation Plan provide a note in the comment.

Field Name	Field Description	Field Value Constraints
Input Category <i>(utility provided)</i>	Provide the utilities category name for the data inputs. Input categories shall be listed in worksheet 1a-Exposure Risk Model. For example, Vegetation, Terrain, Weather, Population, ...	Text
Utility Input File Name <i>(utility provided)</i>	Provide the utilities file name.	Text
Model <i>(utility provided)</i>	Provide the name of the electric utilities model that the dataset feeds into. If the dataset feeds into more than one model, create an entry row	Text

Field Name	Field Description	Field Value Constraints
	for each model input. All model names shall be listed in worksheet 1a-Exposure Risk Model.	
Intermediate Results Output A <i>(utility provided)</i>	Provide the electric utilities file name for the intermediate dataset output. All intermediate result outputs shall be listed in worksheet 1a-Exposure Risk Model. Details for the intermediate results output shall be provided in worksheet 1c-Exposure Risk Intermediate.	Text
Intermediate Results Output B <i>(utility provided)</i>	If the model produces a secondary intermediate dataset, provide the electric utilities file output name. All intermediate result outputs shall be listed in worksheet 1a-Exposure Risk Model. Details for the intermediate results output shall be provided in worksheet 1c-Exposure Risk Intermediate.	Text
Intermediate Results Output C <i>(utility provided)</i>	If the model produces a third intermediate dataset, provide the electric utilities file output name. All intermediate result outputs shall be listed in worksheet 1a-Exposure Risk Model. Details for the intermediate results output shall be provided in worksheet 1c-Exposure Risk Intermediate.	Text
Data Source Type (Internal, External, or Intermediate) <i>(utility provided)</i>	What is the source of the data. For example, internal, external, or intermediate. If external, provide the data source.	Text
Data Source Name <i>(utility provided)</i>	What is the name of the source file.	Text
Data Spatial Resolution <i>(utility provided)</i>	If applicable provide the spatial resolution of the dataset. For example, 1 meter, 30 meter, and point, line, or polygon...	Text
Data Temporal Resolution <i>(utility provided)</i>	If applicable provide the temporal (frequency at which data is collected) resolution of the dataset. For example, daily, annually, biannually, ...	Text
Data Vintage <i>(utility provided)</i>	What date was the file created or updated. For example, for a model run in 2025 the data is updated through 2023.	Text
Data Field Used <i>(utility provided)</i>	Within the dataset what data field attributes were used in the analysis. For example, wind speed, aspect, conifer, ...	Text
What transformations are applied to the data (for example, are percentiles or thresholds used to segment the data?) <i>(utility provided)</i>	Designate any transformation used to analyze and process the data. Examples include how the data was grouped into risk categories, were percentiles used, was data above a threshold used...	Text

Field Name	Field Description	Field Value Constraints
Comments <i>(utility provided)</i>	Provide any additional comments	Text

1.c Exposure Risk Intermediate

Worksheet 1c is a complement to worksheet 1b. Worksheet 1c summarizes intermediate outputs from modeled source data. Intermediate result output names should match those provided in workbook 1b-Exposure Risk Data. Provide information for any accompanying model, the data resolution, the attribute utilized within the data set, and how the data is transformed to inform greater ignition and fire spread.

Field Name	Field Description	Field Value Constraints
Intermediate Results Output <i>(utility provided)</i>	Provide the electric utilities file name of the intermediate dataset output. All intermediate result outputs shall be listed in worksheet 1a-Exposure Risk Model and 1b-Exposure Risk Data.	Text
Model <i>(utility provided)</i>	Provide the name of the electric utility model that the intermediate dataset feeds into. If the dataset feeds into more than one model create an entry row for each model input. All model names shall be listed in worksheet 1a-Exposure Risk Model. <i>Note: worksheet 1b-Exposure Risk Data provides the model which produced the intermediate result output.</i>	Text
Data Spatial Resolution <i>(utility provided)</i>	If applicable provide the spatial resolution of the dataset. For example, 1 meter, 30 meter, ...	Text
Data Field Used <i>(utility provided)</i>	Within the dataset what data field attributes were used in the analysis. For example, wind speed, aspect, tree species, ...	Text
What transformations are applied to the data (for example, are percentiles or thresholds used to segment the data?) <i>(utility provided)</i>	Designate any transformation used to analyze and process the data. Examples include how the data was grouped into risk categories, were percentiles used, was data above a threshold used...	Text
Comments <i>(utility provided)</i>	Provide any additional comments	Text

1.d Segment Exposure Results

Worksheet 1d, Segment Exposure Results, provides the foundation for evaluating RSE by utilizing the results from the HFRZ model to outline the underlying risk of the landscape, weather, fire spread scenario modeling and other risk factors used in the HFRZ model. As a starting point for

evaluating risks, Staff requests that the electric utilities identify circuit segments which will be used throughout the RSE workbook. Staff believe the best approach to developing circuit segments is to request this be done using zones of protection. The zone of protection is the area or segment of an electrical power system usually distinguished by particular protective devices. By creating circuit segments, utilities are able to focus their risk analysis to develop tangible and specific mitigation approaches to address the distinct risk factors for the circuit segment.

Electric utilities shall include details around each circuit segment, these include the utilities' circuit id, circuit segment number, the utilities' facility point ID for the start and end points of the circuit segment, the operating area, total circuit segment miles, total circuit segment miles within the HFRZ, and the current HFRZ geographic designation name (if applicable). Additionally, Staff requests the utilities provide an Exposure Risk Score⁴ for each circuit segment, as well as the accompanying statistical results of the intersection of the overlapping circuit to the base HRFZ modeled results for the service area. The HFRZ statistical results for each circuit segment include the number of observations (or cells the asset intersects), the mean, median, min, max, and standard deviation. The figure below is an illustrative example of overlaying the utility assets onto the results of the risk model.

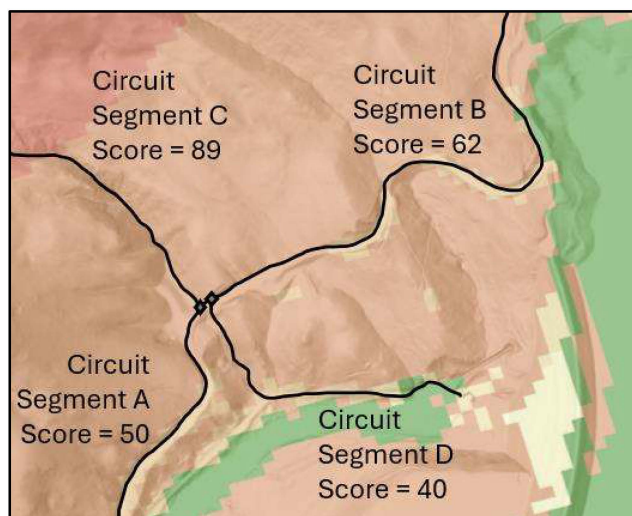


Figure 4: Illustrative example of utility assets overlaid on the risk model

⁴ Exposure Risk Score is a utility provided value assigned to all circuit segments regardless of whether segment overlaps with a utility defined HFRZ boundary. The value for the circuit segment is developed using the output of the HFRZ model created within the electric utilities' service territory (regardless of where the electric utility equipment currently exists) and a reasonable distance from the utility's generation or transmission assets. This term may be further modified in the future as other risks are incorporated into the framework.

Field Name	Field Description	Field Value Constraints
Circuit Segment ID <i>(post-populated with circuit ID and circuit segment/ZOP id)</i>	Field concatenates the electric utility provided Circuit (Utility Circuit ID) and Circuit Segment/ZOP. This ID is used throughout the report.	Text
Circuit (Utility Circuit ID) <i>(utility provided)</i>	The electric utilities' circuit id. These values should stay consisted for year-over-year reporting, unless a new circuit is created.	Text
Circuit Segment/ZOP ID <i>(utility provided)</i>	The electric utilities' circuit segment ID based on the protective devices that make up the zone of protection. These values should stay consisted for year-over-year reporting, unless a new circuit or circuit segment was created as a result of the installation for a new protective device.	Text or numeric
Start Segment Facility Point <i>(utility provided)</i>	The electric utilities' facility point ID for the protective device at the start of the segment. This could include the substations circuit breaker. These values should stay consisted for year-over-year reporting, unless a new circuit or circuit segment was created due to the installation for a new protective device. In sequencing segment IDs the facility point for the end of one segment will be the start for the next segment.	Text
End Segment Facility Point <i>(utility provided)</i>	The electric utilities' facility point ID for the protective device at the end of the segment. These values should stay consisted for year-over-year reporting, unless a new circuit or circuit segment was created due to the installation for a new protective device. In sequencing segment IDs the facility point for the end of one segment will be the start for the next segment.	Text
Operating Area <i>(utility provided)</i>	The operating area for the circuit segment.	Text
Total Segment Miles <i>(utility provided)</i>	The total miles for the circuit segment.	Numeric
Segment % in HFRZ <i>(utility provided)</i>	If the circuit overlaps with the utilities' defined HFRZ boundary provide the circuit miles within the HFRZ.	Numeric
Current HFRZ Geographic Designation Name <i>(utility provided)</i>	If the circuit is within an HFRZ provide the electric utilities' HFRZ Geographic Designation Name.	Text
Exposure Risk Score <i>(utility provided)</i>	The electric utilities' exposure risk score for the circuit segment based on the HFRZ model.	Numeric
Exposure Risk Score Rank <i>(post-populated after the utility enters the exposure risk score)</i>	Field automatically calculates the ranking after the electric utility has provided its circuit segment exposure risk score.	Numeric
Number of observations (N) <i>(utility provided)</i>	The total number of observations or cells that the circuit segment intersects with when overlaid on the HFRZ modeled results. Should a utility use a buffer around the circuit segment provide the total number of cell observations used in determining the exposure risk score.	Numeric

Field Name	Field Description	Field Value Constraints
Mean Exposure Risk Score <i>(utility provided)</i>	Provide the mean value using the results of the observed overlapping cells between the circuit segment and HFRZ modeled results. This applies to all areas regardless of the utilities HFRZ boundary.	Numeric
Min Exposure Risk Score <i>(utility provided)</i>	Provide the minimum value using the results of the observed overlapping cells between the circuit segment and HFRZ modeled results. This applies to all areas regardless of the utilities HFRZ boundary.	Numeric
Max Exposure Risk Score <i>(utility provided)</i>	Provide the maximum value using the results for the observed overlapping cells between the circuit segment and HFRZ modeled results. This applies to all areas regardless of the utilities HFRZ boundary.	Numeric
Standard Deviation Exposure Risk Score <i>(utility provided)</i>	Provide the standard deviation using the results of the observed overlapping cells between the circuit segment and HFRZ modeled results. This applies to all areas regardless of the utilities HFRZ boundary.	Numeric
Comment <i>(utility provided)</i>	Provide any additional comments	Text

2 Outage/Fault Ignition Risk

This section evaluates the historical risk for circuit segments based on outage fault records. In this section electric utilities outline how they align internal outage categories and subcategories to the Staffs Ignition Risk Groupings based on the risk event types and drivers outline the Data Template Guidelines. Utilities collect historical outage records based on the Ignition Risk Groupings and if the event occurred during fire season or non-fire season. Outage data is analyzed based on the probability for the outage to create an ignition.

Further, this section evaluates an initial set of mitigation options and the effectiveness of each mitigation at reducing ignitions associated with each ignition risk grouping. The results are then calculated to determine the pre and post mitigation ignition risks based on the ignition risk grouping. The results are then compiled in Risk Summary, which normalizes and summarizes each circuit's risk, and Section 6 where the RSE calculations are completed.

2.a Ignition Risk Grouping

Table 2a maps the association of the utilities' internal outage fault codes to the OPUC classification. The risk event categories, types, and drivers⁵ within the table are aligned to IEEE 1782-2022 and were established in 2024 upon the development and approval of the Data Template Guidelines. The data is then subclassified into RSE Ignition Risk Grouping. These subcategories are aimed at balancing event types with the enhanced detail of equipment risk event drivers. Classifying outage fault data and ignition event data using the same structure allows for constancy in the correlation between the two metrics.

Note: If a utility does not track the specific grouping for equipment related outages they shall default to the "equipment degradation" sub-driver. Equipment failures due to extreme weather shall default to the "equipment environmental" sub-driver. If there is a case where, after best efforts are made, a company's internal outage cause cannot be aligned to a specific risk event or category then include the results in "Other/Other".

Field Name	Field Description	Field Value Constraints
Risk Event Category <i>(pre-defined)</i>	Overview categorization of the adverse effects from a hazard considering the consequences and frequency of the hazard occurring for the input metric. Data is either considered a wire down event (which did not result in an unplanned outage but may cause the electric utility to voluntarily de-energize) or an unplanned outage (an event in which asset protection system responded causing an unplanned outage).	Text
Risk / Ignition Event Type (IEEE 1782-2022 - Category) <i>(pre-defined)</i>	Outage/ignition event risk classification type for reporting. (aligned to IEEE 1782-2022)	Text
Ignition Risk Event Driver (IEEE 1782-2022 - Subcategory) <i>(pre-defined)</i>	Outage/ignition event driver subclassifications for reporting.	Text
RSE Ignition Risk Grouping <i>(pre-defined)</i>	Risk Spend Efficiency ignition risk groupings <ul style="list-style-type: none"> - Contamination - Equipment Deteriorating/Failure⁶ - Equipment Error (failure operated unexpectedly) 	Text

⁵ Aligned to IEEE 1782-2022 and were established in 2024 upon the development of the and approval of the Data Template Guidelines.

⁶ **Equipment:** If the utility is currently unable to differentiate the risk event sub-driver for equipment they shall default to the equipment degradation sub-driver.

Field Name	Field Description	Field Value Constraints
	<ul style="list-style-type: none"> - Equipment Environmental (failure to operate as designed) ⁷ - Equipment Other - Lightning - Public Contact - Vegetation Contact - Wildlife Contact - Wire-to-Wire Contact - Other - Unknown 	
Utility Risk Category (Cause Category) <i>(utility provided)</i>	Utility aligned cause/ignition risk category that corresponds to the IEEE/OPUC.	Text
Utility Risk Subcategory (Cause Subcategory) <i>(utility provided)</i>	Utility aligned cause/ignition risk subcategory that corresponds to the IEEE/OPUC.	Text
Does the Utility Consider the Risk Driver in its Ignition Risk Models(s)? (Y/N) <i>(utility provided)</i>	Indicate yes or no if the Utility Risk Subcategory (Cause Subcategory) is modeled as an ignition risk.	Text (Y/N)
Comment <i>(utility provided)</i>	Provide any additional comments	Text

2.b Outage History

In worksheet 2b, Outage History, utilities report historical outages⁸ by the Ignition Risk Groupings (as classified in worksheet 2a) and if the event occurred during fire season or non-fire season for each circuit segment defined in worksheet 1d. In addition, utilities report the number of PSPS events which occurred and the number outages that resulted in a sustained outage while the circuit segment was in sensitive settings. This information is also segmented by fire season and non-fire season. Note: that the sensitive setting counts are not to be considered the cause of the outage (which should be tracked by Ignition Risk Grouping) but rather the number of sustained outages on the circuit segment which occurred when sensitive settings were enabled.

⁷ Extreme Weather Outages: Equipment outages which are the result of a non-lightning weather condition should be tracked under the Equipment Category with the subcategory of Environmental-Structural Elements, Environmental-Line Element, Environmental-Protective/Control Device, Environmental-Voltage Control, Environmental-Other, or Environmental-Unknown.

⁸ Utilities should provide outage history for as many years as they can accurately provide. Results shall include a full years' worth of outage history.

Field Name	Field Description	Field Value Constraints
Circuit Segment ID <i>(utility defined reference)</i>	Concatenated from the electric utility provided Circuit ID and Circuit Segment/ZOP entry from worksheet 1d-Segment Exposure Results.	Text
Total Segment Miles <i>(utility defined reference)</i>	Utility provided Circuit Segment/ZOP miles from worksheet 1d-Segment Exposure Results.	Numeric
Average Annual Fire Season Outages <i>(calculated)</i>	The average annual outage occurrence on the circuit segment during fire season. <i>Calculation: Fire Season Total Outages divided the Number of Years of provided data</i>	Numeric
Rank Annual Fire Season Outages <i>(calculated)</i>	Ranking of the Average Annual Fire Season Outages for all circuit segments. The lower the rank the higher the risk of ignition. <i>Calculation: excel rank formula</i>	Numeric
Average Annual Non-Fire Season Outages <i>(calculated)</i>	The average annual outage occurrence on the circuit segment during non-fire season. <i>Calculation: Fire Season Total Outages divided the Number of Years of provided data</i>	Numeric
Rank Annual Non-Fire Season Outages <i>(calculated)</i>	Ranking of the Average Annual Non-Fire Season Outages for all circuit segments. The lower the rank the higher the risk of ignition. <i>Calculation: excel rank formula</i>	Numeric
Historical period (YYYY-YYYY) <i>(utility provided)</i>	Range of years used for the provided outage data	Years
Number of Years <i>(utility provided)</i>	Utility provided number of years for the outage data provided	Numeric
Total Outages <i>(calculated)</i>	Total outage events for the number of years of data provided. <i>Calculation: Sum of all probable Ignition Risk Events</i>	Numeric
Fire Season Total Outages <i>(calculated)</i>	Total number of outage events during fire season over the number of years of data provided. <i>Calculation: Sum of fire season outages</i>	Numeric
Non-Fire Season Total Outages <i>(calculated)</i>	Total number of outage events during non-fire season over the number of years of data provided. <i>Calculation: Sum of non-fire season outages</i>	Numeric
Fire Season: Outages by Ignition Risk Grouping <i>(utility provided)</i>	Utility provided fire season outage occurrences during the Historical Period by Ignition Risk Groupings. <ul style="list-style-type: none"> - Contamination - Equipment Deteriorating/Failure - Equipment Error - Equipment Environmental - Equipment Other - Lightning - Public Contact - Vegetation Contact - Wildlife Contact - Wire-to-Wire Contact 	Numeric

Field Name	Field Description	Field Value Constraints
	<ul style="list-style-type: none"> - Other - Unknown 	
Fire Season: Sensitive setting outages (sustained events) <i>(utility provided)</i>	The number sustained outages during fire season while the circuit segment was in sensitive settings. <i>Note: that the sensitive setting counts are not to be considered the cause of the outage.</i>	Numeric
Fire Season: PSPS <i>(utility provided)</i>	The number of fire season PSPS events for the circuit segment.	Numeric
Non-Fire Season: Outages by Ignition Risk Grouping <i>(utility provided)</i>	Utility provided non-fire season outage occurrences during the Historical Period by Ignition Risk Groupings. <ul style="list-style-type: none"> - Contamination - Equipment Deteriorating/Failure - Equipment Error - Equipment Environmental - Equipment Other - Lightning - Public Contact - Vegetation Contact - Wildlife Contact - Wire-to-Wire Contact - Other - Unknown 	Numeric
Non-Fire Season: Sensitive setting outages (sustained events) <i>(utility provided)</i>	The number sustained outages during non-fire season while the circuit segment was in sensitive settings. <i>Note: that the sensitive setting counts are not to be considered the cause of the outage.</i>	Numeric
Non-Fire Season: PSPS <i>(utility provided)</i>	The number of non-fire season PSPS events for the circuit segment.	Numeric

2.c Outage to Ignition Mapping

Worksheet 2c, Outage to Ignition Mapping, outlines the conditional probability of an ignition, given an outage has occurred, by ignition risk groups during non-fire season and fire season. Current percent probability values are based on Staff ignition rank order, subject matter expertise, and utility provided historical results. As historical utility tracking of ignition events develops, these probabilities will continue to be refined and updated based on best available data. These values are the basis for calculating base ignition risk and the ignition mitigation effectiveness for section 2 of the RSE Workbook (Outage/Fault Ignition Risk).

Field Name	Field Description	Field Value Constraints
Ignition Risk Groupings <i>(pre-defined)</i>	Ignition Risk Groupings: <ul style="list-style-type: none"> - Contamination - Equipment Deteriorating/Failure - Equipment Error 	Text

Field Name	Field Description	Field Value Constraints
	<ul style="list-style-type: none"> - Equipment Environmental - Equipment Other - Lightning - Public Contact - Vegetation Contact - Wildlife Contact - Wire-to-Wire Contact - Other - Unknown 	
Fire Season Outages <i>(calculated from utility entry)</i>	The calculated number of outages during fire season from worksheet 2a.	Numeric
Non-Fire Season Outages <i>(calculated from utility entry)</i>	The calculated number of outages during non-fire season from worksheet 2a.	Numeric
Probability of Fire Season Outage --> Ignition <i>(pre-defined)</i>	The percentage probability of an ignition given an outage has occurred during fire season by Ignition Risk Groupings ⁶	Percentage
Probability of Non-Fire Season Outage --> Ignition <i>(pre-defined)</i>	The percentage probability of an ignition given an outage has occurred during non-fire season by Ignition Risk Groupings ⁶	Percentage
Approximate Fire Season Ignition Events <i>(calculated from utility entry)</i>	The approximate number of ignition events based on the number of outages during fire season. <i>Calculation: Total Fire Season Outages multiplied by the Probability of Fire Season Outages --> Ignition.</i>	Numeric
Approximate Non-Fire Season Ignition Events <i>(calculated from utility entry)</i>	The approximate number of ignition events based on the number of outages during non-fire season. <i>Calculation: Total Non-Fire Season Outages multiplied by the Probability of Non-Fire Season Outages --> Ignition.</i>	Numeric
Share of Fire Season Outages <i>(calculated from utility entry)</i>	The share of total outages based on the number of Ignition Risk Grouping outages during fire season. <i>Calculation: Total Fire Season Outages by Ignition Risk Groupings divided by the total number of Fire Season Outages.</i>	Percentage
Share of Fire Season Ignitions <i>(calculated from utility entry)</i>	The share of total ignitions based on the approximate number of ignitions by Ignition Risk Grouping ignitions during fire season. <i>Calculation: Total approximate Fire Season ignitions by Ignition Risk Groupings divided by the total approximate number of Fire Season ignitions.</i>	Percentage
Share of Non-Fire Season Outages <i>(calculated from utility entry)</i>	The share of total outages based on Ignition Risk Grouping during non-fire season. <i>Calculation: Total Non-Fire Season Outages by Ignition Risk Groupings divided by the total number of Non-Fire Season Outages.</i>	Percentage
Share of Non-Fire Season Ignitions <i>(calculated from utility entry)</i>	The share of total ignitions based on the approximate number of ignitions by Ignition Risk Grouping ignitions during non-fire season. <i>Calculation: Total approximate Non-Fire Season ignitions by Ignition Risk Groupings divided by the total approximate number of Non-Fire Season ignitions.</i>	Percentage

2.d Ignition Risk

Worksheet 2d Ignition Risk, utilizes the circuit segment outage results from worksheet 2b and the conditional probability of an ignition given an outage has occurred by Ignition Risk Grouping from worksheet 2c. As a result, this worksheet requires no utility data entry. The data calculated within the table establishes the base outage/fault ignition risk on each of the previous provided circuit segments.

Field Name	Field Description	Field Value Constraints
Circuit Segment ID <i>(utility defined reference)</i>	Concatenated from the electric utility provided Circuit ID and Circuit Segment/ZOP entry from worksheet 1d-Segment Exposure Results.	Text
Total Segment Miles <i>(utility defined reference)</i>	Utility provided Circuit Segment/ZOP miles from worksheet 1d-Segment Exposure Results.	Numeric
Average Annual Fire Season Ignition Risk Events <i>(calculated)</i>	Average annual ignitions on the circuit segment during fire season. <i>Calculation: Fire Season Total Ignition Risk divided Number of Years of provided data</i>	Numeric
Rank Fire Season Ignition Risk Events <i>(calculated)</i>	Ranking of the Average Annual Fire Season Ignition Risk Events for all circuit segments. The lower the rank the higher the risk of ignition. <i>Calculation: excel rank formula</i>	Numeric
Annual Average Non-Fire Season Ignition Risk Events <i>(calculated)</i>	Average annual ignitions on the circuit segment during non-fire season. <i>Calculation: Non-Fire Season Total Ignition Risk Events divided Number of Years of provided data</i>	Numeric
Rank Non-Fire Season Ignition Risk Event Drivers <i>(calculated)</i>	Ranking of the Average Annual Non-Fire Season Ignition Risk Events for all circuit segments. The lower the rank the higher the risk of ignition. <i>Calculation: excel rank formula</i>	Numeric
Number of Years <i>(utility defined reference)</i>	Utility provided number of years for the outage data from worksheet 2b-Outage History	Numeric
Total Ignition Risk Events <i>(calculated)</i>	Total expected ignition events over the number of years of provided outage data. <i>Calculation: Sum of all probable Ignition Risk Events</i>	Numeric
Fire Season Total Ignition Risk Events <i>(calculated)</i>	Total expected ignition events during fire season over the number of years of provided outage data. <i>Calculation: Sum of fire season probable Ignition Risk Events</i>	Numeric
Non-Fire Season Total Ignition Risk Events <i>(calculated)</i>	Total expected ignition events during non-fire season over the number of years of provided outage data. <i>Calculation: Sum of non-fire season probable Ignition Risk Events</i>	Numeric
Fire Season: Ignitions by Ignition Risk Grouping <i>(calculated)</i>	Expected ignition events during fire season over the number of years provided by Ignition Risk Groupings. - Contamination	Numeric

Field Name	Field Description	Field Value Constraints
	<ul style="list-style-type: none"> - Equipment Deteriorating/Failure - Equipment Error - Equipment Environmental - Equipment Other - Lightning - Public Contact - Vegetation Contact - Wildlife Contact - Wire-to-Wire Contact - Other - Unknown <p><i>Calculation: number of fire season outages provided by the utility (in worksheet 2b-Outage History) divided Probability of Fire Season Outage --> Ignition (from worksheet 2c-Outage to ignition mapping).</i></p>	
<p>Non-Fire Season: Ignition by Ignition Risk Grouping <i>(calculated)</i></p>	<p>Expected ignition events during non-fire season over the number of years of provided data by Ignition Risk Groupings.</p> <ul style="list-style-type: none"> - Contamination - Equipment Deteriorating/Failure - Equipment Error - Equipment Environmental - Equipment Other - Lightning - Public Contact - Vegetation Contact - Wildlife Contact - Wire-to-Wire Contact - Other - Unknown <p><i>Calculation: number of non-fire season outages provided by the utility (in worksheet 2b-Outage History) divided Probability of Non-Fire Season Outage --> Ignition (from worksheet 2c-Outage to ignition mapping).</i></p>	<p>Numeric</p>

2.e Ignition Mitigation Effectiveness

Worksheet 2e, Ignition Mitigation Effectiveness, defines the percent effectiveness of reducing ignitions for the given mitigation option on the Ignition Risk Grouping. The various mitigation options align with the initiative categories and activities as defined in the WMP Data templates and Data Template Guidelines. The current values are based on an average of the mitigation effectiveness assessments and data analysis from Staff, the WMP Independent Evaluator, and the three Oregon Investor Owner Utilities. Staff will continue to evaluate and update effectiveness, using results provided by the industry of ignition event occurrences prior to and after the mitigation. These values are the basis for calculating the ignition mitigation effectiveness in section 2 of the RSE Workbook (Outage/Fault Ignition Risk). For details outline the mitigation see Appendix A: Mitigation Specifics.

Field Name	Field Description	Field Value Constraints
Ignition Risk Groupings <i>(pre-defined)</i>	Ignition Risk Groupings: <ul style="list-style-type: none"> - Contamination - Equipment Deteriorating/Failure - Equipment Error - Equipment Environmental - Equipment Other - Lightning - Public Contact - Vegetation Contact - Wildlife Contact - Wire-to-Wire Contact - Other - Unknown 	Text
GDSH - Undergrounding <i>(pre-defined)</i>	Grid Design and System Hardening (GDSH) initiative category. Percent effectiveness of reducing ignitions by Undergrounding for each Ignition Risk Grouping.	Percentage
GDSH -Tree Wire Covered Conductor (not all phases on legacy arms) <i>(pre-defined)</i>	Grid Design and System Hardening (GDSH) initiative category. Percent effectiveness of reducing ignitions by installing Tree Wire Covered Conductor (not all phases on legacy arms) for each Ignition Risk Grouping.	Percentage
GDSH -Tree Wire Covered Conductor (on legacy arms) <i>(pre-defined)</i>	Grid Design and System Hardening (GDSH) initiative category. Percent effectiveness of reducing ignitions by installing Tree Wire Covered Conductor (on legacy arms) for each Ignition Risk Grouping.	Percentage
GDSH - Spacer Cable Covered Conductor <i>(pre-defined)</i>	Grid Design and System Hardening (GDSH) initiative category. Percent effectiveness of reducing ignitions by installing Spacer Cable Covered Conductor for each Ignition Risk Grouping.	Percentage
GDSH - Traditional overhead hardening <i>(pre-defined)</i>	Grid Design and System Hardening (GDSH) initiative category. Percent effectiveness of reducing ignitions by installing Traditional overhead hardening for each Ignition Risk Grouping.	Percentage
GDSH - Installation of system automation equipment <i>(pre-defined)</i>	Grid Design and System Hardening (GDSH) initiative category. Percent effectiveness of reducing ignitions by installing system automation equipment for each Ignition Risk Grouping and using the system automation equipment for Equipment Settings and Grid Response.	Percentage
GOP - Equipment Settings and Grid Response <i>(pre-defined)</i>	Grid Operations and Protocols (GOP) initiative category. Percent effectiveness of reducing ignitions by utilizing Equipment Settings and Grid Response for each Ignition Risk Grouping. System automation equipment is not included.	Percentage
IC - Inspect Correct <i>(pre-defined)</i>	Inspect correct (IC) initiative category. Percent effectiveness of reducing ignitions by performing asset inspection and correction programs for each Ignition Risk Grouping.	Percentage
VM - Vegetation Management <i>(pre-defined)</i>	Vegetation Management (VM) initiative category.	Percentage

Field Name	Field Description	Field Value Constraints
	Percent effectiveness of reducing ignitions by performing Vegetation inspection and correction programs for each Ignition Risk Grouping.	
PSPS - PSPS <i>(pre-defined)</i>	Public Safety Power Shutoff (PSPS) initiative category. Percent effectiveness of reducing ignitions by utilizing a PSPS for each Ignition Risk Grouping. Expressed as the percent reduction in total fire-season ignitions caused by calling a PSPS event on a circuit segment.	Percentage

2.f Ignition Mitigation Reduction

Worksheet 2f, Ignition Mitigation Reduction, utilizes the circuit segment ignition results from worksheet 2d and the mitigation effectiveness by Ignition Risk Grouping from worksheet 2e. As a result, this worksheet requires no utility data entry. The data calculated within the table produced the mitigation ignition risk reduction on each of the previous provided circuit segments.

Field Name	Field Description	Field Value Constraints
Circuit Segment ID <i>(utility defined reference)</i>	Concatenated from the electric utility provided Circuit ID and Circuit Segment/ZOP entry from worksheet 1d-Segment Exposure Results.	Text
Total Segment Miles <i>(utility defined reference)</i>	Utility provided Circuit Segment/ZOP miles from worksheet 1d-Segment Exposure Results.	Numeric
Number of Years <i>(utility defined reference)</i>	Utility provided number of years for the outage data from worksheet 2b-Outage History	Numeric
Annual Average Fire Season Ignitions <i>(calculated)</i>	Average annual ignitions on the circuit segment during fire season. <i>Calculation: Average Annual Fire Season Ignition Risk Events (from worksheet 2d-Ignition Risk)</i>	Numeric
Annual Average Non-Fire Season Ignitions <i>(calculated)</i>	Average annual ignitions on the circuit segment during non-fire season. <i>Calculation: Average Annual Non-Fire Season Ignition Risk Events (from worksheet 2d-Ignition Risk)</i>	Numeric
Fire Season Total Ignitions <i>(calculated)</i>	Total ignitions during fire season over the number of years of provided outage data. <i>Calculation: Fire Season Total Ignition Risk Events (from worksheet 2d-Ignition Risk)</i>	Numeric
Non-Fire Season Total Ignitions <i>(calculated)</i>	Total ignitions during non-fire season over the number of years of provided outage data. <i>Calculation: Non-Fire Season Total Ignition Risk Events (from worksheet 2d-Ignition Risk)</i>	Numeric
Fire Season: Mitigation (Post-Mitigation Annual Ignitions) <i>(calculated)</i>	Total expected ignitions during fire season after a mitigation has been applied to the circuit segment: - GDSH – Undergrounding	Numeric

Field Name	Field Description	Field Value Constraints
	<ul style="list-style-type: none"> - GDSH -Tree Wire Covered Conductor (not all phases on legacy arms) - GDSH -Tree Wire Covered Conductor (on legacy arms) - GDSH - Spacer Cable Covered Conductor - GDSH - Installation of system automation equipment - GDSH - Traditional overhead hardening - GOP - Equipment Settings and Grid Response - IC - Inspect Correct - VM - Vegetation Management - PSPS - PSPS <p><i>Calculation: Sum of (fire season ignitions by Ignition Risk Grouping (from worksheet 2d-Ignition Risk) multiplied by 1 minus the percent mitigation effectiveness value for the ignition risk grouping (from worksheet 2e-Ignition Mitigation Effectiveness)) divided by the number of years of outage data (from worksheet 2b-outage history)</i></p>	
Non-Fire Season: Ignition by Ignition Risk Grouping (Post-Mitigation Annual Ignitions) <i>(calculated)</i>	<p>Total expected ignitions during non-fire season after a mitigation has been applied to the circuit segment:</p> <ul style="list-style-type: none"> - GDSH – Undergrounding - GDSH -Tree Wire Covered Conductor (not all phases on legacy arms) - GDSH -Tree Wire Covered Conductor (on legacy arms) - GDSH - Spacer Cable Covered Conductor - GDSH - Installation of system automation equipment - GDSH - Traditional overhead hardening - GOP - Equipment Settings and Grid Response - IC - Inspect Correct - VM - Vegetation Management - PSPS - PSPS <p><i>Calculation: Sum of (non-fire season ignitions by Ignition Risk Grouping (from worksheet 2d-Ignition Risk) multiplied by 1 minus the percent mitigation effectiveness value for the ignition risk grouping (from worksheet 2e-Ignition Mitigation Effectiveness)) divided by the number of years of outage data (from worksheet 2b-outage history)</i></p>	Numeric

2.g Segment Ignition Reduction

Worksheet 2g Segment Reduction Results summarizes the result of section 2. Circuit segments are ranked by highest Exposure Risk Score with pre-mitigation risk and the post mitigation risk for each of the mitigation types. Additionally, risk and reductions are broken into fire season, non-fire season, and annual results.

Field Name	Field Description	Field Value Constraints
Exposure Risk Score Rank <i>(calculated)</i>	Ranking of circuit segment exposure risk score from worksheet 1d-Segment Exposure Results.	Numeric

Field Name	Field Description	Field Value Constraints
Exposure Risk Score <i>(utility defined reference)</i>	The circuit segment exposure risk score from worksheet 1d-Segment Exposure Results.	Numeric
Circuit Segment ID <i>(utility defined reference)</i>	Concatenated from the electric utility provided Circuit ID and Circuit Segment/ZOP entry from worksheet 1d-Segment Exposure Results.	Text
Total Segment Miles <i>(utility defined reference)</i>	Utility provided Circuit Segment/ZOP miles from worksheet 1d-Segment Exposure Results.	Numeric
Total Segment Miles in HFRZ <i>(utility defined reference)</i>	The total circuit segment miles in the HFRZ from worksheet 1d-Segment Exposure Results.	Numeric
Pre-Mitigation Average Annual Ignitions <i>(referenced calculation)</i>	Average annual ignitions on the circuit segment from worksheet 2d-Ignition Risk	Numeric
Pre-Mitigation Average Annual Fire Season Ignitions <i>(referenced calculation)</i>	Average annual ignitions during fire season on the circuit segment from worksheet 2d-Ignition Risk	Numeric
Pre-Mitigation Average Annual Non-Fire Season Ignitions <i>(referenced calculation)</i>	Average annual ignitions during non-fire season on the circuit segment from worksheet 2d-Ignition Risk	Numeric
'Mitigation' Post-Mitigation Annual Ignitions <i>(calculation)</i>	Average annual ignitions after a mitigation has been applied on the circuit segment, by Ignition Risk Grouping <i>Calculation: sum of 'Mitigation' Post-Mitigation Fire Season Ignitions and 'Mitigation' Post-Mitigation Non-Fire Season Ignitions</i>	Numeric
'Mitigation' Post-Mitigation Fire Season Ignitions <i>(referenced calculation)</i>	Average annual ignitions during fire season after a mitigation has been applied on the circuit segment, by Ignition Risk Grouping, from worksheet 2f-Ignition Mitigation Reduction	Numeric
'Mitigation' Percent Reduction in Fire Season Ignitions <i>(calculation)</i>	The percent of mitigated ignition risk during fire season. <i>Calculation: 1 minus (Mitigation' Post-Mitigation Fire Season Ignitions divided by Pre-Mitigation Average Annual Fire Season Ignition Risk Events 'Mitigation' Post-Mitigation Fire Season Ignitions)</i>	Numeric
'Mitigation' Post-Mitigation Non-Fire Season Ignitions <i>(referenced calculation)</i>	Average annual ignitions during non-fire season after a mitigation has been applied on the circuit segment, by Ignition Risk Grouping, from worksheet 2f-Ignition Mitigation Reduction	Numeric
'Mitigation' Percent Reduction in Non-Fire Season Ignitions <i>(calculation)</i>	The percent of mitigated ignition risk during non-fire season. <i>Calculation: 1 minus (Mitigation' Post-Mitigation Non-Fire Season Ignitions divided by Pre-Mitigation Average Annual Non-Fire Season Ignition Risk Events 'Mitigation' Post-Mitigation Non-Fire Season Ignitions)</i>	Numeric

3 Asset Health Risk

To be developed.

4 Qualitative Risk Analysis

To be developed.

Risk Summary

The risk summary worksheet provides a high-level view of the risk for each circuit segment and does not consider the length of the segment. The table compiles circuit segment pre-mitigated risk results from worksheets 1d-Segment Exposure Results and 2d-Ignition Risk (ignition results). In the future the worksheet will include risk results for pre-mitigated Assets and Qualitative measurement. This worksheet compiles all pre-mitigation risks to develop an aggregated risk score and rank. The intent is to highlight areas that have been designated with the highest ignition risk potential, therefore concentrating on mitigation efforts and investments where the need is greatest.

Field Name	Field Description	Field Value Constraints
Exposure Risk Score Rank <i>(calculated)</i>	Ranking of circuit segment exposure risk score from worksheet 1d-Segment Exposure Results.	Numeric
Exposure Risk Score <i>(utility defined reference)</i>	The circuit segment exposure risk score from worksheet 1d-Segment Exposure Results.	Numeric
Normalized to 1 - Exposure Risk Score <i>(calculated)</i>	Normalizes the circuit segment exposure risk score to a 0 to 1 scale, with one being the highest risk and 0 being the lowest risk. <i>Calculation: circuit segment exposure score divided by the highest circuit segment exposure score</i>	
Circuit Segment ID <i>(referenced calculation)</i>	A look up of the Circuit Segment ID based on Exposure Risk Score Rank from worksheet 1d-Segment Exposure Results.	Text
Total Segment Miles <i>(utility defined reference)</i>	Utility provided Circuit Segment/ZOP miles from worksheet 1d-Segment Exposure Results.	Numeric
Total Segment Miles in HFRZ <i>(utility defined reference)</i>	The total circuit segment miles in the HFRZ from worksheet 1d-Segment Exposure Results.	Numeric
Pre-Mitigation Average Annual Ignitions <i>(referenced calculation)</i>	The expected average annual ignitions on the circuit segment from worksheet 2d-Ignition Risk	Numeric
Pre-Mitigation Normalized to 1 - Annual Ignitions <i>(calculation)</i>	Normalizes the circuit segment pre-mitigated annual ignitions score to a 0 to 1 scale, with one being the highest risk and 0 being the lowest risk. <i>Calculation: circuit segment pre-mitigated annual ignitions score divided by the highest circuit segment pre-mitigated annual ignitions score.</i>	Numeric

Field Name	Field Description	Field Value Constraints
Pre-Mitigation Average Annual Fire Season Ignitions <i>(referenced calculation)</i>	The expected average annual ignitions fire season on the circuit segment from worksheet 2d-Ignition Risk	Numeric
Pre-Mitigation Average Annual Non-Fire Season Ignitions <i>(referenced calculation)</i>	The expected average annual ignitions during non-fire season on the circuit segment from worksheet 2d-Ignition Risk	Numeric
Pre-Mitigation Asset Health Risk Score <i>(referenced calculation)</i>	To be developed	Numeric
Pre-Mitigation Normalized to 1 - Asset Health Risk Score <i>(calculation)</i>	To be developed	Numeric
Pre-Mitigation Qualitative Risk Score <i>(referenced calculation)</i>	To be developed	Numeric
Pre-Mitigation Normalized to 1 - Qualitative Risk Score <i>(calculation)</i>	To be developed	Numeric
Pre-Mitigation Aggregate Risk Score <i>(referenced calculation)</i>	Combined aggregate scoring for each normalized risk factor: <ul style="list-style-type: none"> - HFRZ Exposure Risk Modeling (section 1) - Outage/Fault Ignition Risk (section 2) - Asset Health Risk (section 3 TBD) - Qualitative Risk Analysis (section 4 TBD) <i>Calculation: Sum (Normalized HFRZ Score, Pre-Mitigation Normalized Annual Ignitions, Pre-Mitigation Normalized Asset Health Risk Score, and Pre-Mitigation Normalized Qualitative Risk Score)</i>	Numeric
Pre-Mitigation Aggregate Risk Ranking <i>(calculation)</i>	Ranking of circuit segment Pre-Mitigation Aggregate Risk Score results.	Numeric

5 Mitigation Cost

This section of the report defines the average mitigation capital and operation and maintenance (O&M) costs and savings for each of the predefined mitigations. It then applies each of the mitigation costs and savings to the circuit segments to develop a lifetime cost and an annualized cost.

5.a Mitigation Cost Inputs

Worksheet 5a, Mitigation Cost Inputs, defines the average mitigation costs for capital and O&M for each mitigation type by a specified unit, such as miles, structures, or devices. Additionally, the

worksheet takes into account the lifetime of the mitigation and financing costs and depreciation rates. The worksheet also provides input for any O&M savings. The current values are based on Staff analysis of information provided by the three Oregon IOUs, industry costs, and WMP Independent Evaluator. Staff will continue to evaluate and refine these inputs as mitigation costs become more transparent. These values are the basis for calculating the determining the lifetime of and cost of a given mitigations option and are used in the RSE calculation.

Field Name	Field Description	Field Value Constraints
Mitigation Measure <i>(pre-defined mitigation type)</i>	Predefined mitigation options which align with the initiative categories and activities as defined in the WMP Data templates and Data Template Guidelines. <ul style="list-style-type: none"> - GDSH - Undergrounding - GDSH -Tree Wire Covered Conductor (not all phases on legacy arms) - GDSH -Tree Wire Covered Conductor (on legacy arms) - GDSH - Spacer Cable Covered Conductor - GDSH - Traditional overhead hardening - GDSH - Installation of system automation equipment (non-field resources) - GOP - Equipment Settings and Grid Response (requires field resources) - VM - Vegetation Management - PSPS - PSPS 	Text
Capital Cost (\$1000) Per Unit <i>(pre-defined)</i>	The average capital cost of the mitigation per defined capital units.	Numeric
Capital Units <i>(pre-defined)</i>	Units of measurement for capital costs.	Text
Asset Life (years) <i>(pre-defined)</i>	The expected lifetime of the mitigation type.	Numeric
Annual Interest Rate or Financing Cost (%) <i>(pre-defined)</i>	Average interest rate for capital projects.	Percentage
Depreciation Rate (leave blank for straight-line depreciation) <i>(utility defined)</i>	Utilities may define a percent depreciation rate for the mitigation asset. If left blank, the mitigation asset will be depreciated on a straight-line basis.	Percentage
Annual Labor and O&M Cost (\$1000) Per Unit <i>(pre-defined)</i>	Annual operation and maintenance costs per O&M unit.	Numeric
Annual Labor and O&M Savings (\$1000) Per Unit <i>(pre-defined)</i>	Annual operation and maintenance savings per O&M unit.	Numeric
O&M Units <i>(pre-defined)</i>	Units of measurement for O&M costs.	Text

Field Name	Field Description	Field Value Constraints
Notes <i>(pre-defined)</i>	Notes referencing capital or O&M costs for the mitigation.	Text
Additional parameter (a) <i>(pre-defined)</i>	Additional space for cost parameters, such as number of system automation devices per mile and inspection cycle frequency.	Numeric
Additional parameter (b)	Additional space for cost parameters, such as number of system automation devices per mile and inspection cycle frequency.	Numeric
Notes <i>(pre-defined)</i>	Notes to define any additional cost parameters in (a) or (b).	Text

5.b Circuit Mitigation Cost

Worksheet 5b, circuit mitigation costs, utilizes the information provided in worksheets 1d, 2b, and 5a to calculate the average cost of each mitigation option per circuit segment. The worksheet calculates the total costs of the mitigation over its lifetime as well as annualized costs. The worksheet uses default values for the circuit segment mileage and the segment miles within the HFRZ, while also allowing the utility to enter or adjust for circuit segment miles mitigated, average installation of automatic reclosers, and the number of structures within the circuit segment. These calculations are a high-level view of mitigation costs and will continue to be refined as RSE work continues.

Field Name	Field Description	Field Value Constraints
Aggregate Risk Ranking <i>(calculation)</i>	Ranking of circuit segment Pre-Mitigation Aggregate Risk Score results.	Numeric
Aggregate Risk Score <i>(referenced calculation)</i>	Combined aggregate scoring for each normalized risk factor from the Risk Summary Worksheet	Numeric
Exposure Risk Score Rank <i>(calculated)</i>	Ranking of circuit segment exposure risk score from worksheet 1d-Segment Exposure Results.	Numeric
Exposure Risk Score <i>(utility defined reference)</i>	The circuit segment exposure risk score from worksheet 1d-Segment Exposure Results.	Numeric
Circuit Segment ID <i>(utility defined reference)</i>	Concatenated from the electric utility provided Circuit ID and Circuit Segment/ZOP entry from worksheet 1d-Segment Exposure Results.	Text
Total Segment Miles <i>(utility defined reference)</i>	Utility provided Circuit Segment/ZOP miles from worksheet 1d-Segment Exposure Results.	Numeric
Total Segment Miles in HFRZ <i>(utility defined reference)</i>	The total circuit segment miles in the HFRZ from worksheet 1d-Segment Exposure Results.	Numeric

Field Name	Field Description	Field Value Constraints
<p>Mitigation Miles (Utility input, default is miles HFRZ in Column G) <i>(utility defined)</i></p>	<p>Input field for utilities to adjust the miles mitigated for the circuit segment. This is used in calculations for the following mitigation types:</p> <ul style="list-style-type: none"> - GDSH - Undergrounding - GDSH -Tree Wire Covered Conductor (not all phases on legacy arms) - GDSH -Tree Wire Covered Conductor (on legacy arms) - GDSH - Spacer Cable Covered Conductor - GDSH - Traditional overhead hardening 	<p>Numeric</p>
<p># of Automatic Reclosers (Default = 5a device_mile x HFRZ miles) <i>(utility defined)</i></p>	<p>Value defaults to calculate the average number of automatic reclosers based on the total miles of the circuit segment multiplied by the device per mile for GDSH - Installation of system automation equipment (non-field resources) in worksheet 5a.</p> <p>This value can be manually adjusted by the utility to reflect the number of automated reclosers.</p> <p>This is used in calculations for the following mitigation types:</p> <ul style="list-style-type: none"> - GDSH - Installation of system automation equipment 	<p>Numeric</p>
<p>Average Structures (Default value is: 25 per mile for Circuit Segment) <i>(utility defined)</i></p>	<p>Value defaults to calculate the average number of total structures for the circuit segment based on the total miles of the circuit segment multiplied by an average of 25 poles per mile.</p> <p>This value can be manually adjusted by the utility to reflect the number of structures with the circuit segment.</p> <p>This is used in calculations for the following mitigation types:</p> <ul style="list-style-type: none"> - IC - Inspect Correct 	<p>Numeric</p>
<p>GDSH - Undergrounding <i>(calculated)</i></p>	<p>The undergrounding mitigation option calculates the following:</p> <ul style="list-style-type: none"> - <u>Initial capital costs in thousands</u>, using the mitigation miles (with the default milage being the total segment mile in HFRZ) multiplied by the average cost per mile to underground from Worksheet 5a. - <u>Lifetime capital cost in thousands</u>, by incorporating the Annual Interest Rate or Financing Cost (%) and Depreciation Rate into the Initial capital costs. - <u>Lifetime labor and O&M net cost in thousands</u>, calculates the Annual Labor and O&M Cost (\$1000) Per Unit and Annual Labor and O&M Savings (\$1000) Per Unit over the lifetime of the mitigation. - <u>Total lifetime costs in thousands</u>, adds the Lifetime capital cost and Lifetime labor and O&M net cost. - <u>Average annual net costs in thousands</u>, takes the total lifetime cost of the mitigation and divides by the lifetime of the mitigation. 	<p>Numeric</p>
<p>GDSH -Tree Wire Covered Conductor (not all phases on legacy arms)</p>	<p>The tree wire covered conductor with some crossarm replacements mitigation option calculates the following:</p>	<p>Numeric</p>

Field Name	Field Description	Field Value Constraints
<i>(calculated)</i>	<ul style="list-style-type: none"> - <u>Initial capital costs in thousands</u>, using the mitigation miles (with the default milage being the total segment mile in HFRZ) multiplied by the average cost per mile to underground from Worksheet 5a. - <u>Lifetime capital cost in thousands</u>, by incorporating the Annual Interest Rate or Financing Cost (%) and Depreciation Rate into the Initial capital costs. - <u>Lifetime labor and O&M net cost in thousands</u>, calculates the Annual Labor and O&M Cost (\$1000) Per Unit and Annual Labor and O&M Savings (\$1000) Per Unit over the lifetime of the mitigation. - <u>Total lifetime costs in thousands</u>, adds the Lifetime capital cost and Lifetime labor and O&M net cost. - <u>Average annual net costs in thousands</u>, takes the total lifetime cost of the mitigation and divides by the lifetime of the mitigation. 	
GDSH -Tree Wire Covered Conductor (on legacy arms) <i>(calculated)</i>	The tree wire covered conductor with no crossarm replacement mitigation option calculates the following: <ul style="list-style-type: none"> - <u>Initial capital costs in thousands</u>, using the mitigation miles (with the default milage being the total segment mile in HFRZ) multiplied by the average cost per mile to underground from Worksheet 5a. - <u>Lifetime capital cost in thousands</u>, by incorporating the Annual Interest Rate or Financing Cost (%) and Depreciation Rate into the Initial capital costs. - <u>Lifetime labor and O&M net cost in thousands</u>, calculates the Annual Labor and O&M Cost (\$1000) Per Unit and Annual Labor and O&M Savings (\$1000) Per Unit over the lifetime of the mitigation. - <u>Total lifetime costs in thousands</u>, adds the Lifetime capital cost and Lifetime labor and O&M net cost. - <u>Average annual net costs in thousands</u>, takes the total lifetime cost of the mitigation and divides by the lifetime of the mitigation. 	Numeric
GDSH – Spacer Cable Covered Conductor <i>(calculated)</i>	The spacer cable covered conductor mitigation option calculates the following: <ul style="list-style-type: none"> - <u>Initial capital costs in thousands</u>, using the mitigation miles (with the default milage being the total segment mile in HFRZ) multiplied by the average cost per mile to underground from Worksheet 5a. - <u>Lifetime capital cost in thousands</u>, by incorporating the Annual Interest Rate or Financing Cost (%) and Depreciation Rate into the Initial capital costs. - <u>Lifetime labor and O&M net cost in thousands</u>, calculates the Annual Labor and O&M Cost (\$1000) Per Unit and Annual Labor and O&M Savings (\$1000) Per Unit over the lifetime of the mitigation. - <u>Total lifetime costs in thousands</u>, adds the Lifetime capital cost and Lifetime labor and O&M net cost. 	Numeric

Field Name	Field Description	Field Value Constraints
	<ul style="list-style-type: none"> - <u>Average annual net costs in thousands</u>, takes the total lifetime cost of the mitigation and divides by the lifetime of the mitigation. 	
<p>GDSH - Traditional overhead hardening <i>(calculated)</i></p>	<p>The tree wire covered conductor with no pole replacement mitigation option calculates the following:</p> <ul style="list-style-type: none"> - <u>Initial capital costs in thousands</u>, using the mitigation miles (with the default milage being the total segment mile in HFRZ) multiplied by the average cost per mile to underground from Worksheet 5a. - <u>Lifetime capital cost in thousands</u>, by incorporating the Annual Interest Rate or Financing Cost (%) and Depreciation Rate into the Initial capital costs. - <u>Lifetime labor and O&M net cost in thousands</u>, calculates the Annual Labor and O&M Cost (\$1000) Per Unit and Annual Labor and O&M Savings (\$1000) Per Unit over the lifetime of the mitigation. - <u>Total lifetime costs in thousands</u>, adds the Lifetime capital cost and Lifetime labor and O&M net cost. - <u>Average annual net costs in thousands</u>, takes the total lifetime cost of the mitigation and divides by the lifetime of the mitigation. 	<p>Numeric</p>
<p>GDSH - Installation of system automation equipment (non-field resources) <i>(calculated)</i></p>	<p>The installation of system automation equipment mitigation option calculates the following:</p> <ul style="list-style-type: none"> - <u>Initial capital costs in thousands</u>, using the mitigation miles (with the default milage being the total segment mile in HFRZ) multiplied by the average cost per mile to underground from Worksheet 5a. - <u>Lifetime capital cost in thousands</u>, by incorporating the Annual Interest Rate or Financing Cost (%) and Depreciation Rate into the Initial capital costs. - <u>Lifetime labor and O&M net cost in thousands</u>, calculates the O&M costs associated with restoring power to a circuit segment and administering Equipment Settings and Grid Response, over the lifetime of the mitigation. - <u>Total lifetime costs in thousands</u>, adds the Lifetime capital cost and Lifetime labor and O&M net cost. - <u>Average annual net costs in thousands</u>, takes the total lifetime cost of the mitigation and divides by the lifetime of the mitigation. 	<p>Numeric</p>
<p>GOP - Equipment Settings and Grid Response (requires field resources) <i>(calculated)</i></p>	<p>The costs of Equipment Settings and Grid Response is calculated as follows:</p> <ul style="list-style-type: none"> - <u>Annual labor and O&M net cost in thousands</u>, calculates the O&M costs associated with restoring power to a circuit segment and administering Equipment Settings and Grid Response - <u>Total annual costs in thousands</u>, considers only annual labor and O&M costs. 	<p>Numeric</p>

Field Name	Field Description	Field Value Constraints
IC - Inspect Correct <i>(calculated)</i>	<p>The inspection and correction mitigation option calculates the following:</p> <ul style="list-style-type: none"> - <u>Initial capital costs in thousands</u>, using the mitigation miles (with the default milage being the total segment mile in HFRZ) multiplied by the average cost per mile to underground from Worksheet 5a. - <u>Lifetime capital cost in thousands</u>, by incorporating the Annual Interest Rate or Financing Cost (%) and Depreciation Rate into the Initial capital costs. - <u>Lifetime labor and O&M net cost in thousands</u>, calculates the Annual Labor and O&M Cost (\$1000) Per Unit and Annual Labor and O&M Savings (\$1000) Per Unit over the lifetime of the mitigation. - <u>Total lifetime costs in thousands</u>, adds the Lifetime capital cost and Lifetime labor and O&M net cost. - <u>Average annual net costs in thousands</u>, takes the total lifetime cost of the mitigation and divides by the lifetime of the mitigation. 	Numeric
VM - Vegetation Management <i>(calculated)</i>	<p>The vegetation management mitigation option calculates the following:</p> <ul style="list-style-type: none"> - <u>Annual labor and O&M net cost in thousands</u>, multiplies the total circuit segment miles by the O&M mitigation cost per mile from Worksheet 5a. - <u>Total annual costs in thousands</u>, only considers O&M costs. 	Numeric
PSPS – PSPS <i>(calculated)</i>	<p>The PSPS mitigation option calculates the following:</p> <ul style="list-style-type: none"> - <u>Expected PSPS events per year (default 1 per year)</u>, defaults as one PSPS event per year until more historical data is available. - - <u>Annual labor and O&M net cost in thousands</u>, applies the number of expected PSPS events per year by the O&M cost per event from Worksheet 5a, and includes the costs of administering the PSPS program. - <u>Total annual costs in thousands</u>, only considers O&M costs. 	Numeric

6 Risk Spend Efficiency

Section 6 of the RSE Workbook brings together information from Sections 1-5 to evaluate the costs, risk reductions, and cost-effectiveness of various mitigation options.

6.a RSE Details

Worksheet 6a RSE Detail, compiles data from the pervious sections, sorted by the highest cumulative risk for sections 1-4 and calculates the circuit segment RSE results for each mitigation

option using the calculation shown in figure 2 of the of the Risk Spend Efficiency model. There is no utility data entry required in this worksheet.

Field Name	Field Description	Field Value Constraints
Aggregate Risk Ranking <i>(calculation)</i>	Ranking of circuit segment Pre-Mitigation Aggregate Risk Score results.	Numeric
Aggregate Risk Score <i>(referenced calculation)</i>	Combined aggregate scoring for each normalized risk factor from the Risk Summary Worksheet	Numeric
Circuit Segment ID <i>(utility defined reference)</i>	Concatenated from the electric utility provided Circuit ID and Circuit Segment/ZOP entry from worksheet 1d-Segment Exposure Results.	Text
Total Segment Miles <i>(utility defined reference)</i>	Utility provided Circuit Segment/ZOP miles from worksheet 1d-Segment Exposure Results.	Numeric
Total Segment Miles in HFRZ <i>(utility defined reference)</i>	The total circuit segment miles in the HFRZ from worksheet 1d-Segment Exposure Results.	Numeric
Miles of Mitigation	The number of miles of mitigation applied to the circuit segment. Defaults to Total Segment Miles if the utility did not specify in 5b-Circuit Mitigation Cost.	Numeric
Exposure Risk Score Rank <i>(calculated)</i>	Ranking of circuit segment exposure risk score from worksheet 1d-Segment Exposure Results.	Numeric
Exposure Risk Score <i>(utility defined reference)</i>	The circuit segment exposure risk score from worksheet 1d-Segment Exposure Results.	Numeric
Pre-mitigation results <i>(calculated)</i>	<p>Pulls in Pre-mitigated risk results for each section</p> <ul style="list-style-type: none"> - Ignition Risk Score from worksheet 2d - Asset Risk Score (TBD) - Qualitative Risk Score (TBD) - Calculates the total risk score by summing up the above 	Numeric
Post-Mitigation: GDSH - Undergrounding <i>(calculated)</i>	<p>Pulls in Mitigated scores for each section</p> <p>Segment Ignition Reduction from worksheet 2g, and adjusted on a pro-rata basis if Mitigation Miles is less than Total Segment Miles</p> <ul style="list-style-type: none"> - Asset Risk Score (TBD) - Qualitative Risk Score (TBD) - Calculates the total risk reduced score by subtracting the pre-mitigation total risk score by the three mitigated scores above. - Weighted Risk Reduced weights the risk reduction by incorporating the exposure risk score into the risk reduction. - Mitigation Lifetime from worksheet 5a - Annual costs in thousands from worksheet 5b 	Numeric

Field Name	Field Description	Field Value Constraints
	<ul style="list-style-type: none"> - Annual Mitigation RSE in millions calculating the annual reduced risk by the annual cost of the mitigation. 	
Post-Mitigation: GDSH - Tree Wire Covered Conductor (not all phases on legacy arms) <i>(calculated)</i>	Pulls in Mitigated scores for each section Segment Ignition Reduction from worksheet 2g, and adjusted on a pro-rata basis if Mitigation Miles is less than Total Segment Miles <ul style="list-style-type: none"> - Asset Risk Score (TBD) - Qualitative Risk Score (TBD) - Calculates the total risk reduced score by subtracting the pre-mitigation total risk score by the three mitigated scores above. - Weighted Risk Reduced weights the risk reduction by incorporating the exposure risk score into the risk reduction. - Mitigation Lifetime from worksheet 5a - Annual costs in thousands from worksheet 5b Annual Mitigation RSE in millions calculating the annual reduced risk by the annual cost of the mitigation. 	Numeric
Post-Mitigation: GDSH - Tree Wire Covered Conductor (on legacy arms) <i>(calculated)</i>	Pulls in Mitigated scores for each section <ul style="list-style-type: none"> - Segment Ignition Reduction from worksheet 2g, and adjusted on a pro-rata basis if Mitigation Miles is less than Total Segment Miles - Asset Risk Score (TBD) - Qualitative Risk Score (TBD) - Calculates the total risk reduced score by subtracting the pre-mitigation total risk score by the three mitigated scores above. - Weighted Risk Reduced weights the risk reduction by incorporating the exposure risk score into the risk reduction. - Mitigation Lifetime from worksheet 5a - Annual costs in thousands from worksheet 5b Annual Mitigation RSE in millions calculating the annual reduced risk by the annual cost of the mitigation. 	Numeric
Post-Mitigation: GDSH – Spacer Cable Covered Conductor <i>(calculated)</i>	Pulls in Mitigated scores for each section <ul style="list-style-type: none"> - Segment Ignition Reduction from worksheet 2g, and adjusted on a pro-rata basis if Mitigation Miles is less than Total Segment Miles - Asset Risk Score (TBD) - Qualitative Risk Score (TBD) - Calculates the total risk reduced score by subtracting the pre-mitigation total risk score by the three mitigated scores above. - Weighted Risk Reduced weights the risk reduction by incorporating the exposure risk score into the risk reduction. - Mitigation Lifetime from worksheet 5a 	Numeric

Field Name	Field Description	Field Value Constraints
	<ul style="list-style-type: none"> - Annual costs in thousands from worksheet 5b Annual Mitigation RSE in millions calculating the annual reduced risk by the annual cost of the mitigation. 	
Post-Mitigation: GDSH - Traditional overhead hardening <i>(calculated)</i>	Pulls in Mitigated scores for each section <ul style="list-style-type: none"> - Segment Ignition Reduction from worksheet 2g, and adjusted on a pro-rata basis if Mitigation Miles is less than Total Segment Miles - Asset Risk Score (TBD) - Qualitative Risk Score (TBD) - Calculates the total risk reduced score by subtracting the pre-mitigation total risk score by the three mitigated scores above. - Weighted Risk Reduced weights the risk reduction by incorporating the exposure risk score into the risk reduction. - Mitigation Lifetime from worksheet 5a - Annual costs in thousands from worksheet 5b Annual Mitigation RSE in millions calculating the annual reduced risk by the annual cost of the mitigation. 	Numeric
Post-Mitigation: GDSH - Installation of system automation equipment (non-field resources) <i>(calculated)</i>	Pulls in Mitigated scores for each section <ul style="list-style-type: none"> - Segment Ignition Reduction from worksheet 2g, and adjusted on a pro-rata basis if Mitigation Miles is less than Total Segment Miles - Asset Risk Score (TBD) - Qualitative Risk Score (TBD) - Calculates the total risk reduced score by subtracting the pre-mitigation total risk score by the three mitigated scores above. - Weighted Risk Reduced weights the risk reduction by incorporating the exposure risk score into the risk reduction. - Mitigation Lifetime from worksheet 5a - Annual costs in thousands from worksheet 5b Annual Mitigation RSE in millions calculating the annual reduced risk by the annual cost of the mitigation. 	Numeric
Post-Mitigation: GOP - Equipment Settings and Grid Response (requires field resources) <i>(calculated)</i>	Pulls in Mitigated scores for each section <ul style="list-style-type: none"> - Segment Ignition Reduction from worksheet 2g, and adjusted on a pro-rata basis if Mitigation Miles is less than Total Segment Miles - Asset Risk Score (TBD) - Qualitative Risk Score (TBD) - Calculates the total risk reduced score by subtracting the pre-mitigation total risk score by the three mitigated scores above. - Weighted Risk Reduced weights the risk reduction by incorporating the exposure risk score into the risk reduction. - Mitigation Lifetime from worksheet 5a 	Numeric

Field Name	Field Description	Field Value Constraints
	<ul style="list-style-type: none"> - Annual costs in thousands from worksheet 5b Annual Mitigation RSE in millions calculating the annual reduced risk by the annual cost of the mitigation. 	
Post-Mitigation: IC - Inspect Correct <i>(calculated)</i>	Pulls in Mitigated scores for each section <ul style="list-style-type: none"> - Segment Ignition Reduction from worksheet 2g, and adjusted on a pro-rata basis if Mitigation Miles is less than Total Segment Miles - Asset Risk Score (TBD) - Qualitative Risk Score (TBD) - Calculates the total risk reduced score by subtracting the pre-mitigation total risk score by the three mitigated scores above. - Weighted Risk Reduced weights the risk reduction by incorporating the exposure risk score into the risk reduction. - Mitigation Lifetime from worksheet 5a - Annual costs in thousands from worksheet 5b Annual Mitigation RSE in millions calculating the annual reduced risk by the annual cost of the mitigation. 	Numeric
Post-Mitigation: VM - Vegetation Management <i>(calculated)</i>	Pulls in Mitigated scores for each section <ul style="list-style-type: none"> - Segment Ignition Reduction from worksheet 2g, and adjusted on a pro-rata basis if Mitigation Miles is less than Total Segment Miles - Asset Risk Score (TBD) - Qualitative Risk Score (TBD) - Calculates the total risk reduced score by subtracting the pre-mitigation total risk score by the three mitigated scores above. - Weighted Risk Reduced weights the risk reduction by incorporating the exposure risk score into the risk reduction. - Mitigation Lifetime from worksheet 5a - Annual costs in thousands from worksheet 5b Annual Mitigation RSE in millions calculating the annual reduced risk by the annual cost of the mitigation. 	Numeric
Post-Mitigation: PSPS – PSPS <i>(calculated)</i>	Pulls in Mitigated scores for each section <ul style="list-style-type: none"> - Segment Ignition Reduction from worksheet 2g - Asset Risk Score (TBD) - Qualitative Risk Score (TBD) - Calculates the total risk reduced score by subtracting the pre-mitigation total risk score by the three mitigated scores above. - Weighted Risk Reduced weights the risk reduction by incorporating the exposure risk score into the risk reduction. - Mitigation Lifetime from worksheet 5a - Annual costs in thousands from worksheet 5b Annual Mitigation RSE in millions calculating the annual reduced risk by the annual cost of the mitigation. 	Numeric

6.b RSE Summary

Worksheet 6b, RSE Summary, assembles the RSE calculations from worksheet 6a. The data assembled orders the circuit segments by highest cumulative risk scores and then ranks the result of the RSE values that produce the highest value risk spend efficiency by long-term and short-term mitigation options. There is no utility data entry required in this worksheet.

Field Name	Field Description	Field Value Constraints
Aggregate Risk Ranking <i>(calculation)</i>	Ranking of circuit segment Pre-Mitigation Aggregate Risk Score results.	Numeric
Aggregate Risk Score <i>(referenced calculation)</i>	Combined aggregate scoring for each normalized risk factor from the Risk Summary Worksheet	Numeric
Exposure Risk Score Rank <i>(calculated)</i>	Ranking of circuit segment exposure risk score from worksheet 1d-Segment Exposure Results.	Numeric
Exposure Risk Score <i>(utility defined reference)</i>	The circuit segment exposure risk score from worksheet 1d-Segment Exposure Results.	Numeric
Circuit Segment ID <i>(utility defined reference)</i>	Concatenated from the electric utility provided Circuit ID and Circuit Segment/ZOP entry from worksheet 1d-Segment Exposure Results.	Text
Total Segment Miles <i>(utility defined reference)</i>	Utility provided Circuit Segment/ZOP miles from worksheet 1d-Segment Exposure Results.	Numeric
Total Segment Miles in HFRZ <i>(utility defined reference)</i>	The total circuit segment miles in the HFRZ from worksheet 1d-Segment Exposure Results.	Numeric
Long-term Mitigations <i>(calculated)</i>	Ranks the highest RSE score of long-term Mitigations from 1 st to 4 th	
Short-term Mitigations <i>(calculated)</i>	Ranks the lowest RSE score of long-term Mitigations from 1 st to 4 th	
Mitigation RSE Scores	Compiles the RSE scores for each circuit segment by mitigation. <ul style="list-style-type: none"> - GDSH - Undergrounding - GDSH -Tree Wire Covered Conductor (not all phases on legacy arms) - GDSH -Tree Wire Covered Conductor (on legacy arms) - GDSH - Spacer Cable Covered Conductor - GDSH - Traditional overhead hardening - GDSH - Installation of system automation equipment (non-field resources) - GOP - Equipment Settings and Grid Response (requires field resources) - VM - Vegetation Management - PSPS – PSPS 	

7 Co-Benefits

To be developed.

Appendix A: Mitigation Specifics

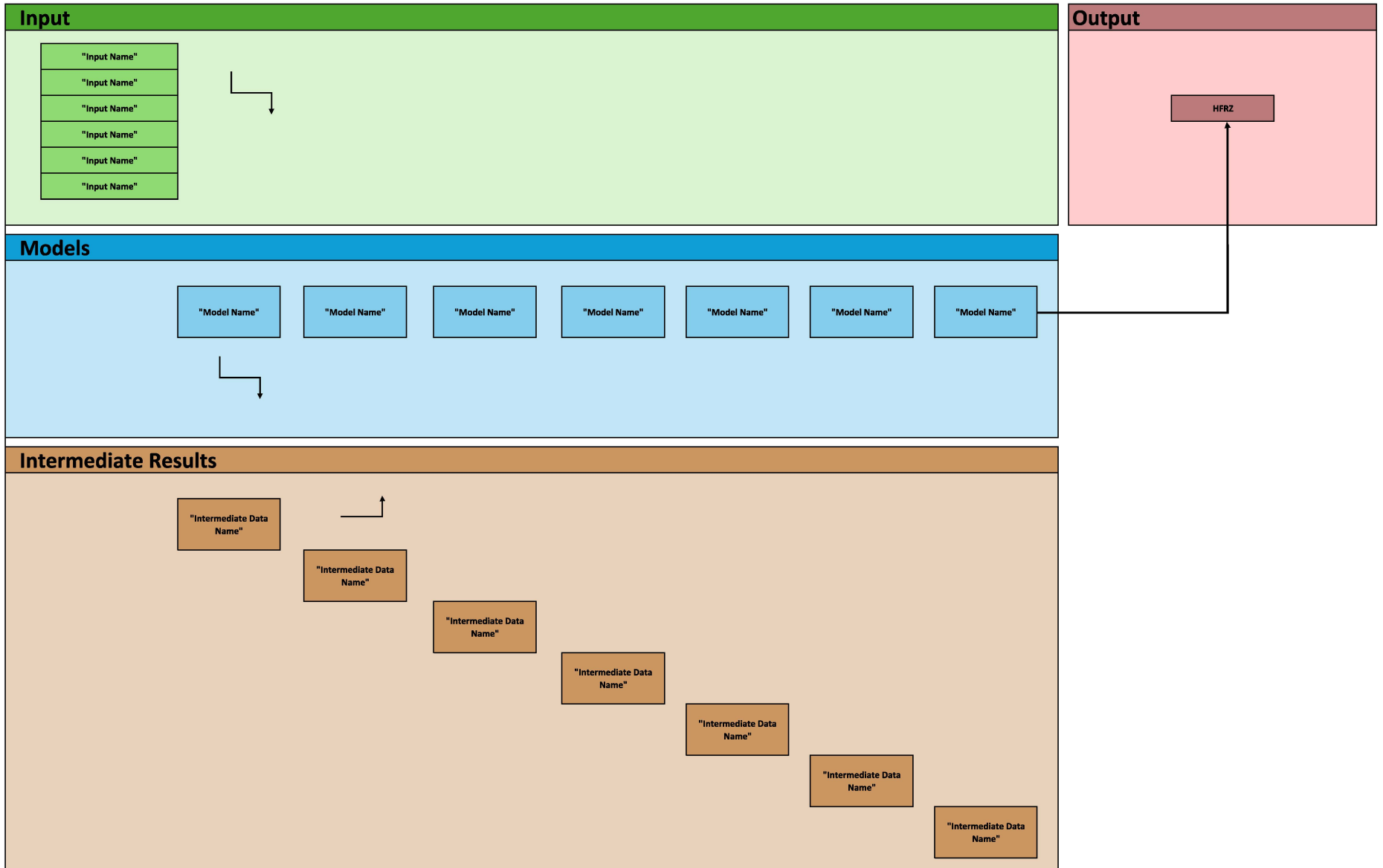
Mitigation Type	Mitigation Specifics
GDSH - Undergrounding	<ul style="list-style-type: none"> • Installation of underground conductor. • Does not differentiate between installation within existing conduit or the need to install conduit
GDSH -Tree Wire Covered Conductor (not all phases on legacy arms)	<ul style="list-style-type: none"> • Installation of tree wire covered conductor. • Includes the need to replace some crossarms on existing structures
GDSH -Tree Wire Covered Conductor (on legacy arms)	<ul style="list-style-type: none"> • Installation of tree wire covered conductor. • Does not require the replacement of crossarms on existing structures.
GDSH - Spacer Cable Covered Conductor	<ul style="list-style-type: none"> • Installation of space cable covered conductor.
GDSH - Installation of system automation equipment (non-field resources)	<ul style="list-style-type: none"> • Installation of electronic circuit breaker relays. • Creation of remote-control functionality to breaker or recloser relays. • Installation of modern line recloser (and controls), i.e. backbone reclosers. • Installation of modern tap line recloser (and controls), i.e. fusesavers and tripsavers. • Installation of fault detection sensors (remote accessible), i.e. CFCIs. • Installation of incipient fault detection sensors, i.e. DFA, wave form analytics. • Remotely Deployed Equipment Settings, Sensitive Settings to Reduce Wildfire Risk (Grid Ops).
GDSH - Traditional overhead hardening	<ul style="list-style-type: none"> • Distribution pole replacements and reinforcements. These include items such as: <ul style="list-style-type: none"> ○ Structural hardening: replacing pole, including fire resistant pole. ○ Minor structural hardening: replacing crossarms, pole strengthening, trussing, etc. ○ Electrical hardening: does not include replacement of small diameter conductor, which would be accomplished under Phase 2 reconductor, but does include replacing problematic components, such as lightning arrestors, potted porcelain cutouts, shunting automatic sleeves, replacing aluminum bells, etc.

Mitigation Type	Mitigation Specifics
	<ul style="list-style-type: none"> ○ Environmental hardening: includes animal guarding, traffic control measures such as impact attenuators, spacer bars to mitigate line slap. ● Transmission pole/tower replacements and reinforcements. These include items such as: <ul style="list-style-type: none"> ○ Structural hardening: enhancing existing strength of structural components, i.e. phase raisers, tightening existing components, installing additional structural elements for enhancement of structural capacity. ○ Electrical hardening: replacing cracked, damaged or failed insulating elements such as insulators, replacing connectors or other components showing indications of electrical leakage/heating, replacing or placing lightning arrestors. ○ Environmental hardening: includes animal guarding, vibration dampening measures (to mitigate aeolian or other harmonic behaviors).
GOP - Equipment Settings and Grid Response (requires field resources)	<ul style="list-style-type: none"> ● Locally Deployed Equipment Settings, Sensitive Settings to Reduce Wildfire Risk (Grid Ops). ● Grid Response Procedures and Notifications (Grid Ops).
IC - Inspect Correct.	<ul style="list-style-type: none"> ● Asset Inspections OAR 860-024-011(1)(B)(c) & (2)(c). ● Ignition prevention inspection OAR 860-024-011 (2)(a). ● Fire season safety patrols. ● Corrections regarding heightened fire risk, imminent danger, occupant violation, other Div. 24 corrections. ● Removal or permanent de-energization of equipment. ● Quality control and performance monitoring activities.
VM - Vegetation Management.	<ul style="list-style-type: none"> ● Routine work includes vegetation inspections and correction of clearance, fall-in mitigation, quality assurance and control, substation defensible space, vegetation imagery (lidar, satellite), vegetation management enterprise system, and performance monitoring. ● Non-routine work includes vegetation inspections and correction of clearance, emergency response vegetation management of fall-in mitigation, fire-resilient rights-of-way, high-risk species, pole clearing, quality assurance and control, substation defensible space, vegetation imagery (lidar, satellite), wood and slash management, vegetation management enterprise system, and performance monitoring.
PSPS – PSPS.	<ul style="list-style-type: none"> ● Utility plan establishment of PSPS (building the plan, identifying the system control points, developing rostering process etc).

Mitigation Type	Mitigation Specifics
	<ul style="list-style-type: none">• Utility plan for customer support (identifying local assets or remotely deployable assets for communities during PSPS, establishing contracts etc., could include some local installation of equipment to effectuate a CRC).• Utility plan execution for an estimated PSPS activation (estimated crews and support teams to perform PSPS, including any local situational awareness needed only for that PSPS).• Utility plan execution for customer support during an estimated PSPS activation (community resource center costs, etc.).• Execution on the above.

Process		
Section 1		
Utility Input	1a-Exposure Risk Model	<p>Overview graphic of environmental risk exposure for HFRZ</p> <p>Fill in data inputs</p> <p>Identify and label models and connect data inputs to the models</p> <p>Identify and label the outputs from the models and show how intermediate results flow into other models by connecting them</p> <p>Show how models and intermediate results are used for HFRZ determination by connecting them to the HFRZ output box</p>
Utility Input	1b-Exposure Risk Data	<p>An overview of the data inputs used for risk modeling</p> <p>Add in details for all underlying data used in the base environmental risk exposure modeling for development of HFRZ per OAR 860-300-0020(1)(A)+(B)</p> <p>Identify the models and intermediate results that each data input is used for</p> <p>Provide additional details regarding input source and document any calculations or transformations applied to the input data</p>
Utility Input	1c-Exposure Risk Intermediate	<p>Intermediate result details</p> <p>Describe the intermediate results</p>
Utility Input	1d-Segment Exposure Details	<p>Circuit segment level details (preferably by zones of protection)</p> <p>Include circuit location, length, and overlap with HFRZ</p> <p>Provide the score for the circuit segment when overlaid with the final modeled results</p> <p>Provide summary statistics for the circuit segment based on the segment overlay of the gridded final modeled results.</p>
Section 2		
Utility input	2a-Ignition Risk Grouping	<p>Align the utilities outage risk driver categorization to the OPUC risk driver categorization</p> <p>If the utility is currently unable to differentiate the risk event sub-driver for equipment they shall default to the equipment degradation sub-driver.</p>
Utility input	2b-Outage History	<p>Historical outage data</p> <p>Input the historical period (e.g., 2019-2024) that the outage data covers</p> <p>In the green cells, input the number of outages during the historical period, segmenting the data by risk driver and by fire-season</p> <p>Note: that the sensitive setting counts are not to be considered the cause of the outage.</p>
	2c-Outage to Ignition Mapping	<p>The percentage probability of an ignition given an outage has occurred during fire season by Ignition Risk Groupings</p> <p>Current percent probability values are based on Staff ignition rank order, subject matter expertise, and utility provided historical results.</p>
	2d-Ignition Risk	<p>Estimates the conditional probability of an ignition during fire season and non-fire season given an outage has occurred by Ignition Risk Grouping.</p> <p>Worksheet results are formula driven based on inputs from Worksheets 2b-Outage History and 2c-Outage to Ignition Mapping</p>
	2e-Ignition Mitigation Effectiveness	<p>Assumed outage rate reduction by mitigation type effectiveness and Ignition Risk Grouping during fire season and non-fire season.</p> <p>The current values are based on an average of the mitigation effectiveness assessments and data analysis from Staff, the WMP Independent Evaluator, and Oregon IOUs.</p>
	2f-Ignition Mitigation Reduction	<p>Assumed outage ignition reduction by mitigation type effectiveness for Ignition Risk Grouping during fire season and non-fire season</p> <p>Worksheet results are formula driven based on inputs from Worksheets 2d-Ignition Risk and 2e-Ignition Mitigation Effectiveness</p>
	2g-Segment Ignition Reduction	<p>Summary worksheet of the initial ignition risk and the various mitigation types</p>

Process		
Section 3	3- Asset Health Risk	Future Development
Section 4	4- Qualitative Risk	Future Development
Risk Summary	Risk Summary	Summary of pre-mitigated risk scores for sections 1-4. Compiles and normalizes pre-mitigation risk scores to develop rank pre-mitigation risk score.
Section 5	5a-Mitigation Cost Inputs	Defines the average mitigation costs for capital and O&M for each mitigation type by a specified unit, such as miles, structures, or devices. The current values are based on Staff analysis of information provided by the three Oregon IOUs, industry costs, and WMP Independent Evaluator. Utilities may choose to enter a depreciation rate in green cells
Utility refinement		
Section 5	5b-Circuit Mitigation Cost	Calculate a high level overview of potential costs of the mitigation over its lifetime as well as annualized costs for each mitigation type on each circuit segment. Utilities may choose to provide an adjusted value for the miles mitigated in column H. Default value is Miles in HFRZ Utilities may choose to provide an adjusted number of installed Automatic reclosures for the total line segment in column G Utilities may choose to provide an adjusted total number of structures for the line segment in column I Utilities may choose to adjusted the Initial capital cost (\$1000) for certain mitigation types if they have developed an estimated project cost for the specific mitigation type and line segment.
Utility refinement		
Utility refinement		
Utility refinement		
Section 6	6b-RSE Detail	Compiles data from the pervious sections, sorted by the highest cumulative risk for sections 1-4 and calculates the circuit segment RSE results for each mitigation option Details pre-mitigation risk scores against post-mitigation risk score, mitigation lifetime, and mitigation cost for general RSE
	6b-RSE Summary	Orders the circuit segments by highest cumulative risk scores and summarizes the mitigation RSE scores. Ranks the result of the RSE values that produce the highest value risk spend efficiency by long-term and short-term mitigation options.
	Co-Benefits	Future Development



Circuit Segment ID	Circuit (Utility Circuit ID)	Circuit Segment/ZOP ID	Start Segment Facility Point	End Segment Facility Point	Operating Area	Total Segment Miles	Total Segment Miles in HFRZ	ZOP % in HFRZ	Current HFRZ Geographic Designation Name	Exposure Risk Score	Exposure Risk Score Rank	Number of observations (N)	Mean Exposure Risk Score	Median Exposure Risk Score	Min Exposure Risk Score	Max Exposure Risk Score	Standard Deviation Exposure Risk Score	

Risk Event Category	Risk / Ignition Event Type	Ignition Risk Event Driver	RSE Ignition Risk Grouping	Utility Risk Category	Utility Risk Subcategory	Does the Utility Consider the Risk Driver in its Risk Models(s)? (Y/N)
	(IEEE 1782-2022 - Category)	(IEEE 1782-2022 - Subcategory)		(Cause Category)	(Cause Subcategory)	
Wire Down Event or Unplanned Outage	Contamination	Contamination	Contamination			
	Equipment	Degradation-Structural Elements	Equipment Deterioration/Failure			
		Degradation-Line Element				
		Degradation-Protective/Control Device				
		Degradation-Voltage Control				
		Degradation-Other				
		Degradation-Unknown				
		Equipment Error-Structural Elements	Equipment Error (failure operated unexpectedly)			
		Equipment Error-Line Element				
		Equipment Error-Protective/Control Device				
		Equipment Error-Voltage Control				
	Equipment Error-Other					
	Equipment Error-Unknown					
	Environmental-Structural Elements	Equipment Environmental (failure failed to operate as designed)				
Environmental-Line Element						
Environmental-Protective/Control Device						
Environmental-Voltage Control						
Environmental-Other						
Environmental-Unknown						
Other-Structural Elements	Equipment Other					
Other-Line Element						
Other-Protective/Control Device						
Other-Voltage Control						
Other-Other						
Other-Unknown						
Lightning	Direct Strike Indirect Strike	Lightning				
Public Contact	Dig-in Fire/Police Foreign Contact-3rd party contact Foreign Contact-Aircraft vehicle contact Foreign Contact-Balloon contact Foreign Contact-Land vehicle contact Foreign Contact-Vandalism/theft Other	Public Contact				
Wildlife Contact	Mammal Bird Reptile/Amphibian Other/Unknown	Wildlife Contact				
Other	Utility Error/Other Utility Error/Other Utility Error/Other Utility Error/Other Utility Error/Other Utility Error/Other Utility Error/Other	Other				
Unknown	Unknown	Unknown				
Vegetation	Outside Clearance Zone Within Clearance Zone (right-of-way) Other	Vegetation Contact				
Wire-to-wire contact	Wire-to-wire contact	Wire-to-wire contact				

Circuit Segment ID	Total Segment Miles	Average Annual Fire Season Outages	Rank Annual Fire Season Outages	Average Annual Non-Fire Season Outages	Rank Annual Non-Fire Season Outages	Historical period (YYYY-YYYY)	Number of Years	Total Outages	Fire Season Total Outages	Non-Fire Season Total Outages	Fire Season: Contamination	Fire Season: Equipment Deterioration/Failure	Fire Season: Equipment Error (failure operated unexpectedly)	Fire Season: Equipment Environmental (failure failed to operate as designed)	Fire Season: Equipment Other	Fire Season: Lightning	Fire Season: Public Contact	Fire Season: Vegetation

Circuit Segment ID	Fire Season: Wildlife Contact	Fire Season: Wire-to-wire contact	Fire Season: Other	Fire Season: Unknown	Fire Season: Sensitive setting outages (sustained events)	Fire Season: PSPS	Non-Fire Season: Contamination	Non-Fire Season: Equipment Deterioration/Failure	Non-Fire Season: Equipment Error (failure operated unexpectedly)	Non-Fire Season: Equipment Environmental (failure failed to operate as designed)	Non-Fire Season: Equipment Other	Non-Fire Season: Lightning	Non-Fire Season: Public Contact	Non-Fire Season: Vegetation	Non-Fire Season: Wildlife Contact	Non-Fire Season: Wire-to-wire contact	Non-Fire Season: Other	Non-Fire Season: Unknown	Non-Fire Season: Sensitive setting outages (sustained events)	Non-Fire Season: PSPS

Ignition Risk Grouping	Fire Season Outages	Non-Fire Season Outages	Probability of Fire Season Outage --> Ignition	Probability of Non-Fire Season Outage --> Ignition	Approximate Fire Season Ignition Events	Approximate Non-Fire Season Ignition Events	Share of Fire Season Outages	Share of Fire Season Ignitions	Share of Non-Fire Season Outages	Share of Non-Fire Season Ignitions
Contamination			2.50%	0.50%						
Equipment Deterioration/Failure			7.00%	0.50%						
Equipment Error (failure operated unexpectedly)			0.50%	0.25%						
Equipment Environmental (failure failed to operate as designed)			7.00%	1.00%						
Equipment Other			0.50%	0.25%						
Lightning			1.35%	0.50%						
Public Contact			4.00%	1.00%						
Vegetation			7.50%	0.25%						
Wildlife Contact			3.00%	0.25%						
Wire-to-wire contact			7.50%	5.00%						
Other			1.00%	0.01%						
Unknown			3.80%	0.01%						
Total			-	-						

Circuit Segment ID	Total Segment Miles	Average Annual Fire Season Ignition Risk Events	Rank Fire Season Ignition Risk Events	Annual Average Non-Fire Season Ignition Risk Events	Rank Non-Fire Season Ignition Risk Event Drivers	Number of Years	Total Ignition Risk Events	Fire Season Total Ignition Risk Events	Non-Fire Season Total Ignition Risk Events	Fire Season: Contamination	Fire Season: Equipment Deterioration/Failure	Fire Season: Equipment Error (failure operated unexpectedly)	Fire Season: Equipment Environmental (failure failed to operate as designed)	Fire Season: Equipment Other	Fire Season: Lightning	Fire Season: Public Contact	Fire Season: Vegetation	Fire Season: Wildlife Contact

Circuit Segment ID	Fire Season: Wire-to-wire contact	Fire Season: Other	Fire Season: Unknown	Non-Fire Season: Contamination	Non-Fire Season: Equipment Deterioration/Failure	Non-Fire Season: Equipment Error (failure operated unexpectedly)	Non-Fire Season: Equipment Environmental (failure failed to operate as designed)	Non-Fire Season: Equipment Other	Non-Fire Season: Lightning	Non-Fire Season: Public Contact	Non-Fire Season: Vegetation	Non-Fire Season: Wildlife Contact	Non-Fire Season: Wire-to-wire contact	Non-Fire Season: Other	Non-Fire Season: Unknown

Ignition Risk Grouping	Effectiveness in reducing risk driver (outages)	GDSH - Undergrounding	GDSH -Tree Wire Covered Conductor (not all phases on legacy arms)	GDSH -Tree Wire Covered Conductor (on legacy arms)	GDSH - Spacer Cable Covered Conductor	GDSH - Traditional overhead hardening	GDSH - Installation of system automation equipment (non-field resources)	GOP - Equipment Settings and Grid Response (requires field resources)	IC - Inspect Correct	VM - Vegetation Management	PSPS - PSPS	PSPS - PSPS
Contamination		99%	71%	79%	84%	39%	47%	47%	34%	14%	80%	
Equipment Deterioration/Failure		99%	59%	70%	75%	38%	52%	52%	31%	8%	80%	
Equipment Error (failure operated unexpectedly)		99%	56%	60%	63%	23%	52%	52%	31%	8%	80%	
Equipment Environmental (failure failed to operate as designed)		99%	45%	38%	55%	38%	52%	52%	31%	8%	80%	
Equipment Other		99%	60%	69%	80%	23%	52%	52%	31%	8%	80%	
Lightning		98%	29%	50%	48%	24%	47%	47%	6%	8%	80%	
Public Contact		95%	48%	73%	78%	5%	30%	30%	2%	9%	80%	
Vegetation		99%	59%	67%	77%	7%	47%	47%	24%	43%	80%	
Wildlife Contact		97%	76%	74%	81%	72%	47%	47%	11%	14%	80%	
Wire-to-wire contact		99%	81%	85%	86%	41%	47%	47%	2%	8%	80%	
Other		95%	45%	60%	70%	16%	30%	30%	24%	8%	80%	
Unknown		95%	45%	60%	70%	16%	30%	30%	24%	9%	80%	

Circuit Segment ID	Total Segment Miles	Number of Years	Annual Average Fire Season Ignitions	Annual Average Non-Fire Season Ignitions	Fire Season Total Ignitions	Non-Fire Season Total Ignitions	Fire Season: GDSH - Undergrounding (Post-Mitigation Annual Ignitions)	Fire Season: GDSH -Tree Wire Covered Conductor (not all phases on legacy arms) (Post-Mitigation Annual Ignitions)	Fire Season: GDSH -Tree Wire Covered Conductor (on legacy arms) (Post-Mitigation Annual Ignitions)	Fire Season: GDSH - Spacer Cable Covered Conductor (Post-Mitigation Annual Ignitions)	Fire Season: GDSH - Traditional overhead hardening (Post-Mitigation Annual Ignitions)	Fire Season: GDSH - Installation of system automation equipment (non-field resources) (Post-Mitigation Annual Ignitions)	Fire Season: GOP - Equipment Settings and Grid Response (requires field resources) (Post-Mitigation Annual Ignitions)	Fire Season: IC - Inspect Correct (Post-Mitigation Annual Ignitions)

Circuit Segment ID	Fire Season: VM - Vegetation Management (Post-Mitigation Annual Ignitions)	Fire Season: PSPS - PSPS (Post-Mitigation Annual Ignitions)	Non-Fire Season: GDSH - Undergrounding (Post-Mitigation Annual Ignitions)	Non-Fire Season: GDSH -Tree Wire Covered Conductor (not all phases on legacy arms) (Post-Mitigation Annual Ignitions)	Non-Fire Season: GDSH -Tree Wire Covered Conductor (on legacy arms) (Post-Mitigation Annual Ignitions)	Non-Fire Season: GDSH - Spacer Cable Covered Conductor (Post-Mitigation Annual Ignitions)	Non-Fire Season: GDSH - Traditional overhead hardening (Post-Mitigation Annual Ignitions)	Non-Fire Season: GDSH - Installation of system automation equipment (non-field resources) (Post-Mitigation Annual Ignitions)	Non-Fire Season: GOP - Equipment Settings and Grid Response (requires field resources) (Post-Mitigation Annual Ignitions)	Non-Fire Season: IC - Inspect Correct (Post-Mitigation Annual Ignitions)	Non-Fire Season: VM - Vegetation Management (Post-Mitigation Annual Ignitions)	Non-Fire Season: PSPS - PSPS (Post-Mitigation Annual Ignitions)

Exposure Risk Score Rank	Exposure Risk Score	Circuit Segment ID	Total Segment Miles	Total Segment Miles in HFRZ	Average Annual Ignitions	Pre-Mitigation		Post-Mitigation Annual Ignitions	GDSH - Undergrounding			Post-Mitigation Annual Ignitions	GDSH - Tree Wire Covered Conductor (not all phases on legacy arms)					
						Average Annual Fire Season Ignitions	Average Annual Non-Fire Season Ignitions		Post-Mitigation Fire Season Ignitions	Percent Reduction in Fire Season Ignitions	Post-Mitigation Non-Fire-Season Ignitions		Percent Reduction in Non-Fire-Season Ignitions	Post-Mitigation Fire Season Ignitions	Percent Reduction in Fire Season Ignitions	Post-Mitigation Non-Fire-Season Ignitions	Percent Reduction in Non-Fire-Season Ignitions	

Circuit Segment ID	GDSH - Tree Wire Covered Conductor (on legacy arms)					GDSH - Spacer Cable Covered Conductor					GDSH - Traditional overhead hardening				
	Post-Mitigation Annual Ignitions	Post-Mitigation Fire Season Ignitions	Percent Reduction In Fire Season Ignitions	Post-Mitigation Non-Fire-Season Ignitions	Percent Reduction in Non-Fire-Season Ignitions	Post-Mitigation Annual Ignitions	Post-Mitigation Fire Season Ignitions	Percent Reduction in Fire Season Ignitions	Post-Mitigation Non-Fire-Season Ignitions	Percent Reduction in Non-Fire-Season Ignitions	Post-Mitigation Annual Ignitions	Post-Mitigation Fire Season Ignitions	Percent Reduction in Fire Season Ignitions	Post-Mitigation Non-Fire-Season Ignitions	Percent Reduction in Non-Fire-Season Ignitions

Circuit Segment ID	GDSH - Installation of system automation equipment (non-field resources)				GOP - Equipment Settings and Grid Response (requires field resources)				IC - Inspect Correct					
	Post-Mitigation Annual Ignitions	Post-Mitigation Fire Season Ignitions	Percent Reduction in Fire Season Ignitions	Post-Mitigation Non-Fire-Season Ignitions	Percent Reduction in Non-Fire-Season Ignitions	Post-Mitigation Annual Ignitions	Post-Mitigation Fire Season Ignitions	Percent Reduction in Fire Season Ignitions	Post-Mitigation Non-Fire-Season Ignitions	Percent Reduction in Non-Fire-Season Ignitions	Post-Mitigation Annual Ignitions	Post-Mitigation Fire Season Ignitions	Percent Reduction in Fire Season Ignitions	Post-Mitigation Non-Fire-Season Ignitions

Circuit Segment ID	VM - Vegetation Management					PSPS - PSPS				
	Post-Mitigation Annual Ignitions	Post-Mitigation Fire Season Ignitions	Percent Reduction in Fire Season Ignitions	Post-Mitigation Non-Fire-Season Ignitions	Percent Reduction in Non-Fire-Season Ignitions	Post-Mitigation Annual Ignitions	Post-Mitigation Fire Season Ignitions	Percent Reduction in Fire Season Ignitions	Post-Mitigation Non-Fire-Season Ignitions	Percent Reduction in Non-Fire-Season Ignitions
[Redacted Content]										

Exposure Risk Score Rank	Exposure Risk Score	Circuit Segment ID	Total Segment Miles	Total Segment Miles in	Asset Health Score	Rank - Asset Health Score

Exposure Risk Score Rank	Exposure Risk Score	Circuit Segment ID	Total Segment Miles	Total Segment Miles in	Rank - Qualitative Score

Exposure Risk Score Rank	Exposure Risk Score	Normalized to 1 - Exposure Risk Score	Circuit Segment ID	Total Segment Miles	Total Segment Miles in HFRZ	Pre-mitigation			
						Average Annual Outage Ignitions	Normalized to 1 - Annual Outage Ignitions	Average Annual <u>Fire Season</u> Outage Ignitions	Average Annual <u>Non-Fire Season</u> Outage Ignitions

Pre-mitigation			Pre-mitigation		Pre-mitigation		
Asset Health Risk Score	Normalized to 1 - Asset Health Risk Score		Qualitative Risk Score	Normalized to - Qualitative Risk Score	Comments	Aggregate Risk Score	Aggregate Risk Ranking

<i>Lookups</i>	<i>capital_unit</i>	<i>lifetime</i>	<i>interest_rate</i>	<i>dep_rate</i>	<i>om_unit</i>	<i>om_savings_unit</i>		
Mitigation Measure	Capital Cost (\$1000) Per Unit	Capital Units	Asset Life (years)	Annual Interest Rate or Financing Cost (%)	Depreciation Rate (leave blank for straight-line depreciation)	Annual Labor and O&M Cost (\$1000) Per Unit	Annual Labor and O&M Savings (\$1000) Per Unit	O&M Units
GDSH - Undergrounding	\$2,250.000	Line Miles	57.5	6.1%		\$2.144	\$8.532	Line Miles
GDSH -Tree Wire Covered Conductor (not all phases on legacy arms)	\$1,200.000	Line Miles	55	6.1%		\$0.000	\$0	Line Miles
GDSH -Tree Wire Covered Conductor (on legacy arms)	\$1,200.000	Line Miles	55	6.1%		\$0.000	\$0	Line Miles
GDSH - Spacer Cable Covered Conductor	\$1,200.000	Line Miles	55	6.1%		\$0.000	\$0	Line Miles
GDSH - Traditional overhead hardening	\$250.000	Line Miles	30	6.1%		\$0.000	\$0	Line Miles
GDSH - Installation of system automation equipment (non-field resources)	\$55.000	Devices	15	6.1%		\$0.284	\$0	Line Miles
GOP - Equipment Settings and Grid Response (requires field resources)	-	-	-	-		\$0.284	\$0	Line Miles
IC - Inspect Correct	\$3	Average structure correction	55	6.1%		\$0.127		Structure
VM - Vegetation Management	-	-	-	-		\$13.772		Miles inspected/corrected
PSPS - PSPS	-	-	-	-		\$1.485		Line Miles

Lookups

device_mile

readiness_cost

Mitigation Measure	Notes	Additional Parameters (a) (see Notes)	Additional Parameters (b) (see Notes)	Additional Parameters (b) (see Notes)
GDSH - Undergrounding		-	-	-
GDSH -Tree Wire Covered Conductor (not all phases on legacy arms)	Include capital cost per mile, cost to maintain the circuit segment, and cost savings per mile	-	-	-
GDSH -Tree Wire Covered Conductor (on legacy arms)		-	-	-
GDSH - Spacer Cable Covered Conductor		-	-	-
GDSH - Traditional overhead hardening		Include capital and maintenance costs of traditional overhead hardening.	-	-
GDSH - Installation of system automation equipment (non-field resources)	Include capital costs of system automation equipment, and average costs to restore power ("truck-roll") for each event per Line Mile when a circuit segment is de-energized due to equipment settings	0.18	\$0.033	(a) Number of system automation devices per mile (b) Average cost per line-mile for Equipment Settings program cost, calculated by dividing total program cost by number of line-miles in program (\$000s).
GOP - Equipment Settings and Grid Response (requires field resources)	Average costs to restore power ("truck-roll") for each event per <u>Line Mile</u> when a circuit segment is de-energized due to equipment settings.	-	\$0.033	(b) Average cost per line-mile for Equipment Settings program cost, calculated by dividing total program cost by number of line-miles in program (\$000s).
IC - Inspect Correct	Include capital cost of structure correction, and average costs per structure inspected/corrected. Can be calculated by dividing total inspect/correct costs by number of structures covered in program.	-	-	-
VM - Vegetation Management	Cost per inspect/correct-mile for vegetation management inspections and hazard removal. Can be calculated by dividing total vegetation management costs by circuit-miles inspected and circuit-miles of hazard removal.	1.00	-	Inspection cycles. The number of times per year a circuit-segment is inspected for vegetation management or hazard removal work is completed.
PSPS - PSPS	Average costs to restore power ("truck-roll") for each event per line mile when a circuit segment is de-energized due to PSPS.	1.00	\$0	(a) Number of PSPS events per circuit segment to calculate costs for (b) Average readiness cost per line-mile for PSPS program cost, calculated by dividing fixed PSPS costs by number of line-miles in program (\$000s).

Aggregate Risk Ranking	Aggregate Risk Score	Exposure Risk Score Rank	Exposure Risk Score	Circuit Segment ID	Total Segment Miles	Total Segment Miles in HFRZ	mitigation_miles			capital_unit									
							Mitigation Miles (utility input, default is miles HFRZ in Column G)	# of Automatic Reclosers (Default = 5a device_mile x HFRZ miles)	Average Structures (Default value is: 25 per mile for Circuit Segment)	GDSH - Undergrounding									
							Initial capital cost (\$1000)	Lifetime capital cost (\$1000)	Lifetime labor and O&M net cost (\$1000)	Total lifetime costs (\$1000)	Average annual net costs (\$1000)								

Circuit Segment ID	<i>capital_unit</i> GDSH -Tree Wire Covered Conductor (not all phases on legacy arms)					<i>capital_unit</i> GDSH -Tree Wire Covered Conductor (on legacy arms)					<i>capital_unit</i> GDSH - Spacer Cable Covered Conductor				
	Initial capital cost (\$1000)	Lifetime capital cost (\$1000)	Lifetime labor and O&M net cost (\$1000)	Total lifetime costs (\$1000)	Average annual net costs (\$1000)	Initial capital cost (\$1000)	Lifetime capital cost (\$1000)	Lifetime labor and O&M net cost (\$1000)	Total lifetime costs (\$1000)	Average annual net costs (\$1000)	Initial capital cost (\$1000)	Lifetime capital cost (\$1000)	Lifetime labor and O&M net cost (\$1000)	Total lifetime costs (\$1000)	Average annual net costs (\$1000)

Circuit Segment ID	<i>capital_unit</i> GDSH - Traditional overhead hardening					<i>capital_unit</i> GDSH - Installation of system automation equipment (non-field resources)					Fire Season: Sensitive setting outages <i>capital_unit</i> <i>om_unit</i> Non-Fire Season: S GOP - Equipment Settings and Grid Response (requires field resources)			
	Initial capital cost (\$1000)	Lifetime capital cost (\$1000)	Lifetime labor and O&M net cost (\$1000)	Total lifetime costs (\$1000)	Average annual net costs (\$1000)	Initial capital cost (\$1000)	Lifetime capital cost (\$1000)	Lifetime labor and O&M net cost (\$1000)	Total lifetime costs (\$1000)	Average annual net costs (\$1000)	Expected outage events per year by mile	Lifetime capital cost (\$1000)	Annual labor and O&M net cost (\$1000)	Total annual costs (\$1000)

Circuit Segment ID	<i>capital_unit</i>		<i>om_unit</i>	<i>capital_unit</i>		<i>om_unit</i>	Fire Season: PSPS	<i>capital_unit</i>		<i>om_unit</i>	Non-Fire Season	
	IC - Inspect Correct	VM - Vegetation Management			PSPS - PSPS							
	Initial capital cost (\$1000)	Lifetime capital cost (\$1000)	Lifetime labor and O&M net cost (\$1000)	Total lifetime costs (\$1000)	Total annual costs (\$1000)	Lifetime capital cost (\$1000)	Annual labor and O&M net cost (\$1000)	Total annual costs (\$1000)	Expected PSPS events per year (default: 1 per year)	Capital cost per event (\$1000)	O&M cost per event (\$1000)	Total annual costs (\$1000)

Pre-Mitigation								Pre-mitigation results			
Aggregate Risk Ranking	Normalized Risk Score	Circuit Segment ID	Total Segment Miles	Total Segment Miles in HFRZ	Mitigation Miles	Exposure Risk Score Rank	Exposure Risk Score	Ignition Risk Score	Asset Risk Score	Qualitative Risk Score	Risk Score

Circuit Segment ID	Post-Mitigation: GDSH - Undergrounding								Post-Mitigation: GDSH -Tree Wire Covered Conductor (not all phases on legacy arms)							
	Ignition Score	Asset Score	Qualitative Score	Risk Reduced	Weighted Risk Reduced	Mitigation Lifetime	Annual costs (\$1000)	Annual Mitigation RSE (millions)	Ignition Score	Asset Score	Qualitative Score	Risk Reduced	Weighted Risk Reduced	Mitigation Lifetime	Annual costs (\$1000)	Annual Mitigation RSE (millions)

Circuit Segment ID	Post-Mitigation: GDSH -Tree Wire Covered Conductor (on legacy arms)								Post-Mitigation: GDSH - Spacer Cable Covered Conductor							
	Ignition Score	Asset Score	Qualitative Score	Risk Reduced	Weighted Risk Reduced	Mitigation Lifetime	Annual costs (\$1000)	Annual Mitigation RSE (millions)	Ignition Score	Asset Score	Qualitative Score	Risk Reduced	Weighted Risk Reduced	Mitigation Lifetime	Annual costs (\$1000)	Annual Mitigation RSE (millions)

Circuit Segment ID	Post-Mitigation: GDSH - Traditional overhead hardening								Post-Mitigation: GDSH - Installation of system automation equipment (non-field resources)							
	Ignition Score	Asset Score	Qualitative Score	Risk Reduced	Weighted Risk Reduced	Mitigation Lifetime	Annual costs (\$1000)	Annual Mitigation RSE (millions)	Ignition Score	Asset Score	Qualitative Score	Risk Reduced	Weighted Risk Reduced	Mitigation Lifetime	Annual costs (\$1000)	Annual Mitigation RSE (millions)

Circuit Segment ID	Post-Mitigation: GOP - Equipment Settings and Grid Response (requires field resources)								Post-Mitigation: IC - Inspect Correct							
	Ignition Score	Asset Score	Qualitative Score	Risk Reduced	Weighted Risk Reduced	Mitigation Lifetime	Annual costs (\$1000)	Annual Mitigation RSE (millions)	Ignition Score	Asset Score	Qualitative Score	Risk Reduced	Weighted Risk Reduced	Mitigation Lifetime	Annual costs (\$1000)	Annual Mitigation RSE (millions)

Circuit Segment ID	Post-Mitigation: VM - Vegetation Management								Post-Mitigation: PSPS - PSPS							
	Ignition Score	Asset Score	Qualitative Score	Risk Reduced	Weighted Risk Reduced	Mitigation Lifetime	Annual costs (\$1000)	Annual Mitigation RSE (millions)	Ignition Score	Asset Score	Qualitative Score	Risk Reduced	Weighted Risk Reduced	Mitigation Lifetime	Annual costs (\$1000)	Annual Mitigation RSE (millions)

