Wildfire Risk Governance Forum
November 13th, 2020

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Decision and Action Item Review

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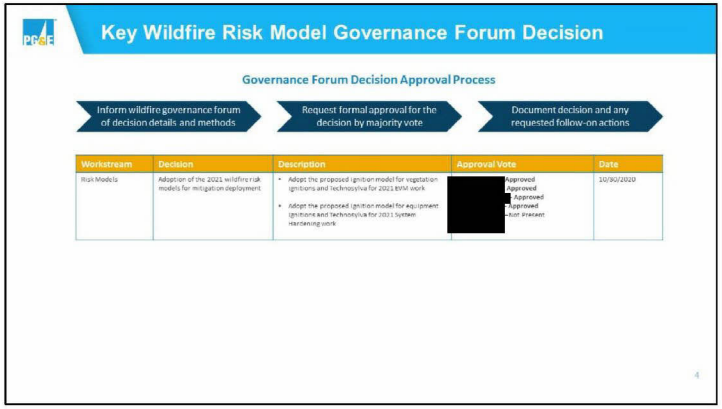

Key Decision – Adoption of the 2021 Risk Model for Mitigation Deployment

Approval Status	Approved

Decision Detail

The approval is for moving from the 2018 wildfire risk model to the 2021 wildfire risk model to inform system hardening, enhanced vegetation management and inspections. These changes included:

- Update to vegetation ignition model (LoRe)
- Update to conductor model (LoRe)
- Update to consequence (CoRe)

Concerns and Mitigations

- Inclusion of non-HFTD areas requested in the next model iteration
- Inclusion of Egress model requested in the next model iteration
- Resource availability to complete "not-risk informed planned work" was challenged
- Detailed description of variables in particular "non-burnable area" requested
- The ability to calculate tree density within pixels was challenged

Approvals

[redacted]	Approved
	Approved
	Approved
	Approved
	Abstain – Not Present

Action Items and Validations

Adoption of the 2021 wildfire risk models for mitigation deployment Deep dive risk model session	**Completed** - Adopt the proposed ignition model for vegetation ignitions and Technosylva for 2021 EVM work
	Completed - Adopt the proposed ignition model for equipment ignitions and Technosylva for 2021 System Hardening work
Risk models comparison	**Completed** - Create risk comparison between the 2018 risk model and 2021 risk model to highlight movement of CPZs (Targeting top 100 circuits or CPZs)
Deep dive risk model session	**Completed** - Hold a Deep Dive Session with (1) the Federal Monitor and (2) the Operational Observer
Model process documentation	**In Process** - Bring the Model Process Level Documentation to this forum for an official approval
Egress Consideration	**Road Mapped** - Factor in Egress into process for selecting the protection zones to be worked

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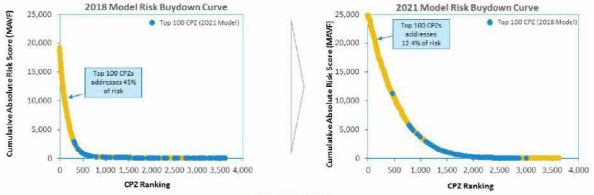
Risk Model Action Items

Workstream	Action Item	Description	Responsible party	Resolution	Date
Risk Models	Risk models comparison WSE – 10/30/2020	Create risk comparison between the 2018 risk model and 2021 risk model to highlight movement of CPZs (Targeting top 100 circuits or CPZs)	[redacted]	Complete – See the Risk Model Follow-up Section	11/13/2020



Key Takeaways

- No CPZs in the top 100 overlap
- This will result in significant change to the prioritization and expected risk buydown of mitigations
- The 2018 risk results were not distance weighted, where the 2021 prioritization included a distance factor.

Risk Model Action Items

Workstream	Action Item	Description	Responsible party	Resolution	Date
Risk Models	Deep dive risk model session WGS – 10/30/2020	Hold a Deep Dive Session with (1) the Federal Monitor and (2) the Operational Observer	[redacted]	Complete – Meetings have been scheduled for 11/9 & 11/12	11/12/2020

Updates

- First Deep Dive session held on Monday 11/10/2020 at 1:00pm PST
- Second session will be held on Thursday 11/12/200 at 12:30pm PST

Risk Model Action Items

Workstream	Action Item	Description	Responsible party	Resolution	Date
Risk Models	Risk model contributors	Provide a detailed description of the top model contributors	[redacted]	Complete – Targeted for inclusion in deep dive sessions	11/12/2020

Vegetation Model – Contributors Description

Variable	Description
Tree-height-max	Maximum tree height, in meters, for each 100m x 100m pixel area along the distribution grid
100-hour-fuels-avg	The dead fuel moisture data from GRIDMET
Vapor-pressure-deficit-avg	The average vapor pressure deficit from the GRIDMET dataset
Gusty-summer-day-pct	Percentage of days that have high frequency of gusts
Hftd	High fire threat district
Precipitation-avg	The average daily precipitation from the GRIDMET dataset
Impervious	Impervious ground cover (i.e. non-flammable)
Specific-humidity-avg	The average specific humidity from the GRIDMET dataset
Burn-index-avg	An derived variable based off of the geographical and topographical aspects of a location
Wind-max	The maximum wind velocity at a height of 10-meters from the Real-Time Mesoscale Analysis(RTMA) dataset at a resolution of 2.5-km
Temperature-avg	The average temperature from the GRIDMET dataset
Windy-summer-day-pct	Percentage of days that have a high percentage of days with high average wind speed
Local-topography	The topographic position index (TPI) was extracted from a USGS digital elevation model (DEM) at 100-meter resolution
1000-hour-fuels-avg	The dead fuel moisture data from GRIDMET
Energy-release-avg	Average release of energy from fuels

Conductor Model – Contributors Description

Variable	Description
Non-burnable area	Land surface descriptor similar to imperviousness that includes surfaces that typically don't ignite when a spark occurs
Daily precipitation, mean	The average daily precipitation from the GRIDMET dataset
Conductor material: ACSR	Aluminum conductor steel-reinforced
Estimated conductor age	Number of years since the installation year
Max tree height	Maximum tree height, in meters, for each 100m x 100m pixel area along the distribution grid
Reliability Program splice	Spans with more than three splice per phase
Vapor pressure deficit, mean	The average vapor pressure deficit from the GRIDMET dataset
Conductor size: 2	Conductor-size-2
Conductor size: 4	Conductor-size-4
100-hour fuels, mean	The dead fuel moisture data from GRIDMET
Max temperature, mean	The average maximum temperature from the GRIDMET dataset.
Wind speed, mean	The average wind velocity at a height of 10-meters from the Real-Time Mesoscale Analysis(RTMA) dataset at a resolution of 2.5-km
Local topography	The topographic position index (TPI) was extracted from a USGS digital elevation model (DEM) at 100-meter resolution

Risk Model Action Items

Workstream	Action Item	Description	Responsible party	Resolution	Date
Risk Models	Model process documentation	Bring the Model Process Level Documentation to this forum for an official approval	[redacted]	In Process – Targeted for inclusion in deep dive sessions	11/20/2020

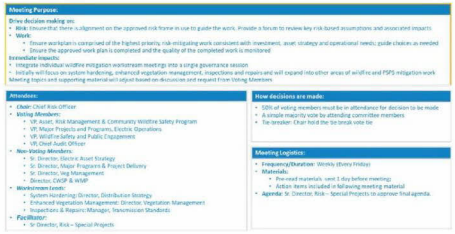
1 User Guide

Model procedure and details will be provided in the user guide to the forum for review at the 11/20 session

Risk Model Action Items

Workstream	Action Item	Description	Responsible party	Resolution	Date
Wildfire Governance Charter	Charter update	Update charter to include review of broader set of WP risk reduction activities and project oversight	[redacted]	**Completed** - Risk charter has been updated, included in attached materials	11/05/2020

See updated slide for the updated wildfire governance Charter



Meeting Purpose:

Drive decision making on:

- **Risk:** Ensure that there is alignment on the approved risk frame in use to guide the work. Provide a forum to review key risk-based assumptions and associated impacts
- **Work:**
  - Ensure workplan is comprised of the highest priority risk-mitigating work consistent with investment, asset, strategy and operational needs; guide choices as needed
  - Ensure the approved work plan is completed and the quality of the completed work is monitored

Immediate Impacts:

- Integrate individual wildfire mitigation workstream meetings into a single governance session
- Initially will focus on system hardening, enhanced vegetation management, inspections and repairs and will expand into other areas of wildfire and PSPS mitigation work

Meeting topics and supporting material will adjust based on discussion and request from Voting Members

Attendees:

- **Chair:** Chief Risk Officer
- **Voting Members:**
  - VP, Asset, Risk Management & Community Wildfire Safety Program
  - VP, Major Projects and Programs, Electric Operations
  - VP, Wildfire Safety and Public Engagement
  - VP, Chief Audit Officer
- **Non-Voting Members:**
  - Sr. Director, Electric Asset Strategy
  - Sr. Director, Major Programs & Project Delivery
  - Sr. Director, Veg Management
  - Director, CWSP & WMP
- **Workstream Leads:**
  - System Hardening Director, Distribution Strategy
  - Enhanced Vegetation Management: Director, Vegetation Management
  - Inspections & Repairs: Manager, Transmission Standards
- **Facilitator:**
  - Sr Director, Risk – Special Projects

How decisions are made:

- 50% of voting members must be in attendance for decision to be made
- A simple majority vote by attending committee members
- Tie-breaker: Chair hold the tie-break vote tie

Meeting Logistics:

- **Frequency/Duration:** Weekly (Every Friday)
- **Materials:**
  - Pre-read materials sent 1 day before meetings
  - Action items included in following meeting material
- **Agenda:** Sr. Director, Risk – Special Projects to approve final agenda.

System Hardening

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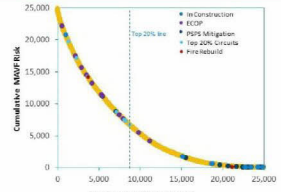
The team proposes a "No Regrets" plan for approaching initial wildfire scope

Included Scope

- All projects in the top 20% CPZ
- Any ECOP projects in the top 20% CPZs
- All PSPS Mitigation Projects
- All Fire Rebuild Projects

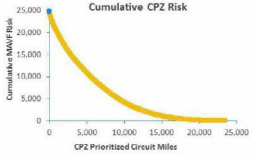


	Miles	Projects	Risk Reduction[1]	High Risk Area Miles	Expected Case
In Construction	41.17	27	7.62	5.11	[redacted]
ECOP (In Estimating)	55.94	17	68.03	49.04	
PSPS Mitigation	14.47	12	17.45	14.47	
Top 20% MAVF CPZ	41.32	8	70.58	41.42	
Fire Rebuild	12.7	2	8.12	12.7	

The "No Regrets" plan is an initial scope of work for the 2021 wildfire season that rests in the highest risk locations for either experienced or predicated fire risk. This scope of work will allow for the system hardening execution teams to remain fully utilized while confirmation of the remaining workplan is underway.

The system hardening team is requesting approval to move forward with this initial scope of work from the wildfire governance team.

The top 50 miles of CPZs will be targeted for 25 miles of system hardening in 2021



Protection Zone Name	Miles	Cumulative Miles	Mean MAVF Score	Total CPZ Mavf	% total risk reduced (62%)
OREGON TRAIL [redacted]	0.02	0.02	3.16	3.16	**0.01%**
CALPINE [redacted]	0.01	0.03	1.88	1.88	**0.01%**
MARIPOS	0.08	0.12	1.69	1.69	**0.02%**
SHEPHER	0.01	0.13	1.44	1.44	**0.02%**
MIDDLET	0.05	0.18	1.30	5.20	**0.03%**
UPPER LA	1.00	1.17	1.26	3.77	**0.04%**
KESWICK	6.66	7.83	1.25	48.84	**0.17%**
MIDDLET 1102302	4.21	12.04	0.92	48.56	**0.29%**
KONOCTI	5.61	17.65	0.88	51.70	**0.42%**
MARIPOS	0.64	18.29	0.77	10.81	**0.44%**
BUCKS CR	4.29	22.58	0.73	9.55	**0.47%**
DEL MAR	0.09	22.67	0.73	2.19	**0.47%**
MIDDLET	0.42	23.08	0.72	8.70	**0.49%**
MIDDLET	24.80	47.88	0.72	151.83	**0.87%**

Key Takeaways

- Mitigating 25 of the 50 riskiest miles within PG&E's service territory would reduce ~0.5% of PG&E's total wildfire risk.
- Some of these segments are relatively small and may be the result of edge effects. However trends in the data, such as the Middletown circuit, highlight areas of high risk were more extensive remediation can occur
- The team recommends creating a strike team to assess the most effective way to address and mitigate the wildfire risk across these circuits and locations to complete these in 2021 as a stretch target

Overhead Inspections

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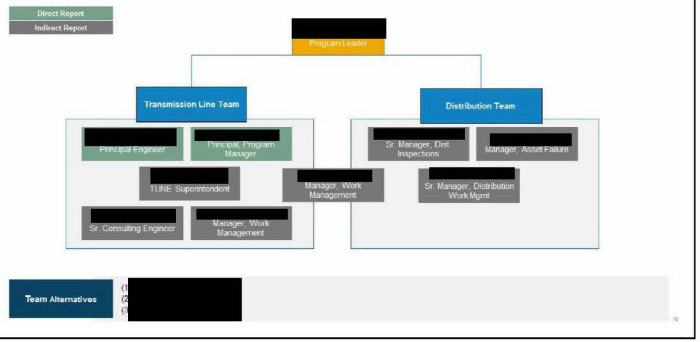
The inspections team will be responsible for seeing to the following tasks to meet the organizations wildfire risk objectives

The inspections team is requesting the following structure to support the execution of the defined scope



Enhanced Vegetation Management

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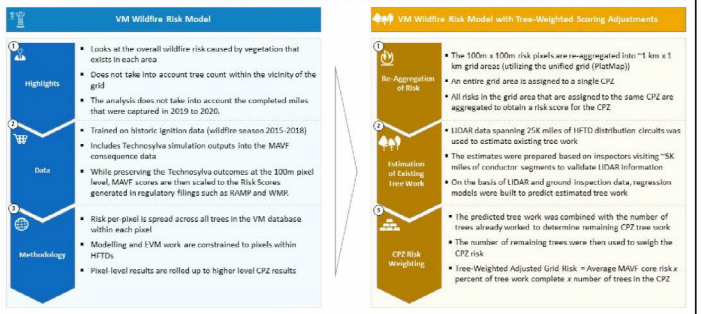
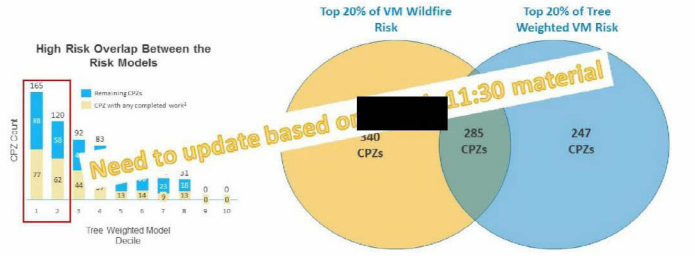
The VM Wildfire Risk Model, which forms the basis of EVM risk calculations, has been modified to obtain a tree-weighted risk scoring



Tree Weighted Risk = (VM Wildfire Risk) X (% CPZ Completed) X (Trees in CPZ)

A "no regrets" approach of tackling the CPZs identified as high risk by both models is proposed for adoption to operationalize work



285 CPZs were common across the VM Wildfire risk ranking and the Tree Weighted risk ranking. Both models highlight these areas as high impact, and should be prioritized for EVM work.

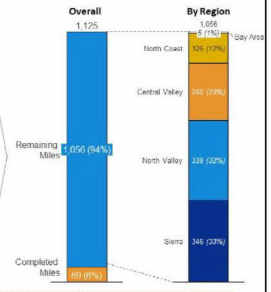
EVM is requesting approval to commence work on ~1,056 'no regret' miles involving a total of 49 Circuit Protection Zones (CPZs)

Circuit Protection Zones with 'No Regret' Remaining Miles

Risk Tier: <=10%

CPZ Name	Completed Miles	Total Remaining Miles	Estimated Remaining Tree work
Higgin[redacted]	-	51	1,849
Dasch	-	45	2,321
Shingl	-	40	1,632
Red Bl	-	40	506
Auber	6	40	1,260
Marip	-	39	676
Auber	1	33	380
Bell 11	2	30	886
Cedar	-	29	2,143
Higgin	-	28	1,217
Remai	58	680	29,879
Total	**69**	**1,056**	**42,749**

Remaining Miles (Top 10% of Risk)



While the full EVM 2021 work plan is being discussed, the EVM team seeks an approved scope for work starting in December that includes 1,056 miles prior to the approval of the full 2021 work plan

2021 Draft EVM Plan

Key Features and Scope Areas

Circuit Protection Zones (CPZs)

- The 2021 plan incorporates the **concept of the CPZ** – a term coined by the Asset Strategy team
- CPZs are being used because they are **tied to isolation devices** on circuits, and in the case of PSPS events, indicate a way to isolate a circuit from a certain point

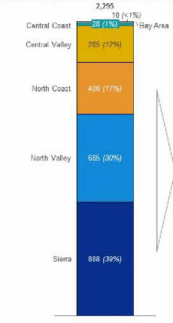
Plan rationale

- The 2021 EVM plan has been prepared with the intent that:
  - The plan **avoids any System Hardening projects** in 2021
    - Need final 2021 System Hardening Plan in order to complete full 2021 proposed projects

Scope

- The plan targets **~190,000** trees and **2,295** miles of distribution circuits
- The plan envisions a **pre-inspection of between 894-973K** trees, **tree work** of an estimated **171-210K** trees and **removal of an estimated 107-143K trees**
- The current plan has been prepared on the basis of a tree-based weighted analysis of risk across CPZs to take into account tree work already completed – a variable that is missing from the VM Wildfire Risk model

Regional Distribution of Targeted Mileage (miles)



Other Considerations

- **Plan inputs:** The plan has been prepared on the basis of work completed and risk from the VM Wildfire Risk Model
- The plan overlaps with inputs from local subject matter experts (SMEs), prior inspections and local customer/agency contacts
- **Regions:** Plan targets have been balanced with respect to a 12-year plan across each of the regions
- **Estimated cost:** A direct cost of ~**$845 million** is estimated for pre-inspection and tree work spend

Action Items

Workstream	Action Item (Initial Date)	Description	Responsible party	Resolution	Date
Enhanced Vegetation Management	EVM Risk Buydown Curve WGR – 11/3/2020	Plot and show the 1130 miles (60-90% Carry Over Work that needs to be finished) on the EVM – CPZ (Strike Tree and Overhang Weighted) Risk Buydown Curve	[redacted]	**Not Applicable –** Scope has moved away from the prior Carryover plan	11/13/2020
Enhanced Vegetation Management	EVM programs timeframes WGR – 11/3/2020	Determine the overall time frame and pace for the EVM program when Strike Potential Trees are factored into the 25500 miles of HFTD Circuits. Understand which of the 25500 miles need EVM work	[redacted]	**In Process –** Forecast program time is being developed alongside tree weighted risk	11/20/2020
Enhanced Vegetation Management	EVM programs and resources WGR – 11/3/2020	Provide a full picture of all vegetation management work, outside of just the enhanced vegetation management.	[redacted]	**In Process –** Review of other programs underway, dependent upon total EVM scope for resourcing	11/20/2020
Enhanced Vegetation Management	System hardening and EVM work overlay WGR – 11/3/2020	Evaluate the areas that are being targeted by system hardening to align for operational efficiencies between the two programs. Dependency on 2021 SH Work Plan	[redacted]	**Not Applicable –** Changes to system assets and structure limit ability to complete to EVM standards	11/13/2020
Enhanced Vegetation Management	Tree density statistic WGR – 11/3/2020	Show Tree Density from the 2019 and 2020 Work. Provide tree density number per mile proposed as we show future work 2021, 2022	[redacted]	**Road Mapped –** LiDAR Tree density will be examined for inclusion in future risk modeling	11/13/2020

Follow-Ups and Next Steps

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Upcoming Review Agenda Items

11/20/2020

- Final Decision on System Hardening Plan (If feasible)
- Initial Review into Inspections 2021 Plan
- Initial Review into Repairs 2021 Plan
- Close out Completed Action Items

12/01/2020

- Final Decision on EVM 2021 Plan (If feasible)
- Decision Items needed for Inspections 2021 Work Plan
- Close out Completed Action Items

12/08/2020

- Decision needed on Inspection, Initial views of 2021 Work Plan
- Decisions needed on Repairs 2021 Work Plan
- Tier 1 – Overhead Conductor Replacement Discussion

Complete Action Items from 11/09/2020 (Federal Monitor Meeting)

Workstream	Action Item	Description	Responsible party	Resolution	Date
Risk Models	Risk models comparison WGR - 10/30/2020	Include high risk areas outside of HFTD (Jon Eric) in the next iteration of the Dx Model	[redacted]	**Road Mapped** - This will be added as an enhancement to the model road map	11/13/20
Risk Models	Risk Model Enhancement	Incorporate 2019 LIDAR data, and species data in the next iteration of the Dx model		**Road Mapped** – This will be added as an enhancement to the model road map	11/13/20
Risk Models	Risk Model Enhancement	Include Egress on the consequence side for the next iteration of the Dx Model		**Road Mapped** – This will be added as an enhancement to the model road map	11/13/20
Risk Models	Model Documentation	Axis to be added to charts on slide 22 (ppt 11.09.2020 Wildfire Risk Model Review Final v1)		**Completed**	11/13/20

Complete Action items

Workstream	Action Item	Description	Responsible party	Resolution	Date
Inspection	Inspection Workstream Owner	Schedule meeting to identify the owner of the inspections and repair workstream		**Completed** – Inspections lead identified	10/23/2020
Risk model	Risk Model Deep Dive	The risk model needed further detailed discussion before voting and approval could take place		**Completed** – Follow-up session held 10/27. Detail on the risk model was provided in advance of 10/30 approval meeting.	10/23/2020
EVM	EVM review meeting	Schedule additional meeting for EVM review		**Completed** – Follow up meeting was help on 11/05	11/05/2020
Governance meetings	Meeting updates	Update meeting to be 90 minutes		**Completed** – Future meetings updated – effective 11/13	11/03/2020
Governance meetings	Ad [redacted] to future meetings	[redacted] to be added to future meetings to provide additional direction from audit		**Completed** [redacted] has been added to all future governance meetings	10/23/2020

Action Item Tracking

Workstream	Action Item	Description	Responsible party	Resolution	Date
Risk Models	Risk models comparison WGR – 10/30/2020	Create risk comparison between the 2018 risk model and 2021 risk model to highlight movement of CPZs (Targeting top 100 circuits or CPZs)	[redacted]	**Completed**	11/13/2020
Risk Models	Deep dive risk model session WGR – 10/30/2020	Hold a Deep Dive Session with (1) the Federal Monitor and (2) the Operational Observer		**Completed**	11/12/2020
Risk Models	Risk model contributors	Highlight contributors to the risk model		**Completed**	11/13/2020
Risk Models	Model process documentation	Bring the Model Process Level Documentation to this forum for an official approval		**In Process** – Targeted for inclusion in deep dive sessions	11/20/2020
Risk Models	Egress Consideration	Factor in Egress into process for selecting the protection zones to be worked		**Road Mapped** – Egress has been considered as a future enhancement for the risk model	11/03/2020
Wildfire Governance Charter	Charter update	Update charter to include review of broader set of WF risk reduction activities and project oversight		**Complete** Risk charter has been updated, included in attached materials	11/09/2020

Action Items from 11/09/2020 (Federal Monitor Meeting)

Workstream	Action Item	Description	Responsible party	Resolution	Date
Risk Models	Risk models comparison WGR – 10/30/2020	Include high risk areas outside of HFTD (on Erin) in the next iteration of the Dx Model	[redacted]	**Road Mapped** – This will be added as an enhancement to the model road map	XXX
Risk Models	Risk Model Enhancement	Incorporate 2019 LiDAR data, and species data in the next iteration of the Dx model		**Road Mapped** – This will be added as an enhancement to the model road map	XXX
Risk Models	Risk Model Enhancement	Include Egress on the consequence side for the next iteration of the Dx Model		**Road Mapped** – This will be added as an enhancement to the model road map	XXX
Risk Models	Model Documentation	Axis to be added to charts on slide 22 (ppt 11.09.2020 Wildfire Risk Model Review Final v1)		**Completed**	11/18/2020

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Appendix

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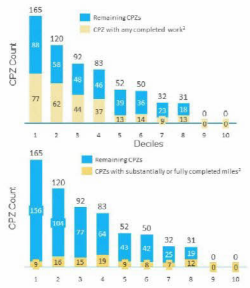
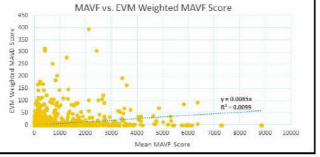
Comparison of the Tree Weighted model to the Dx Model

Overlap between the Risk Models



Key Take-aways

- The correlation between the EVM weighted prioritization scores and the MAVF score is low at 0.0099
- Of the top 20% of circuits that were identified in the Dx model, 285 remained in the top two deciles of the Tree Weighted model.
- Of the top 100 CPZs, only 14 were common across both prioritization lists
- Over 10% of the CPZs identified to have risk in the Dx model were zero risk locations in the tree weighted model.



22 circuits have seen at least five unique PSPS events in the 2019-2020 timeframe

Seven PSPS Events

Circuit Name	County	Total Customer Events
ORO FINO 1101	BUTTE	25091
ORO FINO 1102	BUTTE	21561
PARADISE 1104	BUTTE	14710
PARADISE 1105	BUTTE	12054
CLARK ROAD 1102	BUTTE	10410
PARADISE 1103	BUTTE	5534
BUTTE 1105	BUTTE	3194
BIG BEND 1102	BUTTE	2772
WYANDOTTE 1105	BUTTE	2560
BIG BEND 1101	BUTTE	2332

Six PSPS Events

Circuit Name	County	Total Customer Events
WYANDOTTE 1103	BUTTE	13105
NOTRE DAME 1104	BUTTE	4317
PARADISE 1106	BUTTE	3503

Five PSPS Events

Circuit Name	County	Total Customer Events
WYANDOTTE 1107	BUTTE	14544
BANGOR 1101	YUBA	12328
DOBBINS 1101	YUBA	7096
CHALLENGE 1102	YUBA	6719
KANAKA 1101	BUTTE	4572
BANGOR 1101	BUTTE	4373
KANAKA 1101	YUBA	417
CHALLENGE 1102	BUTTE	266
BUCKS CREEK 1101	PLUMAS	35