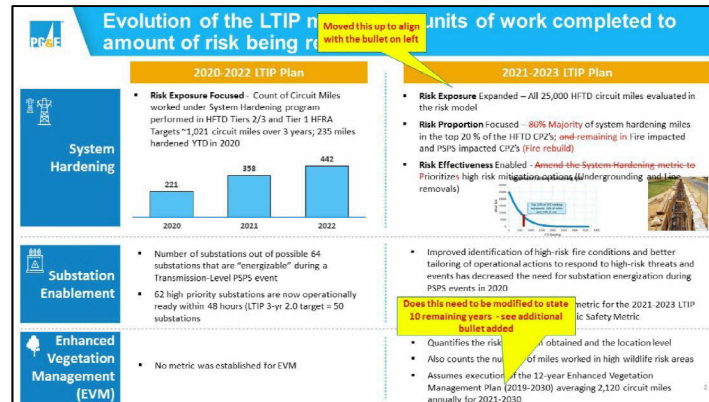


**Public Safety
Long Term Incentive Plan (LTIP)
Target Setting**

November 13, 2020





Risk Model and Risk Quantification

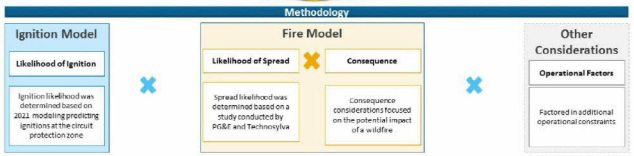
J. Smith

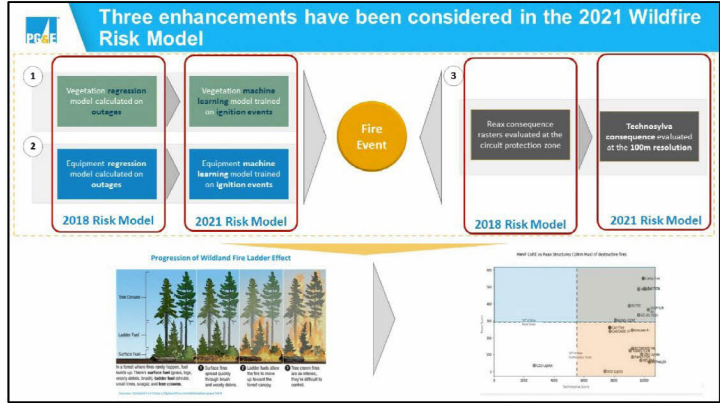
The wildfire risk model considers the likelihood and consequences of potential wildfires

- | LoRE | CoRE |
|--|---|
| <ul style="list-style-type: none"> The likelihood of a risk event (LoRE) is the relative frequency of a specific risk event occurring. In the case of wildfire risk, this is the relative likelihood of a ignition occurring. | <ul style="list-style-type: none"> The consequence of a risk event (CoRE) is the average impact of the risk should it materialize across key metrics (Safety, Reliability, Financial). In the case of wildfire risk, consequence contains serious injuries, fatalities, property damage, and impacts to reliability. |

Risk = LoRE X CoRE

- Risk is the product of the likelihood and consequence of a risk event.
- This method produces an expected value of impact across the consequence metrics, and when combined results in a multi-attribute score that can inform risk based decision making.

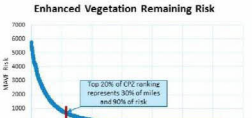




The risk model is used to develop risk buydown curves for EVM and System Hardening

The risk buydown curve shows the amount of risk that can be addressed with every subsequent mile or CPZ that is initiated. This view shows the relative magnitude of potential projects and can compare impacts of programs with varied effectiveness. The visualization helps to highlight the consolidation of risk by mile as you move down the prioritization list.

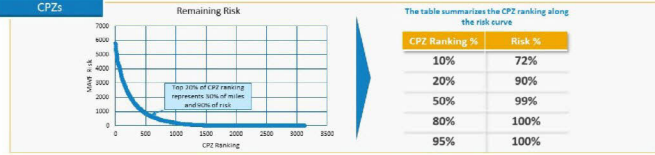
Do you happen to have the 2018 and 2021 Buydown curves for System Hardening and EVM



Project Example

7/20/2014

Our first condition puts a focus on identifying projects that are in the top 20% of riskiest CPZs



Map View of CPZ TBD

Selected Project

Can we say anything here to describe this CPZ such as likelihood of fire ignition (tree species, canopy shape etc.), likelihood of spread (wind, fuel type), asset condition and type -- to bring this CPZ more to life?

CPZ Attributes

- Quantified Risk Value:
- Estimated number of miles:


Project Attributes

- Number of miles considered:
- Total addressable risk value:

Our second condition puts a focus on the method considered for System Hardening


Overhead Hardening

Overhead Hardening may include: replacement of bare overhead conductors, poles, primary line equipment, and raising transformers to lower fire ignition risk.




Underground

Undergrounding is the replacement of the primary (and some secondary) overhead conductors and cables, eliminating the need for overhead lines altogether.



Remote Grid

Remote Grid uses standalone, distributed energy sources and utility infrastructure for 24/7/365 reliable energy delivery in lieu of traditional wires.



Execution Complexity

Cost of Solution

Residual Risk

Execution Complexity

Cost of Solution

Residual Risk

Execution Complexity

Cost of Solution

Residual Risk

High → Medium → Low

MITIGATION METHODS	MILES	EFFECTIVENESS
System Hardening- Underground	X	98%
System Hardening- Overhead	Y	65%
Line Removal	Z	100%

Examples of factors to determine Undergrounding, OH Hardening, and Removal:

- Past PSPS occurrences
- Lifecycle cost considerations
- Number of customers
- Miles of work
- Timeline considerations

Total CPZ Risk Score: 12.06

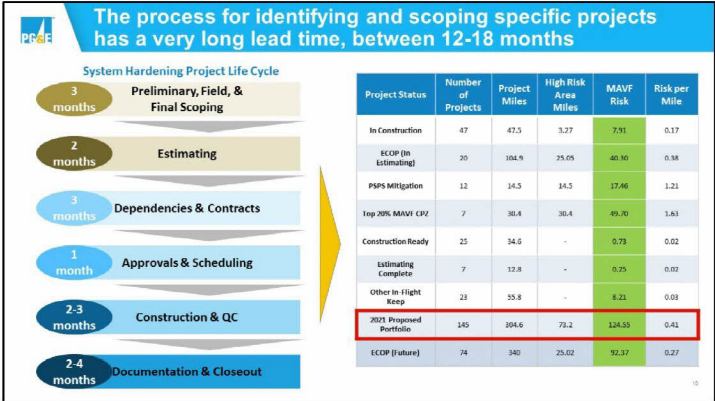
Risk Reduction: 9.45

Residual Risk: 2.58

CPZ Risk

Can be achieved through project execution of OH, UG, and Removal

Placeholder Picture for illustrative CPZ risk buydown



Target Setting

© 2008

PG&E Approach to the 2021 work plan attempts to balance with maximized risk reduction

Conditions

- Risk Exposure Expanded**
 - All 25,000 HFD miles were evaluated within the 2021 Risk Model
- Risk Proportion Focused**
 - Majority of system hardening miles in the top 20% of the HFD CPZ's, remaining in Fire impacted and PPS impacted CPZ's (Fire rebuild)
 - 2021 is a transition year given risk model enhancements and evolution
- Risk Effectiveness Enabled**
 - Prioritizes high risk mitigation options (Undergrounding and Line removals)
 - 5%, 10% and 15% of Undergrounding work in the System Hardening project portfolio in 2021, 2022 and 2023, respectively

2021 System Hardening Workplan

Recommendation

Use the 2021 wildfire risk model to inform the prioritization of project scope work, while maximizing the amount of efficient system hardening that can be completed before wildfire season 2022. Additional resources not used to complete this plan will be assigned to address the backlog of CC tags in the HFD. The workplan will focus on:

Included in Scope:	Additional Review: (Complete partial CPZ)
<ul style="list-style-type: none"> CPZ currently in construction CPZ in the top 20% of Highest Risk CPZs ECOP and PPS Projects 	<ul style="list-style-type: none"> Construction ready projects Remaining complete projects awaiting dependencies
Highest Risk Area Miles: 73.2	Miles Addressed: 206.4
	MAVR Reduced: 124.55 (0.3%)

Alternatives

Alternative 1	Alternative 2
<p>Focus exclusively on the highest risk area miles, and address excess resources to complete HFD CC tags and other non-hardening capital work</p> <p>Included in Scope:</p> <ul style="list-style-type: none"> Current scope of highest risk area miles 	<p>Maximize the amount of system hardening work that can be completed by carrying over all construction ready work for 2022</p> <p>Included in Scope:</p> <ul style="list-style-type: none"> All current construction ready 2021 system hardening projects
Highest Risk Area Miles: 73.2	Highest Risk Area Miles: 7.2
Miles Addressed: 73.2	Miles Addressed: 254.18
Risk Reduced: 156.79 (0.4%)	Risk Reduced: 30.27 (0.1%)

12



The LTIP targets for system hardening are set based on 2021 risk area miles and program funding assumptions

Program Funding

Forecast of wildfire Mitigation capital spend (bulk of which is System Hardening) in 2021 consistent with the Settlement for the 2020-2022 GRC. 2022 forecast escalates 2021 by 15% and 2023 forecast escalates 2021 by 30%.

Unit Costs

Assumes four circuit miles of Overhead SI work and four circuit miles of Underground work

Program Duration

Execution of the 13-year plan focusing on top 20% CPZs by 2032

System Hardening LTIP Targets

	LTIP 0.5	LTIP 1.0	LTIP 2.0
2021	305	320	350
2022	350	368	403
2023	396	416	455
2021-2023	1,051	1,103	1,209

Targets are miles of system hardening work for specific risk-prioritized work

The total mileage of the proposed 2021 Project Portfolio was set as the threshold goal (LTIP 0.5) for 2021, 2022 and 2023 LTIP 0.5 goals reflect escalation of program funding level. The target and stretch goals (LTIP 1.0, 2.0) were set as 5% and 15% higher, respectively.



The LTIP targets for EVM are set based on work to be completed over the remaining ten years of the program

Program Funding

- Forecast of [redacted] and [redacted] spend on EVM program in 2021, 2022 and 2023 respectively (in alignment with POR)

Unit Costs

- TBD (can we say anything here about cost assumptions?)

Program Duration

- Assumes execution of the 12-year Enhanced Vegetation management Plan (2019-2030)

Enhanced Vegetation Management LTIP Targets

	LTIP 0.5	LTIP 1.0	LTIP 2.0
2021	2,120	2,226	2,438
2022	2,120	2,226	2,438
2023	2,120	2,226	2,438
2021-2023	6,360	6,678	7,314

Targets are miles of EVM work for specific risk-prioritized work.

The total mileage of the proposed 2021 Project Portfolio was set as the threshold goal (LTIP 0.5) for 2021. The target and stretch goals (LTIP 1.0, 2.0) were set as 5% and 15% higher, respectively.

Appendix

11/15/2014

PG&E Sample System Hardening Project

Project Name: CWSP-COLUMBIA HILL 1101-LR 2212 PH4

Line of Business: Electric Operations - Distribution


Start Date: 6/1/2020	In-Service Date: 9/22/2020	Completion Date: 12/28/2020
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Action Recommended: Reconductor in Tier 3 Fire Risk Area. It is recommended that the Senior Director of Asset Strategy approve a capital expenditure of [REDACTED] for the planned reconductor of 5,647 as part of the 2020 O&M Wildfire Mitigation Program.

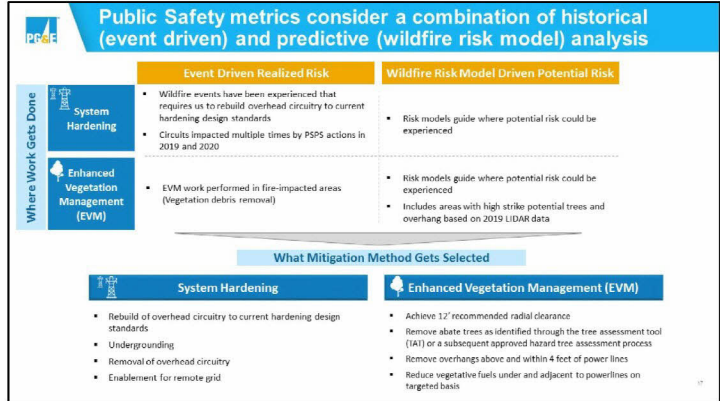
Project Scope and Cost Assumptions:

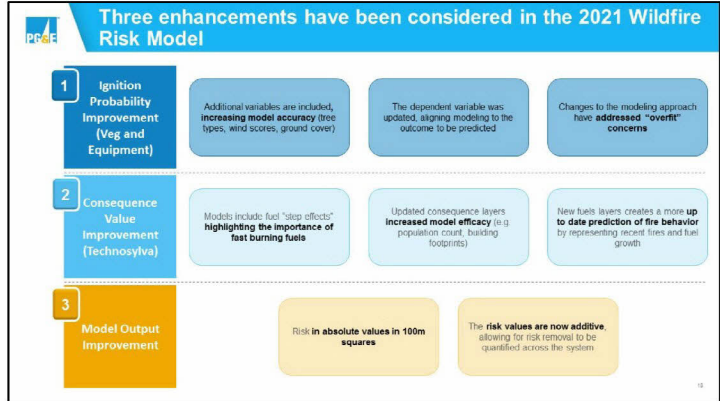
- Estimate assumed to be at AACE class 2
- Land and Environmental issues are known and have been addressed
- Crews will remain onsite through project completion
- Reconductor 5,647
- Install 3,781' of 3.1/0A EPR & 1.4" Conduit 12kV
- Install 1,546' of 3.1/0A TW 12kV
- Install 335' of 2.1/0A TW 12kV
- Replace/Install 10 poles
- Replace/Install 1 transformers
- Replace/Install 2 fuses
- Install 6 new #6 UG Enclosure
- Vegetation (non-compliance tree thinning) \$350,000
- Helicopter Contract Costs \$50,000

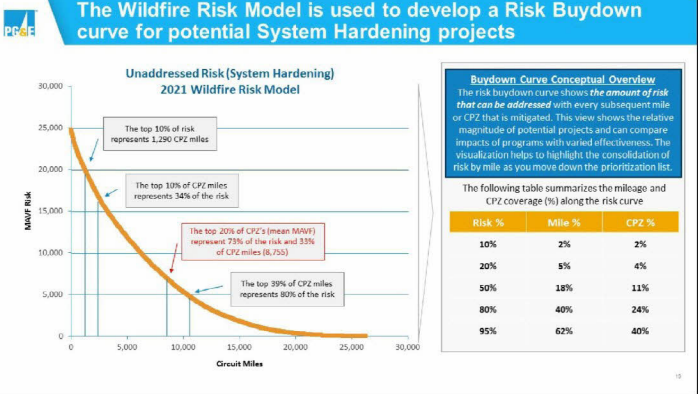
Impacted Metrics: Goal of hardening 221 miles in 2020, this project will contribute 1.07 miles to towards the goal.

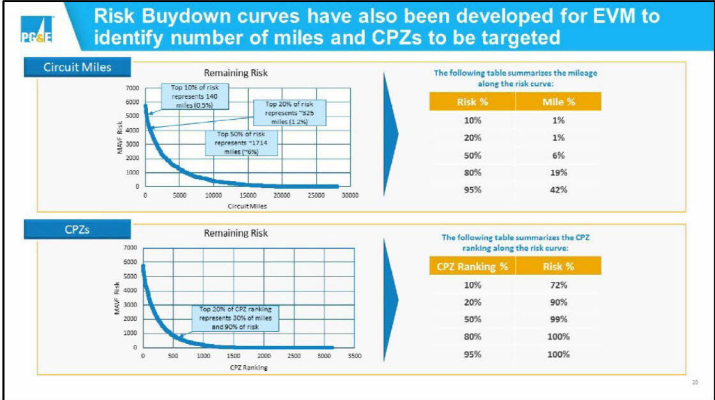


Expense	\$0
Expense Contingency	\$0
Capital	[REDACTED]
Risk Allowance	[REDACTED]
Total Project Cost	[REDACTED]
Risk Contingency	[REDACTED]
AACE Class Contingency	[REDACTED]
Total Contingency	[REDACTED]
Total Authorized Amount	[REDACTED]

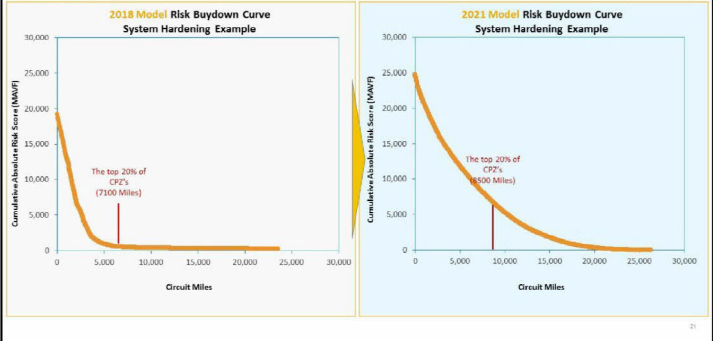


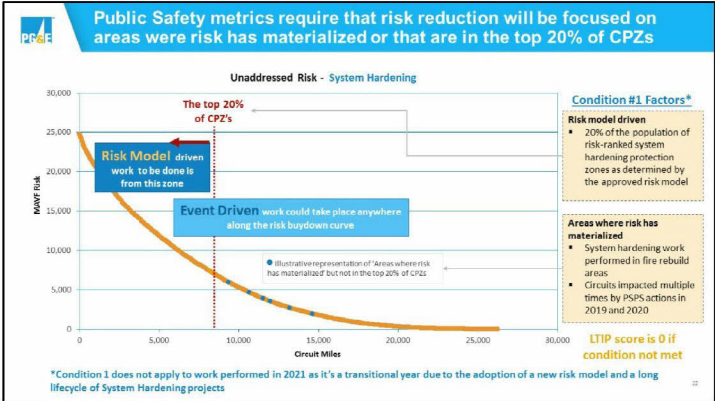






As a result of modeling enhancements risk buydown curves have evolved







Public Safety metrics require that a portion of the mitigation focus on alternate hardening strategies

Underground



Undergrounding is the replacement of the primary (and some secondary) overhead conductors and cables, eliminating the need for overhead lines altogether

Remote Grid



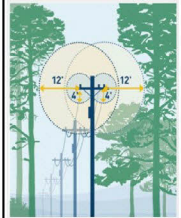

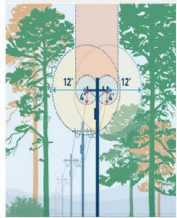

Remote Grid uses stand-alone, distributed energy sources and utility infrastructure for 24/7/365 reliable energy delivery in lieu of traditional wires

Condition #2 Factors

- Mitigation Method
- At least 5%, 10%, and 15% of undergrounding or line removal work in the system hardening project portfolio in 2021, 2022, and 2023, respectively

LTIIP score is 0 if condition not met

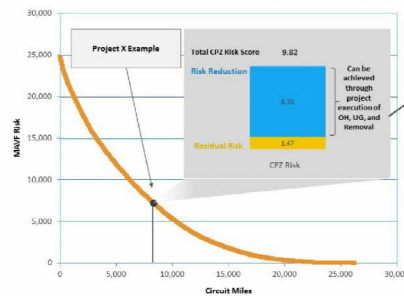
Public Safety metrics require that EVM consider four aspects

1 Vegetation Clearance	2 Tree Assessment Tool	3 Branch Overhang Clearance	4 Fuel Reduction
<p>Achieving 12' recommended radial clearance</p> 	<p>Removing abate trees as identified through the tree assessment tool (TAT) or a subsequent approved hazard tree assessment process</p>  <p>Assessment on multitude of strike, failure, and impact attributes targeted towards failure impact on PG&E assets</p>	<p>Removing overhangs above and within 4 feet of power lines</p> 	<p>Reducing vegetative fuels under and adjacent to powerlines on targeted basis</p> 

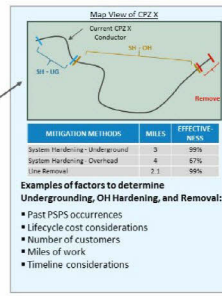


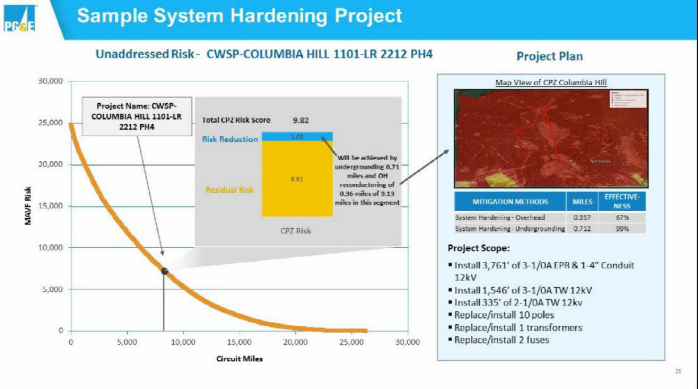
A project is evaluated based on where it is being performed and what mitigation method is being used

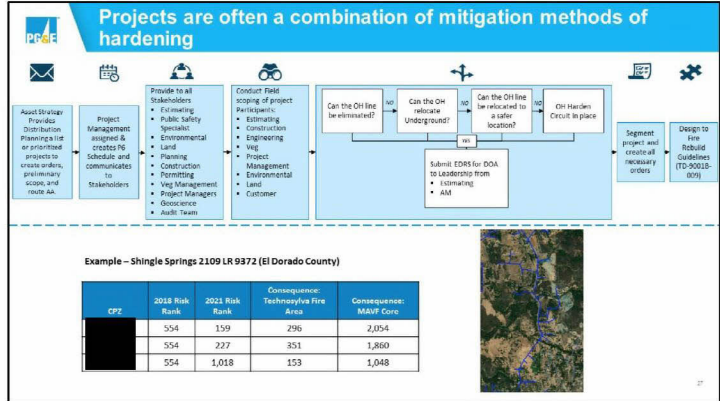
Unaddressed Risk - Illustrative System Hardening Project



Example Project X Plan







PG&E Recommendation and Alternatives

Recommendation

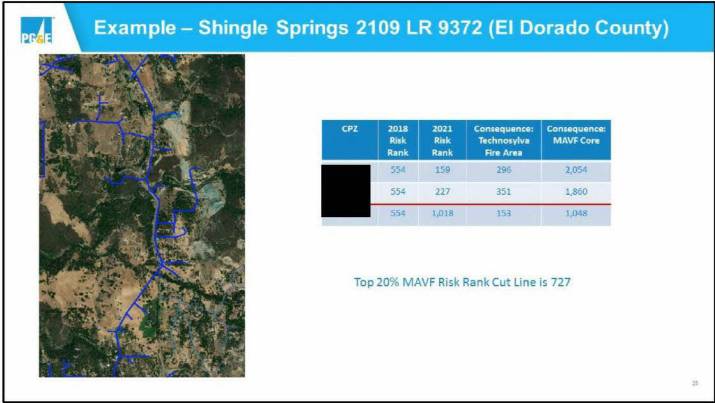
Utilize the 2021 wildfire risk model to inform the prioritization of current scoped work, while maximizing the amount of efficient system hardening that can be completed before wildfire season 2021. Additional resources not used to complete this plan will be assigned to address the backlog of EC tags in the HFTD. The workplan will focus on:

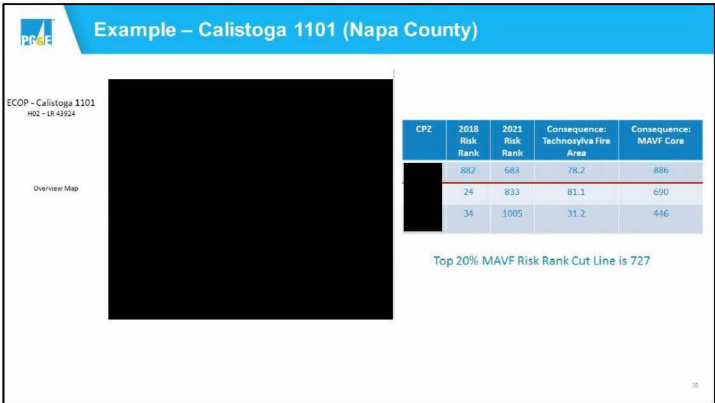
<p>Included in Scope:</p> <ul style="list-style-type: none"> • CPZs currently in construction • CPZs in the top 20% of MAVF Risk CPZs • ECOP and PSPS Projects 	<p>Additional Review: (Complete partial CPZs)</p> <ul style="list-style-type: none"> • Construction ready projects • Estimating complete projects awaiting dependencies
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Highest Risk Area Miles: 73.2	Miles Addressed: 306.4	MAVF Reduced: 124.55 (0.5%)
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Alternatives

Alternative 1	Alternative 2
<p>Focus exclusively on the highest risk area miles, and utilize excess resources to complete HFTD EC tags and other non-hardening capital work</p> <p>Included in Scope:</p> <ul style="list-style-type: none"> • Current scope of highest risk area miles 	<p>Maximize the amount of system hardening work that can be completed by carrying over all construction ready work for 2021</p> <p>Included in Scope:</p> <ul style="list-style-type: none"> • All current construction ready 2021 system hardening projects
Highest Risk Area Miles: 73.2	Highest Risk Area Miles: 7.2
Miles Addressed: 73.2	Miles Addressed: 254.18
Risk Reduced: 106.70 (0.4%)	Risk Reduced: 30.27 (0.1%)







Example – Miwuk 1701 CB Zone (Tuolumne County)



CPZ	2018 Risk Rank	2021 Risk Rank	Consequence: Technology/ Fire Area	Consequence: MAVF Core
45	1,569	12.2	296	
139	1,887	14.8	242	
12	2,267	10.3	31.4	
7	2,353	11.4	64.1	
1	2,690	3.7	8.3	

Top 20% MAVF Risk Rank Cut Line is 727



Ladder Effects

Ladder effects in wildland fires create the conditions for low lying fast burning fuels to intensify as they move from up the canopy and into more energy dense fuel sources. Accounting for this effect in wildfire modeling de-emphasizes areas of dense fuels as high risk for ignition, due to lack of potential surface fuels.

Additionally, locations that have large amounts of surface fuels that can sustain high temperatures are rated more highly as these are more likely to ladder into difficult to contain crown fires.

Progression of Wildland Fire Ladder Effect



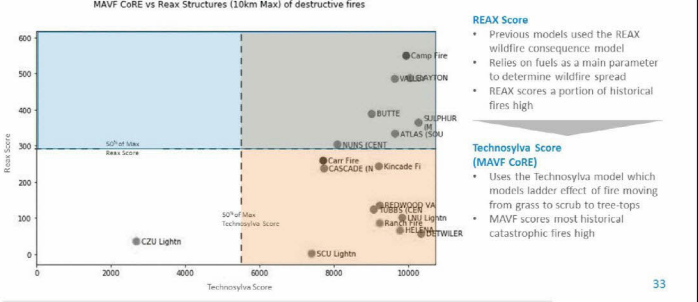
In a forest where fires rarely happen, fuel builds up. Think of surface fuel (grass, logs, woody debris, brush, ladder fuel (snags, small trees, snags), and tree crowns).

- 1 Surface fires spread quickly through brush and woody debris.
- 2 Ladder fuels allow the fire to reach up toward the forest canopy.
- 3 Tree crown fires are intense, they're difficult to control.

Source: <http://www.fire.ca.gov/2014/04/01/understanding-wildfire-science/>

Technosylva more accurately predicts high consequence fires as having high risk

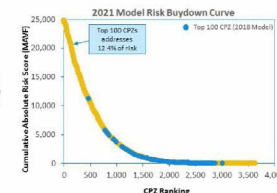
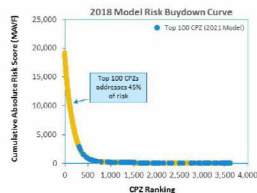
Technosylva based wildfire consequence data better identifies historical destructive fire locations





Risk Model Action Items

Workstream	Action Item	Description	Responsible party	Resolution	Date
Risk Model	Risk Model Comparison W08 - 10/30/2020	Create risk comparison between the 2018 risk model and 2021 risk model to highlight movement of CPZs. The getting top 100 CPZs in CPZs.	Jon Eric Thainan	Complete - See the Risk Model Followup Section	11/3/2020



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.

