Tree Strike Risk Calculation for

Bucks Creek 1101

- *Count Trees within 6 ft of Conductor*
- *Calculate Tree Strike Residual Risk for*
  - ❑ *Non-Hardened Circuits*
  - ❑ *Circuits generically hardened with 1/0 ACSR XLPE*
  - ❑ *Circuits generically hardened with 397.5 AAC XLPE*

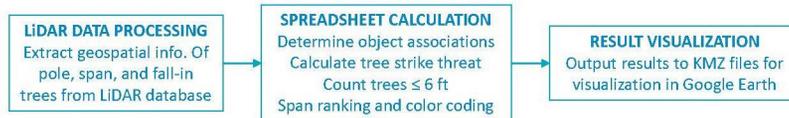**PG&E** Together, Building a Better California

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- LiDAR data processing
  - Extract pole, span, and fall-in tree geospatial information from LiDAR database
- Import processed data into Excel spreadsheet
  - Determine Tree–Span–Pole associations based on the LiDAR geospatial info
  - **Tree strike threat**: Calculate number of fall-in trees in each span that can touch the line
  - **Trees within 6 ft**: Calculate number of fall-in trees in each span that are within 6 ft from the line
  - Rank and color code the spans in each category based on the number of trees in each span
- Output results to Google Earth for visualization
  - For each circuit, span, pole, and tree results are output to separate KMZ files such that they are shown as different layers in Google Earth

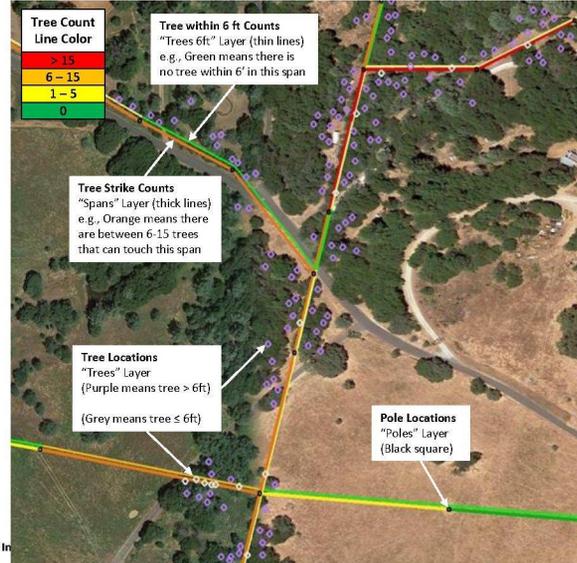| **LiDAR DATA PROCESSING** Extract geospatial info. Of pole, span, and fall-in trees from LiDAR database	→	**SPREADSHEET CALCULATION** Determine object associations Calculate tree strike threat Count trees ≤ 6 ft Span ranking and color coding	→	**RESULT VISUALIZATION** Output results to KMZ files for visualization in Google Earth

- Tree-Span relationship is tagged in LiDAR (see figure)
- All fall-in trees have potential to strike the span regardless of wind speed and wind direction
- Tree strike failure is counted as true when a tree is tagged as fall-in with non-zero Overstrike
- Spans are ranked based on the number of fall-in trees in each span

Overstrike

Tree Height

Calculated Span Height

Offset
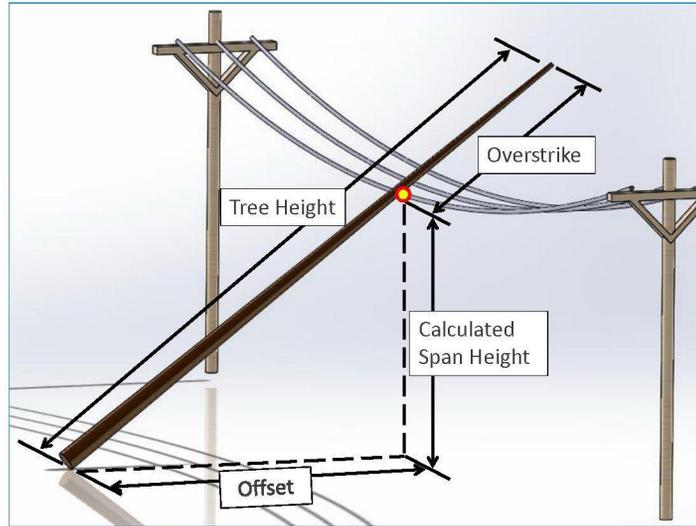
Definition of KMZ Layer Symbols and Line Colors

- Tree strike threat color coding
  - Thick red lines: Spans that have more than 15 fall-in trees that can touch the line
  - Thick orange lines: Spans that have 6 to 15 fall-in trees that can touch the line
  - Thick yellow lines: Spans that have 1 to 5 fall-in trees that can touch the line
  - Thick green lines: Spans that have zero fall-in tree that can touch the line

- Tree distance color coding
  - Thin red lines: Spans that have more than 15 fall-in trees within 6 ft of the line
  - Thin orange lines: Spans that have 6 to 15 fall-in trees within 6 ft of the line
  - Thin yellow lines: Spans that have 1 to 5 fall-in trees within 6 ft of the line
  - Thin green lines: Spans that have zero 15 fall-in tree within 6 ft of the line

Tree Count Line Color
| > 15 |
| 6 – 15 |
| 1 – 5 |
| 0 |

Tree within 6 ft Counts
"Trees 6ft" Layer (thin lines)
e.g., Green means there is no tree within 6' in this span

Tree Strike Counts
"Spans" Layer (thick lines)
e.g., Orange means there are between 6-15 trees that can touch this span

Tree Locations
"Trees" Layer
(Purple means tree > 6ft)
(Grey means tree ≤ 6ft)

Pole Locations
"Poles" Layer
(Black square)

RESULTS – Bucks Creek 1101

- Tree strike threat calculation
  - Tree counts that can touch the non-hardened line
  - Tree counts that can break a hardened line
- Residual risk calculation

$$= \frac{No.\ of\ Spans\ in\ Threat\ Level}{Total\ Spans} \times Weight\ Factor$$

Bucks Creek 1101 (Non-hardened)

Threat Level	Trees Touching Non-Hardened (No. of spans)	Linear Span Length (miles)	Tree Strike Residual Risk	
			Weight Factor	Non-Hardened
High (15+ trees)	13	0.74	1	0.078
Medium (5-15 trees)	51	2.35	0.75	0.229
Low (1-5 trees)	60	2.36	0.50	0.180
None	43	1.78	0	0.000
Total:	167	7.23		0.487

Bucks Creek 1101 (Hardened w/ 1/0 ACSR XLPE)

Threat Level	Trees Breaking Hardened (No. of spans)	Linear Span Length (miles)	Tree Strike Residual Risk	
			Weight Factor	Non-Hardened
High (15+ trees)	1	0.04	1	0.006
Medium (5-15 trees)	27	1.22	0.75	0.121
Low (1-5 trees)	65	2.84	0.5	0.195
None	74	3.13	0	0.000
Total:	167	7.23		0.322

Bucks Creek 1101 (Hardened w/ 397.5 AAC XLPE)

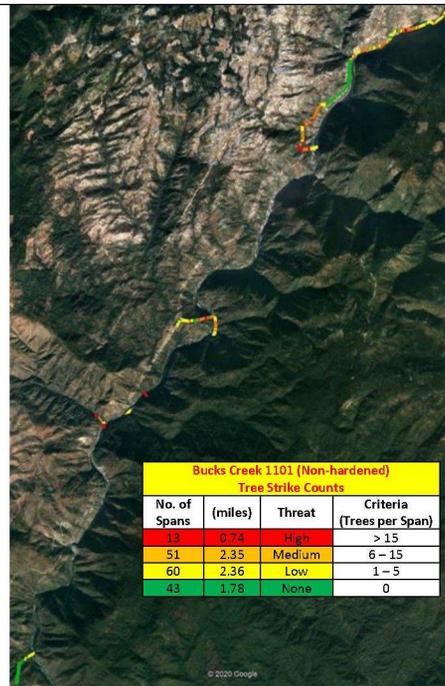| Threat Level	Trees Breaking Hardened (No. of spans)	Linear Span Length (miles)	Tree Strike Residual Risk	
			Weight Factor	Non-Hardened
High (15+ trees)	0	0.00	1	0.000
Medium (5-15 trees)	18	0.84	0.75	0.081
Low (1-5 trees)	69	3.00	0.5	0.207
None	80	3.38	0	0.000
Total:	167	7.23		0.287

Bucks Creek 1101

- * - Trees 6ft.kmz
- Trees that are within 6 ft of line
  - 0 span have more than 15 trees
    in each span that are within 6 ft
  - 0 span have 6 to 15 trees
    in each span that are within 6 ft
  - 4 spans have 1 to 5 trees
    in each span that are within 6 ft
  - 163 spans have zero tree
    in each span that are within 6 ft

Bucks Creek 1101
Tree ≤ 6ft Counts

No. of Spans	Criteria (Trees per Span)
0	> 15
0	6 – 15
4	1 – 5
163	0

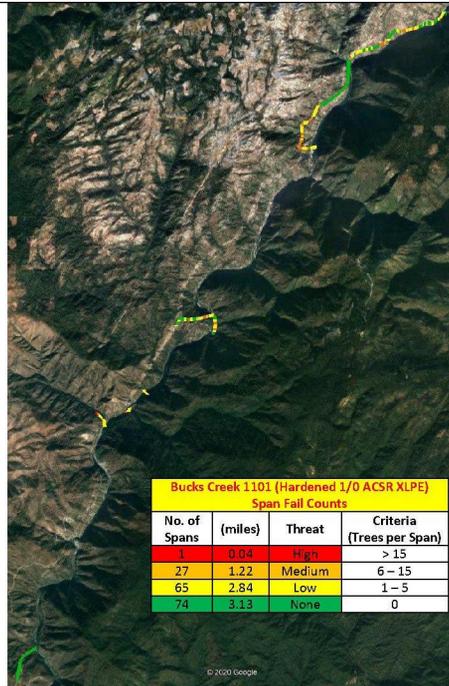© 2020 Google

Bucks Creek 1101

- * - Spans.kmz
- Based on 2019 LiDAR
- Trees that can touch the line
  - 13 spans have more than 15 trees in each span that can strike
  - 51 spans have 6 to 15 trees in each span that can strike
  - 60 spans have 1 to 5 trees in each span that can strike
  - 43 spans have zero tree in each span that can strike

Bucks Creek 1101 (Non-hardened) Tree Strike Counts

No. of Spans	(miles)	Threat	Criteria (Trees per Span)
13	0.74	High	> 15
51	2.35	Medium	6 – 15
60	2.36	Low	1 – 5
43	1.78	None	0

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Bucks Creek 1101

- * - Spans.kmz
- Based on 2019 LiDAR
- Trees that can break 1/0 ACSR XLPE
  - 1 span have more than 15 trees
    in each span that can break the span
  - 27 spans have 6 to 15 trees
    in each span that can break the span
  - 65 spans have 1 to 5 trees
    in each span that can break the span
  - 74 spans have zero tree
    in each span that can break the span

**Bucks Creek 1101 (Hardened 1/0 ACSR XLPE)
Span Fail Counts**

No. of Spans	(miles)	Threat	Criteria (Trees per Span)
1	0.04	High	> 15
27	1.22	Medium	6 – 15
65	2.84	Low	1 – 5
74	3.13	None	0

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Bucks Creek 1101

- * - Spans.kmz
- Based on 2019 LiDAR
- Trees that can break 397.5 AAC XLPE
  - 0 spans have more than 15 trees
    in each span that can break the span
  - 18 spans have 6 to 15 trees
    in each span that can break the span
  - 69 spans have 1 to 5 trees
    in each span that can break the span
  - 80 spans have zero tree
    in each span that can break the span

**Bucks Creek 1101 (Hardened 397.5 AAC XLPE)
Span Fail Counts**

No. of Spans	(miles)	Threat	Criteria (Trees per Span)
0	0.00	High	> 15
18	0.84	Medium	6 – 15
69	3.00	Low	1 – 5
80	3.38	None	0