WMP Risk Modeling

Presented to the Office of Energy Infrastructure Safety

Rick Dalton
Senior Director, Engineering
Liberty Utilities

October 5, 2021

Liberty

Liberty Utilities

- ~49,000 customers
- ~724 miles of overhead distribution and transmission lines *(>90% HFTD)*
- ~24,700 utility poles
- 15 substations
- Connected to Nevada Balancing Authority (*not CAISO*)
- 125 employees

Liberty

Overview of Wildfire Risk Models

- Liberty utilized varying modeling tools to assess wildfire risk at the system level and at the circuit level
- Reax fire propagation and consequence model
  - Resulted in segmenting service territory into “polygons” by fire risk and suppression cost consequences
- Probability of ignition model
  - Based on historic outage data by wildfire risk driver
  - Analysis performed at the circuit level and Reax polygon level
- PSPS model (in development)
  - Possible use of historic Fire Potential Index modeling inputs for Burn Index (BI) and Energy Release Component (ERC)

Liberty

Overview of Reax Fire Risk Model

- In 2020, Liberty retained Reax to develop a fire propagation and consequence model for its service territory
- Reax assessed and categorized areas of heightened wildfire concern for further analysis based on match drop fire simulations
- Result was a segmented wildfire risk map classified by low, medium, high and very high wildfire risk into area “polygons” that was a key input for the wildfire risk analysis
  - Segmented polygons were based on fire probability (fire volume) multiplied by the number of impacted assets (consequence) and resulted in varying fire risk regions. For example, very-high risk polygons had high structure density, high fuel load, limited accessibility, and greater distance to fire stations

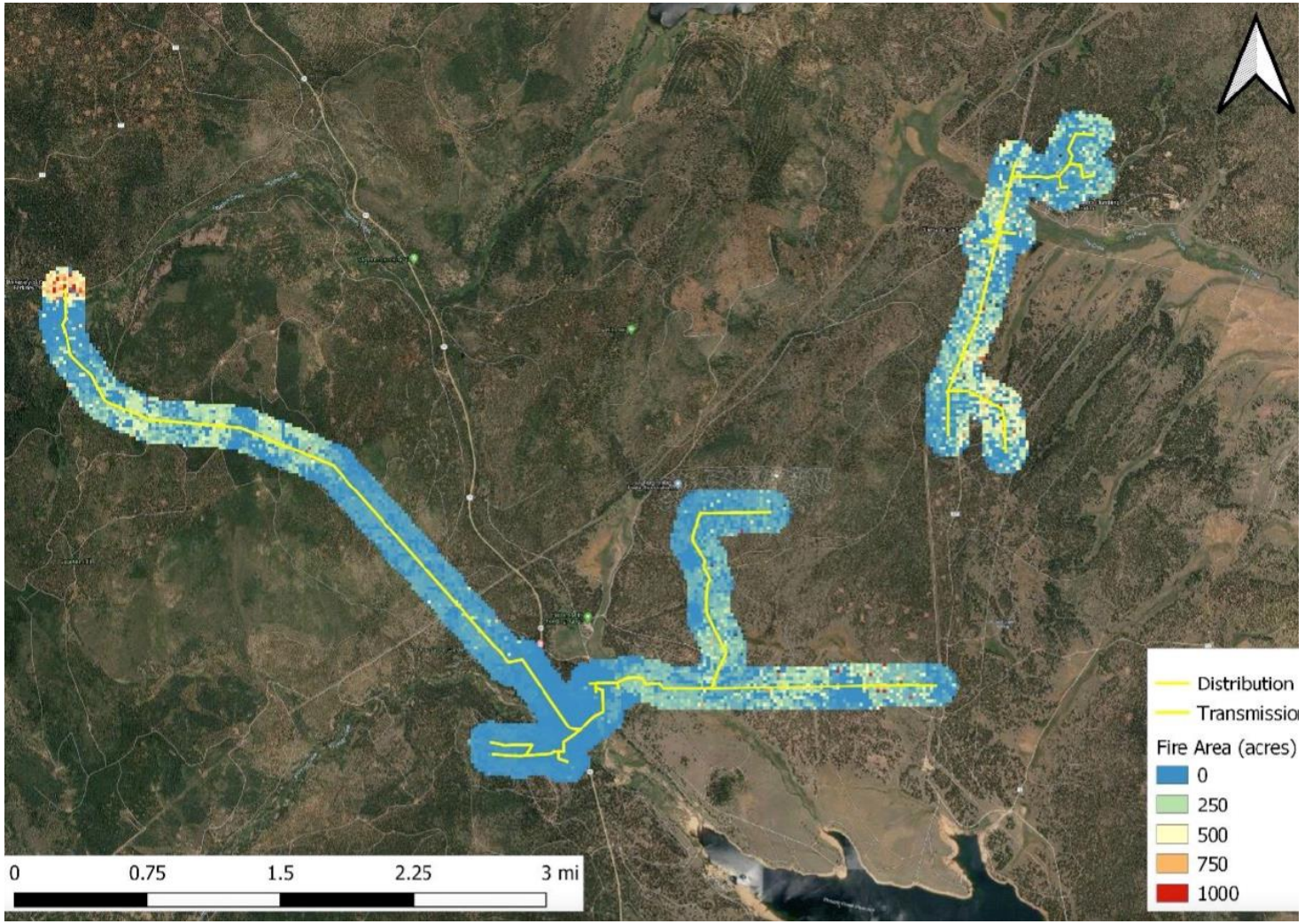
Liberty

Fire spread and consequence model

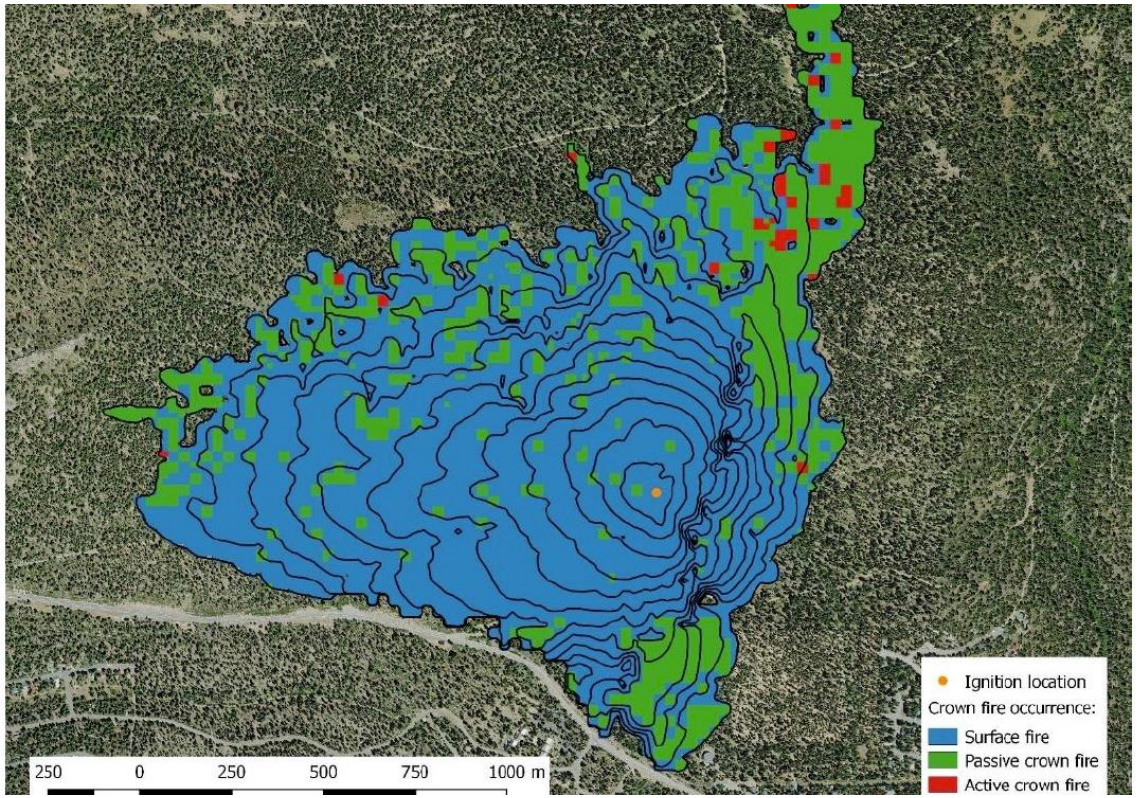
- Monte Carlo fire spread modelling
  - Historic wind/weather data analyzed
    - NARR data used for determining days of historic weather significance
    - WRF model then used to generate wind and weather data for significant weather days
      - High resolution hourly weather data included RH, temp, dead fuel moisture, wind speed & direction
  - Fire spread analysis conducted using ELMFIRE – Inputs included Weather data, Topography/Fuel, Timber, Structure Density
- Ignitions were randomly selected within a 1 km buffer of lines and modeled with random climatology over 6-hours
- Fire volume was used as a proxy for fire probability of escaping initial containment
- Fire consequence was estimated using items such as negative impacts in structures, timber, sensitive habitats and fire suppression cost.
- Fire risk was calculated by multiplying the quantified probability times the quantified cost for every 30m pixel
- Results included fire size (acres), fire volume (acres/ft), and number of assets-at-risk

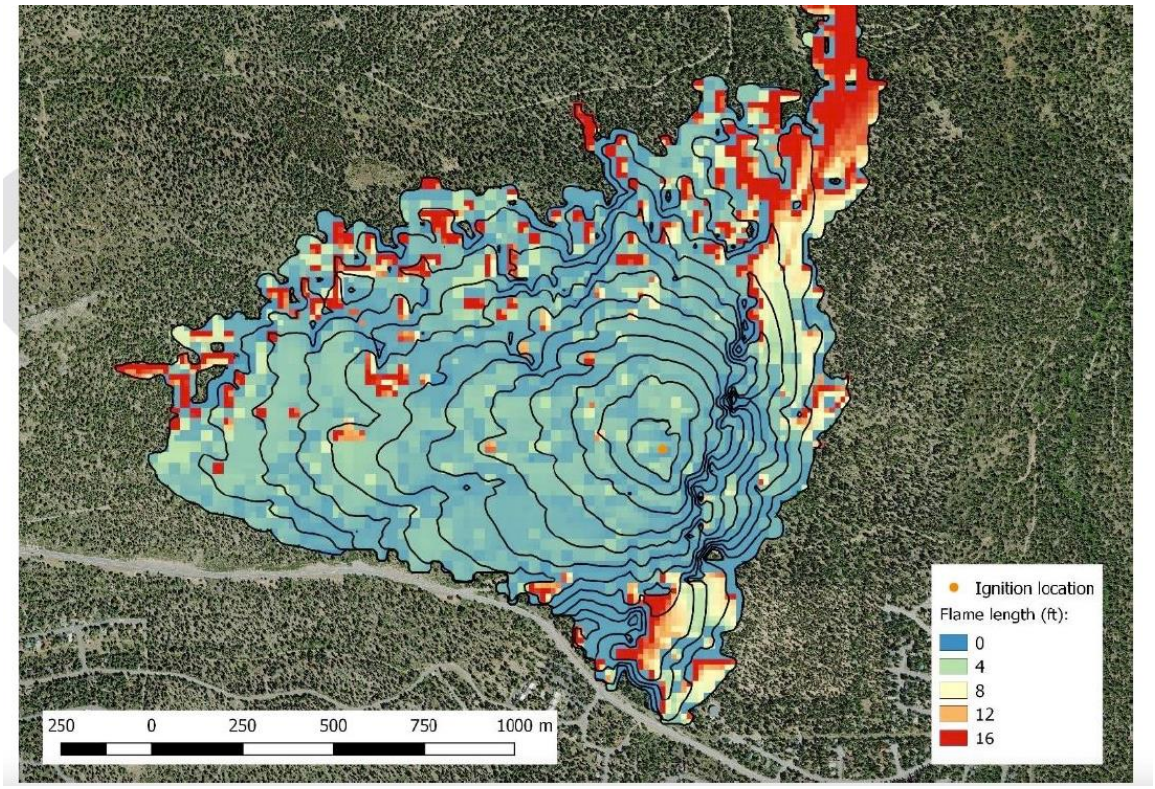
Liberty

Example of simulated ignition locations along Liberty's OH lines



Liberty





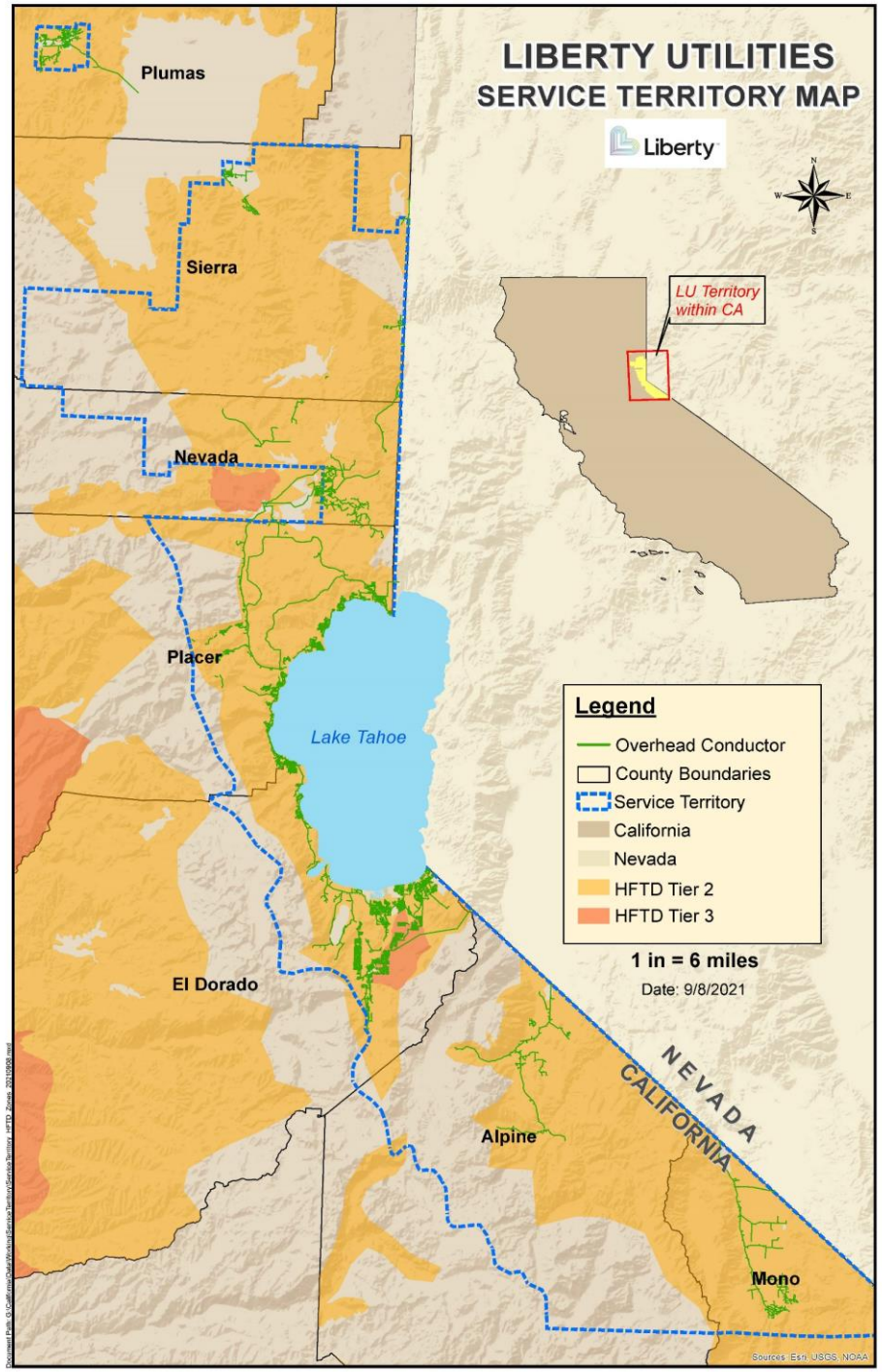
Example of Reax fire spread modelling

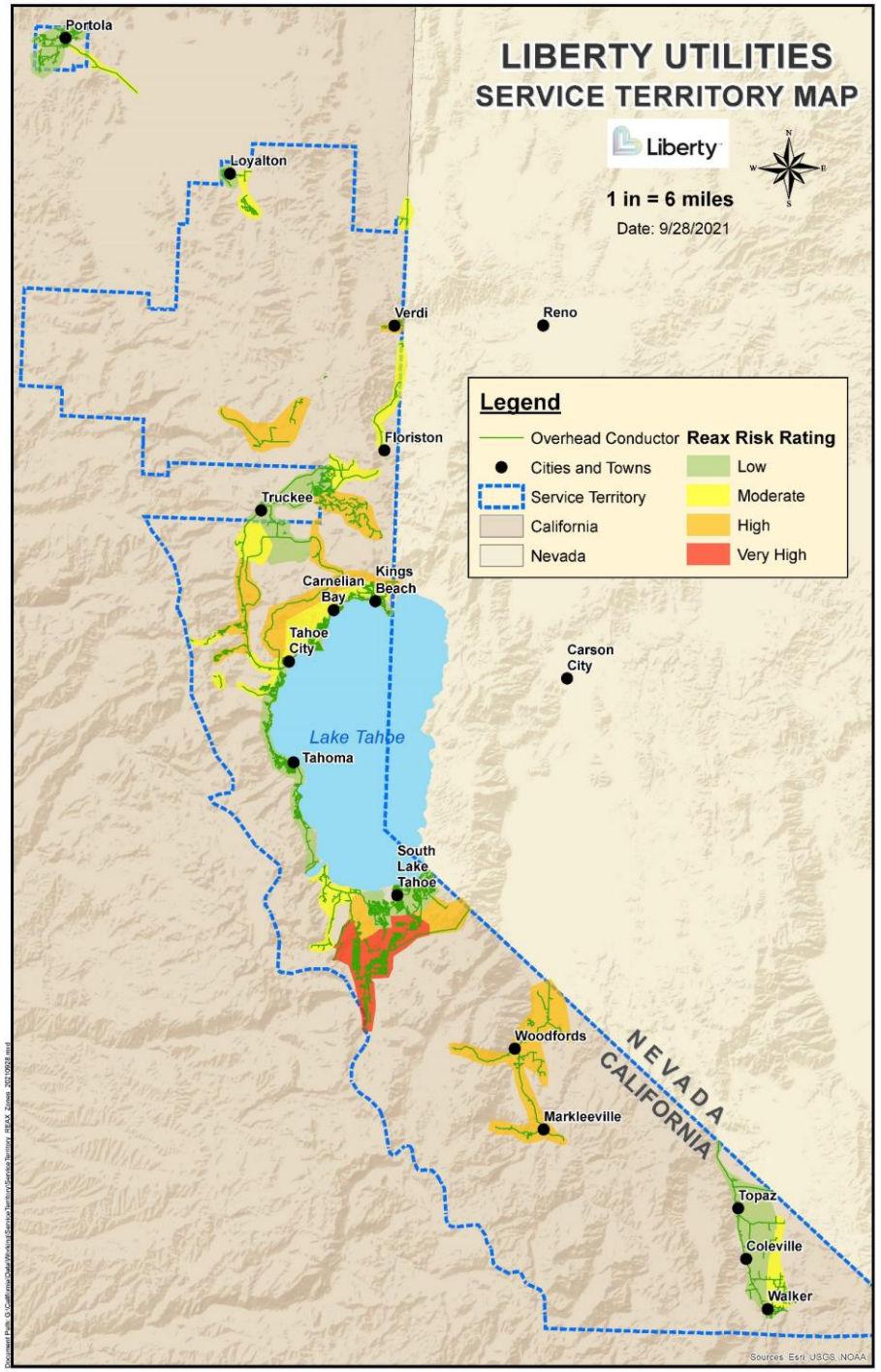
- Simulated fire spread progression over 24-hr period
- Each black contour line represents 2-hr intervals
- Total acres burned was 560

Liberty

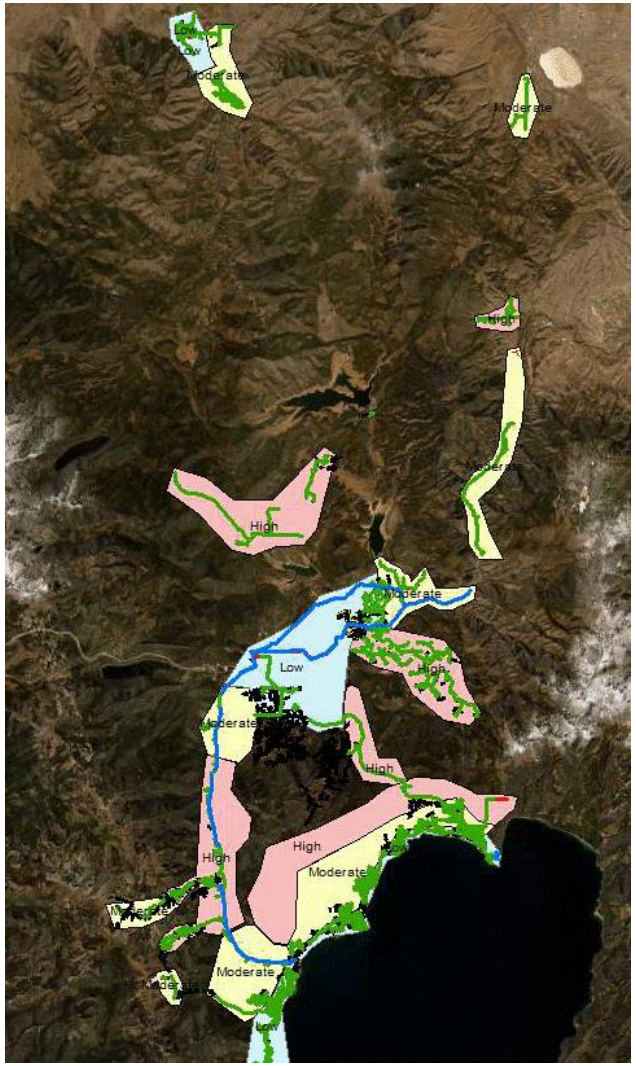
HFTD Zones and Reax Fire Threat Zones

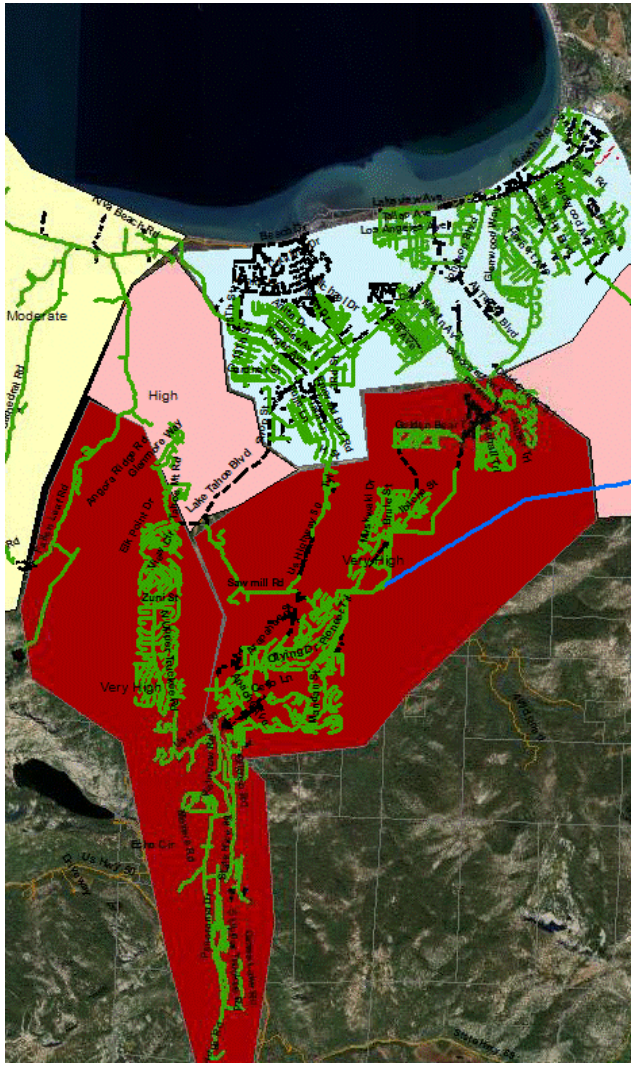
Liberty





North and South Lake Tahoe “Polygons”





Liberty

Risk-Based Decision Model Summary

- Created fire risk maps based on utility asset locations, weather data and topology data
- Completed Circuit Risk Evaluation (qualitative ranking)
  - Reax polygons (fire risk and suppression cost estimates)
  - Tree Risk (Vegetation Management data)
    - Number of dead/dying trees
    - Non-compliant tree work identified
  - Pole Risk (Asset Survey Data)
    - System survey provided a baseline data inventory for pole work needed
    - Primarily identified poles with integrity issues (pole leaning, pole top split) as “high risk poles”
  - Reliability metrics (SAIDI/SAIFI)
- Completed Risk Spend Efficiency (RSE) calculations for select Mitigations

Liberty

RSE Methodology

- Compiled event data from Responder OMS by driver for 2016 – 2020
- Estimated reduction of risk events over the life of the mitigation
- Estimated NPV of Mitigation costs over the life of the mitigation
- RSE = Risk Reduction / NPV Mitigation Cost * $1M
  - Risk Reduction = Events Reduced X Combined Risk Score
  - Combined Risk Score = Financial + Safety Serious Injury + Safety Fatality + Reliability
  - RSE calculated for average risk scores and also for high (tail) risk scores

Liberty

Uncertainties

- Event data is lacking in quantity
- Event data is lacking in quality
- Predicted mitigation effectiveness is subjective
- Methodologies may not model real world

Liberty

Future Changes to Risk Model

- Data Governance Changes
  - Move to cloud-based data server to house various types of data
  - GIS upgrade to improve risk mapping and geospatial asset inventory
  - LiDAR data integration and program expansion for asset inspections in high fire risk areas
  - Continually improve event data collection
  - Sectionalizing circuits for fire risk analysis
  - Refine process to assign risk drivers and evaluate historic outage data for POI
- Modelling refinements
  - Refine RSE methodology in all areas

Liberty

Conclusion

Liberty has done an initial round of risk modelling which has resulted in the refinement of the understanding of fire risk in our service territory. This has provided an understanding of the relative risk levels for areas and circuits in the system. It has also provided a preliminary indication of the RSEs for select mitigation methods. Refinements are needed and will be undertaken as Liberty continues to address wildfire mitigation.

Liberty