The Value of Sharing and Consolidating Critical Community, Electricity, and Natural Hazard Information

CPUC Workshop

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Background and Introduction

- Investor-owned utilities (IOUs) across California have expended significant resources to respond to and prepare for natural hazards. These efforts will likely reduce the number of customers affected when public safety power shut-offs (PSPS) events are required

- **Unfortunately, there is no centralized system that contains the location and characteristics of both critical community and electricity infrastructure**

- To date, geographic information system (GIS)-based information about infrastructure exists in two or more separate data streams:

    1. the CPUC has required–via CPUC Proceeding R.19-09-009–that utilities upload the location and other details about their electricity infrastructure into *Microgrid Planning Portals* (CPUC 2019)

    2. local and tribal governments often collect information on their critical infrastructure, including the location of police/fire stations, telecommunications, water/wastewater treatment plants, hospitals, and emergency shelters (among other categories). This information is often compiled and disseminated within state, local, and tribal *hazard mitigation plans*, which are required by the U.S. government to receive "certain types of non-emergency disaster assistance" (FEMA 2023).

Background and Introduction (cont.)

- FEMA indicates that:

  “Hazard mitigation planning reduces loss of life and property by minimizing the impact of disasters. It begins with state, tribal and local governments identifying natural disaster risks and vulnerabilities that are common in their area. After identifying these risks, they develop long-term strategies for protecting people and property from similar events. Mitigation plans are key to breaking the cycle of disaster damage and reconstruction.” (FEMA 2023)

- **It is anticipated that the existence of a single GIS-based system containing both critical community and electricity infrastructure—as well as natural hazard layers—would facilitate greater degrees of communication, coordination, and long-term planning between the IOUs, first responders, and emergency coordinators within individual communities and beyond**

Background and Introduction (cont.)

- For this reason, the California Public Utilities Commission (CPUC) requested technical assistance from Lawrence Berkeley National Laboratory (Berkeley Lab)

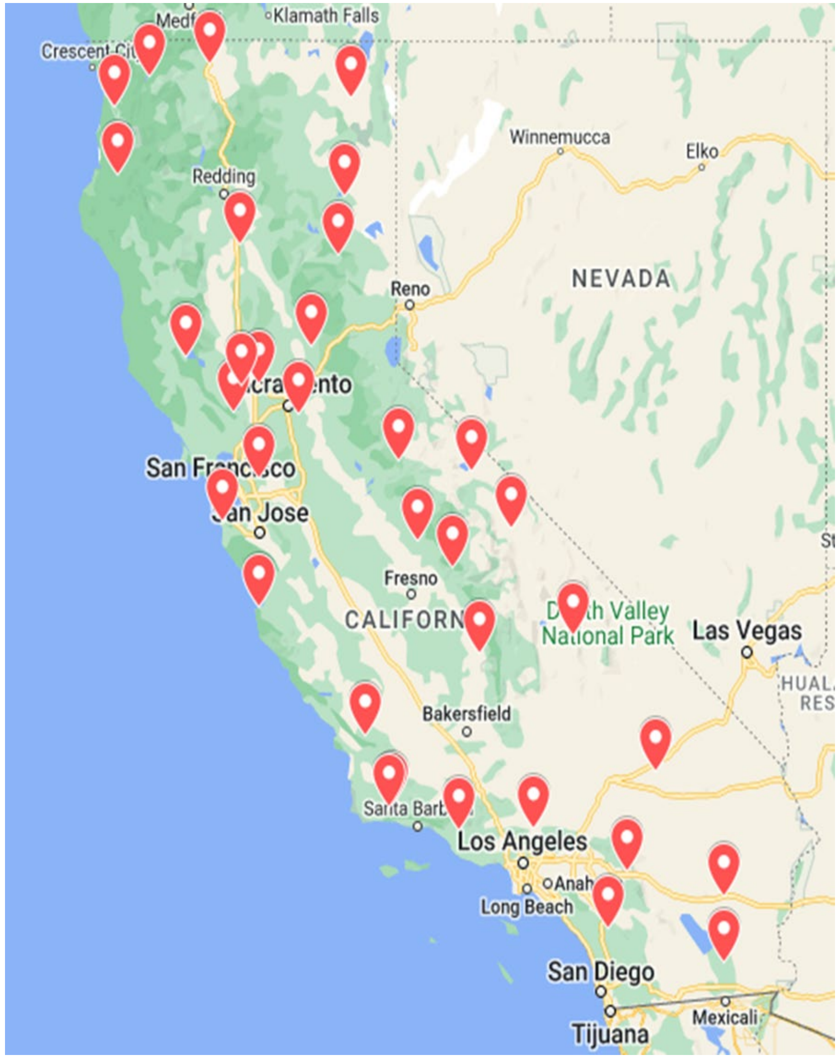
- This technical assistance activity involved Berkeley Lab researchers reviewing hazard mitigation plans to:
  1. assess the natural hazards that communities are most concerned about
  2. the variety of–and terminology used to describe–critical community infrastructure
  3. the availability of GIS information that could be incorporated into the Microgrid Planning Portals

- In addition, we develop a common, but generic data taxonomy showing what fields to collect to encourage consolidating and sharing of this information in the future

Method: Hazard Mitigation Plan Selection Criteria

- We selected 34 county and tribal hazard mitigation plans based on the:
  - public availability of these plans
  - geographic spread
  - variety of utilities providing electricity service
  - type of government
  - range of hazards

Region	County or Tribe
North Coastal (five hazard mitigation plans)	Yurok Tribe, Humboldt County, Contra Costa County, San Mateo County, Monterey County
North Inland (12 plans)	Karuk Tribe, Siskiyou County, Modoc County, Lassen County, Tehama County, Plumas County, Nevada County, Scotts Valley Band of Pomo Indians, Napa County, Sacramento County, Yolo County, Yocha Dehe Wintun Nation
Central Coastal (three plans)	San Luis Obispo County, Santa Barbara County, Santa Ynez Chumash Tribe
Central Inland (seven plans)	Tuolumne County, Madera County, Mono County, Bishop Paiute Tribe, Inyo County, Fresno County, Tulare County
South Coastal (three plans)	Ventura County, Los Angeles County, Pala Tribe
South Inland (four plans)	San Bernardino County, Riverside County, Morongo Band of Mission Indians, Imperial County



Method: Standardizing Disparate Hazard Risk Ratings

- The risk rating methodology employed by most jurisdictions in this analysis was the Calculated Priority Risk Index (CPRI)
  - Some plans used the FEMA Hazards USA Multi-Hazard (Hazus-MH) prioritization methodology
  - A number of plans did not explicitly state the methodology used to rate hazard risk
- For consistency and to facilitate comparison, **we created a common risk rating system that was uniform across all jurisdictions**
- We summed up these quantitative values to determine which hazards – per investor-owned utility – were of the most concern to hazard mitigation planners

Numerical Risk Rating	Rating Description
5	severe, extreme or very high
4	high or catastrophic
3	moderate, medium, critical, substantial
2	low or limited
1	possible, minor or very low
0	mentioned

Method: Naming Conventions Describing Critical Infrastructure

- The hazard mitigation plans included chapters or technical appendices describing critical infrastructure that may be exposed to hazard risk
- **We compiled details on the critical infrastructure-at-risk and identified examples when plans referred to a particular type of facility using similar terminology**
- This process resulted in identifying the types of infrastructure most-commonly described in hazard mitigation plans
- We also collected the name of the lead agency responsible for preparing the plan, the hazard mitigation plan point of contact, and, if available, the name of the GIS expert

Hazards, Terminology, and Availability of GIS Information

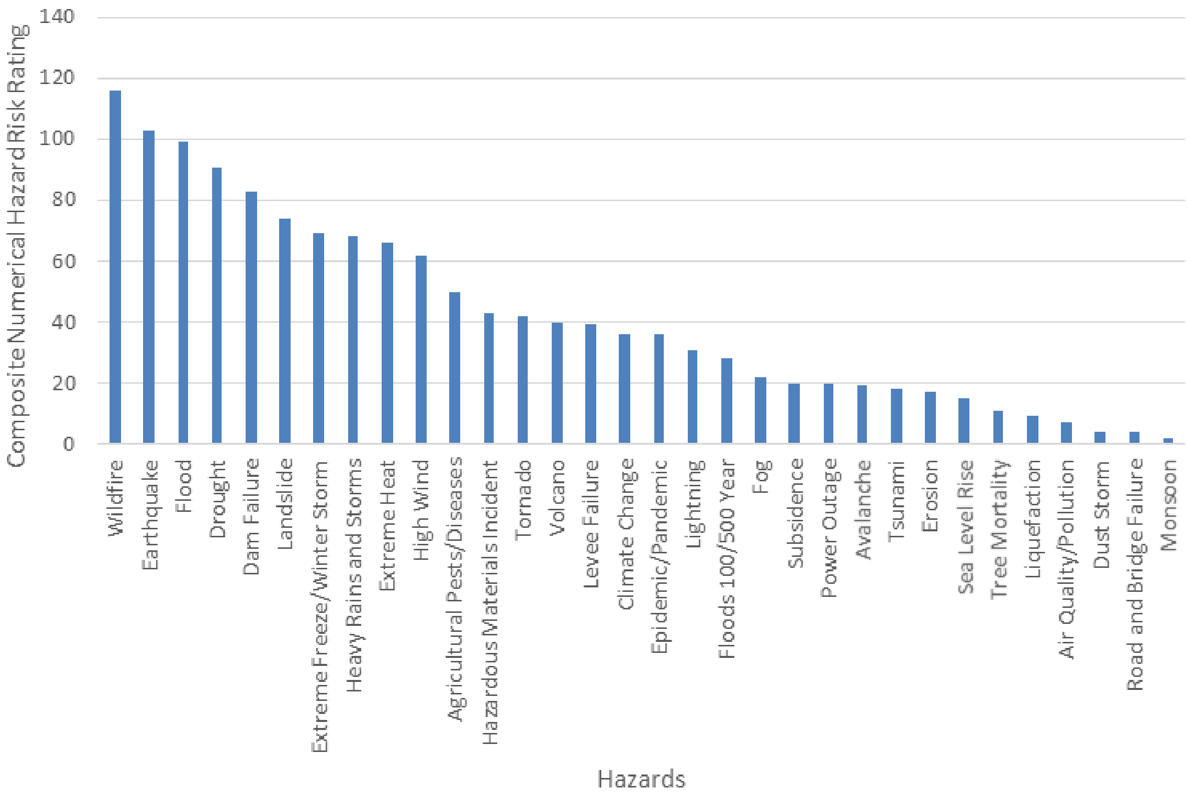
- We collected the range of hazards identified across all hazard mitigation plans (total number of plans referencing each hazard is reported in parentheses)

Climate change (13)	Subsidence (8)	Avalanche (8)	Lightning (11)
Wildfire (33)	Floods (32)	Fog (7)	Tornado (15)
Drought (32)	Dam or levee failure (31)	Dust storm (2)	Air quality (2)
Earthquake (34)	Tsunami (9)	Monsoon (1)	Power outage (7)
Landslide (28)	Extreme heat (23)	Heavy rains (23)	Hazardous material incident (17)
Erosion (8)	Extreme cold/winter storm (23)	High wind (20)	Road/bridge failure (1)
Volcano (17)	Tree mortality (3)	Agricultural pests and diseases (18)	Epidemic/pandemic (13)

Hazards, Terminology, and Availability of GIS Information: Identification and Ranking

- We recorded the hazard risk ratings for each jurisdiction and then created a composite hazard risk score by summing the quantitative hazard risk ratings of all jurisdictions by hazard type

- Across all nine electricity service areas studied, the top hazards of concerns to planners were:
  - Wildfire
  - Earthquake
  - Localized flood
  - Drought
  - Dam failure

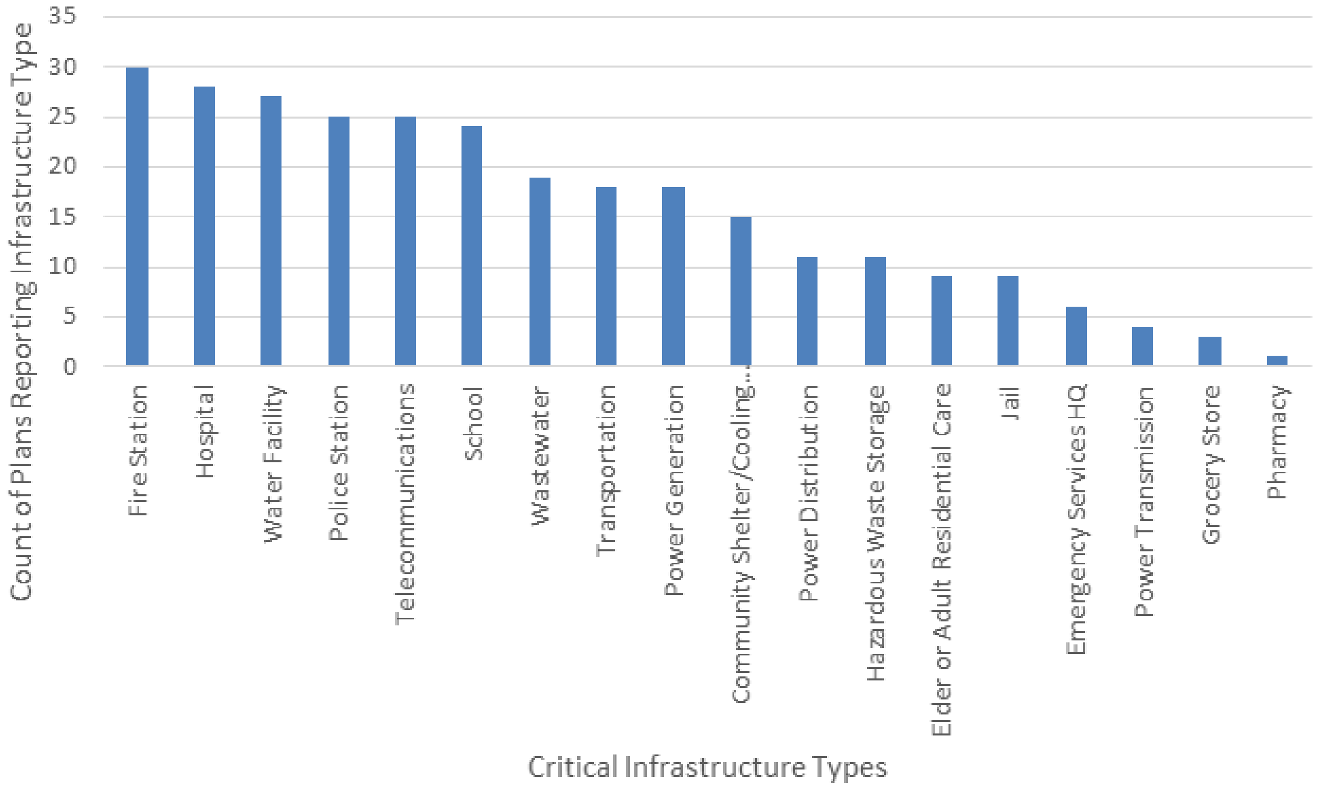


Hazards, Terminology, and Availability of GIS Information: Infrastructure Types

- **We reviewed the hazard mitigation plans to assess the types of critical infrastructure that may be at risk to one or more hazards**
- There were 15 general types of critical infrastructure consistently mentioned across the selected jurisdictions →
- However, we found significant variability in the specific terminology used to describe critical infrastructure. Local context appears to be key in the identification of critical community infrastructure

Hospital	Elder or adult residential care facility	Emergency services headquarters
Pharmacy	Community shelter/cooling center	Telecommunications
Police station	Grocery store	Power generation, transmission, and distribution
Fire station	Transportation	Water and wastewater treatment
School	Jail	Hazardous waste storage

Hazards, Terminology, and Availability of GIS Information: Infrastructure Types (cont.)



- We counted if the previously mentioned types of critical infrastructure were mentioned in the 34 hazard mitigation plans
- Across all jurisdictions, fire stations, hospitals, water treatment facilities, police stations, and telecommunications were the most commonly-reported type of infrastructure referenced in hazard mitigation plans

Hazards, Terminology, and Availability of GIS Information: Other Useful Information

- Although not explicitly noted in the hazard mitigation plans, **information about the "resilience posture" of community facilities could be incredibly useful for hazard mitigation practices and planning**

- We define resilience posture as the ability of community infrastructure to continue to provide critical services in the event of a power interruption affecting the community or broader region

- Community infrastructure that have technologies including backup generation, solar plus storage capabilities, or stand-alone storage may be able to provide critical services if there is an outage affecting the bulk power system

Hazards, Terminology, and Availability of GIS Information: Other Useful Information (cont.)

Technology	Characteristic	Units
Onsite backup generation (emergency only)	Nameplate capacity	kW
	Fuel type	Gasoline, diesel, propane, natural gas
	Fuel tank size	Gallons, therms
	Efficiency	MMBtu/kWh, gallons/kWh
	Run time on full tank	Hours
	Average daily peak demand of facility	kW
	Average daily energy usage of facility	kWh
	Facility peak load served during emergency	%
	Failure rate to operate	%
Photovoltaic solar with storage (continuous use, but available for emergencies)	Nameplate capacity of PV-solar (AC-rated)	kW
	Average daily production of PV-solar	kWh
	Average daily storage roundtrip efficiency	%
	Rated power capacity of storage	kW
	Energy capacity of storage	kWh
	Average daily peak demand of facility	kW
	Average daily energy usage of facility	kWh
	Facility peak load served during emergency	%
	Expected state of charge during power interruption	%
Stand-alone storage (emergency only; assumes 100% charge state)	Rated power capacity of storage	kW
	Energy capacity of storage	kWh
	Facility peak load served during emergency	%
	Average daily peak demand of facility	kW
	Average daily energy usage of facility	kWh

Hazards, Terminology, and Availability of GIS Information: GIS Data Availability

- It is important to note that only one jurisdiction out of the 34–Santa Barbara County—shared contact information for their GIS analyst in an accessible location on a county website

- This finding along with several conversations that we have had confirm that many local governments in California do not have the resources to support full-time staff specializing in GIS

- Furthermore, local government staff often take on multiple roles within a department thus preventing them from dedicating resources to ongoing hazard and community infrastructure mapping capabilities

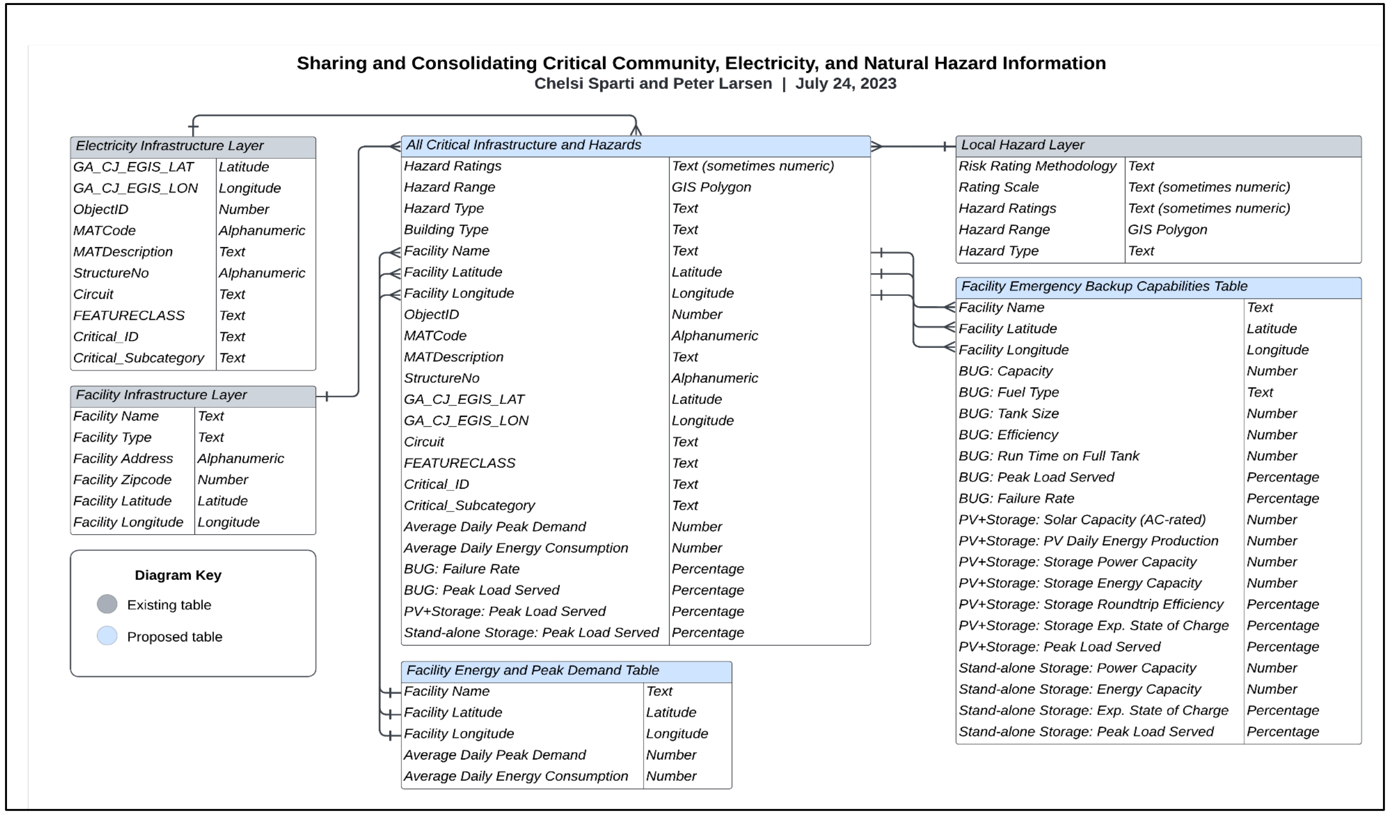
- Specific hazard data and critical infrastructure locations are often considered “sensitive” and are not available to the public

- **It is clear that accessing this sensitive data will likely require conversations with each local government and a lengthy approval process**

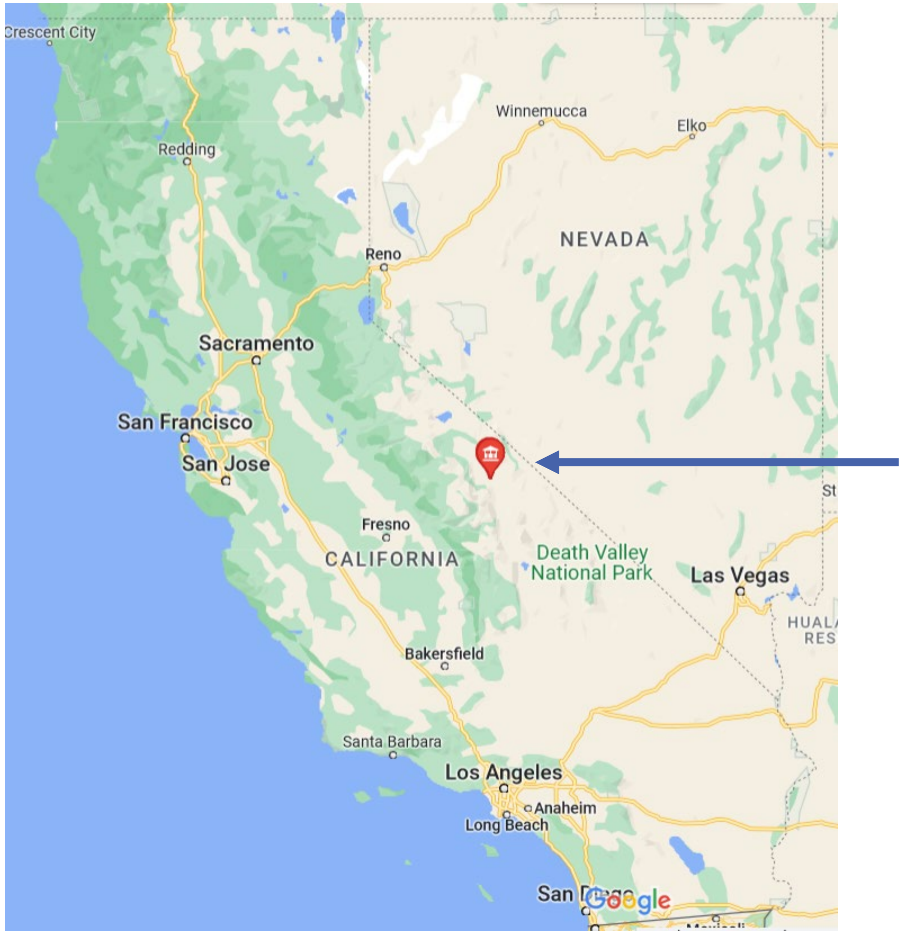
Data Taxonomy for Consolidating and Sharing of Information

- **We prepared a basic data schema (i.e., database structure) that demonstrates how disparate data sources including hazard areas, electricity infrastructure, and critical community infrastructure could be combined to inform long-term electric system and hazard mitigation planning efforts**

- In addition, we recommend collecting information about critical facility peak electricity demand and consumption as well as information about the facility's existing resilience posture



Example of Overlaying Electricity, Community, and Hazard Information

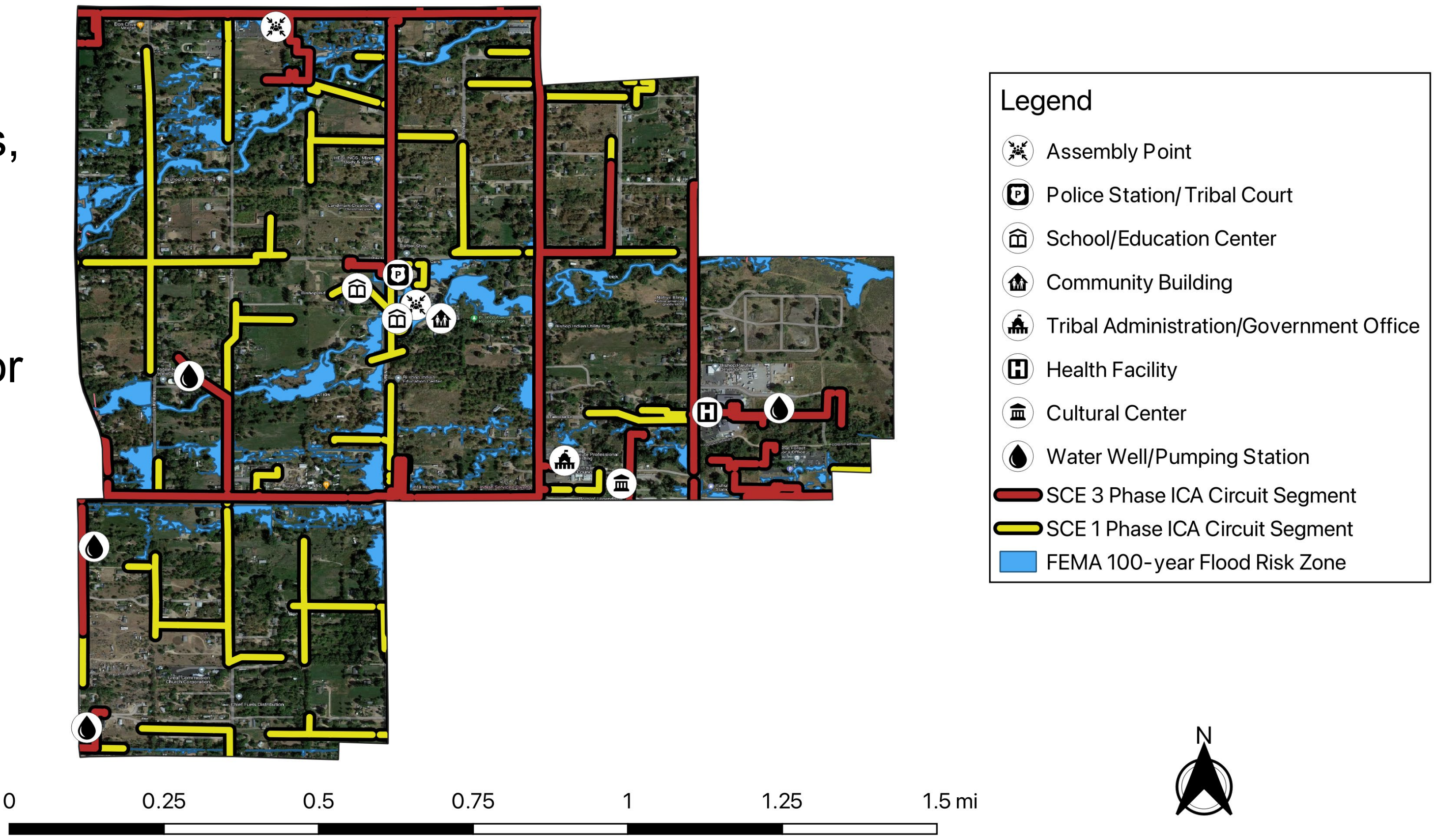


- **We partnered with the Environmental Management Office of the Bishop Paiute Tribe to demonstrate the value of combining electricity infrastructure, critical community infrastructure, and natural hazard locations into a single map**
- The Bishop Paiute Tribal land encompasses 879 acres (roughly 1.17 square miles) and is located in the Owens Valley at the base of the Sierra Nevada Mountain range
- We collaborated with tribal staff to produce three maps that demonstrate the usefulness of combining critical community facilities, electricity infrastructure, and hazard zones into a single set of images

Example of Overlaying Electricity, Community, and Hazard Information (cont.)

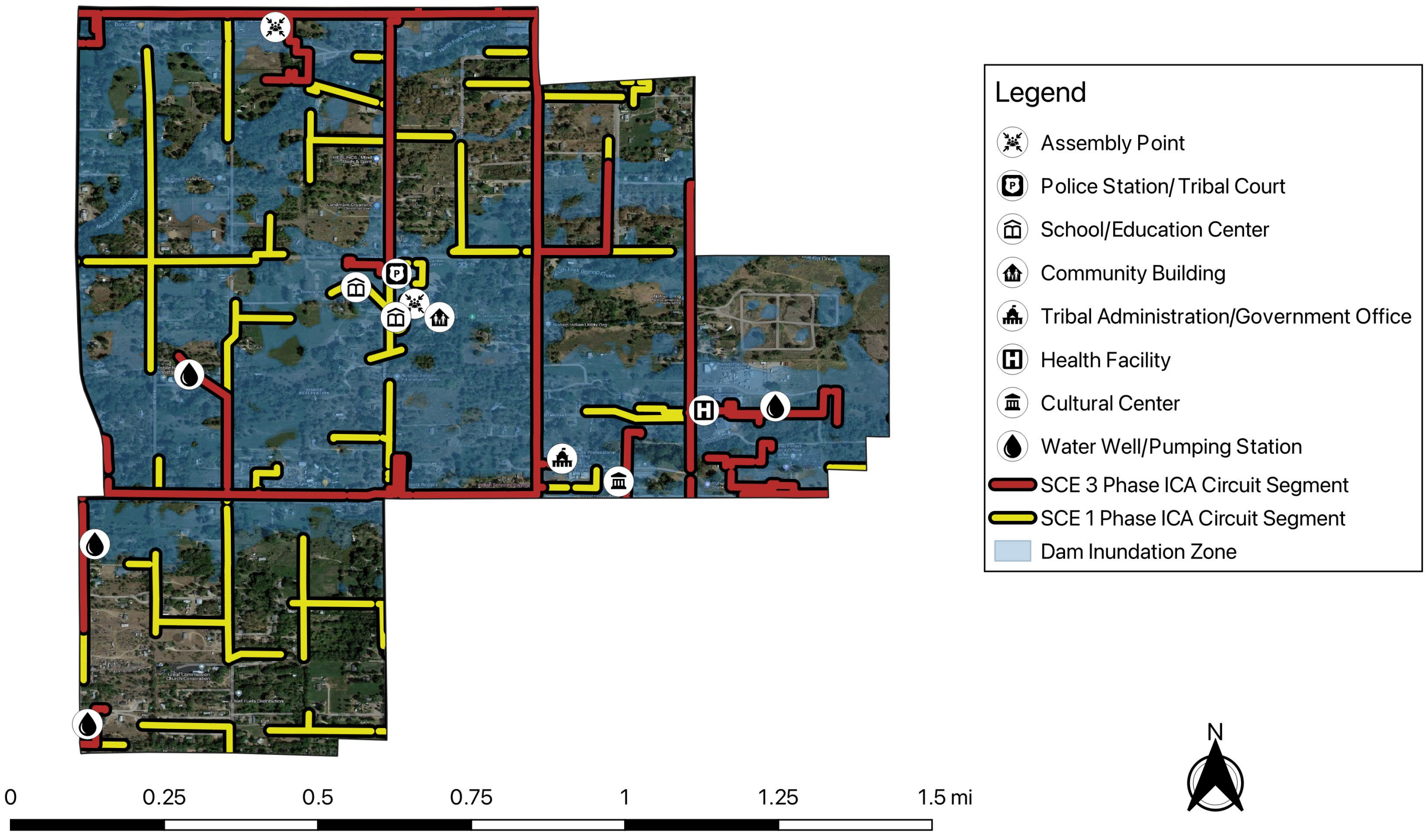
- The information displayed includes the location of Bishop Paiute critical facilities (e.g., police station), segments of SCE 3-phase and 1-phase interconnection capacity analysis (ICA) power line circuits, and an overlay of 100-year FEMA flood zones
- Floods are rated as a moderate hazard for the Bishop Paiute reservation, and the data is from FEMA via Bishop Paiute (Bishop Paiute 2023)
- It is likely that the overall rating of moderate flood risk is due to the potential of widespread inundation from a dam failure (see next slide)

Bishop Paiute Reservation
Map of Critical Infrastructure, Utilities and Flood Zones



Example of Overlaying Electricity, Community, and Hazard Information (cont.)

Bishop Paiute Reservation
Map of Critical Infrastructure, Utilities and Dam Inundation Zones



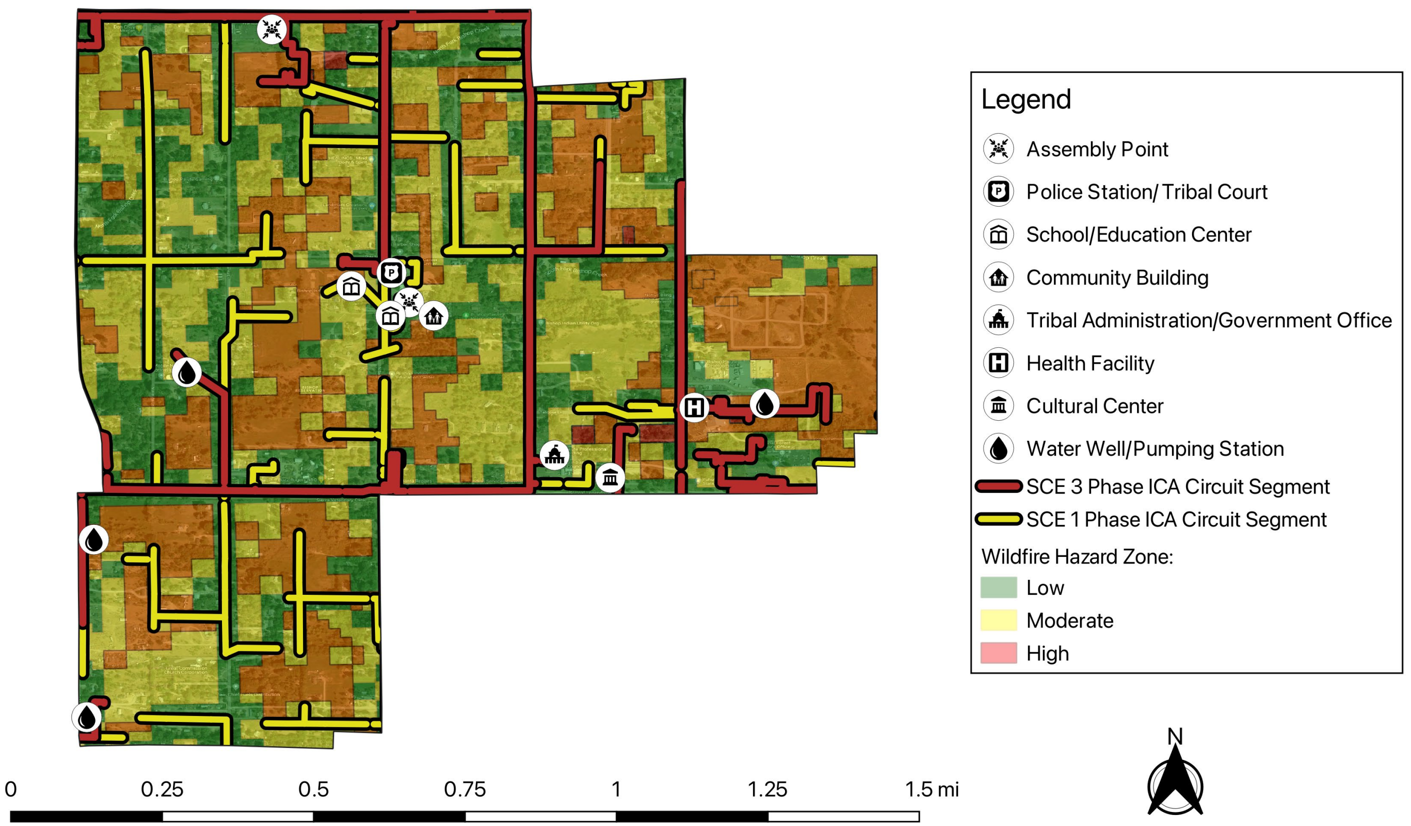
- The information presented includes the location of Bishop Paiute critical facilities, segments of SCE 3-phase and 1-phase ICA circuits, and an overlay of hydroelectric dam inundation zones from the nearby Hillside dam.
- Dam inundation is rated as a moderate hazard and a dam breach would likely lead to inundation across large portions of the reservation. The data is from the California Department of Water Resources (California Department of Water Resources, 2020)

Example of Overlaying Electricity, Community, and Hazard Information (cont.)

- The information presented includes the location of Bishop Paiute critical facilities, segments of SCE 3-phase and 1-phase ICA circuits, and an overlay of wildfire hazard zones identified by the County of Inyo (County of Inyo, 2023) in their preliminary risk assessment

- Wildfires are rated as a high risk hazard in Inyo County

Bishop Paiute Reservation
Map of Critical Infrastructure, Utilities and Wildfire Hazard Zones



Misc. Observations

- We gained a number of important insights that should be taken into consideration if/when the State of California mandates the consolidation of these data sources into a single online portal:
  - Most communities did not assign explicit risk levels to each of the critical infrastructure types identified in their hazard mitigation plans
  - Every plan was unique in its comprehensiveness, depth, and vintage—some hazard mitigation plans contained comprehensive and detailed risk analyses while others had very little information
  - Some plans were prepared “in-house” by government agency staff while others were prepared by third-parties under contract
  - Many communities, including the tribes, have a limited number of staff dedicated to conducting hazard analyses and planning—and there are even fewer staff who whose job exclusively focuses on the spatial mapping of infrastructure
  - There are significant concerns about data security—the location and characteristics of critical energy infrastructure and community infrastructure is often restricted from being shared with the general public

Conclusion and Acknowledgments

- A number of these issues will need to be addressed before the State of California considers mandating the consolidation and sharing of critical electricity and community infrastructure information

- **It is clear that having this type of information in a consolidated location—and available statewide—would ultimately result in significant progress towards making California communities more resilient to hazards**

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