Electric Reliability amidst Drought and Storms

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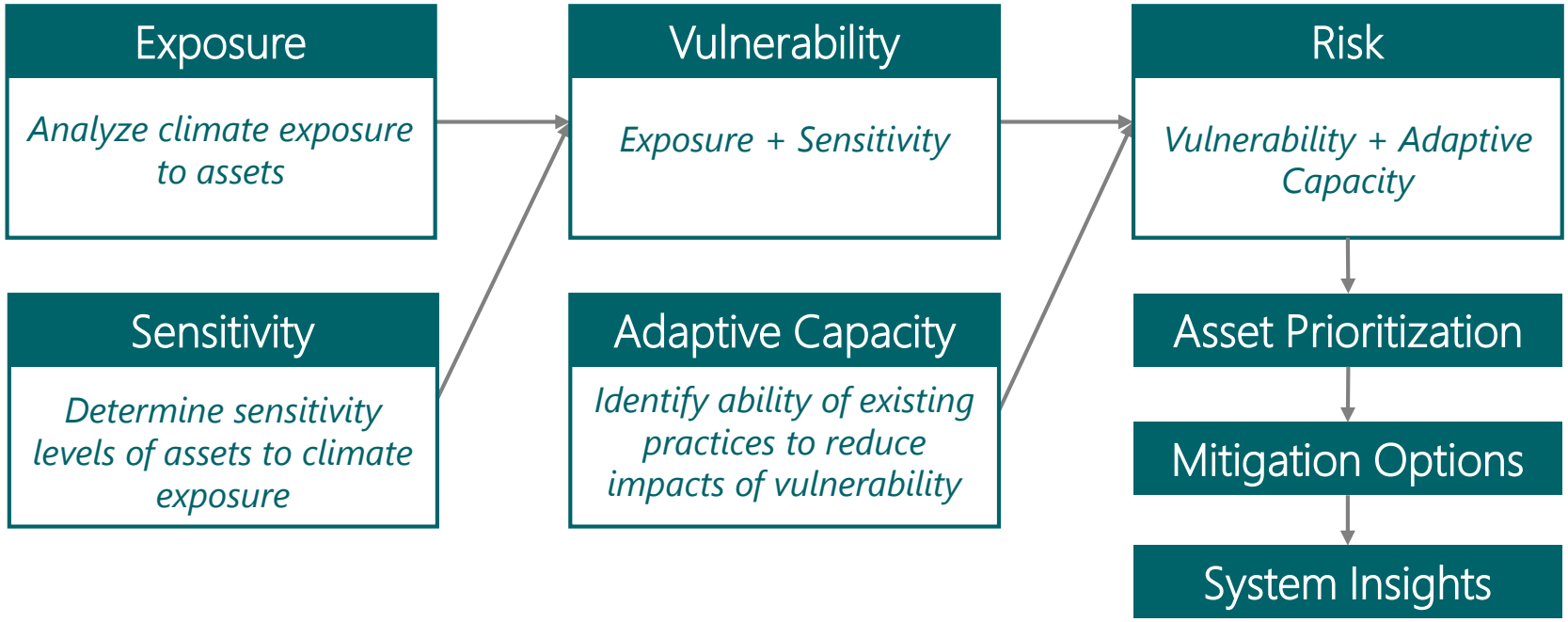
SCE's Vulnerability Assessment Scope – CA CPUC Requirements

- Identify expected climatic impacts to **assets, operations**, services, and communities
- Include **temperature, precipitation, sea level rise, wildfire**, & cascading impacts (based on "business as usual" RCP 8.5 projections)
- Assess mitigation needs for **20-30 years in the future**, as well as 10-20 and 30-50 years out

Vulnerability Assessment Methodology



Relevant Findings from IPCC AR6

Drought

- Over the 21st century, the total **land area** subject to drought will increase and droughts will become more **frequent** and **severe** (*high confidence*)

Storm

- **River floods** are projected to increase for North American regions (*medium confidence*)
- Extreme precipitation is projected to increase in major **mountainous regions** (*medium to high confidence* depending on location), with potential cascading consequences of floods, landslides and lake outbursts in all scenarios (*medium confidence*)

Drought

Energy for What's Ahead℠

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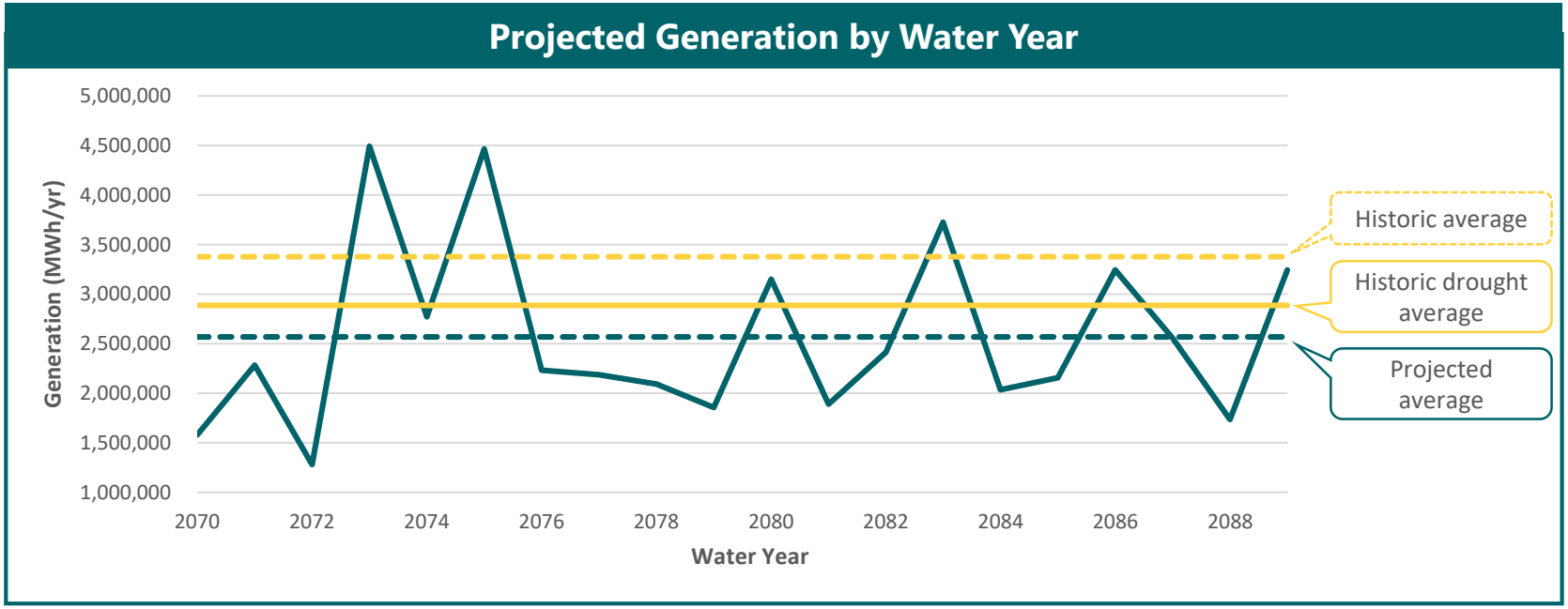
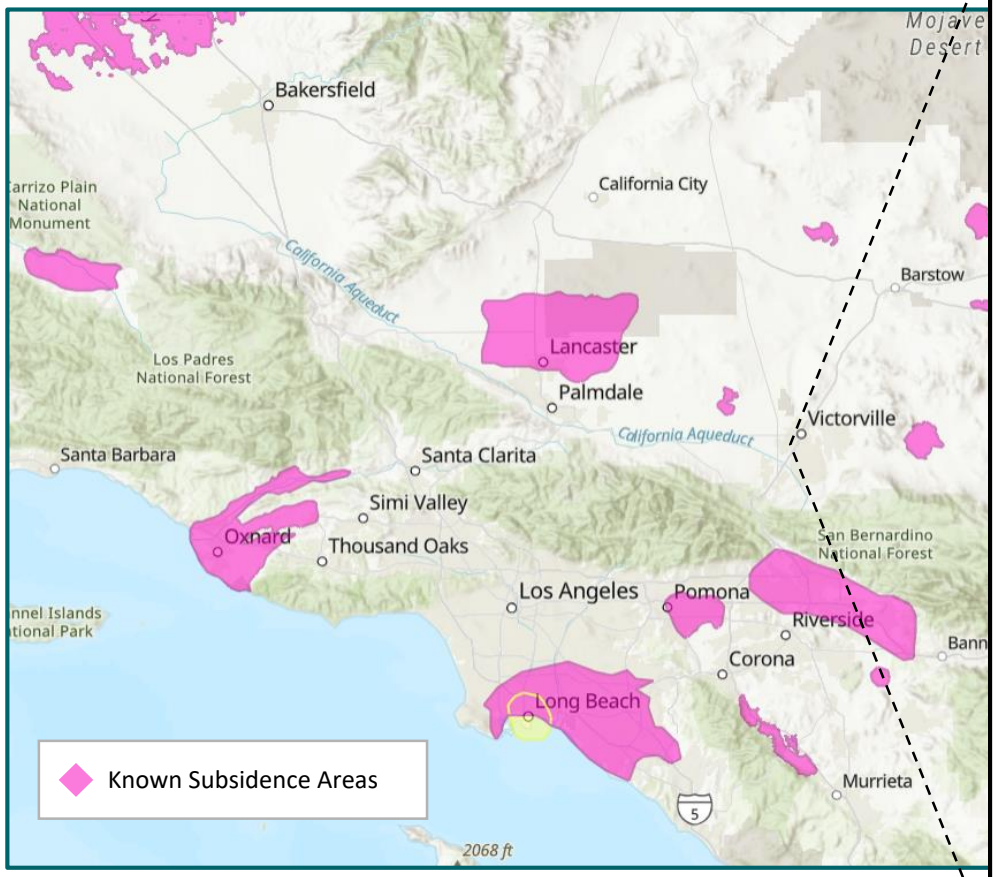
Future drought may strain hydroelectric generation

Future 20-year extended drought in Big Creek, using internal generation data and Cal-Adapt runoff projections:

- Could result in production being nearly 24% lower than historical averages
- Average production for the future scenario is projected to be 11% lower than average production in historical drought years.
- Although Big Creek will have reduced energy output during drought, it will still be able to generate electricity as a dispatchable resource during peak hours and provide ancillary services & contingency reserves during other periods



Drought may exacerbate subsidence, threatening asset stability



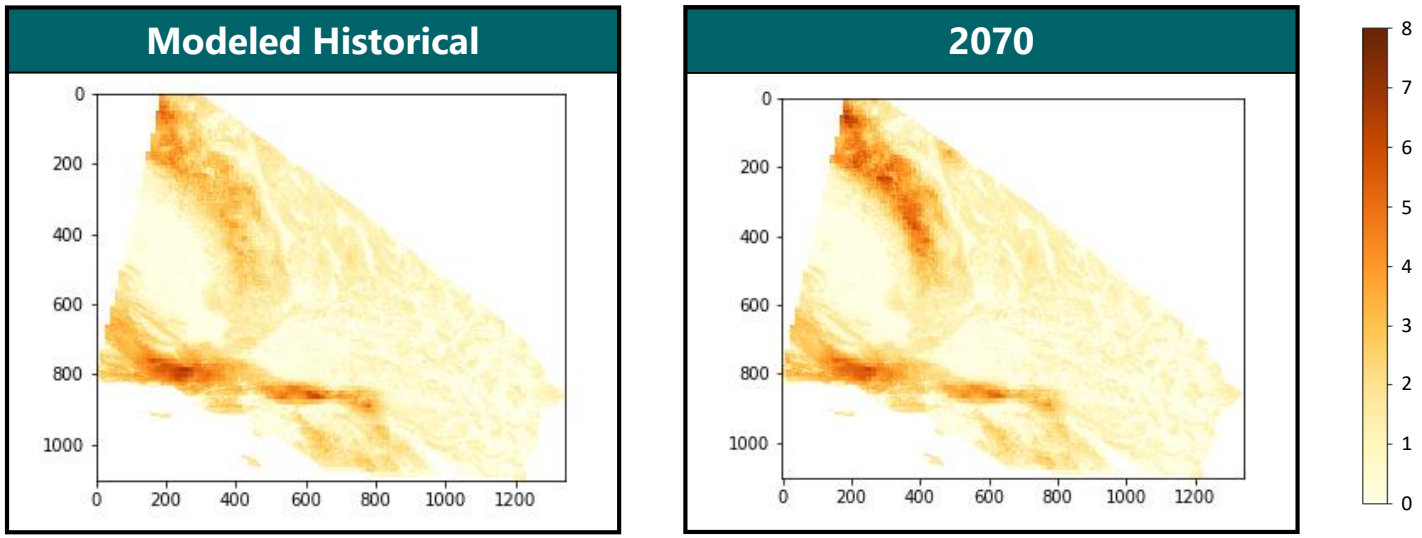
Key Findings:

1. ***Future drought may further deplete groundwater***
   - Mitigations such as freshwater injection may not be feasible under future drought conditions
2. ***Assets may experience more frequent flooding from subsidence-driven elevation loss***
   - Areas in floodplains may be exposed to prolonged flooding
   - Areas near the coast may subside as sea level encroaches, threatening permanent inundation
3. ***Localized subsidence may alter topographic gradients, causing ground-failure***
   - Current data is too coarse to integrate building and asset foundational threats into planning

Storms

Cascading events of more intense fire seasons and more extreme precipitation may cause sudden increased debris flow

- A relative debris flow metric was developed using USGS deep-seated landslide susceptibility data and Cal-Adapt wildfire area burned and precipitation projections
- Assets under high relative exposure were further prioritized based on a watershed score and proximity to a FEMA floodplain or NHD flowline



- The highest potential debris flow regions within SCE service territory are near **Santa Barbara** County, **Angeles National Forest**, and the **Sierra Nevada mountains**
- Results suggest that debris flow-prone regions are unlikely to significantly change, but some areas could continue to see "**hotspots**"

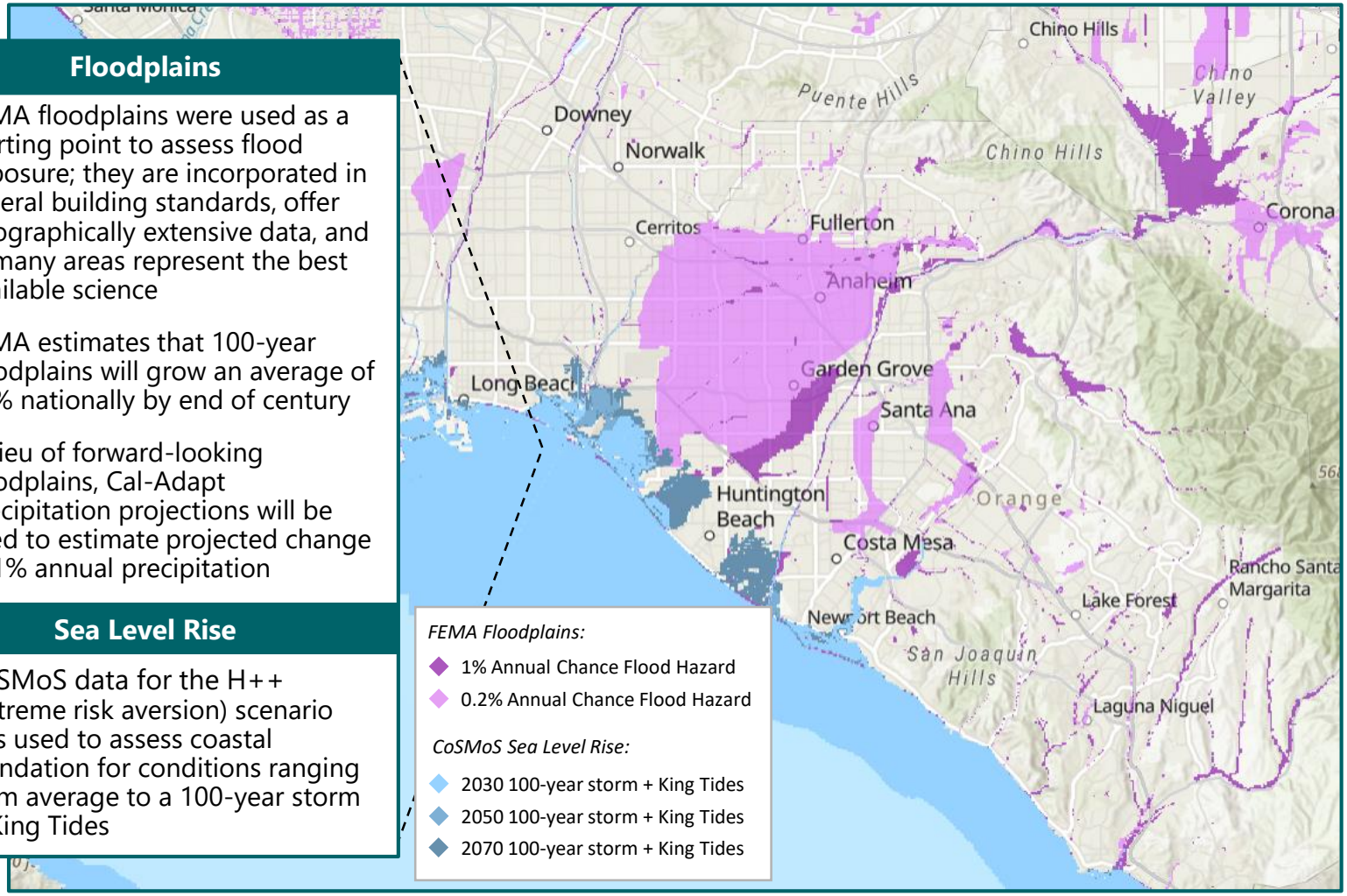
Floodplains will grow as precipitation becomes more extreme; SLR will threaten coastal assets

Floodplains

- FEMA floodplains were used as a starting point to assess flood exposure; they are incorporated in federal building standards, offer geographically extensive data, and in many areas represent the best available science
- FEMA estimates that 100-year floodplains will grow an average of 45% nationally by end of century
- In lieu of forward-looking floodplains, Cal-Adapt precipitation projections will be used to estimate projected change in 1% annual precipitation

Sea Level Rise

- CoSMoS data for the H++ (extreme risk aversion) scenario was used to assess coastal inundation for conditions ranging from average to a 100-year storm + King Tides



Climate Science Gaps

Drought

- Most observational records are not long enough to completely capture the **wet/dry cycles** of California's hydroclimate, therefore analyses using these records may be compromised
- Need to improve understanding of processes that contribute to the formation and variability of **atmospheric river** events (ARE). Further work is needed to develop ARE characteristics so that they can be used to for planning and forecasting.

Storm

- FEMA **floodplains** do not indicate how flood risk will change as a consequence of climate change
- Santa Ana Winds play a critical role in shaping peak fire season severity. **Wind projections** contain a high amount of error due to the highly variable nature of surface air flow from both a spatial and temporal perspective. Downscaled GCM data is still too coarse to adequately resolve complex terrain to provide trustworthy wind forecasts.