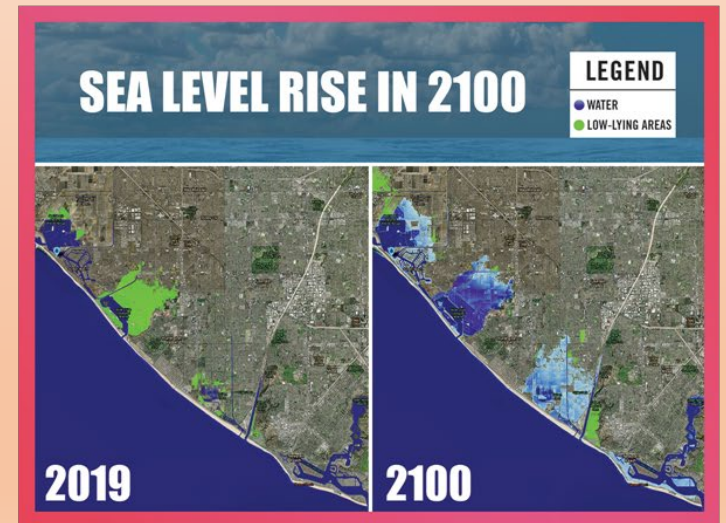
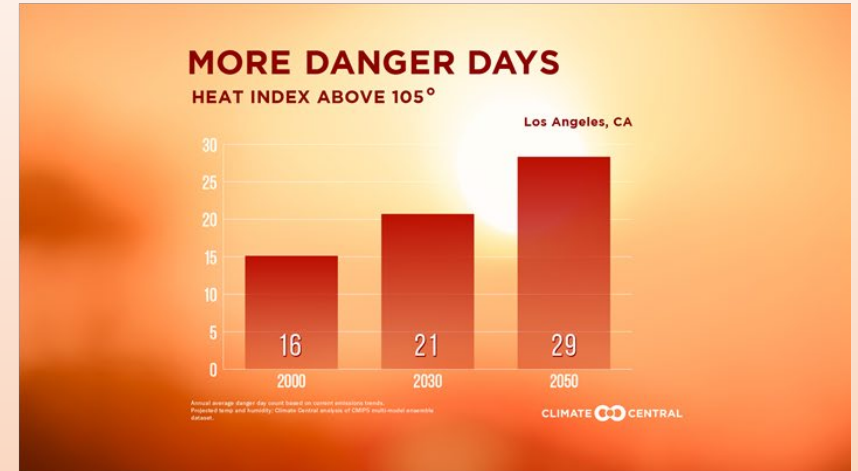


State of the Climate and Impacts on Metropolitan Water District Supplies and Operations



Liz Crosson, Sustainability, Resilience and Innovation
Bill Hasencamp, Colorado River Resources
Nina Hawk, Bay-Delta Initiatives
Mickey Chaudhuri, Water System Operations
Brad Coffey, Water Resources Management

Impacts Beyond Drought



Cascading Impacts Expose Vulnerabilities



Drought + Drought
Drought + Drought + Drought
Drought + Extreme Heat
Drought + Flooding
Drought + Fire

Climate Vulnerability and Risk Assessment

Climate Hazards
drought, extreme heat, flooding, rising avg temp, wildfire, sea level rise



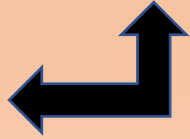
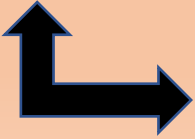
Impacts to critical systems
water supply sources, power supply, supply chain, communications

Impacts to physical assets / infrastructure

Impacts to workforce, member agencies, customers, communities
vulnerabilities specific to a MA, community or group of customers



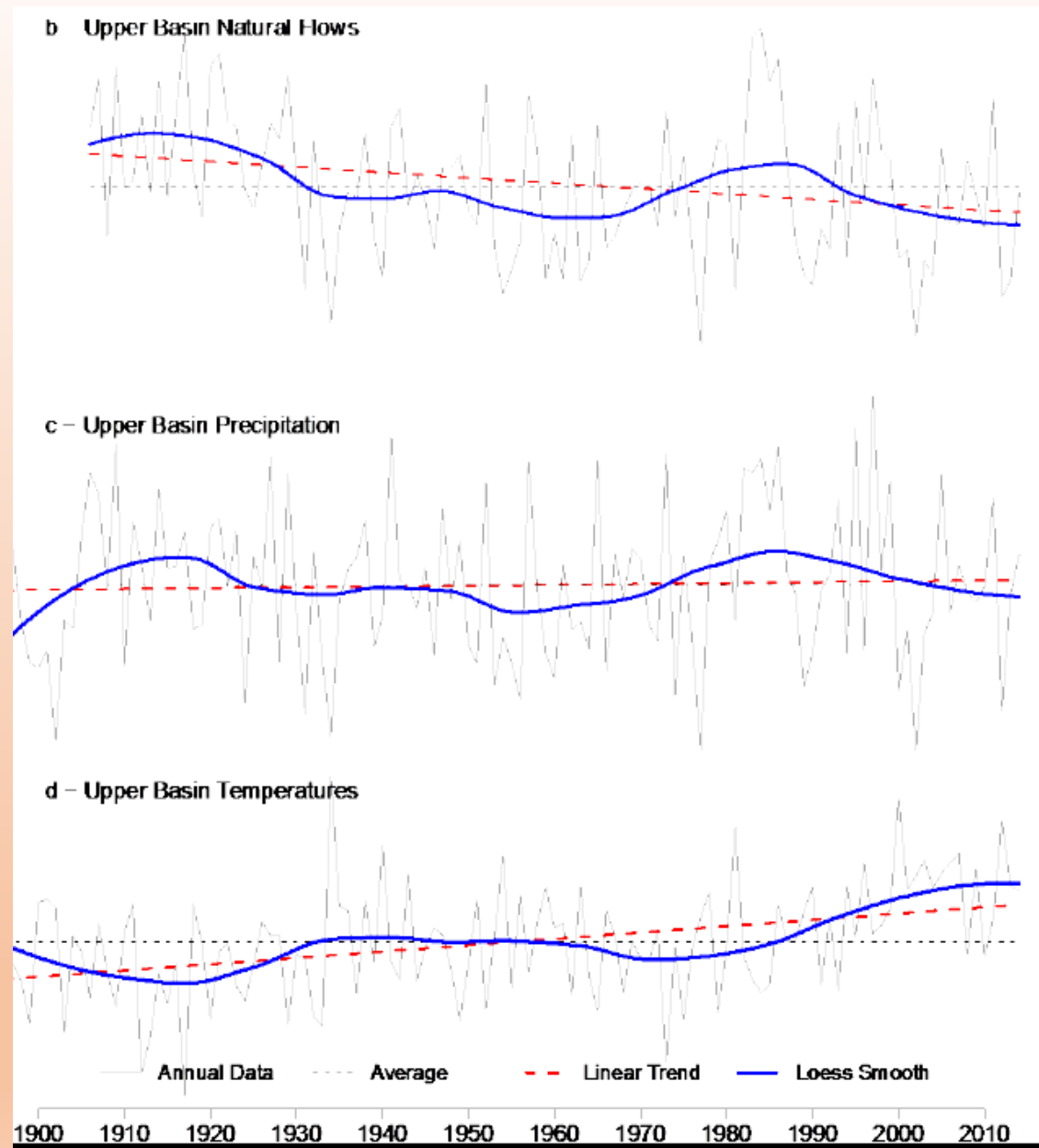
Climate Adaptation Opportunities
asset mgmt, CIP, IRP, property mgmt, system operations, emergency response, workforce, finance



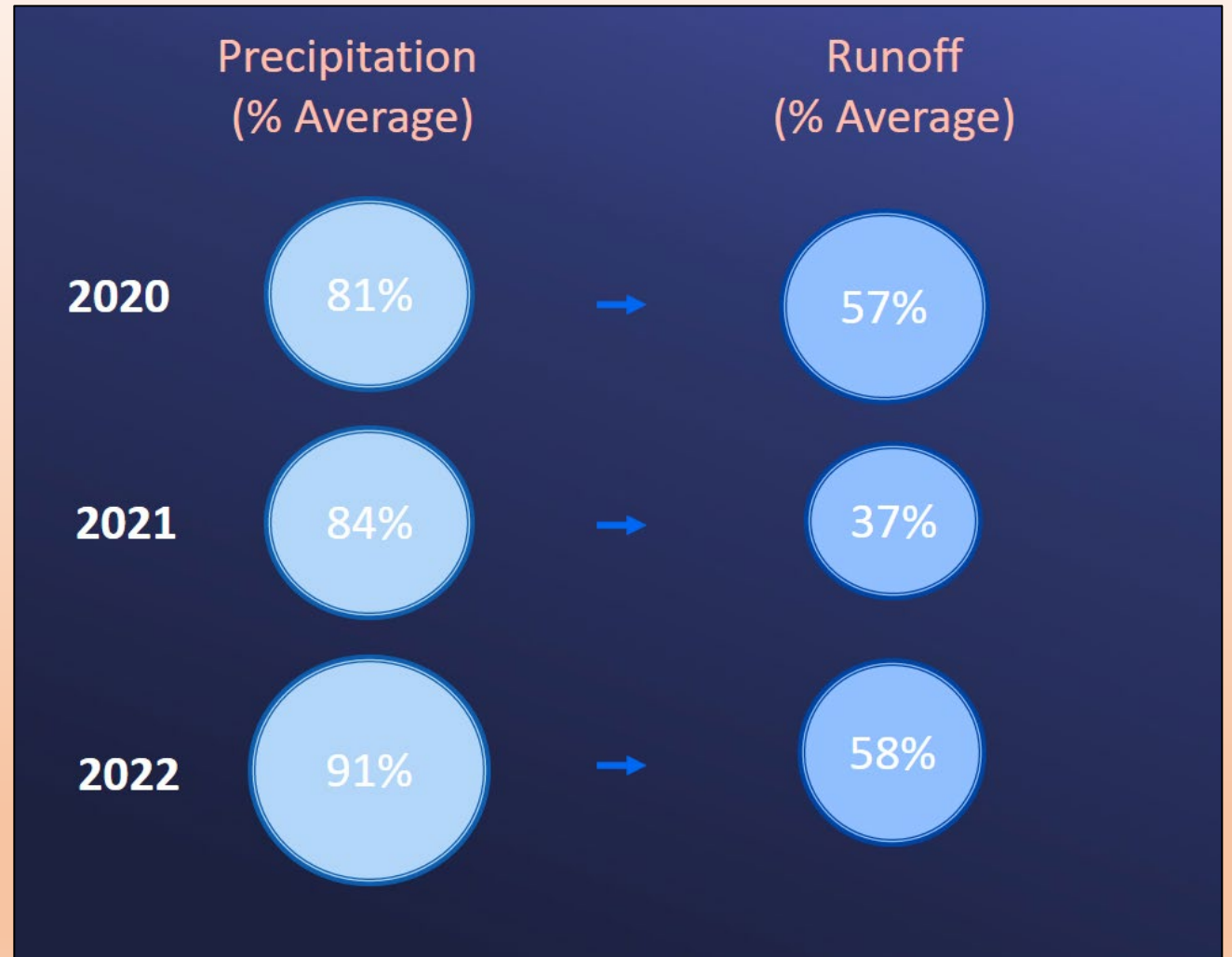
The Colorado River Basin



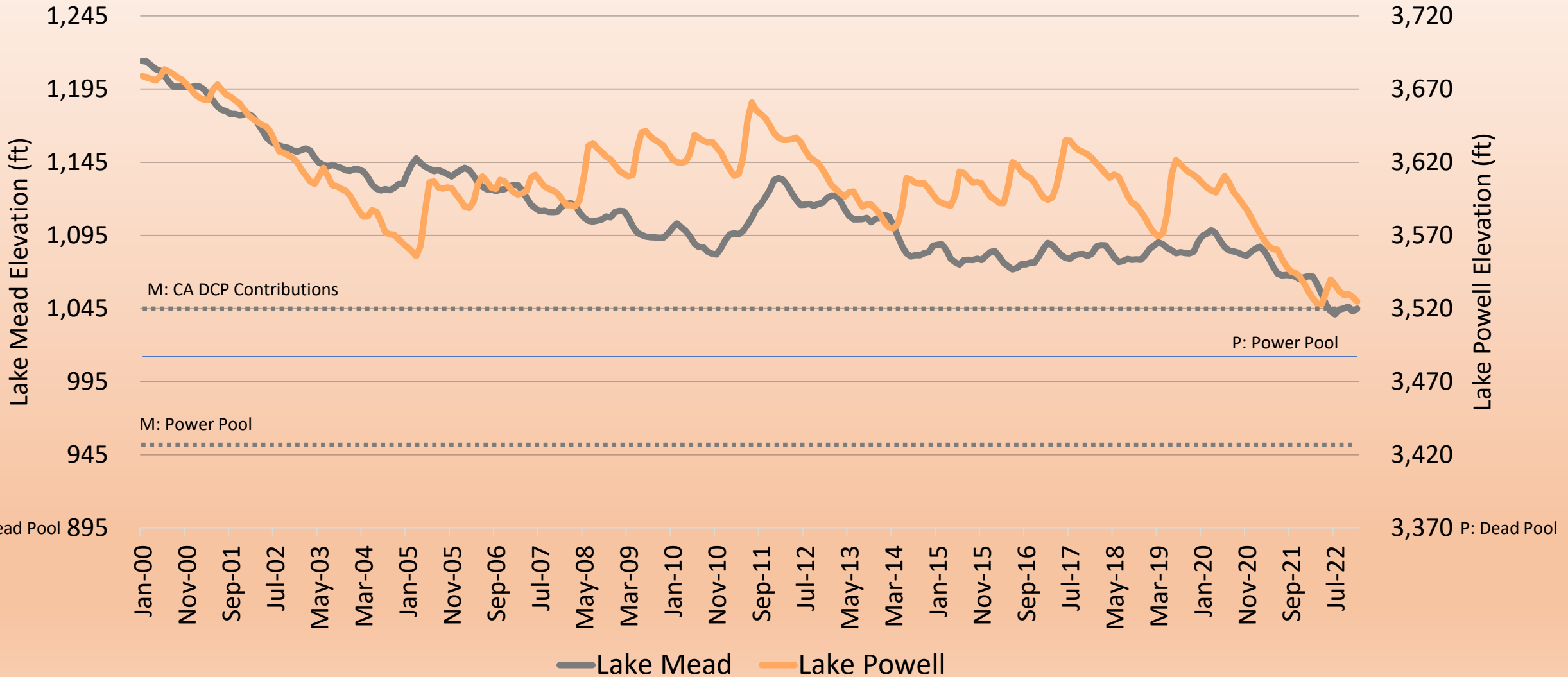
A “Heat Drought”



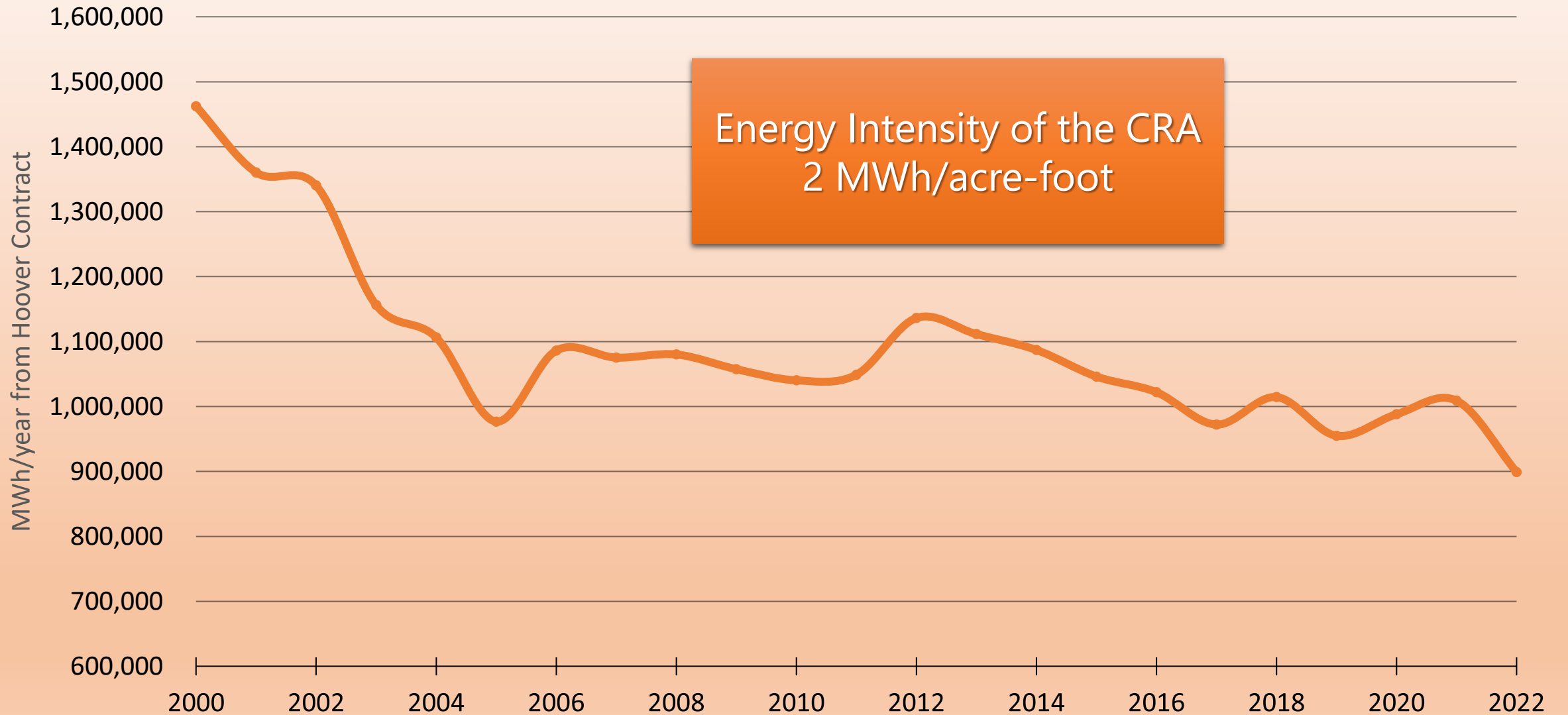
Decreased Runoff Efficiency



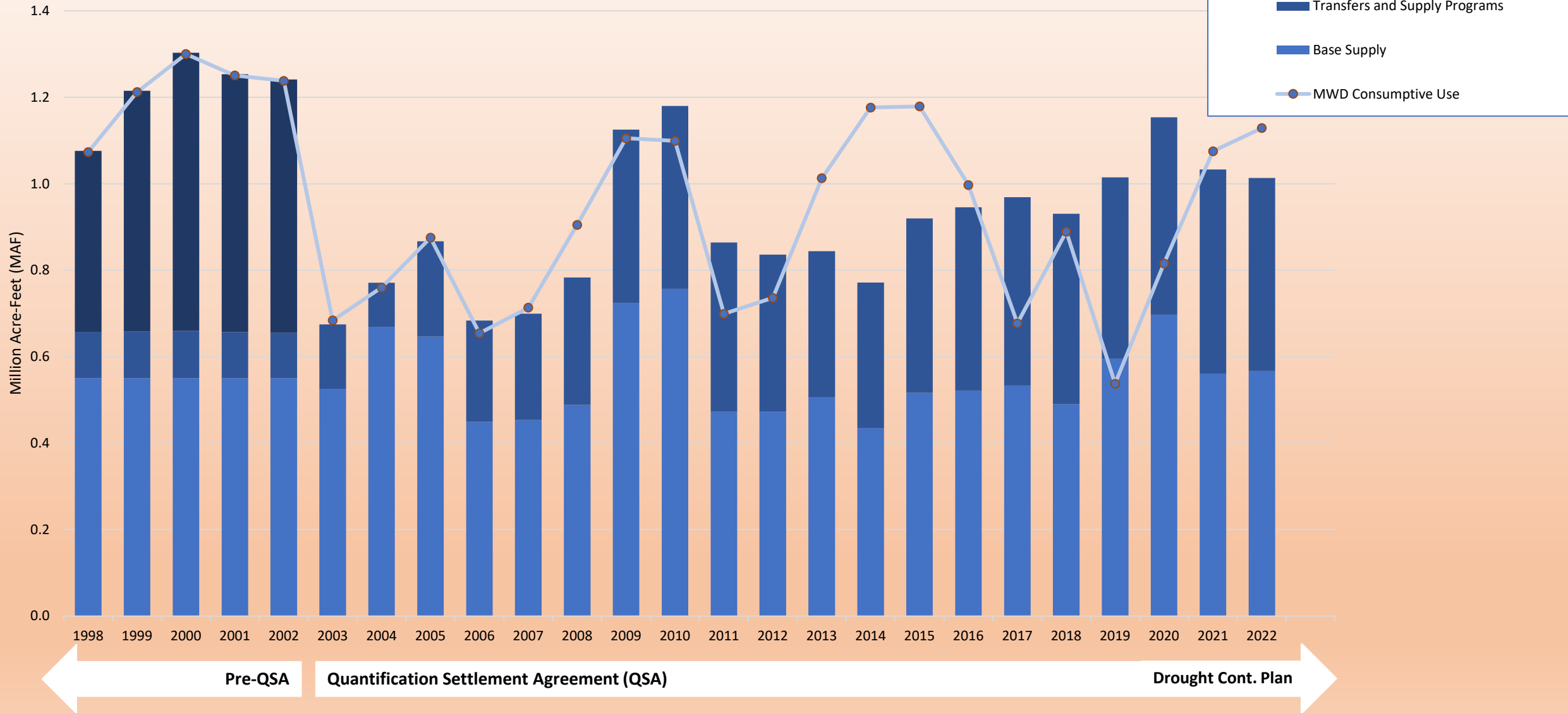
Lake Powell and Lake Mead Decline Since 2000



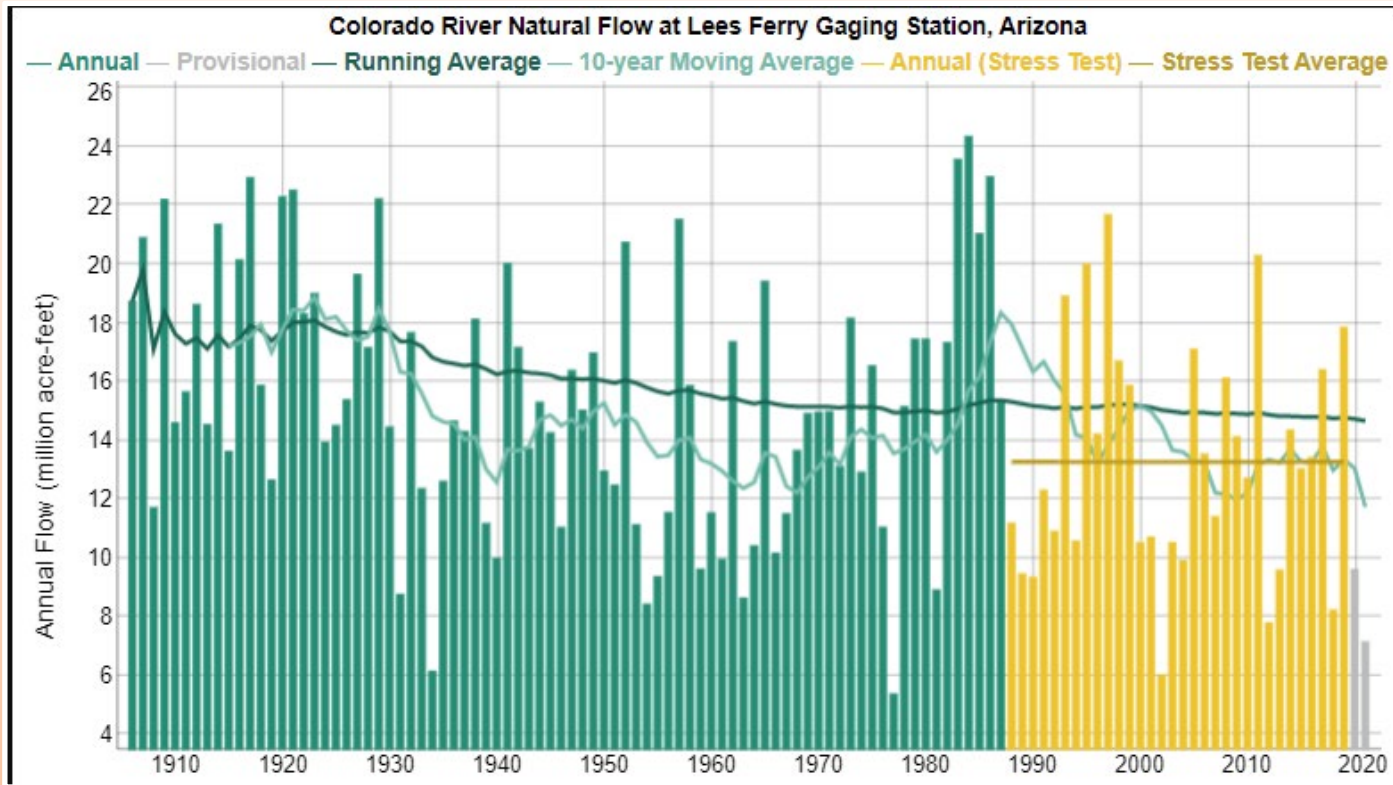
Metropolitan's Hoover Power Resource has Declined



Metropolitan Colorado River Supply

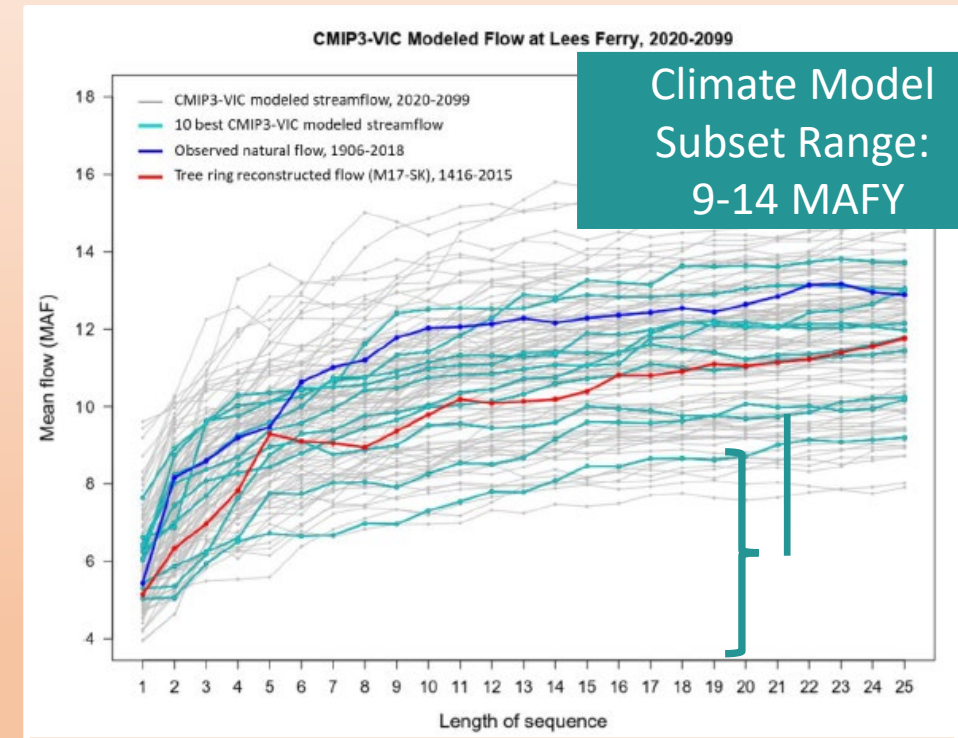


Historical and Future Colorado River Flows

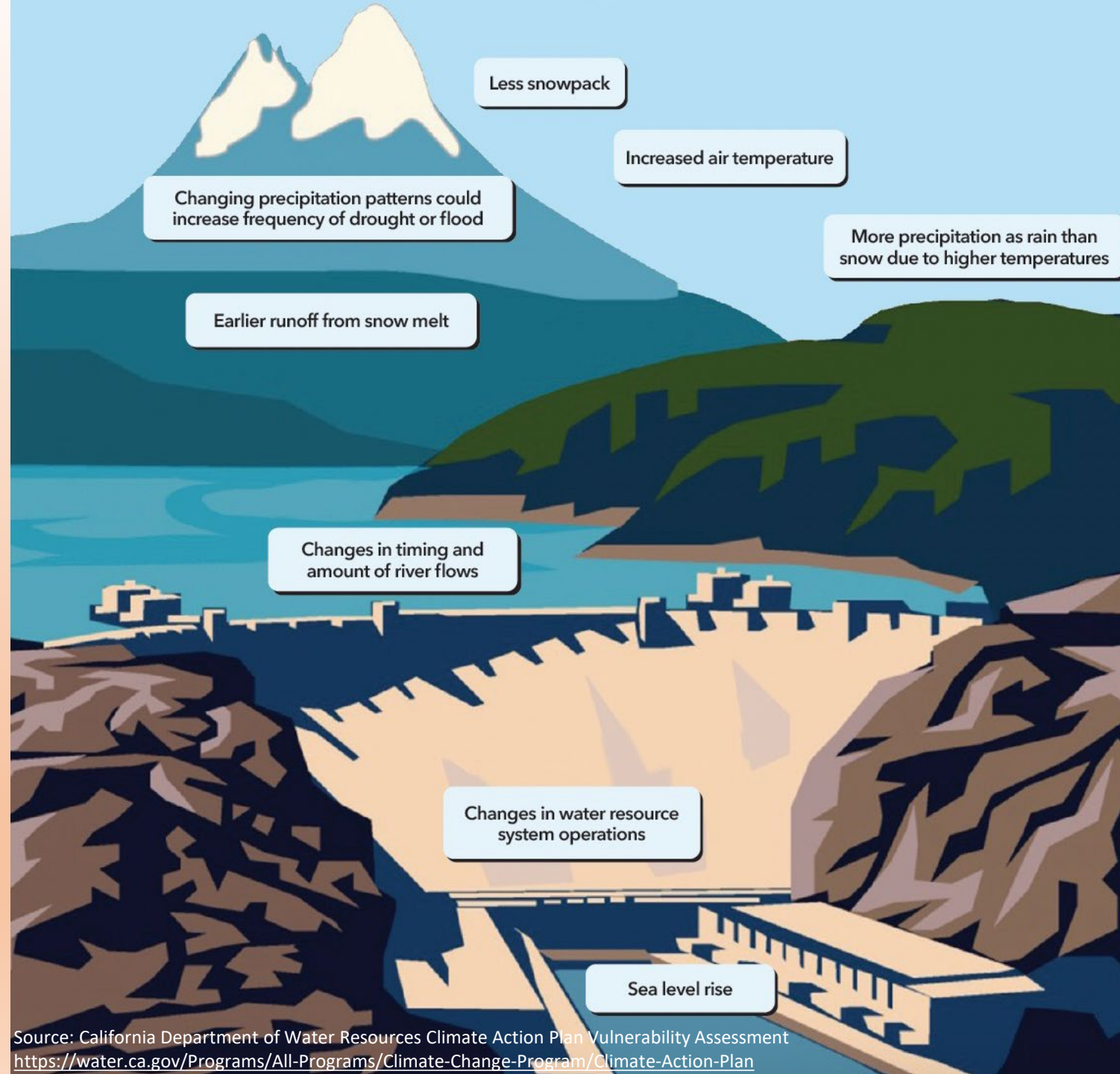


Historical Natural Flow
at Lees Ferry

Global Climate Model Future Projections

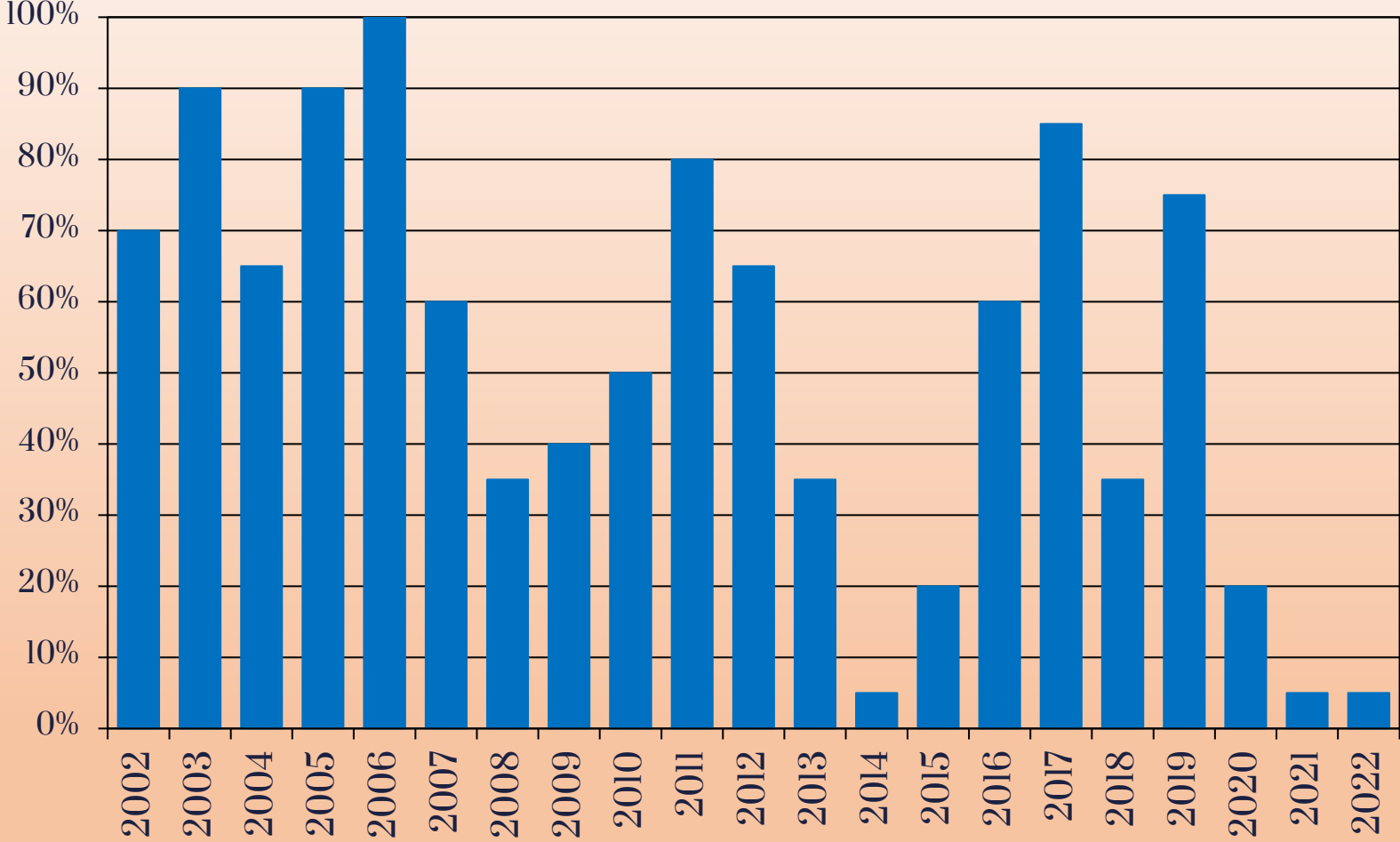


State Water Project Reliability and Climate Vulnerabilities



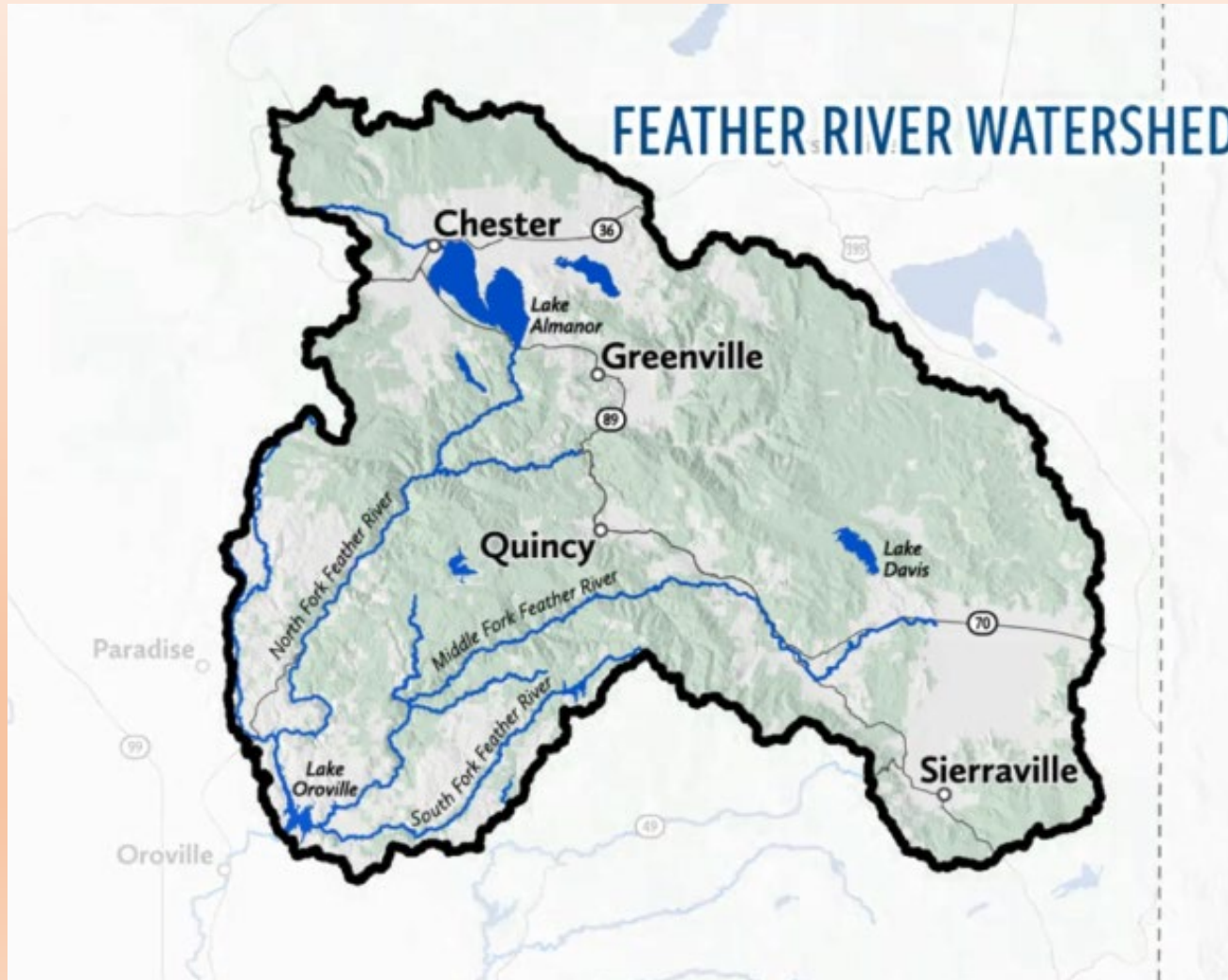
Historic State Water Project Allocations

Reliability of supplies is decreasing



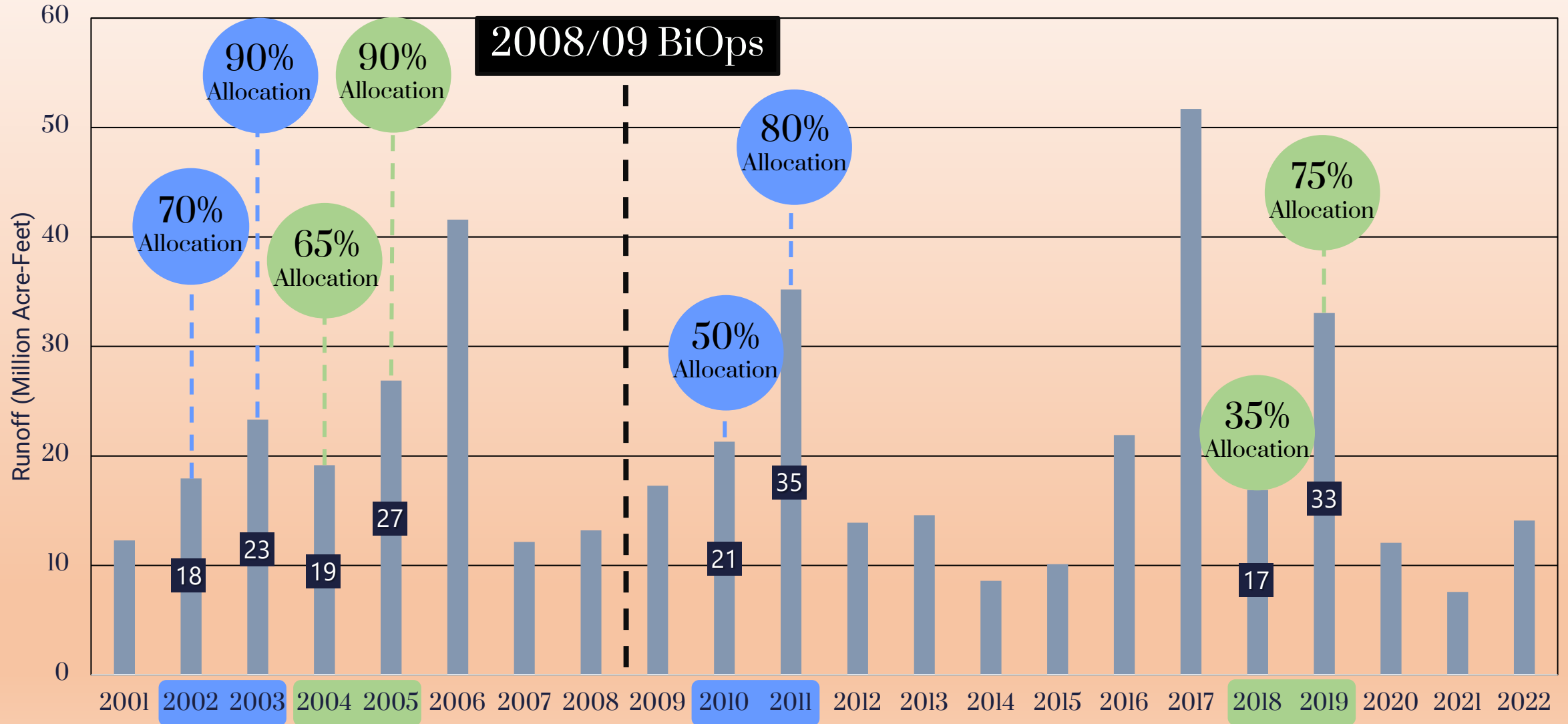
Source: Department of Water Resources Historical State Water Project Allocation Summaries <https://water.ca.gov/programs/state-water-project/management/swp-water-contractors>
California Ocean Protection Council https://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf

State Water Project Headwaters Vulnerable to Climate Change



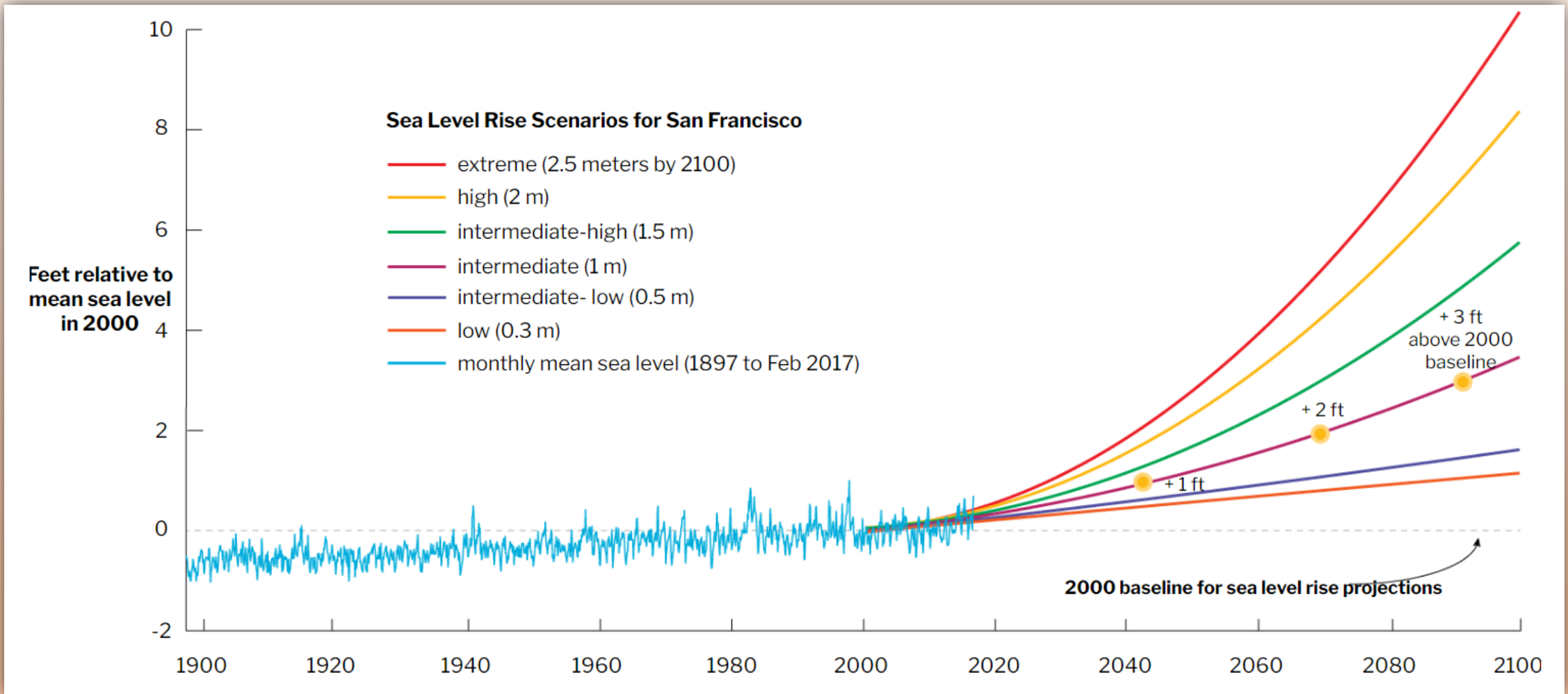
Wildfire frequency and severity are increasing

Balancing Water Supply with the Environment



Source: Department of Water Resources Water Supply Index History, Combined Eight River Index Runoff <https://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST>

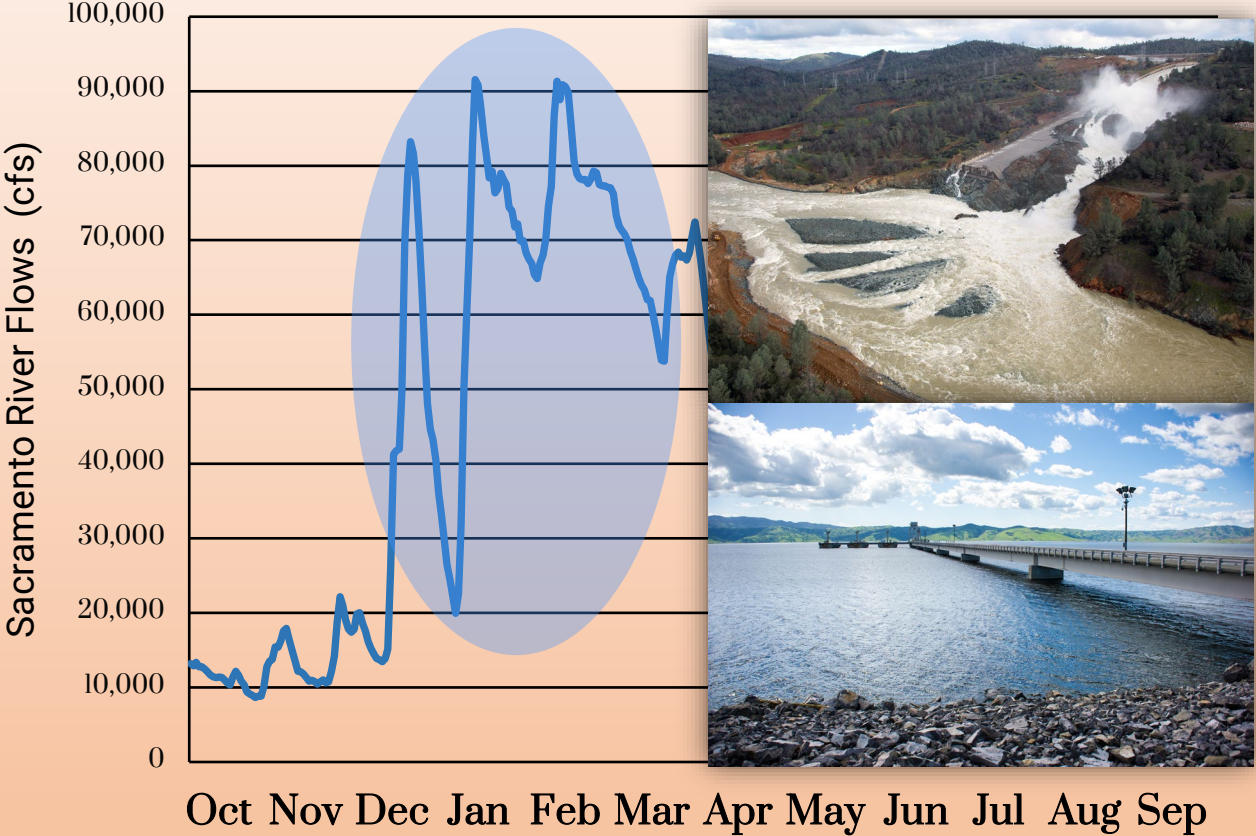
Sea Level Rise at Golden Gate Bridge



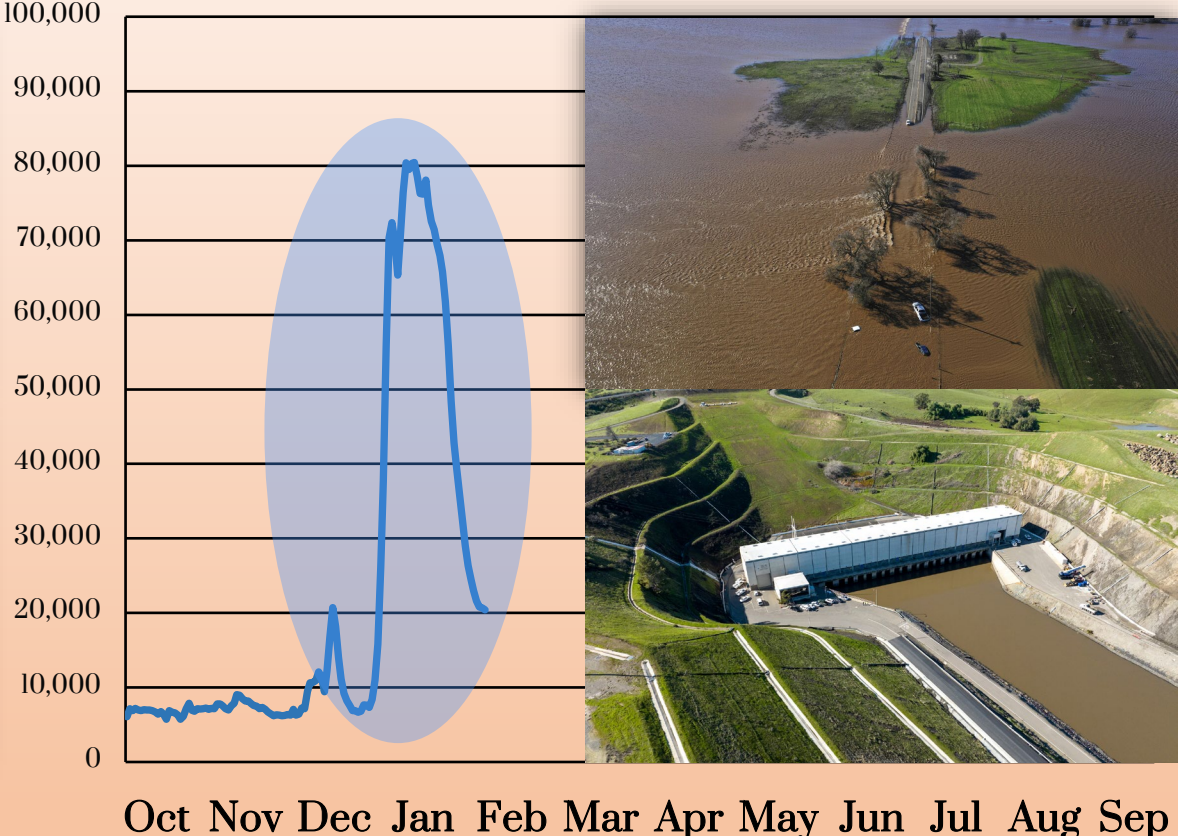
Source: San Francisco Baykeeper: <https://baykeeper.org/shoreview/california-slr.html>

California Ocean Protection Council https://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf

Atmospheric Rivers Present Risks and Opportunities



**2017 Water Year
(Wet)**



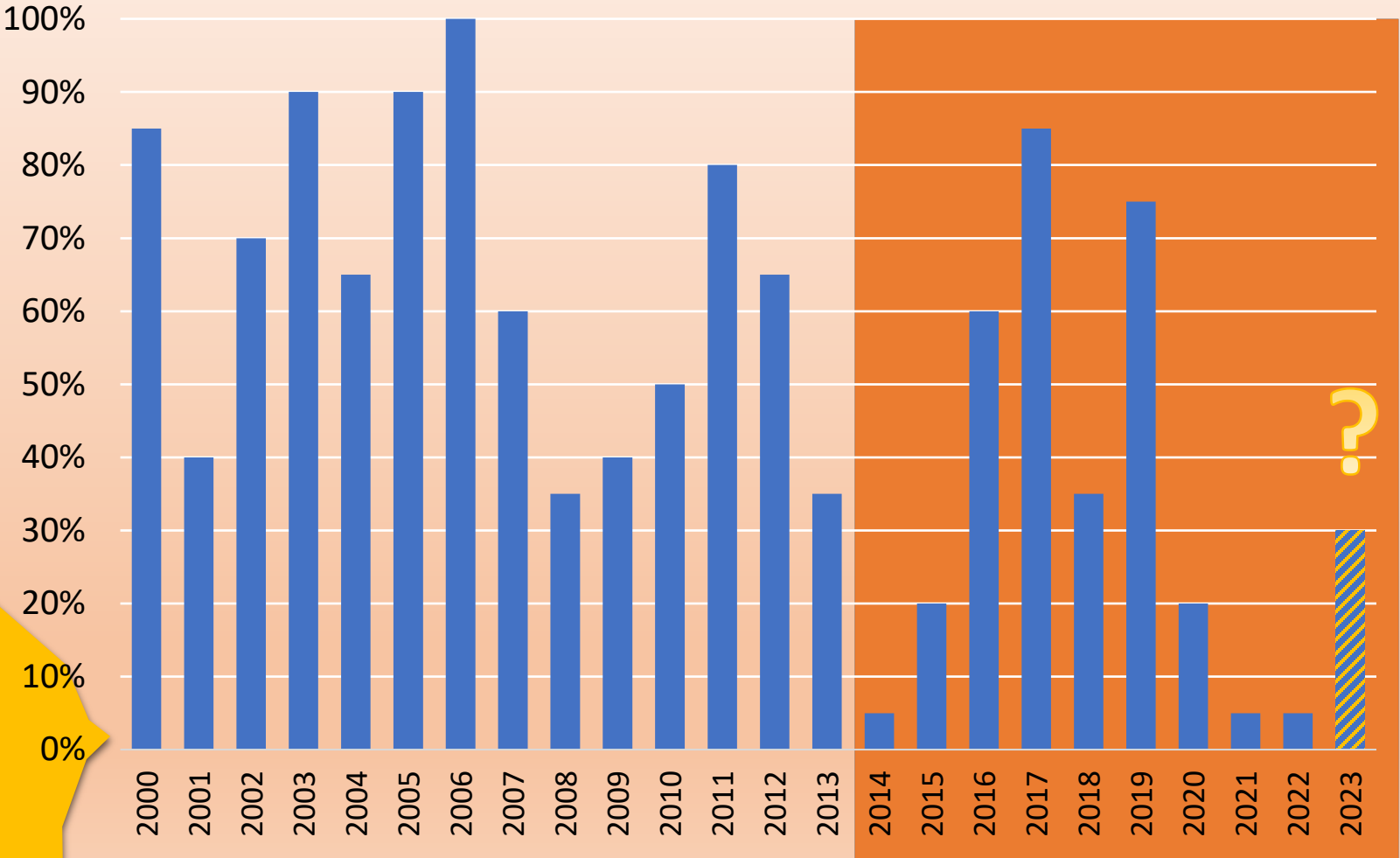
**2023 Water Year
(Above Normal)**

Sources: Sacramento River Flows at Freeport via California Data Exchange Center <https://cdec.water.ca.gov/>
 DWR 2023 Water Supply Index <https://cdec.water.ca.gov/reportapp/javareports?name=WSI>

Adapting Operations to Longer and More Intense Dry Periods with Flashes of Abundance



SWP Allocation



Operating under Extremes

Last Drought (2014-15) – Began implementing innovative drought actions



PROGRAMS



PUMPING



INFRASTRUCTURE



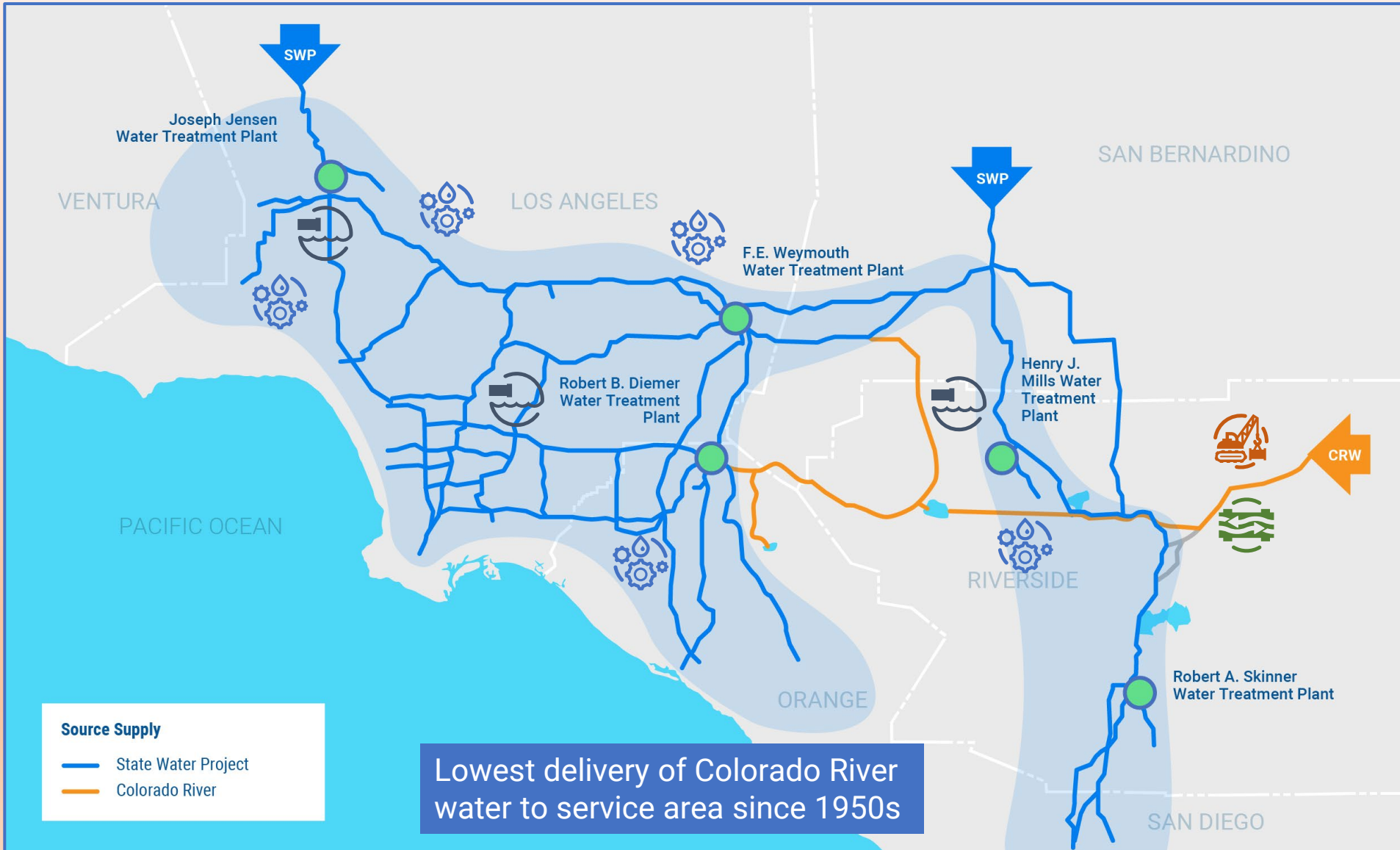
SPECIAL OPERATIONS



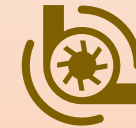
EXCHANGES

Operating under Extremes

Record Wet (2017 & 2019) – Adapted to surplus conditions with new actions



PROGRAMS



PUMPING



INFRASTRUCTURE



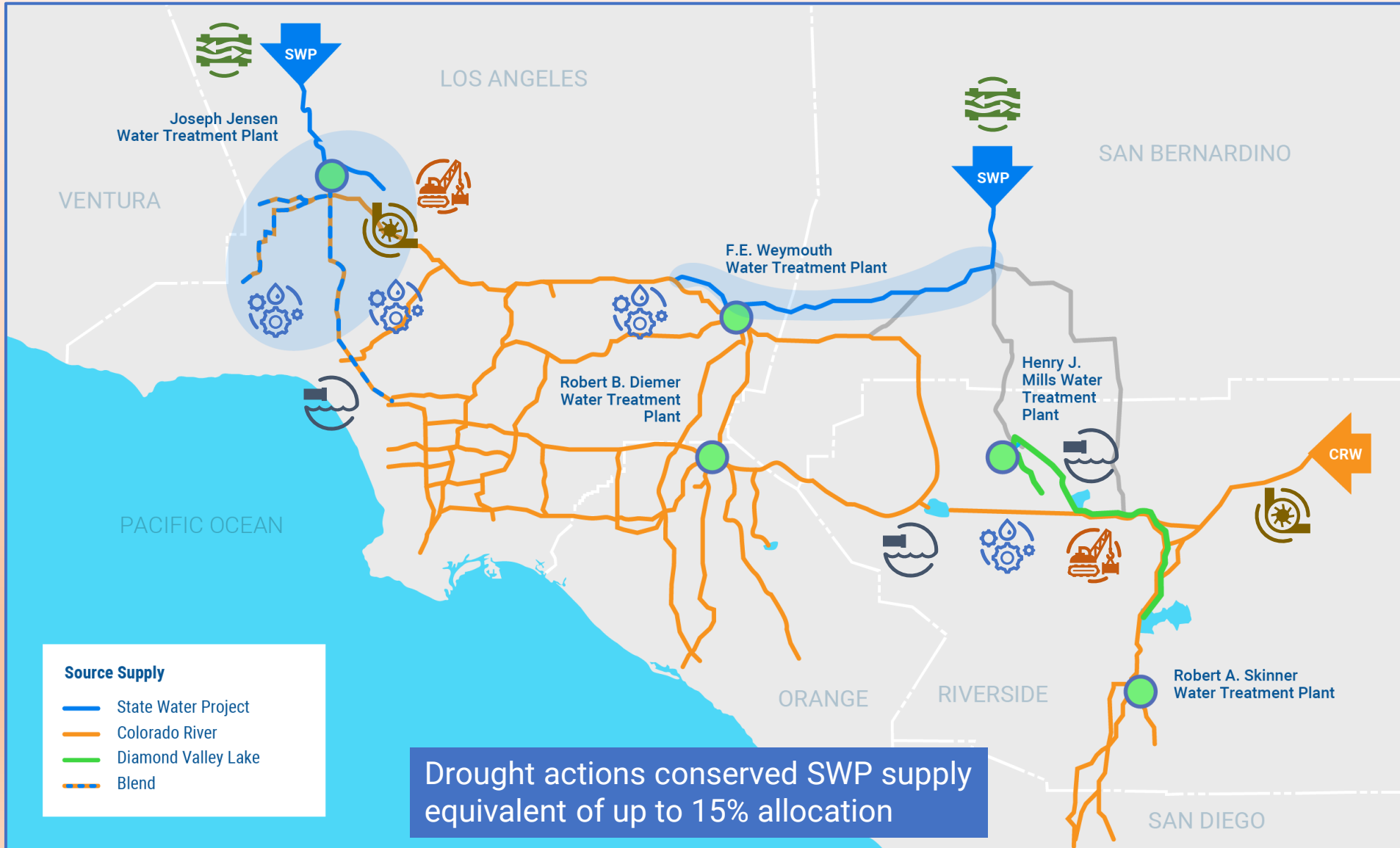
SPECIAL OPERATIONS



EXCHANGES

Operating under Extremes

Record Drought (2020-22) – Added new drought actions to portfolio



-  PROGRAMS
-  PUMPING
-  INFRASTRUCTURE
-  SPECIAL OPERATIONS
-  EXCHANGES

Challenges when Operating in a Changing Climate



System Stress



Energy Costs



Emergency Events



Supply Chain Impacts



Water Quality Changes



Low and High Flow Operations



Complex Shutdown Planning



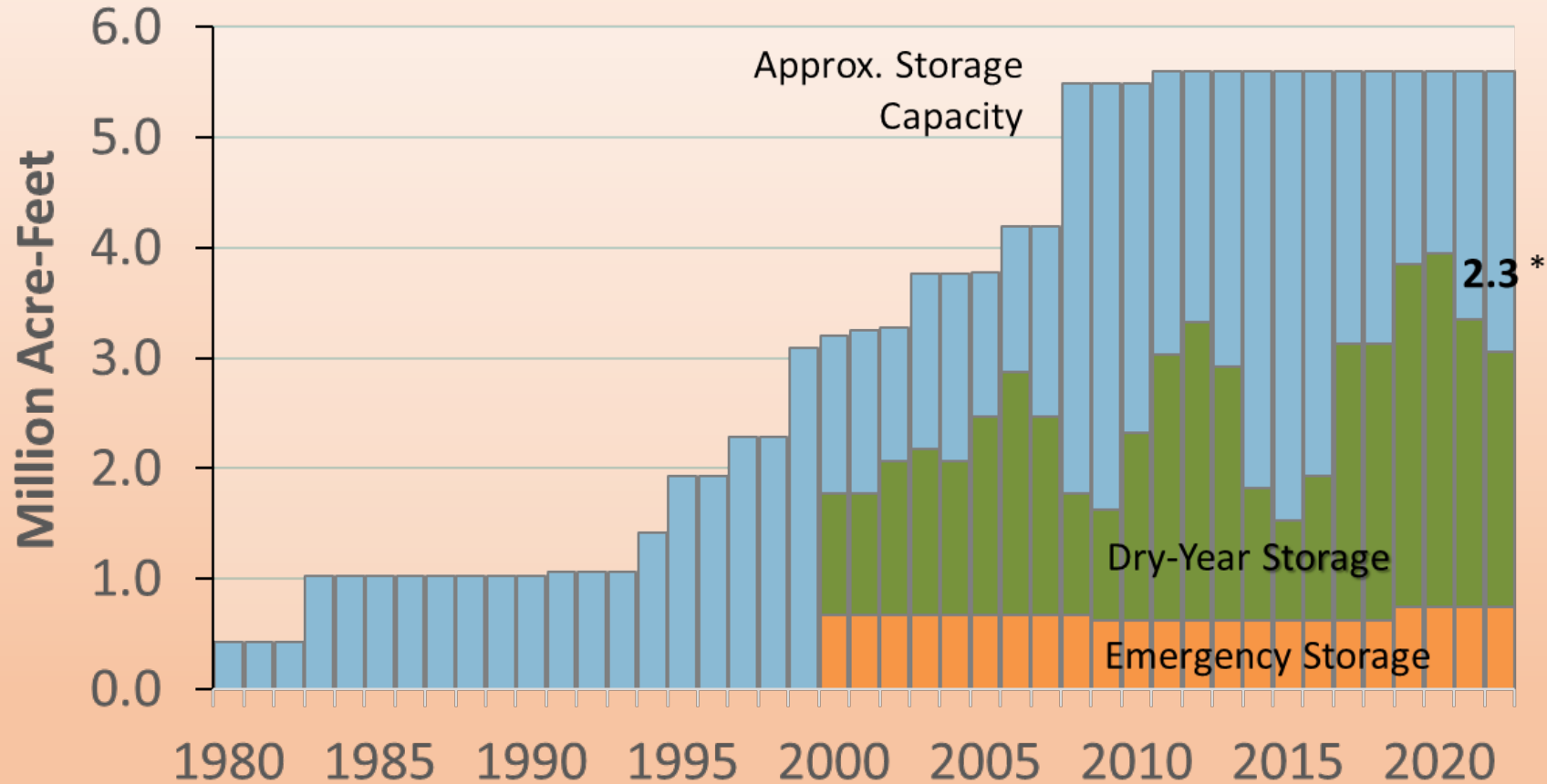
New and Emerging Regulations

Exposing a Vulnerability to Regional Reliability

New actions are tackling SWP Dependent Area reliability, but more must be done

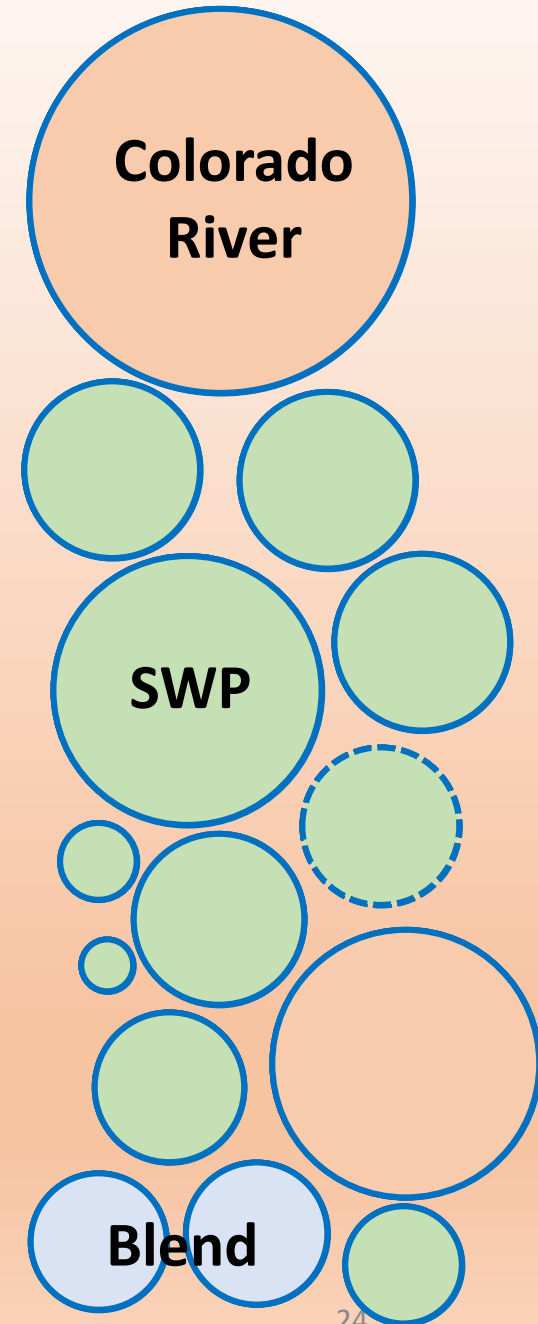


Storage provides great benefit, but is not immune to changing conditions

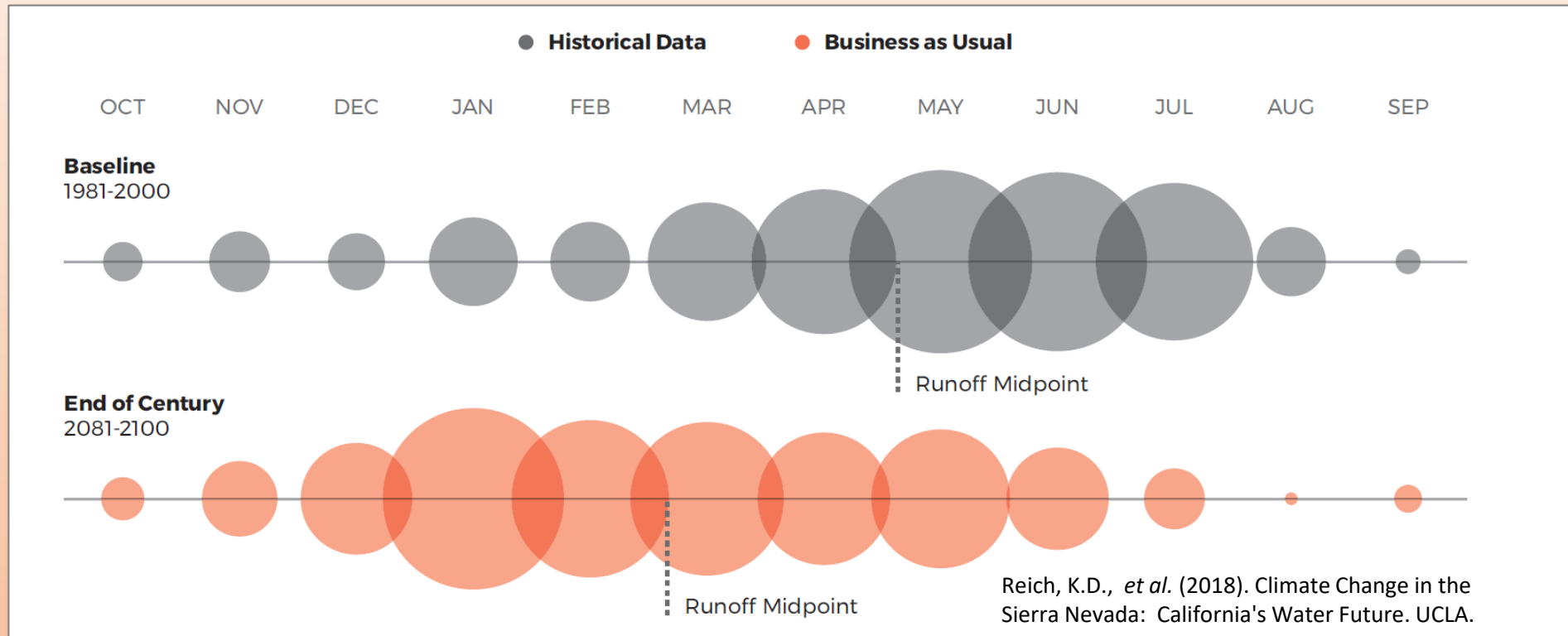


IRP Needs Assessment Identified
Challenges and Opportunities

* 2022 EOY
Estimate

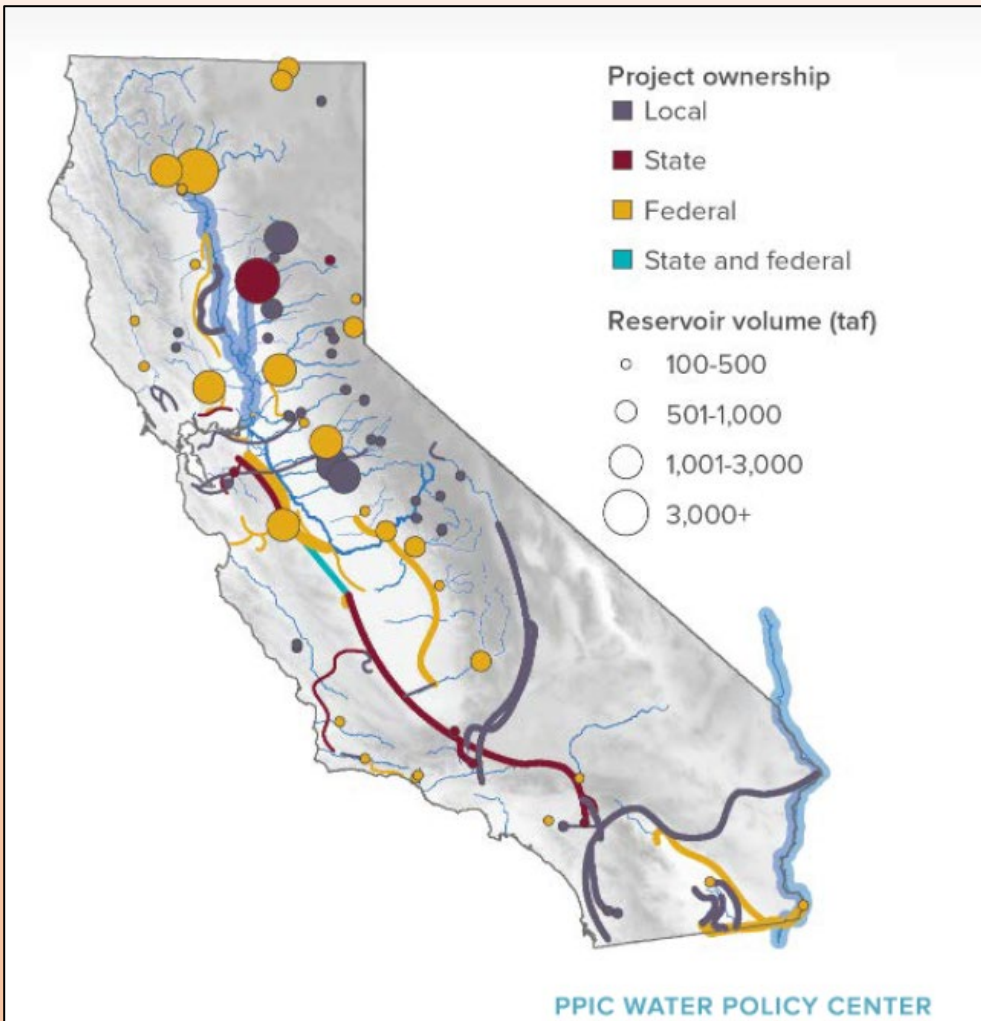


Climate change stresses the water grid feeding our storage



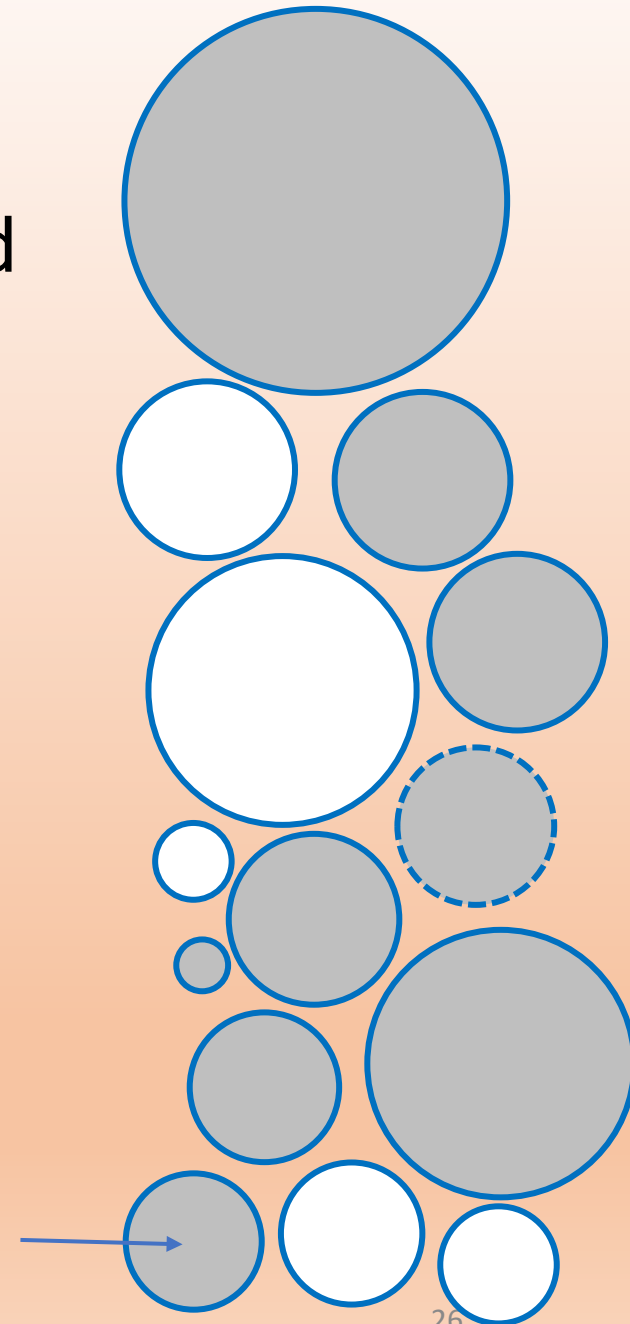
- Less snow/more fire
- Big atmospheric river events get bigger
- Flooding increases dramatically
- Dry years (probably) get drier

Preserving storage requires action

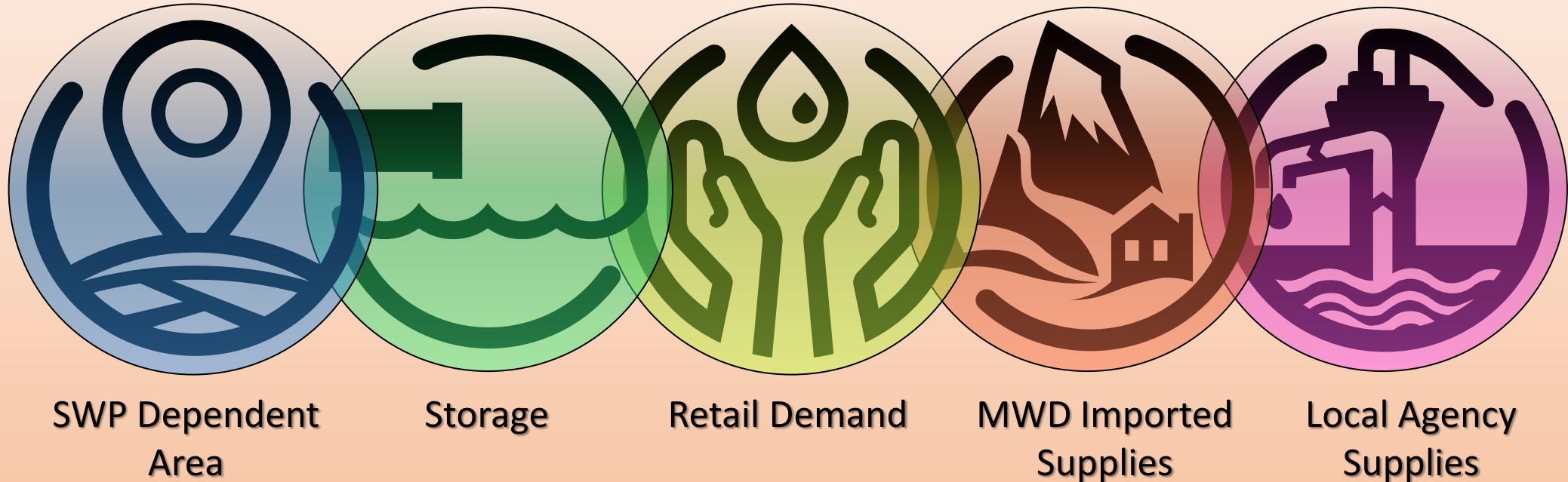


- Modernize the state and regional water grid
 - Connect storage to demand
 - Ensure replenishment in wet years
- Adapt to contaminants and invasive species
- Renegotiate storage agreements

Agreements expiring in 2037 or earlier

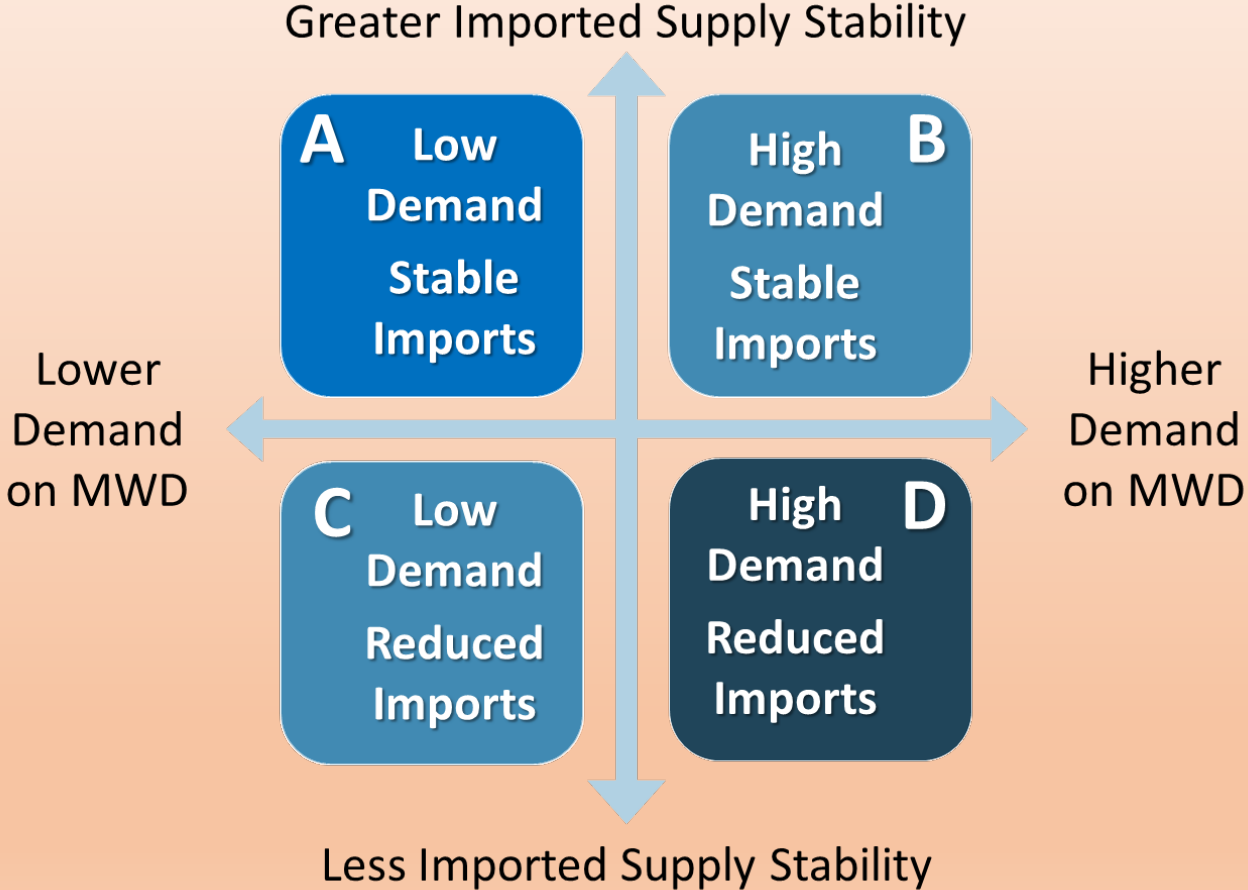


IRP needs assessment identified vulnerabilities and findings



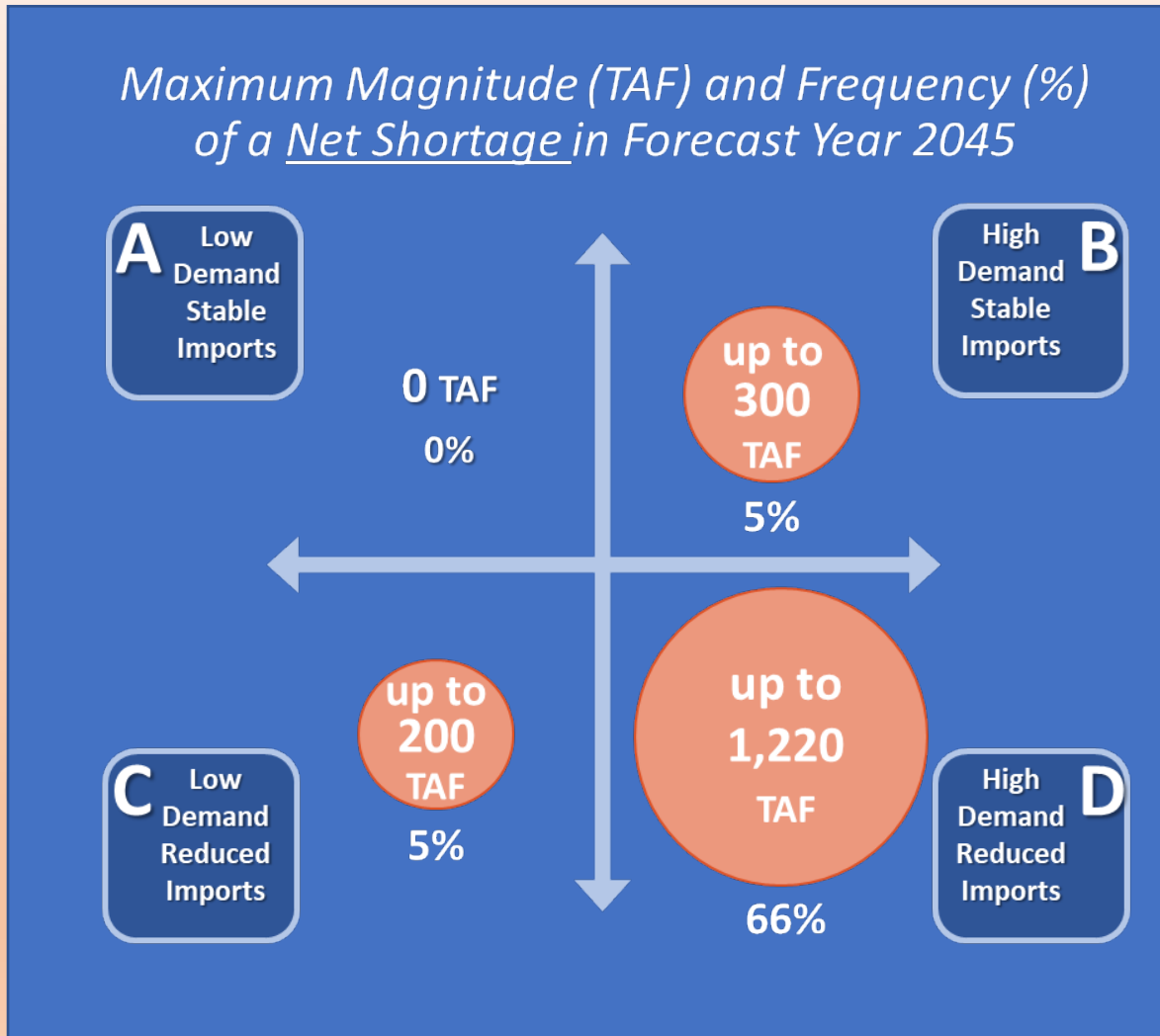
- Surplus/Shortage - Quantified for each scenario
- Portfolio Categories - Examined for effectiveness
- Findings - Grouped into five focus areas

2020 IRP scenarios encompassed wide range of climate outcomes



- **State Water Project**
Used DWR’s severe impact analysis with additional 25% degradation by 2035
- **Colorado River**
Used severe climate change (RCP 8.5); 26% decrease in runoff; 4.5% increase in evaporation by 2045
- **Local Agency Supplies**
Adjusted groundwater yields;
Adjusted Los Angeles Aqueduct supply;
Increased frequency/intensity of extreme wet/dry years

IRP needs assessment rang an alarm for action—and opportunity

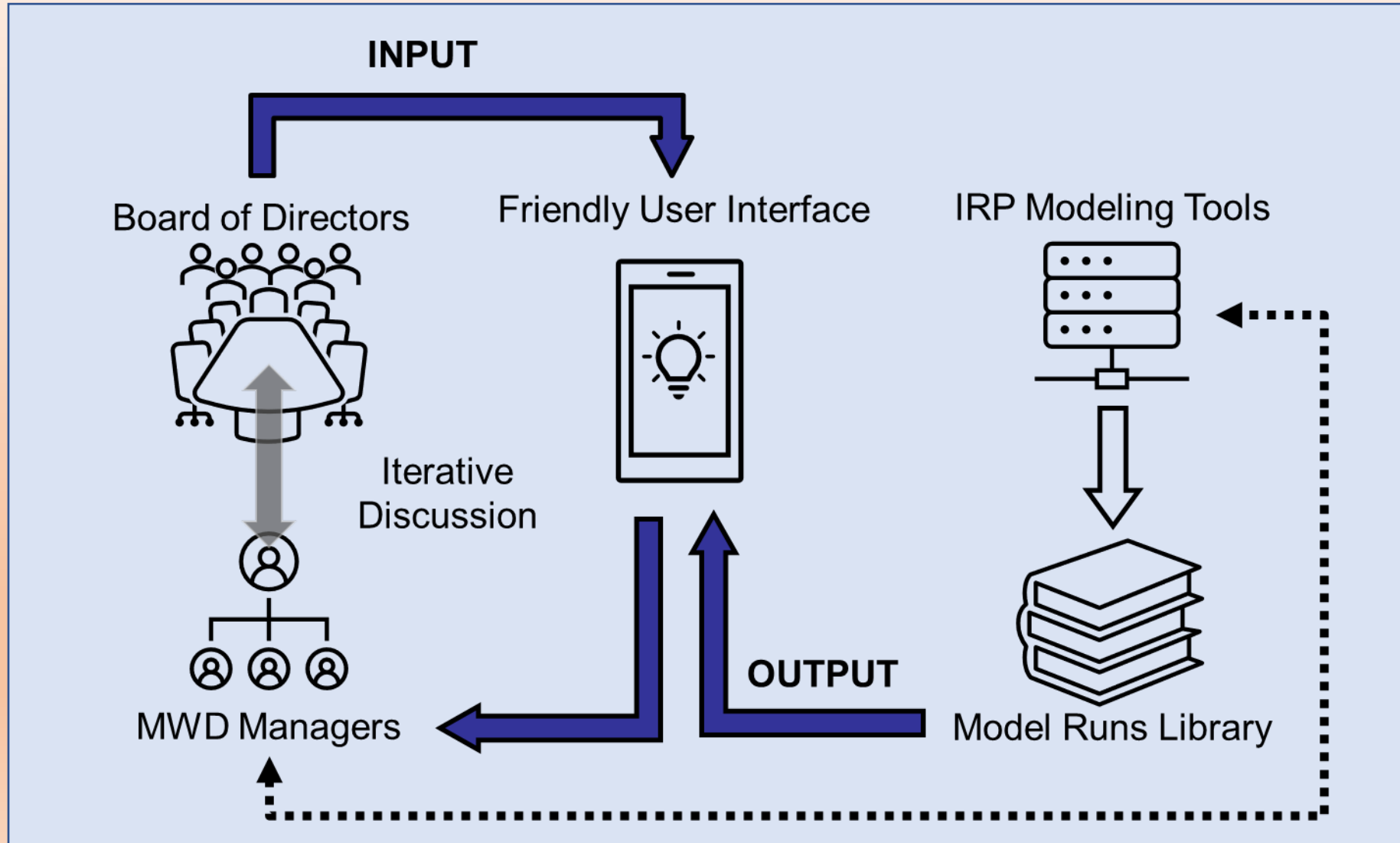


Scenario D Modeling	
New Storage (AF)	Core Supply Needed by 2045 (AF)
0	650,000
100,000	600,000
250,000	550,000
500,000	500,000

IRP implementation objectives

- Fully use analysis and tools from Phase 1 Assessment
- Develop user/process interface to structure and respond to Board questions
- Identify policy/strategy choices and tradeoffs to simulate under current and future scenarios
- Refine elements and investment options under assessment targets

IRP implementation objectives



What does Climate Action look like?

Reduce Emissions

- Inventory, track and measure GHGs
- Commit to be carbon neutral
- Public-facing dashboard to be transparent
- Focus on electricity use and new renewable energy sources

Build Resilience

- Evaluate projects and programs through a climate lens
- Plan to be integrated, redundant, flexible, adaptable
- Empower the workforce and protect assets
- Adopt an adaptive business model

Ensure Equity

- Manage supplies and operations to protect the most vulnerable
- Maximize external engagement

Embrace Uncertainty

- Use best available and evolving science
- Conduct risk analyses
- Innovate
- Use adaptive management

State of California Governor's Office of Planning and Research Definition of Resilience

Resilience is the capacity of any entity – an individual, a community, an organization, or a natural system – to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience.

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