

California Water 101

Newsha Ajami, PhD

Chief Strategy and Development Officer for Research
Earth and Environmental Sciences Area
Lawrence Berkeley National Lab

The Classical Elements of Municipal Law:

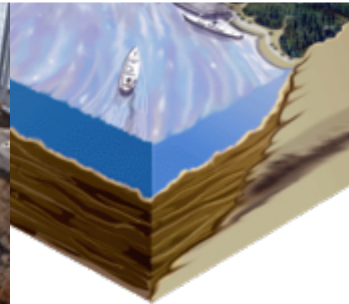
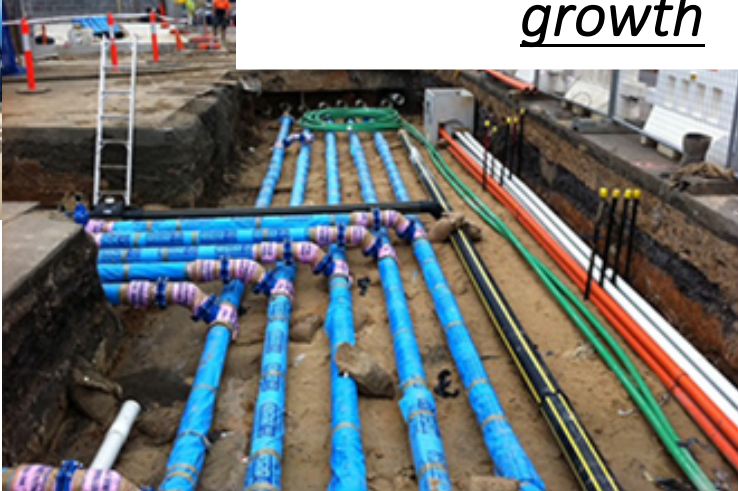
An Aristotelian Approach

March 18, 2022

20th Century Centralized Water Infrastructure Model



- Once through systems
- Based on
 - water abundance
 - hydrologic stationarity
 - Steady and perpetual demand growth



Climate Change

Increased frequency & severity of extreme events



Image: California Department of Water Resources

Image: George Herald



Aging Infrastructure

\$1 trillion to update US drinking water systems

Urbanization

68% urban population in 2050



Image: Getty Images

Image: The Atlantic

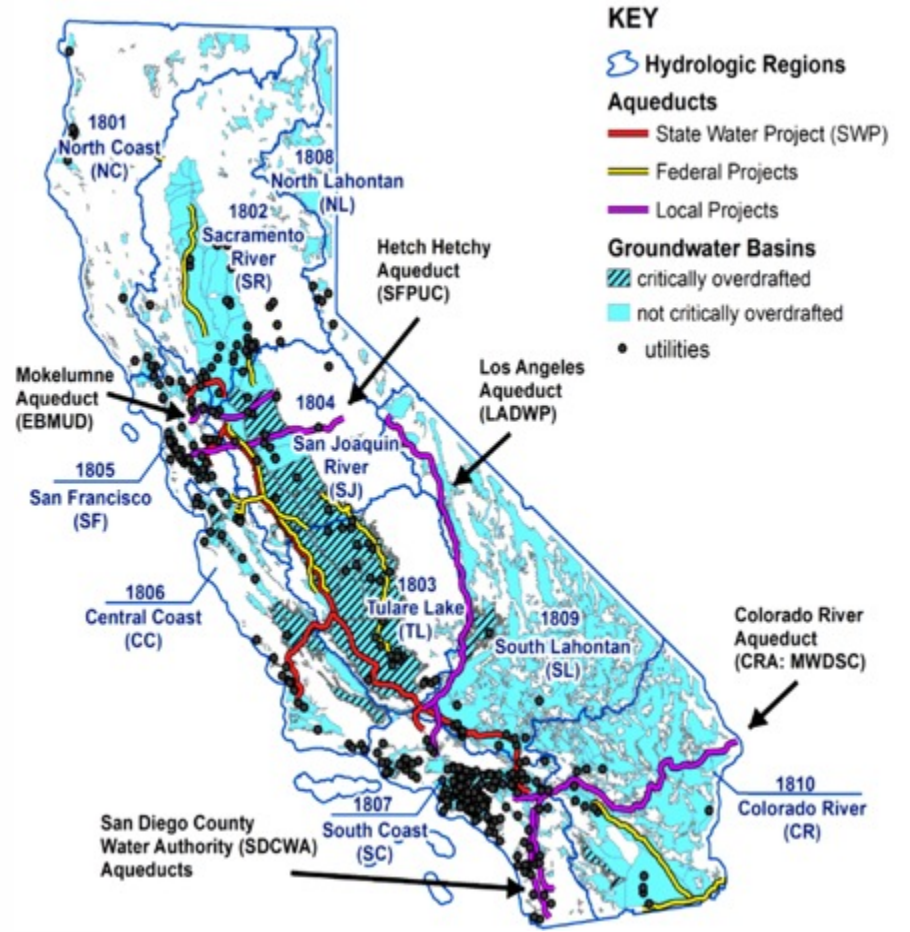
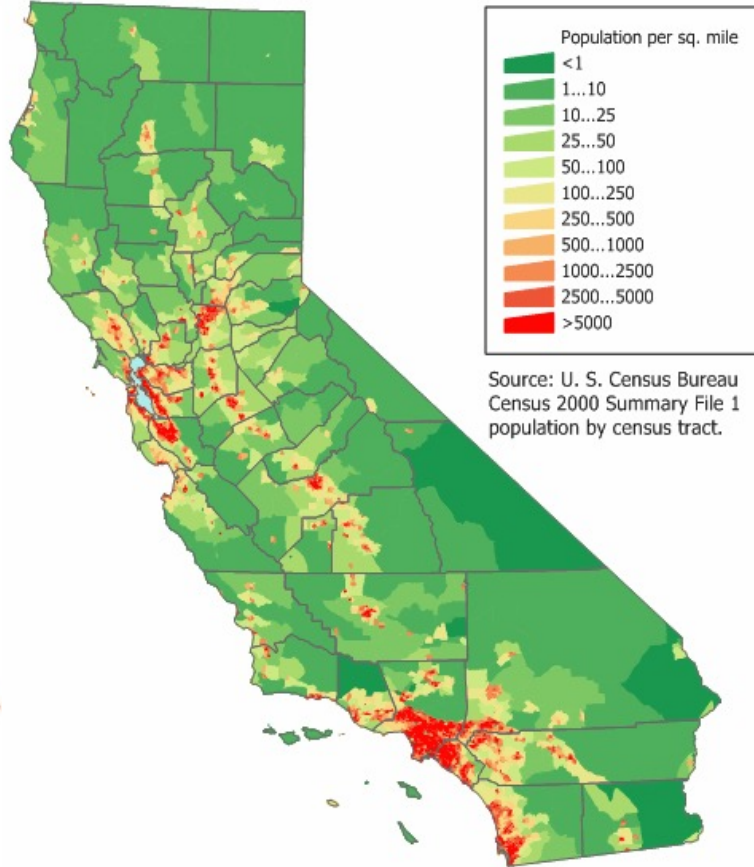
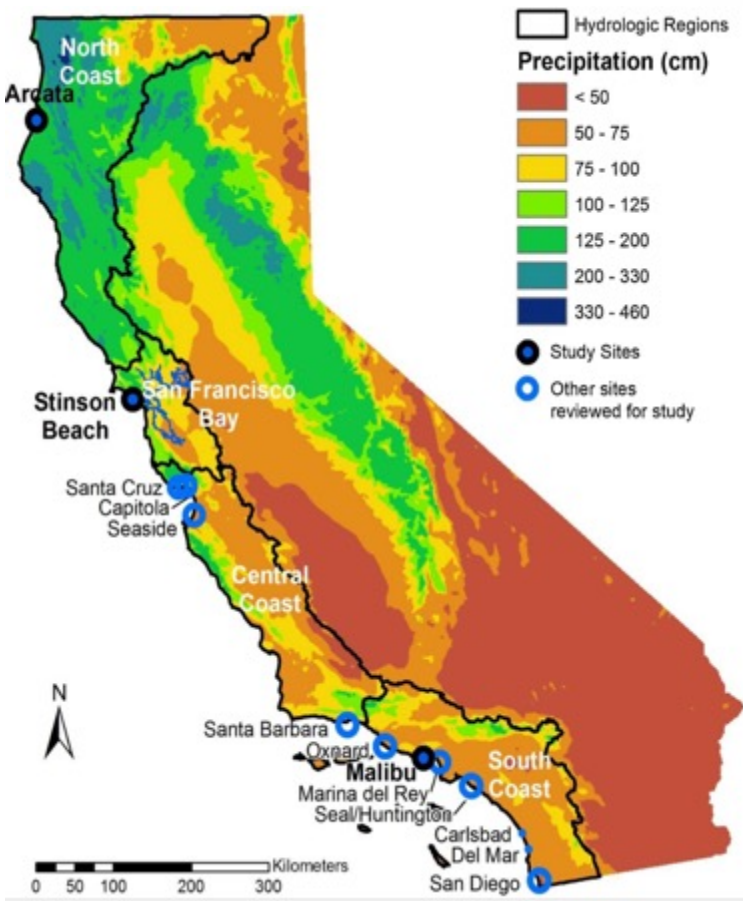


Competing Environmental Needs

Stricter regulations

The water sector is facing many modern challenges

Water Resources, Population, and Infrastructure

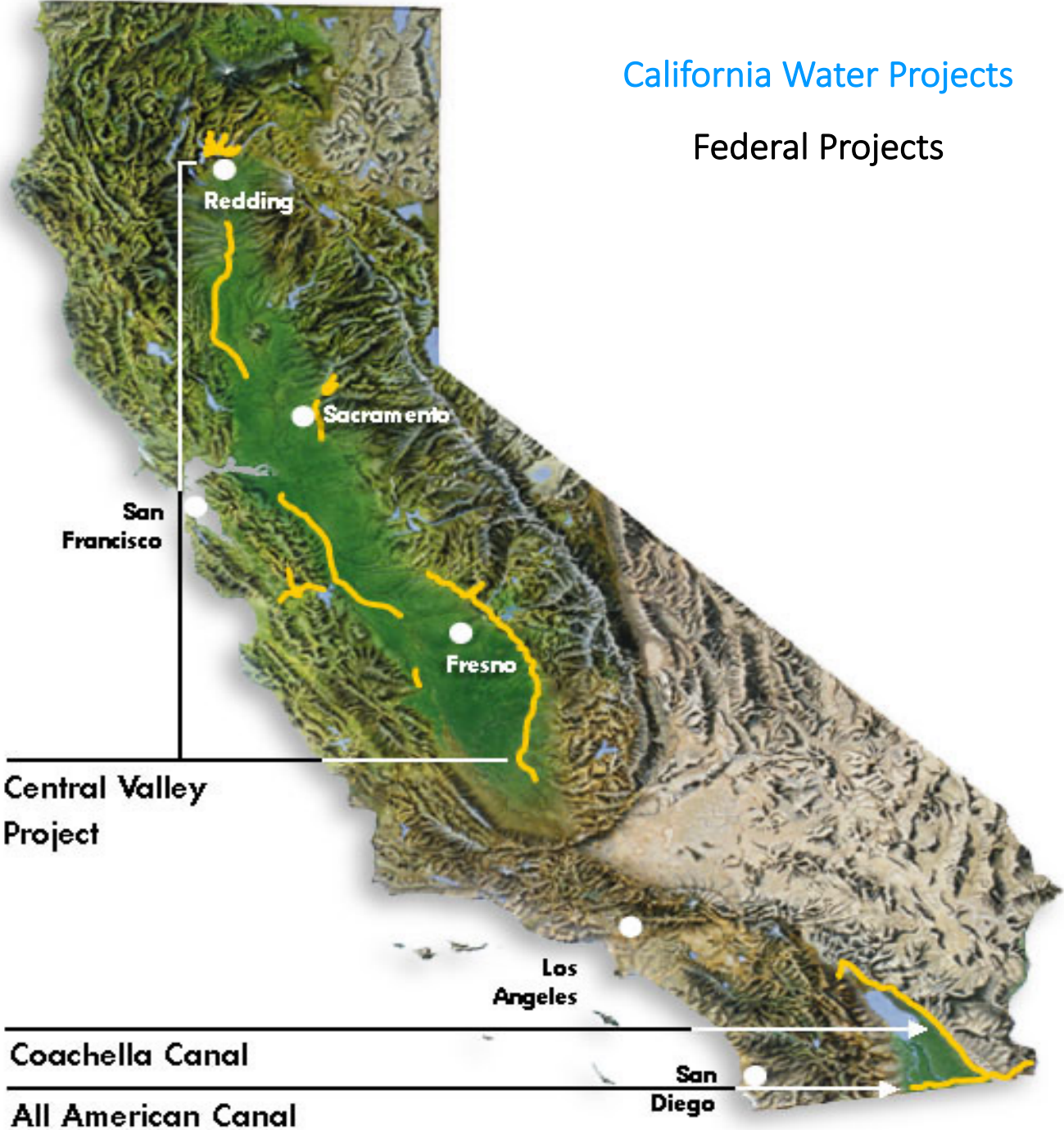


Hoover et al. 2017

(Stokes-Draut, et al., Environmental Research Letters 2017)

California Water Projects

Federal Projects



California Water Projects

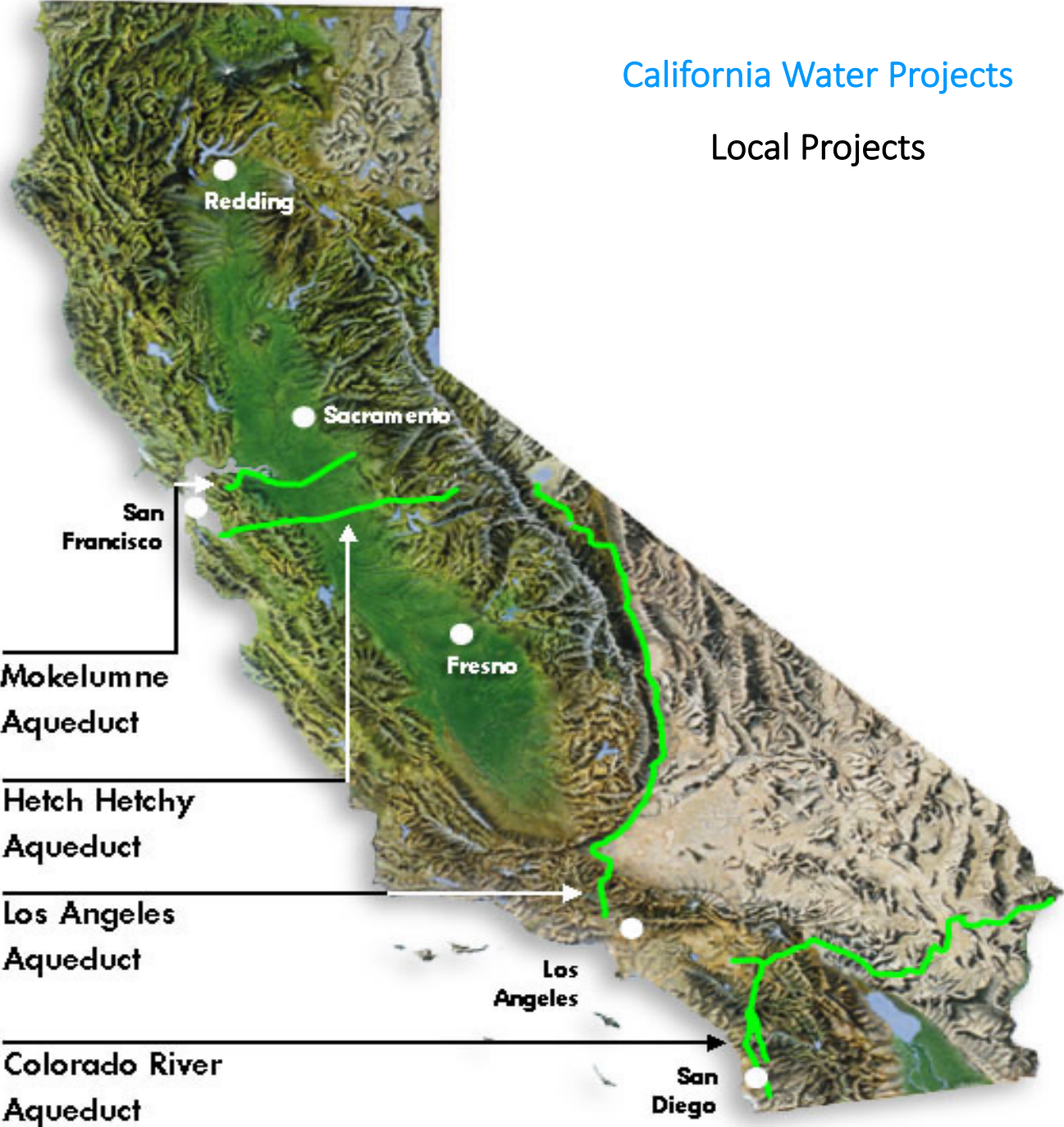
State Projects



[map from CDWR 2002]

California Water Projects

Local Projects



California Water Projects

All Water Projects



[map from CDWR 2002]

California has an elaborate system to move water

The "Delta"

The Delta is the "heart" of California's water system.



Sacramento-San Joaquin Delta

- Historically – a very rich inland aquatic ecosystem.
- It is the center of California's water distribution system: from North/Sierra to South/Coastal.
- Ecosystems are collapsing there and new laws and court rulings say water must be returned to the environment.



Competing Demands in California

Domestic



Power & Industry



Wildlife



Agriculture

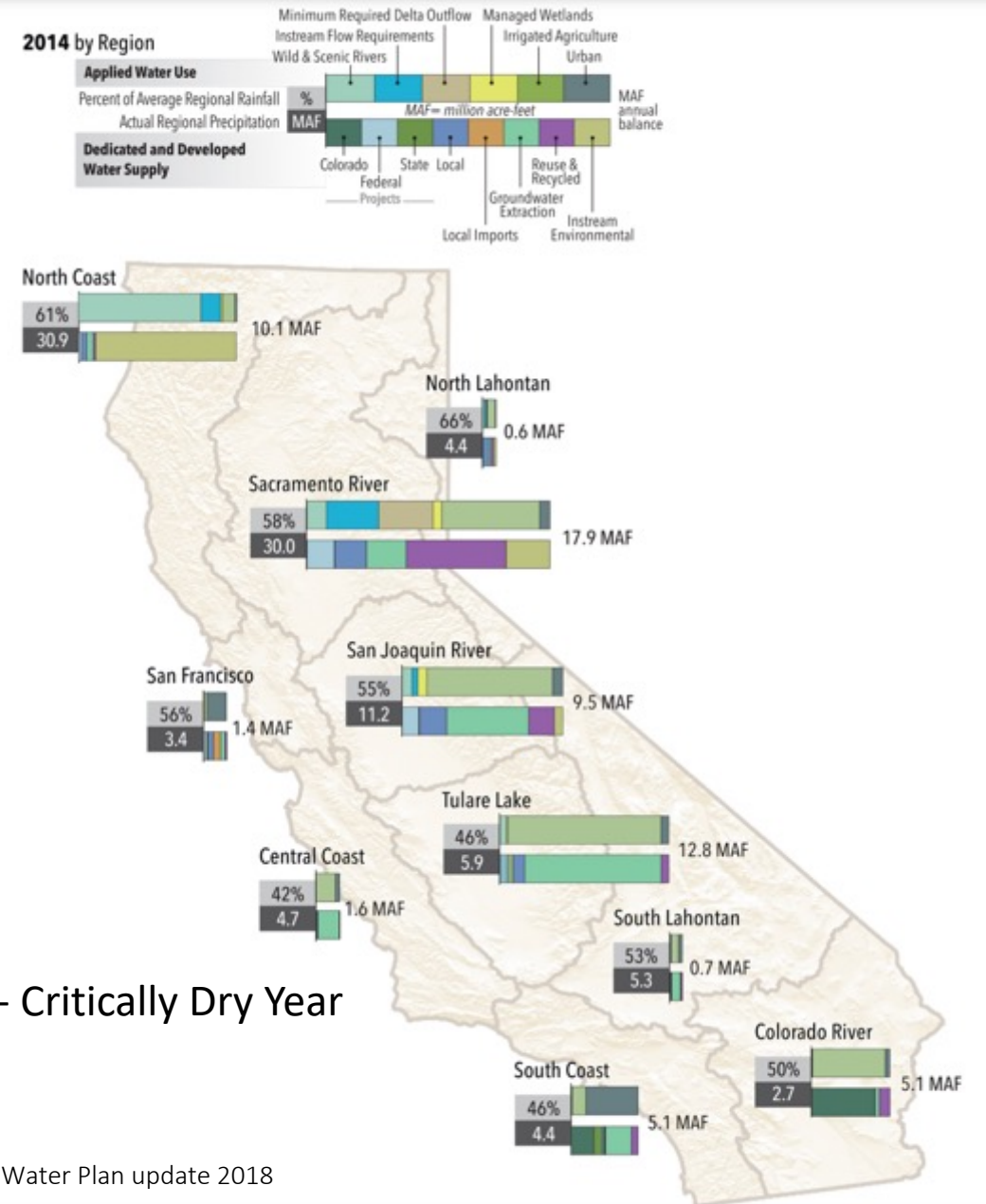
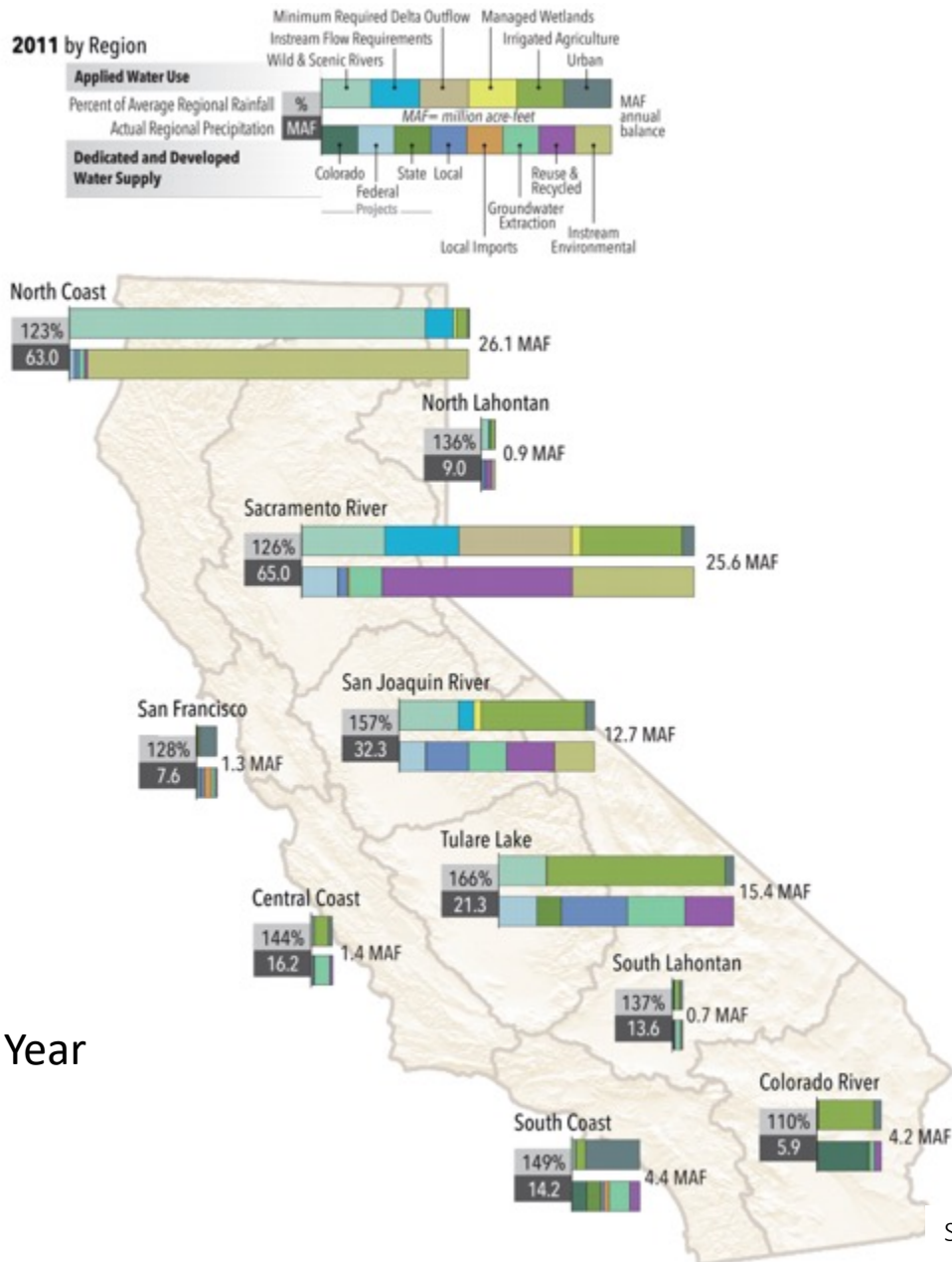


Recreation

COMPUTER IMAGE BY CHUCK CARTER

Navigation

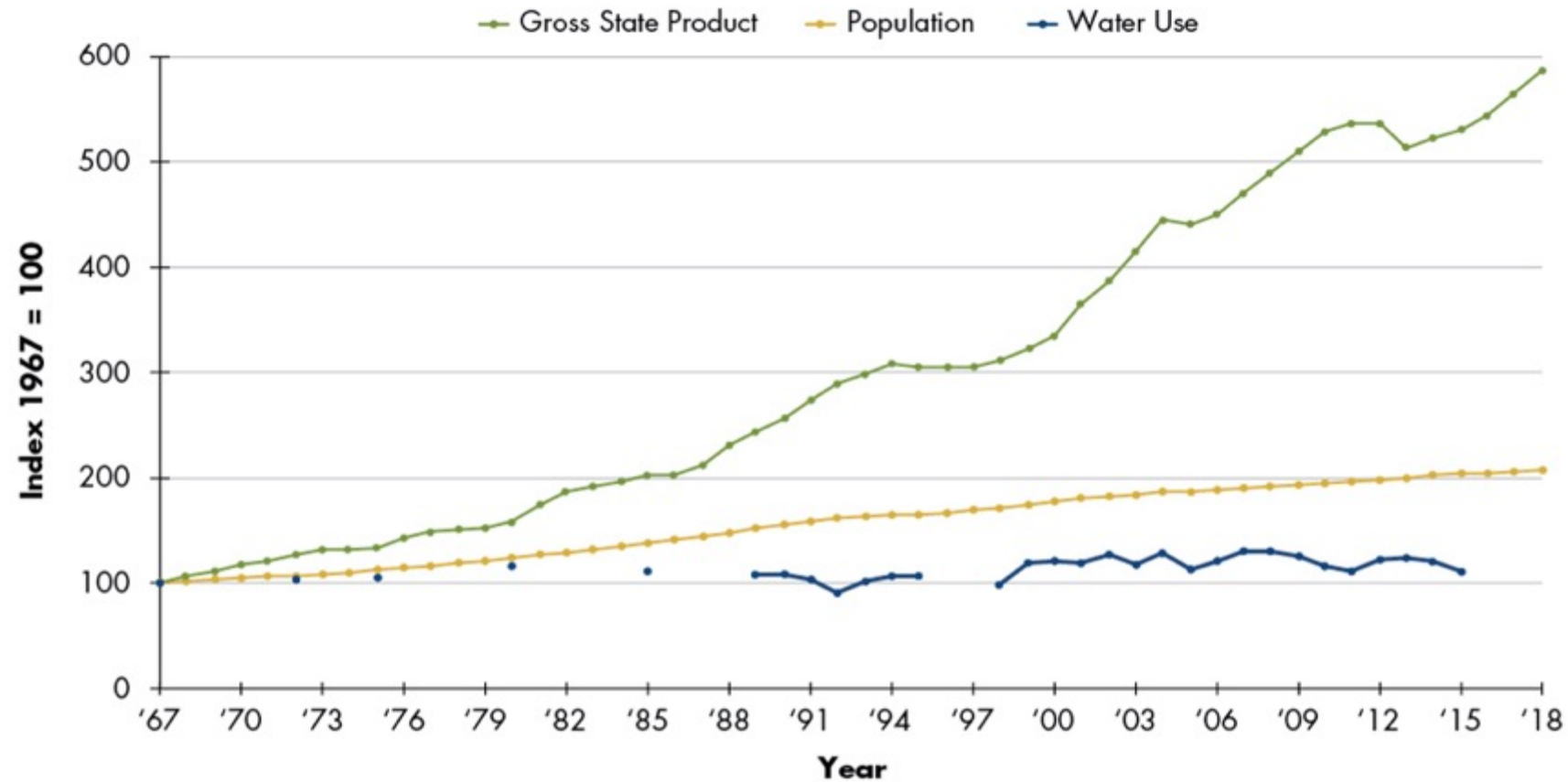
Regional Precipitation, Supply, and Demand



Source: California Water Plan update 2018

Water use has declined despite population and economic growth in California

Figure 1. California Population, Gross State Product, and Water Use Indices, 1967 to 2018 🔍



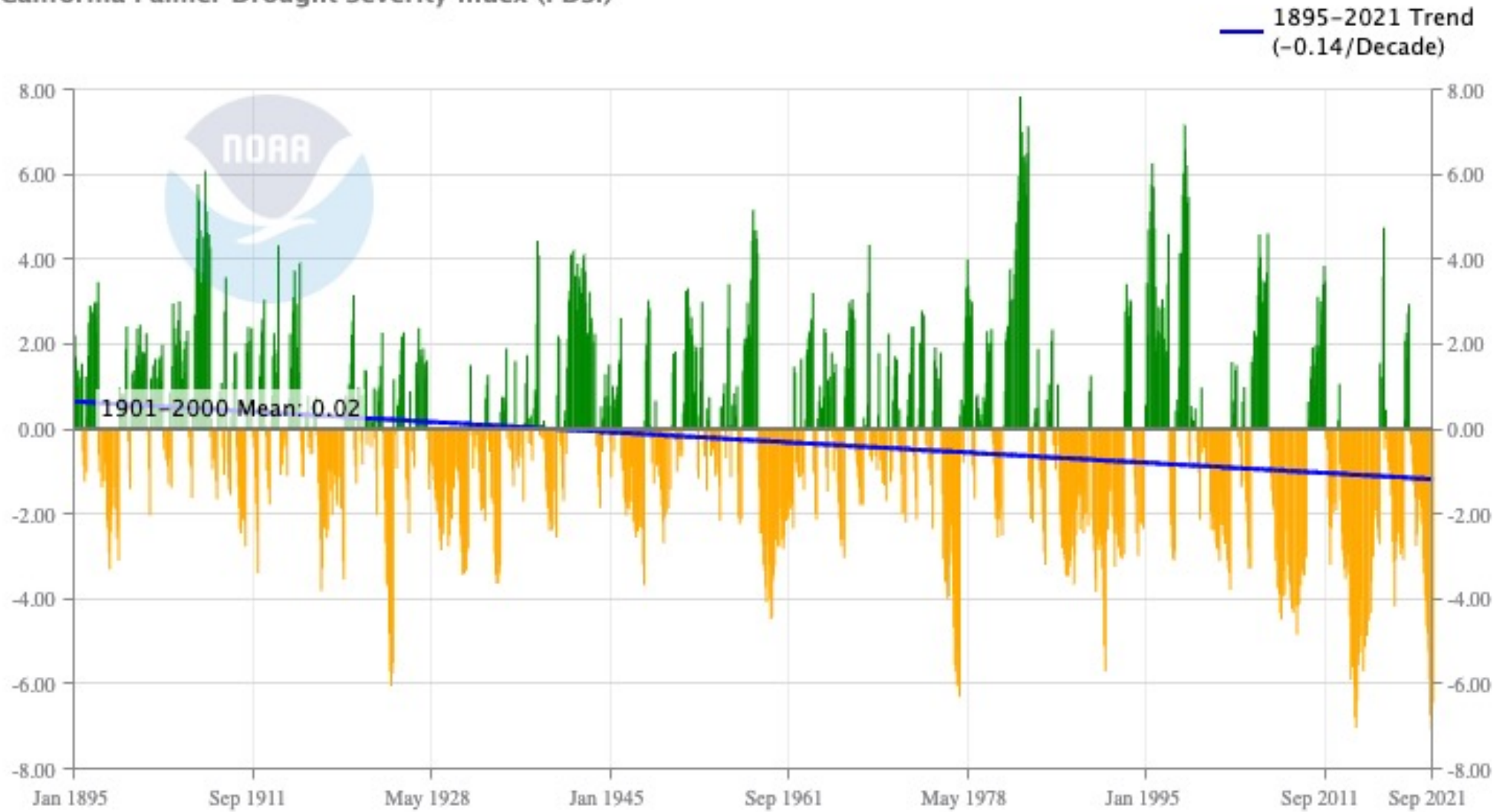
Note: All values are indexed to their 1967 values to allow for comparison. Statewide water use data are not yet available for 2016 through 2018.

Data source: Water use data from DWR ([1964](#), [1970](#), [2018](#), and [2019](#)). Population data from California Department of Finance (2018). Gross state product from US Bureau of Economic Analysis ([2019](#)).

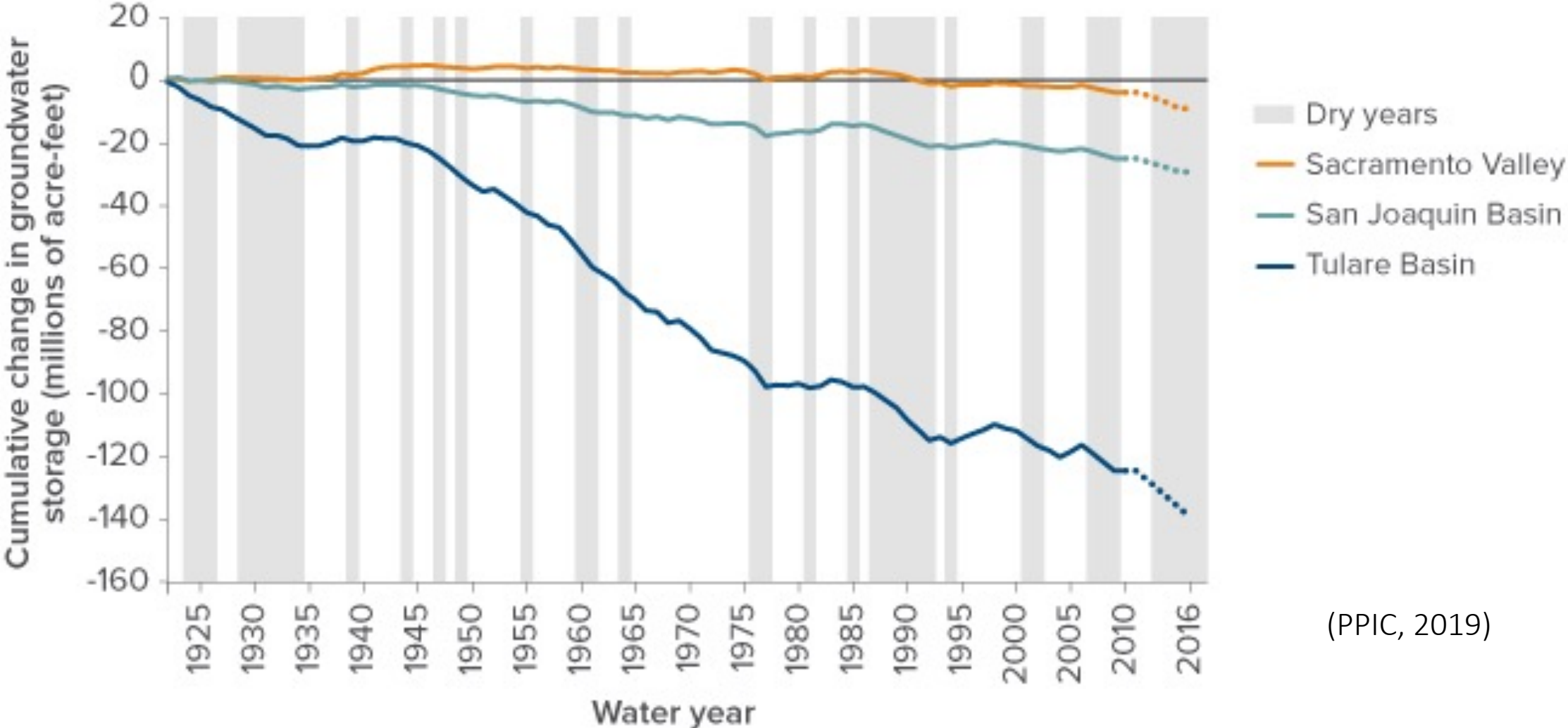


Changing climatic patterns

California Palmer Drought Severity Index (PDSI)

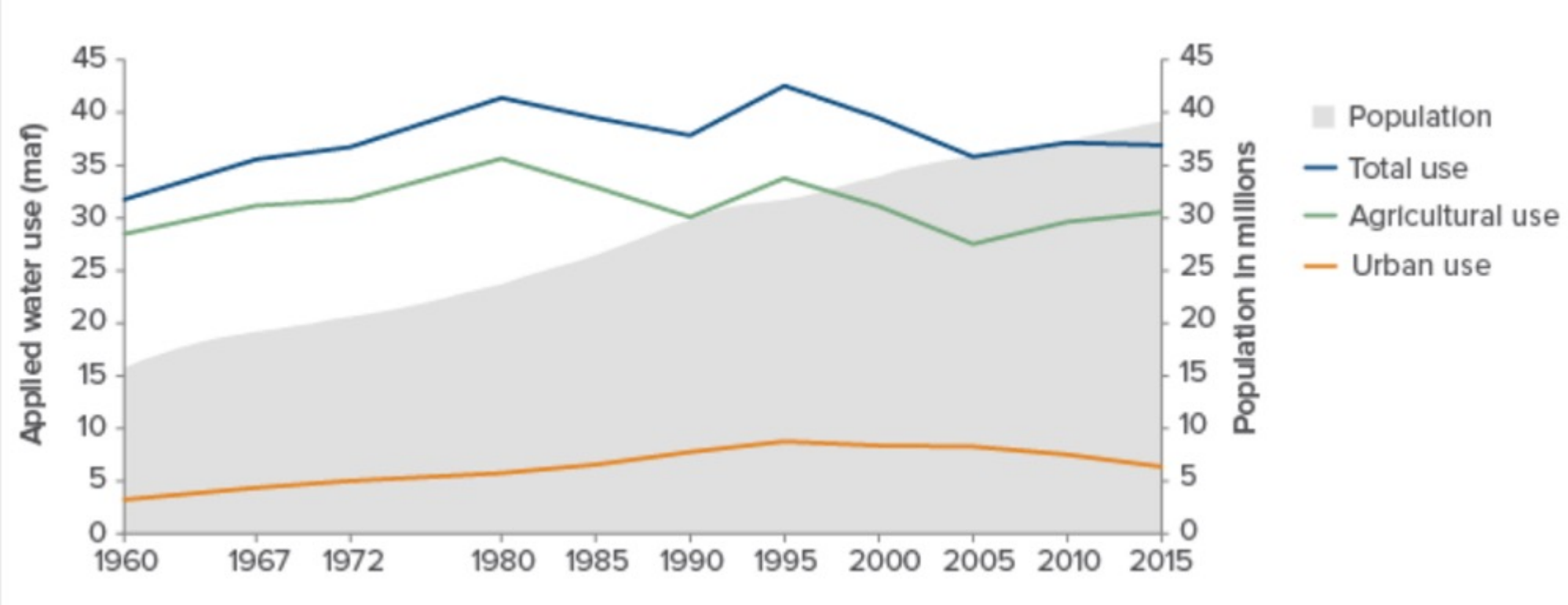


Groundwater conditions



(PPIC, 2019)

Demand Uncertainty



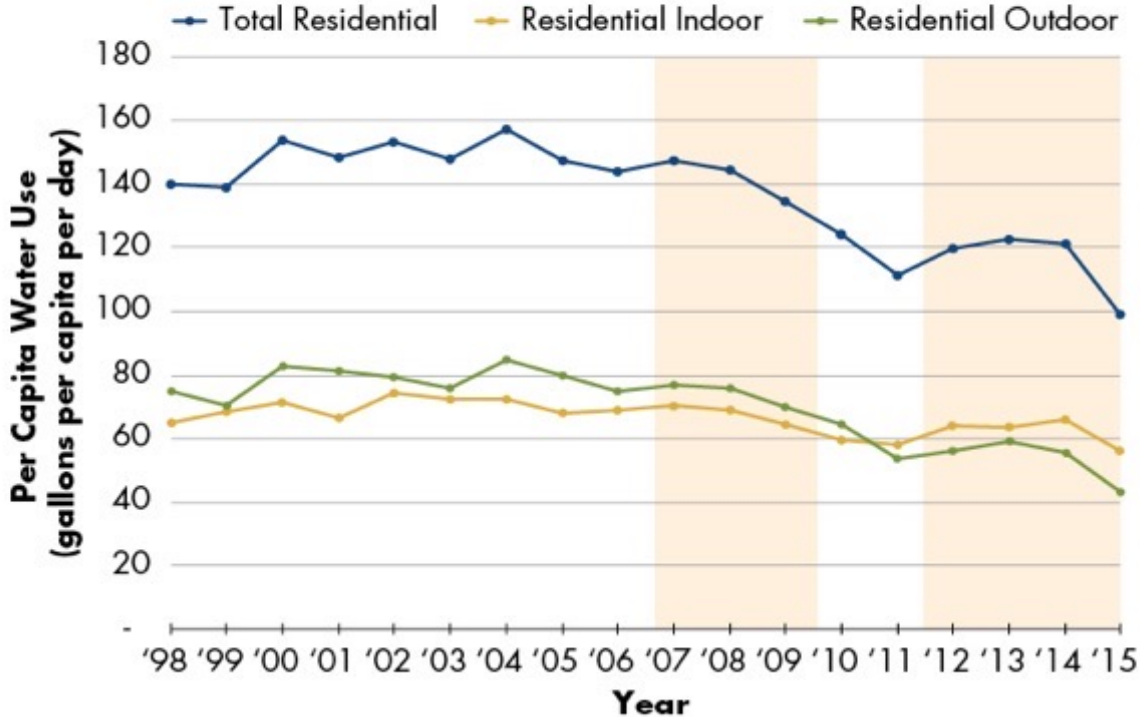
(PPIC, 2019)

Demand Uncertainty

Figure 9. Total, Indoor, and Outdoor Residential Per Capita Water Use in California, 1998 to 2015 🔍

Note: Statewide multi-year droughts are shown in shaded orange areas.

Data source: Water use data from [DWR \(2019\)](#)

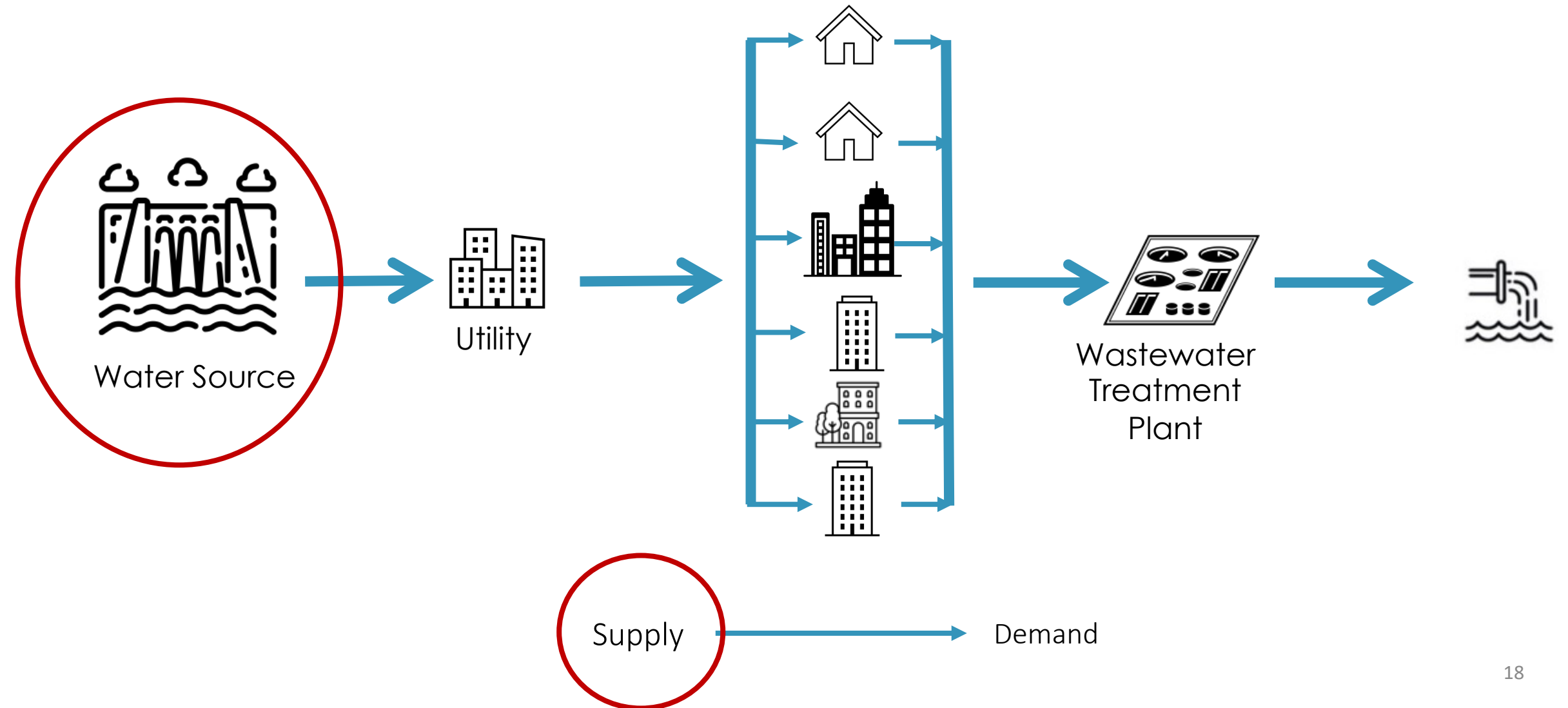


Cooley, Heather. 2020. *Urban and Agricultural Water Use in California, 1960-2015*. Oakland, Calif.: Pacific Institute. <https://pacinst.org/wp-content/uploads/2020/06/PI-Water-Use-Trends-June-2020.pdf>



The 20th century water infrastructure model:

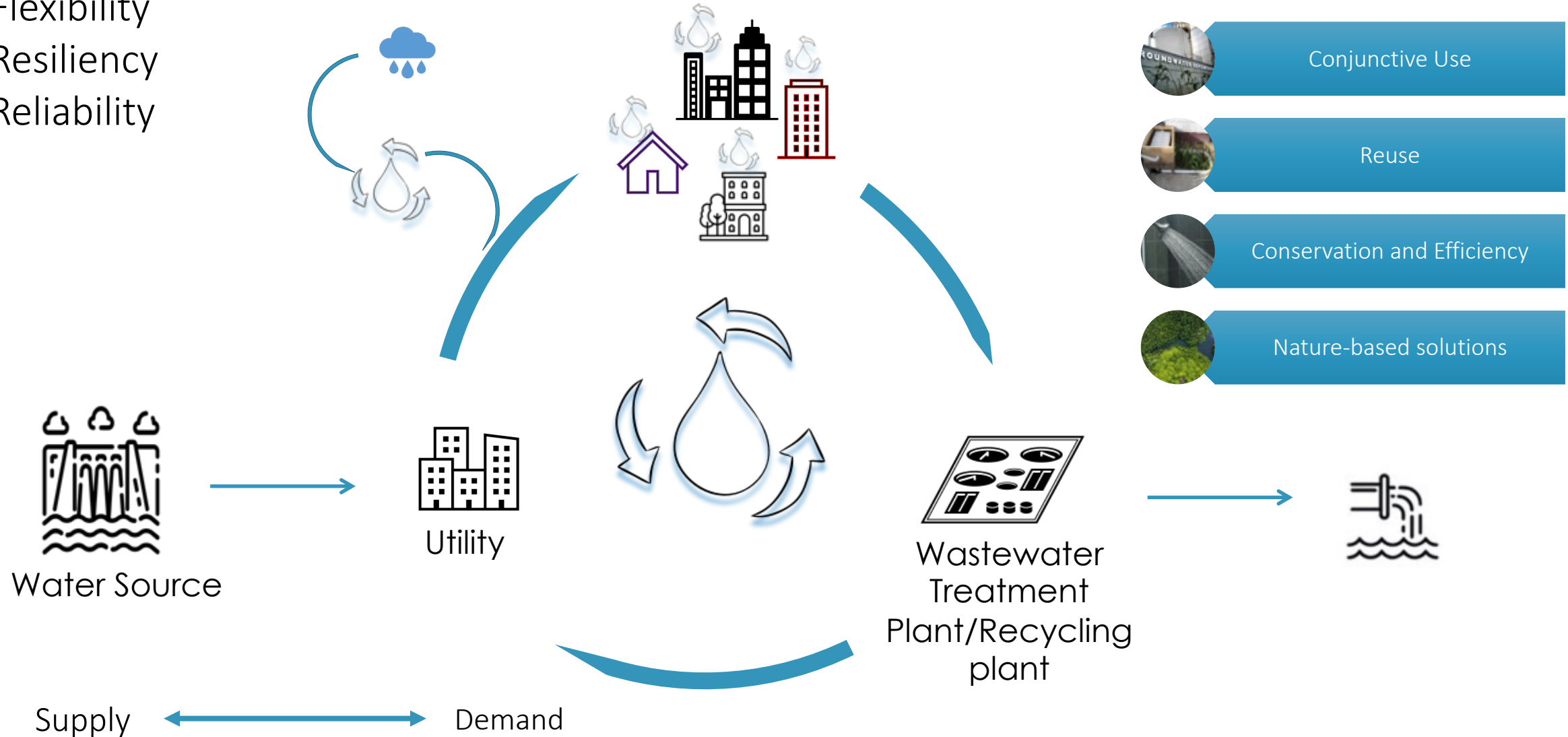
A linear/ once-through system



The 21th century urban water infrastructure model: circular and hybrid

Distributed and decentralized water solutions

- Flexibility
- Resiliency
- Reliability

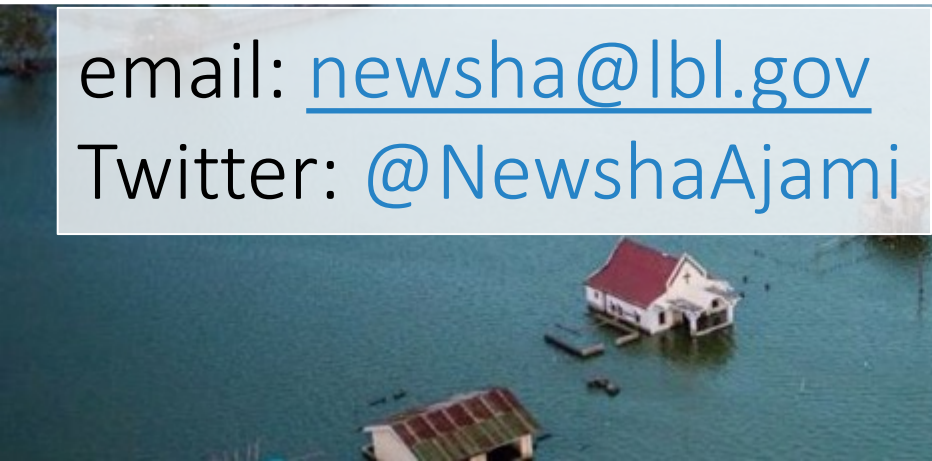


Thank you!



“We can't solve problems by using the same kind of thinking we used when we created them.” Albert Einstein

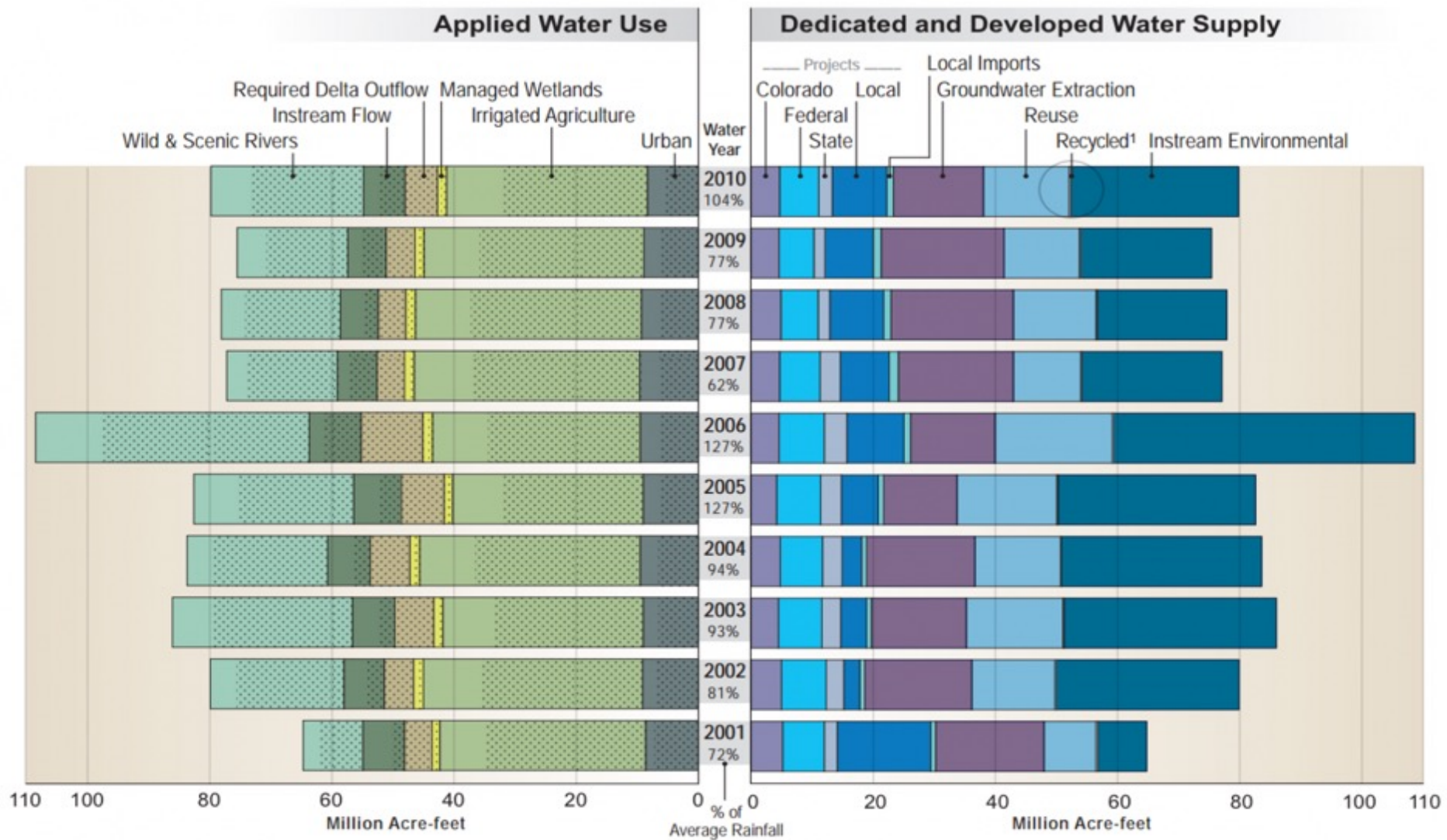
email: newsha@lbl.gov
Twitter: [@NewshaAjami](https://twitter.com/NewshaAjami)



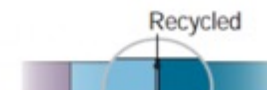
Questions?



California Water Supply and Use Portfolio (2001-2010)



Stippling in bars indicates depleted (irrecoverable) water use (water consumed through evapotranspiration, flowing to salt sinks like saline aquifers, or otherwise not)



¹ Detail of bar graph: For water years 2001-2010, recycled municipal water varied from 0.2 to 0.7 MAF of the