

Butte Subbasin Groundwater Advisory Board

Preliminary Basin Setting Results

April 23, 2020, 1:00– 3:00 p.m.



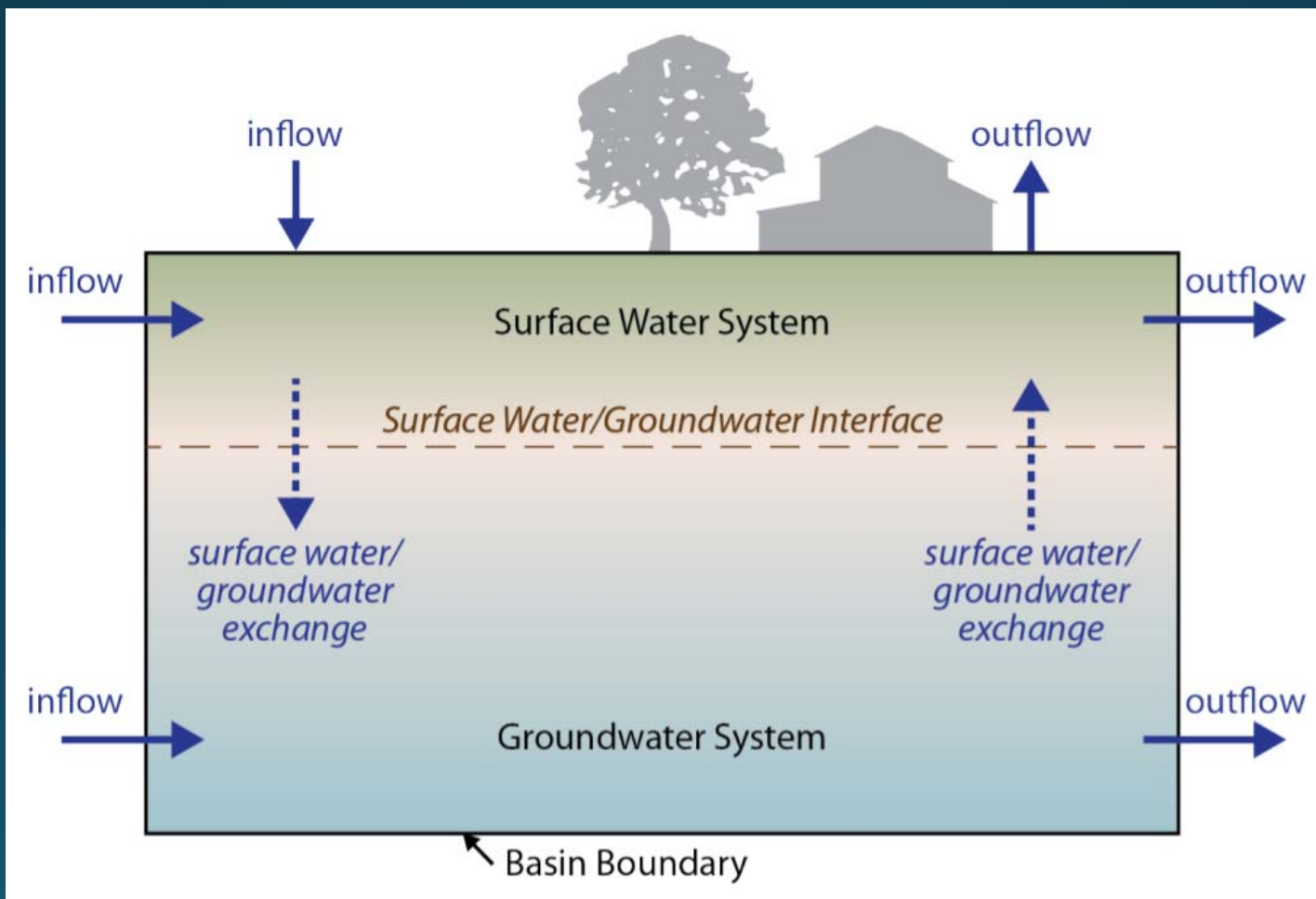


Water Budget Overview

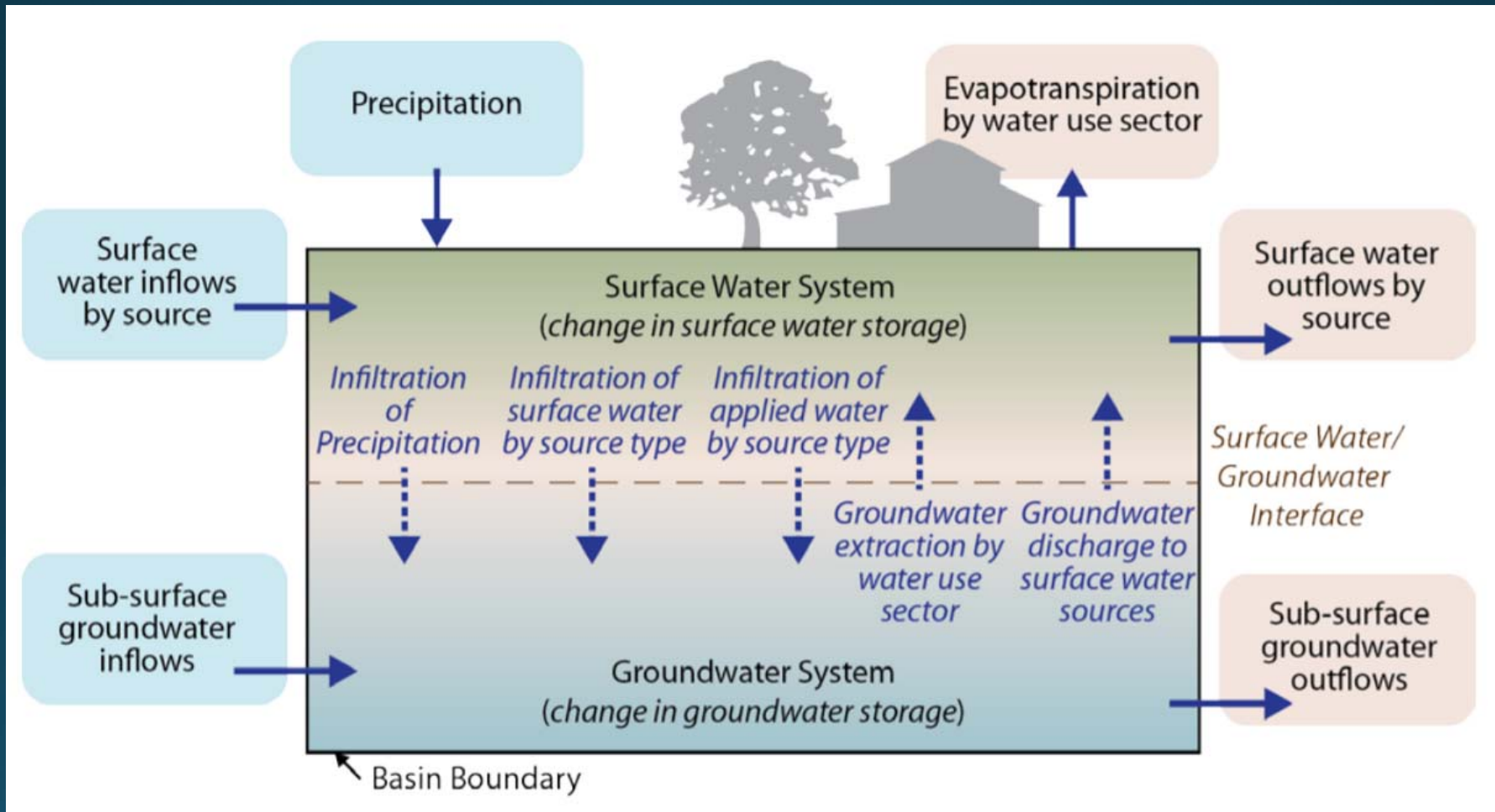
Water Budget Overview

- Complete accounting of inflows, outflows, and change in storage
- Just like a checking account:
 - Deposits – Withdrawals = Balance Change, or
 - Inflows – Outflows = Change in Storage
- Grounded in available data
- Estimated using Butte Basin Groundwater Model
- Focus on water years 2000 – 2015

Basic Water Budget Structure (DWR BMP)

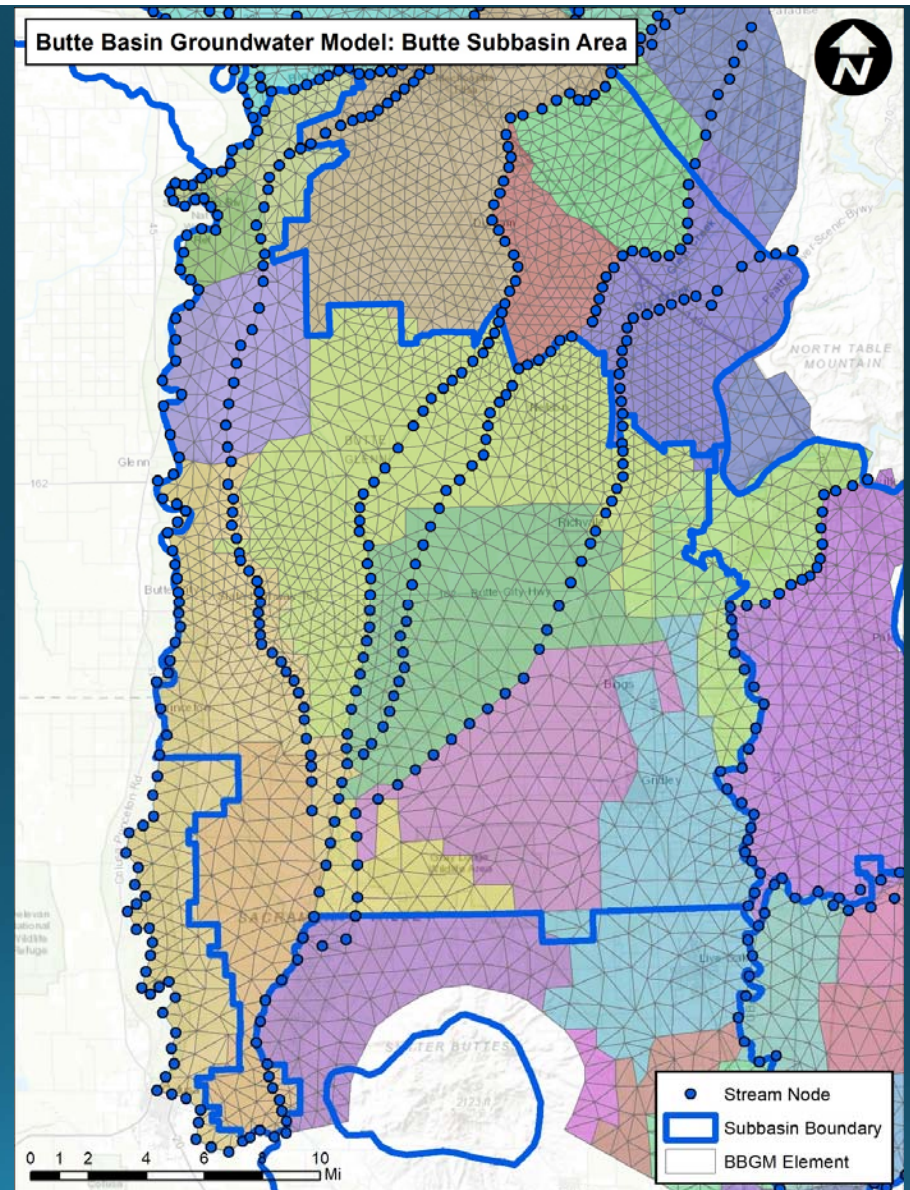


Detailed Water Budget Structure (DWR BMP)



Water Budget Approach

- Butte Basin Groundwater Model
- Daily Calculations
- 2,221 Elements in Butte Subbasin (119 acres, on average)
- Primary Streams:
 - Sacramento River
 - Feather River
 - Butte Creek
 - Cherokee Canal (Dry Creek)
 - Little Dry Creek
 - Angel Slough

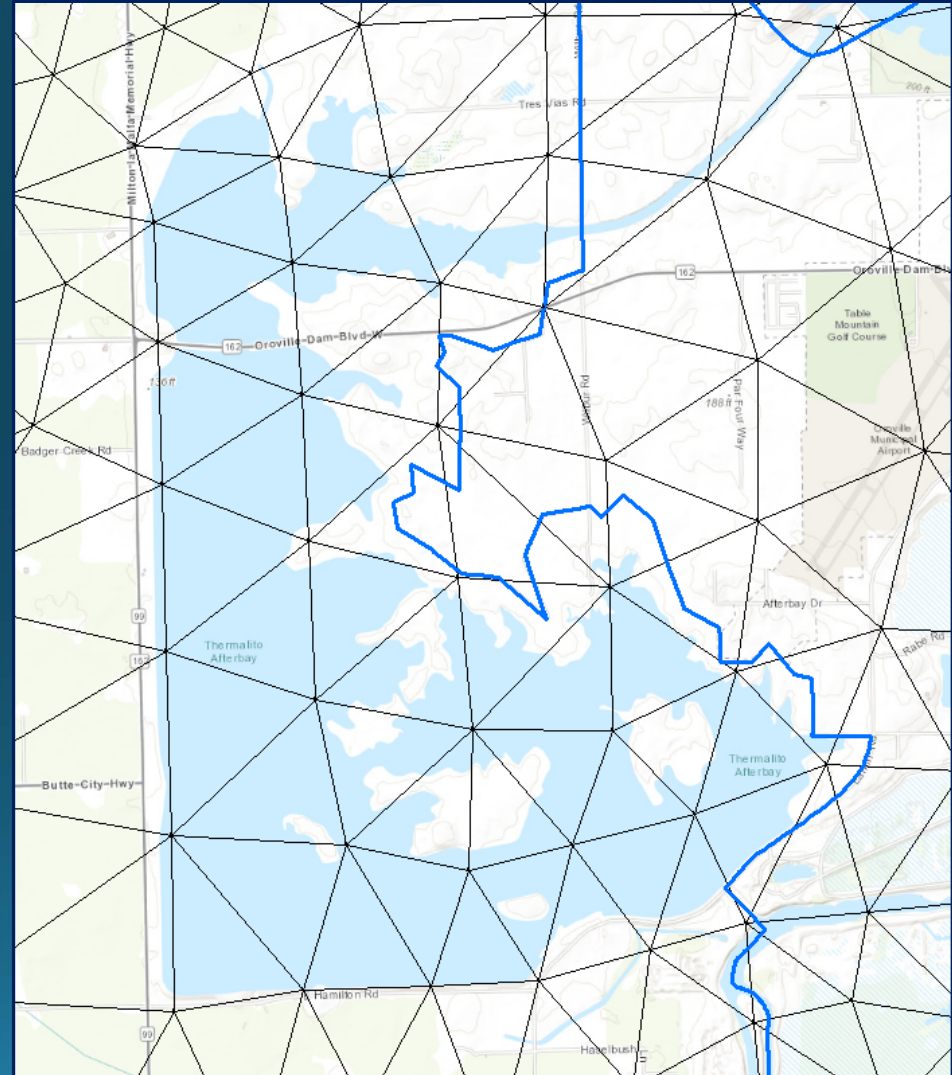


Thermalito Afterbay

- 40 Model Elements (4,780 ac)
- Specified Net Seepage
 - Total Seepage – Afterbay Pumping
 - 30,000 af/yr*
- Estimated Seepage Based on
 - DWR Study (1977)
 - Recent Analysis (DE 2019)

* ~26 TAF/yr in Butte Subbasin, with Remainder in Wyandotte Creek Subbasin

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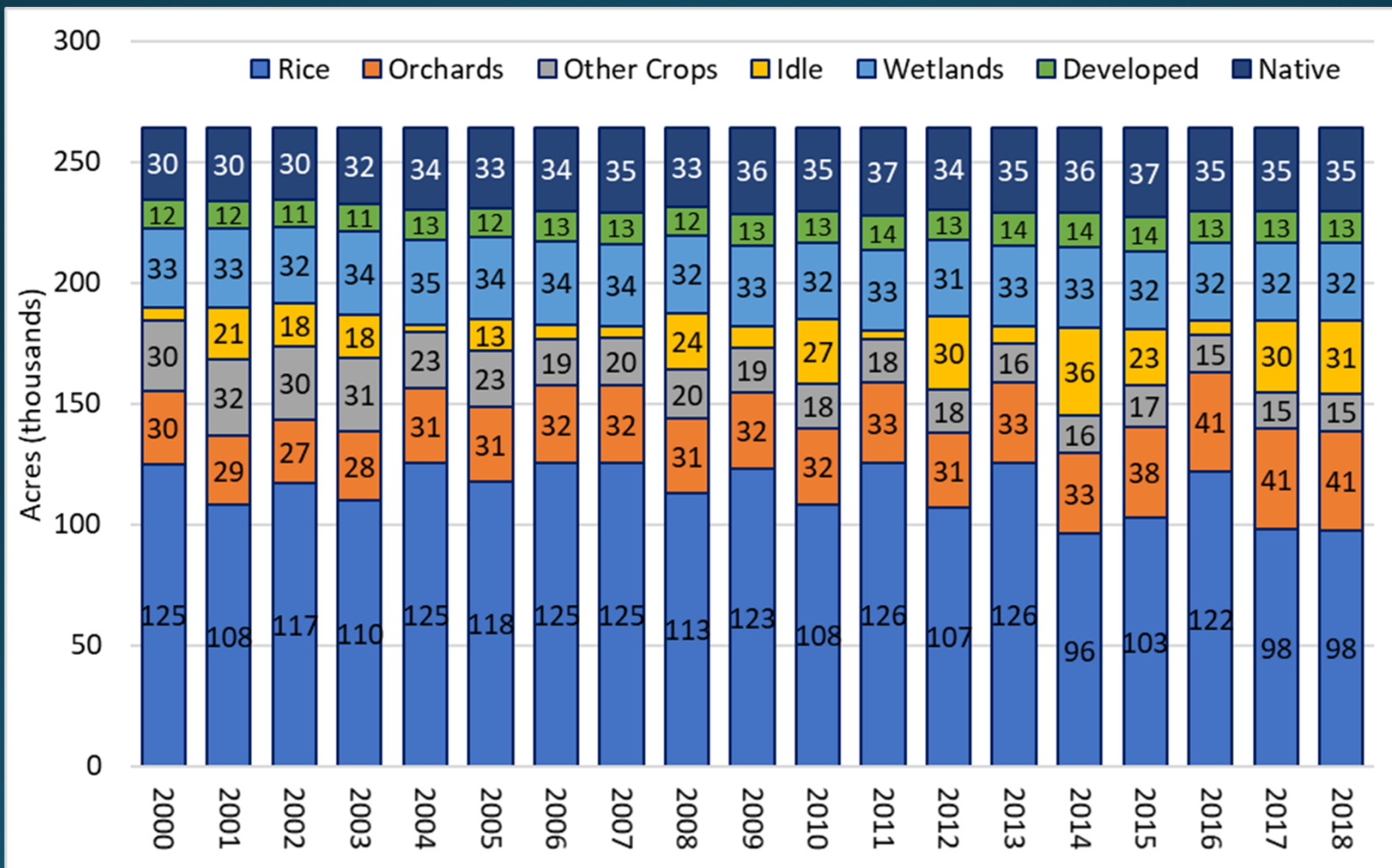
Draft Historical Water Budget

Primary Water Budget Drivers

- Land Use
- Precipitation
- Evapotranspiration
- Surface Water Supplies
- Groundwater Pumping
- Percolation
- Surface Water – Groundwater Interaction
- Interbasin Flows

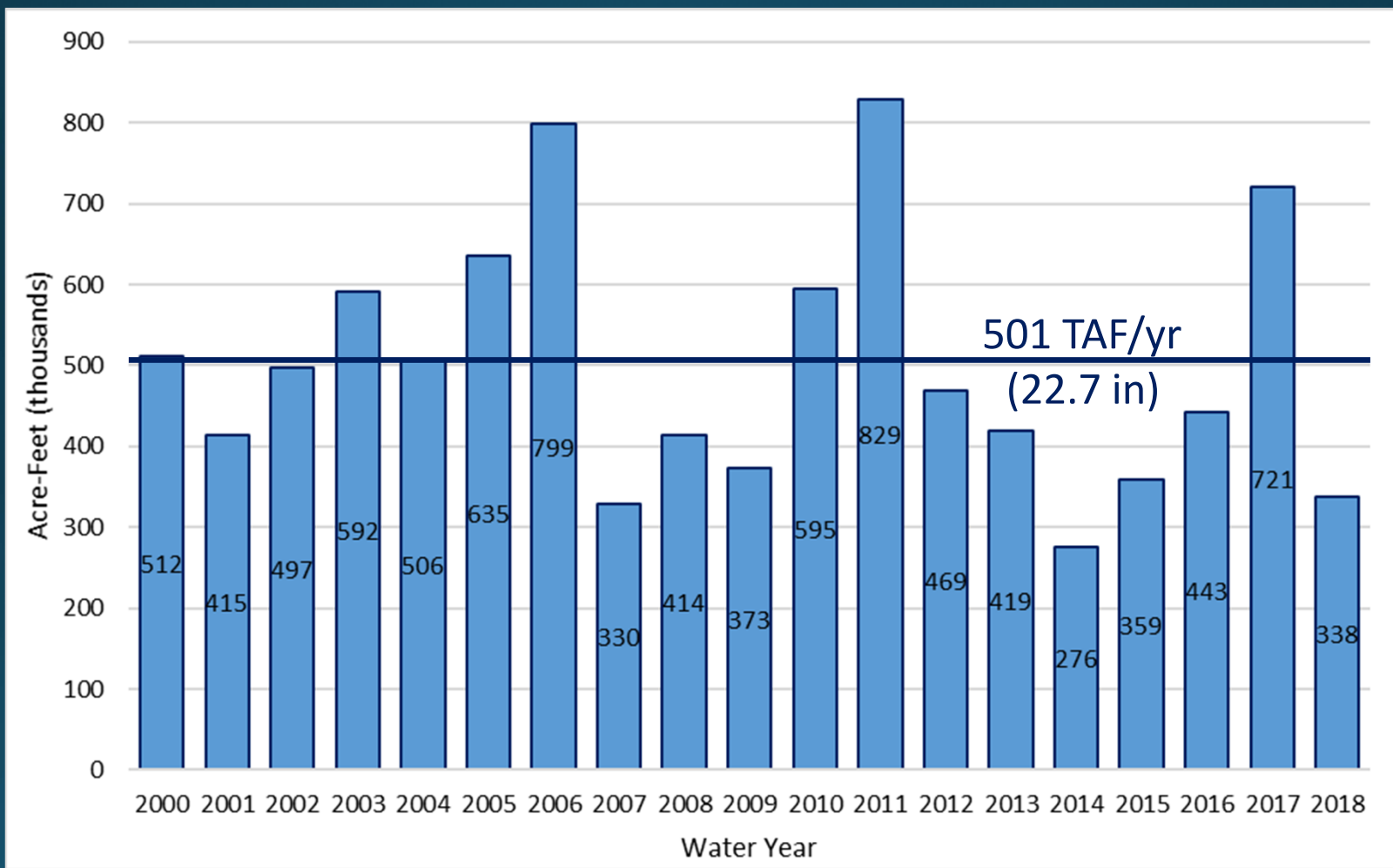
Land Use

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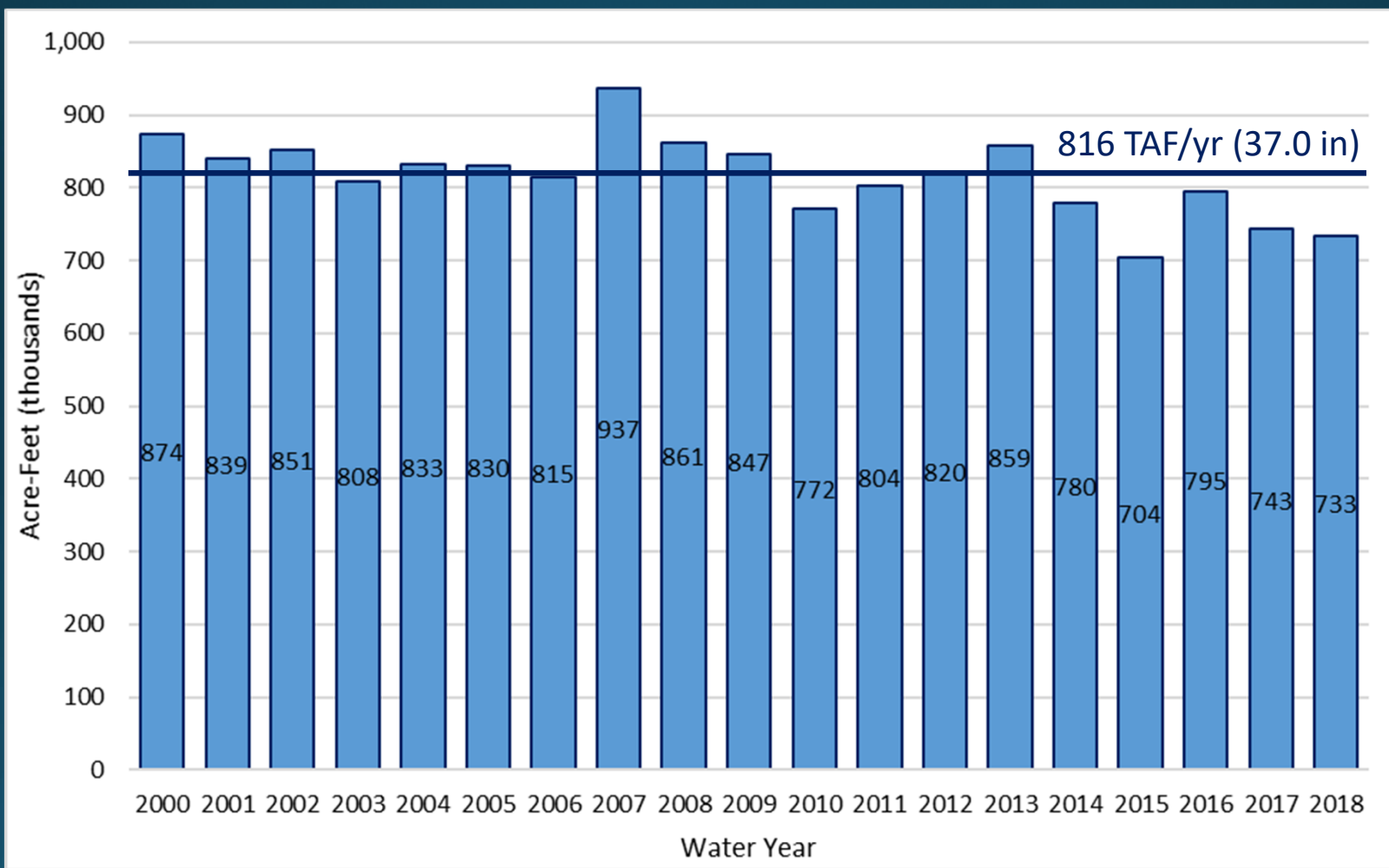
Precipitation

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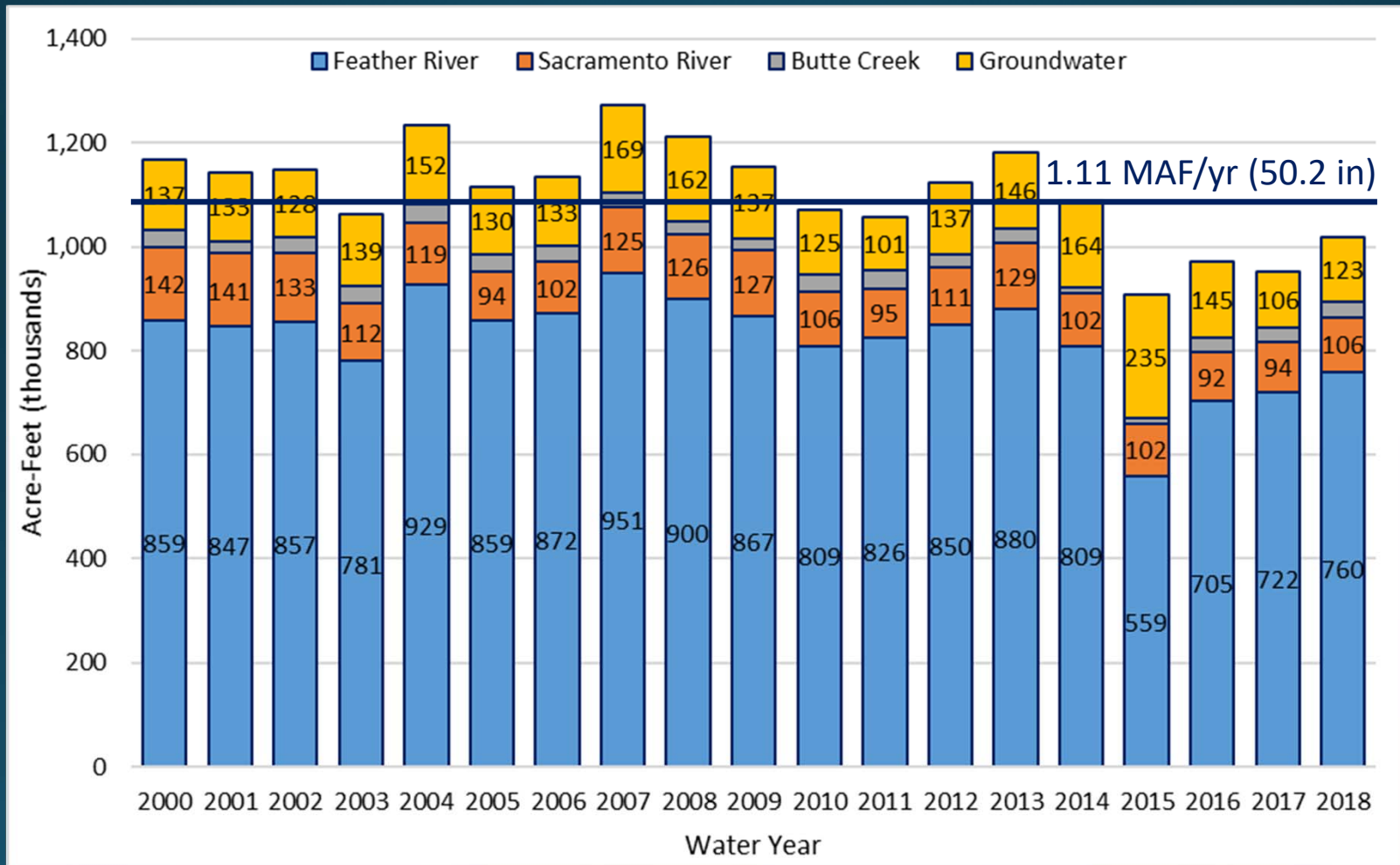
Evapotranspiration

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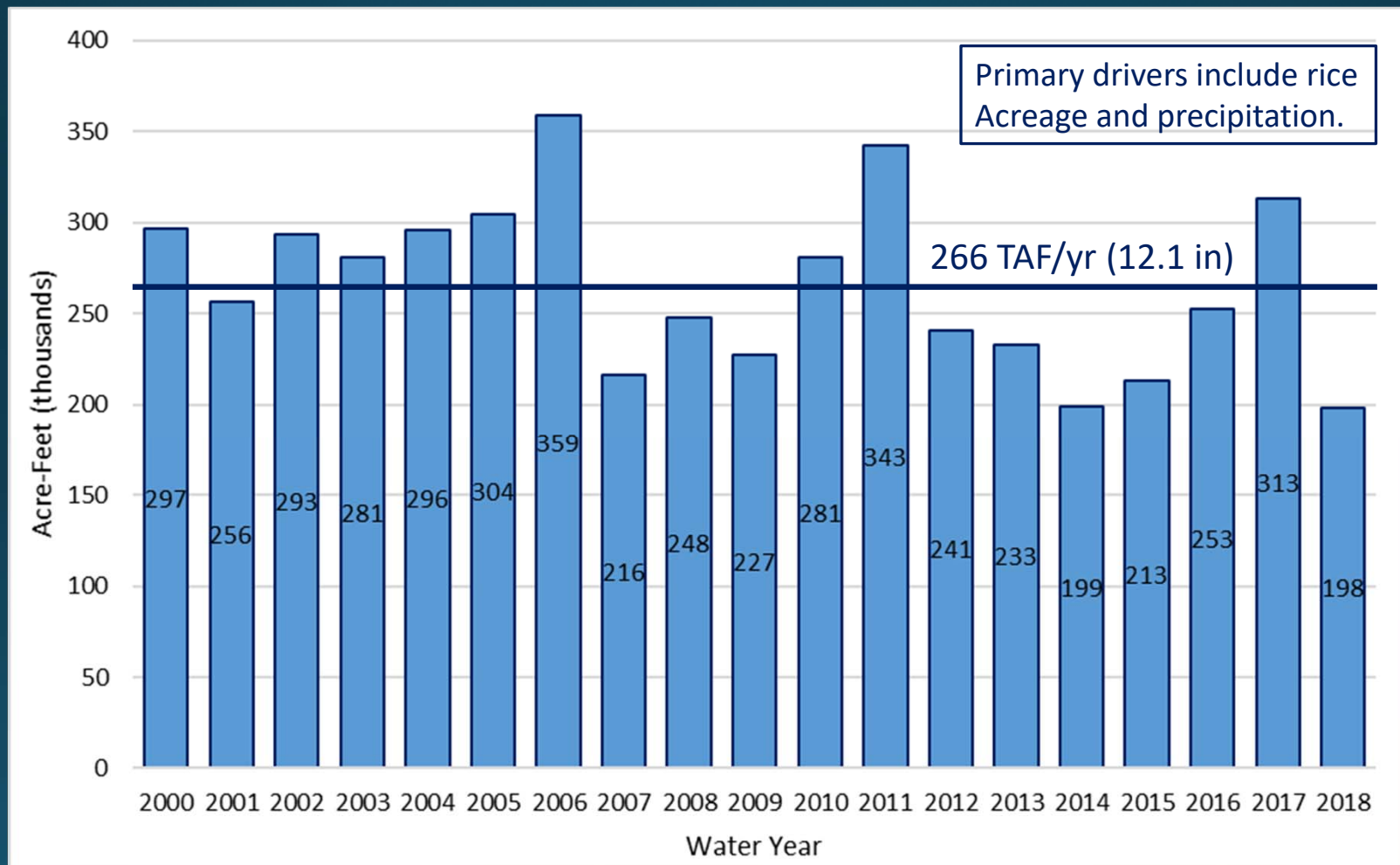
Water Supplies

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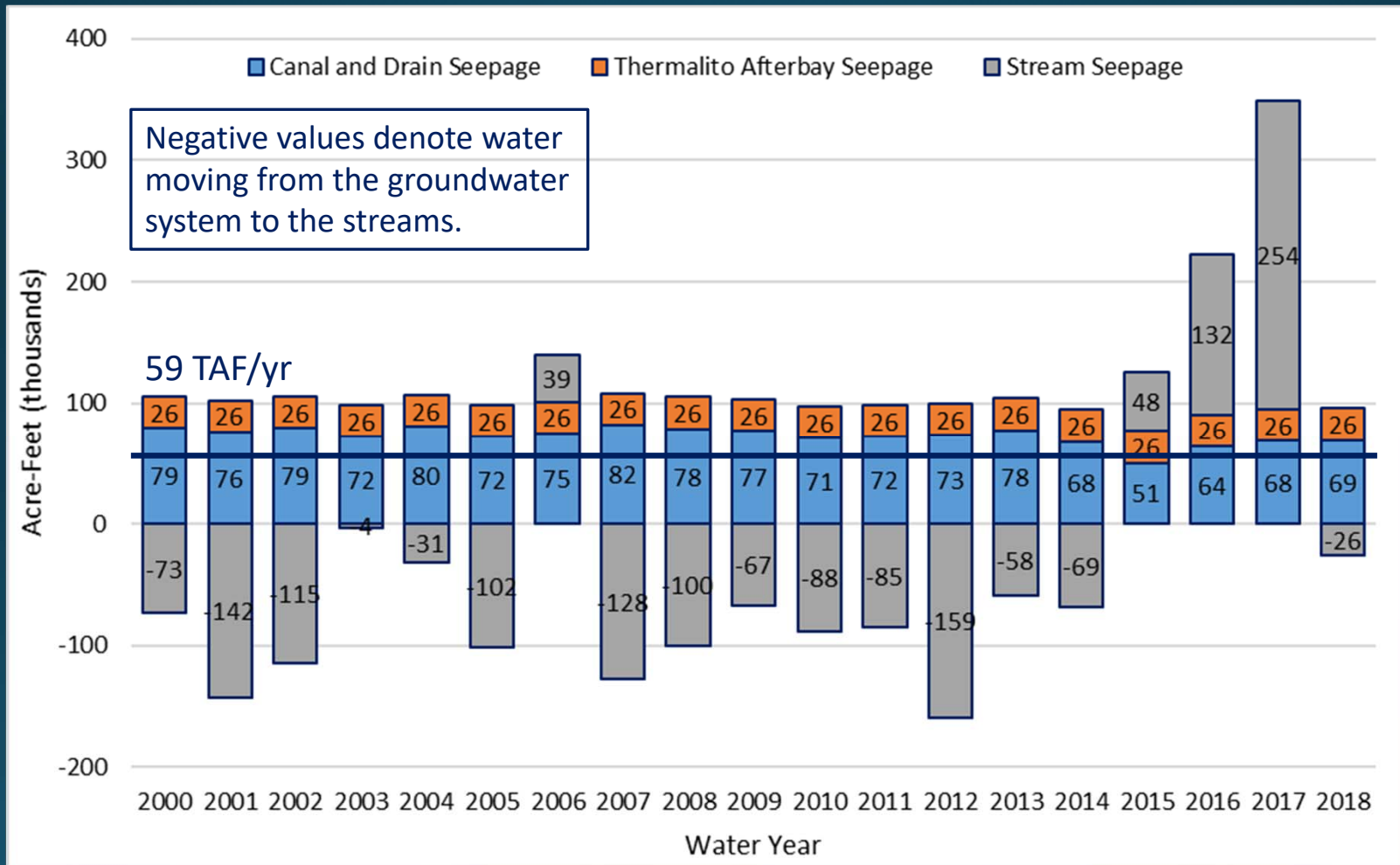
Percolation

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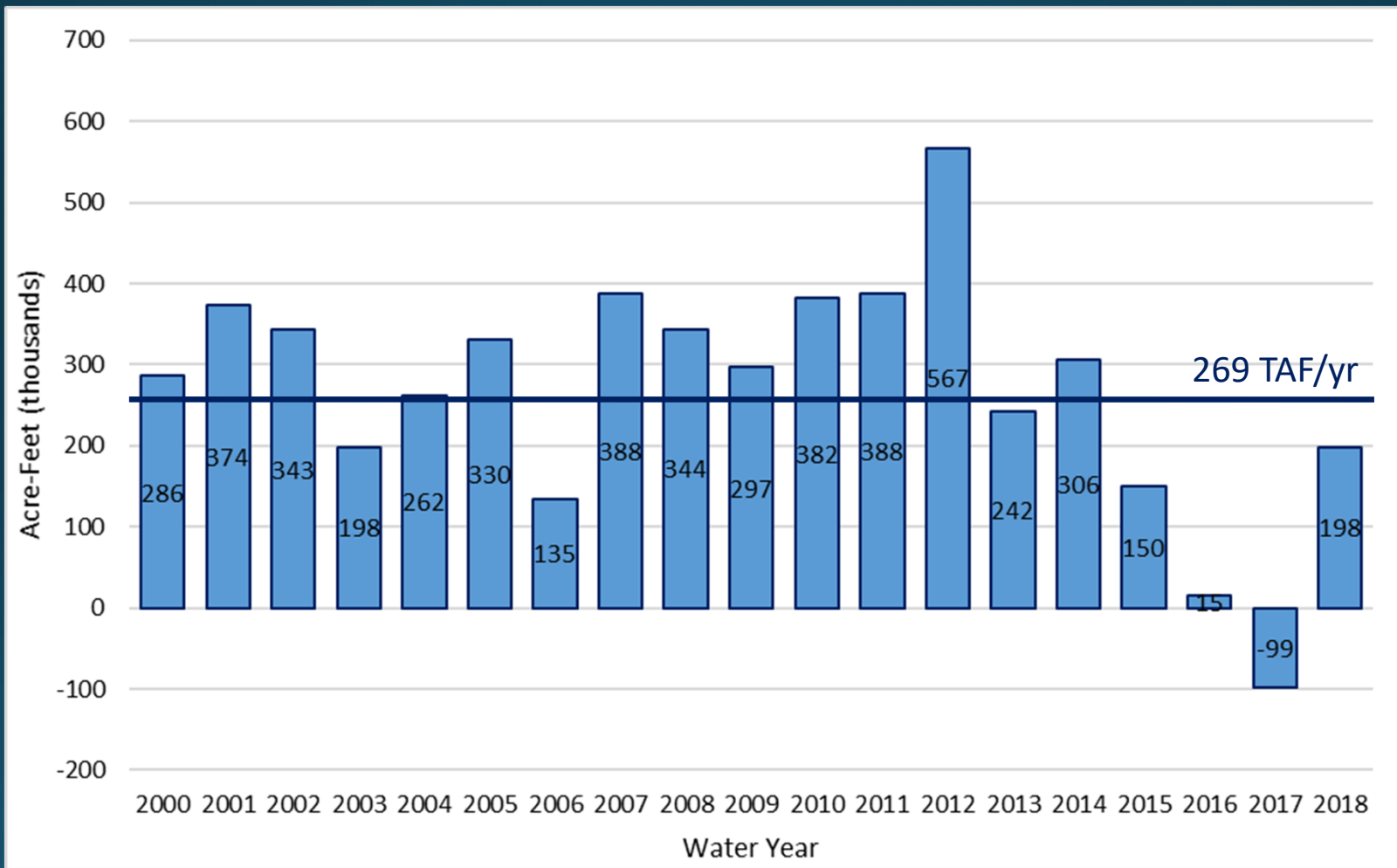
Surface Water – Groundwater Interaction

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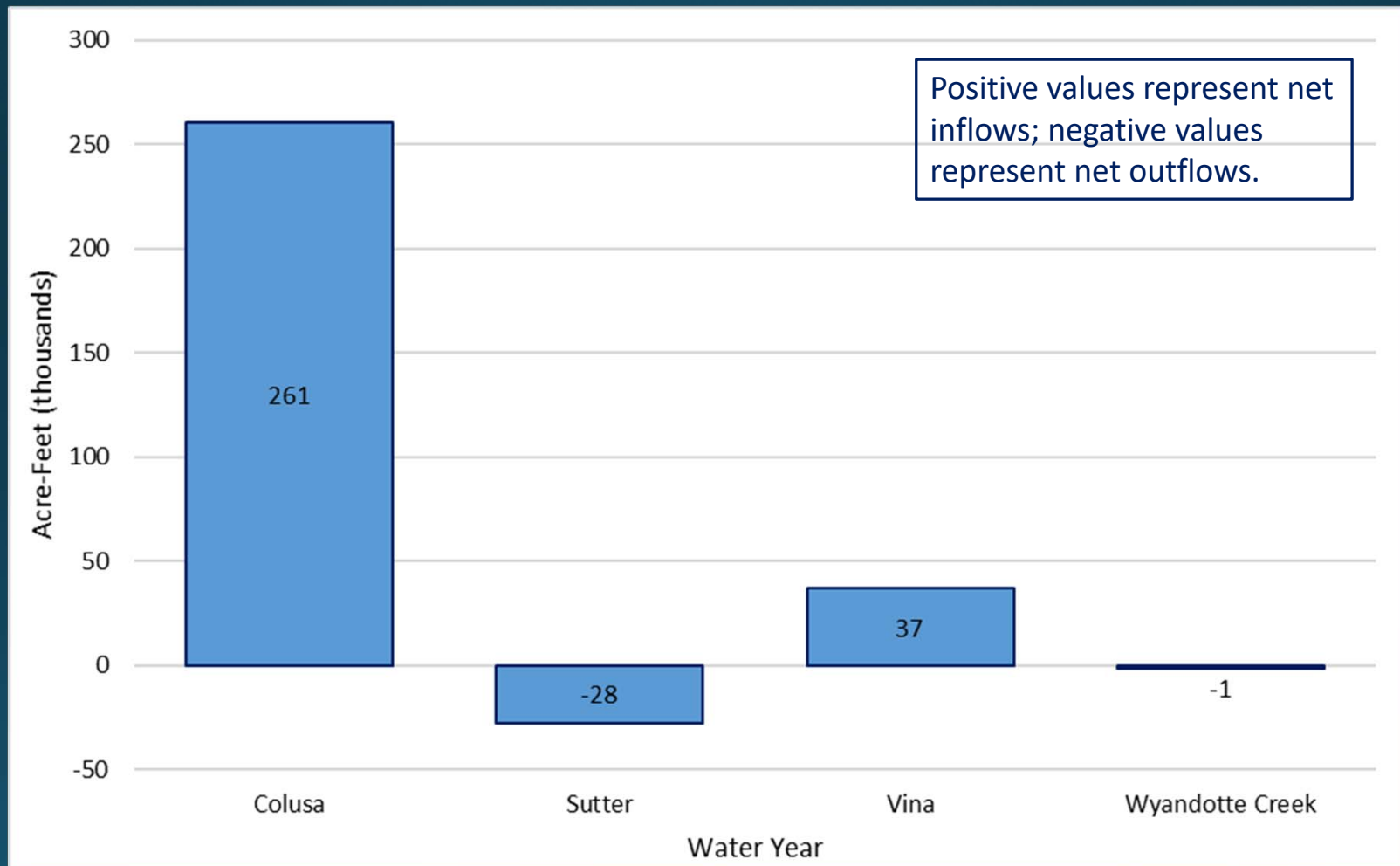
Interbasin Flows

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Interbasin Flows

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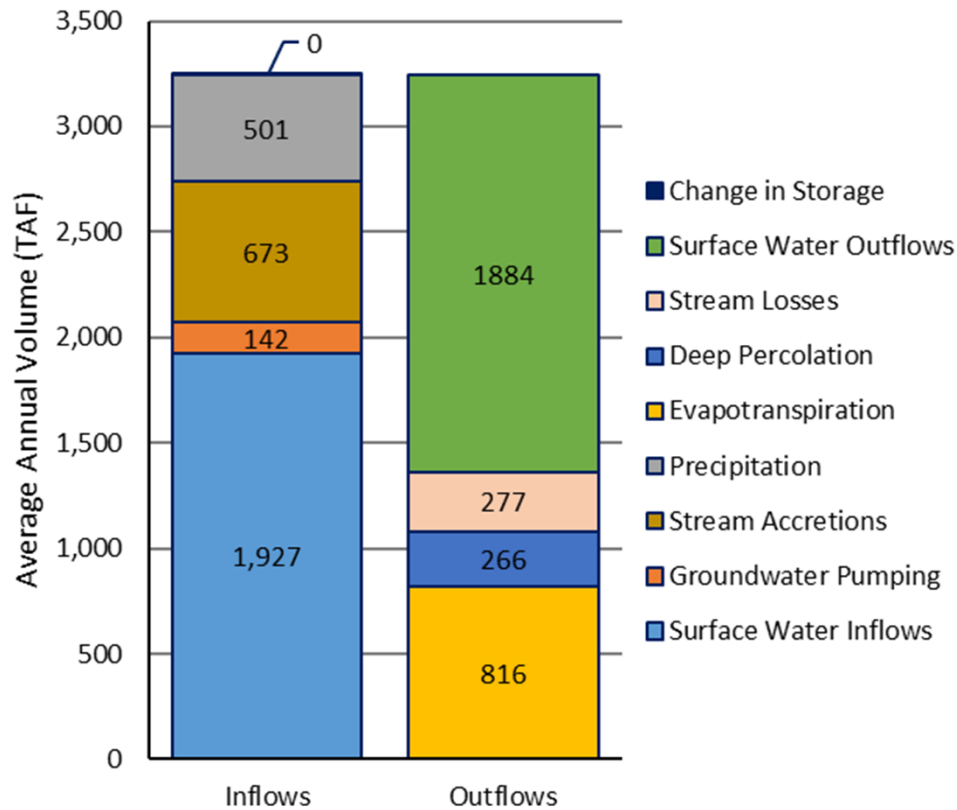


Historical Water Budget Summary

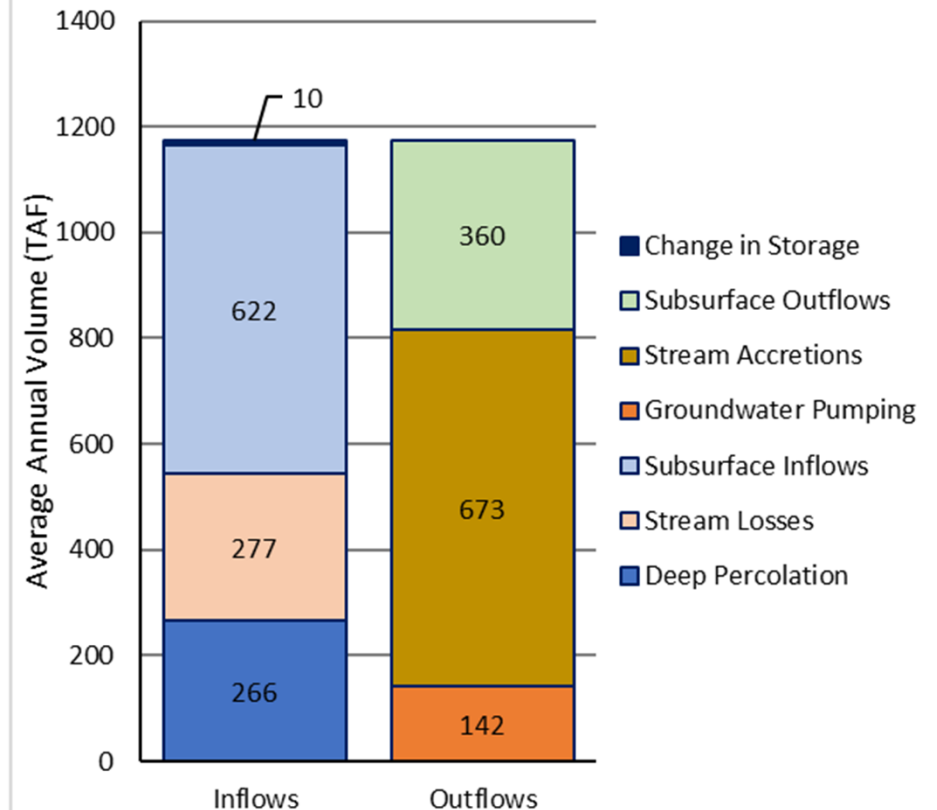
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Land and Surface Water System

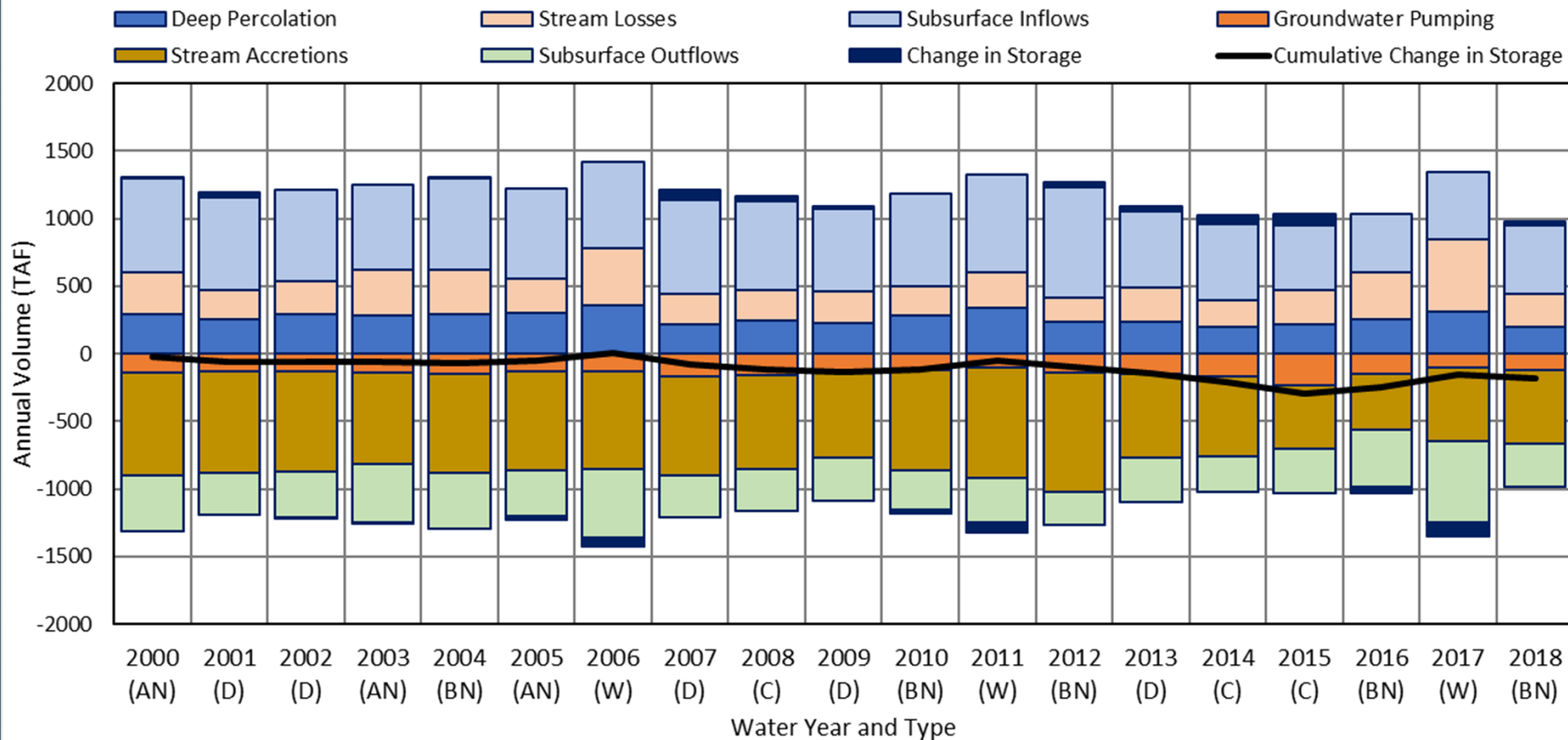


Groundwater System



Historical Water Budget Summary

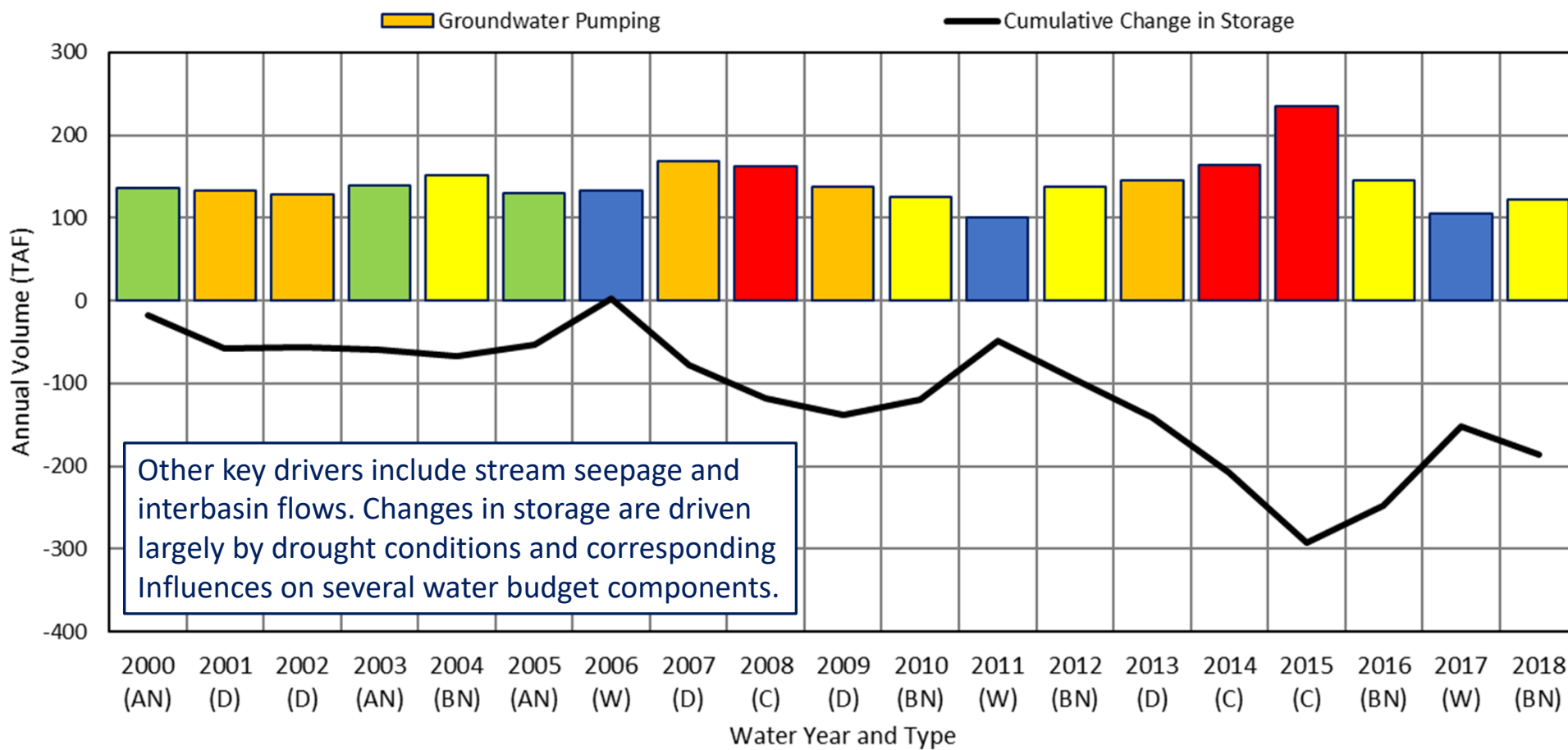
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Year Types: Critical (C), Dry (D), Below Normal (BN), Above Normal (AN), Wet (W)

Historical Water Budget Summary

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Year Types: Critical (C), Dry (D), Below Normal (BN), Above Normal (AN), Wet (W)

Historical Water Budget Takeaways

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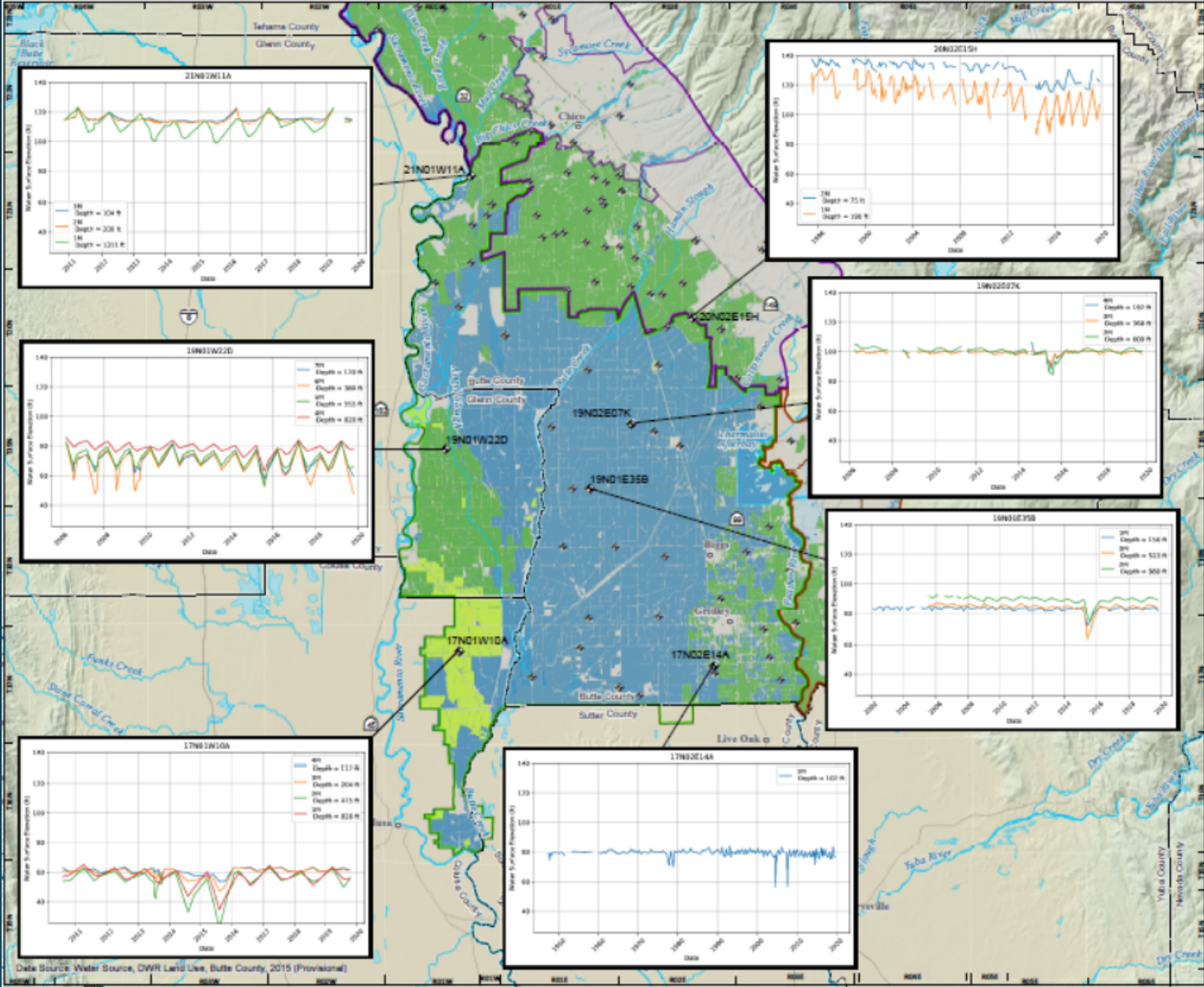


- Land use has changed somewhat over time, but is relatively stable
- Conditions vary from year to year due to hydrology and other factors
- Groundwater is a relatively small component of irrigation water supplies
- Percolation and seepage contribute substantially to the groundwater system, with significant quantities returning to the streams
- Initial estimates suggest substantial inflows from the Colusa Subbasin, but need to be explored further
- Reductions in groundwater storage over the historical period are relatively small

Groundwater Conditions

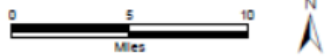
Groundwater Conditions

- Dynamic (time-dependent) aspects of groundwater hydrology
 - Groundwater Elevations
 - Groundwater Storage
 - ~~Seawater Intrusion~~
 - Groundwater Quality
 - Land Subsidence
 - Interconnected Surface Water and Depletions
 - Groundwater Dependent Ecosystems (GDEs)
- Must include description as of January 1, 2015



HYDROGRAPHS

- ◆ Well with hydrograph
- ◆ Other Active DWR Well
- Subbasins**
- Butte Subbasin
- Vina Subbasin
- Wyandotte Creek Subbasin
- Water Source**
- Surface Water
- Mixed Surface Water and Groundwater
- Groundwater
- Reclaimed
- Not Irrigated / Data not collected
- All Other Features**
- Highway
- Waterway
- Lake



BUTTE SUBBASIN GSP

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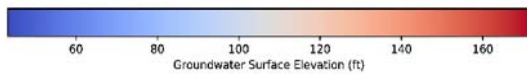
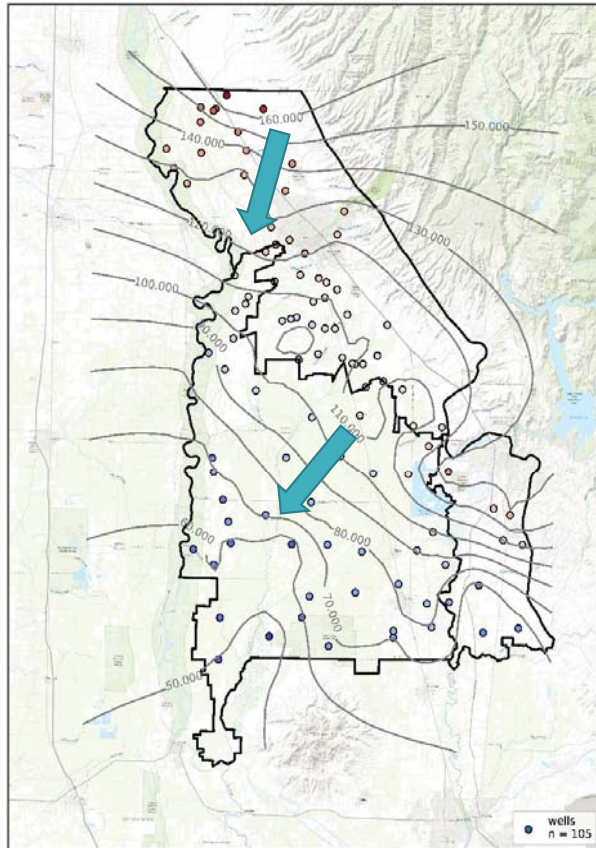
Date Source: Water Source, DWR Land Use, Butte County, 2015 (Provisional)

Contoured Groundwater Surface 2019 (Upper Aquifer)

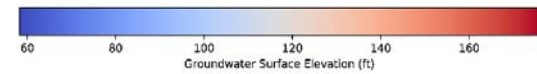
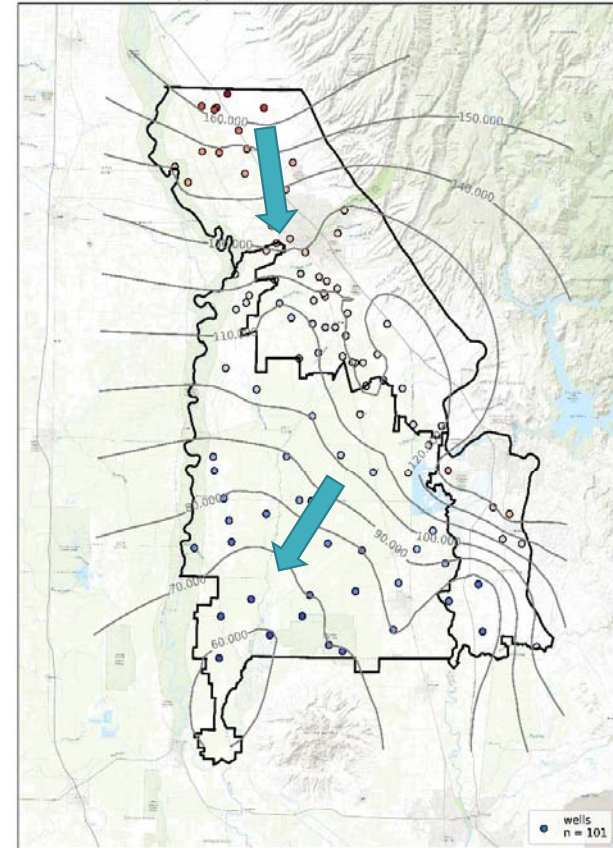
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Fall 2019 Contoured Groundwater Surface



Spring 2019 Contoured Groundwater Surface

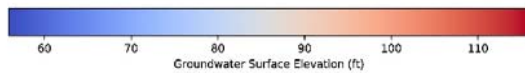
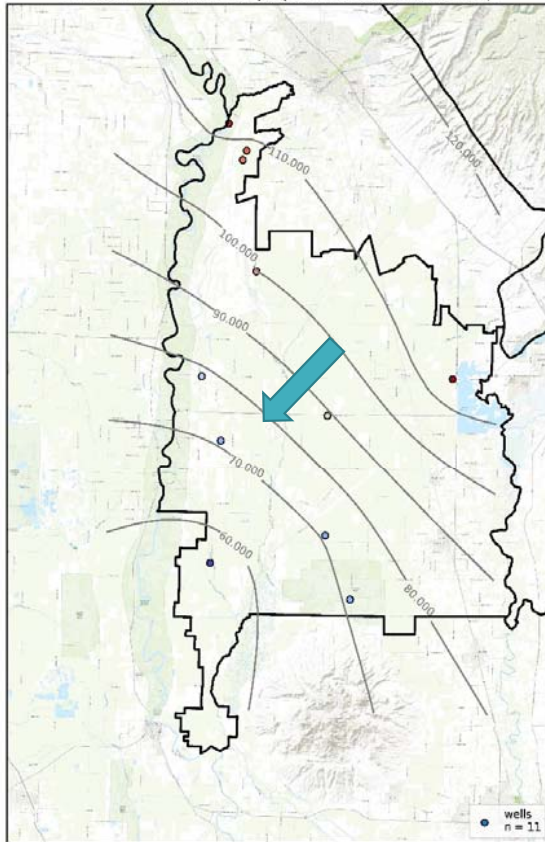


Contoured Groundwater Surface 2019 (Deep Aquifer)

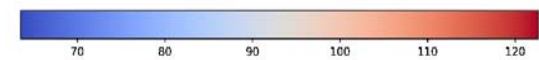
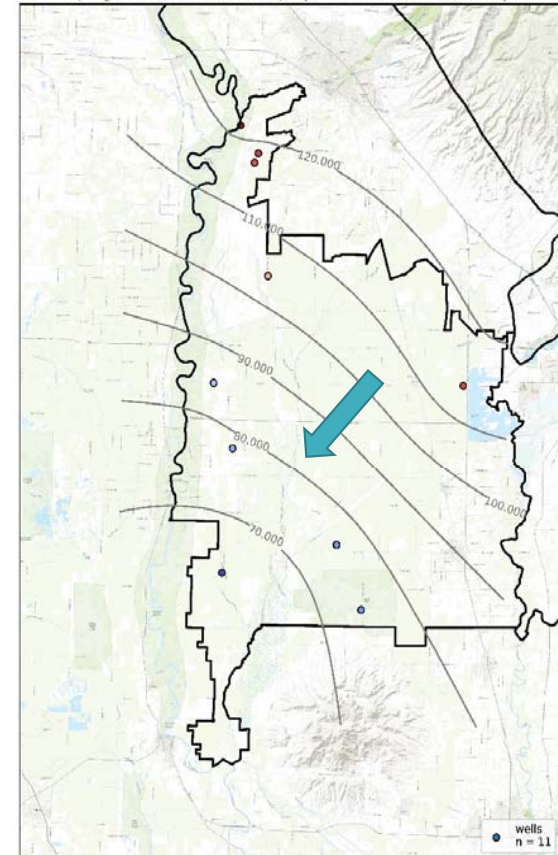
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Fall 2019 Butte Subbasin Deep Aquifer Groundwater Contour Map



Spring 2019 Butte Subbasin Deep Aquifer Groundwater Contour Map



Current and Projected Water Budget Scenarios

Current and Projected Water Budget Assumptions

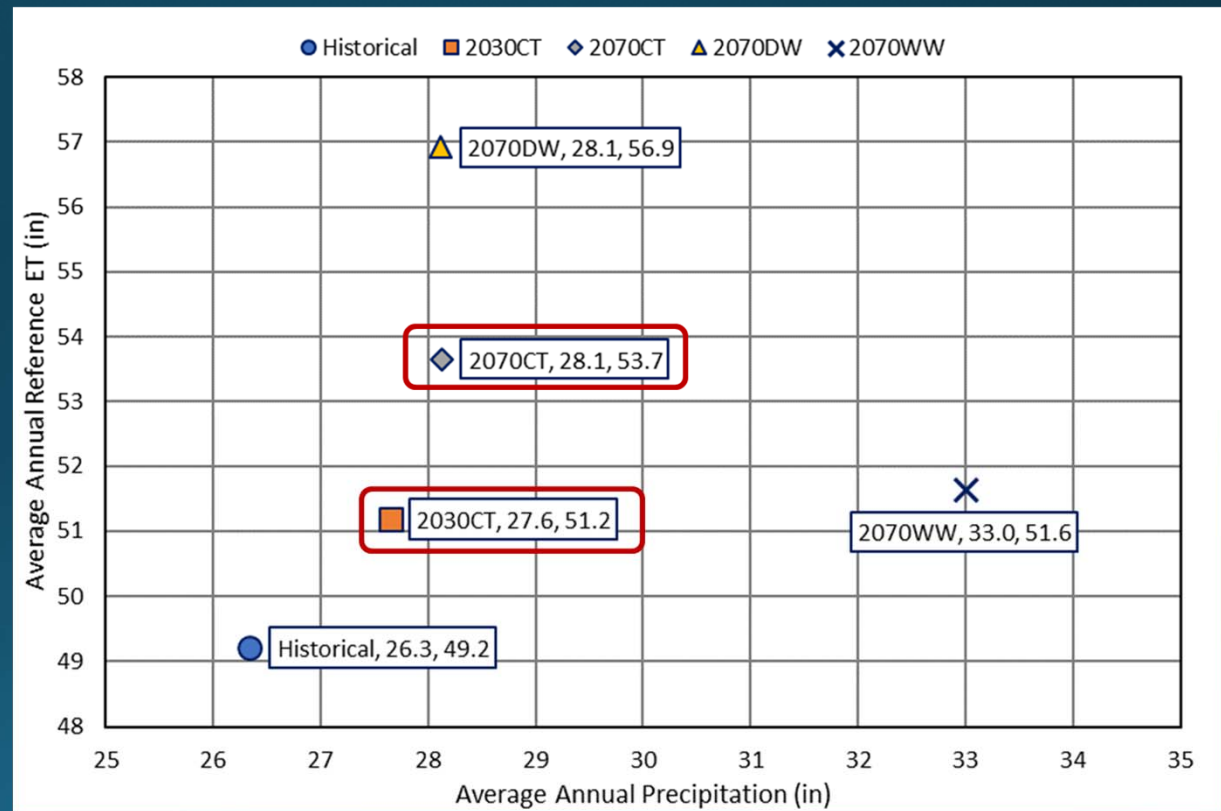
- Current Conditions
 - 1971 – 2018 hydrology (precipitation, ET, streamflows)
 - 2015 and 2016 land use and diversions, mapped to historical hydrology for curtailment/non-curtailment years
- Future Conditions
 - Builds on current conditions scenario
 - Three additional scenarios
 - Future development without climate change
 - 2030 and 2070 DWR central tendency climate change scenarios

Climate Change Assumptions

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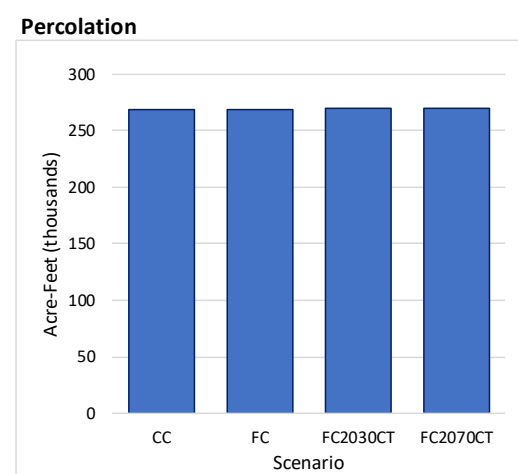
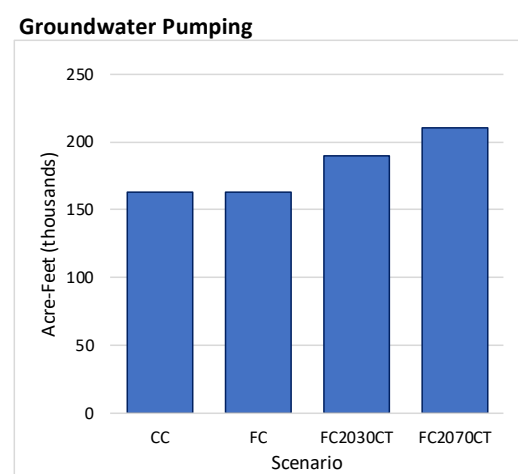
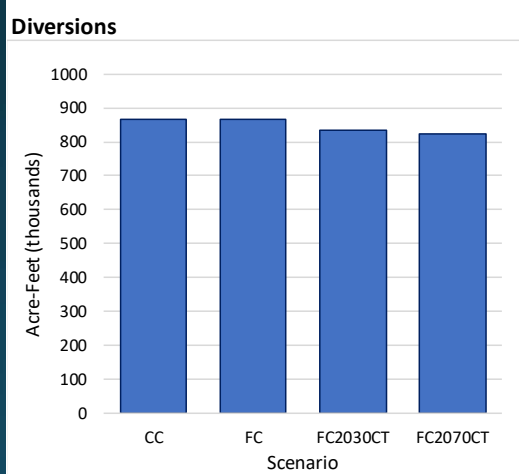
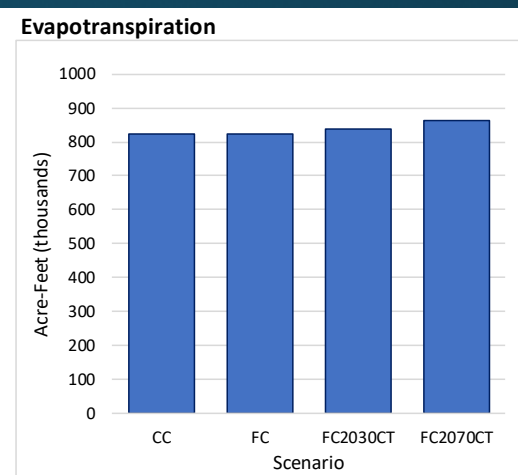
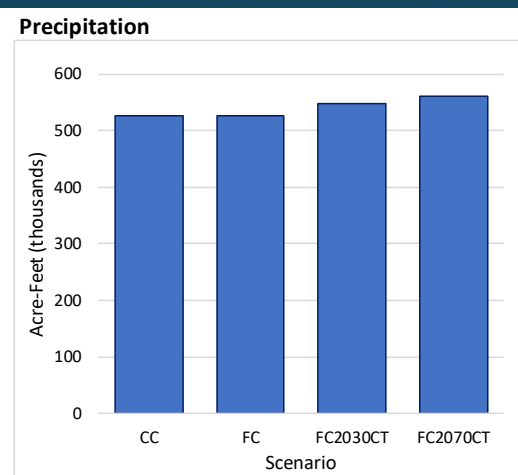
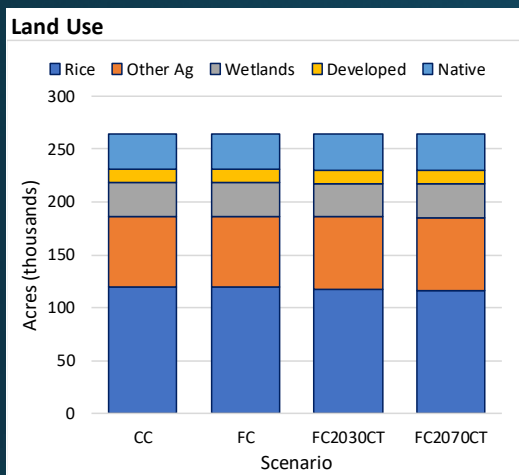


- Provided by DWR
- Modest Increase in Total Precipitation
- Increase in Evapotranspiration (ET)
- Shift of Precipitation to Winter Months
- Increased Frequency of Curtailment
 - Current conditions – 4 years
 - 2030 Scenario – 11 years
 - 2070 Scenario – 13 years



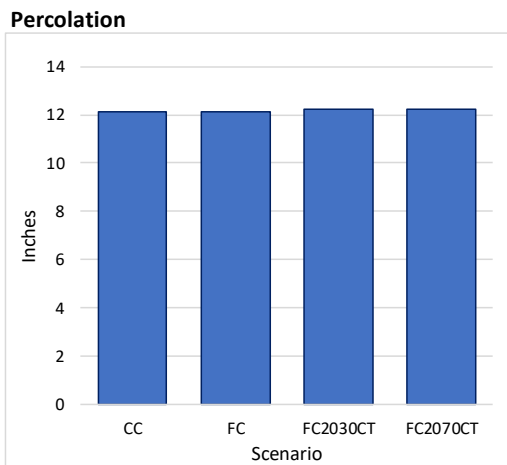
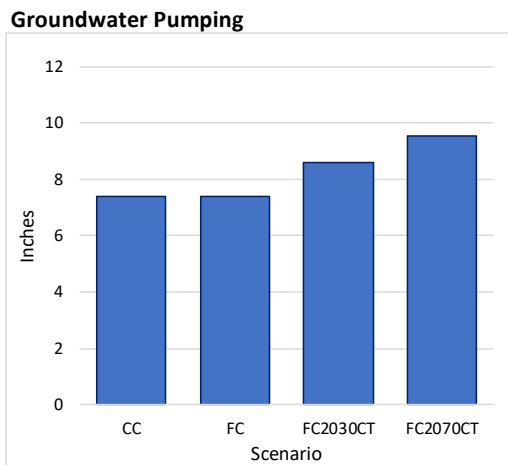
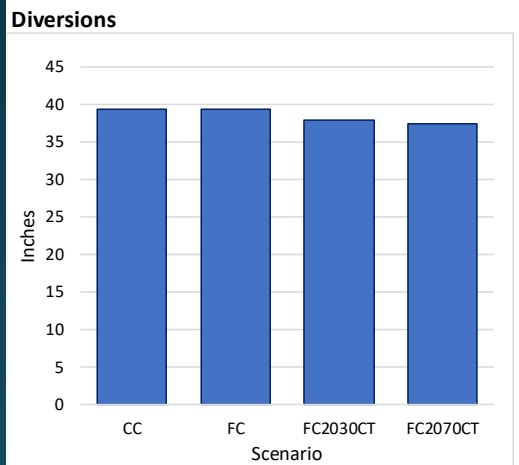
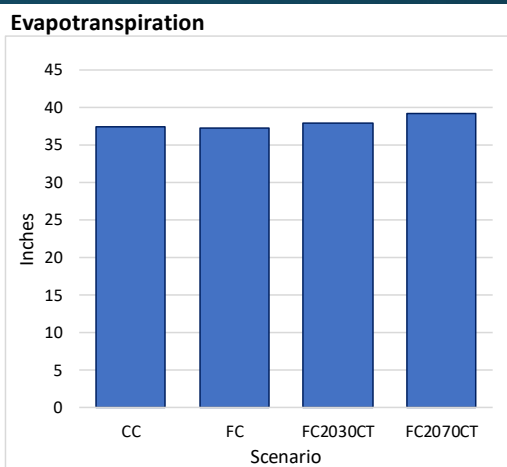
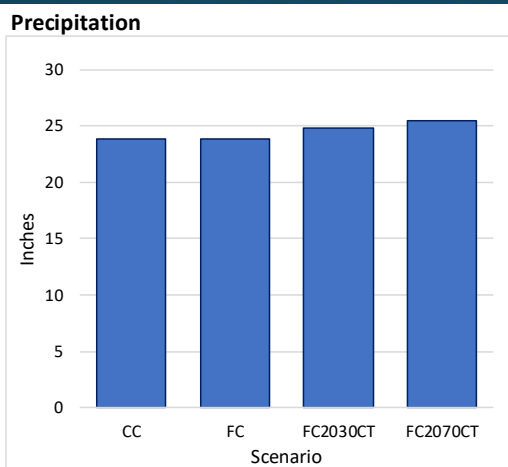
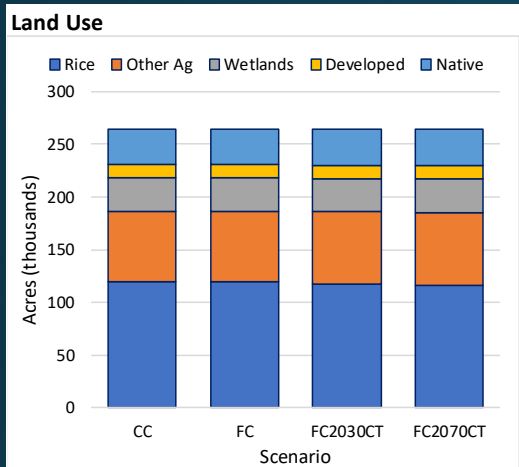
Changes in Water Budget Components (Acre-Feet)

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Scenarios: Current Conditions (CC), Future Conditions, no Climate Change (FC), Future Conditions, 2030 Climate Change (FC2030), Future Conditions, 2070 Climate Change (FC2070)

Changes in Water Budget Components (Inches) DRAFT



Scenarios: Current Conditions (CC), Future Conditions, no Climate Change (FC), Future Conditions, 2030 Climate Change (FC2030), Future Conditions, 2070 Climate Change (FC2070)

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Water Budget Summary

Land and Surface Water System

Water Budget Scenario	Inflows (TAF/yr)				Outflows (TAF/yr)				Change in Storage (TAF/yr)
	Surface Water In	Groundwater Pumping	Stream Accretions	Precipitation	Evapotranspiration	Deep Percolation	Stream Losses	Surface Water Out	
Historical	1,927	142	673	501	816	266	277	1884	0
Current	1,927	163	422	526	823	268	355	1592	0
Future, No Climate Change	1,931	163	420	526	822	268	356	1594	0
Future, 2030 Climate Change	1,914	189	403	547	837	270	361	1586	0
Future, 2070 Climate Change	1,922	211	389	561	863	270	363	1588	0

Groundwater System

Water Budget Scenario	Inflows (TAF/yr)			Outflows (TAF/yr)			Change in Storage (TAF/yr)
	Deep Percolation	Stream Losses	Subsurface In	Groundwater Pumping	Stream Accretions	Subsurface Out	
Historical	266	277	622	142	673	360	-10
Current	268	355	431	163	422	464	5
Future, No Climate Change	268	356	425	163	420	463	4
Future, 2030 Climate Change	270	361	426	189	403	460	4
Future, 2070 Climate Change	270	363	426	211	389	456	3

Projected Water Budget Takeaways

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- Land use anticipated to remain similar to recent historical
- Conditions vary from year to year due to hydrology and other factors
- Increased reliance on groundwater, primarily due to climate change and impacts to surface water supplies
- Local recharge from percolation and seepage exceeds anticipated groundwater demands
- Assumptions related to interbasin flows need further evaluation
- Overall, projected increase in groundwater storage

Additional Discussion