



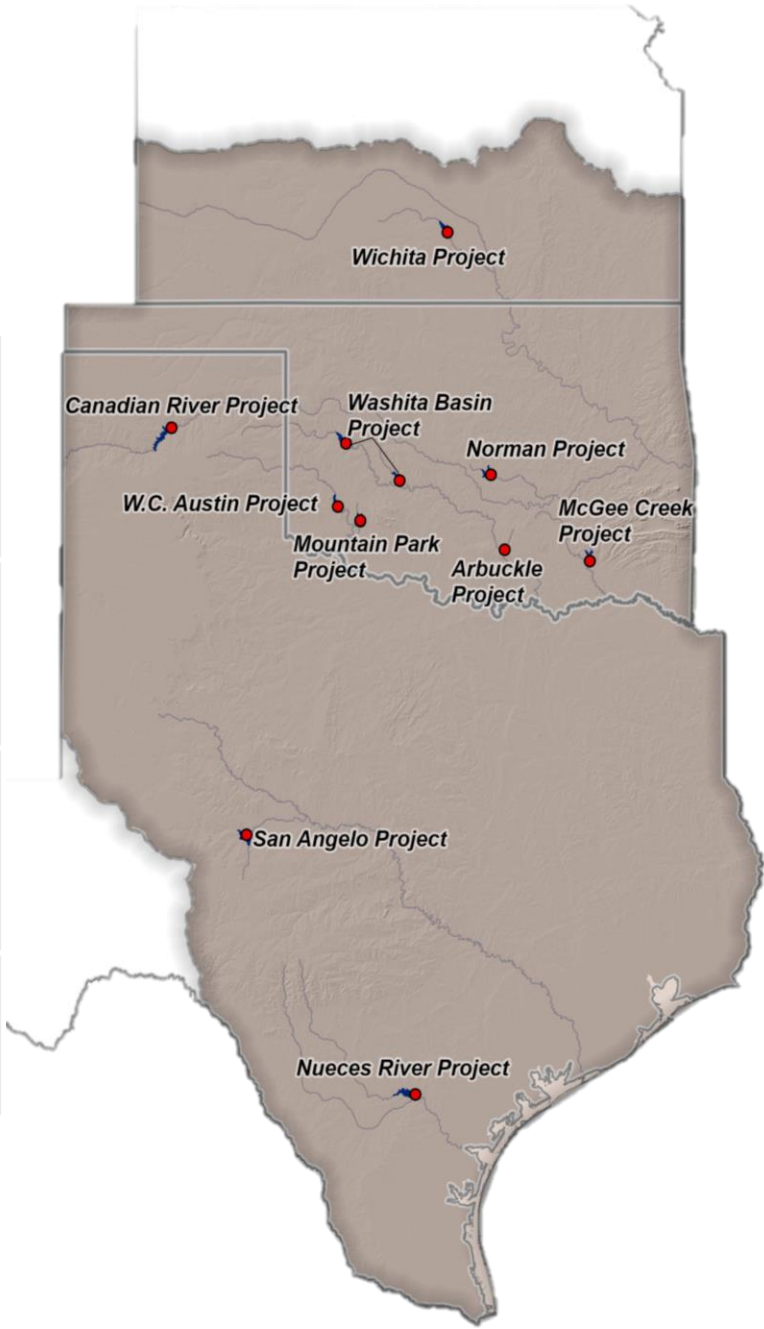
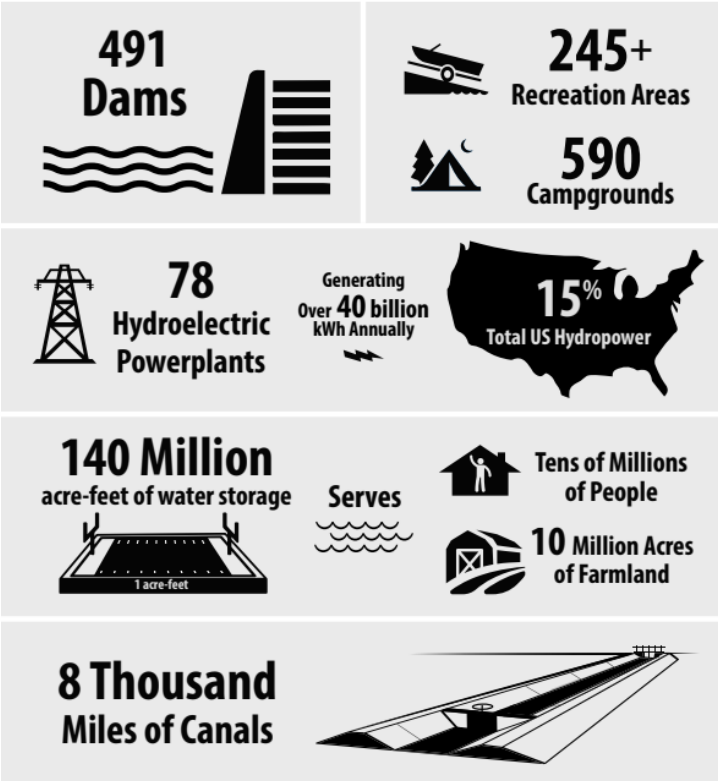
— BUREAU OF —
RECLAMATION

Upper Red River Basin Study

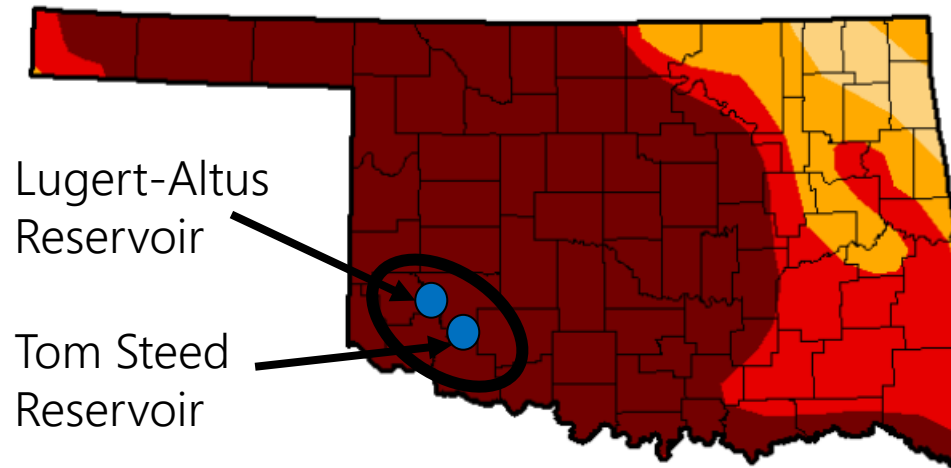
October 20, 2022
Western States Water
Council Meeting



Bureau of Reclamation

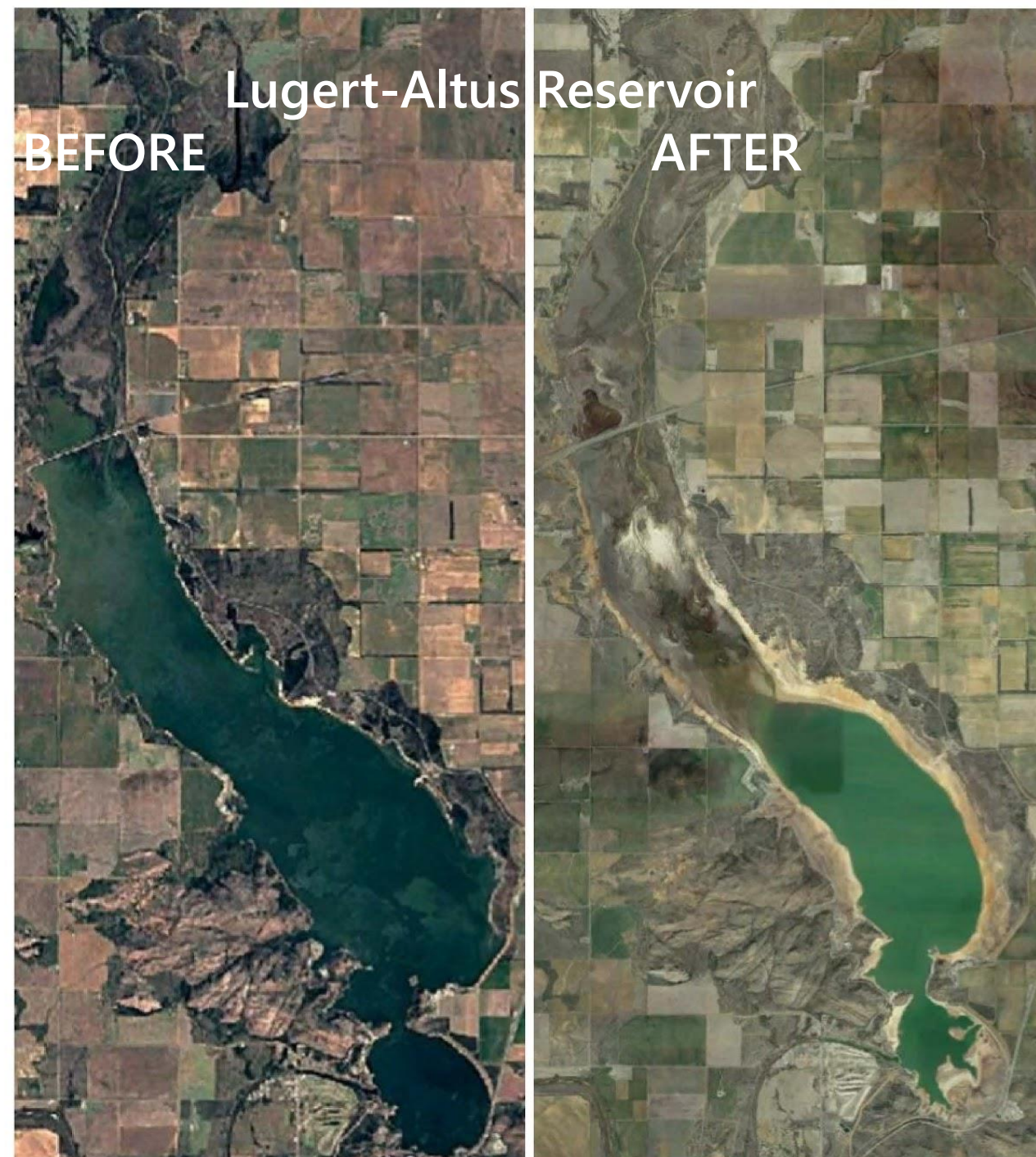


2010-2015, A New Drought of Record



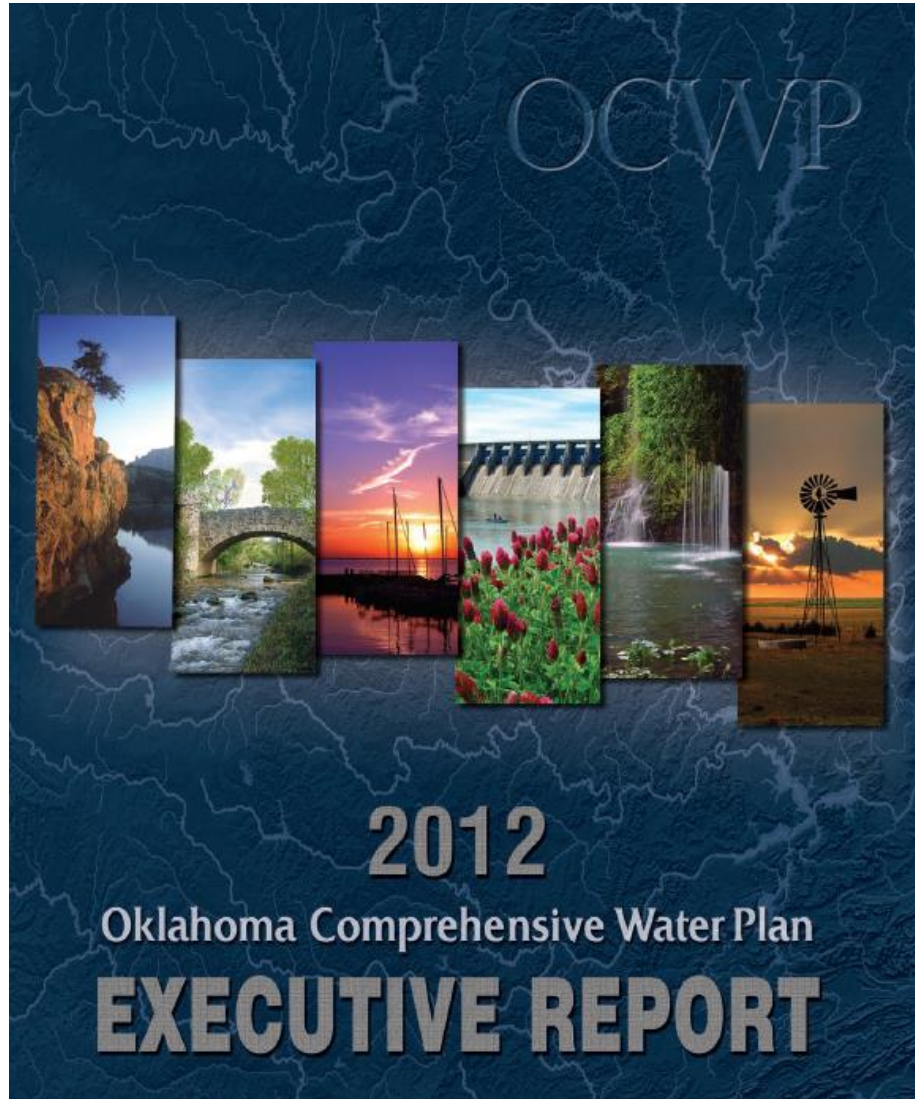
Oklahoma Water Rights 101

- Groundwater: regulated separately than surface
- Surface: Prior Appropriation Doctrine "1st in time, 1st in right"
- Rights to reservoir water are held by Districts and are senior to most other rights.
- Lack of data and models to define "interference"



Beginnings of Collaborative Basin Studies, OK

High Priority Recommendations, OCWP 2012



Develop groundwater models to quantify amount of groundwater for permitting

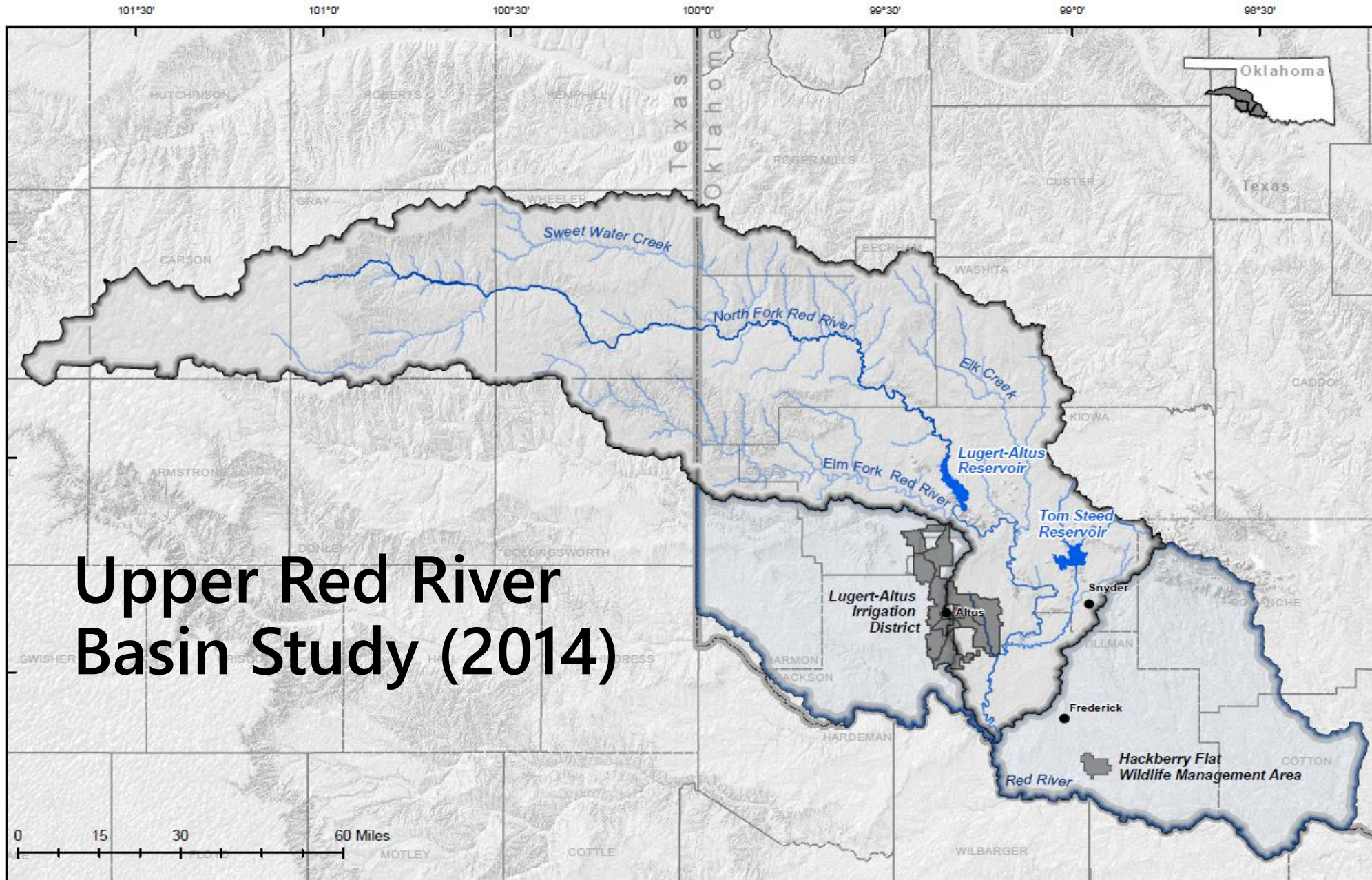
Develop surface water models to manage surface water permits

Define interference and trigger points

Condition permits to protect dependable yield of reservoirs

Conjunctive management of ground and surface water

Stakeholder involvement key



Upper Red River Basin Study (2014)

- Reclamation
- Oklahoma Water Resources Board
- Lugert-Altus Irrigation District
- Mountain Park Master Conservancy District

EXPLANATION

- Hydrologic Basin
- Adjacent Basins that Receive Reclamation Water

Basin Study Modeling Approach



- Consensus between Reclamation and OWRB on the science
- Independent Peer Reviews Completed

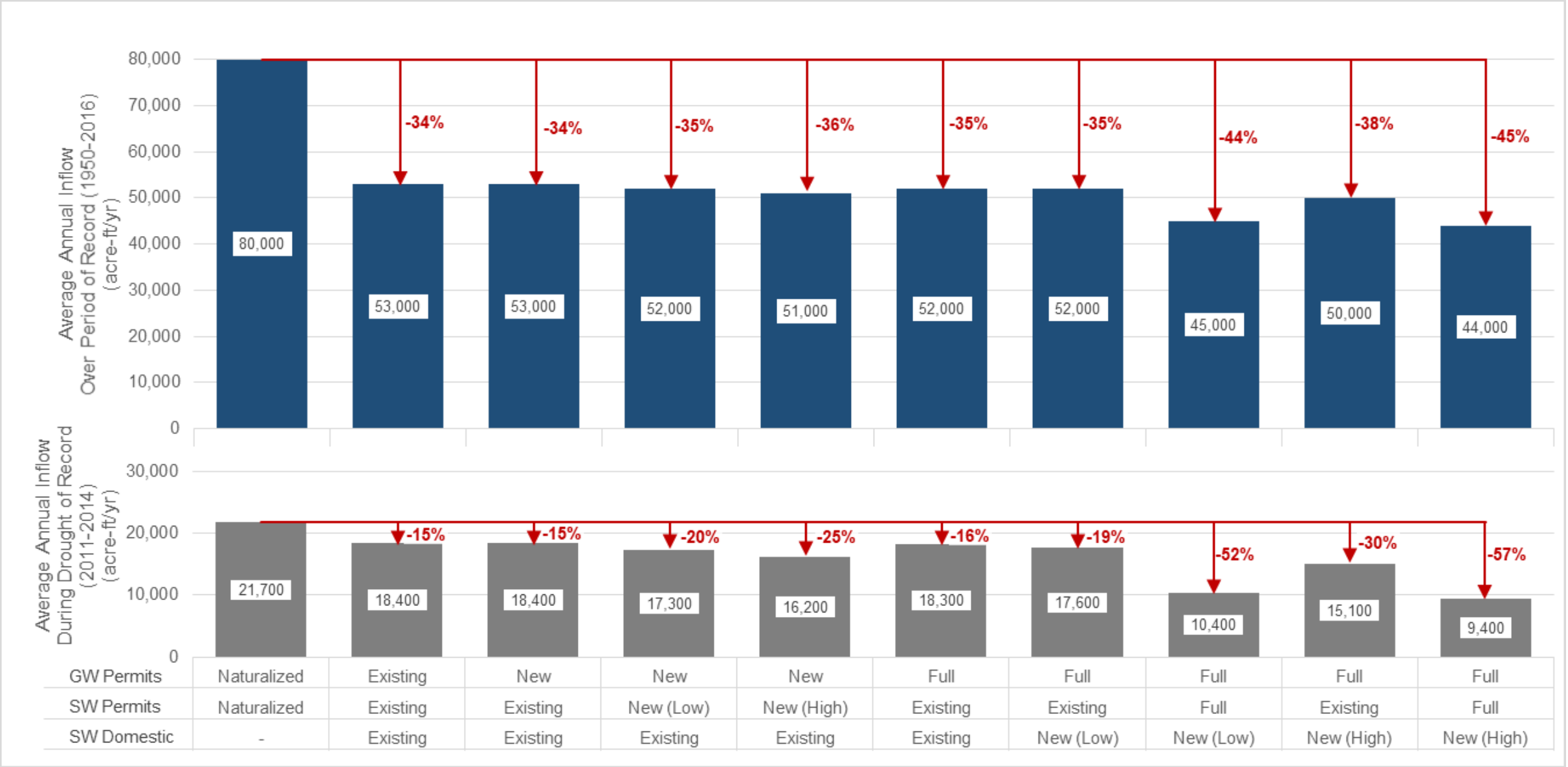
Status Quo Key Findings

- Reservoir supplies may be insufficient to meet demands, especially during severe drought periods.
- Climate/hydrology was the primary source of storage deficits.

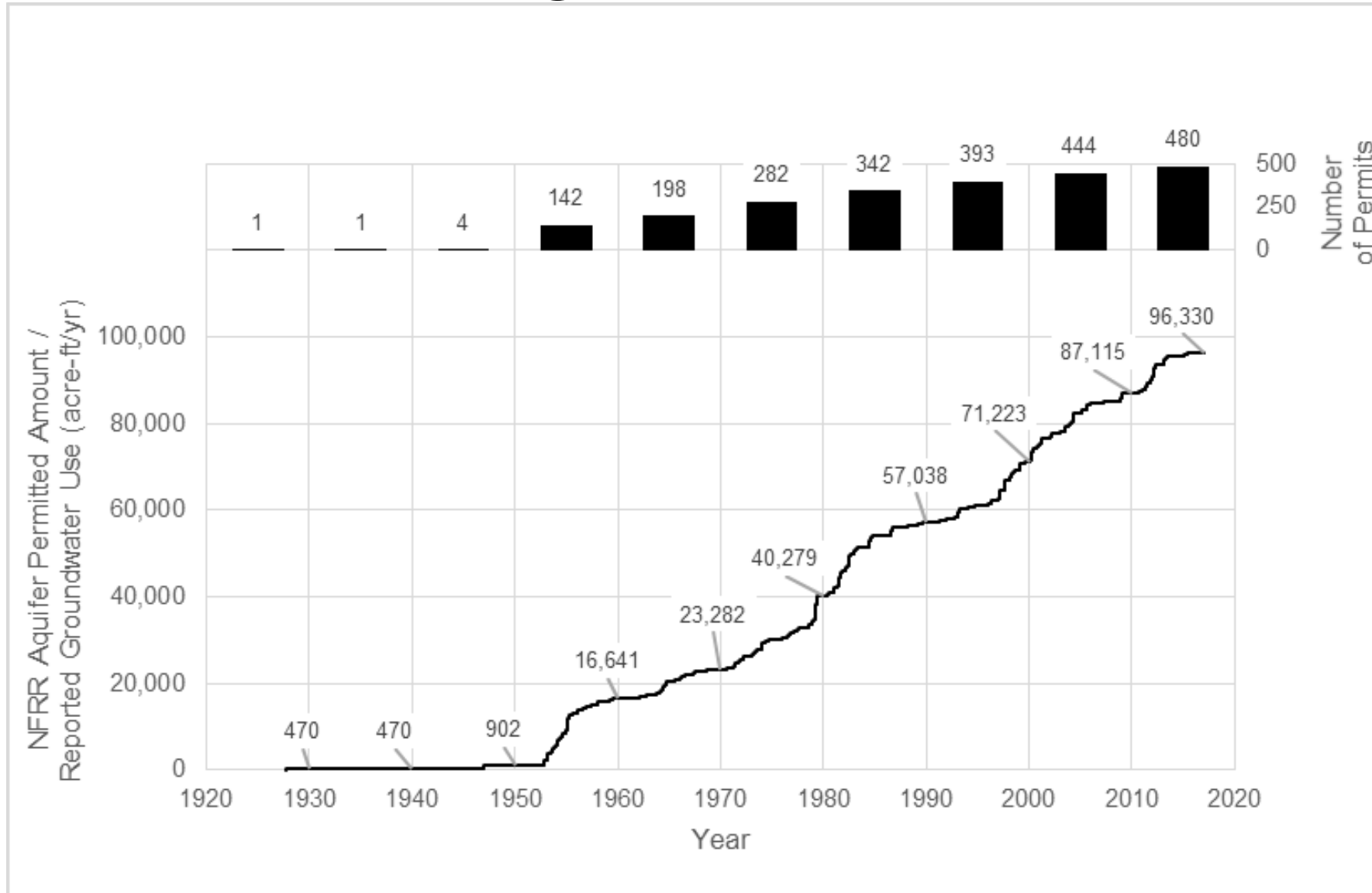
Status Quo Key Findings

- Tom Steed Reservoir: Future permitted stream diversions was the second largest cause of storage deficits.
- Lugert-Altus Reservoir: Existing permitted groundwater pumping was the second largest cause of storage deficits.
- Strategies are needed to mitigate both climate/hydrology and permitted ground and surface water withdrawals.

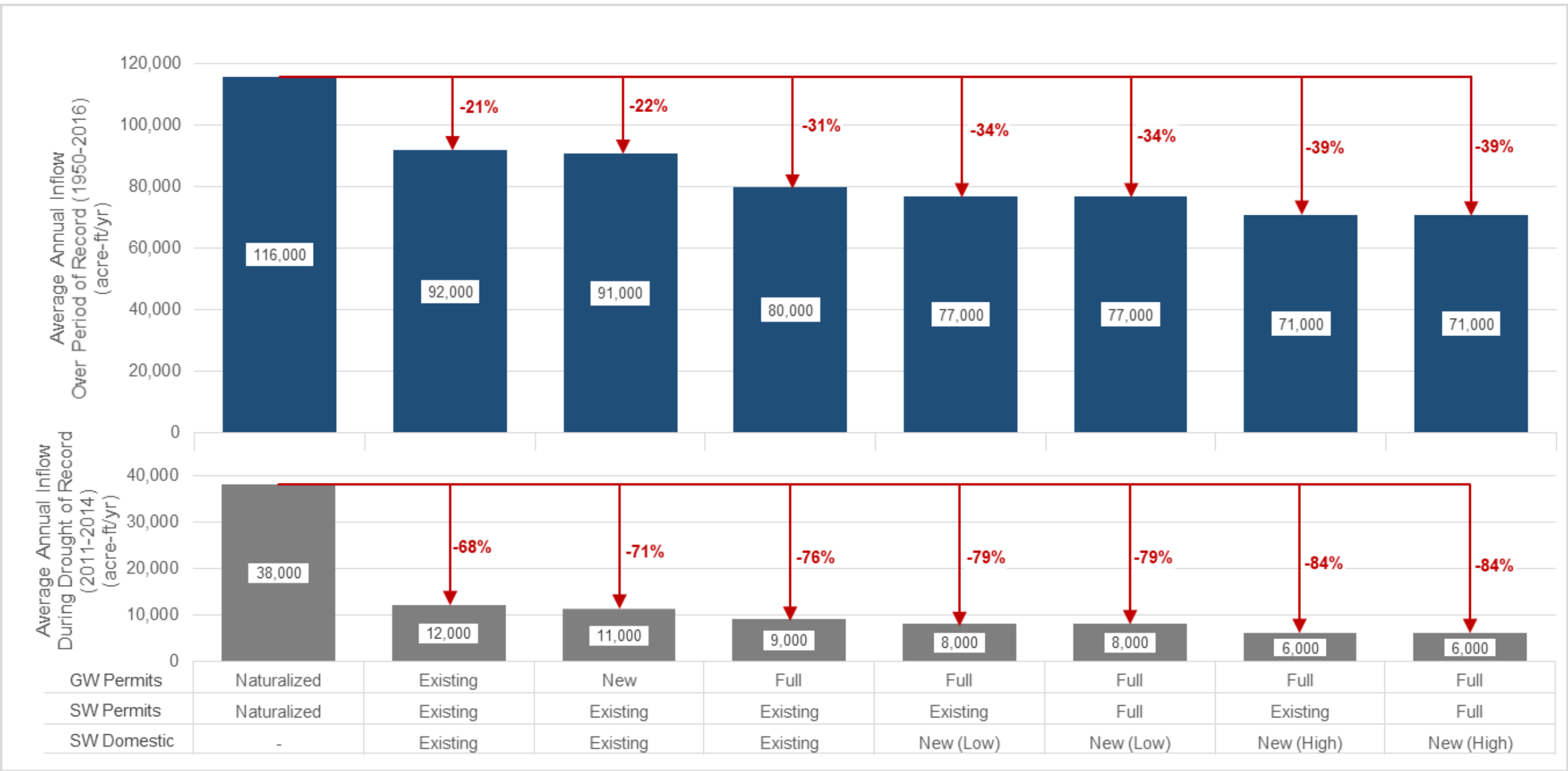
Status Quo Key Findings (Tom Steed Reservoir Inflow)



North Fork Red River Aquifer Existing Groundwater Permit Holders above Lugert-Altus Reservoir

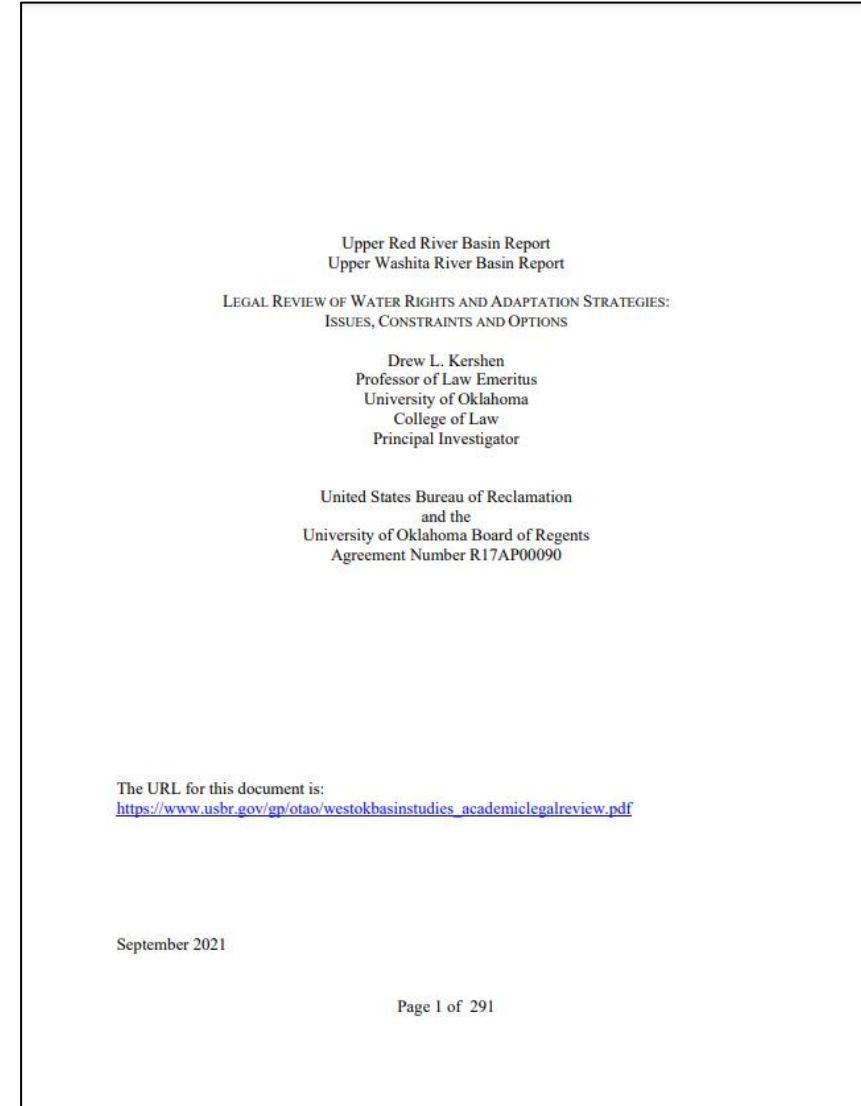


Status Quo Key Findings (Lugert-Altus Reservoir Inflow)



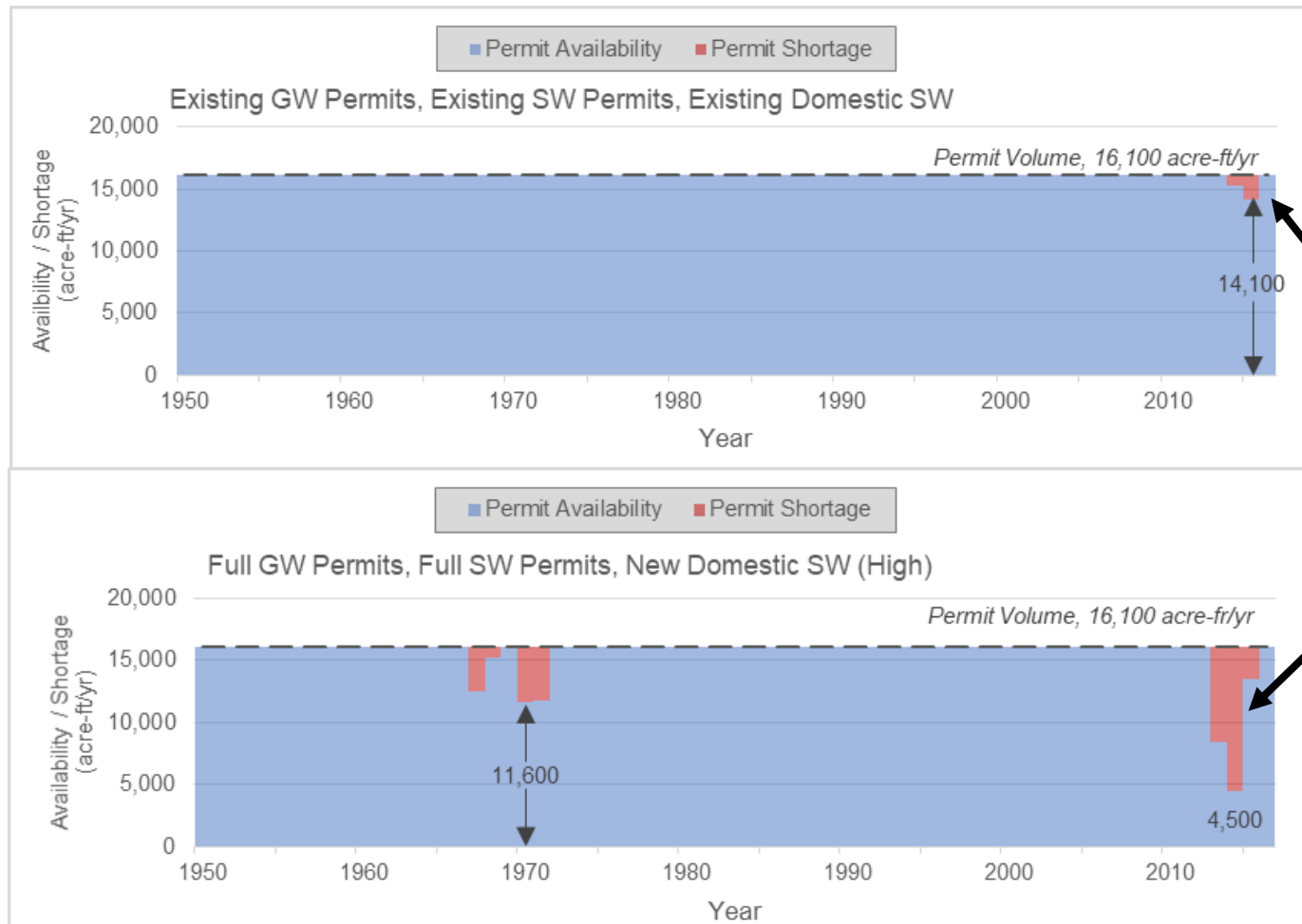
Identification of Adaptation Strategies

1. Clarification of existing streamwater rights
2. Protection of existing streamwater rights
 - a. **Regulatory** (*primary subject of today's presentation*)
 - b. Non-regulatory (purchase or lease of senior streamwater rights)
3. Additional streamwater rights
4. Conjunctive management of groundwater and surface water
5. Reclassification of alluvial groundwater to streamwater
6. Development of supplemental supplies
7. Water Conservation



Planning Objective

- Maximize yield of Tom Steed Reservoir up to 16,100 acre-ft/yr
- Maximize beneficial use for upstream permits and avoid futile calls



Reduce these
projected permit
shortages



Regulatory Protection of MPMCD's Streamwater Right

Goal: Identify a range of hydrologic indicators with corresponding thresholds that could be used to indicate the onset of a severe drought and the need to curtail junior permitted streamwater diversions in the basin.



Analysis Details

Hydrologic Indicators Identified

Regional Indicators

1. Palmer Drought Severity Index (PDSI)
2. Palmer Hydrological Drought Index (PHDI)
3. Standard Precipitation Index (SPI)

Local Indicators

1. Reservoir Inflow
2. Reservoir Storage



How to Select Indicators and Thresholds?

A & D are good; B & C are not good.

		Drought Observed?	
		Yes	No
Drought Onset Predicted?	Yes	A	B
	No	C	D



Analysis Details

Hydrologic Indicators and Thresholds Analysis

1. Reclamation and OWRB jointly conducted rigorous statistical analyses on indicators and thresholds
2. An independent peer review was performed on the 150-page technical memorandum

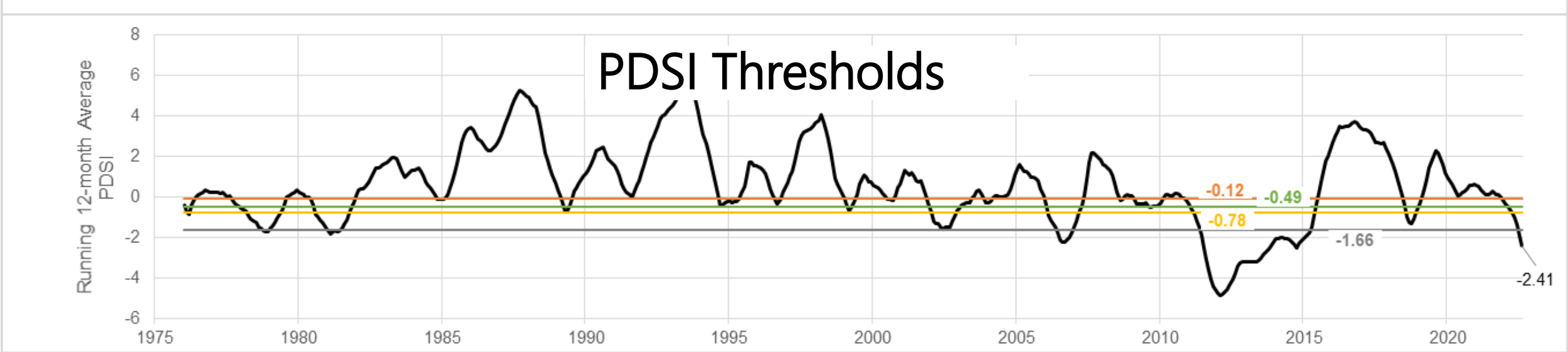
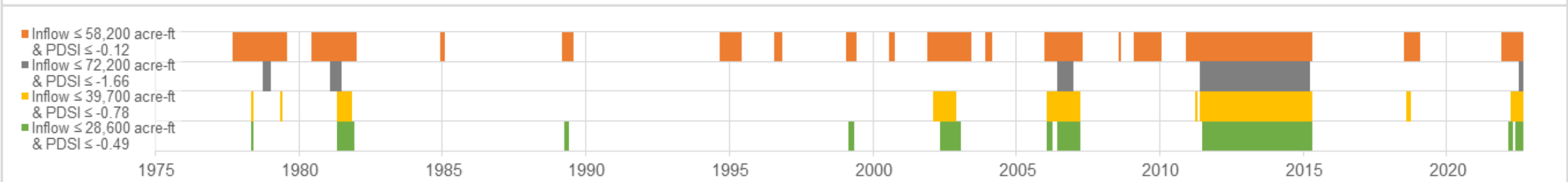
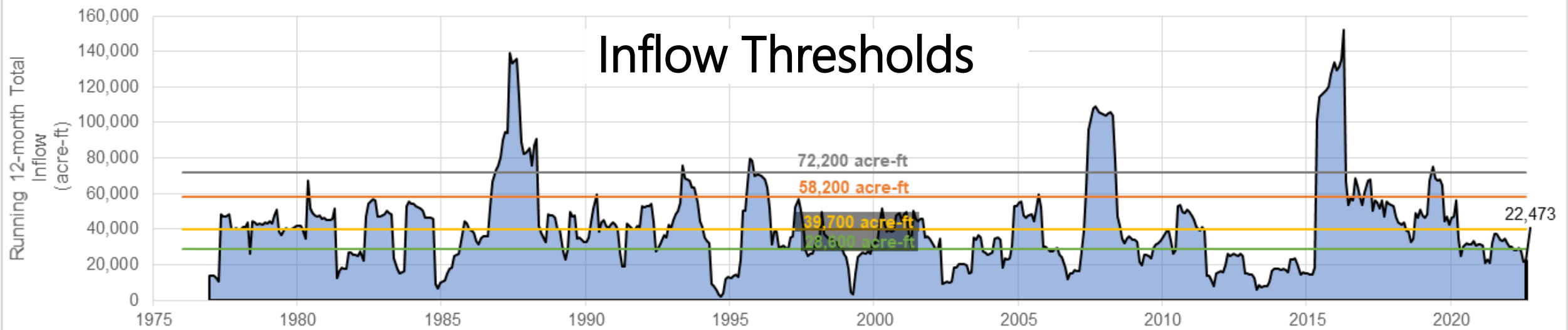


Hydrologic Indicators and Thresholds for Regulatory Protection of Senior Rights to Tom Steed Reservoir

Threshold	Drought Indicator	
	Inflow (acre-ft/yr)	Palmer Drought Severity Index
1	58,200	-0.12
2	72,200	-1.66
3	39,700	-0.78
4	28,600	-0.49

Combined with Reservoir Storage Thresholds

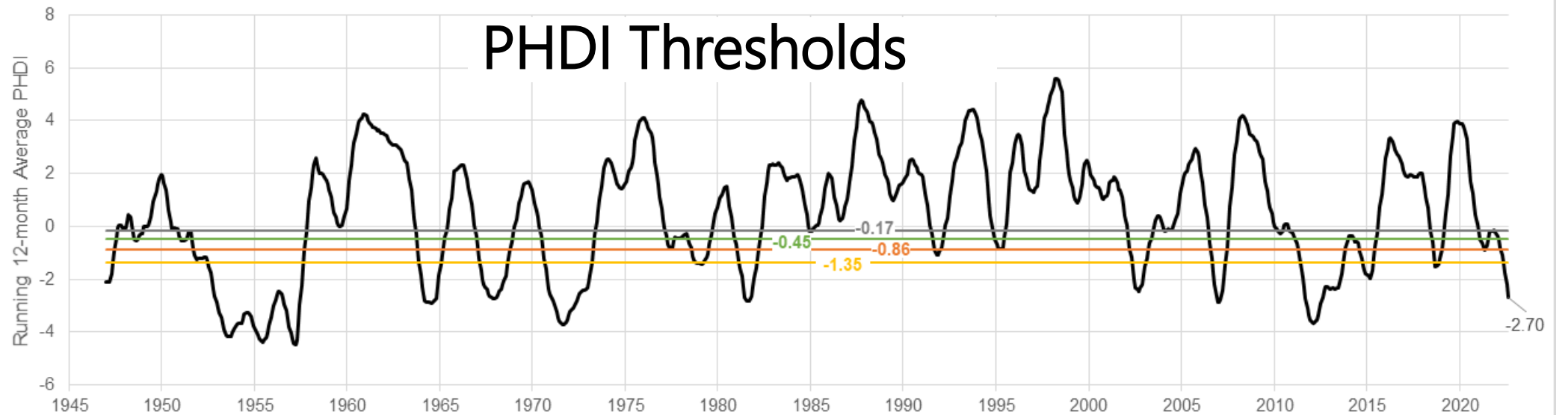
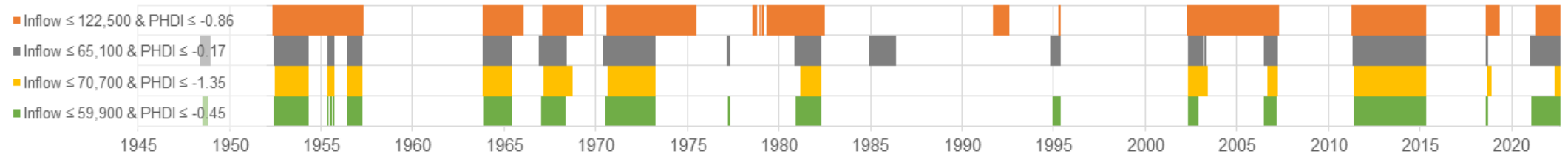
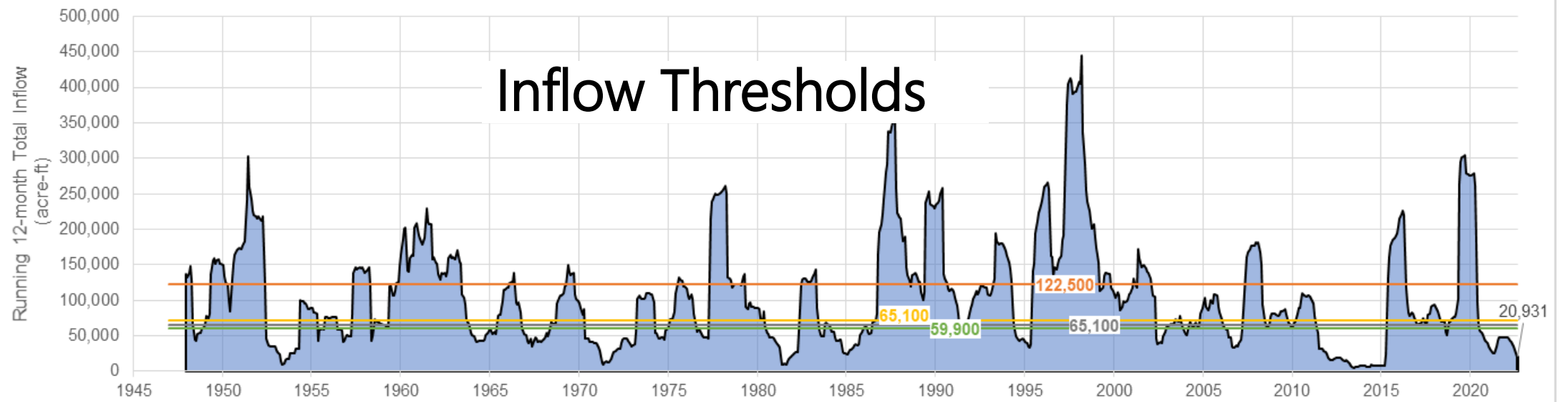




Hydrologic Indicators and Thresholds for Regulatory Protection of Senior Rights to Lugert-Altus Reservoir

Threshold	Drought Indicator	
	Inflow (acre-ft/yr)	Palmer Hydrological Drought Index
1	122,500	-0.86
2	65,100	-0.17
3	70,700	-1.35
4	59,900	-0.45

Combined with Reservoir Storage Thresholds



Final Range of Streamwater Rights Management Alternatives

- Curtailment Thresholds
 - 50 Reservoir Storage-Inflow-PDSI combinations
- Two Curtailment Timing Scenarios
 - Initiate any month of the year vs. initiate only in September (once per year)
- Two Curtailment Types
 - Curtail only new permits or curtail both existing junior permits and new permits together
- Three Tom Steed Reservoir Use Conditions
 - Existing Use
 - Mid-Range Use
 - Full Permit Use



Water Availability Modeling Scenarios

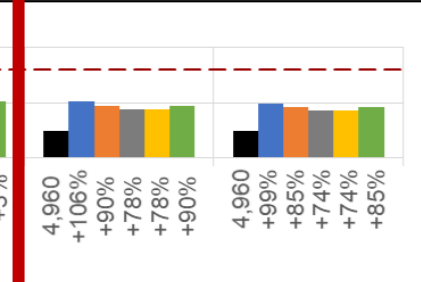
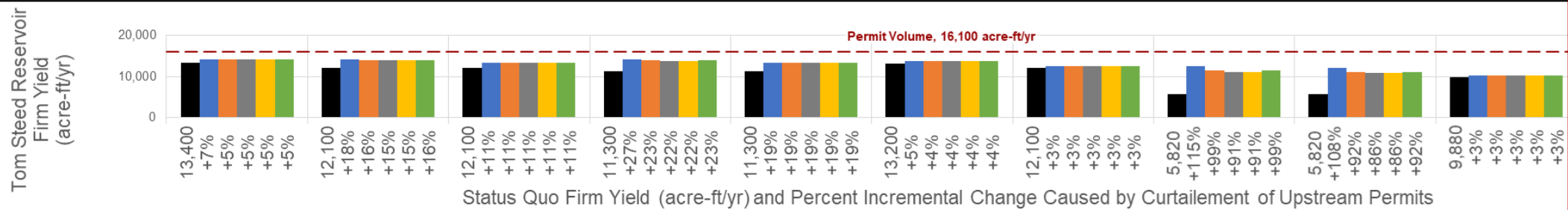
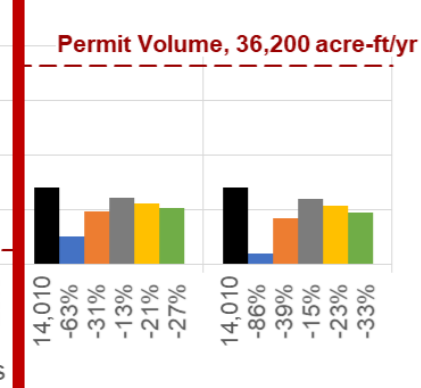
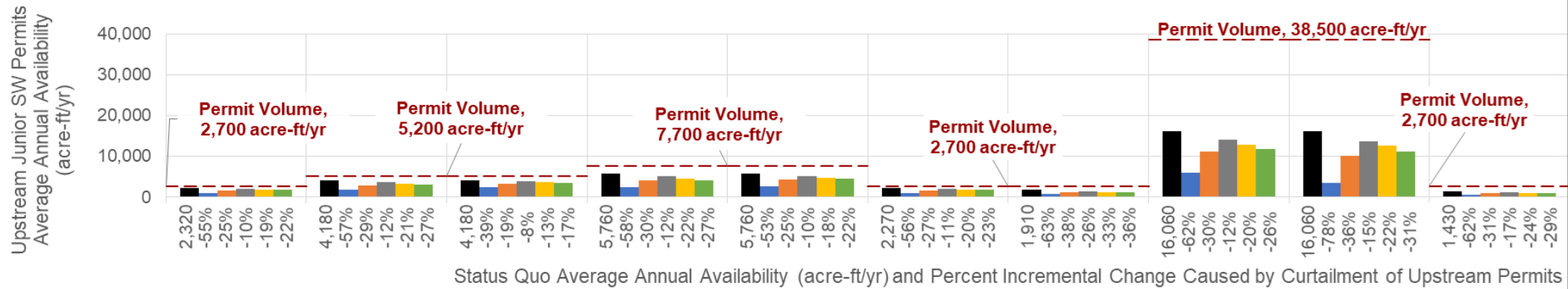
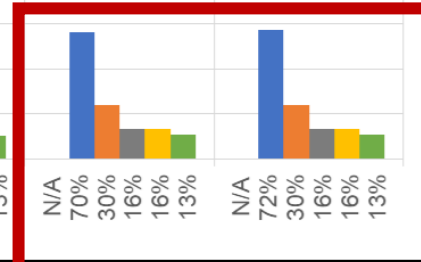
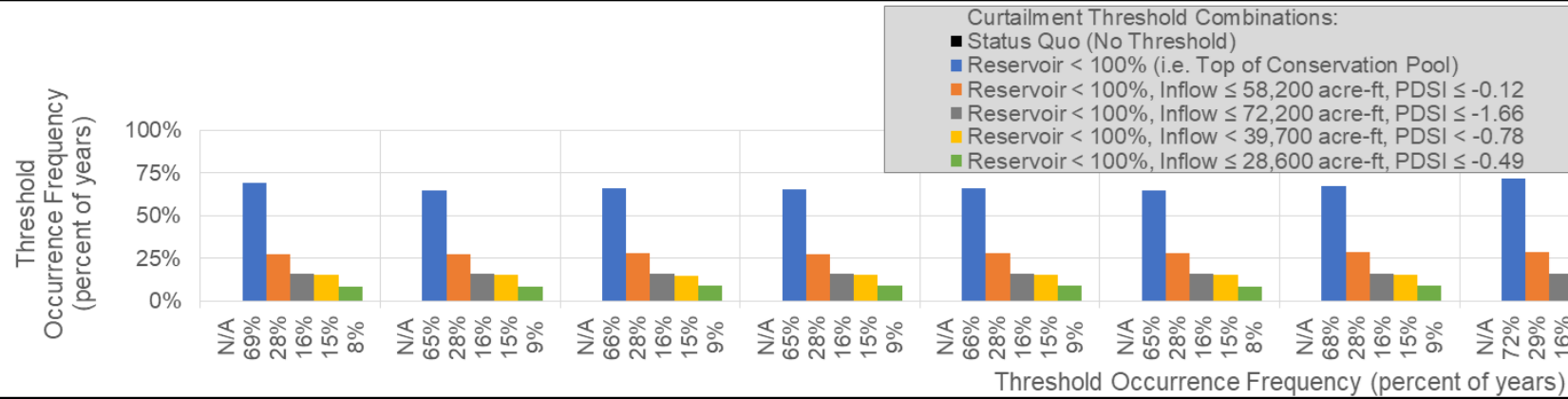
Over 2,500 discrete
model simulations



Water Availability Modeling Results (Tom Steed Reservoir)

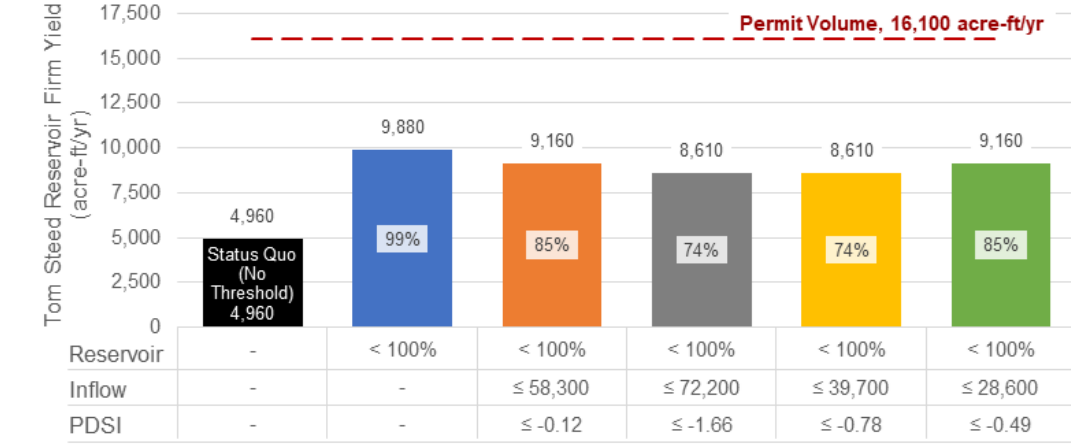
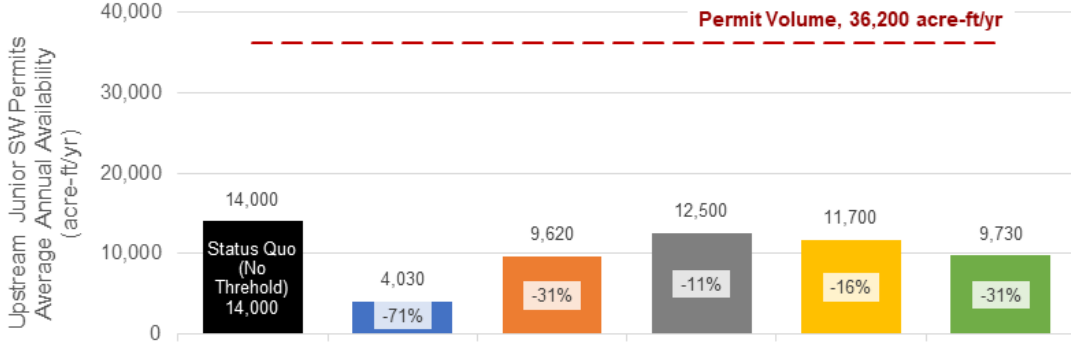
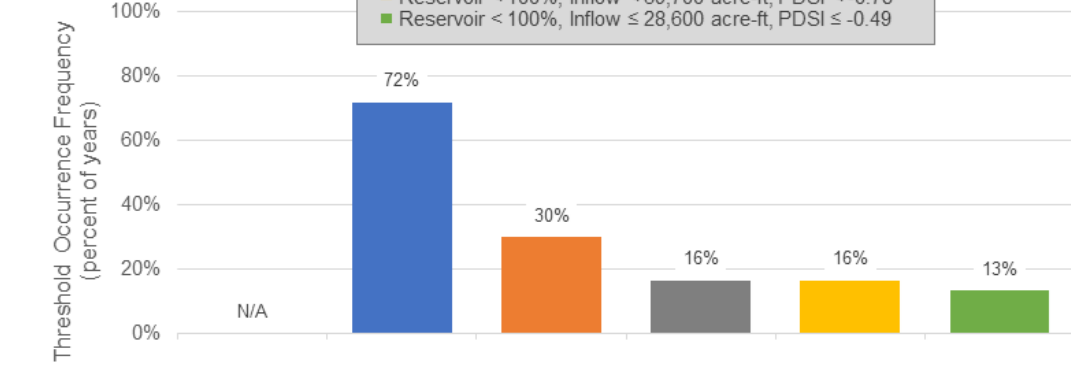
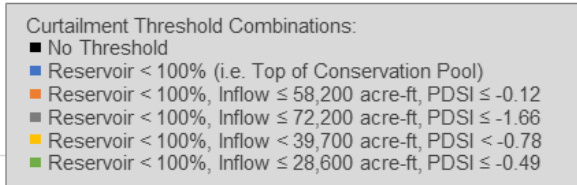
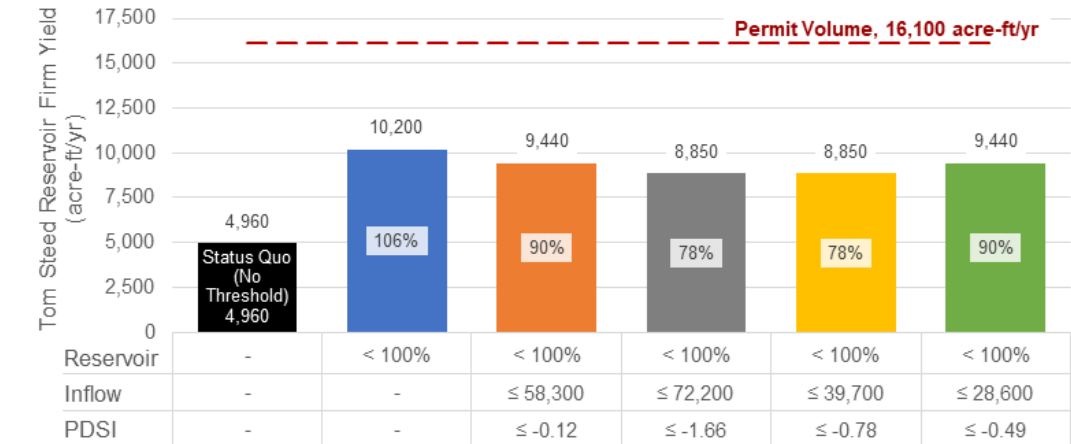
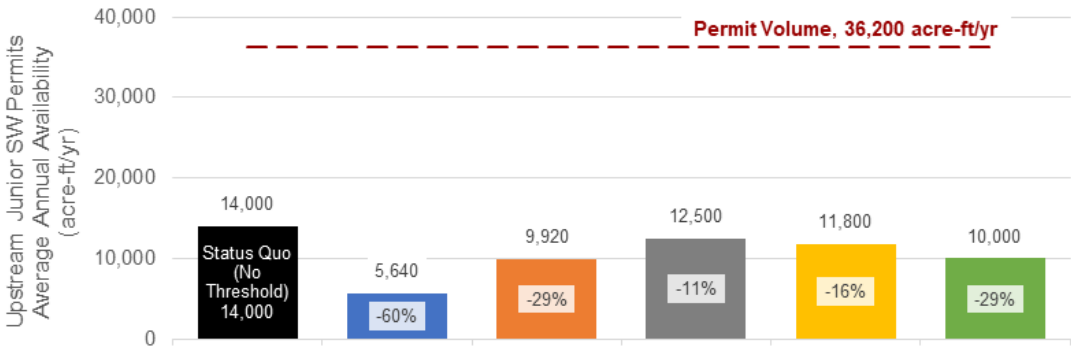
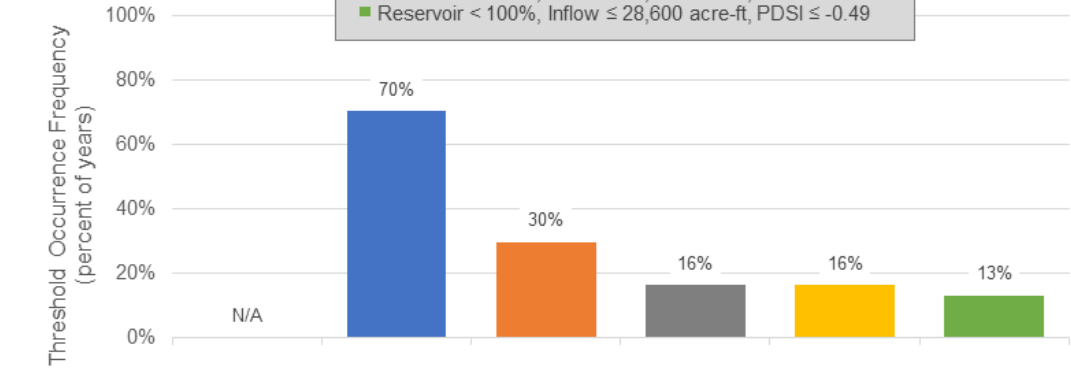
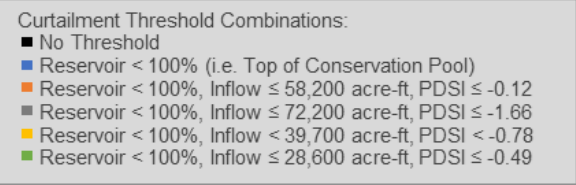
Threshold Name	Threshold
Status Quo	No Threshold
Blue	Top of Conservation Storage alone
Orange	Reservoir Storage and Inflow $\leq$ 58,300 acre-ft and PDSI $\leq$ -0.12
Gray	Reservoir Storage and Inflow $\leq$ 72,200 acre-ft and PDSI $\leq$ -1.66
Yellow	Reservoir Storage and Inflow $\leq$ 39,700 acre-ft and PDSI $\leq$ -0.78
Green	Reservoir Storage and Inflow $\leq$ 28,600 acre-ft and PDSI $\leq$ -0.49

Water Availability Modeling Results (Tom Steed Reservoir)



GW Permits	Existing and New	Existing and New	Existing and New	Existing and New	Existing and New	Full	Full	Full	Full	Full
SW Domestic	Existing	Existing	Existing	Existing	Existing	Existing	New (Low)	New (Low)	New (Low)	New (High)
SW Permits	Existing	New (Low)	New (Low)	New (High)	New (High)	Existing	Existing	Full	Full	Existing
Curtailing	Existing	Existing and New	New Only	Existing and New	New Only	Existing	Existing	Existing and New	New Only	Existing
Groundwater and Streamwater Development Scenarios										

Full	Full
New (High)	New (High)
Full	Full
Existing and New	New Only



Next Steps

- Basin Study Report review
- Questions



