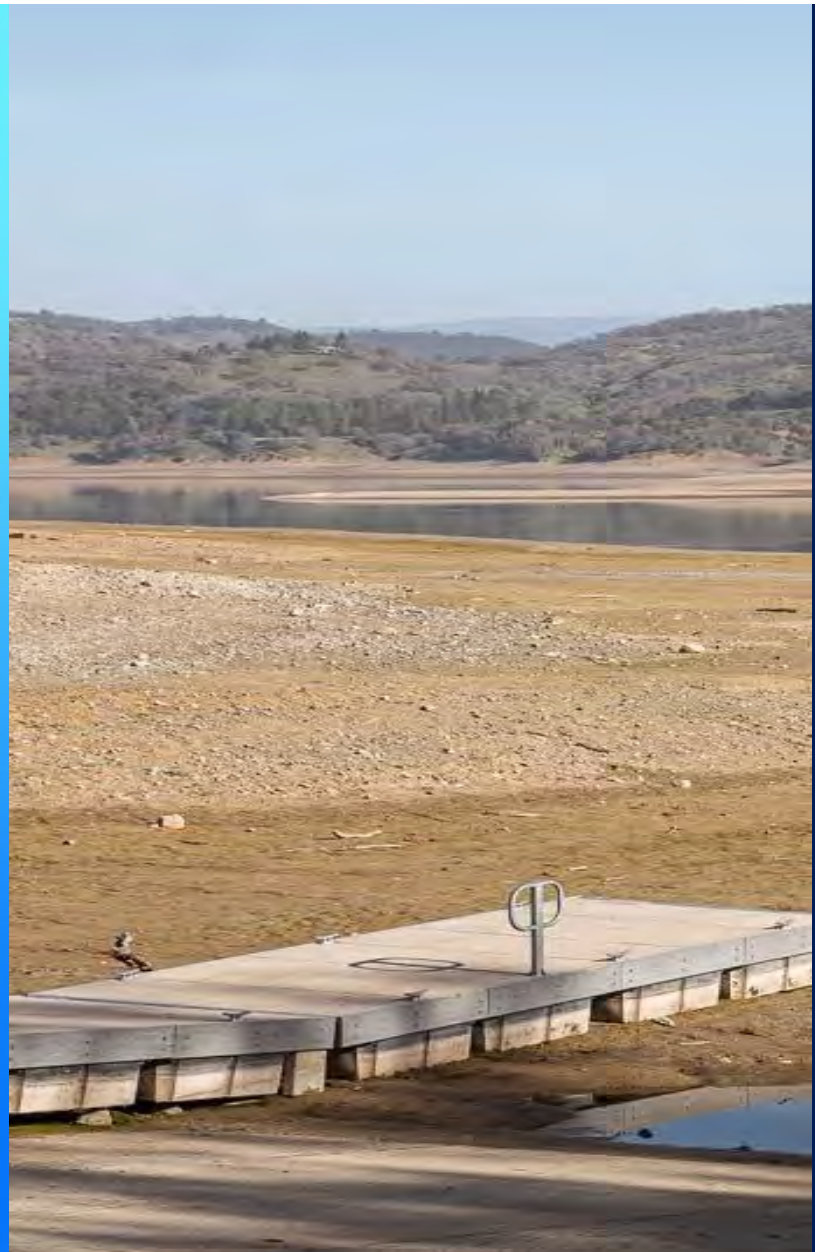
Jacobs Challenging today. Reinventing tomorrow.

Sonoma Water Resiliency Study

Drought Management Option Updates

WAC Briefing

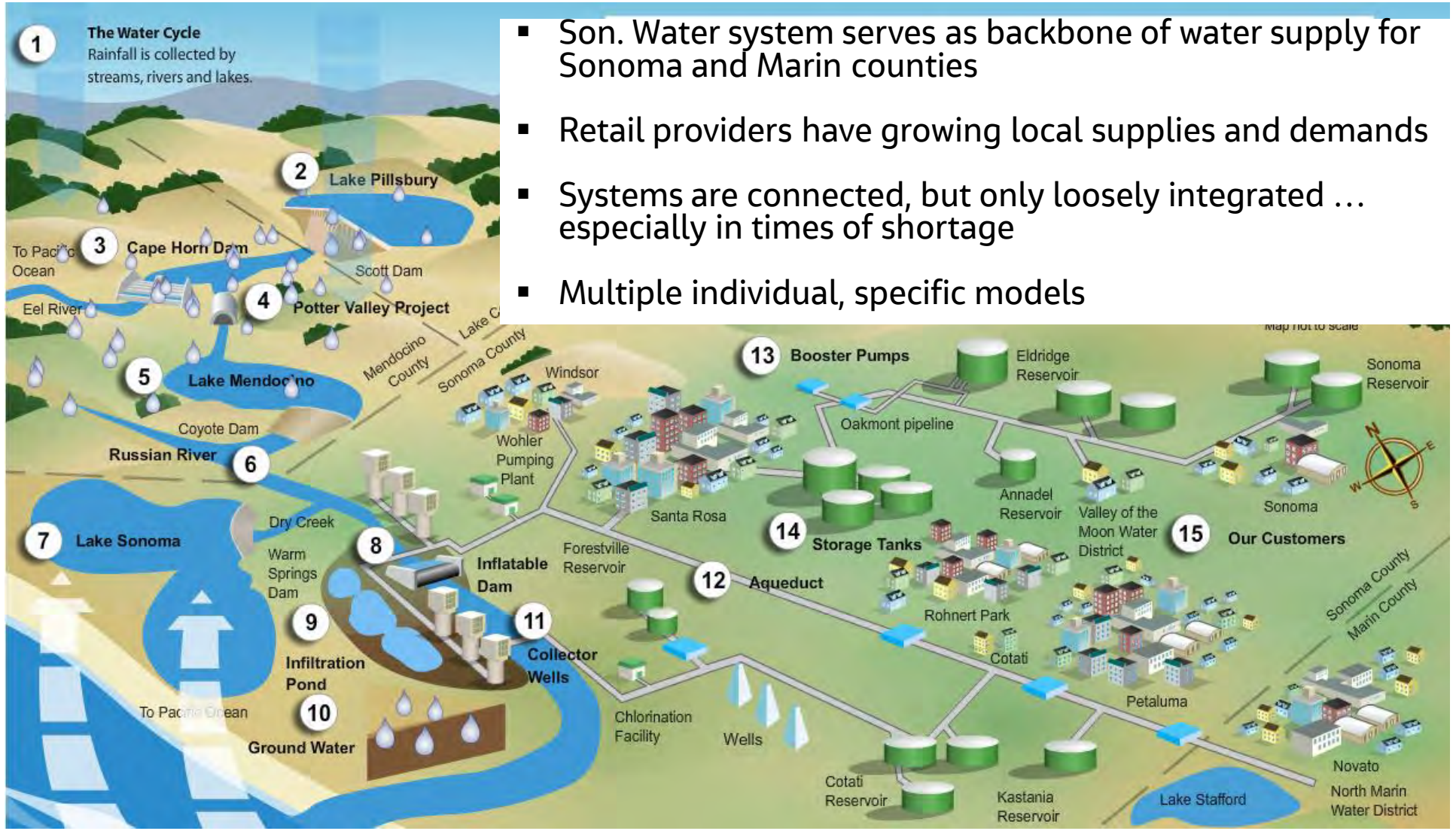
February 7, 2022



Meeting Agenda

- Resiliency Study Background
- Decision Support Model
- Drought Management Options
- Summary and Recommendations

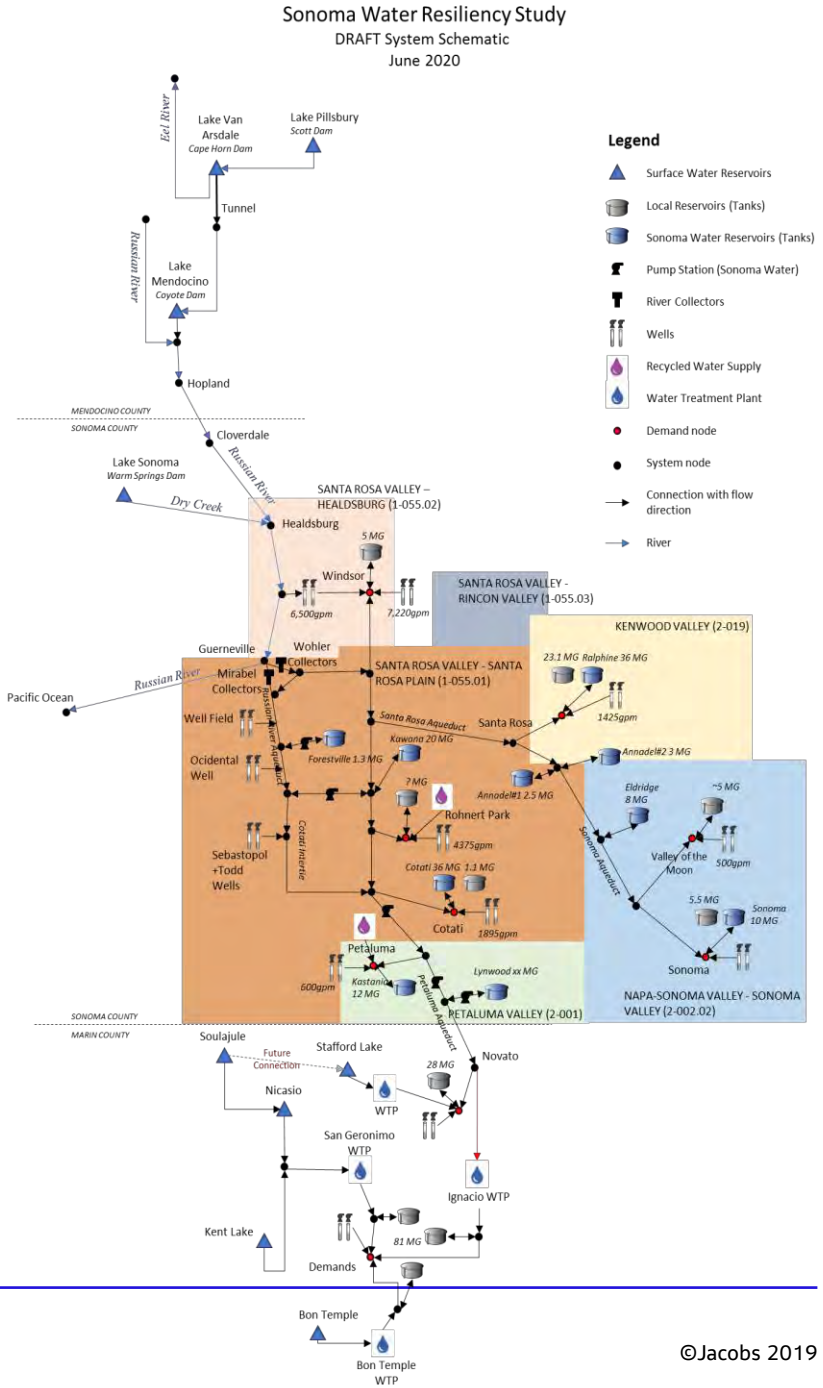
Complex Inter-Connected System



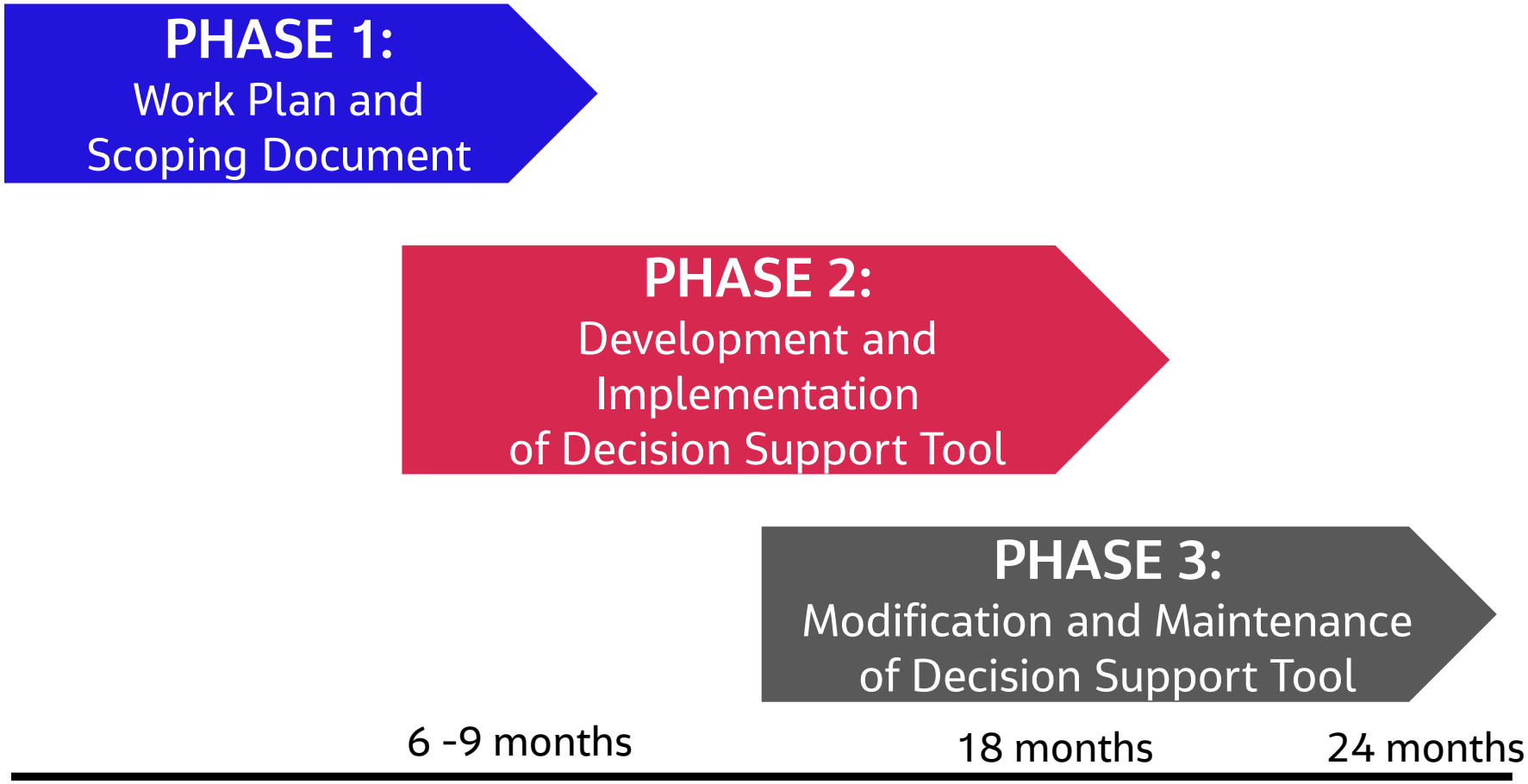
- Son. Water system serves as backbone of water supply for Sonoma and Marin counties
- Retail providers have growing local supplies and demands
- Systems are connected, but only loosely integrated … especially in times of shortage
- Multiple individual, specific models

Sonoma Water Resiliency Study

- Resiliency Study seeks to:
  - identify the key factors impacting regional water supply resiliency,
  - evaluate the current levels of resiliency,
  - develop a decision support framework model and process, and
  - identify promising opportunities for Sonoma Water and its retail customers to improve regional resilience in the future
- First of a kind look at the Integrated Regional System
  - Russian River & Potter Valley Project (Eel River)
  - Sonoma Water "backbone" system
  - 9 retail customer systems
  - 6 groundwater basins
  - local supplies and recycled water
  - multiple risk drivers
  - decision support model



Resiliency Study Project Overview



Ranking Risk Drivers

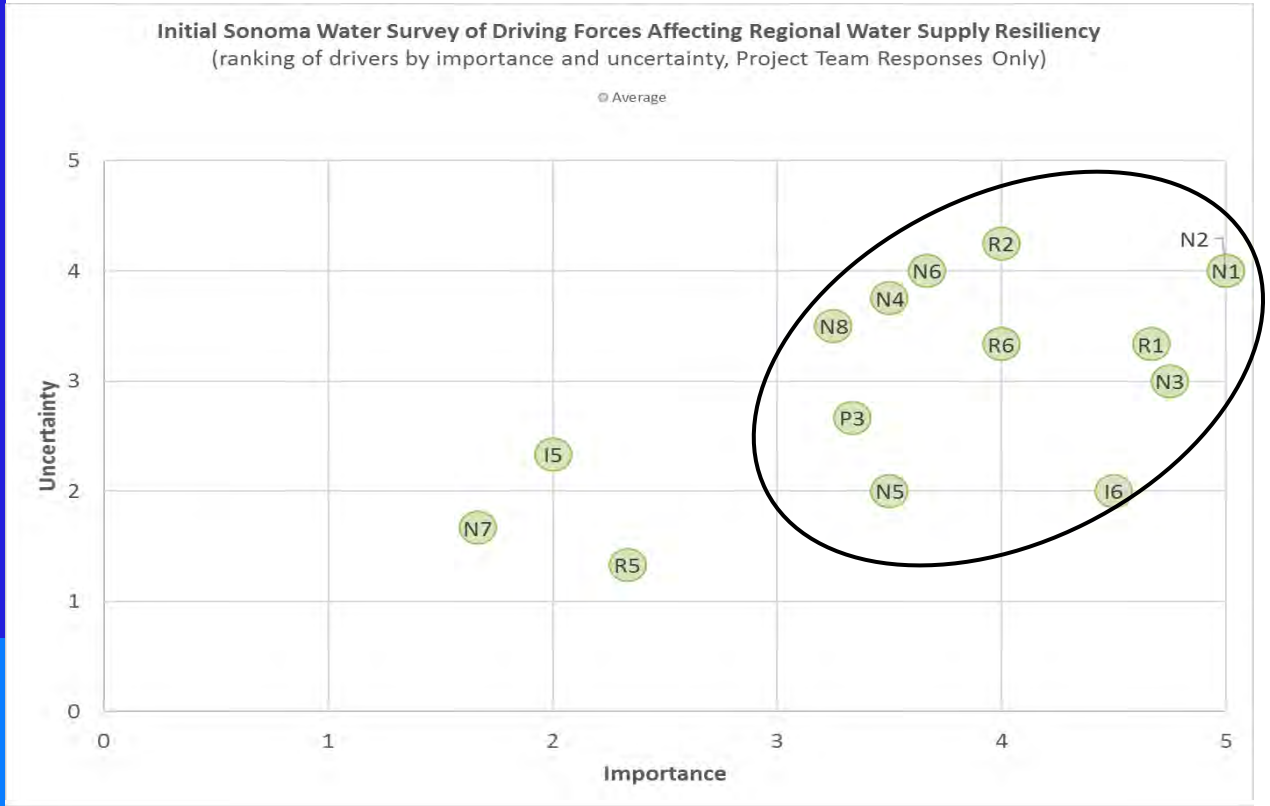


Figure 4. Average Results for the Risk Driver Survey Conducted by Project Team Members
(*Note: I11 and I12 risk drivers were not included in the initial survey and are thus not shown in the graphic).*

No.	Risk Driver	Risk Type	Phase of Study
N1	Wildfire	Sudden	Phase 2
N2	Earthquake	Sudden	Phase 2
N3	Drought	Sudden/Gradual	Phase 2
N4	Russian River Water Quality Contamination	Sudden	Phase 2
N5	Power Loss	Sudden	Phase 2
N6	Flooding	Sudden	Phase 2
N7	Sea Level Rise	Gradual	TBD
N8	Local Source Water Quality Contamination	Sudden	Phase 2
P3	Rapid Demand Growth	Sudden/Gradual	Phase 2 (TBD)
R1	Potter Valley Project Uncertainty (seismic/regulatory)	Sudden/Gradual	Phase 2
R2	New Russian River Treatment Regulations	Gradual	TBD
R5	SGMA Impacts on Groundwater Supply (City of Sonoma/VOMWD)	Gradual	Phase 2 (TBD)
R6	Changing Biological Opinions	Gradual	TBD
I5	Groundwater Well Operational Failures	Sudden	Phase 2
I6	Aging Infrastructure	Sudden/Gradual	Phase 2
I11	COVID 19 Workforce Response	Sudden/Gradual	TBD
I12	Operational Control Systems Disruption	Sudden	Phase 2

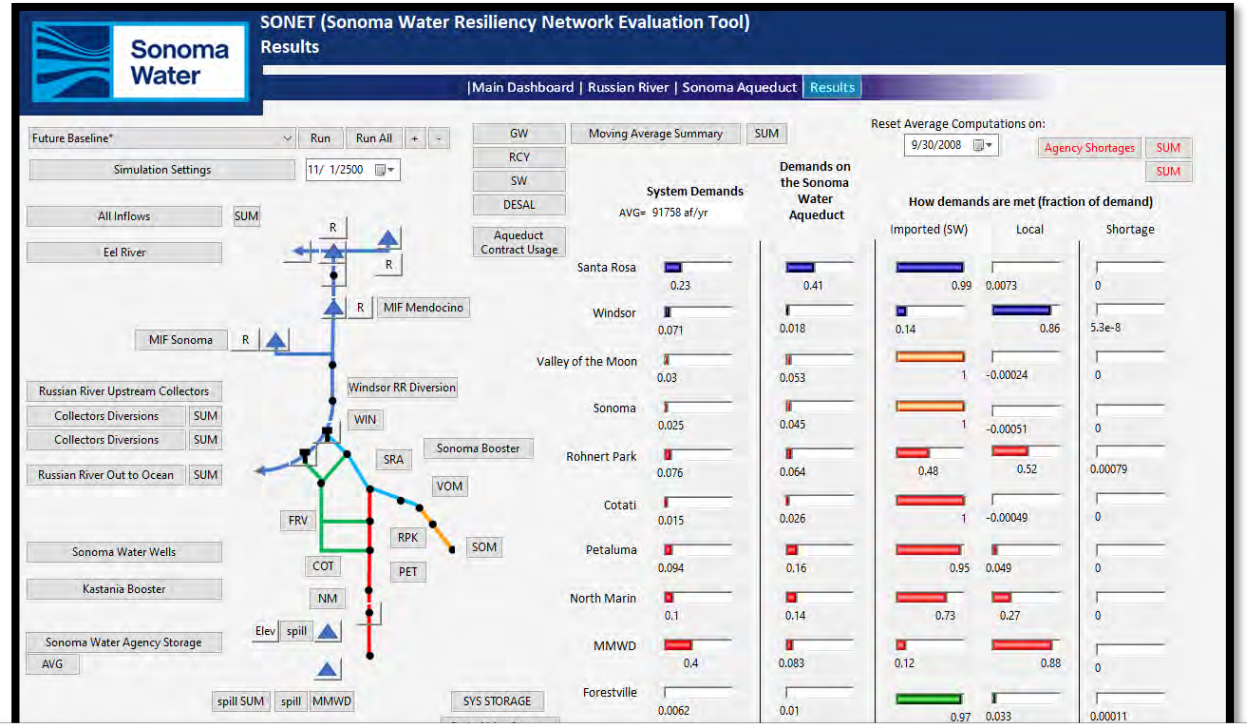
Decision Support Model Update

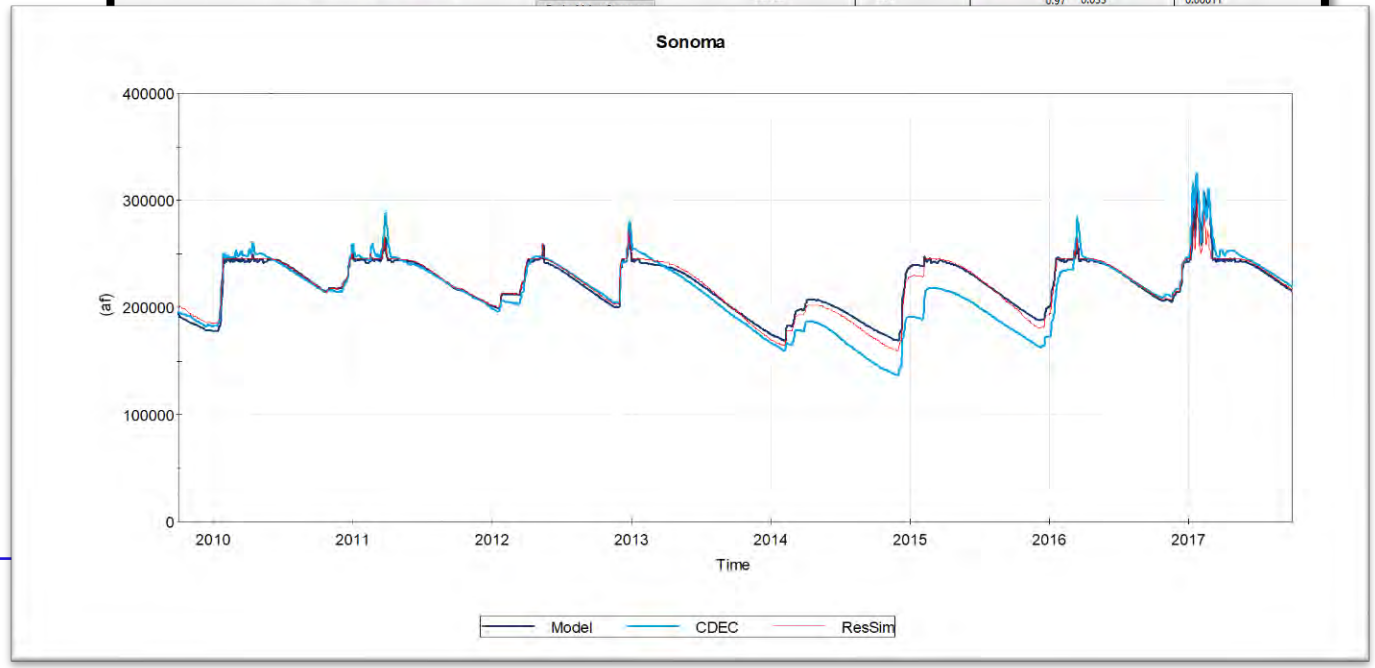
Decision Support Model Scope and Operational Overview

- Model that Integrates 3 major systems,
  - Russian River and Potter Valley Project
  - Sonoma Transmission System
  - Retail Customer Systems
- Main Model Inputs
  - Reservoir and river flows
  - Member agency demands
  - Maximum Member Agency local supplies available
- Model rules deliver supplies to member agencies
  - Rules decide priority of supplies used by member agencies

DSM Validation

- Validation period 2009 – 2017
- Member agencies local **supplies** (groundwater, recycled water) were set to what was **delivered**
- Historical inflow to the system provided by HEC-ResSim model and MMWD GoldSim Model
- Historical member agencies deliveries used as model demands
- Validation of storage, diversions, and deliveries



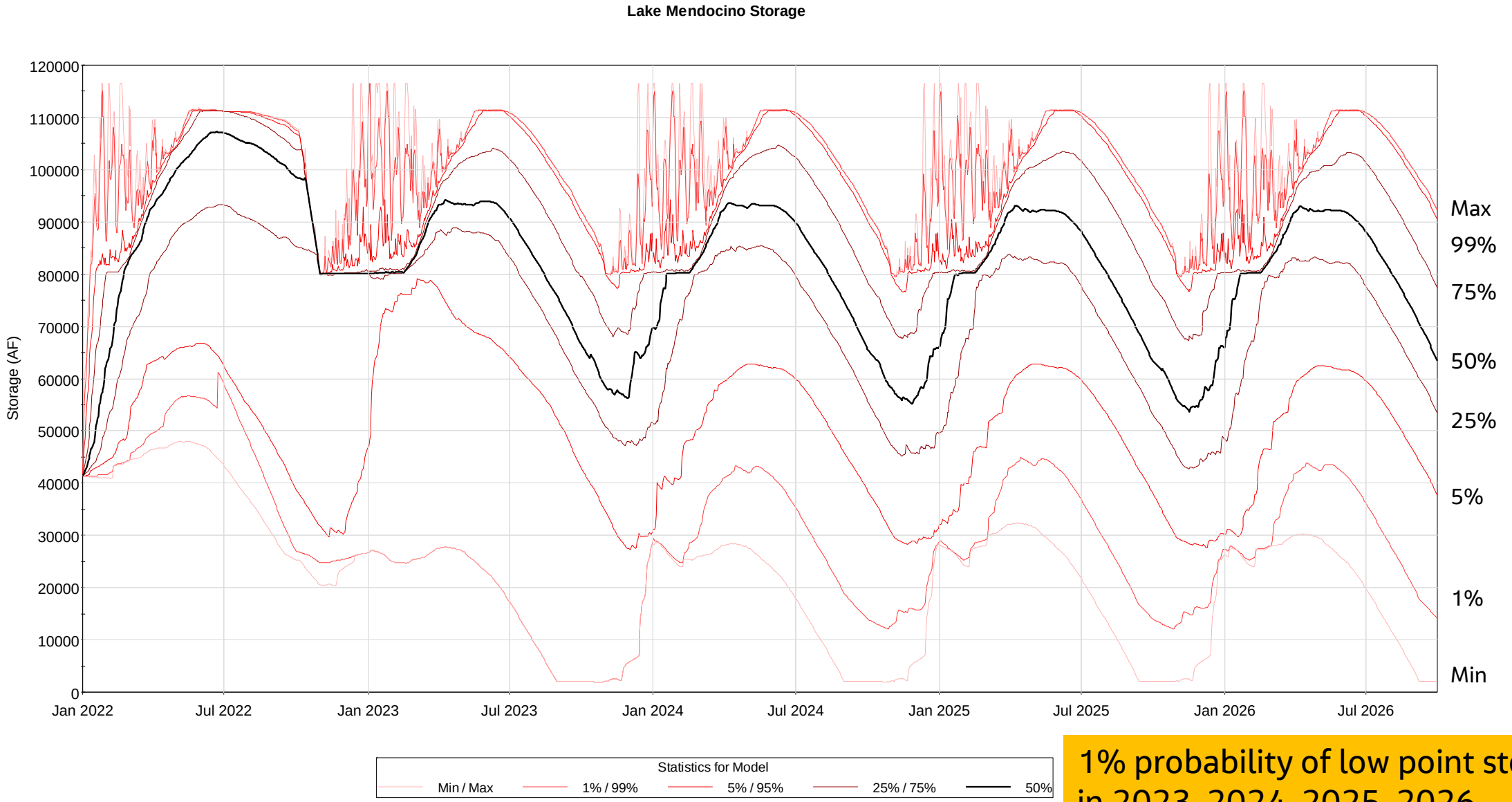


Future Baseline Projections

Future Baseline Simulations

- Assumptions
  - Conditions as of Nov 1, Dec 1, and Jan 1
  - No Actions taken to mitigate drought impacts
  - UWMP demand assumptions
  - Historical hydrology 1910-2017
  - 5-year future simulations: WY 2022-2026
- Stochastic Simulations
  - Simulations using 108 traces of historical hydrology
  - Index sequential method maintains the hydrological sequences of the past
  - Probabilities of storage and shortage conditions derived from traces
- Stress Test Hydrology
  - WY 1976-980 hydrology represents the most severe conditions in the historical record
  - Represents a severe 2-year drought following the current drought
  - Used as stress test hydrology for evaluating the resilience of the system and management actions

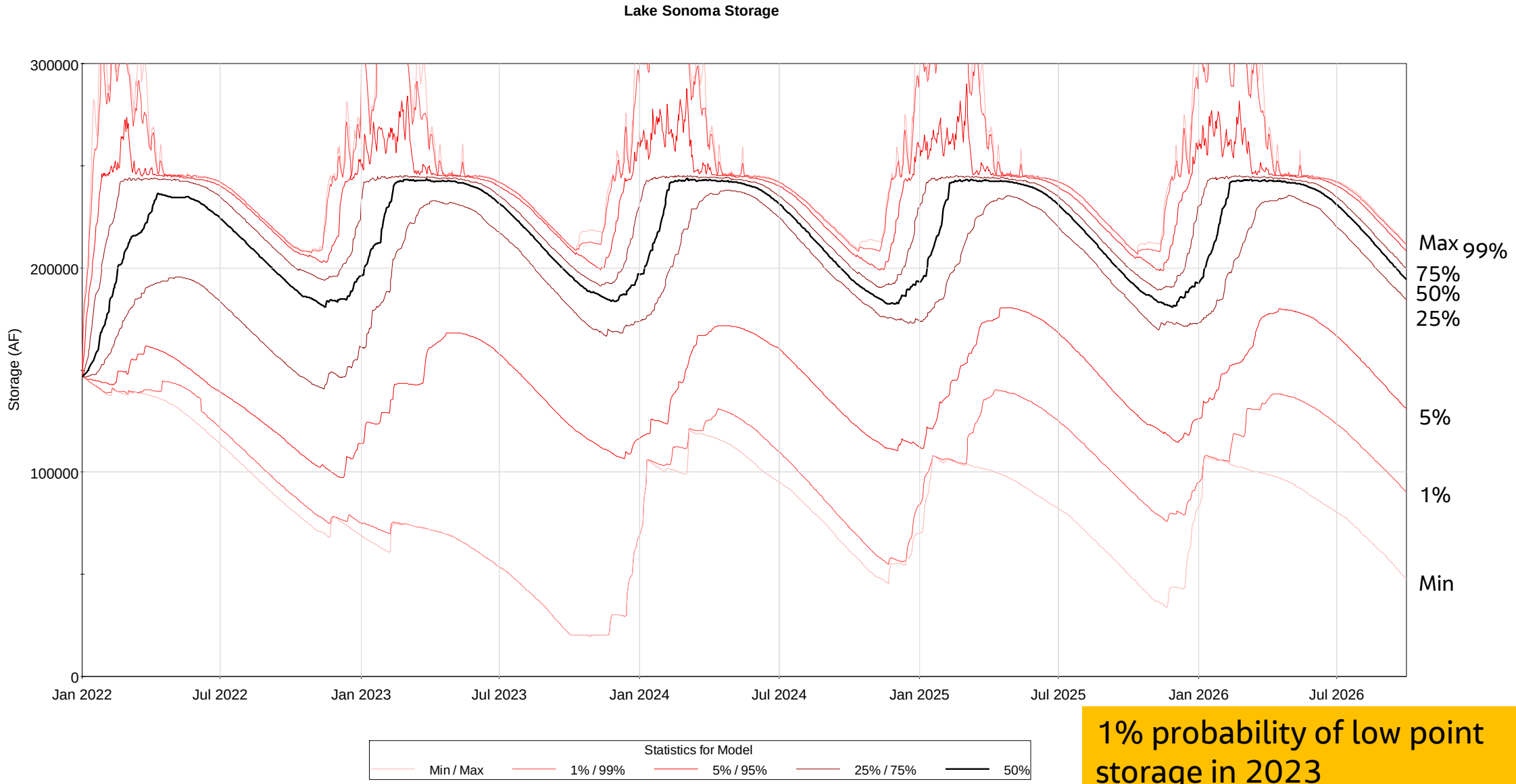
Lake Mendocino Storage – Probabilities from 108 Historical Hydrological Traces



1% probability of low point storage in 2023, 2024, 2025, 2026

Scenario does NOT include any actions to mitigate drought impacts

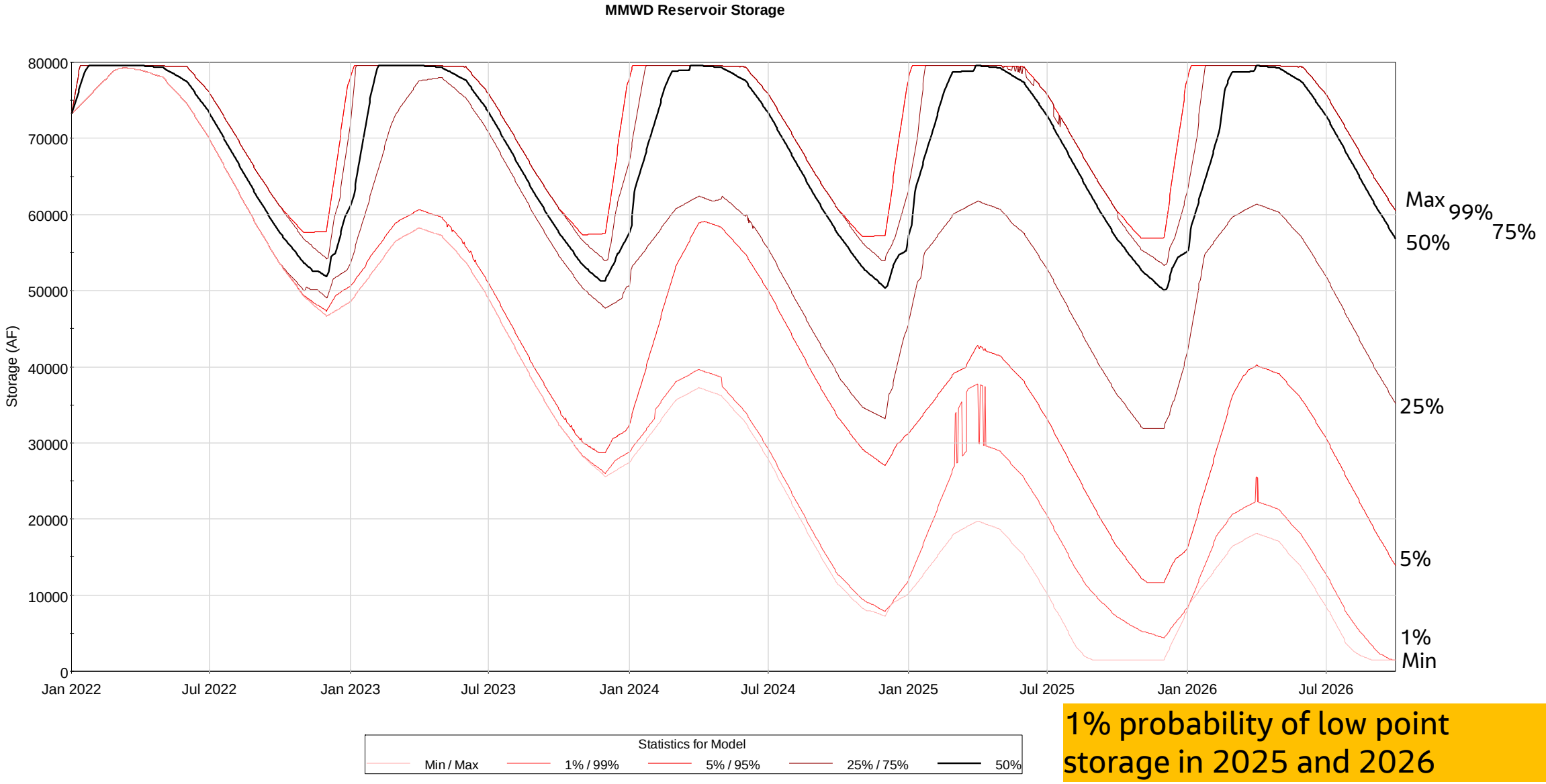
Lake Sonoma Storage – Probabilities from 108 Historical Hydrological Traces



1% probability of low point storage in 2023

Scenario does NOT include any actions to mitigate drought impacts

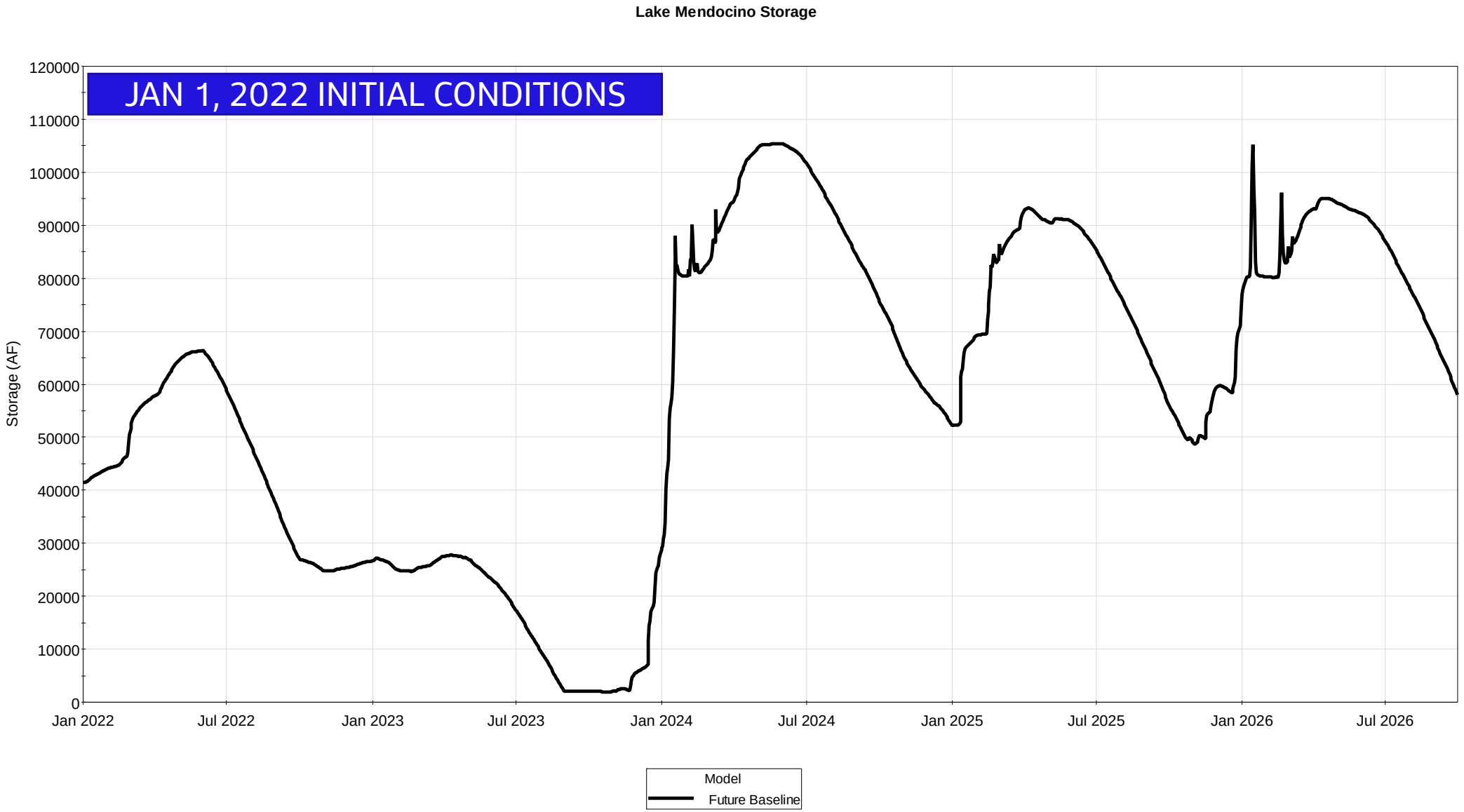
MMWD Storage – Probabilities from 108 Historical Hydrological Traces



1% probability of low point storage in 2025 and 2026

Scenario does NOT include any actions to mitigate drought impacts

Lake Mendocino Storage – WY 1976-1980 Stress Test Hydrology



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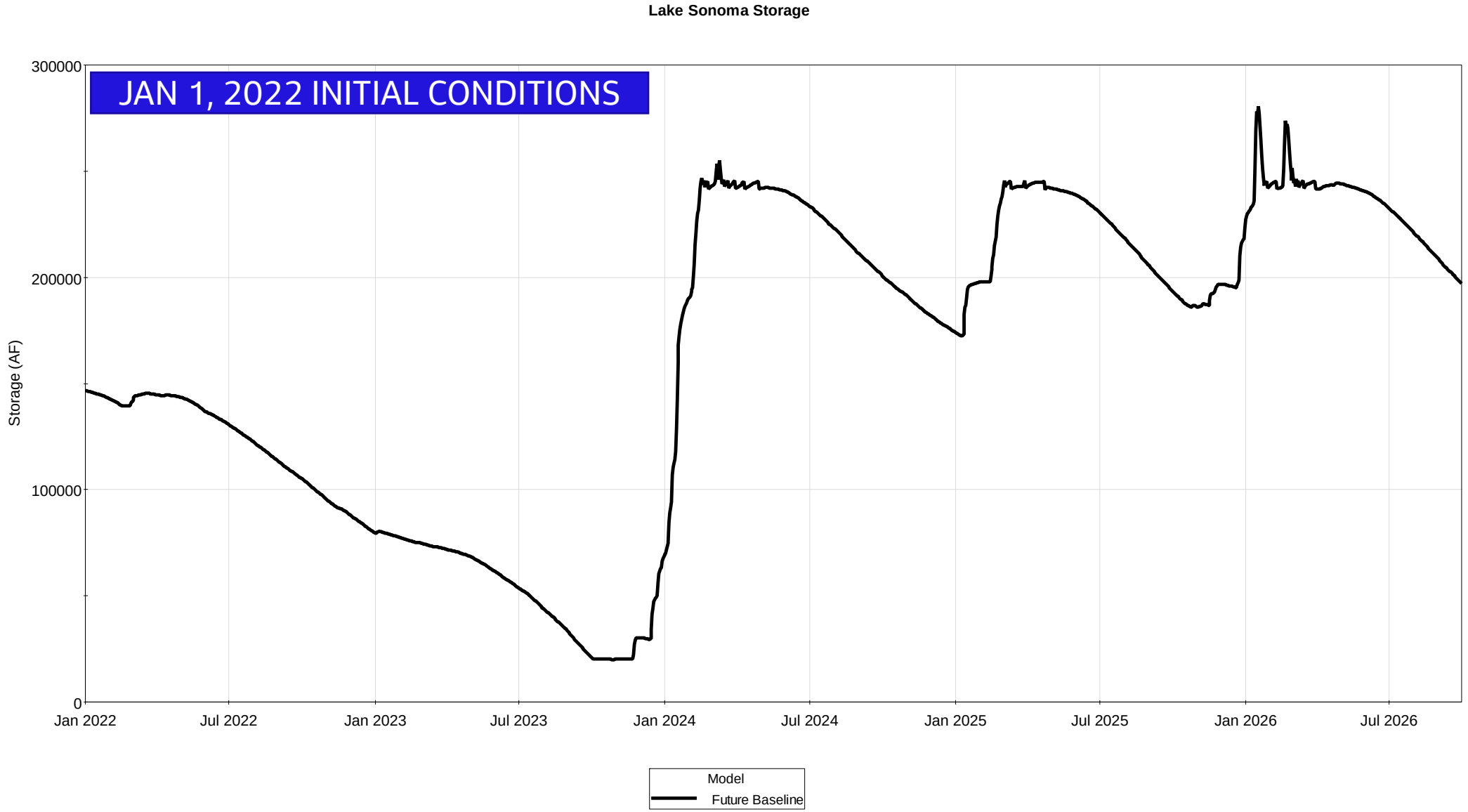
Lake Sonoma – WY 1976-1980 Stress Test Hydrology



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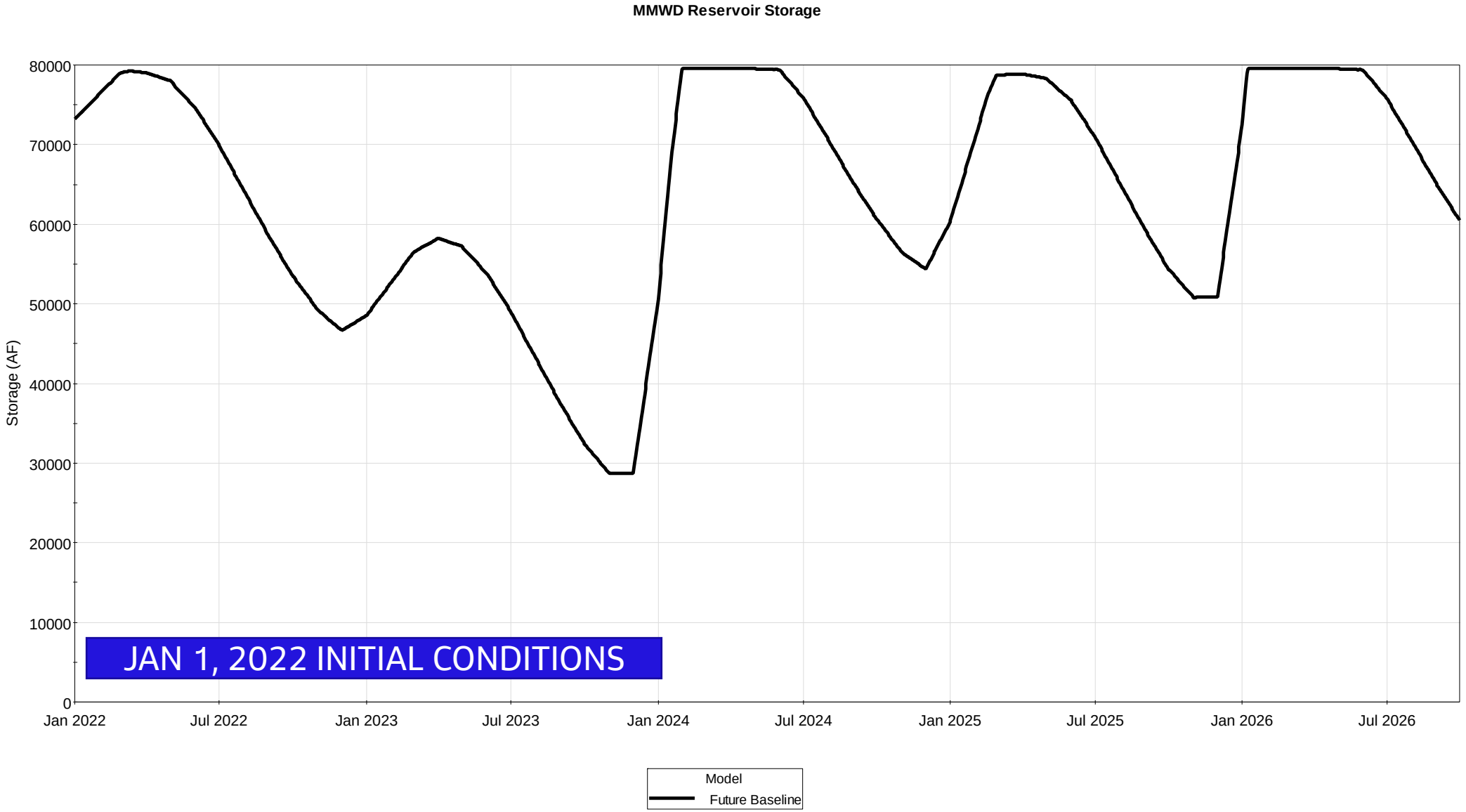
MMWD Storage – WY 1976-1980 Stress Test Hydrology



Scenario does NOT include any actions to mitigate drought impacts

Near-Term Drought Risk has Lessened, but Not Eliminated

- Outlook improved with December storms, but dry January and likely continual dry conditions in February suggest drought risk is still a possibility
- Action is still needed to address residual risks of a continued dry seasonal outlook

Initial Storage Conditions	NO ACTION Projected 5-Year Shortage Total	Shortage as % of Sonoma Water Delivery*	Shortage as % of Total Water Demand*
Nov 1, 2021	25,600 AF	25%	13%
Dec 1, 2021	23,200 AF	23%	12%
Jan 1, 2022	6,900 AF	7%	4%

Drought Management Options

Survey of Range of Drought Management Options

- Jacobs met with most retail customers to develop ideas on range of drought management options
- Synthesized options into 4 major categories
  - Increase supply
  - Reduce demand
  - Improve operations
  - Modify policy and regulations

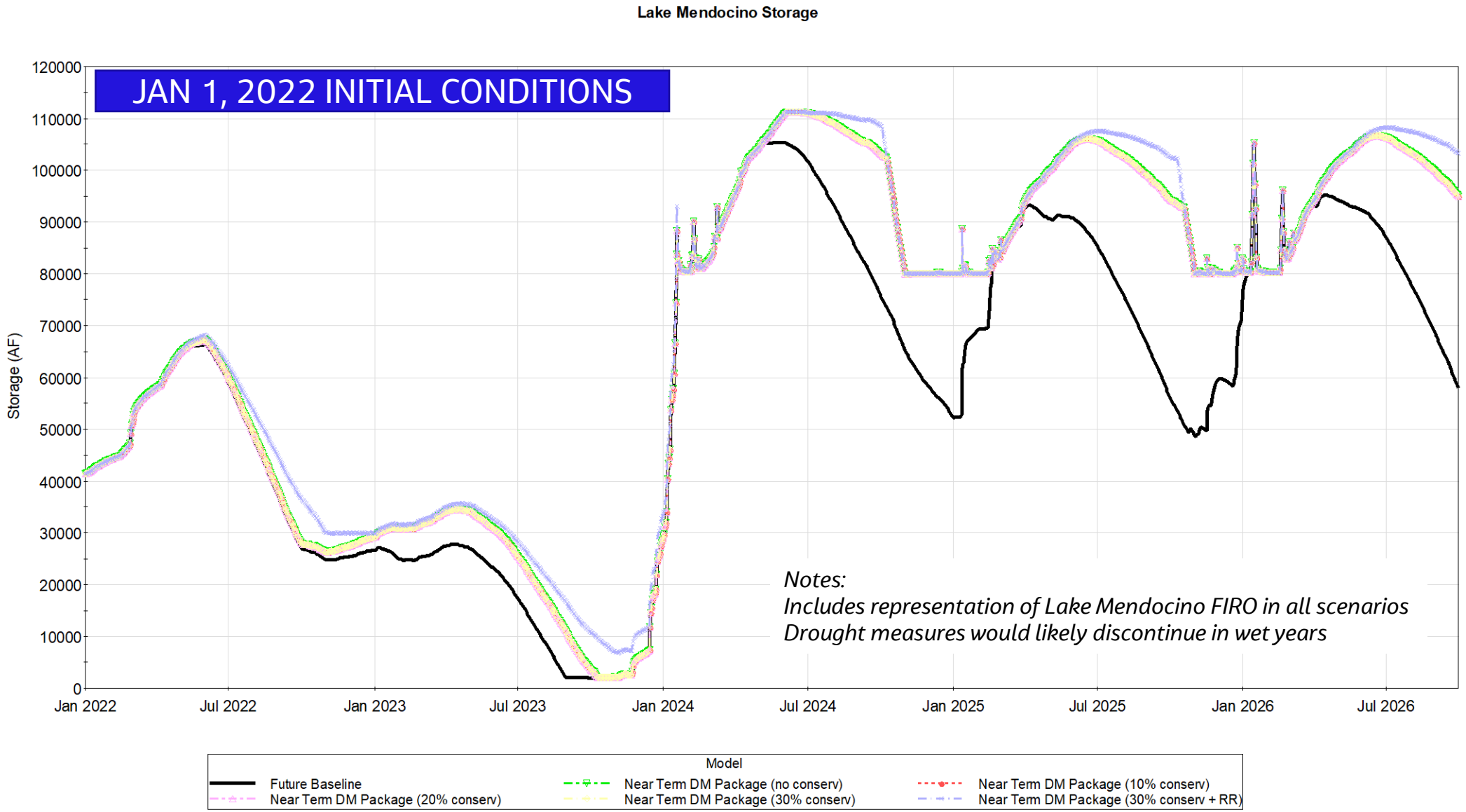
Synthesis of Drought Water Management Options

- **Increase Supply**
  - Increase groundwater production (new or rehabilitated wells)
  - Winter water diversion
  - Regional groundwater bank (Santa Rosa Plain, Sonoma Valley, Petaluma)
  - Alexander Valley FloodMAR
  - Sonoma Developmental Center water supply and forebay for groundwater recharge
  - Expand recycled water supply
  - Ocean desalination and/or brackish water desalination
  - Interconnection with Bay Area supplies (water transfers)
- **Reduce Demand**
  - Water conservation and water use efficiency in agricultural, municipal, and CII sectors
- **Improve Operations**
  - Kastania Pump Station improvements
  - Expand surface storage (Lake Stafford weir, sediment removal)
  - Lake Sonoma Forecast Informed Reservoir Operations (FIRO)
  - Increase recycled water storage
  - Storage operational management levels
  - Lake Mendocino variable gates and outlet channel improvements
- **Modify Policy and Regulations**
  - Regulatory flexibility through TUCPs

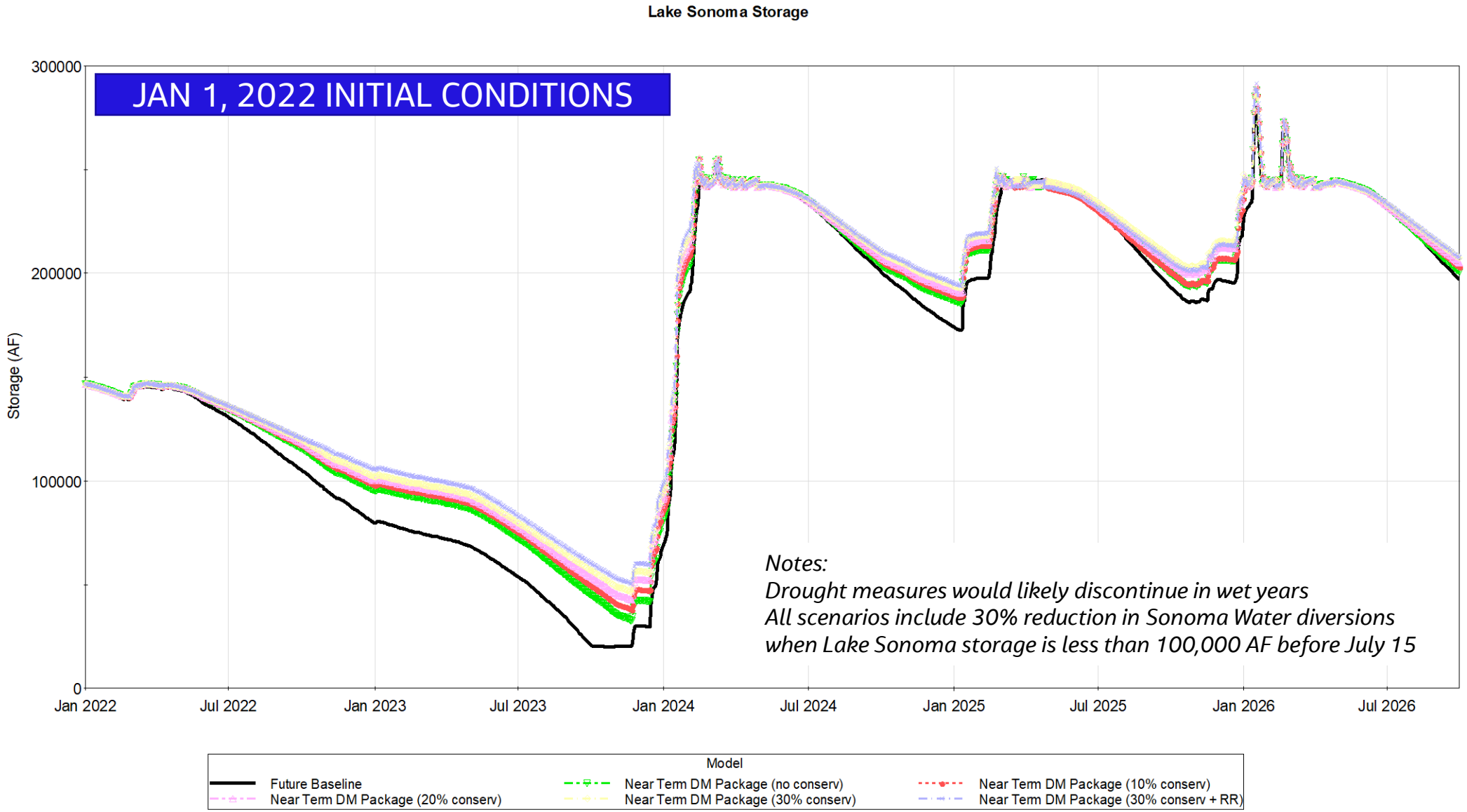
Near-Term Drought Resiliency/Response Actions

- Maximize delivery of natural flows from Russian River system
- Kastania Booster Station rehabilitation
- Increase groundwater production (Sonoma Water)
- Increase groundwater production (Retail Customers)
- Regulatory flexibility through TUCPs
- Water conservation and water use efficiency (Retail Customers and diverters)

Lake Mendocino Storage – WY 1976-1980 Stress Test Hydrology



Lake Sonoma – WY 1976-1980 Stress Test Hydrology



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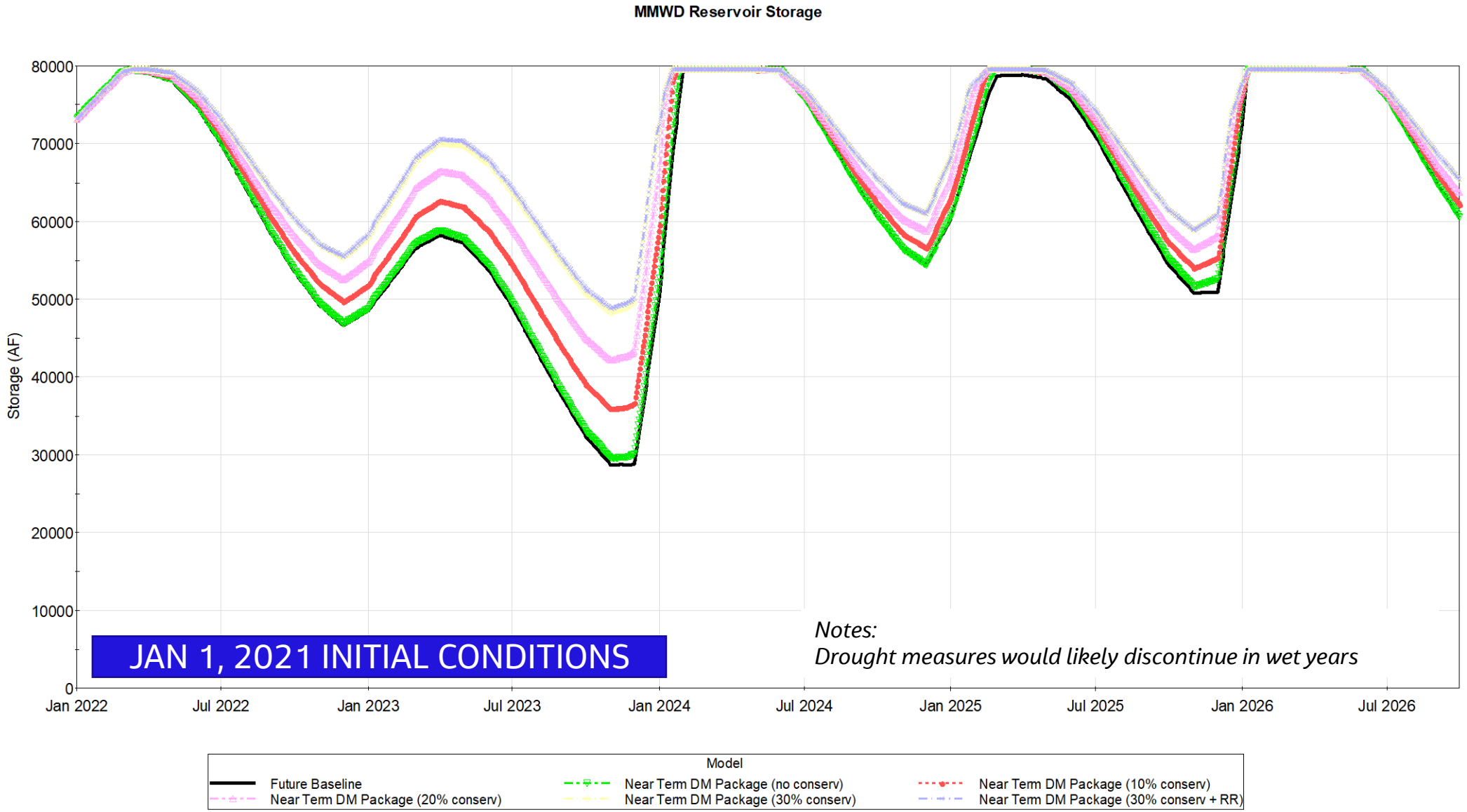
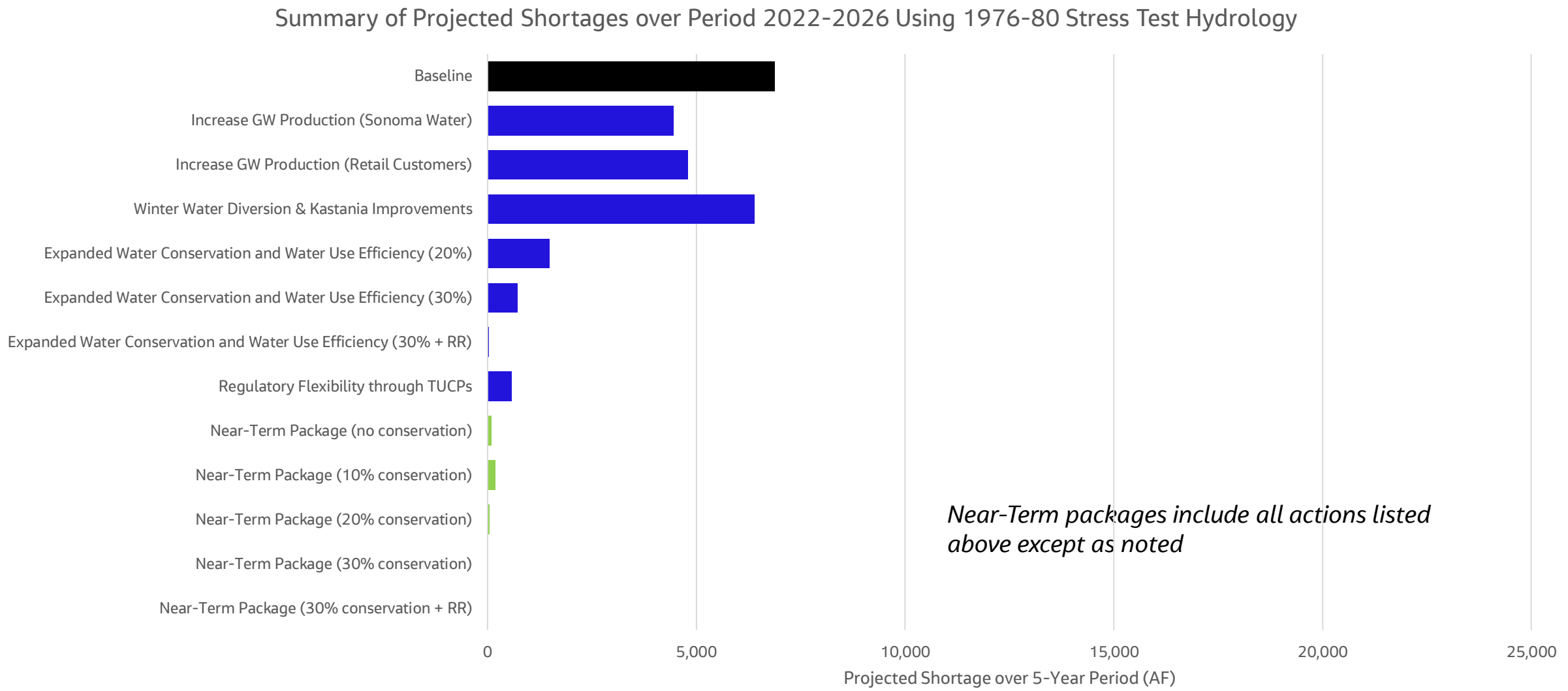


Simulation Results – Near-Term Package Resolves Stress Test Shortages

JAN 1, 2022 INITIAL CONDITIONS



Planning for Longer-Term Droughts

- Early Actions Offer Immediate Opportunities for Resiliency Benefits
  - Water conservation
  - Flexibility through TUCPs
  - Increasing groundwater production (Sonoma Water and Retail Customers)
  - Kastania Pump Station improvements
- Longer-Term Actions Offer Potential for Resiliency during Prolonged, Extreme Droughts
  - Lake Sonoma FIRO
  - Regional groundwater bank
  - Expand winter water diversion
  - SDC water supply
  - Ocean and brackish Desalination
  - Water transfers with Bay Area water agencies
  - Expand surface storage
  - Expand recycled water supply
  - Alexander Valley Flood-Managed Aquifer Recharge

Summary and Recommendations

- DSM Model
  - Russian River, Transmission System, and Retail Customer Systems have been interconnected
  - DSM has been validated for system water supply and operations
  - Representation of retail customer systems is adequate for this level of analysis
  - DSM can simulate individual years or stochastic simulations involving ensemble of hydrology
- Drought Risks
  - Existing hydrologic conditions continue to be challenging
  - December storms have altered near-term drought outlook
  - Unlikely, but possible risk to Lake Mendocino storage and Lake Sonoma storage (2023), and delivery (2023-24)
  - Stress test hydrology of WY 1976-1980 is used to test drought options
- Drought Management Options
  - Near-term package of options resolves stress test shortages
  - *Winter water diversions* and *groundwater production* helps resolve shortages
  - *Conservation* and *regulatory flexibility under TUCPs* is most important in bolstering Lake Sonoma and Mendocino storage
  - Longer-term actions of *regional groundwater bank* and *Lake Sonoma FIRO* will provide benefit for future droughts but require initial wet period to begin storage phase

Next Steps

Next Steps

- Technical memorandum on drought assessment
- Continued updates to the WAC/TAC
- Further review of long-term drought management strategies
- Continue with assessment of resiliency in response to other identified risks (seismic, wildfire, power, water quality, etc)