An Assessment of CVP-SWP System Performance Under Alternative Delta Regulations, Infrastructure and Climate Change Scenarios Using CalSim II

Statewide Water Analysis Network Workshop

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Water Resources Challenges Identified

- Delta Health
- Climate Change
- Drought

Water Resources Management Responses

- New Delta Conveyance
- New Storage
  - Surface Storage
  - Groundwater Banking
- Integrated Regional Water Management Actions

Five Base Scenarios

1. D1641
2. Wanger Restrictions
3. BDCP
4. North-of-the-Delta Offstream Storage (NODOS)
5. SOD Groundwater Bank

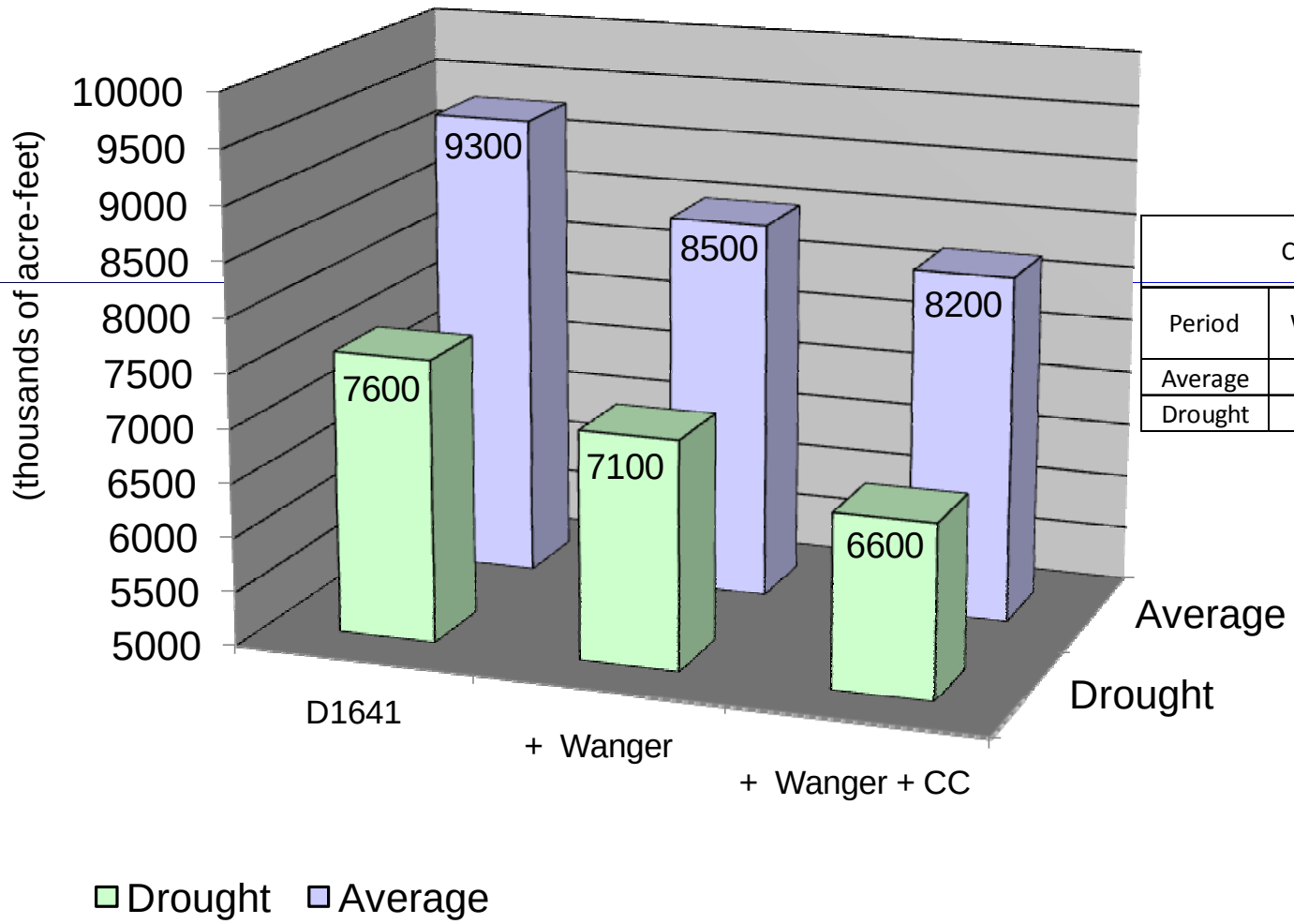
Five Scenarios With Climate Change

- Future Scenarios with Climate Change created from each base scenario (except for D1641 base study)
- One representative climate change scenario (with 1 foot Sea Level Rise) used

General Study Assumptions

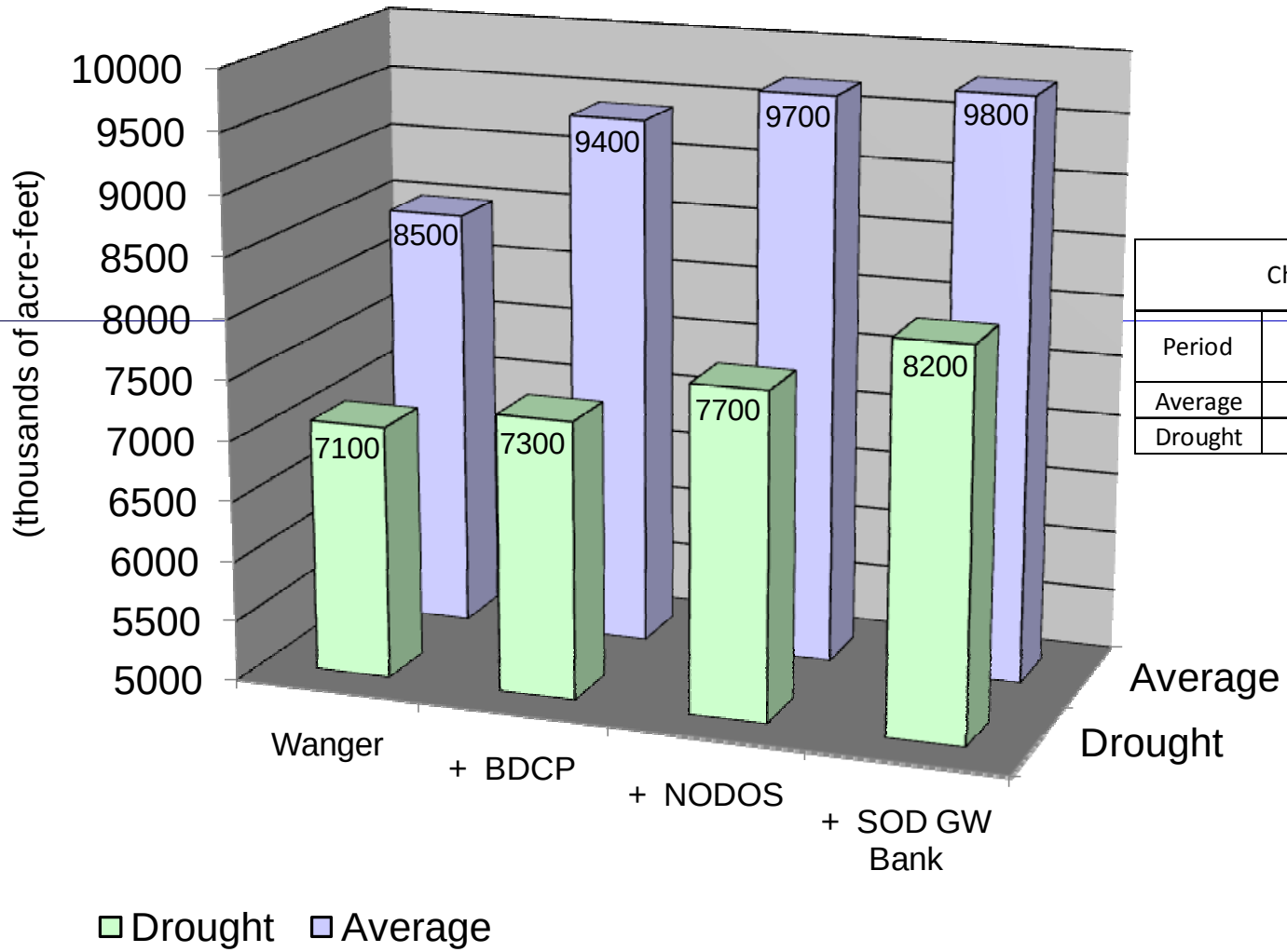
- 2030 Level Of Development (Sac and SJ Valley Land Use and Demands Fixed)
- D1641 Regulations and Operations Criteria
- Present COA Maintained
- CVPIA 3406 (b)(2) Discretionary Actions Modeled
- CVP Demands Per Contract
- SWP demands – Full Table A and Article 21 (to extent possible)

Total CVP & SWP Deliveries (NOD and SOD)



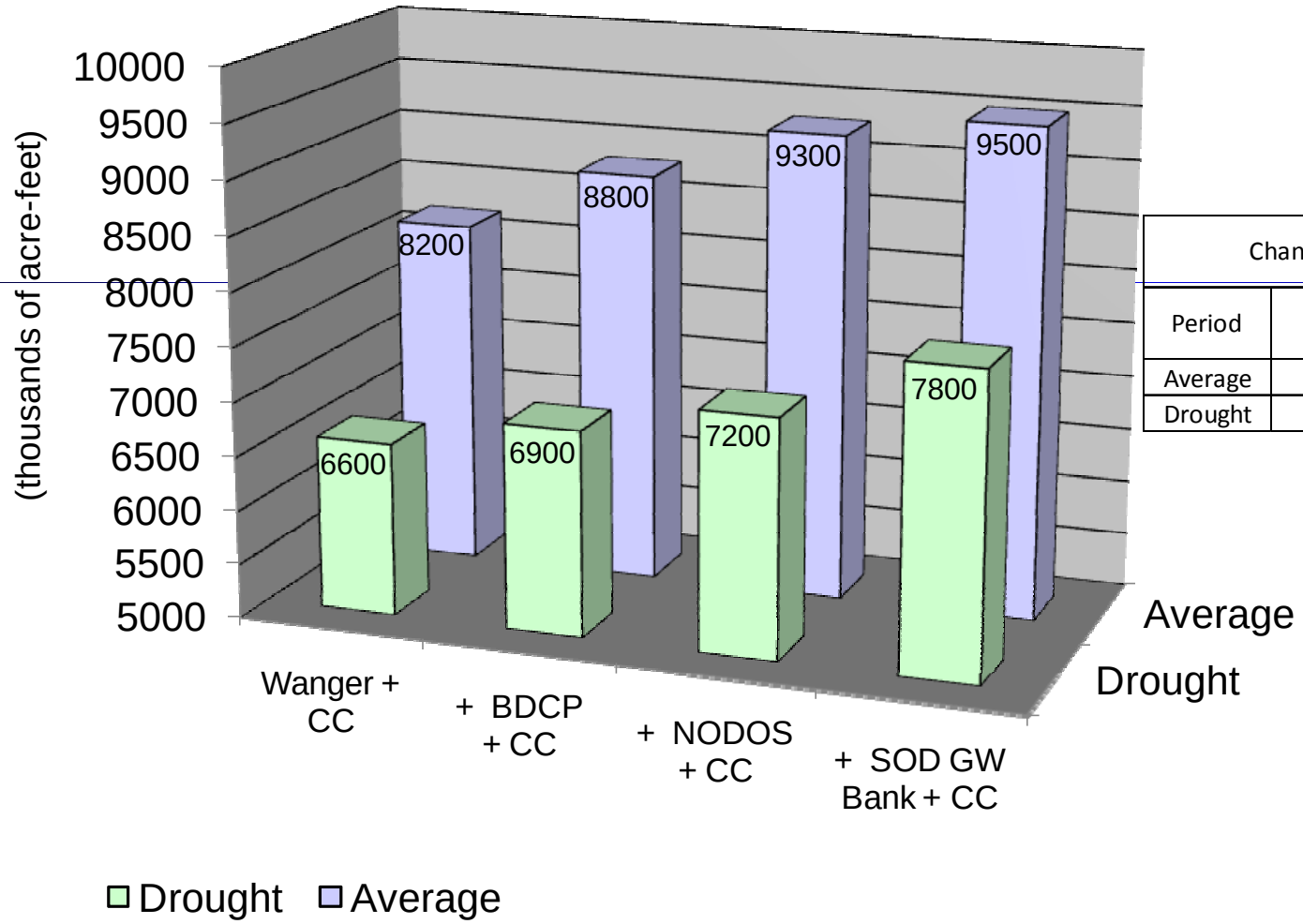
Changes from D1641			
Period	Wanger	CC	Wanger + CC
Average	-800	-300	-1100
Drought	-500	-500	-1000

Total CVP & SWP Deliveries (NOD and SOD) With New Facilities



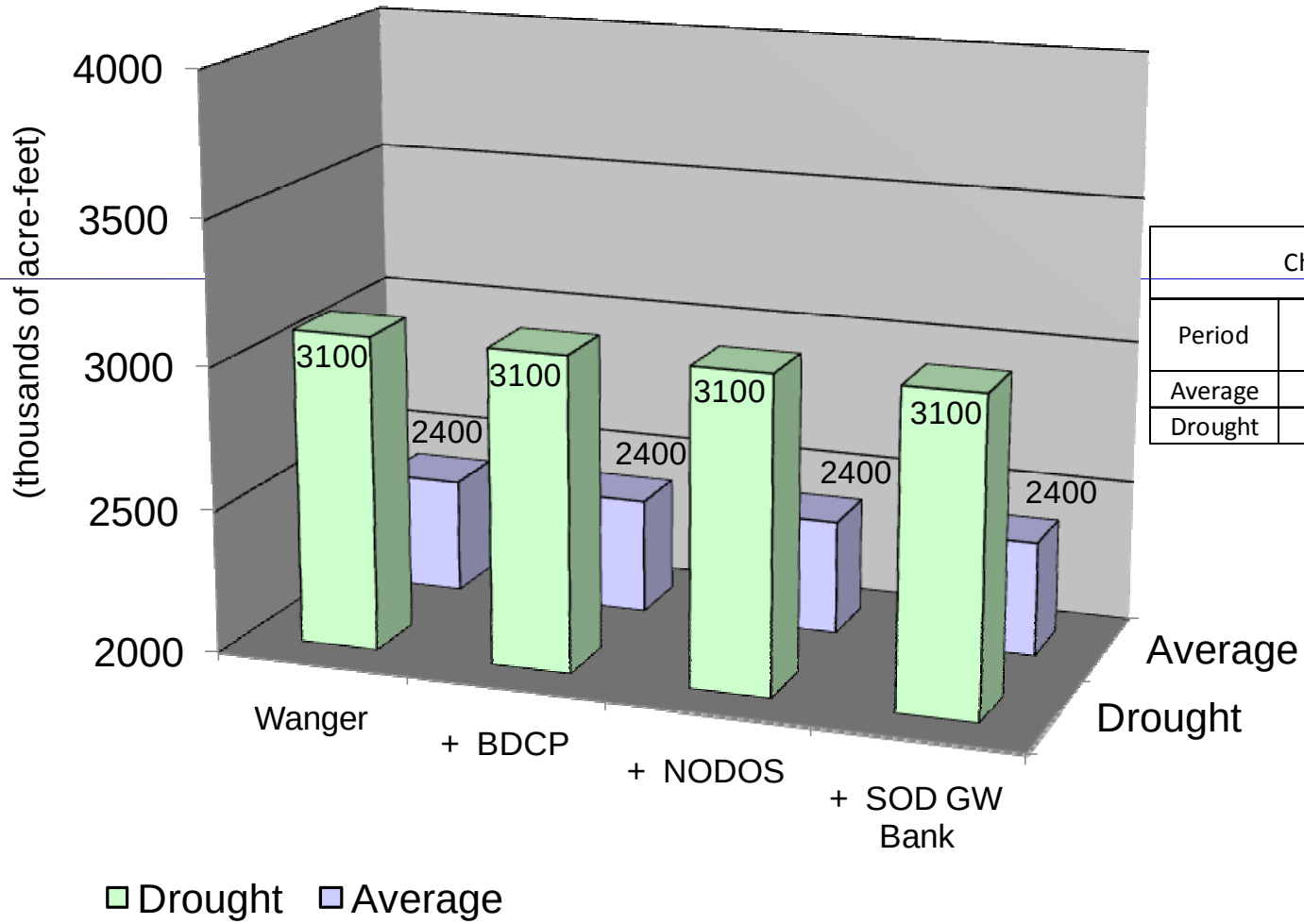
Changes from Wanger			
Period	BDCP	NODOS	SOD GW Bank
Average	900	1200	1300
Drought	200	600	1100

Total CVP & SWP Deliveries (NOD and SOD) With New Facilities and Climate Change



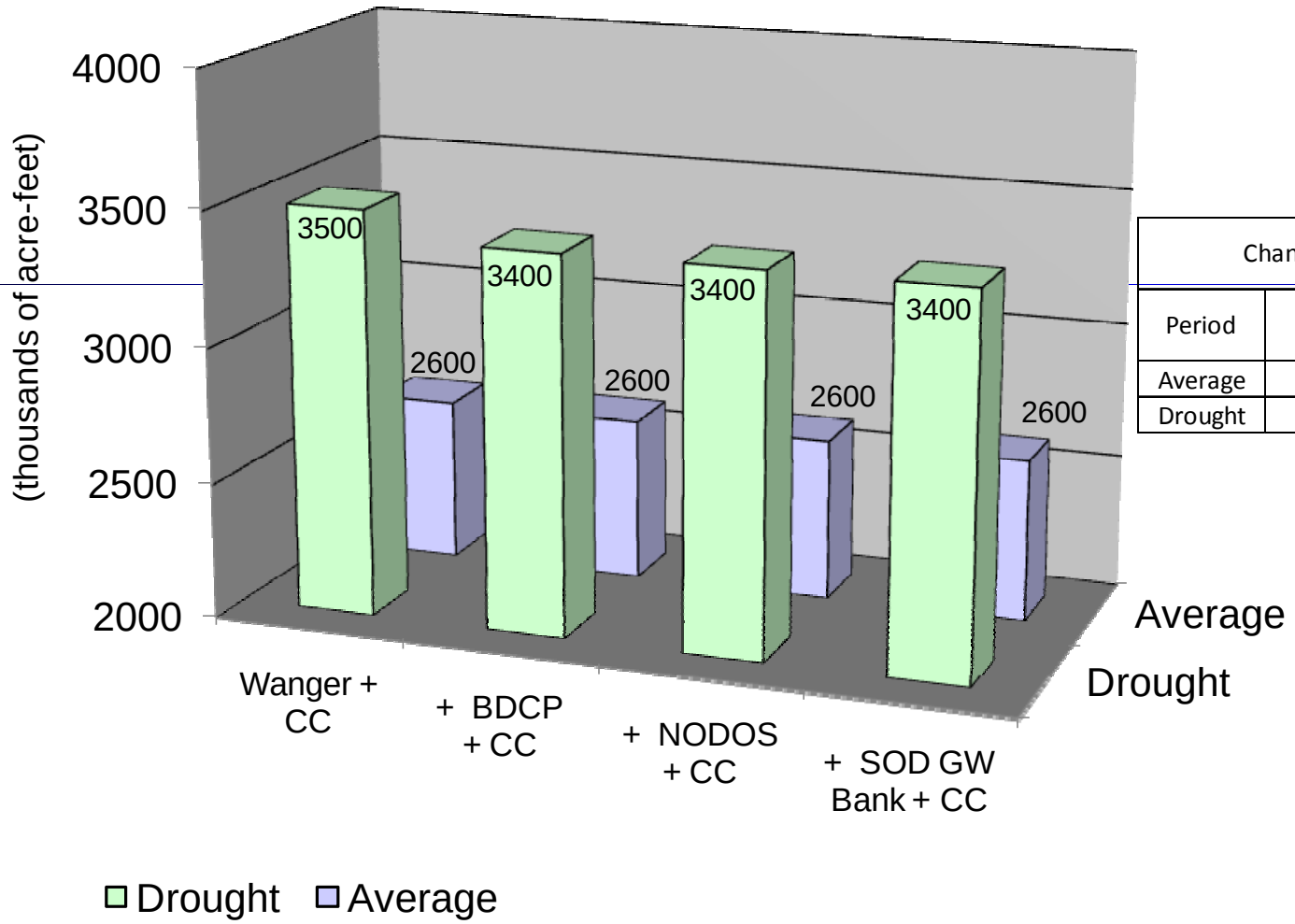
Changes from Wanger + CC			
Period	BDCP + CC	NODOS + CC	SOD GW Bank + CC
Average	600	1100	1300
Drought	300	600	1200

Sacramento Basin Groundwater Pumping
Without Climate Change



Changes from Wanger			
Period	BDCP	NODOS	SOD GW Bank
Average	0	0	0
Drought	0	0	0

Sacramento Basin Groundwater Pumping With Climate Change



Changes from Wanger + CC			
Period	BDCP + CC	NODOS + CC	SOD GW Bank + CC
Average	0	0	0
Drought	-100	-100	-100

Numbers of Dead Storage Months for North-of-Delta Reservoirs from Climate Change

Scenario	Trinity	Shasta	Oroville	Folsom	Total
D1641	3	6	0	6	15
(+) Wanger with CC	9	24	21	25	79
(+) BDCP with CC	12	21	10	39	82
(+) NODOS with CC	15	24	17	42	98
(+) SOD GW Bank with CC	17	27	23	46	113

Summary Observations

- New conveyance and new storage provide reliability benefits under most future scenarios.
- New storage provides the greatest supply reliability benefits under drought or climate-changed conditions.

Observations (continued)

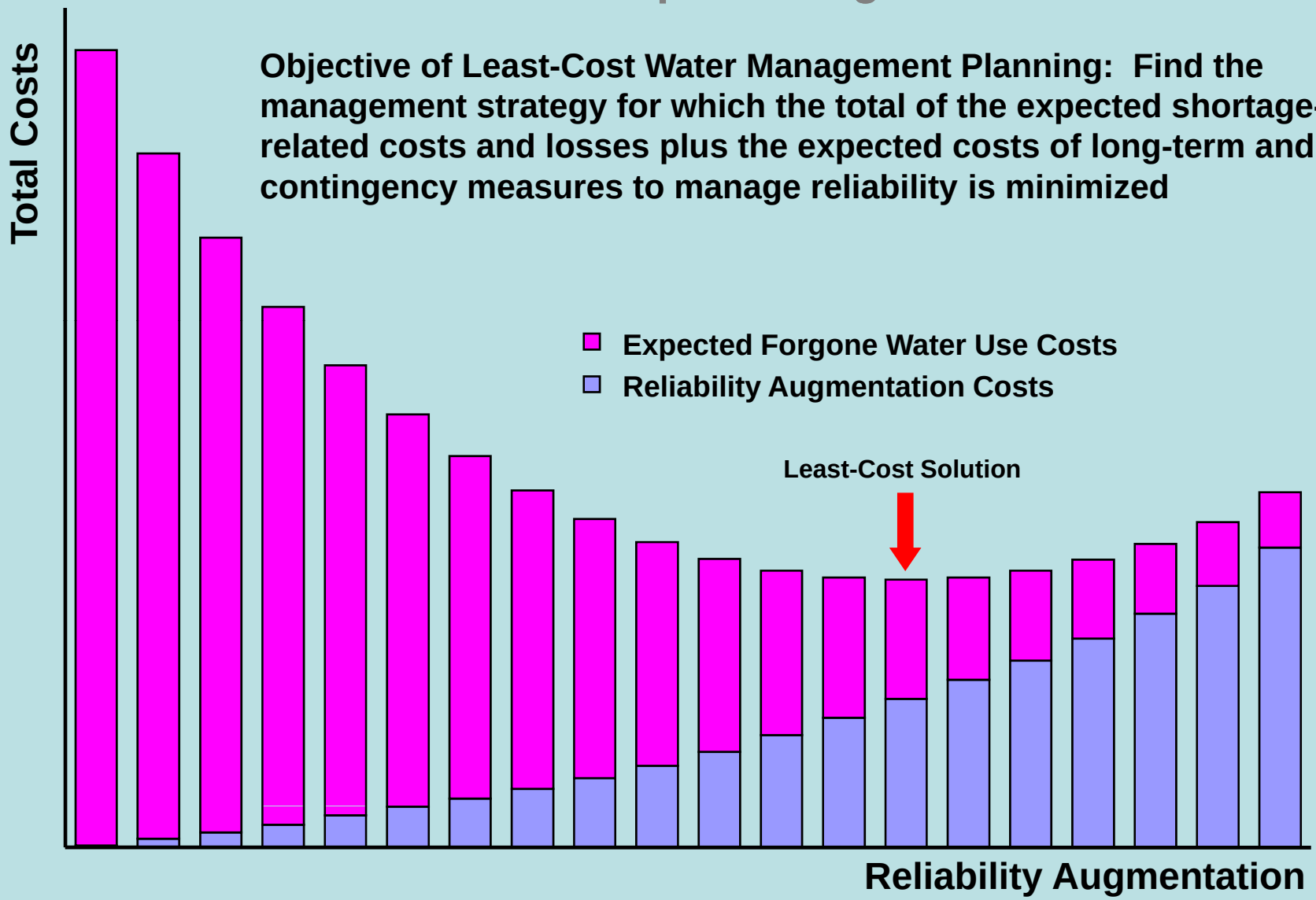
- New groundwater storage performs similarly, with even greater drought year performance. New groundwater storage performs best during both climate-changed and drought conditions.
- A range of IRWM implementations do not appear to significantly affect Delta operations or deliveries.
- The relative frequency of dead storage conditions in upstream reservoirs indicate that significantly modified operations will be required with climate-changed conditions.

Recommendations

- ***We recommend that all twelve climate change scenarios be evaluated for at least one future to demonstrate the sensitivity of the system to hydrologic changes associated with climate.***
- ***We recommend that DWR develop a reoperation strategy for the CVP and SWP that includes modified operations scenarios to mitigate the effects of dead storage during climate change conditions prior to release of any studies (either these or BDCP) that include climate change.***
- ***We recommend that economic modeling and results be completed and included with prepared information.***

Least-Cost Water Management Planning Conceptual Diagram

Objective of Least-Cost Water Management Planning: Find the management strategy for which the total of the expected shortage-related costs and losses plus the expected costs of long-term and contingency measures to manage reliability is minimized



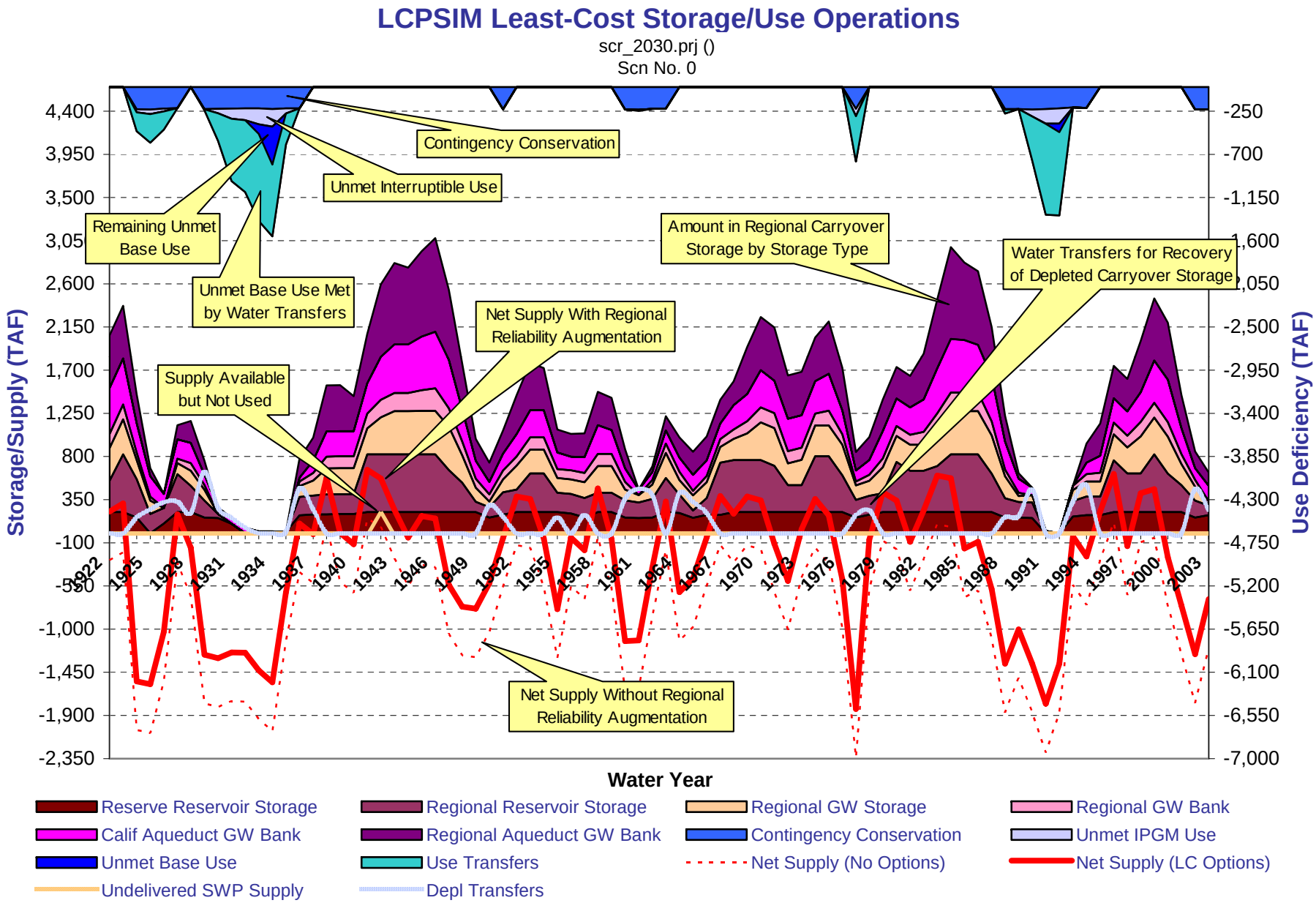
LCPSIM Description

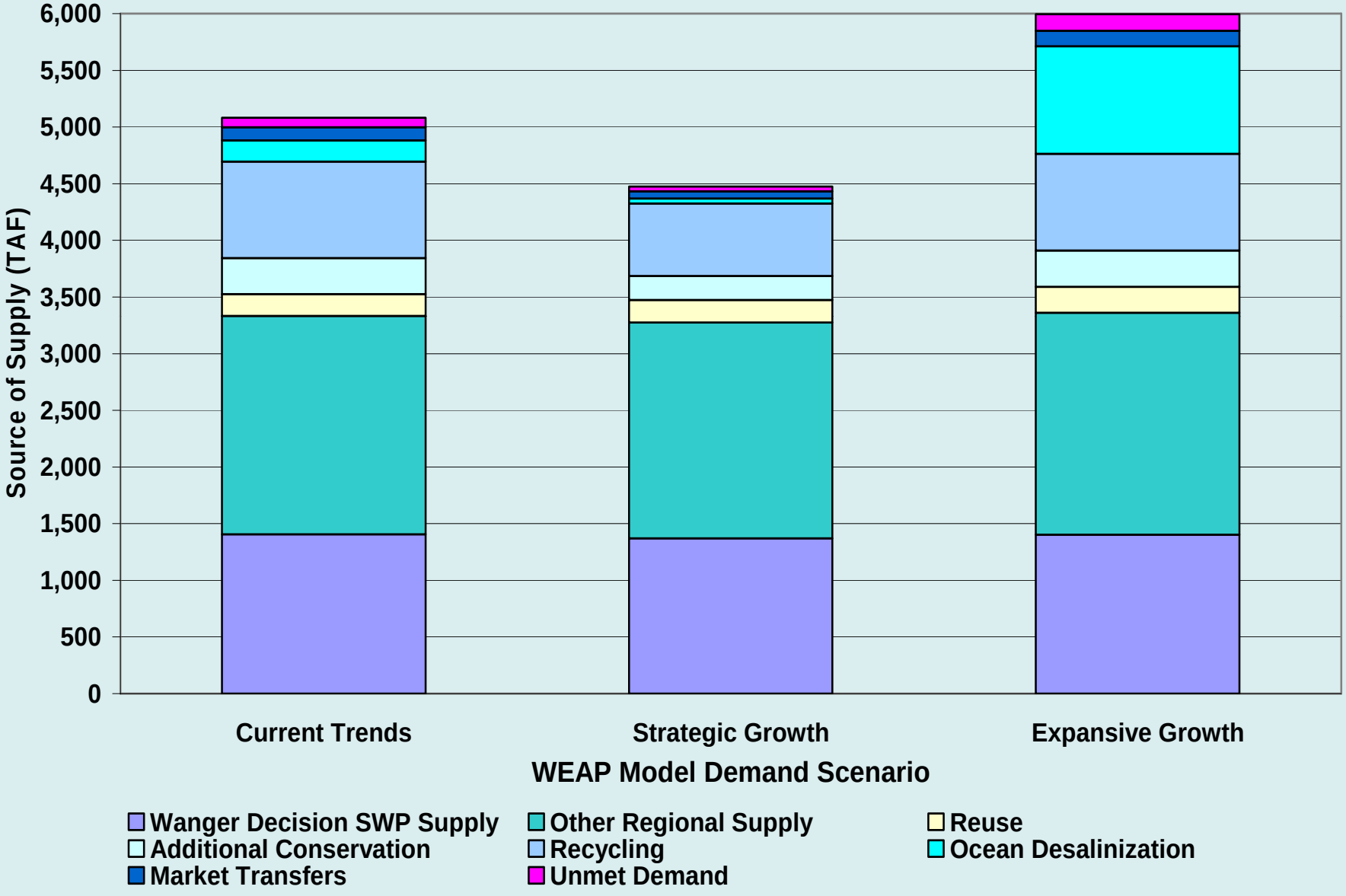
- Designed to identify a statewide economic interest in supporting imported urban supply projects after all economically efficient regional self-sufficiency actions have been taken, including regional interconnections and management policies that mitigate shortage impacts
- Priority-based (where should the water go?), mass balance-constrained (water in equals water out) linear programming is used to simulate regional water management operations on a yearly time step (currently 82 years of historical hydrology) for a fixed level of development (e.g., 2030)
- Operations include prioritized management of regional surface and groundwater carryover storage (eleven storage operations currently used to represent the South Coast region)
- Delta to tap—simulates all operations costs, including cost of conveyance from the Delta

LCPSIM Description - Cont.

- Quadratic programming is used to minimize the incremental cost of adding to reliability with available regional supply and conservation options when iterating to find the least-cost management solution
- Economic losses due to shortage-related forgone water use are based on single-family residential water user demand and shortage allocation logic for five urban water user types
- Losses are adjusted to reflect the level of use of long-term conservation measures (demand hardening)
- Annual water market purchases are simulated by quadratic programming, generating the least-cost combination of regional economic losses and transferred water cost
- Data-driven for flexibility (e.g., carryover storage operations are added by including a line of parameters in a text file)

Operations Trace Example



Preliminary LCPSIM Results

South Coast Region Water Management Example