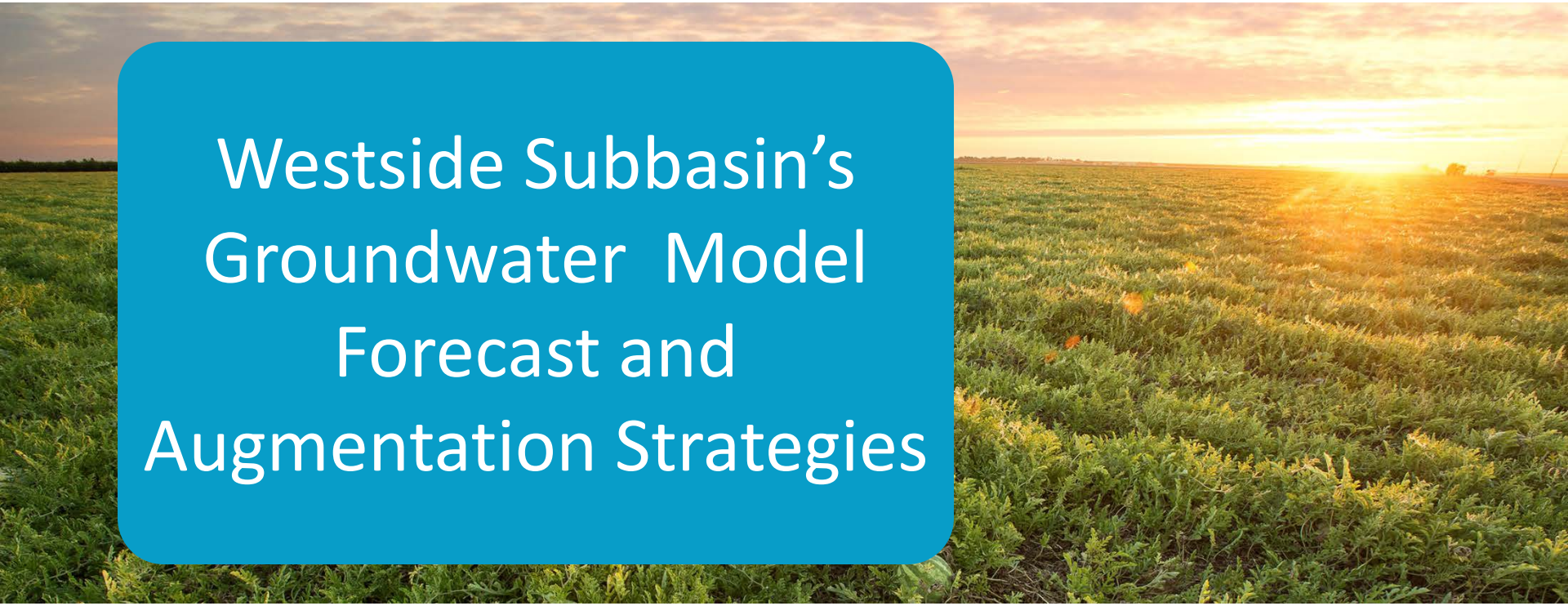
Westlands Water District



Westside Subbasin's Groundwater Model Forecast and Augmentation Strategies

WWD's Special Board Meeting
April 3, 2019

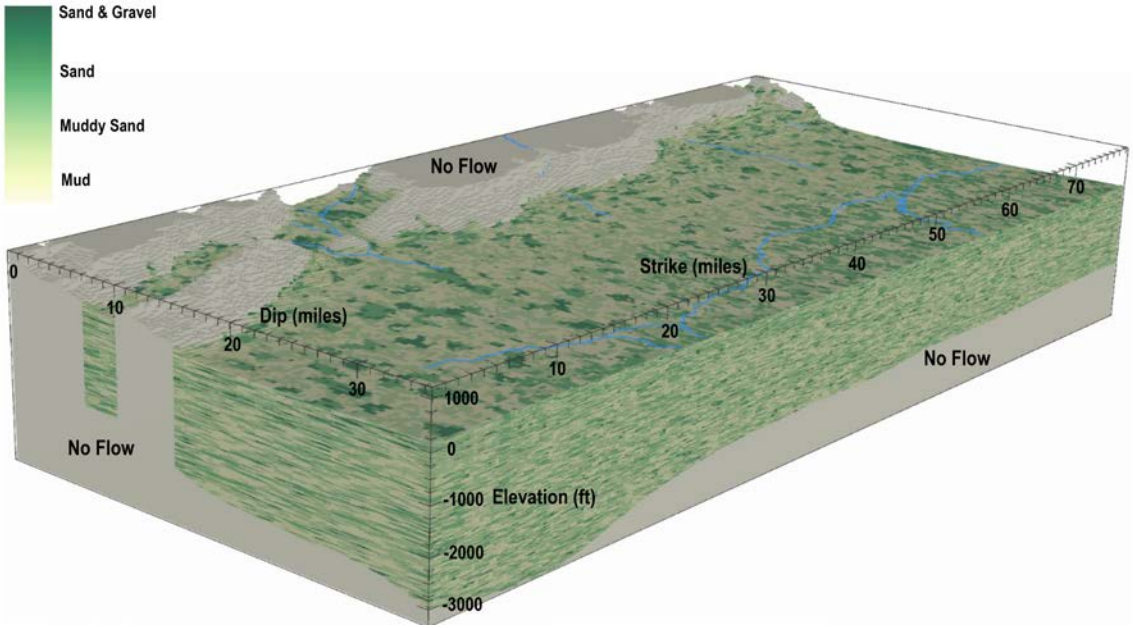
Outline

- Model Updates
- Predictive Scenario Development
- Modeling Results
- Summary
- Groundwater Management Strategies
- Questions

WWD

Model Updates

- Incorporated updated well construction and surface water deliveries in adjacent subbasins
- Refined farm delineation in adjacent subbasins
- Updated aquifer properties
- 9/17/18 Workshop
  - https://wwd.ca.gov/wp-content/uploads/2018/09/gw-modeling-ws-en.pdf



WWD

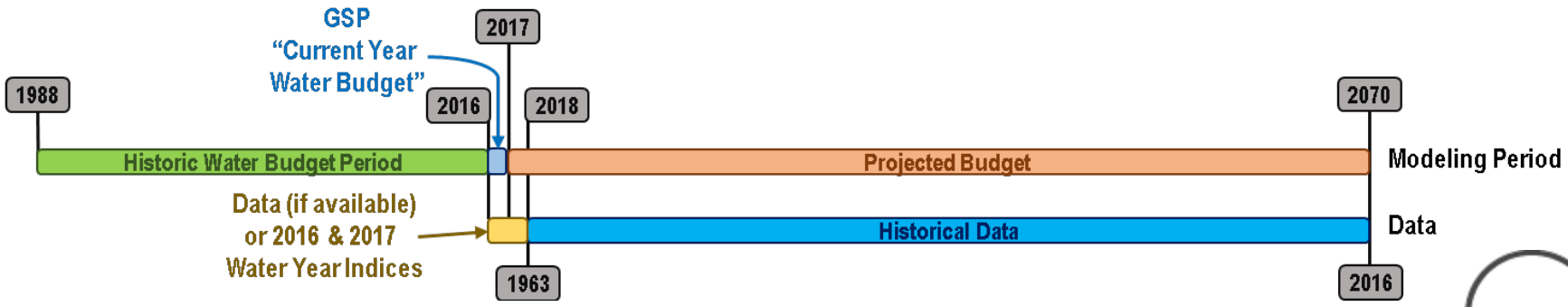
Projected Water Budget Scenarios

- Baseline Projected Model
- Scenario 1: Supplemental Surface Water Delivery
- **Scenario 2:** Variable Irrigated Acreage
- **Scenario 3:** Aquifer Storage and Recovery
- **Scenario 4:** Groundwater Pumping Redistribution
- **Scenario 5:** Groundwater Pumping Reductions in Sensitive Areas with Supplemental Supplies

WWD

Projected Water Budget and Scenario Assumptions

- Water Budget Period: 2017 – 2070
- Monthly stress periods (660 total)
- Aquifer properties, well construction and initial conditions from calibrated model
- Model stresses using historical hydrology (1963 – 2015)



WWD

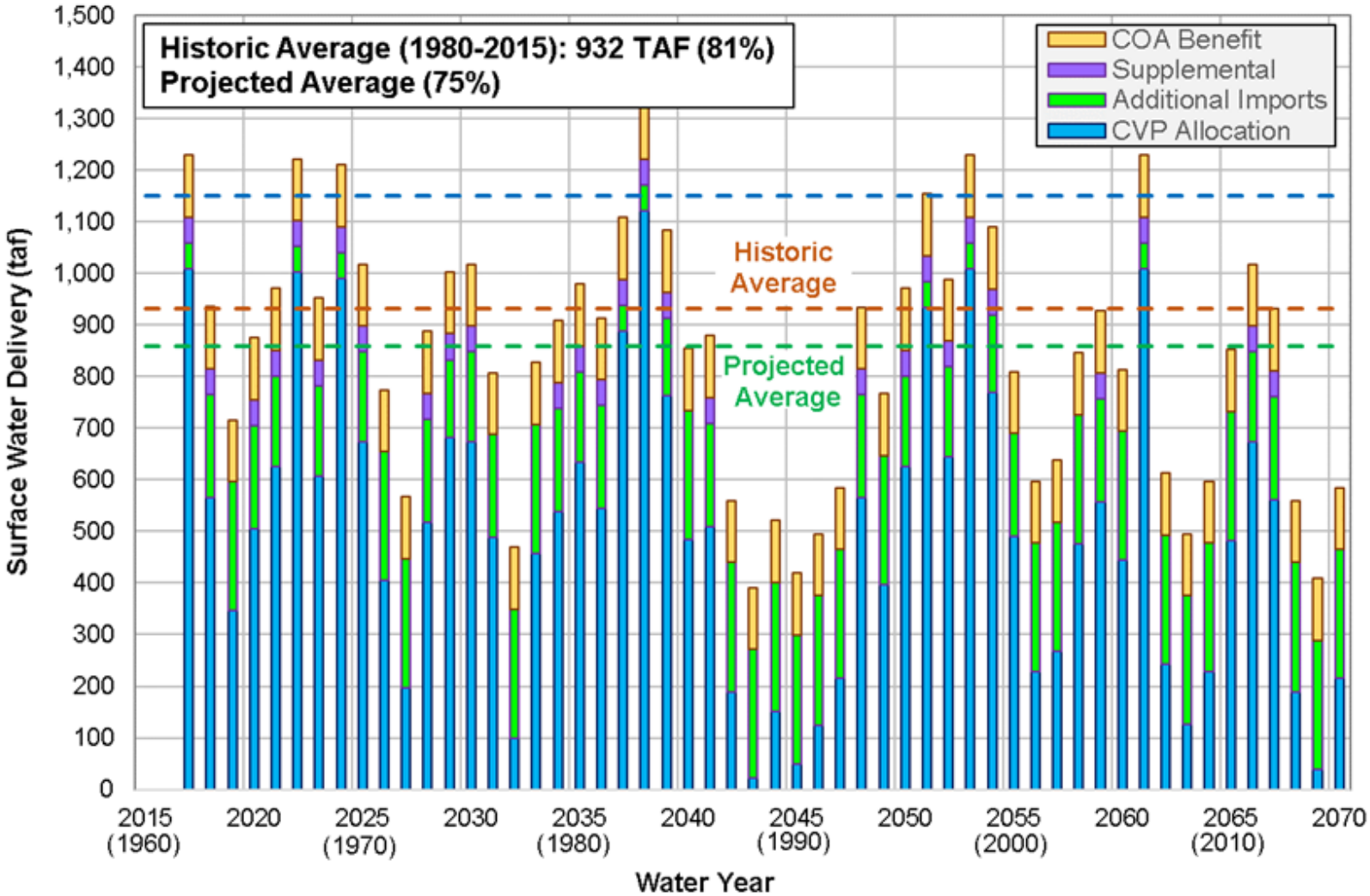
Surface Water Deliveries

- Surface Water Sources
  - CVP deliveries average about 44% of 1.195 MAF allocation*
  - Non-CVP supplies
  - Supplemental water in wet years (included in Scenarios 1-5)
  - Additional Coordinated Operations Agreement benefit (to be Included in model)
- Annual amounts assigned to each month based on irrigation demand

* Original Coordinated Long-Term Operation of the Central Valley Project and State Water Project - Draft Environmental Impact Statement

WWD

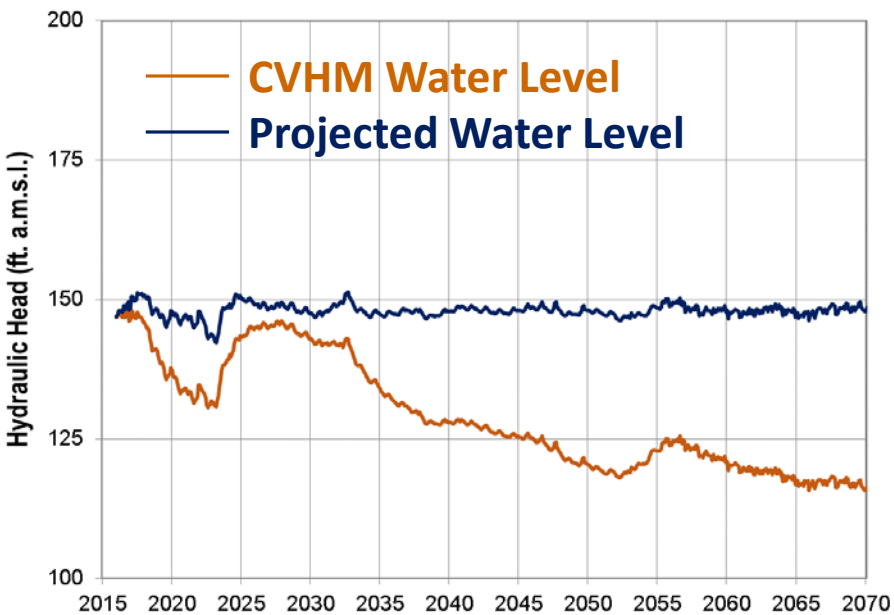
Annual Surface Water Deliveries



WWD

Lateral Boundary Conditions

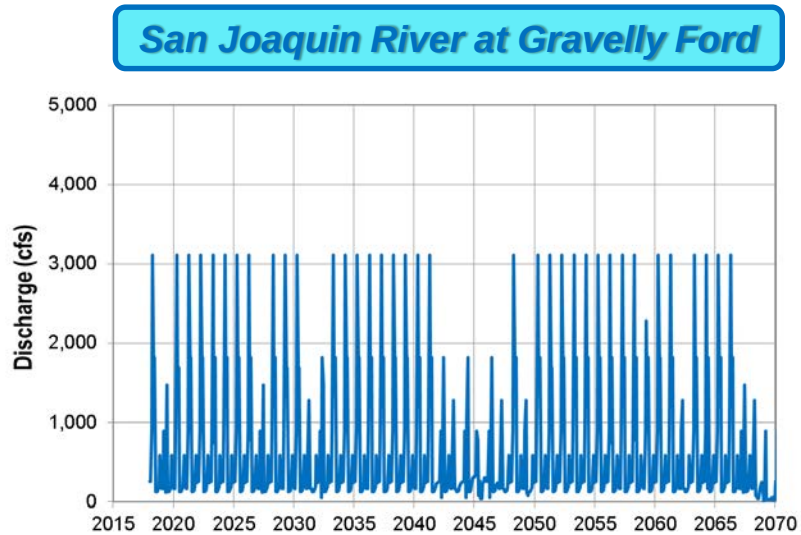
- Based on historic water levels simulated using the Central Valley Hydrologic Model (CVHM)
- Water levels adjusted so average long-term water levels do not vary: SGMA influence
- Incorporate short-term variability corresponding with hydrologic year-type

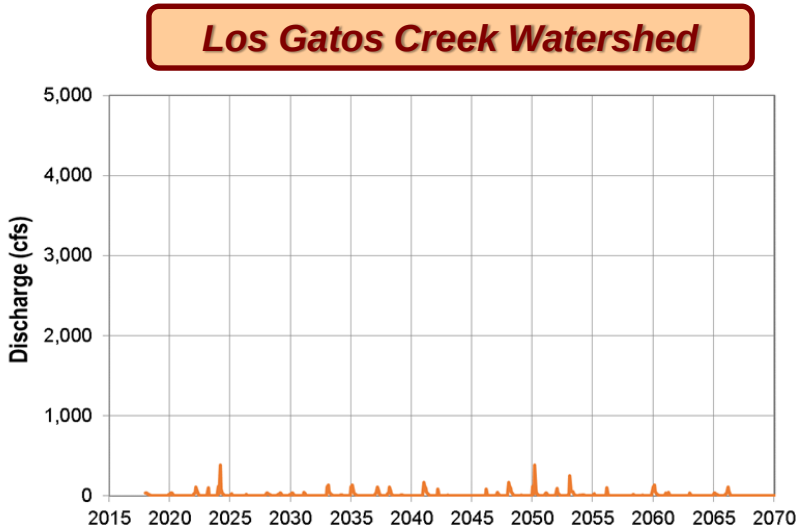


Example Water Level from One Cell at Model Boundary

WWD

Climate and Streams

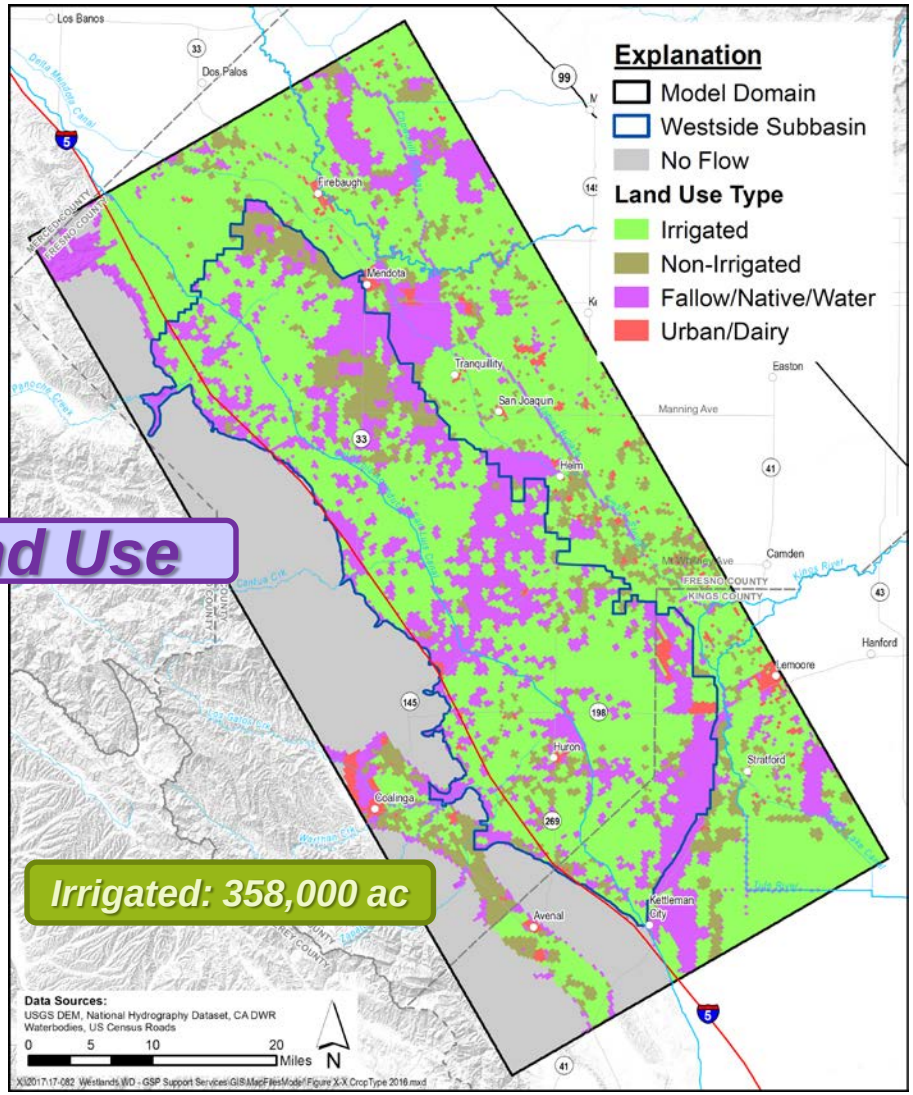




- Precipitation, reference ET and streams simulated using historic data
- Similar water year types based on DWR – San Joaquin Valley Water Year Index used to fill data gaps
- Flows in San Joaquin River assigned using **SJRRP Guidelines** based on historic unimpaired inflow into Millerton Reservoir

WWD

2016 Land Use



2016 Land Use

Irrigated: 358,000 ac

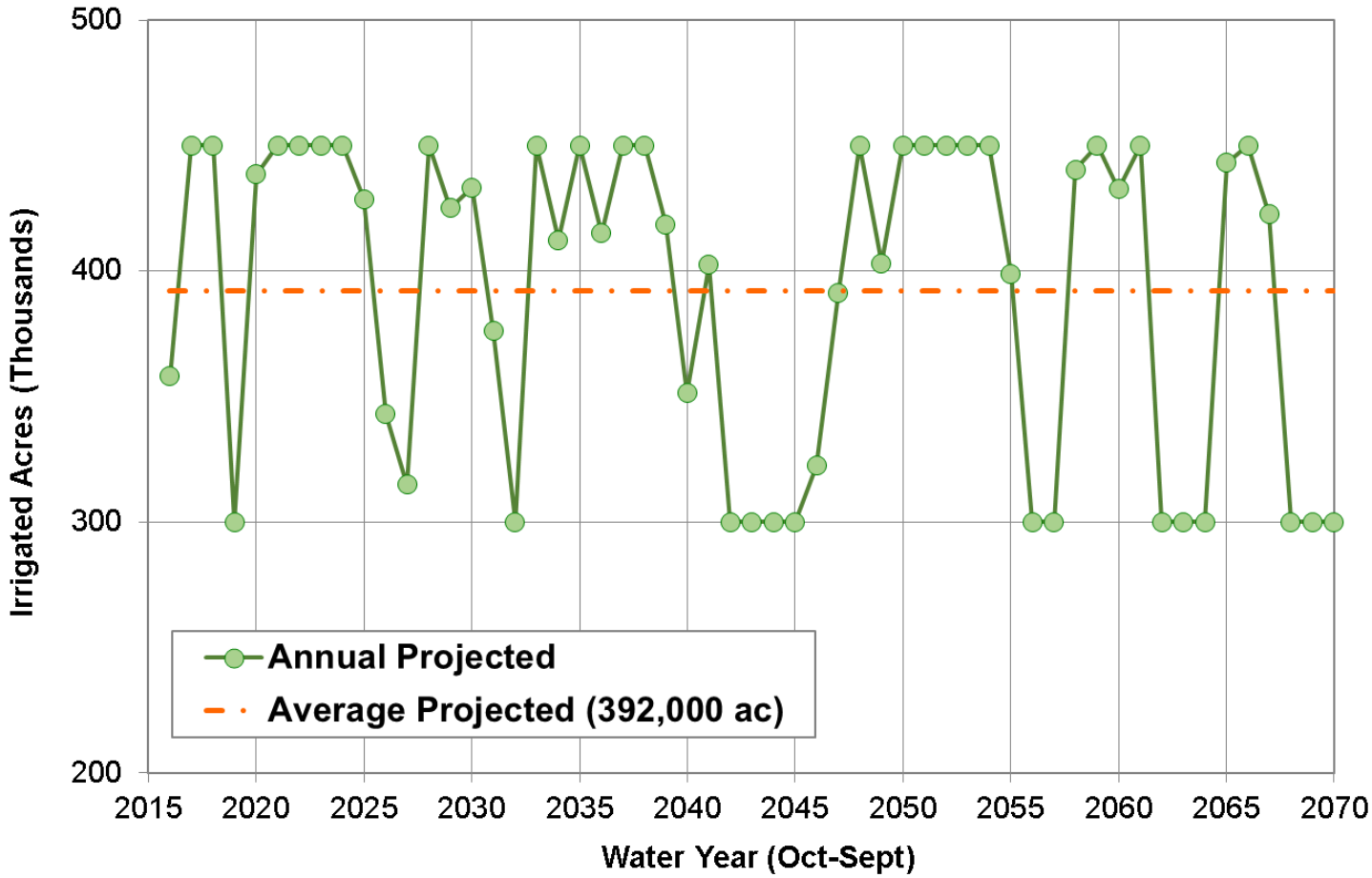
WWD

Land Use Assumptions

- Based on 2016 Land Use
- Irrigated land adjusted annually from **300,000** to **450,000** acres
- Adjustment based on available surface water and precipitation with conjunctive use
- Adjacent irrigated acreage adjusted to reflect water supply
  - Annual average of ≈ **300,000 acres**

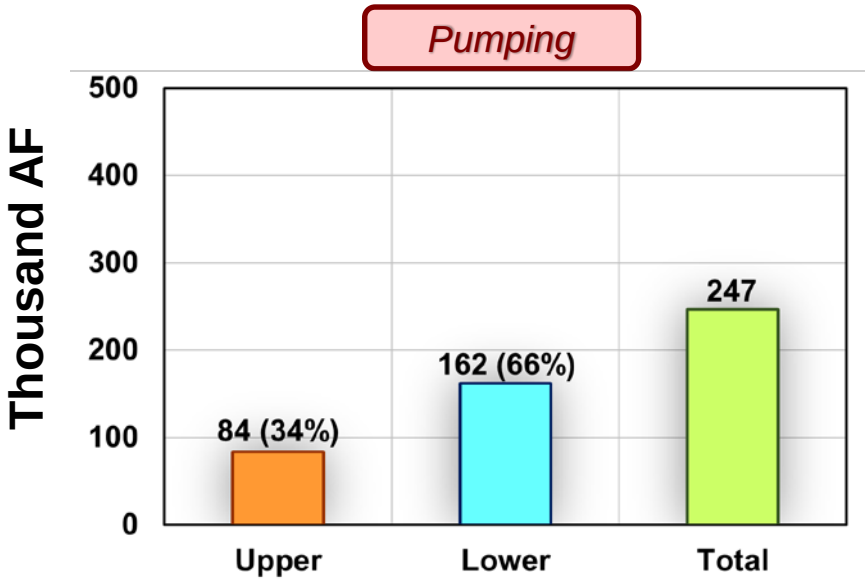
WWD

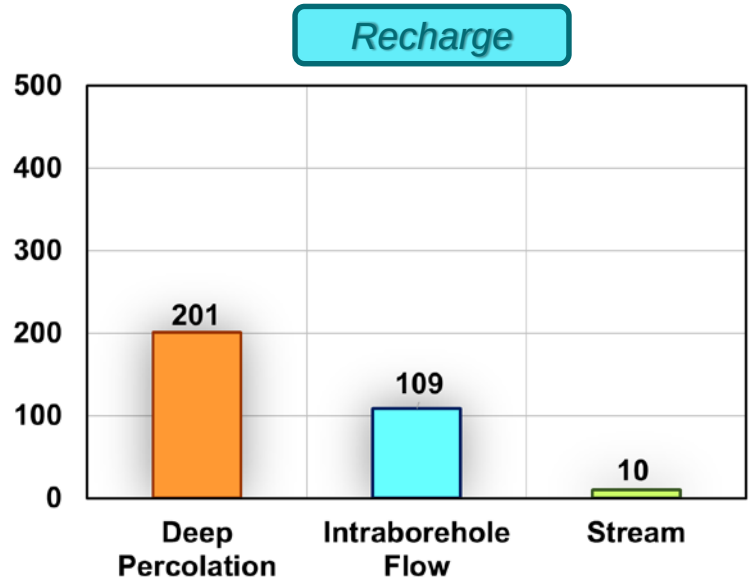
Irrigated Land - Westlands Water District

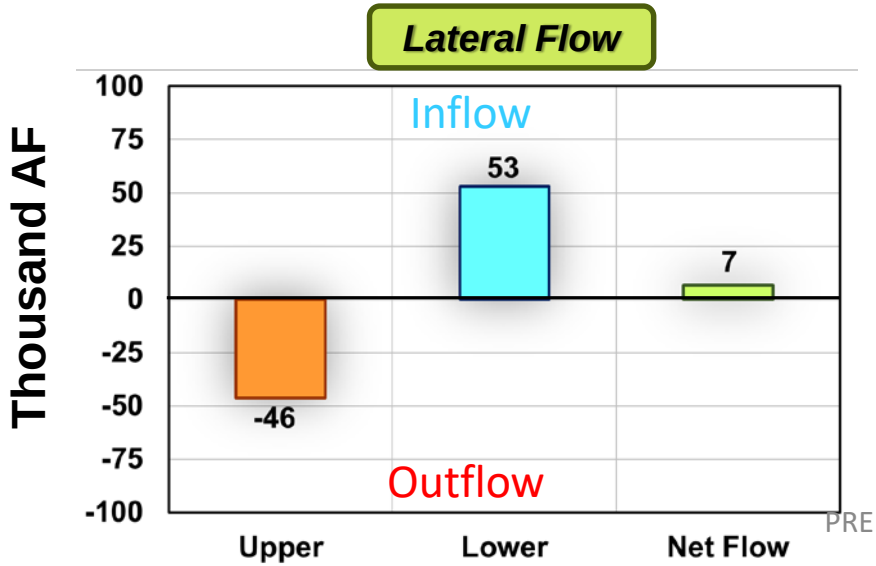


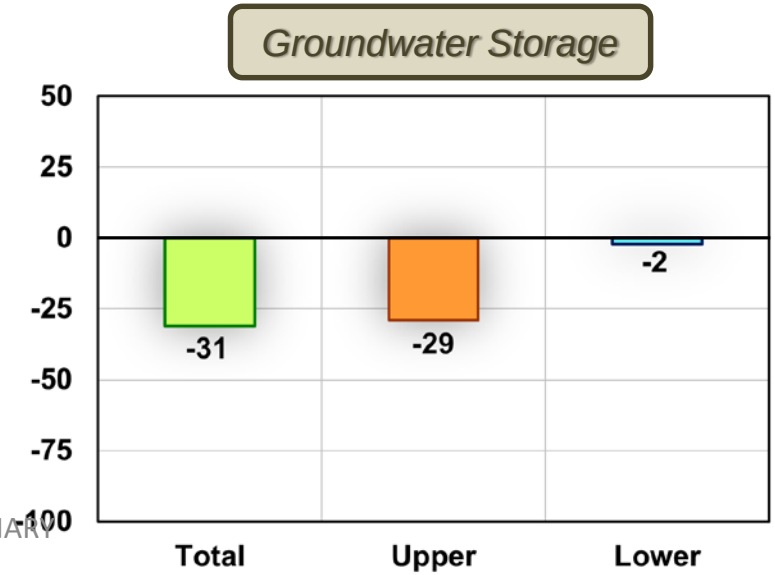
WWD

Scenario 2 Model Results – Water Budget









PRELIMINARY

Sustainable Yield

Sustainable Yield:

The amount of groundwater that can be withdrawn from an aquifer on a sustained basis without creating significant and unreasonable undesirable effect:

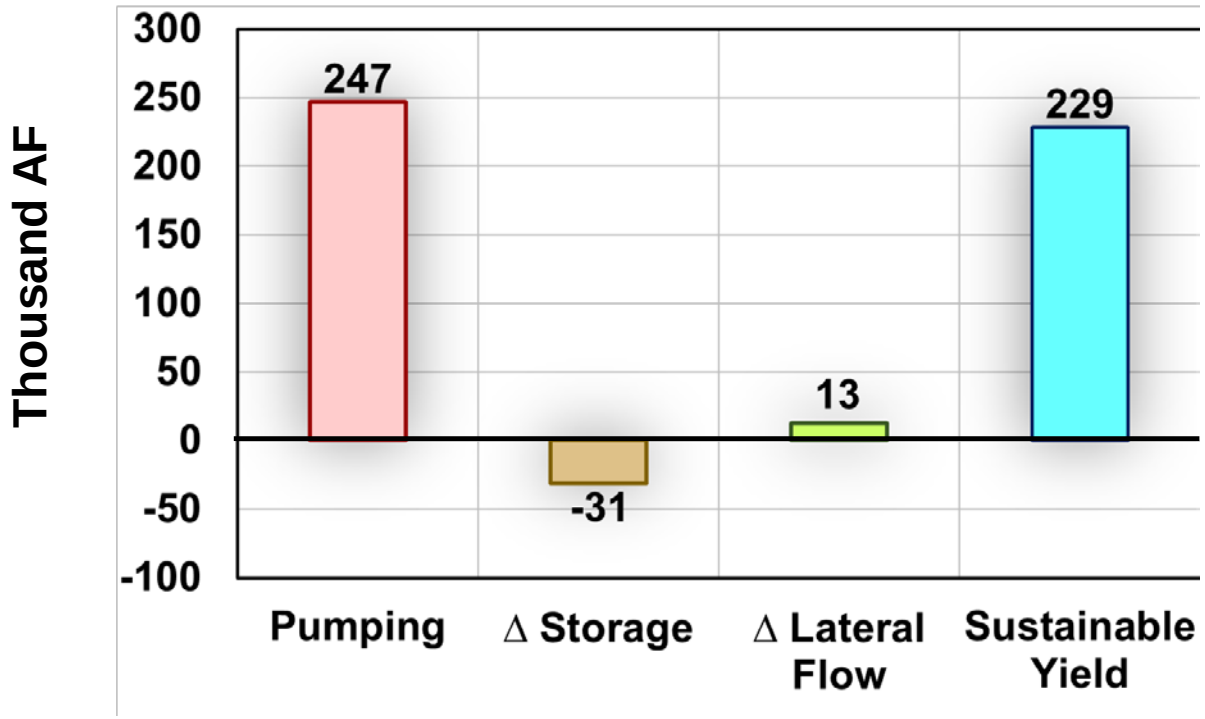
Gross change in **Groundwater Storage** can be used as a subbasin scale approximation of other undesirable results:

- Added condition that there is no significant change in **Lateral Subsurface GW Flow** between adjacent subbasins

WWD

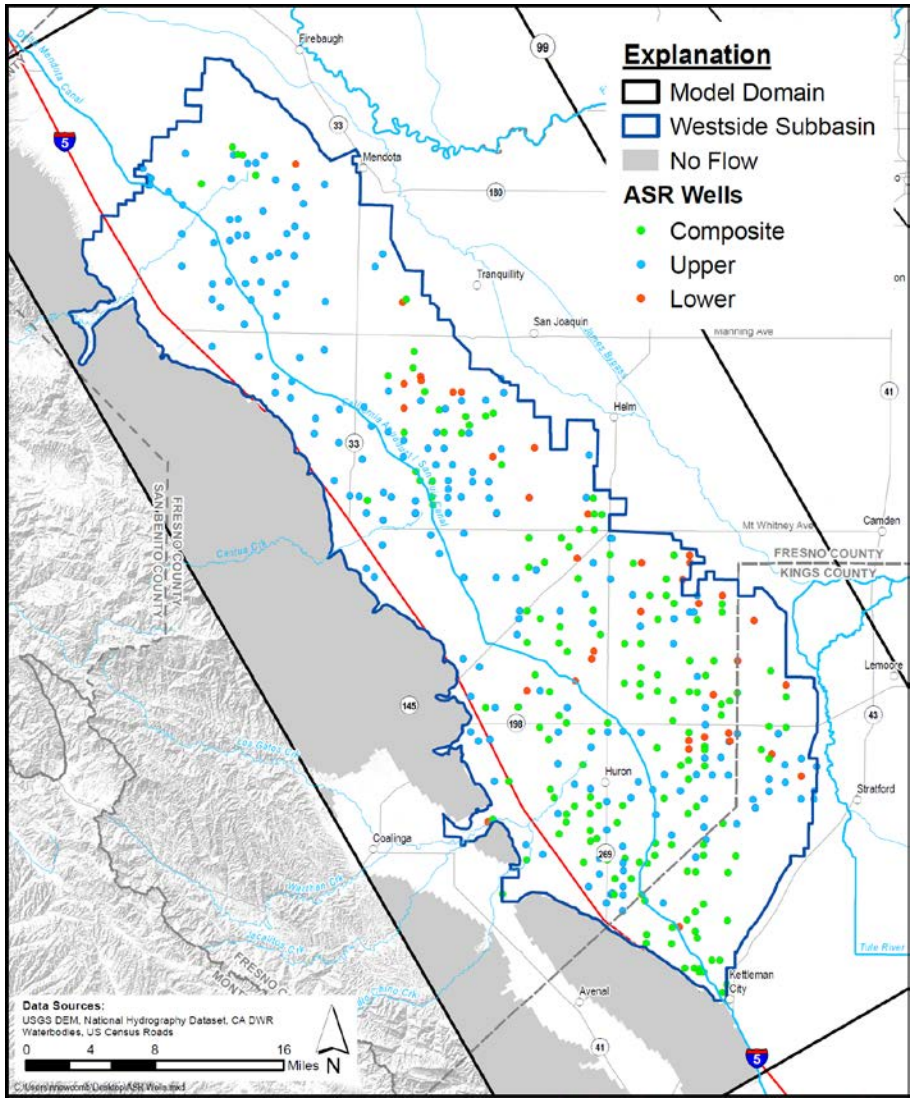
Scenario 2 Results – Sustainable Yield

Sustainable Yield = Pumping + ΔStorage + ΔLateral Subsurface Flow



WWD

Scenario 3 - Aquifer Storage and Recovery

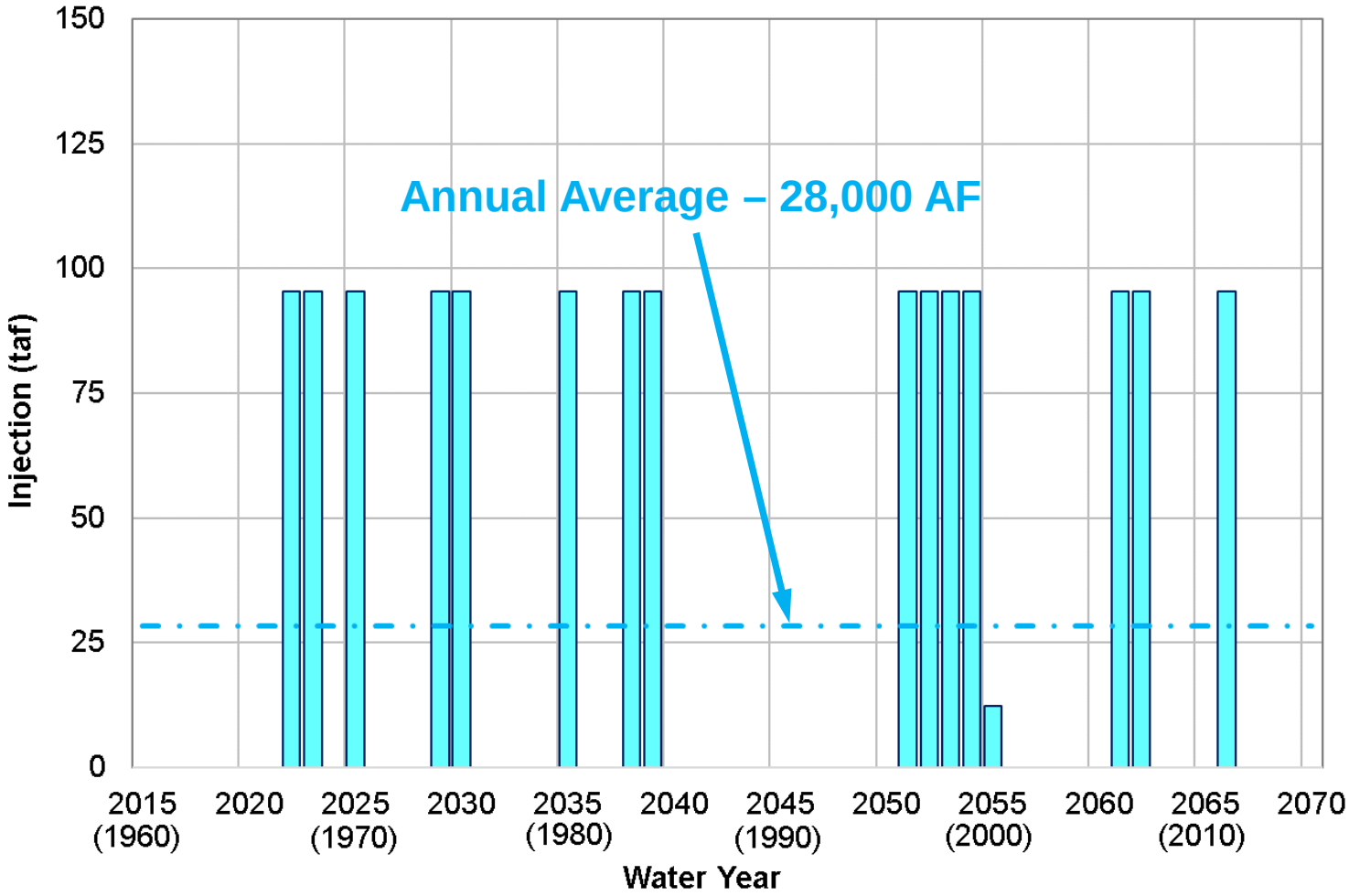


PRELIMINARY

- Source of injected water is **Section 215** water and unused surface water delivery in **Wet Years**
- Injection occurs in December-March starting in 2020
- Injection occurs in 400 existing production wells (random selection)
  - **37 Upper**
  - **204 Lower**
  - **159 Composite**

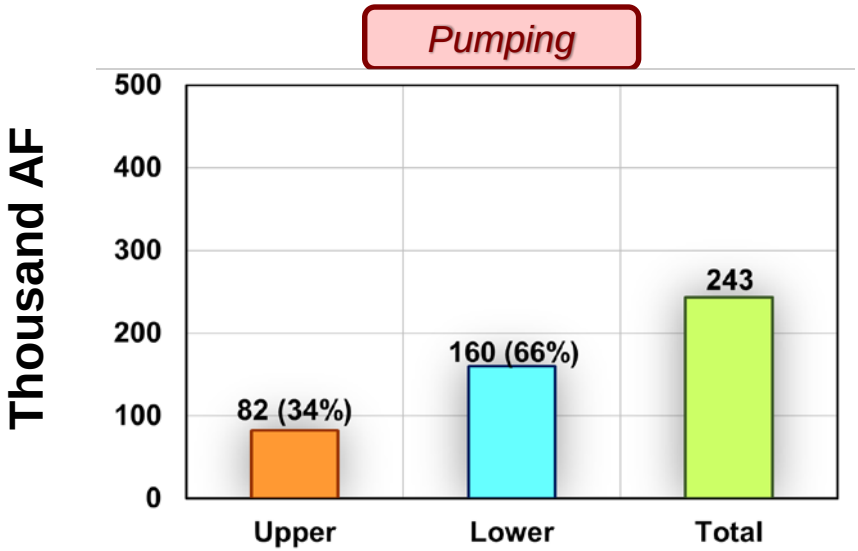
WWD

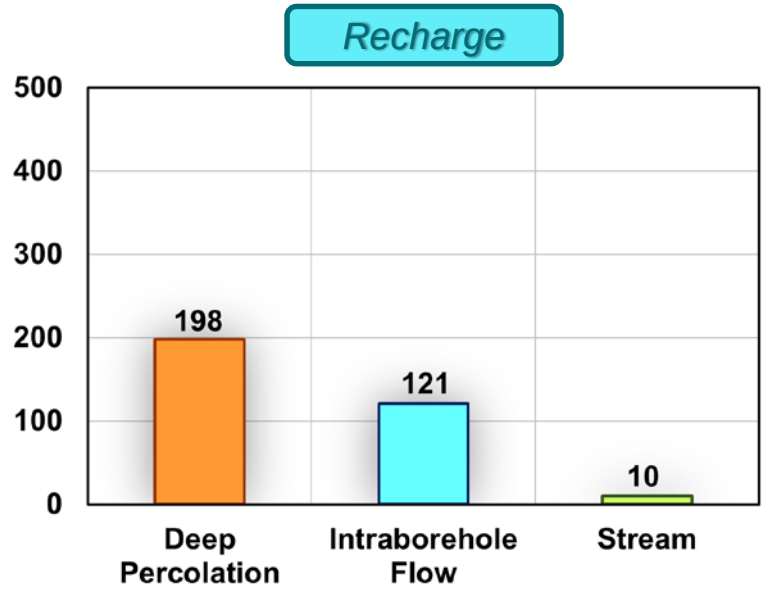
Scenario 3 - Injection Amounts

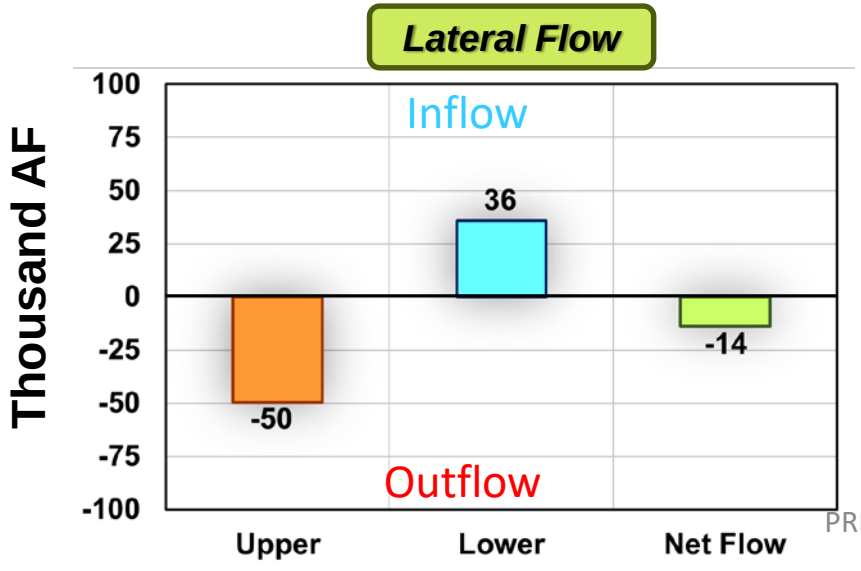


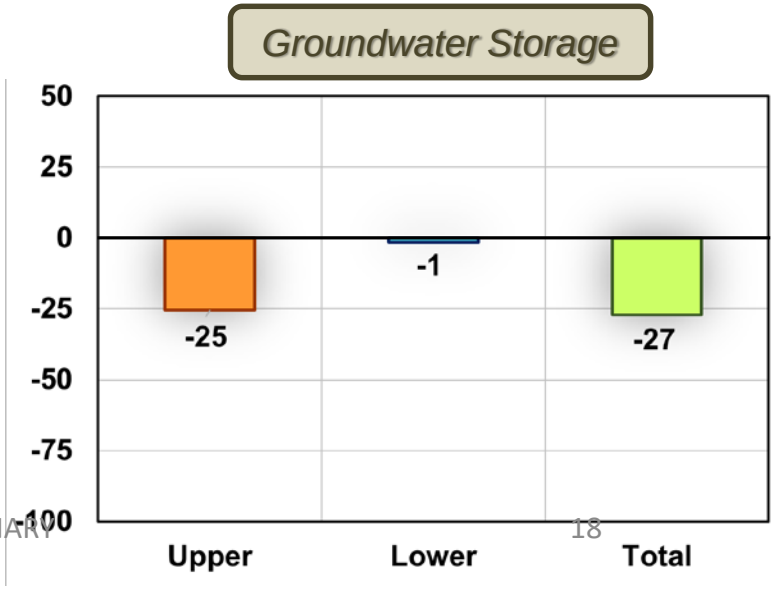
WWD

Scenario 3 Model Results – Water Budget



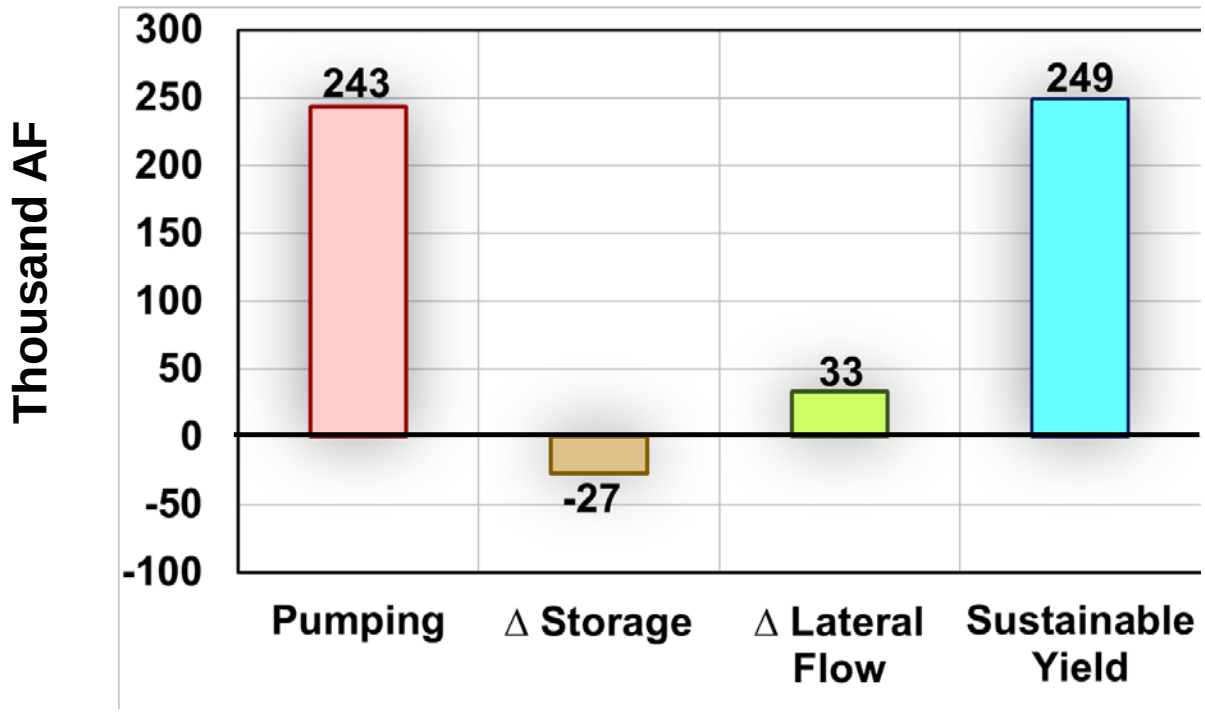






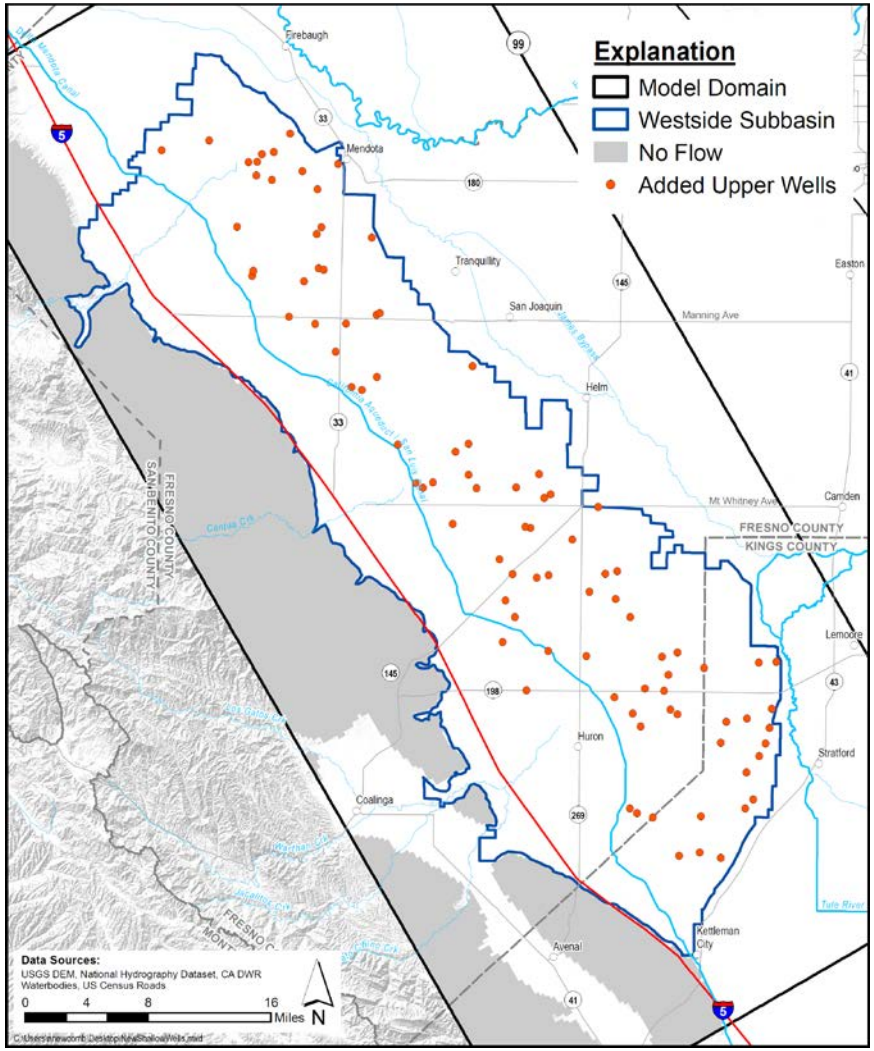
Scenario 3 Results – Sustainable Yield

Sustainable Yield = Pumping + ΔStorage + ΔLateral Subsurface Flow



WWD

Scenario 4 - Pumping Redistribution

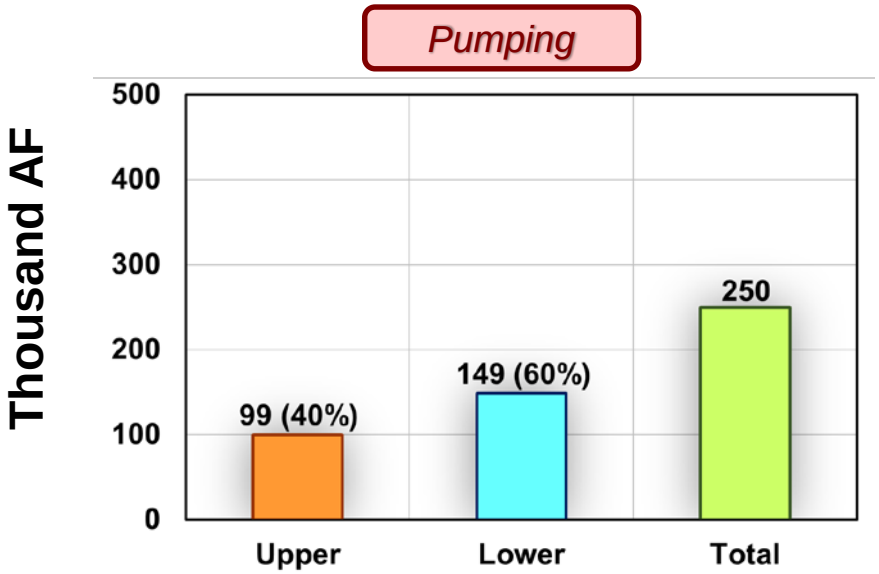


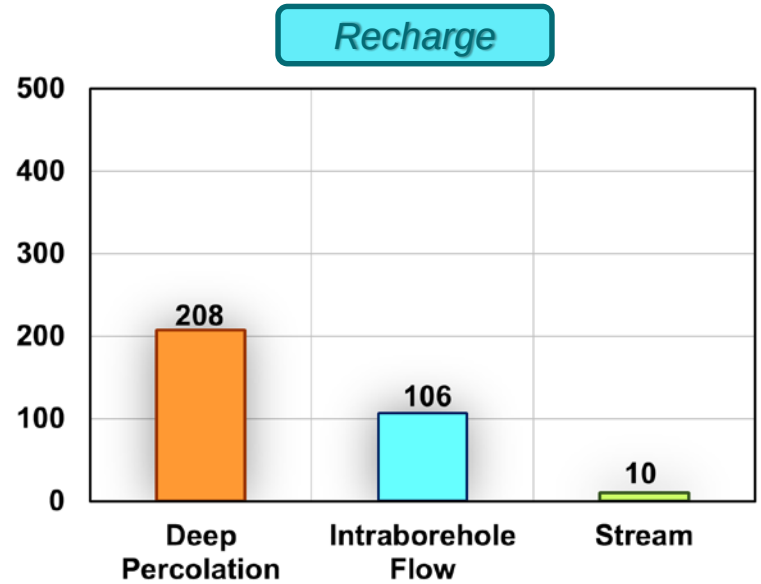
- Increase in upper aquifer pumping to approximately 40%
- Achieved by adding upper aquifer well capacity
  - 94 Additional Upper Aquifer Wells (2020 to 2070)

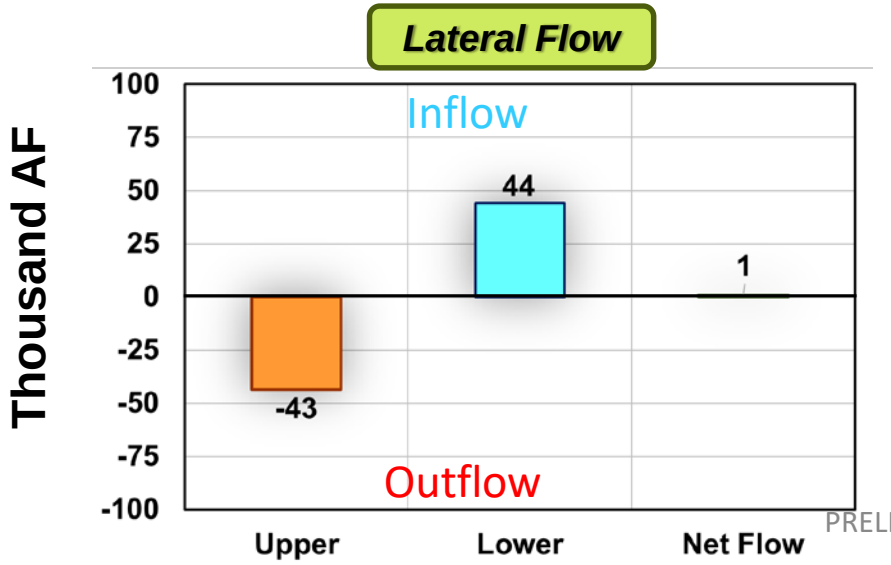
PRELIMINARY

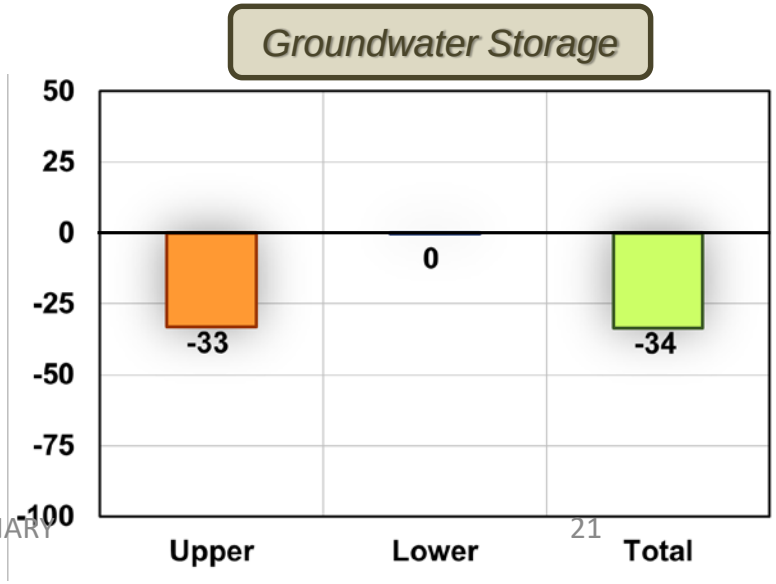
WWD

Scenario 4 Model Results – Water Budget



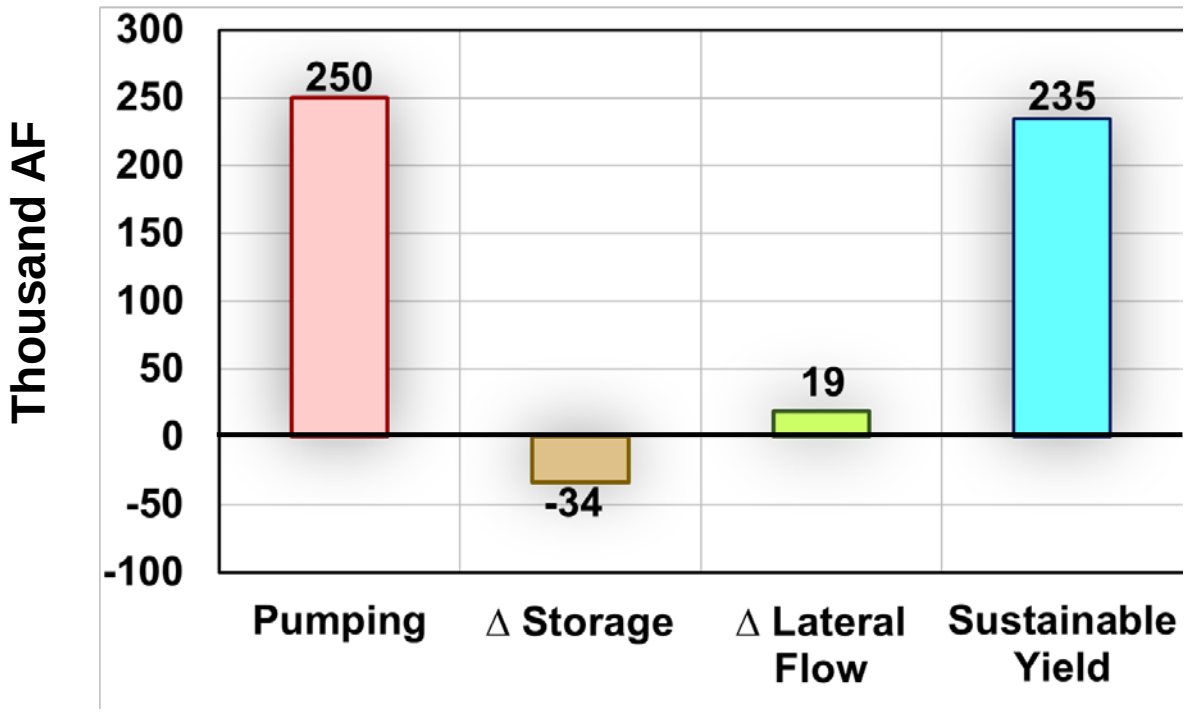






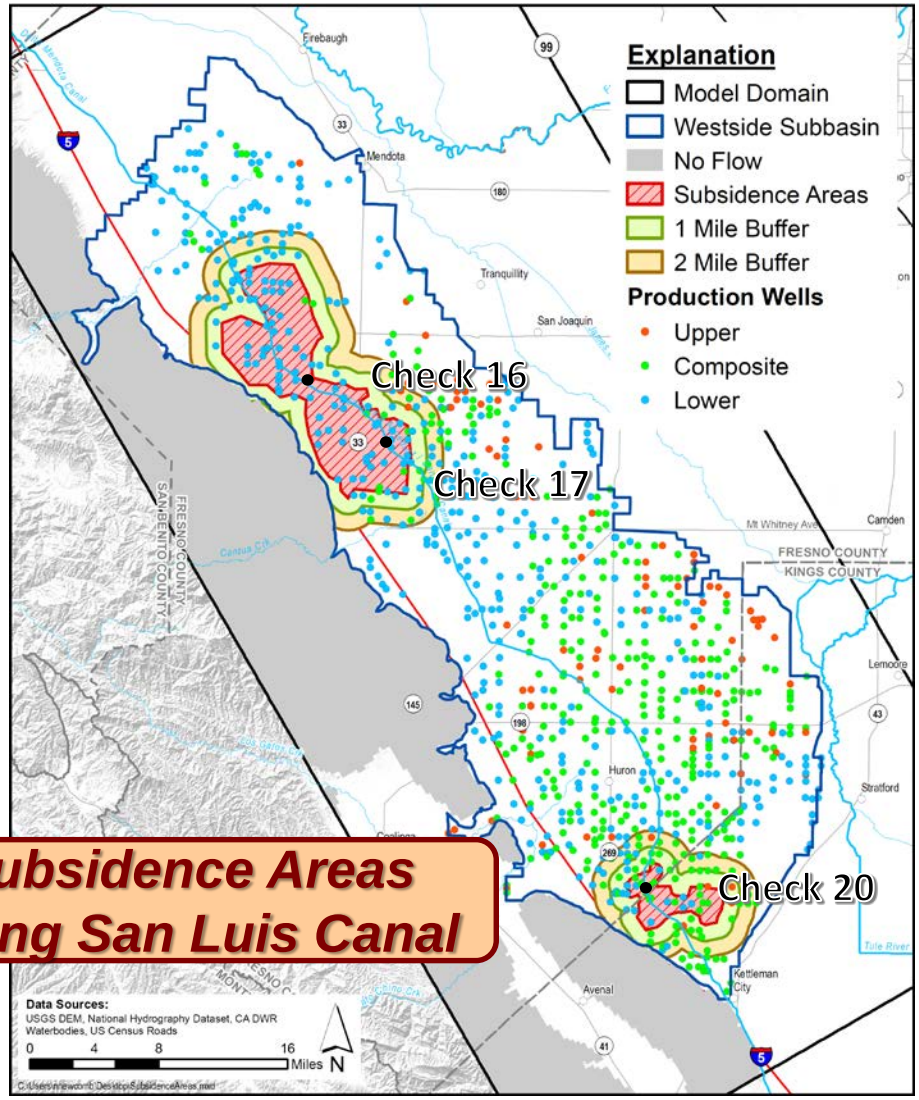
Scenario 4 Results – Sustainable Yield

Sustainable Yield = Pumping + ΔStorage + ΔLateral Subsurface Flow



WWD

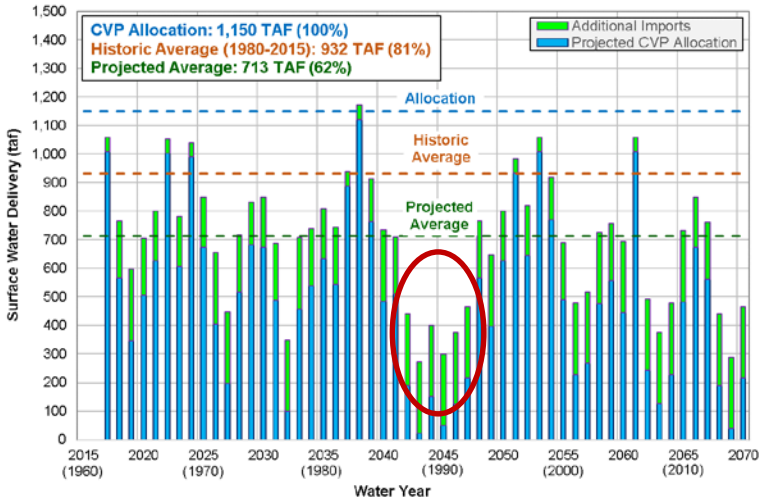
Scenario 5 – Pumping Reduction



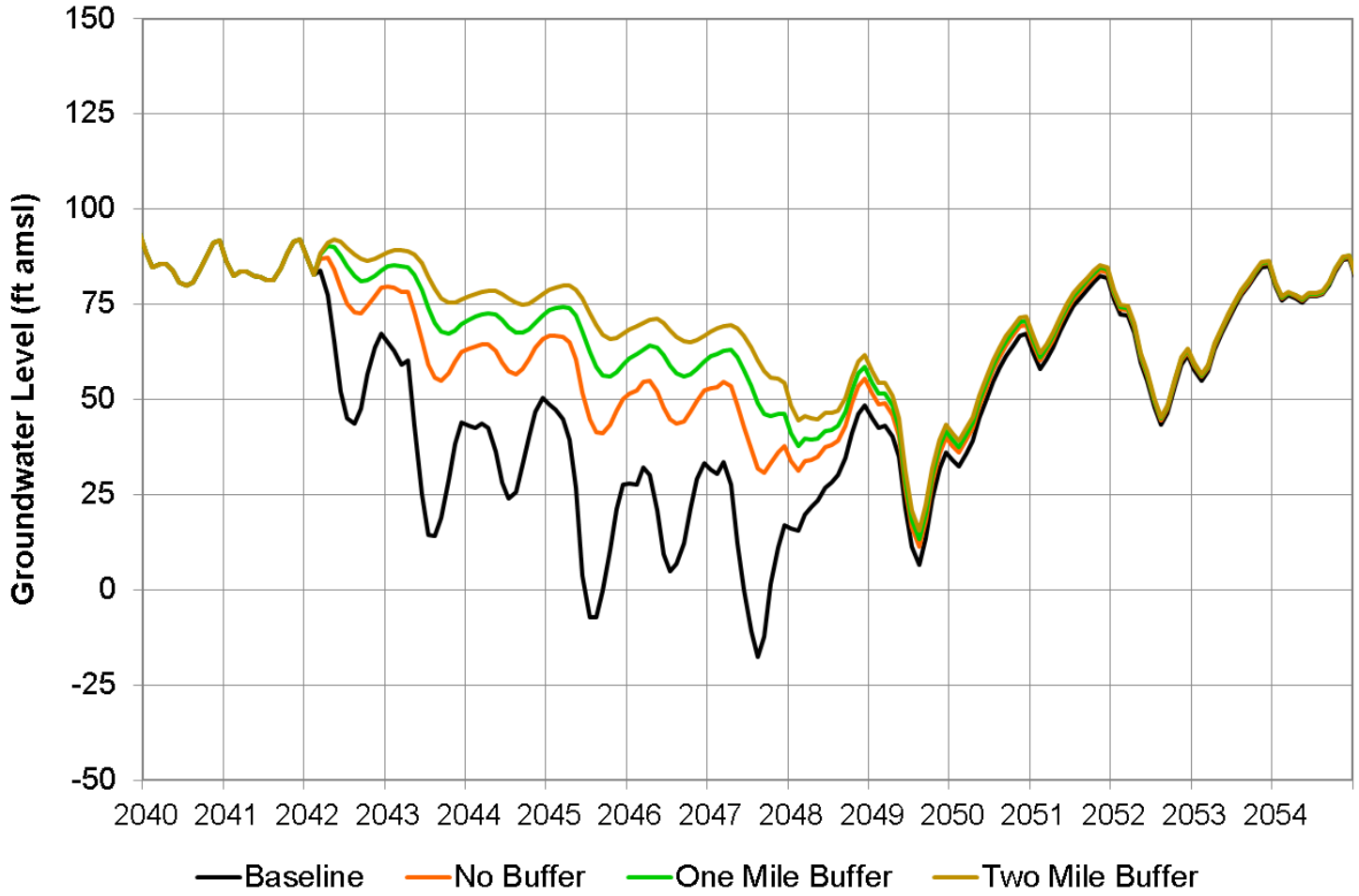
Subsidence Areas Along San Luis Canal

PRELIMINARY

- Pumping reductions in subsidence areas along San Luis Canal
- Offset by increased SW Deliveries
- Evaluated reductions over three areas
- **94 Wells in Subsidence Area**
- **165 Wells in 1 Mile Buffer**
- **240 Wells in 2 Mile Buffer**
- **Time Period**: 2042 to 2047



Check 16 (Lower Aquifer)



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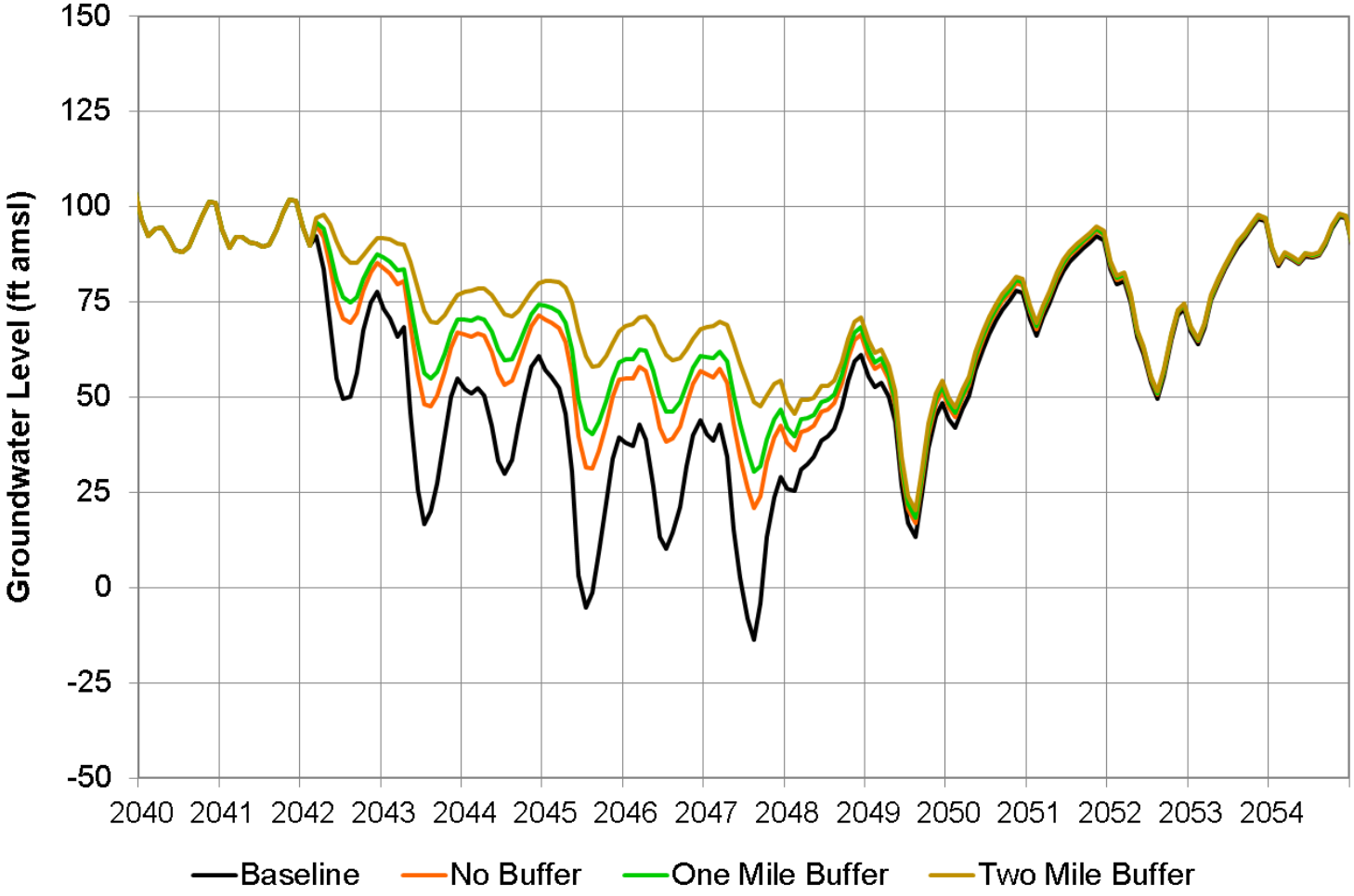
Check 17 (Lower Aquifer)



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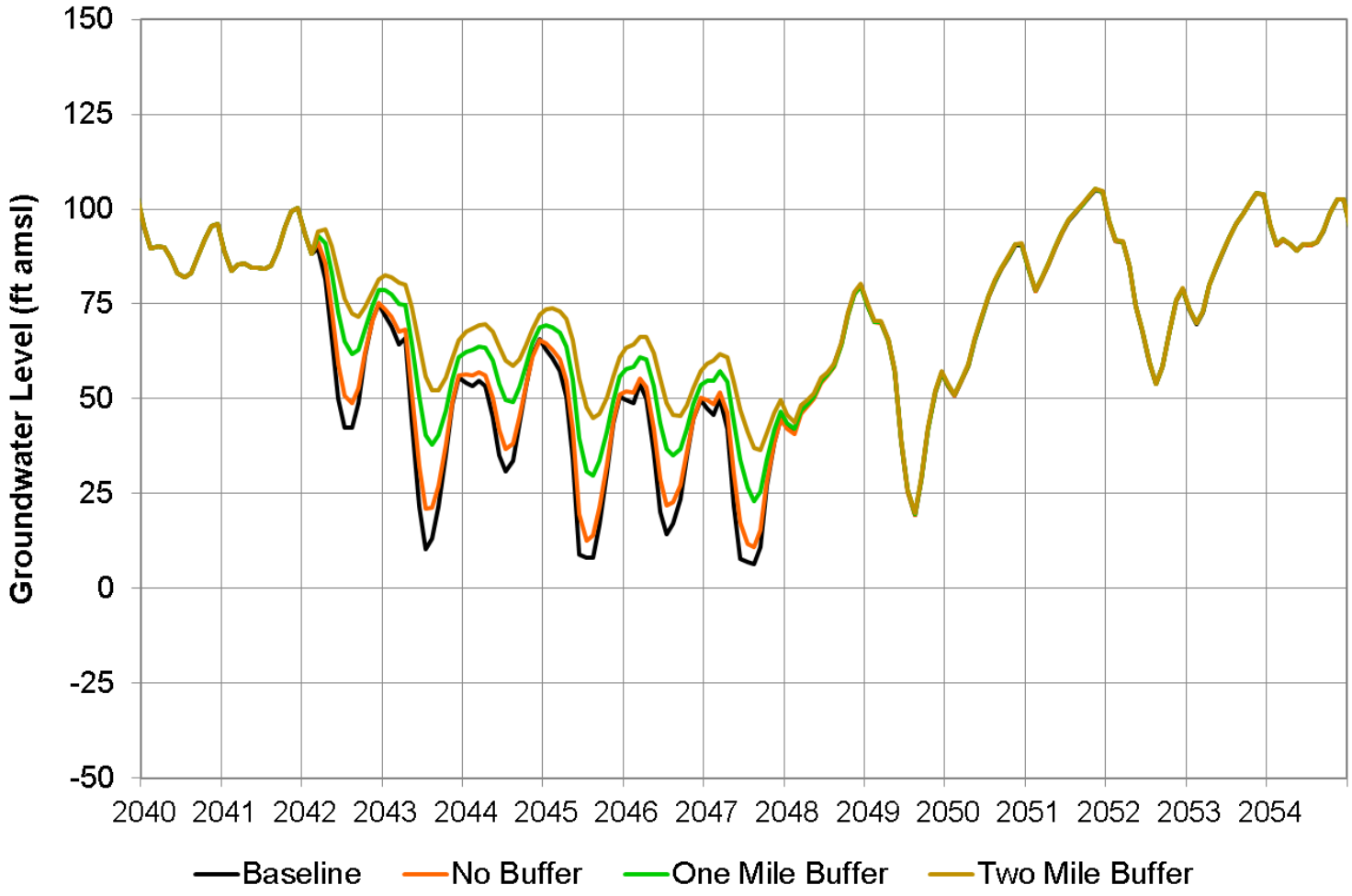
Check 20 (Lower Aquifer)



WWD

Scenario 5 Summary

Check 16 & 17 Subsidence Area

- Substantial benefits from pumping reduction in **Subsidence Area** only
  - Pumping reduction affects **74 Production Wells**
- Moderate additional benefits from reduction in **One Mile Buffer**
  - Pumping reduction affects **120 Production Wells**

Check 20 Subsidence Area

- Limited benefits from pumping reduction in **Subsidence Area** only
  - Pumping reduction affects **20 Production Wells**
- Substantial relative benefits from reduction in **One Mile Buffer**
  - Pumping reduction affects **53 Production Wells**

Summary

- Model scenario results suggest a **Sustainable Yield** from **230 to 250 TAF**
- Consideration of historic groundwater conditions suggest a range from **250 to 300 TAF**
- **Management Focus**:
  - Flexibility in land use to facilitate **Demand Reduction** in **Dry Years**
  - Optimize surface water use in wet years to promote in-lieu recharge or active recharge through **ASR** or **Recharge Ponds**
  - **Reducing** or **Redistributing** pumping to limit impact on sensitive areas

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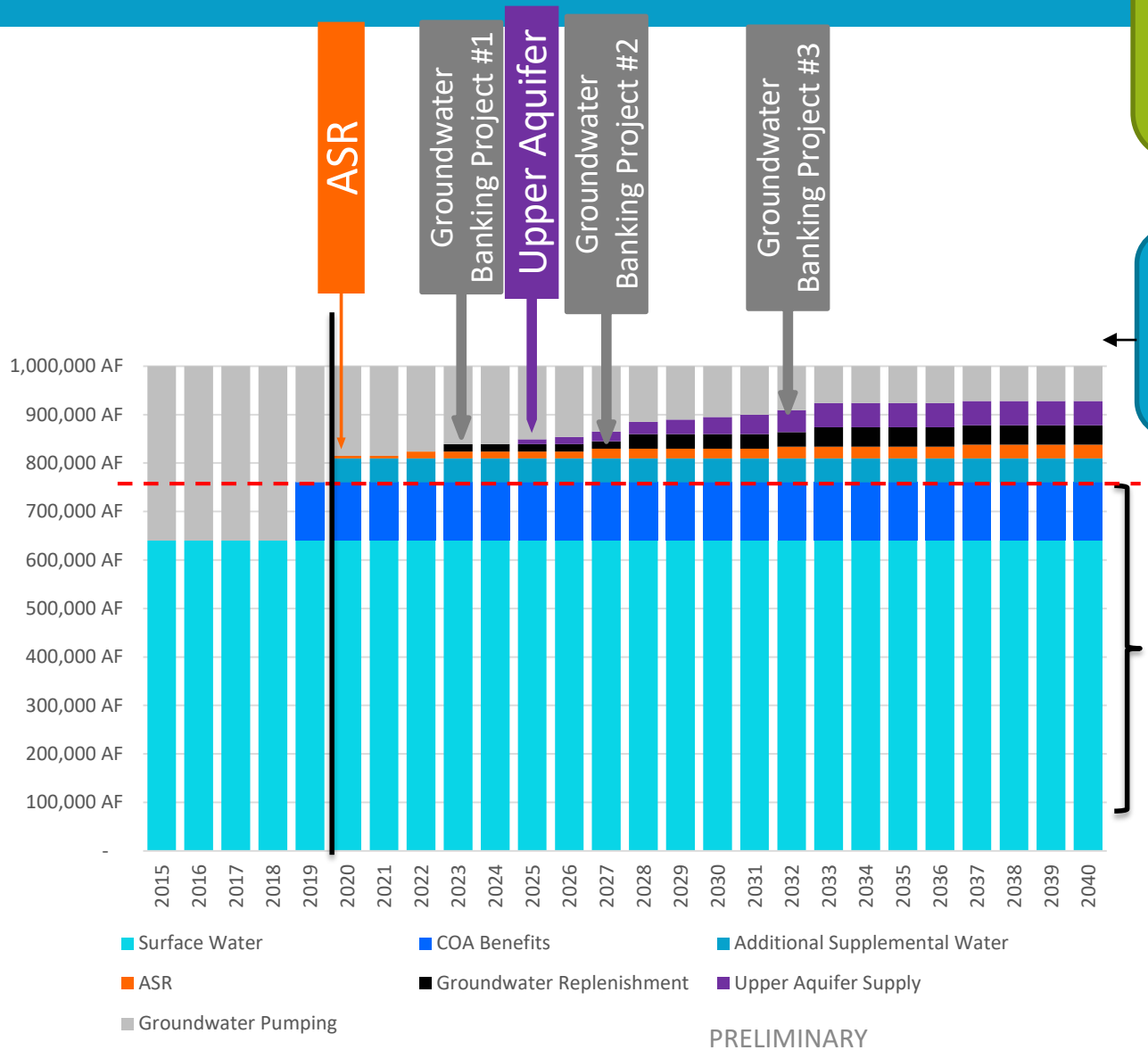
Groundwater Management Strategies

Westlands Water District

Water Balance



Land Use Breakdown (2012 Example)

390,000 Acres Irrigated
60,000 Acres Dry Farmed
120,000 Acres Fallow
570,000 Acres Total

Avg. Demand

390,000 Acres Irrigated
* 2.56 AF/Acre
1,000,000 AF

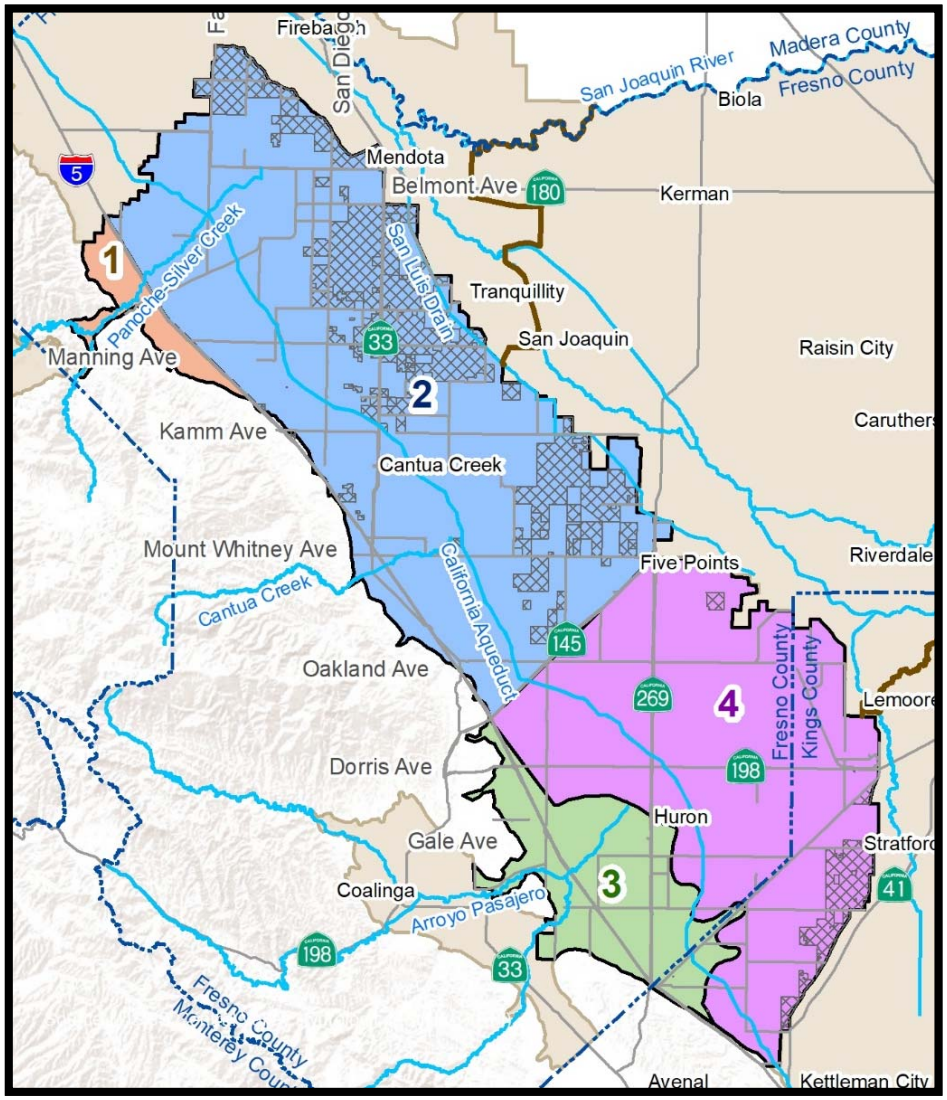
Avg. Surface Water

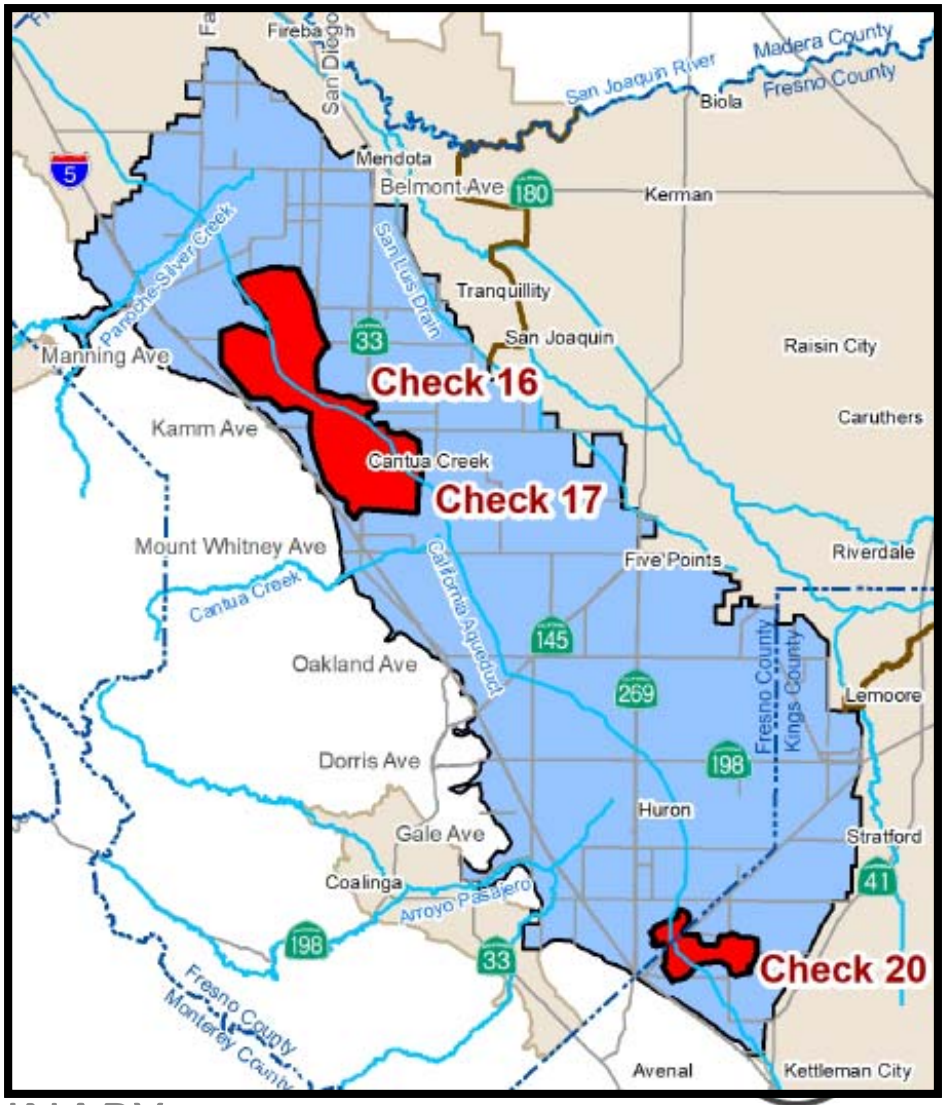
598,000 AF 50% Allocation
124,000 AF Supplemental
38,000 AF W.U. Transfers
760,000 AF Total

PRELIMINARY

WWD

Management Area Consolidation





PRELIMINARY

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Allocation Options

Option 1: Allocation Irrespective of Aquifer Source
Allocation = 0.45 AF/acre

Option 2: Allocation by Aquifer

Aquifer	Groundwater Allocation (AF/Acre)
Upper	0.25
Lower	0.35
Total	0.60

PRELIMINARY

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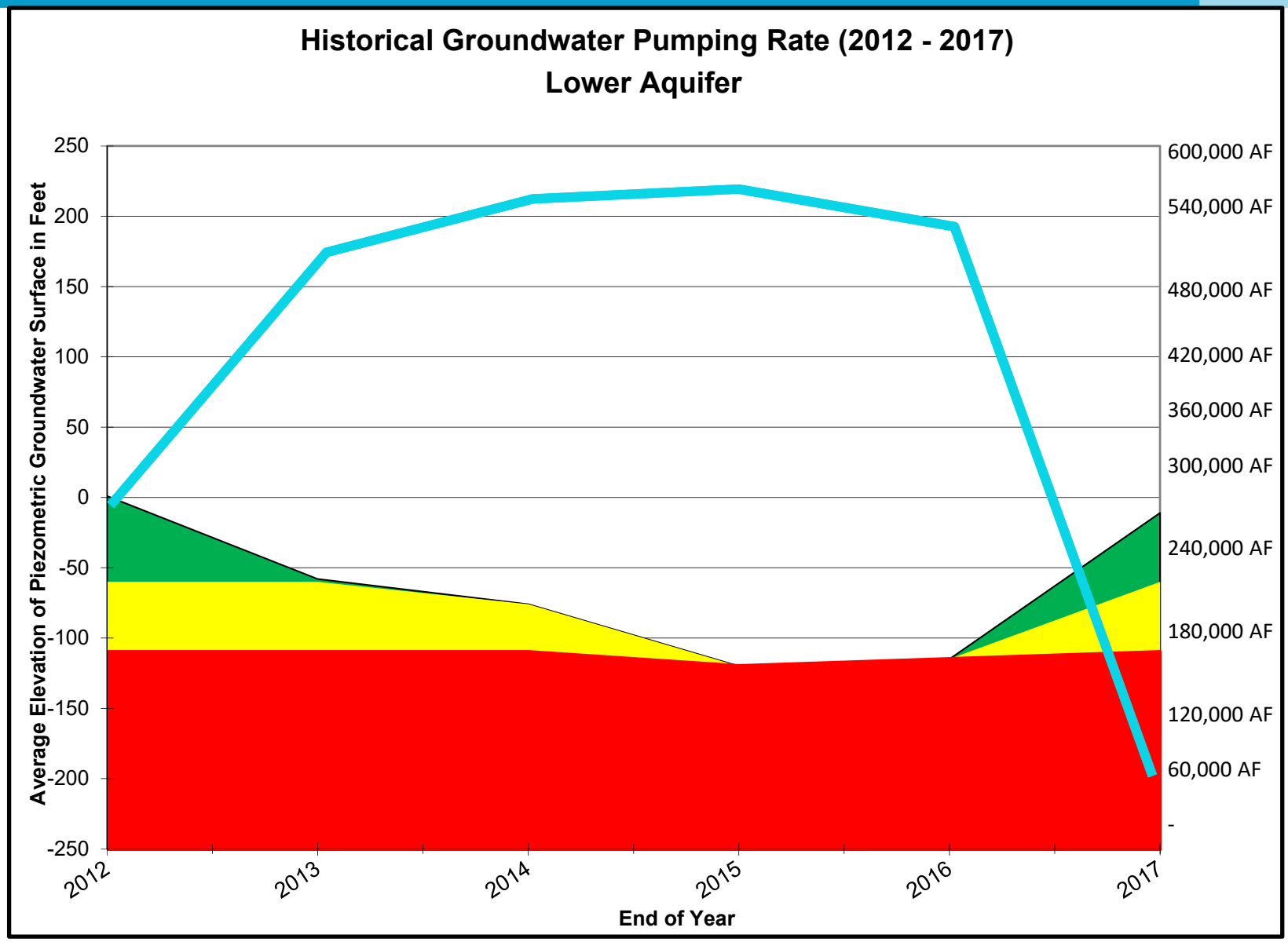
Water Levels



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Questions

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Westlands Water District