GROUNDWATER SUSTAINABILITY PLAN (GSP)
PROJECTED WATER BUDGETS – FUTURE BASELINE

WTSGSA BOARD MEETING

FEBRUARY 4, 2020

Meeting Agenda

- What are the Projected Water Budgets?
  - How are they used?
  - How were they prepared?
- What are the results of the Projected Water Budget baseline analysis?
  - What are the potential future impacts on groundwater?
  - What are the potential future impacts on surface water?
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GSP Water Budgets

Completed	*Completed*	*Recently Completed*	*In Progress*
Historical Conditions Historical * Land use * Water use * Hydrology WY 1991-2015	**Current Conditions** Current * Land use * Water use Historical * Hydrology WY 2015	**Projected Conditions** Projected * Land use * Water use Historical * Hydrology (1969-2018) 50-Year Forecast	**Projected with Climate Change** Projected * Land use * Water use Projected • Hydrology 50-Year Forecast

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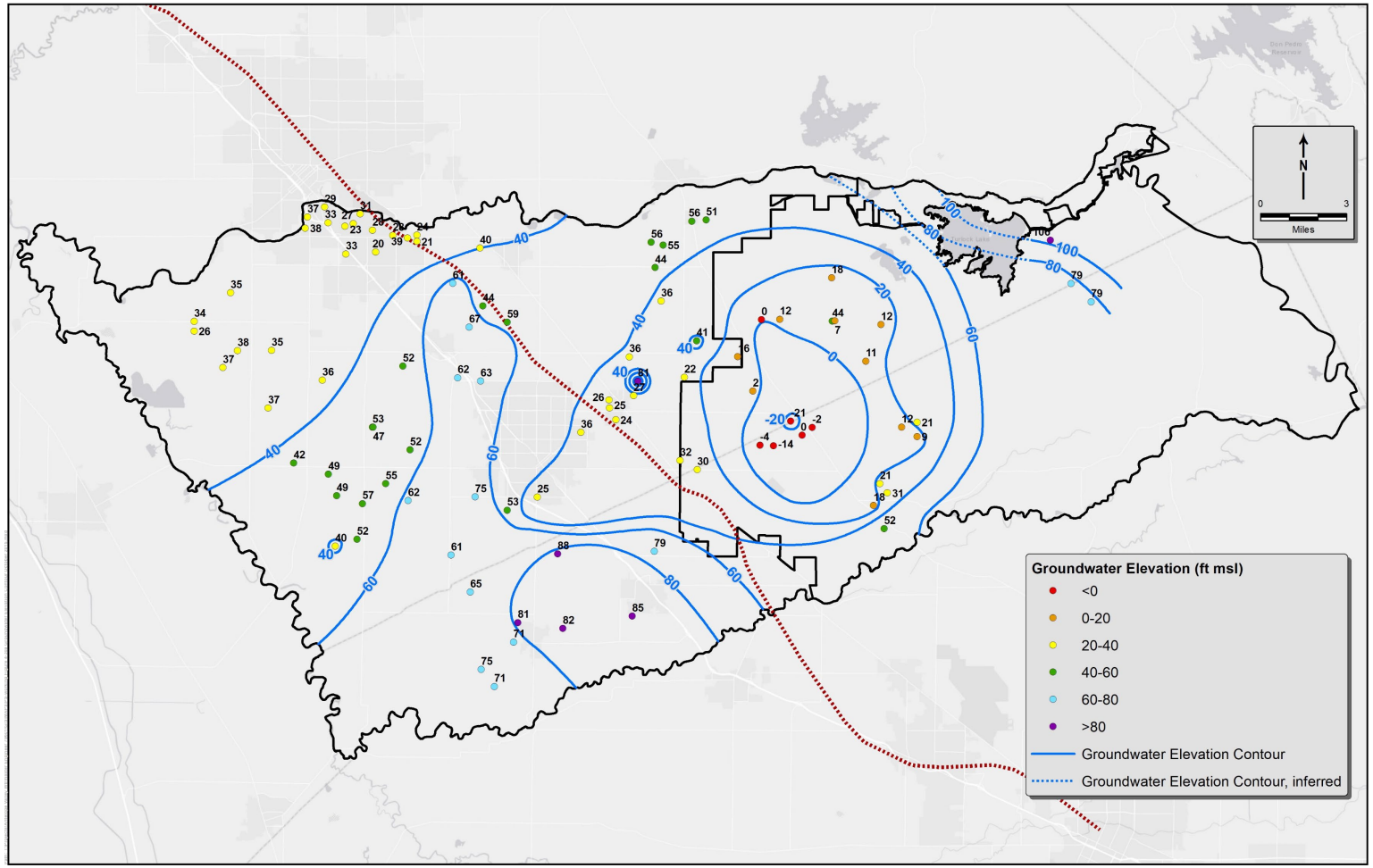
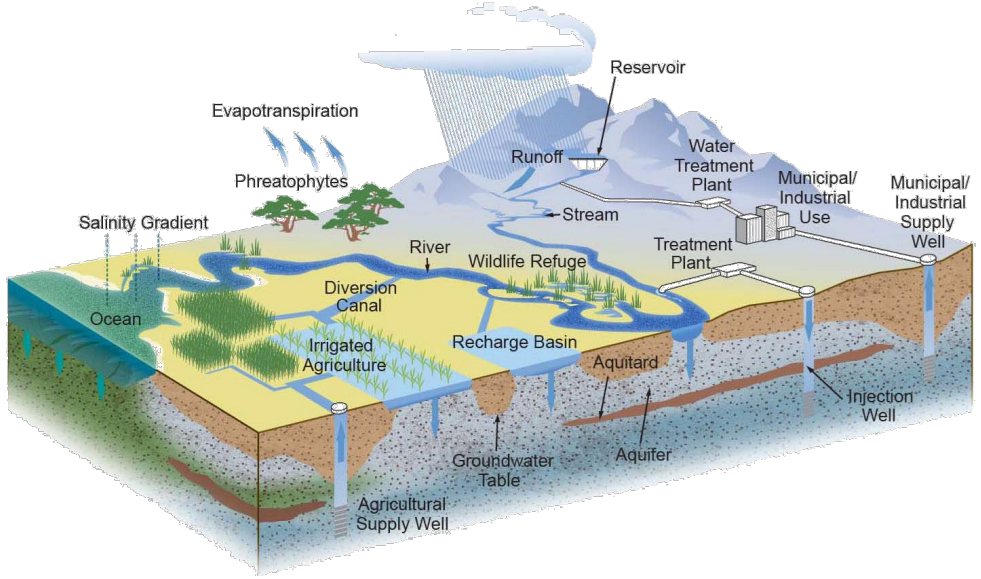
2015 GROUNDWATER CONDITIONS



- Historical overdraft and declining water levels, primarily in eastern Subbasin
- Projected water budget forecasts future groundwater conditions that may occur if no projects or management actions are implemented

PROJECTED WATER BUDGETS

- Forecast future inflows and outflows over the planning and implementation horizon (50 years)
- Provide a *baseline* of future conditions <u>without projects or management actions</u>
- Assist with sustainable management criteria (undesirable results)
- Target projects and actions needed to achieve sustainability



Quantify natural and managed recharge, extractions/discharge, subsurface flows, and interactions between rivers/surface water and groundwater (aquifer-stream interaction)

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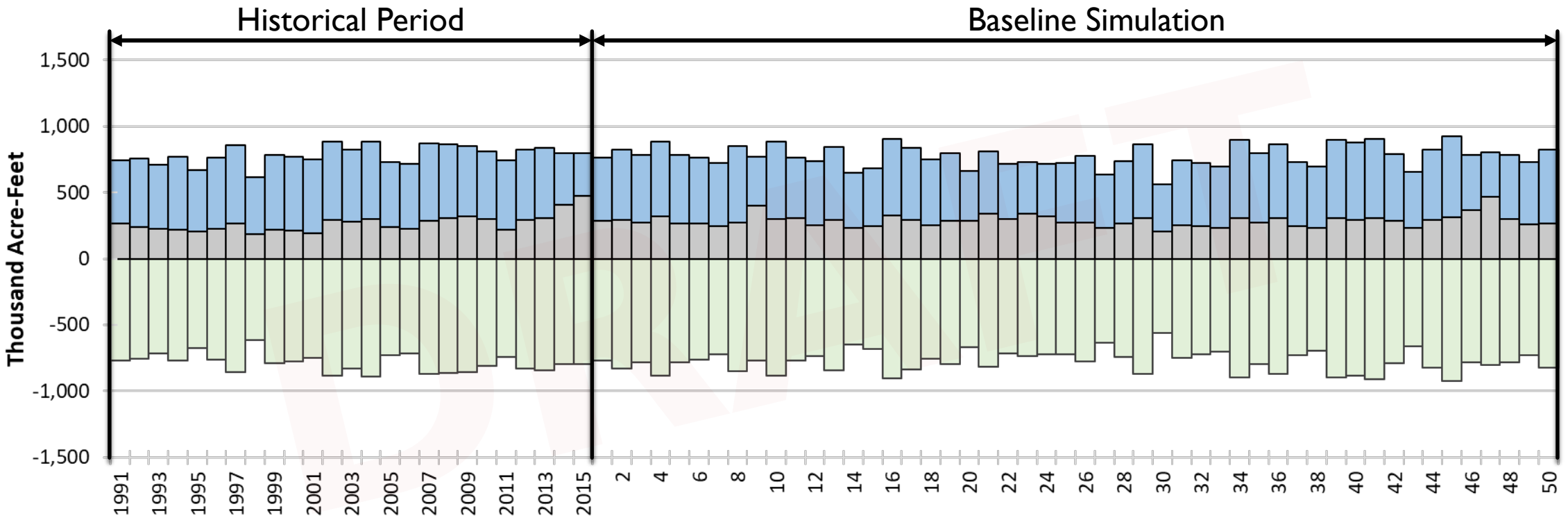
TURLOCK SUBBASIN GSP BASELINE ASSUMPTIONS

Baseline Feature	Projected Conditions
Hydrologic Conditions	50-Yr hydrology (based on natural historical hydrology WY 1969-2018)
Land Use	Held constant using 2015 land use and cropping patterns
Ag. Demand	Estimated by model based on land use with modern irrigation practices
Ag. Surface Water Supply	Surface water supplies as reported by TID's reservoir operations Model (TRS)
Ag. Groundwater Supply	Groundwater supply estimated to meet demand not otherwise met by surface water
Urban Demand	Projected urban demand based on 2015 UWMPs or other planning documents
Municipal RW Supplies	Projected urban demand based on 2015 UWMPs or other planning documents
Municipal GW Supplies	Projected urban groundwater based on 2015 UWMPs distributed to existing wells
Municipal Wells	Current facilities in place and proposed wells when information available

Agricultural Water Use – Turlock Subbasin Historical and Baseline Periods



Notes:

1. Baseline period uses the hydrology from WY1969-2018, representing a 50-year hydrologic period required by the GSP regulations
2. Projected ag demand is estimated based on the 2015 land use and cropping patterns and monthly hydrologic data for the 50-yr period, and current irrigation practices
3. Ag deliveries include surface water and groundwater supplied by irrigation districts through the irrigation conveyance network
4. Ag pumping includes private (non-district) groundwater pumping

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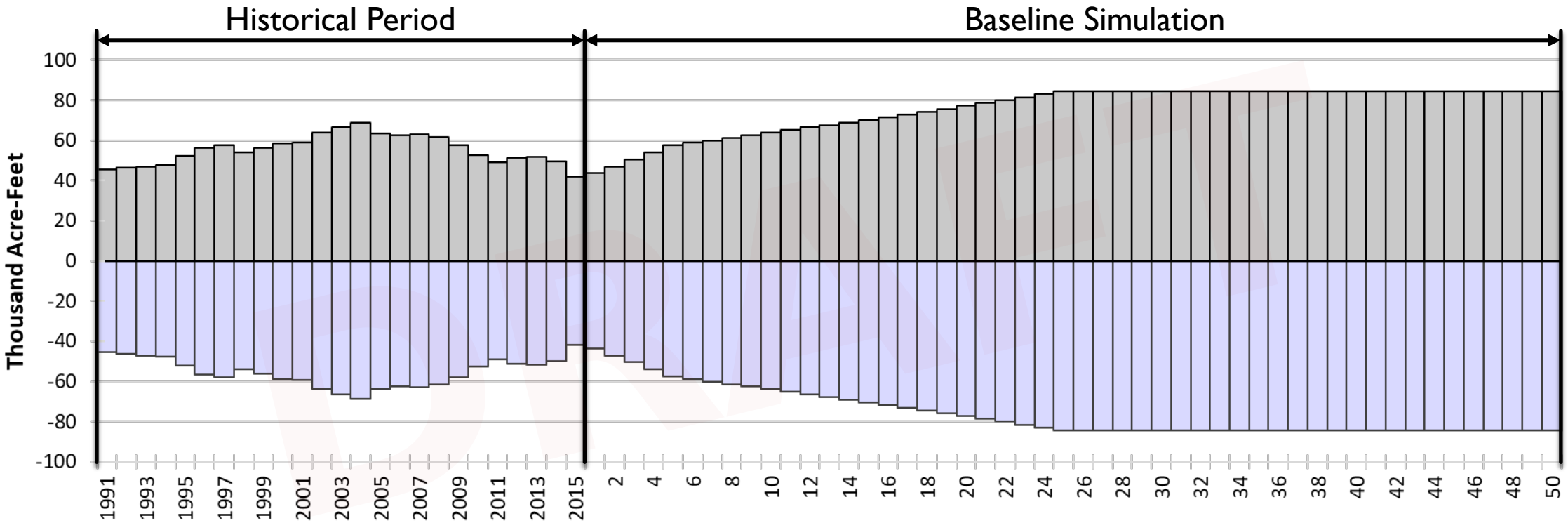
Urban Water Use – Turlock Subbasin Historical and Baseline Periods



Notes:

1. Baseline period uses the hydrology from WY1969-2018, representing a 50-year hydrologic period required by the GSP regulations
2. Projected urban demands are estimated based on the per-capita water use and population projections through 2040, and no population growth past 2040.
3. Urban pumping consists of groundwater pumping by municipalities and private groundwater wells across the subbasin

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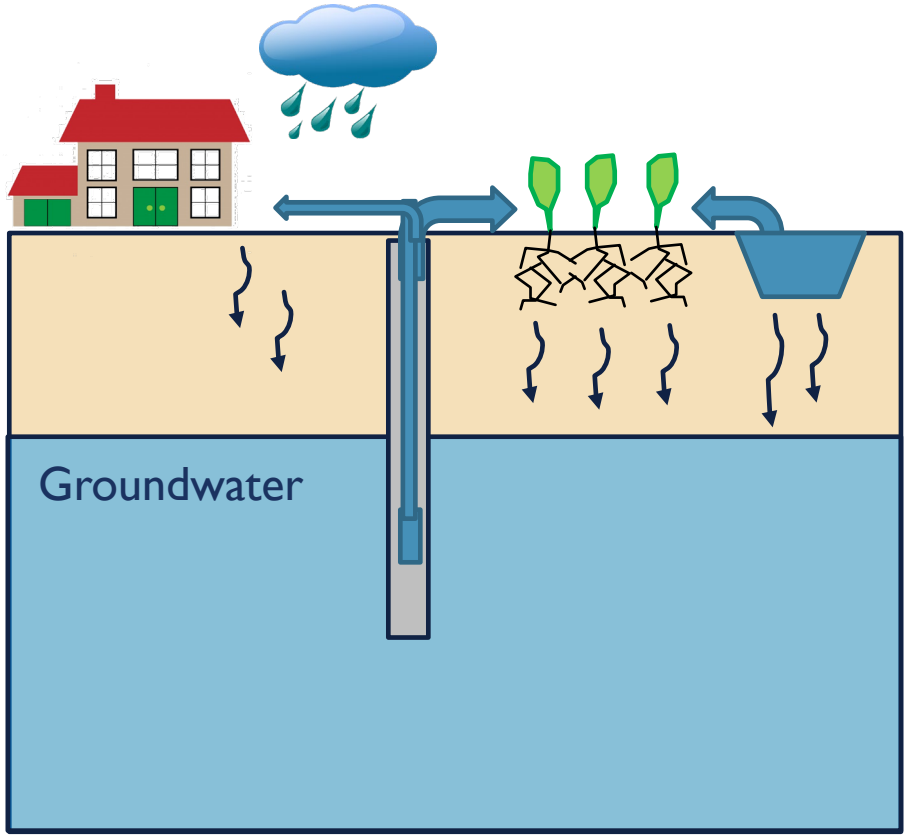
Operational Water Budget Components
Recharge and Extraction



- Includes Groundwater Recharge and Extraction:
  - Recharge from precipitation and irrigation
  - Recharge from agricultural conveyance and distribution systems
  - Groundwater pumping
- Does Not Include:
  - Recharge or baseflow from rivers (i.e., aquifer-stream interaction)
  - Subsurface flows

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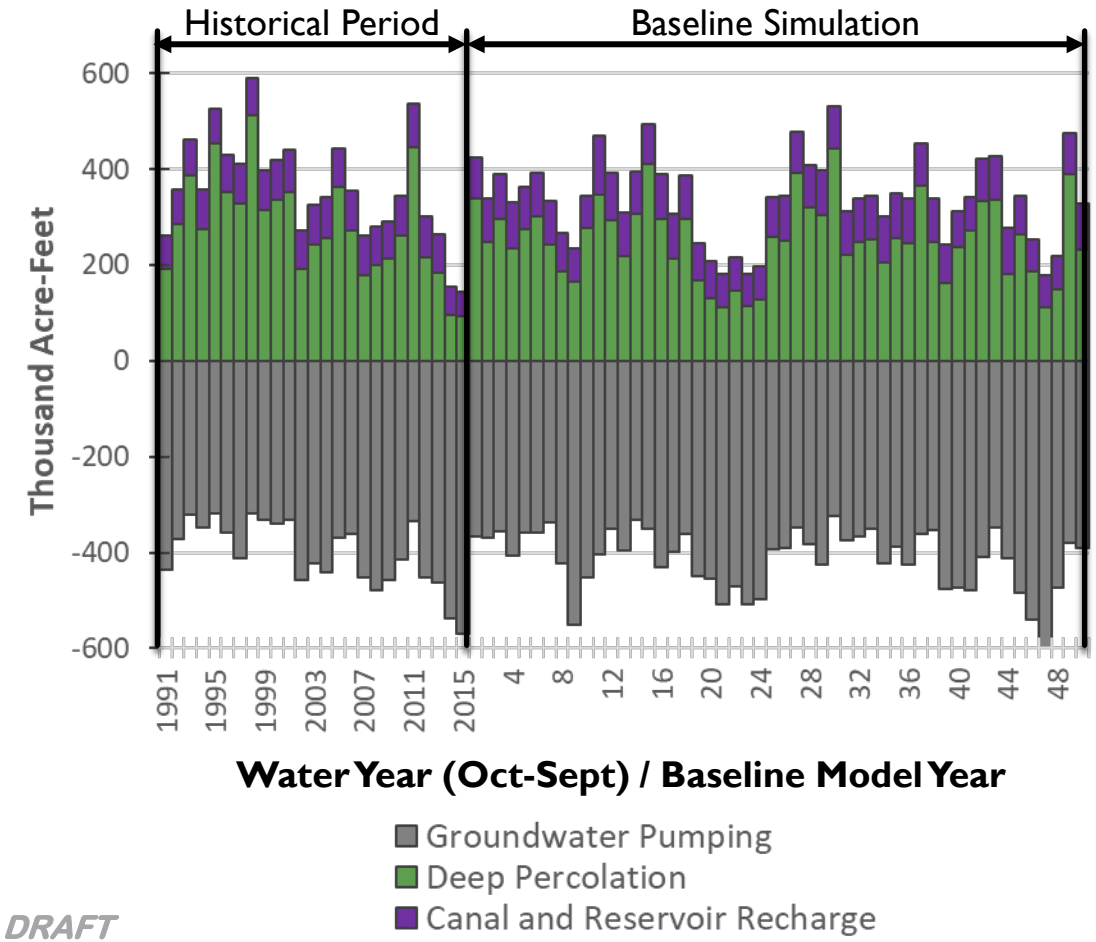
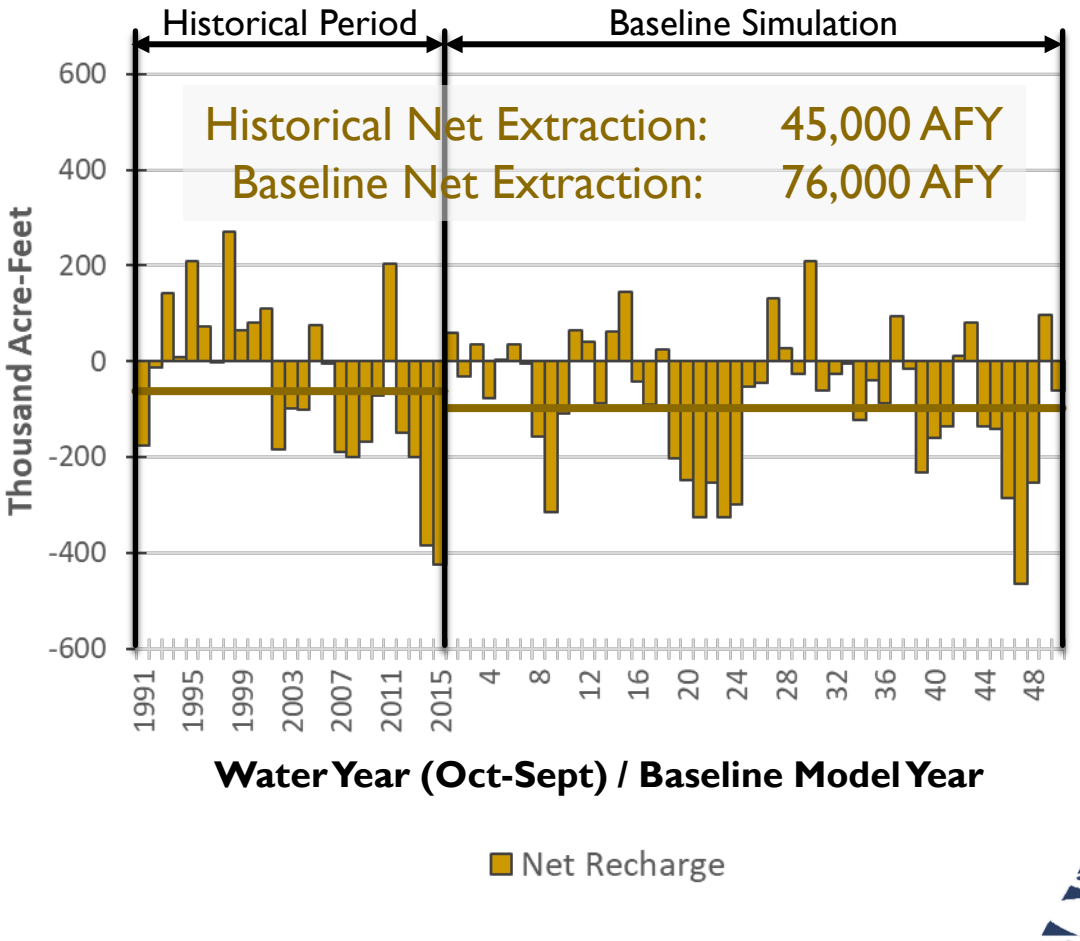
Turlock Subbasin Extractions Greater than Recharge (net extractor of groundwater)





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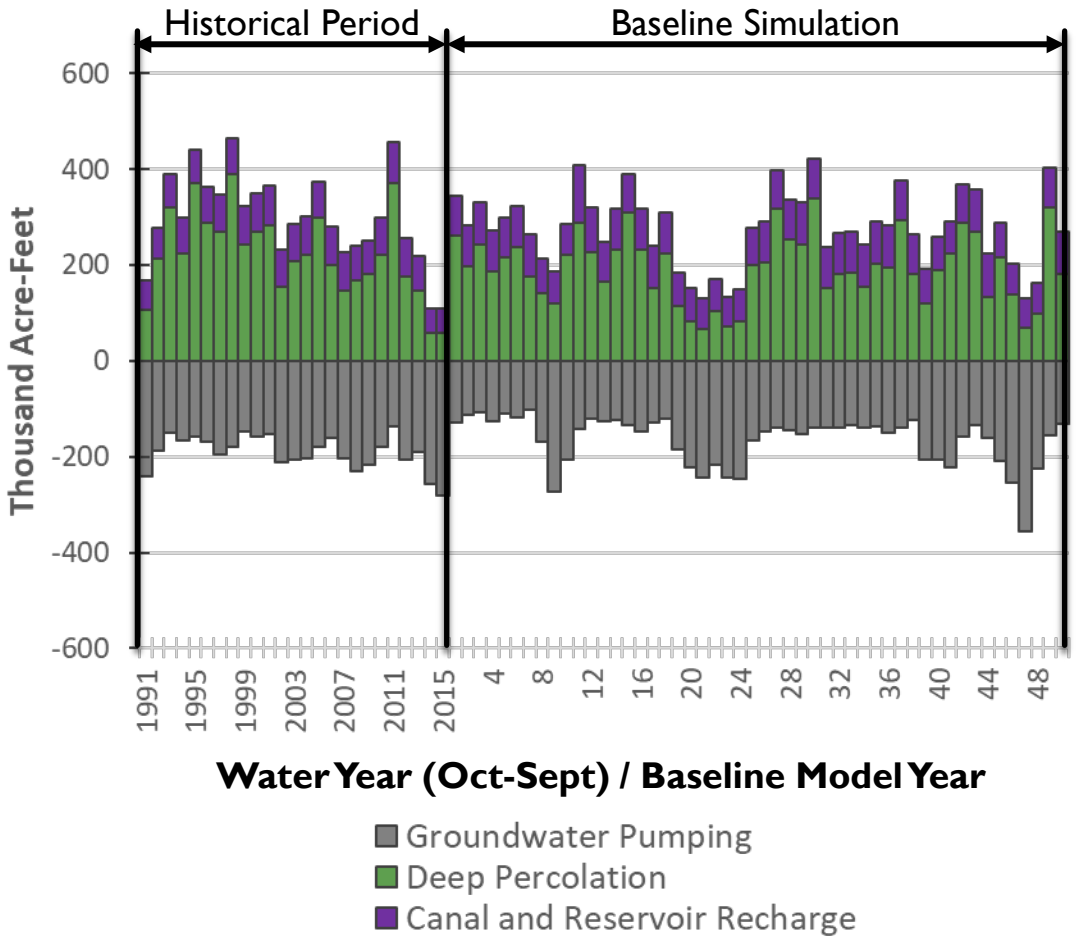
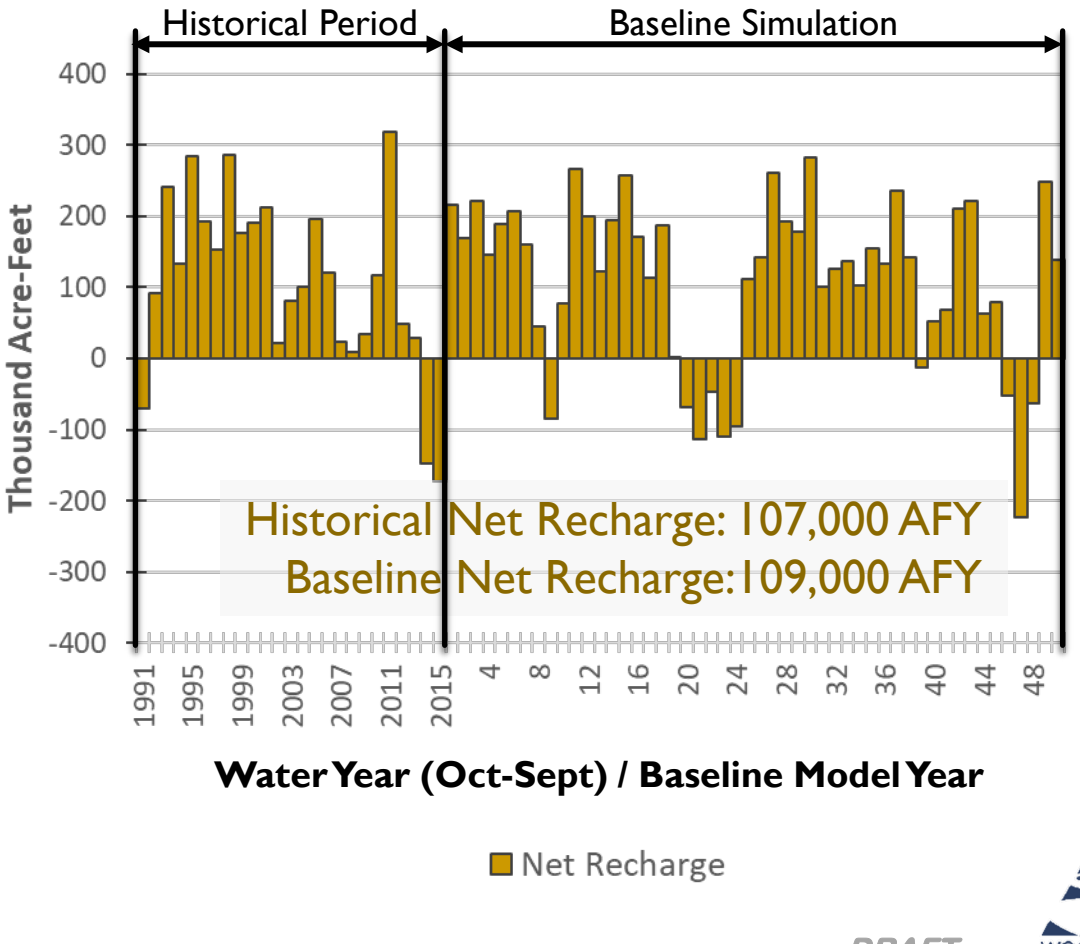
WTSGSA
Net Contributor to Groundwater





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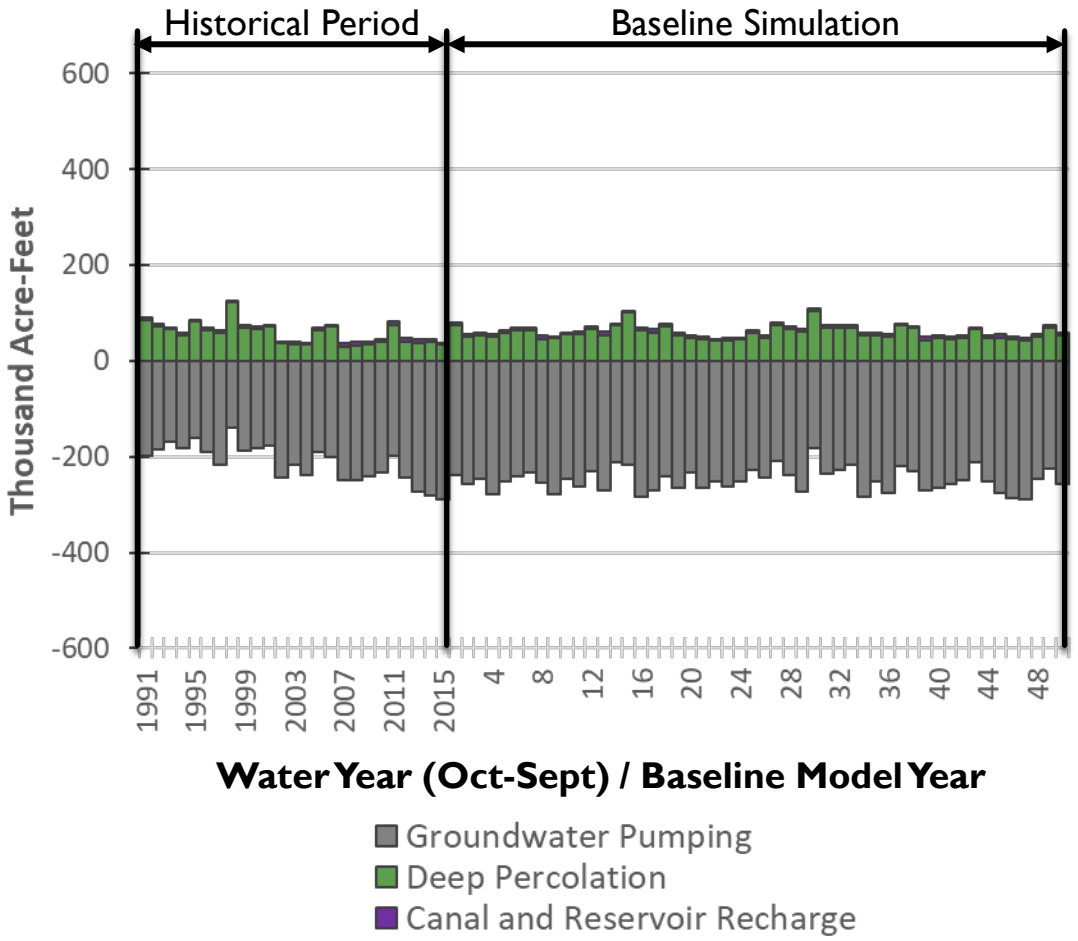
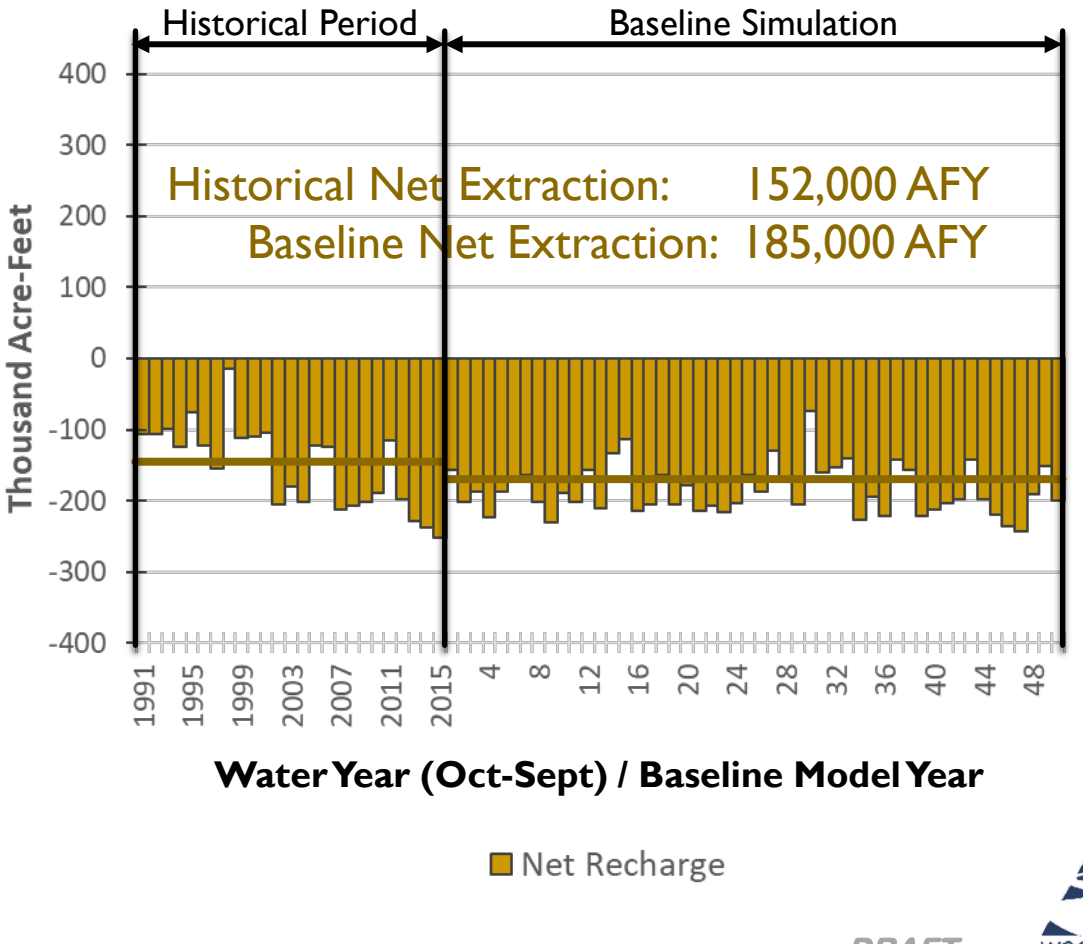
ETSGSA
Net Extractor of Groundwater





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River Operations: Baseline Assumptions

Tuolumne River

- Tuolumne River System Management Model
  - **Tuolumne River inflow**
  - La Grange Dam diversions
  - Canal & reservoir seepage
    - Turlock Lake
    - Upper Main
    - Lower System
  - TID farm gate deliveries
  - TID operational spills

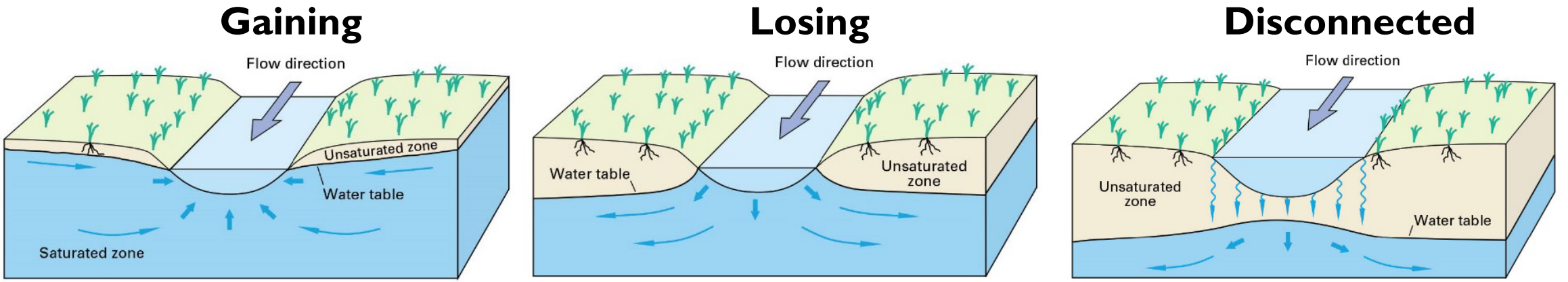
Merced River

- MIDH2O & MercedWRM
  - **Merced River inflow**
  - Merced ID Diversions
    - Northside Canal at Merced Falls
    - Main Canal at Crocker-Huffman Dam
  - Northside Canal farm gate deliveries
  - Northside Canal seepage/spills

San Joaquin River

- C2VSimFG Historical Operations
  - Riparian Diversions

Interconnected Surface Water



Source: UC Water

- Historical water budget – Tuolumne and San Joaquin rivers were net gaining rivers; Merced River was a slightly losing river, on average.
- Projected future baseline suggests the Tuolumne River will transition to a slightly losing stream and the Merced River loss will increase.
- Streamflow depletion provides a benefit to groundwater supply but can adversely impact surface water rights and ecosystems (e.g., GDEs).

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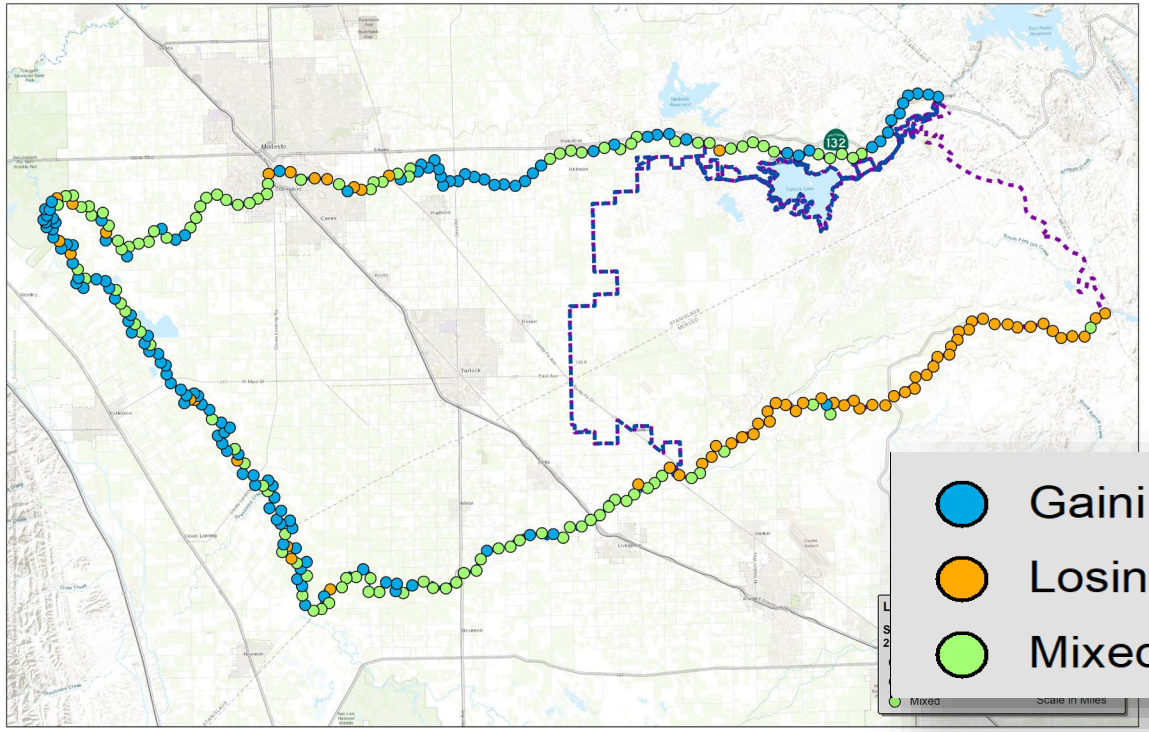
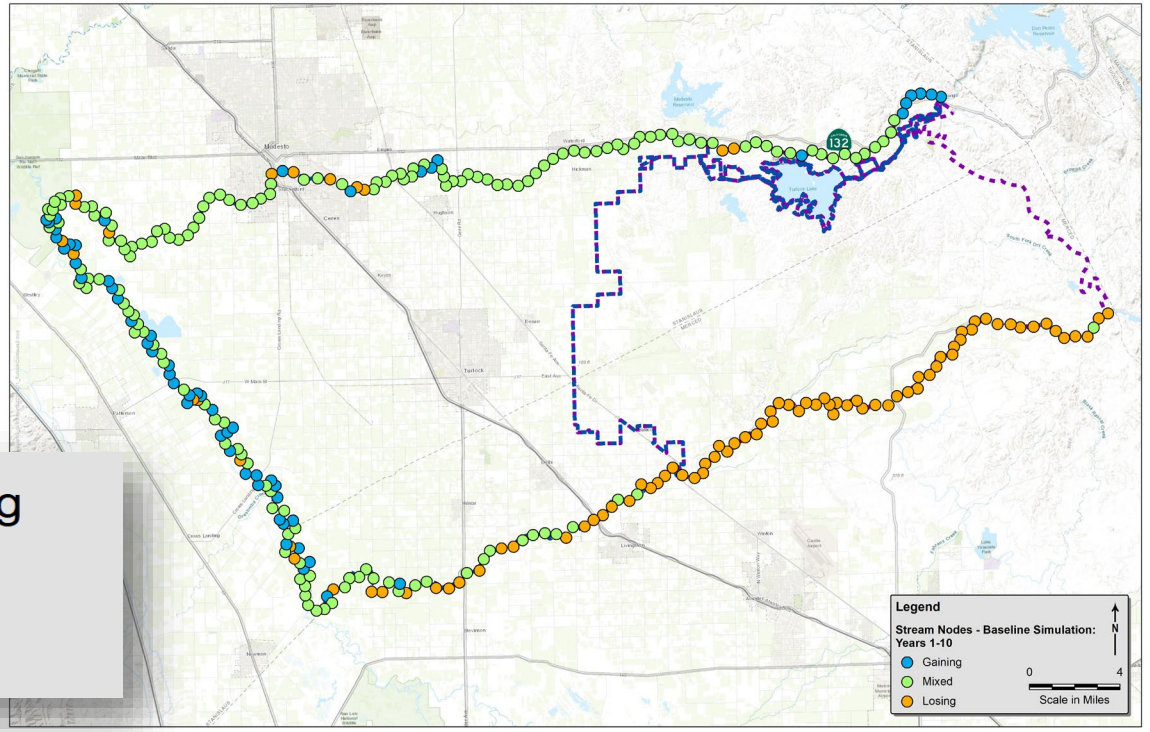
Stream-Aquifer Interaction

Historical Simulation: Years 2006-2015



Baseline Simulation: Years 1-10



- Maps show points along each river course, with each point represented as a **net** gaining, losing, or a mixed condition, over long-term hydrologic conditions.
- Determination of losing/gaining at each point based on integrated SW-GW modeling.

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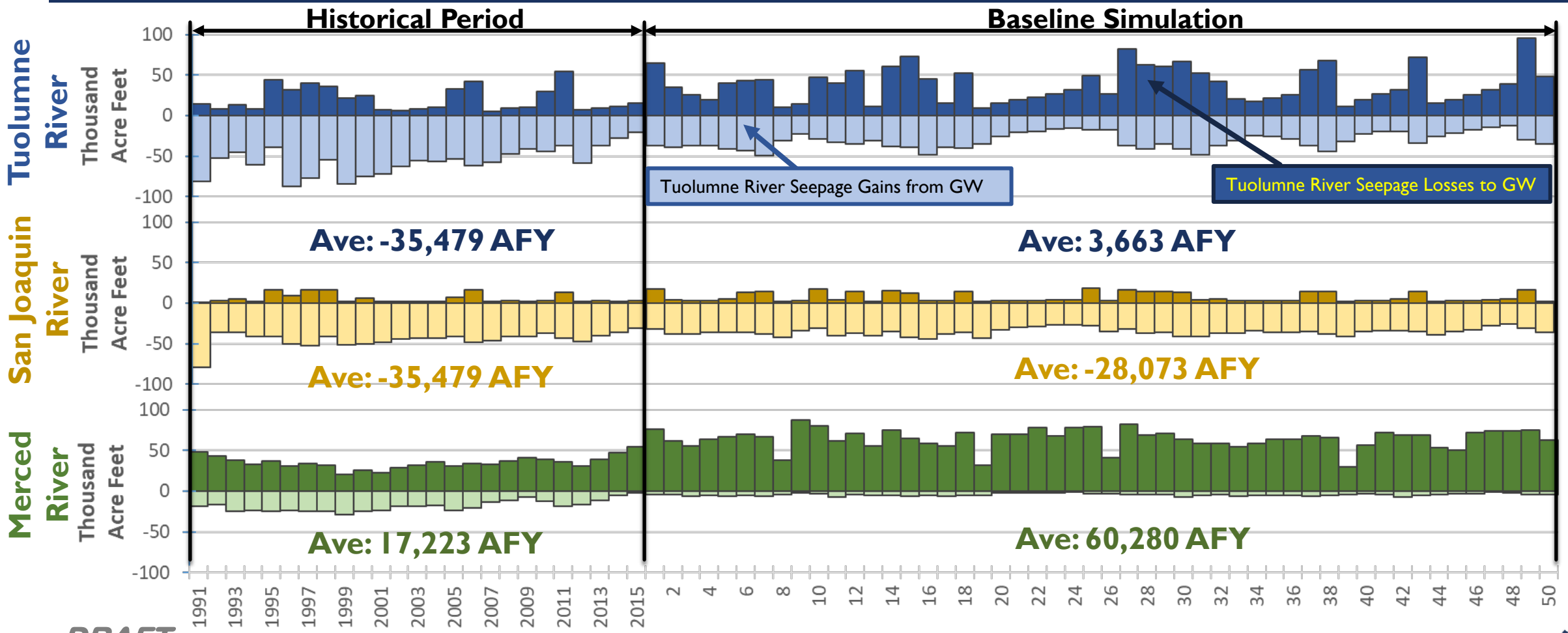
Stream-Aquifer Interaction
Turlock Subbasin



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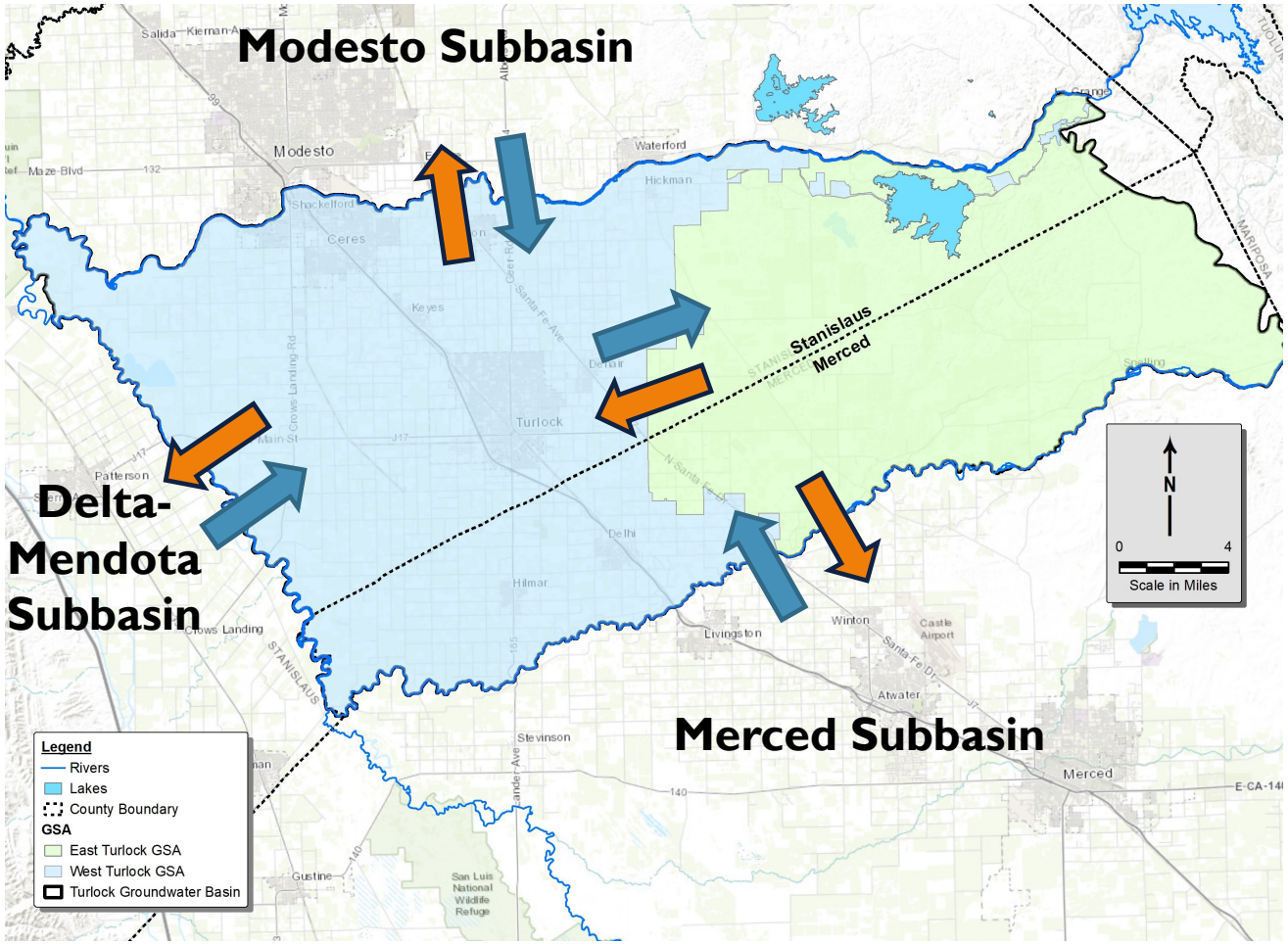
Inter- and Intra-Subbasin Subsurface Flows



Net Subsurface Inflows and Outflows

- Along Subbasin boundaries (flow through the aquifer from one Subbasin to another)
- Within the Turlock Subbasin between the WTSGSA and the ETSGSA

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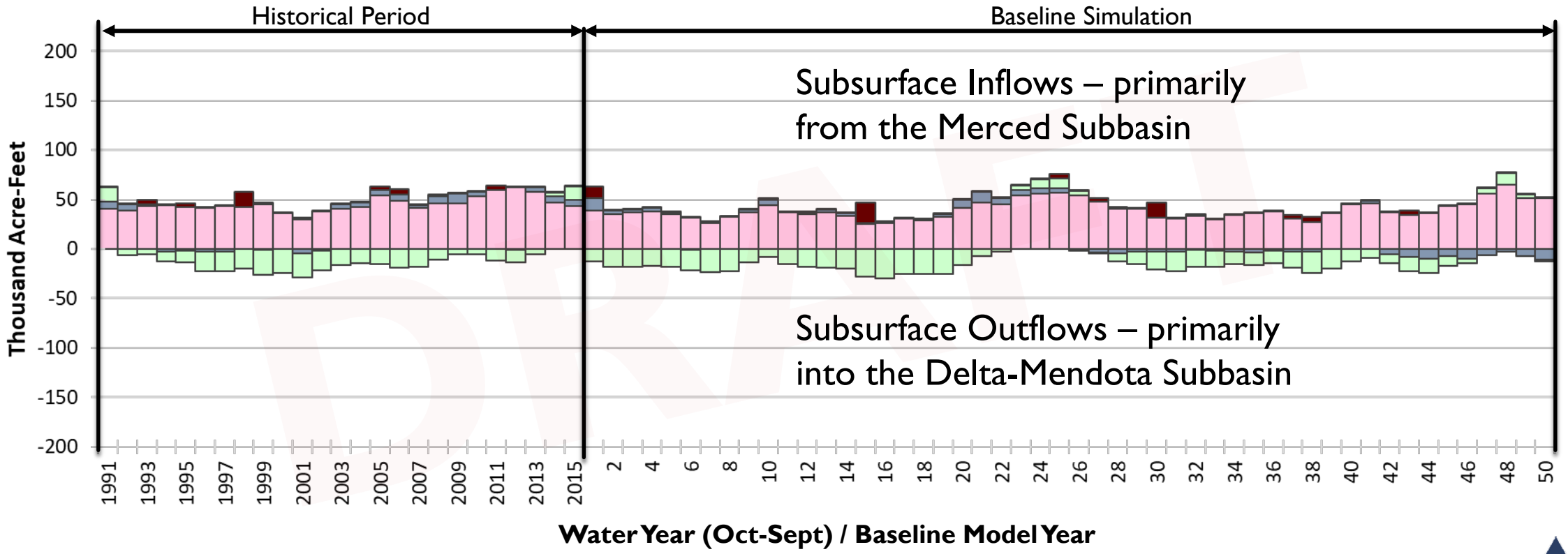
Boundary and Subsurface Flows Turlock Subbasin



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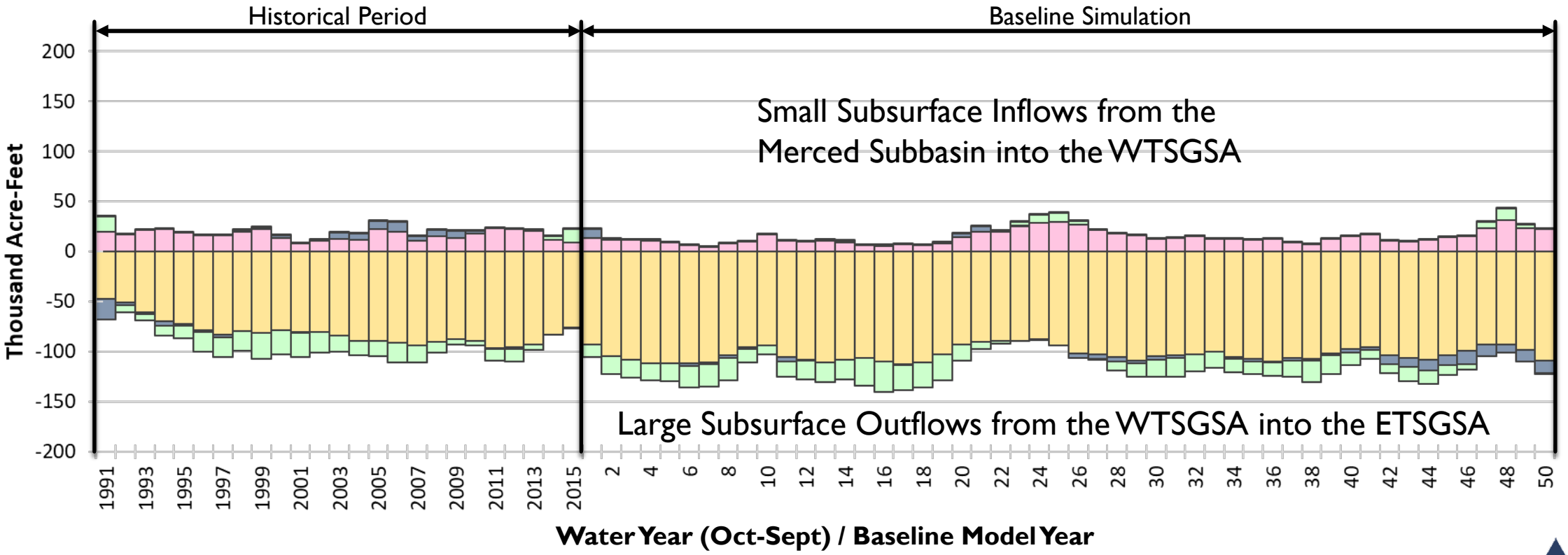
Note:

- This chart shows annual net boundary and subsurface flows across each of the boundaries between the Turlock Subbasin and the neighboring Subbasins

Boundary and Subsurface Flows WTSGSA



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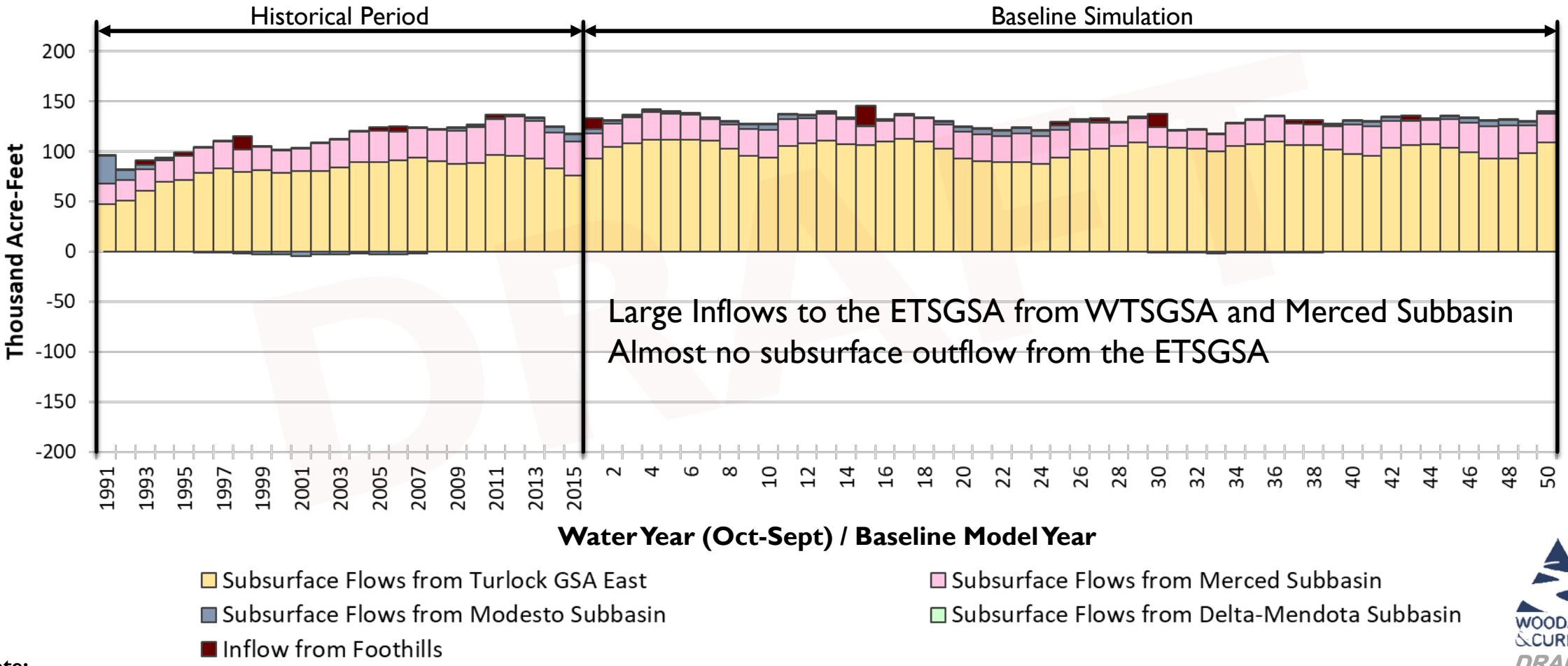
Boundary and Subsurface Flows ETSGSA



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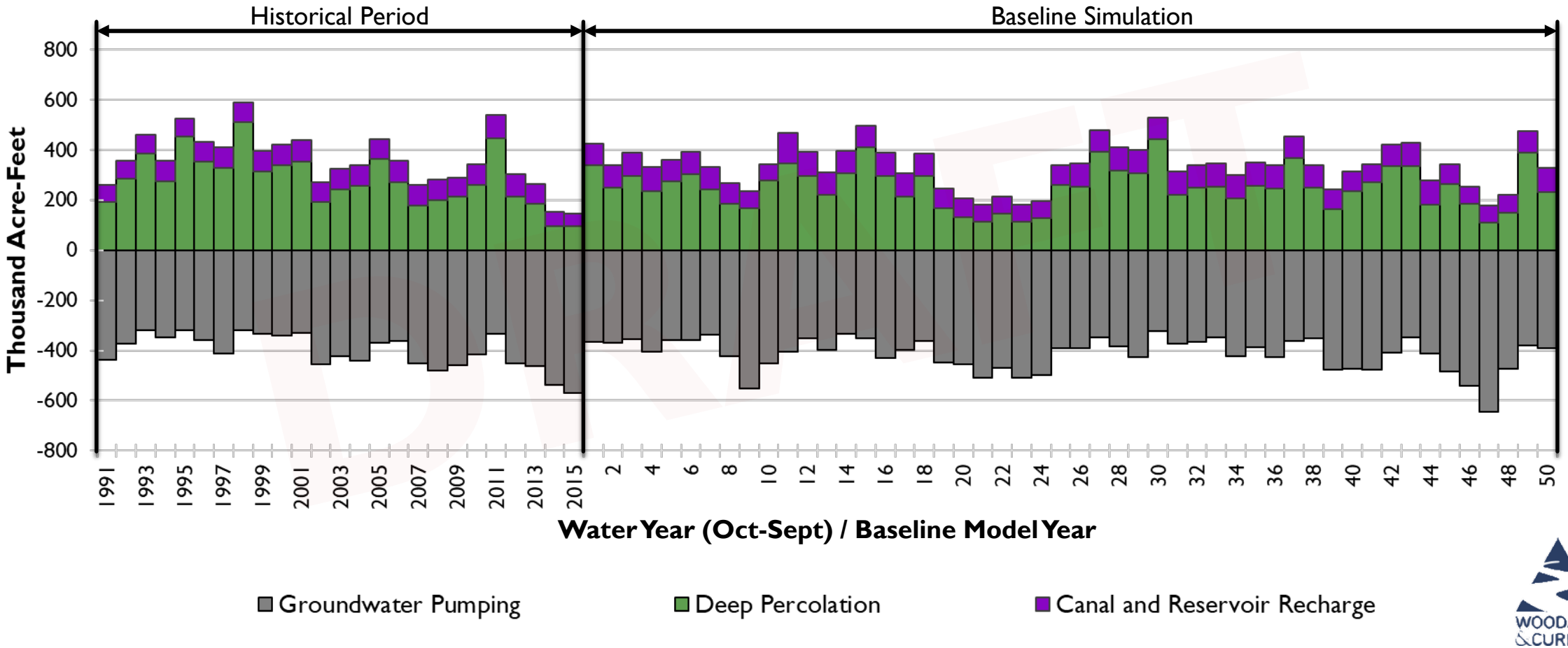
GROUNDWATER BUDGET: TURLOCK SUBBASIN



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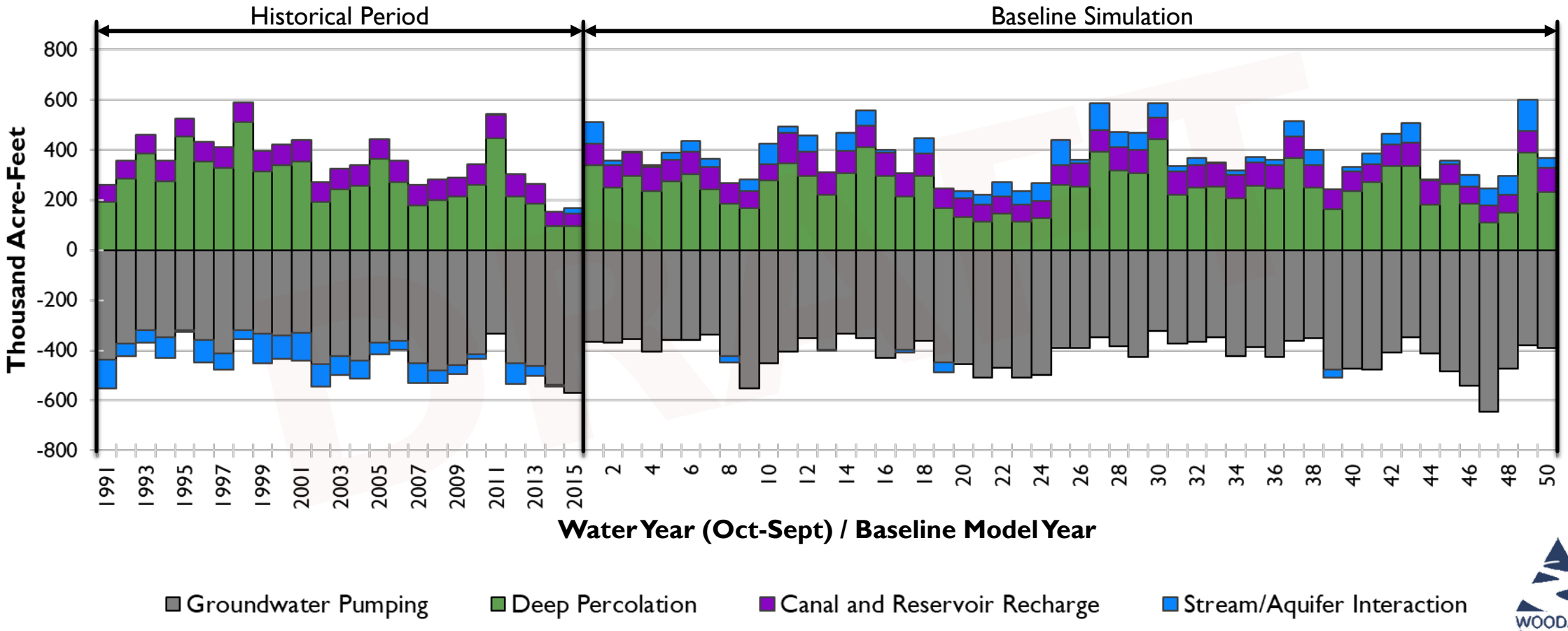
GROUNDWATER BUDGET: TURLOCK SUBBASIN



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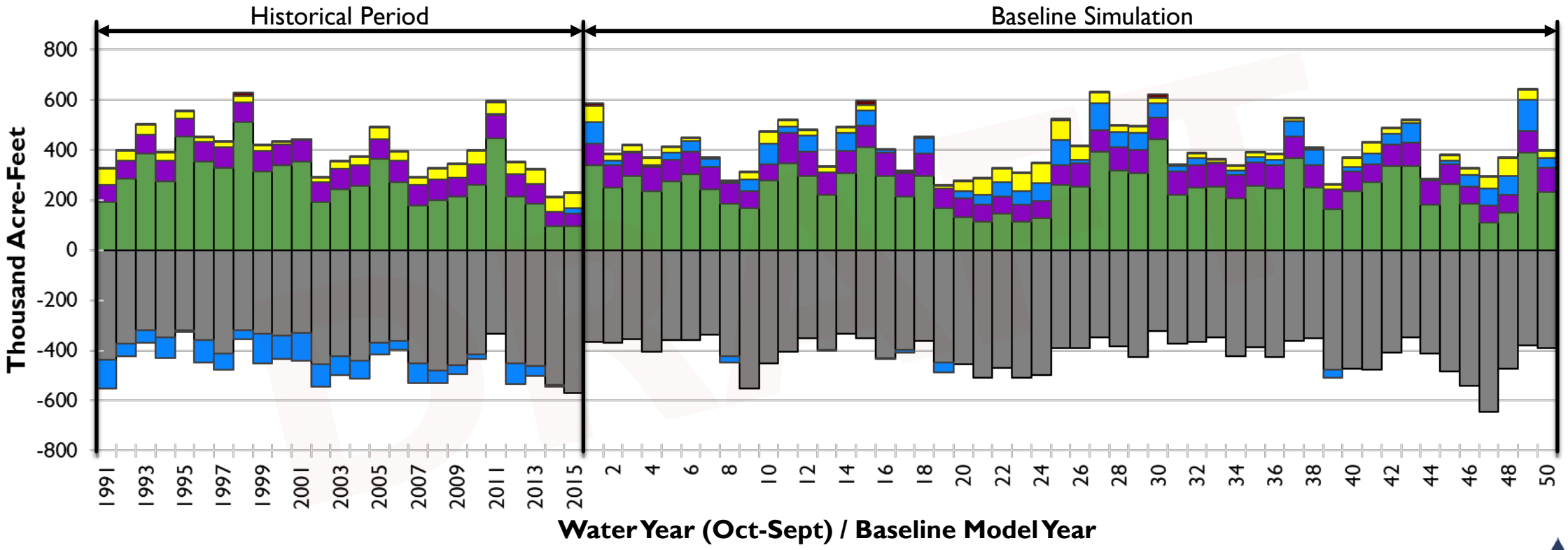
GROUNDWATER BUDGET: TURLOCK SUBBASIN



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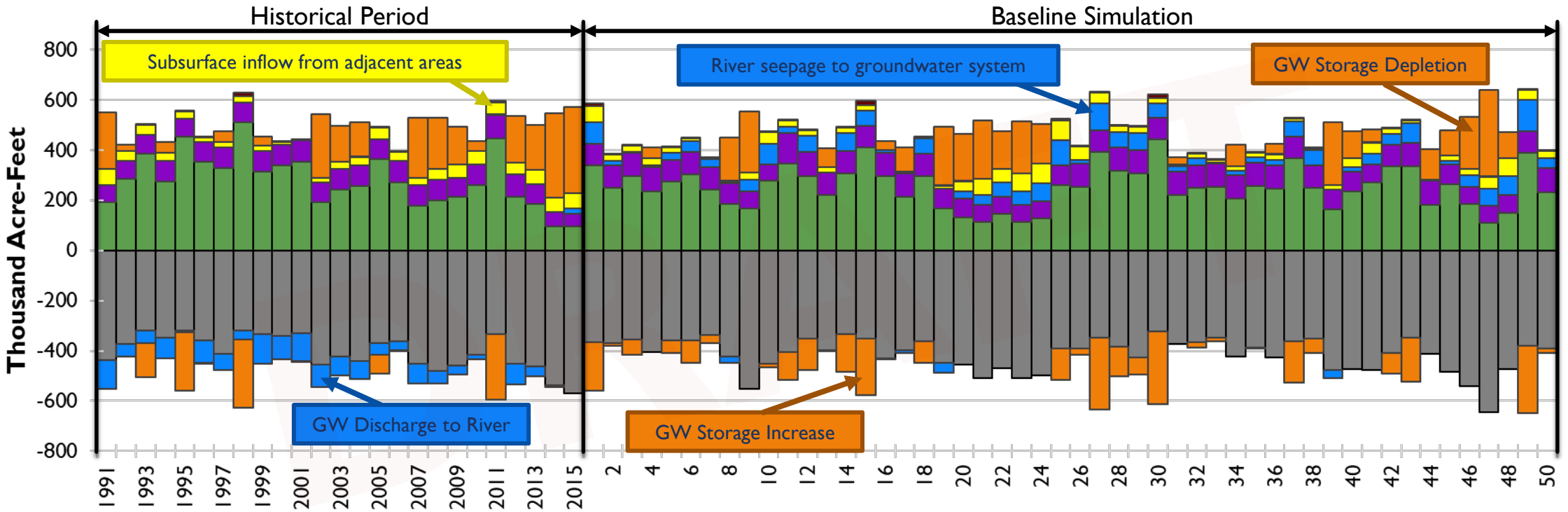
Complete Groundwater Budget
Turlock Subbasin



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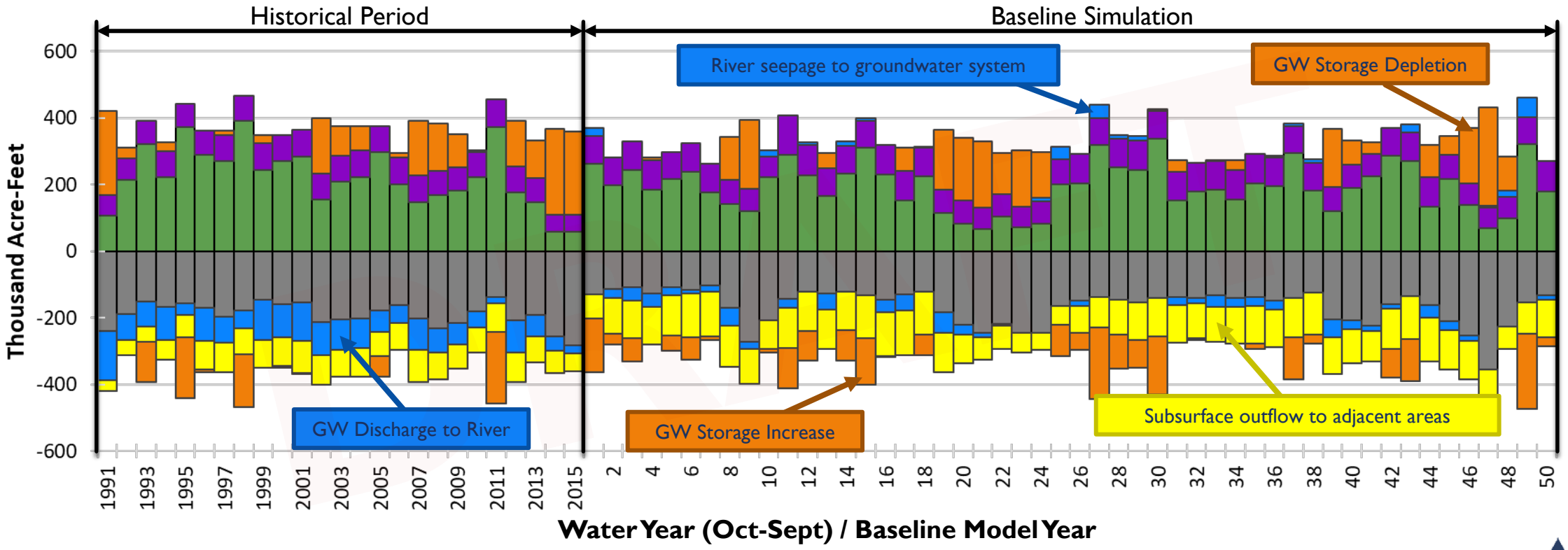
Complete Groundwater Budget WTSGSA



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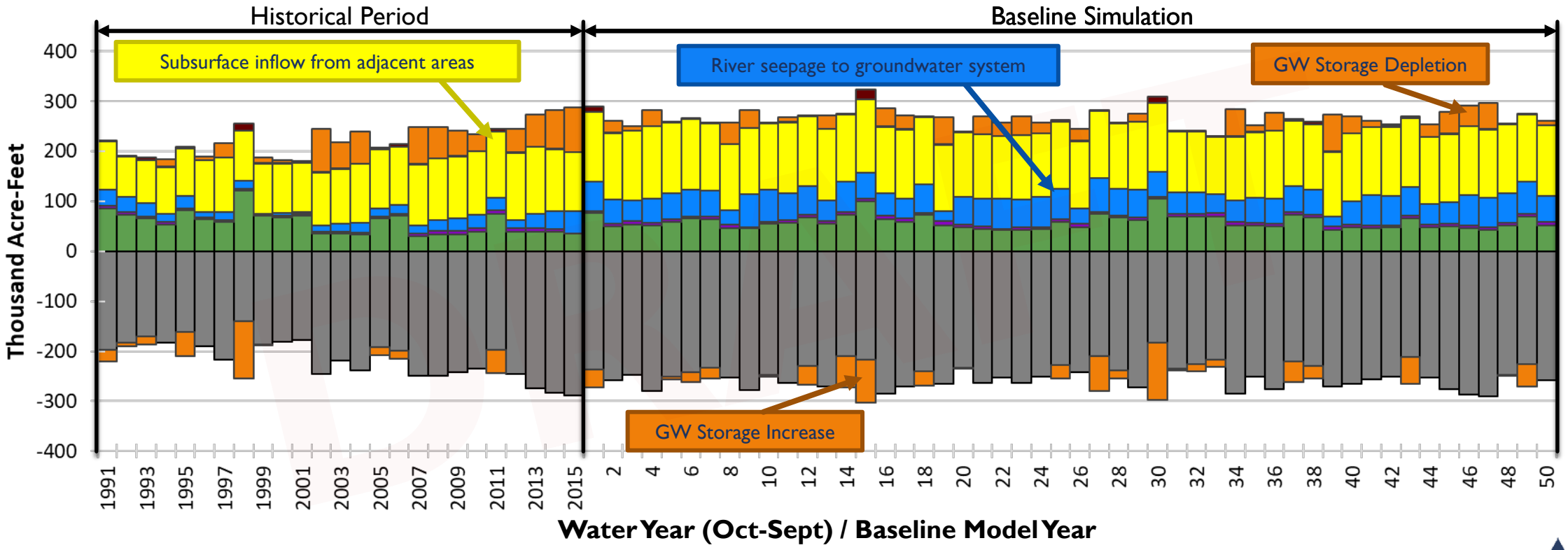
Complete Groundwater Budget ETSGSA



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Next Steps

- Upcoming Modeling Scenarios
  - Climate Change Analysis
  - Sustainable Yield Analysis
- Selection of Sustainable Management Criteria
- Projects and Management Actions

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QUESTIONS?