Napa Valley Groundwater Sustainability: A Basin Analysis Report for the Napa Valley Subbasin (Draft)

November 3, 2016

Watershed Information & Conservation Council

By Vicki Kretsinger Grabert and Reid Bryson

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Overview

- Overview of Basin Analysis Report and Comments Received to Date
- Groundwater and Surface Water Conditions (Ch. 4 Draft)
- Historical, Current, and Projected Water Supplies (Ch. 5 Draft)
- Sustainable Yield Analysis Refinements (Ch. 6 Draft)
- Sustainability Indicators and Monitoring (Ch. 7 Draft)
- Sustainable Groundwater Management (Ch. 9 Draft)
- Findings and Recommendations (Ch. 10 Draft)
- Next Steps

SGMA Basin Analysis Report

- **What it is:**
  - Functionally equivalent to a Groundwater Sustainability Plan
  - For basins operated sustainably for at least 10 years
  - Covers the whole DWR-designated basin
  - Conditions typical throughout the basin
- **What it is not:**
  - Not the whole County
  - Not the hillsides, MST, or Carneros areas
  - Does not require return to pre-development conditions
  - Does not focus on very local groundwater problems (like well interference)

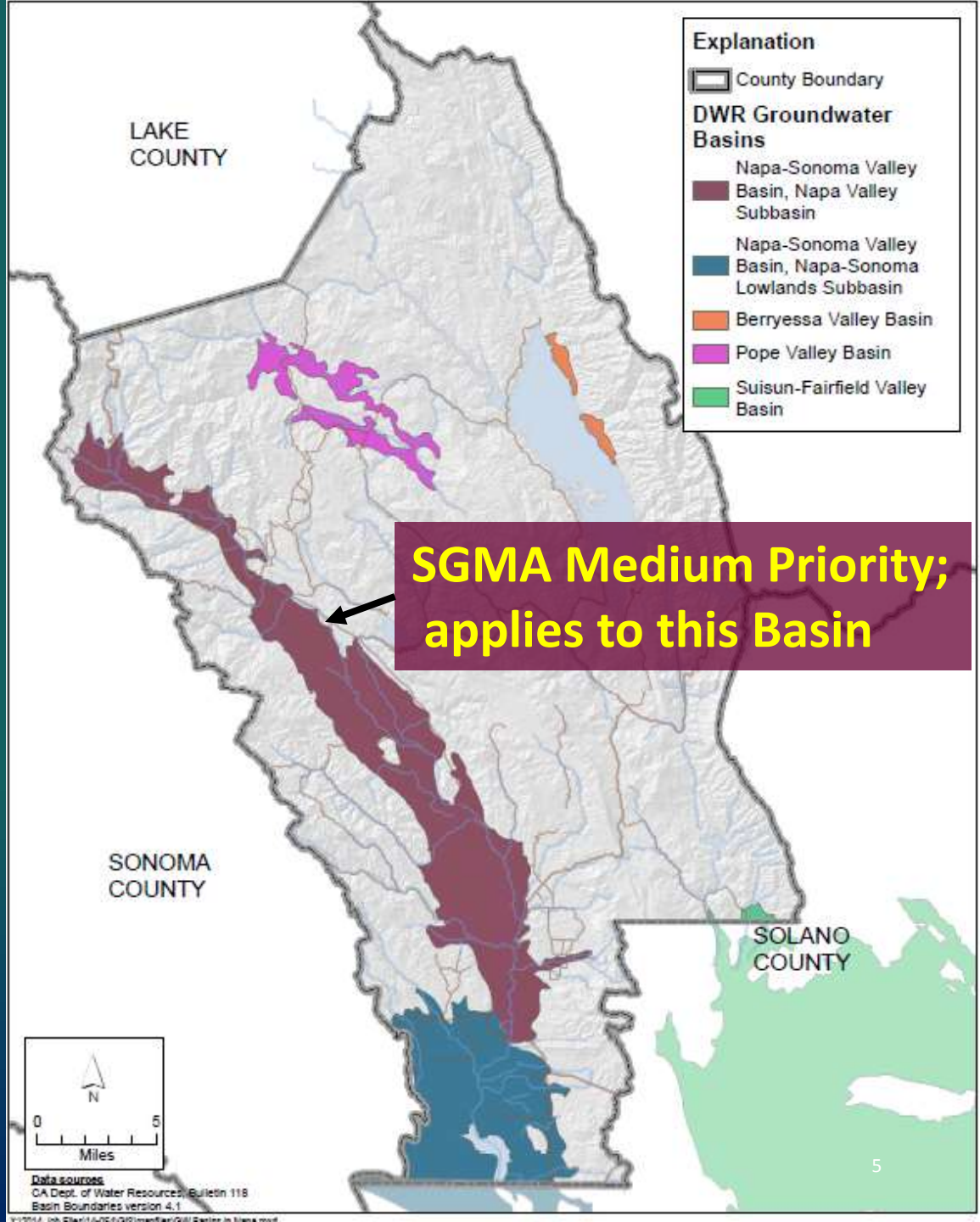
Basin Analysis Report Contents

1. Introduction
2. Physical Setting and Hydrogeology
3. Monitoring Network and Program
4. Groundwater and Surface Water Conditions
    a) Groundwater
    b) Surface water
5. Historical, Current and Projected Water Supply
6. Sustainable Yield Analysis
7. Napa Valley Subbasin Sustainability Goals
8. Monitoring Data Management and Reporting
9. Sustainable Groundwater Management
10. Findings and Recommendations

Appendices

Groundwater Basins

- Napa Sonoma Valley Basin
  - **Napa Valley Subbasin**
  - Napa-Sonoma Lowlands Subbasin
- Berryessa Valley Basin
- Pope Valley Basin
- Suisun-Fairfield Valley Basin



Comments Received to Date

- Comments received through November 1.
- Comment topics have included:
  - the scope of monitoring efforts,
  - concerns about groundwater level declines and changes in summer baseflow conditions,
  - the influence of land uses in the Subbasin watershed (i.e., hillsides) on the Subbasin water budget, and
  - the importance of incorporating Best Management Practices by all whose actions influence the Subbasin.

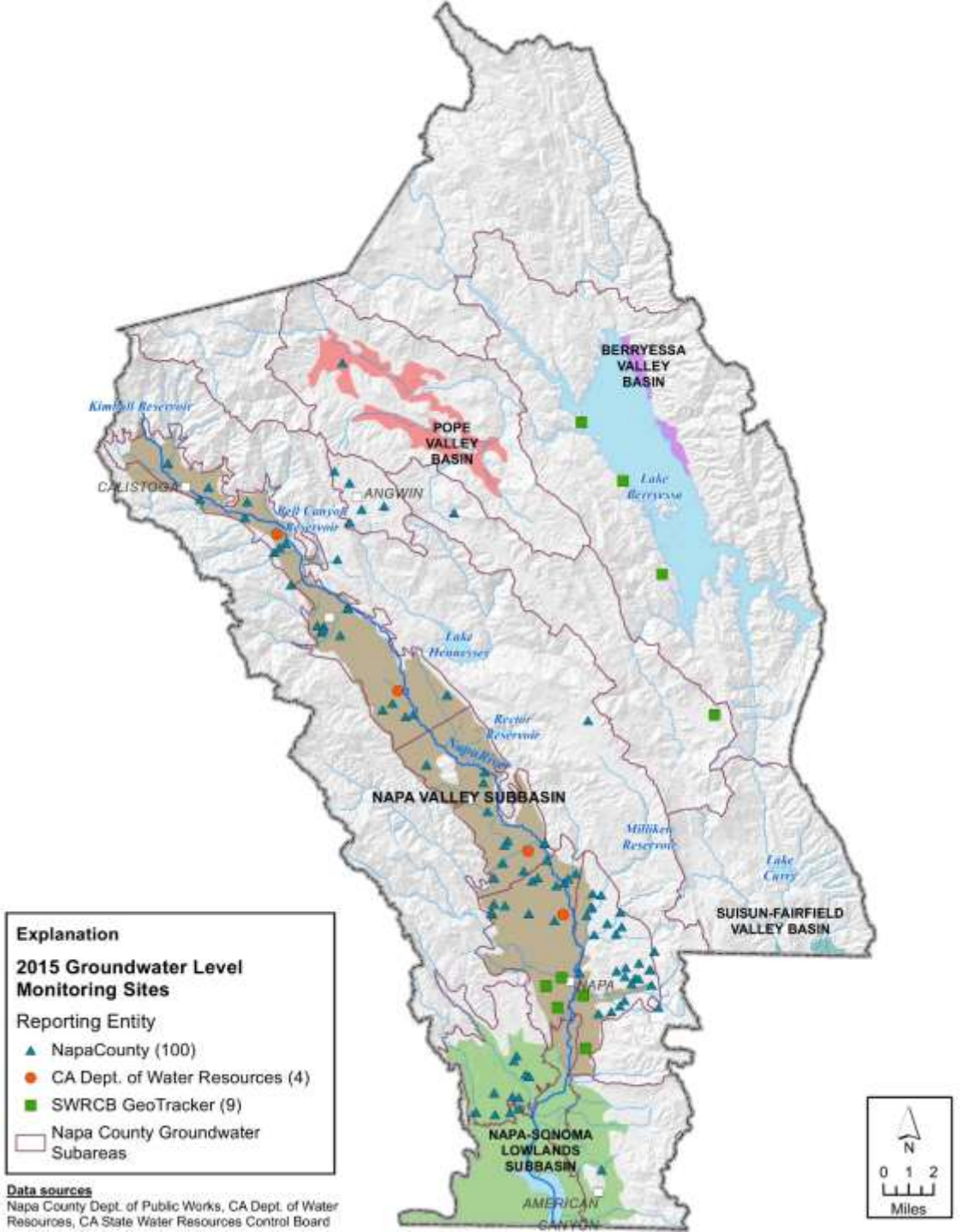
Groundwater and Surface Water Conditions (Ch. 4 Draft)

Groundwater Level Monitoring, 2015

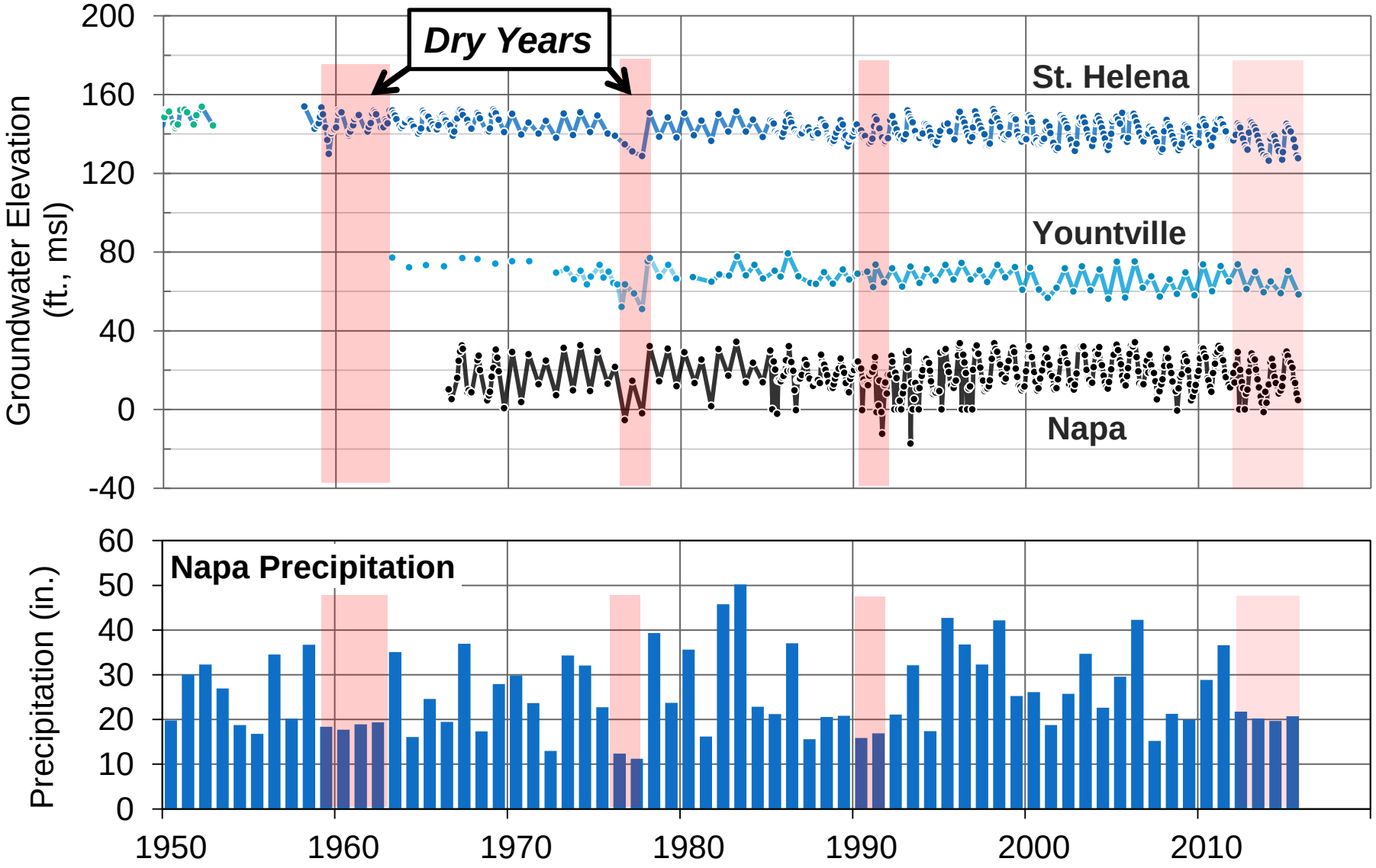
- Napa Co., 100 (includes 48 volun., 10 SW/GW)
- DWR, 4
- GeoTracker, 9

Total Wells = 113 Sites

Ongoing network enhancements.



Groundwater Conditions: Napa Valley Subbasin

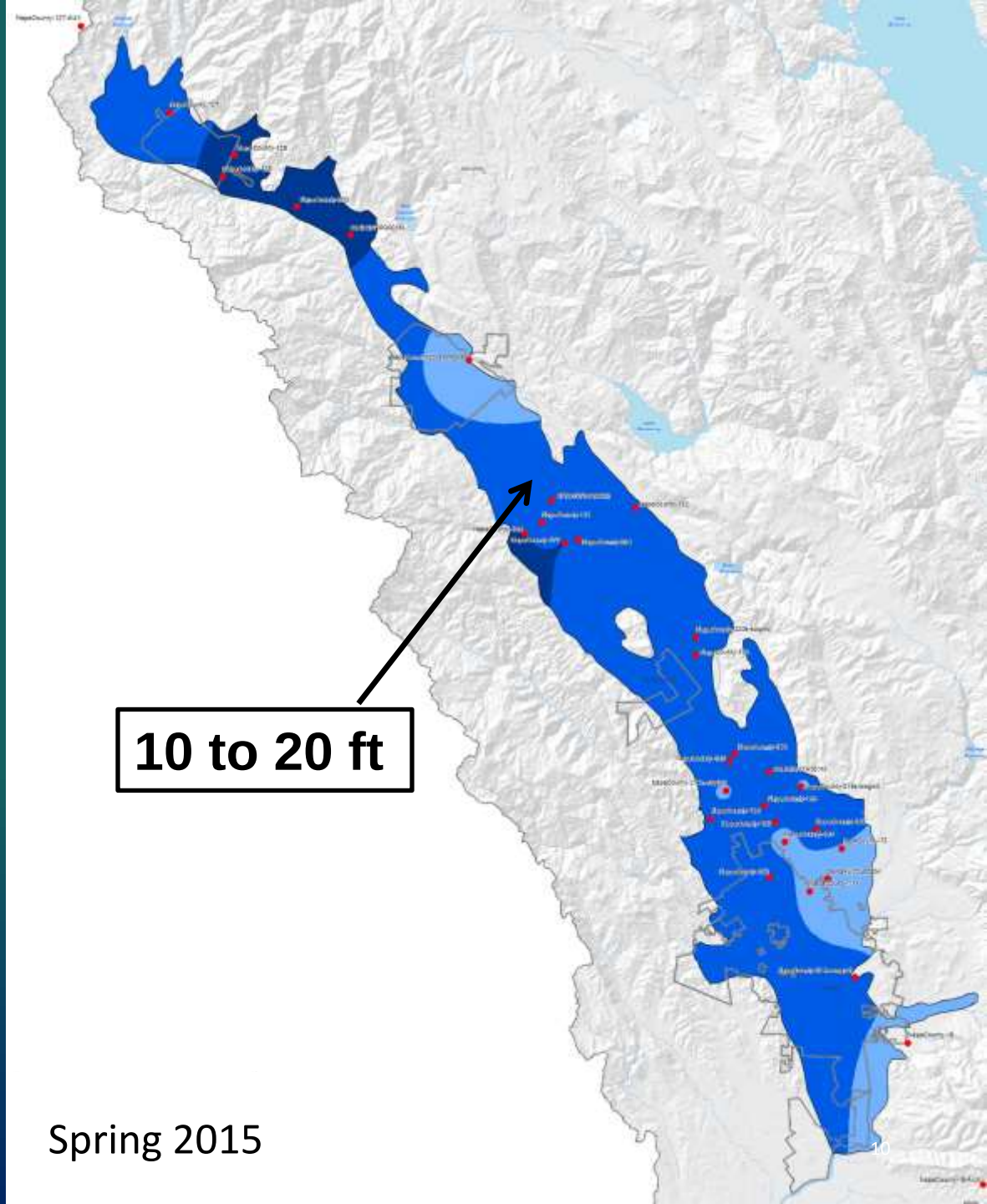


Depth to Groundwater

Feet below ground surface

- 0 - 10
- 10.01 - 20
- 20.01 - 30

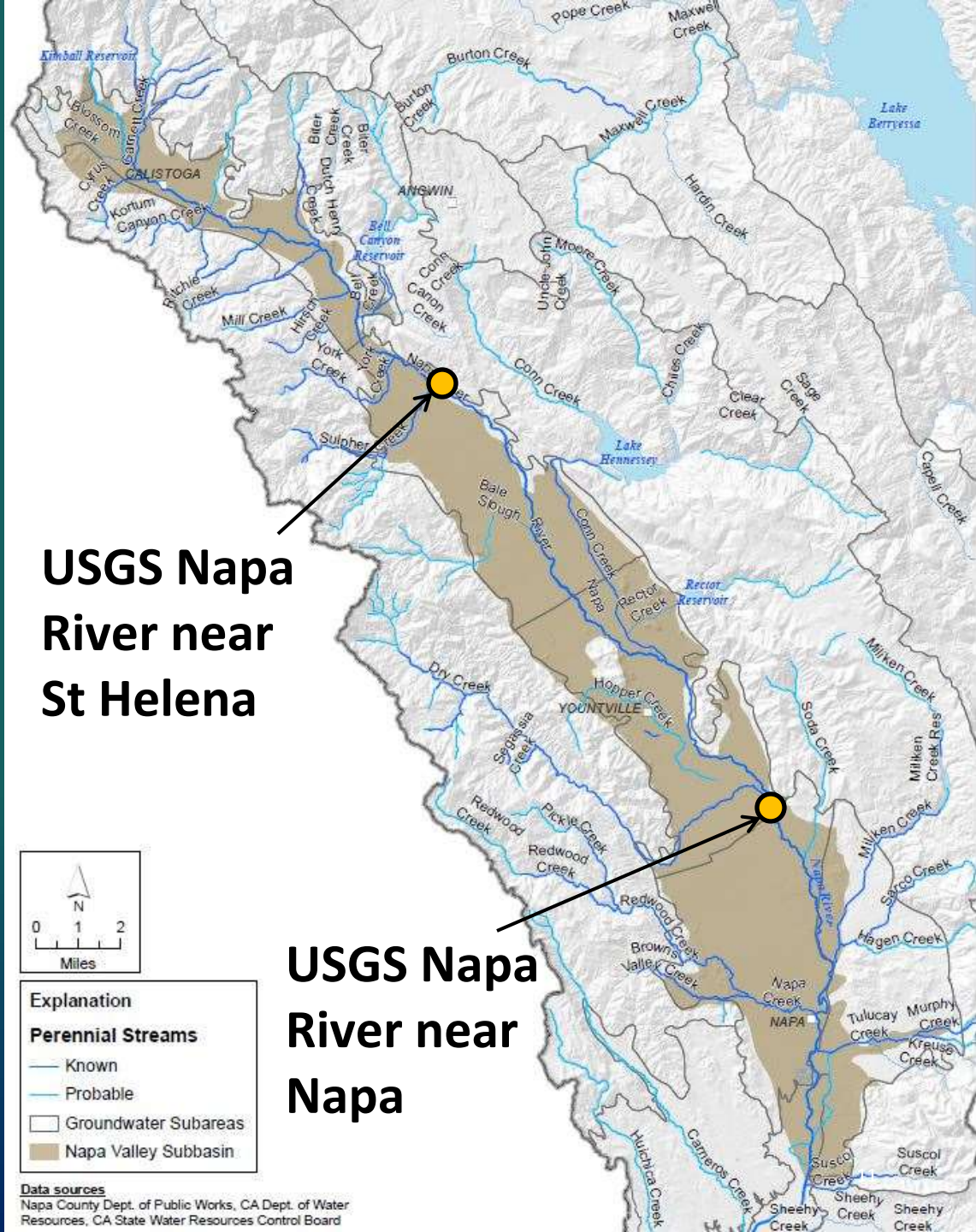
Water table (Valley Floor) generally very shallow; basin quite "full"



Spring 2015

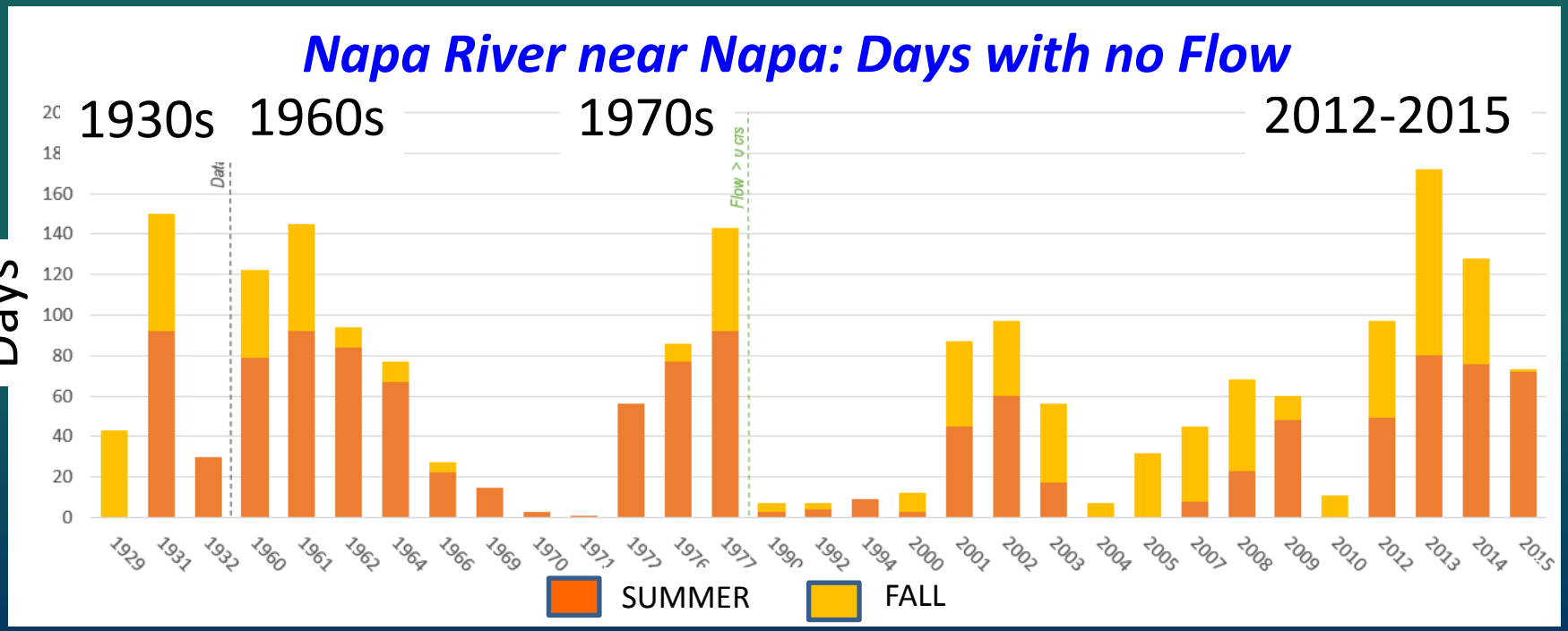
Groundwater Interactions with Surface Water

- Perennial Streams Recharge the Napa Valley Subbasin
- Groundwater contributes to stream baseflow

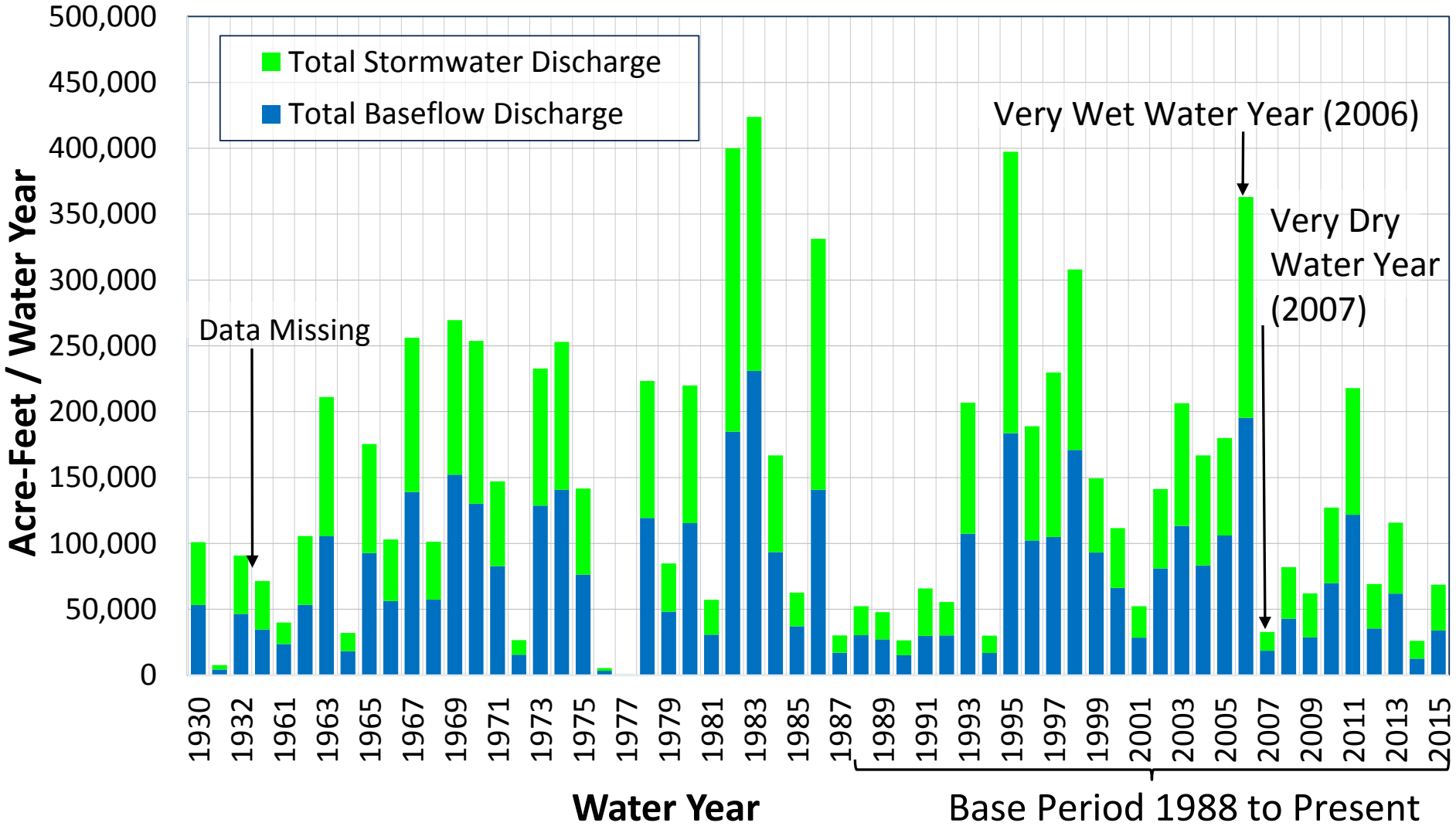


Historical to Current Streamflow Observations

- Historical streamflows in Napa Valley varied considerably season-to-season & year-to-year (USGS WRI 13-73, 1973)

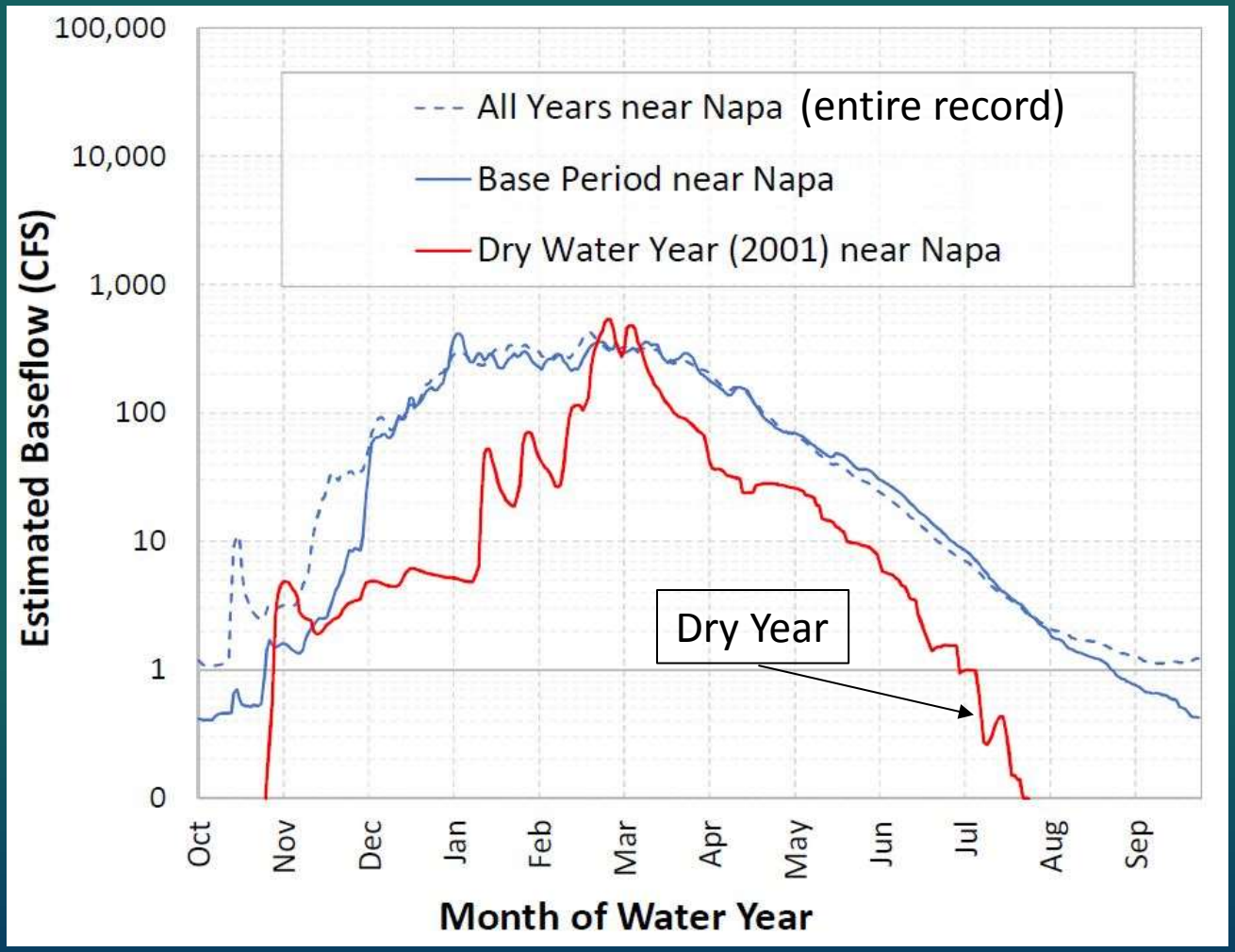


Total Baseflow (GW) & Stormflow



Average Napa River Baseflow

(Napa River near Napa)

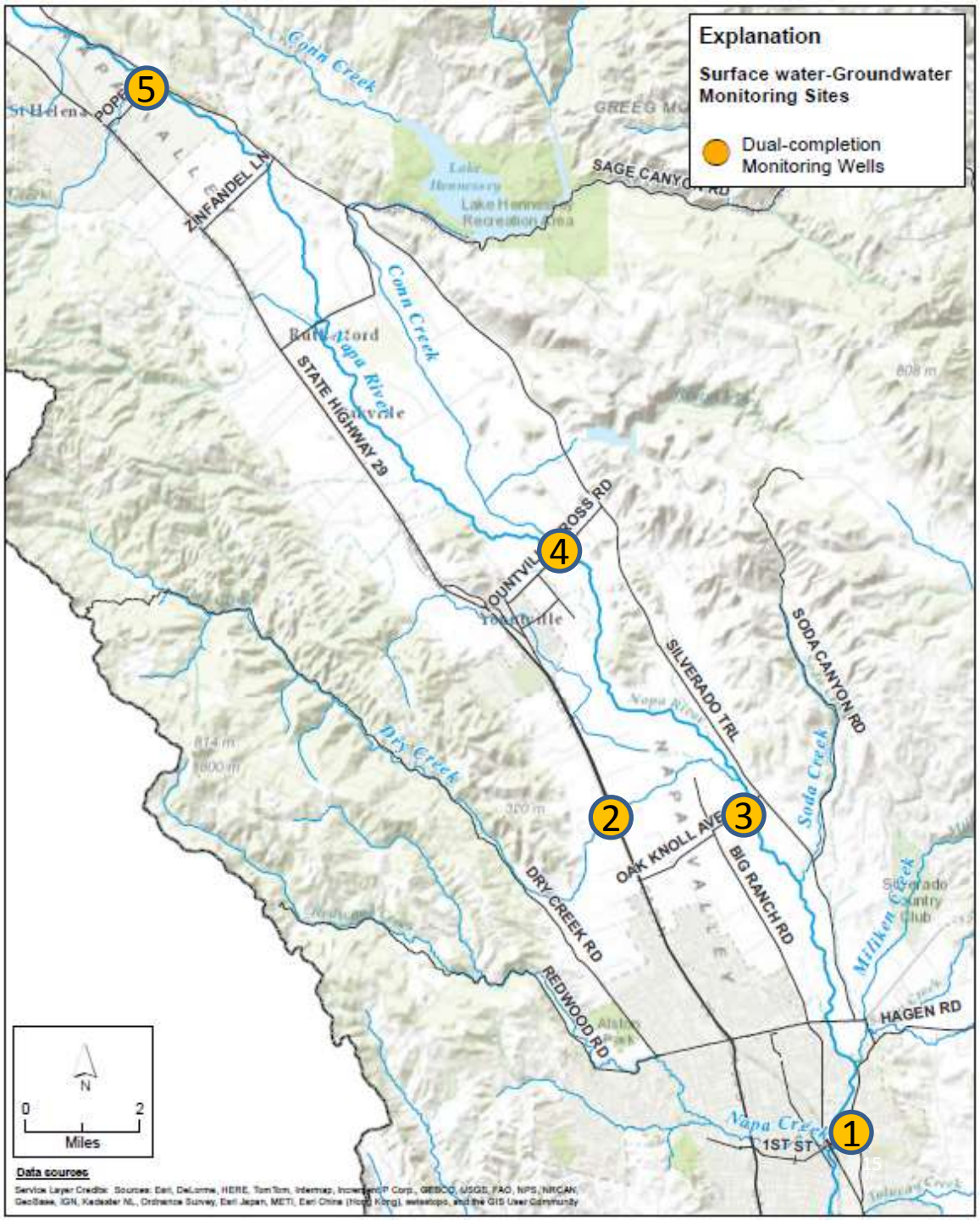


Baseflow estimate is from stream gage data. Historical seasonal variations in flow are typical.

Surface Water/ Groundwater

Monitoring at 5 Sites

- Shallow MWs each site
  - Levels & quality
- Stream gauge each site
  - Streamflow & quality

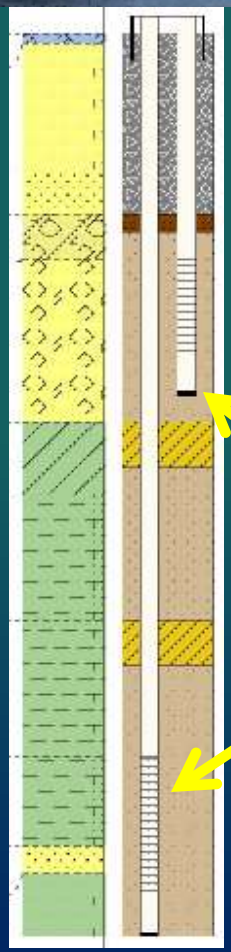


GW Monitoring Wells Near River

Above Ground
Locked Protection

Looking Down at MWs

2-inch dia. casings



Sand and Gravel

Below Ground
"Nested" Monitoring Wells

40 ft Deep

2-inch dia. casings

Sand

100 ft Deep

Not to Scale

SW/GW Interaction:
Site 5: St. Helena, Oct. 2014 & Dec. 2014

D S

WL Elev., msl

206.08ft

December
185.85ft

189.04ft

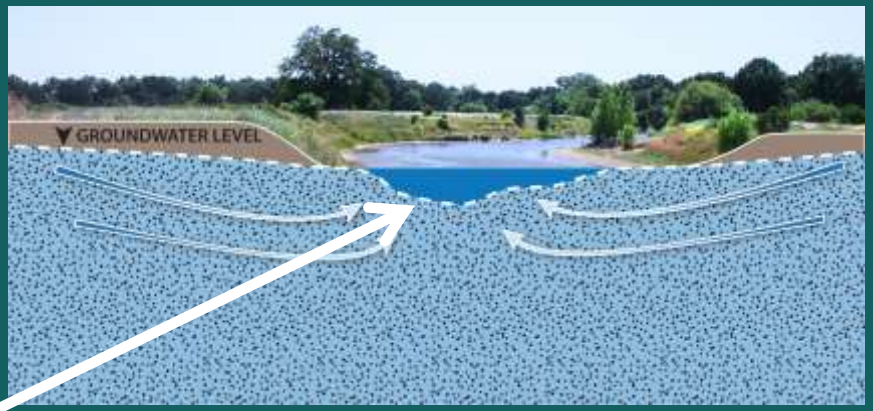
40ft TD

October
173.05ft

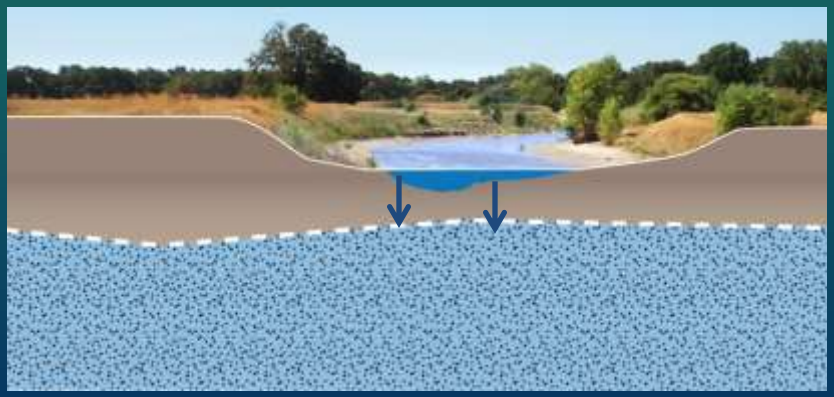
100ftTD

Not drawn to scale

Elevation of
Thalweg
196.00ft, msl

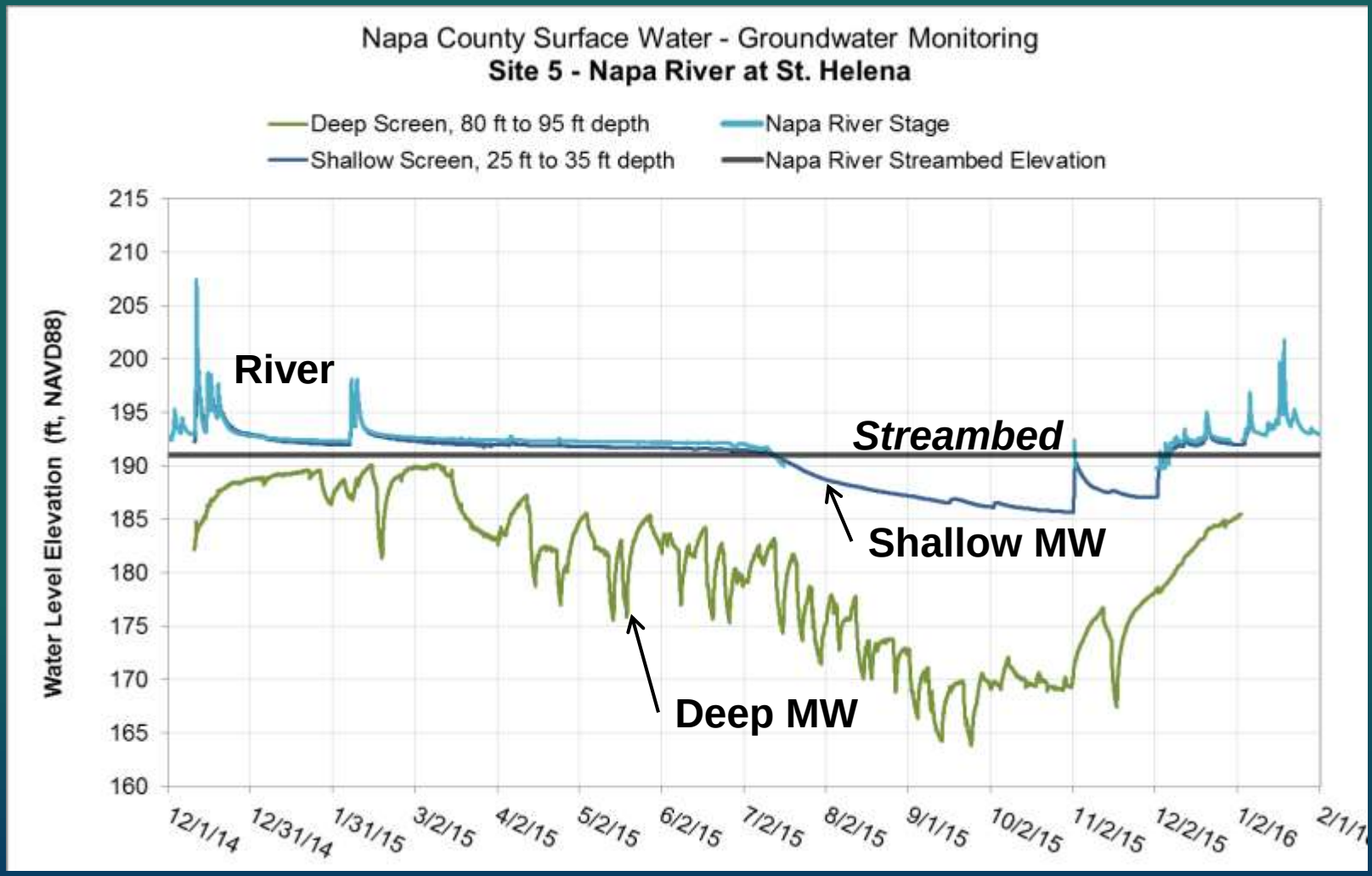


GW above in Dec. 2014



GW below in Oct. 2014

SW/GW Interaction: Site 5 St. Helena



WL Difference Shallow and Deep Oct. 2015 = 17 ft.

Groundwater/Surface Water Summary

- Overall, groundwater conditions stable
- Shallow depth to groundwater in the Valley Floor; the basin is quite “full”
- Historical streamflows varied considerably season-to-season and year-to-year
- Groundwater contributes to the total volume of streamflow
- Napa River system is hydrogeologically sensitive to climatic variations and other factors that change the water balance

Key Terms and Scale of Analysis

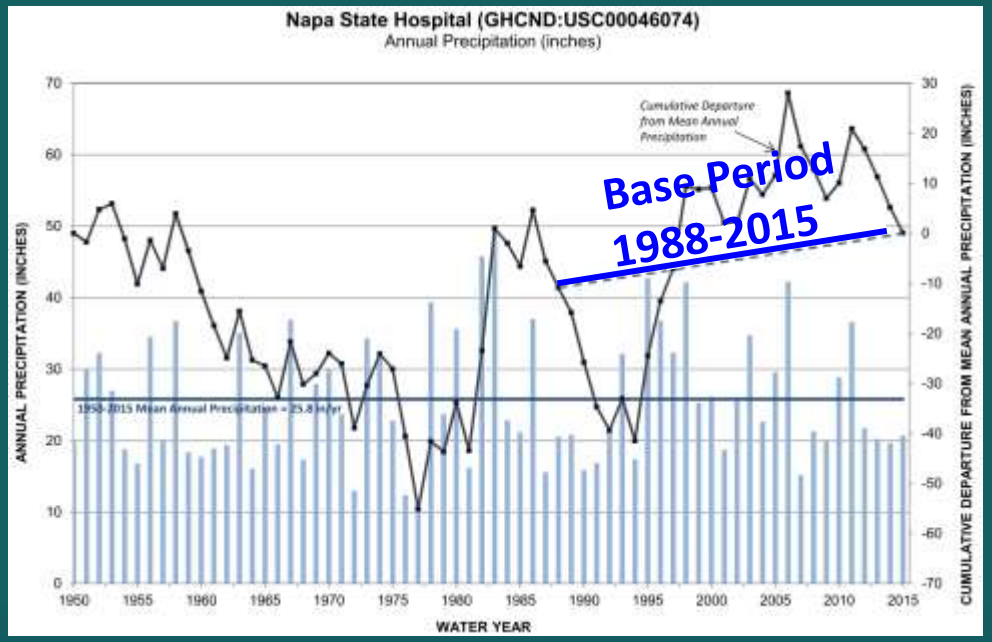
Sustainable Yield

Sustainable Yield (Definition; Water Code Section 10721(v)):

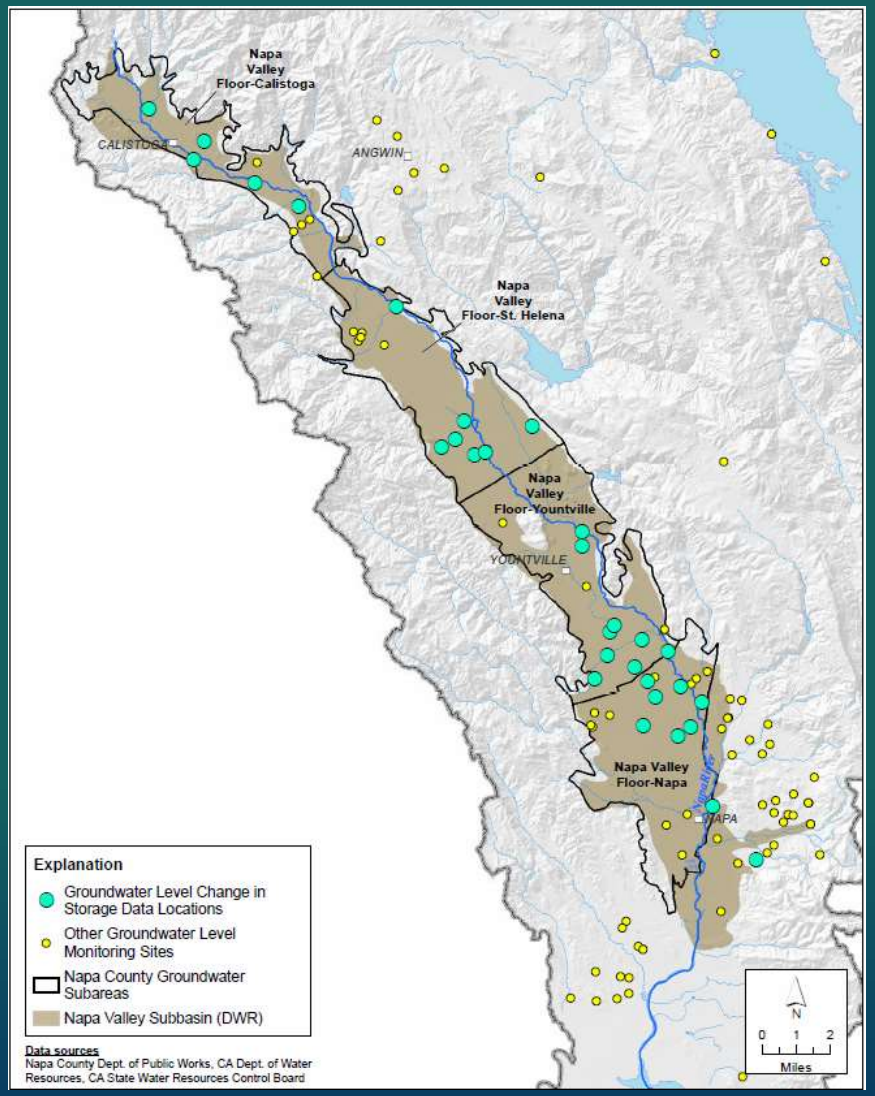
"*Maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually without causing an undesirable result*."

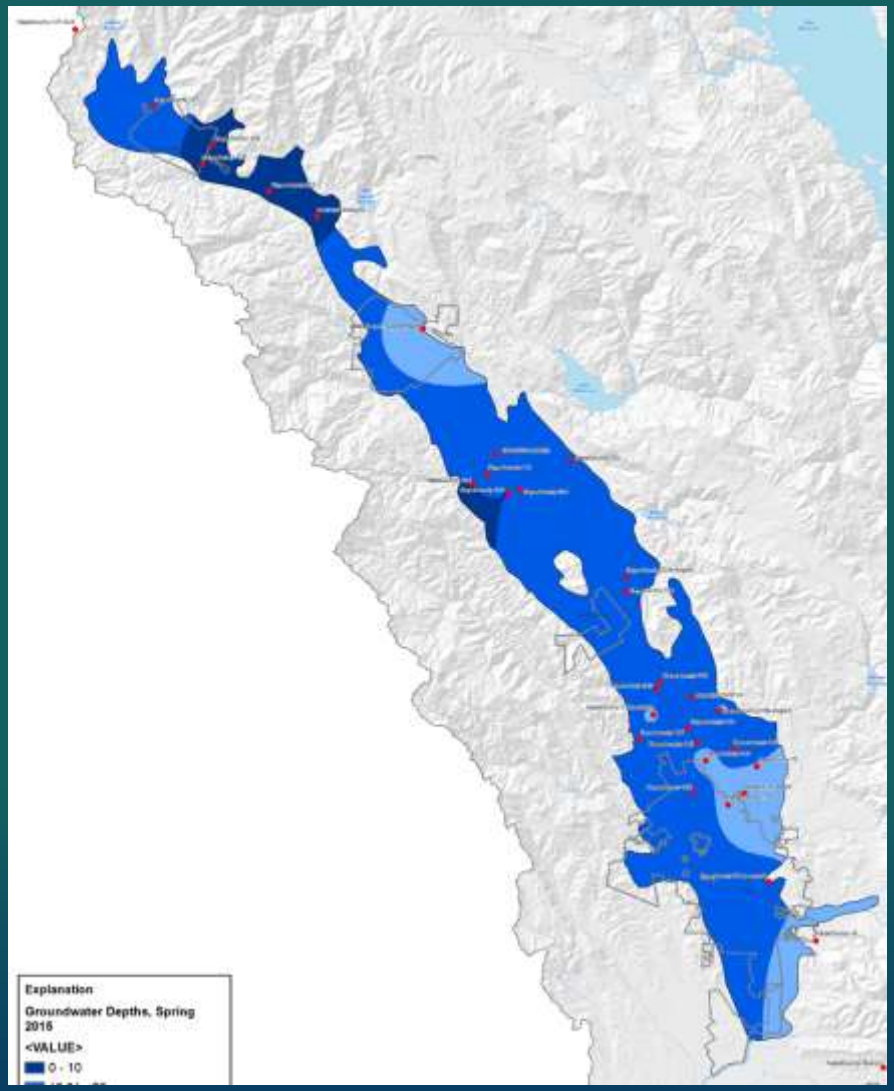
Hydrologic Base Period

- Antecedent Dry Conditions
- Stable Cultural Conditions
  - Water Supply Sources
  - Land Use
- Mixture of Wet and Dry Water Year Types
- Similar Water Year Types at Start and End



Scale of Analysis: Napa Valley Subbasin



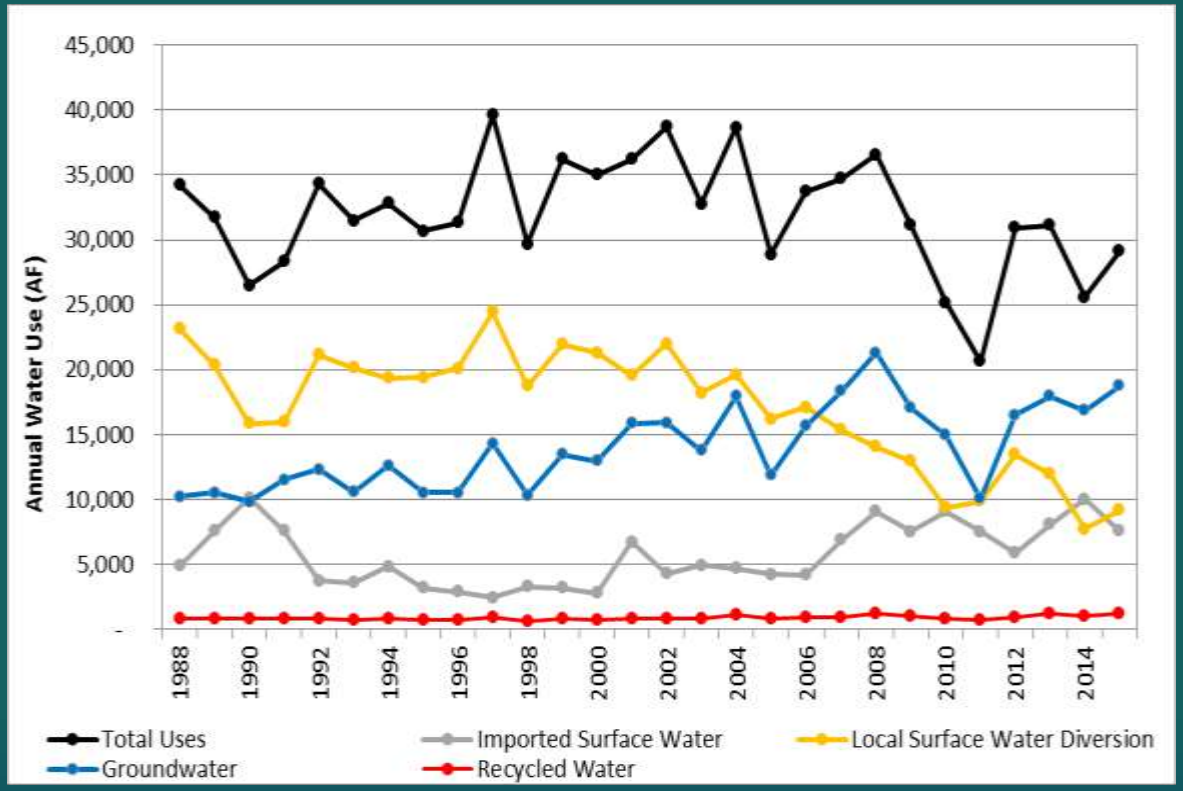


Sustainable Yield Analysis Addresses **Subbasin Scale**
Not Well or Parcel Scale

Historical, Current, and Projected Water Supplies (Ch. 5 Draft)

Total Subbasin Water Use

- Total water use generally remained stable 1988-2015.
- GW has increased as a source of supply based on land use mapping from 1987-2011.
- Use of SW diverted from within the Subbasin or by muni reservoirs in the Subbasin watershed has decreased by about half from 1988-2015.



Data sources: Basin Analysis Report Root Zone Model, City of Calistoga, City of Napa, City of St. Helena, Town of Yountville, NCFCWCD, and Napa San. Dist., with additional calculations based on U.S. Census Bureau population data and Napa County Winery Permit records.

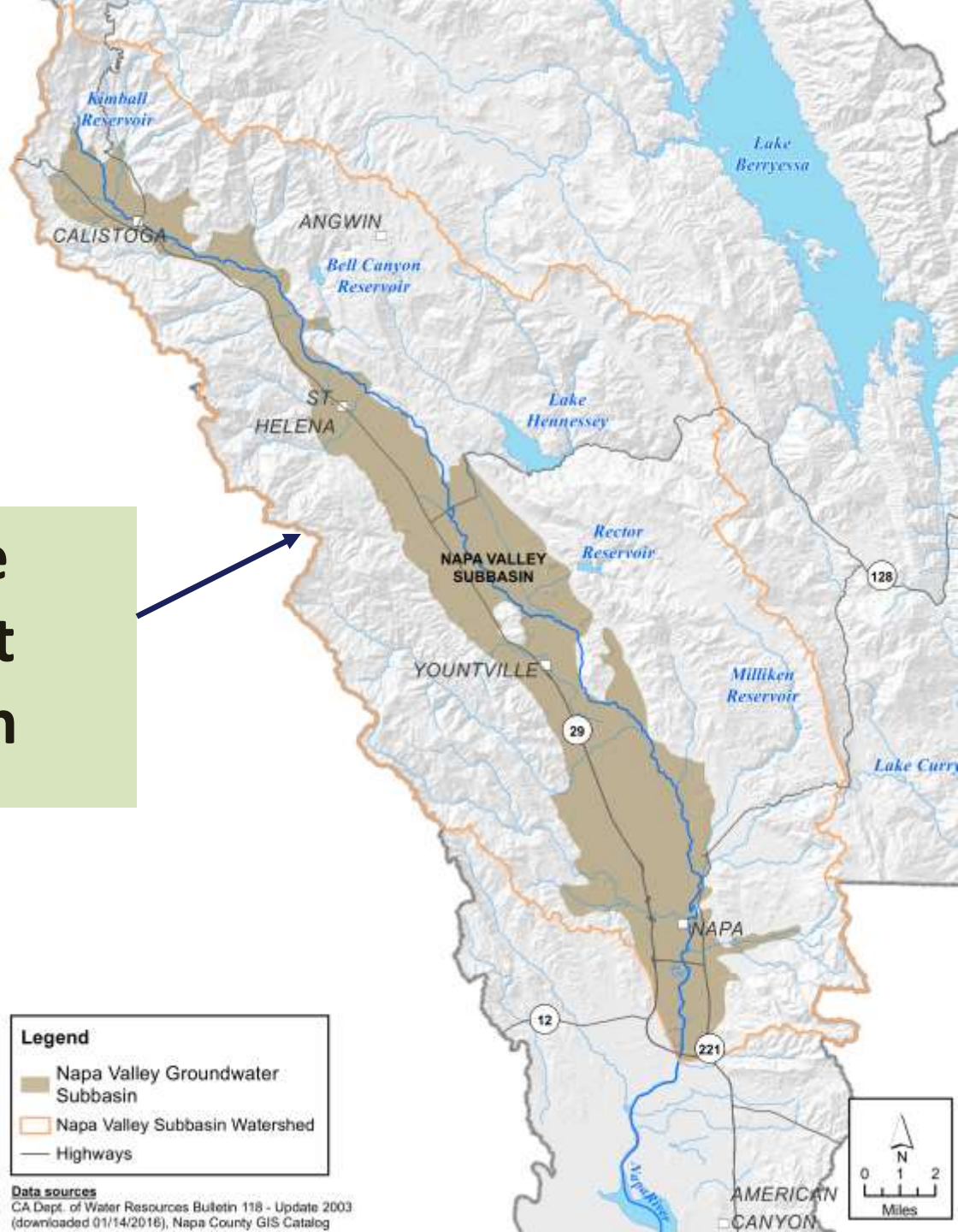
Sustainable Yield Analysis (Ch. 6 Draft)

Water Budget Refinements Since Sept. Draft

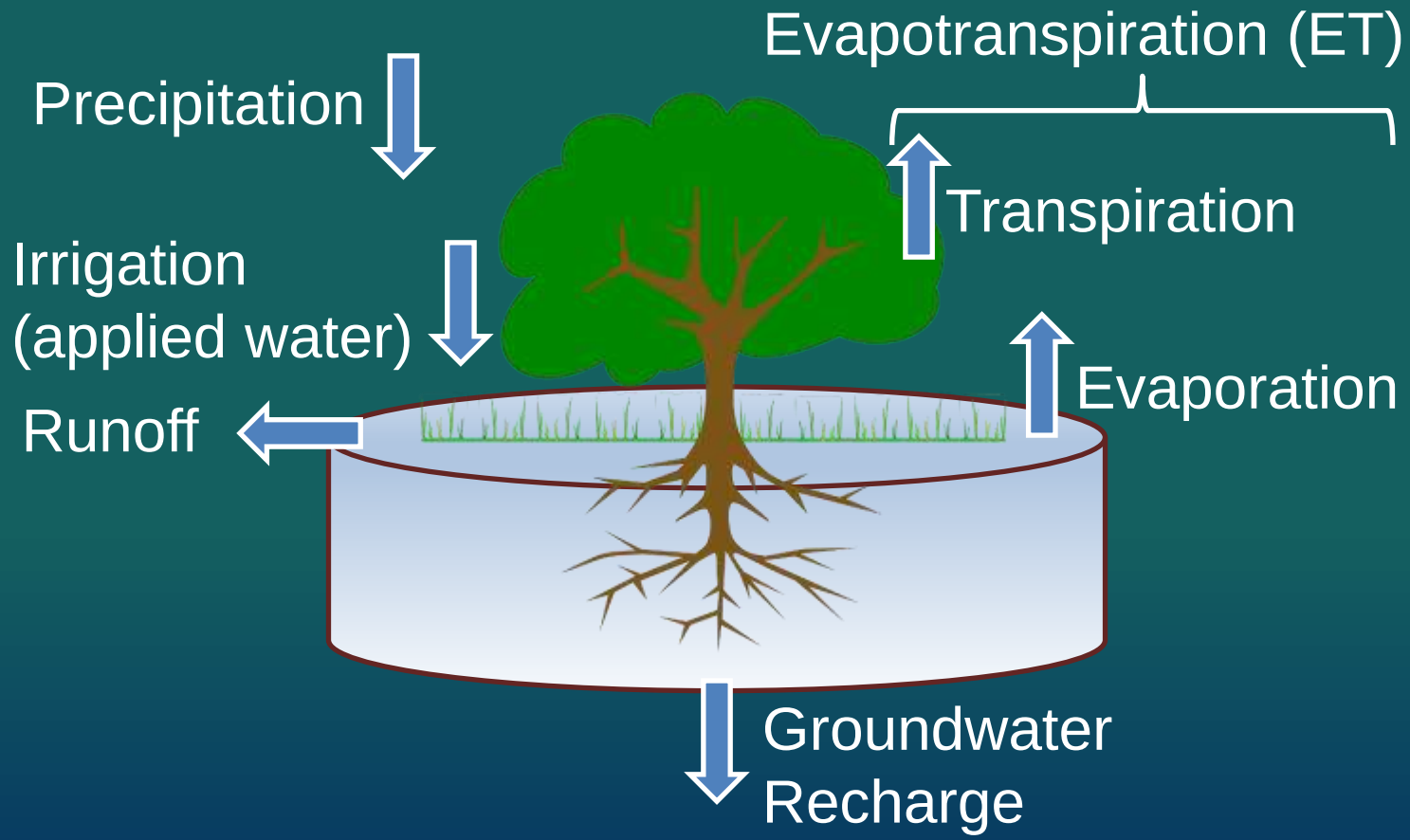
- Refinements to the Root Zone Model and Water Budget were implemented in response to additional review and comments.
- **Vineyard Irrigation Practices:** assumed to have been less efficient earlier in the base period, resulting in increased water use of 21% compared to the September draft.
- **Unincorporated Residential Water Use:** more accurately represented based on water use data from the North Bay region and consistent with the decreasing trend in unincorporated population countywide.
- **Water Budget Component "Consumptive Uses of Groundwater and Surface Water":** used (instead of simply GW pumping) to correctly reflect the total outflow from the Subbasin due to Evapotranspiration.

Water Budget Area:
Napa Valley Subbasin

Water budgets involve the watershed not just the groundwater basin

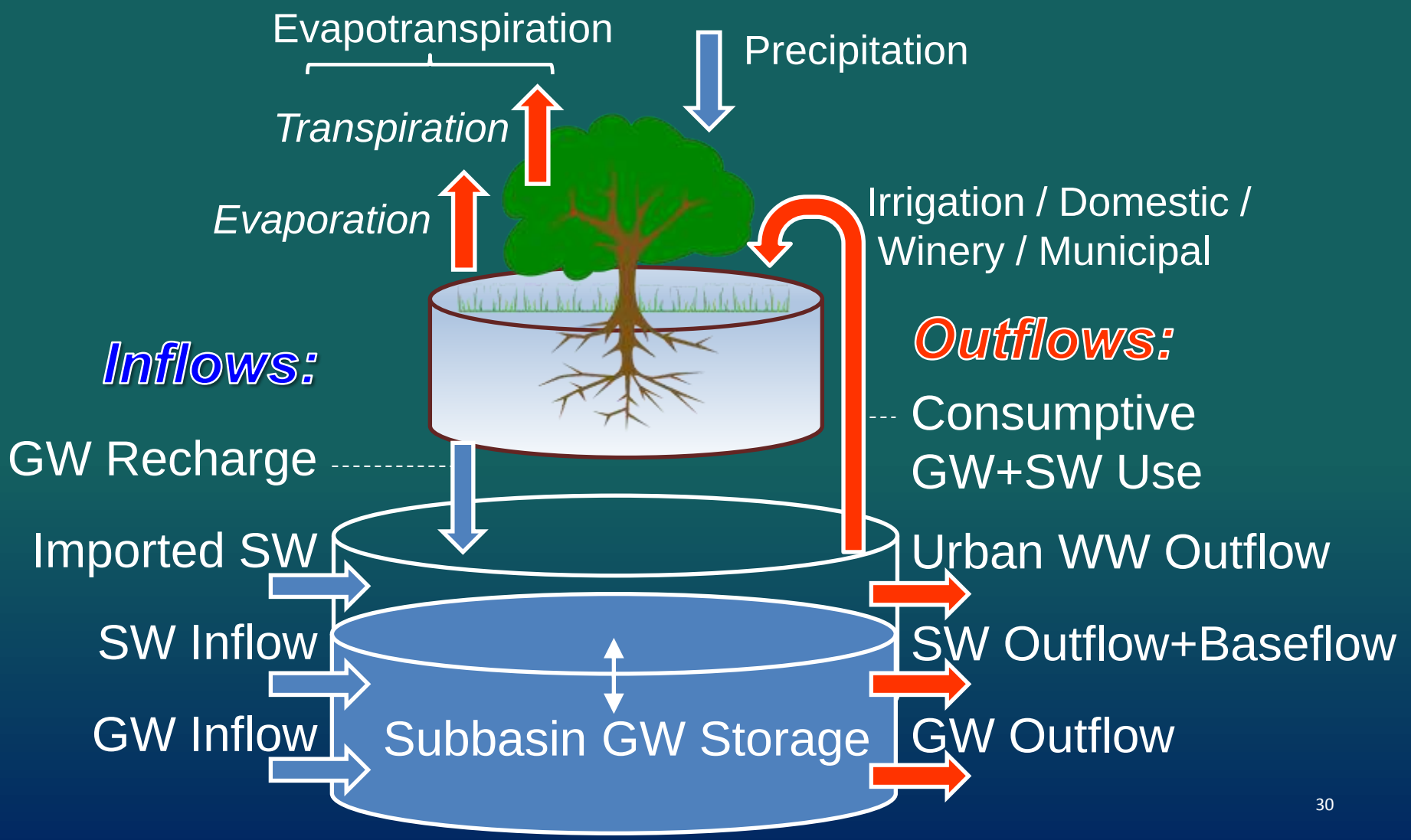


Root Zone Model (RZM)
Napa Valley Subbasin

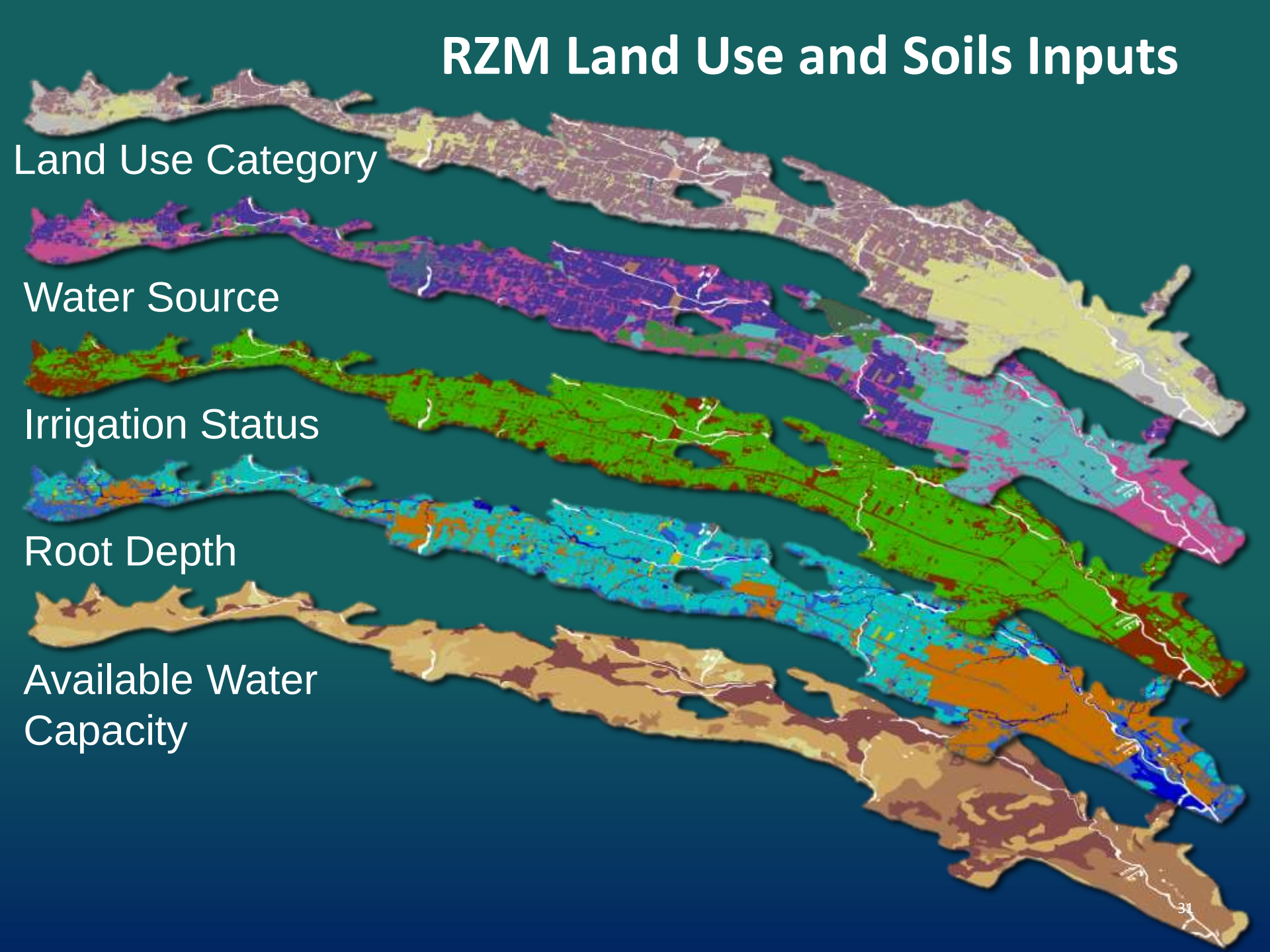


Subbasin Water Budget Components

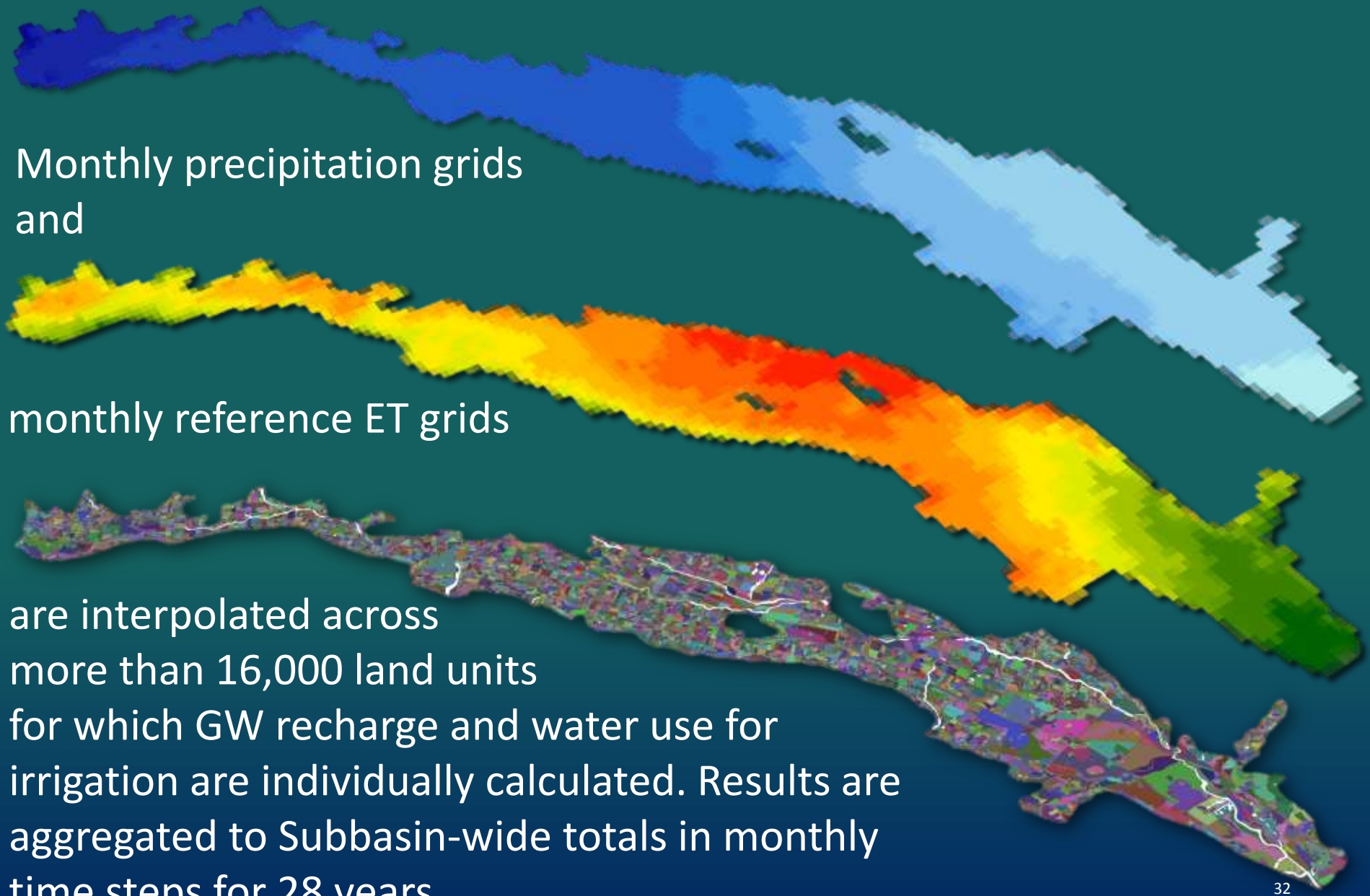
Inflows **–** ***Outflows*** **=** **Δ** ***S*** *Change in GW Storage*



RZM Land Use and Soils Inputs



RZM Monthly Hydrologic Inputs



Monthly precipitation grids
and

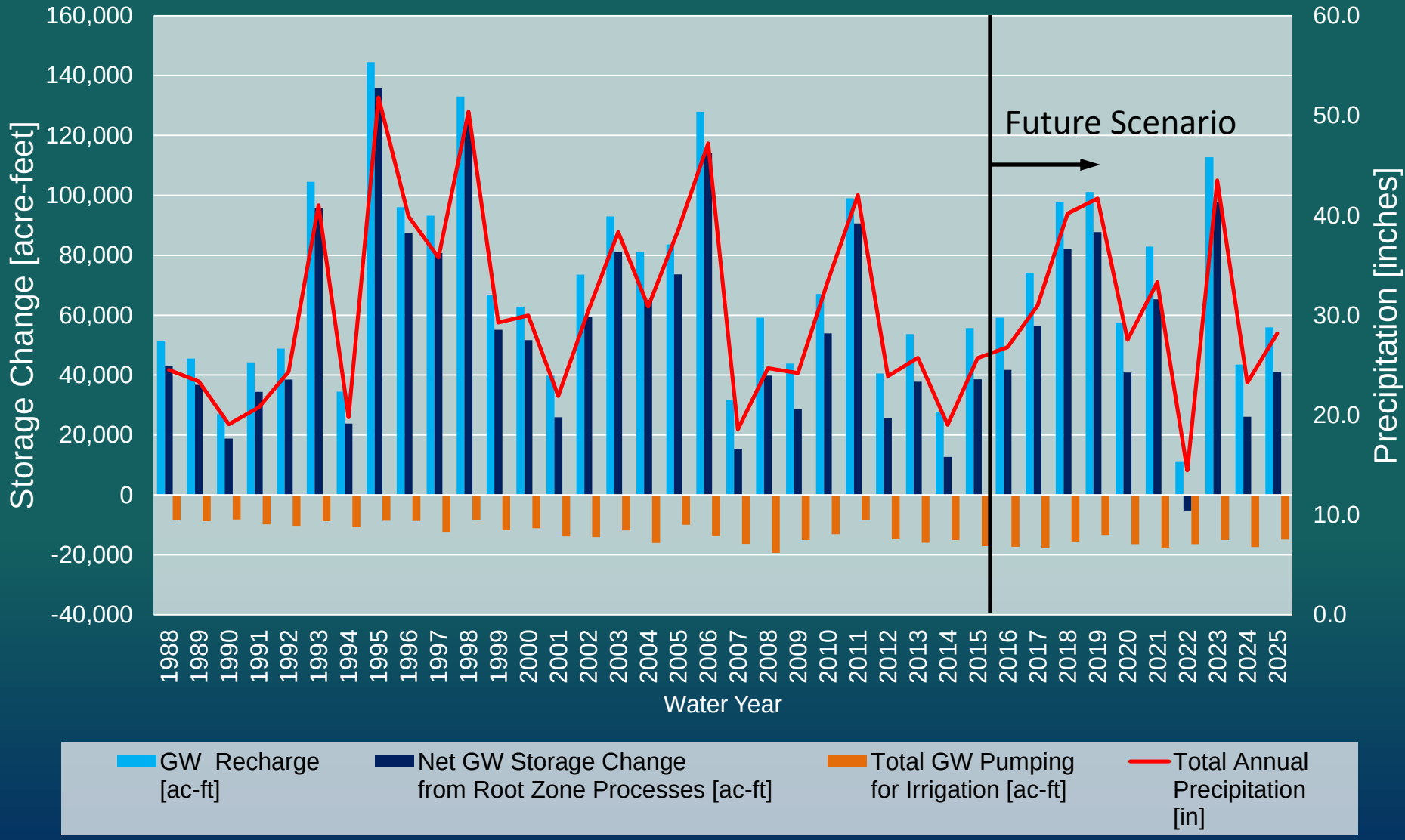
monthly reference ET grids

are interpolated across
more than 16,000 land units
for which GW recharge and water use for irrigation are individually calculated. Results are aggregated to Subbasin-wide totals in monthly time steps for 28 years.

Future Scenario

- Future climate is simulated for years 2016-2025 based on downscaled climate model outputs for Napa Valley.
- Future land uses held constant at 2011 land use mapping, based on limited number of pending discretionary projects in the Subbasin (Valley Floor).
- Imported surface water deliveries held constant at 2011-2015 average, reflecting potential continuation of recent drought conditions and an average State Water Project Allocation of 42%.

Root Zone Model Output



Groundwater Pumping

Groundwater Use	2012 – 2015 Average Acre-Ft/Yr
Vineyard Irrigation	12,263
Other Ag Irrigation	448
Unincorporated Residential (indoor use)	371
Semi-Ag, Residential, and Commercial Unincorporated Areas, Irrigation	2,885
Unincorporated Wineries	1,222
Municipal	317
Total Average Groundwater Pumping 2012 - 2015	17,506

Water Budget Results

Est. Inflows (1988-2015)	Avg. Annual Ac-Ft/Yr
Upland Runoff	*145,000*
GW Recharge	69,000
Imported SW Deliveries	17,000
Uplands Subsurface Inflow	5,000

−

Est. Outflows (1988-2015)	Avg. Annual Ac-Ft/Yr
SW Outflow and Baseflow	*176,000*
Net GW Use Net SW Use	13,000 14,000
GW Subsurface Outflow	19,000
Urban Waste-water Outflow	8,000

=

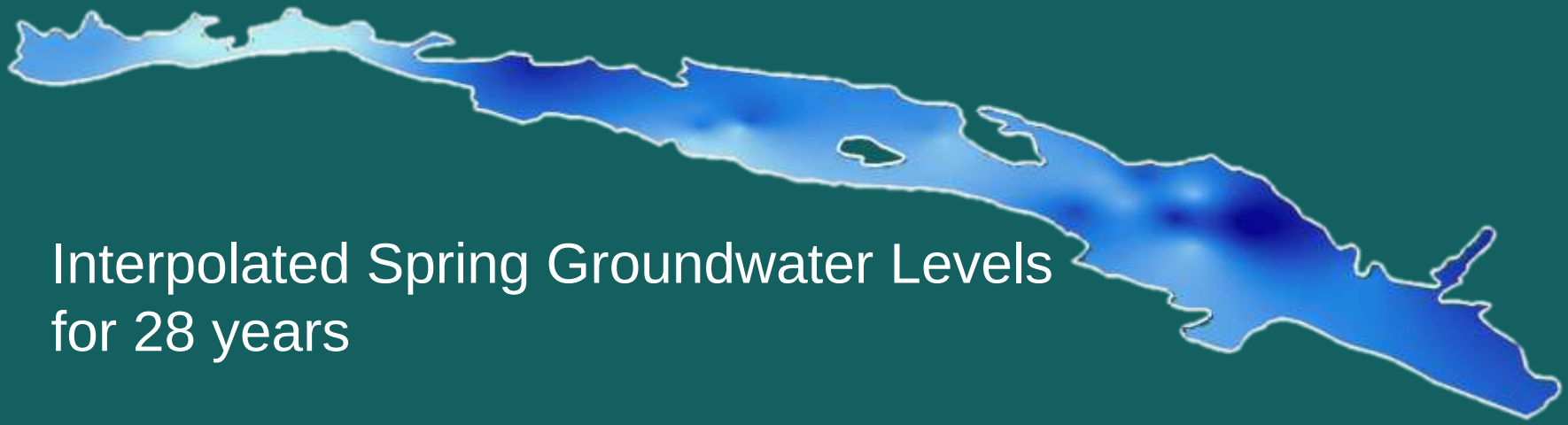
Net Avg. Annual Change in Subbasin Storage = 6,000 Acre-Ft/Yr

(uncertainty in individual budget components; *italicized more uncertain*)

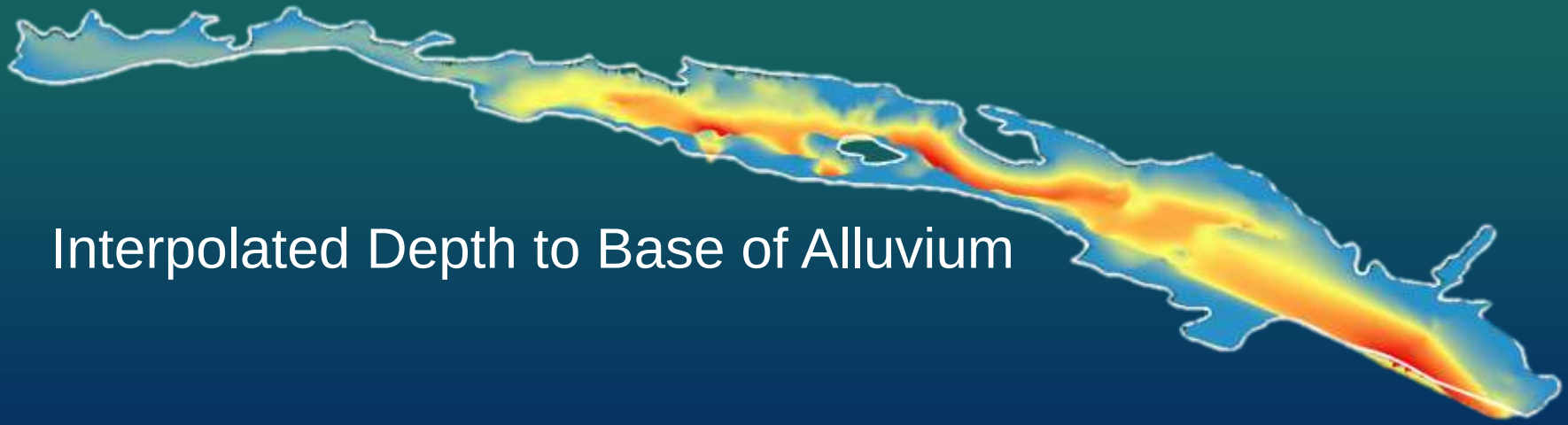
Water Budget In Balance

- Annual variations in net Subbasin storage largely driven by fluctuations in uplands runoff and streamflow components.
- Avg. annual change in storage over the 1988-2015 base period (5,900 AFY) is consistent with the stable to slightly above average cumulative precipitation inputs.
- Positive avg. annual change in storage supports Subbasin monitoring showing stable trends; indicates current levels of GW pumping have not exceeded the Subbasin sustainable yield.
- Projected water budget results through 2025 show avg. annual changes in storage from 8,000 AFY to -5,100 AFY; indicates importance of continued monitoring, efforts to reduce water budget uncertainty, and responsive Subbasin management.

Groundwater Level Change in Storage



Interpolated Spring Groundwater Levels for 28 years

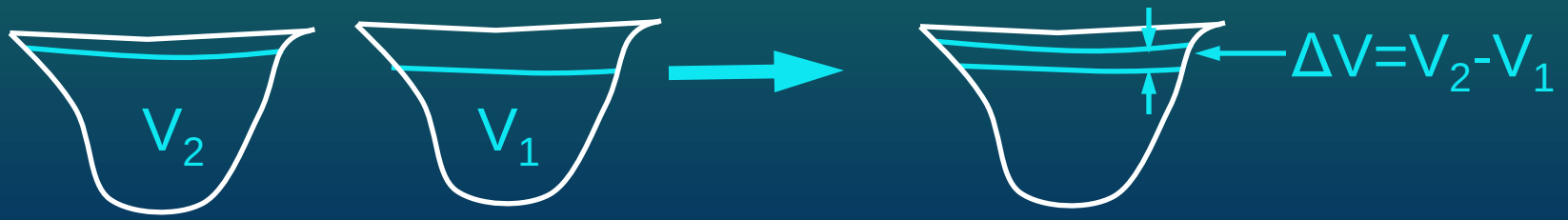


Interpolated Depth to Base of Alluvium

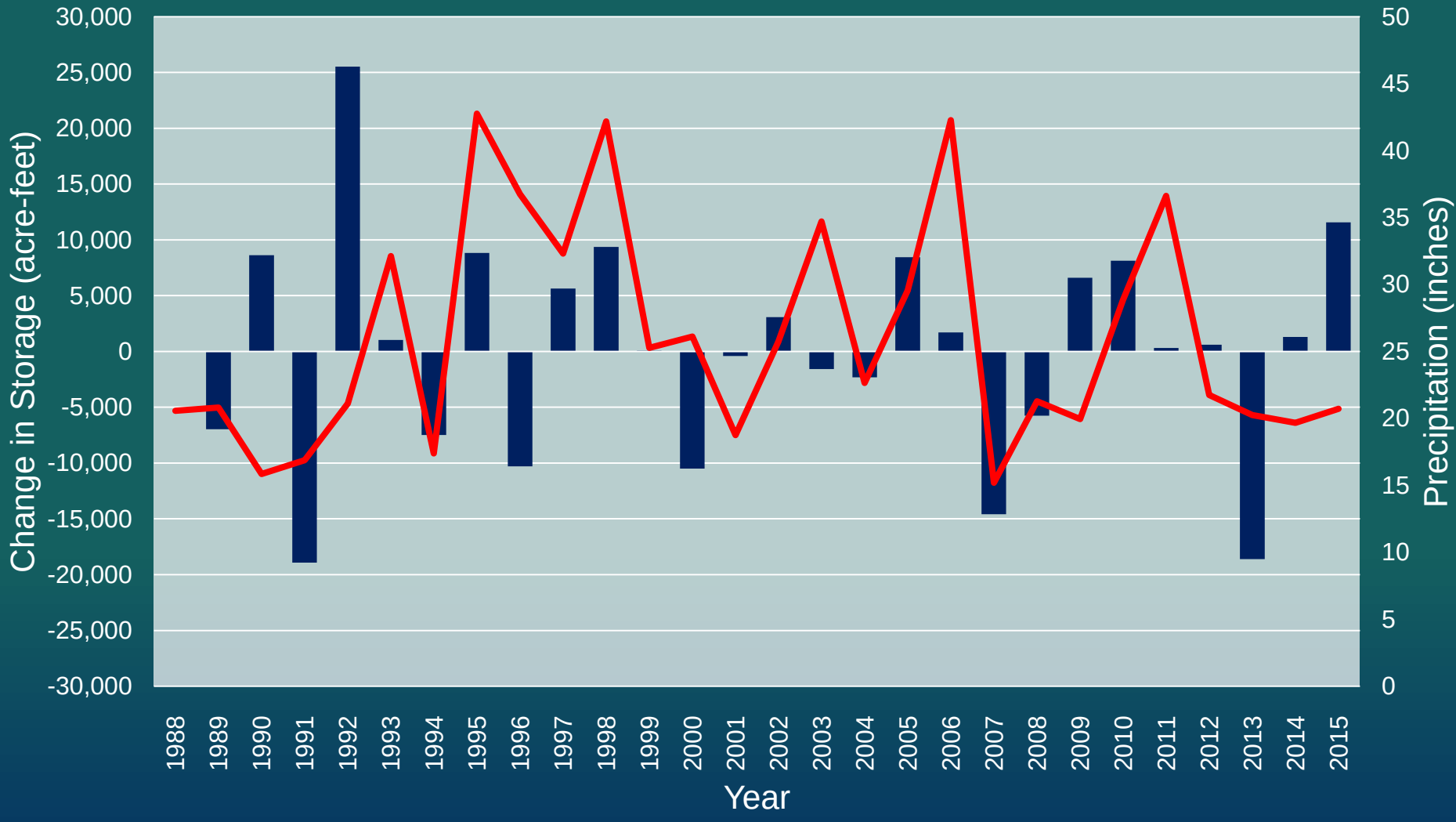
Groundwater Level Change in Storage

- 3D GIS Models of Saturated Aquifer Volumes (V) are generated for 28 Years

- Change in Groundwater Storage = Change in Aquifer Volumes (ΔV) Between 2 yrs x Specific Yield



Groundwater Level Change in Storage



Sustainable Yield

- Sustainable yield is not a fixed value for a given basin or subbasin.
- The Draft Basin Analysis Report references recent GW pumping rates to estimate a base period sustainable yield.
- Results of Subbasin monitoring, water budget, and groundwater level change in storage each indicate that the sustainable yield was not exceeded during the base period from 1988-2015 ; estimated Sustainable Yield between 17,000—20,000 AFY.

Napa Valley Subbasin Sustainability Goal (Ch. 7 Draft)

(Sustainability Indicators and Monitoring)

Sustainable Yield and Related Terms

Sustainable Yield (Definition; Water Code Section 10721(v)):

"*Maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually without causing an undesirable result*."

"Undesirable Result" – key term linked to accomplishing sustainability.

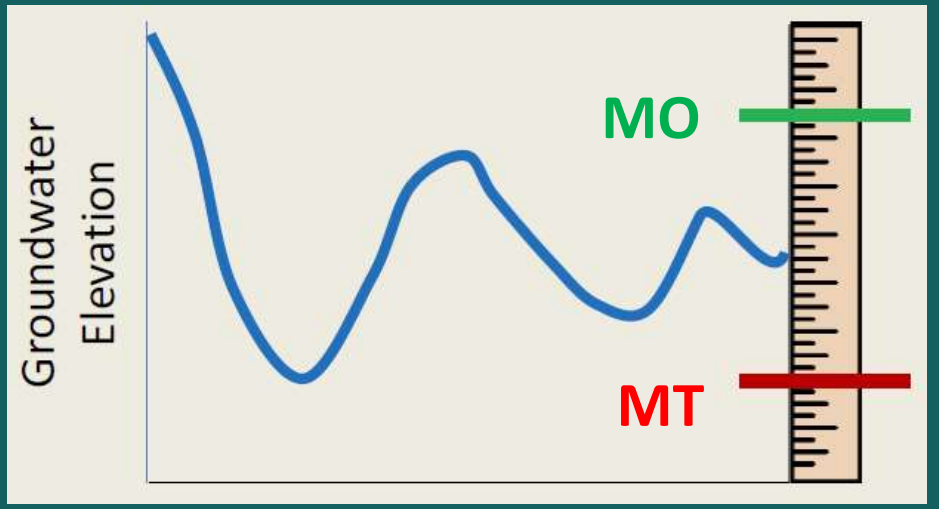
Groundwater Sustainability Indicators

Not Causing Undesirable Results:
Means Avoiding Significant and Unreasonable …

- Lowering of GW Levels
- Reduction of GW Storage
- Seawater Intrusion
- Water Quality Degradation
- Land Subsidence
- Depletion of Surface Water

Napa Valley Hydrogeologically Sensitive to this Indicator

Minimum Thresholds and Measurable Objectives



(DWR, March 2016)

- **Minimum Threshold (MT)**

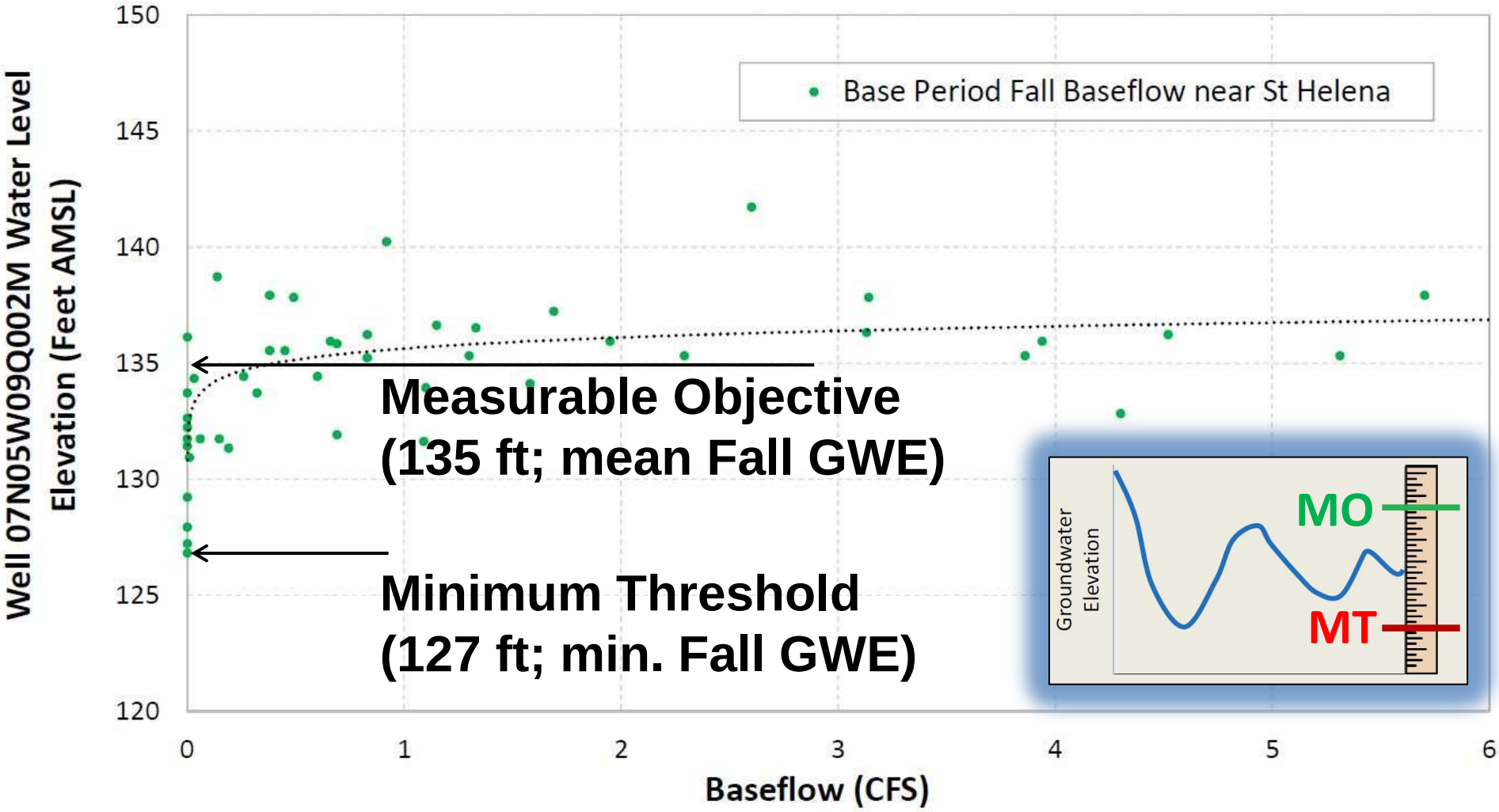
"a numeric value for each sustainability indicator used to define undesirable results" (Section 351)

- **Measurable Objective (MO)**

"specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions" (Section 351)

Measurable objectives and minimum thresholds are recommended to ensure GW sustainability or improve GW conditions.

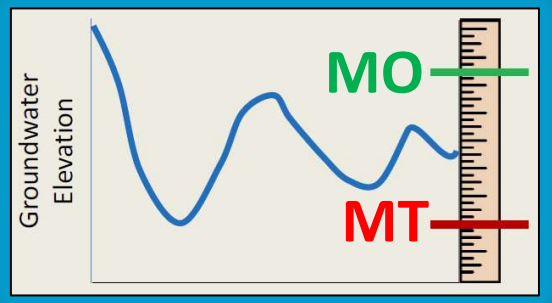
Relationship Between Fall Groundwater Levels and Baseflow



- **Analysis uses all historical baseflow data/groundwater data for GW & Stream Gage sites (not just the base period data)**

Groundwater Elevations to Avoid Streamflow Depletion Serve as Proxies for Other Indicators

- The streamflow Minimum Thresholds represent the lowest GW elevation (GWE) that has occurred historically in the Fall; below this GWE, additional streamflow depletion is likely to occur.
  - Prefer Fall GW levels approximate Measurable Objectives (MO)
  - Stay at or above Fall GW levels established as Minimum Threshold (MT)
  - Avoid GW Levels at Minimum Threshold on continuous basis; this would contribute to worsening of existing conditions



- These minimum thresholds also serve as proxies for other sustainability indicators.

Sustainable Groundwater Management (Ch. 9 Draft)

- Napa County 2008 General Plan includes 6 goals, 28 policies, and 10 water resources action items within the Conservation Element and related to water resources.
- Groundwater Ordinances are already in place to regulate groundwater usage and well development in the County.
- County has a required Water Availability Analysis and has developed new 2015 guidelines that help applicants comply with CEQA guidelines.
- County promotes education and collaboration through: the WICC, well owner outreach, self-directed well monitoring, and IRWMPs.

Sustainable Groundwater Management (Ch. 9 Draft)

- Assessments of GW conditions and Subbasin sustainability will occur annually and every 5 years.
- Best Management Practices already in place for existing monitoring and reporting programs and will be expanded upon with the first 5-year Basin Analysis Report update.
- Incremental implementation of additional management actions will be considered, in coordination with other municipal agencies and stakeholders, to ensure long-term sustainability of the Subbasin.

Findings and Recommendations (Ch. 10 Draft)

Findings

- The Subbasin has operated within its sustainable yield from 1988-2015.
- Simulated future conditions, from 2016-2025, show GW use remaining within the base period sustainable yield.
- Sustainable yield may change due to variations in Subbasin inflows, management strategies (enhanced recharge), or evolving sustainability objectives.

Recommendations

- Chapter 10 Table 10-1
  - –Previous recommendations from 2011; 18 recommended actions, nearly all completed
    - Included prepare a workplan for a “Groundwater Sustainability Plan” and preparation of a “Groundwater Sustainability Plan”
  - –Groundwater Resources Advisory Committee (Feb. 2014); 6 recommendations
    - Many implemented and ongoing
  - – Basin Analysis Report; 13 recommendations
    - Example follow

Recommendations Summary

Summary	Time Frame	Relative Priority
Continue and improve GW and SW monitoring programs	Ongoing	1
Coordinate with Planning Dept. to improve data collection as part of existing and future discretionary permits	Near Term	1 - 2
Evaluate and address uncertainties in water budget components, incl. water use and trends in the unincorp. areas	Near to Mid Term	1-2

Recommendations Summary (continued)

Summary	Time Frame	Relative Priority
Evaluate opportunities for additional recharge and the distribution of GW Dependent Ecosystems	Near to Mid Term	1 - 2
Encourage GW stewardship	Near Term	2
Coordinate with BMPs published by DWR	Near Term	1

Next Steps

- Respond to comments received
- Prepare final draft Basin Analysis Report
- Napa County Board of Supervisors: December 13, 2016
- Submit Basin Analysis Report to DWR before January 1, 2017

Thank You