Napa Valley Groundwater Sustainability: A Basin Analysis Report for the Napa Valley Subbasin (Draft Chapters 6 and 7)

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Watershed Information & Conservation Council

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LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Overview

- Basin Analysis Report Contents
- Overview of Groundwater Conditions
- Groundwater/Surface Water Interaction
- Ch. 6 (Draft): Sustainable Yield Analysis
- Ch. 7 (Draft): Napa Valley Subbasin Sustainability Goal
- Next Steps

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SGMA Basin Analysis Report

- **What it is:**
  - Alternative submittal (functionally equivalent) to a Groundwater Sustainability Plan
  - Basins that have been 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)

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Basin Analysis Report Contents

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

Appendices

Comparison Table: GSP to Basin Analysis Report

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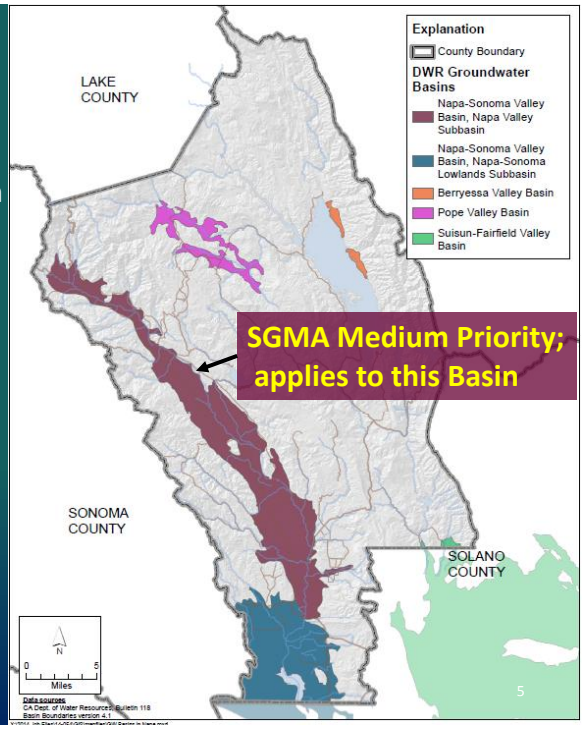
Groundwater Basins

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



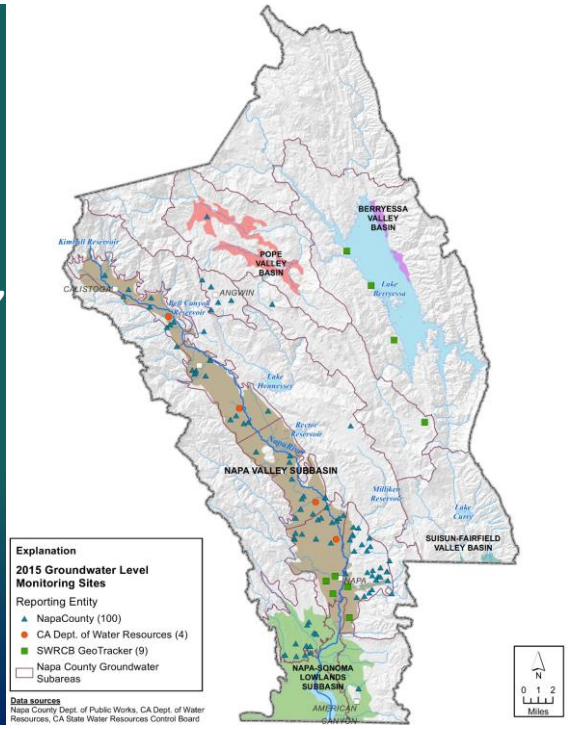
GW Level Monitoring, 2015

Napa Co., 100 (incld. 48 volun., 10 SW/GW)

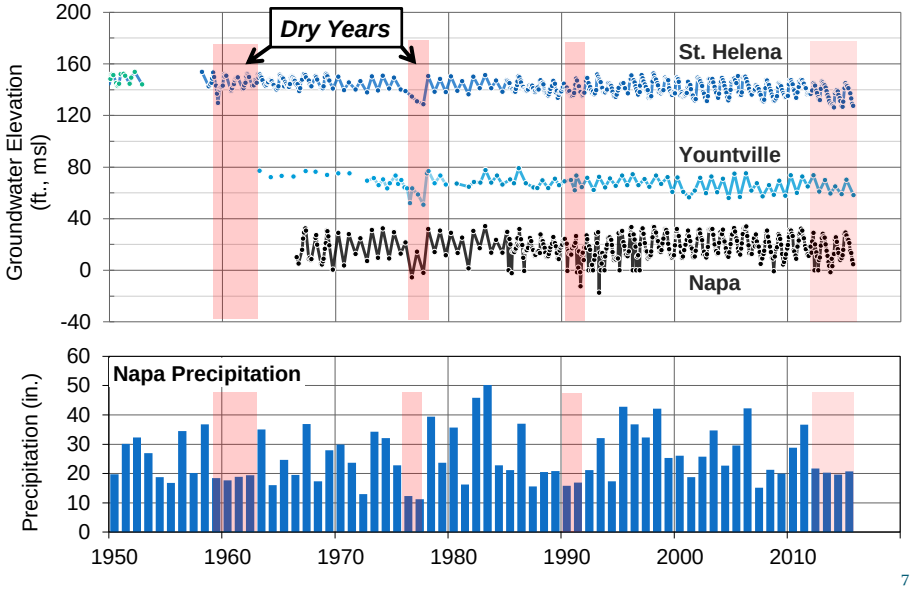
DWR, 4

GeoTracker, 9

Total Wells = 113 Sites



Groundwater Conditions: Napa Valley Subbasin



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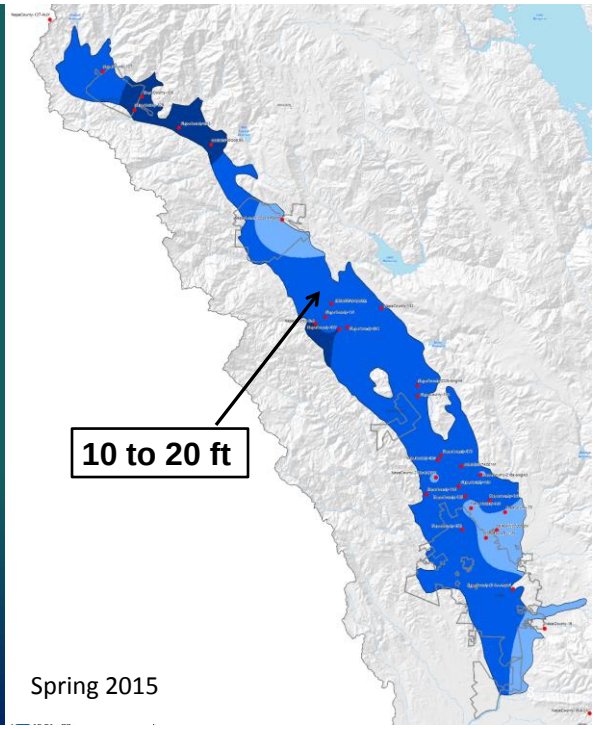
Depth to Groundwater

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/Surface Water Interaction

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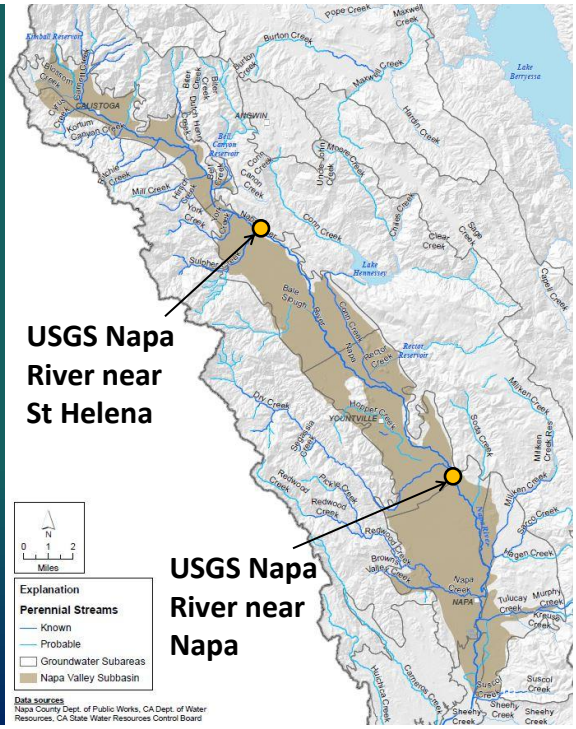
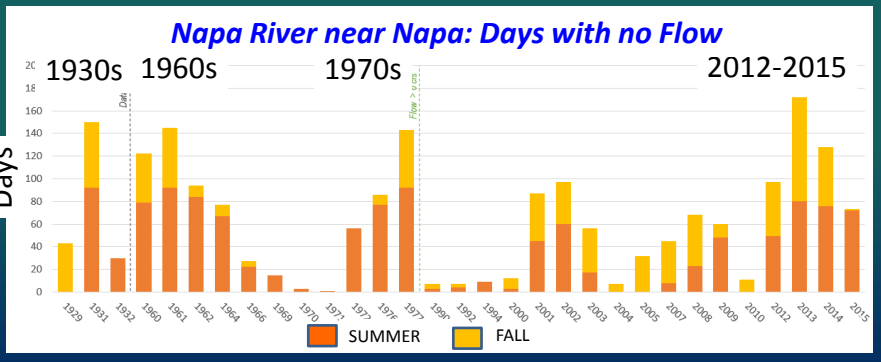
Groundwater Interactions with Surface Water

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

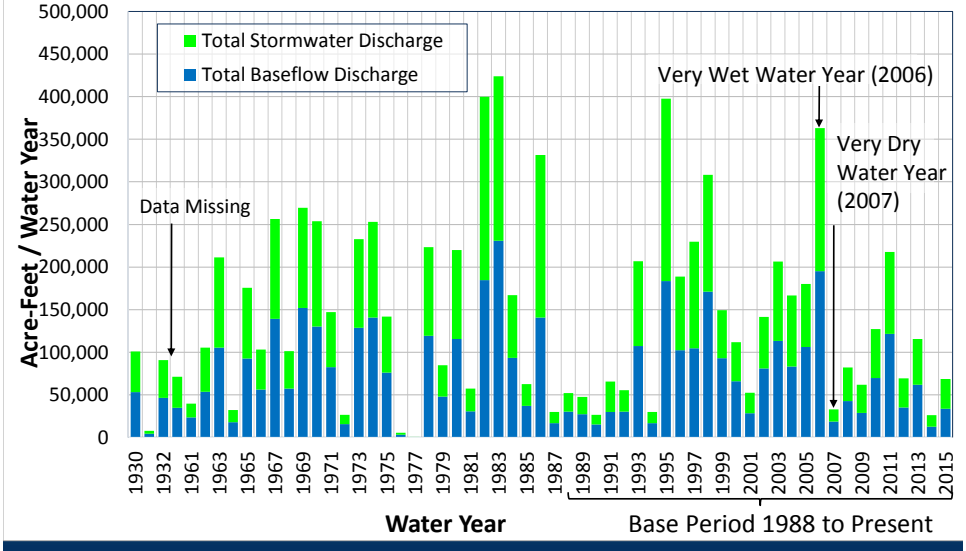


Historical to Current Streamflow Observations

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



Total Baseflow (GW) & Stormflow



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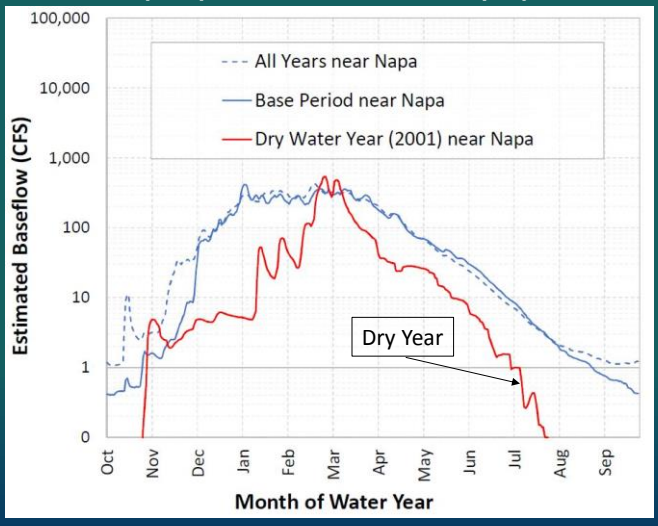
Average Napa River Baseflow

(Napa River near Napa)



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

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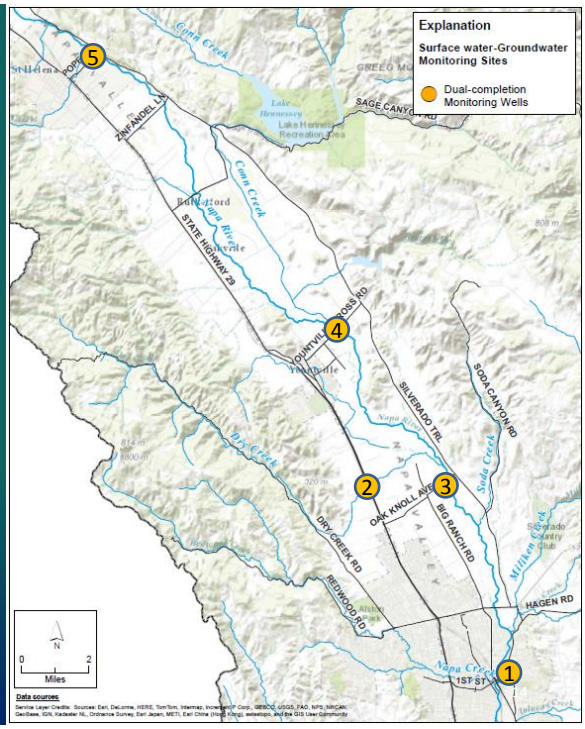
Surface Water/ Groundwater

Monitoring at 5 Sites

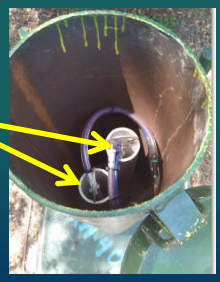
- Shallow MWs each site
  - Levels & quality
- Stream gauge each site
  - Streamflow & quality



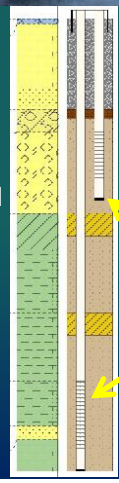
GW Monitoring Wells Near River

Above Ground
Locked Protection

Looking Down at MWs



2-inch dia. casings



Sand and Gravel

Sand

Below Ground
"Nested" Monitoring Wells

40 ft Deep

2-inch dia. casings

100 ft Deep

Not to Scale

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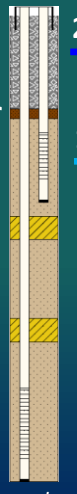
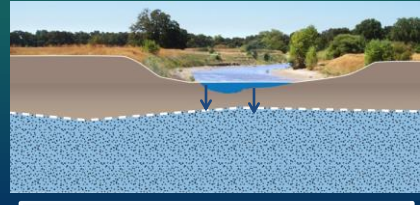
SW/GW Interaction: Site 5: St. Helena, Oct. 2014 & Dec. 2014



Not drawn to scale

GW above in Dec. 2014

Elevation of *Thalweg* 196.00ft, msl



GW below in Oct. 2014

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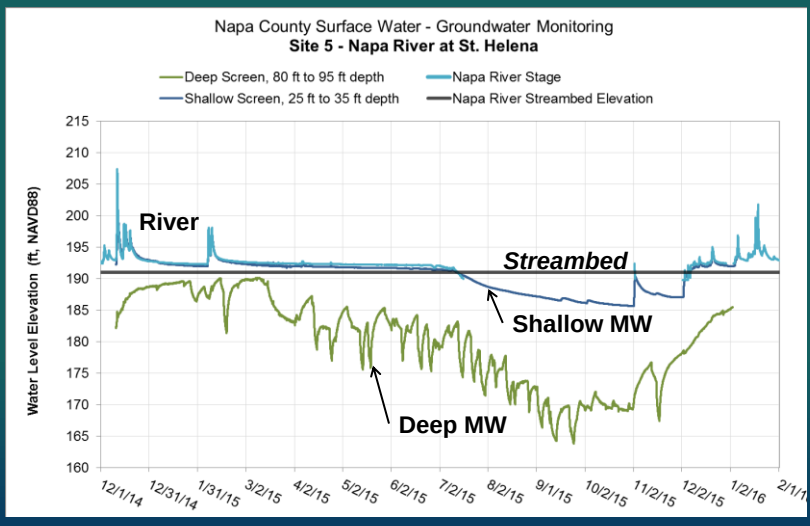
SW/GW Interaction: Site 5 St. Helena



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

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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

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Chapter 6: Sustainable Yield Analysis

- Hydrologic Base Period Determination
- Water Budget
- Groundwater Level Change in Storage

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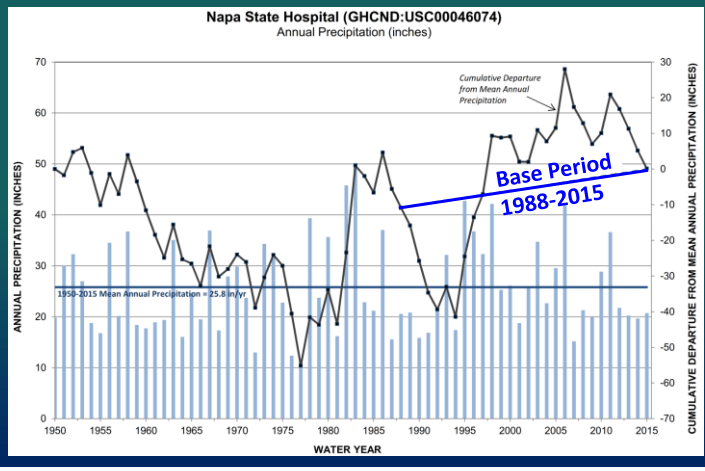
Hydrologic Base Period

*"Sustainable yield means the 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 from a groundwater supply without causing an undesirable result." (Section 10721(v))*



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Water Budget

- Subbasin conceptual model
- Compile available data to calculate Subbasin inflows and outflows
- Evaluate average change in Subbasin storage based on Subbasin inflows and outflows

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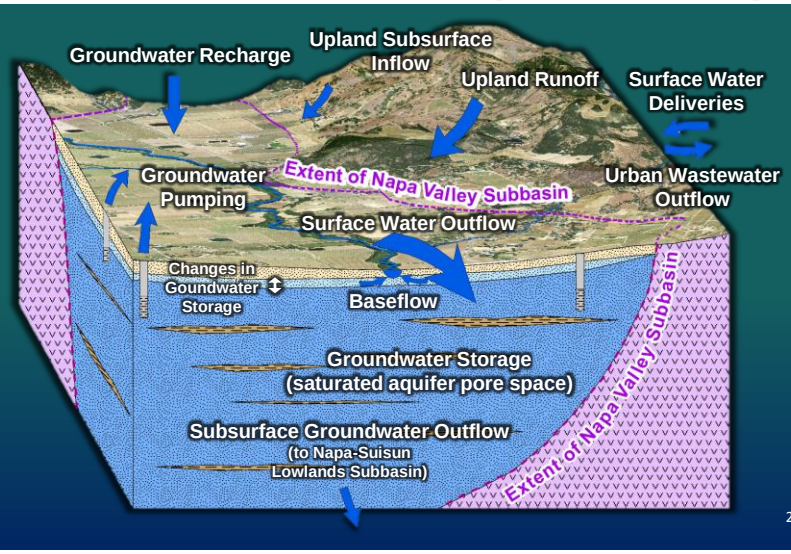
Water Budget: Core Element of Groundwater Sustainability

Inflows – Outflows = ΔS Change in GW Storage



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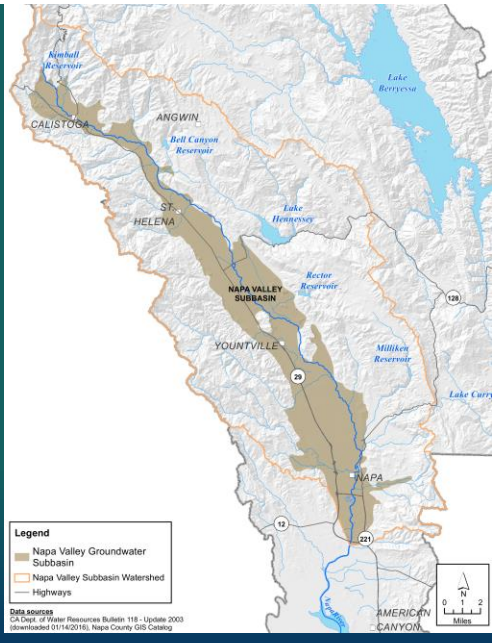
Water Budget Data Source Types

- Basin Characterization Model (USGS)
- Napa River Streamflow (USGS)
- Updated Hydrogeologic Conceptualization and Characterization of Conditions (LSCE and MBK, 2013)
- Imported Surface Water Deliveries for All Municipalities
- Napa Sanitation District Influent Data
- US Census and California Water Plan



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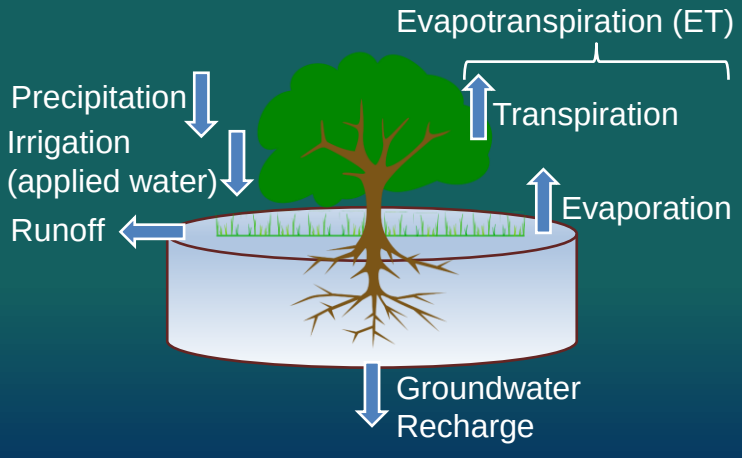
Root Zone Model

Napa Valley Subbasin



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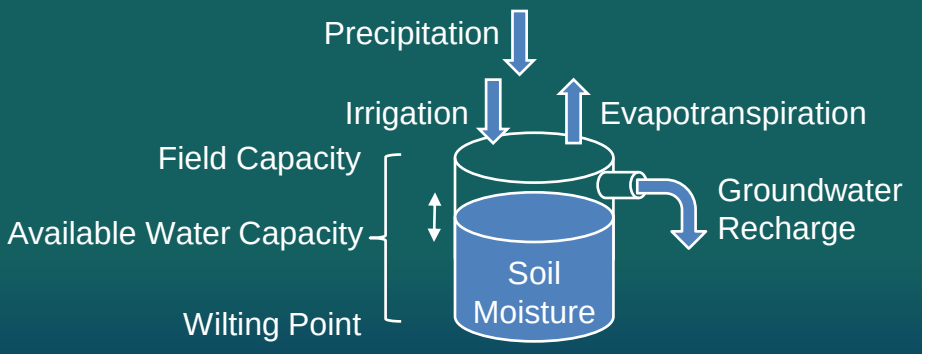
Root Zone Model



Model calculates root zone water balance on monthly time steps over a 28-year period.

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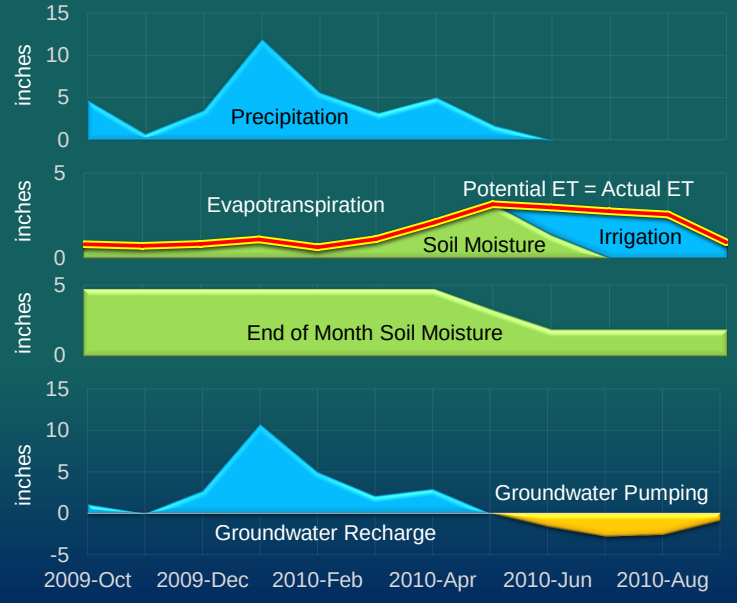
Root Zone Model – Irrigated Land



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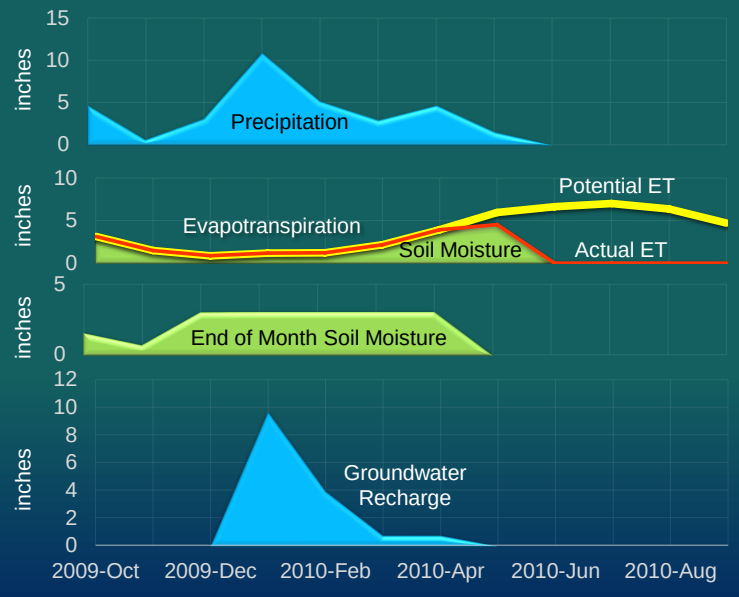
Root Zone Model – Non-Irrigated Land



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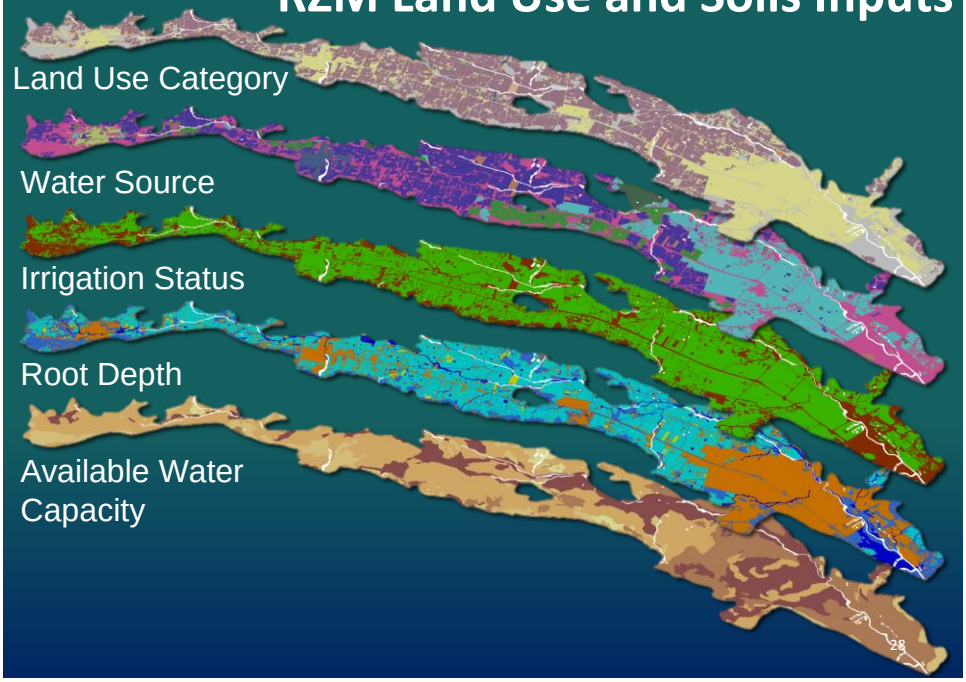
RZM Land Use and Soils Inputs



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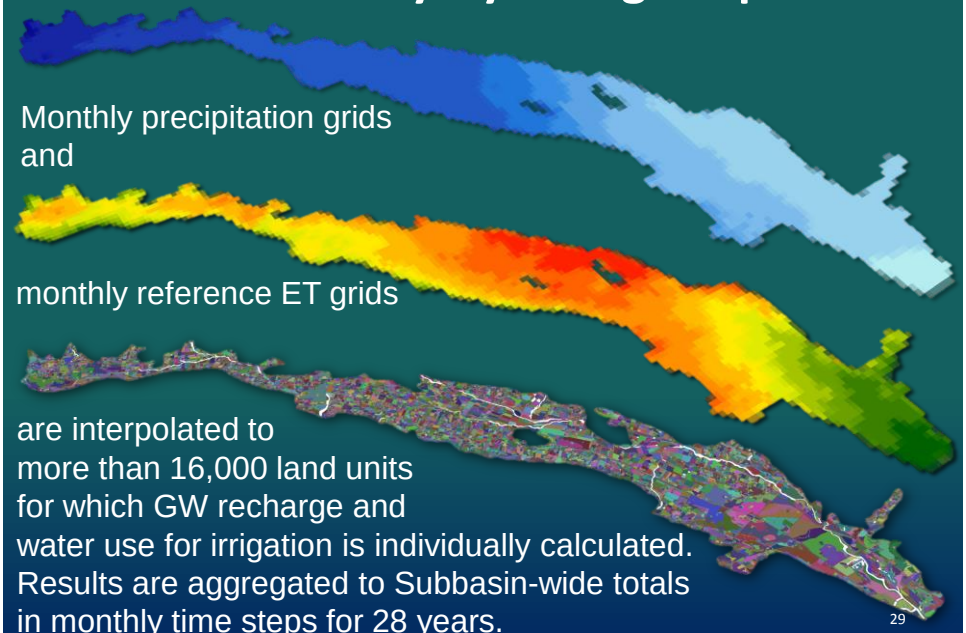
RZM Monthly Hydrologic Inputs



Monthly precipitation grids and

monthly reference ET grids

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

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Future Scenario

- Future climate simulated from 2016 – 2025 based on downscaled climate model outputs for Napa Valley
- Future land uses held constant at 2011 land use mapping, based on the limited number of pending discretionary projects in the Subbasin (Valley Floor).

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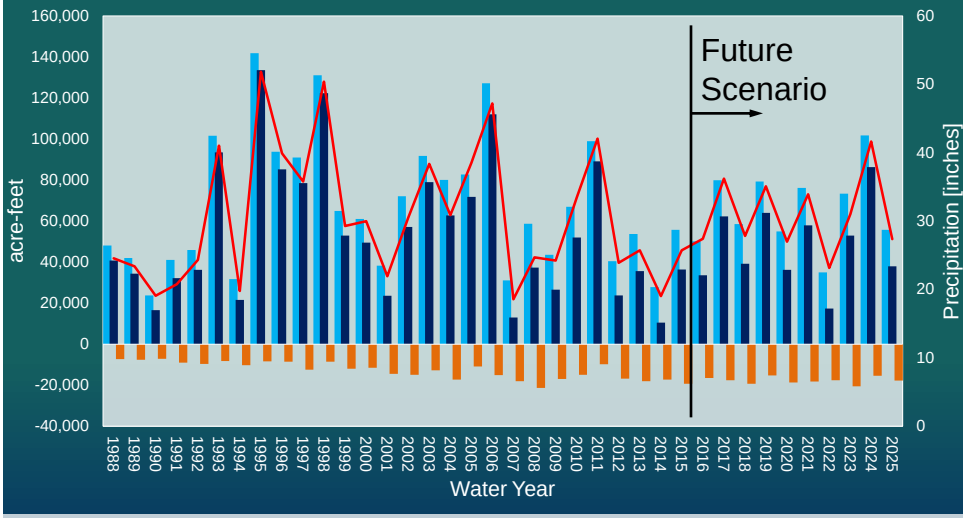
Root Zone Model Output



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Groundwater Pumping

Groundwater Use	2012 – 2015 Average Acre-Ft/Yr
Vineyard Irrigation	12,651
Other Ag Irrigation	522
Unincorporated Residential (indoor and outdoor irrigation)	1,100
Semi-Ag, Residential, and Commercial Unincorporated Areas, Irrigation	4,393
Unincorporated Wineries	1,222
Municipal	295
Total GW Pumping	20,184

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Water Budget In Balance

Inflows		Outflows
Upland Runoff	≈	Total GW Pumping
Uplands Subsurface Inflow		Urban Waste-water Outflow
Imported SW Deliveries		SW Outflow and Baseflow
GW Recharge		GW Subsurface Outflow

Inflows and outflows should balance over long-term.

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DRAFT Water Budget Results

Est. Inflows	Avg. Annual Acre-Ft/Yr
Upland Runoff	148,000
GW Recharge	67,000
Imported SW Deliveries	15,000
Uplands Subsurface Inflow	6,000

−

Est. Outflows	Avg. Annual Acre-Ft/Yr
SW Outflow and Baseflow	178,000
Total GW Pumping	15,000
GW Subsurface Outflow	19,000
Urban Waste-water Outflow	8,000

=

Net Avg. Annual Change in Subbasin Storage = 17,000 Acre-Ft/Yr
(uncertainty in individual budget components)

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Change in Groundwater Storage

First Step: Define 3-D boundary of Alluvium

Mapped Alluvium Isopach Contours and Geologic Cross Sections (3-D view) (LSCE and MBK, 2013)

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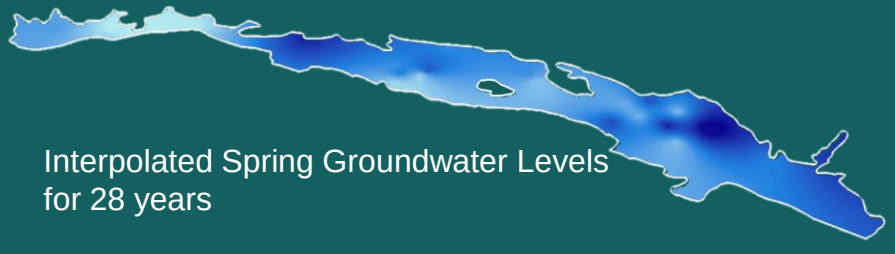
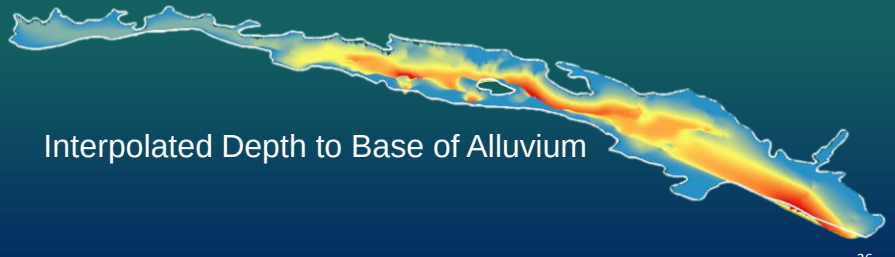
Change in Groundwater Storage



Interpolated Spring Groundwater Levels for 28 years



Interpolated Depth to Base of Alluvium

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Change in Groundwater 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

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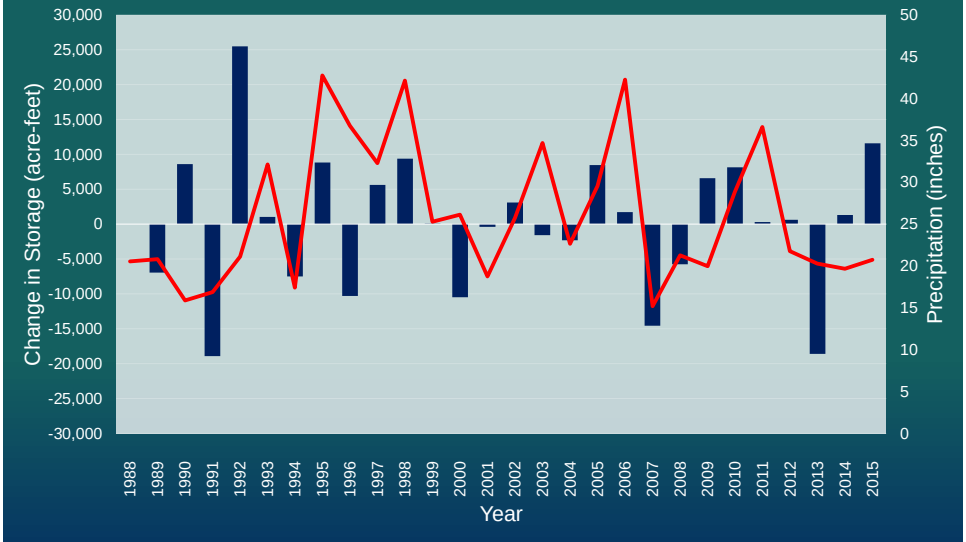
Change in Groundwater Storage



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Sustainable Yield

- Sustainable yield is not a fixed value for a given basin or subbasin.
- Chapter 6 draft references recent groundwater pumping rates to estimate a base period sustainable yield.
- The calculated positive average storage change indicates the influence of uncertainties.
- Refinements to the analyses will be conducted in response to comments prior to finalization.

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CHAPTER 7: Napa Valley Subbasin Sustainability Goal

SGMA requires each agency to establish a sustainability goal for the basin (Section 354.24)

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Sustainability Goal

- ***Napa Valley Subbasin SGMA Sustainability Goal*:***
  To protect and enhance groundwater quantity and quality for all the people who live and work in Napa County, regardless of the source of their water supply. The County and everyone living and working in the county will integrate stewardship principles and measures in groundwater development, use, and management to protect economic, environmental, and social benefits and maintain groundwater sustainability indefinitely without causing undesirable results, including unacceptable economic, environmental, or social consequences.

* Expanded based on GRAC sustainability goal (GRAC goal in yellow text; white text to meet SGMA intent).

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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.

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Groundwater Sustainability

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**

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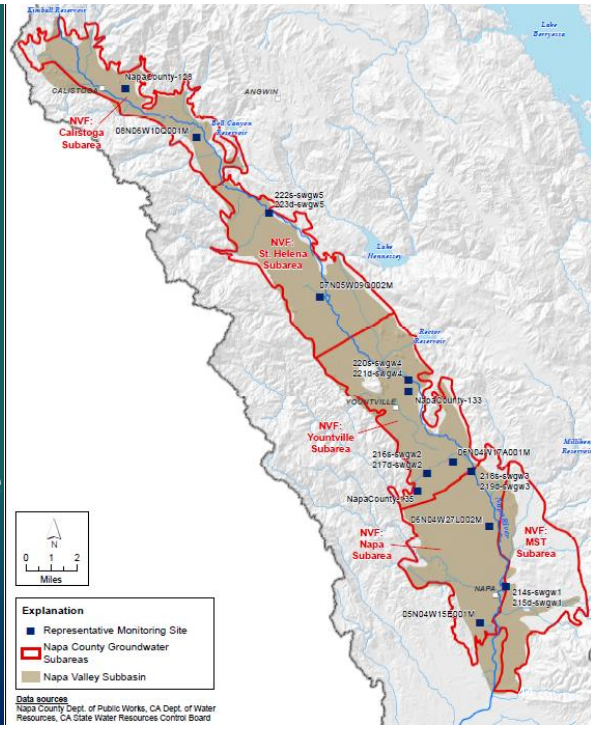
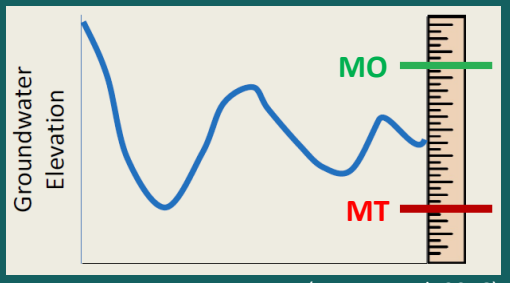
Representative Monitoring Sites

- Representative wells to ensure sustainability
- 18 locations
- Metrics for each sustainability indicator, as applicable



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)

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Napa River System: Most Sensitive Sustainability Indicator

- **Napa River system is the most sensitive sustainability indicator in the Napa Valley Subbasin**
  - Measurable objectives and minimum thresholds are recommended to ensure GW sustainability or improve GW conditions
- Napa Valley Subbasin has been sustainably operated for more than 10 years; overall GW conditions stable. Baseflow is lower and/or not present at some locations during the summer to fall period, pending the water year type (Grossinger, 2012; Faye, 1973).
- SGMA: GSP/alternative submittal not required to address undesirable results that occurred before and have not been corrected by, January 1, 2015. GSA/local agency has discretion to set measurable objectives and timeframes for achieving them. (Section 10727.2).

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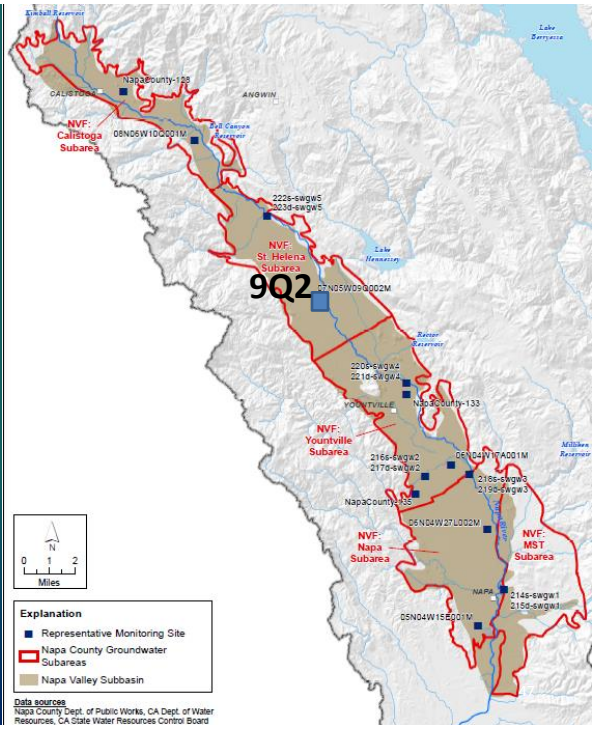
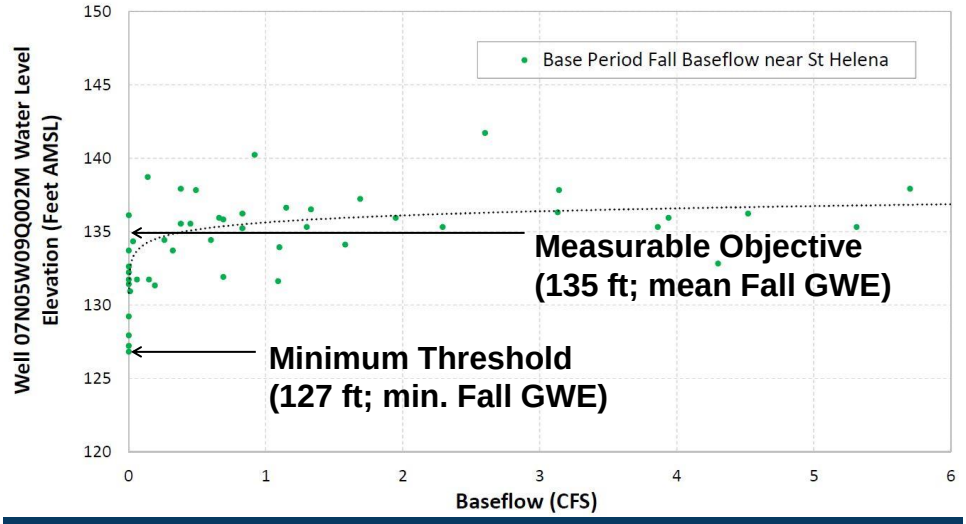
Representative Monitoring Sites

- 9Q2: location of representative well for example (next slide)



Relationship Between Fall Groundwater Levels and Baseflow



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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.
- These levels are not acceptable on a continuous basis as this would contribute to a worsening of existing conditions.
- These minimum thresholds also serve as proxies for other sustainability indicators.

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Next Steps

- Complete draft Basin Analysis Report
- Public Workshop: November 3, 2016
- Respond to comments
- Prepare final draft Basin Analysis Report
- Napa County Board of Supervisors: December 6, 2016
- Submit Basin Analysis Report to DWR before January 1, 2017

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Thank You

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