NAPA COUNTY

GROUNDWATER SUSTAINABILITY AGENCY

Annual Report – Water Year 2020

Prepared by

April 2021

Luhdorff & Scalmanini
Consulting Engineers

Napa County Groundwater Sustainability Agency Annual Report – Water Year 2020

Prepared for

Napa County Groundwater Sustainability Agency and

Napa County Department of Planning, Building, and Environmental Services

Prepared by

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LIST OF ABBREVIATIONS & ACRONYMS

AFY	Acre-feet per year
Basin Analysis Report	*Napa Valley groundwater sustainability: a basin analysis report for the Napa Valley Subbasin (LSCE, 2016)*
BMP	Best Management Practices (Guidance documents prepared by the California Department of Water Resources)
BOS	Board of Supervisors
CalEPA	California Environmental Protection Agency
CASGEM	California Statewide Groundwater Elevation Monitoring
CCP	Center for Collaborative Policy
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CGS	California Geological Survey
CIMIS	California Irrigation Management Information System
Cl	chloride
DMS	Database Management System
DPH	California Department of Public Health
DWR	California Department of Water Resources
EC	electrical conductivity
ET	Evapotranspiration
ETo	Reference Evapotranspiration
eWRIMS	State Water Resources Control Board Electronic Water Rights Information Management System
GDE	Groundwater Dependent Ecosystem
GPM	Gallons per minute
GRAC	Groundwater Resources Advisory Committee
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWE	Groundwater Elevation
GWL	Groundwater Level

GWQ	Groundwater Quality
IRWM	Integrated Water Resources Management
IRWMP	Integrated Water Resources Management Plan
LGA	Local Groundwater Assistance (California Department of Water Resources grant program)
LSCE	Luhdorff & Scalmanini, Consulting Engineers
MCL	Maximum Contaminant Level
MST	Milliken-Sarco-Tulucay
NAVD88	North American Vertical Datum of 1988
NCFCWCD	Napa County Flood Control and Water Conservation District
NHD	National Hydrography Dataset
NSD	Napa Sanitation District
NSH	Napa State Hospital
NVIHM	Napa Valley Integrated Hydrologic Model
Plan	*Napa County groundwater monitoring plan 2013*
QA, Qa	Quaternary Alluvium
Qsb	Quaternary sedimentary basin
RCD	Resource Conservation District
RWMG	Regional Water Management Group
SFEI	San Francisco Estuary Institute
SGMA	Sustainable Groundwater Management Act
SMR	Soil moisture retention
Subbasin	Napa Valley Subbasin
SWN	State Well Number
SWP	State Water Project
SWRCB	California State Water Resources Control Board
TAF	Thousand Acre-feet
Tss	Tertiary sedimentary rocks
Tsv	Tertiary Sonoma volcanic rocks
TNC	The Nature Conservancy

USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
WAA	Water Availability Analysis
WAFR	Water Available for Replenishment
WEAP	Water Evaluation and Planning Model
WICC	Watershed Information & Conversation Council
WY	Water Year

EXECUTIVE SUMMARY

ES 1 INTRODUCTION

This Report, *Napa County Groundwater Sustainability Annual Report – Water Year 2020,* presents an update on groundwater conditions and water use in the Napa Valley Subbasin (Subbasin). [1,2] As in the past, the Report includes an update on groundwater conditions elsewhere in the county. This Report also provides an update on the recommended Sustainable Groundwater Management Act (SGMA) implementation actions previously approved by Napa County (LSCE, 2016c and LSCE, 2018a).[3] The Napa County Groundwater Sustainability Agency (GSA) and Napa Valley Groundwater Sustainability Plan Advisory Committee[4] are currently developing a Groundwater Sustainability Plan (GSP) for the Napa Valley Subbasin, planned to be submitted to DWR by January 31, 2022.

Groundwater and surface water are highly important natural resources in Napa County. Together, the County and other municipalities, water districts, public water system operators, commercial and industrial operations, the agricultural community, and the public, are stewards of available water resources. Everyone living and working in Napa County has a stake in protecting the county's groundwater resources, including groundwater supplies, groundwater quality, and associated watersheds (GRAC, 2014).

For many decades, Napa County and its citizens have acted to conserve and preserve groundwater resources and protect beneficial uses and users throughout the county. In 1966, Napa County restricted development and land use conversion in Napa Valley, with similar restrictions added for remaining parts of the Napa River Watershed beginning in 1973. Groundwater management actions taken by Napa County since 1991 have also aligned land use permitting with best-available data consistent with the objectives of SGMA. County actions have included setting objective criteria to avoid undesirable results by avoiding overdraft, maintaining historic groundwater levels, protecting against water quality degradation and land subsidence, preventing increased surface water flow reductions, and other adverse environmental impacts (see **Section 1.2.1**).

As part of its overall land use and groundwater management actions, Napa County also recognizes that long-term, systematic monitoring programs are essential to provide data and the scientific analyses that

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[1] Consistent with the GSP Regulations, the term "water year" is used in this report to refer to the period from October 1 through the following September 30, with the year designated according to the calendar year in which it ends (i.e., water year 2020 spanned from October 1, 2019 through September 30, 2020).

[2] Although Napa County began groundwater conditions reporting in 2011, the first required SGMA Annual Report submittal for the Napa Valley Subbasin is due April 1, 2022, for Water Year 2021 (GSP Regulations Section 356.2).

[3] The 2018 Amendment to the Basin Analysis Report is also referenced as the Northeast Napa Management Area Report. See **Section 1.2.2** for more information.

[4] In June 2020, the GSA appointed a 25-member GSP Advisory Committee (GSPAC) charged with developing and recommending a draft GSP for GSA consideration by November 2021.

allow for improved evaluation of water resources conditions and to facilitate effective water resources planning and management. Napa County has been monitoring groundwater conditions since the 1960s, when it collaborated with the U.S. Geological Survey on a study of groundwater resources in Napa Valley (**Faye, 1973**).

Since 2008, the County has implemented additional groundwater management actions to better understand groundwater conditions, conduct education and outreach, modify land use permitting, and develop other programs to assess and maintain groundwater sustainability. These efforts included the adoption of Goals and Policies in Napa County's 2008 General Plan, commencing new studies of the County's groundwater resources in 2009, and creation of a Groundwater Resources Advisory Committee (GRAC; 2011 to 2014) to spearhead management implementation and community outreach. In 2019, the County took the additional step of forming the Napa County Groundwater Sustainability Agency as provided for under the Sustainable Groundwater Management Act (SGMA). The next major milestone for groundwater management will be the adoption of a GSP for the Napa Valley Subbasin, planned to occur by January 31, 2022.

A *Napa County Groundwater Monitoring Plan 2013* (Plan) was prepared to formalize and augment groundwater monitoring efforts conducted as part of a Comprehensive Groundwater Monitoring Program (LSCE, 2013a). The Plan recommended annual reports on groundwater conditions and modifications to the countywide groundwater monitoring program as needed. To date, six Annual Reports have been prepared (LSCE, 2015, 2016a, 2017a, 2018b, 2019, 2020). This is the seventh Annual Report and the fourth report prepared to meet additional annual reporting requirements of the Groundwater Sustainability Plan (GSP) Regulations.[5]

[5] References to GSP Regulations in this report California Code of Regulations refer to Title 23 of the (CCR) originally developed and adopted by the California Department of Water Resources in 2016, as required by the 2014 Sustainable Groundwater Management Act (SGMA). SGMA is published in California Water Code Section 10733.2.

ES 2 GROUNDWATER RESOURCES GOALS AND MANAGEMENT OBJECTIVES

The Department of Water Resources (DWR) has identified the major groundwater basins and subbasins in and around Napa County (DWR, 2016).[6] The basins include the Napa-Sonoma Valley (which includes the Napa Valley and Napa-Sonoma Lowlands Subbasins), Berryessa Valley, Pope Valley, and a small part of the Suisun-Fairfield Valley Groundwater Basins (**Figure 2-1**). DWR-designated groundwater basins and subbasins do not cover all of Napa County. For purposes of local planning, understanding, and studies, the County has additionally defined groundwater subareas to track and report on groundwater conditions more comprehensively. These subareas were delineated based on major watersheds, groundwater basins, and the County's environmental resource planning areas (**Figure 2-2**).

The countywide groundwater level monitoring program includes the following objectives:

- Expand groundwater level monitoring in priority County subareas to improve the understanding of the occurrence and movement of groundwater; monitor local and regional groundwater levels including seasonal and long-term trends; and identify hydraulic connections in aquifer systems and aquifer-specific groundwater conditions, especially in areas where short- and long-term development of groundwater resources are planned;
- Detect the occurrence of natural or induced factors that affect groundwater levels and trends;
- Identify appropriate monitoring sites to further evaluate groundwater/surface water interaction and recharge/discharge mechanisms, including whether groundwater utilization is affecting surface water flows;
- Establish a monitoring network to aid in the assessment of changes in groundwater storage; and
- Generate data to better estimate groundwater basin conditions and assess local current and future water supply availability and reliability; and update these analyses as additional data become available.

Based on the analysis of existing groundwater data and conditions described in the report *Napa County Groundwater Conditions and Groundwater Monitoring Recommendations* (LSCE, 2011a) and with input received from the Groundwater Resources Advisory Committee (GRAC), the key objectives for future groundwater level monitoring for each subarea are summarized in LSCE (2013a) and in **Section 3** of this Report.

ES 2.1 Sustainable Groundwater Management Act

In September 2014, the California Legislature passed the Sustainable Groundwater Management Act (SGMA). SGMA changes how groundwater is managed in the state and includes certain requirements of local agencies managing groundwater basins or subbasins that DWR designates as medium priority or

[6] https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118

high priority. Previously under the California Statewide Groundwater Elevation Monitoring Program[7] (CASGEM), DWR classified California's groundwater basins and subbasins as either high, medium, low, or very low priority. The CASGEM priority classifications were made based on eight criteria that include the overlying population, the reliance on groundwater, and the number of wells in a basin or subbasin.

In 2018, DWR began a statewide process to revise the SGMA priority designations that it assigns to groundwater basins.[8] Through that process, DWR changed the designation for the Napa Valley Subbasin from medium priority to high priority (**Figure 2-3**). The increase in priority designation for the Napa Valley Subbasin in 2018 was due primarily to revised projections of future population for the Subbasin, an increased assessment of the total number of wells in the Subbasin, and a revised approach to evaluating water quality in the Subbasin compared to the previous prioritization analysis performed in 2014. The change from medium priority to high priority does <u>not</u> affect requirements for the Napa Valley Subbasin under SGMA. The changed priority designation is also not a determination by DWR that the Subbasin has groundwater conditions of concern; to the contrary, the Subbasin is operating within its sustainable yield. Information about DWR's prioritization process and results can be found on DWR's website: https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization.

For most basins designated by DWR as medium priority or high priority, SGMA requires the formation of groundwater sustainability agencies (GSA) and the adoption of a GSP; or development of an alternative to a GSP, provided that the local entity (entities) can meet certain requirements. Under SGMA, a local entity (or entities) can pursue an alternative to a GSP provided that certain sustainability objectives are met. An alternative to a GSP may include "An analysis of basin conditions that demonstrates that the basin has operated within its sustainable yield over a period of at least 10 years" (Water Code Section 10733.6(b)(3)). In response to SGMA, Napa County prepared a Basin Analysis Report for the Napa Valley Subbasin per the requirements of Water Code Section 10733.6 (b)(3). While the Basin Analysis Report analyzed areas outside the Subbasin to determine how those areas affect recharge and runoff in the Subbasin, the areas outside the Subbasin are not subject to SGMA. The Basin Analysis Report (LSCE, 2016c) was submitted to DWR on December 16, 2016 in compliance with SGMA. On July 17, 2019, DWR released a tentative determination to not approve the Basin Analysis Report. On November 13, 2019, DWR issued a final determination consistent with the draft determination.

Although the Basin Analysis Report was not approved, DWR's Staff Report to Napa County stated that DWR "did not consider and does not conclude that the Napa Valley Subbasin is, or has been, managed unsustainably" (DWR, 2019). Rather, DWR's decision focused on DWR's interpretation that the County had not implemented SGMA-equivalent metrics to define sustainable groundwater management prior to the passage of SGMA in 2014. Despite its final determination on the Basin Analysis Report, DWR

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[7] CASGEM is the California Statewide Groundwater Elevation Monitoring program implemented under Water Code Part 2.11 Groundwater Monitoring and administered by DWR.

[8] The California Water Code (Sections 10933 and 12924) requires DWR to prioritize California's groundwater basins and subbasins statewide. Details are available at https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization

found the County to be “proactively managing groundwater” and noted that the Alternative submittal positioned the County for successful development of a GSP for the Napa Valley Subbasin (DWR, 2019).

Following DWR’s decision to not approve the Basin Analysis Report. The Napa County Board of Supervisors acted on December 17, 2019 to become a GSA for the Napa Valley Subbasin and declare their intent to develop a GSP for the Subbasin by January 31, 2022.[9]

In December 2019, DWR released another round of SGMA basin prioritizations, which maintained the very low priority designation for the Napa-Sonoma Lowlands Subbasin (**Figure 2-3**).[10] The Lowlands Subbasin occurs along the lower Napa River, including the Carneros Subarea and American Canyon, and includes areas within Solano County (**Figure 2-1**). An earlier draft of the reprioritization released in 2018 had shown the Lowlands Subbasin designation increasing from very low priority to medium priority.

All other basins and subbasins located in Napa County continue to be designated as very low or low priority according to DWR’s revised 2018 and 2019 designations (**Figure 2-3**). None of the basins and subbasins designated as very low or low priority are subject to additional requirements under SGMA, such as the development of a GSP.

During the past ten years, Napa County has made significant progress towards executing groundwater-related studies and implementing recommendations provided by those studies to improve local understanding of groundwater conditions and ensure resource sustainability.

In conformance with SGMA and the intent of the GRAC, the Napa County Board of Supervisors previously approved a Napa Valley Subbasin SGMA Sustainability Goal (LSCE, 2016c). As part of the overall sustainable management criteria for the Napa Valley Subbasin, the sustainability goal is under review by the GSPAC and GSA and may be revised as part of GSP development.

> *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. – Napa Valley Subbasin Sustainability Goal, approved December 13, 2016*

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[9] More information on the formation of the Napa County Groundwater Sustainability Agency is available at https://sgma.water.ca.gov/portal/gsa/print/488

[10] More information on DWR Basin Prioritization is available at https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization

The sustainability goal provides guidance for groundwater management in the Subbasin, implemented in a manner that avoids undesirable results due to groundwater conditions.

The Basin Analysis Report (LSCE, 2016c) comprised a first step in the implementation of SGMA monitoring and reporting requirements. Consistent with the requirements of Section 356.2 of the GSP Regulations, this Report, *Napa County Groundwater Sustainability Annual Report – Water Year 2020,* presents:

- An update on groundwater conditions both in the Napa Valley Subbasin and in other areas across the county (see **Section 5**),
- An update on water use in the Napa Valley Subbasin (see **Section 6**),
- An update on the implementation of management actions presented in the 2016 Basin Analysis Report and 2018 Basin Analysis Report Amendment developed to maintain groundwater sustainability (see **Section 7**), and
- An update on planned near-term activities, consistent with the Basin Analysis Report management recommendations, to maintain or improve groundwater conditions and ensure overall water resources sustainability in the Napa Valley Subbasin (see **Section 8**).

SGMA implementation activities underway or completed in 2020, in addition to the monitoring efforts and analyses presented in this Report, include (**Figure 7-1**):

A. Formation of the 25-member Napa Valley Groundwater Sustainability Plan Advisory Committee (GSPAC) in June 2020, with monthly public meetings of the GSPAC held each month beginning in July 2020.

B. Development of the Napa County Groundwater Sustainability Agency Stakeholder Communication and Engagement Plan (CEP), which was adopted by the GSA and submitted to DWR a deliverable under its Proposition 68 Sustainable Groundwater Management Program Grant.

C. Data analysis and preparation of draft Groundwater Sustainability Plan (GSP) Sections addressing the Subbasin setting, historical and current groundwater and surface water conditions, monitoring networks, hydrogeologic conceptual model, and existing land use and water management programs.

D. Collaboration and coordination with outside agencies and experts including through presentations at GSPAC public meetings by Professor Thomas Harter of UC Davis, Professor Barton “Buzz” Thompson of Stanford University Law School, Pepperwood Preserve and U.S. Geological Survey, the California Department of Fish & Wildlife, the California Environmental Flows Framework Technical Team, and the California Department of Water Resources.

E. Development and launch of the Napa County Groundwater Sustainability Agency website, including an interactive web map providing access to groundwater and surface water data collected by the County as well as state and federal agencies.

F. Initiated development of an online tool for groundwater use data reporting by permittees with a requirement to report data to the County.

G. Initiated refinements to the PBES permitting database to improve the capture of data regarding well locations and construction details, informed by an existing well completion report database maintained by DWR.

H. Coordination with other local and regional water management and planning programs, particularly the Drought Contingency Plan.

ES 3 GROUNDWATER MONITORING NETWORK

Groundwater level monitoring was conducted at a total of 107 sites across Napa County in water year 2020. These included 60 sites within the Napa Valley Subbasin (**Table ES-1)**. **Figure 4-1** shows the distribution of sites monitored in 2020 by data reporting entity. Out of the total 107 sites monitored in 2020, 96 were wells monitored by Napa County and four were wells monitored by DWR. The remaining seven sites are regulated facilities with multiple wells with data reported as part of the State Water Resources Control Board (SWRCB) Geotracker Program. Data collection experienced some disruptions in 2020 due to the COVID-19 pandemic and site access constraints due to wildfire activity.

Table ES-1 Groundwater Level Monitoring Sites in the Napa Valley Subbasin and Napa County Groundwater Subareas[1]

Groundwater Basin or Groundwater Subarea	Number of Monitored Sites					
	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020
Napa-Sonoma Valley – Napa Valley Subbasin	56	57	61	61	64	60
Napa Valley Floor - Calistoga	9	7	7	8	9	8
Napa Valley Floor - MST	27	26	25	24	24	24
Napa Valley Floor - Napa	20	21	21	21	22	20
Napa Valley Floor - St. Helena	14	14	14	14	15	14
Napa Valley Floor - Yountville	14	13	13	13	14	13
Carneros	12	12	12	12	12	12
Jameson/American Canyon	1	1	1	1	1	1
Napa River Marshes	-	-	-	-	-	-
Angwin	5	5	5	5	5	5
Berryessa	3	1	1	2	-	2
Central Interior Valleys	2	2	2	2	1	2
Eastern Mountains	4	3	3	3	3	3
Knoxville	-	-	-	-	-	-
Livermore Ranch	-	-	-	-	-	-
Pope Valley	1	1	1	1	1	1
Southern Interior Valleys	-	-	-	-	-	-
Western Mountains	1	2	2	2	2	2
Total Sites	**113**	**108**	**107**	**108**	**109**	**107**

[1] DWR Basins are depicted in **Figure 2-1**. Napa County groundwater subareas are depicted in **Figure 2-2**. Wells summarized in this table, DWR groundwater basins and Napa County groundwater subareas are depicted in **Figure 4-1**.

ES 4 SUMMARY AND RECOMMENDATIONS

ES 4.1 Groundwater Conditions

Groundwater level trends in the Napa Valley Subbasin of the Napa-Sonoma Valley Groundwater Basin are stable in the majority of wells with long-term groundwater level records (see **Sections 5.1.1 and 5.1.2**). Data from the monitoring network reflect the Very Dry 2020 water year conditions; however, the variability in groundwater levels do not indicate long term depletions of the Subbasin's principal aquifer system. Despite this past water year's Very Dry conditions, groundwater levels in the Subbasin's representative wells do not indicate long term groundwater depletions. In spring 2020, depths to water in the alluvial aquifer of the Napa Valley Subbasin in ranged from 7 feet to 50 feet below ground surface (**Figure 5-5**).

Water year 2020 was categorized as a Very Dry year (12.19 inches) at a representative precipitation gage with the longest period of record in the Subbasin (see **Section 5**). Spring 2020 groundwater levels were lower than levels measured in spring 2019, which was a Wet year. Overall, groundwater levels in fall 2020 remained comparable to levels in recent years. Compared to the Very Dry 2007 water year, the most recent year with a similar annual precipitation total (15.19 inches), groundwater levels in spring and fall 2020 were generally slightly lower than levels recorded in 2007. In spring 2020, depths to water in the alluvial aquifer of the Napa Valley Subbasin in ranged from 7 feet to approximately 50 feet below ground surface (**Figure 5-5**).

Water year 2021 precipitation, as of the date of this report, has again trended well below the long-term average. Through mid-April 2021 the precipitation gages located around Napa County received about 40% of average rainfall for the first five and half months of the water year, when the majority of precipitation typically occurs.

Groundwater levels recorded in 2020 were above the minimum thresholds established as sustainability criteria in 13 of 20 SGMA Representative Wells with water level criteria (see **Section 5.1.3**). Three of the seven wells with minimum threshold exceedances are dedicated monitoring wells in the County's dedicated groundwater-surface water monitoring network where minimum thresholds were established in 2016 with only about two years of available data, with an acknowledgement that there would likely be a need for revision as data from a wider range of water years becomes available. All wells with subsequent available monthly monitoring data experienced water level recovery above the site-specific minimum thresholds over the subsequent months, even during the diminished wet season of water year 2021.

Although designated as a groundwater subarea for local planning purposes, the majority of the Milliken-Sarco-Tulucay (MST) subarea is not part of a groundwater basin or subbasin as mapped by DWR.[11] Groundwater level declines observed in the MST Subarea as early as the 1960s and 1970s have

[11] For purposes of local planning, understanding, and studies, Napa County has defined groundwater subareas that cover the entire county. DWR separately delineates groundwater basins and subbasins, which do not cover the entire county (see **Section 2.1**).

stabilized since about 2009 (see **Section 5.2**). Groundwater level responses differ within the MST Subarea and even within the north, central, and southern sections of this subarea, indicating localized conditions. The localized groundwater conditions are considered to be primarily influenced by the geologic setting or anthropogenic sources specific to the subarea. An expanding recycled water distribution system in the MST Subarea, supplied by the Napa Sanitation District, delivered 422 acre-feet of recycled water to users in the MST Subarea in water year 2020. Increased distribution and use of this new source of water along with continued land use permitting constraints are expected to aid in maintaining stable groundwater level conditions in the MST subarea.

ES 4.2 Napa Valley Subbasin Groundwater Storage Changes

In the Quaternary alluvial deposits, the principal aquifer system of the Napa Valley Subbasin, the volume of groundwater in storage decreased in spring 2020 (a Very Dry year) relative to spring 2019 (a Wet year) based on an analysis of groundwater levels measured throughout the Subbasin (see **Section 5.1.4**). The volume of groundwater in storage decreased in 2020 by 24,707 acre-feet to result in a total storage volume of 196,651 acre-feet. From 1988 through 2020, the cumulative annual storage change is a net decrease of 8,945 acre-feet in the Subbasin.

Over the full 33-year period, annual storage changes in the aquifer system have fluctuated between positive and negative values, generally in accordance with the water year type. Cumulative changes in groundwater storage have also fluctuated between positive and negative values, indicating long-term stable groundwater storage conditions, the absence of chronic depletions of groundwater storage, and an overall condition of a basin in balance. (**Table ES-2**).

Maps of saturated thickness and groundwater storage changes in the principal aquifer system show decreases in saturated thickness and groundwater storage throughout most of the Subbasin between spring 2019 and spring 2020 (**Figures 5-13 and 5-15**). These decreases are consistent with the considerable lack of precipitation in water year 2020. Decreases in saturated thickness occurred in the vicinity of Rutherford.

Changes in saturated thickness in the alluvial deposits of the Napa Valley Subbasin, the primary aquifer, and changes groundwater storage volume changes were also evaluated for the period from spring 2007 to spring 2020, for comparison with the most recent year with a similar precipitation total. Saturated thickness and groundwater storage volumes were slightly less in spring 2020 compared to spring 2007 (**Figures 5-14**). Groundwater storage volumes were generally 0 to 3 acre-feet per acre less in spring 2020 than in spring 2007 (**Figure 5-16**). Saturated thickness in spring 2020 was generally 0 to 10 feet less than conditions measured in spring 2007.

ES 4.3 Napa Valley Subbasin Water Use

Total water use in the Napa Valley Subbasin, including groundwater extracted from the Subbasin, surface water from sources within the Napa River Watershed, and imported surface water delivered through the State Water Project, is estimated to have been 38,073 acre-feet in water year 2020 (see **Section 6.1.4**).

Table ES-2 Napa Valley Subbasin Principal Aquifer Groundwater Storage Changes, Water Years 1988 - 2020

Water Year	Water Year Classification (see Section 2.2.2)	Napa Valley Subbasin Alluvial Aquifer Storage (Acre-feet)	Annual Storage Change (Acre-feet)	Cumulative Storage Change (Acre-feet)
1988	Normal (below average)	205,596	-	-
1989	Normal (below average)	198,305	(7,290)	(7,290)
1990	Dry	202,469	4,164	(3,126)
1991	Dry	192,046	(10,424)	(13,550)
1992	Normal (below average)	212,532	20,486	6,936
1993	Wet	215,486	2,953	9,890
1994	Dry	208,000	(7,486)	2,404
1995	Very Wet	215,361	7,361	9,765
1996	Wet	211,141	(4,220)	5,545
1997	Wet	216,835	5,695	11,239
1998	Very Wet	219,733	2,898	14,138
1999	Normal (above average)	219,981	247	14,385
2000	Normal (above average)	213,878	(6,103)	8,282
2001	Dry	210,997	(2,881)	5,401
2002	Normal (above average)	214,534	3,537	8,938
2003	Wet	208,394	(6,140)	2,798
2004	Normal (below average)	204,592	(3,802)	(1,004)
2005	Wet	217,650	13,058	12,054
2006	Very Wet	222,904	5,254	17,308
2007	Very Dry	200,359	(22,545)	(5,237)
2008	Normal (below average)	201,029	670	(4,567)
2009	Normal (below average)	205,160	4,132	(436)
2010	Wet	210,929	5,769	5,333
2011	Wet	214,705	3,776	9,109
2012	Normal (below average)	210,338	(4,367)	4,742
2013	Normal (below average)	201,193	(9,145)	(4,403)
2014	Dry	191,523	(9,670)	(14,073)
2015	Normal (below average)	208,771	17,248	3,175
2016	Normal (below average)	214,827	6,056	9,232
2017	Very Wet	219,298	4,470	13,702
2018	Dry	209,984	(9,314)	4,388
2019	Wet	221,358	11,374	15,762
2020	**Very Dry**	**196,651**	**(24,707)**	**(8,945)**
	Average (1988 – 2020)	**209,407**	**(471)**	
	Median (1988 – 2020)	**210,929**	**1,784**	

Total estimated groundwater use in the Subbasin was 17,933 acre-feet. Groundwater use for water year 2020 is presented along with values for 1988 – 2019 developed previously in **Figure 6-7**. The figure also includes calculated annual and cumulative changes in groundwater storage in the alluvial aquifer system of the Subbasin. As noted above, groundwater storage volume decreased in 2020 by 24,707 acre-feet. Cumulative changes in groundwater storage show a net decrease of 8,945 acre-feet from 1988 – 2020 in the principal aquifer of Napa Valley Subbasin (**Table ES-2**).

Groundwater use in water year 2020 was comparable to amounts used in recent years dating back to at least 2004 (**Figure 6-7**). Over the full 30-year period, annual storage changes in the aquifer system have fluctuated between positive and negative values, generally in accordance with the water year type (e.g. precipitation). Cumulative changes in groundwater storage have also fluctuated between positive and negative values, indicating long-term stable groundwater storage conditions, the absence of chronic depletions of groundwater storage, and an overall condition of a basin in balance. Groundwater use in the Subbasin in water year 2020 remained within the sustainable yield range of 17,000 to 20,000 acre-feet per year determined in 2016 (LSCE, 2016c). **Findings presented in this report regarding groundwater conditions at representative monitoring sites, changes in groundwater storage, and groundwater use demonstrate that the Napa Valley Subbasin has continued to be managed sustainably through 2020.**

For water year 2020, an additional analysis of groundwater use by Groundwater Dependent Ecosystems (GDEs)[12] was conducted to improve the understanding of their groundwater use relative to other users in the Subbasin (see **Section 6.1.4**).The GDE groundwater use analysis found that total groundwater use by GDEs, was between 3,492 acre-feet and 4,184 acre-feet during the months when groundwater would be the dominant source of water available to GDEs (**Table 6-7**). The result indicates that groundwater use by GDEs in water year 2020 was approximately 19% to 23% of the total groundwater use of 17,933 acre-feet by other uses and users in the Subbasin (**Table 6-6**). This analysis provides a quantitative point of comparison that will be useful going forward, along with updated GDE mapping, to understand the distribution and health of GDEs over time.

The results from the GDE water use analysis are not additive for the purposes of evaluating annual use of groundwater relative to the sustainable yield for the Subbasin. The prior analysis of sustainable yield addressed "withdrawals" from the Subbasin due to groundwater pumping and not outflows due to ET or subsurface outflows to the Lowland Subbasin, though the latter two components were explicitly addressed and the water budget analysis presented in 2016 (LSCE, 2016c). GDEs are among the beneficial users of groundwater in the Subbasin. The use of groundwater by GDEs represents one

[12] Groundwater Dependent Ecosystems were initially identified in the Basin Analysis Report based on a review of a draft dataset of potential groundwater dependent ecosystems under development by The Nature Conservancy, in collaboration with DWR and California Department of Fish and Wildlife (CDFW), as the Basin Analysis Report was being developed. The Napa Valley Subbasin GDEs include a variety of wetland and vegetation communities that may rely on groundwater as a water supply.

indication of the health of GDEs. The County is working to better understand and account for these uses of groundwater.

ES 4.4 Recommendations for Continued SGMA Implementation[13]

The following paragraphs provide an update on planned near-term activities, consistent with management recommendations supported by the Napa County Board of Supervisors in the Basin Analysis Report (LSCE, 2016c) and Northeast Napa Management Area Report (LSCE, 2018a) to maintain or improve groundwater conditions and ensure overall sustainability in the Napa Valley Subbasin. On December 17, 2019, the Napa County Board of Supervisors formed the Napa County GSA.

The Napa County GSA is now responsible for providing sustainable management of groundwater within the Napa Valley Subbasin and must develop and implement a GSP, with consideration of the beneficial uses and users of groundwater and interconnected surface waters, define undesirable results, set measurable objectives and minimum thresholds and establish monitoring programs, and prepare and submit annual reports to DWR. Although they have separate duties and responsibilities, the Napa County Board of Supervisors and the Napa County GSA have a shared obligation in taking actions to implement SGMA, thereby managing and ensuring the long-term sustainability of Napa County's groundwater resources.

ES 4.4.1 Data Gap Refinement (SGMA Implementation Recommendations 11, 13, and 14)

Outreach to solicit wells for voluntary inclusion in the groundwater monitoring network will continue through the Napa County GSA, County, and Watershed Information and Conservation Council (WICC) websites, groundwater listserv emails, public presentations regarding groundwater conditions, and other means. Napa County will also continue to review discretionary projects recently approved by the County with conditions of approval requiring that project wells be made available for inclusion in the groundwater monitoring network.

Coordination with other County departments and other agencies that collect or utilize groundwater data could also provide additional data in areas of interest. Several local agencies, including the Town of Yountville, City of St. Helena, and City of Napa, already monitor groundwater levels at locations around the county.

ES 4.4.2 Ongoing Water Quality Sampling (SGMA Implementation Recommendation 15)

Groundwater quality sampling is recommended to continue at select wells throughout the Napa Valley Subbasin and Napa-Sonoma Lowlands Subbasin. Additional water quality sampling for a reduced set of constituents, including nitrate and chloride, is also recommended for the five dual-completion

[13] The Basin Analysis Report for the Napa Valley Subbasin includes a comprehensive list of monitoring and management recommendations developed since 2011. Additional recommendations developed as part of the Basin Analysis Report and the Northeast Napa Management Area Report were added to the list in sequence, beginning at number 13. Recommendations 1 – 12 are referenced in this Section where applicable to ongoing activities.

monitoring wells constructed in 2014 at surface water-groundwater monitoring sites. Prior sampling at these sites occurred 2015 and 2018.

ES 4.4.3 Improve Data Collection and Evaluation from Discretionary Permittees Required to Monitor Groundwater Conditions and Groundwater Use (SGMA Implementation Recommendations 16 and 25)

Through coordination between the Napa County Public Works Department and Planning, Building, and Environmental Services Department, continue to improve procedures for receiving data reported by permittees required to report groundwater data and regularly incorporate those data into the Napa County Groundwater Data Management System (DMS).

As noted in **Section 7.4**, this effort is underway and includes development of an electronic application and database to facilitate tracking water use data reported by groundwater permittees.

ES 4.4.4 Evaluate Strategic Recharge and Water Conservation Opportunities (SGMA Implementation Recommendations 8 and 19)

While additional data are being utilized to improve the understanding of water use by public water systems throughout the county, data gaps remain regarding water use on vineyards and other irrigated crops. As part of continued refinements of the water budget analysis for the Napa Valley Subbasin, it is recommended that the Napa County GSA hold workshops with agricultural industry representatives to develop a shared understanding of water use practices applied across the Subbasin, including irrigation, frost and heat protection, and tile drainage operations. In addition to providing shared information, the workshops would be held to further improve the calibration and parameterization of the Napa Valley Integrated Hydrologic Model (NVIHM)) and the water budget analysis being developed for the Napa Valley Subbasin GSP.

ES 4.4.5 Evaluate Distribution of Groundwater Dependent Ecosystems; Coordinate Evaluation with Guidance Developed by DWR, The Nature Conservancy, California Native Plant Society or Others (SGMA Implementation Recommendations 11 and 20)

With technical assistance from the Napa County Resource Conservation District (Napa RCD) and other local experts, the Napa County GSA will continue to review and implement guidance on evaluating GDEs released by The Nature Conservancy (Rhode et al., 2018 and Rhode et al., 2019), to refine the mapping and assessment of GDEs in the Napa Valley Subbasin. The GDE mapping and analysis included in the Napa Valley Subbasin GSP will also reflect guidance from TNC, CDFW, and others on approaches to considering the dependence on groundwater by endangered, threatened, and sensitive species present in the Subbasin (Rohde et al., 2019).

Part of this effort will include data collection using the Stream Watch website, with data collection occurring at 26 sites (see **Section 5.7** and **Section 7.5**). Through this approach, the GSA will collect standardized information and photographs documenting streamflow conditions at priority sites multiple times throughout the year. This information will complement existing stream gaging station data collected by Napa County, the Napa RCD, and U.S. Geological Survey.[14]

ES 4.4.6 Update the Napa County Groundwater Ordinance for the Northeast Napa Management Area (SGMA Implementation Recommendation 28)

On October 24, 2017, the Napa County Board of Supervisors directed County staff to update the Napa County Groundwater Ordinance to reflect the additional requirements for project-specific analysis and to incorporate water use criteria and water use reporting requirements for the Northeast Napa Management Area using an approach similar to what has already been implemented in the MST Subarea. In response, Napa County Public Works Department and Planning, Building, and Environmental Services Department staff are coordinating resources to develop an update to the Groundwater Ordinance. The Planning, Building, and Environmental Services Department has developed specific mapping data to assist and alert its land use planners when a project is located in the Northeast Napa Management Area. For discretionary projects in the Northeast Napa Management Area, additional project-specific analyses (Napa County Water Availability Analysis-Tier 2) will be required to ensure that the proposed project location or planned use of groundwater does not cause an undesirable result (e.g., locate proposed wells at appropriate distances from surface water [or consider well construction approaches that avoid streamflow effects] and avoid mutual well interference to neighboring wells) (Napa County, 2015).

ES 4.4.7 Continue to Implement Improvements to Napa County's Data Management System (SGMA Implementation Recommendation 1.1b)

GSP regulations developed by DWR require GSAs to develop and maintain a data management system (DMS) to store and report information relevant to GSP development (GSP Regulations Section 352.6). Napa County developed a DMS for its groundwater program in 2012 and has used the DMS since that time to support groundwater conditions monitoring and reporting. In 2020 and continuing in future years, additional DMS development is recommended to further incorporate additional data used for GSP development and to enable interactive visualizations of those data by SGMA stakeholders.

ES 4.4.8 Develop Well Testing Standards (SGMA Implementation Recommendation 30)

Consistent with the recommendation approved by the Board of Supervisors in the January 2018 Amendment to the Basin Analysis Report, it is recommended that the Napa County GSA develop appropriate well testing standards and require that the standards be applied under certain circumstances. Testing standards will provide well owners and the Napa County GSA with improved data on aquifer properties and well productivity. It is recommended that the new well testing standards be required when new production wells are constructed in areas where hydraulic conductivity and other aquifer parameters are less well known, including the Northeast Napa Management Area east of the Napa River and in deeper geologic units throughout the rest of the Napa Valley Subbasin. Because older and less productive geologic formations occur near ground surface in the northeast Napa Area east of

[14] see https://napa.onerain.com/

the Napa River, it is likely that pump tests will need to be performed for all new production wells in that area (**Figure 2-1).** Similar pump testing will be required for non-domestic production wells, and for wells that are completed in deeper geologic units below the Quaternary alluvium throughout the Napa Valley Subbasin.

1 INTRODUCTION

1.1 Purpose

This Report, *Napa County Groundwater Sustainability Annual Report – Water Year 2020,* presents an update on groundwater conditions and water use in the Napa Valley Subbasin (Subbasin).[15] As in the past, the Report includes an update on groundwater conditions elsewhere in the county. This Report also provides an update on the recommended Sustainable Groundwater Management Act (SGMA) implementation actions previously approved by Napa County (LSCE, 2016c and LSCE, 2018a). **Table 1-1** provides a cross reference between the required Annual Report elements described in the Groundwater Sustainability Plan (GSP) Regulations[16] and the corresponding components included in this Report.

Groundwater and surface water are highly important natural resources in Napa County. Together, the County, municipalities, water districts, public water system operators, commercial and industrial operations, the agricultural community, and the public are stewards of available water resources. Everyone living and working in Napa County has a stake in protecting the county's groundwater resources, including groundwater supplies, quality, and associated watersheds (GRAC, 2014). Without sustainable groundwater resources, the character of the County would be significantly different in terms of its economy, communities, rural character, ecology, housing, and lifestyles.

Similar to other areas in California, businesses and residents of Napa County face many water-related challenges including:

- Sustaining the quality, availability, and reliability of local and imported water supplies;
- Meeting challenges that arise during drought and flood conditions;
- Avoiding adverse environmental effects due to water use; and
- Changes in long-term water availability due to climate change.

For many decades, Napa County and its citizens have acted to conserve and preserve groundwater resources and protect beneficial uses and users throughout the county. In 1966, Napa County restricted development and land use conversion in Napa Valley, with similar restrictions added for remaining parts of the Napa River Watershed beginning in 1973. Groundwater management actions taken by Napa County since 1991 have also aligned land use permitting with best-available data consistent with the objectives of SGMA. County actions have included setting objective criteria to avoid undesirable results by avoiding overdraft, maintaining historic groundwater levels, protecting against water quality

[15] Consistent with the GSP Regulations, the term "water year" is used in this report to refer to the period from October 1 through the following September 30, with the year designated according to the calendar year in which it ends (i.e., water year 2020 spanned from October 1, 2019 through September 30, 2020).

[16] References to GSP Regulations in this report refer to Title 23 of the California Code of Regulations originally developed and adopted by the California Department of Water Resources in 2016, as required by the 2014 Sustainable Groundwater Management Act (SGMA). SGMA is published in California Water Code Section 10733.2.

degradation and land subsidence, preventing increased surface water flow reductions, and other adverse environmental impacts (see **Section 1.2.1)**.

As part of its overall land use and groundwater management actions, Napa County also recognizes that long-term, systematic monitoring programs are essential to provide data and the scientific analyses that allow for improved evaluation of water resources conditions and to facilitate effective water resources planning and management. Napa County has been monitoring groundwater conditions since the 1960s, when it collaborated with the U.S. Geological Survey on a study of groundwater resources in Napa Valley (Faye, 1973).

Table 1-1 Groundwater Sustainability Plan Regulations Annual Reporting Requirements

GSP Regulations Reference [1]	Required Component Summary	Corresponding Annual Report Contents
356.2(a)	General Information, including an executive summary and location map depicting the basin covered by the report	Executive Summary, Figure 2-1
356.2(b)(1)(A)	Groundwater elevation contour maps for each principal aquifer in the basin	Section 5.1, Figures 5-8 and 5-9
356.2(b)(1)(B)	Hydrographs of groundwater elevations and water year type	Section 5.1, Table 5-1, Figure 5-1, Figure 5-6, Figure 5-7, Figure 5-10, Figure 5-11, Appendix B
356.2(b)(2)	Groundwater extraction for the preceding water year	Section 6.1, Figure 6-5, Figure 6-6, Table 6-6
356.2(b)(3)	Surface water supply used or available for use for groundwater recharge or in-lieu use for the preceding water year	Section 6.2, Table 6-8
356.2(b)(4)	Total water use by water use sector	Section 6.1, Table 6-3, Table 6-4, Table 6-5, Table 6-6, Table 6-7
356.2(b)(5)(A)	Change in groundwater storage maps for each principal aquifer in the basin	Section 5.1.4, Figure 5-15, Figure 5-16
356.2(b)(5)(B)	A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available	Section 6.1, Figure 6-7
356.2(c)	A description of progress towards implementing the Plan (Basin Analysis Report)	Section 5.1.3, Table 5-2, Section 7, Table 7-1, Figure 7-1

[1] The GSP Regulations are published in Title 23 of the California Code of Regulations.

In 2009, Napa County embarked on a countywide project referred to as the "Comprehensive Groundwater Monitoring Program, Data Review, and Policy Recommendations for Napa County's Groundwater Resources" (Comprehensive Groundwater Monitoring Program), to address groundwater management action items identified in the 2008 General Plan update. The Program emphasizes developing a sound understanding of groundwater conditions and implementing an expanded groundwater monitoring and data management program as a foundation for ongoing coordinated, integrated water resources planning and management.

On June 28, 2011, the Napa County Board of Supervisors adopted a resolution to establish a Groundwater Resources Advisory Committee (GRAC). On September 20, 2011, the Board of Supervisors appointed 15 residents to the GRAC, which held its first organizational meeting on October 27, 2011. GRAC members represented diverse interests, including environmental, agricultural, development, and community interests. The GRAC concluded its work in February 2014.

The GRAC was created to assist County staff and technical consultants with recommendations regarding:

- Synthesis of existing information and identification of critical data needs;
- Development and implementation of an ongoing non-regulatory groundwater monitoring program;
- Development of revised well pump test protocols and related revisions to the County's groundwater ordinance;
- Conceptualization of hydrogeologic conditions in various areas of the County and an assessment of groundwater resources as data become available;
- Development of groundwater sustainability objectives that can be achieved through voluntary means and incentives; and
- Building community support for these activities and next steps.

From January 2012 until January 2013, the GRAC reviewed and provided feedback on the development of the *Napa County Groundwater Monitoring Plan 2013* (Plan) (LSCE, 2013a). The Plan was prepared to formalize and augment groundwater monitoring efforts to better understand the groundwater resources of Napa County. The Plan aids in making the County eligible for public funds administered by the California Department of Water Resources (DWR) and establishes regular evaluation of trends to identify changes in levels and/or quality and factors related to those changes that warrant further examination to ensure sustainable groundwater resources over the long-term. The Plan included refinement of criteria used to identify priority monitoring areas, a proposed expanded monitoring network, and the annual reporting of groundwater conditions (the purpose of this report).

The Napa County groundwater monitoring program relies on both publicly-owned and volunteered private wells. To fulfill its mission and garner community interest and support, the GRAC developed a Communication and Education Plan, designed to implement the Plan through voluntary participation. This effort included the development of an outreach brochure and a series of fact sheets on specific topics.

Some of the many activities accomplished by the GRAC between 2011 and 2014 included:

- Provided updates to agriculture industry groups, environmental organizations and others;
- Led and supported outreach efforts to well owners for volunteer monitoring wells, which has been very successful in adding new wells to the Napa County groundwater monitoring program;
- Held joint public outreach meetings of the GRAC and Watershed Information and Conservation Council (WICC) Board (July 26, 2012 and July 25, 2013);
- Reviewed and recommended modifications to the Napa County Water Availability Analysis procedure and Groundwater Ordinance; and
- Developed and approved Groundwater Sustainability Objectives (GRAC, 2014).

The Plan recommended annual reports on groundwater conditions and modifications to the countywide groundwater monitoring program as needed. To date, six Annual Reports have been prepared (LSCE, 2015, 2016a, 2017a, 2018b, 2019, and 2020). This is the seventh Annual Report and the fourth report prepared to meet additional annual reporting requirements of the GSP Regulations.

1.2 Background

1.2.1 History of Land Use and Groundwater Management Actions

Napa County and its citizens have a legacy of watershed stewardship. Efforts to conserve and preserve land, water, and ecological communities have been underway since at least the 1960s. Highlights of those efforts include:

- Establishment of the Napa Valley Agricultural Preserve (1966),
- Napa Valley safe yield analysis and permitting actions to avoid undesirable results (1991)
- A collaborative effort to develop the Napa River Watershed Owner's Manual (1992),
- Formation of the Watershed Information and Conservation Council (2002),
- Private-public partnerships to restore watershed function and aquatic habitat, including the Rutherford Reach Restoration Project (2002) and Oakville to Oak Knoll Reach Restoration project (in progress).
- The work of the Groundwater Resources Advisory Committee (2011-2014) to enhance groundwater and surface water monitoring and advance hydrogeologic studies, and
- Additional efforts during the past decade directed towards sustainable groundwater management including mapping groundwater dependent ecosystems, water budget analyses, and estimating the sustainable yield for the Napa Valley Subbasin (since 2009).

- Current efforts underway by the Groundwater Sustainability Plan Advisory Committee (GSPAC) to advise the Napa County Groundwater Sustainability Agency (GSA) on the preparation of a GSP for the Napa Valley Subbasin.

Napa County has proactively managed its environmental resources through land use controls and other regulations for over five decades. Although the terminology was different, the County Board of Supervisors (BOS) understood even in the 1960s that the "sustainable yield" should not be exceeded. The BOS was concerned about water, air quality, roads capacity, open space, and other environmental and quality of life indicators. From 1966 to 1968, dozens of public hearings were held, which resulted in County adoption of Ordinance No. 274, establishing a 20-acre minimum parcel size on the valley floor (increased to 40-acres in 1979), famously known as the Agricultural Preserve (Ag Preserve). In 1973, the minimum parcel size in the Ag Watershed, essentially all the hillside areas that make up the greater Napa River Watershed, was established at 40 acres. The Ag Preserve and Ag Watershed protections limit the ability to create small, privately owned parcels, and therefore limit the amount of development and groundwater demand that can occur in Napa Valley, preserving the runoff and recharge potential of the valley and its surroundings.

In 1980, voters approved an initiative know as Measure A limiting housing growth in the unincorporated county to less than 1% per year. In 1990 and again in 2008, voters approved initiatives prohibiting the conversion of agricultural lands to non-agricultural uses without a vote of the people, now in effect through 2058. Through these land use management actions groundwater demand in Napa Valley and the surrounding Napa River Watershed continues to be managed through controls on growth and development.

In 1991, Napa County began implementing land and water use management actions with the intent of avoid undesirable results, consistent with the objectives of SGMA. First adopted by the Napa County Planning Commission in 1991 and later revised in 2003, 2007, and 2015, the Water Availability Analysis (WAA) describes the procedures and water demand criteria for the Napa Valley based on analyses of safe yield, published by the USGS in 1973 and by Montgomery Engineers in 1991 (Faye, 1973 and James M. Montgomery Consulting Engineers, 1991). As an administrative process, use permit applicants are required to provide an analysis, consistent with the County's WAA guidance, to demonstrate that the proposed uses of groundwater will not result in impacts to neighboring wells, surface waters, or on the overall aquifer system. The WAA established groundwater use thresholds across residential, agricultural, commercial, and industrial sectors, based on the basic premise that each landowner has equal right to the groundwater below their property. The current WAA provides objective water use criteria, well spacing and construction criteria, and surface water setback and streamflow depletion criteria. Proposed projects are subject to site-specific study under certain conditions including projects that do not initially meet the applicable screening criteria and any project located in areas outside of the Napa Valley Floor, an area defined by the County with a boundary similar to that of the Napa Valley Subbasin.

In collaboration with Napa Valley municipalities, the County formed the Water Advisory Committee (WAC) in 1992 to guide future groundwater management actions. In 1993, the WAC synthesized recent studies of Napa Valley water demands and supplies and recommended management strategies to avoid future shortfalls. The management strategies developed by the WAC included short-term, mid-term, and long-term strategies for coordinated actions. Those recommended strategies furthered the County's understanding of water supply conditions and informed future actions, including the adoption of ordinances to regulate groundwater extraction and use, and adoption of County policy through the 2008 General Plan Update. Building on the work of the WAC, the County, through the Napa County Flood Control and Water Conservation District, in coordination with Napa Valley municipalities have avoided water supply shortfalls through a range of actions including conservation, expansion of recycled water supplies, and increases in surface water supplies available through the State Water Project.

In 1999, the County BOS adopted Ordinance No. 1162 with the intent to regulate the extraction and use and promote the preservation of the County's groundwater resources. This is accomplished through requiring groundwater permits for discretionary uses, defining and delineating groundwater deficient areas where exceptions to groundwater permitting requirements are not applicable, requiring groundwater permits for zoning or parcel subdivision applications where groundwater is required or anticipated to provide a source of supply. In addition to these regulations, the 1999 groundwater ordinance revised the County Code to include an objective "to avoid overdrafts in extraction from the groundwater basins of Napa County, to maximize the long-term beneficial use of Napa County's groundwater resources, and to ensure that sufficient groundwater is available for the long-term viability of agriculture in Napa County" (Code of Ordinances, Chapter 18.04). Later updates to the Groundwater Conservation Ordinance were introduced over time, with Ordinance No. 1230 (adopted November 5, 2003) providing an explicit definition of overdraft and implementing groundwater use restrictions dependent of land type and proportional to land acreage, and Ordinance No. 1254 (adopted March 8, 2005) excluding ministerial approval for applications for single-family dwelling units if a public water supply is available on the property.

In 2002, the County BOS created the Watershed Information and Conservation Council (WICC). The WICC serves as an advisory committee to the County BOS – assisting with the Board's decision making and serving as a conduit for citizen input by gathering, analyzing, and recommending options related to the management of watershed resources (WICC, 2015). The WICC is comprised of a Board of Directors chosen to represent the diversity of the Napa County community. The WICC Board of Directors includes representation from every municipality in Napa County (City of Calistoga, City of St. Helena, Town of Yountville, City of Napa, and City of American Canyon) and a broad at large membership representing environmental, agricultural, development and community interests.

The WICC is charged with guiding and supporting community efforts to maintain and improve the health of Napa County's watershed lands by coordinating and facilitating partnerships among the individuals, agencies, and organizations involved in improving watershed health and restoration; supporting watershed research activities; and providing watershed information and education. Since 2011, the WICC has received presentations and briefings on the County's comprehensive groundwater studies. Since 2014, after the work of the GRAC was completed, the WICC effectively served as the County BOS advisory committee on groundwater. The WICC has standing groundwater items on its agenda. At these public meetings, the WICC is presented with updates and status reports on the County's groundwater program and SGMA implementation. The WICC and the public provided comments on the Basin Analysis Report prior to its adoption by the County BOS and submittal to DWR in December 2016.

With input from the WICC and the public, in recent years the County has coordinated the regulation of groundwater use and land use through the General Plan, last updated in 2008. The Conservation Element of the General Plan contains goals, policies, and action items that establish County objectives for the sustainable management of natural resources (see **Section 3.1**).

In 2011, the County BOS appointed 15 Napa County residents to the Groundwater Resource Advisory Committee (GRAC) to assist the County with implementing the General Plan with input from diverse environmental, agricultural, and community interests. The GRAC was responsible for developing the sustainability goal and sustainability objectives that were presented in the Basin Analysis Report (see **Section 1.2.2**).

In Napa County, watershed stewardship is supported by partnerships developed to protect and restore the landscape, guided by the best available science and public input. These stewardship efforts reflect a growing awareness of ecosystem needs. As the understanding of ecosystem needs has improved, the County and its partners have responded by changing how land and water resources are managed.

As California's watersheds continue to face pressures from population growth and climate change, watershed management approaches will remain an integral part of maintaining whole system balance, including sustaining natural resource ecosystems. The County remains committed to stakeholder collaboration and advancing science-based sustainable watershed management to enhance watershed resilience and protect multiple beneficial uses of water for people and ecosystems. Resilience-focused approached include ongoing restoration efforts along the Napa River and its tributaries, drought contingency planning, and groundwater sustainability planning. Through these and other efforts, Napa County is well-positioned to continue its legacy of stewardship for generations to come.

1.2.2 Napa Valley Groundwater Sustainability: A Basin Analysis Report for the Napa Valley Subbasin

In response to the 2014 Sustainable Groundwater Management Act (SGMA), Napa County prepared a Basin Analysis Report for the Napa Valley Subbasin (LSCE, 2016c), an Alternative Submittal per the requirements of Water Code Section 10733.6 (b)(3). The report was submitted to DWR on December 16, 2016. The Basin Analysis Report provided an analysis of basin conditions that demonstrated that the basin has operated within its sustainable yield over a period of at least 10 years. The Basin Analysis Report covered the entire Napa Valley Groundwater Subbasin, designated by the State as a high-priority basin and subject to specific requirements under SGMA. While the report analyzed areas outside the Subbasin to determine how those areas affect recharge and runoff in the Subbasin, the areas outside the Subbasin are not subject to SGMA.

During the past ten years, Napa County has made significant progress towards implementing groundwater-related studies and recommendations.

As described in previous reports (LSCE, 2016c and LSCE, 2018a), groundwater conditions in the Napa Valley Subbasin have been, and continue to be, assessed using current and historical groundwater level and groundwater quality data. An extensive network of wells is used in these annual assessments. Monitoring results have shown that groundwater level trends in the Napa Valley Subbasin are stable in a majority of wells with long-term groundwater level records.

The Napa River system is affected by a number of factors, groundwater being only one of them. The river system is predominantly influenced by the variability in water year conditions (precipitation levels) from year-to-year and the extent of drier seasonal periods that occur within the year. Records dating back to the 1930s show the Napa River system has experienced these temporal and seasonal effects over many decades, particularly during the summer to fall period. The timing and amount of precipitation and natural groundwater recharge events affect the amount of groundwater baseflow discharged to the Napa River system. Heterogeneous (i.e., variable) subsurface conditions also affect the amount and location of recharge to groundwater and discharge to surface water.

While outflows from the Subbasin, including groundwater pumping, influence the surface water system, monitoring data and water budget analyses indicate that effects on the Napa River due to more or less groundwater pumping did not change during water years 1988-2015 (LSCE, 2016c). Additionally, groundwater pumping is a relatively small outflow component compared to surface water stormflows and groundwater baseflow discharged to the River and ultimately to the San Pablo Bay, both of which are primarily driven by precipitation. Flow and other aspects of the Napa River are affected by many factors beyond the County’s control (e.g., precipitation and climate change), and some factors within the State’s control (e.g., upstream damming or withdrawal of water from tributaries and historical removal of natural wetlands and floodplains). While these are not under the purview of SGMA, the Napa County BOS is addressing many of them in other appropriate forums.

Groundwater and surface water supplies, including imported surface water supplies, in the Napa Valley Subbasin are dependent on population trends, land uses, and conservation efforts. Long-term conditions in the Napa Valley Subbasin during the 1988 to 2015 base period were marked by relatively stable land uses and stable supplies of imported surface water (LSCE, 2016c). While most of the population in the Subbasin lives in the four incorporated municipalities (Cities of Napa, St. Helena, Calistoga, and Town of Yountville), the majority of the land is outside the municipalities and used primarily for agriculture. Municipal water use in the Subbasin ranged from a low of 14,700 acre-feet per year (AFY) in 2015 to a high of 20,400 AFY in 2002. Average annual municipal use in the Subbasin was 17,300 AFY over the 1988 to 2015 study period. The majority of municipal water supplies, averaging 96% from 1988 to 2015, were provided by reservoirs. Municipal supplies derived from reservoirs included increasing amounts imported from sources outside of the Napa River Watershed through the State Water Project. Groundwater and recycled water each provided an average of 2% of the municipal water supplies during the same period. Over the 28-year base period, non-agricultural water uses in the unincorporated part of the Subbasin, including residential and commercial uses, increased from about 4,000 AFY to about 5,000 AFY and are mostly supplied by groundwater.

Agricultural water supplies include groundwater pumped from the Subbasin, recycled water, surface water diverted from the Napa River system within the Subbasin, and surface water diverted from the Subbasin watershed (i.e., hillside areas). On average, total water use by agriculture within the Subbasin decreased slightly from approximately 18,000 AFY between 1988 and 1991 to approximately 16,000 AFY between 2012 and 2015. With variations in the water supply mix on a year-to-year basis, overall surface water use decreased by about 8,900 AFY from 1988 to 2015, while groundwater utilization increased by about 7,400 AFY over the same period. These changes are affected by a number of factors, including increases from new and expanded wineries and vineyards, balanced against greatly improved water conservation practices and decreased residential population in the unincorporated areas.

A combined surface water and groundwater Subbasin water budget was developed to assess inflows and outflows to the Subbasin and to determine the average annual change in groundwater storage over the 28-year base period from 1988 to 2015 using a model with a monthly time step. Very large volumes of upland runoff and surface water outflows move through and out of the Subbasin and are the predominant sources of water budget inflow and outflow in most years. Average annual changes in groundwater storage over the base period were positive, indicating that current groundwater pumping rates were within the sustainable yield for the Subbasin. The average annual increase in storage was estimated to be 5,900 AFY, consistent with stable to slightly above average cumulative precipitation inputs over the 28-year base period. A separate independent analysis of groundwater levels was also conducted to compute the change in groundwater storage from year to year; this analysis also showed positive average annual changes in groundwater storage for the 1988 to 2015 base period (LSCE, 2016c).

The Basin Analysis Report determined the sustainable yield for the Napa Valley Subbasin, consistent with the definition established as part of SGMA, as the maximum amount of groundwater that can be withdrawn annually without causing an undesirable result.[17] A breadth of data presented in the Basin Analysis Report, including the Subbasin water budget, groundwater conditions analysis, and groundwater level change in storage analysis, demonstrated that rates of groundwater pumping over the 28-year period of analysis did not exceed the sustainable yield for the Subbasin.

1.2.3 DWR Alternative Evaluation

The Basin Analysis Report was submitted to DWR in 2016 and provided analyses of basin conditions to demonstrate that the Napa Valley Subbasin had operated within its sustainable yield over a period of at least 10 years. DWR released its tentative recommendation to not approve the Basin Analysis Report on July 17, 2019. The County was given the opportunity to respond to DWR comments on the Report. The County submitted responses to DWR on October 11, 2019. On November 13, 2019 DWR published a

[17] The sustainable yield analysis for the Napa Valley Subbasin will be updated in the Napa Valley Subbasin GSP to reflect consideration of any revisions to the sustainable management criteria and water budget analyses presented in the GSP.

final notice maintaining its decision to not approve the Basin Analysis Report. Although the Basin Analysis Report was not approved, DWR's Staff Report to Napa County stated that DWR "did not consider and does not conclude that the Napa Valley Subbasin is, or has been, managed unsustainably" (DWR, 2019). Rather, DWR's decision focused on DWR's interpretation that the County had not implemented SGMA-equivalent metrics to define sustainable groundwater management prior to the passage of SGMA in 2014. Despite its final determination on the Basin Analysis Report, DWR found the County to be "proactively managing groundwater" and noted that the Alternative submittal positioned the County for successful development of a GSP for the Napa Valley Subbasin (DWR, 2019).

1.2.4 Groundwater Sustainability Agency (GSA) Formation

The Napa County Board of Supervisors held a public hearing on December 17, 2019 and adopted Resolution No. 2019-152 approving the formation of the Napa County GSA for the Napa Valley Subbasin, pursuant of Water Code Section 10723.8. The County's action was in response to DWR's final notice on November 13, 2019 that a GSA must be formed for the Napa Valley Subbasin as an outcome of its evaluation of the Basin Analysis Report.

On December 17, 2019, the County filed a notice with DWR of the County's decision to become a GSA for the Napa Valley Subbasin (Napa County, 2019).[18]

1.2.5 Groundwater Sustainability Plan (GSP) Development

In approving the formation of the Napa County GSA on December 17, 2019, the Napa County BOS also indicated its intent that the new GSA develop a GSP for the Napa Valley Subbasin. On February 6, 2020, the County submitted an initial notification to DWR, consistent with SGMA requirements, to provide notice of the GSA's intent to develop a single GSP for the Napa Valley Subbasin.[19]

In June 2020, the GSA appointed a 25-member GSP Advisory Committee (GSPAC) charged with developing and recommending a draft GSP for GSA consideration by November 2021. The GSP is currently in development and planned to be submitted to DWR by January 31, 2022. The GSP will build on existing groundwater studies, land use and water management plans, and information provided in the Basin Analysis Report (LSCE, 2016c). Progress regarding GSP development is presented at public

[18] More information on the formation of the Napa County Groundwater Sustainability Agency is available at https://sgma.water.ca.gov/portal/gsa/print/488

[19] The GSP Initial Notification is available at https://sgma.water.ca.gov/portal/gsp/init/preview/190

meetings, including meetings of the Napa County GSA and the GSPAC.[20,21] These public meetings allow for stakeholder and public input on the GSP as it is being developed.

Draft GSP Sections are being released for public input and comment as they are developed, prior to consideration for approval by the Napa County GSA. The GSA has published a schedule for GSA meetings, GSP development, and GSPAC meetings on its website.[22] GSP development updates are also communicated to stakeholders and the public through the Napa County GSA, County, and WICC websites, groundwater listserv emails, and other means.

GSP development is supported by a Sustainable Groundwater Management planning grant from DWR. Additionally, new groundwater-surface water monitoring wells are planned to be installed in 2021 to inform GSP development, also with funding from the DWR grant.

1.2.6 Annual Groundwater Conditions Reports

Since 2014, Napa County has developed annual groundwater conditions reports that summarize activities implemented as part of the County's Comprehensive Groundwater Monitoring Program. The annual reports include summaries of current monitoring activities and additionally recommended groundwater monitoring needed to fill specific data gaps, and activities implemented since 2014 (LSCE, 2015; LSCE, 2016a; LSCE, 2017a; LSCE, 2018b; LSCE, 2019; LSCE, 2020). The Annual Reports also summarize the overarching groundwater level and quality monitoring objectives defined by the County and the GRAC. These objectives provide the framework necessary to ensure that the monitoring program and data collected from the countywide monitoring facilities can address these objectives. The 2017, 2018, 2019, and this 2020 Annual Report present an update on both groundwater conditions and water use in the Napa Valley Subbasin as required for SGMA Annual Reports by Section 356.2 of the GSP Regulations.

The 2015 Annual Report (LSCE, 2016a) includes an update on groundwater quality data reported between 2009 and 2015. Those data were reviewed to provide an updated understanding of conditions and trends relative to the most recent countywide review of groundwater quality data published in the Napa County Groundwater Conditions and Groundwater Monitoring Recommendations Report (LSCE, 2011a). Between 2009 and 2015, groundwater quality data were available from a total of 81 sites. Groundwater quality data show generally good water quality with stable conditions in the Napa Valley Floor Subareas between 2009 and 2015 compared to the conditions reported previously based on data

[20] Agendas, minutes, and video recordings of GSA Board of Directors meetings are available at: https://napa.granicus.com/ViewPublisher.php?view_id=33

[21] Agendas, minutes, and video recordings of GSPAC meetings are available at: https://napa.granicus.com/ViewPublisher.php?view_id=35

[22] https://www.countyofnapa.org/3085/Governance-Meetings

reported through 2008 (LSCE, 2011a); the 2015 Annual Report also presents groundwater quality information for other groundwater subareas in the county (LSCE, 2016a; see also LSCE, 2016c).

1.3 Organization of Report

This Report summarizes activities implemented to improve the understanding of groundwater resource conditions and availability and actions taken by the County to ensure groundwater sustainability.

The Report includes the following sections:

Section 2: Hydrogeology of Napa County

- DWR Basins/Subbasins and County Subareas
- Summary of Geology and Groundwater Resources
- Groundwater Studies and Programs: 2009 – 2020
- Recent Reports

Section 3: Groundwater Resources Goals and Management Objectives

- Napa County Water Resources Goals and Policies
- Overarching Groundwater Monitoring Objectives

Section 4: Groundwater Monitoring Network

- Groundwater Level Monitoring
- Surface Water-Groundwater Monitoring
- SGMA Representative Monitoring Sites

Section 5: Groundwater Level Conditions and Trends

- Napa Valley Subbasin
    - Napa Valley Subbasin – Calistoga and St. Helena Subareas
    - Napa Valley Subbasin – Yountville and Napa Subareas
    - Napa Valley Subbasin Sustainability Indicators
    - Napa Valley Subbasin Groundwater Level Change in Storage
- Milliken-Sarco-Tulucay (MST) Subarea
- Napa-Sonoma Lowlands Subbasin and Subareas South of the Napa Valley Floor
- Subareas East and West of the Napa Valley Floor
- Pope Valley Basin and Pope Valley Subarea
- Angwin Subarea
- Napa Valley Surface Water-Groundwater Monitoring

Section 6: Napa Valley Subbasin Water Use and Surface Water Availability

- Subbasin Water Use by Sector

- Surface Water Supply Available for Use for Groundwater Recharge or In-lieu Use

Section 7: SGMA Planning and Implementation for the Napa Valley Subbasin

- Update the Napa County GSA Stakeholder Communication and Engagement Plan
- Expand the Capacity to Encourage Groundwater Stewardship
- Napa Valley Groundwater Model Development
- Developing Best Available Water Use Data
- Evaluation of Groundwater Dependent Ecosystem Water Use
- Coordination with Other Water Management and Planning Programs
- Integrated Regional Water Management Plans
- Watershed Information and Conservation Council of Napa County
- Northeast Napa Management Area Designation
- Tracking Well Permits and Construction
- Revised Conditions of Approval for Discretionary Permits
- SGMA Stakeholder Survey and Draft GSP Surveys

Section 8: Summary and Recommendations

- Data Gap Refinement
- Ongoing Water Quality Sampling
- Improve Data Collection and Evaluation from Discretionary Permittees Required to Monitor Groundwater Conditions and Groundwater Use
- Evaluate Strategic Recharge and Water Conservation Opportunities
- Evaluate Distribution of Groundwater Dependent Ecosystems; Coordinate Evaluation with Guidance from DWR, The Nature Conservancy, California Native Plant Society or Others
- Update the Napa County Groundwater Ordinance for the Northeast Napa Management Area
- Continue to Implement Improvements to Napa County's Data Management System
- Develop Well Testing Standards

2 HYDROGEOLOGY OF NAPA COUNTY

This section summarizes the countywide geologic and hydrologic setting and includes information about Department of Water Resources (DWR) groundwater basin/subbasin delineations and prioritizations, and a description of the Napa County groundwater monitoring subareas. Numerous studies that form the basis of the understanding of County hydrogeology are referenced, including the *Updated Hydrogeologic Conceptualization and Characterization of Conditions* (LSCE and MBK, 2013).

2.1 DWR Basins/Subbasins and County Subareas

DWR has identified the major groundwater basins and subbasins in and around Napa County (DWR, 2016).[23] The basins include the Napa-Sonoma Valley (which includes the Napa Valley and Napa-Sonoma Lowlands Subbasins in Napa County), Berryessa Valley, Pope Valley, and a small part of the Suisun-Fairfield Valley Groundwater Basins (**Figure 2-1**). These basins and subbasins are generally defined based on boundaries to groundwater flow and the presence of water-bearing geologic units. Not all of the groundwater basins defined by DWR are confined within county boundaries, and the DWR-designated groundwater basins and subbasins do not cover all of Napa County.

Groundwater conditions outside of the DWR-designated basins and subbasins are also very important in Napa County. An example of such an area is the Milliken-Sarco-Tulucay (MST) area, a locally identified groundwater deficient area. For purposes of local planning, understanding, and studies, the County has additionally defined groundwater subareas to track and report on groundwater conditions more comprehensively (**Figure 2-2**). These subareas were delineated based on the main watersheds and the County's environmental resource planning areas, and with consideration of groundwater basins; these geographic subareas are not groundwater basins or subbasins. The subareas include the Knoxville, Livermore Ranch, Pope Valley, Berryessa, Angwin, Central Interior Valleys, Eastern Mountains, Southern Interior Valleys, Jameson/American Canyon, Napa River Marshes, Carneros, Western Mountains Subareas and five Napa Valley Floor Subareas (Calistoga, St. Helena, Yountville, Napa, and MST).[24]

Previously under the California Statewide Groundwater Elevation Monitoring Program (CASGEM)[25], DWR classified California's groundwater basins and subbasins as either high, medium, low, or very low priority.

In 2018, DWR began a statewide process to revise the groundwater basin priority designations that it previously published in 2014.[26] Through that process, DWR changed the designation for the Napa Valley

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[23] https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118

[24] The majority of the following Napa Valley Floor Subareas align with the Napa Valley Subbasin: Calistoga, St. Helena, Yountville, and Napa. Most of the Napa Valley Floor-MST Subarea is located outside of the Napa Valley Subbasin and other designated basins or subbasins in Napa County.

[25] CASGEM is the California Statewide Groundwater Elevation Monitoring program implemented under Water Code Part 2.11 Groundwater Monitoring and administered by DWR.

[26] The California Water Code (Sections 10933 and 12924) requires DWR to prioritize California's groundwater basins and subbasins statewide. Details are available at

Subbasin from medium priority to high priority, according to criteria specified in California Water Code Part 2.11 Groundwater Monitoring (**Figure 2-3**). The priority designation method used by DWR primarily considers the population within a basin or subbasin, projected population growth, the density of wells, overlying irrigated agriculture, and the degree to which groundwater is used as a source of supply. The change from medium priority to high priority does not affect requirements for the Napa Valley Subbasin under SGMA. The changed priority designation is also not a determination by DWR that the Subbasin has groundwater conditions of concern; to the contrary, the Subbasin is operating within its sustainable yield.

The increase in priority designation for the Napa Valley Subbasin in 2018 was due primarily to revised projections of future population for the Subbasin, an increased assessment of the total number of wells in the Subbasin, and a revised approach to evaluating water quality in the Subbasin compared to the previous prioritization analysis performed in 2014.

The 2019 Final SGMA Basin Prioritization, released in December 2019, resulted in the Napa-Sonoma Lowlands Subbasin maintaining a very low priority designation. The Napa-Sonoma Lowlands Subbasin is located along the lower Napa River, which includes the Carneros Subarea and American Canyon, and also areas within Solano County (**Figure 2-3**).

2.2 Summary of Geology and Groundwater Resources

2.2.1 Previous Studies

Previous hydrogeologic studies and mapping efforts in Napa County are divisible into geologic studies and groundwater studies. The more significant studies and mapping efforts are mentioned in this section. **Table 2-1** shows the chronological sequence of these numerous efforts that span more than six decades. Weaver (1949) presented geologic maps which covered the southern portion of the county and provided a listing of older geologic studies. Kunkel and Upson (1960) examined the groundwater and geology of the northern portion of the Napa Valley. DWR (Bulletin 99, 1962) presented a reconnaissance report on the geology and water resources of the eastern area of the County; Koenig (1963) compiled a regional geologic map which encompasses Napa County. Fox and others (1973) and Sims and others (1973) presented more detailed geologic mapping of Napa County. Faye (1973) reported on the groundwater of the northern Napa Valley. Johnson (1977) examined the groundwater hydrology of the MST area.

Helley and others (1979) summarized the flatland deposits of the San Francisco Bay Region, including those in Napa County. Fox (1983) examined the tectonic setting of Cenozoic rocks, including Napa County. Farrar and Metzger (2003) continued the study of groundwater conditions in the MST area.

Wagner and Bortugno (1982) compiled and revised the regional geologic map of Koenig (1963). Graymer and others (2002) presented detailed geologic mapping of the southern and portions of the

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https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization.

eastern areas of the County, while Graymer and others (2007) compiled geologic mapping of the rest of Napa County.

In 2005 to 2007, DHI Water & Environment (DHI) contributed to the 2005 *Napa County Baseline Data Report* (DHI, 2006a and Jones & Stokes et al., 2005) which was part of the County's General Plan update (Napa County, 2008). A computer model was developed by DHI in conjunction with the Napa Valley and Lake Berryessa Surface Water models to simulate existing groundwater and surface water conditions on a regional basis primarily in the North Napa Valley and the MST and Carneros Subareas (DHI, 2006b). A 2007 technical memorandum, *Modeling Analysis in Support of Vineyard Development Scenarios Evaluation* (DHI, 2007), was prepared to document the groundwater model update which was used to evaluate various vineyard development scenarios.

Additional geologic maps, groundwater studies, and reports are listed in the references of the *Napa County Groundwater Conditions and Groundwater Monitoring Recommendations* (LSCE, 2011a). Additional work has been conducted to update the conceptualization and characterization of hydrogeologic conditions particularly for the Napa Valley Floor (LSCE and MBK, 2013 and LSCE, 2013b).

Highlights of additional groundwater studies between 2009 and 2020 are provided in Section 2.3 followed by summaries of the recent reports in Section 2.4 including: 1) *Napa County Groundwater/Surface Water Monitoring Facilities to Track Resource Interrelationships and Sustainability* (LSCE, 2016b)*, 2) Northeast Napa Area: Special Groundwater Study* (LSCE, 2017b), and 3) *Napa Valley Groundwater Sustainability Northeast Napa Management Area: An Amendment to the 2016 Basin Analysis Report for the Napa Valley Subbasin* (LSCE, 2018a).

Table 2-1 Summary and Chronology of Hydrogeologic and Geologic Studies and Mapping Efforts in Napa County

Hydrogeologic and/or Geologic Studies and Mapping Efforts	1940s	1950s	1960s	1970s	1980s	1990s	2000s	2010s	2020s
Weaver, 1949	Report and Map produced								
Kunkel and Upson,1960			Report and Map produced						
DWR, 1962			Report only						
Koenig, 1963			Map only						
Fox et al., 1973				Report only					
Sims et al., 1973				Map only					
Faye, 1973				Report and Map produced					
Johnson, 1977				Report only					
Helley et al., 1979				Report and Map produced					
Wagner and Bortugno, 1982					Map only				
Fox, 1983					Report and Map produced				
Montgomery, 1990						Report only			
Graymer et al., 2002							Map only		
Farrar and Metzger, 2003							Report and Map produced		
Graymer et al., 2007							Map only		
DHI, 2006 and 2007							Report only		
LSCE, 2011a								Report only	
LSCE and MBK, 2013								Report and Map produced	
LSCE, 2013a								Report only	
LSCE, 2013b								Report only	
LSCE, 2014								Report only	
LSCE, 2015								Report and Map produced	
LSCE, 2016a								Report and Map produced	
LSCE, 2016b								Report and Map produced	
LSCE, 2016c								Report and Map produced	
LSCE, 2017a								Report and Map produced	
LSCE, 2017b								Report and Map produced	
LSCE, 2018a								Report and Map produced	
LSCE, 2018b								Report and Map produced	
LSCE, 2019								Report and Map produced	
LSCE, 2020									Report and Map produced
LSCE, 2021 (This Report)									Report and Map produced

◆ = Report and Map produced ◆ = Report only ◆ = Map only

2.2.2 Precipitation Monitoring and Water Year Classifications

Infiltration of precipitation has been shown to provide significant groundwater recharge in Napa County, particularly in unconsolidated geologic settings (Kunkel and Upson 1960, LSCE and MBK 2013).

Precipitation records in Napa County date to 1906 at the longest continually operating gage at the Napa State Hospital (GHCND: USC00046074). In a separate analysis, precipitation data from the Napa State Hospital gage in Napa (elevation 35 feet) have been shown to have strong linear correlations (i.e., $R^2 \geq 0.90$) with monthly and annual precipitation totals from two other gages in St. Helena (elevation 1,780 feet) and Angwin (elevation 1,815 feet) (2NDNature, 2014). Based on the strength of those correlations, the Napa State Hospital gage has been recommended for use as an index gage for the Napa River Watershed.

The water year classification presented in **Table 2-2** is revised from the version developed by 2NDNature (2014). The classification presented here accounts for gaps in the daily precipitation record at the Napa State Hospital gage. Specifically, missing daily precipitation data in the Napa State Hospital gage record from water years 1920 through 2015 were estimated based on daily data from the St. Helena precipitation gage (GHCND: USC00047646) and Oakville precipitation gage (elevation: 190 feet, CIMIS Station No. 77). These gages show very strong linear correlations (i.e., $R^2 > 0.99$) for cumulative daily data from the Napa State Hospital gage. Estimated daily precipitation values were calculated to fill gaps in the Napa State Hospital gage record using observed values from either the Oakville or St. Helena gages and the linear regression for cumulative daily precipitation between those gages and the Napa State Hospital gage.

A frequency analysis was used to define Very Dry, Dry, Normal, Wet, and Very Wet water year types according to exceedance probabilities calculated from the 96-year period of record for precipitation at the Napa State Hospital gage from water years 1920 through 2015. Data from water years prior to 1920 were excluded from the frequency analysis due to large gaps in the Napa State Hospital gage record prior to that year that were not able to be estimated using data from other gages. Further information regarding precipitation in Napa County is included in **Section 5**.

Table 2-2 Napa River Watershed Water Year Classification

Year Type	Water Year Precipitation Total		Annual Precipitation Exceedance Probability (%)	Number of Years in Period of Record
	Lower Bound (inches)	Upper Bound (inches)		
Very Dry		15.19	≥ 91	9
Dry	15.20	19.67	≥ 67	23
Normal	19.68	26.99	≥ 33	33
Wet	27.00	36.75	≥ 10	22
Very Wet	36.76		< 10	9
Napa State Hospital (NSH) Average Annual Water Year Precipitation (1920 – 2020) = 26.14 inches Period of record used for frequency analysis: 1920 – 2015				

Direct infiltration of precipitation is a major component of recharge in the main Napa Valley Floor. Outside of the Napa Valley Floor, percolation of surface water appears to be the primary source of recharge. The rate of recharge within areas such as the MST Subarea has been shown to be significantly higher where streams and tributaries cross highly permeable outcrops (e.g., the tuffaceous member of the Sonoma Volcanics or shallow alluvium). Recharge outside of the Napa Valley Floor throughout much of the county is generally limited by underlying shallow bedrock of low permeability. An additional component of groundwater recharge that is less understood is deep percolation through fractured rock and fault zones. This type of recharge can be very difficult to quantify due to the highly variable size and distribution of faults, fractures, and joints in a given area.

Groundwater Occurrence and Quality in the Sonoma Volcanics

Groundwater occurs in the Sonoma Volcanics in Napa County and yields water to wells. Well yields are highly variable from less than 10 to several hundred gallons per minute (gpm). The most common yields are between 10 to 100 gpm. Faye (1973) reported well-test information which showed an average yield of 32 gpm and an average specific capacity of 0.6 gallons per minute per foot of drawdown. From the available well log data, the Tertiary marine sedimentary rocks are poor groundwater producers either for a lack of water or poor water quality (high salinity). At great depths, groundwater quality in the Tertiary marine sedimentary rocks is generally poor due to elevated chloride (salt) concentrations.

According to Kunkel and Upson (1960), groundwater in the Sonoma Volcanics is generally of good quality except in three areas. The first area with poor groundwater quality, the Tulucay Creek drainage basin, east of the City of Napa, contains groundwater with elevated iron, sulfate, and boron. The Suscol area, south of the City of Napa, is the second area where some wells exhibit poor quality groundwater due to elevated chloride concentrations, possibly from leakage from salty water in the Napa River, alluvial material above, or the existence of zones of unusually saline connate water deep within the Sonoma Volcanics. The third area of poor groundwater quality, the Calistoga area in the northern end of the Napa Valley, contains isolated wells with naturally occurring elevated chloride, boron, and some trace metal concentrations.

Kunkel and Upson (1960) reported that the principal water yielding units of the Sonoma Volcanics are the tuffs, ash-type beds, and agglomerates. The lava flows were reported to be generally non-water bearing. However, it may be possible that fractured, fragmental, or weathered lava flows could yield water to wells. The hydrogeologic properties of the volcanic-sourced sedimentary deposits of the Sonoma Volcanics are complex and poorly understood.

Groundwater Occurrence in Other Units and in the Quaternary Sedimentary Deposits

Several hundred wells and test holes on record have been drilled into the exposed Huichica Formation. Well yields tend to be low to modest (< 10 gpm to tens of gpm). Only a few known wells on record are completed in the Clear Lake Volcanics near the northern County line. Three wells report high yields of 400 to 600 gpm. Much of the Clear Lake Volcanics to the south appear to be thinner, limited in extent, and in ridge-top locations where possible groundwater production appears to be less likely.

Groundwater production from Quaternary Alluvium Deposits is variable, with yields ranging from <10 gpm in the East and West mountainous areas to a high of 3,000 gpm along the Napa Valley Floor where the alluvium is thickest (>200 feet). According to Faye (1973), average yield of wells completed in the alluvium is 220 gpm. Many wells drilled in the alluvium within the last 30 years extend beyond the alluvium and into the underlying Cenozoic units. Kunkel and Upson (1960) report that groundwater in the alluvium is generally of good quality. The groundwater is somewhat hard and of the bicarbonate type, with small concentrations of sulfate, chloride, and total dissolved solids. A few isolated areas have increased chloride and boron concentrations. The Quaternary Alluvial Deposits comprise the principal aquifer system of the Napa Valley Subbasin (LSCE, 2016c).

2.3 Groundwater Studies and Programs: 2009 to 2020

This section summarizes the studies and initiatives recently completed by Napa County.

2.3.1 Napa County's Comprehensive Groundwater Monitoring Program

In 2009, Napa County implemented a Comprehensive Groundwater Monitoring Program to meet action items identified in Napa County's 2008 General Plan update (Napa County, 2008). The program emphasizes developing a sound understanding of groundwater conditions and implementing an expanded groundwater monitoring and data management program as a foundation for future coordinated, integrated water resources planning and dissemination of water resources information. The program covers the continuation and refinement of countywide groundwater level and quality monitoring efforts (including many basins, subbasins and/or subareas throughout the county) for the purpose of understanding groundwater conditions (i.e., seasonal and long-term groundwater level trends and also quality trends) and availability.

This information is critical to enable integrated water resources planning and the dissemination of water resources information to the public, state, and local decision-makers. Napa County's combined efforts through the Comprehensive Groundwater Monitoring Program along with the related AB 303 Public Outreach Project on groundwater (CCP, 2010) and the efforts of the Watershed Information and Conservation Council (WICC) of Napa County create a foundation for the County's continued efforts to increase public outreach and participation in water resources understanding, planning, and management.

Napa County's Comprehensive Groundwater Monitoring Program involved many tasks that led to the preparation of five technical memorandums and a report on *Napa County Groundwater Conditions and Groundwater Monitoring Recommendations* (LSCE, 2011a). That report and the other related documents are available on the WICC website (http://www.napawatersheds.org/groundwater). The report documents existing knowledge of countywide groundwater conditions and establishes a framework for the monitoring and reporting of groundwater levels and groundwater quality on a periodic basis. The report also summarizes priorities for groundwater level and quality monitoring for each of the county subareas.

The *Napa County Groundwater Monitoring Plan 2013* (Plan) (LSCE, 2013a) was prepared to formalize and augment groundwater monitoring efforts to better understand the groundwater resources of Napa County, aid in making the County eligible for public funds administered by DWR, and regularly evaluate trends to identify changes in levels and/or quality and factors related to those changes that warrant further examination to ensure sustainable water resources. The Plan included refinement of criteria used to identify priority monitoring areas and a proposed expanded monitoring network. During Plan implementation, the Groundwater Resources Advisory Committee (GRAC) led and supported outreach efforts to well owners for volunteer monitoring wells; the GRAC efforts were very successful in adding new wells to the Napa County groundwater monitoring program.

2.3.2 California Statewide Groundwater Elevation Monitoring Program (CASGEM) in Napa County

This section describes the DWR California Statewide Groundwater Elevation Monitoring (CASGEM) program.[27] The wells included by the County in the CASGEM program are a *subset* of the overall network of wells monitored in Napa County.

In November 2009, Senate Bill SBX7 – 6 mandated that the groundwater elevations in all basins and subbasins in California be regularly and systematically monitored with the goal of demonstrating seasonal and long-term trends in groundwater elevations. In accordance with the mandate, DWR developed the CASGEM program. DWR is facilitating the statewide program which began with the opportunity for local entities to apply to DWR to assume the function of regularly and systematically

[27] More information on the CASGEM Program is available at this website: https://water.ca.gov/Programs/Groundwater-Management/Groundwater-Elevation-Monitoring--CASGEM

collecting and reporting groundwater level data for the above purpose. These entities are referred to as Monitoring Entities.

Wells designated for inclusion in the CASGEM program have groundwater levels monitored at least semiannually to provide data on groundwater conditions in state-designated groundwater basins and subbasins. A key aspect of the program is to make certain elements of the groundwater level information available to the public. On December 29, 2010, the County applied to DWR to become the local countywide Monitoring Entity responsible for designating wells as appropriate for monitoring and reporting groundwater elevations for purposes of the CASGEM program.

Some well owners whose wells are included in the County monitoring network have elected to be part of the CASGEM program. The wells in the CASGEM program are a *subset* of the overall wells monitored, i.e., the County has a much larger overall monitoring network. The County's participation in the CASGEM program complements groundwater monitoring that has been ongoing in Napa County for a hundred years.

Following confirmation by DWR, the County, as the Monitoring Entity, proceeded to identify a *subset* of monitored wells to be included in the CASGEM network and to prepare a CASGEM Network Plan as required by DWR (LSCE, 2011b and LSCE, 2014). The initial CASGEM Network Plan submitted to DWR included a subset of fourteen wells. DWR formally designated Napa County as the Monitoring Entity for two basins in August 2014, specifically:

- Napa County was designated as the Monitoring Entity for the 2-2.01 Napa Valley Subbasin
- Napa County was designated as the Monitoring Entity for the 2-2.03 Napa-Sonoma Lowlands Subbasin in Napa County

The current CASGEM network wells, which includes 34 wells, are located primarily on the Napa Valley Floor, Carneros Subarea, and in the MST Subarea. Twenty of the CASGEM Network wells in Napa County are located in the Napa Valley Subbasin of the Napa-Sonoma Valley Groundwater Basin (see **Section 4.1.2**). Some of these wells do not have sufficient construction details to define which portion of the aquifer system is represented by measured water levels. Additional data collection and surveying will be performed, with this information provided in future annual reports as it becomes available. Depending on the results of the County's evaluation, future actions may include removal and replacement of CASGEM wells with wells that are more representative of local groundwater conditions to better meet the objectives of the CASGEM program and the overall objectives of the County's Comprehensive Groundwater Monitoring Program.

In addition to the CASGEM well network described herein, the County is currently exploring the availability of additional monitoring wells in the Pope Valley Groundwater Basin[28]. There is a well monitored by the County in Pope Valley, however, it is not designated as a CASGEM well. Public

[28] The Overall Basin Ranking Score for the Pope Valley Groundwater Basin is "0.0"; the very low priority basin ranking range is 0 - 7. https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization

outreach is underway through community organizations and other contacts. The Berryessa Valley Groundwater Basin has a very low priority designation and extremely small utilization of groundwater.[29] Per discussions with DWR, outreach will continue but no monitoring is planned in this groundwater basin at this time.

The Suisun-Fairfield Valley Basin has a low priority designation. This basin is located mostly in Solano County, with a very small area (less than 0.3% of the total basin area) in Napa County (**Figure 2-3**). The Suisun-Fairfield Valley Basin is monitored by Solano County Water Agency as the CASGEM Monitoring Entity for Solano County.[30]

The Napa-Sonoma Lowlands Subbasin (Lowlands Subbasin), which includes portions of Napa County and Solano County (63% in Napa County, 37% in Solano County), is currently monitored within the Napa County portion of the subbasin. Monitoring in the Lowlands Subbasin has expanded since 2014. Napa County will continue to seek additional wells to monitor as necessary to ensure representative coverage in coordination with the Solano County Water Agency. As described in **Section 2.1**, the priority designation for the Lowlands Subbasin was finalized as very low priority as of December 2019.

2.3.3 Updated Hydrogeologic Conceptualization and Characterization of Conditions

In 2012, the Napa County undertook an update of the characterization and conceptualization of hydrogeologic conditions (LSCE and MBK, 2013). This work included:

1) Updated Napa Valley hydrogeologic conceptualization,
2) Linking well construction information to groundwater level monitoring data,
3) Groundwater recharge characterization and estimates, and
4) Evaluation of surface water/groundwater interrelationships.

Updated Napa Valley Geologic Conceptualization

As a part of the updated hydrogeologic conceptualization (LSCE and MBK, 2013), eight cross-valley geologic sections were constructed (**Figure 2-4**). About 1,300 water well drillers' reports were reviewed and located on topographic base maps; 191 of these were selected for use in the cross sections. Geologic correlations seen on the cross sections were extended between sections by available well control and surficial geologic maps. From the geologic cross-sections and correlations of other water well drillers' reports, the Quaternary alluvium was separated from underlying units, and an isopach (contours of equal thickness) map was constructed. Although many different geologic units underlie the Napa Valley Subbasin, the Quaternary alluvium unit forms the principal aquifer system for water supply purposes (LSCE, 2016c).

[29] The Overall Basin Ranking Score for the Berryessa Valley Groundwater Basin is "0.0"; the very low priority basin ranking range is 0 -7. https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization

[30] The Overall Basin Ranking Score for the Suisun-Fairfield Valley Groundwater Basin is "11.5"; the low priority basin ranking range is 8 - 14. https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization

The alluvium was classified and mapped as three facies according to patterns detected in the lithologic record and used to delineate the depositional environment that formed them: fluvial, alluvial fan, and sedimentary basin (LSCE and MBK, 2013 and LSCE, 2013b). The fluvial facies consist of a thin narrow band of stream channel sands and gravels deposited by the Napa River. The sand and gravel beds tend to be thicker and/or more numerous in the fluvial facies area. They are interbedded with finer-grained clay beds of probable floodplain origin. Wells constructed in the fluvial facies tend to be moderately high yielding (for the valley, roughly 50 to 200 gallons per minute, or gpm). Local areas where thicker sand and gravel beds are reported, the well yields are the highest in the valley, ranging from about 200 to 2,000 gpm.

These areas with thick sand and gravel beds occur in the Yountville Narrows area, which extends about five miles from Oakville south to Ragatz Lane. Local areas of relatively lower well yield values of 200 to 500 gpm occur to the north and south. Hydraulic properties of these deposits are recorded during airlift testing, and drawdown values are generally not reported. Only a few well pump test results have been found, and these are in the high yielding area just north of the Yountville Narrows.

The alluvial fan facies of the Quaternary alluvium extends outward from the central fluvial facies and thins to zero thickness at the edge of the valley sides. These deposits appear to have been deposited as tributary streams and alluvial fans. These deposits appear to consist of interbedded sandy clays with thin beds (less than 10 feet thick) of sand and gravel. Wells constructed in the alluvial plain facies tend to be low yielding, ranging from a few gpm to a few tens of gpm. By at least 1970, most wells drilled on the alluvial plain facies were constructed to deeper depths into the underlying Sonoma Volcanics, although the proportion of groundwater that such wells derive from the Sonoma Volcanics is believed to be low.

The boundaries of certain alluvial facies (shown in **Figure 2-5**) coincide with areas of shallow groundwater levels. This suggests a relationship between shallow depths to groundwater and Quaternary Alluvial Fan (Qaa) and Quaternary Fluvial (Qaf) units. These areas represent somewhat more likely areas of connection between surface waters and groundwater.

At the northern end of the lower valley, the Quaternary alluvial fan transitions to the sedimentary basin facies. The sedimentary basin facies is characterized by fine-grained silt, sand, and clays with thin to scattered thicker beds of sand and gravel. The sedimentary basin facies is believed to be floodplain deposits that extend to the southern marshland/estuary deposits. As noted, the extent of this facies is poorly known due to lack of well control farther south. Limited information indicates low to moderate well yields of a few gpm to possibly up to 100 gpm. Again, the lack of well pump test information makes hydraulic properties of the deposits difficult to assess.

Portions of Napa Valley north of Lodi Lane were not characterized according to their Quaternary alluvial facies by LSCE and MBK (2013). However, depths to groundwater in the vicinity of monitored wells indicate the potential for connection between surface water and groundwater in the vicinity of Garnett Creek and Cyrus Creek in and near Calistoga.

Beneath the alluvium is a complex sequence of Tertiary sedimentary deposits (Huichica Formation) and igneous deposits of the Sonoma Volcanics. These units are strongly deformed by folding and faulting and have complex stratigraphic relationships. A structure contour map (contours of elevation) of the top of these units and the subcrop[31] pattern was developed from the geologic cross-sections, lateral correlations informed by borehole lithologies between cross sections, and surficial geologic map relationships (LSCE and MBK, 2013). From north of the City of Napa near Oak Knoll Avenue extending southward through the City, these deposits are dominated by fine-grained basin fill deposits with few sand and gravels of floodplain or estuarine origin. North towards Yountville, sedimentary deposits of the Huichica Formation appear to overlie Sonoma Volcanics andesites and tuffs. Sonoma Volcanics and the older Mesozoic Great Valley sequence are exposed in a structural uplift area in the small hills in the Yountville area.

Further north, a Sonoma Volcanics andesite flow breccia appears to transition into a sedimentary conglomerate along the center of the valley. This unit is encountered in deep, high yielding wells also completed in the overlying alluvium fluvial facies, but it is not clear if this unit also is high yielding. Overlying the conglomerate/breccia on the east is the Tertiary sedimentary deposits sequence (Huichica Formation) of sandstones and mudstones. To the west of the unit occur older Sonoma Volcanics andesites, tuffs in the south, and possibly younger Sonoma Volcanics tuffs interbedded with Tertiary sedimentary deposits (Huichica Formation) of sand and gravels and clays. All of the Tertiary units beneath the Napa Valley Floor appear to be low to moderately water yielding with poor aquifer characteristics (LSCE and MBK, 2013).

Linking Well Construction Information to Groundwater Monitoring Data

As part of the updated hydrogeologic characterization (LSCE and MBK, 2013), existing monitoring well construction data from all available public sources were reviewed to determine the distribution of aquifer-specific monitoring data in the Napa Valley. This effort addresses recommendations from the Comprehensive Groundwater Monitoring Program to identify and fill data gaps that will allow for analysis of groundwater occurrence and flow as a more robust understanding of the extent of groundwater resources in the county is developed. A major component of this work included identifying construction information for dozens of previously monitored wells in Napa Valley.

Groundwater level monitoring needs identified through the Comprehensive Groundwater Management Program include improved spatial distribution of groundwater level monitoring, additional characterization of subsurface geologic conditions in county subareas to identify aquifer characteristics, further examination of well construction information to define which portion of the aquifer system is represented by water levels measured in the currently monitored wells (and in many cases to link construction information to the monitored wells), and improve the understanding of surface water/groundwater interactions and relationships.

[31] Occurrence of strata in contact with the undersurface of a stratigraphic unit, which in this case includes the strata beneath the alluvium.

Groundwater Recharge Characterization and Estimates

Another important feature of the updated hydrogeologic investigation was the development of improved characterization of groundwater recharge in the areas of greatest groundwater development, with an emphasis on Napa Valley. Understanding the volume of and mechanisms driving groundwater recharge in the county are essential in determining where and how much groundwater can be produced without incurring negative impacts (LSCE, 2011a). The high permeability of the alluvial sediments in Napa Valley permit precipitation and surface water to readily infiltrate and recharge groundwater throughout the majority of the valley floor.

Mass balance and streamflow infiltration methods were used to estimate regional and local recharge. Streamflow infiltration can be characterized by comparing the elevation of surface water to the shallowest adjacent groundwater. Detailed remotely sensed elevation data of the mainstem Napa River and several major tributaries were obtained for this purpose. LiDAR data were paired with previously collected groundwater level data and estimates of areas of greatest recharge potential to characterize the potential for direct hydraulic connections between surface water and groundwater and the potential for groundwater recharge through streambed infiltration.

In addition, mass balance recharge estimates were developed for the Napa River watershed and major tributary watersheds using a range of available data (LSCE and MBK, 2013). Available records for streamflow, precipitation, land use, and vegetative cover throughout these watersheds were used to develop spatially-distributed estimates of annual hydrologic inputs and outputs in order to solve for the volume of groundwater recharge at the watershed scale. Key components of this work included quantifying the distribution of precipitation across the land surface, quantifying the amount of water that returns to the atmosphere by evapotranspiration, and quantifying the hydraulic properties of soil and alluvial materials through which water must infiltrate to reach groundwater. Estimates developed through the mass balance approach were evaluated using a sensitivity analysis to determine the degree to which any individual or set of inputs affects the recharge estimate.

Additional work has been conducted in the Napa Valley Subbasin to quantify recharge for water budget purposes (LSCE, 2016c); see also **Section 1.2.2**.

Groundwater-Surface Water Interrelationships: Depth to Groundwater Relative to Stream Thalweg

The groundwater surface elevation and the estimated stream thalweg elevation data are important components for characterizing the groundwater/surface water relationship in the Napa Valley area. The spring 2010 contours of equal groundwater elevation were used to provide a snapshot representation of groundwater conditions with which to compare the vertical relationship between groundwater and surface water (LSCE and MBK, 2013 and LSCE, 2013b). This spatial relationship assisted in developing an understanding of the nature of water exchange between the groundwater and surface water systems. Elevation data obtained from these focused efforts contributed to the development of dedicated groundwater-surface water monitoring facilities to further characterize site-specific characteristics. Documented in the *Napa County groundwater/surface water monitoring facilities report,* temporal relationships between groundwater and stream levels were used to determine gaining and losing stream conditions throughout each year (LSCE, 2016b) (**Section 2.4.1**).

Other Areas of County

Potential connections between surface water and groundwater in other areas of the county are less well known. Perennial and intermittent water courses have been mapped in Napa County as part of the U.S. Geological Survey National Hydrography Dataset[32] (**Figure 2-6**).

2.3.4 Updated Groundwater Dependent Ecosystem (GDE) Mapping

SGMA requires that all beneficial uses and users of groundwater be considered in the development and implementation of GSPs, including Groundwater Dependent Ecosystems (GDEs). GDEs are defined in SGMA as “ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface.” GSP regulations include specific requirements to identify GDEs and consider them when determining if groundwater conditions are or will affect beneficial uses and users. Napa County initially mapped and described GDEs in the Napa Valley Subbasin (Subbasin) as part of the Basin Analysis Report (LSCE, 2016c). In 2018, DWR published guidance for mapping GDEs developed in partnership with The Nature Conservancy, California Department of Fish and Wildlife (CDFW), and others (Rohde et al, 2018).

The County contracted with the University of California at Davis (UC Davis) in 2018 to develop an updated vegetation map. The updated vegetation map was finalized in 2019 and subsequently used to update mapping of GDEs in the Napa Valley Subbasin along with wetlands mapping published by the San Francisco Estuary Institute (SFEI) and DWR, as part of its technical support for SGMA implementation.

The Basin Analysis Report identified 2,286 acres of likely and potential GDE vegetation and 819 acres of GDE wetlands, whereas updated 2019 mapping shows 2,663 acres of likely/potential GDE vegetation and 230 acres of GDE wetlands in the Napa Valley Subbasin.[33] The reduction in wetland area is largely the result of excluding saline estuarine wetlands from the analysis in 2019, compared to the analysis in the Basin Analysis Report, consistent with guidance from DWR and TNC.

Updated 2019 GDE mapping will be available for review and comment by stakeholders during GSP development. The GDE mapping and analysis included in the GSP will also reflect more recent guidance from TNC, CDFW, and others on approaches to considering the dependence on groundwater by endangered, threatened, and sensitive species present in the Subbasin (Rohde et al., 2019).

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[32] In addition to the countywide dataset available from the U.S. Geological Survey (USGS), a dataset of stream alignments with attributes including perennial and intermittent flow designations, is available from the Napa RCD. The Napa RCD dataset is under review as part of ongoing efforts to characterize connections between surface water and groundwater.

[33] GDE acreage evaluated in 2019 shows a substantial increase in mapped Bulrush-Cattail vegetation (located south of West Imola Ave) and a decrease in wetlands, attributed to the exclusion of saline estuarine wetlands.

2.4 Recent Reports

2.4.1 Napa County Groundwater/Surface Water Monitoring Facilities

In January of 2014, Napa County implemented a project to monitor interactions between groundwater and surface water resources in the Napa Valley Subbasin (LSCE, 2016b). Initial funding for the project was provided by DWR, through the Local Groundwater Assistance Grant Program, and Napa County. The project scope included monitoring facilities construction, data collection, and presentation of the results of initial data collection efforts. The project included construction of five dual-completion monitoring wells adjacent to the Napa River and Dry Creek in the Napa Valley Subbasin (**Figure 2-7**). Prior to construction of the monitoring facilities, hydrologic and geologic data were compiled and evaluated for each site to inform the monitoring well design. Monitoring well construction and development occurred in September and October of 2014. Data collection at the sites began in October of 2014 with manual groundwater level measurements followed by the installation of continuously recording pressure, temperature, and electrical conductivity transducers.

The following paragraphs summarize initial project implementation activities, as documented in the *Napa County groundwater/surface water monitoring facilities report (LSCE, 2016b).* Data were regularly downloaded from project transducers. The transducers were re-calibrated and serviced as needed. Project data were reviewed for quality control purposes and incorporated into the existing Napa County Data Management System (DMS). Data collection and analysis from these wells has continued, as described above, to track groundwater/surface water interactions. Project outreach continues through a variety of means, including presentations to the WICC, presentations to community groups around Napa Valley, and a field tour (i.e., such as one organized by the Sacramento-based Water Education Foundation).

The construction of dedicated monitoring facilities to track groundwater/surface water interactions in the Napa Valley Subbasin provides the County with an important source of data about these interconnected resources. Data collected in 2015 and 2016 showed that shallow groundwater and surface waters were hydraulically connected throughout much of the winter and spring at the mainstem Napa River sites, and longer into summer at some locations. The direction of flow indicated by monitoring data varied between gaining stream (flow of groundwater into surface water) and losing stream (flow of surface water into the groundwater system) at most sites. Two sites maintained losing stream conditions (flow from surface water into groundwater) throughout 2015: Site 2 located on Dry Creek at Washington Street and Site 5 located on the Napa River at Pope Street. Water year 2015 marked the fourth year of California's statewide drought. Continued data collection in subsequent years has provided a more robust understanding of the range of conditions at these sites (see **Section 5.7**).

Implementation of groundwater/surface water monitoring in the Napa Valley Subbasin has already proven to be very valuable for improving the understanding of surface water and groundwater interactions. Similar facilities at additional locations would help further this understanding and aid in ongoing efforts to sustainably manage the Napa Valley Subbasin. Additional monitoring continues at these sites and will aid in achieving the objective of maintaining or improving streamflow during drier years and/or seasons. As a result, it was recommended that the County, in coordination with the Napa

RCD, the Napa County Flood Control and Water Conservation District and others, as appropriate (LSCE, 2016c; see also **Section 7** in this Report):

- Evaluate stream gaging network objectives, particularly with respect to the water budget requirements contained in the SGMA GSP Regulations and determine the need and feasibility of additional streamflow monitoring sites.
- Consider additional areas that may also benefit from nested groundwater monitoring wells located near the Napa River or its tributaries (similar to the facilities constructed as part of the current project) to monitor groundwater/surface water interactions in areas where data are lacking or where geologic conditions indicate that conditions are not adequately represented by the current monitoring network.
- Continue efforts to integrate data collected at the groundwater/surface water monitoring sites with existing remote data acquisition systems in order to facilitate monitoring aquifer conditions in real-time.

In early 2020, DWR awarded Napa County a Sustainable Groundwater Management planning grant that includes funding for construction of eight additional groundwater-surface water monitoring wells at four additional sites in the Napa Valley Subbasin.

2.4.2 Northeast Napa Area: Special Groundwater Study and Management Area Basin Analysis Report Amendment

On October 24, 2017, the Napa County Board of Supervisors received a report on groundwater conditions in a portion of the Napa Valley Subbasin, known as the northeast Napa Study Area (**Figure 2-8**). The report, *Northeast Napa Area: Special Groundwater Study*, (Special Study Report) was initiated by Napa County to understand recent, historical changes in water level trends in a small portion of the Napa Valley Subbasin (LSCE, 2017b).

This northeast Napa Study Area, or Study Area, experienced historical groundwater level trends east of the Napa River that are different from and not representative of those that are typical of groundwater level trends for the overall Napa Valley Subbasin. The Study Area contains two wells that experienced historical groundwater level declines of between 20 feet and 30 feet[34], with groundwater levels in those same wells having stabilized since about 2009. Due to potential concerns relating to continued groundwater development in the area, and due to the complex hydrogeologic setting which includes mapped faults and the Napa River in relatively close proximity to the area of interest, the County authorized a study to better understand groundwater conditions and potential factors relating to historical groundwater levels in the northeast Napa Area. The study, conducted between 2016 and 2017, included evaluation of the potential effects from pumping in the overall Study Area, potential mutual well interference in an area of interest near Petra Drive, and potential streamflow effects.

The objectives of the Special Study were to:

[34] Both of these wells are constructed in aquifer units with semi-confined characteristics. Groundwater level declines in these wells do not imply equivalent declines in the unconfined water table.

1. Examine existing and predicted future water use in the northeast Napa Area,
2. Identify sources of groundwater recharge, and
3. Evaluate the geologic setting to address questions regarding the potential for long-term effects on groundwater resources and streamflow.

As part of the Special Study, a transient numerical groundwater flow model was developed that incorporates the data collected for a base period of water years from 1988 to 2015 to analyze groundwater conditions in the Study Area and the area of interest near Petra Drive. The objectives of the groundwater flow model included:

1. Assessment of potential mutual well interference of wells located in the Petra Drive area;
2. Assessment of the potential streamflow effects from current and historical land uses;
3. Assessment of the potential influence of previously documented groundwater cones of depression in an area external to the Napa Valley Subbasin known as the MST Subarea to the east of the Study Area;
4. Assessment of the groundwater supply sufficiency to meet current and potential future groundwater demands for the Study Area; and
5. Assessment of whether potential groundwater management measures or controls (similar to those previously implemented in the MST) are warranted in the Study Area.

At their meeting on October 24, 2017, the Board of Supervisors supported the findings and recommendations of the Special Study Report and directed staff to develop documentation to formally establish the Northeast Napa Management Area covering approximately 1,960 acres within the 45,928-acre Napa Valley Subbasin (**Figure 2-8**). In response, Napa County developed, and submitted to DWR, the 2018 Amendment to the Basin Analysis Report for the Napa Valley Subbasin (Northeast Napa Management Area Report) (LSCE, 2018a).

The 2018 Amendment was a supplement to the Basin Analysis Report for the Napa Valley Subbasin, the purpose of which was to designate a management area within the Napa Valley Subbasin: the Northeast Napa Management Area. GSP Regulations, developed by DWR in 2016, define a management area as, "an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors" (GSP Regulations Section 351).

The 2018 Basin Analysis Report Amendment was developed as a supplement to the Basin Analysis Report for the Napa Valley Subbasin. It did not change the findings of the 2016 Basin Analysis Report, rather it provided additional detail about conditions in the Northeast Napa Management Area and establishes sustainable management criteria at seven Representative Wells and described management actions intended to support continued groundwater sustainability in the Napa Valley Subbasin.[35] These elements from the 2018 Basin Analysis Report Amendment are planned to be incorporated into the Napa Valley Subbasin GSP.

[35] Four of the representative wells designated for the Northeast Napa Management Area were previously designated as representative wells for the Napa Valley Subbasin, while three of the sites were newly designated as part of the Northeast Napa Management Area Report.

3 GROUNDWATER RESOURCES GOALS AND MANAGEMENT OBJECTIVES

3.1 Napa County Water Resources Goals and Policies

The County's 2008 General Plan update recognizes, "water is one of the most complex issues related to land use planning, development, and conservation; it is governed and affected by hundreds of federal, state, regional, and local mandates pertaining to pollution, land use, mineral resources, flood protection, soil erosion, reclamation, etc. Every year, the state legislature considers hundreds of bills relating to water issues, and in Napa County, more than two dozen agencies have some say in decisions and regulations affecting water quality and water use." As part of the 2008 General Plan update, and within the Conservation Element, six goals are set forth relating to the county's water resources, including surface water and groundwater. Complementing these goals are 28 policies and 10 water resources action items. Napa County's six water resources goals are included below (the entire group of water resources goals, policies, and action items is included in LSCE, 2011a).

> **Goal CON-8:** Reduce or eliminate groundwater and surface water contamination from known sources (e.g., underground tanks, chemical spills, landfills, livestock grazing, and other dispersed sources such as septic systems).
>
> **Goal CON-9:** Control urban and rural storm water runoff and related non-point source pollutants, reducing to acceptable levels pollutant discharges from land-based activities throughout the county.
>
> **Goal CON-10:** Conserve, enhance and manage water resources on a sustainable basis to attempt to ensure that sufficient amounts of water will be available for the uses allowed by this General Plan, for the natural environment, and for future generations.
>
> **Goal CON-11:** Prioritize the use of available groundwater for agricultural and rural residential uses rather than for urbanized areas and ensure that land use decisions recognize the long-term availability and value of water resources in Napa County.
>
> **Goal CON-12:** Proactively collect information about the status of the County's surface and groundwater resources to provide for improved forecasting of future supplies and effective management of the resources in each of the County's watersheds.
>
> **Goal CON-13:** Promote the development of additional water resources to improve water supply reliability and sustainability in Napa County, including imported water supplies and recycled water projects.

Addressing the six water resources goals above, Napa County has produced specific General Plan Action Items related to the focus and objective of this Plan. Those action items include:

Action Item CON WR-1: Develop basin-level watershed management plans for each of the three major watersheds in Napa County (Napa River, Putah Creek, and Suisun Creek). Support each basin-level plan with focused sub-basin (drainage-level) or evaluation area-level implementation strategies, specifically adapted and scaled to address identified water resource problems and restoration opportunities. Plan development and implementation shall utilize a flexible watershed approach to manage surface water and groundwater quality and quantity. The watershed planning process should be an iterative, holistic, and collaborative approach, identifying specific drainage areas or watersheds, eliciting stakeholder involvement, and developing management actions supported by sound science that can be effectively implemented. [Implements Policies 42 and 44]

Action Item CON WR-4: Implement a countywide watershed monitoring program to assess the health of the County's watersheds and track the effectiveness of management activities and related restoration efforts. Information from the monitoring program should be used to inform the development of basin-level watershed management plans as well as focused sub-basin (drainage-level) implementation strategies intended to address targeted water resource problems and facilitate restoration opportunities. Over time, the monitoring data will be used to develop overall watershed health indicators and as a basis of employing adaptive watershed management planning. [Implements Policies 42, 44, 47, 49, 63, and 64]

Action Item CON WR-6: Establish and disseminate standards for well pump testing and reporting and include as a condition of discretionary projects that well owners provide to the County upon request information regarding the locations, depths, yields, drilling and well construction logs, soil data, water levels and general mineral quality of any new wells. [Implements Policy 52 and 55]

Action Item CON WR-7: The County, in cooperation with local municipalities and districts, shall perform surface water and groundwater resources studies and analyses and work toward the development and implementation of an integrated water resources management plan (IRWMP) that covers the entirety of Napa County and addresses local and state water resource goals, including the identification of surface water protection and restoration projects, establishment of countywide groundwater management objectives and programs for the purpose of meeting those objectives, funding, and implementation. [Implements Policy 42, 44, 61 and 63]

Action Item CON WR-8: The County shall monitor groundwater and interrelated surface water resources, using County-owned monitoring wells and stream and precipitation gauges, data obtained from private property owners on a voluntary basis, data obtained via conditions of approval associated with discretionary projects, data from the State Department of Water Resources, other agencies and organizations. Monitoring data shall be used to determine baseline water quality conditions, track groundwater levels, and identify where problems may exist. Where there is a demonstrated need for additional management actions to address groundwater problems, the County shall work collaboratively with property owners and other stakeholders to prepare a plan for managing groundwater supplies pursuant to State Water Code Sections 10750-10755.4 or other applicable legal authorities. [Implements Policy 57, 63 and 64]

Action Item CON WR-9.5: The County shall work with the SWRCB[36], DWR, DPH, CalEPA, and applicable County and City agencies to seek and secure funding sources for the County to develop and expand its groundwater monitoring and assessment and undertake community-based planning efforts aimed at developing necessary management programs and enhancements.

In 2014, the Napa County Groundwater Resources Advisory Committee (GRAC) further defined "groundwater sustainability[37]" as:

> *Groundwater sustainability depends on the development and use of groundwater in a manner that can be maintained indefinitely without causing unacceptable economic, environmental, or social consequences, while protecting economic, environmental, and social benefits.*

The GRAC concluded that groundwater sustainability is both a goal and a process; most importantly, it is a shared responsibility. Everyone living and working in the county has a stake in protecting groundwater resources, including groundwater supplies, groundwater quality, and the watersheds that support groundwater resources (GRAC, 2014). The GRAC further found that healthy communities, healthy agriculture and healthy environments exist together and not in isolation. Without sustainable groundwater resources, the character of the county would be significantly different in terms of its economy, communities, rural character, ecology, housing, and lifestyles. The GRAC also developed five major sustainability objectives that include: initiating and carrying out outreach and education efforts; optimizing existing water supplies and systems; continuing long-term monitoring and evaluation; improving the scientific understanding of groundwater recharge and groundwater/surface water interactions; and improving preparedness to address groundwater issues that might emerge (GRAC, 2014).

3.1.1 Napa Valley Subbasin Sustainability Goal

GSP Regulations require that each groundwater sustainability agency establish a sustainability goal for the applicable basin or subbasin "that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline" (GSP Regulations Section 354.24). In conformance with SGMA and the intent of the GRAC, the Napa County Board of Supervisors previously approved a Napa Valley Subbasin SGMA Sustainability Goal (LSCE, 2016c). As part of the overall sustainable management criteria

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[36] SWRCB is the California State Water Resources Control Board. DPH is the California Department of Public Health, which has since been re-organized to place drinking water oversight and regulatory authority under the purview of the Division of Drinking Water within the SWRCB.

[37] The definition for Groundwater Sustainability developed by the GRAC is separate from the definition of Sustainable Groundwater Management applied in the 2014 Sustainable Groundwater Management Act, see **Section 3.1.1** of this Report for additional information.

for the Napa Valley Subbasin, the sustainability goal is under review by the GSPAC and GSA and may be revised as part of GSP development.

> *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. – Napa Valley Subbasin Sustainability Goal, approved December 13, 2016*

The sustainability goal provides guidance for groundwater management in the Subbasin, implemented in a manner that avoids undesirable results due to groundwater conditions.

3.1.2 Napa Valley Subbasin Sustainability Criteria

SGMA defines undesirable results in the context of six sustainability indicators as "one or more of the following effects caused by groundwater conditions occurring throughout the basin (or subbasin):

i. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.

ii. Significant and unreasonable reduction of groundwater storage.

iii. Significant and unreasonable seawater intrusion.

iv. Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.

v. Significant and unreasonable land subsidence that substantially interferes with surface land uses.

vi. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water." (Water Code Section 10721(x)

Interconnected surface water in the Napa River system is considered to be the most sensitive sustainability indicator in the Napa Valley Subbasin. Measurable objectives and minimum thresholds (i.e., metrics required by SGMA to track conditions relative to the sustainability indicators) were established in the Basin Analysis Report (LSCE, 2016c) to ensure continued groundwater sustainability, or improve groundwater conditions, and provide ongoing management targets devised to address potential future effects on surface water.

The GSP Regulations define “representative monitoring” as “a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin” (Section 351(ac)). The County has established a subset of groundwater monitoring sites in the Napa Valley Subbasin for the purpose of monitoring groundwater conditions that are representative of the Subbasin overall and of the Northeast Napa Management Area, consistent with the GSP Regulations (Section 354.36). For SGMA purposes for the Napa Valley Subbasin, these representative sites are where sustainability indicators are monitored, and minimum thresholds and measurable objectives are defined based on work conducted for the Basin Analysis Report (LSCE, 2016c) and the Northeast Napa Management Area Report (LSCE, 2018a). Many of the representative sites are monitored for more than one sustainability indicator. In the Napa Valley Subbasin, 21 Representative Monitoring Sites have been selected to monitor sustainability indicators, through quantitative minimum thresholds and measurable objectives (see **Section 4.3**).

The GSP Regulations define a “minimum threshold” as “a numeric value for each sustainability indicator used to define undesirable results” (Section 351(t)). The Napa Valley Subbasin Basin Analysis Report and the 2018 Amendment discussed the preliminary minimum thresholds established to quantify groundwater conditions for each applicable sustainability indicator at representative monitoring sites. Justification is provided for the thresholds based on best available data, including groundwater levels, groundwater quality, and surface water flows.

The GSP Regulations define “measurable objectives” as “specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions” (Section 351(s)). Measurable objectives for each sustainability indicator are based on quantitative values using the same metrics and monitoring sites that are used to define the minimum thresholds. These objectives provide a reasonable margin of operational flexibility under adverse conditions where applicable and utilize components such as historical water budgets, seasonal and long-term trends, and periods of drought. See **Section 5.1.3** of this Annual Report for further discussion of the measurable objectives compared with 2020 monitoring results.

For representative monitoring sites where long-term periods of record are not available, minimum thresholds and measurable objectives established in the Basin Analysis Report (LSCE, 2016c) will be reviewed and reevaluated in future years to better reflect true long-term variability and representativeness of conditions at those sites. Any updates to the minimum thresholds and measurable objectives will be considered as part of the development of the Napa Valley Subbasin GSP with opportunities for stakeholder and public input as described in **Section 1.2.5**.

This 2020 Annual Report summarizes groundwater conditions and compares them to the current minimum thresholds and the measurable objectives established in the Basin Analysis Report (LSCE, 2016c) and the Northeast Napa Management Area Report (LSCE, 2018a).

3.2 Overarching Groundwater Monitoring Objectives

This section describes the water level and quality objectives established for the countywide Comprehensive Groundwater Monitoring Program[38] initially described in the *Napa County Groundwater Monitoring Plan 2013* (Plan) (LSCE, 2013a). The overarching groundwater monitoring objectives are linked to: 1) the County's General Plan goals and action items presented above, and 2) hydrogeologic conditions and potential areas of concern, including (but not limited to):

- Monitoring trends in groundwater levels and storage (e.g., groundwater balance) to assess and ensure long-term groundwater availability and reliability;
- Monitoring of groundwater/surface water interactions to ensure sufficient amounts of water are available to the natural environment and for future generations;
- Monitoring in significant recharge areas to assess factors (natural and human-influenced) that may affect groundwater recharge (including climate change) and also aid the identification of opportunities to enhance groundwater recharge and storage;
- Monitoring to establish baseline conditions in areas of potential saline water intrusion;
- Monitoring of general water quality to establish baseline conditions, trends, and protect and preserve water quality.
- Identify where data gaps occur in the key subareas and provide infill, replacement, and/or project-specific monitoring (e.g., such as may occur for planned projects or expansion of existing projects) as needed; and
- Coordinate with other entities on the collection, utilization, and incorporation of groundwater level data in the countywide DMS.

In addition to the countywide monitoring objectives summarized below, the Plan also includes subarea-level objectives for groundwater level and groundwater quality monitoring, based on the analysis of existing groundwater data and conditions described in the report *Napa County Groundwater Conditions and Groundwater Monitoring Recommendations* (LSCE, 2011a) and with input received from the GRAC.

3.2.1 Groundwater Level Monitoring Objectives

The countywide groundwater level monitoring program includes the following objectives:

- Expand groundwater level monitoring in priority County subareas to improve the understanding of the occurrence and movement of groundwater; monitor local and regional groundwater levels including seasonal and long-term trends; and identify vertical hydraulic head differences in the aquifer system and aquifer-specific groundwater conditions, especially in areas where short- and long-term development of groundwater resources are planned (this includes additional monitoring of the Tertiary formation aquifer in the area between the MST Subarea

[38] These objectives were developed by the Napa County GRAC prior to passage of the 2014 Sustainable Groundwater Management Act. SGMA defines measurable objectives as quantitative means of evaluating the efficacy of groundwater basin management, which is different from the approach applied by the GRAC.

and the northeastern part of the Napa Subarea to determine whether groundwater water conditions in the MST Subarea are affecting other areas (LSCE and MBK, 2013);

- Detect the occurrence of, and factors attributable to, natural (e.g., direct infiltration of precipitation, surface water seepage to groundwater, groundwater discharge to streams) or induced factors (e.g., pumping, purposeful recharge/infiltration operations; application of recycled water) that affect groundwater levels and trends;
- Identify appropriate monitoring sites to further evaluate groundwater/surface water interaction and recharge/discharge mechanisms, including whether groundwater utilization is affecting surface water flows;
- Establish a monitoring network to aid in the assessment of changes in groundwater storage; and
- Generate data to better estimate groundwater basin conditions and assess local current and future water supply availability and reliability; update analyses as additional data become available.

3.2.2 Groundwater Quality Monitoring Objectives

The primary objectives of the countywide groundwater quality monitoring program include (LSCE, 2013a):

- Evaluate groundwater quality conditions in the various county subareas and identify differences in water quality spatially across areas and vertically in the aquifer system within a subarea;
- Detect the occurrence of and factors attributable to natural (e.g., general minerals and trace metals) or other constituents of concern;
- Establish baseline conditions in areas of potential saltwater intrusion, including the extent and natural occurrence and/or causes of saltwater beneath the Carneros, Jameson/American Canyon and Napa River Marshes Subareas;
- Assess the changes and trends in groundwater quality; and
- Identify the natural and human factors that affect changes in water quality.

4 GROUNDWATER MONITORING NETWORK

4.1 Groundwater Level Monitoring

Groundwater level monitoring was conducted at a total of 107 sites across Napa County in water year 2020 (**Table 4-1)**. **Figure 4-1** shows the distribution of sites monitored in 2020 by data reporting entity.

Table 4-1 Current Groundwater Level Monitoring Sites in Napa County by Reporting Entity

Reporting Entity / Monitoring Network	Number of Monitored Wells, Fall 2017	Number of Monitored Wells, Fall 2018	Number of Monitored Wells, Fall 2019	Number of Monitored Wells, Fall 2020
NAPA COUNTY				
California Statewide Groundwater Elevation Monitoring (CASGEM) Network				
Surface Water-Groundwater Monitoring Wells	*10*	*10*	*10*	*10*
Domestic and Irrigation Wells	*23*	*24*	*24*	*24*
CASGEM Subtotal	33	34	34	34
State Water Data Library / CASGEM (Voluntary) Network	16	16	16	16
County Volunteer Groundwater Monitoring Network	47	47	47	46
Napa County Subtotal	**96**	**97**	**97**	**96**
CALIFORNIA DEPARTMENT OF WATER RESOURCES				
State Water Data Library / CASGEM (Voluntary)	**4**	**4**	**4**	**4**
STATE WATER RESOURCES CONTROL BOARD				
Geotracker Regulated Facilities	**7**	**7**	**3**	**7**
U.S. GEOLOGICAL SURVEY (USGS)				
Groundwater Level Monitoring	**0**	**0**	**5**	**0**
Total Sites, All Entities	**107**	**108**	**109**	**107**

Out of the total 107 sites monitored in water year 2020, 96 wells were monitored by Napa County and four wells were monitored by DWR. The remaining seven sites are regulated facilities with multiple wells with data reported as part of the State Water Resources Control Board (SWRCB) Geotracker Regulated Facilities Program (**Table 4-1**). While SWRCB Geotracker sites often includes multiple wells where data are collected, for the purposes of this report all wells at a given site are considered to be part of a single site.

Wells monitored in 2020 were distributed across 13 of 18 groundwater subareas (**Table 4-2 and Figure 2-2**).[39] As in previous years, most monitored wells were in the five Napa Valley Floor groundwater subareas and the Carneros Subarea. Groundwater levels were monitored at 60 sites distributed throughout the Napa Valley Subbasin.

Additional summary information for currently monitored sites is provided in **Appendix A**.

4.1.1 Napa County Monitoring Network

In 2020, Napa County monitored groundwater levels at 96 wells. Eight wells were monitored by Napa County at a monthly interval, to address temporal data gaps identified in the 2014 Annual Monitoring Report (LSCE, 2015). Ten wells were monitored using continuously recording instrumentation at dedicated monitoring facilities constructed as part of the County's Surface Water–Groundwater Monitoring Project. Data collection experienced some disruptions in 2020 due to the COVID-19 pandemic and site access constraints due to wildfire activity.

4.1.2 California Statewide Groundwater Elevation Monitoring Program (CASGEM) Network

The CASGEM Monitoring Network is a subset of the total wells in the Napa County monitoring program. Well owners voluntarily choose whether to participate in the State's CASGEM Program. As of fall 2020 the Napa County CASGEM Network included 24 privately-owned wells monitored by Napa County and 10 dedicated monitoring wells from the Surface Water-Groundwater Monitoring Project (**Figure 2-7**). Wells in the CASGEM Network are distributed across all five Napa Valley Floor Subareas (Calistoga, St. Helena, Yountville, Napa, and MST) as well as the Carneros, Angwin, and Western Mountains Subareas (**Table 4-3 and Figure 4-2**). Twenty of the CASGEM Network wells in Napa County are located in the Napa Valley Subbasin of the Napa-Sonoma Valley Groundwater Basin (**Table 4-4**). In addition, six CASGEM Network wells are located in the Napa-Sonoma Lowlands Subbasin of the Napa-Sonoma Valley, while eight are not located in any DWR-designated groundwater basin or subbasin.

[39] For purposes of local planning, understanding, and studies, Napa County has defined groundwater subareas that cover the entire county. DWR separately delineates groundwater basins and subbasins, which do not cover the entire county (see **Section 2.1**).

Table 4-2 Groundwater Level Monitoring Sites in the Napa Valley Subbasin and Napa County Groundwater Subareas[1]

Groundwater Basin or Groundwater Subarea	Number of Monitored Sites					
	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020
Napa-Sonoma Valley – Napa Valley Subbasin	56	57	61	61	64	60
Napa Valley Floor - Calistoga	9	7	7	8	9	8
Napa Valley Floor - MST	27	26	25	24	24	24
Napa Valley Floor - Napa	20	21	21	21	22	20
Napa Valley Floor - St. Helena	14	14	14	14	15	14
Napa Valley Floor - Yountville	14	13	13	13	14	13
Carneros	12	12	12	12	12	12
Jameson/American Canyon	1	1	1	1	1	1
Napa River Marshes	-	-	-	-	-	-
Angwin	5	5	5	5	5	5
Berryessa	3	1	1	2	-	2
Central Interior Valleys	2	2	2	2	1	2
Eastern Mountains	4	3	3	3	3	3
Knoxville	-	-	-	-	-	-
Livermore Ranch	-	-	-	-	-	-
Pope Valley	1	1	1	1	1	1
Southern Interior Valleys	-	-	-	-	-	-
Western Mountains	1	2	2	2	2	2
Total Sites	**113**	**108**	**107**	**108**	**109**	**107**

[1] DWR Basins are depicted in **Figure 2-1**. Napa County groundwater subareas are depicted in **Figure 2-2**. Wells summarized in this table, DWR groundwater basins and Napa County groundwater subareas are depicted in **Figure 4-1**.

Table 4-3 Current CASGEM Network Sites in Napa County by Groundwater Subarea[1]

Groundwater Subarea	Number of Monitored Sites, Fall 2020
Napa Valley Floor-Calistoga	2
Napa Valley Floor-MST	5
Napa Valley Floor-Napa	9
Napa Valley Floor-St. Helena	5
Napa Valley Floor-Yountville	5
Carneros	6
Jameson/American Canyon	-
Napa River Marshes	-
Angwin	1
Berryessa	-
Central Interior Valleys	-
Eastern Mountains	-
Knoxville	-
Livermore Ranch	-
Pope Valley	-
Southern Interior Valleys	-
Western Mountains	1
Total Sites	**34**

[1] Napa County groundwater subareas are depicted in **Figure 2-2**. Wells summarized in this table and Napa County groundwater subareas are depicted in **Figure 4-1**.

4.1.3 DWR Monitoring Network

DWR monitored four wells in Napa County as part of its voluntary groundwater monitoring efforts during all or part of 2020 (**Table 4-1**). Monitoring was conducted monthly at most wells, with some disruptions to the COVID-19 pandemic and site access constraints due to wildfire activity. These wells are distributed across the Napa Valley Subbasin. As of November 2020, DWR has ceased monitoring of well 07N05W09Q2 due to a lack of well construction information. The County is currently evaluating options to attain the well's construction information or identify new wells to monitor in this area. DWR is also attempting to acquire updated landowner access agreements for the other three wells and may discontinue monitoring of those wells in 2021, pending the outcome of that effort. Napa County GSA staff are communicating with DWR staff and assisting with those outreach efforts.

Table 4-4 Current CASGEM Network Sites in Napa County by Groundwater Basin[1]

Basin/Subbasin Number	Basin Name	Subbasin Name	Number of Monitored Sites, Fall 2019
2-2.01	Napa-Sonoma Valley	Napa Valley	20
2-2.03	Napa-Sonoma Valley	Napa-Sonoma Lowlands	6
5-20	Berryessa Valley	-	-
5-68	Pope Valley	-	-
2-3	Suisun-Fairfield Valley	-	-
-	Non-basin Areas	-	8
		Total Sites	**34**

[1] Wells summarized in this table and DWR groundwater basins are depicted in **Figure 4-2**.

4.1.4 State Water Resources Control Board Geotracker Network

The State Water Resources Control Board (SWRCB) stores environmental data for regulated facilities in California in their Geotracker database, including groundwater levels and groundwater quality. Data from these regulated facilities usually include manual measurements and samples from groundwater monitoring wells (typically shallow wells) at each site. Groundwater level data are available for seven Geotracker sites located throughout Napa County in 2020 (**Table 4-1**). The groundwater level monitoring frequency is typically semi-annual or quarterly, although more frequent measurements are sometimes recorded. Three of the Geotracker sites with data reported in 2020 are located in the Napa Valley Floor-Napa Subarea and one is located in the Napa Valley Floor-MST Subarea (**Figure 4-1**). The remaining sites monitored in 2020 are located in the Central Interior Valleys and Berryessa Subareas.

4.1.5 U.S. Geological Survey Monitoring Network

In October 2019, the USGS monitored groundwater level conditions at five wells in Napa County, four of which are located within the Napa Valley Subbasin (**Figure 4-1**). These five wells are part of the public-supply network within the USGS Groundwater Ambient Monitoring and Assessment (GAMA) program. In addition to the public supply network, the USGS GAMA program maintains a domestic supply network as well. The GAMA program is a statewide assessment of groundwater quality designed to characterize regional constituents and identify potential risks to groundwater resources. The USGS reports sampling of each network every 5 years. The wells sampled in October 2019 as part of this monitoring effort are not expected to be resampled until 2024.

4.2 Surface Water-Groundwater Monitoring

Funding from DWR through the 2012 Local Groundwater Assistance Grant Program enabled Napa County to construct 10 monitoring wells at five sites in the Napa Valley Subbasin in September 2014. These wells comprise the groundwater monitoring facilities for the Napa County Surface Water-Groundwater Monitoring Project. In addition to grant funding from DWR, Napa County provided matching funds to cover a portion of the monitoring well construction and instrumentation costs (LSCE, 2016b). In early 2020, DWR awarded Napa County a Sustainable Groundwater Management planning grant that includes funding for the construction of eight additional groundwater-surface water monitoring wells at four additional sites in the Napa Valley Subbasin. Napa County is committed to the long-term operation of these facilities to improve the understanding of surface water and groundwater interactions.

4.2.1 Surface Water-Groundwater Monitoring Network

Four of the current surface water-groundwater sites are located along the Napa River while one is adjacent to Dry Creek (**Figure 2-7**). The five sites are within the Napa, Yountville, and St. Helena Subareas of the Napa Valley Floor.

Each of the five sites includes a dual-completion monitoring well to enable monitoring of groundwater conditions at specific depth intervals. These dual-completion wells consist of two separate casings in a single borehole. Each casing is independent of the other with distinct total depths and screen intervals. The construction details for each casing were developed based on site-specific hydrogeologic and surface water channel considerations.

In general, groundwater monitoring facilities at each site consist of one shallow casing constructed to represent groundwater conditions at the water table surface and at elevations similar to the adjacent surface water channel. The second casing at each site is constructed to a deeper depth with screen intervals coinciding with aquifer materials and depths likely to be accessed by production wells in the vicinity. Paired casings are separated within the borehole by intermediate seals designed to provide a physical separation such that groundwater conditions reflected by each casing are not influenced by conditions in other portions of the groundwater system.

4.3 SGMA Representative Monitoring Sites

The GSP Regulations define “representative monitoring” as “a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin” (Section 351(ac)). Groundwater level conditions are currently monitored at 60 sites distributed throughout the Napa Valley Subbasin (**Table 4-2** and **Figure 4-3**). These sites include 20 wells identified as groundwater level representative wells in the Basin Analysis Report (LSCE, 2016c) and the Northeast Napa Management Area Report (**Table 4-5**).[40] This subset of representative monitoring sites has been established for the purpose of monitoring groundwater conditions that are representative of the Subbasin overall and of the Northeast Napa Management Area, consistent with the GSP Regulations (Section 354.36). For SGMA purposes for the Napa Valley Subbasin, these sites are where sustainability indicators are monitored, and minimum thresholds and measurable objectives are defined.

[40] Well 5N/4W-15E1 is currently the only representative monitoring site designated for groundwater quality criteria, but not groundwater level criteria. Therefore, a total of 21 representative monitoring sites are established for the Napa Valley Subbasin, twenty of which have groundwater level criteria.

Napa County has used the term “representative” in reference to hydrographs presented in previous reports (LSCE, 2011a; 2015; 2016a). Specific representative monitoring sites that typify conditions in the Subbasin are designated in the Basin Analysis Report and Northeast Napa Management Area Report, to align ongoing monitoring efforts with SGMA (LSCE, 2016c). Seven of the SGMA representative wells were selected because of their long historical groundwater level record and their prior use in Napa County groundwater-related reports as “representative” wells with hydrographs that typify groundwater conditions and trends in the Subbasin. Ten relatively new wells in the surface water-groundwater monitoring network were selected because of their construction and location, for the specific purpose of assessing surface water and groundwater interaction. One other well, 5N4W-15E1, was selected because of its location in the southern part of the Subbasin, moderate historical groundwater level record, likely construction in unconfined part of the groundwater system, and for the purpose of tracking groundwater trends and gradients near the adjoining subbasin. Well 5N4W-15E1 is currently only associated with minimum thresholds and measurable objectives for groundwater quality.[41]

As part of its ongoing efforts to refine the understanding of how groundwater conditions in individual wells relate to different aquifer zones in the Subbasin, Napa County will continue to review new information on well construction and other information that may provide additional insights on the interpretation of well-specific data in relation to the hydrogeologic conceptual model for the Subbasin. One example of such review is NapaCounty-135, which is understood to be in an area where alluvial deposits are relatively thin. Analysis conducted for the water year 2017 Annual Report showed that the well likely has the majority of its screened interval in formations of the Tertiary Sonoma Volcanics, below the alluvium.

[41] Groundwater quality monitoring also occurs at the 10 dedicated monitoring wells owned by Napa County at surface water-groundwater monitoring sites and three additional production wells monitored by DWR in the Napa Valley Subbasin. In addition, groundwater quality monitoring is planned to occur at up to 16 wells in the Napa County voluntary monitoring network.

Table 4-5 Napa Valley Subbasin Representative Monitoring Sites

Well ID	Data Source	Aquifer Designation[1]	Subarea	Well Depth (ft)	Basis for Selection
06N04W17A001M	DWR	Qa	Yountville	250	Long record
06N04W27L002M	DWR	Qa	Napa	120	Long record
07N05W09Q002M	DWR	ND	St. Helena	232	Long record
08N06W10Q001M	DWR	ND	Calistoga	200	Long record
5N/4W-15E1	DWR	Qa	Napa	158	Moderate record [2]
NapaCounty-76	Napa County	Tsv	Napa	405	Aquifer-specific construction, Moderate record
NapaCounty-122	Napa County	Tss	MST	210	Aquifer-specific construction, Moderate record
NapaCounty-229	Napa County	Tss	MST	350	Aquifer-specific construction, Moderate record
NapaCounty-128	Napa County	Qa	Calistoga	50	Long record
NapaCounty-133	Napa County	Qa	Yountville	120	Long record
NapaCounty-135	Napa County	Qa, Tsv	Yountville	125	Long record
NapaCounty-214s-swgw1	Napa County	Qa	Napa	53	Designated SW/GW facility [3]
NapaCounty-215d-swgw1	Napa County	Qa	Napa	98	Designated SW/GW facility
NapaCounty-216s-swgw2	Napa County	Qa	Yountville	50	Designated SW/GW facility
NapaCounty-217d-swgw2	Napa County	Qa	Yountville	86	Designated SW/GW facility
NapaCounty-218s-swgw3	Napa County	Qa	Napa	40	Designated SW/GW facility
NapaCounty-219d-swgw3	Napa County	Qa	Napa	93	Designated SW/GW facility
NapaCounty-220s-swgw4	Napa County	Qa	Yountville	45	Designated SW/GW facility
NapaCounty-221d-swgw4	Napa County	Qa	Yountville	85	Designated SW/GW facility
NapaCounty-222s-swgw5	Napa County	Qa	St. Helena	40	Designated SW/GW facility
NapaCounty-223d-swgw5	Napa County	Qa	St. Helena	100	Designated SW/GW facility

1. Aquifer Designations: Qa = Quaternary Alluvium, Tsv = Tertiary Sonoma Volcanic Rocks, Tss = Tertiary Sedimentary Rocks, ND = Not Determined
2. Well 5N4W-15E1 is currently designated as a representative site for groundwater quality criteria only.
3. Designated SW/GW facility refers to surface water and groundwater monitoring facilities installed as part of a Local Groundwater Assistance Program grant awarded to Napa County by DWR for the purposes of evaluating the connectivity between groundwater and surface water.

5 GROUNDWATER LEVEL CONDITIONS AND TRENDS

Groundwater data availability in Napa County varies widely between local subareas. The bulk of sites with historical and current groundwater level and quality data are located in the Napa Valley Floor Subareas (e.g., the Calistoga, St. Helena, Yountville, Napa, and MST Subareas), with less abundant records available in other Napa County subareas.[42] Except for the MST Subarea, the Napa Valley Floor subareas generally coincide with the Napa Valley Subbasin delineated by DWR. This section presents a discussion of groundwater levels, with a focus on groundwater level characteristics by local subarea. Data from multiple sources were compiled and evaluated for this report (see Section 4). Groundwater level data collection procedures used by Napa County are provided **Appendix C**.

Precipitation records in Napa County date back to 1906 at the longest continually operating gage at the Napa State Hospital (GHCND: USC00046074). In a separate analysis, precipitation data from the Napa State Hospital gage in Napa (elevation 35 feet) have been shown to have strong linear correlations (i.e., $R^2 \geq 0.90$) with monthly and annual precipitation totals from two other gages in St. Helena (elevation 1,780 feet) and Angwin (elevation 1,815 feet) (2NDNature, 2014). Based on the strength of those correlations, the Napa State Hospital gage has been recommended for use as an index gage for the Napa River Watershed.

Mean annual precipitation at the Napa State Hospital gage from 1988 to 2020 is 26.14 inches. The precipitation total in water year 2020 was 12.19 inches and registered as a Very Dry year on the five-stage rating system of Very Dry, Dry, Normal, Wet and Very Wet water year types (**Table 5-1**). Precipitation at the Napa State Hospital gage in 2020 is comparable to other past dry years such as 2007 (15.19 inches, Very Dry), 2014 (19.67 inches, Dry), and 2018 (19.30 inches, Dry). Although Very Dry years conditions occurred as recently as 2007, prior to water year 2020 the last time that fewer than 15 inches of precipitation were recorded at the Napa State Hospital gage was water year 1977.

Figure 5-1 depicts both the annual water year precipitation recorded at the Napa State Hospital gage along with the cumulative departure from the mean water year precipitation value for water years 1950 through 2020. A cumulative departure from mean curve is often used to identify trends in historical climatic conditions, such as periods of dry, average, or wet conditions. To develop a cumulative departure curve, the long-term mean (average) of a set of climatic data is calculated and compared to each annual amount. The cumulative departure curve is then compiled by progressively accumulating these annual departure amounts, from the first year through the last year of the historical period. The cumulative departure curve always begins and ends at zero, because the values are a measure of deviation from an arithmetic mean across the complete dataset on which the mean is calculated. Downward trends through time are indicative of a period of overall dry conditions, upward trends indicate a period of overall wet climatic conditions, and level sections of the curve indicate a period of

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[42] For purposes of local planning, understanding, and studies, Napa County has defined groundwater subareas that cover the entire county. DWR separately delineates groundwater basins and subbasins, which do not cover the entire county (see **Section 2.1**).

overall average conditions. This cumulative departure curve was developed for the Napa Valley Subbasin to identify precipitation trends over time.

Table 5-1 Recent Napa State Hospital Annual Precipitation Totals and Napa River Watershed Water Year Types

Water Year	Annual Precipitation (in) (updated values from LSCE)	Water Year Type
2007	15.19	Very Dry
2008	21.28	Normal (below average)
2009	19.96	Normal (below average)
2010	28.85	Wet
2011	36.62	Wet
2012	21.75	Normal (below average)
2013	20.26	Normal (below average)
2014	19.67	Dry
2015	20.72	Normal (below average)
2016	24.42	Normal (below average)
2017	45.5	Very Wet
2018	19.3	Dry
2019	33.29	Wet
2020	**12.19**	**Very Dry**

The cumulative departure values calculated for **Figure 5-1** provide a tally of precipitation received relative to the mean value over time. Beginning in water year 1988, the first year of the water budget analysis study period (LSCE, 2016c), three different periods are evident. From 1988 to 1994, the Subbasin received below average precipitation in six of seven years. From 1995 to 2006, the Subbasin received above average precipitation in nine of twelve years, resulting in a broadly positive trend in the cumulative departure curve. From 2007 to 2016, the Subbasin received below average precipitation in eight of ten years.

Notably, the eight-year span from 1987 through 1994, with only one year of above average precipitation, resulted in a net cumulative departure deficit[43] of 48.3 inches (**Figure 5-1**). This protracted period contrasts with the Very Dry years of 1976 and 1977, which although more acute, produced a less severe net cumulative departure deficit of 28.6 inches. Groundwater level records from the Napa Valley Subbasin that include both of these time periods generally show the lowest spring groundwater levels in

[43] The progressive accumulation or deficit of precipitation (i.e., cumulative annual departure relative to the mean) can have important effects on hydrologic relationships (e.g., streamflow) that are directly related to precipitation.

1977, as compared to the 1987 to 1994 period. This indicates that the Subbasin experienced sufficient recharge relative to outflows allowing it to maintain relatively stable spring groundwater levels over an eight-year period when precipitation totals were below average on the whole.

The five-year span from 2012 through 2016 produced a net cumulative departure deficit of 23.5 inches. Despite the decline in the cumulative departure curve of precipitation in Napa Valley, groundwater levels in the Napa Valley Subbasin have remained stable since 2012 at the Subbasin scale. Groundwater levels in the Quaternary alluvial formations that comprise the principal aquifer system of the Napa Valley Subbasin continued to experience groundwater recharge and corresponding rises in groundwater levels from fall to spring during this time.

In addition to precipitation and corresponding cumulative departure, **Figure 5-2** to **Figure 5-4** depict historical and current precipitation accumulation at the Napa State Hospital gage (GHCND: USC00046074) and Calistoga gage (GHCND: USC00041312). From 1988 through 2021, total precipitation was lowest during 2020 out of the base period, in which a majority of the precipitation received in 2020 occurred in November and December (**Figure 5-2**). The water year with the highest total precipitation of record (50.19 inches) occurred in 1983, whereas 1924 marks the lowest total precipitation year, with a total of 9.52 inches, followed by 11.23 inches in 1977 (**Figure 5-3**). Precipitation accumulation recorded in the Calistoga region can vary from precipitation recorded in Napa. Total precipitation recorded at the Calistoga gage in 1995 was approximately 26 inches greater than in Napa, marking the wettest year of record (69.46 inches) (**Figure 5-4**). Similar to the Napa State Hospital gage, however, 1977 marks the driest water year of record in Calistoga.

Water year 2017 was the single wettest year since 1983 in the Subbasin. It was followed by a Dry year in 2018, with an annual total (19.30 inches) similar to that of 2014 (19.67 inches). Conversely, water year 2019 was a Wet year with an annual total precipitation of 33.29 inches, which was similar to that of 2011 (36.62 inches). Water year 202 was the driest year recorded since 1977, which received 11.23 inches of precipitation. The annual total precipitation at the Napa State Hospital in 2020 was 53% of the median annual total of 22.84 inches for years since 1950.

Depths to water in the Subbasin in spring 2019 ranged from 7 to 76 feet below ground surface (**Table 5-3**). Spring 2020 depths to groundwater in the alluvial aquifer are shown in **Figure 5-5** using an interpolation of measured depths to water in wells throughout the Subbasin. The pattern or distribution of depths to water in the alluvial aquifer in spring 2020 is similar to observations in prior years. However, depths to groundwater were generally greater (i.e., deeper) in spring 2020 than compared to spring 2019, consistent with Very Dry water year conditions in 2020.

Overall, the depth to the groundwater table in the alluvial aquifer of the Subbasin is quite shallow; the depth to groundwater in the main part of the Napa Valley Floor in the spring 2020 was between 7 and 50 feet.[44] While agricultural land use, especially vineyards, have covered much of the Napa Valley Floor

[44] A depth to water of 76 feet recorded at NapaCounty-131 in spring 2020; however, based on field observations about changes in the pattern of use of that well and available well construction information, that depth to water is

for decades, the water requirements for this type of agricultural land use are significantly lower than agricultural commodities grown elsewhere in California, such as in the Central Valley (LSCE, 2016c). **The Napa Valley Subbasin remains full overall due to high recharge potential in most years, relatively low water requirements for vineyards and a hydrogeologic setting that is conducive to recharge.**

Underlying geologic setting and differences in aquifer zones within a subarea or groundwater subbasin are additional considerations relevant to the interpretation of groundwater levels, particularly for wells constructed entirely or partially within the alluvium in Napa Valley. **Figure 5-6** depicts three wells located relatively near each other at the land surface that exhibit distinct groundwater levels due in part to having been constructed within different aquifer zones. Well 07N05W09Q2 has a total depth of 232 feet and is located near the center of Napa Valley, where the alluvium extends to approximately 200 feet below ground surface (LSCE and MBK, 2013). NapaCounty-138 has a total depth of 321 feet and is located closer to the western edge of Napa Valley in an area where the alluvium extends only about 50 feet below ground surface. NapaCounty-177 has a total depth of 123 feet and is located closer to the center of Napa Valley where the alluvium extends to depths of about 130 feet. Observed water levels are more variable at NapaCounty-138 than compared to water levels measured at well 07N05W09Q2 or NapaCounty-177. The lower static water levels measured in the fall at NapaCounty-138 indicate that the well draws water from a geologic formation below the alluvium and is therefore not interpreted to provide accurate representation of static groundwater level conditions in the alluvial aquifer system in fall when water levels in the well are most impacted by groundwater pumping that has occurred over the dry season. **Knowledge of the geologic setting and construction details for a given well are very important considerations when interpreting groundwater level data.**

Figure 5-7 depicts another example of the influence that aquifer zones can have on water levels in wells located in the same area. In this case, the well located east of the Napa River is constructed in the Sonoma Volcanics, while the well west of the Napa River are constructed within alluvial sediments. Water levels at well 06N04W27L002M vary up to 30 feet between the spring and fall, whereas at NapaCounty-76 water levels vary up to 50 feet. Additional discussion of these wells is provided in **Section 5.1.2**.

The groundwater elevation contours described below are derived from available depth to water measurements made in wells. Prior to interpolating groundwater elevations across the valley, depth to water values were converted to groundwater elevation values by subtracting the measured depth to water from the reference point elevation at each monitored well. In this way, the depth to water measurements were related to the North American Vertical Datum 1988 (NAVD88) as a standard point of reference. The resulting groundwater elevation values at each well were used to interpolate groundwater elevation contours for the alluvial aquifer system of the Napa Valley Floor and in the aquifer system of the volcanic sediments and volcanic rock formations in the MST area. A contour line represents a line of equal elevation of the water surface similar to the way a topographic map contour

more likely representative of a composite hydraulic head for the aquifer system rather than the water table condition.

line shows a line of equal elevation of ground surface. The direction of groundwater flow is perpendicular to the contour lines.

5.1 Napa Valley Subbasin

The Napa Valley Groundwater Subbasin predominantly coincided with four of the Napa Valley Floor groundwater subareas. From north to south these areas are the Calistoga, St. Helena, Yountville, and Napa subareas. The Napa Valley Subbasin also includes minor portions of the Milliken-Sarco-Tulucay (MST) subarea, although the majority of the MST is not part of a groundwater basin as mapped by DWR. The groundwater level conditions in the Napa Valley Subbasin are described below.

Over the length of the Napa Valley, groundwater is contained in and moves primarily through the older and younger Quaternary alluvial formations from Calistoga to San Pablo Bay. These alluvial formations comprise the principal aquifer system of the Napa Valley Subbasin (LSCE, 2016c). For the purposes of contouring groundwater data on a regional basis, wells with measurements representing and/or primarily representing these formations were used for contouring. Groundwater levels that were determined to represent a non-alluvial part of the aquifer system were excluded from the contouring dataset. Monitoring conducted since 2014 at dedicated monitoring wells along the Napa River and Dry Creek within Napa Valley and data from other wells show that within the Napa Valley alluvial formations groundwater conditions range from unconfined to semi-confined throughout the Valley Floor and Napa Valley Subbasin. The degree of confinement in groundwater results from variations in the nature of geologic materials, with more extensive and thicker areas of fine-grained, low-permeability materials leading to semi-confined conditions in underlying aquifer materials that can result in groundwater levels in deeper portions of the alluvium being offset from groundwater levels in shallower portions of the alluvium. These differences in groundwater levels are an indication of physical resistance to vertical groundwater flow between unconfined to semi-confined areas. Data from wells constructed in semi-confined portions of the Subbasin are included in the development of groundwater level contour maps for spring only if spring groundwater levels measured at those locations are consistent with groundwater levels in other wells in the vicinity.

Interpreted groundwater elevation contours for spring and fall 2020 are shown in **Figures 5-8** and **5-9,** respectively. Groundwater elevation contours for Napa Valley in spring 2020 are similar to those developed for prior years dating back to spring 2010, however, with two local depressions in the Calistoga and St. Helena Subareas due to the Very Dry 2020 Water Year (LSCE, 2013b; LSCE, 2015; LSCE, 2016a; LSCE, 2017a; LSCE, 2018b). Contours across these time periods show a generally southeasterly to east-southeasterly groundwater gradient paralleling the valley axis from Calistoga to Yountville with similar groundwater elevation ranges. In the southern portion of the valley, near the City of Napa, contours indicate a more eastward flow direction, consistent with the spring contours dating back to 2014. Through the valley, groundwater elevations in spring 2020 ranged from 382 feet near Calistoga to 6 feet along the Napa River near First Street in Napa.

5.1.1 Napa Valley Subbasin – Calistoga and St. Helena Subareas

The hydrographs for the representative wells illustrated on **Figure 5-10** show groundwater elevations and corresponding depths to groundwater from 1975 to present, as available.[45] Groundwater levels have been generally stable over time in the Calistoga Subarea and northern portion of the St. Helena Subarea. Groundwater levels in the representative wells are frequently very shallow at less than 10 feet below the ground surface in the spring in the Calistoga Subarea and less than 20 feet in northern St. Helena Subarea. Minor seasonal groundwater level variations of about 10 feet occur between spring and fall in the Calistoga Subarea. Groundwater levels in well 08N06W10Q1 have been lower in the late September to December timeframe since 2001, however, groundwater levels typically return to within 10 feet of the ground surface the following spring.

Elsewhere in the St. Helena Subarea, groundwater levels exhibit greater seasonal declines of about 20 feet. Groundwater levels at well 07N05W09Q2 have remained relatively stable although somewhat susceptible to dry years. An example of this occurred in 1976 and 1977, two Very Dry years in the Napa River Watershed. In 1976, the spring groundwater level measurement was 18.8 feet below ground surface, which is lower by more than 10 feet from the prior spring. In 1977, the spring groundwater level measurement was 26.7 feet below ground surface, down almost 8 feet from the spring 1976 measurement. Spring water levels in the same well in 2014 and 2015 were 18.1 feet and 12.7 feet below ground surface, respectively; the spring 2014 and 2015 levels are above the levels measured in 1976 and 1977. In 2018, the spring groundwater level was measured at 17.9 feet below ground surface. Fall water levels in 07N05W09Q2 remained about 5 feet above levels recorded at similar times of year from 2013 to 2015. Consistent with the increase in precipitation and available groundwater recharge in 2019, spring 2019 water levels were measured 7.9 feet below ground surface. In spring 2020, water levels at 07N05W09Q2 were within 20 feet of the ground surface.

NapaCounty-132 was noted in the 2014 Annual Monitoring Report for possible signs of declining water levels. This well is recorded as having a total depth of 265 feet, screened from 25 feet to 265 feet, in an area where the thickness of alluvial deposits is likely less than 100 feet. The driller's log for the well indicates extensive clay (or fine grained, low permeability) layers were encountered, particularly in the upper 100 feet of the boring. In spring 2015, a depth to groundwater of 16.1 feet was measured at this well, which is more comparable to levels seen prior to 2014. A site visit to this well conducted in 2015 showed that much of the surrounding acreage is planted in young vines. A subsequent review of aerial photography showed that a large-scale vineyard replanting took place in 2007. Given these observations it is possible that changing irrigation demands have been a factor in this area since 2007. In spring 2019, the depth to groundwater at NapaCounty-132 was 8.4 feet below ground surface, compared to a depth of 9.4 feet in spring 2011. As of spring 2020, the depth to groundwater was 20.2 feet below ground surface, compared to a depth of 18.9 feet in spring 2007, during similar dry conditions (**Appendix B**).

[45] Hydrographs contained in Figures 5-10, 5-11, 5-19, and 5-20 include only data that are not designated with questionable measurement flags, which are used to indicate when a measurement is likely to not accurately represent a static water level. Hydrographs for the same wells are included in Appendix B with all available data points plotted.

5.1.2 Napa Valley Subbasin – Yountville and Napa Subareas

The representative hydrographs shown in **Figure 5-11** show groundwater elevations and corresponding depths to water in the Yountville and Napa Subareas. Long-term groundwater elevations have remained stable in most of the representative wells in the Yountville Subarea. In the Yountville Subarea, the depth to groundwater in the spring is generally less than 10 to 20 feet under non-drought conditions, similar in nature to the Calistoga and St. Helena Subareas to the north. Seasonal fluctuations vary by proximity to the center of the valley. Along the western and eastern edges of the subarea, levels are more subject to larger seasonal fluctuations. Groundwater elevations in the center of the valley fluctuate seasonally approximately 10 to 25 feet, and near the edge of the valley fluctuate approximately 25 to 35 feet.

In the Napa Subarea, depth to water ranges from about 20 to 30 feet below ground surface during the spring in most years. Seasonal groundwater elevations in this subarea generally fluctuate from 10 to 40 feet. Long-term trends have been generally stable with the exception of the northeastern area at NapaCounty-76, where groundwater levels have locally declined by about 20 to 30 feet since monitoring began in 2000 (**Appendix B**). However, from 2009 and onward, NapaCounty-76 has generally stabilized and shown an increase in groundwater elevation, despite showing responses to dry years.

NapaCounty-76 is located east of the Napa River and East Napa Fault and west of Soda Creek Fault. The well is completed below the alluvium in the Sonoma Volcanics formation. The Sonoma Volcanics are also present in the MST Subarea to the east, where previous monitoring has shown several pumping depressions (LSCE, 2011a). Analyses conducted with the groundwater flow model developed for the Northeast Napa Special Groundwater Study found a trend of decreasing subsurface inflow into the Napa Valley Subbasin from portions of the MST Subarea east of the Soda Creek Fault resulting from the influence of the cones of depression east of the Soda Creek Fault outside of the Subbasin (**Figure 2-8**) (LSCE, 2017b).

Three monitored wells located west of the Napa River and nearest to NapaCounty-76 (i.e., 06N04W27L002M, NapaCounty-218s, and NapaCounty-219d) are constructed to depths of 120 feet or less and are completed in the alluvium. These three wells have shown stable groundwater level trends. Well 06N04W27L002M, in particular, has shown stable water levels since the 1960s. It appears that the extent of the pumping depression beyond the MST Subarea is limited to the northeastern Napa Subarea east of the Napa River.

As part of increased attention on the northeast portion of the Napa Subarea, three additional wells, NapaCounty-182, NapaCounty-228, and NapaCounty-229, have been added to the County’s monitoring networks in this area in recent years (**Appendix B**).

In the southwestern part of the Yountville Subarea and at the Napa Valley margin, groundwater levels in NapaCounty-135 have exhibited increasing seasonal variation from spring to fall, since the first measurements were recorded in the late 1970s and early 1980s. The well also experienced very limited water level recovery in spring 2014, with a measurement of 76 feet below ground surface (**Figure 5-11**). In response to these observations Napa County began monitoring this well at monthly intervals in fall 2015. Water levels measured at NapaCounty-135 recovered to 23.8 feet below ground surface and in

2016 and 21.3 feet in 2017, indicating that groundwater levels observed during the preceding years were primarily the result of reductions in groundwater recharge during drier years. With a return to wet conditions in 2019, the depth to groundwater in NapaCounty-135 decreased compared to 2018, at approximately 29 feet below ground surface, compared to a 2018 spring level of 41 feet below ground surface. Following the Very Dry 2020 wet season, a depth to groundwater of 50.76 feet below ground surface was recorded at NapaCounty-135 in spring 2020. Closer to the valley axis, spring 2020 groundwater levels at well 06N04W17A001M measured 14.5 feet below ground surface, compared to 1.09 feet measured in the spring of the previous year and 21.8 feet measured in spring 2007.

Regarding the increasing seasonal variation observed at NapaCounty-135, monthly data collected at this well in the fall of 2015 and 2016 show monthly variations between October and November of 7 and 23 feet, respectively. Spring measurements recorded in March and April 2017 differed by more than 6 feet. These variations indicate the potential variability that semi-annual data collection at this well from 1979 through 2014 did not capture. Seasonal variability between spring and fall 2020 show a minimum depth to groundwater of 50.76 feet below ground surface in the spring and a maximum depth of 89.4 feet below ground surface in the fall, compared to 31 and 95 feet measured during the previous wet year.

Very little construction information is available for NapaCounty-135. It is known to have a total depth of 125 feet and is located in an area where the total thickness of the alluvium is likely less than 50 feet, based on contours of alluvium thickness developed as part of the report *Updated Hydrogeologic Conceptualization and Characterization of Conditions Report* (LSCE and MBK Engineers, 2013). As at NapaCounty-132, the construction information and alluvium thickness data for the area around the well suggest that a substantial portion of the well screen is likely exposed to geologic formations below the alluvium, as a result conditions in this well in the fall are reflective of conditions in older, semi-consolidated formations below the primary alluvial aquifer of the Napa Valley Subbasin.

5.1.3 Napa Valley Subbasin Sustainability Indicators

As described in **Section 1.2.2**, the Basin Analysis Report for the Napa Valley Subbasin provides an updated sustainability goal for the Subbasin based on the requirements of SGMA (LSCE, 2016c). The Basin Analysis Report updated sustainability criteria for the Napa Valley Subbasin in conformance with the definitions provided in SGMA. To evaluate the condition of the Subbasin in relation to the sustainability goal, the sustainability criteria include measurable objectives and minimum thresholds developed to avoid the six undesirable results identified in SGMA (LSCE, 2016c and LSCE, 2018a). Sustainability criteria are established for 20 wells identified as groundwater level representative wells in the Basin Analysis Report and the Northeast Napa Management Area Report (see **Section 4.3**). For SGMA purposes, “measurable objectives” are “specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions” (GSP Regulations Section 351(s)). GSP Regulations additionally define a “minimum threshold” as “a numeric value for each sustainability indicator used to define undesirable results” (Section 351(t)).

Groundwater levels recorded in fall 2020 were at or above the minimum thresholds established as sustainability criteria in 13 of 20 SGMA Representative Wells with water level criteria (**Table 5-2**)

Groundwater levels were reduced below the minimum threshold at seven SGMA Representative Wells, including: 06N04W17A001M, 08N06W10Q001M, NapaCounty-122, NapaCounty217d-swgw2, NapaCounty221d-swgw4, NapaCounty223d-swgw5, and NapaCounty-229.

Three of these, NapaCounty217d-swgw2, NapaCounty221d-swgw4, and NapaCounty223d-swgw5, are dedicated monitoring wells in the County's dedicated groundwater-surface water monitoring network where minimum thresholds were established in 2016 with only about two years of available data, with an acknowledgement that there would likely be a need for revision as data from a wider range of water years becomes available. Notably, all three of these monitoring wells experienced water level recovery over the subsequent winter months as limited, recharging surface water flows were again observed at the co-located surface water monitoring sites.

Fall 2020 water levels were approximately 6 feet below the minimum threshold at 06N04W17A001M, in the Napa Subarea. By November 2020, water levels had recovered above the minimum threshold. Fall 2020 water levels were approximately 23 feet below the minimum threshold at 08N06W10Q001M, in the Calistoga Subarea. By December 2020, water levels had recovered above the minimum threshold.

The reduction of groundwater levels below the minimum thresholds at seven of 20 Representative Wells does not constitute an undesirable result for the Subbasin according to the sustainable management criteria adopted in 2016 and 2018. These conditions are consistent with the Very Dry water year 2020 conditions and precipitation totals lower than the most recent Very Dry year in 2007 and similar to totals recorded during the 1976-1977 drought.

The measurable objectives established in the Basin Analysis Report for the Napa Valley Subbasin provide a reasonable margin of operational flexibility under adverse conditions where applicable and utilize components such as historical water budgets, seasonal and long-term trends, and periods of drought. Groundwater elevations serve as the proxy for multiple sustainability indicators where reasonable. For representative monitoring sites where, long-term periods of record are not available, as in the case of the dedicated monitoring wells constructed in 2014, which were developed specifically to monitor groundwater/surface water interactions, measurable objectives established at these facilities will be reviewed and reevaluated as appropriate, as the collection of available data for each site expands to better reflect true long-term variability at those locations. Any updates to the minimum thresholds and measurable objectives will be considered as part of the development of the Napa Valley Subbasin GSP with opportunities for stakeholder and public input as described in **Section 1.2.5**.

As noted earlier in this Report, the Napa River system is considered to be the most sensitive sustainability indicator in the Napa Valley Subbasin (also see **Section 3**). Measurable objectives and minimum thresholds were established to ensure continued groundwater sustainability, or improve groundwater conditions, and provide ongoing management targets devised to address potential future effects on surface water.

Based on the analyses of surface water and groundwater interconnections, measurable objectives and minimum thresholds for streamflow depletion are set at 16 SGMA-related representative wells in the Subbasin (**Table 5-2**) (LSCE, 2016c). The measurable objectives represent the mean fall groundwater level elevations that occurred historically. The minimum thresholds represent the lowest static groundwater level elevation that has occurred historically in the fall and an elevation below which additional streamflow depletion is likely to occur, i.e., expand the duration of annual no flow days in some reaches of the Napa River. The minimum thresholds also represent the lowest static groundwater elevation to which groundwater levels may reasonably be lowered at the end of a dry season without exacerbating streamflow depletion. These levels are not acceptable on a continuous basis as this would contribute to a worsening of existing conditions. Taken together, the measurable objectives and minimum thresholds represent the fall groundwater elevations within which groundwater elevations are reasonably likely to fluctuate during fall (including fall periods for all water year types) without exacerbating streamflow depletion.

Measurable objectives and minimum thresholds for the avoidance of chronic groundwater level decline, land subsidence, and a reduction in groundwater storage are based on fall groundwater levels at representative wells that use the fall groundwater elevations for avoidance of streamflow depletion as the proxy (**Table 5-2**). One additional well NapaCounty-135, located away from the Napa River, is an additional representative well used for these sustainability indicators.

Table 5-2 Sustainability Indicators: Groundwater Levels

Representative Monitoring Sites Well ID	Date Monitored	Measured Minimum 2020 Fall Groundwater Elevation (GWE) (Feet)[1]	Chronic Lowering of GWLs		Reduced GW Storage		Land Subsidence		Streamflow Depletion	
			Minimum Threshold (Fall GWE, Feet)	Measurable Objective (Fall GWE, Feet)	Minimum Threshold (Fall GWE, Feet)	Measurable Objective (Fall GWE, Feet)	Minimum Threshold (Fall GWE, Feet)	Measurable Objective (Fall GWE, Feet)	Minimum Threshold (Fall GWE, Feet)	Measurable Objective (Fall GWE, Feet)
06N04W17A001M	10/5/2020	**31**	37	50	37	50	37	50	37	50
06N04W27L002M	11/9/2020	5	-2	12	-2	12	-2	12	-2	12
07N05W09Q002M	9/14/2020	128	127	135	127	135	127	135	127	135
08N06W10Q001M	9/14/2020	**246**	269	281	269	281	269	281	269	281
NapaCounty-76	10/26/2020	-23	-30	20	-30	20	-	-	-	-
NapaCounty-122	10/29/2020	**-52**	-45	-26	-45	-26	-45	-26	-	-
NapaCounty-128	10/19/2020	330	320	331	320	331	320	331	320	331
NapaCounty-133	10/23/2020	72	72	76	72	76	72	76	72	76
NapaCounty-135	10/22/2020	53	20	60	20	60	20	60	-	-
NapaCounty-214s-swgw1	9/11/2020	3	2	4	2	4	-	-	2	4
NapaCounty-215d-swgw1	9/11/2020	3	2	4	2	4	-	-	2	4
NapaCounty-216s-swgw2	9/11/2020	71	61	76	61	76	-	-	61	76
NapaCounty-217d-swgw2	9/11/2020	**60**	61	76	61	76	-	-	61	76
NapaCounty-218s-swgw3	9/11/2020	29	29	32	29	32	-	-	29	32
NapaCounty-219d-swgw3	9/11/2020	29	29	32	29	32	-	-	29	32
NapaCounty-220s-swgw4	9/11/2020	75	75	77	75	77	-	-	75	77
NapaCounty-221d-swgw4	9/11/2020	**74**	75	77	75	77	-	-	75	77
NapaCounty-222s-swgw5	9/11/2020	185	185	190	185	190	-	-	185	190
NapaCounty-223d-swgw5	9/11/2020	**156**	164	175	164	175	-	-	164	175
NapaCounty-229	10/26/2020	**-88**	-69	-51	-69	-51	-69	-51	-	-

1. Values below a minimum threshold shown in bold. Non-static measurements excluded, such as measurements affected by recent or nearby pumping.

GWE = Groundwater Elevation

NapaCounty-214s-swgw1, NapaCounty-215d-swgw1, NapaCounty-218s-swgw3, NapaCounty-219d-swgw3, NapaCounty-76, NapaCounty-122, and NapaCounty-229 are all designated as representative wells for the Northeast Napa Management Area as part of the Napa Valley Subbasin.

5.1.4 Napa Valley Subbasin Groundwater Level Change in Storage

Analysis of groundwater levels in the Napa Valley Subbasin was conducted for this Report to evaluate changes in groundwater storage in the principal aquifer, the Quaternary alluvial aquifer system, in accordance with the requirement of the GSP Regulations (Section 356.2(b)(5)). This analysis builds on a similar analysis performed as part of the Basin Analysis Report (LSCE, 2016c). The objective of the analysis provided in this Report is to continue tracking changes in groundwater storage for the alluvial aquifer system over time and identify any chronic storage depletions, if any. The total change in groundwater storage over the historical period through the current water year (WY) (1988-2020) was estimated using available groundwater level data.

The analysis generally relies on water level measurements from 27 wells located throughout the Napa Valley Subbasin (**Table 5-3**), as available over time. Two wells located at the northern and southern ends of the Subbasin were duplicated as “Auxiliary” wells for the analysis to achieve a result inclusive of the entire Subbasin. Use of these auxiliary wells in the analysis assumes a consistent water level condition between the true well and the auxiliary well. This approach is consistent with the method used for the earlier analysis described in the Basin Analysis Report (LSCE, 2016c). However, the 27 wells used for this analysis are reduced from 32 wells used in the earlier analysis, in order to omit deeper wells that have greater exposure to deeper water-bearing formations, which are less likely to represent the local condition in the principal aquifer, the alluvial aquifer system.

Depths of the wells included in the analysis range from 40 feet to 321 feet. Water levels in these wells are expected to represent local groundwater levels in the principal aquifer, namely the Quaternary alluvial aquifer. As noted earlier in this Report, some of these wells occur in areas of relatively thin alluvial deposits and may draw water from deeper formations, particularly later during the dry season. Since this analysis is conducted using spring water levels, when static water levels in the wells are within the alluvial zone, it is assumed that any vertical gradients between the shallow alluvium and deeper formations are negligible.

For each year, a continuous surface representing the groundwater table of the alluvial aquifer was created by interpolating available water level measurements, using the Inverse Distance Weighting interpolation method in ArcGIS software. The saturated thickness of the alluvium throughout the Subbasin was calculated by subtracting the depth to groundwater table from the previously mapped alluvium thickness dataset (LSCE and MBK Engineers, 2013). The total saturated volume of alluvium was calculated from the summation of saturated alluvium thickness throughout the Subbasin. Finally, the volume of groundwater that occurs in the alluvium was calculated by multiplying the saturated volume of alluvium by 0.06, the bulk specific yield of the aquifer (LSCE, 2016c). This procedure is consistent with the method used for the earlier analysis described in the Basin Analysis Report (LSCE, 2016c).

Table 5-3 Spring Depths to Groundwater 2007, 2019, and 2020

Well ID	RPE[2]	Depth[3]	2007 Depth to Water (feet below ground surface)	2019 Depth to Water (feet below ground surface)	2020 Depth to Water (feet below ground surface)
NapaCounty-127-AUX [1]	392.5	149	8.1	4.3	9.8
NapaCounty-127	392.5	149	8.1	4.3	9.8
NapaCounty-128	343.7	50	7.2	3.8	8.2
NapaCounty-129	338.7	253	-	3.3	7.9
08N06W10Q001M	293.4	200	6.8	5.2	7
NapaCounty-222s-swgw5	217.1	40	-	18.5	20.4
07N05W09Q002M	158.2	232	17.7	7.9	16.9
NapaCounty-132	142.7	265	18.9	8.4	20.2
NapaCounty-131	173.5	221	33.5	9.3	76.1
NapaCounty-138	195.1	321	-	7	46.5
NapaCounty-204	141.7	220	-	-	-
NapaCounty-177	149.3	123	-	7.3	8.1
NapaCounty-220s-swgw4	98.2	45	-	11.1	18
NapaCounty-133	94.7	120	12.6	5	13.57
NapaCounty-179	74.3	150	-	5.5	18
06N04W17A001M	70.3	250	21.8	1.1	22.8
NapaCounty-218s-swgw3	56.1	40	-	13.1	22.6
NapaCounty-216s-swgw2	103.1	50	-	15.6	17.7
NapaCounty-139	85.8	120	13.7	7.7	15.7
NapaCounty-135	129.2	125	23.9	29.4	50.8
NapaCounty-185	83.0	260	-	11.5	22.6
06N04W27L002M	53.6	120	33.9	17.8	32.8
NapaCounty-152	78.3	-	-	7.9	8.6
NapaCounty-136	53.2	120	24	12.8	27.5
NapaCounty-214s-swgw1	20.1	53	-	13.8	12.8
SL0605536682MW-1	31.63	24	-	4.4	-
T0605514064MW1	14	21	-	2.3	-
NapaCounty-18	124.3	189	19	18.7	25.7
NapaCounty-18-AUX [1]	124.3	189	19	18.7	25.7

1. Auxiliary data point to achieve water level interpolation covering entire Subbasin
2. Reference Point Elevation (ft, NAVD88)
3. Total depth of the well (ft)

The resulting cumulative and annual change in groundwater storage from water years 1988 to 2020 are shown in **Figure 5-12** and **Table 5-4**. Twenty-four wells in the monitoring network were measured in spring 2020 to calculate the change in groundwater storage for the 2020 WY. Consistent with the Very Dry water year condition, the volume of groundwater in storage decreased in 2020 by 24,707 acre-feet to result in a total storage volume of 196,651acre-feet. From 1988 through 2020, the cumulative annual storage change is a net decrease of 8,945 acre-feet in the Subbasin (**Table 5-4**). The volume of groundwater in storage calculated for Spring 2020 is below the average (209,407 AF) and median (210,929 AF) volumes calculated from 1988 to 2020. Based on annual spring groundwater level data, the overall trend in groundwater storage change from year to year generally fluctuates in accordance with the current or preceding water year type (**Figure 5-12**).

The change in alluvial aquifer saturated thickness from spring 2019 to spring 2020 is depicted in **Figure 5-13**. Saturated thickness generally decreased between 0 and 15 feet throughout most of the Subbasin. Larger decreases in saturated thickness occurred in the vicinity of the Rutherford. Two wells in this area, NapaCounty-138 and NapaCounty-131, recorded particularly divergent spring groundwater levels during 2020 than compared to past years. Groundwater levels recorded at these wells are several tens of feet lower than spring levels recorded during past Dry years, such as in 2007 and 2014. Conversely, NapaCounty-177 and 07N05W09Q002M are within a mile of these two wells and recorded groundwater levels that resemble those of past years, including Dry years. These wells also recorded groundwater levels 40 to 70 feet higher than NapaCounty-138 and NapaCounty-131.

The contrast of spring groundwater levels between the four sites accompanied by abnormal spring 2020 measurements at NapaCounty-138 and NapaCounty-131 indicate the latter wells may be drawing groundwater from a deeper aquifer zones or formations below the alluvial deposits during dry periods. This interpretation is also supported by the total recorded depths for these wells, which are 321 feet (NapaCounty-138) and 221 feet (NapaCounty-131) which are greater than the thickness of alluvial deposits mapped in their vicinity. Field observations also note that at least one of the wells supplies a residence that was recently re-occupied, which may have affected the ability to obtain static water level measurements. Based on field observations about changes in the pattern of use of that well and available well construction information, depths to water measured at NapaCounty-131 and NapaCounty-138 are more likely representative of a composite hydraulic head for the aquifer system rather than the water table condition.

Saturated thickness of the alluvial aquifer in spring 2020 was also slightly less than conditions in spring 2007, the most recent year to have experience similarly low precipitation conditions, at 15.19 inches. Spring 2020 saturated thickness was generally 0 to 10 feet less than the saturated thickness in spring 2007 throughout a majority of the Subbasin north of the Napa Subarea, and generally 0 to 10 feet greater in the Napa Subarea (**Figure 5-14**). The largest difference in saturated thickness is shown in the Rutherford area between Zinfandel Lane and Oakville Cross Road, where the saturated thickness in spring 2020 was up to 42 feet less than the spring 2007 condition.

Areas within the Subbasin with no value shown for change in saturated thickness represent areas where the interpolated groundwater surface was below the bottom of the Quaternary alluvial deposits.

Changes in groundwater storage in the principal aquifer system of the Subbasin are shown in **Figures 5-15 and 5-16**. As noted above, areas within the Subbasin with no value shown for change in groundwater storage represent areas where the interpolated groundwater surface was below the bottom of the Quaternary alluvial deposits. Volumetric changes depicted in these figures are similar to the changes in saturated thickness shown in **Figures 5-13 and 5-14**.

A majority of the Subbasin experienced a decline in groundwater storage ranging from 0 to 5 acre-feet/acre between spring 2019 and spring 2020. Decreases in groundwater storage were largest in the Rutherford area, where NapaCounty-138 and NapaCounty-131 are located (**Figure 5-15**). This distinctive area within Rutherford shows a decrease in storage of up to 24 acre-feet/acre, in contrast to the positive change that occurred in this area from 2018 to 2019. The area surrounding Rutherford shows a decrease in storage ranging from 5 to 10 acre-feet/acre.

Groundwater storage changes between spring 2007 and spring 2020 are generally negative in the Calistoga, St. Helena, and Yountville Subareas and positive in the Napa Subarea (**Figure 5-16**), consistent with the Subbasin-wide decrease in groundwater storage volume between those years (**Table 5-4**) and the generally lower groundwater levels in spring 2020 compared to spring 2007.

Table 5-4 Napa Valley Subbasin Principal Aquifer Groundwater Storage Changes, Water Years 1988 - 2020

Water Year	Water Year Classification (see Section 2.2.2)	Napa Valley Subbasin Alluvial Aquifer Storage (Acre-feet)	Annual Storage Change (Acre-feet)	Cumulative Storage Change (Acre-feet)
1988	Normal (below average)	205,596	-	-
1989	Normal (below average)	198,305	(7,290)	(7,290)
1990	Dry	202,469	4,164	(3,126)
1991	Dry	192,046	(10,424)	(13,550)
1992	Normal (below average)	212,532	20,486	6,936
1993	Wet	215,486	2,953	9,890
1994	Dry	208,000	(7,486)	2,404
1995	Very Wet	215,361	7,361	9,765
1996	Wet	211,141	(4,220)	5,545
1997	Wet	216,835	5,695	11,239
1998	Very Wet	219,733	2,898	14,138
1999	Normal (above average)	219,981	247	14,385
2000	Normal (above average)	213,878	(6,103)	8,282
2001	Dry	210,997	(2,881)	5,401
2002	Normal (above average)	214,534	3,537	8,938
2003	Wet	208,394	(6,140)	2,798
2004	Normal (below average)	204,592	(3,802)	(1,004)
2005	Wet	217,650	13,058	12,054
2006	Very Wet	222,904	5,254	17,308
2007	Very Dry	200,359	(22,545)	(5,237)
2008	Normal (below average)	201,029	670	(4,567)
2009	Normal (below average)	205,160	4,132	(436)
2010	Wet	210,929	5,769	5,333
2011	Wet	214,705	3,776	9,109
2012	Normal (below average)	210,338	(4,367)	4,742
2013	Normal (below average)	201,193	(9,145)	(4,403)
2014	Dry	191,523	(9,670)	(14,073)
2015	Normal (below average)	208,771	17,248	3,175
2016	Normal (below average)	214,827	6,056	9,232
2017	Very Wet	219,298	4,470	13,702
2018	Dry	209,984	(9,314)	4,388
2019	Wet	221,358	11,374	15,762
2020	**Very Dry**	**196,651**	**(24,707)**	**(8,945)**
	Average (1988 – 2020)	**209,407**	**(471)**	
	Median (1988 – 2020)	**210,929**	**1,784**	

5.2 Milliken-Sarco-Tulucay (MST) Subarea

Although designated as a groundwater subarea for local planning purposes, the majority of the MST is not part of a groundwater basin as mapped by DWR. In the MST, the aquifer system is composed primarily of the Sonoma Volcanics and associated Tertiary sedimentary deposits. These aquifer materials have different hydraulic properties than the Napa Valley Subbasin alluvial deposits and the level of communication and connectivity between the two areas is believed to be more limited. Groundwater levels used for contour mapping in the MST Subarea generally represent conditions of a composite aquifer system of those Sonoma Volcanics and Tertiary sediments as previously described by Farrar and Metzger (2003).

Historically, groundwater flow directions in the MST Subarea were generally from the Coast Range Mountains that include Mt. George[46] along the eastern border of the MST Subarea toward the Napa River to the west. Beginning in the 1970s, investigators have identified pumping depressions in the northern, central, and southern parts of the MST (Johnson 1977, Farrar and Metzger 2003). The current coverage of wells does not extend to the former location of the central (and deepest) pumping depression; therefore, flow directions cannot be visualized and evaluated. However, the coverage does extend to the former locations of the northern and southern depressions, and they are shown in the spring and fall 2020 groundwater level contour maps (**Figures 5-17** and **5-18**).

In the northern MST, the highest spring groundwater elevations of 32 feet and 30 feet occurred between Monticello Road along the lower one mile of Sarco Creek. Groundwater flow directions were to the east and north of this area. Groundwater elevation gradients were steepest to the east and were towards an area of -51 feet groundwater elevations (NAVD88) east of Vichy Avenue. A less steep northerly gradient to the north was toward Milliken Creek where monitored wells recorded spring groundwater elevations ranging from -8 feet to -51 feet west of the Soda Creek Fault.

In the southern MST, groundwater flow continues to be generally northwest (unchanged direction since 2009) in the spring and fall 2020 with a minimum spring groundwater elevation of about -56 feet and maximum groundwater elevation of 166 feet (NAVD88). However, the western portion of this area has no coverage of wells with water level data, which limits the ability to define the extent of the pumping depression.

Representative hydrographs for the MST illustrated on **Figures 5-19 and 5-20** show groundwater elevations and corresponding depths to groundwater since 1975 in the northern (**Figure 5-19**) and central/southern parts of the MST (**Figure 5-20**). In the northern MST, groundwater levels were stable throughout the late seventies until the mid-1980s (1986), at which time a decline of about 10 to 40 feet occurred. Following this decline, groundwater levels stabilized until the late 1990s to early 2000s. After

[46] This range is referenced as the Howell Mountains by Farrar and Metzger (2003). However, that name does not appear in the USGS Geographic Names Information System as of 2018.

that time, groundwater levels experienced a gradual decline of about 10 to 30 feet until approximately 2009. After 2009, groundwater levels have shown signs of stabilizing in three of four currently monitored wells in the northern MST (NapaCounty-2, NapaCounty-43, and NapaCounty-122), while NapaCounty-98 has shown continued declines, possibly resulting from recent dry years. Depths to groundwater in the northern part of the MST Subarea currently range from about 60 to 200 feet.

An important geologic feature within the northern part of the MST is the Soda Creek Fault that several previous investigators have described as an occasional barrier to groundwater flow. It is described by Weaver (1949) as a normal fault with more than 700 feet vertical displacement downward on the western side. Johnson (1977) and Farrar and Metzger (2003) describe groundwater elevations were about 10 feet higher on the eastern side of the fault during their respective study periods.

Groundwater elevations in the central and southern portion of the MST have stabilized since about 2009 (**Figure 5-20**). The groundwater elevations in the central portion of the MST began to decline in the 1950s and currently have declined up to 250 feet in some locations. The central portion of the MST also corresponds to an area in which the main water bearing rocks of the Sonoma Volcanics utilized elsewhere in the subarea, the tuffaceous member of that unit, is not present. Based on the groundwater level trends and local geologic conditions, some of these trends may be the result of variations in geologic conditions or increasing levels of development relative to conditions 40 to 50 years ago. However, the stability of water levels over the past ten years indicates that rate of groundwater extraction is being balanced by rates of groundwater recharge.

An expanding recycled water distribution system in the MST subarea, supplied by the Napa Sanitation District, delivered 422 acre-feet of recycled water to users in the MST Subarea in 2020. Increased distribution and use of this new source of water along with continued land use permitting constraints are expected to aid in maintaining stable groundwater level conditions in the MST subarea.

5.3 Napa-Sonoma Lowlands Subbasin and Subareas South of the Napa Valley Floor

In 2020, twelve groundwater level monitoring sites were located in the Carneros Subarea (**Table 4-2**). The longest period of record among them extended back to October 2011 (NapaCounty-150, **Appendix A**). All monitored wells are located in the southern half of the subarea at land surface elevations between 100 feet and 15 feet (NAVD88). Patterns of groundwater level fluctuations in these wells have shown annual variations of approximately 5 feet from spring to fall (**Appendix B**). Groundwater elevations range from about 30 feet, relative to mean sea level, to -5 feet, relative to mean sea level. Depths to groundwater below ground surface have varied more widely from 5 feet to 100 feet. Groundwater levels have been stable to increasing in 11 of 12 currently monitored wells. In 2019, groundwater levels were above levels measured in 2014 and 2015 in one well that showed groundwater level declines since monitoring began in 2011 (NapaCounty-150).

In the Jameson/American Canyon Subarea, the only current groundwater level data are from one well recently volunteered for monitoring (NapaCounty-196). Spring and fall measurements recorded in that well between 2014 and 2020 show shallow depths to groundwater ranging from 3 feet in the spring to 14 feet in the fall.

5.4 Subareas East and West of the Napa Valley Floor

The Eastern Mountains and Western Mountains Subareas flank the Napa Valley Floor Subareas and comprise the uplands of the Napa River Watershed. The geology of these large subareas is complex and highly variable. Recent efforts to expand the Napa County monitoring network have resulted in five wells volunteered for monitoring between the two subareas (**Table 4-2**).

Groundwater level monitoring data for these wells include measurements recorded semi-annually for the past seven years. The depths to groundwater in these wells ranged from 4 feet to about 250 feet.

5.5 Pope Valley Basin and Pope Valley Subarea

The only current groundwater level monitoring site in Pope Valley is a single well in the Pope Valley Basin with data available from 2014 to 2020 (NapaCounty-211) (**Table 4-2**). Depths to water have ranged from 3 to 35 feet below ground surface over that time. The deepest water level recorded was during fall 2020.

5.6 Angwin Subarea

In 2020, groundwater level monitoring in the Angwin Subarea was performed at five wells by Napa County, Howell Mountain Mutual Water Company, and Pacific Union College at recently volunteered wells (**Table 4-2**).

Groundwater level monitoring data for the Angwin Subarea wells are available from 2014 to 2020. Depths to groundwater in these wells ranged from 95 feet to 233 feet.

5.7 Napa Valley Surface Water-Groundwater Monitoring

Napa County has a network of five sites with dedicated monitoring wells near the Napa River and Dry Creek to enable monitoring of distinct depth intervals within the alluvial deposits of the Napa Valley Subbasin (see **Section 4.2**). In early 2020, DWR awarded Napa County a Sustainable Groundwater Management planning grant that includes funding for the construction of eight additional groundwater-surface water monitoring wells at four additional sites in the Napa Valley Subbasin. **Figure 5-21** shows the locations of the current surface water-groundwater monitoring network and the general locations of the four planned sites. Napa County is committed to the long-term operation of these facilities to improve the understanding of surface water and groundwater interactions.

Across six years of monitoring through 2020, groundwater levels at four of the five existing sites experienced the lowest recorded water levels. Data from Site 1 (**Figure 5-22**) show that groundwater levels were above or very near the riverbed elevation throughout 2020, indicating connectivity between groundwater and the nearby surface water. Sites 2 (**Figure 5-23**), 3 (**Figure 5-24**), 4 (**Figure 5-25**), and Site 5 (**Figure 5-26**) recorded variable hydraulic connections between surface water and groundwater. Groundwater levels in the uppermost part of the aquifer system at these four sites remained were at or above the streambed for a portion of the year in 2020; however, all three of the four sites recorded data consistent with hydraulic disconnection during the summer and fall of 2020 as groundwater elevations dropped below the streambed elevation. At Site 4, groundwater elevations remained within about 4 feet of the streambed and observations from the Stream Watch program show that isolated pools remained throughout 2020 indicating that a limited hydraulic connection was maintained.

Site 1 is located within the City of Napa and is the farthest downstream along the Napa River (**Figure 2-7**). The river is perennially wetted and tidally-influenced at this site with a 5-foot to 7-foot tidal range observed during the period of record. Data from Site 1 show that groundwater levels were above the elevation of the riverbed and near to or slightly above the elevation of water in the river channel, indicating a connection between groundwater and surface water. However, the fine-grained nature of the riverbed in the vicinity of Site 1 and the distinct and stable differences in electrical conductivity concentrations between the river and both monitoring wells suggest a limited degree of flow between groundwater and surface water at this site (LSCE, 2016b).

Data from Sites 3 and 4 along the Napa River showed groundwater elevations were 4 to 5 feet above the adjacent streambed in spring 2020, gradually declining over summer to a elevations 2 to 4 feet below the adjacent streambed by fall 2020 (**Figure 5-24** and **Figure 5-25**).

At both Site 2 (**Figure 5-23**) and Site 5 (**Figure 5-26**) the direction of groundwater flow was predominantly away from the streambed and into the subsurface in 2020, as in prior years. At both sites, the streams are mapped by the USGS as intermittent in the reaches adjacent to the monitoring sites (**Figure 2-7**). The seasonal disconnection between shallow groundwater and the streambed observed at these sites, even after a very wet precipitation year in 2017, indicates that these are perennially losing reaches where surface water infiltrates along the streambed to recharge the alluvial aquifer of the Napa Valley Subbasin.

At Site 2, located along Dry Creek, unconfined groundwater levels in the shallow monitoring well were within a few feet of the streambed during the winter and spring while stormflows provided recharge. However, the deeper, semi-confined portion of the aquifer system at Site 2, monitored by the deeper monitoring well, did not see groundwater levels equilibrate with the shallow, unconfined part of the aquifer system between 2015 and 2020. At both Sites 2 and 5, groundwater levels in the shallow, unconfined part of the aquifer system were consistently below the streambed elevation in the summer and fall of 2020, indicating that groundwater was disconnected from the stream.

Site 2 also showed groundwater level differences between the shallow and deep casings of about 10 feet for most or all of 2020. Given that most groundwater withdrawals in Napa Valley occur from depths greater than 50 feet, the groundwater level data at Site 2 indicate how reductions in groundwater levels in deeper aquifer zones do not always result in equivalent water level reductions at the water table, where stream aquifer interactions can occur. Data collected at Site 2 show that this is true even at times of the year when the streambed is dry and groundwater recharge is not occurring along the stream.

Although the period of record at these sites is short compared to many wells monitored by Napa County, **Figure 5-27** demonstrates how the range of groundwater elevations monitored at a Surface Water – Groundwater Network site are comparable to a well constructed in a similar part of the aquifer system nearby. NapaCounty-133 is located approximately 0.5 miles south from Site 4 and a similar distance from the Napa River (**Figure 4-2**). Data from NapaCounty-133 from 1978 through 2019 show a similar range and stable trend in groundwater elevations from spring to fall across the full period of record, including 2019.

In addition to continuous surface water-groundwater monitoring at five dedicated monitoring facilities, Napa County, in cooperation with the WICC and the Napa County Resource Conservation District (Napa RCD), continue to collect observations regarding streamflow conditions within the Napa Valley Subbasin through the Stream Watch Program.[47] Napa County staff and members of the public who participate in the project receive training on data collection methods from the Napa RCD. Volunteers record the site number, date, location, degree of litter, and the relative amount of flow observed, along with a site image at the time each observation is collected.

Throughout 2020, over 450 observations were recorded at 26 sites, up from 200 observations made during 2019 (**Figure 5-28**). Observations of flow conditions submitted to the Stream Watch website are summarized in **Appendix D**. Flow type and trash observations are recorded using qualitative measurements (**Figure 5-29**). Observations are then converted to a numerical value on a scale of 0 to 2 for flow and 0 to 3 for trash. The qualitative observations and their corresponding numerical values are shown below in **Table 5-5**.

Table 5-5 Stream Watch Observations and Corresponding Values

Flow Observation	Flow Value	Trash Observation	Trash Value
Dry	0	Not Littered	0
Isolated pools	1	Slightly Littered	1
Flowing	2	Littered	2
		Very Littered	3

Stream Watch observations from Sites 1, 2, 4, and 6 are provided in **Figures 5-30** to **5-33**, where data collection began in 2017. Observations compiled for Stream Watch Site 1 indicate the Napa River at the Yountville Ecological Reserve flows year-round following average and above-average wet seasons but can stop flowing during dry periods. This site has maintained isolated pools when not flowing, indicating that groundwater may be close to the streambed, perhaps supporting some aquatic species (**Figure 5-30a** and **Figure 5-30b**). The Napa River at Stream Watch Site 2 stops flowing every year regardless of rainfall amount; however, in average and dry years, it can go completely dry to the point that isolated

[47] https://www.napawatersheds.org/streamwatch

pools cannot be maintained (**Figure 5-31a** and **Figure 5-31b**). South of Calistoga at Larkmead Lane (Stream Watch Site 4), the Napa River maintains year-round flow during wet years, however, flow in the River has been observed to cease in average precipitation years and even dry out completely following below-average wet seasons (**Figure 5-32**). Stream observations at Selby Creek (Stream Watch Site 6) indicate the tributary remains dry for almost all of the year. During average or above-average precipitation years, however, Selby Creek can flow for a few weeks or months during the winter (**Figure 5-33**). These observations provide a useful complement to traditional stream gage sites in the Subbasin by providing an understanding of streamflow conditions as they change throughout the year over a broad area. Knowledge of when wetted channels appear and recede is important in understanding baseflow influences on Groundwater Dependent Ecosystems (GDEs), including fish and other aquatic species.

6 NAPA VALLEY SUBBASIN WATER USE AND SURFACE WATER AVAILABILITY

Groundwater Sustainability Plan (GSP) Regulations require reporting of best available information on water use by sector, groundwater extraction, and surface water used or available for groundwater recharge or in-lieu use[48] (Section 356.2(b)(2-4)). The following sections are included to meet the requirements for SGMA reporting and align with the format of water use information presented in the Basin Analysis Report updated with water use data and estimates for water year 2020. An additional analysis of groundwater use by Groundwater Dependent Ecosystems (GDEs) was conducted for water year 2020 and is presented in **Section 6.1.4**.

As part of the development of a Groundwater Sustainability Plan for the Napa Valley Subbasin, the GSA is updating its prior water budget, including through the use of a calibrated numerical model, the Napa Valley Integrated Hydrologic Model (NVIHM). The NVIHM and GSP water budget analysis will build on the work conducted for the Basin Analysis Report, in part by addressing data gaps identified previously. Future GSA Annual Reports will incorporate additional and refined methods for water use analysis, based on the GSP water budget analysis and additional sources of information planned to become available (see **Sections 7.4 and 7.5**).

6.1 Subbasin Water Use by Sector

6.1.1 Agricultural Water Use

Water supplies available to agricultural land uses in the Subbasin include groundwater pumped from the Subbasin, recycled water, surface water diverted from the Napa River system within the Subbasin, and to a lesser extent surface water diverted outside the Subbasin from reservoirs in the Napa River Watershed. In this Report, agricultural land use and water use include uses specifically for crop/vineyard production, rather than related activities such as winery operations. Winery water use is discussed in **Section 6.1.3**. Diversions of surface water from the Subbasin watersheds are a minor source of supply to agriculture within the Subbasin, although the Cities of Napa and St. Helena have reported some sales of water totaling a few hundred acre-feet in most years.

Similar to many areas of the state, there is no comprehensive data collection effort in the Subbasin to monitor groundwater use by agriculture. Limited data on surface water diversions are available from the State Water Resources Control Board (SWRCB) Electronic Water Rights Information Management System (eWRIMS), although the deadline for required annual reporting of diversions to the SWRCB falls after the timeline for SGMA Annual Report preparation. While diversion data reported to the SWRCB are useful for GSP development and updates occurring every five years, diversion data from SWRCB are not available in a timely manner for use in SGMA annual reports. To address the lack of comprehensive data, a root zone water balance model was developed for the Basin Analysis Report to more accurately quantify rates of water application to meet evapotranspiration demands by crops or other irrigated vegetation over the based period from 1988 to 2015 (LSCE, 2016c). The Root Zone Model accounts for

[48] SGMA defines in-lieu use as “groundwater use by persons who could otherwise extract groundwater in order to leave groundwater in the basin” (Water Code Section 10721(m)).

applications of groundwater, surface water, and recycled water to meet crop water demands. Estimates of water use for crop production since 2015 were developed for the prior Annual Report and this Report based on linear relationships between monthly irrigation demand and environmental variables (i.e., precipitation and reference evapotranspiration (ETo).

Monthly values of each variable were used to determine a relationship that might be used to predict water usage (from groundwater and surface water) for years without simulated or measured values using data based on monthly simulated quantities from the Root Zone Model from water years 2011 to 2025.[49] On average, most groundwater pumping and surface water use occur in May, June, July, August, and September. A collection of plots that illustrate the linear and non-linear relationships between total groundwater pumping, vineyard groundwater pumping, other agricultural groundwater pumping, total surface water use, vineyard surface water use, other agricultural surface water use, and either ETo or precipitation is included in **Appendix E**.

Relationships with a coefficient of determination (R^2) value of greater than 0.75 were initially selected for consideration for interpolating water budget components for 2018 using precipitation data and evapotranspiration data from the Oakville station in the California Irrigation Management Information System (CIMIS) Network. The table below summarizes the R^2 values for each relationship described above (**Table 6-1**). Not all months with R^2 values greater than 0.75 for either ETo of precipitation were used to develop monthly use estimates. For example, coefficients of determination values are high between precipitation and five out six water use categories in June (**Table 6-1**); however, the strength of those correlations is greatly influenced by a very small number of data pairs where high precipitation totals occur.

Four interpolation methods were employed to estimate monthly pumping and surface water use amounts:

> **Method 1:** Linear interpolation using linear relationships between measured ETo or precipitation for water use categories with an R^2 value of greater than 0.75;
>
> **Method 2:** Average monthly proportions of groundwater pumping for each category (“Other Agricultural Pumping”, “Vineyard Groundwater Pumping”, “Semi-Agricultural Pumping”, and “Urban Groundwater Pumping”) were estimated based on estimates of total groundwater pumping and Root Zone Model simulated values. Average monthly proportions of surface water use were also estimated for each surface water use category (“Other Agricultural Surface Water Use”, “Vineyard Surface Water Use”, “Semi-Agricultural Surface Water Use”, and “Urban Surface Water Use”) based on estimates of total surface water use and Root Zone Model simulated values (**Figure 6-1**).

[49] Although simulated Root Zone Model data including groundwater pumping and surface water use for various categories of water use are available from water year 1988 to 2025, the land use coverage from 2011 was selected to represent current conditions and only simulated water use data from 2011 on was used for this interpolating exercise.

<u>**Method 3:**</u> For months with no acceptable linear correlation (e.g., February, March, July, August, and December) to use for interpolation, average monthly proportions of annual totals of groundwater pumping and surface water use values were used from Root Zone Model output (from water years 2011-2025) (**Figure 6-2**).

<u>**Method 4:**</u> For months in which the only interpolated values are for total groundwater pumping or total surface water use, the monthly average proportion of total groundwater to total surface water use is employed to estimate the other total water use category (either total groundwater pumping or total surface water use) (**Figure 6-3**).

These four methods employed together provide monthly estimates for each category of water use for groundwater pumping and surface water for water year 2020, putting the most confidence in the linearly interpolated values (from Method 1). Certain monthly category values estimated using Method 2 above had to be slightly adjusted in order to agree with the linearly interpolated total groundwater pumping or total surface water use amount when one or more groundwater or surface water categories (e.g., "Other Agricultural Pumping", "Vineyard Surface Water Use", etc.) are interpolated from the linear interpolation method (these months were September and October). Adjustments were minor, indicating that the linearly interpolated total groundwater/surface water amount agrees well with the proportion of the other linearly interpolated water use category for that month.[50] Interpolated and estimated monthly water use values are presented in **Table 6-2** for water year 2020. Consistent with methods applied in the Basin Analysis Report, pumping volumes reported for Semi-Agricultural and Urban groundwater use were reduced to exclude areas supplied by municipal water systems that report water delivery data separately.

The estimated agricultural water uses for water year 2020, along with data from years since 2013, are summarized in **Table 6-3**. Groundwater use comprised 81% of agricultural water use in 2020. Surface water use, supplied primarily by diversions occurring within the Subbasin, comprised 16% of agricultural water use in water year 2020. Recycled water use comprised 3% of agricultural water use in 2020. Accuracy data are not available for the water year 2020 estimates of agricultural water use in the Subbasin. Additional study and data collection are planned to occur regarding water use and water conservation practices (see **Sections 8.1.4 and 8.1.5**). The planned efforts will provide a basis for evaluating the accuracy of unincorporated area water use estimates.

[50] Adjustments to the groundwater pumping components totaled 127 acre-feet for the water year. Adjustments to the surface water use components totaled 58 acre-feet for the water year.

Table 6-1 Coefficient of Determination (R^2) Values for Napa Valley Subbasin Agricultural Water Use and Evapotranspiration and Precipitation

Month	Evapotranspiration					
	Total GW Pumping	Vineyard GW Pumping	Other Ag GW Pumping	Total SW Use	Vineyard SW Use	Other Ag SW Use
January	0.67	N/A	**0.77**	0.52	N/A	**0.77**
February	0.06	N/A	0.06	0.06	N/A	N/A
March	0.07	N/A	0.05	0.09	N/A	0.09
April	0.56	0.22	0.36	0.63	0.10	0.12
May	0.44	0.46	0.21	0.23	0.49	0.38
June	0.60	0.60	0.52	0.60	0.65	0.69
July	0.06	0.04	0.32	0.24	0.05	0.21
August	0.05	0.08	0.03	0.04	0.03	0.01
September	**0.84**	**0.86**	0.51	0.62	**0.84**	0.47
October	**0.96**	N/A	**0.95**	**0.96**	N/A	**0.93**
November	**0.82**	N/A	**0.76**	**0.79**	N/A	**0.81**
December	0.04	N/A	0.01	0.22	N/A	0.01
Month	**Precipitation**					
	Total GW Pumping	**Vineyard GW Pumping**	**Other Ag GW Pumping**	**Total SW Use**	**Vineyard SW Use**	**Other Ag SW Use**
January	0.13	N/A	0.09	0.17	N/A	0.09
February	0.19	N/A	0.12	0.18	N/A	N/A
March	0.33	N/A	0.22	0.33	N/A	0.05
April	**0.75**	0.26	0.34	**0.83**	0.13	0.12
May	0.28	0.21	0.58	**0.76**	0.17	0.29
June	**0.89**	**0.87**	**0.96**	**0.89**	**0.75**	0.72
July	0.03	0.02	0.08	0.08	0.04	0.08
August	0.41	0.47	0.09	0.06	0.35	0.11
September	**0.98**	**0.98**	**0.75**	**0.84**	**0.97**	0.72
October	**0.95**	N/A	**0.93**	**0.96**	N/A	**0.91**
November	0.41	N/A	0.33	0.49	N/A	0.39
December	0.25	N/A	0.12	0.34	N/A	0.13

Table 6-2 Interpolated and Estimated Values of Water Use Components for 2020

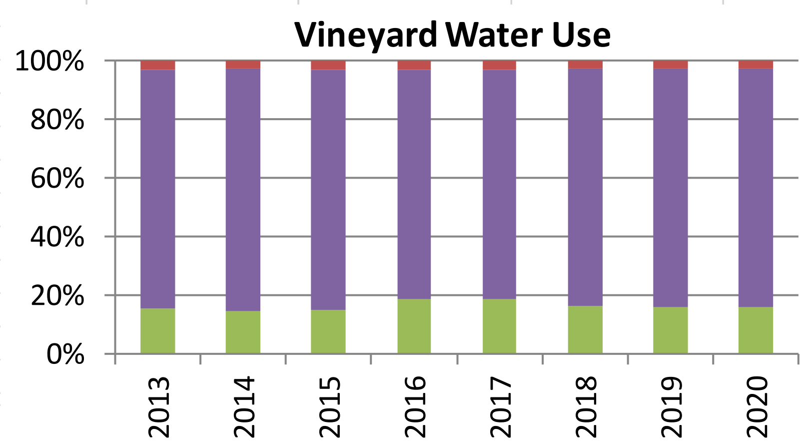
Month	Year	Groundwater Pumping Components (Acre-Feet)					Surface Water Use Components (Acre-Feet)				
		Other Agricultural Pumping	Vineyard Groundwater Pumping	Semi-Agricultural Pumping	Urban Groundwater Pumping	Total Groundwater Pumping	Other Agricultural Surface Water Use	Vineyard Surface Water Use	Semi-Agricultural Surface Water Use	Urban Surface Water Use	Total Surface Water Use
October	**2019**	34	0	*27*	*211*	272	14	0	*5*	*845*	863
November	**2019**	1	0	*1*	*15*	18	1	0	0	96	97
December	**2019**	0	0	0	4	4	0	0	0	29	29
January	**2020**	0	0	0	0	0	0	0	0	0	0
February	**2020**	0	0	0	0	0	0	0	0	0	0
March	**2020**	0	0	0	0	0	0	0	0	0	0
April	**2020**	7	11	31	206	256	0	2	5	660	668
May	**2020**	54	537	68	408	1,066	3	55	5	618	681
June	**2020**	137	3,214	117	692	4,161	46	630	19	1,894	2,589
July	**2020**	122	3,690	99	589	4,500	68	746	23	2,093	2,930
August	**2020**	88	3,455	76	459	4,078	45	698	18	1,810	2,571
September	**2020**	55	1,269	13	393	1,730	23	245	13	*1,272*	1,554

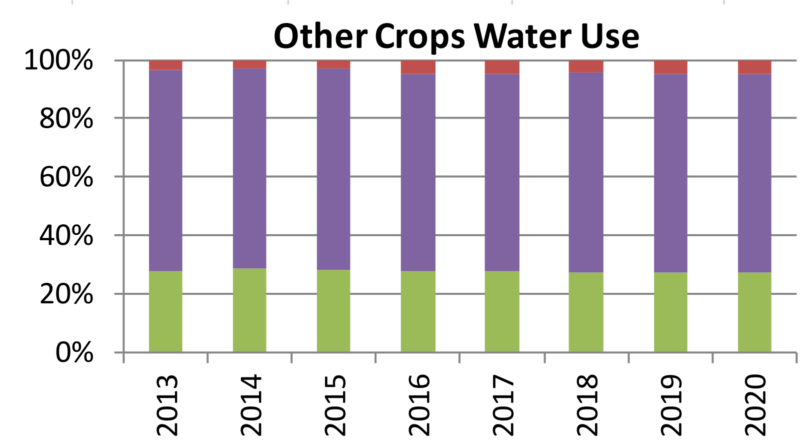
Explanation:

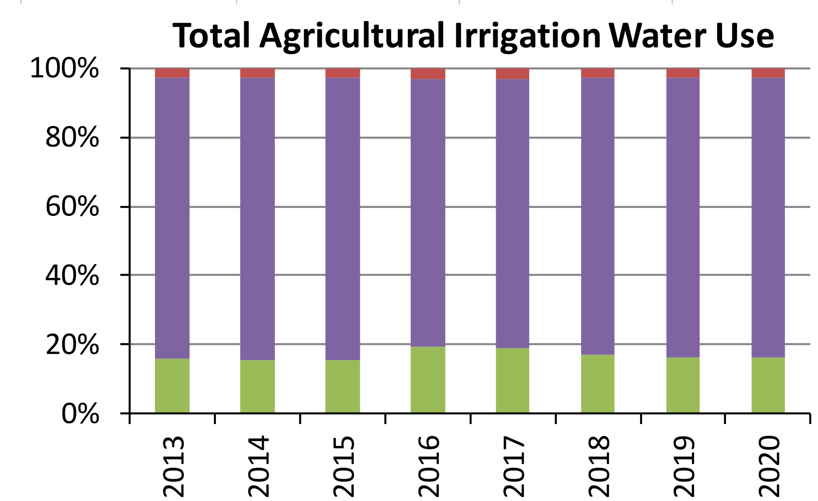
Method 1 – Linearly interpolated values estimated using relationships between actual measured monthly ET or precipitation.
Method 2 – Estimated values based on monthly average proportions of each water use category.
Method 3 – Estimated values based on monthly proportions of annual groundwater and surface water totals from the previous year.
Method 4 – Estimated values based on monthly surface water to groundwater total proportions.
italic Italic values indicate an adjustment was made to water use category values in order to match the interpolated total groundwater or surface water values. Adjustments to the Semi-Agricultural and Urban groundwater pumping components totaled 149 acre-feet. Adjustments to the Semi-Agricultural and Urban surface water use components totaled 238 acre-feet.

Table 6-3 Napa Valley Subbasin Agricultural Water Use

Year	Vineyards – Local Supply: Surface Water (Diversions Within Subbasin) [AF]	Vineyards – Local Supply: Groundwater [AF]	Vineyards – Local Supply: Recycled Water [AF]	Vineyards: Total [AF]	All Other Crops – Local Supply: Surface Water (Diversions Within Subbasin) [AF]	All Other Crops – Local Supply: Groundwater [AF]	All Other Crops – Local Supply: Recycled Water [AF]	All Other Crops: Total [AF]	All Agricultural Irrigation – Local Supply: Surface Water (Diversions Within Subbasin) [AF]	All Agricultural Irrigation – Local Supply: Groundwater [AF]	All Agricultural Irrigation – Local Supply: Recycled Water [AF]	All Agricultural Irrigation: Total [AF]
2013	2,373	12,447	458	**15,278**	181	445	21	**647**	2,554	12,892	479	**15,925**
2014	2,058	11,499	378	**13,935**	200	474	20	**694**	2,258	11,973	398	**14,629**
2015	2,479	13,412	479	**16,370**	191	465	21	**677**	2,670	13,877	500	**17,047**
2016	2,461	10,225	407	**13,093**	191	459	33	**683**	2,652	10,684	440	**13,776**
2017	2,461	10,386	407	**13,254**	193	467	33	**693**	2,654	10,853	440	**13,947**
2018	2,459	12,133	407	**14,999**	206	516	33	**755**	2,665	12,649	440	**15,754**
2019	2,374	12,159	407	**14,940**	200	497	33	**730**	2,574	12,656	440	**15,670**
2020	2,376	12,176	407	**14,959**	200	499	33	**732**	2,576	12,675	440	**15,691**







NOTES:
All data after 2016 are estimates calculated from relationships between precipitation and reference evapotranspiration measured in the Subbasin and outputs from the Napa Valley Subbasin Rootzone Model published in the 2016 Basin Analysis Report for the Napa Valley Subbasin.

6.1.2 Municipal Water Use

Four municipalities overlie parts of the Napa Valley Subbasin: Calistoga, St. Helena, Yountville, and Napa (**Figure 2-1**). Municipal sector water use data for water year 2020 were provided for this report by the City of Napa and the City of St. Helena, while municipal water use for the City of Calistoga and Town of Yountville were estimated based on previous reporting years. Annual calendar year reports of diversion and water use were available through 2020 from Rector Reservoir through the State Water Resources Control Board (water right application number: A010456). Available data are summarized in **Table 6-4**.

The sources of supply for municipal water suppliers in the Napa Valley Subbasin remained consistent in water year 2020 as in the latter years of the 1988 – 2015 water budget analysis study period (LSCE, 2016c). Surface water, from local sources and the State Water Project, comprised the majority of water supplied by municipalities in the Subbasin. State Water Project water supplies, delivered from reservoirs outside of Napa County via the North Bay Aqueduct, comprised 49% of municipal water use in water year 2020. Local reservoirs, located outside the Subbasin but within the Subbasin watershed, supplied 44% of municipal water use in water year 2020. Groundwater pumped from the Subbasin accounted for 2% of the municipal water use in recent years. Recycled water comprised 5% of municipal water use in water year 2020.

Three of four municipalities in the Napa Valley Subbasin currently re-use wastewater, at varying treatment levels. The City of Calistoga produces recycled water that is used to irrigate city-owned properties. The Town of Yountville has a tertiary treatment facility and produces recycled water, some of which is used for the irrigation of some Town properties and some of which is sold to local vineyards for use as irrigation water.

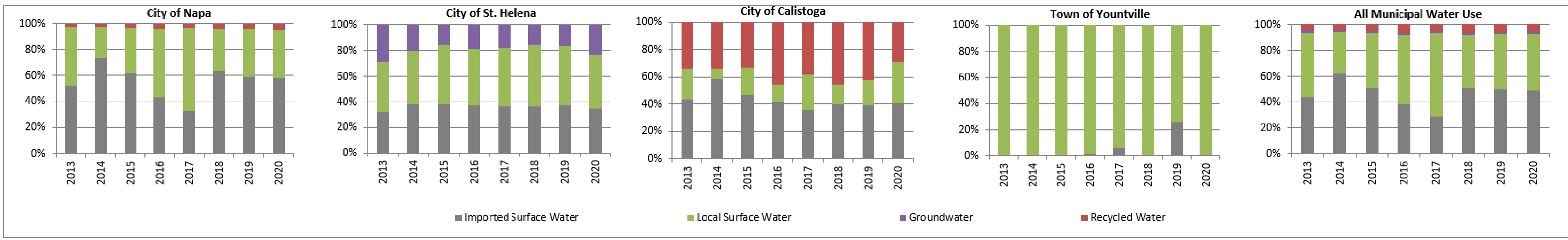
The Napa Sanitation District (NSD) produced recycled water from City of Napa wastewater. NSD recycled water is delivered along two main pipelines running southeast and north of the NSD Soscol Water Recycling Facility, including connections in the southern portions of the Napa Valley Subbasin and a branch that now extends to the MST Subarea adjacent to the Napa Valley Subbasin. The NSD is working with water users throughout southern Napa County to identify areas where recycled water could replace the use of potable water, surface water, or groundwater. The pipeline serving the MST Subarea was put into service in 2016 and is designed to initially deliver up to 700 acre-feet per year (230 million gallons), with the potential to deliver up to 2,000 acre-feet per year (650 million gallons). In water year 2020, the NSD delivered 422 acre-feet of recycled water to users in the MST Subarea, an increase of over 40% from the prior year.

The City of St. Helena applies some tertiary treated wastewater to spray fields adjacent to its wastewater treatment plant, which is not considered a re-use.

The 2015 City of Napa Urban Water Management Plan reports an estimated accuracy of +/-2% for water meters used to track the supply used from sources owned by the City, local reservoirs in the Subbasin watershed. The same +/-2% accuracy estimate pertains to the State Water Project deliveries to Calistoga, St. Helena, and Yountville reported in **Table 6-4**.

Table 6-4 Napa Valley Subbasin Municipal Water Use

Year	City of Napa					City of St. Helena				City of Calistoga					Town of Yountville			State of CA	All Municipal Suppliers				
	Imported Supply	*Local Supply*				*Imported Supply*	*Local Supply*			*Imported Supply*	*Local Supply*				*Imported Supply*	*Local Supply*		*Local Supply*	*Imported Supply*	*Local Supply*			
	State Water Project [AF]	Lake Hennessey [AF]	Milliken Reservoir [AF]	Recycled Water [AF]	Total [AF]	City of Napa Purchase [AF]	Bell Canyon [AF]	Groundwater [AF]	Total [AF]	State Water Project [AF]	Kimball Reservoir [AF]	Groundwater [AF]	Recycled Water [AF]	Total [AF]	State Water Project [AF]	Rector Reservoir [AF]	Total [AF]	Rector Reservoir [AF]	State Water Project [AF]	Surface Water, Local Reservoirs [AF]	Groundwater [AF]	Recycled Water [AF]	Total [AF]
2013	6,992	5,903	191	330	**13,416**	583	737	526	**1,846**	505	263	0	402	**1,170**	0	630	**630**	1,421	8,080	9,144	526	732	**18,483**
2014	8,854	2,331	508	318	**12,012**	593	646	317	**1,555**	580	71	0	341	**992**	0	560	**560**	1,028	10,027	5,143	317	659	**16,146**
2015	6,539	2,921	660	393	**10,513**	582	713	244	**1,540**	439	176	0	311	**927**	0	492	**492**	1,258	7,560	6,220	244	704	**14,729**
2016	4,612	5,683	39	428	**10,763**	574	670	285	**1,529**	503	162	0	555	**1,220**	6	481	**486**	944	5,695	7,980	285	983	**14,942**
2017	3,565	6,841	157	364	**10,926**	607	769	293	**1,670**	409	302	0	442	**1,153**	27	444	**471**	1,792	4,607	10,305	293	805	**16,011**
2018	7,199	3,526	62	436	**11,223**	634	846	267	**1,748**	542	199	0	617	**1,358**	0	472	**472**	1,663	8,375	6,768	267	1,054	**16,464**
2019	6,750	4,197	0	458	**11,404**	591	730	261	**1,582**	451	223	0	488	**1,162**	142	417	**559**	1,298	7,934	6,865	261	946	**16,005**
2020	7,341	4,661	0	578	**12,581**	623	736	418	**1,777**	446	339	0	320	**1,105**	0	505	**505**	1,308	8,410	7,550	418	898	**17,276**



NOTES:
All data are direct measurements reported by each entity, except for Town of Yountville Water Year 2018 use supplied by Rector Reservoir, which is shown as the average of data reported from 2013 to 2017, and Water Year 2018 total supplies from Rector Reservoir, which is shown here as average of reported data from 2013 to 2017.
City of Napa uses shown, excepting recycled water uses, are 89.9% of the total amount reflecting the estimated proportion of the City of Napa Population within the Napa Valley Subbasin as of the 2010 census.
Recycled water use by City of Napa reflects use by those customers located within the Napa Valley Subbasin, as reported by City of Napa staff.
The City of Napa 2015 Urban Water Management Plan Update estimates the accuracy of metered use by source is +/- 2%.

6.1.3 Unincorporated Area Water Use

Water use in unincorporated areas of the Subbasin has been estimated and is summarized in **Table 6-5**. The sources of supply are consistent with information presented in the Basin Analysis Report (LSCE, 2016c). The estimate of indoor residential water use is projected based on a per capita daily demand of 60.3 gallons and estimated for the entire unincorporated Subbasin based on the projected population. Water use for landscape irrigation in unincorporated areas is based on the linear correlation analysis described in **Section 6.1.1**, using data from the Root Zone Model and precipitation and evapotranspiration data from 2020.

Water use by wineries in the Subbasin was updated for water year 2020 using the same estimation method developed for the Basin Analysis Report, which estimates water use based on the details of approved winery permits in the Subbasin (outside of municipal boundaries). The water year 2020 estimate is updated to reflect winery permits approved in 2020, including new use permits and modifications of existing permits (**Figure 6-4**). In 2020, Napa County approved sixteen permits for wineries and other discretionary projects with new uses of groundwater, three of which were new use permits and thirteen were permit modifications. Five of the sixteen permits have one or more water supply wells located in the Napa Valley Subbasin.

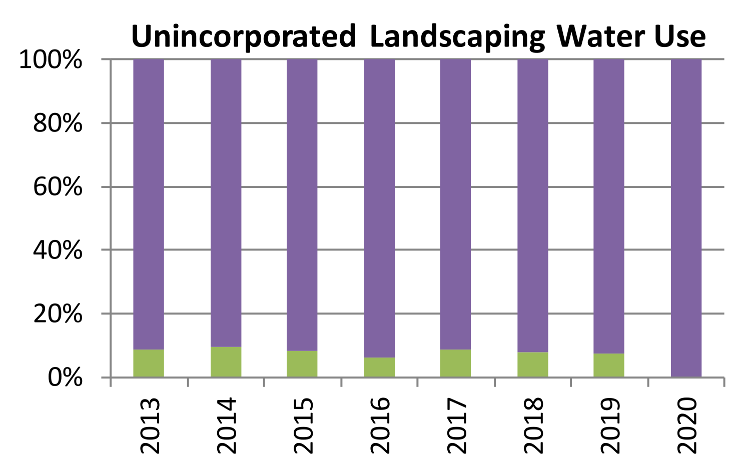
As in the Basin Analysis Report, the estimates of winery water use assume that all use is supplied by groundwater and that all wineries are operating at their full, permitted capacity.

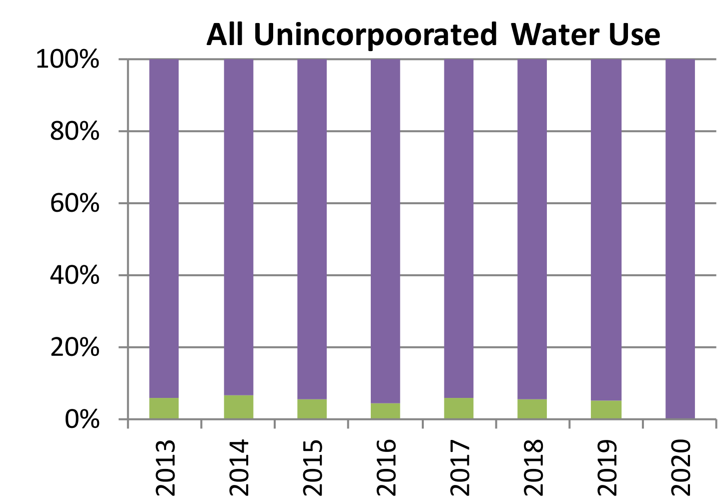
Additional water use data from small public water systems, including in unincorporated areas within the Napa Valley Subbasin, have become available in recent years through the SWRCB. While those data are being evaluated as part of the water budget analysis underway for the Napa Valley Subbasin GSP, the timing of annual reporting and data availability for those data falls after the timeline for SGMA Annual Report preparation, similar to the limitation noted in **Section 6.1.1** for surface water diversion data. As a result, those data are not available in a timely manner for use in SGMA annual reports.

Overall, 95% of water use in unincorporated areas of the Subbasin, excluding water used for crop production, is estimated to have been supplied by groundwater in water year 2020 (**Table 6-5**). The remaining amounts are estimated to have been supplied by diversions of surface water from within the Subbasin. Accuracy data are not available for the water year 2020 estimates of water use in unincorporated areas of the Subbasin. Additional study and data collection are planned to occur regarding water use and water conservation practices (see **Sections 8.1.4 and 8.1.5**). The planned efforts will provide a basis for evaluating the accuracy of unincorporated area water use estimates.

Table 6-5 Napa Valley Subbasin Unincorporated Water Use

Year	Unincorporated Domestic (Indoor)		Unincorporated Landscaping Irrigation				Unincorporated Wineries		All Unincorpoorated			
	Local Supply		*Local Supply*				*Local Supply*		*Local Supply*			
	Groundwater [AF]	Total [AF]	Surface Water [AF]	Groundwater [AF]	Recycled Water [AF]	Total [AF]	Groundwater [AF]	Total [AF]	Surface Water [AF]	Groundwater [AF]	Recycled Water [AF]	Total [AF]
2013	372	**372**	277	2,928	0	**3,205**	1,222	**1,222**	277	4,522	-	**4,799**
2014	369	**369**	317	2,958	0	**3,275**	1,222	**1,222**	317	4,549	-	**4,866**
2015	367	**367**	291	3,202	0	**3,493**	1,222	**1,222**	291	4,791	-	**5,082**
2016	366	**366**	291	4,497	0	**4,788**	1,207	**1,207**	291	6,070	-	**6,361**
2017	363	**363**	294	3,109	0	**3,403**	1,213	**1,213**	294	4,685	-	**4,979**
2018	360	**360**	286	3,384	0	**3,669**	1,229	**1,229**	286	4,973	-	**5,258**
2019	357	**357**	270	3,276	0	**3,547**	1,233	**1,233**	270	4,866	-	**5,137**
2020	356	**356**	267	3,245	0	**3,512**	1,238	**1,238**	267	4,840	-	**5,106**





NOTES:

Unincorporated Domestic Indoor use data are estimates calculated based on a per household demand of 161 gallons per day for indoor uses (Aquacraft, 2011) and annual unincorporated Subbasin population and average household size based on population projections based on U.S. Census data for 2000 and 2010.

Unincorporated Landscape Irrigation use data are estimates calculated from relationships between precipitation and reference evapotranspiration measured in the Subbasin in Water Year 2018 and outputs from the Napa Valley Subbasin Rootzone Model published in the 2016 Basin Analysis Report for the Napa Valley Subbasin.

Unicorporated Wineries uses data are estimates calculated based on Napa County Planning, Building, and Environmental Services Dept. records of permitted wineries, includes uses for winemaking,

6.1.4 Water Use Summary

Total water use in the Napa Valley Subbasin, including groundwater extracted from the Subbasin, surface water from sources within the Napa River Watershed, and imported surface water delivered through the State Water Project, is estimated to have been 38,073 acre-feet in water year 2020 (**Table 6-6**). State Water Project supplies provided 22% of water used in 2020 across the Subbasin. Reservoirs located in the Subbasin watershed provided 27% of water used in 2020. Groundwater pumped in the Subbasin provided 47% of water used in 2019. Recycled water supplied 4% of total water used during the water year.

Total estimated groundwater use in the Subbasin was 17,933 acre-feet in water year 2010. **Figure 6-5** shows the distribution of water supply wells according to the designated use provided on Well Completion Reports, to demonstrate the variability in groundwater well densities across the Subbasin. The mapped densities apply to the entire section, not only the portion within the Subbasin, based on the total number of wells by type as provided in the DWR Well Completion Report Web Map Application. The two most common well types, domestic and irrigation wells, are found throughout the Subbasin, with the exception of some sections in the vicinity of Napa and near the southern boundary of the Subbasin. Domestic wells are most concentrated near the head of Napa Valley in the vicinity of Calistoga. High concentrations of domestic wells are also found in the sections that overlie portions of the narrow, eastward extension of the Subbasin, although it is not clear how many of the wells in those sections are located within the extent of the Quaternary alluvium that is the basis for the Subbasin boundary. Irrigation wells are distributed more evenly throughout the Subbasin, with a slightly higher concentration to the south of St. Helena. Refined well location data are under development and will be presented in the Napa Valley Subbasin GSP and future Annual Reports.

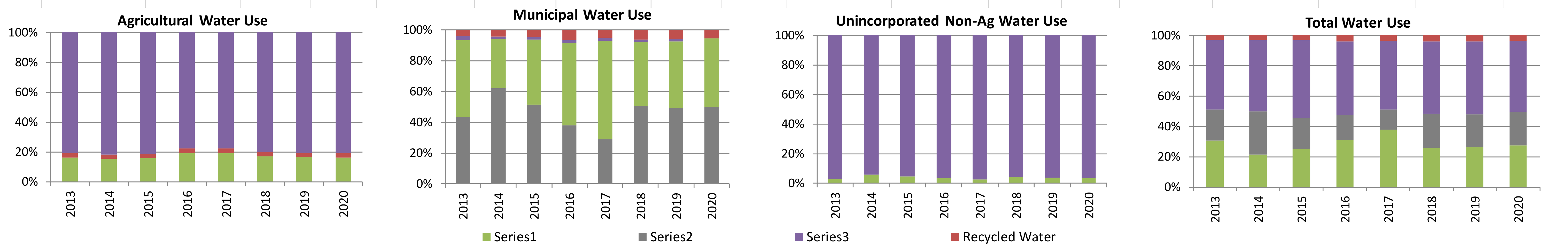
The approximate distribution of groundwater extraction in water year 2020 is shown **Figure 6-6** based on the sum of outputs from the Root Zone Model[51], census estimates for population in the unincorporated areas, groundwater use reported by municipalities, and winery water use estimates.

Groundwater use for water year 2020 is presented along with values for 1988 to 2019 developed previously in **Figure 6-7**. The figure also includes calculated annual and cumulative changes in groundwater storage in the alluvial aquifer system of the Subbasin. Water year types are indicated by labels along the bottom axis of the figure. The "Variable" label is used when both above and below average years occurred over time. "Dry" and "Wet" labels are used when a series of years of the same type occurred or when particularly notable single years occurred. As described in **Section 5.1.4**, groundwater storage volume decreased in 2020, by 24,707 acre-feet. Cumulative changes in groundwater storage show a net decrease of 8,945 acre-feet from water year 1988 to 2020 (**Table 5-4**).

[51] Since estimates of groundwater use for irrigation were derived from Root Zone Model outputs developed for the Basin Analysis Report, the distribution of irrigation demand included in these figures is based on scaled Root Zone Model outputs for comparable years. Root Zone Model output for 2015 was scaled to match the total irrigation demand estimated for 2019.

Table 6-6 Napa Valley Subbasin Total Water Use

Year	Agricultural Irrigation Uses				Municpal Uses					Unincorporated, Non-Agricultural Uses				Total Water Use				
	Local Supply				*Imported Supply*	*Local Supply*				*Local Supply*				*Imported Supply*	*Local Supply*			
	Surface Water (Diversions Within Subbasin) [AF]	Groundwater [AF]	Recycled Water [AF]	Total [AF]	State Water Project [AF]	Surface Water, Local Reservoirs [AF]	Groundwater [AF]	Recycled Water [AF]	Total [AF]	Surface Water (Diversions Within Subbasin) [AF]	Groundwater [AF]	Recycled Water [AF]	Total [AF]	State Water Project [AF]	Surface Water (Local Reservoirs and Diversions Within Subbasin) [AF]	Groundwater [AF]	Recycled Water [AF]	Total [AF]
2013	2,554	12,892	479	**15,925**	8,080	9,144	526	732	**18,483**	277	4,522	0	**4,799**	8,080	11,975	17,940	1,211	**31,127**
2014	2,258	11,973	398	**14,629**	10,027	5,143	317	659	**16,146**	317	4,549	0	**4,866**	10,027	7,718	16,839	1,057	**25,614**
2015	2,670	13,877	500	**17,047**	7,560	6,220	244	704	**14,729**	291	4,791	0	**5,082**	7,560	9,181	18,912	1,204	**29,298**
2016	2,652	10,684	440	**13,776**	5,695	7,980	285	983	**14,942**	291	6,070	0	**6,361**	5,695	10,923	17,039	1,423	**35,079**
2017	2,654	10,853	440	**13,947**	4,607	10,305	293	805	**16,011**	294	4,685	0	**4,979**	4,607	13,253	15,831	1,245	**34,936**
2018	2,665	12,649	440	**15,754**	8,375	6,768	267	1,054	**16,464**	286	4,973	0	**5,258**	8,375	9,719	17,889	1,493	**37,476**
2019	2,574	12,656	440	**15,670**	7,934	6,865	261	946	**16,005**	270	4,866	0	**5,137**	7,934	9,709	17,783	1,386	**36,812**
2020	2,576	12,675	440	**15,691**	8,410	7,550	418	898	**17,276**	267	4,840	0	**5,106**	8,410	10,392	17,933	1,338	**38,073**



Groundwater use in water year 2020 was comparable to amounts used in recent years dating back to at least 2004 (**Figure 6-7**). Over the full 33-year period, annual storage changes in the aquifer system have fluctuated between positive and negative values, generally in accordance with the water year type. Cumulative changes in groundwater storage have also fluctuated between positive and negative values, indicating long-term stable groundwater storage conditions, the absence of chronic depletions of groundwater storage, and an overall condition of a basin in balance. Groundwater use in the Subbasin in water year 2020 remained within the sustainable yield range of 17,000 to 20,000 acre-feet per year identified in the Basin Analysis Report (LSCE, 2016c).

For water year 2020, an additional analysis of groundwater use by Groundwater Dependent Ecosystems (GDEs)[52] was conducted to improve the understanding of their groundwater use relative to other users in the Subbasin. Likely and potential GDEs depicted in the Basin Analysis Report were used for the analysis (**Figure 6-8**, see also LSCE, 2016c). Estimates of groundwater use by GDEs for water year 2020 were developed by referencing draft results from the Napa Valley Integrated Hydrologic Model. Additional reference was made to spatial evapotranspiration datasets developed using LandSat imagery and processed according to the METRIC Evapotranspiration (ET) method developed for prior annual report.[53]

The GDE groundwater use analysis found that total groundwater use by GDEs, as determined from evapotranspiration, was between 3,492 acre-feet and 4,184 acre-feet during the months when groundwater would be the dominant source of water available to GDEs (**Table 6-7**). This result quantifies water use in unirrigated areas where vegetation mapping has identified likely or potentially groundwater-dependent vegetation. The result indicates that groundwater use by GDEs in water year 2020 was approximately 19% to 23% of the total groundwater use of 17,933 acre-feet by other uses and users in the Subbasin (**Table 6-6**). This analysis provides a numerical point of comparison that will be useful going forward, along with updated GDE mapping, to understand the distribution and health of GDEs over time.

The results from the GDE water use analysis are not additive for the purposes of evaluating annual use of groundwater relative to the sustainable yield for the Subbasin. The prior analysis of sustainable yield addressed “withdrawals” from the Subbasin due to groundwater pumping and not outflows due to ET or subsurface outflows to the Lowland Subbasin, though the latter two components were explicitly addressed in the water budget analysis presented in 2016 (LSCE, 2016c). GDEs are among the beneficial users of groundwater in the Subbasin. The use of groundwater by GDEs represents one indication of the

[52] Groundwater Dependent Ecosystems were initially identified in the 2016 based on a review of a draft dataset of potential groundwater dependent ecosystems under development by The Nature Conservancy, in collaboration with DWR and California Department of Fish and Wildlife (CDFW). The Napa Valley Subbasin GDEs include a variety of wetland and vegetation communities that may rely on groundwater as a water supply.

[53] Mapping EvapoTranspiration at high Resolution with Internalized Calibration (METRIC) is an analytical method that applies an energy balance method to calculate field-scale evapotranspiration using energy flux data collected by satellites, paired with data from ground reference points.

health of GDEs. The County is working to better understand and account for these uses of groundwater, consistent with recommendations in the Basin Analysis Report (LSCE, 2016c).

Table 6-7 Napa Valley Subbasin Groundwater Dependent Ecosystems 2020 Estimated Groundwater Use

	ET (in)	GDE Area (acres)	ET (AF)
Likely GDEs	19.8	2,117	3,492
Potential GDEs	15.21	546	692
Total*	**18.86**	**2,663**	**4,184**

AF = acre-feet
* Total ET (in) is an area weighted sum.

6.2 Surface Water Supply Available for Use for Groundwater Recharge or In-lieu Use

GSP Regulations call for annual reporting on the supply of surface water available for use for groundwater recharge or in-lieu use to offset groundwater pumping. **Table 6-8** presents estimates based on a method developed by DWR (DWR, 2017). The DWR method is one approach for estimating the availability of surface water available for recharge (WAFR) based on historical gaged streamflow, monthly simulated outflows from the Water Evaluation and Planning (WEAP) model, and information on existing water rights and water diversions in each gaged watershed. This method results in estimates of water that may be available to divert for groundwater recharge projects while allowing for minimum streamflow requirements and the capacity of existing, approved diversions.

The DWR WAFR method provides a way to estimate the amount of surface water available for recharge based on the proportion of average annual gaged outflow that could potentially be diverted by a conceptual replenishment project, referred to as the WAFR Fraction. A range of conceptual replenishment projects is envisioned, resulting in a range of WAFR Fractions for a given gaged watershed. The so-called Best Estimate WAFR Fraction replicates the capacity of the single largest existing diversion in the gaged watershed. Additional bounds for the WAFR estimate are provided by calculating a WAFR Fraction based on one-half of the single largest existing diversion capacity, the Lower Uncertainty WAFR Fraction, and doubling the single largest existing diversion capacity, the Upper Uncertainty WAFR Fraction.

Instream flow requirements are also taken into account as part of the conceptual replenishment projects. The WAFR Fractions calculated based on the conceptual project capacities described above are also subject to instream flow requirements that limit the potential for surface water diversions. Existing instream flow requirements, whether established for the watershed as a whole or the largest existing diversion, were used as applicable. If neither are applicable, an instream flow requirement was determined by the Tennant method (Tennant, 1975). Instream flow requirements are assumed to be applied constantly throughout the year. The DWR method varies the instream flow requirement for the

Lower Uncertainty WAFR Fraction estimate to account for the potential for additional constraints on diversions. The Lower Uncertainty WAFR Fraction uses a doubled instream flow requirement relative to the existing requirement, while the Upper Uncertainty WAFR Fraction and the Best Estimate WAFR Fractions apply the existing instream flow requirement.

As described above, the DWR method allows for uncertainty by including a range of WAFR fractions for each gaged watershed. In addition to the Lower and Upper Uncertainty WAFR Fractions, DWR allows for a maximum project estimate with an unlimited diversion capacity. **Table 6-8** omits the maximum project estimate for the Napa River because the WAFR fraction used by DWR, 95.59%, represents a level of diversion that is not practical for the Napa Valley Subbasin.

Estimates for the surface water supply from the Napa River that could have been available for groundwater recharge or in-lieu use range from 500 acre-feet to 2,000 acre-feet in 2020, a substantial decrease from amounts calculated for 2019 that ranged from 7,200 acre-feet to 27,300 acre-feet. The lower amounts estimated for 2020 are a direct result of the decreased stream discharge measured at the USGS Napa River near Napa stream gage in 2020, during a Very Dry water year. Streamflow in the Napa River was much greater overall in 2019, as a result of the Wet water year. These estimates are understood to be preliminary, pending confirmation of actual surface water diversions in the watershed and the timing of storm flows relative to restrictions on diversions that were implemented as part of the 1976 Permanent Injunction 31785 and any subsequent limitations imposed by the DWR Watermaster or the State Water Resources Control Board.

Table 6-8 Napa Valley Subbasin Surface Water Supply Used or Available for Use for Groundwater Recharge or In-Lieu Use

Water Year	USGS Napa River near Napa Gage Outflow (TAF)	Low Uncertainty, 3.03% (TAF)	Best Estimate, 6.52% (TAF)	Upper Uncertainty, 11.46% (TAF)
2016	111.8	3.39	7.29	12.8
2017	376.2	11.4	24.5	43.2
2018	28.6	0.9	1.9	3.3
2019	238.2	7.2	15.5	27.3
2020	17.3	0.5	1.1	2.0
TAF = Thousand Acre-Feet				

Other sources of water for groundwater recharge and in-lieu use in the Napa Valley Subbasin include recycled water and conservation. Recycled water is currently used in the Subbasin to offset groundwater use. It is estimated that 440 acre-feet of recycled water was used for crop production in the Subbasin in water year 2020 (**Table 6-3**). These amounts are based on the areas where recycled water has been identified as a source of irrigation supply in DWR land use maps and other information, including vineyards receiving recycled water from the Town of Yountville (LSCE, 2016c) (**Figure 6-9**). Additional recycled water use in the Subbasin occurs by customers of the City of Calistoga and the City of Napa/Napa Sanitation District. Recycled water supplied by those municipalities may offset groundwater use if customers have access to a well as a source of supply in addition to a connection to the public water system. Recycled water is also not known to be used for groundwater recharge purposes in the Subbasin, although some deep percolation of recycled water or treated wastewater may occur when used for irrigation.

7 SGMA PLANNING AND IMPLEMENTATION FOR THE NAPA VALLEY SUBBASIN [54]

For many decades, Napa County and its citizens have acted to conserve and preserve groundwater resources and protect beneficial uses and users throughout the county. Napa County has restricted development and land use conversion both in Napa Valley, beginning in 1966, and in the larger Napa River Watershed, beginning in 1973. In 1980, voters approved an initiative know as Measure A limiting housing growth in the unincorporated county to less than 1% per year. In 1990 and again in 2008, voters approved initiatives prohibiting the conversion of agricultural lands to non-agricultural uses without a vote of the people, now in effect through 2058 (see **Section 1.2.1**).

Groundwater management actions taken by Napa County since 1991 have also aligned land use permitting with best-available data consistent with the objectives of SGMA. County actions have included setting objective criteria to avoid undesirable results by avoiding overdraft, maintaining historic groundwater levels, protecting against water quality degradation and land subsidence, preventing increased surface water flow reductions, and other adverse environmental impacts (see **Section 1.2.1)**.

Progress towards maintaining sustainable groundwater conditions in the Napa Valley Subbasin has continued since submittal of the Basin Analysis Report in 2016. In its capacity as GSA, Napa County is developing a GSP for the Napa Valley Subbasin that will include a refined sustainability goal, sustainable management criteria, and projects and management actions to maintain groundwater sustainability. In June 2020, the GSA appointed a 25-member GSP Advisory Committee (GSPAC) charged with developing and recommending a draft GSP for GSA consideration by November 2021.

Figure 7-1 illustrates the implementation activities conducted in recent years. Annual reporting, additional public outreach and further scientific studies are underway to improve upon best-available datasets regarding groundwater conditions, water use, surface water-groundwater interactions, groundwater dependent ecosystems, and other priorities identified by the County and stakeholders.

The Basin Analysis Report (LSCE, 2016c) included a discussion of groundwater management policies and projects currently implemented in the Napa Valley Subbasin. They include Napa County General Plan policies, Napa County's Groundwater Ordinance, Napa County's Water Availability Analysis procedure for discretionary proposed permits, water conservation outreach and education, collaboration with other water management planning programs, and ongoing water resources monitoring efforts. In addition, the Basin Analysis Report summarized groundwater management recommendations developed by the County since 2011 and records the status or anticipated completion of those recommendations. Thirteen of those recommendations were newly developed for the Basin Analysis

[54] The Basin Analysis Report for the Napa Valley Subbasin includes a comprehensive list of monitoring and management recommendations developed since 2011. Additional recommendations developed as part of the Basin Analysis Report and the Northeast Napa Management Area Report were added to the list in sequence, beginning at number 13. Recommendations 1 – 12 are referenced in this Section where applicable to ongoing activities.

Report. Those recommendations are included in **Table 7-1** (Items 13 – 25) with updated notations regarding status, as appropriate.

Table 7-1 also includes five management recommendations (Items 26 – 30) developed as part of the Northeast Napa Special Groundwater Study (see **Section 2.4.2**). These management actions complement the management actions described in the Basin Analysis Report and are intended to maintain groundwater sustainability for the Napa Valley Subbasin. The management recommendations developed as part of the Northeast Napa Special Groundwater Study were presented to the Napa County Board of Supervisors on October 24, 2017, as part of the Special Study Report. The Board of Supervisors indicated its support for the new management recommendations, and they were subsequently included in an amendment to the Basin Analysis Report establishing the Northeast Napa Management Area (LSCE, 2018a).

Table 7-1 Napa Valley Subbasin Summary of Recommended SGMA Implementation Steps

Item	Summary Description	Implementation Time Frame[1]	Relative Priority Ranking [2]	Status/ Anticipated Completion
Napa County Groundwater Conditions and Groundwater Monitoring Recommendations (2011)				
1.1a	Input archived data not previously available, link WellMA table information, add well construction data from wells the County monitors, add recent surface water delivery information, add municipal pumping data, and other information along with development and implementation of quality control protocols for inputting new data and reviewing existing data discrepancies	**Near to Long Term**	**1**	**Complete**
1.1b	Establishment of a map-interface with the DMS to enhance the use of the database by non-database users	**Near Term to Mid Term**	**1**	**Ongoing**
2.1a	Input CASGEM groundwater level data into the DMS	**Ongoing**	**1**	**Ongoing**
2.1b	Establish data format to meet DWR guidelines for electronic data transfer	**Near Term**	**1**	**Complete**

Table 7-1 Napa Valley Subbasin Summary of Recommended SGMA Implementation Steps

Item	Summary Description	Implementation Time Frame[1]	Relative Priority Ranking [2]	Status/ Anticipated Completion
2.1c	Optimize CASGEM monitoring well network per DWR guidelines by filling in data gaps where identified	**Mid to Long Term**	**3**	**Complete**
3.1a	Update County field procedures for measuring groundwater levels	**Near Term**	**1**	**Complete**
3.1b	Develop and/or expand aquifer-specific groundwater monitoring network in Napa Valley Floor, Pope Valley and Carneros Subareas by identifying existing wells with well construction data and constructing new aquifer-specific monitoring wells as needed where data gaps may exist	**Near to Mid Term**	**2**	**Ongoing**
3.1c	Develop aquifer-specific groundwater monitoring network in other Subareas by identifying existing monitored wells with well construction data and constructing new wells where data gaps may exist	**Mid to Long Term**	**3**	**Ongoing**
4.1a	Update geologic cross sections for the Napa Valley Floor and Carneros Subareas (previous ones were 50 years old)	**Near to Mid Term**	**2**	**Complete**
4.1b	Develop new geologic cross sections in those areas with the greatest short- and long-term growth and/or land use potential	**Near to Long Term**	**2**	**Ongoing**
4.1c	Investigate groundwater/surface water interactions and the effect of recharge and pumping on groundwater levels in the Napa Valley Floor Subareas, along with the Carneros Subarea to assess the sustainability of groundwater resources. May include groundwater modeling, as needed.	**Near to Mid Term**	**1**	**Complete/ Ongoing**

Table 7-1 Napa Valley Subbasin Summary of Recommended SGMA Implementation Steps

Item	Summary Description	Implementation Time Frame[1]	Relative Priority Ranking [2]	Status/ Anticipated Completion
5.1a	Prepare workplan for the purposes of preparing a Groundwater Sustainability Plan; workplan includes steps to implement County Monitoring Program and CASGEM Program	**Near Term**	**1**	**Complete, includes CASGEM Plan (LSCE, 2014)**
5.1b	Utilize the Watershed Information & Conservation Council (WICC) Board for various public outreach components related to groundwater sustainability planning	**Near Term**	**2**	**Ongoing**
5.1c	Develop objectives for public outreach, including information sharing and education about the County's groundwater resources	**Near to Mid Term**	**2**	**Complete**
5.1d	Preparation of a Groundwater Sustainability Plan for Napa County (Napa Valley Subbasin)	**Near to Mid Term**	**2**	**2021**
5.2a	Public outreach, including information sharing and education about the County's groundwater resources	**Ongoing**	**3**	**Ongoing**
6.1a	Updating of Ordinances 13.04, 13.12, and 13.15	**Mid Term**	**2**	**Complete**
6.1b	Update Groundwater Permitting Process	**Mid Term**	**3**	**Complete**
Groundwater Resources Advisory Committee (February 2014)				
7	Develop and widely distribute public outreach programs and materials; educate people about opportunities for taking action	**Near Term/ Ongoing**	**1**	**Ongoing**

Table 7-1 Napa Valley Subbasin Summary of Recommended SGMA Implementation Steps

Item	Summary Description	Implementation Time Frame[1]	Relative Priority Ranking [2]	Status/ Anticipated Completion
8	Support landowners in implementing best sustainable practices; Solicit information on, and widely share best practices with regard to water use in vineyards, wineries, and other agricultural/commercial applications	**Near Term/ Ongoing**	**1**	**Ongoing**
9	Enhance the water supply system and infrastructure to improve water supply reliability (regional and local)	**Near Term (evaluate and rank opportunities); Long Term – seek funding for high value projects**	**2**	**Ongoing**
10	Share groundwater conditions data and results; updates through BOS/WICC/Other	**Near Term/ Ongoing**	**1**	**Ongoing**
11	Continue to improve scientific understanding of groundwater recharge and groundwater- surface water interactions	**Near Term/ Ongoing**	**1**	**Ongoing**
12	Improve preparedness for responding to long-term trends and evolving issues; improve preparedness for responding to acute crises, such as water supply disruptions and multiyear drought conditions	**Long Term**	**3**	**2021**
Basin Analysis Report for the Napa Valley Subbasin (2016)				
13	Address groundwater monitoring data gaps to improve spatial distribution of water level measurements in the alluvial aquifer	**Near Term**	**1**	**Ongoing**
14	Evaluate and address groundwater monitoring data gaps to improve spatial distribution of water level measurements in the semi-confined to confined portions of the aquifer system	**Near Term**	**1**	**Ongoing**

Table 7-1 Napa Valley Subbasin Summary of Recommended SGMA Implementation Steps

Item	Summary Description	Implementation Time Frame[1]	Relative Priority Ranking [2]	Status/ Anticipated Completion
15	Implement Napa County groundwater quality monitoring program; includes water quality monitoring in a subset of current monitoring network wells	**Near Term**	**1**	**Ongoing**
16	Coordinate with existing discretionary permit applicants (e.g., wineries and others) regarding existing groundwater level and/or water quality information)	**Near Term**	**1**	**Ongoing**
17	Coordinate with RCD and others regarding current stream gaging and supplemental needs for SGMA purposes; consider areas that may also benefit from nearby shallow nested groundwater monitoring wells (similar to LGA SW/GW facilities)	**Near- to Mid Term**	**2**	**Ongoing**
18	Install test hole(s) and multiple completion monitoring wells at south end of Napa Valley Subbasin/Napa Sonoma Lowlands Subbasin for improved understanding of freshwater/salt water interface	**Mid Term**	**2**	**2021 - 2022**
19	Evaluate strategic recharge opportunities, particularly along Subbasin margin and in consideration of hydrogeologic factors and O'Geen (2015) mapping. Evaluate approaches for retaining and using stormwater and/or tile drain water to increase water conservation, examining opportunities to reduce pumping and streamflow diversions, potentially lessening streamflow effects during drier years or drier periods of the year, and creating additional climate resiliency through targeted recharge strategies	**Near- to Mid Term**	**2**	**Ongoing**
20	Evaluate distribution of Groundwater Dependent Ecosystems and relationships to depth to groundwater; coordinate evaluation with BMPs or guidance developed by DWR, Nature Conservancy, California Native Plant Society or others	**Near Term**	**1**	**Underway/2021**

Table 7-1 Napa Valley Subbasin Summary of Recommended SGMA Implementation Steps

Item	Summary Description	Implementation Time Frame[1]	Relative Priority Ranking [2]	Status/ Anticipated Completion
21	Review of and coordination with BMPs published on DWR's web site	**Near Term**	**1**	**Ongoing**
22	Evaluate and address uncertainties in historical water budgets to improve calibration of budget components and reduce uncertainty of projected future water budgets.	**Near- to Mid Term**	**1-2**	**2021**
23	Revise the standard Conditions of Approval used by Napa County for discretionary projects to include, for all future projects, groundwater monitoring and water use monitoring, reporting data to the County when requested, and use of project wells for monitoring when requested and needed to support this plan, and provisions for permit modification based on monitoring results	**Near Term**	**2**	**Complete**
24	Expand the capacity to encourage groundwater stewardship/groups through education, facilitation, and equipment	**Near- to Mid Term**	**2**	**Ongoing**
25	Develop an improved understanding of surface water and groundwater uses in unincorporated areas in the County and trends in those uses	**Near Term**	**1**	**2021**
Northeast Napa Management Area Report - An Amendment to the 2016 Basin Analysis Report for the Napa Valley Subbasin (2018)				
26	Expand and improve the groundwater flow model developed for the Northeast Napa Special Groundwater Study (LSCE, 2017b) to facilitate further regional groundwater analyses and assessment of streamflow depletion required for continued SGMA implementation.	**Near- to Mid Term**	**1**	**2021**

Table 7-1 Napa Valley Subbasin Summary of Recommended SGMA Implementation Steps

Item	Summary Description	Implementation Time Frame[1]	Relative Priority Ranking [2]	Status/ Anticipated Completion
27	Expand the existing network of dedicated surface water/groundwater monitoring facilities and construct shallow nested groundwater monitoring wells east of the Napa River in the vicinity of Petra Drive.	**Mid Term**	**1**	**2021**
28	For discretionary projects in the Northeast Napa Management Area, additional project-specific analyses (Napa County Water Availability Analysis-Tier 2) will be conducted to ensure that the proposed project location or planned use of groundwater does not cause an undesirable result. In addition, the Napa County Board of Supervisors has directed staff to update the Napa County Groundwater Ordinance to reflect the additional requirements for project-specific analysis and to incorporate water use criteria and water use reporting requirements for the Management Area using an approach similar to what has already been implemented in the MST Subarea.	**Near Term**	**1**	**Initiation in 2018, then ongoing**
29	As a precautionary measure, Napa County will track new non-discretionary groundwater wells constructed in the Northeast Napa Management Area, including their planned usage and location.	**Near Term**	**2**	**Initiation in 2019, then ongoing**
30	Develop appropriate standards and require that pumping test data be collected when new production wells are constructed in areas where the distribution of hydraulic conductivities is less known, including the Northeast Napa Management Area east of the Napa River and in deeper geologic units throughout the rest of the Napa Valley Subbasin.	**Mid Term**	**1**	**Initial standards developed by 2019, then ongoing**

[1] Implementation schedule reflects relative multi-year time frames for completing or conducting the task. Near, Mid, and Long Terms are reflective of 3, 5, and 10-year periods.

[2] Priority ranking is on a scale of 1 to 3 with 1 being the highest priority and 3 being the lowest.

7.1 Update the Napa County GSA Stakeholder Communication and Education Plan (SGMA Implementation Recommendation 5.1b and 5.2a)

GSA staff, consultants and the GSPAC developed the Napa County Groundwater Sustainability Agency Stakeholder Communication and Engagement Plan (CEP) which was adopted by the GSA and submitted to DWR as a deliverable under its Proposition 68 Sustainable Groundwater Management Program Grant in December 2020 (CONCUR, 2020). The CEP provides guidance to the GSA to create meaningful opportunities for a broad range of stakeholders to learn about and share their concerns and ideas regarding groundwater management in order to develop and implement an effective GSP.

7.2 Expand the Capacity to Encourage Groundwater Stewardship (SGMA Implementation Recommendation 24)

Napa County continues to encourage groundwater stewardship through many programs and activities, as it has for many decades. Through collaborations with the U.S. Geological Survey to monitor groundwater conditions beginning in the 1960s to current efforts to work with stakeholders to implement the Sustainable Groundwater Management Act (SGMA), the County has consistently recognized the need to empower water users to better understand groundwater conditions.

Since 2014, Napa County has developed annual groundwater conditions reports that summarize activities implemented as part of the County's Comprehensive Groundwater Monitoring Program. The annual reports include summaries of current monitoring activities and additionally recommended groundwater monitoring needed to fill specific data gaps, and activities implemented since 2014 (see **Section 1.2.6**). Since 2017, Annual Reports have also presented an update on both groundwater conditions and water use in the Napa Valley Subbasin as required for SGMA Annual Reports by Section 356.2 of the GSP Regulations.

Since 2016, Napa County has expanded its efforts to empower County residents to monitor and understand groundwater conditions in wells that they own through the Do It Yourself (DIY) Groundwater Level Monitoring Program.[55,56] The County maintains an acoustic groundwater level sounder and makes it available to residents as a short-term free rental. In addition to providing the acoustic sounder, County staff also provide training to residents who use the sounder to ensure that they collect accurate data. The program has been advertised in the Napa County Resource Conservation District (Napa RCD) and Napa County Farm Bureau newsletters, direct emails through the Napa Valley Grapegrowers Association and Napa Valley Vintners, promoted on the County's social media channels, and hosted on the County and WICC websites. Promotion of the Do It Yourself (DIY) Groundwater Level Monitoring Program (during community events, meetings and lectures) will continue in the future to increase awareness and participation.

[55] https://www.napawatersheds.org/files/managed/Document/7964/DIYmonitoring_flyer.pdf

[56] https://www.napawatersheds.org/DIY-monitoring-program

In July 2017, Napa County published the *Well Owners Guide, A Guide for Private Well Owners in Napa County* (Guide) (Napa County, 2017).[57] This 23-page document communicates important concepts, including state and local standards for well construction, well permitting requirements, the importance of regular well maintenance, and land use practices to limit risks to groundwater quality. The Guide also answers frequently asked questions about the County's Voluntary Groundwater Monitoring Program and provides information on the County's Do It Yourself (DIY) Groundwater Level Monitoring Program. The Guide is available on the WICC website and on the County groundwater webpage.[58,59]

In December 2020, the GSA published a website to provide a central resource for information on SGMA planning efforts, including GSP development for the Napa Valley Subbasin.[60] The GSA website includes Frequently Asked Questions and an interactive web map providing access to groundwater and surface water data collected by the County as well as state and federal agencies. Draft GSP Sections, or chapters, are also posted to the GSA website to encourage public review and comment on the GSP while it is under development.

7.3 Napa Valley Groundwater Model Development (SGMA Implementation Recommendation 25)

The Napa County GSA is developing a numerical model to support the Napa Valley GSP as a robust tool for evaluating historical, current, and projected water budgets for the Napa Valley Subbasin consistent with the requirements of State GSP Regulations. The Napa Valley Integrated Hydrologic Model (NVIHM) is being developed using software developed by the U.S. Geological Survey that is referenced in SGMA guidance documents published by DWR. The NVIHM will promote water resources sustainability by applying best-available tools and data to inform water users, stakeholders, and decision-makers about the status of water resources and options for maintaining sustainability.

In 2020, efforts focused on developing NVIHM input files related to the geologic formations present in the Napa Valley Subbasin, surface water channels significant to the management of the Subbasin, and inflows of water to the Subbasin from precipitation and runoff from the surrounding watersheds. In October 2020, the GSPAC received a presentation from LSCE on the hydrogeologic conceptual model that informs the design of the NVIHM. In November 2020, the GSPAC heard a presentation from Paul Wells, of DWR, on State requirements and guidance for incorporating climate change analyses as part of projected water budgets evaluated in GSPs. Also in November 2020, the GSPAC heard a presentation from Dr. Lisa Micheli, of Pepperwood Preserve, on climate change projections developed for North Bay counties including Napa County and the suitability of those climate change projections for supporting the GSP water budget analysis.

[57] https://www.napawatersheds.org/files/managed/Document/8773/20170720_Well_Owners_Guide_Final.pdf

[58] https://www.napawatersheds.org/groundwater

[59] https://www.countyofnapa.org/1230/Groundwater

[60] https://www.countyofnapa.org/3074/Groundwater-Sustainability

In 2021 to date, the GSPAC has received three additional presentations on the NVIHM describing the model design and development process, as well as initial water budget results. During the remainder of 2021, model results will continue to be presented to the GSPAC for use in informing the Committee's input on refinements to sustainable management criteria for the Subbasin.

7.4 Developing Best Available Water Use Data (SGMA Implementation Recommendation 25)

Water use tracking and reporting is an important aspect of sustainable groundwater management, as recognized in the State GSP Regulations. The Napa County GSA continues efforts to acquire and update datasets for water use in the Napa Valley Subbasin in support of SGMA planning and implementation activities. These efforts have included acquisition of groundwater, surface water, and recycled water production and use data from municipalities and the Napa Sanitation District as well as annual reports of surface water diversion and small public water system annual water use reports acquired from SWRCB. These data are very important for informing water budget analyses that account for water use and deliveries of water to the Subbasin, as required by SGMA.

Napa County is also developing an electronic application and database to facilitate tracking water use data reported by groundwater permit holders with a requirement to report their use to the County. The application will improve efficiency data management and reporting efficiency for the County and a more convenient reporting method for permit holders.

In addition, Napa County is updating its well permitting database to improve the capture of data regarding well locations and construction details, informed by an existing well completion report database maintained by DWR.

7.5 Evaluation of Groundwater Dependent Ecosystem Water Use

As described in **Section 6.1.4**, an analysis of groundwater use by Groundwater Dependent Ecosystems (GDEs) was conducted for water year 2020. The analysis improves the understanding of groundwater use by GDEs relative to other users in the Subbasin.

During 2020, in cooperation with the WICC and the Napa RCD, Napa County continued to collect observations about streamflow conditions within the Napa Valley Subbasin through the Stream Watch Program.[61] Over 450 observations were recorded at 26 sites by trained volunteers during Water Year 2020. total (**Figure 5-28**). These observations provide a complement to traditional stream gage sites in the Subbasin, by providing an understanding of streamflow conditions as they change throughout the year over a broader area. Knowledge of when wetted channels appear and recede is important in understanding baseflow influences on GDEs, including fish and other aquatic species.

[61] https://www.napawatersheds.org/streamwatch

7.6 Coordination with Other Water Management and Planning Programs

7.6.1 Integrated Regional Water Management Plans

Integrated Regional Water Management (IRWM) is defined by DWR as "a collaborative effort to identify and implement water management solutions on a regional scale that increase self-reliance, reduce conflict, and manage water to concurrently achieve social, environmental, and economic objectives" (DWR, 2015).

Napa County's Participation in San Francisco Bay Area and Westside Sacramento IRWMPs

In 2005, the County formed the Napa County regional water management group (RWMG), a working group of local water agencies, where the Napa County Flood Control and Water Conservation District served as the lead agency. The County RWMG worked together to draft the Napa-Berryessa Integrated Regional Water Management Plan (IRWMP) Functional Equivalent (Napa-Berryessa Regional Water Management Group, 2005).

In 2009, DWR established IRWM regions that have been accepted through the Regional Acceptance Process (DWR, 2009). Currently, there are two formally accepted regions that include Napa County; these regions are: 1) the San Francisco Bay Area Region (which covers the generally southern part of Napa County and focuses on the Napa River and Suisun Creek watersheds), and 2) the Westside Sacramento Region (which covers the generally northern part of Napa County and focuses on the Putah Creek/Lake Berryessa watershed; the Westside Region also covers parts of Yolo, Solano, Lake, and Colusa Counties).

The County is contributing to the two regional IRWMPs. The County collaborates with the San Francisco Bay and Westside RWMGs to update the Plans according to DWR guidance and IRWM funding availability (San Francisco Bay[62], Kennedy Jenks et al., 2013; Westside Sacramento Region[63], Kennedy Jenks, 2019). The Bay Area IRWMP, which includes the Napa Valley Subbasin, was most recently updated in 2020. The County's representation and participation in both the San Francisco Bay and Westside IRWMPs enables further coordination and sharing of information on water resources management planning programs and projects (particularly those that are a high priority for the County) and other information for IRWMP grant funding and implementation locally and across the region.

7.6.2 Watershed Information and Conservation Council (WICC) of Napa County (SGMA Implementation Recommendations 5.1b, 5.2a, 7, and 25)

The WICC[64] was established in 2002 to serve as an advisory committee to Napa County Board of Supervisors – assisting with the Board's decision making and serving as a conduit for citizen input by gathering, analyzing, and recommending options related to the management of watershed resources

[62] http://bayareairwmp.org/

[63] http://www.westsideirwm.com

[64] Prior to 2015 this organization was named the Watershed Information Center and Conservancy.

(WICC, 2015). The WICC has achieved significant accomplishments in its 18-year history – both alone and in partnership with nonprofits, public agencies, and private landowners.

The WICC Mission is: improving the health of Napa County's watersheds by informing, engaging, and fostering partnerships within the community.

The 2015 WICC Strategic Plan outlines five goals, including (WICC, 2015):

- Goal 1: Coordinate and facilitate watershed planning, research, and monitoring efforts among Napa County organizations, agencies, landowners, and citizens.
- Goal 2: Strengthen and expand community understanding, connections, and involvement to improve the health of Napa County's watersheds.
- Goal 3: Support informed decision-making on topics that affect the health of Napa County's watersheds.
- Goal 4: Improve WICC Board efficiency and effectiveness.
- Goal 5: Explore additional funding opportunities to support the goals of the WICC.

Additionally, Subgoal 1B to Goal 1 includes the WICC serving as the local clearinghouse for groundwater resource data, mapping, and monitoring (Implements: Napa County General Plan Action Item CON WR-4). As part of developing education and outreach for the community regarding groundwater conditions, the WICC is expanding groundwater information on the WICC website by offering an online groundwater information portal: www.napawatersheds.org/groundwater. This portal provides groundwater summary data and graphs for the County's groundwater basins and/or subareas that are delineated on the website's interactive maps. Data are displayed at the watershed scale and are not project or parcel specific. Information includes:

- Updates on groundwater resource issues locally and throughout California,
- Articles explaining key technical issues related to groundwater,
- Updates on groundwater mapping and monitoring in Napa County, including copies of groundwater reports and studies,
- Educational materials and resources on groundwater recharge areas and ways to improve these areas,
- Report on the Napa County Voluntary Groundwater Level Monitoring Program, and
- Educational guides, resources, and videos.

Napa County conducted public outreach regarding the status of SGMA implementation and groundwater conditions in several ways in 2020. County staff provided an update on groundwater conditions and GSP development to the WICC in February and October 2020. In March and June 2020 County staff and LSCE presented at the GSA Board meetings with updates on the GSP scope and schedule and an annual groundwater conditions update focusing on the Water Year 2019 Annual Report, respectively.

The WICC has supported continued efforts to refine the groundwater monitoring network in Napa County by publicizing outreach maps at public meetings. **Figure 7-2** depicts six areas of interest for monitoring network expansion and refinement, previously presented to the WICC. The areas of interest were identified through an ongoing review of currently monitored wells, including the distribution of wells and their exposure to different aquifer zones and geologic formations. WICC members and Napa County staff have worked to recruit new wells to the voluntary monitoring network within the areas of interest through individual outreach and publication in WICC email newsletters.

Throughout 2020, the County continued to provide notifications of new document availability and public meetings through the WICC's automated weekly news digest, distributed by email on the Thursday mornings The County also communicated with stakeholders and the public regarding SGMA implementation using a groundwater email listserv that it maintains as a list of SGMA interested parties, currently with over 230 recipients. Seventeen SGMA-specific email announcements were sent to recipients on the listserv in 2020 announcing public meetings and the availability of draft GSP Sections for public review and comment.

7.7 Northeast Napa Management Area Designation

Following completion of the Basin Analysis Report, Napa County undertook the Northeast Napa Special Groundwater Study (Special Study) to refine the understanding of groundwater conditions in a study area within the Napa Valley Subbasin. The Special Study was referenced as a planned implementation activity in the Basin Analysis Report.

At their meeting on October 24, 2017, the County BOS supported the findings and recommendations of the Special Study Report and directed staff to develop documentation to formally establish the Northeast Napa Management Area covering approximately 4% or 1,960 acres within the 45,928-acre Napa Valley Subbasin (**Figure 2-8**). In response, Napa County developed an Amendment to the Basin Analysis Report for the Napa Valley Subbasin (the Northeast Napa Management Area Report) (LSCE, 2018a). The County BOS approved the Amendment for submittal to DWR on March 20, 2018.

The Amendment is a supplement to the Basin Analysis Report for the Napa Valley Subbasin, the purpose of which is to designate a management area within the Napa Valley Subbasin: The Northeast Napa Management Area. GSP Regulations adopted by the California Water Commission in 2016 define a management area as, "an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors" (GSP Regulations Section 351).

The 2018 Amendment was developed as a supplement to the Basin Analysis Report for the Napa Valley Subbasin, demonstrating Napa County's active commitment to ensuring the sustainability of the Subbasin. The 2018 Amendment does not change the findings of the 2016 Basin Analysis Report, rather it provides additional detail about conditions in the Northeast Napa Management Area and establishes additional sustainable management criteria and management actions intended to support continued groundwater sustainability in the Napa Valley Subbasin as a whole.

The 2018 Basin Analysis Report Amendment includes refined definitions for undesirable results[65] in the Napa Valley Subbasin by considering the possibility of future localized conditions that could create significant and unreasonable effects in the Northeast Napa Management Area that may not be experienced throughout the Subbasin due to local geologic conditions. By refining the definitions for undesirable results in this manner, this Amendment intends to be protective of conditions within the Management Area to an even greater degree than would occur if the Management Area were not designated.

The 2018 Amendment designates seven representative monitoring sites as a subset of the monitoring sites in the Northeast Napa Management Area for the purpose of monitoring groundwater conditions that are representative of the management area, consistent with the GSP Regulations (Section 354.36). For SGMA purposes for the Napa Valley Subbasin, these seven sites are where sustainability indicators are monitored, and minimum thresholds and measurable objectives are defined. Many sites are monitored for more than one sustainability indicator. Four of the representative sites designated for the Northeast Napa Management Area were previously designated as representative sites for the Napa Valley Subbasin. The sustainability criteria established for those sites in the 2016 Basin Analysis Report were incorporated in the Amendment for tracking conditions in the Management Area. The seven representative monitoring sites for the Northeast Napa Management Area are part of a larger network of 21 sites for the overall Napa Valley Subbasin. More information on representative monitoring sites is available in **Section 3.1.2** and **Section 4.3**.

The Amendment presents Northeast Napa Management Area minimum thresholds for all six undesirable results described in SGMA. Minimum thresholds are set (in feet above mean sea level) to avoid chronic lowering of groundwater levels and reduced groundwater storage for seven representative monitoring sites. Minimum thresholds for surface water depletion due to groundwater extraction and use in the Subbasin are provided for two representative sites; for one representative monitoring site to avoid degraded groundwater quality (e.g., for nitrate); for one representative monitoring site (for chloride concentrations) to avoid seawater intrusion; and for two representative monitoring sites to avoid land subsidence.

Northeast Napa Management Area measurable objectives, or specific quantifiable goals for maintaining or improving groundwater conditions, are provided with respect to avoidance of chronic lowering of groundwater levels and groundwater storage depletion for seven representative monitoring sites. Measurable objectives for surface water due to groundwater extraction and use in the Subbasin are provided in this Amendment for two representative monitoring sites. The measurable objective to

[65] According to SGMA definitions, Undesirable Results include: chronic lowering of groundwater levels (overdraft); significant and unreasonable reduction of groundwater storage; significant and unreasonable seawater intrusion; significant and unreasonable land subsidence that substantially interferes with surface land uses and; depletions of interconnected surface water due to groundwater extraction and use in the Subbasin that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

maintain or improve groundwater quality is set for one representative monitoring site; for one representative monitoring site to avoid seawater intrusion; and for two representative monitoring sites to avoid land subsidence.

7.8 Tracking Well Permits and Construction (SGMA Implementation Recommendation 29)

In response to a recommendation approved by the Napa County Board of Supervisors in 2018, County staff began tracking and reporting on new wells constructed in the Northeast Napa Management Area. In 2020, that effort was expanded to include tracking of well permits and construction countywide. County records for well permits issued for new and replacement groundwater production wells were evaluated along with records of well completion reports for new groundwater production wells submitted to DWR by well drillers (**Figure 7-3**). County permit records include 50 permits issued in 2020 for new and replacement wells countywide. Nine of those permits were issued for parcels in the Napa Valley Subbasin, one of which was also in the Northeast Napa Management Area. Three permits were issued for parcels in the Napa-Sonoma Lowlands Subbasin. Well completion reports submitted to DWR by well drillers include 45 new groundwater production wells. Of those well completion reports, twenty are for wells located in the Napa Valley Subbasin and two are for wells located in the Napa-Sonoma Lowlands Subbasin. Information developed by the Napa County GSA indicates that there are approximately 2,600 groundwater production wells in the Napa Valley Subbasin. Information developed by DWR as part of the 2019 Basin Prioritization indicates that there are approximately 280 production wells in the Napa-Sonoma Lowlands Subbasin.

7.9 Revised Conditions of Approval for Discretionary Permits (SGMA Implementation Recommendation 23)

In 2017 Napa County staff revised the standard Conditions of Approval (CoA) used by the Planning, Building, and Environmental Services Department when recommending County approval of discretionary projects proposing to use groundwater as a source of supply. The revised CoA requires that permittees monitor groundwater levels in project wells and record amounts of groundwater pumped at regular intervals. In addition, permittees are required to report those data to the County and make project wells available as part of the County's groundwater monitoring program, subject to certain conditions. The revised CoA language is excerpted below.

> ***GROUND WATER MANAGEMENT – WELLS***
>
> *This condition is implemented jointly by the Public Works and PBES Departments:*
>
> *The permittee shall be required (at the permittee's expense) to record well monitoring data (specifically, static water level no less than quarterly, and the volume of water withdrawn no less than monthly). Such data will be provided to the County, if the Director of Planning, Building, and Environmental Services (PBES Director) determines that substantial evidence [1] indicates that water usage at the project is affecting, or would potentially affect, groundwater supplies or nearby wells. If data indicates the need for additional monitoring, and if the applicant is unable*

to secure monitoring access to neighboring wells, onsite monitoring wells may need to be established to gauge potential impacts on the groundwater resource utilized for the project. Water usage shall be minimized by use of best available control technology and best water management conservation practices.

In order to support the County's groundwater monitoring program, well monitoring data as discussed above will be provided to the County if the Director of Public Works determines that such data could be useful in supporting the County's groundwater monitoring program. The project well will be made available for inclusion in the groundwater monitoring network if the Director of Public Works determines that the well could be useful in supporting the program.

In the event that changed circumstances or significant new information provide substantial evidence [1] that the groundwater system referenced in this use permit would significantly affect the groundwater basin, the PBES Director shall be authorized to recommend additional reasonable conditions on the permittee, or revocation of this permit, as necessary to meet the requirements of the County Code and to protect public health, safety, and welfare.

1. Substantial evidence is defined by case law as evidence that is of ponderable legal significance, reasonable in nature, credible and of solid value. The following constitute substantial evidence: facts, reasonable assumptions predicated on facts; and expert opinions supported by facts. Argument, speculation, unsubstantiated opinion or narrative, or clearly inaccurate or erroneous information do not constitute substantial evidence.

7.10 SGMA Stakeholder Survey and Draft GSP Surveys

In January 2018, DWR finalized a Stakeholder Communication and Engagement guidance document advising local agencies implementing SGMA to develop a Communications and Engagement Plan to document local efforts to encourage stakeholder involvement in groundwater sustainability planning. GSP regulations developed by DWR require that local agencies document opportunities for stakeholders to engage in groundwater sustainability planning.

In June 2019, a stakeholder survey was prepared to help the County and GSA understand community interests and to guide outreach efforts specific to the Napa Valley Subbasin for SGMA purposes.[66] The survey was distributed to at least 1,740 recipients through the County's SGMA email listserv, the WICC weekly e-news emails, and through email distributions by other organizations. The County provided a summary of initial response received through mid-July at the July 2019 WICC meeting.

[66] The stakeholder survey is available online at

https://www.surveymonkey.com/r/NapaCounty-Groundwater-Stakeholder-Survey

The survey concluded in July 2020, having received 79 responses. Reponses were summarized and presented to the GSPAC in August 2020 along with a report on the key themes heard during a round of GSPAC member introductory interviews.

The GSA has continued using online surveys to receive GSPAC and public comments on draft GSP Sections and GSPAC input on sustainable management criteria for the Napa Valley Subbasin. A total of seven of these surveys have been prepared to date. Surveys available for public comment on draft GSP Sections are available on the GSA website at the following link:
https://www.countyofnapa.org/3081/Documents-Resources

8 SUMMARY AND RECOMMENDATIONS

Groundwater level monitoring was conducted at a total of 107 sites across Napa County in 2020, including 60 wells within the Napa Valley Subbasin (**Table 4-1** and **Table 4-2)**. The number and distribution of wells monitored in 2020 was consistent with monitoring conducted in recent decades and the objectives presented in the 2013 Groundwater Monitoring Plan, with a greater emphasis on areas where most groundwater use occurs.

Groundwater level trends in the Napa Valley Subbasin of the Napa-Sonoma Valley Groundwater Basin are stable in the majority of wells with long-term groundwater level records (see **Sections 5.1.1 and 5.1.2**). Data from the monitoring network reflect the Very Dry 2020 water year conditions; however, the variability in groundwater levels do not indicate long term depletions of the Subbasin's principal aquifer system.

Water year 2020 was categorized as a Very Dry year (12.19 inches) at a representative precipitation gage with the longest period of record in the Subbasin (see **Section 5**). Spring 2020 groundwater levels were lower than levels measured in spring 2019, which was a Wet year. Overall, groundwater levels in fall 2020 remained comparable to levels in recent years. Compared to the Very Dry 2007 water year, the most recent year with a similar annual precipitation total (15.19 inches), groundwater levels in spring and fall 2020 were generally slightly lower than levels recorded in 2007. In spring 2020, depths to water in the alluvial aquifer of the Napa Valley Subbasin in ranged from 7 feet to approximately 50 feet below ground surface (**Figure 5-5**).

Water year 2021 precipitation, as of the date of this report, has again trended well below the long-term average. Through mid-April 2021 the precipitation gages located around Napa County received about 40% of average rainfall for the first five and half months of the water year, when the majority of precipitation typically occurs.

Groundwater levels recorded in 2020 were above the minimum thresholds established as sustainability criteria in 13 of 20 SGMA Representative Wells with water level criteria (see **Section 5.1.3**). Three of the seven wells with minimum threshold exceedances are dedicated monitoring wells in the County's dedicated groundwater-surface water monitoring network where minimum thresholds were established in 2016 with only about two years of available data, with an acknowledgement that there would likely be a need for revision as data from a wider range of water years becomes available. All wells with subsequent available monthly monitoring data experienced water level recovery above the site-specific minimum thresholds over the subsequent months, even during the diminished wet season of water year 2021.

The reduction of groundwater levels below the minimum thresholds at seven of 20 Representative Wells does not constitute an undesirable result for the Subbasin according to the sustainable management criteria adopted in 2016 and 2018. These conditions are consistent with the Very Dry water year 2020 conditions and precipitation totals lower than the most recent Very Dry year in 2007 and similar to totals recorded during the 1976-1977 drought.

Consistent with the Very Dry water year condition, the volume of groundwater in storage decreased in 2020 by 24,707 acre-feet year over year resulting in a total storage volume of 196,651 acre-feet. From 1988 through 2020, the cumulative storage change recorded is a net decrease of 8,945 acre-feet in the Subbasin (**Table 5-4**). The volume of groundwater in storage calculated for Spring 2020 was below the average (209,407 acre-feet) and median (210,929 acre-feet) volumes calculated from 1988 to 2020.

Maps of saturated thickness and groundwater storage changes in the principal aquifer system show decreases in saturated thickness and groundwater storage throughout most of the Subbasin between spring 2019 and spring 2020 (**Figures 5-13 and 5-15**). These decreases are consistent with the considerable lack of precipitation in water year 2020. Decreases in saturated thickness occurred in the vicinity of Rutherford.

Changes in saturated thickness in the alluvial deposits of the Napa Valley Subbasin, the primary aquifer, and changes groundwater storage volume changes were also evaluated for the period from spring 2007 to spring 2020, for comparison with the most recent year with a similar precipitation total. Saturated thickness and groundwater storage volumes were slightly less in spring 2020 compared to spring 2007 (**Figures 5-14**). Groundwater storage volumes were generally 0 to 3 acre-feet per acre less in spring 2020 than in spring 2007 (**Figure 5-16**). Saturated thickness in spring 2020 was generally 0 to 10 feet less than conditions measured in spring 2007.

Total water use in the Napa Valley Subbasin, including groundwater extracted from the Subbasin, surface water from sources within the Napa River Watershed, and imported surface water delivered through the State Water Project, is estimated to have been 38,073 acre-feet in water year 2020 (**Table 6-6**). Total estimated groundwater use in the Subbasin was 17,933 acre-feet. Groundwater use for water year 2020 is presented along with values for 1988 – 2019 developed previously in **Figure 6-7**. The figure also includes calculated annual and cumulative changes in groundwater storage in the alluvial aquifer system of the Subbasin. As noted above, groundwater storage volume decreased in 2020 by 24,707 acre-feet. Cumulative changes in groundwater storage show a net decrease of 8,945 acre-feet from 1988 – 2020 in the principal aquifer of Napa Valley Subbasin (**Table 5-4**).

Groundwater use in water year 2020 was comparable to amounts used in recent years dating back to at least 2004 (**Figure 6-7**). Over the full 30-year period, annual storage changes in the aquifer system have fluctuated between positive and negative values, generally in accordance with the water year type (e.g. precipitation). Cumulative changes in groundwater storage have also fluctuated between positive and negative values, indicating long-term stable groundwater storage conditions, the absence of chronic depletions of groundwater storage, and an overall condition of a basin in balance. Groundwater use in the Subbasin in water year 2020 remained within the sustainable yield range of 17,000 to 20,000 acre-feet per year determined in 2016 (LSCE, 2016c). **Findings presented in this report regarding groundwater conditions at representative monitoring sites, changes in groundwater storage, and groundwater use demonstrate that the Napa Valley Subbasin has continued to be managed sustainably through 2020.**

For water year 2020, an additional analysis of groundwater use by Groundwater Dependent Ecosystems (GDEs)[67] was conducted to improve the understanding of their groundwater use relative to other users in the Subbasin (see **Section 6.1.4**).The GDE groundwater use analysis found that total groundwater use by GDEs, was between 3,492 acre-feet and 4,184 acre-feet during the months when groundwater would be the dominant source of water available to GDEs (**Table 6-7**). The result indicates that groundwater use by GDEs in water year 2020 was approximately 19% to 23% of the total groundwater use of 17,933 acre-feet by other uses and users in the Subbasin (**Table 6-6**). This analysis provides a quantitative point of comparison that will be useful going forward, along with updated GDE mapping, to understand the distribution and health of GDEs over time.

The results from the GDE water use analysis are not additive for the purposes of evaluating annual use of groundwater relative to the sustainable yield for the Subbasin. The prior analysis of sustainable yield addressed “withdrawals” from the Subbasin due to groundwater pumping and not outflows due to ET or subsurface outflows to the Lowland Subbasin, though the latter two components were explicitly addressed and the water budget analysis presented in 2016 (LSCE, 2016c). GDEs are among the beneficial users of groundwater in the Subbasin. The use of groundwater by GDEs represents one indication of the health of GDEs. The County is working to better understand and account for these uses of groundwater.

Although designated as a groundwater subarea for local planning purposes, the majority of the Milliken-Sarco-Tulucay (MST) subarea is not part of a groundwater basin or subbasin as mapped by DWR.[68] Groundwater level declines observed in the MST Subarea as early as the 1960s and 1970s have stabilized since about 2009 (see **Section 5.2**). Groundwater level responses differ within the MST Subarea and even within the north, central, and southern sections of this subarea, indicating localized conditions. The localized groundwater conditions are considered to be primarily influenced by the geologic setting or anthropogenic sources specific to the subarea. An expanding recycled water distribution system in the MST Subarea, supplied by the Napa Sanitation District, delivered 422 acre-feet of recycled water to users in the MST Subarea in water year 2020. Increased distribution and use of this new source of water along with continued land use permitting constraints are expected to aid in maintaining stable groundwater level conditions in the MST subarea.

[67] Groundwater Dependent Ecosystems were initially identified in the Basin Analysis Report based on a review of a draft dataset of potential groundwater dependent ecosystems under development by The Nature Conservancy, in collaboration with DWR and California Department of Fish and Wildlife (CDFW), as the Basin Analysis Report was being developed. The Napa Valley Subbasin GDEs include a variety of wetland and vegetation communities that may rely on groundwater as a water supply.

[68] For purposes of local planning, understanding, and studies, Napa County has defined groundwater subareas that cover the entire county. DWR separately delineates groundwater basins and subbasins, which do not cover the entire county (see **Section 2.1**).

8.1 Recommendations for Continued SGMA Implementation [69]

The following paragraphs provide an update on planned near-term activities, consistent with management recommendations supported by the Napa County Board of Supervisors in the Basin Analysis Report (LSCE, 2016c) and Northeast Napa Management Area Report (LSCE, 2018a) to maintain or improve groundwater conditions and ensure overall sustainability in the Napa Valley Subbasin. On December 17, 2019, the Napa County Board of Supervisors formed the Napa County GSA.

The Napa County GSA is now responsible for providing sustainable management of groundwater within the Napa Valley Subbasin and must develop and implement a GSP, with consideration of the beneficial uses and users of groundwater and interconnected surface waters, define undesirable results, set measurable objectives and minimum thresholds and establish monitoring programs, and prepare and submit annual reports to DWR. Although they have separate duties and responsibilities, the Napa County Board of Supervisors and the Napa County GSA have a shared obligation in taking actions to implement SGMA, thereby managing and ensuring the long-term sustainability of Napa County's groundwater resources.

8.1.1 Data Gap Refinement (SGMA Implementation Recommendations 11, 13, and 14)

Outreach to solicit wells for voluntary inclusion in the groundwater monitoring network will continue through the Napa County GSA, County, and Watershed Information and Conservation Council (WICC) websites, groundwater listserv emails, public presentations regarding groundwater conditions, and other means. Napa County will also continue to review discretionary projects recently approved by the County with conditions of approval requiring that project wells be made available for inclusion in the groundwater monitoring network.

Coordination with other County departments and other agencies that collect or utilize groundwater data could also provide additional data in areas of interest. Several local agencies, including the Town of Yountville, City of St. Helena, and City of Napa, already monitor groundwater levels at locations around the county.

8.1.2 Ongoing Water Quality Sampling (SGMA Implementation Recommendation 15)

Groundwater quality sampling is recommended to continue at select wells throughout the Napa Valley Subbasin and Napa-Sonoma Lowlands Subbasin. Additional water quality sampling for a reduced set of constituents, including nitrate and chloride, is also recommended for the five dual-completion monitoring wells constructed in 2014 at surface water-groundwater monitoring sites. Prior sampling at these sites occurred 2015 and 2018.

[69] The Basin Analysis Report for the Napa Valley Subbasin includes a comprehensive list of monitoring and management recommendations developed since 2011. Additional recommendations developed as part of the Basin Analysis Report and the Northeast Napa Management Area Report were added to the list in sequence, beginning at number 13. Recommendations 1 – 12 are referenced in this Section where applicable to ongoing activities.

8.1.3 Improve Data Collection and Evaluation from Discretionary Permittees Required to Monitor Groundwater Conditions and Groundwater Use (SGMA Implementation Recommendations 16 and 25)

Through coordination between the Napa County Public Works Department and Planning, Building, and Environmental Services Department, continue to improve procedures for receiving data reported by permittees required to report groundwater data and regularly incorporate those data into the Napa County Groundwater Data Management System (DMS).

As noted in **Section 7.4**, this effort is underway and includes development of an electronic application and database to facilitate tracking water use data reported by groundwater permittees.

8.1.4 Evaluate Strategic Recharge and Water Conservation Opportunities (SGMA Implementation Recommendations 8 and 19)

While additional data are being utilized to improve the understanding of water use by public water systems throughout the county, data gaps remain regarding water use on vineyards and other irrigated crops. As part of continued refinements of the water budget analysis for the Napa Valley Subbasin, it is recommended that the Napa County GSA hold workshops with agricultural industry representatives to develop a shared understanding of water use practices applied across the Subbasin, including irrigation, frost and heat protection, and tile drainage operations. In addition to providing shared information, the workshops would be held to further improve the calibration and parameterization of the Napa Valley Integrated Hydrologic Model (NVIHM)) and the water budget analysis being developed for the Napa Valley Subbasin GSP.

8.1.5 Evaluate Distribution of Groundwater Dependent Ecosystems; Coordinate Evaluation with Guidance Developed by DWR, Nature Conservancy, California Native Plant Society or Others (SGMA Implementation Recommendations 11 and 20)

With technical assistance from the Napa County Resource Conservation District (Napa RCD) and other local experts, the Napa County GSA will continue to review and implement guidance on evaluating GDEs released by The Nature Conservancy (Rhode et al., 2018 and Rhode et al., 2019), to refine the mapping and assessment of GDEs in the Napa Valley Subbasin. The GDE mapping and analysis included in the Napa Valley Subbasin GSP will also reflect guidance from TNC, CDFW, and others on approaches to considering the dependence on groundwater by endangered, threatened, and sensitive species present in the Subbasin (Rohde et al., 2019).

Part of this effort will include data collection using the Stream Watch website, with data collection occurring at 26 sites (see **Section 5.7** and **Section 7.5**). Through this approach, the GSA will collect standardized information and photographs documenting streamflow conditions at priority sites multiple times throughout the year. This information will complement existing stream gaging station data collected by Napa County, the Napa RCD, and U.S. Geological Survey.[70]

[70] see https://napa.onerain.com/

8.1.6 Update the Napa County Groundwater Ordinance for the Northeast Napa Management Area (SGMA Implementation Recommendation 28)

On October 24, 2017, the Napa County Board of Supervisors directed County staff to update the Napa County Groundwater Ordinance to reflect the additional requirements for project-specific analysis and to incorporate water use criteria and water use reporting requirements for the Northeast Napa Management Area using an approach similar to what has already been implemented in the MST Subarea. In response, Napa County Public Works Department and Planning, Building, and Environmental Services Department staff are coordinating resources to develop an update to the Groundwater Ordinance. The Planning, Building, and Environmental Services Department has developed specific mapping data to assist and alert its land use planners when a project is located in the Northeast Napa Management Area. For discretionary projects in the Northeast Napa Management Area, additional project-specific analyses (Napa County Water Availability Analysis-Tier 2) will be required to ensure that the proposed project location or planned use of groundwater does not cause an undesirable result (e.g., locate proposed wells at appropriate distances from surface water [or consider well construction approaches that avoid streamflow effects] and avoid mutual well interference to neighboring wells) (Napa County, 2015).

8.1.7 Continue to Implement Improvements to Napa County's Data Management System (SGMA Implementation Recommendation 1.1b)

GSP Regulations developed by DWR require GSAs to develop and maintain a data management system (DMS) to store and report information relevant to GSP development (Section 352.6). Napa County developed a DMS for its groundwater program in 2012 and has used the DMS since that time to support groundwater conditions monitoring and reporting. In 2020 and continuing in future years, additional DMS development is recommended to further incorporate additional data used for GSP development and to enable interactive visualizations of those data by SGMA stakeholders.

8.1.8 Develop Well Testing Standards (SGMA Implementation Recommendation 30)

Consistent with the recommendation approved by the Board of Supervisors in the January 2018 Amendment to the Basin Analysis Report, it is recommended that the Napa County GSA develop appropriate well testing standards and require that the standards be applied under certain circumstances. Testing standards will provide well owners and the Napa County GSA with improved data on aquifer properties and well productivity. It is recommended that the new well testing standards be required when new production wells are constructed in areas where hydraulic conductivity and other aquifer parameters are less well known, including the Northeast Napa Management Area east of the Napa River and in deeper geologic units throughout the rest of the Napa Valley Subbasin. Because older and less productive geologic formations occur near ground surface in the northeast Napa Area east of the Napa River, it is likely that pump tests will need to be performed for all new production wells in that area (**Figure 2-1).** Similar pump testing will be required for non-domestic production wells, and for wells that are completed in deeper geologic units below the Quaternary alluvium throughout the Napa Valley Subbasin.

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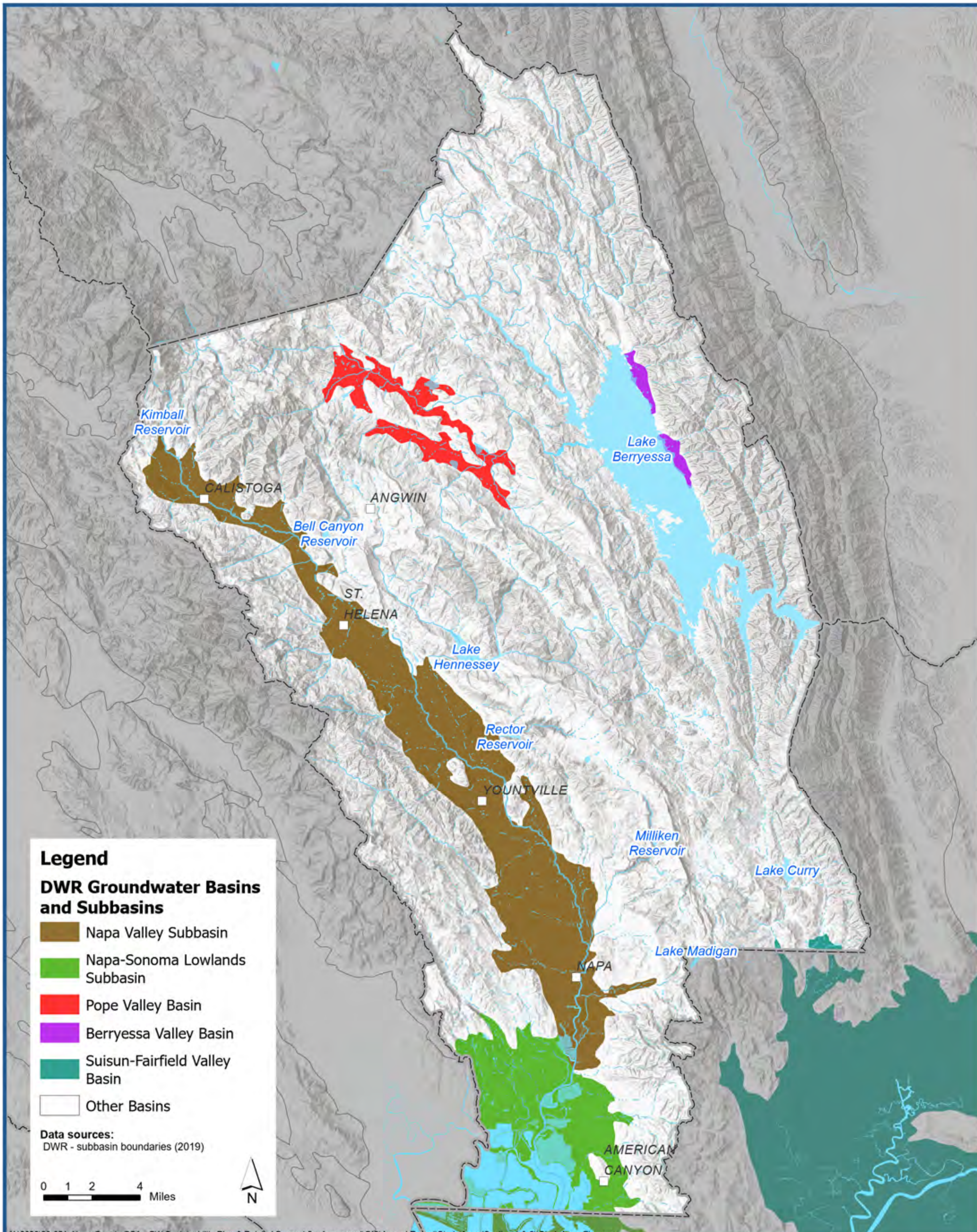
FIGURES



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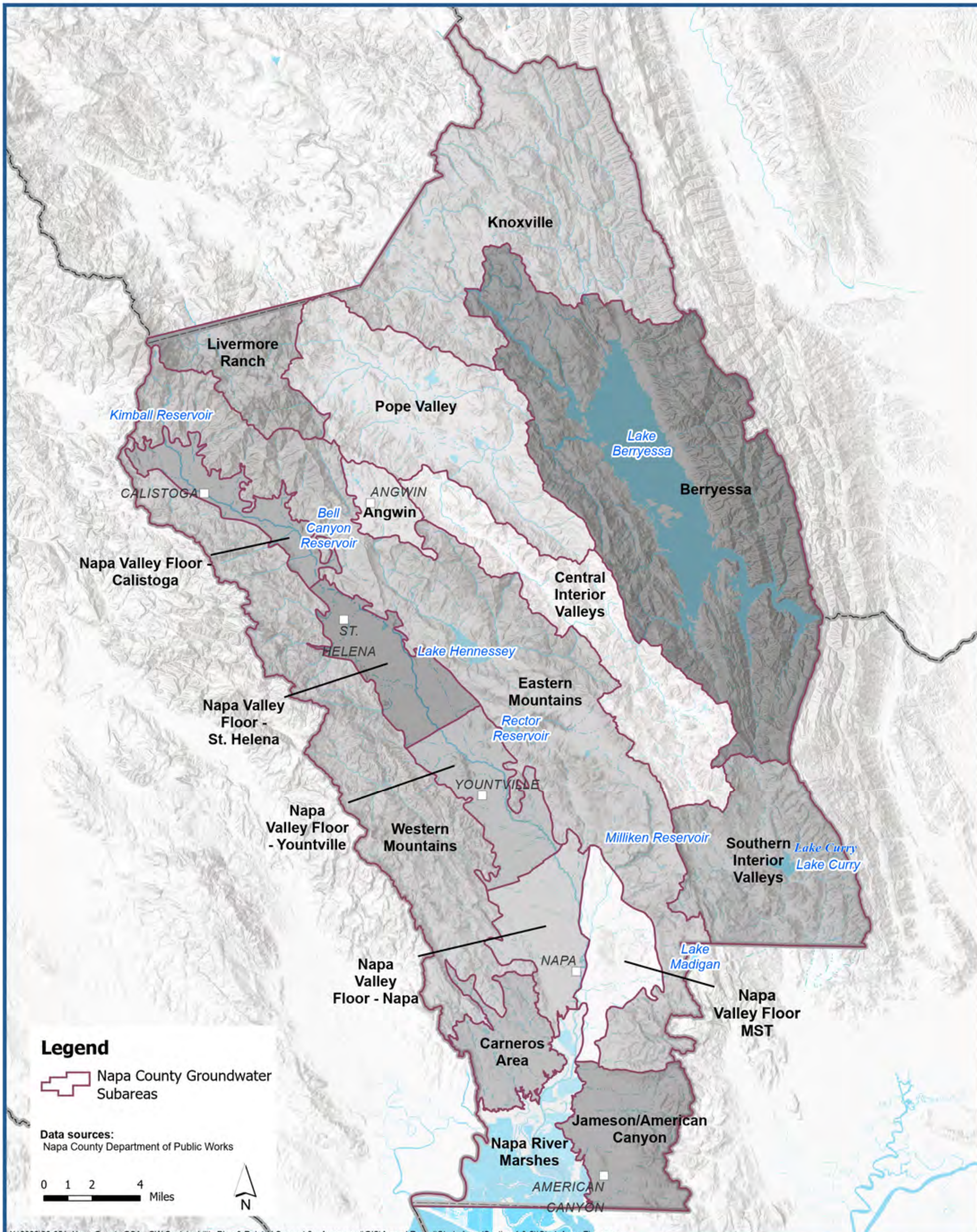
Groundwater Basins in Napa County

Figure 2-1

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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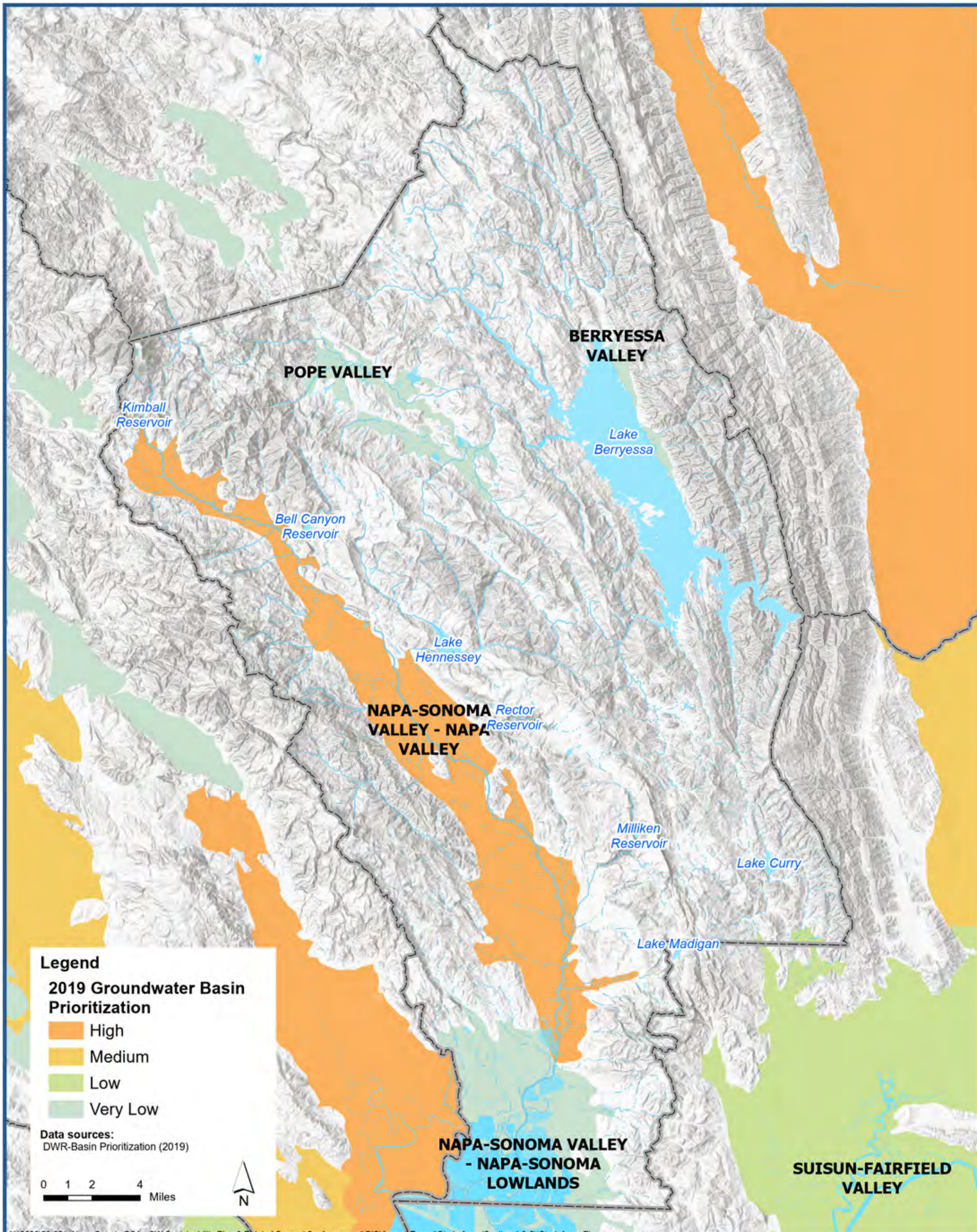
Napa County Groundwater Subareas

Figure 2-2

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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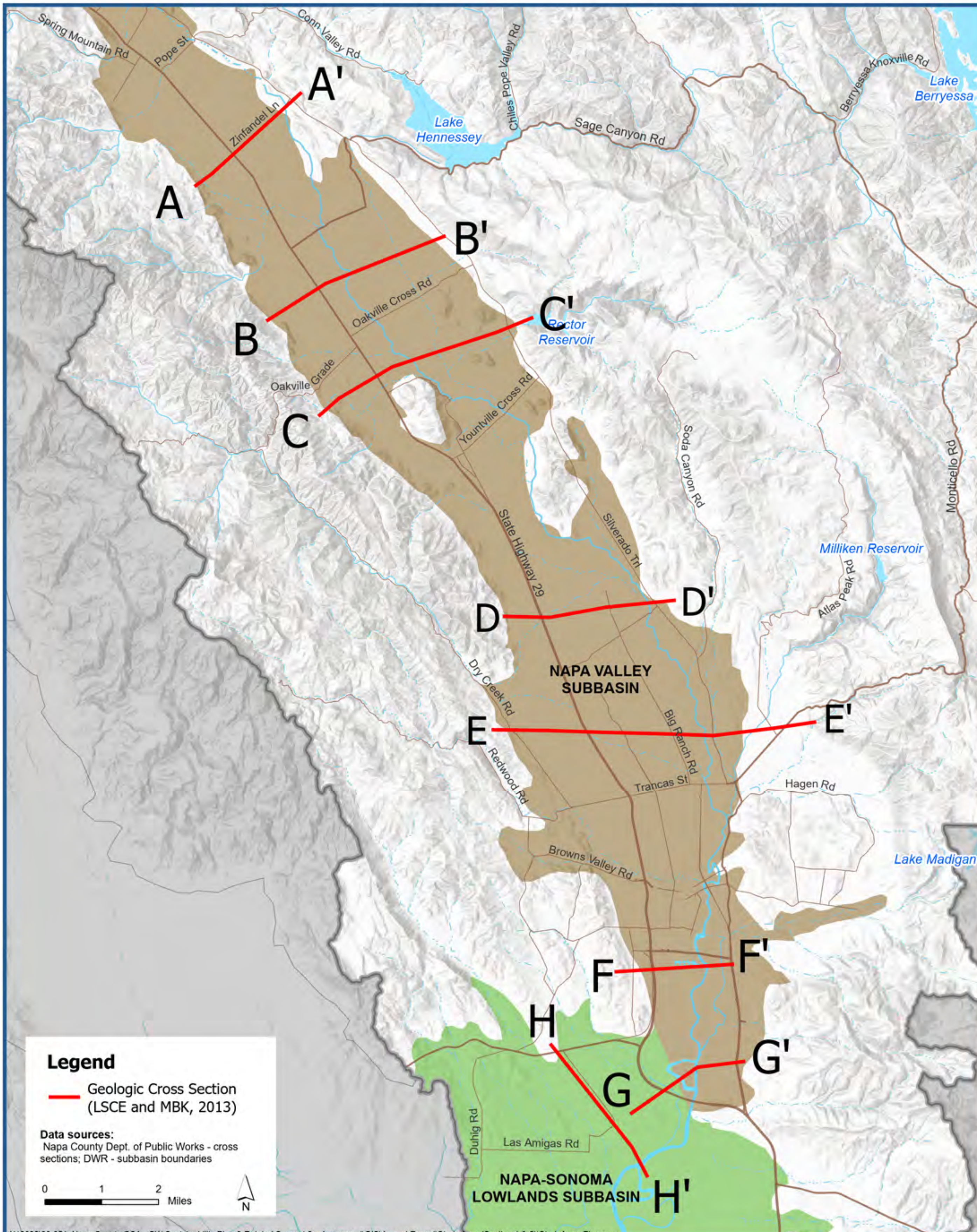
California Department of Water Resources Groundwater Basin Prioritizations

Figure 2-3

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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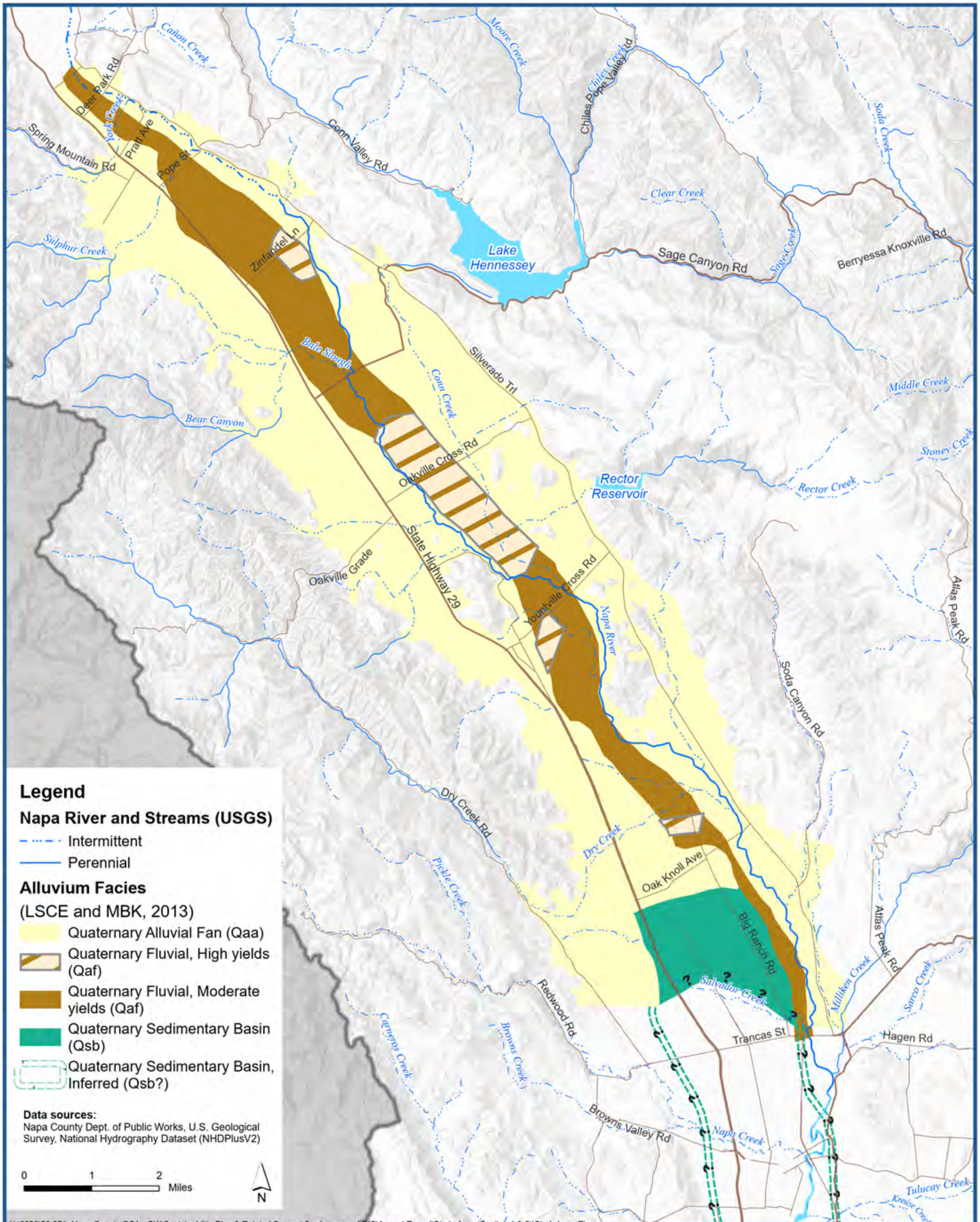
Updated Hydrogeologic Conceptualization
Geologic Cross Section Locations

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 2-4



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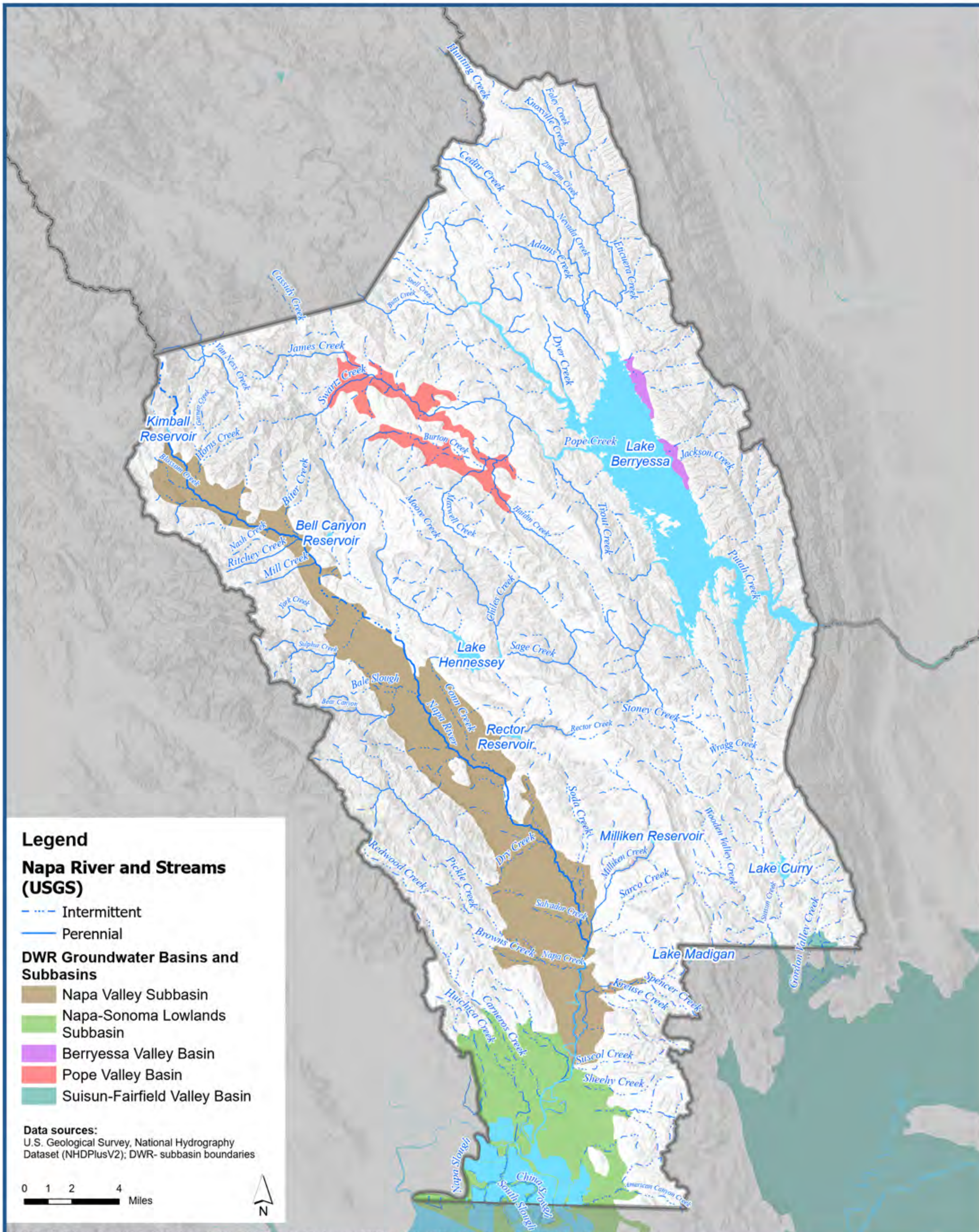
Streams and Alluvium Facies, Napa Valley Floor

Figure 2-5

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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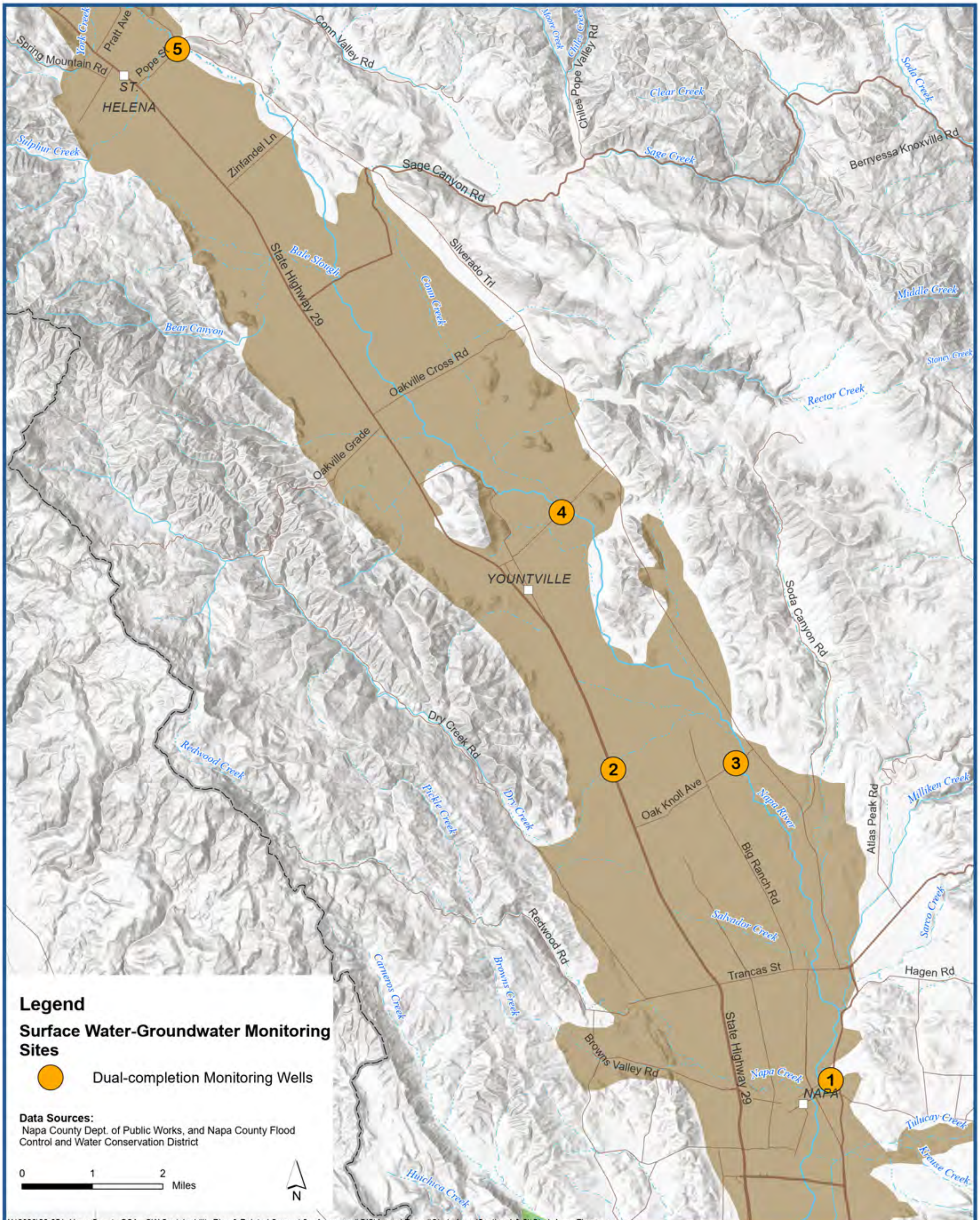
Perennial Streams and Intermittent Streams, Napa County

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 2-6



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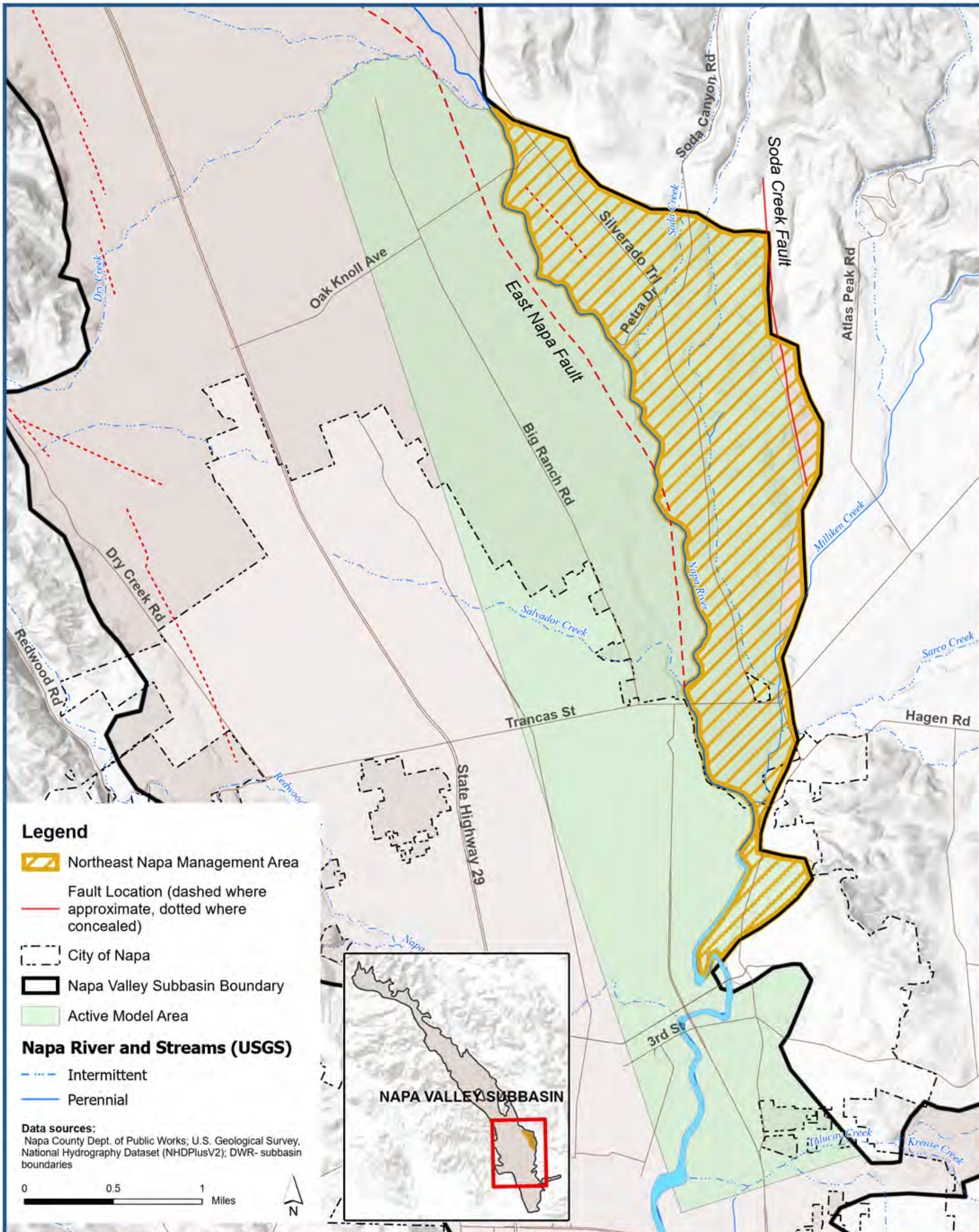
Napa County Surface Water-Groundwater Monitoring Sites

Figure 2-7

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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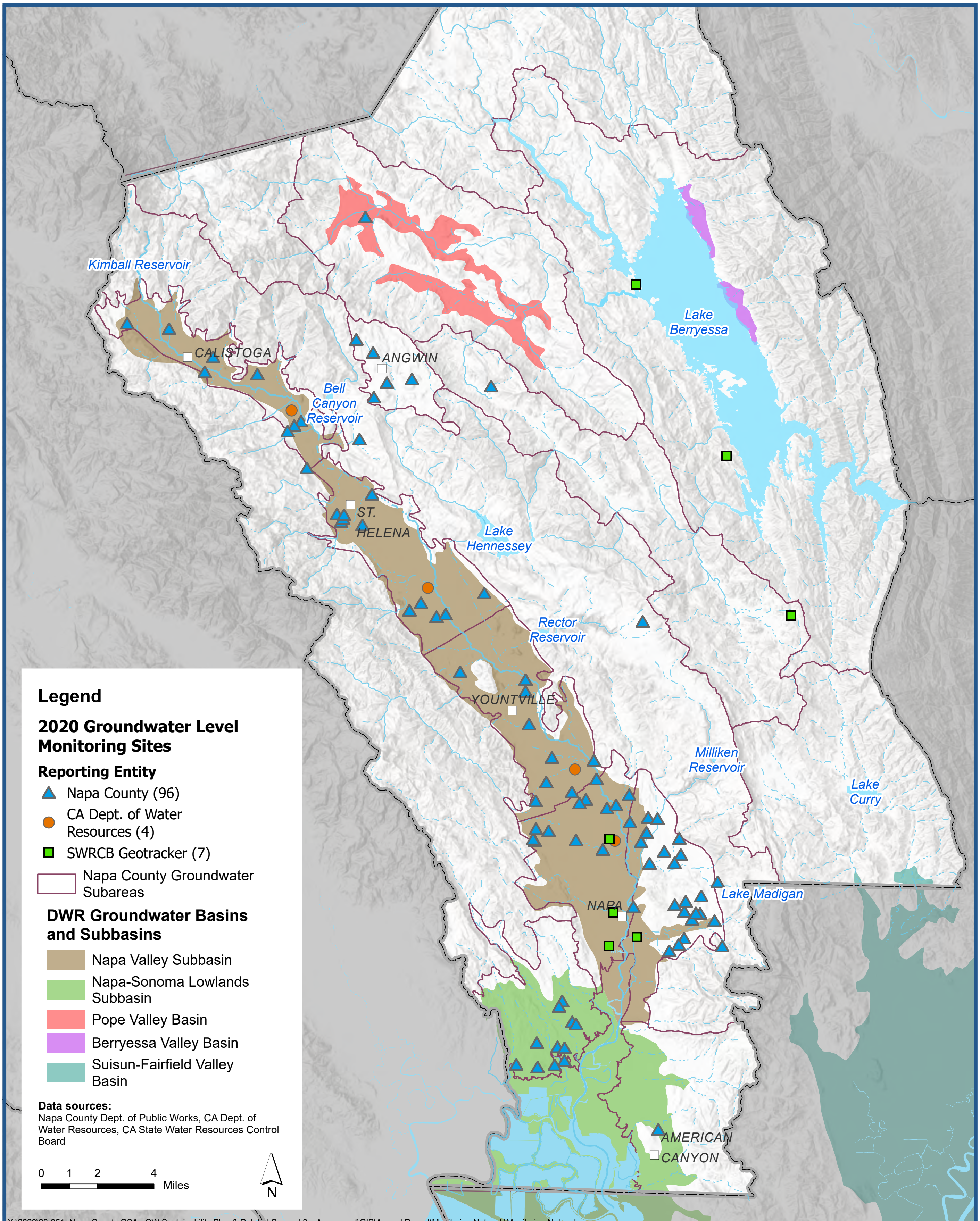
Napa Valley Subbasin: Northeast Napa Management Area

Figure 2-8

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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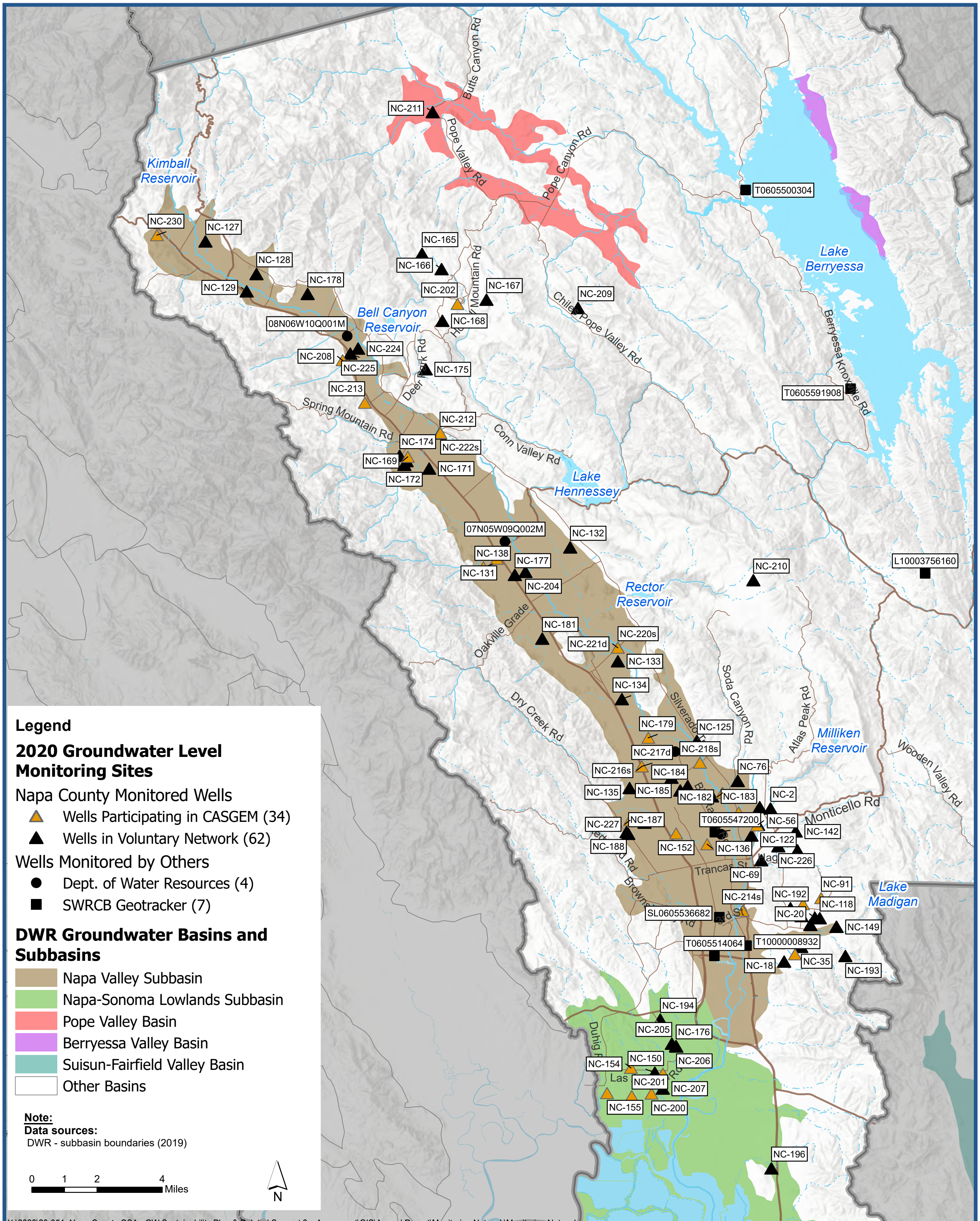
Current Groundwater Level Monitoring Sites by Reporting Entity

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 4-1



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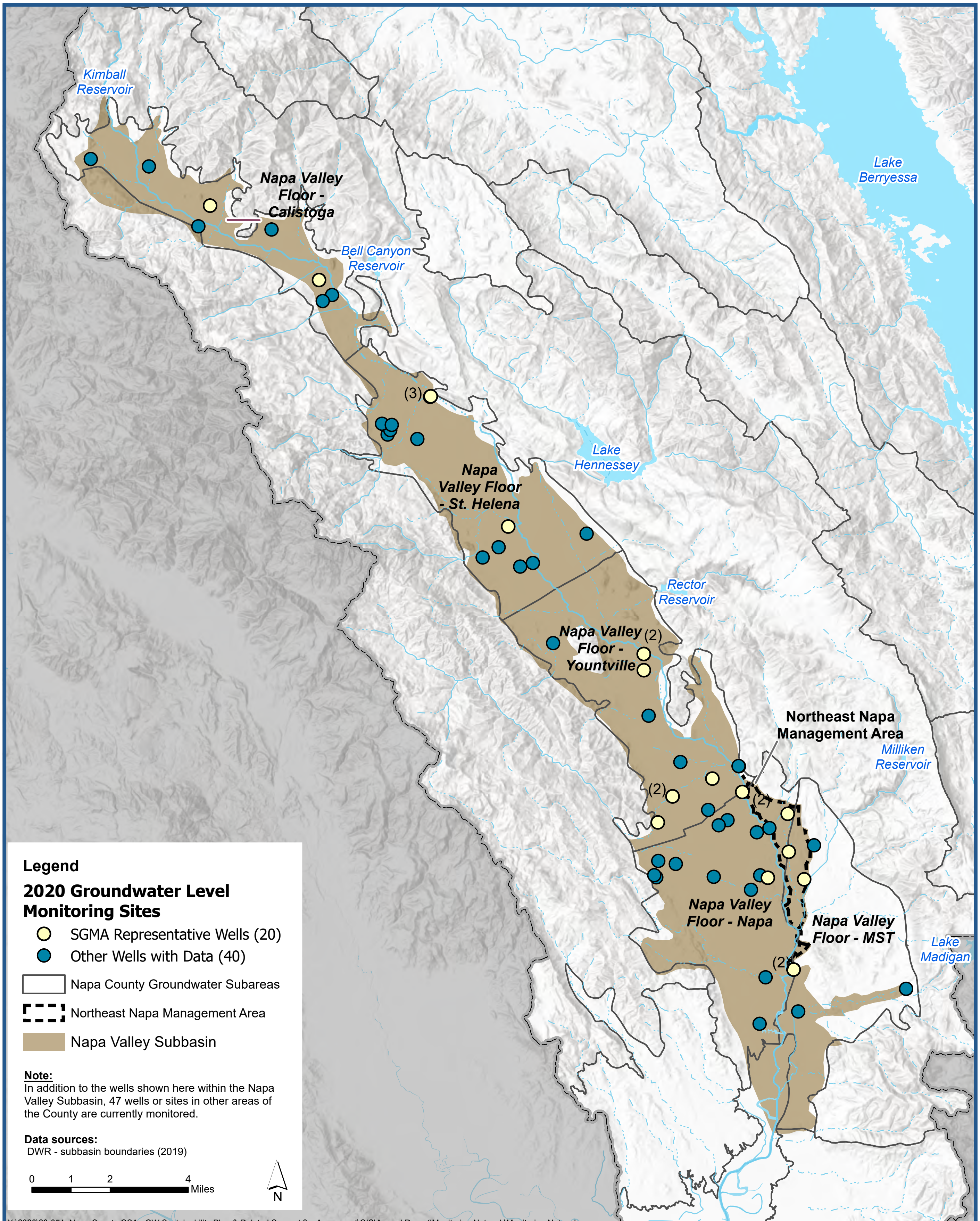
Current Groundwater Level Monitoring Network and CASGEM Sites, Napa County, CA

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 4-2



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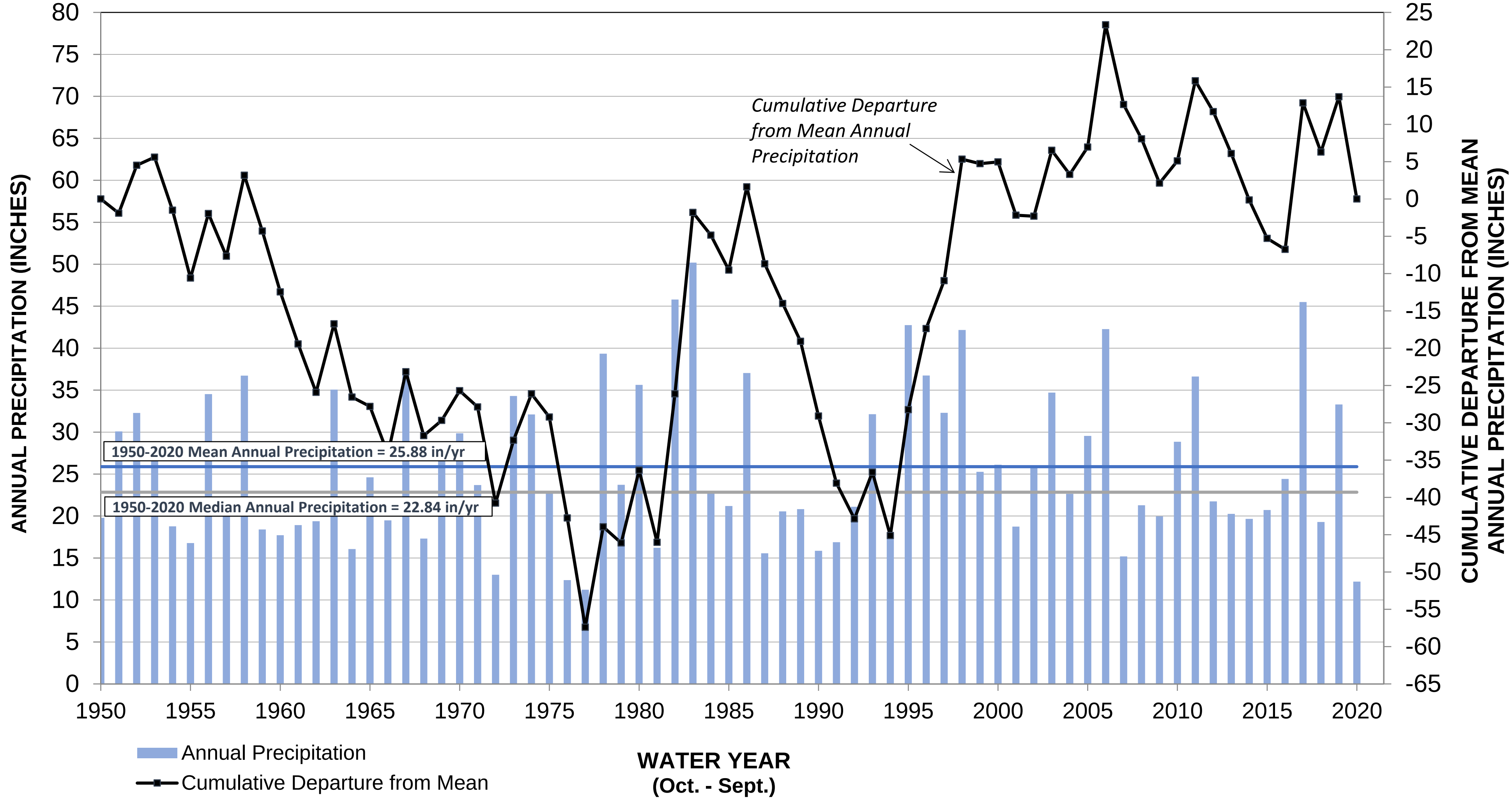
Representative Wells and Wells Utilized for Analyses in the Napa Valley Subbasin

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 4-3



NOTE: Gaps in this data record have been reconstructed using data from the Oakville CIMIS station (77) and NOAA Saint Helena, CA station (GHCND:USC0004764).

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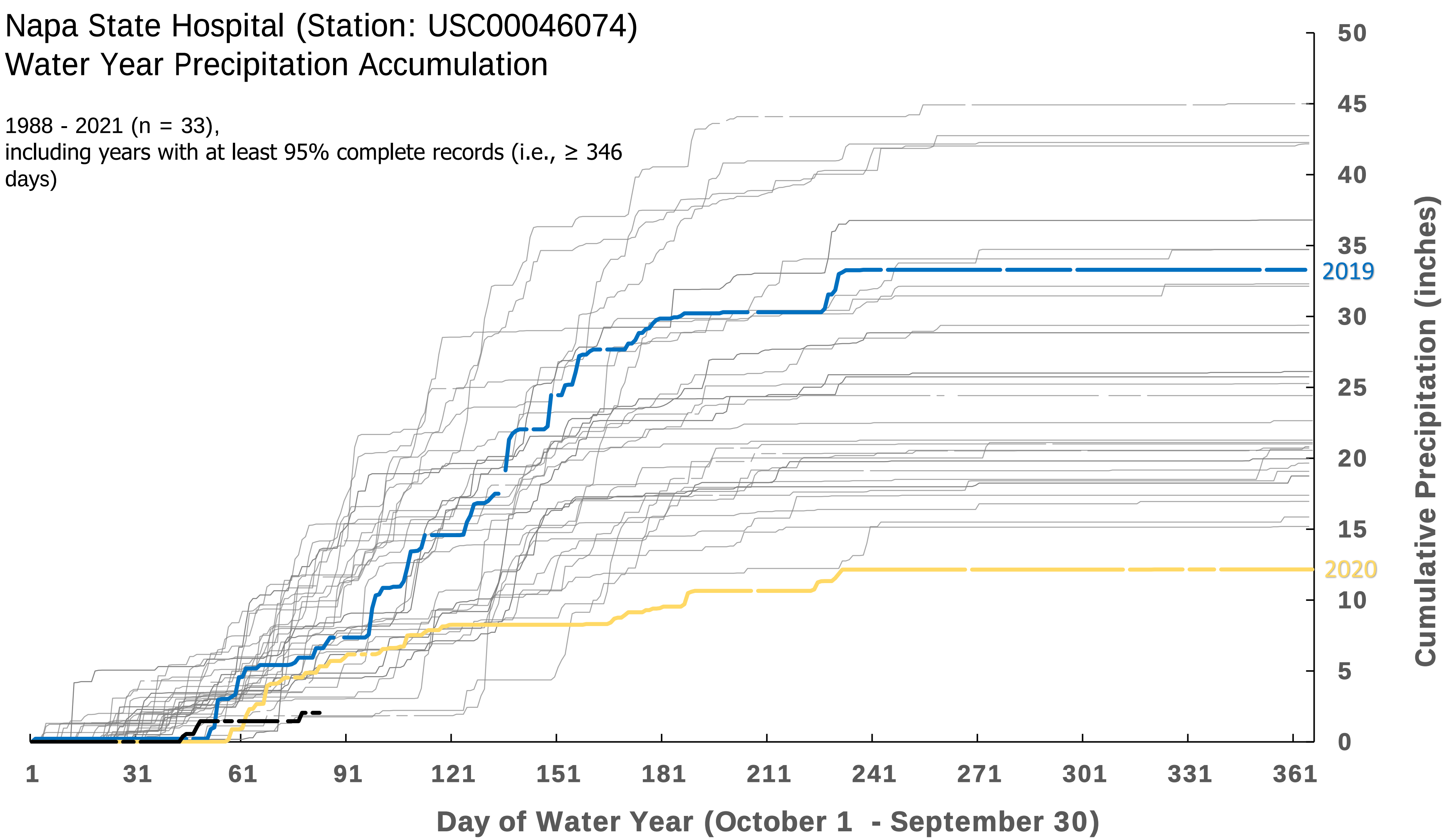
Napa State Hospital Water Year Precipitation and Cumulative Departure, Water Years 1950 - 2020

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 5-1



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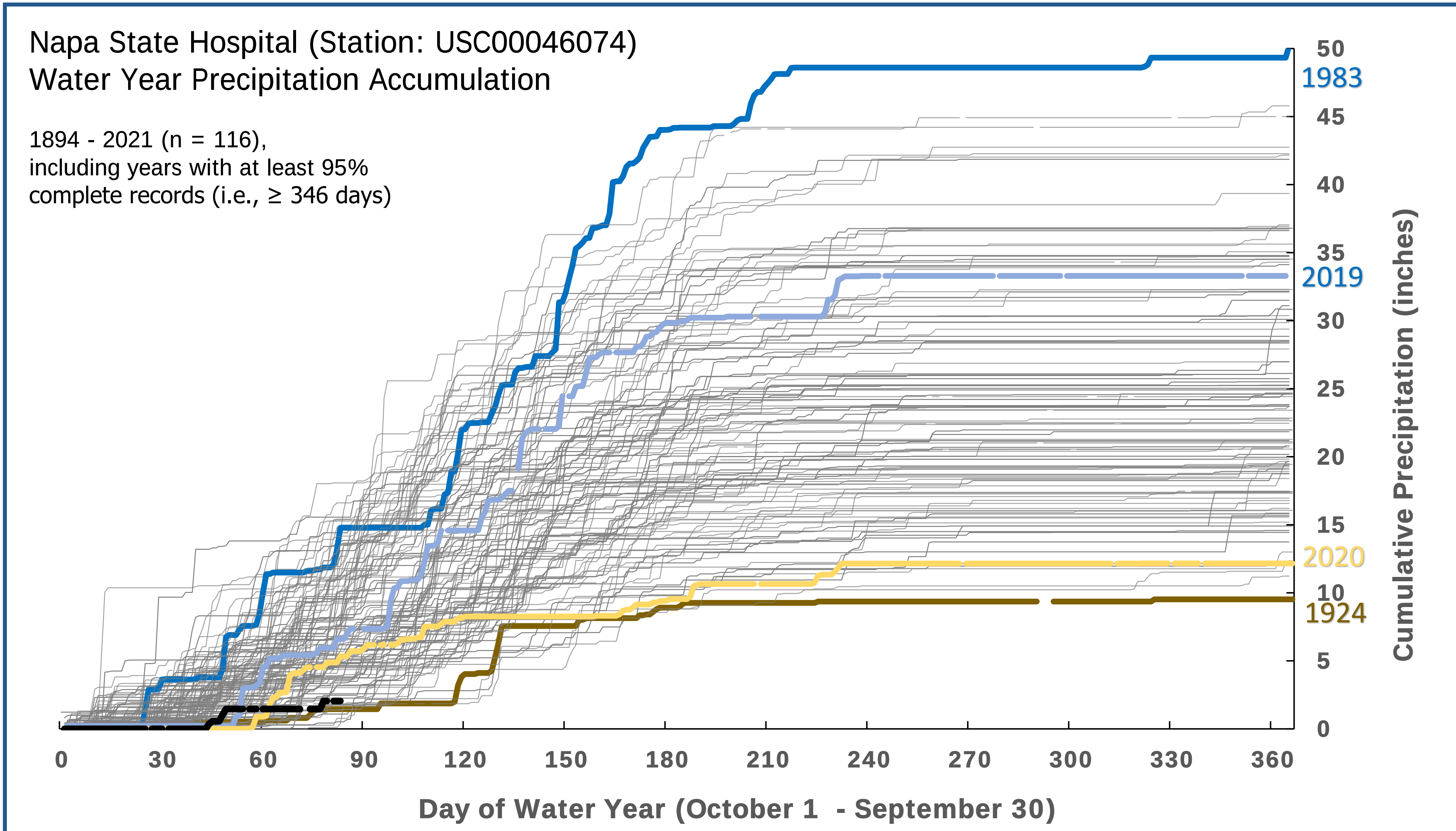
Napa State Hospital (NOAA Station: USC00046074) Precipitation Accumulation 1988-2021

Figure 5-2

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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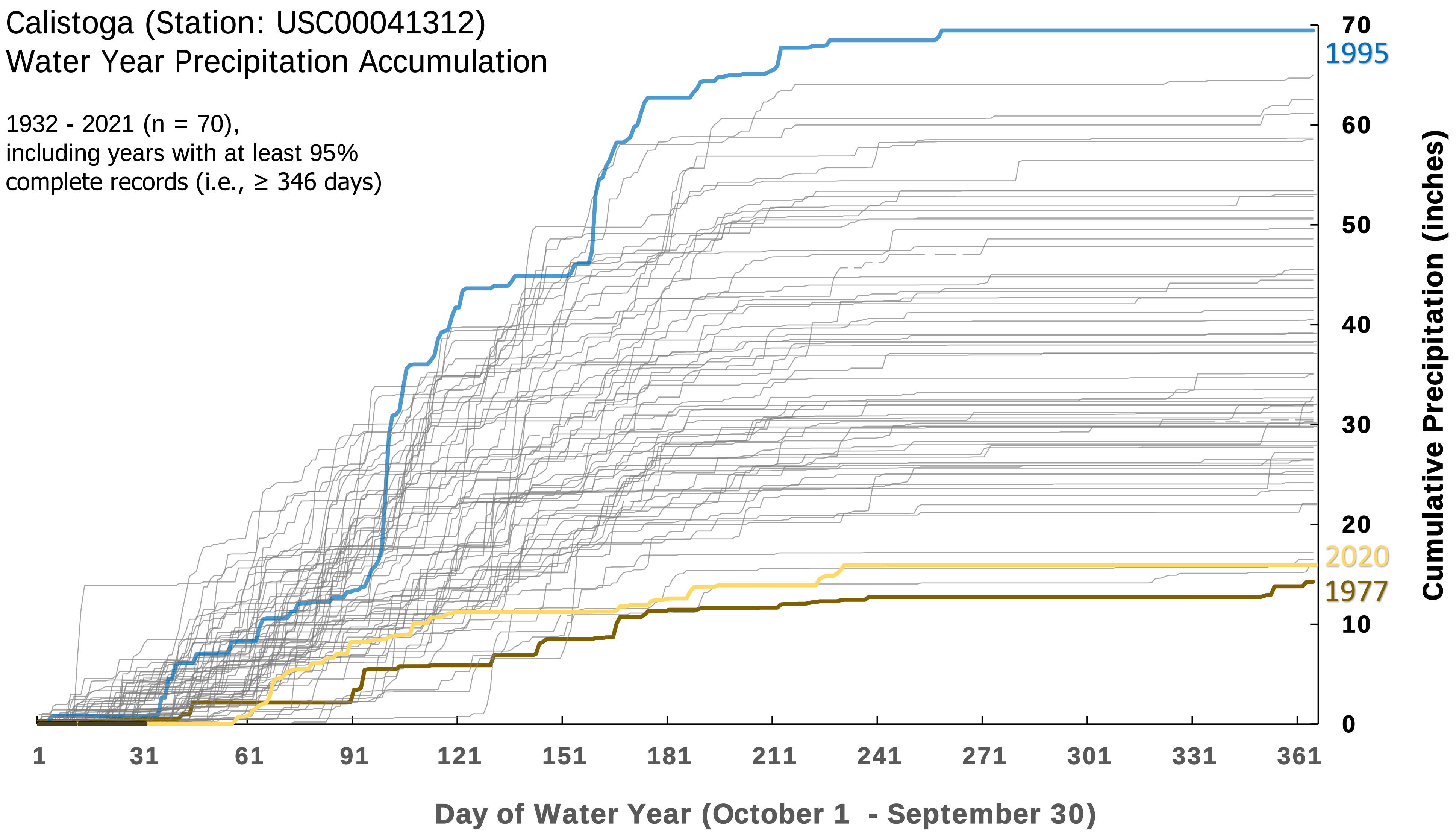
Napa State Hospital (NOAA Station: USC00046074) Precipitation Accumulation 1894-2021

Figure 5-3

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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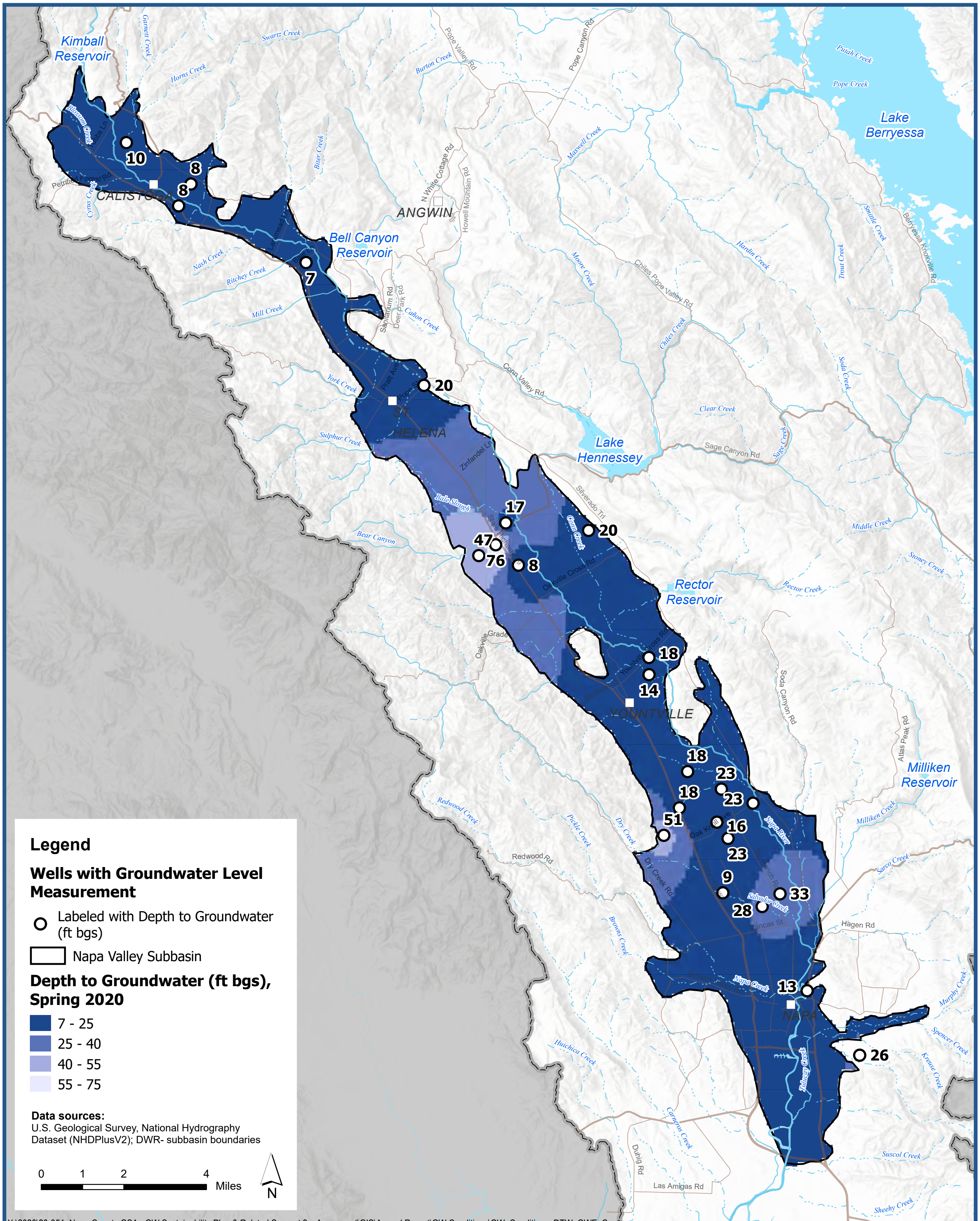
Calistoga (NOAA Station: USC00041312) Precipitation Accumulation 1932 - 2021

Figure 5-4

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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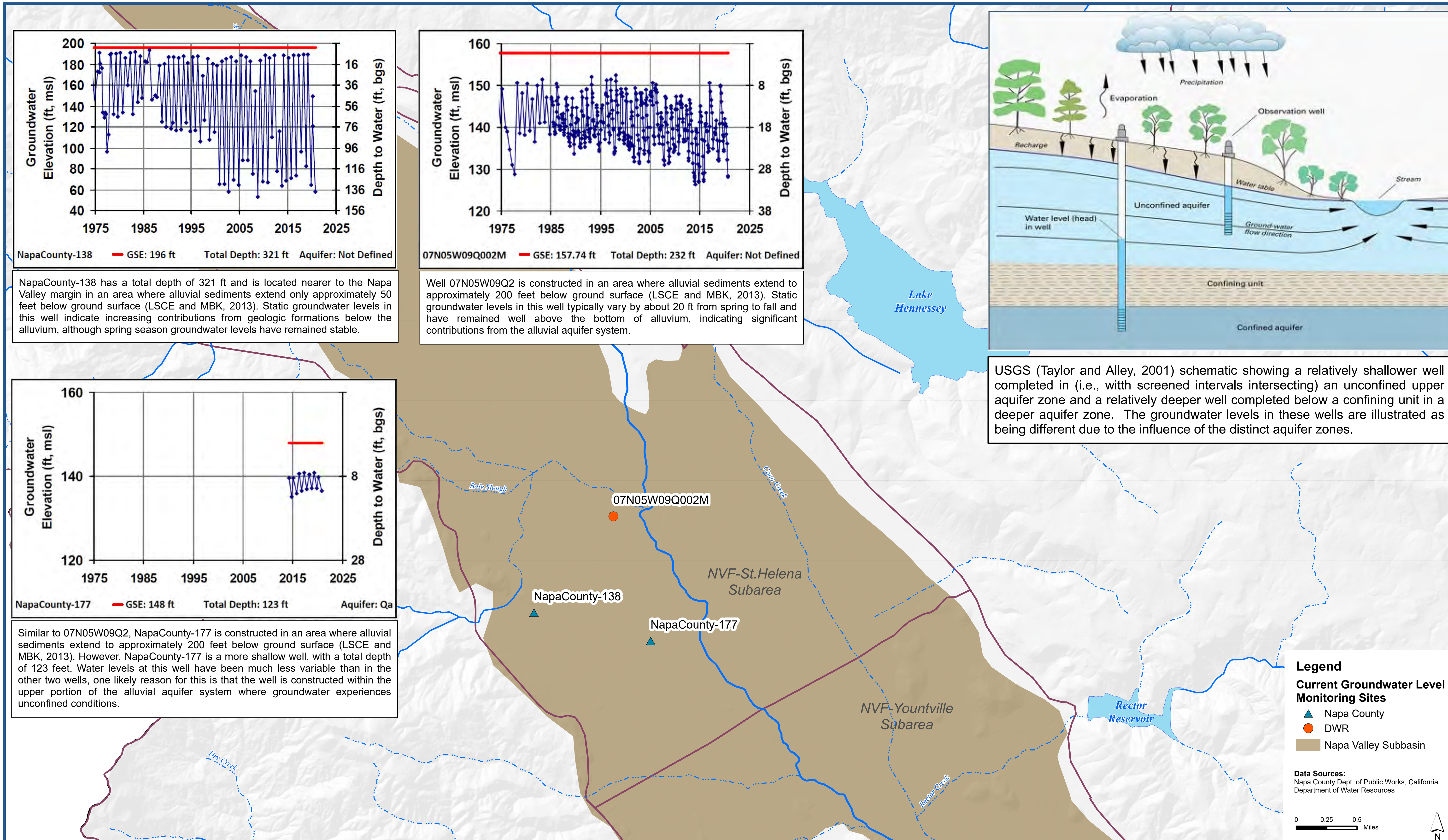
Napa Valley Subbasin Spring 2020 Interpolated Depth to Groundwater

Figure 5-5

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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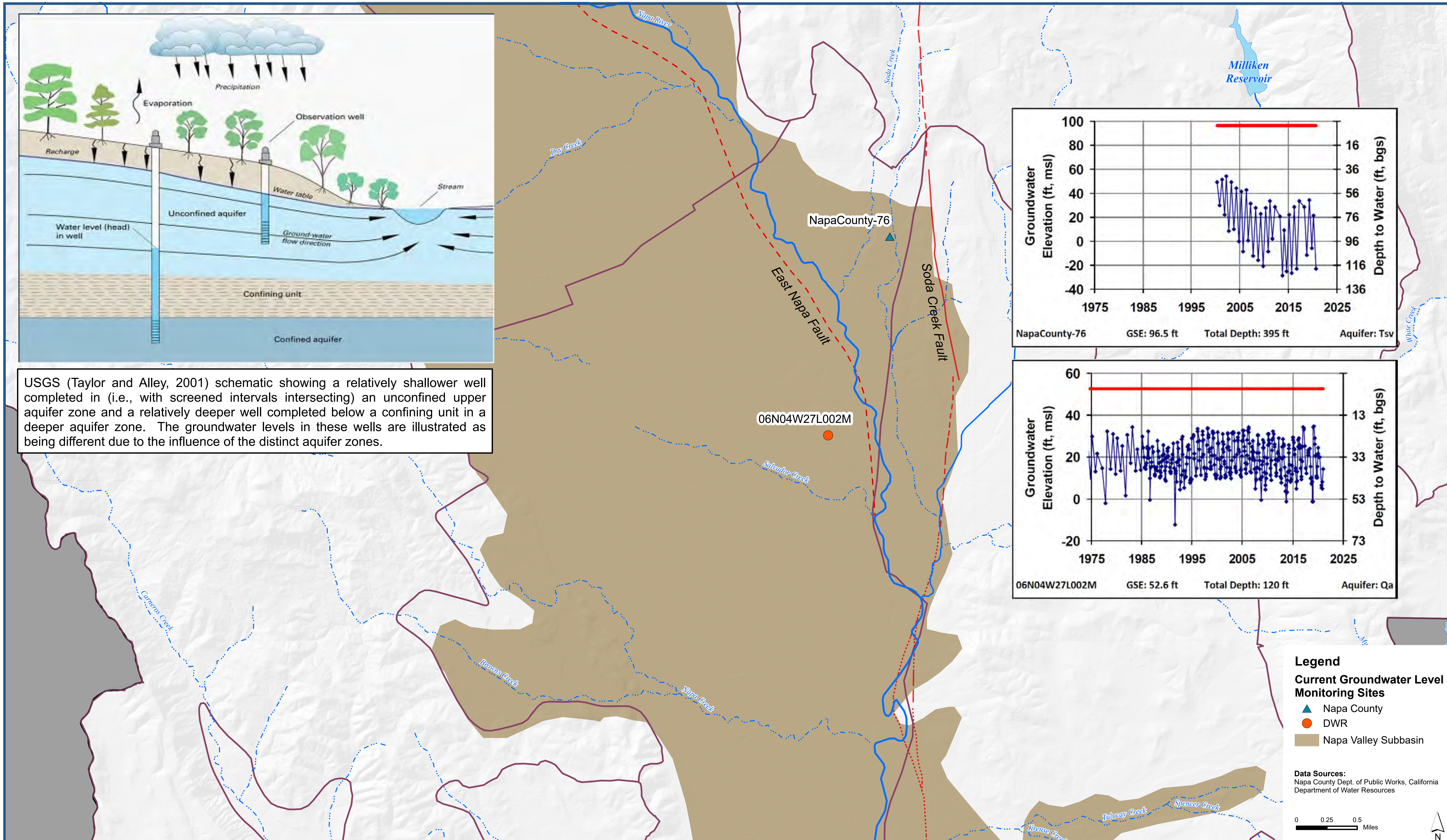
Southern St. Helena Subarea Aquifer Zone Schematic and Illustrative Hydrographs

Figure 5-6

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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Northeast Napa Subarea Aquifer Zone Schematic and Illustrative Hydrographs

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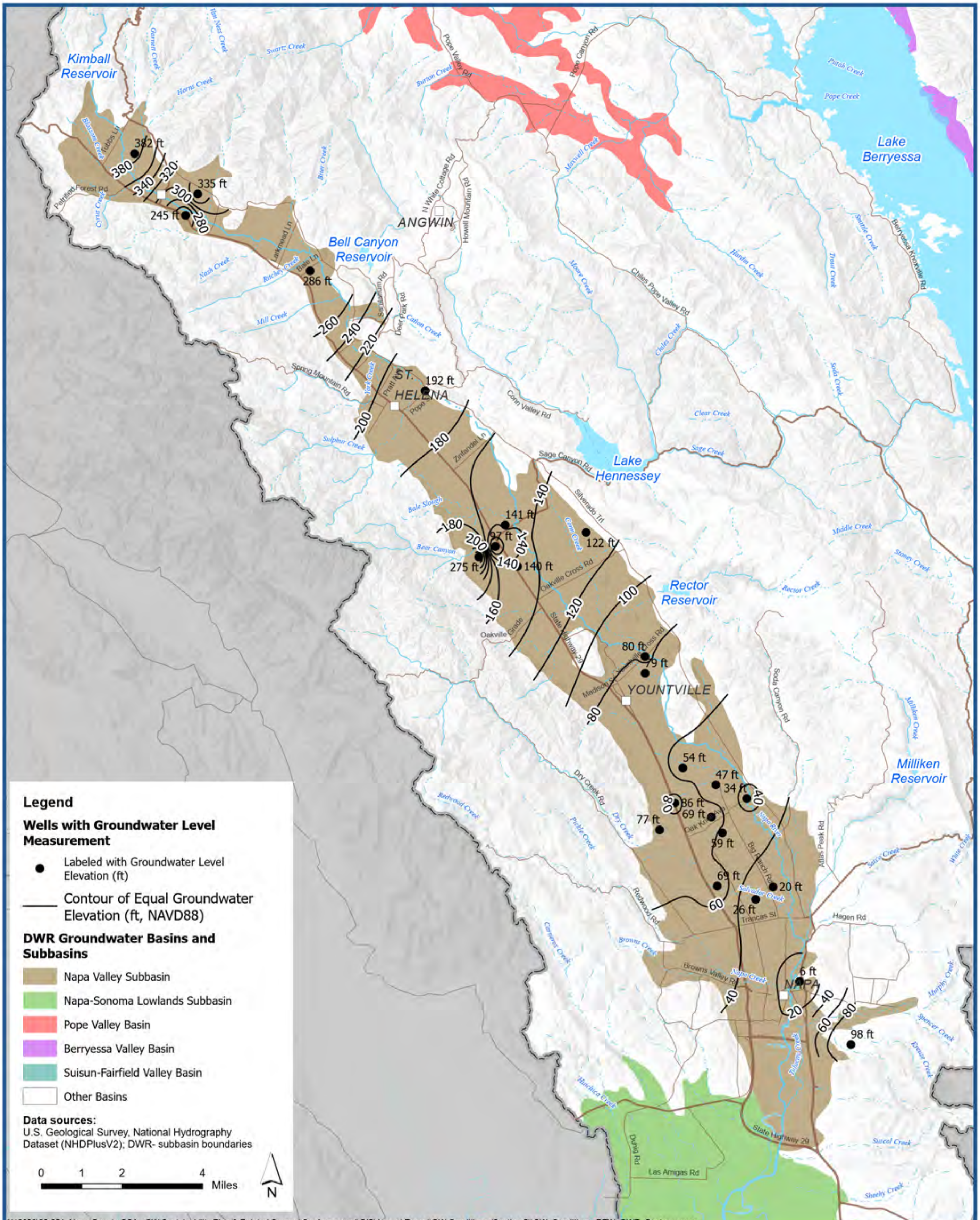
Annual Report - Water Year 2020

Figure 5-7



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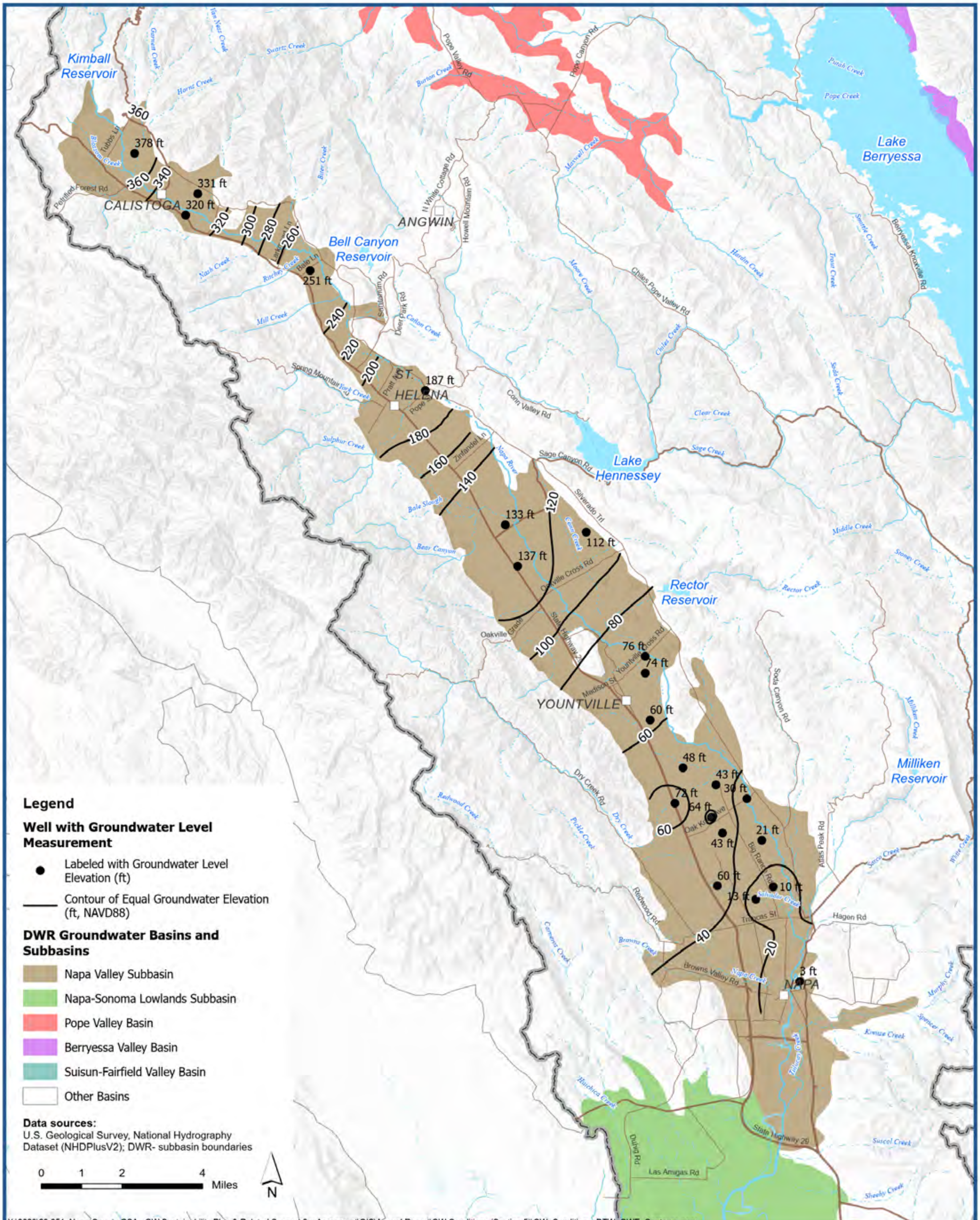
Contours of Equal Groundwater Elevation, Spring 2020
Napa Valley Subbasin, Napa County, CA

Figure 5-8

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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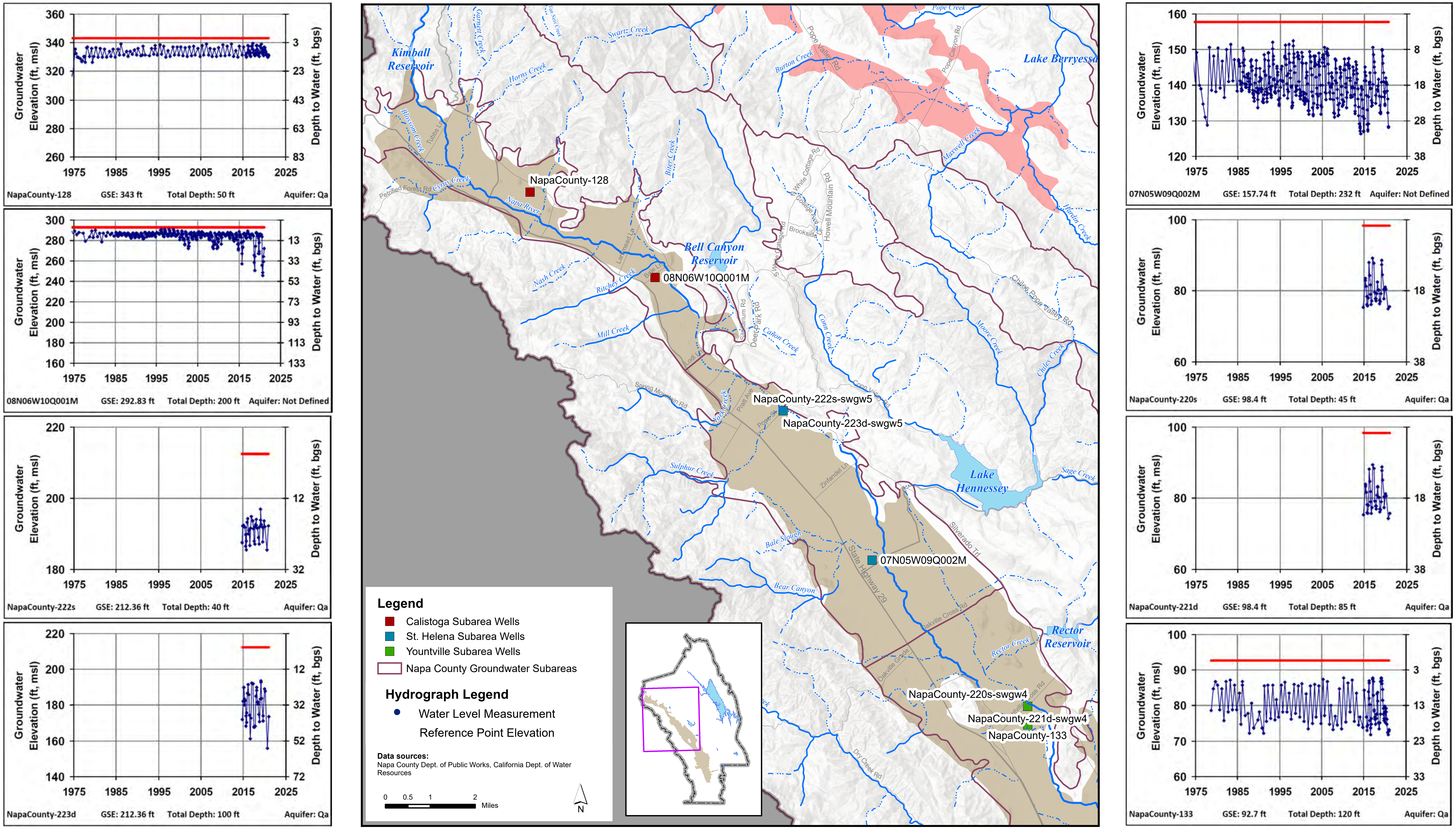
Contours of Equal Groundwater Elevation, Fall 2020
Napa Valley Subbasin, Napa County, CA

Figure 5-9

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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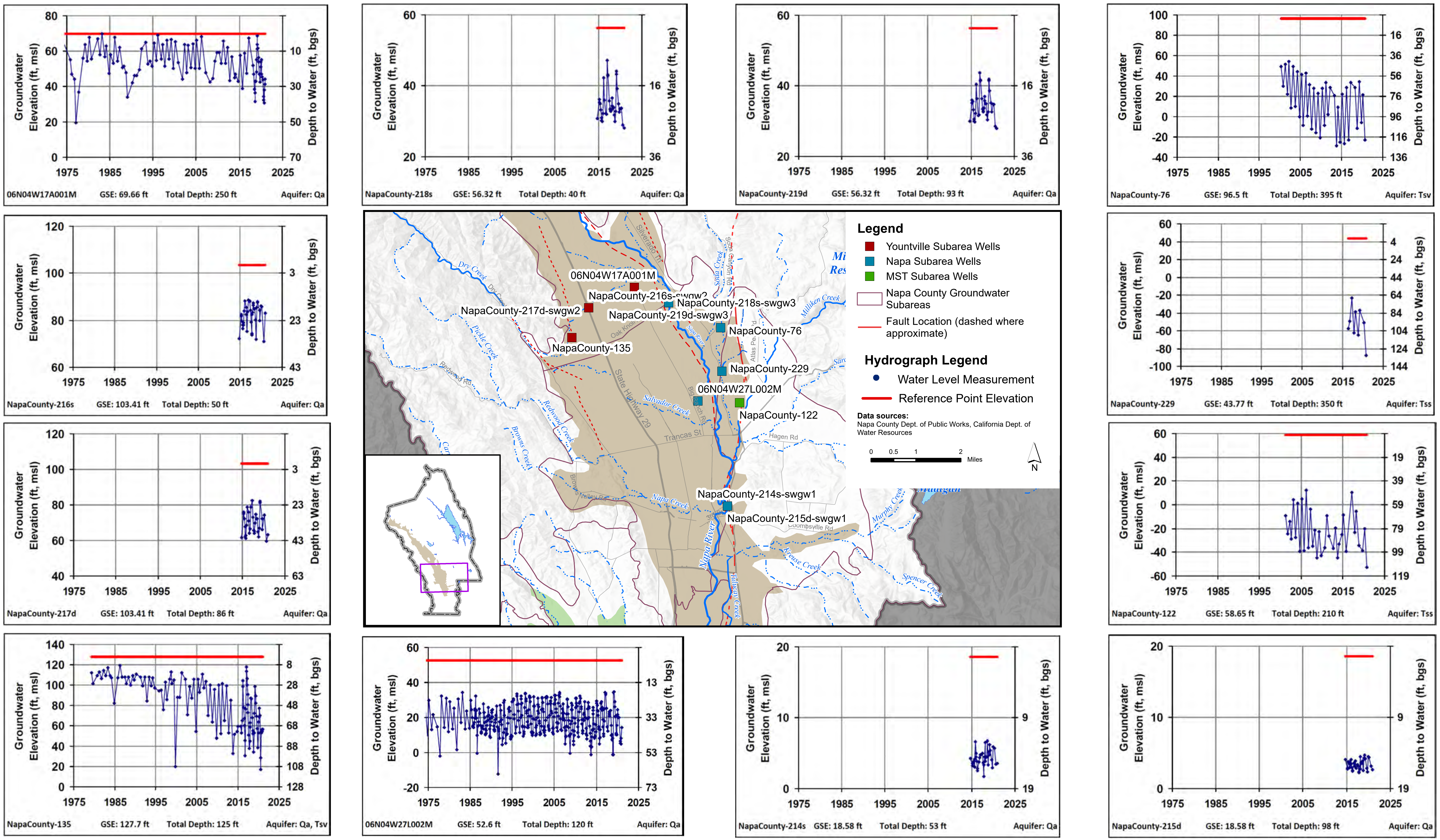
Sustainable Groundwater Management Act Representative Groundwater Hydrographs, Northern Napa Valley Subbasin

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 5-10



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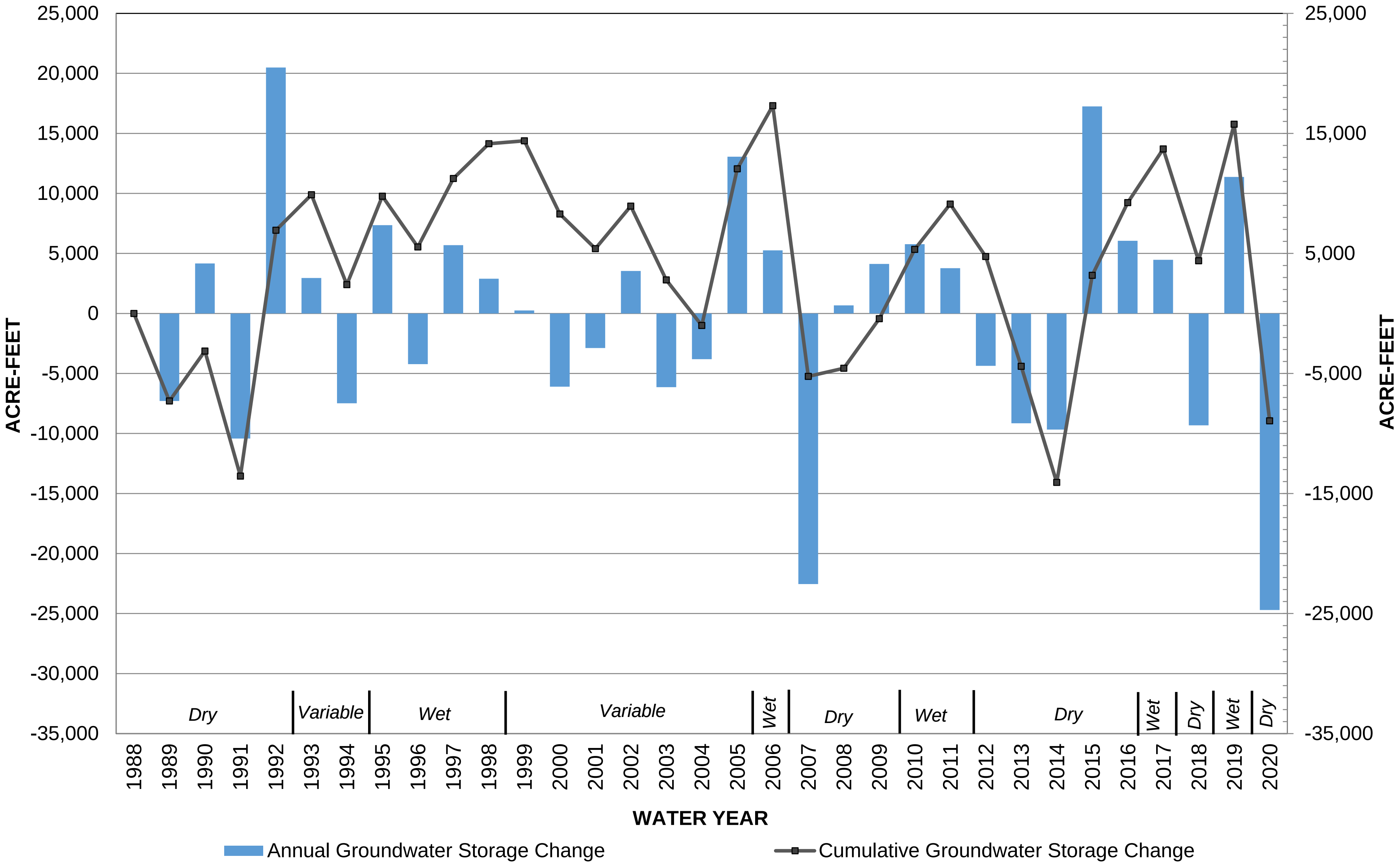
Sustainable Groundwater Management Act Representative Groundwater Hydrographs, Southern Napa Valley Subbasin

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 5-11



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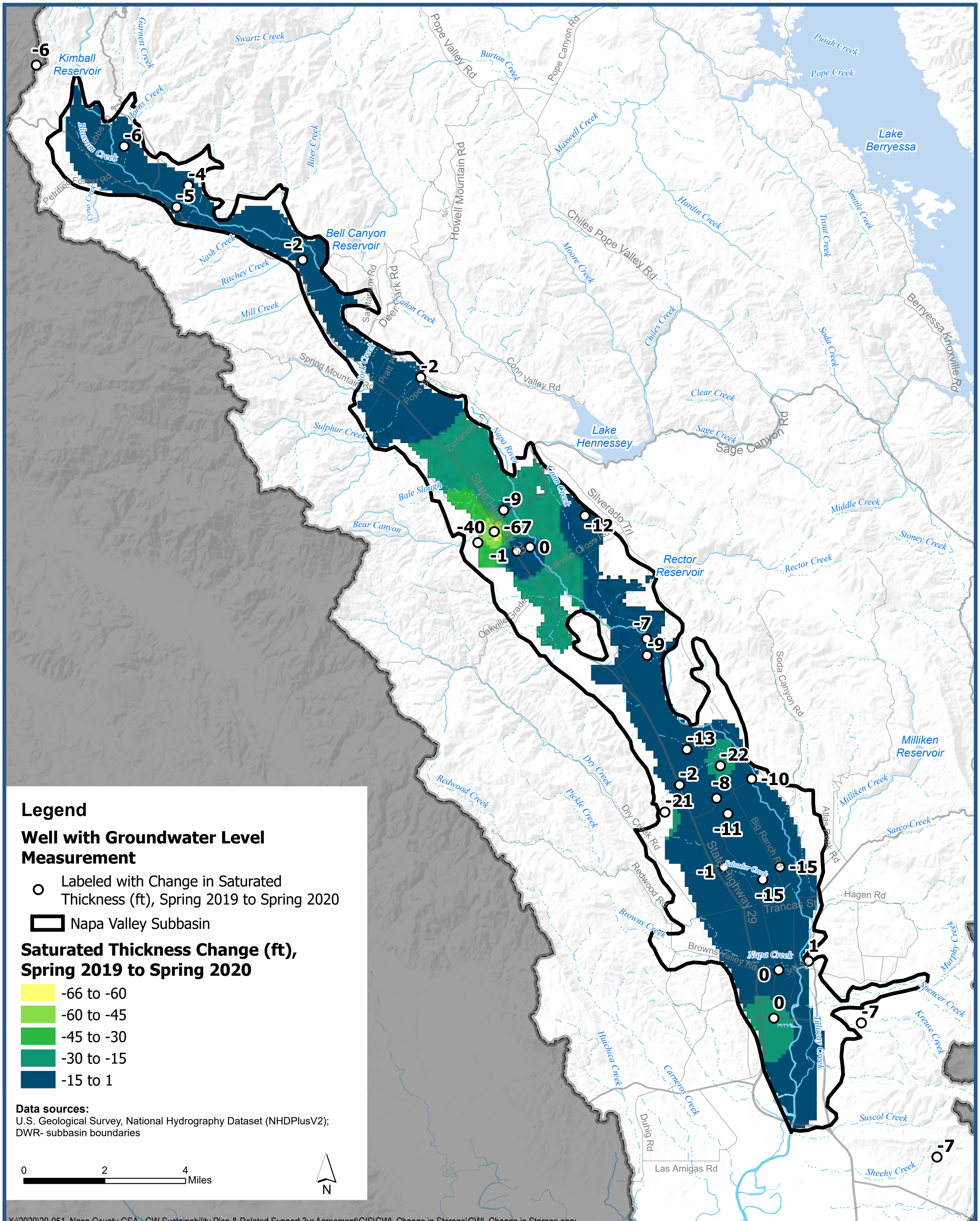
Napa Valley Subbasin Groundwater Storage Changes, Water Years 1988 - 2020

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 5-12



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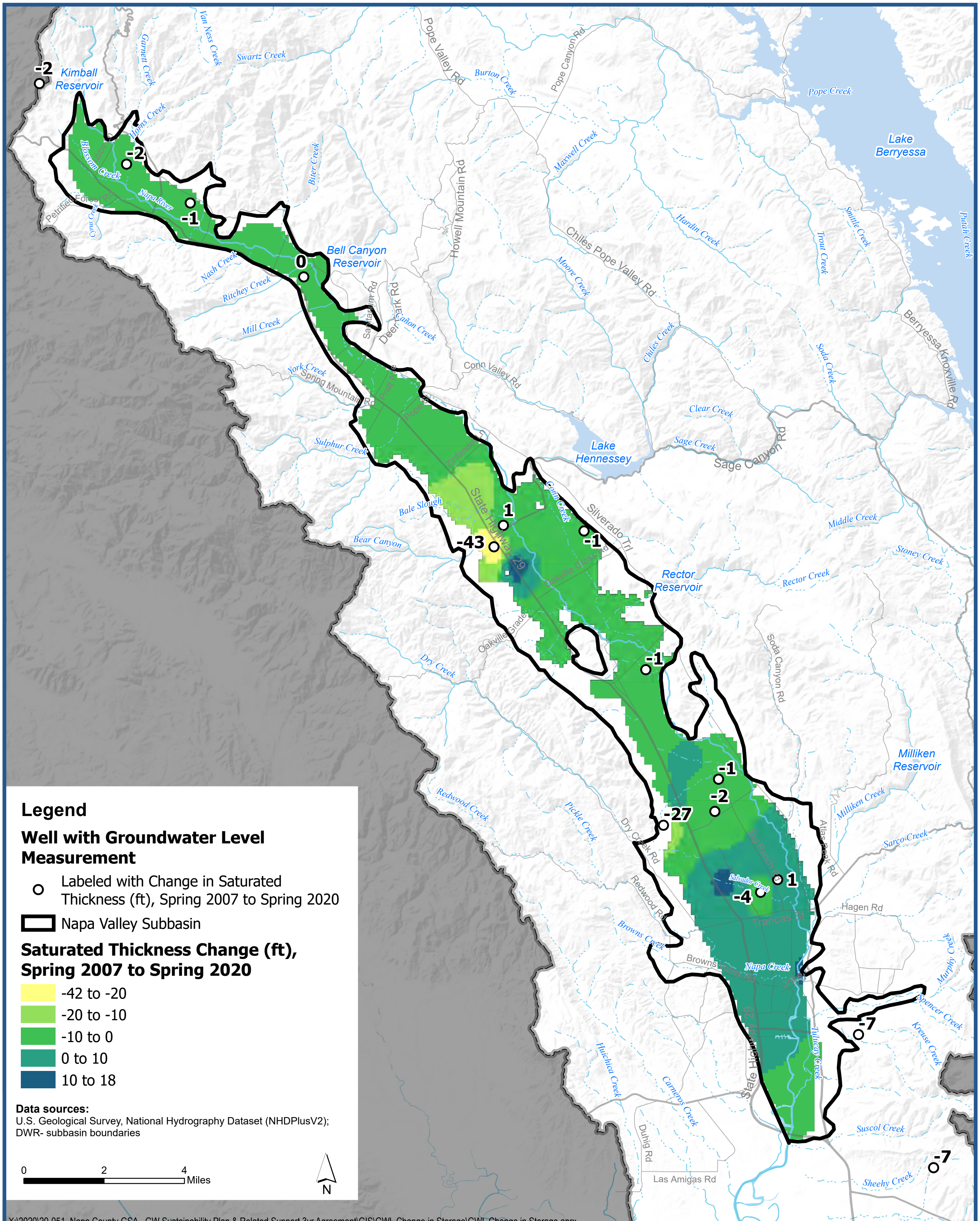
Napa Valley Subbasin Principal Aquifer
Change in Saturated Thickness, Spring 2019 to Spring 2020

Figure 5-13

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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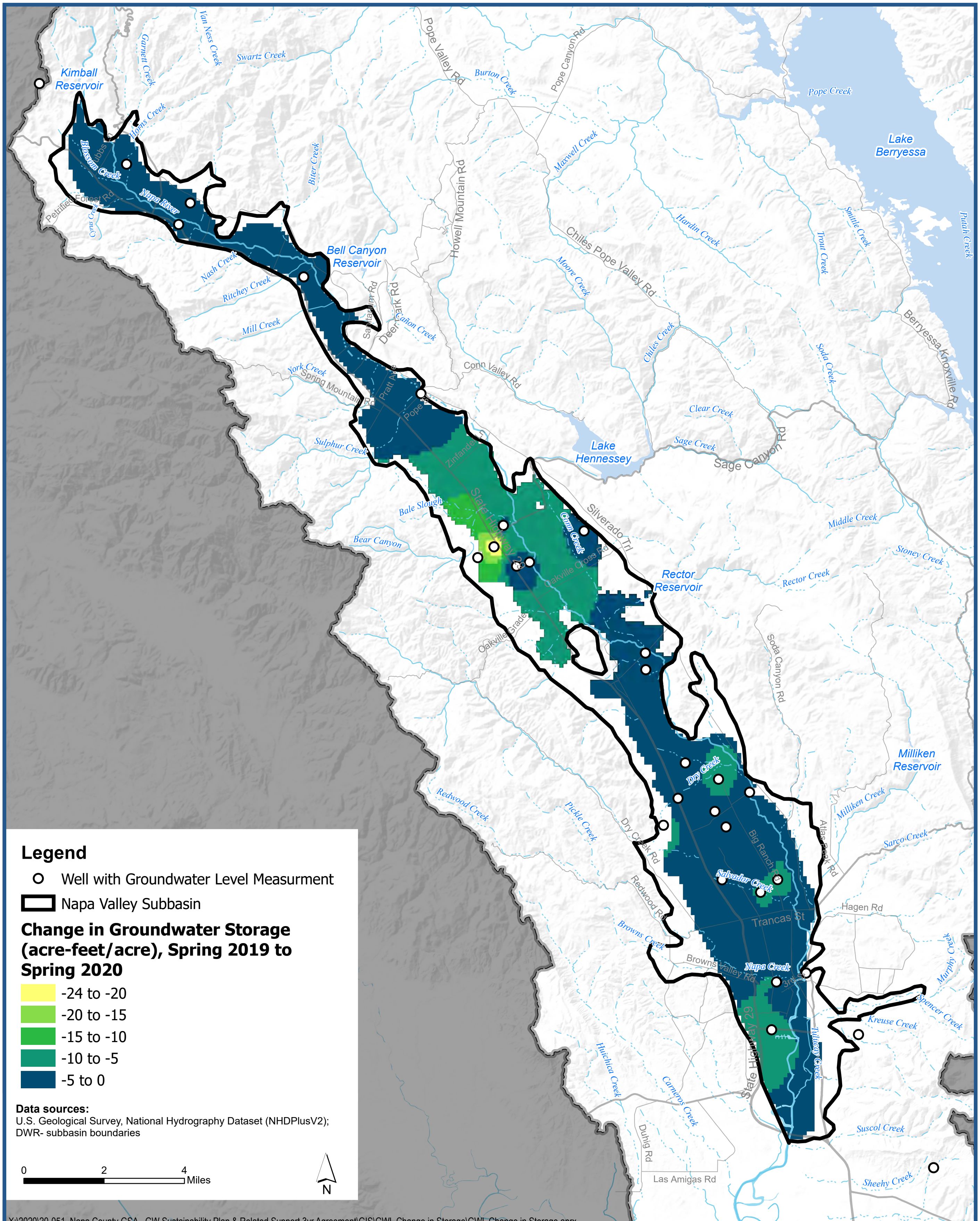
Napa Valley Subbasin Principal Aquifer Change in Saturated Thickness, Spring 2007 to Spring 2020

Figure 5-14

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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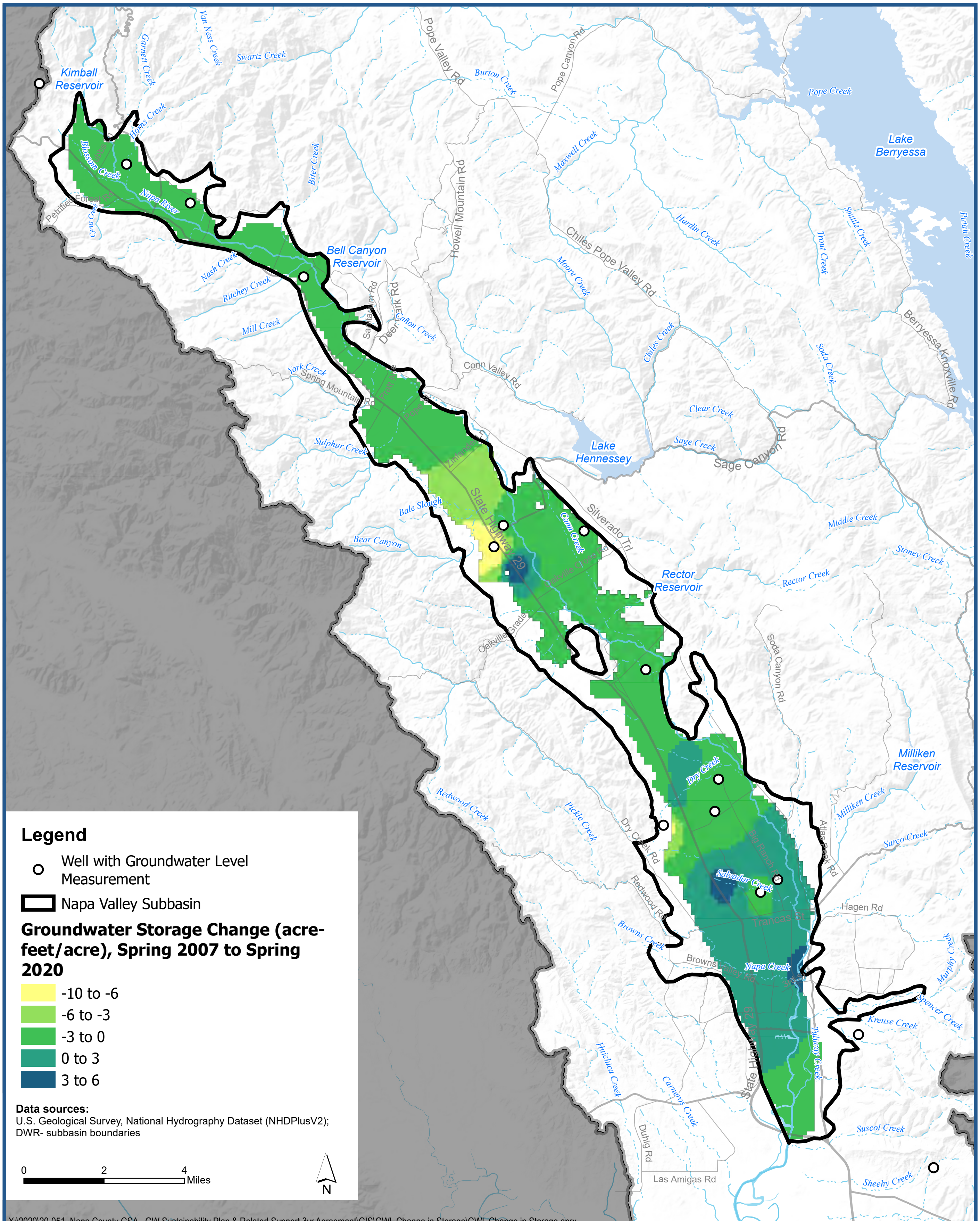
Napa Valley Subbasin Principal Aquifer Change in Groundwater Storage, Spring 2019 to Spring 2020

Figure 5-15

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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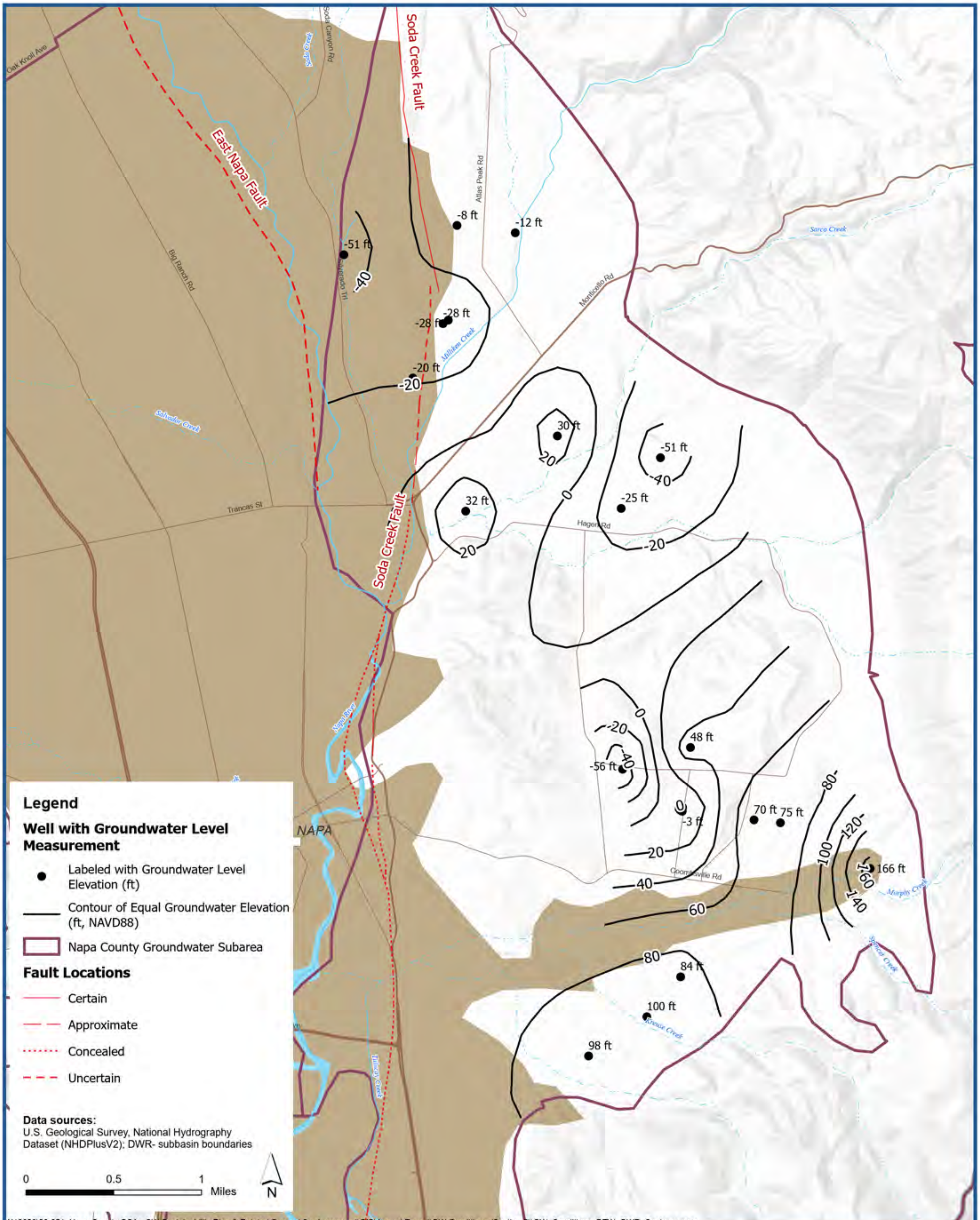
Napa Valley Subbasin Principal Aquifer Change in Groundwater Storage, Spring 2007 to Spring 2020

Figure 5-16

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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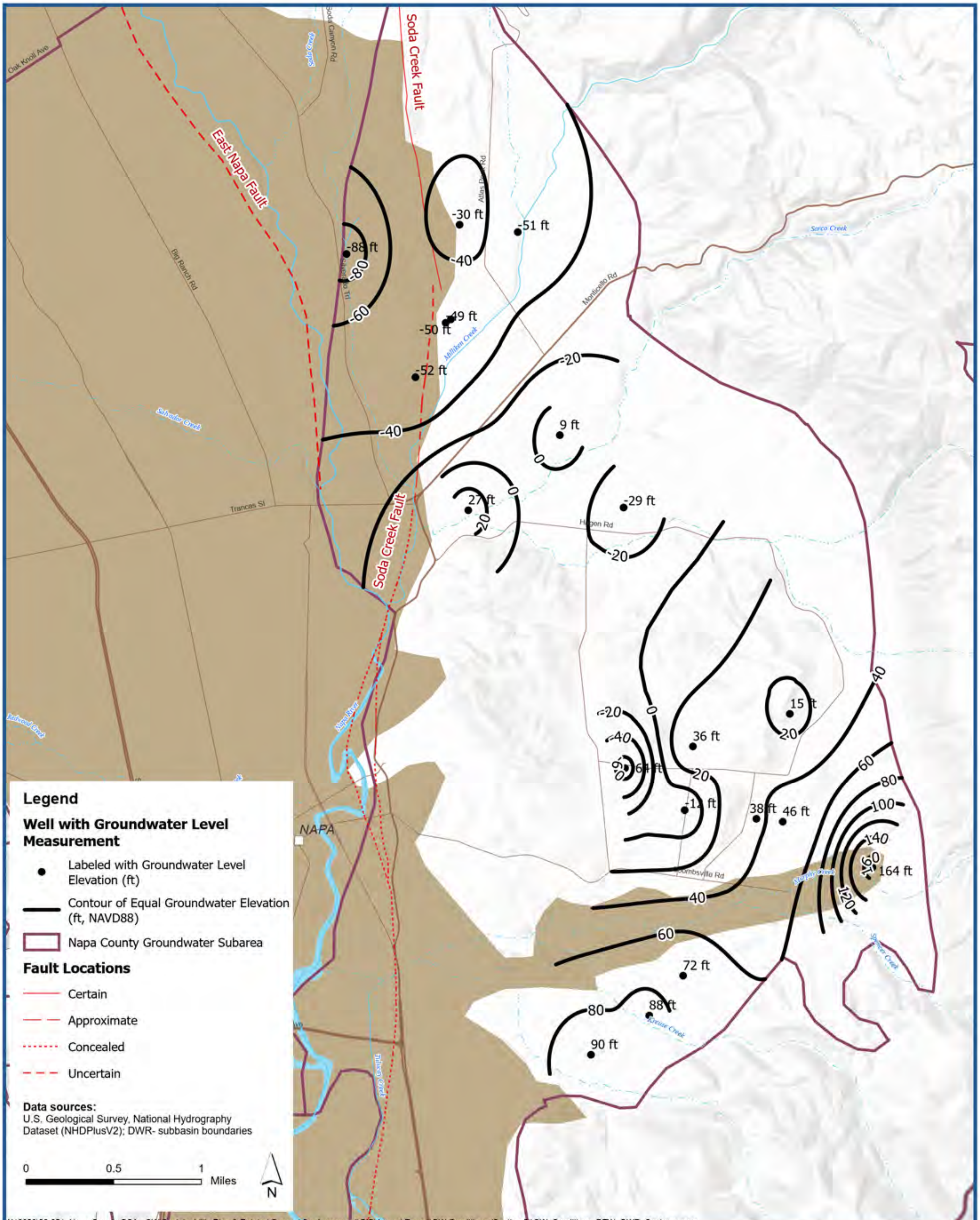
Contours of Equal Groundwater Elevation, Spring 2020
MST Subarea, Napa County, CA

Figure 5-17

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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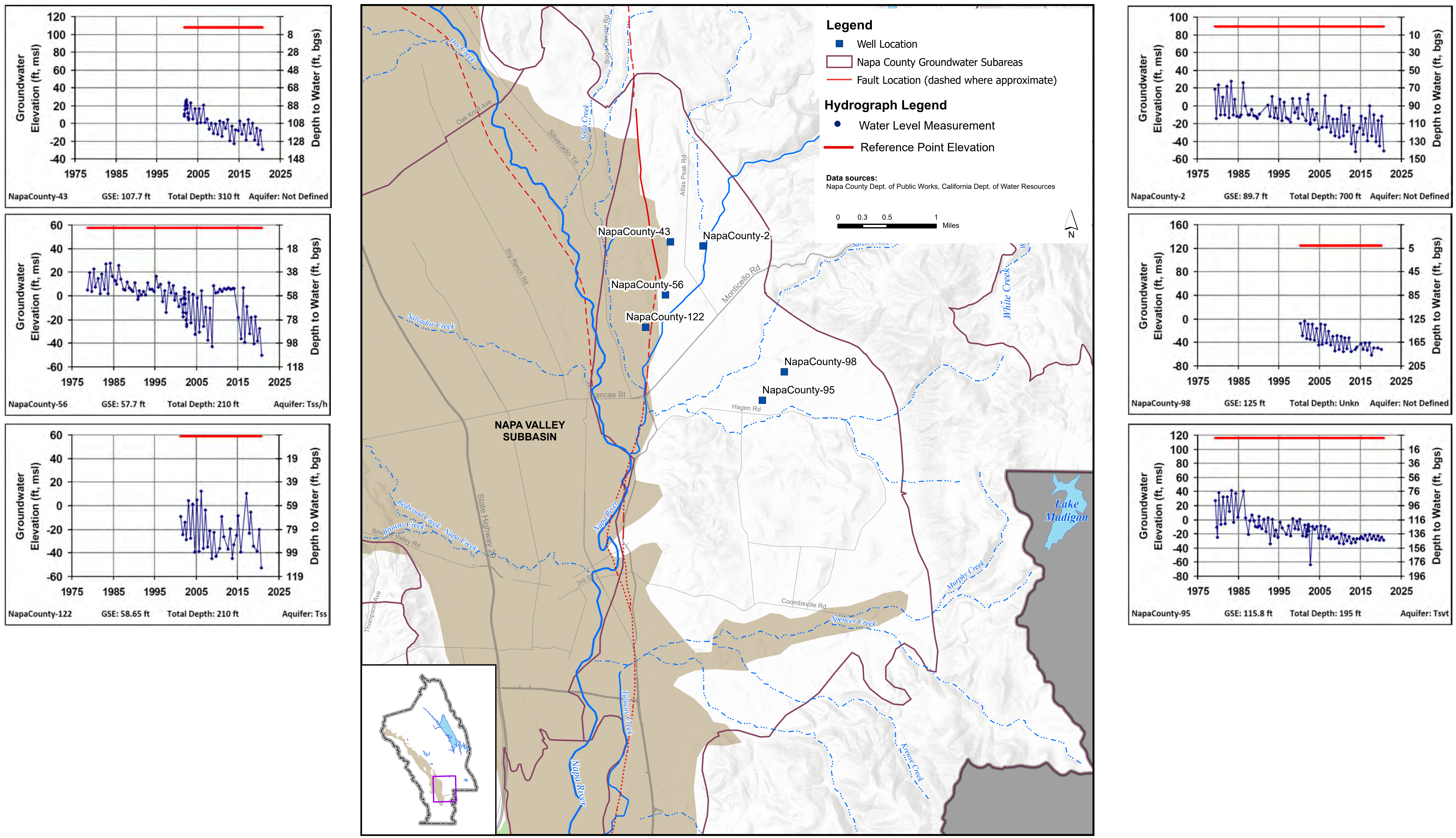
Contours of Equal Groundwater Elevation, Fall 2020
MST Subarea, Napa County, CA

Figure 5-18

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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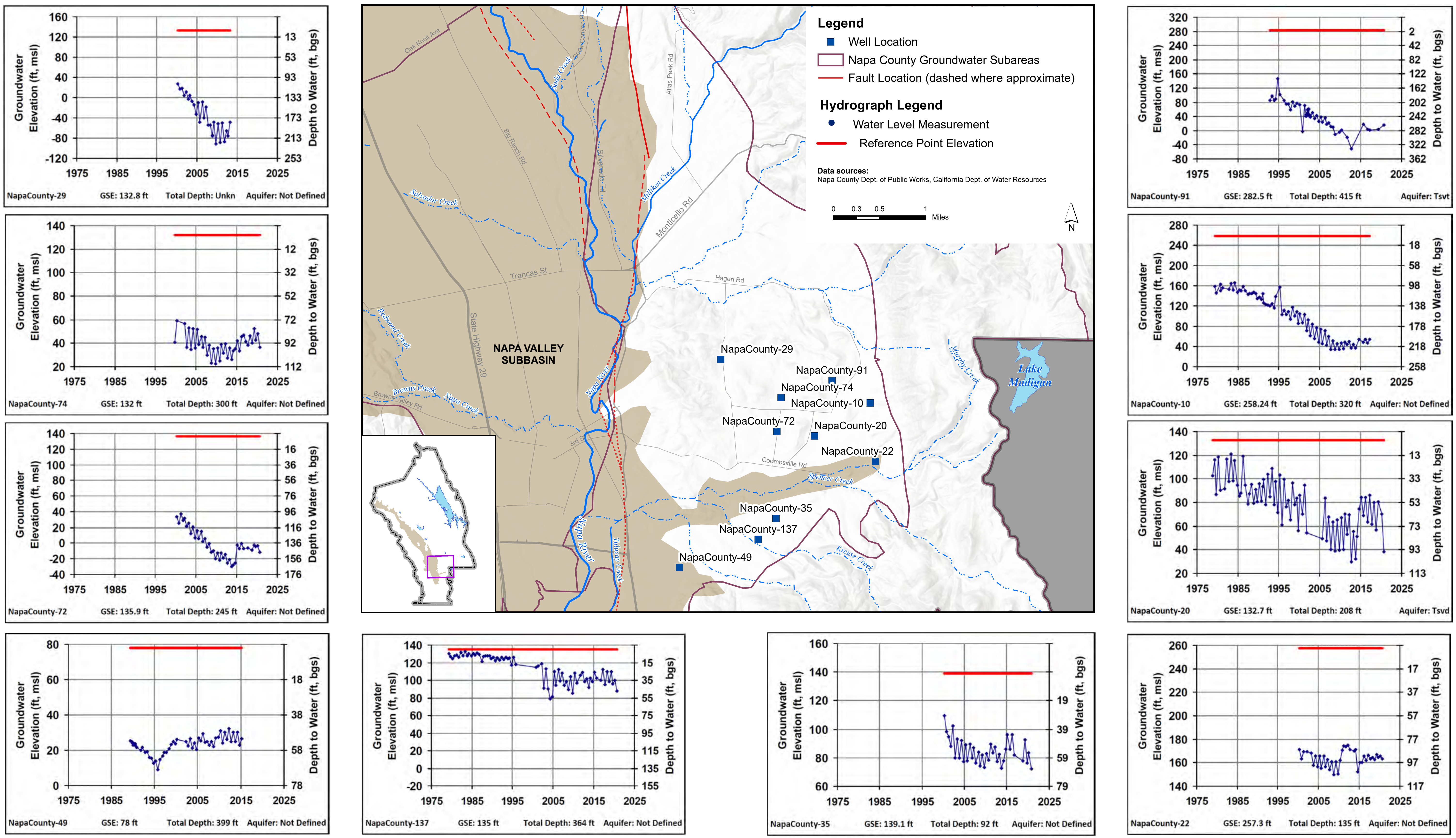
Representative Groundwater Hydrographs, Northern MST Subarea

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 5-19



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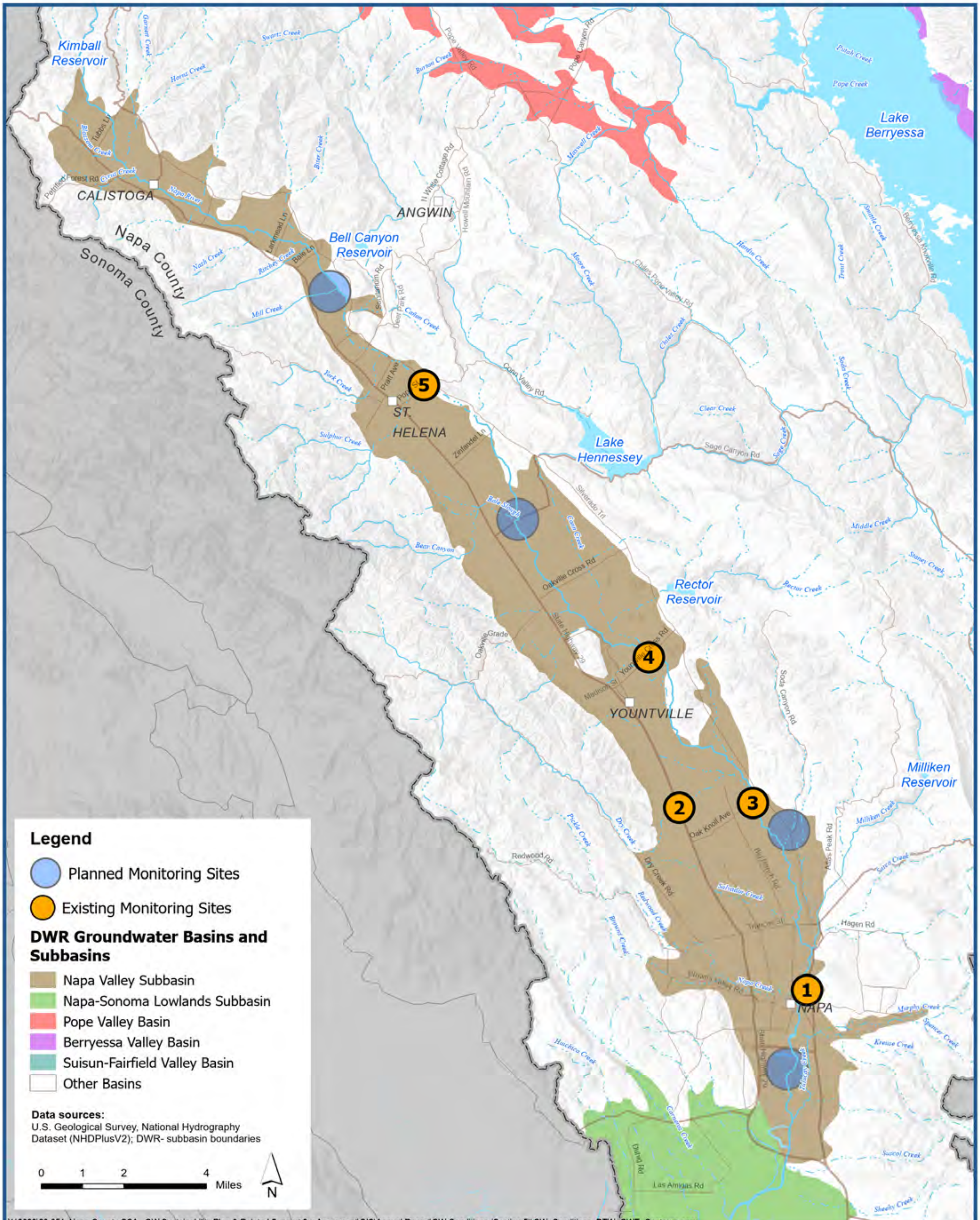
Representative Groundwater Hydrographs, Southern MST Subarea

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 5-20



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Planned Surface Water-Groundwater Monitoring Network Expansion

Figure 5-21

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

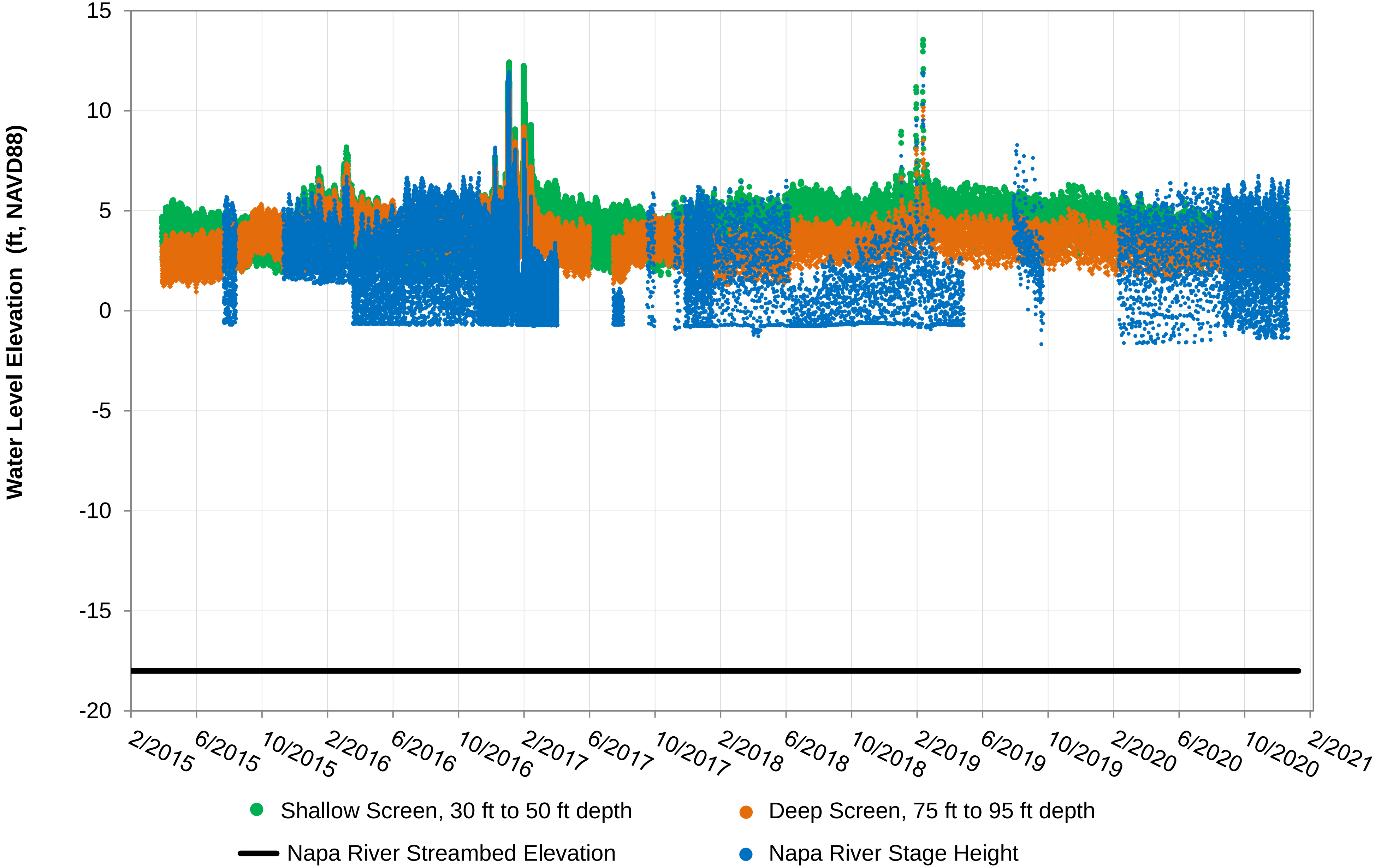

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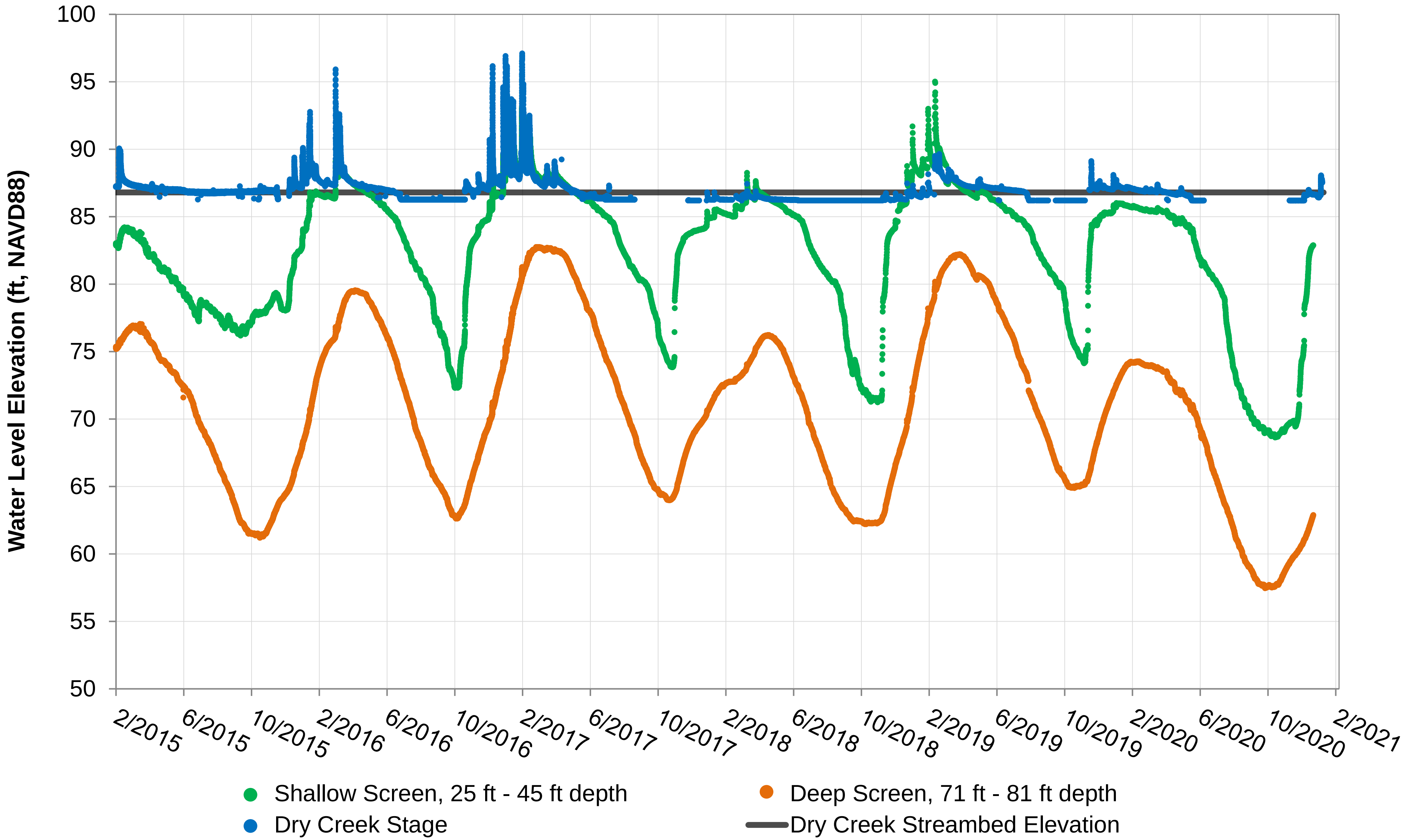
FIGURE 5-22
Surface Water-Groundwater Hydrograph
Site 1: Napa River at First Street

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



Note: Creek stage values below the streambed elevation may reflect conditions where water is present in the channel in a pool or depression at the gauge but not above the surveyed thalweg elevation.

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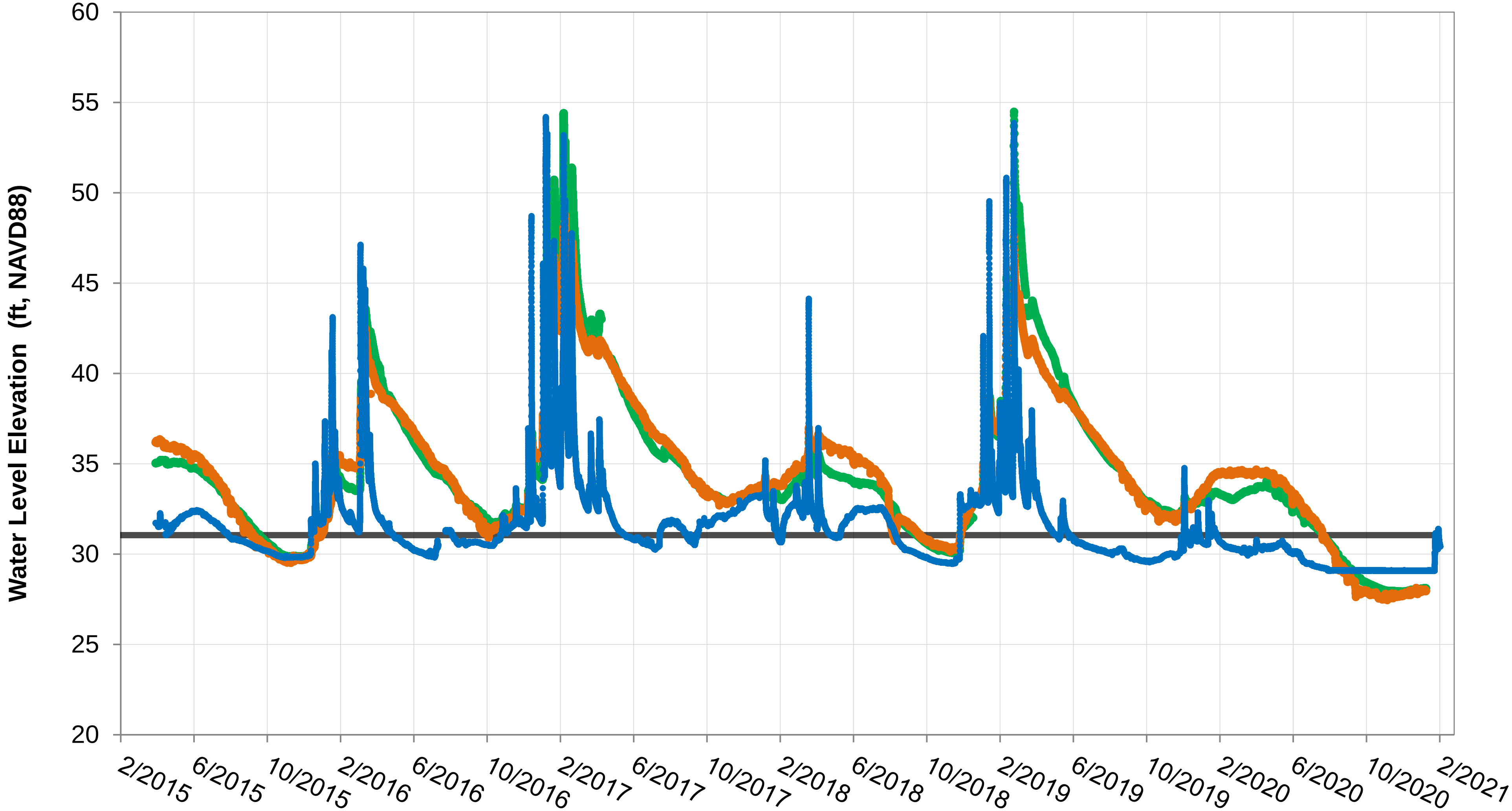
FIGURE 5-23
Surface Water-Groundwater Hydrograph
Site 2: Dry Creek at Washington Street

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



Note: River stage values below the streambed elevation may reflect conditions where water is present in the channel in a pool or depression at the gauge but not above the surveyed thalweg elevation.

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FIGURE 5-24
Surface Water-Groundwater Hydrograph
Site 3: Napa River at Oak Knoll Avenue

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

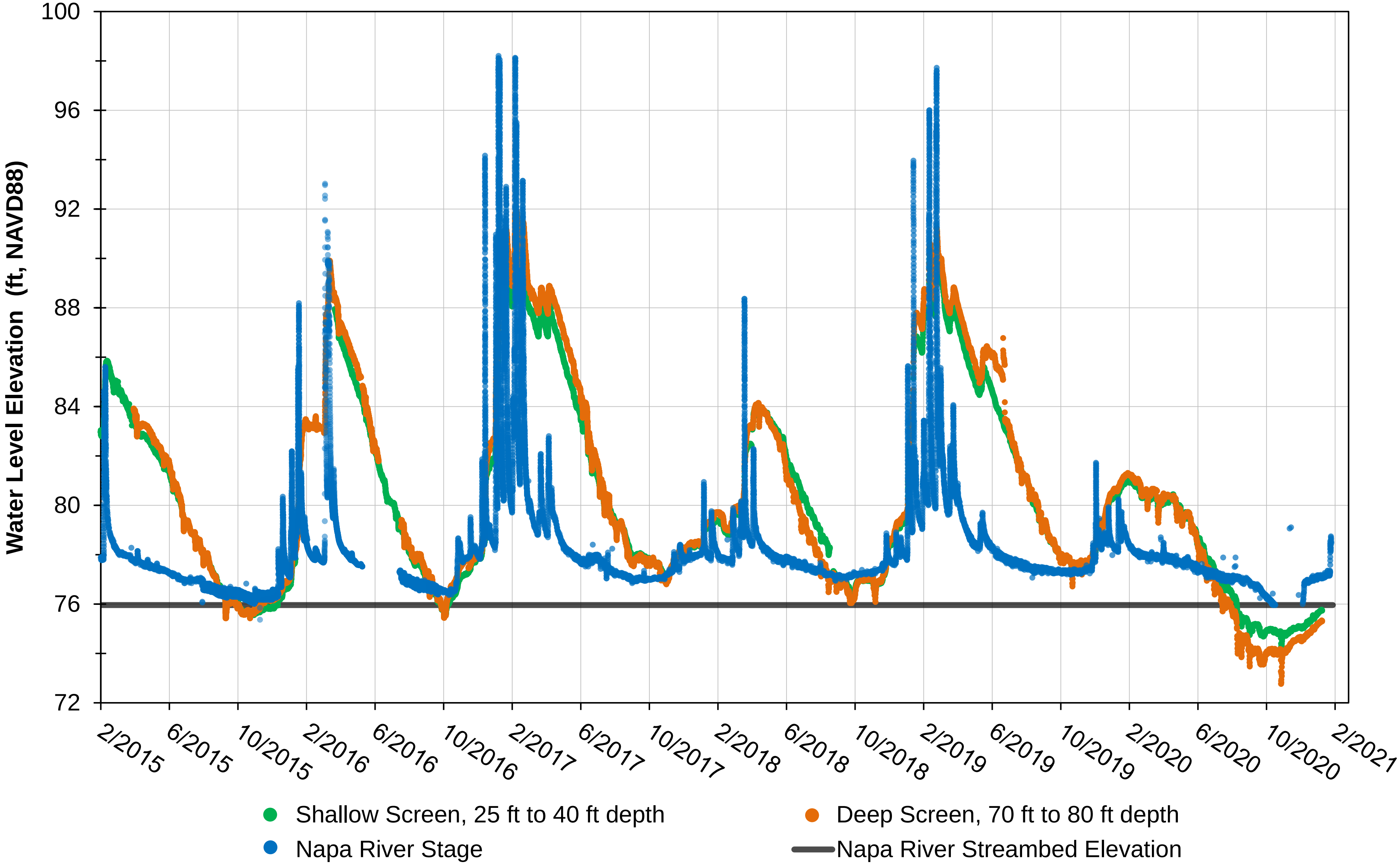

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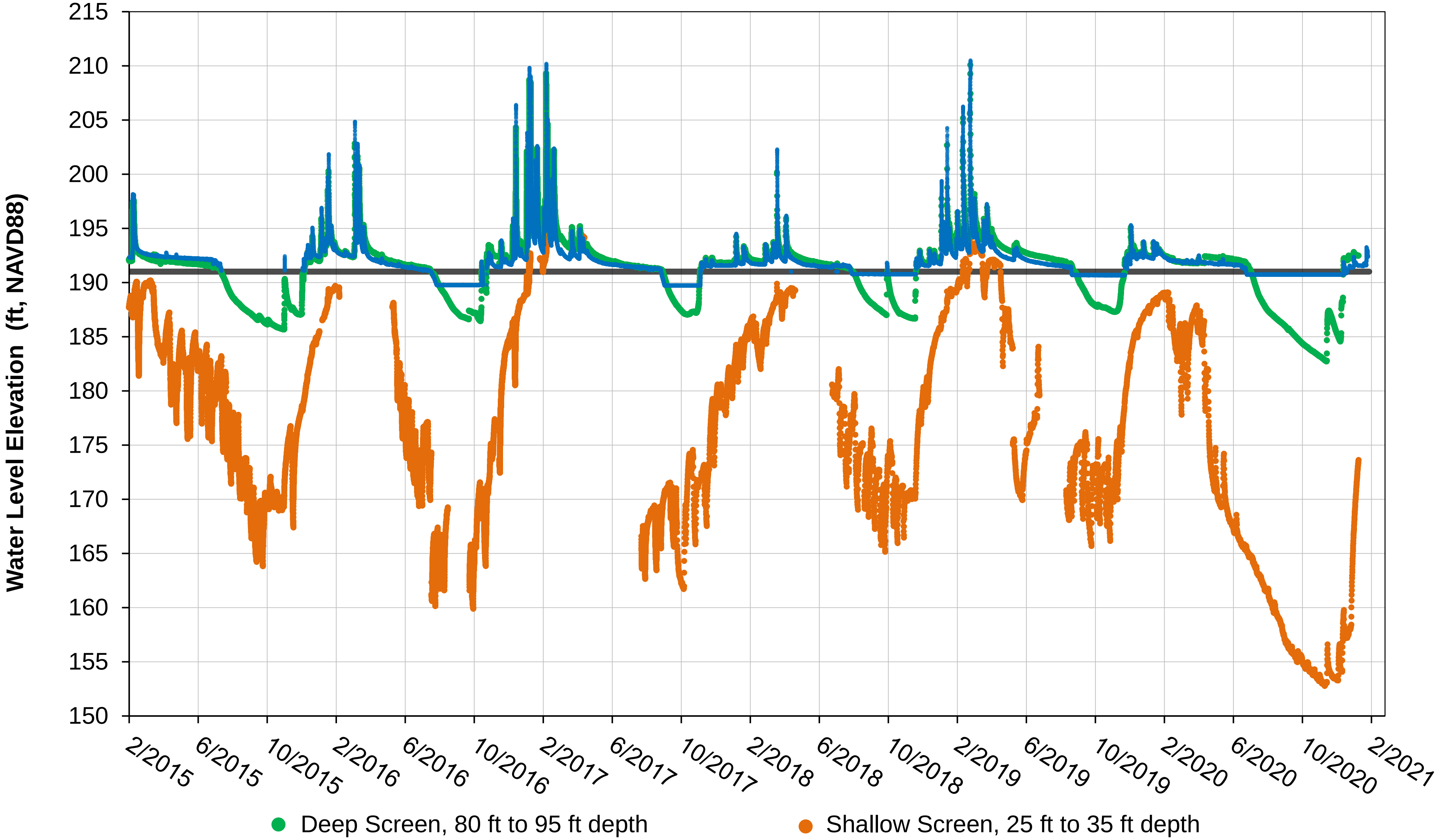
FIGURE 5-25
Surface Water-Groundwater Hydrograph
Site 4: Napa River at Yountville Cross Road

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



Note: River stage values below the streambed elevation may reflect conditions where water is present in the channel in a pool or depression at the gauge but not above the surveyed thalweg elevation.

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FIGURE 5-26
Surface Water-Groundwater Hydrograph
Site 5: Napa River at Pope Street

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

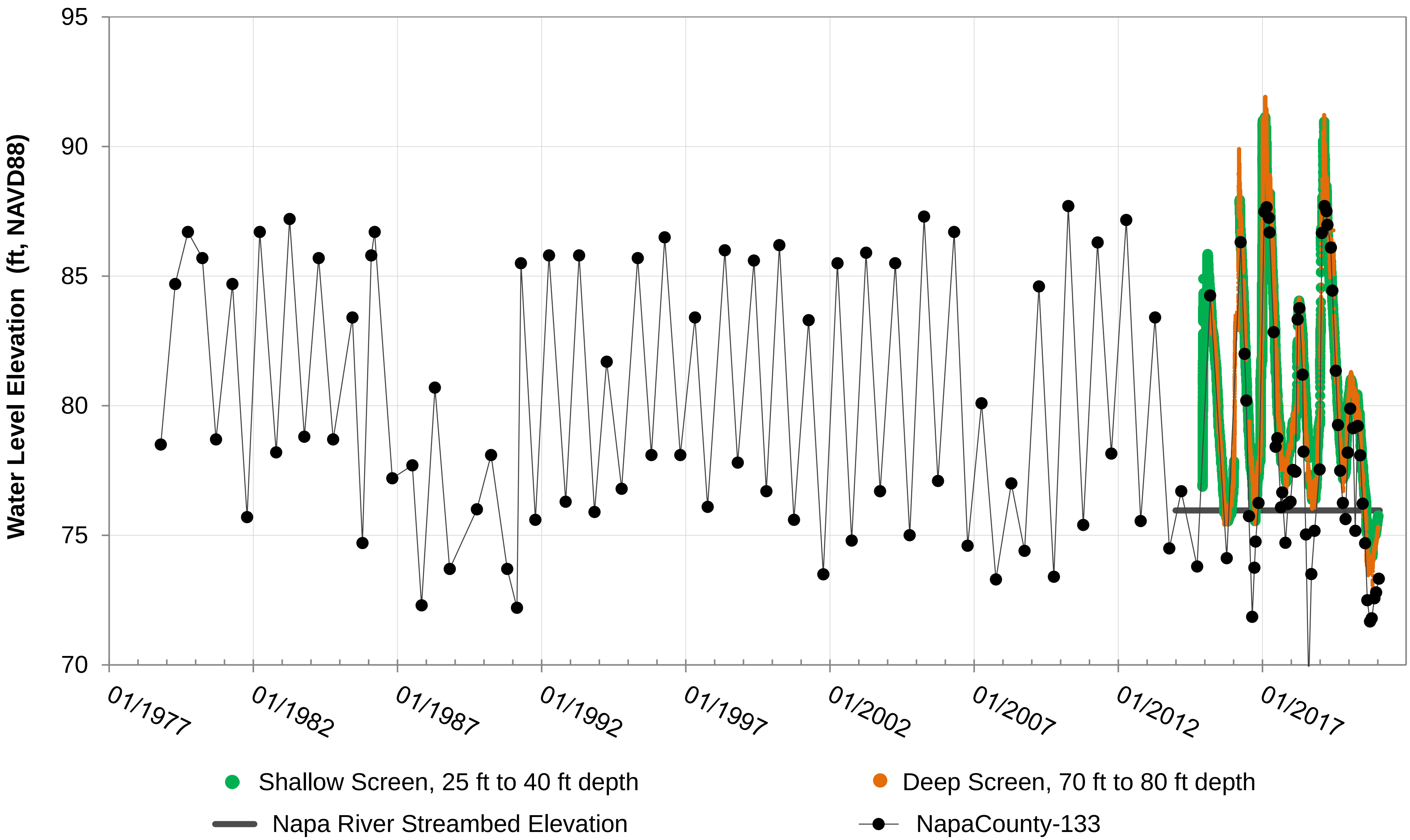

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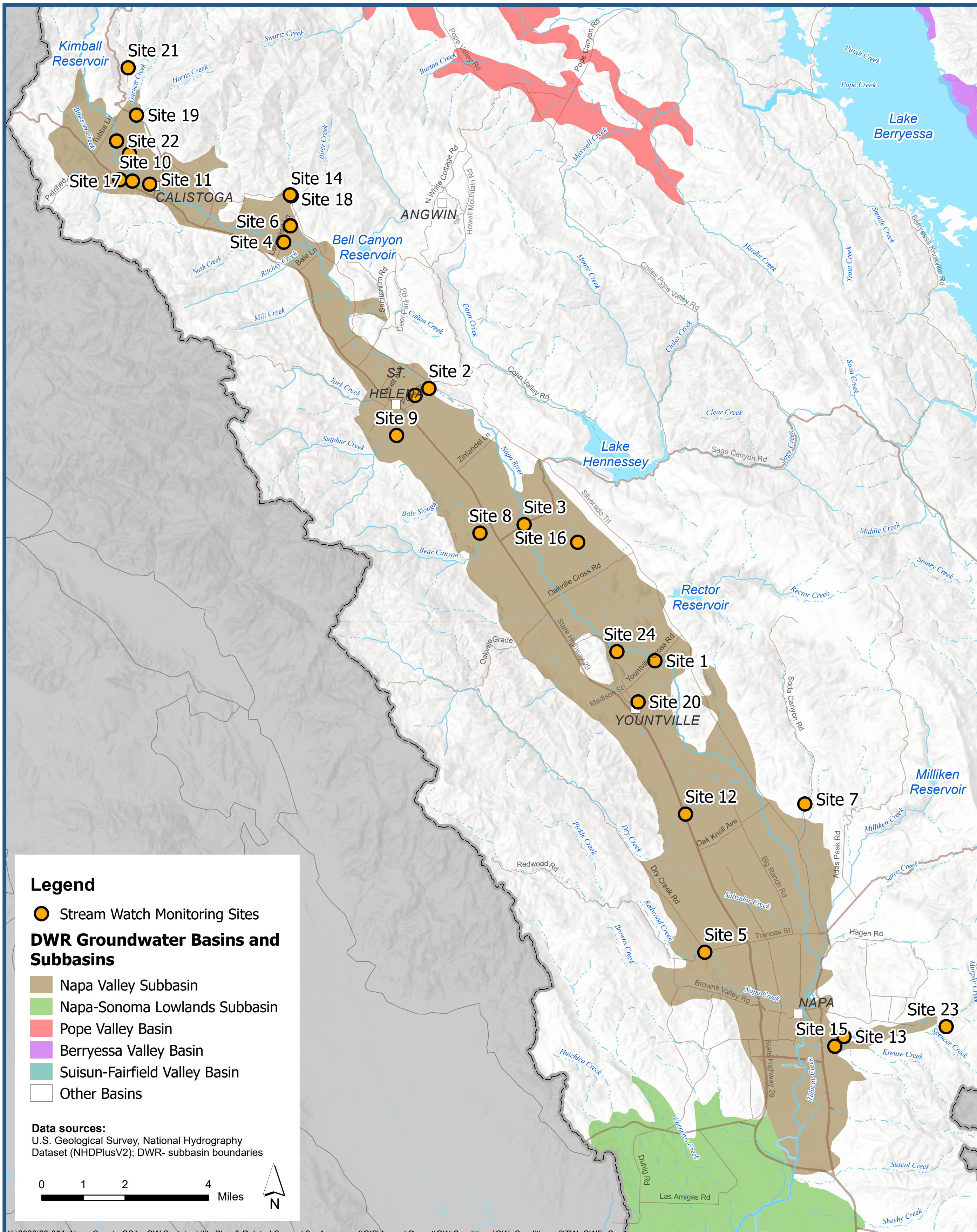
FIGURE 5-27
Surface Water-Groundwater Network Historical Hydrograph
Site 4: Napa River at Yountville Cross Road



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Stream Watch Monitoring Sites

Figure 5-28

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Stream Flow Observation Guide

Dry- No water. Creek bed is completely dry.

Isolated Pools- Water in stream, but it is not connected, and does not appear to be flowing. Pools of water separated by rocks or other materials.

Flowing- Water is continuous and can range from not moving, moving slowly, to moving quickly. If not moving, a leaf on the water surface would not move downstream. If moving slowly, small ripples may be seen on the surface. If moving quickly, white caps may be visible, but are not a requirement.

Trash Observation Guide

Trash cannot be seen on the banks or in the water without searching for it; less than one piece of trash is seen for every 30 feet.

A few pieces of trash can be seen, but the majority of the area is free of trash. There is less than 10 pieces on the bank or in the water.

Trash is spread throughout the majority of the area, with a few areas remaining clean. There are 10 or more pieces of trash within the vicinity.

Trash is seen throughout the area, large piles have accumulated. A serious lack of concern for the area is felt.

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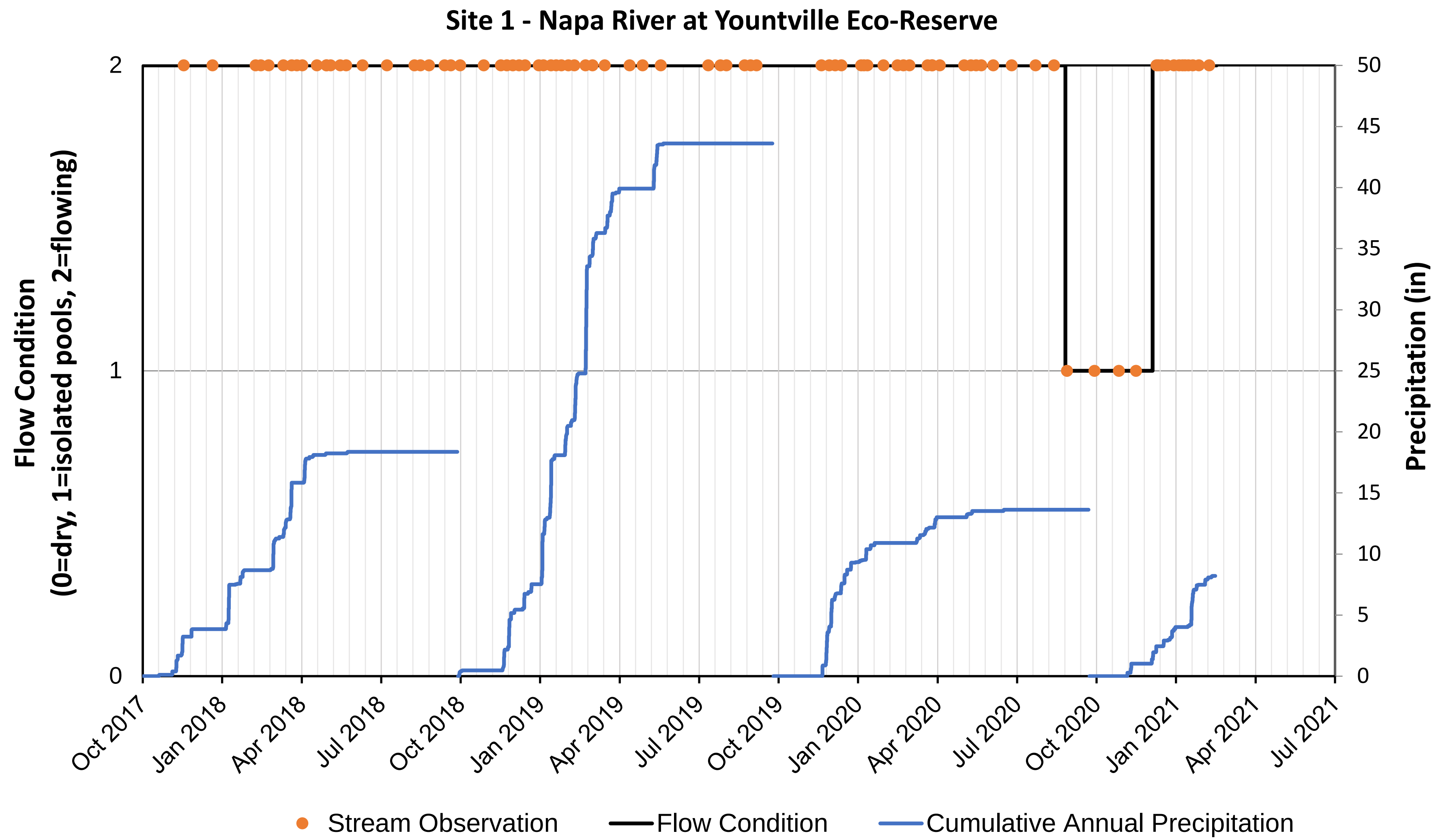
Stream Watch Observation Guide

Figure 5-29

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Napa River at Yountville Eco-Reserve gage, Site ID: 12.

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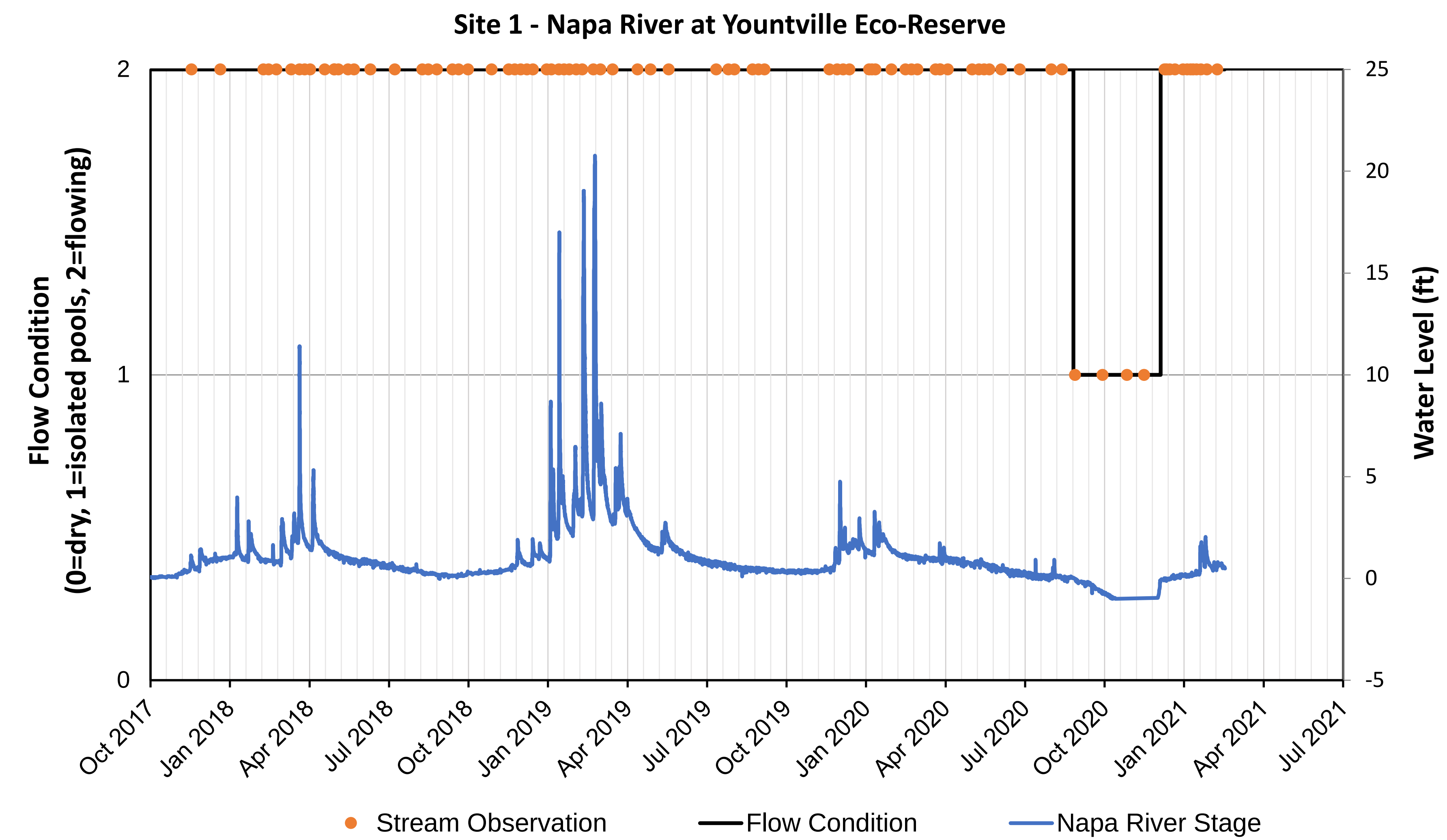
Stream Watch Site 1 - Napa River at Yountville Ecological Reserve, with Cumulative Annual Precipitation

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 5-30a



Note: Chart provided by Napa County Resource Conservation District. River stage data from Napa County Flood District Flood Alert Napa River at Yountville Eco-Reserve gage, Site ID: 12.

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Stream Watch Site 1 - Napa River at Yountville Ecological Reserve, with Napa River Stage

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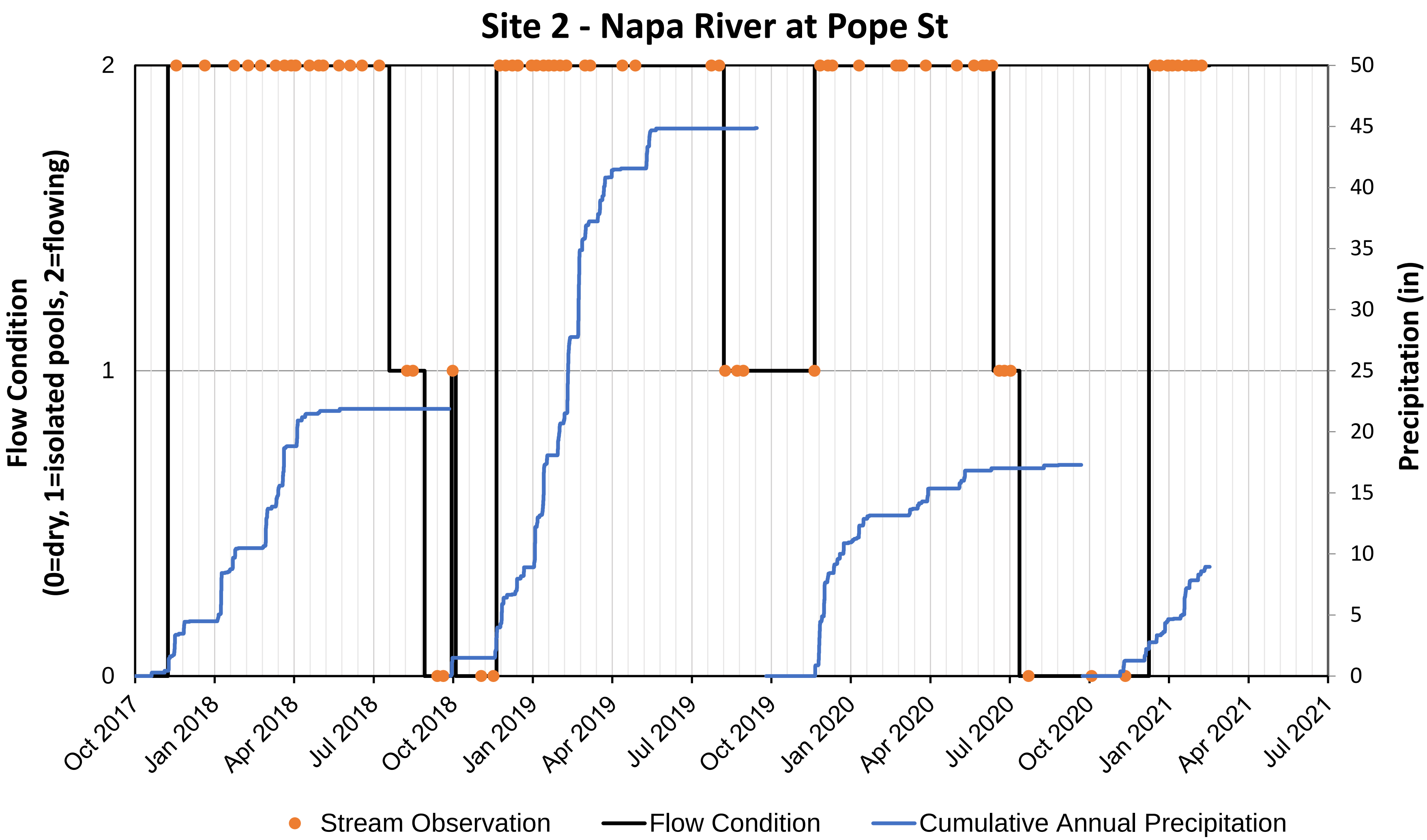
Figure 5-30b



Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Sulphur Creek at Pope St gage, Site ID: 40141.

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Stream Watch Site 2 -
Napa River at Pope Street, with Cumulative Annual Precipitation

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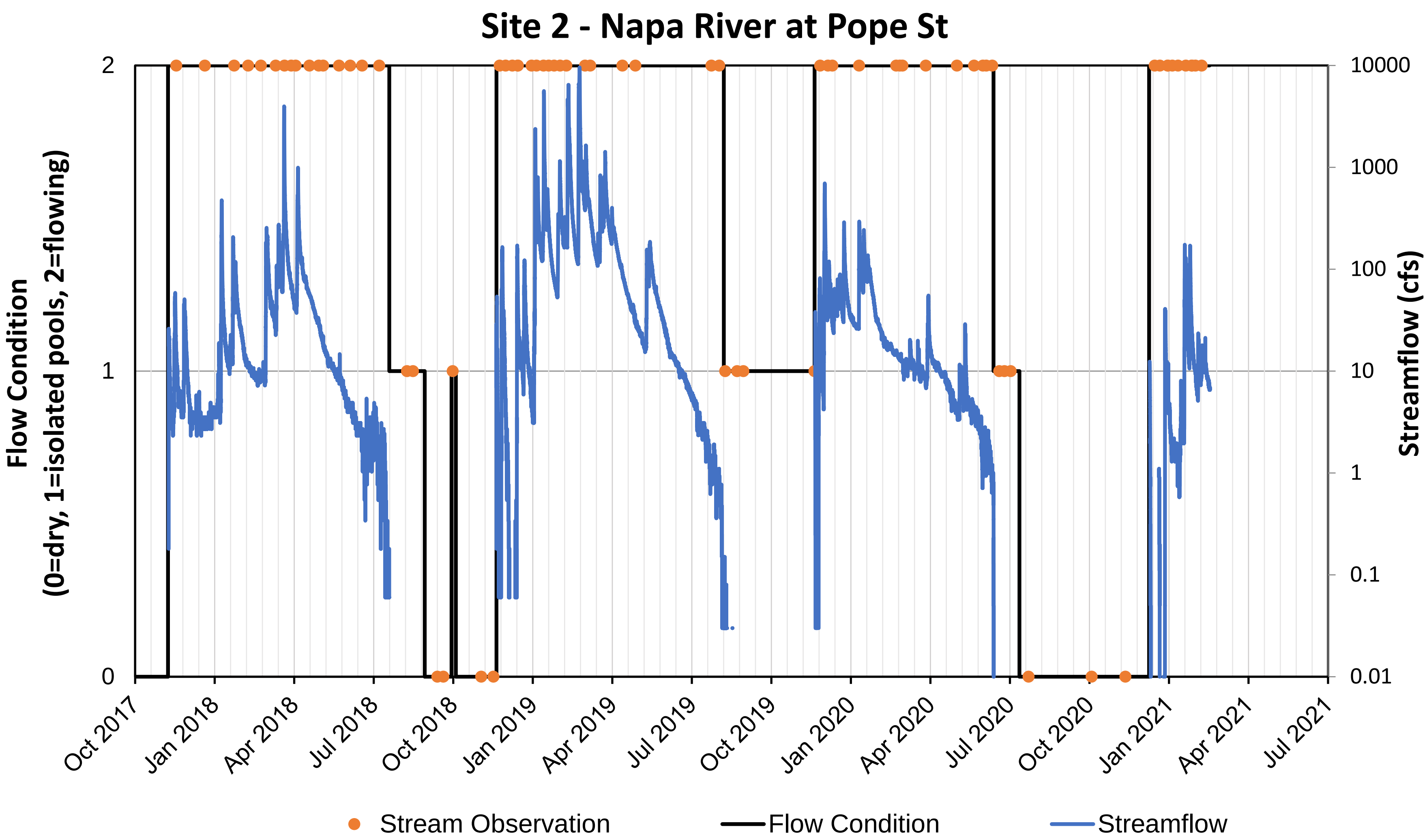
Annual Report - Water Year 2020

Figure 5-31a



Note: Chart provided by Napa County Resource Conservation District. River flow data from Napa County Flood District Flood Alert Napa River near St. Helena gage, Site ID: 1145600.

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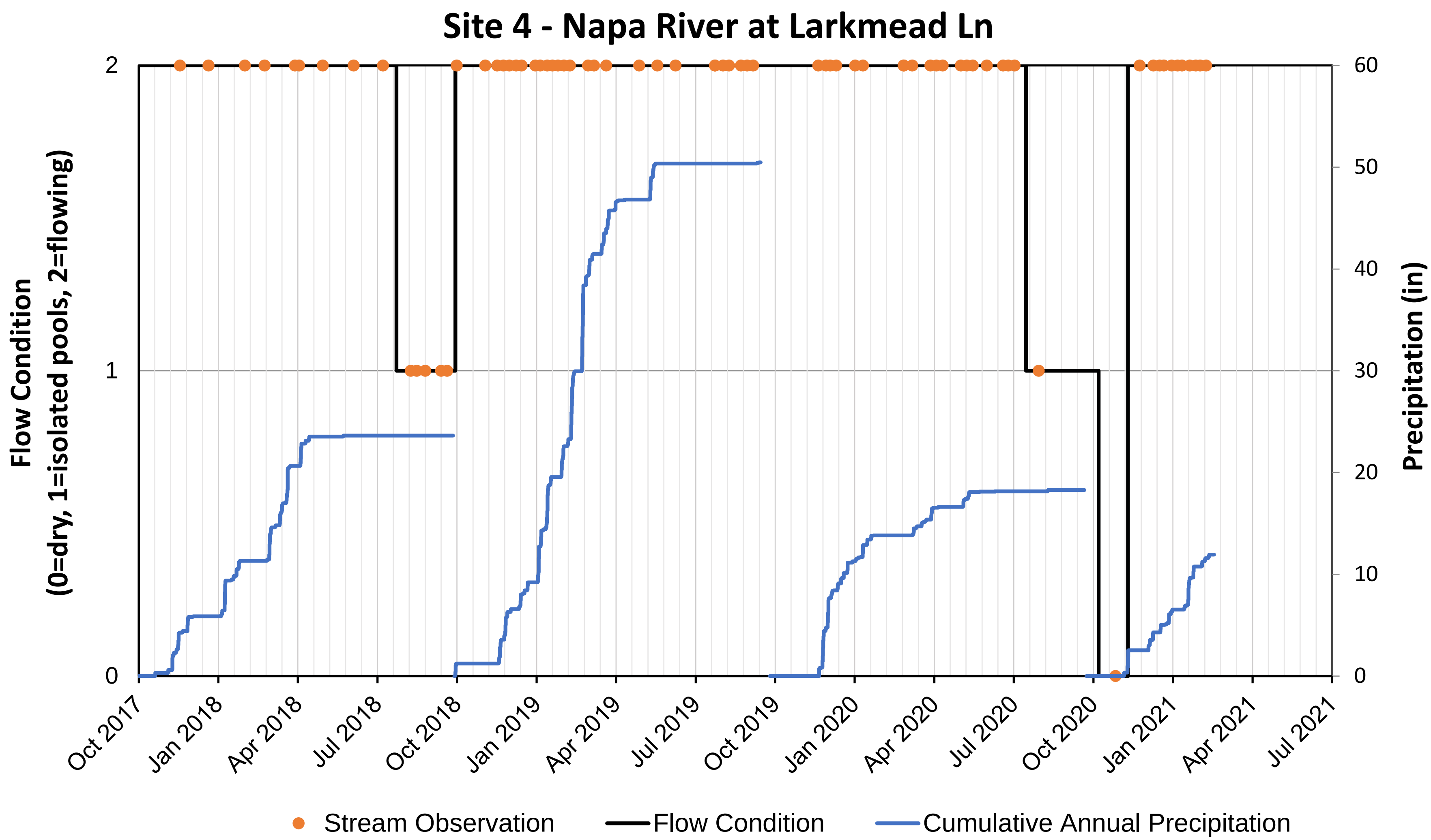
Stream Watch Site 2 -
Napa River at Pope Street, with Napa Streamflow

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 5-31b



Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Napa River at Dunaweal Ln gage, Site ID: 40142.

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Stream Watch Site 4 - Napa River at Larkmead Lane, with Cumulative Annual Precipitation

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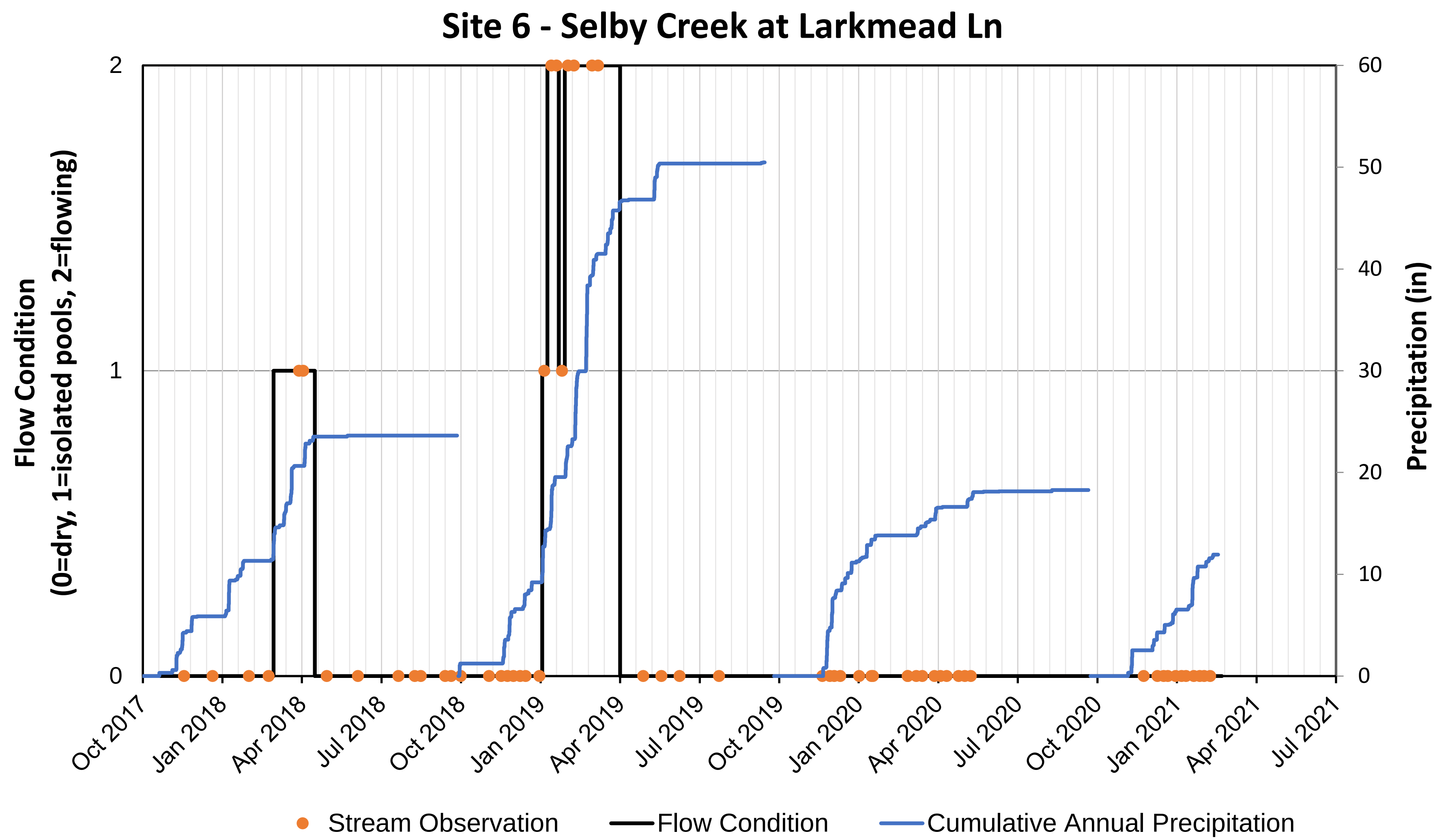
Figure 5-32



Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Napa River at Dunaweal Ln gage, Site ID: 40142.

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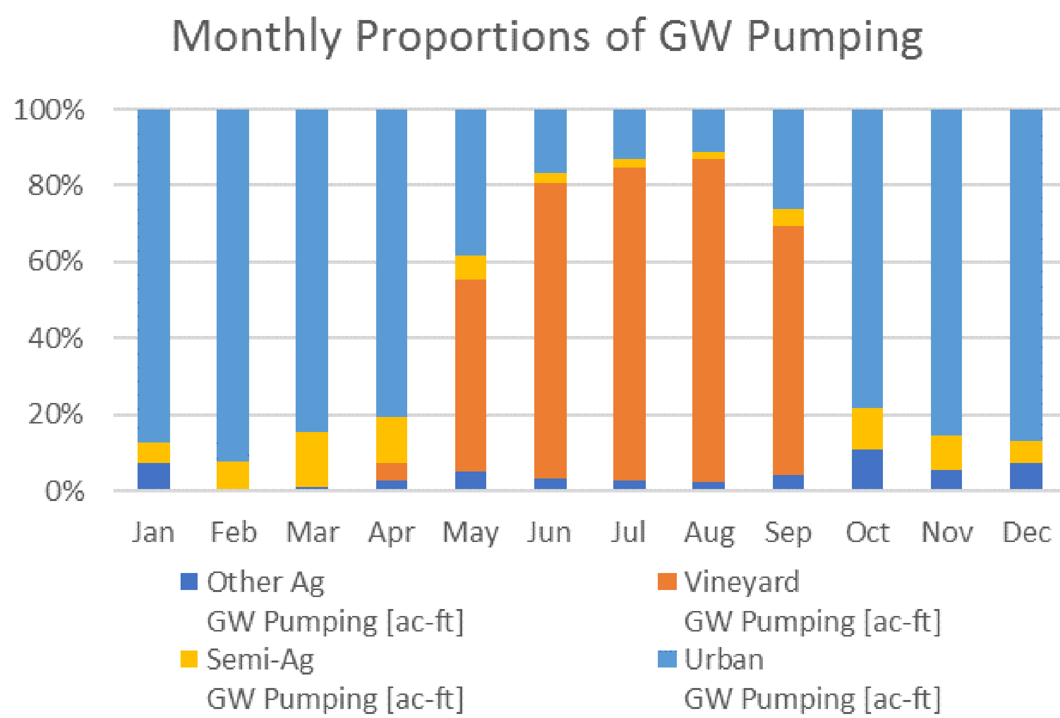
Stream Watch Site 6 Selby Creek at Larkmead Lane, with Cumulative Annual Precipitation

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 5-33



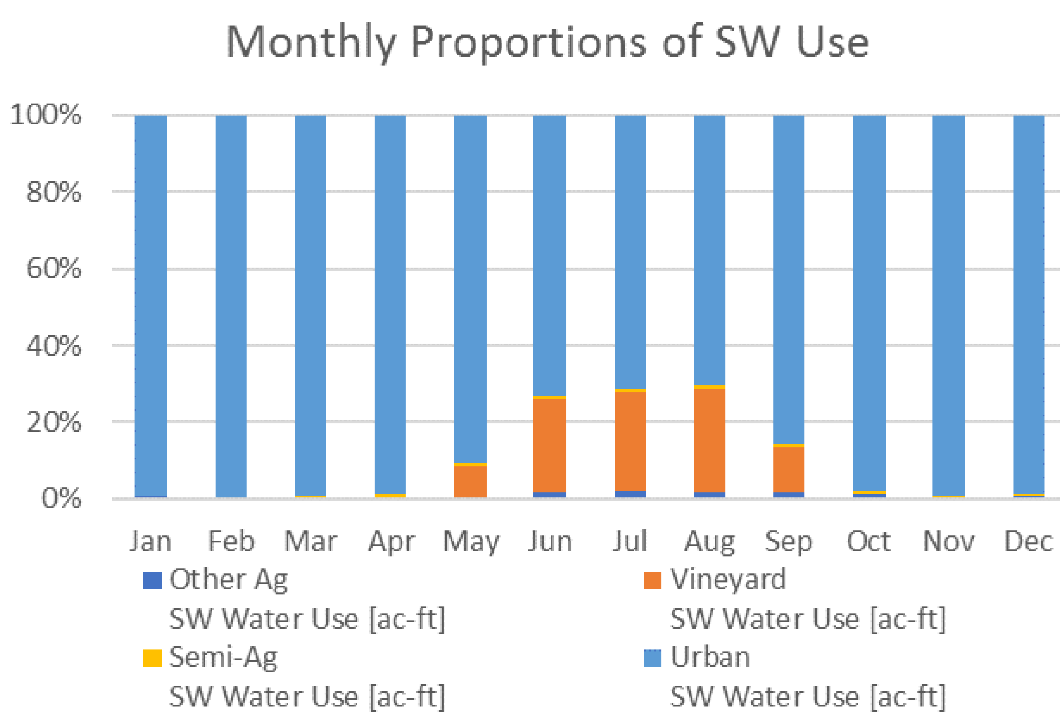


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FIGURE 6-1
Monthly Proportions of Groundwater and Surface Water Use for Irrigation

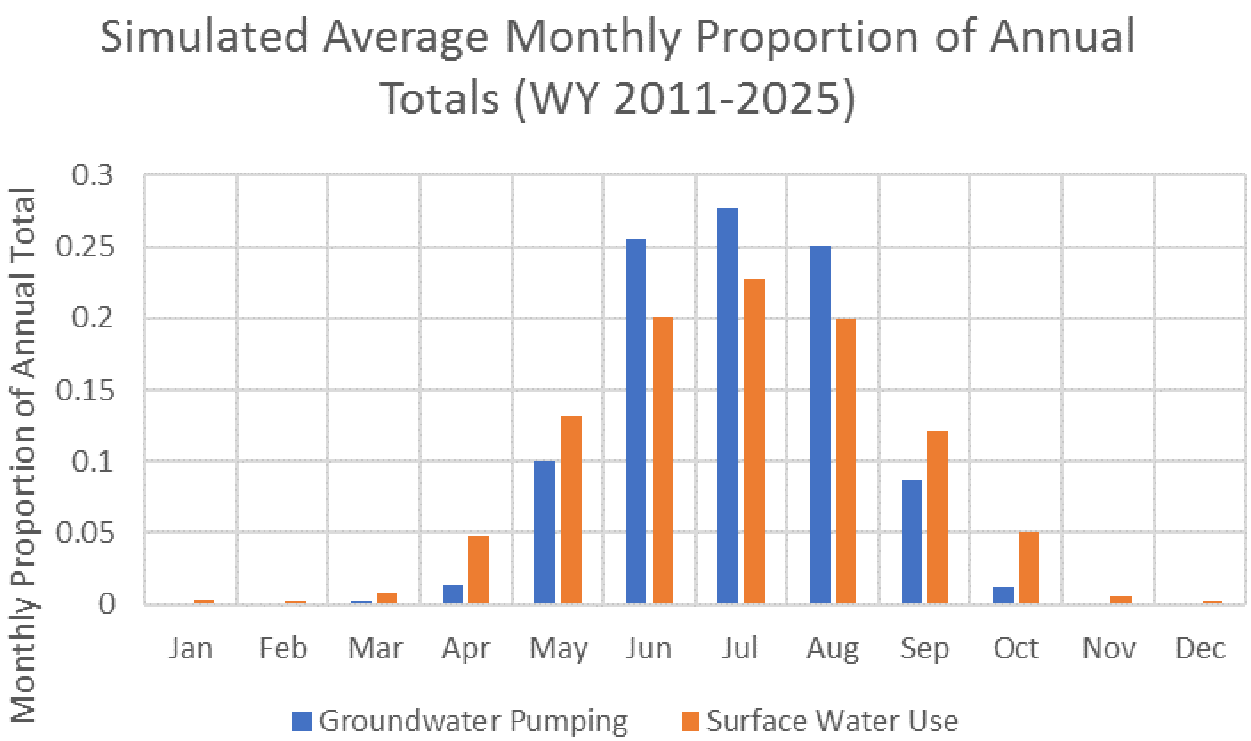


FIGURE 6-2
Simulated Average Monthly Proportion of Annual Total Groundwater and Surface Water Use for Irrigation

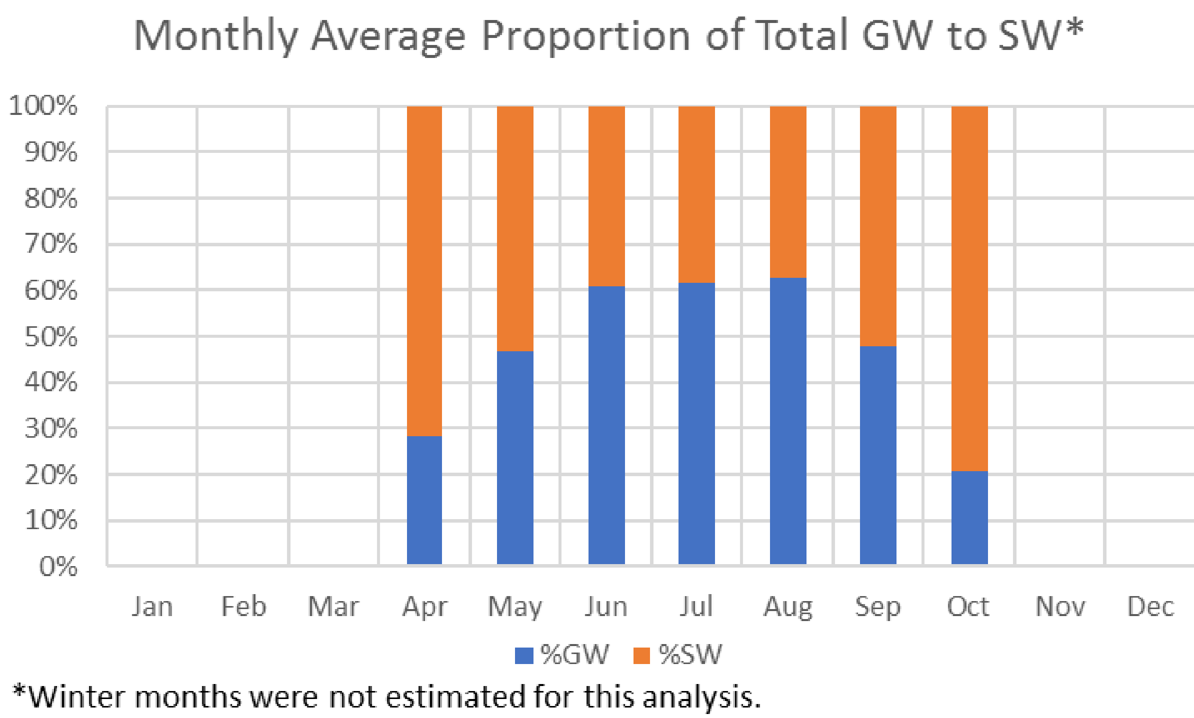
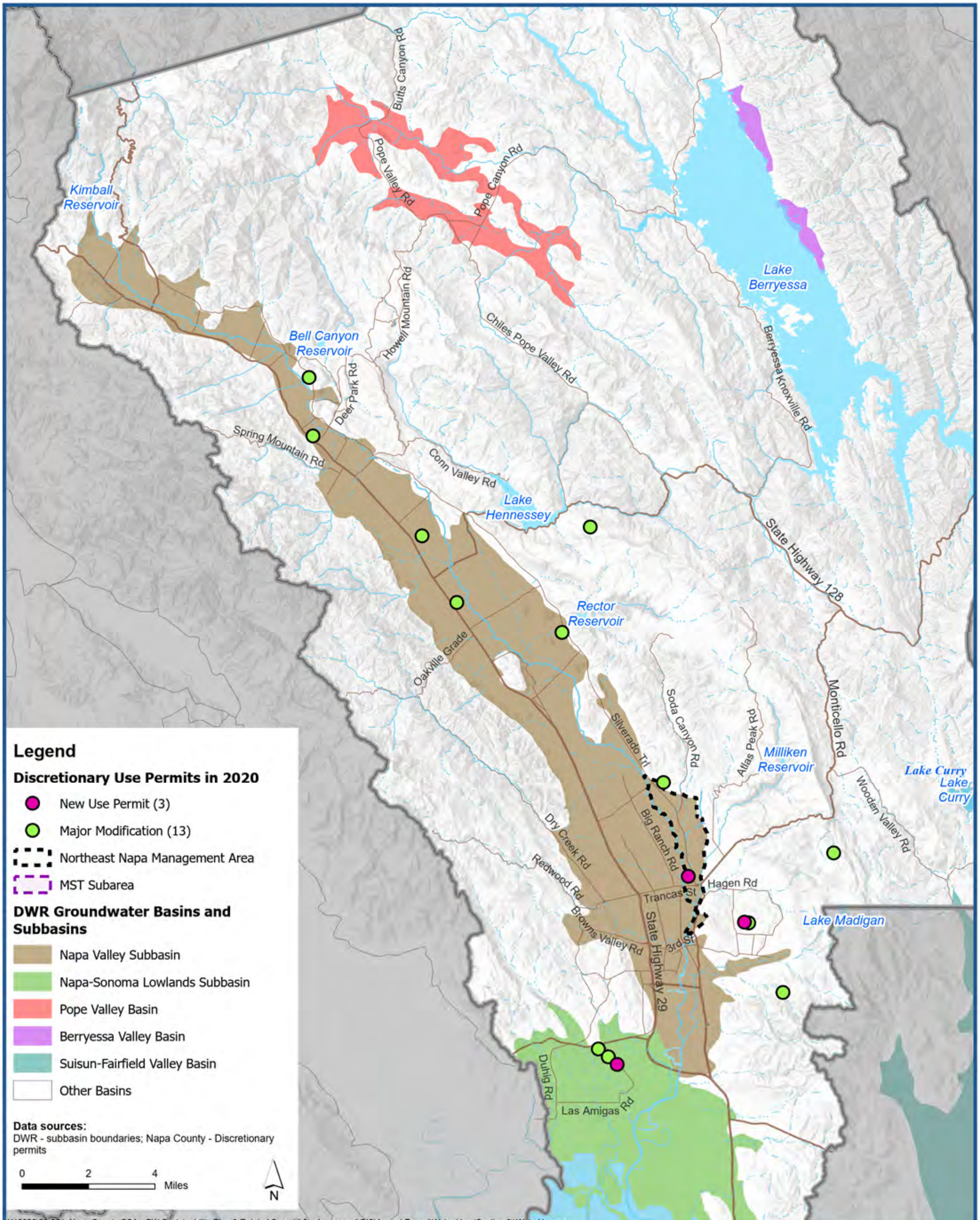


FIGURE 6-3
Monthly Average Proportion of Total Groundwater and Surface Water Use for Irrigation



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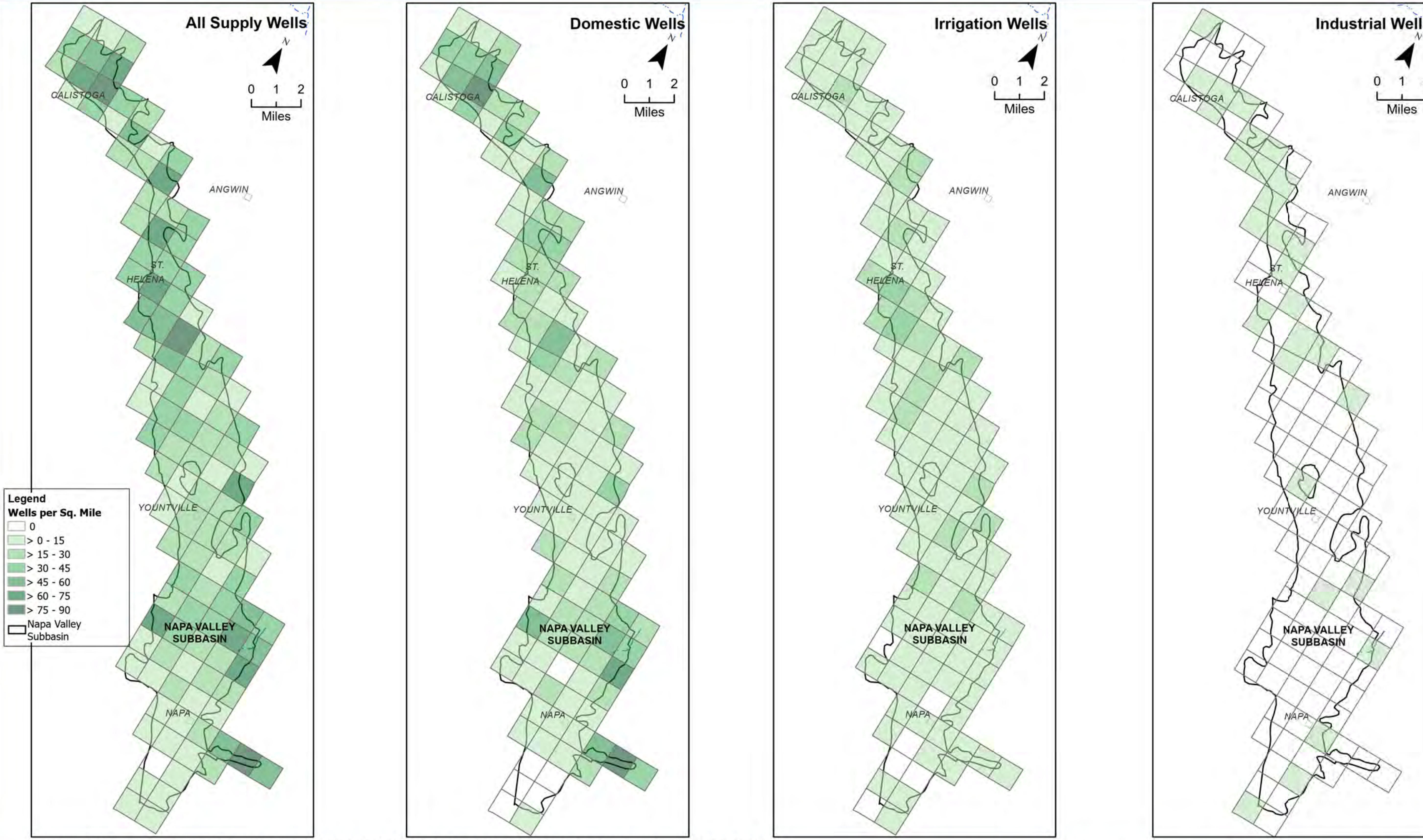
Discretionary Use Permits Issued by Napa County in 2020 with New Uses of Groundwater

Figure 6-4

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



Data sources: CA Dept. of Water Resources Bulletin 118 - Update 2003 downloaded 01/14/2016), CA Dept. of Water Resources Well Completion Report Summary for Napa County

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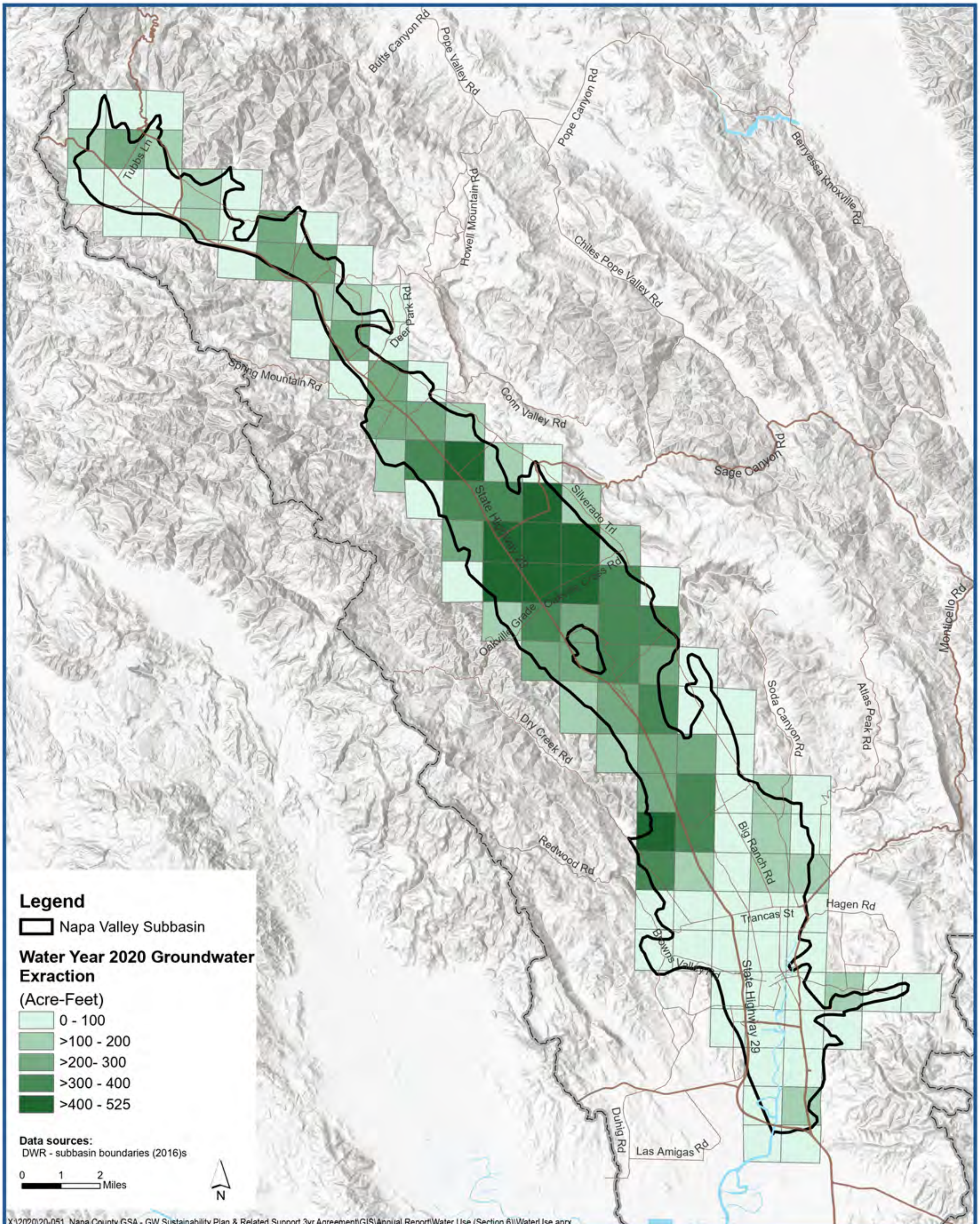
Groundwater Well Density, Napa Valley Subbasin

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 6-5



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Estimated Volume of Groundwater Use, Napa Valley Subbasin 2020

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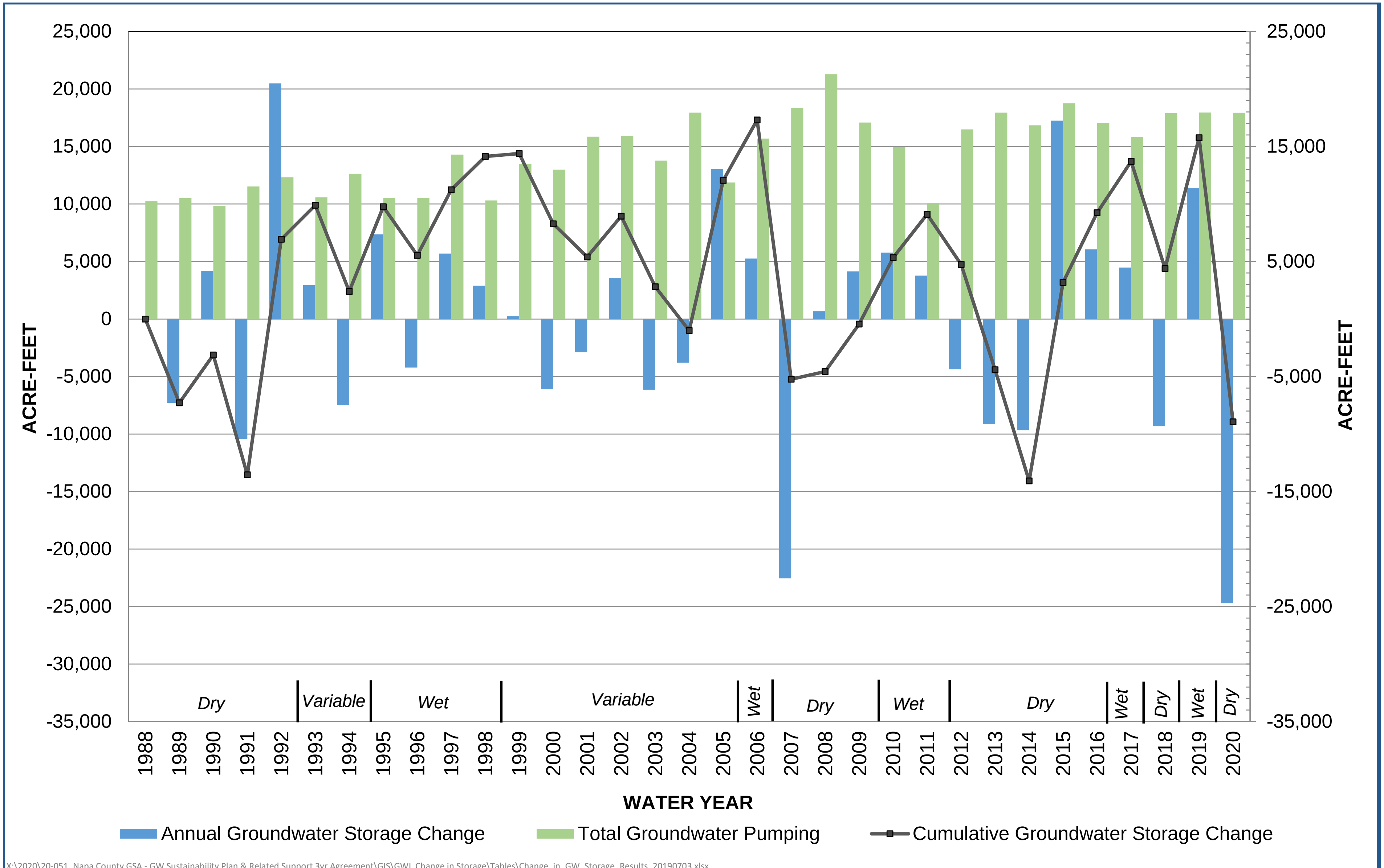
Annual Report - Water Year 2020

Figure 6-6



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Napa Valley Subbasin Groundwater Use and Groundwater Storage Changes, Water Years 1988 - 2020

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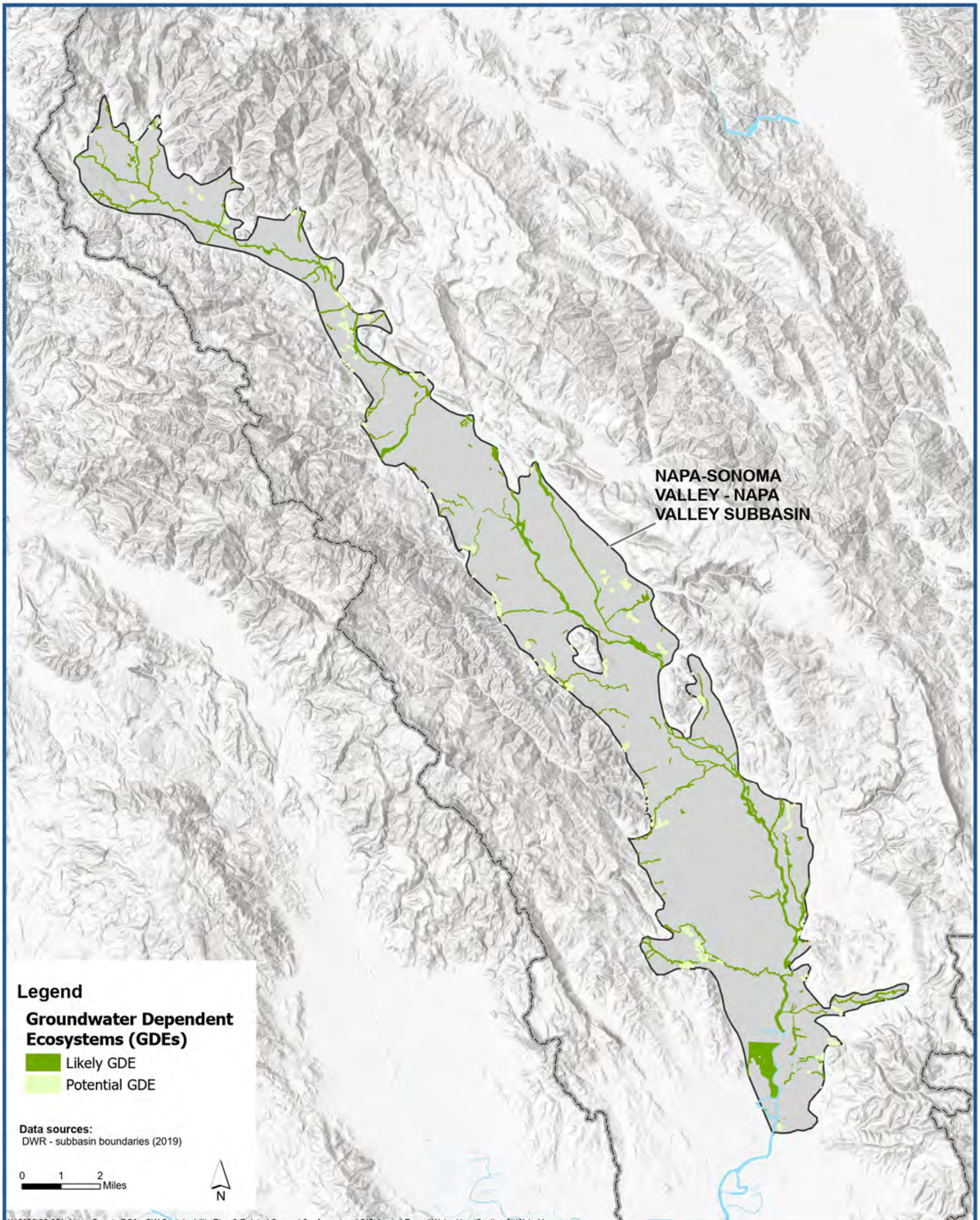
Annual Report - Water Year 2020

Figure 6-7



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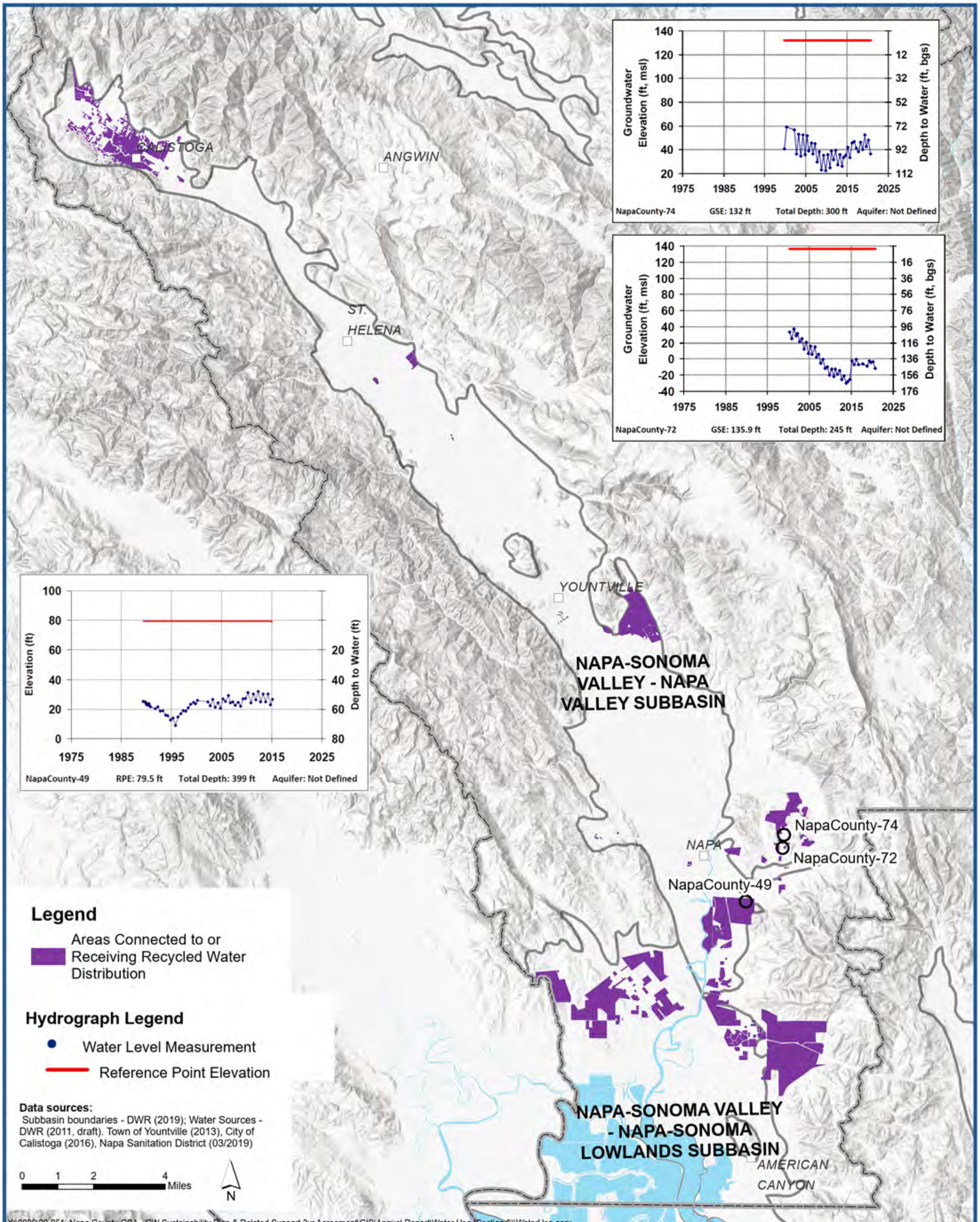
Napa Valley Subbasin Groundwater Dependent Ecosystems Included in Groundwater Use Analysis

Figure 6-8

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020



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Areas Receiving Recycled Water

Figure 6-9

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Implementation Item or Activity	2019												2020												2021			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Outreach and Communications																												
SGMA Implementation Updates and Outreach (Public Meetings: Groundwater Sustainability Agency (GSA), GSP Advisory Committee (AC), Board of Supervisors (BOS), WICC Outreach (OM), E-news Listserv Mailings (EN), Biennial Watershed Symposia (BWS))	*OM EN*	*EN*	*BOS EN*	*EN*	*EN*	*EN*	*BWS OM EN*	*EN*	*EN*	*EN*	*EN*	*EN*	*GSA EN*	*OM EN*	*GSA EN*	*EN*	*EN*	*GSA EN*	*GSA AC EN*	*GSA AC EN*	*AC EN*	*GSA AC EN*	*AC EN*	*GSA EN*	*AC EN*	*AC EN*	*AC EN*	*AC EN*
Continuing Outreach and Recruitment to Fill Data Gaps through the Voluntary Groundwater Monitoring Program	*WICC Outreach Meeting : 01/2019*						*WICC Outreach Meeting: 07/2019*							*WICC Outreach Meeting : 02/2020*								*WICC Outreach Meeting: 10/2020*						*Ongoing*
Stakeholder Communication and Education Plan (CEP) Update																						*Draft CEP*		*Final CEP*				
SGMA Stakeholder Survey and Draft GSP Surveys																												*Ongoing*
Do It Youself (DIY) Groundwater Level Monitoring Program																												*Ongoing*
Water Budget Refinement																												
Napa Valley Subbasin Groundwater Model Development																												*Ongoing*
Tracking Water Uses in Unincorporated Areas															*Compile Data from Public Water Systems and Surface Water Diversions (Ongoing)*													
Monitoring Basin Conditions																												
Monthly and Semi-annual Groundwater Level Monitoring and Annual Groundwater Quality Monitoring																												*Ongoing*
SGMA Annual Reports (LSCE, 2017a, 2018b, 2019, 2020, & 2021)																												*Ongoing*
Continuing Outreach and Recruitment to Fill Data Gaps through the Voluntary Groundwater Monitoring Program	*WICC Outreach Meeting : 01/2019*						*WICC Outreach Meeting: 07/2019*							*WICC Outreach Meeting : 02/2020*								*WICC Outreach Meeting: 10/2020*						*Ongoing*

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Sustainable Groundwater Management Act Planning and Implementation Activities

Napa County Groundwater Sustainability Agency
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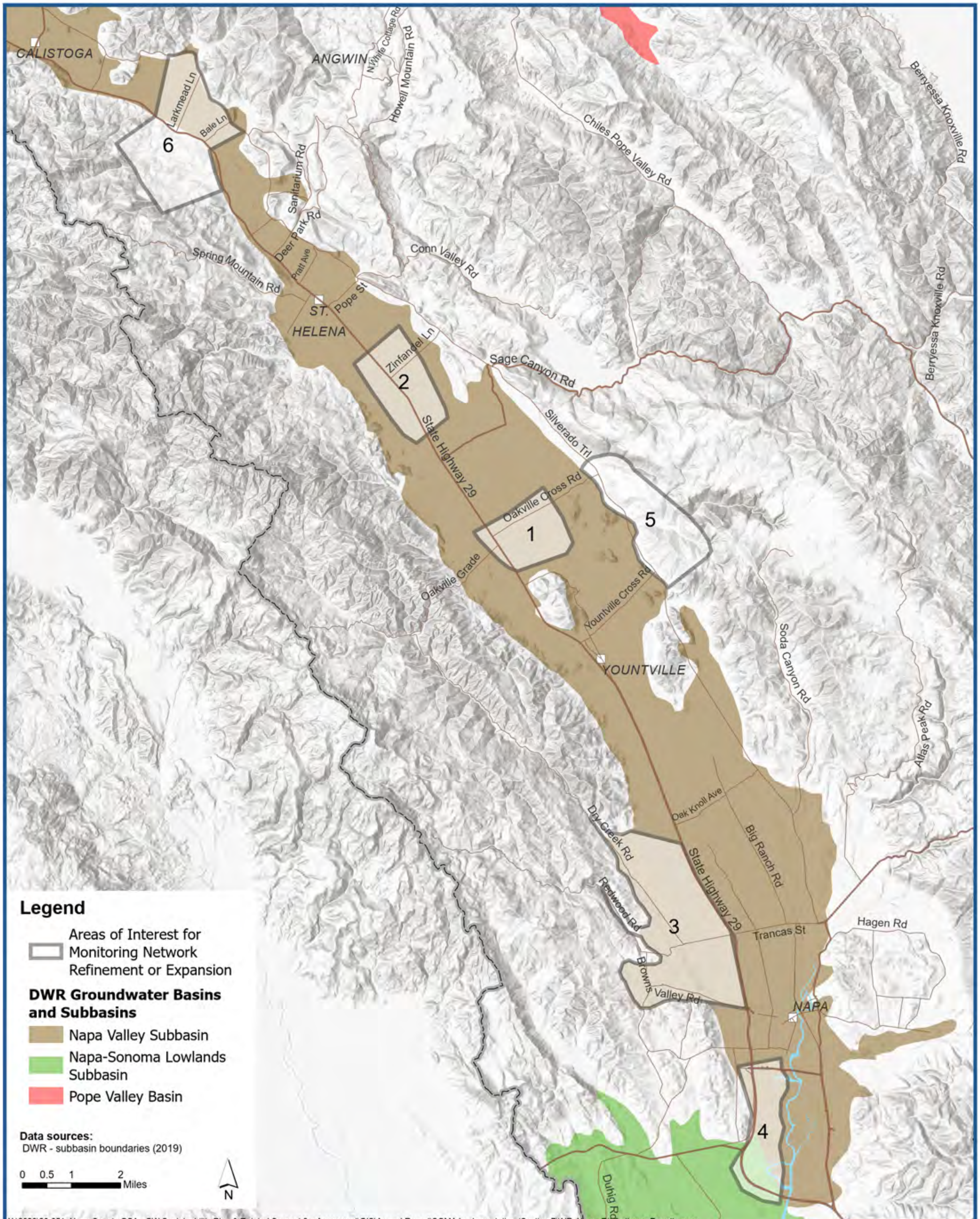
Figure 7-1



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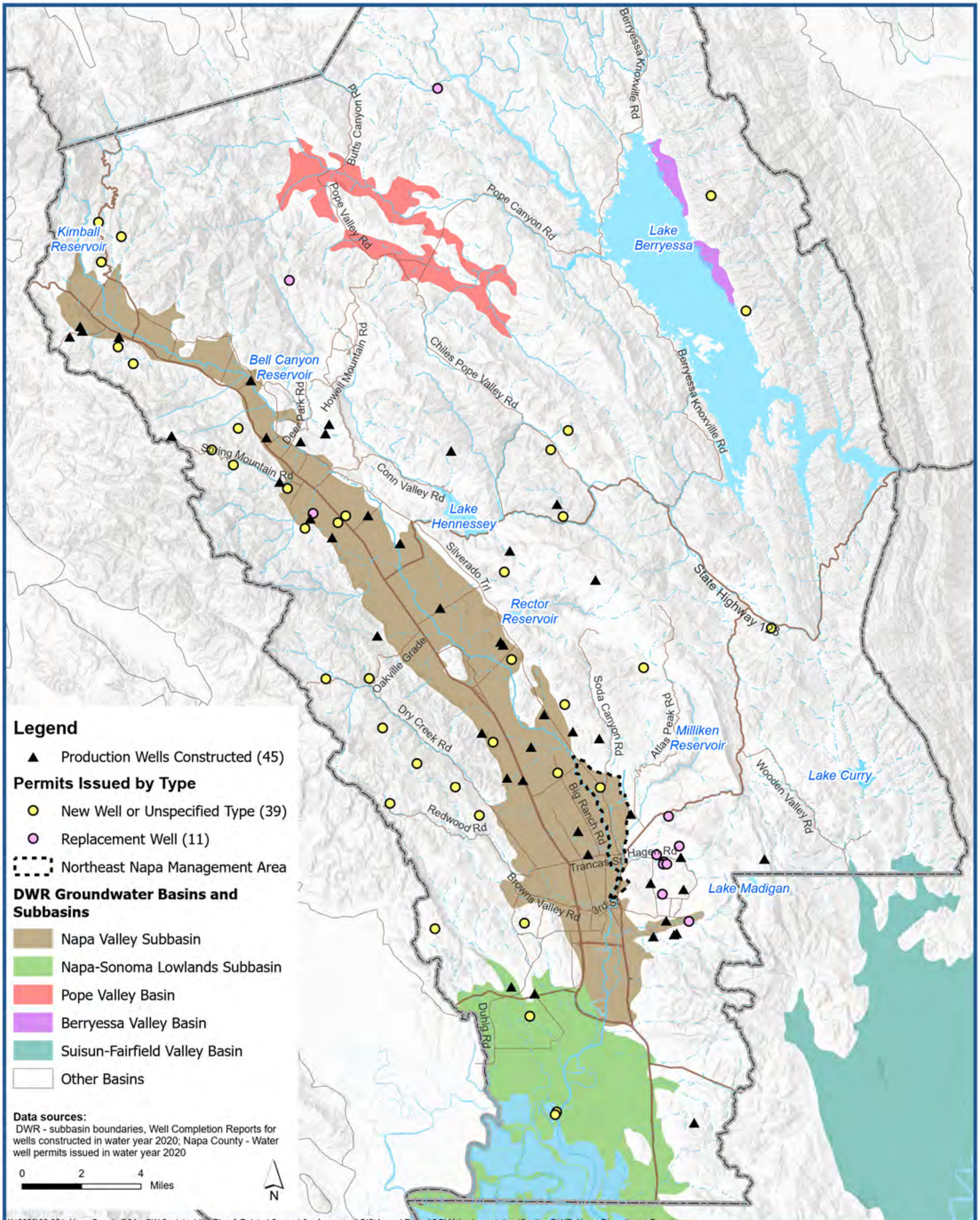
Areas for Monitoring Network Refinement and Expansion

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

Figure 7-2



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Production Well Permits Issued and Wells Constructed, Water Year 2020

Figure 7-3

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

APPENDIX A

Summary of Currently Monitored Wells

Well ID or System Number	Napa County Subarea	Primary Monitoring Entity	Primary Network	Monitoring Frequency	Period of Record	DWR Subbasin Number	DWR Basin	DWR Subbasin	Aquifer Designation
08N06W10Q001M	Napa Valley Floor-Calistoga	DWR	CASGEM (Voluntary)/Water Data Library	Monthly	1949 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
383148122292901	Napa Valley Floor-Calistoga	USGS	USGS GAMA	Quinquennial	2019 - 2019	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-127	Napa Valley Floor-Calistoga	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	1962 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-128	Napa Valley Floor-Calistoga	Napa County	CASGEM (Voluntary)/Water Data Library	Monthly	1962 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-178	Napa Valley Floor-Calistoga	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-224	Napa Valley Floor-Calistoga	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-225	Napa Valley Floor-Calistoga	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-230	Napa Valley Floor-Calistoga	Napa County	CASGEM	Semiannual	2018 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tsv
NapaCounty-122	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2001 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tss
NapaCounty-149	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2010 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-22	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2000 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-43	Napa Valley Floor-MST	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	2001 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
06N04W27L002M	Napa Valley Floor-Napa	DWR	CASGEM (Voluntary)/Water Data Library	Monthly	1966 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
381932122172601	Napa Valley Floor-Napa	USGS	USGS GAMA	Quinquennial	2019 - 2019	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-136	Napa Valley Floor-Napa	Napa County	CASGEM	Monthly	1979 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-152	Napa Valley Floor-Napa	Napa County	CASGEM	Semiannual	2012 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-182	Napa Valley Floor-Napa	Napa County	CASGEM	Monthly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tsv
NapaCounty-183	Napa Valley Floor-Napa	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa, Tsv?

Well ID or System Number	Napa County Subarea	Primary Monitoring Entity	Primary Network	Monitoring Frequency	Period of Record	DWR Subbasin Number	DWR Basin	DWR Subbasin	Aquifer Designation
NapaCounty-184	Napa Valley Floor-Napa	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tsv, Tss/h?
NapaCounty-185	Napa Valley Floor-Napa	Napa County	Napa County Volunteer	Monthly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-187	Napa Valley Floor-Napa	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tsv?, KJgv?
NapaCounty-188	Napa Valley Floor-Napa	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tsv, KJgv
NapaCounty-189	Napa Valley Floor-Napa	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-214s-swgw1	Napa Valley Floor-Napa	Napa County	CASGEM	Quarterly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-215d-swgw1	Napa Valley Floor-Napa	Napa County	CASGEM	Quarterly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-218s-swgw3	Napa Valley Floor-Napa	Napa County	CASGEM	Quarterly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-219d-swgw3	Napa Valley Floor-Napa	Napa County	CASGEM	Quarterly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-227	Napa Valley Floor-Napa	Napa County	CASGEM	Semiannual	2015 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-229	Napa Valley Floor-Napa	Napa County	CASGEM	Semiannual	2016 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tss
NapaCounty-231	Napa Valley Floor-Napa	Napa County	Napa County Volunteer	Semiannual	2020 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-76	Napa Valley Floor-Napa	Napa County	Napa County Volunteer	Semiannual	2000 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tsv
SL0605536682	Napa Valley Floor-Napa	SWRCB	SWRCB Geotracker	Various	2005 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
T0605514064	Napa Valley Floor-Napa	SWRCB	SWRCB Geotracker	Various	2005 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
07N05W09Q002M	Napa Valley Floor-St. Helena	DWR	CASGEM (Voluntary)/Water Data Library	Monthly	1949 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-131	Napa Valley Floor-St. Helena	Napa County	CASGEM	Semiannual	1963 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-132	Napa Valley Floor-St. Helena	Napa County	CASGEM (Voluntary)/Water Data Library	Monthly	1962 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa, Tsvab
NapaCounty-138	Napa Valley Floor-St. Helena	Napa County	CASGEM	Semiannual	1949 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined

Well ID or System Number	Napa County Subarea	Primary Monitoring Entity	Primary Network	Monitoring Frequency	Period of Record	DWR Subbasin Number	DWR Basin	DWR Subbasin	Aquifer Designation
NapaCounty-169	Napa Valley Floor-St. Helena	Napa County	CASGEM	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-171	Napa Valley Floor-St. Helena	Napa County	Napa County Volunteer	Monthly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tst/s
NapaCounty-172	Napa Valley Floor-St. Helena	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-173	Napa Valley Floor-St. Helena	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-174	Napa Valley Floor-St. Helena	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-177	Napa Valley Floor-St. Helena	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-204	Napa Valley Floor-St. Helena	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-212	Napa Valley Floor-St. Helena	Napa County	Napa County Volunteer	Semiannual	2015 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-222s-swgw5	Napa Valley Floor-St. Helena	Napa County	CASGEM	Quarterly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-223d-swgw5	Napa Valley Floor-St. Helena	Napa County	CASGEM	Quarterly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
06N04W17A001M	Napa Valley Floor-Yountville	DWR	CASGEM (Voluntary)/Water Data Library	Monthly	1949 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
382553122232501	Napa Valley Floor-Yountville	USGS	USGS GAMA	Quinquennial	2019 - 2019	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-125	Napa Valley Floor-Yountville	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	1979 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tsva
NapaCounty-126	Napa Valley Floor-Yountville	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	1984 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tsva
NapaCounty-133	Napa Valley Floor-Yountville	Napa County	CASGEM (Voluntary)/Water Data Library	Monthly	1978 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-134	Napa Valley Floor-Yountville	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	1963 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa

Well ID or System Number	Napa County Subarea	Primary Monitoring Entity	Primary Network	Monitoring Frequency	Period of Record	DWR Subbasin Number	DWR Basin	DWR Subbasin	Aquifer Designation
NapaCounty-135	Napa Valley Floor-Yountville	Napa County	CASGEM (Voluntary)/Water Data Library	Monthly	1979 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa, Tsv
NapaCounty-139	Napa Valley Floor-Yountville	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	1978 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-179	Napa Valley Floor-Yountville	Napa County	CASGEM	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-181	Napa Valley Floor-Yountville	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Tsv
NapaCounty-216s-swgw2	Napa Valley Floor-Yountville	Napa County	CASGEM	Quarterly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-217d-swgw2	Napa Valley Floor-Yountville	Napa County	CASGEM	Quarterly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-220s-swgw4	Napa Valley Floor-Yountville	Napa County	CASGEM	Quarterly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-221d-swgw4	Napa Valley Floor-Yountville	Napa County	CASGEM	Quarterly	2014 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Qa
NapaCounty-129	Western Mountains	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	1962 - 2020	2-2.01	NAPA-SONOMA VALLEY	NAPA VALLEY	Not Determined
NapaCounty-150	Carneros	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	2011 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	Not Determined
NapaCounty-153	Carneros	Napa County	CASGEM	Semiannual	2012 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	TQsb
NapaCounty-154	Carneros	Napa County	CASGEM	Semiannual	2012 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	TQsb
NapaCounty-155	Carneros	Napa County	CASGEM	Semiannual	2012 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	TQsb
NapaCounty-176	Carneros	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	Not Determined

Well ID or System Number	Napa County Subarea	Primary Monitoring Entity	Primary Network	Monitoring Frequency	Period of Record	DWR Subbasin Number	DWR Basin	DWR Subbasin	Aquifer Designation
NapaCounty-194	Carneros	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	Not Determined
NapaCounty-195	Carneros	Napa County	CASGEM	Semiannual	2014 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	Not Determined
NapaCounty-200	Carneros	Napa County	CASGEM	Semiannual	2014 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	Not Determined
NapaCounty-201	Carneros	Napa County	CASGEM	Semiannual	2014 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	Not Determined
NapaCounty-205	Carneros	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	Not Determined
NapaCounty-206	Carneros	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	Not Determined
NapaCounty-207	Carneros	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	Not Determined
NapaCounty-196	Jameson/American Canyon	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	2-2.03	NAPA-SONOMA VALLEY	NAPA-SONOMA LOWLANDS	Not Determined
NapaCounty-211	Pope Valley	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	5-68	POPE VALLEY		Not Determined
NapaCounty-165	Angwin	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	-	Outside	-	Not Determined
NapaCounty-166	Angwin	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	-	Outside	-	Not Determined
NapaCounty-167	Angwin	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	-	Outside	-	Not Determined
NapaCounty-168	Angwin	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	-	Outside	-	Not Determined
NapaCounty-202	Angwin	Napa County	CASGEM	Semiannual	2014 - 2020	-	Outside	-	Not Determined
L10003756160	Central Interior Valleys	SWRCB	SWRCB Geotracker	Various	1990 - 2020	-	Outside	-	Not Determined

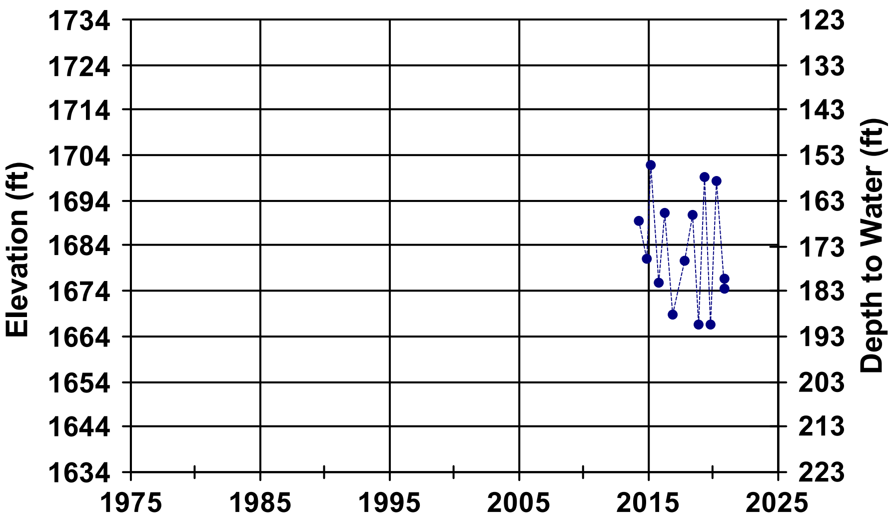
Well ID or System Number	Napa County Subarea	Primary Monitoring Entity	Primary Network	Monitoring Frequency	Period of Record	DWR Subbasin Number	DWR Basin	DWR Subbasin	Aquifer Designation
NapaCounty-209	Central Interior Valleys	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	-	Outside	-	Not Determined
NapaCounty-175	Eastern Mountains	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	-	Outside	-	Tsv
NapaCounty-193	Eastern Mountains	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	-	Outside	-	Not Determined
NapaCounty-210	Eastern Mountains	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	-	Outside	-	Not Determined
NapaCounty-208	Napa Valley Floor-Calistoga	Napa County	CASGEM	Semiannual	2014 - 2020	-	Outside	-	Tsv
381639122150801	Napa Valley Floor-MST	USGS	USGS GAMA	Quinquennial	2019 - 2019	-	Outside	-	Not Determined
NapaCounty-118	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2001 - 2020	-	Outside	-	Not Determined
NapaCounty-137	Napa Valley Floor-MST	Napa County	CASGEM	Semiannual	1979 - 2020	-	Outside	-	Not Determined
NapaCounty-142	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2001 - 2020	-	Outside	-	Not Determined
NapaCounty-18	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2000 - 2020	-	Outside	-	Not Determined
NapaCounty-191	Napa Valley Floor-MST	Napa County	CASGEM	Semiannual	2014 - 2020	-	Outside	-	Not Determined
NapaCounty-192	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2014 - 2020	-	Outside	-	Not Determined
NapaCounty-2	Napa Valley Floor-MST	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	1979 - 2020	-	Outside	-	Not Determined
NapaCounty-20	Napa Valley Floor-MST	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	1978 - 2020	-	Outside	-	Tsvd
NapaCounty-226	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2015 - 2020	-	Outside	-	Not Determined
NapaCounty-35	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2000 - 2020	-	Outside	-	Not Determined
NapaCounty-56	Napa Valley Floor-MST	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	1978 - 2020	-	Outside	-	Tss/h
NapaCounty-69	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2000 - 2020	-	Outside	-	Not Determined

Well ID or System Number	Napa County Subarea	Primary Monitoring Entity	Primary Network	Monitoring Frequency	Period of Record	DWR Subbasin Number	DWR Basin	DWR Subbasin	Aquifer Designation
NapaCounty-72	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2000 - 2020	-	Outside	-	Not Determined
NapaCounty-74	Napa Valley Floor-MST	Napa County	CASGEM	Semiannual	1999 - 2020	-	Outside	-	Not Determined
NapaCounty-81	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2000 - 2020	-	Outside	-	Not Determined
NapaCounty-91	Napa Valley Floor-MST	Napa County	CASGEM	Semiannual	1992 - 2020	-	Outside	-	Tsvt
NapaCounty-92	Napa Valley Floor-MST	Napa County	CASGEM	Semiannual	1999 - 2020	-	Outside	-	Not Determined
NapaCounty-95	Napa Valley Floor-MST	Napa County	CASGEM (Voluntary)/Water Data Library	Semiannual	1979 - 2020	-	Outside	-	Tsvt
NapaCounty-98	Napa Valley Floor-MST	Napa County	Napa County Volunteer	Semiannual	2000 - 2020	-	Outside	-	Not Determined
383038122271301	Napa Valley Floor-St. Helena	USGS	USGS GAMA	Quinquennial	2019 - 2019	-	Outside	-	Not Determined
NapaCounty-213	Western Mountains	Napa County	CASGEM	Semiannual	2014 - 2020	-	Outside	-	Not Determined

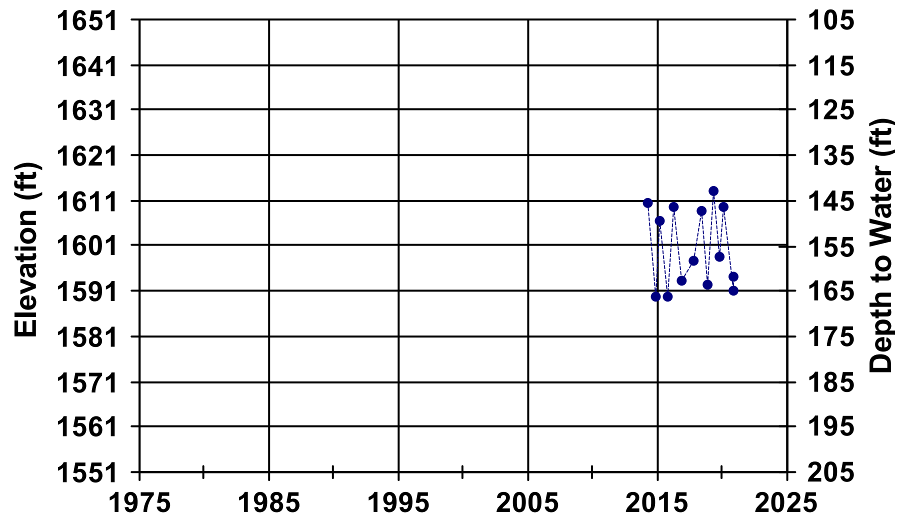
APPENDIX B

Groundwater Level Hydrographs for Currently Monitored Wells

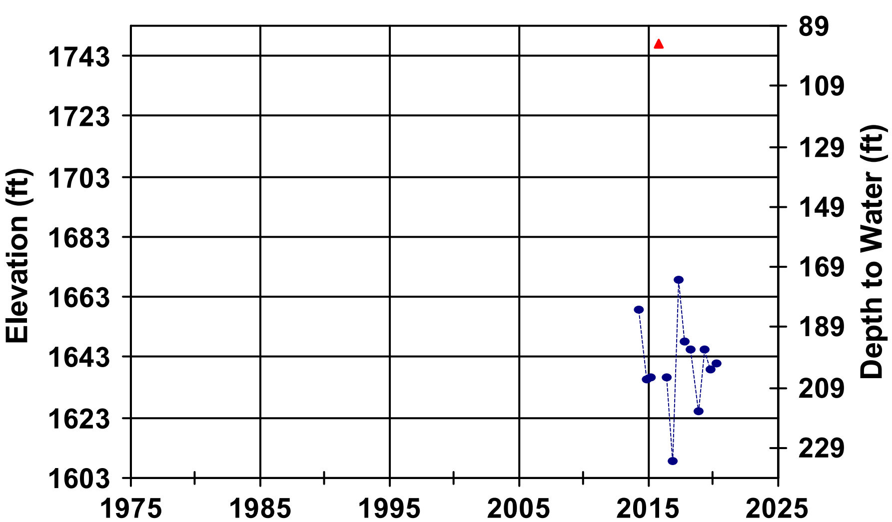
WellID: **NapaCounty-165** RPE: 1857 ft, msl SWN: Unknown
Subarea: Angwin Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 11/24/2020



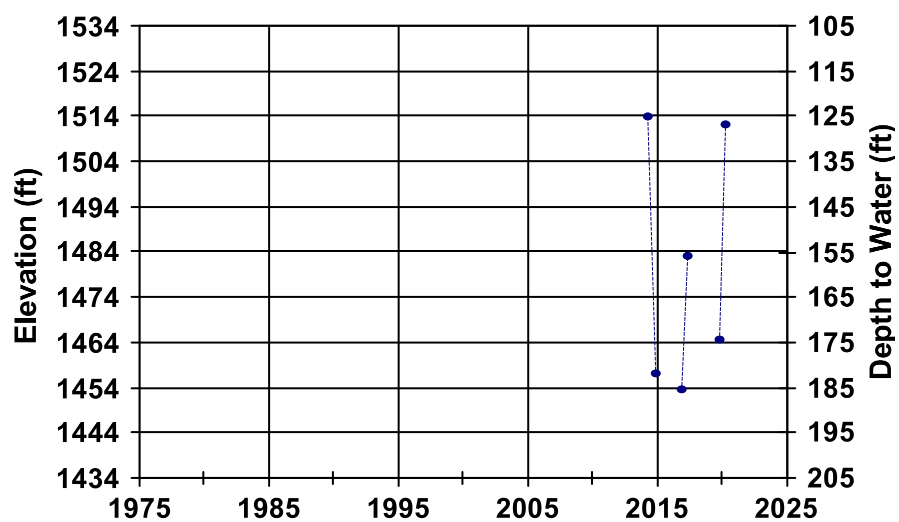
WellID: **NapaCounty-166** RPE: 1755.8 ft, msl SWN: Unknown
Subarea: Angwin Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 11/24/2020



WellID: **NapaCounty-167** RPE: 1842.3 ft, msl SWN: Unknown
Subarea: Angwin Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 3/30/2020

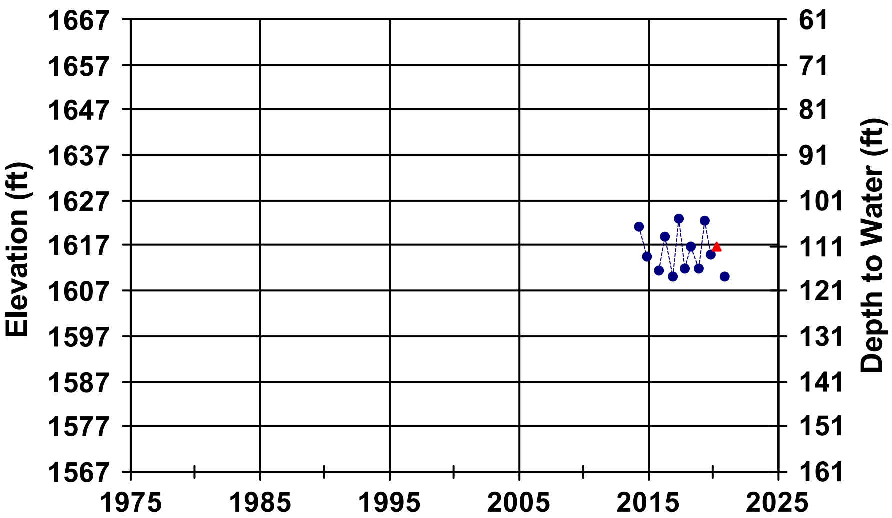


WellID: **NapaCounty-168** RPE: 1639 ft, msl SWN: Unknown
Subarea: Angwin Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 3/31/2020

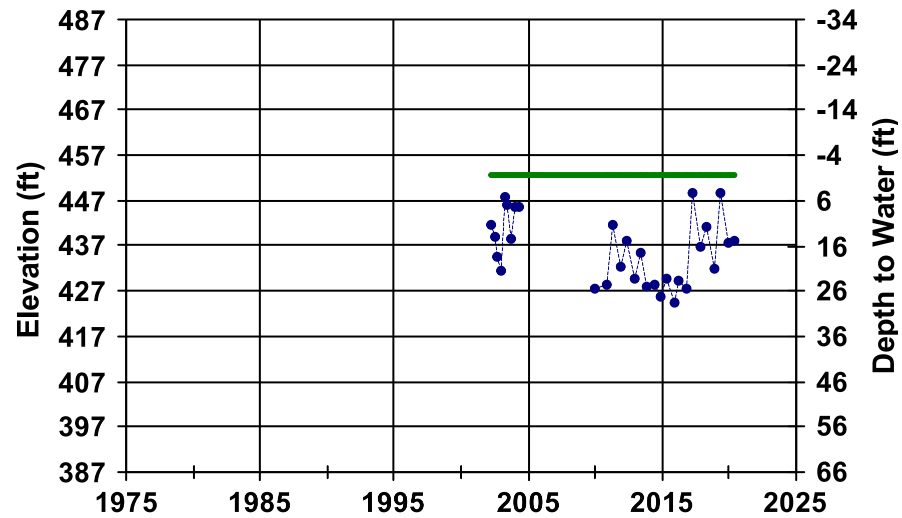


Static Water Level Questionable Measurement Reference Point Elevation

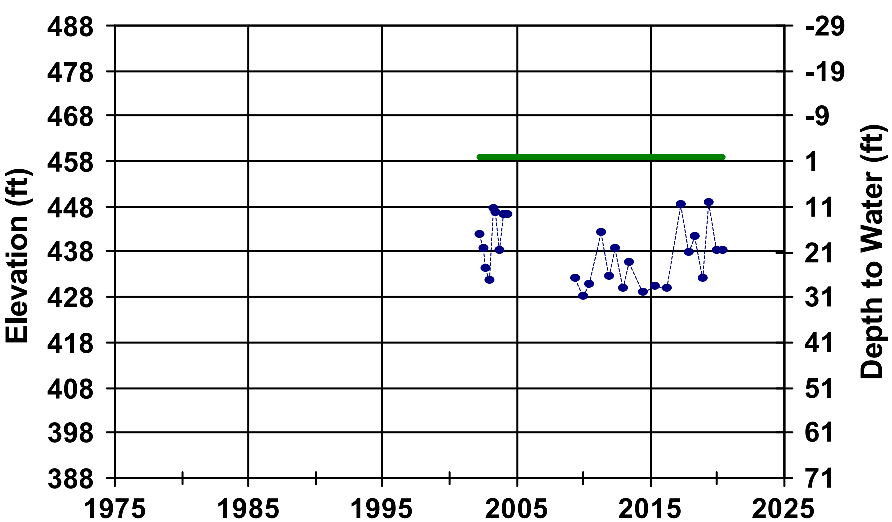
WellID: NapaCounty-202
Subarea: Angwin
Groundwater Basin Not within a basin
RPE: 1728.2 ft, msl
Source: NapaCounty
SWN: Unknown
Aquifer Zone: undefined
Last Msmt Date 10/19/2020



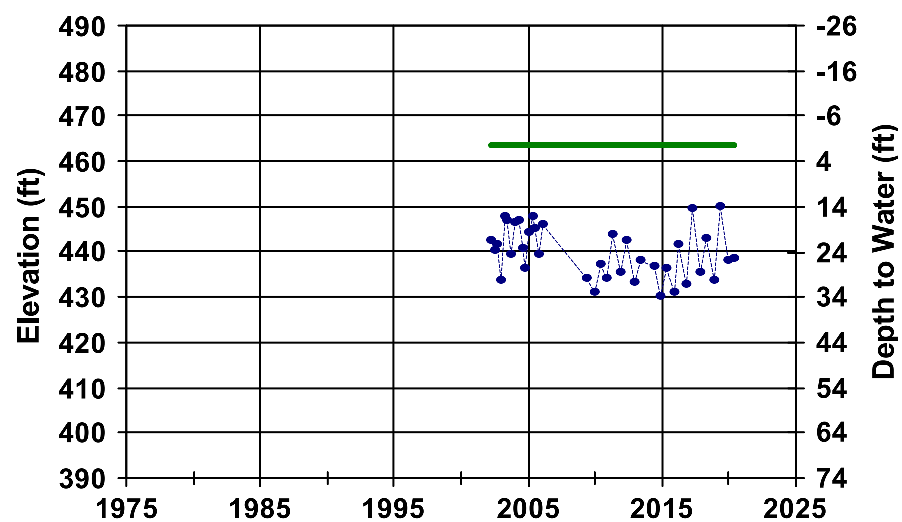
WellID: T0605500304MW-1
Subarea: Berryessa
Groundwater Basin Not within a basin
RPE: 452.82 ft, msl
Source: Geotracker
SWN: Unknown
Aquifer Zone: undefined
Last Msmt Date 5/20/2020



WellID: T0605500304MW-4
Subarea: Berryessa
Groundwater Basin Not within a basin
RPE: 458.83 ft, msl
Source: Geotracker
SWN: Unknown
Aquifer Zone: undefined
Last Msmt Date 5/20/2020

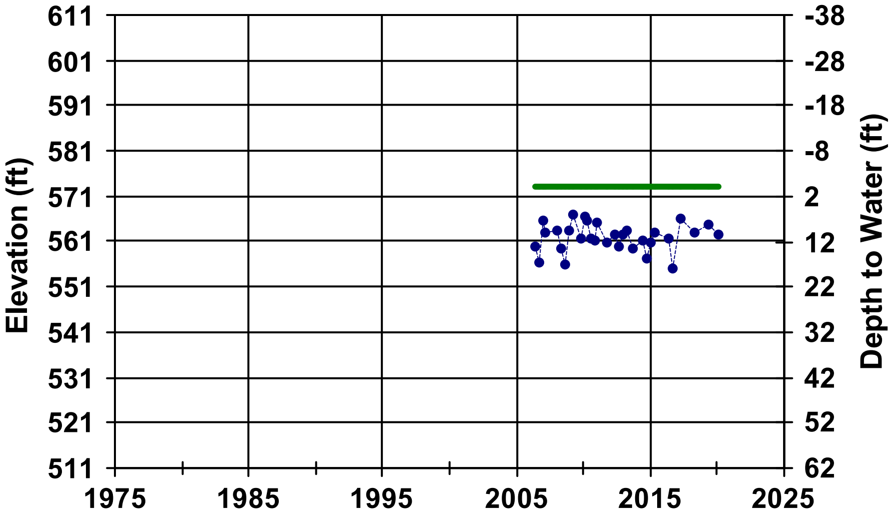


WellID: T0605500304MW-8
Subarea: Berryessa
Groundwater Basin Not within a basin
RPE: 463.73 ft, msl
Source: Geotracker
SWN: Unknown
Aquifer Zone: undefined
Last Msmt Date 5/20/2020

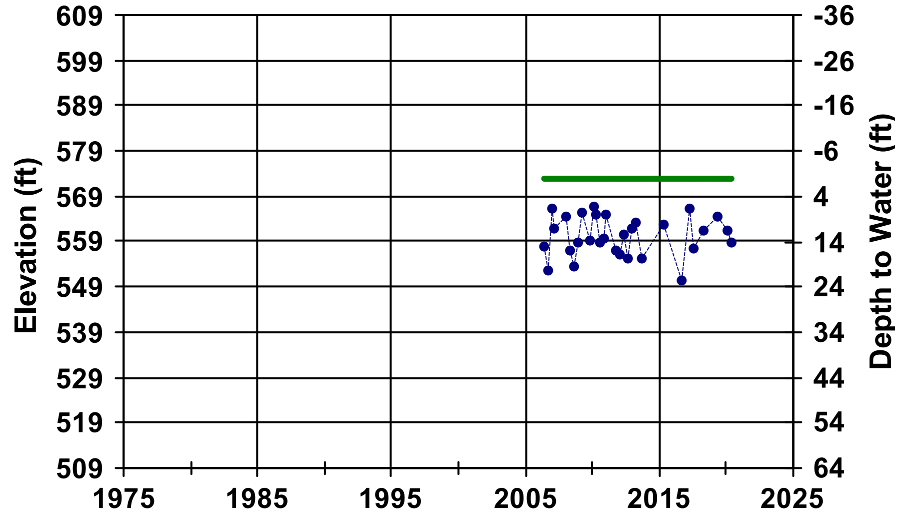


Static Water Level
Questionable Measurement
Reference Point Elevation

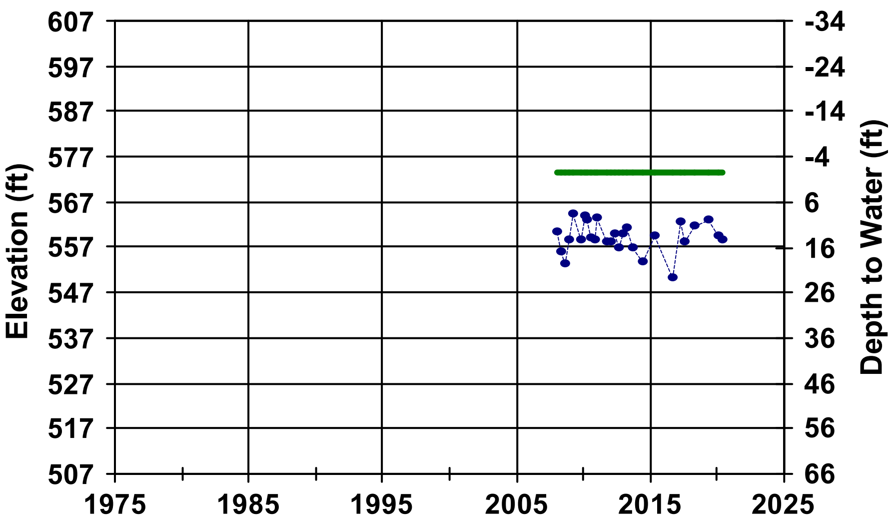
WellID: T0605591908MW-1 RPE: 573.28 ft, msl SWN: Unknown
Subarea: Berryessa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 2/18/2020



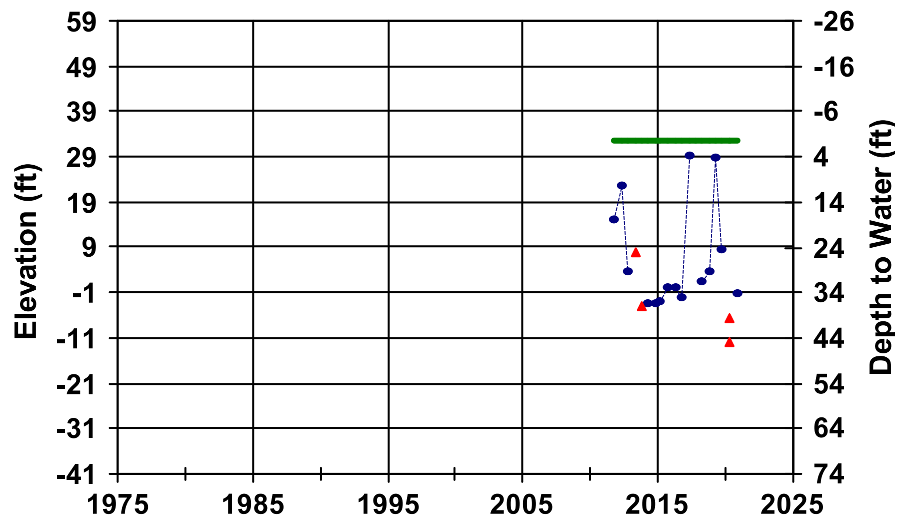
WellID: T0605591908MW-2 RPE: 573.08 ft, msl SWN: Unknown
Subarea: Berryessa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 6/4/2020



WellID: T0605591908MW-6 RPE: 573.3 ft, msl SWN: Unknown
Subarea: Berryessa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 6/4/2020

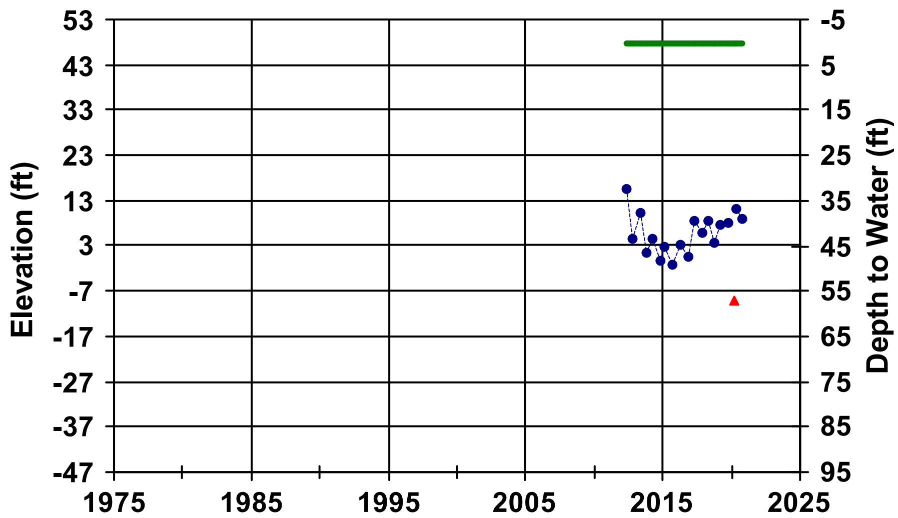


WellID: NapaCounty-150 RPE: 32.7 ft, msl SWN: 004N004W05C001
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/20/2020

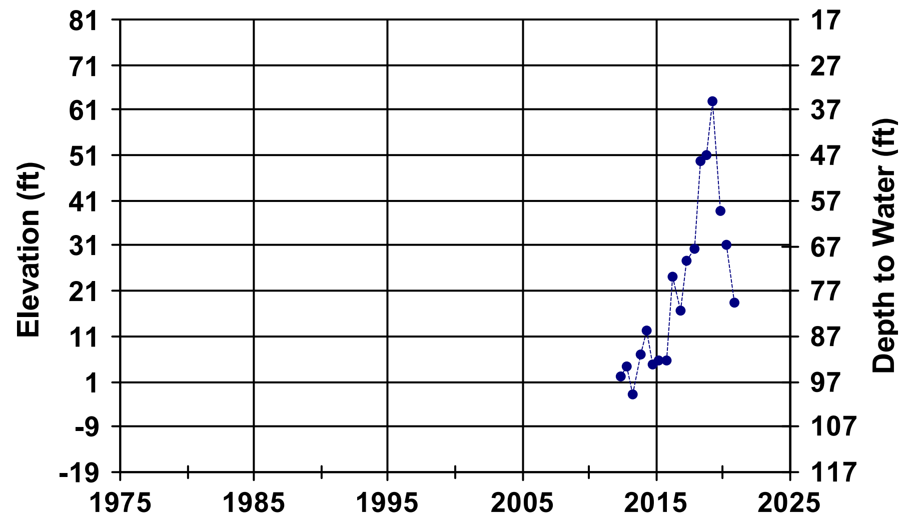


Static Water Level Questionable Measurement Reference Point Elevation

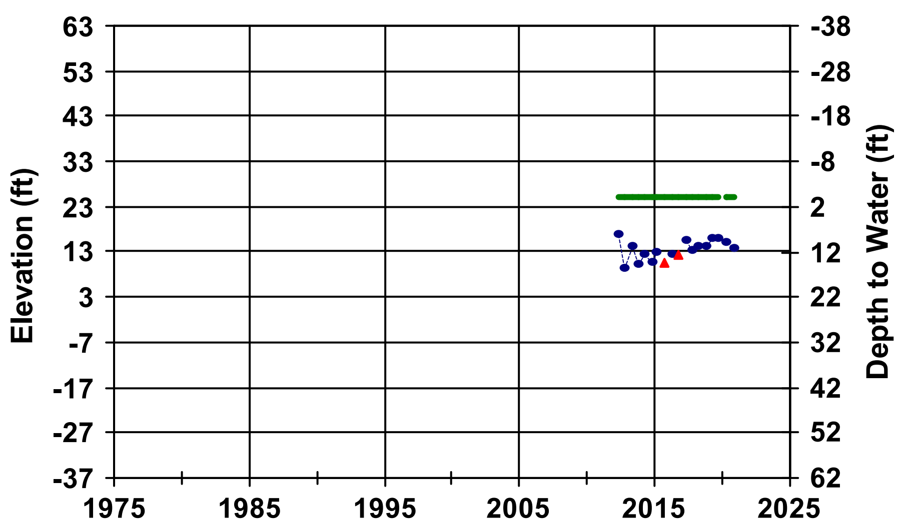
WellID: NapaCounty-153 RPE: 47.35 ft, msl SWN: 004N004W05A001
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/20/2020



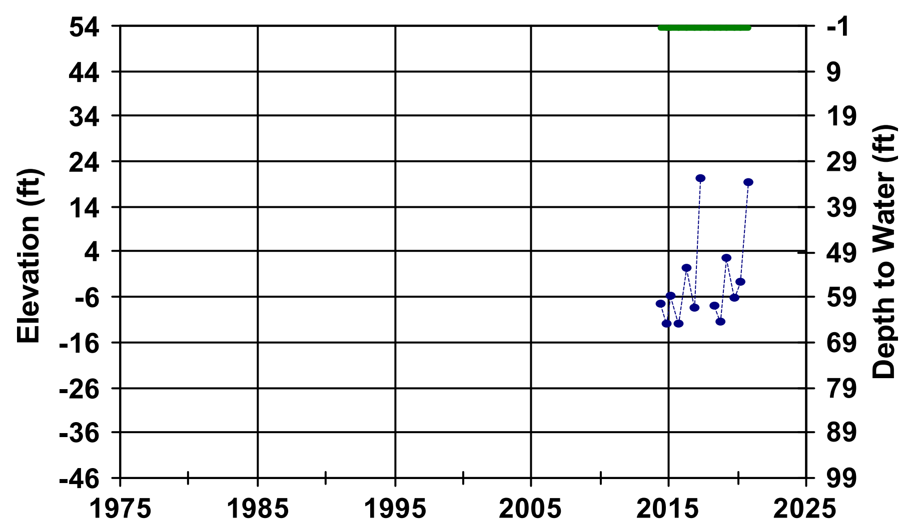
WellID: NapaCounty-154 RPE: 98 ft, msl SWN: 005N004W31R001
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/20/2020



WellID: NapaCounty-155 RPE: 25 ft, msl SWN: 004N004W06M001
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/20/2020

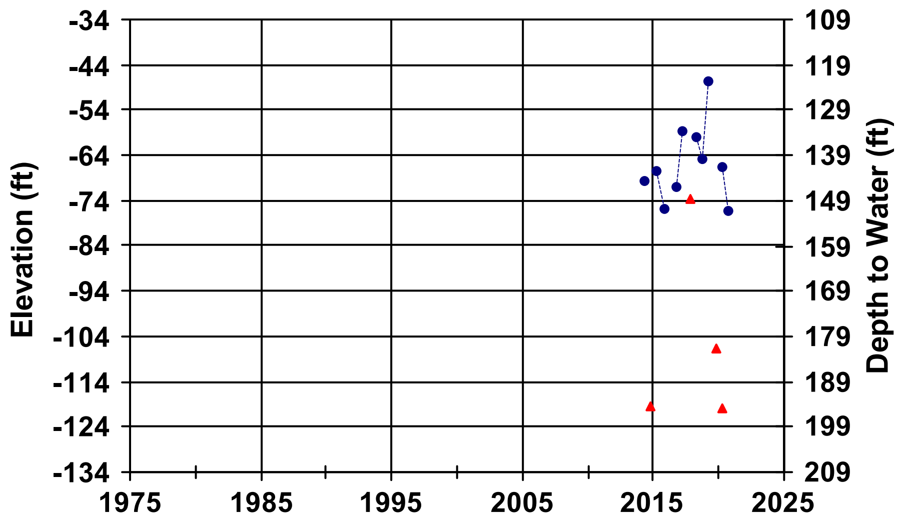


WellID: NapaCounty-176 RPE: 53.4 ft, msl SWN: Unknown
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/20/2020

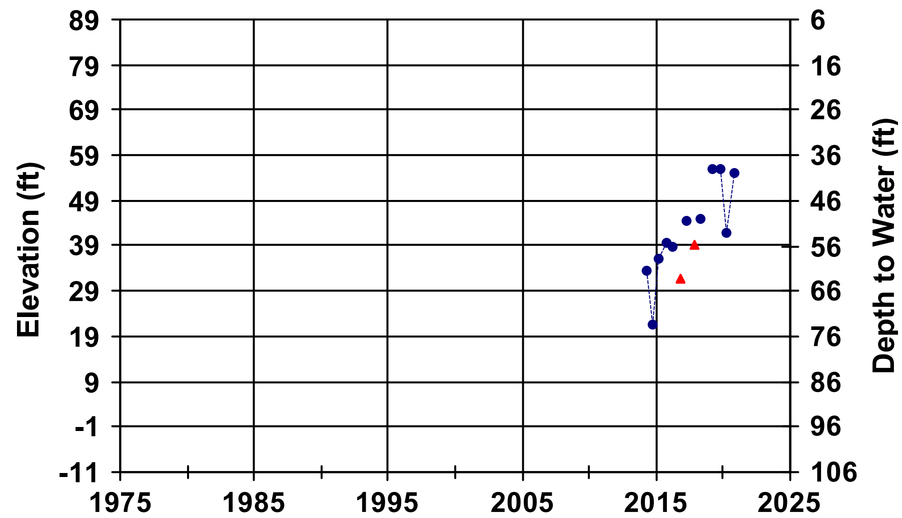


● Static Water Level ▲ Questionable Measurement — Reference Point Elevation

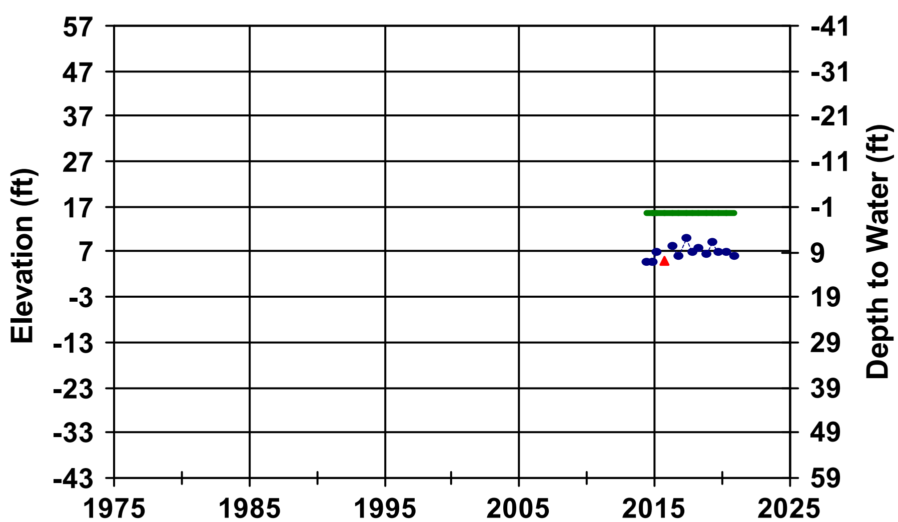
WellID: NapaCounty-194 RPE: 75.1 ft, msl SWN: Unknown
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/20/2020



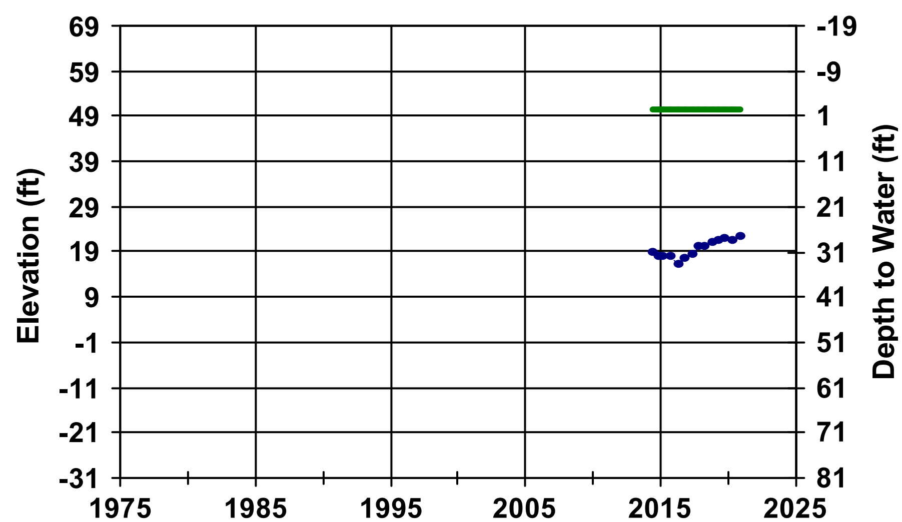
WellID: NapaCounty-195 RPE: 94.8 ft, msl SWN: Unknown
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/20/2020



WellID: NapaCounty-200 RPE: 15.7 ft, msl SWN: Unknown
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/23/2020

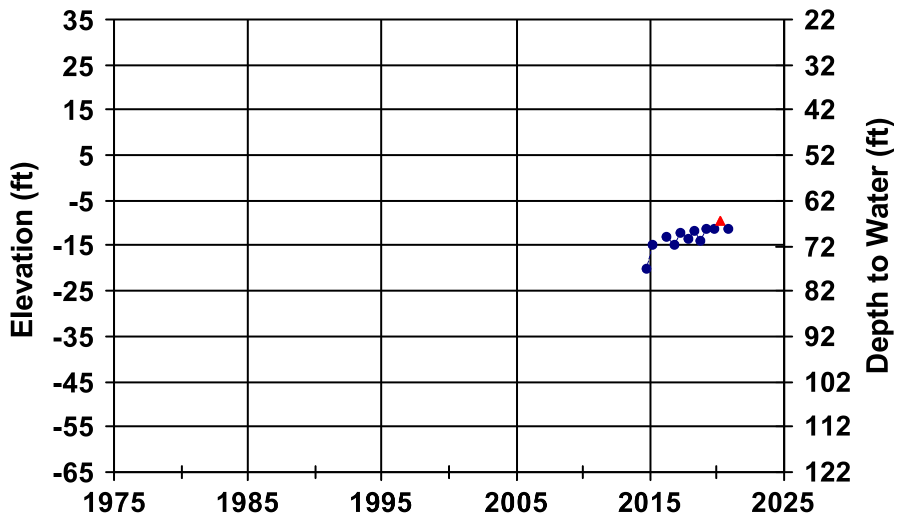


WellID: NapaCounty-201 RPE: 50.4 ft, msl SWN: Unknown
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/20/2020

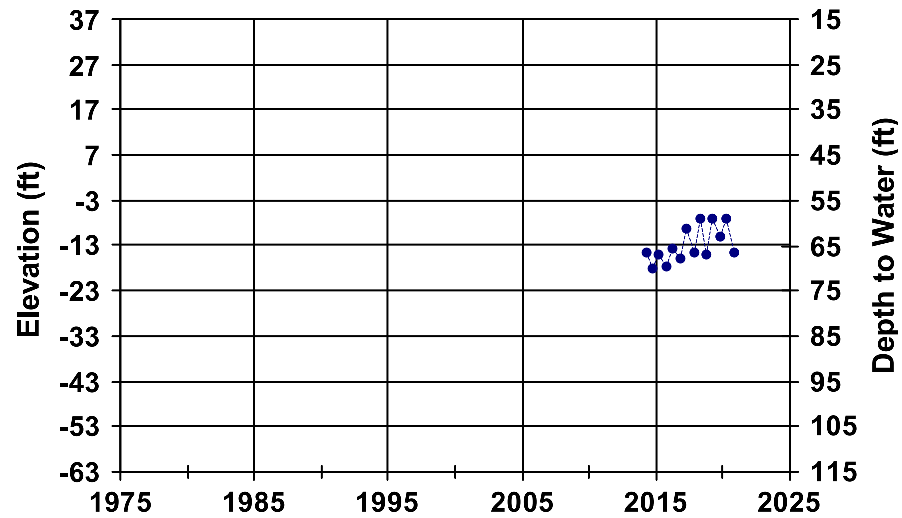


Static Water Level Questionable Measurement Reference Point Elevation

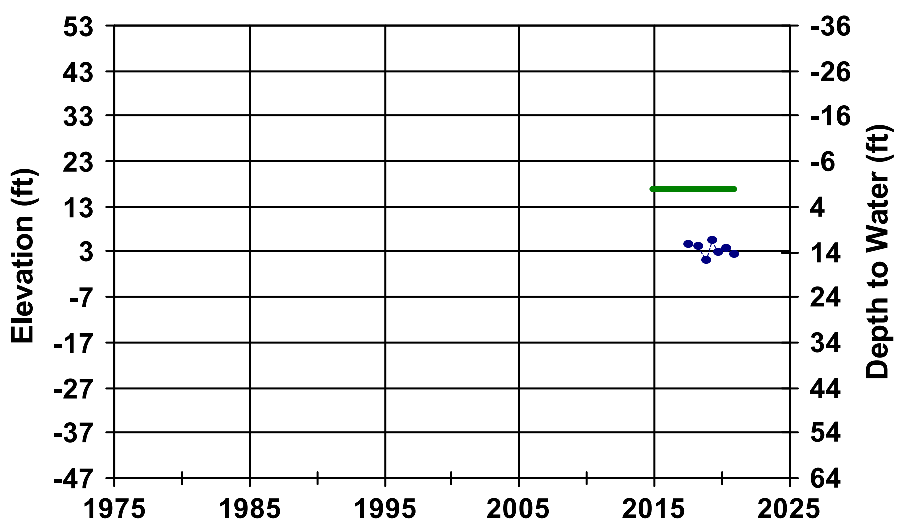
WellID: **NapaCounty-205** RPE: 56.8 ft, msl SWN: Unknown
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/20/2020



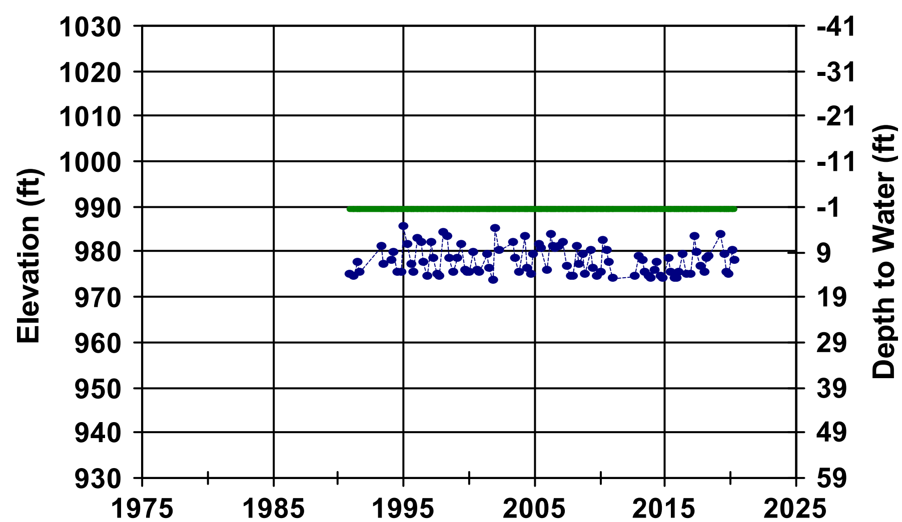
WellID: **NapaCounty-206** RPE: 52.4 ft, msl SWN: Unknown
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/20/2020



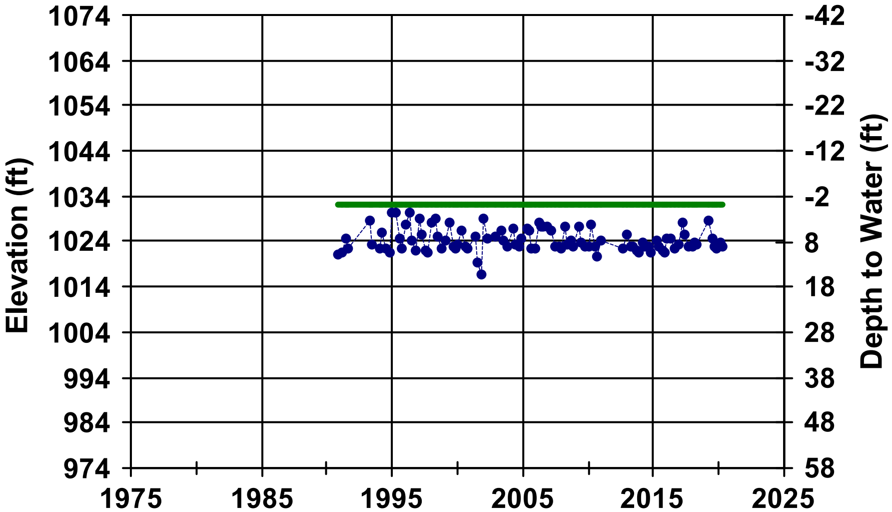
WellID: **NapaCounty-207** RPE: 17 ft, msl SWN: Unknown
Subarea: Carneros Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/20/2020



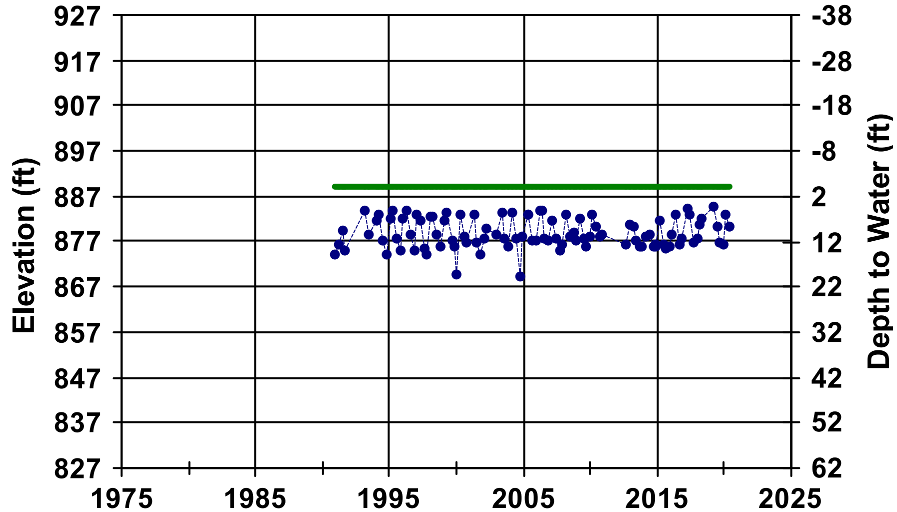
WellID: **L10003756160MW-6** RPE: 989.39 ft, msl SWN: Unknown
Subarea: Central Interior Valleys Source: Geotracker Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 5/7/2020



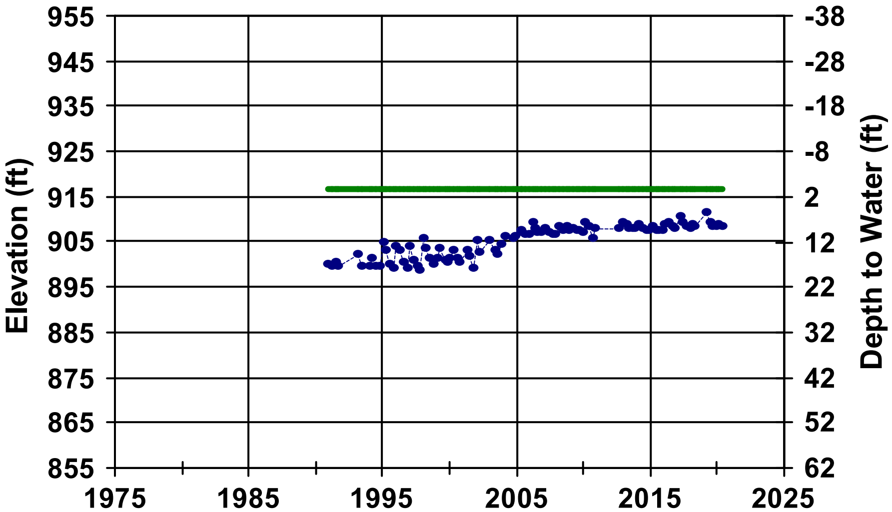
WellID: L10003756160MW-7 RPE: 1032.16 ft, msl SWN: Unknown
Subarea: Central Interior Valleys Source: Geotracker Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 5/7/2020



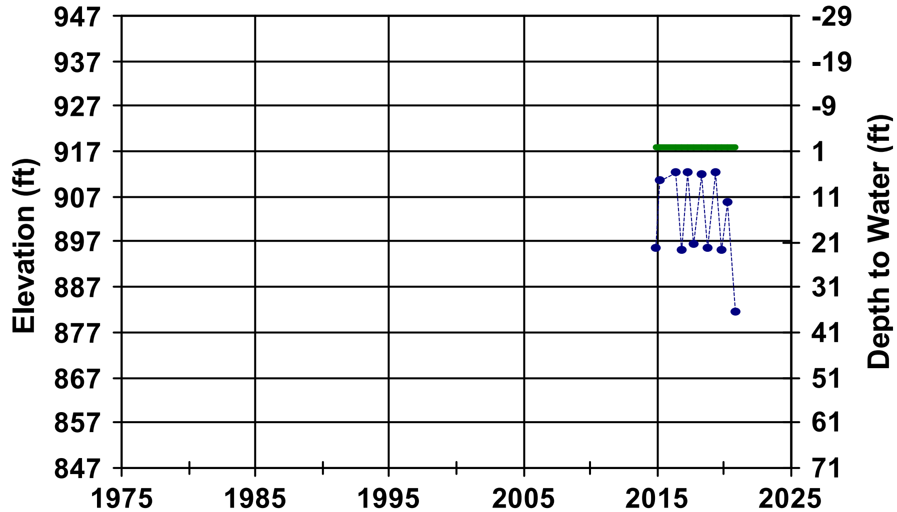
WellID: L10003756160MW-8 RPE: 889.03 ft, msl SWN: Unknown
Subarea: Central Interior Valleys Source: Geotracker Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 5/7/2020



WellID: L10003756160MW-9 RPE: 916.87 ft, msl SWN: Unknown
Subarea: Central Interior Valleys Source: Geotracker Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 5/7/2020

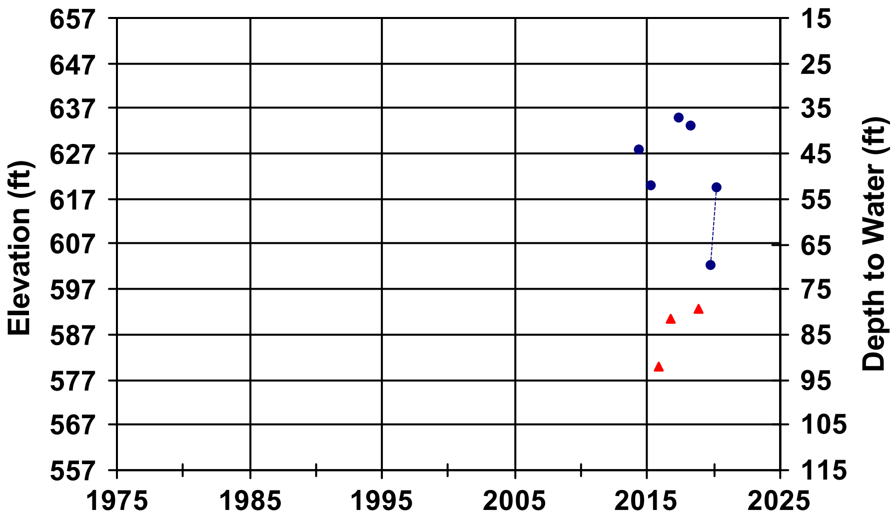


WellID: NapaCounty-209 RPE: 918 ft, msl SWN: Unknown
Subarea: Central Interior Valleys Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/29/2020

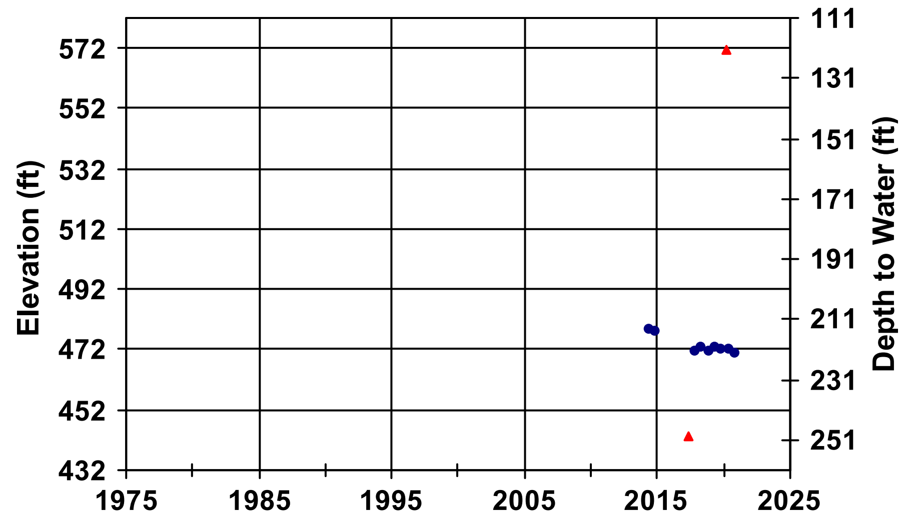


● Static Water Level ▲ Questionable Measurement — Reference Point Elevation

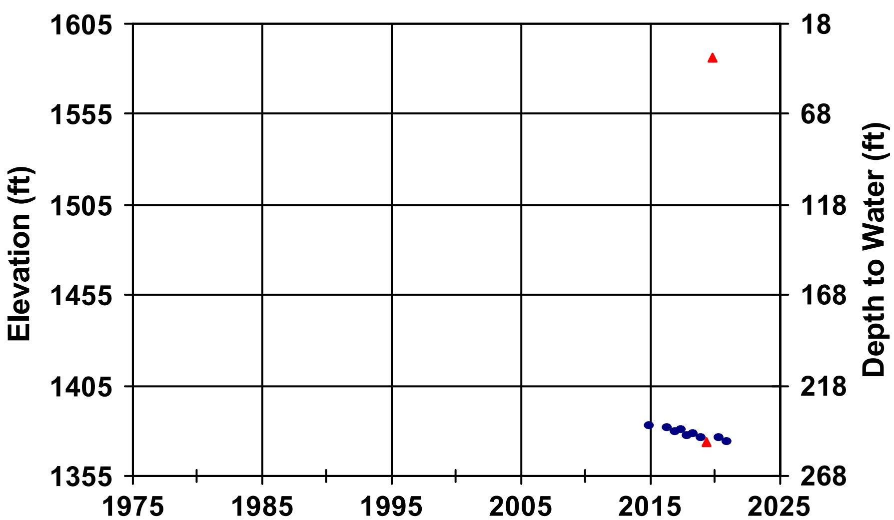
WellID: NapaCounty-175 RPE: 672.3 ft, msl SWN: Unknown
Subarea: Eastern Mountains Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 3/31/2020



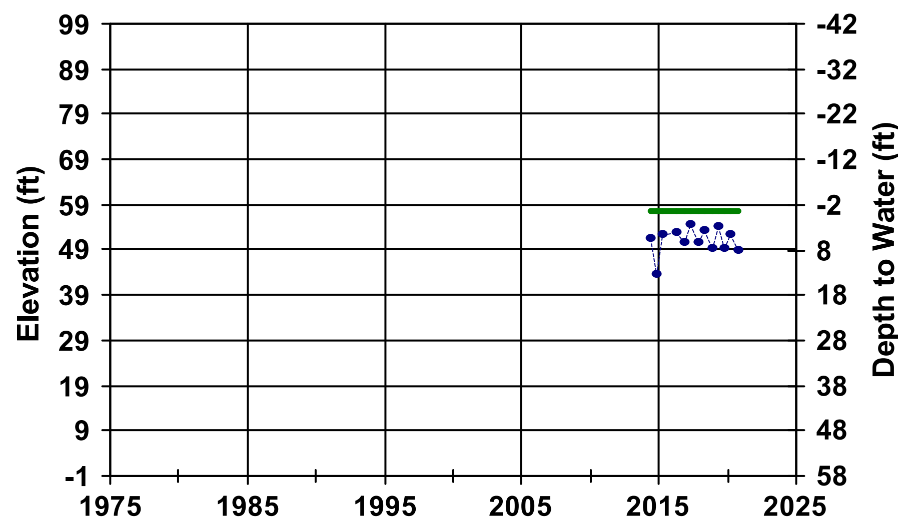
WellID: NapaCounty-193 RPE: 693.1 ft, msl SWN: Unknown
Subarea: Eastern Mountains Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/23/2020



WellID: NapaCounty-210 RPE: 1622.9 ft, msl SWN: Unknown
Subarea: Eastern Mountains Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/26/2020

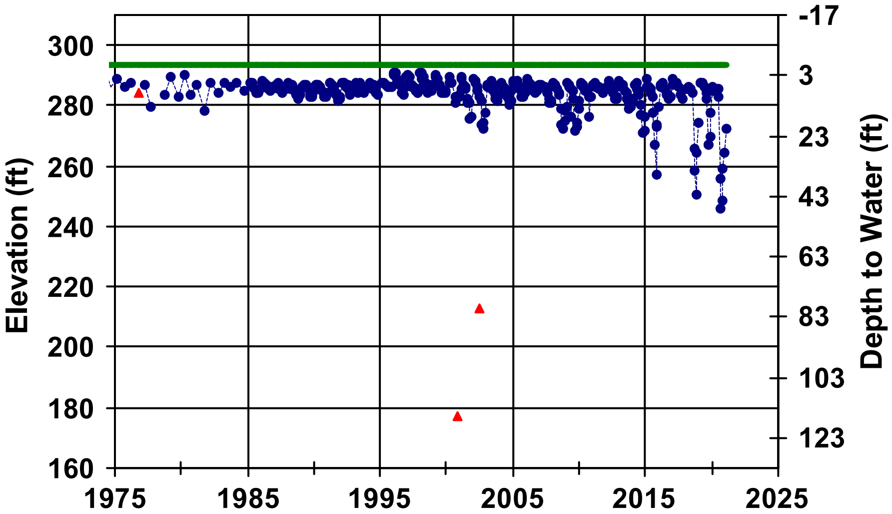


WellID: NapaCounty-196 RPE: 57.4 ft, msl SWN: Unknown
Subarea: Jameson/American Canyon Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA-SONOMA LOWLANDS SUBBASIN Last Msmt Date 10/23/2020

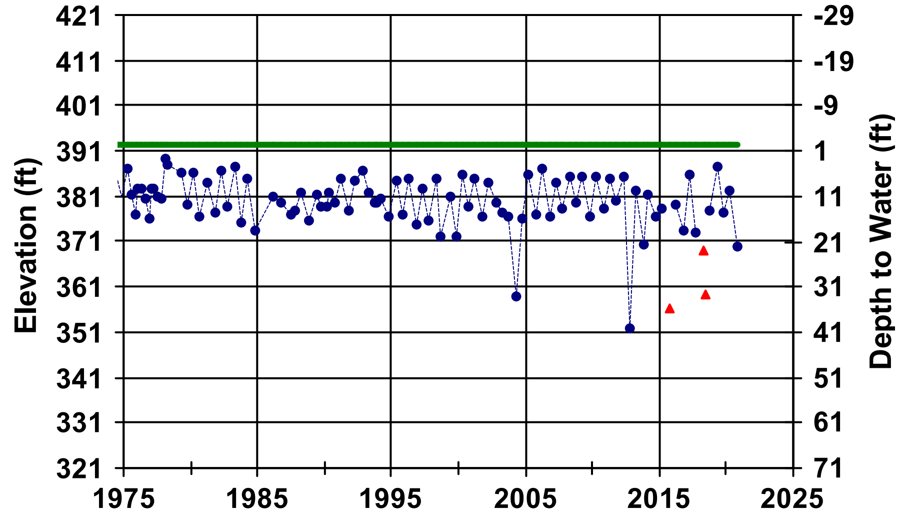


Static Water Level Questionable Measurement Reference Point Elevation

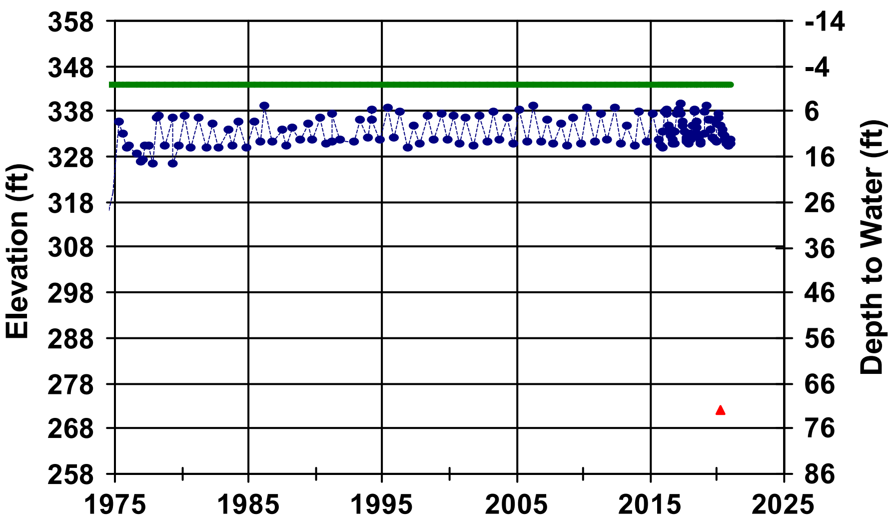
WellID: 08N06W10Q001M RPE: 293.43 ft, msl SWN: 008N006W10Q001
Subarea: Napa Valley Floor-Calistoga Source: DWR Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/22/2021



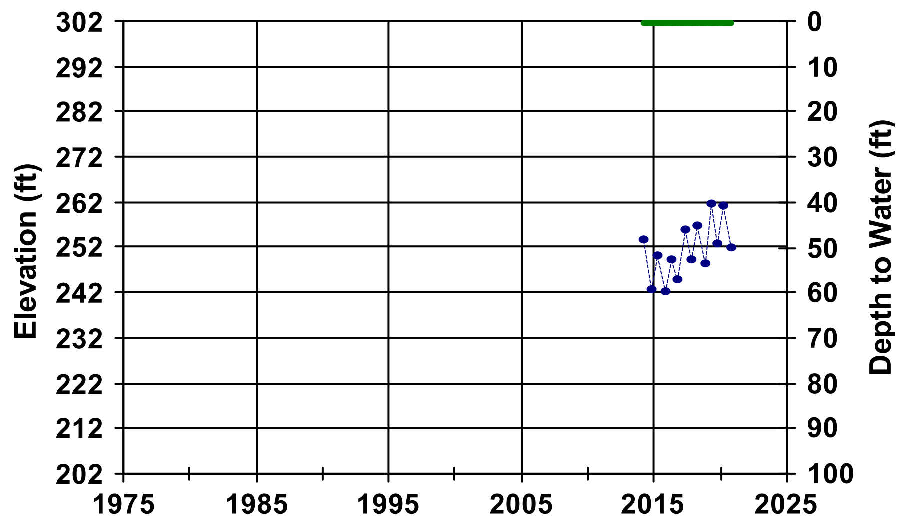
WellID: NapaCounty-127 RPE: 392.5 ft, msl SWN: 009N007W25N001
Subarea: Napa Valley Floor-Calistoga Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/19/2020



WellID: NapaCounty-128 RPE: 343.7 ft, msl SWN: 009N006W31Q001
Subarea: Napa Valley Floor-Calistoga Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/19/2021

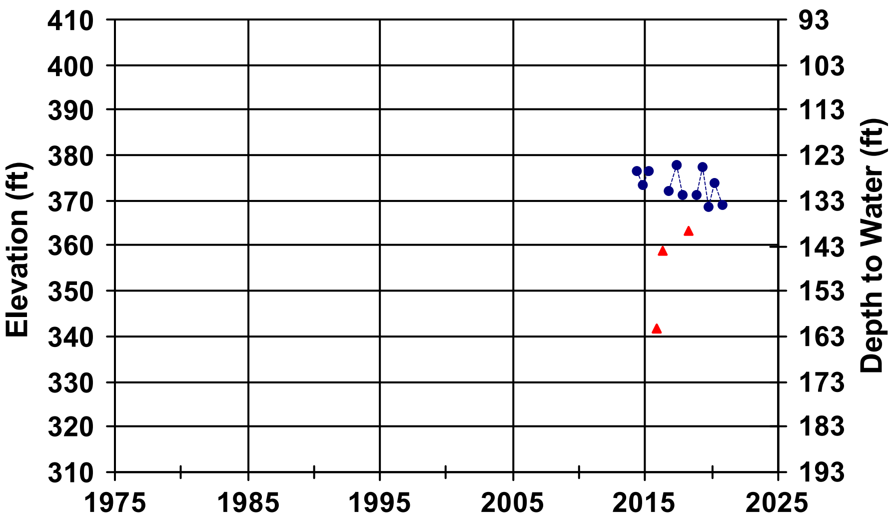


WellID: NapaCounty-178 RPE: 301.5 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Calistoga Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/19/2020

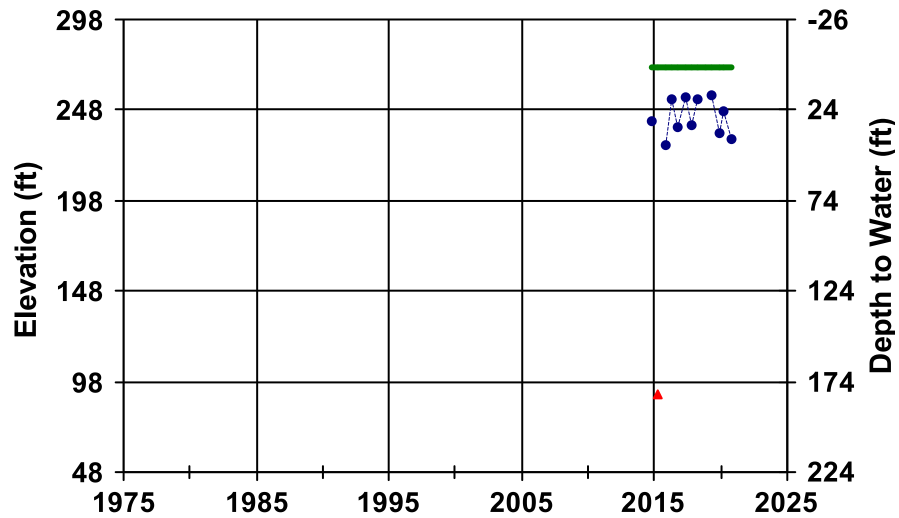


● Static Water Level ▲ Questionable Measurement — Reference Point Elevation

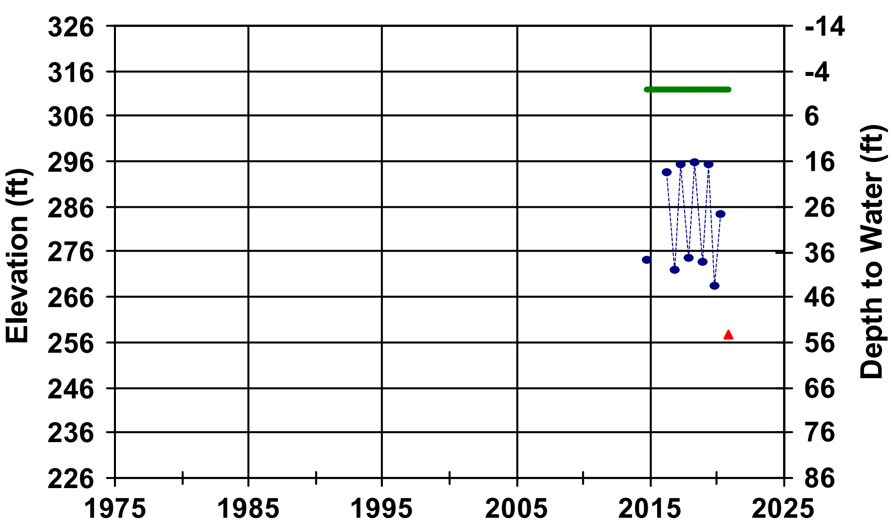
WellID: NapaCounty-208 RPE: 503.4 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Calistoga Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/20/2020



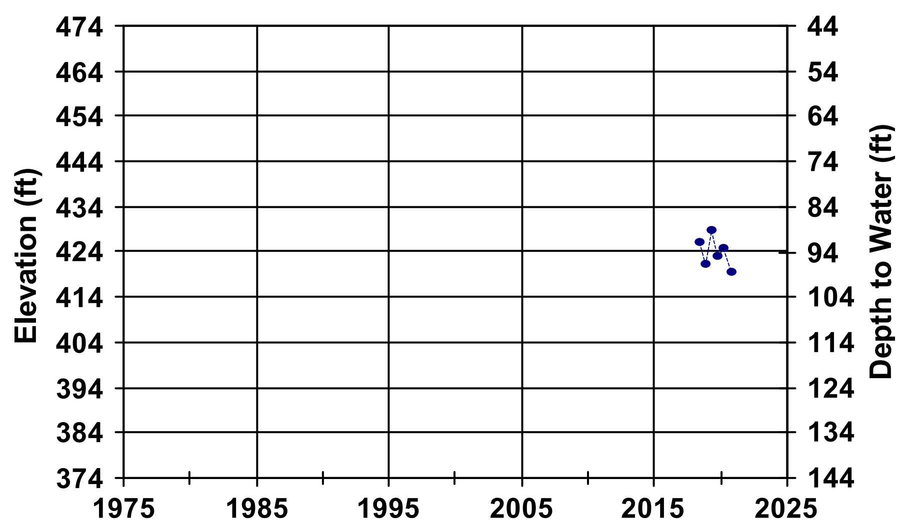
WellID: NapaCounty-224 RPE: 272 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Calistoga Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/20/2020



WellID: NapaCounty-225 RPE: 311.75 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Calistoga Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/20/2020

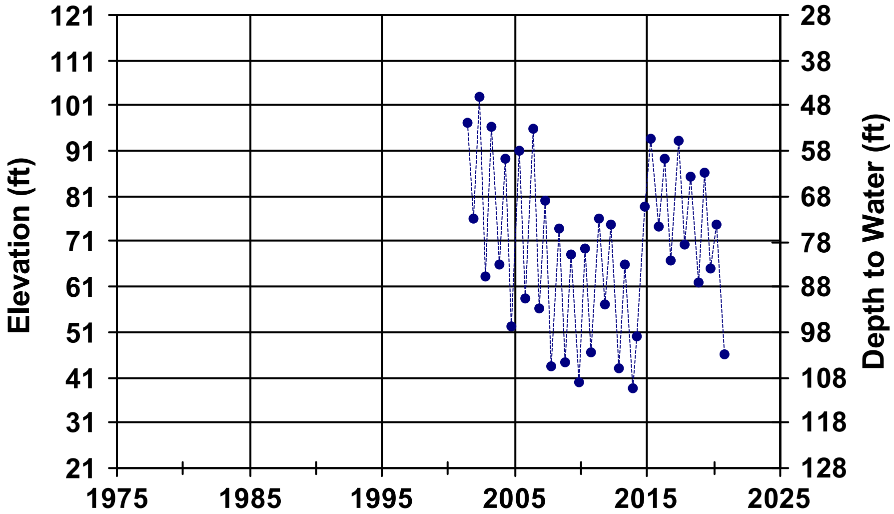


WellID: NapaCounty-230 RPE: 518.09 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Calistoga Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/19/2020

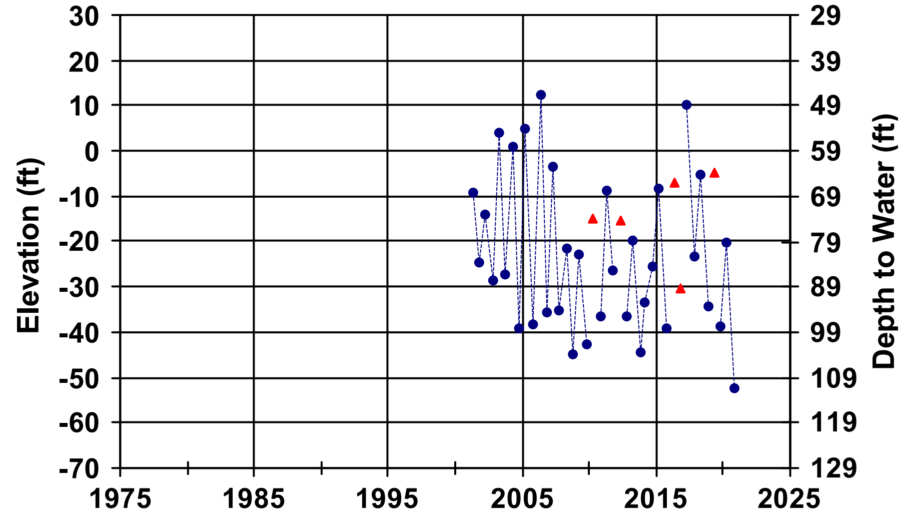


Static Water Level Questionable Measurement Reference Point Elevation

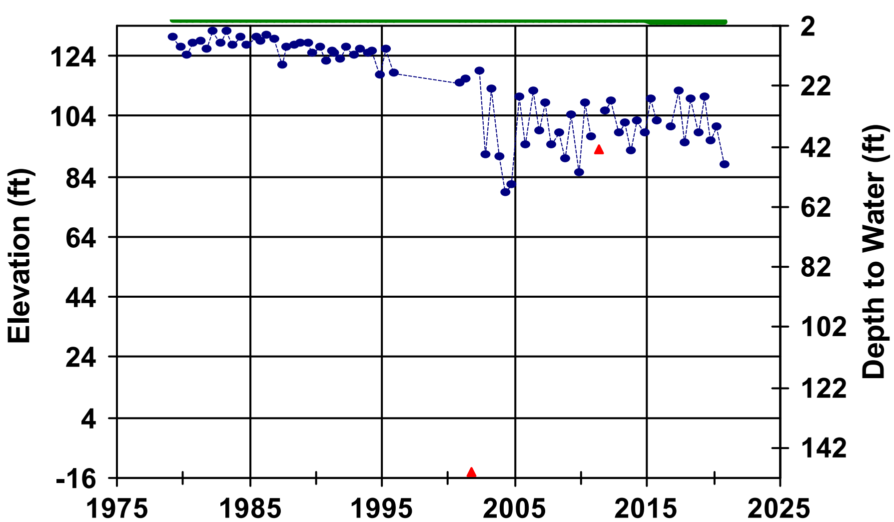
WellID: NapaCounty-118 RPE: 148.65 ft, msl SWN: 005N003W07B00_
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/23/2020



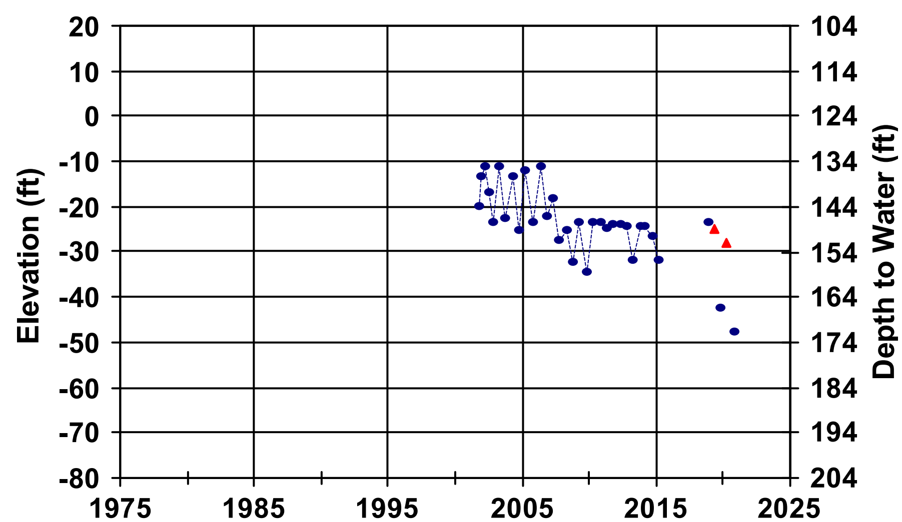
WellID: NapaCounty-122 RPE: 59.15 ft, msl SWN: 006N004W26L005
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/29/2020



WellID: NapaCounty-137 RPE: 135.9 ft, msl SWN: 005N004W13H001
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/23/2020

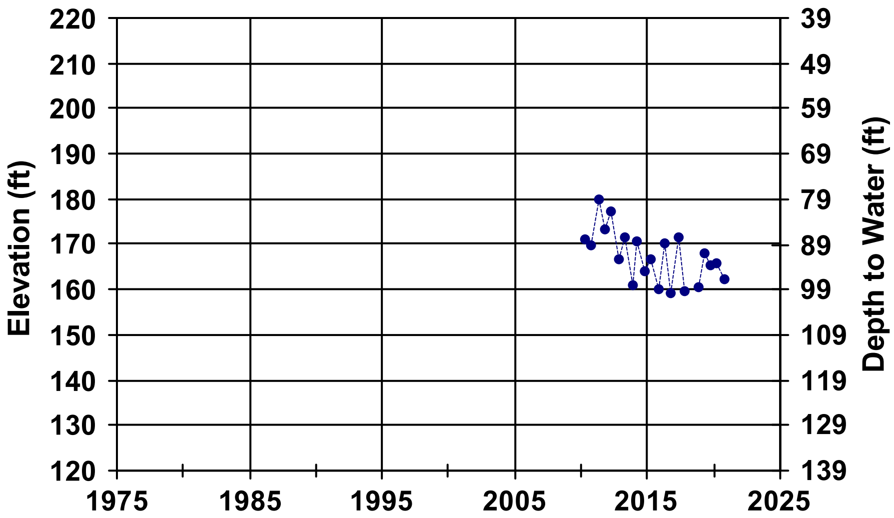


WellID: NapaCounty-142 RPE: 124.2 ft, msl SWN: 006N004W25G00_
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/30/2020

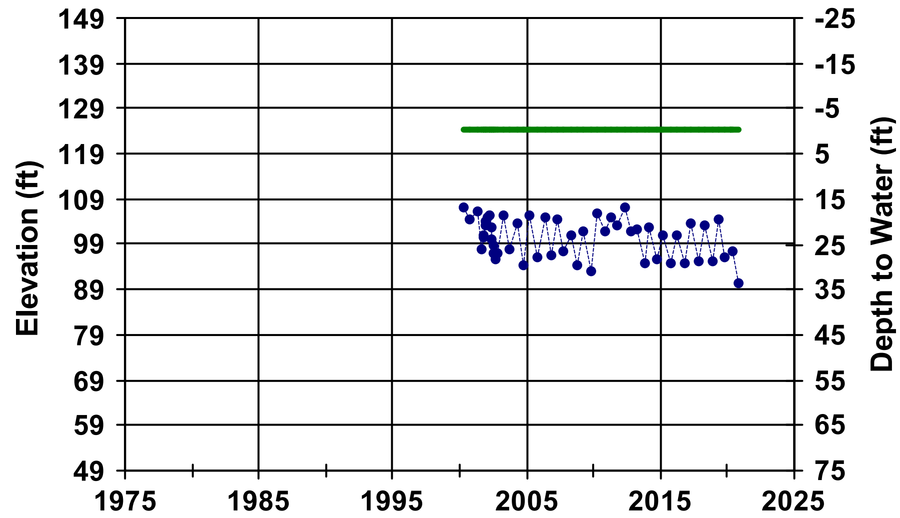


Static Water Level Questionable Measurement Reference Point Elevation

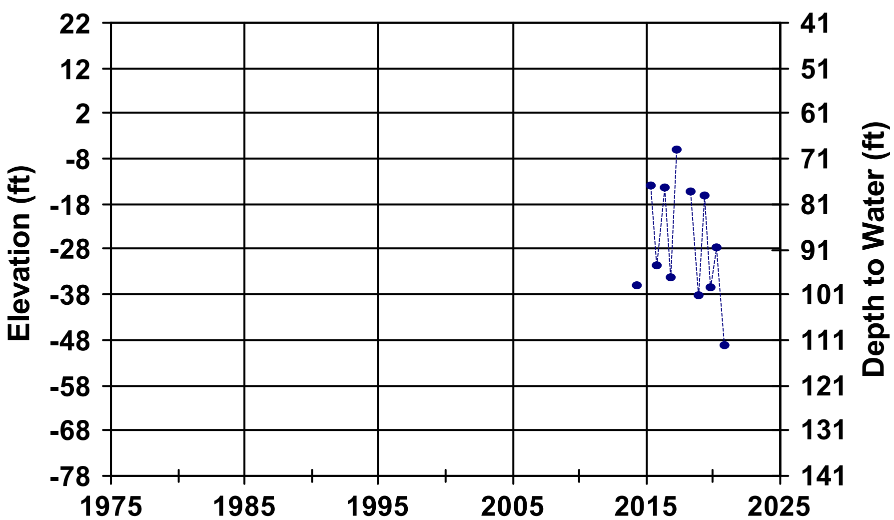
WellID: NapaCounty-149 RPE: 258.9 ft, msl SWN: 005N003W08E00_
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/27/2020



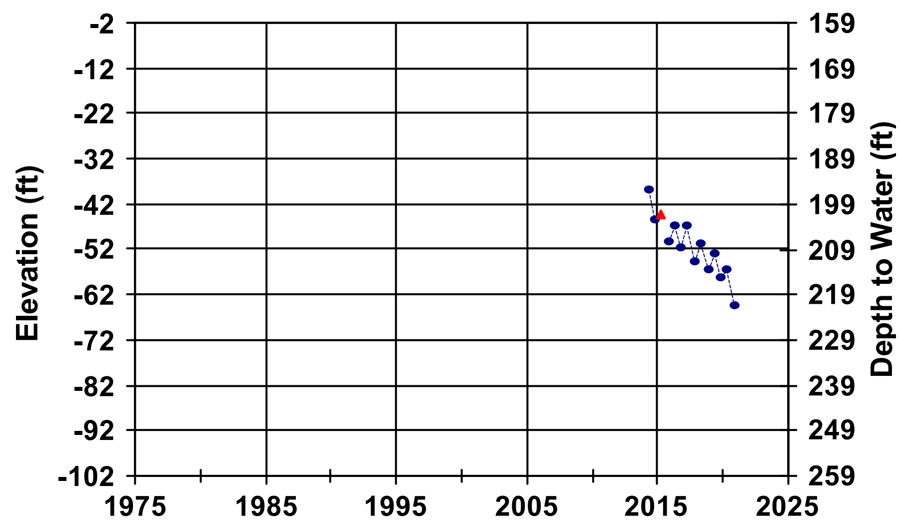
WellID: NapaCounty-18 RPE: 124.3 ft, msl SWN: 005N004W13G004
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/23/2020



WellID: NapaCounty-191 RPE: 63.1 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/29/2020

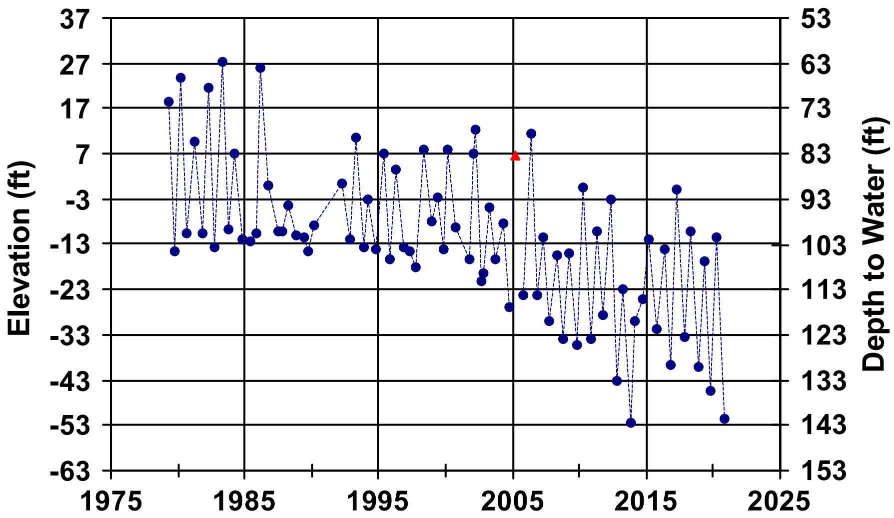


WellID: NapaCounty-192 RPE: 156.8 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/27/2020

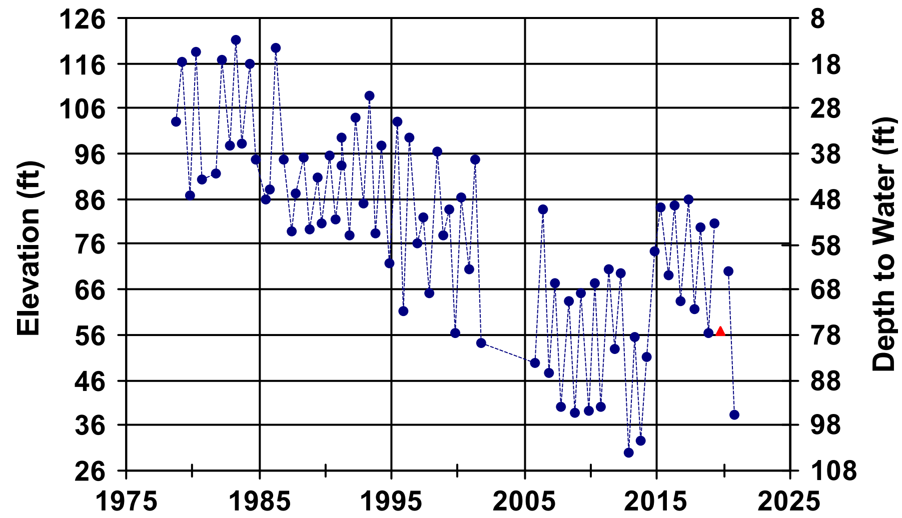


Static Water Level Questionable Measurement Reference Point Elevation

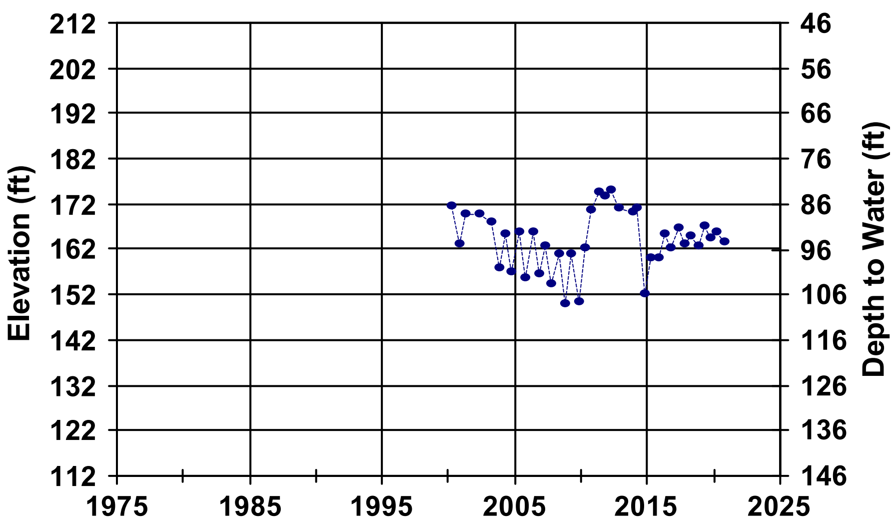
WellID: NapaCounty-2 RPE: 90.5 ft, msl SWN: 006N004W23J001
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/26/2020



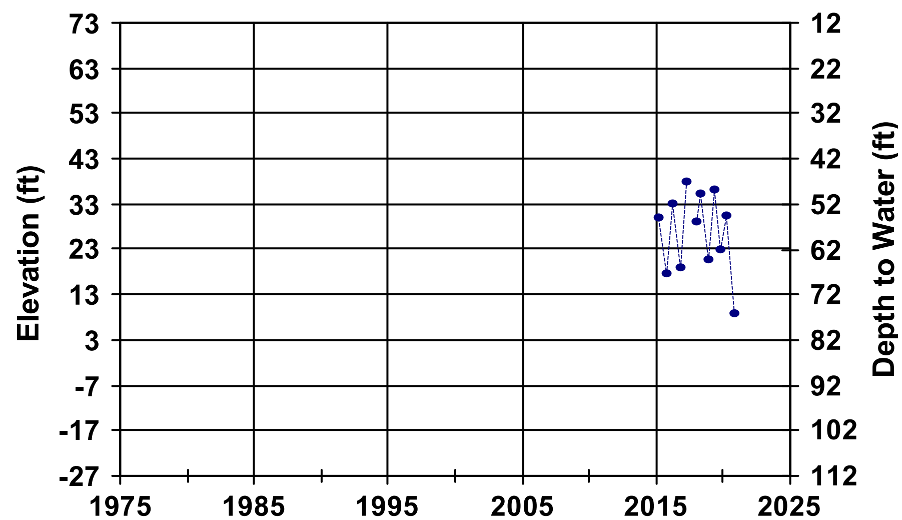
WellID: NapaCounty-20 RPE: 134.5 ft, msl SWN: 005N003W07C003
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/23/2020



WellID: NapaCounty-22 RPE: 257.7 ft, msl SWN: 005N003W08E001
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/27/2020

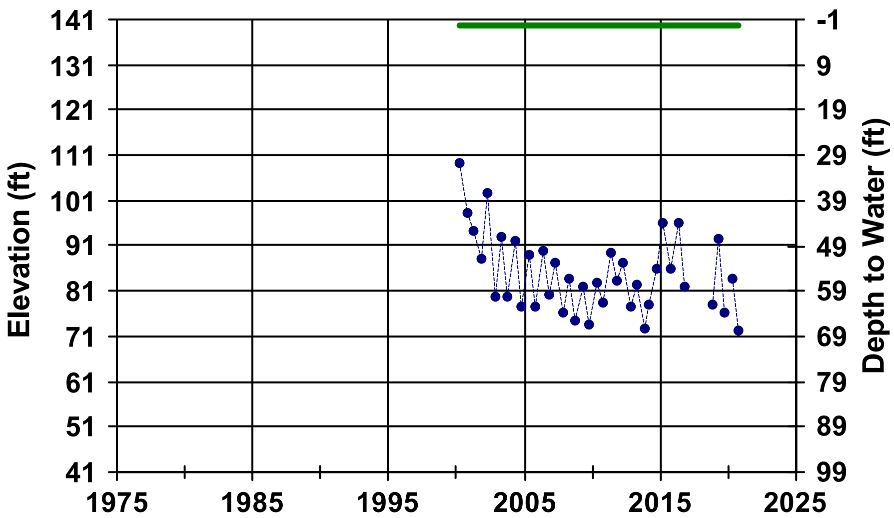


WellID: NapaCounty-226 RPE: 84.9 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/28/2020

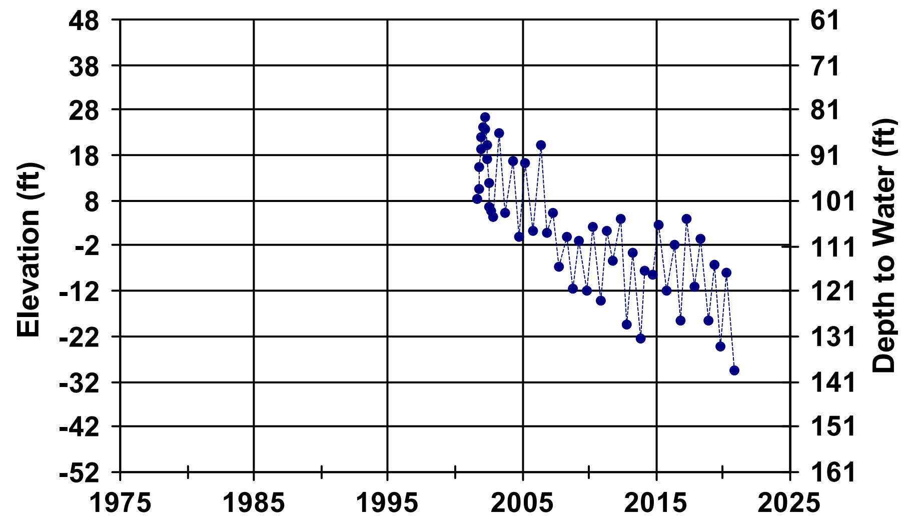


Static Water Level Questionable Measurement Reference Point Elevation

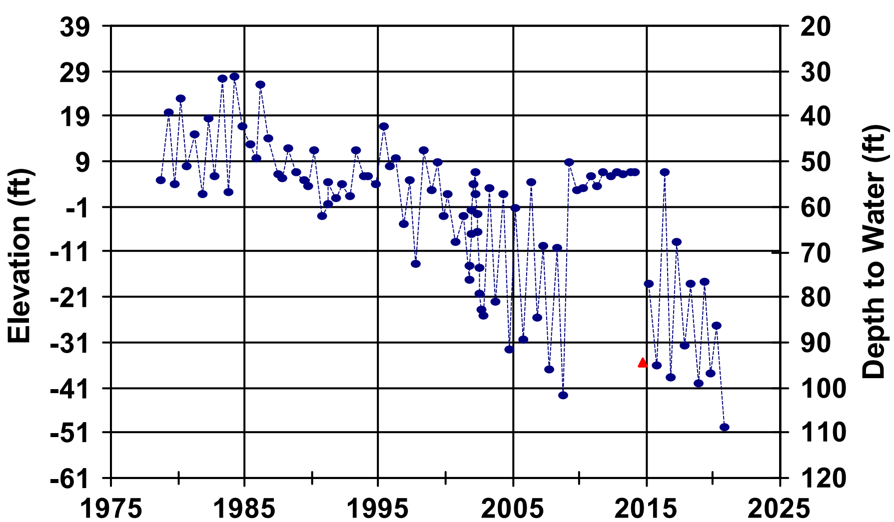
WellID: NapaCounty-35 RPE: 139.6 ft, msl SWN: 005N003W18D001
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/23/2020



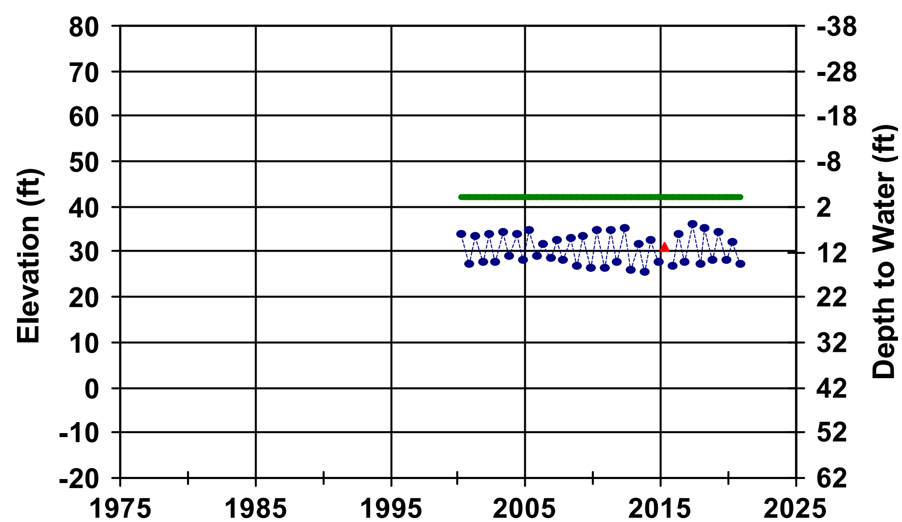
WellID: NapaCounty-43 RPE: 109 ft, msl SWN: 006N004W23Q003
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/29/2020



WellID: NapaCounty-56 RPE: 58.6 ft, msl SWN: 006N004W26G001
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/29/2020

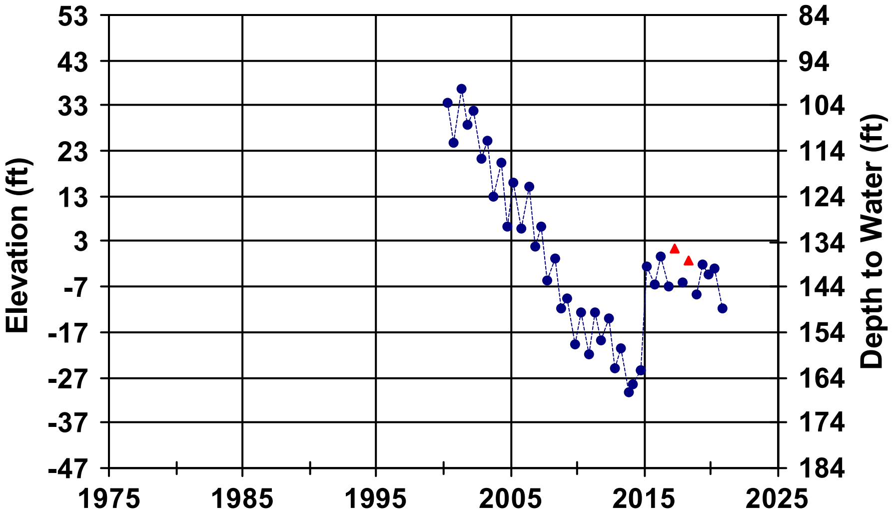


WellID: NapaCounty-69 RPE: 42.1 ft, msl SWN: 006N004W35G005
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/29/2020

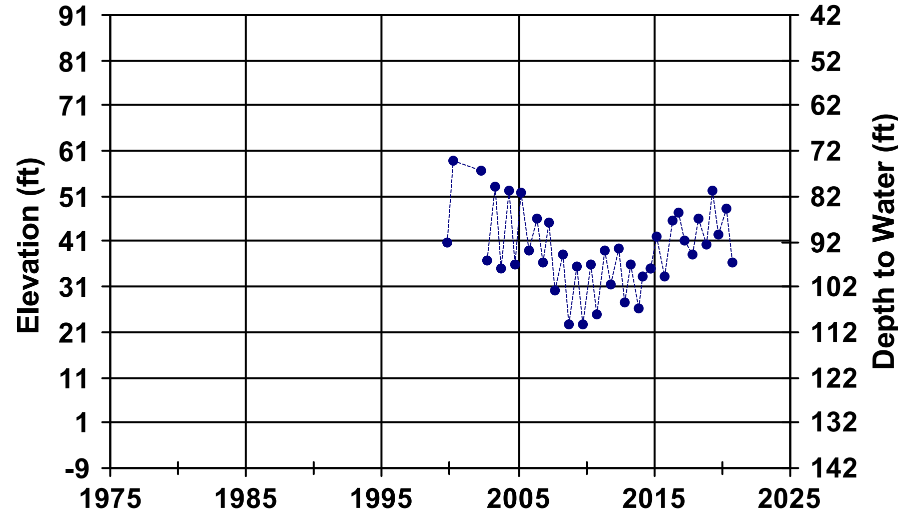


Static Water Level Questionable Measurement Reference Point Elevation

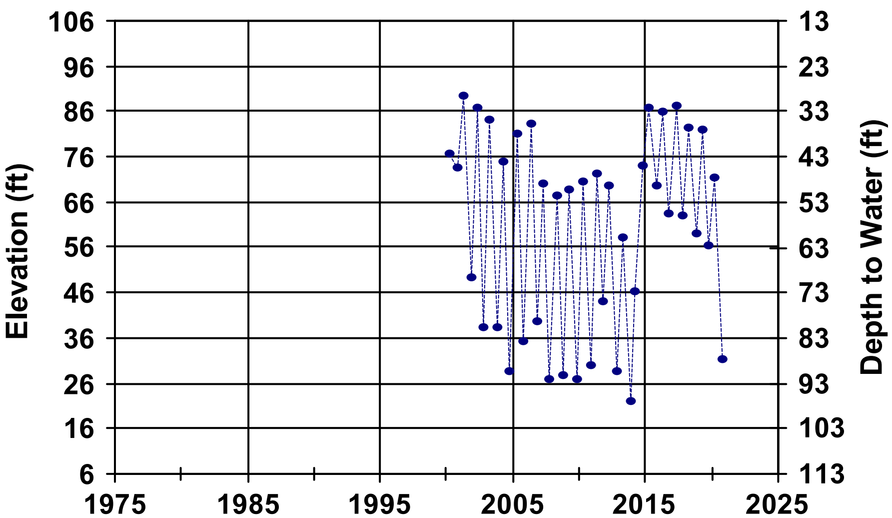
WellID: NapaCounty-72 RPE: 137.1 ft, msl SWN: 005N003W07D003
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/27/2020



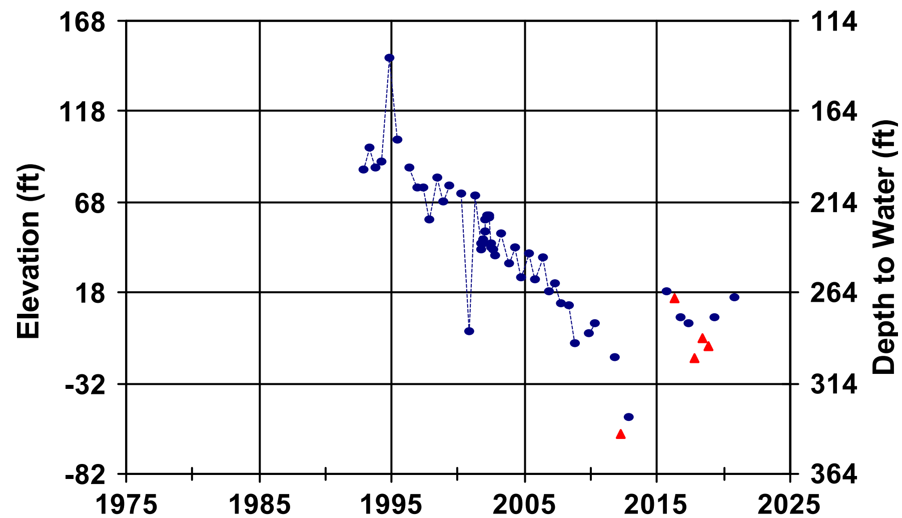
WellID: NapaCounty-74 RPE: 133.3 ft, msl SWN: 005N003W06M001
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/27/2020



WellID: NapaCounty-81 RPE: 118.6 ft, msl SWN: 005N003W07F003
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/23/2020

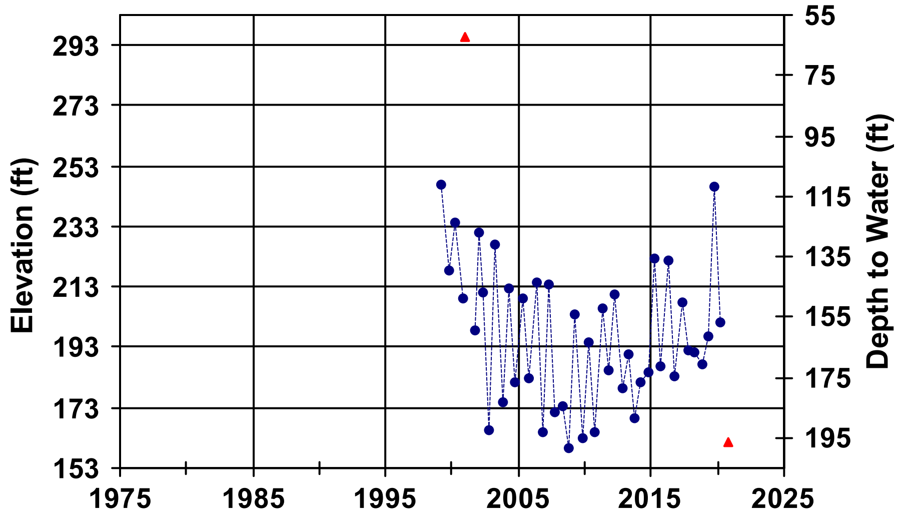


WellID: NapaCounty-91 RPE: 281.9 ft, msl SWN: 005N003W06B002
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/27/2020

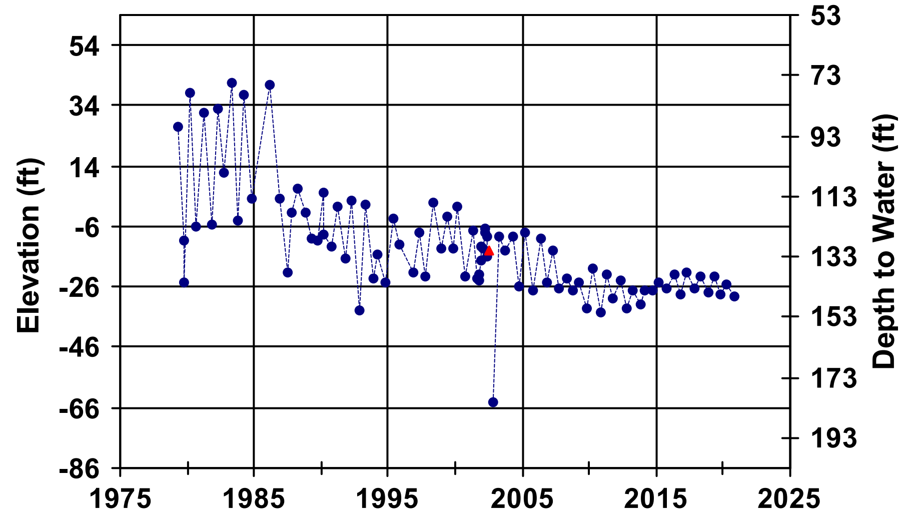


Static Water Level Questionable Measurement Reference Point Elevation

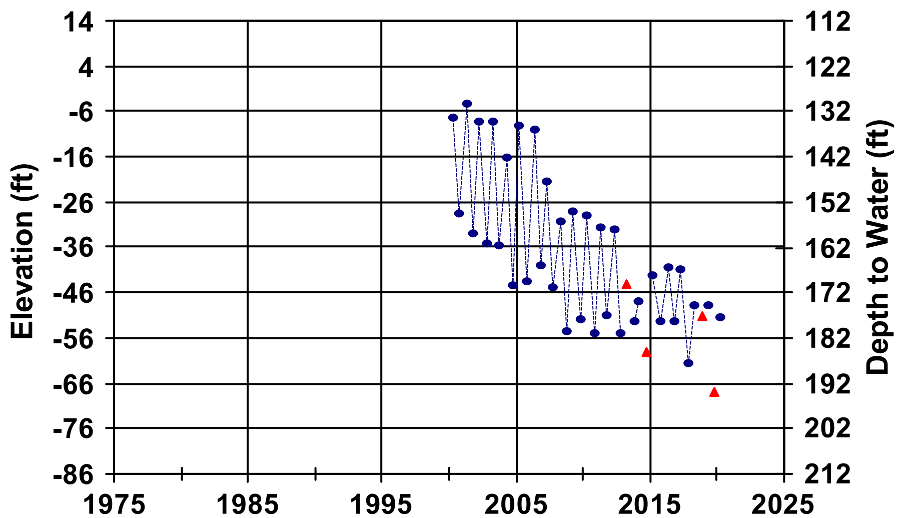
WellID: NapaCounty-92 RPE: 358.2 ft, msl SWN: 005N003W06A001
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/30/2020



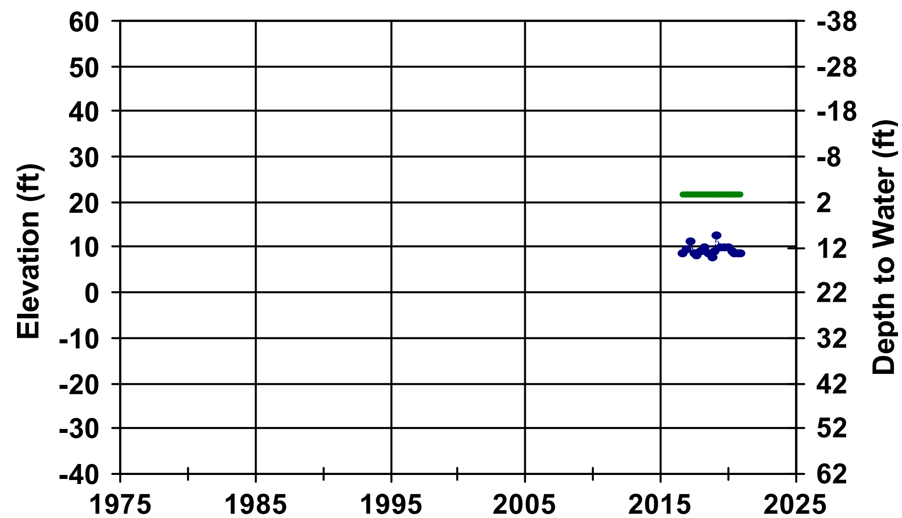
WellID: NapaCounty-95 RPE: 116.9 ft, msl SWN: 006N004W36G001
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 10/29/2020



WellID: NapaCounty-98 RPE: 125.7 ft, msl SWN: 006N004W36A001
Subarea: Napa Valley Floor-MST Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin Not within a basin Last Msmt Date 3/31/2020

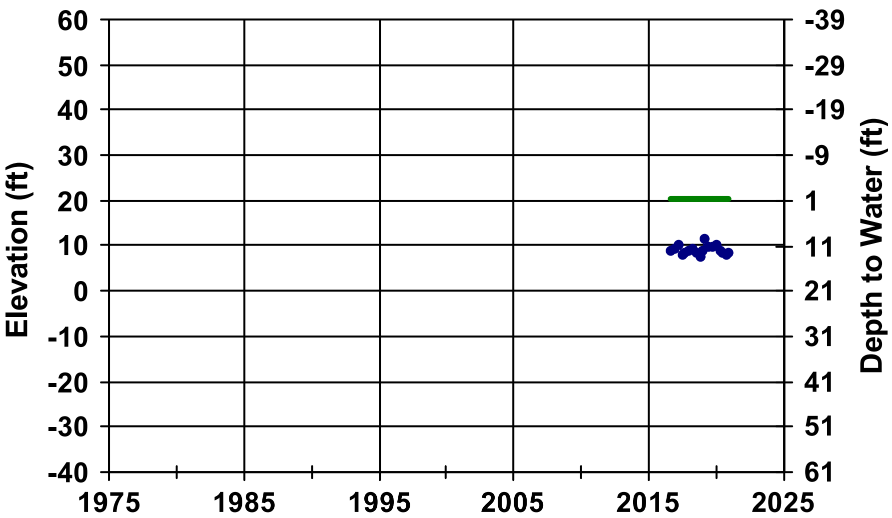


WellID: T10000008932MW-3 RPE: 21.76 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-MST Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 12/3/2020

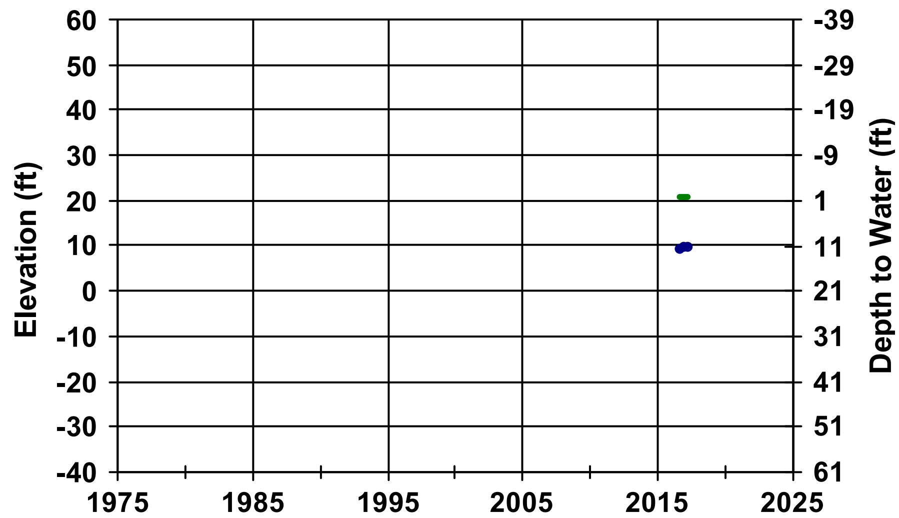


Static Water Level Questionable Measurement Reference Point Elevation

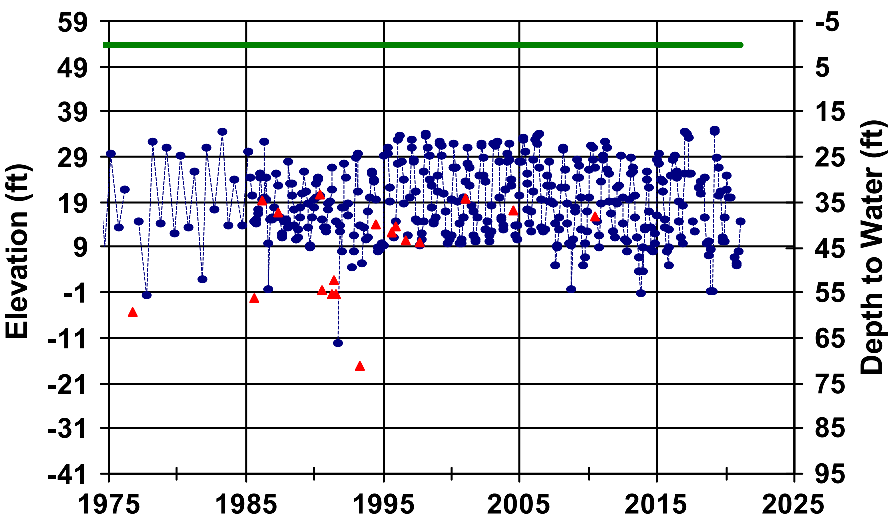
WellID: T10000008932MW-4 RPE: 20.56 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-MST Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 12/3/2020



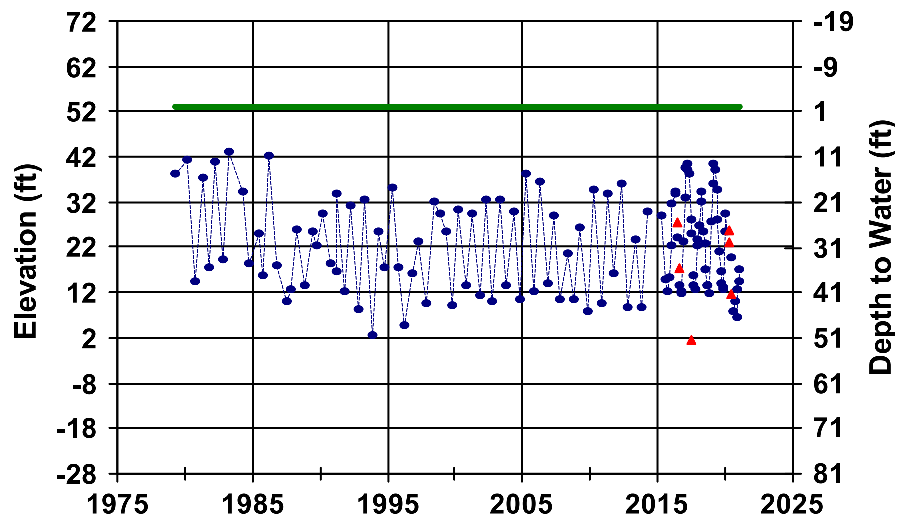
WellID: T10000008932MW-5 RPE: 20.63 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-MST Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 3/1/2017



WellID: 06N04W27L002M RPE: 53.6 ft, msl SWN: 006N004W27L002
Subarea: Napa Valley Floor-Napa Source: DWR Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/22/2021

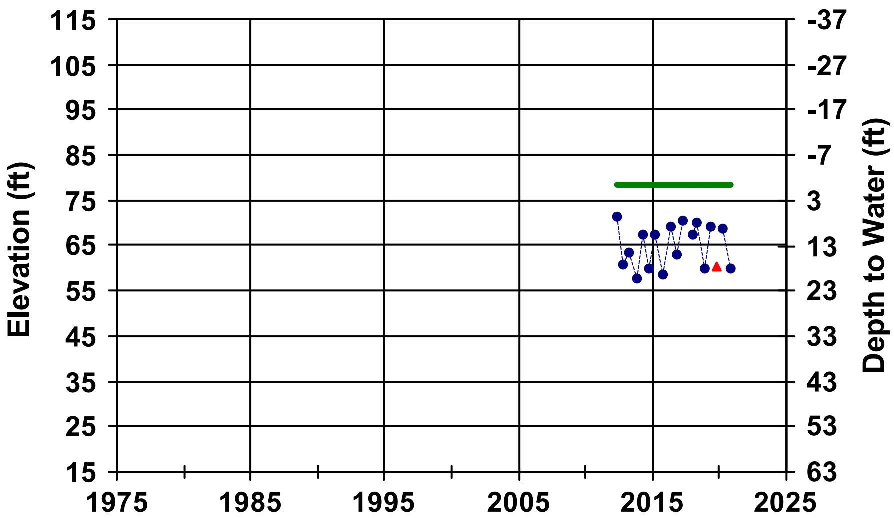


WellID: NapaCounty-136 RPE: 53.2 ft, msl SWN: 006N004W27N001
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/19/2021

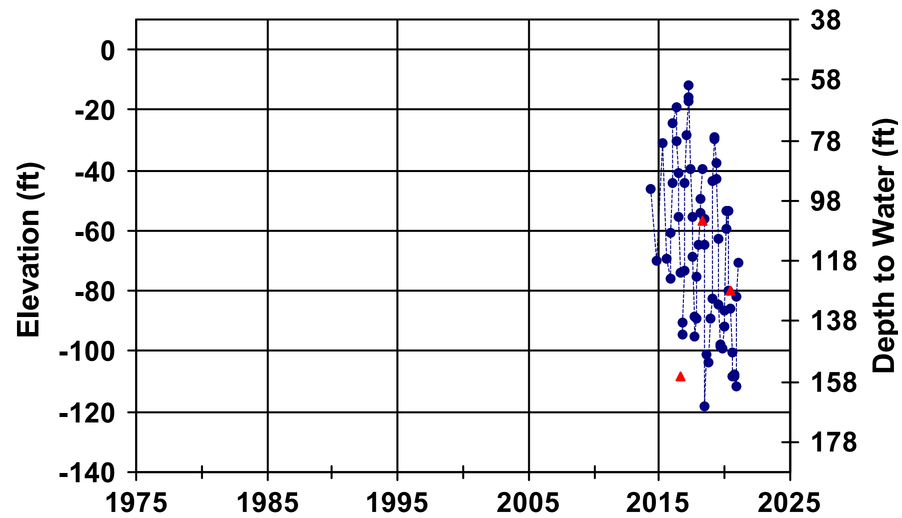


Static Water Level Questionable Measurement Reference Point Elevation

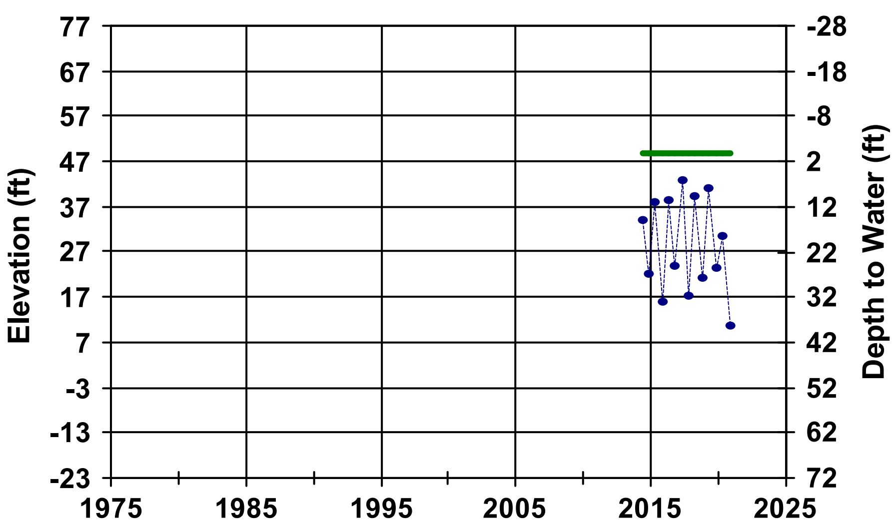
WellID: NapaCounty-152 RPE: 78.3 ft, msl SWN: 006N004W28Mx
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/30/2020



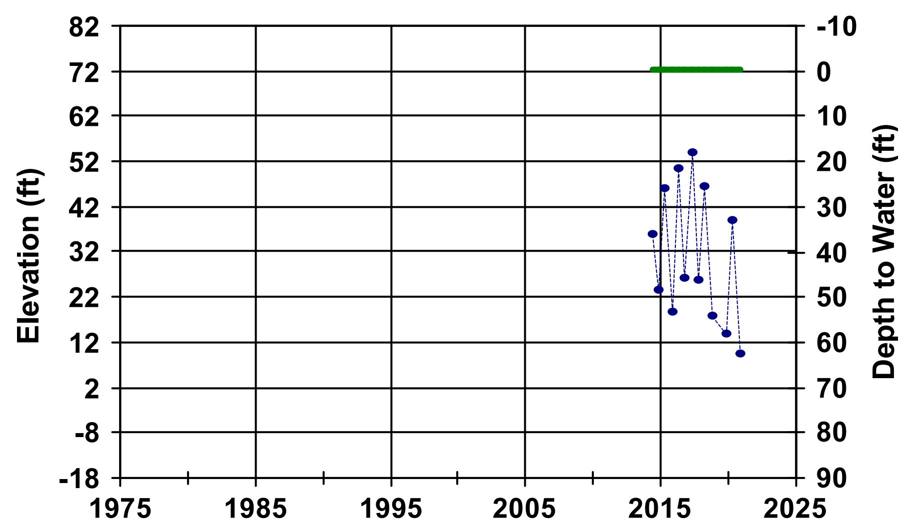
WellID: NapaCounty-182 RPE: 48.1 ft, msl SWN: 006N004W22B00X
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/19/2021



WellID: NapaCounty-183 RPE: 48.9 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/29/2020

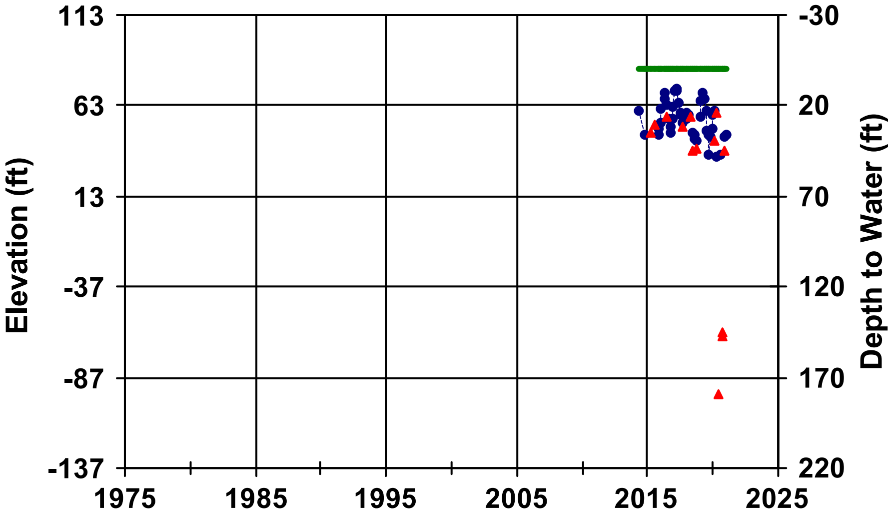


WellID: NapaCounty-184 RPE: 72.5 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/29/2020

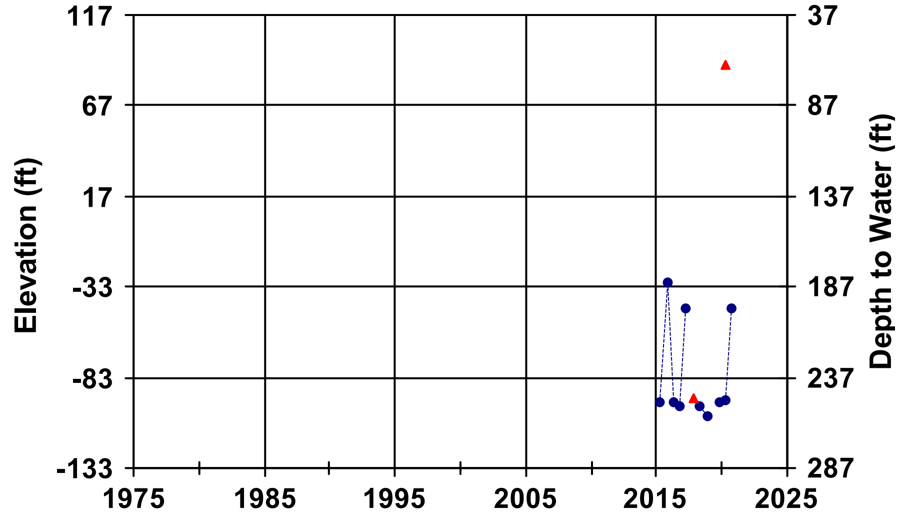


● Static Water Level ▲ Questionable Measurement — Reference Point Elevation

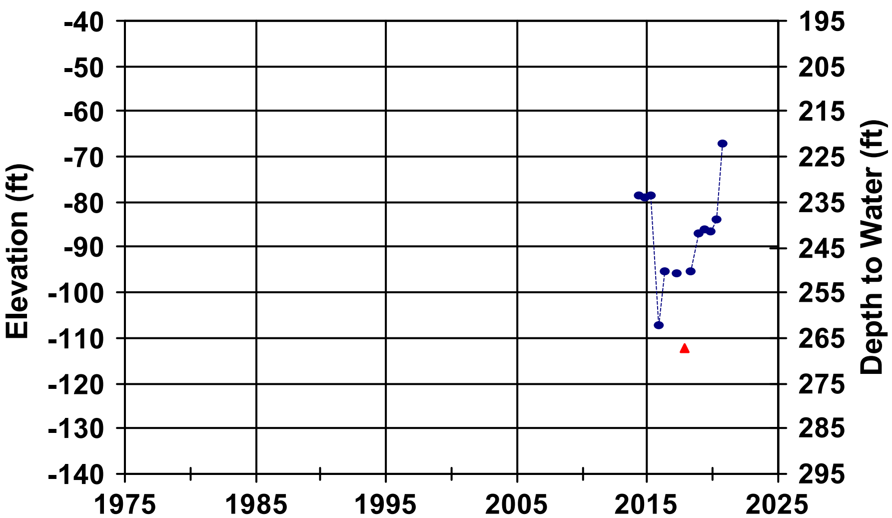
WellID: **NapaCounty-185** RPE: 83 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/19/2021



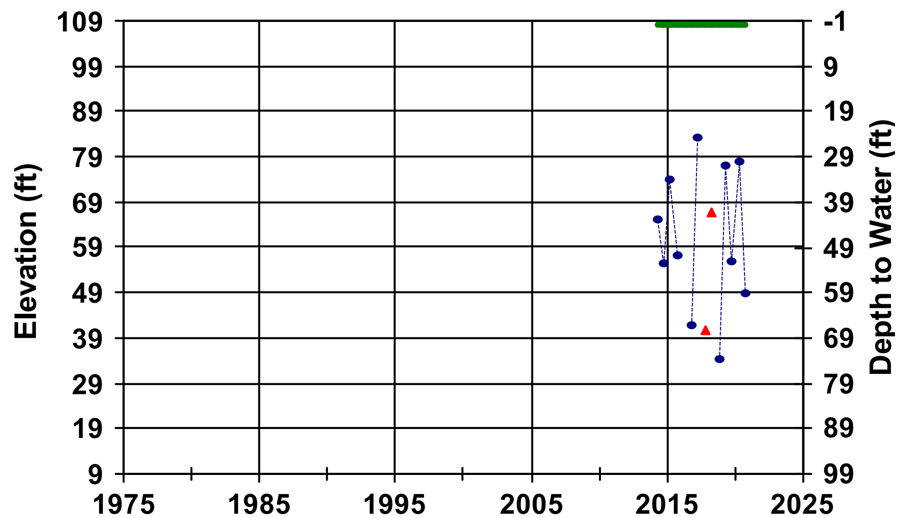
WellID: **NapaCounty-187** RPE: 153.5 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/22/2020



WellID: **NapaCounty-188** RPE: 154.6 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/22/2020

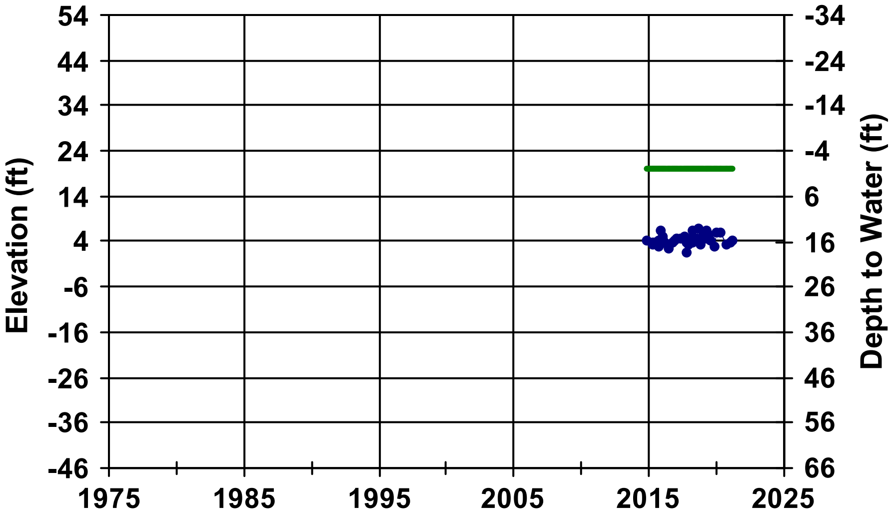


WellID: **NapaCounty-189** RPE: 108.25 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/22/2020

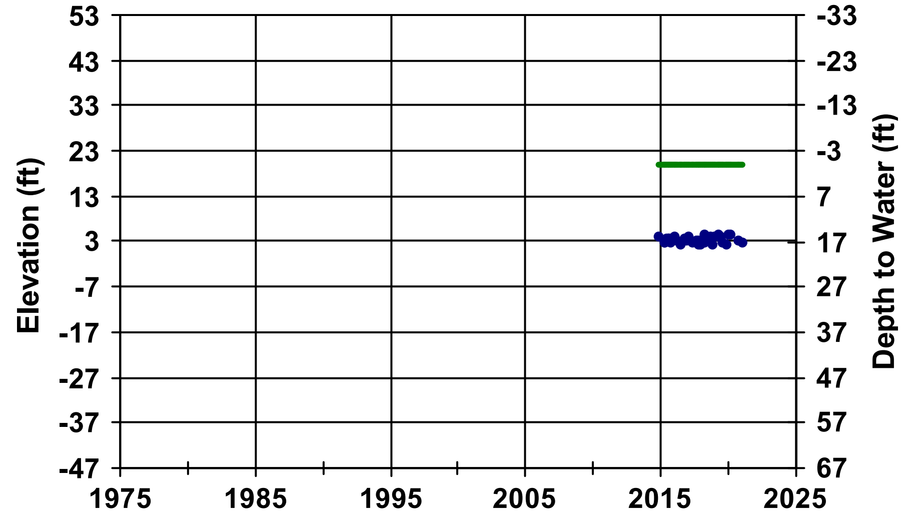


Static Water Level Questionable Measurement Reference Point Elevation

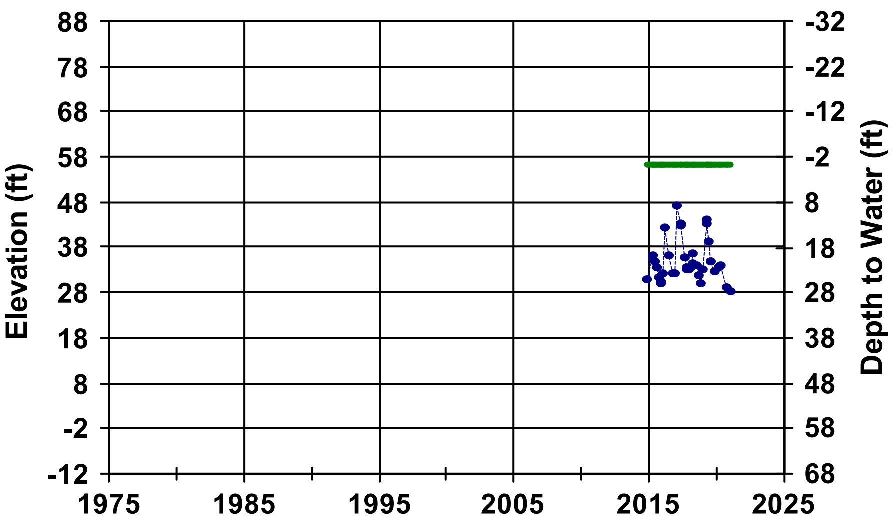
WellID: NapaCounty-214s-swgw1 RPE: 20.12 ft, msl SWN: 05N04W02N002M
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 3/18/2021



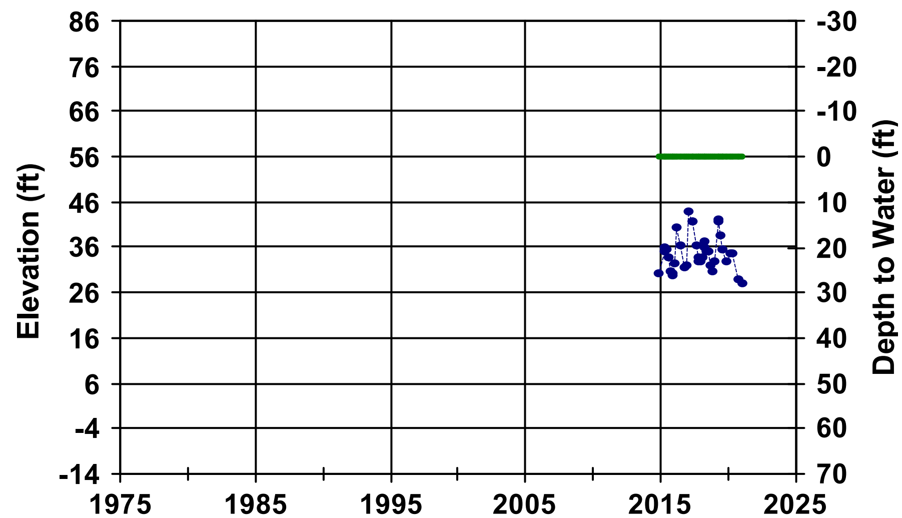
WellID: NapaCounty-215d-swgw1 RPE: 20.07 ft, msl SWN: 05N04W02N001M
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/13/2021



WellID: NapaCounty-218s-swgw3 RPE: 56.12 ft, msl SWN: 06N04W16G001M
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/13/2021

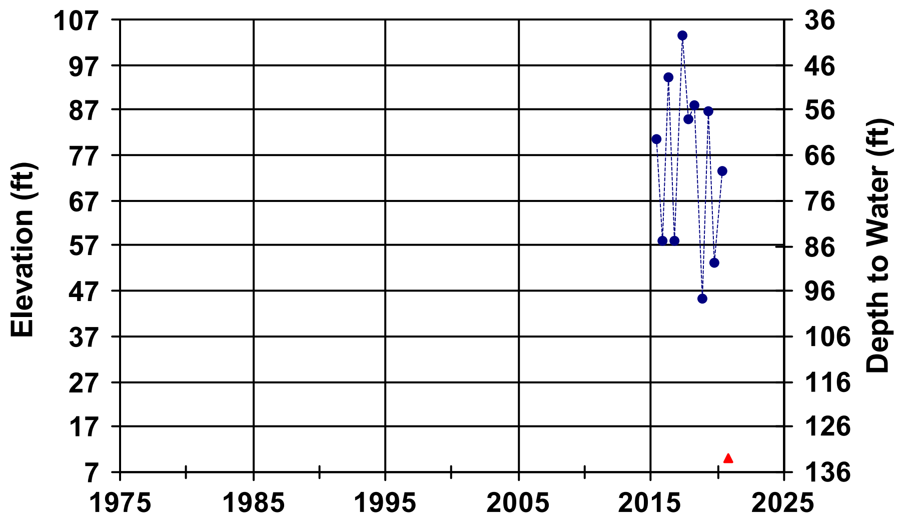


WellID: NapaCounty-219d-swgw3 RPE: 56.14 ft, msl SWN: 06N04W16G002M
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/13/2021

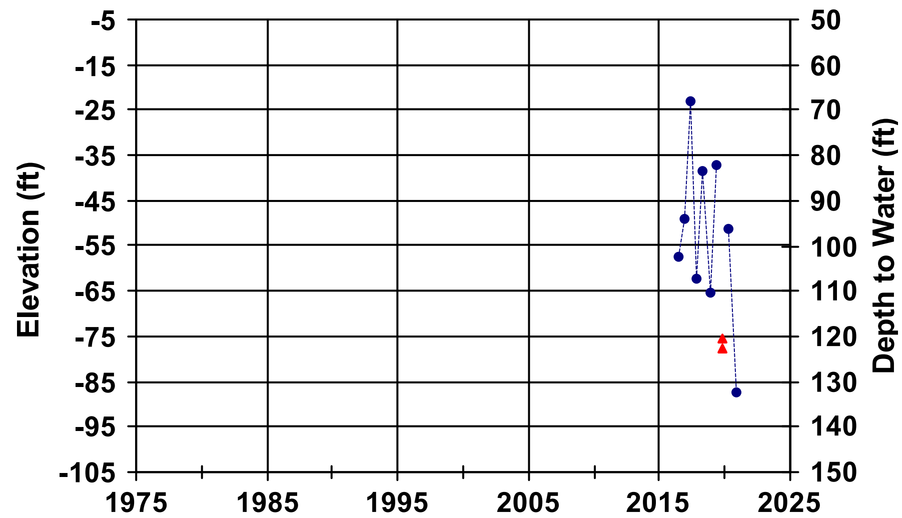


Static Water Level Questionable Measurement Reference Point Elevation

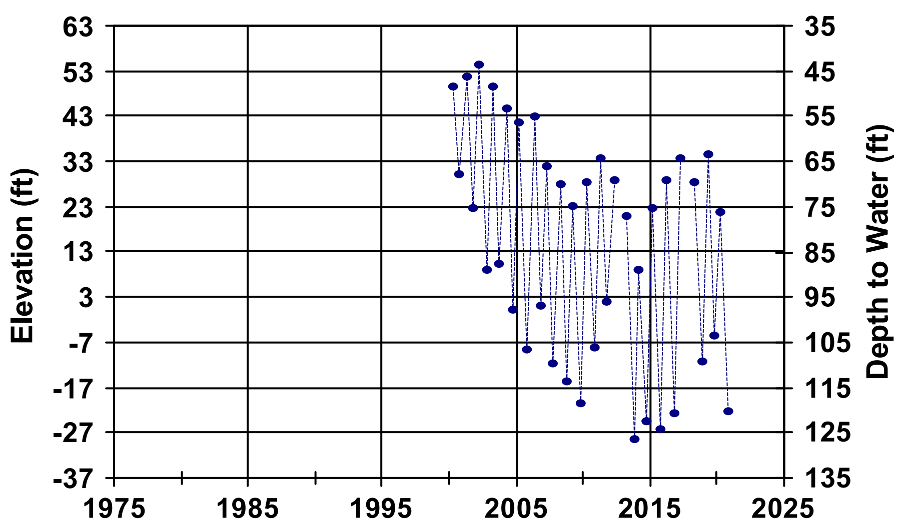
WellID: NapaCounty-227 RPE: 143.3 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/22/2020



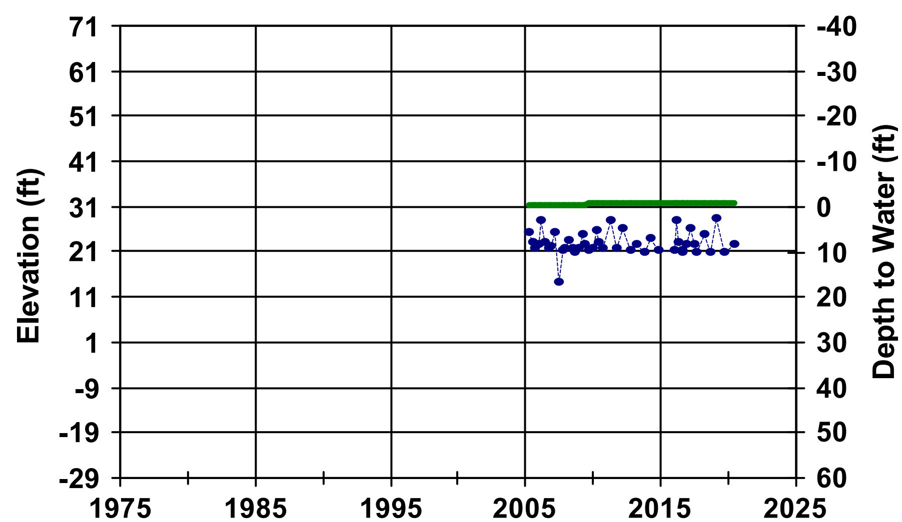
WellID: NapaCounty-229 RPE: 45.07 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/26/2020



WellID: NapaCounty-76 RPE: 97.85 ft, msl SWN: 006N004W15R003
Subarea: Napa Valley Floor-Napa Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/26/2020

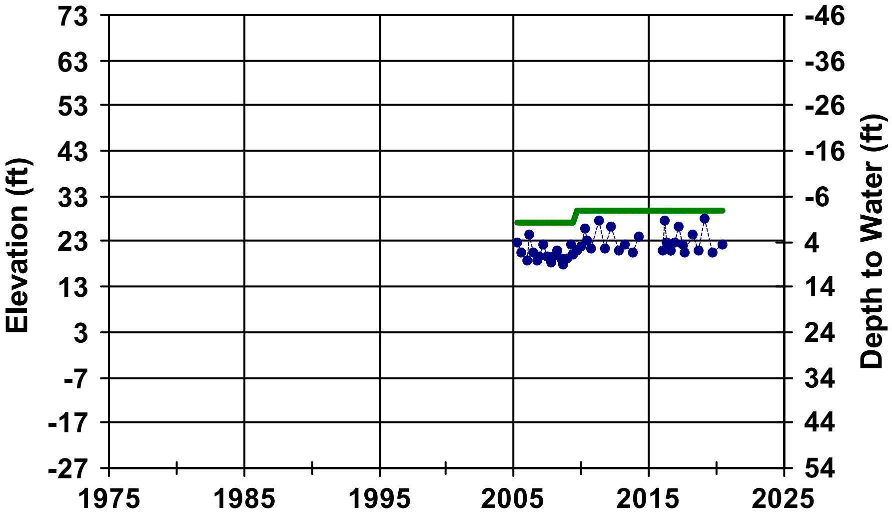


WellID: SL0605536682MW-1 RPE: 31.63 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 5/28/2020

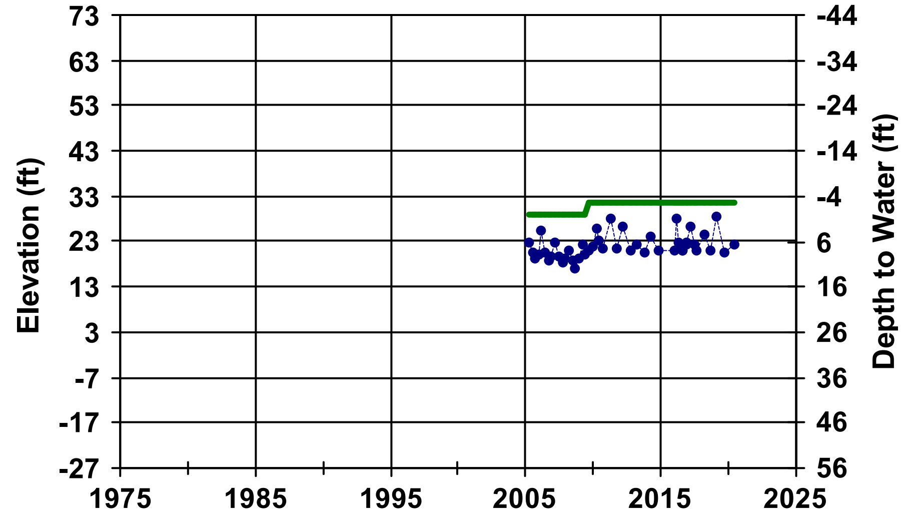


● Static Water Level ▲ Questionable Measurement — Reference Point Elevation

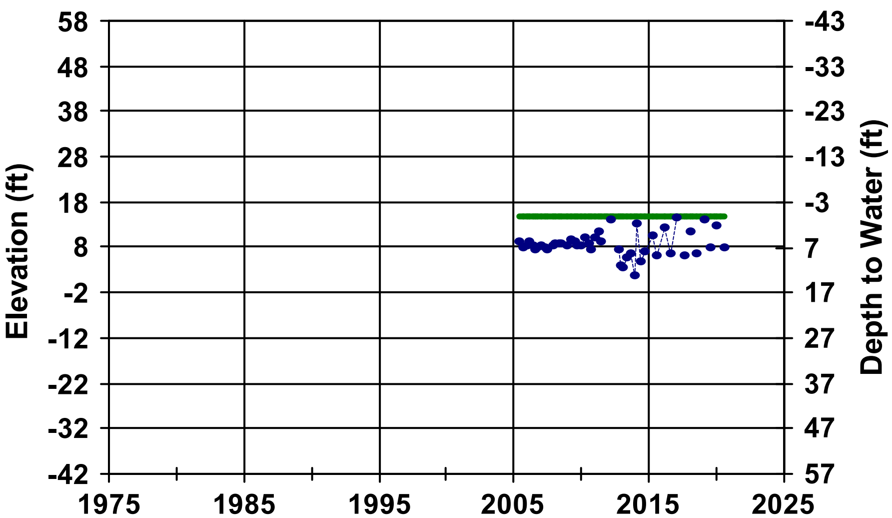
WellID: SL0605536682MW-2 RPE: 27.24 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 5/28/2020



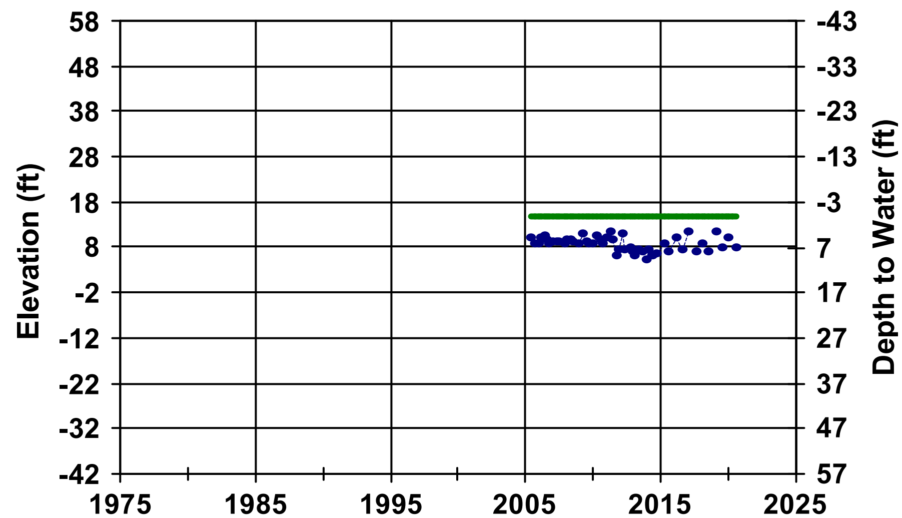
WellID: SL0605536682MW-3 RPE: 28.86 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 5/27/2020



WellID: T0605514064MW1 RPE: 14.72 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 7/27/2020

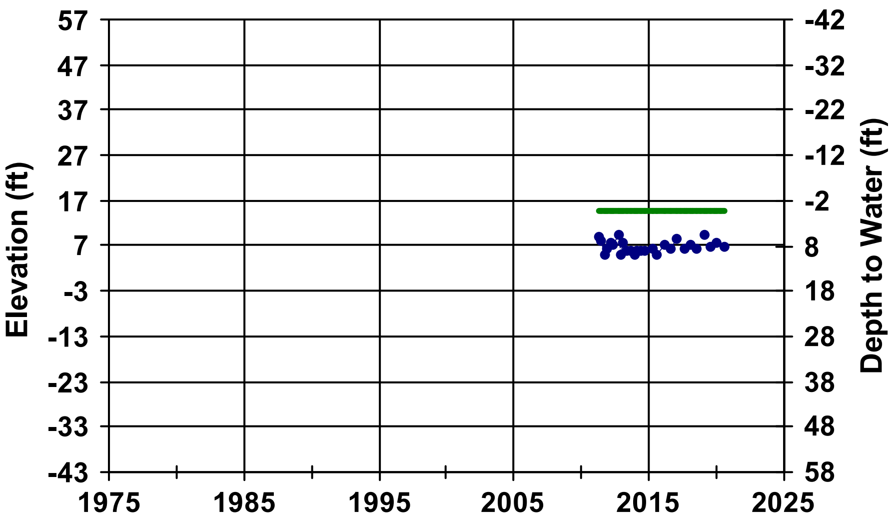


WellID: T0605514064MW2 RPE: 14.61 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 7/27/2020

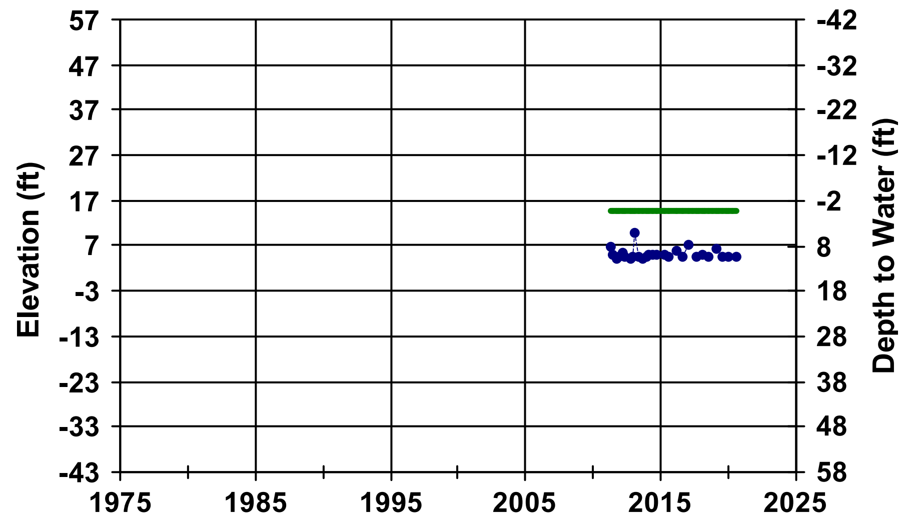


Static Water Level Questionable Measurement Reference Point Elevation

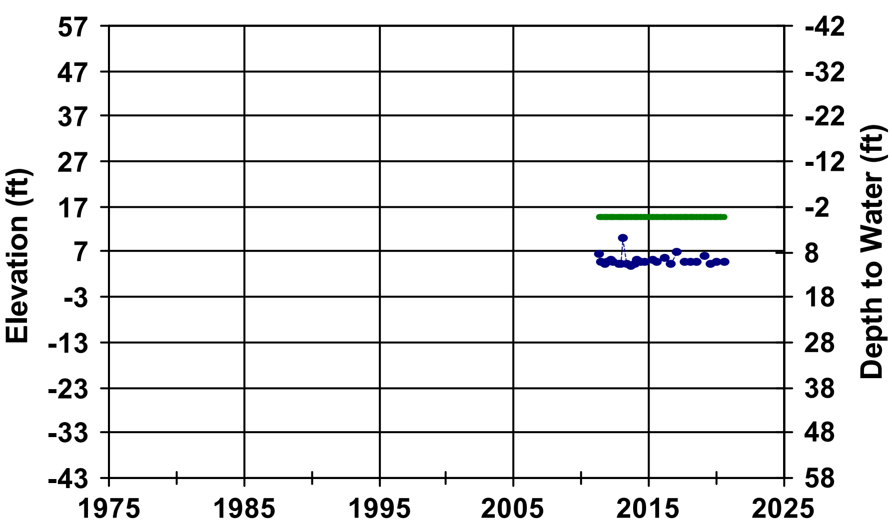
WellID: T0605514064MW21A RPE: 14.79 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 7/27/2020



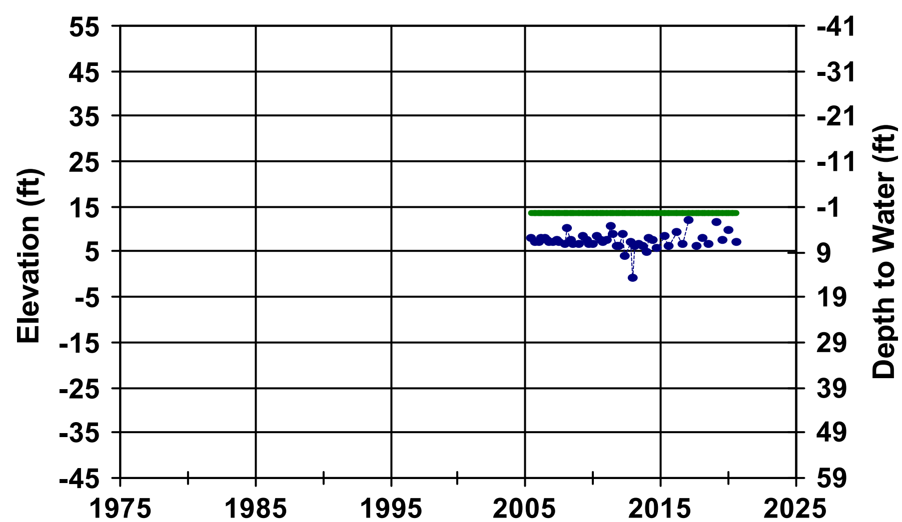
WellID: T0605514064MW21B RPE: 14.85 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 7/27/2020



WellID: T0605514064MW21C RPE: 14.82 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 7/27/2020

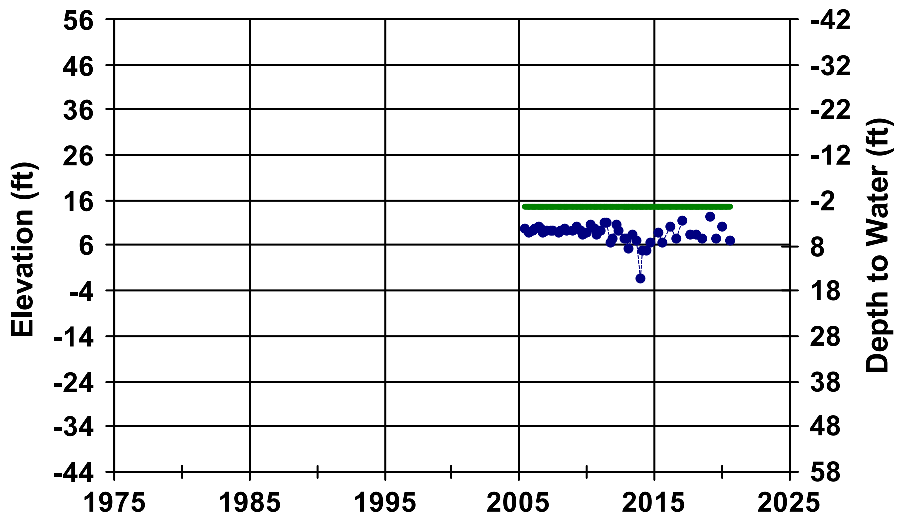


WellID: T0605514064MW3 RPE: 13.68 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 7/27/2020

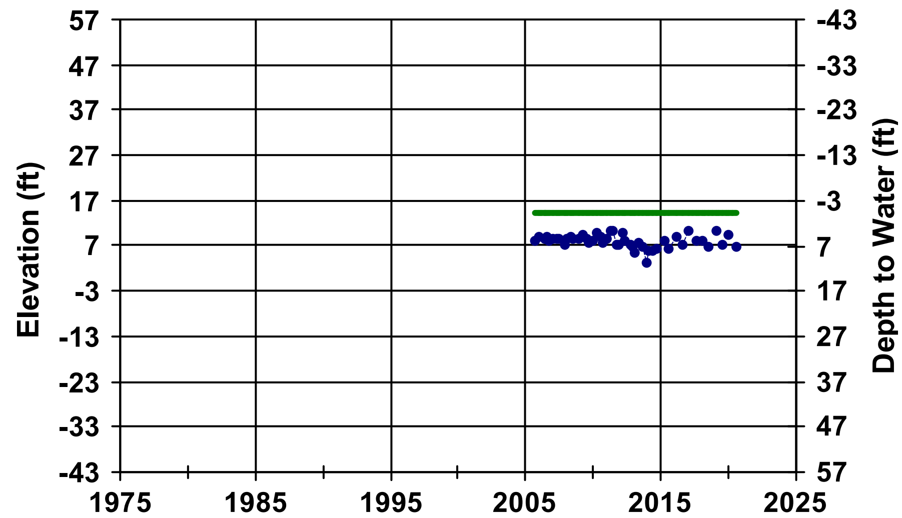


Static Water Level   Questionable Measurement   Reference Point Elevation

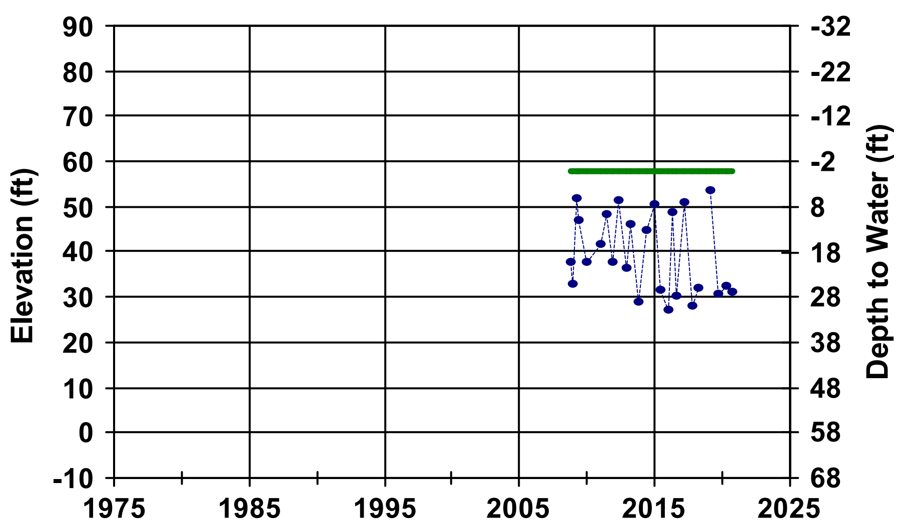
WellID: T0605514064MW4 RPE: 14.4 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 7/27/2020



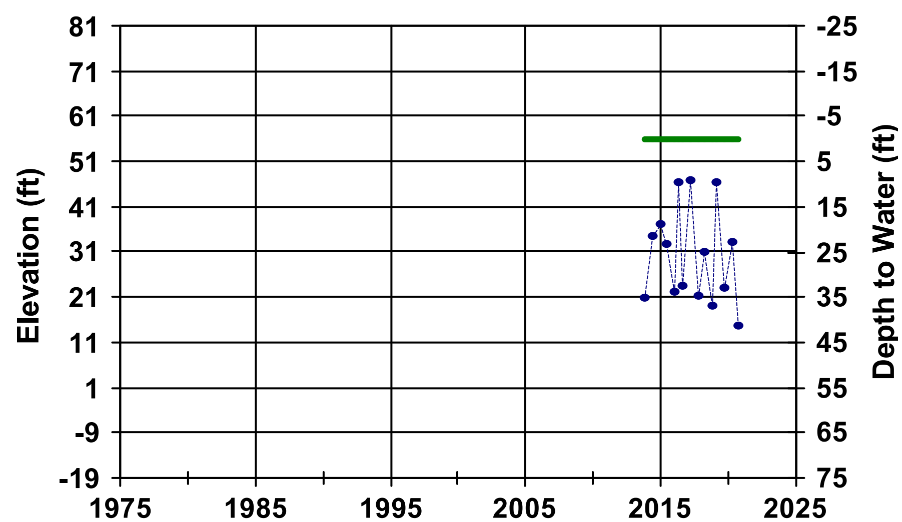
WellID: T0605514064MW5 RPE: 14.09 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 7/27/2020



WellID: T0605547200MW-1 RPE: 60.54 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/7/2020

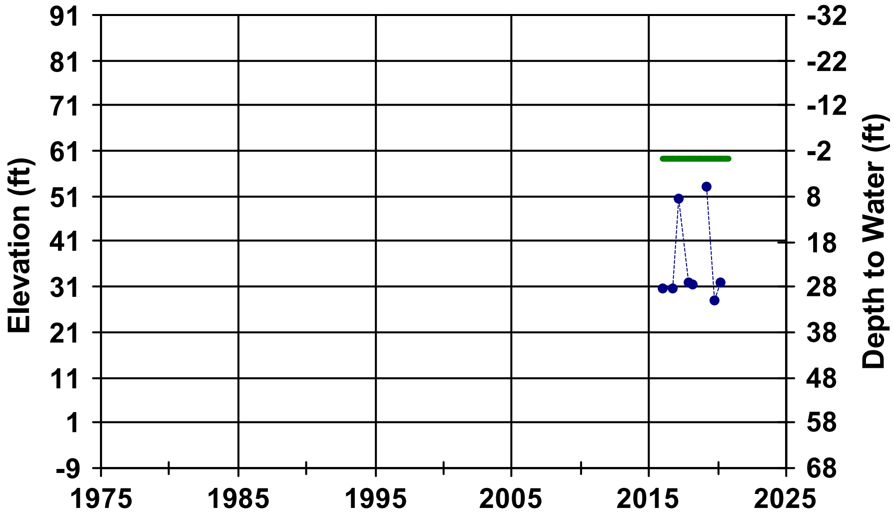


WellID: T0605547200MW-8D RPE: 55.87 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/7/2020

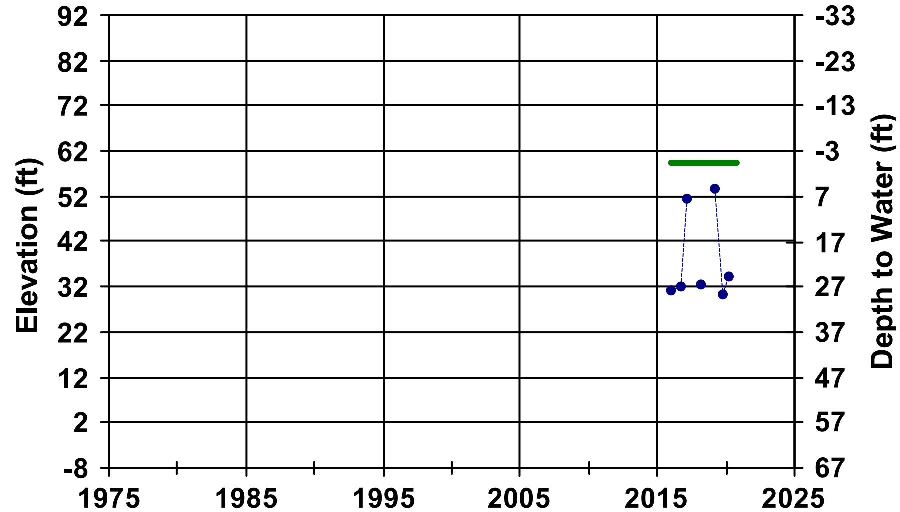


Static Water Level Questionable Measurement Reference Point Elevation

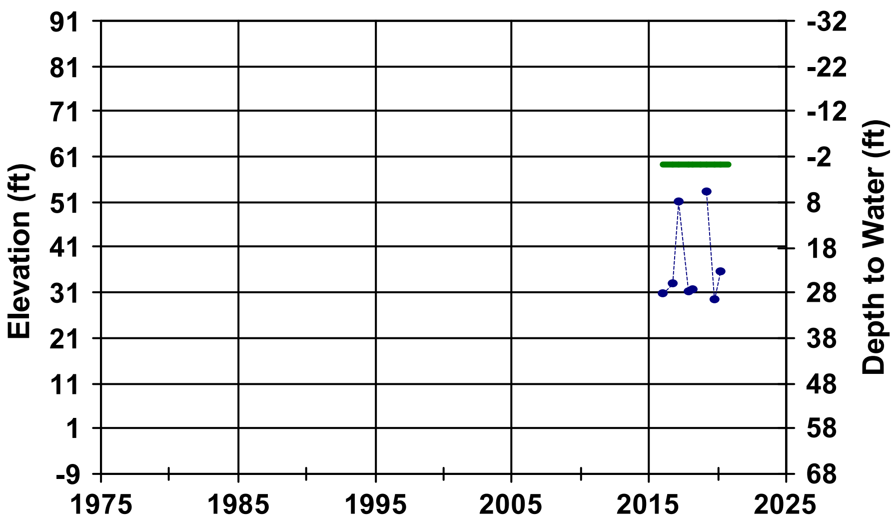
WellID: T0605547200SVE-1 RPE: 59.16 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 3/24/2020



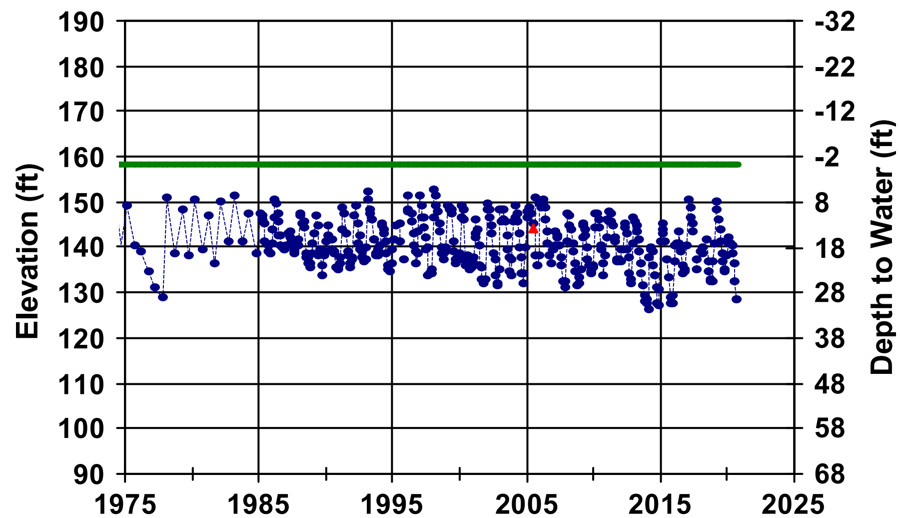
WellID: T0605547200SVE-2 RPE: 59.43 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 3/24/2020



WellID: T0605547200SVE-3 RPE: 59.33 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Napa Source: Geotracker Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 3/24/2020

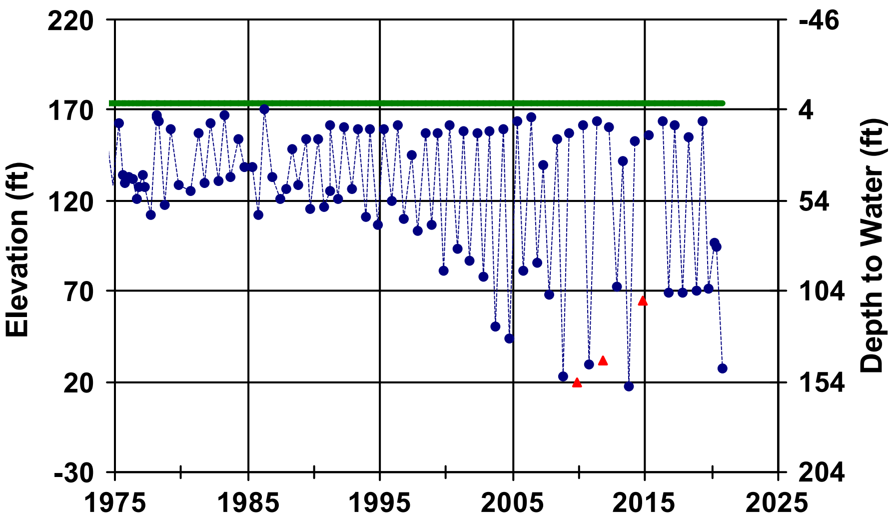


WellID: 07N05W09Q002M RPE: 158.24 ft, msl SWN: 007N005W09Q002
Subarea: Napa Valley Floor-St. Helena Source: DWR Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/5/2020

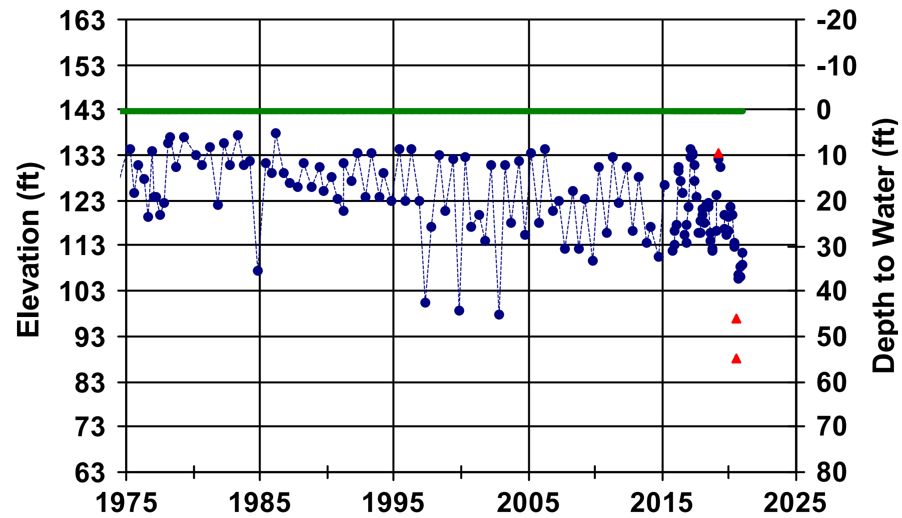


● Static Water Level ▲ Questionable Measurement — Reference Point Elevation

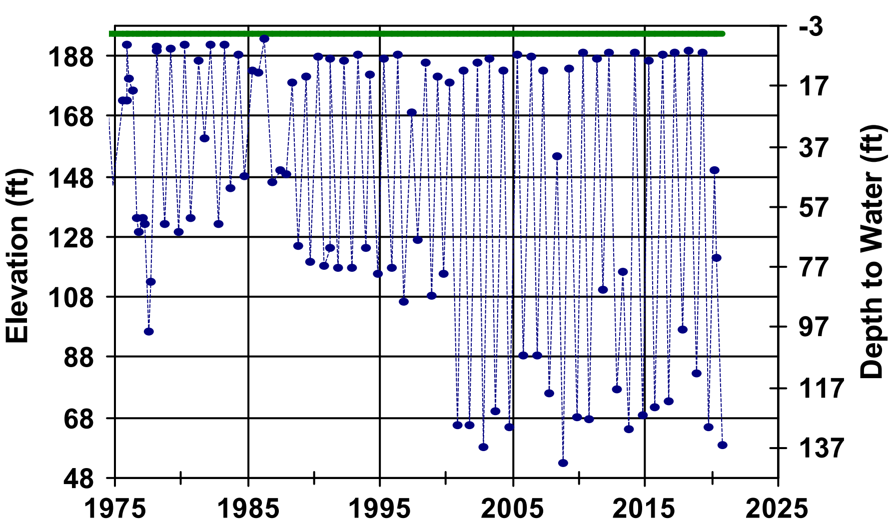
WellID: NapaCounty-131 RPE: 173.5 ft, msl SWN: 007N005W16L001
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/22/2020



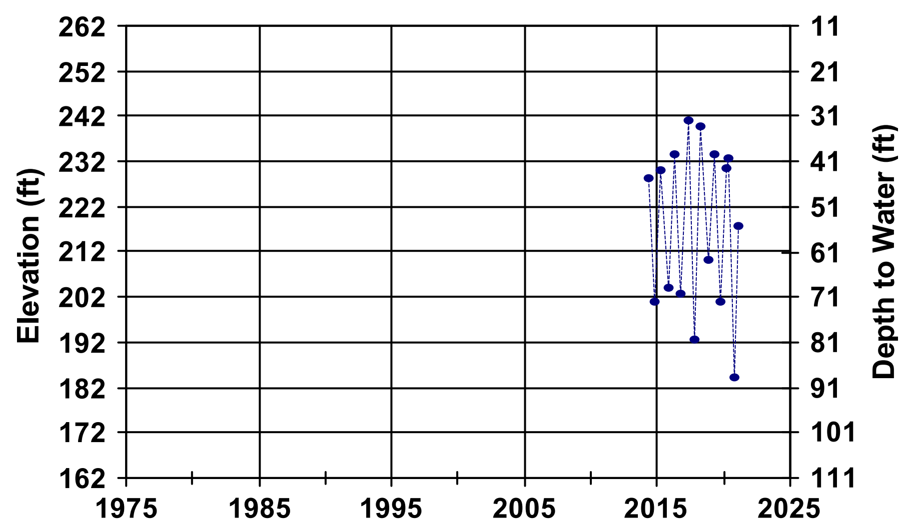
WellID: NapaCounty-132 RPE: 142.7 ft, msl SWN: 007N005W14B002
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/19/2021



WellID: NapaCounty-138 RPE: 195.1 ft, msl SWN: 007N005W16N002
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/22/2020

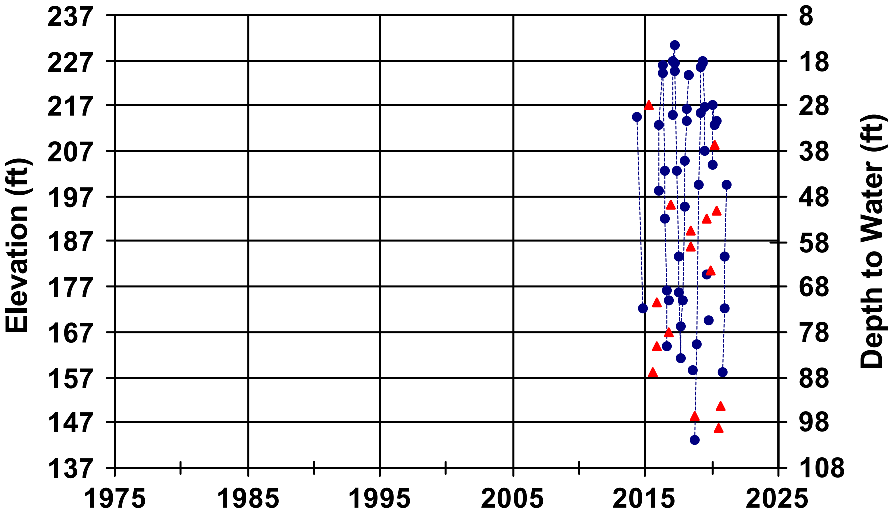


WellID: NapaCounty-169 RPE: 273.4 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/21/2021

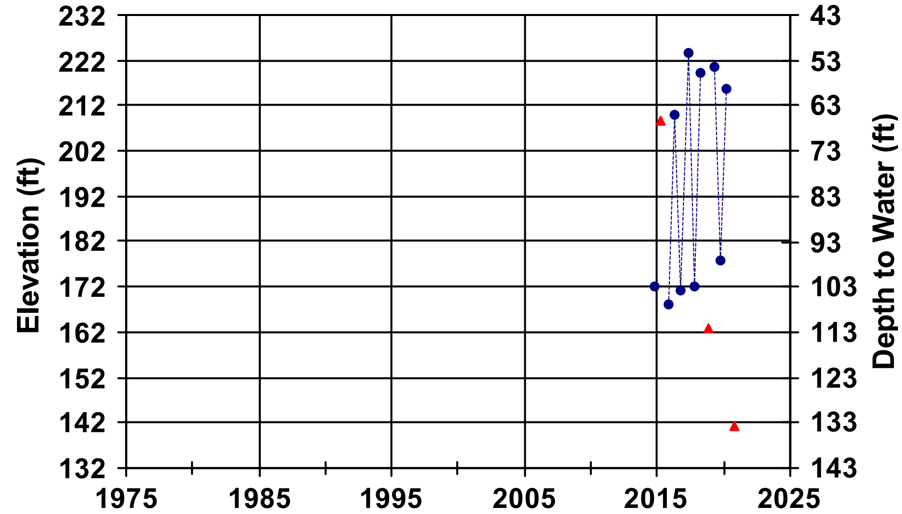


● Static Water Level ▲ Questionable Measurement — Reference Point Elevation

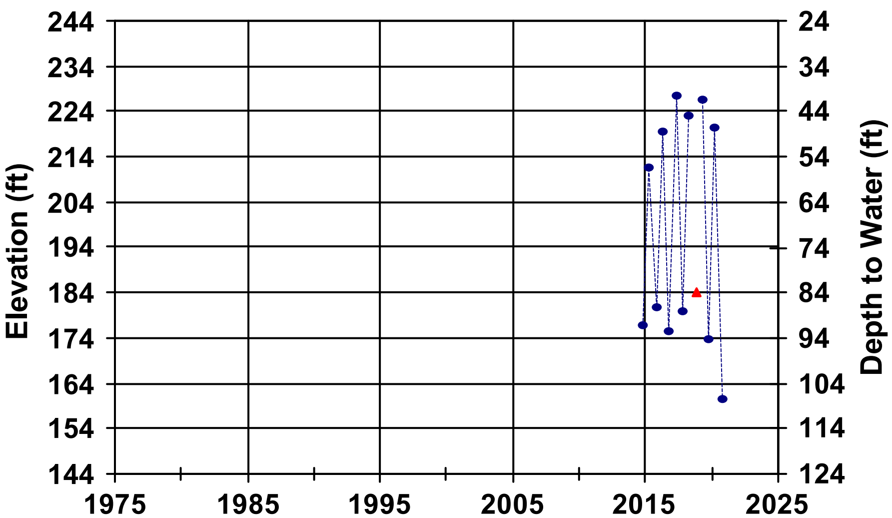
WellID: NapaCounty-171 RPE: 245.1 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/19/2021



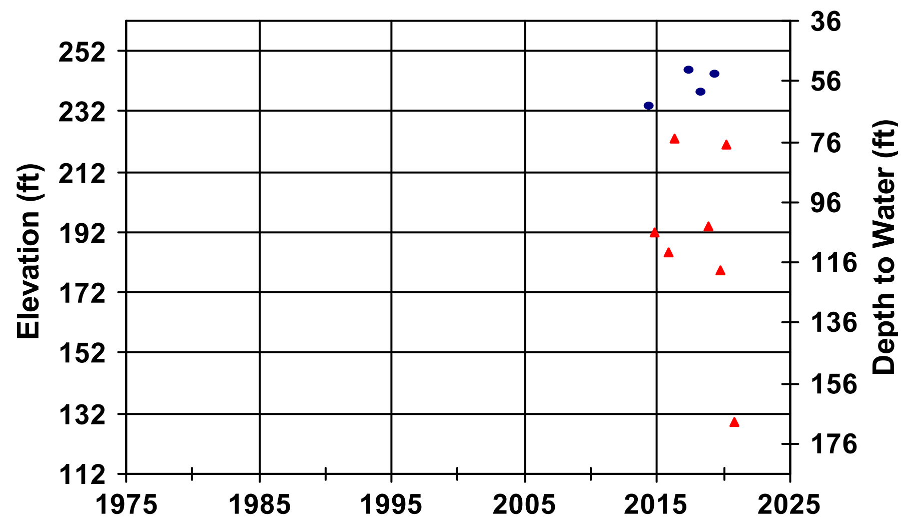
WellID: NapaCounty-172 RPE: 275.2 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/22/2020



WellID: NapaCounty-173 RPE: 268.3 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/22/2020

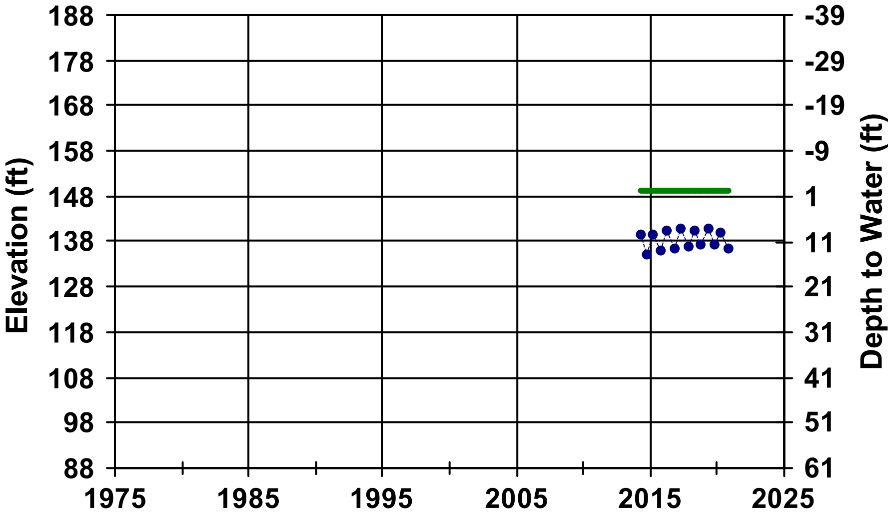


WellID: NapaCounty-174 RPE: 298.2 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/22/2020

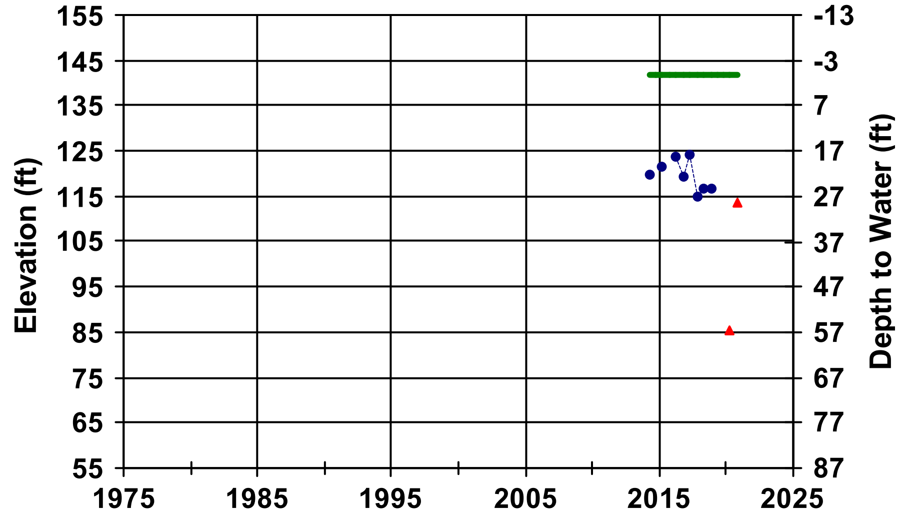


● Static Water Level ▲ Questionable Measurement — Reference Point Elevation

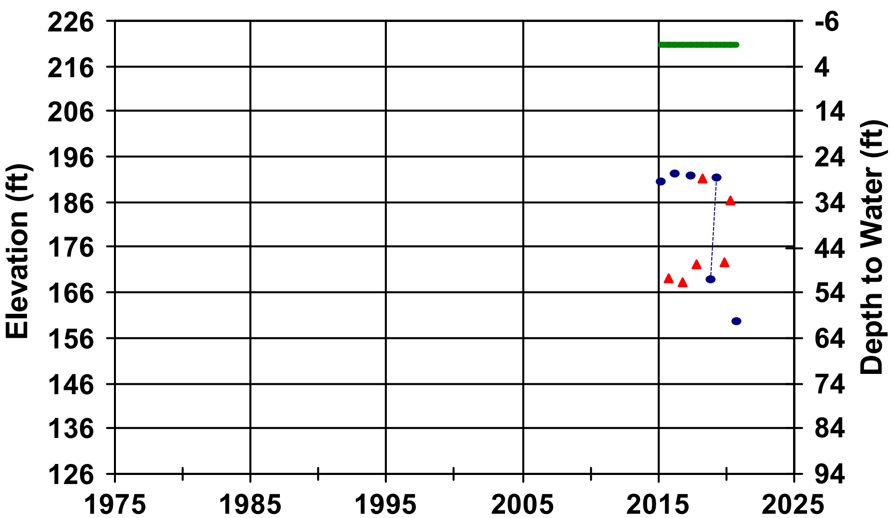
WellID: NapaCounty-177 RPE: 149.3 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/23/2020



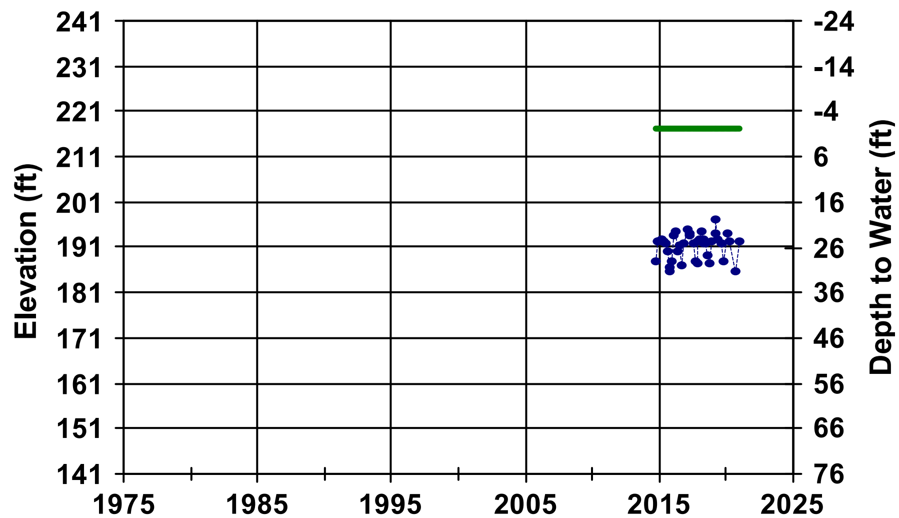
WellID: NapaCounty-204 RPE: 141.7 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/23/2020



WellID: NapaCounty-212 RPE: 220.5 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/19/2020

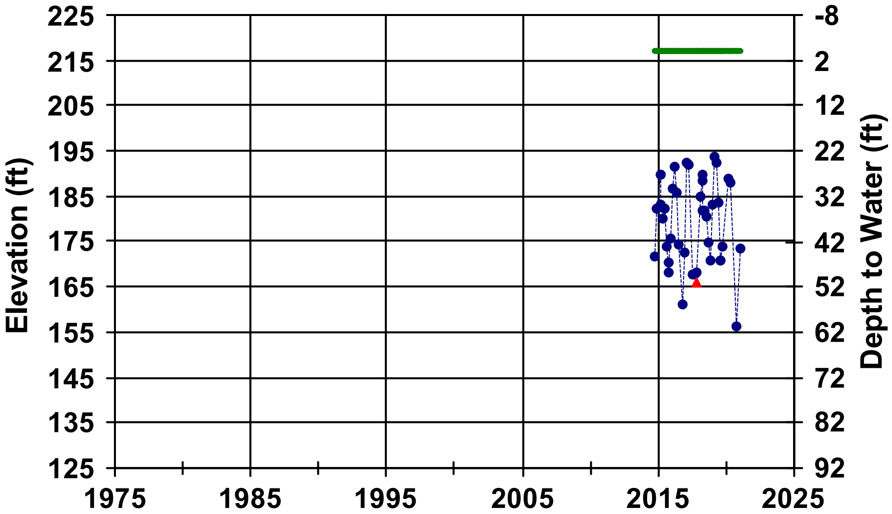


WellID: NapaCounty-222s-swgw5 RPE: 217.07 ft, msl SWN: 08N05W30Q001M
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/13/2021

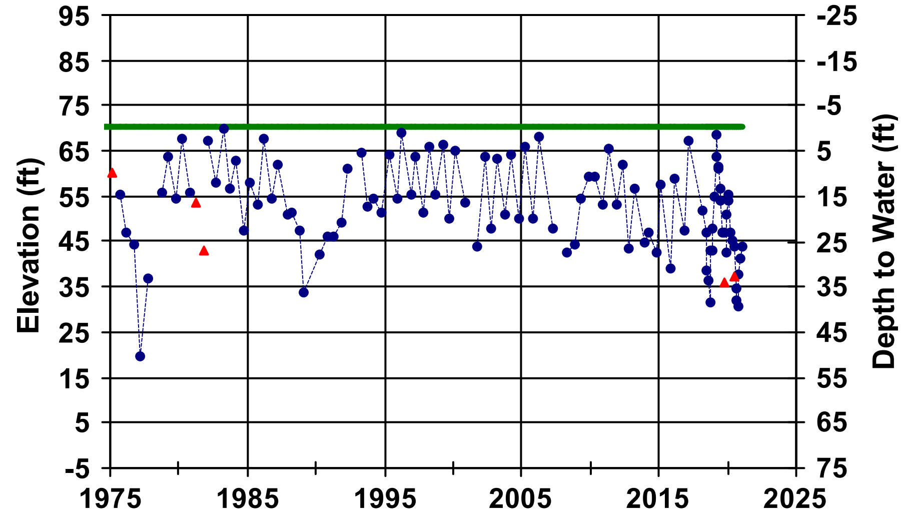


Static Water Level Questionable Measurement Reference Point Elevation

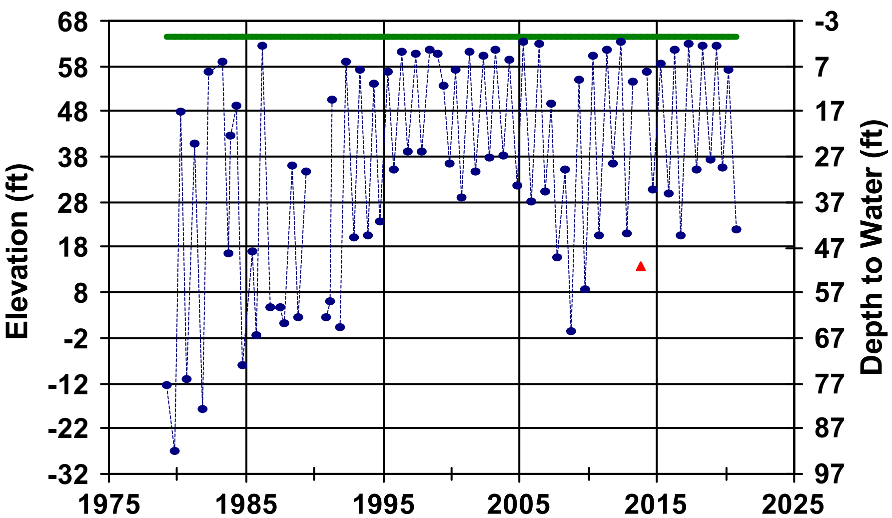
WellID: NapaCounty-223d-swgw5 RPE: 217.1 ft, msl SWN: 08N05W30Q002M
Subarea: Napa Valley Floor-St. Helena Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/13/2021



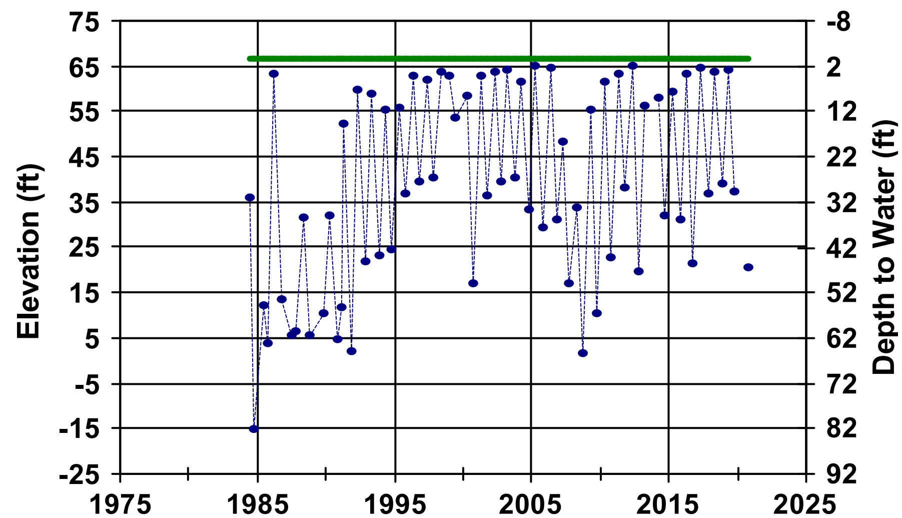
WellID: 06N04W17A001M RPE: 70.26 ft, msl SWN: 006N004W17A001
Subarea: Napa Valley Floor-Yountville Source: DWR Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/22/2021



WellID: NapaCounty-125 RPE: 64.6 ft, msl SWN: 006N004W09Q001
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/20/2020

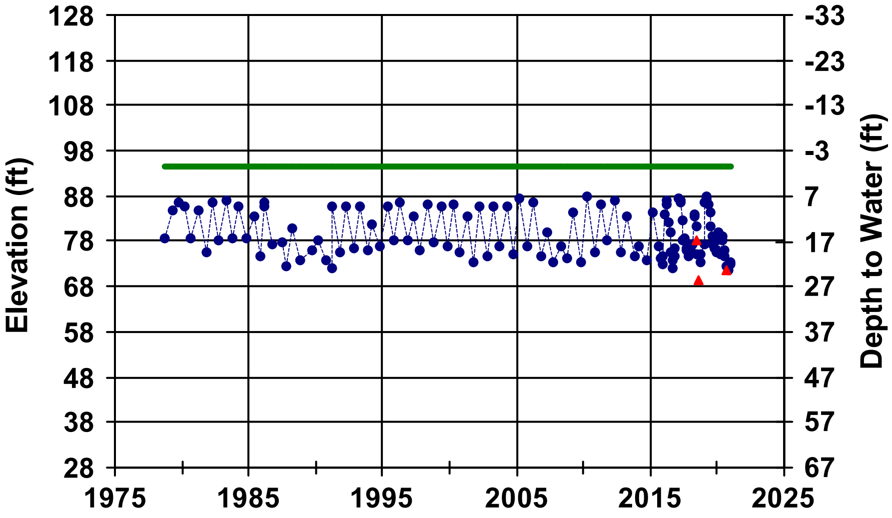


WellID: NapaCounty-126 RPE: 66.7 ft, msl SWN: 006N004W09Q002
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/20/2020

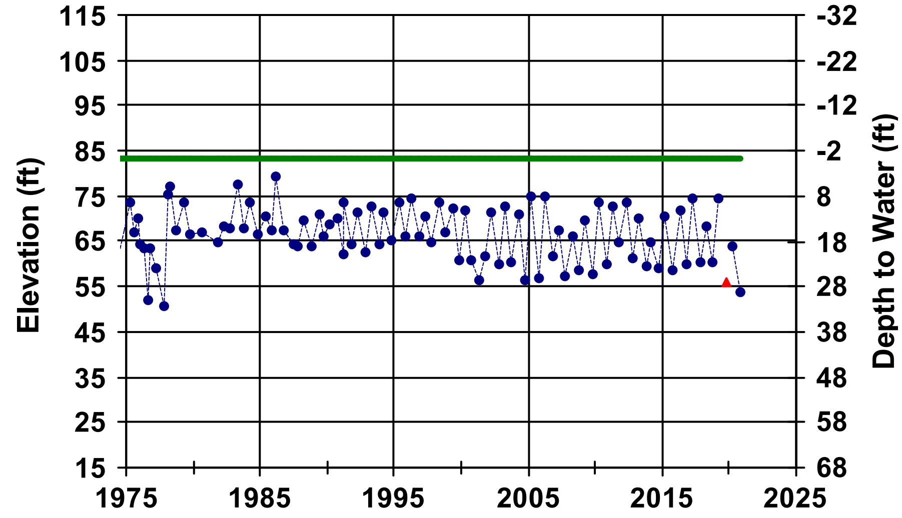


Static Water Level   Questionable Measurement   Reference Point Elevation

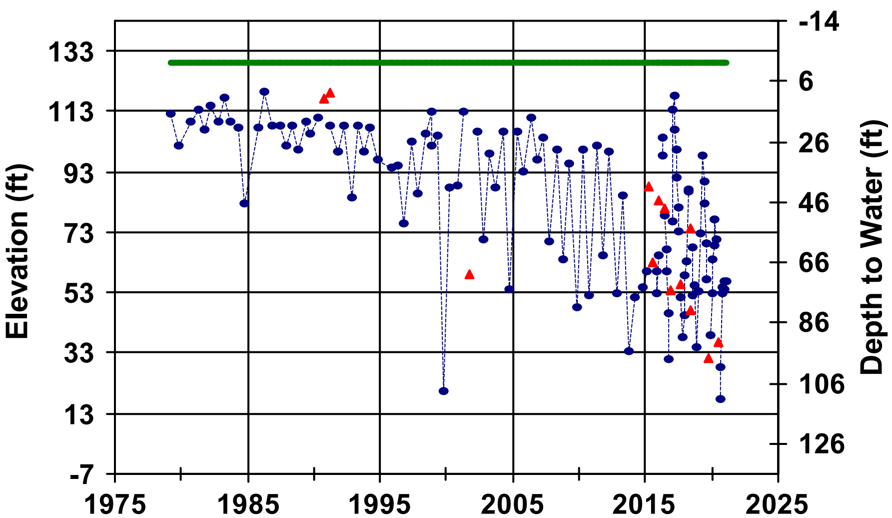
WellID: NapaCounty-133 RPE: 94.7 ft, msl SWN: 007N004W31M001
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/19/2021



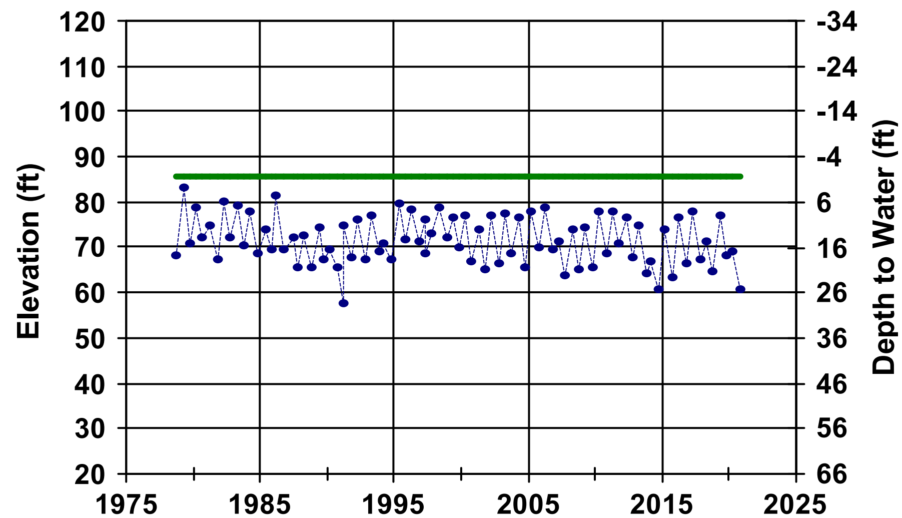
WellID: NapaCounty-134 RPE: 83.4 ft, msl SWN: 006N004W06L002
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/23/2020



WellID: NapaCounty-135 RPE: 129.2 ft, msl SWN: 006N004W19B001
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/19/2021

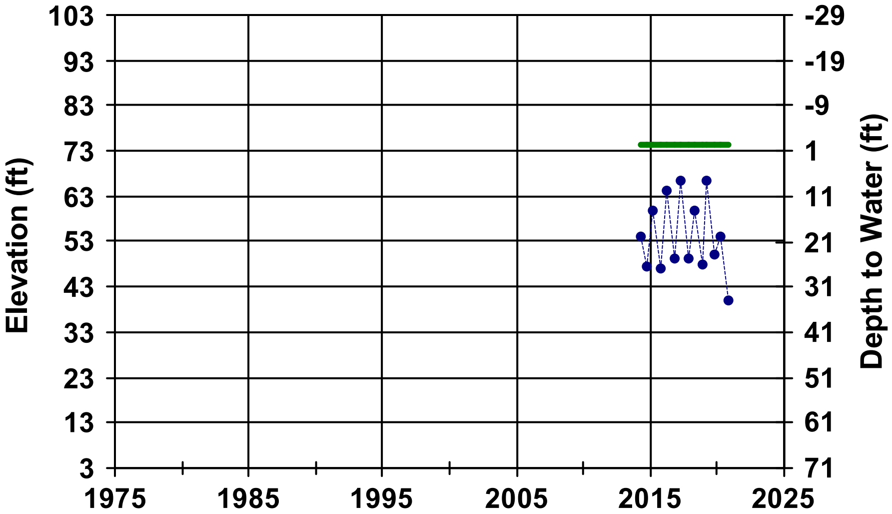


WellID: NapaCounty-139 RPE: 85.8 ft, msl SWN: 006N004W17R002
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/20/2020

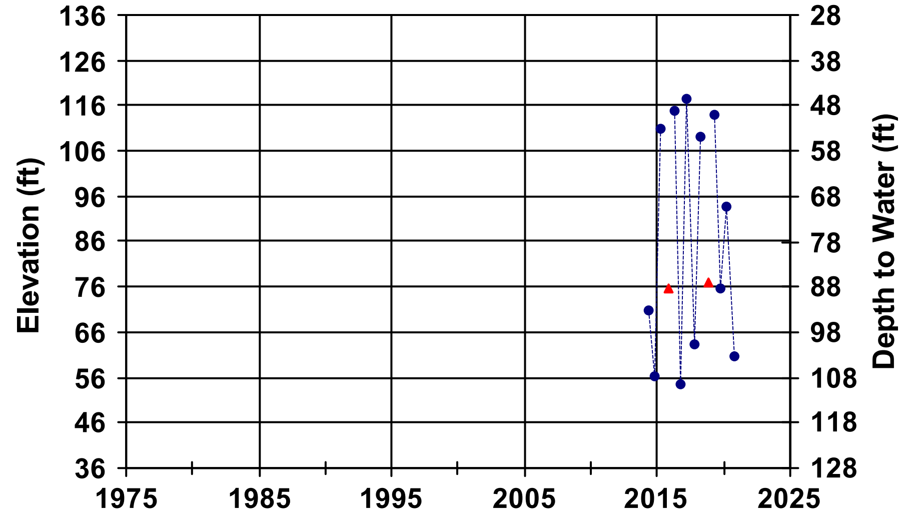


● Static Water Level ▲ Questionable Measurement — Reference Point Elevation

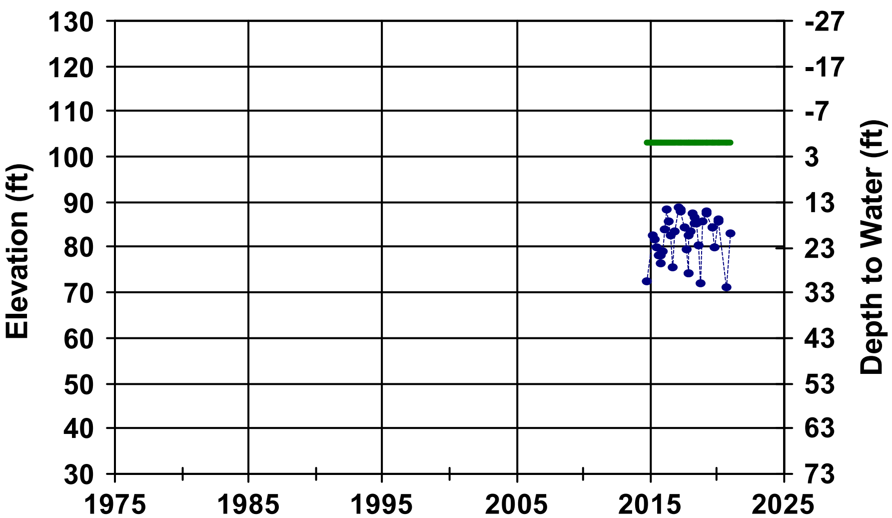
WellID: NapaCounty-179 RPE: 74.3 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/23/2020



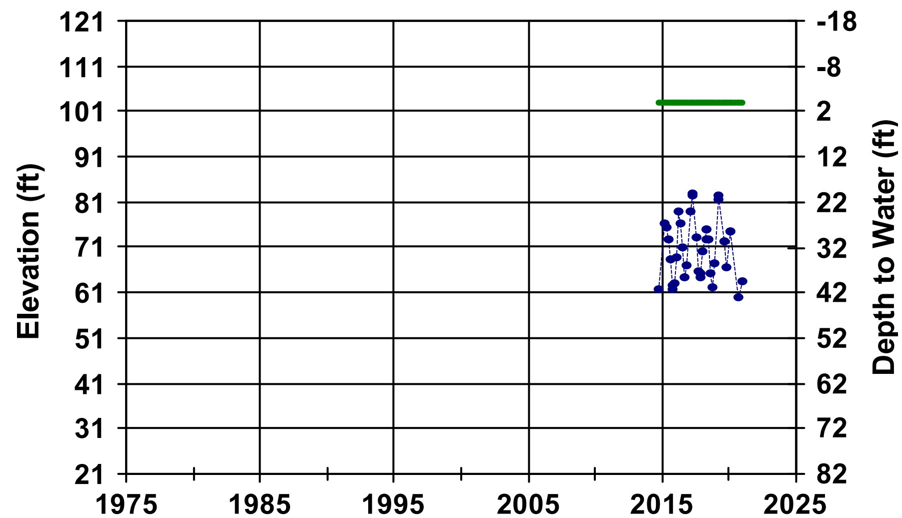
WellID: NapaCounty-181 RPE: 163.6 ft, msl SWN: Unknown
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/23/2020



WellID: NapaCounty-216s-swgw2 RPE: 103.1 ft, msl SWN: 06N04W18J003M
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/13/2021

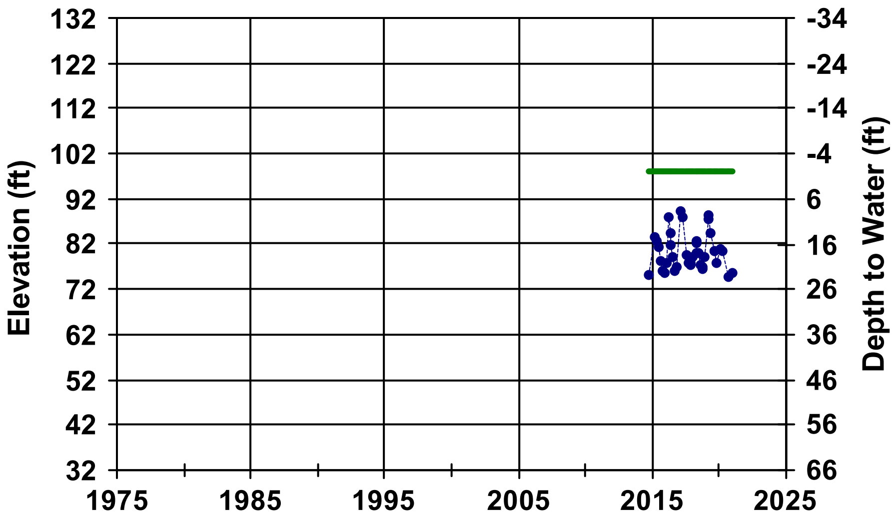


WellID: NapaCounty-217d-swgw2 RPE: 103.08 ft, msl SWN: 06N04W18J004M
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/13/2021

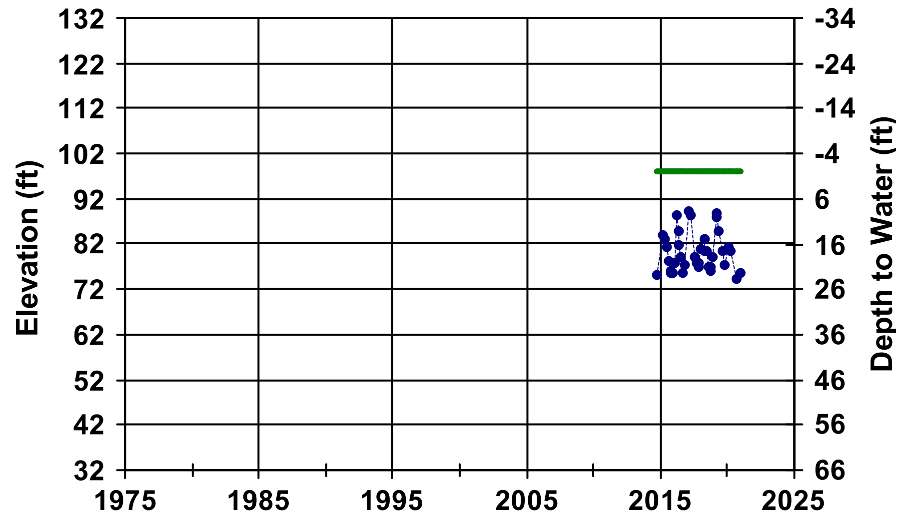


Static Water Level Questionable Measurement Reference Point Elevation

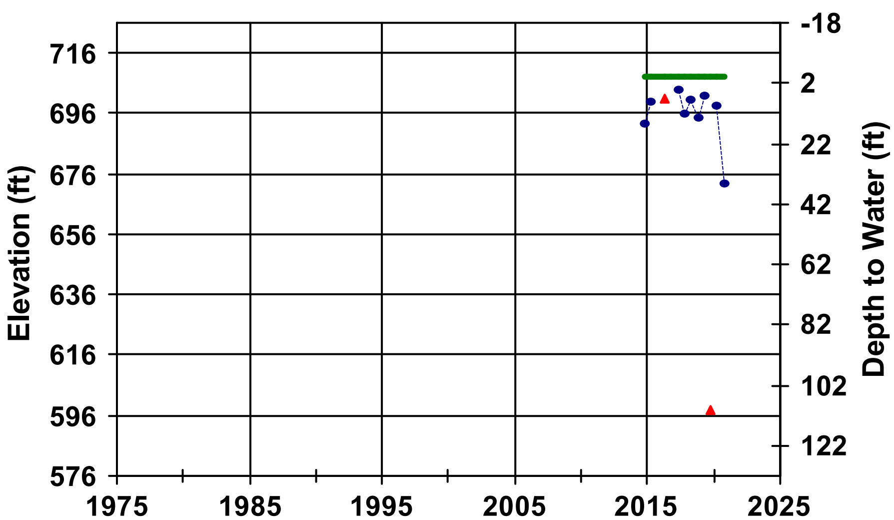
WellID: NapaCounty-220s-swgw4 RPE: 98.22 ft, msl SWN: 07N04W31D001M
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/13/2021



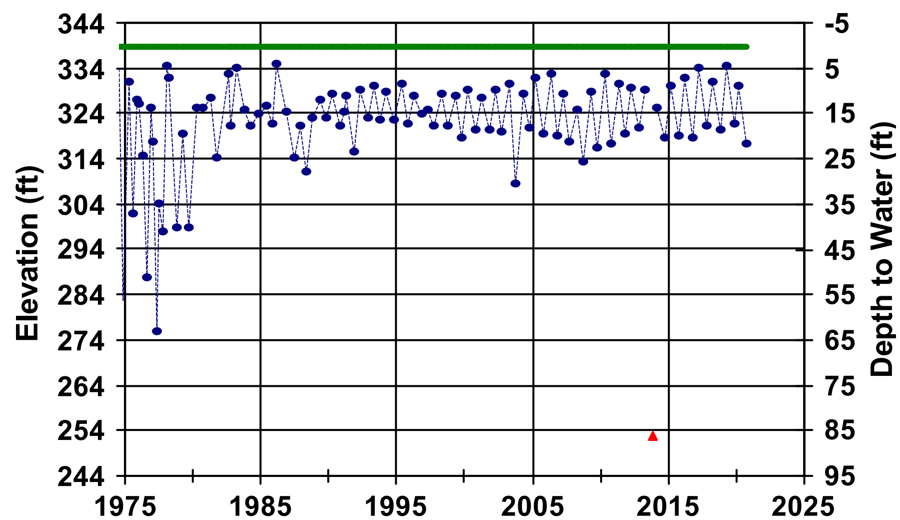
WellID: NapaCounty-221d-swgw4 RPE: 98.28 ft, msl SWN: 07N04W31D002M
Subarea: Napa Valley Floor-Yountville Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 1/13/2021



WellID: NapaCounty-211 RPE: 708.2 ft, msl SWN: Unknown
Subarea: Pope Valley Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin POPE VALLEY BASIN Last Msmt Date 10/29/2020



WellID: NapaCounty-129 RPE: 338.7 ft, msl SWN: 008N006W06L004
Subarea: Western Mountains Source: NapaCounty Aquifer Zone: undefined
Groundwater Basin NAPA VALLEY SUBBASIN Last Msmt Date 10/19/2020

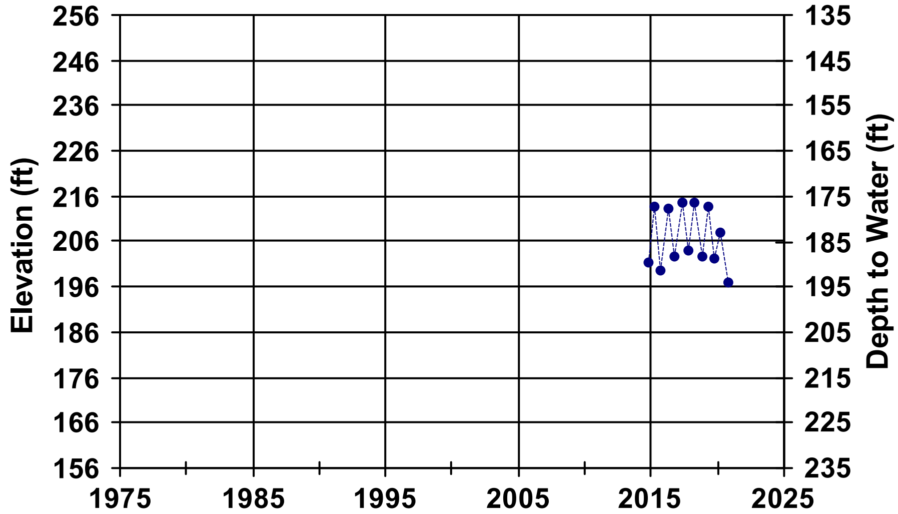


Static Water Level   Questionable Measurement   Reference Point Elevation

WellID: NapaCounty-213
Subarea: Western Mountains
Groundwater Basin Not within a basin

RPE: 390.8 ft, msl
Source: NapaCounty

SWN: Unknown
Aquifer Zone: undefined
Last Msmt Date 10/22/2020



APPENDIX C

Napa County Procedure for
Measuring Groundwater Levels

NAPA COUNTY PROCEDURE FOR MEASURING

THE DEPTH TO WATER IN MONITORING AND PRODUCTION WELLS

Purpose

To obtain an accurate dated and timed measurement of the static depth to water in a well that can be converted into a water level elevation in reference to a commonly used reference datum (e.g., NAVD 1988). In this context, static means that the water level in the well is not influenced by pumping of the well. For comparability, measurements should be obtained according to an established schedule designed to capture times of both highest and lowest seasonal water level elevations. Also for comparability, measurements during a particular field campaign should be obtained consecutively and without delay within the shortest reasonable time.

Measurement Procedure

- If well is being pumped, do not measure; return later, but not sooner than 60 minutes and preferably after 24 hours (see below "Special Circumstances – Pumping Water Level on Arrival" for additional instructions).
- Turn on water level indicator signaling device and check battery by hitting the test button.
- Remove access plug or well cap from the well cover and lower probe (electric sounder) into the well.
- When probe hits water a loud "beep" will sound and signal light will turn red.
- Retract slightly until the tone stops.
- Slowly lower the probe until the tone sounds.
- Note depth measurement at rim (i.e., the surveyed reference point for water level readings) of well to the nearest 0.01 foot and rewind probe completely out of well.
- Remove excess water and lower probe once again into well and measure again.
- If difference is within ±0.02 foot of first measurement, record measurement.
- If difference is greater repeat the same procedure until three consecutive measurements are recorded within ± 0.02 foot.
- Rewind and remove probe from well and replace the access plug or well cap in the well cover.
- Clean and dry the measuring device/probe and continue to next well.

Special Circumstances

Oil Encountered in Well

If oil is detected in the well structure, the depth to the air-oil interface is measured. To obtain such a measurement, the electric sounder is used similar to the way chalked steel tapes were traditionally used for depth-to-water measurements.

1. Lower the cleaned probe well below the air-oil interface (e.g., 1 foot). Read and record the depth at the reference point (since this depth is chosen somewhat arbitrarily by the field technician, an even number can be chosen, e.g., 37.00 feet). This measurement is the length of cable lowered into the well and corresponds to a line that the oil leaves on the probe or cable (i.e., the oil inundation line). Above this line, smudges of oil may appear on the cable. Below this line, the cable/probe is completely covered with oil. If the probe is lowered too far, completely penetrates the oil, and is far submerged in the water below the oil, parts of the probe/cable below the oil inundation line may also appear smudgy.
2. Retrieve probe, identify and record the oil inundation line on the cable (e.g., 2.72 feet). This measurement does not reflect the thickness of the oil. It reflects the length of the cable below the air-oil interface.
3. Compute the depth to oil by subtracting the length of line below the air-oil interface from the corresponding measurement at the reference point: Depth to oil = 37.00 feet – 2.72 feet = 34.28 feet.

Since oil has a slightly smaller density than water, a depth-to-oil measurement will always be smaller than a corresponding depth-to-water measurement in the same well if oil were not present. Depth-to-oil measurements yield a reasonable approximation to depth-to-water measurements unless the oil thickness is great. For each foot of oil in the well casing, the depth-to-oil measurement will be approximately 0.12 foot smaller than a corresponding depth-to-water measurement if oil were not present.

Pumping Water Level on Arrival

If well is being pumped, do not measure. Return later when the water level has stabilized. Using past field notes, the field technician will use his/her experience to determine the appropriate duration necessary for static measurements. Upon returning to the well site (at a location where pumping was previously noted on the same day), the technician will measure the water level. The technician will have available historical water level data to determine whether the measurement is consistent with past measurements. If the initial measurement appears anomalous, the technician will measure water levels every 10 minutes over a period of 30 minutes.[1] If measurements vary significantly from past measurements (taking into account seasonal variations), the technician will note the circumstances (i.e., the date and time when the well was first visited, total time it was pumping (if known), when it was shutoff, when the

[1] During this period, if the groundwater level difference is greater than +/- 0.02 feet, repeat the same procedure until three consecutive measurements are recorded within +/- 0.02 feet.

technician returned, and subsequent water level measurements [on the same day, or as the case may be based on experience, the day immediately following]). Subsequent consideration of pumping effects at a site-specific well location will be addressed as necessary.

Recordation

1. Name of field technician
2. Unique identification of well
3. Weather and site conditions (e.g., clear, sunny, strong north wind, intense dust blowing over wellhead from nearby plowed field; dry ground, easy access)
4. Condition of well structure (e.g., well cap cracked – replaced with new one; wasp hive between well casing and well housing; no action, discuss with project manager)
5. Time and date of depth-to-water reading
6. Any other pertinent comments (e.g., sounder hangs up at 33 feet, thus no measurement; or: fifth measurement of ~55.68 feet in a row…residual water in end cap?; or: oil in well…measurement is depth to oil; or: intense sulfur odor upon opening well cap; or: nearby (west ~100 feet) irrigation well pumping)

CALIFORNIA STATEWIDE GROUNDWATER ELEVATION MONITORING
(CASGEM)

STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES

GROUND WATER LEVEL MEASUREMENTS

Monitoring Entity: Napa County
Monitoring Period:______________________________________
Measuring Agency Number: 3983
Measured By:____

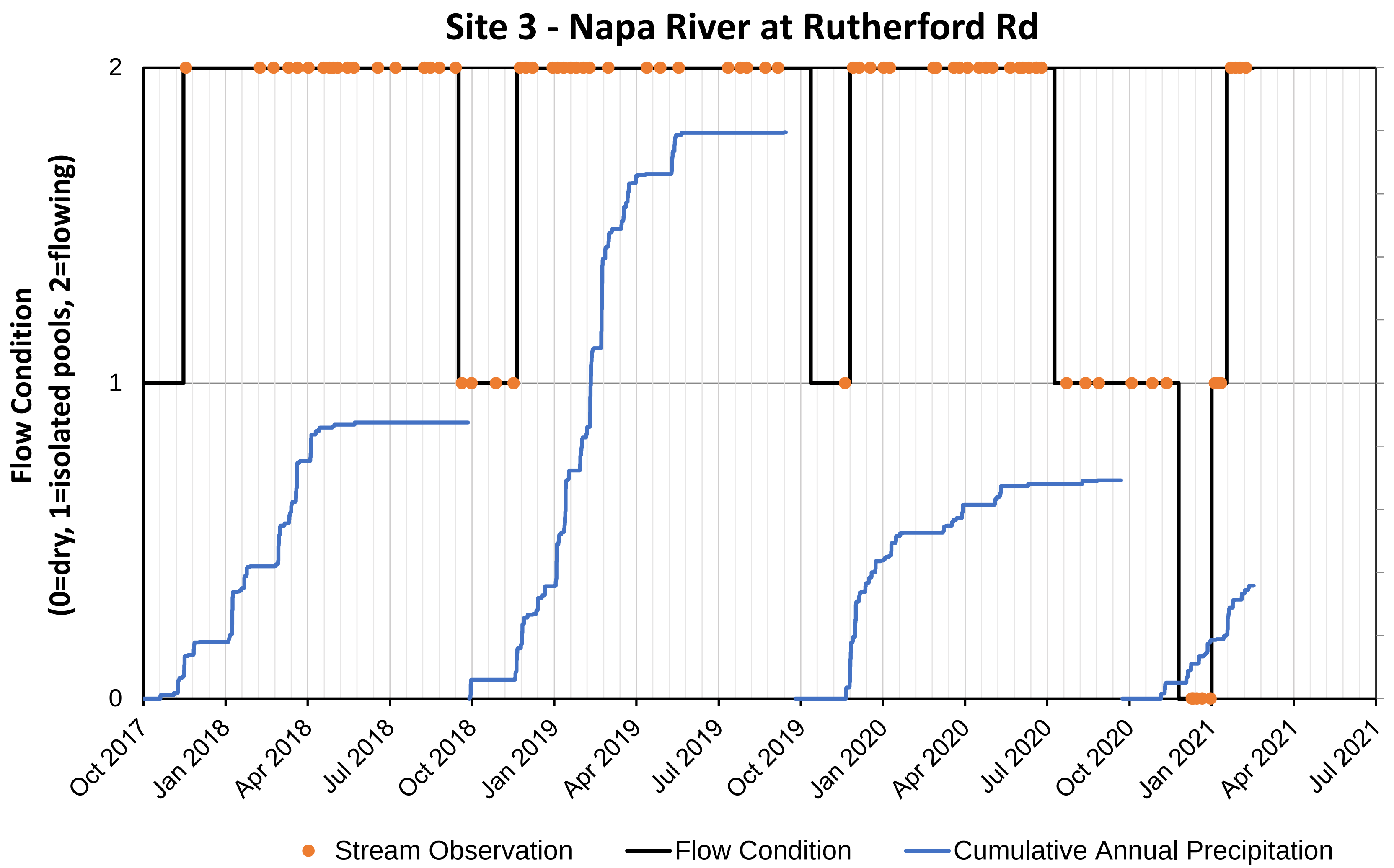
STATE WELL NUMBER	COUNTY WELL ID	MSRMNT DATE	R.P. ELEVATION (NAVD88 ft)	DIST. R.P. TO WATER	METHOD OF WATER DEPTH MSRMNT	MSRMNT QUALITY CODES[1]	MSRMNT TIME	COMMENTS

1 MEASUREMENT QUALITY CODES:

- If **no** measurement is taken, a specified "no measurement" code, must be recorded.
  0. Discontinued 1. Pumping 2. Pumphouse locked 3. Tape hung up 4. Can't get tape in casing 5. Unable to locate well 6. Well destroyed 7. Special 8. Casing leaking or wet 9. Temporarily inaccessible D. Dry well F. Flowing well
- If the quality of a measurement is **uncertain**, a "questionable measurement" code can be recorded.
  0. Caved or deepened 1. Pumping 2. Nearby pump operating 3. Casing leaking or wet 4. Pumped recently 5. Air or pressure gauge measurement 6. Other 7. Recharge operation at nearby well 8. Oil in casing 9. Acoustical sounder measurement

APPENDIX D

Stream Watch Monitoring Site Observations



Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Sulphur Creek at Pope St gage, Site ID: 40141.

Luhdorff & Scalmanini
Consulting Engineers

Stream Watch Site 3 - Napa River at Rutherford Road, with Cumulative Annual Precipitation

Napa County Groundwater Sustainability Agency
Annual Report - Water Year 2020

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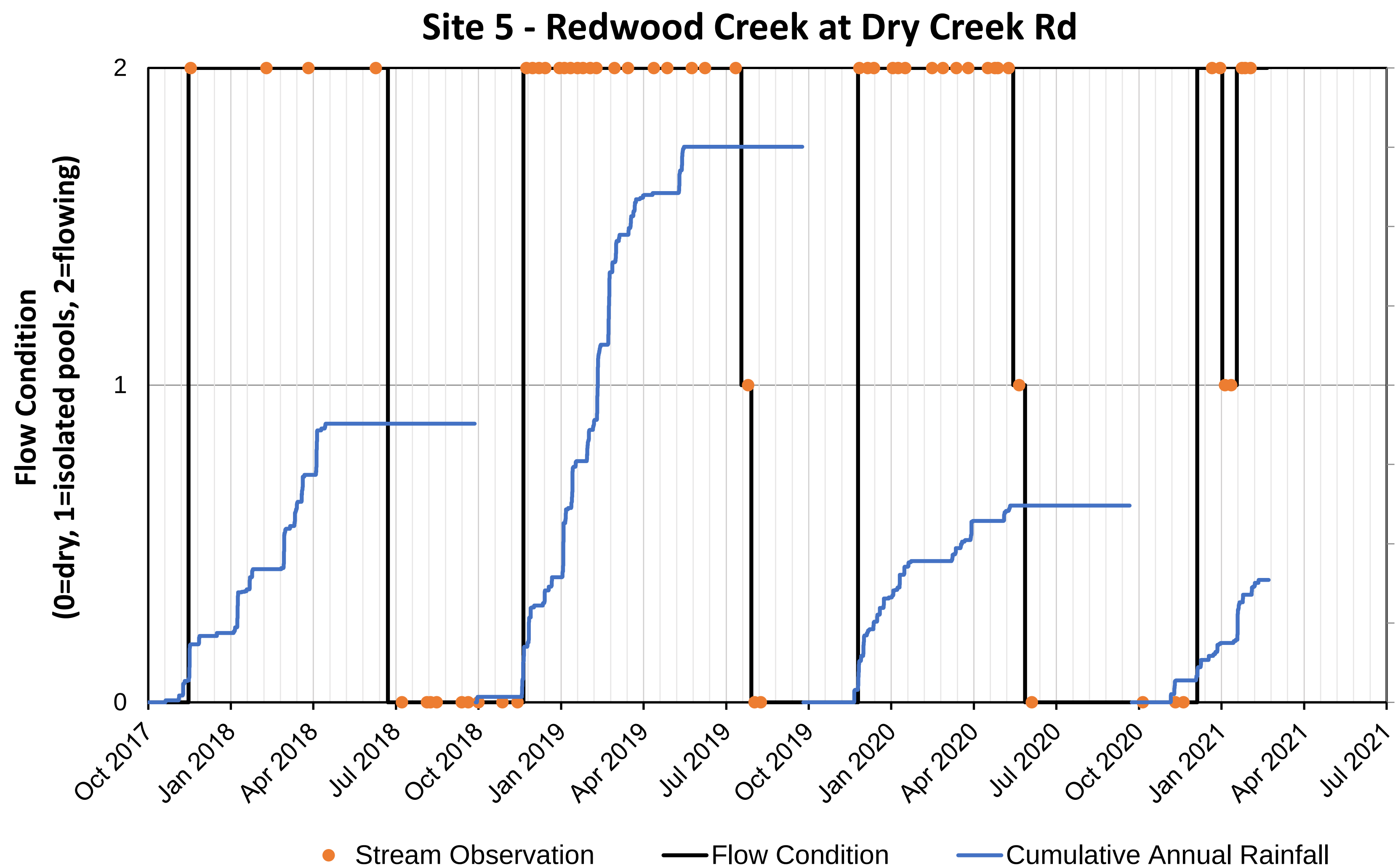

Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Napa River at Lincoln Ave (Napa) gage, Site ID: 40103.

Luhdorff & Scalmanini Consulting Engineers

Stream Watch Site 5 - Redwood Creek at Dry Creek Rd, with Cumulative Annual Precipitation

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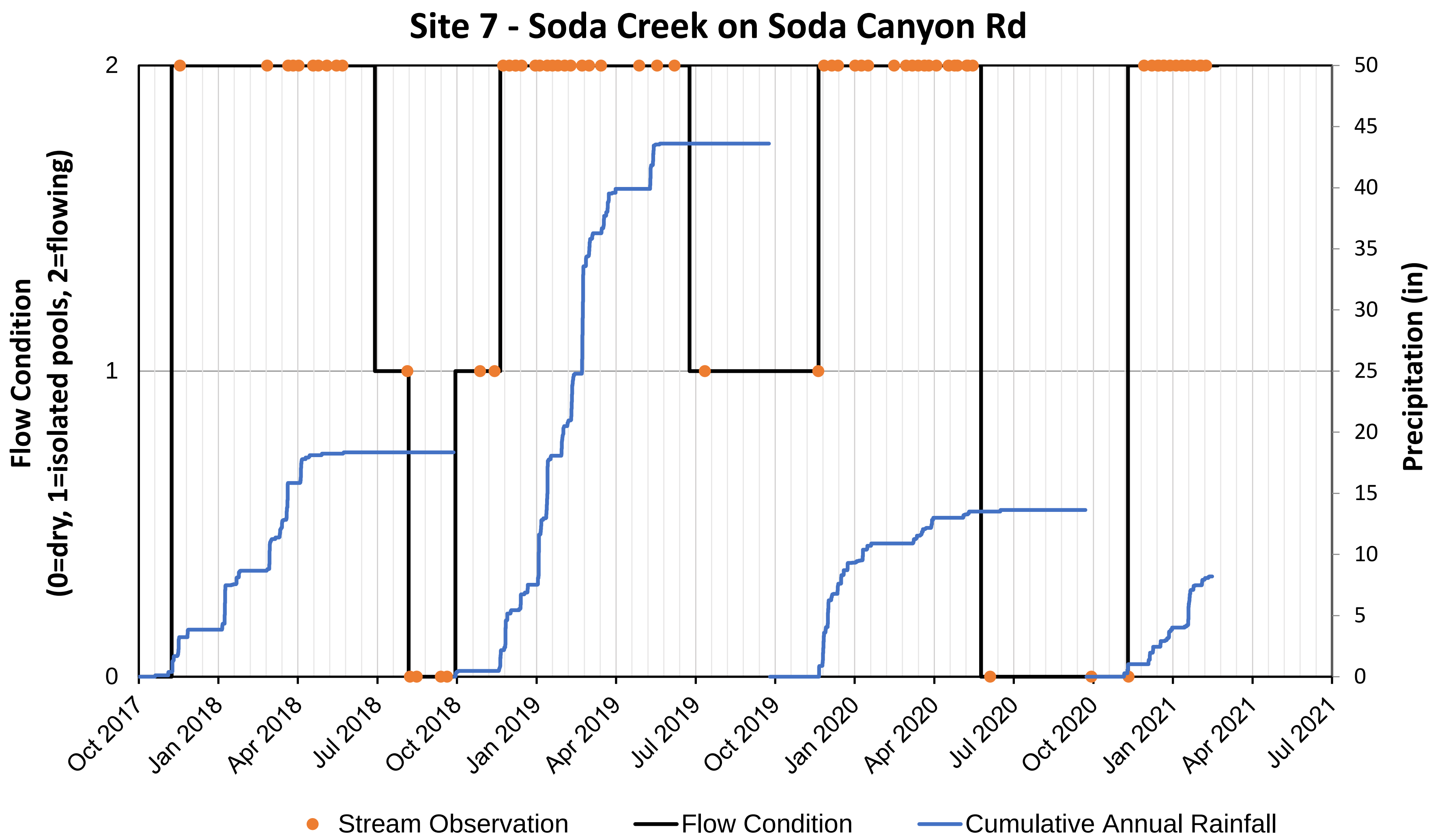

Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Napa River at Yountville Cross Rd gage, Site ID: 12.

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Stream Watch Site 7 - Soda Creek on Soda Canyon Road, with Cumulative Annual Precipitation

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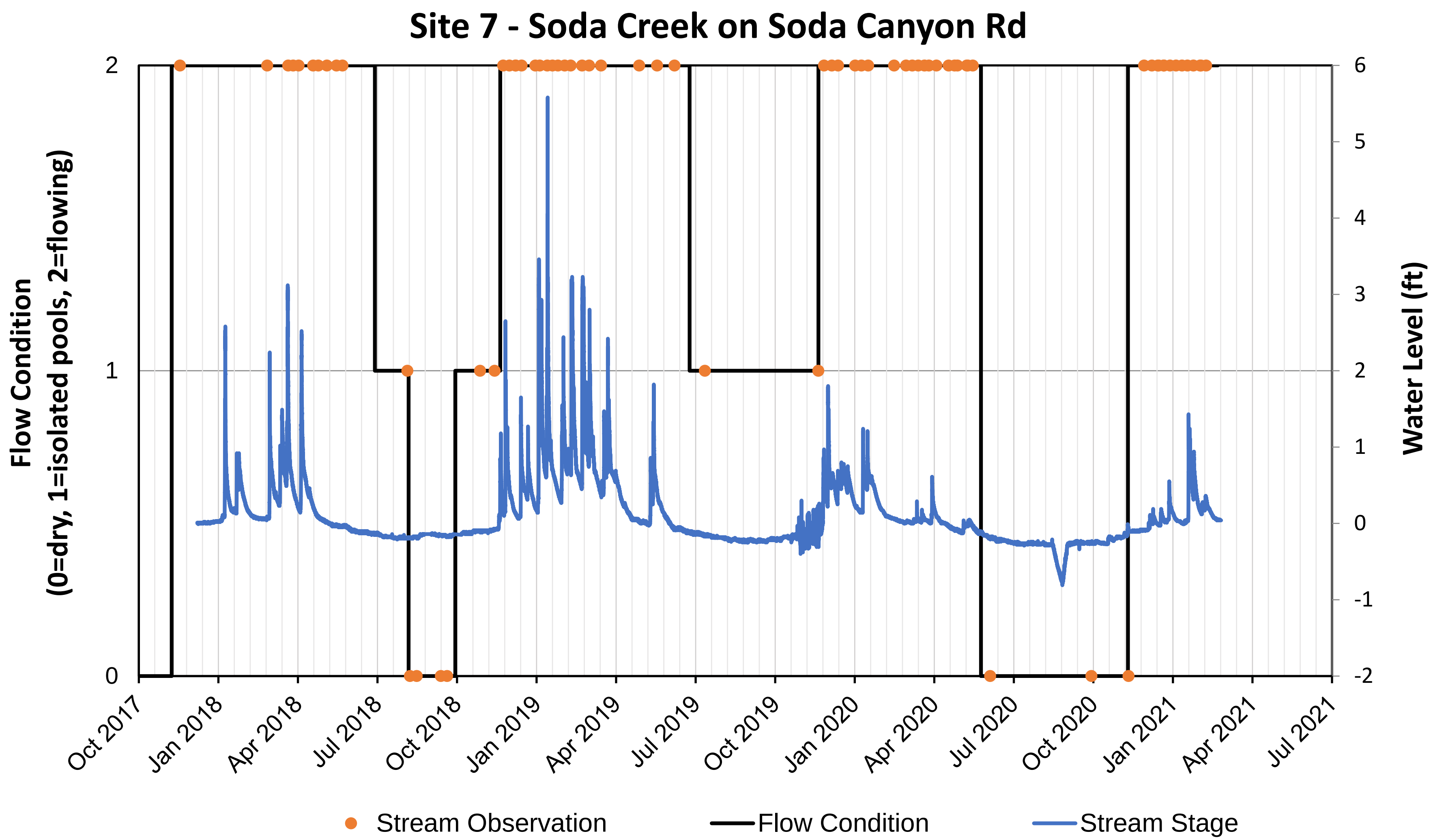
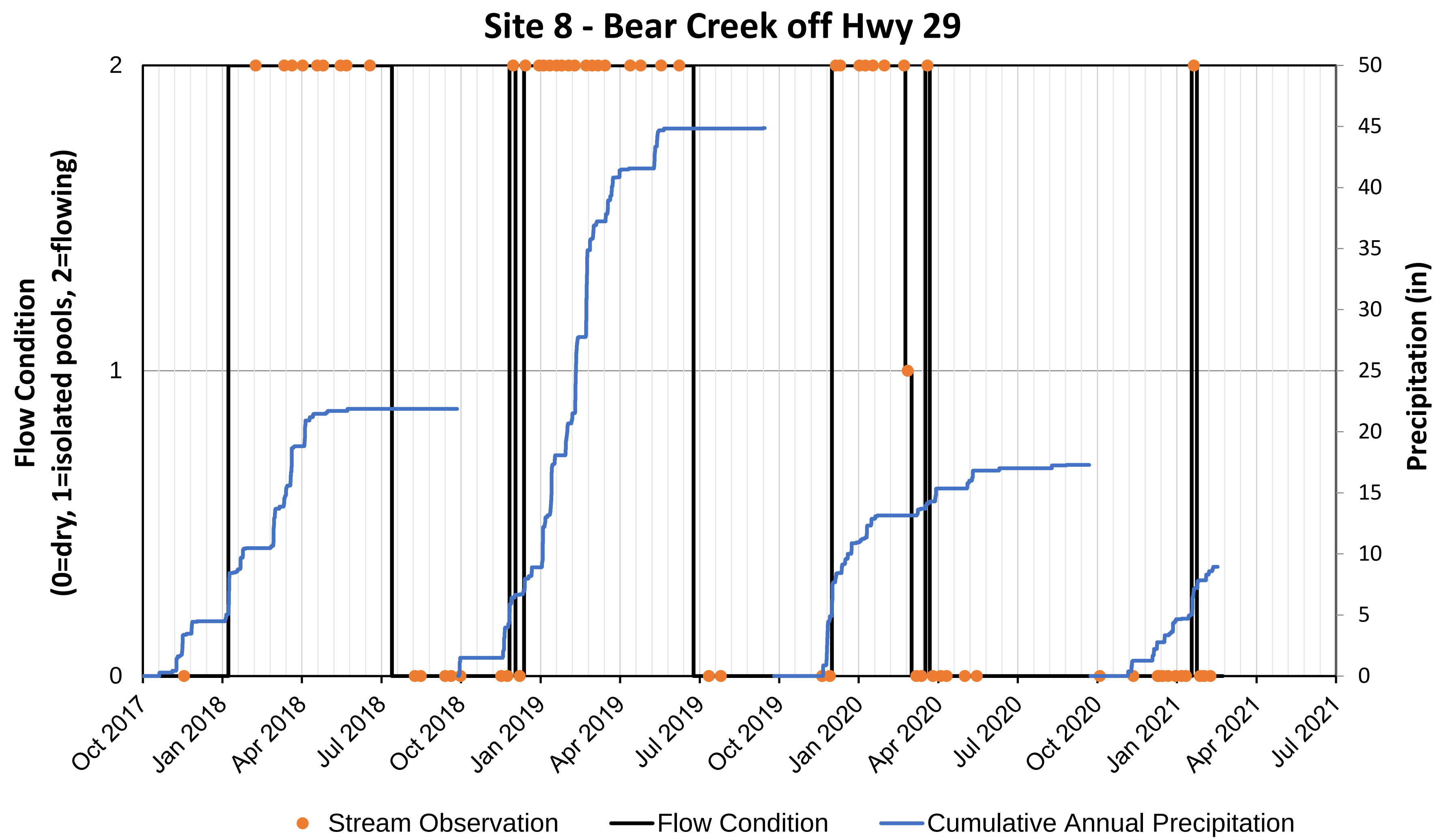


Note: Chart provided by Napa County Resource Conservation District. Stage data from Napa County Flood District Flood Alert Napa River at Yountville Cross Rd gage, Site ID: 12.



Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Sulphur Creek at Pope St gage, Site ID: 40141.

Luhdorff & Scalmanini Consulting Engineers

Stream Watch Site 8 - Bear Creek off Highway 29, with Cumulative Annual Precipitation

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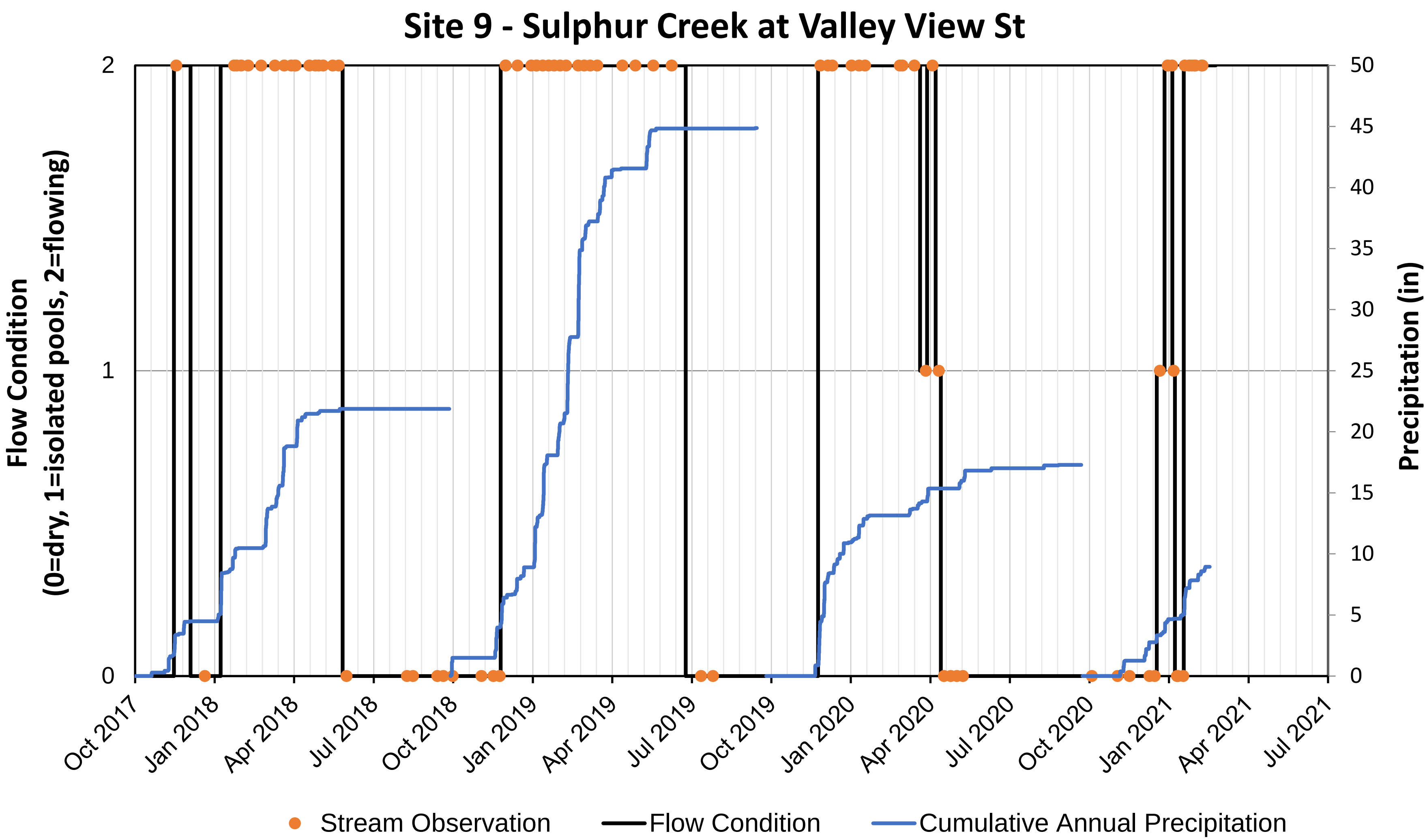

Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Sulphur Creek at Pope St gage, Site ID: 40141.

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Stream Watch Site 9 - Sulphur Creek at Valley View Street, with Cumulative Annual Precipitation

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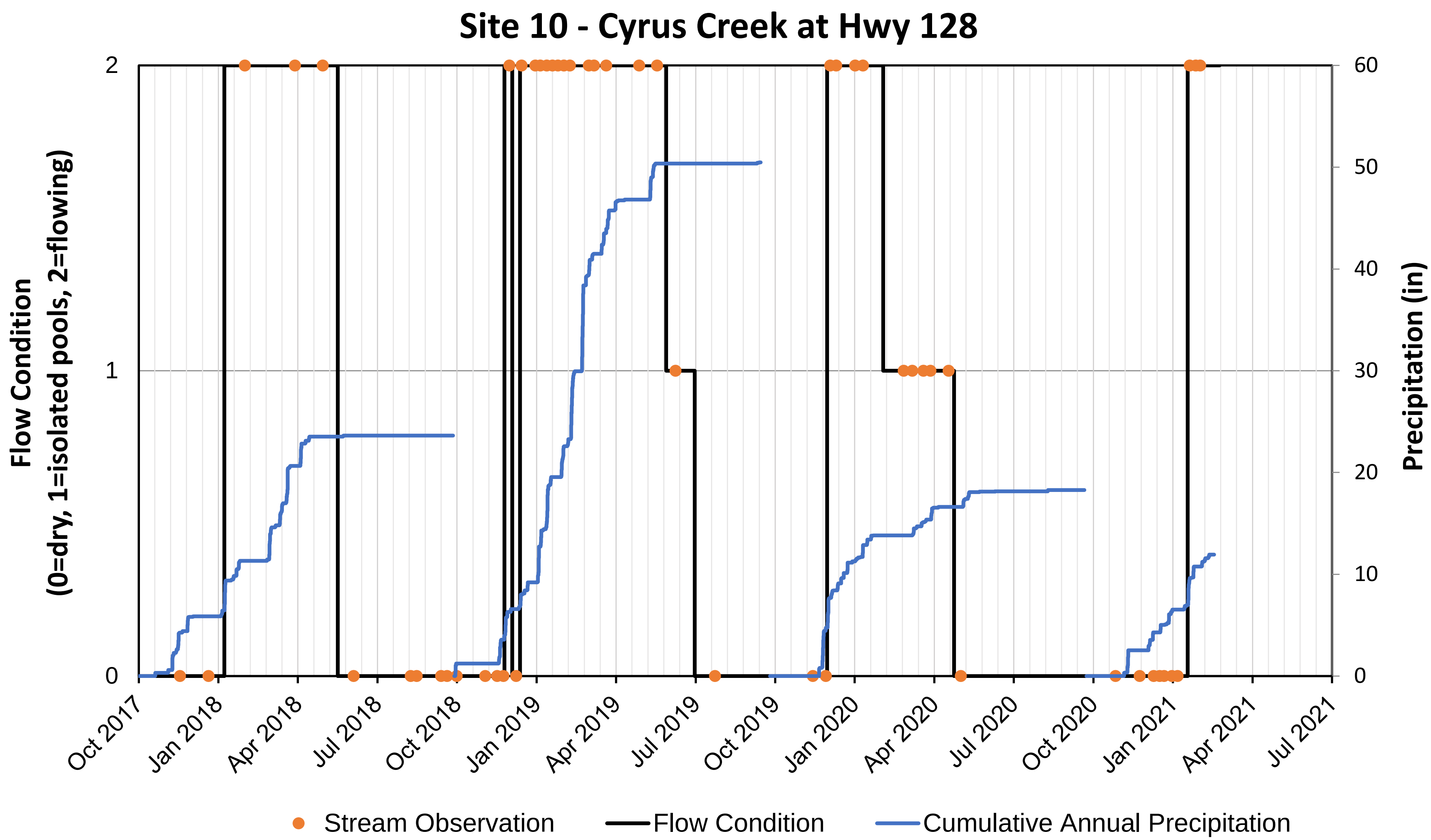

Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Napa River at Dunaweal Ln gage, Site ID: 40142.

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Stream Watch Site 10 - Cyrus Creek at Highway 128, with Cumulative Annual Precipitation

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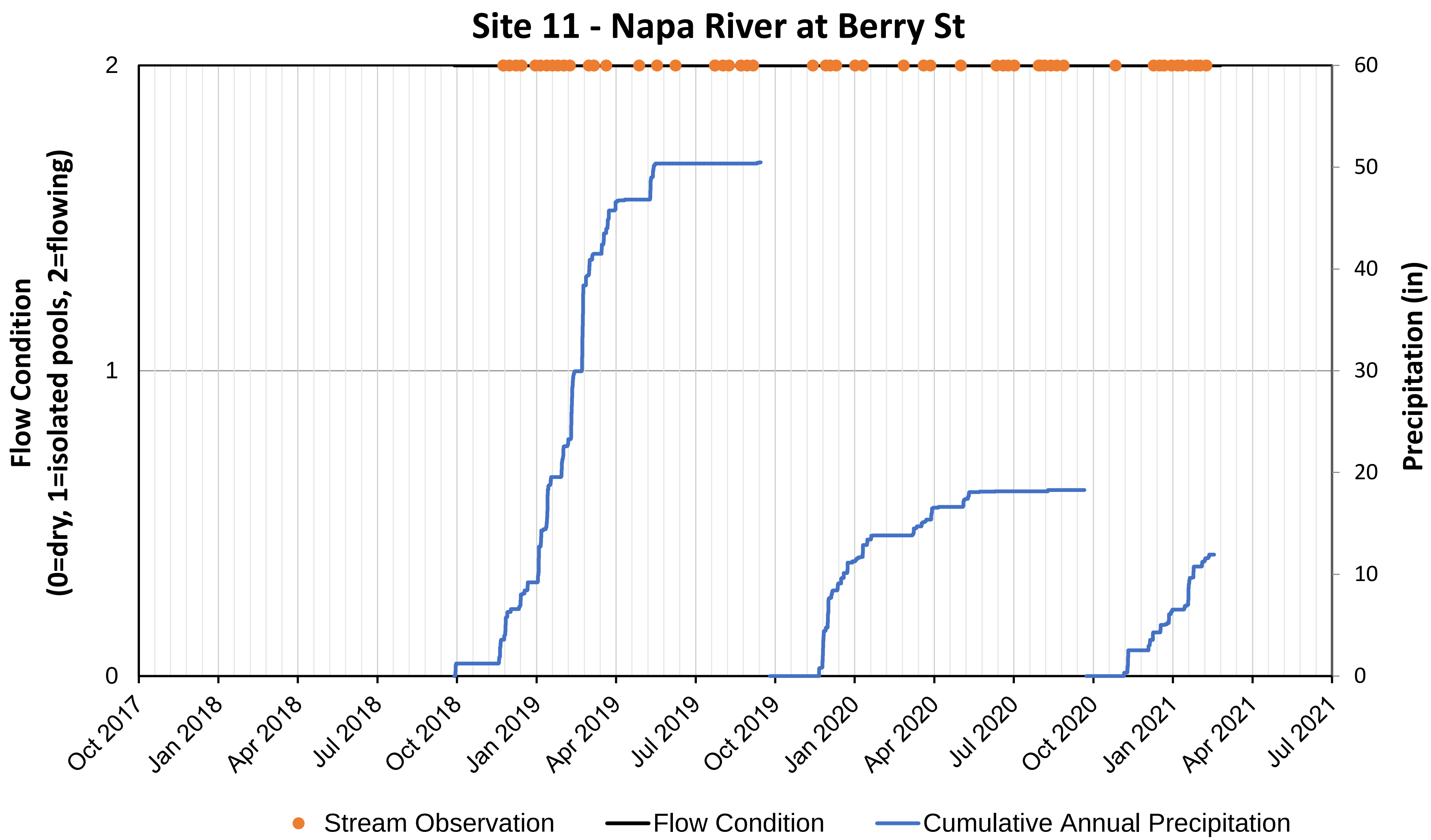

Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Napa River at Dunaweal Ln gage, Site ID: 40142.

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Stream Watch Site 11 - Napa River at Berry Street, with Cumulative Annual Precipitation

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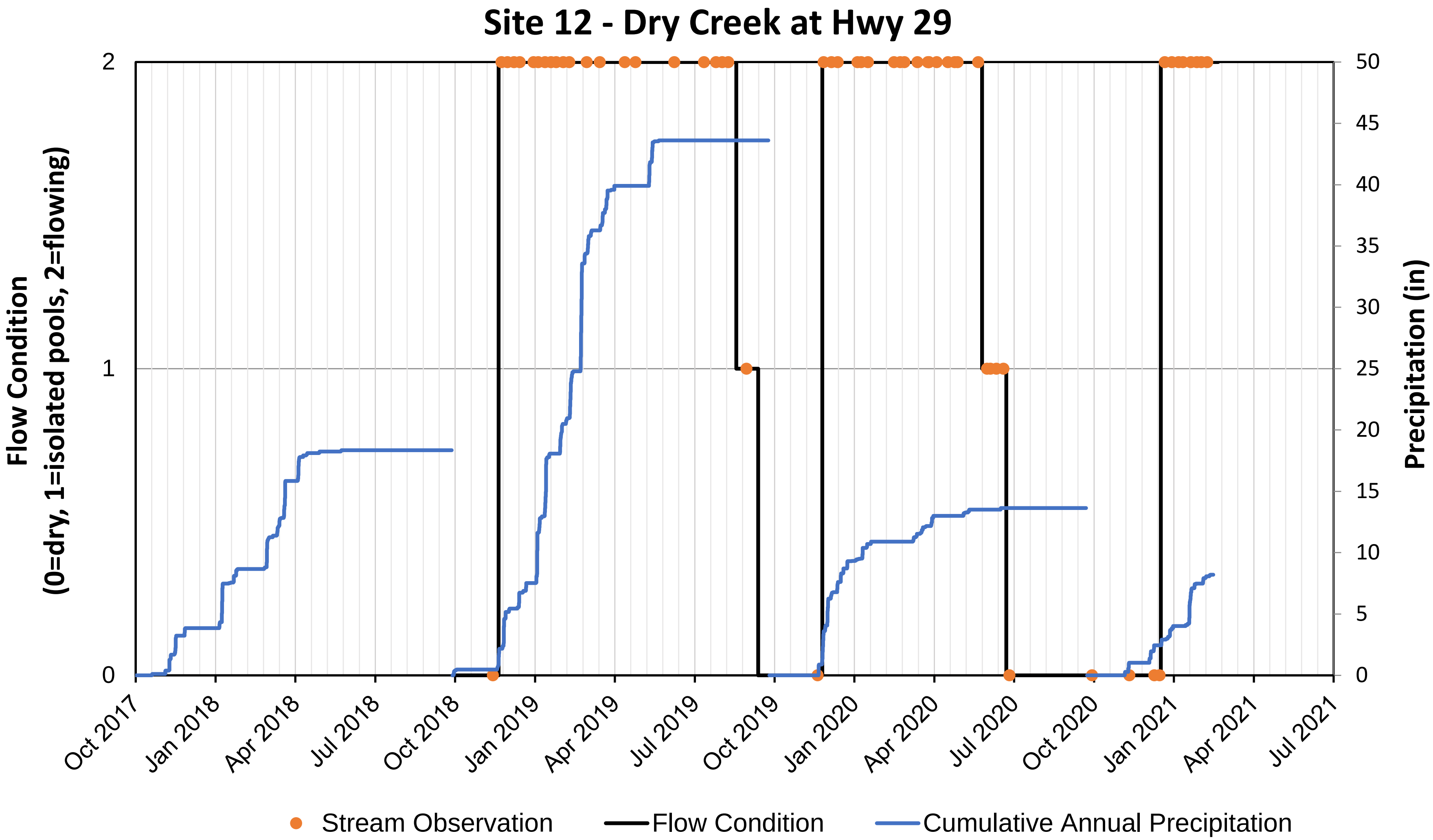
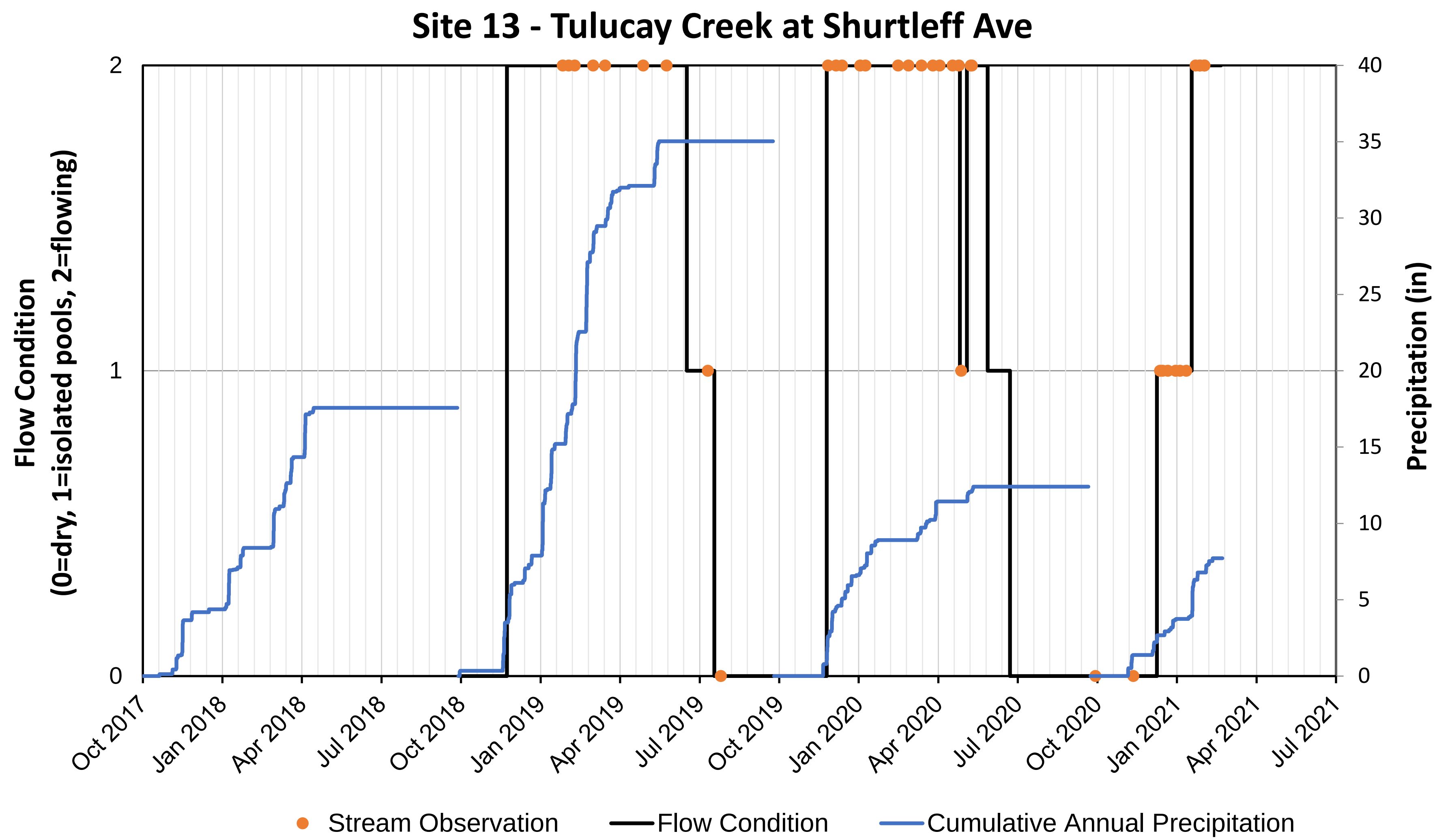


Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Napa River at Yountville Cross Rd gage, Site ID: 12.



Note: Chart provided by Napa County Resource Conservation District. Precipitation data from Napa County Flood District Flood Alert Napa River at Lincoln Ave (Napa) gage, Site ID: 40103.

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Stream Watch Site 13 - Tulucay Creek at Shurtleff Avenue, with Cumulative Annual Precipitation

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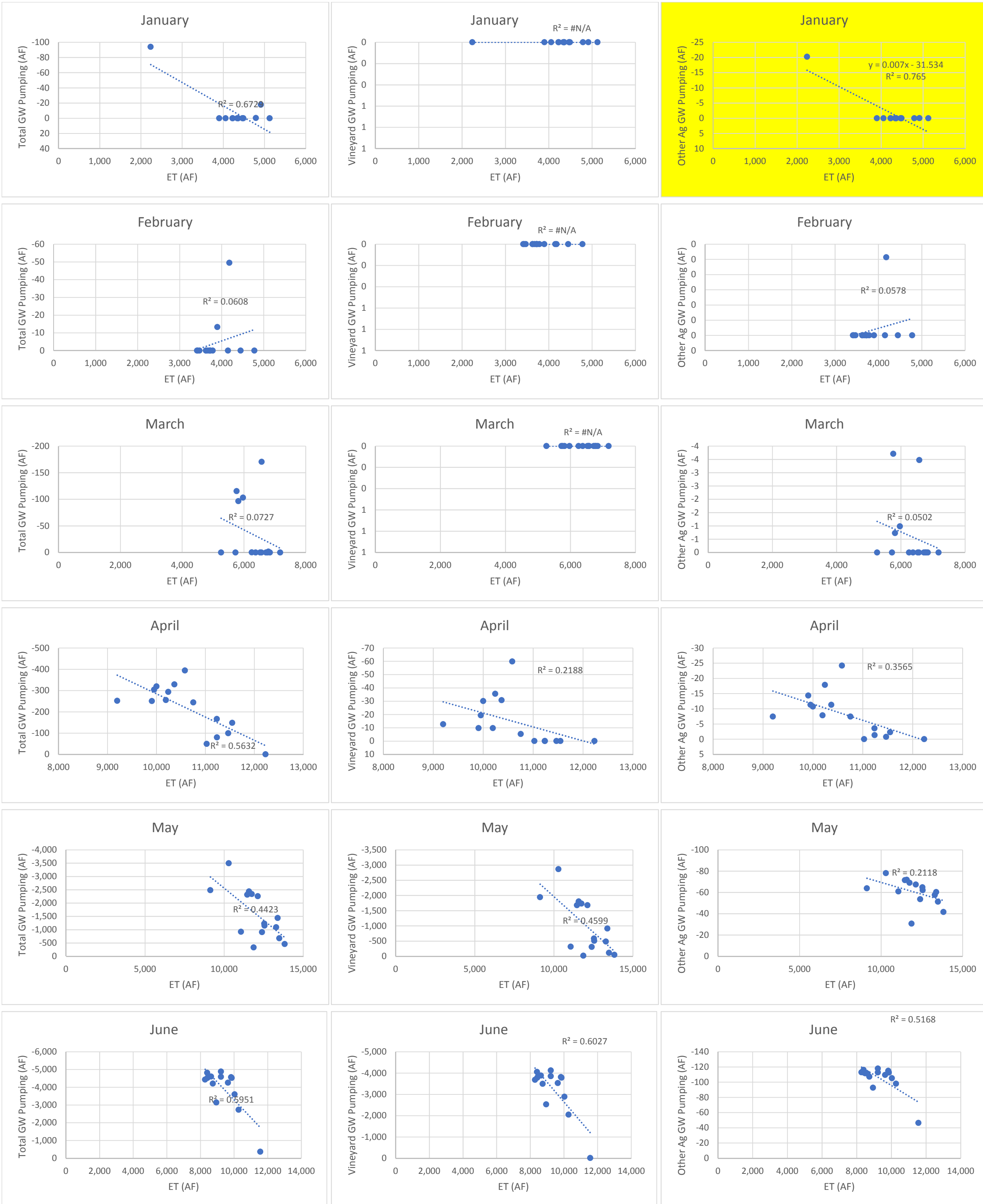
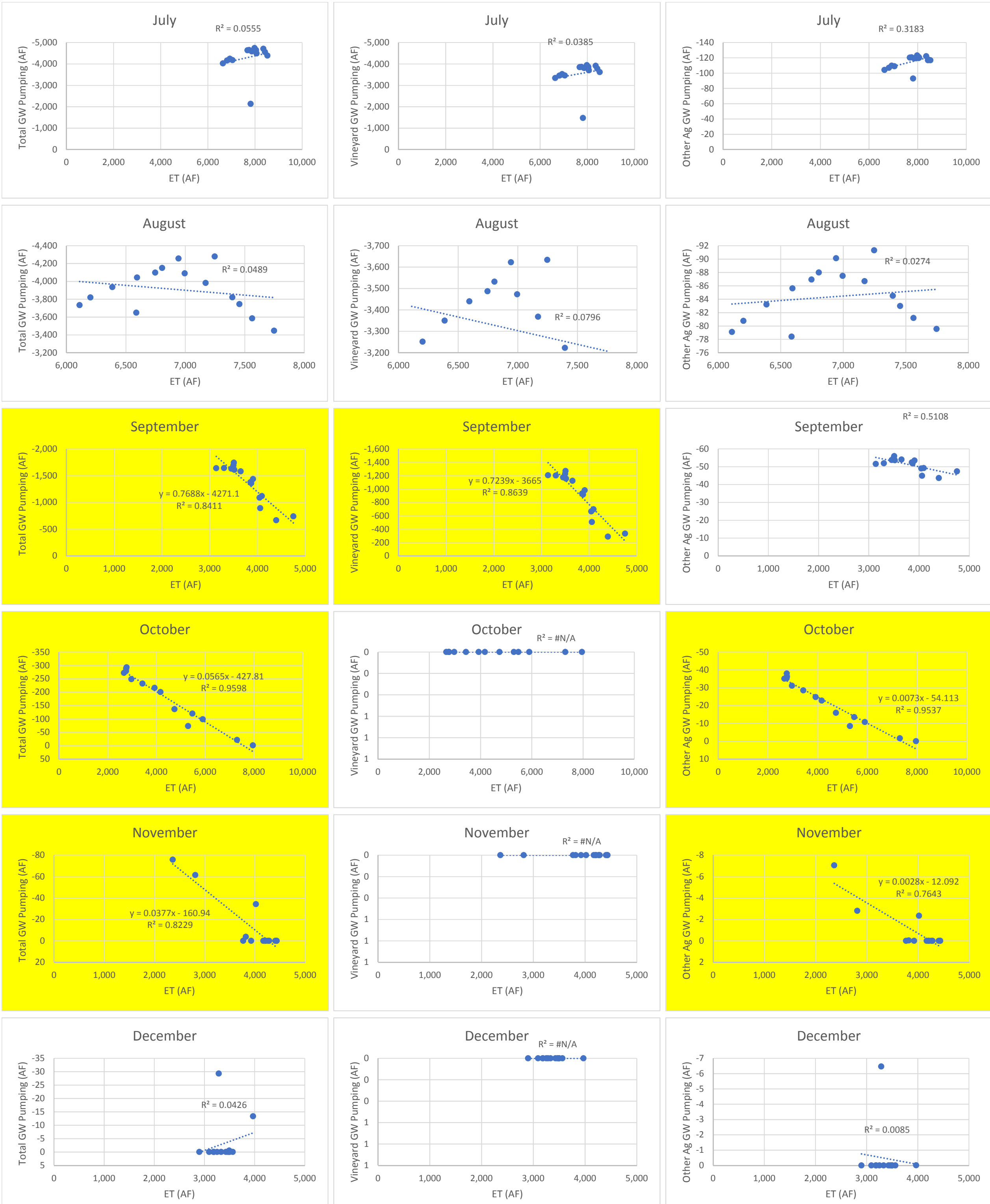
APPENDIX E

Linear Correlation Plots

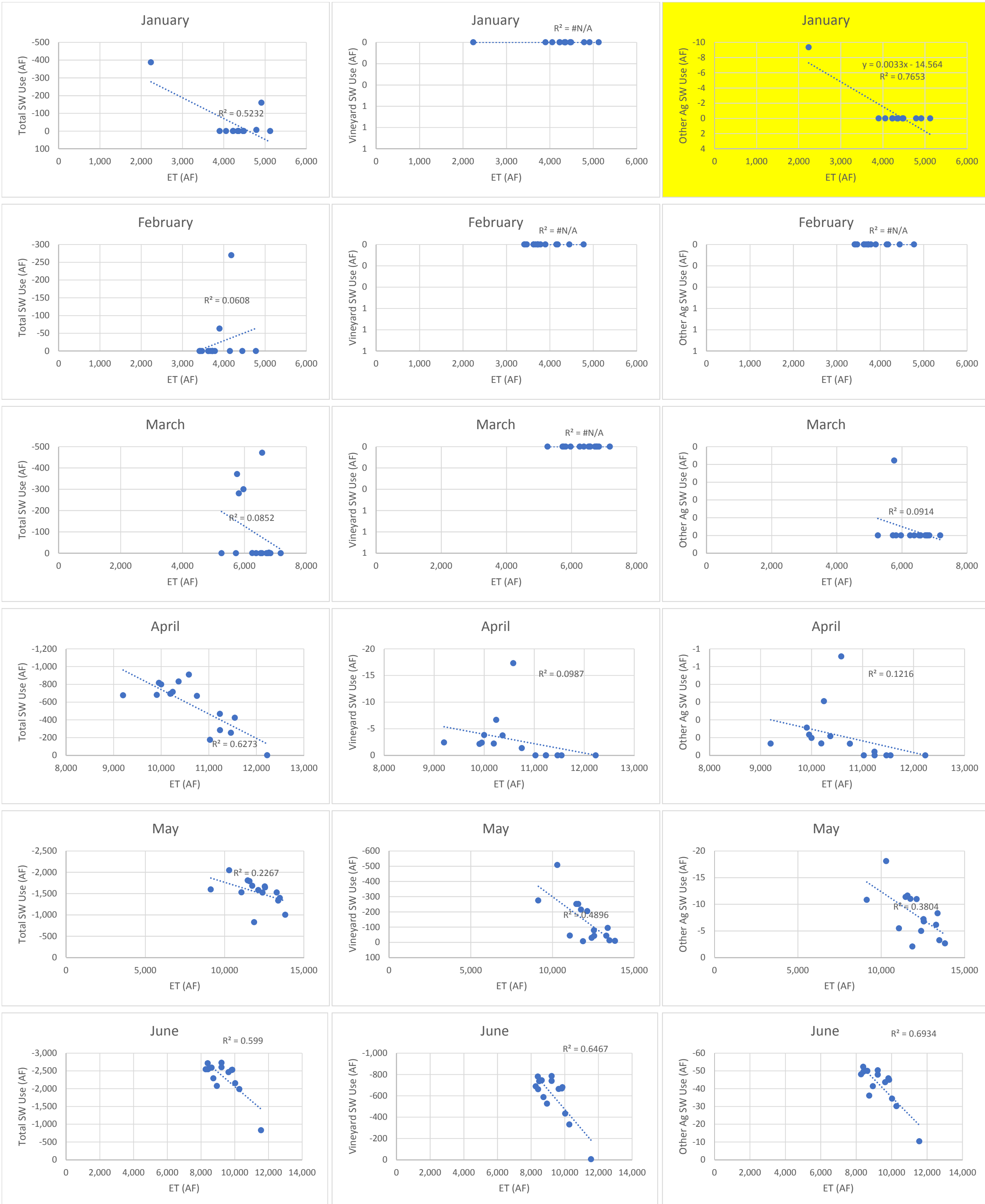
Monthly Groundwater Components vs Evapotranspiration (Jan - June)



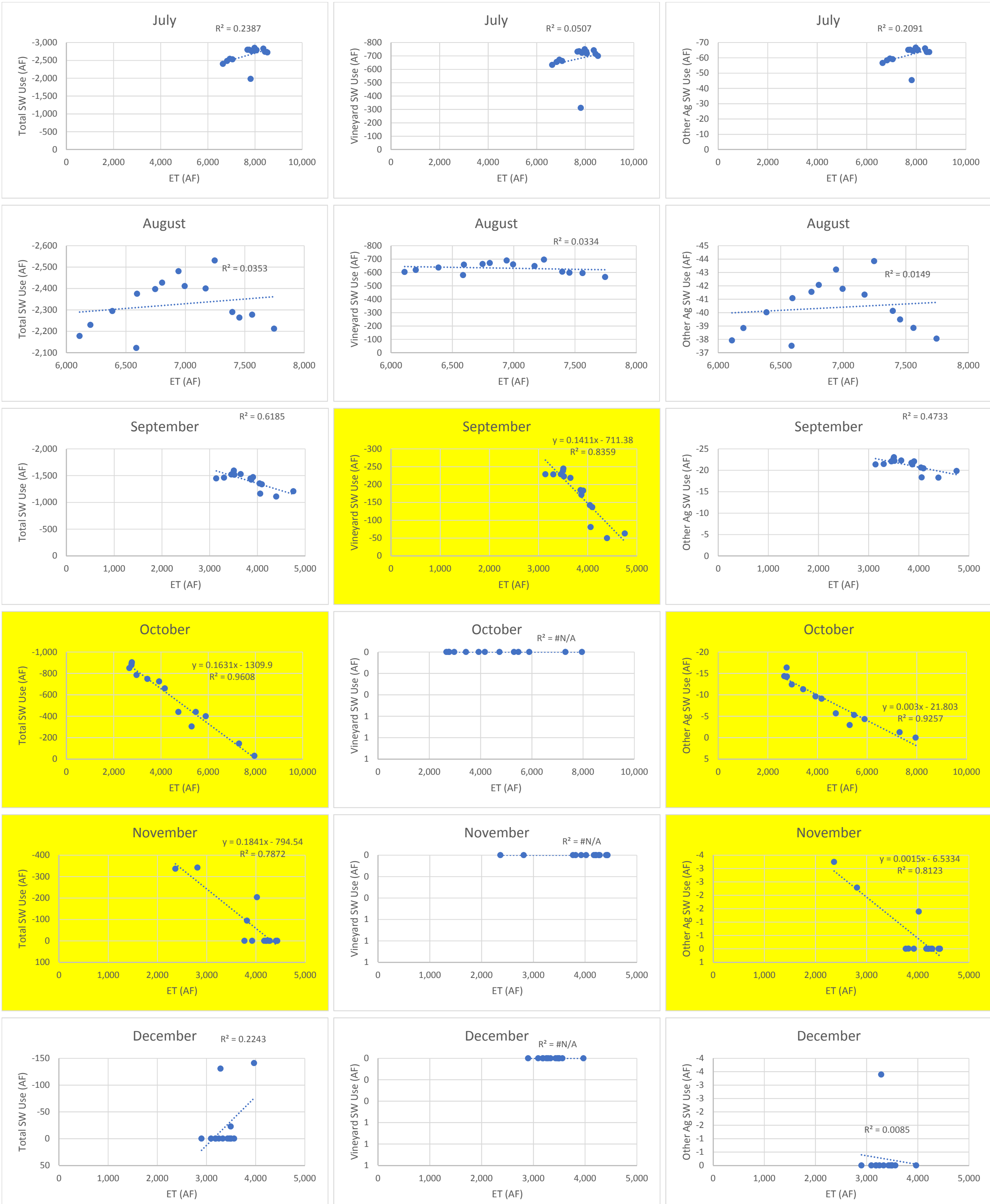
Monthly Groundwater Components vs Evapotranspiration (July - Dec)



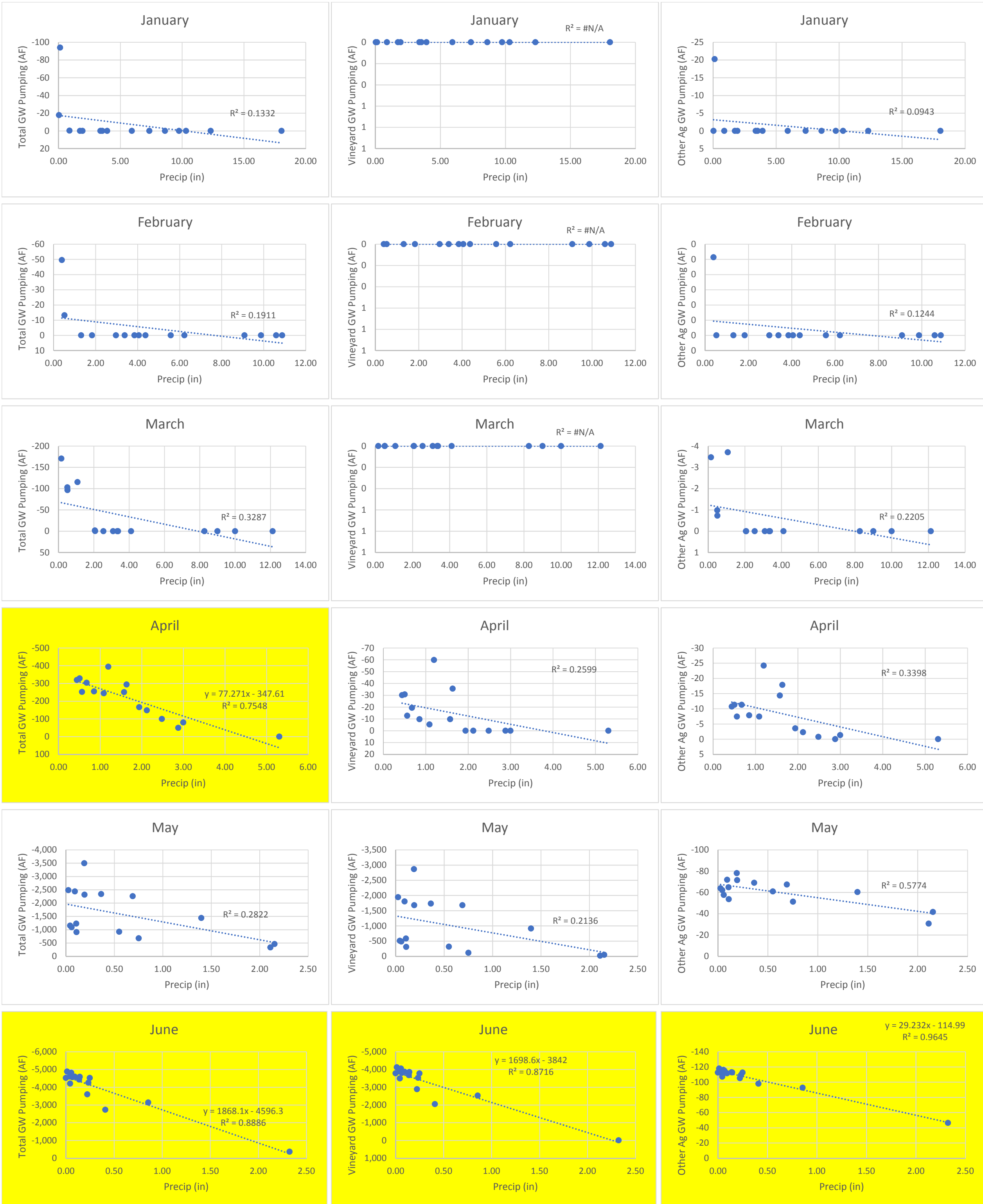
Monthly Surface Water Components vs Evapotranspiration (Jan - June)



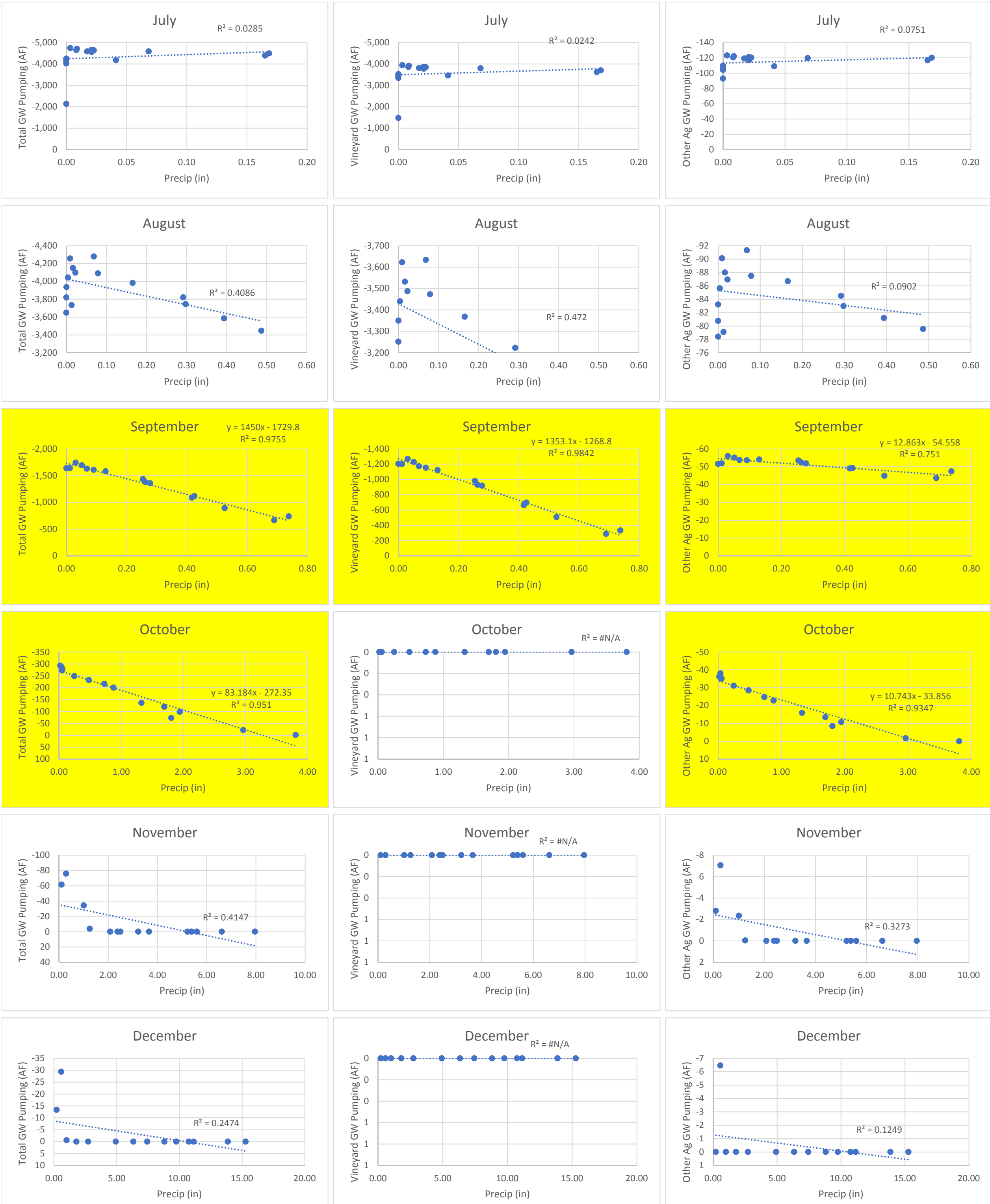
Monthly Surface Water Components vs Evapotranspiration (July - Dec)



Monthly Groundwater Components vs Precipitation (Jan - June)



Monthly Groundwater Components vs Precipitation (July - Dec)



Monthly Surface Water Components vs Precipitation (Jan - June)

Monthly Surface Water Components vs Precipitation (July - Dec)