Napa County Groundwater Sustainability Agency

Technical Advisory Group

Annual Report

Water Year 2022

March 9, 2023

Luhdorff & Scalmanini
Consulting Engineers

Outline

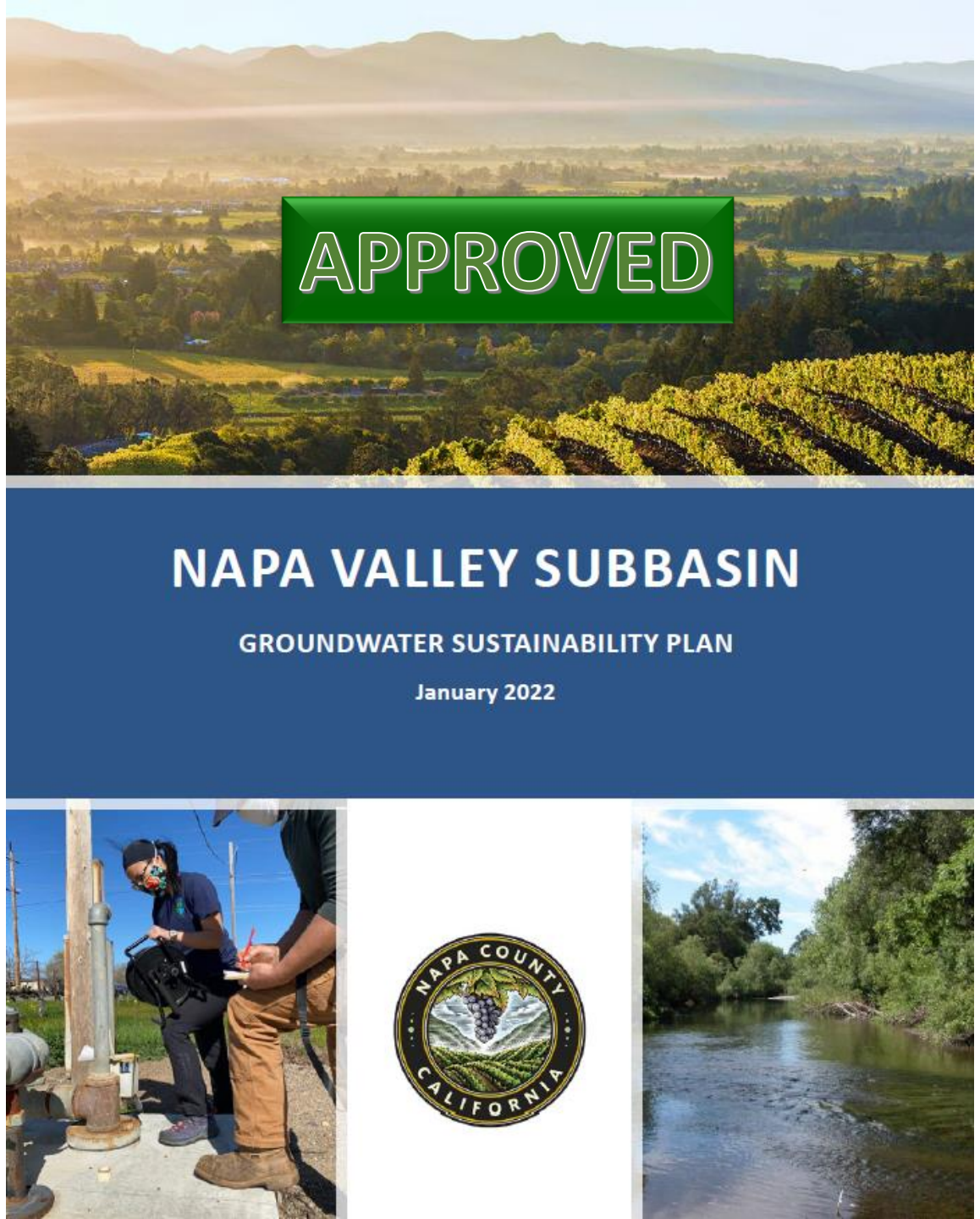
- Napa County and Climate Change
- Napa County & Subbasin Monitoring
- Napa Valley Subbasin Water Budget
- Sustainability Indicators & Metrics
- GSP Implementation & Response Actions

DWR Approves GSP

DWR Letter of Approval: Jan. 26, 2023

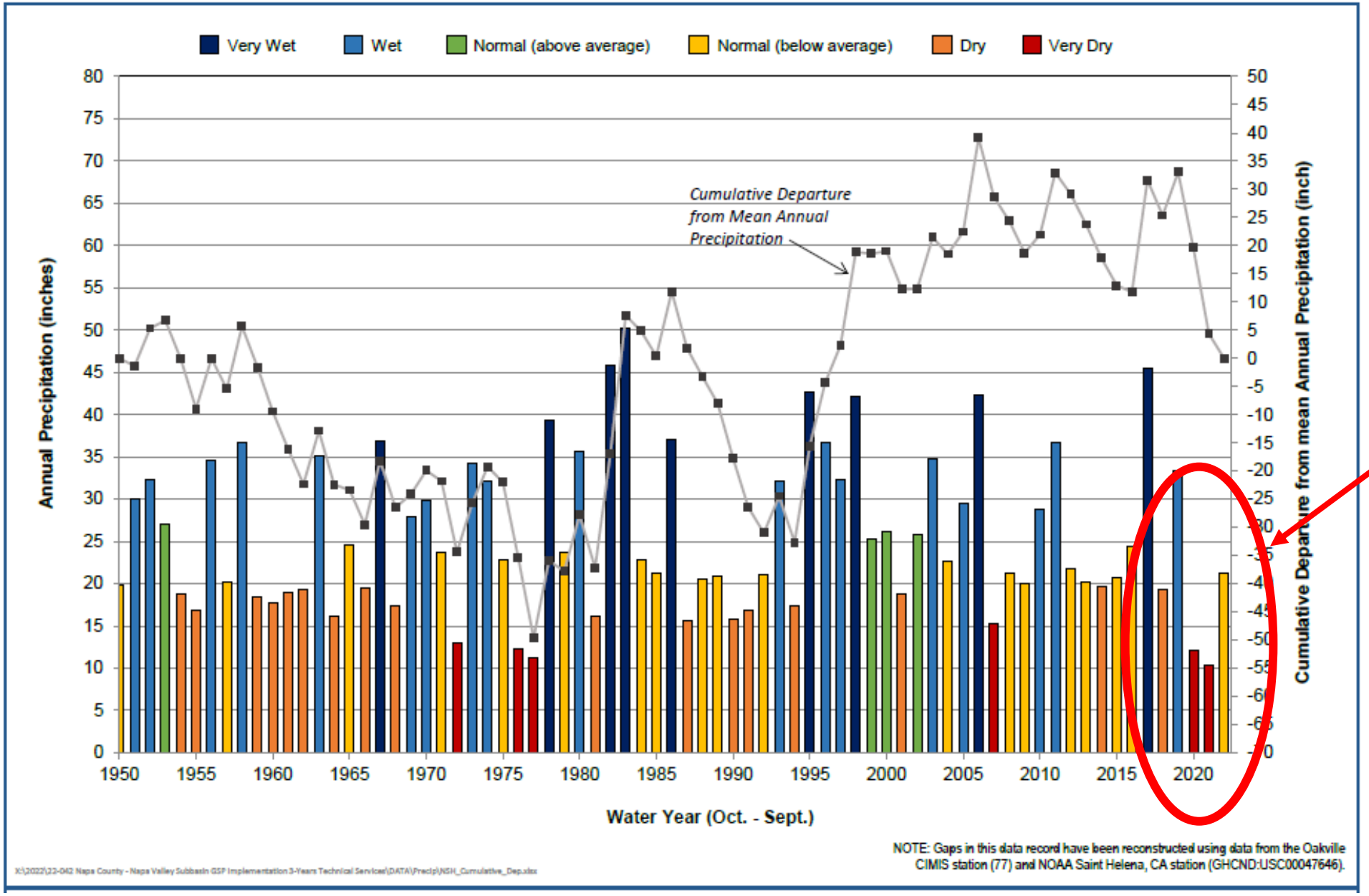
Recommended Corrective Actions for 5-Year Update (2027)

- Revise definition for chronic groundwater level decline sustainable management criterion to remove drought year condition or discuss management of extractions and recharge to offset decreases that occurred during drought
- Less rigorous MT for annual land subsidence, i.e., define a cumulative metric for the subsidence MT of 0.5 ft within a 5-year period; this also avoids incremental effects of land subsidence
- Consider DWR guidance intended to assist GSAs to sustainably manage depletions of interconnected surface water *when the guidance is developed*



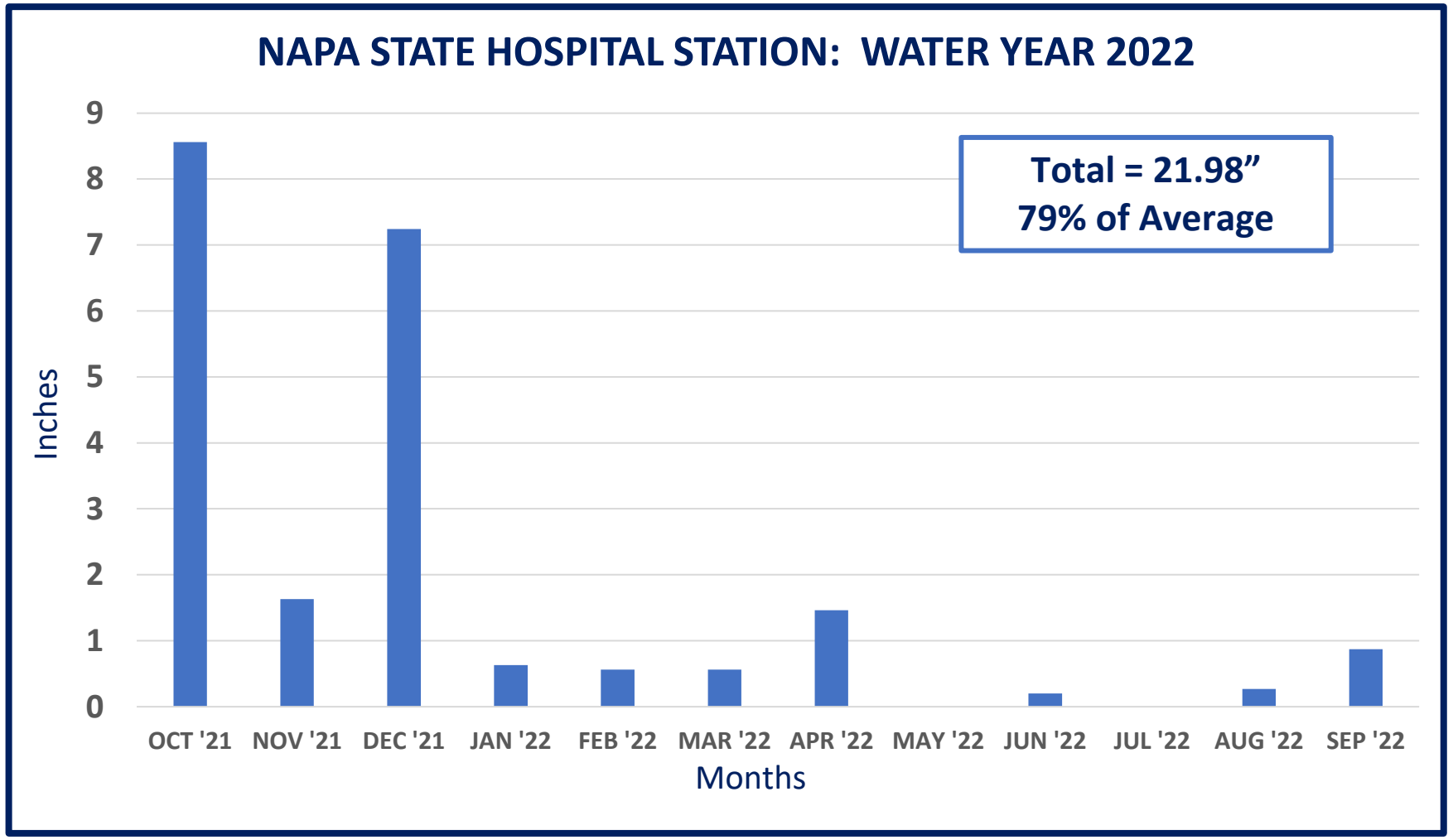
Napa County and Climate Change

Historical Precipitation at Napa State Hospital

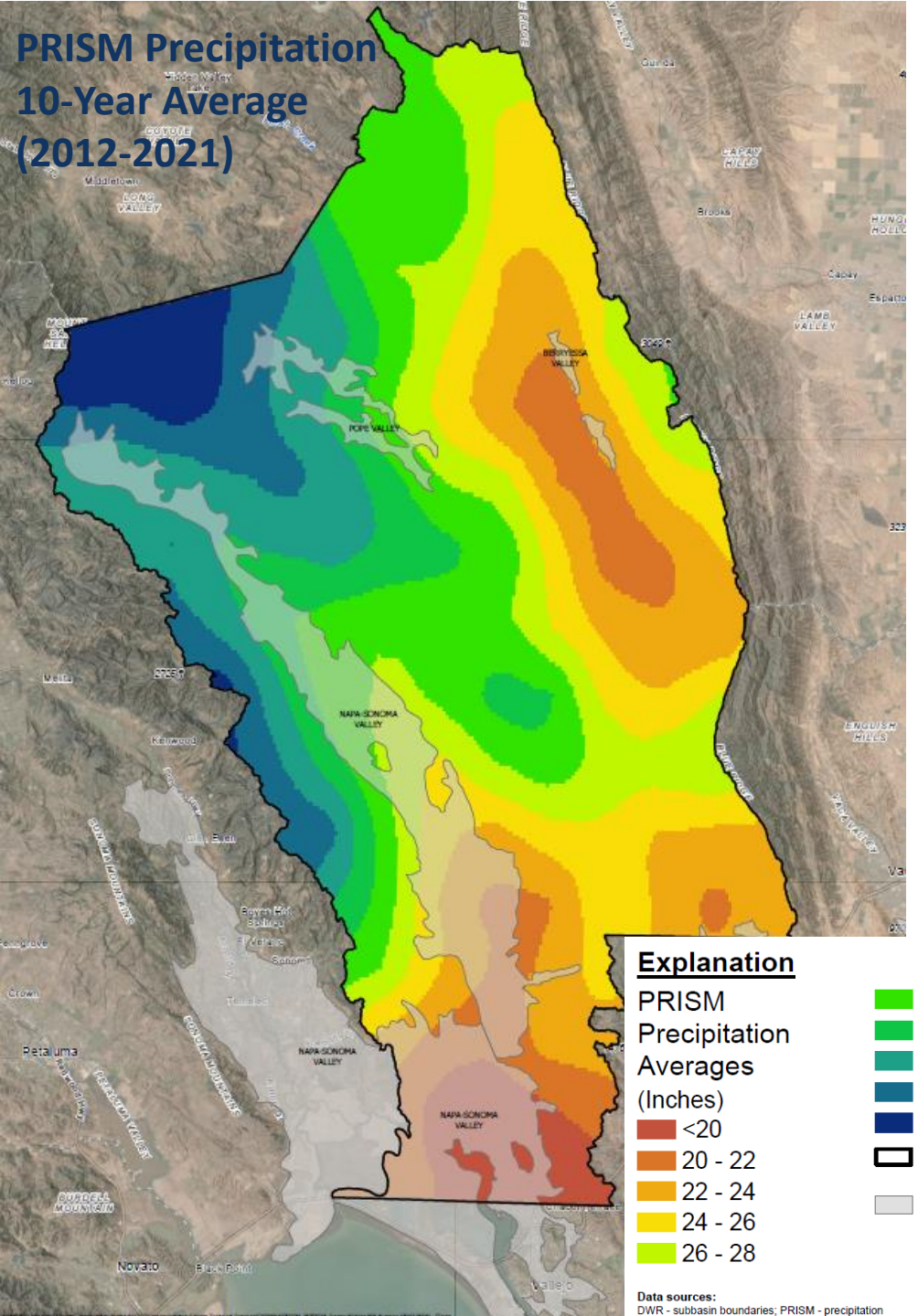


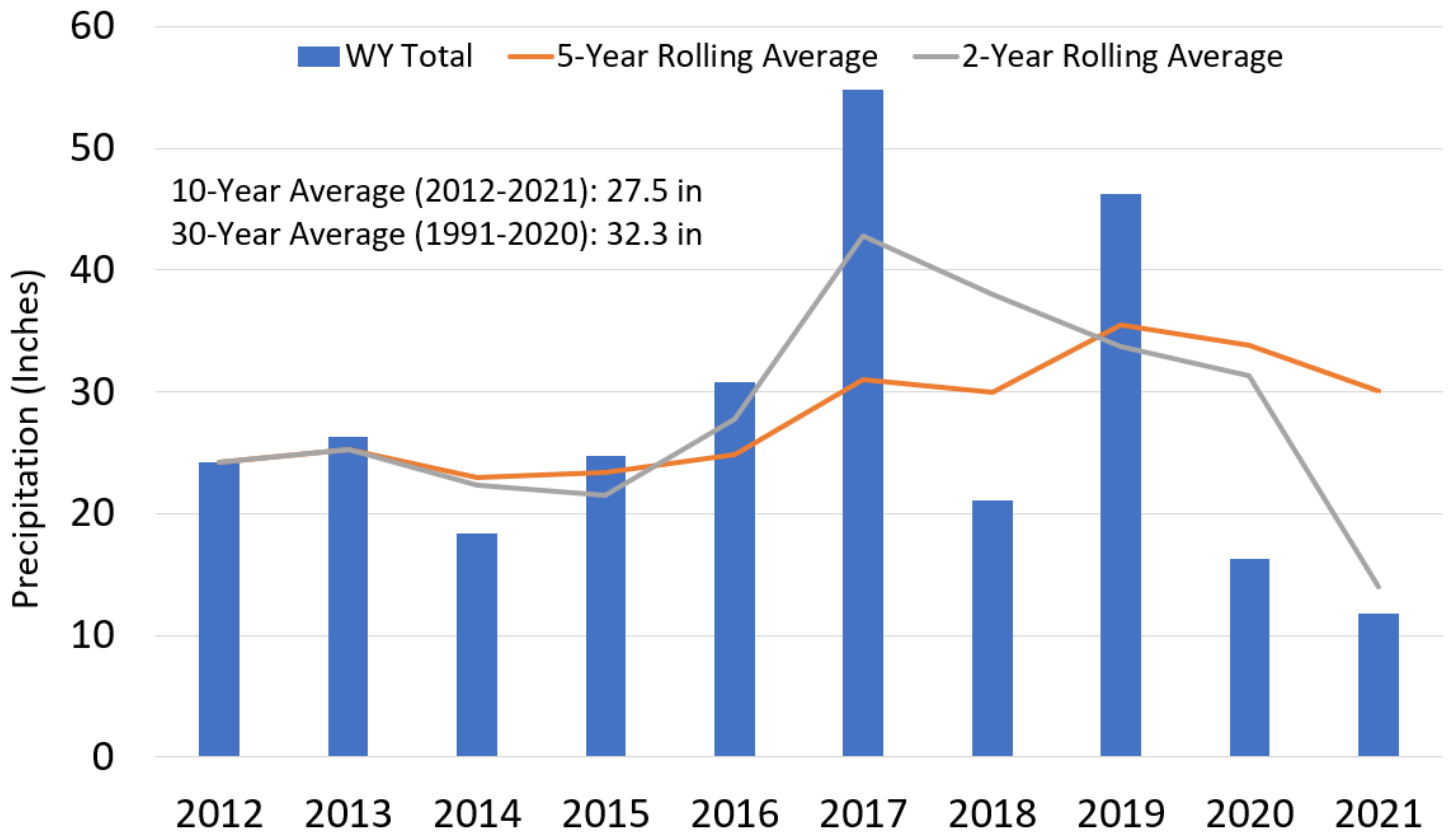
WYs 2020 & 2021 Very Dry;
WY 2022 Normal (below average)

Precipitation: Water Year 2022



Precipitation Changing: Drier 10-Year Average

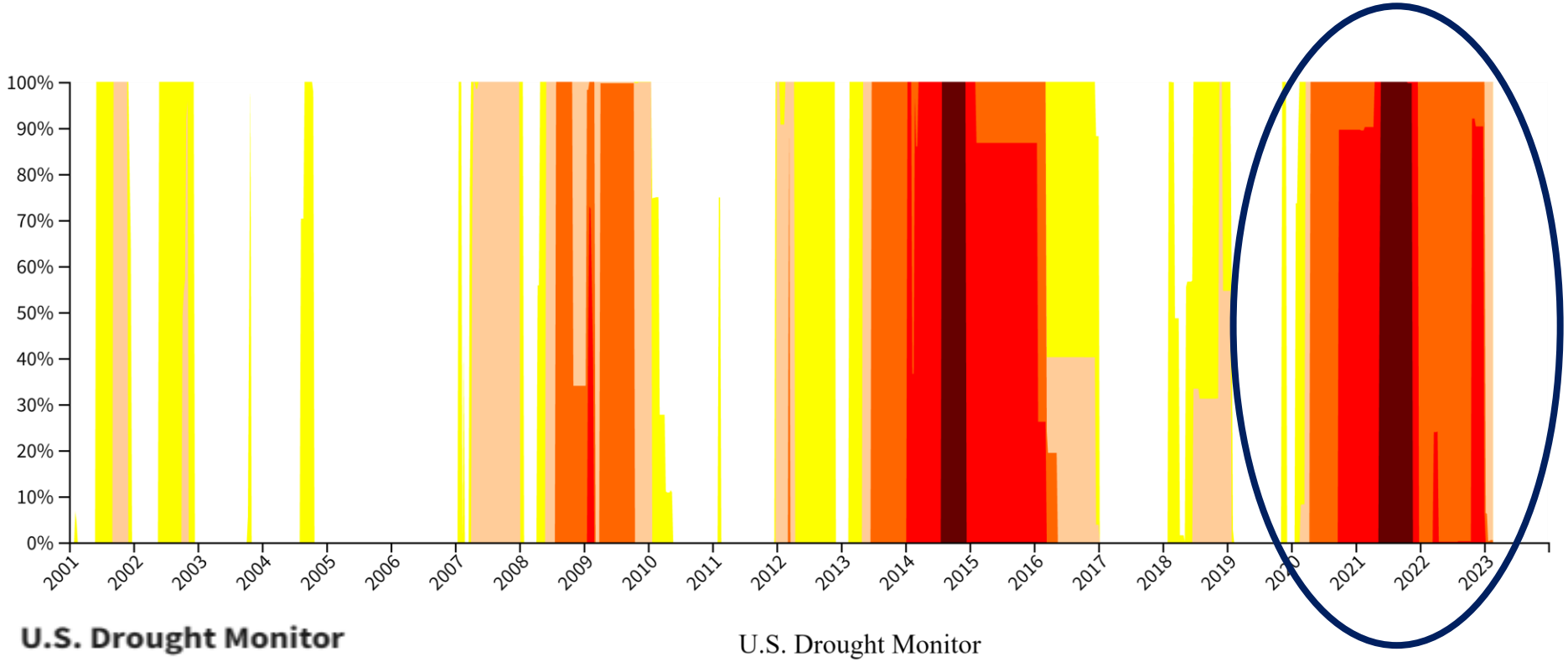




Eastern Napa County February 25, 2023

- 9 inches of snow
- 13th Wettest January on record over the past 129 years (7 inches above normal)
- 13th Wettest year to date over the past 129 years (January 2023)

U.S. Drought Monitor: Napa County



U.S. Drought Monitor
Napa County, CA

U.S. Drought Monitor

- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought

- Increasingly hotter/drier conditions
- Extreme variability
- WYs 2020, 2021, 2022: Severe to Exceptional Drought
- WY 2023: Moderate Drought(?)

Data as of: 2/21/2023

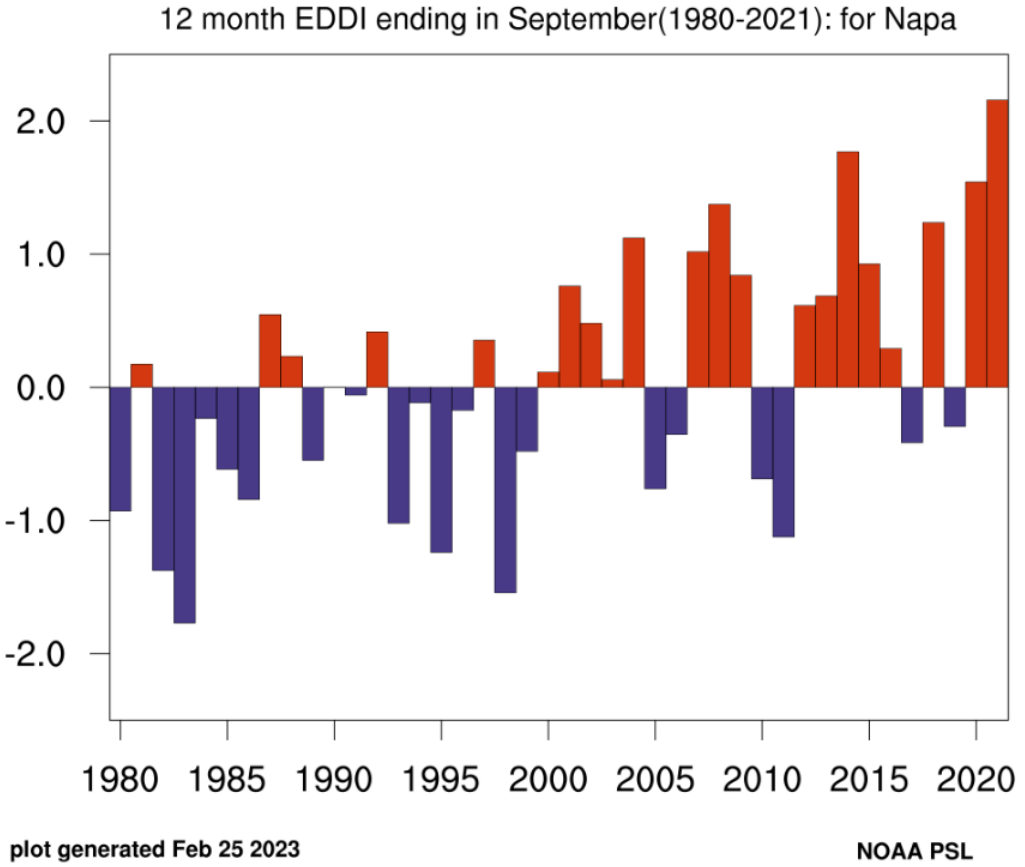
Source(s): USDA NASS

Napa: Evaporative Drought Demand Index

"the thirst of the atmosphere"

"California has experienced its two most severe dry periods on record since 2000 (2012–16 and 2020–present) and researchers now report that the state has, in fact, been experiencing a "megadrought" since the turn of the century. Indeed, this "megadrought" appears to be the worst such drought since the year 800 and its severity is due, in large part, to climate change.[1]"

"It is increasingly clear that climate change will stress water resources and its management like no other time in recorded history." *(February 28, 2023; Informational Hearing: Committee on Water, Parks, and Wildlife)*



[1]*A. Park Williams, Edward Cook, and Jason Smerdon et al, "Large contribution from anthropogenic warming to an emerging North American megadrought," Science 368, 6488 (2020): 314-318, DOI: 10.1126/science.aaz9600.*

Napa County & Napa Valley Subbasin Monitoring

9 GSP Monitoring Networks

- GWL — Groundwater Levels
- GWQ — Groundwater Quality
- GST — Groundwater Storage
- GDE — Groundwater Dependent Ecosystems
- SUB — Land Subsidence
- SW/GW — Interconnected Surface Water and Groundwater
- SWQ — Surface Water Quality
- SSD — Stream Stage & Stream Discharge
- SEA — Seawater Intrusion

Monitoring Network	Measurement Type	Total			GSP-Specific	
		County	Napa Valley Subbasin	RMS	Supplemental	Planned
Groundwater Level	GW Levels	98	59	27	30	8
Groundwater Storage	GW Levels	--	27	0	27	0
	NVIHM Model	--	1	1	--	--
Land Subsidence	GW Levels	--	12	15	0	0
	Benchmark Monitoring	--	8	5	3	0
	InSAR		1			
Stream Stage and Stream Discharge	Stream Stage and Stream Discharge	--	5	0	5	Yes
	Stream Watch	39	33	--	--	Yes
	Flood Control	--	18	0	18	0
Interconnected Surface Water – Groundwater	GW Levels	--	26	7	11	8+
	NVIHM Model	--	2	2	--	--
GDE Monitoring	GW Level	--	22	0	15	8
	Stream Habitat	--	1	--	--	TBD
	Remote Sensing	--	10	0	10	0
Groundwater Quality	GW Quality	1,621[1]	34	21	18	0
Seawater Intrusion	Chloride testing	--	16	9	7	2
Surface Water Quality	SW Quality	--	6	7	0	0

[1] Includes regulated facility sites

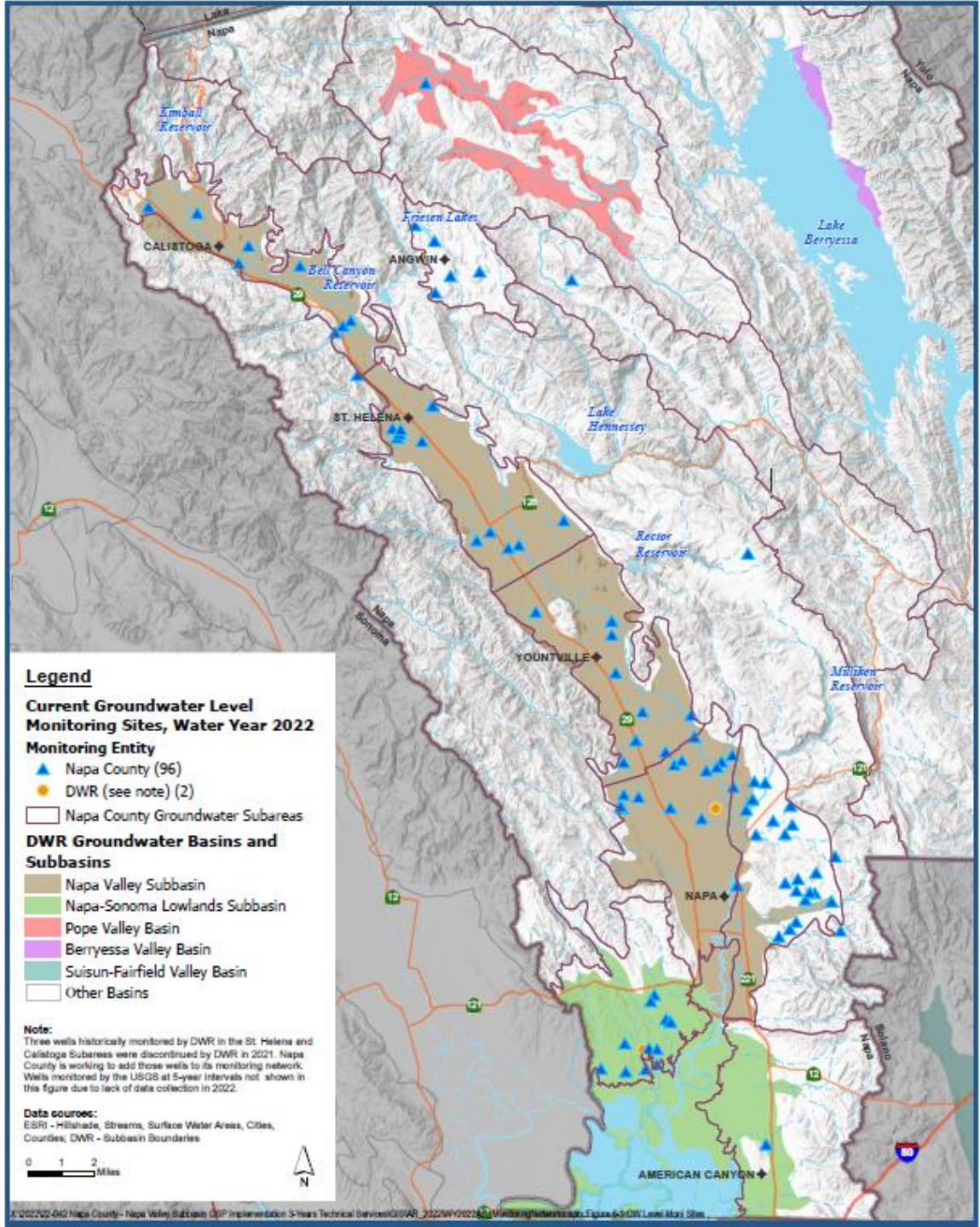
Nine Monitoring Networks

Groundwater Level Monitoring: 2022

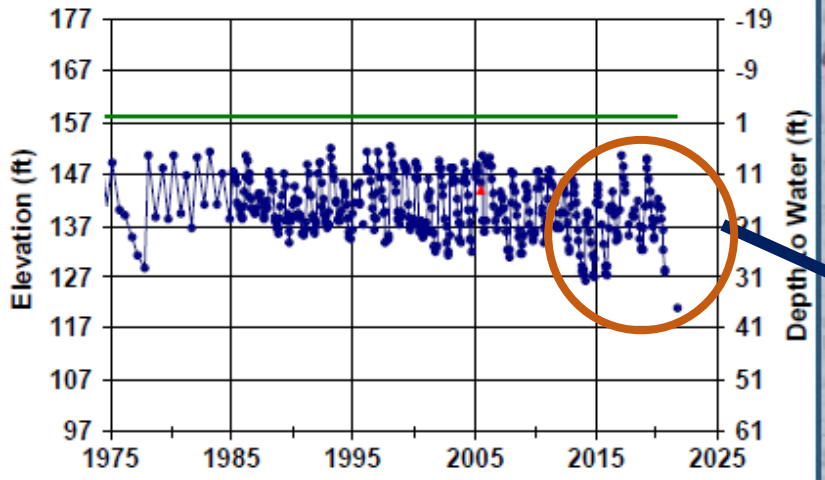
Napa Co., 96 (including 10 SW/GW)

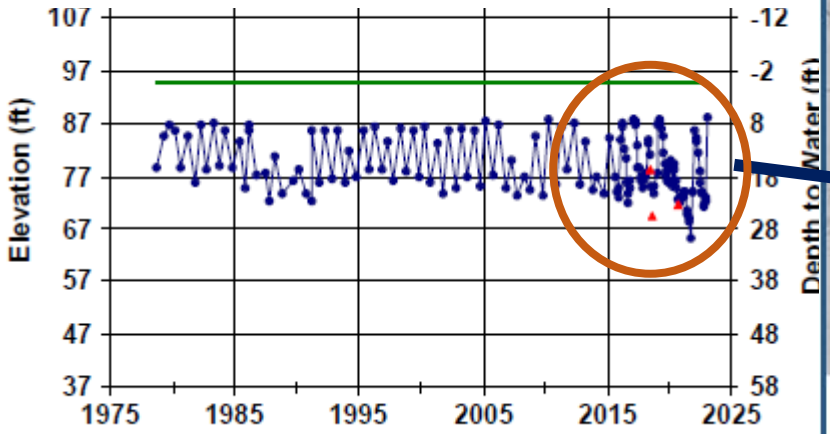
DWR, 2

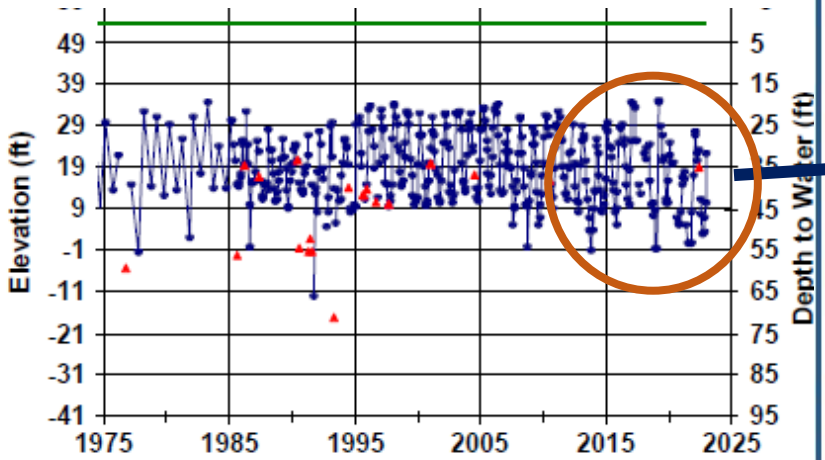
Total = 98

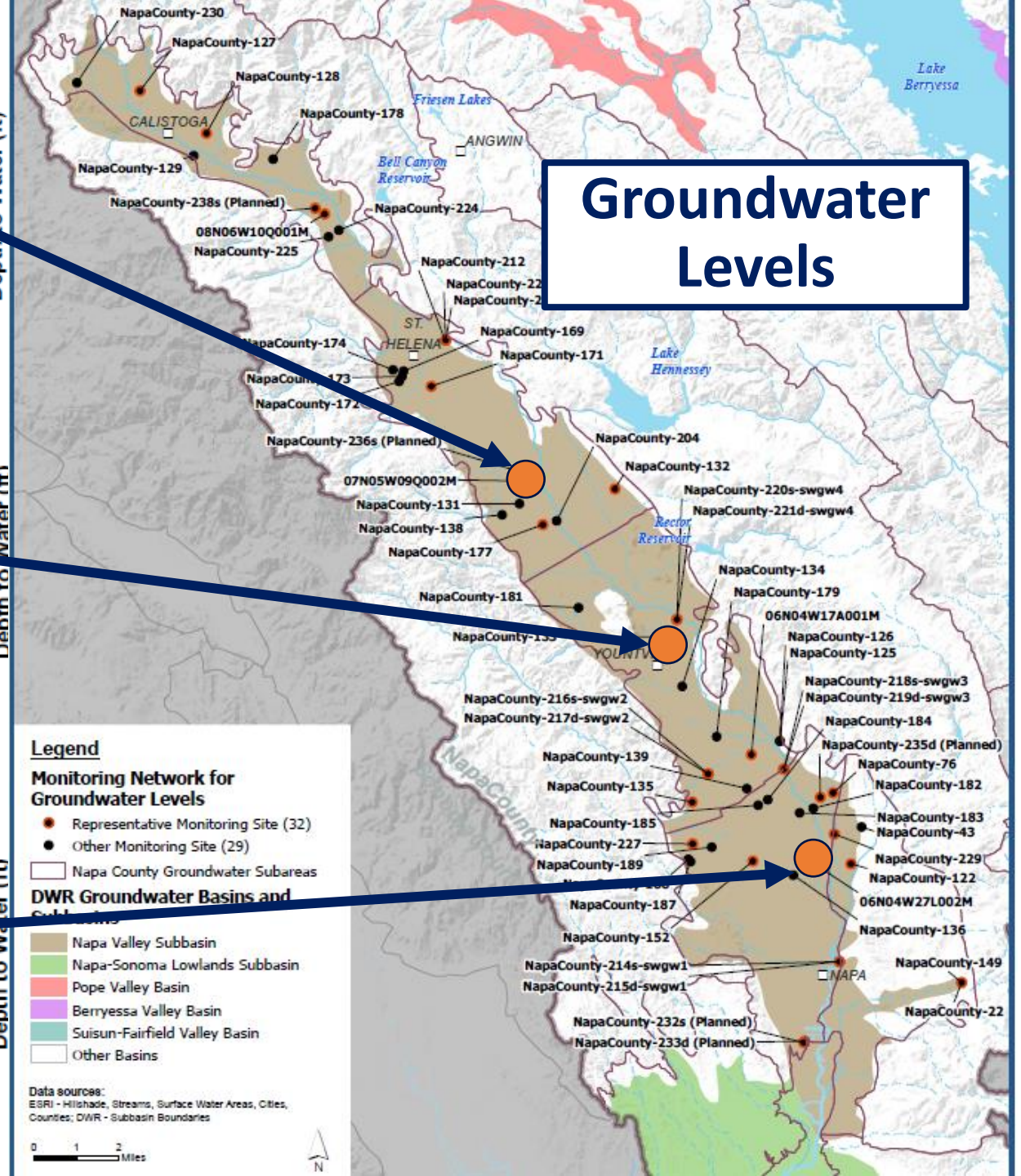


Recent Drought Effects





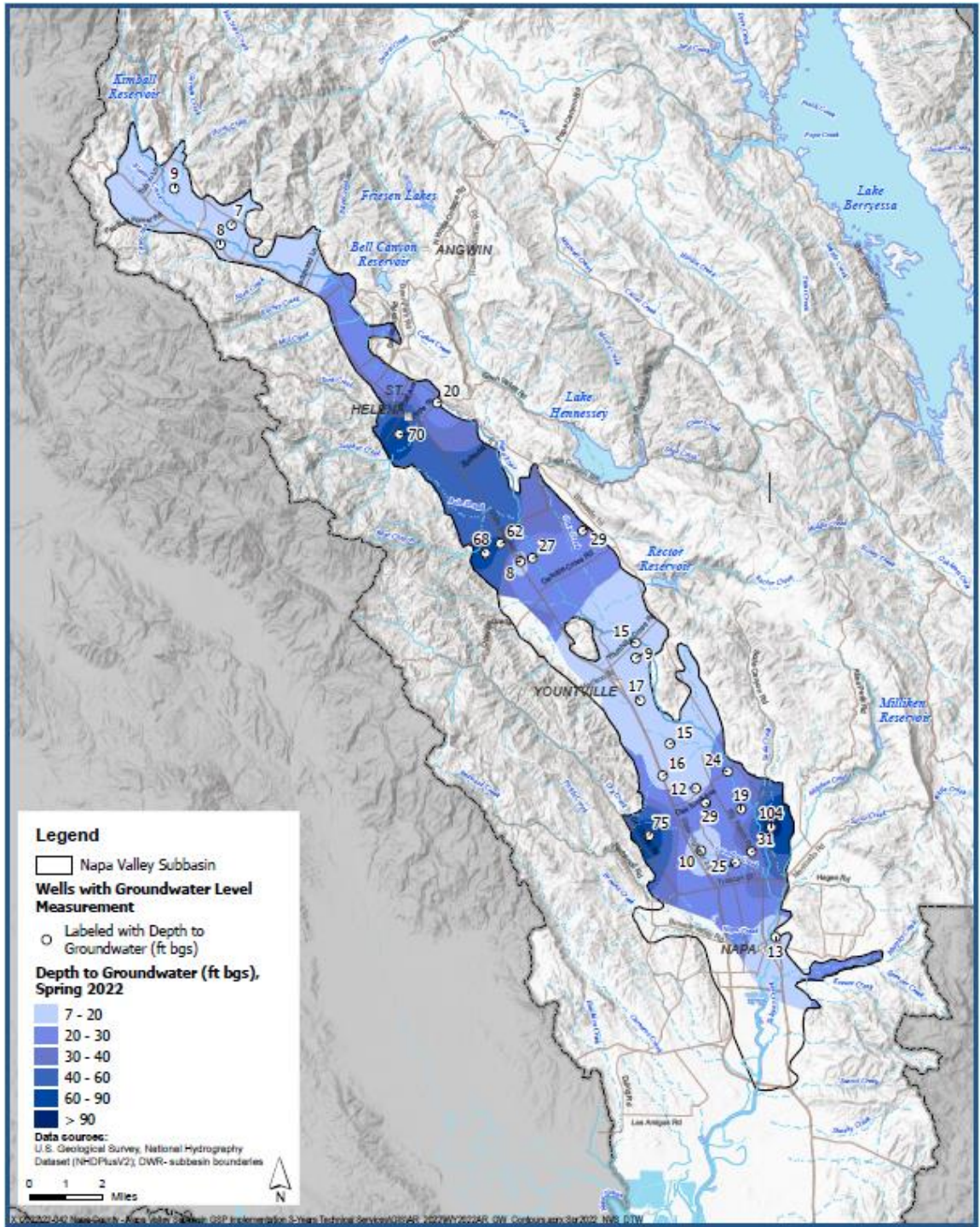




Monitoring Results: Depth to Groundwater

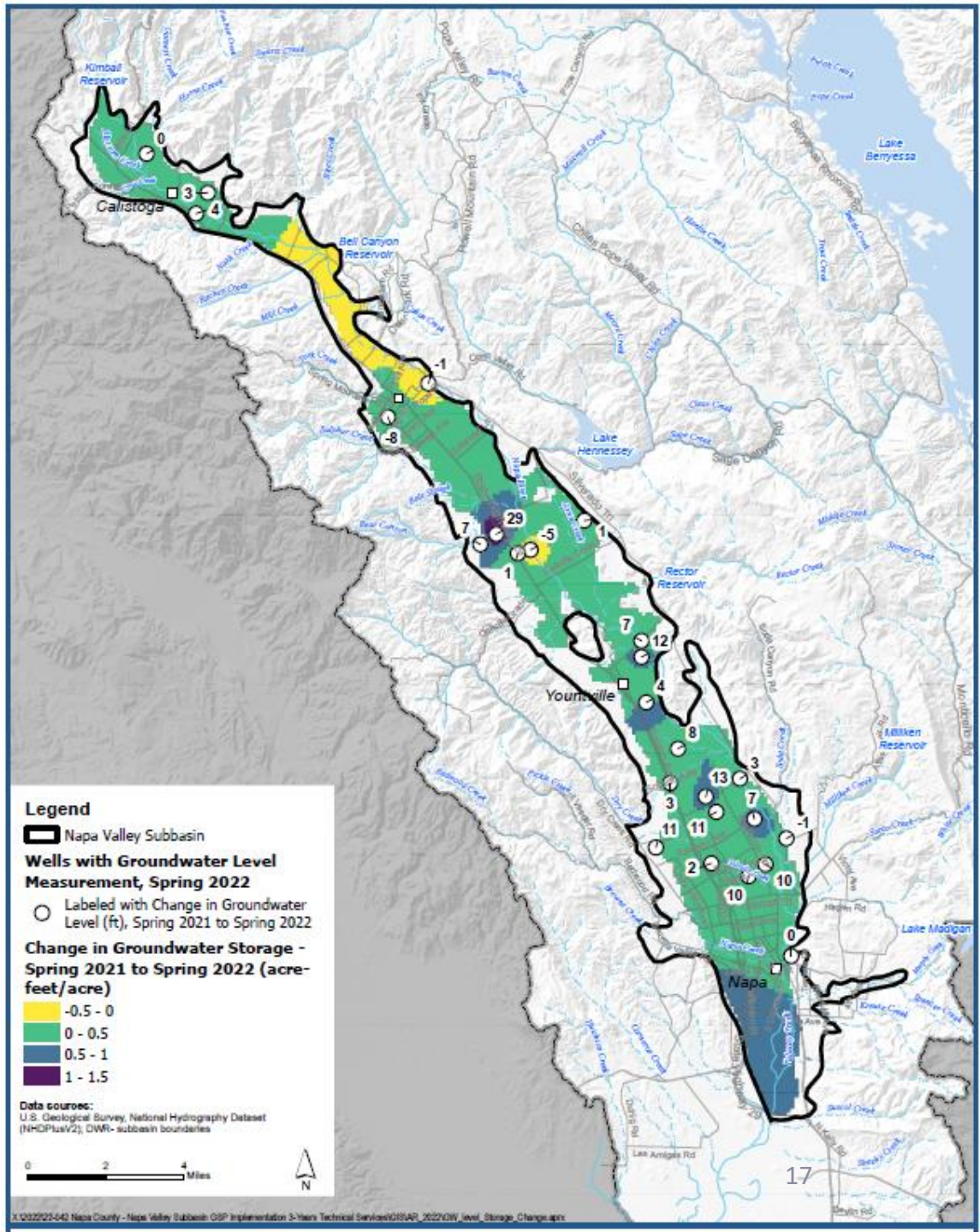
Napa Valley Subbasin

- Spring Depth to Water (DTW) in the Subbasin generally shallow and stable over time; recent drought effects observed in increased DTW
- **2022 Spring DTW ~10 to 60 ft below ground surface**



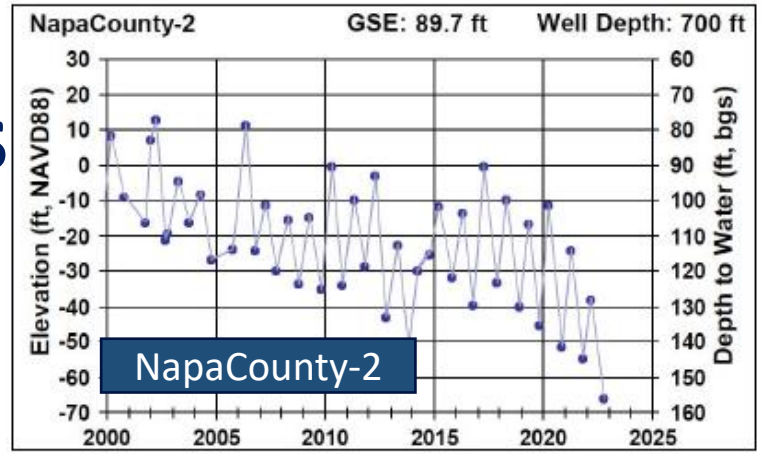
Principal Aquifer Change in Storage: Spring 2021 to Spring 2022

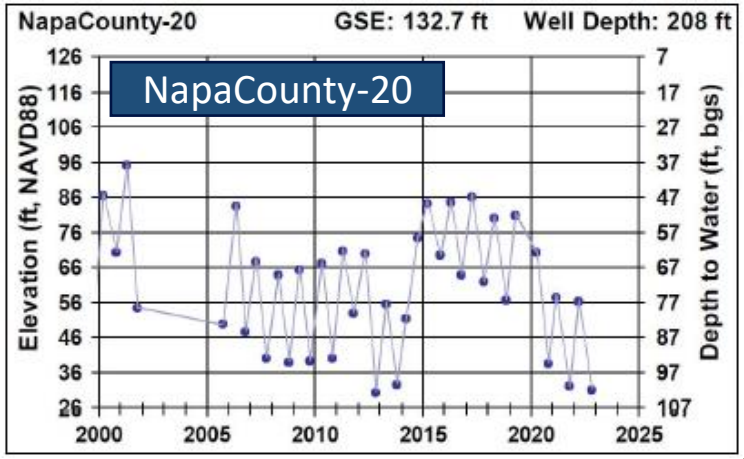
- Change in GW storage computed using Spring GW level measurements
- Total estimated GW storage change for Spring 2021 to Spring 2022 = +6,509 AF

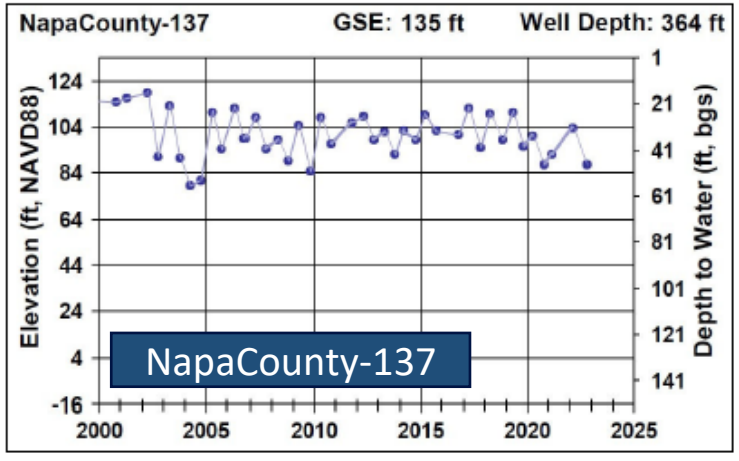


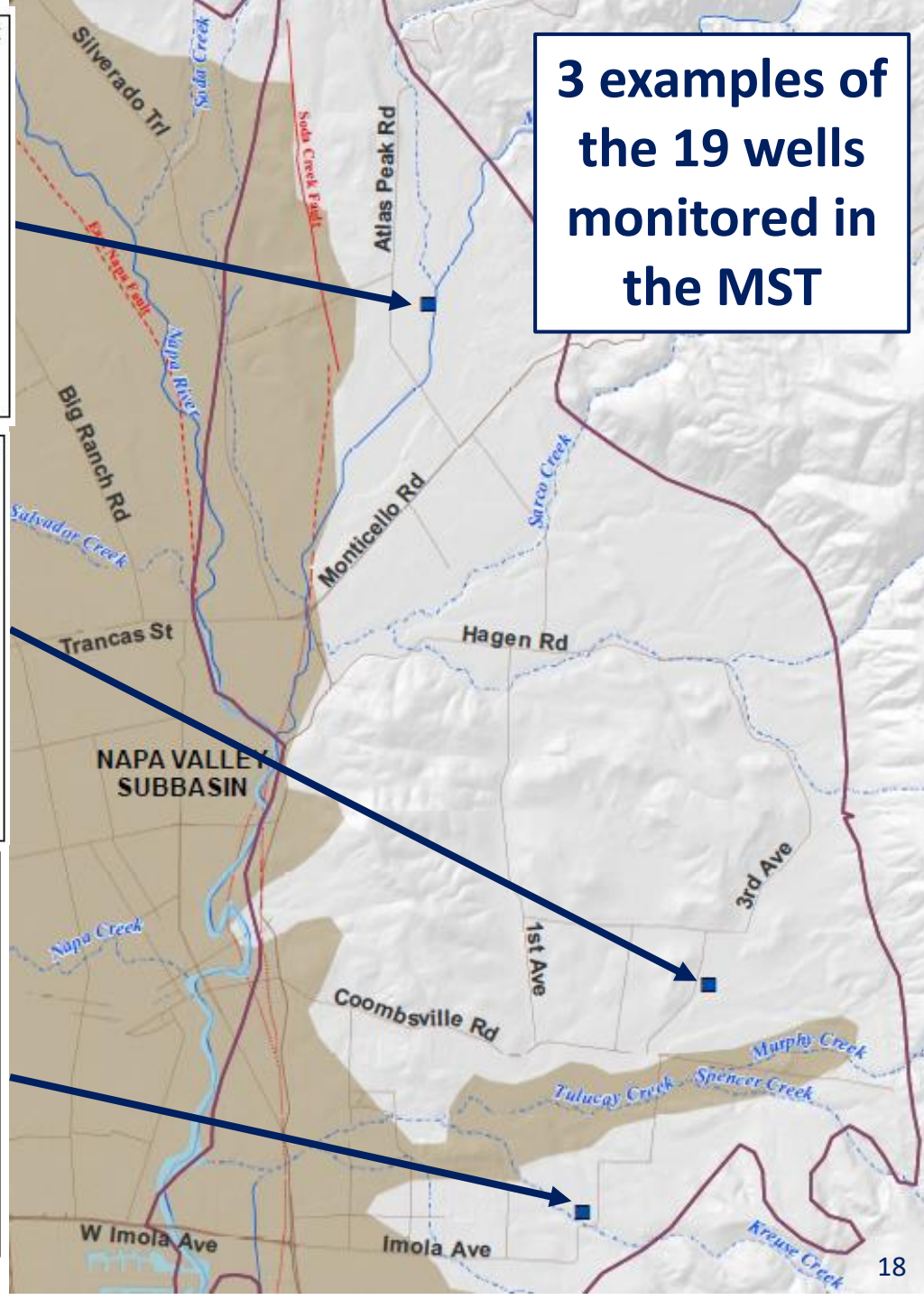
MST Hydrographs

- Monitoring data available for more than four decades
- Recognized historical declines
- Stable groundwater levels ~ 2009-2020
- Many monitoring wells show recent declines

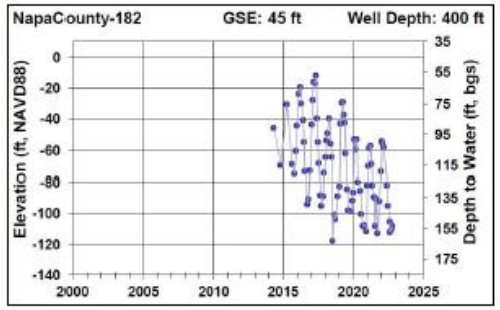


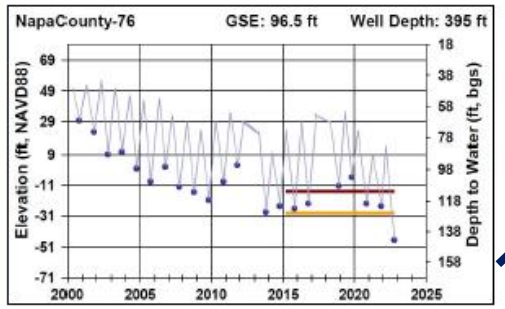


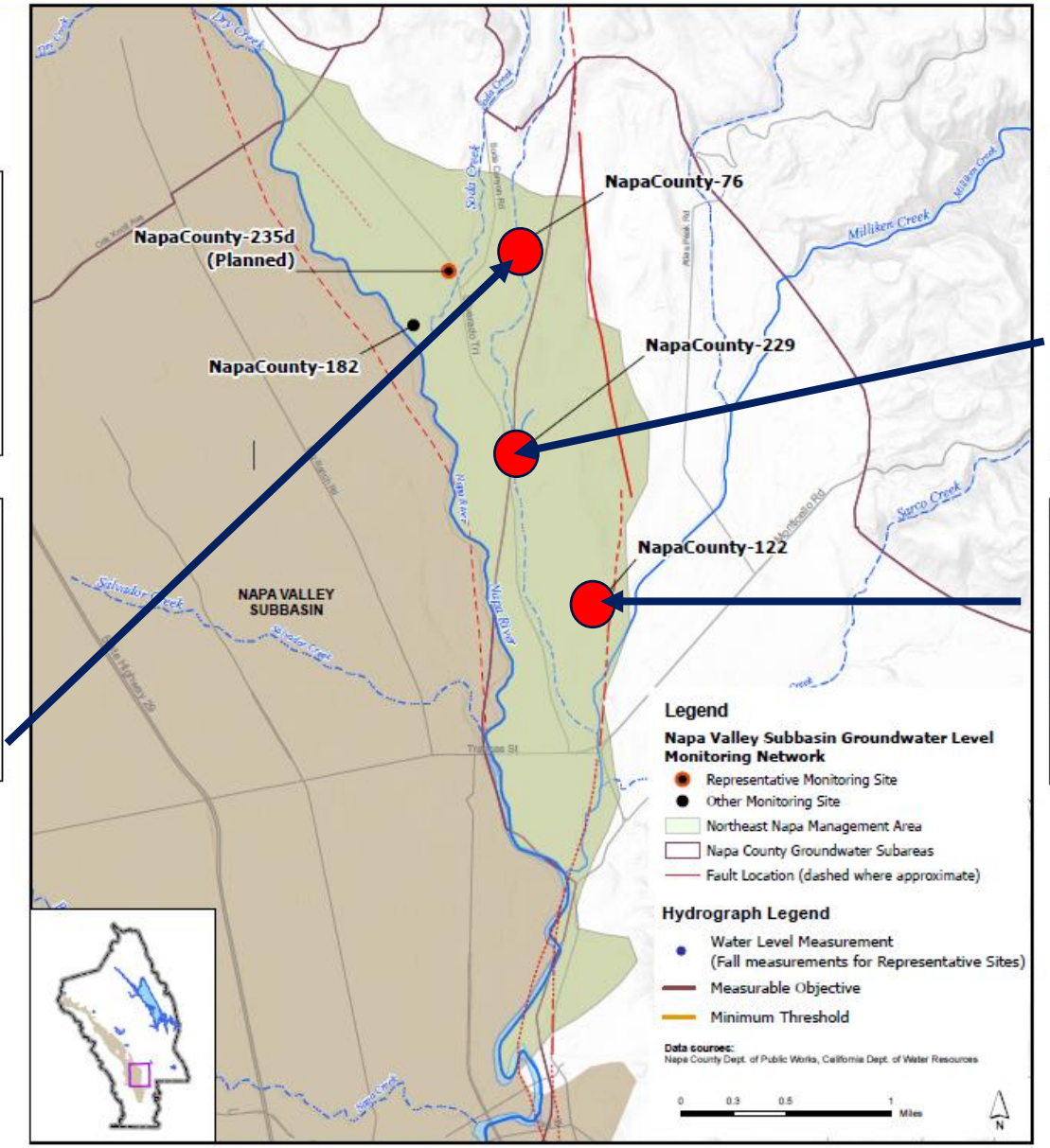


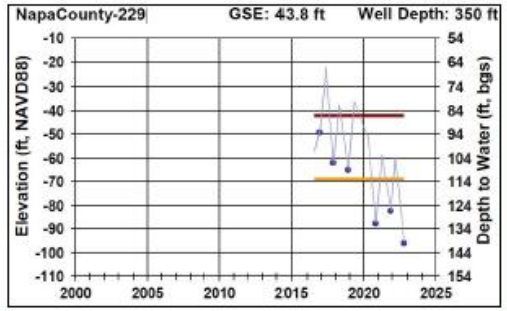


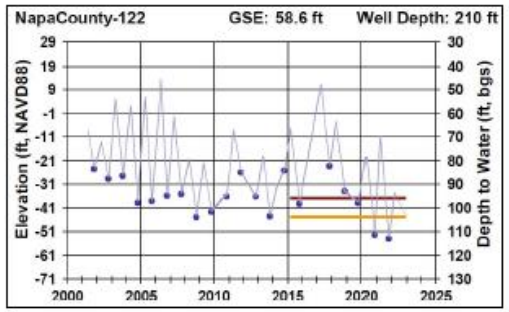
Northeast Napa Management Area: Hydrographs









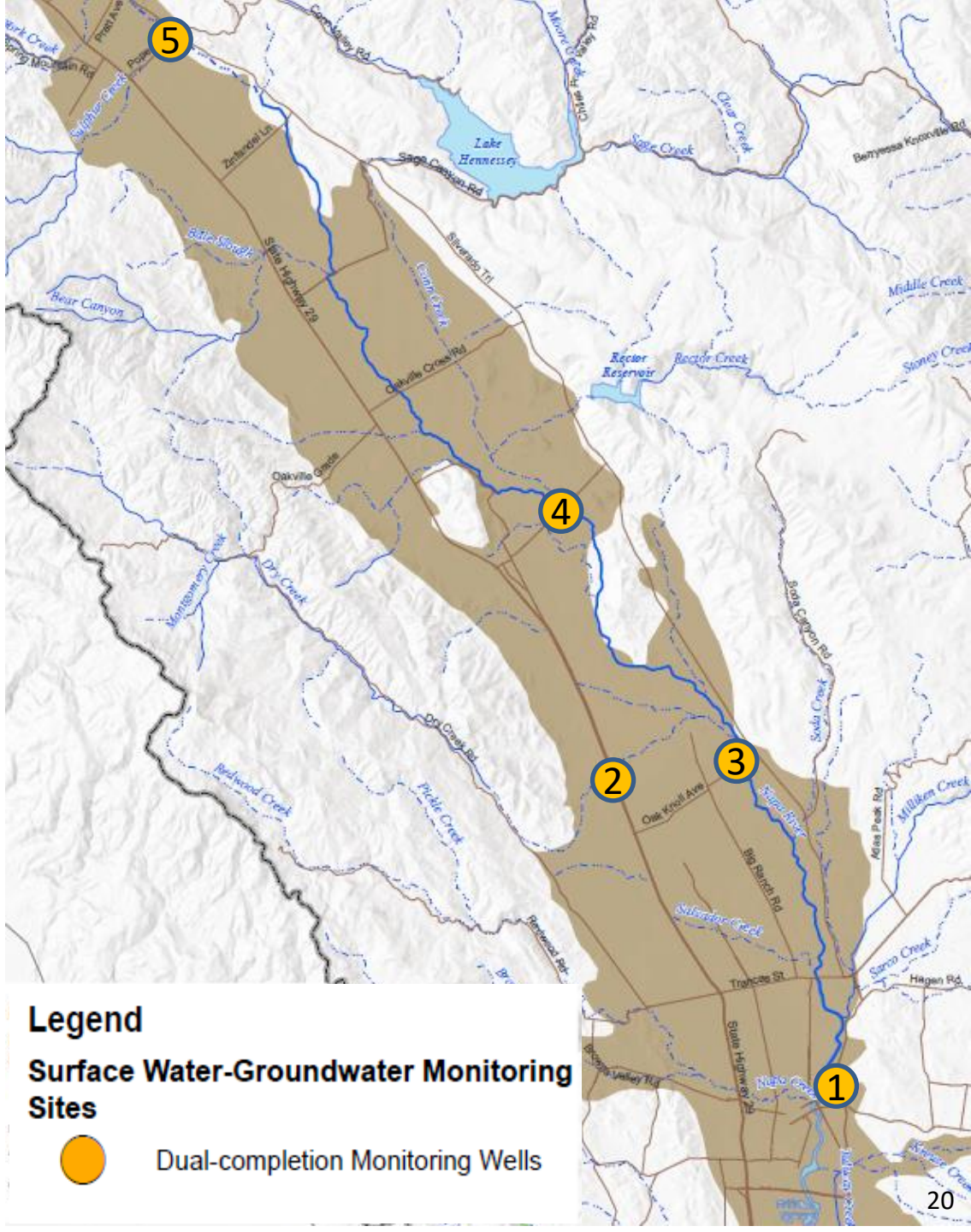


Existing RMS Well with MT Exceedance

Surface Water/Groundwater Interaction

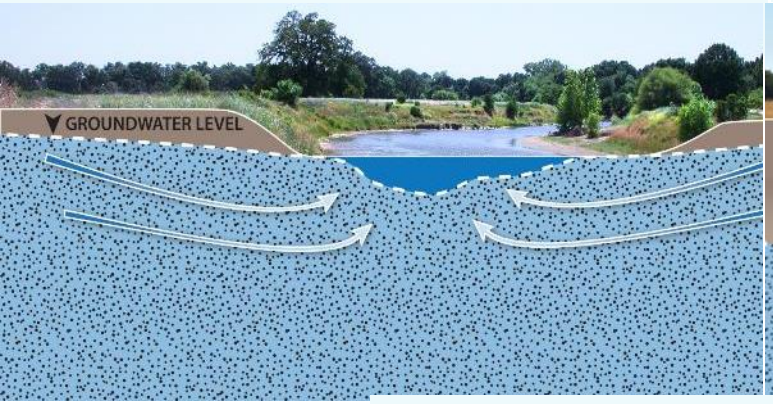
Dedicated Monitoring Facilities at 5 Sites

- DWR grant support: 2014 Pre-SGMA
- Paired Shallow Monitoring Wells (MWs) each site
  - Levels & quality
- Stream Gauge each site
  - Streamflow & quality
- > 8 years of data

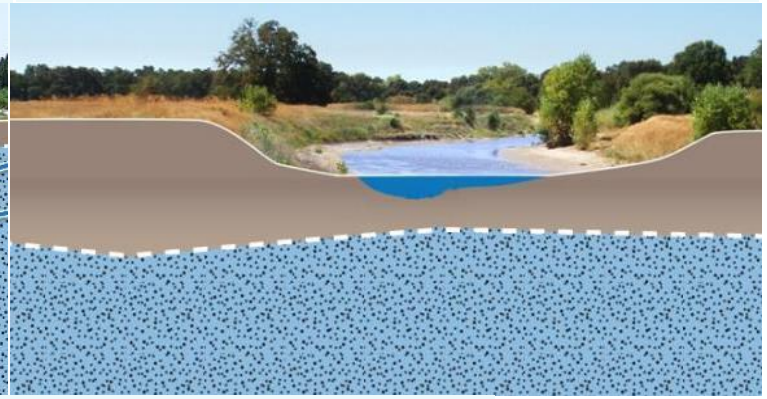


Surface Water/Groundwater Interactions

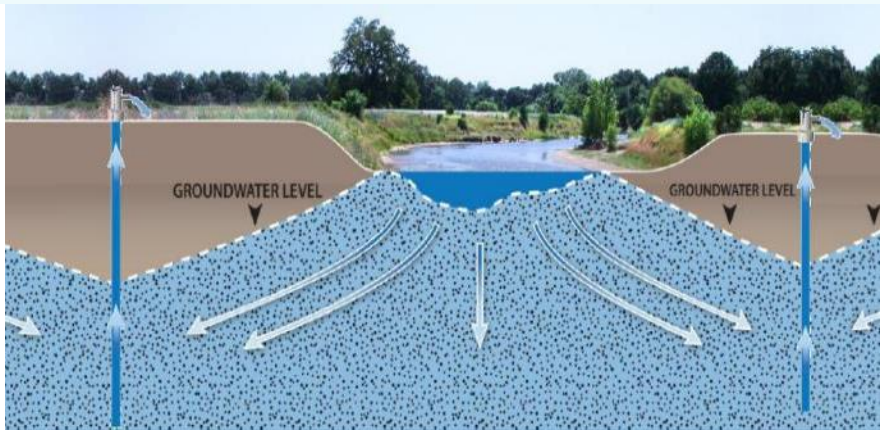
Direct Connection
Maintains/Discharges to Stream (Groundwater Baseflow)



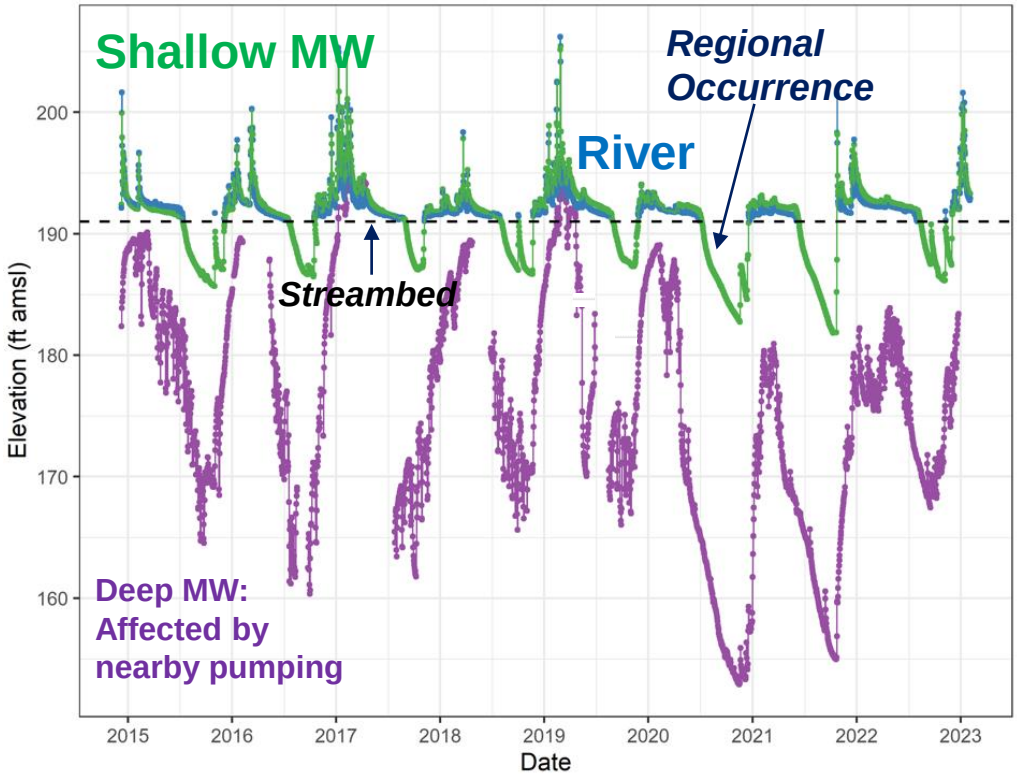
Indirect Connection
Stream Seepage Independent of GW Levels



Groundwater Pumping
Stream Loses Water/Recharge to GW



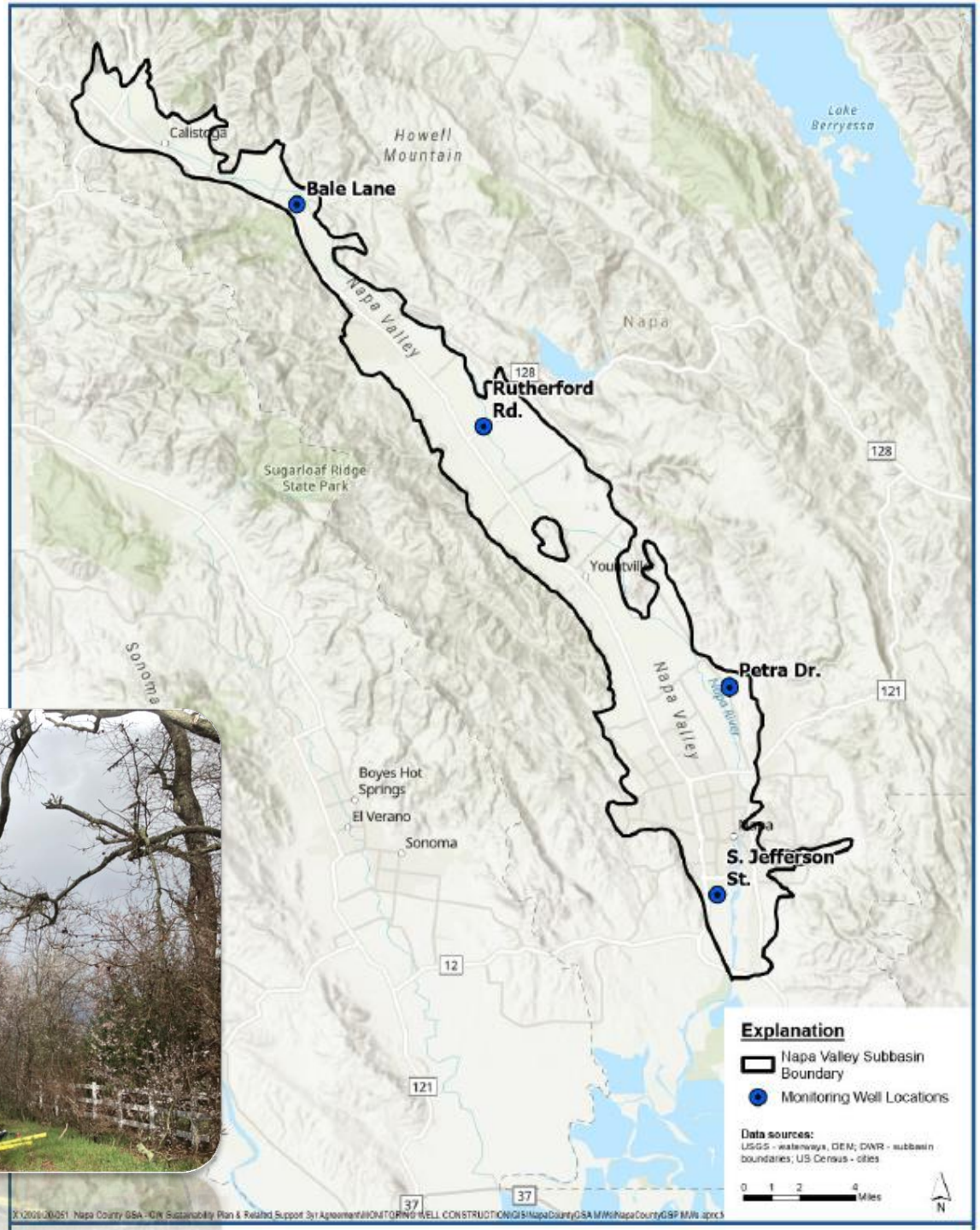
St. Helena SW/GW Site 5



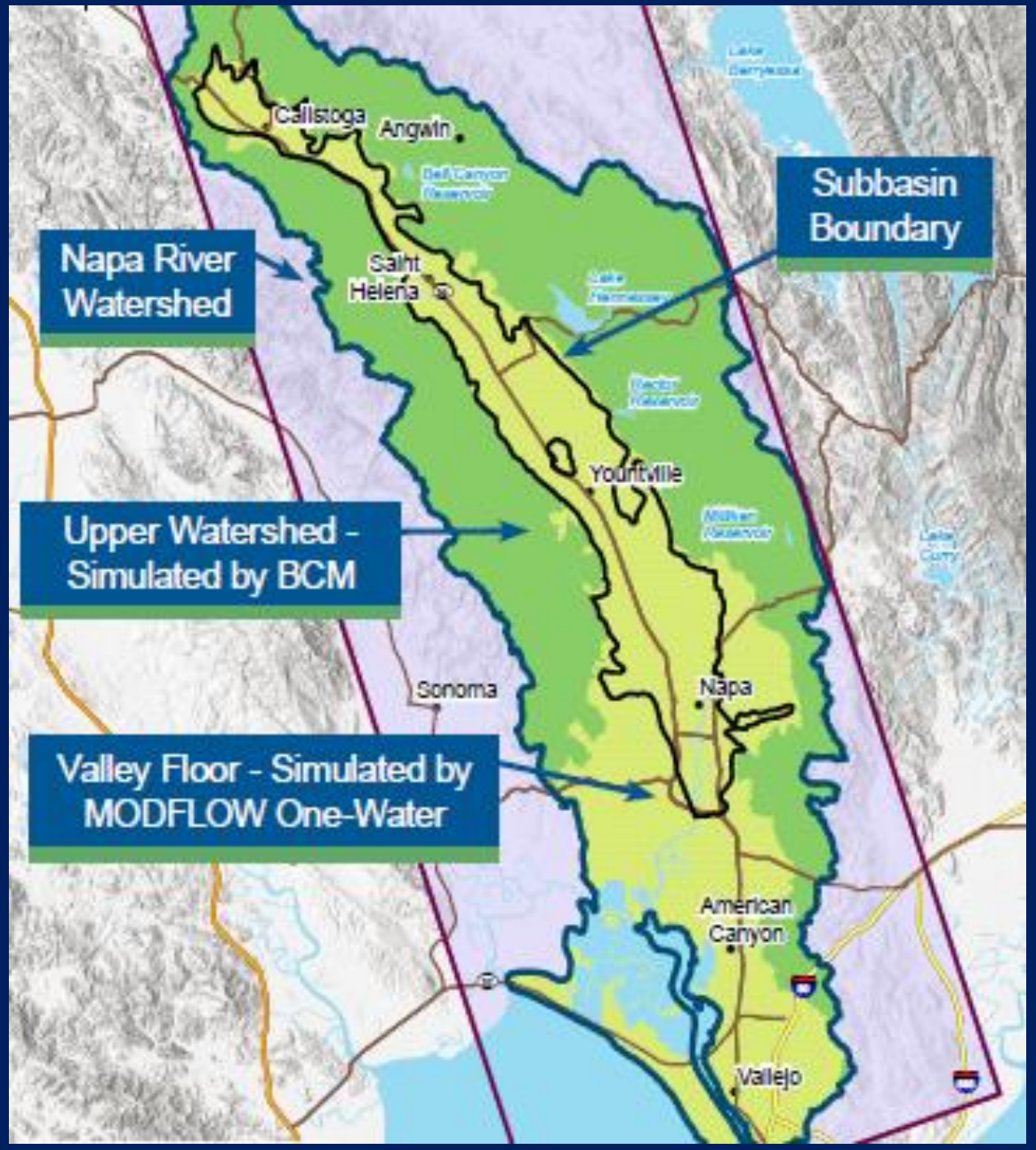
River and Shallow MW not exhibiting short-term pumping effects

Four New MW Sites

- Four new monitoring sites (8 MWs)
- Site access arranged, and drilling commenced in January 2023
- Two sites (4 MWs installed; January/February 2023)
- When sites accessible, two other sites (4 MWs) to be installed (March-April 2023)



Napa Valley Subbasin Water Budget WY 2022



Napa Valley Integrated Hydrologic Flow Model (NVIHM)

During GSP Development

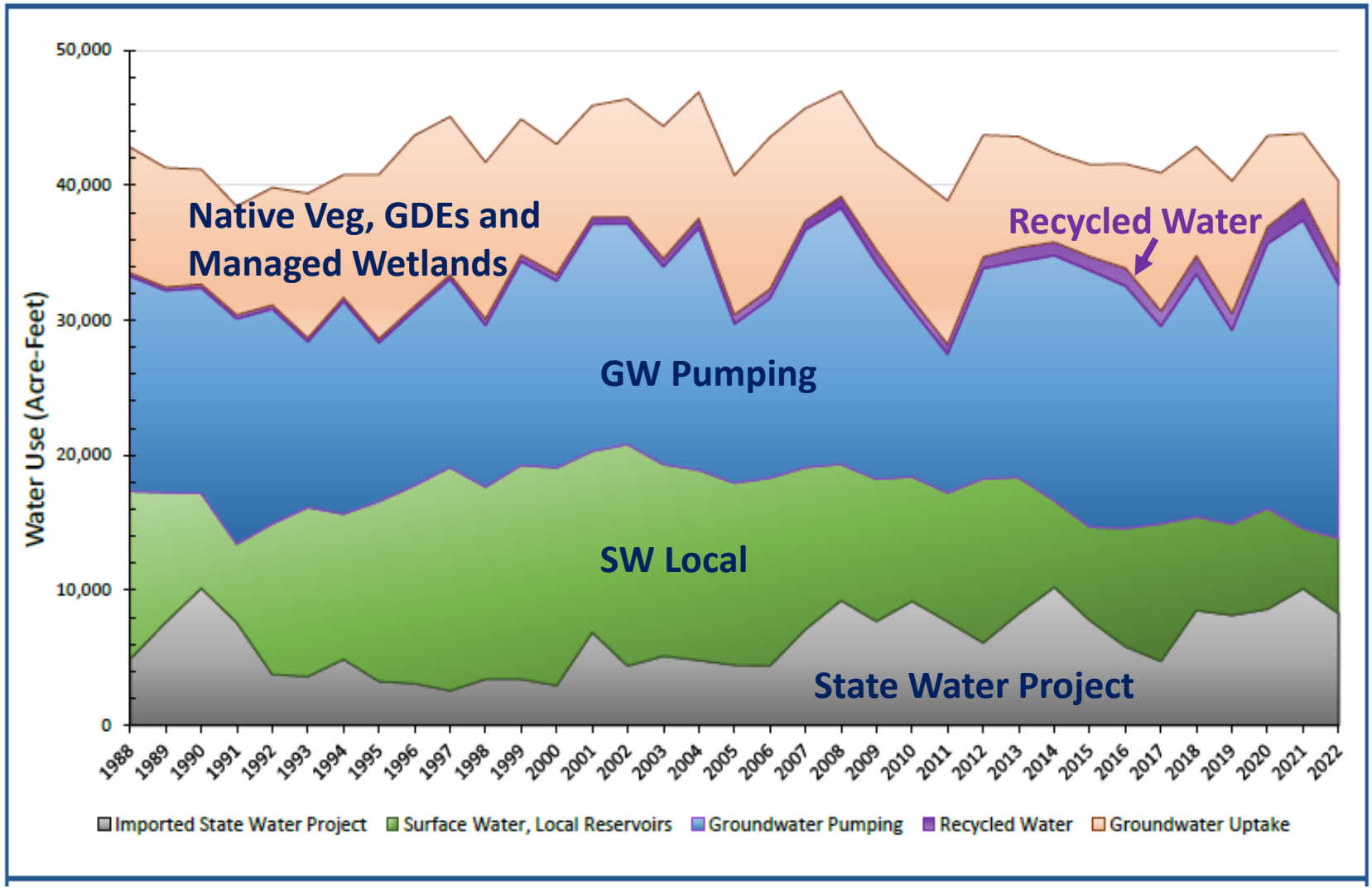
- Develop water budgets: historical, current and projected (50-Year)
- Simulate response to climate change and future land use
- Evaluate projects and management actions to maintain sustainability

Updates WY 2022 Annual Report

- Basin Characterization Model (BCM): Climate WY 2022
- MODFLOW: Land use (2019) and water budget components thru WY 2022

Water Use: WY 2022

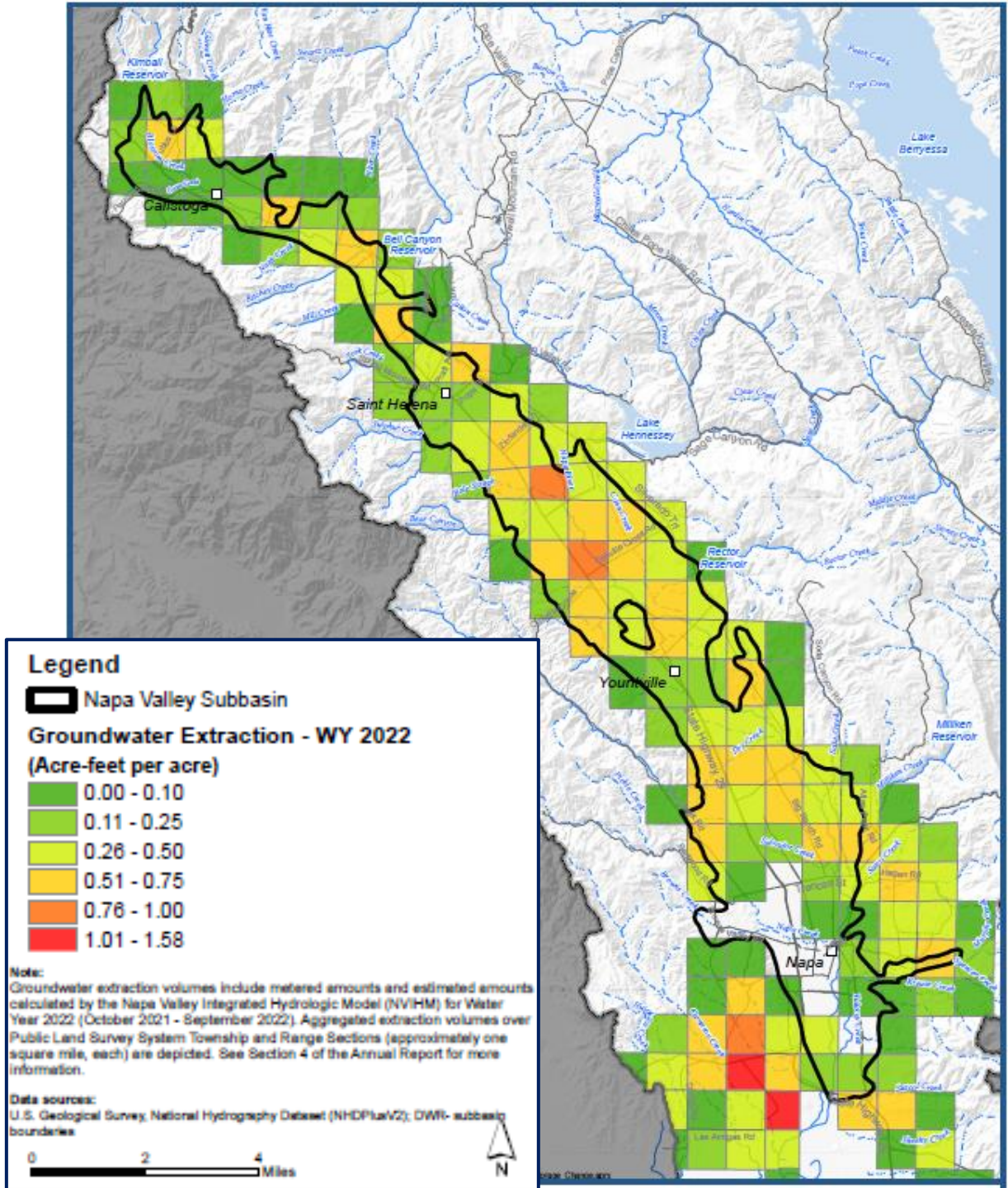
Water Use	Acre-Feet
2022 Groundwater Pumping	18,790
2022 Native Veg, GDEs & Managed Wetlands	6,440
2022 Recycled Water Use	1,220
2022 Local Surface Water Use (including reservoirs, diversions, etc.)	5,562
2022 State Water Project Use	8,290
TOTAL	**40,302**



Groundwater Pumping, 2022 (Acre-feet)

Groundwater Pumping	Acre-feet	Percent Use
Ag (vines and other)	14,210	76%
Municipal	450	2%
Self-Supplied Users Domestic (2,815 AF for outdoor use)	3,060	16%
Small Public Water Systems	1,070	6%

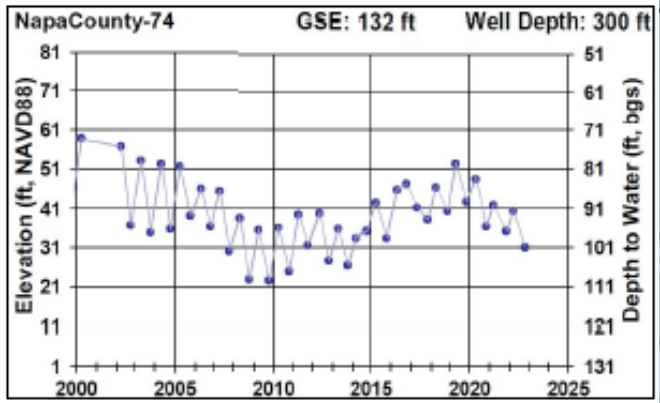
TOTAL = 18,790 Acre-feet

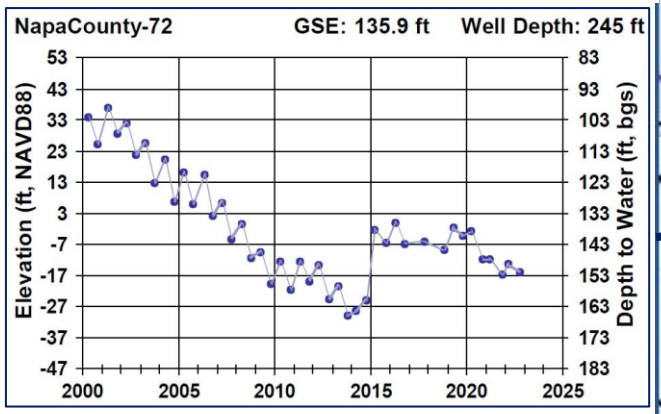


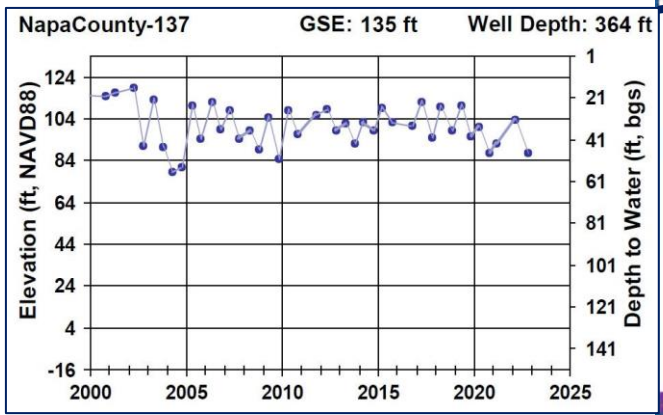
Recycled Water Use: WY 2022

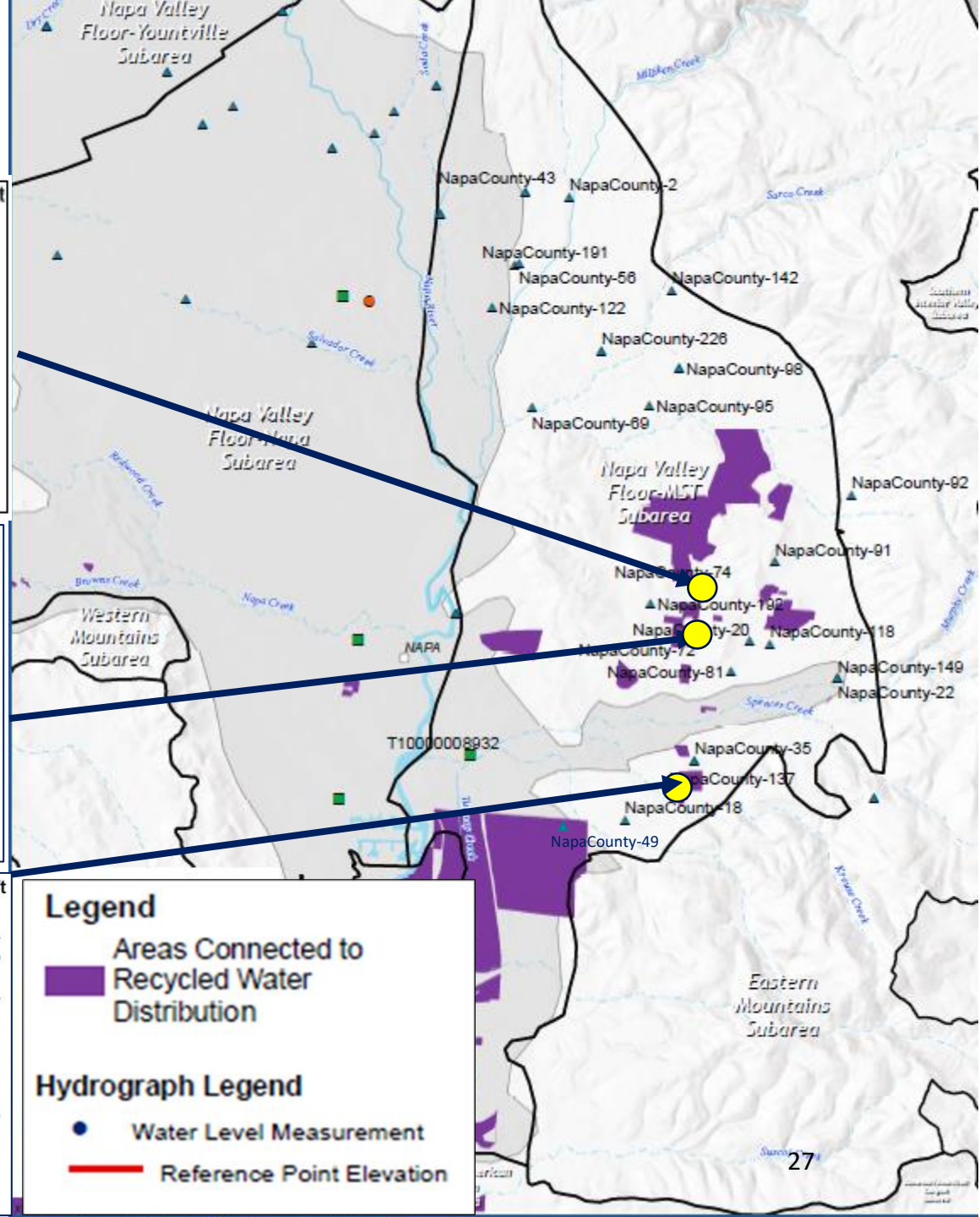
Recycled Water Use	Acre-feet
Ag (vines and other)	250
Municipal	890
Small Public Water Systems	80

TOTAL=
1,220 Acre-feet





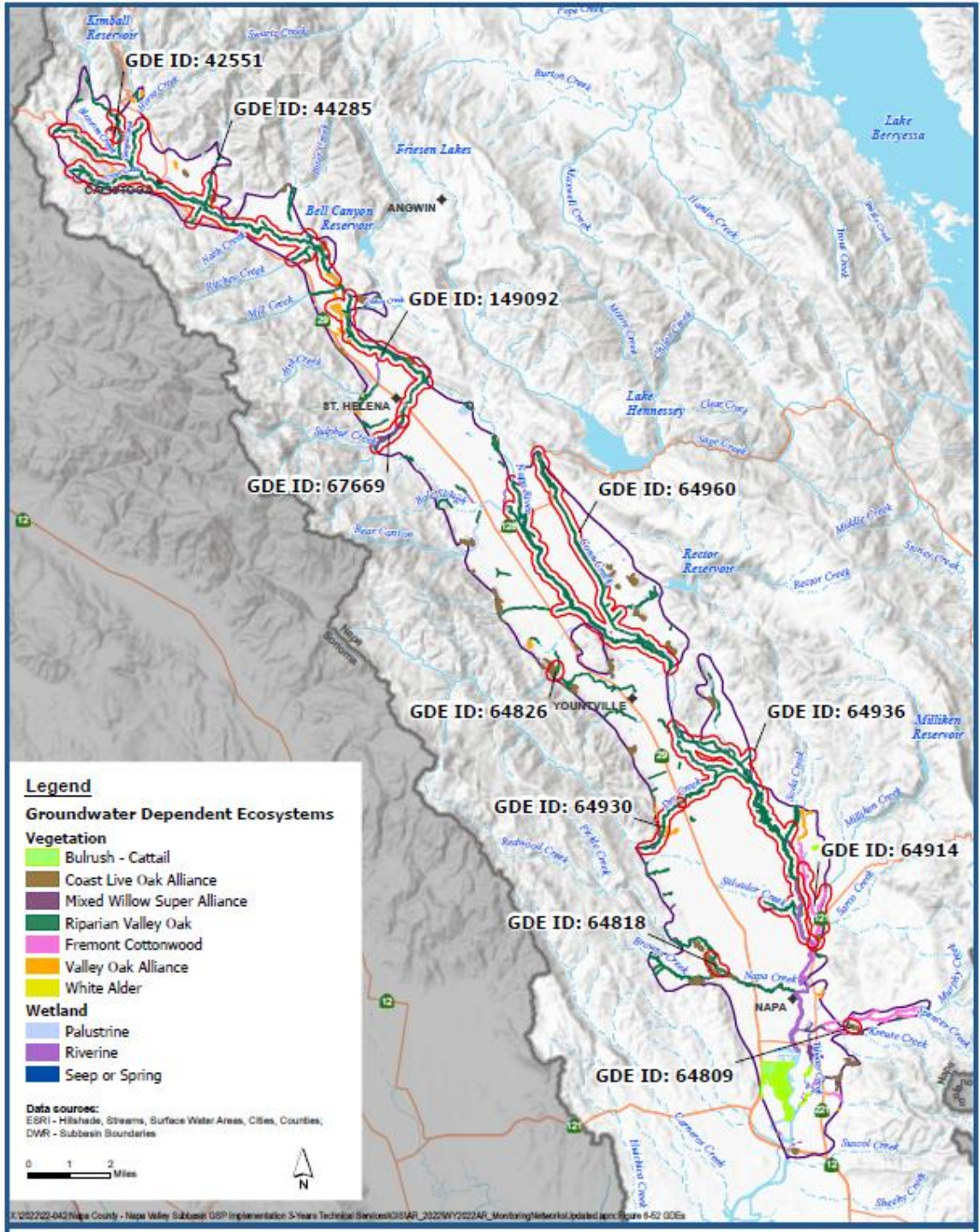




Groundwater Dependent Ecosystems Water Use: WY 2022

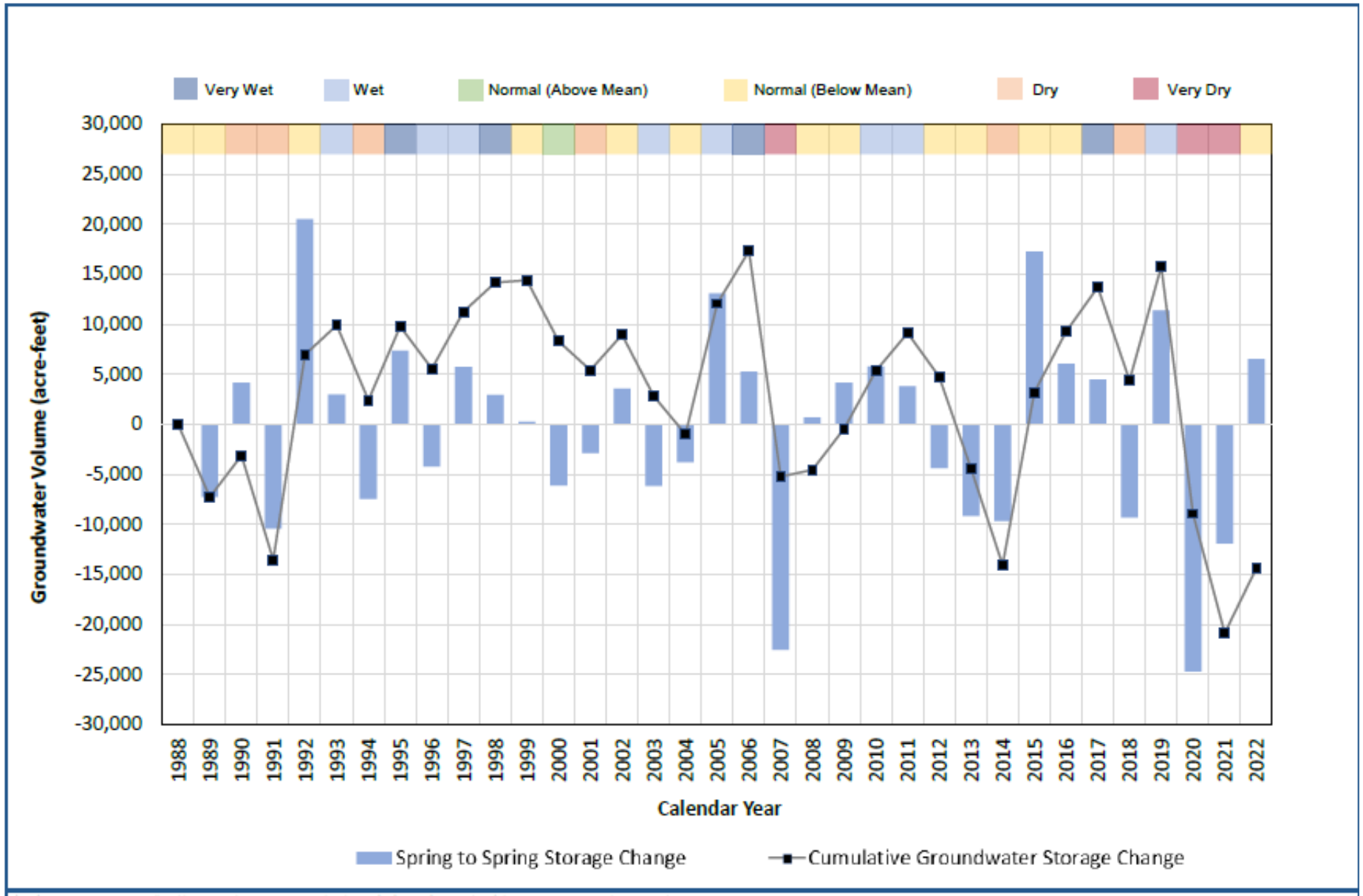
- GDEs are an important groundwater user and component of the water budget
- GDE Acreage (Vegetation and Wetland Types): 2,893 acres

TOTAL= 3,670 Acre-feet



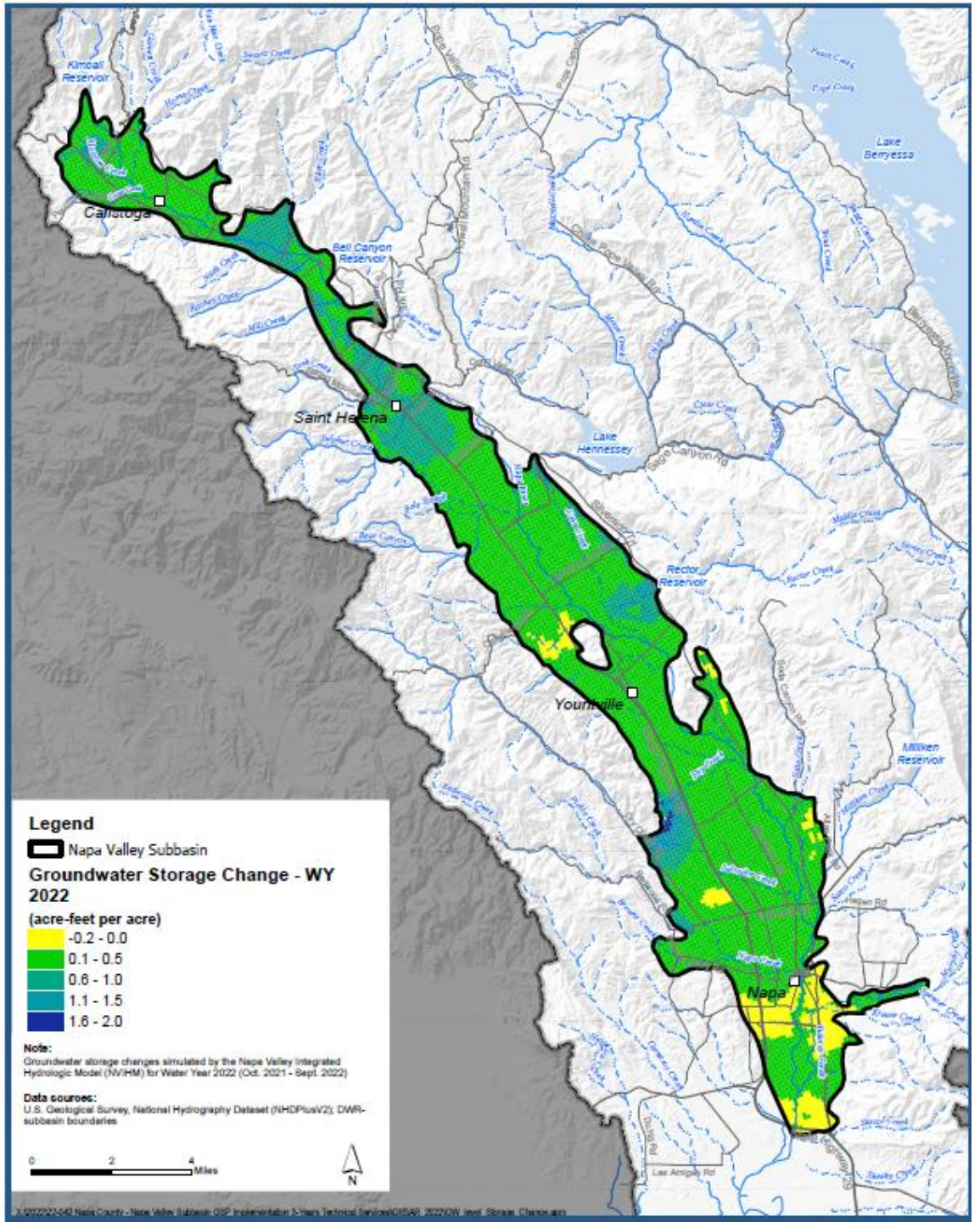
Change in Groundwater Storage: WY 2022

- Change in groundwater storage influenced by water year and pumping
- Increase in storage in WY 2022
- From 1988 to 2022, cumulative storage changes show depletion of supply.

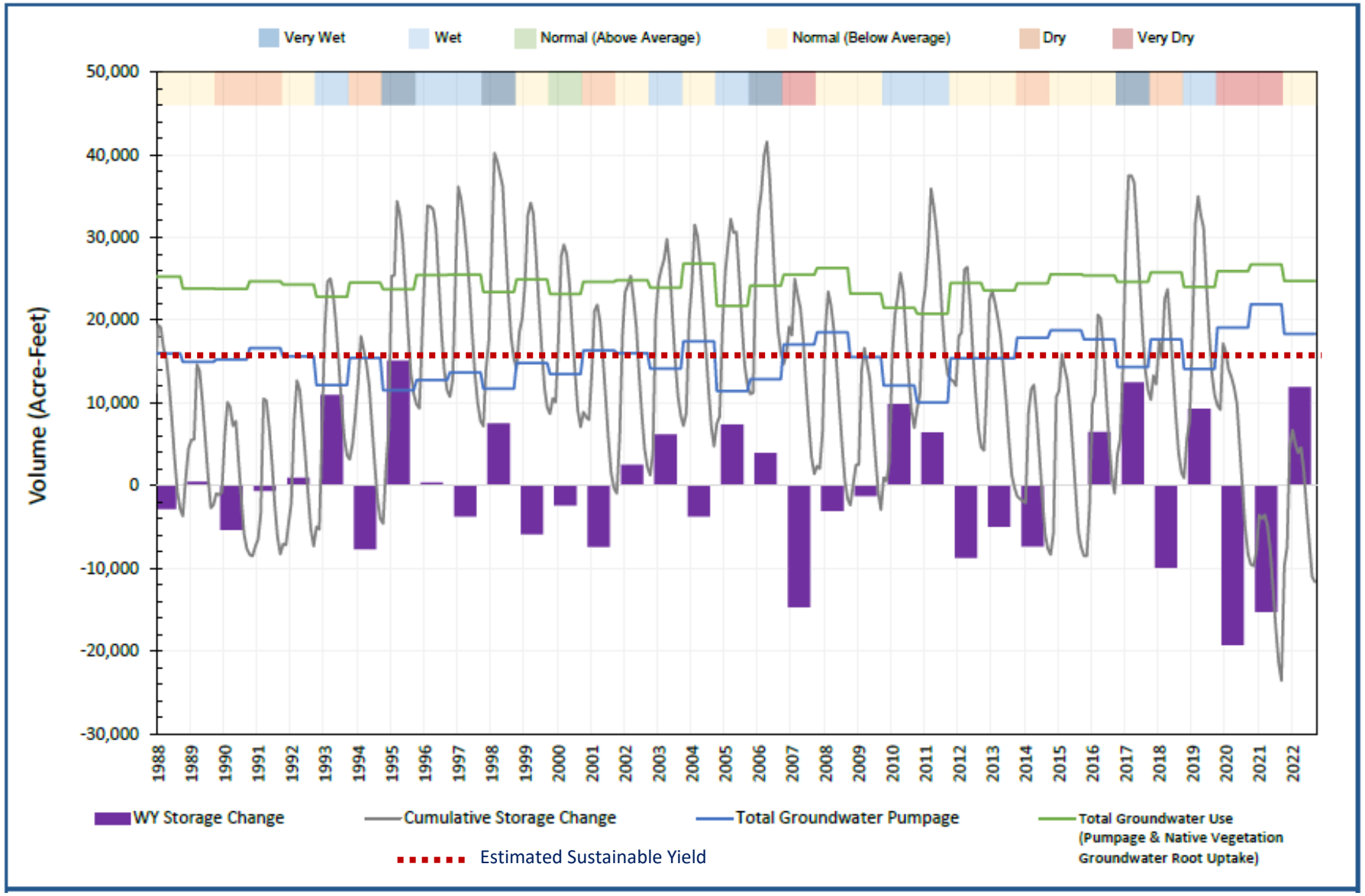


GW Storage Change Simulated NVIHM 10/2021-09/2022

- Increase in GW storage in WY 2022 across most of the Subbasin
- Increase in GW storage based on NVIHM (Oct. 2021 to Sept. 2022) = 11,910 AF



GW Pumping, Total Use, and GW Storage Change and Cumulative Change (1988-2022)



- Very dry years (2020-2021)
- Prolonged drought
- Increase in EDDI, i.e., atmospheric thirst
- Reduced recharge
- General increase in GW pumping since ~2014
- Cumulative effect on reduced GW storage

Sustainability Indicators & Metrics

Groundwater Sustainability Indicators

Not Causing Undesirable Results:
Means Avoiding Significant and Unreasonable …

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

Napa Valley Hydrogeologically Sensitive to this Indicator

Sustainable Management Criteria (SMC) for Chronic Lowering of Groundwater Levels (CGWL)

Minimum Threshold

Minimum static October groundwater elevation prior to 2015

Undesirable Result

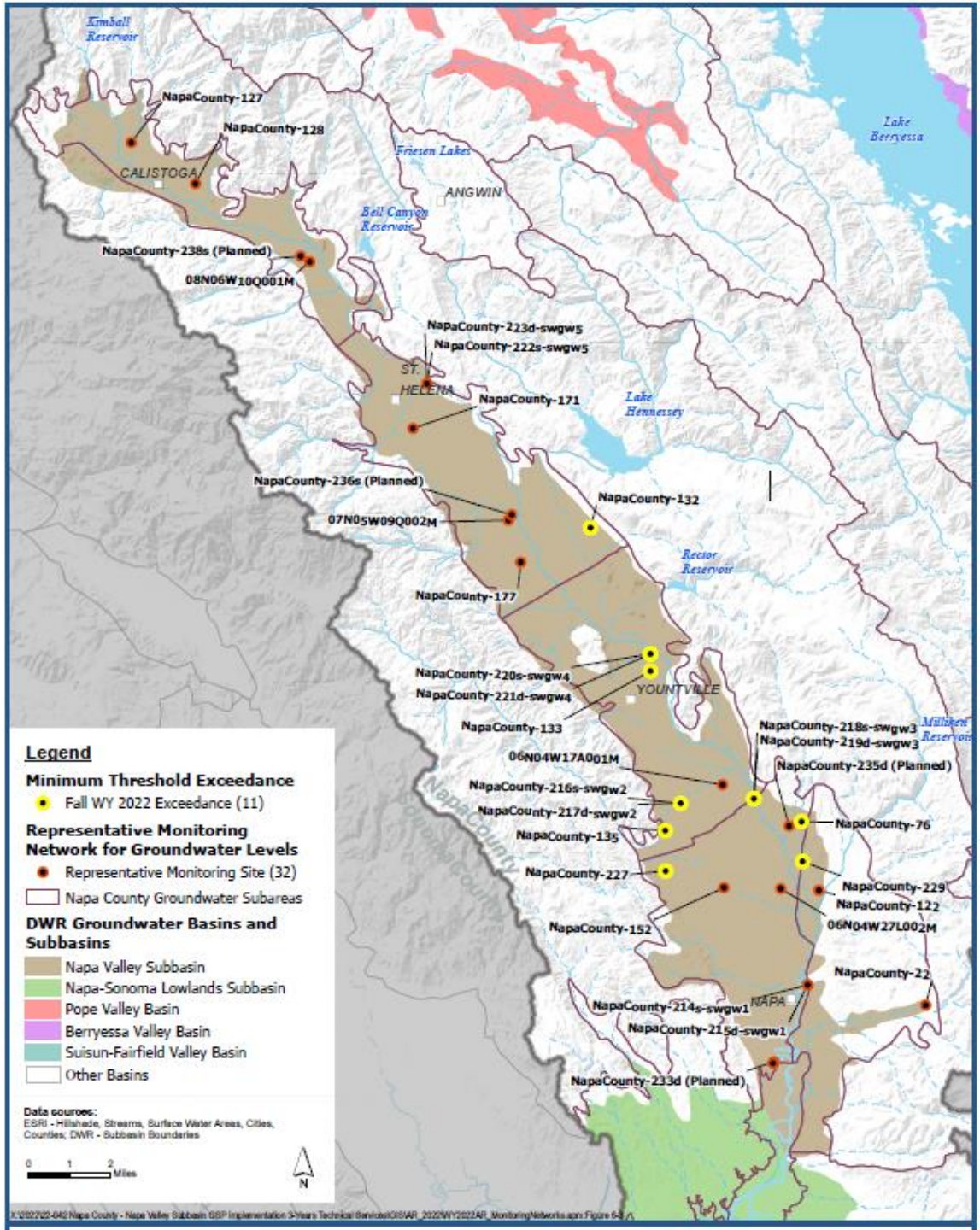
20% of designated RMS well levels fall below the MT in fall (October) for 3 consecutive years of fall measurements in non-drought years

Trigger

20% of designated RMS well levels are below the MT in the Fall during a single year

RMS Groundwater Levels: Fall 2022

- 24 RMS wells measured
- 11 of the 24 wells (46%) had exceedances
  - 5 wells had exceedances of > 10 ft
  - 1 well had exceedance of 2-5ft
  - 5 wells had exceedances of 0-1ft



MT Exceedance Summary for Fall 2022

- 11 of the 24 wells (46%) had exceedances
- 6 RMS wells with 3 consecutive years of Fall MT exceedances
- No UR since at least 2 of the 3 years are drought years

Table 1 Fall Groundwater Levels with respect to Minimum Thresholds for Chronic Lowering of Groundwater Levels

Chronic Lowering of Groundwater RMS Wells	Minimum Thresholds (ft msl)	Fall Groundwater Elevations (ft)			Comments
		2020	2021	2022	
06N04W17A001M	42	30.56	13.06	--	
06N04W27L002M	-2	5.4	0.2	3.1	
07N05W09Q002M	126	128.34	120.85	--	
08N06W10Q001M	270	248.43	253.63	--	
NapaCounty-122	-45	-52.35	-54.1	-14.45	
NapaCounty-127	351	370.02	380.9	373.92	
NapaCounty-128	330	330.08	335.7	331.2	
NapaCounty-132	109	106.3	100.81	97.25	Three Years of MT Exceedance
NapaCounty-133	73	71.8	73.91	71.02	
NapaCounty-135	33	52.68	17.89	20.89	
NapaCounty-152	55	60.16	67.38	59.5	
NapaCounty-171	165	158.27	208.35	167.3	
NapaCounty-177	131	136.51	139.75	136.68	
NapaCounty-214s-swgw1	2	3.432	3.69	3.882	
NapaCounty-215d-swgw1	2	3.198	3.34	3.648	
NapaCounty-216s-swgw2	66	70.995	65.93	67.915	
NapaCounty-217d-swgw2	60	59.627	52.47	56.137	Three Years of MT Exceedance
NapaCounty-218s-swgw3	29	29.04	25.38	27.86	
NapaCounty-219d-swgw3	29	28.59	23.03	27.47	Three Years of MT Exceedance
NapaCounty-22	150	163.55	162.4	163.3	
NapaCounty-220s-swgw4	75	74.871	70.61	74.511	Three Years of MT Exceedance
NapaCounty-221d-swgw4	75	74.205	69.99	73.985	Three Years of MT Exceedance
NapaCounty-222s-swgw5	185	185.47	182.3	187.05	
NapaCounty-223d-swgw5	164	156.12	155.82	172.4	
NapaCounty-227	59	--	38.53	42.8	
NapaCounty-229	-69	-87.59	-82.33	-95.93	Three Years of MT Exceedance
NapaCounty-76	-29	-22.65	-24.54	-46.78	

SMC for Depletion of Interconnected Surface Water: GW Levels

Minimum Threshold

- Minimum static October groundwater elevation between 2005-2014 (10 years prior to SGMA adoption)

  Summer/early Fall (June to October) streamflow depletion volumes exceeding the second highest seasonal volume of streamflow depletion that occurred from 2005-2014 at 2 RMS on Napa River at Pope St. and Oak Knoll Ave. [NEED MODEL]

Undesirable Result

- 20% of designated RMS well levels fall below the MT in Fall (October) for 3 consecutive years of fall measurements

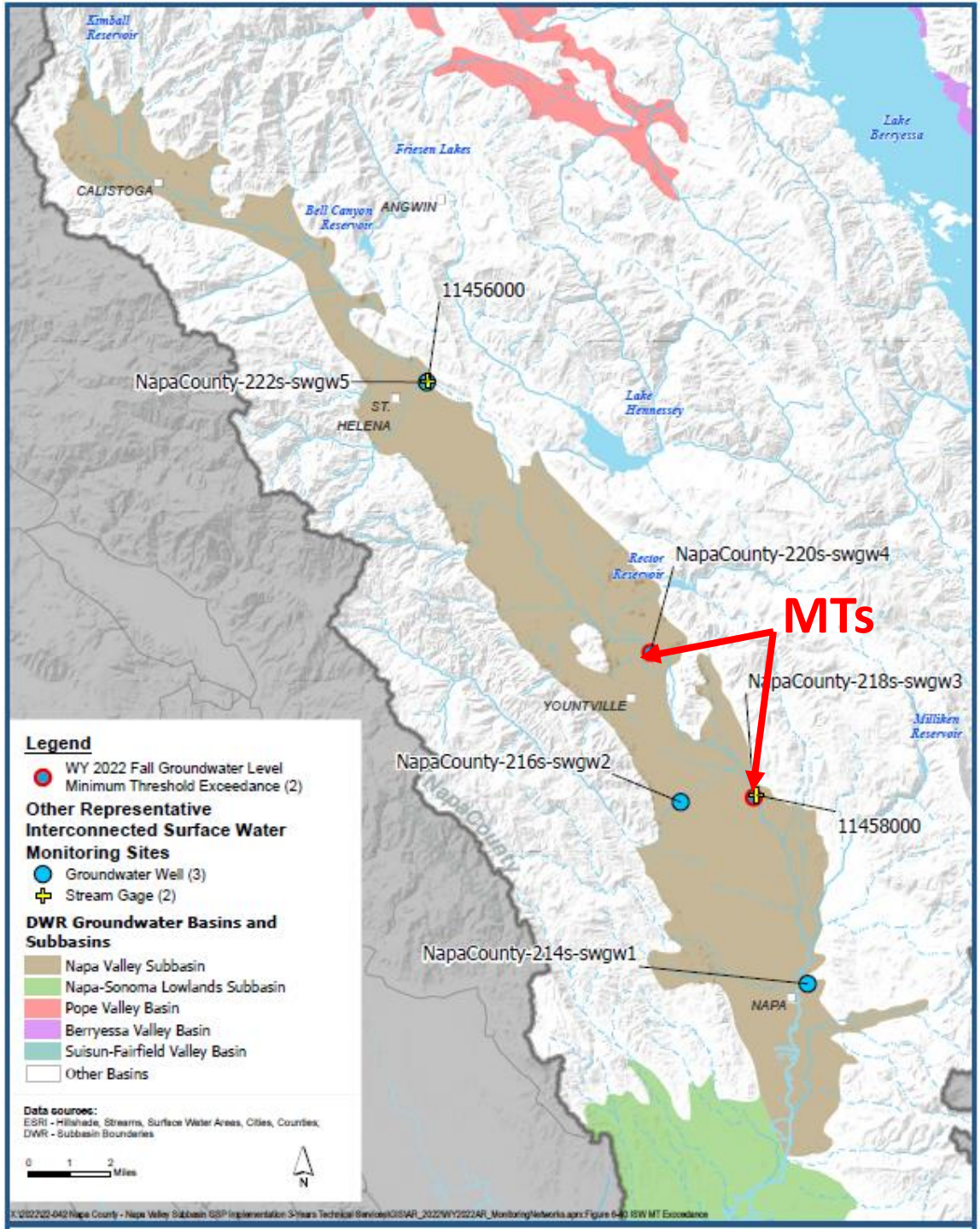
  Exceedance of MT for volume of streamflow depletion occurring 3 consecutive years at either of above stations. [NEED MODEL]

Trigger

Occurs when there is an exceedance of the MT in the Fall for Groundwater Level in a single year

Interconnected Surface Water: GW Levels and MTs

- 2 RMS/ISW wells with MT exceedances
- 1 RMS/ISW well with 3 consecutive Fall exceedances
  (north end of Northeast Napa area; Oak Knoll SW/GW site)



Interconnected Surface Water: MT Exceedance Summary for Fall 2022

Table 2 Fall Groundwater Levels with respect to Minimum Thresholds for Interconnected Surface Water

Interconnected Surface Water RMS Wells	Minimum Thresholds (ft msl)	Fall Groundwater Elevations			Comments
		2020	2021	2022	
NapaCounty-214s-swgw1	2	3.432	3.69	3.882	
NapaCounty-216s-swgw2	66	70.995	65.93	67.915	
NapaCounty-218s-swgw3	29	29.04	25.38	27.86	
NapaCounty-220s-swgw4	75	74.871	70.61	74.511	Three Years of MT Exceedance
NapaCounty-222s-swgw5	185	185.47	182.3	187.05	

- 2 of the 5 wells (40%) had MT exceedances
- 1 RMS well with 3 consecutive years of Fall MT exceedances
- UR occurred since one RMS/ISW well had 3 consecutive Fall exceedances (any water year type)

SMC for Depletion of Interconnected Surface Water: Depletion Volume

Interim Minimum Threshold

- Summer/early Fall (June to October) streamflow depletion volumes exceeding the second highest seasonal volume of streamflow depletion that occurred from 2005-2014 at 2 RMS on Napa River at Pope St. and Oak Knoll Ave. [NEED MODEL]

Interim Undesirable Result

- Exceedance of MT for volume of streamflow depletion occurring 3 consecutive years at either of above stations. [NEED MODEL]

Trigger

Occurs when there is an exceedance of the MT in the Fall for Streamflow Depletion Volume in a single year

Interconnected Surface Water and Model Results

Recent Seasonal (June to October) Streamflow Depletion Volume Estimated with NVIHM at RMS USGS Stream Sites

Well ID	Representative Site		Seasonal Depletion (AF)			WY 2022 MT Exceedance	Three Consecutive WY MT Exceedances
	Minimum Threshold (AF)	Measurable Objective (AF)	WY 2020	WY 2021	WY 2022		
11458000 (Napa River at Oak Knoll Avenue, Napa)[1]	**3,190**	2,370	740	3,829	3,120	-	-
11456000 (Napa River at Pope Street, St. Helena)[1]	**1,400**	1,120	141	1,018	1,215	-	-

1. Site name represents the location of a U.S. Geological Survey stream site where the NCGSA monitors stream depletion, calculated by the NVIHM.

- Seasonal streamflow depletion volume conditions **do not fit** the interim definition for an undesirable result.
- However, an WY 2022, **an undesirable result occurred for this sustainability indicator based on groundwater elevations.**

Reduction of Groundwater Storage

Minimum Threshold

Net GW extraction by pumping exceeding the sustainable yield for the Subbasin, where net GW extraction is the volume extracted less any volume of augmented recharge achieved by projects implemented in the Subbasin.

Undesirable Result

Seven (7) year average annual net GW extraction in the Subbasin exceeds the sustainable yield.

- UR occurred since 7-year average exceeds the sustainable yield for the Subbasin.

Sustainable Yield (Est.) = ~15,000 AFY

Year	Total Groundwater Extraction (AF)
2016	17,980
2017	14,640
2018	17,960
2019	14,340
2020	19,610
2021	22,840
2022	18,790
7 Year Avg.	**18,023**

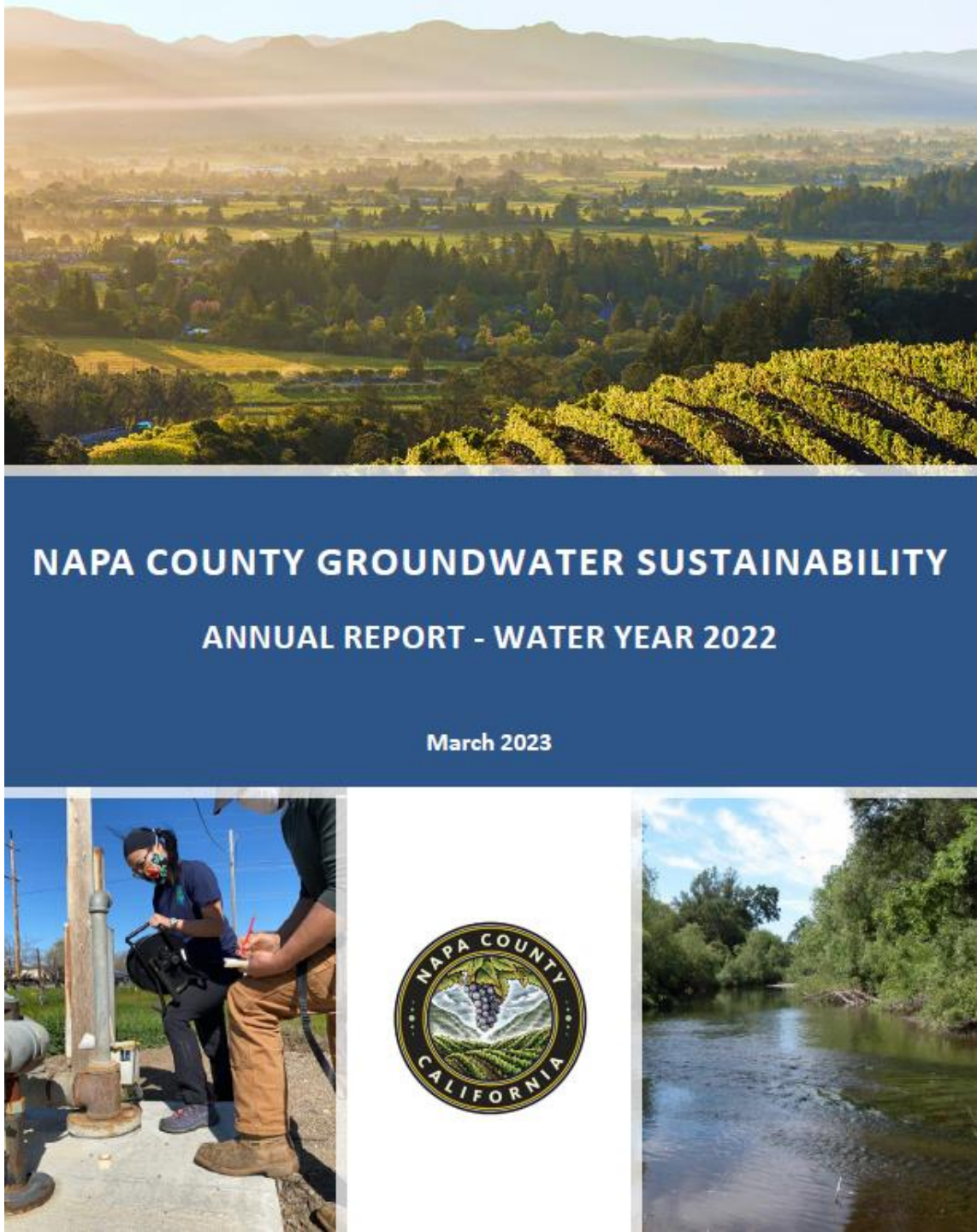
RMS Groundwater Levels: Response Action Required

- 11 RMS/Chronic GW Level Lowering wells have Fall 2022 MT exceedances
- 6 RMS/Chronic GW Level Lowering wells have three consecutive Fall MT exceedances
  - **No UR for Chronic GWL lowering since two very dry years (2020 & 2021) and one normal (below avg.) year**
- 2 RMS/ISW wells have Fall 2022 MT exceedances
- 1 RMS/ISW well has three consecutive Fall MT exceedances
  - **UR has occurred for depletion of ISW since this applies to any water year type**
- Avg. GW pumping over 7-year period exceeds Sustainable Yield
  - **UR has occurred for Reduction in Groundwater Storage (WYs 2021 and 2022)**

Sustainability Indicator	WY 2021	WY 2022
	UR: Yes or No	UR: Yes or No
Chronic GWL Lowering (CGWL)	No	No
Depletion of Interconnected Surface Water (ISW)	No	Yes
GW Quality Degradation	No	No
Reduction of GW Storage	Yes	Yes
Land Subsidence	No	No
Seawater Intrusion	No	Future evaluation

WY 2022 Annual Report: Summary

- Subbasin: GW level decline in response to drought and lack of recharge
  - Some GW replenishment due to precipitation in Oct-Dec 2021
  - Still had GW level MT exceedances in WY 2022
  - UR: Interconnected Surface Water
  - UR: Reduction of GW Storage
  - Coordination occurring for RMS Wells for GW Quality and Seawater Intrusion
- GW level declines in MST moderated before recent drought years, but drought effects observed



Response Actions & GSP Implementation

Response Actions: Near-Term and Subsequent

Very Near-Term

- Voluntary Drought Measures
- GSA: Subbasin
- County: Watershed/County
- Local: Cities/Communities
- Agricultural/Wineries

Short Term

- Stormwater Resource
- Water Conservation
- Groundwater Pumping Reduction
- Interconnected Surface Water & GDEs

Mid-Term

- ID Recharge Areas of Interest
- Explore Recharge Opportunities
- Implement Workplans
- GW Pumping Reduction Options

GSP Implementation

- NCGSA Technical Advisory Group (Kick-Off August 2022)
- Interconnected Surface Water and GDEs Workplan (Fall 2023)
- Napa County Vineyard and Winery Water Conservation Workplan (Summer 2023)
- Groundwater Pumping Reduction Workplan (Summer 2023)
- Stormwater Resource Plan (March 2023)
- Refining Water Use Data (ET: OpenET and Local Land-Based Sensors; in Progress)
- MW Installation (4 Sites/8 MWs: April 2023)
- Other MW Sites (being Evaluated)
- RCD and Stream Watch Monitoring (in Progress)
- Evaluate Potential Recharge Areas and Feasibility (in Progress)
- Stakeholder Coordination and Outreach (Ongoing)
- Coordination with Napa County Drought and Water Shortage Efforts

DWR Approved Napa Valley Subbasin GSP January 26, 2023

Thank You

Vicki Kretsinger Grabert
Luhdorff & Scalmanini, C. E.
vkretsinger@lsce.com
(530) 661-0109

Luhdorff & Scalmanini
Consulting Engineers

Napa County Groundwater Sustainability Agency

Jamison Crosby, Natural Resources Conservation Manager
Planning, Building, and Environmental Services Department
1195 Third Street
Suite 210
Napa, CA 94559
jamison.crosby@countyofnapa.org

David Morrison, ***Interim Executive Officer***
Napa County Groundwater Sustainability Agency
1195 Third Street
Napa, CA 94559

Brian Bordona, ***Interim Director***
Planning, Building, and Environmental Services Department
1195 Third Street
Napa, CA 94559