

Napa Valley Grapegrowers
Water Mitigation Strategies in Napa Valley Vineyards
*Presentation to the Technical Advisory Group for the Napa
Groundwater Sustainability Agency*

Garrett Buckland

Partner, Premiere Viticulture and Board Member, Napa Valley Grapegrowers

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Presentation Outline

PART I: Molly Moran Williams, Industry & Community Relations Director, NVG

- NVG 2022 Water-Focused Survey Results
 - Growers Want to Conserve Water
 - Water Conservation Tactics
 - Monitoring Plant Water Status
 - Water Sourcing
 - Water Use Practices in the Last 5-10 Years
 - Survey Takeaways

PART II: Garrett Buckland, Partner, Premiere Viticulture and Board Member, NVG

- Dry Viticultural Areas and Rainfall
- Application & Efficacy of Supplemental Irrigation
- Plant Adaptation
- Tactics and Farm Practices
- NVG's Proposed Data Collection Project to Improve County Water Use Model

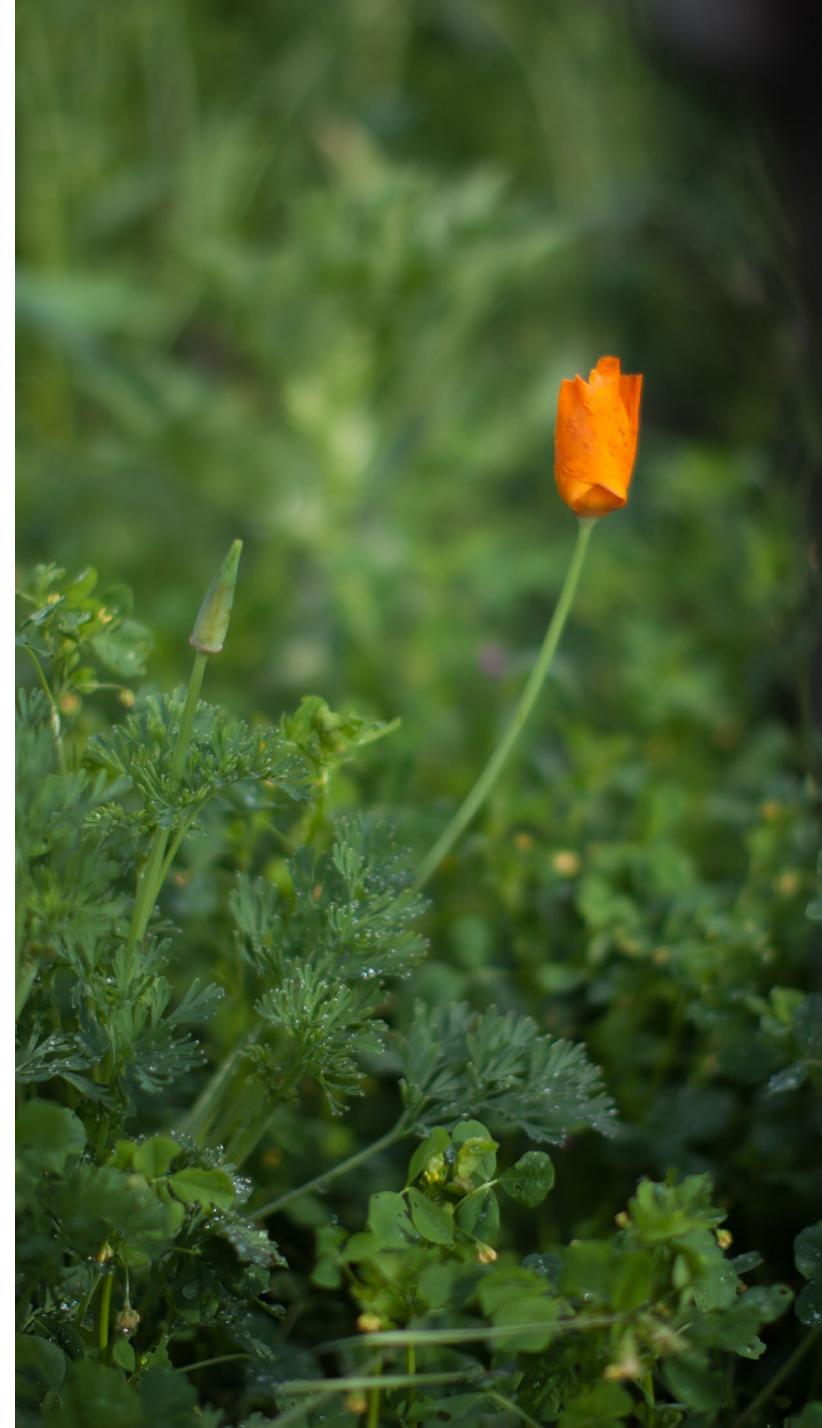
PART III: Concluding Remarks & Q&A with Molly and Garrett



Growers Want to Conserve Water

Report on Water-Focused Survey January 2022

- Napa Valley Grapegrowers conducted a water-focused survey of members in January 2022
- 91% of respondents are interested in more programs related to water use and water conservation
- Due to this interest and NVG's long track record of success in educating growers on best farming practices, NVG has received a grant from the US Department of Agriculture's Risk Management Agency to expand education on water management in a drought, converting to recycled water and complying with the Groundwater Sustainability Plan in 2023



Water Conservation Tactics

January 2022 Survey

Question: What water conservation methods do you employ in your vineyards?

Cover crops	88%
Rootstock selection	78%
Soil management practices (cultivation)	74%
Soil nutrition	59%
Vineyard trellising and design	53%
Vineyard site selection	30%
Dry farming	22%
Other*	19%

*Other includes:

- Soil moisture monitoring and sensors
- Leaf stress monitoring and sensors
- Plant and field water status monitoring
- Targeted drip irrigation



Monitoring Plant Water Status

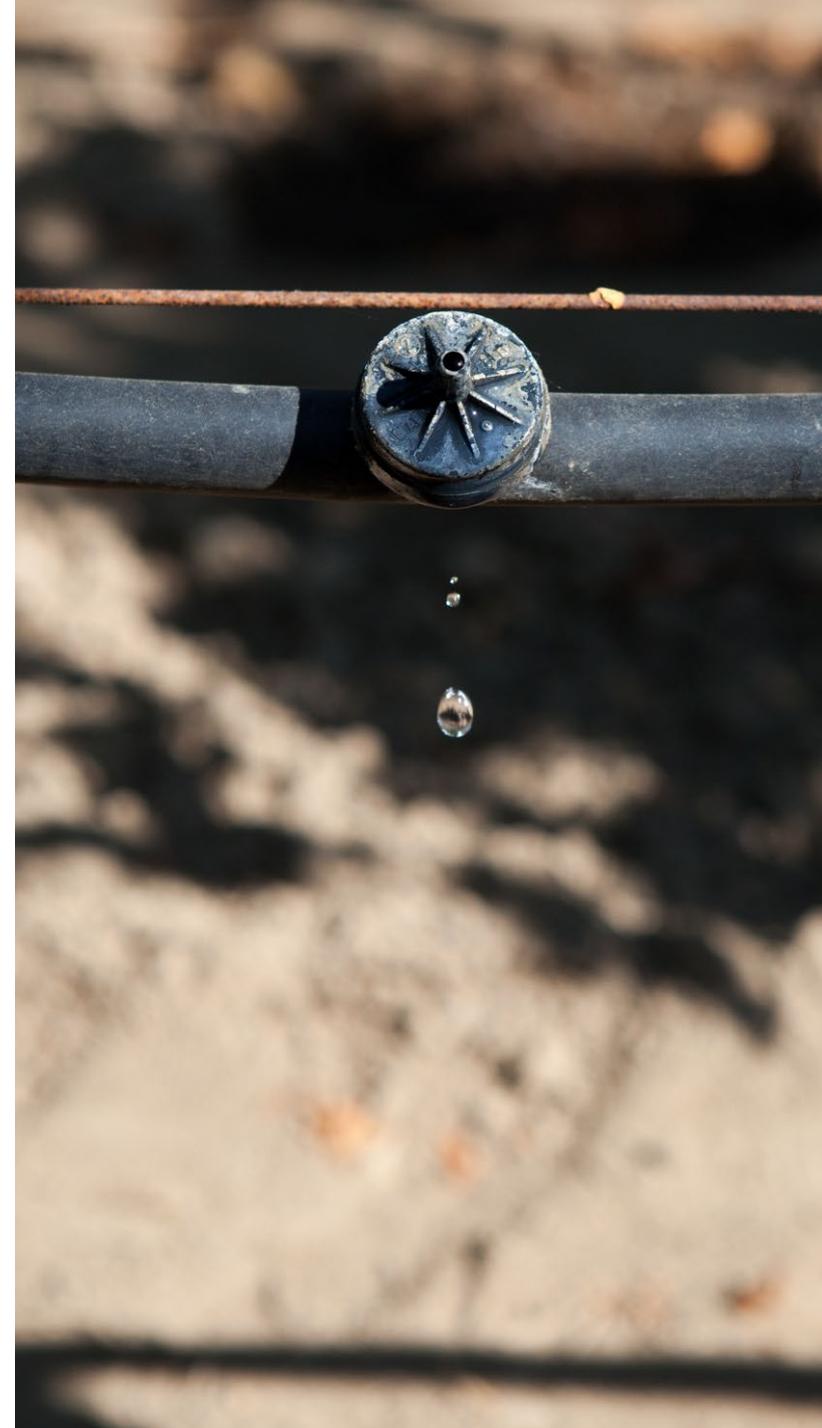
January 2022 Survey

Question: How do you monitor plant water status?

Visual symptoms in the field	79%
Soil moisture probes	53%
Pressure bombs	47%
Remote imaging (NDVI)	43%
Other*	16%
Specialized software	14%
Leaf temperature	11%
Surface renewal technology	10%
Sap flow	10%
Leaf porometer	5%

Other* includes:

- ET sensors
- Tule sensors
- Trunk microtensiometer
- Leaf temp by touch
- Dendrometer



Water Sourcing

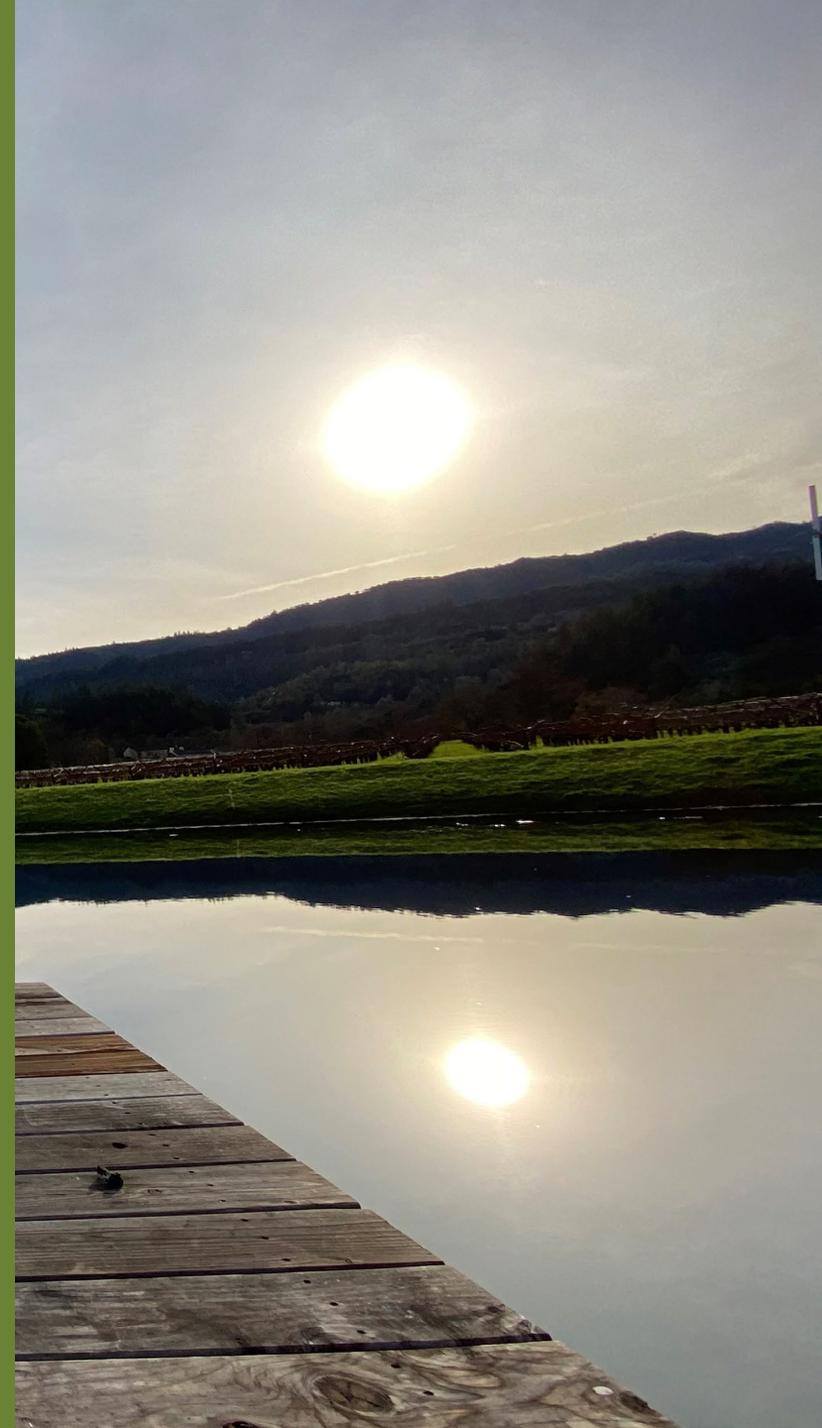
2022 versus 2015 Surveys

Question: Where do you source water for irrigation?

WATER SOURCE	2022	2015
Groundwater	84.78%	84.44%
Surface water	44.57%	44.44%
Recycled water - NapaSan	16.30%	17.78%
Municipal water	10.87%	6.67%
Water delivery by truck	9.78%	2.22%
Recycled water - private source	6.52%	NA
Other*	11.96%	NA

*Other includes:

- Ag pond and/or rain/spring fed reservoir
- Lake Hennessey
- Am Can recycled water





Water Use Practices in the Last 5-10 Years

January 2022 Survey

Question: Please explain how your water use practices have changed over the last 5-10 years.

“[Irrigation] used to be on a calendar schedule. Now its tailored to specific blocks/varietals based on climatic demand and water stress.”

“We've gotten better at monitoring our water use and are continually looking for ways to reduce consumption.”

“[We are taking a] different approach to vineyard design and rootstock choice. Defined the goal of having a self-sustaining vine, encouraging deep roots and stronger, bigger vines.”

“Doing larger, less frequent irrigations, have reduced water use by more than half in most locations.”

“All irrigation recommendations are driven by data from multiple sources.”

“Installation of subsurface delivery of drip irrigation. Monitoring of soil moisture levels combined with vineyard observation to delay and schedule irrigation. In general, using 30 percent less water than 10 years ago.”





Survey Takeaways

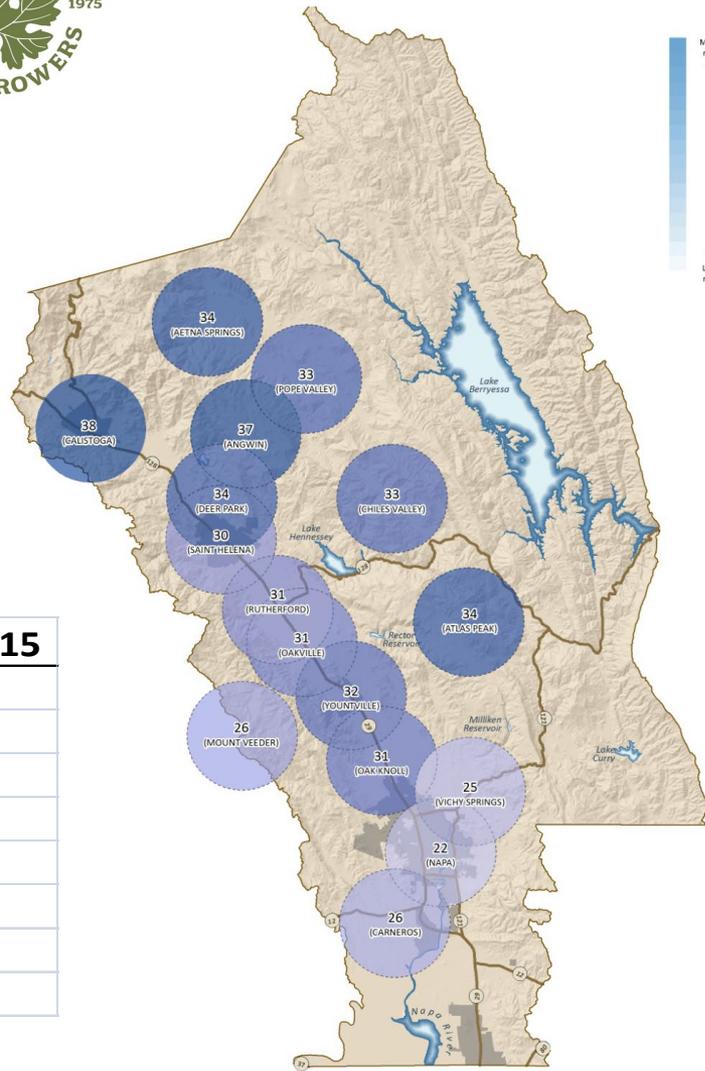
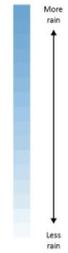
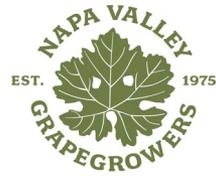
- Napa County growers want to be part of the solution when it comes to protecting communitywide water resources; growers in Napa County are deeply committed to water conservation and have been employing best practices since the beginning of this long-term drought
- There are an array of tactics currently being employed in Napa County vineyards, and in most cases several tactics are being employed; it's not a “one size fits all” approach due to different sites, soil types, vineyard designs, and farming practices
- Many growers use more than one source of water allowing for seasonal flexibility and leveraging water supplies when they are at highest levels
- As a community, we can proactively meet the goals of the GSP. We've hit a trigger when it comes to sustainable yields, which gives an opportunity to respond to achieve over all 10% reductions across the industry
- Education is desired and key in achieving the results the County would like to see; since the survey NVG has received a grant that will allow us to increase educational efforts around water conservation
- NVG is drafting additional survey questions to get more into the nuance of some of these tactics; NVG has identified willing vineyard sites when it comes to a pilot data collection program that would inform the County's GSP work plan





What are Other “Dry” Viticultural Areas?

	Average Rainfall Amounts
• California	
• Paso Robles	14”
• Fresno	11”
• Coachella Valley	3.2”
• Australia (not as dry as you’d think)	
• Barossa Valley	21”
• McLaren Vale	20”
• Washington	
• Walla Walla	20”
• Prosser	8.9”
• Western Idaho	10”
• West Texas & New Mexico	8”
• Argentina	
• Almost every area	4-8”
• Napa River Sub-Basin	22-36”



Area	Rainfall (inches) 7/1/14 - 5/28/15
Atlas Peak	33
St. Helena	32.5
Angwin	34
Calistoga	33
Rutherford	29.3
Coombsville	28.8
Oak Knoll	29
Carneros	22.6



Rainfall Total versus Rainfall Timing

- Timing is everything
 - After reaching field capacity, the plant only cares about timing of rainfall
 - Most soils in the sub basin “hold” no more than 8-10 inches of water available to grapes
 - Rainfall in April/May has a much larger outcome on the type of season than cumulative rainfall
- The last day of “field capacity” is what concerns growers in a low rainfall year
 - Nutrient status is affected in a dry spring
 - Canopy growth is affected in a dry spring
 - Supplemental irrigation can often be initiated earlier in a dry spring, but not always



Supplemental Irrigation Application and Efficiency

- Conventional tools
 - Neutron Probes
 - ET Deficit Irrigation Model
 - A Shovel
 - Our own Eyes
- Pressure Chamber
 - Pre-Dawn LWP
 - Mid-day Leaf Water Potentials
 - Stem Water Potentials
 - Porometer
- Real Time (constant) vineyard sensors
 - Weather stations
 - Soil Moisture probes
 - Sap Flow Sensors
 - Actual ET sensors (Tule Technologies)
 - Phytogram
 - Dendrometer
 - AI technology to replace Pressure the Pressure Chamber



Plant Adaptation

Grapevines are extremely drought tolerant but need to balance commercial viability with resource conservation.





Rootstocks

- Wide variety of rootstocks, many drought tolerant options
- Replanting today is focusing primarily on drought tolerance and water stress tolerance
- We have a wide variety of options for different soil types

Table 4. Rootstocks with Some Degree of Tolerance to Soil Limitations

Water Stress	Wet Soils	Saline Soils	Sodium & Chloride	Acid Soils	Alkaline Soils
99R	R. Gloire	140R	140R	99R	5BB
110R	SO4	101-14	Schwarzmann	140R	420A
140R	Schwarzmann	Schwarzmann	1616C		140R
1103P	1616C	1616C	Ramsey		
SO4	Harmony	Harmony			
5BB		Ramsey			
125AA		Dogridge			
Freedom					
St. George					
Ramsey					
Dogridge					
1616C					



Row Orientation

- Can have a dramatic impact on baseline and supplemental water use
- 30-40% reduction by shading the canopy and fruit at peak radiation intensity 1:00-4:00pm mid-summer
- Most vineyards being replanted to better row orientations than 30 years ago



Canopies

New, fleshy leaves using water-inefficiently

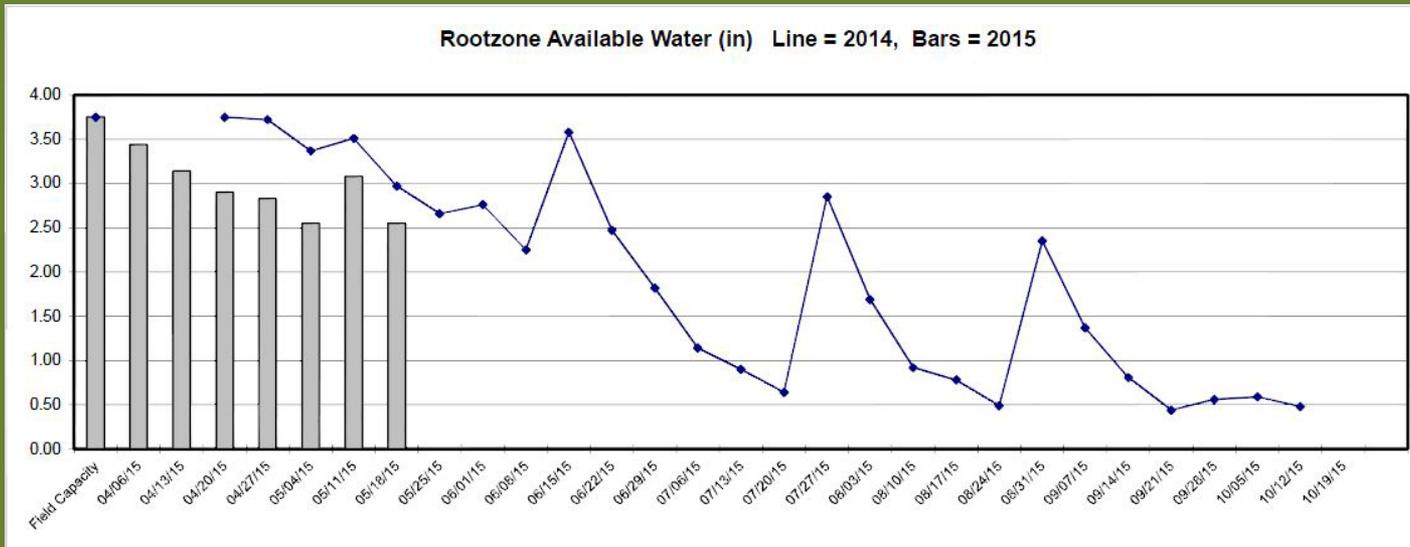


Water-conserving canopy





Soil Moisture View of Drip Irrigation: Drip Irrigation Delays Soil Drying Trend





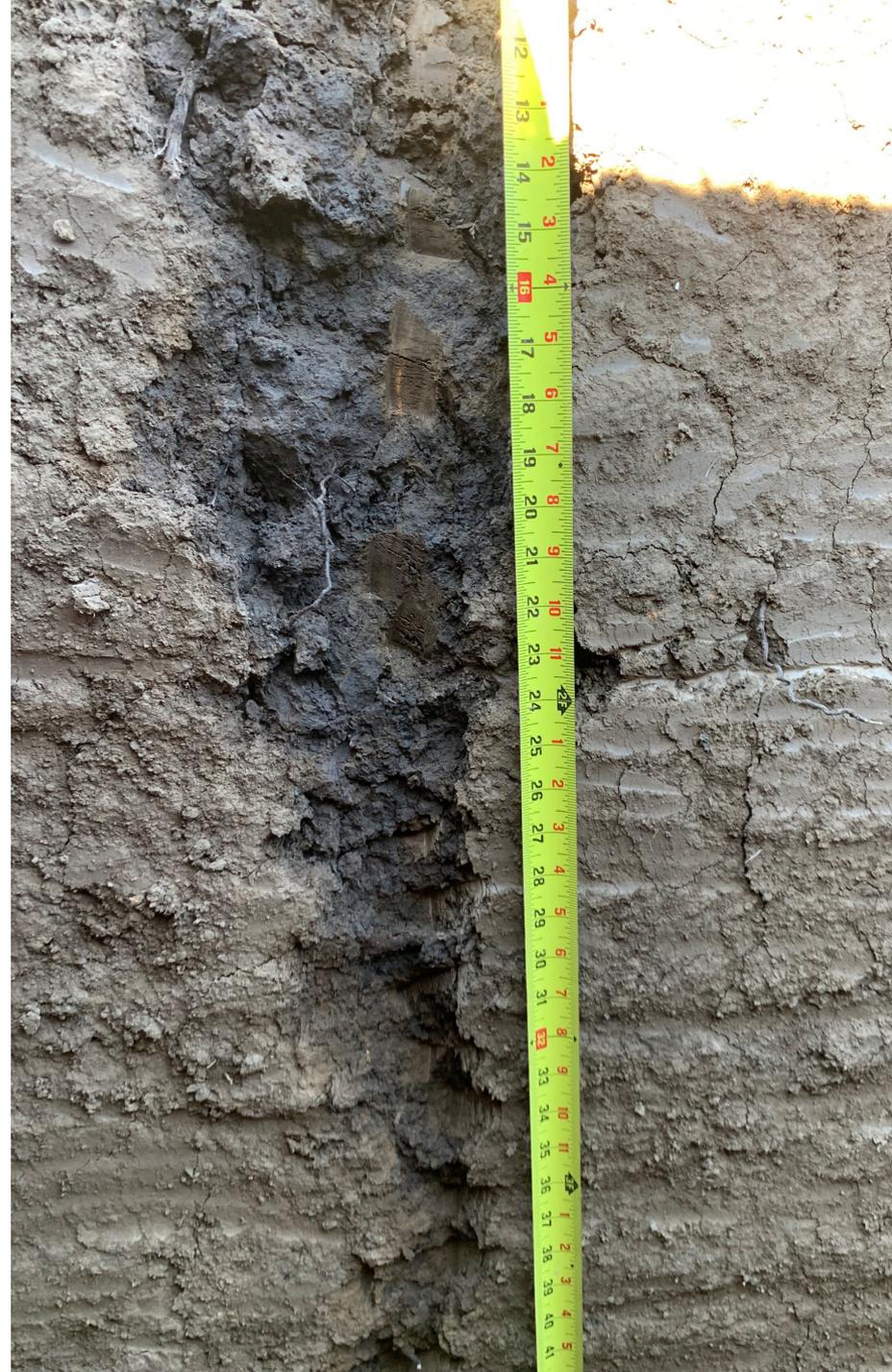
Proposed Data Collection to Improve Water Use Model

- Choose 5 representative volunteer sites throughout the basin
 - Collect water usage data on well water, surface water, recycled water
 - Collect method of use i.e. drip, overhead, microsprinklers, misters, etc...
 - Classify main soil types, water holding capacity, depth, clay content, depth to hardpan, etc...
 - Aggregate historical usage, integrate ET modeling through weather station and crop coefficients
 - Document cover crop usage and estimated increase in water usage
 - Interview property manager about water use strategy and changes over time
 - Test captured data against assumptions in the model and revise data collection as needed to improve water usage estimates
- Query membership on water use trends, decision making around water use over time



Example Site: Yountville Area

- Yolo Loam
 - A horizon 0-24” Silt Loam
 - C1 horizon 24-45” Silt Loam
 - C2 horizon 45-60” Silt Loam
 - Restrictive layer at 80+”, no rust mottling
 - Effective rooting depth 80”
 - Fairly well drained
 - Hydrologic soil group B
 - Medium susceptibility to compaction
 - Plant available water: 0-150 cm (effective rooting depth): 30 cm (11.8”)





Example Site: Yountville Area

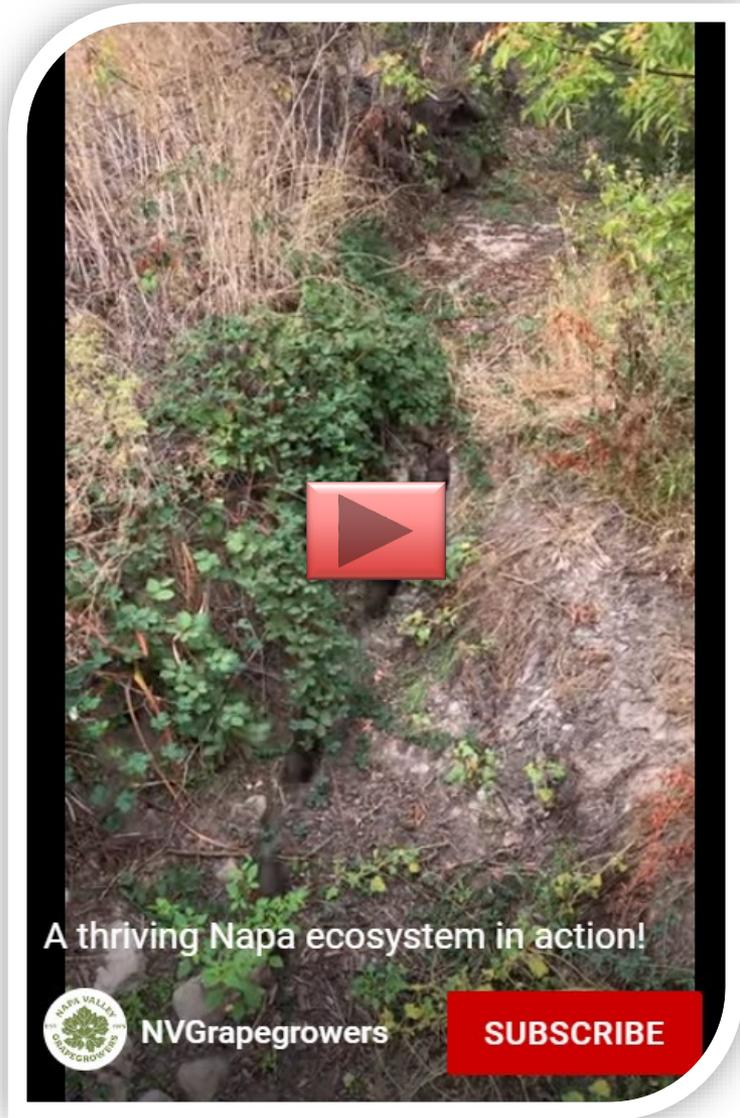
- Vineyard Details
 - 3309 Rootstock (medium drought tolerance)
 - Cabernet Sauvignon
 - Average Length of season budbreak-harvest: 180 days
 - Row orientation: 35 degrees east of north (low water use orientation)
 - Seasonal Kc factor = .65 (VSP with crossarms)
 - Average supplemental drip irrigation = .21 acre ft/acre/year
 - No frost sprinklers used, no heat mitigation
 - Onsite rainfall average = 32"
 - 100% well water use
 - 50% disked, 50% Fescue permanent cover crop





The Otters of Bale Slough!

An example of the volunteer efforts being taken on by growers is the restoration of Bale Slough. Saving water isn't just about using less, but also supporting the natural systems that help our aquifers recharge.





Q&A and Additional Resources

Napa Valley Grapegrowers Community Resources:

- [Heat & Drought](#)
- [Climate Resilience](#)
- [Napa County's Conservation Landscape](#)

Contact:

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