MANAGING WATER USE FOR IRRIGATION AND FROST PROTECTION (LEVEL II CERT)

Background: Efficient irrigation management maximizes crop production and quality, while minimizing water losses caused by leakage, runoff, evaporation, and deep percolation. It applies enough water to meet essential plant needs, but no more. Water applied during irrigation benefits crop growth by providing moisture for plant respiration and metabolism, preventing the build-up of salts in the root zone, and in some cases moderating the air temperature around the crop. Irrigation that causes water to run off or percolate beyond the root zone wastes water and energy, increases greenhouse gas emissions, and may contribute to surface water or groundwater pollution.

See chapter 9 of the Resource Guide for more information on managing water use for irrigation and frost protection, including BMP descriptions, irrigation evaluation information, and information related to frost protection technology.

Purpose: Identify practices, currently in use or intended for implementation, to ensure that water is used efficiently.

Water Sources and Management

I1. Check all sources of water and infrastructure that are utilized.

☐ Surface Water (If yes, describe below whether you have a water right or where you are in the process of obtaining a water right.)

☒ Ground Water

☐ Municipal Water

☐ Mutual Water Company Water (from off-site)

☐ Reclaimed / Recycled Water (from off-site)

☐ Reclaimed / Recycled Water (from site)

☐ Harvested Rainwater

☐ Pond

☐ Storage Tank

☐ Other (list)

Describe as needed:

I2. If surface water is diverted from waterways, a fish screen is in place, as required by National Marine Fisheries Service and California Department of Fish and Wildlife?

☐ Yes

☐ No (Practice # 34 listed in Table I1 below may be required)

☒ N/A (No surface water diversion on-site OR surface water diverted only from off-stream pond)

Describe as needed:

I3. Check all systems that are utilized.

☒ Drip/micro irrigation system

☐ Sprinkler for irrigation (Implement practice # 2, listed in Table I1 below)

☐ Sprinkler for frost protection

☐ Wind Machine

☐ Cold air drain

☐ Other (list)

Describe as needed:

I4. Irrigation and/or frost protection systems were designed by an agricultural engineer, irrigation system designer, irrigation consultant, or other professional.

☒ Yes

☐ No (Consider practices # 1 and 33 listed in Table I1 below)

Describe as needed:

I5. How old is the irrigation system?

Block A, B, C, D, E, G approximately 25 years old. Block F, 1-year-old (2016)

I6. Irrigation is scheduled and applied according to plant needs as determined by soil water and plant stress monitoring and management tools (e.g., gypsum blocks, neutron probes, tensiometers, volumetric and capacitance soil probes, leaf pressure bombs, porometers, CIMIS, weather stations, other ET monitoring systems, etc.) and visual observations.

☒ Yes (Describe which tools are used)

☐ No (Consider practices # 6 and 7 listed in Table I1 below)

Weekly monitoring includes soil moisture monitoring with an Aquacheck capacitance probe; vine water stress is measured using a pressure bomb (leaf water potential) and leaf porometer (stomatal conductivity), and visual monitoring of shoot tips and vine vigor. NDVI is used on a bi-weekly basis.

I7. Water management techniques such as delayed onset of irrigation, dry farming, regulated deficit irrigation, and partial root-zone drying are considered and used to meet viticultural and conservation goals.

☒ Yes (Describe which techniques are used)

☐ No (Consider practices # 5, 6 and 8 listed in Table I1 below)

The onset of irrigation is delayed until late June to early July, mainly by monitoring the soil moisture and irrigating when it reaches the critical Allowable Soil Moisture Depletion level. Regulated Deficit Irrigation is practiced as a general technique to control vine vigor and produce higher quality grapes.

I8. Professional services for water, plant stress and ET monitoring are utilized?

☒ Yes (Describe services utilized)

☐ No (Consider practices #1 listed in Table I1 below)

Professional services are utilized for the installation and maintenance of the soil moisture probes. All plant and water stress, and ET monitoring is conducting in house with a seasonal intern.

I9. Irrigation and frost protection (if applicable) systems are monitored for leaks and performance, and maintained regularly.

☒ Yes (Describe how often and briefly describe your monitoring protocol)

☐ No (Consider practices #4, 10, 12 through 16, and 24 listed in Table I1 below)

Describe, as needed: at least twice a month during irrigation system RCD vineyard manager walks through blocks during irrigation. Additionally, monitoring the flow meter allows detection of leaks.

I10. On a scale of 1-10, 10 being the best, how would you rate the performance of your system?

Rate and describe why you selected the performance rating: 6. There are some blocks that have poor distribution uniformity due to considerable emitter variation.

I11. If there are noticeable issues with the irrigation system, are irrigation evaluations conducted? For example: distribution uniformity, pump capacity or well production test, or similar evaluations.

☒ Yes (Describe evaluations conducted)

☐ No (Consider practices #1, 3, and 16 listed in Table I1 below)

Distribution Uniformity rating evaluation have been completed in many blocks throughout the vineyard. Yearly water quality tests are conducted to monitor and address the salinity issue.

I12. Irrigation emitters are checked and replaced before and during irrigation season?

☒ Yes (Describe your protocol)

☐ No (Consider practices #4 and 1, listed in Table I1 below)

Describe as needed: Before the irrigation season officially begins, all irrigation blocks are turned on and general maintenance is performed, including, replacing emitters, or unplugging emitters by injecting a drip cleaner acid solution.

I13. Water use is monitored with a flow meter and documented.

☒ Yes (Indicate type of meter and how often you check and log readings)

☐ No (Consider practice # 17 listed in Table I1 below)

Describe as needed: Netafim 3" WST Water Meter. We recorded the flow meter readings after every irrigation event.

I14. Water use is estimated by tracking pump hours and multiplying by flow rate, or other method?

☐ Yes

☒ No (Consider practice # 17 listed in Table I1 below)

Describe as needed: We monitory water use with a flow meter

I15. Reclaimed, recycled and harvested water are utilized to the extent practicable.

☐ Yes (Describe roughly what percent and any issues you have with the water)

☒ No (Consider practices #18 through 20 listed in Table I1 below)

Describe as needed:

I16. If there are pond(s) on the property, are they maintained to reduce leaking and evaporation?

☐ Yes (Describe what practices you use)

☐ No (Consider practices #21 and 22 listed in Table I1 below)

☒ N/A (no ponds on property)

Describe as needed:

I17. If a pump is used in your irrigation or frost protection system, does the pump have a Variable Frequency Drive (VFD)?

☒ Yes (Describe your VFD system)

☐ No (Consider practice #11 listed in Table I1 below)

☐ N/A (no irrigation pumps are used)

Describe as needed: 7 – ½ HP, 230 Volt, 3 phase VFD

I18. Would it benefit the operation if more irrigation blocks could be run at the same time?

☐ Yes

☒ No

Describe as needed:

I19. Are the block manifold valves controlled by electric valves and timers?

☒ Yes (Consider practice #10 listed in table I1 below)

☐ Some (Consider practice #9 listed in table I1 below)

☐ No (Consider practice #9 listed in table I1 below)

Describe as needed:

I20. Do you use automated communication devices (telemetry) to assist with your scheduling and irrigation?

☒ Yes (Describe your system)

☐ No (Consider practice #9 listed in table I1 below)

Describe as needed: Ranch Systems is used to open and close the irrigation valves and monitor the flow rate in real time.

I21. Are there clogging and plugging issues at the filter or within the emitters?

☒ Yes (Describe the issues) (Consider practices # 14, 15, and 24 through 26 listed in Table I1 below)

☐ No

Describe as needed: Old emitter clogging due to poor filtration system. The filter has been upgraded and the filtration has eliminated many solids entering the system. However, there are still old emitters in the vineyard that are slightly plugged and need to be replaced.

I22. Are the ends of drip hoses flushed at least annually?

☒ Yes (Describe how long it takes for the water to run clear and what types of materials (e.g., sediment/organics) are discharged from the flush)

☐ No (Consider practices # 14 and 15 listed in Table I1 below)

Describe as needed: water runs clean after a second

I23. Irrigation water quality is tested regularly?

☒ Yes (Describe how often, when was it last tested, and list any constituents of concern)

☐ No (Consider practice # 27 listed in Table I1 below)

Well water is tested since 2015 and will be monitored each year due to concerning levels of salts and high pH.

I24. How old is your filtration system?

Brand new in 2016

I25. Irrigation filter systems are cleaned regularly?

☒ Yes (Describe how often)

☐ No (Consider practice # 24 listed in Table I1 below)

Describe as needed: The filtration system is automatically flushed every 24 hours, or when there is a pressure differential of at least 5 psi.

I26. Does the main filter at the pump have an automatic back-flushing system?

☒ Yes

☐ No (Consider practice # 26 listed in Table I1 below)

I27. Are you implementing any practices to infiltrate more water into the soil or retain more onsite?

☒ Yes (Describe practices)

☐ No (Consider practices #29 and 30 listed in Table I1 below)

Compost and gypsum application. Cover cropping. Future plans to incorporate subsoiling techniques such as plowing with Yeoman's plow which promotes deep water percolation and sheet flow attenuation/ infiltration.

I28. Do you manage water in the soil through the use of cover crops?

☒ Yes

☐ No (Consider practices #28 and 31 listed in Table I1 below)

Describe as needed: yes, non-tillage cover cropping creates competition with vines for water and control vine vigor.

I29. Do you utilize practices that reduce compaction from heavy equipment?

☒ Yes (Describe practices)

☐ No (Consider practice # 32 listed in Table I1 below)

Describe as needed: The main access and avenue networks around the vineyard are not traveled unless the top soil has drained enough to allow vehicle traffic without creating rutting or compaction. All tractor work throughout the vineyard is delayed and timed in late winter and early spring so that the top soil is not super saturated, and dry enough to allow equipment operation without rutting and or tire compaction.

Cover crops are planted every year in the tillage rows, and the non-tillage permanent covers promote strong soil structure and optimal water infiltration.

There are some areas within the non-tillage rows that are compacted, and need to be addressed. The long term plan will be to incorporate subsoiling techniques, such as Keyline plowing, to break up the compaction and enhance storm water infiltration and subsoil moisture recharge.

I30. Do you have replanting plans that might allow for irrigation system redesign or improvement?

☒ Yes (Consider practice #33 listed in Table I1 below)

☐ No

Where replanting occurs we will resign the irrigation system to improve pressure and efficiency.

I31. Do replanting plans include soil analysis for selecting site appropriate and or drought-tolerant rootstock?

☒ Yes (If information is known, describe below)

☐ No (Consider practice #23 listed in Table I1 below)

☐ N/A (no replant planned)

This is standard procedure for replanting.

I32. Are there other water management issues you would like to address?

Describe as needed: There are high sodium and pH levels under the drip zone as a result of high Sodium Adsorption Ration in the well water. We need to select a water treatment plan to dissolve Na in solution at the pump discharge, and or use Sonoma's Recycled water line, which is capped at the northern corner of the property. Currently, gypsum is applied under the vine to leach out the Na and replace Na with Ca after winter rains. Because the well is ~15 feet from the creek, there is a chance that the well may be drawing subsurface streamflow in addition to groundwater. Well pumping generally begins in early to mid-June, with two irrigation events over 24 hours each in June (total of 60,000 gallons per event) usually after the reach goes dry in May/June. If pumping affects stream flow, and pumping occurs in spring, there is potential to impact outmigrating steelhead smolts. Future management may include plotting the pumping schedule on a hydrograph to better assess potential impacts to the stream. Reducing use of well water and pursuing options to irrigate with Recycled water will have co-benefits in reducing sodium build up and potentially reducing impact to stream flow in Huichica Creek.

Table I1: Conservation Practices for Managing Irrigation

The following table provides an assortment of management practices that are used to improve and maximize water use efficiency. Implementation of all practices is not necessary or required. Selection of practices must be done on a site-specific basis. An assortment of practices to suit your circumstance should be selected. NRCS Practice Titles are provided for your reference and you should consider contacting your local NRCS or RCD field office for technical and/or possible financial assistance.

Conservation Practice	*NRCS Practice Title*	*Current Practice*	*Planned Implementation Date / Status*	*Location / Notes*
1. Consult a Professional		☐		
2. Convert to a drip irrigation system	Irrigation System, Micro-irrigation (441)	☒		
3. Conduct a distribution uniformity evaluation and implement system improvements accordingly (every 3-5 years recommended)	Irrigation Water Management (449)	☒		
4. Check and replace or clean broken or dysfunctional emitters on a regular basis	Irrigation System, Micro-irrigation (441)	☒		
5. Determine yearly water budget for vines, integrating regulated deficit irrigation strategy		☒		
6. Install and utilize soil moisture monitoring devices, remote sensing and telemetry devices	Irrigation Water Management (449)	☒		
7. Install and utilize a weather monitoring system or utilize a near-by CIMIS weather station to inform irrigation and frost protection scheduling	Irrigation Water Management (449)	☒		CIMIS station located 200 feet from the vineyard.
8. Delay onset of irrigation by observing shoot tips and utilizing soil and plant stress monitoring	Irrigation Water Management (449)	☒		
9. Integrate timers, controllers, and telemetry into the irrigation system	Irrigation Water Management (449)	☒		

Conservation Practice	*NRCS Practice Title*	*Current Practice*	*Planned Implementation Date / Status*	*Location / Notes*
10. Update controllers and timers throughout season to match actual water needs		☒		
11. Integrate Variable Frequency Drives with your irrigation system	Pumping Plant (533)	☒		
12. Conduct system test annually, prior to frost and/or irrigation season.		☒		
13. Conduct regular monitoring (for leaks and other issues) during the season of use and repair as necessary.		☒		
14. Flush hose lines on a regular basis		☒		
15. Conduct end of season system maintenance to clear lines		☒		
16. Conduct pump efficiency tests and retrofit pumps as needed		☐		
17. Install and utilize flow meters to monitor and record water use	Irrigation Water Management (449)	☒		
18. Consider options for reclaimed / recycled water, including possibility of recycled water from local treatment plants that may be available for trucking		☒		Recycled water pipeline from Sonoma County Water Agency is capped off on the property. Tentative plans are in place to purchase the water and developed the infrastructure.
19. Install bioreactors to manage wastewater and create additional irrigation supplies	Denitrifying Bioreactor (747)	☐		
20. Consider rainwater harvesting (i.e. tanks and ponds) and storage, particularly if there are large buildings on-site	Water Harvesting Catchment (636)	☐		No buildings
21. Install pond liners and covers	Pond Sealing or Lining (521)	☐		No ponds
22. Inspect ponds for leaks, clogging and other issues		☐		No ponds

Conservation Practice	*NRCS Practice Title*	*Current Practice*	*Planned Implementation Date / Status*	*Location / Notes*
23. Upon replant, consider rootstocks and varietals that are more drought tolerant		☒		
24. Regularly clean and inspect filters		☒		
25. Replace or upgrade filtration equipment	Irrigation System, Micro-irrigation (441)	☒		New filtration system in 2016
26. Install and utilize an auto backflush system at the filter near the pump	Irrigation System, Micro-Irrigation (441)	☒		
27. Test water quality at a lab every 2-3 years	Well Water Testing (355)	☒		Every year.
28. Build organic matter in soil with cover crops and/or compost applications	Cover Crop (340)	☒		Both are done
29. Increase infiltration with swales, infiltration trenches, catchment basins, and other means	Grassed Waterway (412) Sediment Basin (350)	☒		Wetland on property
30. Investigate opportunities to catch surface waters and tile drain water in ponds, and divert to infiltration zones	Water and Sediment Control Basin (638)	☐		
31. Manage water in soil through use of a cover crop	Cover Crop (340)	☒		
32. Reduce soil compaction by limiting use of heavy equipment and repetitive passes		☒	2017	Working on plan to reduce compaction in no-till blocks with subsoiling equipment
33. Redesign and improve irrigation system when replanting		☒		Remaining blocks will be replanted within next ten years
34. Install a fish screen where natural surface waters are diverted	Structure for Water Control (587)	☐		
Other:		☐		

Water Management for Frost Protection

I33. Water is used for frost protection.

☐ Yes (Describe approximately how much is used per frost event, consider practices # 5 or 6 in Table I2 below)

☒ No (If frost damage is an issue you wish to manage, consider practices # 2 through 6, 8, and 10 in table I2 below. Skip the remainder of section)

Describe as needed:

I34. Passive frost protection methods (e.g. timed mowing of cover crops, creating air barriers, planting varieties and rootstocks with later budbreak) are utilized.

☒ Yes (Describe what passive methods are used)

☐ No (Consider practices # 3, 4, 8, and 10 in table I2 below)

Describe as needed:

I35. Water, as a frost management tool, is utilized only in areas where alternative practices are not feasible.

☐ Yes (Identify on a map, or describe below, where water is the only feasible frost protection method)

☒ No (Consider practices # 3, 4 and 7 through 10 in table I2 below).

Describe as needed: N/A

I36. The frost protection system is turned on based upon the factors of temperature and humidity (wet-bulb temperature or forecast dew point) and turned off as soon as danger has passed.

☐ Yes

☒ No (Consider practice # 9 and 11 in table I2 below).

Describe as needed: N/A

Table I2: Conservation Practices for Frost Protection

The following table provides an assortment of management practices that are intended to improve water use efficiency. Implementation of all practices is not necessary or required. Selection of practices must be done on a site-specific basis. An assortment of practices to suit your circumstance should be selected. NRCS Practice Titles are provided for your reference and you may contact your local NRCS or RCD field office for technical and/or possible financial assistance.

Conservation Practice	*NRCS Practice Title*	*Current Practice*	*Planned Implementation Date / Status*	*Location / Notes*
1. Consult a Professional		☐		
2. Identify potential frost hazard areas		☐		
3. If feasible, mow cover crop and keep it short during the frost season		☒		
4. Install or remove “air barriers” to optimize air drainage and prevent pooling of cold air in vineyard areas		☐		
5. Install wind machines in areas where noise pollution is not a consideration		☐		
6. Install cold air drains in frost pockets where wind machines are not an option		☐		
7. Convert to a system of microsprayers		☐		
8. Upon replant, consider alternative frost protection methods, including planting varieties and rootstocks with later bud-break, to shorten frost hazard period		☐		
9. Use available weather, temperature, and humidity information to make informed decision about the timing of frost protection.	Irrigation Water Management (449)	☐		
10. Delay pruning, and/or prune in two stages, to delay vine growth and shorten frost hazard period		☒		
11. Use professional services to monitor weather and frost events		☒		
Other:		☐		