Russian River Watershed Conservation Council

855 Bordeaux Way, Suite 100
Napa, CA 94558

September 1, 2015

Ms. Barbara Evoy
Deputy Director, Division of Water Rights
State Water Resources Control Board
P O Box 100
Sacramento, Ca 95812

Re: 2015 Annual Report for Russian River Watershed Conservation Council

Dear Ms. Evoy,

In February, 2015 the Russian River Watershed Conservation Council (Council) identified itself as a governing body for the Sonoma County reach of the Russian River *Water Demand Management Program (WDMP)* and provided a list of participating grape growers. The Council also committed to submit, by September 1, 2015, an *Annual Report* associated with the 2015 frost protection activities of the Council's participants. The Council coordinated all data collection and report activities through the North Coast Water Coalition.

The attached document prepared by Dr. Matthew Deitch of the Center for Ecosystem Management and Restoration, titled *Risk Assessment for the Use of Water for Frost Protection in the Russian River Drainage Network, Sonoma County:* North Coast Water Coalition (Risk Assessment) contains the following:

1) An updated inventory of gages;
2) stream stage monitoring data;
3) a Risk Assessment by sub-watershed; and
4) recommendations to monitor and protect stream stages.

This letter serves as confirmation that the Council met and shared the attached report with National Marine Fisheries Service (NMFS) and the California Department of Fish and Wildlife (CDFW). Both NMFS and CDFW will be forwarding a letter to your attention detailing their response to the information and recommendations detailed in the *Risk Assessment*.

Should you have any questions regarding the attached document, please do not hesitate to contact me at (707) 480-2585 or by email at dmcilroy@rodneystrong.com.

Sincerely,

Doug McIlroy
Russian River Watershed Conservation Council

cc: David Hines
National Oceanic and Atmospheric Administration
david.hines@noaa.gov

Corinne Gray
California Department of Fish and Wildlife
Corinne.gray@wildlife.ca.gov

Risk Assessment for the Use of Water for Frost Protection in the Russian River Drainage Network, Sonoma County

North Coast Water Coalition

August 31, 2015

1. Introduction

Monitoring effects of frost protection water use on water levels in the Russian River drainage network is a complex water management issue, spanning a variety of geographies and microclimates, with hundreds of stakeholders and several different methods employed to protect grapes from frost. The State Water Board's new regulation for frost protection requires all Water Demand Management Plans (WDMPs) to include a risk assessment to evaluate the potential for fish stranding and mortality caused by instream diversions during the frost season. The North Coast Water Coalition is the first self-regulating group in Sonoma County to address this frost protection regulation at a countywide scale. The overall objective of this Risk Assessment Report is to evaluate whether water use for frost protection among agricultural producers registered with the North Coast Water Coalition (NCWC) cause a measureable change in water level in the Sonoma County portion of the Russian River and its tributaries. This report examines areas in the Sonoma County portion of the Russian River watershed potentially effected by frost protection and provides insights on how to narrow down monitoring efforts in areas where there are likely no impacts to aquatic habitats, as well as ways to expand monitoring efforts where it is needed to better understand impacts of frost water use. This first assessment of water use related to the frost protection regulation provides a solid foundation to build and develop tools in future protection risk assessments.

In this Risk Assessment, stream stage (which describes water levels in streams) is used as an indicator to whether frost protection water use has the potential to affect instream habitat conditions. We use stage data from 41 stream gauges in Sonoma County, operated by organizations including the US Geological Survey, National Marine Fisheries Service (NMFS), State Water Board (SWRCB), the Russian River Property Association (RRPOA), and CEMAR, which were identified by the North Coast Water Coalition as gauges currently in operation. This report is organized by sub-region to help focus the analysis of water level data area to determine whether and where water levels change irregularly during the frost protection season. The focus by

sub-region is also helpful to examine frost protection water use among registered grape growers and whether any changes in stream levels on days when water was used for frost protection propagated downstream.

This report also includes a general summary of potential locations to be used in 2016 to monitor areas that are currently not covered by the 41 stream gauges documented in this report. In addition, this Risk Assessment outlines a set of methods that could be used in 2016 to evaluate the extent of salmonid habitat loss caused by changes in water levels from frost protection, and corrective actions that could be employed to prevent these changes from happening. Finally, this report describes additional observations and factors in each watershed that may potentially complicate the extrapolation of stage data to the entire drainage network, such as locations and reasons why water level dynamics in each stream reach could be different from the collected data.

2. Study Area

For this study, the Sonoma County portion of the Russian River was divided into six main focus areas: Alexander Valley, Maacama Creek, Dry Creek, Mark West Creek, Santa Rosa Plain, and the Lower Russian/Green Valley area (Figure 1).

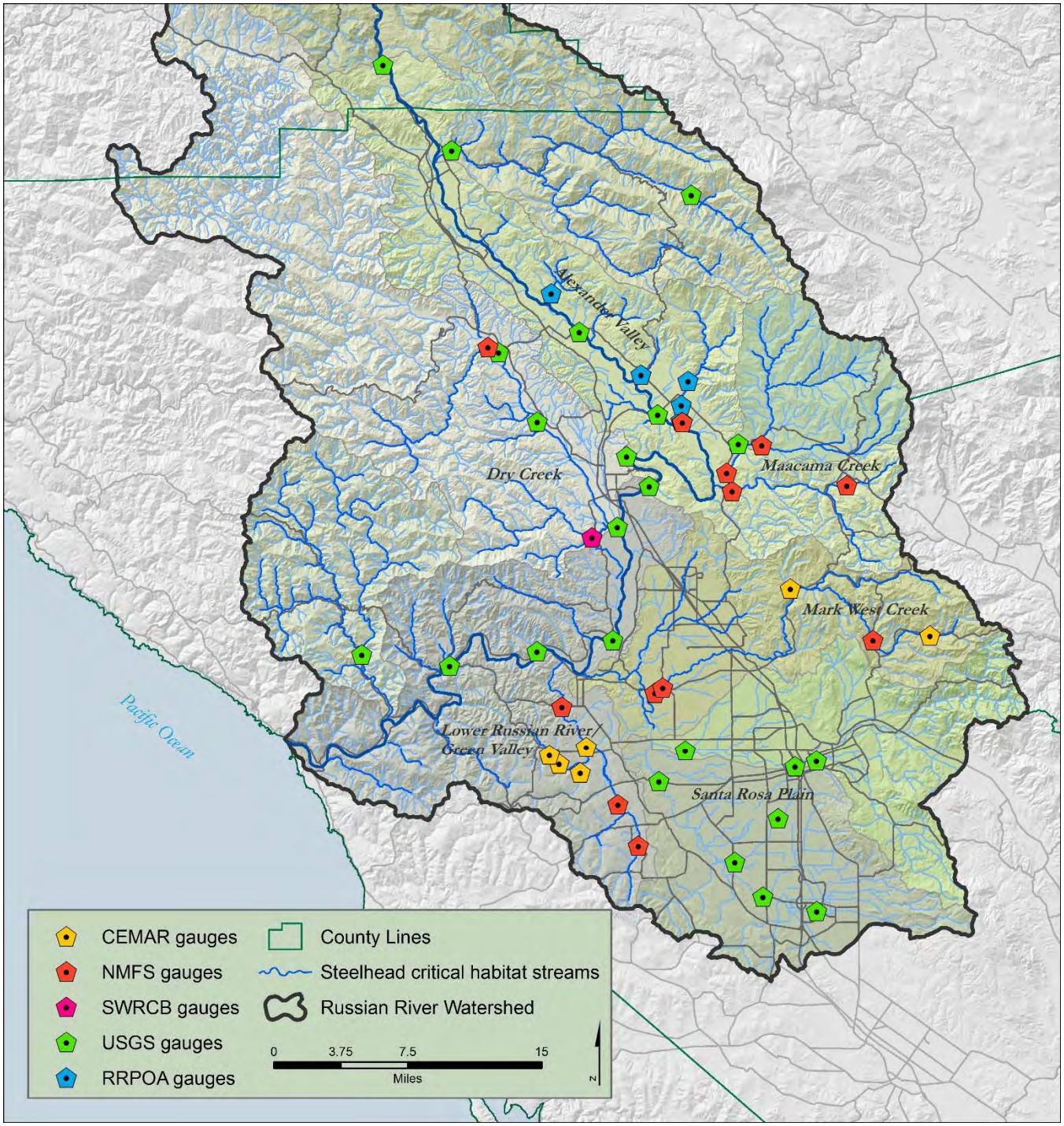

Figure 1. Locations of gauges used for the NCWC Frost Risk Assessment analyses.

3. Methods

Water level data

Several organizations operated water level monitoring instruments in the Russian River and its tributaries in spring 2015. The US Geological Survey operates several gauges in the Russian River and Dry Creek as well as within the Santa Rosa Plain, Big Sulphur Creek, and Austin Creek. NOAA and the State Water Board installed gauges in the Green Valley, Mark West, and Maacama Creek drainage networks. CEMAR operated gauges in the Green Valley Creek and Mark West Creek drainage networks. The Russian River Property Owners Association operated gauges in Alexander Valley tributaries Sausal, Gird, and Gill Creeks. All of these gauges were set to log the level of the water every 15 minutes; this interval is sufficient to identify whether stream water level changed as a result of upstream water management actions. Gauges operated by CEMAR and NMFS are reported to have an accuracy of +/- 0.01 ft (primarily In situ LevelTROLL 500 or GlobalWater WL16 instruments).

All water level data were plotted over the period March 15 to May 15, bracketing the time period identified in the regulation. Data were reviewed to identify whether any changes in water level occurred whereby water levels dropped over a portion of the day and then returned to previous levels, suggesting that water was pumped from the stream for frost protection use. The goal of this study was to evaluate whether diversions for frost protection caused any changes in water level in spring 2015 when North Coast Water Coalition members reported using water for frost protection, throughout the Sonoma County portion of the Russian River watershed. If changes in water level were detected, then follow-up studies will be conducted in 2016 to evaluate the effects of these changes in habitat and potential for stranding of juvenile salmonids.

Water use data

Grape growers that registered with the North Coast Water Coalition were provided with forms to indicate the days when water was used for frost protection during the frost protection season. All data were tabulated into spreadsheets and then a GIS approximately based on parcel numbers. These data allowed for the identification of participating grape growers in each region who used water for frost protection on any day. In all, NCWC participants registered 15,766 acres of grapes in the program.

If any drops in water level occurred in the stream water level data, the dates of occurrence were compared to water use information to determine whether water use among program participants could be attributed to detected changes in water level possibly from frost protection.

4. Results

4.1 Alexander Valley

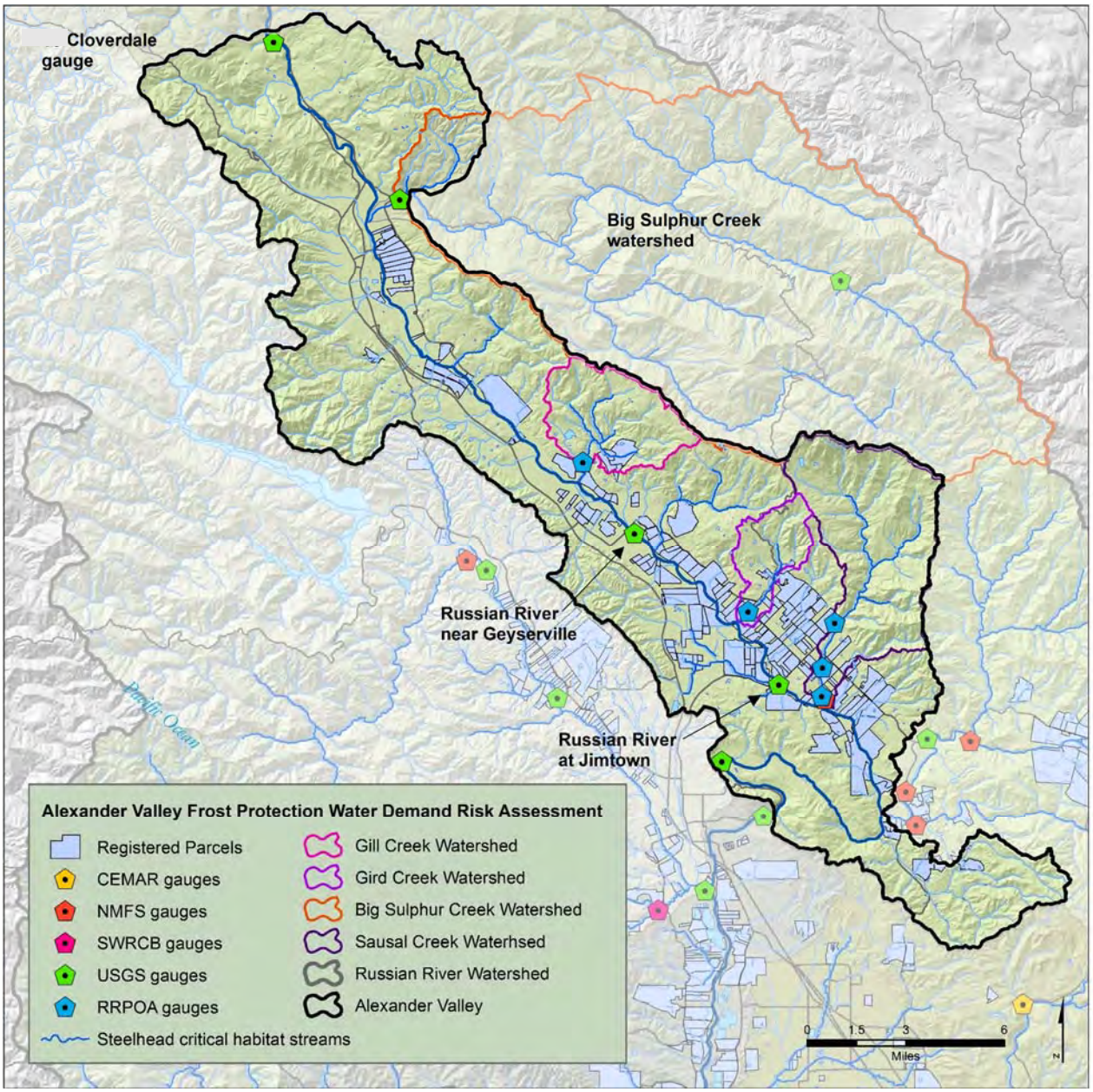

Figure 2. Alexander Valley gauge location, vineyards and participants in the Water Demand Management Program.

Within the Alexander Valley region there were 11 gauge instruments measuring and recording water levels at 15-minute intervals through the 2015 frost protection season (Figure 2). Four of these gauges are located on the mainstem Russian River –Russian River near Geyserville, Russian River near Jimtown, Russian River at Digger Bend, and Russian River near Healdsburg. Eight gauges are located on tributaries in the valley – Gird Creek (1), Gill Creek (1), Sausal Creek (4), and Big Sulphur Creek (1). Data from an additional streamflow gauge on the Russian River near Cloverdale (five miles upstream of Alexander Valley) and an upper Big Sulphur Creek streamflow gauge were also graphed in this section.

Mainstem Russian River, Alexander Valley

Data from the USGS gauges at Cloverdale (upstream of Alexander Valley), Geyserville (middle of Alexander Valley), Jimtown (lower Alexander Valley), Digger Bend (downstream of Alexander Valley) and Healdsburg (also downstream of Alexander Valley) indicate similar changes in water level through the March 15-May 15 period. Rainfall on April 6-8 exceeded one inch at Healdsburg (Table 1), which caused water levels to rise by as much as 0.6 ft (Figure 3). Water levels at each site receded at an accelerated rate beginning the first week of May, possibly reflecting a change in release schedule upstream at Coyote Dam. Stage data from the Russian River near Cloverdale gauge (upstream of Alexander Valley) show irregular decreases in stage in March, April, and May 2015; though in each case, the change in water level was less than 0.1 ft at the Cloverdale gauge. The change in water level on 4/6 propagated downstream to the Geyserville gauge, but other changes in water level observed at Cloverdale are not distinguishable downstream (especially given the noise, or imprecision, of the water level data at Geyserville and Jimtown).

Among the other four sites, a few changes in water level that showed characteristics that might be attributed to frost protection water use were recorded at the Geyserville gauge on 4/22, 5/1, and 5/4; though on each occasion, the changes in water level were on the order of the noise through each day. On each occasion, water level dropped and then rose 0.03 to 0.05 ft over the following three hours. These changes may not be a result of frost protection water use because they were only observed at a site with relatively noisy stage data (where stage data changed irregularly by as much as 0.04 ft from one 15-minute interval to the next). No participating NCWC growers indicated using water for frost protection on 4/22, 5/1, or 5/4.

Table 1. Rainfall recorded in the Russian River, spring 2015 (from the National Climate Data Center, NCDC.noaa.gov).

Date	Rainfall at Graton, in	Rainfall at Healdsburg, in
4/6/2015	0.2	0.23
4/7/2015	0.73	0.95
4/8/2015	0.08	0.24
4/25/2015	0.58	0.39

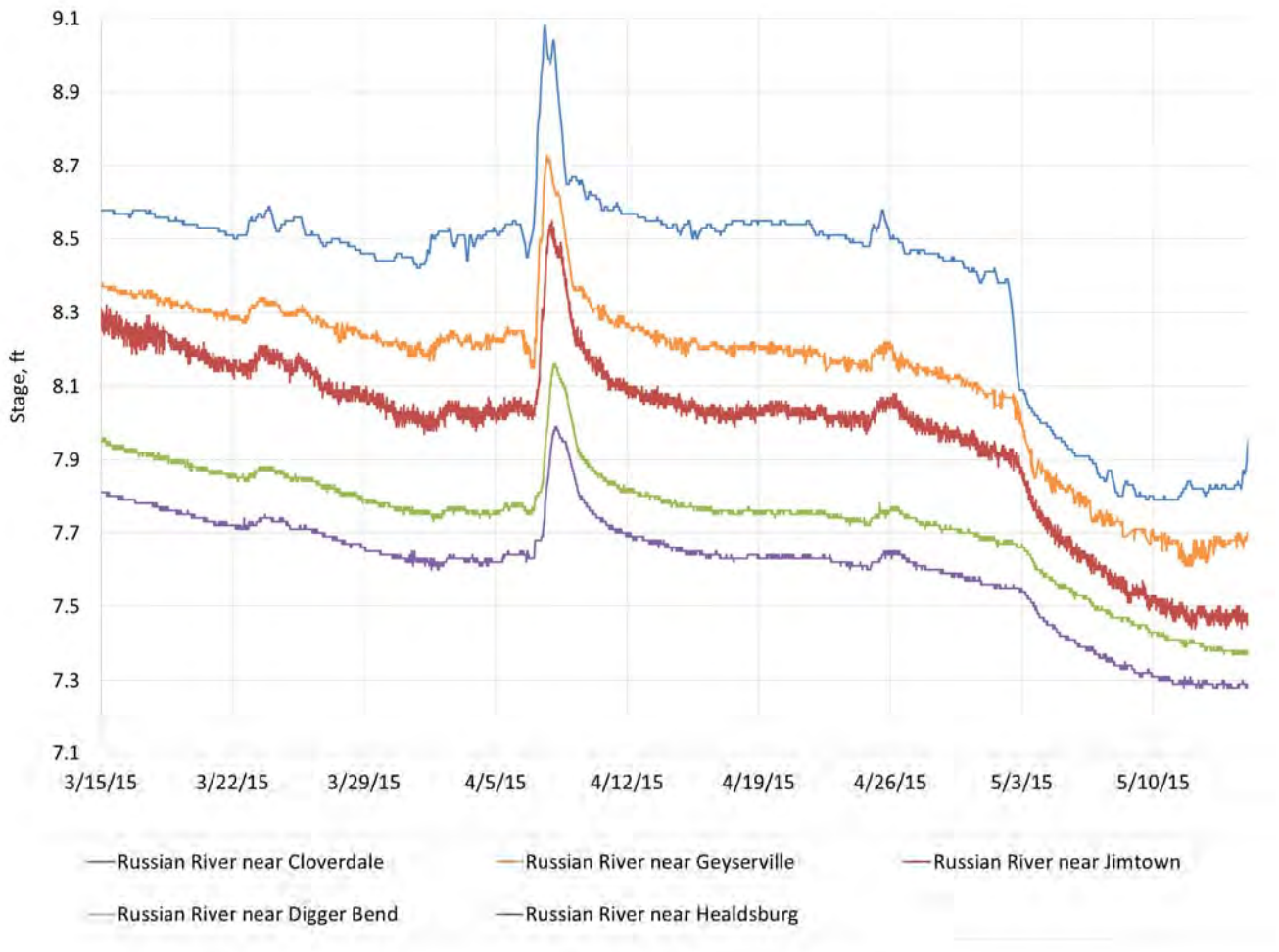

Figure 3. Stage recorded in the mainstem Russian River in/near Alexander Valley March 15 – May 15 2015.

Gird and Gill Creeks

Stage data from the Gird and Gill Creek gauges show a declining hydrograph and both channels become dry in mid-April (Figure 4). Water depth rose in both creeks during the April 6- April 8 rain event and then quickly declined. Data from the Upper Gill Creek gauge show a recession in stage on March 19 as well as from March 21 to 24, but these changes in water level could be attributed to the stream's drying process rather than frost protection water use. The portion of Gill Creek in Alexander Valley becomes dry each summer, as flow from the mountainous portion of the watershed upstream of the valley falls below the capacity for flow to infiltrate into the shallow aquifer. Previous studies by RRPOA found that this drying happens abruptly, and can happen even in winter in a very dry year (e.g., 2014, when it became dry in early February). Data from the Gird Creek gauge show irregular fluctuations in stage that could be associated with frost protection on 3/31, 4/2, 4/3 and 4/4, though they are very small (0.03 ft) and gradual; these could also be a result of the stream becoming dry (which happens in mid-April). In addition, water depth decreased to zero and rose back to previous water levels on 4/13 and 4/15, likely a result of flow from upstream infiltrating into the aquifer and no longer being able to support base flow.

Research by the Russian River Property Owners Association has indicated that Gird and Gill Creeks at these two locations typically show this pattern of sudden drying during the dry season. This usually occurs in late spring and summer in a normal or wet year, but can occur much earlier in a dry year. The drying of these tributaries

during the frost protection season is likely a manifestation of four consecutive years of below-average rainfall in the region. The sudden re-wetting of the channel after drying (e.g., 4/13, 4/15) could be due to environmental factors such as evapotranspiration as well as water use; determining whether this sudden drying and re-wetting is due to environmental or human-driven causes is an important task for year 2016.

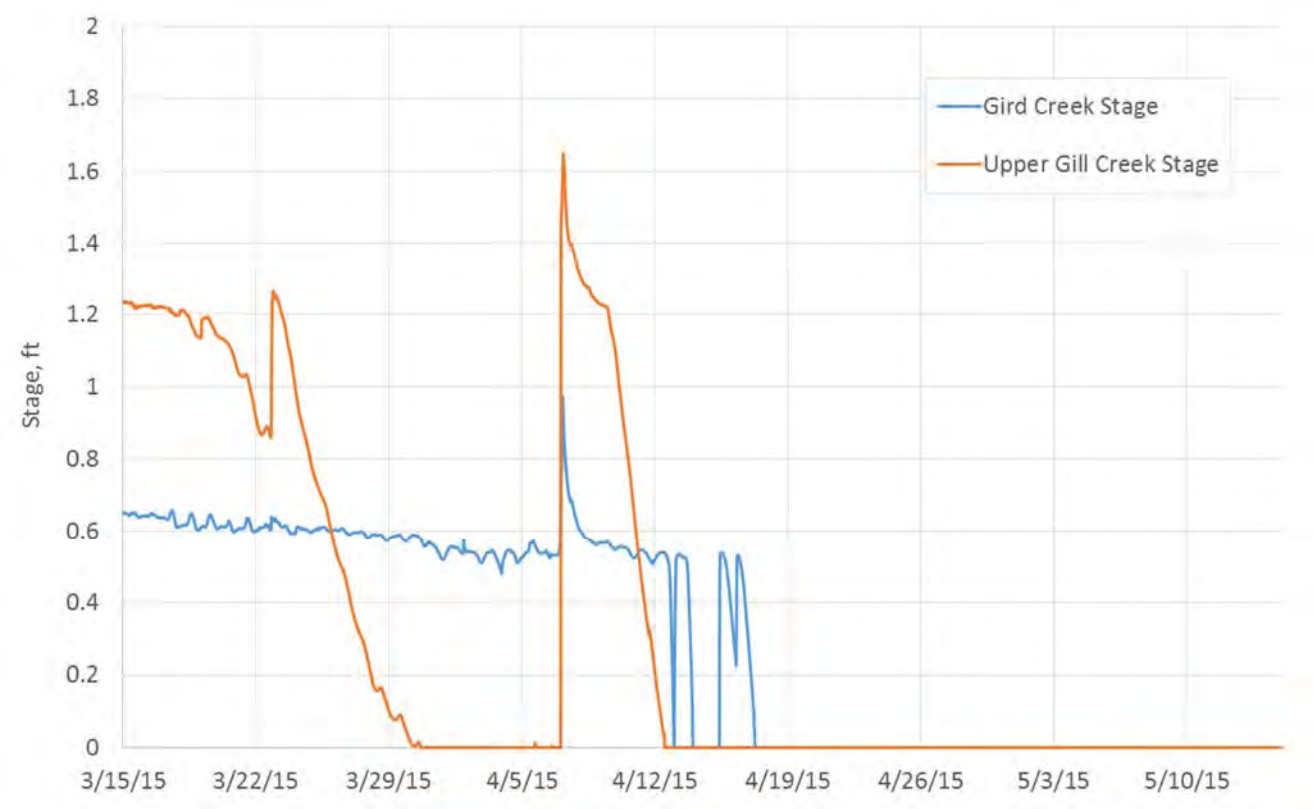

Figure 4. Stage recorded in Gird Creek and Upper Gill Creek during spring 2015.

Sausal Creek

The four gauges in Sausal Creek – Lower Sausal, Lower Sausal at E. Soda Rock Lane, Middle Sausal, and Upper Sausal – generally show the same patterns of rising and receding water levels associated with rainfall, evapotranspiration, and a quickly drying channel. Water depths rose by up to 0.5 ft due to rainfall during the frost protection season.

Overall, the water level dynamics in Sausal Creek show no indications of changes in water levels that might result from frost protection diversion. The rapid reductions in water level at Upper Sausal on 5/1 and 5/2, and at Lower Sausal beginning on 4/23 and again on 4/28 likely reflect the stream's natural drying process. As in Gill and Gird Creeks, evaluating the likelihood of human or environmental processes causing the stream to dry will be a project task for year 2016.

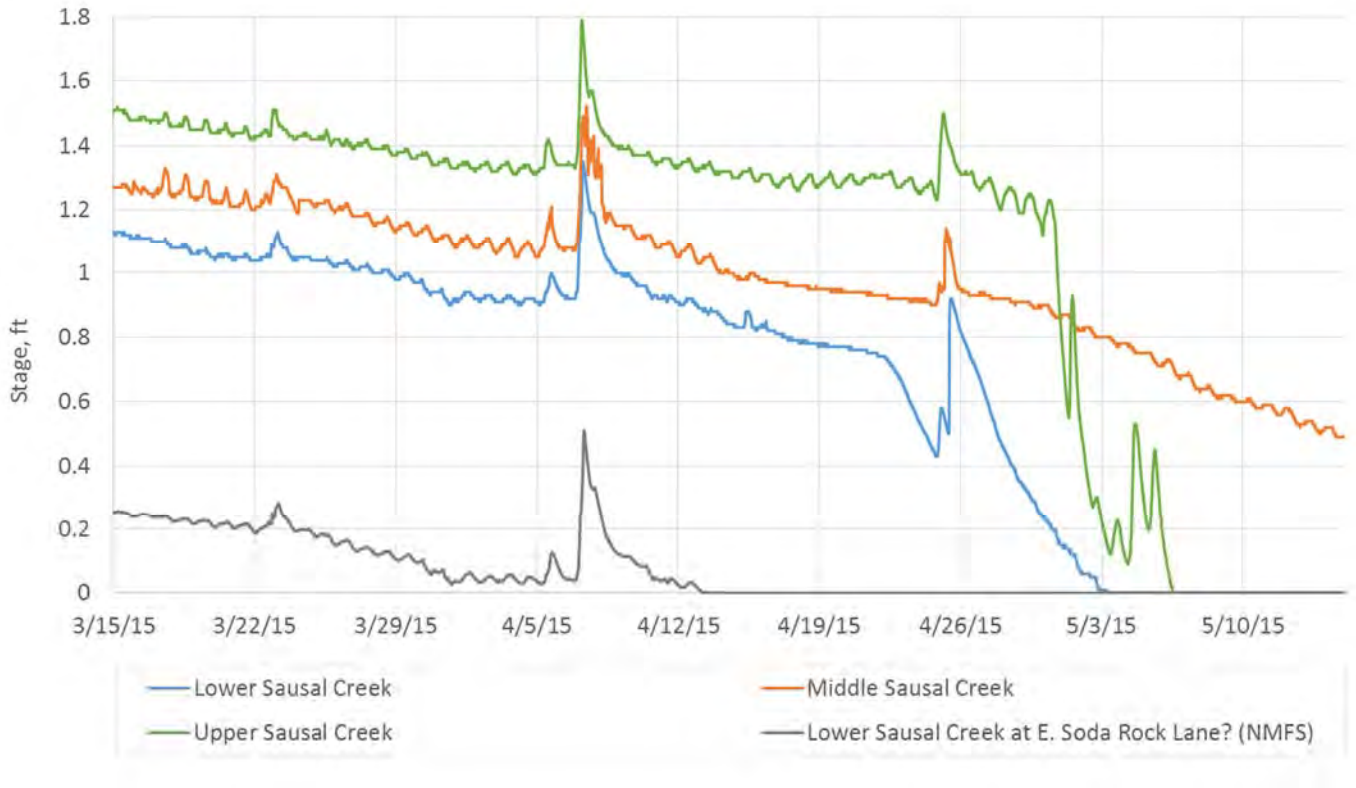

Figure 5. Stage recorded in Sausal Creek during spring 2015.

Big Sulphur Creek

Big Sulphur Creek drains a watershed more than 80 square miles in size, but the catchment has very little land in wine grape cultivation. The two gauges on Big Sulphur Creek recorded similar trends in rising and falling water levels through the frost protection season (Figure 6). Water levels in both gauges rose with rain events and showed a natural decline in water levels through the season. In both gauges, the stage data show no irregular fluctuations that could be associated with frost protection.

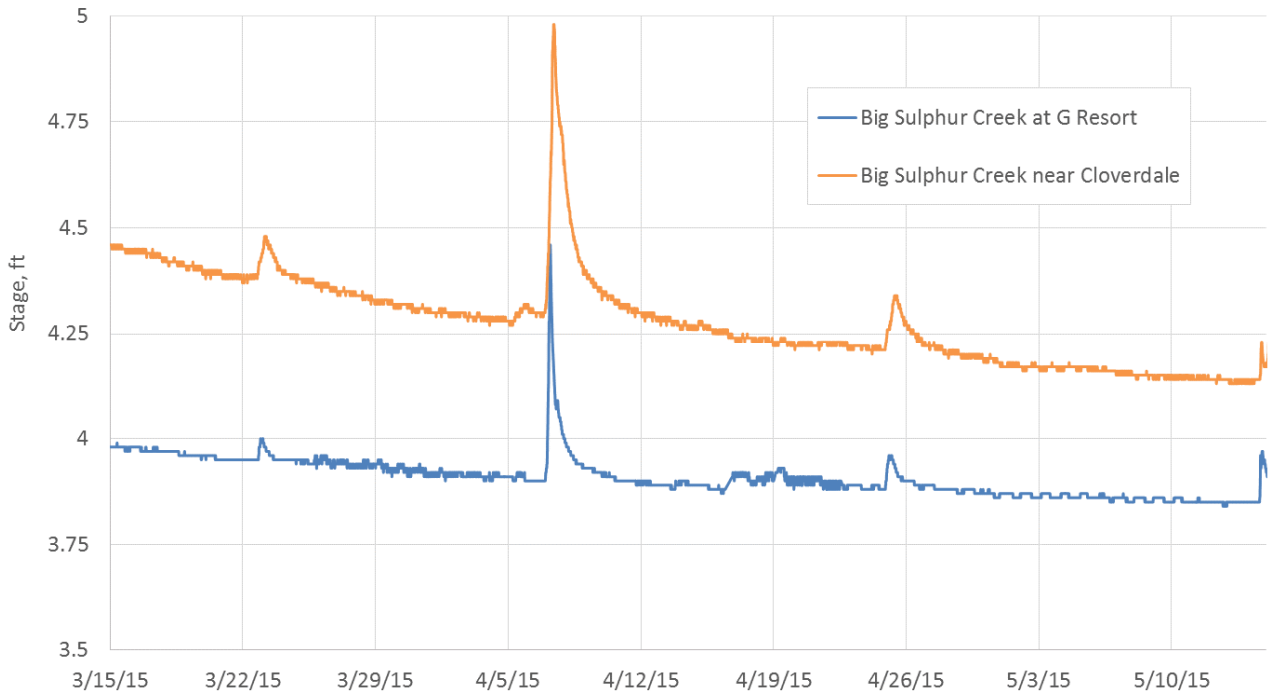

Figure 6. Stage recorded in Sausal Creek during spring 2015.

Frost Protection Water Use in the Alexander Valley Area

Program participants in the North Coast Water Coalition program reported using 79.4 acre-ft of water for frost protection is spring 2015 (Figure 7). Nearly all of the frost protection water reported used in Alexander Valley was used over on three days – April 3, 5, and 7 (90% of which was used on April 7).

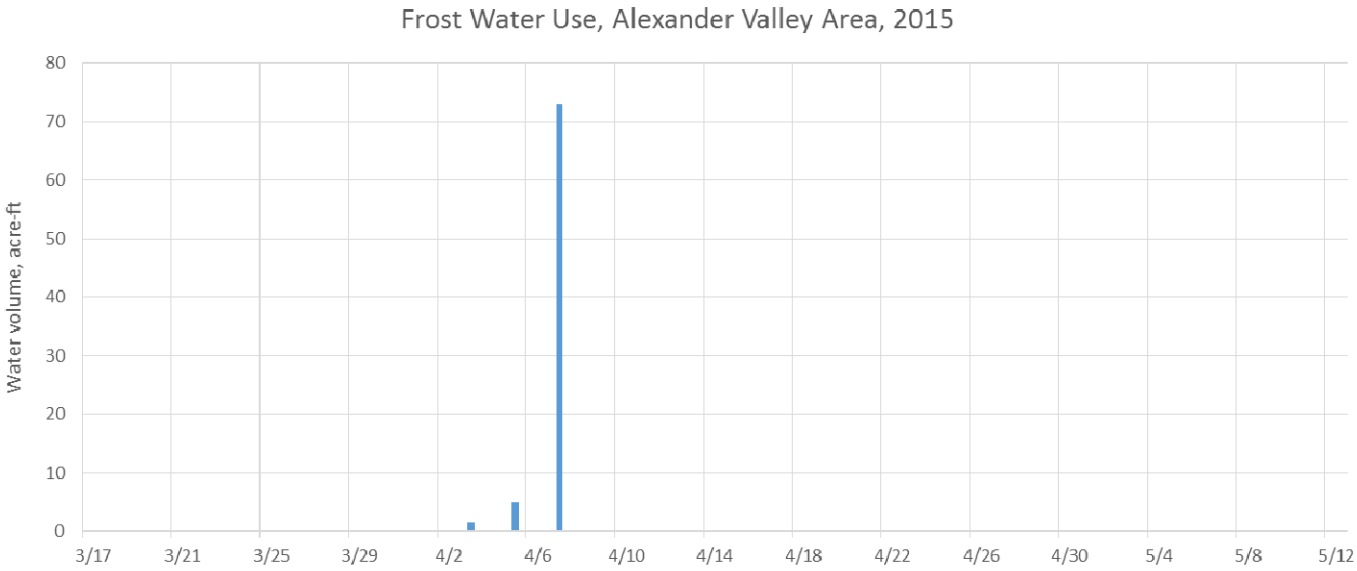

Figure 7. Water reported used for frost protection in the Alexander Valley region, spring 2015.

Alexander Valley Region: Assessment of Risk and Future Steps

Russian River Mainstem

As corroborated by previous research by the Russian River Property Owners Association (RRPOA), the mainstem Russian River in Alexander Valley appears to be at low risk of impact from frost protection water use in the region. Overall, reported water use is low: Alexander Valley grape growers reported needing less than 90 acre-ft of water for frost protection in all of 2015. This could be due to an increase in the use of fans to protect grapes, as well as a relatively warm spring season (similar to the previous five years studied by RRPOA).

In the mainstem Russian River, only one site (at the Geyserville gauge) showed small changes in water level (0.05 ft or less) possibly resulting from frost protection water use, but it could also be a result of imprecise water level data at the USGS gauge. Previous RRPOA reports indicated that a pressure transducer installed less than 1,000 ft upstream of the Jimtown Russian River gauge provided a more precise (less noisy) record of water level with similar accuracy, so a useful next step may be to install a pressure transducer near the Jimtown and Geyserville gauges to develop a more precise record of water levels in the Russian River during the frost season than the USGS gauge provides.

Gill, Gird, Sausal, and Big Sulphur Creeks

Tributaries in Alexander Valley are at high risk of stranding principally because of environmental factors. The high infiltration capacity of the alluvial aquifer and low discharge from upstream tributary catchments results in streams becoming dry, independent of water uses in the region. In dry years such as 2015, this drying can happen during important outmigration periods for juvenile salmonids. It is difficult to generalize about these relationships because the timing and occurrence of drying is highly variable among streams: parts of Sausal Creek in Alexander Valley remained flowing through the 2015 frost season, while lower reaches of Gird and Gill Creek near the Russian River confluence were not gauged in 2015 because they were dry long before March 15.

Other than the sudden drying at frost protection gauges that may or may not have been a result of environmental factors in Gill, Gird, and Sausal Creeks, only data from Gird Creek showed irregular changes in

water level that might be attributed to frost protection diversions, and the magnitude of those changes was approximately 0.03 ft. These changes occurred when growers reported needing water for frost protection, so a useful next step in advance of the 2016 frost season will be to discuss frost protection methods used in 2015 and possible alternatives with growers who used water from Gird Creek; and to determine whether these changes in water level are enough to cause salmonid stranding in Gird Creek (though the changes were very small). A primary focus of frost protection monitoring efforts in this region in 2016 will be to better characterize drying in Alexander Valley tributaries and determine the extent to which human and environmental factors influence drying (including factors such as maximum and minimum air temperature in these analyses).

4.2 Maacama Creek Catchment

In the Maacama Creek catchment (including Franz Creek, which joins Maacama Creek just before meeting the Russian River) there are two gauges on Maacama Creek and one on the tributary Redwood Creek, one gauge on Bidwell Creek in Knights Valley, and one gauge on Franz Creek just before its confluence with Maacama Creek (Figure 8).

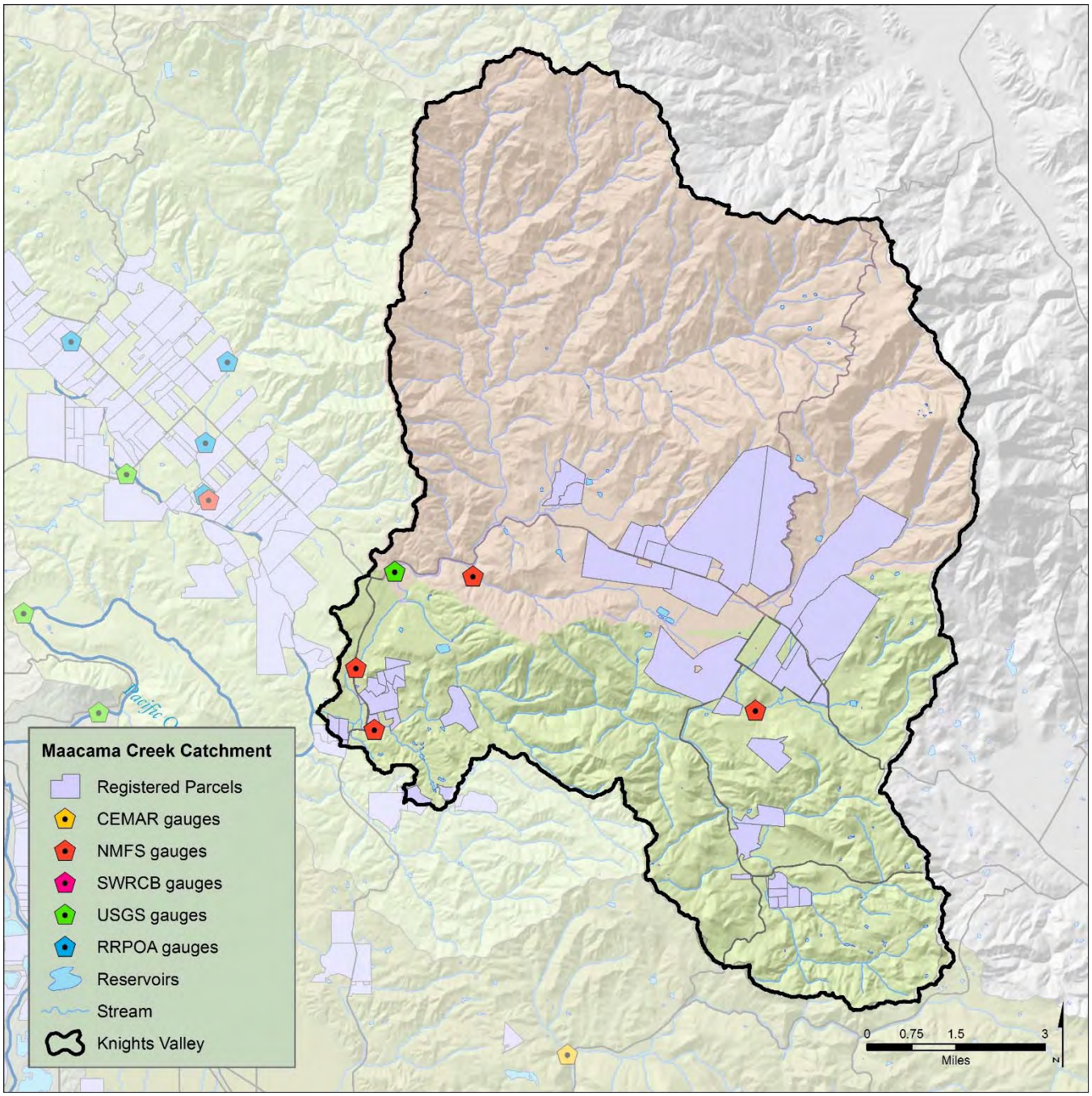

Figure 8. Stream gauges in the Maacama Creek catchment.

Stream Water Levels in Maacama Creek, spring 2015

Water levels recorded from the Lower Redwood Creek gauge show fluctuations in water levels potentially associated with frost protection diversions.

Two different patterns were recorded by pressure transducers in Redwood Creek:

1. On nine occasions between March 15 and May 15, measured water level dropped either 0.04 or 0.05 ft over a period of time ranging from 6 to 13 hours, and then rose back to near the previous level three to six hours later (Table 2). The magnitude of change detected by the sensor is four to five times the uncertainty reported by sensor manufacturers (0.01 ft). The changes in water level typically began at the Redwood Creek gauge between 10:30 AM and 11:45 AM (and often lasted until early the next day); if the changes in water level were a result of frost protection diversions, they likely occurred far enough upstream that the recession of flow took several hours to propagate downstream.
2. On two occasions (one beginning on March 2 and the other on April 3), water level at the Redwood Creek gauge receded more gradually—0.06 ft over 18 hours—beginning at approximately 9:15 AM on both occasions. On both occasions, water levels remained low for four days before rising to baseline levels.

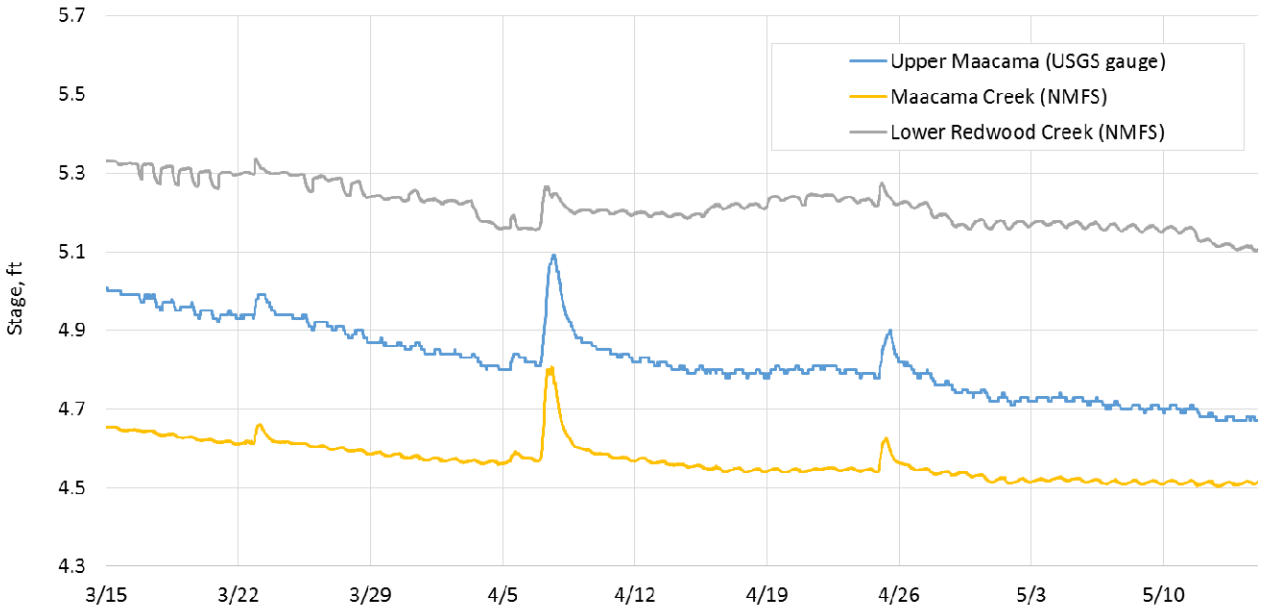

Figure 9. Water level data in Maacama Creek and Redwood Creek, spring 2015.

Table 2. Changes in water level possibly due to frost protection water diversion, Redwood Creek

Begin date/ time	Initial stage, ft	Lowest stage, ft	Time of minimum	Resumed stage, ft	Time of return	Total duration, hrs	Reported volume, AF
3/16/15 4:00 PM	5.32	5.28	3/16/15 9:30 PM	5.32	3/17/15 12:30 AM	8.5	0
3/17/15 11:30 AM	5.32	5.27	3/17/15 8:00 PM	5.31	3/18/15 12:00 AM	12.5	0.06
3/18/15 11:45 AM	5.32	5.27	3/18/15 7:45 PM	5.31	3/19/15 12:30 AM	12.5	0
3/19/15 11:45 AM	5.31	5.27	3/19/15 9:30 PM	5.30	3/20/15 1:15 AM	13.5	0
3/20/15 11:15 AM	5.31	5.26	3/20/15 8:30 PM	5.30	3/21/15 1:15 AM	14	0
3/25/15 11:15 AM	5.30	5.25	3/25/15 8:45 PM	5.29	3/26/15 3:00 AM	15	0
3/27/15 9:30 AM	5.29	5.24	3/27/15 10:15 PM	5.27	3/28/15 1:15 AM	16	0
4/3/15 9:00 AM	5.23	5.16	4/4/15 8:30 PM	Interrupted by rain, 4/7/15 2:00 AM		44.5	8.6

Overall, the grape growers in the Maacama watershed reported using 10.5 acre-ft of water for frost protection during the period (on some days, water was reported used with no changes in water level in Redwood Creek).

The water fluctuations detected at the Lower Redwood Creek gauge propagate downstream to the Upper Maacama Creek gauge, though the fluctuations have decreased in magnitude (possibly due to the increased distance from the diversion), and are within the range of uncertainty (+/- 0.01 ft). No additional water fluctuations were recorded at the Upper Maacama and lower Maacama gauges.

Stream Water Levels in Franz and Bidwell Creek, spring 2015

Water levels recorded from the gauge in the Bidwell Creek watershed show small daily fluctuations in water levels starting on April 14th; water levels recorded from the Franz Creek gauge show daily water level fluctuations starting on April 28th. The fluctuations in water levels recorded at both the Bidwell Creek and Franz Creek gauges in April and May do not correspond to frost events in the region and are most likely caused by daily evapotranspiration as the stream reaches intermittence.

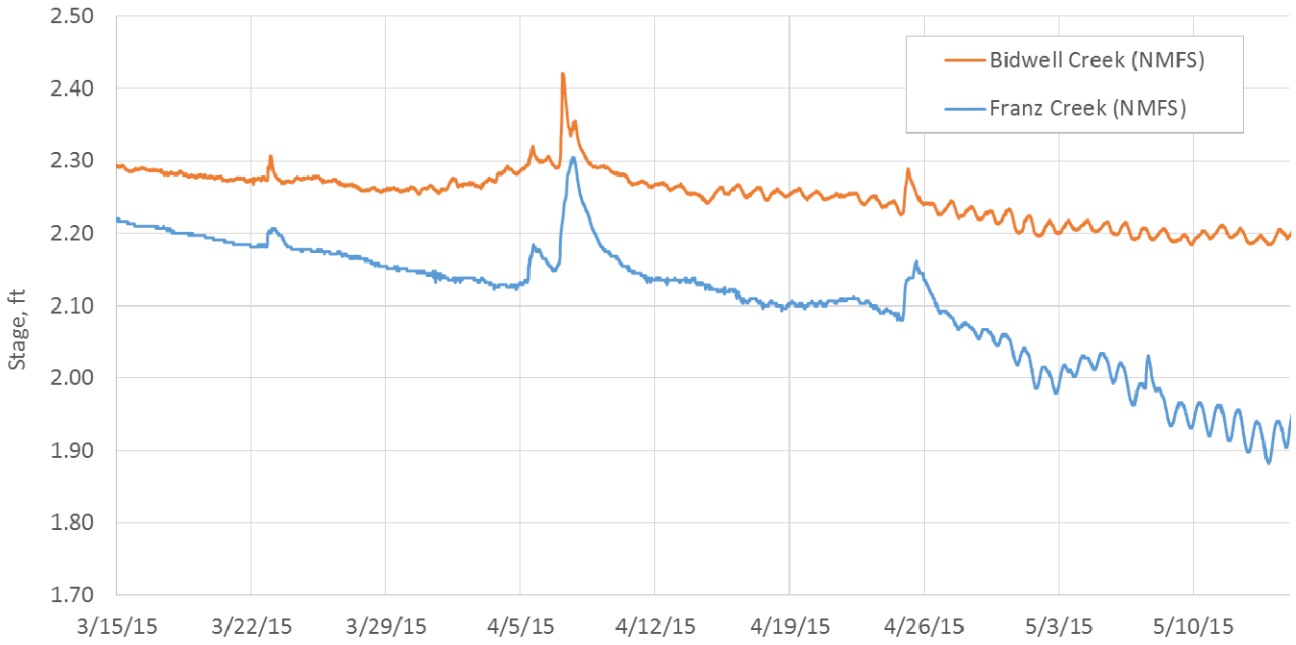

Figure 10. Water levels in Bidwell and Franz Creeks, spring 2015.

Frost Protection Water Use in the Maacama Creek watershed

North Coast Water Coalition program members reported using approximately 11 acre-feet of water for frost protection during spring 2015. Seventy percent of the reported frost protection water used in the Maacama Creek watershed was used in four days, April 5, 7, 8, and 9 (Figure 11).

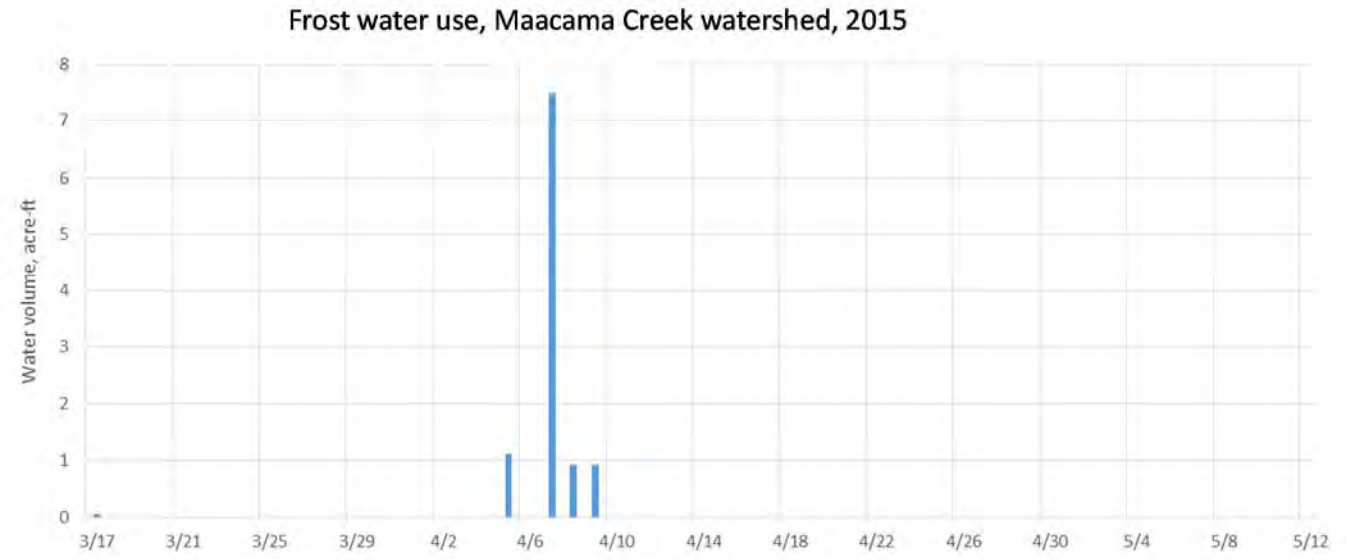

Figure 11. Water used for frost protection among participants, Maacama Creek watershed, spring 2015

Risk and Future Steps

The frequent changes in water level in March and April 2015 at one of the five gauges suggest that parts of the Maacama Creek watershed are at risk of causing stranding; though stage data elsewhere in Maacama Creek and from the gauges in Bidwell and Franz Creek show no changes in water levels related to frost protection. Evaluating the impacts of stage drops in Redwood Creek on salmonid habitat, and determining whether changes in water level are greater farther upstream, are important steps for future years. Risk of affecting salmonid habitat may also be greater in a year with more widespread frost.

Also, the timing of reported water used for frost protection does not consistently match all the water level fluctuations recorded from the instream gauges. For example, the water level fluctuation from 4/5 to 4/9 occur when frost registrants reported using water for frost protection; registered participants did not report using water when similar changes in water level occurred before April 1. Given that many changes in water level occurred when NCWC members did not report using water, these changes may have been a caused by nonmembers in the area (including nearby orchards).

4.3 Mark West Creek

The upper and lower portions of the Mark West Creek watershed have distinctly different land-use characteristics and topography. The upper Mark West Creek watershed is primarily a forested mountainous landscape with small patches of vineyards and residents scattered throughout the area. In the lower portion of the watershed, the creek enters into the (flatter) valley floor, where the landscape is dominated by vineyards and residential areas. Within the watershed, six gauges measured and recorded water levels at 15-minute intervals through the 2015 frost protection season (Figure 12): two in the lower watershed, and four in the upper watershed.

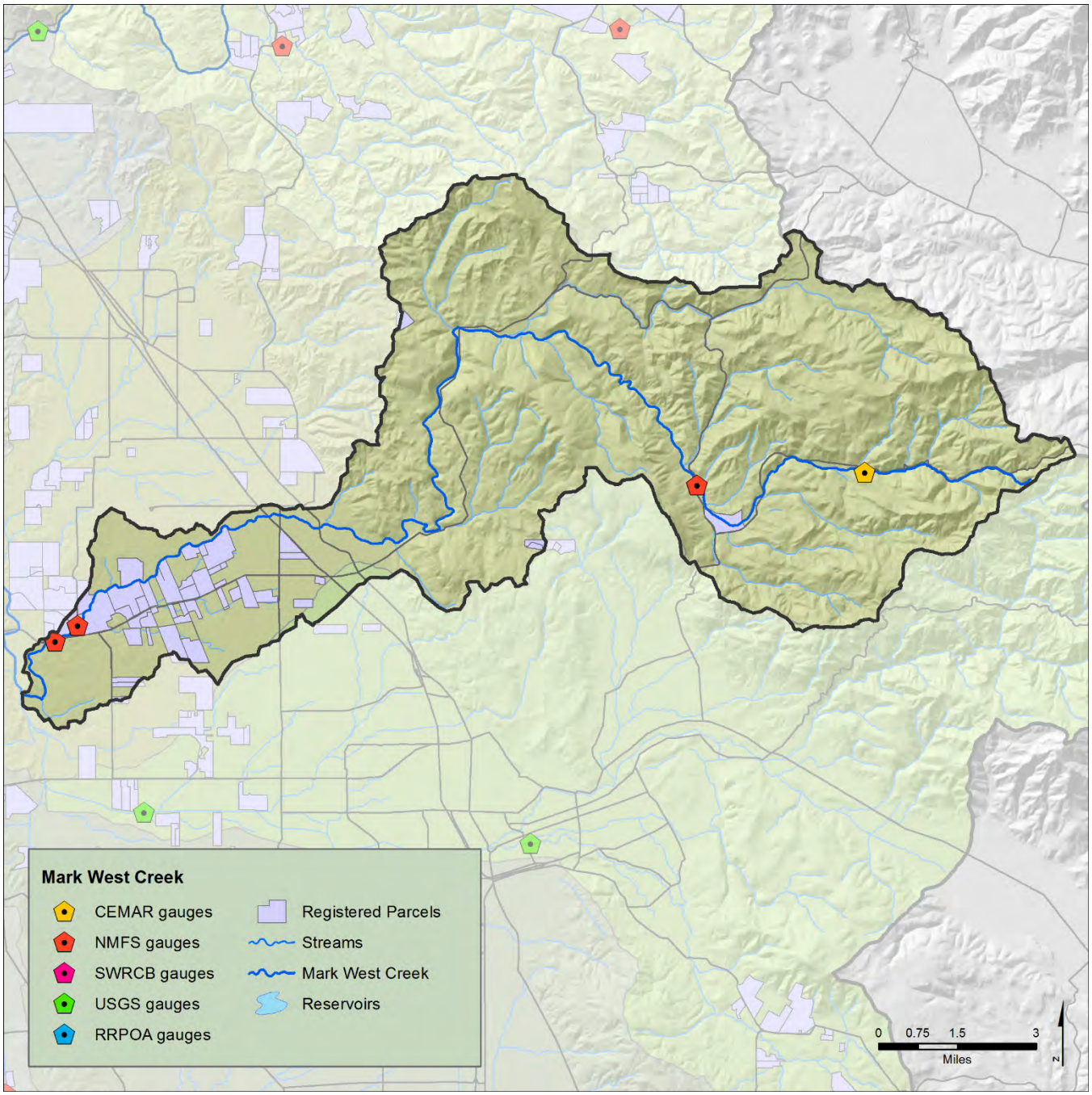

Figure 12. Water level gauges in Mark West Creek.

Stream Water Levels in Mark West Creek, spring 2015

Water levels recorded at the six gauges in Mark West Creek provide useful insights on frost protection in the watershed in spring 2015 (Figure 13). The upper gauge on Mark West Creek, Mark West Creek below Tarwater Rd, show no changes in water levels attributed to frost protection diversions; additionally, there are no identified riparian vineyards upstream of this gauge. Small water level fluctuations were detected at the Mark West Creek at Calistoga Road gauge on April 15 and April 24th (with the largest corresponding to a change of 0.03 ft).

Figure 13. Water levels in Mark West Creek, spring 2015.

On three occasions between March 15 and May 15, measured water level in Mark West Creek at River Road dropped either 0.02 or 0.03 ft over a period of time ranging from 8 to 10 hours, and then rose back to near the previous level three hours later (Table 3). These changes in water level did not propagate downstream to the next gauge. The magnitude of change detected by the sensor is at or slightly greater than the uncertainty reported by sensor manufacturers (+/- 0.01 ft). The changes in water level typically began at gauge in late evening or early morning (and often lasted until early the next day). These fluctuations were not detected at the lowest gauge on Mark West Creek near Mirabel Heights, indicating that the fluctuations were attenuated with distance downstream.

The water level on Mark West Creek recorded at Calistoga Road also changed once during the frost season: on April 24, water level changed 0.03 ft beginning at 9:00 AM and lasting until the April 25 rainfall event (approximately midnight at the beginning of April 25).

Table 3. Changes in water level possibly due to frost protection water diversion, Mark West Creek at River Road.

Begin date/ time	Initial stage, ft	Lowest stage, ft	Time of minimum	Resumed stage, ft	Time of return	Total duration, hrs	Reported volume, AF
4/17/15 10:00 PM	1.45	1.43	4/18/15 12:30 AM	1.45	4/18/15 7:00 AM	9	0.0174
4/19/15 6:30 PM	1.45	1.43	4/19/15 8:30 PM	1.45	4/19/15 11:00 PM	4.5	0
5/16/15 12:30 AM	1.43	1.40	5/16/15 4:15 AM	1.45	5/16/15 9:30 AM	9	NA

Frost Protection Water Use in the Mark West Creek Watershed

North Coast Water Coalition program members reported using approximately 35 acre-feet of water for frost protection during spring 2015. NCWC registrants reported using water for frost protection in the Mark West Creek watershed on five days: April 3, 5, 7, 8, and 10 (Figure 14).

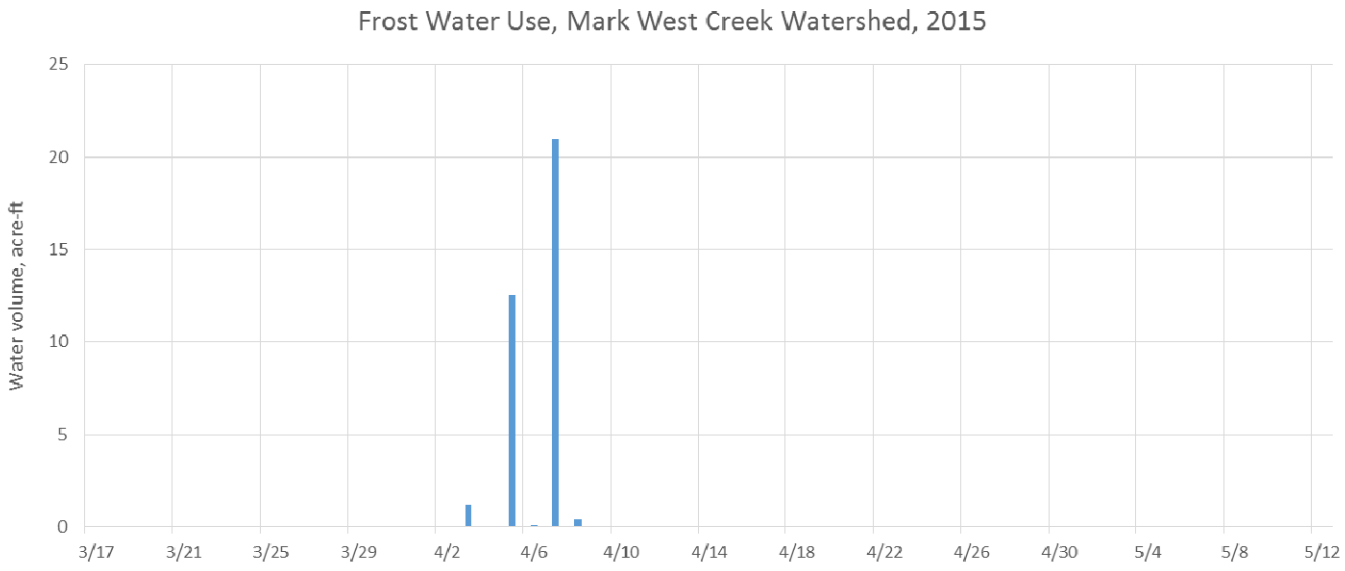

Figure 14. Reported water use for frost protection, Mark West Creek watershed

Risk and Future Steps

Water level data from the six instruments in Mark West Creek show that the parts of the stream may be affected by diversion for frost protection, though the impact detected at the gauges was small. The small fluctuations in water level recorded in Mark West Creek (with the largest being 0.03 ft) are likely attenuated with distance downstream (so that their impacts are reduced downstream); impacts may be greater upstream. In future years, it will be important to evaluate whether these types of changes in water levels have significant impacts on salmon habitat, and to determine whether impacts to water level in lower Mark West Creek are greater upstream. Risk of affecting salmonid habitat may also be greater in a year with more widespread frost. To address these risks, an additional gauge will be installed in Mark West Creek in 2016 mid-way through the valley floor.

Also, the timing of reported water used for frost protection does not consistently match all the water level fluctuations recorded from the instream gauges. Given that many changes in water level occurred when NCWC members did not report using water, these changes may have been a caused by nonmembers in the area.

4.4 Dry Creek

USGS operates three gauges in the Dry Creek watershed: Dry Creek near Geyserville (upper), Dry Creek below Lambert Bridge (middle) and Dry Creek near Healdsburg (lower) (Figure 15). In addition NMFS operates one gauge on Mill Creek, a tributary to Dry Creek, at West Side School in the lower reaches of the watershed near its confluence with Dry Creek.

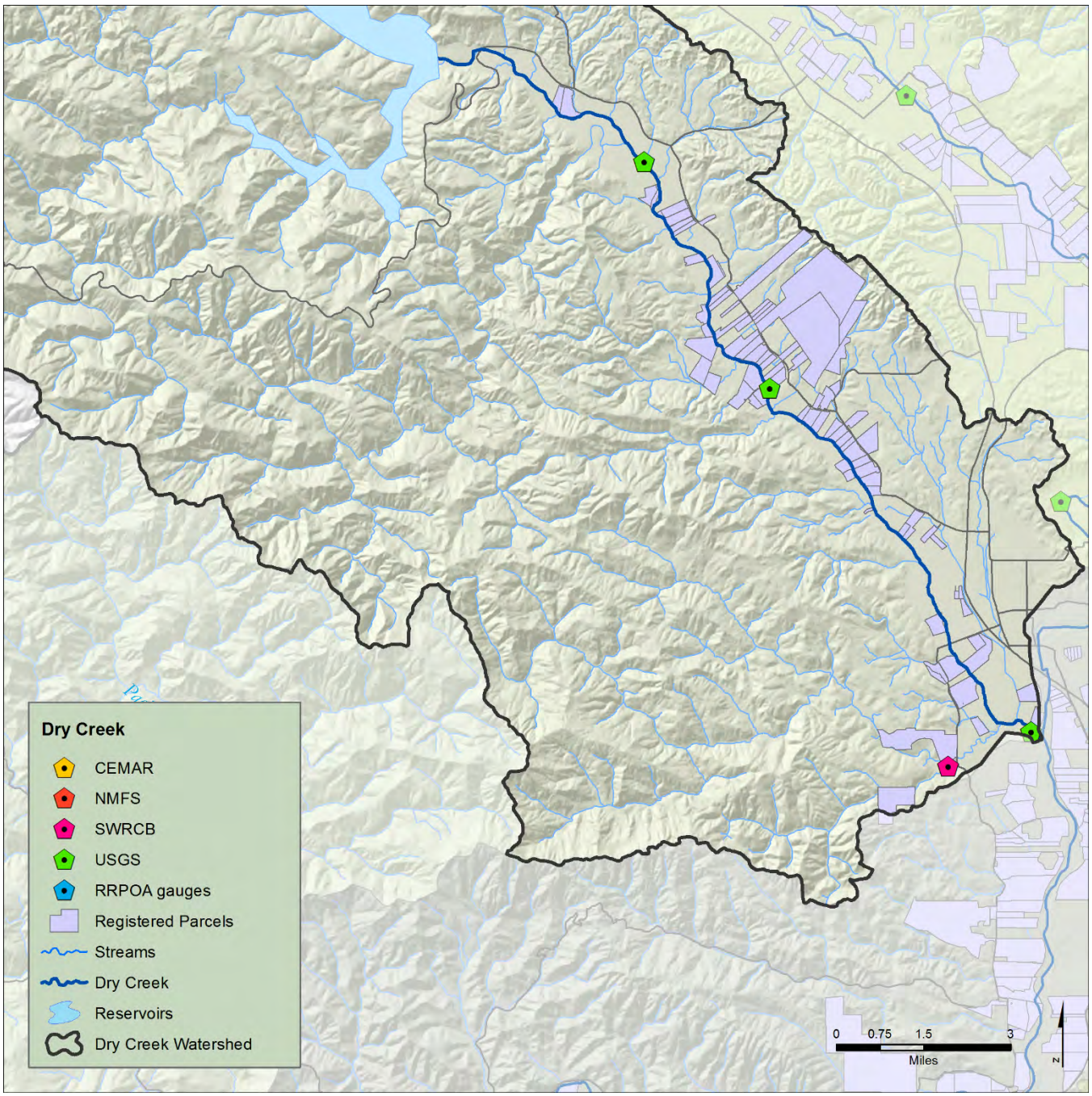

Figure 15. Stream gauges in the Dry Creek watershed.

Water levels in the three gauges in Dry Creek and the Mill Creek gauge all rose from rainfall during the frost protection season. In addition, water level at the Dry Creek gauge near Geyserville (the upper gauge) showed an increase in stage on 5/1, likely caused by a water release from the upstream dam. The increase in stage from the upper gauge propagated downstream to the below Lambert Bridge gauge (Figure 16). In addition, the gauge near Geyserville recorded an irregular decrease in water levels on 5/6, lasting approximately one day. This may have been a result of changes in the dam release.

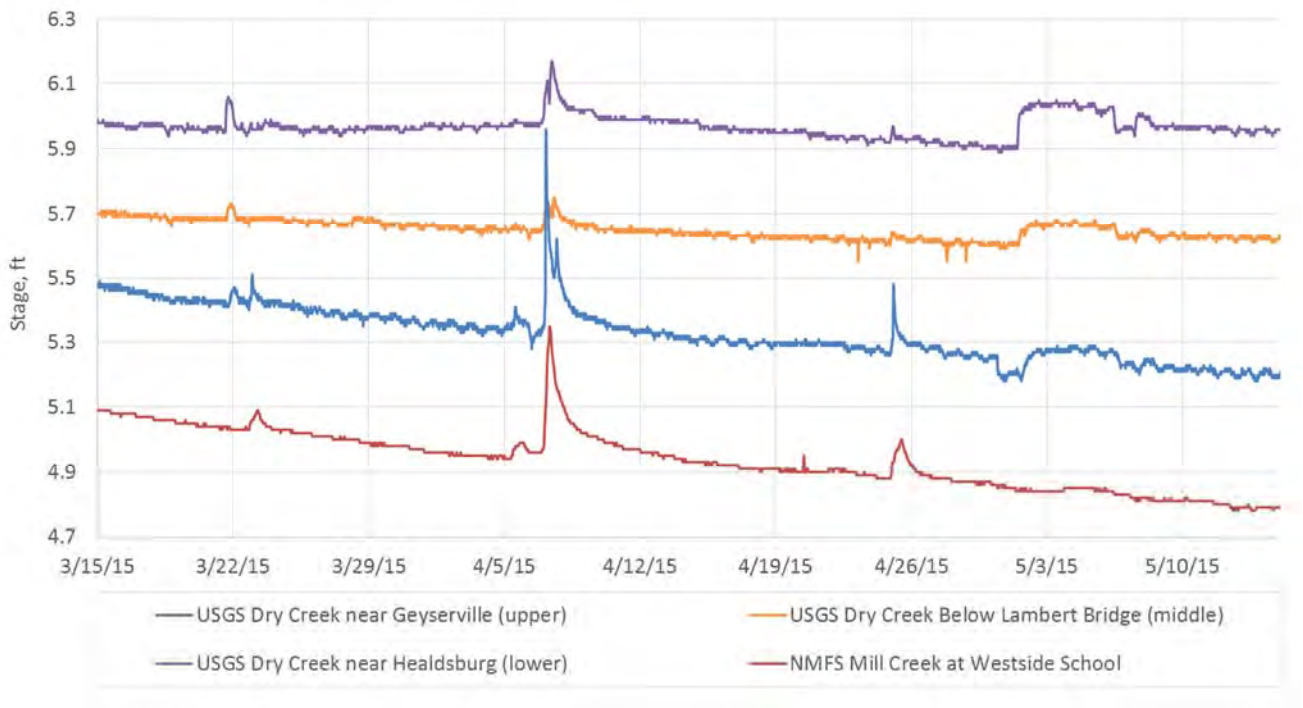

Figure 16. Water level recorded at four locations in the Dry Creek watershed, spring 2015.

On three occasions between March 15 and May 15, measured water level in Dry Creek at Lambert Bridge dropped either 0.06 or 0.07 ft over a period of time ranging from 1 to 3 hours, and then rose back to near the previous level one to three hours later (Table 4). These changes in water level did not propagate downstream to the next gauge. The changes in water level typically occurred late in the evening.

Table 4. Changes in water level possibly due to frost protection water diversion, Dry Creek at Lambert Bridge.

Begin date/ time	Initial stage, ft	Lowest stage, ft	Time of minimum	Resumed stage, ft	Time of return	Total duration, hrs	Reported volume, AF
4/23/15 5:30 AM	5.62	5.55	4/23/15 6:15 AM	5.62	4/23/15 7:30 AM	2	
4/27/15 6:30 PM	5.61	5.55	4/27/15 8:15 PM	5.61	4/27/15 10:30 PM	4	
4/28/15 7:00 PM	5.61	5.55	4/28/15 7:45 PM	5.61	4/28/15 9:00 PM	2	

On one occasion between March15 and May 15, measured water level in Dry Creek near Healdsburg dropped 0.07 ft over a 31 hour period before rising back to near the previous level eight hours later (Table 5).

Table 5. Changes in water level possibly due to frost protection water diversion, Dry Creek at Lambert Bridge.

Begin date/ time	Initial stage, ft	Lowest stage, ft	Time of minimum	Resumed stage, ft	Time of return	Total duration, hrs	Reported volume, AF
4/30/15 10:30 AM	5.26	5.18	4/30/15 7:30 PM	5.26	5/02/15 2:00 AM	2	

Frost Protection Water Use in the Dry Creek Watershed

North Coast Water Coalition program members reported using 10.8 acre-feet of water for frost protection in spring 2015. Nearly all the water use occurred over two days on April 7th and 8th (Figure 16).

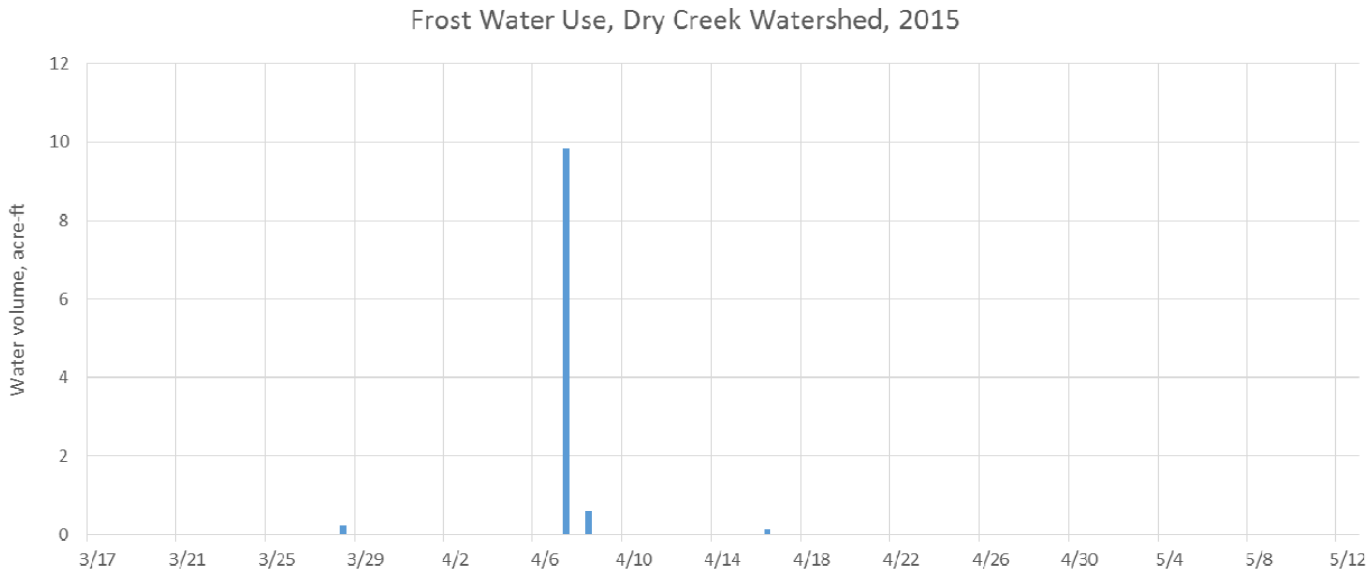

Figure 16. Reported water use in the Dry Creek watershed, spring 2015.

Risk and Future Steps

Stage data in the Dry Creek watershed show some fluctuations in water levels associated with frost protection. However, Dry Creek has artifically high flows due to the upstream dam releases, which may reduce the impact of frost diversions on aquatic habitat. Several of the drops in water levels recorded by mulitple gauges in the Dry Creek watershed occurr on days participants in the North Coast Water Colation program did not claim to use water. As in other regions described above, changes in water level may have been a caused by growers in the area who are not part of the NCWC. It may be possible to release water from Warm Springs Dam in tandem with frost events to mitigate any negative impacts of diversions on aquatic habitat, but an important first step would be to evaluate where these changes in water levels impact salmonid habitat (which may be small due to the magnitude of flow released from the dam).

4.5 Santa Rosa Plain

The US Geological Survey operates eight gauges in the Santa Rosa Plain: Santa Rosa Creek at Willowside Road and Santa Rosa Creek at Santa Rosa; Laguna de Santa Rosa at Stonypoint Road and Laguna de Santa Rosa near Sebastopol; Colgan Creek near Santa Rosa and Colgan Creek near Sebastopol; Copeland Creek near Rohnert Park, and Matanzas Creek at Santa Rosa (Figure 17).

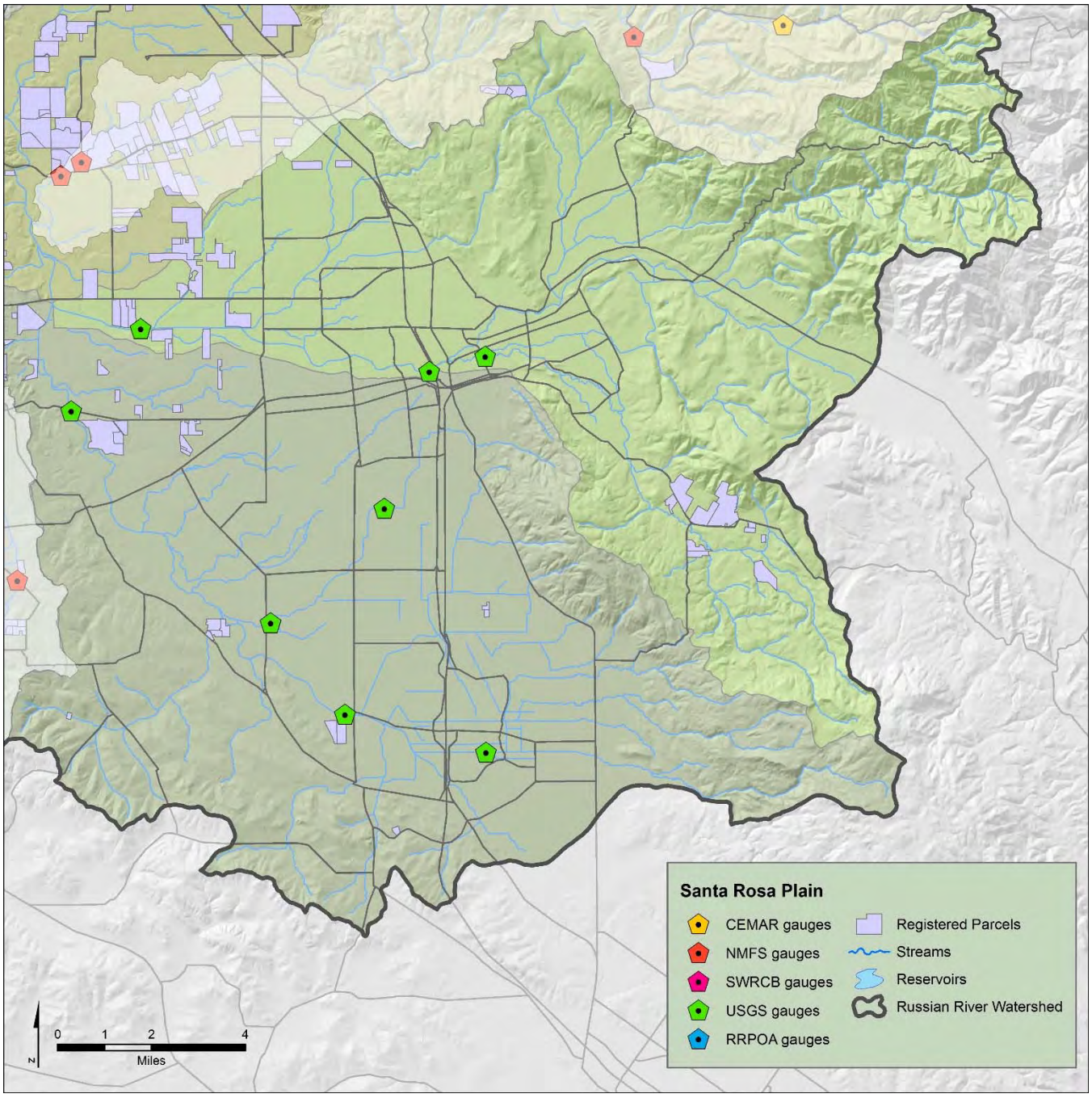

Figure 17. Water level gauges in the Santa Rosa Plain.

Water levels in the gauges in the Santa Rosa Plain area all rose from rainfall during the frost protection season (Figure 18). All sites in the Santa Rosa Plain show no fluctuations in water levels that could potentially be associated with diversions for frost protection.

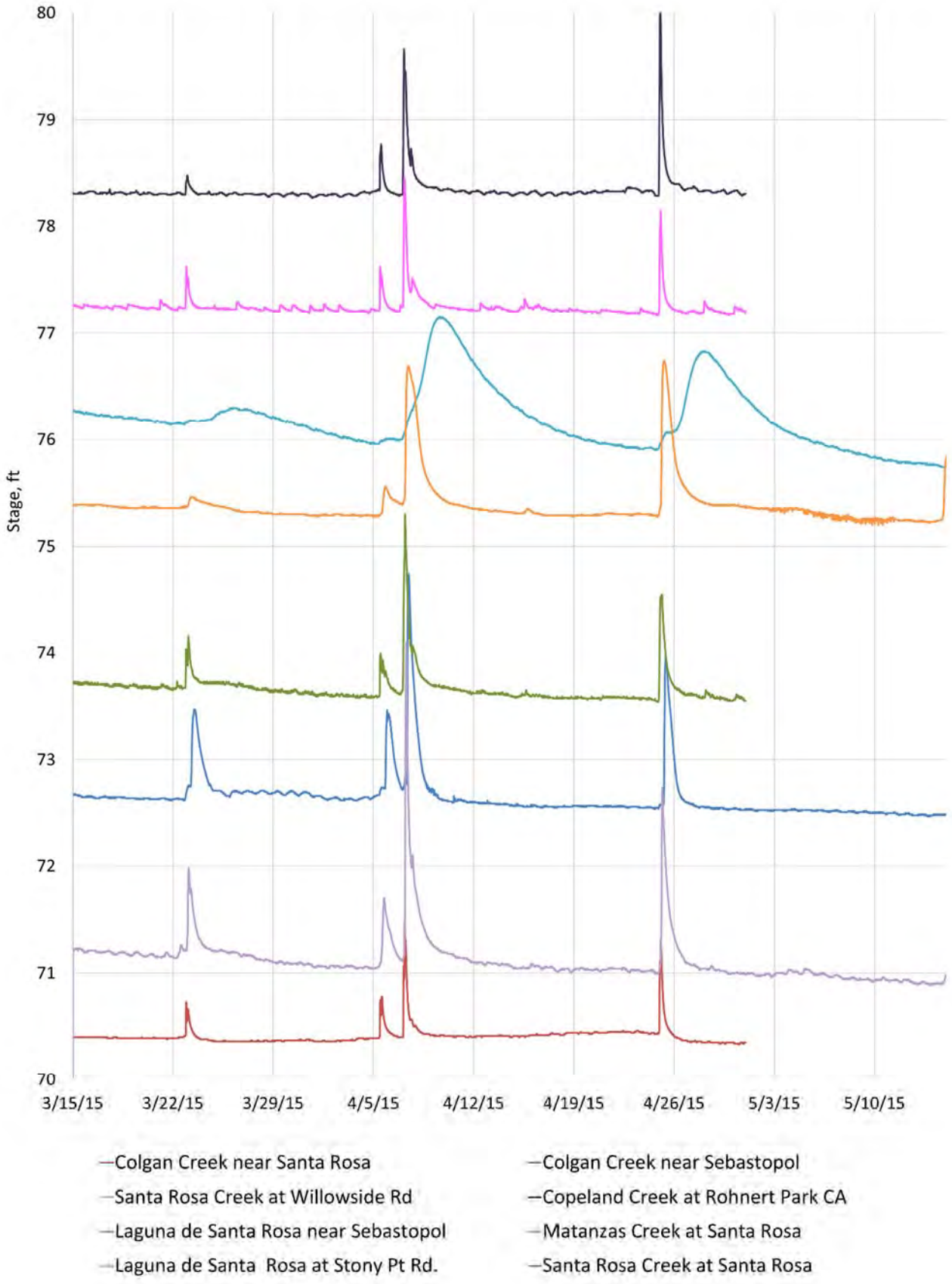

Figure 18. Water level recorded by gauges in the Santa Rosa Plain, spring 2015.

Reported frost protection water use, Santa Rosa Plain watershed

North Coast Water Coalition program members in the Santa Rosa Plain area reported using 52 acre-ft of water for frost protection in spring 2015 frequently through the month of April and occasionally in May. Water was reported used on April 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 15, 17, 20 and 23; and on May 3, 6, and 12 (Figure 19).

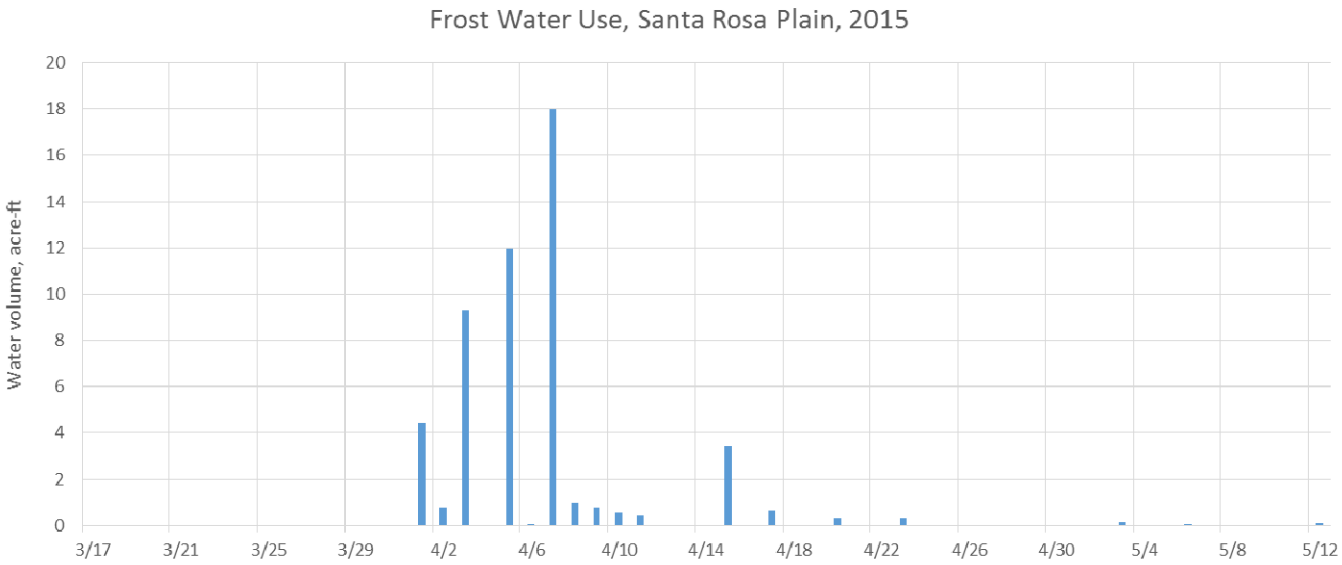

Figure 19. Water use reported for frost protection in the Santa Rosa Plain, spring 2015.

Risk and future steps

Based on the water level data from the eight gauges in the Santa Rosa Plain area, most of the drainage network appears to not be affected by water diversions for frost protection. However, the spatial distribution of gauges in the area may not accurately cover all tributaries with vineyards that may have frost diversions impacting water levels in the Santa Rosa Plain. While it is important to note that not all areas in this region are thoroughly covered, the streams are not considered critical habitat for salmon, therefore it may not be a priority for the North Coast Water Coalition to monitor the area in greater depth.

4.6 Lower Russian River/Green Valley Creek

Within the Lower Russian River/Green Valley Creek area, six instruments measured and recorded water level at 15-minute intervals through the frost protection season: four on Green Valley Creek from its headwaters to near the Russian River confluence, one on Atascadero Creek, and one on Purrington Creek (Figure 20).

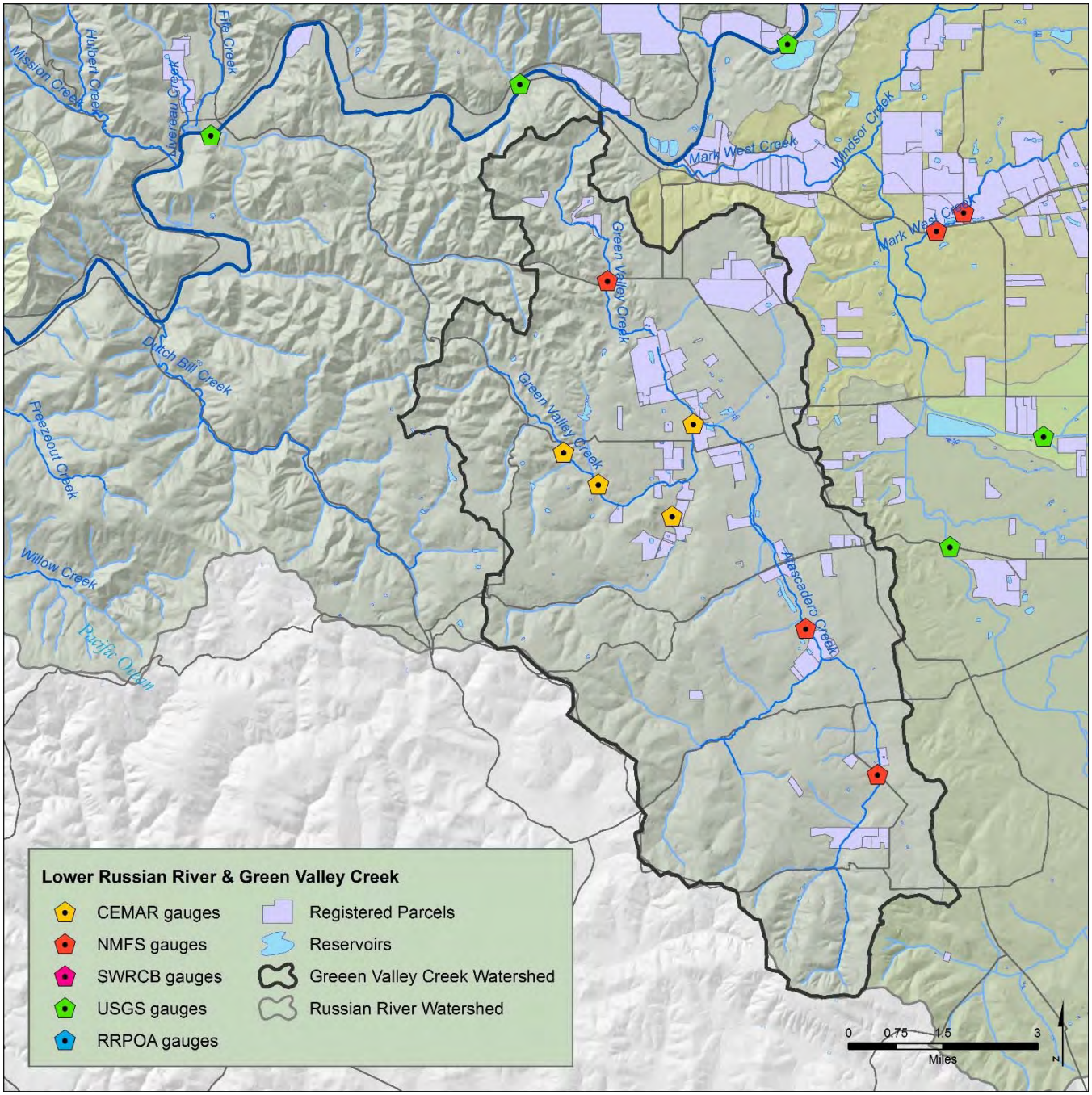

Figure 20. Water level gauges in the Green Valley Creek watershed and lower Russian River.

Green Valley Creek Water levels

The two Green Valley Creek gauges upstream of the Purrington Creek confluence showed no changes in water level that might be attributed to diversion for frost protection, and no vineyards have been identified above the upstream of these two gauges (Figure 21). Both did, however, show a sudden recession in water level that lasted for four days, from April 26 to April 30. This change in water level was not attributable to vineyard water needs because no vineyards were located upstream of the uppermost Green Valley Creek gauge. The drop in water level was detected in the two upstream Green Valley Creek gauges.

Small water level fluctuations were detected in Purrington Creek on April 15 and April 17-18. On both occasions, water level fell by 0.03 ft and 0.04 ft, respectively (slightly greater than the uncertainty level of the sensors) and rose to previous levels 10 hours later on April 15 and 21 hours later on April 17-18. These changes in water level were not detected at the Green Valley Creek gauge below the Purrington Creek confluence (GVC above Atascadero Creek), nor were any other changes in flow that could be attributed to frost protection water use. The upper Atascadero Creek gauge located at Watertrough Road near Sebastopol also detected no changes in water level that could be attributed to frost protection water use (a downstream Atascadero Creek gauge operated by NMFS in the past did not operate in spring 2015).

On nine occasions between March 15 and May 15, measured water level in Green Valley Creek at Highway 116 dropped by between 0.12 and 0.19 ft over a period of time ranging from 8 to 10 hours, and then rose back to near the previous level five to eight hours later (Table 6). The changes in water level typically began at approximately 8:30 PM with a minimum value in early morning; water level returned to previous the level at approximately noon the next day.

Table 6. Changes in water level possibly due to frost protection water diversion, Green Valley Creek at Highway 116.

Begin date/ time	Initial stage, ft	Lowest stage, ft	Time of minimum	Resumed stage, ft	Time of return	Total duration, hrs	Reported volume, AF
4/4/15 3:30 AM	0.57	0.44	4/4/15 8:00 AM	0.56	4/4/15 12:30 PM	9	0
4/4/15 9:30 PM	0.56	0.43	4/5/15 1:30 AM	0.56	4/5/15 11:30 AM	14	0
4/5/15 9:00 PM	0.57	0.41	4/6/15 6:39 AM	0.56	4/6/15 12:30 PM	15.5	0
4/6/15 8:30 PM	0.56	0.39	4/7/15 12:00 AM	Interrupted by rain, 4/7, 3AM		7	0
4/7/15 8:00 PM	0.82	0.70	4/7/15 11:00 PM	0.82	4/8/15 10:30 AM	14.5	0
4/8/15 8:00 PM	0.79	0.67	4/9/15 5:00 AM	0.78	4/9/15 8:00 AM	12	0
4/13/15 9:00 PM	0.60	0.43	4/14/15 5:30 AM	0.58	4/14/15 11:00 AM	14	0
4/14/15 8:30 PM	0.58	0.39	4/15/15 4:00 AM	0.57	4/15/15 12:00 PM	15.5	0
4/30/15 1:00 AM	0.55	0.36	5/1/15 6:00 AM	0.55	5/1/15 1:00 PM	12	0

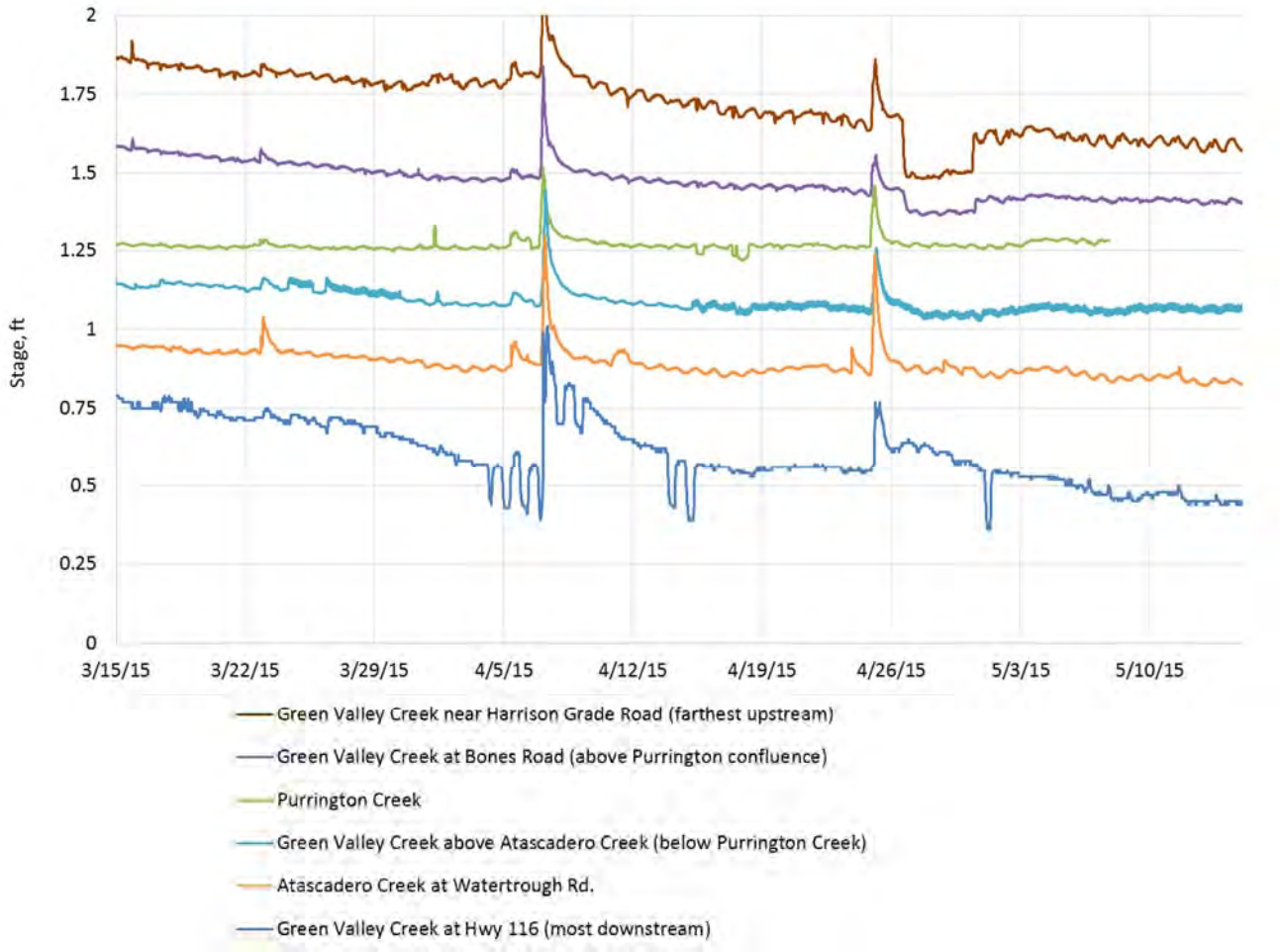

Figure 21. Water level at six gauges in the Green Valley Creek drainage network.

Reported frost protection water use, Green Valley Creek watershed

North Coast Water Coalition program members reported using 43.9 acre-ft of water for frost protection in spring 2015. Ninety-eight percent of the water reported used in the Green Valley Creek watershed was used on four days: April 1, 3, 4, and 6 (Figure 22).

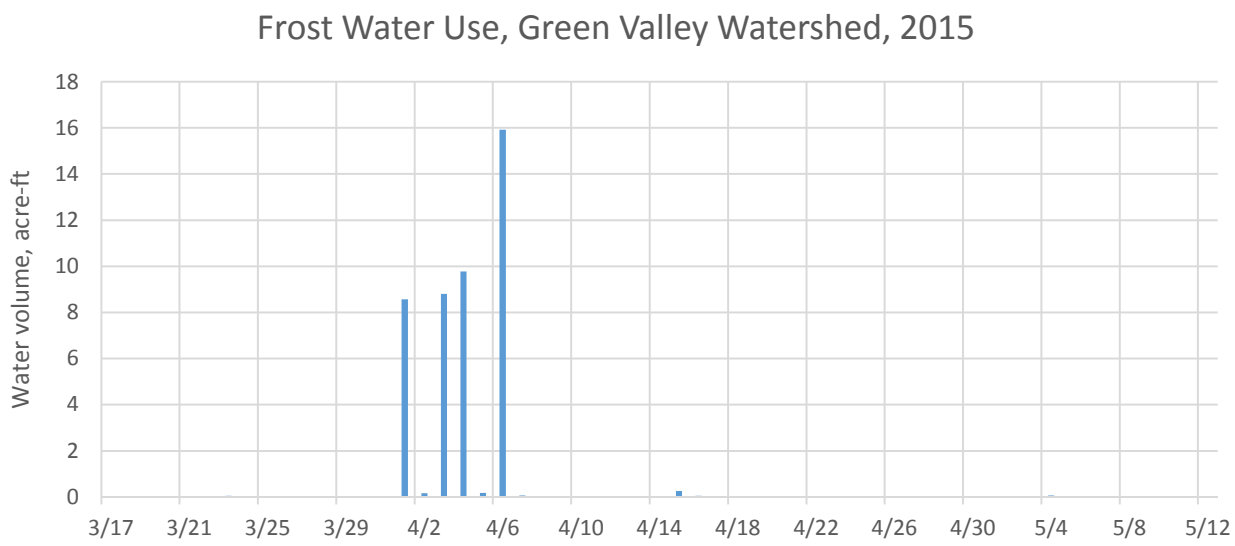

Figure 22. Water use reported in the Green Valley Creek watershed, spring 2015.

Risk and future steps

Based on the water level data from six instruments in the Green Valley Creek watershed, most of the drainage network is not affected by diversions for frost protection. The exception to this is the lower section of Green Valley Creek (below the confluence with Atascadero Creek), where water levels changed by more than 0.1 ft on nine occasions in spring 2015—indicating risk of stranding due to frost diversion. In future years, it will be important to evaluate whether those changes in water level have significant impacts to salmonid habitat (it may also be important to evaluate impacts to habitat in Purrington Creek, though the changes in water level were small).

The lower Green Valley Creek stage data indicated nine changes in water level during the frost protection season, though water users only reported using more than 0.25 acre-ft of water on four days. As in other regions described above, changes in water level may have been a caused by growers in the area who are not part of the NCWC.

Water levels, Lower Russian River

USGS operates three gauges in the lower portion of the Russian River: near Windsor, near Guerneville, and near Johnsons Beach. However, the Johnsons Beach gauge did not operate during the frost protection season, and the Windsor gauge began on May 1. Figure 23 shows water level data from these gauges as well as the five Russian River gauges in and near Alexander valley to illustrate fluctuations in water levels entering the lower Russian River. Water level data from the two gauges located within this study reach show natural rises in water levels from rainfall during the frost protection season, and do not show any fluctuations in water levels typical of frost diversions.

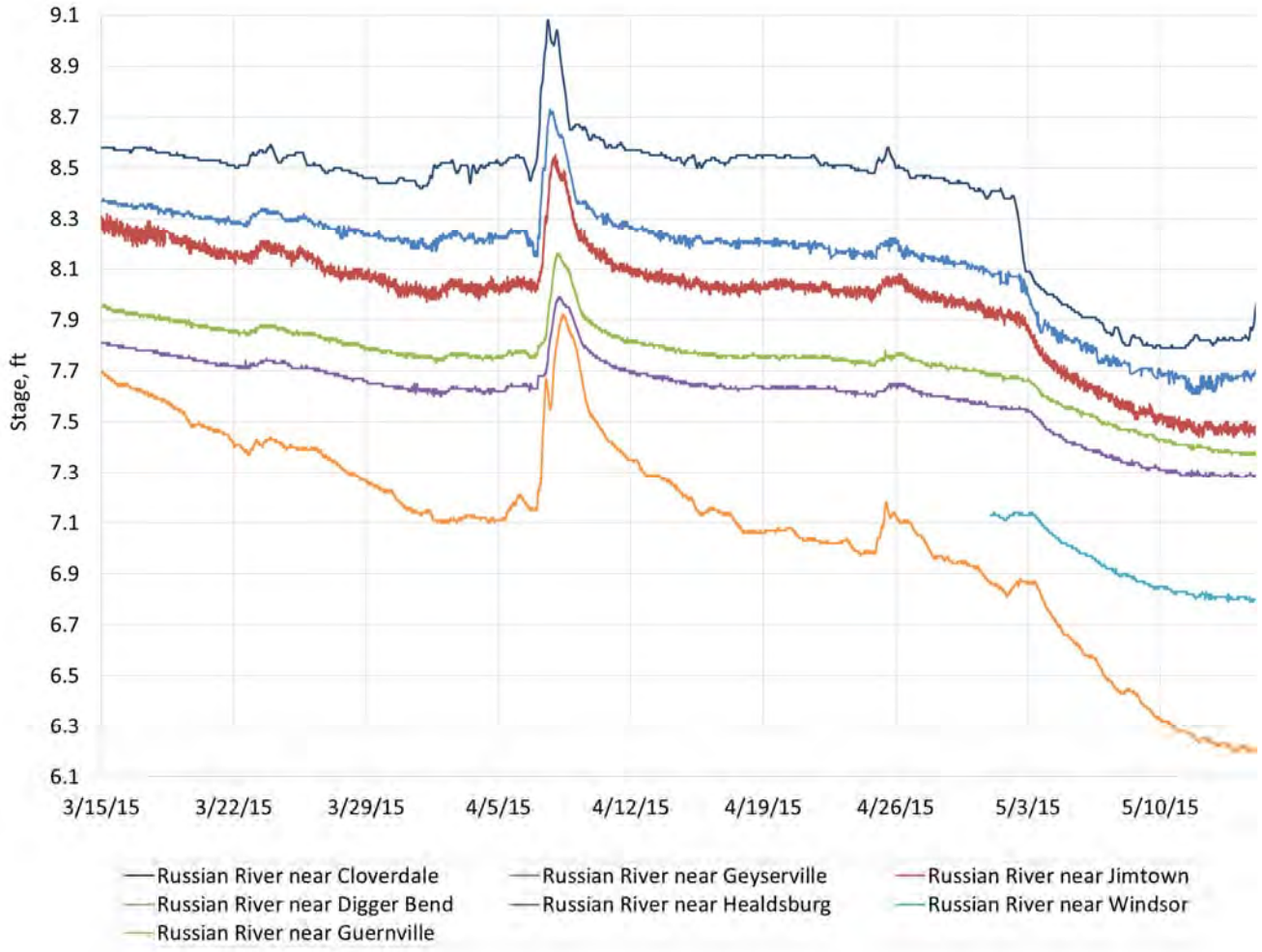

Figure 23. Changes in water level, Russian River, spring 2015.

Risk and future steps

Stage data from the lower Russian River area indicate no changes in water levels attributed to frost diversions. Similar to the Russian River in Alexander Valley, the lower Russian River is at low risk of impacts from frost diversions causing stranding based on 2015 data. Given the locations of the gauges in this area with the locations of vineyard operations, the gauges' spatial distributional adequately captures water levels in this region.

5. Overall risk of water use affecting salmonids; and next steps

The data gathered in 2015 provide the first countywide assessment of potential impacts of water diversions for frost protection affecting salmonid habitat. The objective of the 2015 work was to help focus the NCWC's efforts on particular locations for further evaluation and to reduce attention to other areas where effects of water diversions on water levels did not appear significant.

This report reviewed publicly available data from several watersheds important for maintaining steelhead and coho in the Russian River and where there is overlap with viticulture: Maacama Creek, Mark West Creek, Green Valley Creek, Dry Creek and its tributaries, and the mainstem Russian River in Alexander Valley and the Russian

River Valley. Overall, grape growers describe 2015 as a light frost year; and in general, the changes in water level that might be attributed to instream diversion detected by water level sensors was small. No noteworthy changes in stage occurred in the mainstem Russian River Big Sulphur Creek, and the Santa Rosa Plain, as well as most locations in Alexander Valley tributaries, in Mark West Creek, Maacama Creek, and Dry Creek. Small changes in water levels that might be attributed to frost protection water use occurred elsewhere in Mark West, Maacama, and Dry Creeks; and in Green Valley Creek, a larger change in water level was recorded. When sites in each region are graphed together, the changes in water level in Green Valley Creek appear much larger than those in other regions (Figure 24).

Additionally, in some regions, the timing of reported water used for frost protection does not consistently match all the water level fluctuations recorded from the instream gauges. One source of risk for stranding is the potential changes in water level caused by those grape growers not registered with NCWC.

Other streams, including Big Sulphur Creek and those in the Santa Rosa Plain, showed no changes in water level that could be attributed to instream diversion for frost protection.

In 2016, three changes to the 2015 study design will be made:

1. Because the effects of diversions can be attenuated with distance, additional instruments in Mark West, Redwood, and Gird Creeks (one or two in each stream) may be important to ensure that changes in water level do not adversely affect salmonid habitat. Additional instruments in Green Valley Creek may be useful as well (especially at two gauge sites recently retired by other organizations).
2. The 2015 study does not make any connections between changes in water level and changes in habitat. The 2016 study will evaluate whether changes in water level in each region occurs again, and how changes in water level on the order of 0.05 ft, 0.1 ft, or 0.2 ft could affect wetted area (and thus lead to stranding of juvenile salmonids). This will be done by measuring cross-sections at reaches where changes in flow were detected in 2015 during the frost protection season and correlating the change in depth with the change in wetted area at each location.
3. Additional evaluation of drying and relationship with environmental factors will be conducted in Alexander Valley tributaries in 2016.

Timeline

Over the next three months, the NCWC will develop a timeline for a 2016 Evaluation of Risk, considering the major additional components to incorporate into next year's study plan described above. In particular:

- A study plan for evaluating impact of frost diversions on habitat will be shared with NMFS, CDFG, and SWRCB by November 1, 2015. This will include methods, field schedule, and locations selected for conducting the study.
- Locations of additional stream gauges will be determined by November 1, 2015. New gauges will be installed during the first week of March, 2016
- A study plan to evaluate drying and the environmental- and human-driven factors contributing to drying of Alexander Valley tributaries will be shared with NMFS, CDFW, and SWRCB by November 30, 2015.
- Additional changes to the NCWC survey for growers will be completed by November 30, 2015.

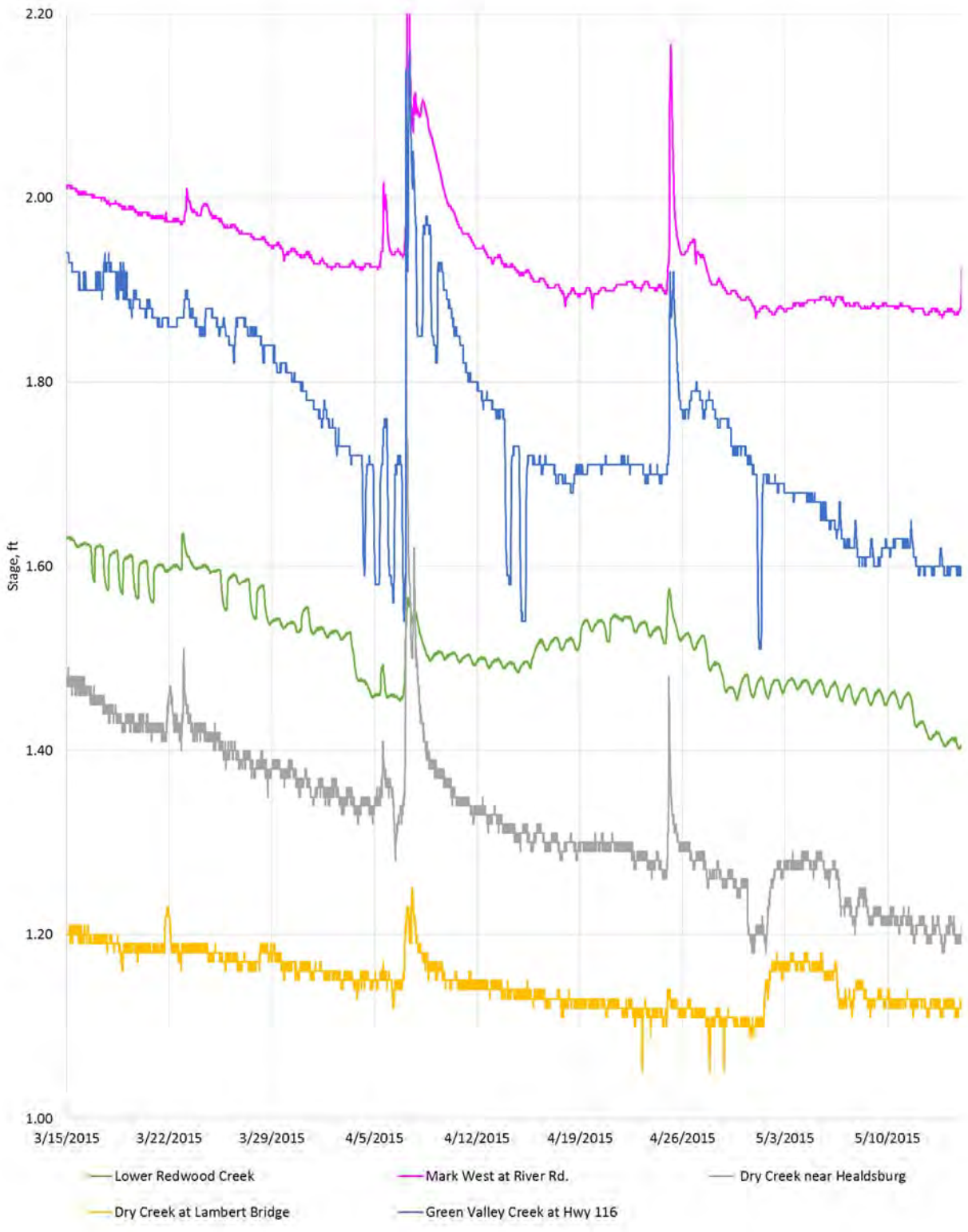

Figure 24. Changes in water level recorded in Dry Creek, Redwood Creek, Green Valley Creek, and Mark West Creek, spring 2015, at sites where changes in water level were detected.