CHAPTER 4.2 Water Quality

4.2.1 Introduction

This chapter identifies the water resources and water quality conditions within the Fish Habitat Flows and Water Rights Project (Proposed Project) area. Section 4.2.2, “Environmental Setting,” describes the regional and project area environmental setting, including important water bodies and water quality. Section 4.2.3, “Regulatory Framework,” details the federal, state, and local laws related to water quality. Potential impacts to water quality resulting from the Proposed Project are analyzed in Section 4.2.4, “Impact Analysis,” in accordance with the California Environmental Quality Act (CEQA) significance criteria (CEQA Guidelines, Appendix G) and mitigation measures are proposed that could reduce, eliminate, or avoid such impacts.

Other impacts to related resources are addressed in other chapters as follows: changes in water levels at Lake Sonoma and Lake Mendocino, and changes in instream flow velocity and stage height in the Russian River and Dry Creek are addressed in Chapter 4.1, “Hydrology”; impacts to fisheries resources are addressed in Chapter 4.3, “Fisheries Resources”; impacts to vegetation and wildlife are addressed in Chapter 4.4, “Vegetation and Wildlife”; and impacts to recreation are addressed in Chapter 4.5, “Recreation.”

4.2.2 Environmental Setting

The environmental setting for water quality includes all areas that could be affected by activities associated with the Proposed Project. As stated in Chapter 3, “Background and Project Description,” the objective of the Fish Flow Project is to manage Lake Mendocino and Lake Sonoma water supply releases to provide instream flows that will improve habitat for threatened and endangered fish, while updating the Water Agency’s existing water rights to reflect current conditions. The Water Agency would manage water supply releases from Lake Mendocino and Lake Sonoma to provide minimum instream flows in the Russian River and Dry Creek that would improve habitat for listed salmonids and meet the requirements of the Russian River Biological Opinion. Consequently, the environmental setting includes Lake Mendocino, the Russian River downstream of Coyote Valley Dam to the Pacific Ocean, tributaries entering the Russian River, Lake Sonoma, and Dry Creek downstream of Warm Springs Dam. The Russian River Estuary (Estuary) is defined as the tidal portion of the lower Russian River from the Duncans Mills area to the Pacific Ocean at Jenner.

The water resources within the project area exist in various forms, locations, and levels of quality. Water is usually considered to be a beneficial resource; however, water can also be the source of public health concerns. The following discussion covers the various aspects of the quality of water resources in the project area. Please refer to Chapter 4.1, “Hydrology,” for a detailed discussion of water resources as they relate to hydrology and surface storage, water rights and diversions, infiltration and groundwater, and flood hazards in the project area. Please refer to Chapter 4.0, “Introduction to Environmental Setting, Impacts, and Mitigation Measures,” for a general discussion of climate in the project area.

Russian River Watershed

The Russian River drains 1,485 square miles (mi^2) from the Coast Ranges in northern California, flowing 110 miles (mi) from its origination point near the City of Ukiah to the Pacific Ocean near the town of Jenner (USACE 1986, Florsheim and Goodwin 1993) (Figure 3-1). The watershed is 80 mi long and 32 mi across at its widest point, and lies within a narrow valley between the Mendocino Range to the west, with elevations ranging from 1,500 to 3,000 feet, the Mayacamas Mountains to the east, with elevations ranging from 3,000 to 4,000 feet, and Sonoma Mountains to the south (Ritter and Brown 1971, USACE 1986). The Russian River is about 110 miles long and flows southward from its headwaters near Redwood and Potter Valleys, through Ukiah, Hopland, and Alexander Valleys to Forestville where the direction of flow changes to westward as the river transects a part of the Coast Ranges (Rantz and Thompson 1967, Sylvester 1984). The several alluvial valleys through which the river flows are separated by mountain gorges (Rantz and Thompson 1967). Principal tributaries of the Russian River are the West and East Forks of the Russian River, Robinson, Feliz, Big Sulphur, Maacama, Dry Creek, Mark West, and Austin creeks.

Coyote Valley Dam receives runoff from 105 square miles (mi^2) of the upper watershed on the East Fork Russian River (approximately 7 percent of the entire Russian River watershed), just upstream of the confluence with the Russian River. The watershed contributing to Lake Sonoma behind Warm Springs Dam encompasses an area of 130 square miles, which is approximately 9 percent of the Russian River watershed. Please refer to Table 4.1-1 in Chapter 4.1, “Hydrology,” for a description of the major tributaries to the Russian River and their approximate watershed size.

Precipitation patterns within the Russian River basin reflect a Mediterranean climate, with hot, dry summers and cool, wet winters. Mean daily summer temperatures range from 72 to 75 °F inland (with maximum temperatures in excess of 90 °F) to 61 to 64 °F near the coast, while mean winter temperatures range from 40 to 50 °F (PRISM 2015a, b, c). Most precipitation falls as rain from October through May, with 90 percent occurring from November through April and ranging from 28 to 80 inches across the watershed (USACE 1986, Opperman et al. 2005, PRISM 2013). These patterns are driven by Pacific frontal storms bringing warm subtropical moisture to produce intense, short bursts of rainfall (Mount 1995). The seasonal southerly migration of the Aleutian low pressure system forces westward moving storms over the Coast Ranges (USACE 1984), creating an orographic effect whereby water vapor cools and condenses as it rises, then rapidly precipitates. Rainfall tends to be heaviest at higher elevations near the coast, with average annual rainfall of 80 inches per year near Cazadero at the western edge of the watershed. In lower elevation valley areas, annual precipitation ranges from 22 inches per year near Santa Rosa to 41 inches per year at the City of Healdsburg (Inter-Fluve 2010, PRISM 2013).

Precipitation that lands on impermeable surfaces, or that falls at a greater rate than a permeable surface's ability to absorb, will become runoff or surface water.

Please refer to Chapter 3, “Background and Project Description”, and Chapter 4.1, “Hydrology,” for more information on the operation of dams and reservoirs of the region and surface water regulation.

Seasonal Hydrology and Water Quality

As described in Chapter 3, “Background and Project Description,” the Water Agency is the local sponsor for Lake Mendocino and Lake Sonoma and manages water supply releases from both reservoirs in accordance with its water right permits issued by the State Water Resources Control Board (SWRCB) as those permits were amended by the SWRCB’s Decision 1610, adopted in 1986. Decision 1610 established minimum instream flow requirements for the Russian River and Dry Creek, which are included as terms in the Water Agency’s water right permits. Refer to Section 3.3.4 in Chapter 3, “Background and Project Description,” for details regarding Decision 1610 minimum instream flow requirements. The minimum instream flows requirements were established for four reaches in the Russian River watershed: 1) East Fork Russian River from Coyote Valley Dam to the confluence with the Russian River; 2) the Russian River between the East Fork confluence and Dry Creek; 3) the Russian River between Dry Creek and the Pacific Ocean; and 4) Dry Creek downstream of Warm Springs Dam to the confluence with the Russian River.

Water quality in the Russian River watershed is influenced primarily by the various inflows or inputs into its rivers and creeks and is a function of the season, the surrounding land use, and the tributaries flowing in the watershed. Operations related to Coyote Valley Dam, Warm Springs Dam, and water production facilities directly affect flows in the Russian River and in Dry Creek. Additional factors that affect instream flows in the Russian River and Dry Creek include municipal, domestic, and agricultural water demands, summer impoundments, and weather.

During the wet season (typically November through April) unimpaired stream flows, including storm water runoff, accounts for most of the flow in the Russian River and Dry Creek. Treated wastewater discharges from various cities and communities in the Russian River watershed also account for a small portion of the instream flow in the Russian River during the wet season. Ukiah and Cloverdale have permits for wet season discharge into the Russian River, which typically run from October 1 to May 14. The cities, communities, and special districts of Windsor, Santa Rosa Sub- Regional Water Reuse System (which includes Santa Rosa, Rohnert Park, Cotati, and Sebastopol), Forestville, Graton, Occidental, and the Russian River County Sanitation District, discharge into the Russian River or tributaries of the Russian River during the wet season. The City of Healdsburg has a permit for wet season discharge to the Russian River (Scates, 2016), however the city continues to discharge year-round, under a North Coast Regional Water Quality Control Board (NCRWQCB) Cease and Desist Order (CDO), to a former gravel mining pit which was determined in a court decision to be functionally connected to the Russian River (USCOA 2007). To address conditions of the CDO, Healdsburg is currently working to expand its irrigation alternatives to reduce dry season discharges to the former gravel mining pit (Scates 2016).

Non-point source discharges from agricultural and industrial runoff, failing septic systems, and other sources along the Russian River are more difficult to quantify, although unsewered communities along the Russian River are known to have high concentrations of failing septic systems (NCRWQCB 2007, 2008). Bacteriological pollution, such as coliform bacteria, is an indicator of contamination from human or animal wastes. Such pollution can pose a public health concern.

Stream channelization, road construction along stream margins, bank stabilization, and water diversions in tributaries have significantly degraded stream habitats throughout the watershed by simplifying stream channels, isolating them from their floodplains, greatly increasing sedimentation, blocking fish migrations, and reducing or eliminating flow and cover. Water quality priorities within the watershed include the need for control of nonpoint source runoff from logging, rural roads, agriculture, and urban areas. Sediment, temperature, nutrients, bacteria, and mercury are the water quality parameters of primary concern for the NCRWQCB (see Section 4.2.3, “Regulatory Framework,” for details). For a discussion of sediment, please see Chapter 4.1, “Hydrology.”

The NCRWQCB listed the entire Russian River on the 2010 Clean Water Act (CWA) Section 303(d) List of Water Quality Limited Segments (NCRWQCB, 2011) for sedimentation/siltation and temperature impairments. Lake Mendocino and Lake Sonoma are on the 303(d) List for mercury impairments in fish tissue. Several hydrologic sub-areas within the Russian River watershed that could be affected by the Proposed Project are also listed for impairments including aluminum, indicator bacteria, and specific conductivity. Although the segments of the Russian River that could be affected by the Proposed Project are not listed as impaired from biostimulatory substances or low dissolved oxygen (DO) concentrations, excessive concentrations of nutrients can contribute to nuisance conditions resulting in low DO and high algal (chlorophyll-a) concentrations. As such, a discussion of DO, nutrients, and algae is included below, and an assessment of the potential for the Proposed Project to affect biostimulatory substances is included in Section 4.2.4, “Impact Analysis.”

Constituents of Concern

Temperature

Water temperature has direct and indirect effects on aquatic ecology. For example, oxygen is more soluble in cold water than hot water (i.e., solubility is a function of water temperature); therefore DO levels may be higher in waters at lower temperatures. Temperature also influences the rate of photosynthesis by algae and aquatic plants. Water bodies such as the Russian River have naturally fluctuating temperatures due to the dynamic conditions associated with a coastal climate and localized weather patterns. Seasonal changes in water temperature in rivers closely follow seasonal trends in mean monthly air temperature, except that in winter the water temperature does not fall below 0°C (32°F), and warm air warms more rapidly in the spring than does water (Allan 1995). The annual temperature range in temperate rivers is usually between 0 and 25°C (77°F) (Allan 1995). For temperatures above freezing, Crisp and Howson (1982) found that mean weekly water temperature could be predicted very accurately from air temperatures using a 5 to 7 day lag (Allan 1995).

Temperatures less than 17°C (62.6°F) are typically preferred by juvenile steelhead (Sullivan et al., 2000). In general, salmonids in warmer waters require more food and oxygen because their metabolism increases with temperature (Moyle, 2002). The high productivity associated with healthy estuaries provides an abundant food source for many fish species and can allow temperature-sensitive fish, such as juvenile salmonids, to withstand greater water temperatures than the typical optimal range, and can actually result in greater growth rates (Bond et al., 2008).

The Water Quality Control Plan for the North Coast Region (Basin Plan) includes narrative and numeric water quality objectives for temperature that apply to the Russian River (Table 4.2-1) (NCRWQCB 2011 and 2015). Please refer to Chapter 4.3, "Fisheries Resources" for potential impacts to fish related to temperature. Please refer to Section 4.2.3, "Regulatory Framework," for a description of the Basin Plan.

Dissolved Oxygen

Wind plays an important role in the distribution of dissolved gases by providing the energy to stir the water column (Horne and Goldman 1994). As they splash over rocks, streams are naturally aerated and are usually saturated with oxygen (Horne and Goldman 1994). In small, turbulent streams that have received only limited pollution, diffusion maintains oxygen near saturation (Allan 1995). However, when surface flows become intermittent, oxygenation processes including diffusion and turbulence are reduced and DO concentrations can decline over time. Groundwater can be very low in dissolved oxygen (Allan 1995). This can result in depressed surface water DO concentrations "when there are substantial groundwater inputs that have had little opportunity for equilibration with the atmosphere" (Allan 1995). Oxygen gas occurs in the atmosphere and dissolves into water according to partial pressure and temperature (Allan 1995). Increasing temperatures reduce the amount of oxygen that can dissolve into water from the atmosphere. For example, the concentration of DO in saturated pure water at sea level ranges from 14.2 milligrams per liter (mg/L) at zero degrees Celsius (0°C) to 7.5 mg/L at 30°C (Allan 1995).

There are a multitude of chemical and biological processes that can increase or decrease DO levels during a typical daily (diel) cycle, including primary production, predation, and decomposition. DO levels can be affected by excessive concentrations of nutrients including nitrogen and phosphorus. These nutrients can accumulate in standing water during an extended period of time and contribute to biostimulatory conditions. These conditions can promote excessive plant and algal growth that can alter the concentration of DO through photosynthesis and respiration. Excessive respiration of DO by plants and algae during the diel cycle can result in DO levels that can affect overall ecological health of the river and potentially lead to eutrophication.

DO concentrations also affect habitat quality and use, physiological stress, and mortality of fish and other aquatic organisms. In general, DO concentrations less than 5 to 6 milligrams per liter (mg/l) are considered to be unsuitable for most fish species, including steelhead (Bell, 1973; Barnhardt, 1986). Salmonids generally require a DO level of at least 8 mg/l for optimal growth and survival, and depending on temperature, the lower lethal limit for salmonids is a DO level of around 3 mg/l. Please refer to Chapter 4.3, “Fisheries Resources,” for potential impacts to fish related to DO concentrations. The Basin Plan includes narrative and numeric water quality objectives for the protection of beneficial uses that have been identified for a given waterbody. Numeric water quality objectives have been established for DO concentrations in the Russian River (Table 4.2-1) (NCRWQCB 2015). Please refer to Section 4.2.3, “Regulatory Framework,” for a description of the Basin Plan.

Table 4.2-1. Water Quality Control Plan for the North Coast Region (Basin Plan) Water Quality Objectives for Applicable Beneficial Uses (NCRWQCB, 2011 and 2015).

Parameter/ Constituent	Water Quality Objectives	Applicable Beneficial Use or Designation[1]
Temperature	The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses. At no time or place shall the temperature be increased more than 5 Degrees Fahrenheit (5ºF) above natural receiving water temperature.	Cold freshwater habitat (COLD) Warm freshwater habitat (WARM)
Dissolved Oxygen	Daily Minimum – 5.0 mg/L[2] 7-Day Moving Average[3] – 6.0 mg/L	(WARM)
	Daily Minimum – 6.0 mg/L 7-Day Moving Average – 8.0 mg/L	(COLD)
	Daily Minimum – 9.0 mg/L 7-Day Moving Average – 11.0 mg/L	Spawning, Reproduction, and/or Early Development (SPWN)[4]
Biostimulatory substances	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.	(REC-1) (REC-2) (COLD) (WARM)
Bacteria	The bacteriological quality of waters of the North Coast Region shall not be degraded beyond natural background levels. In no case shall coliform concentrations in waters of the North Coast Region exceed the following: Median fecal coliform concentration based on a minimum of not less than 5 samples for any 30-day period shall not exceed 50/100 milliliter (ml), nor shall more than 10% of total samples during any 30-day period exceed 400/100 ml (State Department of Health Services).	Water contact recreation (REC-1) Non-contact water recreation (REC-2)
Specific Conductance	(Mainstem upstream of Laguna de Santa Rosa) 90% Upper Limit[5]: 320 micromhos 50% Upper Limit[6]: 250 micromhos	Municipal and Domestic Supply (MUN)
	(Mainstem downstream of Laguna de Santa Rosa)[7] 90% Upper Limit: 375 micromhos 50% Upper Limit: 285 micromhos	
Chemical Constituents (Aluminum)	Waters shall not contain concentrations of chemical constituents in amounts that cause nuisance or adversely affect beneficial uses.	(MUN)

[1] These are applicable Beneficial Uses within the project area and do not represent all Beneficial Uses protected by these standards that may apply to the project area.
[2] Milligrams per liter (mg/L).
[3] A 7-day moving average is calculated by taking the average of each set of seven consecutive daily averages.
[4] Water quality objectives designed to protect SPWN-designated waters apply to all fresh waters designated in Table 2-1 of the Basin Plan as SPWN in those reaches and during those periods of time when spawning, egg incubation, and larval development are occurring or have historically occurred. The period of spawning, egg incubation, and emergence generally occur in the North Coast Region between the dates of September 15 and June 4.
[5] 90% upper limits represent the 90 percentile values for a calendar year. 90% or more of the values must be less than or equal to an upper limit.
[6] 50% upper limits represent the 50 percentile values of the monthly means for a calendar year. 50% or more of the monthly means must be less than or equal to an upper limit.
[7] Does not apply to estuarine areas.

Biostimulatory Substances (Nutrients and Algae)

Nutrients such as nitrogen and phosphorus are essential for life processes in aquatic organisms, including algal growth. Through a process called photosynthesis, algae utilize solar energy to convert simple inorganic nutrients into complex organic molecules. The organic matter in turn serves as an energy source for other organisms (Deas and Orlob, 1999).

Increased cellular processes such as photosynthesis and respiration result in greater algal growth and accumulation of organic matter especially in waters that have lower DO levels and high temperatures, which in turn affect the overall health of the water body. The rates of such processes vary with the nature of the water bodies. The Basin Plan includes a narrative water quality objective for biostimulatory substances that can promote aquatic growths to the extent that such growths cause nuisance or adversely affect designated beneficial uses (Table 4.2-1).

The process for developing nitrogen and phosphorus nutrient criteria for the region started in 1998 with the publication of the United State Environmental Protection Agency (USEPA), *National Strategy for the Development of Regional Nutrient Criteria* (USEPA 2006). USEPA Region IX formed a Regional Technical Advisory Group (RTAG) in 1999 and the SWRCB created the State Regional Board Technical Advisory Group (STRTAG) in 2001 to work with the RTAG to develop nutrient criteria for California.

To address the potential for nutrient-related impairments to surface water quality, the USEPA established Section 304(a) Ambient Water Quality Criteria Recommendations for nutrients in rivers and streams across 14 major ‘ecoregions’ of the United States referred to as Level III Aggregate Ecoregions (USEPA 2000). USEPA’s Section 304(a) criteria are intended to provide for the protection and propagation of aquatic life and recreation (USEPA, 2000). The Russian River was designated as occurring in Aggregate Ecoregion III. These criteria were established for freshwater systems, and as such, are only applicable to the freshwater portions of the river. Currently, there are no numeric nutrient criteria established for estuaries. It is important to note that these criteria are recommended levels and are not enforceable standards. The USEPA also established section 304(a) nutrient criteria for lakes and reservoirs in Aggregate Ecoregion III (USEPA 2001a).

The USEPA’s desired goal for total nitrogen in Aggregate Ecoregion III is 0.38 milligrams per liter (mg/L) for rivers and streams not discharging into lakes or reservoirs (Table 4.2-2). Calculating total nitrogen values requires the summation of the different components of total nitrogen; organic and ammoniacal nitrogen (together referred to as total kjeldahl nitrogen or TKN), and nitrate and nitrite nitrogen. The USEPA’s desired goal for total phosphates as phosphorus in Aggregate Ecoregion III has been established as 21.88 micrograms per liter (μg/L), or approximately 0.022 mg/L, for rivers and streams not discharging into lakes or reservoirs (Table 4.2-2).

The USEPA’s desired goal for total nitrogen in Aggregate Ecoregion III is 0.40 milligrams per liter (mg/L) for lakes and reservoirs (Table 4.2-2). The USEPA’s desired goal for total phosphates as phosphorus in Aggregate Ecoregion III has been established as 17.00 μg/L or 0.017 mg/L for lakes and reservoirs (Table 4.2-2).

In the process of photosynthesis, chlorophyll-a - a green pigment in plants - absorbs sunlight and combines carbon dioxide and water to produce sugar and oxygen. Chlorophyll-a can therefore serve as a measureable indicator of algal growth. Qualitative assessment of primary production on water quality can be based on chlorophyll-a concentrations. Primary productivity is the conversion of energy to organic substances through photosynthesis. A University of California, Davis report on the Klamath River (1999) assessing potential water quality and quantity regulations for restoration and protection of anadromous fish in the Klamath River includes a discussion of chlorophyll-a and how it can affect water quality. The report characterizes the effects of chlorophyll-a in terms of different levels of discoloration (e.g., no discoloration to some, deep, or very deep discoloration). The report indicated that less than 10 µg/L (or 0.01 mg/L) of chlorophyll-a exhibits no discoloration (Deas and Orlob, 1999). Additionally, the USEPA recommended criteria for chlorophyll-a in Aggregate Ecoregion III is 1.78 µg/L, or approximately 0.0018 mg/L for rivers and streams not discharging into lakes or reservoirs (Table 4.2-2) (USEPA 2000). The USEPA criteria for chlorophyll-a in Aggregate Ecoregion III is 3.40 µg/L or 0.0034 mg/L for lakes and reservoirs (Table 4.2-2) (USEPA 2001a).

The USEPA and SWRCB continued to work on refining nutrient criteria and in 2006 released the *Technical Approach to Develop Nutrient Numeric Endpoints for California* (USEPA 2006). The following is an excerpt from the 2006 USEPA document:

> *The RTAG conducted a pilot project in 1999 and 2000 to develop a water quality database organized by ecoregion to assess the availability of existing water quality and biological data to support nutrient criteria development, and to evaluate regional reference conditions for streams and rivers in aggregated Ecoregion II (Western Forested Mountains). The results of this project suggested that the proposed reference condition distributions used by USEPA would require some refinement and supporting studies to ensure that the adopted criteria were appropriate.*
>
> *In 2000 the RTAG and STRTAG reviewed the findings of the pilot study using the original Level III ecoregions to evaluate the draft default 304(a) criteria included in the criteria document that had been completed for rivers and streams. The comparison tables for total phosphorus (TP) and total nitrogen (TN) suggest that if the EPA reference-based values (draft 304(a)) are adopted that a large number of probably un-impaired water bodies would be misclassified as impaired. Therefore the RTAG and STRTAG responded to this potential for misclassification by adopting a resolution to pursue the USEPA approved alternative to development alternate nutrient criteria.*

Also from the 2006 USEPA document:

> *However, ambient concentration data may not be effective in assessing eutrophication and the subsequent impact on water use because algal productivity depends on several additional factors such as morphology, light availability, flooding frequency, biological community structure, etc. Except in extreme cases, nutrients alone do not impair beneficial uses. Rather, they cause*

> *indirect impacts through algal growth, low DO, and so on, that impair uses. These impacts are associated with nutrients, but result from a combination of nutrients interacting with other factors. Appropriate nutrient targets for a waterbody should take into account the interactions of these factors to the extent possible. For instance, the nutrient concentration that results in impairment in a high-gradient, shaded stream may be much different from the one that results in impairment in a low-gradient, unshaded stream. Instead of setting criteria solely in terms of nutrient concentrations, it is preferable to use an analysis that takes into account the risk of impairment of uses.*
>
> *The nutrient criteria framework needs to contain, in addition to nutrient concentrations, targeting information on secondary biological indicators such as benthic algal biomass, planktonic chlorophyll, dissolved oxygen, dissolved organic carbon, macrophyte cover, and clarity. These secondary indicators provide a more direct risk-based linkage to beneficial uses than the nutrient concentrations alone.*

As a result, the USEPA Region IX and the SWRCB began to develop statewide numeric nutrient endpoints (NNE) to include a threshold for benthic algal biomass and chlorophyll-a in place of individual nutrient concentrations (USEPA 2006). The intention of the proposed approach is to select nutrient response indicators that can be used to evaluate risk of use impairment, rather than using pre-defined nutrient limits that may or may not result in eutrophication for a particular water body (USEPA 2006). To date, this level of comprehensive data collection and analysis has not been conducted within the Russian River watershed to establish baseline conditions within the watershed as they relate to biostimulatory substances or nuisance conditions. As a result, the Water Agency continues to rely on recommended nutrient and chlorophyll-a criteria for USEPA Aggregate Ecoregion III to identify the potential for nuisance conditions to occur.

Table 4.2-2. United States Environmental Protection Agency recommended criteria for aquatic life and recreation, and California Department of Public Health draft guidance for freshwater beaches (USEPA, n.d., 2000, 2001a, 2001b, 2002; CDPH, 2006).

Parameter/ Constituent	Water Quality Objectives	Applicable Waterbody[1]
USEPA Section 304(a) Recommended Criteria[1]		
Total Nitrogen	0.38 mg/L	Rivers and streams not discharging to lakes or reservoirs
Total Phosphates	0.022 mg/L	Rivers and streams not discharging to lakes or reservoirs
Chlorophyll-a	0.0018 mg/L	Rivers and streams not discharging to lakes or reservoirs
Total Nitrogen	0.40 mg/L	Lakes and reservoirs
Total Phosphates	0.017 mg/L	Lakes and reservoirs
Chlorophyll-a	0.0034 mg/L	Lakes and reservoirs
Methylmercury in fish tissue	0.3 mg methylmercury/kg fish (based on daily consumption of 00.0175 kg or 17.5 g of fish)[2]	All waterbodies

CDPH Draft Guidance for Freshwater Beaches[3]		
Total Coliform	10,000 MPN[4]/100 milliliters	Freshwater beaches
Enterococcus	STV[5] - 61 MPN/100 milliliters	Freshwater beaches
Escherichia coli (*E. coli*)	STV - 235 MPN/100 milliliters	Freshwater beaches

[1] United States Environmental Protection Agency (USEPA) 304(a) (2002): Applicable to freshwater areas; no numeric criteria for estuaries currently available.
[2] Kilograms (kg) and grams (g).
[3] California Department of Public Health (CDPH) Draft Guidance for Freshwater Beaches (2006).
[4] Most Probable Number (MPN).
[5] STV – Statistical Threshold Value represents the 75th percentile value for a given sample set (less than 25% of samples can exceed the STV).

Indicator Bacteria

The Basin Plan contains a fecal coliform bacteria freshwater water quality objective for the protection of waters designated with the contact recreation beneficial use (REC-1). Water quality objectives in the Basin Plan were developed in the 1970s and based on recommendations provided by the California Department of Public Health (CDPH) (formerly California Department of Health Services) at that time. However, since the 1970s, the USEPA and the CDPH have recommended standards that differ from the current Basin Plan freshwater bacteria objective.

In 2006, CDPH developed the "Draft Guidance for Fresh Water Beaches," which describes bacteria levels that, if exceeded, may require posted warning signs in order to protect public health (CDPH 2011). The CDPH draft guideline for total coliform is 10,000 most probable number (MPN) per 100 milliliters (ml) (Table 4.2-2). The MPN for Enterococcus is 61 per 100 ml, and the MPN for *Escherichia coli* (*E. coli*) is 235 per 100 ml (Table 4.2-2).

However, the NCRWQCB has indicated, based on guidance from Sonoma County Department of Health Services (Sonoma County DHS), that Enterococcus is not currently being utilized as a fecal indicator bacteria in freshwater conditions due to uncertainty in the validity of the lab analysis to produce accurate results, as well as evidence that Enterococcus colonies can be persistent in the water column and therefore its presence at a given site may not always be associated with a fecal source (NCRWQCB 2013).

In 2012, the USEPA issued Clean Water Act (CWA) Section 304(a) Recreational Water Quality Criteria (RWQC) for States (USEPA 2012). The RWQC recommends using two criteria for assessing water quality relating to fecal indicator bacteria: the geometric mean (GM) of the dataset, and changing the single sample maximum (SSM) to a Statistical Threshold Value (STV) representing the 75th percentile of an acceptable water-quality distribution. However, the USEPA recommends using STV values as SSM values for potential recreational beach posting.

These are draft guidelines and criteria, not adopted standards, and are therefore both subject to change (if it is determined that the guidelines and/or criteria are not accurate indicators) and are not currently enforceable. In addition, these draft guidelines were established for and are only applicable to fresh water beaches. Currently, there are no numeric guidelines that have been developed for estuarine areas.

Sources of these bacteria include the natural environment (soils and decaying vegetation), stormwater, urban runoff, animal waste (both wildlife and domestic animals), and human sewage. Analysis for total coliform, *E. coli*, and Enterococcus bacteria are widely used as an indicator test. Coliform is a heading that describes a type of bacteria, which includes *E. coli*. It is found within the intestines of warm-blooded animals. Enterococcus is much like coliform bacteria, but is known to have a greater correlation with swimming-associated illnesses and is less likely to die-off in highly saline water. While these bacteria normally occur at low levels in the environment, high levels can indicate contamination (but do not cause illness) and the presence of other harmful pathogens.

In 2013, the NCRWQCB indicated that Enterococcus was not being utilized as a fecal indicator bacteria for freshwater environments due to uncertainty in the validity of the lab analysis to produce accurate results, as well as evidence that Enterococcus colonies can be persistent in the water column and therefore its presence at a given site may not always be associated with a fecal source (NCRWQCB 2013). Total coliform include bacteria that are not found in human or animal waste and may not always be an accurate indicator of a fecal source in surface water. Fecal coliforms are a sub-set of total coliforms that are considered to specifically inhabit the gut and feces of humans and animals. *E. coli* is a species within the fecal coliform sub-set and is considered to be a strong indicator of the presence of fecal matter in surface water. Available total coliform data is not as consistent and as robust as the available *E. coli* data. Therefore, *E. coli* data will be relied upon when determining potential changes to water quality from changes to lake elevations and instream flows.

Mercury

Lake Mendocino and Lake Sonoma have been listed under Section 303(d) for mercury pollution measured in fish tissue (NCRWQCB 2016a). Mercury, also called quicksilver, is a heavy metal and potent neurotoxin that is harmful to humans and wildlife (NCRWQCB 2016a). Mercury builds up in the bodies of fish and also in people who eat contaminated fish. Possible mercury sources include naturally-occurring mercury contained in soils, gold mines, soil erosion due to human activities such as logging and road construction, and airborne sources from North America and Asia (NCRWQCB 2016a).

Erosional sources that contribute to mercury accumulation in fish tissue are associated with the active transport of mercury-containing soils into the receiving water body. The degree of mercury accumulation due to erosional sources is dependent in large part on current and past land use practices upstream of the receiving water body coupled with rain and wind transport. Depositional sources are associated with atmospheric mercury that is released into the air as a result of industrial production activities and is also dependent on rainfall and wind transport.

The SWRCB is currently developing a statewide mercury program that will include a control program for reservoirs that will address controlling sources of mercury and water quality objectives for mercury. The USEPA recommended water quality criterion for concentrations of methylmercury in fish tissue is 0.3 mg methylmercury/kg fish (USEPA 2001b). This is the concentration in fish tissue that should not be exceeded based on a total fish and shellfish consumption-weighted rate of 0.0175 kg (17.5 grams) fish/day (USEPA 2001b).

Aluminum

Aluminum is a naturally occurring element in the soil that can be transported into surface water through erosion and rainfall. Uncontaminated rain water is naturally acidic. Free hydrogen ions, the actual acid part of rain, are very active (Horne 1994). As hydrogen ions pass through the soil (with rain water) they cause the release of free ions of copper, zinc, aluminum, and other heavy metals. At elevated concentrations aluminum ions can be directly toxic to fish, invertebrates, and algae (Horne 1994). The NCRWQCB recently amended the Basin Plan dissolved oxygen water quality objective, which included changes to the water quality objectives for chemical constituents including aluminum (NCRWQCB 2015) as follows:

> Waters shall not contain concentrations of chemical constituents in amounts that cause nuisance or adversely affect beneficial uses.
>
> In no case shall waters designated for use as domestic or municipal supply (MUN) contain concentrations of chemical constituents in excess of the following maximum contaminant level (MCL) and secondary maximum contaminant level (SMCL) provisions specified in title 22 of the California Code of Regulations:
>
> a) Table 64431-A, MCLs - Inorganic Chemicals (§ 64431)
> b) Table 64444-A, MCLs - Organic Chemicals (§ 64444)
> c) Table 64449-A, SMCLs - "Consumer Acceptance Contaminant Levels" (§ 64449)
> d) Table 64449-B, SMCLs - "Consumer Acceptance Contaminant Level Ranges" (§64449)
> e) Table 64442, Radionuclide Maximum Containment Levels and Detection Levels for Purposes of Reporting (DLRs) (§ 64442)
> f) Table 64443, Radionuclide Maximum Contaminant Levels and
> g) DLRs (§ 64443)
>
> These provisions are incorporated by reference into this Basin Plan. This incorporation by reference is prospective, including future changes to the incorporated provisions as the changes take effect.

The primary maximum contaminant level (MCL) for public water systems in Table 64331-A is 1.0 mg/L (Westlaw 2016a). The secondary maximum contaminant level (SMCL), also known as a Consumer Acceptance Contaminant Level, listed in Table 64449-A of the Code of Regulations for Aluminum is 0.2 mg/L (Westlaw 2016b).

Specific Conductance

Conductivity is a measure of ionized or dissolved minerals in the water and is often reported as specific conductance. A higher than normal conductivity reading could indicate the presence of a nonpoint source runoff of animal wastes (which are high in ionized salts). The NCRWQCB has established specific conductance objectives for the Russian River that are included in Table 4.2-1 (NCRWQCB 2011).

Water Quality Monitoring

Water quality monitoring in the Russian River watershed, including Dry Creek, is conducted by the Water Resources Division of the U.S. Geological Survey (USGS), in cooperation with state and federal agencies; the NCRWQCB; municipalities that discharge into the Russian River and its tributaries; and community groups. In addition, the Water Agency is participating in several efforts to monitor water quality in the Russian River watershed. The USGS maintains several gaging stations in the Russian River and tributaries, including Dry Creek that measure various constituents including stream flow, stage height, temperature, dissolved oxygen, pH, specific conductance, and turbidity. Several Russian River USGS stations are monitored by the Water Agency as compliance points for minimum instream flows that are required by the Water Agency's water right permits and for alternative minimum instream flows authorized through SWRCB-issued temporary urgency change orders. The Water Agency, Sonoma County DHS, and the NCRWQCB have also collected water samples that have been analyzed for several constituents including nutrients, chlorophyll-a, and bacteria. The following is a brief description of several water quality monitoring programs that have been and/or are currently being conducted in the Russian River watershed.

USGS

The USGS annually publishes a report series entitled "Water Resources Data – California." Data on the quality of Russian River water was summarized in Volume 2 of the USGS's Water Resources Data – California Water Year 2004 (USGS 2004). Water quality data in the USGS report included dissolved oxygen, pH, specific conductance, temperature, turbidity, and cross-section analysis.

Beginning in 2003, the USGS, in cooperation with the Water Agency, collected chemical, microbiological, and isotopic data from surface water and groundwater sites in Mendocino and Sonoma counties (Anders 2011). The overall objective of the program was to determine the chemical, isotopic, and microbiological composition of the surface water and ground water in the Lower Russian River Basin in the vicinity of the Water Agency's water supply facilities where the Russian River water is treated by riverbank filtration and during reduced summer flows. The program included: (1) data compilation; a Geographic Information System (GIS) database was compiled to include relevant land use, meteorology, stream daily and storm flow data, historic water quality and ground water levels for the Lower Russian River Basin. The database compiled during this study was incorporated into the GIS already being developed for the Russian River area by the Water Agency; (2) preliminary evaluation of water-quality data; chemical, isotopic and microbiological data collected from relevant surface-water and ground-water locations to evaluate the overall water-quality conditions within the Lower Russian River Basin; (3) identification of water-quality changes; identify changes in water quality that occur in the vicinity where the Russian River water is treated by riverbank filtration; and (4) assessment of low-flow conditions; the water-quality implications of reduced flows were assessed in the Lower Russian River Basin. Field measurements included streamflow, barometric pressure, dissolved oxygen, pH, specific conductance, temperature, and turbidity. All samples were analyzed for nutrients, major ions, trace metals, total and dissolved organic carbon, organic wastewater compounds, standard bacterial indicators (total coliform, *E. coli*, enterococci, and *Clostridium perfringens*), and the stable isotopes of hydrogen and oxygen.

Between 2003 and 2005 water samples were collected from 10 Russian River sites within the Lower Russian River Basin between the city of Healdsburg and the Pacific Ocean, 10 monitoring wells, a gravel-pit terrace site, 11 tributary sites including Mark West Creek, and an estuary site. All samples were analyzed for nutrients, major ions, trace metals, total and dissolved organic carbon, organic wastewater compounds (OWCs), standard bacterial indicators (total coliform, *Escherichia coli*, and *enterococci*), and the stable isotopes of deuterium and oxygen and suspended sediment.

In 2006, chemical, microbiological, and isotopic data were collected from 6 main-stem river sites, 8 tributary sites and a sewage treatment plant along the lower Russian River and in 2007 water samples were collected from 10 surface-water sites along the Russian River three times during the summer and analyzed for the same constituents as previous years.

The USGS completed a data report in October 2011. "*DS610, Water-Quality Data for the Russian River Basin, Mendocino and Sonoma Counties, California, 2005-2010*" (Anders 2011) is a compilation of the hydrologic and water-quality data collected from 14 Russian River sites, 8 tributary sites, 1 gravel-terrace pit site, 14 groundwater wells, and a wastewater treatment plant between the City of Ukiah and Duncans Mills for the period August 2005 through October 2010.

North Coast Regional Water Quality Control Board

In 1993, the NCRWQCB summarized Russian River water quality data collected from 1972 to 1992 (NCRWQCB 1993). Water quality parameters in the NCRWQCB report included nutrients, bacteria, physio-chemical, toxic chemicals, and biological parameters. The report found that significant improvements had been made in Russian River water quality since the early 1970s. Significant decreases in the levels of nutrients (nitrates and phosphates) and bacteria in the Russian River and its tributaries were attributed to increased levels of pollution control at municipal, industrial, and agricultural facilities; seasonal prohibitions on discharges to the Russian River during low flow periods; and increased public awareness of water quality issues. The NCRWQCB also summarized water quality conditions in the Russian River for the years 2000 and 2001 and concluded that water quality conditions are generally supportive of NCRWQCB water quality objectives in the Russian River watershed, with the exception of seasonal temperature impairments in some tributaries and reaches of the Russian River, and seasonal water quality impairments in the Laguna de Santa Rosa (NCRWQCB 2005).

Total Maximum Daily Load Monitoring

Most recently, the NCRWQCB has been collecting water quality monitoring and sampling data to support the Total Maximum Daily Load (TMDL) process. The TMDL process leads to a "pollution budget" designed to restore the health of a polluted or impaired body of water. The TMDL process provides a quantitative assessment of water quality problems, contributing sources of pollution, and the pollutant load reductions or control actions needed to restore and protect the beneficial uses of an individual waterbody impaired from loading of a particular pollutant. The technical definition of a TMDL is the “sum of the individual wasteload allocations for point sources, load allocations for nonpoint sources and natural background pollutants, and an appropriate margin of safety.” TMDLs serve to identify impaired water bodies, determine the sources of this impairment, and implement mitigation measures to reduce those sources and remove impairments (NCRWQCB 2014).

Since 2001, the NCRWQCB has been collecting water samples to measure *E. coli* bacteria concentrations at several locations in the Russian River to assess impairment to recreational uses. Most recently, the NCRWQCB has initiated several monitoring and sampling programs and conducted studies on pathogens including a study conducted in coordination with the Aquatic Ecosystems Analysis Laboratory at UC Davis to identify the locations and sources of pathogens in the Russian River and its tributaries (Viers, 2009).

The NCRWQCB is currently utilizing data collected by the Sonoma County DHS for their Freshwater Quality Sampling at Russian River Beaches Program to help inform the development of a TMDL for pathogens in the Russian River. As part of that effort, the NCRWQCB conducted a study; *“The Effect of Russian River Dry Season Stream Flow Management on E. coli Bacteria Concentrations”,* included as Appendix C in the *Draft Staff Report for the Action Plan for the Russian River Watershed Pathogen Indicator Bacteria TMDL* (NCRWQCB, 2015). Since 2004, the Water Agency has petitioned for and the SWRCB approved several temporary changes to the minimum instream flow requirements for the Russian River due to low storage levels in Lake Mendocino, prolonged drought conditions, and to address the requirements of the Russian River Biological Opinion. These temporary urgency change petitions (TUCPs) were approved by the SWRCB through issuance of temporary urgency change orders (TUCOs). The NCRWQCB study analyzed the effect of reduced minimum instream flow requirements authorized by the TUCOs on *E. coli* and conducted a statistical analysis of *E. coli* concentrations during TUCO years and non-TUCO years to determine if flows that are lower than D1610 minimum instream flows cause an increase in *E. coli* concentrations. See Chapter 3, “Background and Project Description,” for more information regarding temporary urgency changes to minimum instream flow requirements.

Surface Water Ambient Monitoring Program (SWAMP)

As part of the NCRWQCB’s ongoing Surface Water Ambient Monitoring Program (SWAMP), fish tissue samples were collected as part of a mercury monitoring effort in Lake Sonoma and Lake Mendocino between 2007 and 2009 and were analyzed for methylmercury.

Water Agency Water Quality Monitoring Efforts

Temporary Urgency Change Order Monitoring Programs

In 2002, 2004, 2007, and 2009, water storage levels in Lake Mendocino declined to low levels. In 2002, the Decision 1610 Hydrologic Index (described in Chapter 3, “Background and Project Description”) designated the water year as a “dry” year, and thus resulted in reductions in the minimum instream flow requirements, but this was not the case in 2004, 2007 or 2009. In those years, the Water Agency petitioned for and the SWRCB approved temporary urgency changes to Water Agency water right permits to temporarily reduce the minimum instream flow requirements, to preserve Lake Mendocino water storage and to maintain a reliable water supply.[a] Low water storage levels in Lake Mendocino during these years were due to lack of rainfall and, in 2007 and 2009, were also due to lower inflows into the East Fork Russian River from PG&E's PVP, resulting from the 2004 changes in the FERC license for the PVP.

The Water Agency also petitioned for and the SWRCB approved temporary urgency changes in April and December 2013, 2014, and 2015, in response to ongoing, prolonged drought conditions resulting in low inflows into Lake Mendocino and declining water supply reliability in the reservoir.

TUCPs filed in 2010, 2011 and 2012 were required by the Russian River Biological Opinion to reduce instream flow conditions to improve habitat for the threatened and endangered fish species.

Additional water quality monitoring was included in the TUCOs issued by the SWRCB. The following sections provided a summary of those monitoring efforts.

Datasonde Deployment

In coordination with the USGS, the Water Agency maintains three, multi-parameter water quality datasondes on the Russian River located at Russian River near Hopland, Russian River at Diggers Bend near Healdsburg, and Russian River near Guerneville (aka Hacienda Bridge) (Figure 4.2-1). These three datasondes are referred to as "permanent" because the Water Agency maintains them as part of its early warning detection system for use year-round. The datasondes take real time readings of water temperature, pH, DO, specific conductivity, turbidity, and depth, every 15 minutes. A fourth datasonde was located at the Water Agency's River Diversion System (RDS) facilities near Forestville, but was not deployed in 2014, 2015, and 2016 while replacement of the fish ladder and fish screens at the RDS occurred.

In addition to the permanent datasondes, the Water Agency, in cooperation with the USGS, installed three seasonal datasondes with real-time telemetry at the USGS river gage station at Russian River near Cloverdale (north of Cloverdale at Comminsky Station Road), at the gage station at Russian River at Jimtown (Alexander Valley Road Bridge), and at Johnson's Beach in Guerneville (Figure 4.2-1). The two seasonal datasondes at Cloverdale and Jimtown are included by the USGS on its "Real-time Data for California" website[b].

The data collected by the datasondes are evaluated to determine whether and to what extent reduced minimum instream flows authorized by the TUCOs cause any impacts to water quality or availability of aquatic habitat for salmonids.

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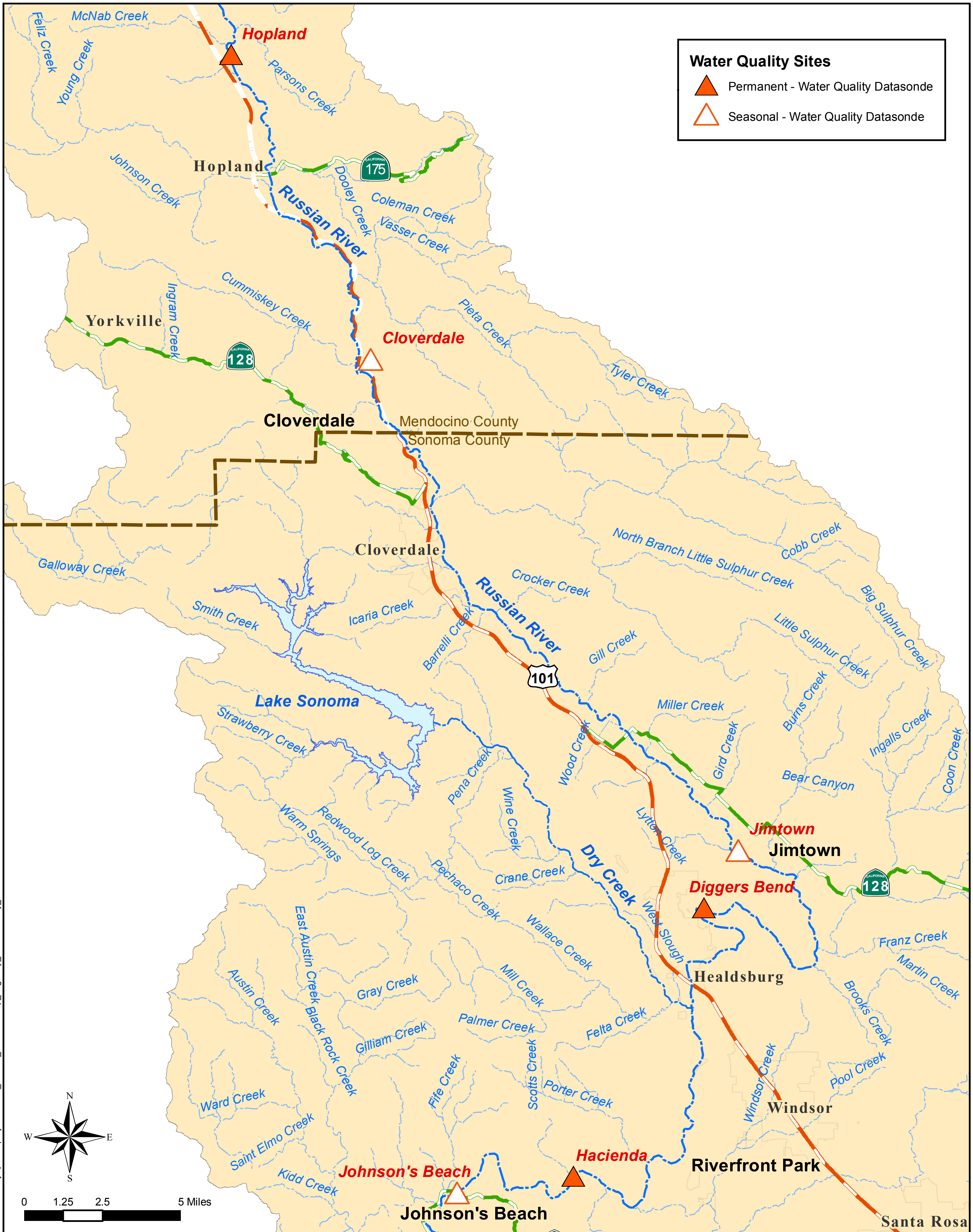
[a] The SWRCB approved the 2004 petition for temporary urgency change in its Order WRO 2004-0035. The 2007 temporary urgency change petition was approved in Order WRO 2007-0022. The 2009 temporary urgency change petition was approved in Order WRO 2009-0034-EXEC.

[b] http://waterdata.usgs.gov/ca/nwis/current?type=all&group_key=county_cd&search_site_no_station_nm=



\\SD-DATA\Proj\special projects\7323_RRIFR_D1610\Temp_Urgency_WaterQuality_2014a.mxd

Russian River Mainstem
Water Quality Monitoring Stations

This Map is for general reference only.

Figure 4.2-1 Permanent and Seasonal Datasondes

In 2009, Water Agency staff deployed additional datasondes in Monte Rio, at Riverfront Park in Windsor, and on the East Fork Russian River that collected hourly readings for specific conductance (micromhos), water temperature (degrees Celsius), dissolved oxygen (percent saturation), dissolved oxygen (milligrams per liter), pH (hydrogen ion), and depth (meters). This effort was also undertaken to evaluate whether and to what extent the reduced flows authorized by the TUCOs cause any impacts to water quality or availability of aquatic habitat for salmonids.

In July of 2013, Water Agency staff permanently deployed a datasonde in the East Fork Russian River to collect hourly data readings for temperature, DO, pH, specific conductance, and turbidity. In 2013, Water Agency staff also began to collect vertical profile data in Lake Mendocino for temperature, DO, pH, and specific conductance. The Water Agency continues to collect data on an annual basis.

Russian River Grab Sampling

The NCRWQCB and Sonoma County DHS have collected grab samples[c] to be analyzed for indicator bacteria as part of the annual freshwater beach monitoring program at several sites on the Russian River. These data have been incorporated in the TUCO annual monitoring reports to further determine the potential changes to water quality and aquatic habitat availability from reduced instream flows.

The USGS water quality effort from 2005 to 2010 discussed above (Anders 2011) included a large sampling program at eleven surface water sites and four groundwater sites during two sampling events in 2010; the first in June and the second in September. All samples were analyzed for nutrients, major ions, trace metals, total and dissolved organic carbon, a broad suite of organic wastewater compounds (polyaromatic hydrocarbons, disinfection-by-products, selected pesticides and herbicides, and personal care and household products such as fragrances and detergents), by laboratories operated by the USGS. In addition, water samples collected at surface-water sites located at Russian River near Hopland, Russian River at Digger Bend near Healdsburg, Russian River near Guerneville and at Russian River at Casini Ranch were analyzed for human-use pharmaceuticals.

In 2010, the NCRWQCB conducted weekly bacteriological sampling in cooperation with the Sonoma County DHS at Upper Russian River and Lower Russian beaches that experience the greatest recreational body contact. The NCRWQCB seasonal sampling locations consisted of: Camp Rose Beach; Healdsburg Veterans Memorial Beach; Steelhead Beach; Forestville Access Beach; Johnson's Beach; and Monte Rio Beach. Per request by the SWRCB and to supplement the USGS and NCRWQCB sampling programs, the Water Agency conducted weekly grab samples from September 21 through October 12 for both pathogens and nutrients at six stations in the Russian River, including Hopland at the USGS gaging station, upstream of Cloverdale at Comminsky Station, Jimtown in Alexander Valley, Digger's Bend in Healdsburg, the Water Agency's River Diversion System (RDS) in Forestville, Hacienda Bridge upstream of Guerneville, and Johnson's Beach in Guerneville.

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[c] Grab samples are samples of water collected from the water column in sample jars and bottles for lab analysis.

In 2011, the Water Agency collected grab samples at nine stations in the Russian River including Diggers Bend, Camp Rose, Memorial Beach, below Memorial Beach and above Dry Creek confluence, approximately 1,500 feet below Dry Creek confluence, Riverfront Park, approximately 150 feet below Water Agency RDS, approximately 1,300 feet below Mark West Creek confluence, and Steelhead Beach. All samples were analyzed for nutrients, chlorophyll-a, standard bacterial indicators (total coliforms, *E. coli*, fecal coliform and enterococcus), total and dissolved organic carbon, and total dissolved solids.

The NCRWQCB collected grab samples for standard bacterial indicators (total coliforms, *E. coli*, and enterococcus) at seven stations in the Russian River, including Alexander Valley Campground, Camp Rose Beach, Healdsburg Veterans Memorial Beach, Steelhead Beach, Forestville Access Beach, Johnson's Beach, and Monte Rio Beach.

In 2012, the Water Agency collected grab samples at six stations in the Russian River including Hopland at the USGS gaging station, upstream of Cloverdale at Comminsky Station, Jimtown in Alexander Valley, Digger's Bend in Healdsburg, Riverfront Park, and Hacienda Bridge upstream of Guerneville. All samples were analyzed for nutrients, chlorophyll-a, standard bacterial indicators (*E. coli,* and enterococci), total and dissolved organic carbon, total dissolved solids, and turbidity.

The NCRWQCB 2012 seasonal bacteria sampling locations consisted of Cloverdale River Park, Crocker Road (downstream end of Cloverdale River Park below Big Sulphur Creek confluence), Alexander Valley Campground (Jimtown Bridge), Camp Rose Beach, Healdsburg Veterans Memorial Beach, Steelhead Beach, Forestville Access Beach, Johnson's Beach, and Monte Rio Beach.

Several agencies conducted water quality monitoring in the Russian River during the term of the 2013 TUCO. From May 30 through September 4, the NCRWQCB conducted weekly bacteriological sampling for *E. coli* and Enterococcus to support the development of their Pathogen TMDL at eight beaches with recreational activities involving the greatest body contact. Beach sampling locations included Cloverdale River Park, Camp Rose, Healdsburg Veterans Memorial, Steelhead, Forestville Access, Sunset, Johnson's, and Monte Rio. From May 28 through September 3, Sonoma County DHS, in cooperation with the NCRWQCB, also monitored bacterial levels in the water at eight beaches on the Russian River, including seven beaches that the NCRWQCB monitors. The Water Agency conducted weekly bacteriological, nutrient and algal sampling at six sites along the Russian River from May 16 through October 31 including Hopland, Comminsky Station, Jimtown Bridge, Digger's Bend, Riverfront Park, and Hacienda.

The Sonoma County DHS continued their annual summer beach monitoring for indicator bacteria at nine sites along the Russian River in 2014. Samples were collected at Cloverdale River Park, Camp Rose Beach, Healdsburg Memorial Beach, Steelhead Beach, Forestville Access Beach, Sunset Beach, Johnson's Beach, Monte Rio Beach, and Patterson Point and analyzed for total coliforms and *E. coli*. Data collected for the beach sampling program have been incorporated in the TUCO annual monitoring reports to further determine the potential changes to water quality and aquatic habitat availability from reduced minimum instream flows.

In 2015, the Water Agency continued to use indicator bacteria grab sampling data collected by Sonoma County DHS for the freshwater beach sampling program. Samples were collected at Cloverdale River Park, Camp Rose Beach, Healdsburg Memorial Beach, Steelhead Beach, Forestville Access Beach, Sunset Beach, Johnson's Beach, Monte Rio Beach, and Patterson Point and analyzed for total coliforms and *E. coli*. Data collected for the beach sampling program have been incorporated in the TUCO annual monitoring reports to further determine the potential changes to water quality and aquatic habitat availability from reduced minimum instream flows.

Operations Monitoring Program

The Water Agency conducts an ongoing program to sample (approximately monthly) for coliform bacteria at the RDS facility. Special sampling from 7 sites on the Russian River (Camp Rose, Memorial Beach, Steelhead Beach, Sunset Beach, Johnson's Beach, Vacation Beach and Monte Rio) was also conducted during the two Temporary Urgency Order years (2004 and 2007) and included bacterial indicators, temperature, DO and pH.

Estuary Monitoring Program

The Water Agency has conducted several years of water quality monitoring in the Russian River Estuary. From 1996 to 2000, Merritt-Smith Consulting monitored water quality for the Water Agency (temperature, conductivity, salinity and dissolved oxygen) from the mouth to Sheephouse Creek during the summer and fall months as part of the sandbar breaching monitoring program[d].

In 2005, Water Agency staff began monitoring water quality in the Russian River Estuary from the mouth of the Russian River upstream to Bridgehaven; expanding up to Freezeout Creek near the town of Duncans Mills in 2006. This monitoring was also associated with the sandbar breaching program. Multi-parameter, continuously-recording water quality datasondes were deployed at three stations in 2005 and five stations in 2006 and 2007. In 2008, a sixth station was added at Heron Rookery located between Sheephouse and Freezeout creeks. In 2010, a seventh station was located in Monte Rio and two tributary stations were added in Willow and Austin creeks for a total of nine stations. In 2011, the program was further expanded to ten stations between the mouth of the Russian River and Monte Rio, including two tributary stations. Estuary stations were located at the mouth of the Russian River, Patty's Rock, Sheephouse Creek, Heron Rookery, Freezeout Creek, Brown's Pool, Villa Grande, and Monte Rio, while tributary stations continued to be located in Willow and Austin creeks. Monitoring in 2012 was continued at all 2011 stations, with the exception of the Brown's Pool Station, for a total of nine monitoring stations. In 2013, the Heron Rookery station was not monitored for a total of eight monitoring stations. In 2014 and 2015, monitoring was expanded back to a total of nine stations, including the two tributary stations at Willow and Austin creeks. The stations were located at the mouth of the Russian River, Patty's Rock, Sheephouse Creek, Freezeout Creek,

[d] Reports are available on the Water Agency's website (http://www.scwa.ca.gov/environment/russian_river_estuary.php).

Brown's Pool, Patterson Point, and Monte Rio (Figure 4.2-2). For the 2016 season, Estuary monitoring is currently being conducted at Patty's Rock, Freezeout Creek, Brown's Pool, Patterson Point, and Monte Rio and tributary monitoring continues to be conducted in Willow and Austin creeks.

Datasondes are deployed once river flows have declined to safe levels, usually mid-April to mid-May, and are retrieved prior to the onset of winter rains (November to December in most years). These datasondes collect hourly readings of salinity (parts per thousand), specific conductance (micromhos), water temperature (degrees Celsius), dissolved oxygen (percent saturation), dissolved oxygen (milligrams per liter), pH (hydrogen ion), and depth (meters). Monitoring will continue until 2023 to satisfy requirements of the Russian River Biological Opinion.

Data collected in the Estuary were included in the evaluation to determine whether and to what extent the reduced minimum instream flows authorized by the TUCOs resulted in any impacts to water quality or availability of aquatic habitat for salmonids

Estuary Grab Sampling Programs: 2009 – 2016

Nutrient and indicator bacteria (pathogen) sampling was undertaken in the Russian River Estuary in 2009 to satisfy requirements identified in the Water Agency's 2009 TUCO to reduce minimum instream flows in the Russian River, which was done to satisfy requirements of the Russian River Biological Opinion. Sampling was conducted at three stations in 2009 including at the Jenner Boat Ramp, Bridgehaven, and Duncans Mills at the Moscow Road Bridge. Sampling stations were added from 2010 through 2013 to include Casini Ranch and Monte Rio for a total of five sample collection stations. In 2014 and 2015, two sampling locations were shifted from Bridgehaven and Duncans Mills to Patterson Point and Vacation Beach to extend monitoring to additional public recreational areas. The Bridgehaven station is primarily an unimproved kayak and canoe launch point in a predominantly estuarine environment and the Duncans Mills station is located on private property not accessible to the general public. Whereas the Patterson Point station is located at a privately owned, but publicly accessible beach in Villa Grande, and the Vacation Beach station is located near Guerneville at a public beach with a summer road crossing and summer dam that allows for launching boats. Sampling continued to be conducted at Patterson Point, Monte Rio, and Vacation Beach in 2016 between May 15 and October 15. However, sampling was discontinued at the Jenner Boat Ramp and Casini Ranch. The Jenner Boat Ramp is located in a predominantly estuarine habitat and Casini Ranch is a private campground.

4.2.3 Regulatory Framework

Federal Regulations

Clean Water Act

Under the Clean Water Act (CWA) of 1977, the USEPA seeks to restore and maintain the chemical, physical, and biological integrity on the nation's waters. The CWA authorizes the

USEPA to implement water quality regulations. Section 303(d) of the CWA requires that each state identify water bodies or segments of water bodies that are "impaired" (i.e., do not meet one or more of the water quality standards established by the state). These waters are identified in the Section 303(d) list as waters that are polluted and need further attention to support their beneficial uses. Once the water body or segment is listed, the state is required to establish a TMDL for the pollutant which is causing the conditions of impairment. The National Pollutant Discharge Elimination System (NPDES) permit program under Section 402(p) of the CWA controls water pollution by regulating point sources that discharge pollutants into waters of the U.S. California has an approved state NPDES program. The USEPA has delegated authority of issuing NPDES permits to the SWRCB, which has nine regional boards. The NCRWQCB regulates water quality in the project area.

Section 208 of the CWA Water Quality Control Plans

Section 208 of the CWA requires the preparation of local water quality control plans by regulatory agencies throughout the nation. Each water quality control plan covers a defined drainage area. The primary goal of each water quality control plan is to attain water quality standards established by the CWA and the state governments within the defined area of coverage. Minimum content requirements, preparation procedures, time constraints, and federal grant funding criteria pertaining to the water quality control plans are established in Section 208. Preparation of water quality control plans has been delegated to the individual states by the USEPA.

Section 303(d) of the CWA Impaired Watersheds

Section 303(d) of the CWA requires the designation of "impaired waterbodies" be applied to any watershed exceeding specified thresholds for various pollutants or water temperatures. The Russian River within the project area is listed as impaired for sedimentation, temperature, mercury, aluminum, indicator bacteria, and specific conductance (NCRWQCB 2014).

Section 304(a)

Section 304(a) of the CWA promulgates Ambient Water Quality Criteria Recommendations for nutrients in rivers and streams to provide for the protection and propagation of aquatic life and recreation (USEPA, 2000), with the Russian River residing in Aggregate Ecoregion III (Table 4.2-2) as described in Section 4.2.2, "Environmental Setting." The USEPA has also established Ambient Water Quality Criteria Recommendations in lakes and reservoirs in Aggregate Ecoregion III (USEPA 2001a). These criteria are recommended levels and are intended to provide a framework for states and regions to help identify appropriate water quality conditions on a statewide, regional, and local basis. It is important to note that these criteria are established for freshwater systems, and as such, are only applicable to the Russian River and the freshwater portions of the Estuary, typically upstream of Duncans Mills. Currently, there are no numeric nutrient criteria established for estuaries. These recommended criteria are identified in Table 4.2-2.

Section 319 of the CWA Nonpoint Source Management Program

Section 319 of the CWA establishes a national program to control nonpoint sources of water pollution through the development of assessment reports, adoption of management programs, and implementation of those management programs. The USEPA awards grants to states to assist them in implementing the nonpoint source pollution management programs.

Section 401 of the CWA Water Quality Certifications

Section 401 of the CWA requires that, prior to the issuance of a federal license or permit for an activity or activities that may result in a discharge of pollutants into navigable waters (see Section 404 discussion below), the permit applicant must first obtain a certification from the state in which the discharge would originate. A state certification indicates that the proposed activity or activities would not result in a violation of applicable water quality standards established by federal or state law, or that there are no water quality standards that apply to the proposed activity.

Section 402 of the CWA National Pollutant Discharge Elimination System (NPDES)

Section 402 of the CWA requires permits for pollution discharges into water bodies such that the permitted discharge does not cause a violation of federal and state water quality standards. NPDES permits define quantitative and/or qualitative pollution limitations for the permitted source, and control measures that must be implemented to achieve the pollution limitations. Pollution control measures are often referred to as Best Management Practices (BMPs).

Section 404 of the CWA Discharge of Dredge and Fill Material

Section 404 of the CWA assigns the United States Army Corps of Engineers (Corps), with permitting authority for proposed discharges of dredged and fill material into waters of the U.S., defined as "…waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; territorial seas and tributaries to such waters". Section 404 is applicable to projects in which fill material would be placed within or below the ordinary high water mark of a stream. Any project requiring a Section 404 permit also requires a Section 401 water quality certification (discussed above).

Federal regulations 40 CFR 131.38 (CA Toxics Rule)

This regulation promulgates criteria for priority toxic pollutants in the State of California for inland surface waters and enclosed bays and estuaries. This regulation establishes two numerical criteria for a substantial list of constituents: Criteria Maximum Concentration (CMC) and Criteria Continuous Concentration (CCC). CMC equals the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time without deleterious effects. CCC equals the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects.

Total Maximum Daily Load (TMDL)

Section 303(d) of the CWA and 40 CFR §130.7 require states to identify water bodies that do not meet water quality standards and are not supporting their beneficial uses. These waters are placed on the Section 303(d) List of Water Quality Limited Segments (also known as the list of Impaired Waterbodies). The RWQCBs submit recommendations for updates to the 303(d) List to the SWRCB. The SWRCB reviews the recommendations from all of the RWQCBs and submits a final statewide 303(d) List to the EPA. Placement on this list generally triggers development of a pollution control plan called a Total Maximum Daily Load (TMDL) for each waterbody and associated pollutant/stressor on the list. TMDL is the maximum amount of a pollutant that a water body can receive and still meet water quality standards (NCRWQCB 2016b). Typically, TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources.

State Regulations

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Act) allows the SWRCB to adopt statewide water quality control plans. The purpose of the plans is to establish water quality objectives for specific water bodies. The Act also authorizes the NPDES program under the CWA, which establishes effluent limitations and water quality requirements for discharges to waters of the state. Under the NPDES program, the NCRWQCB has established requirements for water quality in the project area.

The Porter-Cologne Water Quality Control Act (SWRCB 2016) requires that “any person discharging waste, or proposing to discharge waste, within any region that could affect the waters of the State to file a report of discharge” with the RWQCB through an application for waste discharge. The term “waters of the State” is defined as any surface water or groundwater, including saline waters within the boundaries of the state. It should be noted that pursuant to the Porter-Cologne Water Quality Control Act, the RWQCB also regulates “isolated wetlands” or those wetlands considered to be outside of the U.S. Army Corps of Engineers’ (USACE) jurisdiction under the federal CWA.

State Water Resources Control Board

The SWRCB and the local RWQCBs are responsible for ensuring implementation and compliance with the provisions of the federal CWA and California’s Porter-Cologne Water Quality Control Act. While the USACE administers permitting programs that authorize impacts to waters of the Unites States, including wetlands, and other waters, any USACE permit authorized for a proposed project would be invalid unless it is a Nationwide Permit (NWP) that has been certified for use in California by the SWRCB, or if the RWQCB has issued a project specific certification or waiver of water quality. Certification of NWP requires a finding by the SWRCB that the activities permitted by the NWP will not violate water quality standards individually or cumulatively over the term of the issued NWP (typically a 5-year term). Certification must be consistent with the requirements of the federal CWA, CEQA, California

Endangered Species Act (CESA), and the SWRCB's mandate to protect beneficial uses of waters of the state. Any denied (i.e., not certified) NWPs, and all Individual USACE permits, would require a project specific RWQCB certification or waiver or water quality.

Regional Water Quality Control Board - North Coast Region

The project area is located within the jurisdiction of the NCRWQCB. The NCRWQCB has the authority to implement water quality protection standards through the issuance of permits for discharges to waters at locations within its jurisdiction. Water quality objectives for the Russian River and its tributaries are specified in the Basin Plan prepared by the NCRWQCB in compliance with the federal CWA and the Porter-Cologne Act (NCRWQCB 2011). Responsibilities of the NCRWQCB are discussed below.

Water Quality Control Plan for the North Coast Region

The quality of surface and ground waters in the North Coast Region of California is governed by the *Water Quality Control Plan for the North Coast Region* (Basin Plan) and state-wide policies. The Basin Plan identifies the existing and potential beneficial uses of water within the North Coast Region and the water quality objectives necessary to protect those uses. The Basin Plan provides a program of actions designed to preserve and enhance the water quality and to protect beneficial uses of water in the North Coast region, and sets the numeric water quality objectives for the Russian River (NCRWQCB 2011). Most recently, the NCRWQCB adopted Resolution No. R1-2015-0018 amending the Section 3 of the Basin Plan to update Water Quality Objectives including revisions to the dissolved oxygen objectives in surface waters (NCRWQCB 2015a). Because the project area is located within the NCRWQCB's jurisdiction, all discharges to surface water or groundwater are subject to the Basin Plan requirements.

Relevant existing beneficial uses identified in the Basin Plan that apply to the project area include, but are not limited to: Municipal and Domestic Supply (MUN); Agricultural Supply (AGR); Groundwater Recharge (GWR); Water Contact Recreation (REC1); Non-Contact Water Recreation (REC2); Warm Freshwater Habitat (WARM); Cold Freshwater Habitat (COLD); Estuarine Habitat (EST); Rare, Threatened, or Endangered Species (RARE); Migration of Aquatic Organisms (MIGR); and Spawning, Reproduction, and/or Early Development (SPWN). Please refer to the Basin Plan for a complete list of beneficial uses supported in the Russian River watershed. Together, water quality objectives, beneficial uses, the anti-degradation policy, and implementation policies are known as "water quality standards".

Total Maximum Daily Load (TMDL)

The NCRWQCB implements the TMDL program for each 303(d)-listed waterbody within its jurisdiction. The Russian River Pathogen Indicator Bacteria TMDL is currently being prepared by the NCRWQCB (NCRWQCB 2016a). The term TMDL is used by the NCRWQCB and the EPA to identify, on a stream-specific basis, pollutant limitation standards.

Department of Water Resources (DWR)

The California DWR is the state agency responsible for managing California's water resources, including conducting technical studies of surface water and groundwater in cooperation with local agencies, overseeing certain flood prevention and floodplain management programs, and developing and implementing water conservation and efficient water use strategies and programs in cooperation with local agencies. DWR is also responsible for building, operating, and maintaining the State Water Project, which supplies drinking water and agricultural irrigation water to various parts of the state (but not Sonoma County).

National Pollutant Discharge Elimination System (NPDES) Program

The SWRCB and the nine RWQCBs in California implement the state and federal clean water laws, including the NPDES permitting program. This program regulates point source discharges from industrial, municipal, and other facilities if their discharges go directly to surface waters. In 1987, the NPDES program also began a phased approach to addressing non-point source pollution from streets, parking lots, construction sites, homes, businesses, and other sources.

Under Phase I of the NPDES stormwater program, all medium separate storm sewer systems (serving a population of 100,000 to 249,000) and large separate storm sewer systems (serving a population of 250,000 or more) are required to obtain a municipal permit. Under Phase II of the program, small storm sewer systems are also required to obtain coverage under a Regional Board-issued permit.

The NPDES permit program also affects construction sites that disturb one acre or more. Under the Phase I NPDES stormwater program, construction sites that are larger than five acres are required to obtain a General Construction Activity Stormwater Permit. Under the Phase II NPDES program, construction sites disturbing one to five acres of land are also required to obtain coverage under the General Construction Activity Stormwater Permit. Permit applicants are required to prepare a Stormwater Pollution Prevention Plan (SWPPP), implement construction-related BMPs, monitor discharges, and implement post-construction BMPs

The NPDES program is the basis for Sonoma County's Storm Water Quality Ordinance (SWRCB 2013). Violations are considered misdemeanors and public nuisances and may be subject to court orders, fines, and reimbursement of County of Sonoma's costs and damages.

Local Regulations

Mendocino County General Plan

Portions of the Proposed Project are located within the jurisdiction of the Mendocino County General Plan (Mendocino County 2009). For a discussion of local general plan policies related to water resources, please refer to Section 4.2.5, "General Plans and Consistency".

Sonoma County General Plan

The Proposed Project is located within the jurisdiction of *Sonoma County General Plan 2020* (PRMD 2008). Please refer to Section 4.2.5, "General Plans and Consistency" for a detailed discussion of goals, policies, and objectives related to water quality that are applicable to the Proposed Project.

Sonoma County Stormwater Quality Ordinance

Chapter 11A, Stormwater Quality, (Sonoma County Code Chapter 11A) of the Sonoma County Code, adopted December 12, 2009, re-designates and amends the former Chapter 11 of the County Code, entitled Drainage and Stormwater Management. The purpose of this ordinance is to protect and enhance the water quality of Sonoma County's watercourses pursuant to and consistent with the Federal CWA and the conditions set forth by the NPDES as requirements for stormwater discharge permits (PRMD 2015).

4.2.4 Impact Analysis

This section describes the impact analysis relating to water quality for the Proposed Project. It describes the methods used to determine the impacts of the project and lists the thresholds used to conclude whether an impact would be significant. Measures to mitigate potentially significant impacts accompany each impact discussion, where applicable.

Methodology

Impacts on water quality resources are evaluated by analyzing constituents of concern (as identified by the NCRWQCB) that could cause impairments within the project area (as discussed in Section 4.2.2, "Environmental Setting"), and the likely effects that changes in reservoir levels and instream flows could have on these constituents. The analysis of the effects of the project alternatives on water quality resources emphasizes potential impacts to beneficial uses that have been identified by the Basin Plan within the project area.

The analysis of effects on temperature and DO relies on modeled data that simulates temperature and dissolved oxygen conditions in the Russian River and Dry Creek under Baseline Conditions and the Proposed Project and the No Project 1 and No Project 2 alternatives (as described below). Please refer to Chapter 4.3, "Fisheries", for a discussion and analysis of temperature and DO modeling results as they relate to potential impacts to fisheries resources.

The analysis of effects on bacteria and biostimulatory substances relies on data collected by the Water Agency in the Upper Russian River and Lower Russian River as described in Section 4.2.2, "Environmental Setting," under a variety of instream flows during Baseline Conditions (2006 to 2014) and in 2015 that are similar to the Proposed Project and the No Project 1 and No Project 2 Alternative minimum instream flow requirements. Data collected during instream flows that are similar to the Proposed Project and the No Project 1 and No Project 2 Alternatives was then analyzed against data collected during instream flows similar to the Baseline Condition for potential changes.

The analysis of effects for mercury, aluminum, and specific conductance rely on modeled data that simulates surface elevations in Lake Mendocino and Lake Sonoma, and stage height in the Russian River downstream of the reservoirs. Projected changes in reservoir surface elevations and stream flow under the Proposed Project and No Project 1 and No Project 2 alternatives were then compared against Baseline Conditions to determine potential impacts. Please refer to Chapter 4.1, "Hydrology, for a detailed discussion of Baseline Conditions and an analysis of water surface elevation modeling results as they relate to the Proposed Project, the No Project 1and the No Project 2 alternatives.

Russian River Model

The Russian River Reservoir Simulation (Russian River ResSim) model, and its 104 years of estimated unimpaired hydrology, was used to compare between Baseline Conditions and the Proposed Project and No Project 1 and No Project 2 alternatives. The model simulates storage levels in and releases from Lake Mendocino and Lake Sonoma, and instream flows along the Russian River and Dry Creek. The Russian River ResSim model is detailed in Appendix G.

Water surface elevations

The Russian River ResSim Model was used to estimate changes to the Baseline Condition for water level elevations at Lakes Mendocino and Sonoma and in the Russian River and Dry Creek that would result from the Proposed Project and two alternatives (please see Appendix G for details). The Baseline Condition was used to simulate lake levels under existing conditions and these levels are compared to those modeled to occur under the Proposed Project and the No Project 1 and No Project 2 Alternatives. Please refer to Chapter 3, "Background and Project Description", for a discussion of Decision 1610 minimum instream flows. Please refer to Chapter 4.0, "Introduction to Environmental Setting, Impacts and Mitigation Measures", for a discussion of the Baseline Condition. Instream flow throughout the Russian River and Dry Creek during the wet season (November through April) is largely influenced by rainfall and unimpaired flows. The Proposed Project instream flows are most relevant during the dry season (typically May 15 to October 15) when releases from Lake Mendocino and Lake Sonoma contribute a large portion of the instream flows to the Russian River and Dry Creek.

Water Quality

A water quality model of the Russian River was developed using HEC 5Q to simulate water temperature and dissolved oxygen in Lakes Mendocino and Sonoma, the Upper and Lower Russian River, and Dry Creek. Simulated instream flow for the Baseline Condition and the Proposed Project and the No Project 1 and No Project 2 alternatives were generated using the Russian River ResSim model (Appendix G) and used as input into the water quality model. The HEC 5Q water quality model is described in further detail in Appendix G. Please refer to Chapter 4.3, "Fisheries", for a discussion and analysis of temperature and DO modeling results for Baseline Conditions and the Proposed Project and the No Project 1 and No Project 2 Alternatives as they relate to potential impacts to fisheries resources.

Significance Criteria

Based on the Appendix G of California Environmental Quality Act (CEQA) Guidelines, project implementation would have significant impacts and environmental consequences on water quality resources if it would result in any of the following:

- Violate any water quality standards or waste discharge requirements;
- Otherwise substantially degrade water quality.

Implementation of the Proposed Project would not involve any construction activities or new or changed facilities. Therefore, there would be no temporary or permanent impacts on water resources resulting from construction or maintenance activities.

All potential impacts would be associated with operational changes to releases from Lake Mendocino and Lake Sonoma and minimum instream flows in the Russian River and Dry Creek. The following assumptions were also made regarding Proposed Project-related impacts on water quality resources:

- During the dry season (May 15 through October 15), much of the instream flow in the Russian River and Dry Creek is comprised of water released from Lake Mendocino or Lake Sonoma. Implementation of the Proposed Project would occur year round, but the greatest effects to water quality would primarily be experienced during the dry season. As such, the analysis of effects for bacteria and biostimulatory substances (and related nuisance conditions including low DO and high chlorophyll-a) relies on dry season data (May 15 to October 15) to represent the greatest potential effect to water quality from changes to minimum instream flow requirements.
- Minimum instream flow requirements in the Upper Russian River, Lower Russian River, and Dry Creek would decrease compared to Baseline Conditions during the dry season as a result of the Proposed Project. These instream flow changes could have an indirect effect on water quality in the Russian River. Instream flows during the wet season, when flows are largely from rainfall runoff and tributary flow, would be negligibly effected by changes to reservoir releases under the Proposed Project.
- Estuaries are complex, dynamic ecosystems, normally experiencing changes between seasons, between years, and between different places in the same estuary. For an evaluation of the potential effects to the water quality in the Estuary due to minimum instream flow changes in the Russian River, when anticipating future conditions, the determination of significance is compared to Baseline Conditions. Under Baseline Conditions, water depth, temperature, and salinity, as well as other water quality parameters, fluctuate at varying degrees and continuously across a wide range of values and flows into the Estuary and are dependent in large part on the strength of the tidal cycle during open conditions and the frequency, timing, and duration of river mouth closures, as well as the presence of external factors including potential pollutants along

the near shore line that are inundated during river mouth closures. The shift from an estuary to lagoon conditions and resultant changes to water quality conditions in the underlying saline layer and overlying freshwater layer typically begin to occur within hours after river mouth closure and are not dependent on dry season minimum instream flow rates.

Surface water quality in the Russian River watershed shows distinct patterns and trends associated with climate and regulation. To facilitate the analysis of potential effects, the project area has been subdivided into several geographic regions:

- Lake Mendocino;
- Lake Sonoma;
- Upper Russian River: the Russian River below Coyote Valley Dam downstream to the confluence with Dry Creek near Healdsburg;
- Lower Russian River: the Russian River downstream of its confluence with Dry Creek to the Pacific Ocean in Jenner; and
- Dry Creek: Dry Creek between Warm Springs Dam and its confluence with the Russian River.

Impacts and Mitigation Measures

The following section presents a detailed discussion of potential water quality-related impacts associated with the project alternatives, including the Proposed Project, the No Project 1 Alternative, and the No Project 2 Alternative. Each impact discussion includes an analysis of the impact, a summary statement of the impact and its significance, and proposed mitigation measures, where applicable. Impacts are summarized and categorized as either “no impact,” “less than significant,” “less than significant with mitigation,” “significant and unavoidable,” or “beneficial.”

Impact 4.2-1. Implementation of the Fish Flow Project could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality relating to mercury accumulation in fish tissue in Lake Mendocino and Lake Sonoma. (Less than Significant)

Minimum instream flow changes implemented by the Fish Flow Project could decrease water surface elevation within Lake Mendocino and Lake Sonoma and expose previously submerged shoreline. The existing operation of Lake Mendocino and Lake Sonoma for maintaining instream flows, flood control, and water conservation purposes causes fluctuations of the water surface elevation. Increased areas of exposed shoreline could lead to greater erosion from surface runoff during precipitation, thereby increasing sediment delivery and potentially mercury delivery to the reservoirs. Both Lake Mendocino and Lake Sonoma are included on the 303(d) List for mercury in fish tissue impairments.

Lake Mendocino

Under the No Project 1 Alternative, minimum instream flow requirements and releases from Lake Mendocino in the Upper Russian River would be the same as under Baseline Conditions, which follow minimum instream flow requirements in the Water Agency's water right permits and in the Decision 1610 Hydrologic Index. As described in Chapter 4.1, "Hydrology," releases from Coyote Valley Dam would be the same as under Baseline Conditions across the entire range of exceedances. There would be no changes in impact to the area of exposed shoreline in Lake Mendocino in a manner which could result in substantial erosion or sedimentation. Therefore, there would be no change in the erosional potential of the near shore line that could significantly exacerbate the water quality condition of the lake resulting from mercury accumulation. The primary sources of mercury contributing to the 303(d) listing for fish tissue would continue to be erosional sources from adjacent soils and tributaries to the lake as well as depositional sources in the atmosphere. As such, there would be no change in the potential for mercury deposition in Lake Mendocino that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore no impact associated with the No Project 1 Alternative.

Under the Proposed Project and No Project 2 Alternative, water surface elevations would increase in Lake Mendocino in nearly all months across all exceedances. Please refer to Chapter 4.1, "Hydrology", Section 4.1.4, "Impact Analysis" Methodology, for a detailed discussion of the hydrologic assessment for the Proposed Project and No Project 2 Alternative. The increase would inundate a greater area of shoreline compared to Baseline Conditions and would not expose shoreline to potential surface erosion.

As such, the changes in water surface elevations at Lake Mendocino associated with the Proposed Project and No Project 2 Alternative would not cause a change in the erosional potential of the near shoreline that could significantly exacerbate the water quality condition of the lake resulting from mercury accumulation. Please refer to Chapter 4.1, "Hydrology", Impact 4.1.3, for a detailed discussion of potential erosion hazards at Lake Mendocino. The primary sources of mercury contributing to the 303(d) listing for fish tissue would continue to be erosional sources from adjacent soils and tributaries to the lake as well as depositional sources in the atmosphere. As such, there would be no change in the potential for mercury deposition in Lake Mendocino that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore no impact associated with the Proposed Project and No Project 2 Alternative.

Lake Sonoma

Under the No Project 1 Alternative, water surface elevation would decrease in Lake Sonoma in all months across the 0.75 to 0.99 exceedances, and from May through October during median flows. Please refer to Chapter 4.1, "Hydrology", Section 4.1.4, "Impact Analysis" Methodology, for a detailed discussion of the hydrologic assessment for the No Project 1 Alternative. Decreases in stage would be less than 4 feet in most cases under median flows and less than 7 feet in most cases during drier conditions. The area of exposed shoreline during median flows would be similar to Baseline Conditions with moderate increases from October through January. The area of exposed shoreline during drier conditions (0.90 exceedance) would be greater than Baseline Conditions, with increases throughout the year. While the additional area of exposed shoreline is greater, it would only be exposed infrequently during the driest years with little to no precipitation.

The changes in water surface elevation at Lake Sonoma associated with the No Project 1 Alternative are not sufficiently significant to cause a change in the erosional potential of the near shoreline to a degree that could significantly exacerbate the water quality condition of the lake resulting from mercury accumulation. Please refer to Chapter 4.1, “Hydrology,” Impact 4.1.3, for a detailed discussion of potential erosion hazards at Lake Sonoma. The primary sources of mercury contributing to the 303(d) listing for fish tissue will continue to be erosional sources from adjacent soils and tributaries to the lake as well as depositional sources in the atmosphere. As such, the potential for impacts associated with mercury deposition in Lake Sonoma that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality would be less than significant.

Under the Proposed Project and No Project 2 Alternative, water surface elevation in Lake Sonoma would be similar to Baseline Conditions across 0.05 to 0.90 exceedances during all months, with some slight increases or decreases. Please refer to Chapter 4.1, “Hydrology,” Section 4.1.4, “Impact Analysis” Methodology, for a detailed discussion of the hydrologic assessment for the Proposed Project. Water surface elevation would increase during 0.95 exceedances leading to less exposed shoreline. The greatest decreases in water surface elevation, and potential increase in exposed shoreline would occur during the driest conditions (0.99 exceedance) during all months. But, precipitation during these conditions would likely be low compared to the other conditions, and this increase would likely not lead to greater erosion from surface runoff during precipitation.

As such, the changes in water surface elevations at Lake Sonoma associated with the Proposed Project and No Project 2 Alternative are not sufficiently significant to cause a change in the erosional potential of the near shore line to a degree that could significantly exacerbate the water quality condition of the lake resulting from mercury accumulation. Please refer to Chapter 4.1, “Hydrology”, Impact 4.1.3, for a detailed discussion of potential erosion hazards at Lake Sonoma. The primary sources of mercury contributing to the 303(d) listing for fish tissue would continue to be erosional sources from adjacent soils and tributaries to the lake as well as depositional sources in the atmosphere. As such, the potential for impacts associated with mercury deposition in Lake Sonoma that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality under the Proposed Project and No Project 2 Alternative would be less than significant.

Impact 4.2-2. Implementation of the Fish Flow Project could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality as it relates to aluminum and specific conductance in the Russian River. (Less than Significant)

Minimum instream flow changes implemented by the Fish Flow Project could increase exposure of previously submerged shoreline along banks adjacent to the Russian River. Increased exposure could lead to greater erosion from surface runoff during precipitation, thereby increasing sediment delivery to adjacent waterways. Substantial decreases in stage could also steepen the water surface slope from tributary streams, increasing erosive power at tributary junctions causing elevated sediment delivery to the Russian River. Substantial increases in stage could lead to greater erosion from increased scour. Erosion could contribute to elevated aluminum concentrations and specific conductance values. The Russian River is included on the 303(d) List as impaired for aluminum in the Upper Russian River in the Ukiah area and Healdsburg from the Railroad Bridge to Highway 101, and in the Lower Russian River from Fife Creek to Dutch Bill Creek. The Upper Russian River is also included on the 303(d) List as impaired for specific conductance in Healdsburg from the Railroad Bridge to Highway 101. Dry Creek is not included on the 303(d) List as impaired for aluminum or specific conductance, therefore no impacts to Dry Creek are anticipated for the Proposed Project and the No Project 1 and No Project 2 Alternatives. The Russian River Estuary is included in the Lower Russian River and therefore potential impacts to water quality associated with changes to minimum instream flows in the Lower Russian River could include the Estuary.

No Project 1 Alternative

Upper Russian River

Under the No Project 1 Alternative, minimum instream flow requirements and releases from Lake Mendocino in the Upper Russian River would be the same as under Baseline Conditions, which follow minimum instream flow requirements in the Water Agency's water right permits and in the Decision 1610 Hydrologic Index. Instream flows would be the same at all nodes in the Upper Russian River across the entire range of exceedances. Please refer to Chapter 4.1, "Hydrology", Section 4.1.4, "Impact Analysis" Methodology, for a detailed discussion of the hydrologic assessment for the No Project 1 Alternative.

As instream flows would be the same as under Baseline Conditions, there would be no changes in impact to drainage patterns or erosion or sedimentation. Please refer to Chapter 4.1, "Hydrology", Impact 4.1.2, for a detailed discussion of potential erosion and sedimentation hazards in the Upper Russian River. Therefore, there would be no change in the erosional potential of the near shoreline that could significantly exacerbate the water quality condition of the Upper Russian River resulting from aluminum deposition or increases in specific conductance values. Aluminum is a naturally occurring element in the soil that can be transported into surface water through erosion and rainfall. Conductivity is a measure of ionized or dissolved minerals in the water and is often reported as specific conductance. A higher than normal conductivity reading could indicate the presence of a nonpoint source runoff of animal wastes (which are high in ionized salts). As such, there would be no change in the potential for aluminum deposition and elevated specific conductance values in the Upper Russian River that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore no impact associated with No Project 1 Alternative.

Lower Russian River

Under the No Project 1 Alternative, the greatest stage changes at the Hacienda Bridge USGS gage in the Lower Russian River would occur during 0.50 and 0.05 exceedances. Please refer to Chapter 4.1, “Hydrology”, Section 4.1.4, “Impact Analysis” Methodology, for a detailed discussion of the hydrologic assessment for the No Project 1 Alternative. Modeling data show that stage would lower from May through November under median flow and 0.05 exceedances and similar or slightly lower the remainder of the year. Some decreases in stage would occur during lower flows from June to November, with low velocity, and would not be likely to cause increased erosion. Further, since the changes are relatively small (0.2 foot) compared to the overall stage heights (2.0 feet), there would be little effect on water surface slope, and resulting erosion from or within tributaries. During high flow, stage changes would be even smaller (0.2 foot) relative to overall stage heights (11 to 25 feet) and the potential impact to drainage patterns and erosion and sedimentation would be less than significant.

The changes in stage in the Lower Russian River, including the Estuary, associated with the No Project 1 Alternative are not sufficiently significant to cause a change in the erosional potential of the near shore line to a degree that could significantly exacerbate the water quality condition resulting from aluminum deposition. Please refer to Chapter 4.1, “Hydrology”, Impact 4.1.2, for a detailed discussion of potential erosion and sedimentation hazards in the Lower Russian River. Aluminum is a naturally occurring element in the soil that can be transported into surface water through erosion and rainfall. As such, the potential for impacts associated with aluminum deposition in the Lower Russian River that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality would be less than significant.

No Project 2 Alternative

Upper Russian River

Under the No Project 2 Alternative, stage at USGS gages along the Upper Russian River would be less than Baseline Conditions from May through September across 0.05 and 0.75 exceedances and from May through October during median conditions. Please refer to Chapter 4.1, “Hydrology”, Impact 4.1.2, for a detailed discussion of potential erosion and sedimentation hazards in the Upper Russian River. During dry conditions (0.90, 0.95, and 0.99 exceedances), stage would be lower from August through October, but generally the same or higher through the year.

The stage decrease during May through September under median flow is 0.3 to 0.4 foot and would expose previously submerged streambank. The bank would be exposed during relatively dry months and would be unlikely to lead to greater erosion from surface runoff during precipitation or bank erosion from high water velocity. Further, the overall stage changes would be small and would likely have a minor effect on water surface slope, and resulting erosion from or within tributaries.

During wet conditions (0.05 exceedance), stage increases in October, likely in response to releases from Coyote Valley Dam to increase reservoir storage for flood control. The greatest changes would occur upstream near Coyote Valley Dam at the Hopland USGS gage in October (2.4 feet), but would also occur during periods of seasonal low flow. This could still cause bank erosion, but this potential change would occur relatively infrequently (0.05 exceedance [approximately one out of twenty years]) during a single month (October). Further, natural stage increases due to seasonal rainfall would exceed the magnitude and duration of this stage increase. Under the No Project 2 Alternative and Baseline Conditions during 0.05 exceedance, stage would increase above 3.1 feet (up to 13.0 feet) from November through April. The potential impact to drainage patterns and erosion and sedimentation would be less than significant.

The changes in stage in the Upper Russian River associated with the No Project 2 Alternative are not sufficiently significant to cause a change in the erosional potential of the near shore line to a degree that could significantly exacerbate the water quality condition resulting from aluminum deposition or increases in specific conductance values. Please refer to Chapter 4.1, “Hydrology”, Impact 4.1.2, for a detailed discussion of potential erosion and sedimentation hazards in the Upper Russian River. Aluminum is a naturally occurring element in the soil that can be transported into surface water through erosion and rainfall. Conductivity is a measure of ionized or dissolved minerals in the water and is often reported as specific conductance. A higher than normal conductivity reading could indicate the presence of a nonpoint source runoff of animal wastes (which are high in ionized salts). As such, the potential for impacts associated with aluminum deposition and elevated specific conductance values in the Upper Russian River that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality would be less than significant.

Lower Russian River

Under the No Project 2 Alternative, the greatest stage changes at the Hacienda Bridge USGS gage in the Lower Russian River would occur from May through June under all but the driest flow conditions (0.99 exceedance). Please refer to Chapter 4.1, “Hydrology”, Impact 4.1.2, for a detailed discussion of potential erosion and sedimentation hazards in the Lower Russian River. Modeling data show that stage is lower from April through October across 0.50 and 0.75 exceedances and similar or slightly lower the remainder of the year, while during wetter flow conditions (0.05 exceedance), stage is lower from May through September, but increases substantially in October, likely in response to releases from Coyote Valley Dam to increase storage for flood control. Decreases in stage would occur during lower flows from May to October, with low velocity, and are not likely to cause increased erosion. Further, since the changes are relatively small (0.5 feet) compared to the overall stage heights (2.0 to 5.0 feet), there would be little effect on water surface slope, and resulting erosion from or within tributaries.

The increase in stage in October would be larger (1.8 feet) relative to overall stage height (5.0 feet), but would also occur during periods of seasonal low flow. This could still cause bank erosion, but this potential change would occur relatively infrequently (0.05 exceedance [approximately one out of twenty years]) during a single month (October). Further, natural stage increases due to seasonal rainfall would exceed the magnitude and duration of this stage increase. Under the No Project 2 Alternative and Baseline Conditions during 0.05 exceedance, stage would increase above 5.0 feet (up to 25.0 feet) from November through May. The potential impact to drainage patterns and erosion and sedimentation would be less than significant.

The changes in stage in the Lower Russian River, including the Estuary, associated with the No Project 2 Alternative are not sufficiently significant to cause a change in the erosional potential of the near shore line to a degree that could significantly exacerbate the water quality condition resulting from aluminum deposition. Please refer to Chapter 4.1, "Hydrology", Impact 4.1.2, for a detailed discussion of potential erosion and sedimentation hazards in the Lower Russian River. Aluminum is a naturally occurring element in the soil that can be transported into surface water through erosion and rainfall. As such, the potential for impacts associated with aluminum deposition in the Lower Russian River that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality would be less than significant.

Proposed Project

Upper Russian River

Under the Proposed Project, stage at USGS gages along the Upper Russian River would be lower from March, April, or May through September or October across 0.50 and 0.75 exceedances and drier conditions (0.90 and 0.95 exceedances). Please refer to Chapter 4.1, "Hydrology", Impact 4.1.2, for a detailed discussion of potential erosion and sedimentation hazards in the Upper Russian River. During wetter conditions (0.05 exceedance), stage increases in October, likely in response to releases from Coyote Valley Dam to increase storage for flood control. The greatest changes would occur upstream near Coyote Valley Dam at the Hopland USGS gage. The stage decrease during May through September under median flows is 0.4 to 0.5 foot would expose previously submerged streambank. The bank would be exposed during relatively dry months and would be unlikely to lead to greater erosion from surface runoff during precipitation or be subject to bank erosion from high water velocity. Additionally, the overall stage changes are small and would likely have a minor effect on water surface slope, and resulting erosion from or within tributaries.

The increase in stage in October (2.4 feet) would occur during periods of seasonal low flow. This could still cause bank erosion, but this potential change would occur relatively infrequently during a single month (October). Further, natural stage increases due to seasonal rainfall would exceed the magnitude and duration of this stage increase. Under the Proposed Project and Baseline Condition during 0.05 exceedance, stage would increase above 4.0 feet (up to 13.0 feet) from November through April. The potential impact to drainage patterns and erosion and sedimentation would be less than significant.

The changes in stage in the Upper Russian River associated with the Proposed Project are not sufficiently significant to cause a change in the erosional potential of the near shore line to a degree that could significantly exacerbate the water quality condition resulting from aluminum deposition or increases in specific conductance values. Please refer to Chapter 4.1, "Hydrology", Impact 4.1.2, for a detailed discussion of potential erosion and sedimentation hazards in the Upper Russian River. Aluminum is a naturally occurring element in the soil that can be transported into surface water through erosion and rainfall. Conductivity is a measure of ionized or dissolved minerals in the water and is often reported as specific conductance. A higher than normal conductivity reading could indicate the presence of a nonpoint source runoff of animal wastes (which are high in ionized salts). As such, the potential for impacts associated with aluminum deposition and elevated specific conductance values in the Upper Russian River that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality would be less than significant.

Lower Russian River

Under the Proposed Project, the greatest stage changes at the Hacienda Bridge USGS gage in the Lower Russian River would occur from May through October across all exceedances. Please refer to Chapter 4.1, “Hydrology”, Impact 4.1.2, for a detailed discussion of potential erosion and sedimentation hazards in the Lower Russian River. Modeling data show that stage is lower from May through October across 0.50 and 0.75 exceedances and similar or slightly lower the remainder of the year, while during wetter conditions (0.05 exceedance), stage is lower from May through September, but increases in October, likely in response to releases from Coyote Valley Dam to increase storage for flood control. Decreases in stage would occur across all other exceedances during lower minimum flows from May to October, with low velocity, and would not be likely to cause increased. The stage change during June through August under median flows would be 0.6 to 0.9 foot compared to the overall stage heights of 2.0 feet and would expose previously submerged streambank. This would occur during relatively dry months and would be unlikely to lead to greater erosion from surface runoff during precipitation.

The increase in stage in October would be large (1.9 feet) relative to overall stage height (5.0 feet), but would also occur during periods of seasonal low flow. This could still cause bank erosion, but this potential change would occur relatively infrequently (0.05 exceedance [approximately one out of twenty years]) during a single month (October). Further, natural stage increases due to seasonal rainfall would exceed the magnitude and duration of this stage increase. Under the Proposed Project and Baseline Condition during 0.05 exceedance, stage would increase above 5.0 feet (up to 25.0 feet) from November through May. The potential impact to drainage patterns and erosion and sedimentation would be less than significant.

The changes in stage in the Lower Russian River, including the Estuary, associated with the Proposed Project are not sufficiently significant to cause a change in the erosional potential of the near shore line to a degree that could significantly exacerbate the water quality condition resulting from aluminum deposition. Please refer to Chapter 4.1, “Hydrology”, Impact 4.1.2, for a detailed discussion of potential erosion and sedimentation hazards in the Lower Russian River. Aluminum is a naturally occurring element in the soil that can be transported into surface water through erosion and rainfall. As such, the potential for impacts associated with aluminum deposition in the Lower Russian River that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality would be less than significant.

Impact 4.2-3. Implementation of the Fish Flow Project could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality relating to temperature and dissolved oxygen in the Russian River and Dry Creek. (No Impact)

As described in Methodology above, the water quality model for the Russian River was developed using HEC 5Q to simulate how changes in flow affect water temperature and dissolved oxygen in the Russian River downstream of Warm Springs and Coyote Valley dams, and Dry Creek. Simulated flow for Baseline Conditions and the Proposed Project and the No Project 1 and No Project 2 alternatives were generated using the Russian River ResSim (see Appendix G) and used as input into the water quality model.

Upper Russian River

Since the completion of Coyote Valley Dam and the consequent filling and operation of Lake Mendocino, the Russian River has been transformed into a perennial flowing stream with highly regulated flood flows and dry season base flows. Water temperatures in the Upper Russian River are largely regulated by the temperature of water releases from Lake Mendocino downstream to the Hopland area with seasonal maximum temperatures typically ranging between 60°F and 70°F (Figure 4.2-2). A dam that releases surface water will usually increase the annual temperature range immediately downstream, whereas a deep release dam will lessen the annual variation (Allan 1995). Lake Mendocino has one release point at the bottom of the lake where the water typically remains colder than surface temperatures until mixing of the stratified water layers occurs in late summer/ early fall (Figure 4.2-3).

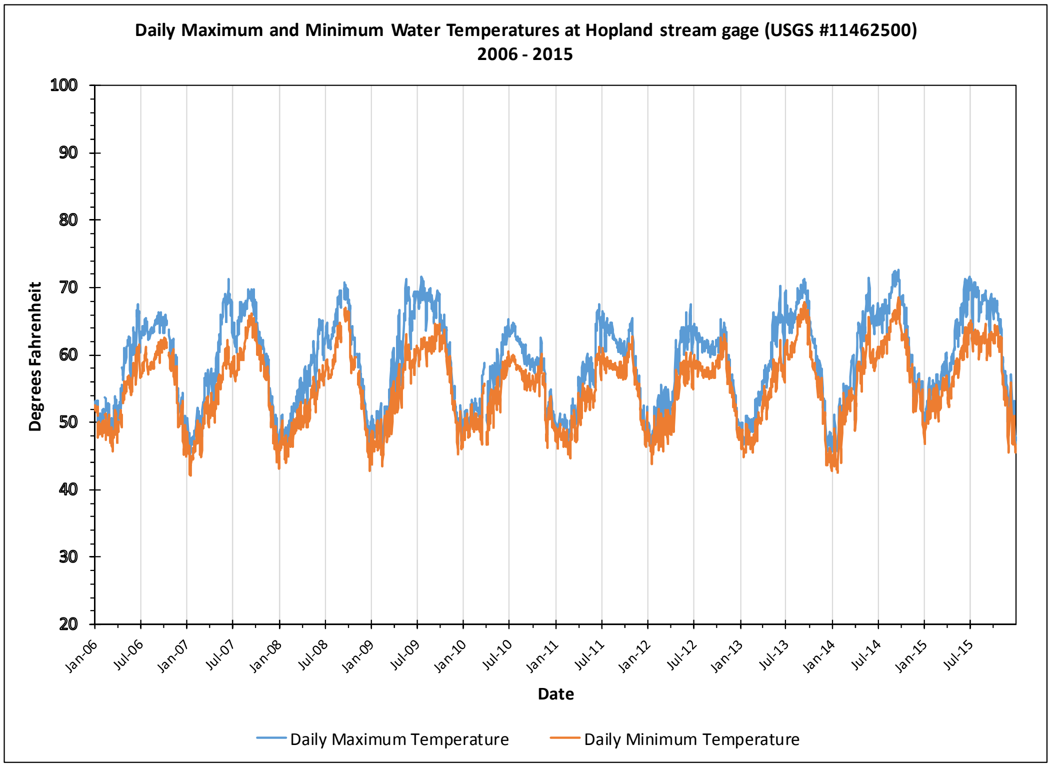

Figure 4.2-2. Daily Maximum and Minimum Water Temperatures at USGS Russian River near Hopland stream gage (USGS 11462500) between 2006 and 2015.

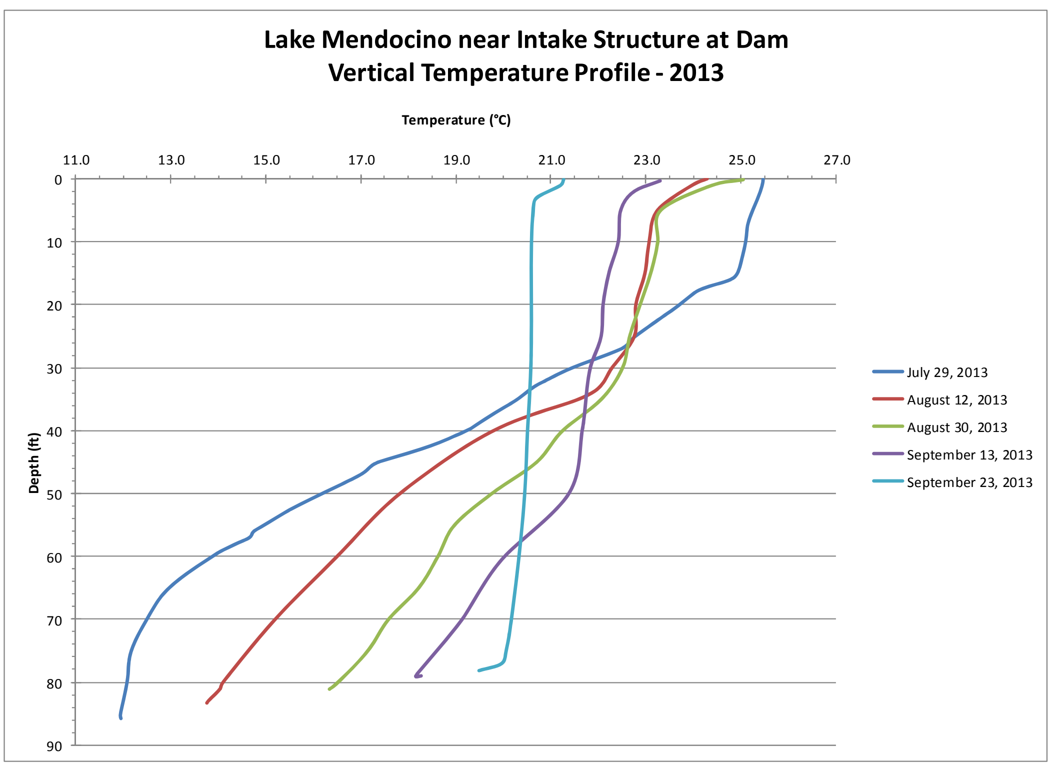

Figure 4.2-3. 2013 Vertical Temperature Profiles in Lake Mendocino near the Intake Structure at the Dam. Source: Sonoma County Water Agency

Lake Mendocino DO concentrations tend to decline at depth in the late spring, often resulting in low DO conditions in the East Fork of the Russian River immediately below the lake. DO levels within the cold water pool typically remain depressed through the summer months until the lake seasonally mixes. The top 20 feet to 30 feet of water in Lake Mendocino that is exposed to sunlight (photic zone) remains well oxygenated (Figure 4.2-4). However once the anoxic bottom layer and the oxygenated surface layer mix, the DO concentration increases in the bottom layer and decreases in the photic zone to an intermediate concentration (Figure 4.2-4).

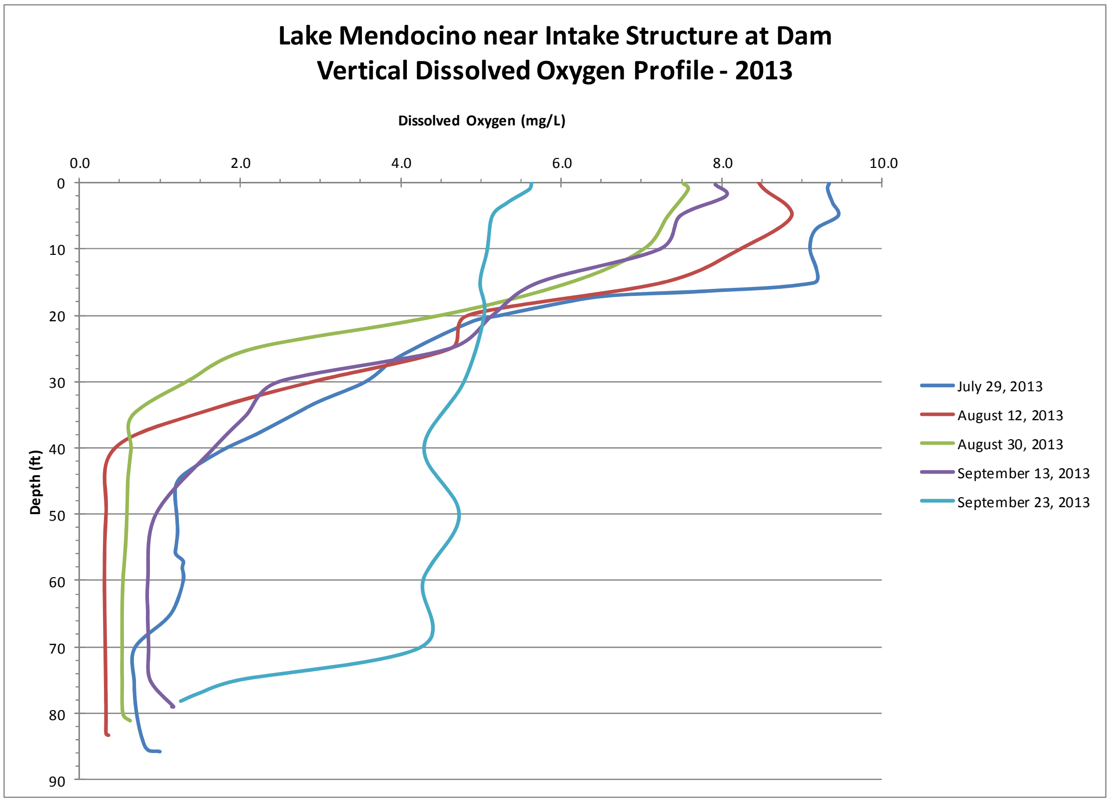

Figure 4.2-4. 2013 Vertical Dissolved Oxygen Profiles in Lake Mendocino near the Intake Structure at the Dam. Source: Sonoma County Water Agency

Atmospheric conditions tend to increase water temperatures during the dry season (May 15 through October 15) as water flows downstream through the Upper Russian River. As a result, dry season daily maximum water temperatures are typically higher in the Healdsburg area (Digger Bend) (Figure 4.2-5) compared to the Hopland area (Figure 4.2-2).

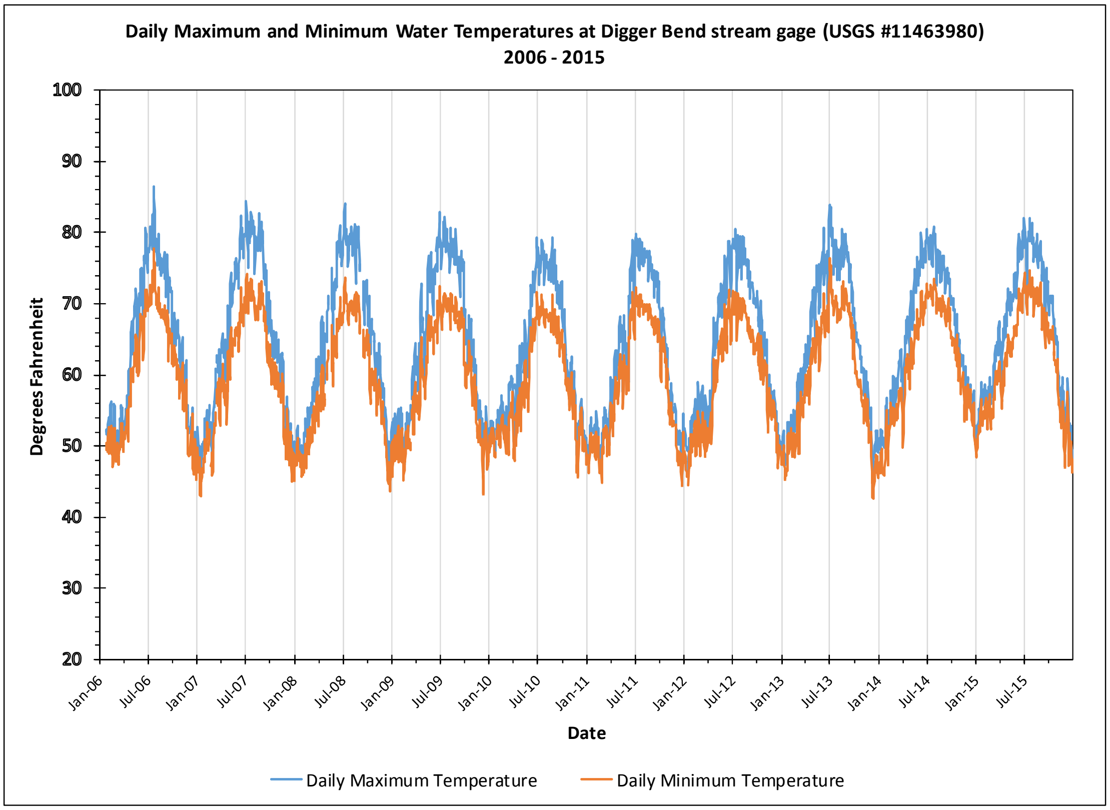

Figure 4.2-5. Daily Maximum and Minimum Water Temperatures at USGS Russian River at Digger Bend near Healdsburg stream gage (USGS 11463980) between 2006 and 2015.

Lower releases similar to the Proposed Project and the No Project 2 Alternative would result in more water remaining in storage on an annual basis compared to Baseline Conditions and the No Project 1 Alternative. This would typically result in a longer seasonal retention of cooler, more oxygenated water in Lake Mendocino as water is released from the bottom of the reservoir, which serves to deplete the cold water pool located in the lower portion of the lake.

Lower Russian River

Since the completion of Coyote Valley Dam and Warm Springs Dam and the consequent filling and operation of Lake Mendocino and Lake Sonoma, the Russian River has been a perennial flowing stream with regulated flood flows and dry season base flows. Atmospheric conditions tend to increase water temperatures during the dry season (May 15 through October 15) as water flows downstream through the Lower Russian River (Figure 4.2-6). However, as the river flows past the Duncans Mills area, the natural cooling effect of the air coming off the Pacific Ocean or tidal migration of cooler ocean derived saline water begin to decrease overall water temperatures of the Lower Russian River as it transitions from a predominantly freshwater stream into a brackish to saline estuary.

Estuaries are complex, dynamic ecosystems, normally experiencing changes between seasons, between years, and between different places in the same estuary. For an evaluation of the potential effects to the water quality in the Russian River Estuary due to minimum instream flow changes in the Lower Russian River, when anticipating future conditions, the determination of significance is compared to Baseline Conditions. Under Baseline Conditions, water depth, temperature, and salinity, as well as other water quality parameters, fluctuate at varying degrees and continuously across a wide range of values and flows into the Estuary and are dependent in large part on the strength of the tidal cycle during open conditions and the frequency, timing, and duration of river mouth closures, as well as the presence of external factors including potential pollutants along the near shore line that are inundated during river mouth closures. The shift from an estuary to lagoon conditions and resultant changes to water quality conditions in the underlying saline layer and overlying freshwater layer typically begin to occur within hours after river mouth closure and are not dependent on dry season minimum instream flow rates. Therefore, because lagoon conditions in the Estuary are part of the Baseline Condition, changes to minimum instream flows would have the greatest effect on temperature and DO during open river mouth conditions.

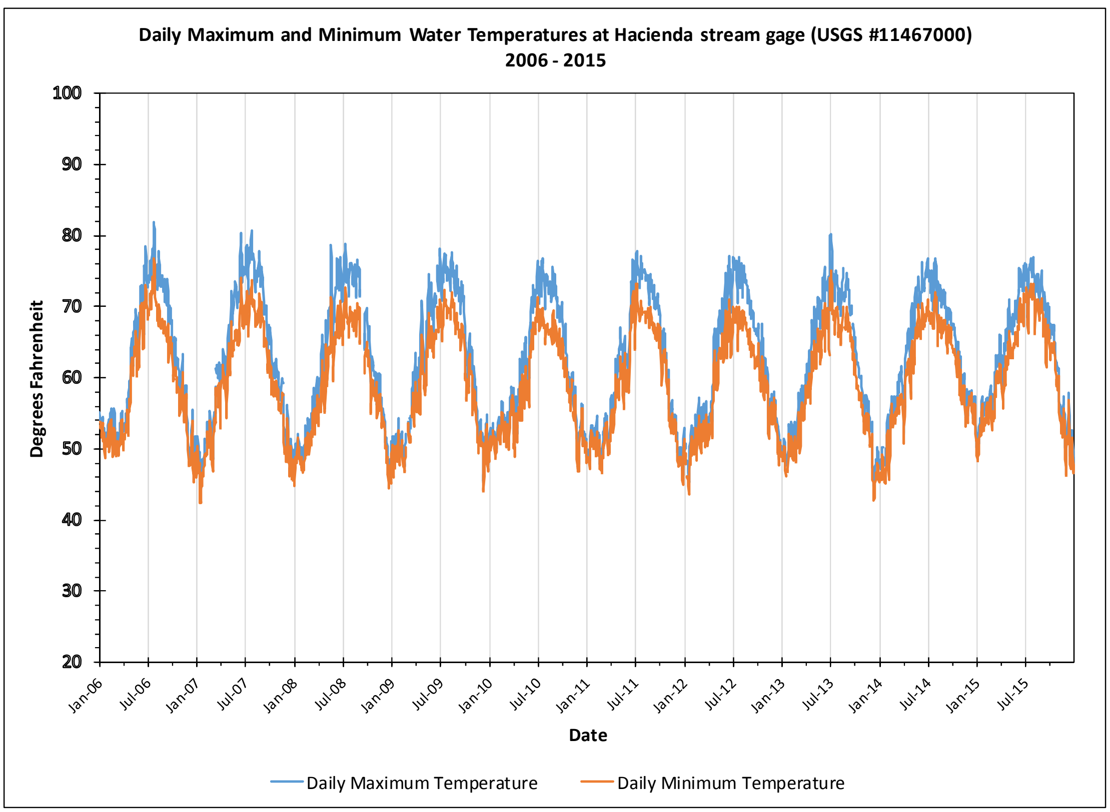

Figure 4.2-6. Daily Maximum and Minimum Water Temperatures at USGS Russian River near Guerneville (Hacienda) stream gage (USGS 11467000) between 2006 and 2015.

Dry Creek

Since the completion of Warm Springs Dam and the consequent filling and operation of Lake Sonoma, Dry Creek has been transformed into a perennial flowing stream with highly regulated flood flows and dry season base flows. Lake Sonoma is a deep cold water lake, with a permanently stratified cold water pool at depth. The release of water from Lake Sonoma is not only regulated for flow, but also for temperature (Figure 4.2-7). Temperature is regulated by releasing water from the lake through a combination of inlet structures positioned at various depths to provide for water temperatures that are suitable for the Warm Springs Dam hatchery operations for hatching and rearing steelhead and coho salmonids. This results in a consistently cool water source flowing down the length of Dry Creek to the confluence with the Russian River. There is also an aeration system to maintain sufficient oxygen levels for use at the hatchery and for release into Dry Creek.

Temperature data collected at the USGS Dry Creek below Warm Springs Dam stream gage (USGS 11465240) before and after the construction and operation of Lake Sonoma were observed to have maximum temperatures as high as 80°F before the dam and maximum temperatures in the low 60°F range after the dam (Figure 4.2-7).

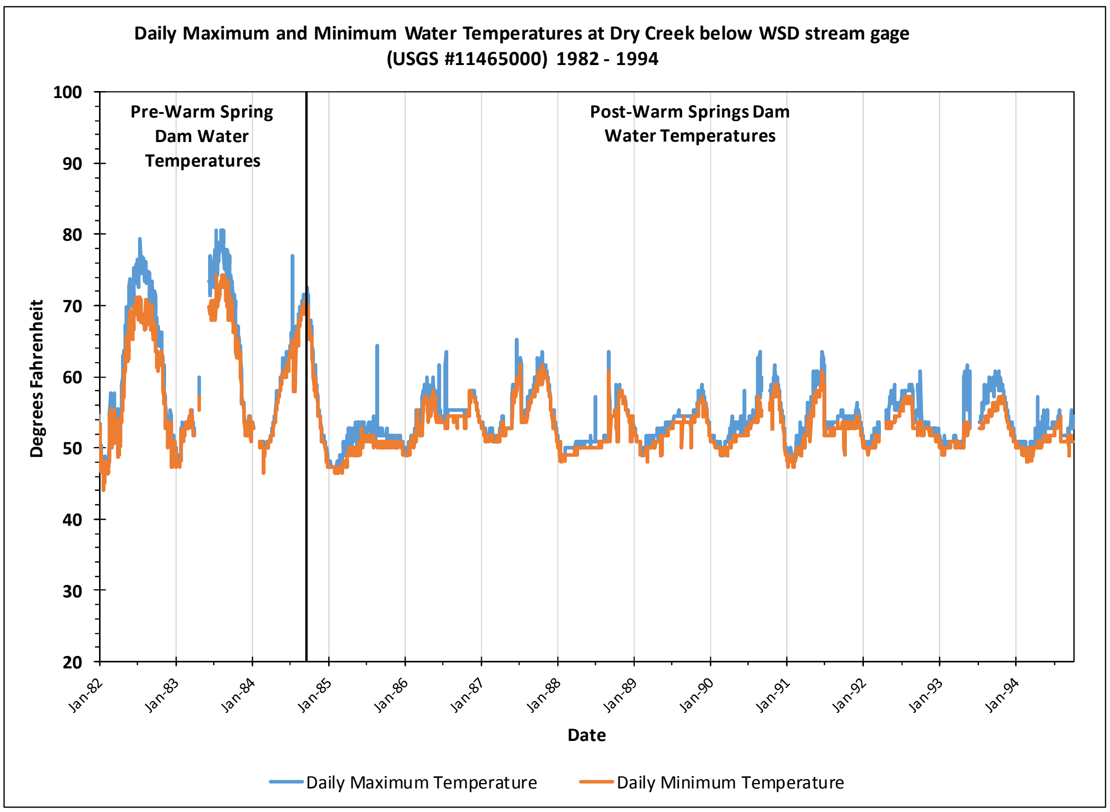

Figure 4.2-7. Daily Maximum and Minimum Water Temperatures at USGS Dry Creek below Warm Springs Dam stream gage (USGS 11465000) between 1982 and 1994.

Current temperatures in Dry Creek compared to pre-dam conditions allow for higher concentrations of DO to be contained within the water column during the warmer, dry-season months. DO data collected at Dry Creek below Lambert Bridge stream gage had concentrations that ranged between approximately 8.8 mg/L to 12.2 mg/L from May through October for the years 2012 through 2014 (Figure4.2-8). DO data is generally recorded every 15 minutes at this stream gage. DO concentrations of at least 7mg/L are typically considered suitable for rearing salmonids (See Chapter 4.3, “Fisheries Resources” for a full discussion on suitable DO levels for salmonid species).

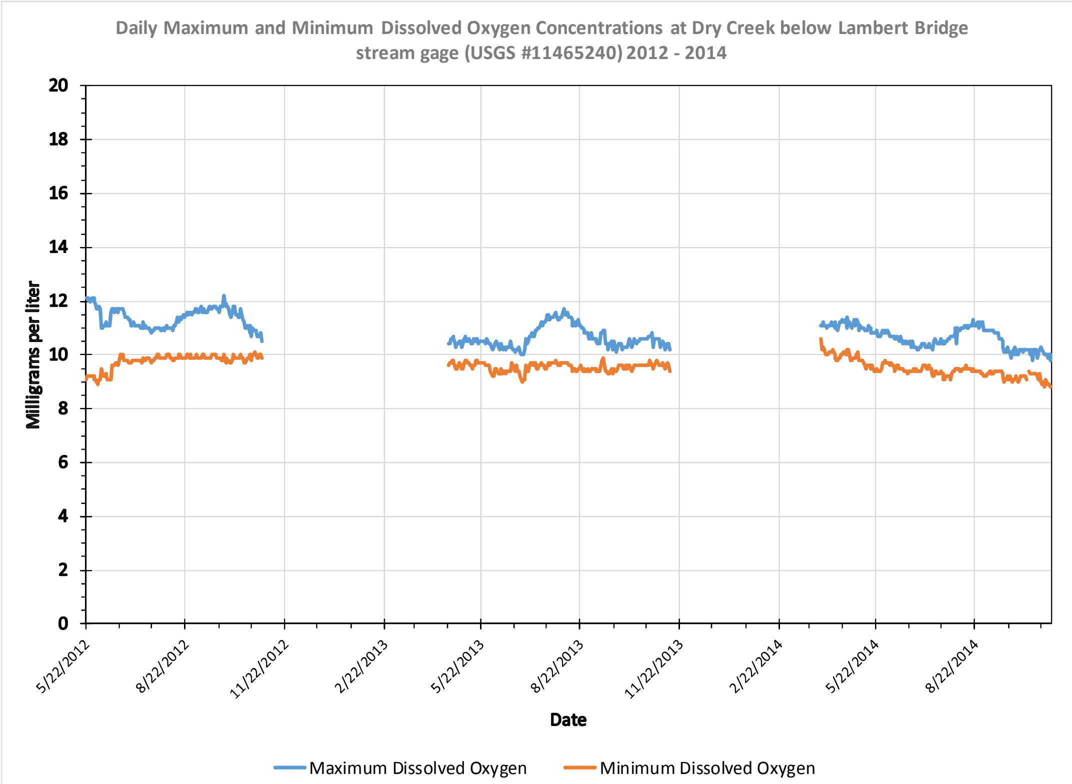

Figure 4.2-8. Daily Maximum and Minimum Dissolved Oxygen Concentrations at USGS Dry Creek below Lambert Bridge stream gage (USGS 11465240) between 2012 and 2014.

No Project 1 Alternative

Upper Russian River

Under the No Project 1 Alternative, the modeled temperature and dissolved oxygen content of water being released from Lake Mendocino at the Coyote Valley Dam (CVD) Outlet would remain the same as Baseline Conditions. Refer to Appendix G, for temperature modeling results for the No Project 1 Alternative. Likewise, there would be no change in temperature or dissolved oxygen compared to Baseline Conditions at any of the modeled nodes in the Upper Russian River. As such, there would be no change for temperatures or dissolved oxygen concentrations compared to Baseline Conditions that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore no impact associated with the No Project 1 Alternative.

Lower Russian River

Under the No Project 1 Alternative, the modeled temperature and dissolved oxygen content of water would be similar to Baseline Conditions in the Lower Russian River, including the Estuary. Refer to Appendix G, for temperature modeling results for the No Project 1 Alternative. As such, there would be no change for temperatures or dissolved oxygen concentrations compared to Baseline Conditions that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore no impact associated with the No Project 1 Alternative.

Dry Creek

Under the No Project 1 Alternative, the modeled temperature and dissolved oxygen content of water being released from Lake Sonoma at the Warm Springs Dam (WSD) Outlet would be similar to Baseline Conditions. Refer to Appendix G, for temperature modeling results for the No Project 1 Alternative. There would be a slight increase in temperature and a slight decrease in DO content in October and November, but the differences would be very small. Water temperatures and dissolved oxygen content would remain similar to Baseline Conditions through all of the modeling nodes in Dry Creek, with slight decreases in temperature at Dry Creek at Lambert Bridge and Dry Creek at the Mouth nodes between the months of June and October. As such, there would be no change to dissolved oxygen concentrations and a slight improvement for temperatures that would provide a benefit and would not result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore there would no impact associated with the No Project 1 Alternative.

No Project 2 Alternative

Upper Russian River

Under the No Project 2 Alternative, the modeled temperature of water being released from Lake Mendocino at the Coyote Valley Dam Outlet would be lower than Baseline Conditions from June through October and nearly identical from November through June. Refer to Appendix G, for temperature modeling results for the No Project 2 Alternative. Temperatures under the No Project 2 Alternative would be slightly higher at the downstream modeled nodes from May to July down to the Hopland node than Baseline Conditions, but would be several degrees cooler during the second half of the summer into October when seasonal temperatures are typically highest. Temperatures under the No Project 2 Alternative would be slightly higher at the Cloverdale, Geyserville and Healdsburg nodes during the late spring leading into summer than Baseline Conditions, but would also be slightly cooler during the latter half of summer into October.

Under the No Project 2 Alternative, the modeled dissolved oxygen concentration of water being released from Lake Mendocino at the Coyote Valley Dam Outlet would be slightly lower (>1 mg/L) than Baseline Conditions in May and June, but would be higher from July to September. The turnover of the lake would occur slightly later in the season than Baseline Conditions resulting in the recovery of DO concentrations occurring slightly later in the season than Baseline Conditions, however overall DO concentrations would remain higher under the No Project 2 Alternative prior to the turnover event than would occur under Baseline Conditions. This pattern would continue downstream to the Healdsburg modeling node where dissolved oxygen concentrations under the No Project 2 Alternative would be similar to Baseline Conditions.

Reducing releases from Lake Mendocino for the No Project 2 Alternative would be a benefit temperatures in the reservoir as it would result in an increase in late summer storage levels, resulting in a retention of the cold water pool for longer in the season than currently occurs. Longer retention of the cold water pool at Lake Mendocino would also benefit overall water quality in the Upper Russian River and would not degrade current water quality conditions, but would merely shift the timing of water quality changes associated with the annual turnover and mixing of Lake Mendocino waters. As such, changes to temperatures or dissolved oxygen concentrations compared to Baseline Conditions would not result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore no impact is associated with the No Project 2 Alternative.

Lower Russian River

Under the No Project 2 Alternative modeled temperatures would be slightly lower than Baseline Conditions from August to October and similar to Baseline Conditions the rest of the year in the Lower Russian River, including the Estuary. Refer to Appendix G, for temperature modeling results for the No Project 2 Alternative. Under the No Project 2 Alternative modeled dissolved oxygen concentrations would be slightly higher than Baseline Conditions during the mid to late summer and would be similar to Baseline Conditions the rest of the year. As such, there would be a slight improvement for temperatures and dissolved oxygen concentrations that would provide a benefit and would not result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore no impact is associated with the No Project 2 Alternative.

Dry Creek

Under the No Project 2 Alternative, the modeled temperature and dissolved oxygen content of water being released from Lake Sonoma at the Warm Springs Dam Outlet would remain similar to Baseline Conditions. Refer to Appendix G, for temperature modeling results for the No Project 2 Alternative. The modeled temperature and dissolved oxygen concentrations would be similar to Baseline Conditions at all of the Dry Creek modeled nodes. As such, there would be no change for temperatures or dissolved oxygen concentrations compared to Baseline Conditions that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore no impact is associated with the No Project 2 Alternative.

Proposed Project

Upper Russian River

Under the Proposed Project, the modeled temperature of water being released from Lake Mendocino at the Coyote Valley Dam Outlet would be lower than Baseline Conditions from May through October and slightly higher from November through March. Refer to Appendix G, for temperature modeling results for the Proposed Project. Temperatures under the Proposed Project would be slightly higher at the downstream modeled nodes from April to July down to the Hopland node than Baseline Conditions, but would be several degrees cooler during the second half of the summer into October when seasonal temperatures are typically highest. Temperatures under the Proposed Project would be slightly higher at the Cloverdale, Geyserville and Healdsburg nodes during the late spring leading into summer than Baseline Conditions, but would also be slightly cooler during the latter half of summer into October.

Under the Proposed Project, the modeled dissolved oxygen concentration of water being released from Lake Mendocino at the Coyote Valley Dam Outlet would be higher than Baseline Conditions from June to September. The turnover of the lake would occur slightly later in the season than Baseline Conditions resulting in the recovery of dissolved oxygen concentrations occurring slightly later in the season than Baseline Conditions, however overall DO concentrations would remain higher under the Proposed Project prior to the turnover event than would occur under Baseline Conditions. This pattern would continue downstream to the Healdsburg modeling node with slightly lower dissolved oxygen concentrations in late spring to early summer, but higher dissolved oxygen concentrations in the latter half of the summer leading into fall.

Reducing releases from Lake Mendocino for the Proposed Project would be benefit water temperatures as it would result in an increase in late summer storage levels, resulting in a retention of the cold water pool for longer in the season than under Baseline Conditions. Longer retention of the cold water pool at Lake Mendocino would also benefit overall water quality in the Upper Russian River and would not degrade current water quality conditions, but would merely shift the timing of water quality changes associated with the annual turnover and mixing of Lake Mendocino waters. As such, changes to temperatures or dissolved oxygen concentrations compared to Baseline Conditions would not result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore no impact is associated with the Proposed Project.

Lower Russian River

Under the Proposed Project modeled temperatures would be slightly lower than Baseline Conditions from July through October and similar to Baseline Conditions the rest of the year in the Lower Russian River, including the Estuary. Refer to Appendix G, for temperature modeling results for the Proposed Project. Under the Proposed Project modeled dissolved oxygen concentrations would be slightly higher than Baseline Conditions during the mid to late summer and would be similar to Baseline Conditions the rest of the year. As such, there would be a slight improvement for temperatures and dissolved oxygen concentrations that would provide a benefit and would not result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore no impact is associated with the Proposed Project.

Dry Creek

Under the Proposed Project, the modeled temperature and dissolved oxygen content of water being released from Lake Sonoma at the Warm Springs Dam Outlet would remain similar to Baseline Conditions. Refer to Appendix G, for temperature modeling results for the Proposed Project. The modeled temperature at the downstream nodes would be slightly higher during the month of June and slightly lower during the month of August, but remain similar the rest of the year compared to Baseline Conditions. Modeled dissolved oxygen concentrations would be similar compared to Baseline Conditions at all of the Dry Creek modeled nodes. As such, there would be no change for temperatures or dissolved oxygen concentrations compared to Baseline Conditions that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and therefore no impact is associated with the Proposed Project.

Impact 4.2-4. Changes to minimum instream flows could result in a violation of water quality standards or waste discharge requirements or otherwise degrade water quality relating to biostimulatory substances in the Russian River. (Significant and Unavoidable)

High concentrations of biostimulatory substances including nitrogen, phosphorus, and algae (chlorophyll-a) could have a negative effect on water quality in the Russian River, including the Estuary. High levels of nutrients can contribute to excessive algal growth in river and streams, causing nuisance conditions which can affect dissolved oxygen, pH, and temperature and the overall quality of aquatic habitat. Excessive algal growth can affect the aesthetics of the river negatively impacting contact and non-contact recreation. Excessive algal growth can also contribute to the proliferation of blue-green algae, which in turn can pose a risk to contact recreation through the release of cyanotoxins into the water column.

During the process of developing statewide criteria for biostimulatory substances, the SWRCB has found that a given concentration of nitrogen and phosphorus does not consistently result in nuisance conditions in a given stream, and concluded that a single nutrient concentration threshold is not appropriate for identifying when nuisance conditions may be occurring. As a result, the SWRCB began developing criteria for algal biomass concentrations that can cause nuisance conditions. Ultimately, this algal biomass concentration would then be used in individual streams to identify site specific nutrient concentration thresholds and potentially chlorophyll-a concentrations that may indicate when a nuisance condition is occurring. An algal biomass threshold was developed using data from rivers and streams throughout the state, however there is no algal mass data from the Russian River that can be used to analyze the Proposed Project and the No Project 1 and No Project 2 Alternatives against the Baseline Condition.

There is no simulation model available for the Russian River that can adequately simulate algal biomass or nutrient and chlorophyll-a concentrations under a range of different flows. In the absence of an available model, total nitrogen, total phosphorus and chlorophyll-a data will be relied upon to analyze the Proposed Project and the No Project 1 and No Project 2 Alternatives against the Baseline Condition for potential changes to impacts in the Russian River.

Dry Creek is not included on the 303(d) List as impaired for biostimulatory substances and is not currently considered to be impaired for biostimulatory substances, therefore no impacts to Dry Creek are anticipated for the Proposed Project and the No Project 1 and No Project 2 Alternatives.

Upper Russian River Biostimulatory Substance Conditions

The Upper Russian River has been divided into two sections for the purposes of the biostimulatory substances analysis: the Mendocino County section which includes monitoring sites in Hopland and at Comminsky Station north of Cloverdale, and the Sonoma County section which includes Jimtown in Alexander Valley and Digger's Bend in Healdsburg. This division into two sections was done to more accurately reflect differences in nutrient and chlorophyll-a conditions that have been observed in the Upper Russian River.

Sampling for nutrients and chlorophyll-a was conducted in the Upper Russian River at four USGS gaging stations in 2010, 2012, and 2013. Upper Russian River data was collected during minimum instream flows in 2010 and 2012 that are similar to the Baseline Condition instream flows and conditions that could occur under the No Project 1 Alternative instream flows (Table 4.2-3). Although the period of record for Baseline Conditions includes the years 2006 through 2014, Upper Russian River instream flows during 2013 and 2014 were reduced through a TUCO and are similar to the Proposed Project and No Project 2 Alternative instream flows (Table 4.2-3). Therefore, the 2013 and 2014 data collected during instream flows similar to the Proposed Project and No Project 2 Alternative were analyzed against the data collected in 2010 and 2012 (with instream flows similar to the Baseline Condition) to identify potential impacts. The No Project 1 Alternative instream flows are similar to Baseline Condition instream flows, therefore the data collected in 2010 and 2012 will be analyzed for potential changes from Baseline Conditions.

Median and mean total nitrogen and total phosphorus concentrations were observed to be higher in the Hopland and Comminsky area than in the Jimtown and Digger Bend area for all three years (Table 4.2-3). The highest median and mean values for total nitrogen in the Hopland and Comminsky area occurred during 2012, with instream flows similar to the Baseline Condition and No Project 1 Alternative. Median total phosphorus concentrations in the Hopland and Comminsky area were the same all three years, however the mean concentration was observed to be highest in 2010, with instream flows similar to the Baseline Condition and No Project 1 Alternative. Median and mean algal concentrations measured as chlorophyll-a in the water column were highest during 2013, with instream flows similar to the Proposed Project and No Project 2 Alternative. Overall, nutrient concentrations were fairly consistent in the Hopland area between the three years, with elevated levels of nitrogen and phosphorus exceeding the USEPA recommended concentrations of 0.38 mg/L for nitrogen and 0.022 mg/L for phosphorus in streams occurring in Aggregate Ecoregion III.

There were some measureable differences in chlorophyll-a concentrations between the years. Exceedances of the USEPA recommended concentration of 0.0017 mg/L were observed to occur in 2010 (similar to Baseline and No Project 1) and 2013 (similar to the Proposed Project and No Project 2), but were not observed to occur in 2012, which also had instream flows similar to the Baseline Condition and No Project 1 Alternative (Table 4.2-3).

Table 4.2-3. Annual Nutrient and chlorophyll-a Concentrations at USGS Russian River near Hopland (USGS 11463980), USGS Russian River near Cloverdale (Comminsky) (USGS 111463000), USGS Russian River at Jimtown (USGS11463682), and USGS Russian River at Digger Bend near Healdsburg (USGS 11463980) stream gages for the years 2010, 2012, and 2013. Bold values represent exceedances of the USEPA recommended criteria for total nitrogen, total phosphorus, and chlorophyll-a.

Year	Stations Sampled*	Total Nitrogen		Total Phosphorus		Chlorophyll-a		Flow**			Total Sample Events
		Median (mg/L)	Mean (mg/L)	Median (mg/L)	Mean (mg/L)	Median (mg/L)	Mean (mg/L)	Median (cfs)	Mean (cfs)	Range (cfs)	
2010	Hopland, Comminsky	**0.41**	**0.43**	**0.053**	**0.063**	0.0014	**0.0029**	174	274	158 - 749	8
2012	Hopland, Comminsky	**0.48**	**0.49**	**0.053**	**0.061**	0.0016	0.0015	156	154	121 - 183	42
2013	Hopland, Comminsky	**0.43**	**0.43**	**0.055**	**0.061**	**0.0028**	**0.0031**	116	112	82 - 137	44
2010	Jimtown, Digger Bend	0.26	0.27	**0.022**	0.021	0.00092	0.0011	158	174	135 - 246	8
2012	Jimtown, Digger Bend	0.31	0.33	0.014	0.018	0.00056	0.00071	137	144	115 - 240	41
2013	Jimtown, Digger Bend	0.28	0.27	0.014	0.016	0.0011	0.0014	95	95	75 - 121	43

* USGS 11462500 Russian River near Hopland, USGS 11463000 Russian River near Cloverdale (Comminsky), USGS 11463680 Russian River at Jimtown, and USGS 11463980 Russian River at Digger Bend near Healdsburg stream gage stations.
** Flow was measured at the USGS stream gage stations.

Differences in median and mean chlorophyll-a concentrations between the years can be the product of various external factors including weather and air temperatures, and additional sampling and analysis would need to be conducted to account for those external factors. However, it does appear that biostimulatory conditions could be occurring with instream flows similar to the Baseline Condition and the Proposed Project and the No Project 1 and No Project 2 Alternatives.

Median and mean total nitrogen and total phosphorus concentrations in the Jimtown and Digger Bend area were lower than in the Hopland and Comminsky area (Table 4.2-3). The highest median and mean values for total nitrogen at Jimtown and Digger Bend occurred during 2012, with instream flows similar to the Baseline Condition and No Project 1 Alternative. The highest median and mean values for total phosphorous at Jimtown and Digger Bend occurred in 2010, with instream flows similar to the Baseline Condition and No Project 1 Alternative.

The highest median and mean values for chlorophyll-a occurred in 2013 at Jimtown and Digger Bend, with instream flows similar to the Proposed Project and No Project 2 Alternative instream flows (Table4.2-3). However, median and mean chlorophyll-a concentrations did not exceed the USEPA recommended concentration in any of the three years. Likewise, median and mean total nitrogen concentrations at Jimtown and Digger Bend did not exceed the USEPA recommended concentrations in any of the three years. The median value for total phosphorus at Jimtown and Digger Bend did match the USEPA recommended criteria of 0.22 mg/L in 2010, with instream flows similar to the Baseline Condition and No Project 1 Alternative, however the mean value was just below the USEPA recommended criteria (Table 4.2-3).

Dissolved oxygen data was collected at the USGS Hopland stream gage and at the USGS Digger Bend stream gage under a variety of instream flows during Baseline Conditions (2006 to 2014) and in 2015 that are similar to the Proposed Project and the No Project 1 and No Project 2 Alternative minimum instream flow requirements. Data collected during instream flows that are similar to the Proposed Project and the No Project 1 and No Project 2 Alternatives was then analyzed against data collected during instream flows similar to the Baseline Condition for potential changes.

DO concentrations at Hopland and Digger Bend fluctuate on a daily, seasonal, and yearly basis. DO concentrations tend to be higher during wet season months (November through April) when water temperatures are cooler, and the level of primary production and respiration associated with plant and algal growth decline. The availability of nutrients in the water column can also affect DO concentrations. These nutrients can accumulate in standing water during an extended period of time and contribute to biostimulatory conditions. These conditions can promote excessive plant and algal growth that can alter the concentration of DO through photosynthesis and respiration.

Although water temperatures at Hopland are generally cooler than at Jimtown during the dry season, both stations were observed to have seasonally depressed DO concentrations as well as supersaturation conditions during the period of Record for Baseline Conditions and in 2014 and 2015, with instream flows similar to the Proposed Project and No Project 2 Alternative instream flows (Figure 4.2-9 and 4.2-10). Supersaturated DO concentrations can be caused by excessive plant and algal growth during photosynthesis in which excess oxygen is produced and released into the water column typically during the daytime. Whereas depressed DO concentrations can be the result of excessive plant and algal respiration and decomposition when oxygen in the water column is consumed typically at night. Consequently, it does appear that biostimulatory conditions could be occurring with instream flows similar to the Baseline Condition and the Proposed Project and the No Project 1 and No Project 2 Alternatives.

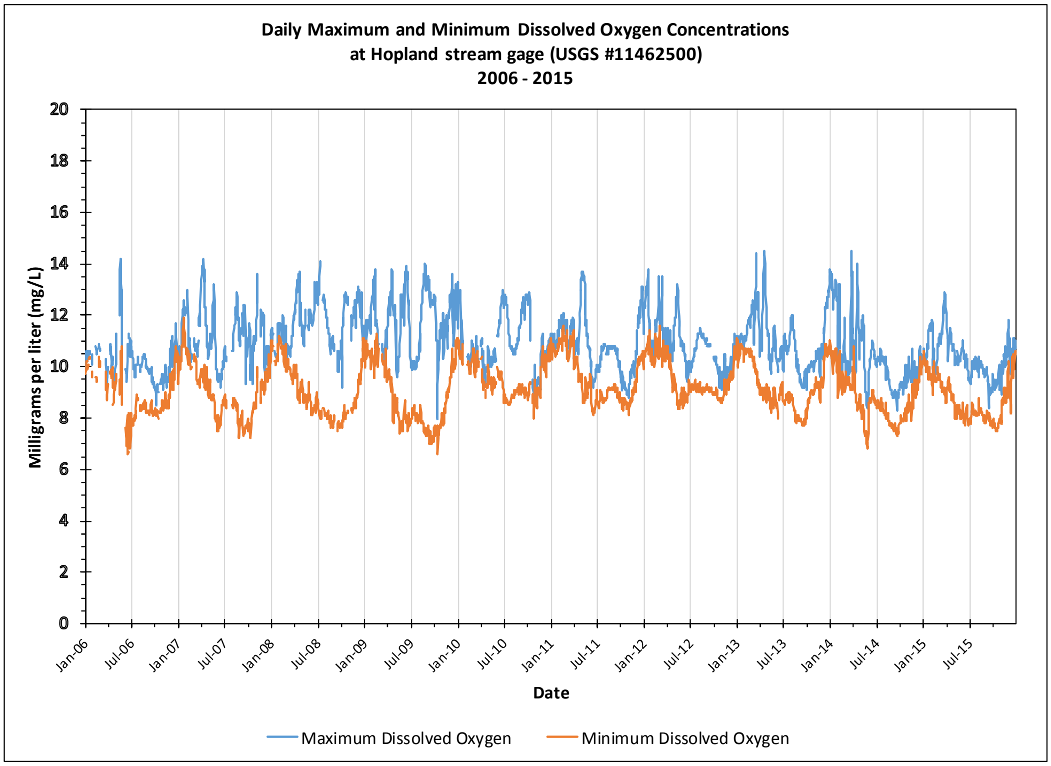

Figure 4.2-9. Daily Maximum and Minimum Dissolved Oxygen Concentrations at USGS Russian River near Hopland stream gage (USGS 11462500) between 2006 and 2015.

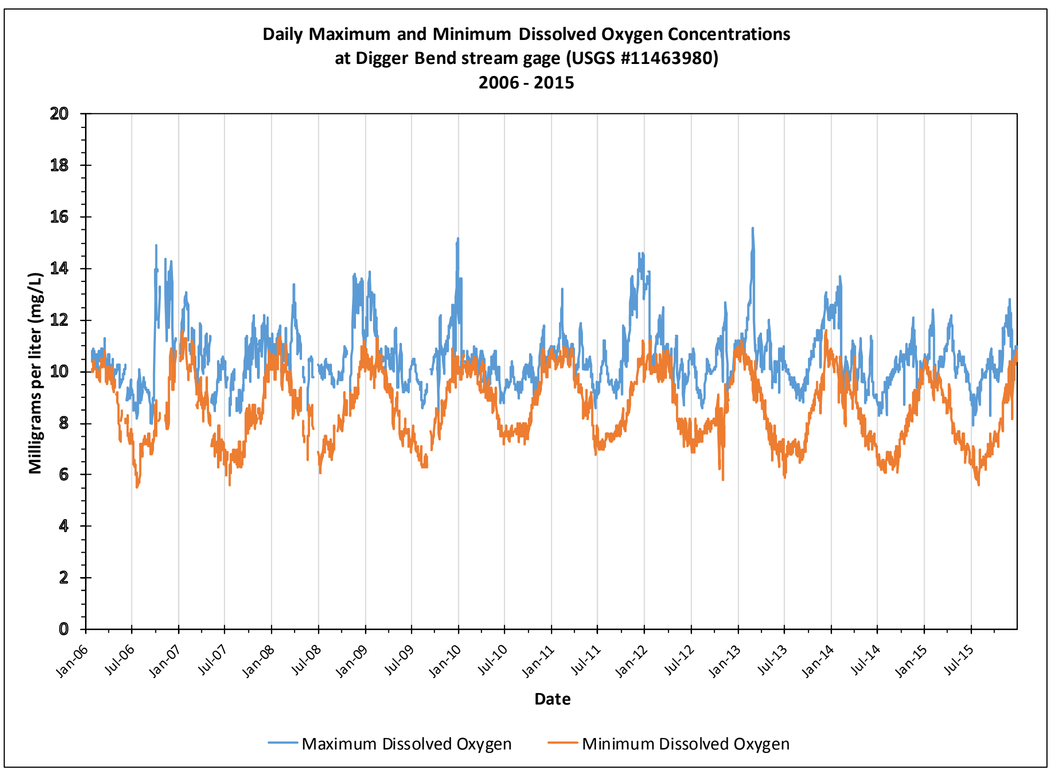

Figure 4.2-10. Daily Maximum and Minimum Dissolved Oxygen Concentrations at USGS Russian River at Digger Bend near Healdsburg stream gage (USGS 11463980) between 2006 and 2015.

Lower Russian River Biostimulatory Conditions

Lower Russian River data was collected under a variety of instream flows during Baseline Conditions (2006 to 2014) and in 2015 that are similar to the Proposed Project and the No Project 1 and No Project 2 Alternative minimum instream flow requirements. . Although the period of record for Baseline Conditions includes the years 2006 through 2014, Lower Russian River instream flows during 2013 and 2014 were reduced through a TUCO and are similar to the Proposed Project and No Project 2 Alternative instream flows. As such, the 2013 and 2014 data was analyzed with data collected in 2015 during reduced TUCO minimum instream flows (that are similar to conditions that could occur under the Proposed Project and the No Project 2 Alternative) against the data collected in 2010, 2011, and 2012 during instream flows that are similar to the Baseline Condition to identify potential impacts. The No Project 1 Alternative instream flows are similar to Baseline Condition instream flows, therefore the data collected in 2010, 2011, and 2012 were analyzed for potential changes from Baseline Conditions.

Estuaries are complex, dynamic ecosystems, normally experiencing changes between seasons, between years, and between different places in the same estuary. For an evaluation of the potential effects to the water quality in the Russian River Estuary due to minimum instream flow changes in the Lower Russian River, when anticipating future conditions, the determination of significance is compared to Baseline Conditions. Under Baseline Conditions, water depth, temperature, and salinity, as well as other water quality parameters, fluctuate at varying degrees and continuously across a wide range of values and flows into the Estuary and are dependent in large part on the strength of the tidal cycle during open conditions and the frequency, timing, and duration of river mouth closures, as well as the presence of external factors including potential pollutants along the near shore line that are inundated during river mouth closures. The shift from an estuary to lagoon conditions and resultant changes to water quality conditions in the underlying saline layer and overlying freshwater layer typically begin to occur within hours after river mouth closure and are not dependent on dry season minimum instream flow rates. Therefore, because lagoon conditions in the Estuary are part of the Baseline Condition, changes to minimum instream flows would have the greatest effect on biostimulatory substances during open river mouth conditions.

Total nitrogen concentrations in the Lower Russian River were observed to remain below USEPA recommended criteria during all years with instream flows similar to Baseline Conditions and the Proposed Project and No Project 1 and No Project 2 Alternatives. The highest median and mean total nitrogen concentrations in the Lower Russian River occurred in 2011 with instream flows similar to Baseline Condition and the No Project 1 Alternative instream flows (Table 4.2-4). Total phosphorus concentrations in the Lower Russian River were observed to exceed the USEPA recommended criteria during all years with instream flows similar to Baseline Conditions and the Proposed Project and No Project 1 and No Project 2 Alternatives. In addition, the highest median and mean total phosphorus concentrations occurred in 2011 with instream flows similar to Baseline Condition and the No Project 1 Alternative instream flows (Table 4.2-4). The highest median and mean values for chlorophyll-a in the Lower Russian River occurred in 2011, with instream flows similar to Baseline Condition and the No Project 1 Alternative instream flows (Table4.2-4). However, median and mean chlorophyll-a concentrations did not exceed the USEPA recommended concentration in any of the three years.

Table 4.2-4. Annual Nutrient and chlorophyll-a Concentrations at USGS Russian River near Hacienda stream gage (USGS 11467000), Vacation Beach, Monte Rio, Patterson Point, Casini Ranch, and Duncans Mills for the years 2010 through 2015. Bold values represent exceedances of the USEPA recommended criteria for total nitrogen, total phosphorus, and chlorophyll-a.

Year	Stations Sampled[1]	Total Nitrogen		Total Phosphorus		Chlorophyll-a		Flow*			Total Sample Events
		Median (mg/L)	Mean (mg/L)	Median (mg/L)	Mean (mg/L)	Median (mg/L)	Mean (mg/L)	Median (cfs)	Mean (cfs)	Range (cfs)	
2010	Monte Rio, Casini Ranch, Duncans Mills	0.25	0.25	**0.032**	**0.034**	0.00069	0.00085	172	232	146 - 660	21
2011	Monte Rio, Casini Ranch, Duncans Mills	0.37	0.37	**0.047**	**0.048**	**0.0032**	**0.0032**	219	290	129 - 767	39
2012	Hacienda, Monte Rio, Casini Ranch, Duncans Mills	0.21	0.29	**0.026**	**0.025**	0.00025	0.00068	117	137	100 - 323	69
2013	Hacienda, Monte Rio, Casini Ranch, Duncans Mills	0.28	0.27	**0.039**	**0.044**	0.0012	0.0016	100	110	77 - 177	73
2014	Vacation Beach, Monte Rio, Patterson Point, Casini Ranch,	0.28	0.27	**0.041**	**0.043**	0.0012	0.0014	96	102	70 - 147	76
2015	Vacation Beach, Monte Rio, Patterson Point, Casini Ranch,	0.24	0.24	**0.034**	**0.034**	0.0014	0.0015	88	103	66 - 183	64

* Measured at USGS 11467000 Russian River near Guerneville (Hacienda) stream gage station.

Dissolved oxygen data was collected at the USGS Hacienda stream gage under a variety of instream flows during Baseline Conditions (2006 to 2014) and in 2015 that are similar to the Proposed Project and the No Project 1 and No Project 2 Alternative minimum instream flow requirements. (Figure 4.2-11).

DO concentrations at Hacienda fluctuate on a daily, seasonal, and yearly basis. DO concentrations tend to be higher during wet season months (November through April) when water temperatures are cooler, and the level of primary production and respiration associated with plant and algal growth decline. The availability of nutrients in the water column can also affect DO concentrations. These nutrients can accumulate in standing water during an extended period of time and contribute to biostimulatory conditions. These conditions can promote excessive plant and algal growth that can alter the concentration of DO through photosynthesis and respiration.

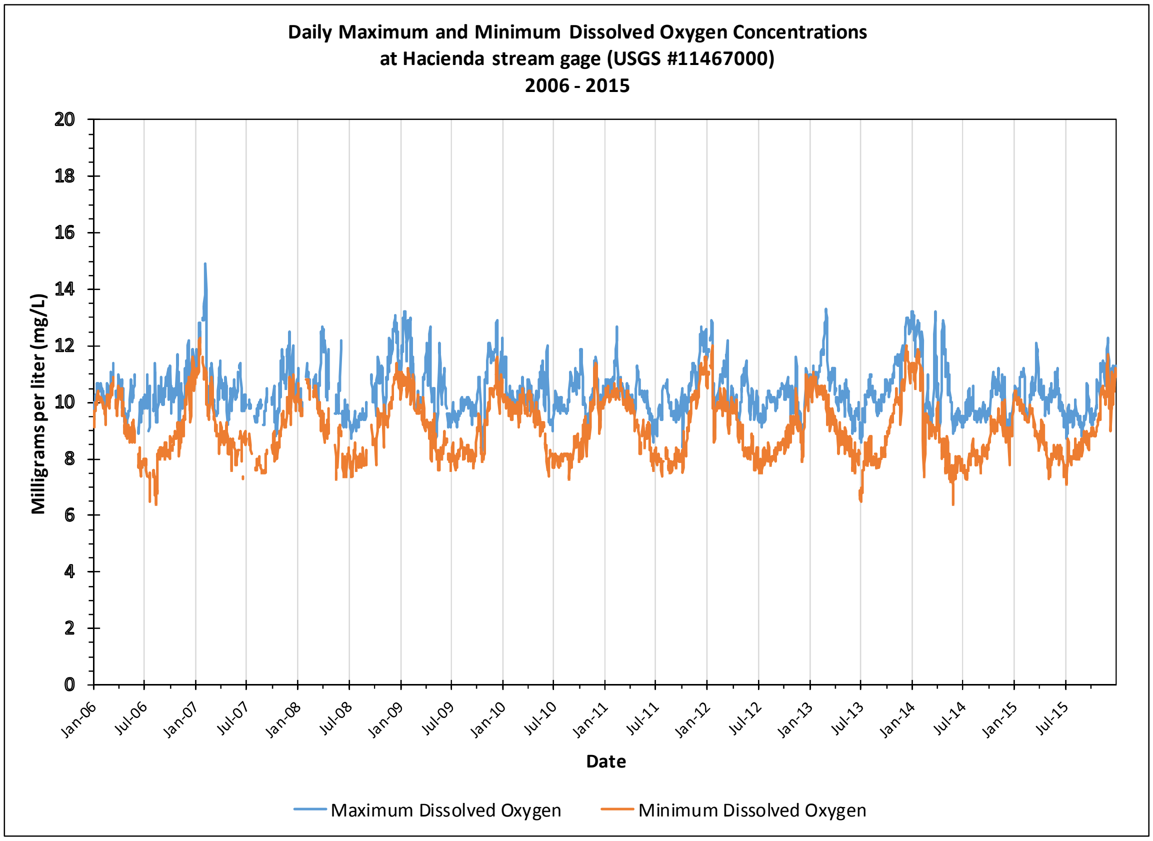

Figure 4.2-11. Daily Maximum and Minimum Dissolved Oxygen Concentrations at USGS Russian River near Guerneville (Hacienda) stream gage (USGS 11467000) between 2006 and 2015.

The Hacienda station was observed to occasionally have depressed DO concentrations as well as supersaturation conditions during Baseline Conditions and in 2015, with instream flows similar to the Proposed Project and the No Project 1 and No Project 2 alternatives (Figure 4.2-11). Supersaturated DO concentrations can be caused by excessive plant and algal growth during photosynthesis in which excess oxygen is produced and released into the water column typically during the daytime. Whereas depressed DO concentrations can be the result of excessive plant and algal respiration and decomposition when oxygen in the water column is consumed typically at night. Consequently, it does appear that biostimulatory conditions could be occurring with instream flows similar to the Baseline Condition and the Proposed Project and the No Project 1 and No Project 2 alternatives.

No Project 1 Alternative

Upper Russian River

Under the No Project 1 Alternative, instream flows in the Upper Russian River would be similar to Baseline Conditions, which follow minimum instream flow requirements in the Water Agency's water right permits and in the Decision 1610 Hydrologic Index. Please refer to Chapter 3, "Background and Project Description", and Chapter 4.0, "Introduction to Environmental Setting, Impacts and Mitigation Measures", for a discussion of the No Project 1 Alternative.

The Upper Russian River at Hopland and Comminsky had elevated median and mean total nitrogen and total phosphorus concentrations during 2010 and 2012 that exceeded the USEPA recommended criteria during both years, with instream flows similar to the Baseline Condition (Table 4.2.3). The mean chlorophyll-a concentration exceeded the USEPA recommended criteria in 2010, with instream flows similar to the Baseline Condition (Table 4.2-3). In addition, DO concentrations at Hopland and Digger Bend were observed to fluctuate with both depressed and supersaturation DO concentrations during the Baseline Condition period of record (Figure 4.2-9 and 4.2-10). Although No Project 1 instream flows are similar to Baseline Conditions, concentrations of biostimulatory substances currently exceed USEPA recommended criteria under Baseline Conditions and would likely continue to exceed USEPA recommended criteria under the No Project 1 Alternative. In addition, depressed and supersaturated DO concentrations recorded in the Upper Russian River under Baseline Conditions would likely continue to occur under the No Project 1 Alternative. Therefore these continued exceedances of USEPA recommended criteria for biostimulatory substances could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality. There is much uncertainty about biostimulatory conditions in the Russian River. Elevated concentrations of biostimulatory substances exist under Baseline Conditions. Given these uncertainties, implementation of the No Project 1 Alternative could result in an impact on water quality related to biostimulatory conditions and as such, the impact could be significant and unavoidable.

Lower Russian River

Under the No Project 1 Alternative, instream flows in the Lower Russian River, including the Estuary, would be similar to Baseline Conditions, which follow minimum instream flow requirements in the Water Agency's water right permits and in the Decision 1610 Hydrologic Index. Please refer to Chapter 3, "Background and Project Description", and Chapter 4.0, "Introduction to Environmental Setting, Impacts and Mitigation Measures", for a discussion of the No Project 1 Alternative.

The Lower Russian River had median and mean total phosphorus concentrations that exceeded the USEPA recommended criteria during all years with flows similar to the Baseline Condition (Table4.2-4). The median and mean chlorophyll-a concentration exceeded the USEPA recommended criteria in 2011 during the Baseline Condition period of record. In addition, DO concentrations Lower Russian River were observed to fluctuate with both depressed and supersaturation DO concentrations during the Baseline Condition period of record (Figure 4.2-11). Although No Project 1 instream flows are similar to Baseline Conditions, concentrations of biostimulatory substances currently exceed USEPA recommended criteria under Baseline Conditions and would likely continue to exceed USEPA recommended criteria under the No Project 1 Alternative. In addition, occasional depressed and supersaturated DO concentrations recorded in the Lower Russian River under Baseline Conditions would likely continue to occur under the No Project 1 Alternative. Therefore these continued exceedances of USEPA recommended criteria for biostimulatory substances could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality. There is much uncertainty about biostimulatory conditions in the Russian River. Elevated concentrations of biostimulatory substances exist under Baseline Conditions. Given these uncertainties, implementation of the No Project 1 Alternative could result in an impact on water quality related to biostimulatory conditions and as such, the impact could be significant and unavoidable.

No Project 2 Alternative

Upper River

Under the No Project 2 Alternative, instream flows in the Upper Russian River would be similar to instream flows recorded in the Upper River in 2013 (Table 4.2-3). Please refer to Chapter 3, “Background and Project Description”, and Chapter 4.0, “Introduction to Environmental Setting, Impacts and Mitigation Measures”, for a discussion of the No Project 2 Alternative.

The Upper Russian River at Hopland and Comminsky had elevated median and mean total nitrogen and total phosphorus concentrations during 2013 that exceeded the USEPA recommended criteria, with instream flows similar to the No Project 2 Alternative (Table 4.2.3). The median and mean chlorophyll-a concentration also exceeded the USEPA recommended criteria in 2013 (Table 4.2-3). In addition, DO concentrations at Hopland and Digger Bend were observed to fluctuate with both depressed and supersaturation DO concentrations during 2013, with inflows similar to the No Project 2 Alternative (Figure 4.2-9 and 4.2-10). Concentrations of biostimulatory substances exceeded the USEPA recommended criteria in 2013, and would likely continue to exceed USEPA recommended criteria under the No Project 2 Alternative. In addition, depressed and supersaturated DO concentrations recorded in the Upper Russian River during 2013 would likely continue to occur under the No Project 2 Alternative. Therefore these continued exceedances of USEPA recommended criteria for biostimulatory substances could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality. There is much uncertainty about biostimulatory conditions in the Russian River. Elevated concentrations of biostimulatory substances exist under Baseline Conditions. Given these uncertainties, implementation of the No Project 2 Alternative could result in an impact on water quality related to biostimulatory conditions and as such, the impact could be significant and unavoidable.

Lower River

Under the No Project 2 Alternative, instream flows in the Lower Russian River, including the Estuary, would be similar to instream flows recorded in the Lower Russian River in 2013 (Table 4.2-4). Please refer to Chapter 3, “Background and Project Description”, and Chapter 4.0, “Introduction to Environmental Setting, Impacts and Mitigation Measures”, for a discussion of the No Project 2 Alternative.

The Lower Russian River had elevated median and mean total phosphorus concentrations during 2013, 2014, and 2015 that exceeded the USEPA recommended criteria, with instream flows similar to the No Project 2 Alternative (Table 4.2.4). The median and mean chlorophyll-a concentration did not exceed the USEPA recommended criteria in 2013, 2014, or 2015 (Table 4.2-4). However, DO concentrations at Hacienda were observed to fluctuate with both depressed and supersaturation DO concentrations during 2013, 2014, and 2015 with inflows similar to the No Project 2 Alternative (Figure 4.2-11). Concentrations of biostimulatory substances exceeded the USEPA recommended criteria for all three years, and would likely continue to exceed USEPA recommended criteria under the No Project 2 Alternative. In addition, depressed and supersaturated DO concentrations recorded in the Lower Russian River during 2013, 2014, and 2015 would likely continue to occur under the No Project 2 Alternative. Therefore these continued exceedances of USEPA recommended criteria for biostimulatory substances could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality. There is much uncertainty about biostimulatory conditions in the Russian River. Elevated concentrations of biostimulatory substances exist under Baseline Conditions. Given these uncertainties, implementation of the No Project 2 Alternative could result in an impact on water quality related to biostimulatory conditions and as such, the impact could be significant and unavoidable.

Proposed Project

Upper Russian River

Under the Proposed Project, instream flows in the Upper Russian River would be similar to instream flows recorded in the Upper River in 2013 (Table 4.2-3). Please refer to Chapter 3, "Background and Project Description", and Chapter 4.0, "Introduction to Environmental Setting, Impacts and Mitigation Measures", for a discussion of the Proposed Project.

The Upper Russian River at Hopland and Comminsky had elevated median and mean total nitrogen and total phosphorus concentrations during 2013 that exceeded the USEPA recommended criteria, with instream flows similar to the Proposed Project (Table 4.2.3). The median and mean chlorophyll-a concentration also exceeded the USEPA recommended criteria in 2013 (Table 4.2-3). In addition, DO concentrations at Hopland and Digger Bend were observed to fluctuate with both depressed and supersaturation DO concentrations during 2013, with inflows similar to the Proposed Project (Figure 4.2-9 and 4.2-10). Concentrations of biostimulatory substances exceeded the USEPA recommended criteria in 2013, and would likely continue to exceed USEPA recommended criteria under the Proposed Project. In addition, depressed and supersaturated DO concentrations recorded in the Upper Russian River during 2013 would likely continue to occur under the Proposed Project. Therefore these continued exceedances of USEPA recommended criteria for biostimulatory substances could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality. There is much uncertainty about biostimulatory conditions in the Russian River. Elevated concentrations of biostimulatory substances exist under Baseline Conditions. Given these uncertainties, implementation of the Proposed Project could result in an impact on water quality related to biostimulatory conditions and as such, the impact could be significant and unavoidable.

Lower Russian River

Under the Proposed Project, instream flows in the Lower Russian River, including the Estuary, would be similar to instream flows recorded in the Lower Russian River in 2013 (Table 4.2-4).

Please refer to Chapter 3, “Background and Project Description”, and Chapter 4.0, “Introduction to Environmental Setting, Impacts and Mitigation Measures”, for a discussion of the Proposed Project.

The Lower Russian River had elevated median and mean total phosphorus concentrations during 2013, 2014, and 2015 that exceeded the USEPA recommended criteria, with instream flows similar to the Proposed Project (Table 4.2.4). The median and mean chlorophyll-a concentration did not exceed the USEPA recommended criteria in 2013, 2014, or 2015 (Table 4.2-4). However, DO concentrations at Hacienda were observed to fluctuate with both depressed and supersaturation DO concentrations during 2013, 2014, and 2015 with inflows similar to the Proposed Project (Figure 4.2-11). Concentrations of biostimulatory substances exceeded the USEPA recommended criteria for all three years, and would likely continue to exceed USEPA recommended criteria under the Proposed Project. In addition, depressed and supersaturated DO concentrations recorded in the Lower Russian River during 2013, 2014, and 2015 would likely continue to occur under the Proposed Project. Therefore these continued exceedances of USEPA recommended criteria for biostimulatory substances could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality. There is much uncertainty about biostimulatory conditions in the Russian River. Elevated concentrations of biostimulatory substances exist under Baseline Conditions. Given these uncertainties, implementation of the Proposed Project could result in an impact on water quality related to biostimulatory conditions and as such, the impact could be significant and unavoidable.

Mitigation Measure 4.2-4: None Available.

Impact 4.2-5. Changes to minimum instream flows could result in a violation of water quality standards or waste discharge requirements or otherwise degrade water quality relating to bacteria in the Russian River. (No Impact)

Dry Creek is not included on the 303(d) List as impaired for bacteria, and is not currently considered to be impaired for bacteria, therefore no impacts to Dry Creek are anticipated for the Proposed Project and the No Project 1 and No Project 2 Alternatives.

Upper Russian River Bacteria

E. coli grab sampling was conducted in the Upper Russian River at four USGS gaging stations in 2012 and 2013. Upper Russian River *E. coli* data was collected during minimum instream flows in 2012 that are similar to the Baseline Condition instream flows and conditions that could occur under the No Project 1 Alternative instream flows (Table 4.2-5). Although the period of record for Baseline Conditions includes the years 2006 through 2014, Upper Russian River instream flows during 2013 were reduced through a TUCO and are similar to the Proposed Project and No Project 2 Alternative instream flows (Table 4.2-5). Therefore, the 2013 *E. coli* data collected during instream flows similar to the Proposed Project and No Project 2 Alternative were analyzed against the data collected in 2012 (with instream flows similar to the Baseline Condition) to identify potential impacts. The No Project 1 Alternative instream flows are similar to Baseline Condition instream flows, therefore the data collected in 2012 will be analyzed for potential changes from Baseline Conditions.

Maximum *E. coli* concentrations were observed to remain below the CDPH recommended concentrations for freshwater beaches during 2012 at all monitoring stations, with instream flows similar to Baseline Condition and the No Project Alternative instream flows (Table 4.2-5). Maximum *E. coli* concentrations were also observed to remain below the CDPH recommended concentrations for freshwater beaches during 2013 at all monitoring stations, with instream flows similar to the Proposed Project and No Project 2 Alternative instream flows (Table4.2-5).

Table 4.2-5. Annual Escherichia coli (*E. coli*) Concentrations at USGS Russian River near Hopland (USGS 11463980), USGS Russian River near Cloverdale (Comminsky) (USGS 111463000), USGS Russian River at Jimtown (USGS11463682), and USGS Russian River at Digger Bend near Healdsburg (USGS 11463980) stream gages for the years 2012 and 2013. Bold values represent exceedances of the CDPH Guidelines of 235 MPN for *E. coli*.

Year	Stations Sampled*	Escherichia coli (E. coli)					Flow**			Total Samples Collected
		Median MPN	Mean MPN	Min MPN	Max MPN	Percent Exceedance	Median (cfs)	Mean (cfs)	Range (cfs)	
2012	Hopland, Comminsky	51.2	52.2	16.1	93.3	0.0	156	154	121 - 183	42
2013	Hopland, Comminsky	67.0	65.8	19.1	187.2	0.0	115	111	82 - 137	43
2012	Jimtown, Digger Bend	8.6	11.0	3.1	30.9	0.0	137	144	115 - 240	41
2013	Jimtown, Digger Bend	10.9	18.5	3.0	224.7	0.00	95	95	76 - 121	43

* USGS 11462500 Russian River near Hopland, USGS 11463000 Russian River near Cloverdale (Comminsky), USGS 11463680 Russian River at Jimtown, and USGS 11463980 Russian River at Digger Bend near Healdsburg stream gage stations.
** Flow was measured at the USGS stream gage stations.

Lower Russian River Bacteria

Lower Russian River *E. coli* data was collected under a variety of instream flows during Baseline Conditions (2006 to 2014) and in 2015 that are similar to the Proposed Project and the No Project 1 and No Project 2 Alternative minimum instream flow requirements (Table 4.2-6). Again, although the period of record for Baseline Conditions includes the years 2006 through 2014, Lower Russian River instream flows during 2013 and 2014 were reduced through a TUCO and are similar to the Proposed Project and No Project 2 Alternative instream flows (Table 4.2-6). As such, the 2013 and 2014 *E. coli* data was analyzed with data collected in 2015 during reduced TUCO minimum instream flows (that are similar to conditions that could occur under the Proposed Project and the No Project 2 Alternative) against the data collected in 2009, 2011, and 2012 during instream flows that are similar to the Baseline Condition to identify potential impacts. The No Project 1 Alternative instream flows are similar to Baseline Condition instream flows, therefore the data collected in 2009, 2011, and 2012 were analyzed for potential changes from Baseline Conditions.

Estuaries are complex, dynamic ecosystems, normally experiencing changes between seasons, between years, and between different places in the same estuary. For an evaluation of the potential effects to the water quality in the Russian River Estuary due to minimum instream flow changes in the Lower Russian River, when anticipating future conditions, the determination of significance is compared to Baseline Conditions. Under Baseline Conditions, water depth, temperature, and salinity, as well as other water quality parameters, fluctuate at varying degrees and continuously across a wide range of values and flows into the Estuary and are dependent in large part on the strength of the tidal cycle during open conditions and the frequency, timing, and duration of river mouth closures, as well as the presence of external factors including potential pollutants along the near shore line that are inundated during river mouth closures. The shift from an estuary to lagoon conditions and resultant changes to water quality conditions in the underlying saline layer and overlying freshwater layer typically begin to occur within hours after river mouth closure and are not dependent on dry season minimum instream flow rates. Therefore, because lagoon conditions in the Estuary are part of the Baseline Condition, changes to minimum instream flows would have the greatest effect on bacteria during open river mouth conditions. In addition, in the absence of water quality standards or recommended criteria for bacteria in estuarine environments, changes from Baseline Conditions to *E. coli* concentrations observed in the upper freshwater portion of the estuary were considered indicative of potential changes to *E. coli* concentrations in the lower more saline portion of the Estuary during open conditions.

Several exceedances of the CDPH recommended freshwater *E. coli* concentration of 235 MPN have been recorded in the backwater area during late summer and early fall river mouth closures when the shoreline becomes inundated, often capturing previously deposited animal waste. These closures often overlap with the removal of summer recreational dams that appear to influence bacterial concentrations as well.

These elevated *E. coli* values occur under normal Baseline Condition instream flows and reduced TUCO flows that are similar to Proposed Project and No Project 2 Alternative instream flows. Therefore this represents a Baseline Condition that occasionally occurs during Baseline instream flows and is anticipated to continue to occasionally occur under the Proposed Project and the No Project 1 and No Project 2 Alternatives. Therefore, no change over Baseline Conditions is anticipated as a result of the Proposed Project.

Maximum *E. coli* concentrations were observed to remain below the CDPH recommended concentrations for freshwater beaches during 2009, 2011, and 2012 at all monitoring stations during open river mouth conditions, with instream flows similar to Baseline Condition and the No Project Alternative instream flows (Table 4.2-6). Maximum *E. coli* concentrations were also observed to remain below the CDPH recommended concentrations for freshwater beaches during 2013, 2014, and 2015 at all monitoring stations during open river mouth conditions, with instream flows similar to the Proposed Project and No Project 2 Alternative instream flows (Table 4.2-6).

Table 4.2-6. Annual Escherichia coli (*E. coli*) Concentrations at USGS Russian River near Hacienda stream gage (USGS 11467000), Vacation Beach, Monte Rio, Patterson Point, Casini Ranch, and Duncans Mills between the years 2009 and 2015. Bold values represent exceedances of the USEPA recommended criteria for *E. coli*.

Year	Stations Sampled	Escherichia coli (E. coli)					Flow*			Total Samples Collected
		Median MPN	Mean MPN	Min MPN	Max MPN	Percent Exceedance	Median (cfs)	Mean (cfs)	Range (cfs)	
2009	Duncans Mills	31.0	31.0	20.0	41.0	0.0	106	128	65 - 234	4
2011	Monte Rio, Casini Ranch, Duncans Mills	20.0	33.1	6.2	150.0	0.0	219	290	129 - 767	39
2012	Hacienda, Monte Rio, Casini Ranch, Duncans Mills	9.7	12.3	0.7	47.1	0.0	117	137	82 - 323	69
2013	Hacienda, Monte Rio, Casini Ranch, Duncans Mills	8.5	15.5	1.0	214.3	0.0	102	110	77 - 177	69
2014	Vacation Beach, Monte Rio, Casini Ranch, Duncans Mills	10.0	12.4	0.7	43.5	0.0	96	102	70 - 147	76
2015	Vacation Beach, Monte Rio, Casini Ranch, Duncans Mills	12.1	15.4	2.0	63.7	0.0	88	103	66 - 183	64

* Flow was measured at USGS 11467000 Russian River near Guerneville (Hacienda) stream gage station

No Project 1 Alternative

Upper River

Under the No Project 1 Alternative, instream flows in the Upper Russian River would be similar to Baseline Conditions, which follow minimum instream flow requirements in the Water Agency's water right permits and in the Decision 1610 Hydrologic Index. Please refer to Chapter 3, "Background and Project Description", and Chapter 4.0, "Introduction to Environmental Setting, Impacts and Mitigation Measures", for a discussion of the No Project 1 Alternative.

There were no exceedances of the CDPH guidelines of 235 MPN in the Upper Russian River for *E. coli* during 2012, when instream flows were similar to Baseline Conditions and the No Project 1 Alternative instream flows (Table 4.2-5). Therefore, no change in *E. coli* concentrations is expected that could result in a violation water quality standards or waste discharge requirements or otherwise substantially degrade water quality and there is no impact associated with the No Project 1 Alternative.

Lower River

Under the No Project 1 Alternative, instream flows in the Lower Russian River, including the Estuary, would be similar to Baseline Conditions, which follow minimum instream flow requirements in the Water Agency's water right permits and in the Decision 1610 Hydrologic Index. Please refer to Chapter 3, "Background and Project Description", and Chapter 4.0, "Introduction to Environmental Setting, Impacts and Mitigation Measures", for a discussion of the No Project 1 Alternative.

There were no exceedances of the CDPH guidelines of 235 MPN in the Lower Russian River for *E. coli* during the years 2009, 2011, and 2012, during open river mouth conditions when instream flows were similar to Baseline Conditions and the No Project 1 Alternative instream flows (Table 4.2-6). Therefore, no change in *E. coli* concentrations is expected that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and there is no impact associated with the No Project 1 Alternative.

No Project 2 Alternative

Upper River

Under the No Project 2 Alternative, instream flows in the Upper Russian River would be similar to instream flows recorded in the Upper River in 2013 (Table 4.2-5). Please refer to Chapter 3, "Background and Project Description", and Chapter 4.0, "Introduction to Environmental Setting, Impacts and Mitigation Measures", for a discussion of the No Project 2 Alternative.

There were no exceedances of the CDPH guidelines of 235 MPN in the Upper Russian River for *E. coli* during 2013, when instream flows were similar to the No Project 2 Alternative instream flows (Table 4.2-5). Therefore, no change in *E. coli* concentrations is expected that could result in the violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and there is no impact associated with the No Project 2 Alternative.

Lower River

Under the No Project 2 Alternative, instream flows in the Lower Russian River, including the Estuary, would be similar to instream flows recorded in the Lower Russian River in 2013, 2014, and 2015 (Table 4.2-6). Please refer to Chapter 3, "Background and Project Description", and Chapter 4.0, "Introduction to Environmental Setting, Impacts and Mitigation Measures", for a discussion of the No Project 2 Alternative.

There were no exceedances of the CDPH guidelines of 235 MPN in the Lower Russian River for *E. coli* during the years 2013, 2014, and 2015, during open river mouth conditions when instream flows were similar to the No Project 2 Alternative instream flows (table 4.2-6). Therefore, no change in *E. coli* concentrations is expected that could result in the violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and there is no impact associated with the No Project 2 Alternative.

Proposed Project

Upper Russian River

Under the Proposed Project, instream flows in the Upper Russian River would be similar to instream flows recorded in the Upper River in 2013 (Table 4.2-5). Please refer to Chapter 3, "Background and Project Description", and Chapter 4.0, "Introduction to Environmental Setting, Impacts and Mitigation Measures", for a discussion of the Proposed Project.

There were no exceedances of the CDPH guidelines of 235 MPN in the Upper Russian River for *E. coli* during 2013, when instream flows were similar to the Proposed Project instream flows (Table 4.2-5). Therefore, no change in *E. coli* concentrations is expected that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and there is no impact associated with the Proposed Project.

Lower Russian River

Under the Proposed Project, instream flows in the Lower Russian River, including the Estuary, would be similar to instream flows recorded in the Lower Russian River in 2013, 2014, and 2015 (Table 4.2-6). Please refer to Chapter 3, "Background and Project Description", and Chapter 4.0, "Introduction to Environmental Setting, Impacts and Mitigation Measures", for a discussion of the Proposed Project.

There were no exceedances of the CDPH guidelines of 235 MPN in the Lower Russian River for *E. coli* during the years 2013, 2014, and 2015, during open river mouth conditions when instream flows were similar to the Proposed Project instream flows (Table 4.2-6). Therefore, no change in *E. coli* concentrations is expected that could result in a violation of water quality standards or waste discharge requirements or otherwise substantially degrade water quality and there is no impact associated with the Proposed Project.

4.2.5 General Plans and Consistency

The project area includes portions of Sonoma and Mendocino counties. The following section lists goals, policies, and objectives related to water resources from the general plans of these municipalities and ends with a brief analysis discussing consistency with these plans.

Mendocino County General Plan

The County of Mendocino General Plan (Mendocino County 2009) sets forth the following goals, objectives, and policies related to watersheds, water supplies, and water quality that are applicable to the project:

Resource Management Goals

Goal RM-1 (Watersheds) Land uses, development patterns and practices that facilitate functional and healthy watershed ecosystems.

- **Policy RM-1:** Protect stream corridors and associated riparian habitat.
- **Policy RM-2:** Promote and participate in watershed restoration and enhancement projects.
- **Policy RM-3:** Work cooperatively with property owners, agencies, and organizations to develop and support programs that maintain the integrity of stream systems for flood control, aquatic habitat, and water supply.
- **Policy RM-4:** Promote and support public outreach and education programs pertaining to watershed and water resources stewardship.
- **Policy RM-5:** Promote and encourage land use activities that maintain or improve channel elevation and banks for rivers and streams in the county.

Goal RM-2 (Water Supply) Protection, enhancement, and management of the water resources of Mendocino County.

- **Policy RM-6:** Promote sustainable management and conservation of the county's water resources.
- **Policy RM-10:** Continue to seek and advocate for dependable water resources necessary to support all sectors of the economy and other beneficial uses.
- **Policy RM-11:** Work with local, state, and federal agencies and organizations to develop and protect water supplies in a manner that is consistent with adopted General Plan policies, recognizing sustainable yields and protections for the environment.
- **Policy RM-12:** Support the creation of a comprehensive plan for surface and groundwater resources in Mendocino County.
- **Policy RM-15:** Maximize the use of existing water supplies while proceeding with the development of new water supplies.

Goal RM-3 (Water Quality) Land use development and management practices that protect or enhance water quality.

- **Policy RM-22:** Support public and private programs to reduce water contamination and improve the water quality in county rivers and streams, specifically those which do not meet federal water quality standards.
- **Policy RM-23:** The County shall work with other responsible regulatory agencies to prevent the discharge or threatened discharge of sediment from any activity in amounts deleterious to beneficial uses of the water.

Sonoma County General Plan 2020

The Sonoma County General Plan 2020 (PRMD 2008) includes goals addressing the preservation of water resources in the region. The Water Resources Element of the Sonoma County General Plan 2020 contains the following goals, objectives, and policies that would be applicable to the proposed project:

Land Use Element

Goal LU-8: Protect Sonoma County's water resources on a sustainable yield basis that avoids long term declines in available surface and groundwater resources or water quality.

- **Objective LU-8.1:** Protect, restore, and enhance the quality of surface and groundwater resources to meet the needs of all beneficial uses.

Water Resources Element

Goal WR-1: Protect, restore and enhance the quality of surface and groundwater resources to meet the needs of all beneficial uses.

- **Objective WR-1.1:** Work with the Regional Water Quality Control Boards (RWQCB) and interested parties in the development and implementation of RWQCB requirements.
- **Objective WR-1.2:** Avoid pollution of stormwater, water bodies and groundwater.

The following policies, in addition to those in the Land Use and Public Facilities and Services Elements, shall be used to accomplish the above objectives:

- **Policy WR-1a:** Coordinate with the RWQCB, public water suppliers, Cities, Resource Conservation Districts, watershed groups, stakeholders and other interested parties to develop and implement public education programs and water quality enhancement activities and provide technical assistance to minimize stormwater pollution, support RWQCB requirements and manage related County programs. Where appropriate, utilize watershed planning approaches to resolve water quality problems.
- **Policy WR1-f:** Work closely with the RWQCB, incorporated cities, public water suppliers, and other interested parties in the development and implementation of water quality plans and measures.
- **Policy WR-1k:** Seek opportunities to participate in developing programs and implementing projects for water quality restoration and remediation with agencies and

organizations such as RWQCBs, CDFG and RCDs in areas where water quality impairment is a concern.

GOAL WR-3: Encourage public water systems and their sources to provide an adequate supply to meet long-term needs that is consistent with adopted general plans and urban water management plans and that is provided in a manner that maintains water resources for other water users while protecting the natural environment.

- **Objective WR-3.1:** Assist public water suppliers in the collection and dissemination of surface and groundwater data and the assessment of available water supplies and protection of water quality.
- **Policy WR-3b:** Support to the extent feasible the actions and facilities needed by public water suppliers to supply water sufficient to meet the demands which are estimated in adopted master facilities plans, consistent with adopted general plans, urban water management plans and the sustainable yields of the available resources and in a manner protective of the natural environment.
- **Policy WR-3d:** Assist public water suppliers in complying with Federal and State water quality standards by assuring that water sources used for public water systems are not contaminated by land uses or pollutants in the watershed, by supporting continued study and monitoring of water quality, and by encouraging acquisition of critical watershed areas by the suppliers or the Sonoma County Agricultural Preservation and Open Space District.

Consistency

The Fish Flow Project would be consistent with the goals, objectives, and policies of the Mendocino County General Plan and Sonoma County General Plan because it would conserve and enhance surface water resources through continued maintenance of surface flows across a wide range of flow conditions.

4.2.6 References

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