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Sonoma County Water Agency
2018 Watershed Sanitary Survey

December 2018

Prepared for:

Sonoma Water

Prepared By:

Palencia Consulting Engineers

Sonoma County Water Agency Watershed Sanitary Survey
Third Update
FINAL REPORT
December 2018

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LIST OF ABBREVIATIONS

ACL – Administrative Civil Liability
ARM Plan- Aggregate Resource Management Plan

BAT – Best Available Technology
BCT – Best Conventional Technology
BMP – Best Management Practice
BOD – Biological Oxygen Demand

CDO – Cease and Desist Order
CDPH – California Department of Public Health
CEC – Constituent of Emerging Concern
cfs – cubic feet per second
CIWQS – California Integrated Water Quality System
CUPA – Certified Unified Program Agency

DDW – Division of Drinking Water
DBP – disinfection by-product
DOC – dissolved organic carbon

E. coli – *Escherichia coli*

FMMP- Farmland Mapping and Monitoring Program

gpd – gallons per day
gpm – gallons per minute
GWUDI – groundwater under the direct influence of surface water

HA – Health Advisory
HAA5 – haloacetic acids

IESWTR – Interim Enhanced Surface Water Treatment Rule

LT1ESWTR – Long Term 1 Enhanced Surface Water Treatment Rule
LT2ESWTR – Long Term 2 Enhanced Surface Water Treatment Rule
LUST – leaking underground storage tank

MCL – maximum contaminant level
µg/L - micrograms per liter
mgd – million gallons per day
mg/L – milligrams per liter
MPN/100 mL – most probable number per 100 milliliters
MS4 – Municipal Separate Storm Sewer Systems
MSL – mean sea level
MTBE – methyl tertiary-butyl ether

NMP – Nutrient Management Plan
North Coast Regional Water Quality Control Board – Regional Board
NPDES – National Pollution Discharge Elimination System

OAL – Office of Administrative Law
OES – California Office of Emergency Services
OWTS – Onsite Wastewater Treatment System

PCSs – Potential Contaminating Sources
PFOS – perfluorooctane sulfonate
PG&E – Pacific Gas and Electric
PRMD – Permit Resource Management Department
PWRPA – Power and Water Resources Pooling Authority

RAA – running annual average
Regional Board – North Coast Regional Water Quality Control Board
RIMS – Response Information Management System
RRWA – Russian River Watershed Association

SCWA – Sonoma County Water Agency
SEMS – Standardized Emergency Management System
SMARTS – Storm Water Multiple Application and Report Tracking System
SOC – synthetic organic compound
SSMP – Sewer System Management Plan
SSO – Sanitary Sewer Overflow
SWPPP – Storm Water Pollution Prevention Plan
SWRCB – State Water Resources Control Board
SWTR – Surface Water Treatment Rule

TMDL – Total Maximum Daily Load
TOC – total organic carbon
TTHM – total trihalomethanes

ug/L – micrograms per liter
URO – urban runoff
USEPA – US Environmental Protection Agency
USGS – US Geological Survey
UV – Ultraviolet light
UVSD – Ukiah Valley Sanitation District

VESCO – Vineyard Erosion and Sedimentation Control
VOC – volatile organic compound

WDR – Waste Discharge Requirement
WWTP – Wastewater Treatment Plant

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INTRODUCTION

Drinking water utilities that use surface water or groundwater under the influence of surface water are required to conduct a watershed sanitary survey for that source, under the California Surface Water Treatment Rule (SWTR). This survey must be updated every five years. This Third Update for the Sonoma County Water Agency (Water Agency) watershed sanitary survey covers the period January 1, 2013 through December 31, 2017.

OBJECTIVES OF THE UPDATE

A watershed sanitary survey focuses on the first barrier to contamination of the drinking water supply, namely source water protection. Evaluating source water quality and watershed contaminant sources provides key information to aid in understanding how to maintain and possibly improve the first barrier.

This Third Update is intended to accomplish the following objectives:

1) Fulfillment of the California SWTR requirements mandates that a watershed sanitary survey be completed every five years by utilities that use surface water or groundwater under the influence of surface water. Any significant changes within the last five years that affect source water quality are to be identified in each update. In addition, it is required to comment on the appropriate level of treatment for pathogens, specifically for *Giardia*, viruses, and *Cryptosporidium*.

2) Review and evaluation of selected constituents of interest to identify potential water quality issues at Radial Collector Well 5. Assess the ability of Radial Collector Well 5 to meet standards based on current regulatory framework.

3) Review and evaluation of selected potential contaminating activities to identify impacts on source water quality.

4) Identification of appropriate watershed management actions to protect and possibly improve source water quality. Development of recommendations for watershed management actions that are economically feasible and within the authority of the Water Agency to implement is critical.

KEY FINDINGS AND CONCLUSIONS

The key findings and conclusions for this report are organized as they pertain to water quality and watershed contaminant sources. Highlights of these findings and conclusions are presented below.

Water Quality

Very few contaminants were detected in Radial Collector Well 5 and all primary and secondary MCLs were met with a large margin of safety. Most of the inorganic contaminants regulated with a primary MCL were not detected; with fluoride and gross alpha particle radioactivity being the two exceptions. Both of these contaminants were detected at levels well below the primary MCLs. No synthetic or volatile organics were detected in the five years of annual monitoring.

Most of the contaminants regulated with a secondary MCL were not detected in Radial Collector Well 5. Color was detected in one sample at a low level, below the secondary MCL. The salinity constituents (total dissolved solids, specific conductance, chloride, and sulfate) were all detected at low levels and were well below the recommended secondary MCLs.

Based on a review of the water quality data and an evaluation of the contaminant sources in the watershed, the key constituents identified for further evaluation in this watershed sanitary survey are turbidity, microbiological constituents, and disinfection byproducts. Key findings for the constituents of interest are presented below.

Turbidity

- Turbidity levels in the Russian River at the diversion location are quite variable, ranging from less than 2.0 to over 300 NTU. The highest levels are typically found during the wet season when Radial Collector Well 5 is not being used as a water supply source.
- Turbidity levels in Radial Collector Well 5 are very low with peak values of 2.0 NTU and annual averages of 0.01 to 0.06 NTU.
- DDW requires that Radial Collector Well 5 be taken out of service if turbidity exceeds 5.0 NTU at any time or if turbidity exceeds 1.0 NTU for more than four hours. The turbidity levels in Radial Collector Well 5 never exceeded 1.0 NTU for more than four hours or 5.0 NTU at any time.
- These data indicate that riverbank filtration is effectively removing the high particulate levels seen in the Russian River.

Microbiological Constituents

- The Russian River has relatively high levels of coliforms, associated when watershed runoff is high due to precipitation. Therefore, the highest levels of *E. coli* generally occur when Collector 5 is not operating, as the Water Agency does not operate Collector 5 when it is under the direct influence of surface water (when the flow in the Russian River at Hacienda Bridge reaches 5,000 cubic feet per second cfs and until the flow drops below 2,000 cfs).

- Total coliforms and *E. coli* were analyzed in samples collected from Radial Collector Well 5 prior to disinfection, when it was operating. Total coliforms were found two times at 1.0 and 2.0 MPN/100 ml. *E. coli* was never detected.
- *Giardia* was only occasionally detected in river samples. *Cryptosporidium* was never detected in samples collected from July 2016 to June 2018.
- The Radial Collector Well 5 data show that riverbank filtration is very effective in removing microorganisms from the water, producing high quality groundwater for the Water Agency's system.

Disinfection By-Products and Precursors

- The Russian River has relatively low levels of organic carbon, the main precursor that reacts with chlorine to form disinfection byproducts in the distribution system.
- Total trihalomethanes (TTHM) and haloacetic acids (HAA5) concentrations in the storage tanks of the Water Agency's distribution system are consistently below the MCLs of 80 micrograms/L (µg/L) and 60 µg/L, respectively.

Watershed Contaminant Sources

There are numerous types of potential contaminating sources (PCSs) in the study watershed. Nine PCSs were selected for evaluation in this report based on constituents of interest and predominance in the watershed. Timber harvesting and landfills were evaluated but eliminated from the report as they are not located in the study watershed.

Each PCS was given a vulnerability assessment ranking as shown in **Table ES-1** based on having a direct or indirect impact to the Russian River, proximity, number of occurrences, and possible impact to Radial Collector 5 water quality.

Table ES-1. Vulnerability Assessment Ranking for each PCS in Study Area

Contaminant Source	Vulnerability
Spills	High
Wineries	Low
Agriculture	Low/Medium
Mines	Medium
Urban Runoff	Low
Wastewater	Medium
Recreation	Low
Leaking Underground Storage Tanks	Low
Fires	Medium/High

Selected findings for each of the nine PCSs are provided below.

Spills

From 2013 to 2017 there were 32 spills involving a variety of contaminants such as sewage, diesel fuel, oil, non-hazardous geothermal condensate, winery waste, and fire retardant. All of the spills impacted water. Out of the 32 spills, 12 spills were sewage-related, seven spills involved either diesel fuel, gasoline, or oil, five spills were winery-related, and three were fire-fighting related. .

The largest sewage spill occurred on October 5, 2017 in the City of Healdsburg when 166,000 gallons entered a storm drain due to failure of a contractors sewage pump. The second largest sewage spill occurred on April 14, 2017 when 20,000 gallons entered an unnamed creek near 481 Hidden Acres Road in the City of Healdsburg due to blockage.

The two largest non-sewage spills by volume occurred on January 12, 2013 when 100,000 gallons of fire-fighting water and foam flowed to Foss Creek in Healdsburg. Another large spill was caused by CalPine in the City of Cloverdale when 3,000 gallons of recycled water and geothermal condensate entered Squaw Creek on September 9, 2014 due to a broken pipe.

Although no spills occurred in close proximity to Radial Collector Well 5 from 2013 to 2017, the potential for a hazardous materials spill or sanitary sewer overflow to impact source water quality in the future is high because there are a number of potential sources in the watershed. A large volume sewage spill or petroleum spill in the vicinity of Radial Collector Well 5 could impact water quality.

Wineries

There are 54 wineries in the study watershed, as queried from the California Integrated Water Quality System (CIWQS) database and from the Storm Water Multiple Application and Report Tracking System (SMARTS) database. The CIWQS database includes wineries that produce over 1,500 gallons of process wastewater in one day, and the SMARTS database includes wineries required to obtain a General Industrial Storm Water Permit.

The three largest wineries in the study watershed based on process volume are the Asti Winery in Cloverdale, Fetzer Vineyards in Hopland, and the Francis Coppola Winery in Geyserville.

This assessment indicates the vulnerability for source water quality impacts due to wineries is low. As wineries treat and reuse their process wastewater on-site, there is no impact to the Russian River from the processing of grapes into wine. Unauthorized discharges could potentially impact water quality in the vicinity of the discharge but would be unlikely to affect the water quality of Radial Collector Well 5.

Mines

Within the study watershed, there is one active mine and one reclaimed mine in Sonoma County and five active mines in Mendocino County. The mines located in Sonoma County are primarily in-stream mines, and the mines in Mendocino County are primarily quarries and terrace mines.

In late 2010, the Sonoma County Board of Supervisors approved the Syar Alexander Valley Instream Mining Project, which is the first mining project of significance in the lower Alexander Valley in over 15 years. Although the mine has been approved it will need to meet conditions of compliance by March 2020 or the approval will expire. Conditions of compliance are obtaining necessary permits, paying road fees, and establishing certain operating hours.

This assessment indicates the vulnerability for source water quality impacts due to mines is medium. The closest mine to Radial Collector Well 5 is the Middle Reach Russian River Vested Bars. According to Sonoma County PRMD, this mine has not been operated in several years. The normal operation would occur during the dry season on accumulated gravel bars. The main water quality concern with regard to mines is an increase in sediment loading to the Russian River. As discussed previously, turbidity levels in Radial Collector Well 5 are consistently low, indicating that sediment is effectively removed by riverbank filtration.

Agriculture

According to the Regional Board, there is one dairy, Bucher Farms, in the study watershed. Bucher Farms is located at 5285 Westside Road in Healdsburg, and the farm has 700 milking cows. Rancho Laguna Dairy and Ocean View Farms, located just outside of the study watershed (in the Laguna de Santa Rosa and Mark West subwatersheds), were converted to vineyards since the last 2013 Update.

Dairies could potentially have a significant impact on water quality during an extreme flood event. Ponds holding process wastewater could overflow, manure and bedding could be washed away, as well as other unauthorized discharges.

Information on crop types was obtained from the Sonoma County Agriculture Commissioner. As shown in **Attachment D**, the three crop types with the highest number of parcels are grapes for wine (vineyard) at 68 percent, then grapes (mixed with other use) at 11 percent, and olives at 10 percent. **Section 4** also provided locational information on the top five parcels for the highest single and total pesticide use (in lbs.) in 2018 depicted by meridian range township section (MRTS) which is approximately 1 X 1 mile. Based on this information, sulfur and 1,3-dichloropropene are used in the highest amounts, close to the Russian River, in our study watershed.

This assessment indicates the vulnerability for source water quality impacts due to agriculture is low/medium. Due to the proximity of the wine grape crops to the Russian River, there may be an impact to water quality from the use of pesticides/herbicides and erosion. However, there were no pesticides/herbicides detected at Radial Collector Well 5. As stated above for mines, turbidities are also low at Radial Collector Well 5, indicating that vineyards are also not impacting turbidity levels in Radial Collector Well 5. Therefore, there is no evidence from the monitoring conducted at Radial Collector Well 5 that croplands and vineyards are impacting water quality.

Recreation

There are a number of recreational uses in the study watershed such as boating, camping, picnicking, hiking, fishing, mountain biking, and equestrian trails. Source water quality may be impacted from body contact recreation such as swimming, waterskiing, and use of personal watercraft. According to Sonoma County Regional Parks, the primary swimming areas are Veteran's Memorial Beach in Healdsburg, Riverfront Regional Park, Camp Rose and Del Rio Woods Beach. However, swimming can be at many points along the river during warm weather. Recreational uses at Lake Sonoma include boating, swimming, fishing, camping, hiking, biking, and horseback riding trails.

E. coli levels in the summer season at the diversion location are low. Additionally, *Cryptosporidium* monitoring at the diversion location conducted by the Water Agency did not detect any *Cryptosporidium* from July 2016 to June 2018. These data indicate that the various sources of fecal indicator bacteria and human pathogens in the watershed, associated with recreational use, are not impacting the microbial quality of source water at the diversion location and at Radial Collector Well 5. This assessment indicates the vulnerability for source water quality impacts due to recreation is low.

Urban Runoff

This assessment indicates the vulnerability for source water quality impacts due to urban runoff is low. Eight percent of the study watershed is classified under urban land uses, while the majority of the land use is comprised of open space and agricultural uses. Additionally, the cities of Healdsburg, Cloverdale and Ukiah have storm water management plans and best management practices in place to reduce pollutants from entering into the storm drain system.

Wastewater

The three wastewater treatment plants (WWTPs) in the study watershed which are permitted to discharge to the Russian River are the City of Ukiah's WWTP, the City of Cloverdale's WWTP, and the City of Healdsburg's WWTP. Specific information about flow rates, treatment processes, and effluent discharge locations are discussed in **Section 4**. If the effluent is tertiary treated, it may be discharged directly to the Russian

River from October 1st to May 14th only, and must be limited to one percent of the flow in the Russian River. Discharge of secondary treated wastewater is never allowed to the Russian River.

The City of Ukiah has plans to construct a recycled water system to reduce discharge to the Russian River. Recycled water will be provided for landscape irrigation, agricultural irrigation, and frost protection. Construction began in spring 2018 and is expected to be complete by Spring 2019.

The City of Cloverdale is not planning to install advanced treatment facilities or a recycled distribution system, as they are not needed to address capacity or operational issues.

Since the 2013 Update, the City of Healdsburg has constructed major improvements to its recycled water system, and is continuing to expand its recycled water infrastructure to cease all discharge to Basalt Pond, which is connected to the Russian River.

The Sonoma County Permit and Resource Management Department estimates that there are 45,000 septic systems in all of Sonoma County. As discussed in the 2013 Update, the Regional Board is developing a pathogen TMDL for the Russian River. Based on a number of water quality studies conducted for the pathogen TMDL, the Regional Board is now looking at septic systems as a contributory source of human waste which occurs year-round. The County of Sonoma is currently updating County regulations for septic systems. The updated County regulations are contained in the Onsite Wastewater Treatment Systems (OWTS) Manual which was released on August 31, 2018. Public feedback on the proposed OWTS manual was solicited from August to October 2018. The meeting to consider the proposed OWTS Manual is scheduled for January 29, 2019.

The City of Cloverdale and the City of Healdsburg WWTPs appear to be in compliance with their effluent limitations. As the WWTPs transition to tertiary treatment and recycling the treated effluent instead of discharging to the Russian River, the impact from WWTPs will decrease in the future. However, there are a large number of septic systems in the study watershed which will continue to age and possibly fail. As some septics are located in close proximity to the Russian River, wastewater is considered a medium risk PCS.

Leaking Underground Storage Tanks

There are no leaking underground storage tanks within the 2500 foot protection zone for Radial Collector Well 5. The three open leaking underground storage tank (LUST) sites in Healdsburg are much farther away from Radial Collector Well 5, and have been determined to have no impact on the Russian River. Therefore, this assessment indicates the vulnerability for source water quality impacts due to current LUST sites is low.

Fires

There were six fires which occurred within the study watershed since 2013. Specific information on acreage burned, dates and locations are discussed in **Section 4**.

As a result of the wildfires which occurred in October 2017, the Water Agency conducted baseline and post-storm monitoring at 15 locations. The post-storm monitoring conducted by the Water Agency after the October 2017 fires did show an impact at the Russian River near Mirabel, specifically an increase in DOC and nitrate. Therefore, this assessment indicates the vulnerability for source water quality impacts due to fires is medium/high.

RECOMMENDATIONS

A number of recommendations were developed for this Third Update. Please refer to **Section 5** for further information on the recommendations.

INTRODUCTION

This report presents the findings of the Third Update to the Sonoma County Water Agency's (Water Agency) Watershed Sanitary Survey. This study covers the period January 1, 2013 through December 31, 2017. The Second Update was completed in November 2013, the First Update was completed in March 2007, and the initial Watershed Sanitary Survey was completed in 2001 in accordance with the California Surface Water Treatment Rule (SWTR).

For assistance with abbreviations and acronyms, the reader is referred to the List of Abbreviations at the front of the report.

OBJECTIVES OF THE UPDATE

A watershed sanitary survey focuses on the first barrier to contamination of the drinking water supply, namely source water protection. Evaluating source water quality and watershed contaminant sources provides key information to aid in understanding how to maintain and possibly improve the first barrier.

This Third Update is intended to accomplish the following objectives:

1) Fulfillment of the California SWTR and the Interim Enhanced Surface Water Treatment Rule (IESWTR) require that surface water agencies or groundwater under the influence of surface water agencies conduct a watershed sanitary survey of the source watershed once every five years. Any significant changes within the last five years that affect source water quality are to be identified in each update. In addition, it is required to comment on the appropriate level of treatment for pathogens, specifically for *Giardia*, viruses, and *Cryptosporidium*.

2) Review and evaluation of selected constituents of interest to identify potential water quality issues at Radial Collector Well 5. Assess the ability of Radial Collector Well 5 to meet standards based on current regulatory framework.

3) Review and evaluation of selected potential contaminating activities to identify impacts on source water quality. Determine whether it may be useful to conduct additional monitoring to further assess contaminant levels in the source water or contaminants from a particular watershed source.

4) Identification of appropriate watershed management actions to protect and possibly improve source water quality. Development of recommendations for watershed management actions that are economically feasible and within the authority of the Water Agency to implement is critical.

CONSTITUENTS AND POTENTIAL CONTAMINATING ACTIVITIES COVERED IN THE THIRD UPDATE

Several water quality constituents were selected for evaluation as part of the Third Update. **Table 1-1** presents a summary of the water quality constituents selected and the reason for selection.

Table 1-1
Water Quality Constituents Selected for Evaluation as Part of the Third Update

Constituent	Reason for Inclusion in Third Update
Turbidity	Turbidity is a measurement of suspended solids in water. Division of Drinking Water (DDW) requires routine monitoring of turbidity in Radial Collector Well 5 to demonstrate the integrity of the Riverbank Filtration system.
Total Coliform	Levels in source water need to be evaluated to determine appropriate level of treatment for *Giardia* and viruses under the SWTR (if Radial Collector Well 5 were used during the periods when it is under the direct influence of surface water).
E. coli	*E. coli* is specific for fecal contamination.
Giardia	*Giardia lamblia* is infectious to humans. Source water levels of *Giardia* are used to determine treatment requirements under the SWTR (if Radial Collector Well 5 were used during the periods when it is under the direct influence of surface water).
Cryptosporidium	*Cryptosporidium parvum* is infectious to humans. Actual source water levels of *Cryptosporidium* were evaluated as part of the Long Term 2 Enhanced Surface Water Treatment Rule (if Radial Collector Well 5 were used during the periods when it is under the direct influence of surface water).
Total Organic Carbon	Total organic carbon (TOC) is a surrogate measure of disinfection by-products (DBP) precursor material in water.
Total Trihalomethanes	Total Trihalomethanes (TTHMs) are disinfection by-products formed in disinfected treated water. Treated water levels are regulated by the Stage 2 D/DBP Rule.
Haloacetic Acids	Haloacetic acids (HAA5) are disinfection by-products formed in disinfected treated water. Treated water levels are regulated by the Stage 2 D/DBP Rule.

Nine potential contaminating activities were selected for review as part of the Third Update: spills, wineries, mines, agriculture, recreation, urban runoff, wastewater, leaking

underground storage tanks, and fires. Each of these activities can contribute at least one of the constituents identified in **Table 1-1** to the source water. These activities were selected based on their presence in the study watershed, and were identified by the Water Agency as key contaminating activities.

DESCRIPTION OF HOW THE THIRD UPDATE WAS CONDUCTED

The project team consisted of a Technical Committee comprised of representatives from the Water Agency and the consultant team of Palencia Consulting Engineers. The Technical Committee participated in developing the scope of work and reviewed identification and development of key findings and recommendations.

Water quality data for Radial Collector Well 5 and the Russian River at the diversion point was obtained from the Water Agency. The consultant team collected information on contaminant sources in the watershed through literature reviews, Internet searches, and discussions with various agencies' staff. References and agency contact information is provided in **Appendix A**.

REPORT ORGANIZATION

Section 1 – Introduction

This section describes the objectives of the Third Update, lists the main constituents and potentially contaminating activities covered, describes how the Third Update was conducted, and includes a description of the basic report organization.

Section 2- The Watershed and Supply Systems

This section is largely descriptive and provides: (1) a brief overview of the physical, hydrologic, and land use characteristics of the study watershed, (2) a description of the existing water supply system, and (3) watershed maps delineating the study watershed and outlining land use in the watershed. For more detailed descriptive information on watershed characteristics, the reader is referred to the 2001 and 2007 Watershed Sanitary Surveys.

Section 3 – Water Quality Review

This section provides a review of the constituents of interest, including an explanation for their selection and a summary of the data obtained for the period of study for each constituent.

Section 4 – Watershed Contaminant Sources Review

This section describes pertinent characteristics of each of the nine potential contaminating activities that were reviewed as part of this Third Update. If applicable, each potential contaminating activity will include a discussion on background and

occurrence, seasonal patterns, water quality issues and data review, regulation and management, and source water protection activities.

Section 5 – Recommendations

This section consists of a list of recommendations for future source water protection efforts.

SECTION 2 – WATERSHED AND WATER SUPPLY SYSTEMS

WATERSHED DESCRIPTION

This section provides an overall description of the study watershed and summarizes physical, hydrologic, and land use characteristics. This section also provides a description of the Sonoma County Water Agency (Water Agency) water supply system.

The entire Russian River watershed occupies much of both Mendocino and Sonoma counties, and is roughly 1,485 square miles, from the top of the watershed just north of Lake Mendocino to the terminus of the Russian River at the Pacific Ocean.

This report will focus on Radial Collector Well 5, as it is under the influence of surface water under certain Russian River flow conditions. Thus, any watershed lands draining to the Russian River downstream of Radial Collector Well 5 are not included in this survey. The study watershed for this report is shown in **Attachment A**, and includes the cities of Ukiah, Cloverdale, Geyserville, and Healdsburg. Similar to the previous watershed sanitary prepared in 2007, the survey will primarily focus on the Russian River watershed from the City of Cloverdale to the Water Agency's intakes at the Wohler/Mirabel site.

Major tributaries in the study area are Dry Creek, Big Sulphur Creek and Maacama Creek. Mark West Creek, and the Laguna De Santa Rosa are downstream of Radial Collector Well 5 and are not included in the study watershed. This is beneficial as these subwatersheds have urbanized areas and agriculture which does not impact the source water quality at Radial Collector Well 5.

Dry Creek Subwatershed

Elevations in this subwatershed range from 100 feet mean sea level (MSL) in the lower valley area near Healdsburg, to approximately 4,000 MSL in the upland areas surrounding Red Mountain. While the headwaters are steep and rugged, the southern half of the subwatershed opens up to the wide alluvial plain of Dry Creek.

Vegetation consists mostly of oak woodland with areas of Douglas fir forest, mainly on north facing slopes, and with patches of chaparral, coast redwood, nonnative grassland, vineyard and cropland. Land use is primarily rural (57 percent), agricultural, mainly vineyards and orchards (20 percent) and recreational (12 percent).

Big Sulphur Creek Subwatershed

This subwatershed is bound to the east by the Mayacamas Mountain Range and to the west by the Alexander Valley. Elevations in the watershed range from 4,000 feet MSL along the border between Sonoma and Lake Counties, to approximately 400 MSL at the confluence of Big Sulphur Creek and the Russian River.

The Big Sulphur Creek subbasin is characterized by steep rugged terrain. Vegetation consists of chaparral, oak woodland, and some areas of mixed oak and pine forests at

higher elevations and north slopes. Land use is 97 percent rural, and three percent agricultural.

Maacama Creek Subwatershed

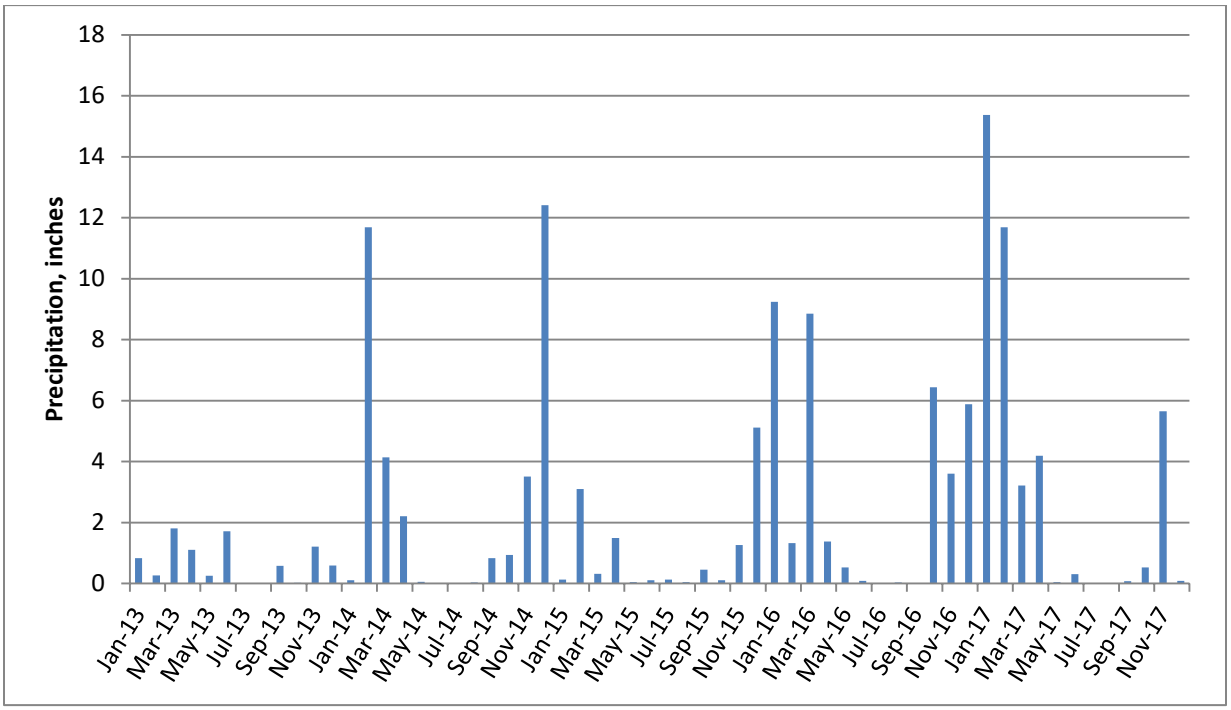
This subwatershed is located in east-central Sonoma County. Vegetation is predominantly brush land and oak woodland intermixed with open Douglas fir and pine forests at higher elevations and north facing slopes. Land use is primarily rural residential (44 percent) and agricultural (46 percent) in the vicinity of Knights Valley.

Climate and Precipitation

Average annual precipitation ranges from roughly 20 inches in the southeastern portion of Sonoma County to 30 to 40 inches in central and northern valley areas. Annual precipitation generally increases with elevation.

Figure 2-1 shows monthly precipitation totals from the California Department of Forestry rain gage in Santa Rosa from January 2013 to December 2017. The average annual rainfall over this five year period was 27 inches. **Table 2-1** shows annual rainfall totals from 2013 to 2017; the wettest year was 2017 with 41.1 inches of rain.

Figure 2-1
Monthly Rainfall Totals at Santa Rosa, 2013-2017



Note: Data obtained from CDEC, station SRO

Table 2-1
Annual Rainfall Totals at California Department of Forestry's Rain Gauge in Santa Rosa
2013-2017

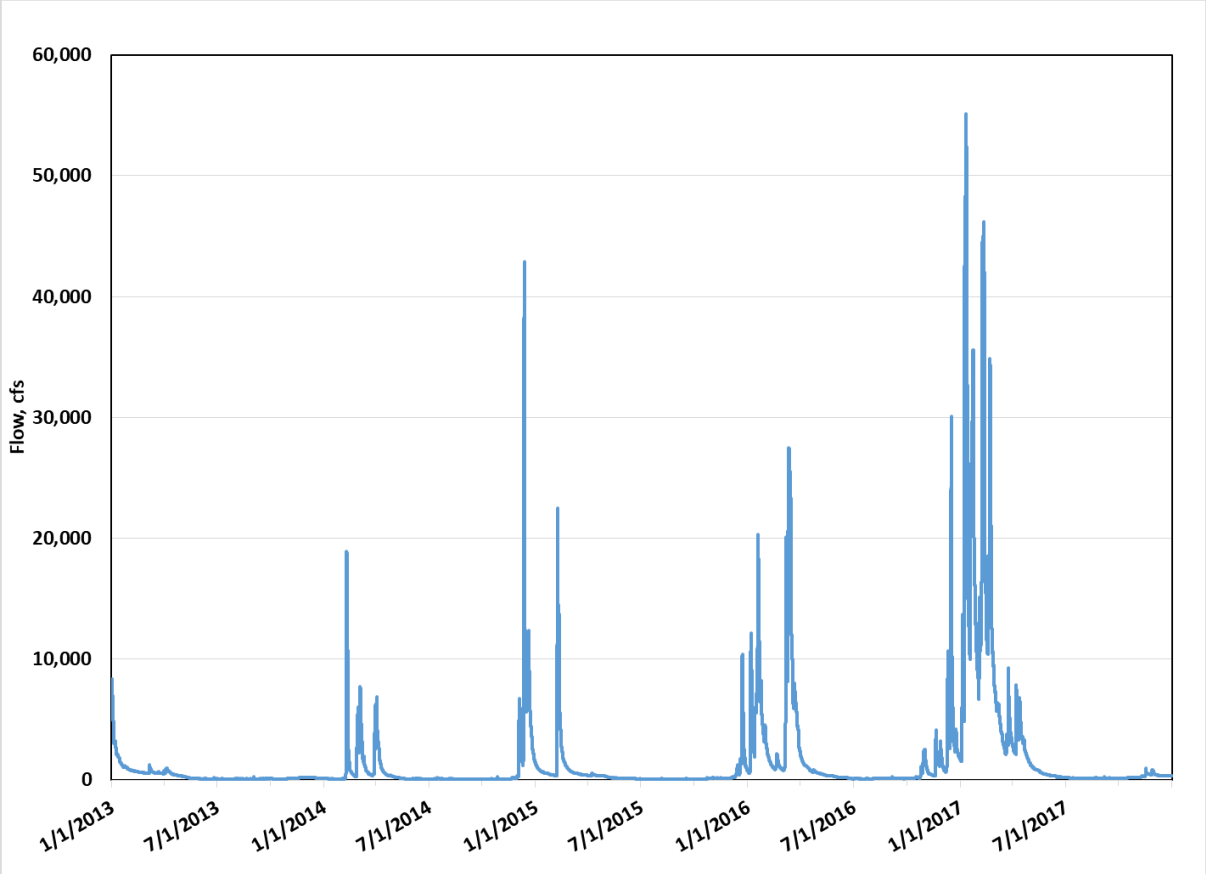
Year	Rainfall, inches
2013	8.37
2014	35.91
2015	12.27
2016	37.35
2017	41.1

Flow

The United States Geologic Survey (USGS) maintains a number of stream flow gages on the Russian River. As shown in **Figure 2-2**, the highest daily mean flow on the Russian River at Hacienda Bridge over the reporting period was 54,100 cubic feet per second (cfs) on January 11, 2017.

Floods in the Russian River watershed are generally of short duration, lasting three to four days. They normally develop within 24 to 48 hours after the beginning of a large flood-producing storm event, and recede within two to three days or less of the end of the storm. Typically, flows in the smaller tributaries to the Russian River rise so rapidly that flooding occurs within four to six hours of a storm event. Coyote Valley Dam and Warm Springs Dam provide flood protection from overflow of the Russian River during the winter and spring months.

Figure 2-2. Russian River Flow at Hacienda Bridge



Land Use

The majority of the land use in the Sonoma County portion of the study watershed is predominantly agricultural related, with 58.2 percent dry farmland and 23.3 percent irrigated farmland. **Table 2-2** provides percentages for the various land use categories, and **Attachment B** shows land use in the study watershed.

Table 2-2
Land Use in the Russian River Study Watershed

Land Use	Percentage of Watershed
Commercial	0.2
Dry Farm	58.2
Government	7.8
Industrial	2.4
Institutional	0.3
Irrigated Farm	23.3
Miscellaneous	2.2
Recreational	0.2
Residential	5.3

Changes Since 2012

Google Earth photos along the river corridor from Healdsburg to Radial Collector Well 5 were reviewed from 2012 to 2018. Overall, there appears to be very little change along the river corridor. As shown in **Attachment C**, photos #1 and #2 shows the Mirabel/Wolher area in 2012 and 2018, respectively. Photos #3 and #4 shows from Mirabel/Wohler area to the Healdsburg WWTP, in 2012 and 2018, respectively, and photos #5 and #6 shows the Healdsburg area in 2012 and 2018, respectively.

Population

The major cities in the watershed are Healdsburg, Cloverdale, Geyserville, and Ukiah. In 2017, the following populations were reported: 11,840 for Healdsburg, 8,803 for Cloverdale, 862 for Geyserville, and 16,036 for Ukiah.

WATER SUPPLY SYSTEM

Background

The Water Agency was created as a special district in 1949 by the California Legislature to provide flood protection and water supply services. Legislation enacted in 1995 added the treatment and disposal of wastewater to the Water Agency's responsibilities. The Water Agency also provides recycled water services.

The Water Agency manages and maintains a water transmission system that provides naturally filtered Russian River water to nine cities and special districts that in turn delivers drinking water to more than 600,000 residents in portions of Sonoma and Marin counties.

- City of Cotati
- Marin Municipal Water District
- North Marin Water District
- City of Petaluma
- City of Rohnert Park
- City of Santa Rosa
- City of Sonoma
- Valley of the Moon Water District
- Town of Windsor

Three major reservoir projects provide water supply for the Russian River watershed: Pacific Gas & Electric Company’s (PG&E) Lake Pillsbury on the Eel River, Lake Mendocino on the East Fork of the Russian River, and Lake Sonoma on Dry Creek. Lake Mendocino and Lake Sonoma provide water for municipal and industrial uses, in addition to maintaining the minimum stream flows required by Water Agency water rights permits. These minimum stream flows provide recreation and fish habitat/passage for salmon and steelhead. The Russian River receives some water

year-round from the Eel River through the Potter Valley Project. Streamflows are augmented by releases from Lake Mendocino and Lake Sonoma.

Scott Dam and Lake Pillsbury:

Scott Dam is a concrete gravity dam on the Eel River that captures a drainage area of 298 square miles and forms PG&E's Lake Pillsbury. Lake Pillsbury has a storage capacity of 86,388 acre-feet. Since 1923, the lake stored water for diversion to the Potter Valley Project through a tunnel constructed through a mountain ridge.

Coyote Valley Dam and Lake Mendocino:

Located on the East Fork of the Russian River, Coyote Valley Dam is a rolled earth embankment that forms Lake Mendocino. Lake Mendocino is a U.S. Army Corps of Engineers project that began storing water in 1959. It captures a drainage area of about 105 square miles, and provides a total storage capacity of 118,000 acre-feet with a water supply pool of 70,000 acre-feet.

Coyote Valley Dam/Lake Mendocino is a multi-purpose reservoir that serves as a flood control, water supply and recreational facility. The Water Agency is the local cost-sharing partner for Coyote Valley Dam and determines the amount of water to be released when the lake level is in the water supply pool. The US Army Corps of Engineers manages flood control releases.

Warm Springs Dam and Lake Sonoma:

Located about 14 miles northwest of Healdsburg, Warm Springs Dam is a rolled earth embankment dam that forms Lake Sonoma. The Water Agency generates electricity at Warm Springs Dam and sells the power to the Power and Water Resources Pooling Authority (PWRPA), a joint powers authority that coordinates power supplies for its members. The Water Agency is member of the PWRPA and receives credit for providing and utilizing the power it generates at Warm Springs Dam. Located at the confluence of Warm Springs Creek and Dry Creek, this lake began storing water in 1984 and has a total storage capacity of 381,000 acre-feet with a water supply pool of 212,000 acre-feet.

Warm Springs Dam/Lake Sonoma is a multi-purpose reservoir that serves as a flood control, water supply and recreational facility. The Water Agency is the local cost-sharing partner for Warm Springs Dam and determines the amount of water to be released when the lake level is in the water supply pool. The US Army Corps of Engineers manages flood control releases.

Potable Water Production

Water produced by the Water Agency originates from the following water supply facilities: six Radial Collector wells along the Russian River; seven production wells along the Russian River; and three production wells along the Cotati Aqueduct in the

Santa Rosa Plain. There are three Radial Collector Wells at Wohler (1, 2, and 6) and three Radial Collector Wells at Mirabel (3, 4, and 5). The seven production wells are at Mirabel between Radial Collector Well 5 and Radial Collector Well 2.

Radial Collector Wells 1 and 2 were constructed in the late 1950's and Radial Collector Wells 3, 4 and 5 were constructed between 1975 and 1985. Construction of Radial Collector Well 6 was completed in the spring of 2006 and is located several thousand feet upstream of the Wohler Bridge.

The Water Agency has an inflatable dam that is put up across the Russian River during the spring/summer. The inflatable dam creates a backwater that raises the upstream water level, and allows river water to be pumped into infiltration ponds where it filters into the ground. The dam and the infiltration ponds also help to recharge the alluvial aquifer so that the Water Agency can meet peak demand for water in the summer. The dam is typically lowered in the late autumn or early winter after water demands have decreased and Russian River discharge is increasing.

The State Water Resources Control Board Division of Drinking Water (DDW) currently classifies Radial Collector Well 5 as being under the direct influence of surface water when 1) the flow in the Russian River at Hacienda Bridge reaches 5,000 cfs and 2) until the flow at the Hacienda Bridge drops below 2,000 cfs. During periods that the Russian River flows meet these criteria, Radial Collector Well 5 must be operated under the Surface Water Treatment Rule (SWTR). Over the reporting period from 2013 to 2017, Radial Collector Well 5 was not operated under the SWTR.

By locating the wells adjacent to the Russian River, the Water Agency is able to take advantage of the natural filtration process of the riverbed to treat the river water before it is distributed into the drinking water supply. The only treatment extracted groundwater requires is disinfection with chlorine and pH adjustment to prevent pipe corrosion.

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SECTION 3 – WATER QUALITY

This section provides an overall review of the Russian River water quality data available within the focus area of this study. Primarily, this includes all of the source (raw) water data collected by the Sonoma County Water Agency (Water Agency) at the diversion location and at Collector 5. In addition to those data sets, there were two ambient water quality monitoring programs/studies with relevant water quality data during the study period. Work conducted by the North Coast Regional Water Quality Control Board (Regional Board) and the Sonoma County Department of Health Services will be discussed separately from the data collected by the Water Agency as shown in **Table 3-1**. The frequency of data collection varies by constituent and monitoring program.

This section then provides a review of the constituents of interest, including an explanation for their selection and a summary of the data obtained for the reporting period, which is 2013 through 2017.

For assistance with abbreviations and acronyms, the reader is referred to the List of Abbreviations at the front of the Report.

Table 3-1
Summary of Outside Water Quality Data Sources

Agency	Data Collected	Sampling Location	Period of Record
Regional Board – Constituents of Emerging Concern (CEC) study	12 CECs 163 pesticides	Various locations throughout watershed	One time sampling in March 2016 for CECs, one time sampling in October 2016 for pesticides
Regional Board and Sonoma County Dept. of Health Services	Cyanotoxins	Various locations through watershed	Summer 2017 and Summer 2018

AMBIENT MONITORING PROGRAM DESCRIPTIONS

CONSTITUENTS OF EMERGING CONCERN

The Regional Board commissioned a pilot study to screen for Constituents of Emerging Concern (CEC) in the Russian River watershed. This study consisted of three tasks: Task 1) targeted analysis of CECs in water and sediment, Task 2) targeted analysis of CECs in fish tissue, and Task 3) initial monitoring of an expanded list of pesticides applied to agricultural lands.

The monitoring locations for Task 1 are shown in **Figure 3-1,** and the 12 CEC targeted for sampling were: 17 beta-estradiol, 4-nonylphenol, bifenthrin, bisphenol A, diclofenac, estrone, ibuprofen, perfluorooctane sulfonate (PFOS), permethrin, triclosan, fipronil, galaxolide. Sampling was conducted on March 5, 2016 only. Samples were also taken from the Ukiah wastewater treatment plant (WWTP) and the Cloverdale WWTP (not shown on **Figure 3-1**).

Figure 3-1. CEC monitoring locations along the Russian River

Table 3-2 shows monitoring results for all locations; however the locations within the study area are El Roble, Airport, Riverfront and Mirabel. The report did not include results from Pull-Out location. There were four CECs detected at El Roble, three CECs

detected at Airport, two CECs detected at Riverfront, and six CECs detected at Mirabel. Galaxolide and 4-nonylphenol were detected at all four sites within the study area, and PFOS was detected at all four sites except not at Riverfront. Mirabel also had permethrin, estrone, and fipronil detected.

Table 3-2. Dissolved Phase Aqueous Concentrations (ng/l) of Target CECs in the Russian River watershed

SAMPLE ID	2016-0007	2016-0011	2016-0015	2016-0019	2016-0023	2016-0027	2016-0031	2016-0035
COLLECTION DATE	3/5/2016	3/5/2016	3/5/2016	3/5/2016	3/5/2016	3/5/2016	3/5/2016	3/5/2016
SAMPLE DESCRIPTION	114RR0898	RIVERFRONT	MIRABEL	PINER CR	114LY0010	STA RSA CR	AIRPORT	EL ROBLE
ANALYTE								
17β-estradiol	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
4-nonylphenol[1]	37.4	81.9	25.4	53.3	25.1	62	76	63
bifenthrin	<0.10	<0.10	<0.10	0.2	<0.10	0.10	<0.10	<0.10
bisphenol A	<10	<10	<10	55.0	<10	16	<10	<10
diclofenac	<10	<10	<10	<10	<10	<10	<10	<10
estrone	<0.50	<0.50	0.5	0.6	<0.50	<0.50	<0.50	<0.50
ibuprofen	<10	<10	<10	<10	<10	<10	<10	<10
PFOS[2]	1.28	<1.0	11.5	9.5	2.0	5.8	1.65	1.15
permethrin	<0.1	<0.1	0.2	0.1	<0.1	0.12	<0.10	<0.10
triclosan	<10	<10	<10	<10	<10	<10	<10	<10
fipronil	<2.0	<2.0	4.8	4.7	<2.0	6.6	<2.0	2.3
galaxolide	150	130	370	190	120	150	230	330
No. CECs Detected	3	2	6	8	3	7	3	4

[1] technical mixture

[2] perfluorooctane sulfonate

< not detected (value is reporting limit)

There are no primary maximum contaminant levels (MCLs) for the six CECs detected at Mirabel. There is a State Water Resources Control Board Division of Drinking Water (DDW) notification level of 13 ng/L for PFOS and human health benchmarks for permethrin and fipronil established by the U.S. Environmental Protection Agency (USEPA). PFOS was detected at Mirabel at 11.5 ng/L, which is close to the DDW Notification Level.

USEPA develops human health benchmarks as screening levels for use by states and water systems in determining whether the detection of a pesticide in drinking water or a drinking water source may indicate a potential health risk. All benchmarks were calculated with updated exposure assumptions (related to body weight and drinking water intake).The benchmarks are for pesticides for which the USEPA has not issued a drinking water health advisory or set an enforceable federal drinking water standard. Permethrin was detected at 0.2 ng/L at Mirabel which is much lower than the human health benchmark of 1,700,000 ng/L (acute) and 1,600,000 ng/L (chronic). Fipronil was detected at 4.8 ng/L at Mirabel which is much lower than the human health benchmark of 170,000 ng/L (acute) and 1,000 ng/L (chronic).

CECs were also sampled in the City of Ukiah and City of Cloverdale WWTP effluent. As shown in **Table 3-3**, all of the 12 CECs were detected in the City of Ukiah effluent, and 5 CECs were detected in City of Cloverdale effluent (4-nonylphenol, bisphenol A, PFOS, permethrin, and galaxolide). There are no human health benchmarks for galaxolide, bisphenol A and triclosan, and 4-nonylphenol as they are not pesticides. Detected levels of PFOS are below its DDW notification level and detected levels of permethrin and fipronil are much lower than their respective USEPA human health benchmarks.

Table 3-3. Dissolved Phase Aqueous Concentrations (ng/L) of Target CECs in Wastewater and QA/QC samples in the Russian River watershed

SAMPLE ID	2016-0039	2016-0043	2016-0047	2016-0063	2016-0067
COLLECTION DATE	3/5/2016	3/5/2016	3/5/2016	4/13/2016	8/2/2016
SAMPLE DESCRIPTION	LAB BLANK	FLD BLANK	SAMPLE DUPL	EFF-CLVDALE	EFF-UKIAH
ANALYTE					
17β-estradiol	<0.50	<0.50	<0.50	<0.50	0.6
4-nonylphenol[1]	24.2	30.2	41.7	60.8	247
bifenthrin	<0.10	<0.10	<0.10	<0.10	0.14
bisphenol A	<10	11	<10	36.0	12.0
diclofenac	<10	<10	<10	<10	46.0
estrone	<0.50	<0.50	<0.50	<0.50	11.0
ibuprofen	<10	<10	<10	<4.0	611
PFOS[2]	<1.0	<1.0	1.82	1.0	5.0
permethrin	<0.10	<0.10	<0.10	0.35	1.9
triclosan	<10	<10	<10	<10	22.0
fipronil	<2[5]	<2.0	<2.0	<4.0	40.0
galaxolide	120	81.0	110	1300	16000
No. CEC Detected	2	3	3	5	12

[1] technical mixture

[2] perfluorooctane sulfonate

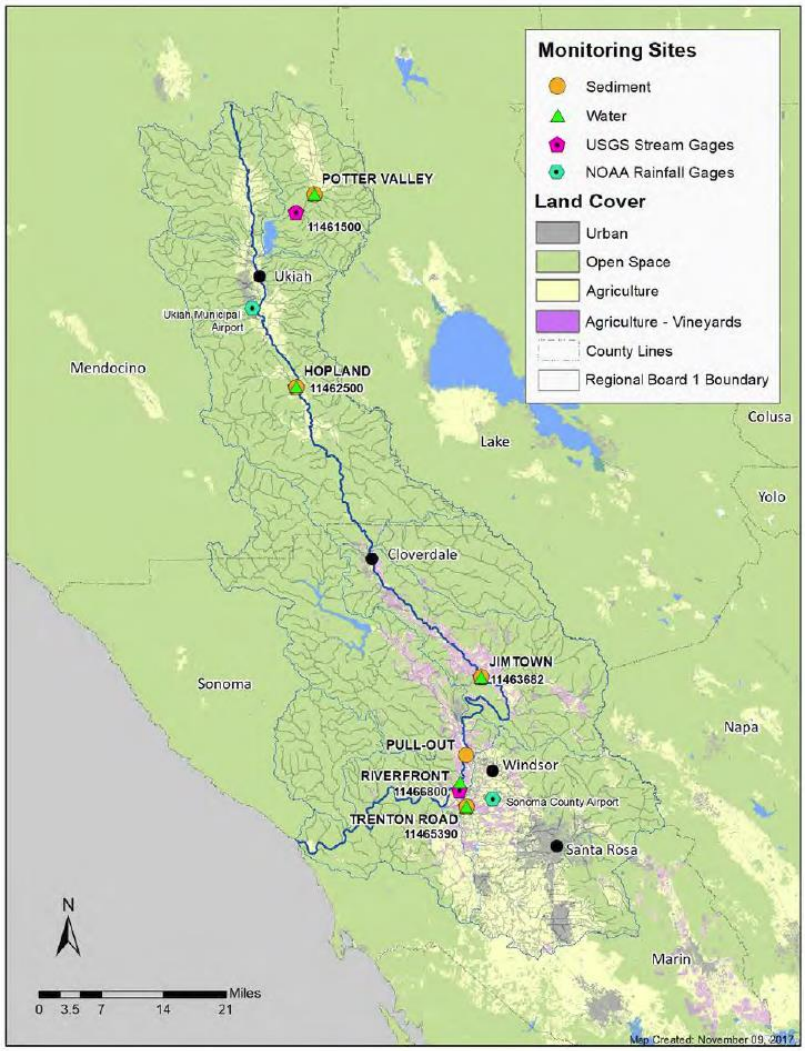
< not detected (value is reporting limit)

The five monitoring locations (Potter Valley, Hopland, Jimtown, Riverfront, and Trenton Road) for pesticide monitoring (Task 3) are shown in **Figure 3-2.** Grab samples were collected In October 2016 designed to capture the first flush on a single day. Out of 162 pesticides, none were detected at Potter Valley, four pesticides were detected at Hopland, three were detected at Jimtown, and four were detected at Riverfront. The highest number of pesticides, 22 pesticides were detected at Trenton Road, which is outside of the study area. Detected results for Hopland, Jimtown, and Riverfront are included in **Table 3-4.** There were no pesticides detected above any respective MCLs, health advisories or human health benchmarks.

Table 3-4. Detected Pesticides (ng/L) along the Russian River

	Riverfront	Jimtown	Hopland	MCL or Health Advisory (HA)
Boscalid (F)	39	41.9	18.2	USEPA HHBM 1,400,000 ng/L (Chronic)
Carbendazim (F)	3.8	3.9	8.5	USEPA HHBM 110,000 ng/L (chronic) and 160,000 ng/L (acute)
Dichlorophenyl Urea, 3-4 (H)	6.2		6.9	
Diuron (H)	15.8		10.2	100,000 ng/L (HA)
Simazine (H)		16.7		4,000 ng/L (MCL)

Figure 3-2. Pesticide Monitoring Locations along the Russian River



CYANOTOXINS

Sonoma County Department of Health Services works collaboratively with the Regional Board to conduct cyanotoxin monitoring at ten public beaches. After Memorial Day, water temperature, flow and visual monitoring is conducted. Once conditions are favorable for cyanobacteria growth, samples are collected for cyanotoxins, specifically, *Anatoxin-a*, *Cylindrospermopsin*, and *Microcystin*. As shown in **Table 3-5**, there have been no detections of *Cylindrospermopsin* and *Microcystin* above their respective USEPA 10-day health advisories in 2017 and 2018 for the locations in the table.

For bottle-fed infants and children less than six years old, the health advisory for *Microcystin* is 0.3 µg/L and 0.7 µg/L for *Cylindrospermopsin*. The health advisory for adults is 1.6 µg/L for *Microcystin* and 3.0 µg/L for *Cylindrospermopsin.*

Of the three cyanotoxins sampled, *Cylindrospermopsin* was detected less frequently than Anatoxin-A and Microcystin. The detections of *Anatoxin-A* and *Microcystin* are very low in concentration.

Table 3-5. Cyanotoxin Detection at Selected Locations in Study Watershed, 2017 and 2018

	Anatoxin-A		***Cylindrospermopsin***		***Microcystin***	
	No health advisory		0.7 µg/L for children and 3.0 µg/L for adults		0.3 µg/L for children and 1.6 µg/L for adults	
	2017	**2018**	**2017**	**2018**	**2017**	**2018**
Cloverdale River Park	One detection at 0.16 µg/L	One detection at 0.15 µg/L	One detection at 0.06 µg/L			Two detections at 0.17 and 0.14 µg/L
Del Rio Woods Beach	One detection at 0.15 µg/L		One detection at 0.06 µg/L			One detection at 0.19 µg/L
Camp Rose Beach		One detection at 0.13 µg/L				Two detections at 0.14 and 0.19 µg/L
Healdsburg Memorial Beach		One detection at 0.13 µg/L				

The Water Agency also conducts sampling for cyanobacteria from Monte Rio to Hopland. In 2017, nine genera of cyanobacteria were observed, five of which are

generally known to produce cyanotoxins such as microcystin, nodularin, anatoxin, saxitoxin and dermatotoxin. Of the potentially toxic cyanobacteria, *Anabaena* was observed the most often. Samples collected at Patterson had the greatest total percent of cyanobacteria detections at 19 percent and Hopland had the lowest percent of cyanobacteria at 8 percent.

OVERALL WATER QUALITY REVIEW

This section provides an evaluation of the Russian River and Radial Collector Well 5 water quality data collected between 2013 and 2017. The Russian River data collected at the diversion location are representative of the source water quality prior to riverbank filtration. The Radial Collector Well 5 data are representative of the quality of water entering the distribution system of Sonoma County Water Agency (Water Agency). The hydrology of the Russian River during the study period is presented first, followed by a discussion of the annual water quality data collected from Radial Collector Well 5. This section then provides a review of the constituents of interest, including an explanation for their selection and a summary of the data obtained during the study period.

HYDROLOGY

Radial Collector Well 5, located on the north bank of the Russian River near Mirabel, has been determined by the DDW to be groundwater under the direct influence of surface water (GWUDI) under certain flow conditions on the Russian River. Radial Collector Well 5 was constructed in 1982 by Ranney Method Western Corporation. The well consists of a 13-foot inside diameter (16-foot outside diameter) steel reinforced concrete caisson that is 99 feet from the floor of the pump house to the floor of the caisson. The well configuration consists of ten 10-inch diameter carbon steel laterals that range in length from 70 to 175 feet with a total of approximately 1,304 lineal feet of screen. The laterals are equipped with 10-inch diameter valves and extend into the aquifer from approximately 42 inches above the caisson floor. The well is equipped with two vertical turbine pumps with 1,250 horsepower motors.

Radial Collector Well 5 and the other collector wells in the Water Agency's water supply system were initially classified as GWUDI by DDW. The Water Agency performed a comprehensive water quality monitoring program in 1992 and 1993 that showed that only Radial Collector Well 5 was actually under the direct influence of surface water when the flow in the Russian River at Hacienda Bridge reaches 5,000 cubic feet per second (cfs) and until the flow drops below 2,000 cfs. **Figure 3-3** presents the flow data for the river at the Hacienda Bridge. This figure shows that there are many periods of time in the wet season when the river flows exceed the conditions that cause Radial Collector Well 5 to be under the influence of surface water. The Water Agency has not used Radial Collector Well 5 when it is under the direct influence of surface water during the study period, per standard operating procedures. This generally limits usage of Radial Collector Well 5 in February and March, and occasionally during other months of the wet season, as shown in red in **Figure 3-4**. There are also other time periods when Collector 5 was not operating, as shown in pink in **Figure 3-4.**

Figure 3-3. Russian River Flow at Hacienda Bridge

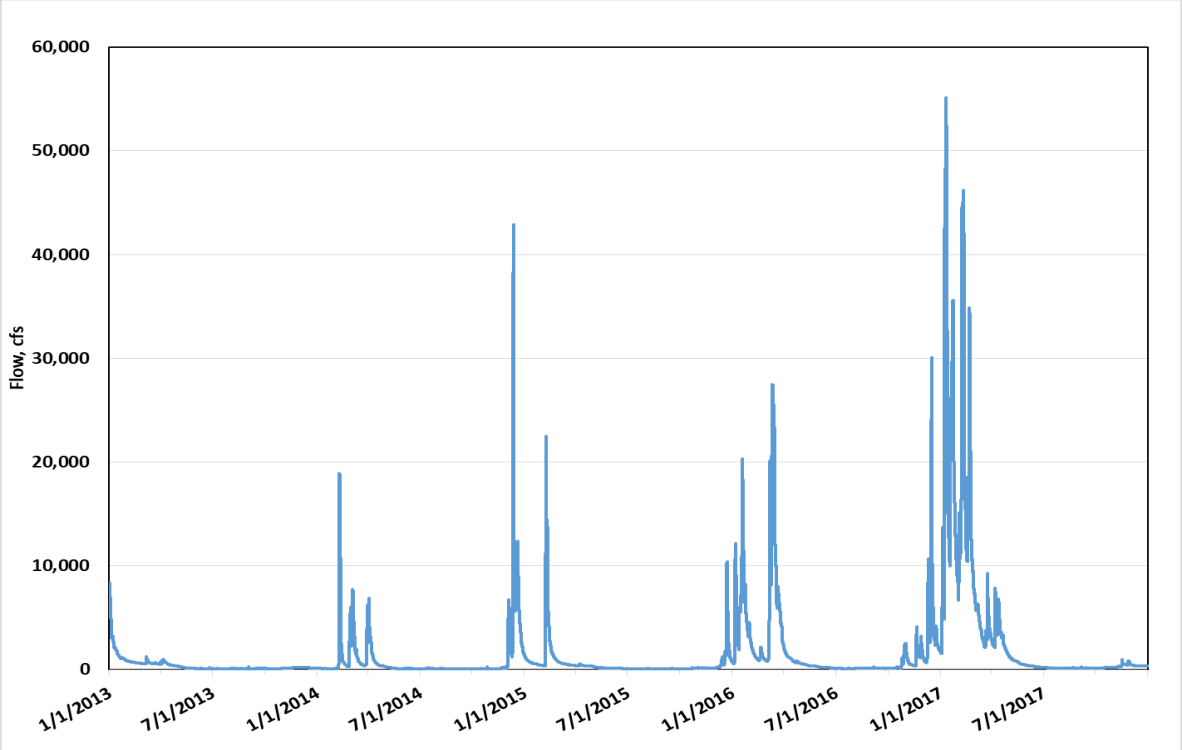


Figure 3-4. Periods of Time When Radial Collector Well 5 Usage was Restricted (shown in red) or Out of Service (pink)

Year	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec
2013		o/s	o/s									
2014					o/s			o/s		o/s		
2015				o/s	o/s			o/s		o/s	o/s	
2016		o/s		o/s		o/s	o/s					
2017								o/s	o/s	o/s	o/s	o/s

	Flows below 2,000
o/s	Flows below 2,000 cfs, but not in operation
	Flows above 5,000 cfs

The Water Agency collects annual samples from Radial Collector Well 5 for organic and inorganic contaminants regulated in drinking water supplies. **Table 3-6** compares the Radial Collector Well 5 data to primary maximum contaminant levels (MCLs) and **Table 3-7** compares the data to secondary MCLs. Very few contaminants were detected in Radial Collector Well 5 and all primary and secondary MCLs were met with a large margin of safety. Most of the inorganic contaminants regulated with a primary MCL were not detected; with fluoride and gross alpha particle radioactivity being the two exceptions. Both of these contaminants were detected at levels well below the primary

MCLs. No synthetic or volatile organics were detected in the five years of annual monitoring. DDW published a Final Hexavalent Chromium Regulation in May 2014 with an MCL of 10 µg/L; effective July 1, 2014. It was repealed on September 11, 2017 and the MCL is no longer in effect. The Water Agency collected samples for hexavalent chromium annually from 2013 to 2017, and the concentrations ranged from <0.5 to 0.7µg/L.

Most of the contaminants regulated with a secondary MCL were not detected in Radial Collector Well 5. Color was detected in one sample at a low level, below the secondary MCL. The salinity constituents (total dissolved solids, specific conductance, chloride, and sulfate) were all detected at low levels and were well below the recommended secondary MCLs.

Table 3-6. Comparison of Radial Collector Well 5 Monitoring Data (2013 to 2017) To Primary Maximum Contaminant Levels

Constituent	Primary MCL	Number of Samples	Median Concentration	Maximum Concentration
Inorganic Chemicals				
Aluminum, µg/L	1000	5	<50	<50
Antimony, µg/L	6	5	<6	<6
Arsenic, µg/L	10	5	<2	<2
Asbestos, MFL	7MFL	5	<0.2	<0.2
Barium, µg/L	1000	5	<100	<100
Beryllium, µg/L	4	5	<1	<1
Cadmium, µg/L	5	5	<1	<1
Chromium, µg/L	50	5	<10	<10
Chromium 6, µg/L	no MCL	5	0.5	0.7
Copper				
Cyanide, mg/L	0.15	5	<0.003	<0.003
Fluoride, mg/L	2	5	<0.1	0.12
Lead				
Mercury, µg/L	2	5	<0.2	<0.2
Nickel, µg/L	100	5	<10	<10
Nitrate, mg/L	10	5	<0.4	<0.2
Nitrate + Nitrite, mg/L	10	5	<0.4	<0.4
Nitrite, mg/L	1	5	<0.2	<0.2
Perchlorate, µg/L	6	5	<4	<4
Selenium, µg/L	50	5	<5	<5
Thallium, µg/L	2	5	<1	<1
Radioactivity				
Gross Alpha Particle, pCi/L	15	4	0.06	0.121
Organic Chemicals[a]				

[a]No organic chemicals were detected.

Table 3-7. Comparison of Radial Collector Well 5 Monitoring Data (2013 to 2017) To Secondary Maximum Contaminant Levels

Constituent	Secondary MCL	Number of Samples	Median Concentration	Maximum Concentration
Inorganic Chemicals				
Aluminum, µg/L	200	5	<50	<50
Color, units	15	5	<3	4
Copper, mg/L	1000	5	<50	<50
MBAS, mg/L	0.5	5	<0.05	<0.05
Iron, mg/L	0.3	5	<0.1	<0.1
Manganese, µg/L	50	5	<20	<20
MTBE, mg/L	0.005	5	<0.003	<0.003
Odor, units	3	5	<1	<1
Silver, mg/L	0.1	5	<0.010	<0.010
Thiobencarb, mg/L	0.001	5	<0.001	<0.001
Turbidity[a], NTU	5	5		2
Zinc, µg/L	5000	5	<50	<50
TDS, mg/L	500-1,500	5	130	160
Specific Conductance, µS/cm	900-2,200	5	230	280
Chloride, mg/L	250-600	5	5.3	6.1
Sulfate, mg/L	250-600	5	13	16

[a] See Table 3-3 for turbidity data.

SELECTED CONSTITUENT REVIEW

Based on a review of the water quality data and an evaluation of the contaminant sources in the study watershed, the key constituents identified for further evaluation in this sanitary survey are turbidity, microbiological constituents, and disinfection byproducts. Furthermore, these key constituents are also regulated by DDW.

Turbidity

General Characteristics and Background

High turbidity levels in surface water sources, such as the Russian River, are typically the result of erosion and sediment transport during high flow events. High flow events on the Russian River can occur as a result of storm events and releases from upstream reservoirs. High turbidity in source water can mask the presence of microorganisms and interfere with disinfection. Turbidity is typically used to evaluate the efficiency of the treatment process in removing particles, including microorganisms, and also to comply

with regulatory requirements. In this evaluation of Radial Collector Well 5, turbidity is used to determine the extent to which Russian River water is filtered through the riverbank prior to reaching Radial Collector Well 5.

DDW requires routine monitoring of turbidity in the collector wells to demonstrate the integrity of the natural filtration system. Although Radial Collector Well 5 has been determined to be GWUDI when river flows are high, it is not typically operated during those conditions so this evaluation focuses on a review of the turbidity data to determine if it meets the DDW requirements during the times it is operated. DDW requires initiation of non-routine monitoring whenever the turbidity level exceeds 0.2 NTU for more than four hours in any individual collector well and removal of a collector well from production whenever turbidity exceeds 1.0 NTU for over four hours or over 5.0 NTU at any time (Sonoma County Water Agency et al., 2013).

Evaluation

Turbidity has been selected for evaluation not only because it is a regulated constituent, but also because it is commonly used as an indicator of general water quality and the effectiveness of riverbank filtration. The Water Agency obtains turbidity data every 15 minutes from the Russian River at the diversion location and at four other locations upstream and downstream of the diversion. Weekly grab samples at the diversion location are shown in **Figure 3-5,** indicating variability in turbidity levels in the river.
Turbidity is also monitored continuously at Radial Collector Well 5 when it is being used as a water supply well with SCADA polling data approximately every 2.5 minutes. **Table 3-8** presents the range and annual average turbidity values for Radial Collector Well 5 for 2013 through 2017. The Water Agency calculates the annual average as the mean of the monthly average values, weighted by hours of pumping each month. This table shows that turbidity levels are exceedingly low. The maximum turbidity level recorded is 2.0 NTU and the annual average ranges from 0.01 to 0.06 NTU. The Radial Collector Well 5 turbidity monitoring is designed to monitor the exceedingly low levels that are found most of the time so the instrument is not able to record values that exceed 2.0 NTU. As discussed previously, a collector well must be taken out of service if turbidity exceeds 1.0 NTU for over four hours or if it exceeds 5.0 NTU at any time. As indicated in **Table 3-8**, the maximum turbidity in Radial Collector Well 5 exceeded 1.0 NTU in all of the years evaluated for this study, based on the data collected every 2.5 minutes. The hourly data from these years were examined to determine if Radial Collector Well 5 ever exceeded 1.0 NTU for over four hours. Turbidity in Radial Collector Well 5 never exceeded 1.0 NTU for over four hours or exceeded 5.0 NTU at any time. Weekly grab turbidity samples at Collector 5 are shown in **Figure 3-6**. These data show that riverbank filtration is effectively removing the high levels of turbidity found in the Russian River.

Figure 3-5. Weekly Turbidity Data in the Russian River at the Diversion Location

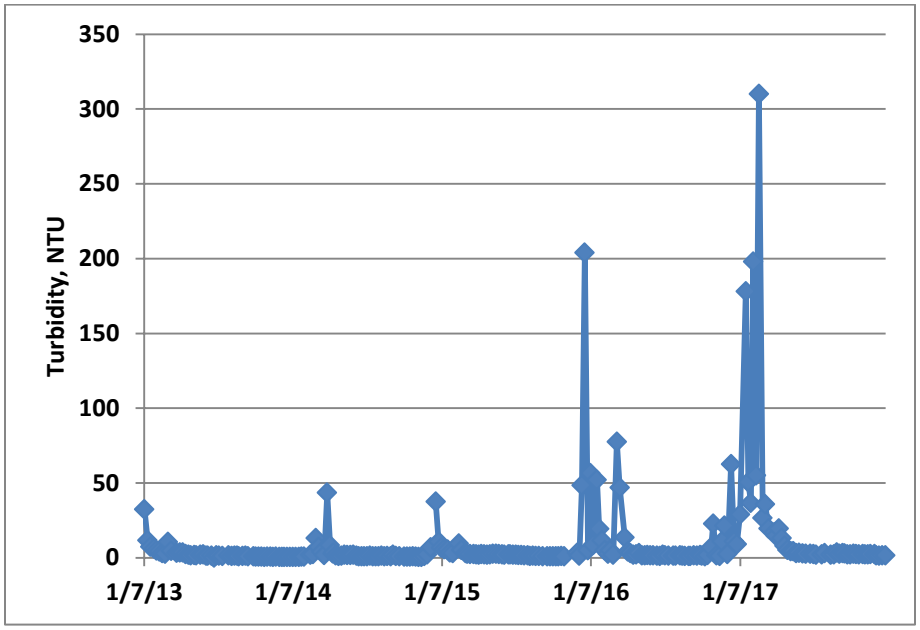


Figure 3-6. Weekly Turbidity Data in the Russian River at Collector 5

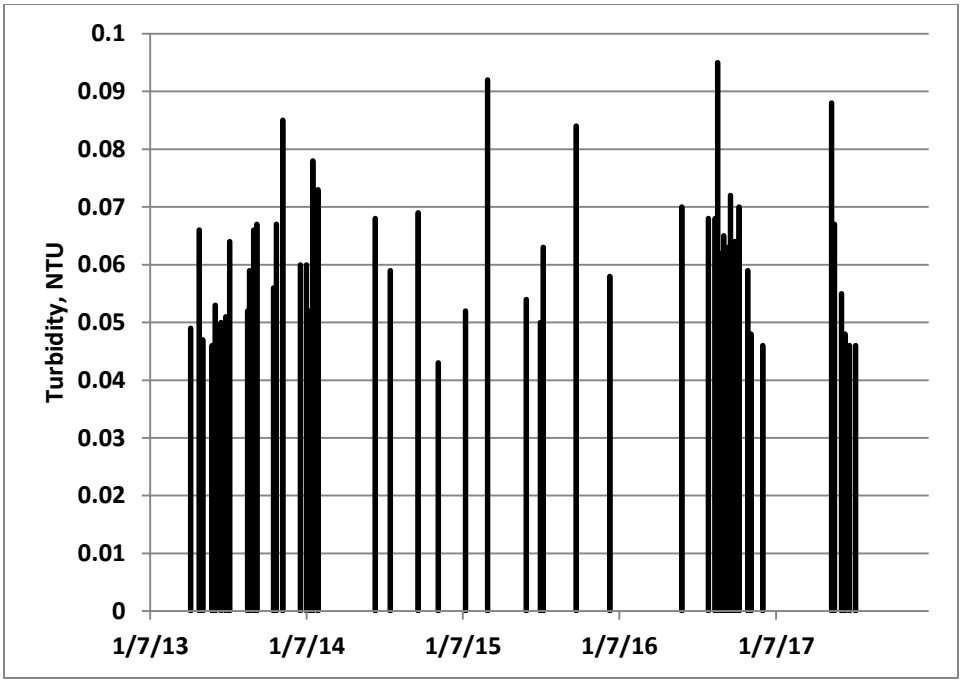


Table 3-8. Radial Collector Well 5 Turbidity Data

Year	Range, NTU	Average, NTU
2013	0.01 – 2.0	0.03
2014	0.06 – 2.0	0.04
2015	0.02 – 2.0	0.04
2016	0.01 – 2.0	0.043
2017	0.04 – 2.0	0.055

Summary

- Turbidity levels in the Russian River at the diversion location are quite variable, ranging from less than 2.0 to over 300 NTU. The highest levels are typically found during the wet season when Radial Collector Well 5 is not being used as a water supply source.
- Turbidity levels in Radial Collector Well 5 are very low with peak values of 2.0 NTU and annual averages of 0.01 to 0.06 NTU.
- DDW requires that Radial Collector Well 5 be taken out of service if turbidity exceeds 5.0 NTU at any time or if turbidity exceeds 1.0 NTU for more than four hours. The turbidity levels in Radial Collector Well 5 never exceeded 1.0 NTU for more than four hours or 5.0 NTU at any time.
- These data indicate that riverbank filtration is effectively removing the high particulate levels seen in the Russian River.

Microbiological Constituents

General Characteristics and Background

The major microbiological constituents of concern include total coliform, fecal coliform, *Escherichia coli (E. coli)*, *Giardia lamblia*, and *Cryptosporidium parvum*. Potential sources of bacteria and protozoans in the watershed include wastewater discharges, spills from wastewater treatment plants, leaking septic tanks and sewers, urban runoff, dairies, recreational usage, and wild animals. Generally speaking, pathogenic organisms carried by mammalian species may be infectious to humans although this depends on the species of microorganism. Pathogens infecting other types of animals, such as birds and reptiles, are usually not infectious to humans; however, some types of animals, such as birds, may be vectors for human pathogens. Each of these constituents was identified for further evaluation because they are currently regulated.

Total and fecal coliform and *E. coli* have been used to indicate the potential presence of pathogenic microorganisms in source waters. Although coliform levels have not been shown to correlate well with pathogenic microorganisms, they continue to be used as indicators due to the lack of affordable analytical methods for detecting pathogens. The U.S. Environmental Protection Agency (USEPA) has determined that the most practical surrogate for protozoans at this time is *E. coli*. Coliform levels in water in the

distribution system are currently regulated through the Total Coliform Rule, to ensure the effectiveness of the disinfection process throughout the distribution system.

Giardia lamblia is a species of the protozoa genus *Giardia* that infects humans and can cause the gastrointestinal disease giardiasis. *Giardia* is found in the environment as a cyst from the feces of humans and animals; both wild and domestic animals may be hosts. Sources close to water bodies have the most potential to introduce viable cysts to the source water. Cysts may be destroyed naturally in the environment by desiccation and/or heat. The cysts are effectively inactivated using chlorine disinfection.

Giardia lamblia is currently regulated by the Surface Water Treatment Rule (SWTR) and the Interim Enhanced Surface Water Treatment Rule (IESWTR). A GWUDI source must provide 3-log reduction of *Giardia* through physical removal and chemical inactivation. The USEPA provided guidance with the SWTR that indicated additional reduction would be appropriate if measured *Giardia* levels in the source water were greater than 0.01 cysts per liter. However, in the 1980's there was no practical means to measure *Giardia*, therefore DDW prepared guidance under the SWTR that indicated that 3-log reduction would likely be appropriate when monthly median levels of total coliform in the raw water were less than 1,000 most probable number per 100 milliliter (MPN/100 ml). In recent years DDW has allowed for the substitution of fecal coliform or *E. coli* levels in raw water since they are more specific indicators. The DDW has set the guidance level for increased treatment at raw water monthly fecal or *E. coli* median levels greater than 200 MPN/100 mL, based on the historic ratio of five total coliform to one fecal coliform. These requirements would apply to Radial Collector Well 5 if the Water Agency intended to use it during the periods of time that it is currently deemed to be a GWUDI source.

Cryptosporidium parvum is a species of the protozoa genus *Cryptosporidium* that infects humans and can cause the gastrointestinal disease cryptosporidiosis. *Cryptosporidium* is found in the environment as an oocyst. Like *Giardia*, *Cryptosporidium* oocysts may be destroyed naturally in the environment by desiccation and/or heat. Once in the source water, however, viable oocysts are very resistant to traditional chemical inactivation using chlorine. Stronger disinfectants such as ozone or ultraviolet (UV) light are required to inactivate these pathogens.

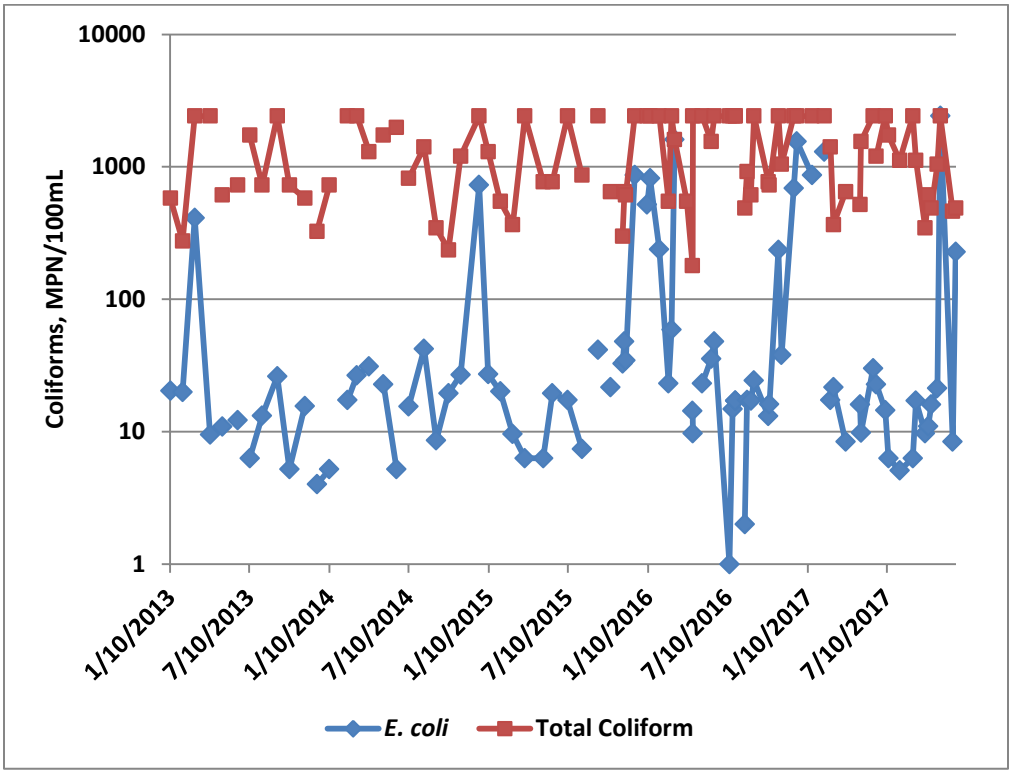
Cryptosporidium is currently regulated through the IESWTR and the Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWRT), which require 2-log reduction, and the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) which potentially requires additional log action based on source water monitoring results for *Cryptosporidium*. Under the IESWTR and LT1ESWTR well-operated treatment plants are granted a 2-log removal credit for *Cryptosporidium* if they meet all treated water turbidity standards. The LT2ESWTR further regulates *Cryptosporidium* and requires additional action (treatment or protection) if the source water quality is determined to be impaired based on *Cryptosporidium* monitoring of the source. These requirements would apply to Radial Collector Well 5 if the Water Agency intended to use it during the periods of time that it is currently deemed to be a GWUDI source.

Evaluation

Total coliform and *E. coli* were analyzed approximately monthly from the Russian River at the diversion location. All samples from the river were positive for both organisms, as shown in **Figure 3-7**. Total coliform levels ranged from 179 to >2,419 MPN/100 ml and *E. coli* levels ranged from 1 to 2,419 MPN/100 ml. **Figure 3-7** shows that 12 of the 84 months monitored during the 2013 to 2017 period had *E. coli* levels that exceeded the DDW guidance of 200 MPN/100 mL that could potentially trigger additional *Giardia* removal or inactivation if the Water Agency were to use Radial Collector Well 5 during the periods when it is deemed to be a GWUDI source. However, there was only one month (November 2016) out of the 12 months when Radial Collector 5 was operating. In other words, although there were months when *E. coli* median was above the 200 MPN/100mL trigger level, there was no need for additional treatment as Collector 5 was not in operation, with the exception of November 2016

Total coliforms and *E. coli* were also analyzed in samples collected from Radial Collector Well 5 prior to disinfection, when it was operating. Total coliforms were found detectable two times, at 1.0 and 2.0 MPN/100 ml. *E. coli* was never detected.

Figure 3-7. Total Coliform and *E. coli* Levels in the Russian River



The water from the collector wells is disinfected prior to entering the distribution system. Total coliform samples are collected throughout the distribution system, generally with over 520 samples collected each year in the study period. Between 2013 and 2017, there were no positive samples. The MCL is less than two positive samples per month.

The Water Agency conducted monitoring for *Cryptosporidium* and *Giardia* to comply with the second round of LT2ESWTR monitoring from July 2016 through June 2018. Samples were collected from the Russian River near the diversion structure once per month.

Twenty-four samples were collected from the Russian River and the approximate total river volume sampled was 264 liters. *Cryptosporidium* was never detected; therefore the Russian River source is placed in Bin 1 for the second round of LT2ESWTR. A total of eleven *Giardia* cysts were detected in these samples, with six cysts in one sample collected on January 23, 2018. The mean discharge of the river near Guerneville (USGS Gauge 11467000) on this date was 3,500 cfs. For the remaining 5 cysts, one cyst was detected on November 16, 2016 when the mean river discharge was 373 cfs, one cyst was detected on July 17, 2017 when the mean river discharge was 162 cfs and two cysts were detected on May 29, 2018 when the mean river discharge was 387 cfs.

Summary

- The Russian River has relatively high levels of coliforms, associated when watershed runoff is high due to precipitation. Therefore, the highest levels of *E. coli* generally occur when Collector 5 is not operating, as the Water Agency does not operate Collector 5 when it is under the direct influence of surface water (when the flow in the Russian River at Hacienda Bridge reaches 5,000 cubic feet per second cfs and until the flow drops below 2,000 cfs).
- Total coliforms and *E. coli* were analyzed in samples collected from Radial Collector Well 5 prior to disinfection, when it was operating. Total coliforms were found two times at 1.0 and 2.0 MPN/100 ml. *E. coli* was not detected. *Giardia* was only occasionally detected in river samples. *Cryptosporidium* was never detected in samples collected from July 2016 to June 2018.
- The Radial Collector Well 5 data show that riverbank filtration is very effective in removing microorganisms from the water, producing high quality groundwater for the Water Agency's system.

Disinfection Byproducts and Precursors

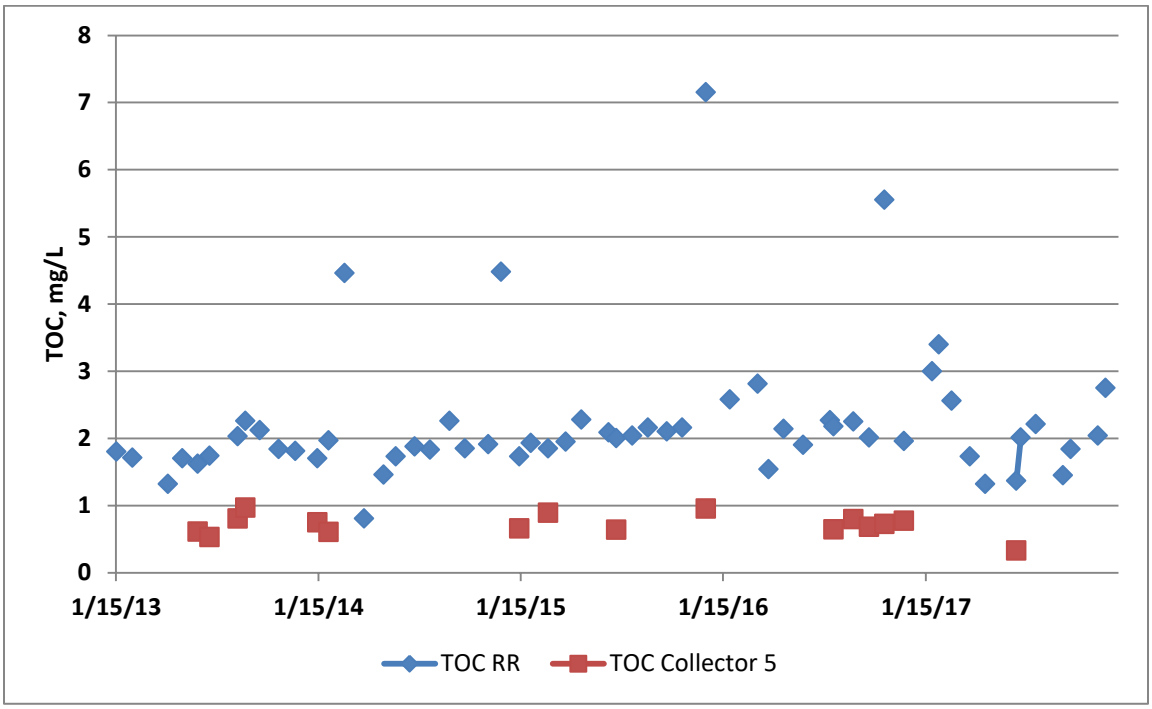
General Characteristics and Background

Disinfection By-Products (DBPs) are formed when disinfectants added to water react with organic carbon and bromide. The most common DBPs are total trihalomethanes (TTHM), which are suspected carcinogens. Other DBPs, including haloacetic acids (HAA5), are suspected mutagens and teratogens. Potential sources of organic carbon are plant matter, animal matter, and soil, which can be contributed by general watershed runoff, urban runoff, agricultural runoff, recreation, grazing, and wastewater sources. TTHMs and HAA5 are regulated by the Stage 1 and Stage 2 Disinfection Byproduct Rules. The MCL for TTHM is 80 µg/L and the MCL for HAA5 is 60 µg/L.

Evaluation

The Water Agency collects total organic carbon (TOC) samples on a monthly basis from the diversion location, and occasionally at Collector 5. **Figure 3-8** presents TOC in river and at Collector 5. TOC in the river ranged from 0.8 to 7.2 mg/L, with an average of 2.2 mg/L. TOC in Collector 5 was much lower, ranging from 0.3 to 0.96 mg/L, with an average of 0.7 mg/L.

Figure 3-8. Total Organic Carbon Concentrations in the Russian River and Collector 5



The Water Agency monitors the individual trihalomethanes and haloacetic acids in samples from the tanks in the water distribution system. TTHM and HAA5 are calculated from the individual species to determine compliance with the MCLs. Since water from Radial Collector Well 5 is mingled with water from other wells in the distribution system, the data for all of the storage tanks have been aggregated and are presented in **Table 3-9**. This table shows that the maximum TTHM concentration detected in a single sample between 2013 and 2017 was 27.5 µg/L in 2016. This is well below the MCL of 80 µg/L. The maximum HAA5 concentration detected in a single sample was 31.8 µg/L in 2014. This is well below the MCL of 60 µg/L.

Table 3-9. Disinfection Byproduct Concentrations in the Storage Tanks

Year	TTHM, µg/L			HAA5, µg/L		
	Min	Max	Average	Min	Max	Average
2013	6.5	20.6	14.0	1.3	10.0	5.9
2014	9.3	22.0	16.6	1.6	31.8	5.9
2015	6.2	19.8	14.0	1.4	9.2	4.5
2016	9.5	27.5	16.3	1.6	15.0	5.9
2017	5.6	17.2	10.4	1.2	9.4	5.4

Summary

- Collector 5 has relatively low levels of organic carbon, the main precursor that reacts with chlorine to form disinfection byproducts in the distribution system.
- TTHM and HAA5 concentrations in the storage tanks of the Water Agency's distribution system are consistently below the MCLs of 80 µg/L and 60 µg/L.

REFERENCES

Sonoma County Water Agency, Smith-Comeskey Ground Water Science, LLC, and Tetra Tech, Inc. 2013. Russian River Collector Multi-Year Operational Analysis Radial Collector Wells 1 through 6.

This section contains an evaluation of the nine potential contaminant sources (PCS) selected for review for the current Update: (1) source water spills, (2) wineries, (3) mines, (4) agriculture, (5) recreation, (6) urban runoff, (7) wastewater, (8) leaking underground storage tanks, and (9) fires. These PCSs were selected based on their presence in the study watershed and their potential to impact Russian River water quality. Timber harvesting and landfills were evaluated but eliminated from the report as they are not located in the study watershed

SPILLS

Background

A hazardous material spill or leak into a surface water body could occur as the result of a vehicular traffic accident, pipeline leak or spill, wastewater treatment plant spill, or other incident. In the event of a leak or spill, timely notification is critical to ensure that the plant operators are provided with sufficient time and information to best respond to potential treatment concerns.

Spills of raw or partially treated wastewater occur from collection systems and from wastewater treatment plants. A sanitary sewer overflow (SSO) is any overflow, spill, release, discharge, or diversion of untreated or partially treated wastewater from a sanitary sewer system. Major causes of SSOs include grease, root and debris blockages; sewer line flood damage; manhole structure failures; vandalism; pump station mechanical failures; power outages; excessive storm or groundwater inflow/infiltration; improper construction; lack of proper operation and maintenance; insufficient capacity; and contractor-caused damage. Spills of raw or partially treated wastewater occur due to equipment malfunctions or operator errors at wastewater treatment plants. Spills also occur during storm events when storm water infiltrates a wastewater collection system and the capacity of the wastewater treatment plant is exceeded.

Seasonal Patterns

There are no seasonal patterns as to when spills may occur due to the various causes of spills and SSOs. However, SSOs may occur more frequently during the wet season, when stormwater can infiltrate a wastewater collection system.

Related Constituents

The most common spills are related to oil and petroleum products or sewage. Therefore, typical constituents of concern range from volatile organic compounds (VOCs) and hydrocarbons to microbial constituents (i.e. viruses, pathogens, *Giardia, Cryptosporidium*). However, hazardous materials emergencies can involve a virtually infinite number of chemicals or chemical combinations.

Occurrence in Watershed

The main transportation routes through the watershed are California State Highway Routes 128, 175, 253, 20 and Interstate Highway 101. Information on spills was obtained from two sources: 1) the Office of Emergency Services (OES) Response Information Management System (RIMS) archived database, and 2) the State Water Resources Control Board's (SWRCB) California Integrated Water Quality System (CIWQS) database on SSOs. Information obtained from OES and from CIWQS provided additional information regarding whether or not the spill impacted surface water.

As shown in **Table 4-1** and in **Attachment A** (hazardous spills), from 2013 to 2017 there were 32 spills involving a variety of contaminants such as sewage, diesel fuel, oil, non-hazardous geothermal condensate, winery waste, and fire retardant. All of the spills impacted water. Out of the 32 spills, 12 spills were sewage-related, seven spills involved either diesel fuel, gasoline, or oil, five spills were winery-related, and three were fire-fighting related. .

The largest sewage spill occurred on October 5, 2017 in the City of Healdsburg when 166,000 gallons entered a storm drain due to failure of a contractors sewage pump. The second largest sewage spill occurred on April 14, 2017 when 20,000 gallons entered an unnamed creek near 481 Hidden Acres Road in the City of Healdsburg due to blockage.

The two largest non-sewage spills by volume occurred on January 12, 2013 when 100,000 gallons of fire-fighting water and foam flowed to Foss Creek in Healdsburg. Another large spill was caused by CalPine in the City of Cloverdale when 3,000 gallons of recycled water and geothermal condensate entered Squaw Creek on September 9, 2014 due to a broken pipe.

As shown in **Table 4-2** and in **Attachment A** (SSOs), the SWRCB's CIWQS database contains information on eight SSOs in the study watershed, with all eight SSOs occurring in Healdsburg. Excluding the 20,000 gallon sewage spill near 481 Hidden Acres Road, the three largest SSOs had volumes of 1400 gallons, 1,225 gallons, and 908 gallons.

The Sonoma County Permit and Resource Management Department is the local agency that permits and inspects septic systems in the County. Although they have a database for septic tank related violations, there was no response for our request for information on septic tank violations from 2013 to 2017. The County is currently very busy working on proposed new regulations for septic systems, as discussed in further detail under Wastewater.

Table 4-1. Summary of Spills in OES Database Occurring in Study Area of Russian River Watershed, 2013-2017

Incident Date	Agency	Substance	Quantity	Type	Water Way	Location
1/6/2013	Calfire	Unknown Oil	Unknown	Unknown	Unnamed Creek (Possibly Vista View Creek)	230 East 3rd St
1/12/2013	Healdsburg F.D.	Fire Fighting water and foam	100,000	Gal(s)	Foss Creek	1430 Grove Street
2/12/2013	Healdsburg F.D.	Red Wine Vinegar	10	Gal(s)	Storm Drain - Foss Creek	238 Twin Oaks Way
2/20/2013	Clos Du Bois Winery	Wine & Water	50-100	Gal(s)	Storm Drain	451 Moore Ln
5/24/2013	City of Healdsburg	sewage	100	Gal(s)	contained in the storm drain system	144 Piper St
5/28/2013	City of Healdsburg Public Works	Sewage	2009	Gal(s)	Foss Creek	Corner of Grove St. and Dry Creek Rd.
6/25/2013	Healdsburg Fire Dept	Motor Oil	5	Qt.(s)	Storm drain	Healdsburg Ave and Parkland Farms
8/8/2013	City of Healdsburg	Raw Sewage	56	Gal(s)	Storm Drain, runs to Foss Creek	Terrace Blvd and Lupine Road
3/17/2014	Concerned Citizen / previous tenant	Battery Acid	unknown	N/A	Sulfur Creek	d.
6/11/2014	Forestville Water District	Sewage	200	Gal(s)	Storm Drain	Intersection of 2nd St. and Front St.
9/9/2014	Calpine	Recycled water & geothermal condensate	3000	Gal(s)	Squaw Creek	Unit 11 Power Plant, Big Sulfur Creek Rd
10/10/2014	Santa Rosa Fire	Diesel	10-30	Gal(s)	Dry Creek Bed	8800 St Helena Rd and Spring Mountain Summit Trail Rd
2/19/2015	Seghesio Family Vineyards	Residual Wine/Water Solution	50	Gal(s)	Foss Creek	700 Grove St
5/29/2015	CalPine	Septic water	5,000	Gal(s)	Big Sulpher Creek	near Geysers West Administration Center at Healdsburg/Geysers Road.
10/7/2015	Constellation Brands, Simi Winery	Grape Residue with rain water mixture.	300	Gal(s)	Foss Creek	162 75 Gilsberg
6/7/2016	FORESTVILLE WATER DISTRICT	Sewage	50	Gal(s)	Storm Drain	Intersection of Second St & HWY 116
7/3/2016	NRC	Gasoline-	unknown	Gal(s)	Lake Sonoma	4200 Skaggs Springs Rd.
8/28/2016	Sonoma County Redcom	Mixed- fuel, oil	unknown	Unknown	Lake Sonoma	11551 Rockpile Rd,
9/25/2016	Cal Fire	Fire Retardant	10-15	Gal(s)	Big Sulfur Creek	Big Sulfur Creek, N 38° 48.75 W 122° 51.33
10/18/2016	Healdsburg FD	Concrete Run-off	20	Gal(s)	Storm Drain, Foss Creek	1261 Grove St
10/27/2016	CHP	Diesel Fuel	80	Gal(s)	Russian River	River Rd. and Martinelli Rd
1/9/2017	Sonoma County Fire Emergency Services Dept,	Diesel	5	Gal(s)	Russian River	11050 Westside Road.
1/10/2017	Forestville Water District	Secondary treated waste water	UNK	Unknown	Jones Creek, Russian River	6194 Forestville St.

Incident Date	Agency	Substance	Quantity	Type	Water Way	Location
3/15/2017	City of Healdsburg, Public Works	Sewage	0.3	Gal(s)	Foss Creek	177 Healdsburg Avenue
3/24/2017	City Healdsburg Public Works	Sewage	1,100	Gal(s)	Russian river	711 Heron Dr.
4/9/2017	City of Healdsburg	Sewage	890	Gal(s)	Foss Creek	Healdsburg Ave., between Exchange and Mill St.
4/14/2017	City of Healdsburg	Sewage	20,000	Gal(s)	Creek (unnamed)	481 Hidden Acres Road
9/1/2017	CalFire LNU	Fire Retardant	100-150	Gal(s)	Lake Sonoma	Lake Sonoma
10/5/2017	Healdsburg Public Works	Sewage	166,000	Gal(s)	Storm Drain	1031 Vine Street
10/5/2017	Sonoma County Fire	Sewage and Wine Washout	500-1000	Gal(s)	Foss Creek	44 Mill St
10/23/2017	Healdsburg Custom Crush	Wine waste	40	Gal(s)	storm drain/Foss Creek	25 Healdsburg Ave
12/27/2017	Anonymous	Carpet cleaning liquids / chemical	unknown	Unknown	Russian River	91 Geyser Ridge / Northern Carpet Care

Table 4-2. SSOs in State Water Resources Control Board Database, 2013-2017

Spill Date	Spill Location	Spill Volume	Spill Recovered	Spill Cause	Impacted Surface Water
5/28/2013	255 Dry Creek Road	1225	100	Debris	Foss Creek
8/8/2013	Terrace Blvd. and Lupine Rd.	299	101	Debris	Foss Creek
12/21/2014	Sunnyvale and University	510	0	Root Intrusion	Tributary to Foss Creek
3/15/2017	171 Healdsburg Ave.	178	0	Pipe structural problem	Foss Creek
3/24/2017	711 Heron Dr.	1400	0	Pump Station Failure	Russian River
4/9/2017	165 Healdsburg Ave.	908	347	Construction Diversion Failure	Foss Creek
4/12/2017	481 Hidden Acres Dr.	23,040	0	Root Intrusion	Russian River
4/13/2017	75 West Matheson St.	10	0	Operator Error	Russian River

Related Water Quality Issues and Data Review

Although there were various petroleum products spilled in the study watershed, there were no volatile organic compounds (VOCs) or synthetic organic compounds (SOCs) detected at Radial Collector Well 5 over the reporting period.

Collector 5 was not in operation during the timing of the two largest sewer spills which occurred on April 14 and October 5, 2017. *E. coli* samples were taken at the Russian River diversion location on May 9, 2017 and October 12, 2017 which were measured at 16 MPN/100mL and 11 MPN/100mL.

Regulation and Management

When a hazardous materials spill or leak of a reportable quantity occurs, notification to an emergency response agency is required by state and federal law. A sewage spill is required to be reported if 1,000 gallons or more are released. An oil or petroleum product spill is required to be reported if 42 gallons or more are released. Any other hazardous materials spill is required to be reported if there is a reasonable belief that the release poses a significant present or potential hazard to human health and safety, property, or the environment. When a hazardous materials spill or leak occurs, it is the owner's or operator's responsibility to notify the local designated emergency response agency, which is called the Certified Unified Program Agency (CUPA), as well as the OES. The local CUPA is the Sonoma County Fire and Emergency Services Department. Depending on the type of spill and where it occurred, other agencies such as the U.S. Forest Service, the U.S. Fish and Wildlife Service, the California Department of Fish and Game, and the North Coast Regional Water Quality Control Board (Regional Board) may be involved. An incident report would then be sent to OES.

California Emergency Management Agency

OES developed the RIMS as part of the development of the State's Standardized Emergency Management System (SEMS). The purpose of RIMS is to provide a single point for tracking the status and progress of hazardous materials spills statewide. Only registered users can input data into RIMS, but anyone can access the website to review current or archived OES cases.

The archived cases, including those from 1993 through 2017, were accessed at: http://www.caloes.ca.gov/cal-oes-divisions/fire-rescue/hazardous-materials/spill-release-reporting

State Water Resources Control Boards

SWRCB Order No. 2006-0003-DWQ *Statewide General Waste Discharge Requirements for Sanitary Sewer Systems*, adopted by the SWRCB on May 2, 2006, establishes minimum requirements to prevent SSOs from publicly owned/operated

sanitary sewer systems. Order No. 2006-0003-DWQ is the primary regulatory mechanism for sanitary sewer systems statewide and serves to provide a unified statewide approach for reporting and tracking SSOs, establishing consistent and uniform requirements for Sewer System Management Plan (SSMP) development, and facilitating consistent reporting and enforcement.

In accordance with Order No. 2006-0003-DWQ, all federal and state agencies, municipalities, counties, districts, and other public entities that own, operate, acquire, or assume responsibility for sanitary sewer systems greater than one mile in length are required to apply for coverage under the statewide general Waste Discharge Requirements (WDRs).

Generally, Order No. 2006-0003 requires that:

- In the event of an SSO, all feasible steps are taken to control the release volume and prevent it from entering a storm drain or creek.
- If an SSO occurs, it must be reported to the SWRCB using CIWQS.

Recommended Source Water Protection Activities

The City of Healdsburg developed a Sewer System Spill Response Plan in March 2009. Sonoma County Water Agency Operations (523-1070) is on the outside agency contact list to be notified of any spills.

The Sonoma County Water Agency (Water Agency) indicated that although notification for upstream sewage spills has occurred in the past, no spill notification was given during the reporting period. Once notified of a spill, the Water Agency considers time, volume and substance to consider potential impact on water supply. The Water Agency indicated that if a spill is significant, surface diversion may be secured until the spill passes.

It is recommended that the Water Agency contact the City of Healdsburg and the City of Cloverdale to remind them that the Water Agency would like to be notified of all sewage spills.

Vulnerability Assessment - High

Although no spills occurred in close proximity to Radial Collector Well 5 from 2013 to 2017, the potential for a hazardous materials spill or sanitary sewer overflow to impact source water quality in the future is high because there are a number of potential sources in the watershed. A large volume sewage spill or petroleum spill in the vicinity of Radial Collector Well 5 could impact water quality.

WINERIES

Background

Winery wastewater comes primarily from grape-crush, barrel-cleaning, and bottling operations. Some wineries send their process wastewater to a septic system, while others send their process wastewater to wastewater ponds. Larger wineries have on-site treatment systems. Generally, treated winery wastewater from on-site ponds or treatment systems is used as irrigation water to designated vineyards, pastures, or landscape irrigation areas through spray or drip irrigation. Treated process wastewater is never allowed to discharge to the Russian River.

If a winery sends their process wastewater to a septic system, then domestic wastewater must be sent to a separate septic system. A combined septic system receiving both process wastewater and domestic wastewater is not allowed. However, a combined leach field is allowed.

Seasonal Patterns

Although the harvest for wine grapes is usually August through early November, the type of grapes and weather can alter the harvest period. Other aspects of the operations such as blending, racking, and bottling occur other times of the year. Since each winery is different, there are no easily identifiable seasonal patterns associated with winery operations.

Related Constituents

Winery wastewater generally does not contain pesticides, chemicals, or fecal matter. One of the key concerns with winery wastewater is natural sugar in the grapes which dissolves easily in the water and is measured as Biochemical Oxygen Demand (BOD).

According to Regional Board staff, water quality downstream of wineries could be impacted if the facility over-irrigates with water from the process wastewater ponds. Other concerns with wineries are storm water runoff, sediment discharges due to erosion, and pesticide use.

It is important to note that wine grapes are typically irrigated using drip irrigation. Due to the nature of drip irrigation, drip irrigated lands do not generate runoff during the growing season when most fertilizers and pesticides are applied. Therefore, irrigation related pesticide or fertilizer transport is highly unlikely to occur.

Occurrence in Watershed

In order to enumerate the number of wineries within the study watershed, two databases were queried. The CIWQS database includes wineries which have enrolled

in either Order R1-2016-0002 or R1-2016-0003 (**Appendix B)**. More information on these orders is provided in the Regulation and Management Section. The Regional Board noted that since these are relatively new Orders, some wineries may not have enrolled yet, or are in the process of being enrolled. Therefore, the number of facilities listed in **Appendix B** is likely a lower estimate of the actual number of facilities. The Storm Water Multiple Application and Report Tracking System, (SMARTS) database includes wineries which were required to obtain a General Industrial Storm Water Permit, as shown in **Appendix C**. Wineries may have one or two permits, depending on their operational procedures. Overall, with the two databases combined, there are 54 wineries in the study watershed as shown in **Attachment A.**

It should be noted that there may be additional winery facilities within the study watershed. These may be smaller wineries (producing less than 1,500 gallons of process wastewater) or tasting rooms, which are both currently unregulated. In addition, there may be unpermitted wineries in the study watershed. Based on the process flow volume, the largest permitted wineries in the study watershed are shown in **Table 4-3.**

Table 4-3. Wineries in Study Watershed and Process Flow

Winery Name	City	Process flow, gpd
Asti Winery	Cloverdale	250,000
Fetzer Vineyards	Hopland	170,000
Francis Coppola	Geyserville	100,000
Kendall Jackson – Stonestreet Facility	Geyserville	70,000
Gallo of Sonoma Dry Creek Winery	Healdsburg	100,000

Related Water Quality Issues and Data Review

There are no direct discharges of process wastewater from wineries. Wineries can potentially impact Russian River water quality due to accidental spills of process wastewater and due to runoff of pesticides and sediment from vineyards (covered in the Agriculture – Crops section).

Regulation and Management

In 2016, the Regional Board approved Order R1-2016-0002 General Waste Discharge Requirements for Discharges of Wine, Beverage, and Food Processor Waste to Land. This order covers the discharge of wine, beverage and food processing waste to land. Order R1-2016-0003 is a Conditional Waiver for small facilities producing less than 1,500 gallons per day of process wastewater. Coverage under the conditional waiver also applies for wineries that produce 3,000 gpd or process wastewater or less, and produce no more than five gallons of wastewater for each gallon of wine produced annually.

Previously, the Regional Board regulated such discharges under Order R1-2002-0012 General Waste Discharge Requirements for Discharges of Winery Waste to Land. Order R1-2016-0002 has effluent limitations for treated winery process wastewater prior to land application for irrigation for BOD, ammonia, nitrate, nitrite, sodium and chloride. The previous Order R1-2002-0012 had effluent limitation for BOD, total suspended solids and settable solids only. There are no effluent limitations for dischargers enrolled in R1-2016-0003.

Under both Order R1-2016-0002 and R1-2016-0003, the discharger is also required to submit a Technical Information Form which discloses information about the facility operation and the waste generated to the Regional Board.

Treated winery process water shall not be applied to the irrigation areas within 24 hours of a forecasted precipitation event with a greater than 50 percent probability of occurring, during a precipitation event, within 24 hours after a precipitation event of a ½ inch or more precipitation that results in a storm water discharge from the land application area, and when the land application area surface soil is saturated.

There are also specific requirements for treatment/holding ponds:

- The dissolved oxygen concentration in the ponds shall not be less than 1.0 mg/L at any time.
- A minimum freeboard, not less than 2 feet shall be maintained at all time.
- Ponds that are constructed or expanded shall be lined with either a relatively impermeable membrane or two feet of soil with a permeability of less than 10^{-6} centimeters per second.
- The ponds shall have sufficient capacity to accommodate wastewater flow, groundwater infiltration, and inflow in the collection system, and seasonal precipitation during the rainy season.

A query using the SWRCB's CIWQS database was conducted to check for violations for all 54 wineries. The only violation occurred at the Hartford Winery in Forestville when 133,000 gallons of process wastewater was released from a pond due to capacity on February 9, 2017.

In March 2000, Sonoma County's Vineyard Erosion and Sedimentation Control Ordinance (VESCO) required growers to submit erosion and sediment control plans for all new vineyards planned for slopes exceeding ten percent on highly erodible soils or 15 percent on all other soils. The ordinance also applies to replanting desired on slopes exceeding 15 percent on highly erodible soils or 30 percent on all other soils. VESCO is designed to protect water quality and conserve soil through the use of riparian setbacks, maximum slope allowed for vineyard planting, and other requirements.

Sonoma County also created an instruction manual "Land Steward's Guide to Vineyard and Orchard Erosion Control" in 2017 to help wineries comply with emerging stormwater runoff regulations.

Recommended Source Water Protection Activities

No source water protection activities are recommended at this time.

Vulnerability Assessment - Low

As wineries treat and reuse their process wastewater on-site, there is no impact to the Russian River from the processing of grapes into wine. Unauthorized discharges could potentially impact water quality in the vicinity of the discharge but would be unlikely to affect the water quality of Radial Collector Well 5.

MINES

Background

There are three types of mines occurring in Sonoma and Mendocino County: instream mining, terrace mining, and quarry mining. In-stream mining occurs within the banks of the watercourse, but never occurs in water. Usually in-stream extraction occurs from the gravel bars that have accumulated after winter storms. Terrace mining does not occur in the water channel itself, but just outside of the watercourse. A quarry is usually extraction from a hillside, and generally more removed from water.

Seasonal Patterns

The instream mining season is generally limited from June 1st to November 1st. Quarries may operate year-round but operations are generally low during the winter season, as quarries serve the construction industry, which slows during the winter.

Related Constituents

The main impact to water quality is sediment. A quarry is similar to a construction site, except that the time span for a quarry may be twenty to forty years.

Typical water quality concerns due to instream mining include discharge of loose decomposed rock and soil stockpiles, increase of fine sediment loads in the Russian River, soil discharge from disturbed slopes, and fuel and chemical discharges from vehicles, and storage and maintenance areas. Loose or unstable soil after skimming slopes can contribute silt and suspended solids to stormwater and to the river at higher flows.

Occurrence in Watershed

For the purpose of this report, the number of active mines within the study watershed will be discussed. Abandoned mines are not included and will not be discussed.

There were a number of mines listed the in previous watershed sanitary survey, but many of these mines were located downstream of Forestville, and are not tributary to surface water under the influence at Radial Collector Well 5.

Within Sonoma County, there is one active mine and one reclaimed mine as shown in **Table 4-4 and Attachment A.** These sites were confirmed by the Sonoma County Permit and Resource Management Department (Personal Communication, Robert Pennington, Sonoma County PRMD). According to the

Sonoma County PRMD, the demand for mining slows when development slows. Currently, it is not anticipated that mining will increase in Sonoma County.

In late 2010, the Sonoma County Board of Supervisors approved another instream mining project, allowing Syar Industries to remove gravel along a 6.5 mile stretch of river in the lower Alexander Valley outside of Geyserville. The Syar Alexander Valley Instream Mining Project is the first mining project of significance in the lower Alexander Valley in over 15 years. Although the mine has been approved it will need to meet conditions of compliance by March 2020 or the approval will expire. Conditions of compliance are obtaining necessary permits, paying road fees, and establishing certain operating hours.

As a side note, there are a number of former terrace pit sites upstream of Wohler Bridge. The Hanson pits and SYAR pits are in the process of being reclaimed or restored and will likely be connected to the Russian River within five years in order to provide additional habitat areas for endangered Steelhead. This work could involve substantial grading.

Within Mendocino County, there are five active mines as shown in **Table 4-5** and in **Attachment A.** These sites were confirmed by the Mendocino County Planning and Building Services. There is one additional mine, the Kunzler Terrace Mine located near the confluence of Ackerman Creek and the Russian River, near Ukiah. Although this mine was approved by the County of Mendocino, the operator has not started operation due to ongoing litigation. According to Mendocino County Planning and Building Services, the mines located in the Russian River watershed in Mendocino County are primarily quarries and terrace mines.

Table 4-4. Active Mines in Sonoma County as of September 2018

Mine Name	Mine ID	Mine Status	Primary Commodity	Mine Owner	Lead Agency	Type of Mining
Russian River Vested Bars	91-49-0028	Active	Sand and Gravel	Syar Industries	Sonoma County	Streambed or Gravel Bar Skimming
Russian River Geyersville Bars	91-49-0022	Inactive, Reclaimed	Sand and Gravel	Syar Industries	Sonoma County	Streambed or Gravel Bar Skimming

Table 4-5. Active Mines in Mendocino County as of September 2018

Mine Name	Primary Commodity	Mine Owner	Lead Agency	Type of Mining
Blue Ridge Rock Products	Stone	Mccutchan	Mendocino County	Quarry
Pieta Quarry	Sand and Gravel	Northern Aggregates	Mendocino County	Quarry
Ford Gravel Co	Sand and Gravel	Granite Construction Co.	Mendocino County	Streambed or Gravel Bar Skimming, Open Pit
Harris Quarry	Sand and Gravel	Northern Aggregates	Mendocino County	Open Pit
Redwood Valley Gravel Products	Sand and Gravel	Redwood Valley Gravel Products	Mendocino County	Streambed or Gravel Bar Skimming, Pitting

Related Water Quality Issues and Data Review

Mines in the study watershed can potentially increase sediment loading to the Russian River, although there have been no studies that document the contribution from mines. The Russian River is on the SWRCB's 303(d) list of impaired water bodies; however, the sediment total maximum daily load (TMDL) has not been developed. However, the Regional Board has an Implementation Policy and a work plan to control excess sediment using existing regulatory measures (Regional Board, 2008). This report contains actions that staff will take to control sediment to the Russian River and includes a section on gravel mines. The primary control measures

for gravel mines are to continue to use existing regulatory tools such as 401 Certifications and industrial stormwater permits.

As described in **Section 3**, turbidity levels in the Russian River at the diversion location are quite high, often exceeding 300 NTU. The highest levels are generally found during the wet season when Radial Collector Well 5 is often taken out of service because it has been classified as groundwater under the direct influence of surface water when flows exceed 5,000 cfs on the Russian River at Hacienda Bridge. During the times that Radial Collector Well 5 is in service, turbidity levels in the well are low with annual average values ranging from 0.01 to 0.06 NTU, with no exceedances above 2 NTU These data indicate that the various sources of sediment in the river, including mines, are not impacting turbidity levels in Radial Collector Well 5 during the periods that it is in use by the Water Agency.

Water quality samples may be required as part of a mine's mitigation monitoring plan, if specified. This may be a requirement for only certain mines.

Regulation and Management

Mining activities are regulated in Sonoma County by the County's Aggregate Resource Management Plan (ARM Plan) and at the State level by the Surface Mining and Reclamation Act.

The ARM Plan establishes specific adaptive management policies and methods that identify where mining can occur, and how the mining areas would be measured to ensure no long term degradation occurs. The ARM Plan relies on a "redline" method, which requires the establishment of baseline elevations below which mining cannot occur. Mining in subsequent years can only occur where there has been sufficient recharge above the baseline elevations. Annual monitoring of the Russian River has shown that the ARM Plan has been very effective at limiting mining to a sustainable yield and minimizing the potential for down cutting of the riverbed.

The Sonoma County Mining and Reclamation Ordinance list criteria that need to be met for surface and instream mining operations. Among the criteria are:

- Incorporation of best management practices to minimize storm water ponding, alterations to the natural drainage system, and siltation of adjacent or downstream watercourses.
- Protection of water quality by meeting all applicable water quality standards of the Regional Board and any other agency with authority for water discharges.
- Prevention of erosion and sedimentation by incorporating approved erosion control and stream bank protection measures. An erosion and sediment control plan must be prepared.

As required by the Surface Mining and Reclamation Act, both Sonoma and Mendocino Counties conduct annual inspection of mines. Primarily they are inspecting for erosion control.

Recommended Source Water Protection Activities

No recommended source water protection activities at this time.

Vulnerability Assessment - Medium

The closest mine to Radial Collector Well 5 is the Middle Reach Russian River Vested Bars. According to Sonoma County PRMD, this mine has not been operated in several years. The normal operation would occur during the dry season on accumulated gravel bars. The main water quality concern with regard to mines is an increase in sediment loading to the Russian River. As discussed previously, turbidity levels in Radial Collector Well 5 are consistently low, indicating that sediment is effectively removed by riverbank filtration.

AGRICULTURE

Background

There are a variety of agricultural-related activities within the watershed, including dairies, crops, and nurseries. The majority of the dairies in Sonoma County are located in the Laguna de Santa Rosa subwatershed of the Russian River.

General trends for the agricultural sector in Sonoma County are an increase in food processing, particularly organic food processing. In addition, there is pressure to convert timberland to non-timber uses, particularly vineyards, due to the increasing profitability of the wine industry. Most of this conversion is taking place in the northwest portion of the county.

Seasonal Patterns

Agricultural operations are most likely to impact source water quality during and after storms because runoff can carry manure, sediment, and pesticide residuals into surface waters.

Related Constituents

Dairies that confine animals in a confinement area generate large volumes of materials that can impact both groundwater and surface water. Examples of such materials include manure; water used for washing and cleaning pens; water used for washing animals; and storm water runoff from areas with manure, litter or bedding. Water from washing the cows before milking can pond and be a source of contamination if the pond were to overflow.

Animal manure and process water are typically high in nutrients such as nitrogen and phosphorus, other salts, bacteria and pathogens, and may also contain small amounts of metals, pesticides, and antibiotics.

Agricultural lands such as row crops, orchards, nurseries, and irrigated pasture have the potential to contribute to water quality problems through the over application of fertilizers and pesticides, erosion, pollutants in tailwater return flows, and removal of riparian vegetation.

It is important to note that wine grapes are irrigated using drip irrigation. Due to the nature of drip irrigation, drip irrigated lands do not generate runoff during the growing season when most fertilizers and pesticides are applied. The main concern is from overland flow during storm events which could transport pesticide and sediment contaminated runoff.

Occurrence in Watershed

Dairies

According to the Regional Board, there is one dairy, Bucher Farms, in the study watershed. Bucher Farms is located at 5285 Westside Road in Healdsburg, and the farm has 700 milking cows. Rancho Laguna Dairy and Ocean View Farms, located just outside of the study watershed (in the Laguna de Santa Rosa and Mark West subwatersheds), were converted to vineyards since the last 2013 Update.

Crops and Pesticide/Herbicide Use

The Sonoma County Crop Report produced by the Office of the Agricultural Commissioner reports that the highest acreage crop are field crops such as hay or oats. **Table 4-6** shows the largest crop types in Sonoma County by acreage from 2013 to 2017. There are also pears, plums, and walnuts grown in Sonoma County, with approximately less than 150 acres each.

Table 4-6. Major Crop Types in Sonoma County, by acreage, from 2013 to 2017

	Wine Grapes	Apples	Olives	Vegetables	Field Crops
2013	59,772	2,155	731	539	348,090
2014	58,280	2,320	422	535	344,796
2015	58,235	2,229	427	512	339,722
2016	60,009	2,193	381	482	341,195
2017	59,972	2,190	381	441	335,383

Attachment D shows the various crop types within the study watershed. This information was obtained by the Sonoma County Agricultural Commissioner. It should be noted that the field boundaries shown are the permitted boundaries by crop, not actual planted. As shown in **Attachment D**, the three crop types with the highest number of parcels are grapes for wine (vineyard) at 68 percent, then grapes (mixed with other use) at 11 percent, and olives at 10 percent.

Information on pesticide and herbicide use was obtained from the Sonoma County Agriculture Commissioners Office. The top five sites for the highest single pesticide (daily) use (in lbs.) in 2018 is shown in **Figure 4-1** by meridian range township section (MRTS) which is approximately 1 X 1 mile. Highest daily chemical usage is summarized in **Table 4-7.** All of the parcels in **Table 4-7** are growing wine grapes.

Table 4-7. Highest Single Daily Chemical Usage for Top 5 Sites in Watershed, 2018

Meridian Township Range Section	Site Name	Chemical	Highest Daily Usage in 2018 (lbs.)
M10N09W35	6580 Hwy 128	9,626	1-3-Dichloropropene
M10N09W33	18630 Hassett Lane	5,311	1-3-Dichloropropene
M08N09W03	10651 Eastside Road	4,796	Sulfur
M10N10W11	22810 Geyserville Ave.	3,551	1-3-Dichloropropene
M10N09W33	780 Lytton Station Road	2,123	Sulfur

An additional map of the top five sites based on total chemical usage in 2018 is shown in **Figure 4-2.** Three out of the five sites were also identified using the highest single use criteria. **Table 4-8** shows the total sum of chemicals applied in 2018, based on active ingredient of pounds applied, as well as identification of some of the individual chemicals with the highest usage.

Table 4-8. Highest Sum of Chemical Usage for Top 5 Sites in Watershed, 2018

Meridian Township Range Section	Site Name	Total pounds applied in 2018 (lbs.) of all chemicals	Chemicals in High Usage
M10N09W33	18630 Hassett Lane	22,198	1-3-dichloropropene and chloropicrin
M10N09W33	780 Lytton Station Road	21,273	Sulfur
M08N09W03	10651 Eastside Road	19,718	Sulfur and glyphosate
M09N09W07	2470 Dry Creek Road	15,409	Sulfur and triflumizole
M09N09W07	2525 Dry Creek Rd	14,570	Sulfur

Sulfur is used as a fungicide used to combat powdery mildew. Sulfur is oxidized by bacteria and becomes sulfate. 1-3-Dichloropropene is used as a soil fumigant and has a primary MCL of 0.0005 mg/L and a public health goal of 0.0002 mg/L. Glyphosate is an herbicide used to control weeds and has a primary MCL of 0.7 mg/L and a public health goal of 0.9 mg/L. There are no drinking water standards for chloropicrin and triflumizole.

M10.0N10.0W11

M10.0N09.0W35

M10.0N09.0W33

M08.0N09.0W03

RUSSIAN RIVER

DRY CREEK

RUSSIAN RIVER

Location Map

Sonoma County

MTRS

AI Pesticides - Single Use per Site*

Top Five - Single Use

Lowest Use

*Data Source: California Department of Pesticide Regulation, https://calpip.cdpr.ca.gov

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure 4-1 Active Ingredient (AI) Pesticides Single Use - 2018

0 0.5 1 2 Miles

Sonoma Water

N

M10.0N09.0W33

M09.0N09.0W07

M08.0N09.0W03

DRY CREEK

RUSSIAN RIVER

Location Map

Sonoma County

MTRS

AI Pesticides - Total Use per Site*

Top Five - Total Use

Lowest Use

*Data Source: California Department of Pesticide Regulation, https://calpip.cdpr.ca.gov

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure 4-2 Active Ingredient (AI) Pesticides Total Use - 2018

0 0.5 1 2 Miles

Sonoma Water

N

Related Water Quality Issues and Data Review

No VOCs or SOCs (including 1,3-dichloropropene and glyphosate) were detected at Collector 5 over the reporting period. Sulfur is the frequently used in large quantities on wine grapes; however, there are no current water quality concerns with sulfate.

Dairies can contribute fecal indicator bacteria and pathogens to the Russian River due to overland flow and pond overflow during storm events and poor management of manure piles.

Bucher Farms is required to collect water quality samples from their facility annually. Since the monitoring is collected as part of a group monitoring project with the Sonoma County Farm Bureau, the sample results are submitted blind and it is not possible to evaluate only the Bucher Farm data. The water quality sampling is required for the Dairy permits (see group monitoring language in the Monitoring and Reporting Program attachment to the GWDR R1-2012-0002 and Waiver R1-2012-0003).

Regulation and Management

Concentrated Animal Feeding Operations

Concentrated animal feeding operations within the study watershed are subject to the Regional Board's Order No. R1-2012-0001, General National Pollutant Discharge Elimination System (NPDES) CAG011001 for Concentrated Animal Feeding Operations within the North Coast Region. The permit covers discharges of process water from a pond to surface water, or discharge of bedding, manure, or process water to land or groundwater. It should be clarified that permitted discharges of wastewater to surface streams may occur only during 25-year, 24-hour or greater, storm events.

In other words, the production area shall be designed, constructed and operated to contain all manure, litter, and process wastewater generated from a 25-year, 24-hour storm event. If a storm is greater than this and precipitation causes an overflow of manure, litter or process water, this discharge is permitted. However, it is prohibited to discharge to the Russian River from May 15th through September 30th each year.

During the period of October 1 through May 14th, discharges shall not exceed one percent of the receiving water flow.

Additionally, all open surface liquid impoundments must have a depth marker which clearly indicates the minimum capacity necessary to contain all process water generated between applications, and the runoff, and precipitation of the 25-year, 24-hour rainfall event.

The Order also requires that each facility complete a Nutrient Management Plan (NMP), which is reviewed by Regional Board staff. The NMP shall ensure adequate storage of manure, litter, bedding, and process water, including procedures to ensure

proper operation and maintenance of the storage facilities. The NMP shall also ensure proper management of mortalities, and prevent direct contact of confined animals with waters of the U.S.

Monitoring of manure, litter, bedding, process water, and soil is required. Manure must be sampled annually for nitrogen and phosphorus, and soil analyzed a minimum of once every five years for phosphorus content.

The Order requires water quality monitoring at the point where discharge from the production area exits, but prior to contact with any receiving water. Samples shall be collected for pH, total nitrogen, nitrate as N, total ammonia as N, total kjeldahl nitrogen, total phosphorus as P, total dissolved solids, BOD, total suspended solids, fecal coliform and temperature. If the discharger has followed the requirement to contain all process wastewater and runoff generated by a 25-year, 24-hour storm then samples would seem to be necessary only for storms greater than the 25-year, 24-hour storm. Beginning October 1, 2012 the discharger shall conduct water course monitoring at watercourses that flow through the dairy property at the point where the watercourse leaves the property for at least three storms exceeding 1 inch of rain. Samples shall be collected for total suspended solids, ammonia-nitrogen, total nitrogen, total phosphorus, specific conductance, pH and temperature.

Recommended Source Water Protection Activities

There are no recommended source water protection activities at this time.

Vulnerability Assessment – Low/Medium

A significant portion of the land use in the study watershed is permitted as agriculture, and the majority of the crops are wine grapes. Due to the proximity of the wine grape crops to the Russian River, there may be an impact to water quality from the use of pesticides/herbicides and erosion.. However, there were no pesticides/herbicides detected at Radial Collector Well 5. As stated earlier in the Mines section, turbidities are also low at Radial Collector Well 5, indicating that vineyards are also not impacting turbidity levels in Radial Collector Well 5. Therefore, there is no evidence from the monitoring conducted at Radial Collector Well 5 that croplands and vineyards are impacting water quality.

There is currently only one dairy in the study watershed, however it is a large facility based on the number of animals. Dairies could potentially have a significant impact on water quality during an extreme flood event. Ponds holding process wastewater could overflow, manure and bedding could be washed away, as well as other unauthorized discharges.

RECREATION

Background

There are a number of recreational uses in the study watershed such as boating, camping, picnicking, hiking, fishing, mountain biking, and equestrian trails. Source water quality may be impacted from body contact recreation such as swimming, waterskiing, and use of personal watercraft.

Seasonal Patterns

All of the recreational uses occur year-round, although body contact recreation occurs primarily from Memorial Day to Labor Day weekend.

Related Constituents

Body contact recreation in general has long been known to be a source of pathogen contamination, resulting partly from personal sanitary conduct and partly from a natural shedding process. Pathogens shed by recreationalists include bacteria, viruses, and protozoa. Moreover, because their origin is human, microorganisms shed by recreationalists are transmittable to other humans.

Occurrence in Watershed

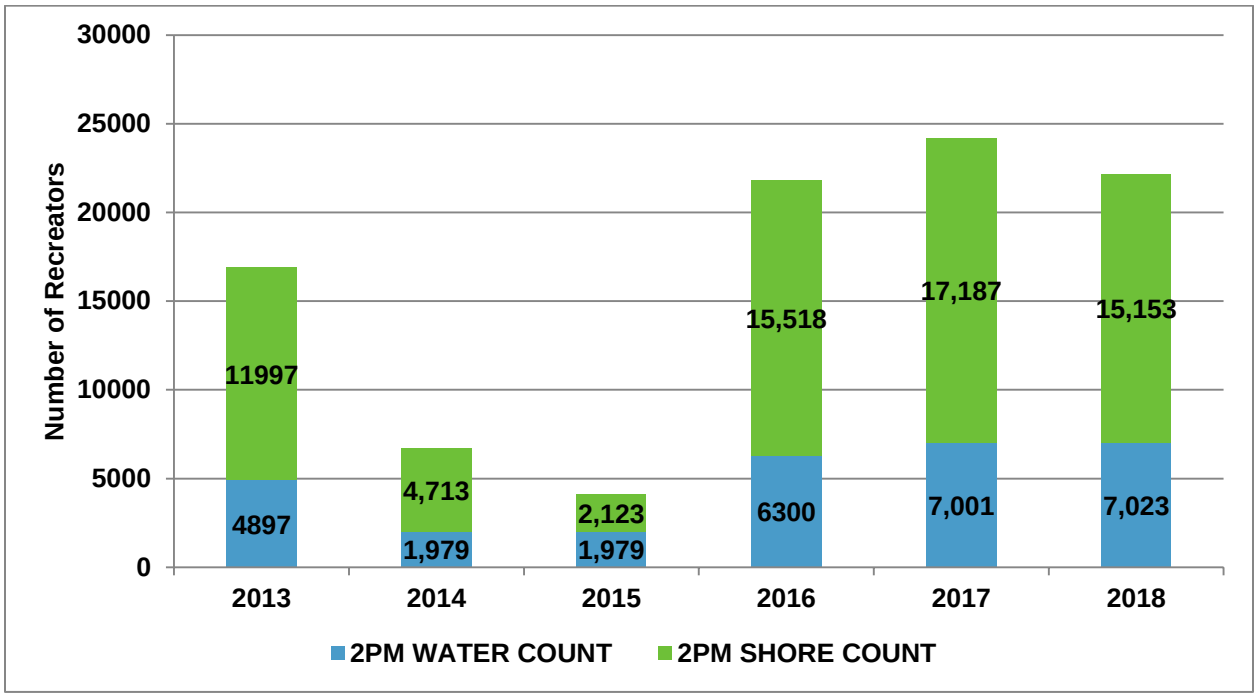
Russian River

According to Sonoma County Regional Parks, the primary swimming areas are Veteran's Memorial Beach in Healdsburg, Riverfront Regional Park, Camp Rose and Del Rio Woods Beach. However, swimming can be at many points along the river during warm weather.

The Sonoma County Regional Parks counts the number of persons in the water and on shore at Veterans Memorial Beach on weekends at 2pm from Memorial Day to Labor Day. As shown in **Figure 4-3** in 2018, the water count over the summer season was 7,023 persons and the shore count was 15,153 persons. The majority of recreators were present during the month of July. According to Sonoma County Regional Parks, the number of recreators was low in 2014 and 2015 due to low level in the river.

Boat launches for small craft are available at Wohler Bridge from October 1 through May 15th and also at Cloverdale River Park. Kayaking tours are also conducted from Alexander Valley to Healdsburg, and from Memorial Beach to Wohler Bridge.

Figure 4-3. Number of Shore and In-Water Recreators at Veteran's Memorial Beach in Healdsburg, 2013-2018



Sonoma County Regional Parks is currently developing a Master Plan for the Veteran's Memorial Beach. Plans are preliminary and open to a public process. Currently, the plans include improving Russian River access for paddle craft launching, providing additional family-centered amenities, connecting restroom to sewer system, and planting vegetated swales to capture and reduce parking lot runoff.

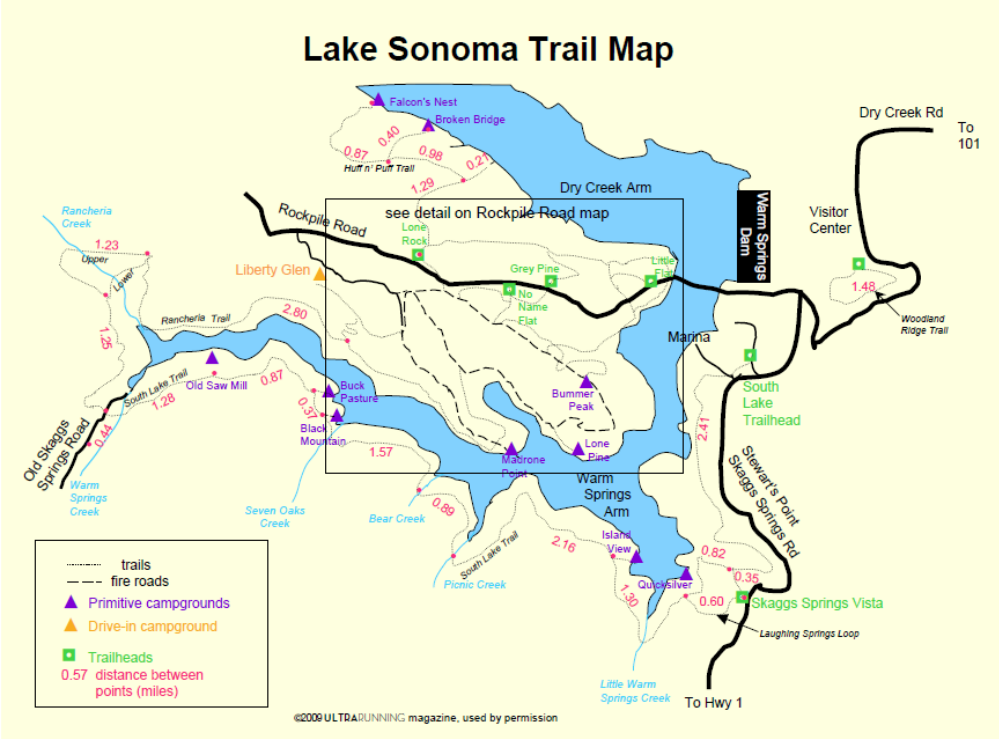
Lake Sonoma

Recreational uses at Lake Sonoma include boating, swimming, fishing, camping, hiking, biking, and horseback riding trails. Lake Sonoma has 115 primitive campsites and two group-use campsites which are all only accessible by boat or hiking trail. The primitive campsites have chemical vault toilets but no potable water. All of the campsites located in the Dry Creek Arm are boat-in only sites. Campsites located in the Warm Springs Arm are either boat-in or hike-in. The only drive-in campground is Liberty Glen campground, located on a ridge above the Warm Springs Arm of the lake as shown in **Figure 4-4.** The Liberty Glen campground has 97 campsites for RV's and tent campers. There are restrooms, showers, potable water but no RV hookups.

The Lake Sonoma Marina has a boat ramp, full service marina, approximately 250 boat slips, boat rentals and a store. There are pumpout facilities and gasoline at the marina. Several areas on the lake are designated for waterskiing and some areas are no wake. The designated swim beach is at Yorty Creek on the north side of Lake

Sonoma. Swimming also occurs near the Public Boat Ramp. The Army Core of Engineers does not count the number of swimmers or boaters in Lake Sonoma.

Figure 4-4. Recreational Sites at Lake Sonoma



Related Water Quality Issues and Data Review

The Sonoma County Department of Health Services, in cooperation with the North Coast Regional Water Quality Control Board and the Sonoma County Water Agency, monitors bacterial levels in the water at beaches on the Russian River. Sampling is conducted regularly between Memorial Day and Labor Day. *E. coli* data for Cloverdale River Park Beach, Camp Rose Beach, and Healdsburg's Veterans Memorial Beach from 2013 to 2017 is shown in **Figure 4-5** and **Table 4-9**. **Figure 4-5** shows that *E. coli* levels at the Healdsburg Veterans' Memorial Beach are normally higher than the Cloverdale Beach Park and at the Camp Rose Beach. The *E. coli* median from 2013 to 2017 at the Healdsburg Veterans Memorial Beach was 52 MPN/100mL.

Figure 4-5. *E. coli* Beach Monitoring Data from 2013 to 2017

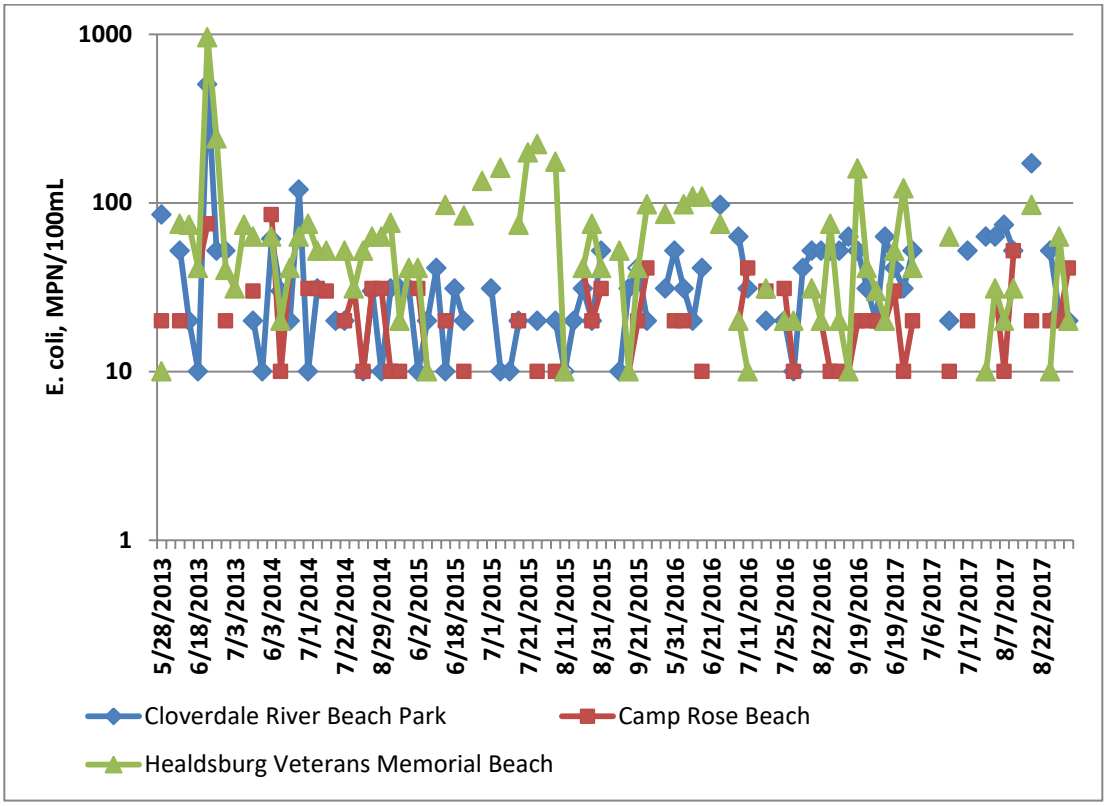


Table 4-9. *E. coli* Beach Monitoring Data from 2013 to 2017, MPN/100mL

	Range	Median
Cloverdale Beach Park	<10 - 504	31
Camp Rose Beach	<10 - 85	20
Healdsburg Memorial Beach	< 10 - 959	52

As described in **Section 3**, fecal indicator bacteria levels in the Russian River at the diversion location can be quite high, with levels exceeding 1500 MPN/100mL. However, it is important to note that the highest *E. coli* levels at the diversion location are during the winter and are associated with runoff, not recreation. *E. coli* levels in the summer season at the diversion location are low. Additionally, *Cryptosporidium* monitoring at the diversion location conducted by the Water Agency did not detect any *Cryptosporidium* from July 2016 to June 2018. These data indicate that the various sources of fecal indicator bacteria and human pathogens in the watershed, associated with recreational use, are not impacting the microbial quality of source water at the diversion location and at Radial Collector Well 5.

Regulation and Management

The US Army Core of Engineers manages recreation at Lake Sonoma, with the exception of the Lake Sonoma Marina which is operated by a private concessionaire.

Recommended Source Water Protection Activities

No recommended source water protection activities at this time.

Vulnerability Assessment - Low

This assessment indicates the vulnerability for source water quality impacts due to recreation is low. As stated above, *E. coli* levels in the summer season at the diversion location are low. Additionally, *Cryptosporidium* monitoring at the diversion location conducted by the Water Agency did not detect any *Cryptosporidium* from July 2016 to June 2018.

URBAN RUNOFF

Background

Urban runoff (URO) is a concern in the study area as there are urbanized areas in the watershed, particularly the cities of Ukiah, Cloverdale and Healdsburg.

Seasonal Patterns

URO occurs on a year-round basis and includes wet and dry weather discharges. Wet weather runoff results from seasonal storms. Wet weather runoff is of relatively short duration and can have highly variable pollutant concentrations. Because of the high degree of imperviousness, urban areas typically generate higher per acre volumes of runoff than undeveloped or agricultural lands. Dry weather runoff results from activities such as lawn irrigation and car washing.

Related Constituents

Data on urban runoff discharges indicate that the runoff is turbid, a source of total organic carbon (TOC), a source of bacteria, a source of nutrients, and a source of other constituents such as pesticides and organic compounds. Generally, the impact is greater during the wet season, immediately following a first-flush event.

Occurrence in Watershed

Municipalities are required to obtain Municipal Separate Storm Sewer Systems (MS4s) Permits which regulate storm water discharges. MS4 permits are issued by Regional Water Quality Control Boards and are usually issued to a group of co-permittees encompassing an entire metropolitan area. Sonoma County has two major watersheds, one regulated by the North Coast Regional Water Quality Control Board, and one by the San Francisco Bay Regional Water Quality Control Board.

For the study watershed, there is one Phase I MS4 permit, Order R1-2015-0030. This permit regulates the discharge of pollutants from the City of Santa Rosa, portions of unincorporated County of Sonoma, Sonoma County Water Agency, the City of Cotati, the City of Cloverdale, the City of Healdsburg, the City of Rohnert Park, the City of Sebastopol, the City of Ukiah and the Town of Windsor. However, the only MS4 areas within the study watershed are the City of Healdsburg, the City of Cloverdale, and portions of unincorporated County of Sonoma and Sonoma County Water Agency.

The MS4 permit requires the discharger to develop and implement a Storm Water Management Program with the goal of reducing the discharge of pollutants to the maximum extent practicable..

Over half of the urban area for the City of Healdsburg falls within the drainage area of Foss Creek. Foss Creek empties into a channel known as West Slough, which then runs south approximately 7,000 feet to its confluence with Dry Creek. The City of Healdsburg operates two off-stream hydraulic detention basins. Water from Foss Creek enters each of the detention basins after the water level in the creek overtops a weir, controlling the peak flows that have historically caused flooding in the City's downtown area. With minor exceptions, all other areas of the City drain directly to the Russian River. Most of the commercial and industrial areas are clustered along the west and southern portions of the City.

The SWRCB's Stormwater Multiple Application and Report Tracking System (SMARTS) database was also queried, and within the study watershed, there were 73 industrial facilities which are covered under the SWRCB General Industrial Activities Storm Water Permit as shown in **Table 4-10.** Of interest, is the increase in the number of industries in the Ukiah area. Facilities covered under the General Construction Activity Storm Water Permit were researched but not compiled, as the construction sites are constantly changing from year to year.

Table 4-10. Industries Covered under State Water Resources Control Board General Industrial Activities Storm Water Permit

Facility Name	Facility Address	City
All Coast Forest Product	250 Asti Rd	Cloverdale
Asti Winery (Winery Waste)	26150 Asti Road	Cloverdale
Asti Remanufacturing Plant	26800 Asti Road	Cloverdale
Bear Republic Brewing Company	110 Sandholm Lane	Cloverdale
Fritz Winery	24691 Dutcher Creek Rd	Cloverdale
MGM Brakes Assembly Plant	1184 Cloverdale	Cloverdale
Nu Forest Products	280 Asti Road	Cloverdale
Redwood Empire	31401 Mccray Rd	Cloverdale
Reuser Inc	370 Santana Dr	Cloverdale
Sonoma Forest Products	27420 Asti Road	Cloverdale
Clos Du Bois Winery	19410 Geyserville Road	Geyserville
Dutcher Crossing Winery	8533 Dry Creek Road	Geyserville
Francis Coppola Winery	300 Via Archimedes	Geyserville
Foley Sonoma Winery	5110 Highway 128	Geyserville
J. Pedroncelli Winery	1220 Canyon Road	Geyserville
Kendall Jackson Vinwood Cellars, Inc.	18700 Geyserville Road	Geyserville
Rack and Riddle Custom Wine Services	4001 Highway 128	Geyserville

Virginia Dare Winery	22281 Chianti Road	Geyserville
Acorn Alegria Winery	PO Box 2061	Healdsburg
AVV Winery	8644 Hwy 128	Healdsburg
Chalk Hill Winery	10300 Chalk Hill Rd	Healdsburg
E. and J. Gallo Winery	3387 Dry Creek Road	Healdsburg
Geyser Peak Winery	2306 Magnolia Drive	Healdsburg
Hafner Vineyard	4280 Pine Flat Road	Healdsburg
Healdsburg Transfer Station	166 Alexander Valley Rd	Healdsburg
J Vineyards and Winery	11447 Old Redwood Hwy	Healdsburg
Klein Food	11455 Old Redwood Hwy	Healdsburg
Lambert Bridge Winery	4085 W Dry Creek Rd	Healdsburg
Lytton Springs Winery	650 Lytton Springs Rd	Healdsburg
Mazzocco Vineyards Inc.	1400 Lytton Springs Road	Healdsburg
Moore Lane Barrel Warehouse	451 Moore Lane	Healdsburg
Nu Forest Product	164 Healdsburg Ave	Healdsburg
Opperman Son Inc.	280 Kinley Dr	Healdsburg
Pezzi King Vineyards	3225 West Dry Creek	Healdsburg
Preston Vineyards	9206 W Dry Creek Rd	Healdsburg
Quaker Hill Development Corp.	16977 Healdsburg Ave	Healdsburg
Quivira Vineyards	4900 West Dry Creek Rd	Healdsburg
Rack Riddle Custom Wine Services	499 Moore Lane	Healdsburg
Rochioli Winery	6192 Westside Rd	Healdsburg
Simi Winery	16275 Healdsburg Ave	Healdsburg
Stonestreet Winery	7111 Highway 128	Healdsburg
Syar Industries	13666 Healdsburg Ave	Healdsburg
Verite Winery	4611 Thomas Rd	Healdsburg
Westec Tank Equipment	1402 Grove St	Healdsburg
Williams Selyem LLC	7227 Westside Rd	Healdsburg
Blue Ridge Quarry	2491 Geysers Road	Hopland
Fetzer Vineyards Hopland Winery	12901 Old River Road	Hopland
JEF Vineyards	11684 S. Highway 101	Hopland
Vintage Wine Estates	13300 Buckman Dr	Hopland
Waterfowl Winery	14100 Mountain House Rd	Hopland
BCI Coca Cola Bottling Co	650 Babcock Lane	Ukiah
C & S Waste Solutions Inc	3515 Taylor Drive	Ukiah
City of Ukiah	300 Plant Road	Ukiah
Coast Wood Preserving	3150 Taylor Dr	Ukiah
Cold Creek Compost Inc.	6000 Potter Valley Rd	Ukiah
Eel River Fuels Inc	3371 N State St	Ukiah
Empire Waste Management	450 Orr Springs Rd	Ukiah
Gobbi Street Facility	751 E Gobbi Street	Ukiah

Maverick Enterprises Inc	650 Ford Road	Ukiah
McNab Winery	2350 McNab Ranch Road	Ukiah
MFP Ukiah Sawmill	850 Kunzler Ranch Rd	Ukiah
Nor Cal Recycled Rock Agg	900 Talmage Rd	Ukiah
North State Street Facility	4201 N State St	Ukiah
Pacific Recycling Solutions	4230 N State St	Ukiah
Redwood Coast Fuels	50 W Lake Mendocino Dr.	Ukiah
Retech Systems LLC	100 Henry Station Rd	Ukiah
RW Murray Inc A to Z Construction	4300 North State Street	Ukiah
Solid Wastes Systems	3151 Taylor Dr.	Ukiah
Ukiah Auto Dismantlers	500 Pinoleville Rd	Ukiah
Ukiah City Municipal Airport	1403 S State St	Ukiah
Ukiah Unified School District	710 Maple Ave	Ukiah
UPS Ukiah	291 Cherry St	Ukiah
York Ranch Landfill	Pomo Rd.	Ukiah

Related Water Quality Issues and Data Review

There are no data on the quality of urban runoff discharged from Healdsburg, Cloverdale, and Ukiah but the impacts on the Russian River at the diversion location are likely minor to non- existent due to the distance between the discharges and the diversion location. As described previously, there is no evidence that contaminant sources in the study watershed are impacting the microbial quality or turbidity levels in Radial Collector Well 5.

Although stormwater monitoring is conducted under the Phase I MS4 Municipal permit for the Water Agency, Sonoma County, and the City of Santa Rosa, it is not relevant as the monitoring locations are not in the study area for this report.

Regulation and Management

State Water Resources Control Board

The Clean Water Act requires the SWRCB and the Regional Boards to regulate the discharge of stormwater from a number of sources. For Phase I, these sources included large (populations greater than 250,000) and medium (population from 100,000 to 250,000) sized municipalities, most industrial sites, and construction activities of one acre or more.

For Phase II, the SWRCB adopted a General Permit for the discharge of stormwater from small MS4s to provide permit coverage for smaller municipalities and non-traditional MS4s, such as military bases, public campuses, and prison and hospital complexes. The Small MS4 Permit regulates storm water discharges from municipalities that serve populations of less than 100,000 persons.

Stormwater discharges are regulated on a statewide and regional basis. The SWRCB issued two General Permits (General Industrial Activities Storm Water Permit and the General Construction Activity Storm Water Permit) to address most of the industrial facilities and construction sites within California. The North Coast Regional Board has also adopted individual stormwater permits for some facilities within their region. The Regional Boards administer the State's General Permits and the Regional Board's individual permits.

As mentioned earlier, the SWRCB has issued two general permits. Dischargers whose projects disturb more than one acre of soil or whose projects disturb less than one acre, but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity. Construction activities subject to this permit include clearing, grading, and disturbances to the ground such as stockpiling or excavation.

The Statewide General Permit for Storm Water Discharges Associated with Industrial Activities, Order 2014-0057-DWQ (Industrial General Permit or IGP) implements the federally required storm water regulations in California for storm water associated with industrial activities discharging to waters of the United States. The Industrial General Permit is a NPDES permit that regulates discharges associated with 10 broad categories of industrial activities. The Industrial General Permit requires the implementation of management measures that will achieve the performance standard of best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT). The Industrial General Permit also requires the development of a Storm Water Pollution Prevention Plan (SWPPP) and a monitoring plan. Through the SWPPP, sources of pollutants are identified, and the means to manage the sources to reduce stormwater pollution are described. The General Industrial Permit requires that an annual report be submitted each July 1.

Source Water Protection Activities

The City of Healdsburg is required to have a storm water management plan which details the City's proposed actions for each of the six required plan components on: public education and outreach, public involvement/participation, illicit discharge detection and elimination, construction activities, post-construction storm water management, and good housekeeping for municipal operations.

Some specific activities conducted by the City of Healdsburg related to storm water management are street sweeping at least once a week, annual employee training on storm water quality, and inspection of restaurants, automotive service facilities, and gasoline stations. City staff also do not apply herbicides during the rainy season, and do not allow irrigation runoff from fertilized turf areas. The Water Agency's Flood Control and Stream Maintenance program has easements to maintain hydraulic capacity and promote riparian habitat health for approximately 100 miles of modified and natural stream channels and 75 miles of engineered flood channels. Usually, ten

miles of stream are maintained every summer. Sediment and garbage is removed, as well as planting trees and bank stabilization projects.

The Water Agency is also part of the Russian River Watershed Association (RRWA) which is a coalition of nine cities, counties and special districts in the Russian River watershed that was formed in 2003. The RRWA works to promote cooperation and implementation of projects that protect watershed resources, restore fisheries and improve water quality at reduced costs. The RRWA developed a Storm Water Resources Plan in July 2018. The main goals of the plan are to identify and prioritize storm water and dry weather capture projects. The RRWA identified 42 potential projects; however, project implementation is driven by the ability to secure grant funding.

Recommended Source Water Protection Activities

There are no recommended source water protection activities at this time.

Vulnerability Assessment - Low

Approximately eight percent of the study watershed is classified under urban land uses, while the majority of the land use is comprised of open space and agricultural uses. Additionally, the cities of Healdsburg, Cloverdale and Ukiah have storm water management plans and best management practices in place to reduce pollutants from entering into the storm drain system. Therefore, urban runoff is a low risk PCS.

WASTEWATER

Background

Various types of wastewater facilities, such as wastewater treatment plants, wastewater ponds, and septic systems will be discussed in this section.

Wastewater is known to contain pathogenic microorganisms. Wastewater treatment plants remove and/or inactivate some, though not all, of these organisms through various treatment processes. Secondary treatment of domestic sewage is expected to remove 75 to 99 percent of enteric viruses (National Research Council, 1998), 85 to 99 percent of heterotrophic bacteria, and 92 percent of *Giardia* cysts (Chauret, 1999).

Seasonal Patterns

The three wastewater treatment plants (WWTPs) in the study watershed which are permitted to discharge to the Russian River are the City of Ukiah's WWTP, the City of Cloverdale's WWTP, and the City of Healdsburg's WWTP. Although the WWTPs are operated year-round, discharge of tertiary treated wastewater to the Russian River is not allowed from May 15th to September 30th of every year. From October 1 to May 14th, discharge is limited to one percent of the flow in the Russian River. Discharge of secondary treated wastewater is never allowed to the Russian River. These sites are also shown in the Potential Sources of Contamination Map, **Attachment A.**

Related Constituents

Wastewater is a blend of sewage, washwater from showers, kitchens, etc., and any effluent from industrial facilities within the sewer collection system. Potential contaminants of concern in wastewater include microbial pathogens (such as bacteria, viruses, and protozoa), TOC, nutrients, VOCs, and SOCs. Septic tank effluent typically contains high concentrations of TDS, chlorides, phosphates, nitrates, bacteria, and viruses.

Occurrence in Watershed

Wastewater Treatment Plants which discharge to Russian River

City of Ukiah

The City of Ukiah WWTP is located at 300 Plant Road in Ukiah, California. The facility produces disinfected secondary effluent for discharge to three percolation ponds and disinfected, dechlorinated tertiary treated effluent for direct discharge to the Russian River. The City of Ukiah discharges to the percolation ponds year-round, but is allowed to discharge tertiary treated effluent to the Russian River during the wet season from October 1 to May 14th. The facility treats wastewater from the City of

Ukiah and the Ukiah Valley Sanitation District (UVSD), serving a population of approximately 21,059. The flow is comprised of 72 percent residential and 28 percent commercial/business. Leachate from the City of Ukiah's municipal landfill is discharged to the WWTP.

The facility is designed to provide secondary treatment for an average daily dry weather flow of 3.01 million gallons per day (MGD) and the peak daily wet weather flow of 24.5 MGD. The treatment system consists of an influent wet well, bar screens, aerated grit removal, primary clarifiers, trickling filters, aerated solids contact tank, secondary clarifiers, and a chlorine contactor. It also has a peak wet weather flow of 7.0 MGD of advanced treated wastewater. The advanced treatment system consists of primary sedimentation, trickling filters, secondary sedimentation, coagulation, multi-media filtration, chlorination, and dechlorination.

During an inspection with the Regional Board in 2017, the City of Ukiah staff indicated that the WWTP is at risk of exceeding the capacity of its effluent storage ponds during the discharge season and has requested an increase in discharge ratio from 1 to 5 percent of the Russian River. However, the City has not provided an official request.

The City of Ukiah has plans to construct a recycled water system to reduce discharge to the Russian River. Recycled water will be provided for landscape irrigation, agricultural irrigation, and frost protection. Construction began in spring 2018 and is expected to be complete by Spring 2019.

City of Cloverdale

The City of Cloverdale WWTP is located at 700 Asti Road in Cloverdale, California. The facility discharges disinfected, secondary wastewater via seven percolation/evaporation ponds, with a combined capacity of 35 million gallons, located on the west bank of the Russian River. Although the facility is permitted to discharge to the Russian River, the discharge must be tertiary treated. Currently, the facility does not have advanced wastewater treatment and is therefore prohibited to discharge to the Russian River. However, the facility has sufficient percolation capacity for disposal of its treated wastewater year-round. Wastewater is received from approximately 3,000 connections, primarily residential, serving a population of approximately 8,800 people and commercial/industrial dischargers.

The facility is designed to provide secondary treatment for an average dry weather flow of 1.0 MGD and a peak daily wet weather flow of 8.25 MGD. The current treatment system is a series of three ponds; Pond No. 1 is a 2.8 million gallon primary aeration pond equipped with a Parkson Biolac extended aeration system, Pond No. 2 is a secondary aeration pond equipped with six aerators, and Pond No. 3 is a settling/polishing pond which allows the suspended solids to settle at the bottom of the pond. The treated wastewater is chlorinated prior to disposal to one of seven percolation ponds.

The City of Cloverdale has identified a number of potential improvements, including installation of advanced treatment facilities and implementation of a recycled water distribution system. However, the City of Cloverdale is not planning to incorporate either of these upgrades, as they are not needed to address capacity or operational issues.

City of Healdsburg

The City of Healdsburg Water Reclamation Facility is located at 340 Foreman Lane in Healdsburg, California. The facility discharges tertiary wastewater to Basalt Pond, which is physically connected to the Russian River.

The facility provides sewerage service to a population of approximately 12,200, which is approximately 90 percent residential and 10 percent combined commercial, industrial, and municipal flows. The City of Healdsburg upgraded its treatment plant from a pond- based secondary treatment process to a tertiary facility which went on-line in April 2008.

The facility is designed to provide tertiary treatment for an average dry weather flow of 1.4 MGD and a peak daily wet weather flow of 4.0 MGD. The current treatment system consists of influent screening, grit removal, extended aeration with biological nutrient removal, microfiltration through hollow membrane fibers (membrane bioreactor), and ultraviolet (UV) light disinfection.

Discharges to the Russian River and its tributaries are prohibited from May 15 through September 30th. As the facility currently discharges year-round to the Basalt Pond, a cease and desist order R1-2010-0035 was adopted by the Regional Board in June 2010. According to this order, the facility must comply with the seasonal discharge prohibition by September 30, 2015 or face penalties. The compliance schedule for the seasonal discharge prohibition has been extended in response to letters submitted by the City of Healdsburg, which explained that plans to recycle 100 percent of the tertiary effluent have been delayed due to economic downturn in 2008, lack of funding and staff turnover. The Regional Board granted an extension to comply with the seasonal discharge from September 30, 2014 to September 30, 2019.

Since the 2013 Update, the City of Healdsburg has constructed major improvements to its recycled water system, including installation of 11,000 feet of recycled water pipeline for vineyard irrigation of up to 600 acres, 25 million gallon recycled water storage pond with synthetic liner, construction of the Dry Creek Bridge, and construction of two filling stations for the trucked recycled water program. The City is continuing to expand its recycled water infrastructure to cease discharge to Basalt Pond.

Wastewater Treatment Plants which discharge to Land

Table 4-11 lists the municipal facilities which hold Waste Discharge Requirements (WDRs) for wastewater disposal within the study watershed, and **Table 4-12** lists the private facilities which hold WDRs for wastewater disposal within the study watershed

Table 4-11. Waste Discharge Requirements Permits in the Study Watershed for Wastewater, Municipal Facilities

	Permit No.	Capacity (gpd)	Treatment Type/Disposal Method
Calpella County Water District	86-16	40,000	Aerated pond treatment, disinfection and percolation disposal
Hopland Public Utility District	R1-2008-0003	90,000	Aerated pond treatment, disinfection and percolation disposal
Geyserville Sanitation Zone	97-67	92,000	Aerated pond treatment, disinfection and percolation disposal

Table 4-12. Waste Discharge Requirements Permits in the Study Watershed for Wastewater, Private Facilities

Facility Name	Permit No.	Capacity (gpd)	Treatment Type/Disposal Method
El Gallo Winery (Healdsburg)	R1-2012-0099 (waiver)	3,060	Conventional septic tank/leachfield system
Virginia Dare Winery (Geyserville)	R1-2017-0013	10,000	Aerated process pond treatment
Coppola Winery(Geyserville)	97-10-DWQ	12,000	Aerobic pretreatment, disinfection, subsurface drip irrigation
Jordan Vineyard (Healdsburg)	97-10-DWQ	3,500	Aerobic pretreatment and mound disposal

Rio Lindo Academy (Healdsburg)	87-094	75,000	Solids separation with Evap/Perc ponds
Lytton Springs Rehab Facility	97-10-DWQ	11,000	Aerated pond, disinfection, spray irrigation

Septic Systems

The Sonoma County Permit and Resource Management Department estimates that there are 45,000 residential septic systems in all of Sonoma County. Within the study watershed, septic systems exist in residential areas outside of the sanitation zones covered by the wastewater treatment plants discussed above.

Related Water Quality Issues and Data Review

Failing or poorly sited septic systems, leaking sewer lines, and wastewater discharges are potential sources of fecal indicator bacteria and human pathogens in the Russian River watershed. As discussed in the 2013 Update, the Regional Board is developing a pathogen TMDL for the Russian River. A number of water quality studies were undertaken, such as DNA tracing to identify sources of fecal waste throughout the watershed. The study found that human and grazer waste are entering the Russian River at locations throughout the middle and lower portions of the watershed. Specifically, the highest matches of human waste were found in Guerneville and the highest matches of grazer waste were found in the Laguna de Santa Rosa watershed. DNA matches for bird fecal waste was evenly distributed throughout the watershed.

The Regional Board also evaluated fecal indicator data based on different land cover types and during both wet and dry periods. It was found that *E. coli* was most strongly associated with unsewered developed areas and shrubland during both wet and dry seasons. The Regional Board is now looking at septic systems as a contributory source of human waste which occurs year-round.

Regulation and Management

Wastewater Treatment Plants

Each of the wastewater treatment plants discussed above has Waste Discharge Requirements which contain effluent limitations for the treated discharge. The following paragraphs will discuss effluent limitations and any violations of those limitations for each WWTP.

The Ukiah WWTP was issued a new NPDES permit No. CA0022888 (Order No. R1-2018-0035) in September 2018. As in the previous Order (R1-2012-0068), the Ukiah WWTP must meet effluent limitations as specified for discharge to the Russian River which include limitations for BOD5, total suspended solids, pH, cyanide, 2,3,7,8-TCDD, copper, dichlorobromomethane, chlorine, nitrate as N, and ammonia. An effluent limitation for total coliform at 2.2 MPN/100mL was also added in the recent 2018 permit. Effluent limitations for discharge to the evaporation/percolation ponds are less stringent and are only for BOD5, total suspended solids, and pH. Effluent limitations for total coliform at 23 MPN/100mL were also added for the discharge to the evaporation/percolation ponds in the recent 2018 permit. The new permit also includes effluent limitations for recycled water for BOD5, total suspended solids, total coliform and pH. The Regional Board has taken a number of enforcement actions against the City of Ukiah over the reporting period. In regards to water quality, two Administrative Civil Liability (ACL) Complaints were filed.

In October 2014, ACL Complaint No. R1-2014-0058 assessed a $51,000 penalty for 17 violations of effluent limitations for acute toxicity, copper, cyanide, and dichlorobromomethane. Six additional effluent violations were found and the penalty was increased to $63,000. In June 2017, ACL Complaint No. R1-2017-0030 assessed a $33,000 penalty for 40 violations of effluent limitations for ammonia, nitrate, dichlorobromomethane and copper.

The Cloverdale WWTP was issued a new NPDES permit No. CA0022977 (Order No. R1-2018-0034) in September 2018. As required in the previous Order R1-2012-0048, the Cloverdale WWTP must meet effluent limitations for discharge to the Russian River which include limitations for BOD5, total suspended solids, pH, total coliforms, total residual chlorine, total copper, total ammonia, chlorodibromomethane,and dichlorobromomethane. There are also limitations set for discharge to the evaporation/percolation ponds. However, these limitations are less stringent and are only for BOD5, total suspended solids, pH and total coliform.

The only violation noted occurred in January 2016, as the WWTP did not achieve a minimum TSS percent reduction of 85 percent; it only achieved 81 percent.

The Healdsburg WWTP was issued a new NPDES permit No. CA0022888 (Order No. R1-2016-0015) in June 2016. As in the previous Order (R1-2010-0034), the Healdsburg WWTP must meet effluent limitations for discharge to the Basalt Pond which include limitations for BOD5, total suspended solids, pH, total coliforms, and copper. A Cease and Desist Order (CDO) R1-2016-0016 was also issued in June 2016, which extended the compliance schedule for the seasonal discharge prohibition to September 30, 2019. The CDO also established interim effluent limitations for copper at 12.3 ug/L (average monthly) and 15.2 ug/L (maximum daily). The average monthly effluent limitation in Order No. R1-2016-0015 is 9.9 ug/L. From December 2010 to January 2016, the average monthly effluent limitation for copper was exceeded twice.

In December 2017, Order R1-2017-0047 modified Order R1-2016-0015 by removing the effluent limitations for copper. The City of Healdsburg demonstrated that copper in the effluent does not exhibit reasonable potential to cause or contribute to an exceedance of water quality objectives.
The use of recycled water from the WWTP is covered under State Water Resources Control Board Order No. WQ 2014-0090-DWQ, General Waste Discharge Requirements for Recycled Water Use.

Residential Septic Systems

Currently, the County inspects non-standard septic systems on a regular basis, and inspects standard systems on a complaint basis.

The SWRCB developed a draft State Policy for Water Quality Control for Siting, Design, Operation, and Management of Onsite Wastewater Treatment Systems (OWTS) which was released in September 2011. The public review period was closed on May 4, 2012. The administrative record for the OWTS Policy was approved by the Office of Administrative Law (OAL) on November 13, 2012 and the OWTS Policy took effect on May 13, 2013.

The County of Sonoma is currently updating County regulations for septic systems in order to meet the OWTS State Policy developed by the SWRCB, mentioned above. The updated County regulations are contained in the OWTS Manual which was released on August 31, 2018. Public feedback on the proposed OWTS manual was solicited from August to October 2018. The meeting to consider the proposed OWTS Manual is scheduled for January 29, 2019. A summary of the main revisions of the proposed OWTS Manual can be found here:

https://sonomacounty.ca.gov/PRMD/Regulations/OWTS-Manual-Revision/#community-input

Source Water Protection Activities

The Regional Board has developed a draft Action Plan for the Pathogen TMDL which has the potential to reduce fecal loads into the Russian River. It is important to note that the Pathogen TMDL has not been adopted yet, and will be subject to a public hearing. It is anticipated that this process will begin in spring 2019.

Some of the proposed changes to occur are:

1) Onsite wastewater treatment systems – The tank and leachfield will need to be inspected every five years by a qualified professional. Owners of OWTS will need to submit information to the Regional Board such as system age, repair history and pumping records. The Regional Board may then notify the owner of corrective action needed.

2) Dairies – Dairy owners will need to develop a Waste Management Plan to prevent discharges of fecal waste to surface water. The plan shall (at a minimum) include a surface monitoring plan for fecal bacteria, prevention of animal access to water courses, and provision of vegetated buffers along water courses.

3) Wastewater holding ponds that discharge to surface water – Effluent limitations for *E. coli* will be added to existing NPDES permits.

As mentioned previously, the Water Agency is also part of the Russian River Watershed Association (RRWA) which is a coalition of nine cities, counties and special districts in the Russian River watershed that was formed in 2003. The RRWA developed a Safe Medicine Disposal Program where unused and expired medications can be taken to a participating take-back location instead of being thrown in the trash or flushed down the drain. There are six dropoff stations in study watershed: Cloverdale Pharmacy, Healdsburg Police Dept., Alliance Medical Center in Healdsburg, as well as Ukiah Police Department, Mendocino County Sheriff's Office and the Ukiah Senior Center.

Recommended Source Water Protection Activities

Due to the number of proposed activities listed in the Action Plan for the Pathogen TMDL, Water Agency staff should consider tracking this effort closely.

Vulnerability Assessment - Medium

The City of Cloverdale WWTP and the City of Healdsburg WWTP appear to be in general compliance with their effluent limitations. As the WWTPs recycle more of the treated effluent instead of discharging to the Russian River, the impact from WWTPs will continue to decrease. However, there are a large number of septic systems in the study watershed which will continue to age and possibly fail. As some septic systems are located in close proximity to the Russian River, wastewater is considered a medium risk PCS.

LEAKING UNDERGROUND STORAGE TANKS

Background

A leaking underground storage tank (LUST) is an underground storage tank that has leaked hazardous substances into the soil or groundwater. Underground storage tanks leak for a variety of reasons such as faulty installation, negligence, or inadequate operation and maintenance. Additionally, some tanks are made of steel, which can corrode over time. Although leakage from underground storage tanks primarily affects groundwater, there is potential for surface water contamination if the contaminated groundwater is hydrogeologically connected to surface water. Once surface water is contaminated, contaminants will be diluted based on fate and transport factors; including the tank site's proximity to the drinking water intake, the magnitude of the spill, and method of transport (surface or groundwater flow).

Seasonal Patterns

There are no seasonal patterns as to when an underground storage tank may leak into the environment.

Related Constituents

Contaminants of concern from LUSTs likely include hydrocarbons from gasoline and other petroleum-based products. Methyl tertiary butyl ether (MTBE) is now less of a concern since it was banned in California fuel supplies in January 2004.

Occurrence in Watershed

The SWRCB maintains a database of leaking underground storage tanks called GEOTRACKER which can be queried by location. As the concern with LUSTs decreases with distance, only LUST sites from the City of Healdsburg downstream to Radial Collector Well 5 were enumerated. **Table 4-13** lists the three open sites where leaking underground storage tanks were documented as of October 2018. These sites are also shown in the Potential Sources of Contamination Map, **Attachment A.**

As **Table 4-13** shows, each site is in various stages of remediation. It should be noted that there were 21 open sites in the 2013 Update, which has been reduced to three sites currently.

Table 4-13. Leaking Underground Storage Tanks in Study Watershed from City of Healdsburg to Radial Collector Well 5, as of October 2018

GEOTRACKER ID	SITE NAME	CLEANUP STATUS	ADDRESS	CITY
T0609700124	VINTAGE II STATION	OPEN – REMEDIATION NOT STARTED YET	1281 HEALDSBURG AVENUE	HEALDSBURG
T0609700161	TEXACO	OPEN – REMEDIATION COMPLETE, VERIFICATION MONITORING	186 DRY CREEK ROAD	HEALDSBURG
T0609700466	CASH OIL COMPANY	OPEN – REMEDIATION WITH HVDPE (High Vacuum Dual-Phase Extraction)	1496 HEALDSBURG AVENUE	HEALDSBURG

Source: Geotracker Database

Related Water Quality Issues and Data Review

Sonoma County indicated that there are no LUST sites currently impacting the Russian River.

Regulation and Management

The Regional Board has jurisdiction over gasoline releases in the City of Healdsburg and the City of Santa Rosa, as well as all other non-gasoline releases. Sonoma County has jurisdiction for all gasoline releases within Sonoma County except for the City of Healdsburg and the City of Santa Rosa.

Recommended Source Water Protection Activities

No source water protection activities are recommended at this time.

Vulnerability Assessment - Low

There are no leaking underground storage tanks within the 2500 foot protection zone for Radial Collector Well 5. The three open LUST sites in Healdsburg are farther away from Radial Collector Well 5, and have been determined to have no impact on the Russian River. Therefore, this assessment indicates the vulnerability for source water quality impacts due to current LUST sites is low.

FIRES

Background

The aftermath of a wildfire or prescribed burn can alter source water quality. In general, the load of dissolved substances to streams will increase following a wildfire due to increased runoff. Increased runoff can occur following a fire because the formation of a hydrophobic organic layer in the soil increases the water repellency of soils (DeBano, 2000). A 2004 USGS study concluded that measurable effects of fires on runoff water quality are most likely to occur if the fire was severe enough to burn large amounts of organic matter, if windy conditions were present during the fire, if heavy rain occurred following the fire, and if the fire occurred in a watershed with steep slopes and soils with little cation-exchange capacity (USGS, 2004).

Seasonal Patterns

Wildfire season in Sonoma County spans the months after the last spring rains until the first fall or winter rains occur. The months of August, September, and October have the greatest potential for wildland fires as vegetation dries out, humidity levels fall, and off shore winds blow.

Related Constituents

The magnitude of the effects of fire on water quality is dependent on how fire characteristics (frequency, intensity, duration, and spatial extent of burning) interact with watershed characteristics (weather, slope, soil type, geology, land use, timing of regrowth of vegetation, and burn history). This interaction is complex and highly variable so that even fires in the same watershed can burn with different characteristics and produce variable effects on water quality. Typically, stormwater runoff from burned forested areas contains high concentrations of phosphorus, nitrogen, dissolved organic carbon (DOC), sediment, and metals such as mercury, lead, and arsenic.

Occurrence in Watershed

There were six fires which occurred within the study watershed since 2013. Fires smaller than 400 acres were not included. **Table 4-14** contains all pertinent information such as date, acreage burned, and description of location. In addition, **Attachment A** shows the burn perimeter areas.

Table 4-14. Summary of Fire Information Over Reporting period

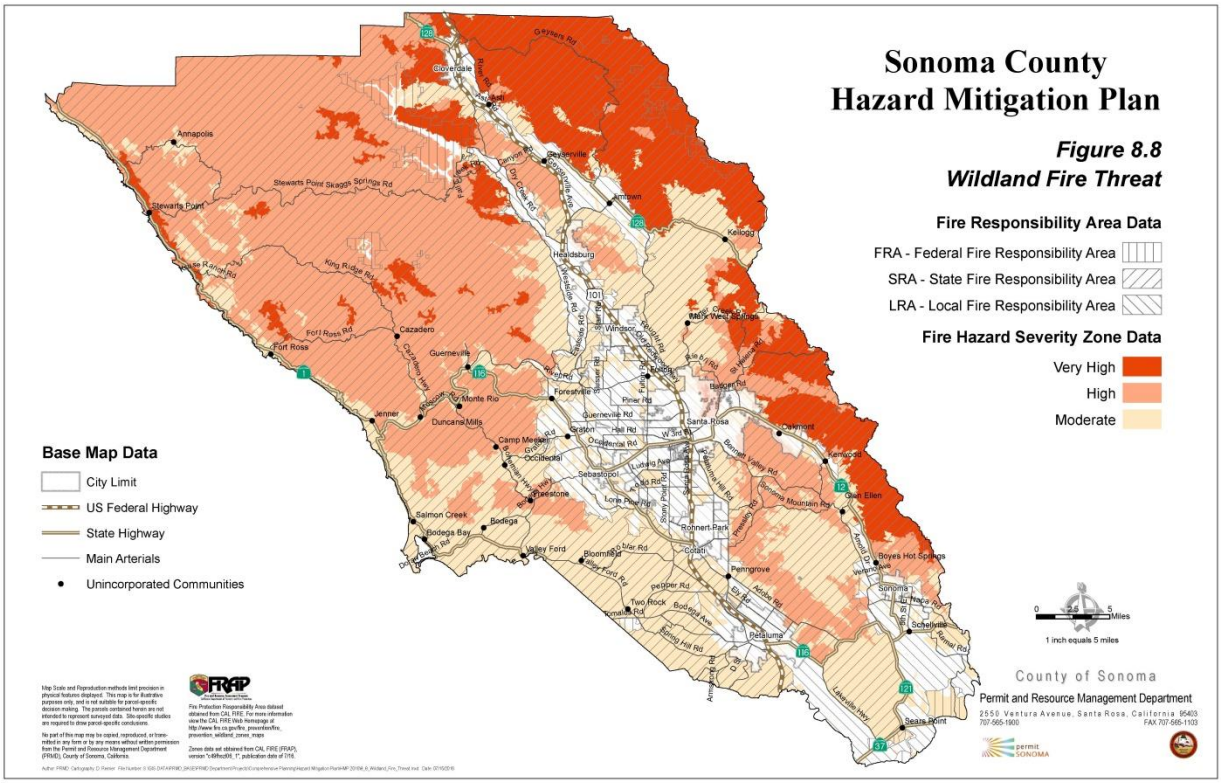
Fire	Date	Acreage Burned	Description
McCabe	November 2013	3,505	Geysers Area, 10 miles northeast of Geyserville
Valley	September 2015	76,067	Cobb in Lake County
Sawmill	September 2016	1,547	Off Big Geyers Road and Geyers Resort Road, 10 miles east of Cloverdale
Redwood Valley	October 2017	36,523	North of Hwy 20, west of Mendocino National Forest, south of Black Road
Pocket	October 2017	17,345	Off of Pocket Ranch Rd and Ridge Ranch Rd, Geyserville
Tubbs	October 2017	36,807	Off of Hwy 128 and Bennett Ln, Calistoga

Source: CALFIRE

As shown in **Figure 4-6**, CALFIRE has mapped fire hazard severity levels in Sonoma County (Sonoma County Hazard Mitigation Plan, 2011). The mountainous eastern range of Sonoma County is designated as Very High Fire Severity Zone. There are also very high and high fire severity zones in the Dry Creek subwatershed as well as east of Healdsburg. CALFIRE has also identified the Geysers area as a "historic wildfire corridor".

CAL FIRE produces Fire Threat Maps for California. Fire threat is derived from a combination of fire frequency, derived from 50 years of fire history, and expected fire behavior under severe weather conditions, based on fuels and terrain data. The Fire Threat Map for Sonoma County is shown in **Figure 4-6**. Over half of Sonoma County has been rated as moderate or high fire hazard risk. The mountainous eastern range of Sonoma County is designated as Very High Fire Severity Zone

Figure 4-6. Wildland Fire Threat, Sonoma County



Related Water Quality Issues and Data Review

After a fire has occurred, the natural vegetation on hillsides is denuded. Additionally, a fire can cause the soils to become hydrophobic. Therefore, increased erosion of soils and associated discharge is expected to occur during the first rains immediately following a fire due to water repellent soils and reduced surface cover.

As a result of the wildfires which occurred in October 2017, the Water Agency conducted baseline and post-storm monitoring at 15 locations as shown in **Figure 4-7.**

Figure 4-7. Post-fire Monitoring Surface Water Quality Locations

Code	Sample Location	Sample Collection
RRCAL	East Fork Russian River - Calpella	Baseline Sampling Post-Storm Sampling
RRWFK	West Fork Russian River	Baseline Sampling Post-Storm Sampling
RRCVD	East Fork Russian River - Coyote	Dry Period Sampling
RRHOP	Russian River - Hopland	Post-Storm Sampling
BSRCR	Big Sulphur Creek	Baseline Sampling Post-Storm Sampling
RRCLV	Russian River - Cloverdale	Baseline Sampling Post-Storm Sampling
RRJIM	Russian River - Jimtown	Baseline Sampling Post-Storm Sampling
MACCR	Maacama Creek	Baseline Sampling
FRACR	Franz Creek	Post-Storm Sampling
DRYCR	Dry Creek	Baseline Sampling Post-Storm Sampling
RRMIR	Russian River Mirabel	Baseline Sampling Post-Storm Sampling Dry Period Sampling
RRWOH	Russian River Wohler	Baseline Sampling Dry Period Sampling (Inflatable Dam Up)
MAWCR	Mark West Creek	Baseline Sampling Post-Storm Sampling
BRUCR	West Fork Brush Creek	Post-Storm Sampling
MATCR	Matanzas Creek	Post-Storm Sampling

As shown in **Table 4-15**, a comparison of the baseline (October 2017) and post-storm (January 2018) monitoring at the Jimtown and Mirabel locations along the Russian River show a significant increase in DOC and nitrate, and a slight increase of chloride at the Mirabel location only. Although water quality samples for metals were collected in the post-storm sampling, samples were not collected during baseline to allow for a comparison.

Table 4-15. Baseline and Post-Storm Monitoring after 2017 Wildfires, Sonoma County Water Agency

	Jimtown			Mirabel		
	Baseline	**Post-Storm**	**Percent Increase**	**Baseline**	**Post-storm**	**Percent Increase**
DOC, mg/L	2.3	7.7	234%	1.9	4.3	126%
Nitrate, mg/L	0.1	0.4	300%	0.1	0.3	200%
Chloride, mg/L	3.9	3.3	-15%	4.2	4.6	9.5%

Regulation and Management

CALFIRE is the lead agency responsible for fighting wildland fires. The Sonoma County Fire and Emergency Services Department provides fire protection, rescue, emergency medical, and arson investigation services for the unincorporated portions of the county that are not included in an independent fire protection district or city fire department.

The use of approved long-term retardants in wildland fire suppression is standard in fire management and planning. The retardants are most often delivered in fixed or rotor- wing aircraft. Current qualified products and approved uses are listed on the U.S. Forest Service Wildland Fire Chemical Systems website (http://www.fs.fed.us/rm/fire). According to the U.S. Forest Service, the fire retardant commonly used is Phos-Check. The use of fire retardants can impact water quality if chemicals are accidentally dropped into a water body, or if heavy rains occur before the product has had time to naturally degrade.

The National Interagency Fire Center has developed *Interagency Standards for Fire and Fire Aviation Operations* which are annually revised. The *Interagency Standards for Fire and Fire Aviation Operations* states, references, or supplements policy for the U.S. Bureau of Land Management, the U.S. Forest Service, the U.S. Fish and Wildlife Service, and the National Park Service. Regarding the use of fire retardants, the Aerial Application Guidelines are to “avoid aerial or ground application of retardant or foam within 300 feet of waterways.” (http://www.fire.blm.gov/Standards/redbook.htm)

Recommended Source Water Protection Activities

After the wildfires of October 2017 the Water Agency participated in, and continues to participate in, numerous efforts to protect watersheds and water supply from potential adverse impacts from the wildfires such as:

- Monitoring water quality in and around burn areas in collaboration with the Regional Water Quality Control Board, United States Geological Survey, and other regional partners;
- Installing wattles, sandbags, and other erosion control techniques to minimize the amount of sediment, debris, and potential pollutants entering waterways;
- Removing debris and excess vegetation from flood control;
- Working to expedite the installation of gages to measure stream flows and precipitation to improve regional storm monitoring, and working to install an X-band radar unit to provide enhanced localized weather forecasting. An Early Warning Forecast and Response System will provide localized information to the National Weather Service, enhancing their ability to send out local advisories, alerts, and warnings to areas where fires have increased the risk of flash flooding, debris flows, and landslides.

No additional source water protection activities are recommended at this time.

Vulnerability Assessment - Medium/High

The post-storm monitoring conducted by the Water Agency after the October 2017 fires did show an impact at the Russian River near Mirabel. Therefore, this assessment indicates the vulnerability for source water quality impacts due to fires is medium/high.

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SECTION 5 – RECOMMENDATIONS

This section consists of a discussion of key findings, update on recommendations from the 2013 watershed sanitary survey and a list of current recommendations.

UPDATE ON 2013 RECOMMENDATIONS

The 2013 Update recommended several actions that Sonoma County Water Agency (Water Agency) should consider to protect source water quality. These recommendations and the Water Agency's response are discussed in **Table 5-1.**

Table 5-1. Recommendations from 2013 Watershed Sanitary Survey

2013 Update Recommendation	Summary of Actions Taken
It is recommended that the Water Agency contact the City of Healdsburg and the City of Cloverdale to remind them that the Water Agency would like to be notified of all sewage spills.	This recommendation was not completed and will be included in the 2018 Recommendations.
Consider reviewing the draft agricultural lands permit being developed by the North Coast Regional Water Quality Control Board for vineyards and orchards in Sonoma County.	The Regional Board is currently not developing an Agricultural Lands Program.
Recommend Sonoma County Agricultural Commission improve GIS data organization to enable mapping of planted acres, and possibly improved data collection methods for GIS database to have more precise locations of pesticide application.	Completed by Sonoma County Agricultural Commission. Pesticide use data by location was available for the 2018 Update.
Consider submitting spill notification language to be included in the City of Healdsburg's NPDES permit when up for renewal by the Regional Board in 2015.	Recommendation was not completed.

RECOMMENDATIONS

Table 5-2 presents the recommendations developed for the 2018 Update. Development of recommendations for watershed management actions that are economically feasible and within the authority of the Water Agency is critical. Recommendations will be implemented as resources are available.

Table 5-2
Recommendations for 2018 Watershed Sanitary Survey

Recommendation	Basis for Recommendation
1) Contact the City of Healdsburg and the City of Cloverdale to remind them that the Water Agency would like to be notified of all major sewage spills.	There were two large sewage spills (23,000 gallons and 166,000 gallons) in Healdsburg in 2017 which the Water Agency was not notified about.
2) Keep track of cyanotoxin monitoring being conducted by the Regional Board and Sonoma County Department of Health Services.	The Water Agency is currently monitoring for cyanobacteria and has found genera which produce cyanotoxins.
3) Due to the number of proposed activities listed in the Action Plan for the draft Pathogen TMDL, Water Agency staff should continue tracking this effort closely.	There are many proposed activities which could impact source water quality of the Russian River.

APPENDIX A
BIBLIOGRAPHY AND LIST OF CONTACTS

BIBLIOGRAPHY AND LIST OF CONTACTS

Mark Cleveland (707) 565-3349 for Healdsburg Veterans Memorial Beach Master Plan, Sonoma County Regional Parks

Joe Lishka, Army Core of Engineers (707)431-4521 for Recreation at Lake Sonoma

Cherie Blatt, North Coast Regional Water Quality Control Board
cherie.blatt@waterboards.ca.gov, Dairies

Rhonda Raymond, North Coast Regional Water Quality Control Board,
Rhonda.Raymond@waterboards.ca.gov, Wineries

Charles Reed, North Coast Regional Water Quality Control Board,
Charles.reed@waterboards.ca.gov, Pathogen TMDL

Beth Lamb, North Coast Regional Water Quality Control Board,
Beth.Lamb@waterboards.ca.gov, Leaking Underground Storage Tanks

Robert Pennington, Sonoma County Permit and Resource Management Department,
Robert.Pennington@sonoma-county.org, Mines

Lesley Pfeiffer, Sonoma County Regional Parks, Lifeguard and Recreation Coordinator, (707) 565- 3080 office

Staff report for the Action Plan for the Russian River Watershed Pathogen Total Maximum Daily Load, California Regional Water Quality Control Board North Coast Region, August 2017.

Pilot Monitoring of Constituents of Emerging Concern (CECs) in the Russian River Watershed (Region 1), Southern California Coastal Water Research Project, Technical Report 2010, March 2018.

Sonoma County Department of Health Services Cyanotoxin Monitoring Data:
https://sonomacounty.ca.gov/Health/Environmental-Health/Water-Quality/Blue-Green-Algae/

Sonoma County Department of Health Services Beach Monitoring:
http://sonomacounty.ca.gov/Health/Environmental-Health/Water-Quality/Fresh-Water-Quality/#springlake

Order No. R1-2018-0035 NPDES No. CA0022888 WDID No. 1B840290MEN Waste Discharge Requirements and Water Recycling Requirements for the City of Ukiah Wastewater Treatment Plant Mendocino County

Order No, R1-2018-0034 NPDES No. CA0022977 WDID No. 1B84032OSON Waste Discharge Requirements for the City of Cloverdale Wastewater Treatment Plant Sonoma County

Order No. R1-2017-0047 Modifying Waste Discharge Requirements NPDES Permit No. R1-2016-0015 for City of Healdsburg Wastewater Treatment, Recycling and Disposal Facility WDID No. 1B82046OSON Sonoma County

Cease and Desist Order No. R1-2016-0016 Requiring the City of Healdsburg to Cease and Desist from Discharging or Threatening to Discharge Effluent in Violation of Waste Discharge Requirements, Order No. R1-2016-0015. NPDES Permit No. CA0025135 WDID No. 1B82046OSON

California Regional Water Quality Control Board North Coast Region Order No. R1-2016-0002 General Waste Discharge Requirements For Discharges Of Wine, Beverage and Food Processor Waste to Land in the North Coast Region

California Regional Water Quality Control Board North Coast Region Order No. R1-2016-0003 Conditional Waiver of Waste Discharge Requirements For Discharges Of Wine, Beverage and Food Processor Waste to Land in the North Coast Region

Water Quality Control Policy for Siting, Design, Operation, and Maintenance of On-site Wastewater Treatment Systems, June 19, 2012. Prepared by State Water Resources Control Board.

California Regional Water Quality Control Board North Coast Region Order No. R1-2015-0030 NPDES NO. CA0025054 National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirement For Discharges from the Municipal Separate Storm Sewer Systems

Leaking Underground Storage Tanks
https://geotracker.waterboards.ca.gov/

CALFIRE:
http://www.fire.ca.gov/current_incidents

Onsite Wastewater Treatment System Regulations and Technical Standards (OWTS Manual), prepared by County of Sonoma, August 31, 2018

Storm Water Multiple Application and Report Tracking System (SMARTS) database for Industrial General Permit
https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.xhtml

Sonoma County Crop Reports, 2012-2017, produced by the Sonoma County Office of the Agricultural Commissioner.

Ranalli, A.J., 2004, A Summary of the Scientific Literature on the Effects of Fire on the Concentration of Nutrients in Surface Waters: U.S. Geological Survey Open-File Report 2004-1296, 23 p.

Sonoma County Hazard Mitigation Plan, April 2017, prepared by Sonoma County Permit and Resource Management Department under the direction of Sonoma County Department of Fire and Emergency Services

Conditional Waiver of Waste Discharge Requirements Order No. R1-2012-0003 for Existing Cow Dairies in the North Coast Region.

APPENDIX B
WINERIES IN CIWQS DATABASE

Facility Name	Facility Address	Latitude	Longitude
Clos Du Bois Winery	19410 Geyserville Road, Geyserville, CA 95441	38.6826	-122.879345
Fetzer Vineyards Hopland Winery	12901 Old River Road, Hopland, CA 95449	38.99087	-123.09745
Fritz Winery	24691 Dutcher Creek Road, Cloverdale, CA 95425	38.7342	-122.98317
J. Pedroncelli Winery	1220 Canyon Road, Geyserville, CA 95441	38.70509	-122.931025
Moshin Winery	10295 Westside Rd, Healdsburg, CA 95448	38.50168	-122.895455
Prevail Winery	2450 Highway 128, Geyserville, CA 95441	38.71111	-122.85444
Ridge Lytton Springs Winery	650 Lytton Springs Road, Healdsburg, CA 95448	38.6592	-122.88546
Robert Young Winery	4950 Red Wine Road, Geyserville, CA 95441	38.69333	-122.830948
Silver Oak Cellars, Alexander Valley	24625 Chianti, Geyserville, CA 95425	38.74182	-122.9561
Yokayo Wine Company	301 West Lake Mendocino Drive, Ukiah, CA 95482	39.19365	-123.20389
E. and J. Gallo Winery	3387 Dry Creek Road, Healdsburg CA 95448		
Francis Copola Winery	300 Via Archimedes Geyserville, CA		
Waterfowl Winery	14100 Mountain House Road Hopland		
Hartford Family Winery	8075 Martinelli Road Forestville		
Masut Wine Company	301 Reeves Canyon Road Redwood Valley		
Potter Valley Wine Works	10320 Main Street Potter Valley		
Arista Winery	7015 Westside Road Healdsburg		
Field Stone Winery and Vineyard	10075 Highway 128 Healdsburg		
Merriam Winery	11650 Los Amigos Road Windsor		
Terra Savia Winery	14200 Mountain House Road Hopland		
Ampere Winery	25475 Cloverdale Peak Road Cloverdale		
Sloan Family Winery	994 Limerick Lane Healdsburg		
Frey Vineyards	11700 West Road Redwood Valley		

APPENDIX C
WINERIES IN SMARTS DATABASE

Facility Name	Facility Address
Verite Winery	4611 Thomas Rd. Healdsburg CA 95448
Ridge Lytton Springs Winery	650 Lytton Springs Road, Healdsburg, CA 95448
Rochioli Winery	6192 Westside Rd Healdsburg CA 95448
Preston Winery	9205 West Dry Creek Road, Healdsburg, CA 95448
Hafner Vineyard	4280 Pine Flat Road, Healdsburg, CA 95448
Lambert Bridge Winery	4085 W Dry Creek Rd Healdsburg CA 95448
E. and J. Gallo Winery	3387 Dry Creek Road, Healdsburg CA 95448
Mazzocco Vineyards Inc.	1400 Lytton Springs Road, Healdsburg, CA 95448
Simi Winery	16275 Healdsburg Ave Healdsburg CA 95448
Asti Winery (Winery Waste)	26150 Asti Road, Cloverdale, CA 95425
Francis Copola Winery	300 Via Archimedes Geyserville, CA
J. Pedroncelli Winery	1220 Canyon Road, Geyserville, CA 95441
Kendall Jackson Vinwood Cellars, Inc.	18700 Geyserville Road, Geyserville, CA 95441
Foley Sonoma Winery	5110 Highway 128 Geyersville CA 95441
Clos Du Bois Winery	19410 Geyserville Road, Geyserville, CA 95441
Virginaia Dare Winery	22281 Chianti, Geyserville, CA 95441
Fetzer Vineyards Hopland Winery	12901 Old River Road, Hopland, CA 95449
Rack and Riddle	4001 Highway 128 Geyserville 95441
Dutcher Crossing Winery	8533 Dry Creek Road Geyserville 95441
Virginia Dare Winery	22281 Chiant Rd. Geyserville 95441
Foley Sonoma Winery	5110 Highway 128 Geyersville CA 95441
Fritz Winery	24691 Dutcher Creek Road, Cloverdale, CA 95425
JEF Vineyards	11684 S Hwy 101 Hopland CA 95449
Vintage Wine Estates	13300 Buckman Drive Hopland CA 95449
Waterfowl Winery	14100 Mountain House Road Hopland
McNab Winery	2350 McNab Ranch Road Ukiah CA 95482
Geyser Peak Winery	2306 Magnolia Dr. Healdsburg CA 95448
AVV Winery	8644 Hwy 128 Healdsburg
J Vineyards and Winery	11447 Old Redwood Highway Healdsburg
Rack Riddle Custom Wine Services	499 Moore Lane Healdsburg
Fieldstone Winery	10075 Hwy 128 Healdsburg
Dry Creek Vineyard	3700 Lambert Bridge Rd Healdsburg
F Teldeschi Winery	3555 Dry Creek Rd Healdsburg
Quivira Vineyards	4900 W Dry Creek Rd Healdsburg
Ferrari Carano Winery	8761 Dry Creek Rd Healdsburg
Pezzi King Vineyards	3225 Dry Creek Rd Healdsburg
Chalk Hill Estate Winery	10300 Chalk Hill Rd Healdsburg
Stonestreet Winery	7111 Highway 128 Healdsburg
Acorn Alegria Winery	PO Box 2061 Healdsburg

Attachment A
Potential Sources of Contamination Map

Attachment A - Potential Sources of Contamination

Legend

- Wineries
- Wastewater Treatment Plants
- Wastewater Discharge To Land
- Sanitary Sewer Overflows
- Dairies
- Underground Storage Tanks (Leaking)
- Hazardous Spills
- Mines (Office of Reclamation)
- Dry Creek
- Russian River
- Fire History - 2013 to 2017*
- Sub Watershed Selection

Van Arsdale Reservoir
Lake Pillsbury
REDWOOD VALLEY FIRE
Lake Mendocino
Coyote Valley Dam
Mendocino County
Colusa County
Lake County
Napa County
Sonoma County
HIGHLAND FIRE
SAWMILL FIRE
MCCABE FIRE
POCKET FIRE
VALLEY FIRE
YELLOW FIRE
YOUNG FIRE
TUBBS FIRE
Lake Sonoma
Warm Springs Dam
Russian River
Dry Creek

Location Map

Tehama, Butte, Glenn, Butte, Mendocino, Colusa, Lake, Yolo, Napa, Sonoma, Santa Rosa, Solano, Marin, Marin

Healdsburg Area Inset

Sunnyvale Dr, March Ave, Monte Vista Ave, Powell Ave, Grove St, University St, Fitch St, North St, Healdsburg, Tayman Park Golf Course, Oak Mound Cemetery, Kinley Dr, Healdsburg Ave, Westside Rd, Colonel Williams R "Bill" Lucius Hwy, 101

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

* CAL FIRE (including contract counties), USDA Forest Service Region 5, USDI Bureau of Land Managment & National Park Service, and other agencies jointly maintain a comprehensive fire perimeter GIS layer for public and private lands throughout the state.

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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Sonoma Water

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Attachment B
Land Use by Parcel Map

Legend

Watershed Land Use - Parcels 2018

Principle Use Code and Percent of Total *

- Dry Farm Properties (58.2%)
- Irrigated Farm Properties (23.3%)
- Government Properties (7.8%)
- Residential Properties (5.3%)
- Industrial Properties (2.4%)
- Miscellaneous Properties (2.2%)
- Institutional Properties (0.3%)
- Commercial Properties (0.2%)
- Recreational Properties (0.2%)

2,500 ft Buffer on Collector 5

Mendocino County

Lake County

Napa County

Lake Sonoma

Warm Springs Dam

Russian River

Dry Creek

Location Map

Glenn, Colusa, Yolo, Lake, Mendocino, Ukiah, Sonoma, Napa, Santa Rosa, Marin

Wohler/Mirabel Collectors Inset

Collector No. 3, Collector No. 4, Collector No. 5

0 0.25 0.5 1 Miles

* Percentages are based on parcel Sq Footage for parcels shown.

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Attachment B - Land Use by Parcel

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0 2.5 5 10 Miles

Sonoma Water

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Attachment C
Aerial Photos

Photo #1. Mirabel/Wolher Area 2012

Photo #2. Mirabel/Wolher Area 2018

Photo #3. Mirabel to Healdsburg WWTP 2012

Photo #4. Mirabel to Healdsburg WWTP 2018

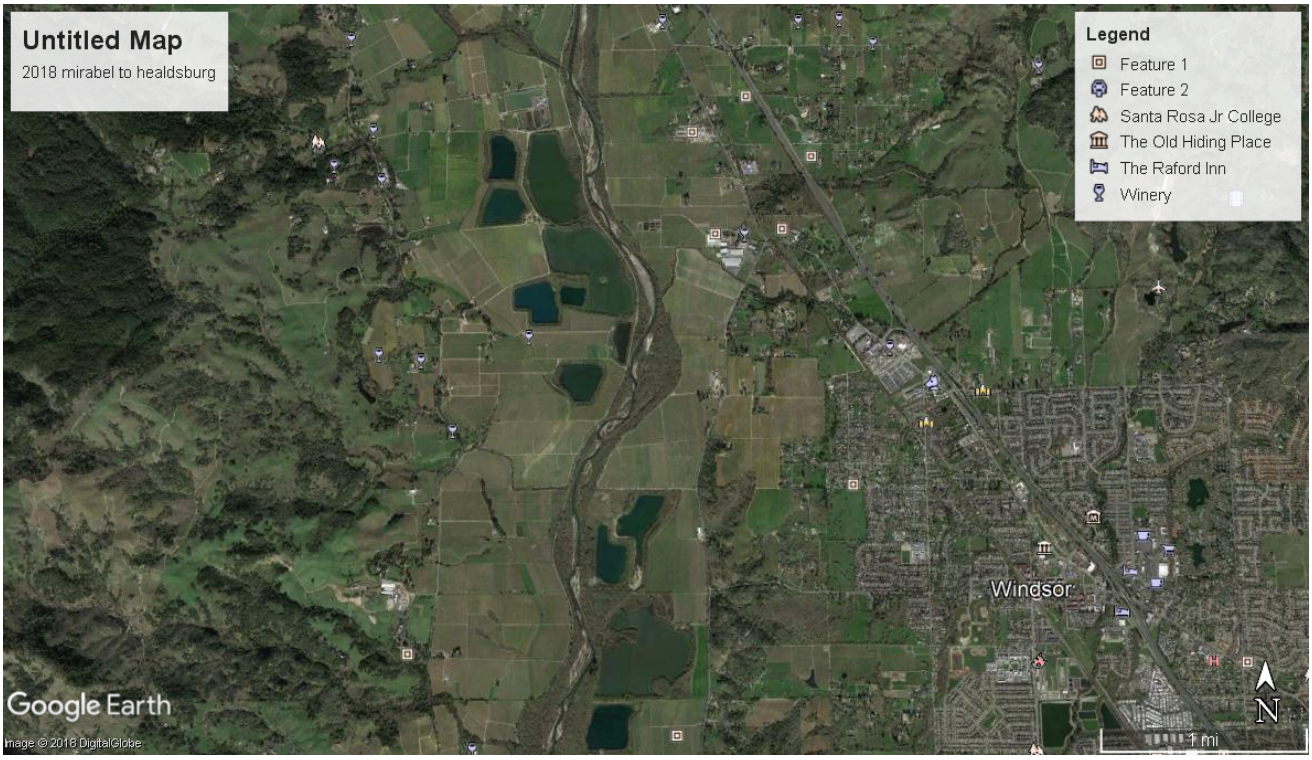

Photo #5. Healdsburg Area 2012

Photo #6. Healdsburg Area 2018

Attachment D
Orchards and Field Crops Map

Mendocino County

Lake County

Sonoma County

Napa County

Lake Sonoma

Warm Springs Dam

Lake Sonoma Recreation Area

Russian River

Dry Creek

Wheatfield Fork Gualala River

Location Map

Crops in Sonoma County, (Ag Commission, 2018)*

Crop Type*

- Grapes for Wine, Vineyard (68%)
- Grapes, mixed with other use (11%)
- Olive (10%)
- Pasture, Rangeland and other (5%)
- Right-of-Way (2%)
- Other (2%)
- Primary Orchard Crops (1%)
- Water Area (0.1%)
- Golf Course (0.1%)
- Primary Field Crops (0.1%)
- Sub Watershed Selection

***Sonoma County Agricultural Commissioner's Office Disclaimer: The crop data depicted is intended to provide a visual display of sites that exist on Restricted Materials Permits (or Operator Identification Numbers) which have submitted pesticide use reports for applications in 2012. Although every reasonable effort has been made to assure the accuracy of this data, there are known and unknown errors contained in this dataset. Please contact our office at (707) 565-2371 or sonomaag@sonoma-county.org for more information.**

Percentages presented is for areas shown only and is a gross percent based on number of areas shown, not acres treated by pesticide.

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Attachment D - Orchards and Field Crops

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0 1 2 4 Miles

Sonoma Water