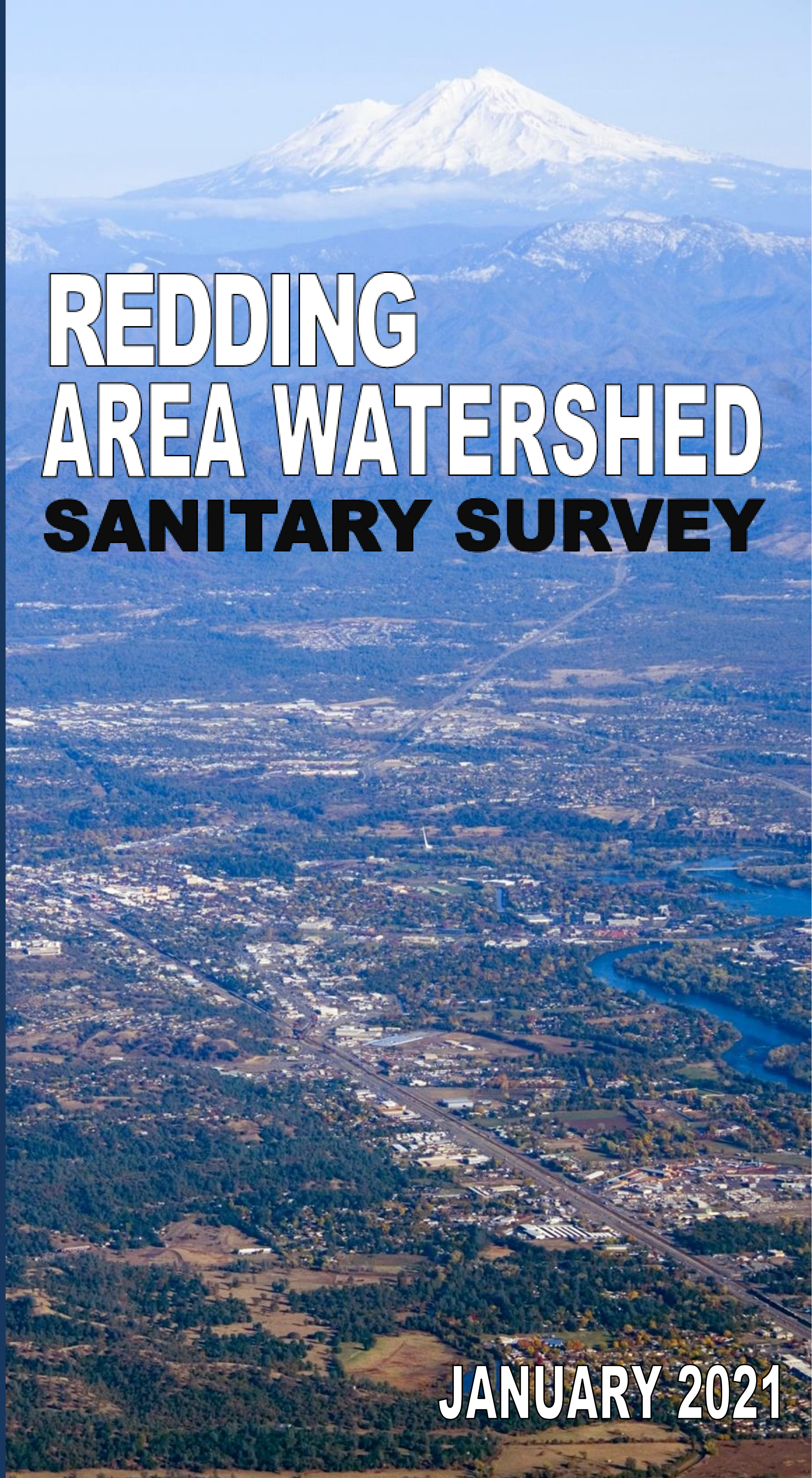
PACE ENGINEERING

REDDING AREA WATERSHED
SANITARY SURVEY

JANUARY 2021



County of Shasta, California

Mountain Gate Community Services District, Established 1956

Shasta Community Service District

Centerville C.S.D.

Clear Creek Community Service District

City of Shasta Lake, Founded July 2, 1993

Bella Vista Water District, Redding CA

City of Redding, California

January 6, 2021

1748.05

Katie Connaughton
Division of Drinking Water
364 Knollcrest Drive, Suite 101
Redding, CA 96002

Dear Katie,

Subject: 2021 Redding Area Watershed Sanitary Survey

PACE Engineering is pleased to submit the:

REDDING AREA WATERSHED SANITARY SURVEY

The Redding Area Watershed Sanitary Survey is a group effort by local Public Water Systems (PWSs) who have combined their resources to update the previous Watershed Sanitary Survey completed in 2016.

Chapter 17, Surface Water Treatment, Article 7, Section 64665 of Title 22 of the California Code of Regulations requires water utilities using surface water to conduct a watershed sanitary survey every five years. Under Section 64665, a watershed sanitary survey should include:

- Physical and hydrogeological description of the watershed.
- Summary of source water quality monitoring data.
- A description of activities and sources of contamination.
- A description of any significant changes that have occurred since the last survey.
- A description of watershed control and management practices.
- An evaluation of each participating water agency's ability to meet the requirements and recommendations for corrective actions.

The survey includes four watershed groups including: (1) Shasta Watershed from Goose Lake in Oregon to Shasta Dam; (2) Trinity Watershed including Trinity Lake and Lewiston Lake; (3) Whiskeytown Watershed including Clear Creek and Whiskeytown National Recreation Area; and (4) Sacramento River Watershed from Shasta Dam to the raw water intakes for the City of Redding and Bella Vista Water District.

The report is subdivided into the following sections:

1. Overview
2. Participating Water Agencies
3. Report Objectives and Previous Studies
4. Watersheds
5. Communications and Emergency Response
6. Drinking Water Regulations
7. Water District Facilities and Treatment Processes
8. Potential Watershed Contaminant Sources
9. Water Quality

The report includes references and a number of tables and figures that pertain to and are located at the end of each of the sections listed above.

PACE Engineering, Inc. is very pleased to have participated in this project. We would like to thank the staffs from all the participating agencies for their able assistance and the Division of Drinking Water and Central Valley Regional Water Quality Control Board (CVRWQCB) for making their files available to our many inquiries.

Please let us know if you have any questions.

Sincerely,

Jessica L. Chandler
Associate Engineer

REGISTERED PROFESSIONAL ENGINEER
JESSICA L. CHANDLER
No. 84911
CIVIL
STATE OF CALIFORNIA

JC/PC
Enclosure
c w/enclosure: David Coxey, General Manager, Bella Vista Water District
Tom Zaharris, Treatment Superintendent, Bella Vista Water District
Conrad Tona, Public Works Supervisor, City of Redding
Josh Watkins, Water Utility Manager, City of Redding
Skip Born, General Manager, Clear Creek CSD
Tony Thomasy, Water Treatment Superintendent, City of Shasta Lake
Chris Muehlbacher, District Manager, Centerville CSD
Chris Koeper, General Manager, Shasta CSD
Shawn Ankeny, Supervising Engineer, Shasta County
Jeff Cole, District Manager, Mt. Gate CSD
Bryan Smith, Senior Engineer, CVRWQCB

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ACRONYMS AND DEFINITIONS

Ac-Ft	Acre Feet
AL	Action Level
AMD	Acid Mine Drainage
BCR	Bioreactor
BLM	Bureau of Land Management
BMP	Best Management Practice
BVWD	Bella Vista Water District
Cal OES	California Office of Emergency Services
Caltrans	California Department of Transportation
CALWARN	California Water/Wastewater Agency Response Network
CCR	Consumer Confidence Report
CDF	California Department of Forestry and Fire Protection (Cal Fire)
CDPH	California Department of Public Health, now DDW
CDPR	California Department of Pesticide Regulation
CERCLA	Comprehensive Environmental Response and Liability Act
CEU	Cannabis Enforcement Unit
CFS	Cubic Feet per Second
CSA	County Service Area
CSD	Community Services District
CT	Product of Chlorine Residual and Contact Time
CWS	Community Water System
D/DBPR	Disinfectants and Disinfection Byproduct Rule
DBP	Disinfection Byproduct
DDW	Division of Drinking Water
DLR	Detection Limit for Reporting Purposes
DOC	Dissolved Organic Carbon
E. coli	Escherichia coli
EPA	Environmental Protection Agency
FT	Feet
GPM	Gallons per Minute
GPM/SF	Gallons per Minute per Square Foot
GWUDISW	Groundwater Under the Direct Influence of Surface Water
HAA5	Haloacetic Acids (Five)
ICR	Information Collection Rule
IDSE	Initial Distribution System Evaluation
IESWTR	Interim Enhanced Surface Water Treatment Rule
IMM	Iron Mountain Mine
IOC	Inorganic Compound

LAFCO	Local Area Formation Commission
LCR	Lead and Copper Rule
LRAA	Locational Running Annual Average
LT1ESWTR	Long Term 1 Enhanced Surface Water Treatment Rule
LT2ESWTR	Long Term 2 Enhanced Surface Water Treatment Rule
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MFL	Million Fibers per Liter
MG	Million Gallon
MGD	Million Gallons per Day
MPN	Most Probable Number
MRDL	Maximum Residual Disinfectant Level
MRDLG	Maximum Residual Disinfectant Level Goal
Mrem/year	Millirems per Year
MS4	Municipal Separate Storm Sewer System
MTBE	Methyl Tert-Butyl Ether
NCWS	Non-Community Water System
NL	Notification Level
NPDES	National Pollutant Discharge Elimination System
NPDWR	National Primary Drinking Water Regulations
NPL	National Priorities List
NPS	National Park Service
NRA	National Recreation Area
NRC	National Response Center
NSE	No Standard Established
NTNCWS	Non-Transient Non-Community Water System
NTU	Nephelometric Turbidity Unit
OHV	Off-Highway Vehicle
p/Ci/L	Picocuries per Liter
PHG	Public Health Goal
PPB	Parts per Billion
PPM	Parts per Million
PPQ	Parts per Quadrillion
PPT	Parts per Trillion
PRV	Pressure Reducing Valve
PSI	Pounds per Square Inch
PWS	Public Water System
RCD	Resource Conservation District
RWQCB	Regional Water Quality Control Board
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SF	Square Feet
SIUR	Small Irrigation Use Registration
SMCL	Secondary Maximum Contaminant Level
SOC	Synthetic Organic Compound
SSO	Sanitary Sewer Overflow
SSVT	Small System Variance Technology

SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
SWTR	Surface Water Treatment Rule
TCR	Total Coliform Rule
TMDL	Total Maximum Daily Load
TNCWS	Transient Non-Community Water Systems
TOC	Total Organic Carbon
TT	Treatment Technique
TTHM	Total Trihalomethanes
USBR	United States Bureau of Reclamation
USFS	United States Forest Service
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WDRs	Waste Discharge Requirements
WERT	Watershed Emergency Response Team Report
WTP	Water Treatment Plant

1 OVERVIEW

The California Surface Water Treatment Rule (SWTR) requires water utilities using surface water or groundwater under the direct influence of surface water to conduct a watershed sanitary survey every five years. This watershed sanitary survey, called the Redding Area Watershed Sanitary Survey, is a group effort by local public water systems (PWSs) who have combined their resources to update the four previous watershed sanitary surveys completed in 2001, amended in December 2006, February 2011, and January 2016. The original 2001 survey reviewed the Whiskeytown Watershed, the Sacramento River Watershed from Shasta Dam to the Bella Vista Water District raw water intakes, and the nearby areas around Shasta Lake in the Shasta Watershed. The 2006, 2011, 2016, and 2021 surveys have been expanded to include the following watersheds: Trinity, Lewiston, Sacramento River, and the complete Shasta Watersheds. This survey updates the previous survey.

The aim of the survey is to examine the PWS watersheds and water treatment systems to determine potential threats to their water quality as well as their ability to treat the water. The Watershed Sanitary Survey Guidance Manual, by the California-Nevada Section of the American Water Works Association, December 1993, was used as a guide to create major topics for the chapters. Each of the four major watersheds has its own major heading within related chapters. Each chapter has a list of references, which has been included to facilitate the next update in 2026. Future updates can utilize the references provided to revise the existing document.

The Redding Area Watershed Sanitary Survey was prepared by PACE Engineering, Inc. for the PWSs that use the Whiskeytown, Trinity, Shasta, and Sacramento River Watersheds as their primary water supply. The PWSs that participated in this sanitary survey include the Bella Vista Water District, City of Redding, Clear Creek Community Services District (CSD), Shasta CSD, Mountain Gate CSD, Centerville CSD, City of Shasta Lake, Sugarloaf County Service Area (CSA) No. 2, Castella CSA No. 3, Jones Valley CSA No. 6, French Gulch CSA No. 11, and Crag View CSA No. 23.

The PWSs participating in this sanitary survey rely upon four major surface water sources: Shasta Lake, Trinity Lake, Whiskeytown Lake, and the Sacramento River. The combined area of the watershed is nearly 5.5 million acres, and almost all of the land is not owned or controlled by the PWSs. Consequently, most of the PWSs are dependent on federal and state agencies to oversee and protect their watershed.

Several watersheds are interlinked by conduits that bypass their natural drainage systems. Water from the Trinity and Lewiston Reservoir system is diverted into Whiskeytown Lake through penstocks at the Carr Powerhouse. This water, in turn, can be diverted through the Spring Creek Conduit forebay of the Keswick Dam on the Sacramento River. Therefore, the City of Redding's Foothill Water Treatment Plant (WTP) and the Bella Vista Water District draw a mixture of water from all four watersheds reviewed in this report. Shasta CSD and City of Redding's Buckeye WTP draw water from the Spring Creek Conduit, which originates from the Trinity and Lewiston Reservoirs via Whiskeytown Lake. The Clear Creek CSD and Centerville CSD draw water from the Muletown Conduit, which originates from the Trinity and Lewiston Reservoirs via Whiskeytown Lake at the dam.

Highways and railroads often parallel waterways and their drainage systems often direct runoff into the nearest waterway. The key to dealing with an accidental spill is communication between federal, state, and local agencies and the PWSs. State and federal agencies have procedures in place to coordinate efforts and coordinate communications should an accidental spill occur.

Water facilities whose intakes are located on rivers or creeks are at greater risk from accidental spills and landslides as opposed to those on lakes that benefit from dilution, settling, and residence time. Fortunately, the creeks used by the CSAs do not appear to receive drainage from major highways and seem to have little, if any, industrial-related traffic in their local upstream watersheds. Landslides resulting in high turbidities are probably of greater concern, and these facilities should investigate whether they need to install raw water turbidimeters and develop procedures for early detection of highly turbid water and automatic shutdown of the WTP until on-site assessments and process adjustments can be made.

Compared to other PWSs, perhaps the water agency at greatest risk from an accidental spill may be the Bella Vista Water District because its intake is located just downstream of two major thoroughfares: Highway 273 and the Southern Pacific Railroad crossing at the Diestlehorst Bridge. The District does monitor and control for high turbidity and conductivity at the Wintu Pump Station and has backup wells and interties with neighboring water agencies that can deliver an alternate water supply in the event of a spill.

Many of the water treatment facilities operated by agencies participating in this survey are over 30 years old and use in-line filtration technology to treat the water. At the time of construction, in-line filtration technology met standards set by the United States Environmental Protection Agency (EPA) and the California Department of Public Health (CDPH), now named the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW). However, since then, in-line filtration was classified as an alternative technology, and DDW required that these systems prove their effectiveness at removing Giardia and Cryptosporidium protozoans through surrogate turbidity or particle removal studies. Of the 13 water treatment facilities operated by the agencies participating in this sanitary survey, 5 are believed to be operated as in-line filtration systems (see Table 7.2). Several of these PWSs have proven that they can reliably achieve less than 0.1 NTU turbidity in 95 percent of the turbidity measurements collected and, therefore, are now considered an approved alternative technology.

Disinfection byproducts (DBPs) appear to be a problem with some water treatment systems. DBPs are a consequence of organic precursors and free chlorine doses used to meet standards for Giardia inactivation.

The overall quality of water from the four watersheds is quite good due in part to:

1) Large volumes of water captured by the watersheds, which dilute contaminants;
2) Presence of five lakes, which allows contaminants to settle out of the water; and
3) Land management regulations of local, state, and federal agencies. It can be argued that the greatest threats to water quality appear to be the possibility of high turbidity from landslides and fire-related erosion, particularly in the Trinity and Whiskeytown Watersheds, and the potential for contamination from accidental spills from highway and railroad accidents, particularly for the Sacramento River and Shasta Lake.

In 2018, the watersheds suffered most dramatically from several major fires, including the Carr, Hirz, and Delta Fires. These fires burned upwards of 380,000 acres, primarily in the Shasta and Whiskeytown Watersheds. These fires not only impacted water quality from increased erosion but also destroyed or damaged treatment facilities and power supplies. The 2018 fire season also impacted various mine sites, including the Iron Mountain Mine (IMM) Superfund site, Washington Mine, Greenhorn Mine, Golinsky Mine, and MRRC-owned mine properties. Conveyance pipelines, process buildings, containment units, and mine ventilation systems were destroyed.

Another round of sampling for the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) took place between 2015 and 2018 for the City of Redding, City of Shasta Lake, and the Bella Vista Water District. All results indicated no detectable Cryptosporidium oocysts in the source water samples.

Historically, there has been illegal cannabis cultivation within the forested areas of the watershed, as well as in and around Clear Creek CSD and Bella Vista Water District. Since the adoption of cannabis cultivation ordinances by Shasta County that prohibits commercial cultivation within the unincorporated areas of Shasta County and any outdoor cultivation, the agencies have noticed much less impact. The Regional Water Quality Control Board (RWQCB) created a Cannabis Cultivation Program, which was approved in December 2017 to help manage the diversion of water and discharge of waste associated with cannabis cultivation.

Urban surface runoff has continued to be of concern to some water agencies, especially Bella Vista Water District, as development continues. Phase 2 Small Municipal Separate Storm Sewer System (MS4) best management practices (BMPs) are still being implemented in the applicable areas; however, these BMPs do not directly address the high velocity discharges to creeks and streams that suspend and transport sediment. The authorities having jurisdiction of the influential areas are responsible for enforcing the MS4 requirements.

The 2021 Watershed Sanitary Survey is structured the same as the 2016 Watershed Sanitary Survey. Major changes that have occurred in the watershed over the past five years have been highlighted in the chapters that follow.

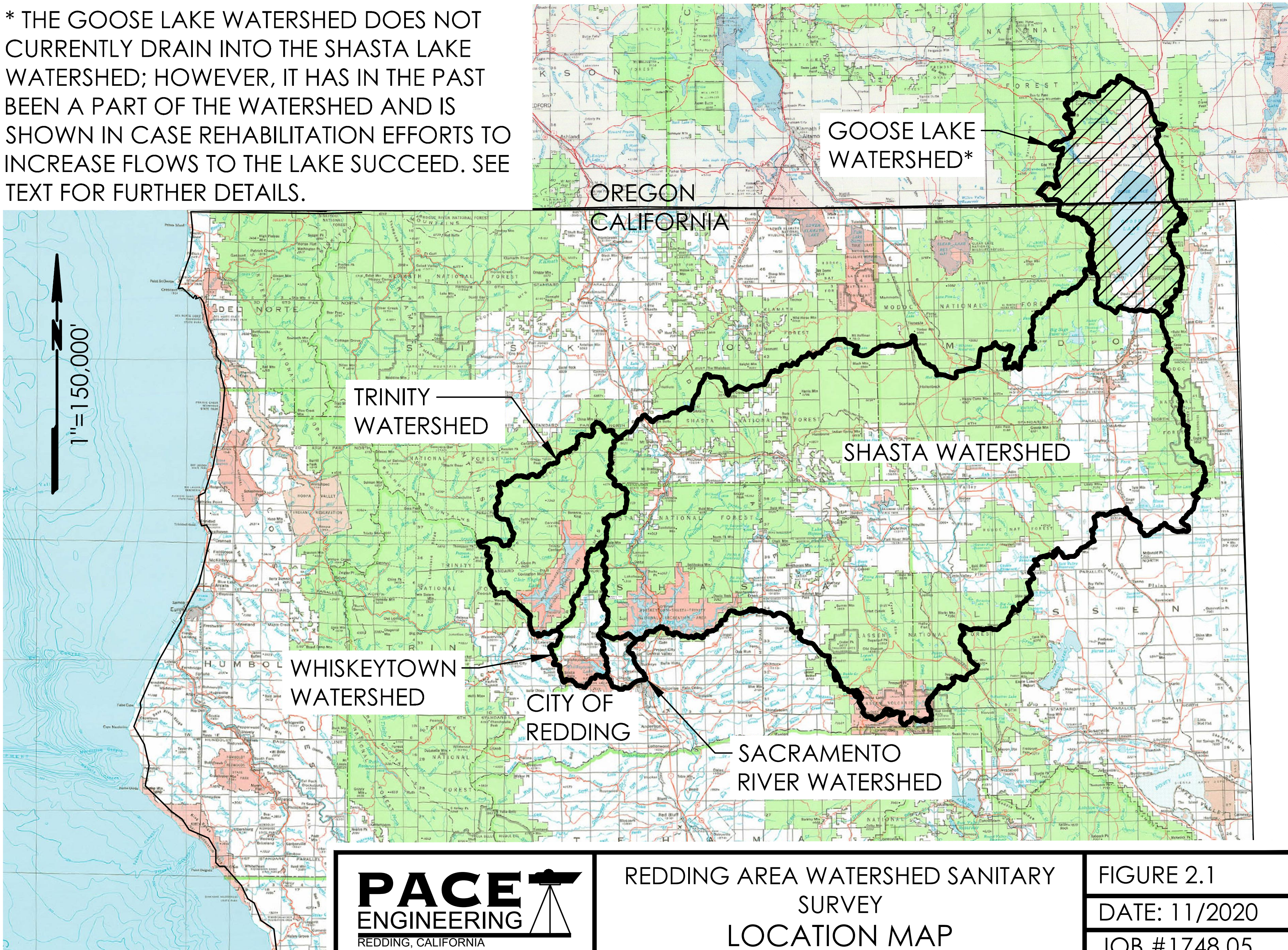
2 PARTICIPATING WATER AGENCIES

The 2021 Redding Area Watershed Sanitary Survey update is a joint effort by the following PWSs:

- Bella Vista Water District
- Centerville CSD
- Clear Creek CSD
- City of Redding
- City of Shasta Lake
- Mountain Gate CSD
- Shasta CSAs:
    - Sugarloaf CSA No. 2
    - Castella CSA No. 3
    - Jones Valley CSA No. 6
    - French Gulch CSA No. 11
    - Crag View CSA No. 23
- Shasta CSD

The above PWSs are also referred to as the "participating agencies" in this Redding Area Watershed Sanitary Survey. Figure 2.1 shows the location of the watersheds included in this report. Figures 4.1 through 4.4 show the watershed boundaries and Figures 4.5 and 4.6 show service area boundaries of the participating agencies.

* THE GOOSE LAKE WATERSHED DOES NOT CURRENTLY DRAIN INTO THE SHASTA LAKE WATERSHED; HOWEVER, IT HAS IN THE PAST BEEN A PART OF THE WATERSHED AND IS SHOWN IN CASE REHABILITATION EFFORTS TO INCREASE FLOWS TO THE LAKE SUCCEED. SEE TEXT FOR FURTHER DETAILS.



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

LOCATION MAP

FIGURE 2.1

DATE: 11/2020

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Plot Date: November 17, 2020 - 3:51 pm Login Name: bagentles
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Shasta Watershed Figures.dwg, Layout: FIGURE 2 LOCATION MAP

3 REPORT OBJECTIVES AND PREVIOUS STUDIES

The objective of this report is to meet the requirements of Title 22 Section 64665 of the California Code of Regulations as follows:

ARTICLE 7 WATERSHED SANITARY SURVEYS

Section 64665. Watershed Requirements:

(a) All suppliers shall have a sanitary survey of their watershed(s) completed at least every five years. The first survey shall be completed by January 1, 1996.
(b) A report of the survey shall be submitted to DDW not later than 60 days following completion of the survey.
(c) The survey and report shall include physical and hydrogeological description of the watershed, a summary of source water quality monitoring data, a description of activities and sources of contamination, a description of any significant changes that have occurred since the last survey which could affect the quality of the source water, a description of watershed control and management practices, an evaluation of the system's ability to meet requirements of this chapter, and recommendations for corrective actions.

This sanitary survey is an update to the January 2016 Redding Area Watershed Sanitary Survey produced by the participating agencies. This survey follows the format of the previous survey.

Watershed sanitary surveys are to be updated every five years. To facilitate future updates, this report has been separated into topics with references added at the end of each section. By creating a "modular" report with references, future authors updating the report can efficiently gather and update relevant information by contacting past references or their offices and add any changes in the watersheds to the existing report. A USB that includes PDFs of the report, tables, and figures has been distributed to the participating agencies as a part of this report.

Per request of DDW and participating agencies, this report expands on the area's vulnerability to wildfires and the impacts that resulted from the 2018 Carr, Hirz, and Delta Fires.

4 WATERSHEDS

Figures 4.1 through 4.4 show the locations of watersheds included in this survey, and Table 4.1 summarizes the land areas of all four major watersheds. This section briefly describes the geographic location of the watersheds and their tributaries. Depending on their location, each participating agency draws their source water from one of or a combination of the watersheds described.

For ease of description, this report considers a portion of the Sacramento River from Shasta Dam to the Bella Vista Water District intakes at Wintu Pump Station near Turtle Bay to be within the City of Redding as shown on Figure 4.4. For the purposes of this report, this section of the river is referred to as the Sacramento River Watershed, even though the Sacramento River Watershed includes the river above Shasta Lake, Shasta Lake and its tributaries, and the river from Shasta Dam to the Sacramento-San Joaquin River Delta.

Whiskeytown Lake receives water from the Trinity Watershed through the Clear Creek Conduit. For the purposes of this report, both Lewiston Lake and Trinity Lake are referred to as the Trinity Watershed.

4.1 Shasta Watershed

Shasta Lake is the largest reservoir in California and was created by the completion of Shasta Dam in 1945 as part of the Central Valley Project. Shasta Lake is formed by the impoundment of three major rivers (Pit, McCloud, and Sacramento) and has a storage capacity of 4,552,000 acre-feet and a surface area of 30,000 acres. The reservoir receives drainage from over 6,665 square miles. Shasta Dam was created to provide flood control, store surplus winter runoff for irrigation, maintain navigation flows, protect the Sacramento-San Joaquin Delta from intrusion of saline ocean water, and generate hydroelectric power.[1]

Water released from Shasta Dam enters the Sacramento River and eventually Keswick Reservoir, which serves as an after bay stabilizing uneven release from Shasta Dam as well as receiving inflow from Whiskeytown Lake via the Spring Creek Tunnel. Keswick Reservoir holds a maximum of almost 24,000 acre-feet[1] and produces electricity and provides recreational opportunities. Releases from Shasta Dam and Keswick Reservoir are controlled by the U.S. Bureau of Reclamation (USBR).

The Shasta Watershed is located in portions of Shasta, Lassen, Siskiyou, and Modoc Counties. The boundaries of the watershed consist of Shasta Dam to the south, the Trinity Divide to the west, Mount Shasta to the north, and the Warner Mountains to the east. Land ownership in the watershed consists of tribal, private, and both state and federally managed property. The U.S. Forest Service (USFS) manages the Shasta, Klamath, Modoc, and Lassen National Forests, which comprise most of the federal lands in the watershed.

In the northwestern portion of the watershed is Mount Shasta. At 14,162 feet, the dormant volcano provides a source of water from snowmelt throughout the summer, and approximately two-thirds of the mountain snowmelt drains into the watershed. To the southeast, approximately one-third of Lassen National Park provides snowmelt to the watershed during the summer. The Pit River, which flows southwesterly into Shasta Lake, extends almost to Nevada and contributes a large portion of the watershed's waters.

Historically, Goose Lake, located in northeastern California and extending into Oregon, was included in the drainage basin and was a source of the headwaters of the Pit River. However, drought and extensive water diversion has caused the lake level to drop below its outlet and occasionally dry up completely.[2] Most recently, Goose Lake dried up in 2015.[7] Goose Lake used to be considered part of the California watersheds due to it flowing into the Pit River; however, considering the infrequency of this occurrence from peak flows, it is addressed as an enclosed basin.[8] This sanitary survey does not include Goose Lake as part of the watershed; however, its watershed boundary is shown on the figures.

Figure 4.6 shows the participating PWSs that obtain all or a portion of their water from the Shasta Watershed. CSAs Sugarloaf No. 2, Castella No. 3, and Crag View No. 23 also receive their waters from the watershed above the lake and are shown on Figures 7.3 and 7.4.

Photo 1 - Shasta Lake, Shasta Dam, and Sacramento River

4.2 Trinity Watershed

Trinity Lake was created by the completion of Trinity Dam in 1962 as part of the Trinity Division Project, and its location and boundaries are shown on Figure 4.2. The lake was renamed for U.S. Senator Clair Engle in 1964 after his death in the same year. In 1997, the Clair Engle Lake's name was changed back to Trinity Lake. The reservoir collects runoff from the roughly 692-square-mile watershed, has a useable storage capacity of 2,448,000 acre-feet, and a surface area of about 15,640 acres.[1,3] The primary benefits of the project were to provide flood control, irrigation, and drinking water, as well as hydroelectric power and recreation. The main tributaries into the lake are Stuart Fork, Swift Creek, East Fork of the Trinity River, Coffee Creek, and the main stem of the Trinity River. A little over 90 percent of the basin is under public ownership and managed by the USFS[3], and the largest community in the watershed is Trinity Center.

Photo 2 - Trinity Lake

Water releases from Trinity Dam, controlled by the USBR, and drains into Lewiston Lake, a reservoir formed behind Lewiston Dam. Lewiston Lake has a capacity of 14,660 acre-feet and a surface area of 673 acres.[3] Water from Lewiston Dam is either released into the Trinity River or diverted into the Clear Creek Tunnel located near the dam. The Clear Creek Tunnel travels southeast almost 11 miles to the Judge Francis Carr Powerhouse, where it enters Whiskeytown Lake. Historically, up to 90 percent of Trinity River water had been diverted from Lewiston Dam into the Whiskeytown Lake via the Clear Creek Tunnel. In 1992, the Secretary of the Interior required that flows into the Trinity River be increased to 25 percent of the river's historic flows, and in 2000, that amount was increased to 50 percent of the historic flows.[3] The Record of Decision called for significant physical/mechanical restoration actions in the main stem, as well as increased flows in the river below the dam to restore fish and wildlife habitat.[4]

4.3 Whiskeytown Watershed

Whiskeytown Lake was formed by construction of the Claire A. Hill Dam in 1963 as part of the Trinity River Division Project and Central Valley Project to minimize flooding, provide a source of irrigation and drinking water, and create recreational opportunities. Whiskeytown Lake is located in the western portion of Shasta County as shown in Figures 4.1 and 4.3. Approximately 200 square miles of the Whiskeytown Watershed drains into Whiskeytown Lake. The lake has a capacity of 241,100 acre-feet, a surface area of 3,250 acres, and 36 miles of shoreline.[5] The Whiskeytown National Recreation Area surrounds the reservoir and is managed by the National Park Service (NPS). French Gulch is the only major community located in the watershed.

Inflow to the reservoir is provided by two main sources: Clear Creek, which drains a majority of the Whiskeytown Watershed, and the Clear Creek Conduit, which conveys water from Lewiston Lake. The Clear Creek Conduit is 17.5 feet in diameter, 10.7 miles long, and conveys water to the Judge Francis Carr Powerhouse located at the northwestern extremity of Whiskeytown Lake.[5] The conduit capacity is 3,200 cubic feet per second (CFS)[5], and during normal precipitation years, total inflow through the Clear Creek Conduit, combined with local runoff, is enough water to fill the reservoir four times over.[1]

Photo 3 - Whiskeytown Lake

Water flows from the reservoir through three outlets: (1) Claire A. Hill Dam into Clear Creek, which flows into the Sacramento River south of Redding; (2) Muletown Conduit to the Clear Creek CSD WTP; and (3) Spring Creek Conduit into Keswick Reservoir located on the Sacramento River. These outlets are controlled by the USBR.

The Spring Creek Conduit is 18.5 feet in diameter, 2.4 miles long, and has a capacity of 3,600 CFS.[5] The tunnel originates at the eastern end of Whiskeytown Reservoir near the visitor center at an elevation of 1,075 feet, where water is drawn into the conduit via the Rock Creek Siphon. Water is then drawn from the conduit by the City of Redding's Buckeye WTP and Shasta CSD before it flows into Keswick Reservoir via the Spring Creek Powerhouse. Furthermore, because the Spring Creek Conduit empties into the Sacramento River at the Keswick Reservoir, the City of Redding Foothill WTP and Bella Vista Water District consider Whiskeytown and Trinity Watersheds a part of their source waters.

The Muletown Conduit begins at Whiskeytown Dam and ends at the Clear Creek CSD 0.25-million-gallon (MG) flow control tank at the intersection of Cloverdale and Clear Creek Roads. The conduit has two intakes located at elevations 1,110 feet and 965 feet (99 feet and 244 feet in depth, respectively, when the reservoir is at full capacity). The intakes allow the Clear Creek CSD to select the optimal depth from which to draw the best quality water with permission from USBR. The conduit is 8.4 miles long, varies from 45 to 42 inches in diameter, and was built in the 1960s to supply agricultural and domestic users in the region west of Redding.[5] The Clear Creek CSD has a water treatment facility located immediately downstream of the dam, and conveys treated water from the WTP to the Clear Creek and Centerville CSDs through the Muletown Conduit.

Figure 4.5 shows the participating PWSs using water from Whiskeytown Lake and Trinity Lake. Water from Whiskeytown Lake is distributed to a majority of the population of the greater Redding area through the City of Redding's two treatment plants and the Bella Vista Water District facilities.

4.4 Sacramento River Watershed

For the purposes of this survey, the Sacramento River Watershed is the drainage area from Shasta Dam to the Bella Vista Water District intake at the Wintu Pump Station. The watershed begins at Shasta Dam and continues to Keswick Dam where water from the Whiskeytown Watershed is introduced through the Spring Creek Conduit. The watershed continues past the City of Redding's Foothill intakes and ends at the Bella Vista Water District Wintu Pump Station. Figure 4.4 shows the boundaries of the Sacramento River Watershed, which encompasses approximately 65 square miles.

4.5 Major Landowners and Controlling Agencies

This section introduces the composition and location of the major landowners in the watersheds. Readers interested in understanding the management practices of the agencies located in the watershed will find a list of watershed management programs and contact information at the end of this section of the report.

None of the participating agencies have direct control of the lands within their watershed. While this could be seen as detrimental, nearly 50 to 70 percent of the lands in all of the watersheds are owned by state and federal agencies, and these agencies have the resources to regulate proper land management techniques. The remaining lands that are designated as unclassified are most likely privately owned, and the impact on water quality from these lands are regulated and controlled by other government agencies, such as the SWRCB.

State and federal agencies that administer federal land in the watersheds, monitor and investigate water quality to determine the impact of their management practices. Often these findings are published, and much of the information included in this survey is based on these reports. Figures 4.7 through 4.10 show the location and composition of the major landowners in the watersheds, and Tables 4.2 through 4.5 present the area and percentage of land owned by government agencies. Table 4.6 summarizes the lands of all landowners in all watersheds.

4.6 Watershed Management Programs

Shasta and Sacramento River Watersheds

Fall River Resource Conservation District
https://www.fallriverrcd.org/about_us

The Fall River Resource Conservation District provides a number of important services to local landowners. Conservation of soil and water on rangeland, pastureland, irrigated cropland, and the water quality of Fall River, Pit River, Hat Creek, Burney Creek, and all the watersheds in the district are the focus of the Fall River Resource Conservation District.

Modoc Resource Conservation District
http://www.modocrcd.org/

The Modoc Resource Conservation District functions to make available technical, financial, and educational resources, whatever their source, and focus or coordinate them so that they meet the needs of local land users for conservation of soil, water, and related resources.

Mount Shasta Bioregional Ecology Center
https://mountshastaecology.org/history/

Mount Shasta Bioregional Ecology Center works through public education, science-based public policy and advocacy, legal challenges, restoration, watershed monitoring, forest stewardship, building partnerships and alliances, and engaging the local community to connect with and protect the bioregion. Through their participation in proposal review processes, this program has halted or modified some of the worst forest practices, preventing forest degradation and sedimentation that threaten pristine waters.

Pit Resource Conservation District
https://www.pitrcd.org/about

The Pit Resource Conservation District was formed in the 1940s to address issues pertaining to soil and water conservation. The District (in cooperation with the Natural Resources Conservation Service) provides technical and financial assistance to agricultural producers and promotes vegetation management to benefit stream channel stability and wildlife enhancement.

Pit River Watershed Alliance
https://www.pitriveralliance.net/

The Pit River Watershed Alliance is a collaborative, non-regulator group that seeks to strengthen individual stakeholder efforts through enhanced coordination. From these efforts, the Alliance is hopeful to achieve long-term cultural, economic, and environmental health in the watershed.

The River Exchange
http://www.sacriver.org/aboutwatershed/roadmap/watersheds/northeast/upper-sacramento-river#:~:text=The%20River%20Exchange%20is%20a,the%20status%20of%20river%20conditions.

The River Exchange is a nonprofit organization established following the 1991 Cantara spill for the purpose of restoring the attributes of the Upper Sacramento River Watershed and establishing a public center for information on the status of river conditions.

Sacramento Watersheds Action Group
https://www.watershedrestoration.org/home/

Sacramento Watersheds Action Group is a 501(c)(3) public benefit corporation that solicits grant funding to restore salmonid and riparian habitat.

Their most recent work is in Sulphur Creek, a small tributary to the Sacramento River in Redding, which has been noted as a tributary of concern for the Bella Vista Water District. They have organized a CRMP (Coordinated Resource Management Planning) Group for several years and conducted a Sulphur Creek Watershed Analysis.

Sacramento River Watersheds Program
http://www.sacriver.org/

The Sacramento River Watershed Program is a 501(c)(3) non-profit corporation that was established to ensure that current and potential uses of the watershed's resources are sustained, restored, and, where possible, enhanced while promoting the long-term social and economic vitality of the region.

Founded in 1996, the Sacramento River Watershed Program brings together dozens of groups and thousands of people concerned about the health of the Sacramento River and its watershed. This group represents the larger Sacramento River Watershed, which includes 27,000 square miles from the Oregon border to the Delta. It strives to resolve watershed issues with local participation and a watershed-wide perspective.

Shasta Valley Resource Conservation District
http://svrcd.org/wordpress/

The Shasta Valley Resource Conservation District's mission is to work with interested landowners on a voluntary basis to enhance the management and sustainable use of natural resources in order to ensure the long-term economic viability of the community.

Western Shasta Resource Conservation District
https://carcd.org/2019/08/get-to-know-western-shasta-rcd/

The Western Shasta Resource Conservation District is a special district of the State of California and is funded entirely by grants and contracts. The District encompasses approximately 1.7 million acres bounded on the east by the watershed divide between eastern and western Shasta County; the north by the Siskiyou County line; the west by the Trinity County line; and the south by the Tehama County line.

Trinity Watershed

Trinity County Resource Conservation District
https://www.tcrcd.net/

The intention of the Trinity County Resource Conservation District's watershed management program is to improve forest health, habitats, ecosystems, and water quality in collaboration with public and private partners. Project focuses include, but are not limited to: road decommissioning, road upgrade, stream and habitat restoration, watershed planning and coordination, and trespass cannabis grow site and illegal dumping cleanup.

Whiskeytown Watershed

Western Shasta Resource Conservation District
https://carcd.org/2019/08/get-to-know-western-shasta-rcd/

See Shasta and Sacramento River Watersheds section above.

<u>References</u>:

1. "PROJECTS & FACILITIES." *Bureau of Reclamation*, www.usbr.gov/projects/index.php?id=342.
2. "Goose Lake (Oregon–California)." *Wikipedia*, Wikimedia Foundation, 12 May 2020, en.wikipedia.org/wiki/Goose_Lake_%28Oregon%E2%80%93California%29.
3. "Upper Trinity River Watershed Analysis," US Forest Service, Shasta-Trinity National Forest, CA, March 2005.
4. "RESTORATION." *Trinity River Restoration Program*, www.trrp.net/restoration/.
5. Watershed Sanitary Survey of Whiskeytown Lake Facilities and Sacramento River Facilities, December 2002, Redding Area Water Agencies.
6. "BLM CA Land Status - Surface Management Areas." *Navigator*, 1 Oct. 2019, navigator.blm.gov/data?id=1fca0357df7c87ae.
7. Goose Lake Dries Up. (n.d.). Retrieved October 28, 2020, from https://earthobservatory.nasa.gov/images/86358/goose-lake-dries-up.
8. Welcome to the Pit River Watershed Alliance. (n.d.). Retrieved October 28, 2020, from https://www.pitriveralliance.net/.

TABLE 4.1

REDDING AREA WATERSHED SANITARY SURVEY

WATERSHED AREAS

WATERSHED	ACRES[1]	SQUARE MILES	PERCENTAGE
Shasta [2]	4,811,732	7,518	88.4%
Trinity	459,817	718	8.5%
Whiskeytown	127,735	200	2.3%
Sacramento River	42,309	66	0.8%
Totals	5,441,593	8,502	100.0%

[1] Includes bodies of water.

[2] Includes Goose Lake.

TABLE 4.2

REDDING AREA WATERSHED SANITARY SURVEY

SHASTA LAKE WATERSHED LAND ADMINISTRATION

ADMINISTRATION	AREA (ACRES)*	PERCENTAGE
Bureau of Indian Affairs	8,708	0.2%
Bureau of Land Management	393,831	8.8%
CA Dept of Fish and Wildlife	6,951	0.2%
Local Government	67	0.001%
National Park Service	56,678	1.3%
Private Lands	1,352,163	30.3%
State Lands	40,106	0.9%
Undetermined Lands	471,960	10.6%
US Bureau of Reclamation	995	0.02%
US Forest Service	2,129,873	47.7%
Total Shasta Lake Watershed Land in California	4,461,331	100.0%

*Area includes portion of Goose Lake located in California.

Source: BLM CA Land Status - Surface Management Areas." Navigator, 1 Oct. 2019, navigator.blm.gov/data?id=1fca0357df7c87ae.

TABLE 4.3

REDDING AREA WATERSHED SANITARY SURVEY

TRINITY LAKE WATERSHED LAND ADMINISTRATION

ADMINSTRATION	AREA (ACRES)	PERCENTAGE
Bureau of Land Management	1,517	0.3%
Private Lands	6,254	1.4%
State Lands	18	0.004%
Undetermined Lands	129,767	28.2%
US Bureau of Reclamation	326	0.1%
US Forest Service	321,935	70.0%
Total Trinity Lake Watershed Land	459,817	100.0%

Source: BLM CA Land Status - Surface Management Areas." Navigator, 1 Oct. 2019, navigator.blm.gov/data?id=1fca0357df7c87ae.

TABLE 4.4

REDDING AREA WATERSHED SANITARY SURVEY

WHISKEYTOWN LAKE WATERSHED LAND ADMINSTRATION

ADMINISTRATION	AREA (ACRES)	PERCENTAGE
Bureau of Land Management	31,936	25.0%
National Park Service	32,056	25.1%
Private Lands	19,831	15.5%
State Lands	80	0.1%
Undetermined Lands	19,888	15.6%
US Bureau of Reclamation	61	0.05%
US Forest Service	23,883	18.7%
Total Whiskeytown Lake Watershed Land	127,735	100.0%

Source: BLM CA Land Status - Surface Management Areas." Navigator, 1 Oct. 2019, navigator.blm.gov/data?id=1fca0357df7c87ae.

TABLE 4.5

REDDING AREA WATERSHED SANITARY SURVEY

SACRAMENTO RIVER WATERSHED LAND ADMINISTRATION

ADMINISTRATION	AREA (ACRES)	PERCENTAGE
Bureau of Land Management	12,417	29.35%
National Park Service	941	2.22%
Private Lands	22,295	52.70%
State Lands	53.00	0.13%
Undetermined Lands	1,071.00	2.53%
US Bureau of Reclamation	5,103	12.06%
US Forest Service	429	1.01%
Total Sacramento River Watershed Land	42,309	100%

Source: BLM CA Land Status - Surface Management Areas." Navigator, 1 Oct. 2019, navigator.blm.gov/data?id=1fca0357df7c87ae.

TABLE 4.6

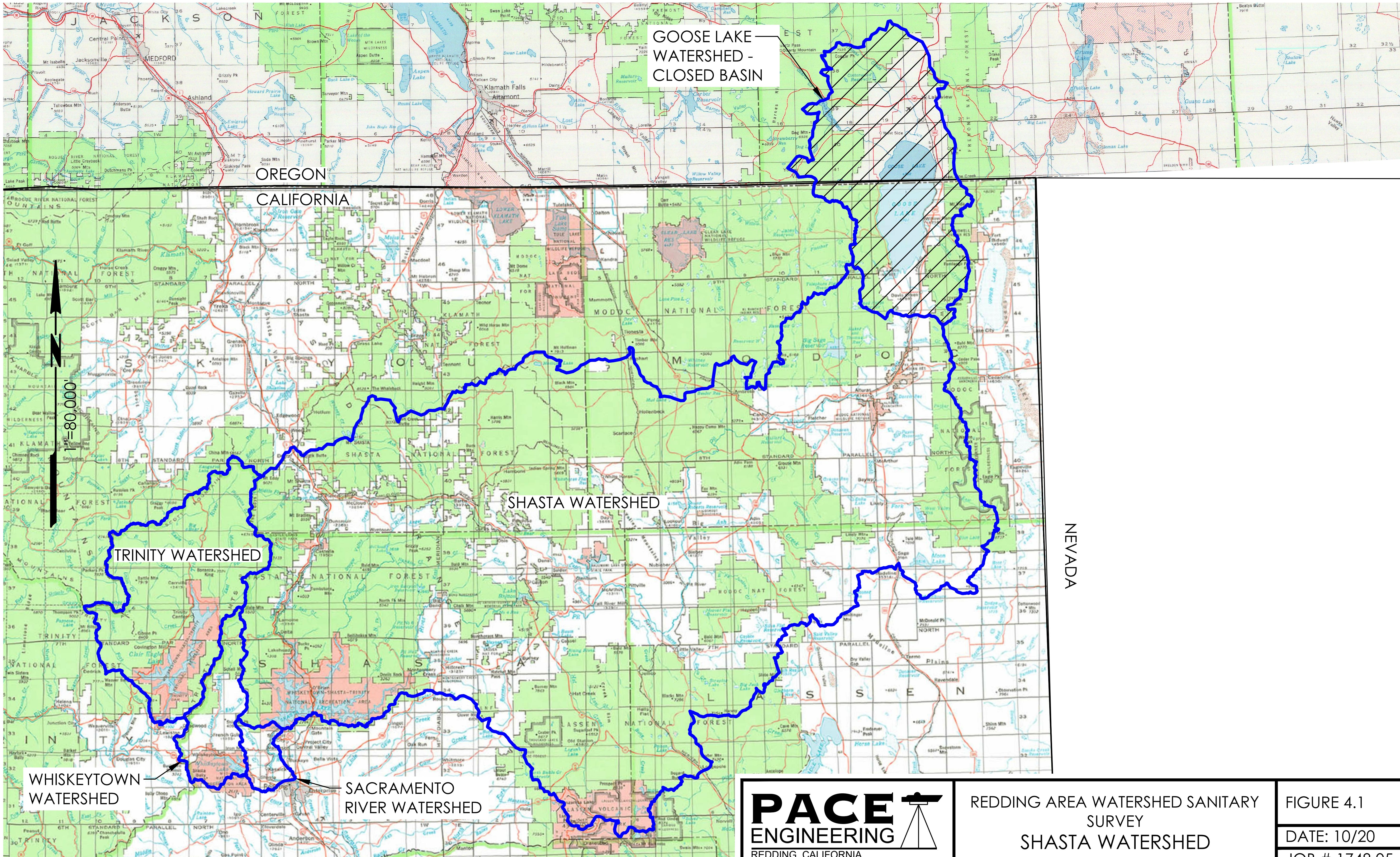
REDDING AREA WATERSHED SANITARY SURVEY

ALL WATERSHED LAND OWNERS AND AREAS

ADMINISTRATION	AREA (ACRES)	PERCENTAGE
Bureau of Indian Affairs	8,708	0.2%
Bureau of Land Management	439,744	8.6%
CA Dept of Fish and Wildlife	6,951	0.1%
Local Government	67	0.001%
National Park Service	89,675	1.8%
Private Lands	1,400,499	27.5%
State Lands	40,257	0.8%
Undetermined Lands	622,686	12.2%
US Bureau of Reclamation	6,485	0.1%
US Forest Service	2,476,120	48.6%
Total[1]	5,091,192	100%

[1] Land totals within California only.

Source: BLM CA Land Status - Surface Management Areas." Navigator, 1 Oct. 2019, navigator.blm.gov/data?id=1fca0357df7c87ae.



PACE ENGINEERING
REDDING, CALIFORNIA

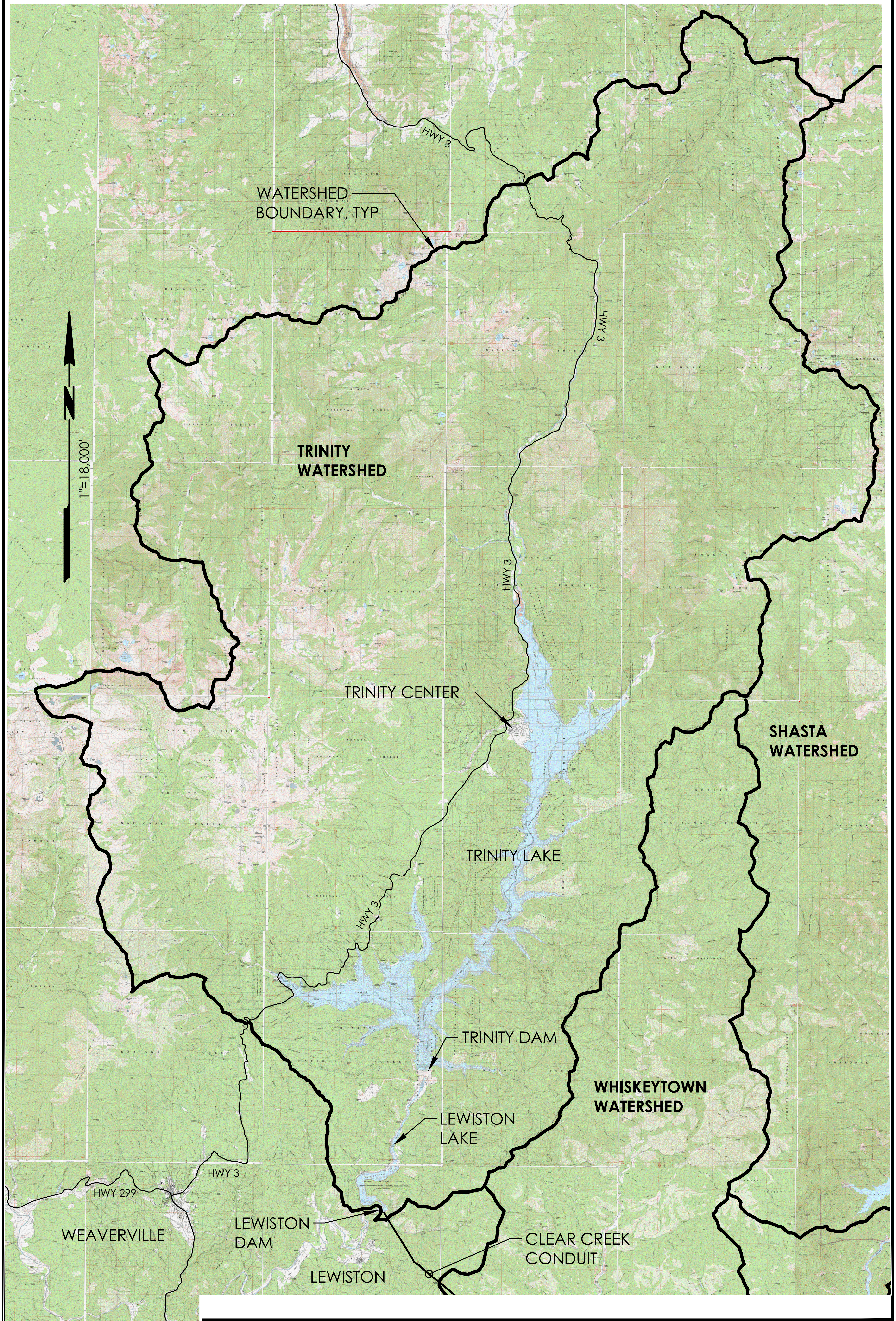
REDDING AREA WATERSHED SANITARY SURVEY
SHASTA WATERSHED

FIGURE 4.1

DATE: 10/20

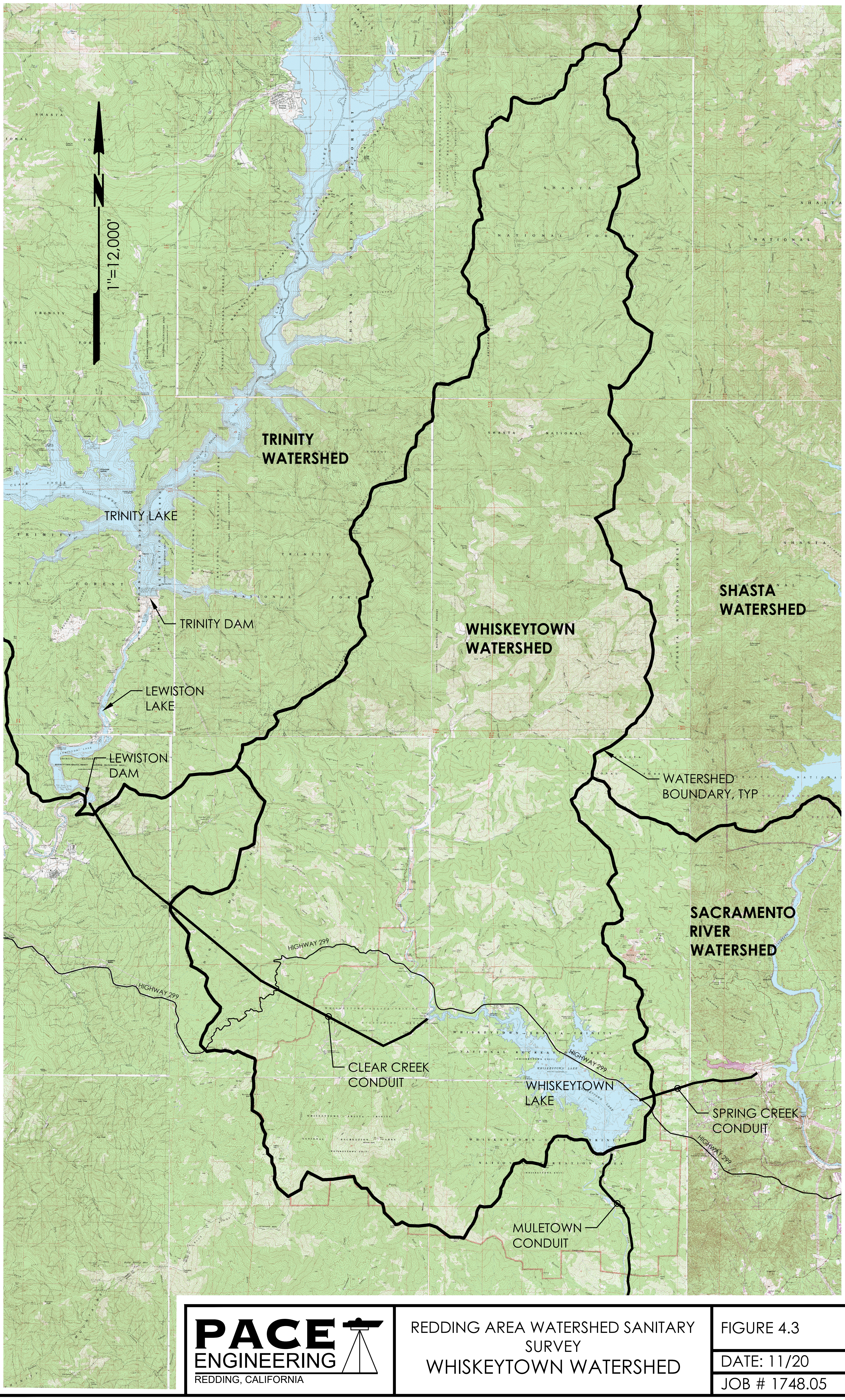
JOB # 1748.05

Plot Date: October 28, 2020 – 9:46 am Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Shasta Watershed Figures.dwg, Layout: 4.1



PACE ENGINEERING REDDING, CALIFORNIA	REDDING AREA WATERSHED SANITARY SURVEY TRINITY WATERSHED	FIGURE 4.2 DATE: 11/2020 JOB # 1748.05

Plot Date: November 19, 2020 - 4:14 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Trinity Watershed Figures.dwg, Layout: FIGURE 4.2

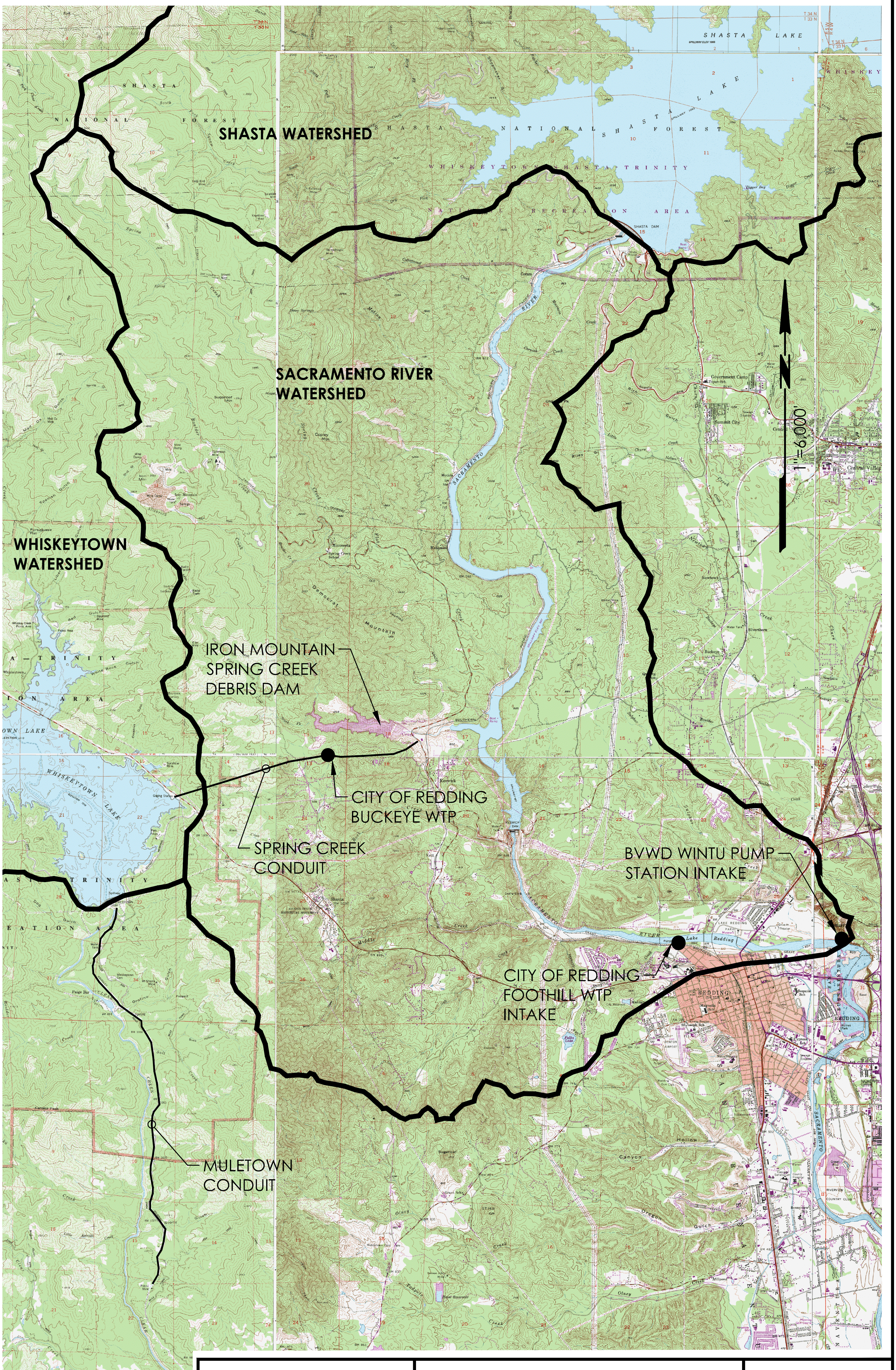


PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY
WHISKEYTOWN WATERSHED

FIGURE 4.3
DATE: 11/20
JOB # 1748.05

Plot Date: November 17, 2020 – 3:10 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Whiskeytown Watershed.dwg, Layout: FIG 4.3 WATERSHED MAP



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

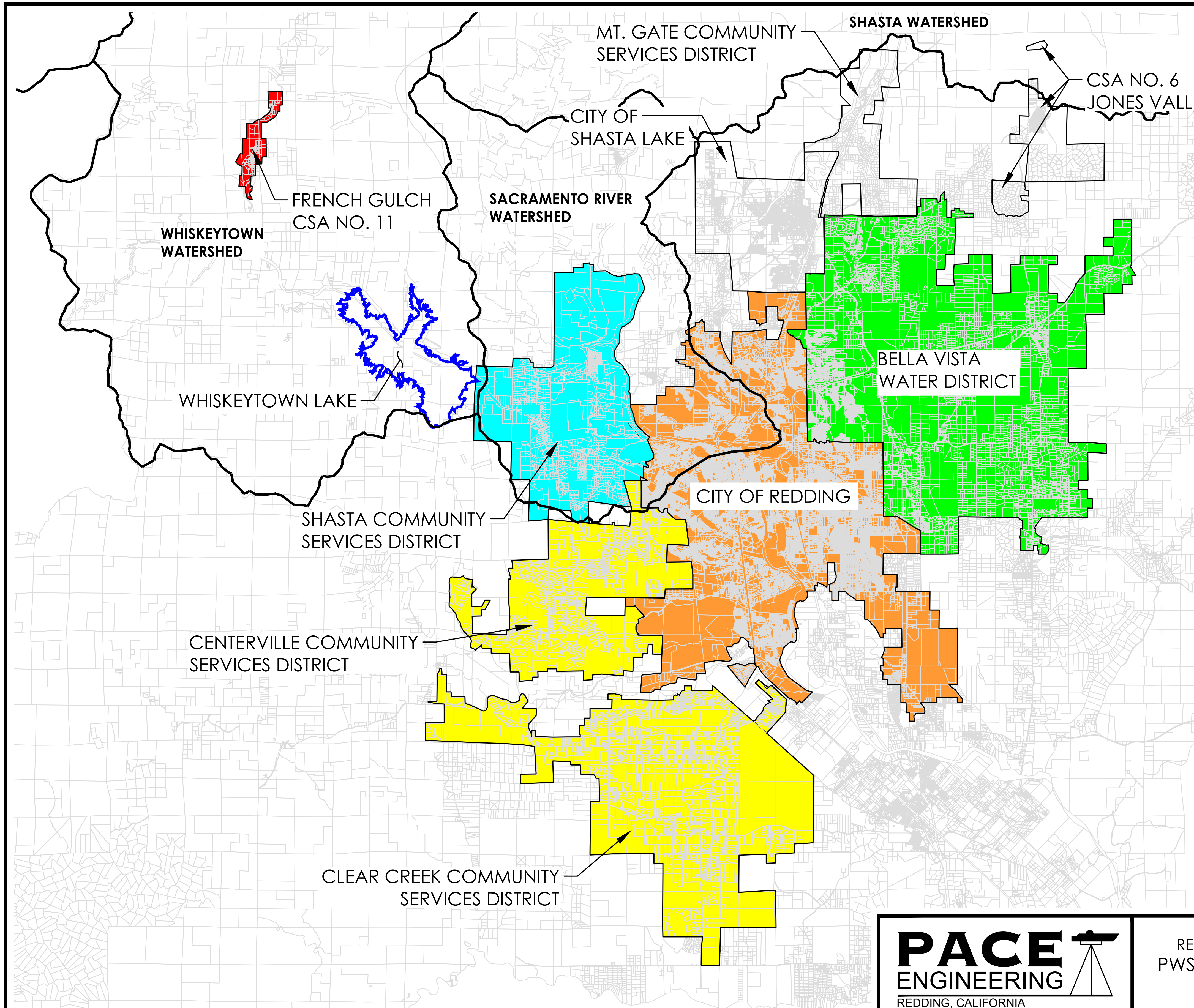
SACRAMENTO RIVER WATERSHED

FIGURE 4.4

DATE: 11/2020

JOB # 1748.05

Plot Date: November 19, 2020 – 4:08 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Sacramento River Watershed Figures.dwg, Layout: FIG 4.4 WATERSHED MAP



LEGEND

- (Yellow) DRAWS WATER FROM THE MULETOWN CONDUIT, WHICH ORIGINATES FROM WHISKEYTOWN RESERVOIR.
- (Cyan) DRAWS WATER FROM THE SPRING CREEK CONDUIT, WHICH ORIGINATES FROM WHISKEYTOWN RESERVOIR.
- (Red) DRAWS WATER FROM CLEAR CREEK ABOVE WHISKEYTOWN RESERVOIR; THEREFORE, NO TRINITY LAKE WATER IS USED.
- (Green) DRAWS WATER FROM THE SACRAMENTO RIVER, WHICH RECEIVES WATERS FROM THE SPRING CREEK CONDUIT AND SHASTA LAKE.
- (Orange) CITY OF REDDING HAS TWO TREATMENT PLANTS. THE FOOTHILL WTP DRAWS WATER FROM THE SACRAMENTO RIVER, WHICH RECEIVES WATERS FROM WHISKEYTOWN LAKE. THE BUCKEYE WTP DRAWS WATER FROM WHISKEYTOWN LAKE THROUGH THE SPRING CREEK CONDUIT.

NOTE: WHISKEYTOWN LAKE RECEIVES LARGE QUANTITIES OF WATER FROM TRINITY LAKE; THEREFORE, ALL OF THE LARGE PWSs SHOWN HERE ARE AFFECTED BY EVENTS AT TRINITY LAKE EXCEPT FOR CSA NO. 11, FRENCH GULCH.

THE LOWER SACRAMENTO RIVER RECEIVES WATERS FROM THE TRINITY LAKE, WHISKEYTOWN LAKE, SHASTA LAKE, AND LOWER SACRAMENTO WATERSHEDS.

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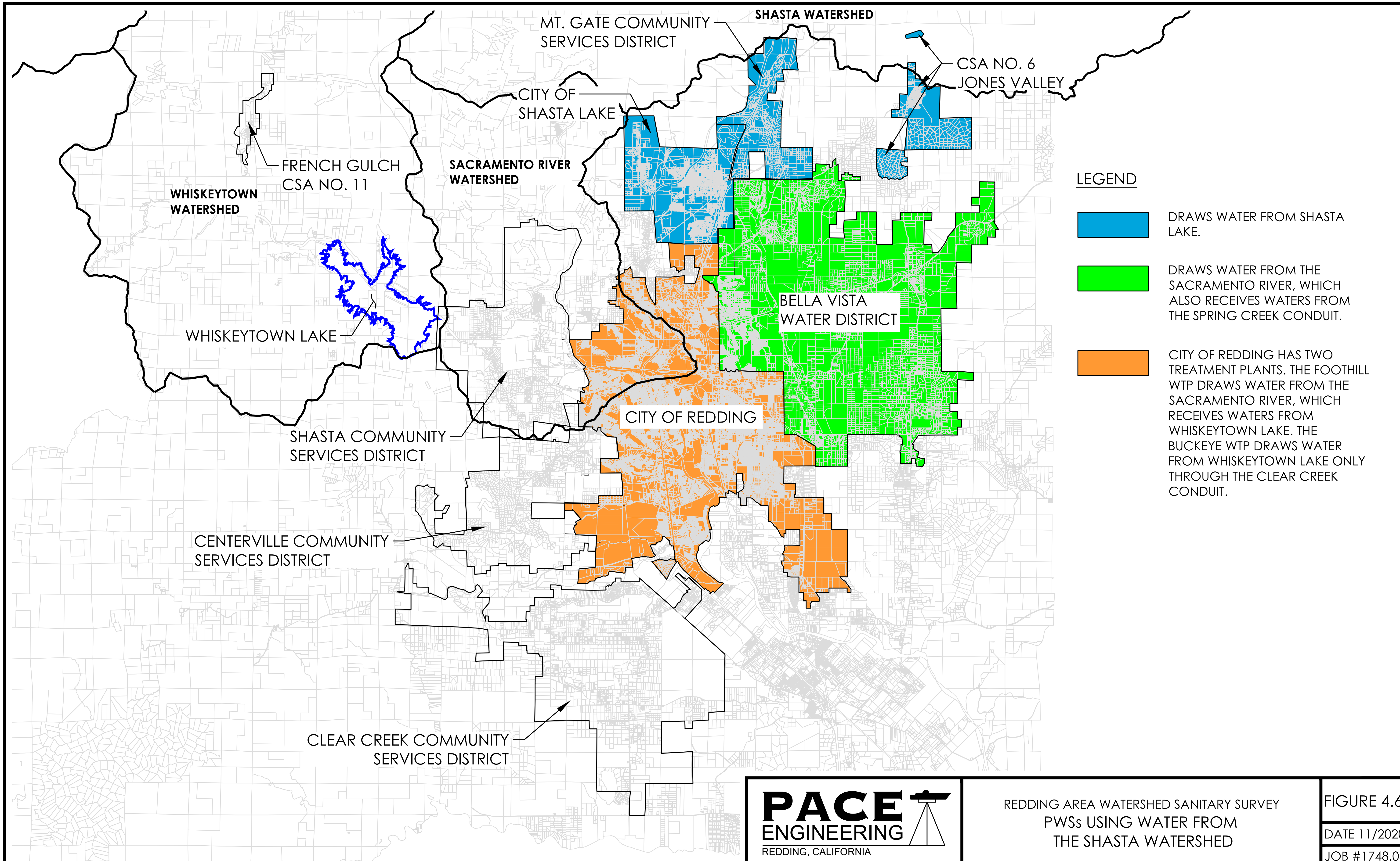
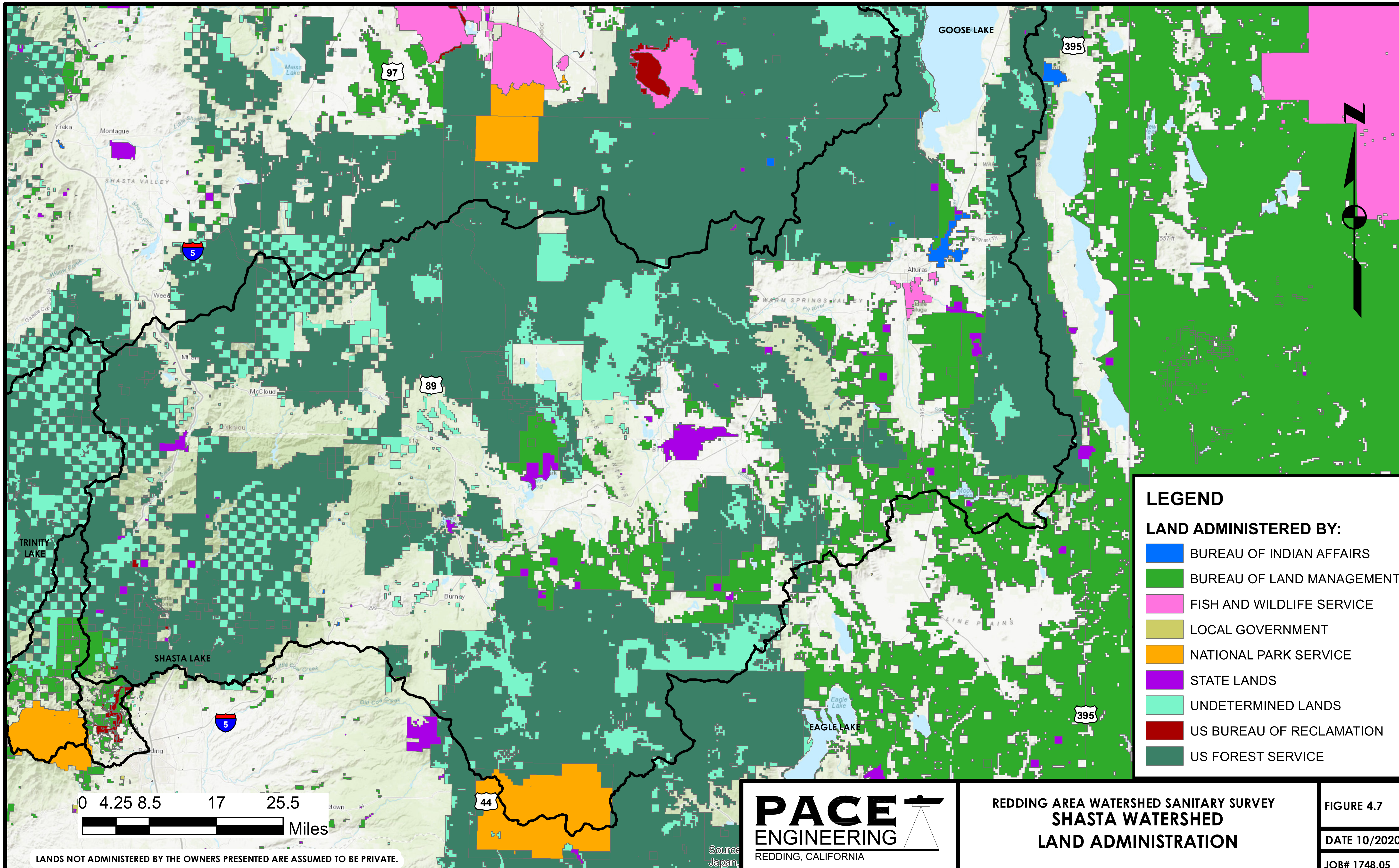
REDDING AREA WATERSHED SANITARY SURVEY
PWSs USING WATER FROM WHISKEYTOWN AND TRINITY WATERSHEDS

FIGURE 4.5
DATE 11/2020
JOB #1748.05

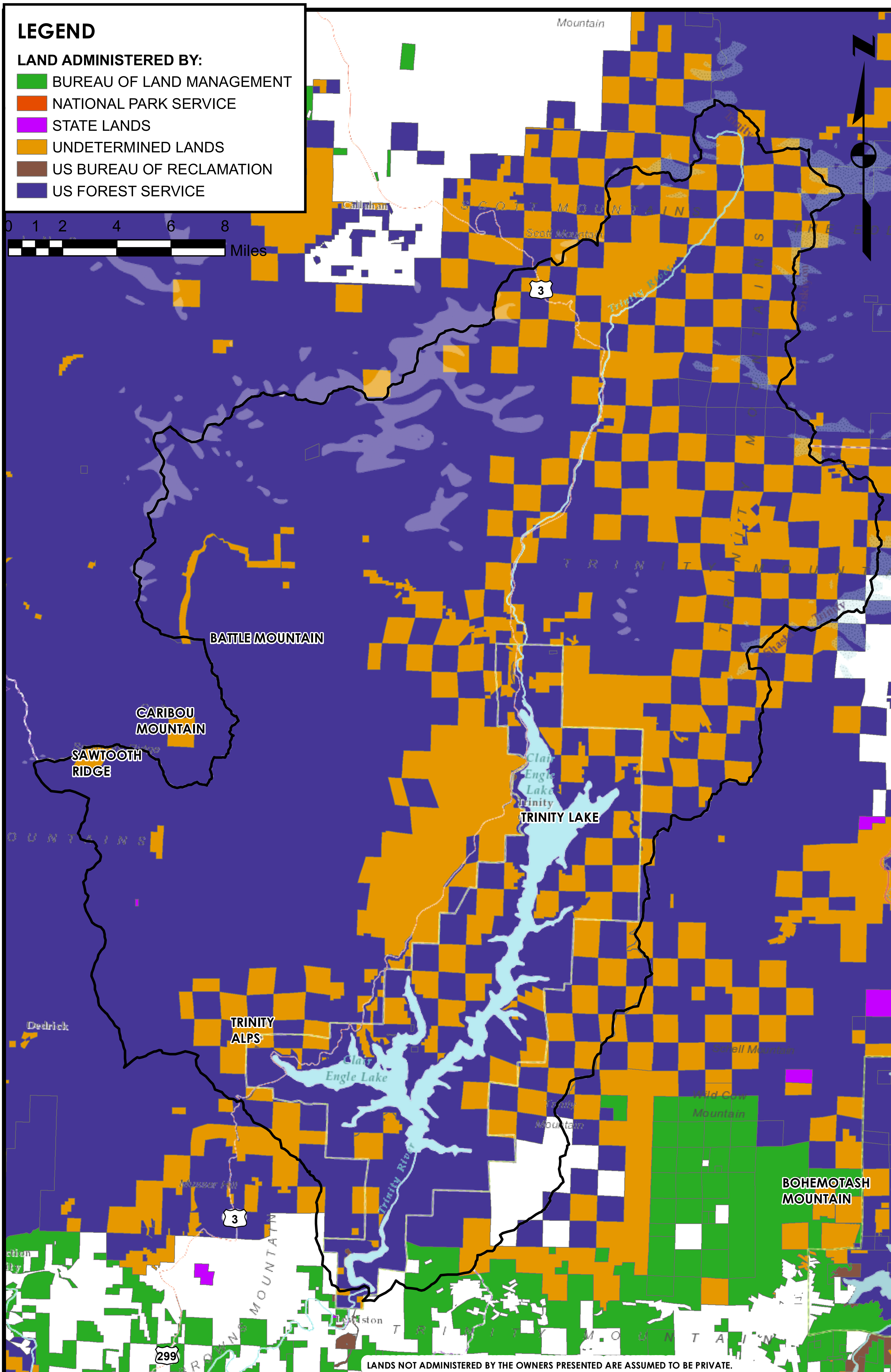


REDDING AREA WATERSHED SANITARY SURVEY
PWSs USING WATER FROM THE SHASTA WATERSHED

FIGURE 4.6
DATE 11/2020
JOB #1748.05



Document Path: M:\GIS\Jobs\1748.05\Maps\FIG 4.7 NEW.mxd



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

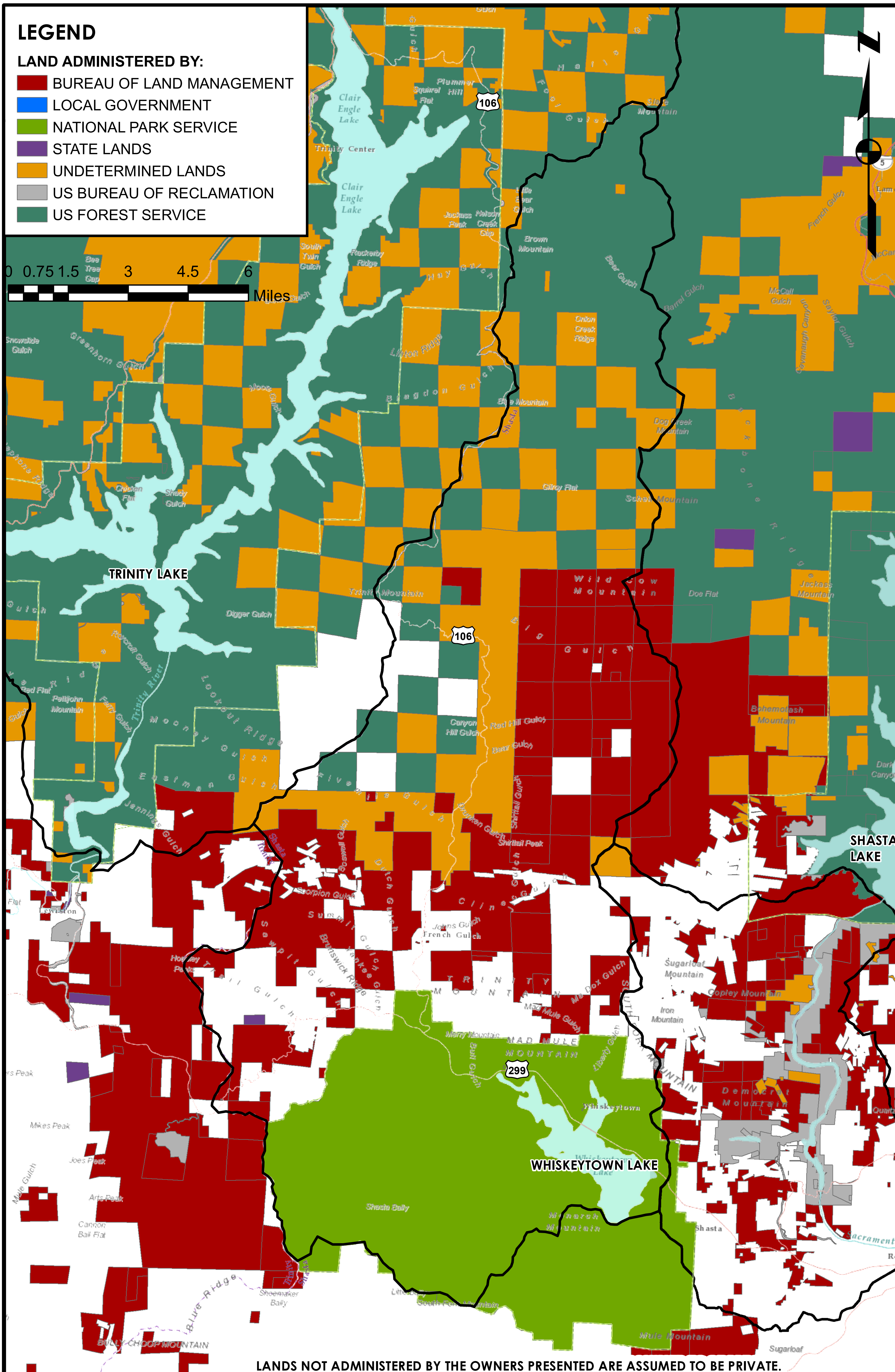
TRINITY WATERSHED
LAND ADMINISTRATION

FIGURE 4.8

DATE 10/2020

JOB#1748.05

Document Path: M:\GIS\Jobs\1748.05\Maps\FIG 4.8 LAND ADMIN.mxd



LANDS NOT ADMINISTERED BY THE OWNERS PRESENTED ARE ASSUMED TO BE PRIVATE.

PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

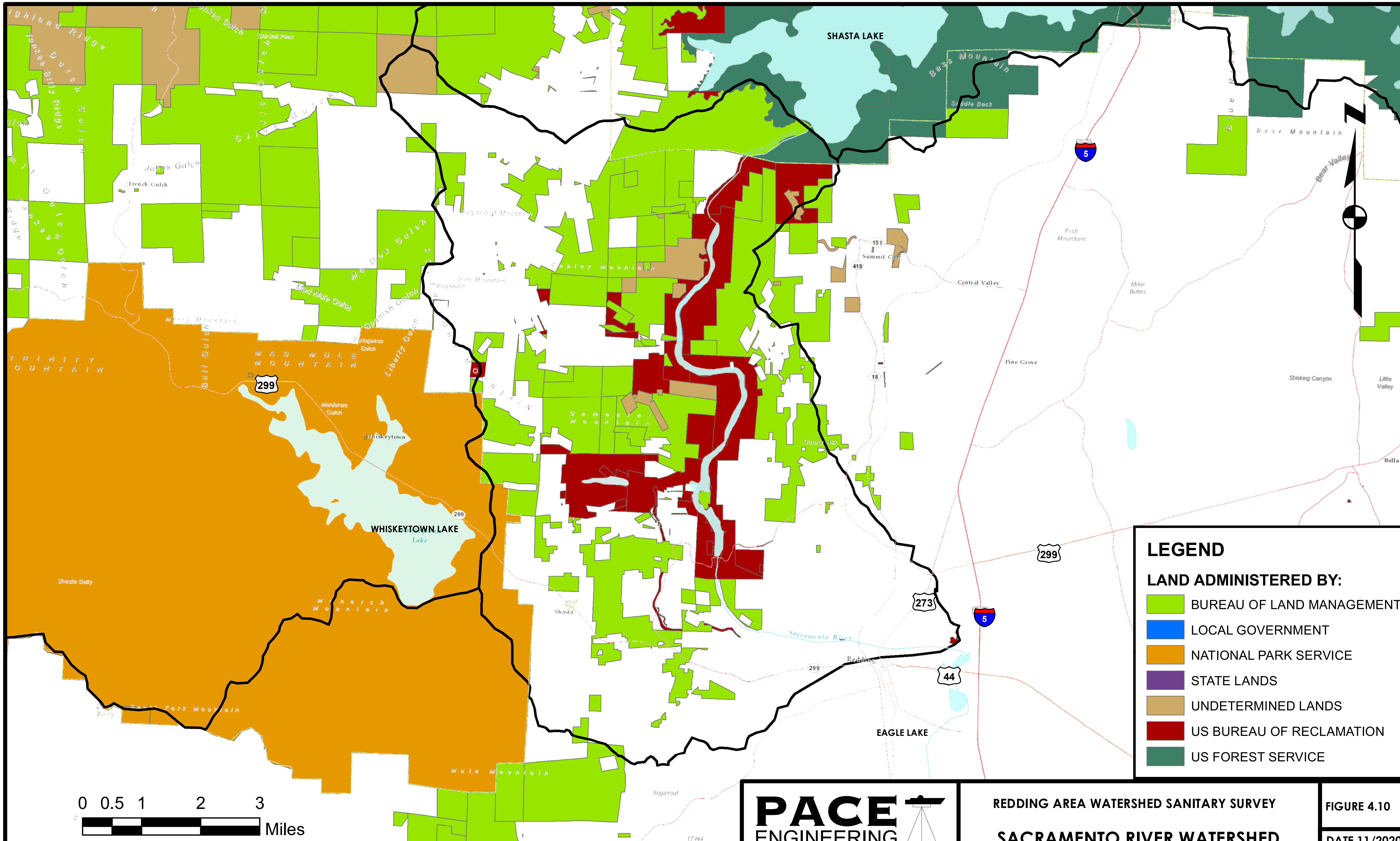
WHISKEYTOWN WATERSHED LAND ADMINISTRATION

FIGURE 4.9

DATE 10/2020

JOB#1748.05

Document Path: M:\GIS\Jobs\1748.05\Maps\FIG 4.9 LAND ADMIN.mxd



LANDS NOT ADMINISTERED BY THE OWNERS PRESENTED ARE ASSUMED TO BE PRIVATE.

PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

SACRAMENTO RIVER WATERSHED LAND ADMINISTRATION

FIGURE 4.10

DATE 11/2020

JOB# 1748.05

Document Path: M:\GIS\Jobs\1748.05\Maps\FIG 4.10 LAND ADMIN.mxd

5 COMMUNICATIONS AND EMERGENCY RESPONSE

Communication between agencies is critical when dealing with accidents or events in a watershed that could impair water quality. Two government agencies have been created to deal with emergencies: The California Office of Emergency Services (Cal OES) is the state agency, and the federal agency is the National Response Center (NRC). A program that exists to mitigate emergency situations is California Water/Wastewater Agency Response Network (CALWARN). A brief description of these agencies is included in this report as an introduction to the emergency response process.

5.1 State Agency

Cal OES is the state agency responsible for coordinating state, county, and local agency responses to emergencies. Cal OES assists government agencies in developing their own emergency preparedness and response plans and promotes public campaigns to help California residents better prepare for emergencies. Any emergency that poses a threat to the public or the environment should be reported to Cal OES. The California State Warning Center is a division of Cal OES that coordinates communications for the agency and is staffed 24 hours a day. The Warning Center is a single point of notification for all state and local agencies.

By law, any significant chemical spill must be reported to Cal OES and any other relevant agencies.[1] For a listing of these agencies, see the Spill Notification Guide at Hazardous Materials Unit, California Hazardous Material Spill/Release Notification Guidance, at the following web page: http://www.caloes.ca.gov/FireRescueSite/Documents/CalOES-Spill_Booklet_Feb2014_FINAL_BW_Acc.pdf

CalWARN functions in coordination with Cal OES to support and promote statewide emergency preparedness, disaster response, and mutual assistance processes for public and private water and wastewater utilities.[2] The CalWARN Program provides its member utilities with the following free services:

- A standard omnibus mutual assistance agreement and process for sharing emergency resources among Signatories statewide
- The resources to respond and recover more quickly from a disaster
- A mutual assistance program consistent with other statewide mutual aid programs and the Standardized Emergency Management System and the National Incident Management System
- A forum for developing and maintaining emergency contacts and relationships
- New ideas from lessons learned in disasters

The following participating agencies are members of CalWARN:

- Bella Vista Water District
- Centerville CSD
- Clear Creek CSD
- City of Redding

5.2 Federal Agency

NRC is the federal agency that coordinates the emergency response to chemical, waste, and hazardous discharges. The NRC informs the federal Incident Commander, who will then manage any response by federal agencies such as the EPA for inland waterways or the Coast Guard for coastal waterways. Notification to NRC is only required when the spill equals or exceeds the

Comprehensive Environmental Response and Liability Act (CERCLA) federal reportable quantities. Any amount of oil reaching or having the potential of reaching navigable waters of California must also be reported.

5.3 Local Communications

State, county, and city law enforcement agencies are trained to notify CalOES and/or the NRC. Other appropriate response agencies, such as local Cal OES offices and state resource agencies responsible for specific regulatory actions, are also contacted and informed of the nature of the event.

Local water service providers also exchange contact information in order to directly share information in case of an emergency event. This helps expedite notification to downstream water districts of a potential problem and allows water districts to work together in an emergency. The following contact information should be used to share information between sister agencies in the events of an emergency:

Anderson Cottonwood Irrigation District

John S. Currey – General Manager	530-209-1350	gm@ACIDistrict.org

Bella Vista Water District

David Coxey – General Manager	530-241-1085 x106	dcoxey@bvwd.org
Wayne Ohlin – District Engineer	530-241-1085 x112	wohlin@bvwd.org
Tom Zaharris – Treatment Superintendent	530-241-1085 x201	tzaharris@bvwd.org

Burney Water District

Willie Rodriguez – District Manager	530-335-3582 530-238-7833 (cell)	districtmanager@burneywater.org
Mike Skelly – Field Superintendent	530-355-3582	mskelly@burneywater.org

Centerville CSD

Chris Muehlbacher – District Manager	530-246-0680	cmuehlbacher@centervillecsd.com

City of Redding

Barry Tippin – City Manager	530-225-4060	btippin@cityofredding.org
Josh Watkins – Water Utility Manager	530-224-6068	joshwatkins@cityofredding.org
Ryan Bailey – Assistant Director of Public Works - Utilities	530-244-6068	rbailey@cityofredding.org
Conrad Tona – Public Works Supervisor	530-225-4475	ctona@cityofredding.org

City of Shasta Lake

John Duckett – City Manager	530-275-7427	jduckett@cityofshastalake.org
Jessaca Lugo – Assistant City Manager	530 275-7464	jlugo@cityofshastalake.org
Jeff Tedder – City Engineer	530-275-7423	jtedder@cityofshastalake.org
Tony Thomasy – WT Superintendent	530 275-7450	tthomasy@cityofshastalake.org

Clear Creek CSD

Kurt "Skip" Born – General Manager	530-524-3306	skip@clearcreekcsd.com
Bill Palmaymesa – Chief Water Treatment Plant Operator	530-241-6264	bills@clearcreekcsd.com

Mountain Gate CSD

Jeff Cole – District Manager	530-945-2134	jcole@moutaingatecsd.com
Tim Heck – Chief Operator	530-524-8060	theck@mountaingatecsd.com

Shasta CSD

Chris Koeper – General Manager	530-241-6264	ckoeper@shastacsd.org

Shasta County

Shawn Ankeny – Supervising Engineer	530-245-6810	sankeny@co.shasta.ca.us
Scott Sealander – Utility Operations Superintendent	530-949-6768	ssealander@co.shasta.ca.us

Weaverville CSD

Tim Kasper – General Manager	530-623-5051	wcsdtim@gmail.com

Weaverville Sanitary District

Jim Cloud – General Manager	530-623-4102	weavervilleSD@yahoo.com

5.4 Emergency Contacts

The first response to a spill should be to dial 911.

Contact the NRC (800-424-8802) only if the spill of hazardous substance equals or exceeds CERCLA Federal Reportable Quantities, or if any amount of oil is reaching or is having the potential of reaching navigable waters. The website address to determine reportable quantities is http://www.epa.gov/superfund/policy/release/rq/index.htm

Oil Spill Hotline (CA, OR, WA, AK, BC CANADA): (800) OILS-911

California State Warning Center (under Cal OES Executive Branch): (800) 852-7550; (916) 845-8510

5.5 Local Offices of Emergency Services

Shasta County Sheriff's Department
Contact: Eric Magrini, (530) 245-6059

Lassen County Sheriff's Department
Contact: Dean Growdon, (530) 251-8013
Emergency: (530) 257-6121

Modoc County Sheriff's Department
Contact: William "Tex" Dowdy, (530) 233-4416

Siskiyou County Sheriff's Department
Contact: Jon Lopey, (530) 842-3200

Trinity County Sheriff's Department
Contact: Tim Saxon, (530) 623-3740

Division of Drinking Water – Section 1
Contact: Kim Hanahan, (916) 341-5865

Central Valley Regional Water Quality Control Board
Contact: Bryan Smith, (530) 226-3425

References:

1. Cal OES (Governor's Office of Emergency Services). (2014). “California Hazardous Material Spill/Release Notification Guidance.”
2. “Calwarn.org.” *California Water/Wastewater Agency Response Network*, calwarn.org/.
3. United States EPA. (2003). “Large Water System Emergency Response Plan Outline: Guidance to Assist Community Water Systems in Complying with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002.”
4. California Emergency Management Agency. “Hazard Mitigation” <myplan.calema.ca.gov> (Dec. 27, 2015).

6 DRINKING WATER REGULATIONS

6.1 Public Water Systems

The Safe Drinking Water Act (SDWA) authorizes the EPA to set and enforce national drinking water standards to protect public health. The SWRCB DDW is the state agency responsible for monitoring and inspecting PWSs using state and EPA guidelines.

A PWS is a treatment and distribution system that provides water through pipes or other conveyances for human consumption to at least 15 services or regularly serves an average of at least 25 individuals at least 60 days of the year.[1] A PWS is classified by type and size. There are two types of PWSs: community water systems (CWSs) and non-community water systems (NCWS). A CWS serves at least 15 connections year-round or serves at least 25 residents year-round, while an NCWS makes up the remainder of the systems, and this, in turn, falls into one of two classifications:

Non-transient, non-community water systems (NTNCWS): These systems regularly serve at least 25 persons over six months per year. Examples include schools, factories, and hospitals that provide their own water.

Transient, non-community water systems (TNCWS): These systems serve at least 25 persons for less than six months per year. Examples include campgrounds and motels that provide their own water.

While EPA and state governments set and enforce standards, local governments and private water suppliers are responsible for their own water quality. Owners of water systems must meet state standards, submit to regular inspections, and report on their water quality to the state and the public. The state and EPA also provide technical assistance to water suppliers and can take legal action against systems that fail to meet those standards.

The key elements of the SWTR are described in Section 6.2, Surface Water Treatment Rules, of this report. All current drinking water rules and regulations are described in Section 6.3, Regulatory Overview.

There are a number of key acronyms and terms that apply to drinking water regulations, including:

Drinking Water Quality Standards

Maximum Contaminant Level (MCL) – Enforceable drinking water standard, set by the EPA and/or DDW. Primary MCLs are based on health risk, detectability, treatability, and cost for treatment and are set as close as technically and economically feasible to the Maximum Contaminant Level Goal (MCLG)/Public Health Goal (PHG). Utilities are required to meet MCLs in finished water. DDW also sets secondary MCLs, which are aesthetically based.

Maximum Contaminant Level Goal/ Public Health Goal (MCLG/PHG) – Level at which there is no significant health risk if consumed in drinking water over a lifetime. EPA sets MCLGs for all constituents with federal MCLs. In California, the Office of Environmental Hazards and Health Assessment sets PHGs for constituents that have or will soon have primary MCLs. These are non-enforceable limits that are part of the basis for setting MCLs. In some cases, adequate laboratory methods do not exist to reliably analyze the constituents to a detection level as low as the MCLG/PHG. In other cases, there is no treatment effective at reliably treating water to meet the specified MCLG/PHG. And in other cases, there may be available treatment but at a cost that is prohibitive.

Action Level (AL) – This is a health-based advisory level, set by DDW, generally in response to contamination of drinking water supplies by a constituent for which there is no MCL. This is a level thought by DDW to not pose a significant health risk when ingested in water daily. Action level also applies to lead and copper concentrations in drinking water. For non-carcinogen constituents, the no observable adverse effect level governs. For carcinogens, the 1/1,000,000 risk level governs. If these levels are below the practical quantitation limit for analysis, then the practical quantitation limit governs. When constituents are detected above the AL, DDW recommends that consumer notification occur and the source be removed from service.

6.2 Surface Water Treatment Rules

The SWTR establishes maximum turbidity limits and requires filtration and disinfection to remove and/or inactivate pathogenic microbes. The SWTR was promulgated in June 1989 and made effective in January 1991. At the time, it was believed that this regulation was adequate to provide safe drinking water. However, following Cryptosporidium outbreaks in Milwaukee, Wisconsin in 1993 and in other cities, it was clear that the SWTR was inadequate at removing or inactivating Cryptosporidium and Giardia.

In response to the outbreaks, the Interim Enhanced Surface Water Treatment Rule (IESWTR) was promulgated in 1998 and became effective in January 2002. The IESWTR adds tougher surface water control regulations to systems serving more than 10,000 people, followed by the Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR), which regulates systems serving fewer than 10,000 people. Both rules were directed to control Cryptosporidium and Giardia.

Giardia

Giardia is a protozoan that is commonly found in the environment as a cyst in the feces of wild animals, although wild and domestic animals as well as humans may be hosts. Giardia may be present in any type of surface water, including pristine supplies. Giardia can infect humans and cause the gastrointestinal disease giardiasis. As with coliforms, any source of mammalian fecal matter may be a source of Giardia.

Giardia is currently regulated under the SWTR. Surface water suppliers must provide for 3-log reduction of Giardia through physical removal and chemical inactivation. Additional reduction may be required for impaired water supplies. EPA and DDW guidance state that 3-log reduction of Giardia is appropriate when average concentrations of Giardia in the source water are less than 0.01 cysts/L. In determining log reduction requirements for Giardia, for systems serving populations less than 10,000, the DDW allows, in the absence of actual Giardia data, the use of surrogate 200 MPN/100mL limit for either fecal coliform or Escherichia coli (E. coli). Source waters with coliform levels consistently below that limit are considered to be appropriate for the minimum 3-log reduction requirement.

The LT2ESWTR is the most recent regulation addressing microbial contaminants, promulgated in January 2006. The LT2ESWTR requires facilities to monitor their raw surface waters for 24 months for Cryptosporidium, E. coli, and turbidity, and the monitoring results determine if a facility requires additional water treatment. See the Regulatory Outline section of this report for more details on the regulations. The City of Redding began monthly sampling of surface water for Cryptosporidium and Giardia in March 2005 under the LT2ESWTR. Only 11 Giardia sample results were greater than 0.1 organisms/liter. Based upon these tests, it appears as if Cryptosporidium and Giardia are present in low numbers in raw waters in northern California. There were no detectable Cryptosporidium oocysts in any of the samples; therefore, both Whiskeytown Lake and Sacramento River sources were classified as a Bin 1 source for the purposes of the LT2ESWTR.

The City of Redding began a second round of sampling for E. coli and Cryptosporidium oocysts in October 2015 that concluded in September 2017. The City of Shasta Lake began their second round of sampling for two years in October of 2016, and the Bella Vista Water District from October 2016 to September 2018. There were no detectable Cryptosporidium oocysts in any of the source water samples for the second round of LT2 sampling.

Cryptosporidium

Cryptosporidium is a protozoan that is found in the environment as an oocyst in the feces of domestic animals (especially young livestock), although wild and domestic animals as well as humans may be hosts. Like Giardia, Cryptosporidium may also be present in any type of surface water, including pristine supplies. Cryptosporidium can infect humans and cause the gastrointestinal disease cryptosporidiosis. As with coliforms and Giardia, any source of mammalian fecal matter may be a source of Cryptosporidium.

The IESWTR and the LT1ESWTR set an MCLG of zero for Cryptosporidium and require a 2-log (99%) reduction of Cryptosporidium. These regulations have been promulgated by the EPA and the DDW. Conventional treatment, direct filtration, slow sand filtration, and diatomaceous earth filtration are all granted 2-log (99%) credit for removal if the treatment plant is meeting turbidity performance standards. Cryptosporidium is further regulated by the LT2ESWTR, which requires source water monitoring and quantification of concentrations to determine if additional action is required.

6.3 Regulatory Overview

The EPA has established a number of drinking water contaminant regulations that DDW must adopt and enforce as a minimum standard. In some cases, DDW adopts even stricter regulations.

Current state and federal drinking water rules and regulations are given an overview below. The reader is advised to check with the local agency, county, or state that has primacy over it when interpreting this information. Additional regulated contaminants can be found in Tables 6.2 through 6.5. Detection limits for purposes of reporting can be found in Table 6.6.

1) SWTR[5]

The SWTR has set up MCLs for viruses, bacteria, and Giardia lamblia and establishes treatment technique requirements for most water systems. This rule applies to all public water systems using surface water sources or groundwater sources under the direct influence of surface water (GWUDISW).[22]

Overview of the Rule	
Title	Surface Water Treatment Rule (SWTR), June 29, 1989, Title 42, Chapter 6A, Subchapter XII, Public Health Service, National Primary Drinking Water Regulations.
Purpose	Improve public health through control of microbial contaminants, filtration facilities to meet 3-log removal of Giardia and 4-log removal of viruses, and set treatment performance goals. It is assumed that properly operated treatment facilities would remove most target organisms.
General Description	The first SWTR; established to set operating parameters for treatment facilities to meet, which would result in the removal of Giardia, Cryptosporidium, Legionella, viruses, and bacteria.
Utilities Covered	Requirement applies to all public water systems that use surface water or groundwater under the direct influence of surface water.

Major Provisions	
Disinfection	Public water systems must meet CT requirements as set by the state primacy agency.
Turbidity Performance Standards	Conventional and direct filtration combined filter effluent: • ≤ 0.5 nephelometric turbidity units (NTU) in at least 95% of measurements taken each month. • Maximum level of 5 NTU.
Turbidity Monitoring Requirements (conventional and direct filtration):	
Combined Filter Effluent	Performed every four hours to ensure compliance with turbidity performance standards.
Combined Filter Effluent	Monitor disinfectant concentration continuously.

Critical Deadlines and Requirements	
June 1993	All systems must be in compliance.

2) Total Arsenic Rule[4]

Consumption of arsenic has become a public health concern as it has been attributed to a number of health effects. While the MCL is now set at 0.010 mg/L, the PHG is 0.004 mg/L based on lung and urinary bladder cancer risk. Arsenic is also responsible for vascular and skin effects at higher levels of exposure. Arsenic is found in nature and common in drinking water sources.[22]

Overview of the Rule	
Title	Arsenic and Clarifications to Compliance and New Source Monitoring Rule 66 FR 6976 (January 22, 2001).
Purpose	To improve public health by reducing exposure to arsenic in drinking water.
General Description	Changes the arsenic MCL from 50 µg/L to 10 µg/L; sets arsenic MCLG to zero; requires monitoring for new systems and new drinking water sources, clarifies the procedures for determining compliance with the MCLs for inorganic compounds (IOCs), synthetic organic compounds (SOCs), and volatile organic compounds (VOCs).
Utilities Covered	All CWSs and NTNCWS must comply with the arsenic requirements.

Critical Deadlines and Requirements	
Jan. 22, 2004	All new systems/sources must collect initial monitoring samples for all IOCs, SOCs, and VOCs within a period and frequency determined by the state.
Jan. 1, 2005	When allowed by the state, systems may grandfather data collected after this date.
Jan. 23, 2006	The new arsenic MCL of 10 µg/L became effective. All systems must begin monitoring or, when allowed by the state, submit data that meets grandfathering requirements.
Dec. 31, 2006	Surface water systems must complete initial monitoring or have a state-approved waiver.
Dec. 31, 2007	Groundwater systems must complete initial monitoring or have a state-approved waiver.
Nov. 28, 2008	California's revised arsenic MCL of 10 mg/L became effective.

Monitoring Requirements for Total Arsenic	
All samples must be collected at each entry point to the distribution system unless otherwise specified by the state.	
Initial Monitoring	One sample after the effective date of the MCL (Jan. 23, 2006). Surface water systems must take annual samples.
Reduced Monitoring	If the initial monitoring result for arsenic is less than the MCL, the surface water systems must collect annual samples. A surface water system that has conducted three rounds of arsenic monitoring, with all previous analytical results less than the MCL, may apply for and be granted a nine-year monitoring waiver.
Increased Monitoring	A system with a sampling point result above the MCL must collect quarterly samples at that sampling point until the system is reliably and consistently below the MCL.

3) IESWTR[6]

The IESWTR applies to all PWSs using surface water, or GWUDISW, that serve 10,000 or more persons. This rule sets a MCLG for Cryptosporidium at zero and establishes 2-log removal for filtered systems.[22]

Overview of the Rule	
Title	Interim Enhanced Surface Water Treatment Rule (IESWTR) 63 FR 69478 – 69521, December 16, 1998, Vol. 63, No. 241. Revisions to the IESWTR, the Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 D/DBPR), and Revisions to State Primacy Requirements to Implement the SDWA Amendments 66 FR 3770, January 16, 2001, Vol. 66, No. 29.
Purpose	Improve public health control of microbial contaminants, particularly Cryptosporidium. Prevent significant increases in microbial risk that might otherwise occur when systems implement the Stage 1 D/DBPR.
General Description	Revisions to the IESWTR builds upon treatment techniques, approach, and requirements of the 1989 SWTR. It relies on existing technologies currently in use at WTPs.
Utilities Covered	Sanitary survey requirements apply to all PWSs using surface water, or GWUDISW, regardless of size. All remaining requirements apply to PWSs that use surface water, or GWUDISW, and serve 10,000 or more people.

Major Provisions	
Cryptosporidium	• MCLG of zero. • 99 percent (2-log) physical removal for systems that filter. • Include in watershed control program for unfiltered systems.
Turbidity Performance Standards	Conventional and direct filtration combined filter effluent: • ≤ 0.3 NTU in at least 95 percent of measurements taken each month. • Maximum level of 1 NTU.
Turbidity Monitoring Requirements (conventional and direct filtration)	
Combined Filter Effluent	Performed every four hours to ensure compliance with turbidity performance standards.
Individual Filter Effluent	Performed continuously (every 15 minutes) to assist treatment plant operators in understanding and assessing filter performance.

IESWTR Critical Deadlines and Requirements	
Feb. 16, 1999	Construction of uncovered finished water reservoirs is prohibited.
March 1999	Public water systems that lack Information Collection Rule (ICR) or other occurrence data will begin four quarters of applicability monitoring for Total Trihalomethanes (TTHM) and haloacetic acids (HAA5) to determine if disinfection profiling is necessary.
Apr. 16, 1999	Systems that have four consecutive quarters of HAA5 occurrence data that meet the TTHM monitoring requirements must submit data to the state to determine if disinfection profiling is necessary.
Dec. 31, 1999	PWSs with ICR data must submit it to the state to determine if disinfection profiling is necessary.
Apr. 1, 2000	PWSs must begin developing a disinfection profile if their annual average (based on four quarters of data) for TTHM is ≥ 0.064 mg/L or HAA5 is ≥ 0.048 mg/L.
March 31, 2001	Disinfection profile must be complete.
Jan. 1, 2002	Surface water systems or GWUDISW serving 10,000 or more people must comply with all IESWTR provisions (e.g., turbidity standards, individual filter monitoring).

4) LT1ESWTR[7]

The LT1ESWTR is similar to the IESWTR but applies to systems serving fewer than 10,000 persons.[22]

Overview of the Rule	
Title	Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) 67 FR 1812, January 14, 2002, Vol. 67, No. 9.
Purpose	Improve public health protection through the control of microbial contaminants, particularly Cryptosporidium, and prevent significant increases in microbial risk that might otherwise occur when systems implement Stage 1 D/DBPR.
General Description	Builds upon requirements of the 1989 SWTR; smaller system counterpart of the IESWTR.
Utilities Covered	PWSs that use surface water or GWUDISW and serve fewer than 10,000 people.

Major Provisions	
Control of Cryptosporidium	• The MCLG is set at zero. • Filtered systems must physically remove 99 percent (2-log) of Cryptosporidium. • Unfiltered systems must update their watershed control programs to minimize the potential for contamination by Cryptosporidium oocysts. • Cryptosporidium is included as an indicator of GWUDISW.
Combined Filter Effluent Turbidity Performance Standards	**Specific combined filter effluent turbidity requirements depend on the type of filtration used by the system**. Conventional and direct filtration: • ≤ 0.3 NTU in at least 95 percent of measurements taken each month. • Maximum level of turbidity: 1 NTU. Slow sand and diatomaceous earth filtration. Continue to meet CFE turbidity limits specified in the SWTR: • ≤ 1 NTU in at least 95 percent of measurements taken each month. • Maximum level of turbidity: 5 NTU.

	Alternative technologies (other than conventional, direct, slow sand, or diatomaceous earth). Turbidity levels are established by the state based on filter demonstration data submitted by the system: • State-set limits must not exceed 1 NTU (in at least 95 percent of measurements) or 5 NTU (maximum).

Turbidity Monitoring and Requirements	
Combined Filter Effluent	• Performed at least every four hours to ensure compliance with combined filter effluent turbidity performance standards.
Individual Filter Effluent (for systems using conventional and direct filtration only)	Since the combined filter effluent may meet regulatory requirements even though one filter is producing high turbidity water, the individual filter effluent is measured to assist conventional and direct filtration treatment plant operators in understanding and assessing individual filter performance. • Performed continuously (recorded at least every 15 minutes). • Systems with two or fewer filters may conduct continuous monitoring of combined filter effluent turbidity in place of individual filter effluent turbidity monitoring. • Certain follow-up actions are required if the individual filter effluent turbidity (or combined filter effluent for systems with two filters) exceeds 1.0 NTU in 2 consecutive readings or more (i.e., additional reporting, filter self-assessments, and/or comprehensive performance evaluations).

LT1ESWTR Critical Deadlines and Requirements	
March 15, 2002	Construction of uncovered finished reservoirs is prohibited.
July 1, 2003	Systems serving 500-9,999 persons must report to the state: • Results of optional monitoring that show levels of TTHM <0.064 mg/L and HAA5 <0.048 mg/L, or • System has started profiling.
Jan. 1, 2004	Systems serving fewer than 500 persons must report to the state: • Results of optional monitoring that show levels of TTHM <0.064 mg/L and HAA5 <0.048 mg/L, or • System has started profiling.
June 30, 2004	Systems serving 500-9,999 persons must complete their disinfection profile unless the state has determined it is unnecessary.
Dec. 31, 2004	Systems serving fewer than 500 persons must complete their disinfection profile unless the state has determined it is unnecessary.
Jan. 14, 2005	Surface water systems or GWUDISW systems serving fewer than 10,000 people must comply with the applicable LT1ESWTR provisions (e.g., turbidity standards, individual filter monitoring, Cryptosporidium removal requirements, and updated watershed control requirements for unfiltered systems).

5) LT2ESWTR[8]

The LT2ESWTR aims to increase the Cryptosporidium requirements to higher risk systems to ensure systems maintain microbial protection.[22]

Overview of the Rule	
Title	Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR): 71 FR 654, Jan. 5, 2006, Vol. 71, No. 3.
Purpose	Improve public health protection through the control of microbial contaminants by focusing on systems with elevated *Cryptosporidium* risk. Prevent significant increases in microbial risk that might otherwise occur when systems implement the Stage 2 D/DBPR.
General Description	The LT2ESWTR requires systems to monitor their source water, calculate an average *Cryptosporidium* concentration, and use those results to determine if their source is vulnerable to contamination and may require additional treatment.
Utilities Covered	• PWSs that use surface water, or GWUDISW. • Schedule 1 systems include PWSs serving or wholesale PWSs that are part of a combined distribution system of 100,000 or more people or wholesale PWSs that are part of a combined distribution system in which the largest system serves 100,000 or more people. • Schedule 2 systems include PWSs serving or wholesale PWSs that are part of a combined distribution system of 50,000-99,999 people. • Schedule 3 systems include PWSs serving or wholesale PWSs that are part of a combined distribution system of 10,000-49,999 people. • Schedule 4 systems include PWSs serving or wholesale PWSs that are part of a combined distribution system of <10,000 people.

LT2ESWTR Major Provisions	
Source Water Monitoring	• Filtered and unfiltered systems must conduct 24 months of source water monitoring for Cryptosporidium. Filtered systems must also record source water E. coli and turbidity levels. Systems will be classified into one of four "bins" based on the results of their source water monitoring. These systems may also use previously collected data (i.e., grandfathered data) instead of monitoring. • Filtered systems providing at least 5.5-log of treatment for Cryptosporidium and unfiltered systems providing at least 3-log of treatment for Cryptosporidium and those systems that intend to install this level of treatment are not required to conduct source water monitoring.
Installation of Additional Treatment	• Filtered systems must provide additional treatment for Cryptosporidium based on their bin classification (average source water Cryptosporidium concentration) using treatment options from the "microbial toolbox." • Unfiltered systems must provide additional treatment for Cryptosporidium using chlorine dioxide, ozone, or UV.
Uncovered Finished Water Storage Facility	• Systems with an uncovered finished water storage facility must either: • Cover the uncovered finished water storage facility; or • Treat the discharge to achieve inactivation and/or removal of at least 4-log for viruses, 3-log for Giardia lamblia, and 2-log for Cryptosporidium.

LT2ESWTR Critical Deadlines and Requirements					
Schedule	**1**	**2**	**3**	**4**	**Crypto Monitoring**
Submit Initial Sample Plan	July 2006	Jan. 2007	Jan. 2008	July 2008	Jan. 2010
Begin Initial Monitoring	Oct. 2006	April 2007	April 2008	Oct. 2008	April 2010
Submit Bin Classification	March 2009	Oct. 2009	Oct. 2010	Sept. 2012	Oct. 2010
*Meet Additional Treatment Requirements	March 2012	Sept. 2012	Sept. 2013	Sept. 2014	Sept. 2014
Submit Second Sample Plan	Jan. 2015	Jan. 2015	July 2016	July 2017	Jan. 2019
Begin Second Round of Sampling	April 2015	Oct. 2015	Oct. 2016	Oct. 2017	April 2019

*If Cryptosporidium monitoring results, place utility in Bin 2, 3, or 4. States can extend the deadline up to an additional 24 months if capital improvements are required.

6) Radionuclides Rule[9]

Radionuclides have been known to cause cancer and damage a person's kidneys. Radionuclides that are monitored are beta, photon emitters, gross alpha particles. Combined Radium-226/228 and Uranium, which are considered to have entered drinking water systems via erosion, chemical weathering of natural occurring mineral deposits, and sometimes activities such as mining, industrial activities, or military activities.[23]

Overview of the Rule	
Title	Radionuclides Rule 66 FR 76708 December 7, 2000, Vol. 65, No. 236.
Purpose	Reducing the exposure to radionuclides in drinking water will reduce the risk of cancer. This rule will also improve public health protection by reducing exposure to all radionuclides.
General Description	The rule retains the existing MCLs for combined Radium-226 and Radium-228, gross alpha particle radioactivity, and beta particle and photon activity. The rule regulates uranium for the first time.
Utilities Covered	Community water systems, all size categories.

Regulated Contaminants		
Regulated Radionuclide	**MCL**	**MCLG**
Beta/photon emitters*	4 mrem/yr	0
Gross alpha particle	15 pCi/L	0
Combined radium-226/228	5 pCi/L	0
Uranium	30 µg/L	0

pCi=picoCuries

* A total of 168 individual beta particle and photon emitters may be used to calculate compliance with the MCL.

Critical Deadlines and Requirements	
Dec. 8, 2003	Systems begin initial monitoring under State-specified monitoring plan unless the State permits use of grandfathered data.
Dec. 31, 2007	All systems must complete initial monitoring.

Monitoring Requirements	
Gross Alpha, Combined Radium-226/228, and Uranium (1)	**Beta Particle and Photon Radioactivity (1)**
Initial Monitoring	
Four consecutive quarters of monitoring	No monitoring required for most CWSs. Vulnerable CWSs (2) must sample for: • Gross beta: quarterly samples. • Tritium and Strontium-90: annual samples.
Reduced Monitoring	
If the average of the initial monitoring results for the contaminant is below the detection limit: one sample every 9 years. If the average of the initial monitoring results for each contaminant is greater than or equal to the detection limit, but less than or equal to one-half the MCL: one sample every 6 years. If the average of the initial monitoring results for each contaminant is greater than one-half the MCL, but less than or equal to the MCL: one sample every 3 years.	If the running annual average of the gross beta particle activity minus the naturally occurring potassium-40 activity is less than or equal to 50 pCi/L: One sample every 3 years.
Increased Monitoring	
A system with an entry point result above the MCL must return to quarterly sampling until four consecutive quarterly samples are below the MCL.	If gross beta particle activity minus the naturally occurring potassium-40 activity exceeds 50 pCi/L, the system must: • Speciate as required by the State. • Sample at the initial monitoring frequency.
(1) All samples must be collected at each entry point to the distribution system. (2) The rule also contains requirements for CWSs using waters contaminated by effluents from nuclear facilities	
Grandfathering of Data	
When allowed by the State, data collected between June 2000 and December 8, 2003 may be used to satisfy the initial monitoring requirements if samples have been collected from: • Each entry point to the distribution system. • The distribution system, provided the system has a single entry point to the distribution system. • The distribution system, provided the State makes a written justification explaining why the sample is representative of all entry points to the distribution system.	

7) Stage 1 D/DBPR[10]

Stage 1 D/DBPR is the first step in reducing consumption of DBPs. Health risks may increase if there is too much exposure over time. This rule applies to systems that disinfect their water.[24]

Overview of the Rule	
Title	Stage 1D/DBPR 63 FR 69390 – 69476, December 16, 1998, Vol. 63, No. 241. Revisions to the IESWTR, the Stage 1D/DBPR, and Revisions to State Primacy Requirements to Implement the SDWA Amendments 66 FR 3770, January 16, 2001, Vol. 66, No. 29.
Purpose	Improve public health protection by reducing exposure to DBPs. Some disinfectants and DBPs have been shown to cause cancer and reproductive effects in lab animals and suggested bladder cancer and reproductive effects in humans.
General Description	The Stage 1D/DBPR is the first of a staged set of rules that will reduce the allowable levels of DBPs in drinking water. The new rule establishes seven new standards and a treatment technique of enhanced coagulation or enhanced softening to further reduce DBP exposure. The rule is designed to limit capital investments and avoid major shifts in disinfection technologies until additional information is available on the occurrence and health effects of DBPs.
Utilities Covered	The Stage 1D/DBPR applies to all sizes of CWSs and NTNCWSs that add a disinfectant to the drinking water during any part of the treatment process and TNCWSs that use chlorine dioxide.

Critical Deadlines and Requirements	
Jan. 1, 2002	Surface water systems and GWUDISW serving ≥ 10,000 people must comply with the Stage 1 D/DBPR requirements.
Jan. 1, 2004	Surface water systems and GWUDISW serving < 10,000 people must comply with the Stage 1 D/DBPR requirements.

Routine Monitoring Requirements		
TTHM/HAA5	Surface and GWUDISW serving ≥ 10,000	4/plant/quarter
	Surface and GWUDISW serving 500-9,999	1/plant/quarter
	Surface and GWUDISW serving < 500	1/plant/year in month of warmest water temperature*
	Groundwater serving ≥ 10,000	1/plant/quarter
	Groundwater serving < 10,000	1/plant/year in month of warmest water temperature*
Bromate[T]	Ozone plants	Monthly at entrance to distribution system
Chlorite	Chlorine dioxide plants	Daily at entrance to distribution system; monthly in distribution system
Chlorine/Choramines	All systems	Same location and frequency as Total Coliform Rule sampling
Chlorine Dioxide	Chlorine dioxide plants	Daily at entrance to distribution system
DBP precursors (TOC/Alkalinity/SUVA)	Conventional filtration systems	Monthly for total organic carbon and alkalinity or the SUVA alternative
*System must increase monitoring to 1 sample per plant per quarter if an MCL is exceeded. [T] Reduced Bromate monitoring may be available based on results of optional Bromide monitoring – See Stage 1 D/DBPR.		

Stage 1D/DBPR Regulated Contaminants/Disinfectants		
Regulated Contaminant	**MCL (mg/L)**	**MCLG (mg/L)**
TTHM	0.080	
Chloroform		-
Bromodichloromethane		Zero
Dibromochloromethane		0.06
Bromoform		Zero
HAA5	0.060	
Monochloroacetic acid		-
Dichloroacetic acid		Zero
Trichloroacetic acid		0.3
Bromoacetic acid		-
Dibromoacetic acid		-
Bromate (WTP that use ozone)	0.010	Zero
Chlorite (WTP that use chlorine dioxide)	1.0	0.8

Regulated Disinfectants	**MRDL* (mg/L)**	**MRDLG* (mg/L)**
Chlorine	4.0 as Cl2	4
Chloramines	4.0 as Cl2	4
Chlorine dioxide	0.8	0.8

*Stage 1D/DBPR includes maximum residual disinfectant levels (MRDL) and maximum residual disinfectant level goals (MRDLGs) which are similar to MCL and MCLG, but for disinfectants.

8) Stage 2 D/DBPR[11]

Stage 2 D/DBPR is the next step in reducing exposure to DBPs by increasing requirements for TTHM and HAA5.[24]

Overview of the Rule	
Title	Stage 2 D/DBPR; 71 FR 388, Jan. 4, 2006, Vol. 71, No. 2.
Purpose	To increase public health protection by reducing the potential risk of adverse health effects associated with DBPs throughout the distribution system; builds on the Stage 1 D/DBPR by focusing on monitoring for and reducing concentrations of two classes of DBPs–TTHM and HAA5 in drinking water.
General Description	Stage 2 D/DBPR requires systems to complete an initial distribution system evaluation (IDSE) to characterize DBP levels in their distribution system and identify locations to monitor DBPs for Stage 2 D/DBPR compliance. The Stage 2 D/DBPR bases TTHM and HAA5 compliance on a locational running annual average (LRAA) calculated at each monitoring location.
Utilities Covered	• All CWSs and NTNCWSs that either add a primary or residual disinfectant other than UV light, or deliver water that has been treated with a primary or residual disinfectant other than UV light. • Schedule 1 systems include CWSs and NTNCWSs serving 100,000 or more people, or CWSs and NTNCWSs that are part of a combined distribution system in which the largest system serves 100,000 or more people. • Schedule 2 systems include affected water systems serving 50,000-99,000 people. • Schedule 3 systems include affected water systems serving 10,000-49,999 people. • Schedule 4 systems include affected water systems serving <10,000 people.

Stage 2 D/DBPR Regulated Contaminants/Disinfectants		
Regulated Contaminant	**MCL (mg/L)**	**MCLG (mg/L)**
TTHM	0.080 LRAA	
Chloroform		0.07
Bromodichloromethane		Zero
Dibromochloromethane		0.06
Bromoform		Zero
HAA5	0.060 LRAA	
Monochloroacetic acid		0.07
Dichloroacetic acid		Zero
Trichloroacetic acid		0.02
Bromoacetic acid		-
Dibromoacetic acid		-

Key Compliance Deadlines by System Size Schedule				
Schedule	**Submit IDSE Plan**	**Complete IDSE or System-Specific Study**	**Submit IDSE Report**	**Comply with DBP Standards on LRAA Basis**
1	Oct. 1, 2006	Sept. 30, 2008	Jan. 1, 2009	Apr. 1, 2012
2	Apr. 1, 2007	Mar. 31, 2009	July 1, 2009	Oct. 1, 2012
3	Oct. 1, 2007	Sept. 30, 2009	Jan. 1, 2010	Oct. 1, 2013
4	Apr. 1, 2008	Mar. 31, 2010	July 1, 2010	Oct. 1, 2013

*NTNCWSs serving fewer than 10,000 people do not need to complete any of the four IDSE options.
IDSE: Initial Distribution System Evaluation
LRAA: Locational Running Annual Average

Systems may apply for reduced monitoring in accordance with Table 64534-D in the California Code of Regulations under DBPs monitoring if the LRAA is ≤0.040 mg/L for TTHM and ≤0.030 mg/L for HAA5 at all monitoring locations.[25]

9) Total Coliform Rule[12]

Total, fecal, and E. coli coliform bacteria are used as general indicators of microbial water quality. Fecal coliform and E. coli are successively more specific as indicators of fecal contamination from humans and other warm-blooded animals (i.e., mammals) and are typically found at much lower concentrations than total coliform. Although coliform levels have not been shown to correlate with levels of pathogenic microorganisms, they are used as indicators because of a continued lack of affordable and reliable direct analytical methods for many pathogens. Any source of mammalian fecal matter is a potential source of fecal coliform and/or E. coli. Principal sources of fecal matter include upper watershed runoff, urban runoff, body contact recreationalists, sanitary sewer overflow (SSO) spills, and failing septic systems.

Overview of the Rule	
Title	Total Coliform Rule. 54 FR 27544-27568, June 29, 1989, Vol. 54, No. 124.
Purpose	Improve public health protection by reducing fecal pathogens to minimal levels through control of total coliform bacteria, including fecal coliforms and E. coli.
General Description	Establishes an MCL based on the presence or absence of total coliforms, modifies monitoring requirements including testing for fecal coliforms or E. coli, requires use of a sample citing plan, and also requires sanitary surveys for systems collecting fewer than five samples per month.
Utilities Covered	The Total Coliform Rule applies to all public water systems.

Major Provisions
Sampling Requirements: • Total coliform samples must be collected at sites that are representative of water quality throughout the distribution system according to a written sample citing plan subject to State review and revision. • Samples must be collected at regular time intervals throughout the month except groundwater systems serving 4,900 persons or fewer may collect them on the same day. • Monthly sampling requirements are based on population served. • A reduced monitoring frequency may be available for systems serving 1,000 persons or fewer and using only groundwater. If a sanitary survey within the past five years shows the system is free of sanitary defects, the frequency may be no less than one sample per quarter for CWSs and one sample per year for NCWSs. • Each total coliform-positive routine sample must be tested for the presence of fecal coliforms or E. coli. • If any routine sample is total coliform-positive, repeat samples are required. • Within 24 hours of learning of a total coliform-positive routine sample result, at least three repeat samples must be collected and analyzed for total coliforms. Additional sampling information required. • A positive routine or repeat total coliform result requires a minimum of five routine samples be collected the following month.

Critical Deadlines and Requirements
No Deadlines.

10) Revised Total Coliform Rule[13]

The Revised Total Coliform Rule aims to continue to improve public health protection.[26]

Overview of the Rule	
Title	Revised Total Coliform Rule, 78 FR 10269, February 13, 2013, Vol. 78, No. 30.
Purpose	Increase public health protection through the reduction of potential pathways of entry for fecal contamination into distribution systems.
General Description	The Revised Total Coliform Rule establishes an MCL for E. coli and uses E. coli and total coliforms to initiate a “find and fix” approach to address fecal contamination that could enter into the distribution system. It requires PWSs to perform assessments to identify sanitary defects and subsequently take action to correct them.
Utilities Covered	The Revised Total Coliform Rule applies to all public water systems.

Major Provisions
Sampling Requirements: • Total coliform samples must be collected at sites that are representative of water quality throughout the distribution system according to a written sample citing plan subject to State review and revision. • For PWSs collecting more than one sample per month, samples must be collected at regular time intervals throughout the month, except groundwater systems serving 4,900 persons or fewer may collect them on the same day. • Monthly sampling requirements are based on population served. • A reduced monitoring frequency may be available for systems serving 1,000 persons or fewer and using only groundwater. If a sanitary survey within the past five years shows the system is free of sanitary defects, the frequency may be no less than one sample per quarter for CWSs and one sample per year for NCWSs. • Each total coliform-positive routine sample must be tested for the presence of E. coli. If any total coliform sample is also E.coli positive, then the sample result must be reported to the State by the end of the day that the PWS is notified. • If any routine sample is total coliform-positive, repeat samples are required. • Within 24 hours of learning of a total coliform-positive routine sample result, at least three repeat samples must be collected and analyzed for total coliforms. Additional sampling information required.

Critical Deadlines and Requirements	
Before April 1, 2016	PWSs must develop a written sample siting plan that identifies the system's sample collection schedule and all sample sites, including sites for routine and repeat monitoring. PWSs monitoring quarterly or annually must also identify additional routine monitoring sites in their sample siting plans.
Starting April 1, 2016	All systems must comply with Revised Total Coliform Rule requirements unless the State selects an earlier implementation date.

11) Lead and Copper Rule (LCR)[14]

The LCR helps to minimize exposure that may cause stomach issues and brain damage due to lead and copper that likely entered the system through plumbing materials.[27]

Overview of the Rule	
Title	Lead and Copper Rule, 56 FR 26460 – 26564, June 7, 1991.
Purpose	Protect public health by minimizing lead and copper levels in drinking water, primarily by reducing water corrosivity. Lead and Copper enter drinking water mainly from corrosion of plumbing materials.
General Description	Establishes AL of 0.015 mg/L for lead and 1.3 mg/L for copper based on 90th percentile level of tap water samples. An AL exceedance is not a violation but can trigger other requirements that include water quality parameter monitoring, corrosion control treatment, source water monitoring/treatment, public education, and lead service line replacement.
Utilities Covered	All CWSs and NTNCWSs are subject to the LCR requirements.

Major Provisions
Sampling Requirements: • First draw samples must be collected by all CWSs and NTNCWSs at cold water taps in homes/buildings that are at high risk of lead and copper contamination as identified in 40 CFR 141.86(a). • Number of sample sites is based on system size (see Table LCR-1). • Systems must conduct monitoring every six months unless they qualify for reduced monitoring (see Table LCR-2).

Critical Deadlines and Requirements
No Deadlines.

12) Filter Backwash Recycling Rule[15]

The Filter Backwash Recycling Rule applies to systems that use filtration for treatment and to ensure proper handling of backwash water.[22]

Overview of the Rule	
Title	Filter Backwash Recycling Rule, 66 FR 31086, June 8, 2001, Vol. 66, No. 111.
Purpose	Improve public health protection by assessing and changing, where needed, recycle practices for improved contaminant control, particularly microbial contaminants.
General Description	The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the State.
Utilities Covered	Applies to public water systems that use surface water or groundwater under the direct influence of surface water, practice conventional or direct filtration, and recycle spent filter backwash, thickener supernatant, or liquids from dewatering processes.

Critical Deadlines and Requirements	
December 8, 2003	Submit recycle notification to the State.
June 8, 2004	Return recycle flows through the processes of a system's existing conventional or direct filtration system or an alternate recycle location approved by the state (a two-year extension is available for systems making capital improvements to modify recycle location). Collect recycle flow information and retain on file.
June 8, 2006	Complete all capital improvements associated with relocating recycle return location (if necessary).

13) Consumer Confidence Report (CCR) Rule[16]

The CCR Rule aims to inform the public and encourage communication with the community about the water system.[28]

Overview of the Rule	
Title	Consumer Confidence Report Rule, 63 FR 44511, August 19, 1998, Vol. 63, No. 160.
Purpose	Improve public health protection by providing educational material to allow consumers to make educated decisions regarding any potential health risks pertaining to the quality, treatment, and management of their drinking water supply.
General Description	The CCR Rule requires all CWSs to prepare and distribute a brief annual water quality report summarizing information regarding source water, detected contaminants, compliance, and educational information.
Utilities Covered	Applies to all CWSs.

Annual Critical Deadlines and Requirements	
April 1	Deadline for a CWS that sells water to another CWS to deliver the information necessary for the buyer CWS to prepare their CCR (requirement outlined in 40 CFR 141.152).
July 1	Deadline for annual distribution of CCR to customers and state or local primary agency for report covering January 1- December 31 of previous calendar year.
Oct 1	Deadline for annual submission of proof of distribution to state or local primacy agency. A CWS serving 100,000 or more persons must also post its current year's report on a publicly accessible site on the Internet. Many systems choose to post their reports at the following EPA website: http://cfpub.epa.gov/safewater/ccr/index.cfm?action=ccrupdate.

14) Public Notification Rule[17]

The Public Notification Rule intends to keep the public informed when problems with the drinking water system arise.[29]

Overview of the Rule	
Title	Public Notification Rule, 65 FR 25982, May 4, 2000.
Purpose	To notify the public of drinking water violations or situations that may pose a risk to public health.
General Description	The Public Notification Rule requires all PWSs to notify their consumers any time a PWS violates a national primary drinking water regulation or has a situation posing a risk to public health. Notices must be provided to persons served (not just billing customers).
Utilities Covered	Applies to all PWSs.
Timing and Distribution	Notices must be sent within 24 hours, 30 days, or one year depending on the tier to which the violation is assigned. The clock for notification starts when the PWS learns of the violation.

Tier 1 (Immediate Notice, Within 24 Hours)

Tier 1 Public Notification is required to be issued as soon as practical but no later than 24 hours after the PWS learns of the violation or situation including:

- Distribution system sample violation when fecal coliform or E. coli are present; failure to test for fecal coliform or E. coli after initial total coliform distribution system sample tests positive.
- Nitrate, nitrite, or total nitrate and nitrite MCL violation; failure to take confirmation sample.
- Special notice for NCWSs with nitrate exceedances between 10 mg/L and 20 mg/L, where system is allowed to exceed 10 mg/L by primacy agency.
- Chlorine dioxide MRDL violation when one or more of the samples taken in the distribution system exceeds the MRDL on the day after a chlorine dioxide measurement taken at the entrance to the distribution system exceeds the MRDL or when required samples are not taken in the distribution system.
- Exceedance of maximum allowable turbidity level if elevated to a Tier 1 notice by primacy agency.
- Waterborne disease outbreak or other waterborne emergency.
- Detection of E. coli, enterococci, or coliphage in a groundwater source sample.
- Other violations or situations determined by the primacy agency.

Tier 2 (Notice as Soon as Practical, Within 30 Days)

Tier 2 Public Notification is required to be issued as soon as practical or within 30 days. Repeat notice every 3 months until violation or situation is resolved.

- All MCL, MRDL, and treatment technique violations, except where Tier 1 notice is required.
- Monitoring violations, if elevated to Tier 2 notice by primacy agency.
- Failure to comply with variance and exemption conditions.
- For groundwater systems providing 4-log treatment and conducting Ground Water Rule compliance monitoring, failure to maintain required treatment for more than 4 hours.
- Failure to take any required corrective action or be in compliance with a corrective action plan for a fecal indicator-positive groundwater source sample.
- Failure to take any required corrective action or be in compliance with a corrective action plan for a significant deficiency under the Ground Water Rule.
- Special public notice for repeated failure to conduct monitoring for Cryptosporidium.

Turbidity consultation is required when a PWS has a treatment technique violation resulting from a single exceedance of the maximum allowable turbidity limit or an MCL violation resulting from an exceedance of the 2-day turbidity limit. The PWS must consult their primacy agency within 24 hours. Primacy agencies will then determine whether a Tier 1 Public Notification is necessary. If consultation does not occur within 24 hours, violations are automatically elevated to require Tier 1 Public Notification.

Tier 3 (Annual Notice)
Tier 3 Public Notification is required to be issued within 12 months and repeated annually for unresolved violations. • All monitoring or testing procedure violations, unless primacy agency elevates to Tier 2, including failure to conduct benchmarking and profiling (surface water systems) and failure to develop a monitoring plan (disinfecting systems). • Operating under a variance and exemption. • Special public notice for availability of unregulated contaminant monitoring results. • Special public notice for fluoride secondary maximum contaminant level (SMCL) exceedance.

Ten Required Elements of a Public Notice

Unless otherwise specified in the regulations,* each notice must contain:

1. Description of the violation or situation, including the contaminant(s) of concern, and (as applicable) the contaminant level(s).
2. When the violation of situation occurred (i.e., date the sample was collected or was supposed to be collected).
3. Any potential adverse health effects from drinking the water and standard language regarding the violation or situation. (For MCL, MRDL, treatment technique violations, or violations of the conditions of a variance or exemption, use health effects language from Appendix B of the Public Notification Rule. For monitoring and testing procedure violations, use the standard monitoring language below.)
4. The population at risk, including subpopulations that may be particularly vulnerable if exposed to the contaminant in their drinking water.
5. Whether alternate water supplies should be used.
6. Actions consumers should take, including when they should seek medical help, if known.
7. What the PWS is doing to correct the violation or situation.
8. When the PWS expects to return to compliance or resolve the situation.
9. The name, business address, and phone number or those of a designee of the PWS as a source of additional information concerning the notice.
10. A statement (see standard distribution language below) encouraging notice recipients to distribute the notice to others, where applicable.

*These elements do not apply to notices for fluoride SMCL exceedances, availability of unregulated contaminant monitoring data, and operation under a variance or exemption. Content requirements for these notices are specified in the Public Notification Rule.

Standard Language:
Standard Monitoring Language: We are required to monitor your drinking water for specific contaminants on a regular basis. Results of regular monitoring are an indicator of whether or not our drinking water meets health standards. During [period] we [did not monitor or test/did not complete all monitoring or testing] for [contaminants(s)], and therefore cannot be sure of the quality of the drinking water during that time.

Standard Distribution Language: Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

15) Variances and Exemptions Rule[18]

The Variances and Exemptions Rule allows water suppliers to provide water that does not meet National Primary Drinking Water Regulations if certain technologies are installed and the water is determined to still protect the health of consumers. Small systems that cannot afford upgrades and systems with poor source quality may fall into this rule.[30]

Title	Variances and Exemptions Rule, 63 FR 43834-43851, August 14, 1998.	
	General and Small System Variances	**Exemptions**
Purpose	Variances allow eligible systems to provide drinking water that does not comply with a National Primary Drinking Water Regulation (NPDWR) on the condition that the system installs a certain technology and the quality of the drinking water is still protective of public health.	Exemptions allow eligible systems additional time to build capacity in order to achieve and maintain regulatory compliance with newly promulgated NPDWRs while continuing to provide acceptable levels of public health protection.
General	There are two types of variances: • *General variances* are intended for systems that are not able to comply with an NPDWR due to their source water quality. • *Small system variances* are intended for systems serving 3,300 persons or fewer that cannot afford to comply with an NPDWR (but may be allowed for systems serving up to 10,000).	Exemptions do not release a water system from complying with NPDWRs; rather, they allow water systems additional time to comply with NPDWRs.

Variances and Exemptions Rule		
Compliance Date	• *General variances* require compliance as expeditiously as practicable and in accordance with a compliance schedule determined by the State. • *Small system variances* require compliance within 3 years (with a possible 2-year extension period).	Systems must achieve compliance as expeditiously as practicable and in accordance with the schedule determined by the State. In addition: • Initial exemptions cannot exceed 3 years. • Systems serving < 3,301 persons may be eligible for one or more additional 2-year extension periods (not to exceed 6 years).
Contaminants Excluded	• *General variances* may usually not be granted for the MCL for total coliforms or any of the treatment technique (TT) requirements of Subpart H of 40 CFR 141. • *Small system variances* may not be granted for NPDWRs promulgated prior to 1986 or MCLs, indicators, and TTs for microbial contaminants.	Exemptions from the MCL for total coliforms may generally not be granted.
All Public Water Systems	Exclusions: • Systems that have received a small system variance are not eligible for an exemption. • Small system variances may not be granted for NPDWRs that do not list a small system variance technology (SSVT). • Systems that have received an exemption are generally not eligible for a variance.	

6.4 Future Federal Regulations

Regulation	Contaminant	MCL/MCLG	Effect	Monitoring Requirement
Hexavalent Chromium [A]	Hexavalent Chromium	To be determined	Carcinogen	
Distribution System Rule	Microbiological Contaminants	To be determined		To be determined.
Radon Rule	Radon	300 pCi/L	Cancer Risk	Each entry point, which is representative of each well after treatment. Initially, four consecutive quarters of monitoring.

[A.] On May 31, 2017, the Superior Court of Sacramento County issued a judgement invalidating the hexavalent chromium MCL for drinking water. The Court's primary reason for finding the MCL invalid is that the California Department of Public Health failed to comply with one of the requirements in the SDWA for adopting an MCL. The Department failed to properly consider the economic feasibility of complying with the MCL. The Court ordered the State Water Board to adopt a new MCL for hexavalent chromium.[2]

6.5 Recently Adopted Regulations

1,2,3-Trichloropropane (1,2,3- TCP)

Beginning December 14, 2017, the SWRCB's DDW adopted an MCL for 1,2,3- TCP, which was to be sampled for starting January 1, 2018.[19]

Source and Reference	MCL Threshold 1	MCL Threshold 2
California Notification Levels (CA DDW)[20]	0.005 µg/L	0.5 µg/L
Threshold 1: Notification Level – above which local government notification is required and customer notification is recommended. Threshold 2: Response Level – drinking water source is recommended to be taken out of service.		

1,2,3- TCP is a manmade chlorinated hydrocarbon found at industrial or hazardous waste sites and has been associated with pesticide products and used as a cleaning and degreasing solvent. It has been detected in groundwater for many years and is very persistent. 1,2,3- TCP is anticipated to be a human carcinogen due to evidence of carcinogenicity in experimental animals. The best available technology for treatment has been determined to be granular activated carbon.[21]

Perchlorate

On July 21, 2020, the EPA published a final action regarding the regulation of perchlorate under the SDWA. Considering the best available science and proactive steps that EPA, states, and PWSs have taken to reduce perchlorate levels, the agency has determined that perchlorate does not meet the criteria for regulation as a drinking water contaminant under the SDWA.[3]

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TABLE 6.1

REDDING AREA WATERSHED SANITARY SURVEY

SACRAMENTO RIVER AND WHISKEYTOWN LAKE RAW TOTAL COLIFORMS / E. COLI QUANTITRAY TEST RESULTS

Source	Sacramento River				Whiskeytown Lake	
Facility	Foothill		Wintu Pump Station		Buckeye	
Organism	*Total C*	*E coli*	*Total C*	*E coli*	*Total C*	*E coli*
Date	(Units: MPN /100 ml)					
2016						
January	1730	115			25	14
February	150	4			10	2
March	72	2				
April	308	12	345	7	81	<1
May	>2420	43	>2420	3	10	<1
June	980	15	1730	16	3	<1
July	613	7	1410	10	3	<1
August	613	3	1410	8	1200	1
September	365	14	1200	15	112	<1
October	249	10	548	13	1300	<1
November	435	10			125	12
December	82	9			40	16
2017						
January	345	30	<1	<1	39	13
February	68	1	133	9	32	2
March	36	1	91	3	29	1
April	41	1	260	1	17	<1
May	770	3			15	3
June	613	3	345	3	47	<1
July	517	5	488	33	291	<1
August	345	5	579	5	613	<1
September	345	10	517	4	517	<1
October	127	5	411	6	1550	<1
November			411	22	1300	<1
December	172	2	411	8	30	1
2018						
January	488	58	387	8	9	4
February	921	<1	1990	12	2	1
March	1990	39	613	10	5	<1
April	517	2	<1	<1	<1	<1
May	330	4	>2420	38	1	<1
June	411	3	579	5	3	<1
July	365	4	162	6	11	<1
August	517	14	548	10	387	<1
September	248	13	727	3	>2420	<1
October	276	2	>2420	20	>2420	<1
November	120	2	770	6	1120	3
December	1990	19	1300	11		
2019						
January	201	4	345	12	23	3
February	99	2	>2420	50	29	4
March	152	1	127	18	65	3
April	<1	<1	204	11	28	<1
May	2420	<1	1730	3	5	<1
June	387	6	308	12	308	10
July	770	1	727	8	>2420	<1
August	365	2	517	3	1120	<1
September	261	3	980	15	488	<1
October	260	5	727	11	1200	<1
November	179	3	816	4	23	2
December	613	12	135	4	12	4
2020						
January	326	<1	326	17	12	<1
February	199	<1			50	<1
March	548	3	345	11	1	<1
April	142	1	<1	<1	6	<1
May	649	2	1990	5	5	1
June	517	5	980	6	5	<1
July	866	3	1550	4	1990	<1
August	1730	2	>2420	15	>2420	<1

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Key
AL = Regulatory Action Level
CCR = Consumer Confidence Report
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
MRDL = Maximum Residual Disinfectant Level
MRDLG = Maximum Residual Disinfectant Level Goal
PHG = Public Health Goal

TT = Treatment Technique
MFL = million fibers per liter
NTU = Nephelometric Turbidity Units
pCi/L = picocuries per liter (a measure of radioactivity)
mrem/year = millirems per year (a measure of radiation absorbed by the body)
ppm = parts per million, or milligrams per liter (mg/L)
ppb = parts per billion, or micrograms per liter (µg/L)

ppt = parts per trillion, or nanograms per liter (ng/L)
ppq = parts per quadrillion, or picograms per liter (ng/L)

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Microbiological Contaminants						
Total Coliform Bacteria (state Total Coliform Rule)	MCL: **Systems that collect ≥40 samples/month:** 5.0% of monthly samples are positive; **Systems that collect <40 samples/month:** 1 positive monthly sample			(0)	Naturally present in the environment	Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful, bacteria may be present. Coliforms were found in more samples than allowed and this was a warning of potential problems.
Fecal coliform and *E. coli* (state Total Coliform Rule)	MCL: a routine sample and a repeat sample are total coliform positive, and one of these is also fecal coliform or *E. coli* positive			(0)	Human and animal fecal waste	Fecal coliforms and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems.

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	**Traditional MCL in mg/L**	**To convert for CCR, multiply by**	**MCL in CCR units**	**PHG (MCLG) in CCR units**	**Major Sources in Drinking Water**	**Health Effects Language**
Total Coliform Bacteria (federal Revised Total Coliform Rule)	TT		TT	n/a	Naturally present in the environment	Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful, waterborne pathogens may be present or that a potential pathway exists through which contamination may enter the drinking water distribution system. We found coliforms, indicating the need to look for potential problems in water treatment or distribution. When this occurs, we are required to conduct assessment(s) to identify problems and to correct any problems that were found during these assessments.
E. coli (federal Revised Total Coliform Rule)	(a)		(a)	(0)	Human and animal fecal waste	*E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Human pathogens in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a greater health risk for infants, young children, the elderly, and people with severely compromised immune systems. *For the CCR, if a water system detects* E. coli *and has violated the* E. coli *MCL, the water system shall include the following statements, as appropriate.* • We had an *E. coli*-positive repeat sample following a total coliform-positive routine sample. • We had a total coliform-positive repeat sample following an *E. coli*-positive routine sample. • We failed to take all required repeat samples following an *E. coli*-positive routine sample. • We failed to test for *E. coli* when any repeat sample tests positive for total coliform.

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
						If the E. coli MCL was not violated, the water system may include a statement that explains that although E. coli *was detected, the water system is not in violation of the* E. coli *MCL.*
(a) Routine and repeat samples are total coliform-positive and either is *E. coli*-positive or system fails to take repeat samples following *E. coli*-positive routine sample or system fails to analyze total coliform-positive repeat sample for *E. coli*.						
E. coli (federal Revised Total Coliform Rule)	TT		TT	n/a	Human and animal fecal waste	*E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Human pathogens in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a greater health risk for infants, young children, the elderly, and people with severely compromised immune systems.
Fecal Indicator *E. coli* (Ground Water Rule)	0	-	0	(0)	Human and animal fecal waste	Fecal coliforms and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems.
Fecal Indicators (enterococci or coliphage) (Ground Water Rule)	TT	-	TT	n/a	Human and animal fecal waste	Fecal indicators are microbes whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems.

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Turbidity	TT	-	TT	n/a	Soil runoff	Turbidity has no health effects. However, high levels of turbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease-causing organisms. These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.
Giardia lamblia Viruses Heterotrophic Plate Count Bacteria *Legionella* *Cryptosporidium*	Surface water treatment = TT			HPC = n/a; Others = (0)	Naturally present in the environment	Inadequately treated water may contain disease-causing organisms. These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.
Radioactive Contaminants						
Gross Beta Particle Activity (pCi/L)	50 [(b)]	-	50	(0)	Decay of natural and man-made deposits	Certain minerals are radioactive and may emit forms of radiation known as photons and beta radiation. Some people who drink water containing beta and photon emitters in excess of the MCL over many years may have an increased risk of getting cancer.
(b) Effective 6/11/2006, the gross beta particle activity MCL is 4 mrem/year annual dose equivalent to the total body or any internal organ. 50 pCi/L is used as a screening level.						
Strontium-90 (pCi/L)	8	-	8	0.35	Decay of natural and man-made deposits	Some people who drink water containing strontium-90 in excess of the MCL over many years may have an increased risk of getting cancer.
Tritium (pCi/L)	20,000	-	20,000	400	Decay of natural and man-made deposits	Some people who drink water containing tritium in excess of the MCL over many years may have an increased risk of getting cancer.
Gross Alpha Particle Activity (pCi/L)	15	-	15	(0)	Erosion of natural deposits	Certain minerals are radioactive and may emit a form of radiation known as alpha radiation. Some people who drink water containing alpha emitters in excess of the MCL over many years may have an increased risk of getting cancer.

REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Combined Radium (Ra) (pCi/L)	5	-	5	(0)[c]	Erosion of natural deposits	Some people who drink water containing Ra-226 or Ra-228 in excess of the MCL over many years may have an increased risk of getting cancer.
Total Radium (pCi/L) (for NTNCWSs)	5		5	n/a	Erosion of natural deposits	Some people who drink water containing Ra-223, Ra-224, or Ra-226 in excess of the MCL over many years may have an increased risk of getting cancer.
(c) If reporting results for Ra-226 and Ra-228 as individual constituents, the PHG is 0.05 pCi/L for Ra-226 and 0.019 pCi/L for Ra-228.						
Uranium (pCi/L)	20	-	20	0.43	Erosion of natural deposits	Some people who drink water containing uranium in excess of the MCL over many years may have kidney problems or an increased risk of getting cancer.
Inorganic Contaminants						
Aluminum (ppm)	1	-	1	0.6	Erosion of natural deposits; residue from some surface water treatment processes	Some people who drink water containing aluminum in excess of the MCL over many years may experience short-term gastrointestinal tract effects.
Antimony (ppb)	0.006	1000	6	1	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder	Some people who drink water containing antimony in excess of the MCL over many years may experience increases in blood cholesterol and decreases in blood sugar.
Arsenic (ppb)	0.010	1000	10	0.004	Erosion of natural deposits; runoff from orchards; glass and electronics production wastes	Some people who drink water containing arsenic in excess of the MCL over many years may experience skin damage or circulatory system problems and may have an increased risk of getting cancer.
Asbestos (MFL)	7 MFL	-	7	7	Internal corrosion of asbestos cement water mains; erosion of natural deposits	Some people who drink water containing asbestos in excess of the MCL over many years may have an increased risk of developing benign intestinal polyps.

TABLE 6.2

REDDING AREA WATERSHED SANITARY SURVEY

REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Barium (ppm)	1	-	1	2	Discharges of oil drilling wastes and from metal refineries; erosion of natural deposits	Some people who drink water containing barium in excess of the MCL over many years may experience an increase in blood pressure.
Beryllium (ppb)	0.004	1000	4	1	Discharge from metal refineries, coal-burning factories, and electrical, aerospace, and defense industries	Some people who drink water containing beryllium in excess of the MCL over many years may develop intestinal lesions.
Cadmium (ppb)	0.005	1000	5	0.04	Internal corrosion of galvanized pipes; erosion of natural deposits; discharge from electroplating and industrial chemical factories, and metal refineries; runoff from waste batteries and paints	Some people who drink water containing cadmium in excess of the MCL over many years may experience kidney damage.
Chromium [total] (ppb)	0.05	1000	50	(100)	Discharge from steel and pulp mills and chrome plating; erosion of natural deposits	Some people who use water containing chromium in excess of the MCL over many years may experience allergic dermatitis.
Copper (ppm)	AL = 1.3	-	AL = 1.3	0.3	Internal corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives	Copper is an essential nutrient, but some people who drink water containing copper in excess of the AL over a relatively short amount of time may experience gastrointestinal distress. Some people who drink water containing copper in excess of the AL over many years may suffer liver or kidney damage. People with Wilson's Disease should consult their personal doctor.

TABLE 6.2

REDDING AREA WATERSHED SANITARY SURVEY

REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Cyanide (ppb)	0.15	1000	150	150	Discharge from steel/metal, plastic, and fertilizer factories	Some people who drink water containing cyanide in excess of the MCL over many years may experience nerve damage or thyroid problems.
Fluoride (ppm)	2.0	-	2.0	1	Erosion of natural deposits; water additive that promotes strong teeth; discharge from fertilizer and aluminum factories	Some people who drink water containing fluoride in excess of the federal MCL of 4 mg/L over many years may get bone disease, including pain and tenderness of the bones. Children who drink water containing fluoride in excess of the state MCL of 2 mg/L may get mottled teeth.
Hexavalent Chromium (ppb)[1]	[8]		[8]	0.02	Discharge from electroplating factories, leather tanneries, wood preservation, chemical synthesis, refractory production, and textile manufacturing facilities; erosion of natural deposits.	Some people who drink water containing hexavalent chromium in excess of the MCL over many years may have an increased risk of getting cancer.
Lead (ppb)	AL = 0.015	1000	AL = 15	0.2	Internal corrosion of household water plumbing systems; discharges from industrial manufacturers; erosion of natural deposits	Infants and children who drink water containing lead in excess of the action level may experience delays in their physical or mental development. Children may show slight deficits in attention span and learning abilities. Adults who drink this water over many years may develop kidney problems or high blood pressure.

[1] There is currently no MCL for hexavalent chromium. The previous MCL of 0.010 mg/L was withdrawn on September 11, 2017. Refer to Appendix A 3.

TABLE 6.2

REDDING AREA WATERSHED SANITARY SURVEY

REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Mercury [inorganic] (ppb)	0.002	1000	2	1.2	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and cropland	Some people who drink water containing mercury in excess of the MCL over many years may experience mental disturbances or impaired physical coordination, speech and hearing.
Nickel (ppb)	0.1	1000	100	12	Erosion of natural deposits; discharge from metal factories	Some people who drink water containing nickel in excess of the MCL over many years may experience liver and heart effects.
Nitrate (ppm)	10 (as N)	-	10 (as N)	10 (as N)	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits	Infants below the age of six months who drink water containing nitrate in excess of the MCL may quickly become seriously ill and, if untreated, may die because high nitrate levels can interfere with the capacity of the infant's blood to carry oxygen. Symptoms include shortness of breath and blueness of the skin. High nitrate levels may also affect the oxygen-carrying ability of the blood of pregnant women.
Nitrite (ppm)	1 (as N)	-	1 (as N)	1 (as N)	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits	Infants below the age of six months who drink water containing nitrite in excess of the MCL may quickly become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blueness of the skin.

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Perchlorate (ppb)	0.006	1000	6	1	Perchlorate is an inorganic chemical used in solid rocket propellant, fireworks, explosives, flares, matches, and a variety of industries. It usually gets into drinking water as a result of environmental contamination from historic aerospace or other industrial operations that used or use, store, or dispose of perchlorate and its salts.	Perchlorate has been shown to interfere with uptake of iodide by the thyroid gland and thereby reduce the production of thyroid hormones, leading to adverse effects associated with inadequate hormone levels. Thyroid hormones are needed for normal prenatal growth and development of the fetus, as well as for normal growth and development in the infant and child. In adults, thyroid hormones are needed for normal metabolism and mental function.
Selenium (ppb)	0.05	1000	50	30	Discharge from petroleum, glass, and metal refineries; erosion of natural deposits; discharge from mines and chemical manufacturers; runoff from livestock lots (feed additive)	Selenium is an essential nutrient. However, some people who drink water containing selenium in excess of the MCL over many years may experience hair or fingernail losses, numbness in fingers or toes, or circulation system problems.
Thallium (ppb)	0.002	1000	2	0.1	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories	Some people who drink water containing thallium in excess of the MCL over many years may experience hair loss, changes in their blood, or kidney, intestinal, or liver problems.

TABLE 6.2

REDDING AREA WATERSHED SANITARY SURVEY

REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Synthetic Organic Contaminants including Pesticides and Herbicides						
2,4-D (ppb)	0.07	1000	70	20	Runoff from herbicide used on row crops, range land, lawns, and aquatic weeds	Some people who use water containing the weed killer 2,4-D in excess of the MCL over many years may experience kidney, liver, or adrenal gland problems.
2,4,5-TP [Silvex] (ppb)	0.05	1000	50	3	Residue of banned herbicide	Some people who drink water containing Silvex in excess of the MCL over many years may experience liver problems.
Acrylamide	TT	-	TT	(0)	Added to water during sewage/wastewater treatment	Some people who drink water containing high levels of acrylamide over a long period of time may experience nervous system or blood problems, and may have an increased risk of getting cancer.
Alachlor (ppb)	0.002	1000	2	4	Runoff from herbicide used on row crops	Some people who use water containing alachlor in excess of the MCL over many years may experience eye, liver, kidney, or spleen problems, or experience anemia, and may have an increased risk of getting cancer.
Atrazine (ppb)	0.001	1000	1	0.15	Runoff from herbicide used on row crops and along railroad and highway right-of-ways	Some people who use water containing atrazine in excess of the MCL over many years may experience cardiovascular system problems or reproductive difficulties.
Bentazon (ppb)	0.018	1000	18	200	Runoff/leaching from herbicide used on beans, peppers, corn, peanuts, rice, and ornamental grasses	Some people who drink water containing bentazon in excess of the MCL over many years may experience prostate and gastrointestinal effects.
Benzo(a)pyrene [PAH] (ppt)	0.0002	1,000,000	200	7	Leaching from linings of water storage tanks and distribution mains	Some people who use water containing benzo(a)pyrene in excess of the MCL over many years may experience reproductive difficulties and may have an increased risk of getting cancer.

TABLE 6.2

REDDING AREA WATERSHED SANITARY SURVEY

REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Carbofuran (ppb)	0.018	1000	18	0.7	Leaching of soil fumigant used on rice and alfalfa, and grape vineyards	Some people who use water containing carbofuran in excess of the MCL over many years may experience problems with their blood, or nervous or reproductive system problems.
Chlordane (ppt)	0.0001	1,000,000	100	30	Residue of banned insecticide	Some people who use water containing chlordane in excess of the MCL over many years may experience liver or nervous system problems and may have an increased risk of getting cancer.
Dalapon (ppb)	0.2	1000	200	790	Runoff from herbicide used on rights-of-way, and crops and landscape maintenance	Some people who drink water containing dalapon in excess of the MCL over many years may experience minor kidney changes.
Di(2-ethylhexyl) adipate (ppb)	0.4	1000	400	200	Discharge from chemical factories	Some people who drink water containing di(2-ethylhexyl) adipate in excess of the MCL over many years may experience weight loss, liver enlargement, or possible reproductive difficulties.
Di(2-ethylhexyl) phthalate (ppb)	0.004	1000	4	12	Discharge from rubber and chemical factories; inert ingredient in pesticides	Some people who use water containing di(2-ethylhexyl) phthalate well in excess of the MCL over many years may experience liver problems or reproductive difficulties and may have an increased risk of getting cancer.
Dibromochloropropane [DBCP] (ppt)	0.0002	1,000,000	200	1.7	Banned nematocide that may still be present in soils due to runoff/leaching from former use on soybeans, cotton, vineyards, tomatoes, and tree fruit	Some people who use water containing DBCP in excess of the MCL over many years may experience reproductive difficulties and may have an increased risk of getting cancer.
Dinoseb (ppb)	0.007	1000	7	14	Runoff from herbicide used on soybeans, vegetables, and fruits	Some people who drink water containing dinoseb in excess of the MCL over many years may experience reproductive difficulties.

TABLE 6.2

REDDING AREA WATERSHED SANITARY SURVEY

REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Dioxin [2,3,7,8-TCDD] (ppq)	0.0000000 3	1,000,000, 000	30	0.05	Emissions from waste incineration and other combustion; discharge from chemical factories	Some people who use water containing dioxin in excess of the MCL over many years may experience reproductive difficulties and may have an increased risk of getting cancer.
Diquat (ppb)	0.02	1000	20	6	Runoff from herbicide use for terrestrial and aquatic weeds	Some people who drink water containing diquat in excess of the MCL over many years may get cataracts.
Endothall (ppb)	0.1	1000	100	94	Runoff from herbicide use for terrestrial and aquatic weeds; defoliant	Some people who drink water containing endothall in excess of the MCL over many years may experience stomach or intestinal problems.
Endrin (ppb)	0.002	1000	2	0.3	Residue of banned insecticide and rodenticide	Some people who drink water containing endrin in excess of the MCL over many years may experience liver problems.
Epichlorohydrin	TT	-	TT	(0)	Discharge from industrial chemical factories; impurity of some water treatment chemicals	Some people who drink water containing high levels of epichlorohydrin over a long period of time may experience stomach problems, and may have an increased risk of getting cancer.
Ethylene dibromide [EDB] (ppt)	0.00005	1,000,000	50	10	Discharge from petroleum refineries; underground gas tank leaks; banned nematocide that may still be present in soils due to runoff and leaching from grain and fruit crops	Some people who use water containing ethylene dibromide in excess of the MCL over many years may experience liver, stomach, reproductive system, or kidney problems and may have an increased risk of getting cancer.
Glyphosate (ppb)	0.7	1000	700	900	Runoff from herbicide use	Some people who drink water containing glyphosate in excess of the MCL over many years may experience kidney problems or reproductive difficulties.

TABLE 6.2

REDDING AREA WATERSHED SANITARY SURVEY

REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	**Traditional MCL in mg/L**	**To convert for CCR, multiply by**	**MCL in CCR units**	**PHG (MCLG) in CCR units**	**Major Sources in Drinking Water**	**Health Effects Language**
Heptachlor (ppt)	0.00001	1,000,000	10	8	Residue of banned insecticide	Some people who use water containing heptachlor in excess of the MCL over many years may experience liver damage and may have an increased risk of getting cancer.
Heptachlor epoxide (ppt)	0.00001	1,000,000	10	6	Breakdown of heptachlor	Some people who use water containing heptachlor epoxide in excess of the MCL over many years may experience liver damage and may have an increased risk of getting cancer.
Hexachlorobenzene (ppb)	0.001	1000	1	0.03	Discharge from metal refineries and agricultural chemical factories; byproduct of chlorination reactions in wastewater	Some people who drink water containing hexachlorobenzene in excess of the MCL over many years may experience liver or kidney problems, adverse reproductive effects, and may have an increased risk of getting cancer.
Hexachlorocyclopentadiene (ppb)	0.05	1000	50	2	Discharge from chemical factories	Some people who use water containing hexachlorocyclopentadiene in excess of the MCL over many years may experience kidney or stomach problems.
Lindane (ppt)	0.0002	1,000,000	200	32	Runoff/Leaching from insecticide used on cattle, lumber, and gardens	Some people who drink water containing lindane in excess of the MCL over many years may experience kidney or liver problems.
Methoxychlor (ppb)	0.03	1000	30	0.09	Runoff/Leaching from insecticide used on fruits, vegetables, alfalfa, and livestock	Some people who drink water containing methoxychlor in excess of the MCL over many years may experience reproductive difficulties.
Molinate [Ordram] (ppb)	0.02	1000	20	1	Runoff/Leaching from herbicide used on rice	Some people who use water containing molinate in excess of the MCL over many years may experience reproductive effects.

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	**Traditional MCL in mg/L**	**To convert for CCR, multiply by**	**MCL in CCR units**	**PHG (MCLG) in CCR units**	**Major Sources in Drinking Water**	**Health Effects Language**
Oxamyl [Vydate] (ppb)	0.05	1000	50	26	Runoff/Leaching from insecticide used on field crops, fruits and ornamentals, especially apples, potatoes, and tomatoes	Some people who drink water containing oxamyl in excess of the MCL over many years may experience slight nervous system effects.
PCBs [Polychlorinated biphenyls] (ppt)	0.0005	1,000,000	500	90	Runoff from landfills; discharge of waste chemicals	Some people who drink water containing PCBs in excess of the MCL over many years may experience changes in their skin, thymus gland problems, immune deficiencies, or reproductive or nervous system difficulties and may have an increased risk of getting cancer.
Pentachlorophenol (ppb)	0.001	1000	1	0.3	Discharge from wood preserving factories, cotton and other insecticidal or herbicidal uses	Some people who use water containing pentachlorophenol in excess of the MCL over many years may experience liver or kidney problems and may have an increased risk of getting cancer.
Picloram (ppb)	0.5	1000	500	166	Herbicide runoff	Some people who drink water containing picloram in excess of the MCL over many years may experience liver problems.
Simazine (ppb)	0.004	1000	4	4	Herbicide runoff	Some people who use water containing simazine in excess of the MCL over many years may experience blood problems.
Thiobencarb (ppb)	0.07	1000	70	42	Runoff/Leaching from herbicide used on rice	Some people who use water containing thiobencarb in excess of the MCL over many years may experience body weight and blood effects.
Toxaphene (ppb)	0.003	1000	3	0.03	Runoff/Leaching from insecticide used on cotton and cattle	Some people who use water containing toxaphene in excess of the MCL over many years may experience kidney, liver, or thyroid problems, and may have an increased risk of getting cancer.

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
1,2,3-Trichloropropane[2]	0.000005	1000	0.005	0.0007	Discharge from industrial and agricultural chemical factories; leaching from hazardous waste sites; used as cleaning and maintenance solvent, paint and varnish remover, and cleaning and degreasing agent; byproduct during the production of other compounds and pesticides.	Some people who drink water containing 1,2,3-trichloropropane in excess of the MCL over many years may have an increased risk of getting cancer.
Volatile Organic Contaminants						
Benzene (ppb)	0.001	1000	1	0.15	Discharge from plastics, dyes and nylon factories; leaching from gas storage tanks and landfills	Some people who use water containing benzene in excess of the MCL over many years may experience anemia or a decrease in blood platelets and may have an increased risk of getting cancer.
Carbon Tetrachloride (ppt)	0.0005	1,000,000	500	100	Discharge from chemical plants and other industrial activities	Some people who use water containing carbon tetrachloride in excess of the MCL over many years may experience liver problems and may have an increased risk of getting cancer.

[2] 1,2,3-trichloropropane (1,2,3-TCP) had a notification level (NL) of 5 ppt until December 14, 2017, when the MCL of 5 ppt became effective.

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
1,2-Dichlorobenzene (ppb)	0.6	1000	600	600	Discharge from industrial chemical factories	Some people who drink water containing 1,2-dichlorobenzene in excess of the MCL over many years may experience liver, kidney, or circulatory system problems.
1,4-Dichlorobenzene (ppb)	0.005	1000	5	6	Discharge from industrial chemical factories	Some people who use water containing 1,4-dichlorobenzene in excess of the MCL over many years may experience anemia, liver, kidney, or spleen damage or changes in their blood.
1,1-Dichloroethane (ppb)	0.005	1000	5	3	Extraction and degreasing solvent; used in manufacture of pharmaceuticals, stone, clay, and glass products; fumigant	Some people who use water containing 1,1-dichloroethane in excess of the MCL over many years may experience nervous system or respiratory problems.
1,2-Dichloroethane (ppt)	0.0005	1,000,000	500	400	Discharge from industrial chemical factories	Some people who use water containing 1,2-dichloroethane in excess of the MCL over many years may have an increased risk of getting cancer.
1,1-Dichloroethylene (ppb)	0.006	1000	6	10	Discharge from industrial chemical factories	Some people who use water containing 1,1-dichloroethylene in excess of the MCL over many years may experience liver problems.
cis-1,2-Dichloroethylene (ppb)	0.006	1000	6	100	Discharge from industrial chemical factories; major biodegradation byproduct of TCE and PCE groundwater contamination	Some people who use water containing cis-1,2-dichloroethylene in excess of the MCL over many years may experience liver problems.

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
trans-1,2-Dichloroethylene (ppb)	0.01	1000	10	60	Discharge from industrial chemical factories; minor biodegradation byproduct of TCE and PCE groundwater contamination	Some people who drink water containing trans-1,2-dichloroethylene in excess of the MCL over many years may experience liver problems.
Dichloromethane (ppb)	0.005	1000	5	4	Discharge from pharmaceutical and chemical factories; insecticide	Some people who drink water containing dichloromethane in excess of the MCL over many years may experience liver problems and may have an increased risk of getting cancer.
1,2-Dichloropropane (ppb)	0.005	1000	5	0.5	Discharge from industrial chemical factories; primary component of some fumigants	Some people who use water containing 1,2-dichloropropane in excess of the MCL over many years may have an increased risk of getting cancer.
1,3-Dichloropropene (ppt)	0.0005	1,000,000	500	200	Runoff/Leaching from nematocide used on croplands	Some people who use water containing 1,3-dichloropropene in excess of the MCL over many years may have an increased risk of getting cancer.
Ethylbenzene (ppb)	0.3	1000	300	300	Discharge from petroleum refineries; industrial chemical factories	Some people who use water containing ethylbenzene in excess of the MCL over many years may experience liver or kidney problems.
Methyl-tert-butyl ether (ppb)	0.013	1000	13	13	Leaking underground storage tanks; discharge from petroleum and chemical factories	Some people who use water containing methyl-tert-butyl ether in excess of the MCL over many years may have an increased risk of getting cancer.

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Monochlorobenzene (ppb)	0.07	1000	70	70	Discharge from industrial and agricultural chemical factories and dry cleaning facilities	Some people who use water containing monochlorobenzene in excess of the MCL over many years may experience liver or kidney problems.
Styrene (ppb)	0.1	1000	100	0.5	Discharge from rubber and plastic factories; leaching from landfills	Some people who drink water containing styrene in excess of the MCL over many years may experience liver, kidney, or circulatory system problems.
1,1,2,2-Tetrachloroethane (ppb)	0.001	1000	1	0.1	Discharge from industrial and agricultural chemical factories; solvent used in production of TCE, pesticides, varnish, and lacquers	Some people who drink water containing 1,1,2,2-tetrachloroethane in excess of the MCL over many years may experience liver or nervous system problems.
Tetrachloroethylene (PCE) (ppb)	0.005	1000	5	0.06	Discharge from factories, dry cleaners, and auto shops (metal degreaser)	Some people who use water containing tetrachloroethylene in excess of the MCL over many years may experience liver problems and may have an increased risk of getting cancer.
1,2,4-Trichlorobenzene (ppb)	0.005	1000	5	5	Discharge from textile-finishing factories	Some people who use water containing 1,2,4-trichlorobenzene in excess of the MCL over many years may experience adrenal gland changes.
1,1,1-Trichloroethane (ppb)	0.200	1000	200	1000	Discharge from metal degreasing sites and other factories; manufacture of food wrappings	Some people who use water containing 1,1,1-trichloroethane in excess of the MCL over many years may experience liver, nervous system, or circulatory system problems.
1,1,2-Trichloroethane (ppb)	0.005	1000	5	0.3	Discharge from industrial chemical factories	Some people who use water containing 1,1,2-trichloroethane in excess of the MCL over many years may experience liver, kidney, or immune system problems.

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	PHG (MCLG) in CCR units	Major Sources in Drinking Water	Health Effects Language
Trichloroethylene [TCE] (ppb)	0.005	1000	5	1.7	Discharge from metal degreasing sites and other factories	Some people who use water containing trichloroethylene in excess of the MCL over many years may experience liver problems and may have an increased risk of getting cancer.
Toluene (ppb)	0.15	1000	150	150	Discharge from petroleum and chemical factories; underground gas tank leaks	Some people who use water containing toluene in excess of the MCL over many years may experience nervous system, kidney, or liver problems.
Trichlorofluoromethane (ppb)	0.15	1000	150	1300	Discharge from industrial factories; degreasing solvent; propellant and refrigerant	Some people who use water containing trichlorofluoromethane in excess of the MCL over many years may experience liver problems.
1,1,2-Trichloro-1,2,2-trifluoroethane (ppm)	1.2	-	1.2	4	Discharge from metal degreasing sites and other factories; drycleaning solvent; refrigerant	Some people who use water containing 1,1,2-trichloro-1,2,2-trifluoroethane in excess of the MCL over many years may experience liver problems.
Vinyl Chloride (ppt)	0.0005	1,000,000	500	50	Leaching from PVC piping; discharge from plastics factories; biodegradation byproduct of TCE and PCE groundwater contamination	Some people who use water containing vinyl chloride in excess of the MCL over many years may have an increased risk of getting cancer.
Xylenes (ppm)	1.750	-	1.750	1.8	Discharge from petroleum and chemical factories; fuel solvent	Some people who use water containing xylenes in excess of the MCL over many years may experience nervous system damage.

TABLE 6.2

REDDING AREA WATERSHED SANITARY SURVEY

REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	Traditional MCL or [MRDL] in mg/L	To convert for CCR, multiply by	MCL or [MRDL] in CCR units	PHG, (MCLG) or [MRDLG]	Major Sources in Drinking Water	Health Effects Language
Disinfection Byproducts, Disinfectant Residuals, and Disinfection Byproduct Precursors						
TTHMs [Total Trihalomethanes] (ppb)	0.080	1000	80	n/a	Byproduct of drinking water disinfection	Some people who drink water containing TTHMs in excess of the MCL over many years may experience liver, kidney, or central nervous system problems and may have an increased risk of getting cancer.
Haloacetic Acids (ppb)	0.060	1000	60	n/a	Byproduct of drinking water disinfection	Some people who drink water containing haloacetic acids in excess of the MCL over many years may have an increased risk of getting cancer.
Bromate (ppb)	0.010	1000	10	0.1	Byproduct of drinking water disinfection	Some people who drink water containing bromate in excess of the MCL over many years may have an increased risk of getting cancer.
Chloramines (ppm)	[MRDL = 4.0 (as Cl_2)]	-	[MRDL = 4.0 (as Cl_2)]	[MRDLG = 4 (as Cl_2)]	Drinking water disinfectant added for treatment	Some people who use water containing chloramines well in excess of the MRDL could experience irritating effects to their eyes and nose. Some people who drink water containing chloramines well in excess of the MRDL could experience stomach discomfort or anemia.
Chlorine (ppm)	[MRDL = 4.0 (as Cl_2)]	-	[MRDL = 4.0 (as Cl_2)]	[MRDLG = 4 (as Cl_2)]	Drinking water disinfectant added for treatment	Some people who use water containing chlorine well in excess of the MRDL could experience irritating effects to their eyes and nose. Some people who drink water containing chlorine well in excess of the MRDL could experience stomach discomfort.
Chlorite (ppm)	1.0	-	1.0	0.05	Byproduct of drinking water disinfection	Some infants and young children who drink water containing chlorite in excess of the MCL could experience nervous system effects. Similar effects may occur in fetuses of pregnant women who drink water containing chlorite in excess of the MCL. Some people may experience anemia.

TABLE 6.2
REDDING AREA WATERSHED SANITARY SURVEY
REGULATED CONTAMINANTS WITH PRIMARY MCLs, MRDLs, TTs, or ALs

Contaminant (CCR units)	**Traditional MCL or [MRDL] in mg/L**	**To convert for CCR, multiply by**	**MCL or [MRDL] in CCR units**	**PHG, (MCLG) or [MRDLG]**	**Major Sources in Drinking Water**	**Health Effects Language**
Chlorine dioxide (ppb)	[MRDL = 0.8 (as ClO_2)]	1000	[MRDL = 800 (as ClO_2)]	[MRDLG = 800 (as ClO_2)]	Drinking water disinfectant added for treatment	Some infants and young children who drink water containing chlorine dioxide in excess of the MRDL could experience nervous system effects. Similar effects may occur in fetuses of pregnant women who drink water containing chlorine dioxide in excess of the MRDL. Some people may experience anemia.
Control of DBP precursors (TOC)	TT	-	TT	n/a	Various natural and manmade sources	TOC has no health effects. However, TOC provides a medium for the formation of DBPs. These byproducts include TTHMs and HAA5s. Drinking water containing these byproducts in excess of the MCL may lead to adverse health effects, liver or kidney problems, or nervous system effects and may lead to an increased risk of cancer.

*Table taken from DDW CCR Guidance Manual 2019.

TABLE 6.3

REDDING AREA WATERSHED SANITARY SURVEY

REGULATED CONTAMINANTS WITH SECONDARY MCLs [(a)]

Monitoring Required by Section 64449 of the California Code of Regulations, Title 22

Constituent	Secondary MCL (units)	To convert to CCR, multiply by	MCL in CCR units	Typical Source of Contaminant
Aluminum	0.2 mg/L	1000	200 µg/L	Erosion of natural deposits; residual from some surface water treatment processes
Color	15 Units	-	15 Units	Naturally-occurring organic materials
Copper	1.0 mg/L	-	1.0 mg/L	Internal corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Foaming Agents [MBAS]	0.5 mg/L	1000	500 µg/L	Municipal and industrial waste discharges
Iron	0.3 mg/L	1000	300 µg/L	Leaching from natural deposits; industrial wastes
Manganese	0.05 mg/L	1000	50 µg/L	Leaching from natural deposits
Methyl-*tert*-butyl ether [MTBE]	0.005 mg/L	1000	5 µg/L	Leaking underground storage tanks; discharge from petroleum and chemical factories
Odor---Threshold	3 Units	-	3 Units	Naturally-occurring organic materials
Silver	0.1 mg/L	1000	100 µg/L	Industrial discharges
Thiobencarb	0.001 mg/L	1000	1 µg/L	Runoff/leaching from rice herbicide
Turbidity	5 Units	-	5 Units	Soil runoff
Zinc	5.0 mg/L	-	5.0 mg/L	Runoff/leaching from natural deposits; industrial wastes
Total Dissolved Solids	1,000 mg/L	-	1,000 mg/L	Runoff/leaching from natural deposits
Specific Conductance	1,600 µS/cm	-	1,600 µS/cm	Substances that form ions when in water; seawater influence
Chloride	500 mg/L	-	500 mg/L	Runoff/leaching from natural deposits; seawater influence
Sulfate	500 mg/L	-	500 mg/L	Runoff/leaching from natural deposits; industrial wastes

(a) There are no PHGs, MCLGs, or mandatory standard health effects language for these constituents because secondary MCLs are set on the basis of aesthetics.

Table taken from DDW CCR Guidance Manual, 2019.

TABLE 6.4

REDDING AREA WATERSHED SANITARY SURVEY

MONITORED CONTAMINANTS WITH NO MCLs

Background

The 1996 Amendments to the SDWA required the U.S. EPA to establish criteria for a monitoring program for unregulated contaminants, and to publish, once every five years, a list of no more than 30 contaminants to be monitored by public water systems (PWS).

Section 64450 of the California Code of Regulations also required certain water systems to monitor a number of unregulated contaminants, with contaminant lists that were published or revised in 1990, 1996, 2000, and 2003. This section of the California Code of Regulations was repealed effective October 18, 2007. Water systems that continued to monitor for state unregulated contaminants are encouraged, but not required, to include the information regarding detected contaminants in the CCR.

Although Section 64450 of the California Code of Regulations was repealed, the State Board may request water systems to monitor for specific contaminants per HSC section 116375(b).

Federal UCMR 1 (2001 – 2003 Monitoring)

The U.S. EPA published the first list of contaminants to monitor as part of the UCMR in September 1999. Contaminants were divided into two lists: Assessment Monitoring (List 1), and Screening Survey (List 2).

Assessment Monitoring of List 1 contaminants was conducted by large PWS serving more than 10,000 people and 800 representative small PWS serving 10,000 or fewer people. Assessment Monitoring was conducted by each PWS over a 12-month period between 2001 and 2003.

Screening Survey was conducted by a randomly selected set of 300 large and small PWSs for List 2 contaminants. Screening Survey for chemical contaminants was conducted in 2001 and 2002 for small and large PWS, respectively. Screening Survey for *Aeromonas* was conducted in 2003 for small and large PWS.

UCMR 1	
List 1 – Assessment Monitoring	**List 2 – Screening Survey**
2,4-dinitrotoluene	1,2-diphenylhydrazine
2,6-dinitrotoluene	2-methyl-phenol
Acetochlor	2,4-dichlorophenol
DCPA mono-acid degradate	2,4-dinitrophenol
DCPA di-acid degradate	2,4,6-trichlorophenol
4,4’-DDE	*Aeromonas*
EPTC	Alachlor ESA
Molinate	Diazinon
MTBE	Disulfoton
Nitrobenzene	Diuron
Perchlorate	Fonofos
Terbacil	Linuron
	Nitrobenzene
	Prometon
	Hexahydro-1,3,5-trinitro-1-3-5-triazine [RDX]
	Terbufos

Federal UCMR 2 (2008 – 2010 Monitoring)

The U.S. EPA published the second list of contaminants to monitor as part of the UCMR in January 2007.

Assessment Monitoring was required of all PWS serving more than 10,000 people and 800 representative PWS serving 10,000 or fewer people for List 1 contaminants. Assessment Monitoring was required of each PWS during a 12-month period from January 2008 to December 2010.

Screening Survey was required of all PWS serving more than 100,000 people, 320 representative PWS serving 10,001 to 100,000 people, and 480 representative PWS serving 10,000 or fewer people for List 2 contaminants. Screening Survey was required of each PWS during a 12-month period from January 2008 to December 2010.

UCMR 2	
List 1 – Assessment Monitoring	**List 2 – Screening Survey**
Dimethoate	Acetochlor ethane sulfonic acid
Terbufos sulfone	Acetochlor oxanilic acid
2,2',4,4'-tetrabromodiphenyl ether	Alachlor ethane sulfonic acid
2,2',4,4',5-pentabromodiphenyl ether	Alachlor oxanilic acid
2,2',4,4',5,5'-hexabromobiphenyl	Metolachlor ethane sulfonic acid
2,2',4,4',5,5'-hexabromodiphenyl ether	Metolachlor oxanilic acid
2,2',4,4',6-pentabromodiphenyl ether	
1,3-dinitrobenzene	Acetochlor
2,4,6-trinitrotoluene (TNT)	Alachlor
Hexahydro-1,3,5-trinitro-1,3,5-trazine (RDX)	Metolachlor
	N-nitrosodiethylamine (NDEA)
	N-nitrosodimethylamine (NDMA)
	N-nitroso-di-n-butylamine (NDBA)
	N-nitroso-di-n-propylamine (NDPA)
	N-nitrosomethylethylamine (NMEA)
	N-nitrosopyrrolidine (NPYR)

Federal UCMR 3 (2013 – 2015 Monitoring)

The third UCMR list of contaminants was published in May 2012.

Assessment Monitoring (List 1 Contaminants) was required of all PWS serving more than 10,000 people and 800 representative PWS serving 10,000 or fewer people. Assessment Monitoring was required of each PWS during a 12-month period from January 2013 to December 2015.

Screening Survey (List 2 Contaminants) was required of all PWS serving more than 100,000 people, 320 representative PWS serving 10,001 to 100,000 people, and 480 representative PWS serving 10,000 or fewer people. Screening Survey was required of each PWS during a 12-month period from January 2013 to December 2015.

Pre-screen Testing (List 3 Contaminants) was required from a selection of 800 representative PWS serving 1,000 or fewer people that do not disinfect. These PWS were selected because they have groundwater wells that were located in areas of karst or fractured bedrock. Monitored lasted 12 months between January 2013 and December 2015.

UCMR 3	
List 1 – Assessment Monitoring 1,2,3-trichloropropane 1,3-butadiene Chloromethane (methyl chloride) 1,2-dichloroethane Bromomethane (methyl bromide) Chlorodifluoromethane (HCFC-22) Bromochloromethane (halon 1011) 1,4-dioxane Vanadium Molybdenum Cobalt Strontium Chromium (total) Chromium-6 Chlorate Perfluorooctanesulfonate acid (PFOS) Perfluorooctanoic acid (PFOA) Perfluorononanoic acid (PFNA) Perfluorohexanesulfonic acid (PFHxS) Perfluoroheptanoic acid (PFHpA) Perfluorobutanesulfonic acid (PFBS)	**List 2 – Screening Survey** 17-β-estradiol 17-α-ethynylestradiol (ethinyl estradiol) 16-α-hydroxyestradiol (estriol) Equilin Estrone Testosterone 4-anderostene-3,17-dione **List 3 – Pre-Screen Testing** Enteroviruses Noroviruses

Federal UCMR 4 (2018 – 2020 Monitoring)

The fourth list of contaminants to monitor as part of the UCMR was published by the U.S. EPA in December 2016.

PWSs are required to monitor for 10 cyanotoxins at the entry point to the distribution system during a 4-consecutive month period from March 2018 through November 2020, according to the table below. PWSs are also required to monitor for 20 additional chemical contaminants and indicators during a 12-month period from January 2018 through December 2020. The sampling site for these additional chemicals is the entry point to the distribution system, except for HAAs that need to be monitored at the Stage 2 D/DBPR sampling sites. The two indicators, *i.e.*, TOC and bromide, need to be monitored at source water intakes.

System Size (Population Served)	10 Cyanotoxins	20 Chemicals
Small Systems (25 – 10,000)	800 randomly selected surface water or ground water under the direct influence of surface water (GWUDI) systems	A different group of 800 randomly selected surface water systems, GWUDI and groundwater systems
Large Systems (10,001 or more)	All surface water and GWUDI systems	All surface water, groundwater and GWUDI systems

Taken from DDW CCR Guidance Manual, 2019.

The 10 cyanotoxins and 20 additional chemical contaminants and indicators are listed in the table below.

UCMR 4	
Cyanotoxins	**Minimum Reporting Level**
Total Microcystin	0.3 µg/L
Microcystin-LA	0.008 µg/L
Microcystin-LF	0.006 µg/L
Microcystin-LR	0.02 µg/L
Microcystin-LY	0.009 µg/L
Microcystin-RR	0.006 µg/L
Microcystin-YR	0.02 µg/L
Nodularin	0.005 µg/L
Anatoxin-a	0.03 µg/L
Cylindrospermopsin	0.09 µg/L
Additional chemicals	**Minimum Reporting Level**
Germanium	0.3 µg/L
Manganese	0.4 µg/L
Alpha-hexachlorocyclohexane	0.01 µg/L
Chlorpyrifos	0.03 µg/L
Dimethipin	0.2 µg/L
Ethoprop	0.03 µg/L
Oxyfluorfen	0.05 µg/L
Profenofos	0.3 µg/L
Tebuconazole	0.2 µg/L
Total Permethrin (cis- & trans-)	0.04 µg/L
Tribufos	0.07 µg/L
HAA5	N/A
HAA6Br[1]	N/A
HAA9[2]	N/A
1-butanol	2.0 µg/L
2-methoxyethanol	0.4 µg/L
2-propen-1-ol	0.5 µg/L
butylated hydroxyanisole	0.03 µg/L
o-toluidine	0.007 µg/L
quinoline	0.02 µg/L
Total Organic Carbon (TOC)	N/A
Bromide	N/A

[1] HAA6Br: Bromochloroacetic acid, bromodichloroacetic acid, dibromoacetic acid, dibromochloroacetic acid, monobromoacetic acid, and tribromoacetic acid.

[2] HAA9: Bromochloroacetic acid, bromodichloroacetic acid, chlorodibromoacetic acid, dibromoacetic acid, dichloroacetic acid, monobromoacetic acid, monochloroacetic acid, tribromoacetic acid, and trichloroacetic acid.

Reporting

U.S. EPA is essentially silent on the issue of reporting federal UCMR contaminants beyond the previous calendar year's detections, other than to say it is not required and that data older than five years need not be reported. As a result, the State Board recommends systems to report data for five years from the date of the last sampling.

Taken from DDW CCR Guidance Manual, 2019.

TABLE 6.5

REDDING AREA WATERSHED SANITARY SURVEY

STATE CONTAMINANTS WITH NOTIFICATION LEVELS

Inclusion of the notification level and health effects language for contaminant concentrations detected above the notification level is recommended, but not required.

Chemical	Notification Level	Health Effects Language (Optional)
Boron	1 mg/L	Boron exposures resulted in decreased fetal weight (developmental effects) in newborn rats.
n-Butylbenzene	260 µg/L	Exposures to cumene (isopropylbenzene), a surrogate for n-, sec-, and tert-butylbenzene, resulted in increased kidney weight in rats.
sec-Butylbenzene	260 µg/L	
tert-Butylbenzene	260 µg/L	
Carbon Disulfide	160 µg/L	Carbon disulfide exposures resulted in decreased motor conduction velocity in people.
Chlorate	800 µg/L	Animal studies demonstrated that chlorate exposure in rats caused adverse effects to the pituitary and thyroid glands.
2-Chlorotoluene	140 µg/L	2-Chlorotoluene exposures resulted in decrease in body weight gain in rats. 4-Chlorotoluene is expected to have health effects similar to those of 2-chlorotoluene.
4-Chlorotoluene	140 µg/L	
Diazinon	1.2 µg/L	Diazinon exposures may result in neurotoxic effects.
Dichlodifluoromethane [Freon 12]	1 mg/L	Dichlorodifluoromethane exposures resulted in reduced body weight in rats.
1,4-Dioxane	1 µg/L	1,4-Dioxane exposures resulted in cancer, based on studies in laboratory animals.
Ethylene Glycol	14 mg/L	Ethylene glycol exposures resulted in kidney toxicity in rats.
Formaldehyde	100 µg/L	Formaldehyde exposures resulted in reduced weight gain and histopathology in rats.
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine [HMX]	350 µg/L	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine exposures resulted in liver lesions in rats.
Isopropylbenzene	770 µg/L	Isopropylbenzene exposures resulted in increased kidney weight in rats.
Manganese	500 µg/L	Manganese exposures resulted in neurological effects. High levels of manganese in people have been shown to result in adverse effects to the nervous system.
Methyl Isobutyl Ketone [MIBK]	120 µg/L	Methyl isobutyl ketone exposures resulted in increased kidney and liver weight, and kidney pathology in rats.
Naphthalene	17 µg/L	Naphthalene exposures resulted in decreased body weight in rats.
N-Nitrosodiethylamine [NDEA]	10 ng/L	N-nitrosodiethylamine exposures resulted in cancer in a variety of laboratory animals.
N-Nitrosodimethylamine [NDMA]	10 ng/L	N-nitrosodimethylamine exposures resulted in cancer in a variety of laboratory animals.

Taken from DDW CCR Guidance Manual, 2019.

TABLE 6.5

REDDING AREA WATERSHED SANITARY SURVEY

STATE CONTAMINANTS WITH NOTIFICATION LEVELS

Chemical	Notification Level	Health Effects Language (Optional)
N-Nitrosodi-n-propylamine [NDPA]	10 ng/L	N-nitrosodi-n-propylamine exposures resulted in cancer in a variety of laboratory animals.
Perfluorooctanoic Acid [PFOA]	14 ng/L	Perfluorooctanoic acid exposures resulted in increased liver weight in laboratory animals.
Perfluorooctanesulfonic Acid [PFOS]	13 ng/L	Perfluorooctanesulfonic acid exposures resulted in immune suppression, specifically, a decrease in antibody response to an exogenous antigen challenge.
Propachlor	90 µg/L	Propachlor exposures resulted in decrease in weight gain, decrease in food intake, and relative liver weight increase in rats.
n-Propylbenzene	260 µg/L	Exposures to cumene (isopropylene), a surrogate for n-propylbenzene, resulted in increased kidney weight in rats.
Hexahydro-1,3,5-trinitro-1-3-5-triazine [RDX]	300 ng/L	Hexahydro-1,3,5-trinitro-1-3-5-triazine exposures resulted in liver carcinomas and adenomas in female mice.
Tertiary Butyl Alcohol [TBA]	12 µg/L	Tert-butyl alcohol exposures resulted in cancer in laboratory animals.
1,2,4-Trimethylbenzene	330 µg/L	1,2,4-Trimethylbenzene exposures resulted in increased serum phosphorus levels in rats.
1,3,5-Trimethylbenzene	330 µg/L	1,3,5-Trimethylbenzene exposures resulted in increased serum phosphorus levels in rats.
2,4,6-Trinitrotoluene [TNT]	1 µg/L	2,4,6-Trinitrotoluene exposures resulted in urinary bladder transitional cell papillomas and squamous cell carcinomas in female rats.
Vanadium	50 µg/L	Vanadium exposures resulted in developmental and reproductive effects in rats.

Taken from DDW CCR Guidance Manual, 2019.

TABLE 6.6

REDDING AREA WATERSHED SANITARY SURVEY

CALIFORNIA'S DETECTION LIMITS FOR REPORTING PURPOSES (DLRs)

Analyte	Storet No. or Assigned ID No.	Reporting Units	MCL	DLR	Notes
1,1,1,2-Tetrachloroethane	77562	µg/L		0.5	
1,1,1-Trichloroethane (1,1,1-TCA)	34506	µg/L	200	0.5	
1,1,2,2-Tetrachloroethane	34516	µg/L	1	0.5	
1,1,2-Trichloroethane (1,1,2-TCA)	34511	µg/L	5	0.5	
1,1-Dichloroethane (1,1-DCA)	34496	µg/L	5	0.5	
1,1-Dichloroethylene (1,1-DCE)	34501	µg/L	6	0.5	
1,1-Dichloropropane	A-007	µg/L			
1,1-Dichloropropene	77168	µg/L		0.5	
1,2,3-Trichlorobenzene	77613	µg/L		0.5	
1,2,3-Trichloropropane	77443	µg/L	0.005	0.005	
1,2,3-Trimethylbenzene	77221	µg/L		0.5	
1,2,4-Trichlorobenzene	34551	µg/L	5	0.5	
1,2,4-Trimethylbenzene	77222	µg/L		0.5	
1,2-Dichlorobenzene (o-DCB)	34536	µg/L	600	0.5	
1,2-Dichloroethane (1,2-DCA)	34531	µg/L	0.5	0.5	
1,2-Dichloropropane	34541	µg/L	5	0.5	
1,2-Diphenylhydrazine	34346	µg/L			
1,3,5-Trichlorobenzene	77614	µg/L			
1,3,5-Trimethylbenzene	77226	µg/L		0.5	
1,3-Dichlorobenzene (m-DCB)	34566	µg/L		0.5	
1,3-Dichloropropane	77173	µg/L		0.5	
1,3-Dichloropropene, Total	34561	µg/L	0.5	0.5	
1,3-Dinitrobenzene	A-083	µg/L			
1,4-Dichlorobenzene (p-DCB)	34571	µg/L	5	0.5	
1,4-Dichlorobutane	77285	µg/L			
1,4-Dioxane	A-032	µg/L		1	
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	C2817	ng/L			
17-B estradiol	A-052	µg/L			
1-Naphthol	77441	µg/L			
2,2',4,4',5,5'-Hexabromobiphenyl (HBB)	A-086	µg/L			
2,2',4,4',5,5'-Hexabromodiphenyl Ether	A-087	µg/L			
2,2',4,4',5-Pentabromodiphenyl Ether	A-085	µg/L			
2,2',4,4',6-Pentabromodiphenyl Ether	A-088	µg/L			
2,2',4,4'-Tetrabromodiphenyl Ether	A-084	µg/L			
2,2-Dichloropropane	77170	µg/L		0.5	
2,3,7,8-TCDD (Dioxin)	34676	pg/L	30	5	units = picogram/L (pg/L)
2,4,5-T	39740	µg/L			
2,4,5-TP (SILVEX)	39045	µg/L	50	1	
2,4,6-Trichlorophenol	34621	µg/L		5	
2,4,6-Trinitrotoluene (TNT)	81360	µg/L			
2,4-D	39730	µg/L	70	10	
2,4-DB	38746	ug/L			
2,4-Dichlorophenol	34601	µg/L		5	
2,4-Dimethylphenol	34606	µg/L		5	
2,4-Dinitrophenol	34616	µg/L		5	
2,4-Dinitrotoluene	34611	µg/L		5	
2,6-Dinitrotoluene	34626	µg/L		5	
2-Chloroethylvinyl Ether	34576	µg/L			
2-Chloronaphthalene	34581	µg/L		5	
2-Chlorophenol	34586	µg/L		5	
2-Chlorotoluene	A-008	µg/L		0.5	
2-Methyl-4,6-Dinitrophenol	34657	µg/L		5	
2-Methylphenol	A-046	µg/L			
2-Nitrophenol	34591	µg/L		5	
3,3-Dichlorobenzidine	34631	µg/L		20	
3,5-Dichlorobenzoic Acid	A-095	ug/L			
3-Hydroxycarbofuran	A-021	µg/L		3	
4,4'-DDD	39310	µg/L		0.02	
4,4'-DDE	39320	µg/L		0.01	
4,4'-DDT	39300	µg/L		0.02	
4,6-Dinitro-o-cresol	A-050	µg/L			
4,8-Dioxa-3H-Perfluorononanoic Acid (ADONA)	C2818	ng/L			
4-Bromophenyl Phenyl Ether	34636	µg/L		5	
4-Chloro-3-Methylphenol	34452	µg/L		5	
4-Chlorophenyl phenyl Ether	34641	µg/L		5	
4-Chlorotoluene	A-009	µg/L		0.5	
4-Nitrophenol	34646	µg/L		5	
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	C2816	ng/L			
Acenaphthene	34205	µg/L		5	
Acenaphthylene	34200	µg/L		5	
Acephate	81815	ug/L		10	
Acetaldehyde	77001	µg/L			
Acetaminophen	A-058	µg/L			
Acetochlor	04240	µg/L			
Acetochlor Ethane Sulfonic Acid (ESA)	A-089	µg/L			
Acetochlor Oxanilic Acid (OA)	A-090	µg/L			

TABLE 6.6

REDDING AREA WATERSHED SANITARY SURVEY

CALIFORNIA'S DETECTION LIMITS FOR REPORTING PURPOSES (DLRs)

Analyte	Storet No. or Assigned ID No.	Reporting Units	MCL	DLR	Notes
Acetone	81552	µg/L			
Aciflurfen	79193	ug/L			
Acrolein	34210	ug/L			
Acrylonitrile (Acritet)	34216	µg/L			
Acti-Dione	A-002	ug/L			
Aggressiveness Index (Corrosivity)	82383				
Alachlor (ALANEX) (also UCMR 2 Monitoring-TM 525.2)	77825	µg/L	2	1	
Alachlor Ethane Sulfonic Acid (ESA)	A-094	µg/L			
Alachlor Oxanilic Acid (OA)	A-091	µg/L			
Aldicarb (TEMIK)	39053	µg/L		3	
Aldicarb Sulfone	A-020	µg/L		4	
Aldicarb Sulfoxide	A-019	µg/L		3	
Aldrin	39330	µg/L		0.075	
Alicep	45608	ug/L			
Alkalinity, (Total) (as CaCO3 equivalents)	00410	mg/L			
alpha-BHC	39337	µg/L		0.01	
Aluminum (Al)	01105	ug/L	1000	50	Also has a secondary MCL of 200 µg/L
Aluminum, Dissolved	01106	ug/L	1000		
Ametryn	82184	ug/L			
Amiben	82051	ug/L			
Aminocarb	38404	ug/L			
Aminotriazole	73509	ug/L			
Ammonia (NH3-N)	00612	mg/L			
Amoxicillin	A-059	µg/L			
Anthracene	34220	µg/L		5	
Antimony	01097	ug/L	6	6	
Arsenic	01002	ug/L	10	2	
Asbestos	81855	MFL	7	0.2	
Atraton	82185	ug/L			
Atrazine (AATREX)	39033	µg/L	1	0.5	
Azinphos Ethyl	81292	ug/L			
Azithromycin	A-060	µg/L			
Barban	38418	ug/L			
Barium (Ba)	01007	ug/L	1000	100	
Benfluralin	39002	ug/L			
Benomyl	38705	ug/L		100	
Bentazon (BASAGRAN)	38710	µg/L	18	2	
Benzene	34030	µg/L	1	0.5	
Benzidine	39120	µg/L		5	
Benzo (a) Anthracene	34526	µg/L		10	
Benzo (b) Fluoranthene	34230	µg/L		10	
Benzo (ghi) Perylene	34521	µg/L		10	
Benzo (k) Fluoranthene	34242	µg/L		10	
Benzo (a) Pyrene	34247	µg/L	0.2	0.1	
Benzyl Butyl Phthalate	34292	µg/L		10	
Beryllium	01012	ug/L	4	1	
beta-BHC	39338	µg/L		0.05	
Betasan	82197	ug/L			
Bicarbonate Alkalinity (as HCO3)	00440	mg/L			
bis (2-Chloroethoxy) Methane	34278	µg/L		5	
bis (2-Chloroethyl) Ether	34273	µg/L			
bis (2-Chloroisopropyl) Ether	34283	µg/L		5	
bis-1,1-Dimethylethylperoxide	A-018	µg/L			
bis-1,1-Dimethylperoxide	A-015	µg/L			
Bisphenol A	81651	µg/L			
Boron	01020	ug/L		100	
Bromacil (HYVAR)	82198	µg/L		10	
Bromate	A-027	ug/L	10	5.0	NOTE: DLR is 1.0 ug/L for analysis performed using EPA Method 317.0
Bromide	82298	mg/L			
Bromobenzene	81555	µg/L		0.5	
Bromochloroacetic Acid (BCAA)	A-038	µg/L		1	
Bromochloromethane	A-012	µg/L		0.5	
Bromodichloroacetic Acid (BDCAA)	A-039	µg/L		1	
Bromodichloromethane (THM)	32101	µg/L		1.0	
Bromoform (THM)	32104	µg/L		1.0	
Bromomethane (Methyl Bromide)	34413	µg/L		0.5	
Butachlor	77860	µg/L		0.38	
Butylate	81410	ug/L			
C3-Alkylbenzene	45046	ug/L			
C4-Alkylbenzene	45049	ug/L			
Cadmium (Cd)	01027	ug/L	5	1	
Caffeine	81436	µg/L			
Calcium (Ca)	00916	mg/L			
Captan	39640	ug/L		0.1	
Captatol	39031	ug/L			
Carbamazepine	A-061	µg/L			

TABLE 6.6

REDDING AREA WATERSHED SANITARY SURVEY

CALIFORNIA'S DETECTION LIMITS FOR REPORTING PURPOSES (DLRs)

Analyte	Storet No. or Assigned ID No.	Reporting Units	MCL	DLR	Notes
Carbaryl (Sevin)	77700	µg/L		5	
Carbendazim	38735	ug/L			
Carbofuran (FURADAN)	81405	µg/L	18	5	
Carbon Dioxide	77000	ug/L			
Carbon Disulfide	77041	µg/L		0.5	
Carbon Tetrachloride	32102	µg/L	0.5	0.5	
Carbonate Alkalinity (as CO3)	00445	mg/L			
Carbophenothion	39786	ug/L			
Carendazim	38735	ug/L			
Casoron	82297	ug/L			
Cesium 137, Total (CS-137)	28401	pCi/L			
Chlorate	A-037	ug/L		20	
Chlordane	39350	µg/L	0.1	0.1	
Chlordecone	81281	ug/L			
Chlordimeform	77953	ug/L			
Chloride	00940	mg/L	500		Upper Secondary MCL
Chlorine Dioxide	50070	mg/L			
Chlorite	50074	mg/L	1.0	0.020	
Chlorobenzilate	39460	ug/L			
Chlorodibromomethane	34307	ug/L	100.0	0.500	
Chloroethane	34311	µg/L		0.5	
Chloroform (Trichloromethane)	32106	µg/L		1.0	
Chloromethane (Methyl Chloride)	34418	µg/L		0.5	
Chloroneb	38423	ug/L			
Chloropicrin	77548	ug/L		1	
Chloropropham	81322	ug/L			
Chloropropylate	38429	ug/L			
Chlorothalonil (DACONIL, BRAVO)	70314	µg/L		5	
Chlorotoluene	77970	ug/L			
Chlorpyrifos	77969	ug/L		1	
Chlorsulfuron	A-006	ug/L			
Chromium (Total Cr-CrVI Screen)	A-044	ug/L			
Chromium (Total Cr)	01034	ug/L	50	10	
Chromium, hexavalent (CrVI)	01032	ug/L		1	
Chrysene	34320	µg/L		5	
Ciodrin	82565	ug/L			
Ciprofloxacin	A-062	µg/L			
cis-1,2-Dichloroethylene (c-1,2-DCE)	77093	µg/L	6	0.5	
cis-1,3-Dichloropropene	34704	ug/L			
cis-Permethrin	82418	ug/L			
Cobalt	01035	ug/L			
Color, Apparent (Unfiltered)	00081	UNITS	15		Secondary MCL
Combined Ra 226 + Ra 228	11503	pCi/L	5	2	
Combined Ra 226 + Ra 228 Counting Error	11504	pCi/L			
Combined Ra 226 + Ra 228 MDA95	A-076	pCi/L			
Copper (Cu)	01042	ug/L	1000	50	Secondary MCL
Courmaphos	81293	ug/L			
Cresote	39140	ug/L			
Cumene	77356	ug/L			
Cyanazine	81757	ug/L		150	
Cyanide	01291	ug/L	150	100	
Cycloate	81892	ug/L			
Dacthal	39770	ug/L		0.1	
Dalapon	38432	µg/L	200	10	
DCPA (total di & mono acid degradates)	A-045	µg/L			
D-D Mixture	A-013	ug/L			
DDD	39360	ug/L			
DDE	39365	ug/L			
DDT	39370	ug/L			
DDVP	38775	ug/L			
delta-BHC	34259	µg/L		0.05	
Demeton	39560	ug/L			
Di(2-ethylhexyl) Adipate	A-026	µg/L	400	5	
Di(2-ethylhexyl) Phthalate	39100	ug/L			
Diazinon	39570	µg/L			
Dibenzo (a,h) anthracene	34556	µg/L		5	
Dibromoacetic Acid (DBAA)	82721	µg/L		1.0	
Dibromochloroacetic Acid (CDBAA)	A-040	µg/L		2	
Dibromochloromethane (THM)	32105	µg/L		1.0	
Dibromochloropropane (DBCP)	38761	µg/L	0.2	0.01	
Dibromomethane	77596	µg/L		0.5	
Dicamba (BANVEL)	82052	µg/L		1.5	
Dichloran	38447	ug/L			
Dichlorbromomethane	34328	ug/L	100	0.5	
Dichloroacetic Acid (DCAA)	77288	µg/L		1.0	
Dichlorodifluoromethane (Freon 12)	34668	µg/L		0.5	
Dichloromethane (Methylene Chloride)	34423	µg/L	5	0.5	

TABLE 6.6
REDDING AREA WATERSHED SANITARY SURVEY
CALIFORNIA'S DETECTION LIMITS FOR REPORTING PURPOSES (DLRs)

Analyte	Storet No. or Assigned ID No.	Reporting Units	MCL	DLR	Notes
Dichloropropane	81327	ug/L			
Dichlorprop	82356	ug/L			
Dicofol	39780	ug/L			
Dicrotophos	82454	ug/L			
Dieldrin	39380	µg/L		0.02	
Diethylbenzene	78214	µg/L			
Diethylhexylphthalate (DEHP)	39100	µg/L	4	3	
Diethyl Phthalate	34336	µg/L		5	
Diethylbenzene	78214	ug/L			
Difenzoquat	78882	ug/L			
Diisopropyl Ether (DIPE)	A-036	µg/L		3	
Dimethoate (CYGON)	38458	µg/L			
Dimethyl phthalate	34341	µg/L		5	
di-n-Butylphthalate	39110	µg/L		5	
di-n-Octylphthalate	34596	µg/L		5	
Dinoseb (DNBP)	81287	µg/L	7	2	
Dioxathion	38783	ug/L			
Diphenamide	78004	ug/L		100	
Diquat	78885	µg/L	20	4	
Disulfoton	81888	ug/L		100	
Diuron	39650	µg/L			
DNOC	39920	ug/L			
Dyfonate	81294	ug/L			
Dylox	39014	ug/L			
Endosulfan I	34361	µg/L		0.01	
Endosulfan II	34356	µg/L		0.01	
Endosulfan Sulfate	34351	µg/L		0.05	
Endothall	38926	µg/L	100	45	
Endrin	39390	µg/L	2	0.1	
Endrin Aldehyde	34366	µg/L		0.05	
EPN	81290	ug/L			
EPTC	81894	ug/L			
Estrone	A-053	µg/L			
Ethanol	77004	ug/L			
Ethinyl Estradiol	A-051	µg/L			
Ethion	39398	ug/L			
Ethyl Benzene	34371	µg/L	300	0.5	
Ethyl Parathion	46315	ug/L			
Ethylene Dibromide (EDB)	77651	µg/L	0.05	0.02	
Ethylene Glycol	77023	µg/L			
Ethylene Thio Urea	38928	ug/L		5	
Ethylenediamine tetra-acetic acid (EDTA)	78151	µg/L			
Ethyl-tert-Butyl Ether (ETBE)	A-033	µg/L		3	
Fenamiphos	38929	ug/L		5	
Fensulfothion	37897	ug/L			
Fenthion	38801	ug/L			
Fenuron	38468	ug/L			
Fenuron-TCA	38473	ug/L			
Ferbam	38806	ug/L			
Field pH	00400	Std Units			
Field Turbidity	82078	NTU		0.1	
Fluchloralin	79194	ug/L			
Fluometuron	38811	ug/L			
Fluoranthene	34376	µg/L		5	
Fluorene	34381	µg/L		5	
Fluoride (F) (Natural-Source)	00951	mg/L	2.0	0.1	
Fluoride (Treatment Related-Distribution)	A-035	mg/L		0.1	
Foaming Agents (MBAS)	38260	mg/L	0.5		Secondary MCL
Fonofos	04095	µg/L			
Formaldehyde	71880	mg/L			
Freon 12	A-017	ug/L			
Freon 113	81611	ug/L			
gamma-BHC	39340	µg/L	0.2	0.2	
Garlon	A-004	ug/L			
Gemfibrozil	A-063	µg/L			
Glyoxal	A-048	µg/L			
Glyphosate	79743	µg/L	700	25	
Gross Alpha	01501	pCi/L	15	3	
Gross Alpha Counting Error	01502	pCi/L			
Gross Alpha MDA95	A-072	pCi/L			MDA95 is Minimum Detectable Activity at the 95% confidence level, per 22 CCR
Gross Beta	03501	pCi/L	50	4	
Gross Beta Counting Error	03502	pCi/L			
Gross Beta MDA95	A-077	pCi/L			MDA95 is Minimum Detectable Activity at the 95% confidence level, per 22 CCR
Gross Beta, Calculated Dose Equivalent	A-071	mrem/yr	4		Gross Beta, Calculated Total Body or Organ Dose Equivalent, per 22 CCR

TABLE 6.6

REDDING AREA WATERSHED SANITARY SURVEY

CALIFORNIA'S DETECTION LIMITS FOR REPORTING PURPOSES (DLRs)

Analyte	Storet No. or Assigned ID No.	Reporting Units	MCL	DLR	Notes
Guthion	39580	ug/L			
Haloacetic Acids (five) (HAA5)	A-049	µg/L	60		
Hardness, (Total) as CACO3	00900	mg/L			
Heptachlor	39410	µg/L	0.01	0.01	
Heptachlor Epoxide	39420	µg/L	0.01	0.01	
Hexachlorobenzene	39700	µg/L	1	0.5	
Hexachlorobutadiene	34391	µg/L		0.5	
Hexachlorocyclopentadiene	34386	µg/L	50	1	
Hexachloroethane	34396	µg/L		5	
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	C2815	ng/L			
Hexanol	81591	µg/L			
Hexazinone	38815	ug/L			
HMX	82203	µg/L			
Hydrazine	81313	µg/L			
Hydrogen Sulfide	71875	mg/L			
Hydroxide Alkalinity (as OH)	71830	mg/L			
Ibuprofen	A-064	µg/L			
Imidan	39800	ug/L			
Indeno (1,2,3-cd) Pyrene	34403	µg/L		10	
Iodide	71865	mg/L			
Iodinated contrast media	A-065	µg/L			
Iodine 131, Total	28301	pCi/L			
Iron (Fe)	01045	ug/L	300	100	Secondary MCL
Iron, Dissolved	01046	ug/L			
Isophorone	34408	µg/L		10	
Isopropyl Alcohol	77015	µg/L			
Isopropylbenzene (Cumene)	77223	µg/L		0.5	
Kerosene	78878	µg/L			
Lampreycide	01302	ug/L			
Langelier Index at 60 C	71813				
Langelier Index at Source Temp.	71814				
Lead (Pb)	01051	ug/L		5	
Lindane (gamma-BHC)	39340	µg/L	0.2	0.2	
Linuron	38478	ug/L			
Lipitor	A-066	µg/L			
Lithium	01132	ug/L			
Londax	A-016	ug/L			
m,p-Xylene	A-014	µg/L		0.5	
Magnesium (Mg)	00927	mg/L			
Malathion	39530	ug/L			
Mancozeb	38831	ug/L			
Maneb	38835	ug/L		20	
Manganese (Mn)	01055	ug/L	50	20	Secondary MCL
Manganese, Dissolved	01056	ug/L	50		
MBAS (Foaming Agents)	38260	mg/L	0.5		Secondary MCL
MCPA	39151	ug/L			
MCPB	38486	ug/L			
MCPP	38492	ug/L			
Mercury (Hg)	71900	ug/L	2	1	
Merphos	39019	ug/L			
Metasystox	39020	ug/L			
Methadone	A-067	µg/L			
Methamidophos	38927	ug/L		10	
Methidathion	78879	ug/L			
Methiocarb	38500	ug/L			
Methomyl	39051	µg/L		2	
Methoxy Methyl Propane	78032	ug/L			
Methoxychlor	39480	µg/L	30	10	
Methyl Ethyl Ketone (MEK, Butanone)	81595	µg/L		5	
Methyl Isobutyl Ketone (MIBK)	81596	µg/L		5	
Methyl Parathion	39600	ug/L			
Methyl Phenol	45058				
Methyl Trithion	39790	ug/L			
Methyl tert-Butyl Ether (MTBE)	46491	µg/L	13	3	Also has a secondary MCL of 5 µg/L
Metolachlor	39356	µg/L			
Metolachlor Ethane Sulfonic Acid (ESA)	A-092	µg/L			
Metolachlor Oxanilic Acid (OA)	A-093	µg/L			
Metribuzin	81408	µg/L			
Mexacarbate	38507	ug/L			
Mirex	39755	ug/L			
Modown	78883	ug/L			
Molinate (ORDRAM)	82199	µg/L	20	2	
Molybdenum	01062	ug/L			
Monobromoacetic Acid (MBAA)	A-041	µg/L		1.0	
Monochloroacetic Acid (MCAA)	A-042	µg/L		2.0	
Monochlorobenzene (Chlorobenzene)	34301	µg/L	70	0.5	
Monocrotophos	81890	ug/L			

TABLE 6.6

REDDING AREA WATERSHED SANITARY SURVEY

CALIFORNIA'S DETECTION LIMITS FOR REPORTING PURPOSES (DLRs)

Analyte	Storet No. or Assigned ID No.	Reporting Units	MCL	DLR	Notes
Monuron	38512	ug/L			
Monuron-TCA	38517	ug/L			
Morphine	A-068	µg/L			
MSMA	38935	ug/L			
m-Xylene	81710	µg/L		0.5	
Nabam	38851	ug/L			
Naled	38855	ug/L			
Naphthalene	34696	µg/L		0.5	
Napropamide	79195	ug/L			
n-Butylbenzene	A-010	µg/L		0.5	
Neburon	38522	ug/L			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid	C2807	ng/L			
Nickel	01067	ug/L	100	10	
Nitrate (as NO3)	71850	mg/L	45	2	
Nitrate as Nitrogen (N)	00618	mg/L	10	0.4	
Nitrate + Nitrite as Nitrogen (N)	A-029	mg/L	10	0.4	
Nitrite as Nitrogen (N)	00620	mg/L	1	0.4	
Nitrite (as NO2)	00615	mg/L			
Nitrobenzene	34447	µg/L			
Nitrofen	81303	ug/L			
N-Methyl Perfluorooctanesulfonamidoacetic Acid	C2808	ng/L			
N-Nitrosodiethylamine (NDEA)	78200	µg/L			
N-Nitrosodimethylamine (NDMA)	34438	µg/L			
N-Nitrosodi-n-butylamine (NDBA)	78207	µg/L			
N-Nitrosodi-n-propylamine (NDPA)	34428	µg/L			
N-Nitrosodiphenylamine	34433	µg/L			
N-Nitrosomethylethylamine (NMEA)	A-070	µg/L			
N-Nitrosomorpholine (NMOR)	73617	ug/L			
N-Nitrosopiperidine (NPIP)	73283	µg/L			
N-Nitrosopyrrolidine (NPYR)	78206	µg/L			
n-Octacosane	78116	µg/L			
Nonadecane (N)	77822	ug/L			
Nonylphenol	77745	µg/L			
Nonylphenol polyethoxylate(s)	A-054	µg/L			
Nortron	45606	ug/L			
n-Propylbenzene	77224	µg/L		0.5	
Octylphenol	A-055	µg/L			
Octylphenol polyethoxylate	A-056	µg/L			
Odor Threshold @ 60 C	00086	TON	3	1	Secondary MCL
Oryzalin	78884	ug/L		10	
Ovex	39022	ug/L			
Oxamyl (Vydate)	38865	µg/L	50	20	
o-Xylene	77135	µg/L		0.5	
Parachlorometa cresol	34453	µg/L			
Paraquat	82416	ug/L		20	
Parathion	39540	ug/L		0.02	
PCB-1016 (as decachlorobiphenyl (DCB))	34671	µg/L		0.5	
PCB-1221 (as DCB)	39488	µg/L		0.5	
PCB-1232 (as DCB)	39492	µg/L		0.5	
PCB-1242 (as DCB)	39496	µg/L		0.5	
PCB-1248 (as DCB)	39500	µg/L		0.5	
PCB-1254 (as DCB)	39504	µg/L		0.5	
PCB-1260 (as DCB)	39508	µg/L		0.5	
PCBs, total -- See "Polychlorinated Biphenyls, Total, as DCB" (below)	39516	ug/L	0.5	0.5	
PCNB	39029	ug/L		0.1	
Penoxalin	82410	ug/L			
Pentachlorobenzene	77793	ug/L			
Pentachloroethane	81501	µg/L			
Pentachlorophenol (PCP)	39032	µg/L	1	0.2	
Perchlorate	A-031	ug/L	6	4	
Perfluorobutanesulfonic Acid (PFBS)	C2801	ng/L			
Perfluorodecanoic Acid (PFDA)	C2809	ng/L			
Perfluorododecanioc Acid (PFDoA)	C2810	ng/L			
Perfluoroheptanoic Acid (PFHpA)	C2802	ng/L			
Perfluorohexane Sulfonic Acid (PFHxS)	C2803	ng/L			
Perfluorohexanoic Acid (PFHxA)	C2811	ng/L			
Perfluorononanoic Acid (PFNA)	C2804	ng/L			
Perfluorooctanoic Acid (PFOA)	C2806	ng/L			
Perfluorooctyl Sulfonate (PFOS)	C2805	ng/L			
Perfluorotetradecanoic Acid (PFTA)	C2812	ng/L			
Perfluorotridecanoic Acid (PFTrDA)	C2813	ng/L			
Perfluoroundecanoic Acid (PFUnA)	C2814	ng/L			
Permethrin	79191	ug/L			
Perthane	39034	ug/L			
PH, Field	00400	Std Units			
PH, Laboratory	00403	Std Units			
Phenanthrene	34461	µg/L		5	

TABLE 6.6

REDDING AREA WATERSHED SANITARY SURVEY

CALIFORNIA'S DETECTION LIMITS FOR REPORTING PURPOSES (DLRs)

Analyte	Storet No. or Assigned ID No.	Reporting Units	MCL	DLR	Notes
Phenol (Carbolic Acid)	34694	µg/L		5	
Phorate	38870	ug/L		0.2	
Phosalone	81291	ug/L			
Phosdin	39610	ug/L			
Phosphate (as PO4)	00650	mg/L			
Phosphate, Ortho (as PO4)	00660	mg/L			
Picloram	39720	µg/L	500	1	
p-Isopropyltoluene	A-011	µg/L			
Polybrominated Diphenyl Ethers	A-057	µg/L			
Polychlorinated Biphenyls, Total, as DCB	39516	µg/L	0.5	0.5	
Potassium (K)	00937	mg/L			
Profluralin	38872	ug/L			
Prometon	39056	ug/L			
Prometryn (CAPAROL)	39057	µg/L		2	
Propachlor	38533	µg/L		0.5	
Propamide	39080	ug/L			
Propane	82358	µg/L			
Propanil	39037	ug/L			
Propargite	82065	ug/L			
Propazine	39024	ug/L			
Propham	39052	ug/L			
Propoxur	38537	ug/L			
p-Xylene	78132	µg/L		0.5	
Pyramin	78132	ug/L			
Pyrene	34469	µg/L		5	
Pyrethrins	39930	ug/L			
Total Radium for NTNC per §64442(b)(3)	A-080	pCi/L			
Total Radium for NTNC per §64442(b)(3) C.E.	A-081	pCi/L			
Total Radium for NTNC per §64442(b)(3) MDA95	A-082	pCi/L			
Radium 226	09501	pCi/L		1	
Radium 226 Counting Error	09502	pCi/L			
Radium 226 MDA95	A-074	pCi/L			MDA95 is Minimum Detectable Activity at the 95% confidence level, per 22 CCR
Radium 228	11501	pCi/L		1	
Radium 228 Counting Error	11502	pCi/L			
Radium 228 MDA95	A-075	pCi/L			MDA95 is Minimum Detectable Activity at the 95% confidence level, per 22 CCR
Radon 222	82303	pCi/L		100	
Radon 222 Counting Error	82302	pCi/L			
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	81364	µg/L			
Ronnel	39357	ug/L			
Round-Up	39941	ug/L			
S,S,S-Tributylphosphorotrithioate	39040	ug/L			
Salicylic acid	77403	µg/L			
Secbumeton	38542	ug/L			
sec-Butylbenzene	77350	µg/L		0.5	
Selenium (Se)	01147	ug/L	50	5	
Siduron	38548	ug/L			
Silica	00955	mg/L			
Silver (Ag)	01077	ug/L	100	10	Secondary MCL
Simazine (PRINCEP)	39055	µg/L	4	1	
Simetryn	39054	ug/L			
Sodium (Na)	00929	mg/L			
Sodium Absorption Ratio	00931				
Sodium Chlorate	00726	ug/L			
Source Temperature C	00010	C			
Specific Conductance (E.C.)	00095	umhos	1600		Upper Secondary MCL
Strontium, Total (as SR)	01082	ug/L			
Strontium 89, Total	15501	pCi/L			
Strontium–90	13501	pCi/L	8	2	
Strontium–90 Counting Error	13502	pCi/L			
Strontium–90 MDA95	A-078	pCi/L			MDA95 is Minimum Detectable Activity at the 95% confidence level, per 22 CCR
Styrene	77128	µg/L	100	0.5	
Sulfate (SO4)	00945	mg/L	500	0.5	Upper Secondary MCL
Sulfide	00745	mg/L			
Sulfometuron Methyl	A-005	ug/L			
SWEP	38555	ug/L			
Tebuthiuron	45607	ug/L			
Tedion	39808	ug/L			
TEPP	39620	ug/L			
Terbacil	38882	µg/L			
Terbufos	82088	µg/L			
Terbufos Sulfone	45612	µg/L			
Terbuthylazine	38559	ug/L			
Terbutryn	38887	ug/L			
tert-Amyl Methyl Ether (TAME)	A-034	µg/L		3	

TABLE 6.6

REDDING AREA WATERSHED SANITARY SURVEY

CALIFORNIA'S DETECTION LIMITS FOR REPORTING PURPOSES (DLRs)

Analyte	Storet No. or Assigned ID No.	Reporting Units	MCL	DLR	Notes
tert-Butyl Alcohol (TBA)	77035	µg/L		2	
tert-Butyl Formate (TBF)	A-047	µg/L			
tert-Butylbenzene	77353	µg/L		0.5	
Tetrachloroethylene (PCE)	34475	µg/L	5	0.5	
Tetrachlorophenol	81849	ug/L			
Thallium	01059	ug/L	2	1	
Thiobencarb (BOLERO)	A-001	µg/L	70	1	Also has a secondary MCL of 1 µg/L
Toluene	34010	µg/L	150	0.5	
Topsin-MR	78880	ug/L			
Total 1,3-Dichloropropene	34561	µg/L	0.5	0.5	
Total Anions		me/L			
Total Filterable Residue @ 180 C (TDS)	70300	mg/L	1000		Upper Secondary MCL
Total Dissolved Solids	70300	mg/L			
Total Organic Carbon (TOC)	00680	mg/L		0.3	
Total Radium for NTNC per 64442(b)(3)	A-080	pCi/L	5	1	
Total Radium for NTNC per 64442(b)(3) C.E.	A-081	pCi/L			
Total Radium for NTNC per 64442(b)(3) MDA95	A-082	pCi/L			
Total Trihalomethanes (TTHMs)	82080	µg/L	80		
Total Xylenes (m,p, & o)	81551	µg/L	1750	0.5	
Toxaphene	39400	µg/L	3	1	
trans-1,2-Dichloroethylene (t-1,2-DCE)	34546	µg/L	10	0.5	
trans-1,3-Dichloropropene	34699	ug/L			
trans-Permethrin	82420	ug/L			
Triadimefon	38892	ug/L			
Tribromoacetic Acid (TBAA)	A-043	µg/L		4	
Trichloroacetic Acid (TCAA)	82723	µg/L		1.0	
Trichloroethylene (TCE)	39180	µg/L	5	0.5	
Trichlorofluoromethane (FREON 11)	34488	µg/L	150	5	
Trichloronate	38897	ug/L			
Trichlorotrifluoroethane (FREON 113)	81611	µg/L	1200	10	
Triclosan	A-069	µg/L			
Trifluralin	81284	ug/L			
Trimethyl Benzene	78136	ug/L		0.5	
Tritium	07000	pCi/L	20000	1000	
Tritium Counting Error	07001	pCi/L			
Tritium MDA95	A-079	pCi/L			MDA95 is Minimum Detectable Activity at the 95% confidence level, per 22 CCR
Turbidity, Field	82078	NTU			
Turbidity, Laboratory	82079	NTU	5	0.1	Secondary MCL
Uranium (ug/L)	28011	ug/L		1	
Uranium (pCi/L	28012	pCi/L	20	1	
Uranium Counting Error	A-028	pCi/L			
Uranium MDA95	A-073	pCi/L			MDA95 is Minimum Detectable Activity at the 95% confidence level, per 22 CCR
Vanadium	01087	ug/L		3	
Vendex	A-003	ug/L			
Vernolate	82200	ug/L			
Vinyl Acetate	77057	µg/L			
Vinyl Chloride (VC)	39175	µg/L	0.5	0.5	
Xylenes (Total)	81551	ug/L	1750	0.5	
Zinc (Zn)	01092	ug/L	5000	50	Secondary MCL
Zineb	38912	ug/L			
Ziram	38917	ug/L			
Zytron	81285	ug/L			

Table from "Chemical IDs and Detection Limits for Purposes of Reporting (DLRs) (Excel)" https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/EDT.html

Last Update: May 6th, 2019

This lookup table is a compilation of chemicals and characteristics that are contained in the Storet.dbf. WQM Documentation.doc is a reference guide for the Storet.dbf and both files can be found on the Download webpage (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/EDTlibrary.shtml).

In case of discrepancies on this list of analytes or the information presented in Write-On, please refer to the Storet.dbf documentation.

Reporting units include micrograms per liter (µg/L), milligrams per liter (mg/L), picograms per liter (pg/L), million fibers per liter (MFL), millirems per year (mrem/yr), and picocuries per liter (pCi/L). MCL = maximum contaminant level; DLR = detection limit for purposes of reporting.

7 WATER DISTRICT FACILITIES AND TREATMENT PROCESSES

7.1 Introduction

Water treatment facilities have long been the first line of defense for the treatment of waterborne pathogens and contaminants. Watershed sanitary surveys expand that line of defense into those facilities' watersheds. This affords water suppliers an opportunity to develop an understanding of the potential threats that may exist in their watersheds and either mitigate those problems or prepare their facilities against those threats. However, water treatment facilities may have little, if any, influence on events or regulations in their watersheds. Furthermore, there are limited steps agencies can take to improve their raw water quality, and water treatment facilities are still the primary means of removing and/or inactivating pathogens.

Four major watersheds are used to supply the water treatment facilities of the participating agencies: Shasta, Trinity, Whiskeytown, and the Sacramento River Watersheds. Figure 7.1 shows the locations of these agencies and their boundaries, if available. The location of a purveyor's intake does not necessarily indicate the watershed from which the source water originates. Examples are the City of Redding Foothill Water Treatment Plant and the Bella Vista Water District, which have intakes on the Lower Sacramento River (below Shasta Dam). Their source water is a combination of waters from Shasta, Whiskeytown, Trinity, and Sacramento River Watersheds. Therefore, an event or condition in either the Trinity Watershed or Whiskeytown Watershed could impact their ability to treat raw water. Figures 4.4 and 4.5 indicate the watershed's raw water source for each participating agency that is located near the City of Redding, and Table 7.1 lists the treatment plant source waters for each of the participating agencies mentioned in this report.

Lakes can dramatically dilute a substance as it disperses and mixes throughout the large volume of water stored. As a result, agencies with intakes located on or downstream of reservoirs are at a reduced risk from contaminants. In contrast, purveyors with their intakes located on creeks or rivers may be at greater risk due to the smaller volume of water in these conduits, which consequently may not adequately dilute contaminants. Most of the participating agencies in this report have water intakes located on or downstream of major reservoirs or lakes. However, Sugarloaf CSA No. 2, Castella CSA No. 3, French Gulch CSA No. 11, and Crag View CSA No. 23 have intakes located on creeks and rivers that might not sufficiently dilute contaminants. Fortunately, the small creeks and rivers these facilities draw their water from do not appear to have major roads or railroads located in their localized watershed, and the possibility of a spill is minor. However, landslides and erosion are still possible and could have a severe impact on water quality, especially since the 2018 fires.

An example of a chemical spill occurred in 1991 when the herbicide metam sodium spilled into the Sacramento River near Dunsmuir due to a rail car accident. The chemical was concentrated enough to kill off virtually all aquatic life in the stretch of river above Shasta Lake Reservoir. As the metam sodium reached Shasta Lake, it sank to the bottom and was diluted by the large volume of water in the reservoir. Consequently, metam sodium was not detected by any treatment facilities on the lake or downstream of the lake.

The goal of a water treatment facility is to make water potable, and proper design, maintenance, and upkeep are critical steps in providing the public with safe drinking water. As aforementioned, one of the requirements of a sanitary survey is to determine the risk to drinking water from Cryptosporidium and Giardia. Therefore, a short description and a review of the water facilities that are owned and operated by the participating agencies in this sanitary survey are included in this report, with an emphasis on how the latest state and federal drinking water regulations are met. Table 7.2 summarizes each facility's ability to achieve the latest surface water treatment regulations that pertain to water treatment. Regulations that do not directly refer to treatment processes have not been considered or investigated in this report.

All sections describing the water treatment facilities are taken from the participating agencies' Master Water Plan and from SWRCB DDW Inspection Reports, unless noted otherwise.

7.2 Bella Vista Water District

INTRODUCTION: The reader should refer to the 2018 DDW Inspection Report for a detailed review of the Bella Vista Water District water treatment and distribution systems.

The Bella Vista Water District is a publicly owned water agency operating under the direction of a five-member elected Board of Directors. Bella Vista Water District supplies agricultural, municipal, and industrial water to individual customers located east of the City of Redding as shown on Figure 7.1. This area includes an overlapping northeastern part of the City of Redding and the unincorporated communities of Bella Vista and Palo Cedro, east of Redding. Bella Vista Water District's existing boundary encompasses approximately 54 square miles with 6,415 service connections as of 2020. Water usage for 2017 was approximately 3,160 MG with an MDD of 20.8 million gallons per day (MGD). In 2001, the MDD was 45.9 MGD.[2] The MDD per connection is considerably higher than other nearby systems due to the number of agricultural, rural, and commercial water users served by the district. Bella Vista Water District has seen a significant drop in water usage over the last two decades. The district's water supply in 2014 and 2015 was severely reduced, receiving zero agricultural supply allocations from the Central Valley Project in both years and only 50% and 25% of historic use for municipal use during the years 2014 and 2015, respectively. As a result, the district implemented its Water Shortage Contingency Plan, encouraged water conservation, and imposed shortage measures including financial penalties for overuse. Despite improved supply, conservation and reduced demands have continued in subsequent years. However, for the 2019 water year, Bella Vista Water District received a full water supply allocation for both agricultural use and for municipal and industrial use as a result of good precipitation and water storage.[21]

SOURCE: Bella Vista Water District currently has a combined surface water and groundwater source capacity of 60.8 MGD[20], which is greater than the district's highest reported maximum day demand over the past two decades of 44 MG in 2004 and 2006. The primary water source is the Sacramento River augmented by five groundwater wells.

Bella Vista Water District is capable of pumping up to 56.16 MGD of water from the Sacramento River at the Wintu Pump Station. Approximately 3.37 billion gallons of the treated water supply was made up of surface water from the Sacramento River in 2019.[21] The source waters are Shasta, Sacramento River, Trinity, and Whiskeytown Watersheds. The district also operates five wells that can operate during periods of high summer demands or during the winter when river turbidity is too high and the WTP is taken off-line or when surface water supplies are curtailed during drought years. In 2019, the wells supplied 56.7 MG, or 1.7% of the total water supply, a significant decrease from the 152.3 MG, or 4.4%, in 2018.[21] See well capacities shown below:[2]

Source	Location	Capacity
Well 1	Clough Creek	980 GPM (1.41 MGD)
Well 2	Old Oregon Trail	660 GPM (0.95 MGD)
Well 3	Palo Cedro	700 GPM (1.01 MGD)
Well 4	Abernathy Lane	250-350 GPM (0.36 MGD)
Well 6	Stillwater Creek	620 GPM (0.89 MGD)

Bella Vista Water District did not receive water through its interties with the City of Redding and Shasta Lake during 2019.

Photo 4 - Wintu Pump Station on the Sacramento River

TREATMENT: With the exception of one raw water delivery point serving the Turtle Bay Arboretum, all surface water undergoes in-line filtration and disinfection. Treatment of the Sacramento River water begins at the Wintu Pump Station with the addition of chlorine. The WTP was designed with the option of adding coagulant at the Wintu Pump Station to convert the WTP to a direct filtration process. In-line filtration is considered to provide equivalent treatment as direct filtration as long as the district consistently meets the <0.1 NTU combined filter effluent limit in at least 95% of samples.[2] Anticipating diminished source water quality due to the Carr, Delta, and Hirz Wildfires, Bella Vista Water District pursued operating the WTP as a direct filtration plant but was denied by DDW due to results from the 2001 Particle Study.

At the WTP, water flows through pressure filters that contain dual media, sand, and anthracite coal. Each of the 16 (10-foot-diameter by 50-foot-long) horizontal filters is equipped with flow control to ensure that the maximum loading rate does not exceed 6 gallons per minute per square foot (GPM/SF). The water is then post chlorinated, if necessary, just before it enters the distribution system.[1]

At a surface loading rate of 6 GPM/SF, the treatment plant is capable of producing up to 69 MGD; however, the Wintu Pump Station pumping capacity and distribution system hydraulics limit the maximum flow of water to 56.16 MGD.[20] In 2019, the maximum daily flow through the WTP was 22.2 MG.[21]

Backwash water is sent to one of two storage ponds where particles are allowed to settle out. Water in the ponds is pumped from a sump at the north end of the ponds, chlorine is added, and the mixture is injected at the headworks upstream of the filters when the WTP is in operation. The backwash return rate is controlled automatically based on the flowrate through the treatment plant to limit the returned backwash water flow rate does not exceed 10% of influent total flow through the WTP. For the 2019 year, approximately 5.2%, or 173.2 MG of the treated water supply was made up of recycled filter backwash water.[21]

Bella Vista Water District's five groundwater wells draw from the Redding groundwater basin. Treatment of the groundwater consists of oxidation of iron and manganese using chlorine, followed by adsorption of the iron and manganese oxides in pressure filters. A chlorine residual is carried through the entire process to aid in maintaining a chlorine residual in the distribution system.

The district has seen a significant drop in demand over the last several years due to the water restrictions imposed from the severe drought. This drop in demand has introduced some new water quality issues for the district. Smaller demands typically indicate longer detention times in tanks, pipes, etc. Increased detention times have been attributed to the elevated TTHM and HAA5 concentrations.

Photo 5 - Bella Vista Water District Treatment Facility

DDW's most recent inspection occured in May and July 2018.

COMPLIANCE WITH THE LT2ESWTR

In order to comply with the LT2ESWTR, Bella Vista Water District performed monthly raw water monitoring for Cryptosporidium between February 25, 2008 and January 25, 2009. Cryptosporidium was not detected in any of the 24 samples; therefore, the source was classified in Bin 1. A second round of LT2 samples for Cryptosporidium, Total Coliforms, and E. coli were collected from October 2016 to September 2018. The results support the Bin 1 classification. The district has continued to collect one raw water bacteriological sample per month from the surface water source, and the average level of fecal coliform bacteria in the raw water samples collected during 2017 and 2018 was 8 MPN/100 mL.

7.3 Centerville CSD

INTRODUCTION: The reader should refer to the December 2015 Centerville CSD Master Water Plan and DDW's 2017 Amended Annual Inspection Report for a detailed review of the district's distribution system.

Centerville CSD is located immediately west of the City of Redding, as shown on Figure 7.1. In 2015, the district served approximately 1,232 connections and had an annual average production of nearly 424.6 MG with an estimated maximum day demand of 2.89 MG.[3]

The district receives treated water through a dedicated capacity water treatment contract with Clear Creek CSD. The contract provides Centerville CSD with 25% (11 MGD) of Clear Creek CSD's future total capacity of 44 MGD. The district is, however, currently limited to 6.9 MGD (4,800 GPM) due to physical constraints at the intertie with the USBR's Muletown Conduit. The contract also states that Centerville CSD shall pay a portion of the total ongoing direct costs for water treatment, maintenance, and repair of the plant and pay a portion of the maintenance of the Muletown Conduit facilities to Centerville's main turn out point.[3]

Centerville CSD is entitled to 3,800 acre-feet (1,239 MG) of water per year through an agreement with the USBR for 2,900 acre-feet and an additional 900 acre-feet of purchased water rights. The reported maximum flow rate of 4,800 GPM through the Muletown Conduit Intertie is greater than the highest estimated maximum day demand over the past 10 years of 3,460 GPM; therefore, Centerville CSD meets Waterworks Standards for the system as a whole. Additionally, the district can receive water, if needed, through an active 8-inch intertie with the City of Redding at Rainer and Sienna.

SOURCE: Centerville CSD receives treated water from the Clear Creek CSD via the Muletown Conduit, which originates at Whiskeytown Dam. See the Clear Creek CSD section of this survey for a description of the source. The Muletown Conduit transmits water to both Centerville CSD and Clear Creek CSD. The Muletown Conduit intertie consists of a 6-inch-diameter main, a 10-inch-diameter main, and a 16-inch-diameter main. The 6-inch line is controlled by a manual valve that stays open as the primary source line. The 16-inch line is controlled by an automatic butterfly valve that responds to the level in Tank B, which relies on the pressure in Zone B.[22] If additional flow is still required, an automatic gate valve allows flow from the 12-inch line to supplement supply.

TREATMENT: Water used by Centerville CSD is produced at Clear Creek CSD treatment facility. See the Clear Creek CSD section of this survey for a description of the treatment process.

REGULATORY STANDARDS REQUIRING ATTENTION

See the Clear Creek CSD section of this survey.

7.4 Clear Creek CSD

The reader should refer to the December 2007 Clear Creek CSD's Master Water Plan and the 2019 DDW Annual Inspection Report[5] for a detailed review of the district's water treatment and distribution system.

Clear Creek CSD is located just southwest of the City of Redding, as shown on Figure 7.1. Clear Creek CSD serves approximately 2,358 connections at an MDD of 20 MGD in 2018 and has a 33.1 MGD capacity in-line filtration plant. A maximum of 25% of the treated water goes to Centerville CSD, which proportionately contributes to the WTP's operation and maintenance costs.[4]

Clear Creek CSD receives all of its water through the Central Valley Project as administered by USBR. The district has a post-1914 water contract obligation of 15,300 acre-feet of Central Valley Project water to be used for municipal, domestic, agricultural, and industrial purposes.

SOURCE WATERS: Water is diverted from Whiskeytown Reservoir through two intakes located in the dam. The intakes are located at elevations of 1,110 and 965 feet and allow the district an opportunity of drawing water from whichever depth to avoid turbid water or other contaminants.

Clear Creek CSD also has three active groundwater wells. See well capacities shown below:

Source	Installed	Capacity
Well 1	November 1991	1,500 GPM
Well 2	March 1999	1,500 GPM
Well 3	March 1999	1,500 GPM

TREATMENT PLANT: In 2018, the maximum day reported production was 20 MG. The treatment plant includes a supervisory control and data acquisition system (SCADA), a streaming current monitor, individual filter train turbidity meters, two chlorine residual analyzers (one pre- and one post-filter), and two low-flow and two high-flow chemical feed pumps. Initially, a poly-aluminum chloride coagulant is dosed immediately downstream of the chlorine addition, followed by a variable residence time in the raw water conduit, leading to the addition of cationic coagulant just upstream of the filters. The operators believe that the addition of a primary coagulant followed by a flocculent aid produces the best water quality.

The plant operates as an in-line filtration plant with four 8 x 40 and four 10 x 50 pressure filters. The filters operate under pressure by gravity from Whiskeytown Reservoir. The four 8 x 40 filters contain two cells apiece and are paired to form two trains. The four 10 x 50 filters consist of three cells apiece and each forms an individual train. Thus, there are a total of six filter trains with a maximum filtration capacity of 33.1 MGD at 7 GPM/SF. However, the WTP typically operates at a loading rate of 3 to 4 GPM/FT^2 in the summer. At this loading rate, filters are typically backwashed every 24 to 48 hours. Backwash water is initially discharged to ponds for settling to occur and then recycled at an injection point approximately 30 feet from the chlorine building in the 450-foot conveyance pipe. Filter-to-waste water is discharged to a pond behind the filters; this water is also recycled. Clear Creek CSD maintains an operational goal of backwash rates of less than 10% of the total flow and turbidity of less than 2.0 NTU to be returned back to the headworks for recycling. Coagulant is not added to the recycled backwash water.[4]

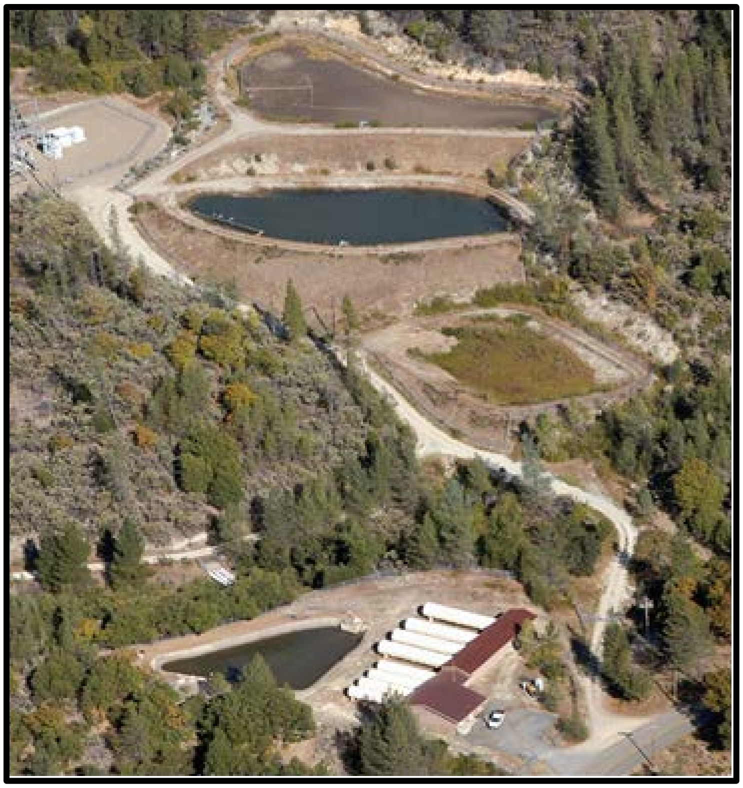


Photo 6 - Clear Creek Water Treatment Plant

In 1994, Montgomery-Watson and PACE Engineering, Inc. conducted a particle study to determine if the in-line facility could meet the then existing standards as an alternative technology. The study demonstrated to DDW that the plant could consistently meet a 2-log (99%) removal of Giardia-sized particles (4 to 10 micron). The study did not focus on demonstrating that the treatment facility could achieve 2-log removal of Cryptosporidium-sized particles (2 to 5 micron). A cursory review of data indicates that, on average, the facility is currently meeting the 2-log removal requirement. In addition, Clear Creek CSD has met the 0.1 NTU CAP goal in at least 99% of the combined filter effluent turbidity measurements reported each month. Clear Creek CSD measures combined filter effluent turbidity, never exceeds 0.3 NTU, and is consistently less than 0.1 NTU.

Raw water turbidities are typically below 2 NTU as shown in Figure 9.6; however, in 2018, the turbidities were significantly higher due to the Carr Fire in the majority of the Whiskeytown Watershed, which placed a heavy load on the filters. Raw water turbidities tend to peak during winter months likely from high rainfall events causing short-term erosion within the watershed.

DDW's most recent inspection was on September 20, 2019.

COMPLIANCE WITH THE LT2ESWTR

In order to comply with the LT2ESWTR, Clear Creek CSD chose to use grandfathered data. On March 18, 2008, the district submitted 24 months of raw water fecal coliform results from 2006 and 2007 to DDW. Clear Creek CSD continued to report the results from two raw water bacteriological samples per month through November 2009 and one per month since then. The district collects one raw water sample each month for E. coli monitoring. Based on past data submitted by the Clear Creek CSD on March 18, 2008, the average level of E. coli bacteria in the district's lake source was below a most probable number (MPN) of 10 E. coli per 100 mL. The federal LT2 allows systems to receive a waiver from Cryptosporidium monitoring requirements if the average level of E. coli in the source water is less than 100 per 100 mL. Clear Creek CSD met this requirement, and the source was classified in Bin 1 for purposes of the LT2.

7.5 Mountain Gate CSD

INTRODUCTION: The reader should refer to the 2007 Mountain Gate CSD's Master Water Plan (by PACE Engineering, Inc.) and DDW's 2015 Inspection Report[5] for a detailed review of the water treatment and distribution system.

Mountain Gate CSD is a publicly owned water agency operating under the direction of a five-member elected Board of Directors. The district supplies municipal and industrial water to individual customers and is located north of the City of Shasta Lake as shown on Figure 7.1. In 2014, the District served 669 connections with approximately 221 MG of water.

SOURCE: The primary water source is Shasta Lake with its intake located on the Pit River arm at Beaver Island. The appropriated water is authorized through the USBR Central Valley Project for 1,350 acre-feet of water per year, subject to shortage provisions. In 2015, USBR has implemented mandatory cutbacks to Mountain Gate CSD, resulting in 195 acre-feet. Therefore, the district has purchased 150 acre-feet from McConnell Foundation to supplement their water needs. Mountain Gate CSD also augments its water supply with three groundwater wells shown below:

Source	Capacity
Well 01A	130 GPM
Well 02	135 GPM
Well 03	50 GPM

The 2012 Water Treatment Improvement Project was completed in December 2014. This project consisted of installing a 0.5 MG finished water storage tank, replacement of Well-01 with Well-01A, extension of source pumps at Beaver Island, installation of a third pressure filter, and SCADA system.

TREATMENT: Chlorine and coagulant are added to the raw water main at the Lake Booster Pump Station. Post chlorination occurs after filtration through one, two, or three dual media 8-foot x 30-foot pressure filters containing gravel, sand, and anthracite coal. At a maximum loading rate of 3 GPM/SF, the facility is capable of producing a maximum of 3.1 MGD.

Photo 7 - Mountain Gate Pressure Filters

REGULATORY STANDARDS REQUIRING ATTENTION

The following concerns were listed in the DDW Inspection Report on March 27, 2015.[5]

- Mountain Gate CSD needs to secure the hatch on the South Storage Tank with a screen, gasket, and shoebox-type rim to prevent dirt, debris, and/or insects from entering the tank.
- Backflow prevention devices shall be tested annually.

COMPLIANCE WITH THE LT2ESWTR

In order to comply with the LT2ESWTR, Mountain Gate CSD chose to use grandfathered E. coli data collected from February 2004 to December 2006; monitoring of Cryptosporidium is not required.[5]

7.6 City of Redding

INTRODUCTION: The reader should refer to the 2016 City of Redding Water Utility Master Plan and DDW's Inspection Report[6] for a detailed review of the water treatment and distribution system.

The City of Redding is located on Interstate 5 as shown on Figure 7.1. The water system infrastructure includes the Foothill and Buckeye WTPs; 14 active, 3 standby, and 1 inactive groundwater wells; approximately 305 miles of main pipeline; 13,793 feet of 30-inch transmission line; 10 pump stations; 10 pressure reducing valve (PRV) stations; and 14 storage tanks. In 2016, the City of Redding water system had an average of 28,160 service connections and a service area population of approximately 91,110 people.[6]

SOURCES: The City of Redding's water system has two surface water treatment facilities that receive water from different sources:

Foothill WTP is supplied from the Sacramento River by Pump Station No. 1, using water from the Trinity, Whiskeytown, Shasta, and Sacramento River Watersheds. The City of Redding has a contract to divert up to 6,842 MG per year from the Sacramento River for the Foothill WTP.[6]

Buckeye WTP is supplied from the Spring Creek Conduit by gravity, which uses water from Trinity and Whiskeytown Watersheds. The City has a contract to divert up to 1,968 MG per year from the Spring Creek Conduit for the Buckeye WTP.[6] The City of Redding also has two groups of groundwater wells: thirteen Enterprise wells, which supply most of the City of Redding's groundwater and five Cascade wells, which provide a relatively minor supply.

The City also provides water via a number of wells:

Source	Status	Capacity (GPM)	Drilled
Cascade Wells			
C-1	Active	185	1961
C-5	Standby	100	1964
C-6	Active	30	1967
C-8	Active	105	1970
C-9	Active (not operational)	Pump pulled	1973
Enterprise Wells			
E-3A	Active	396	1983
E-4	Active (not operational)	382	2001
E-6	Inactive (offline/emergency only)		1968
E-6A	Active (not operational)	646	1983
E-7	Active	1,194	1968
E-8	Active	1,049	1980
E-9	Active	1,750	1986
E-10	Active	1,042	1986
E-11	Standby	1,389	1989
E-12	Active	2,569	2002
E-13	Standby	1,736	2002
E-14	Active	1,736	2006
E-23	Active (not operational)	1,736	2007

TREATMENT

Foothill WTP

The Foothill WTP receives water from Pump Station No. 1 located on the Sacramento River by two 30-inch transmission pipelines. The conventional treatment facilities include a flocculation/sedimentation basin, gravity filters with air scour, backwash, and rinse to waste to an equalization basin, clarifier, return pump station, a sludge drying bed, controls, several chemical feed systems, and a chlorine building housing disinfection materials and equipment. The City recently decided to always bypass the flocculation/sedimentation basins and has not operated the Foothill WTP in conventional mode since 2010.

Buckeye WTP

The Buckeye WTP draws water by gravity from the 17-foot-diameter Spring Creek Conduit. The conventional treatment facility includes a rapid mixing chamber, four flocculation basins, four sedimentation basins, and eight dual media filters with air scour, backwash, and rinse-to-waste system, with a wash water recovery basin and sludge drying beds. Current capacity is 14 MGD with a planned ultimate capacity of 28 MGD. The plant is unmanned most of the time, with key processes being monitored and controlled from the Foothill WTP.

REGULATORY STANDARDS REQUIRING ATTENTION

The following items were noted by DDW's inspection report dated July 12, 2018:[6]

- The City of Redding is past due on some source water chemical monitoring.
- Initiate quarterly monitoring at Wells E-6A, E-7, E-10, E-12, when in operation.
- Complete repairs to Enterprise Wells E-4, E-6A, E-8, and E-23.
- Evaluate the status of Wells C-9 and E-13. Report to DDW if they should be considered abandoned/inactive.
- When City of Redding performs quarterly tank checks, include examination of overflow outlet.
- Collect asbestos samples from the distribution system.
- Verify that Chevron Lubricating Oil FM ISO 32 is NSF 61 certified.
- Test all backflow prevention devices annually.

COMPLIANCE WITH THE LT2ESWTR

The City of Redding collected a second round of sampling to comply with the LT2ESWTR from October 2015 to September 2017. There were no detectable Cryptosporidium oocysts in any of these samples, allowing City of Redding to remain classified in Bin 1 with no additional treatment.[6]

7.7 City of Shasta Lake

INTRODUCTION: The reader should refer to the February 2018 DDW Inspection Report and the 2016-2026 Water Master Plan for a detailed review of the water treatment and distribution system.

The City of Shasta Lake is located approximately seven miles north of Redding off Interstate 5 and just south of Shasta Lake as shown on Figure 7.1. The City of Shasta Lake obtains all of its water from Shasta Lake based on a recent water supply contract renewal with the USBR. The City of Shasta Lake current annual water allocation consists of 4,400 acre-feet from USBR.

The City of Shasta Lake has an annual contract to purchase up to 50 acre-feet per year from the Shasta County Water Agency, and the City of Redding exchanges 30 acre-feet for the City of Shasta Lake to provide water to the Summit City Pressure Zone. In 2017, the City of Shasta Lake had approximately 3,752 service connections and produced 663 MG of treated water.[7]

SOURCE: The City of Shasta Lake pumps water from Shasta Lake with pumps near the base of Shasta Dam. The City of Shasta Lake has interties with the City of Redding and Bella Vista Water District, which have been used in recent years to sustain water needs during "emergencies" such as power outages, line breaks, or other operational constraints.

TREATMENT: The original WTP constructed in 1990 consists of two U.S. Filter (Microfloc) upflow clarifier filters capable of producing a total of 6.5 MGD. Since then, a third filter was added in 2007 increasing the production to 9.69 MGD, not including downtime for backwashing. In 1999, the City of Shasta Lake conducted a particle study, which determined that filter loading rates could be increased from 6 GPM/SF to 6.6 GPM/SF.[7]

Raw water from Shasta Lake is pumped from the bottom of Shasta Dam to the treatment plant where it is injected with a coagulant and a chlorine solution prior to entering one of the three filter trains. The finished water from the filters is dosed with chlorine and pumped into the distribution system.

Backwash water was formerly discharged to holding ponds that eventually ended up in Churn Creek under a National Pollutant Discharge Elimination System (NPDES) permit. However, due to levels of the DBP Dichlorobromomethane detected above permitted MCLs in the sludge, a dewatering facility was completed in 2017, and the NPDES was rescinded. Supernatant is now returned through the plant, and sludge is dewatered and taken to a landfill.

DDW's most recent inspection report was performed on February 8, 14, and 20, 2018.[7]

ADDITIONAL ITEMS TO BE ADDRESSED

The following projects have been identified by the City as highest priority:

- New 1,700 feet of 20-inch raw water transmission main.
- New 2.45 MG finished water tank near Centimudi Boat Ramp.
- New 1.6 MG raw water tank.

COMPLIANCE WITH THE LT2ESWTR

In order to comply with the LT2ESWTR, the City of Shasta Lake submitted data collected between April 2008 and March 2010, and as a result, no additional treatment was required. The city performed a second round of monitoring for Cryptosporidium oocysts and E. coli in the source water beginning in October 2016. No Cryptosporidium oocysts were detected in any of the submitted samples.[7]

7.8 Shasta CSD

The reader should refer to the most recent Shasta CSD and Shasta CSA No. 25 Keswick (Keswick) DDW Inspection Reports for a detailed review of the District's water treatment and distribution system.[8,10]

Shasta CSD is a publicly owned water agency operating under the direction of an elected Board of Directors. The district is located in Shasta County, just west of the City of Redding, as shown in Figure 7.1 and, as of July 2019, provides water to the communities of Shasta and Keswick. Due to the Carr Fire that occurred from July 23 to August 30, 2018, Shasta CSD lost over 500 homes within their service area boundary, reducing their active customers by 62%. Keswick lost all but 10 of their 209 active customers. It became no longer feasible for the two agencies to operate independently; therefore, Shasta CSD annexed Keswick and became one agency. The district moved forward operating its WTP and connected their systems so that adequate water quality and quantity can be provided. The combined district encompasses approximately 12,749 acres and has 622 total service connections combined and produced 131.5 MG of treated water between July of 2019 to July of 2020 from the Shasta WTP.[9]

While Shasta CSD's annexation of Keswick is complete, the district has not officially received Keswick's water allocations; however, they still have access to Keswick's allocations if needed. The district has a water contract obligation of 1,000 acre-feet[9] of Central Valley Project water to be used for only municipal, domestic, and industrial purposes at a maximum rate of 1,750 GPM. Additionally, the district has an agreement for an additional 200 acre-feet per year from Anderson-Cottonwood Irrigation District. These amounts are subject to reduction if drought conditions occur. Keswick's water right includes 500 acre-feet in which Shasta CSD is also considered to have access to until records are combined.[9]

WTP SOURCE: The Shasta CSD and Keswick WTPs both receive their water from Whiskeytown Lake via Spring Creek Conduit.

SHASTA WTP TREATMENT: Water is diverted at a point about 9,000 feet downstream from the intake and normally flows by gravity through the filter treatment plant and then into treated water storage tanks. An underground vault located off Benson Drive at the northern boundary of the district contains a 12-inch tap to the conduit and a USBR meter that measures the volume of water taken by the district. Benson Drive Pump Station, which is located next to the vault, is used often due to low pressure in the Spring Creek Conduit during high demands.[8]

The in-line WTP consists of two horizontal pressure filters with dual media (12 inches of anthracite and 18 inches of sand), with four cells each, and measures 8 feet in diameter by 30 feet in length for a total of 240 square feet of surface area per filter. The filter surface loading rate of 3.0 GPM/SF yields a flow rate of 720 GPM per filter, for a total plant capacity of approximately 2.1 MGD minus approximately 5% backwash for a net 1.97 MGD. The WTP is automated with filter rate of flow, streaming current controller for coagulant addition, surface wash, backwash recycle, and trend monitoring via a programmable logic controller, which has allowed operators to optimize operations.[8]

KESWICK WTP TREATMENT: This plant treats the water from Whiskeytown Lake as an in-line filtration process and includes coagulation with NTU Tech, Cationic Polymer, pre-filter disinfection with 12.5% sodium hypochlorite solution and pressure filtration through six 5-foot-diameter, dual media, vertical pressure filters in parallel. The total filter surface area is 118 SF, providing 353 GPM at a surface loading rate of 3 GPM/SF.[10,17]

<u>COMPLIANCE WITH THE LT2ESWTR</u>

In order to comply with the LT2ESWTR, Shasta CSD submitted City of Redding data of samples taken from March 2005 to March 2007 at the Buckeye WTP. The results for Cryptosporidium were <0.075 oocysts per liter, which classify the district in Bin 1, and no additional treatment is required.[8] A second round of sampling for the existing Keswick WTP was started in October 2017 but was not completed before the Carr Fire in 2018.[10]

7.9 Shasta County Service Areas

Shasta CSAs are water treatment facilities serving small communities that are operated and maintained by the Shasta County Department of Public Works. Many of the CSAs receive water rights through contracts with the Shasta County Water Agency.

Sugarloaf CSA No. 2

INTRODUCTION: Sugarloaf CSA No. 2 is a small community located on the Sacramento River arm of Shasta Lake, directly across from the Salt Creek inlet and south of Lakeshore, as shown on Figure 7.3. CSA No. 2 serves approximately 160 people in an 86-parcel subdivision with two groundwater wells and a standby surface water treatment plant.[11] For a more detailed review of Sugarloaf CSA No. 2, the reader should view the Water System Improvement Project PER from 2019 and the Sugarloaf CSA No. 2 DDW Inspection Report.[11, 18]

SOURCE: In December 2019, the Obsidian Lane Well was brought online, and the surface water treatment plant was taken offline. Surface water from an unnamed spring-fed stream is utilized in emergency situations as a source; however, a boil water notice must be issued in this case.

Source	Capacity
Shale Lane Well (Well 01 or County Well 05)	Max sustained 30 GPM
Obsidian Lane Well (Well 02)	Sustained 18 GPM

TREATMENT: Groundwater from the Shale Lane Well goes through three stages of filtration: 5 micron prefilter, 0.35 micron intermediate filter, and 1 micron final filter. The water is then chlorinated before entering the system. The Obsidian Lane Well groundwater is chlorinated before being sent into the system. If surface water is used for emergencies from the creek, sodium hypochlorite and coagulant are added prior to it running through a single media in-line pressure filter. The filter has four cells and can produce 0.042 MGD.[11]

ITEMS REQUIRING ATTENTION

The following items were listed in the Water System Improvement Project Preliminary Engineering Report put together by PACE Engineering, Inc.:[18]

- Inadequate source water and storage capacity.
- Incomplete monitoring DBPs.
- Poor well and water storage conditions.

Sugarloaf CSA No. 2 has been approved for funding to implement improvements as noted in the Preliminary Engineering Report. These improvements will include distribution improvements and a new storage tank as funding allows.

Castella CSA No. 3

INTRODUCTION: Castella CSA No. 3 is located off Interstate 5, approximately 50 miles north of Redding and 3.5 miles south of Dunsmuir, as shown on Figure 7.4. The reader should refer to the July 2006 Preliminary Engineering Report prepared by PACE Engineering, Inc. and DDW's Annual Inspection Report[17] for a detailed review of the water treatment and distribution center. Water appropriated from Shasta County is limited to 0.1 cubic feet per second and shall not exceed 72.3 acre-feet per year. CSA No. 3 can also divert water under a second permit up to 0.11 cubic feet per second or 80 acre-feet per year from Castle Creek. The total water diverted under both permits must not exceed 120.6 acre-feet per year. CSA No. 3 currently serves potable water to a population of approximately 252 people through 90 metered connections consisting mainly of single-family residences.[12]

SOURCE: Water is withdrawn from Castle Creek year-round through a wooden inlet structure into a 29-foot-deep, 6-foot-diameter clear well. PACE Engineering, Inc. is currently working on a project to improve the intake structure.[13]

TREATMENT: Two alternating raw water pumps direct water from the intake, which is then injected with polymer and chlorine and pumped through the filter unit (at about 130 psi) to the storage tank. Located between the clear well and filter unit are two 95-foot-long pipes in parallel: one is 24 inches in diameter and the other is 6 inches in diameter. The 24-inch-diameter pipe is a flocculator line that was added on in 2008 and the 6-inch line is the original transmission line. Valves exist to close off the 6-inch line, but it is unknown if they are open or closed. The flocculator line can be flushed to the backwash pond via a 6-inch pipe. Water is then filtered and passed through a 24-inch-diameter chlorine contact pipe. Running parallel to the chlorine contact pipe is the original 8-inch-diameter distribution pipe. Valves exist to close off the 8-inch line for this section, but it is also unknown if these valves are open or closed. The chlorine contact pipe narrows down to an 8-inch distribution line and runs 550 feet to the first customer. Finished water is sent both to the distribution system and to the storage tank.[12]

REGULATORY STANDARDS REQUIRING ATTENTION

The following concerns were listed in the DDW Inspection Report dated May 15, 2019:[12]

- Perform filter evaluations annually and submit a summary of findings.
- Submission of an annual documentation of 1) alarm testing per the operations and maintenance manual, 2) alarm settings, 3) problems with alarm system or testing, 4) process for ensuring alarms are reset after repairs.
- An annual visual tank inspection with submitted photos.
- Submit an updated bacteriological site sampling plan.
- Logging of monthly calculated Giardia inactivation.
- Additional grab sampling when residual chlorine is less than 0.2 mg/L.
- Submission of a CCR.
- Submit results of cross connection control program.
- Completion of monitoring waivers.
- Raw water sampling for nitrate and perchlorate.

Jones Valley CSA No. 6

INTRODUCTION: Jones Valley CSA No. 6 is located northeast of Redding and south of the Pit River arm of Shasta Lake as shown on Figure 7.1 and serves a population of approximately 1,120 people with 594 service connections. The reader is directed to the May 2018 Water Meter Replacement and SCADA Improvement Project Preliminary Engineering Report by PACE Engineering, Inc. and DDW's Annual Inspection Report[14].

CSA No. 6 obtains water from Shasta Lake under an agreement between the USBR and Shasta County Water Agency for an appropriative water right of 270 acre-feet from the Sacramento River for year-round diversion. However, diversions between June 16 and August 31 can only occur if replacement water is made available to downstream water rights holders. CSA No. 6 uses 190 acre-feet of Central Valley Project contract water purchased through Shasta County Water Agency to supply the replacement water and to meet a portion of the 420 acre-feet per year water demand.[14]

SOURCE: CSA No. 6 pumps water from the Pit River arm of Shasta Lake to its WTP with three 60 HP variable frequency drive submersible pumps. The third pump is only used for backup purposes.

TREATMENT: The WTP consists of pre-chlorination, coagulant addition, and flocculation through 1,000 feet of 14-inch pipe prior to filtration through four multimedia filters and post chlorination. The raw water is chlorinated and coagulated with polymer and then pumped through the new flocculation pipe to the filters. The WTP is operating as a direct filtration plant.[14]

For a period of about 20 years after the 1997 Improvement Project, the WTP was permitted to run their filters as 5.5 GPM/SF during times of relatively low raw water turbidity. Unfortunately, starting in October of 2018, DDW indicated they must not load the filters more than 3 GPM/SF. This change significantly lowers the quantity of water in which the plant is capable of producing.

There are four 8-foot-diameter pressure filters with anthracite, sand, and gravel. The WTP maximum flow is 600 GPM. The California Surface Water Filtration and Disinfection Regulations for direct filtration technology requires a 2-log (99%) removal of Giardia cysts through filtration and a 1-log (90%) inactivation of Giardia cysts through disinfection. In addition, the filtration system provides a 1-log (90%) virus removal and conforms to the turbidity performance standards of Section 64653.[14]

REGULATORY STANDARDS REQUIRING ATTENTION

The following items were noted during the 2017 DDW Inspection:[14]

- Reduce treatment plant flow rates to meet the surface loading rate of 3 GPM/sq. ft.
- Perform filter evaluation annually and submit findings to the DDW office within 30 days of the evaluation.
- Operate the surface wash system.
- Submit a Standard Operating Procedure for backwashing and associated technical memorandum.
- Install a backwash pump, data loggers, and remote monitoring/controls.
- Maintain adequate post-filtration chlorine residuals to meet the requirements of Title 22 Section 64654(b)(1) and to ensure 1-log Giardia through disinfection is achieved.
- Submit a letter outlining the CSA No. 6's plans to ensure only certified treatment plant personnel operate the treatment plant.
- Arrange for a professional third-party inspection of the 100,000-gallon and 225,000-gallon tanks and submit a report of findings.
- Repair or replace failed backflow prevention devices and report on 2017 electronic Annual Report.
- Begin calculating Giardia Log Inactivation starting with the January 2018 monitoring report due by February 10, 2018.
- Submit a revised Bacteriological Sample Siting Plan to DDW and Basic Lab that incorporates the entire distribution system.
- Submit a revised LCR Sampling Plan and ensure that at least 10 lead and copper samples are collected during the upcoming sampling event (June-September 2018).
- Submit an LT2 raw water monitoring plan.

French Gulch CSA No. 11

INTRODUCTION: French Gulch CSA No. 11 is located approximately three miles north of Highway 299 on Trinity Mountain Road in the Clear Creek Watershed as shown on Figure 7.2. The water system was completed in 1994 and serves a population of 185 people with 82 connections.[15] The reader should refer to the 2019 French Gulch CSA No. 11 DDW Annual Inspection Report[15] for a detailed review of the District's water treatment and distribution system.

SOURCE: Water is diverted from Clear Creek by a diversion dam into a ½-mile-long ditch where it flows by gravity into the treatment plant wet well.

TREATMENT: Sodium hypochlorite and chemical coagulant (alum and polymer) are added to the water prior to flowing through two upflow clarifiers and a multimedia (silica gravel, garnet sand, and anthracite) gravity filter. The clarifier loading capacity is 10 GPM/sq. ft.. Post chlorination follows filtration, and the water is then pumped into a 350,000-gallon tank and distributed throughout the community.

Department of Health Services adopted the term contact clarification/filtration technology to identify the Roberts Pacer II filter process.[15] This contact clarification/filtration technology was given 2-log Giardia and 1-log virus removal credits based on past finished water turbidities (0.2 to < 0.31 NTU). The filter is considered an approved alternative filtration technology. DDW has determined that if treated, water turbidity can be maintained at less than 0.3 NTU, then LT1EWTR of 2-log removal of Cryptosporidium will have been met by the system.

REGULATORY STANDARDS REQUIRING ATTENTION

The following items were noted during the April 2019 DDW inspection:[15]

- Arrange for a professional third-party inspection of the storage tank by February 6, 2020 and plan for appropriate recommended repairs in the next two to five years.
- Install a finer mesh screen on the apex vent of the storage tank by November 6, 2019.
- Submit an updated bacteriological sample siting plan by November 6, 2019.
- Collect raw water perchlorate sample between May 1 to September 6, 2019.
- Consider acquiring a few generators for use amongst all the CSAs.

Crag View CSA No. 23

INTRODUCTION: Crag View CSA No. 23 is located on Interstate 5, approximately 52 miles north of Redding and 2 miles south of Dunsmuir, in the northwestern corner of Shasta County, California as shown on Figure 7.4. Crag View CSA No. 23 currently serves potable water to an approximate population of 200 people through an estimated 66 metered connections.[16] The reader should refer to the 2018 Crag View CSA No. 23 DDW Inspection Report for a detailed description of the system.[16]

SOURCE: The intake is located on Little Castle Creek. Crag View CSA No. 23 obtains its water through an appropriative water right that specifies 200 acre-feet of water per year.

TREATMENT: An inlet structure in Little Castle Creek diverts water into an 18-foot-deep, 16-inch-diameter well casing at the headworks. From the headworks, raw water is pumped to the treatment facility by one of two 7.5 HP multistage submersible pumps. An 8-inch epoxy-lined and coated welded steel pipe serves as the raw water inlet to the well casing.

The WTP and headworks consists of chemical feed, flocculation, filtration, and chlorination disinfection facilities. Treatment of water from Little Castle Creek includes pre-filter coagulant addition and disinfection with 12.5% sodium hypochlorite prior to a flocculation pipe and pressure filtration through three 5-foot-diameter by 7-foot-tall, vertical, single cell, dual media pressure filters. The pre-filter flocculation and chlorine contact pipe and the 200,000-gallon storage reservoir provide the required chlorine contact time prior to the first customer service. DDW has classified the facility as “Direct Filtration” because coagulant is added at the headworks and sufficient flocculation time and energy is allowed prior to filtration.

REGULATORY STANDARDS REQUIRING ATTENTION

The following items were noted during the April 2018 DDW inspeciton:[16]

- Perform filter evaluations annually and submit a summary of findings.
- Perform annual alarm testing per the operations and maintenance manual and submit documentation of testing and alarm settings.
- Perform a visual inspection of the interior and exterior of the 200,000-gallon storage tank and submit photographs, observations, and a description of upcoming scheduled tank maintenance.
- Consistently maintain a residual chlorine of at least 0.2 mg/L in water delivered to the distribution system.
- Submit an updated Bacteriological Site Sampling Plan.
- Submit a copy of the 2017 and 2018 CCR and Certification Forms.
- Submit results of cross connection control device testing performed in 2017 and 2018.
- Raw water sampling due:
    - Nitrate and nitrate by end of 2018.
    - Perchlorate between May 1 and September 30, 2018.
- Complete the Waiver Request form and return to DDW.
- Consider adding post-filtration chlorination capabilities.
- Consider changing the low post-filtration chlorine alarm/shut-off setting to 0.2 mg/L.
- Check the differential pressure gauge across the filter.

7.10 Emergency Interties

The Redding area water systems are connected through a series of interties. In some cases, these interties are utilized for regular water consumption; however, they are primarily for use in emergency situations such as fires. The following are interties between participating agencies and are shown on Figure 7.5.

Fig. 7.5 Reference Nos.	Agency	Intertie Agency	Status	Location	Capacity or Pipe Size	Note
1	City of Shasta Lake	Bella Vista Water District	Standby	Akrich St. & Akrich Park Ave.	10" up to 1,000 GPM	Pump to City of Shasta Lake, gravity feed to Bella Vista Water District, controlled by a gate valve
2		City of Redding	Standby	Ashby Rd. at Knauf Fiberglass	150 GPM	Gravity feed to City of Shasta Lake, pump from City of Shasta Lake
3	Centerville CSD	City of Redding	Active	Rainier & Sienna	8"	City of Redding to Centerville CSD
4		City of Redding	Standby	Record Lane & O'Connor	6"	With 20 HP pump from City of Redding, gravity to Centerville CSD
5		City of Redding	Standby	Clear Creek Road	10" to 12"	Centerville CSD to City of Redding
6	Shasta CSD	City of Redding	Inactive/ Standby	Bandana Trail	≤0.505 MG	City of Redding to Shasta CSD is pumped; Shasta CSD to City of Redding is gravity fed through PRV
7		City of Redding	Inactive/ Standby	Rock Creek Rd.	10"	PRV Intertie from City of Redding to Shasta CSD only
8	Bella Vista Water District	Mt. Gate CSD	Standby			With portable pump
9		City of Redding	Standby	Abernathy & Old Alturas	6"	Gate valve provides water in both directions
10		City of Redding	Standby	WTP fence	12"	Gate valve provides water from City of Redding to Bella Vista Water District
11		City of Redding	Standby	Edgewood & Tiburon	8"	Provides water only to City of Redding
12		CSA No. 8 Palo Cedro	Standby		8"	Gate valve and PRV, only flow to CSA No. 8
13	City of Redding	City of Anderson	Standby	Meadowview - Tucker Oaks	8"	

* Interties are only shown once in the table.

References:

1. Bella Vista Water District, December 2005 Master Plan, prepared by PACE Engineering, Redding, CA.
2. State Water Resources Control Board Division of Drinking Water Sanitary Survey Inspection Report, Bella Vista Water District, May 29 and July 11, 2018.
3. State Water Resources Control Board Division of Drinking Water Drinking Water Field Operations Branch Sanitary Survey (AMENDED), Centerville Community Services District, January 18, 2017.
4. State Water Resources Control Board Division of Drinking Water Sanitary Survey Inspection Report, Clear Creek CSD, September 20, 2019.
5. State Water Resources Control Board Division of Drinking Water Sanitary Survey Inspection Report, Mountain Gate CSD, March 27, 2015.
6. State Water Resources Control Board Division of Drinking Water – Sanitary Survey, City of Redding, February 7 & 14 and April 25, 2018.
7. California Division of Drinking Water Drinking Water Field Operations Branch Inspection Report, City of Shasta Lake, February 8, 14, and 20, 2018.
8. California State Water Resources Control Board Division of Drinking Water Inspection Report, Shasta CSD, Dec. 19, 2014.
9. PACE Engineering, Inc. *Technical Memorandum – Shasta CSD Office Building Project,* Job No. 149.52*.* September 25, 2020.
10. California State Water Resources Control Board Division of Drinking Water Inspection Report, County Service Area No. 25 - Keswick, December 8, 2016.
11. State Water Resources Control Board Division of Drinking Water Sanitary Survey Inspection Report, Shasta County Service Area No. 2 – Sugarloaf, December 12, 2019.
12. State Water Resources Control Board Division of Drinking Water Sanitary Survey Inspection Report, Shasta County Service Area No. 3 – Castella, April 20, 2018.
13. Shasta County CSA No. 3, Preliminary Engineering Report – Castella Water System Improvements Study, by PACE Engineering, Inc., Redding, CA, July 2006.
14. State Water Resources Control Board Division of Drinking Water Inspection Report, Shasta County Service Area No. 6 – Jones Valley, August 23 and October 11, 2017.
15. State Water Resources Control Board Division of Drinking Water Inspection Report, Shasta County Service Area No. 11 – French Gulch, April 16, 2019.
16. State Water Resource Control Board Division of Drinking Water Inspection Report, County Service Area No. 23 – Crag View, April 20, 2018.
17. Shasta County Service Area No. 25 Keswick Water System Improvement Project CDPH Project Number P50-4500001-184 Design Memo 1, December 5, 2013, PACE Engineering, Redding, Ca
18. Shasta County CSA No. 2, Preliminary Engineering Report – Water System Improvement Project, by PACE Engineering, Inc., Redding, CA, November 2019.
19. Shasta County CSA No. 6, Preliminary Engineering Report – Water Meter Replacement and SCADA Improvement Project, by PACE Engineering, Inc., Redding, CA, May 2018.
20. Zaharris, Tom, Treatment Superintendent, Bella Vista Water District, telephone conversation, Oct 26, 2020.
21. Bella Vista Water District, Consumer Confidence Report, 2019.
22. Muehlbacher, Chris, District Manager, Centerville CSD, telephone conversation, December 21, 2020.

TABLE 7.1
REDDING AREA WATERSHED SANITARY SURVEY
TREATMENT FACILITY SOURCE WATERS

WATER TREATMENT PLANT	WATERSHED SOURCE	INTAKES	TYPE OF INTAKE
Bella Vista	Sacramento River[2]	Sacramento River	Pump
Centerville CSD	See Clear Creek CSD	See Clear Creek CSD	See Clear Creek CSD
Clear Creek CSD	Whiskeytown Lake[1]	Whiskeytown Dam	Gravity/Conduit
Mt. Gate CSD	Shasta Lake	Shasta Lake	Pump
City of Shasta Lake	Shasta Lake	Shasta Dam	Pump
Shasta CSD - Keswick	Whiskeytown Lake[1]	Spring Creek Conduit	Gravity/Conduit
Shasta CSD - Shasta	Whiskeytown Lake[1]	Spring Creek Conduit	Gravity (pump available)
City of Redding Foothill	Sacramento River[2]	Sacramento River	Pump
City of Redding Buckeye	Whiskeytown Lake[1]	Spring Creek Conduit	Gravity/Conduit
CSA No. 2 Sugarloaf	Unnamed Creek	Creek	Gravity
CSA No. 3 Castella	Castle Creek	Creek	Pump
CSA No. 11 Jones Valley	Shasta Lake	Shasta Lake	Pump
CSA No. 11 French Gulch	Clear Creek	Creek	Pump
CSA No. 23 Crag View	Little Castle Creek	Creek	Pump
CSA No. 25 Keswick	Whiskeytown Lake[1]	Spring Creek Conduit	Gravity/Conduit

(1) Whiskeytown Lake receives large volumes of water from the Lewiston/Trinity Watershed.
(2) The Sacramento River receives water from all watersheds mentioned in this survey - Lewiston/Trinity, Whiskeytown, Shasta, and Sacramento.

TABLE 7.2

REDDING AREA WATERSHED SANITARY SURVEY

SUMMARY OF REGULATORY COMPLIANCE BY WATER SYSTEMS IN WATERSHED

		WATER DISTRICTS									SHASTA CSAs				
REGULATION	LIMIT	Bella Vista	Centerville CSD	Clear Creek CSD	Mountain Gate CSD	City of Shasta Lake	Shasta CSD - Shasta	Shasta CSD - Keswick	City of Redding Foothill	City of Redding Buckeye	Sugarloaf CSA No. 2	Castella No. 3	Jones Valley CSA No. 6	French Gulch CSA No. 11	Cragview CSA No. 23
Type of Treatment Process															
Type of treatment and approved or unapproved technology		ILF		ILF[a]	DF	AAT	ILF[b]	ILF (b)	ILF	CF	ILF	DF	DF	CC/F[m]	DF
SWTR (6/1989)															
Cryptosporidium[i]	2-log removal		See Clear Creek CSD for compliance.												
Giardia	3-log removal														
Viruses	4-log removal														
Turbidity Standard[j]	≤ 0.5 NTU[g]														
	Max: 5 NTU														
Residual Disinfectant	≥ 0.2 mg/L			(l)											
Individual Filter Turbidity Monitoring	15 minutes						(o)				(o)	(o)	(o)	(o)	
Sanitary Survey[h]	Every 3 years														
IESWTR (12/16/1998)[c]															
Cryptosporidium	2-log removal		See Clear Creek CSD for compliance.	(a)			(p)	(p)							
Turbidity Standard[k]	≤ 0.3 NTU[g]														
	Max: 1 NTU														
LT1ESWTR (1/2002)[d]															
Cryptosporidium	2-log removal		See Clear Creek CSD for compliance.	(a)			(p)	(p)							
Turbidity	≤ 0.3 NTU[g]					(n)									
	Max: 1 NTU														
LT2ESWTR[e]															
Systems serving ≥ 10,000 people Year Implemented	Monitor for Cryptosporidium	2008	See Clear Creek CSD for compliance.	2008	-	2008	-	-	2007	2007	-	-	-	-	-
Systems serving < 10,000 people Year Implemented	Monitor for Cryptosporidium	-		-	2008	-	2008	2008	-	-	-	2008	2008	2008	2008
	Monitor for E. coli	-		-	2010	-	2010	2017	-	-	-	2017	2017	2017	2017
Radionuclides	**MCL**														
Beta/photon emitters[f]	4 mrem/yr	-	See Clear Creek CSD for compliance.	-	-	-	See City of Redding Buckeye	-	-	-	N/A	-	-	-	-
Gross alpha particles	15 pCi/L										N/A			-	
Combined Ra-226/Ra-228	5 pCi/L			-	-			-			N/A	-	-	-	-
Uranium	30 µg/L	-		-	-	-		-			N/A	-	-	-	-
Other	**MCL**														
1,2,3-Trichloropropane	0.005 µg/L	-	-				-	-							

ILF = In-line filtration; CF = Conventional filtration; DF = Direct Filtration; AAT = Approved alternative technology; CC/F = Contact Clarification/Filtration

(a) A particle study done in 1994 allowed the filters to operate up to 8 gpm/sf. However, the study did not address Cryptosporidium sized particles. DDW has required that Clear Creek CSD submit monthly 2-5 µm sized particle removal data. Under DDW policy, Clear Creek CSD may submit combined effluent turbidity data, and it must be below 0.1 NTU 95% of the monthly samples.

(b) DDW has stated if the WTP and filtered water meet their respective operational criteria and performance standards, removal credits will be granted.

(c) The compliance date for systems serving more than 10,000 people is 1/1/2002.

(d) Includes systems with populations less than 10,000.

(e) The LT2ESWTR requires that PWSs monitor their raw water for Cryptosporidium, and depending on the sampling results, those systems may be required to do enhanced water treatment.

(f) A total of 168 individual beta particle and photon emitters may be used to calculate compliance with the MCL.

(g) ≥ 95% of measurements taken each month.

(h) This is not a Watershed Sanitary Survey. The DDW conducts the survey in conjunction with the facility operators.

(i) The Enhanced Surface Water Treatment Rule assumed that if the turbidity requirements were met, then the Cryptosporidium 2-log removal requirement had been met.

(j) Superseded by the IESWTR.

(k) The IESWTR requires conventional or direct filtration facilities to monitor individual filter effluents continuously.

(l) One service does not meet CTs during high summer demands. Clear Creek CSD is in the process of resolving this problem.

(m) DDW has stated that the system is an approved technology if turbidities are kept below 0.3 NTU.

(n) DDW has determined that the City of Shasta Lake must maintain ≤ 0.2 NTU.

(o) No requirement for individual filter monitoring for systems with less than 1,000 service connections.

(p) A 2007 particle study showed that the filters, when operating at 3 gpm/sf, could achieve 2-Log removal of Giardia and Cryptosporidium as long as a 0.2 NTU turbidity standard was met.

-	Not applicable
N/A	Data not available
(green)	Pass or acceptable
(yellow)	Requires attention

TABLE 7.3A

REDDING AREA WATERSHED SANITARY SURVEY

2019 HAA5 AND TTHM RESULTS FOR WATER PURVEYORS

2019 HAA5 & TTHM D/DBR Monitoring											
System	**Source**	**System #**	**Sample Point**		1st qtr	2nd qtr	3rd qrt	4th qtr	**4-qtr Average**	**Status**	
City of Redding	**Sacramento River & Whiskeytown Lake**	**4510005**	**Collyer**	Date	3/29/2019 & 1/11/2019	6/17/2019 & 4/16/2019	9/16/2019 & 7/10/2019	10/3/2019			
				HAA5	36	39	35	36	**37**	**>30**	**Qtrly**
				TTHM	38	31	35	36	**35**	**>40**	**Qtrly**
City of Redding	**Sacramento River & Whiskeytown Lake**	**4510005**	**Heller**	Date	3/29/2019 & 1/11/2019	6/17/2019 & 4/16/2019	9/16/2019 & 7/10/2019	10/3/2019			
				HAA5	2	35	50	15	**26**	**<30**	**Yrly**
				TTHM	ND	6	42	15	**16**	**<40**	**Yrly**
City of Redding	**Sacramento River & Whiskeytown Lake**	**4510005**	**Dove**	Date	3/29/2019 & 1/11/2019	6/17/2019 & 4/16/2019	9/16/2019 & 7/10/2019	10/3/2019			
				HAA5	37	43	43	32	**39**	**>30**	**Qtrly**
				TTHM	46	35	41	40	**40**	**>40**	**Qtrly**
City of Redding	**Sacramento River & Whiskeytown Lake**	**4510005**	**Santa Rosa**	Date	3/29/2019 & 1/11/2019	6/17/2019 & 4/16/2019	9/16/2019 & 7/10/2019	10/3/2019			
				HAA5	28	32	28	31	**30**	**<30**	**Yrly**
				TTHM	35	26	28	33	**30**	**<40**	**Yrly**
City of Redding	**Sacramento River & Whiskeytown Lake**	**4510005**	**Baywood**	Date	3/29/2019 & 1/11/2019	6/17/2019 & 4/16/2019	9/16/2019 & 7/10/2019	10/3/2019			
				HAA5	33	31	30	31	**31**	**>30**	**Qtrly**
				TTHM	34	26	28	34	**30**	**>40**	**Qtrly**
City of Redding	**Sacramento River & Whiskeytown Lake**	**4510005**	**Alta Saga**	Date	3/29/2019 & 1/11/2019	6/17/2019 & 4/16/2019	9/16/2019 & 7/10/2019	10/3/2019			
				HAA5	0	0	1	35	**9**	**<30**	**Yrly**
				TTHM	0	0	0	34	**8**	**<40**	**Yrly**

TABLE 7.3A

REDDING AREA WATERSHED SANITARY SURVEY

2019 HAA5 AND TTHM RESULTS FOR WATER PURVEYORS

2019 HAA5 & TTHM D/DBR Monitoring											
System	**Source**	**System #**	**Sample Point**		1st qtr	2nd qtr	3rd qrt	4th qtr	**4-qtr Average**	**Status**	
City of Redding	**Sacramento River & Whiskeytown Lake**	**4510005**	**Mountain View**	Date	3/29/2019 & 1/11/2019	6/17/2019 & 4/16/2019	9/16/2019 & 7/10/2019	10/3/2019			
				HAA5	33	33	33	32	**33**	**>30**	**Qtrly**
				TTHM	36	29	31	36	**33**	**>40**	**Qtrly**
City of Redding	**Sacramento River & Whiskeytown Lake**	**4510005**	**Lake Blvd**	Date	3/29/2019 & 1/11/2019	6/17/2019 & 4/16/2019	9/16/2019 & 7/10/2019	10/3/2019			
				HAA5	41	44	32	31	**37**	**>30**	**Qtrly**
				TTHM	46	33	45	46	**42**	**>40**	**Qtrly**
Bella Vista	**Sacramento River & Enterprise Wells**	**4510014**	**Blue Sky**	Date	3/13/2019	4/25/2019	7/10/2019	10/22/2019			
				HAA5	0	58	41	42	**35**	**>30**	**Qtrly**
				TTHM	4	57	46	46	**38**	**>40**	**Qtrly**
Bella Vista	**Sacramento River & Enterprise Wells**	**4510014**	**Bishop Quinn**	Date	3/13/2019	4/25/2019	7/10/2019	10/22/2019			
				HAA5	0	53	39	43	**34**	**>30**	**Qtrly**
				TTHM	1	48	44	42	**34**	**>40**	**Qtrly**
Bella Vista	**Sacramento River & Enterprise Wells**	**4510014**	**Logan Road**	Date	3/13/2019	4/25/2019	7/10/2019	10/22/2019			
				HAA5	3	53	48	40	**36**	**>30**	**Qtrly**
				TTHM	9	50	53	44	**39**	**>40**	**Qtrly**
Bella Vista	**Sacramento River & Enterprise Wells**	**4510014**	**Stillwater Heights**	Date	3/13/2019	4/25/2019	7/10/2019	10/22/2019			
				HAA5	0	46	38	42	**32**	**>30**	**Qtrly**
				TTHM	0	40	43	46	**32**	**>40**	**Qtrly**
Centerville CSD	**Whiskeytown Lake**	**4510011**	**Record Lane**	Date	1/22/2020	-	-	-			
				HAA5	33	-	-	-	**33**	**<45**	**Yrly**
				TTHM	55	-	-	-	**55**	**<60**	**Yrly**
Clear Creek CSD	**Whiskeytown Lake**	**4510016**	**Lorina & Towhee**	Date	-	-	7/3/2019	10/10/2019			
				HAA5	-	-	21	25	**23**	**<30**	**Yrly**
				TTHM	-	-	31	41	**36**	**<40**	**Yrly**

TABLE 7.3A

REDDING AREA WATERSHED SANITARY SURVEY

2019 HAA5 AND TTHM RESULTS FOR WATER PURVEYORS

2019 HAA5 & TTHM D/DBR Monitoring											
System	**Source**	**System #**	**Sample Point**		1st qtr	2nd qtr	3rd qrt	4th qtr	**4-qtr Average**	**Status**	
Clear Creek CSD	**Whiskeytown Lake**	**4510016**	**Oak Street**	Date	-	-	-	10/10/2019			
				HAA5	-	-	-	27	**27**	**<45**	**Yrly**
				TTHM	-	-	-	35	**35**	**<60**	**Yrly**
Mountain Gate CSD	**Shasta Lake & Bass Wells (September)**	**4510002**	**Little Acres**	Date	-	-	7/12/2019	-			
				HAA5	-	-	28	-	**28**	**<45**	**Yrly**
				TTHM	-	-	36	-	**36**	**<60**	**Yrly**
City of Shasta Lake	**Shasta Lake**	**4510006**	**Twin View**	Date	1/10/2019	4/10/2019	7/17/2019	10/17/2019			
				HAA5	19	20	24	24	**22**	**<30**	**Yrly**
				TTHM	23	27	41	47	**34**	**<40**	**Yrly**
Shasta CSD	**Whiskeytown Lake**	**4510013**	**299 @ Lower Springs**	Date	3/11/2019	6/17/2019	9/18/2019	12/11/2019			
				HAA5	56	27	12	33	**32**	**>30**	**Qtrly**
				TTHM	63	74	75	61	**68**	**>40**	**Qtrly**
Shasta CSA #2 Sugarloaf	**Stream and well on Oak Knoll Drive**	**4500006**	**End of Oak Knoll Drive**	Date	3/2/2014	5/27/2014	9/1/2014	11/30/2014			
				HAA5	5	98	0	0	**26**	**<30**	**Yrly**
				TTHM	7	52	1	6	**16**	**<40**	**Yrly**
Shasta CSA #3 Castella	**Castle Creek**	**4500015**	**Riverside Drive**	Date	1/4/2019	-	-	12/22/2019			
				HAA5	39	-	-	53	**46**	**>30**	**Qtrly**
				TTHM	42	-	-	51	**46**	**>40**	**Qtrly**
Shasta CSA #6 Jones Valley	**Lake Shasta**	**4510004**	**Elk Trail**	Date	-	-	-	12/18/2019			
				HAA5	-	-	-	26	**26**	**<45**	**Yrly**
				TTHM	-	-	-	43	**43**	**<60**	**Yrly**
Shasta CSA #6 Jones Valley	**Lake Shasta**	**4510004**	**Marti Lane**	Date	-	-	-	12/18/2019			
				HAA5	-	-	-	29	**29**	**<45**	**Yrly**
				TTHM	-	-	-	33	**33**	**<60**	**Yrly**

TABLE 7.3A

REDDING AREA WATERSHED SANITARY SURVEY

2019 HAA5 AND TTHM RESULTS FOR WATER PURVEYORS

2019 HAA5 & TTHM D/DBR Monitoring											
System	**Source**	**System #**	**Sample Point**		1st qtr	2nd qtr	3rd qrt	4th qtr	**4-qtr Average**	**Status**	
Shasta CSA #6 Jones Valley	**Lake Shasta**	**4510004**	**Bear Valley Trail**	Date	-	-	-	12/18/2019			
				HAA5	-	-	-	29	**29**	**<45**	**Yrly**
				TTHM	-	-	-	41	**41**	**<60**	**Yrly**
Shasta CSA #6 Jones Valley	**Lake Shasta**	**4510004**	**Sagebrush**	Date	1/31/2019	6/24/2019	9/26/2019	12/18/2019			
				HAA5	35	9	22	25	**23**	**>30**	**Qtrly**
				TTHM	53	37	47	50	**47**	**>40**	**Qtrly**
Shasta CSA #11 French Gulch	**Clear Creek**	**4500317**	**French Gulch Road**	Date	-	6/26/2019	9/26/2019	12/19/2019			
				HAA5	-	14	14	21	**16**	**<30**	**Yrly**
				TTHM	-	31	29	29	**30**	**<40**	**Yrly**
Shasta CSA #11 French Gulch	**Clear Creek**	**4500317**	**Tailings Drive**	Date	-	6/26/2019	9/26/2019	12/19/2019			
				HAA5	-	13	11	20	**15**	**<30**	**Yrly**
				TTHM	-	31	30	28	**30**	**<40**	**Yrly**
Shasta CSA #23 Cragview	**Little Castle Creek**	**4500028**	**Cragview Drive**	Date	1/4/2019	-	-	12/23/2019			
				HAA5	131	-	-	103	**117**	**>30**	**Qtrly**
				TTHM	103	-	-	59	**81**	**>40**	**Qtrly**

TABLE 7.3B

REDDING AREA WATERSHED SANITARY SURVEY

TTHM RESULTS FOR WATER PURVEYORS

TTHM Monitoring																														
System	**Source**	**Constituent**	**Units**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
City of Redding	**Sacramento River**	Total	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	30.2	27.2	12.9	13.4	6.95	3.325	11.95	9.325	19.1	-	-	-	-	-
		Bromodichlormethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	4.15	4.7	2.6	1.9	1.1	0.4	2.3	1.875	2.5	-	-	-	-	-
		Bromoform	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	21.5	ND	ND	ND	0	0	0	0	0.0	-	-	-	-	-
		Chloroform	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	17.8	21.9	10.1	11.5	5.55	2.925	8.5	7.45	16.2	-	-	-	-	-
		Dibromochloromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	3.6	ND	0.6	ND	0.3	0	2.2	0	0.4	-	-	-	-	-
		Dichlorodifluoromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-					-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-					-	-	-	-	-	-
City of Redding	**Whiskeytown Lake**	Total	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	60.9	57.8	44.6	24.4	26.375	27.55	27.1	28.725	39.4	-	-	-	-	-
		Bromodichlormethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	3.3	13.9	9.4	1.6	2.175	2.225	2.025	3.1	2.8	-	-	-	-	-
		Bromoform	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	8.1	ND	ND	ND	0	0	0	0	0.0	-	-	-	-	-
		Chloroform	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	54.6	54.1	41.5	22.6	24.2	25.33	25.075	25.625	36.6	-	-	-	-	-
		Dibromochloromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	2	ND	ND	0.6	0	0	0	0	0.0	-	-	-	-	-
		Dichlorodifluoromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-					-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-					-	-	-	-	-	-
City of Redding	**Combined**	Total	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.6	18.5	20.9	26.2	27.9
		Bromodichlormethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.6	1.7	1.7	1.7	2.6
		Bromoform	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0
		Chloroform	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.1	17.1	19.1	24.4	25.2
		Dibromochloromethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.1	0.1	0.1	0.1
		Dichlorodifluoromethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100.9	-
Bella Vista Water District	**Sacramento River**	Total	µg/L	-	-	-	-	-	-	0	59.3	71.5	68.2	16	-	-	-	-	-		44.575	38	30.3	45.5	26.7	52.9	31.8	28.9	35.7	
		Bromodichlormethane	µg/L	-	-	-	-	-	-	0	10.7	8.8	13	3.5	-	-	-	-	-		4.1	5.23	4.18	6.35	4.1	5.0	2.9	3.6	3.1	
		Bromoform	µg/L	-	-	-	-	-	-	0	0	9.7	0.73	1.8	-	-	-	-	-		ND	ND	ND	0.3	<1.0	<1.0	<1.0	<1.0	<1.0	
		Chloroform	µg/L	-	-	-	-	-	-	0	47.7	60.6	52.6	7.8	-	-	-	-	-		40.25	32.4	25.82	37.65	19.4	47.8	28.0	26.6	32.2	
		Dibromochloromethane	µg/L	-	-	-	-	-	-	0	0.9	13.5	2.6	3.4	-	-	-	-	-		0.225	0.4	0.38	1.25	1.8	1.1	1.4	0.5	0.4	
		Dichlorodifluoromethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	
		1,2,3-Trichloropropane	µg/L	-	-	-	-	-	-	0	-	-	0	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	
Clear Creek CSD	**Whiskeytown Lake**	Total	µg/L	1.76	-	-	-	-	0	0	-	-	-	-	-	22.88	23.9	25.7	31.2	24.1	31.2	21.7	29.2	39.45	47.0	51.0	44.6	-	35.8	37.7
		Bromodichlormethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	3.03	1.9	2.3	2.4	2.1	2	1.7	1.9	3.15	3.4	3.6	2.8	-	2.3	2.6
		Bromoform	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0.97	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	ND	ND
		Chloroform	µg/L	1.76	-	-	-	-	0	0	-	-	-	-	-	16.88	19	23.4	28.8	22	29.2	20	27.3	36.3	43.6	47.4	41.9	-	33.5	35.1
		Dibromochloromethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	ND	ND
		Dichlorodifluoromethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Centerville CSD	**Whiskeytown Lake**	Total	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33.41	36	48.7	57.5	50.1	39.4	55.2	34.3
		Bromodichlormethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.21	2.6	3.3	4.3	3.4	2.5	4.1	2.7
		Bromoform	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND
		Chloroform	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31.21	33.4	45.4	53.2	46.8	36.9	51.1	31.6
		Dibromochloromethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND
		Dichlorodifluoromethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 7.3B

REDDING AREA WATERSHED SANITARY SURVEY

TTHM RESULTS FOR WATER PURVEYORS

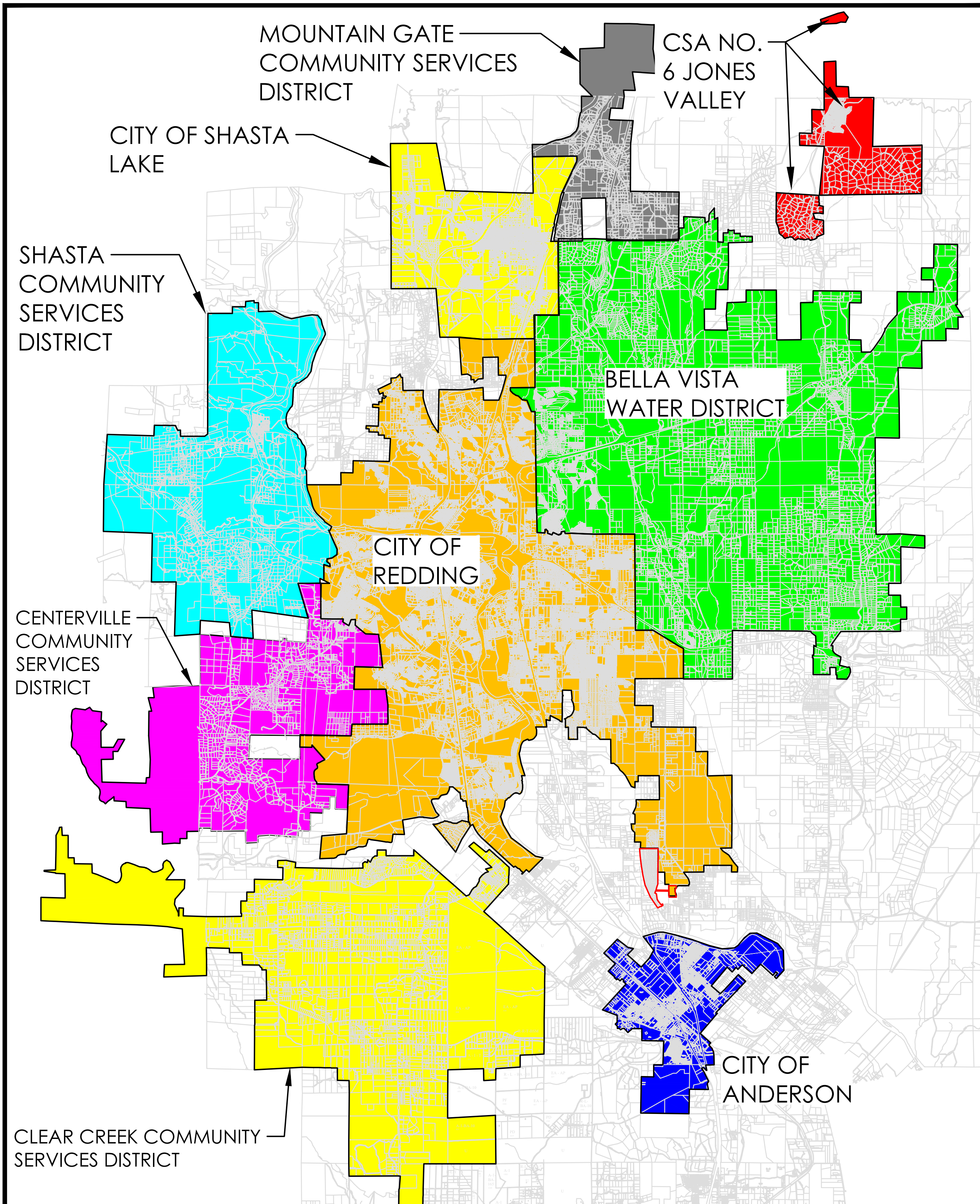
TTHM Monitoring																														
System	**Source**	**Constituent**	**Units**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Mountain Gate CSD	**Shasta Lake & Bass Wells**	Total	µg/L	-	-	-	-	-	1.5	0	-	-	-	-	-	-	-	-	-	-		22.5	21.5	5	-	38.2	24.6	19.34	36.3	-
		Bromodichlormethane	µg/L	-	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-		3.85	4	ND	-	2.7	3.0	2.6	2.6	-
		Bromoform	µg/L	-	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-		ND	ND	1.4	-	ND	ND	ND	ND	-
		Chloroform	µg/L	-	-	-	-	-	1.5	0	-	-	-	-	-	-	-	-	-	-		18.65	17.5	3.6	-	35.5	21.6	16.8	33.8	-
		Dibromochloromethane	µg/L	-	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-		ND	ND	ND	-	ND	ND	ND	ND	-
		Dichlorodifluoromethane	µg/L	-	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-		-	-		-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	-	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-		-	-		-	-	-	-	-	-
Shasta CSA #2 Sugar Loaf	**Unnamed Creek/Spring**	Total	µg/L	-	-	-	-	-	-	-	-	0	-	45	33.2	29.6	24.3	56.7	87.9	97.3	27	21.7	11.6	16.5	7.9	5.7	26.7	5.8	6.2	1.7
		Bromodichlormethane	µg/L	-	-	-	-	-	-	-	-	0	-	1	1.8	2	0.9	0.9	1.5	1.9	0.9	0.9	0.7	0.5	1.2	0.2	0.6	0.5	ND	ND
		Bromoform	µg/L	-	-	-	-	-	-	-	-	0	-	ND	0.6	2.2	1.7	ND	ND	ND	ND	ND	ND	ND	0.0	0.0	0.0	0.0	ND	ND
		Chloroform	µg/L	-	-	-	-	-	-	-	-	0	-	44	29.8	24.1	21.1	55.8	86.4	95.4	26.1	20.7	10.7	15.9	6.7	5.5	26.1	5.4	6.2	1.7
		Dibromochloromethane	µg/L	-	-	-	-	-	-	-	-	0	-	ND	0.9	1.3	0.6	ND	ND	ND	0.1	0.2	0.2	16.5	0.0	0.0	0.0	0.0	ND	ND
		Dichlorodifluoromethane	µg/L	-	-	-	-	-	-	-	-	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	-	-	-	-	-	-	-	-	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-
Shasta CSA #3 Castella	**Castle Creek**	Total	µg/L	-	-	-	-	0	-	-	0	-	-	-	-	25.3	22.4	13.9	15	42.3	24.7	22.6	30.9	44.6	31.3	57.2	61.0	37.5	46.3	34.0
		Bromodichlormethane	µg/L	-	-	-	-	0	-	-	0	-	-	-	-	2.6	1	1.2	0.5	1.7	1.2	0.9	1.7	2.2	1.9	2.1	1.9	2.5	1.5	1.7
		Bromoform	µg/L	-	-	-	-	0	-	-	0	-	-	-	-	4.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		Chloroform	µg/L	-	-	-	-	0	-	-	0	-	-	-	-	15.7	21.4	12.7	14.6	40.6	23.5	21.6	29.1	42.3	29.5	55.1	59.1	35.0	44.7	32.0
		Dibromochloromethane	µg/L	-	-	-	-	0	-	-	0	-	-	-	-	2.5	ND	ND	ND	ND	ND	0.1	0.2	0.1	ND	ND	ND	ND	ND	ND
		Dichlorodifluoromethane	µg/L	-	-	-	-	0	-	-	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	-	-	-	-	0	-	-	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
Shasta CSA #6 Jones Valley	**Shasta Lake**	Total	µg/L	-	0	-	0	-	-	-	8.8	-	-	-	-	27.75	43.3	34.6	23.2	34.6	32.2	32.2	43.5	39.9	51.9	42.4	32.4	41.0	40.8	52.5
		Bromodichlormethane	µg/L	-	0	-	0	-	-	-	2.2	-	-	-	-	3.63	5.5	4.4	4	3.9	3	3.7	4.9	5.1	5.6	3.8	2.9	4.3	4.0	5.3
		Bromoform	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		Chloroform	µg/L	-	0	-	0	-	-	-	5.8	-	-	-	-	23.57	28.6	30.2	18.6	30.4	33.4	28	38.1	34.3	46.2	38.6	29.5	36.8	36.8	47.0
		Dibromochloromethane	µg/L	-	0	-	0	-	-	-	0.8	-	-	-	-	ND	5.3	ND	0.6	ND	0.3	0.5	0.5	0.5	0.1	ND	ND	ND	ND	0.2
		Dichlorodifluoromethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shasta CSA #11 French Gulch	**Clear Creek**	Total	µg/L	-	-	-	-	-	-	-	-	0	-	-	-	27.2	11.7	39.5	52.1	23.7	47.7	46.8	42.8	74.7	48.7	39.0	44.5	63.7	29.7	38.6
		Bromodichlormethane	µg/L	-	-	-	-	-	-	-	-	0	-	-	-	0.9	1.3	1.1	1.1	0.8	1.1	1.3	1.2	2	0.0	0.9	1.4	2.1	1.3	0.9
		Bromoform	µg/L	-	-	-	-	-	-	-	-	0	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		Chloroform	µg/L	-	-	-	-	-	-	-	-	0	-	-	-	26.3	11.5	38.4	51	22.9	46.6	45.5	41.5	72.7	48.7	38.0	43.1	61.7	28.4	37.7
		Dibromochloromethane	µg/L	-	-	-	-	-	-	-	-	0	-	-	-	ND	ND	ND	ND	ND	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND
		Dichlorodifluoromethane	µg/L	-	-	-	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	-	-	-	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 7.3B

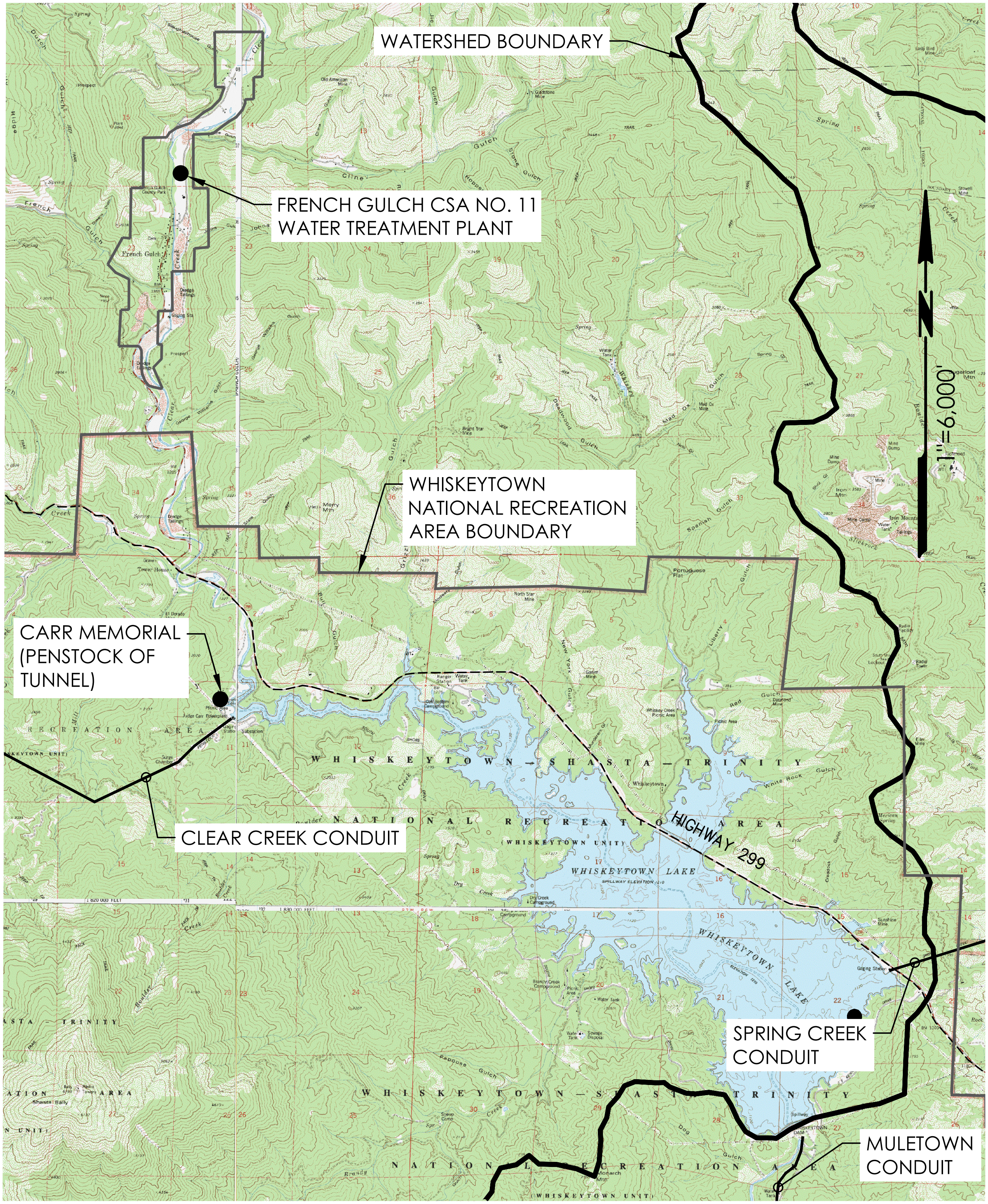
REDDING AREA WATERSHED SANITARY SURVEY

TTHM RESULTS FOR WATER PURVEYORS

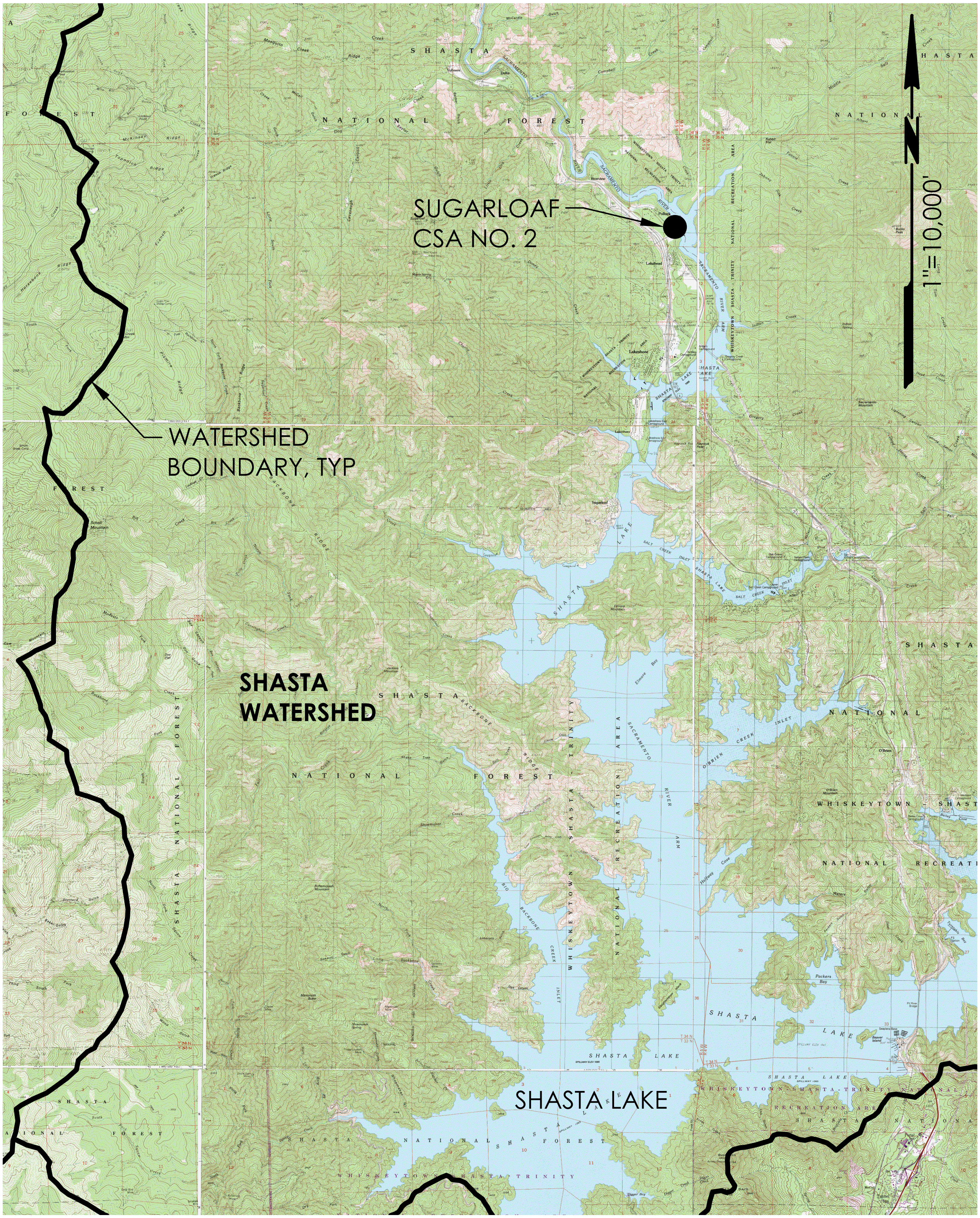
System	Source	Constituent	Units	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
				TTHM Monitoring																										
Shasta CSA #23 Crag View	Little Castle Creek	Total	µg/L	-	-	-	-	54	-	-	0	-	-	-	-	36.8	-	24.9	46.1	-	32.7	42.2	29.5	41.6	62.8	42.1	44.8	50.2	81.1	30.6
		Bromodichlormethane	µg/L	-	-	-	-	2.8	-	-	0	-	-	-	-	3.2	-	1.2	1.2	-	0.9	0.9	1.4	1.6	2.1	0.9	1.5	2.0	1.8	1.0
		Bromoform	µg/L	-	-	-	-	0	-	-	0	-	-	-	-	8.4	-	ND	ND	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		Chloroform	µg/L	-	-	-	-	51	-	-	0	-	-	-	-	21.1	-	23.7	44.9	-	31.8	41.1	28	40	60.6	35.8	43.3	48.2	79.5	29.7
		Dibromochloromethane	µg/L	-	-	-	-	0	-	-	0	-	-	-	-	4.1	-	ND	ND	-	ND	0.2	0.1	ND	ND	ND	ND	ND	ND	ND
		Dichlorodifluoromethane	µg/L	-	-	-	-	0	-	-	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	-	-	-	-	0	-	-	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
Shasta CSD - Keswick	Whiskeytown Lake	Total	µg/L	-	-	-	-	-	-	-	0	-	-	-	33.9	28	-	21.4	34.4	58.2	17.2	31.8	52.5	53.2	59.7	55.9	48.2	46.6	-	-
		Bromodichlormethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	3.9	1.5	-	1.7	2.4	2.6	0.8	1.8	2.5	2.9	4.1	3.3	2.2	2.8	3.3	-
		Bromoform	µg/L	-	-	-	-	-	-	-	0	-	-	-	5.1	ND	-	ND	ND	ND	ND	ND	ND	ND	0.0	0.5	0.0	0.0	-	-
		Chloroform	µg/L	-	-	-	-	-	-	-	0	-	-	-	22.6	26.3	-	19.7	32	55.6	16.2	29.8	49.9	50.2	58.8	50.6	46.7	43.9	-	-
		Dibromochloromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	2.4	0.2	-	ND	0.8	0.07	0.2	0.1	0.1	ND	5.9	5.2	5.1	4.1	-	-
		Dichlorodifluoromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shasta CSD - Shasta	Whiskeytown Lake	Total	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59.5	67.7	47.5	60.9	60.3	52.5	63.4	62.5	67.2	68.3	-
		Bromodichlormethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2.7	2.2	2.6	3.25	3.6	2.6	2.7	3.7	3.6	-
		Bromoform	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-
		Chloroform	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56.5	65	45.3	58.3	57	56.0	60.9	59.9	63.6	64.7	-
		Dibromochloromethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-
		Dichlorodifluoromethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
City of Shasta Lake	Shasta Lake	Total	µg/L	-	-	-	0	-	1.8	-	-	-	-	-	0	-	-	-	-	-	31.38	20.1	22.2	18.5	28.5	34.9	31.9	26.9	34.4	-
		Bromodichlormethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	3.4	3.02	3.43	4.05	4.3	4.1	3.3	3.8	3.3	-
		Bromoform	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	0	0	0	0	0.0	0.0	0.0	0.0	0.0	-
		Chloroform	µg/L	-	-	-	0	-	1.8	-	-	-	-	-	0	-	-	-	-	-	27.97	17.1	18.8	14.2	24.2	30.8	28.6	23.1	31.0	-
		Dibromochloromethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	0	0	0	0.25	0.0	0.0	0.0	0.0	0.0	-
		Dichlorodifluoromethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1,2,3-Trichloropropane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



DATE 11/20	PACE ENGINEERING REDDING, CALIFORNIA	REDDING AREA WATERSHED SANITARY SURVEY REDDING AREA PUBLIC WATER SYSTEMS MAP	FIGURE 7.1 JOB #1748.05

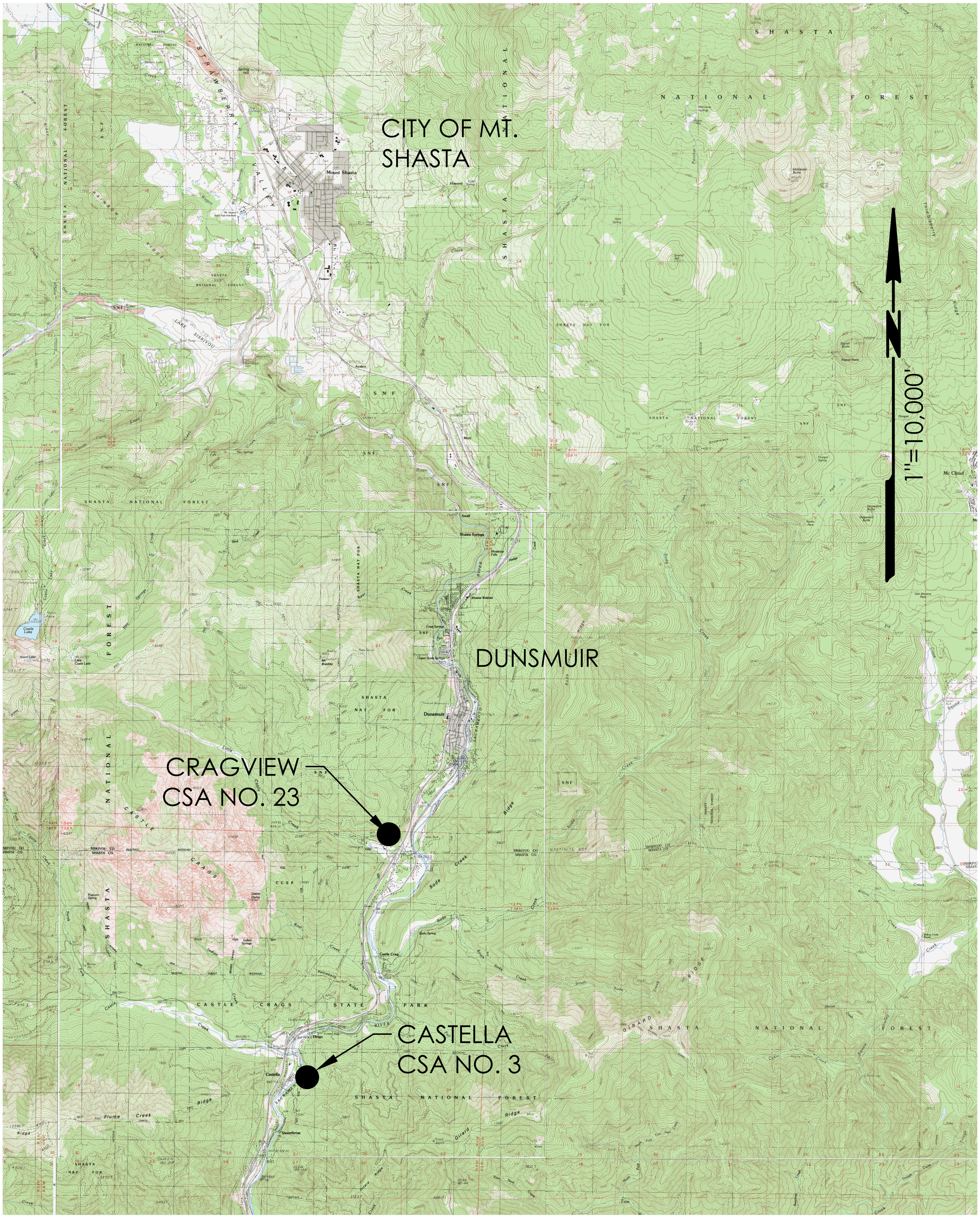


DATE 11/20	PACE ENGINEERING REDDING, CALIFORNIA	REDDING AREA WATERSHED SANITARY SURVEY SHASTA COUNTY SERVICE AREAS IN WHISKEYTOWN WATERSHED	FIGURE 7.2 JOB #1748.05



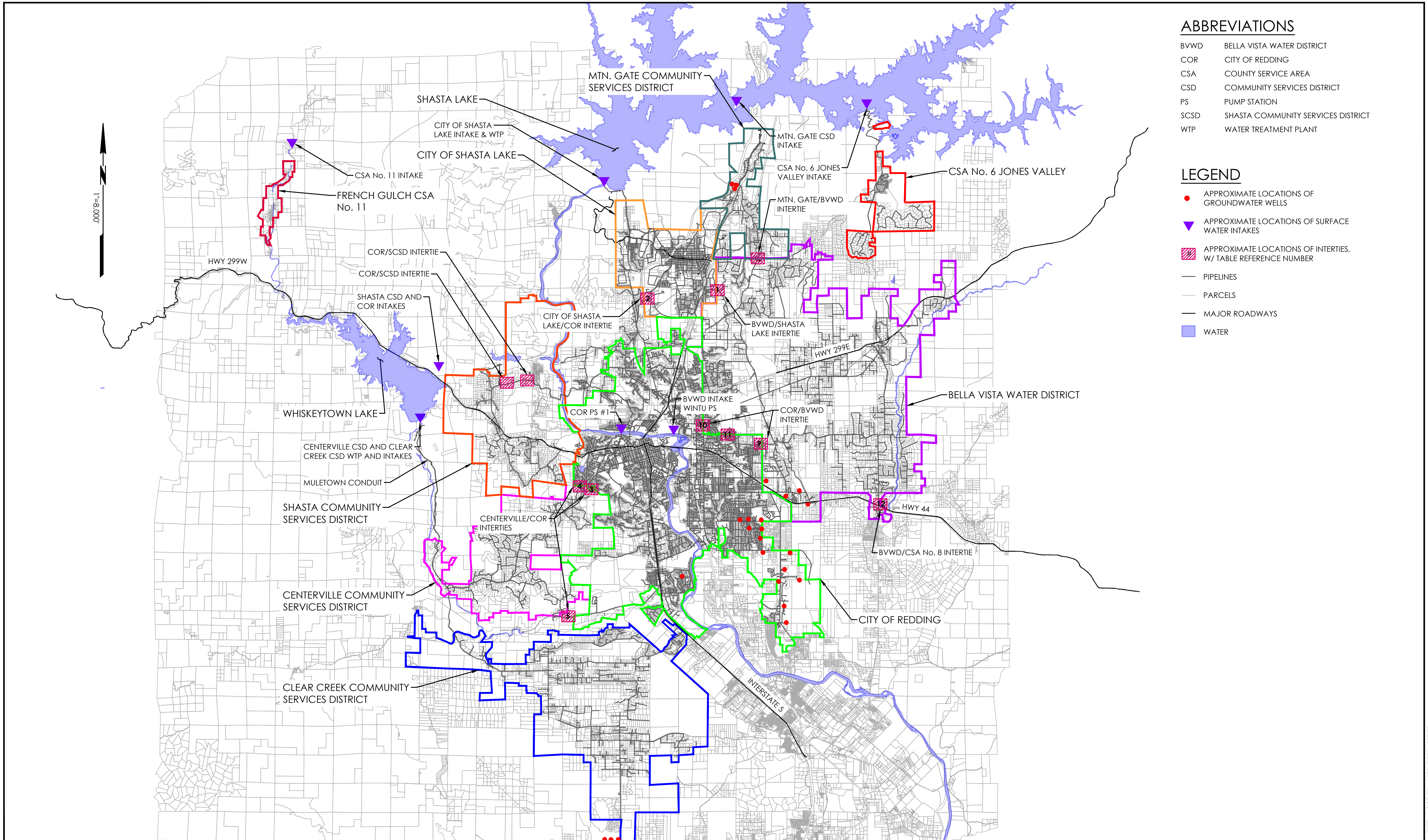
DATE	PACE ENGINEERING	REDDING AREA WATERSHED SANITARY SURVEY	FIGURE 7.3
11/20	REDDING, CALIFORNIA	SHASTA COUNTY SERVICE AREAS IN SOUTHERN SHASTA WATERSHED	JOB #1748.05

Plot Date: November 19, 2020 – 4:20 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Shasta Watershed Figures.dwg, Layout: FIG7.3



DATE 11/20	PACE ENGINEERING REDDING, CALIFORNIA	REDDING AREA WATERSHED SANITARY SURVEY SHASTA COUNTY SERVICE AREAS IN NORTHERN SHASTA WATERSHED	FIGURE 7.4 JOB #1748.05

Plot Date: November 19, 2020 – 4:16 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Shasta Watershed Figures.dwg, Layout: FIG7.4



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATER SANITARY SURVEY
AGENCY BOUNDARIES, INTAKES, & INTERTIES

FIGURE 7.5
DATE: 11/20
JOB # 1748.05

8 POTENTIAL WATERSHED CONTAMINANT SOURCES

8.1 Introduction

This section evaluates the watersheds' potential contaminant sources. These sources include agriculture, fires, geologic hazards, transportation, industry, timber harvesting, mines, toxic cleanup sites, pesticides and herbicides, recreation, septic systems, and urban runoff. Each section opens with a general discussion of the problems in the watersheds and then adds details that are relevant to each individual watershed.

It can be argued that the greatest overall threats to water quality in the watersheds are from erosion and accidental spills. Other potential watershed contaminant sources covered in this section are often under the oversight of state and federal agencies that oversee the watersheds, and should contamination occur, it is likely to have a localized effect on water quality of a nearby stream and is less likely to have an impact on water quality over the entire watershed.

8.2 Agriculture and Ranching

Table 8.1 lists the amount of agricultural farmland and ranching in each county with lands included in the watersheds. Note that Table 8.1 is based on countywide information; therefore, it may also include agricultural area outside the watershed boundaries.

Agriculture and ranching have the potential to impact water quality through increased erosion, the use of pesticides, livestock waste contributions, and agricultural drainage. Erosion may occur from exposed crop fields or where livestock congregates and disrupts the surface soil, particularly near streams. Pesticides and herbicides may be applied on crops, and these are covered in Section 8.10 Pesticides and Herbicides.

Livestock waste may impact the water quality of surface water by contributing excess nutrients and pathogenic microorganisms, such as Giardia and Cryptosporidium from runoff. Research by the U.S. Department of Agriculture has concluded that Cryptosporidium and Giardia appear to be common in beef calves, and fecal shedding of both organisms is related to calf age.[1] Recent studies also suggest that C. parvum, the only Cryptosporidium species infectious to humans, makes up 85 percent of the Cryptosporidium infections in pre-weaned calves but only one percent in post-weaned calves.[2]

Federal and state agencies have established BMPs to be followed by ranchers using their lands for grazing. The standards and guidelines, established by the USFS Forest Plan and in agreement with BLM, were created to protect surface waters by protecting riparian areas from damage by livestock.[2]

Cannabis is legally and illegally cultivated in the watersheds. According to the National Park Service, past incidents in the Whiskeytown Watershed indicated large amounts of fertilizer were released into a creek and made its way to the lake, killing frogs and other organisms along the way. Investigations revealed that the fertilizer originated from cannabis growers.

It is estimated an adult cannabis plant requires five to ten gallons of water per plant per day. Large, unpermitted growers have been known to divert water from streams, which is vastly impacting streams, rivers, and wildlife habitat. In some sensitive watersheds, cannabis grows have been blamed for drying up small streams and creeks. In addition to diverting unpermitted water in a drought from downstream users, growers also may use harmful pesticides that have been known to drain into waterways impacting the quality of water.[56] Earlier this year, approximately 3,000 pounds of trash, hundreds of feet of plastic irrigation piping, discarded camping equipment, and other debris were removed at an illegal grow site in Monterey County. The trash removed also included bottles of rodenticides, insecticides, and fertilizers, which were attributed to wildlife deaths and further damage to the ecosystem. It is expected that other sites and contamination such as this may exist within the Shasta, Whiskeytown, Sacramento River, and Trinity Watersheds.[91]

The RWQCB created a Cannabis Cultivation Program, which was approved and put into the state's regulatory code by the Office of Administrative Law on December 18, 2017. The Cannabis Policy was developed to ensure that the diversion of water and discharge of waste associated with cannabis cultivation does not have a negative impact on water quality, aquatic habitat, riparian habitat, wetlands, and springs. The requirements of the Cannabis Policy are mostly implemented through the Water Boards Cannabis Cultivation General Order and Cannabis Small Irrigation Use Registration (SIUR) permits. The Cannabis Cultivation General Order is a simplified Waste Discharge Requirement (WDR) available to cannabis cultivators to regulate discharges of waste associated with cannabis cultivation.[56] The SIUR requires cannabis cultivators to cease from diverting surface water during the dry season and allows for the diversion and storage of up to 20 acre-feet per year. The Office of Enforcement's Cannabis Enforcement Unit (CEU) is responsible for the inspection and enforcement of water quality impacts for permitted and unpermitted cannabis cultivation sites.[57]

Shasta Watershed

Agricultural activities in the Shasta Watershed include farming, cattle, cannabis, and timber harvesting. Agriculture can noticeably impact local streams and waterways; however, because the volume of Shasta Lake is so large and the amount of agriculture relatively small, most of these pollutants are diluted and have minimal impact on water quality.

Illegal cannabis cultivation in and around Clear Creek CSD boundaries largely attributed to water theft and ground contamination during the time of the last drought, which was in 2014/2015. Since then, Clear Creek CSD has adopted an ordinance giving staff the authority to give fines to those stealing water as well as report the theft to authorities. Clear Creek CSD has also limited theft by locking off hydrants from the public. The Bella Vista Water District also reported similar problems with water theft due to cannabis growth, although the problem has been more minimal recently.[70] Ground contamination concerns due to an increase in cultivation around Whiskeytown Lake and the illegal use of fertilizers and pesticides as well as disposal of their containers in and around the lake have decreased as a result of law enforcement becoming more involved with illegal grows.[62] David Coxey at Bella Vista Water District stated that before growing outdoors was banned,[71] problems with cannabis were escalating in the district. David noted that a large concern for him was that federal water, or water allocated by the USBR, is not legally allowed to be used for the growth of cannabis. Navigating the enforcement of water use was becoming difficult. Since Shasta County's outdoor ban, David has not noticed the problems that were present before.[70] The present concern is still about the use of illegal pesticides.

According to the USFS, there are approximately 117 grazing allotments for cattle and sheep that exist in the Shasta Watershed, with 101 of those being active, totaling about 2,158,706 active acres of allotted grazing, or 44.9% of the watershed within California. These active allotments are distributed amongst the counties, with 28 located in Lassen County, 54 in Modoc County, 7 in

Siskiyou County, and 14 in Shasta County. Approximately 1,857,992 of these acres are within National Forest Lands.[86] See Figure 8.19.

Timber harvesting occurs on national forest and private land in the watershed and is discussed in Section 8.7 Timber Harvesting.

Trinity Watershed

The only reported agricultural activities in the Trinity Watershed are timber harvesting and cattle grazing, and their impact on water quality appears to be minimal.

The USFS reports six active grazing allotments within the Trinity Watershed from a total of 13 allotments. The active allotments make up about 126,693 acres, with 97,883 of those acres within National Forests.[86] See Figure 8.19.

There are likely to be additional livestock grazing or other agricultural operations on private lands; however, no information on those activities is available. The steep slopes and rugged terrain probably deter significant grazing in the watershed; however, cannabis cultivation is known to be rampant in Trinity County.

Whiskeytown Watershed

The only reported agricultural activity in the Whiskeytown Watershed is timber harvesting, which is covered in Section 8.7, and there is no reported ranching or grazing in the watershed. To date, the BLM has not issued any grazing permits in the watershed.[2,3] Consequently, the impact on water quality from agriculture and ranching appears to be minimal.

Pesticides and herbicides can be applied during timber harvesting operations, and this is discussed in Section 8.10 Pesticides and Herbicides.

Sacramento River Watershed

Timber harvesting on private land is the only reported agriculture in the watershed and is located in a small 1.2-square-mile area. There appears to be little impact from agriculture on water quality.

8.3 Fires

The initial threat from fires in a watershed appears to be from direct effects, such as a fire damaging a treatment facility or interrupting the power supply. Soil conditions after a fire have the potential to impair water quality because of increased erosion rates, which may lead to elevated water turbidity. Factors influencing erosion following a fire are: fire severity, soil erodibility, steepness of a slope, and intensity and amount of precipitation following a fire.[5] An intense surface wildfire may destroy all vegetation, and the organic material in the soil may decompose into a water-repelling substance. This prevents precipitation from percolating into the soil and thereby increases runoff.[5] Post-fire erosion rates may be 50 to 100 times greater than pre-fire erosion rates. Mass wasting could also increase following a wildfire due to higher groundwater levels and lack of vegetation to hold the soil in place.[4] Also, firefighting impacts the terrain and can increase erosion rates when heavy machinery disturbs the topsoil and removes vegetation to create fire lines.

Long-term fire suppression activity is also a potential problem because it can promote indirect long-term erosion control by allowing dense organic material to accumulate and to retain excess topsoil. Consequently, if conditions are right, this additional topsoil may be released and washed into surface waters following a fire.

As fires become more frequent and severe, natural flood control decreases and runoff values increase. These impacts and their effect as non-point source pollutant loads have started to come up in conversation more frequently in recent times. Future monitoring and mitigation may be expected.[70]

Figure 8.1 shows the level of fire threats in the watersheds determined by the State of California Department of Forestry and Fire Protection (CDF) and Fire and Resource Assessment Program.[47] Much of the watershed areas are at a high risk for fires. Figure 8.2 shows the location of major fires in the watersheds for the last 136 years, from 1878 to 2019.[47] Since the last watershed survey, nine fires of 1,000 acres and larger have been reported in the areas discussed in this survey. On federal and tribal trust lands, a Burned Area Emergency Stabilization Plan is created following a fire in order to institute re-vegetation, hazard reduction, noxious weed removal, and a monitoring program to reduce the erosion impacts in a watershed.[5] These efforts also include attempts to reduce carbon loading into a water system. The sections below describe fires that have occurred since the last watershed sanitary survey update through 2019. The 2019 fire season in California was minor with no major fires in the watersheds presented in this report. In contrast, the 2018 fire season in California was rather severe, with six major fires - four of which were larger than 30,000 acres - in the watersheds presented in this report.

Based on the burn severity and topography, reduced source water quality was anticipated following the 2018 fire season, such as increased turbidity, TOC, and changes in pH and alkalinity. Considering the typically high-quality source water, the treatment plants for the affected water agencies do not have robust sludge removal capabilities, which caused concern.

The affected water agencies, along with DDW, came up with several options to mitigate potential issues with providing a safe water supply:

- Operating inline filtration plants as direct filtration
- Evaluating serving from storage during times of high turbidity in raw water
- Evaluating serving from groundwater during times of high turbidity in raw water
- New interties between systems
- New booster pump stations
- Evaluating filter replacement options
- Modifying recycled water rates
- Evaluating different coagulants
- Using CO_2 to depress pH
- Evaluating sludge removal options
- Acquiring new treatment plant diagnostic equipment

See Appendix A for the detailed report of post-fire water quality. Section 8.4 has additional information regarding fire impact on erosion.

Shasta Watershed

The total land burned in the Shasta Watershed from 2015 through 2019 is about 429,972 acres or 8.9% of the watershed. New vegetation has begun to grow in these areas, which should reduce erosion and fugitive sediments; however, untreated and severely burned areas could take up to 80 years to recover.[50]

The 2015 and 2016 fire seasons each had one major fire reported, for an approximate total of 5,169 acres and 3,146 acres respectively, within the Shasta Watershed. The Frog Fire in Modoc County was the singular major fire for the 2015 season at 4,863 acres, which was started during a lightning storm. The Soup 2 Fire, also located in Modoc County, near Soup Springs, started due to arson and burned approximately 2,588 acres resulting as the major fire of 2016.[48]

The 2017 fire season burned approximately 40,337 acres, with two major fires within the Shasta Watershed. The Parker2 Fire, southwest of Cedarville, burned about 7,692 acres, and the Cove Fire, northwest of Adin, burned approximately 30,887 acres.[48]

The 2018 fire season proved to be the worst fire season since the last update with a total of six major fires. A total of 380,984 acres burned within the Shasta Watershed that year. Of these six major fires, four fires burned over 30,000 acres each. The Stone Fire was located in Big Canyon, ten miles southwest of Canby, and started due to lightning, burning 39,387 acres and costing approximately $17,000,000.[48] The Hirz Fire started off Gilman and Moore Creek Campground, east of Lakehead, and burned close to 40,580 acres along the McCloud Arm of Shasta Lake. The Delta Fire started at Interstate 5 and Lamoine, two miles northwest of Lakehead, burning approximately 63,311 acres on both sides of the Sacramento River and costing upwards of $54,900,000.[51] Finally, the most devastating fire of the season, the Carr Fire, started due to a spark from a flat tire on Highway 299 at Carr Powerhouse Road. The Carr Fire burned 229,651 acres along the Whiskeytown Lake perimeter and cost $1.658 billion, with most of the fire being located in the Whiskeytown Watershed and roughly a quarter of it burning within the Shasta Watershed.[49]

The Hirz, Delta, and Carr Fires burned with such severity that the water systems that use surface water in the impacted areas were expected to experience reduced source water quality, especially directly following the first few significant rain events. The source waters were expected to have increased turbidity and TOC and experience changes in pH and alkalinity. The first rain season following the fires primarily took place from November 2018 to April 2019, with a total of 81 inches of precipitation in the Whiskeytown National Recreation Area and 53 inches in Redding.[72] Overall, the water quality throughout the wet season decreased during rain events but recovered quickly. This allowed the surface water treatment plants to operate normally throughout the wet season but cease operations during severe storms due to poor source water caused by the fires and runoff. Operators filled their storage tanks in preparation for these events. The treatment plants were able to continue meeting turbidity performance standards and maintaining sludge management. For more details regarding the impacts to water quality following the Hirz, Delta, and Carr Fires, see attached Appendix A.[72] See Section 8.8 Mines for additional potential water quality impacts from the Carr Fire.

A total of approximately 337 acres were burned during the 2019 fire season within the watershed.[48]

Trinity Watershed

There were no major fires located within the Trinity Watershed since the last update. However, small portions of the 2018 Carr and Delta Fires did burn into the Watershed.[48]

Sacramento River

While no major fires burned primarily in the Sacramento River Watershed, the Carr Fire did burn close to half of the watershed.[47] See discussion above and Appendix A for water quality impacts as well as Section 8.8 Mines for additional potential water quality impacts from the Carr Fire.

Whiskeytown Watersheds

During the 2018 fire season, almost 92% of the Whiskeytown Watershed was burned due to the majority of the Carr Fire and a portion of the Delta Fire.[47] See discussion above and Appendix A for water quality impacts as well as Section 8.8 Mines for additional potential water quality impacts from the Carr Fire.

8.4 Geologic Hazards and Erosion

The geology of a watershed can impact water quality by introducing sediment into waterways through landslides, natural erosion, fires, and earthquakes, which can induce mass wasting. Factors that contribute to their occurrence include the slope of the terrain, soil and bedrock structure, amount and intensity of precipitation, and the impact of human activity on the land. Landslides have the greatest potential to adversely impact water quality in a watershed by increasing water turbidity.

Erosion is the transportation of soil particles and other organic material by either water or air. In a watershed, water moves particles through a combination of gravity and overland flow. As particles are detached, rills form, and if the conditions are right, gullies are formed. The particles, otherwise known as sediment, eventually reach surface water and can impair water quality.

There are two sources of erosion: (1) Natural erosion, which is dependent on the type of soil, slope of terrain, amount and intensity of precipitation or flow of water, and type of vegetation and ground cover holding the soil in place and (2) Human-induced erosion due to road construction and use, timber harvesting, recreation, and grading of land. Sediment runoff rates from construction sites are typically 10 to 20 times greater than those from agricultural lands.[6]

Roads can contribute to erosion as a result of:

- Erosion from surface runoff
- Undersized culverts/culvert failure
- Construction of new roads
- Poorly maintained roads
- Wet weather road use
- Rutting
- Fill slope failures
- Slumps and slides
- Gullying

Off highway vehicle (OHV) use is a popular activity on public dirt roads. Erosion from this form of recreation may occur because of unplanned and prohibited road and trail use and improper driving techniques. Recreation is further discussed in Section 8.11 Recreation.

Reservoirs also can contribute to erosion when shorelines are exposed as bare soil. Wave action from wind and boat wakes, water level fluctuations, and impacts from rain can erode the banks and increase turbidity in the reservoir.

With the recent increase in fire activity and the increase in severity of these fires, fire-related erosion is of particular concern. Figures 9.7 and 9.8 show the relationship between rainfall and the increased turbidity following each storm at Keswick Dam and Spring Creek between October 2018 and October 2019. A *Watershed Emergency Response Team Report* (WERT) was completed in September of 2018 for the Carr Fire and covered topics such as soil burn severity, post-fire flood potential, and surface erosion. An important factor for determining fire impact to a watershed is the soil burn severity. Soil burn severity is not always indicated by vegetation consumption but rather by loss of the organic matter and cover on the soil, which generally helps prevent erosion. Losing this layer increases the impact of the water repellent layers, which leads to greater runoff and debris mobilization.[84] Figure 5 in the WERT shows soil burn severity percentages by hydraulic unit code watersheds, which indicate soils upstream of the Whiskeytown Dam suffered the highest proportion of severely burned soil.[83] The French Gulch intake was greatly impacted due to the surrounding burn severity, as seen in Photo 8 that was taken in October of 2018 during the first major rain event.

Photo 8 - French Gulch Intake

Additionally, it is assumed that areas burned will experience post-fire flow multipliers and increased sediment bulking according to burn severity. Refer to Section 4 in the 2018 Carr Fire WERT.[83] Surface erosion was predicted to produce between 0.30 tons acre to 18.50 tons acre of sediment according to the two-year post-fire Erosion Risk Management Tool. The worst of the impacts to runoff from fires usually passes after a year or two, as the water repellent layer dissipates and vegetation cover recovers.[84]

Finally, droughts may also increase erosion rates. When a reservoir is drawn down, more unvegetated shoreline may be exposed to the elements leading to increased erosion. If a large storm occurs following a drought, this may result in significant erosion.

Turbidity

Turbidity is the measurement of the light scatter in a water column caused by suspended particles such as clay, organics, and microorganisms. High turbidity levels are typically the result of erosion and sediment transport during storm/high flow events.

High turbidity levels are undesirable because high levels may mask the presence and interfere with disinfection of microorganisms. Turbidity, like coliform, is used as an indicator of general water quality.

Turbidity is used to evaluate the efficiency of the treatment process and is a regulated constituent. Turbidity was originally regulated as part of the National Interim Primary Drinking Water Regulations in the 1970s. Treated water turbidity standards were also set as part of the SWTR. The current standards for combined filter effluent turbidity are based on the IESWTR (for systems serving greater than a population of 10,000) and the LT1ESWTR (for systems serving less than a population of 10,000). These regulations revise the combined filter effluent turbidity performance criteria to less than 0.3 NTU in 95% of measurements and never to exceed 1 NTU. They also require continuous monitoring of individual filter effluent turbidity.

Turbidity has also been indirectly regulated in drinking water as part of the Filter Backwash Rule. This rule requires utilities that recycle waste streams to return the water to the headworks of the WTP, upstream of all chemical feed systems. This is to ensure that chemical feed is adjusted for blended water quality, including increases in turbidity. The regulation also recommends flow pacing of the recycle stream to minimize pulsing of solids loading.

Shasta Watershed

The Chappie-Shasta OHV area is located in the eastern portion of the Whiskeytown Watershed and includes a southwestern portion of the Shasta Watershed and a western portion of the Sacramento River Watershed as shown on Figure 8.3. The trails are managed by BLM for public OHV use and consist of approximately 52,000 acres of federal and private lands and 250 miles of roads and trails. Most of these roads are unpaved and can result in significant erosion. BLM has an ongoing monitoring and maintenance program that partners with local user groups to ensure that erosion is managed and controlled. More information on OHV use in the area is found in Section 8.11 Recreation.

Erosion Control Regulations in the Watershed

Phase II NPDES Storm Water Program:[6]

- Requires operators of construction activity disturbing more than one acre or whose project disturbs less than one acre, but is part of a larger common plan of development that in total disturbs one or more acres, to apply for coverage under the general permit 2012-0006-DWQ.
- The construction general permit requires a Storm Water Pollution Prevention Plan (SWPPP) be developed and implemented by the discharger. The SWPPP implements practices to minimize pollutant runoff, including non-structural and structural BMPs and monitoring requirements.

Shasta County Grading Ordinance:[7]

- Grading means the movement of any earth materials:
    - in excess of 250 cubic yards; or
    - that damages or has the potential to significantly damage directly, or indirectly through erosion, any natural or manmade watercourse, whether year-round or intermittent, including drainage channels; or
    - to make a road, temporary access road, building pad, mobile home pad or a new sewage disposal system when the installation of the sewage disposal system requires changes in the natural contour of the land; or
    - that disturbs 10,000 square feet or more of surface area; or
    - unless exemptions from the ordinance apply.
- Control erosion and sedimentation and prevent damage to off-site property and streams, watercourses, and aquatic habitat.
- Avoid creation of unstable slopes or fill areas.
- Prevent impairment or destruction of potential leach fields for sewage disposal systems.

Siskiyou and Modoc County Ordinances:[8,60]

- Every approved tentative map or vesting tentative map shall be conditioned on compliance with requirements for grading and erosion control, including prevention of sedimentation or damage to off-site property, as set forth in this code and the adopted development standards.

Lassen County does not have a grading ordinance.

Trinity Watershed

The geology in the Trinity Watershed is mixed ultramafic (serpentine) and granitic rock. Soils derived from these rocks are a concern because of their high erodibility. It is difficult to plant vegetation; therefore, they have a high potential for landslides and are easily eroded.[3]

According to the 2001 EPA Total Maximum Daily Load (TMDL) report for the Trinity River, approximately 21% of the total sediment load can be attributed to timber harvesting activities, 9% to roads, and 1% to mining legacy in the Upper Trinity River Watershed. The remaining 69% of the total sediment load was attributed to non-management, or natural erosion, with landslides making up to 83% of that total. The Upper Trinity River Watershed Analysis found that excessive sediment is the greatest threat to water quality in the watershed.[9]

A TMDL for sediment in the Trinity River has been established by the EPA based on studies by the State of California. Excessive amounts of sediment are adversely affecting water quality and the fishery, and sediment delivery to the lake is detrimental to beneficial uses below Lewiston Dam.[9]

The Whiskeytown-Shasta-Trinity National Recreation Area (NRA) 2014 Management Guide[10] states that within the NRA no temporary or permanent roads can be constructed for timber harvesting purposes in the foreground areas of Trinity Lake, Lewiston Lake, and the Trinity River, unless the roads meet adopted visual quality objectives.

The USFS Forest Plan establishes BMPs standards and guidelines to protect water quality from activities on national public lands.

Erosion Control Regulations in the Watershed

Phase II NPDES Storm Water Program:[6]

- Requires operators of construction activity disturbing more than one acre or whose project disturbs less than one acre, but is part of a larger common plan of development that in total disturbs one or more acres, to apply for coverage under the general permit 2012-0006-DWQ.
- The construction general permit requires a SWPPP be developed and implemented by the discharger. The SWPPP implements practices to minimize pollutant runoff, including non-structural and structural BMPs and monitoring requirements.

Trinity County Grading Ordinance:[59]

- Grading restrictions apply to all individual parcels and any activity:
  - that affects, contains, involves or consists of a volume of graded material greater than 800 cubic yards, whether contiguous or noncontiguous; and/or
  - in which the total contiguous or noncontiguous surface area to be graded is greater than 20,000 square feet; or
  - unless exemption from the 2019 Ordinance applies.

- Permits will not be granted where the following hazards apply:
  - Creation of a hazard to public health and safety.
  - Threat to the stability or use of adjacent property.
  - Damage to public or private utilities.
  - Damage to a public or private roadway or other transportation facility.
  - Damage to, or obstruction of, watercourses or drainage facilities.
  - Observable degradation of water quality of any water body.
  - Damage to existing septic systems and water supply wells.
  - Damage to survey markers, monuments, benchmarks, or geodetic marks.

Whiskeytown Watershed

The intense storms of late December 1996 and early January 1997 resulted in landslides into the south fork of Orofino Creek near the summit of Boulder Peak and into Brandy Creek via Rich Gulch. The amount of sediment washed downstream from the Paige Boulder Creek slide is estimated to have been in excess of 200,000 cubic yards. The negative impacts included the loss of roads, bridges, a plant nursery, and the deposition of thousands of tons of woody debris and sediment on beaches and picnic areas.[20] As a result of the landslide, Clear Creek CSD experienced raw water turbidities from 10 to 12 NTU well into the summer months.

Currently, it is believed that there is extensive road-caused erosion occurring in the Whiskeytown Watershed. Air photo studies of Whiskeytown NRA show an estimated 300 miles of old logging, skid, and mining roads that are contributing significant sediment to the stream systems and Whiskeytown Lake.[20]

The Whiskeytown NRA is known for its weathered rock on steep slopes and high rainfall.[14] Erosion of exposed hillsides at the Greenhorn Mine may be a severe problem according to an assessment by the SWRCB. The NPS is presently looking at these erosion and mass wasting issues and is considering how to reduce the threats from the hundreds of miles of logging and mining roads within the Whiskeytown NRA.

Although there are no known major faults in the watershed and earthquakes are rare, the area is vulnerable to earthquakes from nearby faults.[12]

The Chappie-Shasta OHV area is located in the eastern portion of the Whiskeytown Watershed as shown in Figure 8.3.

Erosion Control Regulations in the Watershed

Phase II NPDES Storm Water Program:[6]

- Requires operators of construction activity disturbing more than one acre or whose project disturbs less than one acre but is part of a larger common plan of development that in total disturbs one or more acres, to apply for coverage under the general permit 2012-0006-DWQ.
- The construction general permit requires a SWPPP be developed and implemented by the discharger. The SWPPP implements practices to minimize pollutant runoff, including non-structural and structural BMPs and monitoring requirements.

Shasta County Grading Ordinance:[7]

- Grading means the movement of any earth materials:
  - in excess of 250 cubic yards; or
  - that damages or has the potential to significantly damage directly, or indirectly through erosion, any natural or manmade watercourse, whether year-round or intermittent, including drainage channels; or
  - to make a road, temporary access road, building pad, mobile home pad, or a new sewage disposal system when the installation of the sewage disposal system requires changes in the natural contour of the land; or
  - that disturbs 10,000 square feet or more of surface area; or
  - unless exemptions from the ordinance apply.
- Control erosion and sedimentation and prevent damage to off-site property and streams, watercourses, and aquatic habitat.
- Avoid creation of unstable slopes or fill areas.
- Prevent impairment or destruction of potential leach fields for sewage disposal systems.

Sacramento River Watershed

The Chappie-Shasta OHV area is partly located in the western portion of the Sacramento River Watershed and may contribute to erosion from heavy use of the trails by OHV riders. See Section-8.11 Recreation for more information and Figure 8.3 for a map of the trails.

Erosion Control Regulations in the Watershed

Phase II NPDES Storm Water Program[6]

- Requires operators of construction activity disturbing more than one acre or whose project disturbs less than one acre but is part of a larger common plan of development that in total disturbs one or more acres, to apply for coverage under the general permit 2012-0006-DWQ.
- The construction general permit requires a SWPPP be developed and implemented by the discharger. The SWPPP implements practices to minimize pollutant runoff, including non-structural and structural BMPs and monitoring requirements.

Shasta County Grading Ordinance:[7]

- Grading means the movement of any earth materials:
  - in excess of 250 cubic yards; or

- o that damages or has the potential to significantly damage directly, or indirectly through erosion, any natural or manmade watercourse, whether year-round or intermittent, including drainage channels; or
  - o to make a road, temporary access road, building pad, mobile home pad, or a new sewage disposal system when the installation of the sewage disposal system requires changes in the natural contour of the land; or
  - o that disturbs 10,000 square feet or more of surface area; or
  - o unless exemptions from the ordinance apply.

- Control erosion and sedimentation and prevent damage to off-site property and streams, watercourses, and aquatic habitat.
- Avoid creation of unstable slopes or fill areas.
- Prevent impairment or destruction of potential leach fields for sewage disposal systems.

City of Redding Municipal Code: Buildings and Construction:[13]

- Chapter 16.12 of the City of Redding Municipal Code requires clearing, grading, fills, and excavation safeguards to life, health, property, the environment, and the public welfare by establishing minimum requirements for grading, clearing, and erosion control.[61]

City of Redding General Plan: Natural Resource Element:

- Minimize soil erosion and sedimentation problems resulting from development activities; improve the quality of stormwater runoff.
- NR1 Policies A-J: Control erosion and sediment.

8.5 Highways and Roads

Highways can impact water quality due to chemical spills that occur from accidents, SSOs and as non-point contamination sources. Non-point sources are discussed under Section 8.13 Urban Runoff. Table 8.2 lists documented hazardous material spills that occurred in the watersheds from 2015 to 2020. The California Highway Patrol is usually the first to respond to a spill on a state highway or interstate and may act as the incident commander during the response unless another agency (e.g., USFS, NPS, city, university) presides over the land.

In order to help prevent hazardous material spills from an accident, the Federal Motor Carrier Safety Administration and California Department of Motor Vehicles regulate the transportation of hazardous materials on California highways and roads.

Roads and highways may also contribute to erosion, as discussed under Section 8.4 Geologic Hazards and Erosion. Herbicides are sometimes applied by the California Department of Transportation (Caltrans) along highways and roads, and this is covered under Section 8.10 Pesticides and Herbicides.

Additionally, attention is beginning to be called toward the materials that are used in vehicle tires, which include: natural rubber, plastic polymers, sulfur, zinc oxide, silica, carbon black, oils, steel wires, and fabric. The average car in the U.S. loses nearly 5 kg of tire fragments annually.[89] Tire fragments are one of the major sources globally of microplastics in waterways, making up almost 30% of the microplastic particles in the ocean.[90] The main chemical associated with harm to the aquatic ecosystem is 6PPD, used to make tires last longer, which reacts with ozone to become

6PPD-quinone.[90] 6PPD-quinone runs off into waterways and is toxic to some aquatic life. The toxicity to aquatic life raises concern for human impact.[88] More studies will need to be conducted to gain a better grasp on what this means for water supply concerns while tire manufacturers work to provide an alternative for this chemical.

Shasta Watershed

Several highways and one interstate traverse the Shasta Watershed. Interstate 5 is a major thoroughfare through the north state traversing the western end of the watershed from north to south. State Highways 44, 89, 139, and 299 also pass through the watershed.

Trinity Watershed

State Highway 3 is the only major road in the Trinity Watershed. Highway 3 heads north from Weaverville to the watershed and travels through the communities of Covington Mill and Trinity Center on the lake before exiting the watershed at the north end.

Whiskeytown Watershed

State Highway 299 is the only highway in the Whiskeytown Watershed. It is also the most direct route for commercial shippers between Redding and the coast.

Sacramento River Watershed

State Highway 299 is the only major highway in the Sacramento River Watershed. As mentioned above, it is also the most direct route for commercial shippers between Redding and the coast. Highway 273 also crosses the watershed near its southern boundary.

8.6 Industry and Regulated Dischargers

Industries that discharge waste are required to obtain permits from the SWRCB. In California, the Office of Environmental Health Hazard Assessment and the SWRCB share responsibility for classifications of waste. The SWRCB issues two types of discharge permits:

- An NPDES discharge permit from the SWRCB is required for any point source that discharges pollutants into waters of the United States.[14]
- A WDR permit from the SWRCB is required if the discharge is from a diffused source (e.g., erosion from soil disturbance or waste discharges to land) and is not released into surface water.

The NPDES program is a federal program that was created in 1972 as a part of the Clean Water Act to reduce or eliminate harmful discharges into surface waters. The SWRCB, along with nine RWQCBs, administer the NPDES program and manage the WDRs of all permit holders. An NPDES permit site is usually inspected once per year, while non-NPDES sites may go several years between inspections.[15] Discharge requirements are established by the RWQCB to abate the impact of discharges on receiving waters.

Wastes must be disposed of properly to prevent environmental contamination and degradation. The most common form of industrial waste is wastewater, which is often treated on-site by the permit-holding industry. The most common type of wastewater is storm water runoff generated from industrial facilities, and they may be required to divert their storm water to settling ponds.

Shasta Watershed

Table 8.3 lists the 56 permits issued by the Central Valley RWQCB in the Shasta Watershed, and Figure 8.4 shows their locations. Of these discharges, 14 have NPDES permits. Mines that release acid mine drainage (AMD) are required to have NPDES permits and are listed in Table 8.6 and described under Section 8.8 Mines. Photo 9 shows one of the Shasta Watershed industrial dischargers, Lehigh Southwest Cement Company, just south of Shasta Lake.

Marinas can have accidental discharges into Shasta Lake as a result of resort and marina operations. It is likely that activities such as the refueling of vessels, storage of fuel, pump out of houseboat wastes, and maintenance of facilities (including cleaning and washing of rental houseboats) result in some quantities of pollutants being discharged into the lake. However, these spills are probably small in overall impact.

Marinas are required by the Central Valley RWQCB to submit monthly sewage discharge summaries for both septic system and off-site disposal. They are also required to collect water samples near the docks a few times each year, on holidays and other busy weekends, to determine fecal and total coliform counts. Total and fecal coliform counts are highest near the marinas during the peak activity summer months of July and August.

Photo 9 - Lehigh Cement, a Regulated Discharge in the Shasta Watershed

There are two pressurized sewer mains that cross the Sacramento River. The two span the upper Sacramento River near the City of Dunsmuir. A gravity sewer main spans a tributary creek at Mary Street in the Lower Sacramento River located in the City of Redding. The Dunsmuir sewer crossings were installed in 1988 and 2006 and meet current standards and regulations. Previously, the Mary Street gravity main along Jenny Creek had the potential to backup during major storm events, contaminating Jenny Creek. The City of Redding has since installed new sewer mains along Jenny Creek and increased the size of the containment pond at the nearby upgraded lift station to reduce the likelihood of overflow.

Trinity Watershed

No NPDES permits have been issued in the Trinity River Basin.[16] There is only one permitted discharger in the Trinity Watershed, and it is shown and described on Figure 8.5.

Whiskeytown Watershed

The only large industrial activity in the Whiskeytown Watershed is the Washington Mine. The mine obtained an NPDES permit for discharge to land or creeks in 2011. Shasta Gold Corp. boasts of a "state of the art" treatment plant that discharges higher quality effluent than the receiving creek water.[76] On June 24, 2006, a pipeline at the mine burst and released approximately 1,150 gallons of contaminated water into the watershed.[21] Other than the mine, there are no other known major industrial activities in the watershed. There are five permitted dischargers in the watershed, and their locations are shown on Figure 8.6 and are described in Table 8.4. The Central Valley RWQCB issues permits for sites that release pollutants that may potentially harm receiving waters.

Four of the five permitted dischargers are discharging domestic wastewater to either a septic/leach field system or to some type of treatment facility. The remaining discharger is a mine, and these are covered under Section 8.8 Mines.

Sacramento River Watershed

There are five permitted dischargers in the Sacramento River Watershed, and these are shown on Figure 8.7 and described in Table 8.5. Three of the dischargers possess NPDES permits that allow them to discharge to receiving waters. The Stowell Mine is known to discharge AMD from several adits. Above the mine discharge, water quality is adequate to support a fishery.[77] The hope was that remedial efforts would lead to the restoration of stream quality between Stowell Mine and IMM; however, it was determined that quality would never support a fishery since remediation was not able to control the flow of contaminated groundwater.[78]

8.7 Timber Harvesting

Timber harvesting generally does not pose a direct threat to water quality; however, activities associated with harvesting timber have the potential to contaminate surface waters. Most timber harvesting activities require roads, which can result in accelerated erosion.

Specific water quality and beneficial use protection programs are in place on both private and public lands. The California Board of Forestry is responsible for the development of the California Practice Rules, a set of BMPs used to ensure resource protection for timber harvesting on state and private lands. Timber Harvest Plans required the CDF to set the stage for planning and implementing BMPs. On private land, the SWRCB monitors implementation of the California Practice Rules and requires compliance with General WDRs or may issue a Categorical Waiver. The Central Valley RWQCB primarily issues a waiver for timber harvesting that includes fuel management and post-fire salvage projects. Recently, the SWRCB has begun to require that timber companies visually monitor creeks and rivers for contamination before, during, and after harvesting. In national forests, the RWQCB monitors the USFS and independent contractors for implementation of BMPs and for compliance with Categorical Waivers.

Contracts between the USFS and timber harvesting companies require that BMPs be implemented to protect surface water during the road building and timber harvesting process.[17] Riparian Reserves, established in the Forest Plan, restrict land use activities along waterways to protect water quality. Management measures exist to address silvicultural sources of nonpoint pollution. From pre-harvest planning to post-harvest revegetation, the forestry management measures aim to reduce surface water contamination from timber harvesting activities.

Salvage harvesting is important in managing a healthy forest from future forest fires and insect outbreaks. However, because of increased environmental requirements and changing environmental practices, salvage harvesting has become almost impossible, as burned timber typically needs to be harvested within a year of being burned before the timber is considered dead. According to a USFS official, completing the required environmental documents may exceed the year, in which the timber is then determined to be no longer salvageable. Limited salvaging occurred from the 2018 Delta, Hirz, and Carr Fires due to additional complexities such as limited access, which discouraged timber companies from applying for salvaging permits with the USFS.[64] The majority of timber salvaging from the Carr Fire occurred in the Trinity Watershed with about 900,000 board feet harvested while the Whiskeytown, Shasta, and Sacramento River Watersheds, combined, only had about 500,000 board feet harvested.[66,67]

Within the Shasta Watershed, most salvaging from the Delta and Hirz Fires occurred within a 350-foot buffer around major roads and Interstate 5.[66]

Shasta Watershed

A significant amount of timber harvesting is occurring in the Shasta Watershed on both public and private lands. Over 75 million board feet have been harvested from the Shasta-Trinity National Forest in the last five years.[65] In previous years, timber harvesting in the Shasta-Trinity National Forest exceeded 120 million board feet. Several private timber companies are harvesting timber from their land in the watershed as well. The cumulative impact from the harvesting of timber is probably not a threat to water quality because of the state and federal agencies regulating and monitoring it.

Most of the timber harvesting in the watershed on National Forest land is occurring on the McCloud Flats area of the McCloud River Watershed. According to a USFS official, there is no direct drainage into surface water from the McCloud Flats area, so erosion is of little threat to water quality.[18] Another timber harvesting area is the Devil's Garden area of the Pit River drainage, which is very flat, and erosion is of little concern due to the runoff collecting in basins instead of creeks and rivers.[19]

The Central Valley RWQCB states that there is significant logging by private companies occurring in both the upper Sacramento River and the Pit River Watersheds and that all activities are monitored closely.[22]

According to the 1996 NRA Management Guide, no additional permanent roads will be constructed for timber harvest within boundaries of the NRA.[10]

Trinity Watershed

Historically, almost 7 million board feet of timber are harvested from public lands in the Trinity Watershed each year.[17] Within the last five years, however, the only harvesting that has occurred was salvage harvesting from the Delta and Carr Fires.[67] The EPA has determined that erosion is the primary contaminant of concern in this watershed. As a result of limited timber harvesting, the impact to water quality due to erosion caused by construction of new roads and deterioration of old roads required for the transportation of harvested timber is likely negligible.

Approximately 70 percent of the watershed is under public ownership and is managed by the USFS,[9] and this includes both national forest and wilderness areas. Only a small portion of the public lands allow timber harvesting.

Logging on both private and national forest land causes some erosion and subsequent sedimentation of the streams and lakes.[9] Historically, the greatest amount of timber harvest activity and road construction has occurred in the Stuart Fork and East Fork Trinity River Watersheds.[9]

The NRA 1996 Management Guide states that future timber management activities in the Trinity Unit of the NRA will be designed to meet recreation, visual, and wildlife objectives while maintaining healthy, diverse, and vigorous vegetative communities.[10]

There may be harvesting of timber on private land, but no documentation is available as to the exact numbers. A majority of the remaining 30 percent of the watershed is owned by two commercial timber companies, Sierra Pacific Industries and Timber Products Company.[9]

Whiskeytown Watershed

The USFS is not issuing timber harvesting permits on National Forest land in this watershed.[64] The only known harvesting occurring on private land was emergency hazardous tree removal following the Carr Fire, and it is reasonable to believe the Carr Fire has reduced the amount of timber available for harvesting in the near future.

There are few, if any, logging roads being constructed in the watershed, but old roads could pose a potential threat to water quality as stated in Section 8.4 Geologic Hazards and Erosion.

Sacramento River Watershed

There is very little to no timber harvesting in the Sacramento River Watershed, and thus, there appears to be no associated threat to water quality. There are few, if any, logging roads being constructed in the watershed, but old roads could pose a potential threat to water quality as explained in Section 8.4 Geologic Hazards and Erosion.

8.8 Mines

Mines can impair water quality by leaching the heavy metals found in the mine and leftover tailings outside of the mine. This process is known as AMD and occurs when metals are exposed to water resulting in the release of hydrogen ions. As hydrogen ions are released, the pH of the water drops and more metals are leached into the water resulting in a cycle of higher metal concentrations and lower pH values. Not all mines create AMD, but those that do may pose a threat to the water quality of local surface water bodies.

A metal of concern is mercury because it was used in the extraction of gold and was discarded by miners near the mine sites during the gold rush. However, the chemistry of mercury is such that it is not readily mobile because mercury tends to accumulate in sediment and in biota and not concentrate in water. A review of the raw water analyses for the PWSs that draw water from the Whiskeytown and Sacramento River Watersheds (Tables 9.4, 9.5, 9.6, 9.7, and 9.12) indicates that there has only been one event where there was detectable mercury levels in the raw water.

To prevent AMD from entering the waterways, a variety of remediations projects have been put in place at certain mines to treat mine leachate and runoff. Per Central Valley RWQCB, many remediation treatment systems at these mines have been upgraded within the last ten years.[73]

In 2009, the State of California prohibited the practice of suction dredge mining, and in 2016, the State began developing an NPDES permit for suction dredge mining.[73] A draft permit for dredging is available, and it is expected that the final permit will be adopted soon.

Mines that discharge AMD and/or mercury into waterways are required to obtain a discharge permit through the NPDES process, administered by the EPA and SWRCB, as was described under Section 8.6 Industry and Regulated Dischargers.

In 2015, approximately three million gallons of AMD was accidentally discharged into the Animas River, a tributary of the Colorado River. This incident prompted the EPA to begin surveys of mine sites to assess sudden discharge potential. A survey had been conducted for Shasta County; however, the final report is still pending.[80]

The recent 2018 fire season has brought a new awareness to potential threats to critical, and often remote, infrastructure that may exist at these mine sites to maintain water quality in the watersheds. The Carr Fire burned significant areas within the Sacramento, Whiskeytown, and Shasta Watersheds impacting the IMM Superfund site, Washington Mine, Greenhorn Mine, Golinsky Mine, and Mining Remedial Recovery Corporation – owned mine properties within the West Squaw Creek and Little Backbone Creek drainages. Infrastructure like conveyance pipelines, process buildings, containment units, and mine ventilation systems were damaged at these sites. The IMM Superfund site is working to make their infrastructure more fire resilient–metal pipelines instead of HDPE pipelines, vegetation management, and fire suppression. Luckily, there were no significant discharges known to surface water as a result of the fire damage.

Shasta Watershed

There are many abandoned mines in the Shasta Watershed, most of which are concentrated in two historical mining districts: the East and West Shasta Copper Districts. Some of these mines are in the remediation process. The Balaklala, Mammoth, and Golinsky Mines, located in close proximity to each other in the western portion of Shasta Lake, are considered Superfund sites, but they are not on the on the EPA's National Priorities List (NPL).[52] The IMM, located nine miles northwest of Redding, is the only mine in the watershed that is currently listed on the EPA Superfund NPL. These mines are known to discharge heavy metals and AMD into surface waters, and their location is shown on Figure 8.8 with a description in Table 8.6. Several of these mines pose a potential threat to water quality from AMD, and most of these mines possess a discharge permit and an NPDES permit.

The IMM does not have a permit and experiences high surface erosion, and its impact on water quality is of concern. The 2018 five-year review for IMM noted that no remediation efforts occurred outside of typical operation and maintenance procedures during that five-year period.[79] The Golinsky Mine is unique in that it is the only mine in the area that is under USFS jurisdiction, and in 2010, a major remediation project was constructed. A 1 GPM sulfur reducing bioreactor (BCR) pilot project in 2003 indicated the AMD could be efficiently treated with this technology. In 2010, the $1.3 million full-scale project was complete, including a 10 GPM BCR and a 1.5-mile-long pipeline to collect and deliver AMD, which was funded by the American Recovery and Reinvestment Act. The treatment system has functioned unattended since installation and is achieving approximately 95 percent metal recovery and a more neutral pH. This construction project came after attempting to contain the AMD through the use of concrete bulkheads, which appeared to further deteriorate the water quality. With a projected useful life of 10 years for the media, it is estimated that the unit treatment cost is approximately 1.3 cents per gallon of AMD in 2015 dollars.[23]

The Bully Hill/Rising Star Mine Complex is a permitted discharger that produces AMD and is managed by a local environmental company. Between 2011 and 2015, upgrades were made to their treatment systems to include two sulfate-reducing bacteria passive treatment systems, a containment dam, and a drain to convey discharge to the passive treatment systems.[73]

The Keystone, Early Bird, Balaklala, Shasta King, Mammoth, and Sutro Mine Complex are permitted dischargers with NPDES permits. The AMD from all of these mines is a potential threat to water quality, and the complex has a remediation program through a separate local environmental company. Recent upgrades were made to the Keystone Mine passive treatment system to treat additional flows.[73]

<u>Trinity Watershed</u>

There are abandoned mines in the Trinity Watershed; however, there is limited information available at present to determine the extent of their impact on water quality. The watershed appears to be contaminated with mercury, and an advisory warning has been issued regarding eating fish caught from the Trinity River, Lewiston Lake, or Trinity Lake.

Sampling by the U.S. Geological Survey (USGS) of mercury concentrations in water, sediment, insects, amphibians, and fish indicates that the inactive Altoona Mercury Mine, located in the East Fork Trinity River Basin, is a significant contributor of mercury to Trinity Lake.[24] In 2009, erosion control measures were installed at the mine site.[82] The location of the mine is shown and described on Figure 8.9. The USGS has contracted with the USFS to monitor the Altoona Mine for mercury contamination; however, it is located on private property and is not registered as a permitted discharger with the Central Valley RWQCB.

Mercury contamination is a concern in the watershed. As previously discussed, mercury was used in the extraction of gold and was discarded by miners near mine sites; however, the chemistry of mercury is such that it is not readily mobile. Mercury tends to accumulate in sediment and in biota. Note that some of the Trinity Watershed waters are diverted to Whiskeytown Lake, which may be the potential source of mercury in the lake. In 2010, Whiskeytown Lake was added to the EPA 303(d) list as impaired because of mercury concentrations. Since 1994, the PWSs that draw water from the Whiskeytown Watershed have only had one detectable measurement of mercury in their raw water analyses. The DDW is considering a policy that states no waivers will be issued for mercury monitoring to any PWS that draws waters originating from the Trinity Watershed.

From 1848 through the mid-1900s, the watershed was extensively mined for gold. Mining processes often involved dredging and hydraulic mining, which removed large amounts of material from hillsides and valley floors. These activities significantly altered the geologic landscape and contributed to accelerated erosion.

A sediment source study done by Graham Matthews and Associates reports that high turbidities in Diener Creek can be attributed to bare ground surrounding an abandoned mine.[25] Ditches created for the diversion of water to hydraulic mining operations have created slope stability problems where surface runoff is trapped and diverted.[25]

The March 2015 Upper Trinity River Watershed Analysis reports that there are no existing mining claims in the watershed, and no new claims will be issued in the NRA.

Whiskeytown Watershed

Mines may be impairing water quality in the Whiskeytown Watershed; however, there is limited data available at present to determine the extent of the threat. As mentioned above, imported water from Trinity and Lewiston Lakes through the Clear Creek Conduit may be contaminating the watershed with mercury.

There is one mine located within the Whiskeytown Watershed registered with Central Valley RWQCB. The Washington Mine has discharge requirements and restarted operations in 2006. The Washington Mine is of concern, as made evident by a pipe break in 2006 that subsequently discharged up to 10 tons of tailings into the Scorpion Gulch Creek over a six- to eight-hour period. In 2010, Washington Mine reopened under new ownership and obtained an NPDES permit from the Central Valley RWQCB. The Central Valley RWQCB issued an NPDES permit outlining seven discharge points, with six locations on Scorpion Gulch Creek. Per the Central Valley RWQCB, in 2017 the tailings from the Washington Mine were consolidated into a lined waste management unit.[73]

The Greenhorn Mine is no longer active and does not have a current NPDES permit. The USGS suspects that the El Dorado Mine is contributing AMD. Figure 8.10 shows the locations of the Washington and El Dorado Mines in the watershed, and Table 8.6 describes the mines.

There are over 100 additional abandoned mines in the Whiskeytown NRA boundary.[12] At least 19 gold mines processed gold using mercury in the amalgamation process.[26] There are some small active mining claims in the Whiskeytown Watershed, and their locations can be found on the BLM GeoCommunicator website.[27] Whiskeytown NRA is currently conducting a study of mining sites suspected of being contaminated by metals.[12] In 2011, Clear Creek CSD, which draws water from the Whiskeytown Watershed, has detected mercury in its raw water analyses.

Sacramento River Watershed

The Stowell Mine and IMM, located in the Sacramento River Watershed, are reported to be producing AMD. The Stowell Mine is part of a mine complex that has discharge requirements and an NPDES permit and is under remediation through the local environmental company that is performing remediation for the Keystone, Early Bird, Balaklala, Shasta King, Mammoth, and Sutro Mine Complex. The rest of the mine complex is located just north of Stowell in the Shasta Watershed. The IMM is a federal Superfund site located in the watershed and is described in Section 8.9 Toxic Cleanup Sites. Figure 8.11 shows the locations of the Stowell Mine and IMM in the watershed.

8.9 Toxic Cleanup Sites

Superfund sites located in the Shasta and Sacramento River Watersheds are shown on Figure 8.12.

Toxic cleanup sites may be managed by two government agencies: The California Department of Toxic Substances Control or the EPA as a Superfund (CERCLA) site. Each agency has its own classification standards and methods to determining if a site is considered toxic and if mitigation is required.

California Department of Toxic Substances Control Mitigation Standards: Because each site is unique, cleanup levels must be calculated for each site through a risk assessment, which takes into account the types of toxic materials at each site, the potential receptors, the pathways that the toxic compounds might follow to get to the receptors, and their fate in the environment. The process begins with a Preliminary Endangerment Assessment, which may be followed by a health risk assessment, depending on the findings of the Preliminary Endangerment Assessment.[28]

EPA Mitigation Standards: The agency uses Preliminary Remediation Goals, which are risked-based tools, for evaluating and cleaning up contaminated sites. The tools are used to streamline and standardize all stages of the risk decision-making process. Exceeding Preliminary Remediation Goals suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate.[29]

CERCLA, commonly known as Superfund, was enacted by Congress in 1980.[30] CERCLA provided broad federal authority to respond to releases, or threatened releases, of hazardous substances and created a fund through taxation of the chemical and petroleum industries to clean up abandoned and uncontrolled hazardous waste sites. All of the toxic sites in the watershed that are being mitigated are being financed through CERCLA.

Shasta Watershed

The Balaklala and Mammoth Mines are toxic cleanup sites located in the Shasta Watershed and are shown on Figures 8.8 and 8.12. These mines leach heavy metals from the mine, adits, portals, and tailings piles and pose a potential threat to water quality in Shasta Lake. These three mines are active cleanup sites; however, they are not listed on the NPL as Superfund sites. The Mammoth Mine is documented as leaching heavy metals and AMD into surface waters and has been partially remediated. The Balaklala Mine has undergone capping of its adits; however, at this time it is unknown if this has resolved the AMD problem.[31]

Trinity Watershed

There are no reported toxic cleanup sites in the Trinity Watershed.[31]

Whiskeytown Watershed

There are no reported toxic cleanup sites in the Whiskeytown Watershed.[31]

Sacramento River Watershed

IMM is the only toxic cleanup site reported in the Sacramento River Watershed and is considered a Superfund site.[31] The mine operated from the 1860s to 1963 and produced iron, silver, gold, copper, zinc, and pyrite. Its location is shown on Figure 8.12. As a result of decades of intense mining operations, an open mine pit and massive amounts of waste rock and tailings remain on-site. The large area of the mine site (4,400 acres) has the potential of creating large volumes of AMD that can drain into Spring Creek, which is a tributary of the Sacramento River.

With the assistance of several governmental agencies acting as a trustee group, an elaborate remediation system has been constructed to reduce the concentration of metals contaminating nearby surface water. The system includes the capping of cracked and caved ground areas, diverting clean water around tailings piles, and constructing a neutralization system to increase the pH of AMD and trap contaminants on-site. Debris dams have been constructed on Spring Creek to collect metals and manage the release of contaminated water into the Sacramento River. The remediation efforts at the IMM have significantly reduced the quantity of metals and highly acidic water leaching into surface waters; however, the site will continue to produce AMD for the foreseeable future.

The historically untreated runoff from IMM flowed into the Spring Creek arm of Keswick Reservoir. As a result, this arm contained high levels of copper and zinc that settled out in the slower moving waters just prior to entering Keswick Reservoir. The heavy metal-laden sediments in this area did not support aquatic life. These contaminated sediments had the potential, if disturbed, to make water toxic.

Remediation efforts have been in place since 1986 and have been providing increased protection of the Sacramento River ecosystem. The Minnesota Flats Treatment Plant was constructed in 1994 and has been improving discharge quality ever since. From January 2013 to December 2017, the plant treated 1.6 billion gallons of AMD, with flows varying between 4 MG/month and 168 MG/month. During this period, approximately 2 million pounds of zinc and 600,000 pounds of copper were removed. The treatment plant regularly met the Clean Water Act requirements for total zinc and copper 99% of the time from January 2008 to December 2017 and 98% of the time from January 2013 to December 2017. Additionally, effluent did not exceed pH daily Clean Water Act limits from January 2013 to December 2017.[79]

Major improvements along Iron Mountain Road have been initiated to rehabilitate the area after heavy metals damage from historic smelters. Three smelters, located in historic towns of Keswick, Coram, and Kennitt in the early 20th century, released heavy metals, such as copper and arsenic, into the atmosphere. These airborne particulates settled out as they were carried south. Of particular note is the region located around Iron Mountain Road. As a result of the heavy metals settling on foliage, the area was denuded. Without presence of vegetation to prevent erosion, much of the topsoil washed away. After the smelters were abandoned, manzanita took over much of the area. In an effort to rehabilitate the region, BLM has begun masticating the existing vegetation and seeding native grasses and forbs.[43]

As mentioned in Section 8.8 Mines, the IMM Superfund site was impacted by the Carr Fire in 2018. Damages to infrastructure did occur, but no major spills resulted.

8.10 Pesticides and Herbicides

Pesticides and herbicides are used in the agricultural and forestry industries to promote healthy crops and eliminate unwanted pests and vegetation. When applied, there is the potential for surface water contamination due to drift and runoff. Some factors that may affect potential surface water contamination from pesticides and herbicides are the amount of pesticide or herbicide applied, the type of soil and slope, and the amount of available water to transport the chemical. Tables 9.4 through 9.14 are a summary of raw water lab testing results performed by the participating agencies, and none of the pesticides or herbicides tested for have been detected by the participating agencies to date.

SOCs are manmade chemicals that are used in both agricultural and industrial applications. This group of contaminants includes pesticides and herbicides. SOCs have not been used, manufactured, transported, stored, or disposed of within the participating agencies' watersheds. CDPH has, therefore, under Section 64445(d)(1) of Title 22, granted vulnerability waivers for SOC monitoring to the participating agencies. As a result, participating agencies have performed little pesticide monitoring.

A timber management specialist with the USFS states that no pesticides have been applied to National Forest land for several years.[17] Caltrans uses herbicides to inhibit unwanted vegetation along roadways; however, they follow an Integrated Pest Management Plan and are monitored by the California Department of Pesticide Regulation (CDPR). Caltrans has been developing a way to reduce the amount of herbicides they apply since 2008. They focus on herbicide application to specific plant material through an intelligent herbicide application system, not the surrounding soil, which helps reduce the quantity of herbicides needed and the amount released into the environment.[81]

In 1990, California became the first state to require full reporting of agricultural pesticide use. CDPR staff prepares annual data summaries by chemical, commodity, and location.[46]

The CDPR's Surface Water Protection Program is the lead agency for regulating the registration, sales, and use of pesticides in California. The CDPR is responsible for conducting studies that measure pesticide concentration in surface water, determine how any residues enter the water, and evaluate or develop methods of keeping pesticides out of waterways. The CDPR is conducting studies to find methods to reduce pesticide runoff.[9]

In 2017, the Central Valley RWQCB established a pyrethroid pesticide control program via Resolution No. R5-2017-0057, which requires the monitoring and/or management of pyrethroid pesticides by August 2021.[80]

County agricultural commissioners serve as the primary local agents enforcing pesticide laws and regulations. They offer education and training sessions to businesses, local agencies, and the public.

The California Code of Regulations contains restrictions on the application of pesticides and herbicides and creates protection areas to prevent contamination of waterways.

The Central Valley RWQCB Management Measures outlines methods to prevent contamination of surface water by proper mixing, transporting, loading, and application of pesticides.

The application of pesticides to illegal cannabis gardens remains a concern. Outdoor cannabis cultivation practices create several negative environmental effects on wildlife, vegetation, water, soil, and other natural resources. The County Sheriff's Office of Marijuana Eradication Team regularly finds containers of pesticides in gardens. This is especially true of Mexican cartel groves. These grows are of particular concern because of the quantity and type of pesticides used. Much of the observed pesticides are outlawed in the United States. Cartel growers use large amounts of these pesticides that have the potential to contaminate surface waters.[45] Quantifying the impact of these practices to nearby surface waters is difficult because of a lack of data. The Office of National Drug Control Policy has reported that the cost to the federal government to clean up and restore one acre of land used to cultivate cannabis is $14,900 to $17,700.[45] In 2010, approximately 10 million plants were removed from nearly 24,000 illegal outdoor grow sites nationwide.[45]

The USFS no longer uses pesticides or herbicides in the Shasta-Trinity or Modoc National Forests. Caltrans uses herbicides along highways only when other nontoxic methods are unavailable or ineffective. The CDPR produces an annual statewide pesticide use report by county. Table 8.7 indicates the reported pounds of pesticides applied per county. However, no information on locations applied has been found. Additional information regarding commodity and number of applications can be found on their website http://www.cdpr.ca.gov/docs/pur/purmain.htm.

In the Whiskeytown watershed, the NPS uses very few pesticides or herbicides. When the NPS applies pesticides or herbicides in Whiskeytown NRA, it follows the NPS Integrated Pest Management Plan.[32] An Integrated Pest Management Plan coordinator must approve all pesticides and quantities applied.[32]

8.11 Recreation

Recreational activities in a watershed include hiking, camping, boating, hunting, fishing, horseback riding, mountain biking, and OHV use, all of which have the potential to impair surface waters. Potential contaminants that could be released from these activities include sediment, petroleum derivatives, Giardia, Cryptosporidium, and coliform bacteria.

Body contact recreation is a potential contamination source. This occurs when the public is in contact with the water, such as swimming, water-skiing, and rafting, and can result in a release of microorganisms into the water through urination, defecation, and a natural shedding/washing of the body.[10] The degree of the contamination is relative to the number of people using the facilities and their behavior. The USFS provides restrooms near campsites, and floating toilets are provided on the lakes that are easily accessible by boats. Microbial contamination from boats with wastewater collection systems on-board is a concern because they may accidentally spill fecal-contaminated water into the surface water.

Petroleum-based discharges from boat and personal watercraft engines may be released into the water. Two-stroke engines release unburned fuel into surface water through the exhaust. The EPA estimates that as much as 30 percent of their fuel and oil can be discharged unburned directly into the water due to inefficient combustion.[11]

MTBE is an oxygenate added to gasoline to reduce air emissions and is a suspected carcinogen. The taste threshold of MTBE is below suspected carcinogenic levels, and water contaminated with MTBE can produce a chemical odor and foul taste making the water undrinkable.[12] The use of MTBE in gasoline was banned in California on January 1, 2004.

The Chappie-Shasta OHV area, shown on Figure 8.3, contains approximately 52,000 acres of federal and private lands and 250 miles of roads and trails that are managed by the BLM for OHV use by the public. Equal portions of this area are located in both the Whiskeytown and Shasta Watersheds, although the Whiskeytown portion of the trails do not appear to be as heavily used by riders or other OHV users.[33] BLM performs an ongoing monitoring and maintenance program to ensure that erosion is managed in the Chappie-Shasta OHV area and to identify areas of concern before they become a problem. The main staging area and some trails are located in the Sacramento River Watershed. Much of the OHV trail system is made up of rocky soil, which minimizes erosion caused by OHV use. To mitigate impacts to the watershed, user groups volunteer to help BLM with trail maintenance. One of the largest user groups, the Redding Dirt Riders, takes the lead in organizing events and trail maintenance. Organized OHV events in the area are permitted and supervised by BLM. The Mining Remedial Recovery Corporation, which is a major private landowner in the area, is actively working to rehabilitate old mining sites in the OHV area and normally does not allow any OHV activity on their property. The Mining Remedial Recovery Corporation does allow restricted access to their lands for OHV events by permission only.[44]

Shasta Watershed

Policies managing recreation in the watershed mitigate the potential adverse impacts from recreational use. Furthermore, recreation does not appear to be a major threat to water quality in the Shasta Watershed because of Shasta Lake's large volume.

The Shasta Watershed is largely made up of the Shasta-Trinity, Modoc, and Lassen National Forests, Whiskeytown-Shasta-Trinity NRA, along with a portion of Lassen National Park. Also found in the watershed are several wilderness areas and state preserves and parks. These areas provide an enormous amount of recreation for thousands of people throughout the year.

Shasta Lake is a very popular destination spot for recreation during the summer months and is the largest reservoir in California. The reservoir is within a half-day's drive for millions of people and provides a great variety of recreation opportunities. Figure 8.13 shows the location of both public and private recreational facilities on the lake, and Figure 8.14 shows the recreation facilities in the northern portion of the watershed on the Sacramento River.[53,54]

Recreation on the lake and surrounding land in the Shasta Watershed is managed by the USFS as part of the Whiskeytown-Shasta-Trinity NRA. Campgrounds located near the lake are equipped with either vault toilets, septic tank/leach field systems, or are connected to a community sewage collection system. All marinas and some campgrounds and recreational areas are required to comply with discharge requirements set by the Central Valley RWQCB. According to the 1996 NRA Management Guide, no additional marinas on the lake beyond the existing eleven will be authorized.[10] Only merging, consolidation, and/or relocations of existing resorts would be considered.

The USFS has established a permitting system to limit the number of houseboats on Shasta Lake to 648 permitted private and 450 permitted commercial houseboats. The USFS issues and monitors the permits; however, the Central Valley RWQCB monitors the water quality impacts from the houseboats. The Central Valley RWQCB decided to review their policies regarding the discharge of graywater into the lake because houseboats had been allowed to discharge graywater into the lake up until 2006. As of September 7, 2006, the policy changed, and it is now unlawful to discharge graywater into the lake.[35] A Memorandum of Understanding was signed by the USFS and the Central Valley RWQCB in January 2001, which outlined the elimination of graywater discharge by houseboats into Shasta Lake over a five-year span. Any discharge of graywater while docked at a marina was banned immediately because the Central Valley RWQCB determined that the discharge of graywater into Shasta Lake was a point source pollutant and violated the Clean Water Act. Houseboat owners are now required to submit yearly self-inspection reports to the USFS to ensure that all graywater is captured, and if staff is available, spot checks are performed on boats that have not submitted a self-inspection report. Some inspections were conducted by the USFS in September 2006 when the graywater discharge ban went into effect. Pump-out services are available at all marinas to help prevent untreated wastewater from entering surface water.

Unorganized camping occurs in the watershed where trash receptacles and sanitary toilet facilities are unavailable, and this could impact local surface waters. These activities probably occur throughout the watershed but are likely to be concentrated near Shasta Lake. BLM and USFS have rules in place for proper disposal of waste in camping situations where no sanitation facilities are provided. The rules outline how to dispose of waste, and the minimum distance to maintain from waterways.

Popular backpacking areas, such as Mt. Shasta, Mt. Eddy, Mt. Lassen, and along the Pacific Crest Trail, experience a significant amount of camping and do not have restroom facilities. Public education by the USFS is done to reduce contamination of surface water by human waste. The USFS enforces laws and regulations prohibiting camping in illegal locations; however, it is lawful to camp in un-established campsites in most parts of the National Forest.

On the shore of the reservoir, auto-access camping is popular where flat areas become exposed from water drawdown. There are approximately ten auto-access sites on Shasta Lake, and two of these sites do not have portable toilets or waste receptacles.[36] Crews patrol these areas frequently to collect garbage and to bury visible human waste. There are sites around the lake accessible only by boat, and no facilities are provided at these locations.

Ninety-four percent of the Modoc National Forest is open to OHV use.[37]

Trinity Watershed

Recreation on both Lewiston Lake and Trinity Lake is popular with boating, fishing, and swimming being the primary recreational activities. Houseboats, personal watercraft, and other types of motorboats are also heavily used on Trinity Lake. Figure 8.15 shows the locations of recreation facilities around Trinity and Lewiston Lakes.[53,54]

Recreational lands in the Trinity Watershed are managed by the USFS, BLM, and USBR. These agencies also oversee recreational activities in the watershed such as camping, boating, and OHV use, all of which have the potential to impact surface waters.

Campgrounds located near the lake are equipped with either vault toilets, septic tank/leach field systems, or are connected to a community sewage collection system. All marinas and some campgrounds and recreational areas are required to comply with discharge requirements by SWRCB.

There are 99 permitted private and 65 permitted commercial houseboats found on Trinity Lake that are permitted and managed by the USFS.[34] Trinity Lake is the only lake in California where the discharge of graywater has not been eliminated.

Of the approximately 70 percent of federal land administered by the USFS in the watershed, one third is within the Trinity Alps Wilderness.[9] There are stringent restrictions on activity in the wilderness areas, and hiking and camping are the most common forms of recreational activities in these areas. Waste containment facilities are not provided in the wilderness areas. Public education by the USFS is conducted to reduce contamination of surface water by human waste. The USFS enforces laws and regulations prohibiting camping in illegal locations; however, it is lawful to camp in un-established campsites in most of the national forest. The BLM and USFS have rules in place for proper disposal of waste in camping situations where sanitary facilities are not provided, including how to dispose of waste and the minimum distance to maintain from waterways.

On non-wilderness national forest land, OHV use on logging roads is common, as well as hunting, horseback riding, mountain biking, camping, and hiking. Camping may occur in sites accessible only by boat, and this may pose a threat to water quality from the unmanaged disposal of waste. No overnight vehicle camping is allowed below the high-water mark.

The Whiskeytown-Shasta-Trinity National Recreation Area Management Guide states that no new land-based recreation facilities will be developed on the east side of Trinity and Lewiston Lakes, and no more than the six existing marinas on Trinity Lake will ever be authorized.

Whiskeytown Watershed

Whiskeytown Lake NRA is a popular destination for recreation during the summer months and throughout the rest of the year. Figure 8.16 shows the location of recreational facilities maintained by the NPS in the Whiskeytown Watershed.[53,54] All marinas and some campgrounds and recreational areas are required to comply with discharge requirements by SWRCB. Campgrounds located near the lake are equipped with either vault toilets, septic tank/leach field systems, or are connected to a community sewage collection system. Section 9.4 Whiskeytown Watershed addresses in greater detail the concerns and effects of body contact recreation at the public beaches located in the watershed and the water quality sampling done by the NPS.

There is a potential source of microbial contamination from boats with on-board wastewater collection systems that may accidentally spill fecal-contaminated water into the surface water. Houseboats are not allowed on Whiskeytown Lake, but smaller boats may have simple restroom facilities.

The NPS provides vault toilets at “back country” campgrounds (Brandy Creek Camps 1 and 2, Sheep Camp, and Brandy Creek Camp). However, at unorganized camping sites where no sanitation facilities are provided, the NPS has rules in place for the proper disposal of waste. The rules state the minimum distance required from waterways to dispose of the waste.

There is a potential for petroleum-based discharge from boats. Personal watercrafts are no longer allowed on Whiskeytown Lake. Fuel may be released directly from boats into the water from leaks, while refueling, or while in operation. Two-stroke engines release unburned fuel into surface water through their exhaust, and the EPA estimates that as much as 30 percent of their fuel and oil may be discharged directly into the water due to inefficient combustion.[11] Because of this, two-stroke boat engines have been banned from Whiskeytown Lake.[32]

A portion of the Chappie-Shasta OHV area is located in this watershed as previously described.

Sacramento River Watershed

A small portion of the Shasta-Trinity NRA is included in the Sacramento River Watershed and is managed by the USFS. Recreational activities in the watershed include camping, boating, bicycling, and OHV use. Figure 8.17 shows the location of recreational facilities located in the Sacramento River Watershed.[53,54]

Campgrounds located near the river are equipped with either vault toilets, septic tank/leach field systems, or are connected to a community sewage collection system. All marinas and some campgrounds and recreational areas are required to comply with discharge requirements by the SWRCB.

There is also OHV use occurring in a small area of land across the river from the Chappie-Shasta OHV area; however, it is not heavily used by OHVs.

BLM has made efforts to control erosion in the watershed by closing unsuitable trails. In addition, major trails have been improved to reduce future degradation. Improvements such as realignment and out-sloping of trails were introduced to minimize fugitive sediments and the resulting increased turbidity seen in receiving waters. On the east side of the Keswick Reservoir, Walker Mine Road was closed to prevent erosion from motorized traffic and the illegal dumping of refuse. As a result of this closure, BLM has seen a decrease in erosion in the area. BLM has developed non-motorized trail systems along the east side of the Keswick Reservoir to encourage responsible recreation. Culverts were installed at all major drainages to mitigate fugitive sediments. The culvert structures include riprap inlets and outlets. A portion of the northern end of the Sacramento River Trail, between Keswick Dam and Shasta Dam, was paved to prevent erosion as well.[43]

8.12 Septic Systems

Septic systems treat wastewater when there is enough available land and/or when a community wastewater collection system is unavailable. A typical design consists of drainage pipes from a facility connected to a septic tank followed by the leach field. The solids settle and remain in the tank and the septic tank effluent is decanted into a leach field. The leach field acts as a wastewater treatment system where microorganisms break down waste products. The solids in the tank must be removed on a regular basis to protect the leach field. The effectiveness of septic systems is dependent on the type and volume of soil the system drains into, and modern septic system standards require new septic systems to test the local soil to verify that a septic system will correctly function.

Septic systems can fail over time or they may have been poorly installed and, thus, deliver untreated or poorly treated sewage into waterways. Because the system is underground, it is difficult to determine if it is failing. Factors contributing to septic system failure include shallow soils, proximity to surface or groundwater, and the age of the system. If a river or lake tests positive for fecal coliform, the source may be from a failing septic system; however, it may be difficult to identify the responsible system.

Septic tank systems are permitted, inspected, and monitored by local county health departments. Commercial facilities discharging wastewater to a septic tank/leach field system are required to apply for discharge permits with the Central Valley RWQCB.

Shasta Watershed

Shasta County Septic System Policy[38]

If a septic system is failing, it is the owner's responsibility to repair it. To build a new septic system, an owner must perform a soil survey and submit an application along with a proposed plan to the Shasta County Department of Environmental Health for review.

Modoc County Septic System Policy[39]

It is the owner's responsibility to repair a failing septic system, and if it is not repaired within a reasonable amount of time, the house is red tagged. New septic systems must meet minimum Modoc County standards.

Siskiyou County Septic System Policy[40]

The investigation system is complaint driven, and septic system pumpers are required to notify Siskiyou County of suspected failing septic systems. To build a new septic system, an owner must perform a soil survey and submit an application along with a proposed plot plan to the Siskiyou County Department of Environmental Health, who will also inspect the installation of the system. There is a minimum 2½-acre lot size requirement for a new septic system.

Trinity Watershed

Lewiston is the primary community sewage collection system in the watershed. All other private residences and businesses rely on their own septic systems to process their waste. According to the Trinity County Environmental Health Department, in the past there have not been problems with septic systems in the Covington Mill community; however, some septic systems in the Trinity Center community may not be properly treating their wastewater due to their septic systems being installed over a shallow impervious ground layer.[41] Officials from Trinity County respond when a complaint is received regarding a septic system, and the usual procedure is to apply a dye to the septic system and search for signs of a leak emanating from the leach field.

Whiskeytown Watershed

Septic systems exist throughout the Whiskeytown Watershed. Clear Creek Mobile Estates on Clear Creek and Whiskey Creek Recreational Area each have septic systems to process their wastewater. All private residences, most of which are located in French Gulch, and public facilities in the watershed treat their wastewater with septic systems. See Shasta County Policy above.

Sacramento River Watershed

The residences in the Sacramento River Watershed located outside of the City of Redding's limits are likely to be on septic systems. The Shasta County Department of Environmental Health is responsible for permitting new septic systems, testing for failing systems, and enforcing the repair of failing systems. There are no reported specific areas in the watershed where septic systems are failing.[42] See Shasta County Policy on Septic tanks above.

8.13 Urban Runoff

Urban surface runoff drains into creeks, rivers, and lakes through storm drain systems to abate flooding in urban areas. Urban runoff may contain both point-source and non-point-source pollutants. Point-source pollutants are direct discharges, such as those from spills, while non-point-source pollutants are pollutants spread over the drainage area, such as petroleum products emanating from vehicles. Non-point-source pollutants usually enter the drainage area from rains, and often the first rains of the year contain the highest concentrations of contaminants. The large area of impermeable surfaces in urban areas allows contaminants to collect and drain quickly into waterways.

Starting in 2013, the Phase II Small MS4 General Permit was adopted and became effective. Phase II Small MS4s, or regulated small MS4s, are designated as an incorporated place or county with a population of less than 100,000, located within a census-defined boundary of an "Urbanized Area," have physical interconnection with other regulated MS4s, or have any of the following criteria:[68]

- Discharging to sensitive waters
- High population density
- High growth or growth potential
- Contiguity to an Urbanized Area
- Significant contributor of pollutants to water of the US
- Ineffective protection of water quality concerns by other programs

Phase II required smaller municipalities to implement MS4 BMPs. Through this program, new development within these Phase II areas must have Post-Construction Standard Plans in addition to SWPPPs during construction.[69] See Appendix B for Phase II MS4 boundary figures extracted from the General NPDES Order No. 2009-0009-DWQ[74] and generated by the Shasta County Department of Public Works[75]. These standard plans are intended to specifically address the concentrated pollution seen in the first flush storms. MS4 BMPs are designed based on a 1-year, 1-hour storm. The enforcement of MS4 requirements is delegated to the permitted municipalities. The RWQCB has jurisdiction to fine the permitted agency/municipality if the permit requirements are not being met.

While most of the land covered in this report is not included in the Phase II Small MS4 General Permit, the remaining areas have minimal development and impact to waterways. New development is still required to create SWPPPs to manage urban runoff and to curb impacts on waterways during construction.

Even with continued regulations, urbanized streams are still causing concern for water suppliers. While there are specific circumstances in which MS4 addresses runoff at peak flows, the primary purpose of the program is to address water quality issues presented from runoff. Stormwater drainage systems discharge directly into these creeks and streams with high velocities that suspend and transport sediment.[58] As development continues, it is anticipated that these issues will increase. Ultimately, it is the responsibility of the authority having jurisdiction of the influential areas to enforce MS4 permit requirements or implement their own stormwater runoff regulations.

The City of Redding is the largest Phase II participant within the watersheds. The City published a Stormwater Resource Plan in December 2019 that addresses their participation in the program, as well as identifies and prioritizes stormwater and dry weather runoff capture projects that provide multiple benefits to water quality, water supply, flood management, the environment, and the community.[63] The City of Redding and Caltrans, both as their own permitted jurisdictions, have the largest impact on the Sacramento River watershed, where Caltrans and the City of Redding Public Works Department direct water from all highways and roads into nearby creeks or into the Sacramento River through culverts and outfalls. Other than the City of Redding, Shasta Lake City runoff likely impacts water quality.

Some of the larger runoff concerns are from the freeways and highways within the watersheds. Interstate 5 is heavily traveled and parallels most of the Sacramento River causing it to be the largest concern. Caltrans directs water from all the highways and roads within the Shasta Watershed into nearby creeks or into the lake through culverts. Highway 3 traverses the Trinity Watershed; however, it is not heavily traveled. Highway 299 traverses the Whiskeytown Watershed, paralleling much of Whiskeytown Lake. Caltrans also directs this runoff into nearby streams or into the lake directly.

8.14 Railroads

<u>Shasta Watershed</u>

Railroads traverse the Shasta Watershed in primarily a north-south orientation as shown in Figure 8.18.[55] The railroads convey a large variety of goods through the Shasta Watershed, and there is always a possibility an accident could compromise water quality.

In 1991, over 19,000 gallons of the herbicide metam sodium was spilled from a railcar into the Sacramento River near Dunsmuir as a result of a derailment. The herbicide virtually destroyed all aquatic life in the river downstream of the accident and was detected in the water column for nearly a month. As a cautionary measure, Lakehead’s intakes were immediately shut down, although it was not detected at any municipal water intakes on Shasta Lake.[22] The density of metam sodium caused it to settle to the bottom of the reservoir, and the large volume of water in the lake appeared to have diluted the herbicide below detection limits. The Southern Pacific Railroad has taken measures to reduce the likelihood of a reoccurrence by building a device at Cantara Loop to reduce the possibility of a railway car derailment at the site. Since the last Sanitary Survey Update, there have been several rail-involved incidents including collisions with trespassers and vehicles. Additionally, there were a total of five train derailments from 2016 to 2019 but none resulting in any known spills. One rail incident in 2019 did report 1,000 gallons of coal ash releasing on the track area near Mountain Gate at Grey Rock Way.

<u>Trinity Watershed</u>

There are no railroads in the Trinity Watershed.

Whiskeytown Watershed

There are no railroads in the Whiskeytown Watershed.

Sacramento River Watershed

A Southern Pacific Railroad line passes through the lower portion of the Sacramento River Watershed, as shown in Figure 8.18.[55]

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TABLE 8.1

REDDING AREA WATERSHED SANITARY SURVEY

AGRICULTURE BY COUNTY[1]

	Lassen	Modoc	Shasta	Siskiyou	Trinity
Total Farms[2]	377	423	1,337	745	185
Farm Acreage	473,413	571,191	409,975	687,313	65,800
Total Cropland Farms	227	319	622	446	107
Harvested Cropland	36,183	115,640	27,794	87,997	860
Total Irrigated Cropland	53,594	142,138	48,791	115,572	(D)
Total Livestock Facilities	262	268	811	428	128
Cattle and Calves Inventory	38,630	59,392	37,068	49,271	2,780
Hogs and Pigs Inventory	154	406	523	(D)	405
Sheep and Lambs Inventory	5,876	7,723	1,652	3,957	357

(1) All agriculture in counties, includes agriculture located outside of watershed boundary.

(2) Does not include agriculture located outside California surrounding Goose Lake.

(D) = Withheld to avoid disclosing data for individual operations.

Source: USDA National Agricultural Statistics Service, 2017 Census of Agriculture, County Data.

TABLE 8.2									
REDDING AREA WATERSHED SANITARY SURVEY									
DOCUMENTED HAZARDOUS MATERIAL SPILLS 2015 TO 2020									
Spill Control #	**Date of Incident**	**Substance**	**Type**	**Amount**	**Comments**	**Contained**	**Water Involved**	**Water Way**	**Watershed**
Lassen County									
'15-4041	7/15/2015	Diesel Fuel	PETROLEUM	80 Gal	Saddle tank punctured due to vehicle accident	Yes	No	None	Shasta Lake
'18-7099	10/19/2018	Diesel	PETROLEUM	75 Gal(s)	Motor vehicle accident, split saddle tank caused release	Stopped, not contained	No		Shasta Lake
'18-8718	12/24/2018	Diesel Fuel	PETROLEUM	5 Gal(s)	Big rig accident, punctured diesel fuel tank	Stopped, Contained	No		Shasta Lake
'19-2939	5/5/2019	Vehicle Fluids	PETROLEUM	Unknown	Vehicle accident into lake causing release	No	Yes	Poison Lake	Shasta Lake
Modoc County									
'15-1442	3/12/2015	Diesel Fuel	PETROLEUM	50 Gal	Truck fire causes oil spill on road	Yes	No		Shasta Lake
'15-2108	4/15/2015	Diesel Fuel	PETROLEUM	50-75 Gal	Saddle tank damaged in big rig accident	Yes	No		Shasta Lake
'15-3859	7/6/2015	Transformer Oil Non-PCB	PETROLEUM	10 Gal	Transformer failed due to lightning strike	Yes	No		Shasta Lake
'15-4053	7/15/2015	Diesel Fuel	PETROLEUM	30 Gal	Vehicle accident	Yes	No		Shasta Lake
'17-3468	5/16/2017	Diesel	PETROLEUM	170 Gal	Big rig saddle tank release into roadway and dirt shoulder	Yes	No		Shasta Lake
'18-3036	5/10/2018	Diesel	PETROLEUM	40 Gal(s)	Big rig accident, damaged saddle tank	Yes	No		Shasta Lake
'18-4465	7/5/2018	Oil - Motor Type, Vehicle Fluids	PETROLEUM	4 Gal(s)	Vehicle crashed into a canal causing the release, material flowed directly into the waterway	Unknown if stopped, Not contained	Yes	Unknown Canal	Shasta Lake
'18-5659	8/21/2018	Hydraulic Oil	PETROLEUM	Unknown	Several 5-gallon buckets and 55-gallon drums of hydraulic oil and unknown substances knocked over or showing signs of leaking into soil	Not stopped, Contained	No	None	Shasta Lake
'18-5643	8/21/2018	Unknown	UNSPECIFIED	Unknown	Big rig possibly had a tire blow out and trailer caught fire	Unknown if stopped, Unknown if contained	No	None	Shasta Lake
'19-3664	6/8/2019	Diesel	PETROLEUM	20 Gal	Big rig accident	No	No		Shasta Lake
'19-6314	9/30/2019	Diesel	PETROLEUM	250 Gal	Big rig accident	No	No		Shasta Lake
'20-3206	6/16/2020	Train vs Trespasser	RAILROAD	1	Rail accident	Yes	No		Shasta Lake
Shasta County									
'15-0120	1/8/2015	Unknown Oil	PETROLEUM	Unknown	Numerous black sheens from an unknown source	No	Yes	Shasta Lake	Shasta Lake
15-0206	1/12/2015	Fuel	PETROLEUM	Unknown	Fuel spilled while filling drums on boat	Unknown	Yes	Shasta Lake	Shasta Lake
'15-0292	1/16/2015	Unknown	UNSPECIFIED	0.25 Cup	Unknown substance found on ground	Yes	No		Sacramento
'15-0692	2/5/2015	Gray Water, Sewage	OTHER	Unknown		No	Yes	Creek	Sacramento
'15-0763	2/8/2015	Diesel	PETROLEUM	150 Gal	Traffic collision	Yes	Yes	Creek (name unknown)	Shasta Lake
'15-0807	2/10/2015	Chlorine	VAPOR	Unknown	Alarm activated indicating a possible leak	Unknown	No		Sacramento
'15-1412	3/12/2015	Potential Release	PETROLEUM	N/A	Truck containing fuel and oil drove off road into lake	Yes	Yes	PG&E Tunnel Reservoir	Shasta Lake
'15-2156	4/16/2015	Automotive Fluids	PETROLEUM	Unknown	Motor home is partially submerged and breaking apart in water	Unknown	Yes	Shasta Lake	Shasta Lake
'15-2435	4/29/2015	Hydraulic Fluid	PETROLEUM	50 Gal	Trespassers used containers to collect hydraulic fluid from ballast tamper and hydraulic fluid spilled	Yes	No	None	Shasta Lake
'15-2439	5/1/2015	Hydraulic Oil	PETROLEUM	15 Gal	Vandals cut hydraulic line	Yes	Yes	Pit River	Shasta Lake
'15-2528	5/6/2015	Unknown	PETROLEUM	15 Gal	Found 3 abandoned 15-gallon containers of unknown substance	Yes	No		Sacramento
'15-2587	5/9/2015	Chlorine - Unk Type	VAPOR	Unknown	Alarm activated indicating a possible leak	Unknown	No		Shasta Lake
'15-2682	5/14/2015	Diesel	PETROLEUM	25-30 Gal	Big rig accident	Unknown	No		Sacramento
'15-2752	5/18/2015	Submerged Vehicle	OTHER	1	Potential release from submerged vehicle	Unknown	Yes	Shasta Lake	Shasta Lake
'15-3282	6/11/2015	Petroleum Products	PETROLEUM	Unknown	Potential release of chemicals and petroleum from submerged vehicle	Unknown	Yes	Clear Creek	Whiskeytown

TABLE 8.2									
REDDING AREA WATERSHED SANITARY SURVEY									
DOCUMENTED HAZARDOUS MATERIAL SPILLS 2015 TO 2020									
Spill Control #	**Date of Incident**	**Substance**	**Type**	**Amount**	**Comments**	**Contained**	**Water Involved**	**Water Way**	**Watershed**
'15-3568	6/24/2015	OIL, MISC: LUBRICATING	PETROLEUM	Unknown	Boom behind power plant catching oil and creating a sheen of oil passed it	Yes	Yes	Sacramento River	Sacramento
'15-3762	7/1/2015	Diesel Fuel	PETROLEUM	100 Gal	Traffic accident	Yes	No		Shasta Lake
'15-4594	8/5/2015	Mineral Oil	PETROLEUM	5 Gal	Substation has a chronic leak	Yes	No		Shasta Lake
'15-4580	8/7/2015	Formaldehyde, UN2209	CHEMICAL	10 oz	Tractor trailer had a loose washout cap	Yes	No		Shasta Lake
'15-4992	8/25/2015	Diesel Fuel	PETROLEUM	Unknown	Traffic accident	Unknown	Yes	Whiskeytown Lake	Whiskeytown
'15-5473	9/16/2015	Diesel	PETROLEUM	200 Gal	Big rig accident	Yes	No		Shasta Lake
'15-5718	9/29/2015	Diesel Fuel	PETROLEUM	50 Gal	Big rig saddle tank leakage	Yes	No		Shasta Lake
'15-6381	10/28/2015	Fuel	PETROLEUM	150 Gal	Big rig accident; saddle tank spilled into storm drain	No	Yes	Sacramento River	Shasta Lake
'15-6860	11/20/2015	Illegal dumping/ miscellaneous items	UNSPECIFIED	Unknown	Found illegal marijuana grow camp; concerned about the safety of drinking water and dumped chemical fertilizer	Unknown	Yes	Drakes Creek	Shasta Lake
'15-7073	12/2/2015	Diesel	PETROLEUM	35 Gal	Big rig accident	Unknown			Shasta Lake
'15-7084	12/3/2015	Diesel	PETROLEUM	40 Gal	Saddle tank punctured due to vehicle accident	Unknown	Yes	Nelson Creek	Shasta Lake
'15-7576	12/28/2015	Amtrak Passenger Train Fire	RAILROAD	N/A	Locomotive fire	Yes	No		Shasta Lake
'16-0043	1/4/2016	Oil - Lubricating Type	PETROLEUM	0.8 Cup(s)	Reported discharge of lubricating grease resulting in a visible sheen	Yes	Yes	Tail Bay	Sacramento
'16-0943	2/12/2016	Hydraulic Oil	PETROLEUM	43226 Gal(s)	Hydraulic line malfunction	Yes	No		Whiskeytown
'16-1023	2/17/2016	Diesel Fuel	PETROLEUM	10 Gal(s)	Big rig accident	Yes	No		Shasta Lake
'16-1128	2/22/2016	Motor Oil	PETROLEUM	43102 Qt(s)	Vehicle accident	Yes	Yes	Sacramento River	Sacramento
'16-2602	5/2/2016	Trespasser Deceased on Right-of-Way	RAILROAD		Per the caller, local 9-1-1 responders found a dead body on railroad right-of-way	Yes	No		Sacramento
'16-2880	5/14/2016	Carbon Dioxide (CO2)	VAPOR	Unknown	Safety valve failure, secondary safety valve later activated	Yes	No		Sacramento
'16-2981	5/19/2016	Hydraulic Oil	PETROLEUM	400 Gal(s)	Failed governor oil system in hydroelectric powerhouse	Yes	Yes	Pitt River	Shasta Lake
'16-3079	5/21/2016	POTENTIAL RELEASE Raw Sewage	SEWAGE	Unknown	Potential release due to large lake event and lack of enough restroom facilities to accommodate event	Unknown	Yes	Lake Shasta	Shasta Lake
'16-3807	6/14/2016	Diesel	PETROLEUM	43393 Gal(s)	Unknown if release was caused by vehicle accident or recovery of vehicle	Yes	No	N/A	Shasta Lake
'16-3953	6/29/2016	Diesel	PETROLEUM	20 Gal(s)	Motor vehicle accident	Yes	No		Shasta Lake
'16-4688	8/1/2016	Diethylene Glycol 70% Triethanolamine Acetate 30%	CHEMICAL	1500 Gal(s)	Leak in elbow joint carrying referenced chemical	Unknown	Yes	Detention Basin #4	Shasta Lake
'16-5583	9/13/2016	Diesel	PETROLEUM	75 Gal(s)	Overturned hay truck released diesel fuel to soil	Yes	No		Shasta Lake
'16-5663	9/16/2016	Boat Aground	PETROLEUM	Unknown	Boat ran aground, potential for release	Yes	No	Britton Lake	Shasta Lake
'16-5707	9/17/2016	Vessel Sinking	OTHER	Uknown	Capsized vessel potentially released small amount of oil and fuel	Yes	Yes	Lake Shasta	Shasta Lake
'16-6288	10/15/2016	Diesel and Motor Oil	PETROLEUM	100 Gal(s)	Big rig accident	No	Yes	Sacramento River	Shasta Lake
'16-6310	10/16/2016	Diesel	PETROLEUM	80-90 Gal(s)	Big rig accident	Yes	Yes	Dog Creek	Shasta Lake
'16-6587	10/29/2016	Diesel	PETROLEUM	100 Gal(s)	Big rig accident	No	Yes	Slate Creek	Shasta Lake
'17-0135	1/7/2017	Diesel fuel	PETROLEUM	20-50 Gal	Saddle tank leak due to big rig accident	Yes	No	None	Shasta Lake

TABLE 8.2									
REDDING AREA WATERSHED SANITARY SURVEY									
DOCUMENTED HAZARDOUS MATERIAL SPILLS 2015 TO 2020									
Spill Control #	**Date of Incident**	**Substance**	**Type**	**Amount**	**Comments**	**Contained**	**Water Involved**	**Water Way**	**Watershed**
'17-0434	1/13/2017	Train vs Trespasser	RAILROAD	1	Rail accident	Yes	No		Shasta Lake
'17-0528	1/18/2017	Train Vs. Vehicle	RAILROAD	1	Rail and vehicle collision	Yes	No		Sacramento
'17-1448	2/16/2017	Train vs. Trespasser	RAILROAD	1	Rail accident	Yes	No	None	Sacramento
'17-2260	3/20/2017	Mineral Oil	PETROLEUM	1 Gal	Dam copper plates leaked oil into river	Unknown	Yes	Sacramento River	Sacramento
'17-2495	3/31/2017	Vessel Fluids	PETROLEUM	20 Gal	Potential release from sinking vessel	Yes	Yes	Shasta Lake	Shasta Lake
'17-2754	4/11/2017	Diesel Fuel	PETROLEUM	80 Gal	Traffic collision	Yes	No		Shasta Lake
'17-3030	4/25/2017	Train Derailment	RAILROAD DERAILMENT	N/A	Rail and vehicle collision	Yes	No		Shasta Lake
'17-4570	4/26/2017	**Historical Report**Unknown Oil	PETROLEUM	3ft x 3 ft Sheen	Sheen over creek; source believed to be tow truck company	Unknown	Yes	Small Creek, Tributary of Hat Creek	Shasta Lake
'17-3344	5/9/2017	Sewage - Raw	SEWAGE	1,000 Gal	Pipe joint rupture; substance flowed onto soil and into storm drian	Yes	Yes	South Fork Salt Creek	Shasta Lake
'17-3388	5/12/2017	Dairy Half and Half	OTHER	100 Gal	Release onto roadway due to traffic accident	No	No		Shasta Lake
'17-3771	5/28/2017	Gasoline	PETROLEUM	30 Gal	Release of substance due to boating accident	Unknown	Yes	Shasta Lake, Sacramento River	Shasta Lake
'17-3754	5/28/2017	Sewage	SEWAGE	3,000 Gal	Mainline blockage caused an overflow release from manhole to creek	No	Yes	Creek (name unknown)	Sacramento
'17-4248	6/15/2017	Gasoline	PETROLEUM	100 Gal	Vessel fire in marina; tank is intact	Yes	Yes	Shasta Lake	Shasta Lake
'17-4553	6/22/2017	Diesel Fuel	PETROLEUM	10 Gal	Traffic collision	Yes	No		Shasta Lake
'17-5741	8/10/2017	Train vs Vehicle	RAILROAD	N/A	Rail and vehicle collision	Yes	No		Shasta Lake
'17-5894	8/14/2017	Spray Cans, Pesticide	CHEMICAL	100+	Substance abandoned on ground	Unknown	No	Montgomery Creek	Shasta Lake
'17-5854	8/15/2017	Oil - Vegetable Type	OTHER	2 Gal	Broke hydraulic line on excavator releasing substance into waterway	Yes	Yes	Pit River	Shasta Lake
'17-5992	8/19/2017	Fuel and Oil	PETROLEUM	100' x 50' Sheen	Boat fire releasing substance on water	No	Yes	Shasta Lake	Shasta Lake
'17-6347	9/1/2017	Diesel	PETROLEUM	Unknown	Big rig saddle tank releasing due to traffic accident	No	Yes	Sacramento River	Shasta Lake
'17-7633	10/19/2017	Diesel	PETROLEUM	20-50 Gal	Saddle tank release due to semi-truck accident	Yes	No		Shasta Lake
'17-7772	10/25/2017	Unknown oil	PETROLEUM	100ft x 100ft Sheen	Unknown source	Unknown	Yes	SHASTA LAKE	Shasta Lake
'17-7902	10/31/2017	Fluorescent Light Bulbs	CHEMICAL	Unknown	Vehicle fire destroying substance	Yes	No	N/A	Shasta Lake
'17-7990	11/3/2017	Diesel Fuel	PETROLEUM	50 Gal	Punctured saddle tank due to big rig accident	No	Yes	Yes/Unknown Waterway	Shasta Lake
'17-8107	11/8/2017	Diesel Fuel	PETROLEUM	30 Gal	Big rig accident	Yes	No		Shasta Lake
'17-8200	11/13/2017	Diesel Fuel	PETROLEUM	100 Gal	Big rig accident; release flowed onto asphalt and into unknown ditch	Yes	Unknown		Shasta Lake
'17-8196	11/13/2017	Diesel Fuel	PETROLEUM	50 Gal	Saddle tank release due to traffic collision	Yes	Unknown	unknown	Shasta Lake
'18-0251	1/11/2018	Diesel	PETROLEUM	50 Gal(s)	Motor vehicle accident	Yes	No	N/A	Sacramento
'18-0237	1/11/2018	Diesel	PETROLEUM	50 Gal(s)	Big rig accident, damaged fuel lines	No	No		Shasta Lake
'18-0530	1/24/2018	Diesel	PETROLEUM	50 Gal(s)	Big rig accident	Yes	No	N/A	Shasta Lake
'18-0639	1/28/2018	Fuel	PETROLEUM	Unknown	Potential release due to upside-down submerged vehicle in the Sacramento River at the very bottom of the north end of Riverview Drive in Lakehead	Unknown	Yes	Sacramento River/Lake Shasta	Shasta Lake
'18-0948	2/11/2018	Diesel	PETROLEUM	50 Gal(s)	Generator mechanical malfunction	Yes	No		Shasta Lake

TABLE 8.2									
REDDING AREA WATERSHED SANITARY SURVEY									
DOCUMENTED HAZARDOUS MATERIAL SPILLS 2015 TO 2020									
Spill Control #	**Date of Incident**	**Substance**	**Type**	**Amount**	**Comments**	**Contained**	**Water Involved**	**Water Way**	**Watershed**
'18-1588	3/10/2018	Dead Deer	UNSPECIFIED		Caller reported dead deer in Castle Creek under spillway, Castle Creek is used for drinking water	Yes	Yes	Castle Creek	Shasta Lake
'18-1721	3/15/2018	Diesel	PETROLEUM	125 Gal(s)	Motor vehicle accident	Yes	No		Shasta Lake
'18-1787	3/18/2018	Suicide on HWY	OTHER		Person jumped in front of a vehicle on Interstate 5	Unknown	No	none	Shasta Lake
'18-2076	3/26/2018	Sewage, Raw	SEWAGE	50 Gal(s)	(caller reported) release started due to a PG&E power failure	Yes	No		Shasta Lake
'18-3057	5/11/2018	Fuel, diesel	PETROLEUM	50'x 30' x 3"	Fuel spill due to a fuel theft from locomotive in Lakehead Rail Yard	Yes	No	None	Shasta Lake
'18-3396	5/26/2018	Diesel	PETROLEUM	50-60 Gal(s)	Material released from saddle tanks due to a traffic collision, material impacted storm drain potentially leading to Sacramento River	Yes	Yes	storm drain	Sacramento
'18-5016	7/25/2018	Gasoline and Motor Oil	PETROLEUM	Unknown	Unknown amount of gasoline and motor oil mix released into Oak Bottom Marina due to Carr Fire, fire burned some of the substance, 200ft x 300ft light sheen remaining but naturally dissipating, potential for more release, remaining substance unrecoverable	Unknown if stopped, Other	Yes	Oak Bottom Marina	Whiskeytown
'18-5066	7/27/2018	Chlorine gas	CHEMICAL	1.5 Ton	Chlorination building at the Whiskeytown water treatment facility on fire, potential release	Other	Yes	Water Treatment Facility	Whiskeytown
'18-5277	8/5/2018	Diesel fuel	PETROLEUM	60-70 Gal(s)	Big rig accident, ruptured saddle tank	Stopped, Contained	No		Shasta Lake
'18-5506	8/8/2018	Insulating Oil / PCB	PETROLEUM	1 Gal(s)	Carr Fire burned a pole holding an overhead transformer causing the release of the material	Stopped, Contained	No		Whiskeytown
'18-5428	8/10/2018	Oil - Mineral Type, Non PCB	PETROLEUM	50 Gal(s)	Pad-mounted transformer damaged by a wildfire incident which caused the release, material combusted then flowed onto the soil and concrete pad	Stopped, Contained	No		Sacramento
'18-5426	8/10/2018	Oil - Vegetable Type, FR3	OTHER	87 Gal(s)	Pole-mounted transformer damaged by a wildfire incident which caused the release, material combusted then flowed onto the soil	Stopped, Contained	No		Whiskeytown
'18-5639	8/21/2018	Derailment	RAILROAD DERAILMENT		Rail car of ballast derailed the third axle upright with no releases and no injuries	Stopped, Contained	No		Shasta Lake
'18-5948	9/3/2018	Diesel Fuel	PETROLEUM	Unknown	Release of diesel fuel from semi truck due to unknown mechanical issues resulting in the release impacting roadway/soil	Not contained	No	No	Shasta Lake
'18-6841	10/9/2018	Waste Water	SEWAGE	114 Gal(s)	Overload on pipe caused release	Stopped, Contained	Yes	Jenni Creek	Sacramento
'18-7668	11/12/2018	Gas, natural	VAPOR	Unknown	Damaged plastic natural gas service line during a residential excavation	Stopped, Not contained	No	None	Sacramento
'18-7789	11/16/2018	Train Vs Trespasser	RAILROAD		Train struck a trespasser at Abrams Lake Rd, Upton Rd resulting in fatal injuries	Stopped, Contained	No		Shasta Lake
'18-7907	11/21/2018	Diesel Fuel	PETROLEUM	100-150 Gal(s)	Traffic accident, ruptured saddle tank	Stopped, Contained	Yes	Slate Creek / Sacramento River	Sacramento
'18-8117	11/29/2018	LEAD	CHEMICAL	Unknown	Concern that bullets used at a shooting range are contaminating soil with lead	Stopped, Contained	No		Sacramento
'18-8665	12/20/2018	Train vs Vehicle	RAILROAD		Train struck unoccupied vehicle stopped on tracks	Other	No	None	Sacramento
'19-0088	1/4/2019	Unknown, Possibly Muriatic Acid	CHEMICAL	1 Gal	Container dropped from vehicle	Yes	No		Sacramento
'19-1737	2/27/2019	Soil and sediment materials	OTHER	120 Cu. Ft.	Soil containing mineral deposits and debris from shooting range washed out into feeder creek to Mary Lake	No	Yes	Unnamed Tributary of Mary Lake	Sacramento
'19-1621	3/6/2019	Possible Spill	UNSPECIFIED	Unknown	Vehicle submerged in creek	No	Yes	Cedar Creek	Shasta Lake

TABLE 8.2									
REDDING AREA WATERSHED SANITARY SURVEY									
DOCUMENTED HAZARDOUS MATERIAL SPILLS 2015 TO 2020									
Spill Control #	**Date of Incident**	**Substance**	**Type**	**Amount**	**Comments**	**Contained**	**Water Involved**	**Water Way**	**Watershed**
'19-1790	3/14/2019	Methamphetamine	UNSPECIFIED	Unknown	Resident believes neighbors are cooking substance and dumping residue down the toilet; concern that substance is in sewer system and comes up other residents septic systems	No	No	None	Sacramento
'19-1827	3/16/2019	Train vs Vehicle	RAILROAD	N/A	Rail and vehicle collision	Other	No		Shasta Lake
'19-2242	4/4/2019	Hydraulic Oil	PETROLEUM	1 Cup	Leak in hydraulic line creating a small sheen on water	Yes	Yes	Iron Canyon Dam	Shasta Lake
'19-2319	4/8/2019	Diesel	PETROLEUM	50 Gal	Vehicle accident causing semi-truck tank to rupture	No	Yes	Sacramento River	Shasta Lake
'19-2293	4/8/2019	Diesel	PETROLEUM	50 Gal	Big rig accident	Yes	No		Shasta Lake
'19-2535	4/18/2019	Mineral Oil, unknown PCB	PETROLEUM	20 Gal	Transformer error due to mechanical fail	Yes	No		Shasta Lake
'19-3155	5/15/2019	Diesel Fuel	PETROLEUM	40 Gal	Saddle tank rupture due to traffic collision; release into unknown waterway	Unknown	Unknown	Unknown Waterway	Sacramento
'19-3456	5/30/2019	Diesel Fuel	PETROLEUM	5 Gal	Traffic collision	Yes	No		Whiskeytown
'19-4012	6/21/2019	Coal Ash	RAILROAD	1,000 Gal	Released onto track area	Yes	No		Sacramento
'19-4196	6/30/2019	Oil, motor	PETROLEUM	Unknown	Vehicle submerged in lake producing sheen	Unknown	Yes	Shasta Lake	Shasta Lake
'19-4652	7/20/2019	Diesel Fuel	PETROLEUM	50-80 Gal	Diesel truck accident	No	No		Shasta Lake
'19-5444	8/22/2019	Diesel	PETROLEUM	150 Gal	Vehicle accident	Yes	No		Shasta Lake
'19-5748	9/5/2019	Unknown Material	UNSPECIFIED	Unknown	Unknown material being discharged by cement plant, release onto pond, producing a white sheen	Unknown	Yes	Holding Pond	Shasta Lake
'19-6250	9/27/2019	Diesel	PETROLEUM	25-30 Gal	Big rig accident	Yes	No		Shasta Lake
'19-6656	10/16/2019	Asbestos	CHEMICAL	Unknown	Dumped asbestos-contaminated trash	Unknown	Unknown		Sacramento
'19-7292	11/13/2019	Hydraulic Oil	PETROLEUM	1 Gal	Hydraulic oil released into waterway due to mechanical malfunction	Yes	Yes	McCloud Reservoir	Shasta Lake
'19-7430	11/19/2019	Oil	PETROLEUM	11 Gal	Truck accident; release of oil, coolant, and diesel onto roadway and into drain	No	Yes	stormdrain	Sacramento
'19-7420	11/19/2019	Motor Oil	PETROLEUM	10-12 Gal	Traffic accident	Yes	No		Sacramento
'19-7498	11/22/2019	Oil	PETROLEUM	1/4-1/2 acresSheen	Sheen on lake sourcing from Antlers Boat Ramp and container on ramp	No	Yes	Shasta Lake	Shasta Lake
'19-7596	11/27/2019	unknown	UNSPECIFIED	Unknown	Due to storms, fluids are leaking from tipped vessels onto waterway	No	Yes	Shasta Lake	Shasta Lake
'19-7679	12/2/2019	Petroleum product	PETROLEUM	Unknown	Substance flowing down street from service station	No	No	None	Shasta Lake
'20-0784	2/9/2020	Train vs Trespasser	RAILROAD	1	Rail accident	Yes	No		Sacramento
'20-1554	2/10/2020	Diesel fuel	PETROLEUM	200 Gal	Substance intentionally released from drums onto dirt	Unknown	Yes	Unknown spring	Shasta Lake
'20-0843	2/11/2020	Turbine Oil	PETROLEUM	300 Gal	Human error	Yes	No		Shasta Lake
'20-1163	2/27/2020	Transformer Oil - Unknown PCB	PETROLEUM	400 Gal	Pad-mounted regulator was vandalized	Yes	No		Shasta Lake
'20-1162	2/27/2020	Oil - Mineral Type, Unk PCB	PETROLEUM	400 Gal	Pad-mounted regulator was vandalized	Yes	No		Shasta Lake
'20-2134	4/19/2020	Train vs Vehicle	RAILROAD	1	Rail and vehicle collision	Yes	No		Shasta Lake
Siskiyou County									
'15-0232	1/13/2015	Sewage	SEWAGE	100 Gal	Blockage in city main causes an overflow of a manhole	Yes	No		Shasta Lake
'15-3469	6/14/2015	Diesel Fuel	PETROLEUM	1 Gal	Vehicle releasing diesel fuel onto ground	Yes	No		Shasta Lake
'15-7139	12/5/2015	Propane	VAPOR	Unknown	Gas leaking from a switch heater	Unknown	No		Shasta Lake
'15-7627	12/29/2015	Diesel Fuel	PETROLEUM	80 Gal	Saddle tank release due to traffic accident	Yes	No		Shasta Lake
'16-0557	1/26/2016	Diesel Fuel	PETROLEUM	15 Gal(s)	Motor vehicle accident, punctured saddle tank of truck	Yes	No		Shasta Lake
'16-1675	3/17/2016	Unknown Chemical	CHEMICAL	1 Gal(s)	Container leaking inside of a trailer	Yes	No		Shasta Lake

TABLE 8.2 REDDING AREA WATERSHED SANITARY SURVEY DOCUMENTED HAZARDOUS MATERIAL SPILLS 2015 TO 2020									
Spill Control #	**Date of Incident**	**Substance**	**Type**	**Amount**	**Comments**	**Contained**	**Water Involved**	**Water Way**	**Watershed**
'16-2294	4/16/2016	Mercury	CHEMICAL	0.5-1 Cup(s)	Mercury spill located on floor of vacated residence	Yes	No	None	Shasta Lake
'16-2552	4/29/2016	Derailment	RAILROAD DERAILMENT		Derailed 8 cars, unconfirmed as empty, 6 on sides 2 upright, no car ID numbers, derailment on main line	Yes	No		Shasta Lake
'16-4928	8/12/2016	Dielectric Oil	PETROLEUM	30 Gal(s)	Mechanical failure on a transformer	Yes	No		Shasta Lake
'16-6368	10/18/2016	Diesel Fuel	PETROLEUM	5 Gal(s)	Broken fuel line in motor vehicle	Yes	No		Shasta Lake
'16-7822	12/23/2016	Treated Water	SEWAGE	10,000 Gal(s)	Ruptured treated water pipeline and overflowed secondary containment berm	Yes	No		Shasta Lake
'17-0335	1/5/2017	Sewage	SEWAGE	Unknown	Main sewer line releasing into wetlands with unknown cause	No	Yes	Unknown Wetlands Area	Shasta Lake
'17-0167	1/8/2017	Sewage	SEWAGE	Unknown	Lines over capacity due to heavy rain and snow; release 150 gal/min of sewage into storm drain	No	Yes	Lake Siskiyou	Shasta Lake
'17-1176	2/7/2017	Mineral Oil - No PCB	PETROLEUM	5 Gal	Transformer broke on a fallen power pole resulting in the release of substance	Yes	No		Shasta Lake
'17-1236	2/9/2017	Sewage	SEWAGE	4500 Gal	Release due to storm surge from manhole to storm drain leading to unnamed tributary	Yes	Yes	unnamed tributary to Lake Siskiyou	Shasta Lake
'17-3600	5/22/2017	Sewage	SEWAGE	Unknown	Pipe broke at lift station; sewage seeping on ground adjacent to Sac River	Yes	No	N/A	Shasta Lake
'17-3656	5/24/2017	Diesel Heating Fuel	PETROLEUM	15 Gal	Ruptured hose while filling up tank	Yes	No		Shasta Lake
'17-3797	5/30/2017	Mineral Oil, Certified Non-PCB	PETROLEUM	1 Gal	Tranformer on power pole fail causing the release of mineral oil on ground	Yes	No		Shasta Lake
'17-5847	8/14/2017	Oil - Mineral Type, Non PCB	PETROLEUM	2 Gal	Transformer broke on power pole resulting in the release of substance	Yes	No		Shasta Lake
'17-7006	9/26/2017	Diesel Fuel	PETROLEUM	30 Gal	Saddle tank broke releasing substance onto soil and asphalt	Yes	No	None	Shasta Lake
'17-8178	11/12/2017	Diesel Fuel	PETROLEUM	Unknown	Locomotive leaking diesel	No	No	N/A	Shasta Lake
'18-0467	1/21/2018	Diesel Fuel	PETROLEUM	10 Gal(s)	Big rig accident	Yes	No	None	Shasta Lake
'18-4245	6/27/2018	Train Derailment	RAILROAD DERAILMENT			Stopped, Contained	No		Shasta Lake
'18-4666	7/13/2018	Paint	CHEMICAL	1-5 Gal(s)	Suspected that contracting agency that paints parking lots poured paint into a storm drain	Not contained	Yes	Storm Drain - Sacramento River	Shasta Lake
'18-5140	7/30/2018	Grease	OTHER	20 Gal(s)	Grease from steam cleaning old appliances and flooring from a restaurant released onto asphalt surface, entered a strom drain that leads to Cold Creek	Not stopped, Contained	Yes	Cold Creek	Shasta Lake
'18-6103	9/9/2018	Oil, dye, non PCB	PETROLEUM	12.9 Gal(s)	Power pole and overhead transformer damaged during vegetation fire, resulted in transformer releasing oil onto soil	Stopped, Contained	No	None	Shasta Lake
'18-6484	9/25/2018	Kerosene or diesel	PETROLEUM	1 Gal(s)	Public works excavated a water meter and crews arrived on scene to discover area filled with either kerosene or diesel	Unknown if stopped, Contained	No	None	Shasta Lake
'18-7231	10/23/2018	Unknown Tar Like Substance	PETROLEUM	1 Gal(s)	Seeping of substance in several locations through wall and on foot path between Sacramento River, sheen observed on the upstream section of foot path	Not stopped, Not contained	Yes	Upper Sacramento River	Shasta Lake
18-7273	10/24/2018	Tar like substance, possibly bunker oil.	RAILROAD,UNSPECIFIED	Unknown	Tar-like substance being released into Sacramento River from seepage from under the UPRR Rail Yard, substance believed to be bunker oil that was stored under the facility in the 1800s	Not stopped, Not contained	Yes	Sacramento River	Shasta Lake
'18-7793	11/16/2018	Train vs. Trespasser	RAILROAD	Unknown	Freight train struck trespasser who jumped off bridge in front of train, 1 fatality	Stopped, Contained	No		Shasta Lake

TABLE 8.2									
REDDING AREA WATERSHED SANITARY SURVEY									
DOCUMENTED HAZARDOUS MATERIAL SPILLS 2015 TO 2020									
Spill Control #	**Date of Incident**	**Substance**	**Type**	**Amount**	**Comments**	**Contained**	**Water Involved**	**Water Way**	**Watershed**
'19-1194	2/18/2019	Train vs Trespasser	RAILROAD	N/A	Rail accident	Yes	No		Shasta Lake
'19-2509	4/17/2019	Unk Petroleum	PETROLEUM	30 Gal	Big rig accident; release into a ditch	No	Yes	Drainage Ditch	Shasta Lake
'19-3575	6/4/2019	Oil, transformer	PETROLEUM	1 Gal	Vehicle and tranformer collision causing release	Yes	No	None	Shasta Lake
'19-3929	6/17/2019	Non-PCB Mineral Oil	PETROLEUM	2 Gal	Transformer struck by tree causing the release	Yes	No		Shasta Lake
'19-4043	6/23/2019	Train Derailment	RAILROAD DERAILMENT	1	No waterways were impacted	Other	No		Shasta Lake
'19-4092	6/24/2019	Air Foam	CHEMICAL	Unknown	Water was contaminated and became discolored and milky	Stopped	Yes	Big Springs Creek	Shasta Lake
'19-4306	7/5/2019	Sewage	SEWAGE	5,000-10,000 Gal	Pump failure on lift station	Yes	No		Shasta Lake
'19-4508	7/14/2019	Mineral Oil - None PCB	PETROLEUM	1 Gal	Transformer having mechanical issues	Yes	No		Shasta Lake
'19-6686	10/16/2019	Waste Petroleum	PETROLEUM	50 Gal	Underground storage tank discovered; long-term release unknown	Yes	No		Shasta Lake
'20-0312	1/16/2020	Diesel	PETROLEUM	200 Gal	Tree fell on residential diesel tank	Yes	Yes	Stream and pond near location	Shasta Lake
'20-0936	2/17/2020	Gasoline	PETROLEUM	5-11 Gal	Traffic accident	Yes	Yes	Ditch - Flowing	Shasta Lake
Trinity County									
'15-7091	12/3/2015	SHEEN	PETROLEUM	1 Pt.	Unknown source of sheen seen on bay	No	Yes	Trinity Bay	Trinity Lake
'17-5542	8/4/2017	Black Viscus Liquid, Possibly Oil	UNSPECIFIED	50 Gal	Caltrans truck dumping substance in their maintance yard near a creek	Unknown	No		Trinity Lake
'17-6095	8/23/2017	Oil, engine	PETROLEUM	5 Gal	Vehicle submerged in creek	No	Yes	Creek	Trinity Lake
'19-2806	4/29/2019	UNKNOWN OIL	PETROLEUM	Unknown sheen	Discharge of unknown oil from unknown source	Unknown	Yes	Lewiston Lake	Trinity Lake
'20-0480	1/12/2020	Sheen	PETROLEUM	Unknown	Sheen from unknown source; possibly from dam when generator turns on	Unknown	Yes	Lewiston Lake	Trinity Lake
'20-0897	2/13/2020	Unknown Material	UNSPECIFIED	Unknown	Sheen from unknown source	Unknown	Yes	Trinity River	Trinity Lake
'20-0889	2/13/2020	Oil Sheen	PETROLEUM	Unknown	Turbines in Trinity Dam discharged oil into water releasing over dam face	Unknown	Yes	Trinity Dam	Trinity Lake

Source: https://www.caloes.ca.gov/FireRescueSite/Pages/Spill-Release-Reporting.aspx

TABLE 8.3

REDDING AREA WATERSHED SANITARY SURVEY

RWQCB PERMITTED WASTE DISCHARGE SUMMARIES[4]

SHASTA WATERSHED

Map Reference #	Discharger	Order #[1]	NPDES #[2]	Discharge/Comments	Location[3]
1	Adin CSD	2014-0153-DWQ-R5178		20,000 GPD of domestic wastewater is discharged to seven stabilization/evaporation ponds.	Section 33, T39N, R9E, MDB&M
2	Alturas Municipal Solid Waste, Class III Landfill	R5-2018-0025		Five unlined waste management units and two unlined surface impoundments are used for septage disposal.	Sections 22 & 23, T42N, R12E, MDB&M
3	Alturas WWTP	R5-2020-0004	CA 0078921	Sewerage service for the City of Alturas and serves a population of approximately 2,500. The design ADWF capacity of the facility is 0.50 MGD and discharges to the Pit River.	Section 14, T42N, R12E, MDB&M
4	Antlers Resort and Marina, Inc., (dba Antlers Resort and Marina) & USFS	R5-2008-0143		Unknown amounts of domestic wastewater is discharged to a septic/leachfield system.	Section 18, T35N, R4W, and Section 26, T35N, R4W, MDB&M
5	Bieber STP	2014-0153-DWQ-R5175		40,000 GPD of domestic wastewater is discharged to two stabilization ponds and two evaporation ponds.	Section 23, T38N, R7E, MDB&M
6	Big Valley Power LLC	R5-2007-0060		Proposing to restart a sawmill and will burn 50,000 dry tons of wood waste; process water will be discharged to northern percolation pond.	Section 14, T38N, R7E, MDB&M
7	Black Butte Class III, Municipal Solid Waste Landfill	R5-2019-0032		Unlined waste management unit; proposal to close landfill in 2003; two septage ponds closed in-place 9/1996; sludge-drying surface impoundment clean closed in 1995.	Section 32, T41N, R4W, MDB&M
8	Burney Forest Power Cogeneration Facility, Shasta Green Burney Sawmill, Fruitgrowers Supply Co.	R5-2019-0048	CA 0082490	Lined recycle pond receives: log deck wastewater; initial flush of stormwater runoff; demineralizer regeneration, and cooling tower blowdown wastewater. Lined powerplant pond receives: plant floor drain wastewater, fuel storage pile leachate, and wood fuel storage stormwater runoff. Unlined stormwater retention pond receives: sawmill and cogeneration facility stormwater runoff and when full, it discharges to Canyon Creek	Section 23, T35N, R2E, MDB&M
9	Burney Water District, WTTP	R5-2017-0050		The facility currently serves approximately 3,000 residents and has approximately 1,352 active connections, consisting of 1,195 single-family residential connections, and 157 commercial connections.	Section 9, T35N, R3E, MDB&M
10	Ca Dept of Fish & Wildlife, Mt Shasta fish hatchery	R5-2014-0161	CAG135001	ADWF of 11.64 MGD wastewater enters settling ponds prior to discharge into Cold and Wagon Creeks; domestic wastewater goes to septic/leachfield system.	Section 17, T40N, R4W, MDB&M
11	CA Dept. Parks and Recreation, Castle Crags State Park	2014-0153-DWQ-R5216		An unknown amount of domestic wastewater is discharged to eight septic tanks/seven leachfields	Section 14, T38N, R4W, MDB&M
12	CA Dept. Parks and Recreation, McArthur-Burney Falls Memorial State Park	98-138		An unknown amount of domestic wastewater to 16 septic/leachfield systems	Sections 4, 5, 19, 20, 29 & 30, T37N, R3E, MDB&M
13	California Department of Transportation, Dunsmuir Grade Facility	2014-0153-DWQ-R5180		1,500-gallon capacity septic tank and leach field to treat domestic-strength wastewater from its truck inspection facility building. Anticipated average and peak daily flows are 1,200 and 1,640 GPD.	Section 35, T40N, R4W, MDB&M
14	California Energy General Corporation & USFS, Glass Mountain Geothermal Unit	R5-2006-0115		Drilling muds with additives, oil, and associated wastewater to a sump and then removed by a tank truck for off-site disposal. A geothermal unit covers 66 sections in the area surrounding Medicine Lake; map reference # is in the middle of the property.	Several sections w/in T43N, R3E, R4E; T44N, R3E, R4E
15	California Pines CSD, California Pines Development	2014-0153-DWQ-R5176		5,000 GPD domestic wastewater discharged to stabilization ponds.	Several sections w/in T39N, T40N, T41N, R10E, R11E

TABLE 8.3

REDDING AREA WATERSHED SANITARY SURVEY

RWQCB PERMITTED WASTE DISCHARGE SUMMARIES[4]

SHASTA WATERSHED

Map Reference #	Discharger	Order #[1]	NPDES #[2]	Discharge/Comments	Location[3]
16	CalTrans, Lakehead Safety Roadside Rest Area	97-010-DWQ-R5152		An unknown amount of domestic wastewater is discharged to a septic/leachfield system.	Section 2, T35N, R5W, MDB&M
17	CalTrans, O'brien Safety Roadside Rest Area	97-010-DWQ		Max of 12,000 GPD is discharged to a disposal system consisting of: two sand filters, two lift stations, two leachfields, and three seepage pits.	Section 16, T34N, R4W, MDB&M
18	CCDA Waters, LLC., Crystal Geyser Water Company	5-01-223		ADWF of 40,000 GPD industrial wastewater discharged to a leachfield; proposed expansion equaling an avg.of 36,000 GPD.	Section 9, T40N, R4W, MDB&M
19	CDF & CDC & USFS, Sugar Pine Conservation Camp	2014-0153-DWQ-R5179		10,000 GPD of domestic wastewater sent to evaporation/percolation ponds and spray field. An unknown amount of vehicle wash water is sent to an oil/water separator and then discharged to ponds. Sewage is sent to a septic tank and effluent is pumped to a lined pond.	Section 4, T33N, R2W, MDB&M
20	CDF & CDC, Intermountain Conservation Camp	97-010-DWQ-R5167		6,000 GPD of domestic wastewater is discharged to a septic/leachfield system.	Section 24, T38N, R6E, MDB&M
21	CDF & USFS, Devil's Garden Conservation Camp	97-010-DWQ		9,800 GPD of domestic wastewater is discharged to a septic tank and lined evaporation pond.	Section 35, T43N, R11E, MDB&M
22	CDFG & PG&E, Crystal Lake Fish Hatchery	R5-2014-0161	CA 0004588	ADWF of 16.4 MGD hatchery wastewater is discharged into Baum Lake, domestic wastewater is discharged to sewage lagoons for evaporation/percolation, and additional domestic wastewater is discharged to a septic/leachfield system.	Section 32, T36N, R4E, MDB&M
23	Cedar Creek MHP	2014-0153-DWQ-R192		Mobile home park with approximately 20 connections discharging an unknown amount of domestic wastewater to the treatment system.	Section 23, T34N, R1W, MDB&M
24	Dicalite Minerals Corp.	97-03-DWQ	CA 0082058	Stormwater runoff is sent to a primary pond and is then pumped to secondary pond for settling before being discharged into a tributary of the Pit River.	Sections 25, 35 & 36, T37N, R2E, MDB&M
25	Doctor's Park Owner's Association	2014-0153-DWQ-R5206		The wastewater treatment system is comprised of a 3,000-gallon septic tank, a 1,000-gallon dosing tank/lifting station with two pumps, a 1,250-square-foot sand filter, disinfection system, monitoring wells, and a leach field.	Sections 8 & 17, T40N, R4W, MDB&M
26	Dunsmuir WWTP	R5-2018-0087	CA 0078441	0.389 MGD treated wastewater effluent is discharged into Sacramento River Sept 16-June 14 and to evaporation/percolation ponds rest of the year	Section 1, T39N, R4W, MDB&M
27	Eagle Peak Rock and Paving, Inc.	99-031		Industrial wastewater is discharged to settling ponds and domestic wastewater is discharged to a septic/leachfield system.	Section 9, T42N, R13E, MDB&M
28	Fall River Mills CSD WWTF	2014-0153-DWQ-R5177		60,000 GPD domestic wastewater is discharged to oxidation/evaporation ponds.	Section 30, T37N, R5E, MDB&M
29	Harkrader Trucking Inc., dba Packers Bay Marina and the U.S. Department of Agriculture, Forest Service (former Holiday Flotels Inc.)	R5-2007-0105		Unknown amounts of domestic wastewater is discharged to a holding tank and then to off-site disposal	Section 29, T34N, R4W, MDB&M
30	Hat Creek Construction & Materials, Inc. & TLT Enterprises, LLC., Aggregate Processing Facility	01-225		3,200 GPD sand wash water and an unknown quantity of a concrete batch plant wash is sent to a 30-acre pond.	Section 10, T36N, R3E, MDB&M
31	Hearst Corporation Vacation Complex	2014-0153-DWQ-R5189		Domestic wastewater flows up to 5,000 GPD for a facility that consists of four aeration tanks, a settling tank and blowers, and two leachfield disposal sites.	Sections 27 & 34, T39N, R2W, MDB&M

TABLE 8.3

REDDING AREA WATERSHED SANITARY SURVEY

RWQCB PERMITTED WASTE DISCHARGE SUMMARIES[4]

SHASTA WATERSHED

Map Reference #	Discharger	Order #[1]	NPDES #[2]	Discharge/Comments	Location[3]
32	Holiday Harbor, Inc. & USFS	R5-2008-0125		An unknown amount of domestic wastewater from houseboats is discharged to a holding tank and then taken offsite for disposal. Domestic wastewater from the marina is discharged to a septic/leachfield system.	Section 15, T34N, R4W, MDB&M
33	Intermountain Fair of Shasta County RV Park & Shasta County	97-010-DWQ-R5147		4,000 GPD domestic wastewater is discharged to two percolation ponds.	Section 9, T37N, R5E, MDB&M
34	Intermountain Landfill, Inc., Class III Landfill	R5-2017-0124		Leachate from a closed landfill is discharged to a storage tank then to a WWTP. Landfill closed in 1993.	Sections 36, T36N, R3E, MDB&M
35	I'Sot Corporation	97-010-DWQ-R5138		30,000 GPD of domestic wastewater is discharged to lined evaporation ponds.	Section 25, T42N, R9E, MDB&M
36	Lassen County, Bieber Class III Landfill	R5-2007-0175		Unlined Class II landfill for non-hazardous solid waste.	Section 14, T38N, R7E, MDB&M
37	Lassen Gold Mining, Inc., Hayden Hill Mine	R5-2003-0022	CAU000191	All waste management units are classified as Class B (wastes that consist of or contain nonhazardous soluble pollutants of concern which exceed water quality objectives for, or could cause, degradation of waters of the state); all waste management units have a leachate collection system.	Sections 1 & 6, T36N, R9E, Sections 31 & 36, T37N, R9E
38	Lassen Volcanic National Park	97-010-DWQ-R5150		Less than 20,000 GPD domestic wastewater is sent to several septic tanks and leachfield systems.	Section 34, T30N, R4E, MDB&M
39	Lehigh Southwest Cement Company	97-03-DWQ	CA 0081191	Stormwater runoff from access roads is sent to intermittent tributaries of the West Fork of Stillwater Creek and Shasta Lake; sediments from rock processing and storm events diverted through a sediment control device; domestic wastewater is discharged to septic/leachfield system; this location is also in Sacramento River zone.	Sections 2, 3, 4, 8, 9, 10, 16 and 17, T33N, R4W, MDB&M
40	McCloud Class III Municipal Solid Waste Landfill	R5-2003-0082		In operation from early 1950s to 2002; proposed to close in 2003.	Sections 6 & 7, T39N, R2W, MDB&M
41	McCloud CSD WWTF	R5-2017-0078	CAU000167	225,000 GPD domestic wastewater is discharged to four ponds and one overland flow area.	Section 7, T39N, R2W, MDB&M
42	Milenimum Holdings,Inc Rising Star Waste Rock Containment	R5-2005-0096		Inactive copper mine in central Shasta County near Shasta Lake with underground workings and large waste rock dumps. Principal sources of low pH, metal-laden discharges referred to as acid rock drainage (ARD).	Section 21, T34N, R3W, MDB&M
43	Mining Remedial Recovery Company, Inc., Keystone, Early Bird, Balaklala, Shasta King, Mammoth, and Sutro Mines	R5-2002-0153	CA 0081876	All abandoned mines. Acid mine drainage (AMD) from mines and several adits; mining concluded in 1927; remedial actions taken to reduce AMD in all mines and adits. Mine sites are located in two watersheds (Shasta Lake & Sacramento River).	Sections 11, 12, 14, 23, T33N, R6W, MDB&M

TABLE 8.3

REDDING AREA WATERSHED SANITARY SURVEY

RWQCB PERMITTED WASTE DISCHARGE SUMMARIES[4]

SHASTA WATERSHED

Map Reference #	Discharger	Order #[1]	NPDES #[2]	Discharge/Comments	Location[3]
44	Mt Shasta Board & Ski Park	2014-0153-DWQ-R5197		Max of 30,000 GPD domestic wastewater is discharged to leachfield; oil/water separator is used to treat industrial wastewater.	Sections 3 & 9, T40N, R3W, MDB&M
45	Mt. Shasta WWTP	R5-2017-0117	CA 0078051	ADWF of 0.637 MGD treated effluent into Sacramento River Nov 16-April 30, and to a leachfield the rest of the year.	Section 28, T40N, R4W, MDB&M
46	Peloria Marinas, LLC (dba Bridge Bay Resort and Marina) & USFS	R5-2018-0045		Sewage generated by three houseboat pumpouts, floating and on-shore restroom facilities (Marina #3), two courtesy docks, an office, on-site employee housing, a mechanic shop, a general store, a restaurant, 40-room hotel, two mobile homes, and a maintenance building.	Section 4, T33N, R4W, MDB&M and Section 33, T34N, R4W, MDB&M
47	Peloria Marinas, LLC, (dba Digger Bay Marina) & USFS	R5-2017-0074		Collects sewage from houseboat pumpouts, floating restroom facilities, and residences in a 4,000-gallon floating holding tank and then pumps that to a 15,000-gallon septic tank where it is pumped to 860 lineal feet of leachfield. The design capacity of the system is estimated to be 4,644 GPD.	Section 11 & 12, T33N, R5W, MDB&M
48	Rancheria RV Park	2014-0153-DWQ-R5211	CA 0082058	Settled stormwater runoff is sent to primary pond and then pumped to secondary for settling and then to a tributary to Pit River.	Section 8, T33N, R5E, MDB&M
49	Shasta Lake Resorts Ltd. Partnership, (dba Jones Valley Resort) &USFS	2014-DWQ-0153-R5332		175,000 gal/yr of domestic wastewater is sent to a septic/leachfield system, unknown amount of domestic wastewater from office/residence is sent to septic/leachfield system; wastewater from houseboat cleaning is discharged to the lake.	Section 4, 5 and 8, T33N, R3W, MDB&M
50	Sierra Pacific Industries-Burney Division Sawmill-Cogeneration Facility	R5-2020-0017	CA 0003981	All industrial wastewater is collected in recycle ponds; First flush of rain of the season is collected in recycle pond, otherwise discharged to Canyon Cr.; domestic wastewater is discharged to a septic/leach field system.	Section 24, T35N, R2E, MDB&M
51	Silverthorn Resort Associates Ltd. Partnership, (dba Silverthorn Resort/Marina) & USFS	R5-2008-0126		750,000 gal/yr of domestic wastewater to septic/leachfield system; ~1% septic wastewater sent for off-site disposal.	Section 31 & 32, T34N, R3W, MDB&M
52	Siskiyou Golf Resort, Inc. Mt. Shasta Resort	R5-2012-0086		Max of 0.7 MGD recycled WWTP effluent is used to water 90 acres of golf course.	Section 28, T40N, R4W, MDB&M
53	Sousa Ready Mix, Inc. Upton Road Facility	98-158		Industrial wastewater is discharged to evap/perc pond and domestic wastewater is discharged to a septic/leachfield system.	Section 5, T40N, R4W, MDB&M
54	Union Pacific Railroad Co. Dunsmuir Railyard	R5-2016-0076-01	CA 0083178	GW extraction and treatment system for the removal of petro contaminants; max of 0.16 MGD treated wastewater is sent to a subsurface infiltration gallery immediately adjacent to Sacramento River.	Section 25, T39N, R4W, MDB&M
55	USFS, Canby Ranger Station	97-010-DWQ-R5142		An unknown amount of domestic wastewater is sent to a septic tank, transfer line, and settling pond.	Section 30, T42N, R10E, MDB&M
56	William T. Murphy and Siskiyou Co., dba Railroad Park	97-010-DWQ-R5155		Max of 1,120 GPD domestic wastewater is sent to a septic/leachfield system, in addition to what is already in place.	Section 2, T38N, R4W, MDB&M

(1) Order # without an NPDES is a Non-15 facility that discharges to land only and not to surface waters.
(2) NPDES number signifies a discharge to surface waters.
(3) The location of the Shasta Watershed dischargers is shown on Figure 8.4.
(4) See Reference 85 at the end of Chapter 8.
Note: Order # 2014-0194-DWQ are applicable to the maintenance of municipal drinking water systems and were excluded from this table.
Source: https://www.waterboards.ca.gov/water_issues/programs/ciwqs/publicreports.html.

TABLE 8.4

REDDING AREA WATERSHED SANITARY SURVEY

RWQCB PERMITTED WASTE DISCHARGE SUMMARIES[4]

WHISKEYTOWN WATERSHED

Map Reference #	Discharger	Order #[1]	NPDES #[2]	Discharge/Comments	Location[3]
1	Kennewick Man, LLC., dba Clear Creek Mobile Estates	2014-0153-DWQ-R5202		15,000 GPD domestic wastewater is discharged to a septic/sand filter/leachfield system.	SECTION 27, T33N, R5W, MDB&M
2	National Park Service, Brandy Creek Recreation Area	2014-0153-DWQ-R5262		Max of 18,000 GPD domestic wastewater is discharged to an activated sludge treatment plant; treated/chlorinated effluent is discharged to a 1 MG tank during wet season and to a spray field in the dry season	SECTION 18, T32N, R6W, MDB&M
3	National Park Service, Oak Bottom Marina	2014-0153-DWQ-R5261		Design flow of 39,000 GPD; domestic wastewater is sent to the WWTP; effluent is sent to the tank to spray fields (June-Oct).	SECTION 6, T32N, R6W, MDB&M
4	National Park Service, Whiskey Creek Recreational Area	97-010-DWQ		Domestic wastewater is sent to a septic/leachfield system.	SECTION 9, T32N, R6W, MDB&M
5	French Gulch Nevada Mining Corporation (Washington Mine)	R5-2011-0026		A gold mine. Wastewater is from tailings. Arsenic is below the MCL. Wastewater is considered Group C and does not pose a threat to water quality.	SECTION 17, T33N, R7W, MDB&M

(1) Order # without an NPDES discharges to land only and not to surface waters.

(2) NPDES number signifies a discharge to surface waters.

(3) The location of the Whiskeytown Lake Watershed dischargers is shown on Figure 8.6.

(4) See Reference 85 at the end of Chapter 8.

Note: Order # 2014-0194-DWQ are applicable to the maintenance of municipal drinking water systems and were excluded from this table.

Source: https://www.waterboards.ca.gov/water_issues/programs/ciwqs/publicreports.html.

TABLE 8.5

REDDING AREA WATERSHED SANITARY SURVEY

RWQCB PERMITTED WASTE DISCHARGE SUMMARIES[4] SACRAMENTO RIVER WATERSHED

Map Reference	Discharger	Order #[1]	NPDES #[2]	Discharge/Comments	Location[3]
1	Stowell Mine	R5-2002-0153	CA 0081876	Abandoned mine. AMD from mine and adits. Mining concluded in 1927. Remedial actions were taken to reduce AMD.	Section 14, T33N, R6W, MDB&M
2	Livingston Stone Hatchery	R5-2014-0161	CAG135001	0.84 MGD granular activated carbon filtered water discharged into Sacramento River; 0-2.45 MGD organic wastewater sent through a UV disinfection system and then to Sac. River; domestic wastewater to septic/leachfield system	Section 15, T33N, R5W, MDB&M
3	Bureau of Reclamation Shasta Dam	93-010		Unknown amounts of domestic wastewater is sent to a septic/leachfield system; unknown amounts of water from water/oil separator is sent to leachfield; 12,000 GPD from facility, oil removed by a belt skimmer and water sent to Sacramento River.	Section 15, T33N, R5W, MDB&M
4	City of Redding, Bureau of Reclamation Buckeye Water Treatment Plant	95-006		Backwash water is sent to recovery basin and three sludge beds; domestic wastewater is sent to a septic/leachfield system.	Section 13, T31N, R6W, MDB&M
5	Crystal Creek Aggregate, Inc. and Jerry Dale Comingdeer	97-010-DWQ	CA 0082767	Aggregate wash water is sent to recycle ponds and then reused after settling; stormwater runoff is sent to settling ponds.	Sections 29 & 30, T39N, R5W, MDB&M

[1] Order # without an NPDES discharges to land only and not to surface waters.

[2] NPDES number signifies a discharge to surface waters.

[3] The location of the Sacramneto River Watershed Dischargers is shown on Figure 8.7.

[4] See Reference 85 at the end of Chapter 8.

Note: Order # 2014-0194-DWQ are applicable to the maintenance of municipal drinking water systems and were excluded from this table.

Source: https://www.waterboards.ca.gov/water_issues/programs/ciwqs/publicreports.html.

TABLE 8.6
REDDING AREA WATERSHED SANITARY SURVEY

MINES OF CONCERN

NAME OF MINE	WATERSHED	PERMITTED DISCHARGER[1]	DESCRIPTION	LOCATION
IRON MOUNTAIN	SACRAMENTO	NO	Designated as a federal Superfund site in 1983 that leachates severe AMD and heavy metals from exposed minerals during mining exploits requiring significant remediation efforts	Sections 8, 9, 10, 11, 12, 15, 16, and 17, T33N, R6W
BULLY HILL RISING STAR	SHASTA LAKE	YES-#48 R5-2005-0096	AMD from several portals, waste rock piles, tailings, smelter wastes, and seeps; mining concluded operation in 1927	Sections 15, 16, and 21, T34N, R4W, MDB&M
SHASTA IRON	SHASTA LAKE	NO	High surface erosion on steep, bare slopes; information lacking; investigation needed to assess potential water quality impacts from mine	Section 26, T34N, R4W
GOLINSKY	SHASTA LAKE	NO	Only mine in area not patented by a mining company; it is instead under public ownership and managed by the USFS; a remediation program is in place to reduce potential threats to water quality from AMD	Section 28, T34N, R5W
KEYSTONE EARLY BIRD BALAKLALA SHASTA KING MAMMOTH STOWELL SUTRO	SHASTA LAKE	YES-#47 R5-2002-0153 NPDES: CA0081876	All abandoned mines; AMD is potential threat to water quality from mines and several adits; mining concluded in 1927; remedial actions taken to reduce AMD in all mines and adits	Sections 11, 12, 14, and 23, T33N, R6W, MDB&M
EL DORADO	WHISKEYTOWN LAKE	NO	Mine of concern for potential contamination according to the USGS	Section 3, T32N, R7W, MDB&M
SCORPION	WHISKEYTOWN LAKE	NO	Collapsed mine with discharge water that contains high levels of arsenic, nickel, and zinc.[3]	Section 18, T33N, R7W
WASHINGTON	WHISKEYTOWN LAKE	Yes-#7 WDR R5-2011-0026	Active gold mine; wastewater from tailings; arsenic below MCL; wastewater is considered Group C and does not pose a threat to water quality	Section 17, T33N, R7W, MDB&M
ALTOONA	TRINITY LAKE	NO	USFS contracted with USGS to monitor; mine is on private land, drainage is on public land; documented contributor of mercury to East Fork Trinity River and Trinity Lake	Section 22, T38N, R6W

[1] See RWQCB Permitted Waste Discharge Summaries Tables.
[2] See Figures 8.8, 8.9, 8.10, & 8.11 for mine locations.
[3] See Reference 87 at the end of Chapter 8.

AMD Acid Mine Drainage
RWQCB Regional Water Quality Control Board
USFS United States Forest Service
USGS United States Geological Service

Table 8.7

REDDING AREA WATERSHED SANITARY SURVEY

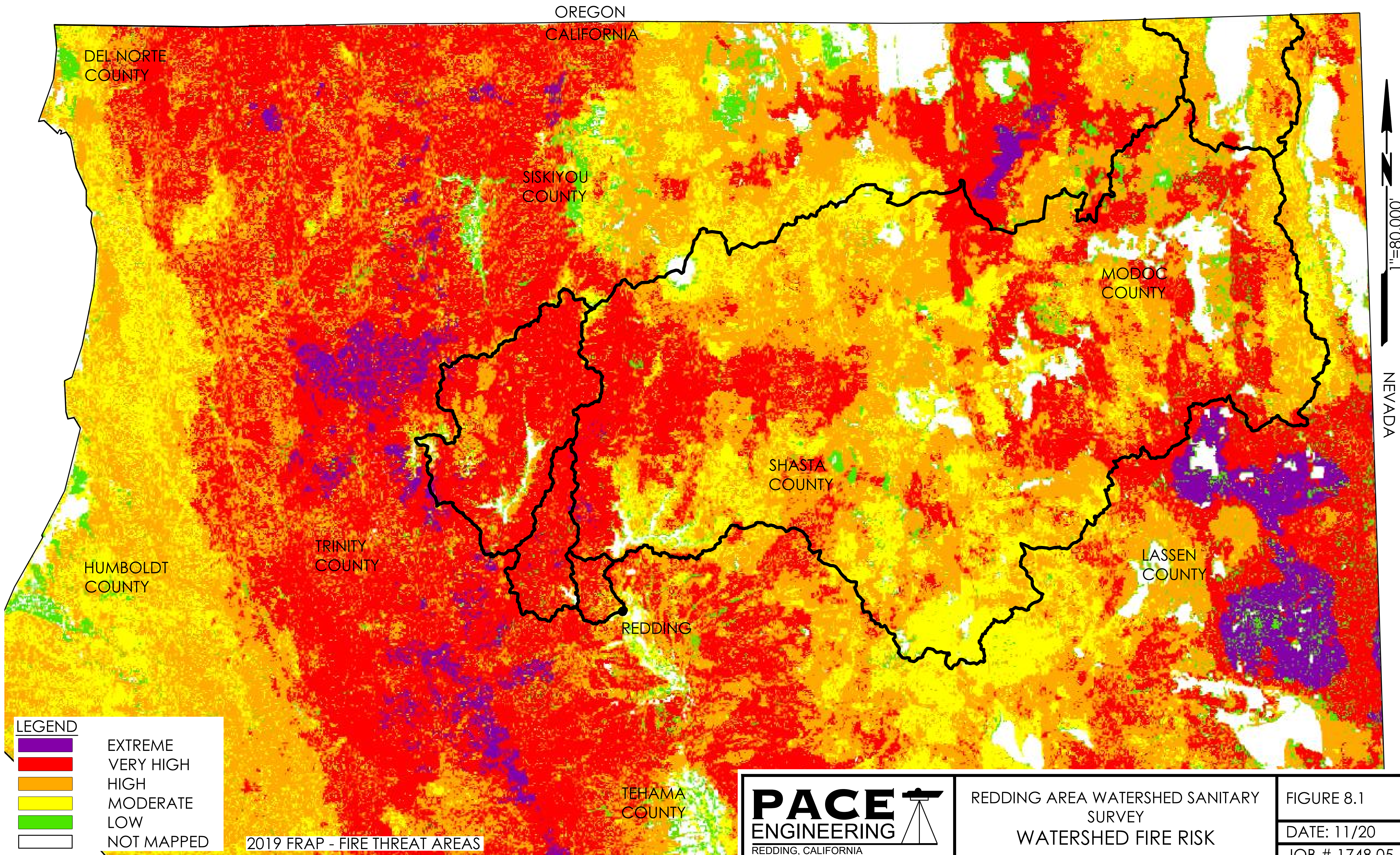
REPORTED PESTICIDE APPLICATION BY COUNTY

REPORTED PESTICIDE APPLICATION BY COUNTY [1]

	2014		2015		2016		2017	
	Total Pesticide Application, Lbs.	Agricultural Application, Lbs.	Total Pesticide Application, Lbs.	Agricultural Application, Lbs.	Total Pesticide Application, Lbs.	Agricultural Application, Lbs.	Total Pesticide Application, Lbs.	Agricultural Application, Lbs.
Shasta	617,600	456,175	681,008	506,539	752,611	593,085	659,216	475,696
Siskiyou	3,455,801	3,398,291	3,042,593	2,996,337	3,174,873	3,111,272	2,606,456	2,567,995
Modoc	246,281	231,990	567,957	445,369	267,066	247,208	248,559	233,236
Lassen	258,899	240,547	164,516	134,903	215,788	191,814	143,523	133,028
Trinity	53,352	48,129	11,991	10,181	54,206	53,479	52,782	52,545

Source: http://www.cdpr.ca.gov/docs/pur/purmain.htm

[1] Calliffornia's pesticide use reporting program requires county agricultural commisioners to report all agricultural pesticide applications, including pesticide applications to parks, golf courses, cemeteries, rangeland, pastures, and along roadside and railroad rights-of-way. A pesticide includes the following: A substance, or mixture of substances, intended to defoliate plants, regulate plant growth, or prevent, destroy, repel, or mitigate any insects, fungi, bacteria, weeds, rodents, predatory animal, or any other form of plant or animal life declared to be a pest detrimental to vegetation, man, animal, or households, or any environment.



PACE ENGINEERING
REDDING, CALIFORNIA

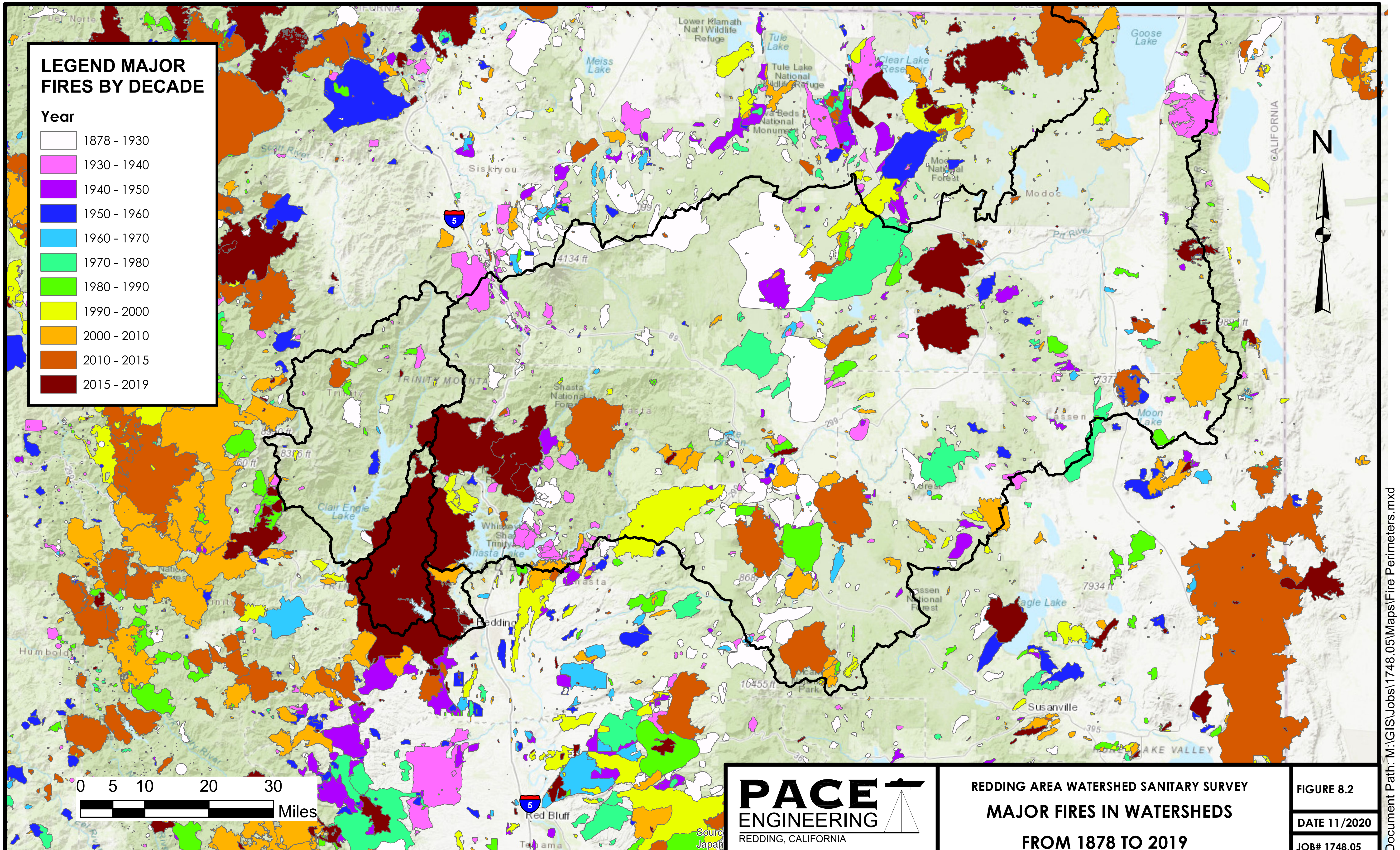
REDDING AREA WATERSHED SANITARY SURVEY
WATERSHED FIRE RISK

FIGURE 8.1

DATE: 11/20

JOB # 1748.05

Plot Date: November 19, 2020 – 10:01 am Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Fire Figures.dwg, Layout: FIG8.1


LEGEND MAJOR FIRES BY DECADE
Year
1878 - 1930
1930 - 1940
1940 - 1950
1950 - 1960
1960 - 1970
1970 - 1980
1980 - 1990
1990 - 2000
2000 - 2010
2010 - 2015
2015 - 2019
N
0 5 10 20 30
Miles
Redding
Red Bluff
Susanville
Siskiyou
Trinity
Shasta
Lassen
Modoc
Humboldt
Clair Engle Lake
Eagle Lake
Goose Lake
Tule Lake
Meiss Lake
Clear Lake Reservoir
Moon Lake
Lower Klamath Nat'l Wildlife Refuge
Tule Lake National Wildlife Refuge
Lava Beds National Monument
Modoc National Forest
Shasta National Forest
Lassen National Forest
Pit River
Scott River
TRINITY MOUNTAINS
Whiskeytown Shasta Trinity
Shasta Lake
HONEY LAKE VALLEY
CALIFORNIA
4134 ft
7934 ft
10455 ft
PACE ENGINEERING
REDDING, CALIFORNIA
REDDING AREA WATERSHED SANITARY SURVEY
MAJOR FIRES IN WATERSHEDS
FROM 1878 TO 2019
FIGURE 8.2
DATE 11/2020
JOB# 1748.05
Document Path: M:\GIS\Jobs\1748.05\Maps\Fire Perimeters.mxd

PACE ENGINEERING
REDDING, CALIFORNIA

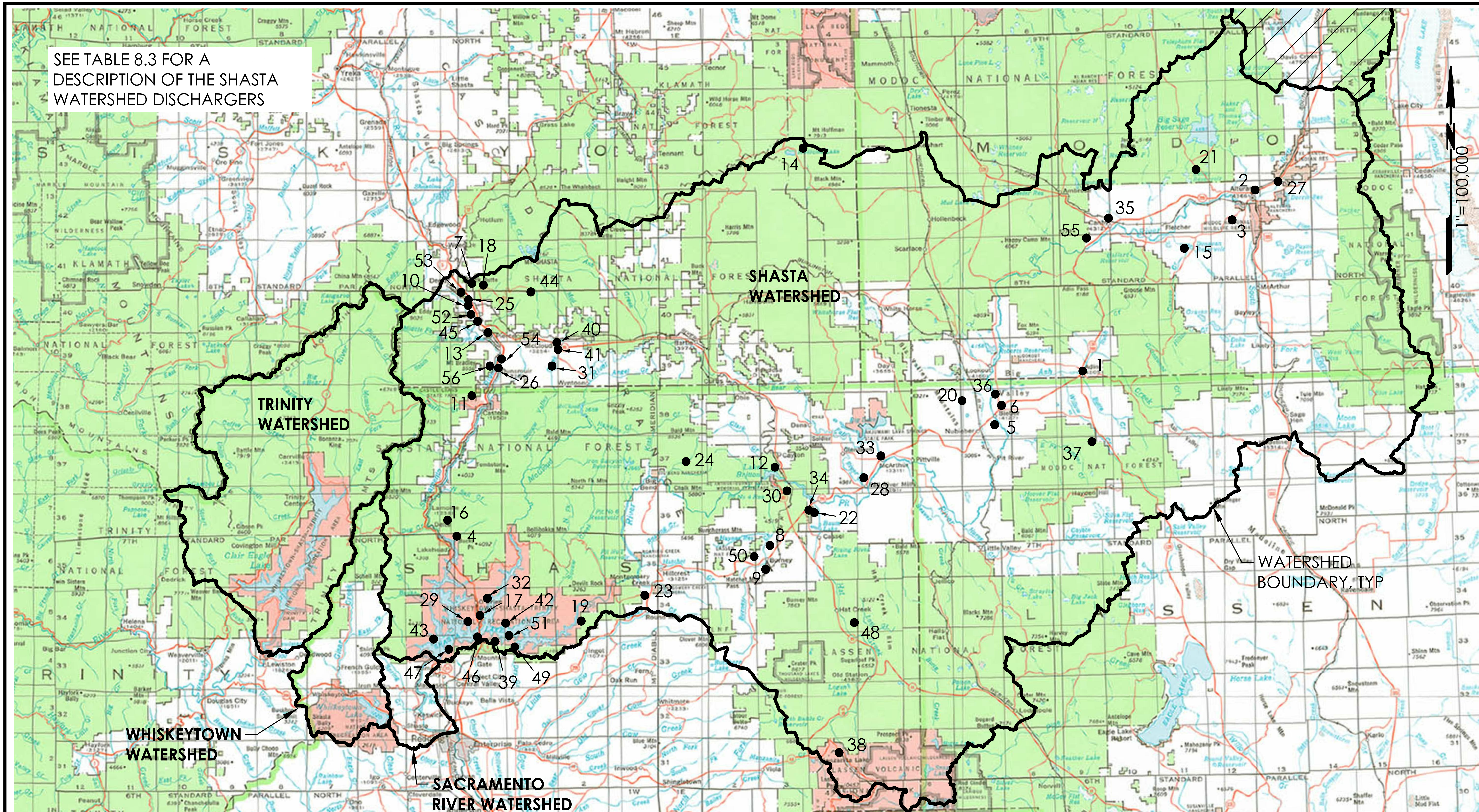
REDDING AREA WATERSHED SANITARY SURVEY
CHAPPIE-SHASTA OFF HIGHWAY VEHICLE TRAILS SHASTA, WHISKEYTOWN, & SACRAMENTO RIVER WATERSHEDS

FIGURE 8.3

DATE: 11/2020

JOB # 1748.05

Plot Date: November 19, 2020 – 2:08 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Figure 8.3.dwg, Layout: FIGURE 8.3



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

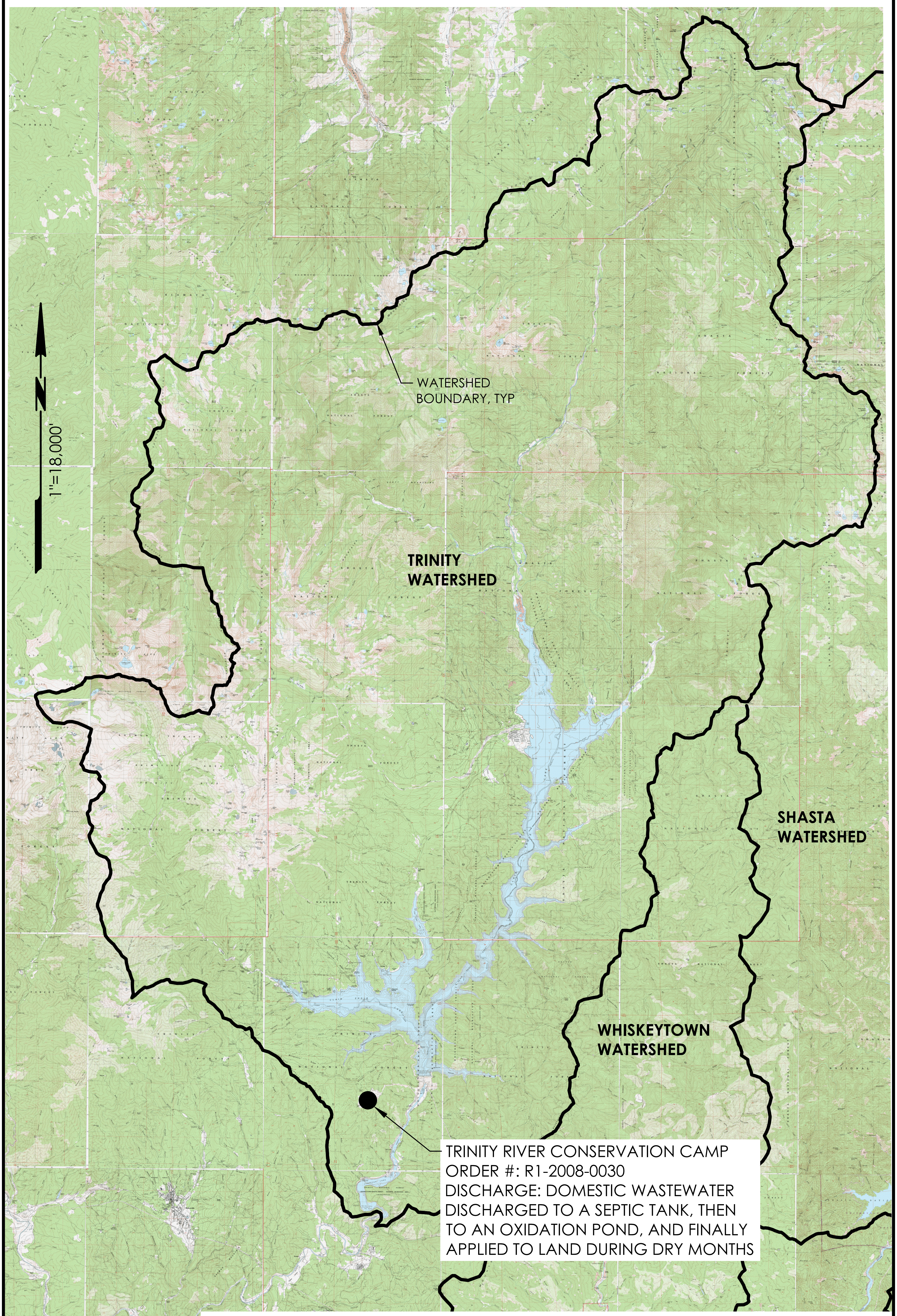
SHASTA WATERSHED PERMITTED DISCHARGERS

FIGURE 8.4

DATE: 11/2020

JOB # 1748.05

Plot Date: November 19, 2020 – 2:28 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Shasta Watershed Figures.dwg, Layout: FIG8.4



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

TRINITY WATERSHED PERMITTED DISCHARGERS

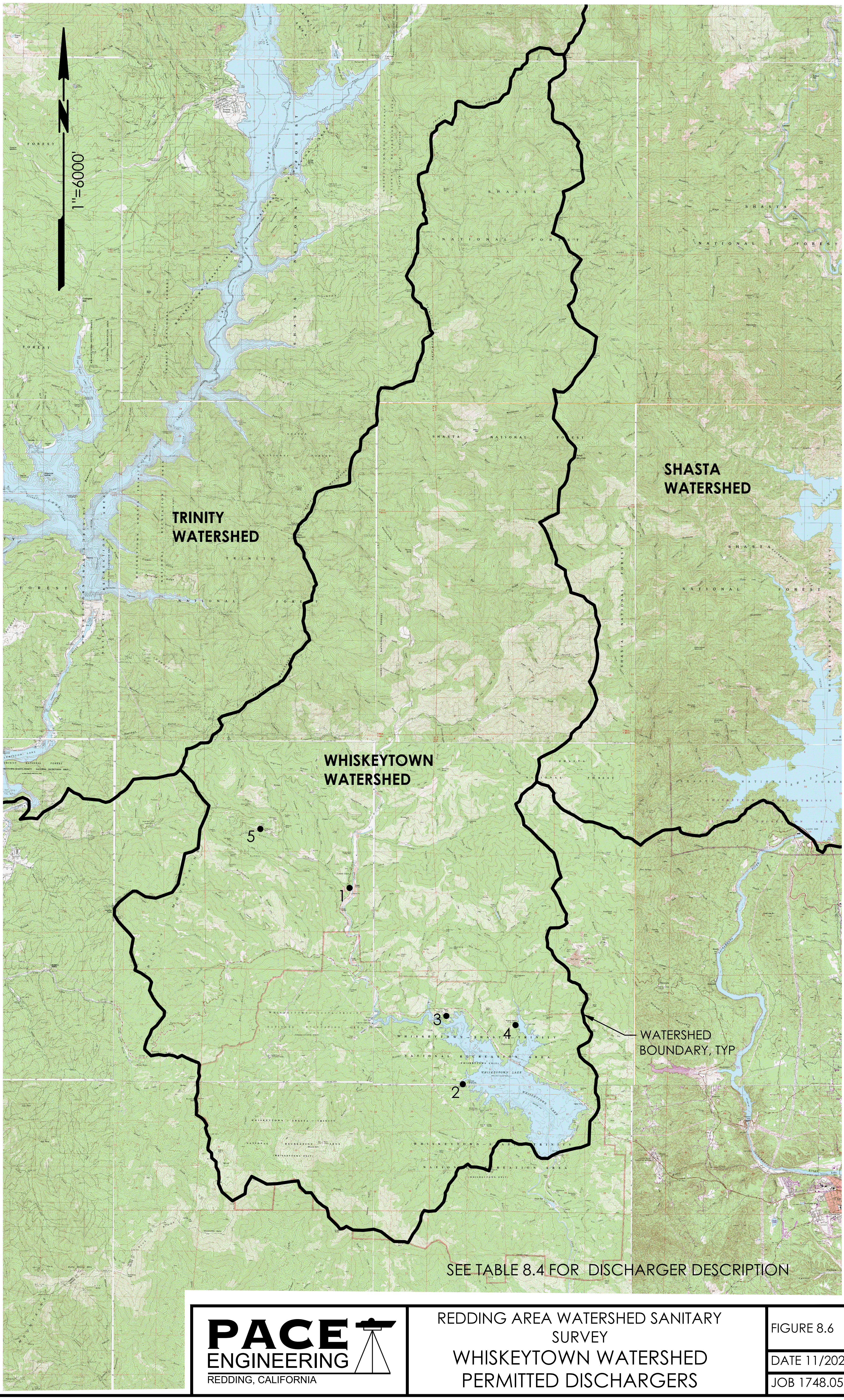
FIGURE 8.5

DATE: 11/2020

JOB # 1748.05

Plot Date: November 19, 2020 – 3:00 pm Login Name: pcibart

File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Trinity Watershed Figures.dwg, Layout: FIGURE 8.5



SEE TABLE 8.4 FOR DISCHARGER DESCRIPTION

PACE ENGINEERING
REDDING, CALIFORNIA

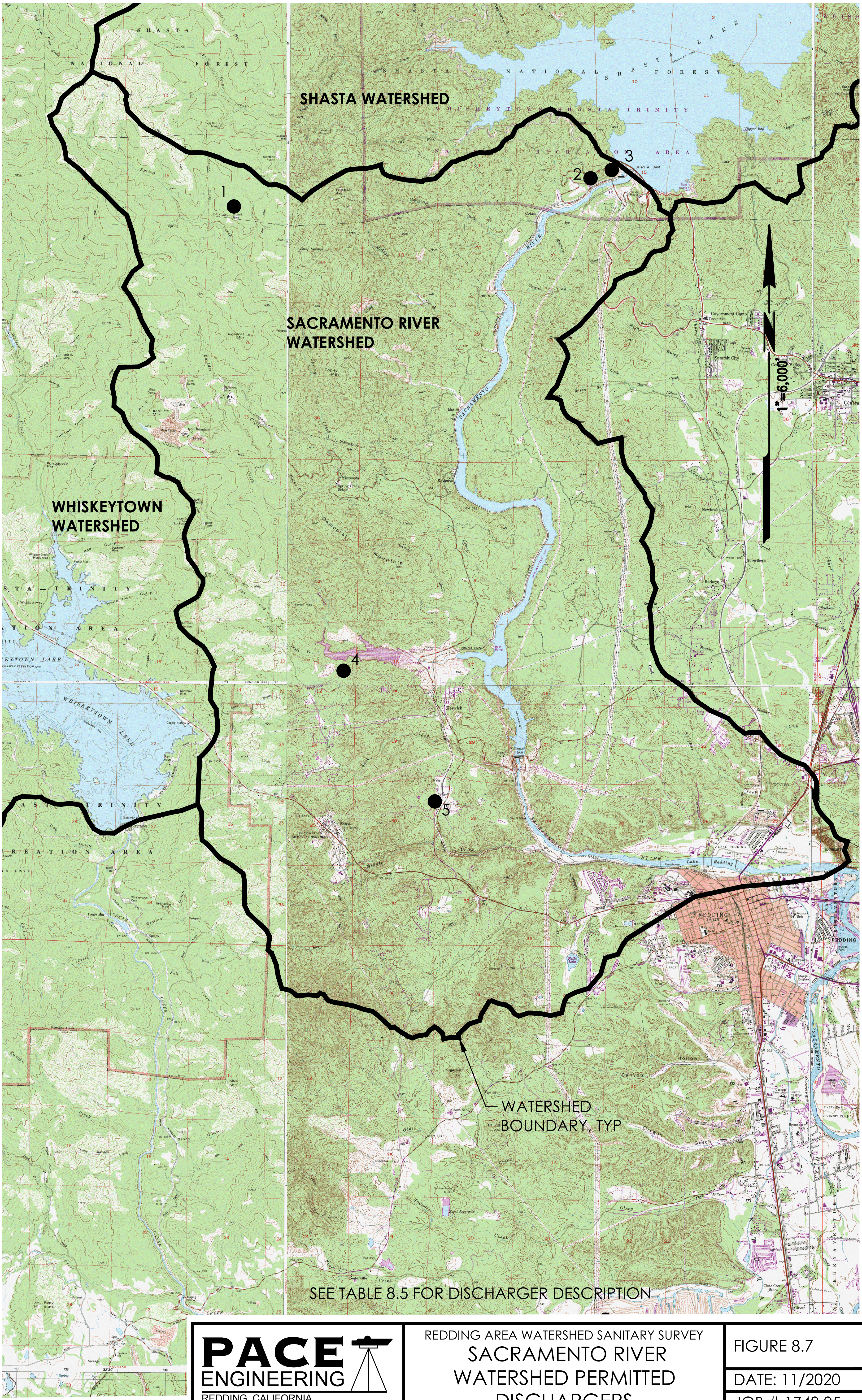
REDDING AREA WATERSHED SANITARY SURVEY
WHISKEYTOWN WATERSHED PERMITTED DISCHARGERS

FIGURE 8.6

DATE 11/2020

JOB 1748.05

Plot Date: November 19, 2020 – 3:28 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Whiskeytown Watershed.dwg, Layout: FIG 8.6 DISCHARGERS



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

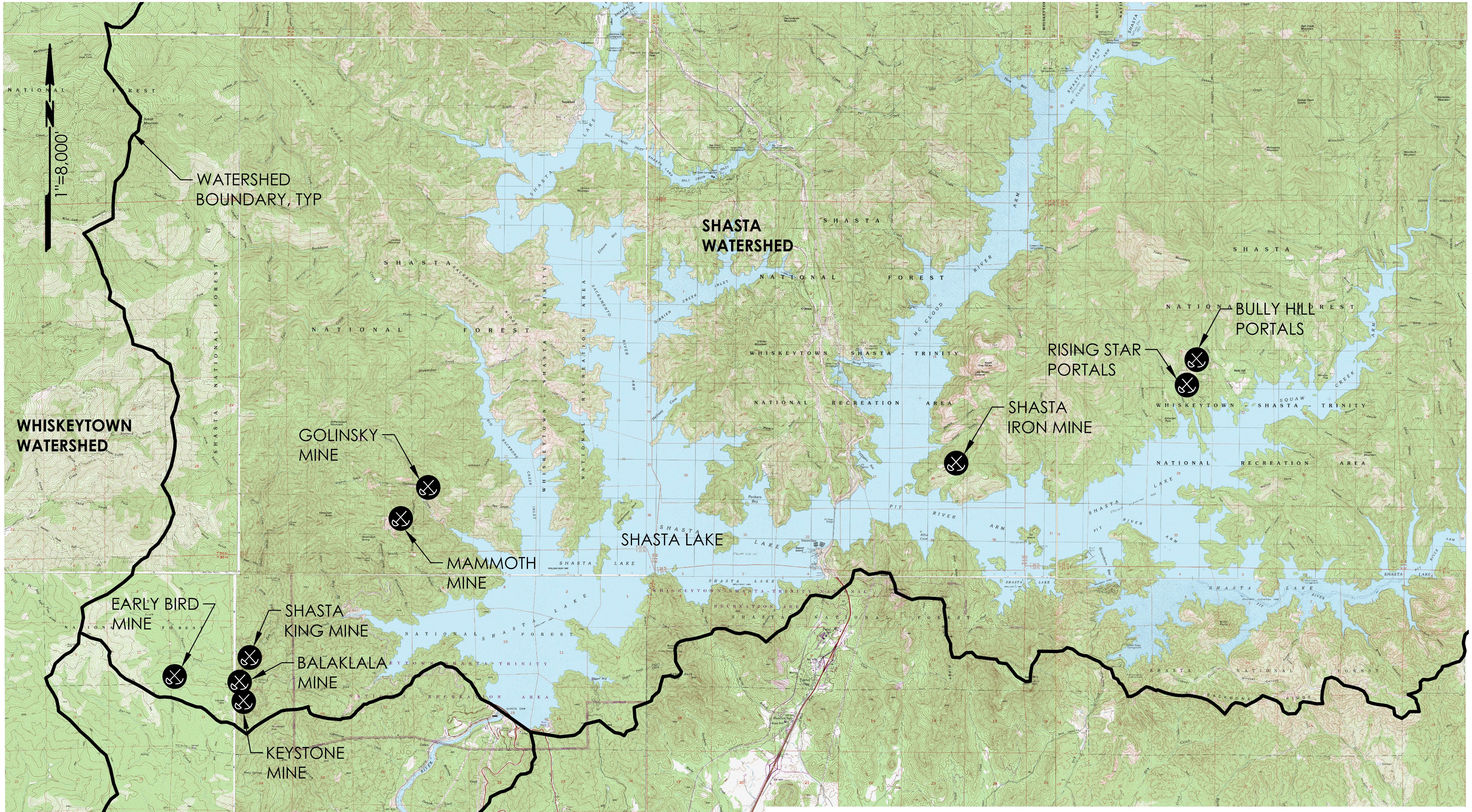
SACRAMENTO RIVER WATERSHED PERMITTED DISCHARGERS

FIGURE 8.7

DATE: 11/2020

JOB # 1748.05

Plot Date: November 19, 2020 – 3:46 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Sacramento River Watershed Figures.dwg, Layout: FIG 8.7 DISCHARGERS



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

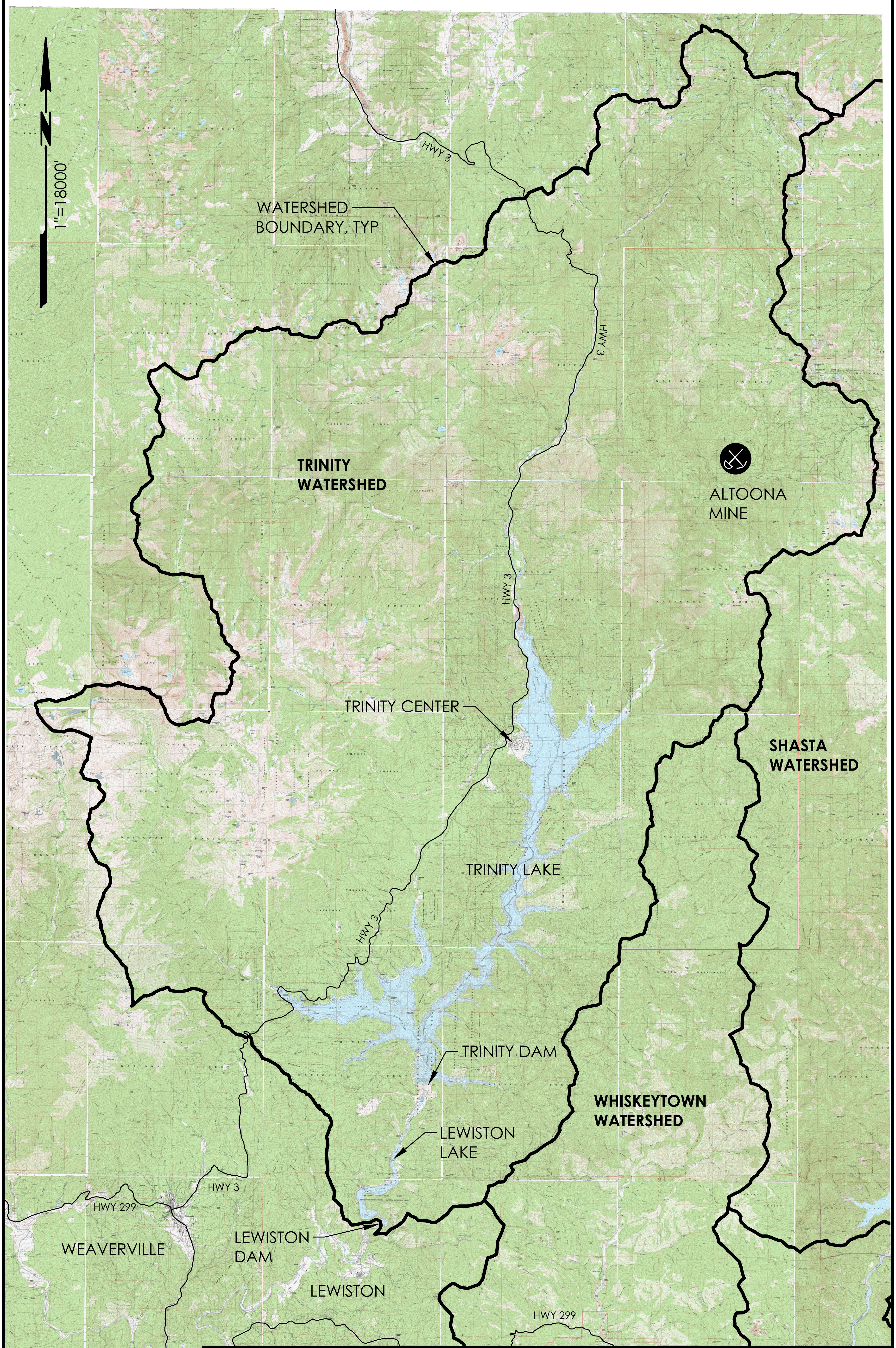
SHASTA WATERSHED MINES OF CONCERN

FIGURE 8.8

DATE: 11/2020

JOB # 1748.05

Plot Date: November 19, 2020 – 2:35 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Shasta Watershed Figures.dwg, Layout: FIG8.8



PACE ENGINEERING
REDDING, CALIFORNIA

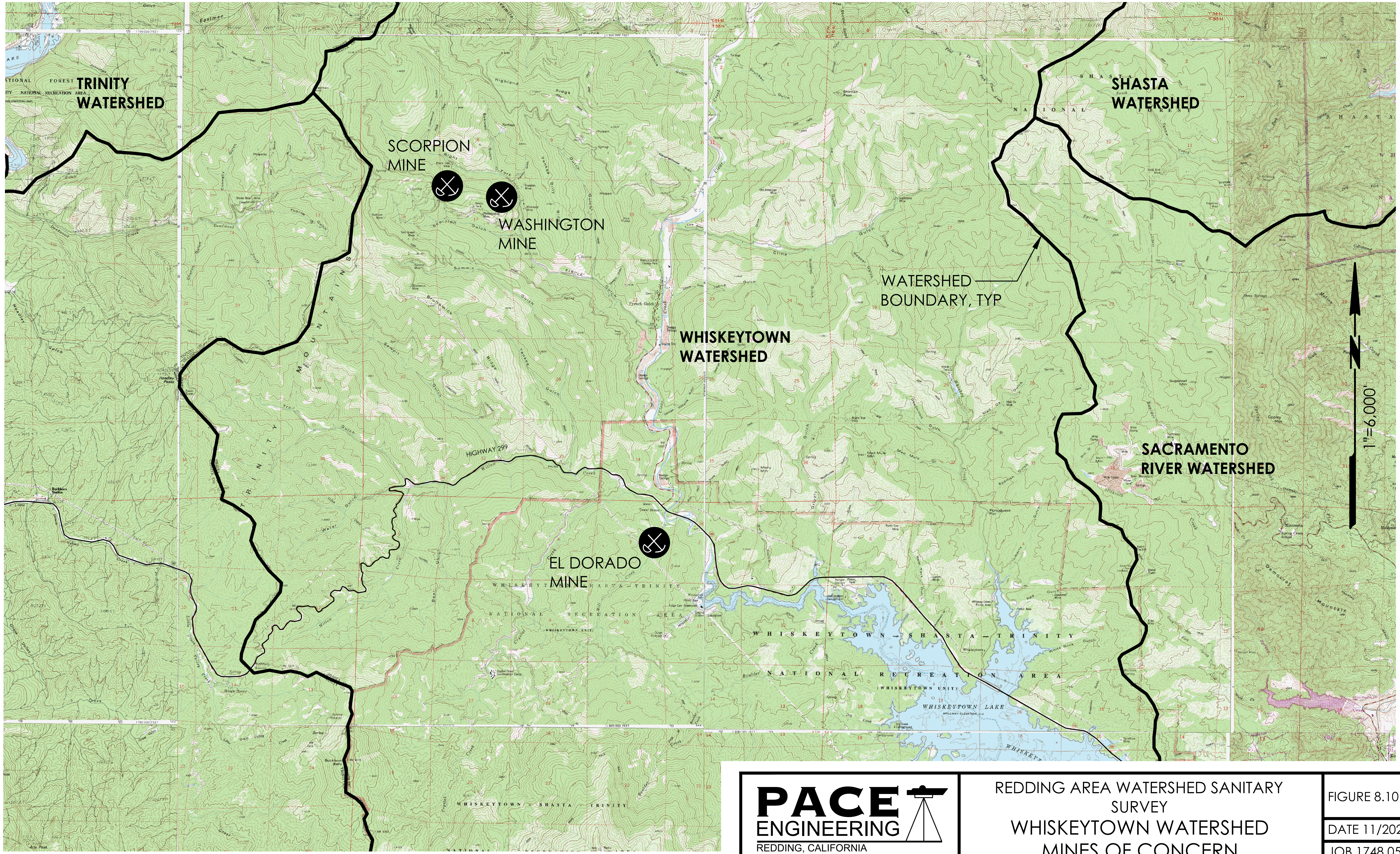
REDDING AREA WATERSHED SANITARY SURVEY
TRINITY WATERSHED
MINES OF CONCERN

FIGURE 8.9

DATE: 11/20

JOB # 1748.05

Plot Date: November 19, 2020 – 3:15 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Trinity Watershed Figures.dwg, Layout: FIGURE 8.9

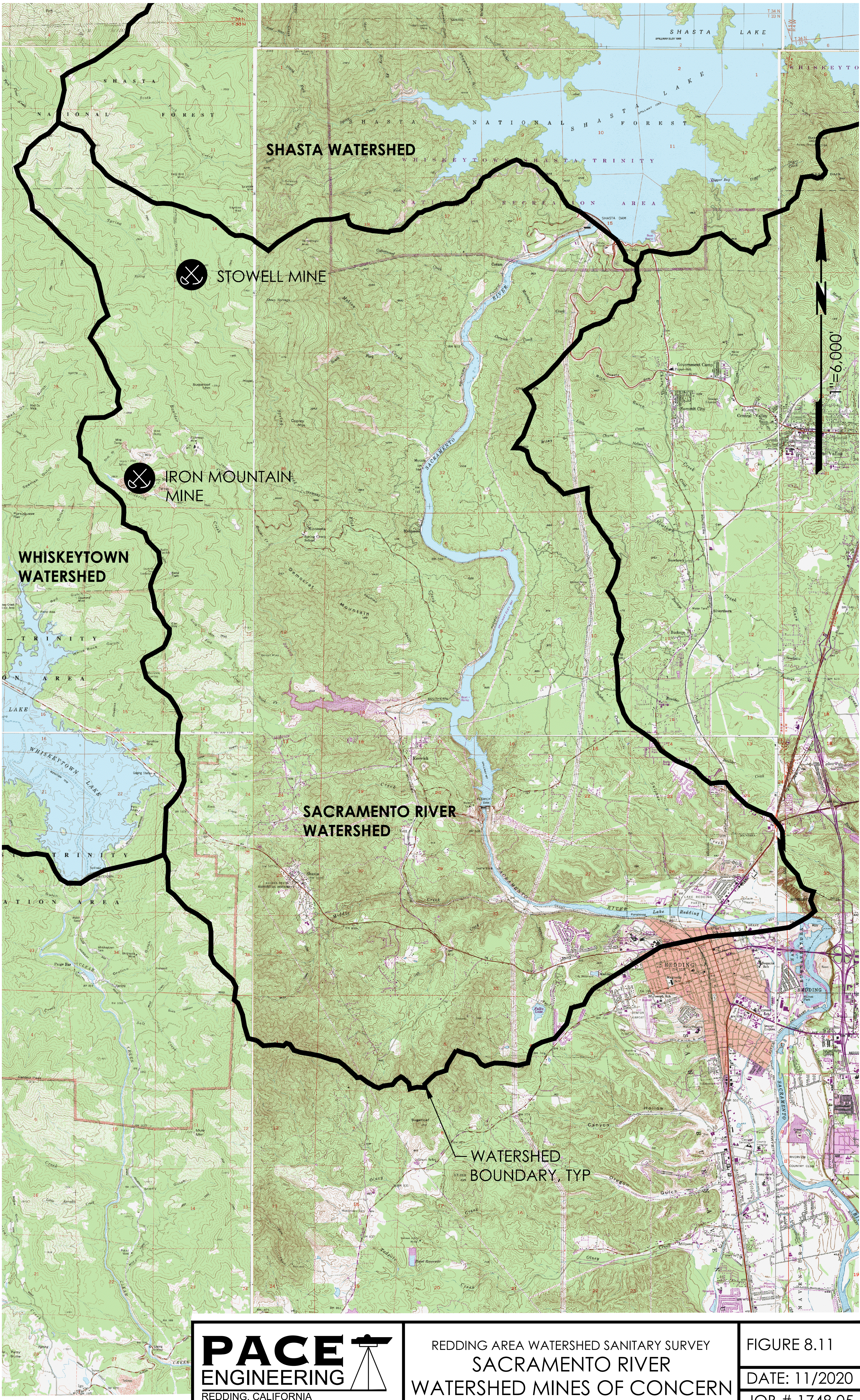


PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY
WHISKEYTOWN WATERSHED
MINES OF CONCERN

FIGURE 8.10
DATE 11/2020
JOB 1748.05

Plot Date: November 19, 2020 – 3:32 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Whiskeytown Watershed.dwg, Layout: FIG 8.10 MINES OF CONCERN

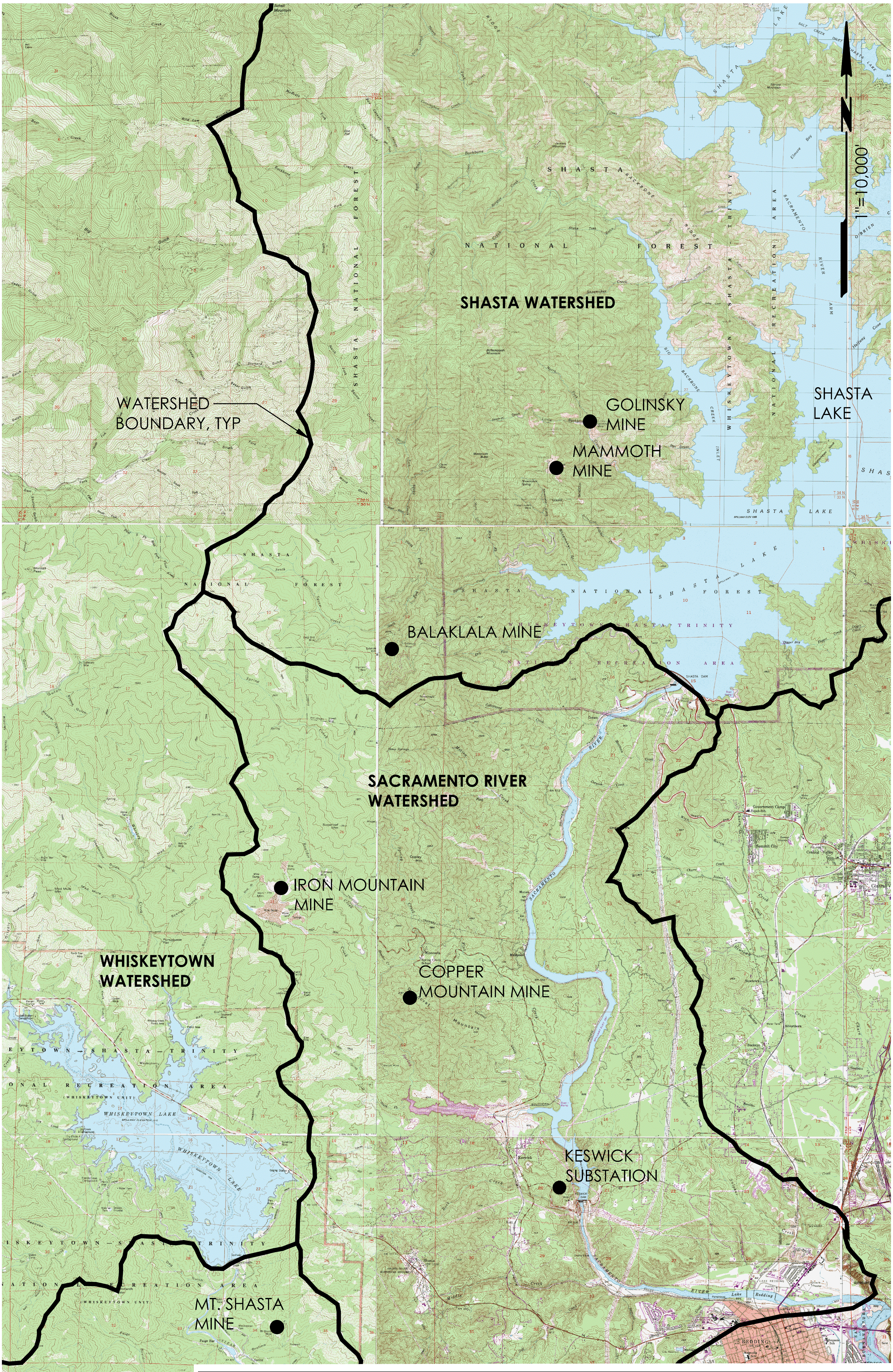


PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY
SACRAMENTO RIVER WATERSHED MINES OF CONCERN

FIGURE 8.11
DATE: 11/2020
JOB # 1748.05

Plot Date: November 19, 2020 – 3:48 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Sacramento River Watershed Figures.dwg, Layout: FIG 8.11 MINES OF CONCERN



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

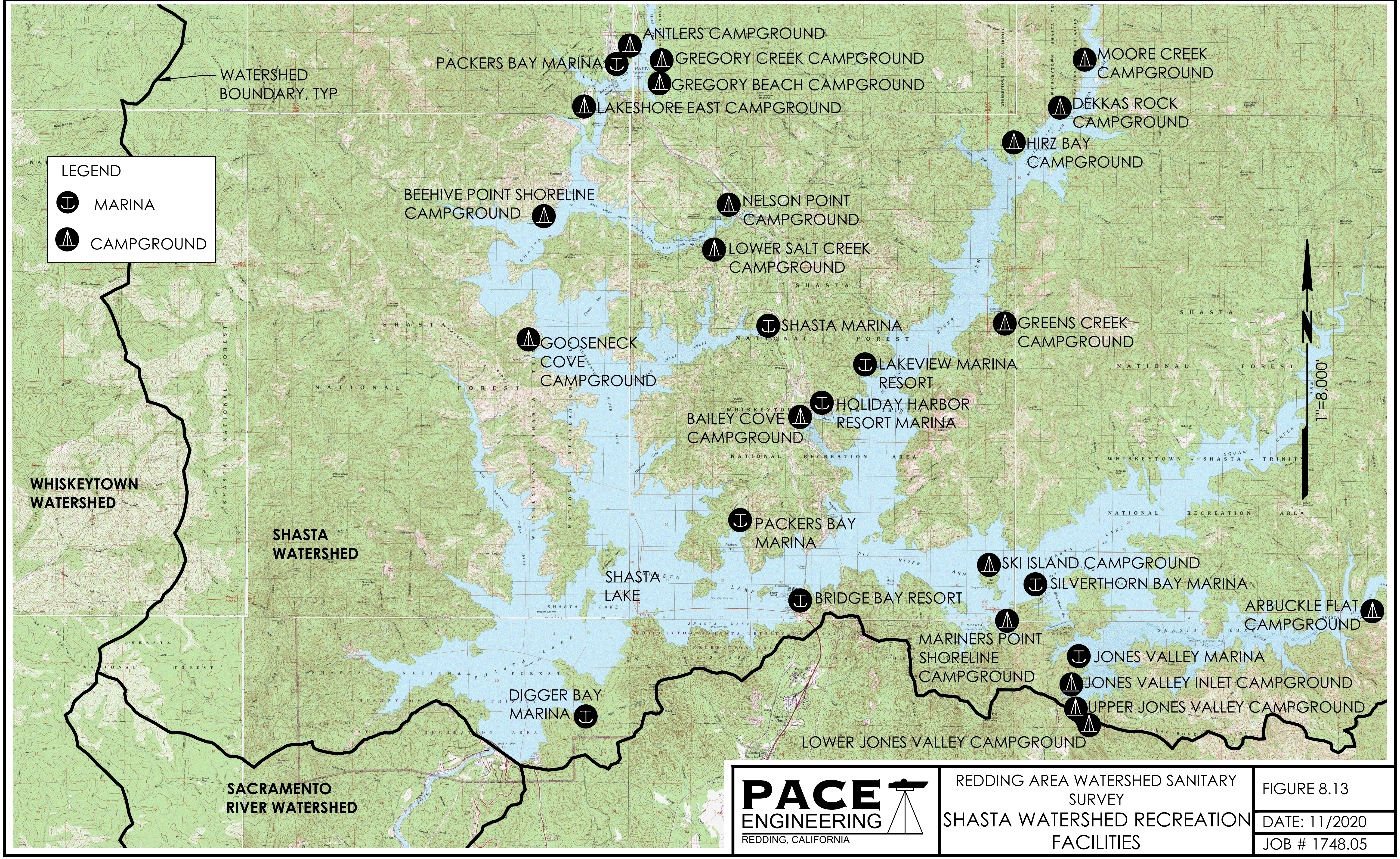
SUPERFUND SITES IN WATERSHEDS

FIGURE 8.12

DATE: 11/20

JOB # 1748.05

Plot Date: November 19, 2020 – 3:52 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Sacramento River Watershed Figures.dwg, Layout: FIG 8.12 SUPERFUND SITES



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

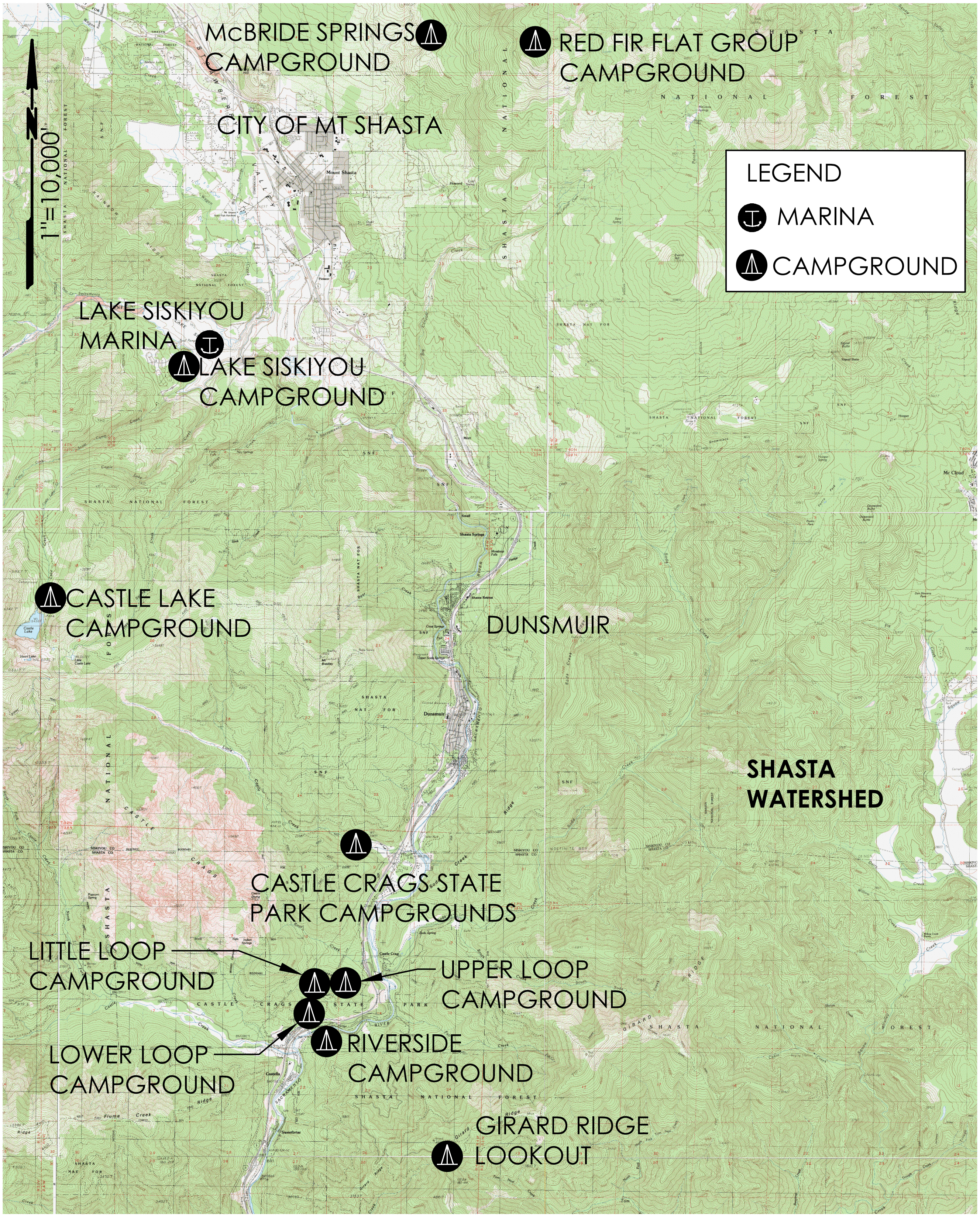
SHASTA WATERSHED RECREATION FACILITIES

FIGURE 8.13

DATE: 11/2020

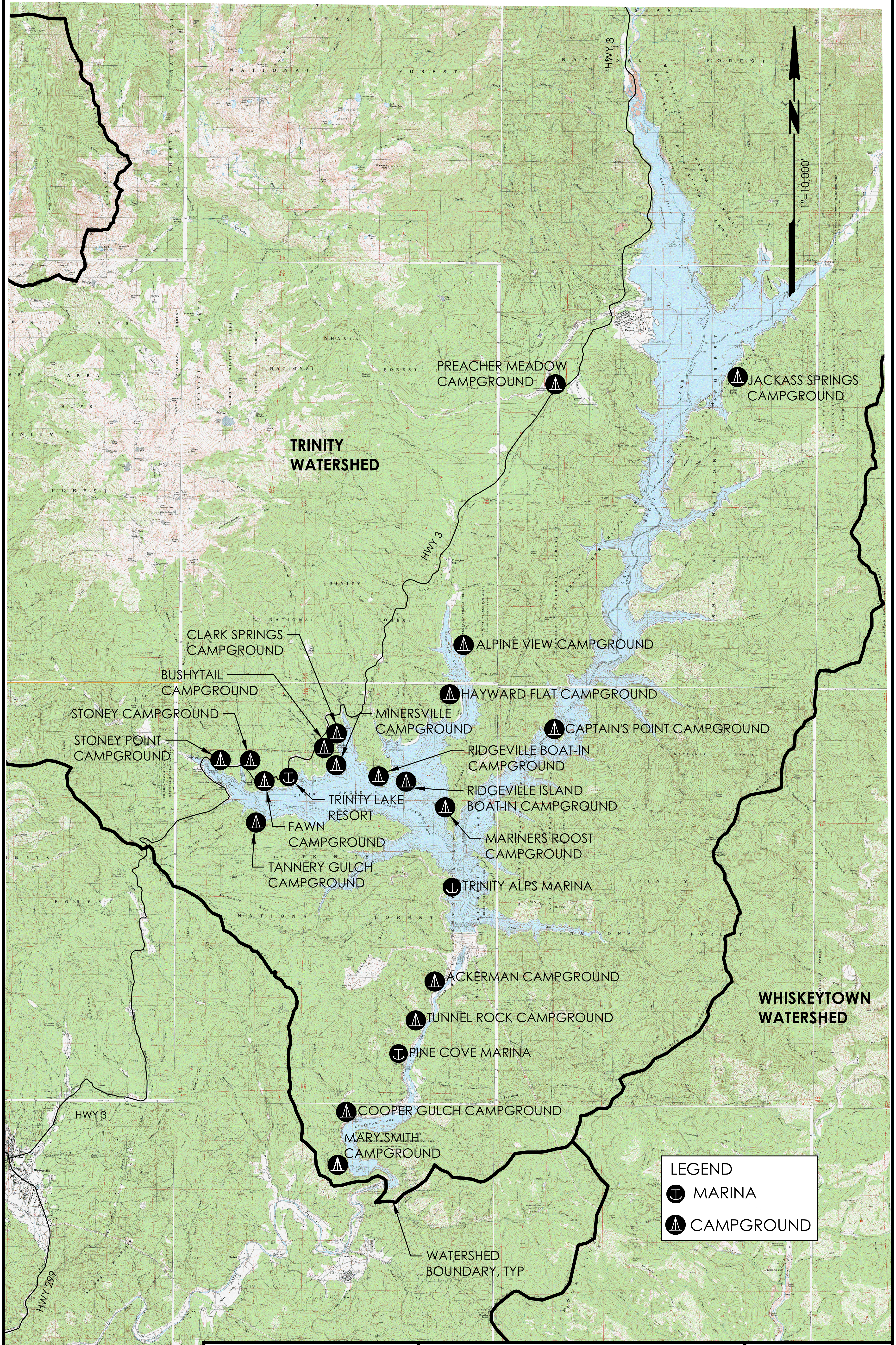
JOB # 1748.05

Plot Date: November 19, 2020 - 2:43 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Shasta Watershed Figures.dwg, Layout: FIG8.13



DATE 11/20	PACE ENGINEERING REDDING, CALIFORNIA	REDDING AREA WATERSHED SANITARY SURVEY NORTHERN SHASTA WATERSHED RECREATION FACILITIES	FIGURE 8.14 JOB #1748.05

Plot Date: November 19, 2020 – 3:02 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Shasta Watershed Figures.dwg, Layout: FIG8.14



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

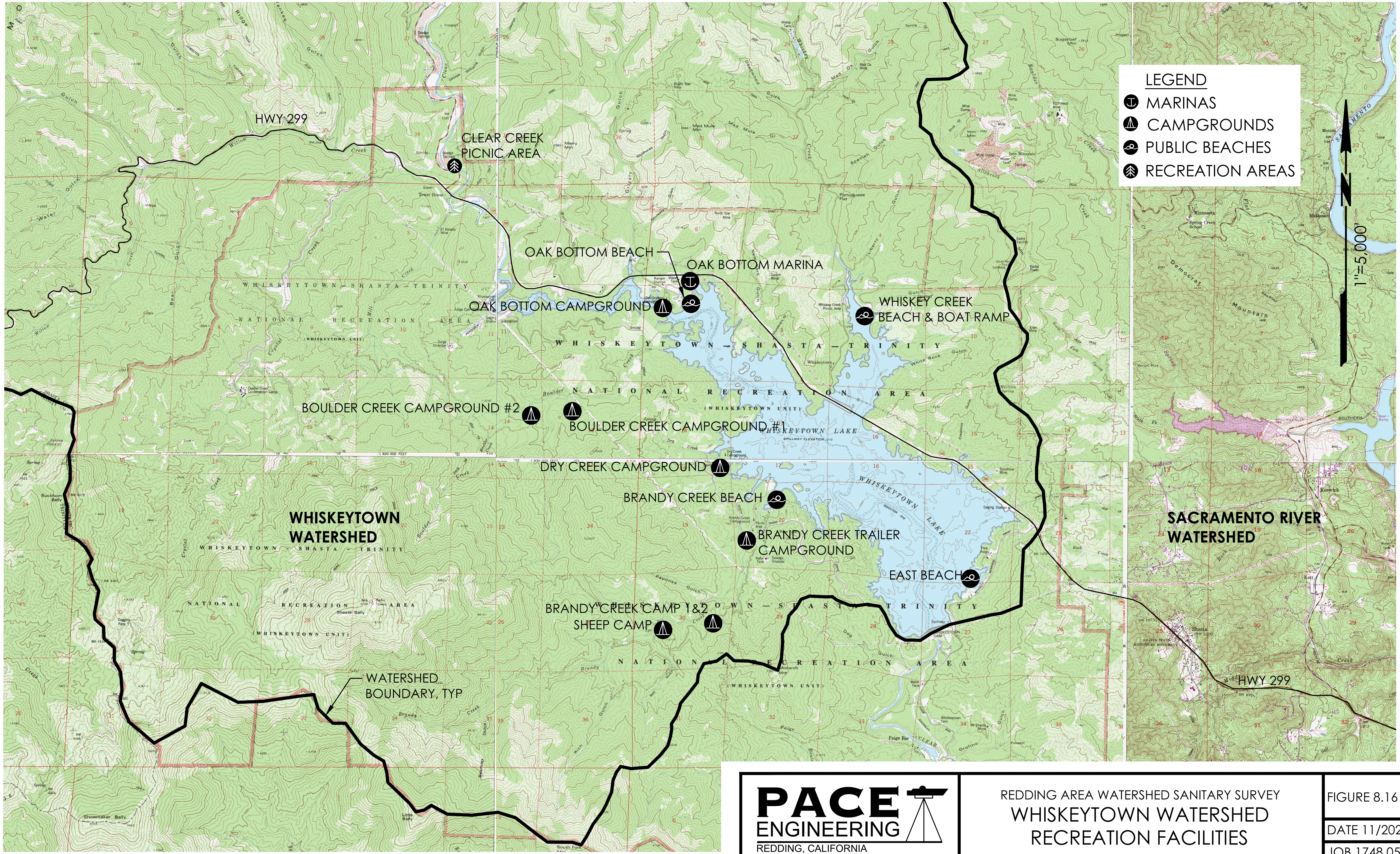
TRINITY WATERSHED RECREATION FACILITIES

FIGURE 8.15

DATE: 11/2020

JOB # 1748.05

Plot Date: November 19, 2020 – 3:24 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Trinity Watershed Figures.dwg, Layout: FIGURE 8.15

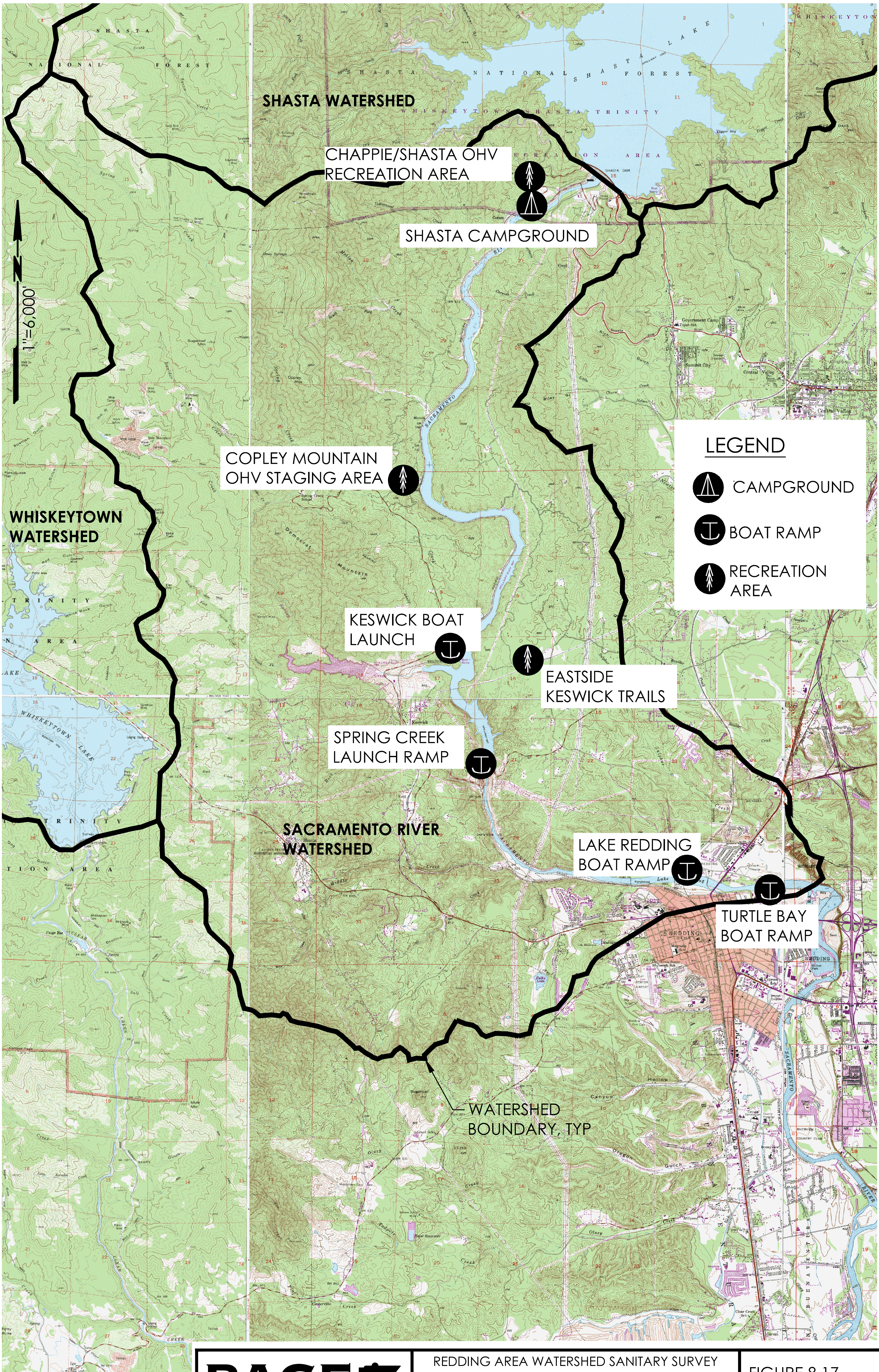


PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY
WHISKEYTOWN WATERSHED
RECREATION FACILITIES

FIGURE 8.16
DATE 11/2020
JOB 1748.05

Plot Date: November 19, 2020 – 3:39 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Whiskeytown Watershed.dwg, Layout: FIG 8.16 PUBLIC FACILITES



PACE ENGINEERING
REDDING, CALIFORNIA

REDDING AREA WATERSHED SANITARY SURVEY

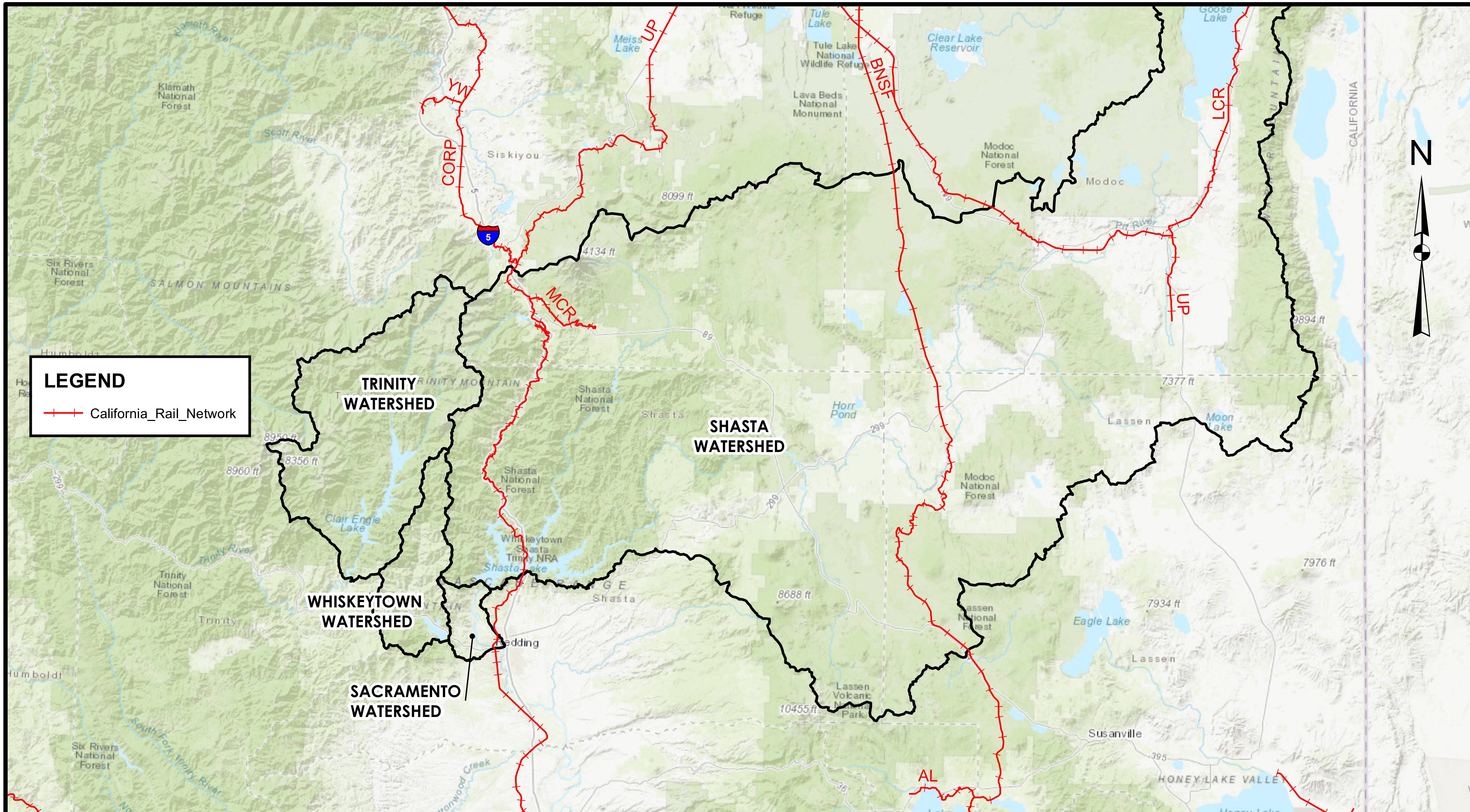
SACRAMENTO RIVER WATERSHED RECREATION FACILITIES

FIGURE 8.17

DATE: 11/2020

JOB # 1748.05

Plot Date: November 19, 2020 – 3:54 pm Login Name: pcibart
File Name: M:\Land Projects\1748.05 2021 WSS Update\Figures\Sacramento River Watershed Figures.dwg, Layout: FIG 8.17 RECREATION



PACE ENGINEERING
REDDING, CALIFORNIA

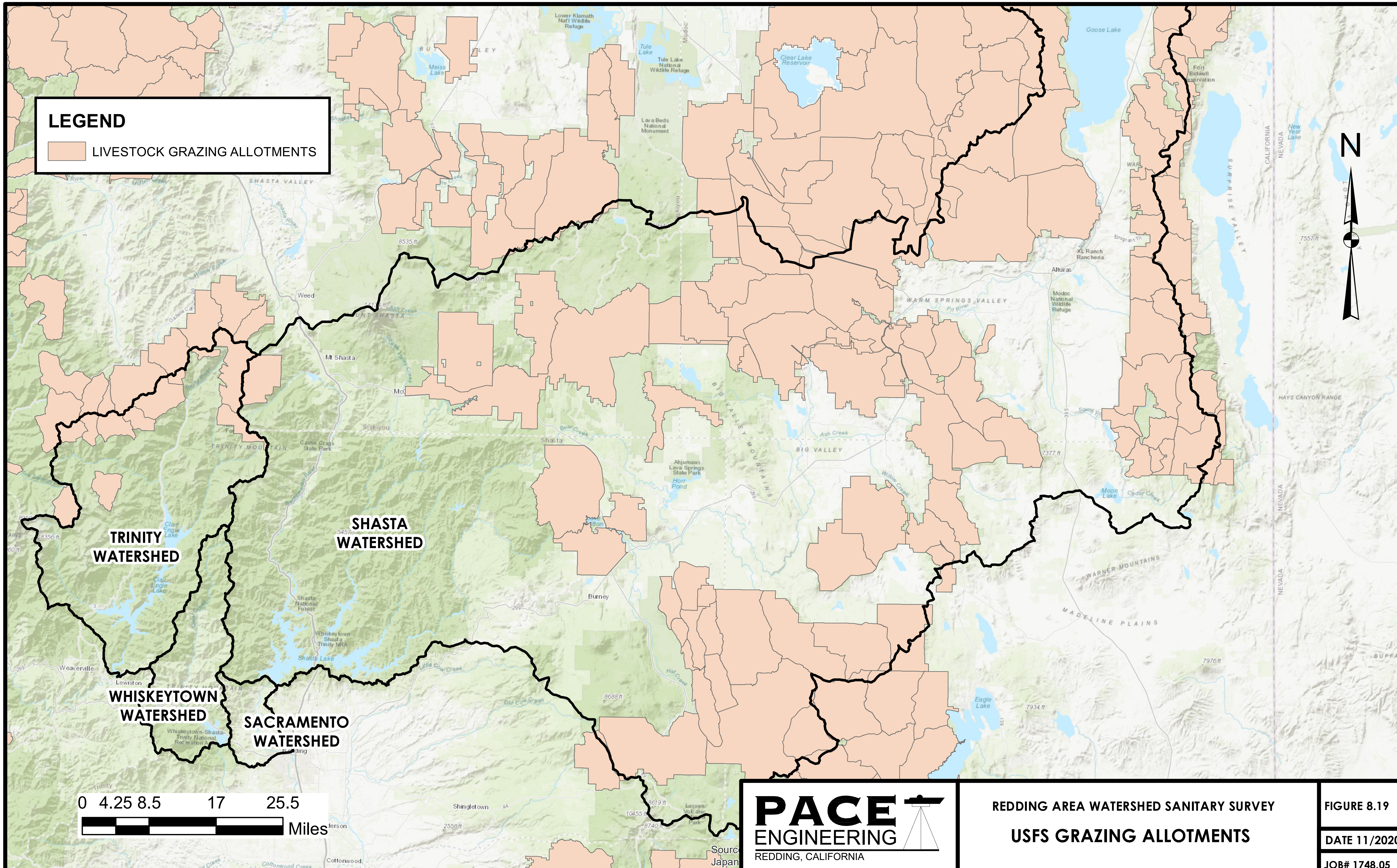
REDDING AREA WATERSHED SANITARY SURVEY

RAILROADS IN THE WATERSHEDS

FIGURE 8.18

DATE 11/2020

JOB# 1748.05



Document Path: M:\GIS\Jobs\1748.05\Maps\Figure 8.19 - Grazing Allotments.mxd

9 WATER QUALITY

9.1 Introduction

Raw water quality determines the level of treatment required as well as the quality of the finished water. This section presents and reviews the raw water testing results collected by the participating agencies and other test data collected by federal and state agencies.

Depending on size and classification, all participating agencies test their raw and/or treated waters for a variety of chemical constituents including general minerals, nitrates, metals, and radiological. Test results are submitted to DDW as well as reported to the public annually through a CCR. The monitoring required by DDW for each of the participating agencies is shown in Tables 9.4 through 9.15. These results show that the water quality in the Redding Area Watersheds is quite good. Metals that are most often detected in the watersheds, with secondary MCLs set on the basis of aesthetics, are copper, iron, aluminum, and zinc. Nickel and cadmium, the metals with primary contaminant levels based on health effects, have been detected well below their respective MCLs.

Monthly raw and treated water samplings from the City of Redding's Buckeye and Foothill WTPs for metals and minerals are presented in Table 9.15. These sampling results show a greater variation in sampling results than the information presented in Tables 9.4 and 9.5. There are occasional spikes of iron in the raw water; however, the usual concentrations of these metals are undetected.

Turbidities vary depending on location, as lakes usually have lower turbidities than river waters. Daily turbidity records from three USGS gaging stations, the City of Redding's two WTPs, and the Clear Creek CSD raw water are presented on Figures 9.1 through 9.6. Shasta and Whiskeytown Lakes act as large settling basins allowing particles to settle and thereby reducing turbidity. Peaks in turbidity were found following the Carr Fire after rain events, see Figures 9.7 and 9.8.

The monthly average turbidity readings from the City of Redding's Buckeye and Foothill WTPs from 2016 to 2020 are presented in Table 9.15 and shown on Figures 9.4 and 9.5. Note that the Sacramento River water turbidities are, on average, higher than the Whiskeytown Lake averages.

The EPA maintains a list of impaired water bodies on its 303(d) list. Impaired water bodies that are located in the Redding Area Watershed are listed in Table 9.3.

Following adoption of the Clean Air Act Amendments, nine of the worst ozone areas were required to use at least 2% oxygenates (typically MTBE) starting in 1995. However, DDW reported MTBE levels of 1.0 µg/L and 0.56 µg/L were detected in the Spring Creek Conduit water in September 1996 and August 1997, respectively. Additional sampling performed by USBR between 1998 and 2002 indicated maximum concentrations of MTBE in Trinity Lake, Shasta Lake, and Whiskeytown Lake as 13 µg/L, 51 µg/L, and 48 µg/L, respectively.[2] After it was determined MTBE was a significant risk to drinking water sources, California banned the use of this additive in 1999. A primary MCL of 13 µg/L was established by DDW in 2000. MTBE was completely eliminated in California by December 31, 2002. The source of the MTBE on Whiskeytown Lake was suspected to have been caused by two-stroke engines, which have since been banned.[1]

This section does not review DBPs, which are typically considered a process problem from inadequate flushing and/or long detention times in the distribution system. Giardia and Cryptosporidium have been the primary focus of recent water treatment rules. Additional information regarding compliance with these rules are discussed under Section 6 Drinking Water Regulations and Section 7 Water District Facilities and Treatment Processes.

9.2 Shasta Watershed

The Whiskeytown-Shasta-Trinity NRA 2014 Management Guide states that the primary water quality concerns in the watershed are turbidity and AMD, with nutrients and bacteria levels being minor concerns.

The primary concern to water quality in the watershed is turbidity due to large amounts of sediment that can enter the watershed from rains, fires, and landslides. The sediment raises turbidity levels and particle counts in the water, which makes it difficult to treat and increases the loading on filters. Figure 9.1 shows the USGS turbidity records for the years 2015-2020 for the Sacramento River above Shasta Lake. Some turbidity readings exceed the apparent measuring capability of 1,000 NTU. Shasta CSAs upstream of Shasta Lake are all located on side creeks and not on the Sacramento River; therefore, they may not receive the same highly turbid waters. Turbidity readings at Shasta Dam for the same period are shown in Figure 9.2, which are significantly lower and show how Shasta Lake can both dilute a contaminant and act as a settling basin, thereby improving water quality. Figure 9.3 shows turbidity levels rise again as local creeks and streams add sediment and runoff to the river water at the USGS Balls Ferry Bridge Gage Station downstream.

The City of Redding's Foothill WTP intakes are located on the Sacramento River approximately four miles downstream of Keswick Dam. The monthly maximum average turbidity readings are shown on Figure 9.5. Additional turbidity data found in Figures 9.7 and 9.8 are from locations that feed the Sacramento River and may be further indicative of the turbidity trends elsewhere in the river. Figure 9.7 samples were taken at the Spring Creek Debris Dam, and Figure 9.8 samples are taken from the Sacramento River just below the Keswick Dam.

Heavy metals and AMD from abandoned mines are a concern, and these mines are discussed in Section 8.9 Toxic Cleanup Sites. Most of the mines listed are in the process of remediation and are located in the southwest portion of the Shasta Watershed. Table 9.3 shows that the western portion of Shasta Lake, where Squaw Creek enters the lake, has high levels of cadmium, copper, zinc, and also high levels of lead coming from Squaw Creek. In August of 2017, the City of Shasta Lake tested their treatment plant backwash sludge for a number of analytes including cadmium, copper, zinc, lead, and mercury, which came back as 3.4, 322, 428, 11.4, and 0.13 mg/kg, respectively, which all fall below the MCLs.

An investigation by the Central Valley RWQCB on the Upper Sacramento River between 1997 and 2001 found that coliform counts increased in the river between Dunsmuir and Sweetbriar, particularly during the November 1997 and January/April 1999 sampling periods. The sampling results are shown in Table 9.2. The report concluded that there may be a hydraulic connection between septic systems and the river and also suggested that another likely source of fecal coliform in the reach are from livestock and pets associated with residences that are close to the river. The report states that other than the highest sample reading of 900 MPN/100 mL, the total coliform numbers for the 2000 samples completed are typical for an unpolluted northern California stream. It is interesting to note that the highest total coliform counts were during 1997, which was a year with heavy rains in the north state.

While recent coliform data was not readily available, Table 9.2B reflects recent total coliform testing completed in the Sacramento River in the applicable watersheds. Additional E. coli and total coliform results can be found for the Sacramento River at the Foothill WTP intake and the Wintu Pump Station from January 2016 to August 2020 in Table 6.1. While total coliform results were inconsistent and high for the most part, the low E. coli results are indicative that coliform counts are more likely due to the natural state of the river. The high total coliform counts are likely environmental, such as vegetation and soil, not fecal contamination from human and animal intestines and feces.

9.3 Trinity Watershed

Sediment being carried into waterways is the primary water quality concern in the Trinity Watershed. The EPA, in its 303(d) list of impaired waters, has listed the East Fork and the main stem of the Trinity River as being impaired by sedimentation and siltation mercury.[3] Turbidity readings for the Trinity Watershed, if they exist, are not readily available. See Section 8.4 Geological Hazards and Erosion for a discussion of the erosion problem and implemented solutions.

Mercury from abandoned mines appears to be contaminating the water in Trinity Lake and the east fork of Trinity River, concentrating in fish and other aquatic organisms. A fish consumption advisory was issued for the watershed in April 2005. Mercury is usually less of a threat to drinking water quality because it does not persist in the water column but tends to enter lake and river sediment where it eventually makes its way into the food chain. However, Shasta Lake and Whiskeytown Lake have recently been added to the EPA 303(d) list of impaired water bodies for mercury.

9.4 Whiskeytown Watershed

The water quality of the Whiskeytown Watershed appears to be relatively good. The greatest concern is turbidity levels from runoff and landslides, which can raise turbidity levels in the lake and make the water difficult to treat. However, the operators at Clear Creek CSD report that since the thermal curtain was installed in 1993,[6] turbidity has improved. Section 8.4 Geologic Hazards and Erosion discusses runoff and landslides in greater detail.

Figures 9.4 and 9.6 and Table 9.15 show the historical turbidity levels, general physical characteristics, and metal concentrations of Whiskeytown Lake at the Spring Creek Conduit recorded by the City of Redding Buckeye WTP and Clear Creek CSD. The general physical characteristics are acceptable, and other than occasional spikes in iron concentrations, the average metal concentrations in the raw water are also acceptable. Turbidity in Whiskeytown Lake is generally below 6 NTU.[4] However, following the Carr Fire, turbidity at the Spring Creek Powerhouse was observed to dramatically increase after each storm event. Figures 9.6, 9.7, and 9.8 display these trends. See Section 8.4 Geologic Hazards and Erosion for additional discussion regarding Carr Fire impacts to erosion and turbidity.

In May 2018, high levels of E. coli were found at Brandy Creek Beach. Park officials discouraged swimming at the beach, but it remained open to visitors. Canada geese that defecate in the beach waters were believed to be the cause of high levels of bacteria.[5] Table 6.1 shows E. coli and total coliform results from the Buckeye WTP intake between January 2016 and August 2020. The results are a good indicator of water quality coming from Whiskeytown Lake. Similar to Sacramento River results, while total coliform results are high in most cases, E. coli levels are rarely greater than 5 MPN/100 mL and often <1 MPN/100 mL.

Whiskeytown Lake was listed on the EPA 303(d) 2006 list as being contaminated with fecal contamination, and the Whiskeytown NPS worked with the SWRCB and California RWQCB to have the lake removed from the EPA 303(d) 2010 list. The current EPA 303(d) list indicates Whiskeytown Lake is contaminated with mercury and metals.[3] It should be noted that the State is required to submit an updated 303(d) list every two years; however, the 2016 list is the current EPA-approved list. Since the initial listing, Whiskeytown NRA has made changes in the park to improve water quality, including replacing the sewage treatment plant at Brandy Creek, replacing portable toilets with vault toilets, educating the public, and monitoring water quality parameters.

High mercury levels have been found in the fish in the Trinity and Lewiston Reservoirs, and these reservoirs contribute large quantities of water to Whiskeytown Lake. Mercury levels in Whiskeytown Lake have reached a level that degraded the water quality and is now listed as impaired for mercury concentrations. Mercury tends to accumulate in sediments, invertebrates, and in the fatty tissue of fish. Mercury carried along on particles in the water would be typically removed by the WTP and concentrated in the backwash sludge. To date, sludge harvested from the backwash ponds at the Clear Creek WTP have not exceeded the MCL for mercury. Backwash sludge sampled in December 2014 reported a mercury concentration of 1.9 ng/L, which is significantly lower than the MCL of 2 µg/L. Furthermore, no public water system that draws water from the watershed has detected any mercury in its raw water samples since the last update.

9.5 Sacramento River Watershed

Water released from Keswick Dam may have come from any one of the four watersheds referred to in this sanitary survey due to the design of the Central Valley Project. Therefore, facilities that draw water from the Sacramento River, below Keswick Dam, are influenced by all of the watersheds discussed herein. The three reservoirs involved in this watershed act as large settling basins and significantly reduce turbidity levels. Even with the reduction in turbidity, Bella Vista Water District typically chooses to cease treating surface water from the Sacramento River and use their groundwater wells during winter periods when raw water turbidity approaches or exceeds 50 NTU.

Raw water sampling results from the Sacramento River collected by City of Redding for the Foothill WTP are shown in Figure 9.5 and Table 9.15. It is unlikely that the diversion from Whiskeytown Lake contributes a large enough volume of water to the Sacramento River to impact Sacramento River water quality. It is more likely that both Shasta Lake and Whiskeytown Lake waters have similar watershed and metal contaminant issues. Though the maximum metal concentrations observed may appear to be high, the averages remain relatively low, and only iron exceeds the SMCL.

Due to elevated concentrations of heavy metals found in Spring Creek (below IMM) and Keswick Reservoir (below confluence with Spring Creek), both of these bodies of water are listed on the EPA 303(d) list of impaired water bodies as shown in Table 9.3. Sacramento River from Keswick Dam to Cottonwood Creek is also listed on the EPA 303(d) list as being contaminated with unknown toxicity.[7]

References:

1. ICIS. Timeline: A very short history of MTBE in the US. Retrieved from http://www.icis.com/resources/news/2006/07/05/1070674/timeline-a-very-short-history-of-mtbe-in-the-us/ 05 July 2006.
2. United States Bureau of Reclamation. Managing Water in the West. Retrieved from Mid-Pacific Region 08 July 2014.: http://www.usbr.gov/mp/mp150/mp157/env_query_station.cfm?pCode=BAS_MTBE.
3. "Final California 2010 Integrated Report (303(d) List/305(b) Report)." Waterboards.ca.gov, www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/00339.shtml.
4. Watershed Sanitary Survey of Whiskeytown Lake Facilities and Sacramento River Facilities, December 2002.
5. Chapman, Mike. "Why Swimmers Should Avoid Popular Beach at Whiskeytown." *Redding Record Searchlight*, Redding, 30 May 2018, www.redding.com/story/news/2018/05/30/whiskeytown-ecoli-bacteria-water-blamed-canada-geese-bacteria/653978002/.
6. "Saving the Salmon." *National Park Service US Department of the Interior.* https://www.nps.gov/whis/planyourvisit/upload/SavingtheSalmon-2.pdf. Accessed November 5, 2020.
7. *EPA*, Environmental Protection Agency, ofmpub.epa.gov/waters10/attains_state.control?p_state=CA.

TABLE 9.1 REDDING AREA WATERSHED SANITARY SURVEY PRESENCE OF E. COLI IN STANDARDS SAMPLES WHISKEYTOWN LAKE[(2)]		
DATE	LOCATION	VALUE[(1)]
7/20/2009	Clear Creek - County Park	291
7/4/2009	Clear Creek - Tower House	238
7/4/2009	Clear Creek - County Park	435
6/29/2009	Clear Creek - NPS Boundary	261
6/29/2009	Clear Creek - County Park	308
6/25/2009	Clear Creek - Tower House	276
9/6/2005	Clear Creek - Tower House	236
8/30/2005	Clear Creek - Tower House	325
7/19/2005	Clear Creek - Tower House	248
8/24/2004	East Beach	272
7/23/2002	Brandy Creek Beach	288
6/25/2002	Oak Bottom Beach	253
6/25/2002	Brandy Creek Beach	305
6/19/2001	East Beach	244

[(1)]Measured in colonies per 100 mL.

[(2)]Only tests that exceeded a county of 235 are shown.

Note: Swimming beach monitoring program began in 1991 after a beach closure due to sewage contamination. The values in this table are from sampling during 2001-2009 and indicate an exceedance of State of California encironmental standards establishing fecal contamination, with E. coli as the indicator. The exceedance value is 235 colonies per 100 mL. A geometric mean from the five most recent samples not to exceed 126 colonies per 100 mL is also calculated. When the standard is exceeded, an immediate re-sampling occurs to verify results. If the second sampling exceeds the standard, warnings are posted on site and smapling occurs until the standard is no longer exceeded. Sampling, using EPA-approved methods, is performed over the summer months during times of peak visitor use.

TABLE 9.2

REDDING AREA WATERSHED SANITARY SURVEY

MAXIMUM COLIFORM BACTERIA IN SACRAMENTO RIVER 1997-2000

SHASTA WATERSHED

STATION	TOTAL (T) FECAL (F)	1997	1998	1999	2000
BOX CANYON	T	900	110	130	900
	F	23	23	8	2
CANTARA	T	500	140	300	80
	F	23	17	170	8
PROSPECT AVE	T	1600	240	300	30
	F	23	7	4	8
U-S DUNSMUIR	T	1600	300	130	130
	F	70	2	13	8
D-S DUNSMUIR	T	>1600	170	240	80
	F	50	2	13	9
D-S DUNSMUIR STP	T	1600	1600	900	300
	F	23	13	22	17
U-S CASTELLA	T	>1600	170	500	170
	F	300	4	130	11
D-S CASTELLA	T	>1600	110	900	80
	F	80	8	50	30
SWEETBRIAR	T	>1600	50	300	130
	F	130	2	80	23
U-S MEARS	T	>1600	22	300	80
	F	80	2	30	4
D-S MEARS	T	30	300	130	80
	F	13	8	23	11
DELTA	T	500	500	300	110
	F	30	2	23	13

All values are in MPN/100ml

TABLE 9.2B

REDDING AREA WATERSHED SANITARY SURVEY

COLIFORM BACTERIA IN SACRAMENTO RIVER 1999-2017[1]

SHASTA WATERSHED

Location	Total Coliforms (MPN/100 mL)			E. Coli (MPN/100 mL)		
	Min	Max	Average	Min	Max	Average
Sacramento River below Keswick	0	62	9.29	-2	8.5	2.28
Sacramento Near Mt. Shasta	98.3	2419.6	1107.79	-1	42	7.21
Sacramento at Fenders Ferry Rd. - Delta	93.5	2419.6	1182.56	1	32.7	8.04

Source: https://ceden.waterboards.ca.gov/AdvancedQueryTool from Surface Water Ambient Monitoring Programs, Irrigated Lands Regulatory Program, and Sacramento River Watershed Program.

(1) Includes only information available between these dates from the cited source.

TABLE 9.3

REDDING AREA WATERSHED SANITARY SURVEY

FEDERAL 303(d)* LIST OF IMPAIRED WATER BODIES (2016)

WATER BODY	WATERSHED	STATE IMPAIRMENT	PARENT IMPAIRMENT
Clear Creek (below Whiskeytown Lake, Shasta County)	Whiskeytown Lake	Mercury	Mercury
Whiskeytown Lake	Whiskeytown Lake	Mercury	Mercury
Whiskeytown Lake (areas near Oak Bottom, Brandy Creek Campgrounds, and Whiskeytown)	Whiskeytown Lake	Mercury	Mercury
Willow Creek (Lassen County, Central Valley)		Indicator Bacteria	Pathogens
		pH	pH/Acidity/Caustic Conditions
Willow Creek (Shasta County, below Greenhorn Mine to Clear Creek)	Whiskeytown Lake	Acid Mine Drainage	Other Cause
		Copper	Metals (other than Mercury)
		Zinc	
Keswick Reservoir (portion downstream from Spring Creek)	Lower Sacramento River	Cadmium	Metals (other than Mercury)
		Copper	
		Zinc	
Sacramento River (Keswick Dam to Cottonwood Creek)	Lower Sacramento River	Toxicity	Total Toxics
Spring Creek, Lower (Iron Mountain Mine to Keswick Reservoir)	Lower Sacramento River	Acid Mine Drainage	Other Cause
		Cadmium	Metals (other than Mercury)
		Copper	
		Zinc	
Shasta Lake (area where West Squaw Creek enters)	Shasta Lake	Cadmium	Metals (other than Mercury)
		Copper	
		Zinc	
West Squaw Creek (below Balaklala Mine)	Shasta Lake	Cadmium	Metals (other than Mercury)
		Copper	
		Lead	
		Zinc	
Horse Creek (Rising Star Mine to Shasta Lake)	Shasta Lake	Cadmium	Metals (other than Mercury)
		Copper	
		Lead	
		Zinc	
		pH	pH/Acidity/Caustic Conditions
Pit River (from confluence of N. and S. Forks to Shasta Lake)	Shasta Lake	Nutrients	Nutrients
		Organic Enrichment/Low Dissolved Oxygen	Organic Enrichment/Low Dissolved Oxygen
		Temperature, Water	Temperature, Water
Shasta Lake	Shasta Lake	Mercury	Mercury
Pit River, North Fork	Shasta Lake	pH	pH/Acidity/Caustic Conditions
Pit River, South Fork	Shasta Lake	Salinity	Salinity/Total Dissolved Solids/Chlorides/Sulfates
		pH	pH/Acidity/Caustic Conditions
Fall River (Pit)	Shasta Lake	Sedimentation/Siltation	Sediment
Fall River, tributary to Feather River, Middle Fork (Butte and Plumas Counties)		Toxicity	Total Toxics
Trinity Lake	Trinity Lake	Mercury	Mercury
Trinity River HU, Upper HA, Trinity River, East Fork	Trinity Lake	Mercury	Mercury
		Sedimentation/Siltation	Sediment

Source: EPA website: California Water Quality Assessment Report
https://ofmpub.epa.gov/waters10/attains_state.control?p_state=CA

* 303(d) List was created by the EPA within the Clean Water Act to identify water bodies that do not meet, or are not expected to meet, water quality standards.

TABLE 9.4

REDDING AREA WATERSHED SANITARY SURVEY

RAW WATER ANALYSES RESULTS

CITY OF REDDING - SACRAMENTO RIVER

Group	Constituent	Units	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Bicarbonate Alkalinity	mg/L	68	-	-	-	-	-	-	-	73	63	68	68	55	60	54	53	52	55	60	61	55	65	52.6	68	57	64
	Calcium	mg/L	13.7	-	-	-	-	-	-	-	-	9	-	-	15	11	12	11	11	10	11	11	11	10.5	9.8	9	10	11
	Carbonate Alkalinity	mg/L	0	-	-	-	-	-	-	-	0	0	0	0	ND	-	-	-	ND	ND	ND	ND	-	0	0.0	0	0	0
	Chloride	mg/L	2	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Color	units	< 5	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Copper	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	2.28	3.69	6.62	1.5525	1.5525	0	0	0.25	0	0	0.0	0	0	0
	Foaming Agents	µg/L	< 0.02	-	-	-	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hardness	mg/L	52	-	-	-	-	-	-	-	-	41	-	-	48	48	49	47	41	46	51	53	48	43.3	37.6	35	41	46
	Hydroxide Alkalinity	mg/L	-	-	-	-	-	-	-	-	-	8	-	0	ND	-	-	-	-	ND	ND	0.25	-	0	0.0	0	0	0
	Iron	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	75	197	53	118	152	13	0	131	0	0	261.0	0	189	36
Secondary	Magnesium	mg/L	5.56	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	3.64	5.1	5.29	6	-	5.3	4.0	4.5	4.7	5.5
	Manganese	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	2.21	18.97	6.73	2.2722	1.6113	0.625	0	0.2	0	0	0.0	1.3	0	0
	Odor Threshhold	TON	< 1	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	pH	-	7.3	-	-	-	-	-	-	-	-	7.88	-	-	7.38	7.35	7.59	7.6067	7.8375	7.975	7.984	7.95	8	7.8	7.8	7.7	7.76	8
	Silver	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sodium	mg/L	7.77	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Specific Conductance	µS	137	-	-	-	-	-	-	-	-	113	-	-	113	121	132	122	113	119	120	131	117	117.2	96.0	126	108	120.3
	Sulfate	mg/L	6	-	-	-	-	-	-	-	-	3.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total Dissolved Solids	mg/L	76	-	-	-	-	-	-	-	-	69	-	-	76	82	53	63	70	75	84	90	71	78	80.0	87	73	74.3
	Turbidity	NTU	0.57	-	-	-	-	-	-	-	-	1.08	-	-	2	3	4	3	0	2	2	3	5	3.2	11.2	2	3	1
	Zinc	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	12.6	0	0	0	0	0	0	6.25	0	0	0.0	0	0	0
	Aluminum	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Antimony	µg/L	-	-	0	-	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Arsenic	µg/L	2	-	-	-	-	-	0	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-
	Asbestos	MFN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-
	Barium	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Beryllium	µg/L	-	-	0	-	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cadmium	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	ND	11	-	-	-	-	-	-	-	-	-	-	-	-
Inorganic	Chromium	µg/L	0	-	-	-	-	-	-	0	-	-	-	-	0.87	5	-	-	-	-	0.35	0.3	-	0	0	-	-	-
	Chromium, Hexavalent	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Fluoride	mg/L	< 0.1	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lead	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	5.58	-	-	-	-	-	ND	-	-	-	-	-	-	-
	Mercury	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nickel	µg/L	-	-	0	-	0	-	-	-	-	2	-	-	1.37	-	-	-	-	-	-	-	-	-	-	-	-	-
	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
	Selenium	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Thallium	µg/L	-	-	0	-	0	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nitrates	mg/L	0.54	0	0	-	0	-	0	0	-	4.49	0	0	ND	-	-	ND	-	-	-	-	0	0	0	0	0	-
Nitrate/Nitrite	Nitrite + Nitrite	µg/L	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nitrite	µg/L	< 0.01	0	0	-	-	-	-	-	0	0	-	0	-	-	-	-	-	-	-	-	0	-	-	0	-	-
	Gross Alpha	pCi/L	0	-	-	-	< 1	-	-	-	< 3	-	-	< 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radiological	Radium 228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	0.24	-	-	-	-	-	-
	Uranium	pCi/L	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Benzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Carbon Tetrachloride	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CIS-1,2-Dichloroethylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dichloromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ethylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methyl-Tert-Butyl-Ether (MTBE)	µg/L	-	-	0	0	0	0	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Monochlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Styrene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tetrachloroethylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Toluene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Trans-1,2-Dichloroethylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Trichloroethylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Trichlorofluoromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Regulated VOCs	Vinyl Chloride	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Xylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,1-Trichloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2,2-Tetrachloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichloropropane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-Trichloropropane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	<0.005	-	-
	1,2,4-Trichlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,4-Dichlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Alkalinity (Total) as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42.3	56	47	53
Unregulated	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4	<4	<4	-
	P-Isopropyltoluene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromochloromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromomethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dibromomethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobutadiene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Isopropylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N-Butylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
	Sec-Butylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
General	Tert-Butylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-Phenylpropane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloropropene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,1,2-Tetrachlorethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-Trichlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,4-Trimethylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3,5-Trimethylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2-Chlorotoluene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,2,-Dichloropropane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4-Chlorotoluene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bentazon	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lindane	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Regulated SOCs	Methoxychlor	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Toxaphene	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,4-D	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,4,5-TP (Silvex)	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Disinfection Byproducts	Total Organic Carbon (TOC)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.23	1.23	1.05	1.2	1.233

TABLE 9.5

REDDING AREA WATERSHED SANITARY SURVEY

RAW WATER ANALYSES RESULTS

CITY OF REDDING - WHISKEYTOWN LAKE

Group	Constituent	Units	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Secondary	Bicarbonate Alkalinity	mg/L	-	28	-	-	-	-	-	-	51	41	51	52	-	40	42	40	33	38	41	41	45	41	47	41	39	45.25	48.3
	Calcium	mg/L	-	9	-	-	-	-	-	-	-	-	4.82	-	-	5.3	5.4	6.8	6.5	6.0	5.2	5.3	5.3	6.0	5.75	5.29	6	6.50	5.87
	Carbonate Alkalinity	mg/L	-	0	-	-	-	-	-	-	0	0	0	0	-	ND	-	-	-	ND	ND	ND	ND	-	0	0	0	0	0
	Chloride	mg/L	-	2	-	-	-	-	-	-	-	-	1.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Color	units	-	20	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Copper	µg/L	-	0	-	-	-	-	-	-	-	-	0	-	-	0.58	5.73	3.82	0.00	1.05	ND	ND	0.00	-	0	0	0	0	0
	Foaming Agents	µg/L	-	< 0.2	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hardness	mg/L	-	34	-	-	-	-	-	-	-	-	29	-	-	39	41	39	36	33	39	41	43	38	33.25	31.71	38	37	38.7
	Hydroxide Alkalinity	mg/L	-	-	-	-	-	-	-	-	-	-	-	0	-	ND	-	-	-	ND	ND	ND	ND	-	0	0	0	0	0
	Iron	µg/L	-	0	-	-	-	-	-	-	-	-	0	-	-	131	20	33	55	28	0	0	0	0	0	38.71	0	81	0
	Magnesium	mg/L	-	4	-	-	-	-	-	-	-	-	4.42	-	-	-	-	-	-	4.47	6.40	6.71	7.25	-	5.25	5	7	6	6.53
	Manganese	µg/L	-	0	-	-	-	-	-	-	-	-	0	-	-	3	4	6	14	2	0	0	0	0	0	0	0	0	0
	Odor Threshhold	TON	-	< 1	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	pH	-	-	7.32	-	-	-	-	-	-	-	-	7.56	-	-	7	7	7	8	8	8	8	8	8	7.63	7.59	7.4	7.56	7.6
	Silver	µg/L	-	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sodium	mg/L	-	1	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Specific Conductance	µS	-	97	-	-	-	-	-	-	-	-	74	-	-	83	82	91	92	85	85	89	89	87	85	77	89	86	89.67
	Sulfate	mg/L	-	14	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total Dissolved Solids	mg/L	-	48	-	-	-	-	-	-	-	-	42	-	-	43	47	44	43	44	52	57	58	57	56	52.14	56.3	55	55.67
	Turbidity	NTU	-	18	-	-	-	-	-	-	-	-	2.4	-	-	0.7	1.0	1.1	1.2	0.8	0.6	0.5	0.5	1.1	0.63	0.01	0	0.9	0.87
	Zinc	µg/L	-	0	-	-	-	-	-	-	-	-	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inorganic	Aluminum	µg/L	-	0	-	-	-	-	-	-	-	-	70.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Antimony	µg/L	-	0	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Arsenic	µg/L	-	0	-	-	-	-	0	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-
	Barium	µg/L	-	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Beryllium	µg/L	-	0	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cadmium	µg/L	-	0	-	-	-	-	-	-	-	-	0	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chromium	µg/L	-	0	-	-	-	-	-	0	-	-	0	-	-	ND	-	-	-	-	-	0.42	0.40	-	0	0	-	-	-
	Fluoride	mg/L	-	0.1	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lead	µg/L	-	0	-	-	-	-	-	-	-	-	0	-	-	0.58	-	-	-	-	-	ND	-	-	-	-	-	-	-
	Mercury	µg/L	-	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nickel	µg/L	-	0	-	-	0	-	-	-	-	-	0	-	-	2.82	-	-	-	-	-	-	-	-	-	-	-	-	-
	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	-	-	-
	Selenium	µg/L	-	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Thallium	µg/L	-	0	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate/Nitrite	Nitrates	mg/L	-	0	-	-	0	0	0	0	0	-	0	0	-	ND	-	-	-	-	-	-	-	0.00	0	0	0	-	0
	Nitrite	µg/L	-	0	-	-	0	-	-	0	0	-		0	-	-	-	-	-	-	-	-	-	0.00	-	-	0	-	-
Radiological	Gross Alpha	pCi/L	-	0	0	-	-	-	< 1	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Radium 228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-
	Uranium	pCi/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Regulated VOCs	Benzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Carbon Tetrachloride	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CIS-1,2-Dichloroethylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dichloromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ethylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methyl-Tert-Butyl-Ether (MTBE)	µg/L	-	-	1	0.56	0	0	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Monochlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Styrene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tetrachloroethylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Toluene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Trans-1,2-Dichloroethylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Trichloroethylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Trichlorofluoromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Vinyl Chloride	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Xylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethylene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,1-Trichloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2,2-Tetrachloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichloropropane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,3 Trichloroporpane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	-	-
	1,2,4-Trichlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,4-Dichlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unregulated	P-Isopropyltoluene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
General	Bromobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromochloromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromomethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloroethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloromethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dibromomethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobutadiene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Isopropylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N-Butylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	-	0
	Sec-Butylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tert-Butylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-Phenylpropane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloropropene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,1,2-Tetrachlorethane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-Trichlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,4-Trimethylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichlorobenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3,5-Trimethylbenzene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2-Chlorotoluene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,2,-Dichloropropane	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4-Chlorotoluene	µg/L	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Regulated SOCs	Bentazon	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lindane	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methoxychlor	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Toxaphene	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,4-D	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,4,5-TP (Silvex)	µg/L	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 9.6

REDDING AREA WATERSHED SANITARY SURVEY

FINISHED WATER ANALYSES RESULTS

BELLA VISTA WATER DISTRICT

Group	Constituent	Units	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Secondary	Aggressive Index	-	-	-	-	-	-	-	-	-	-	-	-	11.2	10.7	-	10.9	10.9	-	11	11	10.8	11.1	10.9	10.7	10.8	10.7	10.6
	Bicarbonate Alkalinity	mg/L	61	-	61	-	-	-	-	-	-	-	-	55	63	68	68	60	60	61	67	64	70	67	58	53	64	55
	Calcium	mg/L	6.95	-	10	-	-	-	-	-	-	-	-	9	10	10.8	11	9.5	11.6	10	11	10	11	11	10	9	11	10
	Carbonate Alkalinity	mg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Chloride	mg/L	3	-	1.71	-	-	-	-	-	-	-	-	3	3	3	3	3.5	5.9	4	4	4	4.8	4	3.9	3	3.4	3.8
	Color	units	< 5	-	10	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Copper	µg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Foaming Agents	µg/L	< .02	-	< .02	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-		ND	ND	ND	ND	ND
	Hardness	mg/L	45	-	42	-	-	-	-	-	-	-	-	42	40	42	50	41	50	46	48	52	48	43	43	36	45	40
	Hydroxide Alkalinity	mg/L	-	-	-	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Iron	µg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Magnesium	mg/L	6.07	-	4	-	-	-	-	-	-	-	-	5	-	-	-	-	-	4	5	5	6	5	5	4	6	5
	Manganese	µg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Odor Threshhold	TON	< 1	-	< 2	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	pH	-	7.63	-	7.66	-	-	-	-	-	-	-	-	8.19	7.59	7.81	7.69	7.82	7.77	7.89	7.85	7.66	7.86	7.77	7.62	7.73	7.58	7.56
	Silver	µg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Sodium	mg/L	5.04	-	6	-	-	-	-	-	-	-	-	4	4	5.79	6	5.2	6.34	6	7	6	8	6	5	4	6.4	5.5
	Specific Conductance	µS	66	-	107	-	-	-	-	-	-	-	-	115	111	117	123	113	133	114	121	117	129	122	107	103	127	118
	Sulfate	mg/L	< 5	-	3.95	-	-	-	-	-	-	-	-	6.9	2.7	2.9	3.2	3.5	9.7	3.69	3.48	2.99	3.33	3.6	3.8	2.7	3.07	3.56
	Total Dissolved Solids	mg/L	86	-	80	-	-	-	-	-	-	-	-	85	67	93	78	-	-	66	97	82	86	72	76	61	83	72
	Turbidity	NTU	0.51	-	3	-	-	-	-	-	-	-	-	1.92	0.32	0.44	0.16	0.27	nd	0.6	ND	ND	ND	ND	ND	ND	ND	ND
	Zinc	µg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Inorganic	Aluminum	µg/L	0	-	87	-	-	-	-	-	-	-	-	103	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Antimony	µg/L	-	-	0	-	-	0	0	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Arsenic	µg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	2	ND	2	ND	ND	ND	ND	ND
	Barium	µg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Beryllium	µg/L	-	-	0	-	-	0	0	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Cadmium	µg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Chromium	µg/L	0	-	0	-	-	-	-	-	-	-	-	1	1	ND	ND	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	ND
	Fluoride	mg/L	< .1	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Lead	µg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Mercury	µg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Nickel	µg/L	-	-	0	-	-	0	0	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Selenium	µg/L	0	-	0	-	-	-	-	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Thallium	µg/L	-	-	0	-	-	0	0	-	-	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrate/Nitrite	Nitrates	mg/L	0.44	-	0	0	0	-	0	-	0	0	0	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Nitrite	µg/L	-	-	0	-	-	-	0	-	0	-	-	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Radiological	Gross Alpha	pCi/L	-	-	0	0	-	-	-	< 1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Radium 228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Regulated VOCs	Benzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Carbon Tetrachloride	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CIS-1,2-Dichloroethylene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dichloromethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ethylbenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methyl-Tert-Butyl-Ether (MTBE)	µg/L	-	-	-	0	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Monochlorobenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Styrene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tetrachloroethylene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Toluene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Trans-1,2-Dichloroethylene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Trichloroethylene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Trichlorofluoromethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Vinyl Chloride	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Xylene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethylene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,1-Trichloroethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloroethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2,2-Tetrachloroethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichlorobenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichloroethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichloropropane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,4-Trichlorobenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,4-Dichlorobenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
General	Bromobenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromochloromethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromomethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloroethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloromethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dibromomethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobutadiene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Isopropylbenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N-Butylbenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sec-Butylbenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tert-Butylbenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-Phenylpropane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloropropene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,1,2-Tetrachlorethane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-Trichlorobenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,4-Trimethylbenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichlorobenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3,5-Trimethylbenzene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2-Chlorotoluene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,2,-Dichloropropane	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4-Chlorotoluene	µg/L	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 9.7

REDDING AREA WATERSHED SANITARY SURVEY

RAW WATER ANALYSES RESULTS

CLEAR CREEK COMMUNITY SERVICES DISTRICT

Group	Constituent	Units	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Secondary	Aggressive Index	-	-	-	-	-	-	-	-	-	-	10.1	-	-	10.6	-	-	W	-	-	-	-	-	-	-	-	10.4	-	-
	Bicarbonate Alkalinity	mg/L	45	-	-	-	-	-	-	-	-	43	-	-	43	-	-	43	-	41	-	-	-	-	-	-	50	-	-
	Calcium	mg/L	7.59	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	6	-	-	-	-	-	-	6	-	-
	Carbonate Alkalinity	mg/L	0	-	-	-	-	-	-	-	-	0	-	-	0	-	-	0	-	ND	-	-	-	-	-	-	0	-	-
	Chloride	mg/L	2	-	-	-	-	-	-	-	-	1.11	-	-	-	-	-	1.5	-	1.5	-	-	-	-	-	-	1.5	-	-
	Color	units	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Copper	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	W	-	5.2	-	-	-	-	-	-	0	-	-
	Foaming Agents	µg/L	< 0.02	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	0	-	-
	Hardness	mg/L	40	-	-	-	-	-	-	-	-	31	-	-	-	-	-	33	-	34.5	-	-	-	-	-	34	40	-	-
	Hydroxide Alkalinity	mg/L	-	-	-	-	-	-	-	-	-	0	-	-	0	-	-	0	-	ND	-	-	-	-	-	-	0	-	-
	Iron	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	51	-	-	-	-	-	-	0	-	-
	Magnesium	mg/L	4.69	-	-	-	-	-	-	-	-	5	-	-	-	-	-	5	-	5	-	-	-	-	-	-	7	-	-
	Manganese	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	5.3	-	-	-	-	-	-	0	-	-
	Odor Threshhold	TON	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	W	-	-	-	-	-	-	-	-	-	-	-
	pH	-	7.2	-	-	-	-	-	-	-	-	7.5	-	-	-	-	-	7.5	-	7.6	-	-	-	-	-	-	7.68	-	-
	Silver	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	ND	-	-	-	-	-	-	0	-	-
	Sodium	mg/L	2.9	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2	-	3	-	-	-	-	-	-	2.5	-	-
	Specific Conductance	µS	94	-	-	-	-	-	-	-	-	79	-	-	-	-	-	78	-	-	-	-	-	-	-	-	95	-	-
	Sulfate	mg/L	6	-	-	-	-	-	-	-	-	2.46	-	-	-	-	-	3	-	-	-	-	-	-	-	-	1.99	-	-
	Total Alkalinity (Total) as CaCO	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41	-	-
	Total Dissolved Solids	mg/L	45	-	-	-	-	-	-	-	-	58	-	-	-	-	-	53	-	-	-	-	-	-	-	-	-	-	-
	Turbidity	NTU	-	-	-	-	-	-	-	-	-	0.62	-	-	-	-	-	0.62	-	-	-	-	-	-	-	-	-	-	-
	Zinc	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	2.7	-	-	-	-	-	-	ND	-	-
Inorganic	Aluminum	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	29.4	-	-	-	-	-	-	0	-	-
	Antimony	µg/L	-	-	0	-	0	-	-	-	-	0	-	-	-	-	-	-	-	ND	ND	-	-	-	-	-	0	-	-
	Arsenic	µg/L	0	-	-	-	-	-	-	-	-	0	-	2.1	-	-	-	2.1	-	0.8	-	-	-	-	-	-	0	-	-
	Asbestos	MFL	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
	Barium	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	0	-	-
	Beryllium	µg/L	-	-	0	-	0	-	-	-	-	0	-	-	-	-	-	0	-	ND	ND	-	-	-	-	-	0	-	-
	Cadmium	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	ND	-	-	-	-	-	-	0	-	-
	Chromium	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	0.4	ND	-	-	-	-	-	0	-	-
	Fluoride	mg/L	< .1	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	0	-	-
	Lead	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0.1	-	-	-	-	-	-	0	-	-
	Mercury	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	1.1	-	-	-	-	-	-	0	-	-
	Nickel	µg/L	-	-	0	-	0	-	-	-	-	2	-	0	-	-	-	0	-	1.2	ND	-	-	-	-	-	0	-	-
	Selenium	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	ND	-	-	-	-	-	-	0	-	-
	Thallium	µg/L	-	-	0	-	0	-	-	-	-	0	-	-	-	-	-	-	-	ND	ND	-	-	-	-	-	ND	-	-
	Perclorate	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4.0	-	ND	ND	ND	ND	<4.0	<4.0	<4.0	<4.0	ND	0
Nitrate/Nitrite	Nitrates	mg/L	0.44	-	0	0	0	0	0	-	0	0	0	-	0	-	-	0	ND	-	ND	ND	ND	ND	ND	ND	ND	ND	-
	Nitrite	µg/L	-	-	0	-	-	0	-	-	0	-	-	-	0	-	-	0	-	-	ND	-	-	ND	ND	ND	ND	-	-
Radiological	Gross Alpha	pCi/L	-	-	-	< 2	-	-	< 1	-	-	-	-	< 3	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Radium 228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	0.50	-	-
Regulated VOCs	Benzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Carbon Tetrachloride	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	CIS-1,2-Dichloroethylene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Dichloromethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Ethylbenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Methyl-Tert-Butyl-Ether (MTBE)	µg/L	-	-	-	-	0	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Monochlorobenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Styrene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Tetrachloroethylene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Toluene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Trans-1,2-Dichloroethylene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Trichloroethylene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Trichlorofluoromethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Vinyl Chloride	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	Xylene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethylene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,1,1-Trichloroethane	µg/L	1.059	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloroethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,1,2,2-Tetrachloroethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,2-Dichlorobenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,2-Dichloroethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,2-Dichloropropane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,2,4-Trichlorobenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
	1,4-Dichlorobenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
Unregulated	P-Isopropyltoluene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
General	Bromobenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromochloromethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromomethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloroethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloromethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dibromomethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobutadiene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Isopropylbenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N-Butylbenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Naphthalene	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sec-Butylbenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tert-Butylbenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-Phenylpropane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloropropene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,1,2-Tetrachlorethane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-Trichlorobenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-Trichloropropane (1,2,3-TCP)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-
	1,2,4-Trimethylbenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichlorobenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3,5-Trimethylbenzene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2-Chlorotoluene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,2,-Dichloropropane	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4-Chlorotoluene	µg/L	0	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 9.7
REDDING AREA WATERSHED SANITARY SURVEY
RAW WATER ANALYSES RESULTS
CLEAR CREEK COMMUNITY SERVICES DISTRICT

Group	Constituent	Units	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Regulated SOC	Atrazine	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bentazon	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Carbofuran	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chlordane	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Di (2-ethylhexyl) Phthalate	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dibromochloropropane	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Endrin	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ethylene Dibromide	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Glyphosate	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor Epoxide	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lindane	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methoxychlor	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Molinate	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Simazine	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Thiobencarb	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Toxaphene	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,4-D	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,4,5-TP (Silvex)	µg/L	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Disinfection Byproducts	Haloacetic Acid (HAA5)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	30.1	-	-	-	-	-	-	-	-	-	-	-
	Total Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.56	1.45	1.43	1.25	1.28	1.5

TABLE 9.8

REDDING AREA WATERSHED SANITARY SURVEY

RAW WATER ANALYSES RESULTS

CITY OF SHASTA LAKE

Group	Constituent	Units	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Secondary	Aggressive Index	-	-	-	-	-	-	-	-	-	-	10.4	-	-	-	-	-	11	-	-	-	-	-	-	-	-
	Bicarbonate Alkalinity	mg/L	72	-	-	-	-	-	-	-	-	59	-	-	-	84	-	70	-	-	-	-	-	-	-	-
	Calcium	mg/L	10.7	-	-	-	-	-	-	-	-	9	-	-	-	12	-	10.3	-	-	-	-	-	-	-	-
	Carbonate Alkalinity	mg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	0	-	0	-	-	-	-	-	-	-	-
	Chloride	mg/L	4	-	-	-	-	-	-	-	-	1.6	-	-	-	3.81	-	2.1	-	-	-	-	-	-	-	-
	Color	units	-	-	-	-	-	-	-	-	-	0	-	-	-	0	-	0	-	-	-	-	-	-	-	-
	Copper	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Foaming Agents	µg/L	0.03	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Hardness	mg/L	54	-	44	42	46	41	47	-	47	36	-	-	-	56	-	50	-	-	-	-	-	-	-	-
	Hydroxide Alkalinity	mg/L	-	-	-	-	-	-	-	-	-	0	-	-	-	0	-	0	-	-	-	-	-	-	-	-
	Iron	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	18	-	0	-	-	-	-	-	-	-	-
	Magnesium	mg/L	5.53	-	-	-	-	-	-	-	-	4	-	-	-	6	-	4.94	-	-	-	-	-	-	-	-
	Manganese	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	0.9	-	0	-	-	-	-	-	-	-	-
	Odor Threshhold	TON	-	-	-	-	-	-	-	-	-	0	-	-	-	0	-	0	-	-	-	-	-	-	-	-
	pH	-	7.65	-	-	-	-	-	-	-	-	7.33	-	-	-	7.87	-	7.9	-	-	-	-	-	-	-	-
	Silver	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Sodium	mg/L	6.76	-	10	4	4	5	6	-	6	5	-	-	-	8	-	6.92	-	-	-	-	-	-	-	-
	Specific Conductance	µS	130	-	-	-	-	-	-	-	-	110	-	-	-	146	-	120	-	-	-	-	-	-	-	-
	Sulfate	mg/L	< 5	-	-	-	-	-	-	-	-	3.12	-	-	-	3.98	-	3.5	-	-	-	-	-	-	-	-
	Total Dissolved Solids	mg/L	84	-	-	-	-	-	-	-	-	64	-	-	-	89	-	81	-	-	-	-	-	-	-	-
	Turbidity	NTU	-	-	-	-	-	-	-	-	-	1.5	-	-	-	-	-	1.8	-	-	-	-	-	-	-	-
	Zinc	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
Inorganic	Aluminum	µg/L	0	-	-	-	-	-	-	-	-	65	-	-	-	-	-	73	-	-	-	-	-	-	-	-
	Antimony	µg/L	-	-	0	0	0	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Arsenic	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Barium	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Beryllium	µg/L	-	-	0	0	0	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Cadmium	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Chromium	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	<1	<1	-	-	-	-
	Fluoride	mg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-
	Lead	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Mercury	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Nickel	µg/L	-	-	0	8	4	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Selenium	µg/L	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Thallium	µg/L	-	-	0	0	0	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
Nitrate/Nitrite	Nitrates	mg/L	< .05	-	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	-	<0.04	<0.04	<0.04	<0.04	0
	Nitrite	µg/L	-	-	0	-	-	0	-	-	0	-	-	0	-	-	-	0	0	-	-	<0.04	-	-	<0.04	-
Radiological	Gross Alpha	pCi/L	-	0	-	-	-	< 1	-	-	-	0.2	-	-	0	-	-	-	-	-	-	<3	-	-	-	-
	Gross Alpha Counting Error	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.344	-	-	-	-
	Gross Alpha MDA95	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.604	-	-	-	-
	Radium 228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	1.6	-	-	-	-	-	-
Regulated VOCs	Benzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Carbon Tetrachloride	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	CIS-1,2-Dichloroethylene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Dichloromethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Ethylbenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Methyl-Tert-Butyl-Ether (MTBE)	µg/L	-	-	0.57	0.99	0	0	0	0	0	-	-	0	-	-	-	0	-	-	-	-	-	-	-	-
	Monochlorobenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Styrene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Tetrachloroethylene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Toluene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Trans-1,2-Dichloroethylene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Trichloroethylene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Trichlorofluoromethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Vinyl Chloride	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Xylene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethylene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,1-Trichloroethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloroethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2,2-Tetrachloroethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichlorobenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichloroethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichloropropane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-Trichloropropane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	<0.005	<0.005	-	-
	1,2,4-Trichlorobenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,4-Dichlorobenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
Unregulated	P-Isopropyltoluene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4	<4	<4	<4	0	-
General	Bromobenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Bromochloromethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Bromomethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Chloroethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Chloromethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Dibromomethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobutadiene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Isopropylbenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	N-Butylbenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Naphthalene	µg/L	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sec-Butylbenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Tert-Butylbenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1-Phenylpropane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloropropene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,1,2-Tetrachlorethane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-Trichlorobenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,4-Trimethylbenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichlorobenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	1,3,5-Trimethylbenzene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	2-Chlorotoluene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	2,2,-Dichloropropane	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	4-Chlorotoluene	µg/L	-	-	-	0	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
Regulated SOCs	Simazine	µg/L	-	-	-	-	-	-	-	< 0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: If no raw water sampling for the above-listed constituents were completed by the agency, the year was omitted from this table.

TABLE 9.9

REDDING AREA WATERSHED SANITARY SURVEY

RAW WATER ANALYSES RESULTS

MOUNTAIN GATE COMMUNITY SERVICES DISTRICT

Group	Constituent	Units	1994	1996	1999	2000	2001	2002	2003	2004	2005	2006	2008	2010	2011	2015	2017	2018	2019	2020
Secondary	Aggressive Index	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.2
	Bicarbonate Alkalinity	mg/L	56	-	-	-	-	65	-	-	-	-	-	-	68	-	-	-	-	77
	Calcium	mg/L	11,700	-	-	-	-	11	-	-	-	-	-	-	11.2	-	-	-	-	12.3
	Carbonate Alkalinity	mg/L	0	-	-	-	-	0	-	-	-	-	-	-	ND	-	-	-	-	0
	Chloride	mg/L	2.53	-	-	-	-	2.31	-	-	-	-	-	-	2	-	-	-	-	2.2
	Color	units	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-
	Copper	µg/L	3.5	-	-	-	-	0	-	-	-	-	-	-	ND	-	-	-	-	0
	Foaming Agents	µg/L	< 0.1	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	0
	Hardness	mg/L	-	-	-	-	-	44	-	-	-	-	-	-	48	-	-	-	-	50
	Hydroxide Alkalinity	mg/L	-	-	-	-	-	0	-	-	-	-	-	-	ND	-	-	-	-	0
	Iron	µg/L	132	-	-	-	-	0	-	-	-	-	-	-	419	-	-	-	-	0
	Magnesium	mg/L	4890	-	-	-	-	5	-	-	-	-	-	-	4	-	-	-	-	5.5
	Manganese	µg/L	27.1	-	-	-	-	0	-	-	-	-	-	-	ND	-	-	-	-	0
	Odor Threshhold	TON	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	pH	-	7.49	-	-	-	-	7.53	-	-	-	-	-	-	7.95	-	-	-	-	7.88
	Silver	µg/L	< 2	-	0	-	-	0	-	-	-	-	-	-	ND	-	-	-	-	0
	Sodium	mg/L	7920	-	-	-	-	7	-	-	-	-	-	-	6	-	-	-	-	8
	Specific Conductance	µS	128	-	-	-	-	125	-	-	-	-	-	-	120	-	-	-	104	137
	Sulfate	mg/L	3.93	-	-	-	-	3.35	-	-	-	-	-	-	3.67	-	-	-	-	3.38
	Total Alkalinity	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63
	Total Dissolved Solids	mg/L	82	-	-	-	-	70	-	-	-	-	-	-	91	-	-	-	-	97
	Turbidity	NTU	-	-	-	-	-	0.75	-	-	-	-	-	-	-	-	-	-	-	-
	Zinc	µg/L	5.2	-	-	-	-	0	-	-	-	-	-	-	ND	-	-	-	-	0
Inorganic	Aluminum	µg/L	34	-	187	-	-	0	-	-	-	-	-	-	465	-	-	-	-	0
	Antimony	µg/L	-	-	0	-	0	0	-	-	-	-	-	-	ND	-	-	-	-	0
	Arsenic	µg/L	1.7	-	0	-	-	2	-	-	-	-	-	-	ND	-	-	-	-	2.08
	Asbestos	MFL	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
	Barium	µg/L	14.1	-	0	-	-	0	-	-	-	-	-	-	17	-	-	-	-	0
	Beryllium	µg/L	-	-	0	-	0	0	-	-	-	-	-	-	ND	-	-	-	-	0
	Cadmium	µg/L	< 1	-	0	-	-	0	-	-	-	-	-	-	ND	-	-	-	-	0
	Chromium	µg/L	< 3	-	0	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	0
	Chromium, Hexavalen	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-
	Fluoride	mg/L	0.06	-	0	-	-	0	-	-	-	-	-	-	-	-	-	-	-	0
	Lead	µg/L	< 0.6	-	0	-	-	0	-	-	-	-	-	-	-	-	-	-	-	0
	Mercury	µg/L	< 0.2	-	0	-	-	0	-	-	-	-	-	-	ND	-	-	-	-	0
	Nickel	µg/L	-	-	0	-	0	0	-	-	-	-	-	-	ND	-	-	-	-	0
	Selenium	µg/L	< 0.6	-	0	-	-	0	-	-	-	-	-	-	ND	-	-	-	-	0
	Thallium	µg/L	-	-	0	-	0	0	-	-	-	-	-	-	ND	-	-	-	-	0
Nitrate/Nitrite	Nitrates	mg/L	-	0	0	-	0	0	0	0	0	-	0	0	ND	0	0	-	0	0
	Nitrite	µg/L	-	0	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0
Radiological	Gross Alpha	pCi/L	< 3.0	-	< 1.0	< 1.0	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Radium 228 MDA95	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.39	-	-	-
Regulated VOCs	Benzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Carbon Tetrachloride	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	CIS-1,2-Dichloroethylene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Dichloromethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Ethylbenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Methyl-Tert-Butyl-Ether (MTBE)	µg/L	-	-	0	0	0	-	< 0.5	-	-	0	-	-	-	-	-	-	-	-
	Monochlorobenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Styrene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Tetrachloroethylene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Toluene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Trans-1,2-Dichloroethylene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Trichloroethylene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Trichlorofluoromethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Vinyl Chloride	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Xylene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,1-Dichloroethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,1-Dichloroethylene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,1,1-Trichloroethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	-	-	0	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,1,2-Trichloroethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,1,2,2-Tetrachloroethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,2-Dichlorobenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,2-Dichloroethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,2-Dichloropropane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,2,4-Trichlorobenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,3-Dichloropropene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,4-Dichlorobenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
Unregulated	P-Isopropyltoluene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	<4	<4		0	0

TABLE 9.9

REDDING AREA WATERSHED SANITARY SURVEY

RAW WATER ANALYSES RESULTS

MOUNTAIN GATE COMMUNITY SERVICES DISTRICT

Group	Constituent	Units	1994	1996	1999	2000	2001	2002	2003	2004	2005	2006	2008	2010	2011	2015	2017	2018	2019	2020
General	Bromobenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Bromochloromethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Bromomethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Chloroethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Chloromethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Dibromomethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Hexachlorobutadiene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Isopropylbenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	N-Butylbenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Naphthalene	µg/L	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sec-Butylbenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	Tert-Butylbenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1-Phenylpropane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,1-Dichloropropene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,1,1,2-Tetrachlorethane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,2,3-Trichlorobenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,2,3-Trichloropropane (1,2,3-TCP)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-
	1,2,4-Trimethylbenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,3-Dichlorobenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,3-Dichloropropane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	1,3,5-Trimethylbenzene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	2-Chlorotoluene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	2,2,-Dichloropropane	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-
	4-Chlorotoluene	µg/L	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-

Note: If no raw water sampling for the above-listed constituents were completed by the agency, the year was omitted from this table.

TABLE 9.10

REDDING AREA WATERSHED SANITARY SURVEY

RAW WATER ANALYSES RESULTS

SHASTA COUNTY CSA #2 SUGARLOAF

Group	Constituent	Units	1997	1999	2000	2001	2002	2003	2006	2007	2008	2009	2010	2012	2013	2014	2015	2016	2017	2018	2019	2020
Secondary	Bicarbonate Alkalinity	mg/L	-	-	12	11	11	-	-	-	-	-	-	143	-	-	-	-	-	-	-	-
	Calcium	mg/L	-	-	1	1	1	-	-	-	-	-	-	4.25	-	-	-	-	-	-	-	-
	Carbonate Alkalinity	mg/L	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloride	mg/L	-	-	0.64	0.5	0	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-
	Color	units	-	-	0	10	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Copper	µg/L	-	0.46	0.396	0.255	0	70	0.26	-	-	0.1	-	0.19	-	-	-	-	-	-	-	0
	Foaming Agents	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hardness	mg/L	-	-	28	11	9	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-
	Iron	µg/L	-	-	0	0	0	83	-	-	-	-	-	149	-	-	-	-	-	-	-	-
	Magnesium	mg/L	-	-	1	1	1	25.9	-	-	-	-	-	5.25	-	-	-	-	-	-	-	-
	Manganese	µg/L	-	-	0	0	0	-	-	-	-	-	-	5.25	-	-	-	-	-	-	-	-
	Odor Threshhold	TON	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	pH	-	-	-	7.09	7.01	6.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Silver	µg/L	-	-	0	0	0	-	ND				-	-	-	-	-	-	-	-	-	-
	Sodium	mg/L	-	-	3	2	2	-	-	-	-	-	-	1.6	-	1.6	-	-	-	-	-	-
	Specific Conductance	µS	-	-	24	29	23	-	-	-	-	-	-	22	-	-	-	-	-	-	-	-
	Sulfate	mg/L	-	-	3.56	3.15	0	-	-	-	-	-	-	2.2	-	-	-	-	-	-	-	-
	Total Dissolved Solids	mg/L	-	-	37	48	22	-	-	-	-	-	-	34	-	-	-	-	-	-	-	-
	Turbidity	NTU	-	-	0.18	0.17	0.19	-	-	-	-	-	-	1.3	1.3	-	-	-	-	-	-	-
	Zinc	µg/L	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inorganic	Aluminum	µg/L	-	-	0	0	0	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
	Antimony	µg/L	-	-	0	0	0	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
	Arsenic	µg/L	-	-	0	0	0	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barium	µg/L	-	-	0	0	0	-	136	-	-	-	123	107	-	-	-	-	-	-	-	-
	Beryllium	µg/L	-	-	0	0	0	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cadmium	µg/L	-	-	0	0	0	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chromium	µg/L	-	-	0	0	0	-	ND	-	-	-	-	-	-	-	-	ND	-	-	-	-
	Fluoride	mg/L	-	-	0	0	0	-	-	-	ND	-	-	0.1	-	-	-	-	-	-	-	-
	Lead	µg/L	-	0.46	14.6	3.2	-	3.6	ND	-	-	8.2	-	ND	-	-	-	-	-	-		0
	Mercury	µg/L	-	-	0	0	0	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nickel	µg/L	-	-	0	0	0	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	0
	Selenium	µg/L	-	-	0	0	0	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
	Thallium	µg/L	-	-	0	0	0	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate/Nitrite	Nitrates	mg/L	-	-	0	0	0	-	-	-	ND	-	-	-	-	-	ND	ND	-	-	0	0
	Nitrite	µg/L	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	ND	-	-	0	-
Radiological	Gross Alpha	pCi/L	< 2	-	-	< 1	-	-	-	ND	ND	-	-	ND	-	-	-	-	-	-	-	-
	Radium 228 MDA95	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.59	0.5	-	-	-
Regulated VOCs	Benzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Carbon Tetrachloride	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	CIS-1,2-Dichloroethylene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Dichloromethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Ethylbenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Methyl-Tert-Butyl-Ether (MTBE)	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Monchlorobenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Styrene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Tetrachloroethylene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Toluene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Trans-1,2-Dichloroethylene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Trichloroethylene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Trichlorofluoromethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Vinyl Chloride	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Xylene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloroethylene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,1,1-Trichloroethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloroethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,1,2,2-Tetrachloroethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichlorobenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichloroethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,2-Dichloropropane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,2,4-Trichlorobenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,4-Dichlorobenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
Unregulated	P-Isopropyltoluene	µg/L	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
General	Bromobenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Bromochloromethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Bromomethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Chloroethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Chloromethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Dibromomethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobutadiene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Isopropylbenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	N-Butylbenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Naphthalene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Sec-Butylbenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	Tert-Butylbenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1-Phenylpropane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloropropene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,1,1,2-Tetrachlorethane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-Trichlorobenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-Trichloropropane (1,2,3-TCP)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-
	1,2,4-Trimethylbenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichlorobenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,3-Dichloropropane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,3,5-Trimethylbenzene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	2-Chlorotoluene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	2,2,-Dichloropropane	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	4-Chlorotoluene	µg/L	-	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-

Note: If no raw water sampling for the above-listed constituents were completed by the agency, the year was omitted from this table.

TABLE 9.11

REDDING AREA WATERSHED SANITARY SURVEY

RAW WATER ANALYSES RESULTS

SHASTA COUNTY CSA #3 CASTELLA

Group	Constituent	Units	1997	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2011	2012	2015	2016	2017	2018	2019	2020
Secondary	Bicarbonate Alkalinity	mg/L	-	-	60	36	62	-	-	-	-	49	-	-	21	-	-	-	-	-	-	45
	Calcium	mg/L	-	-	6	4	8	-	-	-	-	5	-	-	2.44	-	-	-	-	-	-	4.7
	Carbonate Alkalinity	mg/L	-	-	ND	0	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	ND
	Chloride	mg/L	-	-	3	1.12	1.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
	Color	units	-	-	5	20	5	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-
	Copper	µg/L	-	-	-	0	0.672	0.232	0.444	0.33	1.02	0.8	-	10.9	-	0.294	ND	-	-	-	-	-
	Foaming Agents	µg/L	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	Hardness	mg/L	-	-	46	38	45	-	-	-	-	-	-	-	30	-	-	-	-	-	-	35
	Hydroxide Alkalinity	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	Iron	µg/L	-	-	8	0	0	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-
	Magnesium	mg/L	-	-	-	5	8	-	-	-	-	-	-	-	3.86	-	-	-	-	-	-	6.6
	Manganese	µg/L	-	-	-	0	0	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-
	Odor Threshhold	TON	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	pH	-	-	-	7.76	7.48	7.89	-	-	-	-	7.94	-	-	-	-	-	-	-	-	-	-
	Silver	µg/L	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	Sodium	mg/L	-	-	3	2	4	-	-	-	-	-	-	-	0.92	-	-	-	-	-	-	2.2
	Specific Conductance	µS	-	-	-	62	106	-	-	-	-	-	-	-	35	-	-	-	-	-	-	78
	Sulfate	mg/L	-	-	ND	2.49	3.51	-	-	-	-	-	-	-	0.9	-	-	-	-	-	-	1.59
	Total Alkalinity	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37
	Total Dissolved Solids	mg/L	-	-	-	37	67	-	-	-	-	-	-	-	26	-	-	-	-	-	-	51
	Turbidity	NTU	-	-	0.22	1.1	0.14	-	-	-	-	-	-	-	6.5	-	-	-	-	-	-	-
	Zinc	µg/L	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-
Inorganic	Aluminum	µg/L	-	-	ND	64	0	-	-	-	-	-	-	-	177	-	-	-	-	-	-	-
	Antimony	µg/L	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Arsenic	µg/L	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barium	µg/L	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Beryllium	µg/L	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cadmium	µg/L	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chromium	µg/L	-	-	ND	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chromium, Hexavalent	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
	Fluoride	mg/L	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lead	µg/L	-	-	ND	0	9	2.5	9.96	12.4	19.9	ND	-	0.32	-	13	-	-	-	-	-	-
	Mercury	µg/L	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nickel	µg/L	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4	<4	<4	0	-
	Selenium	µg/L	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Thallium	µg/L	-	-	ND	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate/Nitrite	Nitrates	mg/L	-	-	ND	0	0	-	-	-	-	ND	ND	-	-	-	-	ND	ND	ND	0	-
	Nitrite	µg/L	-	-		0	0	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-
Radiological	Gross Alpha	pCi/L	< 2	-	-	< 1	< 3	-	-	-	-	ND	4.1	-	-	-	-	-	-	-	-	-
	Radium 228 MDA95	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.49	-	-	-	-
Regulated VOCs	Benzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Carbon Tetrachloride	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	CIS-1,2-Dichloroethylene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Dichloromethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Ethylbenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Methyl-Tert-Butyl-Ether (MTBE)	µg/L	-	0	-	0	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Monchlorobenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Styrene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Tetrachloroethylene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Toluene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Trans-1,2-Dichloroethylene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Trichloroethylene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Trichlorofluoromethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Vinyl Chloride	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Xylene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1-Dichloroethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1-Dichloroethylene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1,1-Trichloroethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	-	0	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloroethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1,2,2-Tetrachloroethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2-Dichlorobenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2-Dichloroethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2-Dichloropropane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2,4-Trichlorobenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,3-Dichloropropene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,4-Dichlorobenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-
Unregulated	P-Isopropyltoluene	µg/L	-	0	-	0	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
General	Bromobenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Bromochloromethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Bromodichloromethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
	Bromoform	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
	Bromomethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Chloroethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Chloroform	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.88	-	-	-	-
	Chloromethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Dibromochloromethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
	Dibromochloropropane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
	Dibromomethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Dichlorodifluoromethane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
	Hexachlorobutadiene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Isopropylbenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	N-Butylbenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Naphthalene	µg/L	-	0	-	-	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Sec-Butylbenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Tert-Butylbenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1-Phenylpropane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloropropene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1,1,2-Tetrachlorethane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2,3-Trichlorobenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2,3-Trichloropropane (1,2,3-TCP)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	ND	-	-
	1,2,4-Trimethylbenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,3-Dichlorobenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,3-Dichloropropane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,3,5-Trimethylbenzene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	2-Chlorotoluene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	2-Chloroethylvinyl Ether	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	-	-	-	-
	2,2,-Dichloropropane	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	4-Chlorotoluene	µg/L	-	0	-	0	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
Disinfection Byproducts	Total Trihalomethanes	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.88	-	-	-	-

Note: If no raw water sampling for the above-listed constitueNts were completed by the agency, the year was omitted from this table.

TABLE 9.12

REDDING AREA WATERSHED SANITARY SURVEY

RAW WATER ANALYSES RESULTS

SHASTA COUNTY CSA #6 JONES VALLEY

Group	Constituent	Units	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2009	2012	2014	2015	2016	2017	2018	2019
Secondary	Aggressive Index	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-
	Bicarbonate Alkalinity	mg/L	80	64	-	-	-	-	-	-	-	-	67	82	-	-	-	-	-	-	-	-	-
	Calcium	mg/L	14	15	-	-	-	-	-	-	-	-	10.5	-	-	-	-	-	-	-	-	-	-
	Carbonate Alkalinity	mg/L	0	0	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-
	Chloride	mg/L	4	2	-	-	-	-	-	-	-	-	2.13	-	-	-	-	2.5	-	-	-	-	-
	Color	units	< 5	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-
	Copper	µg/L	0	0	0.308	-	-	0.945	0.281	0.499	-	0.217	0	-	0.24	0.13	0.2	-	-	-	-	-	-
	Foaming Agents	µg/L	0.03	< 0.02	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Hardness	mg/L	74	47	-	-	-	-	-	-	-	-	45	-	-	-	-	55	-	-	-	-	-
	Hydroxide Alkalinity	mg/L	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-
	Iron	µg/L	0	357	-	-	-	-	-	-	-	-	183	-	-	-	-	596	-	-	-	-	-
	Magnesium	mg/L	6	5	-	-	-	-	-	-	-	-	3.9	-	-	-	-	-	-	-	-	-	-
	Manganese	µg/L	0	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Odor Threshhold	TON	< 1	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	pH	-	7.2	7.16	-	-	-	-	-	-	-	-	7.34	-	-	-	-	-	-	-	-	-	-
	Silver	µg/L	0	0	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Sodium	mg/L	8	8	-	-	-	-	-	-	-	-	5.68	-	-	-	-	7.9	-	-	-	-	-
	Specific Conductance	µS	140	122	-	-	-	-	-	-	-	-	129	-	-	-	-	144	-	-	-	-	-
	Sulfate	mg/L	< 5	5	-	-	-	-	-	-	-	-	3.8	-	-	-	-	4.1	-	-	-	-	-
	Total Dissolved Solids	mg/L	90	47	-	-	-	-	-	-	-	-	99	-	-	-	-	100	-	-	-	-	-
	Turbidity	NTU	1.9	-	-	-	-	-	-	-	-	-	7.38	-	-	-	-	5	-	-	-	-	-
	Zinc	µg/L	0	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
Inorganic	Aluminum	µg/L	64.6	772	-	-	330	-	-	-	-	-	305	-	-	-	-	535	-	-	-	-	-
	Antimony	µg/L	0	0	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Arsenic	µg/L	2.61	0	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Asbestos	MFL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-
	Barium	µg/L	0	0	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Beryllium	µg/L	0	0	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Cadmium	µg/L	0	0	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Chromium	µg/L	0	0	-	-	0	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chromium, Hexavalent	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-
	Fluoride	mg/L	0	0	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Lead	µg/L	0	0	ND	-	0	6.7	15	7.6	-	11	0	-	ND	7.1	ND	-	-	-	-	-	-
	Mercury	µg/L	0	0	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Nickel	µg/L	0	0	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4	<4	<4	0
	Selenium	µg/L	0	0	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Thallium	µg/L	0	0	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
Nitrate/Nitrite	Nitrates	mg/L	-	1.06	0	0	0	0	0	0	0	-	0	0	0	-	-	-	ND	ND	ND	ND	ND
	Nitrite	µg/L	-	0	-	-	0	0	-	-	0	-	0	-	-	-	-	-	-	-	ND	-	-
Radiological	Gross Alpha MDA95	pCi/L	-	-	-	< 2	-	-	-	-	< 3	-	-	-	0.95	-	ND	-	-	0.79	-	-	-
	Radium 228 MDA95	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.34	-	-	-
Regulated VOCs	Benzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Carbon Tetrachloride	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	CIS-1,2-Dichloroethylene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Dichloromethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Ethylbenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Methyl-Tert-Butyl-Ether (MTBE)	µg/L	-	-	-	0	-	-	-	0	0	-	0	-	ND	-	-	-	-	-	-	-	-
	Monochlorobenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Styrene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Tetrachloroethylene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Toluene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Trans-1,2-Dichloroethylene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Trichloroethylene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Trichlorofluoromethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Vinyl Chloride	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Xylene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,1-Dichloroethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,1-Dichloroethylene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,1,1-Trichloroethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	-	-	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,1,2-Trichloroethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,1,2,2-Tetrachloroethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,2-Dichlorobenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,2-Dichloroethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,2-Dichloropropane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,2,4-Trichlorobenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,3-Dichloropropene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,4-Dichlorobenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
Unregulated	P-Isopropyltoluene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
General	Bromobenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Bromochloromethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Bromomethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Chloroethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Chloromethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Dibromomethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Hexachlorobutadiene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Isopropylbenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	N-Butylbenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Naphthalene	µg/L	-	-	-	0	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Sec-Butylbenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Tert-Butylbenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1-Phenylpropane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,1-Dichloropropene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,1,1,2-Tetrachlorethane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,2,3-Trichlorobenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,2,3-Trichloropropane (1,2,3-TCP)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-
	1,2,4-Trimethylbenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,3-Dichlorobenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,3-Dichloropropane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	1,3,5-Trimethylbenzene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	2-Chorotoluene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	2,2,-Dichloropropane	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-
	4-Chlorotoluene	µg/L	-	0	-	0	-	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-

Note: If no raw water sampling for the above-listed constitueNts were completed by the agency, the year was omitted from this table.

TABLE 9.13

REDDING AREA WATERSHED SANITARY SURVEY

RAW WATER ANALYSES RESULTS

SHASTA COUNTY CSA #11 FRENCH GULCH

Group	Constituent	Units	1999	2000	2001	2002	2003	2004	2006	2007	2008	2009	2011	2012	2014	2015	2016	2017	2018	2019	2020
Secondary	Bicarbonate Alkalinity	mg/L	-	-	-	41	-	-	-	-	-	-	47	-	-	-	-	-	-	-	-
	Calcium	mg/L	-	-	-	11	-	-	-	-	-	-	10.1	-	-	-	-	-	-	-	-
	Carbonate Alkalinity	mg/L	-	-	-	0	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Chloride	mg/L	-	-	-	1.09	-	-	-	-	-	-	0.7	-	1.13	-	-	-	-	-	-
	Color	units	-	-	-	15	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-
	Copper	µg/L	0.699	0.628	0.424	0	0.025	-	0.28	-	-	ND	ND	ND	ND	-	-	-	-	-	-
	Foaming Agents	µg/L	-	-	-	0.04	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
	Hardness	mg/L	-	-	-	52	-	-	-	-	-	-	62	-	-	-	-	-	-	-	-
	Iron	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	185	-	-	-	-	-	-
	Magnesium	mg/L	-	-	-	4	-	-	-	-	-	-	3.53	-	-	-	-	-	-	-	-
	Manganese	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
	Odor Threshhold	TON	-	-	-	0	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
	pH	-	-	-	-	7.31	-	-	-	-	-	-	7.77	-	-	-	-	-	-	-	-
	Silver	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
	Sodium	mg/L	-	-	-	4	-	-	-	-	-	-	4.09	-	-	-	-	-	-	-	-
	Specific Conductance	µS	-	-	-	115	-	-	-	-	-	-	87	-	61	-	-	-	-	-	-
	Sulfate	mg/L	-	-	-	16.2	-	-	-	-	-	-	6.7	-	4.25	-	-	-	-	-	-
	Total Dissolved Solids	mg/L	-	-	-	77	-	-	-	-	-	-	59	-	36	-	-	-	-	-	-
	Turbidity	NTU	-	-	-	1	-	-	-	-	-	-	0.8	-	-	-	-	-	-	-	-
	Zinc	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
Inorganic	Aluminum	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	146.2	-	-	-	-	-	-
	Antimony	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
	Arsenic	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
	Barium	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
	Beryllium	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
	Cadmium	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
	Chromium	µg/L	-	-	-	-	-	-	-	-	-	-	ND	-	ND	-	ND	-	-	-	-
	Chromium, Hexavalent	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	ND	-	-	-	-
	Fluoride	mg/L	-	-	-	18	ND	-	-	-	-	-	0.1	-	ND	-	-	-	-	-	-
	Lead	µg/L	ND	ND	3.9	0	ND	-	ND	-	-	ND	ND	ND	-	-	-	-	-	-	-
	Mercury	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
	Nickel	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
	Selenium	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	-	ND	-	<4	<4	<4	<4	<4	ND	-
	Thallium	µg/L	-	-	-	0	-	-	-	-	-	-	ND	-	ND	-	-	-	-	-	-
Nitrate/Nitrite	Nitrates	mg/L	-	-	-	0	-	0	-	ND	ND	-	ND	-	ND	-	ND	ND	ND	ND	-
	Nitrite	µg/L	-	-	-	0	0	-	-	ND	-	-	ND	-	ND	ND	-	ND	-	-	-
Radiological	Gross Alpha MDA95	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.53	-	-	-	-
	Radium 228 MDA95	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.99	-	-	-	-
Regulated VOCs	Benzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Carbon Tetrachloride	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	CIS-1,2-Dichloroethylene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Dichloromethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Ethylbenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Methyl-Tert-Butyl-Ether (MTBE)	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Monochlorobenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Styrene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Tetrachloroethylene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Toluene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Trans-1,2-Dichloroethylene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Trichloroethylene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Trichlorofluoromethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Vinyl Chloride	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Xylene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,1-Dichloroethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,1-Dichloroethylene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,1,1-Trichloroethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,1,2-Trichloroethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	-	-	ND	-	-	-	-
	1,1,2,2-Tetrachloroethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,2-Dichlorobenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,2-Dichloroethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,2-Dichloropropane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,2,4-Trichlorobenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,3-Dichloropropene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,4-Dichlorobenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
Unregulated	P-Isopropyltoluene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
General	Bromobenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Bromochloromethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Bromomethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Chloroethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Chloromethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Dibromomethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Hexachlorobutadiene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Isopropylbenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Naphthalene	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
	N-Butylbenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Sec-Butylbenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	-	-	ND	-	ND	-	-	-	-
	Tert-Butylbenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1-Phenylpropane	µg/L	-	-	-	0	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloropropene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,1,1,2-Tetrachlorethane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,2,3-Trichlorobenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,2,3-Trichloropropane (1,2,3-TCP)	µg/L	-	-	-	-	-	-	-	-	-	-	ND	-	ND	-	ND	-	ND	-	-
	1,2,4-Trimethylbenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,3-Dichlorobenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,3-Dichloropropane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	1,3,5-Trimethylbenzene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	2-Chloroethylvinyl Ether	µg/L	-	-	-	-	-	-	-	-	-	-	ND	-	ND	-	ND	-	-	-	-
	2-Chlorotoluene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	2,2,-Dichloropropane	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	4-Chlorotoluene	µg/L	-	-	-	0	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
Disinfection Byproducts	Bromodichloromethane	µg/L	-	-	-	ND	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Bromoform	µg/L	-	-	-	ND	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Chloroform	µg/L	-	-	-	ND	-	-	-	ND	-	-	ND	-	1	-	ND	-	-	-	-
	Dibromochloromethane	µg/L	-	-	-	ND	-	-	-	ND	-	-	ND	-	ND	-	ND	-	-	-	-
	Dibromochloropropane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
	Total Trihalomethanes	µg/L	-	-	-	ND	-	-	-	ND	-	-	ND	-	1	-	ND	-	-	-	-

Note: If no raw water sampling for the above-listed constituents were completed by the agency, the year was omitted from this table.

TABLE 9.14
REDDING AREA WATERSHED SANITARY SURVEY
RAW WATER ANALYSES RESULTS
SHASTA COUNTY CSA #23 CRAG VIEW

Group	Constituent	Units	1997	1998	1999	2000	2001	2002	2003	2004	2006	2007	2008	2011	2012	2014	2015	2016	2017	2018	2019	2020
Secondary	Bicarbonate Alkalinity	mg/L	-	-	-	-	23	71	-	-	-	-	-	17	-	-	-	-	-	-	-	49
	Calcium	mg/L	-	-	-	-	2	7	-	-	-	-	-	1.36	-	-	-	-	-	-	-	3.8
	Carbonate Alkalinity	mg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
	Chloride	mg/L	-	-	-	-	0.79	2.69	-	-	-	-	-	0.4	-	-	-	-	-	-	-	0
	Color	units	-	-	-	-	20	5	-	-	-	-	-	ND	-	-	-	-	-	-	-	-
	Copper	µg/L	-	-	0.199	0.1	ND	0	ND	-	0.08	-	-	0.04	1.09	-	-	-	-	-	-	0
	Foaming Agents	µg/L	-	-	-	-	0	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	0
	Hardness	mg/L	-	-	-	-	23	53	-	-	-	-	-	28	-	-	-	-	-	-	-	39
	Hydroxide Alkalinity	mg/L	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	0
	Iron	µg/L	-	-	-	-	0	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	0
	Magnesium	mg/L	-	-	-	-	3	11	-	-	-	-	-	2.62	-	-	-	-	-	-	-	8
	Manganese	µg/L	-	-	-	-	0	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	0
	Odor Threshhold	TON	-	-	-	-	0	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	-
	pH	-	-	-	-	-	7.53	7.85	-	-	-	-	-	7.33	-	-	-	-	-	-	-	-
	Silver	µg/L	-	-	-	-	0	0	-	-	-	-	-	ND	-	-	-	-	-	-	-	0
	Sodium	mg/L	-	-	-	-	2	5	-	-	-	-	-	1.05	-	-	-	-	-	-	-	2.5
	Specific Conductance	µS	-	-	-	-	41	132	-	-	-	-	-	27	-	-	-	-	-	-	-	90
	Sulfate	mg/L	-	-	-	-	2.27	8.86	-	-	-	-	-	0.9	-	-	-	-	-	-	-	3.06
	Total Alkalinity as CaCO3	mg/L	-	-	-	-	19	58	-	-	-	-	-	14	-	-	-	-	-	-	-	41
	Total Dissolved Solids	mg/L	-	-	-	-	26	72	-	-	-	-	-	18	-	-	-	-	-	-	-	57
	Turbidity	NTU	-	-	-	-	0.41	0.12	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-
	Zinc	µg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
Inorganic	Aluminum	µg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
	Antimony	µg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	ND
	Arsenic	µg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
	Barium	µg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
	Beryllium	µg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
	Cadmium	µg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
	Chromium	µg/L	-	-	-	-	0	-	-	-	-	-	-	0	-	-	-	ND	-	-	-	-
	Chromium, Hexavalent	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	ND	-	-	-	-
	Cyanide	µg/L	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Fluoride	mg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
	Lead	µg/L	-	-	7.6	ND	ND	0	ND	-	ND	-	-	0	21.6	-	-	-	-	-	-	-
	Mercury	µg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
	Nickel	µg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
	Perchlorate	µg/L	-	-	-	-	-	-	-	-	-	<4	<4	-	-	<4	-	<4	<4	<4	0	0
	Selenium	µg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
	Thallium	µg/L	-	-	-	-	0	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0
Nitrate/Nitrite	Nitrates	mg/L	-	-	-	-	0	0	-	0	-	ND	ND	-	-	-	ND	ND	ND	ND	ND	ND
	Nitrite	µg/L	-	-	-	-	0	0	-	-	-	ND	-	ND	-	ND	-	ND	-	-	0	-
Radiological	Gross Alpha	pCi/L	< 2	-	-	-	< 1	-	-	-	-	0.92	0.92	ND	ND	-	-	-	-	-	-	-
	Radium 228	pCi/L	-	-	-	-	-	-	-	-	ND	ND	-	-	-	-	-	1.62	-	-	-	-
Regulated VOCs	Benzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Carbon Tetrachloride	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	CIS-1,2-Dichloroethylene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Dichloromethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Ethylbenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Methyl-Tert-Butyl-Ether (MTBE)	µg/L	-	0	-	-	0	0	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Monochlorobenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Styrene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Tetrachloroethylene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Toluene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Trans-1,2-Dichloroethylene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Trichloroethylene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Trichlorofluoromethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Vinyl Chloride	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Xylene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1-Dichloroethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1-Dichloroethylene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1,1-Trichloroethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	-	0	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-
	1,1,2-Trichloroethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1,2,2-Tetrachloroethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2-Dichlorobenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2-Dichloroethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2-Dichloropropane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2,4-Trichlorobenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,3-Dichloropropene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,4-Dichlorobenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
Unregulated	P-Isopropyltoluene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	nd	-	-	-	-
General	Bromobenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Bromochloromethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Bromomethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Chloroethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Chloromethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Dibromomethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Hexachlorobutadiene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Isopropylbenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	N-Butylbenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Naphthalene	µg/L	-	0	-	-	-	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Sec-Butylbenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Tert-Butylbenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1-Phenylpropane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-
	1,1-Dichloropropene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,1,1,2-Tetrachlorethane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2,3-Trichlorobenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,2,3-Trichloropropane (1,2,3-TCP)	µg/L	-	ND	-	-	ND	-	-	-	-	ND	-	-	-	-	-	ND	-	ND	-	-
	1,2,4-Trimethylbenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,3-Dichlorobenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,3-Dichloropropane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	1,3,5-Trimethylbenzene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	2-Chlorotoluene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	2,2,-Dichloropropane	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	4-Chlorotoluene	µg/L	-	0	-	-	0	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
Disinfection Byproducts	Bromodichloromethane	µg/L	-	2.8	-	-	ND	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Bromoform	µg/L	-	ND	-	-	ND	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Chloroform	µg/L	-	51	-	-	ND	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Dibromochloromethane	µg/L	-	ND	-	-	ND	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-
	Dibromochloropropane	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-	-	-
	Total Trihalomethanes	µg/L	-	ND	-	-	ND	-	-	-	-	ND	-	-	-	-	-	ND	-	-	-	-

Note: If no raw water sampling for the above-listed constituents were completed by the agency, the year was omitted from this table.

TABLE 9.15

REDDING AREA WATERSHED SANITARY SURVEY

2016 BUCKEYE WTP AND FOOTHILL WTP PARAMETERS

Analysis performed by Basic Laboratory

BFTPPA.XLS

Buckeye Water Treatment Plant - Treated Whiskeytown Lake Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	6	6	6	6	6	6	6	6	6	5	6	6	71	5.92	NSE
Mg mg/L	8	6	6	4	4	4	4	6	7	7	7	6	69	5.75	
Alkalinity mg/l	43	38	35	28	30	28	30	37	37	38	39	35	418	34.83	NSE
Sp. Cond.	102	97	89	76	75	73	79	86	90	92	88	87	1034	86.17	NSE
Temp. (F)	48	51	49	53	58	56	55	54	60	59	58	52	653	54.42	Degree F
pH	7.62	7.66	7.51	7.47	7.51	7.27	7.39	7.36	7.35	7.42	7.45	7.53	89.54	7.46	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	500 ug/l
Ortho Ph. ug/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	NSE
TDS mg/l													0	0.00	1000 mg/l
Fe ug/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	300 ug/l
Mn ug/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	50 ug/l
NTU	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	43	40	37	30	30	31	31	37	36	36	36	35	422	35.17	NSE

Buckeye Water Treatment Plant - Raw Whiskeytown Lake Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	6			6			6			5			23	5.75	NSE
Mg mg/L	8			4			4			7			23	5.75	
Alkalinity mg/l	47			32			33			42			154	38.50	NSE
Sp. Cond.	101			73			77			89			340	85.00	NSE
Temp. (F)	47			51			55			58			211	52.75	Degree F
pH	7.8			7.66			7.48			7.57			30.51	7.63	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0			0			0			0			0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0			0			0			0			0	0.00	500 ug/l
Ortho Ph. ug/l	0.005			0.009			0			0			0.014	0.00	NSE
TDS mg/l	67			53			48			56			224	56.00	1000 mg/l
Fe ug/l	0			0			0			0			0	0.00	300 ug/l
Mn ug/l	0			0			0			0			0	0.00	50 ug/l
NTU	0.7			1.1			0			0			1.8	0.45	NSE
T.S.S. mg/l													0	#DIV/0!	NSE
Hardness mg/l	43			30			30			30			133	33.25	NSE

Foothill Water Treatment Plant - Treated Sacramento River Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	12	8		10	10	10	10	10	11	11	8		100	10.00	NSE
Mg mg/L	6	6		5	4	5	4	4	5	5	6		50	5.00	
Alkalinity mg/l	62	45		48	47	48		48	49	47	43		437	48.56	NSE
Sp. Cond.	143	109		118	110	106	108	106	113	113	98		1124	112.40	NSE
Temp. (F)	51	49		51	56	55	52	54	53	57	57		535	53.50	Degree F
pH	7.83	7.69		7.79	7.81	7.63	7.67	7.6	7.59	7.55	7.64		76.8	7.68	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0	0		0	0	0	0	0	0	0	0		0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0	0		0	0	0	0	0	0	0	0		0	0.00	500 ug/l
Ortho Ph. ug/l	0.009	0		0	0	0.01	0.007	0.012	0.016	0.018	0.008		0.08	0.01	NSE
TDS mg/l	80	80		94	70	68	73	71	76	88	62		762	76.20	1000 mg/l
Fe ug/l	0	0		0	0	0	0	0	0	0	0		0	0.00	300 ug/l
Mn ug/l	6	0		0	0	0	0	0	0	0	0		6	0.60	50 ug/l
NTU	0	0		0	0	0	0	0	0	0	0		0	0.00	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	51	44		41	42	43	41	40	39	40	38		419	41.90	NSE

Foothill Water Treatment Plant - Raw Sacramento River Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	11			10			10			11			42	10.50	NSE
Alkalinity mg/l	62			51			49			51			213	53.25	NSE
Sp. Cond.	140			116			104			110			470	117.50	NSE
Temp. (F)	50.5			50.5			52			52			205	51.25	Degree F
pH	7.9			7.9			7.69			7.63			31.12	7.78	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0			0			0			0			0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0			0			0			0			0	0.00	500 ug/l
Ortho Ph. ug/l	0.019			0.008			0.018			0.024			0.069	0.02	NSE
TDS mg/l	66			83			71			92			312	78.00	1000 mg/l
Fe ug/l	0			0			0			0			0	0.00	300 ug/l
Mn ug/l	0			0			0			0			0	0.00	50 ug/l
NTU	2.4			4.2			3.5			2.7			12.8	3.20	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	49			42			42			40			173	43.25	NSE

TABLE 9.15

REDDING AREA WATERSHED SANITARY SURVEY

2017 BUCKEYE WTP AND FOOTHILL WTP PARAMETERS

Analysis performed by Basic Laboratory

Buckeye Water Treatment Plant - Treated Whiskeytown Lake Water BFTPPA.XLS

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	6			6	6	5	5	5	5	5	5	6	54	5.40	NSE
Mg mg/L	5			4	4	6	6	7	7	7	7	7	60	6.00	
Alkalinity mg/l	32			29	28	31	36	36	38	39	38	36	343	34.30	NSE
Sp. Cond.	89			72	66	79	81	87	89	88	89	84	824	82.40	NSE
Temp. (F)	48			51	54	49	57	59	57	58	61	52	546	54.60	Degree F
pH	7.3			7.57	7.57	7.64	7.74	7.7	7.59	7.57	7.36	7.37	75.41	7.54	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0			0	0	0	0	0	0	0	0	0	0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0			0	0	0	0	0	0	0	0	0	0	0.00	500 ug/l
Ortho Ph. ug/l	0.012			0	0	0	0	0	0	0.008	0	0	0.02	0.00	NSE
TDS mg/l	56			46	55	37	50	63	58	53	52	58	528	52.80	1000 mg/l
Fe ug/l	0			0	0	0	0	0	0	0	0	0	0	0.00	300 ug/l
Mn ug/l	0			0	0	0	0	0	0	0	0	0	0	0.00	50 ug/l
NTU	0			0	0	0	0	0	0	0	0	0	0	0.00	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	33			29	32	25	36	36	35	35	38	37	336	33.60	NSE

Buckeye Water Treatment Plant - Raw Whiskeytown Lake Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	6	6	5	5		5	5			5			37	5.29	NSE
Mg mg/L	5	4	3	4		6	6			7			35	5.00	
Alkalinity mg/l	36	28	26	32		36	40			42			240	34.29	NSE
Sp. Cond.	85	78	65	69		77	79			86			539	77.00	NSE
Temp. (F)	47	47	48	49		49	55			57			352	50.29	Degree F
pH	7.54	7.36	7.24	7.68		7.77	7.88			7.66			53.13	7.59	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0	0	0	0		0	0			0			0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0	0	0	0		0	0			0			0	0.00	500 ug/l
Ortho Ph. ug/l	0.013	0	0	0.009		0	0.006			0.011			0.039	0.01	NSE
TDS mg/l	57	56	52	53		52	47			48			365	52.14	1000 mg/l
Fe ug/l	0	0	0	153		118	0			0			271	38.71	300 ug/l
Mn ug/l	0	0	0	0		0	0			0			0	0.00	50 ug/l
NTU	0.09	0	0	0		0	0			0			0.09	0.01	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	33	30	24	30		32	37			36			222	31.71	NSE

Foothill Water Treatment Plant - Treated Sacramento River Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	7				9	9	9	10	10	10	11	11	86	9.56	NSE
Mg mg/L	5				4	4	4	4	4	4	4	5	38	4.22	
Alkalinity mg/l	33				35	35	43	43	45	45	47	51	377	41.89	NSE
Sp. Cond.	90				96	96	95	102	107	106	111	112	915	101.67	NSE
Temp. (F)	54				54	54	53	53	53	55	55	54	485	53.89	Degree F
pH	7.34				7.8	7.77	7.74	7.76	7.68	7.65	7.43	7.62	68.79	7.64	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0				0	0	0	0	0	0	0	0	0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0				0	0	0	0	0	0	0	0	0	0.00	500 ug/l
Ortho Ph. ug/l	0.009				0	0	0.008	0.012	0.01	0.013	0.013	0.012	0.077	0.01	NSE
TDS mg/l	56				68	71	60	79	80	72	76	71	633	0.00	1000 mg/l
Fe ug/l	0				0	0	0	0	0	0	0	0	0	0.00	300 ug/l
Mn ug/l	0				0	0	0	0	0	0	0	0	0	0.00	50 ug/l
NTU	0				0	0	0	0	0	0	0	0	0	0.00	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	37				37	36	37	39	37	40	41	44	348	38.67	NSE

Foothill Water Treatment Plant - Raw Sacramento River Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l			10		9	10	10			10			49	9.80	NSE
Mg mg/L			4		4	4	4			4			20	4.00	
Alkalinity mg/l			45		38	31	44			47			205	41.00	NSE
Sp. Cond.			94		93	96	94			103			480	96.00	NSE
Temp. (F)			50		54	54	53			58			269	53.80	Degree F
pH			7.86		7.85	7.85	7.83			7.78			39.17	7.83	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l			0		0	0	0			0			0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l			0		0	0	0			0			0	0.00	500 ug/l
Ortho Ph. ug/l			0.1		0.01	0.012	0.017			0.026			0.165	0.03	NSE
TDS mg/l			89		93	77	64			77			400	80.00	1000 mg/l
Fe ug/l			0		482	347	284			196			1309	261.80	300 ug/l
Mn ug/l			0		0	0	0			0			0	0.00	50 ug/l
NTU			33.4		8.1	6.4	4.5			3.7			56.1	11.22	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l			38		36	37	37			40			188	37.60	NSE

TABLE 9.15

REDDING AREA WATERSHED SANITARY SURVEY

2018 BUCKEYE WTP AND FOOTHILL WTP PARAMETERS

Analysis performed by Basic Laboratory

Buckeye Water Treatment Plant - Treated Whiskeytown Lake Water BFTPPA.XLS

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	6	6	6	7			6	6	5	5	5		52	5.78	NSE
Mg mg/L	6	7	6	7			7	8	7	8	7		63	7.00	
Alkalinity mg/l	39	35	35	35			37	38	37	38	38		332	36.89	NSE
Sp. Cond.	90	91	91	93			92	93	90	88	95		823	91.44	NSE
Temp. (F)	49	50	48	56			60	57	60	59	59		498	55.33	Degree F
pH	7.62	7.39	7.58	7.48			7.22	7.54	7.4	7.21	7.2		66.64	7.40	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0	0	0	0			0	0	0	0	0		0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0	0	0	0			0	0	0	0	0		0	0.00	500 ug/l
Ortho Ph. ug/l	0	0	0	0			0	0	0	0	0.004		0.004	0.00	NSE
TDS mg/l	57	61	64	54			60	54	48	54	61		513	57.00	1000 mg/l
Fe ug/l	0	0	0	0			0	0	0	0	0		0	0.00	300 ug/l
Mn ug/l	0	0	0	0			0	0	0	0	0		0	0.00	50 ug/l
NTU	0.05	0	0	0			0	0	0	0	0		0.05	0.01	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l		36	35	40			44	40	40	40	40		315	39.38	NSE

Buckeye Water Treatment Plant - Raw Whiskeytown Lake Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	6			6			6			6			24	6.00	NSE
Mg mg/L	6			7			7			8			28	7.00	
Alkalinity mg/l	35			39			40			42			156	39.00	NSE
Sp. Cond.	92			89			90			95			366	91.50	NSE
Temp. (F)	50			50			56			58			214	53.50	Degree F
pH	7.29			7.64			7.4			7.4			29.73	7.43	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0			0			0			0			0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0			0			0			0			0	0.00	500 ug/l
Ortho Ph. ug/l	0			0			0			0			0	0.00	NSE
TDS mg/l	58			55			57			55			225	56.25	1000 mg/l
Fe ug/l	0			0			0			0			0	0.00	300 ug/l
Mn ug/l	0			0			0			0			0	0.00	50 ug/l
NTU	0			0			0			0			0	0.00	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	36			40			38			38			152	38.00	NSE

Foothill Water Treatment Plant - Treated Sacramento River Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l					12		11	12	13	12	12	12	84	12.00	NSE
Mg mg/L					5		6	6	5	6	5	6	39	5.57	
Alkalinity mg/l	37		40		55		52	55	55	56	56	52	458	50.89	NSE
Sp. Cond.	97		104		132		123	137	132	126	134	133	1118	124.22	NSE
Temp. (F)	54		51		54		55	57	54	53	57	54	489	54.33	Degree F
pH	7.44		7.68		7.79		7.59	7.62	7.52	7.44	7.42	7.54	68.04	7.56	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l					0		0	0	0	0	0	0	0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0		0		0		0	0	0	0	0	0	0	0.00	500 ug/l
Ortho Ph. ug/l					0.008		0.009	0.015	0.015	0.017	0.019	0	0.083	0.01	NSE
TDS mg/l	47		70		97		88	90	80	86	92	80	730	81.11	1000 mg/l
Fe ug/l					0		0	0	0	0	0	0	0	0.00	300 ug/l
Mn ug/l					0		0	0	0	0	0	0	0	0.00	50 ug/l
NTU	0		0		0		0	0	0	0	0	0	0	0.00	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l			39		46		46	49	48	44	48	47	367	45.88	NSE

Foothill Water Treatment Plant - Raw Sacramento River Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	0				12		12			12			36	9.00	NSE
Mg mg/L	0				6		6			6			18	4.50	
Alkalinity mg/l	54				57		55			57			223	55.75	NSE
Sp. Cond.	126				129		126			123			504	126.00	NSE
Temp. (F)	53				52		53			53			211	52.75	Degree F
pH	7.83				7.84		7.78			7.53			30.98	7.75	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0				0		0			0			0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0				0		0			0			0	0.00	500 ug/l
Ortho Ph. ug/l	0.017				0.015		0.015			0.03			0.077	0.02	NSE
TDS mg/l	84				88		88			86			346	86.50	1000 mg/l
Fe ug/l	0				0		0			0			0	0.00	300 ug/l
Mn ug/l	0				0		0			0			0	0.00	50 ug/l
NTU	1.8				1.6		1.4			1.5			6.3	1.58	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	0				46		46			46			138	34.50	NSE

TABLE 9.15

REDDING AREA WATERSHED SANITARY SURVEY

2019 BUCKEYE WTP AND FOOTHILL WTP PARAMETERS

Analysis performed by Basic Laboratory

Buckeye Water Treatment Plant - Treated Whiskeytown Lake Water

BFTPPA.XLS

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	7	7	7	6	7	7	6	7		6	5.6	5.9	71.5	6.50	NSE
Mg mg/L	7	6	5	4	4	5	6	7		7	6.6	6.2	63.8	5.80	
Alkalinity mg/l	38	32	30	24	23	26	32	34		36	38	36	349	31.73	NSE
Sp. Cond.	101	101	87	76	76	81	87	92		92	93	95	981	89.18	NSE
Temp. (F)	51.3	48	47	62.8	55	60	57	58		58	55	51	603.1	54.83	Degree F
pH	7.42	6.98	7.23	7.07	7.08	7	7.5	7.19		7.34	7.25	7.26	79.32	7.21	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0	0	0	0	0	0	0	0		0	0	0	0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0	0	0	0	0	0	0	0		0	0	0	0	0.00	500 ug/l
Ortho Ph. ug/l	0	0	0	0	0	0	0	0		0	0	0	0	0.00	NSE
TDS mg/l	75	68	48	48	54	56	58	58		56	56	62	639	58.09	1000 mg/l
Fe ug/l	0	0	0	0	0	0	0	0		0	0	0	0	0.00	300 ug/l
Mn ug/l	0	0	0	0	0	0	0	0		0	0	0	0	0.00	50 ug/l
NTU	0	0	0	0	0	0	0	0		0	0	0	0	0.00	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	42	38	30	30	36	30	37	43		38	36	40	400	36.36	NSE

Buckeye Water Treatment Plant - Raw Whiskeytown Lake Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	7			7			6			6			26	6.50	NSE
Mg mg/L	7			4			6			7			24	6.00	
Alkalinity mg/l	42			29			36			40			147	36.75	NSE
Sp. Cond.	99			72			84			89			344	86.00	NSE
Temp. (F)	61			52			55			57			225	56.25	Degree F
pH	7.61			7.53			7.58			7.51			30.23	7.56	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0			0			0			0			0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0			0			0			0			0	0.00	500 ug/l
Ortho Ph. ug/l	0.013			0.017			0			0			0.03	0.01	NSE
TDS mg/l	60			52			50			58			220	55.00	1000 mg/l
Fe ug/l	0			324			0			0			324	81.00	300 ug/l
Mn ug/l	0			0			0			0			0	0.00	50 ug/l
NTU	1.1			1			0.9			0.6			3.6	0.90	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	43			30			37			38			148	37.00	NSE

Foothill Water Treatment Plant - Treated Sacramento River Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l				7	11	10	10	11	11	11	10.5		81.5	10.19	NSE
Mg mg/L				4	4	5	5	5	5	5	4.6		37.6	4.70	
Alkalinity mg/l				28	46	40	44	44	47	45	47		341	42.63	NSE
Sp. Cond.				86	116	105	111	110	115	110	113		866	108.25	NSE
Temp. (F)				50	55	55	54	55	51	52	52		424	53.00	Degree F
pH				7.23	7.52	7.37	7.45	7.49	7.42	7.49	7.41		59.38	7.42	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l				0	0	0	0	0	0	0	0		0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l				0	0	0	0	0	0	0	0		0	0.00	500 ug/l
Ortho Ph. ug/l				0	0	0	0.004	0.013	0.012	0.016	0.013		0.058	0.01	NSE
TDS mg/l				54	79	83	71	67	87	73	74		588	73.50	1000 mg/l
Fe ug/l				0	0	0	0	0	0	0	0		0	0.00	300 ug/l
Mn ug/l				0	0	0	0	0	0	0	0		0	0.00	50 ug/l
NTU				0	0	0	0	0	0	0	0		0	0.00	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l				36	43	38	40	45	42	44	40		328	41.00	NSE

Foothill Water Treatment Plant - Raw Sacramento River Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l				10			10			11			31	10.33	NSE
Mg mg/L				4			5			5			14	4.67	
Alkalinity mg/l				43			49			48			140	46.67	NSE
Sp. Cond.				108			109			107			324	108.00	NSE
Temp. (F)				53			53			51			157	52.33	Degree F
pH				7.81			7.73			7.74			23.28	7.76	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l				0			0			0			0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l				0			0			0			0	0.00	500 ug/l
Ortho Ph. ug/l				0			0.016			0.025			0.041	0.01	NSE
TDS mg/l				67			79			73			219	73.00	1000 mg/l
Fe ug/l				117			226			225			568	189.33	300 ug/l
Mn ug/l				0			0			0			0	0.00	50 ug/l
NTU				2.7			3.9			2.8			9.4	3.13	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l				41			43			40			124	41.33	NSE

TABLE 9.15
REDDING AREA WATERSHED SANITARY SURVEY
2020 BUCKEYE WTP AND FOOTHILL WTP PARAMETERS
Analysis performed by Basic Laboratory

Buckeye Water Treatment Plant - Treated Whiskeytown Lake Water BFTPPA.XLS

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	6.4	6.6	7.1	6.1	6.1	5.7	6.2						44.2	6.31	NSE
Mg mg/L	5.7	5.8	5.7	6.5	6.7	6.8	6.9						44.1	6.30	
Alkalinity mg/l	34	35	35	36	35	36	37						248	35.43	NSE
Sp. Cond.	92	95	96	96	91	95	96						661	94.43	NSE
Temp. (F)	48	47	48	54	54	57	60						368	52.57	Degree F
pH	7.26	7.39	7.3	7.29	7.83	7.29	7.21						51.57	7.37	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0	0	0	0	0	0	0						0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0	0	0	0	0	0	0						0	0.00	500 ug/l
Ortho Ph. ug/l	0	0	0	0	0	0.016	0						0.016	0.00	NSE
TDS mg/l	59	59	60	40	60	55	57						390	55.71	1000 mg/l
Fe ug/l	0	0	0	0	0	0	0						0	0.00	300 ug/l
Mn ug/l	0	0	0	0	0	0	0						0	0.00	50 ug/l
NTU	0	0	0	0	0	0	0						0	0.00	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	37	39	44	40	38	37	40						275	39.29	NSE

Buckeye Water Treatment Plant - Raw Whiskeytown Lake Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	6.4			5.9			5.3						17.6	5.87	NSE
Mg mg/L	5.9			6.7			7						19.6	6.53	
Alkalinity mg/l	38			40			40						118	39.33	NSE
Sp. Cond.	88			90			91						269	89.67	NSE
Temp. (F)	48			50			60						158	52.67	Degree F
pH	7.69			7.74			7.38						22.81	7.60	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0			0			0						0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0			0			0						0	0.00	500 ug/l
Ortho Ph. ug/l	0			0			0						0	0.00	NSE
TDS mg/l	57			55			55						167	55.67	1000 mg/l
Fe ug/l	0			0			0						0	0.00	300 ug/l
Mn ug/l	0			0			0						0	0.00	50 ug/l
NTU	1.2			0.7			0.7						2.6	0.87	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	38			39			39						116	38.67	NSE

Foothill Water Treatment Plant - Treated Sacramento River Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	10.7	6.4	11.7	9.8	10.8	11.8	10.7						71.9	10.27	NSE
Mg mg/L	5.3	6	5.4	5.8	5.6	5.5	5.4						39	5.57	
Alkalinity mg/l	51	35	55	47	50	54	52						344	49.14	NSE
Sp. Cond.	117	93	134	119	119	132	131						845	120.71	NSE
Temp. (F)	53	50	52	51	55	54	54						369	52.71	Degree F
pH	7.67	7.49	7.61	7.84	7.82	7.64	7.49						53.56	7.65	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0	0	0	0	0	0	0						0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0	0	0	0	0	0	0						0	0.00	500 ug/l
Ortho Ph. ug/l	0	0	0	0	0	0.012	0						0.012	0.00	NSE
TDS mg/l	72	55	86	72	84	83	80						532	76.00	1000 mg/l
Fe ug/l	0	0	0	0	0	0	0						0	0.00	300 ug/l
Mn ug/l	0	0	0	0	0	0	0						0	0.00	50 ug/l
NTU	0	0	0	0	0	0							0	0.00	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	48	39	52	46	48	45	46						324	46.29	NSE

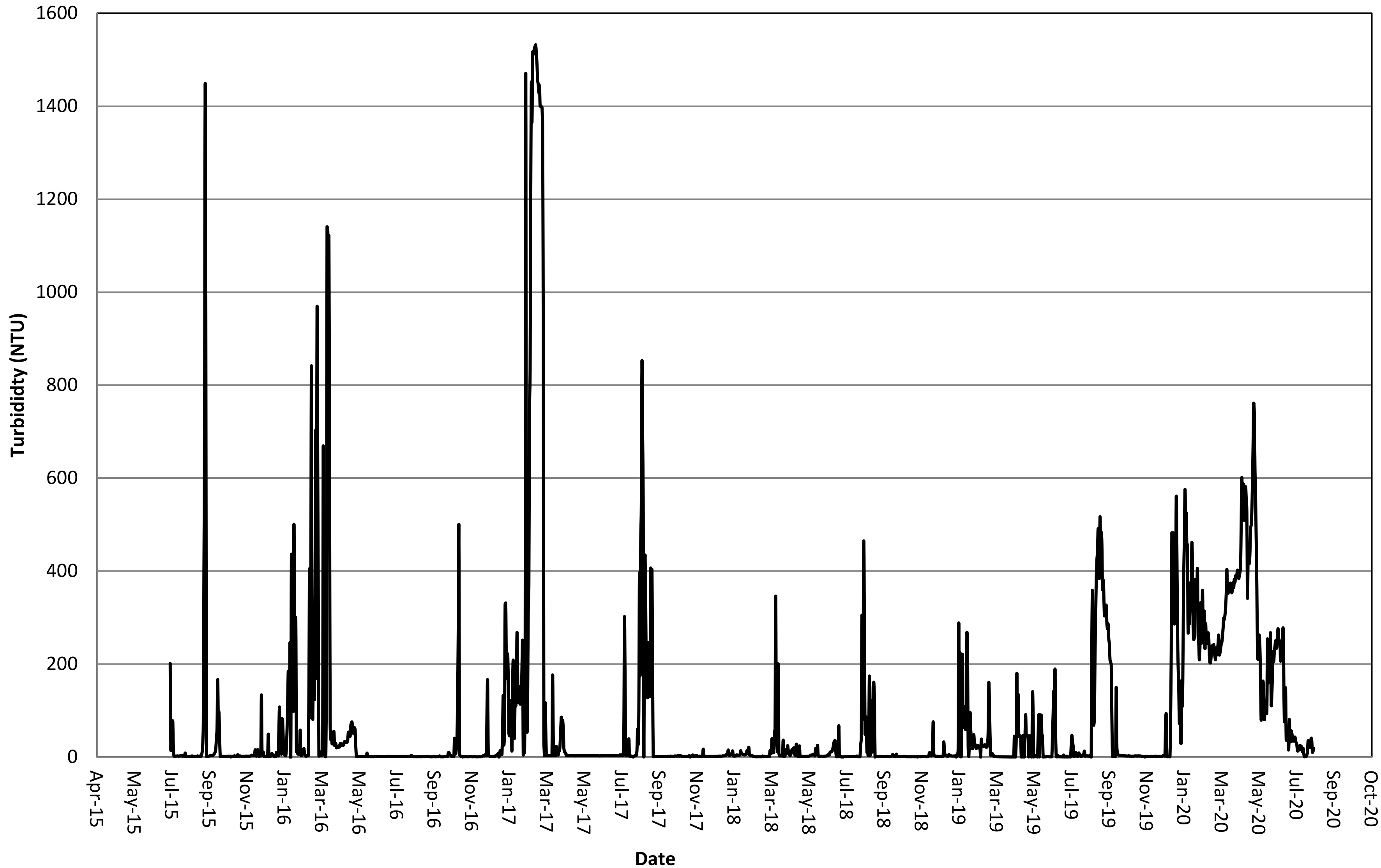
Foothill Water Treatment Plant - Raw Sacramento River Water

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total	Average	MCL
Calcium mg/l	10.3			10.6			10.8						31.7	10.57	NSE
Mg mg/L	5.2			5.7			5.6						16.5	5.50	
Alkalinity mg/l	82			51			54						187	62.33	NSE
Sp. Cond.	115			119			127						361	120.33	NSE
Temp. (F)	52			50			53.6						155.6	51.87	Degree F
pH	7.81			7.85			7.77						23.43	7.81	NSE
Cd ug/l													0	0.00	5 ug/l
Cr ug/l													0	0.00	50 ug/l
Cu ug/l	0			0			0						0	0.00	1000 ug/l
Pb ug/l													0	0.00	AL-15 ug/l
Ni ug/l													0	0.00	100 ug/l
Ag ug/l													0	0.00	100 ug/l
Zn ug/l	0			0			0						0	0.00	500 ug/l
Ortho Ph. ug/l	0.017			0			0.014						0.031	0.01	NSE
TDS mg/l	71			75			77						223	74.33	1000 mg/l
Fe ug/l	109			0			0						109	36.33	300 ug/l
Mn ug/l	0			0			0						0	0.00	50 ug/l
NTU	1.8			0.9			0.7						3.4	1.13	NSE
T.S.S. mg/l													0	0.00	NSE
Hardness mg/l	48			44			45						137	45.67	NSE

FIGURE 9.1

REDDING AREA WATERSHED SANITARY SURVEY

2015-2020 AVERAGE DAILY TURBIDITY IN SACRAMENTO RIVER ABOVE SHASTA LAKE

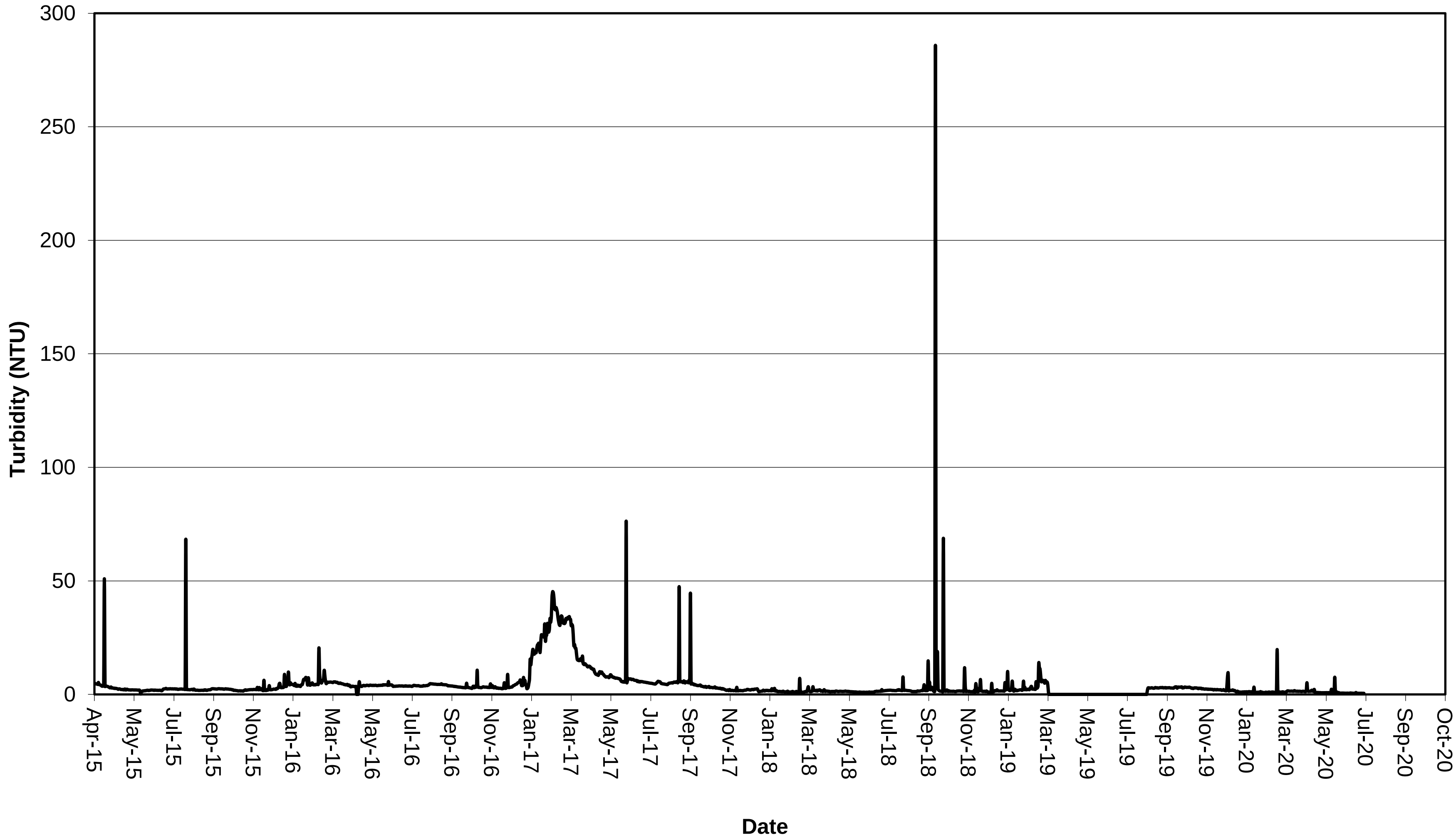


SOURCE: DATA PROVIDED BY CDEC STATION SACRAMENTO RIVER AT DELTA (DLT)

FIGURE 9.2

REDDING AREA WATERSHED SANITARY SURVEY

2015-2020 AVERAGE DAILY TURBIDITY
SHASTA LAKE AT SHASTA DAM



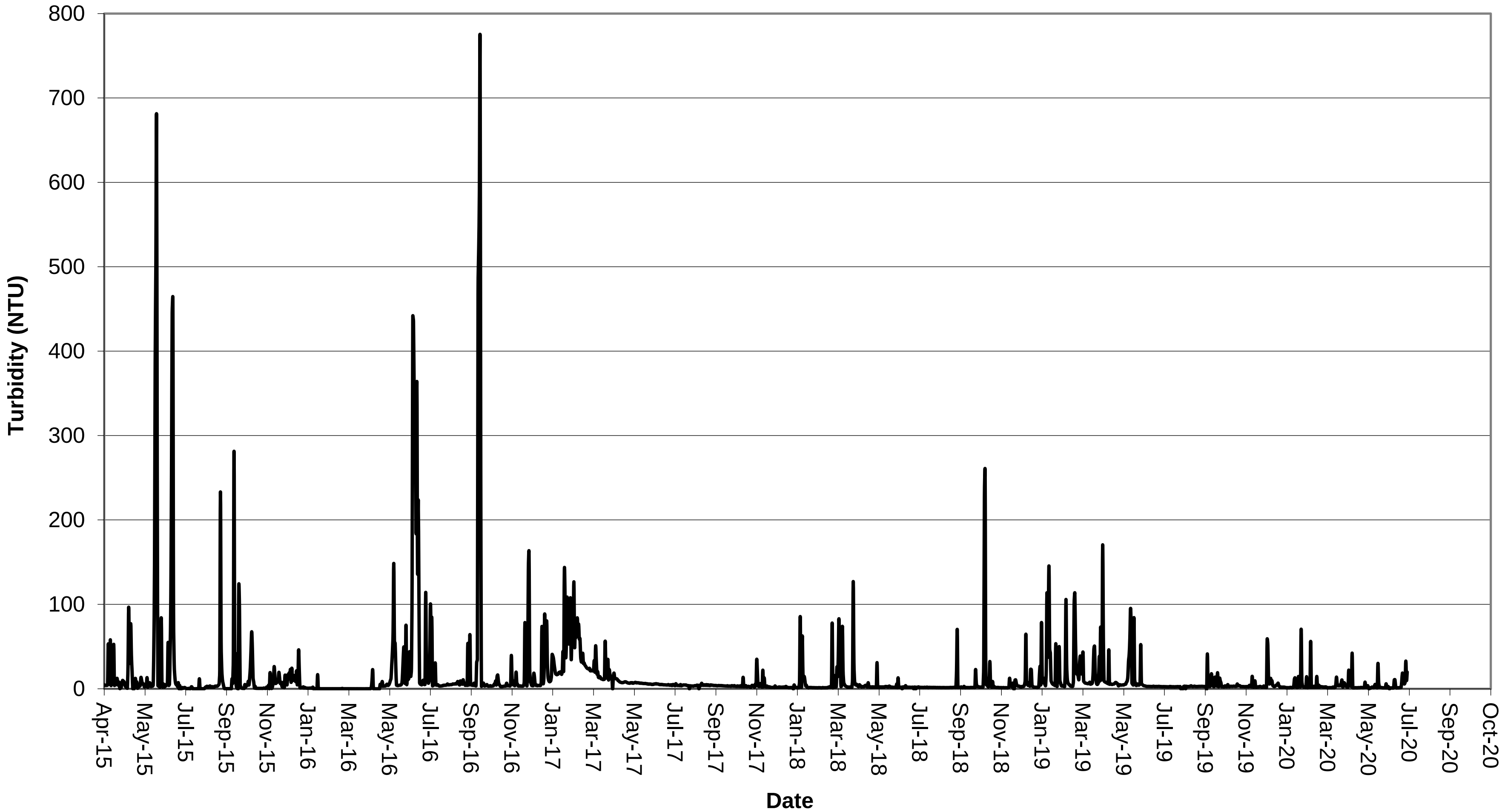
SOURCE: DATA PROVIDED BY CDEC STATION SHASTA DAM (SHD)
DATA NOT AVAILABLE: 3/11/19 TO 8/8/19

FIGURE 9.3

REDDING AREA WATERSHED SANITARY SURVEY

2015-2020 AVERAGE DAILY TURBIDITY

SACRAMENTO RIVER BELOW SHASTA DAM AT BALLS FERRY BRIDGE



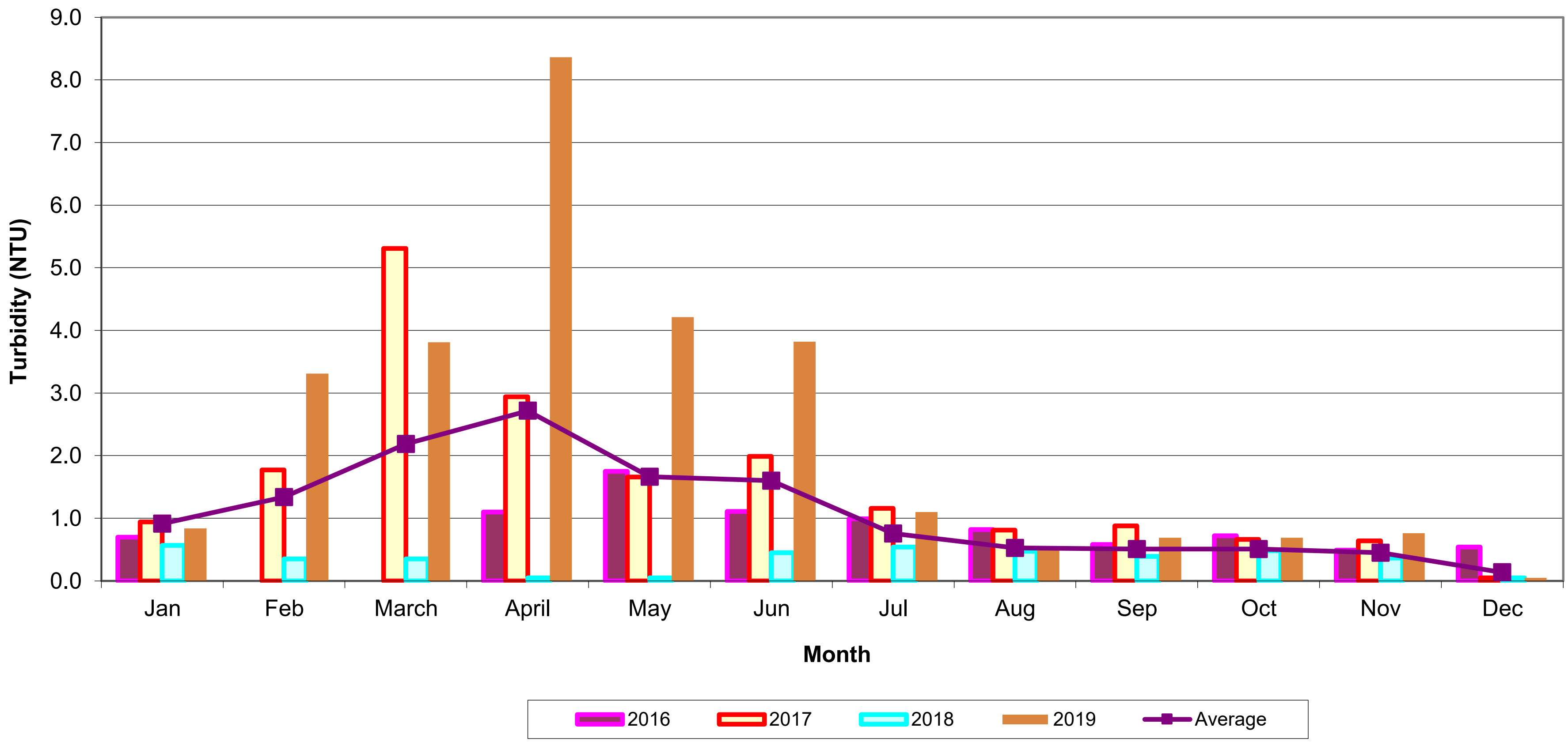
SOURCE: CDEC STATION BALLS FERRY BRIDGE (BSF)

DATA NOT AVAILABLE FROM 1/8/15 TO 3/24/15, 1/29/18,1/30/18, 8/2/18 TO 8/5/18, 8/2/19 TO 8/5/19

FIGURE 9.4

REDDING AREA WATERSHED SANITARY SURVEY

BUCKEYE WATER TREATMENT PLANT RAW WATER MONTHLY MAXIMUM AVERAGE TURBIDITIES 2016-2019 WHISKEYTOWN LAKE (SPRING CREEK CONDUIT)

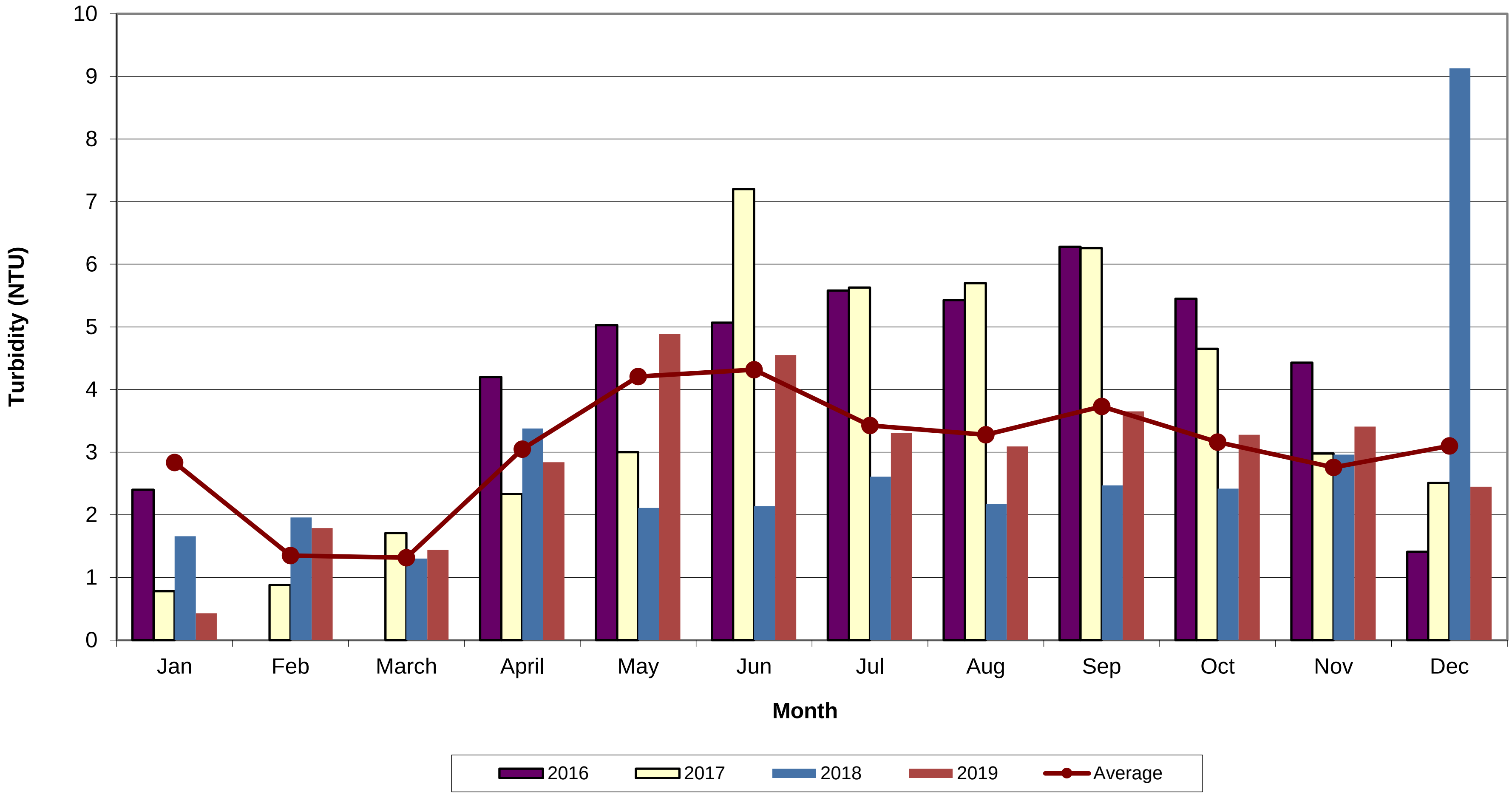


FROM CITY OF REDDING MONTHLY PLANT DATA

FIGURE 9.5

REDDING AREA WATERSHED SANITARY SURVEY

FOOTHILL WATER TREATMENT PLANT RAW WATER MONTHLY MAXIMUM AVERAGE TURBIDITIES 2016-2019 SACRAMENTO RIVER

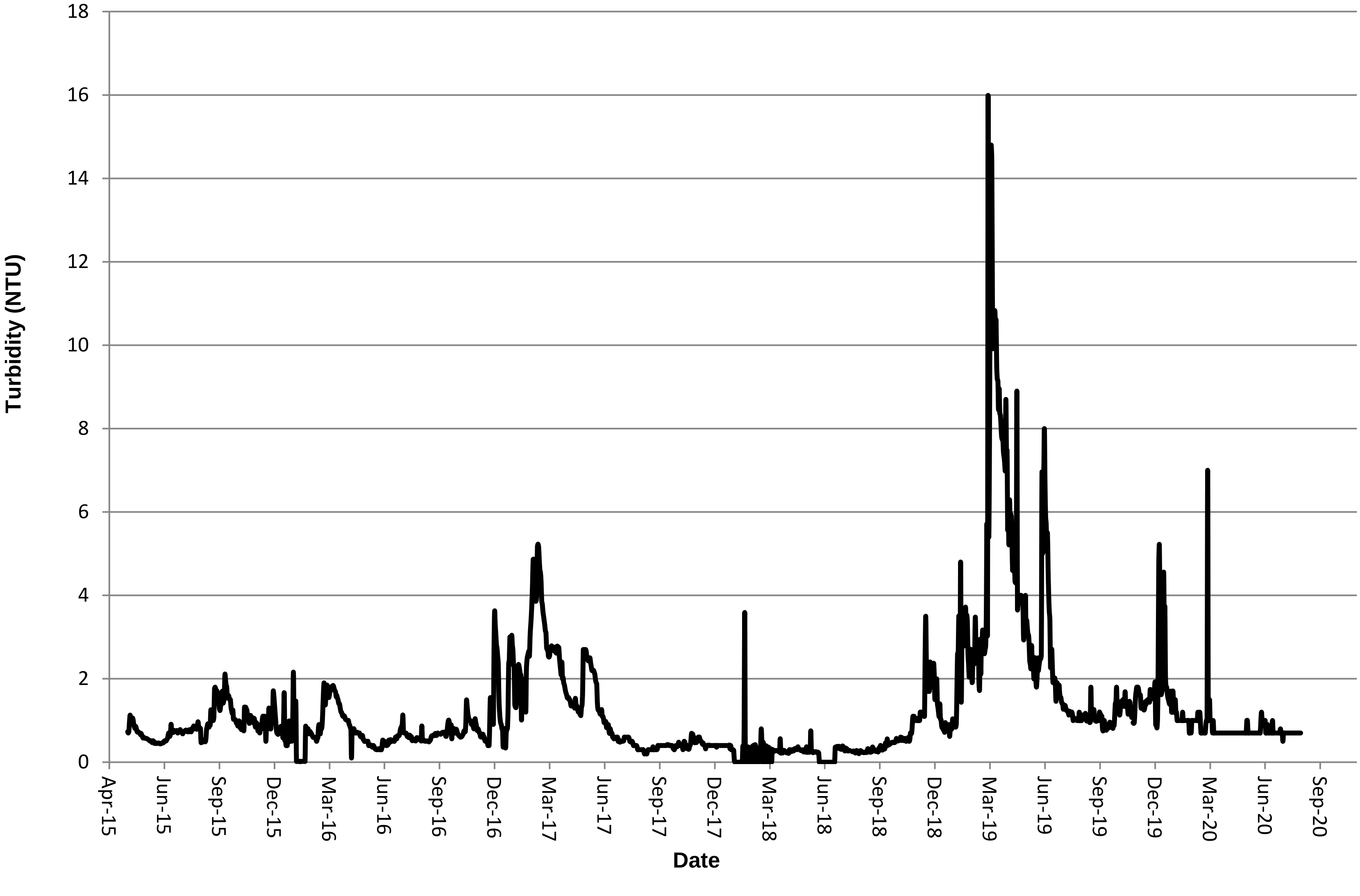


FROM CITY OF REDDING MONTHLY PLANT DATA

FIGURE 9.6

REDDING AREA WATERSHED SANITARY SURVEY

2015-2020 WHISKEYTOWN LAKE AVERAGE DAILY RAW WATER TURBIDITY



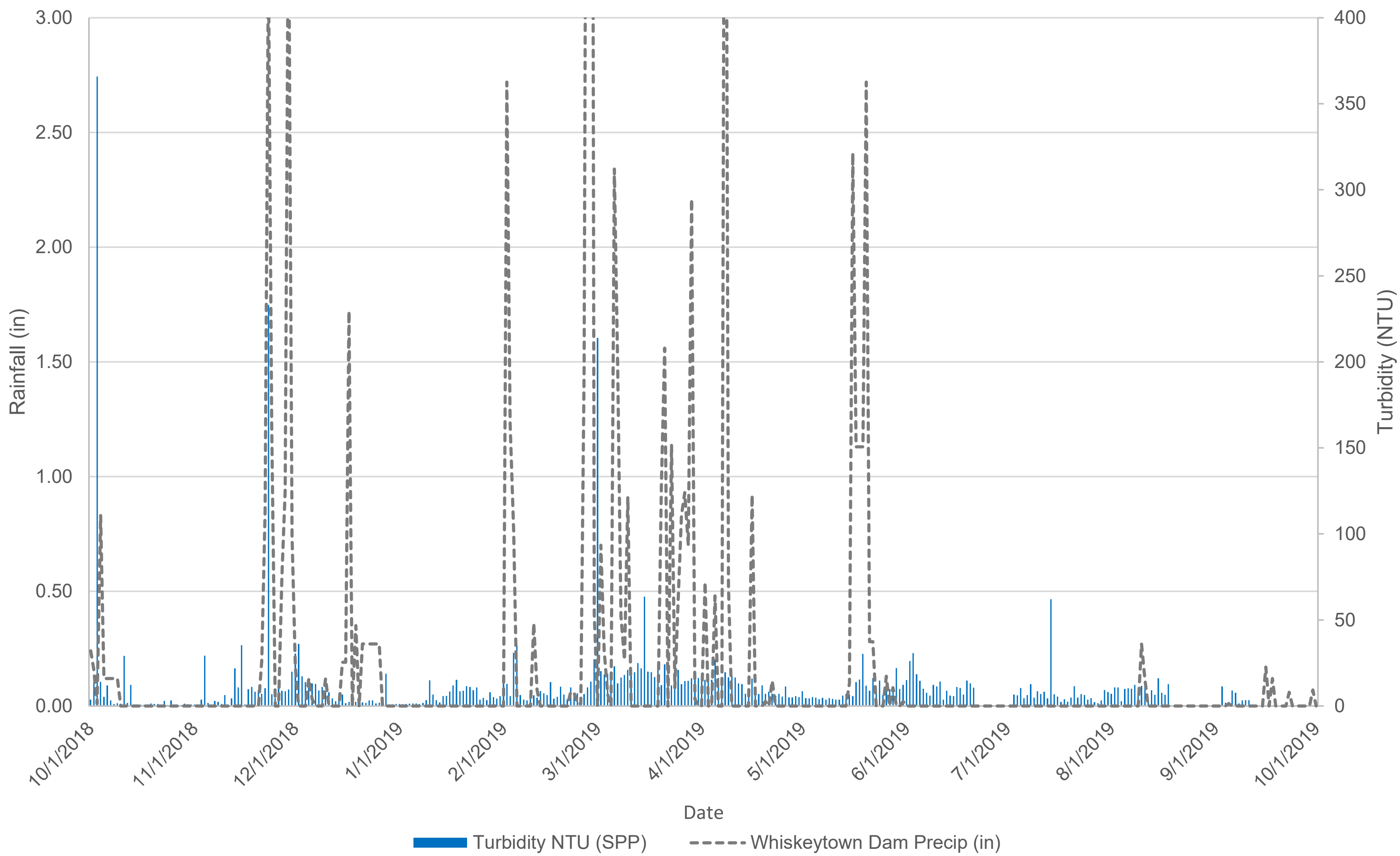
FROM CLEAR CREEK CSD MONITORED RAW WATER (RSW-001)

FIGURE 9.7

REDDING AREA WATERSHED SANITARY SURVEY

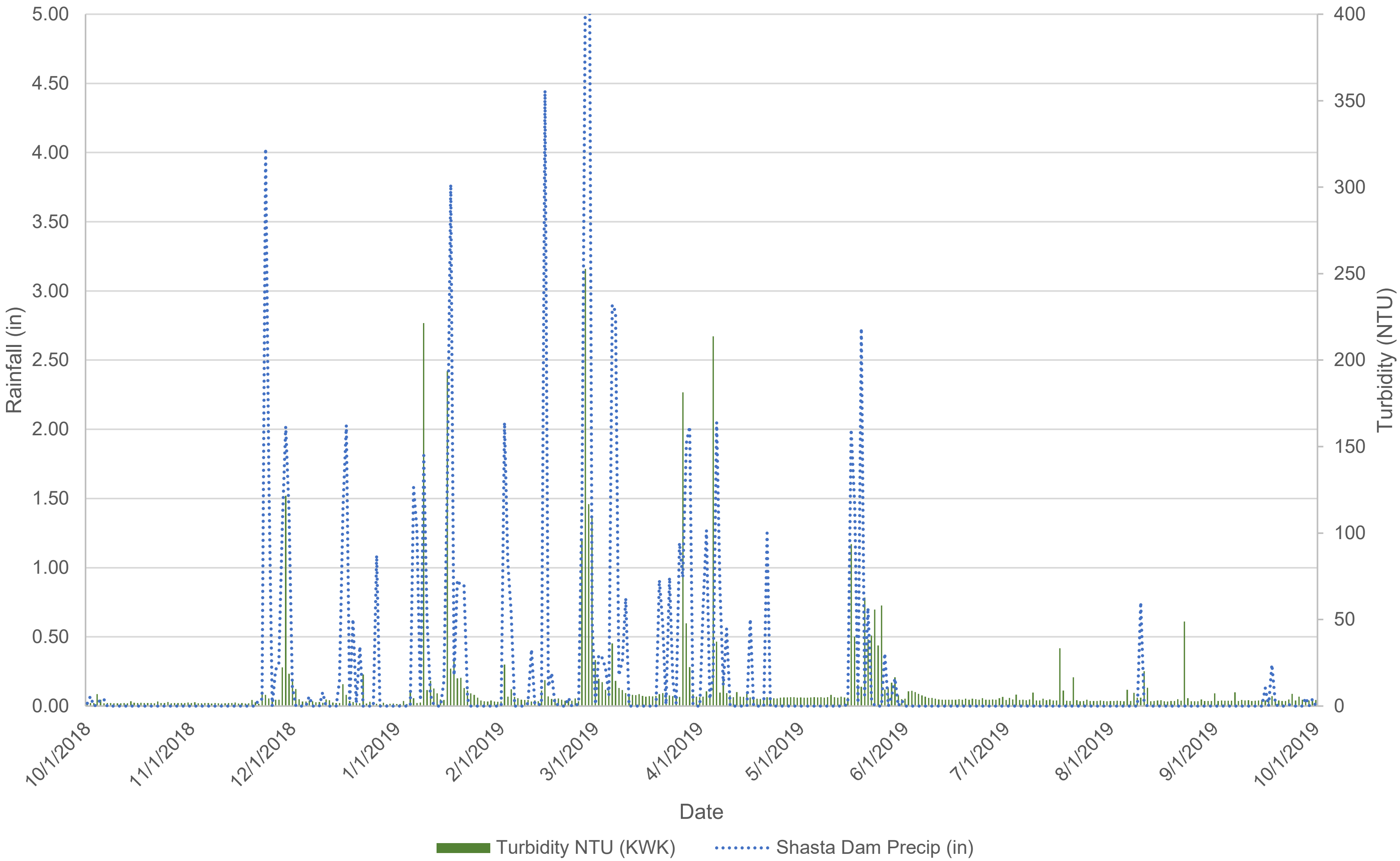
SPRING CREEK TURBIDITY AND WHISKEYTOWN DAM PRECIPITATION

OCTOBER 2018-2019



https://cdec.water.ca.gov/dynamicapp/selectQuery

FIGURE 9.8
REDDING AREA WATERSHED SANITARY SURVEY
SACRAMENTO RIVER TURBIDITY AND SHASTA DAM PRECIPITATION
OCTOBER 2018-2019



https://cdec.water.ca.gov/dynamicapp/selectQuery

APPENDICES

APPENDIX A

Post Fire Water Quality Impacts and Sampling Results at Public Water System Intakes on the Sacramento River, Whiskeytown Lake, Shasta Lake, and Upper Clear Creek

State Water Resources Control Board
Division of Drinking Water

Post Fire Water Quality Impacts and Sampling Results at Public Water System Intakes on the Sacramento River, Whiskeytown Lake, Shasta Lake, and Upper Clear Creek

Prepared by
SWRCB Division of Drinking Water
Lassen District Field Office
August 1, 2019

Introduction

During the summer of 2018, the communities near Redding experienced three major wildfires (Carr, Hirz, and Delta Fires). Some of these community's water systems were directly affected by the fires and required facility and distribution system repairs. For water systems with source water intakes in fire affected watersheds, we anticipated that their raw water quality would be significantly impacted during the wet weather season following the fires. The landscape was significantly altered and water quality in the affected watersheds was expected to decline. In this report, the Division of Drinking Water (Division) provides a summary of water quality data collected at seven drinking water intake locations during the 2018/2019 wet weather season in Upper Clear Creek, Whiskeytown Lake, the Lower Sacramento River, and Shasta Lake.

Summary of Results

In general, water quality impacts in the fire affected areas were not as severe as anticipated. Surface water treatment plants were generally able to operate continuously throughout the winter without any difficulty in meeting turbidity performance standards and only needed to cease treatment for short periods after significant rainfall events, until source water improved.

Background

The Carr Fire was a powerful wildfire that burned in Shasta and Trinity Counties from July 23, 2018 to August 30, 2018. The fire burned 229,651 acres, destroying 1,077 homes and 277 other structures. The fire began at the intersection of Highway 299 and Carr Powerhouse Road in Whiskeytown National Recreation Area (WNRA) and burned throughout the recreation area all around Whiskeytown Lake. As the fire increased in size, the communities of

Shasta, Keswick, Igo, Ono, and French Gulch were evacuated. On July 26, 2018, the fire jumped across the Sacramento River and made its way into the City of Redding and portions of the City were also evacuated. Portions of the City of Shasta Lake and the town of Lewiston in Trinity County were also later evacuated. The Carr Fire affected watersheds along Upper Clear Creek, Whiskeytown Lake, the Sacramento River, and areas of Shasta Lake.

In addition to the Carr fire, two other wildfires, the Hirz and Delta Fires, burned north of Redding, in the Shasta National Forest. The Hirz fire began on August 9, 2018 and was contained on September 12, 2018. The Delta fire began on September 5, 2018 and merged with the Hirz fire. It was contained on October 7, 2018. The Hirz and the Delta fires affected the watersheds along the Upper Sacramento River and portions of Lake Shasta.

The focus of this report is on the water systems affected by the Carr, Hirz, and Delta Fires within Shasta County.

Public Water Systems Affected by the Carr Fire

- City of Redding – Buckeye Water Treatment Plant
- Clear Creek Community Services District
- Centerville Community Services District
- Shasta Community Services District
- Bella Vista Water District
- Shasta County Service Area # 25 – Keswick
- Shasta County Service Area #11 – French Gulch
- Whiskeytown National Recreation Area (WNRA) – Headquarters, Brandy Creek, Dry Creek, Oak Bottom, and Whiskey Creek
- Shasta Lake City
- Mountain Gate Community Services District

Wet Weather Preparations

Based on the burn severity and topography, the Division anticipated that surface water systems in the recently impacted watersheds would experience reduced source water quality, particularly during the first few significant rainstorm events. Significant erosion was expected, especially in the Whiskeytown watersheds and surface water in the affected areas was expected to have increased turbidity and total organic carbon (TOC), and experience changes in pH and alkalinity. These changes were expected based on reports from water systems in California whose watersheds have been affected by fire and significant changes in TOC, pH, alkalinity, and nitrate were observed. Such changes can pose significant challenges for water treatment plant operators. Water quality in the watersheds affected by the Carr, Delta, and Hirz fires is typically very good, with turbidities in Whiskeytown Lake generally below 1 NTU, and turbidities in the Lower Sacramento River and Shasta Lake usually below 5 NTU. Because of this, the surface water treatment plants in the area do not have robust sludge removal capabilities.

The Division and the affected water systems met regularly throughout the fall of 2018 to discuss operational changes that may need to occur to adequately treat drinking water if these changes in water quality were to occur. Potential preparations discussed included:

- Operating inline filtration plants as direct filtration;
- Evaluating the option to serve from storage during high raw surface water turbidity events;
- Evaluating the option to serve groundwater during high raw surface water turbidity events;
- Testing, improving and building new interties between water systems;
- Testing, improving and building new booster pump stations to increase operational flexibility;
- Identifying vendors/contractors to provide temporary booster pump stations;
- Evaluating filter media replacement options;
- Modifying recycled water rates;
- Evaluating different coagulants such as ferric chloride;
- Using CO_2 to depress pH;
- Evaluating sludge removal options; and
- Acquiring new treatment plant diagnostic equipment.

In addition, the City of Redding constructed a new pump station to provide greater flexibility in serving either groundwater or surface water to all its customers.

Sampling Plan

The affected water systems and the Division collected source water samples nearly every two weeks beginning in October 2018 and continuing through April 2019 from surface water intake locations on Upper Clear Creek, Whiskeytown Lake, the Sacramento River, and Shasta Lake. The samples were analyzed for pH, temperature, turbidity, nitrate, total organic carbon (TOC), and alkalinity at the California Department of Public Health (CDPH) – Drinking Water Branch Laboratory in Richmond, CA.

The Central Valley Regional Water Quality Control Board also performed comprehensive water quality sampling within portions of the Trinity River, Whiskeytown Lake, and Sacramento River watersheds. Data for this effort can be obtained at:

https://www.waterboards.ca.gov/centralvalley/water_issues/wildfire_response/carr/

Sample Locations

Sampling locations are presented on the attached map. Note, the water systems in the WNRA were not operating during the majority of the sampling period, therefore, water quality samples were not collected from these intake locations.

Water System	Surface Water Source
Shasta CSA #11 - French Gulch Intake	Upper Clear Creek
City of Redding Buckeye, Shasta CSA #25 Keswick and Shasta CSD Intakes	Whiskeytown Lake (Spring Creek Conduit)
Clear Creek CSD Intake	Whiskeytown Lake (Dam) - two different depth defined intakes
City of Redding Pump Station #1	Sacramento River (upstream of Diestel Horse Bridge)
Bella Vista Water District Wintu Pump Station	Sacramento River (near Hilltop trail)
City of Shasta Lake Intake	Shasta Lake (near Shasta Dam)
Mt. Gate CSD Intake	Shasta Lake (near Bridge Bay)

Results

Heavy precipitation was first experienced in the Redding area on November 23, 2018. The wet weather season continued through April 2019, with cumulative precipitation of 81 inches in the Whiskeytown NRA and 53 inches in Redding measured at the Keswick Dam USBR station. The average annual accumulated precipitation in the Whiskeytown NRA is approximately 66 inches and the 50 percent probability of total rainfall in Redding near the Keswick Dam ranges from 41 to 50 inches (based on CDEC rainfall frequency maps). Rainfall in 2018 exceeded the 50 percent probability in the affected watersheds.

<u>Whiskeytown Lake Intakes – City of Redding, Shasta CSA #25 -Keswick, Shasta CSD, and Clear Creek CSD Water Systems</u>

Turbidity: Turbidity in Whiskeytown Lake exhibited an overall increase from October through March and began to decrease significantly in April. Precipitation and turbidity are measured at two locations near the Clear Creek CSD intake (CDEC station WHI and WTR – see attached map) and recorded daily. When precipitation and turbidity measurements were compared, turbidity is shown to increase following precipitation events, and increased overall throughout the winter. The highest recorded turbidity measurement was 17.2 NTU near the dam, and 21.5 NTU from the spring creek conduit. Turbidity in the winter normally ranges from 0.5 to 5 NTU.

pH and Alkalinity: At the Clear Creek CSD intake pH ranged from 6.8 to 7.7 with an average of 7.1. Alkalinity ranged from 29 to 45.5 mg/L with an average of 39.4 mg/L. The City of Redding Spring Creek Conduit intake pH ranged from 7.0 to 7.6 with an average of 7.4, and alkalinity ranged from 30.5 to 45.5 mg/L with an average of 39.6 mg/L. pH in the Spring Creek Conduit is slightly greater than at the Clear Creek intake, and alkalinity concentrations are similar at the two intakes.

TOC: Concentrations of TOC at the Clear Creek intake showed a slight decrease from October through April. The greatest concentration was observed in November at a concentration of 1.81 mg/L and averaged 1.3 mg/L . TOC concentrations at the City of Redding Spring Creek Conduit intake showed a slight increase from October to January, then similarly began to decrease through April. TOC ranged from 0.9 to 1.6 mg/L, averaging 1.3 mg/L.

<u>Sacramento River Intakes – City of Redding and Bella Vista WD Water Systems</u>
Turbidity: Incremental precipitation measured at the CDEC station located at Keswick Dam was compared to turbidity recorded at the CDEC station and at the City of Redding and Bella Vista intake locations on the Sacramento River. Turbidity is shown to increase in the river following precipitation events and appears to recover back to baseline levels typically under 5 NTU when weather conditions are dry.

pH and Alkalinity: pH at the City of Redding pump station ranged from 7.0 to 7.4 and alkalinity ranged from 46.5 to 66 mg/L, averaging 56.4 mg/L. pH at Bella Vista’s intake ranged from 6.9 to 7.3 and alkalinity ranged from 36.5 to 66.5, averaging 56.5 mg/L.

TOC: TOC concentrations exhibited a slight overall decreasing trend from October through April.

<u>Upper Clear Creek Intake – Shasta CSA #11 – French Gulch Water System</u>
Turbidity: Turbidity measured at the French Gulch water system intake was typically observed below 5 NTU, but ranged from 0.4 to 220 NTU. Turbidity was greatest following the first significant rainstorm event of the season in November.

pH and Alkalinity: pH ranged from 7.2 to 7.8, and alkalinity ranged from 22.3 to 55 mg/L, averaging 37.4 mg/L.

TOC: TOC measured at the French Gulch intake showed an overall decreasing trend from October through April with the exception of a high measurement in November 2018. Disinfection by products were measured at elevated levels in the French Gulch distribution system during this period of elevated TOCs.

Shasta Lake Intakes - City of Shasta Lake and Mt. Gate CSD water systems
Turbidity: Turbidity measured at the City of Shasta Lake intake and Mt. Gate CSD intake increased from October 2018 through April 2019.

pH and Alkalinity: pH at the Mt. Gate intake ranged from 7.4 to 7.8 and alkalinity ranged from 53 to 66 mg/L. pH at the Shasta Lake City intake ranged from 6.9 to 9.0 and alkalinity ranged from 46 to 65 mg/L.

TOC: At the Mountain Gate intake, TOC concentrations increased in March and April after experiencing a decreasing trend from October to February. TOC measurements at the Shasta Lake City intake showed a slightly decreasing trend from October through April.

* The analysis for nitrate ended in January 2019 because all eight rounds of samples at each location were non-detect.

Conclusions

Water quality impacts during the 2018/2019 wet season were not as severe as expected. Water quality throughout the winter and spring decreased for brief periods during a rain event but would recover immediately following the event. This allowed the surface water treatment plants to generally operate continuously throughout the winter and only cease treatment plant operations and serve from storage for short periods until the source water quality improved. With this option to shut down during high turbidity events, no water system had difficulties with meeting turbidity performance standards or with sludge management. The affected landscapes did experience erosion contributing to sediment transport into receiving water bodies, but the area did not show mass wasting or significant debris flow as anticipated. The Clear Creek water treatment plant and a portion of Whiskeytown Lake near the Clear Creek intake experienced an algal bloom in early March 2019, which significantly decreased filter runs lengths. It is unknown if the algal bloom was related to post-fire water quality conditions. The French Gulch water system experienced elevated disinfection by product levels likely caused by elevated TOCs in their source water.

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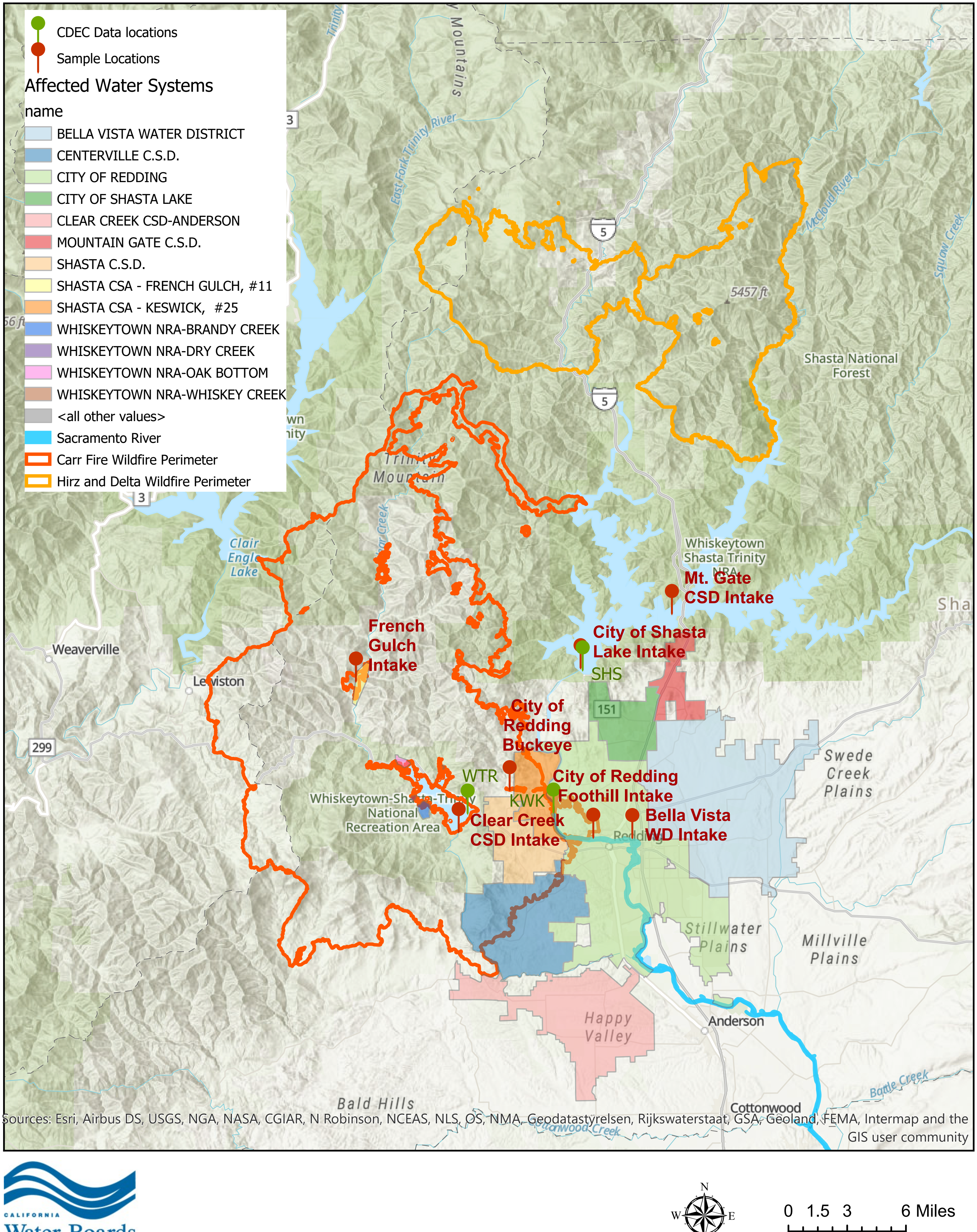
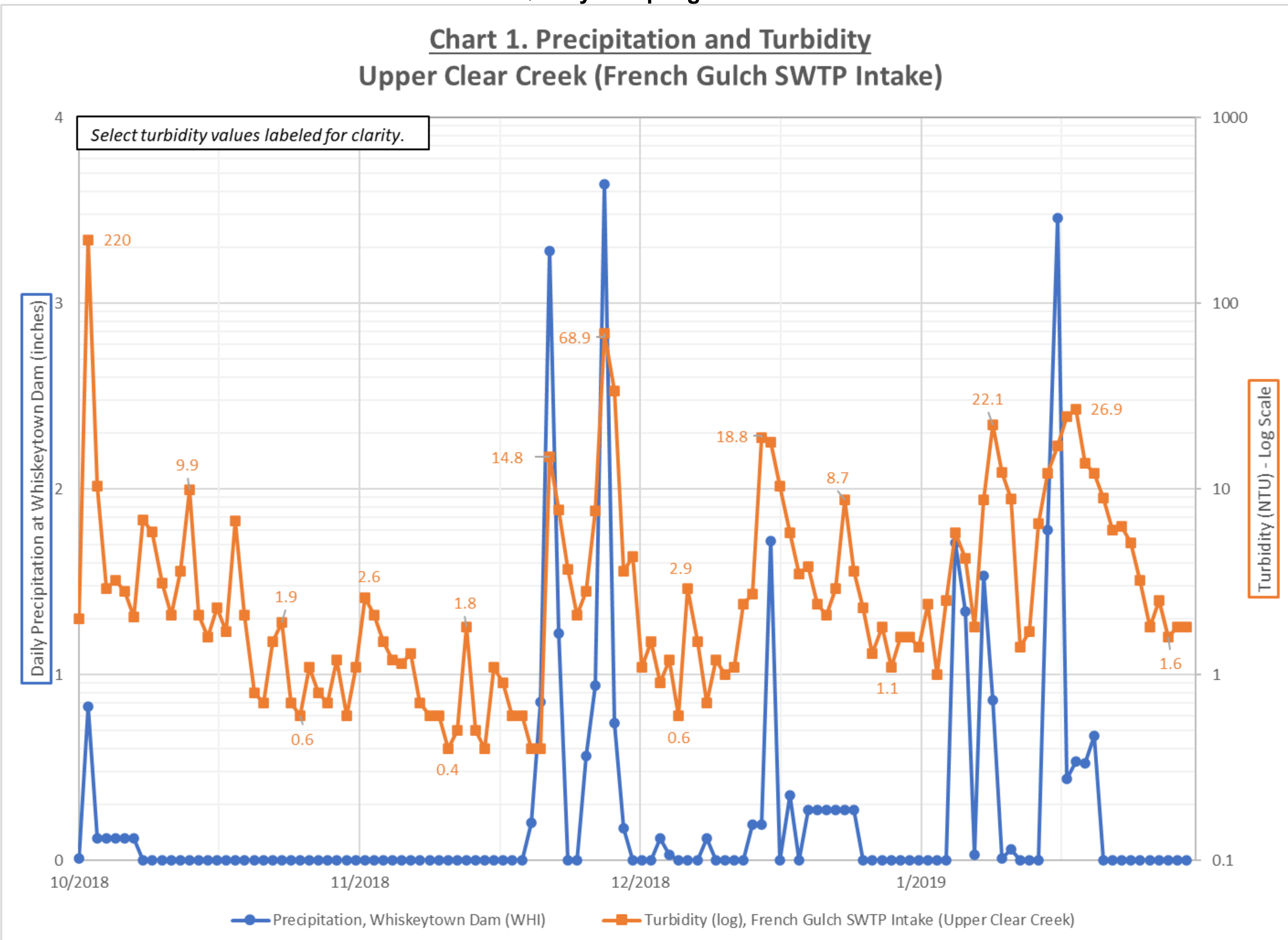


CALIFORNIA Water Boards

State Water Resources Control Board
Division of Drinking Water

Water Quality Sampling Results



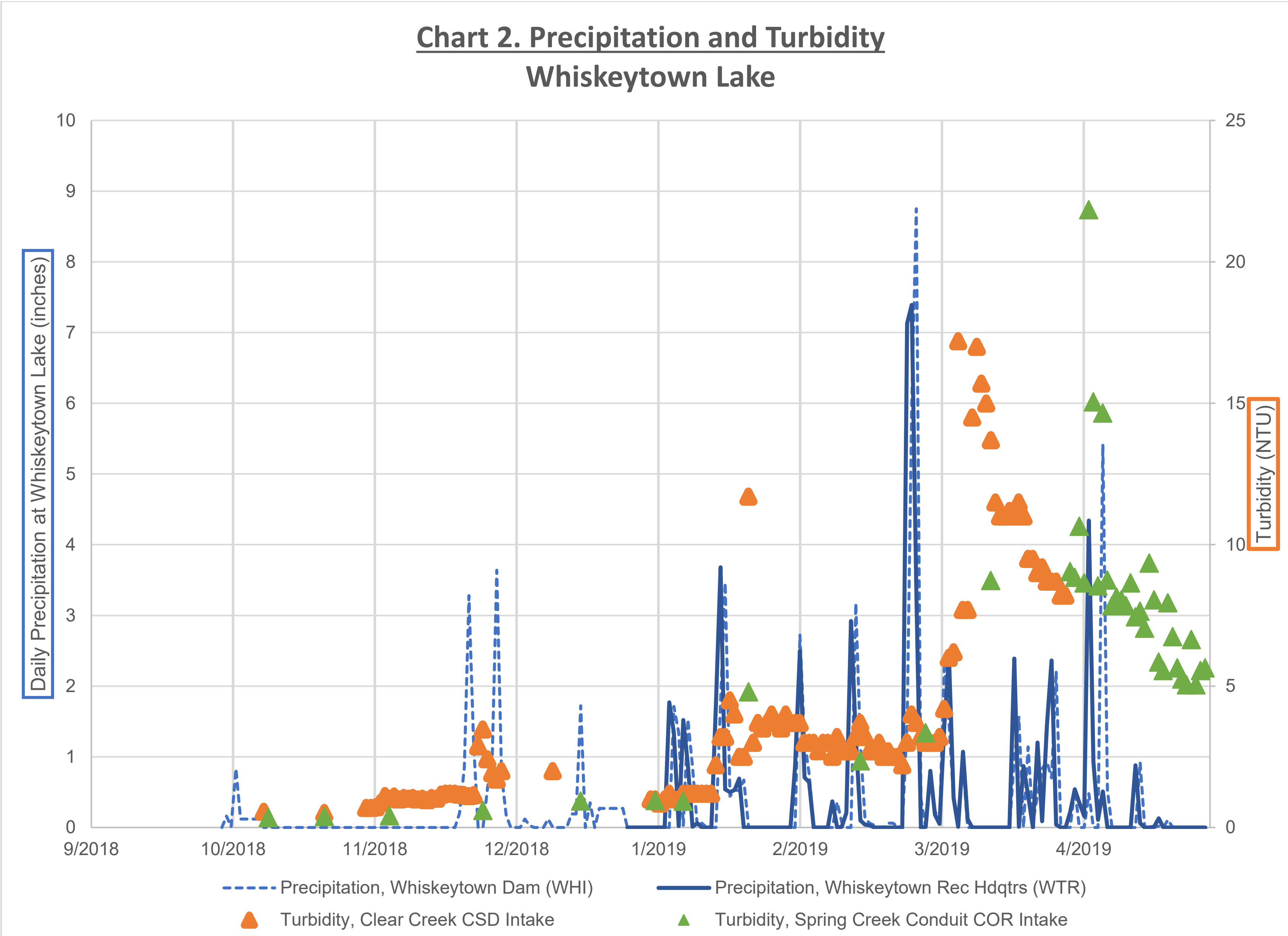


Chart 2. Precipitation and Turbidity
Whiskeytown Lake
Daily Precipitation at Whiskeytown Lake (inches)
Turbidity (NTU)
10
9
8
7
6
5
4
3
2
1
0
25
20
15
10
5
0
9/2018
10/2018
11/2018
12/2018
1/2019
2/2019
3/2019
4/2019
Precipitation, Whiskeytown Dam (WHI)
Precipitation, Whiskeytown Rec Hdqtrs (WTR)
Turbidity, Clear Creek CSD Intake
Turbidity, Spring Creek Conduit COR Intake

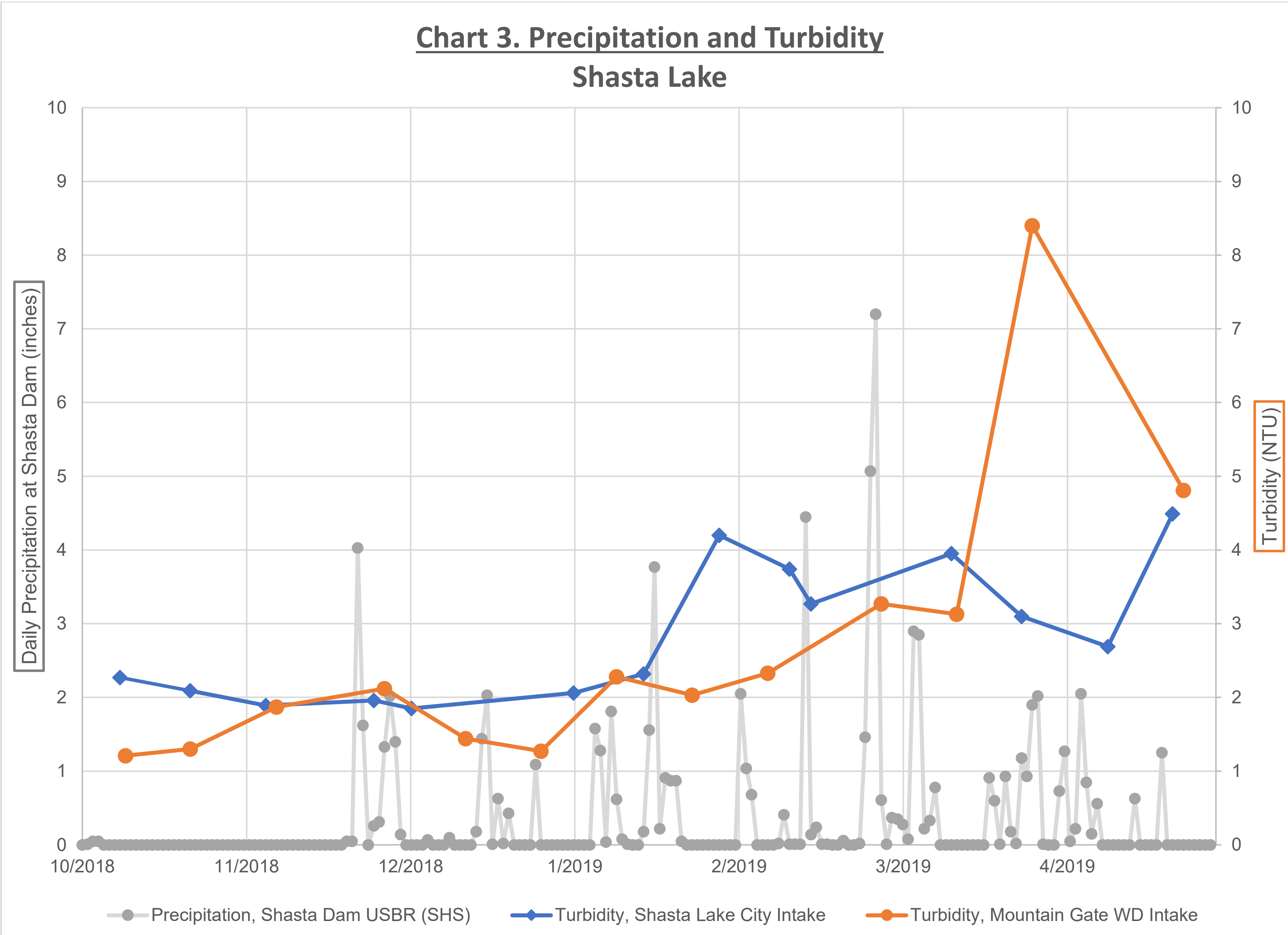


Chart 3. Precipitation and Turbidity
Shasta Lake
Daily Precipitation at Shasta Dam (inches)
Turbidity (NTU)
10
9
8
7
6
5
4
3
2
1
0
10/2018
11/2018
12/2018
1/2019
2/2019
3/2019
4/2019
Precipitation, Shasta Dam USBR (SHS)
Turbidity, Shasta Lake City Intake
Turbidity, Mountain Gate WD Intake

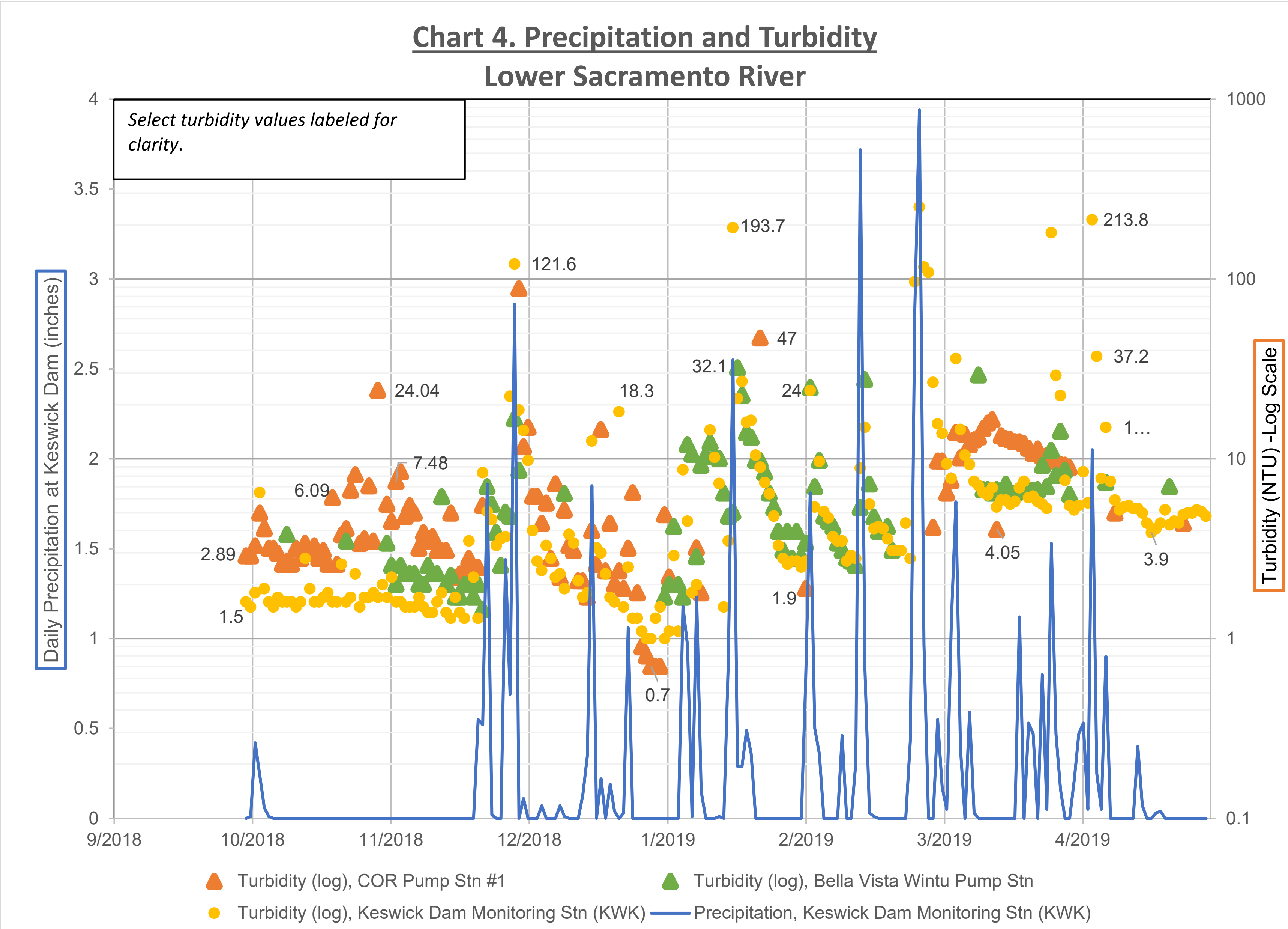


Chart 4. Precipitation and Turbidity
Lower Sacramento River
Select turbidity values labeled for clarity.
Daily Precipitation at Keswick Dam (inches)
Turbidity (NTU) -Log Scale
4
3.5
3
2.5
2
1.5
1
0.5
0
1000
100
10
1
0.1
9/2018
10/2018
11/2018
12/2018
1/2019
2/2019
3/2019
4/2019
2.89
1.5
6.09
24.04
7.48
121.6
18.3
0.7
193.7
32.1
47
24
1.9
213.8
37.2
1…
4.05
3.9
Turbidity (log), COR Pump Stn #1
Turbidity (log), Bella Vista Wintu Pump Stn
Turbidity (log), Keswick Dam Monitoring Stn (KWK)
Precipitation, Keswick Dam Monitoring Stn (KWK)

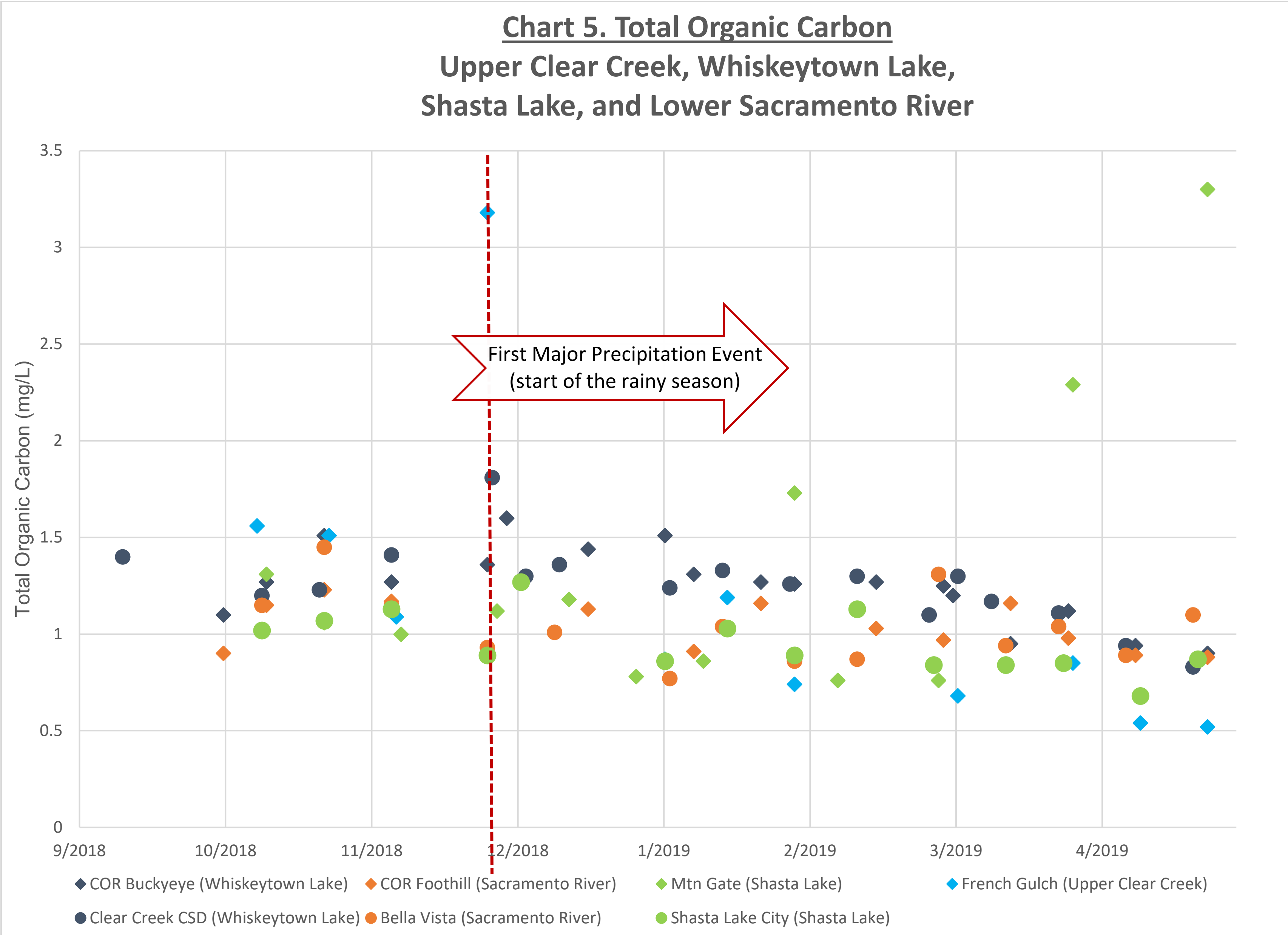


Chart 5. Total Organic Carbon
Upper Clear Creek, Whiskeytown Lake,
Shasta Lake, and Lower Sacramento River
Total Organic Carbon (mg/L)
3.5
3
2.5
2
1.5
1
0.5
0
9/2018
10/2018
11/2018
12/2018
1/2019
2/2019
3/2019
4/2019
First Major Precipitation Event
(start of the rainy season)
COR Buckyeye (Whiskeytown Lake)
COR Foothill (Sacramento River)
Mtn Gate (Shasta Lake)
French Gulch (Upper Clear Creek)
Clear Creek CSD (Whiskeytown Lake)
Bella Vista (Sacramento River)
Shasta Lake City (Shasta Lake)

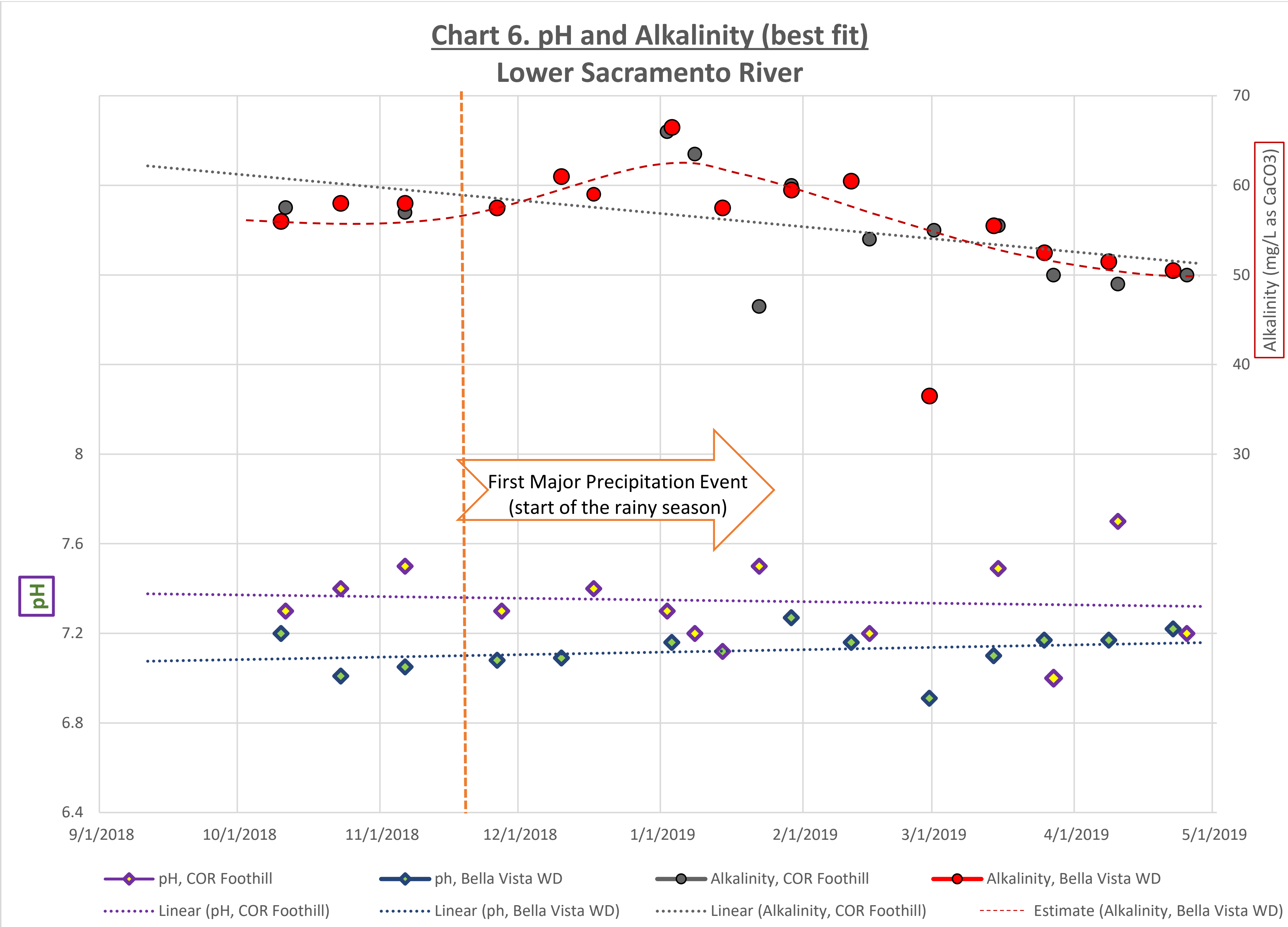


Chart 6. pH and Alkalinity (best fit)
Lower Sacramento River
First Major Precipitation Event
(start of the rainy season)
pH
Alkalinity (mg/L as CaCO3)
70
60
50
40
30
8
7.6
7.2
6.8
6.4
9/1/2018
10/1/2018
11/1/2018
12/1/2018
1/1/2019
2/1/2019
3/1/2019
4/1/2019
5/1/2019
pH, COR Foothill
ph, Bella Vista WD
Alkalinity, COR Foothill
Alkalinity, Bella Vista WD
Linear (pH, COR Foothill)
Linear (ph, Bella Vista WD)
Linear (Alkalinity, COR Foothill)
Estimate (Alkalinity, Bella Vista WD)

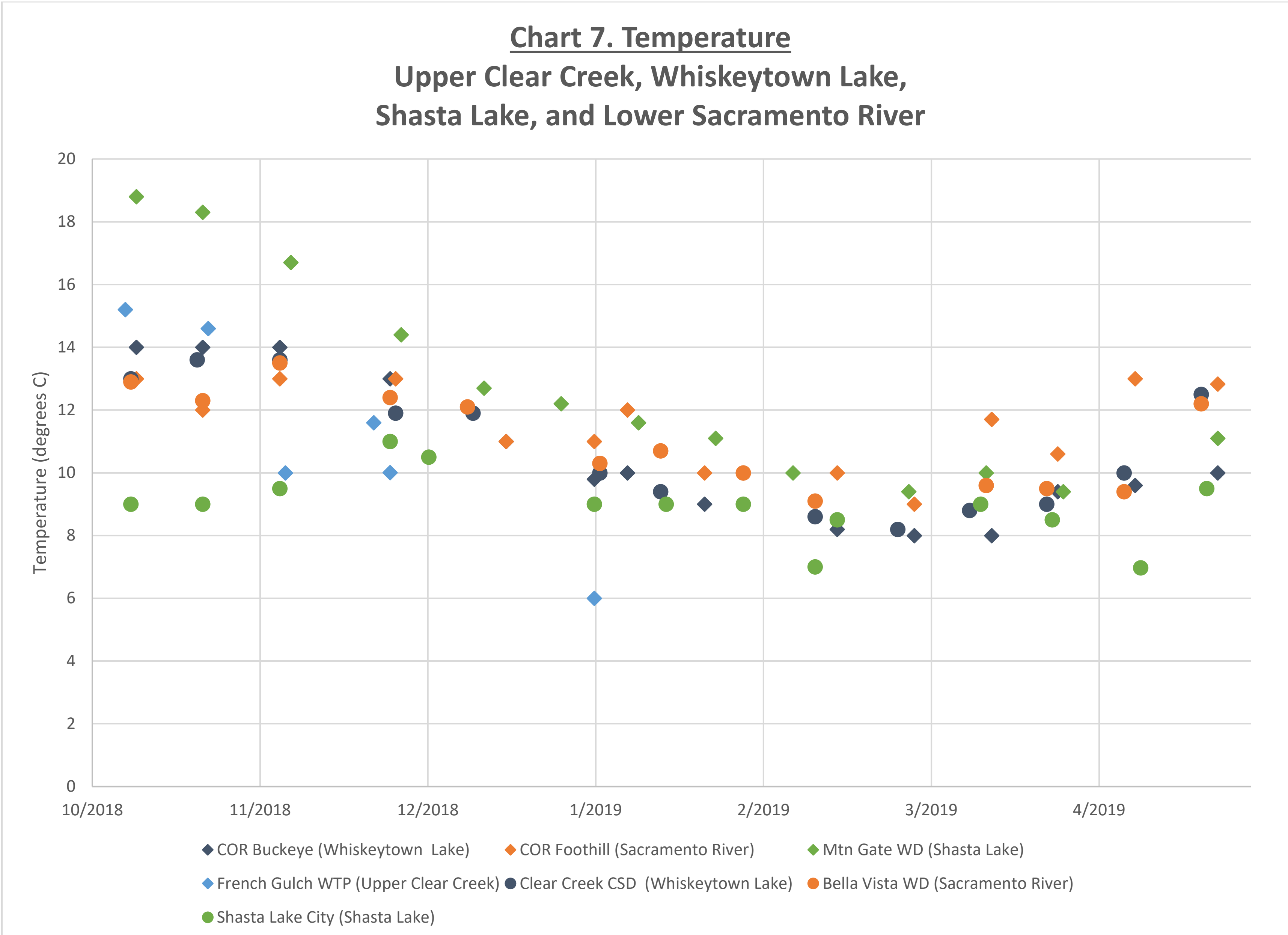


Chart 7. Temperature
Upper Clear Creek, Whiskeytown Lake,
Shasta Lake, and Lower Sacramento River
Temperature (degrees C)
0
2
4
6
8
10
12
14
16
18
20
10/2018
11/2018
12/2018
1/2019
2/2019
3/2019
4/2019
COR Buckeye (Whiskeytown Lake)
COR Foothill (Sacramento River)
Mtn Gate WD (Shasta Lake)
French Gulch WTP (Upper Clear Creek)
Clear Creek CSD (Whiskeytown Lake)
Bella Vista WD (Sacramento River)
Shasta Lake City (Shasta Lake)

APPENDIX B

MS4 Boundary Figures

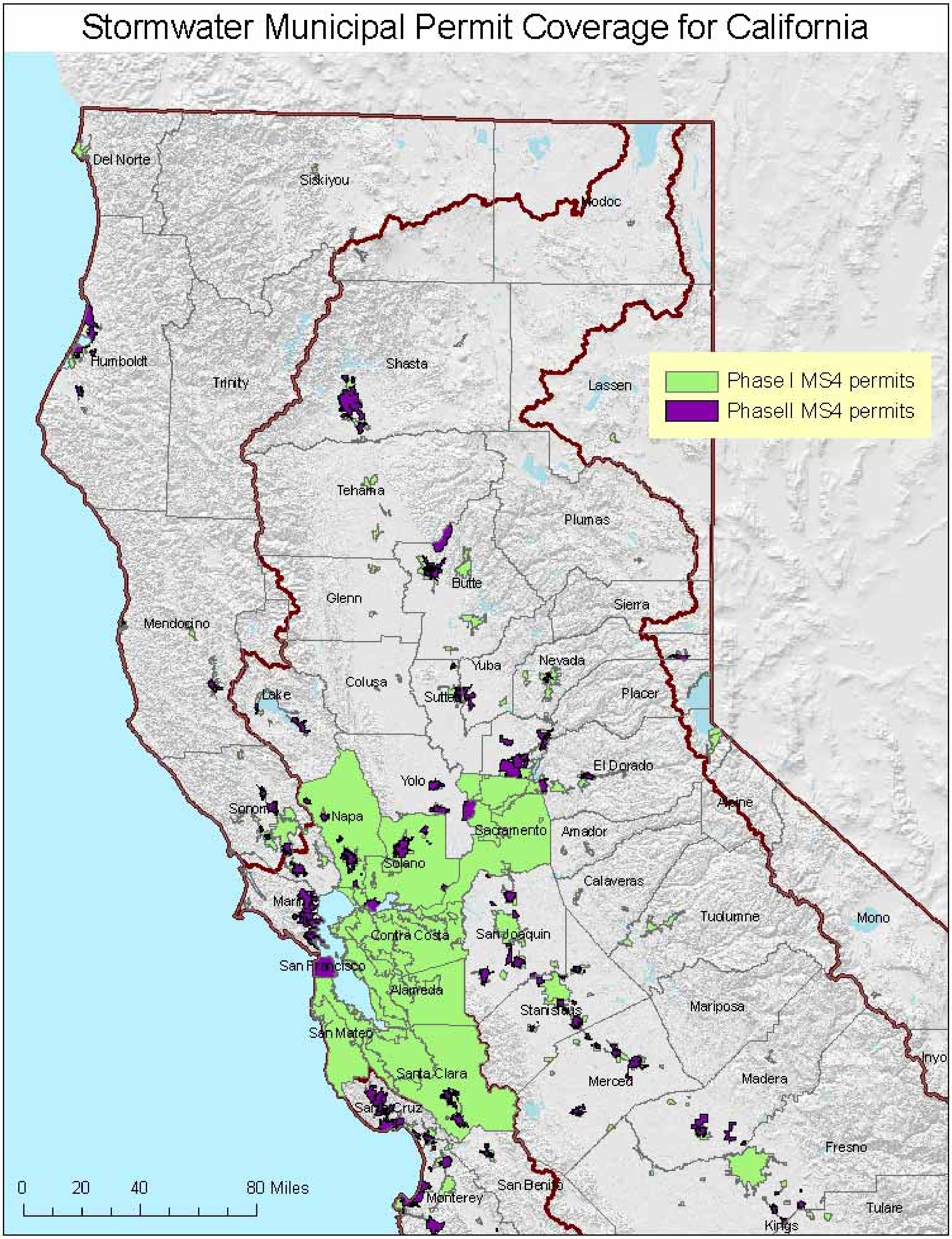
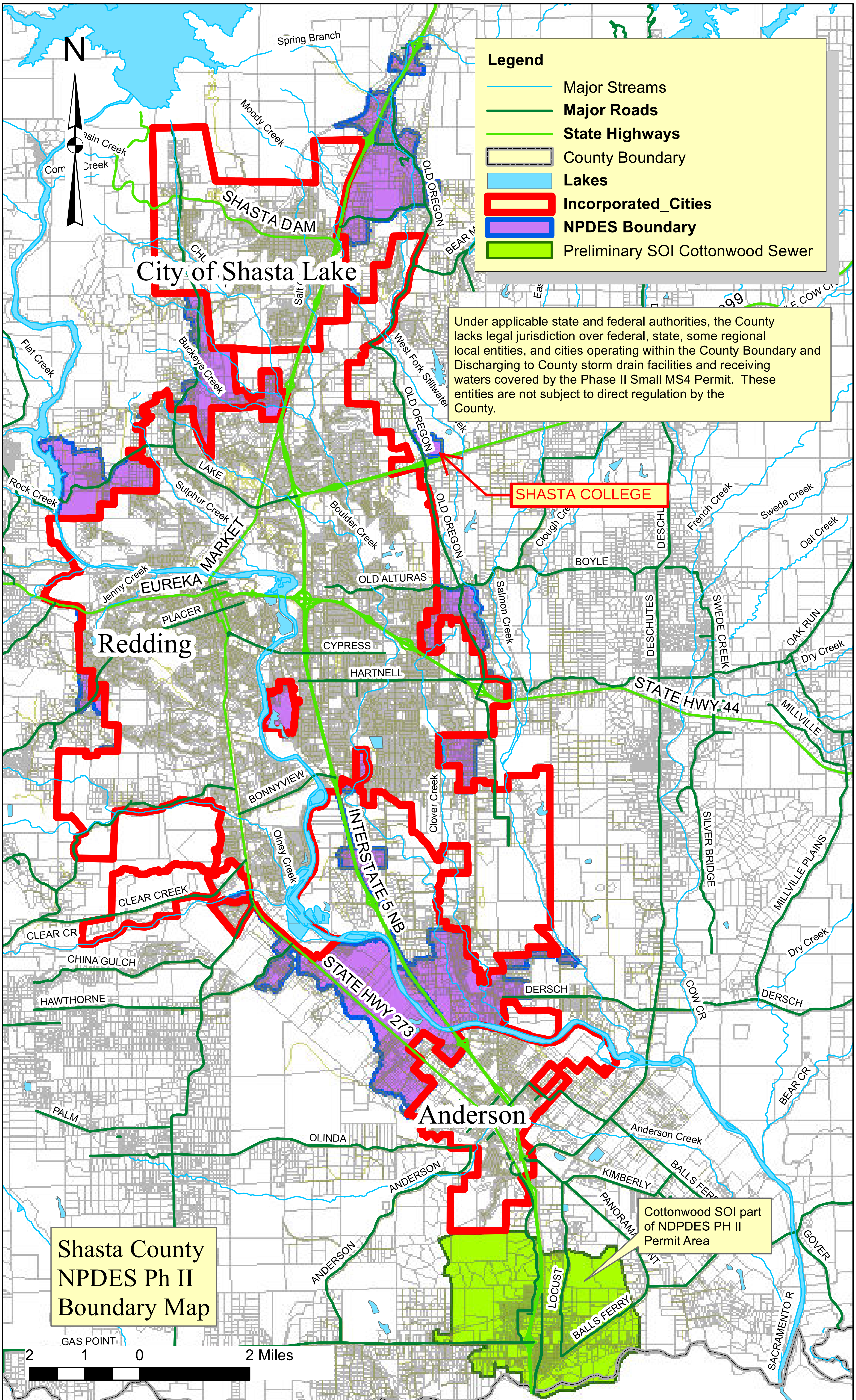


Figure 3 - Northern CA (2009) Counties / Cities With SUSMP-Plus Coverage


Legend
Major Streams
Major Roads
State Highways
County Boundary
Lakes
Incorporated_Cities
NPDES Boundary
Preliminary SOI Cottonwood Sewer
Under applicable state and federal authorities, the County lacks legal jurisdiction over federal, state, some regional local entities, and cities operating within the County Boundary and Discharging to County storm drain facilities and receiving waters covered by the Phase II Small MS4 Permit. These entities are not subject to direct regulation by the County.
SHASTA COLLEGE
City of Shasta Lake
Redding
Anderson
Cottonwood SOI part of NDPDES PH II Permit Area
Shasta County NPDES Ph II Boundary Map
N
2 1 0 2 Miles
Spring Branch
Moody Creek
SHASTA DAM
OLD OREGON
Buckeye Creek
West Fork Stillwater Creek
Flat Creek
Rock Creek
LAKE
Sulphur Creek
MARKET
EUREKA
Jenny Creek
PLACER
Boulder Creek
OLD ALTURAS
BOYLE
Salmon Creek
DESCHUTES
SWEDE CREEK
French Creek
Swede Creek
Oat Creek
OAK RUN
Dry Creek
CYPRESS
HARTNELL
STATE HWY 44
MILLVILLE
BONNYVIEW
Clover Creek
INTERSTATE 5 NB
Olney Creek
SILVER BRIDGE
MILLVILLE PLAINS
CLEAR CREEK
CLEAR CR
CHINA GULCH
HAWTHORNE
STATE HWY 273
DERSCH
COW CR
PALM
OLINDA
ANDERSON
Anderson Creek
KIMBERLY
BALLS FERRY
LOCUST
GOVER
SACRAMENTO R
BEAR CR
GAS POINT