



RON CHAPMAN, MD, MPH  
Director & State Health Officer

State of California—Health and Human Services Agency  
California Department of Public Health



EDMUND G. BROWN JR.  
Governor

PUBLIC WORKS  
FIELD INSPECTIONS  
JAN 04 2013

January 3, 2013

City of Redding  
P.O. Box 496071  
Redding, CA 96049

Attention: Jon McClain, Assistant Public Works Director

**Subject: Public Water System No. 4510005 – Annual Inspection Report**

On April 4, 2012, and April 24, 2012, I met with Conrad Tona, Public Works Supervisor – Water Treatment, and conducted an annual inspection of the City of Redding (City) domestic water system. The Annual Inspection Report and System Deficiency Record are enclosed for your review and action. The water system appears to be operated in a professional and conscientious manner. The field inspection, as well as a review of our records, shows that the drinking water produced by the City consistently meets all drinking water standards. The City has sufficient source and storage capacity to meet Waterworks Standards in the system as a whole as well as each pressure zone.

According to Department records, the City is past due on some source water chemical monitoring. Domestic Water Quality and Monitoring Regulations (California Code of Regulations, Title 22, Chapter 15) require certain chemical analyses be performed on domestic water at specified time intervals. Updated chemical monitoring schedules are enclosed. Please make arrangements with a state-certified laboratory to have the required testing completed, if you have not already done so. Testing that is shown as due now needs to be completed by no later than February 28, 2013. The schedules also show when testing will be required in the future. Please use these schedules as a guide to plan for future testing and to ensure that it is completed in a timely manner. If the City has results from more recent sampling than what is indicated in the enclosed Chemical Monitoring Schedules, please provide this office with copies of the results.

In the past the City has been granted monitoring waivers for Inorganic Chemicals, Secondary Standards, Volatile Organic Chemicals (VOCs), and Synthetic Organic Chemicals (SOCs). In order to ensure that the City continues to receive these waivers where appropriate, the Department recommends that the City complete and submit the enclosed chemical monitoring waiver forms.

According to Department records, the running annual averages (RAA) of TTHMs and HAA5s measured in the distribution system have been less than ½ their respective MCLs of 0.080 mg/L and 0.060 mg/L. Additionally, the annual average level of total organic carbon (TOC) in the raw and treated water, both, is consistently less than 2.0 mg/L. Based on these past results, in a letter dated June 27, 2011, the City was allowed to reduce monitoring for TTHMs and HAA5s to one sample each quarter at each of three sites; however, the City has continued to perform quarterly monitoring at all four sites associated with the Buckeye water treatment plant. However, the City failed to collect and report results for quarterly raw water and treated water

TOC at either treatment plant during the 4<sup>th</sup> quarter of 2010 and the 1<sup>st</sup> quarter of 2011. Additionally, the City failed to collect and report results for quarterly raw water alkalinity monitoring from the 2<sup>nd</sup> quarter of 2010 through the 1<sup>st</sup> quarter of 2011. As a reminder, the City is required to perform at least quarterly monitoring for TOC in both the raw and treated water and alkalinity in the treated water.

In accordance with the federal Stage 2 Disinfection Byproducts Rule (Stage 2 DBPR), the City was required to complete an Initial Distribution System Evaluation (IDSE) by March 31, 2009, and submit an IDSE report by July 1, 2009. On April 2, 2007, the Department received a copy of the City's System Specific Study (SSS) Report. The SSS was approved by the Department as meeting the IDSE requirements. The SSS Report includes the results from TTHM and HAA5 monitoring at 18 separate sites. The number of samples collected at each site varied between 10 and 12, and the initial monitoring dates varied between June 7, 2005, and October 9, 2005, with a final sample date of May 31, 2007 at each site. There are several gaps in the data for each site, and the monitoring does not follow the required schedule of one sample every two months for one year. However, the additional sampling that was performed provides a set of data that is representative of the changing water characteristics throughout the year. The SSS Report includes maps identifying the location of each site as well as all sources and storage tanks. However, the SSS Report does not identify the Federal Stage 2 DBPR compliance monitoring sites and monitoring schedule as required. The City needs to select eight compliance monitoring sites from the 18 sites used in the SSS monitoring and the six sites currently used for compliance monitoring under the state Disinfection Byproducts Rule (DBPR). The eight sites must include the three sites with the highest TTHM results, the three sites with the highest HAA5 results, and two of the existing state DBPR compliance monitoring sites. The City was required to provide the Department with a Stage 2 DBPR Monitoring Plan, including monitoring sites and dates along with justification for the selection of the sites and monitoring dates, for our review and begin compliance monitoring in accordance with the Stage 2 DBPR Monitoring Plan beginning no later than October 1, 2012 (the 4<sup>th</sup> quarter of 2012). Please provide a Stage 2 DBPR Monitoring Plan by no later than February 28, 2013.

Whenever able, main repairs are performed without depressurizing the water main; however whenever the City is unable to maintain pressure in the water main while performing a repair, the water system completes the repair, flushes the main, and collects a bacteriological sample. The Department recommends that the City notify the affected customers that there may be some sediment in the lines and that they should flush the piping in their homes. Sample language, meeting the Department's guidelines, is enclosed.

If you have any questions, please call me at (530) 224-6506 or Michael J. McNamara, P.E., at (530) 224-4800.



Michael T. Burgess  
Lassen District Sanitary Engineer  
DRINKING WATER FIELD OPERATIONS  
BRANCH

Enclosures

### SYSTEM DEFICIENCY RECORD

Name of System City of Redding System Number 4510005

Date Noted	Description of Needed Correction	Order No.	Reported Corrected	Confirmed Corrected
03-16-2006	Begin using a density method on the monthly raw water samples at the active well sources	3	April 2006	April 2006
02-21-2009	Initiate quarterly manganese monitoring of Enterprise Wells E-11 & E-12	2	E-11 - 01/20/2010 E-12 - 03/29/2010	
02-21-2009	Collect quarterly TOC water samples from the Sacramento River and Whiskeytown Lake sources.	2	01/14/2008	01/14/2008
02-21-2009	Collect quarterly nitrate samples during both the second and third quarters while Well E3A is in operation	2	06/03/2009 08/14/2009	06/03/2009 08/14/2009
02-21-2009	Submit a plan and schedule for completing the chemical monitoring and perform the source monitoring of the water sources that are overdue.	2	2007, 2008, & 2009	2007, 2008, & 2009
01-13-2010	When Enterprise Well 10 is returned to service it should be sampled for perchlorate, nitrate, and nitrite	2		
01-13-2010	The next round of lead and copper sampling is due at 30 taps between 06/01/2013 and 09/30/2013	R		
03-11-2011	The City should submit source water chemical monitoring waiver requests for all sources.	R		
04/04/2012	Monitor for disinfection byproduct precursors at least quarterly.	2		
04/04/2012	The City needs to report daily CT provided at the Buckeye treatment plant.	2		
04/04/2012	The City is past due on some chemical monitoring.	2		
04/04/2012	Submit a Stage 2 Disinfection Byproducts Rule Compliance Monitoring Plan for our review.	Federal Requirement		
04/04/2012	Perform quarterly monitoring for manganese at Enterprise Well E-6 and E-7	R		
04/24/2012	Provide notification to all customers affected by a water outage.	R		

**Order Number**

1. Serious health hazard; corrective action must be taken immediately.
  2. Critical system or operational defect &/or potential health hazard; must be corrected as soon as possible.
  3. System or operational defect &/or potential contamination hazards of lesser public health significance. Must be corrected as workload permits.
  4. System or operational defect &/or potential health hazard - costly to correct - to be included in any long-range water improvement project.
- R. Reminder

**California Department of Public Health  
Drinking Water Field Operations Branch  
Inspection Report**

Purveyor City of Redding System Number 4510005  
Person(s) Contacted/Position Conrad Tona, Public Works Supervisor – Water Treatment;  
Mike Sybert, Public Works Supervisor – Distribution  
Date of Inspection April 4 and 23, 2012 Staff Engineer Michael Burgess  
Last Annual Inspection March 1 and 2, 2011, Steve Watson District Engineer Mike McNamara, P.E.

**A. INTRODUCTION**

**1. Ownership & Permit History**

**Full** The most recent full permit was issued on November 28, 1988, for the operation of the 24-MGD Foothill SWTP, eight Enterprise wells, four Cascade wells, two infiltration gallery sources in Westwood Manor, and two small wells south of town (for an isolated system on City property), emergency intertie with the Bella Vista Water District, an intertie with the City of Shasta Lake used to meet summertime demands in the Buckeye and Summit City pressure zones, and distribution system.

**Amendments** Amendment 01-01-95P-006A was issued on June 28, 1995, for the operation of the Buckeye Water Treatment Plant, rated at 7-MGD capacity. Amendment 01-01-96(P)-009A was issued on April 29, 1996, for the sequestering treatment of the following Enterprise Wells: 4, 5, 7, 8, 9, 10, and 11. Amendment 01-02-08(A)001 was issued on April 3, 2008, for the operation of Enterprise Wells 13, 14, and 23.

**Are the permit provisions complied with?** Yes.

**Is the permit up to date?** No, the existing permit and amendments do not include the following facilities: Enterprise Well 12; the sequestering treatment provided at Enterprise Wells E-12, E-13, E-14, and E-23; the 4.0 MG Buckeye Storage Tank; the 4.0 MG Foothill Storage Tank; and the recent 7 MGD expansion of the Buckeye Water Treatment Plant. Additionally, the City has requested that Enterprise Wells E-11 and E-13 be designated as standby sources (they are currently permitted as active sources).

**2. System Improvements**

**Since last inspection** An updated 10-year Water Master Plan was completed and submitted to the Department. The City replaced the gear drive for the backwash recycle basin. When the City had the Pump Station 2 pumps rebuilt, they had larger impellers installed, increasing the capacity to 3,500 gpm per pump. Enterprise Well 10 was being rehabbed at the time of the inspection.

**Planned Future Improvements** The City plans to drill more wells in the Enterprise area. Their current capital improvement plan shows five additional wells to be drilled between 2013 and 2017; however, there are no plans to drill any specific well at this time. Replacement of the 0.225 MG Buckeye storage tank with a 2 MG tank is scheduled to be completed in 2013. The City plans to install an uninterruptable power supply at the Buckeye Water Treatment Plant to ensure a "clean" power supply to the individual filter effluent turbidimeters when the power source is switched from the city electric grid to the on-site emergency generator. The 3.5 MG Enterprise storage tank is scheduled to be replaced in 2014. At the Foothill Water Treatment Plant the City is working with PACE Engineering to develop a long term plan for the flocculation and sedimentation basin. The recapture pump station is being overwhelmed during the winter months with local run-off in addition to the leakage from the clearwell. Plans to relocate and upgrade the Railroad Pump Station have been completed, but the project has not been bid at this time. The City has decided not to upgrade the Cypress Street vault to include pumps to supply water from the Foothill Zone to the Enterprise Zone at this time.

### 3. Consumer & Production Data

Year	Reported Production, MG			Max Day, gpm	Source Capacity, gpm	Conn	Pop.	Max Day, gpmpc
	Annual	Max Mo.	Max Day					
2001	8,564	1,262	47.08	32,694	31,225	25,259	80,865	1.29
2002	8,957	1,397	48.90	33,958	33,835	25,796	84,560	1.32
2003	8,696	1,339	50.26	34,903	33,835	26,278	85,703	1.33
2004	9,302	1,354	49.50	34,375	35,835	26,575	87,208	1.29
2005	8,659	1,370	49.62	34,458	35,835	27,135	89,973	1.27
2006	9,212	<b>1,464</b>	<b>52.46</b>	<b>36,431</b>	35,835	27,682	91,351	1.32
2007	9,354	1,368	49.95	34,688	35,835	27,906	90,045	1.24
2008	<b>9,554</b>	1,296	47.15	32,743	44,360	27,973	90,491	1.17
2009	8,836	1,330	46.72	32,444	44,360	28,123	90,898	1.15
2010	7,904	1,325	48.88	33,944	44,360	28,556	94,235	1.19
2011	7,998	1,144	43.87	30,465	44,568	28,225	90,250	1.08
							<b>10-Year Average</b>	1.24

**Discussion & Appraisal:** The data above from 2005 to 2011 was provided by the City from a production spreadsheet which downloads data from the SCADA system. Prior to 2005, the data was collected from the City's Annual Report to the Department. The average maximum day demand over the past ten years is 1.24 gallons per minute per connection (gpmpc) with a high of 52.46 million gallons (MG) during 2006. Water demands are typical for a metered water system of this type and size in this area.

### B. SOURCE DATA

Source	Status	Capacity (gpm)	Comments
<b>Enterprise Wells</b>			
E-3A	Active	396	Drilled 1983; submersible pump; chlorination facilities in building for Well 3; last on, first off; expensive to run due to low production
E-4	Active	382	Date drilled unknown (per permit); 60 HP submersible pump; PLC controlled; auto soft start
E-6	Off line (emergency only)		Drilled 1968; submersible pump; in building next to Well 6-A; emergency use only; electrical wiring would have to be switched from 6A to use 6; elect. service is only capable of serving one well at a time
E-6A	Active	646	Drilled 1983; behind second fence next to Well E-6; 70 HP submersible pump; motor has reportedly repeatedly burned out
E-7	Active	1,194	Drilled 1968; 200 HP submersible pump with variable speed drive; pump motor speed is varied to maintain a water level in the well casing of 150 feet below grade; on standby in winter in case of loss of SW sources;
E-8	Active	1,049	Drilled 1980; also known as Airport Fire Well; located across the driveway in front of the airport terminal
E-9	Active	1,750	Drilled 1986; on standby in winter in case of loss of SW sources
E-10	Active	1,042	Drilled 1986; 150 HP vertical turbine pump; normally on standby in winter in case of loss of SW sources; currently out of service – needs to be rebuilt.

Source	Status	Capacity (gpm)	Comments
E-11	Active <sup>1</sup>	1,389	Drilled 1989; 200 HP vertical turbine pump. Arsenic issues. Not operated since ~2009, after E-23 was put on-line and Buckeye tied into the system.
E-12	Active	2,569	Drilled 2002; 350 HP vertical turbine pump.
E-13	Active <sup>1</sup>	1,736	Drilled 2002; 250 HP vertical turbine pump. Arsenic issues. Not operated since ~2009, after E-23 was put on-line and Buckeye tied into the system.
E-14	Active	1,736	Drilled 2006; 250 HP vertical turbine pump
E-23	Active	1,736	Drilled 2007; 350 HP vertical turbine pump; run constantly to maintain flow of water from extreme end of system towards town; down for maintenance during inspection.
<b>Subtotal</b>	<b>Active</b>	<b>15,625 (22.5 MGD)</b>	
<b>Cascade Wells (Not Visited During This Inspection)</b>			
C-1	Active (summer)	165	Drilled 1961; submersible pump; provisions for chlorination; tied to (and only 100 feet NW of) C-6 so typically both operate at same time; Well is ~350 ft NW of the Sac. River & ~30 ft NE of a seasonal drainage
C-5	Standby	100	Drilled 1964. This source has been inactive since 1985 due to taste and odor problems; 20 HP vertical turbine; pumped to waste twice each year
C-6	Active (summer)	100	Drilled 1967; submersible pump; provisions for chlorination; tied to C-1 so typically both operate at same time; located ~250 ft NW of the Sac. River & ~20 ft NE of a seasonal drainage
C-8	Active (summer)	150	Drilled 1970; vertical turbine; provisions for chlorination
C-9	Active (summer)	95	Drilled 1973; submersible pump; provisions for chlorination; located ~ 100 ft NW of the Sac. River
<b>Subtotal</b>	<b>Active</b>	<b>510 gpm (0.734 MGD)</b>	
<b>Surface Water</b>			
Foothill WTP	Active	18,611 (26.8 MGD)	24 MGD design capacity; production limited to 26.8 MGD by distribution system hydraulics; has produced as much as 29 MGD; under max filter loading rates SWTR would allow 36 MGD; Sac River PS can deliver 30.6 MG; City can divert up to 6,842 MG per year under water rights contract w/ USBR
Buckeye WTP	Active	9,722 (14 MGD)	Water is delivered to WTP by gravity from Whiskeytown Lake through the Spring Creek Conduit; City can divert up to 1,968 MG per year under water rights contract w/ USBR
Westwood Well No. 2 and No. 3	Off line	---	The City considers these sources to be under direct influence of surface water & is retaining them as future supply for potential growth in south Redding; the No. 2 pump is pulled with no immediate plans to replace; did not inspect
<b>Subtotal</b>		<b>28,333 gpm (40.8 MGD)</b>	Maximum day, total annual production is limited by raw water source capacity of 8,810 MG per year.
<b>Total</b>	<b>Active</b>	<b>44,468 (64.034 MGD)</b>	

<sup>1</sup> The City has applied for a permit amendment to change the well status to "Standby."

Emergency Interties			
System	Status	Size/Capacity	Comments
City of Shasta Lake	Active	150 gpm	The portion of Summit City within City of Shasta Lake (Shasta Lake) was transferred to Shasta Lake water system; Redding supplies water to ~20 customers in Summit City outside Shasta Lake; Redding purchases water from Shasta Lake in Summit City through a 6-inch pipe which can provide water in both directions
City of Anderson	Standby	8-inch	Enterprise Zone - Meadowview-Tucker Oaks; can provide water both directions
Bella Vista Water District	Standby	8-inch	Enterprise Zone - Dana Drive near old pump station (not used).
	Standby	12-inch	Enterprise Zone - Dana Drive near BVWD filter plant; can provide water both directions
	Standby	6-inch	Enterprise Zone - Old Alturas/ Abernathy; can provide water both directions
	Standby	8-inch	Enterprise Zone - Edgewood Drive; can provide water both directions
Centerville CSD	Standby	8-inch	Hill 900 Zone - Record Lane; can provide water both directions
	Standby	12-inch	Cascade Zone; can provide water both directions
	Standby	6-inch	Fire flow only – Rainier Dr. to Siena Ave. – Clear Creek Road
Clear Creek CSD	Proposed	8-inch	For standby use – Water to power plant – Clear Creek Road
Shasta CSD	Proposed	30-inch	For standby use – Benson Drive & Rock Creek Road

**Summary of well features:**

All wells, with the exception E-23 which runs continuously, are run as little as possible to avoid power charges. All Enterprise wells are all equipped with an auto 2 to 6 minute pump-to-waste on start-up. All Enterprise wells are controlled by the water level in the Enterprise Storage Tanks. All Enterprise wells are treated with chlorine gas using 100-lb cylinders and a V10K gas chlorination system and are equipped with chlorine gas alarms. All Enterprise wells, except wells E-3A and E-4, are injected with Carus K5 polyphosphate sequesterant at the wellhead for iron and manganese control.

All turbine pumps are water-lubed except Wells E-8 and E-9, which are oil lubed, using Chevron Lubricating Oil FM ISO 32, a food grade lubricant. The MSDS is in the Main file.

All Enterprise wells are behind 8-foot tall chain-link fencing with locked gates and housed in locked block structures, except Wells E-3A and E-6A. There are currently no building alarms due to a lack of phone lines. The City plans to add building alarms and radio telemetry.

All Enterprise wells except E-23, which runs continuously, and E-7, E-9, and E-10, which are on standby in the winter, are shut down during the winter while the injectors and chlorination equipment are removed and serviced.

The active Cascade wells are operated manually and run continuously during the summer, although they can be controlled by the Redding Ranchettes Tank level. The Cascade wells are not typically used during the winter and were not visited as part of this inspection. The Cascade Wells receive no treatment of any kind.

Normal start-up procedure for wells in the springtime: Flush to waste until water is visibly clear and collect a bacteriological sample. Once a sample tests negative for coliform bacteria the well is placed in service.

None of the wells have standby power.

**Discussion & appraisal (i.e., does source capacity comply with Waterworks Standards?)** In order to meet Waterworks Standards a water system must have sufficient source capacity to reliably meet maximum day demands in the system as a whole as well as in each individual pressure zone. The City's source capacity of 44,568 gpm is greater than the highest reported maximum day demand over the last ten years of 36,431 gpm. The maximum day water demand was estimated for each pressure

zone based on the reported number of service connections and the average maximum day water demand per connection. The source capacity is sufficient to meet maximum day demands in each pressure zone as well.

### C. STORAGE DATA

Reservoir	Type	Capacity MG	Zone	Comments
Foothill WTP Clearwell	Concrete	6.0	FWTP	Constructed 1980; partially in-ground; no leakage noted above ground level; however, diving inspection revealed joint leaks in bottom and top of tank; significant subsurface leakage. Separate inlet/outlet well screened vents.
Foothill	Welded Steel	4.0	Foothill	Constructed in 2006; replaced 2 x 1.5 MG concrete Foothill tanks; separate inlet/outlet. Light sediment.
Enterprise	Welded Steel	6.0	Enterprise	Constructed 1986; next to 3.5 MG Enterprise tank; water level controls Enterprise wells and flow into Enterprise zone from cross-town vault; common inlet/outlet. Very light sediment in both tanks.
Enterprise	Welded Steel	3.5	Enterprise	Constructed 1968; common inlet/outlet; will eventually be replaced with a 6 MG tank
Buckeye	Welded Steel	2.0	Buckeye	Constructed 1995; next to 0.225 MG Buckeye tank; common inlet-outlet pipe; interior recoated in 2006
Buckeye	Welded steel	0.225	Buckeye	Constructed 1978; common inlet-outlet pipe; will eventually be replaced with a 2 MG tank
Hill 900 (West)	Prestressed Concrete	2.0	Hill 900	Constructed 1959; common inlet-outlet pipe. Domed roof with perimeter drains, some pooling of water around edge.
Hill 900 (East)	Welded Steel	2.0	Hill 900	Constructed 1985; common inlet-outlet pipe. Appeared to be light corrosion.
Buckeye WTP	Welded Steel	4.0	BWTP	Constructed 2002; near BWTP; water level controls Pump Stations 3 & 4, and BWTP operation; separate inlet/outlet. Light sediment, inspected and cleaned in 2010. No screen on overflow that discharges to subsurface vault.
Buckeye WTP	Welded Steel	0.2	BWTP	Not inspected.
Buckeye WTP Backwash	Welded Steel	(0.75)	BWTP	Constructed in 1995; supplies backwash water and domestic/process water to WTP; common inlet/outlet. Not inspected.
Buckeye WTP Pressure	Hydro- Pneumatic	(4,000) gallons	BWTP	Constructed in 1995; maintains pressure for domestic water use and process water; common inlet/outlet.
Cascade	Welded Steel	1.0	Cascade	Constructed in 1968; due to elevation slightly lower than Ranchettes Tank, water level controlled by altitude valve; common inlet/outlet. Not inspected.
Ranchettes	Welded Steel	2.0	Cascade	Constructed in 1982; common inlet/outlet. Light sediment, screened vents.
	<b>Total</b>	<b>32.925</b>		

**Are DDW coating procedures adhered to?** Reportedly, yes

**Discussion & appraisal** Due to weather conditions at the time of the inspection, the Cascade Tar. was not inspected. The City reports that all storage tanks were inspected and cleaned by a contracted

tank inspection company between 2009 and 2010. According to the City, the report shows that all the tanks are in good condition, with the exception of the Foothill Water Treatment Plant clearwell. This tank reportedly has nearly 100% seam failure and has cracks in the bottom of the tank which continuously leak. The City captures this water at the Foothill Treatment Plant site and recycles it into the raw water supply. Reportedly, the sump pump used to recycle the water leaking from the tank was unable to handle the flows during winter storms due to the surface runoff into the sump where the tank leakage collects.

All storage tanks are fenced with locked gates. The two, Hill 900, Buckeye, Cascade, and Ranchettes Tanks each have an additional locked gate across the road leading to each tank site. Entrance to the Hill 900 tanks is through Foothill Water Treatment Plant. Common telemetry at the two Hill 900 Tanks, the Buckeye 2 MG and 0.225 MG Tanks, and the two Enterprise Tanks allow telemetry to run from one tank or the other so the tanks can be taken out of service for cleaning, repair, recoating, or replacement with no disruption to the SCADA system.

In order to meet Waterworks Standards, a water system serving more than 1,000 service connections must have sufficient source and storage capacity combined to supply peak hour demands for four consecutive hours in each pressure zone as well as in the system as a whole. The City's highest peak hour demand was estimated to be 54,650 gpm, 150% of the highest reported maximum day demand. Based on a total source capacity of 44,568 gpm, the City needs to provide a minimum of 1.45 MG of storage capacity (10,080 gpm for four hours) in order to meet Waterworks Standards in the system as a whole. The City's total storage capacity of 32.925 MG meets this requirement. The City has sufficient source capacity in all but two pressure zones to meet peak hour demands through source capacity alone. The Hill 900 Zone has an estimated peak hour demand of 8,990 gpm based on 4,539 active service connections. The reported active source capacity in the Hill 900 Zone is 6,135 gpm, 2,855 gpm less than the peak hour demand; therefore, the City is required to provide at least 685,200 gallons of storage (2,855 gpm for 4 hours) in order to meet Waterworks Standards. The storage capacity in the Hill 900 Zone is 4,000,000 gallons, which is sufficient to meet Waterworks Standards.

The Cascade Zone has an estimated peak hour demand of 6,610 gpm, based on 3,339 active service connections. The reported active source capacity in the Cascade Zone is 11,400 gpm, which is greater than the estimated peak hour demand. The source capacity in the Cascade Zone is sufficient to meet Waterworks Standards.

#### D. SURFACE WATER TREATMENT

---

##### TREATMENT:FOOTHILL WATER TREATMENT PLANT – Sacramento River

---

###### 1. Watershed and Source Water

**Name of source** Sacramento River, downstream of Shasta, Keswick and Whiskeytown Lakes (via Spring Creek tunnel); intake built in 1939.

**Are there significant sewage hazards?** No; there are some wastewater hazards from the creeks upstream of the City's intake. Along Jenny Creek, wastewater has overflowed into the creek from an adjacent sewer line during major storms. A containment pond installed at the sewer lift station has reduced the likelihood of overflow, but there is still a potential for the pond to overflow or the line to the lift station to break.

**Is there significant recreation?** Yes; upstream on Shasta, Keswick, and Whiskeytown Lakes.

**Have there been significant changes to or activities on the watershed since the last inspection and/or changes in raw water quality, such as, turbidity or coliform levels?** No. The City has been collecting raw water coliform samples for many years and has not seen any significant changes nor observed any trends.

**What is date of last watershed survey (WSS)?** The 2011 Redding Area Watershed Sanitary Survey was submitted to our office on February 28, 2011.

###### 2. Treatment Plant

**Name of Plant** Foothill Water Treatment Plant (FWTP), built in 1980

---

**TREATMENT: Foothill Water Treatment Plant (cont.) – Sacramento River**

---

**General description of process** Raw water is pumped from the Sacramento River by Pump Station #1 to the Foothill Treatment Plant. Polymer is injected in a 36-inch raw water main upstream of the flocculation and sedimentation basins, or the flocculation and sedimentation basins can be bypassed and the water supplied directly to four dual media filters consisting of approximately 20 inches of anthracite over 12 inches of sand media atop the support media and underdrain. The combined effluent from the four filters flows under gravity to a 6 MG capacity clearwell which gravity feeds the Foothill pressure zone. Booster pumps at the treatment plant deliver water from the clearwell to the Hill 900 storage tanks, which supply the Hill 900 pressure zone. The City utilizes gas chlorination for disinfection. The City is able to chlorinate the water in three locations, two pre-filtration and one post-filtration.

**Classification** In the past the City also operated the Foothill Treatment Plant as a conventional surface water treatment plant at flows less than 13,000 gpm, while bypassing the flocculation and sedimentation basins at flows greater than 13,000 gpm, which is commonly referred to as "in-line" filtration. However, the City recently decided to bypass the floc/sed basins at all times and has not operated the Foothill Water Treatment Plant in conventional mode since 2010. Based on a particle count study performed by the City in 2005, the in-line treatment was deemed equivalent to direct filtration, which receives a 2-log removal credit for *Giardia* cysts and *Cryptosporidium* oocysts. However, at that time, the City only operated the Foothill Treatment Plant in the "in-line" mode during the summer when higher flows were required to meet system demands. The particle count study was conducted during May 2005 and July 2005 at raw water turbidities ranging from 1 NTU to 5 NTU and did not cover the entire range of operating conditions throughout the year.

**Multiple filter units for redundant capacity?** Yes, four filters.

**Standby power for treatment plant?** There is no standby power; however, the Foothill Water Treatment Plant receives power from two separate electrical substations. The electrical supply from either substation is sufficient to operate the plant, providing a reliable redundant electrical supply.

**Are design criteria met? If not, what facilities are needed?** Yes, design criteria are met.

**Is operations plan up-to-date?** Yes, updated December 2000. The City is currently putting together standard operating procedures to augment the existing operations plan.

### 3. Treatment Processes

#### a. Flocculation/Sedimentation

**Mix (type, size, flows, retention time, etc.)** Static mixer on influent pipe

**Flocculation Basin (type, size, flows, retention time, etc.)** When in use, water flows up through the bottom of the first flocculation chamber and into a second flocculation chamber before entering the sedimentation basin through a baffled wall. Water turbulence provides the gentle mixing needed for flocculation so the paddles have been removed.

**Sedimentation Basin (type, size, flows, retention time, etc.)** The inlet to the pipe is screened; the sedimentation basin is approximately 31,300 ft<sup>2</sup>; maximum flow through the sedimentation basin is 13,000 gpm (18.7 MGD), providing an overflow rate of 0.41 gpm/ft<sup>2</sup>. Water exits around the perimeter of the square sedimentation basin through overflow weirs into a channel leading to an 18-inch diameter pipe which supplies the plant's four filters.

**Chemical Addition** The City currently injects CalChem 2220, aluminum chlorohydrate (ACH), as the primary coagulant just upstream from a static mixer. ACH can also be supplied just upstream from the filters as a filter aid. The City can also supply a non-ionic polymer coagulant as a filter aid just upstream from the filters. Typical summer ACH dosages are approximately 2 milligrams per liter (mg/L), while winter dosages are approximately 3 mg/L.

**Coagulant used at all times and optimized or 80% reduction in turbidity** Yes, coagulant used at all times and optimized; typically the plant provides filtered water turbidities less than 0.1 NTU; turbidity reduction exceeds 98%.

**How is coagulant feed rate determined and optimized?** Based on historical data; treatment operators maintain a log book of daily flows, water temp, pH, raw water turbidity, and chemical

---

**TREATMENT: Foothill Water Treatment Plant (cont.) – Sacramento River**

---

dosages. When there is a significant change in the raw water quality, the WTP operators refer to past records to determine appropriate coagulant dose.

**Metering pumps (make, model, and capacity)** ACH is injected upstream of the static mixer into the 36-inch diameter raw water transmission main by two 4.5 gph metering pumps. All or a portion of the ACH supplied by these pumps can also be redirected to a point just upstream from the filters. A 0.75 gph metering pump can also supply a non-ionic polymer coagulant just upstream from the filters as a filter aid. While alum is not currently used, two 95 gph metering pumps are available for injection of alum at the same location as the ACH.

**Standby metering pumps?** Yes, at the peak flow rate of 21,250 gpm, each 4.5 gph metering pump is able to provide a maximum dosage of 6.0 mg/L, which exceeds both the summer and winter time typical target dosages of 2 mg/L and 3 mg/L, respectively. The 0.75 gph metering pump is able to provide a maximum coagulant dosage of 1.0 mg/L, at the treatment plant's maximum flow rate of 21,250 gpm.

**How often are metering pumps calibrated?** Feed rates are verified daily using a graduated cylinder; the pumps are not calibrated over their entire range.

**b. Filtration**

**Filters (gravity/pressure, filter area, media, media depth):** The treatment plant contains four dual-media gravity filters, 1,400 ft<sup>2</sup> each, for a total filter surface area of 5,600 ft<sup>2</sup>. The dual media filters consist of 20 inches of anthracite over 12 inches of sand supported by six 2-inch layers of graded gravel support media, totaling 12 inches.

**Approved maximum filter rate and plant capacity** The original design capacity of the Foothill Water treatment Plant was 24 MGD (a 4 gpm/ft<sup>2</sup> filter-loading rate with one filter out of service); however, dual media gravity filters in conventional or direct mode are limited to a maximum filter-loading rate of 6 gpm/ft<sup>2</sup>, resulting in a maximum treatment plant flow rate of 36.3 MGD (25,200 gpm) with one filter out of service and 48.4 MGD (33,600 gpm) with all four filters in service. However, the treatment plant is currently limited to 30.6 MGD by the capacity of the Sacramento River pump station (Pump Station 1). When operated in conventional mode, the treatment plant flow rate is hydraulically limited to 26.8 MGD.

**How is filter rate controlled?** Constant head filters (approximately 7 ft); the Supervisory Control and Data Acquisition (SCADA) system controls the operation of butterfly valves on each filter effluent to maintain a constant water level over each filter.

**Have filter rates exceeded maximum approved rate?** No

**Are filters operated to minimize shutdowns and startups or rapid changes in filter rates and are filter rates constant or varied to meet system demands?** Yes, shutdowns are minimized; flexibility to vary flow with demands is limited by the pumps at the Sac River Pump Station; the pump station consists of five vertical turbine pumps, one 4,000 gpm, two 5,000 gpm, and two 7,000 gpm pumps. The total pumping capacity of the pump station is 30.6 MGD (21,250 gpm). The City now uses the Buckeye Treatment Plant as its primary source of water and the Foothill Water Treatment Plant is only operated a few hours per week in the winter in order to keep it in good working order and as needed to meet maximum day demands in the summer.

**Describe applicable filtration performance standards.** Under Title 22, Section 64657.3 of the California Code of Regulations, the turbidity level of the combined filter effluent shall be less than or equal to 0.3 NTU in at least 95 percent of the measurements taken each month and shall not exceed 1 NTU for more than 1 continuous hour, measured pursuant to section 64657.40. Furthermore, the turbidity level of the combined filter effluent at four-hour intervals shall never exceed 1 NTU and the combined filter effluent shall not exceed 1.0 NTU for more than 8 consecutive hours while the plant is operating. Whenever the City operates the treatment plant as an in-line filtration plant, they are required to consistently provide water that is less than 0.1 NTU in order to demonstrate equivalence to direct filtration.

**Describe applicable individual filtration performance standards under Section 64660(b)(7):** When any individual filter is placed back into service following backwashing or other interruption

---

**TREATMENT: Foothill Water Treatment Plant (cont.) – Sacramento River**

---

event, the filter water turbidity of the effluent from that filter shall not exceed: 2.0 NTU at any time during the first four hours of filter operation, 1.0 NTU at any time during the first four hours of filter operation following at least 90 percent of the interruption events during any consecutive 12 month period, and 0.5 NTU at the time that the filter has been in operation for 4 hours.

**Are CFE performance standards met?** Yes, typically turbidities are consistently less than 0.1 NTU 95% of the time and are typically less than 0.05 NTU.

**Are IFE performance standards met?** Yes, typically.

**Summarize performance over last year** During the past year the City has been in compliance with turbidity performance standards. However, between February 15 and 16 of 2011, an incident at the Foothill Water Treatment Plant nearly led to a turbidity violation. The City monitors the raw water turbidity straight from the river at Pump Station #1. A raw water sample pump constantly circulates water from the river, providing a sample source for the primary raw water turbidimeter. The intake for the raw water sample pump is equipped with a screen which routinely gets plugged with debris. Therefore, the plant control system is programmed to backwash this screen on a timed interval in order to allow unimpeded flow to the raw water turbidimeter. During the course of moving the control system over from the RONAN to the SCADA/PLC, the control logic for this backwash sequence was inadvertently erased. Therefore, when the intake screen became plugged the turbidimeter no longer received a sample, which caused the turbidity reading to remain constant at its last recorded value, which was somewhere below 10 NTU. On February 15, a major storm event occurred which increased the raw water turbidities from 5 NTU up to 25 NTU during hours that the treatment plant is not normally staffed. The plant control system is programmed to automatically shut down the treatment facility and notify the operator when raw water turbidity is equal to or greater than 10 NTU. However, since the turbidimeter was not receiving sample water, it continued to give a false indication. Meanwhile, high turbidity water continued to be sent to the filters. This eventually overwhelmed the filters, causing filtered water turbidities to rise above performance standards. Normally, when the individual filter effluent (IFE) or combined filter effluent (CFE) turbidity is equal to or greater than 0.25 NTU, the SCADA system would shut down either the individual filters or the entire plant and notify an operator. However, during the course of moving the control system over from the RONAN to the SCADA/PLC, this control logic was also erased. Therefore the plant did not automatically shut down, but did notify the operator of high turbidity in the IFE and CFE. Historical data collected by the SCADA system shows that the CFE turbidity was above 1 NTU for 53 minutes. The City reported that they had the program logic corrected both for the turbidimeter feed water screen backwash cycle and the high IFE and CFE turbidity alarms to prevent this type of failure from reoccurring.

**Describe backwash cycle (source of backwash water, flow rates, use of air/water, length of backwash, surface wash)** Each filter is air scoured at 4.5 cubic feet per minute for approximately six minutes prior to backwashing at 25,000 gpm (18 gpm/ft<sup>2</sup>) for an additional six minutes. Backwash water is supplied from the 6 MG clearwell. The clearwell must be at least 40% full for the backwash pump inlets to be submerged so the filters can be backwashed.

**Frequency of backwashing and/or what initiates backwash** The SCADA system is set to automatically backwash the filters based on length of filter run, finished water turbidity, or the water level in the filters (pressure drop). Generally, the filters are backwashed based on length of filter run; every 24 hours during high summer flows and every 48 hours during low winter flows.

**Method used to minimize turbidity spikes after backwashing or other interruption events.** The 2005 filter media replacement reportedly solved the turbidity spike following backwash problem; the City no longer adds polymer to the backwash water; the City replaced the Leopold underdrain system in 2006 with an infinity underdrain with porous plates by Roberts Filter Group.

**If filter to waste provided, length of time?** No filter to waste is provided.

**Are filter rates gradually increased after backwashing or other shut down?** Yes, valves open gradually.

**If coagulant added to backwash water, dosage and name of coagulant?** N/A

---

**TREATMENT: Foothill Water Treatment Plant (cont.) – Sacramento River**

---

If reclaimed backwash water returned to headworks, describe treatment, settling time provided, percent solids removal, and return rate to plant The City provides a minimum detention time in backwash basin (clarifier) of at least 2 hours via a time delay on the backwash recycle pumps prior to recycling the settled backwash water. Variable speed drives are installed on the pumps, so that the recycle backwash water flow rate does not exceed 10% of total plant flow. The recycle rate is controlled through the City's SCADA system. The City uses an on-line turbidimeter to monitor the turbidity of the recycled backwash water. The City has requested and received approval, by cover letter and memo dated 10/29/2009, from the Department to recapture the 30 to 50 gpm of treated water leaking from the 6 MG reservoir by pumping the water to the backwash basin from which it is pumped to the headworks with the backwash water.

**Are filters physically inspected annually?** The appearance of the filters is monitored on a daily basis by the WTP operators. The City contracts out full filter evaluations including filter bed expansion, solids retention, and solids reduction following backwash. Each filter is evaluated every other year alternating between the Foothill and Buckeye Water Treatment Plants. ERS will be performing the filter evaluations at the Foothill Water Treatment Plant this year.

**Discussion & appraisal** Operations meet requirements of Surface Water Treatment Rule (SWTR) and Interim Enhanced Surface Water Treatment Rule (IESWTR). The City conducted an in-house particle count demonstration study in 2005, and the Department determined that the filters are capable of providing 2-log *Cryptosporidium* oocyst removal and 2-log *Giardia* cyst removal (equivalent to direct filtration) while operating in-line.

**c. Disinfection**

**Required log inactivation** The City is required to provide at least 1-log inactivation of *Giardia* cysts and 3-log inactivation of viruses through disinfection when operating as an in-line filtration treatment plant.

**Type and model of chlorine residual monitors or test kits** Capital Controls chlorine residual analyzer with backup Wallace & Tiernan chlorine residual analyzer.

**Prechlorination**

**Type** Gas chlorine with 1-ton cylinders; Wallace & Tiernan V10K chlorinator

**Capacity** 500 ppd rotameter, space for 8, 1-ton cylinders at treatment plant for both rotameters

**Control** Flow paced, ratio set by plant operator

**Standby feeders** The chlorinator can provide pre and post chlorination, total dosage of 2.0 mg/L at the maximum flow rate of 21,250 gpm.

**Postchlorination**

**Type** Gas chlorine with 1-ton cylinders; Wallace & Tiernan V10K chlorinator

**Capacity** 500 ppd rotameter, space for 8, 1-ton cylinders at treatment plant for both rotameters

**Control** By residual analyzer through SCADA system.

**Standby feeders** The chlorinator can provide pre and post chlorination, total dosage of 2.0 mg/L at the maximum flow rate of 21,250 gpm.

**Injection points, typical dosages, chlorine demand, typical residuals** The City injects chlorine in two locations, in the raw water transmission main just downstream from the raw water flow meter and post filtration in the combined filter effluent just upstream from the clearwell. Reduced pressure principle (RP) backflow prevention devices are installed on both the pre and post chlorination lines to prevent backflow and potential contamination of the treated water.

**Facilities providing contact time** Facilities which provide contact time include the filters and the 6 MG clearwell. The flocculation and sedimentation basin has a total volume of 2.136 MG and is assigned a short-circuiting factor of 0.1; however, since the treatment plant is only operated in direct filtration mode at this time, the floc/sed basin does not provide any contact time. The City performed a tracer study which demonstrated a contact time of 21 minutes for the filters and a short-circuiting factor of 0.235 for the 6 MG clearwell at a flow rate of 24 MGD.

**Are CT requirements being consistently met before the first service connection?** The first service connection is the water treatment plant itself. The City calculates CT on a daily basis and

**TREATMENT: Foothill Water Treatment Plant (cont.) – Sacramento River**

checks compliance with inactivation requirements at the clearwell outlet. Records show that the City consistently provides adequate disinfection at the Foothill Water Treatment Plant.

**Are residuals entering distribution system  $\geq 0.2$  ppm?** Yes

**Are distribution system residuals at least a trace 95%?** Yes

**Is emergency plan for disinfection failure up-to-date?** Yes, we received a copy of the City's disinfection failure plan (emergency guidelines) update on April 7, 2009.

**Discussion & appraisal** The City calculates the daily CT from pre-chlorination through filters and post-chlorination through the clearwell and submits the records to the Department monthly.

According to Department records, the City consistently provides the required 1-log inactivation of *Giardia* cysts through disinfection. The CT necessary to provide the required 3-log inactivation of viruses through disinfection is much less. Based on Department records, the City consistently maintains a chlorine residual in the distribution system and a residual greater than 0.2 mg/L entering the distribution system. It appears that the maximum total available dosage of 3.9 mg/L pre- and post-chlorination, using both 500 ppd rotameters at the maximum reported flow rate of 21,250 gpm, is sufficient to ensure adequate chlorination.

**4. Monitoring and Alarms Related to Foothill Water Treatment Plant**

Parameter	Location	Sample Frequency	Recording	Alarmed (yes/no)	Alarm Setpoint	Alarm Result
Plant Flow	Influent	Continuous	Yes	Yes	Low Flow	PS#1 S/D
Filter Flow	Each filter	None	None	No	N/A	N/A
Turbidity	Sac. River	Continuous	Yes	Yes	Varies	Plant S/D
Turbidity	Raw Influent	Continuous	Yes	Yes	Varies	Plant S/D
Turbidity	CFE	Continuous	Yes	Yes	0.25 NTU	Plant S/D
Turbidity	IFE	Continuous	Yes			
Turbidity	Settled Water	Continuous	Yes	Yes		Operator Notification
Turbidity	Backwash Return	Continuous	Yes	No		
Cl Residual	Clearwell Outlet	Continuous	Yes	Yes	0.25 ppm low	Plant S/D
					1.0 ppm high	Plant S/D
Cl Residual	CFE	Continuous	Yes	Yes	0.20 ppm low	Plant S/D
Temperature	Raw	Continuous	No	No	N/A	
pH	Raw & Treated	Continuous	Yes	No	N/A	
Chemical Tank Level	Poly & Alum	Continuous	Yes	Yes		Operator Notification

**Type and model of turbidimeters used** The City uses Hach Surface Scatter 6 turbidimeters to monitor the raw water, settling basin effluent, and backwash return water turbidity. The City uses Hach 1720Es to monitor the combined filter effluent, individual filter effluent, and treated water after the clearwell (not for compliance purposes). As a result of the turbidity incident in February, an additional Hach SS7 surface scatter turbidimeter was installed at the treatment plant to provide redundant raw water turbidity monitoring.

**How often are turbidimeters calibrated?** The City calibrates the turbidimeters at least quarterly or as needed based on Hach's calibration guidelines using StablCal formazin solution. An Ice-Pik, secondary standard, is used to verify the filtered water turbidimeter measurements weekly, as required by regulation.

**Are samples collected at proper locations that give accurate and representative results (i.e turbidity sample must be before clearwell)** Yes, the City monitors individual filter effluent turbidi

---

**TREATMENT: Foothill Water Treatment Plant (cont.) – Sacramento River**

---

and combined filter effluent turbidity (before clearwell), as well as the treated water turbidity after the clearwell.

**Can each filter and/or filter cell be monitored for turbidity** Yes, continuously.

**Discuss other monitoring or sampling (particle counters, etc.)** The City installed a streaming current monitor; however, it is not in use at this time. The City used two Met-One particle counters for the Foothill Water Treatment Plant demonstration study, but they have been taken off-line.

**Alarms adequate to provide warning of coagulation, filtration, and disinfection failures or describe alternatives?** Yes alarms appear adequate.

**Are alarms tested, and if so, how often?** Alarms are officially tested approximately every 3 months, however, all turbidity alarms are set off once per week when the operators flush and calibrate the turbidimeters. The raw water turbidity alarm is set at 2 to 3 NTU greater than the raw water turbidity observed that day. This assures that an operator will be notified if there is a significant change in the raw water turbidity that could require an adjustment to the chemical dosage.

**Describe (or attach copy of) monthly records maintained of treatment** (See monthly monitoring file.)

**Discussion & appraisal** The monitoring meets the requirements of Surface Water Treatment Rule. However, in order to demonstrate compliance with the backwash water recycling regulations, the City needs to include the recycled backwash water flow rate and the recycled backwash water turbidity as part of the monthly treatment records submitted to the Department. Additionally, the monthly treatment records currently submitted by the City consist of several pages containing redundant information. It is recommended that the City work with Kim Hanagan, Lassen District Associate Sanitary Engineer, to develop a concise, organized Monthly Treatment Records reporting form for submission to the Department.

---

---

**TREATMENT: BUCKEYE WATER TREATMENT PLANT – Whiskeytown Lake**

---

**5. Watershed and Source Water**

**Name of source** Whiskeytown Lake

**Are there significant sewage hazards?** No.

**Is there significant recreation?** Yes.

**Any significant changes to or activities on the watershed since the last inspection?** No.

**Any changes in raw water quality, such as, turbidity or coliform levels?** No recent changes.

**What is date of last watershed survey (WSS)?** The 2011 Redding Area Watershed Sanitary Survey was submitted to our office on February 28, 2011.

---

**6. Treatment Plant**

**Name of Plant** Buckeye Treatment Plant, built in 1980.

**General description of process** Raw water from the Spring Creek Tunnel flows by gravity to the Buckeye Treatment Plant through a flow rate controller. The general process includes rapid mix, flocculation, sedimentation, and filtration. Alum and polymer are added in one of two rapid mix chambers upstream of four parallel flocculation and sedimentation basins (the City alternates operation between the two rapid mixers). The water enters the sedimentation basins from the flocculation basins through ported concrete walls. Each sedimentation basin contains three sawtooth weirs, totaling approximately 36 linear feet, that supply the settled water from each basin to a single channel. The combined settled water from the channel is then split between up to eight constant head, dual media gravity filters. The combined filter effluent flows to the 4 MG Buckeye Tank from which the Buckeye pressure zone is supplied. Gas chlorine is used as a disinfectant and can be added in three locations, the rapid mixer, the settled water at the sedimentation basin outlet, and the combined filter effluent.

**Classification** The Buckeye treatment Plant is classified as conventional treatment, which receives credit for 2.5-log removal of *Giardia* cysts, 2-log removal of cryptosporidium oocysts, and 2-log removal of viruses.

**Multiple filter units for redundant capacity?** Yes, eight filters.

---

---

**TREATMENT: BUCKEYE WATER TREATMENT PLANT (cont.) – Whiskeytown Lake**

---

**Standby power for treatment plant?** Yes, a diesel generator capable of powering the entire plant is tested weekly by isolating the Buckeye Treatment Plant and running it on generator power only.

**Are design criteria met? If not, what facilities are needed?** Yes, design criteria are met.

**Is operations plan up-to-date?** Yes.

**7. Treatment Processes****a. Flocculation/Sedimentation**

**Mix (type, size, flows, retention time, etc.)** Rapid mix with motor driven impeller blades; the impeller rate is adjusted manually by operators based upon experience to obtain dense floc that will settle quickly and produce the lowest settled water turbidity.

**Flocculation Basin** Each of the four flocculation basins is divided into three chambers by baffle walls that alternately force the flow under and over the walls. Each flocculation chamber is equipped with a horizontal paddle wheel, each operating at a lower speed than the one upstream from it. The total size of each basin is 30x30x12, 80,784 gallons.

**Sedimentation Basin** Each sedimentation basin is 100x30x13, 291,720 gallons, resulting in an overflow rate of 0.81 gpm/ft<sup>2</sup> at the maximum allowable flowrate of 14 MGD. This meets Ten-State Standards for sedimentation basin design.

**Chemical Addition** The City uses two primary coagulants, Clarifloc C-308P Polydyne polymer at a dosage of approximately 1.9 mg/L or alum at a dosage of between 2.2 and 2.6 mg/L. The polymer is mixed with water to create a 20% solution in a 3008-gallon capacity feed solution storage tank that supplies the polymer metering pump. A 40%Wt alum solution is delivered by truck and pumped into the 5,140-gallon capacity alum feed tank that supplies the alum metering pump. The coagulant is typically injected at the rapid mix only, but can also be added at the outlet channel from the sedimentation basins as a filter aid. Typically, the City uses Polydyne Clarifloc N-6310 (nonionic polymer) as a filter aid when raw water turbidities exceed 5 NTU or jar testing/filterability testing indicate that a filter aid is needed.

**Coagulant used at all times and optimized or 80% reduction in turbidity** Yes.

**How is coagulant feed rate determined and optimized?** Historical data and jar testing.

**Metering pumps (make, model, and capacity)** 1) Non-ionic polymer: single LMI 1 gph metering pump; 2) Cationic polymer: two LMI, 4.5 gph metering pumps; 3) Alum: two Wallace & Teirnan Chemtube Model 43-300 50 gph metering pumps.

**Standby metering pumps?** Yes, at 14 MGD, a single 4.5 gph metering pump can provide a maximum cationic polymer dose of 5.4 ppm, injecting a 20%Wt polymer solution, and a single 50 gph metering pump, injecting a 40%Wt alum solution, provides a maximum alum dose of 34.5 mg/L at the maximum allowable flow rate of 14 MGD.

**How often are metering pumps calibrated?** Feed rates are verified daily using a graduated cylinder; the pumps are not calibrated over their entire range.

**b. Filtration**

**Filters (gravity/pressure, filter area, media, media depth):** The treatment plant features eight dual media gravity filters each consisting of 24 inches of anthracite media over 12 inches of sand media with 12 inches of graded gravel support media over a Leopold block underdrain. Each filter basin is 14 feet by 15 feet by 11 feet deep, providing a filter surface area of 210 ft<sup>2</sup> each for a total filter surface area of 1,680 ft<sup>2</sup>.

**Approved maximum filter rate and plant capacity** The Buckeye Treatment Plant is currently permitted for a maximum filter-loading rate of 6.0 gpm/ft<sup>2</sup> in accordance with the SWTR. The design capacity of 14 mgd (9,722 gpm) corresponds to a filter-loading rate of 5.8 gpm/ft<sup>2</sup>. Due to the size of the influent flow meter, which is sized to measure flows as high as 49 MGD, the treatment plant operates at a minimum flow rate of 2.16 MGD (1,500 gpm), which corresponds to a filter-loading rate of 0.89 gpm/ft<sup>2</sup>.

**How is filter rate controlled?** The SCADA system controls the operation of butterfly valves c each filter effluent to maintain a constant water level of seven feet over each filter. The SCADA

---

**TREATMENT: BUCKEYE WATER TREATMENT PLANT (cont.) – Whiskeytown Lake**

---

system adjusts the position of the inlet valve and the total flow through the Buckeye Water Treatment Plant based on the water level in the 4 MG Buckeye Tank.

**Have filter rates exceeded maximum approved rate?** No, the SCADA system adjusts the total flow through the Buckeye Water Treatment Plant based on the total number of filters in operation so as not to exceed the maximum allowable filter-loading rate.

**Are filters operated to minimize shutdowns and startups or rapid changes in filter rates and are filter rates constant or varied to meet system demands?** Yes.

**Describe applicable filtration performance standards under Section 64657.3:** The turbidity level of the combined filter effluent shall be less than or equal to 0.3 NTU in at least 95 percent of the measurements taken each month and shall not exceed 1 NTU for more than 1 continuous hour, measured pursuant to section 64657.40. Furthermore, the turbidity level of the combined filter effluent at four-hour intervals shall never exceed 1 NTU and the combined filter effluent shall not exceed 1.0 NTU for more than 8 consecutive hours while the plant is operating.

**Describe applicable individual filtration performance standards under Section 64660(b)(7):** When any individual filter is placed back into service following backwashing or other interruption event, the filter water turbidity of the effluent from that filter shall not exceed: 2.0-NTU at any time during the first four hours of filter operation, 1.0-NTU at any time during the first four hours of filter operation following at least 90 percent of the interruption events during any consecutive 12 month period, and 0.5-NTU at the time that the filter has been in operation for 4 hours.

**Are CFE performance standards met?** Yes, turbidities are consistently less than 0.1 NTU in 95% of the readings each month and are typically less than 0.05 NTU.

**Are IFE performance standards met?** Yes, typically.

**Summarize performance over last year** During the past year the Buckeye Water Treatment Plant has consistently complied with turbidity performance standards.

**Describe backwash cycle (source of backwash water, flow rates, use of air/water, length of backwash, surface wash)** Water for backwashing is stored in a backwash tank located above the treatment facility. When backwash water is needed, it gravity flows from this tank to the filter units. The backwash cycle consists of a two minute air scour followed by one minute air and water; followed by five minutes water only.

**Frequency of backwashing and/or what initiates backwash** The filters can be backwashed based on the filter run length, the finished water turbidity, or the headloss across the filters (depth of water above filters). Currently, the filters are backwashed based on filter run length, after approximately 24 hours of operation during the summer and, due to lower filter-loading rates, after 48-60 hours during the winter, except during high raw water turbidity events.

**Method used to minimize turbidity spikes after backwashing or other interruption events.** The filters are operated in a filter-to-waste cycle for 300 seconds on start-up. If the filter effluent turbidity is greater than 0.25 NTU after the first 300 seconds, the filter -to waste cycle continues for an additional 700 seconds and an operator is notified. If the filtered water turbidity still exceeds 0.25 NTU after a total of 1,000 seconds, the SCADA system shuts down that filter.

**Are filter rates gradually increased after backwashing or other shut down?** Yes, valves open gradually.

**If coagulant added to backwash water, dosage and name of coagulant?** N/A

**If reclaimed backwash water returned to headworks, describe treatment, settling time provided, percent solids removal, and return rate to plant** Backwash water flows by gravity to the wash water recovery basin. The particulates are allowed to settle for at least one hour and then settled water is pumped from the top of the backwash basin to the headworks of the treatment plant. The backwash water recycle rate is set through the SCADA system at no more than 150 gpm so that even during minimum flows through the treatment plant the recycle rate never exceeds 10% of the raw water flow. The City uses an on-line turbidimeter to monitor the turbidity of the recycled backwash water.

**Are filters physically inspected annually?** The appearance of the filters is monitored on a daily basis by the WTP operators. The City contracts out full filter evaluations including filter bed

---

**TREATMENT: BUCKEYE WATER TREATMENT PLANT (cont.) – Whiskeytown Lake**

---

expansion, solids retention, and solids reduction following backwash. Each filter is evaluated every other year alternating between the Foothill and Buckeye Water Treatment Plants. ERS will be performing the City's filter evaluations at the Foothill Treatment Plant this year.

**Discussion & appraisal** The filter operations meet the requirements of the SWTR and IESWTR.

**c. Disinfection**

**Required log inactivation** The City is required to provide 0.5-log *Giardia* cyst inactivation and 2-log virus inactivation.

**Type and model of chlorine residual monitors or test kits** Wallace & Tiernan chlorine residual analyzer.

**Prechlorination**

**Type** Gas chlorination

**Capacity** 200 ppd rotameter, 1-ton cylinders

**Control** Flow-paced

**Standby feeders** The chlorinator can provide pre and post chlorination, total dosage of 1.7 ppm at flow of 14 MGD.

**Injection points, typical dosages, chlorine demand, typical residuals** Injected in rapid mix tank ahead of filters, typical residual of 0.5 ppm.

**Postchlorination**

**Type** Gas chlorination

**Capacity** 200 ppd rotameter, 1-ton cylinders

**Control** Feedback control through SCADA based on continuous chlorine analyzer measurements at outlet from the treatment plant.

**Standby feeders** Yes, can use one chlorinator to provide pre and post chlorination. A single chlorinator is capable of providing a 1.7 mg/L dosage of chlorine at the maximum flow rate of 14 MGD.

**Injection points, typical dosages, chlorine demand, typical residuals** In clearwell effluent, typical chlorine residual of 0.9 ppm leaving the treatment plant.

**Facilities providing contact time** The City calculates CT based on the contact time provided by the sedimentation basins, the 4 MG Buckeye Tank, the transmission main between the treatment plant and the tank, and the transmission main between the tank and the USBR Keswick Facility service connection. A 4,000-gallon capacity pressure tank provides contact time for the treatment plant itself. The City assumes a 0.3 short-circuiting factor for both the sedimentation basin and the clearwell and plug flow through the transmission mains. Based on the size of the pressure tank and an assumed maximum flow through the pressure tank of 20 gpm, the estimated short-circuiting factor for the pressure tank is 0.2.

**Are CT requirements being consistently met before the first service connection?** The first service connection is the water treatment plant itself and the second is the USBR Keswick facility. The City measures the chlorine residual and calculates the CT at the USBR facility once each week. The treatment records state, "in-plant CT is based on sed basins only"; however, the City **does not** consistently provide the CT required for 0.5-log inactivation of *Giardia* cysts through the sedimentation basins alone. The treatment plant receives water through a 4,000-gallon capacity pressure tank at an estimated maximum flow rate of 20 gpm. Assuming a short-circuiting factor of 0.2, the pressure tank provides an additional 40 minutes of contact time. As long as the City maintains a chlorine residual of 0.3 mg/L or greater leaving the treatment plant, they should be able to provide adequate CT at the treatment plant as well, under all operating conditions.

**Are residuals entering distribution system  $\geq 0.2$  ppm?** Yes

**Are distribution system residuals at least a trace 95%?** Yes

**Is emergency plan for disinfection failure up-to-date?** Yes, we received a copy of the City's disinfection failure plan (emergency guidelines) update on April 7, 2009.

**Discussion & appraisal** The City calculates the CT from the sedimentation basins, the 4 M Buckeye Tank, the transmission main between the treatment plant and the tank, and the

**TREATMENT: BUCKEYE WATER TREATMENT PLANT (cont.) – Whiskeytown Lake**

transmission main between the tank and the USBR Keswick Facility service connection weekly and submits the records to the Department monthly. According to Department records, the City consistently provides the required 0.5-log inactivation of *Giardia* cysts through disinfection at the USBR facility. The treatment records state, "in-plant CT is based on sed basins only"; however, the City **does not** consistently provide the CT required for 0.5-log inactivation of *Giardia* cysts through the sedimentation basins alone. The treatment plant receives water through a 4,000-gallon capacity pressure tank at an estimated maximum flow rate of 20 gpm. As long as the City maintains a chlorine residual of 0.3 mg/L or greater leaving the treatment plant, they should be able to provide adequate CT under all operating conditions; however, the City needs to begin calculating and reporting the actual CT at the treatment plant daily in order to demonstrate compliance with the CT requirements at the first service connection. The CT necessary to provide the required 3-log inactivation of viruses through disinfection is much less. Based on Department records, the City consistently maintains a chlorine residual in the distribution system and a residual greater than 0.2 mg/L entering the distribution system.

**8. Monitoring and Alarms Related to WTP Process**

Parameter	Location	Sample Frequency	Recording	Alarmed (yes/no)	Alarm Setpoint	Alarm Result
Plant Flow	Influent	Continuous	Yes	No		
Filter Flow	Each filter	None	None	No	N/A	N/A
Turbidity	Raw Influent	Continuous	Yes	Yes	Varies	Operator Notification Plant S/D
Turbidity	CFE	Continuous	Yes	Yes	0.25 NTU High 0.4 NTU HH	Op. Notific. Plant S/D
Turbidity	IFE	Continuous	Yes	No		
Turbidity	Settled Water	Continuous	Yes	No		
Turbidity	Backwash Return	Continuous	Yes	No		
Cl Residual	Clearwell Efflu.	Continuous	Yes	Yes	0.25 ppm low	Plant S/D
					1.0 ppm high	Plant S/D
Cl Residual	Floc/Sed Basin	Continuous	Yes	No		
Cl Residual	USBR	Grab	Yes	No		
Temperature	Raw	Continuous	No	No	N/A	
pH	Raw & Treat.	Continuous	Yes	No	N/A	
Chem Feed Pressure	Feed Discharge	Continuous	No	Yes		
Chemical Tank Level	Poly & Alum	Continuous	Yes	Yes		Operator Notification

**Type and model of turbidimeters used** Hach 1720E turbidimeters are used to measure the raw, settled, combined filter effluent, and individual filter effluent turbidity.

**How often turbidimeters calibrated?** The City calibrates the turbidimeters at least quarterly or as needed based on Hach's calibration guidelines using StablCal formazin solution. An Ice-Pik,

---

**TREATMENT: BUCKEYE WATER TREATMENT PLANT (cont.) – Whiskeytown Lake**

---

secondary standard, is used to verify the filtered water turbidimeter measurements weekly, as required by regulation.

**Are samples collected at proper locations that give accurate and representative results (i.e. turbidity sample must be before clearwell)** Yes.

**Can each filter and/or filter cell be monitored for turbidity** Yes, continuously

**Discuss other monitoring or sampling (particle counters, etc.)** None.

**Alarms adequate to provide warning of coagulation, filtration, and disinfection failures or describe alternatives?** Yes, the alarms appear to be adequate.

**Are alarms tested, and if so, how often?** Alarms are officially tested approximately every 3 months, however, all turbidity alarms are set off once per week when the operators flush and validate the turbidimeters.

**Describe (or attach copy of) monthly records maintained of treatment** (See monthly monitoring file.)

**Discussion & appraisal** It appears monitoring and alarms meet the requirements of the SWTR.

**9. Compliance with the Federal Long Term 2 Enhanced Surface Water Treatment Rule (LT2)**

**Has the water system submitted an LT2 monitoring plan or “grandfathered data?”** The City is classified as a Schedule 2 water system and was required to submit a monitoring plan by January 1, 2007. According to Department records, the City did not submit an LT2 monitoring plan or state their intent to grandfather data.

**Has the water system performed cryptosporidium/E. coli monitoring under the LT2?** On December 21, 2007, the Department received the results from 25 consecutive months of monitoring for turbidity, fecal coliform, cryptosporidium oocysts, and *Giardia* cysts for both the Whiskeytown Lake source and the Sacramento River source. One sample was collected each month from each source from March 2005 through March 2007. There was no detectable cryptosporidium oocysts in any of the samples collected.

**Discussion & appraisal** According to Department records, the City did not submit the required LT2 monitoring plan or state their intent to grandfather existing data by January 1, 2007. However, on December 21, 2007 the City did submit monitoring results for 25 consecutive months of monitoring for turbidity, fecal coliform, cryptosporidium oocysts, and *Giardia* cysts for both the Whiskeytown Lake source and the Sacramento River source. There were no detectable cryptosporidium oocysts in any of the samples; therefore, both the Whiskeytown Lake and Sacramento River sources were classified as Bin 1 source for the purposes of the LT2.

**E. Groundwater Treatment**

**Is continuous disinfection provided?** Continuous disinfection is provided at each of the Enterprise wells, primarily in order to ensure a measurable chlorine residual throughout the distribution system in compliance with the SWTR. Continuous chlorination is also provided at the Enterprise Wells for taste and odor associated with manganese. The Cascade Wells do not have continuous disinfection; the City maintains that these wells are such low producers relative to the surface water sources that a chlorine residual can be maintained in the distribution system without chlorination.

**Describe facilities** The City utilizes gas chlorination at the Enterprise wells are chlorinated with gas using 150-lb cylinders with booster pump and W&T V10K gas chlorination system, which includes a vacuum regulator mounted at the gas supply, a wall-mounted gas control unit with a rotameter for indication of feed rate, and a water-operated injector that provides the vacuum source to drive the chlorination system. A vacuum regulator is mounted on a 150 pound chlorine cylinder, and chlorine gas is supplied under vacuum through a rotameter to an ejector where it is mixed with water supplied by a small booster pump. This heavily chlorinated water is then injected into the well discharge line downstream from the polyphosphate injection point. The City uses 20 pound per day (ppd) and 50 ppd rotameters at the wells depending on the output of the well pump and age of the well. There is no automatic switchover of gas cylinders. However City personnel check the wells daily when operating and cylinders are switched when near empty. Once the final chlorine gas cylinder is placed in service, the City contacts their supplier who delivers two full

cylinders and picks up the two empty cylinders. In the event that the gas cylinder currently in use becomes empty either through use or a leak, the SCADA system sends out a high vacuum alarm. Additionally, all wells have gas leak detectors with alarms that signal the Foothill WTP. The City provides a chlorine dosage of 0.3 mg/L to 0.5 mg/L at the wells in order to ensure a measurable residual throughout the water system. The City is able to provide a maximum chlorine dosage of at least 1.6 mg/L at each of the Enterprise wells. The chlorine booster pumps are interchangeable between wells and the City maintains complete set of replacement parts for the well chlorination systems.

**Describe Records Maintained of Treatment** The City records the amount of water produced and chlorine used at each well each day that the well is in use. The City measures and records the chlorine residual in the distribution system at the time and location of the collection of bacteriological samples and daily at the distribution sample station nearest each well in operation that day. This allows the operators to better determine any changes in the chlorine demand character of the water produced by the wells. These records are submitted to the Department by the 10<sup>th</sup> day of the following month.

**If disinfection is not provided, are provisions & connections for emergency chlorination provided per DDW guidelines?** Cascade Wells have hose bib sample taps that can be used as injection points and have 110 volt power for metering pumps. The 110V circuits are not slaved to the well pumps; however since the Cascade Wells are operated manually and as a consequence run continuously, this is not a problem. In the event that a Cascade well tests positive for coliform bacteria, the well would be shut down since they are all low producers. City has spare metering pumps at the Foothill Treatment Plant.

**Discussion & appraisal** The well chlorination appears reliable and consistent. The operators check all chlorination facilities on a daily basis. The City keeps a good supply of spare parts and spare chlorinators. The City also has an emergency gas chlorination system on a trailer that can be used, as needed, at wells, storage tanks, booster pump stations, or mains. The treatment records submitted to the Department each month are adequate.

#### F. Other Treatment or Blending Facilities

**Describe facilities & parameters treated/blended (i.e. iron, & manganese, fluoridation, nitrate, corrosion control, organics, etc.)** The City injects Carus K-5 blended polyphosphate sequesterant at Enterprise Wells E-4, E-6A, E-7, E-8, E-9, E-10, E-11, E-12, E-13, and E-23 as a treatment for manganese. The sequestering agent is injected neat at most wells by a Pulsitron 6 gpd metering pump, drawing from a 55-gallon capacity plastic drum just upstream from the chlorine injection points. A 12 gpd metering pump is used to provide the sequestering agent at Well E-11. The polyphosphate blend is injected by a 6 gpd metering pump drawing from a 100-gallon capacity solution storage tank at Well E-23.. The City monitors treatment by measuring the phosphate residual at each well once per week and at three routine coliform sample sites in Enterprise Zone distribution system once each month.

**Describe Records Maintained of Treatment** The City measures and records the concentration of phosphate and manganese in the distribution system weekly. The City monitors monthly for total alkalinity, calcium, temperature, pH, cadmium, chromium, copper, lead, nickel, silver, zinc, iron, manganese, specific conductance and ortho-phosphate at the 18 groundwater and surface water sources, and in each of the eight pressure zones These records are maintained in-house.

**Discussion & appraisal** The City monitors the phosphate at three representative sites in the distribution system monthly and monitors the phosphate in the water entering the distribution system from each source weekly. Our guidelines recommend that the phosphate residual should be measured daily from each treatment facility.

#### G. DISTRIBUTION SYSTEM

##### 1. Transmission Mains

**Describe transmission facilities** The City has only one transmission main in the system, the 30-inch diameter main that delivers treated water from the Buckeye Treatment Plant to the first customer, the USBR. This main is 13,793 feet long.

**Are there low-head lines** No.

**Discussion & appraisal** The Buckeye transmission main is reportedly in good condition.

**2. Pressure Zones**

Pressure Zone	Pressure (psi)	Water Sources	Storage Capacity	No. of Conn. <sup>1</sup>
Summit City	35+	Buckeye Zone	0	24
Buckeye	25 – 150	BWTP (9,722 gpm), & pump stations 3 & 4 (5,200 gpm)	6.225 MG	5,008
Foothill	35 – 115	FWTP (18,000 gpm)	9.0 MG	4,469
Hill 900	35 – 100	Pump Station No. 2 (5,375 gpm)	4.0 MG	4,539
Cascade	40 – 110	Cascade Wells (500 gpm+/-) and connections with the Enterprise, Foothill, and Hill 900 zones	3.0 MG	3,339
Hilltop – Dana	40 – 110	Pump Station No. 5 (5,500 gpm) and two PRVs from Buckeye Zone	None	2,458
Enterprise	35 – 100	Enterprise Wells & connections from Foothill & Hilltop/Dana zones (6,280 gpm+)	9.504 MG	8,719
<b>Total</b>			31.73	28,556

1 As of 2010.

**Discussion & Appraisal** The City maintains over 20 psi at each service connection, which meets the Waterworks Standards for facilities existing prior to 2007.

**3. Booster Pump Stations**

Pump Station	Capacity	From	To	Comments
Pump Station No. 1	30.6 MGD	Sac River	Foothill Treatment Plant	Constructed 1939; 5 oil-lubed, vertical turbine pumps (1x350 HP, 2x500 HP, & 2x700 HP); newer pumps 1&2 on bank; older pumps 4,5,&6 in river; <b>bank pumps cannot be used after the ACID weir removed in the fall &amp; before winter rain because the river is too low; one 12" board left in place would allow FWTP to run without frequent stops/ starts</b> ; new cla-valve replaced 40-year-old Bailey valve; no generator backup but have electric feeds from 2 separate substations; on SCADA
Pump Station No. 2	20.16 MGD	Foothill Treatment Plant	Hill 900	Constructed 1959; 4x200 hp, 3,500 gpm centrifugal pumps located at FWTP; parallel 18-inch Ø pipes on the pump discharge; on SCADA
Pump Station No. 3	4.1 MGD	Foothill	Buckeye	Constructed 1968; used often during summer; 4x75 hp, 800 gpm, canned vertical turbine pumps; controlled by Buckeye 4 MG Tank level and BWTP; manual PRV in underground vault behind PS, plan to bring above ground & put on SCADA; new forward/reverse magmeter; 24 kW diesel backup generator. This is the preferred pump station to deliver water from Foothill to Buckeye.

Pump Station	Capacity	From	To	Comments
Pump Station No. 4	3.4 MGD	Foothill	Buckeye	Constructed 1985; rarely used; 3x75 hp, pressure reducing/pressure sustaining (PR/PS) valve replaced 4th pump; 800 gpm, vert. turbine pumps; controlled by Buckeye 4 MG Tank level and BWTP; used very little during summer, impedes discharge from BWTP; no backup power; on SCADA new forward/reverse magmeter on order
Pump Station No. 5	2.4 MGD	Enterprise	Hilltop	Constructed 1985; 4 VFD canned vert. turbine pumps; maintains pressure at 63 psi; no generator, in event of power failure, check valve provides water from Enterprise Tanks to Hilltop
Mary Lake	4.55 MGD	Hill 900	Mary Lake	Constructed 2002; parallel 40 hp and 75 hp VFD centrifugal pumps boost pressure ~20 psi; operates based on pressure in Mary Lake Zone; on SCADA via radio telemetry; only PS which is not inside a building
Bonnyview	3.5 MGD	Enterprise	Cascade	Constructed May 1995, a 40 hp centrifugal pump located in an underground vault provides increased flow during high demand periods. Operation is controlled by the water level in Ranchettes Tank. A sump pump provides drainage for the vault. The City plans to construct an above ground station in the future.
Goodwater	4.32 MGD	Enterprise	Hilltop	Constructed 2003; 125 hp VFD vertical centrifugal pump; maintains pressure at 110 psi; on SCADA; Rarely used since it pushes Fe/Mn water into the Hilltop zone. Kept for fire flow requirements for Field of Dreams. Can move water through the Enterprise zone.
El Reno	1.1 MGD	Cascade	Hill 900	Constructed 1982; Installed new 75 hp turbine in 1995; controlled by pressure; provides back-up supply to Riviera Drive area in Hill 900 zone; tested once per month; on SCADA; rarely used. Only backup pump station for Hill 900 zone other than the Centerville intertie on Record Lane.
Mercy Hospital	0.25 MGD	Foothill	Mercy Hospital	Rebuilt in 1982; modified in 1987; One 10 hp centrifugal pump; emergency service for Hospital; was necessary when only one main served hospital area from Hill 900 tanks; now have two mains serving area; tested once per month; inactive for 11 years; no SCADA

**Discussion & appraisal** The pump stations are checked daily when in use, weekly when not in use. All pump stations with the exception of Mary Lake and Bonnyview, which are not in buildings, are alarmed. There was approximately one foot of water in the vault housing the Bonnyview Pump Station at the time of the inspection, and the sump pump was not running. Mr. Tona reported that the City has repaired the sump in the Bonnyview Vault and that they now maintain two replacement sump pumps. All areas of the City can be fed from storage by gravity; however, pump stations are necessary in some locations to maintain adequate pressure during high demand periods.

#### 4. Pressure Reducing Valves

Station	Location	Size	From	To	Comments
PS No. 3	Sulfur Creek	8-inch	Buckeye	Foothill	
PS No. 4	Benton Dr @ Barbara Rd	8-inch			
Linden Ave.	Linden @ Olive	8-inch	Hill 900	Foothill	
Palisades #1	Palisades @ Hilltop	12-inch	Buckeye	Hilltop/Dana	
Palisades #2	Riverbend Dr.	3-in. & 8-in.	Buckeye	Hilltop/Dana	
Blossom Park	Constitution @ Twin View	3-in. & 8-in.	Buckeye	Lower Buckeye	Blocked open
Candlewood	Marigold	3-in. & 8-in.	Hilltop/Dana	Hilltop/Dana	Blocked open
Park Marina	Park Marina @ Cypress	8-inch	Foothill	Enterprise	Located under bridge
Railroad Ave	Railroad Ave.	8-in. & 12-in.	Foothill	Southern Foothill/ Cascade	Same location as supervisory vault
Market St.	Market @ Fell	8-inch	Foothill	Southern Foothill/Enterprise	
N. Bechelli Ln	Bechelli @ Redcliff	6-inch	Hilltop/Dana	Enterprise	

**Discussion & appraisal** With the addition of the PRVs at Pump Stations No. 3 and No. 4, the City is now able to move water from the Buckeye Treatment Plant into the Foothill Zone, allowing the City to take the Foothill Treatment Plant out of service during the winter for maintenance. In addition, in the event that the Sacramento River Pump Station or Foothill Treatment Plant is out of service due to a loss of power or pump failure, the Foothill and Hill 900 Zones can now receive water from the Buckeye Treatment Plant.

#### 5. Mains

Material	Amount, miles	Amount, %	Size	Condition	Comments
Cast Iron	56.5	18.5%	2" to 18"	good	
Ductile Iron	43.69 +	14.3%	6" to 48"	good	
Steel	21.9	7.2%	2" to 24"	good	Some cement lined & some tar wrapped
Cement coated concrete	6.66	2.2%	12" to 24"	good	Spiral wound reinforced concrete
Asbestos Cement	106.2	34.8%	2" to 16"	good	
C900 PVC	57.28 +	18.8%	4" to 12"	good	
PVC Schedule 40	2.51	0.8%	1½" to 4"	good	
Class 150, C900 PVC	2.43	0.8%	4" to 8"	good	
Galvanized Steel	7.52	2.5%	1" to 2"	good	
Copper	0.04	0.01%	1"	good	
<b>Total</b>	<b>304.73</b>	<b>100.0%</b>			

**Are mains constructed in accordance with Waterworks Standards?** Yes, all new facilities conform to the Waterworks Standards. New pipe 10-inch and less is PVC, 12-inch and greater is ductile iron.

**Describe water main & sewer line separation practices** The City either conforms to Waterworks Standards or uses approved special construction. The City submits proposed pipe construction projects to the Department for our review.

**Extent of lead pipes, joints, and lead solder used in distribution system & present policy** Reportedly, there is no lead in the distribution system.

**Leak History**

Year	Total No. of Breaks/Leaks	Main Breaks	Service Connection Breaks
2001	343	255	88
2002	396	312	84
2003	412	165	247
2004	443	187	256
2005	426	156	270
2006	404	175	229
2007	617	163	454
2008	454	206	339
2009	147	34	113
2010	85	11	74
2011	84	8	76

**Discussion & appraisal** The size and materials of construction table above has not been updated since 2003. See chemicals for a discussion of required asbestos monitoring. There has been a consistent downward trend in service connection leaks since 2007, indicating that the City's service lateral replacement program is working. Distribution mains appear to be in good condition with materials, size, and installation in conformance with the Waterworks Standards.

**G. WATER QUALITY & MONITORING**

**1. Bacteriological Monitoring**

**Description of program** City staff collect bacteriological samples from 120 dedicated sample stations. Sampling is rotated based on a 5-week schedule. The City collects 23-25 samples per week. The samples are collected every Tuesday by certified operators or by Jeff Thomas, who is not a certified operator but has been trained on how to collect samples, and are analyzed by Basic Laboratory in Redding. Repeat samples are collected from dedicated locations; quick connects, located in nearby customer meter boxes. No samples are collected at private service connections or hose bibs. The sample site locations by pressure zone are summarized below.

**Routine Bacteriological Sample Sites**

Pressure Zone	# Conn.	Population	Number of Samples/Sites				
			Wk1	Wk2	Wk3	Wk4	Wk5
Enterprise	8,719	28,773	6	6	6	6	6
Buckeye	5,008	16,526	4	4	4	4	4
Hill 900	4,539	14,979	3	3	3	3	3
Foothill	4,469	14,748	4	4	4	4	5
Cascade	3,339	11,019	5	5	4	4	3
Hilltop/Dana	2,458	8,111	2	2	2	2	2
Summit City	24	79		1		1	1
Total	28,556	94,235	24	25	23	24	24

**Number of samples per month or week required?** The City is required to collect at least 23 routine samples per week based on population (83,001-96,000). The City collects 23 to 25 samples per week.

**Bacteriological Sampling Siting Plan (BSSP) approved & current (do we have a copy?)**

Yes, the most recent revision to the BSSP, dated December 1, 2009, appears to be current and in compliance with current regulations, including provisions for groundwater source monitoring in compliance with the Groundwater Rule.

**MCL violations in past year?** No, a single routine sample tested positive for total coliform in February 2011, but all four repeat samples tested absent.

**Special/additional monitoring done in past year for:**

**Raw water quality** Under the Interim Enhanced Surface Water Treatment Rule, raw water supplies are to be monitored for total coliform and fecal/*E.coli* bacteria using a density method on a monthly basis. All chlorinated well sources should be monitored for coliform bacteria quarterly and seasonal wells should be monitored monthly while they are operating. The City collects one coliform sample from each surface water and ground water source during any month the source is in use.

**After construction/repair of wells** Yes, bacteriological samples are collected.

**After main installation or repair** Yes, City maintains results in binder.

**After construction, repair, or maintenance of storage tanks** Yes.

**After system pressure loss to less than 5 psi** Yes, City maintains results in binder.

**Discussion & appraisal** None of the raw water samples collected from the groundwater sources during 2011 and 2012 were positive for *E. coli*; and only four samples were total coliform positive. A sample collected from Cascade Well 6 in January 2011 had a total coliform most probable number per 100 ml (MPN) of 1.1. A sample collected from Enterprise Well 4 in May had a total coliform MPN of 2.2. A sample collected from Enterprise Well 8 in June had a total coliform MPN of 21, and a sample collected from Enterprise Well 14 in August had a total coliform MPN of 2. The average level of *E. coli* bacteria in the Sacramento River source during 2011 was an MPN of 21, up from the 2010 average *E.coli* MPN of 11.3. The average level of *E. coli* bacteria in the Whiskeytown Lake source during 2011 was an MPN of 11.4, up from the 2010 average *E.coli* MPN of 8.4. Prior years were not examined during this inspection to see if there is a general trend. At this time, the average level of *E. coli* bacteria in both surface water sources is still well below an MPN of 100 per 100 ml, which would trigger source water monitoring for cryptosporidium. The number and locations of the bacteriological sample sites adequately represents the distribution system, and the City met all bacteriological standards during 2011 and 2012.

## 2. Source Chemical Monitoring

**Description of program** Source water monitoring samples are collected by City personnel in accordance with chemical monitoring schedules provided by the Department. The samples are delivered to a state-certified lab and the results are reported to the State via the electronic data transfer (EDT) reporting system, as required by regulation. The City is currently required to perform increased quarterly monitoring for manganese at Wells E-6, E-7, E-12, and E-14 due to past exceedances of the manganese maximum contaminant level (MCL) of 0.050 milligrams per liter (mg/L) at these wells. Due to recent exceedances of the arsenic MCL of 0.010 mg/L, the City is currently required to sample for arsenic at least once each quarter at Well E-12.

**Primary MCL Violations?** Well E-13 exceeded the arsenic MCL during the 3<sup>rd</sup> and 4<sup>th</sup> quarter 2008, the 1<sup>st</sup> quarter 2009, and during each quarter since the 1<sup>st</sup> quarter of 2011. Well E-11 has arsenic levels which are near or at the MCL. Our office issued compliance order 01-02-09(O)006 on April 20, 2009, which directed the City to submit a compliance report, complete quarterly public notification, submit quarterly status reports, and continue quarterly sampling of both Well E-11 and E-13. The City has not used these wells in over three years, since Well E-23 was permitted as an active source and the Buckeye Zone was tied into the rest of the distribution system. On May 16, 2012, the Department

received a permit amendment application from the City to change the status of Wells E-11 and E-13 to standby. The Department issued permit amendment 01-02-12(A)009 on October 16, 2012, designating Wells E-11 and E-13 as standby sources. As standby sources, the monitoring frequency has been reduced to one sample every nine years for all regulated chemicals except for synthetic organic chemicals and certain radiological constituents for which all monitoring has been waived.

Additionally, Well E-12 exceeded the arsenic MCL in the two most recent sample results reported to the Department for the 2<sup>nd</sup> and 3<sup>rd</sup> quarters of 2012. A sample collected on June 15, 2012 contained 10.2 µg/L arsenic and a sample collected on August 21, 2012, contained 11.9 µg/L arsenic. The City needs to continue quarterly monitoring for arsenic at Well E-12. The Department will determine what additional action is required once the City has completed four quarters of monitoring for arsenic at Well E-12.

**Secondary MCL Violations?** Due to historic results greater than the manganese secondary MCL of 0.05 mg/L, the City was required to begin quarterly monitoring for manganese at Enterprise Wells E-11, E-12, E-13, and E-14 to determine compliance with the MCL. The City initiated quarterly monitoring for manganese at Enterprise Wells E-11, E-12, E-13, and E-14 in January 2010, and Enterprise Wells E-11, E-12, and E-14 have exceeded the secondary MCL of 0.05 mg/L for manganese since the 4<sup>th</sup> quarter of 2010. None of the samples collected from Well E-13 during 2010 exceeded the MCL for manganese. Samples collected from Enterprise Wells E-6A and E-7 in June and July 2011 also exceeded the secondary standard for manganese. Wells E-11 and E-13 are now permitted as standby sources, and as such the City is not required to meet the secondary standard for manganese at Wells E-11 and E-13.

In 1993 the City used a sequestering agent in a pilot program. From 1993 to 1994 the number of taste, odor, and color complaints dropped by 57%. Although the Department has not required the City to treat for manganese in the past, the City injects a polyphosphate sequesterant into the discharge pipe from Enterprise Wells E-6A, E-7, E-8, E-9, E-10, E-11, E-12, E-13, E-14, and E-23, based on the results from the 1993 pilot program. In 1995 the City applied for a permit amendment and on April 29, 1996, the Department issued a permit amendment for the use of a sequestering agent at Wells E-4, E-5, E-7, E-8, E-9, E-10, and E-11. The Department issued a permit amendment to operate Enterprise Wells E-13, E-14, and E-23 on April 3, 2008; however, the permit amendment did not specify nor describe any treatment provided at these wells. According to Department records, a permit was never issued by the Department for the operation of Well E-12.

## Waivers

**Inorganic Chemicals** Our office has historically granted waivers without applications based on a review of the historical data. The current chemical monitoring schedules reflect these waivers.

**Volatile Organic Chemicals** Our office has historically granted waivers without applications for all VOCs based on historical data and susceptibility. The current chemical monitoring schedules reflect these waivers. Groundwater sources are required to complete VOC sampling every 6 years, and surface water sources are not required to sample during the term of the waiver.

**Non-volatile Synthetic Organic Chemicals** Our office has historically granted waivers without applications for all SOCs. The current chemical monitoring schedules reflect these waivers. All of City's wells were monitored at least once for atrazine, simazine, six Title 22 pesticides, and ethylene dibromide. None of these chemicals were detected in any of the City's well sources.

**Cyanide** Our office has historically granted waivers without applications for cyanide based on use and susceptibility. The current chemical monitoring schedules reflect these waivers.

**Asbestos** A review of the California Division of Mines & Geology, Department of Conservation, geologic map shows no Mesozoic ultrabasic (ub) intrusive rock, which may or may not contain serpentine, an asbestos containing formation, in the Redding groundwater source watershed. Therefore, all of the City's well sources are considered non-vulnerable to asbestos, and the Department has waived the asbestos monitoring requirements for the groundwater sources. All

surface water sources are considered vulnerable to asbestos and therefore do not qualify for waivers. Sampling is required every nine years.

**Triggered Monitoring?** Well E-3A has historically produced water which contains nitrate levels below the MCL of 45 mg/L, but higher than the trigger level of 23 mg/L. No single result has ever exceeded the MCL. Our office directed the City to complete quarterly monitoring for nitrate, and these results have shown a nitrate level below the MCL. Therefore, our office directed the City to return to annual nitrate monitoring, as provided in Title 22, Section 64432.1(a)(2) of the California Code of Regulations.

**Discussion and appraisal** While the 1993 study showed a reduction in water quality complaints following the use of a sequesterant, the relatively high number of taste and odor complaints the City has received over the years from customers in the Enterprise area is likely a result of the levels of manganese in the water provided to the customers in the Enterprise area when the Enterprise wells are in operation. Per the Department's June 4, 2012, letter to the City, the City needs to provide the Department with a plan and schedule for coming into compliance with the secondary standard for manganese at Enterprise Wells E-12 and E-14. The City also needs to begin reporting the results from at least quarterly monitoring for manganese at Enterprise Wells E-6A and E-7 during any quarter that the wells are in operation due to the exceedances of the manganese MCL in samples collected from these wells during June and July 2011.

According to Department records, the City is current on most required source water chemical monitoring. According to Department records, the City is past due on monitoring for most inorganic chemicals at Cascade Well 08. Source water chemical monitoring schedules are enclosed showing when the most recent chemical monitoring was performed for each source, the required frequency of monitoring, the number of past results, and when monitoring is next due. In order to continue receiving chemical monitoring waivers, the City should submit waiver requests for IOCs, VOCs, SOCs, cyanide, and asbestos.

### 3. Distribution System Lead & Copper Monitoring

**Description of program** According to Department records, the City has completed a total of six rounds of monitoring for lead and copper in the distribution system with no exceedances of the lead or copper 90<sup>th</sup> percentile action levels of 0.015 mg/L and 1.3 mg/L, respectively. The City is required to collect at least one set of 30 tap water samples from the distribution system in accordance with Department procedures every three years during the summer months.

Round	Date	No. Samples	90 <sup>th</sup> Percentile Pb, mg/L		90 <sup>th</sup> Percentile Cu, mg/L	
			Result	AL	Result	AL
1	05/05/1992	60	0.007	0.015	0.881	1.3
2	08/12/1992	60	0.006		0.641	
3	09/13/1993	30	0.006		0.284	
4	07/13/2004	32	0.005		0.351	
5	08/28/2007	30	0.0032		0.320	
6	08/19/2010	30	ND		0.314	
7		30	Due Summer 2013			

**Discussion & appraisal** Following the City's two initial rounds of standard monitoring, the City applied for and received approval from USEPA to waive lead and copper monitoring since initial results were below action levels. The City resumed lead and copper tap monitoring in 2004. Under reduced lead and copper monitoring the City is required to collect 30 tap samples from the distribution system in accordance with Department procedures once every three years. According to Department records, the City last sampled for lead and copper in the distribution system on August 19, 2010; therefore, the City is required to collect the next set of 30 tap water samples from the distribution system during June, July, August, or September 2013.

#### 4. Disinfection Byproducts Rule Monitoring

**Description of Program:** Based on the number of customers served and past monitoring, the City is currently required to monitor quarterly for total trihalomethanes (TTHMs) and the five regulated haloacetic acids (HAA5s) at each of three sample sites in the distribution system. The City collects a sample associated with the Foothill WTP at 2050 Heller Lane, a sample associated with the Buckeye WTP at 830 Collyer Drive, and a sample associated with the Enterprise Wells at 4665 Alta Saga Drive. The City is also required to perform quarterly monitoring of the raw and treated water total organic Carbon (TOC) and raw water alkalinity at both the Foothill and Buckeye water treatment plants. The City is currently monitoring for TTHMs and HAA5s at three additional sites representative of the Buckeye WTP although the Department notified the City in a letter dated June 27, 2011 that they could reduce monitoring associated with the Buckeye WTP to the single site located on Collyer Drive. Monitoring for TTHMs, HAA5s, TOC and alkalinity is summarized in the tables below.

**TTHM Monitoring Summary, Parts Per Billion (ppb)**

Date	Heller		Collyer		Alta Saga		Santa Rosa		Oasis		Redwood		Total RAA
	Result	RAA	Result	RAA	Result	RAA	Result	RAA	Result	RAA	Result	RAA	
3/29/10	0		31.8		0		26.8		27.8		29.0		
6/14/10	13.4		25.7		20.1		22.4		23.0		26.5		
11/4/10*	24.8	<b>13.0</b>	34.6	<b>30.7</b>	0	<b>6.7</b>	32.3	<b>27.2</b>	34.1	<b>28.3</b>	40.7	<b>32.1</b>	<b>23.0</b>
2/16/11*	0	<b>13.0</b>	30.6	<b>30.3</b>	0	<b>6.7</b>	43.1	<b>32.6</b>	45.2	<b>34.1</b>	50.9	<b>39.4</b>	<b>19.4</b>
5/13/11*	16.3	<b>13.7</b>	28.0	<b>31.1</b>	0	<b>0</b>	16.6	<b>30.7</b>	16.9	<b>32.1</b>	17.3	<b>35.5</b>	<b>23.8</b>
7/29/11	9.4	<b>12.6</b>	29.3	<b>30.6</b>	0	<b>0</b>	23.5	<b>28.9</b>	24.1	<b>30.1</b>	25.5	<b>33.6</b>	<b>34.0</b>
11/23/11	3.5	<b>7.3</b>	21.7	<b>27.4</b>	0	<b>0</b>	19.8	<b>25.8</b>	26.8	<b>28.2</b>	20.9	<b>28.6</b>	<b>19.6</b>
2/16/12	2.5	<b>7.9</b>	23.1	<b>25.6</b>	4.6	<b>1.2</b>	20.6	<b>20.1</b>	21.0	<b>22.2</b>	22.1	<b>21.4</b>	<b>16.4</b>
5/18/12	0	<b>3.9</b>	26.6	<b>25.2</b>	0	<b>1.2</b>	21.7	<b>21.4</b>	23.4	<b>23.8</b>	24.2	<b>23.2</b>	<b>16.4</b>
8/21/12	10.8	<b>4.2</b>	34.3	<b>26.4</b>	1.7	<b>1.6</b>	25.1	<b>21.8</b>	23.9	<b>23.9</b>	29.6	<b>24.2</b>	<b>17.0</b>

\* No result was reported for the 3<sup>rd</sup> qtr of 2010; therefore the RAA was calculated based on the available data from the last 3 qtrs.

**HAA5 Monitoring Summary, Parts Per Billion (ppb)**

Date	Heller		Collyer		Alta Saga		Santa Rosa		Oasis		Redwood		Total RAA
	Result	RAA	Result	RAA	Result	RAA	Result	RAA	Result	RAA	Result	RAA	
3/29/10	1.5		49.5		1.4		41.7		44.2		48.6		
6/14/10	18.6		42.9		24.4		40.0		38.6		43.7		
11/4/10*	33.1	<b>17.7</b>	39.6	<b>44.0</b>	0	<b>8.6</b>	42.9	<b>41.5</b>	44.6	<b>42.5</b>	49.2	<b>47.2</b>	<b>33.6</b>
2/16/11*	0	<b>17.2</b>	32.3	<b>38.3</b>	0	<b>8.1</b>	57.1	<b>46.7</b>	58.0	<b>47.1</b>	52.8	<b>48.6</b>	<b>34.3</b>
5/13/11*	14.9	<b>16.0</b>	23.9	<b>31.9</b>	0	<b>0</b>	22.0	<b>40.7</b>	25.2	<b>42.6</b>	24.4	<b>42.1</b>	<b>28.9</b>
7/29/11	12.9	<b>15.2</b>	37.3	<b>33.3</b>	0	<b>0</b>	32.3	<b>38.6</b>	34.5	<b>40.6</b>	34.1	<b>40.1</b>	<b>28.0</b>
11/23/11	0	<b>7.0</b>	28.7	<b>30.6</b>	0	<b>0</b>	25.5	<b>34.2</b>	25.0	<b>35.7</b>	25.8	<b>34.3</b>	<b>23.6</b>
2/16/12	6.3	<b>8.5</b>	34.0	<b>31.0</b>	8.4	<b>2.1</b>	31.6	<b>27.8</b>	30.6	<b>28.8</b>	31.5	<b>29.0</b>	<b>21.2</b>
5/18/12	0	<b>4.8</b>	45.4	<b>36.4</b>	0	<b>2.1</b>	38.3	<b>31.9</b>	39.0	<b>32.3</b>	41.0	<b>33.1</b>	<b>23.4</b>
8/21/12	13.8	<b>5.0</b>	36.0	<b>36.0</b>	1.2	<b>2.4</b>	25.4	<b>30.2</b>	24.9	<b>29.9</b>	27.7	<b>31.5</b>	<b>22.5</b>

\* No result was reported for the 3<sup>rd</sup> qtr of 2010; therefore the RAA was calculated based on the available data from the last 3 qtrs.

### Disinfection Byproducts Precursor Monitoring

Date	Sacramento River			Whiskeytown Lake		
	Alkalinity, ppm	Raw TOC, ppm	Treated TOC, ppm	Alkalinity, ppm	Raw TOC, ppm	Treated TOC, ppm
1/5/10	63	1.0	1.1	44	1.4	1.3
3/29/10	53	1.3	0.9	32	1.4	1.3
7/23/10		0.7	0.5		1.0	0.8
<b>Annual Average</b>		<b>1.0</b>	<b>0.83</b>		<b>1.3</b>	<b>1.1</b>
5/13/11	53	1.4	0.9	31	1.4	1.2
7/29/11	50	1.2	1.0	39	1.3	1.0
11/23/11	53	1.1	0.9	44	1.3	1.1
<b>Annual Average</b>		<b>1.2</b>	<b>0.9</b>		<b>1.3</b>	<b>1.1</b>
2/16/12	57	0.8	0.6	43	1.0	1.1

**Discussion & appraisal** According to Department records, the running annual averages (RAA) of TTHMs and HAA5s measured in the distribution system have been less than ½ their respective MCLs of 0.080 mg/L and 0.060 mg/L. Additionally, the annual average level of TOC in the raw and treated water, both, is consistently less than 2.0 mg/L. Based on these past results, the City was allowed to reduce monitoring for TTHMs and HAA5s to one sample each quarter at each of three sites; however, the City has continued to perform quarterly monitoring at all four sites associated with the Buckeye WTP. According to Department records, the City failed to report any results for TTHM and HAA5 monitoring during the 3<sup>rd</sup> quarter of 2010. When four consecutive quarters of results are not available, the running annual average (RAA) is calculated based on the available monitoring results. As noted above, the RAA of TTHMs and HAA5s was well below their respective MCLs during this time period as well.

The City failed to collect and report results for quarterly raw water and treated water TOC at either treatment plant during the 4<sup>th</sup> quarter of 2010 and the 1<sup>st</sup> quarter of 2011. Additionally, the City failed to collect and report results for quarterly raw water alkalinity monitoring from the 2<sup>nd</sup> quarter of 2010 through the 1<sup>st</sup> quarter of 2011.

#### 5. Federal Stage 2 Disinfectants and Disinfection Byproducts Monitoring

**Program Description:** Based on the population served, the City is classified as a Schedule 2 system under the federal Stage 2 Disinfection Byproducts Rule (Stage2 DBPR). As such, the City was required to complete an Initial Distribution System Evaluation by March 31, 2009, and submit an IDSE report by July 1, 2009. On April 2, 2007, the Department received a copy of the City's System Specific Study (SSS). The SSS Report includes the results from TTHM and HAA5 monitoring at 18 separate sites. The number of samples collected at each site varied between 10 and 12, and the initial monitoring dates varied between June 7, 2005, and October 9, 2005, with a final sample date of May 31, 2007 at each site. There are several gaps in the data for each site, and the monitoring does not follow the required schedule of one sample every two months for one year. However, the additional sampling that was performed provides a set of data that is representative of the changing water characteristics throughout the year. The sample results for a single site at which 10 samples were collected are summarized in the table below. The SSS Report includes maps identifying the location of each site as well as all sources and storage tanks. The SSS Report does not identify the Federal Stage 2 DBPR compliance monitoring sites and monitoring schedule as required. The City needs to select eight compliance monitoring sites from the 18 sites used in the SSS monitoring and the six sites currently used for compliance monitoring under the state Disinfection Byproducts Rule (DBPR). The eight sites must include the three sites with the highest TTHM results, the three sites with the highest HAA5 results, and two additional sites selected from the existing state DBPR compliance monitoring sites. The City was required to provide the Department with a Stage 2 DBPR Monitoring Plan,

including monitoring sites and dates along with justification for the selection of the sites and monitoring dates, for our review and begin compliance monitoring in accordance with the Stage 2 DBPR Monitoring Plan beginning no later than October 1, 2012 (the 4<sup>th</sup> quarter of 2012). The Department has not received a Stage 2 DBPR Monitoring Plan; however, the City did submit DBP monitoring results from eight sites that were sampled on November 20, 2012. The level of TTHMs and HAA5s at all sites was less than their respective MCLs. The highest TTHM result was 50.1 ppb at 12814 Lake Blvd, and the highest HAA5 result was 26.6 ppb at the 2889 Dove site.

**Keswick Dam Monitoring Site DBP Results**

Date	TTHMs, ppb		HAA5s, ppb	
	Result	RAA	Result	RAA
6/7/2005	31		37	
8/10/2005	32		32	
10/9/2005	33		23	
12/7/2005	27	<b>30.8</b>	41	<b>33.2</b>
7/31/2006	31		29	
8/9/2006	24		24	
10/4/2006	29		25	
11/8/2006	34		24	
12/4/2006	30		25	
2/7/2007	46		46	
4/5/2007	110		88	
5/31/2007	32	<b>42.0</b>	28	<b>36.1</b>
<b>Overall Average</b>		<b>38.2</b>		<b>35.2</b>

**6. Distribution Asbestos Monitoring**

Except for Well C-1, all of the City's sources are considered aggressive. As required by Title 22, Section 64432.2, the City collected asbestos water samples at representative locations of asbestos cement pipe in the distribution system in 1996 and 2006. There was no detectable asbestos in any of these distribution system samples. The City is required to continue monitoring for asbestos in a representative location in the distribution system ever nine years; therefore, the next sample is due during 2015.

**7. Additional Monitoring**

Description of program (Physical quality of distribution system, corrosion, etc.) No additional monitoring is required.

**8. Status of Drinking Water Source Assessment Program (DWSAP)**

Source	Status	Completion Date	Comments
Sacramento River	Complete	June 25, 2002	Completed by Mike Connor, COR
Whiskeytown Lake	Complete	June 25, 2002	Completed by Mike Connor, COR
Well E-3A, E-4, & E-6A	Complete	June 25, 2002	Completed by Mike Connor, COR
Well E-7 & E-10	Complete	June 25, 2002	Completed by Mike Connor, COR
Well E-8	Complete	June 25, 2002	Completed by Mike Connor, COR
Well E-9	Complete	June 25, 2002	Completed by Mike Connor, COR
Well E-11	Complete	June 25, 2002	Completed by Mike Connor, COR
Well E-12	Complete	June 25, 2002	Completed by Mike Connor, COR
Well E-13	Complete	June 25, 2002	Completed by Mike Connor, COR
Well E-14	Complete	March 2008	Completed by Gene Parham
Well E-23	Complete	March 2008	Completed by Gene Parham
Well C-1 & C-6	Complete	June 25, 2002	Completed by Mike Connor, COR
Well C-5	Complete	June 25, 2002	Completed by Mike Connor, COR
Well C-8 & C-9	Complete	June 25, 2002	Completed by Mike Connor, COR

**Discussion and appraisal** The City's sources are considered most vulnerable to the following activities not associated with contaminants detected in the water supply: recreational use, agricultural/irrigation wells, petroleum pipeline, lumber processing and manufacturing, airport maintenance/fueling areas, historic gas stations, historic and active mining operations, historic and active dumps/landfills. The City's sources are considered most vulnerable to the following activities associated with aluminum, arsenic, barium, chromium, fluoride, nitrate, and uranium detected in the water supply: water supply wells, high and low density septic systems, sewer collection systems, wastewater treatment plants, lagoons/liquid wastes, and biosolids application.

**9. Is an approved water quality-monitoring plan on file? (i.e., briefly summarize plan & needed additions)** The City's most recent Plan was submitted to the Department on April 25, 2002. The City samples monthly for total alkalinity, calcium, temperature, pH, cadmium, chromium, copper, lead, nickel, silver, zinc, iron, manganese, specific conductance and ortho-phosphate at the 18 groundwater and surface water sources, and in each of the eight pressure zones. The samples are analyzed by Clear Creek WWTP lab, ELAP certified #1401, for 102-Inorganic Chemistry & 103-Toxic Chemical Elements in Drinking Water. Ray Carr (530 225-4158) is the lab manager.

**10. Was the Consumer Confidence Report (CCR) sent to the customers?** Yes, the 2010 CCR. CCR Certification form received? Yes, on June 26, 2011, the Department received a copy of the 2010 CCR along with a completed CCR Certification Form, certifying that a copy of the CCR was mailed to each customer (multiple copies to apartments, businesses, and schools) and posted on the Internet at the City's website.

**Is a copy of the report on file with DDW?** Yes.

**Are there needed additions or changes?** No.

**11. Triennial Water Quality Relative to Public Health Goals Report & Public Hearing** On 05/12/1998 the Department notified the City of the new requirements in Section 116470, Health & Safety Code, for public water systems with more that 10,000 service connections to produce a "Water Quality Relative to Public Health Goals Report" and hold a public hearing to accept and respond to public comment every three years. The table below is a summary of the City's report and public hearing dates. The next report and meeting are due in 2013.

Date	Report	Public Meeting
06/22/1998	A copy of the final report is in the COR main file	
05/01/1001	A copy of the final report is in the COR main file	
06/14/2004	A copy of the final report is in the COR main file	Held 06/10/2004
2007	No copy in COR file	
05/20/2010	A copy of the final report is in the COR main file	Held 07/14/2010
<b>Due 2013</b>		

## H. OPERATION & MAINTENANCE

### 1. Planning & Personnel

**Are system improvements made in accordance with the Waterworks Standards?** Yes, the City has its own engineering staff check plans for new subdivisions, main extensions, and main replacements to verify compliance with the Waterworks Standards.

**Does the utility have up-to-date distribution system maps?** Yes

**Is up-to-date copy of system schematic on file?** Yes

**What is the minimum grade requirement?** Based on the population served and distribution system complexity, the City's distribution system is classified as a Grade D5 distribution system, requiring a state-certified Grade D5 chief distribution operator and Grade D3 or higher shift operators. The Foothill WTP is classified as a Grade T5 facility, requiring a state-certified Grade T5 chief treatment operator and state-certified Grade T3 or higher shift operators. The Buckeye WTP is classified as a Grade T4 facility, requiring a state-certified Grade T4 chief treatment operator and state-certified Grade T3 or higher shift operators. The Enterprise Wells are classified as Grade T1 facilities, requiring a state-certified Grade T1 chief treatment operator and state-certified Grade T1 or higher shift operators.

**Discussion & appraisal** Conrad Tona is a state-certified Grade T5 treatment operator which meets the chief operator certification requirements, and Mike Sybert is a state-certified Grade D5 distribution operator, which meets the chief distribution operator certification requirements. The City employs several Grade T3 treatment operators and several Grade D3 or higher distribution operators that meet the shift operator requirements.

### 2. Cross-Connection Control Program

**Operating Rules or Ordinances:** Section 14.08.160, Cross-Connections, of the City's April 1984 Water Utility Code, stipulates that the customer must comply with state and federal laws governing the separation of dual water systems or installations of backflow protective devices to protect the public water supply from the danger of cross-connections. Under Section 14.08.100(B), water service may be refused or discontinued to any premises where there exists a cross-connection in violation of state or federal law.

**Is there a copy of the cross-connection control ordinance on file?** Yes

**Surveys:** The City requires an RPP for all new commercial meters or residences with an alternate irrigation source such as a well, or ACID ditch water. As commercial plans are submitted for the City's approval, the level of cross-connection hazard is evaluated and the maximum level of protection is required. The City evaluates all new connections and new customers at existing connection for potential cross-connections as well.

**Trained Person to Carry out the Program** Ralph Ryan, Cross-Connection Coordinator, is a certified cross-connection specialist and backflow prevention device tester. Mr. Ryan has three persons certified in backflow prevention device testing working under him.

**Records of Device Locations, Tests, & Repairs** The City maintains electronic and printed records of device locations, testing status, etc. City personnel perform the testing of all City-owned backflow prevention devices, and the City contracts for the testing of all privately owned devices. The contractor is provided with a list of the devices by pressure zone and with testing forms that include the customer's name and address and directions, if needed, to the location of the backflow prevention

device. Customers served through a backflow prevention device pay a small surcharge each month to cover the cost of testing the devices.

**Recent Backflow Prevention Assembly Testing Records**

Year	Total Number in System	Number Installed	Number Tested	Number Failed	Number Repaired/ Replaced	Comments
2003	2,423	104	2,423	40	40	100% tested
2004	2,463	40	2,463	69	69	100% tested
2005	2,517	54	2,517	67	17	100% tested
2006	2,400	150	2,400	37	23	100% tested
2007*	2,759	76	957	77	77	35% tested
2008*	2,719	152	2253	182	182	83% tested
2009	2,788	6	2,788	56	56	100% tested
2010	2,819	31	2,819	43	43	100% tested
2011	2,857	33	2857	50	50	100% tested

**Note:** \*There was a change in personnel in 2006 and again in 2007

**System for the Testing of Backflow Preventers** The current cross connection control program was started in 1993. It appears to be a good program. Device replacements are at the homeowner's expense and must be done per the City of Redding construction standards. The City develops a list of certified testers each year, any of whom the homeowner can use for the replacement or installation of devices. The list is not exclusive, another certified tester or the homeowner, could install the device. At the device owner's expense a certified tester must do the first test after installation or replacement.

**Additional information** The City also has a program protecting fire hydrants. The program includes monitoring the use of fire hydrants by water tank trucks or other use of water from hydrants during construction. Where backflow devices are required, the City issues a plan to the proposed contractor which includes the location of the backflow device, meter, and shutoff valves. Trucks taking water from a fire hydrant are required to maintain an air gap between the truck and the fire hydrant.

**Discussion & appraisal** With the exception of 2007 and 2008, all of the City's devices have been inspected annually. The City appears to have a well-run comprehensive program for the prevention of possible contamination through backflow.

**3. Complaints**

**Describe program** Complaints are put onto a work order and tracked by COR TRAX. The name, location, type of complaint, and date and time of complaint are entered in the COR TRAX system. A worker is assigned to investigate the problem, when necessary, and the problem resolution is recorded in COR TRAX. The City is switching to Cartograph system, which will allow more detailed tracking of complaints and fewer "other" complaints.

### Reported Complaints

Type	Number				Comments
	2008	2009	2010	2011	
Taste and Odor	50		34	31	
Color	49	50	62	28	
Turbidity	16	2	1	3	
Pressure (high or low)	151	84	114	107	
Illness					
Sediment			9		
Water Outage			39	35	
Other	6	134	176	204	Primarily non-water quality/quantity complaints
Total	272	270	396	408	

**Discussion & appraisal** Record keeping and follow-up by City staff are good. Follow-up for water quality complaints generally includes flushing, collecting a chlorine residual sample, and collecting a bacteriological sample if there appears to be a problem or upon request. The increase in complaints could be attributed to the way the City is reporting/tracking complaints. Two additional complaint types were added to the table above compared to last inspection: sediment and water outage. The taste/odor/color complaints are largely related to the manganese issues in the Enterprise wells.

#### 4. Emergency Response

**Is an up-to-date emergency notification plan (ENP) on file?** Yes, the City's most recent ENP, submitted to the Department on February 7, 2011, appears to be complete and current.

**Emergency response plan** The emergency response plan (ERP) is comprehensive, including the following sub-plans: a Threat Condition Emergency Preparedness Protocol, a Disaster Response Plan, an Earthquake and Blast Destruction Preparedness Procedures, an Emergency Disinfection Failure Plan, a Foothill Water Treatment Plant Spill Prevention Plan, a Buckeye Water Treatment Plant Spill Prevention Plan, and a Pump House #3 Spill Prevention Plan. The City most recently updated their ERP on February 27, 2009.

**Notification of DDW of significant system problems** City personnel are aware we should be notified.

**Discussion & appraisal** The City's ENP and Emergency Response Plan appear to be comprehensive and well thought out.

#### 5. Main Disinfection Program

**Describe main disinfection program (i.e., method, contact time, chlorine residual, bacteriological tests, records) for new & repaired mains** Typically City staff deals only with main repairs where they disinfect by swabbing pipe with chlorine solution, pressurize, flush, and then take bacteriological test in the vicinity of the repaired main. Notification is provided to the affected customers when it is a scheduled repair that will result in a loss of pressure. New mains installed by contractors must be disinfected in accordance with City specs, which conform to AWWA Standards. The City does special coliform test whenever pressure drops below 5 psi.

**Does the main disinfection program comply with AWWA standards?** Yes, for new water mains. The City follows Department recommendations for disinfection, flushing, and testing following main repairs when it is not practical to remove an existing water main from service.

**Discussion & appraisal** The City's main disinfection program meets AWWA Standards and Department guidance for the most part. It is recommended that the City provide notification to affected customers whenever a main break causes depressurization.

## 6. Valve Maintenance Program

**Describe program** The City has electric valve turners and route books similar to meter readers. City personnel record the general condition of the valve, the condition of the valve box, and the number of turns from full open to full close as part of their valve maintenance program. Mike Sybert, the chi distribution operator, reported that the City currently exercises each valve at least once every eight years.

**Are number & location of valves satisfactory? (i.e., mainline, ARVR, blowoff valves, etc.)** Reportedly, yes, the City has approximately 14,541 mainline valves and 3,900 hydrants.

**Discussion & appraisal (i.e., are valves recorded on maps available to field crews? Are all valves located with valve covers raised to grade?)** The program was started in July 1999 to systematically work, repair, raise to grade, mark off-road valves and all hydrants and valves by pressure zone. The maintenance has been completed throughout the system. Some valves are worked periodically when flushing; others have not been worked in years. Valves are recorded on maps; valve boxes are raised to grade and covered. The City valve information has been entered into a GIS computer database, and the City is currently examining the data to determine the most efficient approach to future maintenance.

## 7. Flushing

**Describe flushing program (i.e. deadends, records, etc.)** Because of high manganese in the Enterprise area, historically, the Enterprise area was flushed quarterly. Since initiating sequestering, the City flushes the Enterprise area annually in the spring or early summer. The City attempts to flush dead-ends annually as well, starting on the east side of Redding. The City is not always able to complete the flushing of dead-ends. Flushing is also performed in response to water quality complaints. City personnel report that the Enterprise flushing produces a substantial amount of black water. In 2010 the City reported that it was working with the Regional Water Quality Control Board to determine the appropriate method of disposing of the flush water. Records kept in a notebook show location, time flushed, chlorine residual and who flushed.

**Approximate number of deadends** 240 **Percent with flushing valves** 100%

**Discussion & appraisal** The City has a good flushing program. Users are notified through newspaper before scheduled flushing takes place. Mike Sybert reported that the City's complaint tracking program has helped to streamline the flushing in the Enterprise area by helping to identify problem areas and focus the flushing accordingly.

## I. SYSTEM APPRAISAL

The water system is in good condition, is operated in a professional and conscientious manner, and in general compliance with drinking water regulations. The water produced by the City's surface water treatment plants consistently meets all surface water treatment requirements, and the City has sufficient source and storage capacity to meet Waterworks Standards.

The City submits monthly treatment records for both the Foothill and Buckeye surface water treatment plants that include monitoring of the raw water turbidity, filtered water turbidity, chemical injection, pH, temperature, and chlorine residual. However, the City only submits weekly calculations for the CT provided at the USBR Keswick facility as part of the treatment records submitted for the Buckeye treatment plant. The treatment plant itself is the first connection supplied by the Buckeye treatment plant, not the USBR Keswick facility. The City needs to begin calculating and reporting the daily CT for the water supplied to the treatment plant as part of the monthly treatment records submitted for the Buckeye treatment plant.

The City continues to comply with the directives of Compliance Order 01-02-09(O)006, issued as a result of the continued arsenic violation at well E-13. Well E-11 continues to show arsenic levels at or near the MCL, and other wells have detectable arsenic levels. Well E-13 exceeded the primary standard for arsenic during the 3<sup>rd</sup> and 4<sup>th</sup> quarter 2008, the 1<sup>st</sup> quarter 2009, and during each quarter since the 1<sup>st</sup> quarter of 2011. Well E-11 has arsenic levels which are near or at the MCL as well. Our office issued Compliance Order 01-02-09(O)006 on April 20, 2009, which directed the City to submit a compliance

report, complete quarterly public notification, submit quarterly status reports, and continue quarterly sampling of both Wells E-11 and E-13. The City has not used these wells in over three years since Well E-23 came on-line and the Buckeye Zone was tied into the rest of the distribution system. Following an application by the City, the Department amended the City's permit to designate Wells E-11 and E-13 as standby sources. As standby sources, the City is allowed to reduce monitoring for arsenic to once every nine years and is only required to provide consumer notification in the event that Well E-11 or Well E-13 is used to supply water to the domestic water system. Additionally, Well E-12 exceeded the arsenic MCL in the two most recent sample results reported to the Department for the 2<sup>nd</sup> and 3<sup>rd</sup> quarters of 2012. A sample collected on June 15, 2012 contained 10.2 µg/L arsenic and a sample collected on August 21, 2012, contained 11.9 µg/L arsenic. The City needs to continue quarterly monitoring for arsenic at Well E-12. The Department will determine what additional action is required once the City has completed four quarters of monitoring for arsenic at Well E-12.

A number of the City's wells also have manganese levels near or over the secondary MCL. While manganese sequestering was shown to be effective in reducing the number of taste, odor, and color complaints in a 1993 study, the relatively high number of taste and odor complaints the City has received over the years from customers in the Enterprise area is likely a result of the levels of manganese in the water provided to the customers in the Enterprise area when the Enterprise wells are in operation. The quality of the water in the Enterprise area does appear to have improved over the past few years as the City has tightened controls over the phosphate injection system and developed a more focused flushing program based on the incidence of complaints. However, the City needs to provide the Department with a plan and schedule for coming into compliance with the secondary standard for manganese at Enterprise Wells E-12 and E-14. The City also needs to begin quarterly monitoring for manganese at Enterprise Wells E-6A and E-7 due to the exceedances of the manganese MCL in samples collected from these wells during June and July 2011. Since Wells E-11 and E-13 are now permitted as standby sources, which are not required to meet the secondary standard for manganese, the City is no longer required to perform quarterly monitoring for manganese at Wells E-11 and E-13 or provide treatment of the water produced by Wells E-11 and E-13.

According to Department records, the City is current on most source water chemical monitoring. Source water chemical monitoring schedules are enclosed showing when the most recent chemical monitoring was performed for each source, the required frequency of monitoring, the number of past results, and when monitoring is next due. In order to continue receiving chemical monitoring waivers, the City should submit waiver requests for IOCs, VOCs, SOCs, cyanide, and asbestos.

Based on past monitoring, the Department allowed the City to reduce monitoring for TTHMs and HAA5s to one sample each quarter at each of three sample sites, 2050 Heller Lane (associated with the Foothill Treatment Plant), 830 Collyer Drive (Buckeye Treatment Plant), and 4665 Alta Saga Drive (Enterprise Wells). The City has continued to collect an additional three quarterly samples at sites associated with the Buckeye Water Treatment Plant. The running annual average level of TTHMs and HAA5s is consistently less than ½ their MCLs of 0.080 mg/L and 0.060 mg/L, respectively. The City was also allowed to reduce disinfection byproduct precursor monitoring at each treatment plant to one paired raw water and treated water TOC sample each quarter and one sample for raw water alkalinity each quarter. According to Department records, the City failed to collect and report results for quarterly raw water and treated water TOC monitoring at either treatment plant during the 4<sup>th</sup> quarter of 2010 and the 1<sup>st</sup> quarter of 2011. Additionally, the City failed to collect and report results for quarterly raw water alkalinity monitoring from the 2<sup>nd</sup> quarter of 2010 through the 1<sup>st</sup> quarter of 2011.

On April 2, 2007, the Department received a copy of the City's System Specific Study. In accordance with guidance provided by the Department 18 sample sites were selected for monitoring under the SSS. The City was required to monitor for TTHMs and HAA5s every two months for one year, a total of six samples at each site. The Department received between 10 and 12 sample results from each site, and the initial monitoring dates varied between June 7, 2005, and October 9, 2005, with a final sample date of May 31, 2007 at each site. There are several gaps in the data for each site, and the monitoring does not follow the required schedule of one sample every two months for one year. However, the additional

sampling that was performed provides a set of data that is representative of the changing water characteristics throughout the year. The SSS Report received on April 2, 2007 and subsequent submissions do not identify the Federal Stage 2 DBPR compliance monitoring sites and monitoring schedule as required. The City needs to select eight compliance monitoring sites from the 18 sites used the SSS monitoring and the six sites currently used for compliance monitoring under the state Disinfection Byproducts Rule (DBPR). The eight sites must include the three sites with the highest TTHM results, the three sites with the highest HAA5 results, and two of the existing state DBPR compliance monitoring sites. The Department has not received a Stage 2 DBPR Monitoring Plan; however, the City did submit DBP monitoring results from eight sites selected from among their existing Stage 1 DBP monitoring sites and the 18 SSS monitoring sites. The eight sites were sampled on November 20, 2012. The level of TTHMs and HAA5s at all sites was less than their respective MCLs. The highest TTHM result was 50.1 ppb at 12814 Lake Blvd, and the highest HAA5 result was 26.6 ppb at the 2889 Dove site.

**J. APPENDIX**

- System Deficiency Record
- Chemical Monitoring Schedules
- Sample Customer Notification

Report prepared by:



Michael T. Burgess  
Lassen District Staff Engineer

1/13/13

Date