Chapter 5
Water Quality Assessment

Introduction

This chapter describes the quality of the surface water supplies in the Hodges, Miramar, San Diego River and Otay/Cottonwood Watersheds from 2006 through 2010. This includes all of the source (raw) water data collected by the CSD - both reservoir/watershed data, as well as, Miramar, Alvarado and Otay WTP influent/effluent data (**Appendix 5**). Miramar, Alvarado and Otay WTP influent water sources include water imported from San Diego County Water Authority.

As part of the assessment, raw water quality parameters are compared to drinking water standards for the constituents currently regulated. This includes constituents with primary and secondary Maximum Contaminant Levels (MCLs & SMCLs) and unregulated constituents that have Detection Limits for Reporting (DLRs) set by the California Department of Public Health (CDPH). Exceeding drinking water MCLs, or SMCL in raw source water is NOT a drinking water violation. This evaluation technique indicates which raw water quality parameters require some form of treatment to achieve the current drinking water standards. The goal of this water quality analysis is to evaluate spatial and temporal variability of the key water quality constituents to identify significant changes that have occurred in the five-year period covered by this study (2006 to 2010), and to identify potential actions that can be taken to improve source water quality.

5.1 Summary of Monitoring Program

Table 5.1 summarizes the CSD's monitoring efforts, which for the purpose of this report include two types of monitoring programs: source waters (reservoirs and streams) and water treatment (influent and effluent). Water quality data associated with each of the CSD's nine reservoirs was collected as near to the outlet structure (Station "A") as feasible. There are also several stream sampling points within the CSD's watersheds, of which, thirty six were chosen to present based on the amount of data available. Those sites having fewer than five data points during the past five years were deemed to be unrepresentative of a five year period. Finally, the CSD has sampling points at the influent and effluent of each WTP.

In addition to grab samples the CSD also conducted water quality profiles, at our streams and reservoirs, with the use of in situ instruments (Hydrolab mini sonde 4 and YSI 6600V2 data sonde) to monitor the following parameters: temperature, pH, conductivity, total dissolved solids (TDS), dissolved oxygen, oxidation reduction potential, chlorophyll and blue green algae concentrations.

Table 5.1
City of San Diego
Public Utilities Department
Water Quality Monitoring Frequency [1]

Parameter	Source Waters			Water Treatment Plants	
	Streams	Primary Reservoirs	Secondary Reservoirs	Influent	Effluent
Bacteriological (total and fecal coliform)	S	W	NS	D	5D
Cryptosporidium & *Giardia*	NS	2Y	NS	M	NS
Other Physical/Chemical[2]	S	2W	NS	W	W
General Minerals	S	Q	Q	M	M
Nutrients	S	M	Q	W	W
Organics	S	Q	Q	Q	Q
Metals	S	Q	Q	Q	Q
Radiation	NS	A	NS	A	A
MIB & Geosmin	S	W	NS	W	W
WQ Profile[3]	S	W	M	NS	NS

[1] D=daily,5D= five days a week, W=weekly, 2W= every two weeks, M=monthly, Q=quarterly, S=seasonally, A=annually, 2Y= twice a year, NS= not sampled
[2] Temperature, Color, Turbidity, Specific Conductance, pH
[3]Following Data collected with a YSI 6600V2 Data Sonde or Hydrolab MiniSonde 4: Temperature, pH, Dissolved oxygen, Specific conductivity, Chlorophyll, Blue green algae

5.2 San Diego River System Water Quality Review

Streams, reservoirs and treatment plant influent/effluent were monitored for general physical characteristics, microbiological, metals, organic and inorganic constituents. El Capitan, Murray, and San Vicente Reservoirs and Alvarado WTP influent/effluent were also sampled for radiation. Streams and the Sutherland Reservoir were not monitored for radiation since they do not directly feed the Alvarado WTP.

Tables 5.2 – 5.14 contain the mean water quality values from the 2005 and 2010 WSS for comparison purposes.

See **Appendix 5** for a summary of the water quality data. The Drinking Water Standards used in **Appendix 5** apply to treated, potable water, and are shown for reference only.

Source Water Review

- **General Physical Parameters**

General/physical source water quality parameters for the San Diego River System were within the standards for drinking water except for pH, color, TDS, and turbidity. The water quality is typical of raw water streams and reservoirs in Southern California. Since the streams and reservoirs contain raw water, and the standards are for treated water, the comparison is for reference only.

The maximum pH level was 9.57, above the SMCL range of 6.5 – 8.5. The maximum Turbidity level was 21.5 NTU, where the MCL is 0.5 NTU. The maximum TDS level was 1,760 mg/L and the maximum Conductivity level was 2,830 µS/cm. Both the TDS and Conductivity levels exceeded the SMCL of 1,000 mg/L and 1,600 µS/cm, respectively. The maximum Color level was 52 cu, exceeding the SMCL of 15 cu. TDS, pH, Color, and Conductivity are addressed in the water treatment process. Mean values were used for comparing the water quality results of the 2005 WSS to the 2010 WSS.

Table 5.2

General/Physical Water Quality Parameter Review for the Source Waters of the San Diego River System

Stream Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
General Physical		**Mean**	**Mean**	
Conductivity	µS/cm	1010	1100	90
pH	pH	7.98	7.88	-0.1
Total Dissolved Solids (TDS)	mg/L	676	704	28
Total Suspended Solids (TSS)	mg/L	296	16.5	-279.5

Reservoir Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
General Physical		**Mean**	**Mean**	
Calcium Hardness (CaCO3)	mg/L	138	132	-6
Color	Color	12.5	14.9	2.4
Conductivity	µmho/cm	804	766	-38
Total Alkalinity	mg/L	131	129	-2
Total Dissolved Solids (TDS)	mg/L	457	433	-24
Total Hardness (CaCO3)	mg/L	215	204	-11
Total Suspended Solids (TSS)	mg/L	ns	1.4	na

Turbidity	ntu	1.78	2.02	0.24
pH	pH	8.39	8.27	-0.12

Notes:
(a): All non-detects were reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Indicator Organisms and Pathogens**

  Perhaps the most important group of parameters with respect to public health is microbiological organisms. Source waters may be contaminated with a number of pathogenic bacteria, viruses, and protozoan’s, along with non-pathogenic naturally occurring microorganisms. The presence of these constituents in the raw water governs the overall treatment requirements for the WTPs. Routine monitoring for all possible pathogens is impractical. The CSD’s monitoring program is focused on indicator bacteria (total coliform, fecal (Enterococcus) coliform and *Escherichia coli [E. coli]*) and the pathogenic protozoan’s (*Giardia* and *Cryptosporidium).*

Table 5.3

Indicator Organisms and Pathogens Review for the Source Waters of the San Diego River System

Stream Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Indicator Organisms		**Mean**	**Mean**	
Enterococcus	/100 mL	1050	137	-913
E Coli	/100 mL	884	249	-635
Total Coliform	/100 mL	24800	7760	-17040
Reservoir Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Indicator Organisms		**Mean**	**Mean**	
Enterococcus	/100 mL	2.99	12	9.01
E Coli	/100 mL	23.8	40.1	16.3
Total Coliform	/100 mL	2790	3160	370
Pathogens	**Units**	**Mean**	**Mean**	Change
Cryptosporidium TC	/ L	0.033	0	-0.033
Giardia TG	/ L	0.033	0	-0.033

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as ”na” change.

Streams and Reservoirs of the San Diego River System were monitored for *Enterococcus*, *E. coli*, and total coliform to obtain a representation of microbiological conditions. *Enterococcus levels* ranged from <1 /100mL to 2400/100mL, *E. coli* levels ranged from <10 /100mL to 5700 /100mL, and total coliform levels ranged from <10 /100mL to >240,000 /100mL. Wide ranges in microbiological results are expected in raw water streams and reservoirs. *Cryptosporidium* and *Giardia* were monitored in the primary reservoirs and all samples were reported as ND compared to a mean value of 0.033/L for the 2005 WSS.

- **Nutrient Parameters**

Nutrients are required for the proper functioning of aquatic ecosystems but high concentrations can result in a number of adverse impacts. High levels of Nitrogen and Phosphorus in waters can produce algal blooms that cause taste and odor in drinking water, add organic carbon, obstruct water conveyance facilities, and clog filters. Measurement of nutrient concentrations provides an indicator of the potential for algal and vascular plant growth in systems that are not limited by other factors, such as light availability or adverse temperatures. Nitrogen and phosphorus are the most important required nutrients and are the subject of this analysis.

Nitrogen in the aquatic environment can be present in several biochemically inter-convertible forms including organic nitrogen, ammonia, nitrite, nitrate, and gaseous nitrogen. Although gaseous (atmospheric) nitrogen is actually part of the biochemical cycle, its relationship to the other nitrogen forms is complex. Total nitrogen (TN) is the summation of the nitrogen forms measured and include nitrate, nitrite, ammonia, and organic nitrogen.

Phosphorus is present in both dissolved and particulate forms. Particulate phosphorus consists of organic phosphorus incorporated in planktonic organisms, inorganic mineral phosphorus in suspended sediments, and phosphate adsorbed to inorganic particles and colloids. The dissolved forms include dissolved organic phosphorus, *ortho-P*hosphate, and polyphosphates. Dissolved *ortho*-phosphate is the only form that is generally available for algal and plant uptake, and is the subject of this report.

The USEPA has established nitrogen and phosphorus reference conditions for streams and reservoirs for Ecoregion III, which includes San Diego County. The stream reference concentration for TN is 0.38 mg/L, and for total phosphorus

(TP) is 0.022 mg/L. The reservoir reference concentration for TN is 0.40 mg/L, and for TP is 0.017 mg/L, (USEPA, 2001).

TN levels for streams ranged from ND to 8.31 mg/L, while *ortho*-Phosphate levels ranged from non-detect to 0.87 mg/L. Reservoir TN levels ranged from ND to 5.08 mg/L, and *ortho*-Phosphate levels ranged from ND to 0.61 mg/L.

Mean values for *ortho*-Phosphate and TN for streams and reservoirs within the San Diego River System decreased significantly since the 2005 WSS (**Table 5.4**). However, mean TN and *ortho*-Phosphate values for the streams and TN values for the reservoirs exceed EPA's reference concentrations.

Table 5.4

Nutrient Parameter Review for the Source Waters of the San Diego River System

Stream Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Inorganic Constituents		**Mean**	**Mean**	
Total Nitrogen (TN)	mg/L	3.01	1.12	-1.89
ortho-Phosphate	mg/L	0.194	0.086	-0.108

Reservoir Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Inorganic Constituents		**Mean**	**Mean**	
Total Nitrogen (TN)	mg/L	0.539	0.408	-0.131
ortho-Phosphate	mg/L	0	0	na

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS = Watershed Sanitary Survey

ns: not sampled; Constituents reported as ns in either WSS were also reported as "na" change.

- **Metal Parameters**

The effects of metals in water are varied. Some metals have caused concern due to their physiological and other human health effects while others affect the aesthetics of water. Two of these metals, Iron and Manganese, are nuisance constituents that affect the aesthetic properties of water. Iron and Manganese are of interest since they have aesthetic impacts if left untreated, exert an oxidant demand, and serve as indicators as to reservoir dynamics. The SMCLs for Iron and Manganese are 300 and 50 ug/L, respectively. Both Iron and Manganese are naturally occurring constituents, but can be elevated by contribution from

potential contaminating activities, such as landfills, mines, industrial wastes and urban runoff. Conventional water treatment is very effective at removing both Iron and Manganese.

When using ozonation in water treatment, there is a risk of completely oxidizing the Manganese to Permanganate which could result in pink water. Reports suggest that raw or settled water with levels of Manganese exceeding 100 ug/L could form Permanganate at levels sufficiently high enough to create problems, especially if the ozone dosages are high enough to achieve pathogen inactivation. With the addition of ozone disinfection at the Alvarado and Miramar WTP's, Manganese levels in the CDS's raw water will become more of a concern.

The water samples from the streams in the San Diego River System were monitored for seventeen Total and Dissolved Metals. Samples for dissolved metals were filtered prior to analysis. The mean concentrations were ND for Total and Dissolved Antimony, Beryllium, Cadmium and Thallium; and for dissolved silver. The maximum level of Aluminum was 19,800 ug/L and exceeded the MCL of 1,000 ug/L and the SMCL of 200 ug/L. The maximum level of Lead was 22.8 ug/L and exceeded the treatment technique of 15 ug/L. The maximum level of Manganese was 2,250 ug/L and exceeded the SMCL of 50 ug/L.

Table 5.5
Metal Parameter Review for
the Sources Waters of the San Diego River System

		Stream Data[a]		
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Metals		**Mean**	**Mean**	
Aluminum	µg/L	6590	4490	-2100
Dissolved Aluminum	µg/L	792	28.2	-763.8
Antimony	µg/L	0.053	0	-0.053
Dissolved Antimony	µg/L	0.775	0	-0.775
Dissolved Arsenic	µg/L	2.08	0.545	-1.535
Barium	µg/L	279	120	-159
Dissolved Barium	µg/L	171	77.3	-93.7
Dissolved Beryllium	µg/L	0.833	0	-0.833
Boron	µg/L	161	0	-161
Dissolved Boron	µg/L	114	90.7	-23.3
Dissolved Cadmium	µg/L	1.58	0	-1.58
Chromium	µg/L	13.2	0	-13.2
Dissolved Chromium	µg/L	2.06	0	-2.06

Dissolved Copper	µg/L	5.6	134	128.4
Lead	µg/L	112	0	-112
Dissolved Lead	µg/L	4.61	1.66	-2.95
Manganese	µg/L	1000	309	-691
Dissolved Manganese	µg/L	247	197	-50
Nickel	µg/L	16.1	3.38	-12.72
Dissolved Nickel	µg/L	3.79	2.65	-1.14
Selenium	µg/L	0.425	0	0.425
Dissolved Selenium	µg/L	5.01	0	-5.01
Dissolved Thallium	µg/L	0.309	0	-0.309
Vanadium	µg/L	56.4	26.9	-29.5
Dissolved Vanadium	µg/L	10.8	12.8	2
Zinc	µg/L	110	0	-110
Dissolved Zinc	µg/L	59.4	25.2	-34.2

		Reservoir Data[a]		
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Metals		**Mean**	**Mean**	
Aluminum	µg/L	40.3	0	-40.3
Antimony	µg/L	0.221	0	-0.221
Arsenic	µg/L	1.46	0	-1.46
Cadmium	µg/L	0.008	0	-0.008
Chromium	µg/L	0.231	0	-0.231
Iron	µg/L	56.9	0	-56.9
Magnesium	mg/L	18.5	17.4	-1.1
Manganese	µg/L	29	24.6	-4.4
Mercury	µg/L	0.002	0	-0.002
Molybdenum	µg/L	3.55	5.05	1.5
Nickel	µg/L	1.07	0	-1.07
Selenium	µg/L	0.233	0	-0.233
Sodium	mg/L	67.6	62.8	-4.8
Vanadium	µg/L	5.62	0	-5.62
Zinc	µg/L	1.41	0	-1.41

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Radiological Parameters**

Most drinking water sources have very low levels of radioactive parameters ("radionuclides"), most of which are naturally occurring, although contamination of drinking water sources from human-made nuclear materials could also occur. Most radioactive contaminants are at levels that are low enough to not be considered a public health concern. At higher levels, long-term exposure to radionuclides in drinking water may cause cancer. In addition, exposure to Uranium in drinking water may cause toxic effects to the kidney.

To protect public health, EPA has established drinking water standards for several types of radioactive parameters including combined Radium 226/228 (5 pCi/L), beta particles (50 pCi/L), gross alpha standard (15 pCi/L), and Uranium (20pCi/L).

Primary reservoirs of the San Diego River System were monitored for gross *alpha* and *beta* emitters, combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were below the MCLs (**Table 5.6**).

Table 5.6

Radiological Parameter Review for the Source Waters of the San Diego River System

Reservoir Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Radiological		**Mean**	**Mean**	
alpha Particles	pCi/L	0	0	na
beta Particles	pCi/L	4.74	0	-4.74
Combined Radium-226 & Radium-228	pCi/L	0.563	0.333	-0.23
Strontium-90	pCi/L	0.299	0	-0.299
Tritium	pCi/L	29.8	0	-29.8
Uranium	pCi/L	2.75	2.9	0.15

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS = Watershed Sanitary Survey

ns: not sampled; Constituents reported as ns in either WSS were also reported as ”na” change.

- **Regulated and Unregulated Organic Parameters**

All organic compounds contain carbon in combination with one or more elements. Naturally occurring compounds often contain low levels of Nitrogen, Phosphorous and Sulfur, while synthetic organic compounds may contain halogens. Organic compounds can find their way into water from humic materials from plant and algae, microorganisms and their secretions, and hydrocarbons; commercial and domestic activities and effluent from waste-

water treatment plants and industries into surface waters; and reactions that occur during the treatment of water.

The USEPA has designated three health effects categories for organic chemicals: Category 1- It is known, or there is strong evidence, that the chemical is a carcinogen; Category 2- There is limited but not positive evidence that the chemical is a carcinogen, and there are other known adverse health effects; and Category 3- There is no firm evidence that the chemical is a carcinogen, but there are other known adverse health effects.

MCLs have been established by USEPA and CDHS for a number of organic chemicals that pose a risk in drinking water supplies. Most of these chemicals have never been detected in the CSD's watersheds. The CSD conducted quarterly monitoring for chlorinated organic chemicals, organo-phosphorus pesticides, herbicides, carbamate pesticides, and a variety of other synthetic organics throughout its watersheds, reservoirs and WTP influent and effluent waters.

The source waters of the San Diego River System were monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants. None exceeded the MCL, and sixty of the seventy constituents were not detected during this survey (**Appendix 5**).

TOC is a precursor to Trihalomethanes (THMs) and Haloacetic acids (five) (HAA-5), which are formed as by-products predominantly when chlorine is used to disinfect water for drinking. THMs and HAAs result from the reaction of chlorine and/or bromine with organic matter present in the water being treated. THMs and HAAs have been associated through epidemiological studies with some adverse health effects.

Stream TOC levels ranged from 1.56 mg/L to 11.2 mg/L, while reservoir TOC levels ranged from 3.22 mg/L to 9.91 mg/L. **Tables 5.7 & 5.8** highlight the changes that have occurred since the 2005 WSS.

Table 5.7

Regulated Organic Parameter Review for the Source Waters of the San Diego River System

		Stream Data[a]		
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Organic Constituents Regulated		**Mean**	**Mean**	
Diethylhexylphthalate	µg/L	0.083	0	-0.083
Bis-(2-ethylhexyl) phthalate	µg/L	0.884	0	-0.884
Methyl *tert*-Butyl Ether (MTBE)	µg/L	0.003	0	-0.003
Total Organic Carbon (TOC)	mg/L	7.15	4.65	-2.5

Parameter	Reservoir Data[a] Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Regulated		**Mean**	**Mean**	
Benzene	µg/L	0.003	0	-0.003
Bis-(2-ethylhexyl) phthalate	µg/L	0.042	0	-0.042
Bromodichloromethane	µg/L	0.479	0	-0.479
Bromoform	µg/L	0.128	0	-0.128
Chlorodibromomethane	µg/L	0.49	0	-0.49
Chloroform	µg/L	0.462	0	-0.462
Methyl-*tert*-butyl ether (MTBE)	µg/L	0.925	0	-0.925
Total Xylenes	µg/L	0.009	0	-0.009
Toluene	µg/L	0.006	0	-0.006
Total Organic Carbon	mg/L	5.09	5.17	0.08
Total THMs	µg/L	ns	1.85	na
meta,para-Xylenes	µg/L	0.007	0	-0.007

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

Table 5.8
Unregulated Organic Parameter Review for the Source Waters of the San Diego River System

Parameter	Stream Data[a] Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Unregulated		**Mean**	**Mean**	
Aldicarb sulfoxide	µg/L	0.009	0	-0.009
Benzo(K)fluoranthene	µg/L	0.002	0	-0.002
Naphthalene	µg/L	0.005	0	-0.005

Parameter	Reservoir Data[a] Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Unregulated		**Mean**	**Mean**	
2-Methylisoborneol	ng/L	3.68	5.76	2.08
Geosmin	ng/L	5.66	0	-5.66
tert-Butyl alcohol	µg/L	0.362	0	-0.362

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

Water Treatment Plant Influent/Effluent Review

General Physical Parameters

The monitored general physical parameters for Alvarado WTP influent (**Table 5.9**) were within the standards for drinking water except for Color, Threshold Odor Number (TON), pH and Turbidity. Since the plant influent contains raw water, and the standards are for treated water, the comparison is for reference only. The maximum Turbidity level was 12.5 NTU, where the MCL is for 95% of the filtered water samples to have a Turbidity level $\leq$ 0.5 NTU. The maximum pH level was 8.6 where the SMCL is 8.5. The maximum Color level was 19 cu, where the SMCL is 15 cu. The maximum TON level was 6 odor units, where the SMCL is 3 odor units.

The monitored physical parameters for Alvarado WTP effluent (**Table 5.9**) were within the standards for drinking water. To comply with regulatory plant monitoring requirements, plant operators frequently monitors for both the Turbidity and pH – every 15 minutes for Turbidity, and every two hours for pH at the WTP effluent. Those monitoring results were used for the WTP effluent review. All measurements met Turbidity and pH requirements.

Table 5.9

General/Physical Water Quality Parameter Review for the Alvarado Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
General Physical		**Mean**	**Mean**	
Calcium Hardness (CaCO3)	mg/L	150	141	-9
Color	Color	7.63	6.1	-1.53
Conductivity	µmho/cm	879	870	-9
Corrosivity	--	0.47	0.17	-0.3
Threshold odor number (TON)	Odor	1.7	2.14	0.44
Total Alkalinity	mg/L	121	113	-8
Total Dissolved Solids (TDS)	mg/L	501	519	18
Total Hardness (CaCO3)	mg/L	233	226	-7
Total Suspended Solids (TSS)	mg/L	1.92	1.77	-0.15
Turbidity	ntu	0.851	0.792	-0.059
pH	pH	8.04	7.68	-0.36

Effluent (Treated Water) Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
General Physical		**Mean**	**Mean**	
Calcium Hardness (CaCO3)	mg/L	152	144	-8
Color	Color	3.01	0.895	-2.115
Conductivity	µmho/cm	904	898	-6
Corrosivity	--	0.712	0.508	-0.204
Threshold odor number (TON)	Odor	1	1.01	0.01
Total Alkalinity	mg/L	122	116	-6
Total Dissolved Solids (TDS)	mg/L	507	523	16
Total Hardness (CaCO3)	mg/L	230	230	0
Total Suspended Solids (TSS)	mg/L	0.947	1	0.053
Turbidity	ntu	0.096	0.09	-0.006
pH	pH	8.26	8.03	-0.23

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS= Watershed Sanitary Survey

ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Indicator Organisms and Pathogens**

  Raw waters entering Alvarado WTP were monitored, at the plant influent, for *E. coli*, fecal coliform, heterotrophic bacteria (HPC), and total coliform to obtain a representation of microbiological conditions. *E. coli* levels ranged from <1/100mL to 260/100mL, fecal coliform levels ranged from <2/100 mL to 1600/100 mL, HPC levels ranged from <1cfu/mL to 990cfu/mL and total coliform levels ranged from <2 /100mL to 16000/100mL. Wide ranges in microbiological results are expected in the raw waters entering Alvarado WTP. Elevated total coliform levels trigger increased water treatment requirements. *Cryptosporidium* and *Giardia* levels ranged from <0.1 /100L to 3.3/100L and <0.1 /100L to 6.9/100 L for *Cryptosporidium* and *Giardia*.

  Treated water from Alvarado WTP was monitored, at the plant effluent, for *E. coli*, HPC and total coliform to ascertain compliance with regulations. *E. coli* and total coliform were both reported as always absent out of 1216 samples for this five year period, while HPC values ranged from <1 cfu/mL to 2 cfu/mL. *Cryptosporidium* and *Giardia* were monitored once and both were ND.

Table 5.10

Indicator Organisms and Pathogens Review for the Alvarado Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Indicator Organisms		**Mean**	**Mean**	
E Coli	/100 mL	6.27	22.1	15.83
Fecal Coliform	/100 mL	15.4	39	23.6
Heterotrophic Bacteria (HPC)	cfu/mL	102	89.8	-12.2
Total Coliform	/100 mL	95.9	181	85.1
Pathogens	**Units**	**Mean**	**Mean**	Change
Cryptosporidium TC	mg/L	0.081	0.057	-0.024
Giardia TG	mg/L	0.08	0.121	0.041

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Indicator Organisms		**Mean**	**Mean**	
E Coli	/100 mL	0	0	0
Heterotrophic Bacteria (HPC)	cfu/mL	1.63	1.01	-0.62
Total Coliform	/100 mL	0.004	0	-0.004
Pathogens	**Units**	**Mean**	**Mean**	Change
Cryptosporidium TC	/L	Ns	0	0
Giardia TG	/L	Ns	0	0

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS = Watershed Sanitary Survey

ns: not sampled; Constituents reported as ns in either WSS were also reported as ‘na” change.

Metal Parameters

Water samples were analyzed for twenty-one metals at both the influent and effluent sample points of the Alvarado WTP (**Appendix 5**). Most values were ND with none exceeding there MCL’s. Plant Influent maximum level for Iron was 340 µg/L exceeding the SMCL of 300 µg/L, and the maximum level for Manganese was 252 µg/L, exceeded the SMCL of 50 µg/L.

Table 5.11

Metal Parameter Review for the Alvarado Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Metals		**Mean**	**Mean**	
Boron	µg/L	105	117	12
Iron	µg/L	30.3	45.9	15.6
Magnesium	mg/L	19.1	20.5	1.4
Manganese	µg/L	20.1	33	12.9
Sodium	mg/L	74.4	78.6	4.2

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Metals		**Mean**	**Mean**	
Boron	µg/L	104	121	17
Magnesium	mg/L	18.6	20.4	1.8
Sodium	mg/L	79.3	84	4.7

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS = Watershed Sanitary Survey

ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Inorganic Parameters Including Nutrients**

  The CSD measured twenty-one Inorganic Parameters at the Alvarado WTP influent, and twenty inorganic parameters at the effluent of the Alvarado WTP. None of the levels exceeded the MCLs (**Appendix 5**). Inorganic parameters with levels at ND at both the Alvarado WTP influent and effluent included Bromate, Total Cyanide, *ortho*-Phosphate, Perchlorate, Phosphorus.

Table 5.12

Inorganic (Including Nutrient) Parameter Review for the Alvarado Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Inorganic Constituents		**Mean**	**Mean**	
Ammonia-N	mg/L	0.003	0.005	0.002
Bicarbonate (HCO3)	mg/L	148	137	-11
Calcium	mg/L	60.9	57.9	-3
Chloride	mg/L	77.4	85.7	8.3
MBAS (Detergents)	mg/L	0.043	0	-0.043
Potassium	mg/L	4.11	4.21	0.1
Silica	mg/L	10.2	10.1	-0.1
Total Nitrogen (TN)	mg/L	0.603	0.452	-0.151
UV254 Filtered	ABS	0.062	0.024	-0.038

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Inorganic Constituents		**Mean**	**Mean**	
Ammonia-N	mg/L	0.624	0.60	-0.024
Bicarbonate (HCO3)	mg/L	147	138	-9
Calcium	mg/L	60.6	57.8	-2.8
Carbonate (CO3)	mg/L	0.962	0.83	-0.132
Chloride	mg/L	84.6	93.3	8.7
Fluoride	mg/L	0.261	0.226	-0.035
MBAS (Detergents)	mg/L	0.013	0	-0.013
Nitrate & Nitrite	mg/L	1.54	1	-0.54
Potassium	mg/L	4.25	4.27	0.02
Silica	mg/L	10.1	9.8	-0.3
Sulfate (SO4)	mg/L	158	163	5
Total Nitrogen (TN)	mg/L	0.921	0.873	-0.048

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS = Watershed Sanitary Survey

ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Radiological Parameters**

  Alvarado WTP influent and effluent were monitored for gross *alpha* and *beta* particles, Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All levels were below the MCLs.

Table 5.13
Radiological Parameter Review for the Alvarado Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Radiological		**Mean**	**Mean**	
alpha Particles	pCi/L	3.32	0	-3.32
beta Particles	pCi/L	4.49	5.16	0.67
Combined Radium-226 & Radium-228	pCi/L	0.5	0.58	0.08
Strontium- 90	pCi/L	0.42	0	-0.42
Tritium	pCi/L	-4.25	0	4.25
Uranium	pCi/L	3.4	2.04	-1.36

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Radiological		**Mean**	**Mean**	
alpha Particles	pCi/L	ns	0	na
beta Particles	pCi/L	ns	0	na
Combined Radium-226 & Radium-228	pCi/L	ns	0.378	na
Strontium-90 -	pCi/L	ns	0	na
Tritium	pCi/L	ns	0	na
Uranium	pCi/L	ns	2.26	na

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Regulated and Unregulated Organic Parameters**

  The Alvarado WTP influent was monitored for both regulated (69) and non-regulated (98) organic constituents including herbicides, pesticides, and synthetic

contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5**).

The Alvarado WTP influent TOC levels ranged from 2.07 mg/L to 14.7 mg/L. TOC is a precursor to Trihalomethanes (THMs) and Haloacetic acids (five) (HAA-5). Total THMs (TTHMs) and HAAs are formed from the reaction of chlorine and/or bromine with organic matter present in the water being treated. They are predominately formed as by-products when chlorine is used to disinfect water for drinking. The THMs and HAAs produced have been associated through epidemiological studies with some adverse health effects.

Alvarado WTP influent TTHM levels ranged from ND to 58.6 µg/L, with a mean of 15.8 ug/L. The mean TTHM value increased by 14.01 µg/L from the 2005 WSS (**Table 5.14**). Total HAA-5 levels ranged from ND to 6.65 µg/L, with a mean of 0.716

Alvarado WTP effluent was monitored for both regulated (68) and non-regulated (113) organic constituents including herbicides, pesticides, and synthetic contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5**).

Alvarado WTP effluent TOC levels ranged from 1.87 mg/L to 6.86 mg/L. Alvarado WTP effluent TTHM levels ranged from 34.4 µg/L to 109 µg/L, with a mean of 63.1 ug/L, an increase of 6.7 µg/L from the 2005 WSS (**Table 5.14**). Total HAA-5 levels ranged from 11.4 to 38.2 µg/L, with a mean value of 19.6 µg/L, a decrease of 11.3 µg/L. The MCL for TTHM is a distribution system RRA of 80.0 µg/L, and the MCL for HAA-5 is a distribution system RAA of 60.0 µg/L. These MCLs are not based on an individual sample. Plant effluent samples are not included in the distribution system RAAs.

Table 5.14

Regulated Organic Parameter Review for the Alvarado Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Regulated		**Mean**	**Mean**	
Methyl-tert-butyl ether	µg/L	0.32	0	-0.32
Total Organic Carbon (TOC)	mg/L	3.26	3.17	-0.09
Total THMs	µg/L	1.79	15.8	14.01

Effluent (Treated Water) Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Organic Constituents Regulated		**Mean**	**Mean**	
Bis-(2-ethylhexyl) phthalate	µg/L	0.158	0	-0.158
Dibromoacetic acid	µg/L	4.97	4.52	-0.45
Dichloroacetic acid	µg/L	12.6	8.89	-3.71
Haloacetic acids (five) (HAA-5)	µg/L	30.9	19.6	-11.3
Methyl-tert-butyl ether	µg/L	0.266	0	-0.266
Monobromoacetic acid	µg/L	1.2	0	-1.2
Total Organic Carbon	mg/L	3.07	2.94	-0.13
Total THMs	µg/L	56.4	63.1	6.7
Trichloroacetic acid	µg/L	12.2	6.0	-6.2

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS = Watershed Sanitary Survey

ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

Table 5.15
Unregulated Organic Parameter Review for the Alvarado Water Treatment Plant

Influent (Untreated Raw Water) Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Organic Constituents Unregulated		**Mean**	**Mean**	
2-Methylisoborneol	ng/L	1.29	2.1	0.81
Bromochloroacetonitrile	µg/L	0.235	ns	na
Dibromoacetonitrile	µg/L	0.24	ns	na
Dichloroacetonitrile	µg/L	0.149	ns	na
Dissolved Organic Carbon	mg/L	3.1	2.19	-0.91
Geosmin	ng/L	0.929	0.919	-0.01
Total organic halides	µg/L	23.7	ns	na

Effluent (Treated Water) Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Organic Constituents Unregulated		**Mean**	**Mean**	
1,1,1-Trichloro-2-propanone	µg/L	0.232	ns	na
1,1-Dichloro-2-propanone	µg/L	0.55	ns	na

Bromochloroacetic acid	µg/L	8.73	ns	na
Bromochloroacetonitrile	µg/L	3.31	ns	na
Chlorodibromoacetic acid	µg/L	13.8	ns	na
Chloropicrin	µg/L	0.204	ns	na
Dibromoacetonitrile	µg/L	2.27	ns	na
Dibromochloroacetic acid	µg/L	12.8	ns	na
Dichloroacetonitrile	µg/L	1.83	ns	na
Diethyl phthalate	µg/L	0.045	0	-0.045
Dissolved Organic Carbon	mg/L	3.88	2.24	-1.64
Total organic halides	µg/L	203	ns	na

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

5.3 Otay Cottonwood System Water Quality Review

Streams, reservoirs and treatment plant influent/effluent were monitored for general physical characteristics, microbiological, organic and inorganic constituents. Additionally, Otay Reservoir and Otay WTP influent were sampled for radiation.

Tables 5.16 - 5.29 contain the mean water quality values from the 2005 and 2010 WSS for comparison purposes. These tables do not contain constituents whose levels were below the MDL. See **Appendix 5** for a summary of all water quality data. The Drinking Water Standards used in **Appendix 5** apply to treated, potable water, and are listed for reference only.

Source Water Review

- **General Physical Parameters**

  General/physical source water quality parameters for the Otay Cottonwood System were within the standards for drinking water except for pH, Color, TDS, Conductivity and Turbidity. The maximum pH level was 9.38, and is above the SMCL of 6.5 – 8.5. The maximum Turbidity level was 226 NTU, where the MCL is 0.5 NTU. The maximum TDS level was 8,820 mg/L and exceeded the SMCL of 1000 mg/L, while the maximum Conductivity level was 14,100 µS/cm and exceeded the SMCL of 1,600 mg/L. The maximum Color level was 239 cu and exceeded the SMCL of 15 cu. TDS, Color, pH and Turbidity are treated in the WTP. The water quality is typical of raw water streams and reservoirs in Southern California. Since the streams and

reservoirs contain raw water, and the standards are for treated water, the comparison is for reference only.

Mean values of water quality results were used for comparing the 2005 to the 2010 WSS. Generally, there was little change from the 2005 WSS parameter levels (**Table 5.16**). There were significant increases in the mean Conductivity and TDS levels in streams located in the Otay Cottonwood system from the 2005 to the 2010 WSS.

Table 5.16

General/Physical Water Quality Parameter Review for the Source Waters of the Otay Cottonwood System

Stream Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
General Physical		**Mean**	**Mean**	
Conductivity	µS/cm	887	3,920	3033
pH	pH	7.75	7.76	0.01
Total Dissolved Solids (TDS)	mg/L	790	2,430	1640
Total Suspended Solids (TSS)	mg/L	165	7.56	-157.44

Reservoir Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
General Physical		**Mean**	**Mean**	
Calcium Hardness (CaCO3)	mg/L	129	119	-10
Color	Color	27.8	28.3	0.5
Conductivity	µmho/cm	863	881	18
Total Alkalinity	mg/L	201	192	-9
Total Dissolved Solids (TDS)	mg/L	455	513	58
Total Hardness (CaCO3)	mg/L	212	227	15
Turbidity	ntu	7.06	10.9	3.84
pH	pH	8.55	8.40	-0.15

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS = Watershed Sanitary Survey

ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Microbiological Parameters**

  Streams and Reservoirs of the Otay Cottonwood System were monitored for *Enterococcus*, *E. coli*, and total coliform to obtain a representation of microbiological conditions. *Enterococcus levels* ranged from <1 /100mL to 2,400/100mL, *E. coli* levels ranged from <10 /100mL to 4,100 /100mL, and total coliform levels ranged from <10 /100 mL to >240,000 /100 mL. Wide ranges in microbiological results are expected in raw water streams and reservoirs. *Cryptosporidium* and *Giardia* were monitored at Otay Reservoir and all values were ND.

Table 5.17

Indicator Organisms and Pathogens Review for the Source Waters of the Otay Cottonwood System

Stream Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Indicator Organisms		**Mean**	**Mean**	
Enterococcus	/100 mL	174	468	294
E Coli	/100 mL	277	317	40
Total Coliform	/100 mL	13500	24500	11000

Reservoir Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Indicator Organisms		**Mean**	**Mean**	
Enterococcus	/100 mL	7.3	14.2	6.9
E Coli	/100 mL	33.6	64.5	30.9
Total Coliform	/100 mL	4270	2840	-1430
Pathogens		**Mean**	**Mean**	
Cryptosporidium TC	/ L	ns	0	0
Giardia TG	/ L	ns	0	0

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS = Watershed Sanitary Survey

ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Nutrient Parameters**

  Streams and Reservoirs of the Otay Cottonwood System were monitored for TN and *ortho*-Phosphate. TN levels in streams ranged from ND to 29.4 mg/L, while

ortho-Phosphate levels ranged from ND to 1.02 mg/L. Reservoir TN levels ranged from ND to 2.97 mg/L, while *ortho*-Phosphate levels ranged from ND to 0.858 mg/L.

Mean Values for TN, for streams within the Otay Cottonwood System, increased significantly since the 2005 WSS (**Table 5.18**). The mean TN and *ortho-P*hosphate levels for the streams and mean TN values for reservoirs exceeded EPA's reference concentrations.

Table 5.18

Nutrient Review for the Source Waters of the Otay Cottonwood System

Stream Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Inorganic Constituents		**Mean**	**Mean**	
Total Nitrogen (TN)	mg/L	1.66	5.47	3.81
ortho-Phosphate (PO4)	mg/L	0.051	0.064	0.013

Reservoir Data[a]				
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Inorganic Constituents		**Mean**	**Mean**	
Total Nitrogen (TN)	mg/L	0.921	0.585	-0.336
ortho-Phosphate (PO4)	mg/L	0	0	na

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as "na" change.

- **Metal Parameters**

Water samples from the streams in the Otay-Cottonwood System and Otay Reservoir were monitored for seventeen Total and Dissolved Metal Parameters. The levels were ND for total and Dissolved Beryllium, Cadmium and Thallium; and for Dissolved Silver (**Appendix 5**).

A comparison of the mean metal values (**Table 5.19**) for the Otay Cottonwood System source waters showed the mean value for several Metal Parameters increased significantly from the 2005 WSS levels including Total and Dissolved Arsenic, Barium, Boron, and Selenium. The mean values for Total and Dissolved Aluminum, Cadmium, and Manganese decreased significantly since the 2005

WSS. The maximum level of Aluminum was 255 mg/L and exceeded the SMCL of 200 mg/L. The maximum level of arsenic was 33.1 mg/L and exceeded the MCL of 10 mg/L.

Table 5.19

Metal Parameter Review for the Source Waters of the Otay Cottonwood System

Parameter	Units	Stream Data[a] 2005 WSS[b]	2010 WSS[b]	Change
Metals		**Mean**	**Mean**	
Aluminum	µg/L	5,140	55.1	-5084.9
Dissolved Aluminum	µg/L	238	13.7	-224.3
Dissolved Antimony	µg/L	1.22	0	-1.22
Arsenic	µg/L	1.51	13.0	11.49
Dissolved Arsenic	µg/L	4.11	12.7	8.59
Barium	µg/L	99.3	186	86.7
Dissolved Barium	µg/L	124	197	73
Dissolved Beryllium	µg/L	1.05	0	-1.05
Boron	µg/L	77.2	327	249.8
Dissolved Boron	µg/L	152	345	193
Dissolved Cadmium	µg/L	2.38	0	-2.38
Dissolved Chromium	µg/L	2.66	0	-2.66
Dissolved Copper	µg/L	18.2	62.4	44.2
Lead	µg/L	50	0	-50.
Dissolved Lead	µg/L	4.86	1.25	-3.61
Manganese	µg/L	769	151	-618
Dissolved Manganese	µg/L	167	58	-109
Dissolved Nickel	µg/L	5.62	7.81	2.19
Selenium	µg/L	0.959	17.2	16.241
Dissolved Selenium	µg/L	8.82	16.8	7.98
Dissolved Thallium	µg/L	0.476	0	-0.476
Vanadium	µg/L	28	32.9	4.9
Dissolved Vanadium	µg/L	9.75	30.4	20.65
Dissolved Zinc	µg/L	62	8.03	-53.97
Parameter	**Units**	**Reservoir Data[a] 2005 WSS[b]**	**2010 WSS[b]**	**Change**
Metals		**Mean**	**Mean**	
Antimony	µg/L	0.027	0	-0.027
Arsenic	µg/L	2.85	0	-2.85

Boron	µg/L	119	108	-11
Magnesium	mg/L	19.7	25.9	6.2
Manganese	µg/L	46.7	34.5	-12.2
Nickel	µg/L	0.142	0	-0.142
Sodium	mg/L	84.7	86.6	1.9
Vanadium	µg/L	7	5.04	-1.96

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as ‘”na” change.

- **Radiological Parameters**

  Primary reservoirs of the Otay Cottonwood System were monitored for gross *alpha* and *beta* particles, combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were below the MCLs.

Table 5.20

Radiological Parameter Review for the Source Waters of the Otay Cottonwood System

Parameter	Units	Reservoir Data[a] 2005 WSS[b]	2010 WSS[b]	Change
Radiological		**Mean**	**Mean**	
alpha Particles	pCi/L	0	4.78	4.78
beta Particles	pCi/L	4.59	0	-4.59
Combined Radium-226 & Radium-228	pCi/L	0.584	1.05	0.466
Strontium-90	pCi/L	0	0	0
Tritium	pCi/L	-47	0	47
Uranium	pCi/L	2.29	3.84	1.55

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Regulated and Unregulated Organic Parameters**

  The source waters of the Otay Cottonwood System were monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants.

  Bis-(2-ethylhexyl) phthalate, is widely used as a plasticizer in manufacturing of articles made of PVC, and as a hydraulic and a dielectric fluid in capacitors, and its level exceeded the MCL in a single sample. A single stream sample detected Bis-(2-ethylhexyl) phthalate at 8.67 µg/L exceeding the MCL of 4 µg/L. Additional organic samples were below the MCL.

  Stream TOC levels ranged from 1.1 mg/L to 23.2 mg/L, and reservoir levels ranged from 4.21 mg/L to 8.73 mg/L. **Tables 5.21 & 5.22** highlight the changes that have occurred since the 2005 WSS.

Table 5.21

Regulated Organic Parameter Review for the Source Waters of the Otay Cottonwood System

Stream Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Regulated		**Mean**	**Mean**	
Bis-(2-ethylhexyl) phthalate	µg/L	0.05	0.788	0.738
Benzo[a]pyrene	µg/L	0.01	0	-0.01
Methyl tert-Butyl Ether (MTBE)	µg/L	0.004	0	-0.004
Total Organic Carbon (TOC)	mg/L	4.69	6.49	1.8

Reservoir Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Regulated		**Mean**	**Mean**	
Bis-(2-ethylhexyl) phthalate	µg/L	0.038	0	-0.038
Bromodichloromethane	µg/L	0.031	0	-0.031
Chlorodibromomethane	µg/L	0.024	0	-0.024
Chloroform	µg/L	0.045	0	-0.045
Methyl-*tert*-butyl ether	µg/L	0.36	0	-0.36
Toluene	µg/L	0.006	0	-0.006
Total Organic Carbon (TOC)	mg/L	7.33	5.71	-1.62
Total THMs	µg/L	ns	3.53	na
*meta,para-X*ylenes	µg/L	0.005	0	-0.005

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

Table 5.22

Unregulated Organic Parameter Review for the Source Waters of the Otay Cottonwood System

Stream Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Unregulated		**Mean**	**Mean**	
Aldicarb sulfoxide	µg/L	0.031	0	-0.031

Reservoir Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Unregulated		**Mean**	**Mean**	
2-Methylisoborneol	ng/L	10.8	8.33	-2.47
Aldicarb sulfoxide	µg/L	0.009	0	-0.009
Diethyl phthalate	µg/L	0.01	0	-0.01
tert-Butyl alcohol	µg/L	0.549	0	-0.549

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

Otay Water WTP Influent/Effluent Review

- **General Physical Parameters**

  The monitored physical parameters for Otay WTP influent (**Table 5.23**) were within the standards for drinking water. Since the plant influent contains raw water, and the standards are for treated, the comparison is for reference only.

  To comply with regulatory plant monitoring requirements, plant operators frequently monitor both the Turbidity and pH – every 15 minutes for Turbidity,

and every two hours for pH at the WTP effluent. Those monitoring results were used for the WTP effluent review. All measurements met Turbidity and pH requirements.

Table 5.23

General/Physical Water Quality Parameter Review for the Otay Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
General Physical		**Mean**	**Mean**	
Calcium Hardness (CaCO3)	mg/L	142	137	-5
Color	Color	11.8	8.86	-2.94
Conductivity	µmho/cm	865	902	37
Corrosivity	--	0.515	0.338	-0.177
Total Alkalinity	mg/L	138	121	-17
Total Dissolved Solids (TDS)	mg/L	484	526	42
Total Hardness (CaCO3)	mg/L	224	228	4
Total Suspended Solids (TSS)	mg/L	1.54	1.38	-0.16
Turbidity	ntu	1.1	0.74	-0.36
pH	pH	8.07	7.98	-0.09

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
General Physical		**Mean**	**Mean**	
Calcium Hardness (CaCO3)	mg/L	144	139	-5
Color	Color	2.99	0.967	-2.023
Conductivity	µmho/cm	888	932	44
Corrosivity	--	0.638	0.571	-0.067
Threshold odor number	Odor	1.09	1.04	-0.05
Total alkalinity	mg/L	128	118	-10
Total Dissolved Solids (TDS)	mg/L	496	534	38
Total Hardness (CaCO3)	mg/L	221	233	12
Total Suspended Solids (TSS)	mg/L	0.942	1.13	0.188
Turbidity	ntu	0.132	0.086	-0.046
pH	pH	8.20	8.19	-0.01

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “”na” change.

- **Indicator Organisms and Pathogens**

Raw waters entering Otay WTP were monitored, at the plant influent, for *E. coli*, fecal coliform, heterotrophic bacteria (HPC), and total coliform in order to obtain a representation of microbiological conditions (**Table 5.24**). *E. coli* levels ranged from non-detect to 84/100 mL, fecal coliform levels ranged from <2/100 mL to 1600/100 mL, HPC levels ranged from <1cfu/mL to 3,700 cfu/mL and total coliform levels ranged from <2 /100mL to 16,000/100mL. Wide ranges in microbiological results are expected in the raw waters entering the Otay WTP. Elevated total coliform levels trigger increased water treatment requirements. *Cryptosporidium* and *Giardia* were monitored, and ranged from ND to 1/100 L and ND to 1/100 L for *Cryptosporidium* and *Giardia*.
Treated water from Otay WTP was monitored, at the plant effluent, for *E. coli*, HPC and total coliform to ascertain compliance with regulations. *E. coli* and total coliform were both reported as absent for all 1,016 samples for this five year period while HPC values ranged from <1 cfu/mL to 46 cfu/mL. *Cryptosporidium* and *Giardia* were monitored once and were ND.

Table 5.24
Indicator Organisms and Pathogens Review for the Otay Water Treatment Plant

Influent (untreated raw water) Data[a]

Parameters	Units	2005 WSS[b]	2010 WSS[b]	Change
Indicator Organisms		**Mean**	**Mean**	
E Coli	/100 mL	5.43	18.5	13.07
Fecal Coliform	/100 mL	16.4	30.5	14.1
Heterotrophic Bacteria (HPC)	cfu/mL	526	267	-259
Total Coliform	/100 mL	246	442	196
Pathogens		**Mean**	**Mean**	
Cryptosporidium TC	mg/L	0.083	0	-0.083
Giardia TG	mg/L	0.086	0	-0.083

Effluent (Treated Water) Data[a]

Parameters	Units	2005 WSS[b]	2010 WSS[b]	Change
Indicator Organisms		**Mean**	**Mean**	
E Coli	/100 mL	0.001	0	0
Heterotrophic Bacteria (HPC)	cfu/mL	4.78	1.26	-3.52

Total Coliform	/100 mL	0.003	0	-0.003
Pathogens		**Mean**	**Mean**	
Cryptosporidium TC	/L	0.05	0	-0.05
Giardia TG	/L	0.05	0	-0.05

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Metal Parameters**

  Water samples were analyzed for twenty-one Metal Parameters at both the influent and effluent sample points of the Otay WTP. Most levels were ND with none of the levels exceeded the MCLs (**Appendix 5**). The maximum level for Iron was 822 µg/L exceeding the SMCL of 300 µg/L, and the maximum level for Manganese was 710 µg/L, exceeded the SMCL of 50 µg/L.

Table 5.25

Metal Parameter Review for the Otay Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Metals		**Mean**	**Mean**	
Boron	µg/L	103	133	30
Magnesium	mg/L	18.6	22.3	3.7
Manganese	µg/L	65.7	33.5	-32.2
Sodium	mg/L	76.1	84.9	8.8

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Metals		**Mean**	**Mean**	
Boron	µg/L	106	134	28
Magnesium	mg/L	18.6	22.4	3.8
Sodium	mg/L	79.9	90.2	10.3

Notes:
(a): All non-detects reported as "0" for comparison purposes.

(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as ”na” change.

- **Inorganic Parameters Including Nutrients**

  The CSD measured twenty-two inorganic constituents at the Otay WTP influent, and effluent. None of the levels exceeded the MCLs. Inorganic parameters with levels at ND at both Otay WTP influent and effluent included Bromate, Total Cyanide, Perchlorate, and Phosphorus (**Appendix 5**).

Table 5.26

Inorganic (Including Nutrient) Parameter Review for the Otay Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Inorganic Constituents		**Mean**	**Mean**	
Ammonia-N	mg/L	0	0.045	0.045
Bicarbonate (HCO3)	mg/L	164	146	-18
Bromide	mg/L	0.165	0.165	0
Calcium	mg/L	58	56.2	-1.8
Carbonate (CO3)	mg/L	0.077	0.387	0.31
Chloride	mg/L	79.2	96.8	17.6
Fluoride	mg/L	0.306	0.250	-0.056
Nitrate & Nitrite	mg/L	1.24	0.724	-0.516
Potassium	mg/L	4.22	4.45	0.23
Silica	mg/L	10.3	7.85	-2.45
Sulfate (SO4)	mg/L	142	154	12
Total Nitrogen (TN)	mg/L	0.548	0.383	-0.165
UV254 Filtered	ABS	0.071	0.053	-0.018
UV254	ABS	0.101	0.069	-0.032

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Inorganic Constituents		**Mean**	**Mean**	
Ammonia-N	mg/L	0.647	0.503	-0.144
Bicarbonate (HCO3)	mg/L	155	140	-15
Calcium	mg/L	57.2	55.7	-1.5

Carbonate (CO3)	mg/L	0.575	0.84	0.265
Chloride	mg/L	89.7	108	18.3
Fluoride	mg/L	0.305	0.256	-0.049
Nitrate & Nitrite	mg/L	1.22	0.659	0
Potassium	mg/L	4.17	4.52	0.35
Silica	mg/L	9.88	7.4	-2.48
Sulfate (SO4)	mg/L	143	157	14
Total Nitrogen (TN)	mg/L	0.867	0.82	-0.047

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Radiological Parameters**

  Otay WTP influent and effluent was monitored for gross *alpha* and *beta* particles, combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were below the MCLs.

Table 5.27
Radiological Parameter Review for the Otay Water Treatment Plant

Influent (untreated raw water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Radiological		**Mean**	**Mean**	
alpha Particles	pCi/L	3.4	0	-3.4
beta Particles	pCi/L	0	0	na
Combined Radium-226 & Radium-228	pCi/L	0.692	0.83	0.138
Strontium 90-	pCi/L	0	0	na
Tritium	pCi/L	-0.6	0	0.6
Uranium	pCi/L	3.58	2.14	-1.44

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Radiological		**Mean**	**Mean**	
alpha Particles	pCi/L	ns	0	na
beta Particles	pCi/L	ns	0	na

Combined Radium-226 & Radium-228	pCi/L	ns	0.398	na
Strontium 90-	pCi/L	ns	0	na
Tritium	pCi/L	ns	0	na
Uranium	pCi/L	ns	1.86	na

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 'na" change.

- **Regulated and Unregulated Organic Parameters**

Otay WTP influent was monitored for both regulated (69) and non-regulated organic (98) parameters including herbicides, pesticides, and synthetic contaminants, of which none exceed the MCLs. None of the levels exceeded the MCL with most at ND levels (**Appendix 5**).

The Otay WTP influent TOC levels ranged from 2.22 mg/L to 7.94 mg/L. TOC is a precursor to Trihalomethanes (THMs) and Haloacetic acids (five) (HAA-5). Total THMs (TTHMs) and HAAs are formed from the reaction of chlorine and/or bromine with organic matter present in the water being treated. They are predominately formed as by-products when chlorine is used to disinfect water for drinking. The THMs and HAAs produced have been associated through epidemiological studies with some adverse health effects.

The Otay WTP influent TTHMs levels ranged from ND to 99 µg/L, with a mean of 13.9 ug/L. The mean TTHM value increased by 13.9 µg/L from the 2005 WSS (**Table 5.28**). Total HAA-5 levels ranged from ND to 23.8 µg/L, with a mean of 1.43 µg/L

The Otay WTP effluent was monitored for both regulated (68) and non-regulated (119) organic constituents including herbicides, pesticides, and synthetic contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5**).

The Otay WTP effluent TOC levels ranged from 1.08 mg/L to 6.57 mg/L.

The Otay WTP effluent TTHM levels ranged from 26.8 µg/L to 121 µg/L, with a mean of 60.1 ug/L, an increase of 2.0 µg/L from the 2005 WSS (**Table 5.28**). Total HAA-5 levels ranged from 6.76 µg/L to 41.4 µg/L, with a mean of 16.8 ug/L a decrease of 6.8µg/L from the 2005 WSS. The MCL for TTHM is a distribution system RRA of 80.0 µg/L, and the MCL for HAA-5 is a distribution system RAA of 60.0 µg/L. These MCLs are not based on an individual sample. Plant effluent samples are not included in the distribution system RAAs.

Table 5.28

Regulated Organic Parameter Review for the Otay Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Regulated		**Mean**	**Mean**	
Bromodichloromethane	µg/L	0.014	3.76	3.746
Bromoform	µg/L	0.009	1.89	1.881
Chlorodibromomethane	µg/L	0.026	4.74	4.714
Chloroform	µg/L	0.041	2.42	2.379
Haloacetic Acids (five) (HAA-5)	µg/L	0	1.43	1.43
Methyl-tert-butyl ether	µg/L	0.284	0	-0.284
Total Organic Carbon (TOC)	mg/L	4.39	4.07	-0.32
Total THMs	µg/L	0.031	13.9	13.869

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Regulated		**Mean**	**Mean**	
Bromodichloromethane	µg/L	21.4	20.1	-1.3
Bromoform	µg/L	4.06	5.64	1.58
Chlorodibromomethane	µg/L	19.9	21	1.1
Chloroform	µg/L	16.4	14.9	-1.5
Dibromoacetic acid	µg/L	5.07	3.78	-1.29
Dichloroacetic acid	µg/L	8.48	7.14	-1.34
Haloacetic acids (five) (HAA-5)	µg/L	23.6	16.8	-6.8
Methyl-tert-butyl ether	µg/L	0.234	0	-0.234
Monobromoacetic acid	µg/L	1.5	0	-1.5
Monochloroacetic acid	µg/L	0.09	0	-0.09
Total Organic Carbon (TOC)	mg/L	3.73	3.39	-0.34
Total THMs	µg/L	58.1	60.1	2
Trichloroacetic acid	µg/L	8.43	5.99	-2.44

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS = Watershed Sanitary Survey

ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

Table 5.29
Unregulated Organic Parameter Review for the Otay Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Unregulated		**Mean**	**Mean**	
Dissolved Organic Carbon	mg/L	3.69	3.81	0.12

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Unregulated		**Mean**	**Mean**	
1,1,1-Trichloro-2-propanone	µg/L	0.199	ns	na
1,1-Dichloro-2-propanone	µg/L	0.632	ns	na
1,2,3-trichloropropane	ng/L	0.32	0	-0.32
Bromochloroacetic acid	µg/L	9.03	ns	na
Bromochloroacetonitrile	µg/L	3.34	ns	na
Chloral hydrate	µg/L	0.414	ns	na
Chlorodibromoacetic acid	µg/L	10.2	ns	na
Dibromoacetonitrile	µg/L	2.62	ns	na
Dibromochloroacetic acid	µg/L	11.9	ns	na
Dichloroacetonitrile	µg/L	1.93	ns	na
Total organic halides	µg/L	256	ns	na

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

5.4 Miramar System Water Quality Review

The Miramar Reservoir and WTP influent/effluent were monitored for general physical characteristics, microbiological, organic and inorganic constituents. Additionally, Miramar Reservoir and Miramar WTP influent were sampled for radiation.

Tables 5.30 – 5.43 contain the mean water quality values from the 2005 and 2010 WSS for comparison purposes. These tables do not contain constituents whose levels were below the MDL. See **Appendix 5** for a summary of all water quality data. The Drinking Water Standards used in **Appendix 5** apply to treated, potable water, and are listed for reference only.

Source Water Review

- **General Physical Parameters**

  General/physical sources water quality parameters for Miramar Reservoir were within the standards for drinking water Turbidity. The maximum Turbidity level was 0.78 NTU, exceeding the MCL is 0.5 NTU. Turbidity is treated in the WTP. The water quality is typical of raw water reservoirs in Southern California. Since the reservoir contains raw water and the standards are for treated, the comparison is for reference only. The mean values were used for comparing the 2005 to the 2010 WSS.

Table 5.30
General/Physical Water Quality Parameter Review for the Miramar Reservoir

Parameter	Units	Reservoir Data[a] 2005 WSS[b]	2010 WSS[b]	Change
General Physical		**Mean**	**Mean**	
Calcium Hardness (CaCO3)	mg/L	159	156	-3
Color	Color	4.47	2.8	-1.67
Conductivity	µmho/cm	925	938	13
Total Alkalinity	mg/L	119	110	-9
Total Dissolved Solids (TDS)	mg/L	520	548	28
Total Hardness (CaCO3)	mg/L	243	246	3
Turbidity	ntu	0.499	0.354	-0.145
pH	pH	8.12	8.05	-0.07

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Indicator Organisms and Pathogens**

  The Miramar Reservoir was monitored for *Enterococcus*, *E. coli*, and total coliform to obtain a representation of microbiological conditions. *Enterococcus levels* ranged from <1 /100 mL to 69/100 mL, *E. coli* levels ranged from <10 /100 mL to 110 /100 mL, and total coliform levels ranged from <10 /100 mL to 17,000 /100 mL. Wide ranges in microbiological results are expected in raw water reservoirs. *Cryptosporidium* and *Giardia* were monitored four times at the

Miramar Reservoir with all *Cryptosporidium* samples being ND and one *Giardia* sample reporting a level of 1/L.

Table 5.31
Indicator Organisms and Pathogens Review for Miramar Reservoir

Parameter	Units	Reservoir Data[a] 2005 WSS[b]	2010 WSS[b]	Change
Indicator Organisms		**Mean**	**Mean**	
Enterococcus	/100 mL	1.76	4.36	2.6
E Coli	/100 mL	15.6	16.2	0.6
Total Coliform	/100 mL	1070	726	-344
Pathogens		**Mean**	**Mean**	
Cryptosporidium TC	/ L	ns	0	na
Giardia TG	/ L	ns	0.25	na

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Nutrient Parameters**

  The Miramar Reservoir was monitored for TN and *ortho*-Phosphate. TN levels ranged from ND to 1.93 mg/L, and *ortho*-Phosphate levels ranged from ND to 0.07 mg/L.

Table 5.32
Nutrient Parameter Review for the Miramar Reservoir

Parameter	Units	Reservoir Data[a] 2005 WSS[b]	2010 WSS[b]	Change
Inorganic Constituents		**Mean**	**Mean**	
Total Nitrogen (TN)	mg/L	0.422	0.368	-0.054
ortho-Phosphates (PO4)	mg/L	0	0	na

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Metal Parameters**

The effects of metals in water are varied. Some metals have caused concern due to their physiological and other human health effects while others affect the aesthetics of water. Two of these metals, Iron and Manganese, are nuisance constituents that affect the aesthetic properties of water. Iron and Manganese are of interest since they have aesthetic impacts if left untreated, exert an oxidant demand, and serve as indicators as to reservoir dynamics.

Both Iron and Manganese are naturally occurring constituents, but can be elevated by contribution from potential contaminating activities, such as landfills, mines, industrial wastes and urban runoff. Conventional water treatment is very effective at removing both Iron and Manganese. The maximum level for Iron was 322 µg/L exceeding the SMCL of 300 µg/L, and the maximum level for Manganese was 79.3 µg/L exceeding the SMCL of 50 µg/L.

When using ozonation in water treatment, there is a risk of completely oxidizing the Manganese to Permanganate which could result in pink water. Reports suggest that raw or settled water with levels of Manganese exceeding ug/L could form Permanganate at levels sufficiently high enough to create problems, especially if the ozone dosages are high enough to achieve pathogen inactivation. With the addition of ozone treatment at Miramar WTP's, Manganese levels in the CDS's raw water will become more of a concern.

The Miramar Reservoir was monitored for twenty-one Metal Parameters. The levels were ND for Antimony, Beryllium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, Thallium, Vanadium and Zinc (**Appendix 5**).

Table 5.33
Metal Parameters Review for the Miramar Reservoir

		Reservoir Data[a]		
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Metals		**Mean**	**Mean**	
Barium	µg/L	82.1	105	22.9
Boron	µg/L	115	125	10
Chromium	µg/L	0.231	0	-0.231
Magnesium	mg/L	19.7	22.1	2.4
Manganese	µg/L	10.9	24.3	13.4
Sodium	mg/L	76.2	82.8	6.6

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as "na" change.

The Miramar Reservoir was monitored for gross *alpha* and *beta* particles, combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were below the MCLs

- **Radiological Parameters**

. Table 5.34
Radiological Parameters Review for the Miramar Reservoir

Parameter	Units	Reservoir Data[a] 2005 WSS[b]	2010 WSS[b]	Change
Radiological		**Mean**	**Mean**	
alpha Particles	pCi/L	0	3.14	3.14
beta Particles	pCi/L	4.03	0	-4.03
Combined Radium-226 & Radium-228	pCi/L	0.594	0.221	-0.373
Strontium-90	pCi/L	0.223	0	-0.223
Tritium	pCi/L	782	0	-782
Uranium	pCi/L	2.92	3.83	0.91

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Regulated and Unregulated Organic Parameters**

The Miramar Reservoir was monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5**).

Reservoir TOC levels ranged from 2.51 mg/L, to 3.42 mg/L.

Table 5.35
Regulated Organic Parameter Review for the Miramar Reservoir

Parameter	Units	Reservoir Data[a] 2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Regulated		**Mean**	**Mean**	
Bromodichloromethane	µg/L	1.24	1.29	0.05
Bromoform	µg/L	0.216	0	-0.216
Chlorodibromomethane	µg/L	1.15	1.61	0.46
Chloroform	µg/L	1.34	0	-1.34
Trihaloacetic acids (five) (HAA-5)	µg/L	ns	1.45	na

Methyl-tert-butyl ether	µg/L	0.244	0	-0.244
Total Organic Carbon (TOC)	mg/L	3.04	2.79	-0.25
Total THMs	µg/L	ns	8.84	na
Trichloroacetic acid	µg/L	ns	1.45	na

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

Table 5.36
Unregulated Organic Parameter Review for the Miramar Reservoir

		Reservoir Data[a]		
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Organic Constituents Unregulated		**Mean**	**Mean**	
tert-Butyl alcohol	µg/L	0.474	0	-0.474

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

Miramar WTP Influent/Effluent Review

- **General Physical Parameters**

  The levels of monitored physical parameters for the Miramar WTP influent (**Table 5.37**) were within the standards for drinking water except for Color, TON, pH and Turbidity. Since the plant influent contains raw water, and the standards are for treated, the comparison is for reference only. The maximum Turbidity level was 13.3 NTU, where the MCL is for 95% of the filtered water samples to have a Turbidity level of $\leq$ 0.5 NTU. The maximum pH value was 9.09 where the SMCL is 8.5. The maximum Color level was 37 cu, where the SMCL is 15 cu. The maximum TON level was 18 odor units, where the SMCL is 3 odor units. Color, TON, pH, and Turbidity are treated in the water treatment process.
  The monitored physical parameters for the Miramar WTP effluent (**Table 5.37**) were within the standards for drinking water.

To comply with regulatory plant monitoring requirements, plant operators frequently monitor both the Turbidity and pH – every 15 minutes for Turbidity, and every two hours for pH at the WTP effluent. Those monitoring results were used for the WTP effluent review. All measurements met Turbidity and pH requirements.

Table 5.37

General/Physical Water Quality Parameter Review for the Miramar Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
General Physical		**Mean**	**Mean**	
Calcium Hardness (CaCO3)	mg/L	153	146	-7
Color	Color	6.25	5.61	-0.64
Conductivity	µmho/cm	866	810	-56
Corrosivity	--	0.563	0.425	-0.138
Threshold odor number (TON)	Odor	1.48	0	-1.48
Total Alkalinity	mg/L	117	108	-9
Total Dissolved Solids (TDS)	mg/L	505	532	27
Total Hardness (CaCO3)	mg/L	235	232	-3
Total Suspended Solids (TSS)	mg/L	2.78	2.71	-0.07
Turbidity	ntu	0.885	0.658	-0.227
pH	pH	8.16	8.04	-0.12

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
General Physical		**Mean**	**Mean**	
Calcium Hardness (CaCO3)	mg/L	160	150	-10
Color	Color	1.85	0	-1.85
Conductivity	µmho/cm	917	894	-23
Corrosivity	--	0.607	0.415	-0.192
Threshold odor number	Odor	1	1	0
Total Alkalinity	mg/L	115	107	-8
Total Dissolved Solids (TDS)	mg/L	519	539	20
Total Hardness (CaCO3)	mg/L	241	236	-5
Total Suspended Solids (TSS)	mg/L	0.885	1.11	0.225
Turbidity	ntu	0.09	0.082	-0.008
pH	pH	8.19	8.09	-0.10

Notes:

(a): All non-detects reported as "0" for comparison purposes.

(b): WSS = Watershed Sanitary Survey

ns: not sampled; Constituents reported as ns in either WSS were also reported as “”na” change.

Indicator Organisms and Pathogens

Raw waters entering Miramar WTP were monitored, at the plant influent, for *E. coli*, fecal coliform, heterotrophic bacteria (HPC), and total coliform to obtain a representation of microbiological conditions. *E. coli* levels ranged from <1/100 mL to 50/100 mL, fecal coliform levels ranged from <2/100 mL to 130/100 mL, HPC levels ranged from <1cfu/mL to 3,800 cfu/mL and total coliform levels ranged from <1/100 mL to 16000/100 mL. Wide ranges in microbiological results are expected in the raw waters entering the Miramar WTP. Elevated total coliform levels trigger increased water treatment requirements. *Cryptosporidium* and *Giardia* were monitored, and levels ranged from ND to 4.5/100 L and ND to 5.3/100 L for *Cryptosporidium* and *Giardia,* respectively.

Treated water from Miramar WTP was monitored, at the plant effluent, for *E. coli*, HPC and total coliform to ascertain compliance with regulations. *E. coli* was reported as absent for all 2,370 samples for this five year period while total coliform values ranged from ND to 1/100 mL. HPC levels ranged from <1 cfu/mL to 46 cfu/mL. *Cryptosporidium* and *Giardia* were monitored once and the levels were ND.

Table 5.38

Indicator Organisms and Pathogens Review for the Miramar Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Indicator Organisms		**Mean**	**Mean**	
E Coli	/100 mL	4.98	5.43	0.45
Fecal Coliform	/100 mL	6.35	5.55	-0.8
Heterotrophic Bacteria (HPC)	cfu/mL	243	259	16
Total Coliform	/100 mL	134	136	2
Pathogens		**Mean**	**Mean**	
Cryptosporidium TC	mg/L	0.083	0.078	-0.005
Giardia TG	mg/L	0.096	0.091	-0.005

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Pathogens and Indicator Organisms		**Mean**	**Mean**	
E Coli	/100 mL	0	0	0
Heterotrophic Bacteria (HPC)	cfu/mL	1.09	1.09	0
Total Coliform	/100 mL	0	0	0
Pathogens		**Mean**	**Mean**	
Cryptosporidium TC	/L	0.05	0	-0.05
Giardia TG	/L	0.05	0	-0.05

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Metal Parameters**

  Water samples were analyzed for twenty-one metals at both the influent and effluent sample points of the Miramar WTP. The levels were ND at both the Miramar WTP influent and effluent for Antimony, Beryllium, Cadmium, Chromium, Lead, Mercury, Silver and Thallium. Additionally, the levels of Arsenic and Vanadium were ND at the Alvarado WTP effluent. None of the levels exceeded the MCL’s (**Appendix 5**). Plant Influent maximum level for Iron was 313 µg/L exceeding the SMCL of 300 µg/L, and the maximum level for Manganese was 62.6 µg/L, exceeded the SMCL of 50 µg/L.

Table 5.39

Metal Parameter Review for the Miramar Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Metals		**Mean**	**Mean**	
Barium	µg/L	87.1	105	17.9
Boron	µg/L	114	125	11
Sodium	mg/L	76.7	80.3	3.6

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Metals		**Mean**	**Mean**	
Barium	µg/L	82.4	101	18.6
Boron	µg/L	107	126	19
Magnesium	mg/L	19.4	20.7	1.3
Sodium	mg/L	78	83.3	5.3

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Inorganic Parameters**

  The CSD measured twenty-one Inorganic Parameters at the Miramar WTP influent, and twenty inorganic parameters at the effluent of the Miramar WTP. None of the levels exceeded the MCLs. Inorganic parameters with levels at ND at both the Miramar WTP influent and effluent included Bromate, Total Cyanide, *ortho*-Phosphate and Perchlorate. In addition, the levels of UV 254 Filtered were measured at the Miramar WTP influent.

Table 5.40

Inorganic Parameter Review for the Miramar Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Inorganic Constituents		**Mean**	**Mean**	
Bicarbonate (HCO3)	mg/L	142	131	-11
Bromate (BrO3)	µg/L	ns	0	na
Bromide	mg/L	0.105	0	-0.105
Calcium	mg/L	61.9	59.8	-2.1
Carbonate (CO3)	mg/L	0.091	0.259	0.168
Chloride	mg/L	74.5	84.5	10
Fluoride	mg/L	0.253	0.234	-0.019
Nitrate & Nitrite	mg/L	1.27	1.02	-0.25
Potassium	mg/L	4.07	4.1	0.03
Silica	mg/L	9.04	8.47	-0.57
Sulfate (SO4)	mg/L	170	180	10
Total Nitrogen (TN)	mg/L	0.505	0.412	-0.093
UV254 Filtered	ABS	0.052	0.026	-0.026

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Inorganic Constituents		**Mean**	**Mean**	
Bicarbonate (HCO3)	mg/L	139	128	-11
Calcium	mg/L	63.7	60	-3.7
Carbonate (CO3)	mg/L	0.341	0.517	0.176
Chloride	mg/L	84.6	90.9	6.3
Fluoride	mg/L	0.264	0.236	-0.028
MBAS (Detergents)	mg/L	0.05	0	-0.05
Nitrate & Nitrite	mg/L	1.24	1.02	0
Potassium	mg/L	4.06	4.13	0.07

Silica	mg/L	8.64	8.24	-0.4
Sulfate (SO4)	mg/L	175	180	5
Total Nitrogen (TN)	mg/L	0.865	0.754	-0.111

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Radiological Parameters**

  Miramar WTP influent and effluent were monitored for gross *alpha* and *beta partials* , combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were well below the MCLs.

Table 5.41
Radiological Parameter Review for the Miramar Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Radiological		**Mean**	**Mean**	
alpha Particles	pCi/L	4.01	0	-4.01
beta Particles	pCi/L	4.25	4.45	0.2
Combined Radium-226 & Radium-228	pCi/L	0.615	0	-0.615
Strontium-90	pCi/L	0.493	0	-0.493
Tritium	pCi/L	82.3	0	-82.3
Uranium	pCi/L	3.42	2.36	-1.06

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Radiological		**Mean**	**Mean**	
alpha Particles	pCi/L	ns	0	na
beta Particles	pCi/L	ns	0	na
Combined Radium-226 & Radium-228	pCi/L	ns	0.449	na
Strontium-90	pCi/L	ns	0	na
Tritium	pCi/L	ns	0	na
Uranium	pCi/L	ns	2.16	na

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Regulated and Unregulated Organic Parameters**

The Miramar WTP influent was monitored for both regulated (68) and non-regulated (121) organic constituents including herbicides, pesticides, and synthetic contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5**).

The Miramar WTP TOC levels ranged from 2.12 mg/L, to 3.61 mg/L.

The Miramar WTP influent TTHMs levels ranged from ND to 73.2 µg/L, with a mean value of 24.2 ug/L. The mean TTHM value increased by 22.32 µg/L from the 2005 WSS (**Table 5.42**). There was little change, with the exception of TTHM, in the levels of regulated organic constituents since the 2005 WSS (**Tables 5.41 & 5.42**).

The Miramar WTP effluent was monitored for both regulated (68) and non-regulated organic (120) constituents including herbicides, pesticides, and synthetic contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5**).

The Miramar WTP effluent TOC levels ranged from 1.57 mg/L, to 2.86 mg/L.

The Miramar WTP effluent TTHM levels ranged from 29 µg/L to 88 µg/L, with a mean value of 51.7 ug/L. The mean TTHM value increased by 0.4 µg/L from the 2005 WSS (**Table 5.42**). Total HAA-5 levels ranged from 10.8 to 27.5 µg/L, with a mean value of 17.7 µg/L. The mean HAA-5 value decreased by 4.1 µg/L. The MCL for TTHM is a distribution system RRA of 80.0 µg/L, and the MCL for HAA-5 is a distribution system RAA of 60.0 µg/L. These MCLs are not based on an individual sample, but as a Distribution System RAA Plant effluent samples are not included in the distribution system RAAs.

Table 5.42
Regulated Organic Parameter Review for the Miramar Water Treatment Plant

		Influent (Untreated Raw Water) Data[a]		
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Organic Constituents Regulated		**Mean**	**Mean**	
Bis-(2-ethylhexyl) phthalate	µg/L	0.239	0	-0.239
Bromodichloromethane	µg/L	0.64	6.83	6.19
Bromoform	µg/L	0.126	3.75	3.624
Chlorodibromomethane	µg/L	0.583	8.94	8.357
Chloroform	µg/L	0.568	4.35	3.782
Dibromoacetic acid	µg/L	0	0	0

Dichloroacetic acid	µg/L	0	1.24	1.24
Haloacetic Acids (five) (HAA-5)	µg/L	0.29	3.43	3.14
Methyl-tert-butyl ether	µg/L	0.311	0	-0.311
Total Organic Carbon	mg/L	2.83	2.56	-0.27
Total THMs	µg/L	1.88	24.2	22.32
Trichloroacetic acid	µg/L	0.228	1.35	1.122

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Regulated		**Mean**	**Mean**	
Bis-(2-ethylhexyl) phthalate	µg/L	0.188	0	-0.188
Bromodichloromethane	µg/L	18.5	15.8	-2.7
Bromoform	µg/L	4.22	6.04	1.82
Chlorodibromomethane	µg/L	18.2	18.4	0.2
Chloroform	µg/L	14.8	12.7	-2.1
Dalapon	µg/L	0.177	0	-0.177
Dibromoacetic acid	µg/L	5.52	4.12	-1.4
Dichloroacetic acid	µg/L	8.9	8.25	-0.65
Haloacetic acids (five) (HAA-5)	µg/L	21.8	17.7	-4.1
Methyl-tert-butyl ether	µg/L	0.222	0	-0.222
Monobromoacetic acid	µg/L	0.902	0	-0.902
Monochloroacetic acid	µg/L	0.145	0	-0.145
Total Organic Carbon	mg/L	2.61	2.34	-0.27
Total THMs	µg/L	51.3	51.7	0.4
Trichloroacetic acid	µg/L	6.91	5.10	-1.81

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

Table 5.43
Unregulated Organic Parameter Review for the Miramar Water Treatment Plant

Influent (Untreated Raw Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Unregulated		**Mean**	**Mean**	
1,1,1-Trichloro-2-propanone	µg/L	0.071	ns	na
1,1-Dichloro-2-propanone	µg/L	0.378	ns	na
Bromochloroacetic acid	µg/L	1.11	ns	na
Bromochloroacetonitrile	µg/L	1.32	ns	na
Chloropicrin	µg/L	0.25	ns	na
Dibromoacetonitrile	µg/L	1.56	ns	na
Dichloroacetonitrile	µg/L	0.72	ns	na
Dissolved Organic Carbon (TOC)	mg/L	2.72	2.29	-0.43
Total organic halides	µg/L	21.4	ns	na

Effluent (Treated Water) Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Unregulated		**Mean**	**Mean**	
1,1,1-Trichloro-2-propanone	µg/L	0.17	ns	na
1,1-Dichloro-2-propanone	µg/L	0.472	ns	na
2-Methylisoborneol	ng/L	1.75	1.86	0.11
Bromochloroacetic acid	µg/L	8.84	ns	na
Bromochloroacetonitrile	µg/L	3.36	ns	na
Chlorodibromoacetic acid	µg/L	5.72	ns	na
Chloropicrin	µg/L	0.225	ns	na
Dibromoacetonitrile	µg/L	2.76	ns	na
Dibromochloroacetic acid	µg/L	6.12	ns	na
Dichloroacetonitrile	µg/L	1.46	ns	na
Dissolved Organic Carbon	mg/L	0	2.16	2.16
Total organic halides	µg/L	208	ns	na

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

5.5 Hodges System Water Quality Review

Streams and reservoirs were monitored for general physical, microbiological, organic and inorganic parameters. Since the Hodges System streams and Hodges Reservoir do not directly feed a CSD WTP, they were not monitored for radiation. Standards used in **Appendix 5** apply to treated, potable water, and are for reference only.

Source Water Review

- **General Physical Parameters**

  General/physical source water quality parameters for the Hodges System were within the standards for drinking water except for pH, Color, TDS, Conductivity, and Turbidity. The maximum pH was 8.9, above the SMCL maximum of 8.5. The maximum Turbidity level was 57.1 NTU, where the MCL is 0.5 NTU. The maximum TDS level was 2,160 mg/L exceeding the SMCL of 1000 mg/L. The maximum Conductivity level was 3,160 µS/cm exceeding the SMCL of 1,600 mg/L. The maximum Color level was 95 cu, exceeding the SMCL of 15 cu.

  The water quality is typical of raw water streams and reservoirs in Southern California. Since the streams and reservoirs contain raw water, and the standards are for treated water, the comparison is for reference only. The mean values were used for comparing the water quality data from the 2005 to the 2010 WSS.

Table 5.44

General/Physical Water Quality Parameter Review for the Source Waters of the Hodges System

Stream Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
General Physical		**Mean**	**Mean**	
Conductivity	µS/cm	1910	2000	90
pH	pH	7.88	7.77	-0.11
Total Dissolved Solids (TDS)	mg/L	1310	1340	30
Total Suspended Solids (TSS)	mg/L	26	15.8	-10.2

Reservoir Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
General Physical		**Mean**	**Mean**	
Calcium Hardness (CaCO3)	mg/L	259	179	-80
Color	Color	50.3	35.3	-15

Conductivity	µmho/cm	1860	1570	-290
Total Alkalinity	mg/L	194	188	-6
Total Dissolved Solids (TDS)	mg/L	1040	923	-117
Total Hardness (CaCO3)	mg/L	446	396	50
Turbidity	ntu	9.86	7.66	-2.2
pH	pH	8.31	8.24	-0.07

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Indicator Organisms and Pathogens**

  Streams and Reservoirs of the Hodges System were monitored for *Enterococcus*, *E. coli*, and total coliform to obtain a representation of microbiological conditions. *Enterococcus* levels ranged from <1 /100 mL to 2,400/100 mL, *E. coli* levels ranged from <10 /100 mL to 160,000 /100 mL, and total coliform levels ranged from 41 /100mL to >240,000 /100 mL. Wide ranges in microbiological results are expected in raw water streams and reservoirs. *Cryptosporidium* and *Giardia* were monitored at Hodges Reservoir and all results were ND.

Table 5.45

Indicator Organisms and Pathogens Review for the Source Waters of the Hodges System

Stream Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Indicator Organisms		**Mean**	**Mean**	
Enterococcus	/100 mL	488	480	-8
E Coli	/100 mL	3600	1400	-2200
Total Coliform	/100 mL	24100	20300	-3800

Reservoir Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Indicator Organisms		**Mean**	**Mean**	
Enterococcus	/100 mL	5.43	16.8	11.37
E Coli	/100 mL	12.6	29.3	16.7
Total Coliform	/100 mL	9280	7640	-1640

Pathogens		Mean	Mean	
Cryptosporidium TC	/ L	ns	0	na
Giardia TG	/ L	ns	0	na

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Nutrient Parameters**

  Sources waters of the Hodges System were monitored for TN and *ortho*-Phosphate. The TN levels for streams ranged from ND to 10 mg/L, and *ortho*-Phosphate levels ranged from ND to 2 mg/L. The TN levels at Hodges Reservoir ranged from 0.193 mg/L to 2.68 mg/L, and *ortho*-Phosphate levels ranged from ND to 1.04 mg/L. Mean TN and *ortho*-Phosphate levels for the streams and TN levels for Hodges Reservoir exceeded EPA’s reference concentrations.

Table 5.46
Inorganic Constituents Review for
the Source Waters of the Hodges System

Stream Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Inorganic Constituents		**Mean**	**Mean**	
ortho-Phosphate (PO4)	mg/L	0.307	0.218	-0.089
Total Nitrogen (TN)	mg/L	2.5	1.88	-0.62

Reservoir Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Inorganic Constituents		**Mean**	**Mean**	
ortho- Phosphate (PO4)	mg/L	0	0	0
Total Nitrogen (TN)	mg/L	1.05	1.21	0.16

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as “na” change.

- **Metal Parameters**

  The water samples from the streams in the Hodges System were monitored for seventeen Total and Dissolved Metal Parameters. The samples were filtered before analysis as the Dissolved Metal Parameter. The maximum levels of Aluminum (508 mg/L) and Manganese (5,200 mg/L) from stream samples exceeded the SMCLs of 200 mg/L and 50 mg/L, respectively.

Table 5.47
Metal Parameter Review for
the Source Waters of the Hodges System

		Stream Data[a]		
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Metals		**Mean**	**Mean**	
Aluminum	µg/L	325	107	-218
Dissolved Aluminum	µg/L	57.9	13.6	-44.3
Dissolved Antimony	µg/L	1.39	0	-1.39
Dissolved Arsenic	µg/L	3.76	0	-3.76
Dissolved Barium	µg/L	97.7	66.5	-31.2
Dissolved Beryllium	µg/L	0.8	0	-0.8
Boron	µg/L	143	129	-14
Dissolved Boron	µg/L	140	137	-3
Dissolved Cadmium	µg/L	2.81	0	-2.81
Chromium	µg/L	0.037	0	-0.037
Dissolved Chromium	µg/L	3.57	0	-3.57
Dissolved Copper	µg/L	12	134	122
Dissolved Lead	µg/L	5.63	3.28	-2.35
Manganese	µg/L	191	504	313
Dissolved Manganese	µg/L	141	447	306
Dissolved Nickel	µg/L	8.13	5.56	-2.57
Dissolved Selenium	µg/L	9.15	0	-9.15
Dissolved Thallium	µg/L	0.556	0	-0.556
Vanadium	µg/L	6.5	5.96	-0.54
Dissolved Vanadium	µg/L	16	5.77	-10.23
Dissolved Zinc	µg/L	49.9	17.1	-32.8
		Reservoir Data[a]		
Parameter	**Units**	**2005 WSS[b]**	**2010 WSS[b]**	**Change**
Metals		**Mean**	**Mean**	
Aluminum	µg/L	124	18.4	-105.6
Boron	µg/L	143	132	-11

Iron	µg/L	256	0	-256
Magnesium	mg/L	45.2	52.8	7.6
Manganese	µg/L	389	145	-244
Sodium	mg/L	141	152	11
Vanadium	µg/L	11.7	4.49	-7.21

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as ‘”na” change.

- **Regulated and Unregulated Organic Parameters**

  The source waters of the Hodges System were monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants. Parameter levels in all organic samples were below the MCL and most were ND.
  Stream TOC levels ranged from 0.76 mg/L to 17.5 mg/L, while reservoir TOC levels ranged from 7.72 mg/L to 12.1 mg/L. **Tables 5.48 & 5.49** highlight the changes that have occurred since the 2005 WSS.

Table 5.48

Regulated Organic Parameter Review for the Source Waters of the Hodges System

Stream Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Regulated		**Mean**	**Mean**	
Bis-(2-ethylhexyl) phthalate	µg/L	0.314	0	-0.314
Methyl *tert*-Butyl Ether (MTBE)	µg/L	0.043	0	-0.043
Simazine	µg/L	0.037	0	-0.037
Total Organic Carbon (TOC)	mg/L	6.78	6.23	-0.55

Reservoir Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Regulated		**Mean**	**Mean**	
Bis-(2-ethylhexyl) phthalate	µg/L	0.193	0	-0.193
Methyl-tert-butyl ether	µg/L	1.52	0	-1.52

Xylene, Total	µg/L	0.019	0	-0.019
Toluene	µg/L	0.061	0	-0.061
Total Organic Carbon (TOC)	mg/L	9.97	11	1.03
meta,para-Xylenes	µg/L	0.041	0	-0.041

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 'na" change.

Table 5.49

Unregulated Organic Parameter Review for the Source Waters of the Hodges System

Stream Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Unregulated		**Mean**	**Mean**	
Aldicarb sulfoxide	µg/L	0.028	0	-0.028

Reservoir Data[a]

Parameter	Units	2005 WSS[b]	2010 WSS[b]	Change
Organic Constituents Unregulated		**Mean**	**Mean**	
2-Methylisoborneol	ng/L	ns	6.8	na
tert-Butyl alcohol	µg/L	0.188	0	-0.188

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS = Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as "na" change.