CHAPTER 4: WATER QUALITY ASSESSMENT

Introduction

This chapter contains a summary of the quality of raw and treated water in the Miramar Watershed during the period of January 1, 2001, through December 31, 2005. Following the summary there is an evaluation of the system's ability to comply with current regulations and to meet anticipated future requirements.

The Water Quality Laboratory of the City of San Diego provided monitoring data from Miramar Reservoir, and the Miramar WTP.

Summary Of Monitoring Program

Miramar Reservoir was sampled near the outlet structure at surface level and at various outlet gauges. There also were sampling points at the influent and effluent of the Miramar WTP. See Table 4-4.1 for a summary of the sampling frequency.

The reservoir and treatment plant influent/effluent were monitored for general physical characteristics, organic and inorganic constituents, and radiation. A summary of raw water quality at surface is found in Table 4-4.2. The water quality at the outlet gauges and the treatment plant influent/effluent are summarized in subsequent tables.

Description Of Source Surface Water Quality At Miramar Reservoir

Miramar Reservoir at Surface -

Table 4-4.3 contains a summary of water quality data for Miramar Reservoir at the surface.

General Physical

The monitored physical parameters of Miramar Reservoir at surface were within the standards for drinking water except for turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The turbidity reached a maximum 1.36NTU. Turbidity it did not exceed the SMCL of 5 NTU. Threshold odor was not monitored at surface level.

Inorganic Constituents

There were twenty-eight inorganic constituents measured. The maximum values for Iron exceeded drinking water maximum contaminant levels. Iron average values were below MCL levels. Iron is added in the water treatment process and does not impact the potable drinking water quality.

Microbiological

Total coliform, E. Coli, and Enterococcus were monitored in order to obtain a background representation of microbiological conditions. Total coliforms ranged from <10 /100ml to 20,000 /100ml. The E. Coli range was from <10 /100ml to 130 /100ml, and Enterococcus varied from <1 /100ml to 28/100ml. Cryptosporidium and Giardia were not monitored in the reservoir.

Radiological

Miramar Reservoir was monitored for gross alpha and beta particles, as well as combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were well below the maximum contaminant levels.

Organic Constituents

Miramar Reservoir was monitored for both regulated and non-regulated organic constituents, including herbicides, pesticides, and synthetic contaminants. Only Trihalomethanes (THM), Geosmin and Methyl-isoborneol (MIB) were detected. Geosmin and MIB are monitored for taste and odor and are not regulated. THMs come from Miramar treatment plant filter washing.

Miramar Reservoir at Outlet Gauges

Water quality data at four outlet gauges is summarized in Table 4-4.3. Outlet Gauges were sampled when they were 10 feet or greater under the surface. Gauges measured were ga-51, ga-66, ga-81, and ga-96. The numbers refer to the distance (feet) above the streambed.

General Physical

Samples from all four outlet gauges exceeded the MCL for color, turbidity, and threshold odor. There is some correlation between outlet depth and color, but not with turbidity or odor.

Microbiological

The outlet gauges were measured for Total Coliform, E. Coli, and Enterococcus. All gauges had positive readings. Total coliforms ranged from <10 /100ml to >24,000 /100ml. The E. Coli range was from <10 /100ml to 220 /100ml, and Enterococcus varied from <1 /100ml to 1200 /100ml. This is a common occurrence in raw reservoir water.

Organic Constituents

Total Organic Carbon (TOC), Geosmin, and Methyl Isoborneol (MIB) were monitored at all five outlet gauges. TOC is a precursor to Trihalomethanes, and is monitored in source water. TOC ranged from a

minimum of 2.08 mg/L at gauge 51 to a maximum of 4.37 mg/L at gauge 81. Geosmin and MIB were monitored for aesthetic reasons only. There are no maximum contaminant levels for these three parameters.

Influent to Miramar WTP

Table 4-4.4 contains a summary of water quality data for the influent to the Miramar Water Treatment Plant.

General Physical

The monitored physical parameters of Miramar WTP influent were within the standards for drinking water except for color, odor, pH and turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The maximum pH reading was 8.55, above the SMCL of 6.5 – 8.5. The turbidity reached a maximum 10.6 NTU. The maximum color reading was 39cu, where the SMCL is 15cu. These parameters were easily treated in the Miramar treatment plant.

Microbiological

Total coliform was monitored in order to obtain a background representation of microbiological conditions. Total coliforms ranged from <2 /100ml to 16,000 /100ml. *Cryptosporidium* and *Giardia* were monitored. Neither *Cryptosporidium* or *Giardia* were typically found. *Cryptosporidium* and *Giardia* ranged from <0.1/100L for both to 0.1/100L for *Cryptosporidium* and 0.8/100L for *Giardia*.

Radiological

Miramar WTP influent was monitored for gross alpha and beta particles, as well as combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were well below the maximum contaminant levels.

Inorganic Constituents

There were twenty-eight inorganic constituents measured. Maximum values for Iron and Manganese exceeded the potable water maximum contaminant levels. These constituents were easily treated in the Miramar treatment plant.

Organic Constituents

Miramar WTP influent was monitored for both regulated and non-regulated organic constituents, including herbicides, pesticides, and synthetic contaminants Low levels of Trihalomethanes (THM) were detected. THMs resulted from Miramar plant filter wash water being recycled back to Miramar reservoir. TOC is a precursor to Trihalomethanes, and is monitored in source water. TOC ranged from a minimum of 2.02 mg/L, to a maximum of 5.14 mg/L

Miramar WTP Effluent

Table 4-4.5 contains a summary of water quality data for the Miramar Water Treatment Plant effluent.

General Physical

The monitored physical parameters of Miramar WTP effluent were within the standards for drinking water. The maximum turbidity reading was 0.47. Turbidity is monitored every two hours at the treatment plant and met turbidity requirements.

Microbiological

Total coliform was monitored in order to ascertain compliance with regulations. There were no positive Total coliform samples out of 2410 samples C*ryptosporidium* and *Giardia* were monitored. The range for both was <0.1 /100L to <0.1 /100L.

Inorganic Constituents

Twenty-eight inorganic constituents were monitored, of which none exceeded the maximum contaminant levels.

Organic Constituents

Miramar WTP effluent was monitored for both regulated and non-regulated organic substances, including herbicides, pesticides, and synthetic contaminants. Total THMs (TTHM) ranged from 29.2 to 87.8 ug/L. Compliance is based on a Running Annual Average of distribution system samples. The Miramar system met all TTHM requirements.

Evaluation of Source Water Quality

The sources for the Miramar WTP are Miramar Reservoir, which is largely imported CWA raw water. The influent to Miramar WTP remains relatively constant.

The number of samples showing positive for microorganisms in the source water and the influent is not of concern. It is rare to find raw surface water which does not have microorganisms present. High color and turbidity are also to be expected, since the reservoirs are part of a wildlife habitat.

Evaluation Of System's Ability To Meet Current Drinking Water Standards

The source water is treated at the Miramar WTP to comply with existing drinking water standards. Currently, the system complies with all primary standards. Of the 105 TTHM readings, the maximum was 87.8 µg/L. The system also complies with all secondary standards.

Evaluation Of System's Ability To Meet Current And Anticipated IESWTR And D/Dbp Standards

The Miramar WTP has the ability to meet all current IESWTR And D/DBP standards.

Anticipated Regulations

Stage 2 Disinfectants And Disinfection Byproducts Rule (D/DBP) –

Phase I of the Stage 2 D/DBP rule requires that all water supply systems meet "locational" running annual averages (LRAA) of 120 µg/L for TTHM and 100 µg/L for HAA5 by May 2005. The LRAA for the Miramar system all are within these limits, with a system-wide average of 59.2 µg/L for TTHM, and a system-wide maximum of 42.1 µg/L for HAA5.

Phase II reduces the LRAA to 80 µg/L for TTHM and 60 µg/L for HAA5 in 2012. Phase II also requires water system suppliers to conduct Initial Distribution System Evaluations (IDSE) to select new monitoring sites that more accurately reflect high DBP locations. This evaluation requires water monitoring to be conducted for one year.

Currently the Miramar WTP meets the Phase I standards of the Stage 2 D/DBP rule. For Phase II, the IDSE study will have to be completed to determine the locations of new monitoring sites having the highest TTHM and HAA5 before compliance can be determined. Capital improvement to the Miramar water treatment plant may be required to meet Stage 2 LRAA THM limits.

Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) -

The LT2ESWTR is being developed to provide increased protection against *Cryptosporidium.* This rule incorporates system specific treatment requirements classified into categories, or 'bins', based on the results of the source water *Cryptosporidium* monitoring. Additional treatment requirements depend on the bin to which the system is assigned. Systems will choose technologies to comply with additional treatment requirements from a 'toolbox' of options.

Currently at the Miramar WTP, the system will not require additional treatment, since the average *Cryptosporidium* at Miramar influent is <0.100 /100L.

Arsenic Regulation -

On January 22, 2001, a final rule revised the MCL for Arsenic from 50 µg/L to 10 µg/L. The final rule also clarifies how compliance is demonstrated for many inorganic and organic contaminants in drinking water. The compliance date is five years after the publication of the final rule.

The Miramar WTP complies with the new Arsenic regulation because the maximum Arsenic reading for Miramar WTP effluent was <2 µg/L.

Radionuclides Regulations -

The new Radionuclides Rule went into effect in December 2003. The new rule sets a MCL of 30 mg/L for Uranium and 5 pCi/L for Combined Radium 226/228. It also sets standards of 15 pCi/L for adjusted gross alpha particles and 4 mrem/year for beta particles and photon radioactivity. Compliance with this requirement is assumed if the average concentration of gross beta particle activity is less than 50 pCi/l and if the average concentration of tritium and strontium-90 are less than those listed in Table 4-4.3. The Miramar WTP currently complies with this rule.

Radon Regulation -

The EPA is formulating new regulations concerning Radon. The rule proposes a MCL of 300 pCi/L at the entry point to the distribution system. The EPA is proposing that initial one-year quarterly monitoring should begin three years after publication of the final rule. Radon has not been measured in the Miramar system.

Sulfate Regulation -

The current SMCL range for sulfate is 250 – 500 mg/L. The Miramar WTP currently complies with this regulation, since the maximum sulfate reading for Miramar WTP effluent is 244 mg/L.

Table 4-4.1
RAW WATER QUALITY MONITORING PROGRAM
MIRAMAR TREATMENT PLANT INFLUENT and EFFLUENT, and MIRAMAR RESERVOIR,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]		
	Miramar Reservoir	Miramar WTP Influent	Miramar WTP Effluent
General Physical			
Alkalinity	Q	M[3]	D
Color	Q	D	D
Conductivity	Q	M	M
Corrosivity	Q	M	M
Foaming Agents (MBAS)	A	NS	A
Hardness as $CaCO_3$	Q	M[3]	M
Odor - Threshold	NS[4]	D	D
pH	Q	M	M
Total Dissolved Solids	Q	M	M
Turbidity	Q	D	D
Microbiological			
Total Coliform	W	D	D
E. Coli	W	NS	NS
Enterococcus	W	NS	NS
Cryptosporidium	NS	M	M
Giardia	NS	M	M
Radiological			
Gross Alpha particles	(2)	(2)	NS
Gross Beta particles	(2)	(2)	NS
Combined Radium-226 & Radium-228	(2)	(2)	NS
Strontium-90	(2)	(2)	NS
Tritium	(2)	(2)	NS
Uranium	(2)	(2)	NS
Inorganic Constituents			
Aluminum	Q	M	M
Antimony	Q	Q	Q
Arsenic	Q	Q	Q
Barium	Q	Q	Q
Beryllium	Q	Q	Q
Cadmium	Q	Q	Q
Calcium	Q	M	M
Chloride	Q	M	M
Chromium	Q	Q	Q
Copper	Q	M	M
Cyanide	Q	Q	Q
Fluoride	Q	M	M
Iron	Q	M	M
Lead	Q	M	M
Magnesium	Q	Q	Q
Manganese	Q	M	M
Mercury	Q	Q	Q
Nickel	Q	Q	Q

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2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]		
	Miramar Reservoir	Miramar WTP Influent	Miramar WTP Effluent
Nitrate**	M	M[3]	M[3]
Nitrate + Nitrite**	Q	M[3]	M[3]
Nitrite as Nitrogen	Q	W	W
Phosphate (ortho)**	Q	M	M
Phosphorus (total)**	Q	M	M
Potassium	Q	M	M
Selenium	Q	Q	Q
Silver	Q	Q	Q
Sulfate	Q	M	M
Thallium	Q	Q	Q
Zinc	Q	M	M
Perchlorate	Q	Q	Q
Organic Constituents, Regulated			
1,1,1-Trichloroethane	Q	Q	Q
1,1,2-Trichloro-1,2,2-Trifluoroethane	Q	Q	Q
1,1,2-Trichloroethane	Q	Q	Q
1,1-dichloroethane	Q	Q	Q
1,1-Dichloroethylene	Q	Q	Q
1,2,4-Trichlorobenzene	Q	Q	Q
1,2-dichloroethane	Q	Q	Q
1,2-Dichloropropane	Q	Q	Q
1,4-Dichlorobenzene	Q	Q	Q
2,4,5 TP	Q	Q	Q
2,4-D	Q	Q	Q
Alachlor	Q	Q	Q
Atrazine	Q	Q	Q
Bentazon	Q	Q	Q
Benzene	Q	Q	Q
Benzo(a)pyrene	Q	Q	Q
Bromodichloromethane	Q	W	W
Bromoform	Q	W	W
Carbofuran	Q	Q	Q
Chloramine	Q	Q	Q
Chlordane	Q	Q	Q
Chlorine	Q	Q	Q
Chlorine Dioxide	Q	Q	Q
Chloroform	Q	W	W
cis-1,2-Dichloroethylene	Q	Q	Q
Dalapon	Q	Q	Q
Di(2-ethylhexyl) adipate	Q	Q	Q
Di(2-ethylhexyl) pthalate	Q	Q	Q
Dibromochloromethane	Q	W	W
Dibromochloropropane	Q	Q	Q
Dichloromethane (methylene chloride)	Q	Q	Q

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MIRAMAR TREATMENT PLANT INFLUENT and EFFLUENT, and MIRAMAR RESERVOIR,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]		
	Miramar Reservoir	Miramar WTP Influent	Miramar WTP Effluent
Dinoseb	Q	Q	Q
Diquat	Q	Q	Q
Endrin	Q	Q	Q
Ethylbenzene	Q	Q	Q
Glyphosate	Q	Q	Q
Haloacetic acids (HAA5) (five)	Q	M	W[3]
Heptachlor	Q	Q	Q
Heptachlor epoxide	Q	Q	Q
Hexachlorobenzene	Q	Q	Q
Hexachlorocyclopentadiene	Q	Q	Q
Lindane	Q	Q	Q
Methoxychlor	Q	Q	Q
Methyl tert-Butyl Ether (MTBE)	Q	Q	Q
Molinate	Q	Q	Q
Monochlorobenzene	Q	Q	Q
o-Dichlorobenzene	Q	Q	Q
Oxamyl	Q	Q	Q
Pentachlorophenol	Q	Q	Q
Picloram	Q	Q	Q
Polychlorinated biphenyls (PCBs)	Q	Q	Q
Simazine	Q	Q	Q
Styrene	Q	Q	Q
Tetrachloroethylene	Q	Q	Q
Thiobencarb	Q	Q	Q
Toluene	Q	Q	Q
Total Organic Carbon (TOC)	M	W	W
Total trihalomethanes (TTHM)	Q	W	W
Toxaphene	Q	Q	Q
trans-1,2-Dichloroethylene	Q	Q	Q
Trichloroethylene	Q	Q	Q
Trichlorofluoromethane	Q	Q	Q
Vinyl chloride	Q	Q	Q
Xylenes	Q	Q	Q
Organic Constituents, Unregulated			
Ethyl-tert-Butyl Ether (ETBE)	Q	Q	Q
t-Amyl-methyl ether (TAME)	Q	Q	Q
1,1,1,2-Tetrachloroethane	Q	Q	Q
1,1-Dichloropropene	Q	Q	Q
1,2,3-Trichlorobenzene	Q	Q	Q
1,2,3-Trichloropropane (TCP)	A[3]	Q	Q
1,2,4-Trimethylbenzene	Q	Q	Q
1,3,5-Trimethylbenzene	Q	Q	Q
1,3-Dichlorobenzene	Q	Q	Q
1,3-Dichloropropane	Q	Q	Q
2,2-Dichloropropane	Q	Q	Q

Table 4-4.1
RAW WATER QUALITY MONITORING PROGRAM
MIRAMAR TREATMENT PLANT INFLUENT and EFFLUENT, and MIRAMAR RESERVOIR,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]		
	Miramar Reservoir	Miramar WTP Influent	Miramar WTP Effluent
3-Hydroxycarbofuran	Q	Q	Q
Aldicarb	Q	Q	Q
Aldicarb sulfone	Q	Q	Q
Aldicarb sulfoxide	Q	Q	Q
Aldrin	Q	Q	Q
Bromacil	A	A	A
Bromobenzene	Q	Q	Q
Bromochloromethane	Q	Q	Q
Bromomethane	Q	Q	Q
Butachlor	A	A	A
Carbaryl	Q	Q	Q
Chlorobenzene	Q	Q	Q
Chloroethane	Q	Q	Q
Chloromethane	Q	Q	Q
Dibromomethane	Q	Q	Q
Dicamba	Q	Q	Q
Dichlorodifluoromethane	Q	Q	Q
Dieldrin	Q	Q	Q
Geosmin	M[3]	W	W
Hexachlorobutadiene	Q	Q	Q[6]
Isopropylbenzene	Q	Q	Q[6]
Methomyl	Q	Q	Q[6]
Methyl-isoborneol (MIB)	M[3]	W	W
Metolachlor	A	A	A
Metribuzin	A	A	A
Napthalene	Q	Q	Q
n-Butylbenzene	Q	Q	Q
n-Propylbenzene	Q	Q	Q
Prometryn	A	A	A
Propachlor	Q	Q	Q
sec-Butylbenzene	Q	Q	Q
tert-Butylbenzene	Q	Q	Q

SAMPLING FREQUENCY DESIGNATION
D: Daily
W: Weekly
M: Monthly
Q: Quarterly
A: Annually
NS: Not Sampled

(1) Samples may be taken but not reportable due to instrumentation problems or quality control.
(2) Sample frequency is every four years. The data used in this report was obtained during 2002.
(3) Samples taken twice per month (M[3]), twice per week (W[3]), or twice annually (A[3]).
(4) Sampled at plant effluent and outlet gauges only.

NOTE:
** Denotes the start of a new parameter since the 2000 Sanitary Survey was completed.
Sampling frequency represents current monitoring schedule as of January 2001.

Table 4-4.2
SUMMARY OF RAW WATER QUALITY**
MIRAMAR RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			20	102	133	119	122
Color	cu	1		15	19	nd	10	4.47	4
Conductivity	µS/cm			900-1600	19	840	1130	925	885
Corrosivity[3]	--			non-corrosive	17	-0.03	1.01	0.52	0.6
Foaming Agents (MBAS)	mg/L	.5		0.5	4	nd	nd	nd	nd
Hardness as $CaCO_3$	mg/L	2			21	203	294	243	242
pH	pH			6.5-8.5	18	7.46	8.47	8.12	8.15
Total Dissolved Solids	mg/L	10		500-1000	19	474	568	520	529
Turbidity[2]	nut	0.07	0.5	5	19	0.20	1.36	0.499	0.430
Microbiological									
Total Coliform	/100ml	10	(4)		249	<10	20000	1072	10
Enterococcus	/100ml	1			249	<1	28	1.40	1
E. Coli	/100ml	10			249	<10	130	11.2	10
Radiological									
Gross Alpha particles	pCi/L	3	15		4	nd	3.28	nd	nd
Gross Beta particles	pCi/L	4	50		4	nd	7.71	nd	nd
Combined Radium-226 & Radium-228	pCi/L		5		4	nd	1.93	nd	nd
Strontium-90	pCi/L	2	8		3	nd	nd	nd	nd
Tritium	pCi/L	1000	20000		4	nd	3070	nd	nd
Uranium	pCi/L	2	20		4	2.35	3.40	2.90	3.00
Inorganic Constituents[5]									
Aluminum	µg/L	50	1000	200	21	nd	nd	nd	nd
Antimony	µg/L	6	6		21	nd	nd	nd	nd
Arsenic	µg/L	2	10		21	nd	nd	nd	nd
Barium	µg/L	100	1000		21	nd	nd	nd	nd
Beryllium	µg/L	1	4		20	nd	nd	nd	nd
Cadmium	µg/L	1	5		20	nd	nd	nd	nd
Calcium	mg/L	5			19	46.8	86.4	62.9	62.8
Chloride	mg/L	6.5		250-500	18	63.6	95.4	79.4	82.4
Chromium	µg/L	10	50		21	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	21	nd	nd	nd	nd
Cyanide	µg/L	100	200		13	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		19	0.220	0.336	0.277	0.267
Iron	µg/L	100		300	21	nd	118	nd	nd
Lead	µg/L	5	15		20	nd	nd	nd	nd
Magnesium	mg/L	3			19	6.20	27.8	19.7	20.6
Manganese	µg/L	20		50	21	nd	38.2	nd	nd
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		21	nd	nd	nd	nd
Nitrate	mg/L	2	45		49	nd	nd	nd	nd
Nitrate + Nitrite	mg/L		10		23	0.369	1.48	0.802	0.779
Nitrite as Nitrogen	mg/L	0.4	1		33	nd	nd	nd	nd
Potassium	mg/L	0.5			21	3.25	5.19	4.04	4.09
Selenium	µg/L	5	50		21	nd	nd	nd	nd
Silver	µg/L	10		100	21	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	18	134	216	174	174
Thallium	µg/L	1	2		21	nd	nd	nd	nd
Zinc	µg/L	50		5000	21	nd	nd	nd	nd
Perchlorate	µg/L	5			25	nd	nd	nd	nd

Table 4-4.2
SUMMARY OF RAW WATER QUALITY**
MIRAMAR RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		20	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		20	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-Dichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		20	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		20	nd	nd	nd	nd
1,2-Dichloroethane	µg/L	0.5	.5		20	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		20	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		20	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		19	nd	nd	nd	nd
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		24	nd	nd	nd	nd
Atrazine	µg/L	1	3		26	nd	nd	nd	nd
Bentazon	µg/L	2	18		18	nd	nd	nd	nd
Benzene	µg/L	0.5	1		20	nd	nd	nd	nd
Benzopyrene	µg/L	0.1	.2		18	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			19	0.842	1.70	1.31	1.32
Bromoform	µg/L	0.5			20	nd	0.868	nd	nd
Carbofuran	µg/L	5	18		17	nd	nd	nd	nd
Chlordane	µg/L	0.1	.1		19	nd	nd	nd	nd
Chloroform	µg/L	0.5			20	0.606	1.93	1.34	1.36
cis-1,2-Dichloroethylene	µg/L	0.5	6		20	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		17	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		16	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			20	nd	1.7	1.15	1.17
Dichloromethane (methylene chloride)	µg/L	0.1	5		20	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		18	nd	nd	nd	nd
Endrin	µg/L	0.1	2		37	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		20	nd	nd	nd	nd
Glyphosate	µg/L	25	700		16	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		21	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		21	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		37	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		32	nd	nd	nd	nd
Lindane	µg/L	0.2	.2		19	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		36	nd	nd	nd	nd
Methyl tert-Butyl Ether (MTBE)	µg/L	3	13	5	20	nd	nd	nd	nd
Molinate	µg/L	2	20		14	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		20	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		20	nd	nd	nd	nd
Oxamyl (vydate)	µg/L	20	200		17	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		18	nd	nd	nd	nd
Picloram	µg/L	1	500		18	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	.5		15	nd	nd	nd	nd
Simazine	µg/L	1	4		20	nd	nd	nd	nd
Styrene	µg/L	0.5	100		20	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		20	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	19	nd	nd	nd	nd
Toluene	µg/L	0.5	150		20	nd	nd	nd	nd

Table 4-4.2
SUMMARY OF RAW WATER QUALITY**
MIRAMAR RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Total Organic Carbon (TOC)	mg/L	0.5			80	2.29	4.62	3.04	3.00
Toxaphene	µg/L	1	3		19	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		20	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		20	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		20	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	.5		20	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		20	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether (ETBE)	µg/L	0.3			20	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			20	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			20	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			20	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			11	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			20	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			20	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			20	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			19	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			17	nd	nd	nd	nd
Aldicarb	µg/L	3			16	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			17	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			17	nd	nd	nd	nd
Aldrin	µg/L	0.075			21	nd	nd	nd	nd
Bromacil	µg/L	10			8	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			20	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			20	nd	nd	nd	nd
Bromomethane	µg/L	0.5			20	nd	nd	nd	nd
Butachlor	µg/L	0.38			8	nd	nd	nd	nd
Carbaryl	µg/L	5			17	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
Chloroethane	µg/L	0.5			20	nd	nd	nd	nd
Chloromethane	µg/L	0.5			20	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			20	nd	nd	nd	nd
Dicamba	µg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			20	nd	nd	nd	nd
Dieldrin	µg/L	0.02			21	nd	nd	nd	nd
Geosmin	µg/L	0.003			169	nd	0.086	0.003	nd
Hexachlorobutadiene	µg/L	0.5			20	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			20	nd	nd	nd	nd
Methomyl	µg/L	2			17	nd	nd	nd	nd
Methyl-isoborneol (MIB)	µg/L	.004			165	nd	0.0	nd	nd
Metolachlor	µg/L	10			8	nd	nd	nd	nd
Metribuzin	µg/L	.5			8	nd	nd	nd	nd
Napthalene	µg/L	0.5			36	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			20	nd	nd	nd	nd
Prometryn	µg/L	2			8	nd	nd	nd	nd
Propachlor	µg/L	.1			37	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd

Table 4-4.2
SUMMARY OF RAW WATER QUALITY**
MIRAMAR RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

nd: non-detected at State DLR or MDL if DLR not Available

Table 4-4.3
SUMMARY OF RAW WATER QUALITY**
MIRAMAR RESERVOIR AT OUTLET GAUGES 2001 - 2005

Outlet Gauge	Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
52	**General Physical**									
	Color	cu	1		15	784	nd	19	4.24	4
	Odor - Threshold	Odor	1		3	217	nd	12	2.64	2
	Turbidity[2]	NTU	0.07	0.5	5	248	0.10	1.45	0.383	0.330
	Microbiological									
	Total Coliform	/100ml	10	(3)		249	nd	17000	776	180
	Enterococcus	/100ml	1			249	nd	110	2.1	1
	E. Coli	/100ml	10			249	nd	150	6.1	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			60	2.08	3.75	2.89	2.86
	Geosmin	ng/L	3			170	nd	13.3	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			166	nd	20.5	nd	nd
66	**General Physical**									
	Color	cu	1		15	248	nd	16	4.79	4
	Odor - Threshold	Odor	1		3	223	nd	17	2.63	2
	Turbidity	NTU	0.07	0.5	5	248	0.11	1.21	0.369	0.320
	Microbiological									
	Total Coliform	/100ml	10	(3)		249	nd	>24000	1110	330
	Enterococcus	/100ml	1			249	nd	1200	6.5	1
	E. Coli	/100ml	10			249	nd	63	7.50	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			59	2.21	4.05	2.97	2.94
	Geosmin	ng/L	3			170	nd	36.0	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			166	nd	21.1	nd	nd
81	**General Physical**									
	Color	cu	1		15	234	nd	15	4.89	5
	Odor - Threshold	Odor	1		3	208	nd	12	2.61	2
	Turbidity	NTU	0.07	0.5	5	234	0.09	2.20	0.397	0.340
	Microbiological									
	Total Coliform	/100ml	10	(3)		235	nd	20000	1247	440
	Enterococcus	/100ml	1			235	nd	23	2.4	2
	E. Coli	/100ml	10			235	nd	220	9.9	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			56	2.13	4.37	3.03	3.02
	Geosmin	ng/L	3			166	nd	25.6	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			162	nd	14.7	nd	nd

Table 4-4.3
SUMMARY OF RAW WATER QUALITY**
MIRAMAR RESERVOIR AT OUTLET GAUGES 2001 - 2005

Outlet Gauge	Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
96	**General Physical**									
	Color	cu	1		15	56	1.5	10	4.46	4
	Odor - Threshold	Odor	1		3	48	nd	4	1.62	1.40
	Turbidity	NTU	0.07	0.5	5	56	0.14	1.18	0.371	0.33
	Microbiological									
	Total Coliform	/100ml	10	(3)		56	10	17000	1509	390
	Enterococcus	/100ml	1			56	1	8.40	2.45	2
	E. Coli	/100ml	10			56	10	41	14.4	10
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			14	2.33	3.82	2.92	2.89
	Geosmin	ng/L	3			41	nd	11.7	nd	3.19
	Methyl Isoborneol (MIB)	ng/L	4			40	nd	9.2	nd	nd

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) No more then 5% of distribution system samples can be total coliform positive

nd: non-detected at State DLR or MDL if DLR not Available

Table 4-4.4
SUMMARY OF RAW WATER QUALITY**
MIRAMAR WTP INFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			121	74.3	137	117	117
Color	cu	1		15	1198	nd	38.5	6.23	6
Conductivity	µS/cm			900-1600	1149	636	1190	866	859
Corrosivity[3]	--			non-corrosive	53	0.0	1.04	0.5	0.57
Hardness as $CaCO_3$	mg/L	2			96	182	297	235	235
Odor - Threshold	odor	1		3	1805	1	26	1.5	1.40
pH	pH			6.5-8.5	55	7.62	8.55	8.16	8.17
Total Dissolved Solids	mg/L	10		500-1000	58	422	572	505	504
Turbidity[2]	NTU	0.07	0.5	5	1738	0.12	10.6	0.89	0.73
Microbiological[4]									
Total Coliform	/100ml	2	(4)		1771	nd	16000	129	23
Cryptosporidium	/L	0.1	2 log removal		57	nd	0.1	nd	nd
Giardia	/L	0.1	3 log removal		57	nd	0.8	nd	nd
Radiological									
Gross Alpha particles	pCi/L	3	15		4	nd	5.19	nd	nd
Gross Beta particles	pCi/L	4	50		4	nd	6.55	nd	nd
Combined Radium-226 & Radium-228	pCi/L		5		4	nd	1.72	nd	nd
Strontium-90	pCi/L	2	8		4	nd	nd	nd	nd
Tritium	pCi/L	1000	20,000		4	nd	nd	nd	nd
Uranium	pCi/L	2	20		4	3.31	3.71	3.42	3.32
Inorganic Constituents									
Aluminum	µg/L	50	1000	200	58	nd	778	nd	nd
Antimony	µg/L	6	6		23	nd	n	nd	nd
Arsenic	µg/L	2	10		23	nd	3.84	nd	nd
Barium	µg/L	100	1000		23	nd	118	nd	nd
Beryllium	µg/L	1	4		21	nd	nd	nd	nd
Cadmium	µg/L	1	5		24	nd	nd	nd	nd
Calcium	mg/L	5			57	40.6	90.4	61.9	60.6
Chloride	mg/L	6.5		250-500	67	57.8	91.2	75.6	76.2
Chromium	µg/L	10	50		24	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	58	nd	nd	nd	nd
Cyanide	µg/L	100	200		16	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		56	0.169	0.520	0.253	0.254
Iron	µg/L	100		300	59	nd	535	nd	nd
Lead	µg/L	5	15		57	nd	nd	nd	nd
Magnesium	mg/L	3			57	5.10	34.9	19	20.1
Manganese	µg/L	20		50	58	nd	369	nd	nd
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		24	nd	nd	nd	nd
Nitrate	mg/L	2	45		189	nd	2.80	nd	nd
Nitrate + Nitrite	mg/L		10		100	0.430	2.80	1.27	1.16
Nitrite as Nitrogen	mg/L	0.4	1		244	nd	nd	nd	nd
Potassium	mg/L	0.5			59	3.26	6.58	4.07	3.91
Selenium	µg/L	5	50		23	nd	nd	nd	nd
Silver	µg/L	10		100	23	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	66	110	217	173	173
Thallium	µg/L	1	2		23	nd	nd	nd	nd
Zinc	µg/L	50		5000	57	nd	nd	nd	nd

Table 4-4.4 SUMMARY OF RAW WATER QUALITY** MIRAMAR WTP INFLUENT 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		20	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		20	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-dichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		20	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		20	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	0.5		20	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		20	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		20	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		19	nd	nd	nd	nd
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		23	nd	nd	nd	nd
Atrazine	µg/L	1	3		23	nd	nd	nd	nd
Bentazon	µg/L	2	18		19	nd	nd	nd	nd
Benzene	µg/L	0.5	1		20	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	0.2		19	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			92	nd	3.9	nd	nd
Bromoform	µg/L	0.5			92	nd	1.43	nd	nd
Carbofuran	µg/L	5	18		19	nd	nd	nd	nd
Chlordane	µg/L	0.1	0.1		19	nd	nd	nd	nd
Chloroform	µg/L	0.5			92	nd	3.24	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		20	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		19	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		16	nd	3.82	nd	nd
Dibromochloromethane	µg/L	0.5			65	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		20	nd	nd	nd	nd
Dalapon	µg/L	10	200		18	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		18	nd	nd	nd	nd
Diquat	µg/L	4	20		11	nd	nd	nd	nd
Endrin	µg/L	0.1	2		36	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		19	nd	nd	nd	nd
Glyphosate	µg/L	25	700		18	nd	nd	nd	nd
Heptachlor	µg/L	0.01	0.01		18	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	0.01		19	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		36	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		32	nd	nd	nd	nd
Lindane	µg/L	0.2	0.2		19	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		36	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	20	nd	nd	nd	nd
Molinate	µg/L	2	20		13	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		20	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		20	nd	nd	nd	nd
Oxamyl	µg/L	20	200		19	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		18	nd	nd	nd	nd
Picloram	µg/L	1	500		19	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	0.5		18	nd	nd	nd	nd
Simazine	µg/L	1	4		20	nd	nd	nd	nd
Styrene	µg/L	0.5	100		20	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	19	nd	nd	nd	nd
Toluene	µg/L	0.5	150		20	nd	nd	nd	nd
Total Organic Carbon (TOC)	µg/L	0.5	80		272	2.02	5.14	2.84	2.8

Table 4-4.4
SUMMARY OF RAW WATER QUALITY**
MIRAMAR WTP INFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
Toxaphene	µg/L	1	3		19	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		20	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		20	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		20	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	0.5		20	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		20	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			20	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			20	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			20	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			20	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			22	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			20	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			20	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			20	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			20	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			19	nd	nd	nd	nd
Aldicarb	µg/L	3			19	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			19	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			18	nd	nd	nd	nd
Aldrin	µg/L	0.075			19	nd	nd	nd	nd
Bromacil	µg/L	10			6	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			20	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			20	nd	nd	nd	nd
Bromomethane	µg/L	0.5			20	nd	nd	nd	nd
Butachlor	µg/L	0.38			5	nd	nd	nd	nd
Carbaryl	µg/L	5			19	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
Chloroethane	µg/L	0.5			20	nd	nd	nd	nd
Chloromethane	µg/L	0.5			20	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			20	nd	nd	nd	nd
Dicamba	µg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			19	nd	nd	nd	nd
Dieldrin	µg/L	0.02			19	nd	nd	nd	nd
Geosmin	µg/L	0.003			254	nd	0.012	nd	nd
Hexachlorobutadiene	µg/L	0.5			20	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			20	nd	nd	nd	nd
Methomyl	µg/L	2			19	nd	nd	nd	nd
Methyl Isoborneol (MIB)	µg/L	.004			249	nd	0.019	nd	nd
Metolachlor	µg/L	10			6	nd	nd	nd	nd
Metribuzin	µg/L	0.5			6	nd	nd	nd	nd
Napthalene	µg/L	0.5			36	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			20	nd	nd	nd	nd
Prometryn	µg/L	2			6	nd	nd	nd	nd
Propachlor	µg/L	0.1			36	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd

Table 4-4.4
SUMMARY OF RAW WATER QUALITY**
MIRAMAR WTP INFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A plus quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

nd: non-detected at State DLR or MDL if DLR not Available

Table 4-4.5
SUMMARY OF RAW WATER QUALITY
MIRAMAR WTP EFFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			58	95.4	133	115	115
Color	cu	1		15	57	nd	5	1.8	2
Conductivity	µS/cm			900-1600	58	754	1100	917	902
Corrosivity[3]	--			non-corrosive	56	-0.12	1.07	0.6	0.67
Hardness as $CaCO_3$	mg/L	2			58	181	276	241	246
Odor - Threshold	odor	1		3	1805	nd	1	nd	nd
pH	pH			6.5-8.5	60	7.62	8.61	8.18	8.24
Total Dissolved Solids	mg/L	10		500-1000	58	430	595	519	515
Turbidity[2]	NTU	0.07	0.5	5	598	nd	0.47	0.089	0.090
Microbiological[4]									
Total Coliform	/100ml		(4)		2410	nd	nd	nd	nd
Cryptosporidium	/L	0.1	2 log removal		2	nd	nd	nd	nd
Giardia	/L	0.1	3 log removal		2	nd	nd	nd	nd
Inorganic Constituents[5]									
Aluminum	µg/L	50	1000	200	58	nd	nd	nd	nd
Antimony	µg/L	6	6		21	nd	nd	nd	nd
Arsenic	µg/L	2	10		21	nd	nd	nd	nd
Barium	µg/L	100	1000		21	nd	120	nd	nd
Beryllium	µg/L	1	4		19	nd	nd	nd	nd
Cadmium	µg/L	1	5		21	nd	nd	nd	nd
Calcium	mg/L	5			57	40.8	86.8	63.6	64.3
Chloride	mg/L	6.5		250-500	67	66.5	104	84.6	86.0
Chromium	µg/L	10	50		20	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	58	nd	nd	nd	nd
Cyanide	µg/L	100	200		17	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		56	0.181	0.520	0.264	0.265
Iron	µg/L	100		300	58	nd	131	nd	nd
Lead	µg/L	5	15		58	nd	nd	nd	nd
Magnesium	mg/L	3			57	4.5	28.0	19.4	20.6
Manganese	µg/L	20		50	58	nd	nd	nd	nd
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		21	nd	nd	nd	nd
Nitrate	mg/L	2	45		186	nd	2.66	nd	nd
Nitrate + Nitrite	mg/L		10		98	0.404	2.66	1.24	1.14
Nitrite as Nitrogen	mg/L	0.4	1		235	nd	nd	nd	nd
Potassium	mg/L	0.5			59	3.16	6.76	4.06	3.95
Selenium	µg/L	5	50		21	nd	nd	nd	nd
Silver	µg/L	10		100	21	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	66	111	244	175	175
Thallium	µg/L	1	2		21	nd	nd	nd	nd
Zinc	µg/L	50		5000	57	nd	nd	nd	nd
Perchlorate	ug/L	5			37	nd	5.47	nd	nd
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		21	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		21	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		21	nd	nd	nd	nd

Table 4-4.5
SUMMARY OF RAW WATER QUALITY
MIRAMAR WTP EFFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
1,1-dichloroethane	µg/L	0.5	5		21	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		21	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		21	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	0.5		21	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		21	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		21	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		19	nd	nd	nd	nd
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		24	nd	nd	nd	nd
Atrazine	µg/L	1	3		25	nd	nd	nd	nd
Bentazon	µg/L	2	18		19	nd	nd	nd	nd
Benzene	µg/L	0.5	1		21	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	0.2		19	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			105	nd	31.5	17.2	17.2
Bromoform	µg/L	0.5			105	0.9	10.6	3.85	3.34
Carbofuran	µg/L	5	18		20	nd	nd	nd	nd
Chlordane	µg/L	0.1	0.1		19	nd	nd	nd	nd
Chloroform	µg/L	0.5			110	5.0	37.2	13.5	14.4
cis-1,2-Dichloroethylene	µg/L	0.5	6		21	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		20	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		16	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		21	nd	nd	nd	nd
Dalapon	µg/L	10	200		17	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		18	nd	nd	nd	nd
Diquat	µg/L	4	20		11	nd	nd	nd	nd
Endrin	µg/L	0.1	2		37	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		16	nd	nd	nd	nd
Glyphosate	µg/L	25	700		18	nd	nd	nd	nd
Haloacetic Acids (five) [5]	µg/L	0.5	60		16	15.4	38.7	23.0	21.8
Heptachlor	µg/L	0.01	0.01		19	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	0.01		20	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		38	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		31	nd	nd	nd	nd
Lindane	µg/L	0.2	0.2		19	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		37	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	27	nd	nd	nd	nd
Molinate	µg/L	2	20		18	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		21	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		21	nd	nd	nd	nd
Oxamyl	µg/L	20	200		19	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		18	nd	nd	nd	nd
Picloram	µg/L	1	500		19	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	0.5		18	nd	nd	nd	nd
Simazine	µg/L	1	4		22	nd	nd	nd	nd
Styrene	µg/L	0.5	100		21	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	19	nd	nd	nd	nd
Toluene	µg/L	0.5	150		21	nd	nd	nd	nd
Total Trihalomethanes(TTHM)[6]	mg/L	0.5			105	29.2	87.8	51.3	51.1
Total Organic Carbon (TOC)	µg/L	0.5	80		224	1.82	6.51	2.60	2.53
Toxaphene	µg/L	1	3		19	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		21	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		21	nd	nd	nd	nd

Table 4-4.5
SUMMARY OF RAW WATER QUALITY
MIRAMAR WTP EFFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
Trichlorofluoromethane	µg/L	5	150		21	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	0.5		21	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		21	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			21	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			21	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			21	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			21	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			22	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			21	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			21	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			21	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			21	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			19	nd	nd	nd	nd
Aldicarb	µg/L	3			19	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			19	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			18	nd	nd	nd	nd
Aldrin	µg/L	0.075			20	nd	nd	nd	nd
Bromacil	µg/L	10			6	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			21	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			21	nd	nd	nd	nd
Bromomethane	µg/L	0.5			21	nd	nd	nd	nd
Butachlor	µg/L	0.38			5	nd	nd	nd	nd
Carbaryl	µg/L	5			19	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
Chloroethane	µg/L	0.5			21	nd	nd	nd	nd
Chloromethane	µg/L	0.5			21	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			21	nd	nd	nd	nd
Dicamba	µg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			21	nd	nd	nd	nd
Dieldrin	µg/L	0.02			20	nd	nd	nd	nd
Geosmin	µg/L	0.003			156	nd	0.008	nd	nd
Hexachlorobutadiene	µg/L	0.5			21	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			21	nd	nd	nd	nd
Methomyl	µg/L	2			19	nd	nd	nd	nd
Methyl Isoborneol (MIB)	µg/L	0.004			151	nd	0.020	nd	nd
Metolachlor	µg/L	10			6	nd	nd	nd	nd
Metribuzin	µg/L	0.5			6	nd	nd	nd	nd
Napthalene	µg/L	0.5			36	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			21	nd	nd	nd	nd
Prometryn	µg/L	2			6	nd	nd	nd	nd
Propachlor	µg/L	0.1			38	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd

Table 4-4.5
SUMMARY OF RAW WATER QUALITY
MIRAMAR WTP EFFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

(5) Haloacetic acids (five) is the sum of the concentrations of mon-, di-, and trichloroacetic acids and mono- and dibromoacetic acids. MCL based on Annual Average

(6) Total trihalomethanes is the sum of the concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform. MCL based on Annual Average

nd: non-detected at State DLR or MDL if DLR not Available

nd: non-detected at State DLR or MDL if DLR not Available

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of the key conclusions from this survey and recommendations to improve watershed protection and enhance drinking water quality.

Conclusions

Watershed And Water Supply System -

The watershed is within San Diego City limits. The City owns the majority of the land within the watershed. The remaining land is privately owned. This ownership pattern allows the City to control and implement watershed control efforts in coordination with the citizens of San Diego.

Most of the watershed lands support residential usage. Potential contamination sources include many nonpoint sources, which are more difficult to control than point sources.

The terrain is generally characterized as gentle to moderate slopes with approximately 59% of the watershed having slopes less than 15 degrees. The soils have generally high erosion potential. Rainfall is very low, with approximately 17 inches annually. The runoff from the residential areas is diverted from Miramar Reservoir and is minimally impacted by runoff.

The local water minimally influences the treatment requirements and the quality of water produced by the Miramar water treatment plant. Future infrastructure may allow transfer of water from Hodges Reservoir to Miramar Reservoir. Water transferred from Hodges to Miramar Reservoir will have a significant impact on the water quality supplied to the Miramar WTP. The City has a policy of maximizing the use of local water. This policy minimizes the purchase of imported water.

Potential Contamination Sources in the Watershed -

Potential significant sources of contamination include soil erosion, launching ramp runoff, and discharge of filter backwash and sludge from the Miramar WTP.

Watershed Management and Control Practices -

The City exercises a number of management practices or controls within the watershed. City personnel patrol Miramar Reservoir on a routine basis. The area around the reservoir has informational signs alerting the public about ways to protect the quality of the water.

Water Quality Conditions -

Reservoir raw water quality monitoring indicates few constituents may be of concern. The constituents include turbidity, coliforms and MTBE. Removal of MTBE from gasoline and replacing of 2-stoke rental boat motors with 4-stroke motors has minimized MTBE as a concern. Turbidity and coliforms are at levels treatable in the Miramar WTP.

Recommendations

General Recommendations -

Recommendations and corrective actions were developed for the purpose of improving overall watershed protection and drinking water quality. Generally, the recommendations strengthen this first barrier to water quality degradation – protection of source watershed. By strengthening this first barrier, impacts on the second barrier – water treatment – may be reduced. This will be of significance in the event that Hodges Reservoir water becomes available to Miramar WTP.

The Miramar Water Treatment Plant is effective at treating the raw water to meet current federal and state drinking water regulations. Requirements of the Stage 2 Disinfectants and Disinfection Byproducts Rule promulgated in January 2006 modify distribution system monitoring and compliance criteria. Current treatment plant process and raw water quality make compliance with the Stage 2 rule difficult. Continued protection of the watershed is important in meeting drinking water quality regulations.

The recommendations provided are grouped by the following subjects:

- Watershed Management and Control Practices
- Public Education

Water Quality Monitoring and Evaluation -

During the 2001 – 2005 time period watersheds monitoring was significantly increased. The City should continue monitoring the watersheds. The baseline data for many parameters has been collected.

Additional evaluation of the data should be used to provide guidance on actions necessary to protect the watersheds. As with any monitoring program, the program should be evaluated to help ensure the necessary data is being obtained while conserving laboratory resources.

The monitoring program should place emphases on obtaining information necessary to assisting City and non-City forces efforts to protect the watershed. Continued interaction with all interested parties is necessary to continually improve the monitoring program.

Watershed Management and Control Practices -

Continue to reduce the impacts from the public. Impacts can be minimized by continued reservoir monitoring by City staff and working closely with the public to keep them informed about the importance of clean water.

Public Education -

Public education material has been developed for trail and reservoir usage. Maintaining the educational material in readily available locations will help educate the public to the importance of protecting the watershed. The material should be periodically reviewed to ensure it is accurate and appropriate.

Residents within the watershed have a significant impact on protecting the watershed. Educational programs should emphasize what residents can do to help protect the watershed and how protecting the watershed provides them great benefits.

Keeping the public involved will help ensure Miramar Reservoir maintains high quality water.