

## Introduction

This water quality monitoring fact sheet was prepared by the Irrigated Agriculture Program of the Central Coast Regional Water Quality Control Board (Water Board) and made available on November 30, 2008. The data were delivered by Central Coast Water Quality Preservation, Inc. (CCWQP) to the Water Board as part of the monitoring and reporting requirements for all dischargers enrolled under *Conditional Waiver of Waste Discharge Requirements for Discharge from Irrigated Lands, Order No. R3-2004-0117*. Monitoring stations were selected to represent water quality in predominantly agricultural areas, but in some cases reflect mixed land uses upstream of the sites.

## 312SMA Santa Maria River above Estuary

The Cooperative Monitoring Program sampled Santa Maria River above Estuary 36 times (one sample per month) between January 2005 and December 2007.

## Summary of Water Quality Data

### Notable Measured Analytes for Water Quality Monitoring

Analyte/Parameter	Average	Range	Water Quality Criteria (WQC) or Guideline <sup>1</sup>	Percent Outside WQC or Guideline
Ammonia as N, Unionized	0.013 mg/L	0.001–0.059 mg/L	<0.025 mg/L <sup>+</sup>	11%
Nitrate/Nitrite as N	30.7 mg/L	3.1–56 mg/L	<10.0 mg/L*	93%
Orthophosphate as P	0.29 mg/L	0.00–1.78 mg/L	<0.12 mg/L*	81%
Turbidity (NTU)	422 NTU	39–3000 NTU	<25 NTU*	100%
Conductivity	2.46 mmho/cm	0.00–3.30 mmho/cm	Ranges: <sup>+</sup> <0.75 No Problem 0.75-3.0 Increasing >3.0 Severe	% In Range: 6% 83% 11%
pH	7.9	7.5–8.4	7.0–8.3 <sup>+</sup>	6%
Annual Median Dissolved Oxygen (% Saturation)	2005: 96% 2006: 102% 2007 99%	8–123%	>85% annual median <sup>+</sup>	Std met Std met Std met
Dissolved Oxygen	11.7 mg/L	7.8–86.9 mg/L	>5.0mg/L (GEN/WARM) <sup>+</sup> >7.0mg/L (COLD/SPWN) <sup>+</sup>	0% 0%
Chlorophyll a	3.5 µg/L	0.9–44.4 µg/L	<40 µg/L*	3%
Water Temperature	17.6°C	11.5–23.4°C	Water Basin Specific	--

+ Indicates standard defined in the Water Quality Control Plan, Central Coast Basin (Basin Plan)

\* Indicates guideline not described in the Basin Plan or not specifically stated as applicable to the beneficial uses of the site. Origin of the guideline is described in the individual discussion of the analyte/parameter.

The present and potential beneficial uses for **Santa Maria River** as defined in the Basin Plan include Municipal and Domestic Supply (MUN), Agricultural Supply (AGR), Industrial Process Supply (IND), Ground Water Recharge (GWR), Water Contact Recreation (REC-1), Non-Contact Water Recreation (REC-2), Wildlife Habitat (WILD), Cold Fresh Water Habitat (COLD), Warm Fresh Water Habitat (WARM), Migration of Aquatic Organisms (MIGR), Rare, Threatened, or Endangered Species (RARE), Freshwater Replenishment (FRESH), Commercial and Sport (COMM).

<sup>1</sup> Water Quality Criteria (WQC) are defined in the Water Quality Control Plan, Central Coast Basin (also referred to as the “Basin Plan”) to protect beneficial uses such as drinking water, fish habitat, irrigation water, etc. WQC include general water quality standards for some analytes as well as specific criteria based on the defined beneficial uses. Other water quality guidelines were compiled to provide a standard in order to compare sites. Bold indicates beneficial uses that apply to this watershed.

## Unionized Ammonia (as N)

Unionized ammonia (as N) is a calculated value based on water temperature, pH, and total ammonium concentration. Ammonia can be toxic in water. With high water temperature and/or high pH, ammonia becomes unionized and is toxic at much lower levels. The Basin Plan general water quality objectives state that unionized ammonia should not exceed 0.025 mg/L. Over time, ammonia should reduce to nitrate, so long-lasting levels of ammonia may indicate continuous discharges of waste. **Four of 36 samples (11%) exceeded the standard. All exceedances were between August and September. The average unionized ammonia concentration was 0.013 mg/L.**

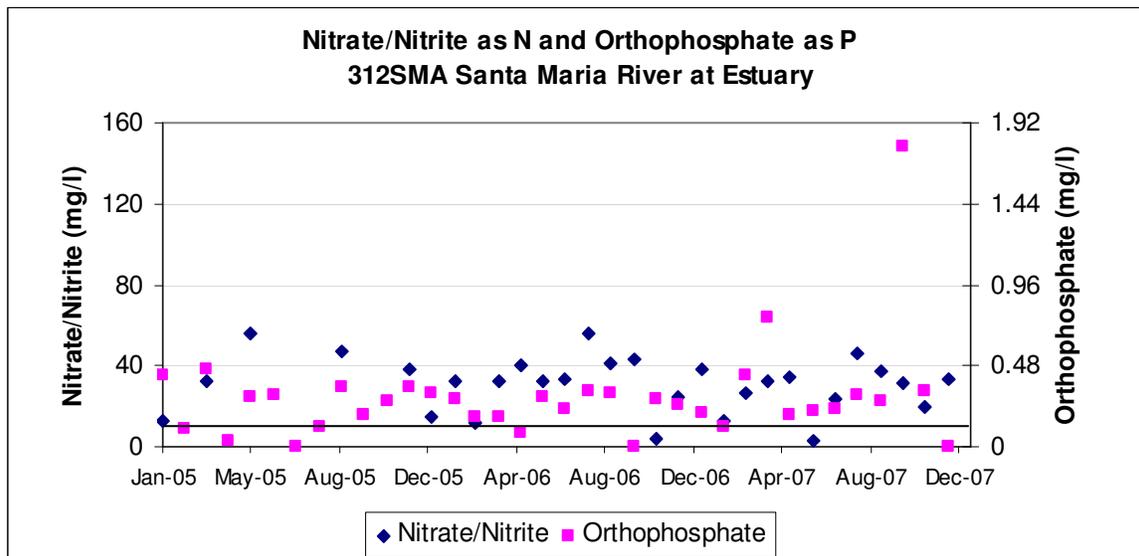
## Nitrate/Nitrite as N

The Municipal and Domestic Supply (MUN) objective states in Table 3-2 of the Basin Plan that nitrate as  $\text{NO}_3$  shall not exceed 45 mg/L. This value is equivalent to 10 mg/L of nitrate as N. Nitrite accounts for a small percent of total nitrate/nitrite, and therefore, nitrate as N criterion was used as a guideline for nitrate/nitrite. **Twenty-seven of 29 nitrate/nitrite samples (93%) exceeded the guideline. The average concentration was 30.7 mg/L (three times the guideline).**

## Orthophosphate as P

The Basin Plan does not contain orthophosphate standards. The Central Coast Ambient Monitoring program (CCAMP) non-regulatory guideline for general water quality objectives states that orthophosphate concentrations shall not exceed 0.12 mg/L. **Orthophosphate concentrations exceeded the guideline in 29 of 36 samples (81%), reaching 1.78 mg/L (nearly 15 times the guideline). The average concentration was 0.29 mg/L. However, the standard deviation was 0.30 mg/L, indicating extreme (high and low) values.**

The chart below shows the nitrate/nitrite and orthophosphate concentrations throughout the sampling period. The guidelines for nitrate/nitrite as N and orthophosphate as P state that their concentrations shall not exceed 10 mg/L and 0.12 mg/L, respectively, shown by the black horizontal line on the graph.



## Turbidity

The Basin Plan states: “Water shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.” Sigler et al.<sup>2</sup> shows that turbidity levels of 25 NTU or greater caused reduction in juvenile salmonid growth due to interference with their ability to find food. Turbidity is often affected by suspended material in runoff. **All 35 turbidity readings exceeded the guideline. Turbidity levels in the Santa Maria River at the Estuary averaged 422 NTU, ranging from 39 NTU to over 3000 NTU. No samples measured below 25 NTU, but 77% of samples remained below 200 NTU. Fourteen percent of the samples were above 1000 NTU.**

<sup>2</sup> Sigler, J.W., T.C. Bjornn, & F.H. Everst. (1984). *Effects of chronic turbidity on density and growth of steelhead and coho salmon*. Transactions of the American Fisheries Society. 113:142-150.

## Conductivity

Conductivity is measured from a water sample. Based on Table 3-3 of the Basin Plan showing Guidelines for Interpretation of Quality of Water for Irrigation, conductivity below 0.75 mmho/cm causes no problems to irrigation, between 0.75 and 3 mmho/cm causes increasing problems, and conductivity above 3 mmho/cm causes severe problems. The conductivity level can be greatly affected by geologic and biological influences and is not necessarily related to agricultural activities. **Two of 35 conductivity samples (6%) indicated no problems to irrigation water; 29 samples (83%) indicated increasing problems; four samples (11%) indicated severe problems.**

## pH

Multiple beneficial uses have objectives for pH. The Basin Plan general water quality objective for pH is between 7.0 and 8.5; MUN, AGR, REC-1, and REC-2 pH objectives are between 6.5 and 8.3. The standard, therefore, is 7.0-8.3 if one or more of MUN, AGR, REC-1, and REC-2 is defined as a beneficial use. pH above 9 can cause skin irritant to humans and makes water inhospitable to many species. **Two of 35 pH samples (6%) exceeded the standard, with pH levels ranging from 7.5 to 8.4.**

## Dissolved Oxygen Concentration and Dissolved Oxygen Saturation

The Basin Plan general water quality objectives state annual median dissolved oxygen shall remain above 85% saturation. General and WARM objectives state that the dissolved oxygen concentration must remain above 5.0 mg/L at all times, and SPWN and COLD objectives state that the dissolved oxygen concentration must remain above 7.0 mg/L at all times. **All 35 samples met the general and WARM and the COLD and SPWN concentration standards. Dissolved oxygen met the saturation standard during 2005, 2006 and 2007, with median annual values of 96, 102, and 99% saturation, respectively. Saturation values ranged from 8 to 123% saturation.**

**Though no standards have been set in the Basin Plan regarding dissolved oxygen supersaturation (>100%), studies have shown that supersaturation of gases may cause gas bubble trauma in fish<sup>3</sup>. Dissolved gas saturation levels were not collected at this site; however, oxygen levels reached 123% saturation, which may indicate dissolved gas supersaturation.**

## Chlorophyll a

Healthy and appropriate Chlorophyll a levels are not defined in the Basin Plan. Chlorophyll indicates phytoplankton growth, a necessary component of healthy water bodies. Because turbidity causes interference for the Chlorophyll a probe, measurements of Chlorophyll a may not be accurate when turbidity is above 1000 NTU. Chlorophyll a levels over 40 µg/L are considered problematic by North Carolina Administrative Code (NCAC). **One of 35 Chlorophyll a readings (3%) exceeded the guideline (January 2005 – 44.47 µg/L). The readings averaged 3.5 µg/L.**

## Temperature

Sullivan et al.<sup>4</sup> state that the maximum weekly average temperatures for protection of steelhead or rainbow trout, and coho salmon are 19.6 and 19.7°C, respectively. **The temperature averaged 17.6°C and ranged from 11.5 to 23.4°C. Though weekly averages were not taken, the temperatures taken at this site indicate averages that may regularly exceed the maximum temperatures for fish protection.**

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<sup>3</sup> Mesa, M.G., L.K. Weiland, & A.G. Maule. (2000). *Progression and severity of gas bubble trauma in juvenile salmonids*. Transactions of the American Fisheries Society. 129:174-185.

<sup>4</sup> Sullivan, K., D.J. Martin, R.D. Cardwell, T.E. Toll, & S. Duke. (2000). *An analysis of the effects of temperature on salmonids of the Pacific Northwest with implications for selecting temperature criteria*. Portland, OR: Sustainable Ecosystems Institute.

## Summary of Toxicity Data

### Species with Significant Mortality

	Feb-05	Mar-05	Apr-05	Jul-05	Sep-05	Feb-06	May-06	Aug-06	Sep-06	Feb-07	Mar-07	Apr-07	Oct-07
Invertebrate (Water Column)	No	Yes <sup>-</sup>		Yes <sup>-</sup>		Yes <sup>&amp;</sup>		Yes <sup>+</sup>	Yes	No*	Yes		Yes
Invertebrate (Sediment)			Yes		Yes		Yes					Yes	
Fish (Water Column)	No	No				No		No	No	No*	No*		No
Algae (Water Column)	No	No				No		No	No	No	No		No

<sup>+</sup>Indicates complete mortality within 24 hours of test initiation

<sup>-</sup>Indicates complete mortality within 48 hours of test initiation

<sup>&</sup>Indicates complete mortality within 96 hours of test initiation

\*Indicates significant effect on growth or reproduction (even though mortality did not have a significant effect)

Significant effect is determined by statistically significant rates of mortality, growth, or reproduction compared to a control sample and provides an indication that something is affecting plant or animal life in the stream. Invertebrates show significant sensitivity to organophosphates and pesticides. Significant effect to algae often indicates the presence of herbicides and metals such as copper. Fish are less sensitive to organophosphates but can be impacted by other pollutants such as ammonia and pyrethroid pesticides.

### Photos of Site



February 2006



July 2006

### QAQC

The data in this water quality monitoring fact sheets meet the quality assurance and quality control requirements of the Water Board's Surface Water Ambient Monitoring Program (SWAMP). Additional surface water monitoring data are available at the Water Board's Central Coast Ambient Monitoring Program website <http://www.ccamp.org>. Any questions regarding the data or analysis should be directed to either **Peter Meertens** at [pmeertens@waterboards.ca.gov](mailto:pmeertens@waterboards.ca.gov) (805) 549-3869 or **Amanda Bern** at [abern@waterboards.ca.gov](mailto:abern@waterboards.ca.gov) (805) 594-6197.

### Attachment: Monitoring Data

Site Tag	Santa Maria River above Estuary													
312 SMA	Beneficial Uses: GWR, WILD, SPWN, REC1, REC2, WARM, BIOL, MIGR, RARE, SHELL, COMM, EST, GEN													
		Ammonia as N, Unionized	Chlorophyll a	Conductivity	Instantaneous Flow	Nitrate/Nitrite as N	N / STD	Orthophosphat e as P	OP / STD	Oxygen, Dissolved	Oxygen, Saturation	pH	Turbidity	Water Temp
Units		mg/L	µg/L	mmho/cm	CFS	mg/L	none	mg/L	none	mg/L	%		NTU	°C
1/27/2005	Jan-05	0.0125	44.37	1.788	30.8	12.3	1.2	0.42	3.5	10.05	92	7.86	94	11.5
2/21/2005	Feb-05	0.0125	16.01	0.69				0.101	0.8	8.05	79	7.97	2839	15.6
3/22/2005	Mar-05	0.0122	7.52	1.27		32	3.2	0.46	3.8	8.47	84	7.82	3000	14.8
4/19/2005	Apr-05	0.0062	2.3	2.969	19.3			0.038	0.3	10.47	123	7.76	139	23.0
5/24/2005	May-05	0.0135	1.17	2.867	12.6	56	5.6	0.29	2.4	9.34	103	8.09	85	19.6
6/21/2005	Jun-05	0.0154	1.3	2.387	12.2			0.31	2.6	8.65	96	8.01	216	19.9
7/26/2005	Jul-05	0.0125	2.09	2.349	13.3			0.001	0.0	8.77	90	7.51	217	16.0
8/31/2005	Aug-05	0.0357	1.36	2.861	11.6			0.116	1.0	8.1	96	7.90	88	22.8
9/27/2005	Sep-05	0.0512	1.18	3.254	12.2	47.2	4.7	0.357	3.0	8.95	101	8.02	70	21.0
10/25/2005	Oct-05	0.0051	1.31	3.298	3.7			0.188	1.6	9.04	91	7.83	41	15.4
11/29/2005	Nov-05	0.00479	1.35	3.114	8.6			0.272	2.3	10.4	103	7.95	72	14.9
12/15/2005	Dec-05	0.0068	0.93	2.984	6.4	37.8	3.8	0.348	2.9	11.02	103	7.77	74	12.1
1/26/2006	Jan-06	0.0039	1.95	1.369	26.1	14.8	1.5	0.32	2.7	12.67	118	8.33	48	12.2
2/24/2006	Feb-06	0.0054	2.09	2.713	12.4	32.6	3.3	0.281	2.3	10.12	106	8.07	191	17.5
3/30/2006	Mar-06	0.00119	3.14	2.418	19.2	11.6	1.2	0.171	1.4	10.51	105	7.73	124	14.3
4/27/2006	Apr-06	0.0125			15.2	32	3.2	0.179	1.5					
5/15/2006	May-06	0.0059	1.68	2.98	11.5	40	4.0	0.085	0.7	9.73	107	8.02	75	19.4
6/28/2006	Jun-06	0.006	2.12	3.087	15.2	32.5	3.3	0.293	2.4	8.37	88	7.52	91	16.8
7/26/2006	Jul-06	0.0135	4.13	2.724	22.5	33.8	3.4	0.223	1.9	7.78	92	7.93	111	22.7
8/23/2006	Aug-06	0.055	1.67	2.79	12.0	55.8	5.6	0.33	2.8	8.43	91	8.07	133	18.8
9/27/2006	Sep-06	0.0125	1.61	2.544	10.7	40.9	4.1	0.32	2.7	9.79	101	8.01	190	16.5
10/25/2006	Oct-06	0.0167	1.09	2.913	6.4	43.2	4.3	0.001	0.0	8.87	102	8.35	62	21.8
11/15/2006	Nov-06	0.0015	1.49	2.454	9.9	3.84	0.4	0.285	2.4	9.16	96	7.98	185	17.4
12/14/2006	Dec-06	0.0125	1.04	2.728	7.0	24.1	2.4	0.249	2.1	9.84	103	8.00	39	17.3
1/30/2007	Jan-07	0.0125	1.62	2.929	9.0	38.6	3.9	0.206	1.7	10.01	98	7.93	53	14.2
2/14/2007	Feb-07	0.0039	0.98	2.245	8.8	12.6	1.3	0.122	1.0	10.57	111	7.78	66	17.7
3/21/2007	Mar-07	0.0039	1.07	2.622	11.9	26.7	2.7	0.428	3.6	10.8	105	7.91	128	13.7
4/11/2007	Apr-07	0.0042	1.08	2.595	16.2	32.8	3.3	0.769	6.4	9.5	94	7.85	196	14.0
5/29/2007	May-07	0.0067	1.34	2.58	8.7	34.4	3.4	0.194	1.6	9	101	7.96	288	20.5
6/26/2007	Jun-07	0.0065	1.4	0.001	9.4	3.13	0.3	0.206	1.7	8.22	95	7.98	2628	22.1
7/26/2007	Jul-07	0.0082	1.8	2.767	8.9	23.3	2.3	0.222	1.9	9.27	107	7.99	62	21.3
8/29/2007	Aug-07	0.0169	3.84	2.895	8.4	46	4.6	0.308	2.6	8.37	100	7.94	150	23.4
9/26/2007	Sep-07	0.002	1.06	2.595	11.0	37.2	3.7	0.271	2.3	9.69	106	7.97	120	19.1
10/24/2007	Oct-07	0.0591	1.55	2.569	10.4	31.7	3.2	1.778	14.8	86.9	8	7.88	1252	20.3
11/29/2007	Nov-07	0.0105	1.9	2.646	6.6	19.2	1.9	0.333	2.8	9.54	96	8.18	1007	15.2
12/18/2007	Dec-07	0.0068	2.48	1.028	10.7	33.5	3.4	0.001	0.0	9.4	90	8.04	628	13.0
Average		0.013	3.5	2.46	12.3	30.7		0.29		11.7	Below	7.9	422	17.6
Standard Deviation		0.014	7.6	0.74	5.7	13.8		0.30		13.1		0.2	790	3.5
Maximum		0.059	44.4	3.30	30.8	56.0		1.78		86.9	123	8.4	3000	23.4
Minimum		0.001	0.9	0.00	3.7	3.1		0.00		7.8	8	7.5	39	11.5
Standard		<0.025	<40	<0.75		<10		<0.12		>7		7-8.3	<25	
%Outside		11%	3%	6%		93%		81%		0%		6%	100%	
Standard 2				>3										
%Outside				11%						Median Annual DO %				
										Year	Median	Meet Criteria		
										2005	96%	Yes		
										2006	102%	Yes		
										2007	99%	Yes		
indicates times exceeding standard														