

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.

309QUI Quail Creek at Highway 101

The Cooperative Monitoring Program sampled Quail Creek at Highway 101 35 times between January 2005 and September 2007 (one sample per month), with additional samples in February 2005 and April 2007.

Summary of Water Quality Data

Notable Measured Analytes for Water Quality Monitoring

Analyte/Parameter	Average	Range	Water Quality Criteria (WQC) or Guideline ¹	Percent Outside WQC or Guideline
Ammonia as N, Unionized	0.106 mg/L	0.001–1.343 mg/L	<0.025 mg/L ⁺	34%
Nitrate/Nitrite as N	27.2 mg/L	5.6–65 mg/L	<10.0 mg/L*	77%
Orthophosphate as P	1.23 mg/L	0.00–3.25 mg/L	<0.12 mg/L*	94%
Turbidity (NTU)	829 NTU	29–3000 NTU	<25 NTU*	100%
Conductivity	0.93 mmho/cm	0.24–1.54 mmho/cm	Ranges:* <0.75 No Problem 0.75–3.0 Increasing >3.0 Severe	% in Range: 24% 76% 0%
pH	8.0	7.3–8.8	7.0–8.5 ⁺	12%
Annual Median Dissolved Oxygen (% Saturation)	2005: 79% 2006: 63% 2007: 81%	31–168%	>85% annual median ⁺	Std not met Std not met Std not met
Dissolved Oxygen	7.4 mg/L	3.2–14.5 mg/L	>5.0 mg/L (GEN/WARM) ⁺ >7.0 mg/L (COLD/SPWN)*	12% 44%
Chlorophyll a	1.7 µg/L	0.3–4.0 µg/L	<40 µg/L*	0%
Water Temperature	17.9°C	8.7–28.3°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 **Quail Creek** are not specified in the Basin Plan. General Basin Plan water quality objectives will apply. Any analytes not specified under the general objectives in the Basin Plan are compared to a different water quality guideline to create a better understanding of the site's condition.

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

¹ 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.

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. **Eleven of 32 (34%) samples exceeded the standard. The exceedances mainly came in succession; in five of eight samples between January and August 2006, and five of five samples between April and September 2007. The average unionized ammonia concentration was 0.106 mg/L. However, the standard deviation was 0.266 mg/L, indicating extreme (high and low) values.**

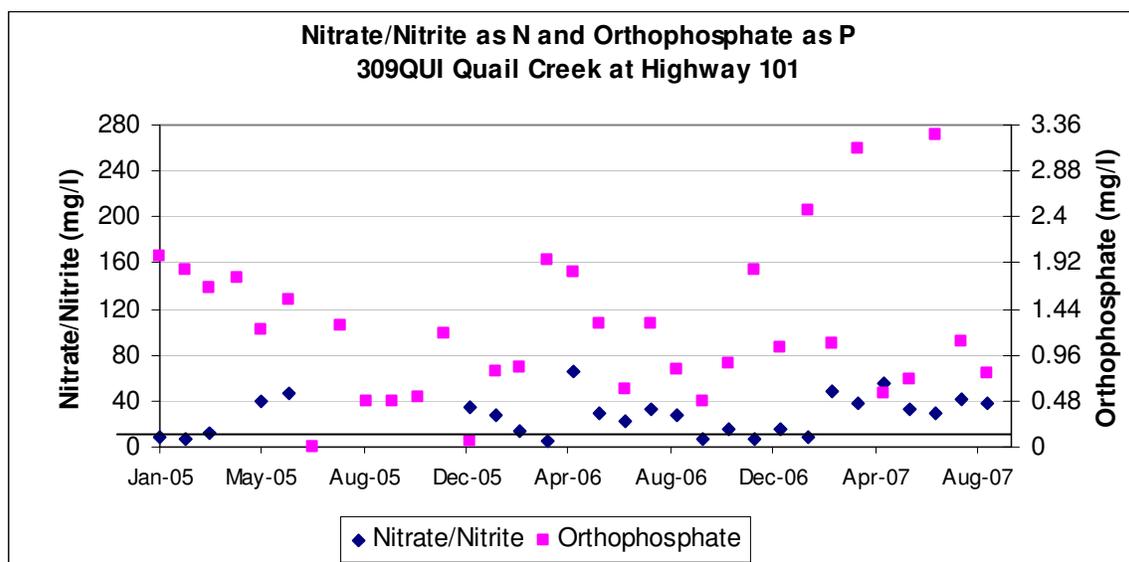
Nitrate/Nitrite as N

The Municipal and Domestic Supply (MUN) objective states in Table 3-2 of the Basin Plan that nitrate as NO₃ 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 of 26 nitrate/nitrite samples (77%) exceeded the guideline. Six of the seven highest concentrations occurred between March and June, with the two highest concentrations occurring in May 2006 (65 mg/L) and May 2007 (55.9 mg/L). The average concentration was 27.2 mg/L.**

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 31 of 33 samples (94%), ranging from non-detectable levels of orthophosphate to 3.25 mg/L (more than 27 times the guideline). All samples in April exceeded the guideline by at least 15 times, averaging 2.27 mg/L during the 3 years sampled. The average concentration was 1.23 mg/L.**

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.² 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 34 turbidity readings exceeded the guideline. Turbidity levels in Quail Creek averaged 829 NTU, with three readings (one per**

² 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.

year) showing turbidity levels greater than 3000 NTU. An additional 18 samples had turbidity levels over 100 NTU. The standard deviation was 1021 NTU, indicating extreme (high and low) readings.

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. **Eight of 34 conductivity samples (24%) indicated no problems to irrigation water; 26 samples (76%) indicated increasing problems; no samples 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 irritation to humans and makes water inhospitable to many species. **Four of 34 pH samples (12%) exceeded the standard. There were no apparent trends or cycles.**

Dissolved Oxygen 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. **Four of 34 samples (12%) did not meet the general and WARM concentration standard. Dissolved oxygen did not meet the saturation standard during 2005, 2006 or 2007, with median annual values of 79, 63, and 81% saturation, respectively.**

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 fish³. Dissolved gas saturation levels were not collected at this site; however, oxygen levels reached 168% saturation, which may indicate dissolved gas supersaturation.

Chlorophyll a

Healthy and appropriate Chlorophyll a levels are not defined in the Basin Plan. Chlorophyll a 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 40µg/L are considered problematic by North Carolina Administrative Code (NCAC). **No readings exceeded the guideline. The Chlorophyll a readings averaged 1.7 µg/L.**

Temperature

Sullivan et al.⁴ 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 17.9°C and ranged from 8.7 to 28.3°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.**

³ 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.

⁴ 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
Invertebrate (Water Column)	Yes ⁺	Yes ⁺		No	Yes	Yes		Yes ⁺	Yes	Yes	Yes	
Invertebrate (Sediment)			Yes				Yes					Yes
Fish (Water Column)	No*	No				No		Yes	No	No	No*	
Algae (Water Column)	No	No				No		No	No	Yes	No	

⁺Indicates complete mortality within 24 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



July 2006



February 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 (805) 549-3869 or **Amanda Bern** at abern@waterboards.ca.gov (805) 594-6197.

Attachment: Monitoring Data

SiteTag	Quail Creek at Highway 101													
309 QUI	Beneficial Uses: Not Specified													
		Ammonia as N, Unionized	Chlorophyll a	Conductivity	Instantaneous Flow	Nitrate/Nitrite as N	N/N / STD	Orthophosphate 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	3.46	0.378	0.1	8.5	0.85	2	16.7	8.64	79	8.13	3000	11.3
2/17/2005	Feb-05	0.0053		0.333						8.17	80	7.84	602	14.3
2/23/2005	Feb-05		2.04	0.241	0.5	6.9	0.69	1.84	15.3	7.92	74	7.65	2261	12.7
3/22/2005	Mar-05	0.0095	3.05	0.378	4.5	12.3	1.23	1.65	13.8	9.13	95	7.79	2741	16.8
4/14/2005	Apr-05	0.0128	2.5	0.928	1.5			1.77	14.8	10.47	89	7.97	368.6	8.7
5/24/2005	May-05	0.0502	1.35	1.099	2.2	39.6	3.96	1.23	10.3	6.95	89	8.04	2904	28.1
6/29/2005	Jun-05	0.0125	0.81	1.060	2.1	47	4.7	1.53	12.8	9.05	106	7.97	276.7	23.0
7/27/2005	Jul-05			1.273	0.3			0.004	0.0	7.82	81	7.78	35	16.6
8/30/2005	Aug-05	0.0176	0.75	1.164	0.8			1.27	10.6	6.74	79	7.76	32.1	23.0
9/28/2005	Sep-05	0.024	1.09	1.076	1.6			0.482	4.0	6.35	65	7.26	41.8	16.3
10/25/2005	Oct-05	0.0018	0.99	0.929	1.1			0.484	4.0	7.41	77	7.72	28.8	17.1
11/29/2005	Nov-05	0.0086	1.48	0.909	0.7			0.516	4.3	3.2	31	7.35	239.2	14.0
12/13/2005	Dec-05	0.0008	1.19	0.962	0.0			1.19	9.9	8.59	79	7.92	63.1	11.6
1/24/2006	Jan-06	0.0599	3.47	0.982	1.7	34.4	3.44	0.06	0.5	10.72	100	8.09	97.4	12.5
2/23/2006	Feb-06	0.0125	4.03	0.990	2.1	27.1	2.71	0.794	6.6	5.9	61	8.10	81.3	17.0
3/30/2006	Mar-06	0.0302	1.96	0.565	0.8	13.1	1.31	0.821	6.8	5.35	53	7.76	114.2	14.7
4/25/2006	Apr-06	0.0125	2.12	0.804	1.2	5.6	0.56	1.941	16.2	10.12	98	8.16	364	13.6
5/25/2006	May-06	1.3426	2.14	1.536	0.9	65	6.5	1.82	15.2	4.85	61	7.88	135.4	26.7
6/27/2006	Jun-06	0.0466	0.65	0.945	4.7	28.9	2.89	1.29	10.8	5.49	66	7.75	400	24.2
7/25/2006	Jul-06	0.0122	1.33	0.982	2.5	21.9	2.19	0.609	5.1	7.73	100	8.61	193.9	28.3
8/24/2006	Aug-06	0.2664	1.81	1.056	3.9	33	3.3	1.29	10.8	4.89	56	7.67	198.3	21.7
9/28/2006	Sep-06	0.0032	1.55	1.010	3.5	27.2	2.72	0.81	6.8	5.38	56	7.83	197.5	17.3
10/24/2006	Oct-06	0.0154	1.58	0.873	3.7	6.1	0.61	0.482	4.0	6.29	69	8.51	392.2	19.7
11/14/2006	Nov-06	0.0044	0.97	0.571	4.3	16	1.6	0.873	7.3	3.58	37	7.39	3000	16.7
12/13/2006	Dec-06	0.016	1.77	0.342	5.3	6.5	0.65	1.853	15.4	7.63	77	8.26	752	16.7
1/30/2007	Jan-07	0.0044	0.27	0.952	3.3	15.4	1.54	1.027	8.6	5.83	61	8.09	1750	17.4
2/15/2007	Feb-07	0.0093	1.89	0.486	2.3	9.35	0.935	2.474	20.6	7.38	76	8.13	1652	17.3
3/22/2007	Mar-07	0.0095	2.4	1.217	1.2	48	4.8	1.0702	8.9	8.98	83	8.26	796	11.5
4/6/2007	Apr-07	0.0333	0.78	1.121	0.7	38.4	3.84			9.19	87	8.51	447	12.6
4/16/2007	Apr-07				0.7			3.111	25.9					
5/30/2007	May-07	0.4982	1.2	1.195	0.4	55.9	5.59	0.5498	4.6	14.52	168	8.79	133.3	22.5
6/27/2007	Jun-07	0.1512	1.94	1.035	1.5	32.1	3.21	0.706	5.9	6.09		8.03	829	17.0
7/24/2007	Jul-07	0.0535	1.72	1.428	1.9	29	2.9	3.253	27.1	7.2	79	7.74	500	19.5
8/28/2007	Aug-07	0.6266	0.71	1.158	1.9	41.8	4.18	1.098	9.1	6.33	76	8.11	567	25.3
9/26/2007	Sep-07	0.0235	1.05	1.481	0.8	37.9	3.79	0.757	6.3	8.62	100	8.01	3000	22.7
Average		0.106	1.7	0.93	1.9	27.2		1.23		7.4	Below	8.0	829	17.9
Standard Deviation		0.266	0.9	0.34	1.5	16.7		0.77		2.2		0.3	1021	5.1
Minimum		0.001	0.3	0.24	0.0	5.6		0.00		3.2	31	7.3	29	8.7
Maximum		1.343	4.0	1.54	5.3	65		3.25		14.5	168	8.8	3000	28.3
Standard		<0.025	<40	<0.75		<10		<0.12		>5		7-8.5	<25	
%Outside		34%	0%	24%		77%		94%		12%		12%	100%	
Standard 2				>3						>7		7-8.3%		
%Outside				0%	Median Annual DO %					44%		12%		
					Year	Median	Meet Criteria							
					2005	79%	No							
					2006	63%	No							
					2007	81%	No							
indicates times exceeding standard														