State of California
California Regional Water Quality Control Board
Central Coast Region
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

WATER QUALITY MONITORING FACT SHEET

November 30, 2008

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.

312BCJ Bradley Channel at Jones Street

The Cooperative Monitoring Program sampled Bradley Channel at Jones Street 34 times (approximately one sample date per month) between February 2005 and December 2007, excluding two sample dates that were recorded as dry or pooled (January and October 2005).

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	0.399 mg/L	0.004–8.260 mg/L	<0.025 mg/L+	55%
Nitrate/Nitrite as N	32.4 mg/L	0.1–98 mg/L	<10.0 mg/L*	82%
Orthophosphate as P	0.67 mg/L	0.00–4.17 mg/L	<0.12 mg/L*	88%
Turbidity (NTU)	441 NTU	20–2579 NTU	<25 NTU*	94%
Conductivity	1.43 mmho/cm	0.00–2.16 mmho/cm	Ranges:* <0.75 No Problem 0.75–3.0 Increasing >3.0 Severe	 19% 81% 0%
pH	8.8	7.7–9.9	7.0–8.5+	66%
Annual Median Dissolved Oxygen (% Saturation)	2005: 112% 2006: 106% 2007: 154%	72–254%	>85% annual median+	Std met Std met Std met
Dissolved Oxygen	12.0 mg/L	6.3–22.2 mg/L	>5.0 mg/L (**GEN**/WARM)+ >7.0 mg/L (COLD/SPWN)*	0% 3%
Chlorophyll a	5.2 µg/L	0–33.0 µg/L	<40 µg/L*	0%
Water Temperature	21.7ºC	12.5–33.7ºC	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 **Bradley Channel** 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. **Eighteen of 33 samples (55%) exceeded the standard, reaching over 330 times the standard (March 2007 – 8.260 mg/L). During the two highest exceedances, pH was greater than 8.8 and the temperature was recorded at about 24ºC. However, these dates do not represent the highest temperature or pH levels. The average unionized ammonia concentration was 0.399 mg/L. Excluding the two highest exceedances, the average unionized ammonia concentration would be 0.094 mg/L.**

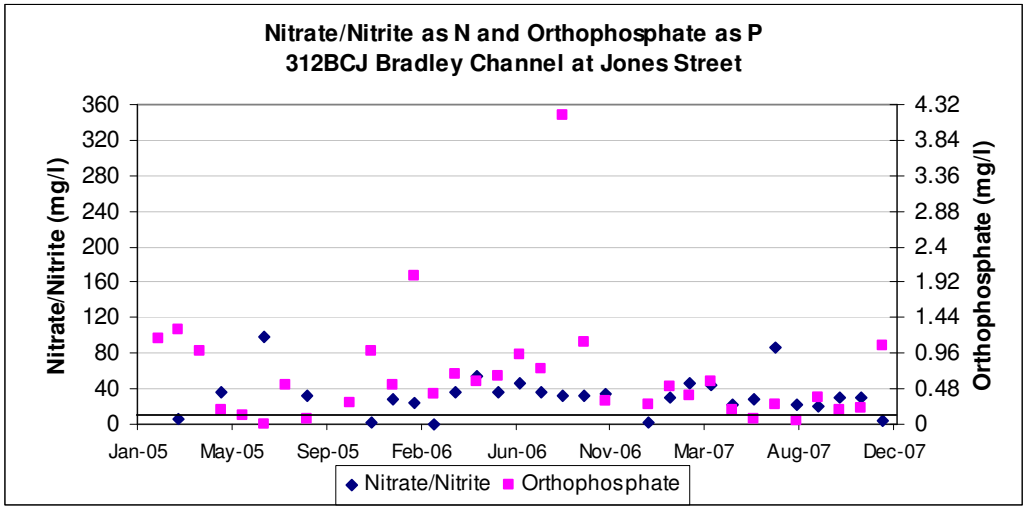
Nitrate/Nitrite as N

The Municipal and Domestic Supply (MUN) objective states in Table 3-2 of the Basin Plan that nitrate as 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-three of 28 nitrate/nitrite samples (82%) exceeded the guideline, with the highest concentration, 98 mg/L, in July 2005. The five samples that did not exceed occurred between December and March. The average concentration was 32.4 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 33 samples (88%), reaching as high as 4.17 mg/L (35 times the guideline). The average concentration was 0.67 mg/L. However, the standard deviation was 0.77 mg/L, indicating extreme (high and low) readings.**

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. **Thirty of 32 turbidity readings (94%) exceeded the guideline. Six of the nine highest exceedances occurred between August and December. Turbidity in Bradley Channel at Jones Street averaged 441 NTU, and reached as high as 2579 NTU.**

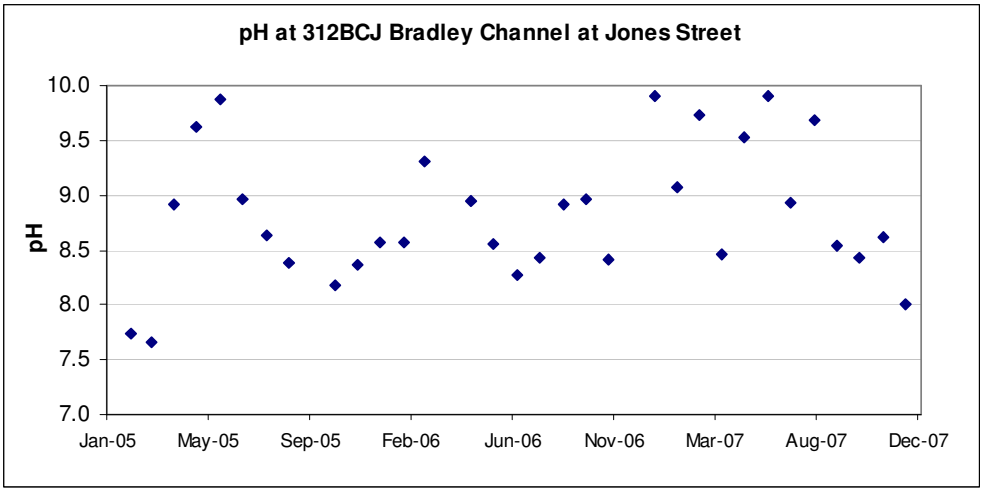
[2] Sigler, J.W., T.C. Bjornn, & F.H. Everst. (1984). *Effects of chronic turbidity on density and growth of steelhead and coho salmon*. Transactions of the American Fisheries Society. 113:142-150

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. **Six of 32 conductivity samples (19%) indicated no problems to irrigation water; 26 samples (81%) 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 irritant to humans and makes water inhospitable to many species. **Twenty-seven of 32 pH samples (84%) exceeded the MUN, AGR, REC-1, REC-2 standard for pH, and 21 pH samples (66%) exceeded the GEN standard for pH. The pH levels averaged 8.8, and reached as high as 9.9. Twelve samples were at or above 9.0. Only one sample between September and December was recorded as 9.0 or greater, while all samples in May were recorded as 9.0 or greater. The following chart shows the pH trend over the sample years.**



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 32 samples met the general and WARM concentration standard, but one sample (3%) did not meet the COLD and SPWN concentration standard. Dissolved oxygen met the saturation standard during 2005, 2006 and 2007, with median annual values of 112, 106, and 154% 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 fish[3]. Dissolved gas saturation levels were not collected at this site; however, oxygen levels reached 254% 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 40 µg/L are considered problematic by North Carolina Administrative Code (NCAC). **No readings exceeded the guideline. The Chlorophyll a readings averaged 5.2 µg.**

[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.

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 19.7ºC respectively. **The temperature averaged 21.7ºC and ranged from 12.5 to 33.7ºC. Though weekly averages were not taken, the temperatures taken at this site indicate averages that may regularly exceed the maximum temperatures for fish protection. The high, 33.7ºC, is extremely warm, even for a warm-water habitat. Because Bradley Channel lacks a stable and constant streambed and flow, the temperature may change more drastically with weather or soil conditions than other water bodies would.**

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	Mar-07	Apr-07	Oct-07
Invertebrate (Water Column)	Yes+	Yes+		Yes+	Yes	Yes+		Yes+	Yes	Yes	Yes			No
Invertebrate (Sediment)			Yes				Yes						Yes	
Fish (Water Column)	Yes	Yes				No		No	No	No		No		No
Algae (Water Column)	No	No				No		No	No	No	No			No

+Indicates complete mortality within 24 hours of test initiation

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

[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.

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	Bradley Channel at Jones Street												
312 BCJ	Beneficial Uses: Not Specified												
		Ammonia as N, Unionized	A / STD	Chlorophyll a	Conductivity	Instantaneous Flow	Nitrate/Nitrite as N	Orthophosphate as P	OP / STD	Oxygen, Dissolved	Oxygen, Saturation	pH	Turbidity	Water Temp
Units		mg/L	none	µg/L	mmho/cm	CFS	mg/L	mg/L	none	mg/L	%		NTU	ºC
1/27/2005	Jan-05					0.0								
2/21/2005	Feb-05	0.0039	0.2	9.58	0.347	14.0		1.170	9.8	9.81	94	7.74	1914	13.3
3/22/2005	Mar-05	0.0051	0.2	12.76	0.442	30.6	5.5	1.290	10.8	8.94	89	7.66	2413	15.4
4/20/2005	Apr-05	0.0410	1.6	33.04	1.606	0.1		1.000	8.3	16.32	180	8.92	369.8	20.2
5/24/2005	May-05	0.0125	0.5	1.36	1.224	0.1	36	0.200	1.7	16.1	229	9.62	25.2	33.7
6/21/2005	Jun-05	0.0125	0.5	7.81	1.778	0.4		0.130	1.1	12.86	181	9.88	21.6	32.9
7/26/2005	Jul-05	0.0125	0.5	3.84	2.094	0.4	98	0.004	0.0	22.23	254	8.96	368.8	21.5
8/31/2005	Aug-05	0.8153	32.6	0.47	1.557	0.3		0.530	4.4	8.86	116	8.64	58.6	29.0
9/27/2005	Sep-05	0.0371	1.5	4.22	1.781	2.0	32.4	0.067	0.6	7.36	89	8.39	446.7	24.5
Oct-05	Oct-05					0.0								
11/29/2005	Nov-05	0.0116	0.5	2.59	1.512	0.9		0.288	2.4	8.01	80	8.18	877.6	15.4
12/15/2005	Dec-05	0.0165	0.7	4.73	1.266	0.9	1.9	0.995	8.3	10.39	107	8.36	425.9	16.9
1/25/2006	Jan-06	0.0502	2.0	2.27	1.608	0.3	28.8	0.526	4.4	9.12	88	8.57	102.7	13.1
2/22/2006	Feb-06	0.3099	12.4	1.82	0.877	0.2	24.4	2.010	16.8	10.57	110	8.57	107.2	17.2
3/30/2006	Mar-06	0.0181	0.7	0.85	0.121		0.1	0.403	3.4	10.85	111	9.31	34.6	15.6
4/27/2006	Apr-06	0.0125	0.5			1.6	37.1	0.665	5.5					
5/16/2006	May-06	0.0328	1.3	10.05	1.991	1.2	54	0.581	4.8	12.77	163	8.95	19.7	27.6
6/27/2006	Jun-06	0.6565	26.3	5.73	2.098	0.4	37.2	0.660	5.5	8.37	103	8.56	116.3	24.8
7/27/2006	Jul-06	0.0299	1.2	7.06	1.951	1.7	46	0.937	7.8	6.26	72	8.27	75.4	21.3
8/22/2006	Aug-06	0.1188	4.8	6.75	1.745	2.5	36.4	0.760	6.3	7.55	101	8.43	738.3	29.8
9/26/2006	Sep-06	0.0874	3.5	0.005	1.670	0.9	31.9	4.170	34.8	11.51	145	8.91	128.5	26.7
10/25/2006	Oct-06	0.0514	2.1	1.72	1.849	0.3	32.8	1.120	9.3	11.33	139	8.97	35.9	25.2
11/15/2006	Nov-06	0.0125	0.5	2.01	1.340	1.2	33.4	0.303	2.5	8.81	101	8.42	738.3	21.9
1/30/2007	Jan-07	0.0125	0.5	3.36	0.173	0.0	2.9	0.267	2.2	16.54	165	9.90	120.2	15.3
2/13/2007	Feb-07	0.0213	0.9	2.81	1.742	0.0	30	0.514	4.3	11	104	9.07	31	12.5
3/20/2007	Mar-07	8.2603	330.4	21.13	1.540	0.0	47.2	0.397	3.3	20.06	203	9.73	62	15.7
4/10/2007	Apr-07	0.0107	0.4	0.16	1.814	1.0	44.6	0.589	4.9	11.94	143	8.46	260.6	23.9
5/29/2007	May-07	0.0645	2.6	0	1.513	0.1	22.7	0.202	1.7	18	214	9.53	47	23.8
6/26/2007	Jun-07	0.0185	0.7	8.48	0.001	0.1	27.7	0.067	0.6	14.16	194	9.90	1823	31.8
7/25/2007	Jul-07	2.0148	80.6	1.76	2.162	0.3	87	0.255	2.1	19.33	235	8.93	26.8	24.6
8/29/2007	Aug-07	0.2319	9.3	0.98	1.909	0.1	22	0.055	0.5	19.72	254	9.69	26.9	27.9
9/25/2007	Sep-07	0.1030	4.1	2.43	1.848	1.0	20	0.371	3.1	7.53	89	8.54	43.7	23.2
10/24/2007	Oct-07	0.0336	1.3	1.95	1.746	1.0	30.4	0.192	1.6	9.07	101	8.43	38.4	20.1
11/28/2007	Nov-07	0.0477	1.9	2.24	1.845	0.2	30.7	0.218	1.8	9.95	100	8.61	44.5	15.2
12/18/2007	Dec-07	0.0105	0.4	3.13	0.487	89.2	4.7	1.056	8.8	9.16	87	8.01	2579	12.9
Average		0.399		5.2	1.43	4.6	32.4	0.67		12.0	Below	8.8	441	21.7
Standard Deviation		**1.461**		**6.7**	0.63	**16.0**	22.1	**0.77**		4.3		0.6	**716**	6.3
Minimum		0.004		0.0	0.00	0.0	0.1	0.00		6.3	72	7.7	20	12.5
Maximum		8.260		33.0	2.16	89.2	98	4.17		22.2	254	9.9	2579	33.7
Standard		<0.025		<40	<.75		<10	<0.12		>7		7-8.5	<25	
%Outside		55%		0%	19%		82%	88%		3%		66%	94%	
Standard 2					>3					>5		7-8.3		
%Outside					0%					0%		84%		

March 2007 ammonia sample is more than all other samples combined.

March 2007 plus July 2007 ammonia is more than 3.5 times all others combined

pH is extremely high

indicates times exceeding standard

Median Annual DO %		
Year	Median	Meet Criteria
2005	112%	Yes
2006	106%	Yes
2007	154%	Yes