

State of California
The Resources Agency

Memorandum

To : Files

Date :

From : Department of Fish and Game -- Post Office Box 47, Yountville, California 94599

Subject: Marin-Sonoma Counties Agricultural Runoff Influence Investigation – 2000-2001 Summary

This program is a continuation of a program initiated in 1991 as a service to the Marin-Sonoma Animal Waste Committee, and local operators of confined animal feeding operations (CAFO), e.g. stables, feedlots and dairies. The Department's program is limited to monitoring water quality at 20 stations in San Antonio, Stemple and Americano Creek watersheds of Sonoma County, and 20 stations in the Tomales Bay watershed of Marin County.

Methods

A water sample was collected from each of 40 stations identified on Figures 1a-e with the aid of an ACE 3-gallon, LRB sampler (little red bucket), and 50 feet of rope. Samples were collected from each station at least biweekly, with the Tomales watershed being sampled on alternating weeks with the Stemple, Americano, and San Antonio Creek watersheds. Some stations were sampled on a more frequent basis as a result of sample collection routing preferences.

All samples were initially collected with the LRB sampler, and then subsampled by immersing a chemically clean, glass, quart jar slowly into the sample as if it were the receiving water. Each subsample was then characterized in the field by measurement of pH, temperature, dissolved oxygen, and electrical conductivity, using a Cole/Parmer Model 5941-00 electronic pH probe, and a YSI Model 85 Dissolved Oxygen-Conductivity-Temperature Meter, respectively.

The quart samples were topped-off, sealed, labeled, placed in a sample carrier, kept cool and transported to the DFG Water Quality Laboratory in Yountville for analysis of turbidity and total ammonia, (usually the next morning), Turbidity and ammonia analyses were conducted using a Hach Model 2100A Turbidimeter calibrated with Gelex² Secondary Turbidity Standards, and an Orion Model 290A pH/ISE meter with an Orion model 95-12 ammonia electrode. Concentrations of un-ionized ammonia (NH₃-tox) were calculated according to methods outlined in Morgan and Turner, 1977.

Results

All 2000-01 (99-2000) Data

	Dissolved Oxygen mg/l	Total Ammonia mg/l	Un-ionized Ammonia mg/l	Conductivity ? mhos/cm
Average *	12.58 (9.29)	0.653 (0.420)	0.0111 (0.0068)	418 (577)
Range	1.6-16.0 (6.2-10.3)	0.0-28.6 (0-25.2)	0.0-0.54 (0-1.071)	83-2259 (8-2342)
Criteria **	5.0-7.0	-	0.025	750
Exceedances	8 (53)	-	18 (39)	39 (125)
Percent Exceedance	2.3 (6.36)	-	5.2 (4.68)	11.2 (15)

* 346 (833) measurements

** SF Bay RWQCB Basin Plan

Discussion

The majority of stations sampled revealed acceptable concentrations of all parameters, e.g. concentration of dissolved oxygen near saturation, low total ammonia and conductivity during most sampling events. Even at those locations where exceedances were locally great, the station averages appeared to indicate that conditions were acceptable, --most of the time. However, keep in mind that averages of any water quality parameter may be statistically relevant, but misleading as fish and aquatic life are sensitive to change, and are more likely to be adversely affected by extremes than by averages. For example, if a lethal threshold of any parameter is reached, even for a few minutes, i.e. toxic levels of ammonia, or insufficient concentrations of dissolved oxygen, sensitive species of fish or invertebrates upon which they rely for food, will be killed. If conditions are then made more acceptable, either by abatement of discharge, reduction of contaminated stormwater runoff, in-stream biodegradation, or dilution, the habitat may again be able to sustain life, but few, if any organisms remain. Clearly, if our local

streams are to have abundant fish and aquatic life, we must work hard to prevent receiving waters from experiencing these deleterious water quality excursions.

San Antonio Creek (>Petaluma River)

Water quality in the San Antonio Watershed, a small basin tributary to the Petaluma river, for which we have the longest continuous record, has shown steady, and at times dramatic improvement over the years. This year's data is no exception. The mean dissolved oxygen concentration in the watershed as increased by almost 1mg/l, yet the range of measured dissolved oxygen clearly shows that oxygen-demanding materials and associated nutrients are being episodically released into this watershed. The mean un-ionized ammonia increased slightly, but the high concentration indicated by the range is clearly acutely toxic, and thus unacceptable. While the mean conductivity decreased slightly, the high is still too high.

**San Antonio Creek
2000-1 (99-00) Data**

	Dissolved Oxygen mg/l	Total Ammonia mg/l	Un-ionized Ammonia mg/l	Conductivity ? mhos/cm
Mean *	10.12 (9.28)	0.3665 (0.4212)	0.0063 (0.00494)	527 (568)
Range	2.9-16.0 (1.78 - 22.39)	0.0-2.82 (0.0 - 7.15)	0.0-0.059 (0 - 0.086)	180-1563 (66 - 2092)
Criteria **	> 5.0	-	0.025	(750)
Exceedance	2 (10)	-	5 (14)	13 (43)
Percent Exceedance	2.9(4.88)	-	7.3 (6.83)	19.1 (20.98)

*68 (108) measurements

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Ellis Creek Watershed (>Petaluma River)

2000-1(99-00) Data

	Dissolved Oxygen mg/l	Total Ammonia mg/l	Un-ionized Ammonia mg/l	Conductivity ? mhos/cm
Average *	11.19 (9.38)	0.959 (0.1693)	0.01842 (0.003921)	703 (998)
Range	8.9-14.8 (2.98 - 15.8)	0.0098- 4.4(0.0 - 0.94)	0.0006-0.108 (0.0 - 0.0262)	472-920 (489 - 1980)
Criteria **	5.0-7.0	-	0.025	(750)
Exceedance	0 (3)	-	1 (1)	4 (24)
Percent Exceedance	0 (10.34)	-	10 (3.5)	40 (79.3)

* 10(29) measurements

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Stemple Creek Watershed (>Estero Americano> Pacific Ocean)
2000-1(99-00) Data

	Dissolved Oxygen mg/l	Total Ammonia mg/l	Un-ionized Ammonia mg/l	Conductivity ? mhos/cm
Average *	9.80 (8.9)	1.0308 (0.876)	0.01597 (0.0180)	504 (546)
Range	4.2-16.8 (0.75 - 27.71)	0.0-21.9 (0.0 - 17.4)	0.0-0.447 (0.0 - 1.071)	3-1200 (6 - 1789)
Criteria **	5.0-7.0	-	0.025	(750)
Exceedance	2 (23)	-	6 (19)	7 (27)
Percent Exceedance	2.5(11)	-	7.5(9.3)	8.8(13)

*79(203) measurements

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Bloomfield Fork of Americano Creek (>Americano Creek> Estero San Antonio)

2000-1 (1999-2000)Data

	Dissolved Oxygen mg/l	Total Ammonia mg/l	Un-ionized Ammonia mg/l	Conductivity ? mhos/cm
Average *	10.07(7.68)	3.102(1.938)	0.044(0.010)	394(447)
Range	7.8-12.5 (1.62-12.6)	0.0-18.4 (0.0-25.2)	0.0-0.323 (0.0-0.201)	183-536 (190-1127)
Criteria **	5.0-7.0	-	0.025	(750)
Exceedance	0(5)	-	2(3)	0(1)
Percent Exceedance	0(13)	-	18(7.9)	0(2.6)

*11(38) measurements

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Tomales Bay Watershed (>Pacific Ocean)

Twenty (20) stations were sampled again this year along the south and eastern shoreline of Tomales Bay at bridges or culverts under Hwy 1 wherever flow could be sampled. No attempt was made to specifically sample streams draining known dairy lands. Many of the tributary streams flow from areas which do not contain any confined animal operations, and as such provide a good reference.

With three notable exceptions, water quality parameters for samples collected within this watershed were very good. D.O. was consistently at or near saturation, total ammonia was low and conductivity was extremely low. These sub-watersheds would provide suitable aquatic habitat during all periods of flow.

2000-2001 (1999-2000)Data

	Dissolved Oxygen mg/l	Total Ammonia mg/l	Un-ionized Ammonia mg/l	Conductivity ? mhos/cm
Average *	10.89(9.87)	0.108(0.061)	0.001(0.001)	289(624)
Range	1.6-16.4 (0.4-14.2)	0.0-1.43 (0.0-3.45)	0.0-0.011 (0.0-0.109)	83-2259 (8-21,500)
Criteria **	5.0-7.0	-	0.025	(750)
Exceedance	2(5)	-	0(3)	5(28)
Percent Exceedance	1.2(1.5)		0(<1)	3.2(8.5)

*155(329) measurements

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Conclusions

The extremely wet winter did not create any serious water quality problems in most streams within the study area. Water quality problems encountered were principally the result of either direct discharge or runoff of animal wastes from confined animal operations, or the resultant eutrophication and disruptive effects upon oxygen dynamics. Operators who experienced problems were contacted by Committee members or Western United Dairymen and responded appropriately to provide the necessary interim corrective action. Most problems encountered were not related to the unusual rainfall

pattern, but rather to poor planning or management on the part of a few operators. Increased participation by operators on the Animal Waste Committee, together with completion of UC Cooperative Extension Ranch Planning Workshops could bring about the necessary improvements in water quality.

If there are any questions on the sample methods, station locations, data or its evaluation, please give me a call at (707) 944-5523.

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Region 3