CNM

Final Report

WASTE REDUCTION STRATEGY

FOR

THE LAGUNA DE SANTA ROSA

Prepared for

California Regional Water Quality Control Board
North Coast Region
5550 Skylane Blvd, Suite A
Santa Rosa, CA 95403

Prepared by

Cecile N. Morris
Associate Water Resource Control Engineer
Surveillance, Monitoring and Planning Unit

March 1, 1995

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF FIGURES

ABSTRACT

Water quality in the Laguna de Santa Rosa has been documented as not meeting the North Coast Regional Water Quality Control Board (NCRWQCB) water quality control plan (basin plan) dissolved oxygen criterion and the USEPA ammonia criterion for the protection of aquatic life (Introduction, & Laguna Water Quality, pages 14-21).

Nonattainment of water quality objectives resulted in the 1992 and 1994 listing of the Laguna on the Clean Water Act Section 303(d) list (Executive Summary, page 2). Section 303(d) also requires states to collect further information, identify and quantify or estimate pollutant loads, and develop a strategy to reduce loading to attain the listed objectives.

Subsequent studies by the City of Santa Rosa, the major point source discharger, funded under Section 205(j) of the Clean Water Act provided load estimates for ammonia nitrogen, total nitrogen, and organic matter from several sources: septic systems, open space, agriculture, urban runoff, and municipal wastewater effluent. NCRWQCB staff used the estimates from that report to develop seasonal estimates (Estimated Waste Loads, pages 28&29).

Though we recognize all the load estimates are not accurate, they provide a basis from which to develop a strategy to reduce nitrogen loads. The NCRWQCB staff used the estimates from the Section 205(j) study, and evaluated a number of scenarios of likely situations in the watershed. We selected one that, in our view, most closely represents current conditions in the watershed (Analysis by Scenarios, & Summary of Scenarios, pages 29-40). Based on the estimates and water quality sampling results, the contribution of nitrogen and organic matter from nonpoint sources should be the primary targeted source category.

We developed nitrogen reduction goals that reflect the various waste dischargers' current abilities and plans for waste reduction and, based on the load estimates, will result in attainment of the target levels for nitrogen (Selected Scenario, pages 33-40). Reductions in waste loading are proposed through existing programs, and are keyed to specific waste sources (Implementation of Waste Reduction Strategy, pages 41-46).

The reduction goals presented in this report target July, 1996 as the attainment date, however the strategy recognizes the uncertainty of the load and reduction estimates and calls for re-evaluation of the estimates and strategy in July, 1996. As such, the reduction goals are long-term goals, however we anticipate reaching them within the following four years (by July of 2000).

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that do not meet water quality objectives. These are placed on a list of water quality impaired water bodies and prioritized for future work. The work may comprise additional investigation to determine the cause of impairment or specific actions to bring the waterbody into attainment.

There are three general steps to bring a waterbody into attainment:

1) Estimating the amount of impairment-causing pollutant from each source and the resulting pollutant concentration in the waterbody;

2) Estimating the maximum pollutant load that can be present and still attain the concentration objective. USEPA calls this pollutant load the "total maximum daily load" (TMDL); and

3) Developing a strategy to reduce pollutant waste loads (inputs) to levels below the maximum pollutant load amount.

The intent of this process is to bring a waterbody into attainment by reducing the amount of waste input.

The Laguna de Santa Rosa was listed on the 303(d) list in September 1992 and 1994 as impaired because of occurrences of high ammonia and low dissolved oxygen. At times, ammonia has exceeded the USEPA criterion for the protection of aquatic life (0.025 mg-N/l unionized ammonia), and dissolved oxygen is below the North Coast Region's Basin Plan minimum objective of 7.0 mg/L. High ammonia levels are the result of inputs of nitrogen in various forms. Low dissolved oxygen levels arise from inputs of organic matter, and algal growth using more oxygen than is produced in the system.

A Section 205(j) study of runoff pollutant sources to the Laguna was conducted by Regional Water Board staff in 1989-91. This study identified urban runoff, runoff of animal waste, and wastewater from the City of Santa Rosa's Subregional Wastewater Reclamation Plant as sources of nitrogen, including ammonia. A follow up 205(j) study by the City of Santa Rosa in 1991-93 resulted in estimates of the relative amounts (waste loads) of nitrogen and organic matter from several pollutant sources: septic systems, open space, agricultural operations, urban runoff, and wastewater from the Subregional Plant.

After evaluating the City's waste load estimates, we have reduced the load estimate for septic systems by 58%. This modification was made because the original estimate is based on exceptional assumptions and appears to be high.

We have evaluated the City of Santa Rosa's nitrogen and organic matter load estimates, utilized this information as well as other available information, and propose a strategy to reduce waste loads within the Laguna watershed. Since we do not understand all the interactions of the water column with sediments, hydrology, and loading effects in the Laguna, we are using a "phased approach" (USEPA 1991). The phased approach allows for immediate targeting of pollution load reductions while conducting additional data collection and analysis. This approach is an iterative process, and generally consists of 1) developing load reductions to meet water quality goals that include margins of safety to allow for uncertainties, 2) determining the effectiveness of the waste reduction strategy, confirming load estimates and assumptions, and checking both of these with actual water quality information, and 3) if needed, making necessary adjustments to load reductions to attain water quality goals. The first check point for the Laguna on this waste reduction strategy is in July 1996.

The high algal productivity of the Laguna (which generally indicates high nutrient levels), the prevalence of many nutrient pollutant sources in the watershed, and the historically documented artificially high concentrations of nitrogen in the Laguna's water column and its impact on beneficial uses were the main reasons that we looked at nutrients in this system. The three main nutrients required for algal growth are carbon, phosphorus and nitrogen. Algal Growth Potential studies conducted on Laguna water as part of the Laguna Monitoring Study (Roth and Smith 1992, 1993, 1994) indicate nitrogen is the limiting plant nutrient. Because of these results, the above factors and the 303(d) listing for unionized ammonia, we focused on total nitrogen and two forms of ammonia-nitrogen: total, and unionized.

The term total nitrogen includes to all forms of nitrogen: nitrate, nitrite, ammonia and organic. Ammonia-nitrogen, a major component of the nitrogen cycle, is formed by chemical and bacterial decomposition or breakdown of animal wastes, principally urea and other protein-bearing materials. In water, ammonia is measured as total ammonia-nitrogen and exists in either an ionic state or unionized state. It is the unionized form that is toxic to fish and aquatic life. The percentage of measured total ammonia-nitrogen which exists in the toxic unionized ammonia form is increased when the pH or water temperature increase. Since total nitrogen may contribute to ammonia nitrogen, high nitrogen concentrations provide the potential for high ammonia concentrations. High ammonia concentrations provide the potential for high unionized ammonia concentrations.

Because of the nature of the nitrogen sources, primarily nonpoint sources, we expect that reductions in total nitrogen will also result in reductions in total ammonia, total phosphate and organic matter. One of the concerns about excessive nutrients and high productivity in the Laguna is that the resulting algae and aquatic plants use dissolved oxygen during respiration in the night and early morning hours. If the amount of respiration from algae and aquatic plant life is high, it results in low dissolved oxygen levels that adversely affect aquatic life. The total nitrogen, total ammonia, phosphate and organic matter reductions should also reduce algal productivity and reduce the daily dissolved oxygen and pH excursions.

The Laguna waste reduction strategy proposes targeting specific pollutant sources found within different areas of the watershed. The Laguna watershed has been divided into four attainment areas, the lowermost point in the stream for each area being the "point of attainment". Several scenarios were developed for different seasonal flow periods and loadings. Each scenario was evaluated, and waste reductions for each pollutant source developed to meet water quality goals. One scenario was selected for this strategy. The criteria for selection were as follows:

- The scenario targets waste load reductions that meet the water quality goals for the Laguna;
- The scenario best represents the Laguna flow and pollutant loading dynamics;
- The scenario provides a reasonable time frame for the dischargers to make load reduction adjustments; and
- The scenario suggests targeted load reductions that appear reasonable and achievable.

The selected scenario was developed on a seasonal basis (winter, spring, summer, and fall) since each seasonal flow and loading pattern contributes to the condition of water quality in the Laguna in a different way. High flows during winter non-storm periods help to dilute pollution entering the Laguna. However, nutrient loading into the Laguna is usually high during storm events and water quality may become poor for short durations. These events are episodic, but the effect of the pollutant loading can be longer and carry over into the spring, summer and fall seasons. Decreasing flows and higher temperatures are typical for the spring and summer seasons. During these seasons, the algae growth cycle accelerates and Laguna water quality may be poor for longer periods. Laguna flows increase and water temperatures decrease during the fall season, generally with improved water quality.

The selected scenario separates Laguna flows into average seasonal flows, and waste load estimates into seasonal load estimates. Except for wastewater, the seasonal load estimates are based on storm event load estimates multiplied by a percentage of storm event flow per season (winter = 81%, spring = 10%, summer = 1%, and fall = 8%) plus non-storm load estimates multiplied by a percentage of non-storm days per season (winter = 33%, spring = 17%, summer = 34%, and fall = 17%). For the portion of seasonal load estimates based on storm event load estimates and flow, we assume a simple relationship exists between flow and rainfall. The seasonal loading estimates for wastewater are based on winter storm plus non-storm load estimates multiplied by a percentage of days per season during the permitted discharge period (winter = 53%, spring = 20%, summer = 0%, and fall = 27%).

As an extra condition, the selected scenario includes over-topping of average dairy manure ponds. This type of load input was included because it seems to be a recurring pollutant problem in the Laguna watershed.

The selected scenario results in targeted waste load reductions for each pollutant source during each season. From the estimated loadings and reductions, mass limit goals were calculated. For the spring and fall seasons, the mass limit goals at the upstream attainment points were adjusted (net loads) to ensure all downstream attainment points met the strategy goals. Tables 1 and 2 show the estimated seasonal loadings, targeted reductions, and net load goals for total ammonia and total nitrogen. During the summer season, each attainment point falls short of the strategy goals. We suspect the problem with strategy nonattainment stems from high load estimates for the summer season, and we plan to obtain information to estimate more accurate summer loads by July 1996.

Table 3 shows the long-term (by July 2000) net load goals for each pollutant source within the sub-watershed above the four attainment points during each season. After receiving comments from the dischargers and interested groups regarding this strategy, interim reduction targets have been developed that are more reasonable and achievable by July 1996. Table 4 shows the long-term reduction targets to be attained by July 2000, the interim reduction targets to be achieved by July 1996 and the anticipated reduction that is expected from current and future projects and programs aimed at waste reduction.

It is important to recognize that attainment of the concentration goals for ammonia and dissolved oxygen will be the final endpoint criteria rather than "loading". The load reduction estimates are useful for targeting, but will not determine the attainment of the water quality goals which are expressed as concentrations. The net load goals and associated load reduction targets are intermediate points of this strategy. The ultimate goal is to reduce waste load inputs such that at specified "attainment points" along the Laguna unionized ammonia does not exceed the USEPA criterion, and dissolved oxygen is above the Basin Plan minimum.

We have developed a plan to monitor water quality at each attainment point systematically throughout each season. We plan to collect water quality samples bi-weekly, but will also supplement this with additional samples as needed to maintain a sampling frequency in proportion to storm events. We will also use continuous remote monitoring for dissolved oxygen, pH, conductance, and temperature on monthly intervals at a minimum. Appendix E describes the monitoring plan in greater detail. The monitoring plan will be used to evaluate Laguna water quality and the success of this strategy, and to guide the future direction of this strategy.

We will use statistical methods to compare the water quality data against the USEPA criterion for unionized ammonia and the Basin Plan minimum objective for dissolved oxygen.

1) The minimum dissolved oxygen objective will be attained if dissolved oxygen concentrations are maintained above 7.0 mg/L. Compliance with the median and 90th percentile values will be determined with cumulative frequency distributions.

2) The water quality data will be evaluated using a staged method to determine the level of attainment with USEPA criterion for unionized ammonia. Attainment goals are: a) 60 percent of the measurements below the EPA criterion by July 1996, b) 70 percent by July 1998, and c) 80 percent by July 2000 on a seasonal basis. We will evaluate the water quality data using cumulative distribution plots and t-tests of the mean of seasonal measurements compared to USEPA criterion for unionized ammonia.

Any necessary adjustments to the strategy based on the results of water quality data will be made by July 1996. If needed, adjustments will be made to the strategy every two years thereafter until attainment is met. However, we anticipate attainment by July 2000.

Implementation of the waste reduction strategy will be through current programs aimed at reducing nitrogen and organic matter inputs into the Laguna. These programs include the following:

Clean Water Act, Section 319(h) grant program aimed at reducing inputs of waste to the Laguna from confined animal operations, primarily diaries;
Stormwater runoff program aimed at eliminating the discharge of pollutants into storm water systems, primarily from urban areas in this watershed;

The NPDES permit program regulating the City of Santa Rosa's Subregional Wastewater Treatment Plant. The City's NPDES permit is scheduled for renewal on August 15, 1995. The City has included appropriate design features in upcoming plant improvement projects for nitrogen removal, and is considering long-term alternative wastewater treatment processes that will provide significant nitrogen removal; and

The Laguna Watershed Coordinated Resource Management and Planning (CRMP) task force composed of a diverse group of agencies, interested groups and landowners. The purpose of this group is to develop objectives for resource management in the Laguna watershed on a voluntary basis. Included in these activities are objectives for improving water quality conditions in the Laguna.

To meet Laguna water quality goals, Regional Board staff proposes to focus existing program activities to varying degrees on the four sub-watersheds and specific pollutant sources described above. The level and focus will be tied directly to the amount of waste load reduction anticipated.

The reduction goals presented in this report target July, 1996 as the attainment date, however the strategy recognizes the uncertainty of the load and reduction estimates and calls for re-evaluation of the estimates and strategy in July, 1996. As such, the reduction goals are long-term goals, however we anticipate reaching them within the following four years (by July of 2000).

TABLE 1: Estimated cumulative seasonal loads (EST LOAD), targeted reductions (TRG RED) adjusted to attain strategy goals during spring and fall seasons, and resulting net load goals (NET LOAD) for total nitrogen for each pollutant source within the sub-watershed above four attainment points.

TOTAL N

ATTAINMENT POINT 1 TRENTON-HEALDSBURG ROAD

SOURCES	WINTER EST LOAD	WINTER TRG RED	WINTER NET LOAD	SPRING EST LOAD	SPRING TRG RED	SPRING NET LOAD	SUMMER EST LOAD	SUMMER TRG RED	SUMMER NET LOAD	FALL EST LOAD	FALL TRG RED	FALL NET LOAD
URBAN	182,353	0	182,353	11,789	0	11,789	647	647	0	7,718	0	7,718
WASTEWATER	244,932	0	244,932	22,059	0	22,059	0	0	0	18,148	0	18,148
NON-IRRIGATED	79,969	0	79,969	9,872	0	9,872	987	0	987	7,897	0	7,897
DAIRY AG.	191,669	0	191,669	9,336	0	9,336	584	584	0	6,218	0	6,218
DAIRY POND	13,323	13,323	0	6,863	6,863	0	13,727	13,727	0	6,863	6,863	0
SEPTIC	28,699	0	28,699	14,094	0	14,094	33,170	0	33,170	14,050	0	14,050
OPEN SPACE	31,631	0	31,631	3,905	0	3,905	390	0	390	3,123	0	3,123
TOTAL	772,576	13,323	759,253	77,918	6,863	71,055	49,505	14,958	34,547	64,017	6,863	57,154

ATTAINMENT POINT 2 GUERNEVILLE ROAD

SOURCES	WINTER EST LOAD	WINTER TRG RED	WINTER NET LOAD	SPRING EST LOAD	SPRING TRG RED	SPRING NET LOAD	SUMMER EST LOAD	SUMMER TRG RED	SUMMER NET LOAD	FALL EST LOAD	FALL TRG RED	FALL NET LOAD
URBAN	129,960	0	129,960	12,017	6,696	5,321	1,086	1,086	0	9,199	6,656	2,543
WASTEWATER	224,932	0	224,932	51,642	29,583	22,059	0	0	0	65,681	47,533	18,148
NON-IRRIGATED	51,544	0	51,544	6,363	0	6,363	636	0	636	5,090	0	5,090
DAIRY AG.	144,369	0	144,369	5,360	1,864	3,496	186	186	0	3,037	1,491	1,546
DAIRY POND	4,462	4,462	0	2,299	2,299	0	4,597	4,597	0	2,299	2,299	0
SEPTIC	20,220	0	20,220	9,930	0	9,930	23,538	0	23,538	9,899	0	9,899
OPEN SPACE	13,988	0	13,988	1,727	0	1,727	172	0	172	1,381	0	1,381
TOTAL	589,475	4,462	585,013	89,338	40,442	48,896	30,215	5,869	24,346	96,586	57,979	38,607

ATTAINMENT POINT 3 OCCIDENTAL ROAD

SOURCES	WINTER EST LOAD	WINTER TRG RED	WINTER NET LOAD	SPRING EST LOAD	SPRING TRG RED	SPRING NET LOAD	SUMMER EST LOAD	SUMMER TRG RED	SUMMER NET LOAD	FALL EST LOAD	FALL TRG RED	FALL NET LOAD
URBAN	42,025	0	42,025	4,244	3,083	1,161	308	308	0	2,980	2,466	514
WASTEWATER	112,466	0	112,466	42,440	33,238	9,202	0	0	0	57,294	48,907	8,387
NON-IRRIGATED	31,219	0	31,219	3,854	0	3,854	385	0	385	3,083	0	3,083
DAIRY AG.	129,275	0	129,275	13,118	9,622	3,496	962	962	0	9,244	7,698	1,546
DAIRY POND	6,968	6,968	0	3,590	3,590	0	7,179	7,179	0	3,590	3,590	0
SEPTIC	12,906	0	12,906	6,338	0	6,338	14,961	0	14,961	6,318	0	6,318
OPEN SPACE	3,749	0	3,749	463	0	463	46	0	46	370	0	370
TOTAL	338,608	6,968	331,640	74,047	49,533	24,514	23,841	8,449	15,392	82,879	62,661	20,218

ATTAINMENT POINT 4 STONY POINT ROAD

SOURCES	WINTER EST LOAD	WINTER TRG RED	WINTER NET LOAD	SPRING EST LOAD	SPRING TRG RED	SPRING NET LOAD	SUMMER EST LOAD	SUMMER TRG RED	SUMMER NET LOAD	FALL EST LOAD	FALL TRG RED	FALL NET LOAD
URBAN	17,054	0	17,054	2,105	944	1,161	211	211	0	1,684	1,170	514
WASTEWATER	0	0	0	0	0	0	0	0	0	0	0	0
NON-IRRIGATED	15,100	0	15,100	1,864	0	1,864	186	0	186	1,491	0	1,491
DAIRY AG.	51,335	0	51,335	6,338	2,842	3,496	634	634	0	5,070	3,524	1,546
DAIRY POND	8,853	8,853	0	4,561	4,561	0	9,122	9,122	0	4,561	4,561	0
SEPTIC	5,993	0	5,993	2,943	0	2,943	6,134	0	6,134	2,934	0	2,934
OPEN SPACE	3,310	0	3,310	409	0	409	41	0	41	327	0	327
TOTAL	101,645	8,853	92,792	18,220	8,347	9,873	16,328	9,967	6,361	16,067	9,255	6,812

TABLE 2: Estimated cumulative seasonal loads (EST LOAD), targeted reductions (TRG RED) adjusted to attain strategy goals during spring and fall seasons, and resulting net load goals (NET LOAD) for total ammonia for each pollutant source within the sub-watershed above four attainment points.

TOTAL NH3

ATTAINMENT POINT 1 — TRENTON-HEALDSBURG ROAD

SOURCES	WINTER EST LOAD	WINTER TRG RED	WINTER NET LOAD	SPRING EST LOAD	SPRING TRG RED	SPRING NET LOAD	SUMMER EST LOAD	SUMMER TRG RED	SUMMER NET LOAD	FALL EST LOAD	FALL TRG RED	FALL NET LOAD
URBAN	16,174	0	16,174	942	0	942	57	57	0	592	53	539
WASTEWATER	30,004	0	30,004	2,218	0	2,218	0	0	0	1,406	0	1,406
NON-IRRIGATED	4,134	0	4,134	510	0	510	51	0	51	408	0	408
DAIRY AG.	31,944	0	31,944	1,468	0	1,468	97	97	0	847	74	773
DAIRY POND	2,218	2,218	0	1,143	1,143	0	2,286	2,286	0	1,143	1,143	0
SEPTIC	9,568	0	9,568	4,698	0	4,698	11,060	0	11,060	4,685	0	4,685
OPEN SPACE	914	0	914	114	0	114	11	0	11	89	0	89
TOTAL	94,956	2,218	92,738	11,093	1,143	9,950	13,562	2,440	11,122	9,170	1,270	7,900

ATTAINMENT POINT 2 — GUERNEVILLE ROAD

SOURCES	WINTER EST LOAD	WINTER TRG RED	WINTER NET LOAD	SPRING EST LOAD	SPRING TRG RED	SPRING NET LOAD	SUMMER EST LOAD	SUMMER TRG RED	SUMMER NET LOAD	FALL EST LOAD	FALL TRG RED	FALL NET LOAD
URBAN	11,593	0	11,593	1,038	662	376	99	99	0	801	661	140
WASTEWATER	30,004	0	30,004	6,356	4,138	2,218	0	0	0	8,008	6,602	1,406
NON-IRRIGATED	2,665	0	2,665	329	0	329	33	0	33	263	0	263
DAIRY AG.	24,061	0	24,061	636	311	325	31	31	0	316	248	68
DAIRY POND	743	743	0	383	383	0	765	765	0	383	383	0
SEPTIC	6,739	0	6,739	3,309	0	3,309	7,845	0	7,845	3,300	0	3,300
OPEN SPACE	405	0	405	51	0	51	5	0	5	39	0	39
TOTAL	76,210	743	75,467	12,102	5,494	6,608	8,778	895	7,883	13,110	7,894	5,216

ATTAINMENT POINT 3 — OCCIDENTAL ROAD

SOURCES	WINTER EST LOAD	WINTER TRG RED	WINTER NET LOAD	SPRING EST LOAD	SPRING TRG RED	SPRING NET LOAD	SUMMER EST LOAD	SUMMER TRG RED	SUMMER NET LOAD	FALL EST LOAD	FALL TRG RED	FALL NET LOAD
URBAN	3,589	0	3,589	330	280	50	28	28	0	234	224	10
WASTEWATER	15,002	0	15,002	5,661	4,966	695	0	0	0	7,642	7,276	366
NON-IRRIGATED	1,614	0	1,614	199	0	199	20	0	20	159	0	159
DAIRY AG.	21,546	0	21,546	1,929	1,604	325	160	160	0	1,351	1,283	68
DAIRY POND	1,160	1,160	0	598	598	0	1,195	1,195	0	598	598	0
SEPTIC	4,301	0	4,301	2,112	0	2,112	4,985	0	4,985	2,106	0	2,106
OPEN SPACE	109	0	109	14	0	14	1	0	1	10	0	10
TOTAL	47,321	1,160	46,161	10,843	7,448	3,395	6,389	1,383	5,006	12,100	9,381	2,719

ATTAINMENT POINT 4 — STONY POINT ROAD

SOURCES	WINTER EST LOAD	WINTER TRG RED	WINTER NET LOAD	SPRING EST LOAD	SPRING TRG RED	SPRING NET LOAD	SUMMER EST LOAD	SUMMER TRG RED	SUMMER NET LOAD	FALL EST LOAD	FALL TRG RED	FALL NET LOAD
URBAN	1,318	0	1,318	163	113	50	16	16	0	130	120	10
WASTEWATER	0	0	0	0	0	0	0	0	0	0	0	0
NON-IRRIGATED	781	0	781	96	0	96	10	0	10	77	0	77
DAIRY AG.	8,556	0	8,556	1,056	731	325	106	106	0	845	777	68
DAIRY POND	1,474	1,474	0	759	759	0	1,519	1,519	0	759	759	0
SEPTIC	1,997	0	1,997	981	0	981	2,044	0	2,044	978	0	978
OPEN SPACE	96	0	96	12	0	12	1	0	1	9	0	9
TOTAL	14,222	1,474	12,748	3,067	1,603	1,464	3,696	1,641	2,055	2,798	1,656	1,142

TABLE 3: Summary of the long-term net load goals for each pollutant source within the sub-watersheds above the four attainment points during each season.

TOTAL NITORGEN (pounds/season)

	ATTAINMENT POINT 1 TRENTON-HEALDSBURG				ATTAINMENT POINT 2 GUERNEVILLE				ATTAINMENT POINT 3 OCCIDENTAL				ATTAINMENT POINT 4 STONY POINT			
SOURCE	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL
URBAN	52,393	6,468	0	5,175	87,935	4,160	0	2,029	24,971	0	0	0	17,054	1,161	0	514
WASTEWATER	0	0	0	0	112,466	12,857	0	9,761	112,466	9,202	0	8,387	0	0	0	0
NON-IRRIGATED	28,425	3,509	351	2,807	20,325	2,509	251	2,007	16,119	1,990	199	1,592	15,100	1,864	186	1,491
DAIRY AG.	47,300	5,840	0	4,672	15,094	0	0	0	77,940	0	0	0	51,335	3,496	0	1,546
DAIRY POND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEPTIC	8,479	4,163	9,632	4,151	7,314	3,592	8,577	3,581	6,913	3,395	8,827	3,384	5,993	2,943	6,134	2,934
OPEN SPACE	17,643	2,178	218	1,742	10,239	1,264	126	1,011	439	54	5	43	3,310	409	41	327
TOTAL	154,240	22,158	10,201	18,547	253,373	24,382	8,954	18,389	238,848	14,641	9,031	13,406	92,792	9,873	6,361	6,812

TOTAL AMMONIA (pounds/season)

	ATTAINMENT POINT 1 TRENTON-HEALDSBURG				ATTAINMENT POINT 2 GUERNEVILLE				ATTAINMENT POINT 3 OCCIDENTAL				ATTAINMENT POINT 4 STONY POINT			
SOURCE	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL
URBAN	4,581	566	0	399	8,004	326	0	130	2,271	0	0	0	1,318	50	0	10
WASTEWATER	0	0	0	0	15,002	1,523	0	1,040	15,002	695	0	366	0	0	0	0
NON-IRRIGATED	1,469	181	18	145	1,051	130	13	104	833	103	10	82	781	96	10	77
DAIRY AG.	7,883	1,143	0	705	2,515	0	0	0	12,990	0	0	0	8,556	325	0	68
DAIRY POND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEPTIC	2,829	1,389	3,215	1,385	2,438	1,197	2,860	1,194	2,304	1,131	2,941	1,128	1,997	981	2,044	978
OPEN SPACE	509	63	6	50	296	37	4	29	13	2	0	1	96	12	1	9
TOTAL	17,271	3,342	3,239	2,684	29,306	3,213	2,877	2,497	33,413	1,931	2,951	1,577	12,748	1,464	2,055	1,142

TABLE 4: Annual estimated long-term load reductions (L-T LOAD RED), interim load reduction (INTERIM LOAD RED), and anticipated load reductions (ANTICP LOAD RED) for total nitrogen and ammonia.

TOTAL NITORGEN (pounds/year)

	ATTAINMENT POINT 1 TRENTON-HEALDSBURG			ATTAINMENT POINT 2 GUERNEVILLE			ATTAINMENT POINT 3 OCCIDENTAL			ATTAINMENT POINT 4 STONY POINT			ANNUAL TOTALS		
SOURCE	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED
URBAN	647	4,250	8,495	14,438	6,100	12,300	5,857	15,000	38,964	2,325	10,000	19,372	23,267	35,350	79,131
WASTEWATER	0	0	0	77,116	22,500	60,000	82,145	22,500	60,000	0	0	0	159,261	45,000	120,000
NON-IRRIGATED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAIRY AG.	584	1,500	3,000	3,511	10,000	30,000	18,282	1,500	3,000	7,000	2,500	5,000	29,377	15,500	41,000
DAIRY POND	40,776	5,500	11,000	13,657	1,500	3,000	21,327	7,500	13,000	27,097	5,000	10,000	102,857	19,500	37,000
SEPTIC	0	375	749	0	325	653	0	320	638	0	250	510	0	1,270	2,550
OPEN SPACE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	42,007	11,625	23,244	108,722	40,425	105,953	127,611	46,820	115,602	36,422	17,750	34,882	314,762	116,620	279,681

TOTAL AMMONIA (pounds/year)

	ATTAINMENT POINT 1 TRENTON-HEALDSBURG			ATTAINMENT POINT 2 GUERNEVILLE			ATTAINMENT POINT 3 OCCIDENTAL			ATTAINMENT POINT 4 STONY POINT			ANNUAL TOTALS		
SOURCE	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED
URBAN	110	378	756	1,422	543	1,095	532	1,335	3,468	249	890	1,724	2,313	3,146	7,043
WASTEWATER	0	0	0	10,740	2,993	7,980	10,740	2,993	7,980	0	0	0	21,480	5,985	15,960
NON-IRRIGATED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAIRY AG.	171	250	500	590	1,665	4,995	3,047	250	500	1,614	416	833	5,422	2,581	6,827
DAIRY POND	6,790	916	1,832	2,274	250	500	3,551	1,249	2,165	4,511	833	1,665	17,126	3,247	6,161
SEPTIC	0	128	255	0	111	223	0	109	218	0	85	174	0	433	870
OPEN SPACE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	7,071	1,672	3,342	15,026	5,561	14,792	17,870	5,935	14,329	6,374	2,224	4,396	46,341	15,392	36,859

INTRODUCTION

This section describes the objectives of the waste load reduction strategy, provides background information, and lists the primary resources used in developing the strategy.

OBJECTIVE

The ultimate objective of the waste load reduction strategy is to use existing programs to reduce waste load inputs into the Laguna such that unionized ammonia does not exceed the USEPA criterion, and dissolved oxygen is above the Basin Plan minimum.

BACKGROUND

The Laguna de Santa Rosa (Laguna) watershed is located near Santa Rosa, California (Figure 1). The Laguna flows northward through the Santa Rosa Plain and enters the Russian River via Mark West Creek. The Laguna wastershed encompasses 250 square miles (160,000 acres) and is bounded by the Sonoma Mountains on the east and low foothills on the north, south, and west. Most of the watershed streams originate from the steeper, east side of the valley. The floodplain, comprising much of the watershed, ranges from 50 to 80 feet above sea level. The gradient, turbulence, and velocity of the Laguna's waters are so low that erosion is slight and transport of sediment is minimal.

The beneficial uses of the Laguna include, but are not limited to, agricultural water supply, groundwater recharge, and a route for migratory fish as well as significant fish and wildlife habitat. The marshes and ponds of the Laguna provide habitat for rare and endangered species. The Department of Fish and Game provided protection for several areas that were designated as "vernal pools", and other sections were set aside as green belts. Lower Russian River beneficial uses include, but are not limited to municipal, agricultural and industrial water supply, groundwater recharge, recreation, wildlife habitat, and a migratory fish route as well as fish spawning areas.

RESOURCES AND DATA

<u>WATER QUALITY DATA</u>

- Discharge Monitoring Reports for the Laguna Subregional Wastewater Reclamation Plant.

- Stream flow and water quality information for the Laguna de Santa Rosa from the City of Santa Rosa and Regional Board, respectively.

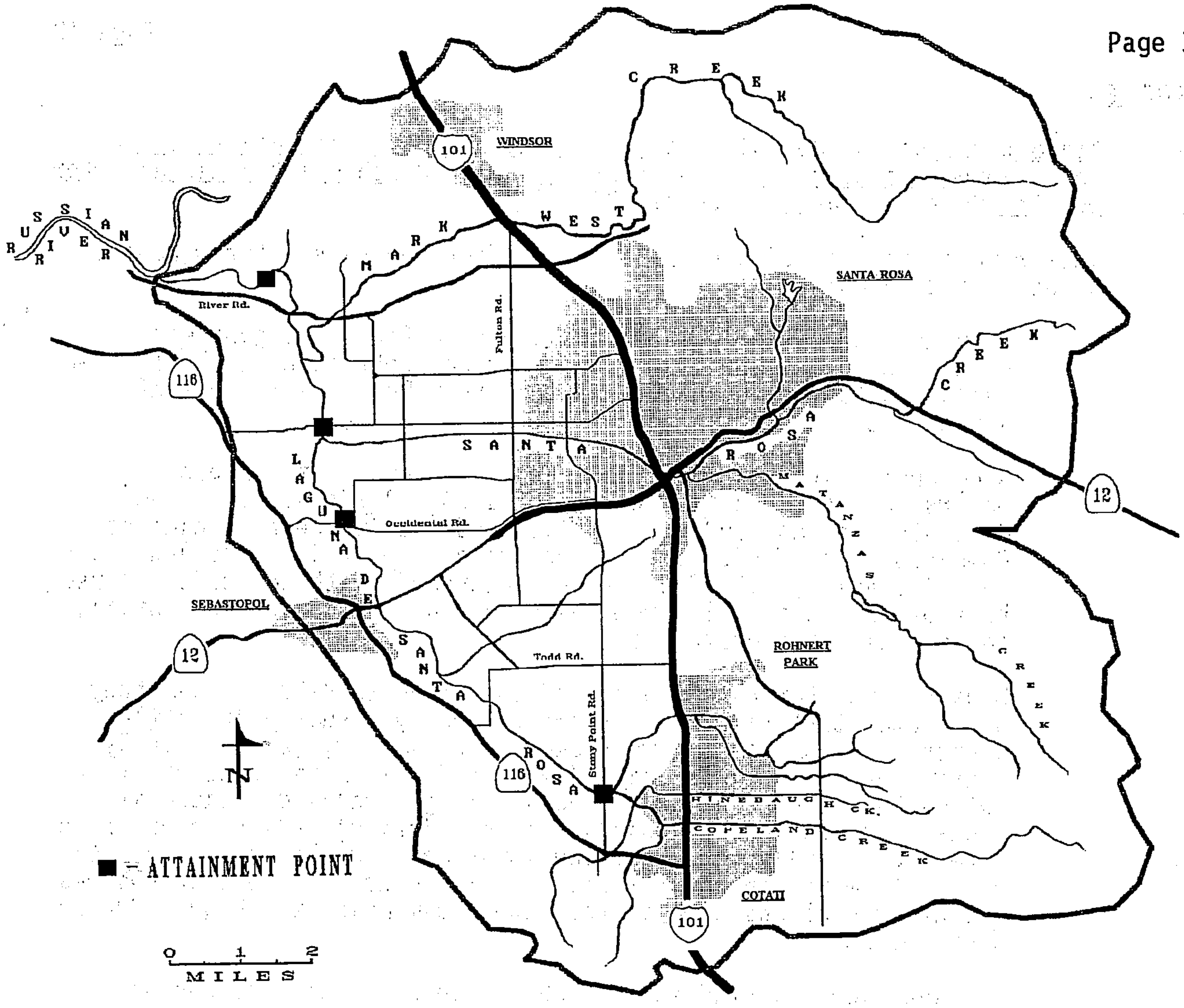


FIGURE 1: Laguna Watershed

STUDIES

- "Investigation for Nonpoint Source Pollutants into the Laguna de Santa Rosa, Sonoma County" prepared by staff to the North Coast Regional water Quality Control Board (September 24, 1992)

  This report consists of a compilation of four separate interim reports as described below:

  - A summary of historic water quality data for the Laguna was conducted in October 1990. The most comprehensive block of water quality data for the Laguna is that from Regional Board staff investigations.

  - A comprehensive survey of land use practices in the Laguna watershed was conducted in October 1990. Agriculture is the dominate land use and residential land use is the next highest. Combined rural residential, open space, and agriculture land uses comprise nearly 84% of the total watershed, with agricultural uses half of that area. The remaining land uses include residential, commercial and industrial;

  - Urban stormwater runoff was studied during 1989-92. This study documented that (1) light storms generally resulted in little significant change in downstream water quality, (2) relatively heavy storms sometimes initially raised some metal concentrations, but as the storm continued, the levels generally decreased at downstream stations (probably due to dilution), (3) some organics were occasionally detected, and important for this strategy, (4) nutrients were generally found in lower concentrations in upstream tributary stations than in the downstream main stem Laguna during storm events.

  - Nutrient levels, studied in 1989-92, increased in the Laguna as a result of nonpoint source discharges. Un-ionized ammonia levels occasionally exceeded EPA criteria for the protection of aquatic life at all monitoring stations. Sediment sampling documented nutrient rich organic matter in areas of stream channel deposition in contrast to non-depositional areas. We suspect that these nutrients are released later contributing to poor summertime water quality.

  - Dissolved oxygen levels were documented lower than the Basin Plan minimum objective. Water temperatures were documented as sometimes too high for cold water fish to thrive. On one occasion, excessively high nutrient levels were traced to a confined animal operation (dairy) not in compliance with water quality control regulations.

- "Laguna de Santa Rosa Water Quality Objective Attainment Plan" prepared for the City of Santa Rosa by CH2M Hill and Merritt Smith Consulting (June 1994)

This report consisted of the following information:

- Characterized the sources of pollutant loads that affect ammonia and oxygen in the Laguna. The primary pollutant sources characterized were: wastewater, urban runoff, runoff from confined animal facilities, septic systems, non-irrigated agriculture, and open space;

- Estimated the quantity of the pollutant load from each source, including the use of a water quality model for the Laguna. The two water quality modeling approaches that were used to evaluate the water quality responses of the Laguna and its tributaries to waste loading were:

  - The steady-state water quality model QUAL2E was used to simulate winter non-storm and summer conditions, when stream flow and waste discharges are relatively constant. QUAL2E does not explicitly simulate benthic processes, therefore both sediment oxygen demand and the benthic source rate of ammonia more closely function as boundary conditions relating to previously deposited organic material (CH2M Hill 1994). It is understood that the modelling is not fully responsive to all dynamics in the Laguna, one of the reasons to use a phased approach to this strategy. However, modelling can provide insight into the dynamics and point to areas requiring further investigation. The City of Santa Rosa is modifying the QUAL2E model, which may prove more useful in the future.

  - The steady-state assumption of QUAL2E was deemed inappropriate to evaluate the effects of pulse loading associated with storm events and the overbank storage along the Laguna. Therefore, hydrodynamics and water quality responses of the Laguna during a winter storm event were simulated using the computer programs RMA-2 and RMA-4. RMA-2 is a generalized free surface hydrodynamic model used to compute a continuous temporal and spatial description of fluid velocities and depth throughout a river or estuary system. RMA-4 is a generalized water quality model which computes a temporal and spatial description of conservative and non-conservative water quality parameters. RMA-4 uses the results from RMA-2 for its description of the flow (CH2M Hill 1994).

  The seasonal load of ammonia, nitrogen and organic matter from each source was estimated. Runoff from dairy facilities was identified as the primary contributor towards exceedences of ammonia. Urban areas and dairies were estimated to contribute organic matter and nutrients during storm events. Septic systems and wastewater contributed nutrients in the spring that may result in aquatic growth;

- Estimated the load reductions to attain water quality objectives in the Laguna. All pollutant sources except dairy facilities were estimated to be sources of ammonia, and sources that are diffused or at a low concentration. However, ammonia from confined animal facilities is episodic and concentrated causing exceedences of water quality objectives. Therefore the estimated pollutant source contribution from the confined animal facilities was the recommended load reduction; and

- Evaluated control strategies to achieve load reductions and recommended an implementation plan. The ammonia control strategy consisted of best management practices for the confined animal facilities. The dissolved oxygen management strategy included management options for the confined animal facilities, urban runoff, wastewater discharges, and septic systems.

- Other information was obtained through discussions with staff from the following agencies: Regional Water Quality Control Board, Resource Conservation District, City of Santa Rosa, Sonoma County Water Agency and Environmental Health Department, and Fish and Game.

LAGUNA WATER QUALITY

The Laguna has long suffered from various degrees of pollution. Until recent wastewater treatment system upgrades, the discharge of sewage effluent to the Laguna was thought to be the primary source of the pollutants. Now that the discharged wastewater meets Basin Plan and EPA criteria, it is apparent that significant amounts of pollutants are entering this aquatic system from various land uses in the watershed. Most of the watershed is rural and agricultural. Agricultural management practices in the watershed have resulted in pollutant load inputs to the Laguna, primarily confined animal facilities such as dairies. However, urban development has increased rapidly in the greater Santa Rosa area and contributes to the water quality problems in the Laguna.

AMMONIA

The high algae productivity in the Laguna generally indicates high nutrient levels. The prevalence of many nutrient pollutant sources in the watershed, along with the historically documented artificially high concentrations of nitrogen in the Laguna's water column and its impact on beneficial uses were the main reasons that we looked at nutrients in the Laguna system. The three main nutrients required for algal growth are carbon, phosphorus, and nitrogen. Algal Growth Potential studies have been conducted on Laguna water as part of the Laguna Monitoring Study (Roth and Smith 1992, 1993, 1994). In these studies, increased algal growth occurred in response to higher nitrogen concentrations in ambient water. No such relationship between phosphorus concentration and algal growth was apparent. The results indicated that nitrogen is the limiting plant nutrient. Because of these factors and the 303(d) listing for unionized ammonia, we focused on total nitrogen and two forms of ammonia-nitrogen: total, and unionized.

The term, total nitrogen, includes all forms of nitrogen: nitrate, nitrite, ammonia and organic. Ammonia-nitrogen, a major component of the nitrogen cycle, is formed by chemical and bacterial decomposition or breakdown of animal wastes, principally urea and other protein-bearing materials. In water, ammonia is measured as total ammonia-nitrogen and exists in either an ionic state or unionized state. It is the unionized form that is toxic to fish and aquatic life. USEPA has established a national criterion for unionized ammonia at 0.025 mg/l for protection of freshwater aquatic life. The percentage of measured total ammonia-nitrogen which exists in the toxic unionized ammonia form is increased when the pH or water temperature increase. Since total nitrogen may contribute to ammonia-nitrogen, high nitrogen concentrations provide the potential for high ammonia concentrations. High total ammonia concentrations provide the potential for high unionized ammonia concentrations.

Table 5 summarizes the number of exceedences of ammonia from 1985 to 1993. The EPA criteria for un-ionized ammonia was exceeded in the Laguna an average of 16% of the measurements.

DISSOLVED OXYGEN

Because of the nature of the pollutants, primarily nonpoint sources, we expect that reductions in total nitrogen will also result in reductions in ammonia, total phosphate and organic matter. One of the concerns about excessive nutrients and high productivity in the Laguna is that the resulting algae and aquatic plants use dissolved oxygen during respiration in the night and early morning hours. If the amount of respiration from algae and aquatic plant life is high, it results in low dissolved oxygen levels that adversely affect aquatic life. The total nitrogen, phosphate and organic matter reductions should also reduce algal productivity and reduce the daily dissolved oxygen and pH excursions.

Dissolved oxygen concentrations in the Laguna vary partly in response to algal production. Figure 2 shows the cumulative percent distribution for dissolved oxygen measured in the Laguna at Trenton-Healdsburg Road from 1987-92. Out of 440 observations, dissolved oxygen was below the Regional Board's Basin Plan minimum objective of 7.0 mg/l about 40% of the time.

Table 5: Number of exceedences of EPA unionized ammonia criteria in the Laguna de Santa Rosa. (Adapted from CH2M Hill 1994)

Station	Percent Exceedences (Total Number of Measurements)		
	1985-88	**1988-93**	**1985-93**
Stony Point	0%(13)	6%(49)	5%(62)
Occidental Road	43%(14)	31%(48)	34%(62)
Above Santa Rosa Creek	19%(26)	19%(47)	19%(73)
Trenton-Healdsburg Road	11%(27)	0%(15)	7%(42)
Totals	18%(80)	14%(159)	16%(239)

Table 5 note: The higher exceedence rates in the middle reaches of the Laguna are probably due to several factors: Stony Point station is the most upstream station with less pollutant loading, narrower channel width providing faster flows, more flushing and generally better water quality than downstream stations; The areas above Occidental Road station and Santa Rosa Creek station have wider stream channels that are slower, shallower and predominately unshaded, and multiple pollutant inputs occur contributing to poorer water quality; Trenton-Healdsburg Road station has the contribution of Mark West Creek which tends to be clearer, provides dilution and better water quality downstream of its confluence.

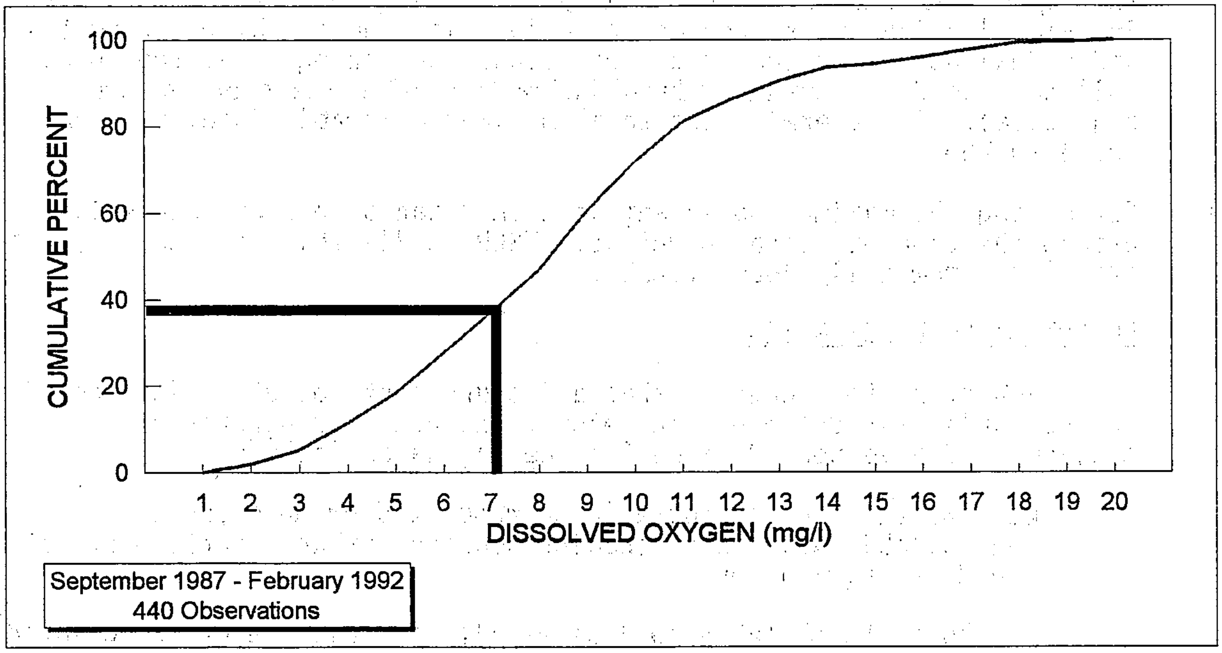


FIGURE 2. Cumulative percent distribution of dissolved oxygen measured in the Laguna at Trenton-Healdsburg Road from 1987-92.

WASTE REDUCTION STRATEGY DEVELOPMENT

There are three general steps to bring a waterbody into attainment:

I. Estimating the amount of impairment-causing pollutant from each source and the resulting pollutant concentration in the waterbody.

POLLUTANT CONCENTRATION

The concentration of a pollutant in a waterbody is equal to the sum of the inputs from the individual sources divided by the volume of the receiving water (equation 1).

(1) $$C_R = \sum_{i=1}^{n} \frac{C_i Q_i}{Q_R} \quad \text{and} \quad Q_R = \sum_{i=1}^{n} Q_i + Q_B$$

Where C_i and Q_i are the concentration and flow rate for "n" individual pollutant sources. C_R and Q_R are the concentration and flow rate of the receiving water. Q_B is the baseline flow.

When C_R is above a water quality objective (WQO), an analysis of the individual pollutant source contributions is needed. By reducing the individual pollutant source contributions and consequently the total pollutant load, C_R can be reduced below the WQO (attainment of the objective). To determine the total maximum allowable load, C_R is set equal to WQO.

II. Estimating the maximum pollutant load that can be present and still attain the concentration objective. USEPA calls this pollutant load the "total maximum daily load" (TMDL).

POLLUTANT LOAD ESTIMATES

It is important to recognize that all sources of pollutant load could not be explicitly defined. Therefore, the basic components of the maximum load have been defined for the Laguna as follows:

WL = waste load attributable to regulated or more easily controllable point and nonpoint sources (urban runoff, wastewater, and dairy agriculture),

L = load attributable to less easily controllable or unregulated nonpoint sources and background sources(open space, septic systems, and non-irrigated agriculture),

MOS = a margin of safety which accounts for uncertainties in the determination of the WL or L (10% of the maximum load),

and equation 2:

(2) TOTAL MAXIMUM SEASONAL LOAD (TMSL) = WL + L + MOS

III. Developing a strategy to reduce pollutant waste loads (inputs) to levels below the maximum pollutant load amount.

STRATEGY DEVELOPMENT

The Laguna waste reduction strategy was based on a watershed approach. The entire Laguna watershed and the different factors contributing to the water quality conditions in the Laguna were considered. The dynamics of the Laguna watershed include different input sources, routes for inputs to occur (point source or non-point source), amount and strength of each input type, as well as seasonal patterns such as rainfall and flow conditions.

The Laguna waste reduction strategy proposes targeting specific pollutant sources found within different areas of the watershed. The Laguna watershed was divided into four attainment areas, the lowermost point in the stream for each area being the "point of attainment". Attainment point one is located in the Laguna at Trenton-Healdsburg Road, attainment point two at Guerneville Road, attainment point three at Occidental Road and attainment point four at Stony Point Road (Figure 3).

Several scenarios were developed for different seasonal flow periods and loadings. Each scenario was evaluated, and waste reductions for each pollutant source developed to meet water quality goals. One scenario was selected for the Laguna waste reduction strategy. The criteria for selection were as follows:

- The scenario targeted waste load reductions that meet the water quality goals for the Laguna;
- The scenario best represented the Laguna flow and pollutant loading dynamics;
- The scenario provided a reasonable time frame for the dischargers to make load reduction adjustments; and
- The scenario suggested targeted load reductions that appear reasonable and achievable.

The intent of this process is to bring a waterbody into attainment by reducing the amount of waste input.

CALCULATION OF AMMONIA AND TOTAL NITROGEN UPPER LIMITS

TOTAL AMMONIA

For the Laguna, the upper limit for total ammonia was calculated from the unionized ammonia equation and coefficients (pKa values) derived from Emerson (Emerson 1975), equation 3 below. The USEPA criterion of 0.025 mg-N/L for unionized ammonia was used. The pKa value and the total ammonia upper limit were calculated using a water temperature of 24°C and pH value of 8.0. The temperature value is the worst-case maximum temperature measured (January 1990 to January 1992) at the monitoring station in the Laguna upstream of Santa Rosa Creek (NCRWQCB 1992). The pH value of 8.0 is the corresponding pH value measured when the maximum temperature value was measured in the Laguna upstream of Santa Rosa Creek (NCRWQCB 992).

(3) $$\text{Unionized Ammonia} = \frac{\text{Total Ammonia}}{1 + 10^{(pka - pH)}}$$ (Emerson, 1975)

Where

- Unionized Ammonia = 0.025 mg-N/l
- pH = 8.0; and
- pKa = 9.2757,
  from temperature = 24°C (Measured highest value)

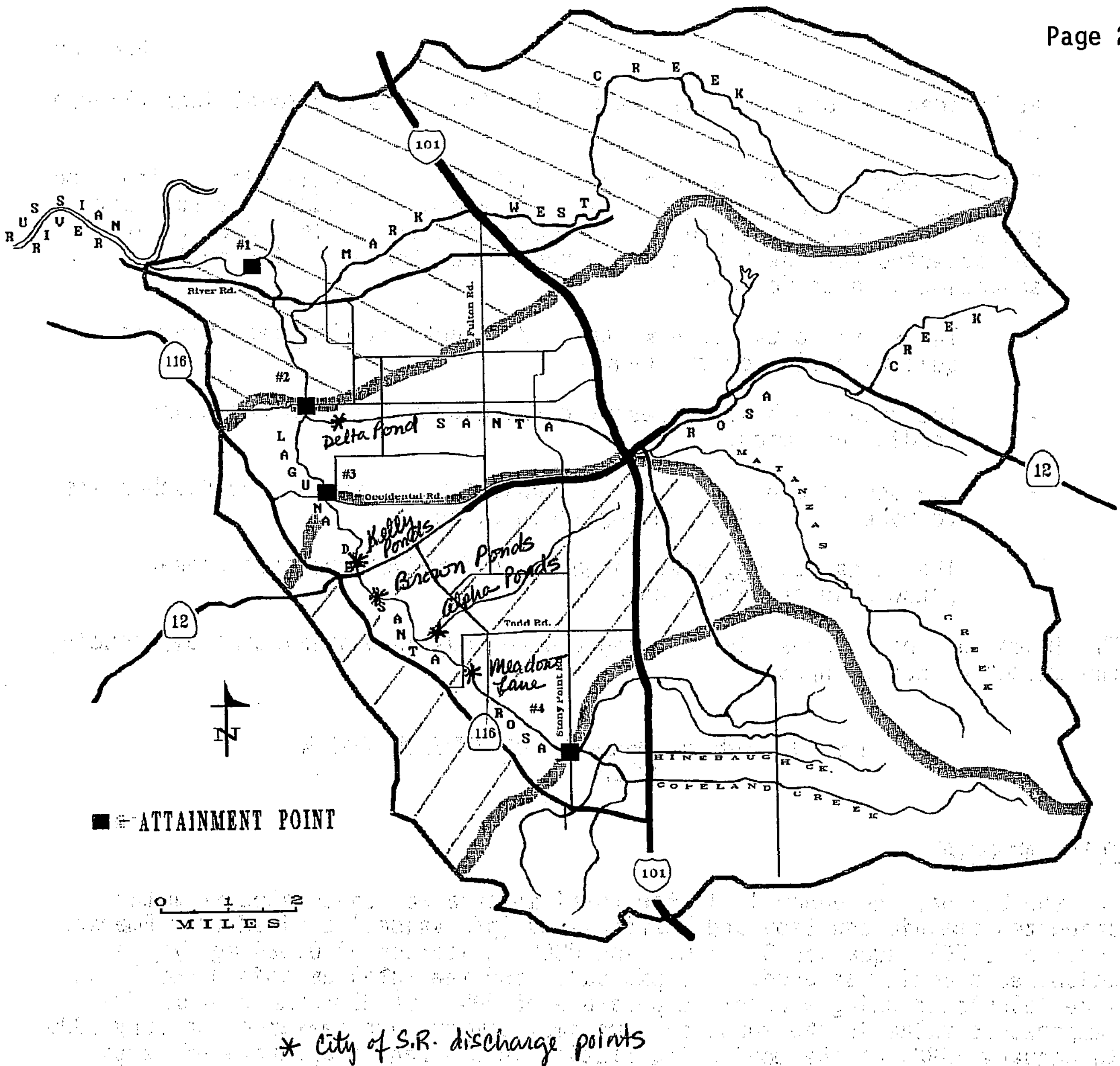


FIGURE 3: Laguna Watershed, Sub-watersheds, and Attainment Points

Rearranging equation (2) gives a

Total Ammonia Upper Limit = 0.497 mg-N/L, or **0.5 mg-N/L**

TOTAL NITROGEN

The term, total nitrogen, includes all forms of nitrogen: nitrite, nitrate, ammonia and organic nitrogen. The total nitrogen upper limit was calculated from first calculating the percent of total ammonia in total nitrogen for each significant pollutant source in the Laguna watershed: wastewater = 13%, non-irrigated agriculture = 5%, dairy agriculture = 17%, septic systems = 34%, open space = 3%, and urban runoff = 9% (CH2M Hill 1994); second, taking the average percent of total ammonia for all the pollutant sources (13%); and third, applying the total ammonia upper limit of 0.5 mg-N/L to the relationship between total ammonia and total nitrogen (equation 4).

(4) Total Ammonia = 13% Total Nitrogen

0.5 mg-N/L = (0.13) Total Nitrogen

Rearranging equation (4) results in a

Total Nitrogen Upper Limit = 3.70 mg/L, or **3.7 mg/L**

STREAM FLOW RELATIONSHIPS

TIME-STEP

From a practical standpoint, the time-step or period considered for loading was an important component. The time-step needed to appropriately consider the dynamics of stream flow and loading inputs, and from the dischargers' standpoint, the time-step needed to be long enough to allow for load reduction adjustments to be made. The time-step conditions that we considered were derived from flow information contained in the City of Santa Rosa's 205(j) Report (CH2M Hill 1994).

Figure 4 shows the average monthly flows for May 1991 through May 1992 measured in the Laguna at Trenton-Healdsburg Road. The average monthly flows for May 1991 through December 1993 measured at Trenton-Healdsburg Road are summarized in Table 6. 1991 and 1992 were dry winter years while 1993 was a wet winter year. Based on this information, a flow-based seasonal time-step was established for the waste reduction strategy. The daily flows at Trenton-Healdsburg Road for 1993 and the corresponding seasonal time-step established for the strategy are displayed as an example in Figure 5.

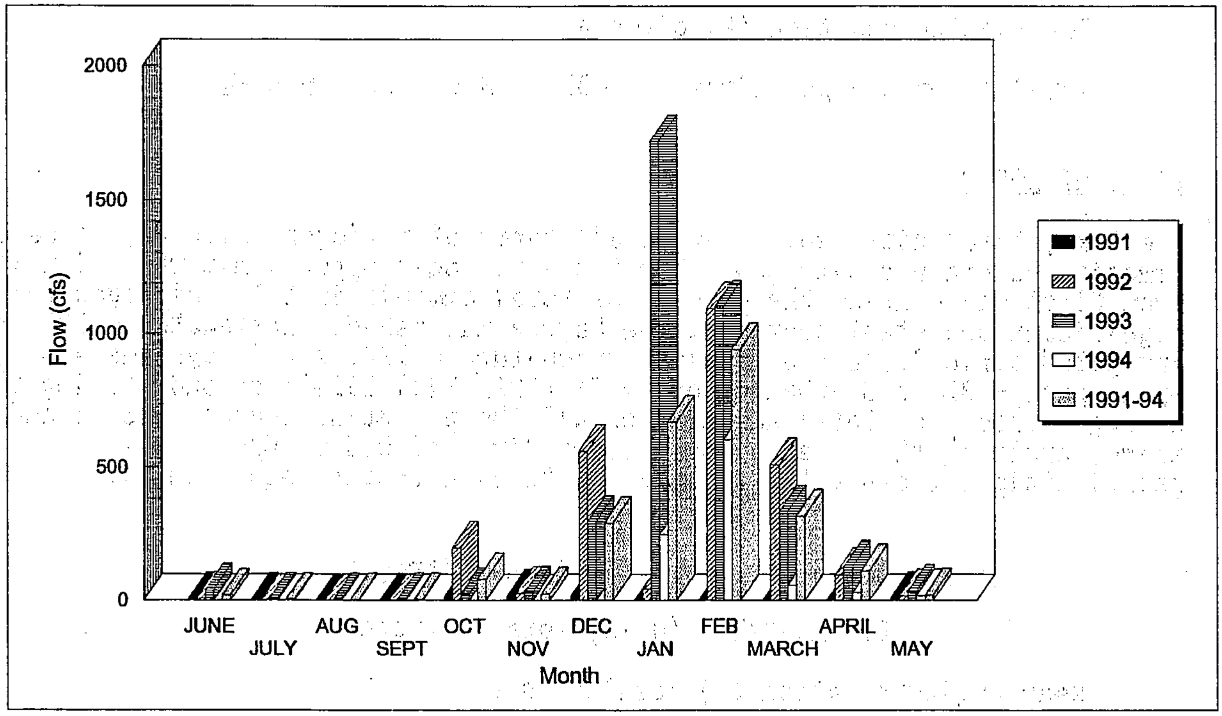


Figure 4. Average monthly flow in the Laguna at Trenton-Healdsburg Road, 1991-1994.

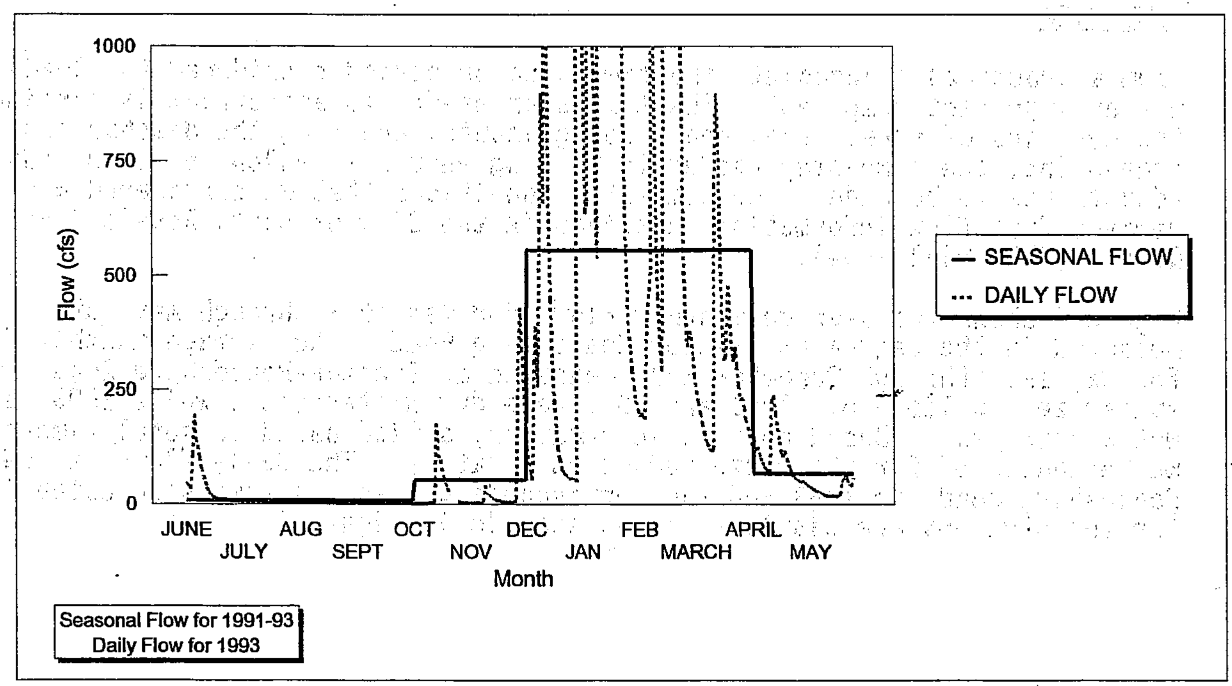


Figure 5. Daily and seasonal flows in the Laguna at Trenton-Healdsburg Road.

Table 6: Seasonal time-step and average measured flow in the Laguna at Trenton-Healdsburg Road.

SEASON	PERIOD	AVERAGE FLOW* (cfs)
Fall	October - November	52.5
Winter	December - March	555.5
Spring	April - May	66.5
Summer	June - September	7.8
Extended Winter	October - April	348.4

*Average flows were derived from measured flow information at Trenton-Healdsburg Road from May 1991-December 1993 (CH2M Hill 1994).

Note for Table 6: The extended winter period was included to consider the wettest winter months of the year irrespective of the City of Santa Rosa's allowed discharge period.

The estimated 24-hour average flow at Trenton-Healdsburg Road for an average winter storm event (6-hr storm event) is 750 cubic feet per second (CH2M Hill 1994). In addition to the above flow information, the estimated 24-hour average flow was used in two scenarios that were evaluated in developing this strategy.

Flows were estimated and analyzed for the four attainment points along the Laguna using the above estimated flow information as well as other flow information (CH2M Hill 1994). Flows for each season at each attainment point were estimated. Since each seasonal flow and loading pattern contributes to the condition of water quality in the Laguna in a different way, several scenarios including the selected scenario were considered on a seasonal basis (winter, spring, summer, and fall).

ESTIMATED WASTE LOADS

The primary pollutant sources contributing to the Laguna were categorized and their loads estimated (CH2M Hill 1994). These sources were categorized as wastewater from the City of Santa Rosa's Subregional Plant, urban runoff, confined animal facilities (primarily dairies), non-irrigated agriculture, septic systems, and open space.

The assumptions used to estimate the septic system loads were based on exceptions and appear to be high. The estimates assumed all wastewater discharged through a septic system reaches the Laguna no matter how far it is located from the Laguna. The septic system estimates also assumed that each person generates 75 gallons of wastewater each day. We feel that 44 gallons per person each day (EPA 1980) is more representative. A more reasonable estimation was made for the septic system loads based on 44 gallons generated per person daily. Therefore, estimated septic system loads were reduced by 58%. We plan to obtain additional information by July 1996 to more accurately estimate septic system loads.

The estimated waste loads were separated into storm event and non-storm as well as summer loadings. The estimated storm and non-storm loadings were divided into seasonal loadings. Except for wastewater, the seasonal load estimates were based on storm event load estimates multiplied by a percentage of storm event flow per season (winter = 81%, spring = 10%, summer = 1%, and fall = 8%) plus non-storm load estimates multiplied by a percentage of non-storm days per season (winter = 33%, spring = 17%, summer = 34%, and fall = 17%). For the portion of seasonal load estimates based on storm event load and flow estimates, we assumed that a simple relationship exists between storm events and flow rates in the Laguna. From this assumption, the storm event loadings were divided up based on the average seasonal flows at Trenton-Healdsburg Road.

Because the City of Santa Rosa's NPDES permit prohibits discharging wastewater during the summer, wastewater loadings only occur during winter, spring, and fall. The seasonal loading estimates for wastewater were based on winter storm plus non-storm load estimates multiplied by a percentage of days per season during the permitted discharge period (winter = 53%, spring = 20%, summer = 0%, and fall = 27%).

As an extra condition, several scenarios included over topping of an average dairy manure pond. This type of load input was included because it seems to be a common and recurring pollutant problem in the Laguna watershed.

ANALYSIS BY SCENARIOS

The waste reduction strategy analyzed different stream flow and loading scenarios. For each of the scenarios, the maximum loads (pounds per day, year or season), the total waste load reduction, and the waste load reduction for each source were calculated. A summary of each scenario follows. More detailed information as well as a line-item description of the calculations used in each scenario is tabulated in Appendix A.

Looking at the results of each scenario, some scenarios show that no waste load reduction is needed for total ammonia and/or total nitrogen, while other scenarios have various reductions that range from about 50% to 100% for total ammonia and total nitrogen.

Some of the scenarios were evaluated further using the flow and loading information available to us. These scenarios were broken down to look at them from each attainment point of the Laguna, and by different loadings. The loadings were separated for each sub-watershed, or cumulated as one goes downstream (i.e. the load from the upstream sub-watershed was added in each time). The information for each of these expanded scenarios (including line-item descriptions for calculations) is tabulated in Appendix B. The selected scenario, which is a combination of important conditions that best represent the Laguna flow and loading dynamics, is explained in greater detail below.

SUMMARY OF SCENARIOS

Approximately 8 different scenarios were analyzed. Table 8 summarizes the scenarios in a matrix formate, and a brief description of each scenario follows:

<u>Scenario 1</u> - Average 24-hour winter storm event flow with total storm event loadings.

In this scenario, the estimated 24-hour flow for an average winter storm in the Laguna at Trenton-Healdsburg Road was used along with estimated total winter storm event loadings. The results show a reduction of about 43% in total ammonia or 53% reduction in total nitrogen waste loads is needed to stay below the maximum total load and concentration goals. This scenario was not selected because it considers only storm event loadings.

<u>Scenario 2</u> - Average 24-hour winter storm event flow with total storm event loadings (Scenario 1) plus over topping of an average dairy manure pond.

This scenario was the same scenario as 1 above with the additional input from a dairy manure pond. The results show a greater reduction since the manure pond over-flow is a prohibited discharge, it would be eliminated. The reduction in total ammonia is about 46% or total nitrogen is about 55%. This scenario was not selected because it considers only storm event loadings.

<u>Scenario 3</u> - Winter Storm event flow with total storm event loadings plus over topping of an average dairy manure pond.

This scenario considered the estimated winter storm event flow in the Laguna at Trenton-Healdsburg Road for an average storm event instead of a 24-hour flow like scenarios 1 and 2. It included total storm event loadings and input from a dairy manure pond. The results show that no reduction in total ammonia or nitrogen is needed to meet the load and concentration goals. However, since the dairy pond overflow must be eliminated, a 5% reduction in total ammonia or a 4% reduction in total nitrogen occurs. This scenario was not selected because it considers only storm event loadings.

<u>Scenario 4</u> - Average monthly winter flow with total storm event and non-storm loadings.

This scenario considered the average winter flow from October to April, and included both winter storm event and non-storm loadings. The results show no reductions are needed for total ammonia or total nitrogen. Because it only considers winter time flows and loadings this scenario was not chosen.

<u>Scenario 5</u> - Scenario 4 plus over topping of an average dairy manure pond.

The results of this scenario are close to scenario 4. It showed no need for reduction of total ammonia except for 100% reduction (elimination) from the dairy manure pond. The overall total ammonia reduction is about 3%, slightly higher than scenario 4 because of the elimination of the over topping dairy pond. The only source reduction for total nitrogen is from the dairy manure pond (100% reduction) which gives an overall reduction in total nitrogen of about 2%. For the same reason as scenario 4, this scenario was not chosen because it considers only winter time flows and loadings.

<u>Scenario 6</u> - Non-storm event flow with total winter non-storm loadings plus over topping of an average dairy manure pond.

The flow and loadings in this scenario were estimated by considering the winter season during periods of no rainfall (non-storm event). The addition of a dairy manure pond was considered since over topping of a pond can occur during non-storm event periods. The results show that no reduction in total ammonia is needed except 100% reduction in the dairy manure pond. This gives a overall reduction of about 5% in total ammonia. The only reduction for total nitrogen is that coming from the over topping manure pond resulting in about 5% overall reduction in total nitrogen. This scenario was not chosen because it does not consider winter storm event loadings, which contribute to the total loads into the Laguna.

<u>Scenario 7A-7D</u> - Average seasonal flows with proportionate winter storm event and non-storm loadings plus over topping of an average manure pond.

Average seasonal flows for winter (7A: December - March), spring (7B: April - May), summer (7C: June - September) and fall (7D: October - November) are considered in this scenario. The estimated total storm and non-storm loadings were used. These loads were broken down into seasonal loads based on seasonal duration. The results are summarized in Table 7.

This scenario best represents the seasonal changes in flow and loadings, but was not chosen because it needed to be broken down further to focus on specific areas or sub-watersheds of the Laguna watershed.

TABLE 8: SUMMARY OF SCENARIOS
(MATRIX)

Description	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Average 24-hr. winter flow	X	X		
Winter storm event flow			X	X
Average monthly winter flow				
Non-storm event flow				
Average seasonal flows				
Flows for each attainment point				
Storm event loadings	X	X	X	X
Winter non-storm loadings				X
Proportionate loadings				
Cumulative loadings				
Over topping of an average manure pond		X	X	

Description	Scenario 5	Scenario 6	Scenario 7A-7D	Scenario 8*
Average 24-hr. winter flow				
Winter storm event flow				
Average monthly winter flow	X			
Non-storm event flow		X		
Average seasonal flows			X	X
Flows for each attainment point				X
Storm event loadings	X		X	X
Winter non-storm loadings	X	X	X	X
Proportionate loadings			X	X
Cumulative loadings				X
Over topping of an average manure pond	X	X	X	X

*Scenario 8 is the Selected Scenario

Table 7: Summary of the percent reduction for total ammonia and total nitrogen in Scenario 7A - 7D

Season	Total Ammonia Percent Reduction	Total Nitrogen Percent Reduction
Winter	6%	4%
Spring	61%	59%
Summer	36%	53%
Fall	72%	70%

SELECTED SCENARIO

Scenario 8 - Average estimated seasonal flows for each attainment point and seasonal proportional loadings (included over topping manure pond) that accumulate downstream.

This scenario was selected because:

- The scenario targets waste load reductions that meet the water quality goals for the Laguna;
- The scenario best represents the Laguna flow and pollutant loading dynamics;
- The scenario provides a reasonable time frame for the dischargers to make load reduction adjustments; and
- The scenario suggests targeted load reductions that appear reasonable and achievable.

The selected scenario was developed on a seasonal basis since each seasonal flow and loading pattern contributes to the condition of water quality in the Laguna in a different way. This scenario separated the Laguna flows into average seasonal flows. A relationship between the average measured flows for each season in the Laguna at Trenton-Healdsburg Road, and the cumulative estimated non-storm flows in the Laguna at each attainment point was developed. The relationship is a flow ratio, and was used for estimating the average seasonal flows for each attainment point. Appendix D, Table D-2 contains the estimated average flows for each attainment point during each season, as well as an example of the flow estimation method.

The loadings for this scenario were broken down into seasonal loads which depend on either a function of time (non-storm load) or a function of flow (storm event load). Except for wastewater, the seasonal loads were based on the estimated storm event load multiplied by a percentage of storm event flow per season (winter = 81%, spring = 10%, summer = 1%, and fall = 8%) plus the estimated non-storm load multiplied by a percentage of non-storm days per season (winter = 33%, spring = 17%, summer = 34%, and fall = 17%). For seasonal load estimates based on a function of flow, we assumed a simple relationship exists between flow, rainfall and loading. The seasonal loads for wastewater were based on winter storm plus non-storm load estimates multiplied by a percentage of days per season during the permitted discharge period (winter = 53%, spring = 20%, summer = 0%, and fall = 27%).

The seasonal proportioned loads for each attainment point and examples of the method used to estimate these loads are summarized in Appendix D, Table D-3.

For clarification, Appendix D contains Tables D-4 through D-13. Tables D-4 and D-5 are tabulated summaries of the estimated loads for total nitrogen and ammonia at each attainment point (derived from CH2M Hill 1994). Tables D-6 through D-9 are summaries of the estimated seasonal proportioned loads entering the Laguna at each sub-watershed above each attainment point. Tables D-10 through D-13 are summaries of the cumulative seasonal proportioned loads entering the Laguna as one goes downstream for each attainment point.

Appendix C contains a more detailed summary of the selected scenario results as well as a line-item table showing the calculations used in this scenario. The mass limit goals exceed the total maximum seasonal load during the summer. We suspect that the estimated loads for the summer are high and expect to obtain additional information by July 1996 that will help us estimate more accurate summer loads. The selected scenario load reductions and mass limit goals were adjusted (targeted load reductions and net load goals) at upstream sub-watersheds to ensure strategy goals were met at all the downstream attainment points during the spring and fall seasons. The estimated seasonal loads, targeted reductions and net load goals for each pollutant source within the sub-watershed above four attainment points during each season are summarized in Tables 9 and 10.

Figures 6 through 9 show the estimated net load goals for each source for total ammonia and total nitrogen. The graphs represent the net load goals within each sub-watershed above each attainment point after reduction has occurred. The total maximum seasonal loading (TMSL) is shown as a line. If the net load goal exceeded the TMSL, then further reduction would be necessary.

TABLE 9: Estimated cumulative seasonal loads (EST LOAD), targeted reductions (TRG RED) adjusted to attain strategy goals during spring and fall seasons, and resulting net load goals (NET LOAD) for total nitrogen for each pollutant source within the sub-watershed above four attainment points.

SOURCES	WINTER			SPRING			SUMMER			FALL		
	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD
ATTAINMENT POINT 1 TRENTON-HEALDSBURG ROAD												
URBAN	182,353	0	182,353	11,789	0	11,789	647	647	0	7,718	0	7,718
WASTEWATER	244,932	0	244,932	22,059	0	22,059	0	0	0	18,148	0	18,148
NON-IRRIGATED	79,969	0	79,969	9,872	0	9,872	987	0	987	7,897	0	7,897
DAIRY AG.	191,669	0	191,669	9,336	0	9,336	584	584	0	6,218	0	6,218
DAIRY POND	13,323	13,323	0	6,863	6,863	0	13,727	13,727	0	6,863	6,863	0
SEPTIC	28,699	0	28,699	14,094	0	14,094	33,170	0	33,170	14,050	0	14,050
OPEN SPACE	31,631	0	31,631	3,905	0	3,905	390	0	390	3,123	0	3,123
TOTAL	772,576	13,323	759,253	77,918	6,863	71,055	49,505	14,958	34,547	64,017	6,863	57,154
ATTAINMENT POINT 2 GUERNEVILLE ROAD												
URBAN	129,960	0	129,960	12,017	6,696	5,321	1,086	1,086	0	9,199	6,656	2,543
WASTEWATER	224,932	0	224,932	51,642	29,583	22,059	0	0	0	65,681	47,533	18,148
NON-IRRIGATED	51,544	0	51,544	6,363	0	6,363	636	0	636	5,090	0	5,090
DAIRY AG.	144,369	0	144,369	5,360	1,864	3,496	186	186	0	3,037	1,491	1,546
DAIRY POND	4,462	4,462	0	2,299	2,299	0	4,597	4,597	0	2,299	2,299	0
SEPTIC	20,220	0	20,220	9,930	0	9,930	23,538	0	23,538	9,899	0	9,899
OPEN SPACE	13,988	0	13,988	1,727	0	1,727	172	0	172	1,381	0	1,381
TOTAL	589,475	4,462	585,013	89,338	40,442	48,896	30,215	5,869	24,346	96,586	57,979	38,607
ATTAINMENT POINT 3 OCCIDENTAL ROAD												
URBAN	42,025	0	42,025	4,244	3,083	1,161	308	308	0	2,980	2,466	514
WASTEWATER	112,466	0	112,466	42,440	33,238	9,202	0	0	0	57,294	48,907	8,387
NON-IRRIGATED	31,219	0	31,219	3,854	0	3,854	385	0	385	3,083	0	3,083
DAIRY AG.	129,275	0	129,275	13,118	9,622	3,496	962	962	0	9,244	7,698	1,546
DAIRY POND	6,968	6,968	0	3,590	3,590	0	7,179	7,179	0	3,590	3,590	0
SEPTIC	12,906	0	12,906	6,338	0	6,338	14,961	0	14,961	6,318	0	6,318
OPEN SPACE	3,749	0	3,749	463	0	463	46	0	46	370	0	370
TOTAL	338,608	6,968	331,640	74,047	49,533	24,514	23,841	8,449	15,392	82,879	62,661	20,218
ATTAINMENT POINT 4 STONY POINT ROAD												
URBAN	17,054	0	17,054	2,105	944	1,161	211	211	0	1,684	1,170	514
WASTEWATER	0	0	0	0	0	0	0	0	0	0	0	0
NON-IRRIGATED	15,100	0	15,100	1,864	0	1,864	186	0	186	1,491	0	1,491
DAIRY AG.	51,335	0	51,335	6,338	2,842	3,496	634	634	0	5,070	3,524	1,546
DAIRY POND	8,853	8,853	0	4,561	4,561	0	9,122	9,122	0	4,561	4,561	0
SEPTIC	5,993	0	5,993	2,943	0	2,943	6,134	0	6,134	2,934	0	2,934
OPEN SPACE	3,310	0	3,310	409	0	409	41	0	41	327	0	327
TOTAL	101,645	8,853	92,792	18,220	8,347	9,873	16,328	9,967	6,361	16,067	9,255	6,812

TABLE 10: Estimated cumulative seasonal loads (EST LOAD), targeted reductions (TRG RED) adjusted to attain strategy goals during spring and fall seasons, and resulting net load goals (NET LOAD) for total ammonia for each pollutant source within the sub-watershed above four attainment points.

ATTAINMENT POINT 1
TRENTON-HEALDSBURG ROAD

SOURCES	WINTER			SPRING			SUMMER			FALL		
	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD
URBAN	16,174	0	16,174	942	0	942	57	57	0	592	53	539
WASTEWATER	30,004	0	30,004	2,218	0	2,218	0	0	0	1,406	0	1,406
NON-IRRIGATED	4,134	0	4,134	510	0	510	51	0	51	408	0	408
DAIRY AG.	31,944	0	31,944	1,468	0	1,468	97	97	0	847	74	773
DAIRY POND	2,218	2,218	0	1,143	1,143	0	2,286	2,286	0	1,143	1,143	0
SEPTIC	9,568	0	9,568	4,698	0	4,698	11,060	0	11,060	4,685	0	4,685
OPEN SPACE	914	0	914	114	0	114	11	0	11	89	0	89
TOTAL	94,956	2,218	92,738	11,093	1,143	9,950	13,562	2,440	11,122	9,170	1,270	7,900

ATTAINMENT POINT 2
GUERNEVILLE ROAD

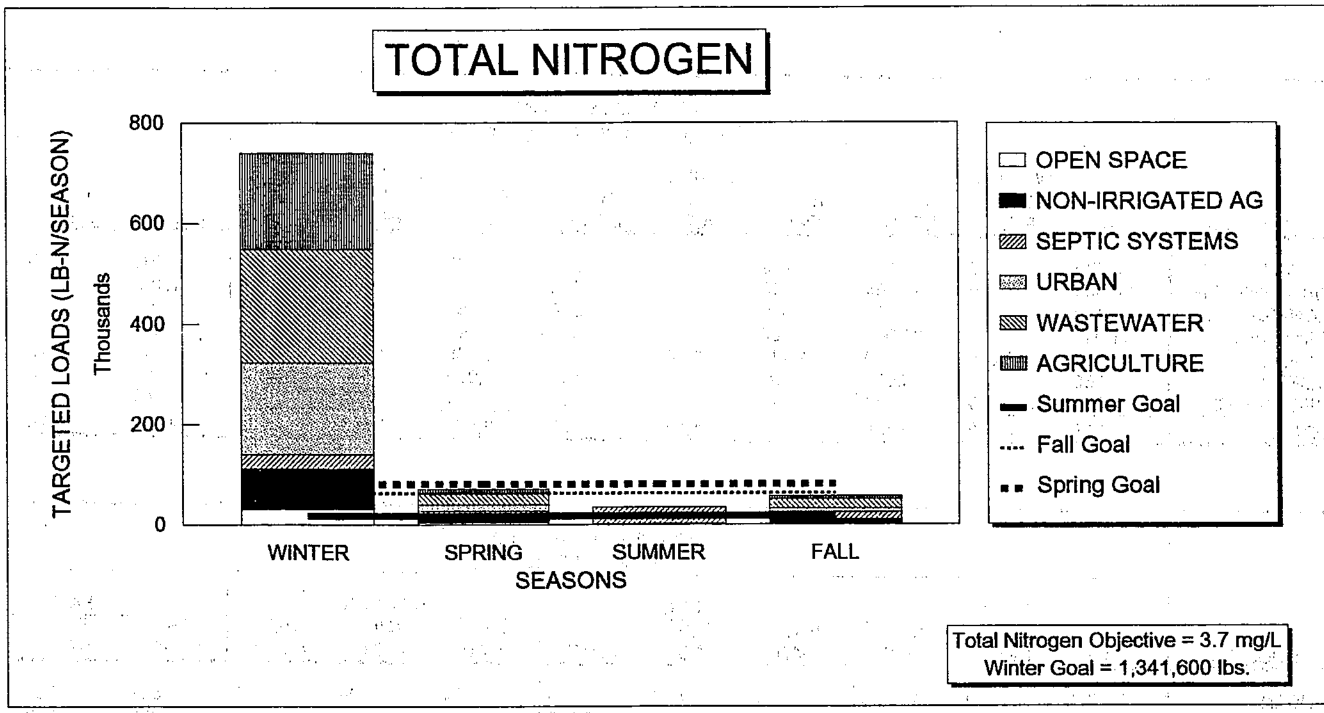
SOURCES	WINTER			SPRING			SUMMER			FALL		
	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD
URBAN	11,593	0	11,593	1,038	662	376	99	99	0	801	661	140
WASTEWATER	30,004	0	30,004	6,356	4,138	2,218	0	0	0	8,008	6,602	1,406
NON-IRRIGATED	2,665	0	2,665	329	0	329	33	0	33	263	0	263
DAIRY AG.	24,061	0	24,061	636	311	325	31	31	0	316	248	68
DAIRY POND	743	743	0	383	383	0	765	765	0	383	383	0
SEPTIC	6,739	0	6,739	3,309	0	3,309	7,845	0	7,845	3,300	0	3,300
OPEN SPACE	405	0	405	51	0	51	5	0	5	39	0	39
TOTAL	76,210	743	75,467	12,102	5,494	6,608	8,778	895	7,883	13,110	7,894	5,216

ATTAINMENT POINT 3
OCCIDENTAL ROAD

SOURCES	WINTER			SPRING			SUMMER			FALL		
	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD
URBAN	3,589	0	3,589	330	280	50	28	28	0	234	224	10
WASTEWATER	15,002	0	15,002	5,661	4,966	695	0	0	0	7,642	7,276	366
NON-IRRIGATED	1,614	0	1,614	199	0	199	20	0	20	159	0	159
DAIRY AG.	21,546	0	21,546	1,929	1,604	325	160	160	0	1,351	1,283	68
DAIRY POND	1,160	1,160	0	598	598	0	1,195	1,195	0	598	598	0
SEPTIC	4,301	0	4,301	2,112	0	2,112	4,985	0	4,985	2,106	0	2,106
OPEN SPACE	109	0	109	14	0	14	1	0	1	10	0	10
TOTAL	47,321	1,160	46,161	10,843	7,448	3,395	6,389	1,383	5,006	12,100	9,381	2,719

ATTAINMENT POINT 4
STONY POINT ROAD

SOURCES	WINTER			SPRING			SUMMER			FALL		
	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD	EST LOAD	TRG RED	NET LOAD
URBAN	1,318	0	1,318	163	113	50	16	16	0	130	120	10
WASTEWATER	0	0	0	0	0	0	0	0	0	0	0	0
NON-IRRIGATED	781	0	781	96	0	96	10	0	10	77	0	77
DAIRY AG.	8,556	0	8,556	1,056	731	325	106	106	0	845	777	68
DAIRY POND	1,474	1,474	0	759	759	0	1,519	1,519	0	759	759	0
SEPTIC	1,997	0	1,997	981	0	981	2,044	0	2,044	978	0	978
OPEN SPACE	96	0	96	12	0	12	1	0	1	9	0	9
TOTAL	14,222	1,474	12,748	3,067	1,603	1,464	3,696	1,641	2,055	2,798	1,656	1,142



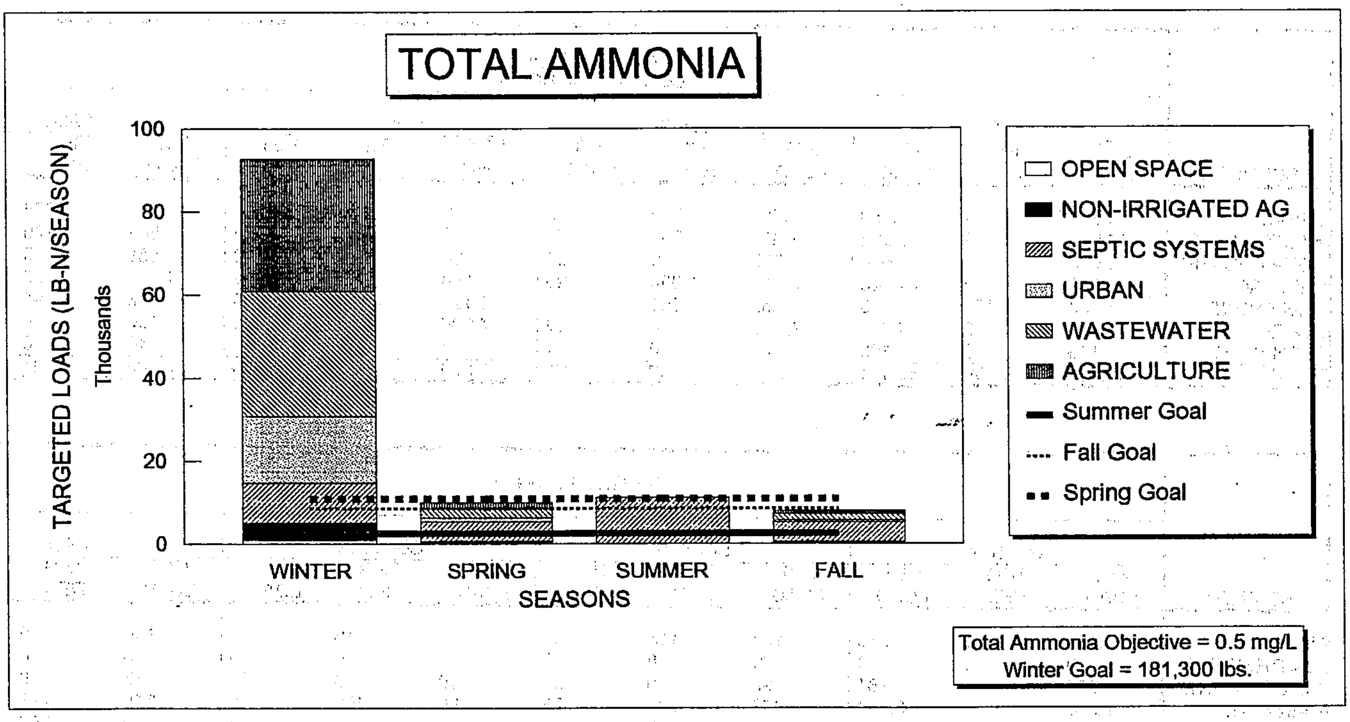
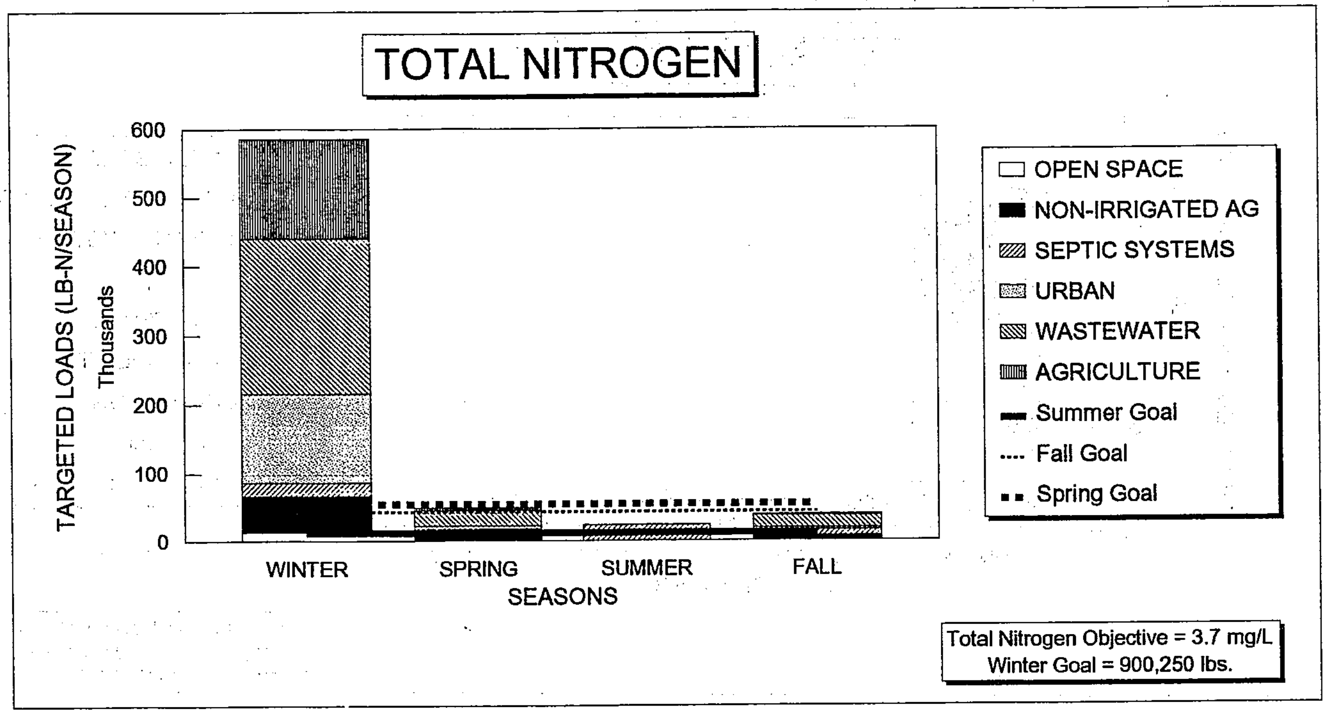


Figure 6. Reduced total nitrogen and total ammonia loads for the selected scenario in the Laguna at Trenton-Healdsburg Road.



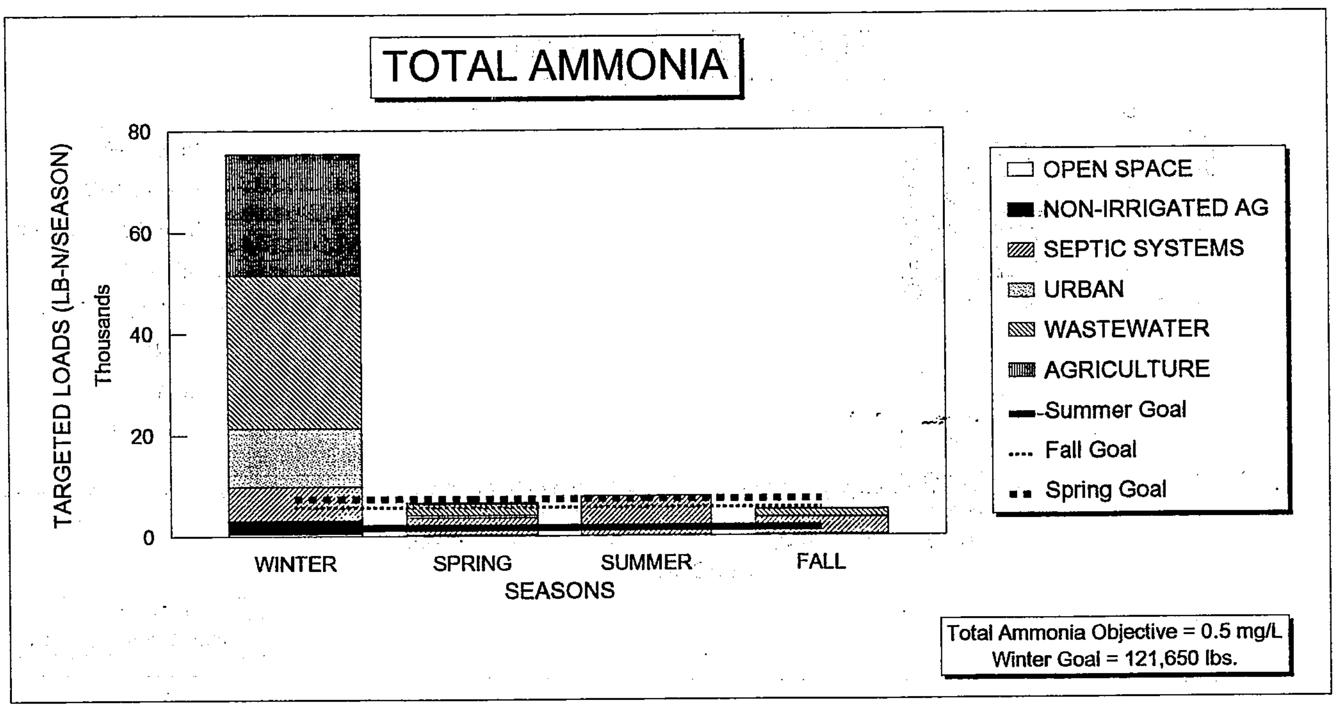
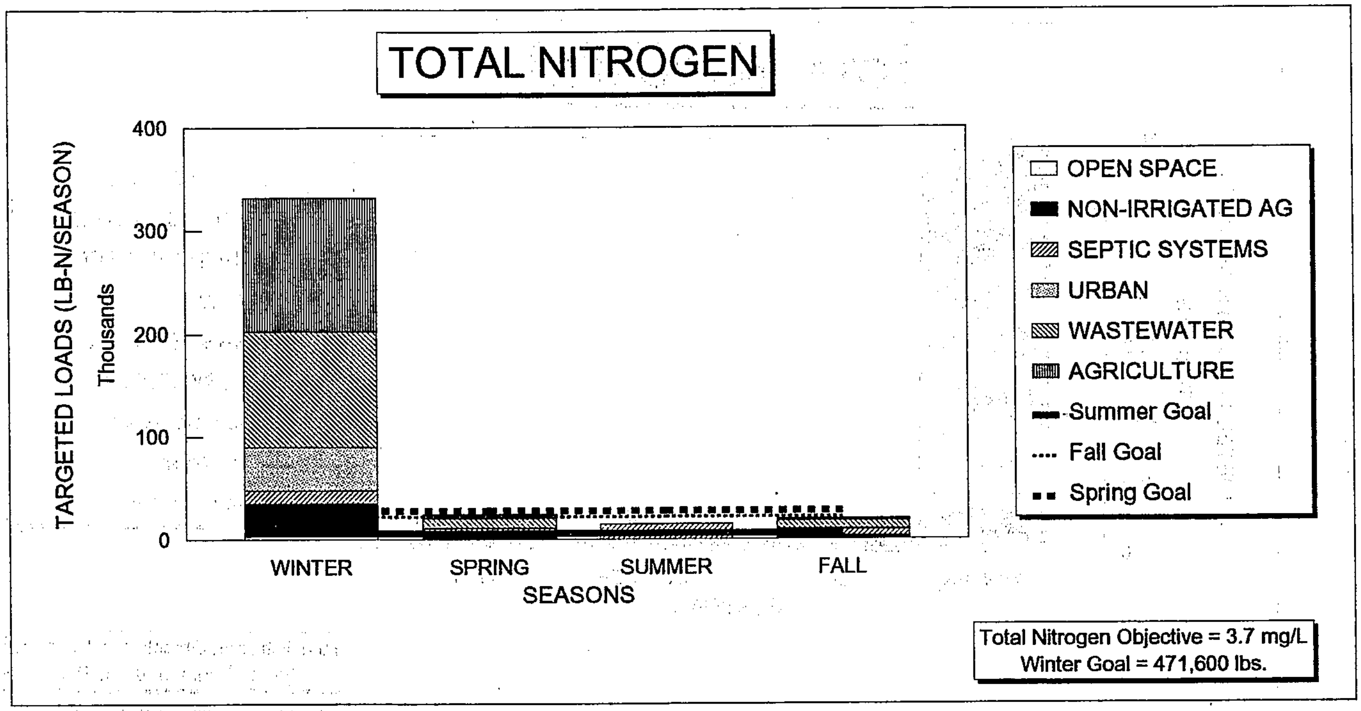


Figure 7. Reduced total nitrogen and total ammonia loads for the selected scenario in the Laguna at Guerneville Road.



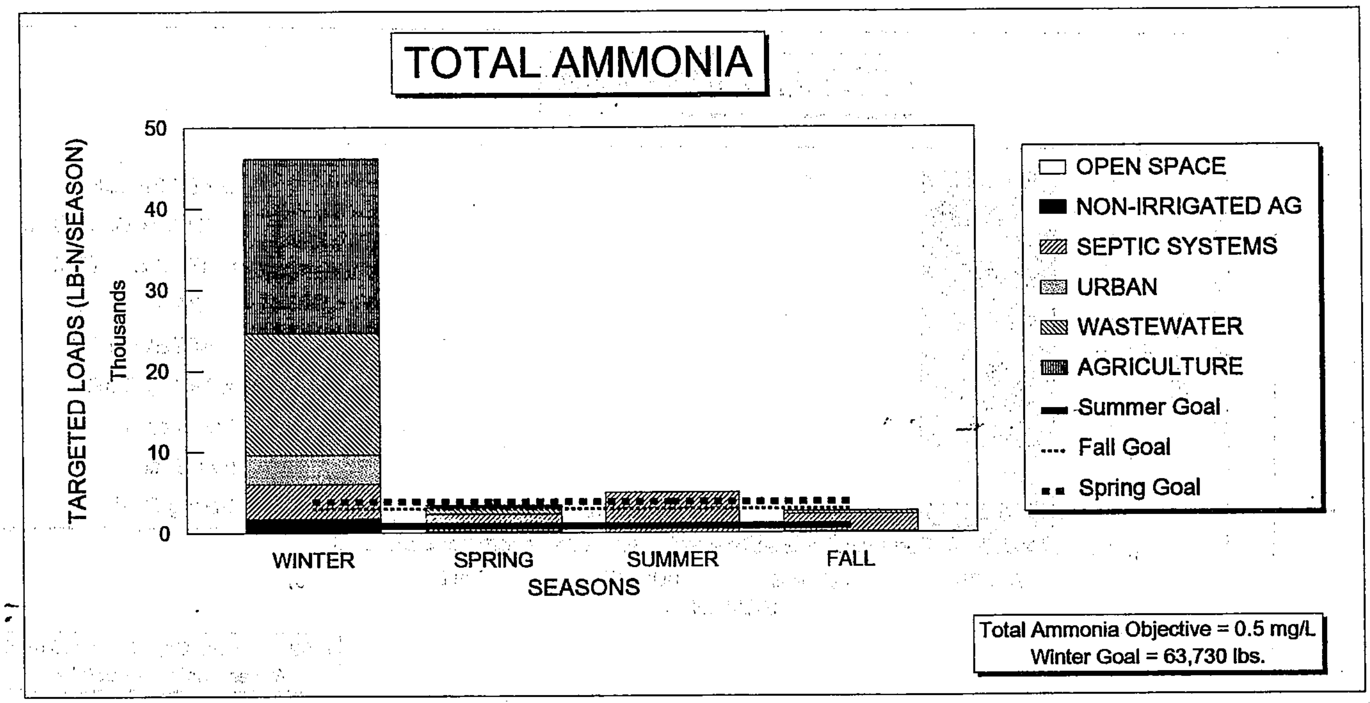
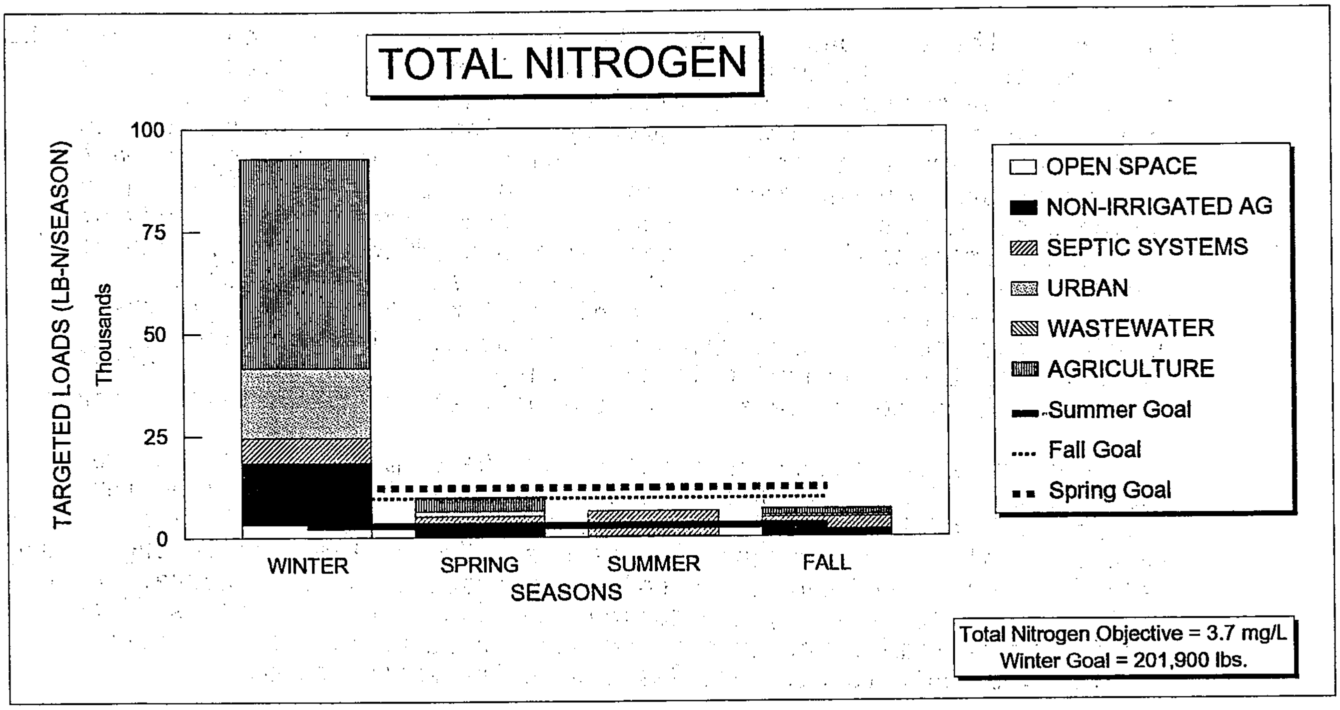


Figure 8. Reduced total nitrogen and total ammonia loads for the selected scenario in the Laguna at Occidental Road.



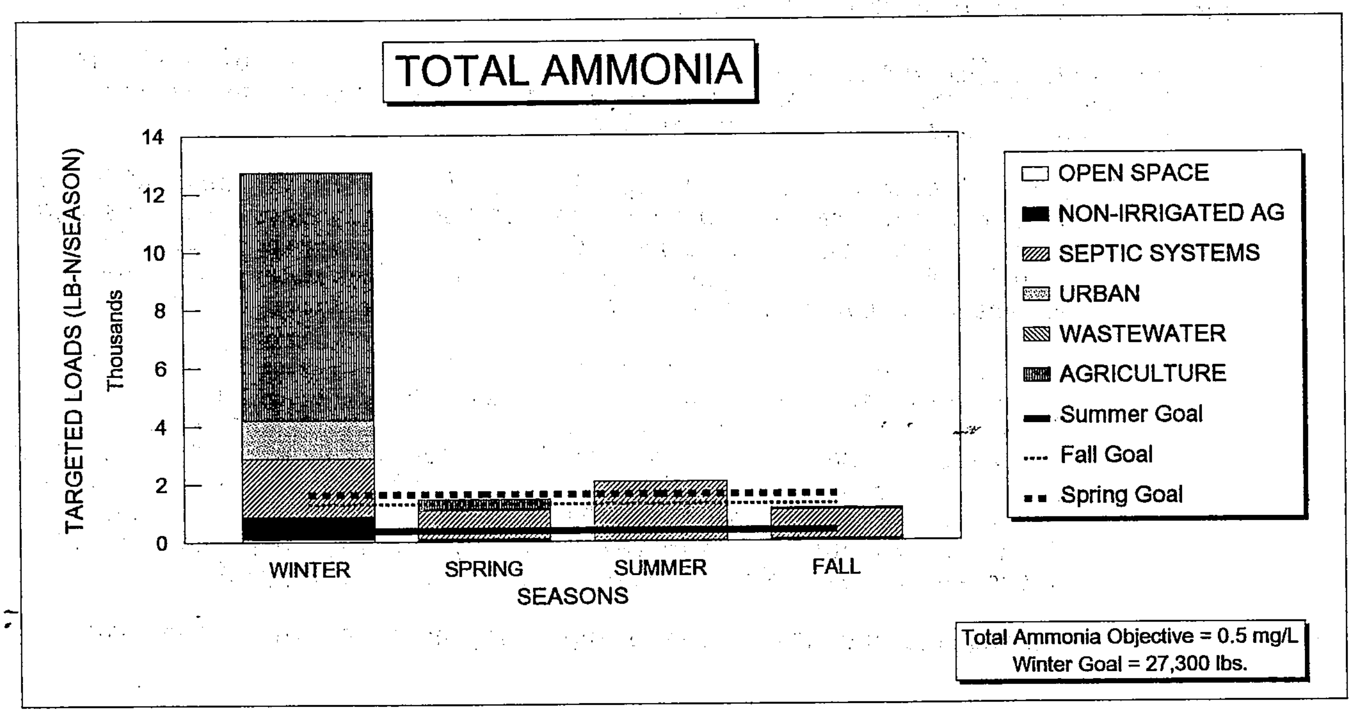


Figure 9. Reduced total nitrogen and total ammonia loads for the selected scenario in the Laguna at Stony Point Road.

As seen in these graphs, we estimate that the summer season will exceed the TMSL at each attainment point. What is not represented in these graphs is the phenomenon that loading during other seasons, such as winter, has an effect on water quality during the spring, summer and fall. For example, a nonpoint source discharge high in organic matter such as an over-topping manure pond, would normally enter the Laguna during a storm event in the winter. As documented during a study of nonpoint sources within the Laguna watershed (NCRWQCB 1992), some of the manure will settle out to the bottom of the stream in the slower downstream reaches. The solid organic matter would then begin the nutrient cycling processes which becomes accelerated with increasing water temperatures beginning in the spring. This condition results in impacts such as excessive algae blooms long after the initial discharge.

The sediment-water column interaction in the Laguna is still not well understood, and room for uncertainties such as this is provided for with a margin of safety. We plan to conduct water quality monitoring throughout the Laguna during all seasons. Summer time monitoring should help define the sediment/water column interaction in the Laguna. As a part of the water quality monitoring, we plan to do specific sediment testing to determine the extent sediment-borne nutrients and aquatic plants contribute to nutrient loading to the water column.

IMPLEMENTATION OF WASTE REDUCTION STRATEGY

Implementation of the waste reduction strategy will be through current programs aimed at reducing nitrogen and organic matter inputs into the Laguna. These programs include the following:

I. Section 319(h) grant program is aimed at reducing inputs of waste in the Laguna from confined animal operations in the watershed, primarily diaries. Individual projects include:

- Installation of pump and pipeline for fertigation (application of manure water combined with reclaimed wastewater) to pastures and crops. This project is expected to reduce up to about 27,000 pounds of total nitrogen each year and is located within the sub-watershed above attainment point 2;

- Construction of additional manure storage ponds which includes waste treatment for separating solids from liquids, installation of pump and pipeline for fertigation. There are three dairies taking these measures. We expect to reduce about 12,000 pounds of total nitrogen per year from a dairy located within the watershed above attainment point 1, 4,000 pounds of total nitrogen per year from a dairy above attainment point 2, and 14,000 pounds of total nitrogen per year from a dairy above attainment point 3;

- Timing and amounts of waste applications to pastures and crops using fertigation, expansion of solids and liquid manure ponds, and installation of a culvert for dry stock crossing. This project is expected to reduce about 12,000 pounds of total nitrogen per year and is located within the sub-watershed above attainment point 4;

- An educational project has been developed for students in Rancho Cotati High School Advance Biology Class to study non-point source issues. The project includes 1) evaluating water quality in Copeland Creek, a tributary to the Laguna, and a report on the findings, and 2) developing a water bill insert brochure and video as educational material. This project will be developed for use throughout the Laguna watershed area.

- Wetland treatment demonstration/pilot project is only expected to reduce a small fraction of the total nutrient load from the dairy because of the size of the wetland area (10 gpm flow through wetland). The project proved to be effective in removal of nutrients, but cost prohibitive because of size requirements (located with the sub-watershed above attainment point 1). Therefore, this type of project will not be implemented.

Implementation recommendation: Continue to encourage efforts by local RCD and dairymen aimed at better manure management within the Laguna watershed, and target nonpoint source control projects (i.e. Section 319(h) grant projects) aimed at reducing nutrient loading into the Laguna. These efforts should focus on those confined animal facilities within Laguna sub-watersheds above attainment point 3, Occidental Road (see Table 11).

II. <u>Other nutrient reduction efforts</u> related to confined animal facilities include:

- The Animal Waste Committee (AWC) has developed management practices (MPs) specific to dairy facilities in the Sonoma-Marin coastal area. These MPs should be applied and implemented at all dairies and confined animal facilities within the Laguna watershed.

- A subcommittee to the AWC has developed an assessment form to be used in developing an individual dairy management plan. The assessment form includes nutrient budgeting and manure management as a part of the individual dairy management plan. These assessment forms are available through the AWC and should be used by all dairies within the Laguna watershed;

- The Farm Bureau publishes a monthly educational and informational newsletter called the "Farm News". The newsletter contains reminders of important manure management practices, particularly important as winter approaches, as well as information on training seminars and other news specific to coastal area dairies. Dairies and many other confined animal facilities within the Laguna watershed receive a copy of this newsletter;

- Natural Resources Conservation Service (formerly Soil Conservation Service) is providing dairymen in the Sonoma-Marin coastal area with 10 training seminars on collecting and assessing water quality samples. The individual dairymen are encouraged to conduct self-monitoring of runoff from their dairy and creeks downstream from their dairy. The sampling kits are being provided by the Western United Dairymen Association;

- Nutrient budgeting is conducted by all dairies as a normal industry practice. Attention to nutrient budgeting varies widely from dairy to dairy throughout the Laguna watershed. Assistance is available and provided by the Resource Conservation Districts. Nutrient budgeting pilot projects are being conducted in Marin with transferable information to dairies within the Laguna watershed;

- Wetlands enhancement demonstration projects including rotational grazing, erosion control, and riparian fencing/exclusion areas. Although these projects are not in the Laguna watershed, the information from this demonstration project is transferable to dairies within the Laguna watershed;

- About 20% of the land used by dairies within the Laguna watershed functions as a filterstrip with slow sheet flow through crop or pasture areas. Although there are no filter strip application projects within the Laguna watershed, information obtained from filter strip application projects outside of the watershed can be applied to these dairies.

Implementation Recommendation: Continue to encourage dairymen and other animal owners to implement MPs as developed by the Animal Waste Committee, and encourage implementation of the recommendations developed by the Laguna CRMP (described below) for land owners within the Laguna watershed. This appears to be particularly important in Laguna sub-watersheds above attainment point 3, Occidental Road (see Table 11).

III. The stormwater runoff program goal is to eliminate the discharge of pollutants into storm water systems, primarily from urban areas. The most practical method to achieve this goal is to prevent the pollution from coming into contact with storm water. This will be accomplished by initiating MPs that focus on prevention rather than on treatment, and by developing a storm water pollution prevention plan.

- The City of Santa Rosa is mandated to have a Municipal Storm Water Permit; the only mandated city in the North Coast Region. Due to interconnections of the storm water systems, three agencies (the County of Sonoma, the Sonoma County Water Agency, and the City of Santa Rosa) are responsible for the municipal permit. A joint powers agreement has been established and submitted to the Regional Board.

The agencies are currently working on the Part 1 Application which includes: 1) General Information, 2) Legal Authority, 3) Source Identification, 4) Discharge Characterization, 5) Management Programs, and 6) Fiscal Resources. The final Part 1 Application was submitted to the Regional Board on February 10, 1995. The second part to the application will include urban runoff program efforts aimed at reducing nutrient inputs (specifically total ammonia and total nitrogen) into the Laguna. The second part is scheduled to be submitted to the Regional Board soon after the first part with implementation by early spring of 1996.

We anticipate a long-term program goal of about 45% reduction of nutrient load inputs from urban runoff during winter, spring and fall and about 25% reduction during the summer as a result of the pollution control efforts implemented by the City of Santa Rosa and Sonoma County. This amounts to an estimated annual total nitrogen reduction of about 70,600 pounds.

- The Cities of Rohnert Park, Cotati, and Sebastopol, and the town of Windsor have similar limited commitments towards reduction of pollution from urban runoff as follows:

  - <u>The City of Rohnert Park</u> plans to implement a public educational program. The program is designed to inform the public about discharges to the storm drains and the fact that these discharges eventually make it to streams, rivers and other waterbodies. The City recently received a grant to develop a television video and radio add to educate the public about discharges to the storm drains. The City continues to provide routine street sweeping as well as catch basin cleaning for the storm drain system. A water conservation program is in place which will help to prevent over-watering landscaped areas and nutrient inputs from landscape fertilizers.

  - <u>The City of Cotati</u> has a very limited urban runoff program. Through a educational program, students have marked storm drains to make the public aware of where discharges go after entering a storm drain. Routine street sweeping is also provided.

  - <u>The City of Sebastopol</u> has routine street sweeping and catch basin cleaning for the storm drain system. The City's General Plan contains a goal to protect, maintain and restore wetlands areas. The General Plan goal includes: (1) labeling each stormwater inlet in the City to identify receiving waters and state that no dumping is permitted; and (2) a statement that all applications for development that would generate runoff into wetlands will contain a condition that design features of the development ensure detention of sediment and contaminants.

- The town of Windsor has a very limited urban runoff program. Storm drains have been marked to make the public aware of where discharges go after entering a storm drain. Routine street sweeping is also provided.

We anticipate about 30% reduction of nutrient load inputs from urban runoff during winter, spring and fall, and 25% reduction during the summer as a result of the pollution control efforts implemented by these cities and the Town of Windsor. The annual total nitrogen reduction from these efforts amounts to about 20,200 pounds.

Implementation Recommendation: Encourage all cities and towns within the Laguna watershed to implement some kind of stormwater runoff program that is aimed at nutrient load reduction and pollution control. We anticipate total load reductions from urban stormwater runoff efforts that will meet or even exceed the strategy goals. Although anticipated load reductions appear greater than targeted long-term load reductions (see Table 11), anticipated reductions may be high and efforts to reduce nutrient loads into the Laguna should be made in all urban areas.

IV. The NPDES permit program regulates the City of Santa Rosa's Subregional Wastewater Treatment Plant. The City's NPDES permit is scheduled for renewal in May 15, 1995. The Subregional Plant currently provides advance (tertiary) waste treatment year round. The advance treatment process inherently provides a degree of nitrification.

The operators of the Subregional Plant are including appropriate design features in upcoming plant improvement projects for some level of ammonia nitrogen removal. The Laguna Upgrade Project is scheduled to be constructed by 1996, and includes the addition of two aeration basins with anoxic zones and a fifth secondary clarifier. Design of the additional units is based on achieving a target treatment level of complete nitrification with ammonia-nitrogen removal to a concentration of less than 0.5 mg N/L. Although ammonia is added towards the end of the treatment process to enhance the effectiveness of chlorine disinfection, an automated ammonia feed, storage and analyzer system will be a part of the upgrade project. The automated ammonia system will lower the final effluent nutrient concentrations. The amount of nitrogen removal that the treatment process will provide after the upgrade projects are complete has been determined by the City to be 120,000 pounds per year. We anticipate the City will be able to meet a interim total nitrogen reduction goal of at least 45,000 pounds each year. The upgrade projects should provide sufficient treatment and removal of nutrients in the effluent to attain the interim wastewater reduction goals proposed in this strategy.

Typo - 5.0 mg/L (?)

The City is developing alternatives for its long-term wastewater treatment project that will provide substantial nitrogen load reduction. We anticipate the final alternative wastewater treatment process will be able to meet the targeted nitrogen and ammonia load reductions contained in this strategy.

Additionally, the facility has an EPA approved pretreatment program which has effectively provided source control of the discharge of pollutants into the waste treatment system. A secondary benefit from this program was the adoption of ordinances which clearly prohibit the discharge of wastewater to the storm drain system.

Implementation Recommendation: Continue to guide the City of Santa Rosa towards a long-term wastewater treatment project that will provide substantial effluent nitrogen removal. Reductions in wastewater nutrient inputs to the Laguna should be planned relative to the seasons. The Laguna appears to be more sensitive to overloading in the spring and fall discharge seasons which may result in exceedences of ammonia and dissolved oxygen criteria.

V. The Laguna Watershed Coordinated Resource Management and Planning (CRMP) Task Force is composed of a diverse group of agencies, interested groups and landowners. The primary purpose of this group is to develop objectives for resource management in the Laguna watershed on a voluntary basis. Included in these activities are objectives for improving water quality conditions in the Laguna. Each member of the CRMP has received a copy of this report, and have incorporated the strategy into the Laguna watershed implementation plan that they are developing. The CRMP can serve as one of the forums for the waste reduction strategy.

Implementation Recommendation: Continue to support recommended management practices, recommended restoration efforts, and an implementation plan aimed at: (1) reducing nutrient load inputs into the Laguna, and (2) reducing unfavorably high temperatures as suggested by the Laguna CRMP to be included in the Laguna watershed management plan.

VI. Septic system permit program - Sonoma County has a permit program that requires septic systems to be upgraded or repaired according to current guidelines whenever building additions or improvements are made. Through this program, an estimated 175-200 septic system permits are issued annually within the Laguna watershed, and an estimated reduction of about 1800 pounds of total nitrogen can be anticipated. The County also has an enforcement program which requires abatement of failing septic systems. Within the Laguna watershed, the enforcement program results about 45-50 septic system repairs. A reduction of about 750 pounds of total nitrogen can be expected through this program annually. The annual reduction of total nitrogen expected as a result of these two programs is 2,550 pounds.

Implementation Recommendation: Continue to support the existing county programs and any improvements to these programs. Additionally, Sonoma County should consider developing a septic system maintenance district as a way to reduce nutrient loading, and encourage effective operation and maintenance of septic systems within the Laguna watershed. It is estimated that nutrient inputs during the summer are critical to Laguna water quality and the primary source of inputs is septic systems.

Table 11 contains a comparison summary of the annual long-term and interim targeted load reductions estimated to meet the strategy goals and the anticipated annual load reductions expected from current and future projects and programs.

To meet Laguna water quality goals, Regional Board staff proposes to focus its existing program activities to varying degrees on the four general watershed areas and specific pollutant sources described above. The level and focus of staff efforts will be tied directly to the amount of waste load reduction anticipated.

SUMMARY

After receiving comments from the dischargers and interested groups regarding this strategy, interim reduction targets have been developed that are more reasonable and achievable by July 1996 (see Table 11). Table 12 summarizes the long-term mass limit goals for each pollutant source within the sub-watershed above four attainment points during each season. We expect to achieve the long-term strategy goals by July 1998.

It is important to recognize that attainment of the concentration goals for ammonia and dissolved oxygen is the final endpoint criterion rather than "loading". The load reduction estimates are useful for targeting, but will not determine the attainment of the concentration goals. The mass limit loadings and associated load reduction targets are intermediate points of this strategy. The ultimate goal is to reduce waste load inputs such that at specified "attainment points" along the Laguna unionized ammonia does not exceed the USEPA criterion, and dissolved oxygen is above the Basin Plan minimum objective.

We have developed a plan to monitor water quality at each attainment point systematically throughout each season. We plan to collect water quality samples bi-weekly, but will also supplement this with additional samples as needed to maintain a sampling frequency in proportion to storm events. We will also use continuous remote monitoring for dissolved oxygen, pH, conductance, and temperature on monthly intervals at a minimum. Appendix E describes the monitoring plan in greater detail. The monitoring plan will be used to evaluate Laguna water quality and the success of this strategy, and to guide the future direction of this strategy.

We will use statistical methods to compare the water quality data against the USEPA criterion for unionized ammonia and the Basin Plan minimum objective for dissolved oxygen.

1) The minimum dissolved oxygen objective will be attained if dissolved oxygen concentrations are maintained above 7.0 mg/L. Compliance with the median and 90th percentile values will be determined with cumulative frequency distributions.

2) The water quality data will be evaluated using a staged method to determine the level of attainment with USEPA criterion for unionized

ammonia. Attainment goals are: a) 60 percent of the measurements below the EPA criterion by July 1996, b) 70 percent by July 1998, and c) 80 percent by July 2000 on a seasonal basis. We will evaluate the water quality data using cumulative distribution plots and t-tests of the mean of seasonal measurements compared to USEPA criterion for unionized ammonia.

The selected scenario provides targeted waste load reductions, implementation of existing programs will continue to focus towards reducing the waste loads into the Laguna, and the water quality monitoring will be used to evaluate Laguna water quality and the success of the strategy. The first check point on the effectiveness of this strategy will be in July 1996 and, if needed, adjustments will be made to meet Laguna water quality objectives, and ultimately create a healthier stream environment.

TABLE 11: Annual estimated long-term (TAR L-T LOAD RED), interim (INTERIM LOAD RED), and anticipated (ANTICP LOAD RED) load reductions for total nitrogen and ammonia.

TOTAL NITORGEN (pounds/year)

	ATTAINMENT POINT 1 TRENTON-HEALDSBURG			ATTAINMENT POINT 2 GUERNEVILLE			ATTAINMENT POINT 3 OCCIDENTAL			ATTAINMENT POINT 4 STONY POINT			ANNUAL TOTALS		
SOURCE	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED
URBAN	647	4,250	8,495	14,438	6,100	12,300	5,857	15,000	38,964	2,325	10,000	19,372	23,267	35,350	79,131
WASTEWATER	0	0	0	77,116	22,500	60,000	82,145	22,500	60,000	0	0	0	159,261	45,000	120,000
NON-IRRIGATED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAIRY AG.	584	1,500	3,000	3,511	10,000	30,000	18,282	1,500	3,000	7,000	2,500	5,000	29,377	15,500	41,000
DAIRY POND	40,776	5,500	11,000	13,657	1,500	3,000	21,327	7,500	13,000	27,097	5,000	10,000	102,857	19,500	37,000
SEPTIC	0	375	749	0	325	653	0	320	638	0	250	510	0	1,270	2,550
OPEN SPACE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	42,007	11,625	23,244	108,722	40,425	105,953	127,611	46,820	115,602	36,422	17,750	34,882	314,762	116,620	279,681

TOTAL AMMONIA (pounds/year)

	ATTAINMENT POINT 1 TRENTON-HEALDSBURG			ATTAINMENT POINT 2 GUERNEVILLE			ATTAINMENT POINT 3 OCCIDENTAL			ATTAINMENT POINT 4 STONY POINT			ANNUAL TOTALS		
SOURCE	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED	TAR L-T LOAD RED	INTERIM LOAD RED	ANTICP LOAD RED
URBAN	110	378	756	1,422	543	1,095	532	1,335	3,468	249	890	1,724	2,313	3,146	7,043
WASTEWATER	0	0	0	10,740	2,993	7,980	10,740	2,993	7,980	0	0	0	21,480	5,985	15,960
NON-IRRIGATED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAIRY AG.	171	250	500	590	1,665	4,995	3,047	250	500	1,614	416	833	5,422	2,581	6,827
DAIRY POND	6,790	916	1,832	2,274	250	500	3,551	1,249	2,165	4,511	833	1,665	17,126	3,247	6,161
SEPTIC	0	128	255	0	111	223	0	109	218	0	85	174	0	433	870
OPEN SPACE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	7,071	1,672	3,342	15,026	5,561	14,792	17,870	5,935	14,329	6,374	2,224	4,396	46,341	15,392	36,859

TAR L-T LOAD RED = TARGETED LONG-TERM LOAD REDUCTION

TABLE 12: Summary of the long-term net load goals for each pollutant source within the sub-watersheds above the four attainment points during each season.

TOTAL NITORGEN (pounds/season)

	ATTAINMENT POINT 1 TRENTON-HEALDSBURG				ATTAINMENT POINT 2 GUERNEVILLE				ATTAINMENT POINT 3 OCCIDENTAL				ATTAINMENT POINT 4 STONY POINT			
SOURCE	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL
URBAN	52,393	6,468	0	5,175	87,935	4,160	0	2,029	24,971	0	0	0	17,054	1,161	0	514
WASTEWATER	0	0	0	0	112,466	12,857	0	9,761	112,466	9,202	0	8,387	0	0	0	0
NON-IRRIGATED	28,425	3,509	351	2,807	20,325	2,509	251	2,007	16,119	1,990	199	1,592	15,100	1,864	186	1,491
DAIRY AG.	47,300	5,840	0	4,672	15,094	0	0	0	77,940	0	0	0	51,335	3,496	0	1,546
DAIRY POND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEPTIC	8,479	4,163	9,632	4,151	7,314	3,592	8,577	3,581	6,913	3,395	8,827	3,384	5,993	2,943	6,134	2,934
OPEN SPACE	17,643	2,178	218	1,742	10,239	1,264	126	1,011	439	54	5	43	3,310	409	41	327
TOTAL	154,240	22,158	10,201	18,547	253,373	24,382	8,954	18,389	238,848	14,641	9,031	13,406	92,792	9,873	6,361	6,812

TOTAL AMMONIA (pounds/season)

	ATTAINMENT POINT 1 TRENTON-HEALDSBURG				ATTAINMENT POINT 2 GUERNEVILLE				ATTAINMENT POINT 3 OCCIDENTAL				ATTAINMENT POINT 4 STONY POINT			
SOURCE	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL
URBAN	4,581	566	0	399	8,004	326	0	130	2,271	0	0	0	1,318	50	0	10
WASTEWATER	0	0	0	0	15,002	1,523	0	1,040	15,002	695	0	366	0	0	0	0
NON-IRRIGATED	1,469	181	18	145	1,051	130	13	104	833	103	10	82	781	96	10	77
DAIRY AG.	7,883	1,143	0	705	2,515	0	0	0	12,990	0	0	0	8,556	325	0	68
DAIRY POND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEPTIC	2,829	1,389	3,215	1,385	2,438	1,197	2,860	1,194	2,304	1,131	2,941	1,128	1,997	981	2,044	978
OPEN SPACE	509	63	6	50	296	37	4	29	13	2	0	1	96	12	1	9
TOTAL	17,271	3,342	3,239	2,684	29,306	3,213	2,877	2,497	33,413	1,931	2,951	1,577	12,748	1,464	2,055	1,142

BIBLIOGRAPHY

CH2M Hill and Merritt Smith Consulting. 1994. *Laguna de Santa Rosa Water Quality Objective Attainment Plan*. June, 1994.

Emerson, K., R.C. Russo, R.E. Lund, and R.V. Thurston. 1975. *Aqueous Ammonia Equilibrium Calculations: Effect of pH and Temperature.*

NCRWQCB 1992. *Final Report - Investigation for Nonpoint Source Pollutants in the Laguna de Santa Rosa, Sonoma County*. North Coast Regional Water Quality Control Board. September 24, 1992.

Roth, J.C. and D.W. Smith 1992. *Final Report: 1990-1991 Laguna de Santa Rosa Water Quality Monitoring Program*. January 1992.

Roth, J.C. and D.W. Smith 1993. *Final Report: 1991-1992 Laguna de Santa Rosa Water Quality Monitoring Program*. May 1993.

Roth, J.C. and D.W. Smith 1994. *Final Report: 1992-1993 Laguna de Santa Rosa Water Quality Monitoring Program*. May 1994.

United States Environmental Protection Agency. 1976. *Quality Criteria for Water. Ammonia.*

United States Environmental Protection Agency. 1980. *Design Manual: Onsite Wastewater Treatment and Disposal*. EPA625/1-80-012.

United States Environmental Protection Agency. 1986. *Quality Criteria for Water. Ammonia.*

United States Environmental Protection Agency. 1991. *Guidance for Water Quality Based Decisions: The TMDL Process.* EPA440-91-001.

United States Environmental Protection Agency. 1991. *Technical Support Document for Water Quality-based Toxic Control*. March 1991. EPA/505/2-90-001.

APPENDIX A

SCENARIOS 1 THROUGH 7D

LINE ITEM DESCRIPTION FOR SCENARIOS 1 THRU 6
ATTAINMENT POINT: DESCRIPTION OF SCENARIO
DESCRIPTION (CONTINUED)

TOTAL AMMONIA   TOTAL NITROGEN

FLOW (cfs) = VALUES GIVEN (SEE TABLE D-1)
CONC (mg-N/l) = VALUES GIVEN (SEE PAGES 25-26)
TMDL (lb/d) = (CONC. mg/L) x (FLOW cfs) x (28.317 L/cf) X (8.64x10E4 s/d) X (2.205X10E-6 lb/mg)
TMSL (lb/yr) = (TMDL) X (DAYS/SEASON)
BKGND LOAD (lb/yr) = (NON-IRRIGATED) + (SEPTIC) + (OPEN SPACE)
MOS (lb/yr) = (TMSL) X (10%)
WLA (lb/yr) = (TMSL) - (BKGND LOAD + MOS), IF <= 0 THEN WLA = 0
WASTE LOAD (lb/yr) = (URBAN) + (WASTEWATER) + (DAIRY AG)
DAIRY POND (lb/yr) = VALUE GIVEN
REDUCTION (lb/yr) = (WASTE LOAD) - (WLA)

TOTAL REDUCTION (lb/yr= (REDUCTION) + (DAIRY POND), IF REDUCTION <=0 THEN TOTAL REDUCTION = DAIRY POND

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN WASTEWATER NON-IRRIGATED DAIRY AGRICULTURE **DAIRY pond** SEPTIC OPEN SPACE	= VALUES GIVEN (SEE TABLE D-6)	= (EST. SEASONAL LOAD) X (REDUCTION/WASTE LOAD)	= 1 - (MASS LIMIT/EST.SEASONAL LOAD) X 100%	= (EST. SEASONAL LOAD) - (WASTE LOAD REDUCTION)
TOTAL	= SUMMATION OF ABOVE VALUES			

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN WASTEWATER NON-IRRIGATED DAIRY AGRICULTURE **DAIRY pond** SEPTIC OPEN SPACE		SAME AS ABOVE		
TOTAL				

SCENARIO 1: Average Winter Storm Event Flow with Total Storm Event Loadings.

TOTAL AMMONIA

FLOW (cfs)	750
CONC (mg-N/l)	0.50
TMDL (lb/d)	2,023
TMSL (lb/yr)	**44,507**
BKGND LOAD (lb/yr)	6,959
MOS (lb/yr)	4,451
WLA (lb/yr)	33,097
WASTE LOAD (lb/yr)	62,915
DAIRY POND (lb/yr)	0
REDUCTION (lb/yr)	29,818
TOTAL REDUCTION (lb/yr	**29,818**

TOTAL NITROGEN

FLOW (cfs)	750
CONC (mg-N/l)	3.70
TMDL (lb/d)	14,970
TMSL (lb/yr)	**329,348**
BKGND LOAD (lb/yr)	139,957
MOS (lb/yr)	32,935
WLA (lb/yr)	156,456
WASTE LOAD (lb/yr)	488,156
DAIRY POND (lb/yr)	0
REDUCTION (lb/yr)	331,700
TOTAL REDUCTION (lb/yr	**331,700**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	19,968	9,464	47	10,504
WASTEWATER	3,510	1,664	47	1,846
NON-IRRIGATED	5,105	0	0	5,105
DAIRY AGRICULTURE	39,437	18,691	47	20,746
DAIRY pond	0	0	100	0
SEPTIC	726	0	0	726
OPEN SPACE	1,128	0	0	1,128
TOTAL	**69,874**	**29,818**	**43**	**40,056**

TOTAL NITROGEN

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	225,128	152,973	68	72,155
WASTEWATER	26,400	17,939	68	8,461
NON-IRRIGATED	98,726	0	0	98,726
DAIRY AGRICULTURE	236,628	160,788	68	75,840
DAIRY pond	0	0	100	0
SEPTIC	2,180	0	0	2,180
OPEN SPACE	39,051	0	0	39,051
TOTAL	**628,113**	**331,700**	**53**	**296,413**

SCENARIO 2: Average Winter Storm Event Flow with Total Storm Event Loadings plus Over Topping of an Average Dairy Manure Pond

TOTAL AMMONIA

FLOW (cfs)	750
CONC (mg-N/l)	0.50
TMDL (lb/d)	2,023
TMSL (lb/yr)	**44,507**
BKGND LOAD (lb/yr)	6,959
MOS (lb/yr)	4,451
WLA (lb/yr)	33,097
WASTE LOAD (lb/yr)	62,915
DAIRY POND (lb/yr)	3,976
REDUCTION (lb/yr)	29,818
TOTAL REDUCTION (lb/yr	**33,794**

TOTAL NITROGEN

FLOW (cfs)	750
CONC (mg-N/l)	3.70
TMDL (lb/d)	14,970
TMSL (lb/yr)	**329,348**
BKGND LOAD (lb/yr)	139,957
MOS (lb/yr)	32,935
WLA (lb/yr)	156,456
WASTE LOAD (lb/yr)	488,156
DAIRY POND (lb/yr)	23,850
REDUCTION (lb/yr)	331,700
TOTAL REDUCTION (lb/yr	**355,550**

TOTAL AMMONIA

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	19,968	9,464	47	10,504
WASTEWATER	3,510	1,664	47	1,846
NON-IRRIGATED	5,105	0	0	5,105
DAIRY AGRICULTURE	39,437	18,691	47	20,746
DAIRY pond	3,976	3,976	100	0
SEPTIC	726	0	0	726
OPEN SPACE	1,128	0	0	1,128
TOTAL	**73,850**	**33,794**	**46**	**40,056**

TOTAL NITROGEN

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	225,128	152,973	68	72,155
WASTEWATER	26,400	17,939	68	8,461
NON-IRRIGATED	98,726	0	0	98,726
DAIRY AGRICULTURE	236,628	160,788	68	75,840
DAIRY pond	23,850	23,850	100	0
SEPTIC	2,180	0	0	2,180
OPEN SPACE	39,051	0	0	39,051
TOTAL	**651,963**	**355,550**	**55**	**296,413**

SCENARIO 3: Winter Storm Event Flow with Total Storm Event Loadings plus Over Topping of an Average Dairy Manure Pond

TOTAL AMMONIA

FLOW (cfs)	8,502
CONC (mg-N/l)	0.50
TMDL (lb/d)	22,933
TMSL (lb/yr)	**504,526**
BKGND LOAD (lb/yr)	6,959
MOS (lb/yr)	50,453
WLA (lb/yr)	447,115
WASTE LOAD (lb/yr)	62,915
DAIRY POND (lb/yr)	3,976
REDUCTION (lb/yr)	-384,200
TOTAL REDUCTION (lb/yr	**3,976**

TOTAL NITROGEN

FLOW (cfs)	8,502
CONC (mg-N/l)	3.70
TMDL (lb/d)	169,704
TMSL (lb/yr)	**3,733,491**
BKGND LOAD (lb/yr)	139,957
MOS (lb/yr)	373,349
WLA (lb/yr)	3,220,184
WASTE LOAD (lb/yr)	488,156
DAIRY POND (lb/yr)	23,850
REDUCTION (lb/yr)	-2,732,028
TOTAL REDUCTION (lb/yr	**23,850**

TOTAL AMMONIA

	ESTIMATED ANNUAL LOAD (LB/YR)	**WASTE LOAD REDUCTION (LB/YR)**	**PERCENT REDUCTION (%)**	**MASS LIMIT (LB/YR)**
URBAN	19,968	0	0	19,968
WASTEWATER	3,510	0	0	3,510
NON-IRRIGATED	5,105	0	0	5,105
DAIRY AGRICULTURE	39,437	0	0	39,437
DAIRY pond	3,976	3,976	100	0
SEPTIC	726	0	0	726
OPEN SPACE	1,128	0	0	1,128
TOTAL	**73,850**	**3,976**	**5**	**69,874**

TOTAL NITROGEN

	ESTIMATED ANNUAL LOAD (LB/YR)	**WASTE LOAD REDUCTION (LB/YR)**	**PERCENT REDUCTION (%)**	**MASS LIMIT (LB/YR)**
URBAN	225,128	0	0	225,128
WASTEWATER	26,400	0	0	26,400
NON-IRRIGATED	98,726	0	0	98,726
DAIRY AGRICULTURE	236,628	0	0	236,628
DAIRY pond	23,850	23,850	100	0
SEPTIC	2,180	0	0	2,180
OPEN SPACE	39,051	0	0	39,051
TOTAL	**651,963**	**23,850**	**4**	**628,113**

SCENARIO 4: Average Monthly Winter Flow with Total Storm & Non-Storm Loadings (Winter Period: October - April)

TOTAL AMMONIA

FLOW (cfs)	350
CONC (mg-N/l)	0.50
TMDL (lb/d)	944
TMSL (lb/yr)	**200,144**
BKGND LOAD (lb/yr)	34,172
MOS (lb/yr)	20,014
WLA (lb/yr)	145,958
WASTE LOAD (lb/yr)	116,015
DAIRY POND (lb/yr)	0
REDUCTION (lb/yr)	-29,943
TOTAL REDUCTION (lb/yr	**0**

TOTAL NITROGEN

FLOW (cfs)	350
CONC (mg-N/l)	3.70
TMDL (lb/d)	6,986
TMSL (lb/yr)	**1,481,069**
BKGND LOAD (lb/yr)	221,575
MOS (lb/yr)	148,107
WLA (lb/yr)	1,111,386
WASTE LOAD (lb/yr)	886,156
DAIRY POND (lb/yr)	0
REDUCTION (lb/yr)	-225,230
TOTAL REDUCTION (lb/yr	**0**

TOTAL AMMONIA

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	19,968	0	0	19,968
WASTEWATER	56,610	0	0	56,610
NON-IRRIGATED	5,105	0	0	5,105
DAIRY AGRICULTURE	39,437	0	0	39,437
DAIRY pond	0	0	100	0
SEPTIC	27,939	0	0	27,939
OPEN SPACE	1,128	0	0	1,128
TOTAL	**150,187**	**0**	**0**	**150,187**

TOTAL NITROGEN

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	225,128	0	0	225,128
WASTEWATER	424,400	0	0	424,400
NON-IRRIGATED	98,726	0	0	98,726
DAIRY AGRICULTURE	236,628	0	0	236,628
DAIRY pond	0	0	100	0
SEPTIC	83,798	0	0	83,798
OPEN SPACE	39,051	0	0	39,051
TOTAL	**1,107,731**	**0**	**0**	**1,107,731**

SCENARIO 5: Average Monthly Winter Flow with Total Winter Storm Event &Non-Storm Loadings plus Over Topping of an Average Dairy Pond.

TOTAL AMMONIA

FLOW (cfs)	350
CONC (mg-N/l)	0.50
TMDL (lb/d)	944
TMSL (lb/yr)	**200,144**
BKGND LOAD (lb/yr)	34,172
MOS (lb/yr)	20,014
WLA (lb/yr)	145,958
WASTE LOAD (lb/yr)	116,015
DAIRY POND (lb/yr)	3,976
REDUCTION (lb/yr)	-29,943
TOTAL REDUCTION (lb/yr	**3,976**

TOTAL NITROGEN

FLOW (cfs)	350
CONC (mg-N/l)	3.70
TMDL (lb/d)	6,986
TMSL (lb/yr)	**1,481,069**
BKGND LOAD (lb/yr)	221,575
MOS (lb/yr)	148,107
WLA (lb/yr)	1,111,386
WASTE LOAD (lb/yr)	886,156
DAIRY POND (lb/yr)	23,850
REDUCTION (lb/yr)	-225,230
TOTAL REDUCTION (lb/yr	**23,850**

TOTAL AMMONIA

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	19,968	0	0	19,968
WASTEWATER	56,610	0	0	56,610
NON-IRRIGATED	5,105	0	0	5,105
DAIRY AGRICULTURE	39,437	0	0	39,437
DAIRY pond	3,976	3,976	100	0
SEPTIC	27,939	0	0	27,939
OPEN SPACE	1,128	0	0	1,128
TOTAL	**154,163**	**3,976**	**3**	**150,187**

TOTAL NITROGEN

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	225,128	0	0	225,128
WASTEWATER	424,400	0	0	424,400
NON-IRRIGATED	98,726	0	0	98,726
DAIRY AGRICULTURE	236,628	0	0	236,628
DAIRY pond	23,850	23,850	100	0
SEPTIC	83,798	0	0	83,798
OPEN SPACE	39,051	0	0	39,051
TOTAL	**1,131,581**	**23,850**	**2**	**1,107,731**

SCENARIO 6: Non-Storm Event Flow with Total Winter Non- Storm Event Loadings plus Normal Over Topping of an Average Dairy Manure Pond.

TOTAL AMMONIA

FLOW (cfs)	200
CONC (mg-N/l)	0.50
TMDL (lb/d)	539
TMSL (lb/yr)	**111,131**
BKGND LOAD (lb/yr)	27,214
MOS (lb/yr)	11,113
WLA (lb/yr)	72,805
WASTE LOAD (lb/yr)	53,100
DAIRY POND (lb/yr)	3,976
REDUCTION (lb/yr)	-19,705
TOTAL REDUCTION (lb/yr	**3,976**

TOTAL NITROGEN

FLOW (cfs)	200
CONC (mg-N/l)	3.70
TMDL (lb/d)	3,992
TMSL (lb/yr)	**822,372**
BKGND LOAD (lb/yr)	81,618
MOS (lb/yr)	82,237
WLA (lb/yr)	658,517
WASTE LOAD (lb/yr)	398,000
DAIRY POND (lb/yr)	23,850
REDUCTION (lb/yr)	-260,517
TOTAL REDUCTION (lb/yr	**23,850**

TOTAL AMMONIA

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	0	0	0	0
WASTEWATER	53,100	0	0	53,100
NON-IRRIGATED	0	0	0	0
DAIRY AGRICULTURE	0	0	0	0
DAIRY pond	3,976	3,976	100	0
SEPTIC	27,214	0	0	27,214
OPEN SPACE	0	0	0	0
TOTAL	84,290	3,976	5	80,314

TOTAL NITROGEN

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	0	0	0	0
WASTEWATER	398,000	0	0	398,000
NON-IRRIGATED	0	0	0	0
DAIRY AGRICULTURE	0	0	0	0
DAIRY pond	23,850	23,850	100	0
SEPTIC	81,618	0	0	81,618
OPEN SPACE	0	0	0	0
TOTAL	503,468	23,850	5	479,618

LINE ITEM DESCRIPTION FOR SCENARIO 7A THRU 7D
ATTAINMENT POINT: DESCRIPTION OF SCENARIO DESCRIPTION (CONTINUED)

SEASON: PERIOD

TOTAL AMMONIA

TOTAL NITROGEN

FLOW (cfs) = VALUES GIVEN (SEE TABLE D-1)
CONC (mg-N/l) = VALUES GIVEN (SEE PAGES 25-26)
TMDL (lb/d) = (CONC. mg/L) x (FLOW cfs) x (28.317 L/cf) X (8.64x10E4 s/d) X (2.205X10E-6 lb/mg)
TMSL (lb/yr) = (TMDL) X (DAYS/SEASON)
BKGND LOAD (lb/yr) = (NON-IRRIGATED) + (SEPTIC) + (OPEN SPACE)
MOS (lb/yr) = (TMSL) X (10%)
WLA (lb/yr) = (TMSL) - (BKGND LOAD + MOS), IF <= 0 THEN WLA = 0
WASTE LOAD (lb/yr) = (URBAN) + (WASTEWATER) + (DAIRY AG)
DAIRY POND (lb/yr) = VALUE GIVEN
REDUCTION (lb/yr) = (WASTE LOAD) - (WLA)
TOTAL REDUCTION (lb/yr= (REDUCTION) + (DAIRY POND), IF REDUCTION <=0 THEN TOTAL REDUCTION = DAIRY POND

TOTAL AMMONIA	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN WASTEWATER NON-IRRIGATED DAIRY AGRICULTURE **DAIRY pond** SEPTIC OPEN SPACE	= VALUES GIVEN (SEE TABLE D-10)	= (EST. SEASONAL LOAD) X (REDUCTION/WASTE LOAD)	= 1 - (MASS LIMIT/EST.SEASONAL LOAD) X 100%	= (EST. SEASONAL LOAD) - (WASTE LOAD REDUCTION)
TOTAL	= SUMMATION OF ABOVE VALUES			

TOTAL NITROGEN	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN WASTEWATER NON-IRRIGATED DAIRY AGRICULTURE **DAIRY pond** SEPTIC OPEN SPACE		SAME AS ABOVE		
TOTAL				

SCENARIO 7A: Average Seasonal Flows with Proportional Seasonal Loadings plus Over Topping of Manure Ponds (Winter Period: December - March)

TOTAL AMMONIA

FLOW (cfs)	556
CONC (mg-N/l)	0.50
TMDL (lb/d)	1,498
TMSL (lb/yr)	**181,305**
BKGND LOAD (lb/yr)	14,617
MOS (lb/yr)	18,130
WLA (lb/yr)	148,557
WASTE LOAD (lb/yr)	78,121
DAIRY POND (lb/yr)	5,595
REDUCTION (lb/yr)	-70,436
TOTAL REDUCTION (lb/yr	**5,595**

TOTAL NITROGEN

FLOW (cfs)	556
CONC (mg-N/l)	3.70
TMDL (lb/d)	11,088
TMSL (lb/yr)	**1,341,655**
BKGND LOAD (lb/yr)	140,299
MOS (lb/yr)	134,165
WLA (lb/yr)	1,067,190
WASTE LOAD (lb/yr)	598,955
DAIRY POND (lb/yr)	33,607
REDUCTION (lb/yr)	-468,235
TOTAL REDUCTION (lb/yr	**33,607**

TOTAL AMMONIA

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	16,174	0	0	16,174
WASTEWATER	30,003	0	0	30,003
NON-IRRIGATED	4,135	0	0	4,135
DAIRY AGRICULTURE	31,944	0	0	31,944
DAIRY pond	5,595	5,595	100	0
SEPTIC	9,568	0	0	9,568
OPEN SPACE	914	0	0	914
TOTAL	**98,333**	**5,595**	**6**	**92,738**

TOTAL NITROGEN

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	182,354	0	0	182,354
WASTEWATER	224,932	0	0	224,932
NON-IRRIGATED	79,968	0	0	79,968
DAIRY AGRICULTURE	191,669	0	0	191,669
DAIRY pond	33,607	33,607	100	0
SEPTIC	28,700	0	0	28,700
OPEN SPACE	31,631	0	0	31,631
TOTAL	**772,861**	**33,607**	**4**	**739,254**

SCENARIO 7B: Average Seasonal Flows with Proportional Seasonal Loadings plus Over Topping of Manure Ponds (Spring Period: April - May)

TOTAL AMMONIA

FLOW (cfs)	67
CONC (mg-N/l)	0.50
TMDL (lb/d)	179
TMSL (lb/yr)	**10,942**
BKGND LOAD (lb/yr)	5,323
MOS (lb/yr)	1,094
WLA (lb/yr)	4,525
WASTE LOAD (lb/yr)	17,263
DAIRY POND (lb/yr)	2,883
REDUCTION (lb/yr)	12,738
TOTAL REDUCTION (lb/yr	**15,621**

TOTAL NITROGEN

FLOW (cfs)	67
CONC (mg-N/l)	3.70
TMDL (lb/d)	1,327
TMSL (lb/yr)	**80,970**
BKGND LOAD (lb/yr)	27,871
MOS (lb/yr)	8,097
WLA (lb/yr)	45,002
WASTE LOAD (lb/yr)	131,056
DAIRY POND (lb/yr)	17,312
REDUCTION (lb/yr)	86,054
TOTAL REDUCTION (lb/yr	**103,366**

TOTAL AMMONIA

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	1,997	1,474	74	523
WASTEWATER	11,322	8,354	74	2,968
NON-IRRIGATED	511	0	0	511
DAIRY AGRICULTURE	3,944	2,910	74	1,034
DAIRY pond	2,883	2,883	100	0
SEPTIC	4,699	0	0	4,699
OPEN SPACE	113	0	0	113
TOTAL	**25,469**	**15,621**	**61**	**9,848**

TOTAL NITROGEN

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	22,513	14,783	66	7,730
WASTEWATER	84,880	55,734	66	29,146
NON-IRRIGATED	9,873	0	0	9,873
DAIRY AGRICULTURE	23,663	15,538	66	8,125
DAIRY pond	17,312	17,312	100	0
SEPTIC	14,093	0	0	14,093
OPEN SPACE	3,905	0	0	3,905
TOTAL	**176,239**	**103,366**	**59**	**72,873**

SCENARIO 7C: Average Seasonal Flows with Proportional Seasonal Loadings plus Over Topping of Manure Ponds (Summer Period: June - September)

TOTAL AMMONIA

FLOW (cfs)	8
CONC (mg-N/l)	0.50
TMDL (lb/d)	21
TMSL (lb/yr)	**2,567**
BKGND LOAD (lb/yr)	11,121
MOS (lb/yr)	257
WLA (lb/yr)	0
WASTE LOAD (lb/yr)	594
DAIRY POND (lb/yr)	5,765
REDUCTION (lb/yr)	594
TOTAL REDUCTION (lb/yr	**6,359**

TOTAL NITROGEN

FLOW (cfs)	8
CONC (mg-N/l)	3.70
TMDL (lb/d)	156
TMSL (lb/yr)	**18,994**
BKGND LOAD (lb/yr)	34,549
MOS (lb/yr)	1,899
WLA (lb/yr)	0
WASTE LOAD (lb/yr)	4,617
DAIRY POND (lb/yr)	34,625
REDUCTION (lb/yr)	4,617
TOTAL REDUCTION (lb/yr	**39,242**

TOTAL AMMONIA

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	200	200	100	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	51	0	0	51
DAIRY AGRICULTURE	394	394	100	0
DAIRY pond	5,765	5,765	100	0
SEPTIC	11,059	0	0	11,059
OPEN SPACE	11	0	0	11
TOTAL	**17,480**	**6,359**	**36**	**11,121**

TOTAL NITROGEN

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	2,251	2,251	100	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	987	0	0	987
DAIRY AGRICULTURE	2,366	2,366	100	0
DAIRY pond	34,625	34,625	100	0
SEPTIC	33,171	0	0	33,171
OPEN SPACE	391	0	0	391
TOTAL	**73,791**	**39,242**	**53**	**34,549**

SCENARIO 7D: Average Seasonal Flows with Proportional Seasonal Loadings plus Over Topping of Manure Ponds (Fall Period: October - November)

TOTAL AMMONIA

FLOW (cfs)	53
CONC (mg-N/l)	0.50
TMDL (lb/d)	142
TMSL (lb/yr)	**8,638**
BKGND LOAD (lb/yr)	5,182
MOS (lb/yr)	864
WLA (lb/yr)	2,592
WASTE LOAD (lb/yr)	20,037
DAIRY POND (lb/yr)	2,883
REDUCTION (lb/yr)	17,445
TOTAL REDUCTION (lb/yr	**20,328**

TOTAL NITROGEN

FLOW (cfs)	53
CONC (mg-N/l)	3.70
TMDL (lb/d)	1,048
TMSL (lb/yr)	**63,923**
BKGND LOAD (lb/yr)	25,072
MOS (lb/yr)	6,392
WLA (lb/yr)	32,459
WASTE LOAD (lb/yr)	151,528
DAIRY POND (lb/yr)	17,312
REDUCTION (lb/yr)	119,069
TOTAL REDUCTION (lb/yr	**136,381**

TOTAL AMMONIA

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	1,597	1,390	87	207
WASTEWATER	15,285	13,307	87	1,978
NON-IRRIGATED	408	0	0	408
DAIRY AGRICULTURE	3,155	2,747	87	408
DAIRY pond	2,883	2,883	100	0
SEPTIC	4,684	0	0	4,684
OPEN SPACE	90	0	0	90
TOTAL	**28,102**	**20,328**	**72**	**7,774**

TOTAL NITROGEN

	ESTIMATED ANNUAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	18,010	14,152	79	3,858
WASTEWATER	114,588	90,042	79	24,546
NON-IRRIGATED	7,898	0	0	7,898
DAIRY AGRICULTURE	18,930	14,875	79	4,055
DAIRY pond	17,312	17,312	100	0
SEPTIC	14,050	0	0	14,050
OPEN SPACE	3,124	0	0	3,124
TOTAL	**193,912**	**136,381**	**70**	**57,531**

APPENDIX B

EXPANDED SCENARIOS 2, 3, & 6

LINE ITEM DESCRIPTION FOR SECENARIOS 2, 3 & 6
ATTAINMENT POINT: DESCRIPTION OF SCENARIO
DESCRIPTION (CONTINUED)

SEASON: PERIOD

TOTAL AMMONIA | TOTAL NITROGEN

FLOW (cfs) = VALUES GIVEN (SEE TABLE D-2)
CONC (mg-N/l) = VALUES GIVEN (SEE PAGES 25-26)
TMDL (lb/d) = (CONC. mg/L) x (FLOW cfs) x (28.317 L/cf) X (8.64x10E4 s/d) X (2.205X10E-6 lb/mg)
TMSL (lb/yr) = (TMDL) X (DAYS/SEASON)
BKGND LOAD (lb/yr) = (NON-IRRIGATED) + (SEPTIC) + (OPEN SPACE)
MOS (lb/yr) = (TMSL) X (10%)
WLA (lb/yr) = (TMSL) - (BKGND LOAD + MOS), IF <= 0 THEN WLA = 0
WASTE LOAD (lb/yr) = (URBAN) + (WASTEWATER) + (DAIRY AG)
DAIRY POND (lb/yr) = VALUE GIVEN
REDUCTION (lb/yr) = (WASTE LOAD) - (WLA)

TOTAL REDUCTION (lb/yr= (REDUCTION) + (DAIRY POND), IF REDUCTION <=0 THEN TOTAL REDUCTION = DAIRY POND

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN WASTEWATER NON-IRRIGATED DAIRY AGRICULTURE **DAIRY pond** SEPTIC OPEN SPACE	= VALUES DERIVED FROM TABLES D-4 AND D-5	= (EST. SEASONAL LOAD) X (REDUCTION/WASTE LOAD)	= 1 - (MASS LIMIT/EST.SEASONAL LOAD) X 100%	= (EST. SEASONAL LOAD) - (WASTE LOAD REDUCTION)
TOTAL	= SUMMATION OF ABOVE VALUES			

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN WASTEWATER NON-IRRIGATED DAIRY AGRICULTURE **DAIRY pond** SEPTIC OPEN SPACE		SAME AS ABOVE		
TOTAL				

SENARIO 2 - LAGUNA AT TRENTON-HEALDSBERG ROAD
ATTAINMENT POINT 1: Average Winter Storm Event Flow with Storm Event Loadings (Laguna Reaches 5,6, & 7).

TOTAL AMMONIA

FLOW (cfs)	750
CONC (mg-N/l)	0.50
TMDL (lb/d)	2,023
TMSL (lb/yr)	**44,507**
BKGND LOAD (lb/yr)	2,658
MOS (lb/yr)	4,451
WLA (lb/yr)	37,398
WASTE LOAD (lb/yr)	15,387
DAIRY POND (lb/yr)	6,722
REDUCTION (lb/yr)	-22,011
TOTAL REDUCTION (lb/yr	**6,722**

TOTAL NITROGEN

FLOW (cfs)	750
CONC (mg-N/l)	3.70
TMDL (lb/d)	14,970
TMSL (lb/yr)	**329,348**
BKGND LOAD (lb/yr)	57,517
MOS (lb/yr)	32,935
WLA (lb/yr)	238,896
WASTE LOAD (lb/yr)	123,078
DAIRY POND (lb/yr)	40,373
REDUCTION (lb/yr)	-115,818
TOTAL REDUCTION (lb/yr	**40,373**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	5,655	0	0	5,655
WASTEWATER	0	0	0	0
NON-IRRIGATED	1,814	0	0	1,814
DAIRY AGRICULTURE	9,732	0	0	9,732
DAIRY pond	6,722	6,722	100	0
SEPTIC	215	0	0	215
OPEN SPACE	629	0	0	629
TOTAL	**24,767**	**6,722**	**27**	**18,045**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	64,683	0	0	64,683
WASTEWATER	0	0	0	0
NON-IRRIGATED	35,092	0	0	35,092
DAIRY AGRICULTURE	58,395	0	0	58,395
DAIRY pond	40,373	40,373	100	0
SEPTIC	644	0	0	644
OPEN SPACE	21,781	0	0	21,781
TOTAL	**220,968**	**40,373**	**18**	**180,595**

SENARIO 2 - LAGUNA AT GUERNEVILLE ROAD
ATTAINMENT POINT 2: Average Winter Storm Event Flow with Storm Event Loadings (Laguna Reaches 3 & 4).

TOTAL AMMONIA

FLOW (cfs)	826
CONC (mg-N/l)	0.50
TMDL (lb/d)	2,228
TMSL (lb/yr)	**49,017**
BKGND LOAD (lb/yr)	1,848
MOS (lb/yr)	4,902
WLA (lb/yr)	42,267
WASTE LOAD (lb/yr)	14,742
DAIRY POND (lb/yr)	2,251
REDUCTION (lb/yr)	-27,525
TOTAL REDUCTION (lb/yr	**2,251**

TOTAL NITROGEN

FLOW (cfs)	826
CONC (mg-N/l)	3.70
TMDL (lb/d)	16,487
TMSL (lb/yr)	**362,722**
BKGND LOAD (lb/yr)	38,289
MOS (lb/yr)	36,272
WLA (lb/yr)	288,161
WASTE LOAD (lb/yr)	140,397
DAIRY POND (lb/yr)	13,521
REDUCTION (lb/yr)	-147,764
TOTAL REDUCTION (lb/yr	**13,521**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	**WASTE LOAD** REDUCTION (LB/YR)	**PERCENT** REDUCTION (%)	**MASS** LIMIT (LB/YR)
URBAN	9,882	0	0	9,882
WASTEWATER	1,755	0	0	1,755
NON-IRRIGATED	1,298	0	0	1,298
DAIRY AGRICULTURE	3,105	0	0	3,105
DAIRY pond	2,251	2,251	100	0
SEPTIC	185	0	0	185
OPEN SPACE	365	0	0	365
TOTAL	**18,841**	**2,251**	**12**	**16,590**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	**WASTE LOAD** REDUCTION (LB/YR)	**PERCENT** REDUCTION (%)	**MASS** LIMIT (LB/YR)
URBAN	108,562	0	0	108,562
WASTEWATER	13,200	0	0	13,200
NON-IRRIGATED	25,092	0	0	25,092
DAIRY AGRICULTURE	18,635	0	0	18,635
DAIRY pond	13,521	13,521	100	0
SEPTIC	556	0	0	556
OPEN SPACE	12,641	0	0	12,641
TOTAL	**192,207**	**13,521**	**7**	**178,686**

SENARIO 2 - LAGUNA AT OCCIDENTAL ROAD
ATTAINMENT POINT 3: Average Winter Storm Event Flow with Storm Event Loadings (Laguna Reaches 1& 2).

TOTAL AMMONIA

FLOW (cfs)	292
CONC (mg-N/l)	0.50
TMDL (lb/d)	788
TMSL (lb/yr)	**17,328**
BKGND LOAD (lb/yr)	1,220
MOS (lb/yr)	1,733
WLA (lb/yr)	14,376
WASTE LOAD (lb/yr)	20,596
DAIRY POND (lb/yr)	3,516
REDUCTION (lb/yr)	6,220
TOTAL REDUCTION (lb/yr	**9,736**

TOTAL NITROGEN

FLOW (cfs)	292
CONC (mg-N/l)	3.70
TMDL (lb/d)	5,828
TMSL (lb/yr)	**128,226**
BKGND LOAD (lb/yr)	20,967
MOS (lb/yr)	12,823
WLA (lb/yr)	94,437
WASTE LOAD (lb/yr)	140,251
DAIRY POND (lb/yr)	21,116
REDUCTION (lb/yr)	45,814
TOTAL REDUCTION (lb/yr	**66,930**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	2,804	847	30	1,957
WASTEWATER	1,755	530	30	1,225
NON-IRRIGATED	1,029	0	0	1,029
DAIRY AGRICULTURE	16,037	4,844	30	11,193
DAIRY pond	3,516	3,516	100	0
SEPTIC	175	0	0	175
OPEN SPACE	16	0	0	16
TOTAL	**25,332**	**9,736**	**38**	**15,595**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	30,829	10,071	33	20,758
WASTEWATER	13,200	4,312	33	8,888
NON-IRRIGATED	19,900	0	0	19,900
DAIRY AGRICULTURE	96,222	31,432	33	64,790
DAIRY pond	21,116	21,116	100	0
SEPTIC	525	0	0	525
OPEN SPACE	542	0	0	542
TOTAL	**182,334**	**66,930**	**37**	**115,404**

SENARIO 2 - LAGUNA AT STONEY POINT ROAD
ATTAINMENT POINT 4: Average Winter Storm Event Flow with Storm Event Loadings (Laguna Headwater Reach).

TOTAL AMMONIA

FLOW (cfs)	260
CONC (mg-N/l)	0.50
TMDL (lb/d)	701
TMSL (lb/yr)	**15,429**
BKGND LOAD (lb/yr)	1,233
MOS (lb/yr)	1,543
WLA (lb/yr)	12,653
WASTE LOAD (lb/yr)	12,190
DAIRY POND (lb/yr)	4,467
REDUCTION (lb/yr)	-463
TOTAL REDUCTION (lb/yr	**4,467**

TOTAL NITROGEN

FLOW (cfs)	260
CONC (mg-N/l)	3.70
TMDL (lb/d)	5,190
TMSL (lb/yr)	**114,174**
BKGND LOAD (lb/yr)	23,184
MOS (lb/yr)	11,417
WLA (lb/yr)	79,572
WASTE LOAD (lb/yr)	84,430
DAIRY POND (lb/yr)	26,828
REDUCTION (lb/yr)	4,858
TOTAL REDUCTION (lb/yr	**31,686**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	1,627	0	0	1,627
WASTEWATER	0	0	0	0
NON-IRRIGATED	964	0	0	964
DAIRY AGRICULTURE	10,563	0	0	10,563
DAIRY pond	4,467	4,467	100	0
SEPTIC	151	0	0	151
OPEN SPACE	118	0	0	118
TOTAL	**17,890**	**4,467**	**25**	**13,423**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD **(LB/YR)**	**WASTE LOAD** REDUCTION **(LB/YR)**	**PERCENT** REDUCTION **(%)**	**MASS** LIMIT **(LB/YR)**
URBAN	21,054	1,211	6	19,843
WASTEWATER	0	0	0	0
NON-IRRIGATED	18,642	0	0	18,642
DAIRY AGRICULTURE	63,376	3,646	6	59,730
DAIRY pond	26,828	26,828	100	0
SEPTIC	455	0	0	455
OPEN SPACE	4,087	0	0	4,087
TOTAL	**134,442**	**31,686**	**24**	**102,757**

SENARIO 3 - LAGUNA AT TRENTON-HEALDSBERG ROAD
ATTAINMENT POINT 1: Winter Storm Event Flow with Cumulative Storm Event Loadings (Laguna Reaches 5,6, & 7).

TOTAL AMMONIA

FLOW (cfs)	8,502
CONC (mg-N/l)	0.50
TMDL (lb/d)	22,933
TMSL (lb/yr)	**504,526**
BKGND LOAD (lb/yr)	6,959
MOS (lb/yr)	50,453
WLA (lb/yr)	447,115
WASTE LOAD (lb/yr)	62,915
DAIRY POND (lb/yr)	16,956
REDUCTION (lb/yr)	-384,200
TOTAL REDUCTION (lb/yr	**16,956**

TOTAL NITROGEN

FLOW (cfs)	8,502
CONC (mg-N/l)	3.70
TMDL (lb/d)	169,704
TMSL (lb/yr)	**3,733,491**
BKGND LOAD (lb/yr)	139,957
MOS (lb/yr)	373,349
WLA (lb/yr)	3,220,184
WASTE LOAD (lb/yr)	488,156
DAIRY POND (lb/yr)	101,838
REDUCTION (lb/yr)	-2,732,028
TOTAL REDUCTION (lb/yr	**101,838**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	**WASTE LOAD** REDUCTION (LB/YR)	**PERCENT** REDUCTION (%)	**MASS** LIMIT (LB/YR)
URBAN	19,968	0	0	19,968
WASTEWATER	3,510	0	0	3,510
NON-IRRIGATED	5,105	0	0	5,105
DAIRY AGRICULTURE	39,437	0	0	39,437
DAIRY pond	16,956	16,956	100	0
SEPTIC	726	0	0	726
OPEN SPACE	1,128	0	0	1,128
TOTAL	**86,830**	**16,956**	**20**	**69,874**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD **(LB/YR)**	**WASTE LOAD** REDUCTION **(LB/YR)**	**PERCENT** REDUCTION **(%)**	**MASS** LIMIT **(LB/YR)**
URBAN	225,128	0	0	225,128
WASTEWATER	26,400	0	0	26,400
NON-IRRIGATED	98,726	0	0	98,726
DAIRY AGRICULTURE	236,628	0	0	236,628
DAIRY pond	101,838	101,838	100	0
SEPTIC	2,180	0	0	2,180
OPEN SPACE	39,051	0	0	39,051
TOTAL	**729,951**	**101,838**	**14**	**628,113**

SENARIO 3 - LAGUNA AT GUERNEVILLE ROAD
ATTAINMENT POINT 2: Winter Storm Event Flow with Cumulative Storm Event Loadings (Laguna Reaches 3 & 4).

TOTAL AMMONIA

FLOW (cfs)	5,507
CONC (mg-N/l)	0.50
TMDL (lb/d)	14,854
TMSL (lb/yr)	**326,796**
BKGND LOAD (lb/yr)	4,301
MOS (lb/yr)	32,680
WLA (lb/yr)	289,816
WASTE LOAD (lb/yr)	47,528
DAIRY POND (lb/yr)	10,234
REDUCTION (lb/yr)	-242,288
TOTAL REDUCTION (lb/yr	**10,234**

TOTAL NITROGEN

FLOW (cfs)	5,507
CONC (mg-N/l)	3.70
TMDL (lb/d)	109,922
TMSL (lb/yr)	**2,418,294**
BKGND LOAD (lb/yr)	82,440
MOS (lb/yr)	241,829
WLA (lb/yr)	2,094,025
WASTE LOAD (lb/yr)	365,078
DAIRY POND (lb/yr)	61,465
REDUCTION (lb/yr)	-1,728,947
TOTAL REDUCTION (lb/yr	**61,465**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	14,313	0	0	14,313
WASTEWATER	3,510	0	0	3,510
NON-IRRIGATED	3,291	0	0	3,291
DAIRY AGRICULTURE	29,705	0	0	29,705
DAIRY pond	10,234	10,234	100	0
SEPTIC	511	0	0	511
OPEN SPACE	499	0	0	499
TOTAL	**62,063**	**10,234**	**16**	**51,829**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	160,445	0	0	160,445
WASTEWATER	26,400	0	0	26,400
NON-IRRIGATED	63,634	0	0	63,634
DAIRY AGRICULTURE	178,233	0	0	178,233
DAIRY pond	61,465	61,465	100	0
SEPTIC	1,536	0	0	1,536
OPEN SPACE	17,270	0	0	17,270
TOTAL	**508,983**	**61,465**	**12**	**447,518**

SENARIO 3 - LAGUNA AT OCCIDENTAL ROAD
ATTAINMENT POINT 3: Winter Storm Event Flow with Cumulative Storm Event Loadings (Laguna Reaches 1& 2).

TOTAL AMMONIA

FLOW (cfs)	2,210
CONC (mg-N/l)	0.50
TMDL (lb/d)	5,961
TMSL (lb/yr)	**131,146**
BKGND LOAD (lb/yr)	2,453
MOS (lb/yr)	13,115
WLA (lb/yr)	115,578
WASTE LOAD (lb/yr)	32,786
DAIRY POND (lb/yr)	7,983
REDUCTION (lb/yr)	-82,792
TOTAL REDUCTION (lb/yr	**7,983**

TOTAL NITROGEN

FLOW (cfs)	2,210
CONC (mg-N/l)	3.70
TMDL (lb/d)	44,113
TMSL (lb/yr)	**970,479**
BKGND LOAD (lb/yr)	44,151
MOS (lb/yr)	97,048
WLA (lb/yr)	829,280
WASTE LOAD (lb/yr)	224,681
DAIRY POND (lb/yr)	47,944
REDUCTION (lb/yr)	-604,599
TOTAL REDUCTION (lb/yr	**47,944**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	**WASTE LOAD** REDUCTION (LB/YR)	**PERCENT** REDUCTION (%)	**MASS** LIMIT (LB/YR)
URBAN	4,431	0	0	4,431
WASTEWATER	1,755	0	0	1,755
NON-IRRIGATED	1,993	0	0	1,993
DAIRY AGRICULTURE	26,600	0	0	26,600
DAIRY pond	7,983	7,983	100	0
SEPTIC	326	0	0	326
OPEN SPACE	134	0	0	134
TOTAL	**43,222**	**7,983**	**18**	**35,239**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD **(LB/YR)**	**WASTE LOAD** REDUCTION **(LB/YR)**	**PERCENT** REDUCTION **(%)**	**MASS** LIMIT **(LB/YR)**
URBAN	51,883	0	0	51,883
WASTEWATER	13,200	0	0	13,200
NON-IRRIGATED	38,542	0	0	38,542
DAIRY AGRICULTURE	159,598	0	0	159,598
DAIRY pond	47,944	47,944	100	0
SEPTIC	980	0	0	980
OPEN SPACE	4,629	0	0	4,629
TOTAL	**316,776**	**47,944**	**15**	**268,832**

SENARIO 3 - LAGUNA AT STONEY POINT ROAD
ATTAINMENT POINT 4: Winter Storm Event Flow with Cumulative Storm Event Loadings (Laguna Headwater Reach).

TOTAL AMMONIA

FLOW (cfs)	1,041
CONC (mg-N/l)	0.50
TMDL (lb/d)	2,808
TMSL (lb/yr)	**61,775**
BKGND LOAD (lb/yr)	1,233
MOS (lb/yr)	6,178
WLA (lb/yr)	54,364
WASTE LOAD (lb/yr)	12,190
DAIRY POND (lb/yr)	4,467
REDUCTION (lb/yr)	-42,174
TOTAL REDUCTION (lb/yr	**4,467**

TOTAL NITROGEN

FLOW (cfs)	1,041
CONC (mg-N/l)	3.70
TMDL (lb/d)	20,779
TMSL (lb/yr)	**457,135**
BKGND LOAD (lb/yr)	23,184
MOS (lb/yr)	45,714
WLA (lb/yr)	388,237
WASTE LOAD (lb/yr)	84,430
DAIRY POND (lb/yr)	26,828
REDUCTION (lb/yr)	-303,807
TOTAL REDUCTION (lb/yr	**26,828**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	1,627	0	0	1,627
WASTEWATER	0	0	0	0
NON-IRRIGATED	964	0	0	964
DAIRY AGRICULTURE	10,563	0	0	10,563
DAIRY pond	4,467	4,467	100	0
SEPTIC	151	0	0	151
OPEN SPACE	118	0	0	118
TOTAL	**17,890**	**4,467**	**25**	**13,423**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	21,054	0	0	21,054
WASTEWATER	0	0	0	0
NON-IRRIGATED	18,642	0	0	18,642
DAIRY AGRICULTURE	63,376	0	0	63,376
DAIRY pond	26,828	26,828	100	0
SEPTIC	455	0	0	455
OPEN SPACE	4,087	0	0	4,087
TOTAL	**134,442**	**26,828**	**20**	**107,614**

SENARIO 6 - LAGUNA AT TRENTON-HEALDSBERG ROAD
ATTAINMENT POINT 1: Average Winter Non-Storm Event Flow with Non-Storm Loadings (Laguna Reaches 5,6, & 7).

TOTAL AMMONIA

FLOW (cfs)	200
CONC (mg-N/l)	0.50
TMDL (lb/d)	539
TMSL (lb/yr)	**111,131**
BKGND LOAD (lb/yr)	8,047
MOS (lb/yr)	11,113
WLA (lb/yr)	91,971
WASTE LOAD (lb/yr)	0
DAIRY POND (lb/yr)	6,722
REDUCTION (lb/yr)	-91,971
TOTAL REDUCTION (lb/yr	**6,722**

TOTAL NITROGEN

FLOW (cfs)	200
CONC (mg-N/l)	3.70
TMDL (lb/d)	3,992
TMSL (lb/yr)	**822,372**
BKGND LOAD (lb/yr)	24,113
MOS (lb/yr)	82,237
WLA (lb/yr)	716,022
WASTE LOAD (lb/yr)	0
DAIRY POND (lb/yr)	40,373
REDUCTION (lb/yr)	-716,022
TOTAL REDUCTION (lb/yr	**40,373**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	**WASTE LOAD** REDUCTION (LB/YR)	**PERCENT** REDUCTION (%)	**MASS** LIMIT (LB/YR)
URBAN	0	0	0	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	0	0	0	0
DAIRY AGRICULTURE	0	0	0	0
DAIRY pond	6,722	6,722	100	0
SEPTIC	8,047	0	0	8,047
OPEN SPACE	0	0	0	0
TOTAL	**14,769**	**6,722**	**46**	**8,047**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD **(LB/YR)**	**WASTE LOAD** REDUCTION **(LB/YR)**	**PERCENT** REDUCTION **(%)**	**MASS** LIMIT **(LB/YR)**
URBAN	0	0	0	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	0	0	0	0
DAIRY AGRICULTURE	0	0	0	0
DAIRY pond	40,373	40,373	100	0
SEPTIC	24,113	0	0	24,113
OPEN SPACE	0	0	0	0
TOTAL	**64,486**	**40,373**	**63**	**24,113**

SENARIO 6 - LAGUNA AT GUERNEVILLE ROAD
ATTAINMENT POINT 2: Average Winter Non-Storm Event Flow with Non-Storm Loadings (Laguna Reaches 3 & 4).

TOTAL AMMONIA

FLOW (cfs)	134
CONC (mg-N/l)	0.50
TMDL (lb/d)	361
TMSL (lb/yr)	**74,458**
BKGND LOAD (lb/yr)	6,934
MOS (lb/yr)	7,446
WLA (lb/yr)	60,078
WASTE LOAD (lb/yr)	26,550
DAIRY POND (lb/yr)	2,251
REDUCTION (lb/yr)	-33,528
TOTAL REDUCTION (lb/yr	**2,251**

TOTAL NITROGEN

FLOW (cfs)	134
CONC (mg-N/l)	3.70
TMDL (lb/d)	2,675
TMSL (lb/yr)	**550,989**
BKGND LOAD (lb/yr)	20,801
MOS (lb/yr)	55,099
WLA (lb/yr)	475,089
WASTE LOAD (lb/yr)	199,000
DAIRY POND (lb/yr)	13,521
REDUCTION (lb/yr)	-276,089
TOTAL REDUCTION (lb/yr	**13,521**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	**WASTE LOAD** REDUCTION (LB/YR)	**PERCENT** REDUCTION (%)	**MASS** LIMIT (LB/YR)
URBAN	0	0	0	0
WASTEWATER	26,550	0	0	26,550
NON-IRRIGATED	0	0	0	0
DAIRY AGRICULTURE	0	0	0	0
DAIRY pond	2,251	2,251	100	0
SEPTIC	6,934	0	0	6,934
OPEN SPACE	0	0	0	0
TOTAL	**35,735**	**2,251**	**6**	**33,484**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	**WASTE LOAD** REDUCTION (LB/YR)	**PERCENT** REDUCTION (%)	**MASS** LIMIT (LB/YR)
URBAN	0	0	0	0
WASTEWATER	199,000	0	0	199,000
NON-IRRIGATED	0	0	0	0
DAIRY AGRICULTURE	0	0	0	0
DAIRY pond	13,521	13,521	100	0
SEPTIC	20,801	0	0	20,801
OPEN SPACE	0	0	0	0
TOTAL	**233,322**	**13,521**	**6**	**219,801**

SENARIO 6 - LAGUNA AT OCCIDENTAL ROAD
ATTAINMENT POINT 3: Average Winter Non-Storm Event Flow with Non-Storm Loadings (Laguna Reaches 1 & 2).

TOTAL AMMONIA

FLOW (cfs)	70
CONC (mg-N/l)	0.50
TMDL (lb/d)	189
TMSL (lb/yr)	**38,896**
BKGND LOAD (lb/yr)	6,552
MOS (lb/yr)	3,890
WLA (lb/yr)	28,454
WASTE LOAD (lb/yr)	26,550
DAIRY POND (lb/yr)	3,516
REDUCTION (lb/yr)	-1,904
TOTAL REDUCTION (lb/yr	**3,516**

TOTAL NITROGEN

FLOW (cfs)	70
CONC (mg-N/l)	3.70
TMDL (lb/d)	1,397
TMSL (lb/yr)	**287,830**
BKGND LOAD (lb/yr)	19,660
MOS (lb/yr)	28,783
WLA (lb/yr)	239,388
WASTE LOAD (lb/yr)	199,000
DAIRY POND (lb/yr)	21,116
REDUCTION (lb/yr)	-40,388
TOTAL REDUCTION (lb/yr	**21,116**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	0	0	0	0
WASTEWATER	26,550	0	0	26,550
NON-IRRIGATED	0	0	0	0
DAIRY AGRICULTURE	0	0	0	0
DAIRY pond	3,516	3,516	100	0
SEPTIC	6,552	0	0	6,552
OPEN SPACE	0	0	0	0
TOTAL	**36,618**	**3,516**	**10**	**33,102**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	0	0	0	0
WASTEWATER	199,000	0	0	199,000
NON-IRRIGATED	0	0	0	0
DAIRY AGRICULTURE	0	0	0	0
DAIRY pond	21,116	21,116	100	0
SEPTIC	19,660	0	0	19,660
OPEN SPACE	0	0	0	0
TOTAL	**239,776**	**21,116**	**9**	**218,660**

SENARIO 6 - LAGUNA AT STONEY POINT ROAD
ATTAINMENT POINT 4: Average Winter Non-Storm Event Flow and Non-Storm Loadings (Laguna Headwater Reach).

TOTAL AMMONIA

FLOW (cfs)	30
CONC (mg-N/l)	0.50
TMDL (lb/d)	81
TMSL (lb/yr)	**16,670**
BKGND LOAD (lb/yr)	335
MOS (lb/yr)	1,667
WLA (lb/yr)	14,668
WASTE LOAD (lb/yr)	0
DAIRY POND (lb/yr)	4,467
REDUCTION (lb/yr)	-14,668
TOTAL REDUCTION (lb/yr	**4,467**

TOTAL NITROGEN

FLOW (cfs)	30
CONC (mg-N/l)	3.70
TMDL (lb/d)	599
TMSL (lb/yr)	**123,356**
BKGND LOAD (lb/yr)	17,044
MOS (lb/yr)	12,336
WLA (lb/yr)	93,976
WASTE LOAD (lb/yr)	0
DAIRY POND (lb/yr)	26,828
REDUCTION (lb/yr)	-93,976
TOTAL REDUCTION (lb/yr	**26,828**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	0	0	0	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	0	0	0	0
DAIRY AGRICULTURE	0	0	0	0
DAIRY pond	4,467	4,467	100	0
SEPTIC	335	0	0	335
OPEN SPACE	0	0	0	0
TOTAL	**4,802**	**4,467**	**93**	**335**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	0	0	0	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	0	0	0	0
DAIRY AGRICULTURE	0	0	0	0
DAIRY pond	26,828	26,828	100	0
SEPTIC	17,044	0	0	17,044
OPEN SPACE	0	0	0	0
TOTAL	**43,872**	**26,828**	**61**	**17,044**

APPENDIX C

SELECTED SCENARIO

LINE ITEM DESCRIPTION FOR SELECTED SECENARIO
ATTAINMENT POINT: DESCRIPTION OF SCENARIO
DESCRIPTION (CONTINUED)

SEASON: PERIOD

TOTAL AMMONIA

TOTAL NITROGEN

FLOW (cfs) = VALUES GIVEN (SEE TABLE D-2)
CONC (mg-N/l) = VALUES GIVEN (SEE PAGES 25-26)
TMDL (lb/d) = (CONC. mg/L) x (FLOW cfs) x (28.317 L/cf) X (8.64x10E4 s/d) X (2.205X10E-6 lb/mg)
TMSL (lb/yr) = (TMDL) X (DAYS/SEASON)
BKGND LOAD (lb/yr) = (NON-IRRIGATED) + (SEPTIC) + (OPEN SPACE)
MOS (lb/yr) = (TMSL) X (10%)
WLA (lb/yr) = (TMSL) - (BKGND LOAD + MOS), IF <= 0 THEN WLA = 0
WASTE LOAD (lb/yr) = (URBAN) + (WASTEWATER) + (DAIRY AG)
DAIRY POND (lb/yr) = VALUE GIVEN
REDUCTION (lb/yr) = (WASTE LOAD) - (WLA)

TOTAL REDUCTION (lb/yr= (REDUCTION) + (DAIRY POND), IF REDUCTION <=0 THEN TOTAL REDUCTION = DAIRY POND

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN WASTEWATER NON-IRRIGATED DAIRY AGRICULTURE **DAIRY pond** SEPTIC OPEN SPACE	= VALUES GIVEN (SEE TABLES D-10 THRU D-13)	= (EST. SEASONAL LOAD) X (REDUCTION/WASTE LOAD)	= 1 - (MASS LIMIT/EST.SEASONAL LOAD) X 100%	= (EST. SEASONAL LOAD) - (WASTE LOAD REDUCTION)
TOTAL	= SUMMATION OF ABOVE VALUES			

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN WASTEWATER NON-IRRIGATED DAIRY AGRICULTURE **DAIRY pond** SEPTIC OPEN SPACE		SAME AS ABOVE		
TOTAL				

LAGUANA AT TRENTON-HEALDSBERG ROAD
ATTAINMENT POINT 1: Average Winter Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 5,6, & 7).

Winter Period: December - March

TOTAL AMMONIA

FLOW (cfs)	556
CONC (mg-N/l)	0.50
TMDL (lb/d)	1,498
TMSL (lb/yr)	**181,305**
BKGND LOAD (lb/yr)	14,616
MOS (lb/yr)	18,130
WLA (lb/yr)	148,558
WASTE LOAD (lb/yr)	78,122
DAIRY POND (lb/yr)	2,218
REDUCTION (lb/yr)	-70,436
TOTAL REDUCTION (lb/yr)	**2,218**

TOTAL NITROGEN

FLOW (cfs)	556
CONC (mg-N/l)	3.70
TMDL (lb/d)	11,088
TMSL (lb/yr)	**1,341,655**
BKGND LOAD (lb/yr)	140,299
MOS (lb/yr)	134,165
WLA (lb/yr)	1,067,190
WASTE LOAD (lb/yr)	598,954
DAIRY POND (lb/yr)	13,323
REDUCTION (lb/yr)	-468,236
TOTAL REDUCTION (lb/yr)	**13,323**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	16,174	0	0	16,174
WASTEWATER	30,004	0	0	30,004
NON-IRRIGATED	4,134	0	0	4,134
DAIRY AGRICULTURE	31,944	0	0	31,944
DAIRY pond	2,218	2,218	100	0
SEPTIC	9,568	0	0	9,568
OPEN SPACE	914	0	0	914
TOTAL	**94,956**	**2,218**	**2**	**92,738**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	182,353	0	0	182,353
WASTEWATER	224,932	0	0	224,932
NON-IRRIGATED	79,969	0	0	79,969
DAIRY AGRICULTURE	191,669	0	0	191,669
DAIRY pond	13,323	13,323	100	0
SEPTIC	28,699	0	0	28,699
OPEN SPACE	31,631	0	0	31,631
TOTAL	**752,576**	**13,323**	**2**	**739,253**

LAGUANA AT GUERNEVILLE ROAD
ATTAINMENT POINT 2: Average Winter Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 3 & 4).

Winter Period: December - March

TOTAL AMMONIA

FLOW (cfs)	373
CONC (mg-N/l)	0.50
TMDL (lb/d)	1,005
TMSL (lb/yr)	**121,655**
BKGND LOAD (lb/yr)	9,809
MOS (lb/yr)	12,166
WLA (lb/yr)	99,681
WASTE LOAD (lb/yr)	65,658
DAIRY POND (lb/yr)	743
REDUCTION (lb/yr)	-34,023
TOTAL REDUCTION (lb/yr)	**743**

TOTAL NITROGEN

FLOW (cfs)	373
CONC (mg-N/l)	3.70
TMDL (lb/d)	7,440
TMSL (lb/yr)	**900,249**
BKGND LOAD (lb/yr)	85,752
MOS (lb/yr)	90,025
WLA (lb/yr)	724,472
WASTE LOAD (lb/yr)	499,261
DAIRY POND (lb/yr)	4,462
REDUCTION (lb/yr)	-225,211
TOTAL REDUCTION (lb/yr)	**4,462**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	11,593	0	0	11,593
WASTEWATER	30,004	0	0	30,004
NON-IRRIGATED	2,665	0	0	2,665
DAIRY AGRICULTURE	24,061	0	0	24,061
DAIRY pond	743	743	100	0
SEPTIC	6,739	0	0	6,739
OPEN SPACE	405	0	0	405
TOTAL	**76,210**	**743**	1	**75,467**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	129,960	0	0	129,960
WASTEWATER	224,932	0	0	224,932
NON-IRRIGATED	51,544	0	0	51,544
DAIRY AGRICULTURE	144,369	0	0	144,369
DAIRY pond	4,462	4,462	100	0
SEPTIC	20,220	0	0	20,220
OPEN SPACE	13,988	0	0	13,988
TOTAL	**589,475**	**4,462**	1	**585,013**

LAGUANA AT OCCIDENTAL ROAD
ATTAINMENT POINT 3: Average Winter Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 1 & 2).

Winter Period: December - March

TOTAL AMMONIA

FLOW (cfs)	195
CONC (mg-N/l)	0.50
TMDL (lb/d)	527
TMSL (lb/yr)	**63,729**
BKGND LOAD (lb/yr)	6,024
MOS (lb/yr)	6,373
WLA (lb/yr)	51,332
WASTE LOAD (lb/yr)	40,137
DAIRY POND (lb/yr)	1,160
REDUCTION (lb/yr)	-11,195
TOTAL REDUCTION (lb/yr)	**1,160**

TOTAL NITROGEN

FLOW (cfs)	195
CONC (mg-N/l)	3.70
TMDL (lb/d)	3,897
TMSL (lb/yr)	**471,596**
BKGND LOAD (lb/yr)	47,874
MOS (lb/yr)	47,160
WLA (lb/yr)	376,562
WASTE LOAD (lb/yr)	283,766
DAIRY POND (lb/yr)	6,968
REDUCTION (lb/yr)	-92,796
TOTAL REDUCTION (lb/yr)	**6,968**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	3,589	0	0	3,589
WASTEWATER	15,002	0	0	15,002
NON-IRRIGATED	1,614	0	0	1,614
DAIRY AGRICULTURE	21,546	0	0	21,546
DAIRY pond	1,160	1,160	100	0
SEPTIC	4,301	0	0	4,301
OPEN SPACE	109	0	0	109
TOTAL	**47,321**	**1,160**	**2**	**46,161**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	42,025	0	0	42,025
WASTEWATER	112,466	0	0	112,466
NON-IRRIGATED	31,219	0	0	31,219
DAIRY AGRICULTURE	129,275	0	0	129,275
DAIRY pond	6,968	6,968	100	0
SEPTIC	12,906	0	0	12,906
OPEN SPACE	3,749	0	0	3,749
TOTAL	**338,608**	**6,968**	**2**	**331,640**

LAGUANA AT STONEY POINT ROAD
ATTAINMENT POINT 4: Average Winter Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Headwater Reach).

Winter Period: December - March

TOTAL AMMONIA

FLOW (cfs)	84
CONC (mg-N/l)	0.50
TMDL (lb/d)	225
TMSL (lb/yr)	**27,285**
BKGND LOAD (lb/yr)	2,874
MOS (lb/yr)	2,729
WLA (lb/yr)	21,683
WASTE LOAD (lb/yr)	9,874
DAIRY POND (lb/yr)	1,474
REDUCTION (lb/yr)	-11,809
TOTAL REDUCTION (lb/yr)	**1,474**

TOTAL NITROGEN

FLOW (cfs)	84
CONC (mg-N/l)	3.70
TMDL (lb/d)	1,669
TMSL (lb/yr)	**201,912**
BKGND LOAD (lb/yr)	24,403
MOS (lb/yr)	20,191
WLA (lb/yr)	157,318
WASTE LOAD (lb/yr)	68,389
DAIRY POND (lb/yr)	8,853
REDUCTION (lb/yr)	-88,929
TOTAL REDUCTION (lb/yr)	**8,853**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	1,318	0	0	1,318
WASTEWATER	0	0	0	0
NON-IRRIGATED	781	0	0	781
DAIRY AGRICULTURE	8,556	0	0	8,556
DAIRY pond	1,474	1,474	100	0
SEPTIC	1,997	0	0	1,997
OPEN SPACE	96	0	0	96
TOTAL	**14,222**	**1,474**	**10**	**12,748**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	17,054	0	0	17,054
WASTEWATER	0	0	0	0
NON-IRRIGATED	15,100	0	0	15,100
DAIRY AGRICULTURE	51,335	0	0	51,335
DAIRY pond	8,853	8,853	100	0
SEPTIC	5,993	0	0	5,993
OPEN SPACE	3,310	0	0	3,310
TOTAL	**101,645**	**8,853**	**9**	**92,792**

LAGUANA AT TRENTON-HEALDSBERG ROAD
ATTAINMENT POINT 1: Average Spring Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 5,6, & 7).

Spring Period: April - May

TOTAL AMMONIA

FLOW (cfs)	67
CONC (mg-N/l)	0.50
TMDL (lb/d)	179
TMSL (lb/yr)	**10,942**
BKGND LOAD (lb/yr)	5,322
MOS (lb/yr)	1,094
WLA (lb/yr)	4,526
WASTE LOAD (lb/yr)	4,458
DAIRY POND (lb/yr)	1,143
REDUCTION (lb/yr)	-68
TOTAL REDUCTION (lb/yr)	**1,143**

TOTAL NITROGEN

FLOW (cfs)	67
CONC (mg-N/l)	3.70
TMDL (lb/d)	1,327
TMSL (lb/yr)	**80,970**
BKGND LOAD (lb/yr)	27,871
MOS (lb/yr)	8,097
WLA (lb/yr)	45,002
WASTE LOAD (lb/yr)	43,184
DAIRY POND (lb/yr)	6,863
REDUCTION (lb/yr)	-1,818
TOTAL REDUCTION (lb/yr)	**6,863**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	939	0	0	939
WASTEWATER	2,333	0	0	2,333
NON-IRRIGATED	510	0	0	510
DAIRY AGRICULTURE	1,185	0	0	1,185
DAIRY pond	1,143	1,143	100	0
SEPTIC	4,698	0	0	4,698
OPEN SPACE	114	0	0	114
TOTAL	**10,923**	**1,143**	**10**	**9,780**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	11,737	0	0	11,737
WASTEWATER	23,278	0	0	23,278
NON-IRRIGATED	9,872	0	0	9,872
DAIRY AGRICULTURE	8,168	0	0	8,168
DAIRY pond	6,863	6,863	100	0
SEPTIC	14,094	0	0	14,094
OPEN SPACE	3,905	0	0	3,905
TOTAL	**77,918**	**6,863**	**9**	**71,055**

LAGUANA AT GUERNEVILLE ROAD
ATTAINMENT POINT 2: Average Spring Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 3 & 4).

Spring Period: April - May

TOTAL AMMONIA

FLOW (cfs)	45
CONC (mg-N/l)	0.50
TMDL (lb/d)	120
TMSL (lb/yr)	**7,342**
BKGND LOAD (lb/yr)	3,689
MOS (lb/yr)	734
WLA (lb/yr)	2,919
WASTE LOAD (lb/yr)	8,096
DAIRY POND (lb/yr)	383
REDUCTION (lb/yr)	5,177
TOTAL REDUCTION (lb/yr)	**5,560**

TOTAL NITROGEN

FLOW (cfs)	45
CONC (mg-N/l)	3.70
TMDL (lb/d)	891
TMSL (lb/yr)	**54,329**
BKGND LOAD (lb/yr)	18,020
MOS (lb/yr)	5,433
WLA (lb/yr)	30,876
WASTE LOAD (lb/yr)	70,115
DAIRY POND (lb/yr)	2,299
REDUCTION (lb/yr)	39,239
TOTAL REDUCTION (lb/yr)	**41,538**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	1,036	662	64	373
WASTEWATER	6,471	4,138	64	2,333
NON-IRRIGATED	329	0	0	329
DAIRY AGRICULTURE	589	377	64	212
DAIRY pond	383	383	100	0
SEPTIC	3,309	0	0	3,309
OPEN SPACE	51	0	0	51
TOTAL	12,168	5,560	46	6,608

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	11,965	6,696	56	5,269
WASTEWATER	52,862	29,583	56	23,278
NON-IRRIGATED	6,363	0	0	6,363
DAIRY AGRICULTURE	5,287	2,959	56	2,328
DAIRY pond	2,299	2,299	100	0
SEPTIC	9,930	0	0	9,930
OPEN SPACE	1,727	0	0	1,727
TOTAL	90,434	41,538	46	48,896

LAGUANA AT OCCIDENTAL ROAD

ATTAINMENT POINT 3: Average Spring Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 1 & 2).

Spring Period: April - May

TOTAL AMMONIA

FLOW (cfs)	23
CONC (mg-N/l)	0.50
TMDL (lb/d)	63
TMSL (lb/yr)	**3,845**
BKGND LOAD (lb/yr)	2,325
MOS (lb/yr)	385
WLA (lb/yr)	1,136
WASTE LOAD (lb/yr)	7,938
DAIRY POND (lb/yr)	598
REDUCTION (lb/yr)	6,803
TOTAL REDUCTION (lb/yr)	**7,401**

TOTAL NITROGEN

FLOW (cfs)	23
CONC (mg-N/l)	3.70
TMDL (lb/d)	466
TMSL (lb/yr)	**28,455**
BKGND LOAD (lb/yr)	10,655
MOS (lb/yr)	2,846
WLA (lb/yr)	14,955
WASTE LOAD (lb/yr)	60,898
DAIRY POND (lb/yr)	3,590
REDUCTION (lb/yr)	45,944
TOTAL REDUCTION (lb/yr)	**49,534**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	333	285	86	48
WASTEWATER	5,661	4,851	86	810
NON-IRRIGATED	199	0	0	199
DAIRY AGRICULTURE	1,945	1,667	86	278
DAIRY pond	598	598	100	0
SEPTIC	2,112	0	0	2,112
OPEN SPACE	14	0	0	14
TOTAL	**10,861**	**7,401**	**68**	**3,461**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	4,517	3,408	75	1,109
WASTEWATER	42,440	32,018	75	10,422
NON-IRRIGATED	3,854	0	0	3,854
DAIRY AGRICULTURE	13,941	10,517	75	3,423
DAIRY pond	3,590	3,590	100	0
SEPTIC	6,338	0	0	6,338
OPEN SPACE	463	0	0	463
TOTAL	**75,143**	**49,534**	**66**	**25,610**

LAGUANA AT STONEY POINT ROAD
ATTAINMENT POINT 4: Average Spring Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Headwater Reach).

Spring Period: April - May

TOTAL AMMONIA

FLOW (cfs)	10
CONC (mg-N/l)	0.50
TMDL (lb/d)	27
TMSL (lb/yr)	**1,647**
BKGND LOAD (lb/yr)	1,089
MOS (lb/yr)	165
WLA (lb/yr)	393
WASTE LOAD (lb/yr)	1,219
DAIRY POND (lb/yr)	759
REDUCTION (lb/yr)	826
TOTAL REDUCTION (lb/yr)	**1,585**

TOTAL NITROGEN

FLOW (cfs)	10
CONC (mg-N/l)	3.70
TMDL (lb/d)	200
TMSL (lb/yr)	**12,188**
BKGND LOAD (lb/yr)	5,216
MOS (lb/yr)	1,219
WLA (lb/yr)	5,753
WASTE LOAD (lb/yr)	8,443
DAIRY POND (lb/yr)	4,561
REDUCTION (lb/yr)	2,690
TOTAL REDUCTION (lb/yr)	**7,251**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	163	110	68	53
WASTEWATER	0	0	0	0
NON-IRRIGATED	96	0	0	96
DAIRY AGRICULTURE	1,056	715	68	341
DAIRY pond	759	759	100	0
SEPTIC	981	0	0	981
OPEN SPACE	12	0	0	12
TOTAL	**3,067**	**1,585**	**52**	**1,482**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	2,105	671	32	1,434
WASTEWATER	0	0	0	0
NON-IRRIGATED	1,864	0	0	1,864
DAIRY AGRICULTURE	6,338	2,019	32	4,319
DAIRY pond	4,561	4,561	100	0
SEPTIC	2,943	0	0	2,943
OPEN SPACE	409	0	0	409
TOTAL	**18,220**	**7,251**	**40**	**10,969**

LAGUANA AT TRENTON-HEALDSBERG ROAD
ATTAINMENT POINT 1: Average Summer Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 5,6, & 7).

Summer Period: June - September

TOTAL AMMONIA

FLOW (cfs)	8
CONC (mg-N/l)	0.50
TMDL (lb/d)	21
TMSL (lb/yr)	**2,567**
BKGND LOAD (lb/yr)	11,122
MOS (lb/yr)	257
WLA (lb/yr)	0
WASTE LOAD (lb/yr)	154
DAIRY POND (lb/yr)	2,286
REDUCTION (lb/yr)	154
TOTAL REDUCTION (lb/yr)	**2,440**

TOTAL NITROGEN

FLOW (cfs)	8
CONC (mg-N/l)	3.70
TMDL (lb/d)	156
TMSL (lb/yr)	**18,994**
BKGND LOAD (lb/yr)	34,547
MOS (lb/yr)	1,899
WLA (lb/yr)	0
WASTE LOAD (lb/yr)	1,231
DAIRY POND (lb/yr)	13,727
REDUCTION (lb/yr)	1,231
TOTAL REDUCTION (lb/yr)	**14,958**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	57	57	100	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	51	0	0	51
DAIRY AGRICULTURE	97	97	100	0
DAIRY pond	2,286	2,286	100	0
SEPTIC	11,060	0	0	11,060
OPEN SPACE	11	0	0	11
TOTAL	13,562	2,440	18	11,122

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	647	647	100	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	987	0	0	987
DAIRY AGRICULTURE	584	584	100	0
DAIRY pond	13,727	13,727	100	0
SEPTIC	33,170	0	0	33,170
OPEN SPACE	390	0	0	390
TOTAL	49,505	14,958	30	34,547

LAGUANA AT GUERNEVILLE ROAD
ATTAINMENT POINT 2: Average Summer Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 3 & 4).

Summer Period: June - September

TOTAL AMMONIA

FLOW (cfs)	5
CONC (mg-N/l)	0.50
TMDL (lb/d)	14
TMSL (lb/yr)	**1,721**
BKGND LOAD (lb/yr)	7,883
MOS (lb/yr)	172
WLA (lb/yr)	0
WASTE LOAD (lb/yr)	130
DAIRY POND (lb/yr)	765
REDUCTION (lb/yr)	130
TOTAL REDUCTION (lb/yr)	**895**

TOTAL NITROGEN

FLOW (cfs)	5
CONC (mg-N/l)	3.70
TMDL (lb/d)	104
TMSL (lb/yr)	**12,736**
BKGND LOAD (lb/yr)	24,346
MOS (lb/yr)	1,274
WLA (lb/yr)	0
WASTE LOAD (lb/yr)	1,272
DAIRY POND (lb/yr)	4,597
REDUCTION (lb/yr)	1,272
TOTAL REDUCTION (lb/yr)	**5,869**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	99	99	100	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	33	0	0	33
DAIRY AGRICULTURE	31	31	100	0
DAIRY pond	765	765	100	0
SEPTIC	7,845	0	0	7,845
OPEN SPACE	5	0	0	5
TOTAL	**8,778**	**895**	**10**	**7,883**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	1,086	1,086	100	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	636	0	0	636
DAIRY AGRICULTURE	186	186	100	0
DAIRY pond	4,597	4,597	100	0
SEPTIC	23,538	0	0	23,538
OPEN SPACE	172	0	0	172
TOTAL	**30,215**	**5,869**	**19**	**24,346**

LAGUANA AT OCCIDENTAL ROAD
ATTAINMENT POINT 3: Average Summer Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 1 & 2).

Summer Period: June - September

TOTAL AMMONIA

FLOW (cfs)	3
CONC (mg-N/l)	0.50
TMDL (lb/d)	7
TMSL (lb/yr)	**902**
BKGND LOAD (lb/yr)	5,006
MOS (lb/yr)	90
WLA (lb/yr)	0
WASTE LOAD (lb/yr)	188
DAIRY POND (lb/yr)	1,195
REDUCTION (lb/yr)	188
TOTAL REDUCTION (lb/yr)	**1,383**

TOTAL NITROGEN

FLOW (cfs)	3
CONC (mg-N/l)	3.70
TMDL (lb/d)	55
TMSL (lb/yr)	**6,672**
BKGND LOAD (lb/yr)	15,392
MOS (lb/yr)	667
WLA (lb/yr)	0
WASTE LOAD (lb/yr)	1,270
DAIRY POND (lb/yr)	7,179
REDUCTION (lb/yr)	1,270
TOTAL REDUCTION (lb/yr)	**8,449**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	28	28	100	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	20	0	0	20
DAIRY AGRICULTURE	160	160	100	0
DAIRY pond	1,195	1,195	100	0
SEPTIC	4,985	0	0	4,985
OPEN SPACE	1	0	0	1
TOTAL	**6,389**	**1,383**	**22**	**5,006**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	308	308	100	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	385	0	0	385
DAIRY AGRICULTURE	962	962	100	0
DAIRY pond	7,179	7,179	100	0
SEPTIC	14,961	0	0	14,961
OPEN SPACE	46	0	0	46
TOTAL	**23,841**	**8,449**	**35**	**15,392**

LAGUANA AT STONEY POINT ROAD
ATTAINMENT POINT 4: Average Summer Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Headwater Reach).

Summer Period: June - September

TOTAL AMMONIA

FLOW (cfs)	1
CONC (mg-N/l)	0.50
TMDL (lb/d)	3
TMSL (lb/yr)	**385**
BKGND LOAD (lb/yr)	2,055
MOS (lb/yr)	39
WLA (lb/yr)	0
WASTE LOAD (lb/yr)	122
DAIRY POND (lb/yr)	1,519
REDUCTION (lb/yr)	122
TOTAL REDUCTION (lb/yr)	**1,641**

TOTAL NITROGEN

FLOW (cfs)	1
CONC (mg-N/l)	3.70
TMDL (lb/d)	23
TMSL (lb/yr)	**2,849**
BKGND LOAD (lb/yr)	6,361
MOS (lb/yr)	285
WLA (lb/yr)	0
WASTE LOAD (lb/yr)	845
DAIRY POND (lb/yr)	9,122
REDUCTION (lb/yr)	845
TOTAL REDUCTION (lb/yr)	**9,967**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	16	16	100	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	10	0	0	10
DAIRY AGRICULTURE	106	106	100	0
DAIRY pond	1,519	1,519	100	0
SEPTIC	2,044	0	0	2,044
OPEN SPACE	1	0	0	1
TOTAL	3,696	1,641	44	2,055

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	211	211	100	0
WASTEWATER	0	0	0	0
NON-IRRIGATED	186	0	0	186
DAIRY AGRICULTURE	634	634	100	0
DAIRY pond	9,122	9,122	100	0
SEPTIC	6,134	0	0	6,134
OPEN SPACE	41	0	0	41
TOTAL	16,328	9,967	61	6,361

LAGUANA AT TRENTON-HEALDSBERG ROAD
ATTAINMENT POINT 1: Average Fall Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 5,6, & 7).

Fall Period: October - November

TOTAL AMMONIA

FLOW (cfs)	53
CONC (mg-N/l)	0.50
TMDL (lb/d)	142
TMSL (lb/yr)	**8,638**
BKGND LOAD (lb/yr)	5,182
MOS (lb/yr)	864
WLA (lb/yr)	2,592
WASTE LOAD (lb/yr)	2,846
DAIRY POND (lb/yr)	1,143
REDUCTION (lb/yr)	254
TOTAL REDUCTION (lb/yr)	**1,397**

TOTAL NITROGEN

FLOW (cfs)	53
CONC (mg-N/l)	3.70
TMDL (lb/d)	1,048
TMSL (lb/yr)	**63,923**
BKGND LOAD (lb/yr)	25,070
MOS (lb/yr)	6,392
WLA (lb/yr)	32,461
WASTE LOAD (lb/yr)	32,083
DAIRY POND (lb/yr)	6,863
REDUCTION (lb/yr)	-378
TOTAL REDUCTION (lb/yr)	**6,863**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	594	53	9	541
WASTEWATER	1,417	0	0	1,417
NON-IRRIGATED	408	0	0	408
DAIRY AGRICULTURE	835	74	9	760
DAIRY pond	1,143	1,143	100	0
SEPTIC	4,685	0	0	4,685
OPEN SPACE	89	0	0	89
TOTAL	9,171	1,270	14	7,901

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	7,797	0	0	7,797
WASTEWATER	18,744	0	0	18,744
NON-IRRIGATED	7,897	0	0	7,897
DAIRY AGRICULTURE	5,542	0	0	5,542
DAIRY pond	6,863	6,863	100	0
SEPTIC	14,050	0	0	14,050
OPEN SPACE	3,123	0	0	3,123
TOTAL	64,016	6,863	11	57,153

LAGUANA AT GUERNEVILLE ROAD
ATTAINMENT POINT 2: Average Fall Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 3 & 4).

Fall Period: October - November

TOTAL AMMONIA

FLOW (cfs)	35
CONC (mg-N/l)	0.50
TMDL (lb/d)	95
TMSL (lb/yr)	**5,797**
BKGND LOAD (lb/yr)	3,602
MOS (lb/yr)	580
WLA (lb/yr)	1,615
WASTE LOAD (lb/yr)	9,138
DAIRY POND (lb/yr)	383
REDUCTION (lb/yr)	7,523
TOTAL REDUCTION (lb/yr)	**7,906**

TOTAL NITROGEN

FLOW (cfs)	35
CONC (mg-N/l)	3.70
TMDL (lb/d)	703
TMSL (lb/yr)	**42,896**
BKGND LOAD (lb/yr)	16,370
MOS (lb/yr)	4,290
WLA (lb/yr)	22,236
WASTE LOAD (lb/yr)	77,917
DAIRY POND (lb/yr)	2,299
REDUCTION (lb/yr)	55,681
TOTAL REDUCTION (lb/yr)	**57,980**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	803	661	82	142
WASTEWATER	8,020	6,602	82	1,417
NON-IRRIGATED	263	0	0	263
DAIRY AGRICULTURE	316	260	82	56
DAIRY pond	383	383	100	0
SEPTIC	3,300	0	0	3,300
OPEN SPACE	39	0	0	39
TOTAL	13,123	7,906	60	5,217

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	9,189	6,566	71	2,622
WASTEWATER	65,681	46,937	71	18,744
NON-IRRIGATED	5,090	0	0	5,090
DAIRY AGRICULTURE	3,047	2,177	71	870
DAIRY pond	2,299	2,299	100	0
SEPTIC	9,899	0	0	9,899
OPEN SPACE	1,381	0	0	1,381
TOTAL	96,586	57,980	60	38,606

LAGUANA AT OCCIDENTAL ROAD

ATTAINMENT POINT 3: Average Fall Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Reaches 1 & 2).

Fall Period: October - November

TOTAL AMMONIA

FLOW (cfs)	18
CONC (mg-N/l)	0.50
TMDL (lb/d)	50
TMSL (lb/yr)	**3,036**
BKGND LOAD (lb/yr)	2,275
MOS (lb/yr)	304
WLA (lb/yr)	457
WASTE LOAD (lb/yr)	9,255
DAIRY POND (lb/yr)	598
REDUCTION (lb/yr)	8,798
TOTAL REDUCTION (lb/yr)	**9,396**

TOTAL NITROGEN

FLOW (cfs)	18
CONC (mg-N/l)	3.70
TMDL (lb/d)	368
TMSL (lb/yr)	**22,465**
BKGND LOAD (lb/yr)	9,771
MOS (lb/yr)	2,246
WLA (lb/yr)	10,447
WASTE LOAD (lb/yr)	71,363
DAIRY POND (lb/yr)	3,590
REDUCTION (lb/yr)	60,916
TOTAL REDUCTION (lb/yr)	**64,506**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	238	226	95	12
WASTEWATER	7,642	7,264	95	378
NON-IRRIGATED	159	0	0	159
DAIRY AGRICULTURE	1,375	1,307	95	68
DAIRY pond	598	598	100	0
SEPTIC	2,106	0	0	2,106
OPEN SPACE	10	0	0	10
TOTAL	**12,128**	**9,396**	**77**	**2,732**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	3,440	2,936	85	504
WASTEWATER	57,294	48,907	85	8,387
NON-IRRIGATED	3,083	0	0	3,083
DAIRY AGRICULTURE	10,629	9,073	85	1,556
DAIRY pond	3,590	3,590	100	0
SEPTIC	6,318	0	0	6,318
OPEN SPACE	370	0	0	370
TOTAL	**84,724**	**64,506**	**76**	**20,218**

LAGUANA AT STONEY POINT ROAD
ATTAINMENT POINT 4: Average Fall Seasonal Flow and Estimated Seasonal Loadings (Mass Limit + Proportional Loadings) (Laguna Headwater Reach).

Fall Period: October - November

TOTAL AMMONIA

FLOW (cfs)	8
CONC (mg-N/l)	0.50
TMDL (lb/d)	21
TMSL (lb/yr)	**1,300**
BKGND LOAD (lb/yr)	1,064
MOS (lb/yr)	130
WLA (lb/yr)	106
WASTE LOAD (lb/yr)	975
DAIRY POND (lb/yr)	759
REDUCTION (lb/yr)	869
TOTAL REDUCTION (lb/yr)	**1,628**

TOTAL NITROGEN

FLOW (cfs)	8
CONC (mg-N/l)	3.70
TMDL (lb/d)	158
TMSL (lb/yr)	**9,619**
BKGND LOAD (lb/yr)	4,752
MOS (lb/yr)	962
WLA (lb/yr)	3,905
WASTE LOAD (lb/yr)	6,754
DAIRY POND (lb/yr)	4,561
REDUCTION (lb/yr)	2,849
TOTAL REDUCTION (lb/yr)	**7,410**

TOTAL AMMONIA

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	130	116	89	14
WASTEWATER	0	0	0	0
NON-IRRIGATED	77	0	0	77
DAIRY AGRICULTURE	845	753	89	92
DAIRY pond	759	759	100	0
SEPTIC	978	0	0	978
OPEN SPACE	9	0	0	9
TOTAL	**2,798**	**1,628**	**58**	**1,170**

TOTAL NITROGEN

	ESTIMATED SEASONAL LOAD (LB/YR)	WASTE LOAD REDUCTION (LB/YR)	PERCENT REDUCTION (%)	MASS LIMIT (LB/YR)
URBAN	1,684	710	42	974
WASTEWATER	0	0	0	0
NON-IRRIGATED	1,491	0	0	1,491
DAIRY AGRICULTURE	5,070	2,139	42	2,931
DAIRY pond	4,561	4,561	100	0
SEPTIC	2,934	0	0	2,934
OPEN SPACE	327	0	0	327
TOTAL	**16,067**	**7,410**	**46**	**8,657**

APPENDIX D

SEASONAL FLOWS

AND

PROPORTIONAL LOADINGS

TABLE D-1: ESTIMATED CUMULATIVE FLOWS FOR EACH ATTAINMENT POINT

LAGUNA DE SANTA ROSA

WINTER NON-STORM AND STORM EVENT FLOWS (CFS)

REACH	RUNOFF	WINTER NON-STORM (BASELINE)	CUMULATIVE NON-STORM (BASELINE)	STORM (BASELINE + RUNOFF)	CUMULATIVE STORM
HW	1,011	30	30	1,041	1,041
1	592	17	47	609	1,650
2	549	11	70	560	2,210
3	208	6	76	214	2,424
4	3,025	58	134	3,083	5,507
5	47	4	138	51	5,558
6	1,672	40	177	1,712	7,269
7	1,210	23	200	1,233	8,502

REACH	ATTAINMENT POINT	CUMULATIVE STORM	CUMULATIVE NON-STORM FLOW	CUMULATIVE EST. 24-HR (AVE. STORM)
HW	4	1,041	30	261
1				
2	3	1,169	70	293
3				
4	2	3,297	134	826
5				
6				
7	1	2,995	200	750

TABLE D-2: ESTIMATED SEASONAL FLOWS FOR EACH ATTAINMENT POINT

ESTIMATED SEASONAL FLOWS

ATTAINMENT POINT	CUMULATIVE NON-STORM FLOW
4	30
3	70
2	134
1	200

Example:

Winter flow ratio = 556 cfs/200 cfs = 2.78

Estimated winter flow for GV = (2.78) (134) = 373 cfs

ESTIMATED SEASONAL FLOWS FOR ATTAINMENT POINTS

	Attainment Point 1	Attainment Point 2	Attainment Point 3	Attainment Point 4
SEASON	MEASURED AVE. SEASON FLOWS @ T-H	ESTIMATED AVE. SEASON FLOWS @ GV	ESTIMATED AVE. SEASON FLOWS @ OCC	ESTIMATED AVE. SEASON FLOWS @ SP
WINTER	556	373	195	84
SPRING	67	45	23	10
SUMMER	8	5	3	1
FALL	53	35	18	8

TABLE D-3: METHOD USED TO CALCULATE SEASONAL PROPORTIONED LOADINGS

ALL STORM EVENT LOADINGS
(EXCEPT WASTEWATER)

SEASON	PERIOD	FLOW	SEASONAL PERCENT = f(flow)
WINTER	Dec.-March	556	81
SPRING	April-May	67	10
SUMMER	June-Sept.	8	1
FALL	Oct.-Nov.	53	8

WASTEWATER LOADINGS

SEASON	PERIOD	TIME	SEASONAL PERCENT = f(time)
WINTER	Dec.-March	121	53
SPRING	April-May	45	20
SUMMER	June-Sept.	0	0
FALL	Oct.-Nov.	61	27

ALL NON-STORM EVENT LOADINGS
(EXCEPT WASTEWATER)

SEASON	PERIOD	TIME	SEASONAL PERCENT = f(time)
WINTER	Dec.-March	121	33
SPRING	April-May	61	17
SUMMER	June-Sept.	122	34
FALL	Oct.-Nov.	61	17

DAIRY MANURE POND LOADINGS

SEASON	PERIOD	TIME	SEASONAL PERCENT = f(time)
WINTER	Dec.-March	121	33
SPRING	April-May	61	17
SUMMER	June-Sept.	122	34
FALL	Oct.-Nov.	61	17

EXAMPLES:

Seasonal Proportional Loading = (storm event, lb/yr)(storm event seasonal percent)
+ (non-storm, lb/yr)(non-storm percent)

Total Nitrogen

Winter Season @ T-H (Attainment Point 1)

Urban = (64683 lb/yr)(0.81) + 0 = 52,393 lb/season
Septic = (1,111 lb/yr)(0.58 adjustment)(0.81)
+ (41,574 lb/yr)(0.58 adjustment)(0.33) = 8,479 lb/season
Wastewater = (0 lb/yr)(0.53) = 0 lb/season

Winter Season @ GV (Attainment Point 2)

Urban = (108,562 lb/yr)(0.81) + 0 = 87,935 lb/season
Septic = (958 lb/yr)(0.58 adjustment)(0.81) + (35,864 lb/yr)(0.58 adjustment)(0.33) = 7,314 lb/season
Wastewater = (13,200 + 199,000 lb/yr)(0.53) = 112,466 lb/season

Summer Season @ T-H (Attainment Point 1)

Urban = (64,684 lb/yr)(0.01) + 0 = 647 lb/season
Septic = (1,111 lb/yr)(0.58 adjustment)(0.01) + (41,574 lb/yr)(0.58 adjustment)(0.34)
+ (2,461 lb/yr)(0.58 adjustement) = 9,632 lb/season
Wastewater = (0 lb/yr)(0.53) = 0 lb/season

TABLE D-4: ANNUAL ESTIMATED LOADINGS FOR TOTAL AMMONIA

(VALUES DERIVED FROM THE CITY OF SANTA ROSA'S 205(J) REPORT)

POUNDS/YEAR

WINTER STORM

SOURCE	ATTAINMENT POINT 1	ATTAINMENT POINT 2	ATTAINMENT POINT 3	ATTAINMENT POINT 4	TOTAL
URBAN	5,655	9,882	2,804	1,627	19,968
WASTEWATER	0	1,755	1,755	0	3,510
NON-IRRIGATED AG	1,814	1,298	1,029	964	5,105
DAIRY AG	9,732	3,105	16,037	10,563	39,437
SEPTIC SYSTEMS	370	319	301	261	1,251
OPEN SPACE	629	365	16	118	1,128
TOTAL	18,200	16,724	21,942	13,533	70,399

WINTER NON-STORM

SOURCE	ATTAINMENT POINT 1	ATTAINMENT POINT 2	ATTAINMENT POINT 3	ATTAINMENT POINT 4	TOTAL
URBAN	0	0	0	0	0
WASTEWATER	0	26,550	26,550	0	53,100
NON-IRRIGATED AG	0	0	0	0	0
DAIRY AG	0	0	0	0	0
SEPTIC SYSTEMS	13,874	11,955	11,297	9,794	46,920
OPEN SPACE	0	0	0	0	0
TOTAL	13,874	38,505	37,847	9,794	100,020

SUMMER

SOURCE	ATTAINMENT POINT 1	ATTAINMENT POINT 2	ATTAINMENT POINT 3	ATTAINMENT POINT 4	TOTAL
URBAN	0	0	0	0	0
WASTEWATER	0	0	0	0	0
NON-IRRIGATED AG	0	0	0	0	0
DAIRY AG	0	0	0	0	0
SEPTIC SYSTEMS	822	863	1,226	191	3,102
OPEN SPACE	0	0	0	0	0
TOTAL	822	863	1,226	191	3,102

TOTALS	32896	56092	61015	23518	173521

TABLE D-5: ANNUAL ESTIMATED LOADINGS FOR TOTAL NITROGEN

(VALUES DERIVED FROM THE CITY OF SANTA ROSA'S 205(J) REPORT) (Table 4-1, Page 64)

POUNDS/YEAR

WINTER STORM

SOURCE	ATTAINMENT POINT 1	ATTAINMENT POINT 2	ATTAINMENT POINT 3	ATTAINMENT POINT 4	TOTAL
URBAN	64,683	108,562	30,829	21,054	225,128
WASTEWATER	0	13,200	13,200	0	26,400
NON-IRRIGATED AG	35,092	25,092	19,900	18,642	98,726
DAIRY AG	58,395	18,635	96,222	63,376	236,628
SEPTIC SYSTEMS	1,111	958	905	785	3,759
OPEN SPACE	21,781	12,641	542	4,087	39,051
TOTAL	181,062	179,088	161,598	107,944	629,692

WINTER NON-STORM

SOURCE	ATTAINMENT POINT 1	ATTAINMENT POINT 2	ATTAINMENT POINT 3	ATTAINMENT POINT 4	TOTAL
URBAN	0	0	0	0	0
WASTEWATER	0	199,000	199,000	0	398,000
NON-IRRIGATED AG	0	0	0	0	0
DAIRY AG	0	0	0	0	0
SEPTIC SYSTEMS	41,574	35,864	33,896	29,387	140,721
OPEN SPACE	0	0	0	0	0
TOTAL	41,574	234,864	232,896	29,387	538,721

SUMMER

SOURCE	ATTAINMENT POINT 1	ATTAINMENT POINT 2	ATTAINMENT POINT 3	ATTAINMENT POINT 4	TOTAL
URBAN	0	0	0	0	0
WASTEWATER	0	0	0	0	0
NON-IRRIGATED AG	0	0	0	0	0
DAIRY AG	0	0	0	0	0
SEPTIC SYSTEMS	2,461	2,585	3,686	577	9,309
OPEN SPACE	0	0	0	0	0
TOTAL	2,461	2,585	3,686	577	9,309

TOTALS	225097	416537	398180	137908	1177722

398,000 (wwtr, N/S)
26,400
424,400 Lbs

TABLE D-6: PROPORTIONAL LOADINGS FOR SUB-WATERSHED ABOVE ATTAINMENT POINT 1

TRENTON-HEALDSBERG
ATTAINMENT POINT 1

SEASON	AVE. FLOW (CFS)
WINTER	556
SPRING	67
SUMMER	8
FALL	53

TOTAL NITROGEN
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	52,393	6,468	647	5,175	64,683
WASTEWATER	0	0	0	0	0
NON-IRRIGATED	28,425	3,509	351	2,807	35,092
DAIRY AG	47,300	5,840	584	4,672	58,395
DAIRY POND	13,323	6,863	13,727	6,863	40,777
SEPTIC*	8,479	4,164	9,632	4,151	26,426
OPEN SPACE	17,643	2,178	218	1,742	21,781

TOTAL AMMONIA
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	4,581	566	57	452	5,655
WASTEWATER	0	0	0	0	0
NON-IRRIGATED	1,469	181	18	145	1,814
DAIRY AG	7,883	973	97	779	9,732
DAIRY POND	2,218	1,143	2,286	1,143	6,789
SEPTIC*	2,829	1,389	3,215	1,385	8,819
OPEN SPACE	509	63	6	50	629

* Septic System loads have been adjusted by 58%

TABLE D-7: PROPORTIONAL LOADINGS FOR SUB-WATERSHED ABOVE ATTAINMENT POINT 2

GUERNEVILLE ROAD
ATTAINMENT POINT 2

SEASON	AVE. FLOW (CFS)
WINTER	211
SPRING	25
SUMMER	3
FALL	20

TOTAL NITROGEN
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	87,935	10,856	1,086	8,685	108,562
WASTEWATER	112,466	42,440	0	57,294	212,200
NON-IRRIGATED	20,325	2,509	251	2,007	25,092
DAIRY AG	15,094	1,864	186	1,491	18,635
DAIRY POND	4,462	2,299	4,597	2,299	13,656
SEPTIC*	7,314	3,592	8,577	3,581	23,064
OPEN SPACE	10,239	1,264	126	1,011	12,641

TOTAL AMMONIA
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	8,004	988	99	791	9,882
WASTEWATER	15,002	5,661	0	7,642	28,305
NON-IRRIGATED	1,051	130	13	104	1,298
DAIRY AG	2,515	311	31	248	3,105
DAIRY POND	743	383	765	383	2,274
SEPTIC*	2,438	1,197	2,860	1,194	7,689
OPEN SPACE	296	37	4	29	365

* Septic System loads have been adjusted by 58%

TABLE D-8: PROPORTIONAL LOADINGS FOR SUB-WATERSHED ABOVE ATTAINMENT POINT 3

OCCIDENTAL ROAD
ATTAINMENT POINT 3

SEASON	AVE. FLOW (CFS)
WINTER	164
SPRING	20
SUMMER	2
FALL	16

TOTAL NITROGEN
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	24,971	3,083	308	2,466	30,829
WASTEWATER	112,466	42,440	0	57,294	212,200
NON-IRRIGATED	16,119	1,990	199	1,592	19,900
DAIRY AG	77,940	9,622	962	7,698	96,222
DAIRY POND	6,968	3,590	7,179	3,590	21,327
SEPTIC*	6,913	3,395	8,827	3,384	22,519
OPEN SPACE	439	54	5	43	542

TOTAL AMMONIA
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	2,271	280	28	224	2,804
WASTEWATER	15,002	5,661	0	7,642	28,305
NON-IRRIGATED	833	103	10	82	1,029
DAIRY AG	12,990	1,604	160	1,283	16,037
DAIRY POND	1,160	598	1,195	598	3,551
SEPTIC*	2,304	1,131	2,941	1,128	7,503
OPEN SPACE	13	2	0	1	16

* Septic System loads have been adjusted by 58%

TABLE D-9: PROPORTIONAL LOADINGS FOR SUB-WATERSHED ABOVE ATTAINMENT POINT 4

STONEY POINT ROAD
ATTAINMENT POINT 4

SEASON	AVE. FLOW (CFS)
WINTER	84
SPRING	10
SUMMER	1
FALL	8

TOTAL NITROGEN
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	17,054	2,105	211	1,684	21,054
WASTEWATER	0	0	0	0	0
NON-IRRIGATED	15,100	1,864	186	1,491	18,642
DAIRY AG	51,335	6,338	634	5,070	63,376
DAIRY POND	8,853	4,561	9,122	4,561	27,096
SEPTIC*	5,993	2,943	6,134	2,934	18,005
OPEN SPACE	3,310	409	41	327	4,087

TOTAL AMMONIA
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	1,318	163	16	130	1,627
WASTEWATER	0	0	0	0	0
NON-IRRIGATED	781	96	10	77	964
DAIRY AG	8,556	1,056	106	845	10,563
DAIRY POND	1,474	759	1,519	759	4,512
SEPTIC*	1,997	981	2,044	978	5,999
OPEN SPACE	96	12	1	9	118

* Septic System loads have been adjusted by 58%

TABLE D-10: ESTIMATED SEASONAL LOADINGS FOR SUB-WATERSHED ABOVE ATTAINMENT POINT 1

TRENTON-HEALDSBERG
ATTAINMENT POINT 1

TOTAL NITROGEN
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	182,353	11,737	647	7,797	202,534
WASTEWATER	224,932	23,278	0	18,744	266,954
NON-IRRIGATED	79,969	9,872	987	7,897	98,725
DAIRY AG	191,669	8,168	584	5,542	205,962
DAIRY POND	13,323	6,863	13,727	6,863	40,777
SEPTIC	28,699	14,094	33,170	14,050	90,013
OPEN SPACE	31,631	3,905	390	3,123	39,049

TOTAL AMMONIA
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	16,174	939	57	594	17,763
WASTEWATER	30,004	2,333	0	1,417	33,754
NON-IRRIGATED	4,134	510	51	408	5,104
DAIRY AG	31,944	1,185	97	835	34,061
DAIRY POND	2,218	1,143	2,286	1,143	6,789
SEPTIC	9,568	4,698	11,060	4,685	30,012
OPEN SPACE	914	114	11	89	1,129

Estimated Seasonal Load = Estimated Proportional Load (Tables D-6 thru D-9)
+ Mass Limit Load at Upstream Attainment Point

TABLE D-11: ESTIMATED SEASONAL LOADINGS FOR SUB-WATERSHED ABOVE ATTAINMENT POINT 2

GUERNEVILLE ROAD
ATTAINMENT POINT 2

TOTAL NITROGEN
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	129,960	11,965	1,086	9,189	152,200
WASTEWATER	224,932	52,862	0	65,681	343,475
NON-IRRIGATED	51,544	6,363	636	5,090	63,633
DAIRY AG	144,369	5,287	186	3,047	152,889
DAIRY POND	4,462	2,299	4,597	2,299	13,656
SEPTIC	20,220	9,930	23,538	9,899	63,587
OPEN SPACE	13,988	1,727	172	1,381	17,269

TOTAL AMMONIA
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	11,593	1,036	99	803	13,531
WASTEWATER	30,004	6,471	0	8,020	44,495
NON-IRRIGATED	2,665	329	33	263	3,290
DAIRY AG	24,061	589	31	316	24,997
DAIRY POND	743	383	765	383	2,274
SEPTIC	6,739	3,309	7,845	3,300	21,193
OPEN SPACE	405	51	5	39	499

Estimated Seasonal Load = Estimated Proportional Load (Tables D-6 thru D-9)
+ Mass Limit Load at Upstream Attainment Point

TABLE D-12: ESTIMATED SEASONAL LOADINGS FOR SUB-WATERSHED ABOVE ATTAINMENT POINT 3

OCCIDENTAL ROAD
ATTAINMENT POINT 3

TOTAL NITROGEN
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	42,025	4,517	308	3,440	50,291
WASTEWATER	112,466	42,440	0	57,294	212,200
NON-IRRIGATED	31,219	3,854	385	3,083	38,541
DAIRY AG	129,275	13,941	962	10,629	154,807
DAIRY POND	6,968	3,590	7,179	3,590	21,327
SEPTIC	12,906	6,338	14,961	6,318	40,523
OPEN SPACE	3,749	463	46	370	4,629

TOTAL AMMONIA
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	3,589	333	28	238	4,189
WASTEWATER	15,002	5,661	0	7,642	28,305
NON-IRRIGATED	1,614	199	20	159	1,993
DAIRY AG	21,546	1,945	160	1,375	25,026
DAIRY POND	1,160	598	1,195	598	3,551
SEPTIC	4,301	2,112	4,985	2,106	13,503
OPEN SPACE	109	14	1	10	134

Estimated Seasonal Load = Estimated Proportional Load (Tables D-6 thru D-9)
+ Mass Limit Load at Upstream Attainment Point

TABLE D-13: ESTIMATED SEASONAL LOADINGS FOR SUB-WATERSHED ABOVE ATTAINMENT POINT 4

STONEY POINT ROAD
ATTAINMENT POINT 4

TOTAL NITROGEN
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	17,054	2,105	211	1,684	21,054
WASTEWATER	0	0	0	0	0
NON-IRRIGATED	15,100	1,864	186	1,491	18,642
DAIRY AG	51,335	6,338	634	5,070	63,376
DAIRY POND	8,853	4,561	9,122	4,561	27,096
SEPTIC	5,993	2,943	6,134	2,934	18,005
OPEN SPACE	3,310	409	41	327	4,087

TOTAL AMMONIA
(LBS/SEASON)

SOURCE	WINTER	SPRING	SUMMER	FALL	TOTAL
URBAN	1,318	163	16	130	1,627
WASTEWATER	0	0	0	0	0
NON-IRRIGATED	781	96	10	77	964
DAIRY AG	8,556	1,056	106	845	10,563
DAIRY POND	1,474	759	1,519	759	4,512
SEPTIC	1,997	981	2,044	978	5,999
OPEN SPACE	96	12	1	9	118

Estimated Seasonal Load = Estimated Proportional Load (Tables D-6 thru D-9)
+ Mass Limit Load at Upstream Attainment Point

APPENDIX E

WATER QUALITY MONITORING PLAN

Laguna de Santa Rosa TMDL Monitoring Plan

February 24, 1995

Objectives:

1) At the four attainment sites in the Laguna determine the level of attainment with:
   a) the USEPA criterion for unionized ammonia, and
   b) the Basin Plan dissolved oxygen objective of 7.0 mg/L, minimum.

2) Use the data from objective 1 to target sub-watersheds for further reductions in nitrogen and/or organic matter.

3) Investigate the extent to which sediments and aquatic vegetation contribute to nutrient and dissolved oxygen flux.

Sampling Design Considerations

Objectives 1 & 2

The primary objective is to determine the level of attainment with the USEPA ammonia criterion and the Basin Plan minimum dissolved oxygen objective. Sample sites are the four attainment points at the end of each sub-watershed (Figure 1). Attainment data will be used as screening level data to direct activities up into the sub-watersheds not meeting the water quality objectives.

Systematic monitoring was considered, however may not adequately address the periodicity associated with point source discharge and storm events (Gordon, et.al. 1993; McDonald, et.al. 1991; Steel & Torrie 1960; Ward, et.al. 1994; Weber 1973). We consider storm events important in describing Laguna water quality since we are dealing with a large nonpoint source component.

Analysis of the January to June flows at Trenton-Healdsburg Road for 1992, 1993, and 1994 revealed that a weekly systematic sampling would bias the sampling towards non-storm periods. On the average, 36% of the daily flows were storm generated (32%-41%). Weekly sampling would catch an average of 27% storm flows (20-31%). The average ratio of storm:non-storm days for 1992-1994 was about 40:60.

We propose to use a proportional allocation stratified sampling design based on storm:non-storm frequency in combination with systematic bi-weekly sampling for six-month periods. The first period is January through June, 1995 (Attachment A). Based on the flow data from 1992-1994, straight bi-weekly systematic sampling would catch an average of 3 storm flows. We propose to sample bi-weekly, but supplement that with enough additional samples to produce a 40:60 ratio of storm:non-storm samples. Based on the analysis, we would collect 13 bi-weekly samples (of which 3 would be storm samples) plus four (4) additional storm samples for a total of 17 samples.

Additionally, we have three data loggers that we will rotate through all four sites to sample through a scheduled sampling event. We will leave them in place to collect hourly data for pH, dissolved oxygen, specific conductance, and temperature for some days before and after the sampling event. Placement of the loggers is dependent on flow and weather conditions. They will be used at locations between the four sites as indicated by the data to further investigate dissolved oxygen and pH swings.

We will sample at least one storm through the hydrograph in spring of 1995 or winter of 1995-96 to determine the relationship of ammonia and total nitrogen to flow through a storm event. Future sampling during storm events will be timed to coincide with the most likely period of high ammonia.

Objective 3

We are evaluating the scientific literature and will develop a study to investigate nutrient and oxygen demand flux from the sediments. We will use either *in situ* measurements (placing a dome over the sediment and monitoring

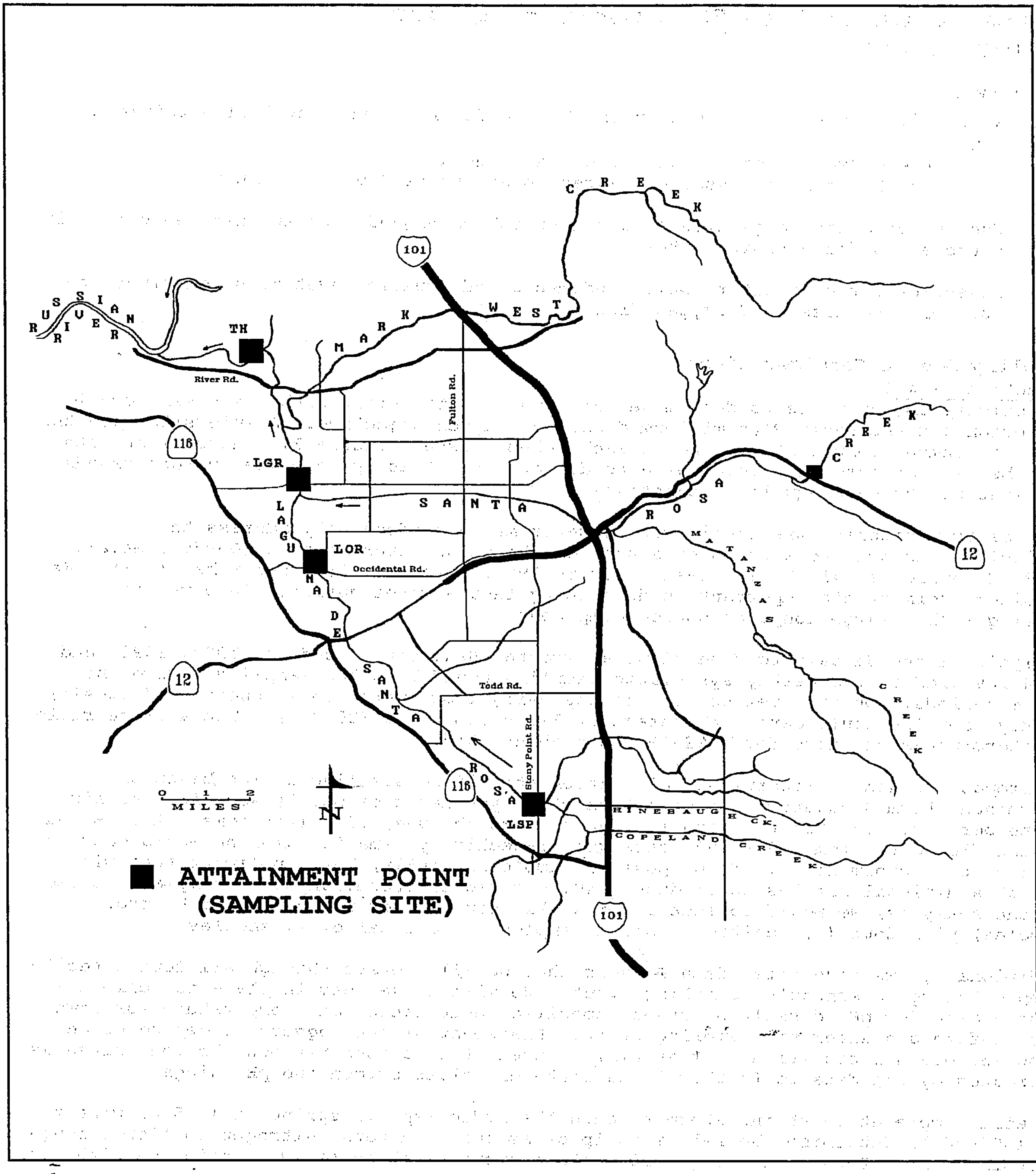


Figure 1. Laguna de Santa Rosa TMDL attainment monitoring sites. (TH = Trenton-Healdsburg Road, LGR = Guerneville Road, LOR = Occidental Road, LSP=Stony Point Road)

changes in the dome compared to outside the dome) or lab bench experiments (bring sediment and water into the laboratory for static "jar tests"), or both.We anticipate addressing the aquatic plant issue through aquatic plant productivity measurements: vegetation coverage over time, chlorophyll or oxygen production rates, growth potential tests, or a combination. As these studies are developed, specific study plans will be prepared.

Sampling Parameters
Field parameters will include pH, specific conductance, dissolved oxygen, water temperature, and stream flow. Attempts to measure stream flow will be made, but cannot be guaranteed at all times due to the nature of the stream system. Continuous stream flow measurement equipment are operating at the TH and LOR sites, and in Santa Rosa Creek near its confluence with the Laguna.

Though the TMSL is for total nitrogen, the listed pollutant is ammonia and the attainment target is the USEPA ammonia criterion. We propose to sample for laboratory analysis of ammonia, nitrate, BOD and field parameters on the systematic plus proportional allocation scheme, collecting samples for total Kjeldahl nitrogen and nitrite every other sampling.

Sampling Costs
Collection of samples at four sites can be done in 6 hours by a team of two. Sampling set-up and cleanup would likely fill out the rest of the day.

Four sites X (13 systematic + 4 storm samples) = 68 samples. Ammonia, Nitrate, BOD = $72 X 68 = $4,896, plus 10% QC = $5,386.

Half frequency for nitrite and total Kjeldahl nitrogen = 34 samples X $46 = $1564, plus 10% QC = $1720.

Total lab cost = $7106.

Data Analysis
Desired comparisons
Objective 1: compare ammonia and DO data to the criteria for each attainment point(station) for the winter season; storm:non-storm period comparisons also will give useful information.
Objective 2: compare stations' ammonia and DO data to provide targeting information; loadings would be helpful.

Statistical Options
Objective 1:
a) cumulative frequency distribution plots of ammonia and DO by station by period will provide the level of attainment picture (two plots per parameter per station - storm and non-storm); and
b) t-tests by station against the target ammonia and DO concentrations.

Objective 2:
a) t-tests (or non-parametric equivalent) - station to station by period; six tests per period (stn 1 vs 2, 1 vs 3, 1 vs 4, 2 vs 3, 2 vs 4, 3 vs 4); to sort out differences between storms, we could t-test storm vs non-storm data by station - four tests;
b) F-test (analysis of variance, AOV) by period; two tests - storm and non-storm;
c) nested AOV yielding two "F" statistics - storm vs non-storm, stations within periods; or
d) Duncan's multiple range test of the means could be used in combination with the nested AOV or by itself as a more refined and powerful modification of t-testing.

Proposed Approach

Objective 1 - both approaches (a) and (b).

Objective 2 - nested AOV (c), since the stratified design (storm/nonstorm) with subsamples (attainment points) fits into the statistical model for analysis of variance with subsampling (nested AOV), unequal sample sizes (Steel and Torrie 1960). We need to investigate if the sampling design will meet all the assumptions. Regardless of whether we use the nested AOV, Duncan's multiple range test could be used to determine the relative order of and differences among sites.

We will perform a pilot analysis on the existing data from other studies to test the statistical method.

Additionally, we have consulted with a UC Davis statistician regarding our design and have received favorable response. Further critique of this design and suggestions for modifications proposed by the statistician will be incorporated into this monitoring plan.

Quality Assurance/Quality Control

The obvious need for QA/QC relates to integrity of the data and determining the precision and accuracy of specific measurement techniques.

The QA program will consist of staff training in sampling, replicate collections, and use of measurement equipment, with followup debriefing of samplers after each sampling event. Samplers will use standardized waterproof forms for recording calibration, QC checks, and sampling site measurements (Attachment B).

The QC program will incorporate approaches for both field and laboratory data. Contract laboratories are required to perform accuracy and precision checks and method blanks on at least 10% frequency. Additionally, we will submit duplicate samples for analysis on a minimum 10% frequency.

Equipment will be calibrated prior to the sampling event and checked for accuracy (calibration drift) at the end of the sampling run. Duplicate equipment will be carried into the field as backup. Field measurements will be performed for pH and specific conductance on a replicate sample at the end of the sampling run. All data will be recorded and submitted to the Regional Board Quality Assurance Officer for review and input to the computerized QC charting program. A procedure to check for "out-of-bounds" measurements with a flow chart for remedial actions is in development.

Data will be handled according the *SMP Unit Procedure for Handling Sampling Data*, revised January 20, 1995 (Attachment C).

Reporting

Data analysis reports will be prepared for six-month periods, with a final report encompassing the period January 1995 through June 1996. The need for modification of the monitoring will be evaluated in July 1996, and appropriate recommendations made at that time.

References

Steel, R.G.D. and J.H. Torrie. 1960. Principles and procedures of statistics. McGraw-Hill, NY.

Ward, R.C., J.C. Loftis, and G.B. McBride. 1994. Design of water quality monitoring systems. Van Nostrand Reinhold, NY.

Weber, C.I.(ed) 1973. Biological field and laboratory methods for measuring the quality of surface waters and effluents. U.S.E.P.A., Office of Res. and Dev. EPA-670/4-73-001.

Gordon, N.D., T.A. McMahon, and B.L. Finlayson. 1993. Stream hydrology - an introduction for ecologists. J. Wiley & Sons, NY.

McBean, E.A. and F.A. Rovers. 1984. Alternatives for handling detection limit data in impact assessments. Groundwater Monitoring Review 4(2):42-44.

McDonald, L.H., A.W. Smart, and R.C. Wissmar. 1991. Monitoring guidelines to evaluate effects of forestry activities on streams in the pacific northwest and Alaska. U.S.E.P.A., Region 10, Water Div. EPA/910/9-91-001.

Robert R. Klamt, Supervisor
Surveillance, Monitoring and Planning Unit
North Coast Regional Water Quality Control Board
5550 Skylane Boulevard, Suite A
Santa Rosa, CA 95403
707-576-2693

"lagmon.wpd"

Attachment A

1995
Laguna de Santa Rosa TMDL Monitoring Schedule

January

19 - Nitrate, Ammonia, BOD REP

February

1 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite REP
16 - Nitrate, Ammonia, BOD

March

1 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite
16 - Nitrate, Ammonia, BOD
29 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite

April

13 - Nitrate, Ammonia, BOD REP
26 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite

May

11 - Nitrate, Ammonia, BOD
24 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite

June

8 - Nitrate, Ammonia, BOD
21 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite REP

July

6 - Nitrate, Ammonia, BOD
19 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite

August

3 - Nitrate, Ammonia, BOD
16 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite
31 - Nitrate, Ammonia, BOD

September

13 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite
28 - Nitrate, Ammonia, BOD

October

11 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite
26 - Nitrate, Ammonia, BOD

November

8 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite
22 - Nitrate, Ammonia, BOD

December

6 - Nitrate, Ammonia, BOD, Kjeldahl-N, Nitrite
21 - Nitrate, Ammonia, BOD

January

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

February

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

March

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

April

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

May

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

June

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

July

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

August

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

September

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

October

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

November

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

December

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

LAGUNA TMDL ATTAINMENT SAMPLING DATE:

Instrument calibration conditions -- Time:

DO Meter # | By - Air / Water | C | Calibration Value: | Meter Reading:

If calib. in water, indicate meter #, etc. calibrated against --

pH Meter Type | Meter # | Buffer Value: | Meter Reading:

SC Meter #

Turbidity Meter | Calibration Value: | Meter Reading:

STATION	TIME	D.O.	pH	S.C.	Temp. (C)	Turbidity	Samples Collected NH3	NO3	BOD		Remark Reference
Stony Point Rd. (# 4)											
Occidental Rd. (# 3)											
Guerneville Rd. (# 2)											
Trenton-Hldbg. Rd. (#1)											
Rep:											

Samplers: ______________________

Weather conditions: ______________________

Previous 24-hr weather and/or hydrologic conditions: ______________________

____

Remarks: ______________________

____

____

____

____

____

____

____

____

____

Calibration Checks -- Time:

DO Meter # | Air / Water | C | Calibration Value: | Meter Reading:

pH Meter Type | Meter # | Buffer Value: | Meter Reading:

SC Meter #

STREAM FLOW RATE MEASUREMENT

Stream: | Date: | Samplers:

Location:

Units: English or metric | Method: Price or Marsh/McBurney | Meter #:

Meas. No.	D*	Z*	V*	Remarks
REW/LEW @ ______ hours				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Meas. No.	D*	Z*	V*	Remarks
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
REW/LEW @ hours				

* D=distance from shore; Z=depth; V=velocity; REW=right edge of water; LEW=left edge of water

Observations: ____________________

SMP UNIT PROCEDURE FOR HANDLING SAMPLING DATA

Lab Reports

responsible staffer checks for inconsistencies
- inconsistencies discussed with QA/QC Officer - Bruce
  - if appropriate, laboratory is contacted by Contract Mgr.
    - Pace = Bob K.
    - North Coast = Bob K.
    - Basic = Bruce
- inconsistency is explained or corrected
  - unresolvable items discussed with Bob K.
  - signoffs = staffer, QA/QC Off., Contract Mgr., Bob K.

responsible staffer
- makes copy of lab report and files in working file

QA/QC Officer files report of inconsistency in QA/QC binder

if Russian River -
- *responsible staffer* provides Bob K. with copy of data
- *Bob K.* then
  - checks for inconsistencies again
  - inputs to database
  - provides responsible staffer with copy to proof
  - *responsible staffer* corrects, signs off, gives to Bob K.
  - *Bob K.* signs off and files in binder

Field Sheets

responsible staffer makes a copy

responsible staffer checks for inconsistencies
- inconsistencies discussed with
  - sample collector
  - QA/QC Officer - Bruce
- inconsistency is explained or corrected
  - unresolvable items discussed with Bob K.
  - signoffs = staffer, QA/QC Off., Contract Mgr., Bob K.
- *QA/QC Officer* files report of inconsistency in QA/QC binder

if Russian River -
- *responsible staffer* provides Bob K. with copy of data
- *Bob K.* then
  - checks for inconsistencies again
  - inputs to database
  - provides responsible staffer with copy to proof
  - *responsible staffer* corrects, signs off, gives to Bob K.
  - *Bob K.* signs off and files in binder

Necessary binders and files -

binders
- QA/QC - Bruce's office
- Russian R. database log - Bob K.'s office

files
- project or basin data file - file area

staffer working files - responsible staffer's office

Responsible Staffer = lead staffer responsible for sampling program coordination, data collection, data analysis, data archiving

QA/QC Officer = Bruce Gwynne, responsible for checking inconsistencies identified in the process and resolving the issues, as well as maintaining the QA/QC information on the equipment and methods

Bob K. = Bob Klamt, SMP Unit Supervisor responsible for oversight of all sampling functions in the Unit, including supervision, problem resolution, budgeting

"dataproc.wpd"
revised Jan 20, 1995

APPENDIX F

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

Public input during the development of this waste reduction strategy was solicited through meetings, distributing the draft waste reduction strategy report for review and comments, as well as other efforts as follows:

Spring 1993 - June 1994	Regional Board staff as well as other interested persons participated in the Technical Review Group for the development of the City of Santa Rosa's report, *Laguna de Santa Rosa Water Quality Objective Attainment Plan*, June 1994.
August 25, 1994	Regional Water Quality Control Board Meeting. Staff updated the Board on the waste reduction strategy for the Laguna.
October 27, 1994	Regional Water Quality Control Board Meeting. Staff updated the Board on the waste reduction strategy for the Laguna.
November 10, 1994	A meeting with the Sonoma-Marin Animal Waste Committee was held. Regional Board staff gave a presentation and answered questions regarding the waste reduction strategy for the Laguna.
November 21, 1994	A meeting with staff from the Regional Board, City of Santa Rosa, Sonoma County Water Agency and Department of Public Works was conducted. Regional Board staff gave a presentation and answered questions regarding the waste reduction strategy for the Laguna.
December 1 & 2, 1994	Draft report on the waste reduction strategy for the Laguna was completed, and copies were mailed out to all Laguna CRMP members (a 30-day review and comment period was requested).
December 2, 1994	A notice was mailed out to the Russian River Monitoring Committee (62 people) stating that the draft report was available for review and comments (a 30-day review and comment period was requested).
December 14, 1994	A meeting for the Laguna CRMP was held. Regional Board staff presented the draft report, answered questions, and requested comments regarding the waste reduction strategy for the Laguna.

December 19 & 20, 1994	Regional Board staff contacted the Cities of Rohnert Park, Sebastopol, and Cotati, and the Town of Windsor (telephone conversations) to discuss the waste reduction strategy for the Laguna and, more specifically, urban runoff aspects of the strategy.
December 19, 1994 - January 20, 1995	The comment period was extended to January 20, 1995. Comments were solicited by Regional Board staff contact (telephone conversations) with representatives from the Goldridge RCD, Sonoma County Water Agency, Sotoyome RCD, Western United Dairymen, Department of Fish and Game, Natural Resources Conservation Service (formerly Soil Conservation Service), Farm Bureau, and Friends of the Russian River.

We received comments from various agencies and interested groups. We responded in writing to all comments received during the review/comment period and incorporated suggestions into the final report. Copies of the written comments and our responses follow.

Comments

DEPARTMENT OF WATER RESOURCES

State of California
The Resources Agency

OFFICE MEMO

TO: I-Ming Cheng Floodplain Management Branch	DATE: December 9, 1994
FROM: Earle W. Cummings Urban Streams Restoration Program	SUBJECT: Review Comments: Waste Reduction Strategy for Laguna de Santa Rosa

The Draft Report on Waste Reduction Strategy for the Laguna de Santa Rosa addresses load reduction from the source perspective pretty well. The major sources are more than adequately characterized. What seems to be missing is a comparably detailed consideration of ways to improve the consumption and natural decomposition of ammonia-nitrogen when it reaches the Laguna, or by modifying the drainage network to alter the pattern of discharge so that existing decomposition or consumption processes have time to work on stormflow before water reaches the Laguna.

Mentioned on page 28, but without much discussion, is the idea of using created wetlands and filter strip applications to reduce nitrogen entering the Laguna. If septic systems are a significant source of nitrogen to the Laguna, filter strips of riparian vegetation that intercept the percolating leachate just before it enters the stream channels would be a valuable addition to the system. Managing vegetation along the top of existing stream and channel banks to produce a dense shade canopy might reduce algal productivity and thus reduce the night-time sag in dissolved oxygen caused by respiration of the dense algal population in sunlit sections of the Laguna tributaries. Although the open water sections of the Laguna might still experience dissolved oxygen sags, the tolerable conditions in tributaries would provide a refugium for sensitive fish species.

There is no discussion of the design of manure storage ponds relative to local terrain. Are overland flows diverted around storage ponds so that storm water from off-site does not contribute to containment failure? Some discussion of grading changes to reduce the risk of pond failure might be appropriate.

Finally, the document develops a large number of scenarios which are dismissed as inadequate, and only a single selected is identified as meeting water quality goals, accurately reflecting flow and pollutant dynamics, calls for reasonable time frames to comply, and appears achievable. Other combinations of features should be explored that could also meet water quality objectives. The other scenarios might place greater emphasis on understanding the interaction of sediment and water column interactions, or greater consideration of ammonia-nitrogen metabolism, or potential watershed hydrological modifications coupled with biological responses to the availability of transported nutrients.

I hope these points are useful. Contact me at (916)327-1656 if I can offer any other information

RRWPC

Russian River Watershed Protection Committee

Post Office Box 501
Guerneville, CA 95446
(707) 869-0410

December 13, 1994

Comments on the North Coast RWQCB Draft Report *Waste Reduction Strategy for the Laguna de Santa Rosa*

This draft strategy relies on two previous reports that contain incomplete analyses and misleading conclusions that the Russian River Watershed Protection Committee has repeatedly commented on (see attached memos). The main issues are:

1. Incomplete analysis of nitrate impacts, especially on algae growth and its subsequent effect on Dissolved Oxygen. This is particularly important during warm, sunny spells in spring when algae blooms can occur, with subsequent night-time reductions in Dissolved Oxygen. Decay of such algae blooms could be contributing to accumulations of benthic nitrogen, which can be re-released to the water column in fall and/or in the following year. These interactions, which are very common, should be thoroughly investigated in the Laguna in order to develop a *direct* strategy for Dissolved Oxygen.

2. Even without analysis of nitrate, effluent discharges from the Laguna Subregional Wastewater Treatment Plant appear to contribute more nitrogen than other sources on an annual basis[1]. Nitrate is *not* included in the technical term "Total Nitrogen" that includes only ammonia and organic nitrogen[2]. Inclusion of nitrate in the wastewater effluent[3] dramatically increases the urgency of developing specific targets for wastewater reductions, rather than the vague generalizations included in this draft (which address only ammonia).

3. As with previous studies, this draft lacks measured data (e.g. diurnal measurements of Dissolved Oxygen), ignores the questionable validity of existing data[4], and relies heavily on an unverified computer model[5].

---

1 Table 4-1 in the *Laguna de Santa Rosa Water Quality Objective Plan*.

2 If the RWQCB and the City of Santa Rosa have calculated the term differently, we would appreciate an explanation.

3 Table 3-9 in the *Laguna de Santa Rosa Water Quality Objective Plan* shows that nitrate in the effluent has an average concentration 3 times higher than ammonia and organic nitrogen together.

4 The RRWPC has presented its critique of the available data on numerous occasions; the main issues are: lack of systematic monitoring, lack of statistical validity, inadequate sampling.

4. The specific focus on ammonia loads from dairies is misleading, since it assumes that the load is the result of "over-topping" storage ponds and runoff from heavily manured areas. This is correct only for documented investigations of ammonia toxicity in creeks. Coupled with the exclusion of nitrate, this focus on ammonia "spills" creates the false impression that Best Management Practices (BMP's) will have an overwhelming impact. On the other hand, the more complex issue of evaluating and balancing all types of nitrogen inputs is missing in this draft (e.g. balancing manure and irrigation-water applications with crop uptake, sub-surface drainage, and salt accumulations in the soil).

5. Strategies for ammonia should be based on concentration as explained in the report, since fish are sensitive to very low concentrations. On the other hand strategies for Dissolved Oxygen should be based on *mass* limits, since suspended organic solids can settle and then create impacts in different seasons and years. Likewise, if nitrates can cause algal blooms and subsequent impacts in different seasons and years. Besides the practical issues of cause and effect, the Clean Water Act also specifies that the targets should be based on mass inputs rather than concentrations.

In summary, we feel that the draft strategy is incomplete and can be improved by: (a) developing direct measures for Dissolved Oxygen, (b) including specific measures for nitrate in the Laguna Subregional Wastewater Treatment Plant effluent, and (c) developing dairy waste BMP's to ensure balanced applications of manure and irrigation-water.

Yours sincerely,

John Rosenblum, Ph.D.

---

5 Doug Green of the RRWPC has presented very detailed critiques of the QUAL2 model on numerous occasions; the main issues are: (a) severe boundary condition discontinuities that preclude applicability to benthic-water column relationships; (b) insupportable uniformity assumptions for different reaches; and (c) incomplete relationships for nutrients and algae. The authors of Santa Rosa's study also allude to these limitations (e.g. p.47 regarding stream flow gauging; p.50 regarding benthic processes).

RRWPC
Russian River Watershed Protection Committee

Post Office Box 501
Guerneville, CA 95446
(707) 869-0410

June 8, 1994

Comments on the Draft Report of the *Laguna de Santa Rosa Water Quality Objective Attainment Plan*

By John Rosenblum, Ph.D.
for the Russian River Watershed Protection Committee

GENERAL COMMENTS

Lack of Measured Data/Reliance on Computer Simulations

The primary concern with this report is the lack of measured data[1] and the over-reliance on computer simulations[2]. At best, we feel that this report can be used only to identify where additional effort is needed to understand the complex relationships that lead to ammonia and dissolved oxygen problems in the Laguna. Without a better understanding of these relationships, the relative importance of each source is unclear, leading to miscalculations and inequitable allocations of Total Maximum Daily Load in the Attainment Plan.

Incomplete Evaluation of Nitrate in Wastewater

The effect of nitrate in the wastewater discharged from the Laguna Subregional Treatment Plant in warm periods between October and May is not adequately evaluated. In addition, the effect of nitrates in irrigation drainage returns is not evaluated at all. Fig. 3-6 of the report shows that nitrate concentrations are 4 times higher than ammonia when the Subregional Plant discharges wastewater; Figures 3-3 to 3-5 show that concentrations of nitrate and ammonia in the Laguna are very similar. Since nitrate is immediately available to aquatic plants and organisms, its effect must be included in the evaluation. By ignoring nitrate, this report has essentially excluded the impact of the Subregional Plant on the Laguna.

1 The RRWPC has presented its critique of the available data on numerous occasions; the main issues are: lack of systematic monitoring, lack of statistical validity, inadequate sampling.

2 Doug Green of the RRWPC has presented very detailed critiques of the QUAL2 model on numerous occasions; the main issues are: (a) severe boundary condition discontinuities that preclude applicability to benthic-water column relationships; (b) insupportable uniformity assumptions for different reaches; and (c) incomplete relationships for nutrients and algae. The authors of this study also allude to these limitations (e.g. p.47 regarding stream flow gauging; p.50 regarding benthic processes).

Need to Address Other Impaired Objectives

While this report focuses on ammonia and dissolved oxygen, the complete Attainment Plan should include other impaired Beneficial Uses. In particular, tests by the City of Santa Rosa have demonstrated chronic toxicity of both the background water in the Laguna and wastewater effluent to indicator species. Although the authors of this report maintain that loss of habitat, rather than water quality, seems to be the main impact on aquatic species (especially Steelhead) in the Laguna, the Attainment Plan is incomplete without addressing habitat restoration.

SPECIFIC COMMENTS

Dissolved Oxygen

The discussion of yearly average dissolved oxygen concentrations in section 2.3.2 and Figs. 2-5 & 2-6 must be expanded to include seasonal and diurnal concentrations. The same applies to the dissolved oxygen results of the model (section 3.4 and Figs. 3-3 to 3-6). In particular, critical periods such as pre-dawn conditions in summer must be evaluated.

Impact of Wastewater

Impact of Discharges

The regression analysis of Fig. 3-1 is inappropriate, not only because of the very low correlation factor (R^2=0.35), but also because discharges are independently and completely controlled by plant operators. A more appropriate evaluation would be to measure the impact at different discharge rates and stream flows (Fig. 3-6 shows a very large nitrogen contribution from the Subregional plant).

Impact of Effluent Irrigation

Although it is stated on p.33 that monitoring data show that irrigation has no impact on groundwater quality, it is unclear whether this also means that irrigation has no impact on the Laguna:

1. Was the data collected near irrigation sites, during the irrigation season, and over several years?
2. How much wastewater irrigation occurred and how does the volume compare to rainfall and other sources of irrigation water?
3. Does subsurface drainage divert irrigation water before it reaches the groundwater? Were measurements taken in nearby surface water during the irrigation season?

Pollutant Load Calibrations

The report uses estimations of pollutant loads from other reports (without discussing applicability to the Laguna), and then reduces these values by an unclear "calibration" factor to reach pollutant concentrations in the Laguna (p.31 for urban sources; p.36 for non-irrigated agriculture). Since Figs. 4-1 to 4-4 which use these calibrated results show that urban and non-irrigated agriculture sources are very significant, the immediate conclusion should be that local measurements must be obtained to validate the Attainment Plan.

Modeling Calibrations

Section 3.4 describes many changes in input assumptions and equation parameters that were required to "fit" the output to results measured on only 2 "calibration" days and 1 "verification" day. What seems to have been lost in the details are:

1. How does the model "fit" for other days and conditions?
2. Are the changes valid[3]?
3. Are other processes (e.g. benthic and sediment reactions), not included in the model, more important in reality?

Lack of Nitrate Evaluation in the Modeling Results

Section 4 of the report lacks a discussion of nitrate, which de-emphasizes of the impact of wastewater from the Subregional Treatment Plant (as direct discharges from October to May, and as irrigation returns in the irrigation season). Total nitrogen analysis by the Kjeldahl method does not include nitrate, thus the comparisons of nitrogen sources shown in Figs 4-1 to 4-4 are misleading. Additional graphs showing nitrate are required for a fair evaluation.

The addition of nitrate would probably show that the nitrogen load from wastewater is as large as that of the dairies. This would require a far more detailed evaluation of wastewater impacts, and a nitrogen control strategy that includes nitrate removal rather than only a reduction of ammonia concentration[4].

---

3 On p.50, how does reallocation 50% of the incremental flow to the headwaters relate to measured volumes (if any exist) in the headwaters? On p.55, how does a sediment oxygen demand of 0.6 g/ft^2 relate to the original value (and to reported or measured values)?

4 The authors of this report acknowledge (p.77) that even though nutrients from the wastewater can contribute to aquatic plant growth, decay, and oxygen depletion, its impact was not evaluated.

Load Reduction Plan

Wastewater Quality Controls

Although some of the options include anaerobic processes, presumably for denitrification, the discussion centers around the removal of ammonia and organic nitrogen. Since the treated effluent is currently nitrified with 15 mg/l of nitrate (Table 3-8), the discussion should explicitly include an evaluation of nitrate reduction.

Dairy BMP's

Although the BMP's are covered in great detail, including costs, there is no mass-balance evaluation. This is a major concern since the source of the nitrogen is imported feed, which means that nitrogen must be somehow eliminated from the wastes in order to provide a steady-state balance. In practical terms, this requires:

1. An evaluation of waste treatment including de-nitrification.
2. An evaluation of the practicality of crop production based on the use of these dairy wastes (liquids and solids) as the primary fertilizer[5].

Neither of these options will be affordable to local dairies under current economic conditions. The report (p.92) recommends 2 institutional/financial strategies that could help offset costs. The real test of practicality is whether the waste BMP's can be combined with reclamation of fertilizer value and changes in dairy practices, to create an affordable long-term solution.

SUMMARY

This report is a reasonable first step in evaluating where further work is required to devise an Attainment Plan. The draft reveals several issues that need to be addressed in more detail in the final report:

1. More <u>measurements</u> of flowrates and water quality are required, especially since the simulation model cannot reflect complex relationships occurring in the Laguna.
2. A detailed evaluation of the impact of nitrate in the wastewater from the Subregional Treatment Plant must be included.
3. Habitat impacts must be addressed.
4. An evaluation of control measures for all forms of nitrogen from the Subregional Plant wastewater, and from dairy wastes must be included.

---

5 To significantly offset feed importation, or for fruit and vegetables to be harvested and sold outside the Laguna system. Another option would be to recover nutrients for use outside the Laguna system.

RWPC

in River Watershed Protection Committee

Post Office Box 501
Guerneville, CA 95446
(707) 869-0410

RSSC COMMENTS ON THE DRAFT REPORT ON NON-POINT SOURCE POLLUTANTS IN THE LAGUNA DE SANTA ROSA

RCSC is pleased that the North Coast Regional Water Quality Control Board has started to address issues related to non-point sources of pollution in the Laguna de Santa Rosa, and would like to offer our comments on the draft report.

Our main concern is that discharges from Santa Rosa's Subregional Wastewater Treatment Plant, which is a point source, might have a far larger impact on the Laguna. In particular, it is unclear from the draft report what the relative importance of the point and non-point sources are. We would like this effort result in measurable improvements to water quality in the Laguna and the Russian river.

Our detailed comments are as follows:

1. The report relates to *concentrations* of pollutants, which provide only part of the impact. Overall *mass-loadings* provide a much better basis for evaluating the impact of the non-point sources on the Laguna and the Russian River. What is required is an estimate of the flowrate or volume of runoff at each monitoring point, so that the mass-loading of each pollutant can be calculated.

2. Although the report mentions that during collection of stream-bottom sediments, it was "... apparent from sight and smell that a substantial amount of these organic solids was cow manure", it is not clear whether: (a) this was true everywhere; and (b) if any attempt was made to verify that the solids were not anaerobically decomposing algae or other plant material.

   We feel that this is an important issue to clarify since Figures 5, 7, 8, 9, 10, and 14 seem to indicate high nitrogen loadings from Santa Rosa's wastewater treatment plant (as implied by concentration measurements):

   Fig. 5 shows that total ammonia from the plant was vey high during the years prior to nitrification, and that the dairy sources contribute only a relatively small load. This does not mean that the dairy sources have no impact, but rather that the cumulative impact of many years of high loadings from the plant must still be addressed.

   Fig. 7and 8 show that the source of un-ionized ammonia is dairies, which is to be expected. The toxicity of the un-ionized ammonia is a concern, but its contibution to the overall nitrogen load in the Laguna is insignificant relative to other nitrogen forms.

   Fig. 9 and 10 show that the wastewater treatment plant might be contributing significantly more nitrate to the Laguna than any other source, especially after nitrification (as indicated by the large difference between the "no discharge" and "pre-nitrification" or "post-nitrification" curves at monitoring-point LTR in Fig.10). There seems to be an error in Fig.9 for the "winter" curve: the nitrate contribution from the plant at monitoring-point LTR is missing. Since nitrate is immediately available for algae and plant growth, this nitrogen load might have the most impact on the Laguna, and since the load from the plant might be larger than that of the dairies, the cumulative impact of many years of high loadings from the plant must still be addressed.

Fig. 14 shows that nitrification at the plant eliminated most of the organic nitrogen and the ammonia, but since total Kjeldahl nitrogen does not include nitrate (which is immediately available for algae and plant growth), this does not mean that the wastewater plant is not a major contributor of nitrogen to the Laguna. In fact, since the nitrate load from the plant was always relatively large, and has increased after nitrification, discharges from the plant must still be addressed before reaching conclusions about the relative importance of non-point source impacts on the Laguna.

3. Since effluent from the wastewater treatment plant is used for irrigation throughout the Laguna, discharges will still have an impact on the Laguna even under "no-discharge" conditions. It is not clear in the report how such loads were accounted for, although it is implied that everything that was not discharged directly from the plant was attributed to dairies, and to a lesser extent to urban runoff. Given the high nutrient concentration in the effluent, and frequently high surface runoff during irrigation, we feel that the impact of irrigation should be evaluated before reaching conclusions about other non-point sources.

Sincerely,

Brenda

Brenda Adelman

PETE WILSON, *Governor*

STATE OF CALIFORNIA - CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION
5550 SKYLANE BLVD. SUITE A
SANTA ROSA, CA 95403
PHONE: (707) 576-2220

October 1, 1992

Brenda Adelman
Russian River Watershed Protection Committee
Post Office Box 501
Guernville, CA. 95446

Dear Brenda:

This letter is in response to your letter and comments to the Regional Board on September 24, 1992 concerning the draft report for the Clean Water Act Section 205(j) project titled "Investigation for Nonpoint Source Pollutants in the Laguna de Santa Rosa, Sonoma County".

We would like to thank you for your advance pre-review of the draft report last month. Your comments were helpful towards our putting together the draft final report which was then released for the publicly noticed 30 day review period prior to the Regional Board meeting.

We agree with your comments that mass-loading calculations for water quality constituents would provide a better basis for further evaluating the impact of nonpoint source discharges on the Laguna. The report addresses this issue at the beginning of the report, on page 3. For this study, the quantification of sources was attained through measurement of constituent concentrations in water over time. Additional flow data would have been necessary to quantify in terms of mass emission. Accurate, permanent flow measuring equipment would have been necessary to do this in the main stem of the Laguna, and was outside the scope of this study. The next phase of the study is now just starting and is being conducted by the City of Santa Rosa using a new Section 205(j) grant from the U.S. Environmental Protection Agency. The city's contract is with the State Water Resources Control Board. Work on mass emission calculations has been made a part of this next study.

You expressed comments as to whether our work on the stream bottom sediments confirmed that the organic matter was cow manure and not anaerobically decomposing algae or other plant material. My personal observations during the sediment core sampling was that most of the organic matter was obviously manure. There is no doubt that some of the organic matter was algae or other plant matter, but it was present in minor amounts relative to the amount of manure. This was particularly obvious at station LOR, the station which represented a wide slow stream reach in which we would expect solids from upstream areas to drop out of the water column and be deposited.

You had a number of written comments on specific Figures (graphs) in the report. My response to those comments are as follows:

Figure 5 does show high median total NH_3-N concentrations during a period when the treatment plant was not nitrifying its effluent. This was a temporary situation that no longer occurs. The treatment plant has been normally nitrifying its effluent since the mid 1970's, and the pre-nitrification data shown on Figure 5 represents a temporary situation during the winter of 1989-90.

Figures 7 and 8 show median un-ionized ammonia concentrations in the Laguna. Because un-ionized ammonia can be toxic to aquatic life in low concentrations, we have concluded that the level of un-ionized ammonia to be extremely significant regardless of the concentration or load of total nitrogen. Un-ionized ammonia can result in direct toxicity, and is considered our most significant concern with respect to nitrogen impacts.

Figures 9 and 10 show median nitrate levels in the Laguna. The treatment plant discharges during the winter period only, when there are naturally low algal production levels in the stream. This means that the nitrate discharged from the treatment plant is not usually available for algal growth during the summer period when nuisance algae blooms are normally expected to occur.

Figure 14 shows median total Kjeldahl nitrogen concentrations in the Laguna. Kjeldahl nitrogen is a measure of organic and ammonia nitrogen. The purpose of Figure 14 was to show only Kjeldahl nitrogen levels, and not to infer anything about nitrate loadings from the treatment plant or nonpoint source discharges. Figure 14 needs to be interpreted in contex with the rest of the report. Post-nitrification median levels of Kjeldahl nitrogen in the Laguna were less than when the treatment plant was not discharging, thus improving water quality in this regard.

You also expressed comments concerning impacts from irrigation runoff into the Laguna. These are reflected in the data at downstream stations during the course of the study. We have concluded from the data that this is a relatively insignificant source of discharge impacts.

Your comment that stream channelization has had impacts to Laguna water quality is well taken. This is mentioned on page 13 of the report during the discussion on water temperatures. Channelization impacts were not within the scope of this study.

I hope I have sufficiently addressed your comments and questions. Thank-you again for your review of the report. Your comments were important for us and made for a better report. Please call me with any additional questions.

Sincerely,

WD Winchester

William D. Winchester
Environmental Specialist III

Lee Erickson

Phone Conversation 12/22/94

RCD Consultant (Goldridge RCD)

Comments:

✓ Add tables that show cummulative portional loads in Appendix D

– Change tables (Appendix A, B & C) to include a row that shows attainment is met (neg. numbers) as well as a row that shows manure pond elimination/reduction ~~rather than the~~

✓ A
✓ B
✓ C

✓ Line items that show step-by-step the calculations used in these tables (more description & clarity is need)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

WATER QUALITY
CONTROL BOARD
REGION 1

JAN 4 '95

☐ BK ☐ RK RRK
☐ CJ ☐ LR
☐ FR ☐ KD
☐ RT ☐ PG
☐ JH ☐ JS
☐ SW ☒ CNM
☐ ☐ REPLY
☐ ALL STAFF ☐ FILE

(In reply, refer to W-3-2)

JAN 03 1995

Ms. Cecile Morris
North Coast Regional Water Quality Control Board
5550 Skylane Blvd., Suite A
Santa Rosa, CA 95403

Dear Ms. Morris:

Thank you for the opportunity to comment on the draft Waste Reduction Strategy for the Laguna De Santa Rosa, dated September 20, 1994. In general, the strategy appears to provide a robust yet feasible framework for targeting and implementing loading reductions needed to bring the Laguna into compliance with water quality standards. I do believe that additional detail and clarification is needed in a few key areas in order for the strategy to be approvable under Clean Water Act Section 303(d) as a TMDL (see below). My additional comments (enclosed) address elements of the report which should be clarified in order to ensure that the strategy is fully understandable to the public and affected dischargers.

Summer Season Attainment

In the selected scenario, the targeted load goals are expected to be exceeded at each attainment point during the summer season (p.25). This problem may exacerbated by the lagged effect of winter and spring discharges, as discussed in the report (p. 25). Does this mean that the water quality standards are not expected to be met during summer? If so, it appears that the strategy does not achieve one of its primary goals: to "target waste load reductions that meet the water quality goals for the Laguna" (p. 4).

TMDLs are required to be established at a level adequate to ensure that water quality standards will be attained [40 CFR 130.7(c)(1)]. The strategy should explain how it will result in standards attainment during the summer season. Alternatively, the strategy could consider whether other load reduction scenarios and implementation actions which would result in standards attainment during the summer season. In particular, the strategy should consider more aggressive efforts to target septic systems since they are almost solely responsible for summer season loadings, and are a significant source during other periods of the year.

Load Reduction Expectations By Source

The strategy should more clearly allocate load reduction responsibilities and expectations. TMDLs should allocate expected load reductions from major sources of concern by category and/or by specific source ("Guidance for Water Quality Based Decisions: The TMDL Process" USEPA. EPA440/4-91-001). Clear descriptions of the load reduction expectations or requirements are essential in order to ensure that the load reduction targets are attainable and to assist different dischargers in understanding what is expected of them and planning the appropriate discharge controls. The discussion of load reduction responsibilities should also be reflected in the implementation plan section.

Implementation Plan Detail

The strategy should describe the implementation plan in greater detail. The September 20th draft implementation plan is substantially improved over the previous draft; however, the report should discuss, to the extent feasible given available information:

- whether the identified implementation actions are expected to result in attainment of the load reduction targets for each attainment point during each season,
- expected load reductions associated with the implementation measures discussed in the implementation plan, and
- who is responsible for implementing each of the identified control actions.

Describe Monitoring and Review Plan

The strategy should describe how the Regional Board will evaluate the effectiveness of this first phase TMDL and make necessary adjustments ("Guidance for Water Quality Based Decisions: The TMDL Process" USEPA. EPA440/4-91-001). Description of the monitoring plan is a required element of a phased approach TMDL. Key questions that should be addressed include:

- What constitutes compliance with water quality objectives, and how will compliance be determined?
- What monitoring will be done to measure compliance, and by whom?
- What will the Regional Board do at the July 1996 checkpoint?

Comment Period

The Regional Board should consider extending the comment period (either formally or informally) in order to provide ample opportunity for the public to obtain, review, and comment on the strategy. I believe an extension is warranted given that the comment period occurred during the holiday season, the report is lengthy and somewhat complex, and specific expectations of different dischargers are not clearly described.

Conclusion

The Waste Reduction Strategy for the Laguna provides an sound basis for implementing appropriate load reductions, and I commend you for a job well done. I believe the strategy will be strengthened if it is clarified and expanded in the areas discussed above and in the enclosed comments. I would be happy to discuss my comments at your convenience and assist you in any way I can to help bring the strategy to completion. Please do not hesitate to call me at 415-744-2012.

Sincerely,

David Smith
TMDL Coordinator

enclosure

Attachment: Detailed Comments on Waste Reduction Strategy

General Comments

The report should be consistent in its citations of reference sources, and should provide a bibliography.

Did you consider the feasiblity of riparian or stream channel restoration as a method of lowering water temperature and associated ammonia toxicity?

Specific Comments

Page	Comment
2	Clarify in paragraph 2 that the Laguna was listed on the §303(d) list in 1992 and 1994.
3	In paragraph 2, cite the EPA guidance which describes the "phased approach" ("Guidance for Water Quality Based Decisions: The TMDL Process" USEPA. EPA440/4-91-001). This is important to provide the authority for the Regional Board's decision to implement this regulatory mandate in a phased manner.
4	The first sentence of paragraph 3 should be clarified. How does each seasonal flow and loading pattern affect water quality "in a different way?" More detailed discussion of this key point is warranted.
6	Regarding paragraph 1 below table 2, while I agree that attainment of criteria is the ultimate endpoint, I suggest that you explicitly recognize the allowable loads and associated load reduction targets developed in this report as intermediate endpoints of the strategy. In this paragraph, it would also be appropriate to summarize the planned monitoring and assessment activities through which you will evaluate the success of the strategy.
9	In bullet 3, emphasize finding number 4 regarding nutrient increase from upstream urban runoff tributaries. This is the key point in this bullet given that the strategy focuses upon nutrients more than metals or organics.
10	In bullet 1, clarify the last sentence. Does the report contain a finding or merely a hypothesis concerning this possible relationship between late release of nutrients and organics, and summertime water quality? This is an important point because the report contains a similarly vague discussion of this issue on page 25. What is really known, and what is theory at this point? What will be done to explore this theory further?

10 In bullet number 4, the water quality model used to estimate pollutant loads should be discussed in somewhat greater detail because many of the loading estimates underlying the strategy analysis appear to rely on its findings. Without going into exhaustive detail, it would be helpful to discuss the type of model used and its degree of reliability.

11 In the paragraph under the Laguna Water Quality title, clarify the statement that "discharged wastewater meets Basin Plan criteria." Does the discharge meet the D.O. objective contained in the Basin Plan and EPA's un-ionized ammonia criteria, which are the goals of the strategy?

The logic of the following paragraph concerning ammonia is not clear. Please clarify <u>why</u> the referenced factors led you to focus on total nitrogen and two forms of ammonia.

12 In paragraph 1, do actual data from the Laguna bear out the statements in the last sentence regarding the positive correlation between high total ammonia and high unionized ammonia, and between high total nitrogen and high ammonia?

The last sentence on the page should be clarified to read: "The EPA criterion for un-ionized ammonia was exceeded in the Laguna 17% of the time."

13 What explains the substantially higher exceedence rates in the middle reaches of the Laguna? The differences in exceedence rates in the middle reaches should be discussed at some point in the text.

14 Clarify the first phrase in the first sentence regarding "the nature of the nitrogen sources" or cite the page where this issue is discussed.

15 The method used to evaluate pollutant concentration in the water column is very conservative in that it assumes no decay of nitrogen compounds after their discharge. EPA supports the use of conservative assumptions, especially when pollutant fate and transport are poorly understood. However, this assumption may result in overly stringent load reduction targets. Do you have the capability (through the Merrit-Smith model, for example), to evaluate the decay of nitrogen compounds after they are discharged to the Laguna? Would it be possible to use a first-order decay coefficient to evaluate the sensitivity of your load reduction target results to this no-decay assumption?

16 Under the definition of waste load, add "more easily" before the word "controllable" in order to reflect the fact that the load sources identified under the definition of load are controllable.

16 Under the definition of load, explain the term "reduced".

17 Define the meaning of the term pKa used in equation (3).

18 Under equation (4), change the term WQO to "upper limit" or something like this to avoid a connotation that you are developing a total nitrogen objective.

In the last paragraph, is the May 1991-May 1994 period of record representative of the longer term flow record?

19 What is the significance of the "Extended Winter" season line in Table 4?

Please clarify how you combined your evaluations of loadings during winter wet and dry weather periods to derive total loads for the winter season.

20 The revised estimated septic system waste loads may still be high given the overly conservative assumption that all wastewater discharged from septic systems reaches the Laguna.

In paragraph 3, explain how "wastewater loadings are divided up by 121 days during the winter..."

Please clarify paragraph 4 to better explain how storm event loadings were calculated. How do results obtained with this method compare to available meteorological data on storm event frequency and intensity?

23 Please clarify the distinctions between scenarios 7A-7D. Do the letters merely indicate the seasonal breakdown? Also, the section title says 7A-7B. Do you mean 7A-7D?

24 Clarify the method described in the last paragraph. The narrative is confusing.

28-30 Please fill in the blanks regarding load reductions expected from different activities.

29 The implementation plan may provide inadequate guidance to the City of Santa Rosa concerning (1) stormwater control levels and (2) wasteload allocations for the Subregional Wastewater Treatment Plant. The TMDL should provide a specific Wasteload Allocation for this key point source discharger. Are there any other point source discharges of concern?

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

NORTH COAST REGION

Interoffice Communication

TO: Cecile Morris **DATE:** January 14, 1995

FROM: Bob Klamt

SUBJECT: **Comments from John Cummings, Laguna CRMP Task Force**

I noted the following comments from the Laguna CRMP Task Force Meeting of 12-14-94 and a telephone conversation with John on 12-16-94.

The relationships of existing conditions, attainment goals, and an ultimate goal is not well explained. We need to explain how the planned reductions between now and July 1996 compare to the ultimate goal. When is the target date for the ultimate goal?

Need clarification on how City of Santa Rosa planned plant upgrades will apply to the TMDL goals. The report only deals with ammonia; how do the other concerns fit in, i.e., total nitrogen, dissolved oxygen. Is the upgrade reasonable? Is it needed to meet the TMDL goals? If it's not needed, why should they do it?

The NPS management practices must be applied with success in mind. Maybe riparian fencing is not all that it's reputed to be in terms of reducing nutrient inputs.

Septic system estimates are shakey. The discussions of ammonia and total nitrogen are not clear; the relationship of the two with actual load reductions is not explained clearly.

Specific pages on which to concentrate: 5, 7, 30.

I believe reworking the tables and providing further explanation re the goals, timing, City of Santa Rosa upgrade, implementation strategy, and septic system estimates per our discussions should adequately address his concerns.

Responses

CNM

PETE WILSON, *Governor*

ATE OF CALIFORNIA - CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

A FORNIA REGIONAL WATER QUALITY CONTROL BOARD
O TH COAST REGION
50 SKYLANE BLVD. SUITE A
NTA ROSA, CA 95403
HC : (707) 576-2220

February 1, 1995

Mr. David Smith, TMDL Coordinator
US Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

Dear Mr. Smith,

Subject: Response to Comments on the Draft Waste Reduction Strategy for the Laguna de Santa Rosa

Thank you for commenting on the draft Waste Reduction Strategy for the Laguna de Santa Rosa. We found your comments very helpful and will incorporate them into the final report. We would like to take this opportunity to respond to your comments and let you know what changes and clarifications we will be making to the report.

Summer Season Attainment

We recognize that the targeted goals for the summer season do not meet the attainment goals, and have the greatest uncertainty due to estimated septic system loadings. We plan to work on fine-tuning the septic system loading estimates by determining a weighted value based on the septic systems' locations and distances from the Laguna. We believe a more accurate estimation can be determined for septic systems, and adjustments to the estimated mass loading limits will be made to more accurately reflect the summer season. In the implementation plan, we will include a description of efforts that should be made to reduce loading from septic systems.

Load Reduction Expectations By Source

We will include a table in the final report that specifically shows the mass limit loadings for each source within the sub-watersheds above the four attainment points during each season. The load reduction responsibilities will be described more clearly in the implementation section to ensure the different dischargers understand the strategy. For comparison purposes, the anticipated load reductions from current and future projects and programs will be summarized in a table along with the strategy load reduction goals. This table will show the load reductions that are met and/or the areas/sources that need further waste reduction efforts.

Implementation Plan Detail

The implementation section will describe in greater detail the current and future efforts for waste load reductions to the Laguna and, more specifically, the anticipated load reductions. The table described above should show the anticipated load reductions by source and whether the current and future efforts are enough to achieve the strategy reduction goals. The responsibilities for implementing the waste reduction efforts will be described and clarified in the implementation section of the final report.

Describe Monitoring and Review Plan

A detailed description of the water quality monitoring plan to be implemented by the Regional Board for the Laguna will be included in the final report as well as monitoring planned by the City of Santa Rosa. The final report will clarify the way we will determine compliance with water quality objectives.

Comment Period

The Regional Board has received comments from most dischargers and interested groups. However, we extended the comment period to January 11, 1995 and attempted to contact all other significant interested groups (those that failed to comment by January 3, 1995) to answer questions and get further comments on the draft report.

General Comments

Adjustments will be made to the final report to provide consistent references, and a bibliography will be added.

To address the unfavorably high temperatures in the Laguna, riparian and stream channel restoration will be suggested in the implementation section of the draft final report. Riparian and stream channel restoration will also be addressed more extensively and made a part of the Laguna CRMP Watershed Management Plan. Although we believe high temperatures are a problem in the Laguna, pH is also of concern. A small change in pH can have a considerable effect on ammonia toxicity while this is not the case for temperature.

Specific Comments

- Page 2, paragraph 2 has been clarified according to your suggestion.
- Page 3, paragraph 3 will include a reference to the USEPA guidance manual.
- Page 4, paragraph 3 will be clarified and expanded to explain how the seasonal flow and loadings affect water quality in different ways.
- Page 6, paragraph below table 2 will be changed to recognize the allowable loads and reductions as interim goals of the strategy. We will also include a description of the water quality monitoring plan and how we will evaluate the success of the strategy.
- Page 9, bullet 3 will be changed to emphasize finding 4 regarding nutrient increase from upstream urban runoff tributaries.

- Page 10, bullet 1 will be clarified to explain that we suspect that the delayed release of nutrient loading from bottom sediments to the water column contributes to the condition of water quality in the Laguna during the summer. We investigated this case with some preliminary sediment testing during the summer of 1992, and a nutrient flux study by a local high school student in 1993 and 1994. The testing was documented in two reports: the Regional Board's 1992 205(j) Laguna Study, and the Piner High School report on file in our office. The results further confirmed our assumption that bottom sediments contribute to the water column nutrient loading during the summer. We will reference these reports in the TMDL report. Additionally, we plan to investigate this further during this summer as a part of our water quality monitoring plan.

- Page 10, bullet 4 will be expanded to describe in greater detail the Laguna models.

- Page 11, paragraph under the Laguna Water Quality title will be clarified regarding discharged wastewater from the City's subregional plant. The discharged wastewater meets Basin Plan criteria, both dissolved oxygen and toxicity objectives. The Basin Plan toxicity objective is a narrative objective and contained as a provision of the City's NPDES Permit. Additionally, we anticipate continued self-monitoring by the City for nitrogen.

  Page 11, ammonia paragraph will be clarified to describe why we are focusing on total nitrogen and two forms of ammonia.

- Page 12, paragraph 1 will be changed to better explain the correlation between high total nitrogen and high total and unionized ammonia.

  Page 12, last sentence will be changed as you suggested.

- Page 13, a discussion will be added to the final draft report to explain the higher exceedances in the middle reaches of the Laguna.

- Page 14, paragraph 1 will be expanded to describe the nature of the waste sources to help explain why a reduction of total nitrogen will lead to reductions in phosphorus and organic matter.

- Page 15, we agree the method used to determine the pollutant concentration in the water column is very conservative and assumes no decay of nitrogen compounds after their discharge into the Laguna. The Laguna models used by the City of Santa Rosa have the capability to varying degrees to evaluate nitrogen cycling, which we will evaluate between now and July 1996.

- Page 16, we agree with your suggestions and will include them in the report.

  We will change the word "reduced" to "less easily controllable nonpoint sources" for better definition of this term.

- Page 17, we will include a definition of the Emerson coefficient, pKa.

- Page 18, we will change the term WQO to "upper limit".

  Page 18, the period of May 1991-94 includes two years of dry and one year of wet winter seasons. This ratio is generally representative of the longer flow record, and is the best information we have regarding Laguna flows. This will be stated in the final report.

- Page 19, the "Extended Winter" represents an extended winter period from October to April to consider the Basin Plan allowed discharge period and all wet weather months. This period is used in scenario 4. An explanation of this will be included in the note under table 4.

  Page 19, the division of loads for the winter season and the other seasons is explained in detail on the next page. We will clarify this section better in the final report.

- Page 20, we agree that the revised estimated septic system loads may still be high. We plan to evaluate the septic system locations with respect to distances from the Laguna, and weight the estimated loading accordingly. We hope this will give us a better estimation of the septic system loading contribution to the Laguna. Our monitoring data for the summer of 1995 should also indicate the extent to which the septic system load estimate philosophy needs adjustment.

  Page 20, paragraph 3 will be changed to better explain the winter season division of the wastewater loading.

  Page 20, paragraph 4 will be expanded to better explain the method used for storm event loadings.

- Page 23, scenarios 7A-7D indicate different seasons. This scenario group will be changed to reflect the seasons (i.e. Wi = winter, Sp = spring, Su = summer, and Fa = fall).

- Page 24, last paragraph will be clarified.

- Pages 28-30 will be completed in the final draft report.

- Page 29, the implementation plan will be expanded to provide better explanation of responsibilities and guidance for the dischargers. We will include a summary table showing targeted reductions needed to achieve attainment, and anticipated reductions expected from current and future programs and projects. We will also summarize targeted mass limits for each source within four sub-watersheds during each season of the year.

We appreciate your assistance in this process, and your comments on the draft waste reduction strategy. We believe they will help to strengthen the final report. We are shooting for March 1, 1995 as the submittal date for the North Coast Regions' Laguna de Santa Rosa TMDL.

Sincerely,

Cecile N. Morris

Cecile N. Morris
Associate Water Resource Control Engineer

CNM:lmf/resepa

CNM

PETE WILSON, *Governor*

ATE OF CALIFORNIA - CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

A FORNIA REGIONAL WATER QUALITY CONTROL BOARD
O TH COAST REGION
50 SKYLANE BLVD. SUITE A
NTA ROSA, CA 95403
IO : (707) 576-2220

February 1, 1995

Dr. Lee Erickson
Goldridge RCD
P.O. Box 446
Valley Ford, CA 94972

Dear Dr. Erickson,

Subject: Response to Comments regarding the draft Waste Reduction Strategy for the Laguna de Santa Rosa

Thank you for commenting on the draft Waste Reduction Strategy for the Laguna de Santa Rosa. We found your comments very helpful and plan to incorporate them into the final report. We would like to take this opportunity to respond to your comments and let you know what changes and clarifications we will be making to the report.

- We have added two tables in Appendix D that show the cumulative proportional loads that are used in the selected scenario.
- The tables in Appendixes A, B and C have been modified to show that attainment was estimated to be met or not met as well as a separate row that shows the estimated manure pond reduction.
- We have developed tables that show the line-items calculations used in the tables contained in Appendixes A, B and C. These "line-item" tables will be included in each appendix. Additionally, we will clarify the calculations used in each table with a more step-by-step description.

We hope to develop more accurate load reduction estimates this summer with Laguna water quality monitoring and assessment of the waste reduction strategy. As developments and adjustments to the strategy occur, we will coordinate our efforts with yours regarding the Section 319(h) grant projects within the Laguna watershed.

Sincerely,

Cecile N. Morris

Cecile N. Morris
Associate Water Resource Control Engineer

CNM:lmf/resgold

CPM

:e of California

e: iorandum

Date : February 1, 1995

: I-Ming Cheng
Floodplain Management Branch
Department of Water Resources

Cecile N. Morris

Cecile N. Morris
Surveillance, Monitoring and Planning

om : **California Regional Water Quality Control Board**
North Coast Region
5550 Skylane Blvd. Suite A
Santa Rosa, CA 95403

u ct: Response to Comments regarding the draft Waste Reduction Strategy for the Laguna de Santa Rosa

Thank you for commenting on the draft Waste Reduction Strategy for the Laguna de Santa Rosa. We found your comments helpful and plan to incorporate the ideas into the final report. We would like to take this opportunity to respond to your comments and let you know what changes and clarifications we will be making to the report.

- The natural decay of ammonia-nitrogen was not analyzed in this strategy primarily due to the capabilities of the computer models used to estimate Laguna water quality responses. Because of this, the strategy load estimates tend to be conservative. We recognize the strategy contains many uncertainties, and hope to reduce these over the next year.

    - We are hoping to investigate in-stream loadings (sediment to water column) interactions this summer as a part of our Laguna water quality monitoring.

    - The septic system load estimate will be revised during the first phase (by July 1996) to a weighted average based on the distance between the system and the Laguna.

    - Evaluation of the effectiveness of the strategy will be based on water quality monitoring, and adjustments made as necessary.

- We agree with your comments regarding riparian and stream channel restoration. To address unfavorably high temperatures in the Laguna, riparian and stream restoration will be suggested in the implementation section of the final report. Riparian and stream restoration will also be addressed more extensively and made a part of the Laguna CRMP Watershed Management Plan.

- We agree with your comments regarding manure storage ponds. Generally, manure ponds and confined animal facilities are designed and managed to divert rainfall runoff around and away from ponds. This recommendation is included in a list of Best Management Practices (BMP) developed by the Animal Waste Committee. BMP for confined animal facilities, including re-routing rainfall runoff, will be recommended in the implementation section of the final report.

- Each scenario developed and included in the draft report met the water quality goals. However, the selected scenario met the selection criteria best. This will be clarified in the final report, and the differences and reasoning behind selecting the final scenario will be described better. Because the waste reduction strategy is a phased approach, other scenarios may develop and would be evaluated based on the selection criteria.

We appreciate your comments on the draft waste reduction strategy and believe they will help to strengthen and clarify the final report.

(resflood)

CNH

PETE WILSON, *Governor*

TATE OF CALIFORNIA - CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION
5550 SKYLANE BLVD. SUITE A
SANTA ROSA, CA 95403
PHONE: (707) 576-2220

February 2, 1995

John Rosenblum
Russian River Watershed Protection Committee
Post Office Box 501
Guerneville, CA 95446

Dear Dr. Rosenblum:

Subject: Response to December 13, 1994 comments on the *Draft Report, Waste Reduction Strategy for the Laguna de Santa Rosa*

Thank you for commenting on the *Draft Report, Waste Reduction Strategy for the Laguna de Santa Rosa* (draft report). We would like to take this opportunity to respond to your December 13, 1994 comments, inform you of the clarifications we will make to the final report, and where further input from you might be useful to these efforts.

Issue/Response

1. We recognize the importance of all forms of nitrogen, algal growth, and the uncertainty that remains with the suspected contribution of nutrient loading from sediments into the water column. That is one of the reasons for a phased TMDL approach and continued water quality monitoring and studies. In 1992, we sampled Laguna bottom sediments, and in 1993 we conducted some preliminary tests on Laguna bottom sediments and nutrient flux into the overlying water. You may recall that we discussed this issue at a meeting on August 4, 1994 with you and Brenda Adelman.

   Modelling performed during the City of Santa Rosa's Section 205(j) study also suggested benthic sources for nitrogen and oxygen demand. In order to achieve acceptable response of the model to observed conditions, the benthic source rates for ammonia and sediment oxygen demand at Occidental Road had to be increased. Those results suggest significant nitrogen and oxygen demand sources at Occidental Road, we suspect from the sediments based on knowledge of potential waste sources and the sampling performed in 1992.

   The preliminary testing results support our theory that sediments contribute to nutrient loading in some sections of the Laguna. To what extent remains uncertain. We will be doing further testing on bottom sediments and nutrient and oxygen demand flux this summer as a part of our water quality monitoring plan for the Laguna, and hope to determine to the best of our abilities the degree of contribution. We also will continue to include nitrate as a constituent in our routine sampling of the Laguna.

The existing dissolved oxygen, nutrient, and algal data for the Laguna will continue to be evaluated with respect to new information as it is collected as part of the phased approach. Our monitoring plan includes rotating the placement of continuous monitoring equipment amongst the four attainment points, bracketing the individual sample collections with hourly measurements for dissolved oxygen, temperature, pH, and specific conductance.

Any specific techniques or methods regarding sediment flux of nutrients and/or oxygen demand that you can recommend would be appreciated.

2. To partially address problems regarding dissolved oxygen, we looked at nutrients and algal growth. The three main nutrients required for algal growth are carbon, phosphorus, and nitrogen. Algal Growth Potential studies were conducted on Laguna water as part of the Laguna Monitoring Study (Roth and Smith, 1992, 1993, 1994). The results indicate that nitrogen is the limiting plant nutrient. Because of that and the 303(d) listing specific to unionized ammonia, the strategy focuses on total nitrogen and ammonia-nitrogen as total and unionized.

   Ms. Adelman of RRWPC was informed of our total nitrogen definition in direct response to her question at the October 27, 1994 Regional Water Board meeting and again at the Laguna CRMP Task Force meeting on December 14, 1994. Total nitrogen equals <u>all</u> forms of nitrogen (nitrate, nitrite, organic nitrogen and ammonia nitrogen). We will clarify the definition in the final report.

3. The draft report does contain measured data. Actual dissolved oxygen data are presented and discussed in Table 3, Figure 2, and page 14 of the draft report. We have looked at these data and information carefully, and do not believe the waste reduction strategy "ignores the questionable validity of existing data". Additionally, the reader is referred to the September 24, 1992 final report on the Regional Water Board's Section 205(j) *Investigation for Nonpoint Source Pollutants in the Laguna de Santa Rosa, Sonoma County* (NCRWQCB 1992) and the City of Santa Rosa's Section 205(j), June 1994 *Laguna de Santa Rosa Water Quality Objective Attainment Plan* (CH2M Hill 1994) for additional data and analysis. In our judgement, it was neither necessary, nor a good use of resources to duplicate those reports in the subject draft report.

   As was discussed at the March 25, 1993 Regional Water Board meeting, the January 26, 1994 Regional Water Board Monitoring Workshop, the subsequent meeting with RRWPC on March 22, 1994, and the last Russian River Monitoring Committee meeting on December 13, 1994, all previous studies on the Laguna have not been systematic for specific purposes. Primarily, this is due to the inability of systematic monitoring to adequately respond to non-systematic events, such as storm events and discharges (Gordon, et.al. 1993; McDonald, et. al. 1991; Steel & Torrie 1960; Weber 1973). Systematic monitoring tends to be biased in favor of non-discharge and non-storm event conditions which are not systematic. Water quality monitoring conducted through previous studies has been designed to achieve the purpose of the studies, and has provided good data representative of differing water quality conditions.

We have developed a water quality monitoring plan for the Laguna to determine the effectiveness of the waste reduction strategy. That plan is being reviewed by a statistics professor at University of California, Davis. The monitoring plan will incorporate a systematic design with a stratified proportional allocation (Gordon, et.al. 1993; McDonald, et. al. 1991; Steel & Torrie 1960; Weber 1973). This will provide water quality data for both storm event and non-storm event conditions on a 40:60 storm:non-storm ratio that is based on the 1992, 1993, and 1994 stream flows as measured at Trenton-Healdsburg Road.

As regards the validity of existing data, we have responded to RRWPC concerns on numerous occasions in private meetings and public meetings and have hosted a number of meetings of a Russian River Monitoring Committee. Though Ms. Adelman and Ann Maurice spent 10 hours or so, combined, in our office looking at a portion of the 20 years of Russian River basin data, no other representatives of the RRWPC have accepted our offers to review, analyze, and discuss the data collection designs and techniques with us. That invitation is still open to you and other RRWPC representatives.

The modelling critiques provided by Doug Green are in reference to the Russian River QUAL2E computer model. Though some of Mr. Green's comments apply as regards the benthic process limitations of QUAL2E, the bulk of his criticisms centered on the calibration and validation of the model specific to the mainstem Russian River. As such, they are not pertinent to the Laguna. Ms. Adelman also was informed of this at the City of Santa Rosa's public meeting on the Laguna Section 205(j) project on April 21, 1993, and at the December 14, 1994 Laguna CRMP Task Force Meeting.

The computer models used for investigating potential water quality responses of the Laguna to nutrient waste loading will be described in the final draft report as follows:

> "The two water quality modeling approaches that were used to evaluate the water quality responses of the Laguna and its tributaries to waste loading were:
>
> - The steady-state water quality model QUAL2E was used to simulate winter non-storm and summer conditions, when stream flow and waste discharges are relatively constant. QUAL2E does not explicitly simulate benthic processes, therefore both sediment oxygen demand and the benthic source rate of ammonia more closely function as boundary conditions relating to previously deposited organic material (CH2M Hill 1994). It is understood that the modelling is not fully responsive to all dynamics in the Laguna, one of the reasons to use a phased approach. However, modelling can provide insight into the dynamics and point to areas requiring further investigation."

As already mentioned, in order to achieve acceptable response of the model to observed summertime conditions, the benthic source rate for ammonia and sediment oxygen demand rate at Occidental Road had to be increased. Those results suggest significant nitrogen and oxygen demand sources at Occidental Road as suspected from the sediment sampling performed in 1992. Additionally, as suggested at meetings of the Russian River Modeling Workshop, inclusion of benthic processes in the City of Santa Rosa's QUAL2E Model was suggested. You are aware that the City of Santa Rosa's consultants are addressing that issue by developing a benthic component for the QUAL2E Model. If that effort is successful, we will investigate doing the same for models used on the Laguna.

The non-storm modelling pointed towards significant nitrogen increases from the City of Santa Rosa's Laguna Reclamation Plan, though response of algae was limited in the winter months ostensibly due to low insolation and water temperatures. A resulting suggestion was to move the discharge point during the spring months downstream to the confluence of the Laguna and Santa Rosa Creek, minimizing the nitrogen input to the system during periods of increasing aquatic plant growth.

> " - The steady-state assumption of QUAL2E was deemed inappropriate to evaluate the effects of pulse loading associated with storm events and the overbank storage along the Laguna. Therefore, hydrodynamics and water quality responses of the Laguna during a winter storm event were simulated using the computer programs RMA-2 and RMA-4. RMA-2 is a generalized free surface hydrodynamic model used to compute a continuous temporal and spatial description of fluid velocities and depth throughout a river or estuary system. RMA-4 is a generalized water quality model which computes a temporal and spatial description of conservative and non-conservative water quality parameters. RMA-4 uses the results from RMA-2 for its description of the flow (CH2M Hill 1994)."

The RMA modelling simulated a continuous discharge from the Laguna Reclamation Plant and dairy waste inputs entering the Laguna system during storm events. Pulses of nitrogen were simulated entering the system and moving downstream through the 72-hour modelling run.

We recognize the uncertainties of the waste load estimates and the need for more focused water quality data. In accordance with Clean Water Act Section 303(d) guidance, we have developed waste load reductions as interim targets with a margin of safety. The strategy is a phased process (iterative) that requires us to fine-tune the waste load estimates and other unknowns as more water quality data and information become available.

Though the RRWPC urged the U.S. EPA in letters dated June 10 and 17, 1993 to require a TMDL for the Laguna within one-year, it should be apparent that the uncertainties associated with such an action at this time necessitate a phased approach. The phased approach is also appealing from the standpoint of allowing action on an interim basis, addressing those problems that are evident while collecting further information on those that are not.

4. It has been our experience that dairy ponds over-top and heavily manured areas contribute to the Laguna. As a participant of the Animal Waste Committee (AWC), you are aware of the 9 Cleanup and Abatement Orders issued to dairies in the area by this office in 1994, as well as the five dairies recently referred to the AWC for significant manure discharge to the Laguna prior to the January storms.

   We agree that there is a need to balance manure and irrigation-water applications with crop uptake, sub-surface drainage, and salt accumulations in the soil. Several Section 319(h) grant projects are aimed at those issues (see page 28 of the implementation plan in the draft report). We met with Dr. Lee Erickson, representing the Goldridge Resource Conservation District on January 11, 1994 to discuss specific projects for their Section 319(h) grant. The final draft report will include more specifics regarding these projects.

5. We agree with and recognize the importance of mass limits with respect to dissolved oxygen. However, the data are not available to propose such limits. Additionally, it is not our understanding that "... the Clean Water Act also specifies that targets should be based on mass inputs rather than concentrations." In fact, USEPA, Region IX TMDL Listing and Development Guidance, November 1994 (copy enclosed) states that the Quantifiable Target can be:

   - a concentration-based objective, or
   - mass loading per unit of time, or
   - needed habitat or waterbody condition (e.g., pool-riffle ratio), or
   - the percent load reduction required.

   The target must be quantified (even if based on narrative criteria) and appropriate for the problem being addressed. The technical basis for the target must be explained.

   Therefore, we have chosen to base attainment on ammonia and dissolved oxygen concentrations applicable to any time of the year. To achieve these goals, the strategy waste reduction targets are based on mass limits for specific sub-watersheds and seasons.

Summary -

(a) We agree that the strategy can be improved with more direct measurements including dissolved oxygen. We plan to collect much of the needed information between now and July 1996. Again, we welcome any specific methods or techniques you may have regarding these studies.

(b) Specific measurement of nitrate in the wastewater discharge is a part of the City's routine water quality data collection. Because of this routine wastewater discharge monitoring, the estimated nitrogen loading to the Laguna due to wastewater is quite accurate.

The definition of total nitrogen equals all forms of nitrogen (nitrite, nitrate, ammonia, and organic as described in 2 above).

(c) The current and future Section 319(h) grant projects are aimed at addressing manure management, including projects to balance manure and irrigation-water.

We appreciate your comments and believe improvements will be made to the Laguna waste reduction strategy as a result of them.

Sincerely,

Cecile N. Morris

Cecile N. Morris
Associate Water Resource Control Engineer

CNM:lmf/resrrwpc

Enclosure

cc: Brenda Adelman

References Cited

NCRWQCB 1992. Final Report - Investigation for Nonpoint Source Pollutants in the Laguna de Santa Rosa, Sonoma County. North Coast Regional Water Quality Control Bd., September 24, 1992.

CH2M Hill and Merritt Smith Consulting 1994. Laguna de Santa Rosa Water Quality Objective Attainment Plan. June, 1994: 95 p.

Gordon, N.D., T.A. McMahon, and B.L. Finlayson 1993. Stream Hydrology - An Introduction for Ecologists. J. Wiley & Sons, NY: 526 p.

McDonald, L.H., A.W. Smart, and R.C. Wissmar. 1991. Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska. U.S.E.P.A., Region 10, Water Div. EPA/910/9-91-001: 166 p.

Roth, J.C. and D.W. Smith 1992. Final Report: 1990-1991 Laguna de Santa Rosa Water Quality Monitoring Program. January 1992.

Roth, J.C. and D.W. Smith 1993. Final Report: 1991-1992 Laguna de Santa Rosa Water Quality Monitoring Program. May 1993.

Roth, J.C. and D.W. Smith 1994. Final Report: 1992-1993 Laguna de Santa Rosa Water Quality Monitoring Program. May 1994.

Steel, R.G.D. and J.H. Torrie 1960. Principle and Procedures of Statistics. McGraw-Hill, NY: 481 p.

Weber, C.I. (ed.) 1973. Biological Field and Laboratory Methods for Measuring the Quality of Surface Waters and Effluents. U.S.E.P.A., Office of Res. and Dev. EPA-670/4-73-001.

CNM

PETE WILSON, Governor

ATE OF CALIFORNIA - CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

A FORNIA REGIONAL WATER QUALITY CONTROL BOARD
O TH COAST REGION
550 SKYLANE BLVD. SUITE A
ANTA ROSA, CA 95403
HO E: (707) 576-2220

February 2, 1995

Miles Farris, Director of Utilities

Rosalind Daniels, Director of Public Works

City of Santa Rosa
Utilities Department
69 Stony Circle
Santa Rosa, CA 95401

Subject: Response to Comments on the Draft Waste Reduction Strategy for the Laguna de Santa Rosa

Thank you for commenting on the draft Waste Reduction Strategy for the Laguna de Santa Rosa. We found your comments helpful, and plan to make changes to the final report as a result. We would like to take this opportunity to respond to your specific comments and let you know what changes and clarifications we will be making to the strategy report.

Ammonia and Total Nitrogen Load from Wastewater

We understand that the City is planning to upgrade its subregional wastewater treatment plant, and that during the interim period effluent may not be able to attain an ammonia nitrogen upper limit of 0.5 mg/L as contained in the waste reduction strategy. We recognize that effluent discharged through the ponds accomplishes more ammonia removal. It would be helpful to measure ammonia nitrogen at the discharge points into the Laguna. The ammonia upper limit of 0.5 mg/L contained in the strategy applies to a concentration goal to be attained throughout the Laguna de Santa Rosa at all times of the year.

We anticipate total nitrogen loads will be substantially reduced with development of the long-term project alternatives. Because the wastewater discharge is one of the primary sources contributing to nutrient loading into the Laguna, we need to be kept informed as to the City's upgrade project and expected performance. The Laguna waste reduction strategy is a phased process allowing adjustments and changes to occur as additional water quality data and information become available.

As an interim target, we will reduce the est. total nitrogen ~~mass loading~~ reduction from 97,000 pounds per year to 45,000 pounds per year, which would still meet the TMSL as estimated in the waste reduction strategy.

Ammonia-Nitrogen Limit

Please understand that when the waste reduction strategy report was drafted, ammonia effluent limits for the City's NPDES permit were being discussed and were anticipated at that time. This is no longer the case, and the final report will be changed accordingly.

There is no need to set specific ammonia effluent limits in the City's NPDES permit at this time because the permit will continue to contain narrative toxicity provisions, as required of all dischargers. Regardless of this waste reduction strategy, the Regional Board has the authority and obligation to revise the City's permit to include specific ammonia effluent limits if Laguna or Russian River beneficial uses might be affected by the discharge.

Septic System Management

We agree with your suggestion to include an estimate of septic system load reduction based on current programs provided by Sonoma County. We plan to have a summary table showing the estimated load reductions needed to attain the concentration goals and anticipated load reductions from current and future projects and programs. This table will show the areas and sources where additional efforts are needed.

We plan to revise the septic system load estimate and provide more accuracy by using a weighted average. The weighted average will be based on the distance between the septic system and the Laguna. We will work on the revised septic system load estimate between now and July 1996.

Additionally, we will include your suggestion of creating a septic system maintenance district in the implementation plan section of the final draft report.

Scope of Urban Runoff Management in the Watershed

We have contacted all the cities and towns within the Laguna watershed that contribute to urban runoff into the Laguna, and have developed a description of the current and future programs aimed at controlling pollution from runoff. Although these cities and towns are small with limited resources, they all make some kind of effort toward urban runoff pollution control. However, most of the urban runoff programs are limited in scope and oriented towards general storm drain and street maintenance. This information will be included in the final report.

The smaller cities and towns are not required to have a stormwater runoff program under the Clean Water Act. However, the general stormwater permits do apply to industrial sites and construction areas greater than five acres regardless of location. We plan to include in the implementation section of the report a proposal for all cities within the Laguna watershed to implement some kind of stormwater runoff program aimed at nutrient reduction.

Additionally, we will revise Figure 1 in the draft final report to include city boundaries.

Ammonia and Total Nitrogen Load from Urban Runoff

Based on our load and reduction estimates, mass limit and/or concentration goals will be exceeded throughout the Laguna during the summer. However, we recognize there is uncertainty in these estimates and hope to develop more accurate estimates during this summer season.

We agree with your comments regarding summer time urban runoff loads, and will adjust the summer time load reduction goal from 100% to more realistic 25%.

We appreciate your comments on the draft report and believe they will help to improve the waste reduction strategy.

Sincerely,

WD Winchester

for Cecile N. Morris
Associate Water Resource Control Engineer

CNM:lmf/ressr