City of Carlsbad
Public Works – Environmental Programs

July 22, 2008

Mr. Alan Monji
San Diego Regional Water Quality Control Board
9174 Sky Park Court, Suite 100
San Diego, CA 92123

Subject: Information to Support Reassessment and Delisting of Indicator Bacteria in Agua Hedionda Lagoon

Dear Mr. Monji:

The Agua Hedionda Lagoon (AHL) Dischargers (Dischargers) appreciate the opportunity to provide the following information to support the reassessment and delisting of the AHL for indicator bacteria during the 2008 listing cycle. Dischargers include Caltrans, the Cities of Carlsbad, Oceanside, San Marcos, Vista, and the County of San Diego.

Monitoring data presented in this document were collected according to Investigation Order No. R9-2006-076 issued by the San Diego Regional Water Quality Control Board (SDRWQCB). The available data were evaluated to determine whether the lagoon would qualify for delisting under the 2004 Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (Listing Policy). This letter provides a review of that dataset and the attached file includes the detailed analysis to support the delisting recommendation.

Data Used in the Analysis

Data for total coliform, fecal coliform, and enterococcus were collected from four lagoons within the Carlsbad Hydrologic Unit for City of Carlsbad, City of Encinitas, City of Escondido, City of Oceanside, City of San Marcos, City of Solana Beach, City of Vista, County of San Diego, California Department of Transportation, and the Hale Avenue Resource Recovery Facility. The data submitted with this analysis are specifically for the AHL over a collection period of January through October 2008. Table 1 lists the sites within AHL and the dates monitoring took place.

To prepare the data for comparison to water quality objectives in a manner consistent with the Listing Policy, a number of steps were required.

1. For each monitoring date, samples were collected at both high and low tide and tested for all three bacteriological indicators. Section 6.1.5.6 of the Listing Policy requires that samples collected from the same site on the same day be combined into a single value for comparison to the objectives. To account for multiple samples collected from one point in a single day, the geometric mean was calculated for each site per day.
2. Data from all six monitoring sites were considered in the analysis since they meet the criteria of being greater than 200 meters apart according to Section 6.1.5.2 of the Listing Policy to qualify as separate locations.

3. At Ocean Inlets 1 and 2, both surface and subsurface samples were collected. The depth range for the subsurface samples was 2.6 to 5.1 meters for Ocean Inlet 1 and 2.6 to 4.1 meters for Ocean Inlet 2. Bacteria water quality objectives for shellfish specify that the criteria are applicable throughout the water column; the bays and estuaries objective is limited to the upper 60 feet. Therefore, depth 1 and 2 samples were included in the daily geometric mean for these two sites when comparing the monitoring data to water quality objectives for shellfish harvesting and bays and estuaries. Only surface sample data was used for assessing compliance with recreation objectives (contact and non-contact) since that is the depth at which contact or exposure occurs.
4. Samples that were non-detect were set equal to the detection limit for the analysis (all detection limits were below all objectives).
5. Samples that were Detected but Not Quantified (DNQ) were set equal to the laboratory value provided for the analysis (all DNQ values were below all objectives).
6. Data were collected in accordance to the Carlsbad Hydrologic Unit SDRWQCB Investigative Order R9-2006-076 Lagoon TMDL Monitoring Quality Assurance Project Plan, revised September 30, 2007. This plan is SWAMP compatible.

Table 1. Agua Hedionda Lagoon Monitoring Sites and Frequency for 2008

Monitoring Site	January		February							April						July						October					
	5	24	4	7	8	11	12	13	19	7	8	9	14	15	16	21	22	23	28	29	30	7	8	9	13	14	15
Ocean Inlet 1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ocean Inlet 2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Segment 1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Transect 1				x								x							x				x				
Transect 2				x								x							x				x				
Transect 3				x								x							x				x				

Comparison of Data to Water Quality Criteria and Listing Policy

For each of the constituents, the sample results were compared to the appropriate water quality objective criteria as shown in the following table. The number of exceedances was then compared to the requirements for delisting presented in Section 4 of the Listing Policy. For bacteriological constituents, the maximum number of exceedances allowed for delisting is shown in Table 4.2 (page 15).

Table 2. Bacteria Water Quality Objectives for Bays, Estuaries, and Coastal Lagoons in the San Diego Region Basin Plan

Beneficial Use	Enterococcus (saltwater)		Fecal Coliform		Total Coliform	
Water Contact Recreation (REC-1)	35/100mL 30-day geometric mean	≤276/100mL single sample maximum (moderately or lightly used area)	Log mean (geometric mean) of at least 5 samples in a 30-day period ≤200/100mL	≤10% of total samples in any 30-day period ≤400/100mL		
Water Non-Contact Recreation (REC-2)			Average concentrations for any 30-day period ≤2,000/100mL	≤10% of samples collected in any 30-day period ≤4,000/100mL		
Shellfish Harvesting (SHELL)					Median concentration throughout the water column for any 30-day period ≤70/100mL	≤10% of samples collected during any 30-day period cannot exceed 230/100mL for a five-tube decimal dilution test
Bays and Estuaries					MPN in the upper 60 ft. ≤1,000/100mL; provided ≤20% of the samples at any sampling station in a 30-day period, may exceed 1,000/100mL; also no single sample may exceed 10,000/100mL	

Calculation Procedures

As shown in Table 2, the objectives for indicator bacteria include geometric means, medians, averages, single sample, and exceedance frequencies for single sample maximums. Each of these objectives requires a different analysis procedure for the data. The analysis procedures for each type of calculation are discussed in this section.

For all objectives except the Bays and Estuaries Total Coliform objective, all monitoring sites were considered together. The Bays and Estuaries objective specifically states that the objectives should be compared to the results from every sampling station.

Geometric Mean, Average and Median Objectives

Similar analysis procedures were used for analyzing the data to calculate geometric means, averages, and medians. These analysis procedures apply to the following objectives:

- Geometric Mean Objectives (REC-1 Enterococcus and Fecal Coliform)
- Average Objectives (REC-2 Fecal Coliform)
- Median Objectives (SHELL Total Coliform)

Geometric means were established in a rolling fashion for every possible 30-day period with a minimum of 5 samples over 2 separate days. Averages and medians were calculated in a rolling fashion for every possible 30-day period without regard to minimum number of samples during the period.

Other mechanisms for calculating the geometric mean, averages and medians are possible and were evaluated (such as calculating geometric means, averages, and medians for each monitoring location separately, or using distinct 30-day periods). However, few geometric means, averages and medians could be calculated using these other approaches and they generally resulted in fewer exceedances. As a result, the chosen method was considered to be the most conservative method of calculating geometric means, averages and medians for comparison to the water quality objectives.

Single Sample and Frequency of Exceedance Objectives

For single sample objectives (REC-1 Enterococcus, Bays and Estuaries Total Coliform) the analysis is straightforward. Each sample is compared to the water quality objective. However, for many of the objectives, a certain number of exceedances are allowed within any 30-day period. The following objectives fall into this category:

- 10% Exceedances (REC-1 and REC-2 Fecal Coliform, SHELL Total Coliform)
- 20% Exceedances (Bay and Estuaries Total Coliform)

For these analyses, the number of exceedances within defined 30-day periods was calculated for each objective. For all months, except February, the 30-day period was just the samples collected within that given month. In February the last sampling date was February 19th and therefore it was appropriate to include data from January 24th in that 30-day period. The result of the analysis was five 30-day periods for which the exceedance frequency could be determined. However, these exceedance periods are not easily compared to the Listing Policy requirements that also include an allowable exceedance frequency. Therefore, although this analysis was conducted, it was determined that for comparison to the Listing Policy, it would be more

conservative and simpler to compare each sample to the objective and consider the total number of exceedances in the context of the Listing Policy. In the results tables, the number of 30-day periods that exceeded the allowable number of exceedances in the criteria is noted.

Analysis Results

Table 3 summarizes the results of the comparison of samples to the water quality objectives in Table 2 and the Listing Policy.

Table 3. Evaluation of Bays and Estuaries Water Quality Objective

Constituent	Objective	# of Samples	# of Exceedances of Objectives[3]	Allowable # Exceedances in Listing Policy	Delist?
Enterococcus[2]	REC-1 Geomean	23	2	4	Yes[1]
	REC-1 Single Sample	93	4	15	Yes
Fecal Coliform[2]	REC-1 Geomean	23	2	4	Yes[1]
	REC-1 10% Exceedance[4]	93	3	15	Yes
	REC-2 Average	23	0	4	Yes[1]
	REC-2 10% Exceedance[5]	93	0	15	Yes
Total Coliform[6]	SHELL Median	23	3	4	Yes[1]
	SHELL 10% Exceedance[7]	93	9	15	Yes
	Bays and Estuaries 20% Exceedance[8]	93	4	15	Yes
	Bays and Estuaries Single Sample	93	0	15	Yes

1. The minimum number of samples for delisting under the Listing Policy is 26 and the number of calculated geomeans, averages, and medians is only 23. However, the allowable number of exceedances for 26 samples is not exceeded and combined with the other objective comparisons, the lines of evidence demonstrate that delisting is appropriate.
2. Only surface depth samples were used for comparison to this objective.
3. In all cases, all of the exceedances occurred during wet weather sampling events. No dry weather exceedances were observed.
4. One out of five 30-day periods exceeded the allowable exceedance frequency.
5. None of the evaluated 30-day periods exceeded the allowable exceedance frequency.
6. Both sampled depths were used for the analysis.
7. Two out of five 30-day periods exceeded the allowable exceedance frequency.
8. Two out of six sites had exceedances during one 30-day period.

As shown in Table 3, all objectives for all constituents meet the criteria for delisting. No exceedances of water quality objectives occurred in dry weather samples, exceedances occurred only during wet weather events. Due to sampling frequency, the sample size for the geometric mean, average and median objectives is slightly below the minimum sample size required for delisting, though the number of allowable exceedances for that sample size is met. As mentioned above, the only water quality objective exceedances in the dataset were samples collected during wet weather. Therefore, it is reasonable to assume that if the sample size were increased, based on the normal weather patterns of the San Diego Region, additional exceedances would not be added to the dataset. Furthermore, during the 2006 listing cycle, San Diego Bay Shoreline, Tidelands Park was delisted for indicator bacteria though only 17 geometric means could be calculated using the available dataset. It was noted that there were

sufficient single samples, in combination with the available geometric means, to recommend delisting.

Based on the analysis summarized in this letter comparing the available data collected under the Investigation Order to applicable water quality objectives and the allowable number of exceedances calculated from the 2004 Listing Policy, it is our recommendation that Agua Hedionda Lagoon be delisted for indicator bacteria.

The attachment to this letter includes the spreadsheet and data calculations used to determine the number of exceedances.

We appreciate your consideration of this information. If you have any questions, please feel free to contact me at 760-602-7582, or via email at elaine.lukey@carlsbadca.gov.

Sincerely,

Elaine M. Lukey MS, CPEA

Environmental Programs Manager