Redwood Shores Lagoon
February 2015
Monthly Water Quality Monitoring Report

Prepared for

Redwood City
Public Works Services Department
1400 Broadway
Redwood City, CA 94063-2594

Prepared by

Clean Lakes, Inc.
P. O. Box 3186
Martinez, CA 94553

March 2015

City of Redwood City staff Richard Chaffey performed the February monthly monitoring on February 11, 2015. General water quality measurements for dissolved oxygen, clarity (as turbidity), salinity, pH, and temperature were recorded at Sites R-1 thru R-5. Nutrients, nitrate as N, and dissolved ortho-phosphate as P were sampled at R-1 thru R-5 via laboratory analysis. Water samples were collected for Fecal Coliform analysis at Sites R-1 and R-2. During each sample visit observations are noted for floatables, oil/grease films and scum, water discoloration, algae and aquatic plant growth, and any presence of dead birds or fish. Water Quality Objectives for Redwood Shores Lagoon is provided below as well Dissolved Oxygen (DO) requirements in Non-Salmonid waters by which to compare field and laboratory results.

Table 1. Redwood Shores Lagoon Water Quality Objectives

Parameter	Criteria	
pH	6.5 – 8.5	
Dissolved oxygen	Minimum of 5.0 mg/L	
Chlorophyll-a	50.0 ug/l	
Fecal coliform bacteria	A median not to exceed 240 MPN/100 mL in 5 consecutive samples with no single sample exceeding 1,000 MPN/100 mL	
Color	No significant increase over that in sloughs	
Oil, grease, and visable films	None	
Floatables	None	
Aquatic growths	None sufficient to cause nuisance conditions	
Turbidity in Belmont, Steinberger and Bay sloughs that receive lagoon discharge	<u>Background Levels</u> 50 NTU 50-100 NTU 100 NTU	<u>Max. Incremental Increase</u> 5 NTU 10 MTU 10 % of background

II. NON-SALMONID WATERS	DO mg/l
A. Early life stages	
No production impairment	6.5
Slight production impairment	5.5
Moderate production impairment	5
Severe production impairment	4.5
Limit to avoid acute mortality	4
B. Other life stages	
No production impairment	6
Slight production impairment	5
Moderate production impairment	4
Severe production impairment	3.5
Limit to avoid acute mortality	3

RESULTS - Water quality results for each site is provided below in Table format for 2015 to allow comparison of results from month to month.

SITE R-1

				Fecal		Dissolved						
	Ortho		Fecal	Coliform	Water	Oxygen	DO		pH	pH		
	Phosphate	Nitrate as N	Coliform	MPN/100 mL	Temp	(DO)	mg/l		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	MPN/100 mL	Limit	C°	mg/l	Limit	pH	Limit	Limit	ppt	NTU
1.15	0.18	ND	>1,600	1,000	12.1	15.49	5	8.40	6.5	8.5	28.39	6.81
2.15	0.17	ND	7.8	1,000	16.8	15.01	5	8.70	6.5	8.5	22.20	5.94
3.15				1,000			5		6.5	8.5		
4.15				1,000			5		6.5	8.5		
5.15				1,000			5		6.5	8.5		
6.15				1,000			5		6.5	8.5		
7.15				1,000			5		6.5	8.5		
8.15				1,000			5		6.5	8.5		
9.15				1,000			5		6.5	8.5		
10.15				1,000			5		6.5	8.5		
11.15				1,000			5		6.5	8.5		
12.15				1,000			5		6.5	8.5		

SITE R-2

				Fecal		Dissolved						
	Ortho		Fecal	Coliform	Water	Oxygen	DO		pH	pH		
	Phosphate	Nitrate as N	Coliform	MPN/100 mL	Temp	(DO)	mg/l		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	MPN/100 mL	Limit	C°	mg/l	Limit	pH	Limit	Limit	ppt	NTU
1.15	0.16	ND	2	1,000	13.0	7.76	5	2.8	6.5	8.5	35.12	21.7
2.15	0.13	ND	7.8	1,000	15.8	3.51	5	8.4	6.5	8.5	30.25	14.3
3.15				1,000			5		6.5	8.5		
4.15				1,000			5		6.5	8.5		
5.15				1,000			5		6.5	8.5		
6.15				1,000			5		6.5	8.5		
7.15				1,000			5		6.5	8.5		
8.15				1,000			5		6.5	8.5		
9.15				1,000			5		6.5	8.5		
10.15				1,000			5		6.5	8.5		
11.15				1,000			5		6.5	8.5		
12.15				1,000			5		6.5	8.5		

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SITE R-3

	Ortho		Water	Oxygen	DO		pH	pH		
	Phosphate	Nitrate as N	Temp	(DO)	mg/l		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	C°	mg/l	Limit	pH	Limit	Limit	ppt	NTU
1.15	0.13	ND	12.30	6.38	5	8.70	6.5	8.5	33.39	49.20
2.15	0.15	ND	14.60	11.31	5	3.30	6.5	8.5	31.48	21.90
3.15					5		6.5	8.5		
4.15					5		6.5	8.5		
5.15					5		6.5	8.5		
6.15					5		6.5	8.5		
7.15					5		6.5	8.5		
8.15					5		6.5	8.5		
9.15					5		6.5	8.5		
10.15					5		6.5	8.5		
11.15					5		6.5	8.5		
12.15					5		6.5	8.5		

SITE R-4

				Dissolved						
	Ortho		Water	Oxygen	DO		pH	pH		
	Phosphate	Nitrate as N	Temp	(DO)	mg/l		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	C°	mg/l	Limit	pH	Limit	Limit	ppt	NTU
1.15	0.12	ND	12.60	8.41	5	1.20	6.5	8.5	37.44	17.10
2.15	0.12	ND	15.40	12.08	5	8.20	6.5	8.5	29.05	15.90
3.15					5		6.5	8.5		
4.15					5		6.5	8.5		
5.15					5		6.5	8.5		
6.15					5		6.5	8.5		
7.15					5		6.5	8.5		
8.15					5		6.5	8.5		
9.15					5		6.5	8.5		
10.15					5		6.5	8.5		
11.15					5		6.5	8.5		
12.15					5		6.5	8.5		

SITE R-5

				Dissolved						
	Ortho		Water	Oxygen	DO		pH	pH		
	Phosphate	Nitrate as N	Temp	(DO)	mg/l		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	C^o	mg/l	Limit	pH	Limit	Limit	ppt	NTU
1.15	ND	ND	12.00	8.06	5	3.90	6.5	8.5	36.83	6.16
2.15	0.11	ND	16.00	10.51	5	8.20	6.5	8.5	28.63	6.09
3.15					5		6.5	8.5		
4.15					5		6.5	8.5		
5.15					5		6.5	8.5		
6.15					5		6.5	8.5		
7.15					5		6.5	8.5		
8.15					5		6.5	8.5		
9.15					5		6.5	8.5		
10.15					5		6.5	8.5		
11.15					5		6.5	8.5		
12.15					5		6.5	8.5		

NUTRIENTS – Orthophosphate as P (ORP) was detected at all sites in a range between 0.11 and 0.17 mg/l. The lowest sites for ORP were at R-4 and R-5 while R-1 measured the highest site. ORP increased at R-3 and decreased or remained at the same levels at all other sites in comparison to January. Phosphorus can stimulate algae blooms, so the City and Waterworks (the maintenance contractor) should monitor conditions closely for potential algae blooms in the coming months as water and air temperatures increase. There were no detectable levels reported for Nitrate as N at any monitoring site.

Phosphorus and nitrogen are essential nutrients for the plants and animals that make up the aquatic food web. Since phosphorus is the nutrient in short supply in most fresh waters, even a modest increase in phosphorus can, under the right conditions, set off a whole chain of undesirable events in a stream including accelerated plant growth, algae blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals.

There are many sources of phosphorus, both natural and human. These include soil and rocks, wastewater treatment plants, runoff from fertilized lawns and cropland, failing septic systems, runoff from animal manure storage areas, disturbed land areas, drained wetlands, water treatment, and commercial cleaning preparations.

Inorganic nitrate as N should be less than 0.3 mg/L to avoid algal blooms. Excessive concentrations of nitrate in lakes and streams greater than about 5 milligrams per liter (measured as nitrogen), depending on the water body, can cause excessive growth of algae and other plants, leading to accelerated eutrophication or "aging" of lakes, and occasional loss of dissolved oxygen. Animals and humans cannot use inorganic forms of nitrogen.

Since phosphorus is often scarce in freshwater ecosystems, it is typically a limiting nutrient, meaning that it limits the amount of life the system can sustain. When humans add phosphate-rich sewage or agricultural runoff, algae growth may no longer be limited by the scarcity of phosphorus in its environment and may grow out of control. In order to control algae growth, the EPA recommends that phosphate levels not exceed 0.05 milligrams per liter for streams discharging into lakes or reservoirs, 0.1 milligrams per liter for lakes and reservoirs, and 0.1 milligrams per liter for other streams and rivers.

FECAL COLIFORM - The fecal coliform levels were at 7.8 MPN/100 mL, close to the detection limit of 1.8 MPN/100 ml, a significant decrease over January 2015 results. Single sample results over 1,000 MPN/mL are considered to exceed limits.

GENERAL WATER QUALITY ANALYSIS – The Dissolved Oxygen (DO) levels in February were below 5.0 mg/l at site R-2 while DO at all sites was above 5.0 mg/l DO was high at Site R-1. DO appears to have been at supersaturated levels at site R-1 which is usually associated with algae blooms or waters enriched through operation of pumps. Water temperature increased several degrees over January with temperatures ranging from 14.6 to 16.8 C. pH measurements were within limits at Site R-2, R-4, and R-5. Salinity measurements varied from approximately 22.2 ppt to a maximum of 31.48 ppt in January. Turbidity was within limits and varied between 5.94 and 21.9.

Field Results

Redwood Shores Lagoon
Monthly Water Quality Monitoring Field Data

Date: 2/11/15 Name(s) of Field Personnel: Richard Chaffey

Weather Conditions Air Temperature: 50'

Wind Conditions: Light / Moderate / High Percent Cloud: 25%

Field Measurements

Sampling Station	Time	Maximum Depth (ft)	Sample Depth (ft)	Water Temp°C	Dis. Oxy. Mg/l	pH units	Salinity ppt	Turbidity NTU
R-1	1217	3.0'	1.5'	16.8	15.01	8.7	22.20	5.94
R-2	1138	6.0'	3.0'	15.8	3.51	8.4	30.25	14.3
R-3	0820	3.0'	1.5'	14.6	11.31	3.3	31.48	21.9
R-4	0919	5.0'	2.5'	15.4	12.08	8.2	29.05	15.9
R-5	1015	4.0'	2.0'	16.0	10.51	8.2	28.63	6.09

Samples for the following test will be collected for laboratory analyses

- Nitrate-N
- Ortho-P04-P (preservative required, do not rinse bottle)
- Fecal Coliform Bacteria (R-1 and R-2 only)

Notes & Observations about floatables, oil & grease, films, scum water discoloration, algae, aquatic plant growth and presence of dead wildlife:

R-1- _____

R-2- _____

R-3- _____

R-4- _____

R-5- _____

Laboratory Results

Alpha Analytical Laboratories Inc.
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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

CHEMICAL EXAMINATION REPORT

Redwood City, City of - Redwood Shores
1400 Broadway Street
Redwood City, CA 94063
Attn: Brandon Gilmore

Report Date: 02/20/15 16:18
Project No: Monthly Monitoring
Project ID: Redwood Shores Lagoon

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
15B1001	02/11/2015 22:50	SEL_REDWOODRS	

Alpha Analytical Laboratories, Inc.

	METHOD	BATCH	PREPARED	ANALYZED	DILUTION	RESULT	PQL	NOTE
R-1 (15B1001-01)			**Sample Type: Water**			**Sampled: 02/11/15 12:17**		
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	SM4500-P E	AB51254	02/12/15 12:30	02/12/15 13:12	1	**0.17 mg/L**	**0.10**	
Anions by EPA Method 300.0								
Nitrate as N	EPA 300.0	AB51227	02/12/15 15:34	02/12/15 15:34	20	ND mg/L	4.0	R-01
Microbiological Parameters by APHA Standard Methods								
Fecal Coliforms	SM9221	AB51747	02/11/15 15:00	02/14/15 15:00	1	**7.8 MPN/100mL**	**1.8**	
R-2 (15B1001-02)			**Sample Type: Water**			**Sampled: 02/11/15 11:38**		
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	SM4500-P E	AB51254	02/12/15 12:30	02/12/15 13:12	1	**0.13 mg/L**	**0.10**	
Anions by EPA Method 300.0								
Nitrate as N	EPA 300.0	AB51227	02/12/15 16:19	02/12/15 16:19	20	ND mg/L	4.0	R-01
Microbiological Parameters by APHA Standard Methods								
Fecal Coliforms	SM9221	AB51747	02/11/15 15:00	02/14/15 15:00	1	**7.8 MPN/100mL**	**1.8**	
R-3 (15B1001-03)			**Sample Type: Water**			**Sampled: 02/11/15 08:20**		
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	SM4500-P E	AB51254	02/12/15 12:30	02/12/15 13:12	1	**0.15 mg/L**	**0.10**	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

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CHEMICAL EXAMINATION REPORT

Redwood City, City of - Redwood Shores
1400 Broadway Street
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Attn: Brandon Gilmore

Report Date: 02/20/15 16:18
Project No: Monthly Monitoring
Project ID: Redwood Shores Lagoon

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
15B1001	02/11/2015 22:50	SEL_REDWOODRS	

Alpha Analytical Laboratories, Inc.

	METHOD	BATCH	PREPARED	ANALYZED	DILUTION	RESULT	PQL	NOTE
R-3 (15B1001-03)			**Sample Type: Water**			**Sampled: 02/11/15 08:20**		
Anions by EPA Method 300.0								
Nitrate as N	EPA 300.0	AB51227	02/12/15 16:39	02/12/15 16:39	20	ND mg/L	4.0	
R-4 (15B1001-04)			**Sample Type: Water**			**Sampled: 02/11/15 09:19**		
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	SM4500-P E	AB51254	02/12/15 12:30	02/12/15 13:12	1	**0.12 mg/L**	**0.10**	
Anions by EPA Method 300.0								
Nitrate as N	EPA 300.0	AB51227	02/12/15 16:56	02/12/15 16:56	20	ND mg/L	4.0	R-01
R-5 (15B1001-05)			**Sample Type: Water**			**Sampled: 02/11/15 10:15**		
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	SM4500-P E	AB51254	02/12/15 12:30	02/12/15 13:12	1	**0.11 mg/L**	**0.10**	
Anions by EPA Method 300.0								
Nitrate as N	EPA 300.0	AB51227	02/12/15 17:11	02/12/15 17:11	20	ND mg/L	4.0	R-01

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END OF REPORT