

**Redwood Shores Lagoon
July 2018
Monthly Water Quality Monitoring Report**



Prepared for

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

Prepared by

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August 2018

City of Redwood City staff member Cory Cattaneo performed the July monthly monitoring on July 18, 2018. Weather conditions were sunny, the air temperature was 75 F, and light winds were recorded.

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> <u>Max. Incremental Increase</u>
	50 NTU 5 NTU
	50-100 NTU 10 MTU
	100 NTU 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

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RESULTS - Water quality results for each site is provided below in Table format for 2018 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
1.18	0.17	ND	17	1,000	13	6.23	5	8.4	6.5	8.5	22.34	9.56
2.18	0.12	ND	4.5	1,000	16.7	7.11	5	8	6.5	8.5	18.67	9.24
3.18	0.15	ND	22	1,000	19	6.75	5	7.7	6.5	8.5	19.35	2.35
4.18	0.12	ND	ND	1,000	20.7	8.7	5	7.9	6.5	8.5	9.11	2.83
5.18	0.14	ND	13	1,000	18.9	6.15	5	7.7	6.5	8.5	30.11	2.32
6.18	0.19	ND	ND	1,000	20.7	6.14	5	7.7	6.5	8.5	30.85	3.31
7.18	0.53	ND	ND	1,000	26.6	2.94	5	7.7	6.5	8.5	25.46	3.41
8.18				1,000			5		6.5	8.5		
9.18				1,000			5		6.5	8.5		
10.18				1,000			5		6.5	8.5		
11.18				1,000			5		6.5	8.5		
12.18				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
1.18	0.16	ND	33	1,000	12.7	6.59	5	7.6	6.5	8.5	26.67	15.1
2.18	0.12	ND	2	1,000	17.6	5.38	5	7.5	6.5	8.5	22.54	5.66
3.18	0.15	ND	14	1,000	19.7	4.11	5	8	6.5	8.5	22.71	5.14
4.18	0.28	ND	350	1,000	22.7	5.2	5	8	6.5	8.5	8.46	23.2
5.18	0.14	ND	8.3	1,000	21.1	3.81	5	8	6.5	8.5	32.71	21.4
6.18	0.19	ND	4.5	1,000	21	3.97	5	8	6.5	8.5	32.33	4.27
7.18	0.55	ND	11	1,000	27.3	3.76	5	7.4	6.5	8.5	23.23	5.93
8.18				1,000			5		6.5	8.5		
9.18				1,000			5		6.5	8.5		
10.18				1,000			5		6.5	8.5		
11.18				1,000			5		6.5	8.5		
12.18				1,000			5		6.5	8.5		

SITE R-3

				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
1.18	0.16	ND	16.4	7.81	5	8	6.5	8.5	32.54	48.3
2.18	0.12	ND	17.2	5.87	5	7.8	6.5	8.5	26.84	6.54
3.18	0.16	ND	18.7	5.75	5	7.9	6.5	8.5	21.43	22
4.18	0.32	ND	23.3	7.42	5	7.6	6.5	8.5	8.73	18
5.18	0.14	ND	19.2	5.19	5	7.8	6.5	8.5	32.01	33.3
6.18	0.19	ND	18.9	4.22	5	7.7	6.5	8.5	31.15	6.24
7.18	0.25	ND	27.1	6.73	5	7.6	6.5	8.5	26.47	29.7
8.18					5		6.5	8.5		
9.18					5		6.5	8.5		
10.18					5		6.5	8.5		
11.18					5		6.5	8.5		
12.18					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
1.18	0.16	ND	17.8	9.65	5	7.7	6.5	8.5	29.25	13.8
2.18	0.12	ND	18.4	7.96	5	8.2	6.5	8.5	31.27	9.88
3.18	0.16	ND	18.9	4.81	5	7.9	6.5	8.5	19.11	6.72
4.18	0.29	ND	22.6	6.23	5	7.9	6.5	8.5	8.67	15.7
5.18	0.14	ND	18.4	5.71	5	7.7	6.5	8.5	33.1	17.4
6.18	0.19	ND	19.5	3.41	5	7.9	6.5	8.5	30.28	9.22
7.18	0.63	ND	26.5	3.78	5	7.4	6.5	8.5	26.72	15.71
8.18					5		6.5	8.5		
9.18					5		6.5	8.5		
10.18					5		6.5	8.5		
11.18					5		6.5	8.5		
12.18					5		6.5	8.5		

				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°	mg/l	Limit	PH	Limit	Limit	ppt	NTU
1.18	0.16	ND	15.9	8.54	5	7.2	6.5	8.5	30.56	5.84
2.18	0.12	ND	17.1	6.54	5	7.8	6.5	8.5	31.66	22.7
3.18	0.16	ND	19.9	4.22	5	7.9	6.5	8.5	20.55	5.45
4.18	0.24	ND	20.6	5.93	5	8.1	6.5	8.5	9.09	23
5.18	0.14	ND	19.8	5.06	5	7.7	6.5	8.5	30.2	10.4
6.18	0.19	ND	19.1	5.01	5	8	6.5	8.5	31.62	6.47
7.18	0.34	ND	23.7	3.27	5	7.2	6.5	8.5	28.19	13.73
8.18					5		6.5	8.5		
9.18					5		6.5	8.5		
10.18					5		6.5	8.5		
11.18					5		6.5	8.5		
12.18					5		6.5	8.5		

NUTRIENTS – Orthophosphate as P (ORP) was detected at every site in a range between 0.25 and 0.63 mg/l. The lowest site for ORP was at R-3 measuring 0.25 mg/l, while R-4 measured 0.63 mg/l. ORP concentrations increased at every site, in comparison to June. Nitrate as N was below the detection limit at all sites in July.

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 measured as Non-Detect for site R-1 and 11 MPN/100mL for site R-2, respectively. Coliform levels decreased or stayed the same in both sites, in comparison to June. Fecal coliform did not exceed the established limits. Single sample results over 1,000 MPN/100mL are considered to exceed limits.

GENERAL WATER QUALITY ANALYSIS – The Dissolved Oxygen (DO) levels in July exceeded the 5.0 mg/l threshold in site R-3. DO was highest at Site R-3 (6.73 mg/l) and lowest at Site R-1 (2.94 mg/l). The water temperature increased at every site in July, with temperatures ranging from 23.7 to 27.3 C. PH measurements were within the limit at every site, ranging from 7.2 to 7.7. Salinity measurements varied from approximately 23.23 ppt. to a maximum of 28.19 ppt. Turbidity was within limits and varied between 3.41 and 29.70 NTU. It was noted in the field data sheet that algae and aquatic plant life were present during the time of sampling in R-1 and R-2.

Field Results

Redwood Shores Lagoon
Monthly Water Quality Monitoring Field Data

Date: 7/18/18 Name(s) of Field Personnel: CORY CATTANED

Weather Conditions _____ Air Temperature: 75°

Wind Conditions Light / Moderate / High Percent Cloud: 0%

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	12:19	5'	2.5'	26.6	2.94	7.7	25.46	3.41
R-2	12:03	5'	2.5'	27.3	3.76	7.4	23.23	5.93
R-3	10:37	3'	1.5'	27.1	6.73	7.6	26.47	29.70
R-4	10:08	6'	3'	26.5	3.78	7.4	26.72	15.71
R-5	9:40	6'	3'	23.7	3.27	7.2	28.19	13.73

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- ALGAE, AQUATIC PLANT LIFE PRESENT AT SAMPLE SITE

R-2- ALGAE, AQUATIC PLANT LIFE PRESENT AT SAMPLE SITE

R-3- _____

R-4- _____

R-5- _____

Laboratory Results



Alpha

Alpha Analytical Laboratories Inc.

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Redwood City, City of - Redwood Shores
1400 Broadway Street
Redwood City, CA 94063

Project Manager: Adrian Lee
Project: Redwood Shores Lagoon
Project Number: Monthly Monitoring

Reported:
08/10/18 11:07

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
R-1 (18G-1896-01)								
Conventional Chemistry Parameters by APHA/EPA Methods:								
Orthophosphate as P	0.53 mg/L	0.20	2	AG83929	07/19/18 12:30	07/19/18 14:44	SM4500-PE	
Anions by EPA Method 300.0								
Nitrate as N	ND mg/L	5.0	25	AG83853	07/20/18 01:45	07/20/18 01:45	EPA 300.0	R-01
Microbiological Parameters by APHA Standard Methods:								
Fecal Coliforms	ND MPN/100mL	1.8	1	AG84058	07/18/18 18:00	07/21/18 16:26	SM9221	
R-2 (18G-1896-02)								
Conventional Chemistry Parameters by APHA/EPA Methods:								
Orthophosphate as P	0.55 mg/L	0.20	2	AG83929	07/19/18 12:30	07/19/18 14:44	SM4500-PE	
Anions by EPA Method 300.0								
Nitrate as N	ND mg/L	5.0	25	AG83853	07/20/18 02:02	07/20/18 02:02	EPA 300.0	R-01
Microbiological Parameters by APHA Standard Methods:								
Fecal Coliforms	11 MPN/100mL	1.8	1	AG84058	07/18/18 18:00	07/21/18 16:26	SM9221	
R-3 (18G-1896-03)								
Conventional Chemistry Parameters by APHA/EPA Methods:								
Orthophosphate as P	0.25 mg/L	0.10	1	AG83929	07/19/18 12:30	07/19/18 14:44	SM4500-PE	

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.

CLEAN LAKES INC.



alpha

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Redwood City, City of - Redwood Shores 1400 Broadway Street Redwood City, CA 94083	Project Manager: Adrian Lee Project: Redwood Shores Lagoon Project Number: Monthly Monitoring	Reported: 08/10/18 11:07
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	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
R-3 (18G1896-03)		Sample Type: Water			Sampled: 07/18/18 10:37			
Anions: by EPA Method 300.0								
Nitrate as N	ND mg/L	5.0	25	AG83853	07/20/18 02:18	07/20/18 02:18	EPA300.0	R-01
R-4 (18G1896-04)		Sample Type: Water			Sampled: 07/18/18 10:08			
Conventional Chemistry Parameters: by APHA/EPA Methods:								
Orthophosphate as P	0.63 mg/L	0.20	2	AG83929	07/19/18 12:30	07/19/18 14:44	SM4500-PE	
Anions: by EPA Method 300.0								
Nitrate as N	ND mg/L	5.0	25	AG83853	07/20/18 02:34	07/20/18 02:34	EPA300.0	R-01
R-5 (18G1896-05)		Sample Type: Water			Sampled: 07/18/18 09:40			
Conventional Chemistry Parameters: by APHA/EPA Methods:								
Orthophosphate as P	0.34 mg/L	0.10	1	AG83929	07/19/18 12:30	07/19/18 14:44	SM4500-PE	
Anions: by EPA Method 300.0								
Nitrate as N	ND mg/L	5.0	25	AG83853	07/20/18 03:40	07/20/18 03:40	EPA300.0	R-01

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END OF REPORT