

**Redwood Shores Lagoon
March 2016
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**

April 2016

RESULTS - Water quality results for each site is provided below in Table format for 2016 to allow comparison of results from month to month.

SITE R-1

	Ortho		Fecal		Dissolved								
	Phosphate	Nitrate as N	Coliform	MPN/100 ml	Water	Oxygen	DO		PH	PH			
Months	mg/l	mg/l	MPN/100 ml	Limit	Temp	(DO)	mg/l	Limit	PH	Limit	Limit	Salinity	Turbidity
1.16	0.11	ND	7.8	1,000	13.3	11.87	5	8.2	6.5	8.5	28.17	2.93	
2.16	0.17	ND	2	1,000	16.1	8.06	5	8.2	6.5	8.5	34.56	9.02	
3.16	0.12	ND	17	1,000	16.8	5.37	5	8.1	6.5	8.5	35.33	5.97	
4.16				1,000			5		6.5	8.5			
5.16				1,000			5		6.5	8.5			
6.16				1,000			5		6.5	8.5			
7.16				1,000			5		6.5	8.5			
8.16				1,000			5		6.5	8.5			
9.16				1,000			5		6.5	8.5			
10.16				1,000			5		6.5	8.5			
11.16				1,000			5		6.5	8.5			
12.16				1,000			5		6.5	8.5			

SITE R-2

	Ortho		Fecal		Dissolved								
	Phosphate	Nitrate as N	Coliform	MPN/100 ml	Water	Oxygen	DO		PH	PH			
Months	mg/l	mg/l	MPN/100 ml	Limit	Temp	(DO)	mg/l	Limit	PH	Limit	Limit	Salinity	Turbidity
1.16	ND	ND	11	1,000	14	10.43	5	1	6.5	8.5	35.41	12.7	
2.16	0.2	ND	7.8	1,000	15.4	4.25	5	7.6	6.5	8.5	38.66	16	
3.16	0.24	ND	4.5	1,000	15.8	4.58	5	7.8	6.5	8.5	39.78	24	
4.16				1,000			5		6.5	8.5			
5.16				1,000			5		6.5	8.5			
6.16				1,000			5		6.5	8.5			
7.16				1,000			5		6.5	8.5			
8.16				1,000			5		6.5	8.5			
9.16				1,000			5		6.5	8.5			
10.16				1,000			5		6.5	8.5			
11.16				1,000			5		6.5	8.5			
12.16				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
1.16	0.19	ND	11.9	9.51	5	5.3	6.5	8.5	35.79	26
2.16	0.15	ND	13.7	8.76	5	8	6.5	8.5	34.56	23.7
3.16	0.17	ND	13.5	7.71	5	8.2	6.5	8.5	38.33	44.6
4.16					5		6.5	8.5		
5.16					5		6.5	8.5		
6.16					5		6.5	8.5		
7.16					5		6.5	8.5		
8.16					5		6.5	8.5		
9.16					5		6.5	8.5		
10.16					5		6.5	8.5		
11.16					5		6.5	8.5		
12.16					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
1.16	ND	ND	13.8	4.61	5	6.1	6.5	8.5	35.98	10.1
2.16	0.19	ND	15.5	4.01	5	7	6.5	8.5	42.08	7.64
3.16	0.25	ND	16.4	3.35	5	7.7	6.5	8.5	36.32	25.9
4.16					5		6.5	8.5		
5.16					5		6.5	8.5		
6.16					5		6.5	8.5		
7.16					5		6.5	8.5		
8.16					5		6.5	8.5		
9.16					5		6.5	8.5		
10.16					5		6.5	8.5		
11.16					5		6.5	8.5		
12.16					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
1.16	ND	ND	13.5	11.4	5	2.4	6.5	8.5	34.67	11.6
2.16	0.17	ND	15	5.8	5	7.8	6.5	8.5	42.63	12.7
3.16	0.19	ND	15.9	5.36	5	7.9	6.5	8.5	40.19	28.3
4.16					5		6.5	8.5		
5.16					5		6.5	8.5		
6.16					5		6.5	8.5		
7.16					5		6.5	8.5		
8.16					5		6.5	8.5		
9.16					5		6.5	8.5		
10.16					5		6.5	8.5		
11.16					5		6.5	8.5		
12.16					5		6.5	8.5		

NUTRIENTS – Orthophosphate as P (ORP) was detected in all of the sites in a range between 0.12 and 0.25 mg/l. The lowest site for ORP was at R-1 measuring 0.12 mg/l while R-4 measured 0.25 mg/l. ORP concentration increased at every site, except for R-1, in comparison to February. Nitrate as N was not detected at any site in March.

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

CLEAN LAKES INC.

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 at 17 MPN/100 mL and 4.5 MPN/100mL for R-1 and R-2, respectively. Coliform levels increased in R-1 and decreased in R-2 in comparison to February 2016. Fecal coliform did not exceed established limits. Single sample results over 1,000 MPN/mL are considered to exceed limits.

GENERAL WATER QUALITY ANALYSIS – The Dissolved Oxygen (DO) levels in March exceeded the 5.0 mg/l threshold for every site except R-2 and R-4. DO was highest at Site R-3 (7.71 mg/l) and lowest at Site R-4 (3.35 mg/l). Water temperature increased at every site except for R-3 over March, with temperatures ranging from 13.5 to 16.8 C. PH measurements were within the limit at every site, ranging from 7.7 to 8.2. Salinity measurements varied from approximately 35.33 ppt. to a maximum of 40.19 ppt. Turbidity was within limits and varied between 5.97 and 44.6 NTU. It was noted in the field data sheet that the pumps were not running in R-4, but they were running in R-5 during the time of sampling.

Field Results

Redwood Shores Lagoon
Monthly Water Quality Monitoring Field Data

Date: <u>3/23/16</u>	Name(s) of Field Personnel: <u>Richard Chaffey</u>
Weather Conditions	Air Temperature: <u>50'</u>
Wind Conditions: <u>Light</u> / Moderate / High	Percent Cloud: <u>50 %</u>
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	1149	5.0'	2.5'	16.8	5.37	8.1	35.33	5.97
R-2	1108	6.0'	3.0'	15.8	4.58	7.8	39.78	24.0
R-3	1011	2.0'	1.0'	13.5	7.71	8.2	38.33	44.6
R-4	0814	6.0'	3.0'	16.4	3.35	7.7	36.32	25.9
R-5	0917	6.0'	3.0'	15.9	5.36	7.9	40.19	28.3

<p>Samples for the following test will be collected for laboratory analyses</p> <ul style="list-style-type: none"> • Nitrate-N • Ortho-P04-P (preservative required, do not rinse bottle) • Fecal Coliform Bacteria (R-1 and R-2 only)
<p>Notes & Observations about floatables, oil & grease, films, scum water discoloration, algae, aquatic plant growth and presence of dead wildlife:</p> <p>R-1- _____ _____</p> <p>R-2- _____ _____</p> <p>R-3- _____ _____</p> <p>R-4- <u>Pumps not running at time of sample.</u> _____</p> <p>R-5- <u>Pumps running at time of sample.</u> _____</p>

Laboratory Results



Alpha Analytical Laboratories Inc.

e-mail: clientservices@alpha-labs.com

Corporate: 208 Mason St., Ukiah, CA 95482 • Phone: (707) 468-0401 • Fax: (707) 468-5267

Bay Area: 6398 Dougherty Rd., Suite 35, Dublin, CA 94568 • Phone: (925) 828-6226 • Fax: (925) 828-6309

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

Redwood City, City of - Redwood Shores 1400 Broadway Street Redwood City, CA 94083	Project Manager: Brandon Gilmore Project: Redwood Shores Lagoon Project Number: Monthly Monitoring	Reported: 04/05/16 09:32
------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------	-----------------------------

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
R-1 (16C2398-01)		Sample Type: Water			Sampled: 03/23/16 11:49			
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	0.12 mg/L	0.10	1	AC63990	03/24/16 09:30	03/24/16 12:42	SM4500-PE	
Anions by EPA Method 300.0								
Nitrate as N	ND mg/L	4.0	20	AC64032	03/25/16 04:33	03/25/16 04:33	EPA 300.0	R-01
Microbiological Parameters by APHA Standard Methods								
Fecal Coliforms	17 MPN/100mL	1.8	1	AC64129	03/23/16 17:00	03/26/16 17:00	SM9221	
R-2 (16C2398-02)		Sample Type: Water			Sampled: 03/23/16 11:08			
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	0.24 mg/L	0.10	1	AC63990	03/24/16 09:30	03/24/16 12:42	SM4500-PE	
Anions by EPA Method 300.0								
Nitrate as N	ND mg/L	4.0	20	AC64032	03/25/16 04:49	03/25/16 04:49	EPA 300.0	R-01
Microbiological Parameters by APHA Standard Methods								
Fecal Coliforms	4.5 MPN/100mL	1.8	1	AC64129	03/23/16 17:00	03/26/16 17:00	SM9221	
R-3 (16C2398-03)		Sample Type: Water			Sampled: 03/23/16 10:11			
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	0.17 mg/L	0.10	1	AC63990	03/24/16 09:30	03/24/16 12:42	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

Alpha Analytical Laboratories Inc.

e-mail: clientservices@alpha-labs.com

Corporate: 208 Mason St., Ukiah, CA 95482 • Phone: (707) 468-0401 • Fax: (707) 468-5267

Bay Area: 6398 Dougherty Rd., Suite 35, Dublin, CA 94568 • Phone: (925) 828-6226 • Fax: (925) 828-6309

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

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

Project Manager: Brandon Gilmore
Project: Redwood Shores Lagoon
Project Number: Monthly Monitoring

Reported:
04/05/16 09:32

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
R-3 (16C2398-03)		Sample Type: Water		Sampled: 03/23/16 10:11				
Anions by EPA Method 300.0								
Nitrate as N	ND mg/L	4.0	20	AC64032	03/25/16 05:38	03/25/16 05:38	EPA 300.0	R-01
R-4 (16C2398-04)		Sample Type: Water		Sampled: 03/23/16 08:14				
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	0.25 mg/L	0.10	1	AC63990	03/24/16 09:30	03/24/16 12:42	SM4500-P E	
Anions by EPA Method 300.0								
Nitrate as N	ND mg/L	4.0	20	AC64032	03/25/16 05:54	03/25/16 05:54	EPA 300.0	R-01
R-5 (16C2398-05)		Sample Type: Water		Sampled: 03/23/16 09:17				
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	0.19 mg/L	0.10	1	AC63990	03/24/16 09:30	03/24/16 12:42	SM4500-P E	
Anions by EPA Method 300.0								
Nitrate as N	ND mg/L	4.0	20	AC64032	03/25/16 06:10	03/25/16 06:10	EPA 300.0	R-01

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.

Page 3 of 6

END OF REPORT