

## TECHNICAL MEMORANDUM

Results of Cyanobacteria and Microcystin Monitoring in the Vicinity of the Klamath Hydroelectric Project

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## Introduction

This technical memorandum summarizes the results for the 2016 public health monitoring for cyanobacteria species and an associated toxin, microcystin, within PacifiCorp's Klamath Hydroelectric Project (Project) from Upper Klamath Lake to the Klamath River below Iron Gate Dam. Microcystin results from 2016 baseline monitoring are also included in the results summaries below. This monitoring is particularly focused on *Microcystis aeruginosa* (MSAE), which is known to produce microcystin. This monitoring also assesses the presence of other potentially-toxigenic cyanobacteria, including *Dolichospermum* sp., and others. Monitoring is being conducted pursuant to Interim Measure 15, Water Quality Monitoring Activities, contained in the Klamath Hydroelectric Settlement Agreement (KHSA) executed between the United States Department of Interior, the states of California and Oregon, PacifiCorp, and other parties.

Results from the baseline and public health sampling are used in coordination with the appropriate public health authority to determine if public health advisories are warranted<sup>1,2</sup>. In addition to PacifiCorp's website ([www.pacificorp.com/es/hydro/hl/kr.html#](http://www.pacificorp.com/es/hydro/hl/kr.html#)), these memos are also posted on the Klamath Basin Monitoring Program's (KBMP) website ([www.kbmp.net](http://www.kbmp.net)) and inform the Blue Green Algae tracker on the KBMP website.

The data in Appendix 1 and Appendix 2 summarize results from all of the 2016 public health sampling events to date and microcystin results from the 2016 baseline sampling events.

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<sup>1</sup> The California State Water Resources Control Board (SWRCB) provides guidelines for posting advisories in recreation water (California SWRCB 2016) for Project waters in California. SWRCB recommends posting advisories in recreation waters at three levels based on laboratory testing for microcystin. The posting levels are Caution, Warning, and Danger at microcystin concentrations of 0.8, 6, and 20 µg/L respectively. Toxin producing cells at concentrations of over 4,000 cells/ml or blooms, scums, or mats would result in posting at the Caution level.

<sup>2</sup> Postings of Project waters in Oregon are coordinated with the Oregon Health Authority (OHA; 2016). The health advisory guideline in Oregon waters is microcystin concentrations of 10 µg/L or more, over 100,000 cells/mL of all toxigenic species combined, or over 40,000 cells/mL of *Microcystis* spp. or *Planktothrix* spp.

## Methods

PacifiCorp and the Oregon Department of Environmental Quality (ODEQ) are conducting public health sampling at ten sites (Table 1). Samples are collected and sent for laboratory analysis of potentially toxigenic cyanobacteria, notably MSAE and microcystin, from sites at:

- Three shoreline sites in Upper Klamath Lake, Oregon
- One shoreline site in Keno Reservoir, Oregon
- One shoreline site in J.C. Boyle Reservoir, Oregon
- Four shoreline sites in coves in Copco and Iron Gate reservoirs (i.e., two cove sites in each reservoir), California
- One Klamath River site below Iron Gate Dam near the hatchery bridge, California

<b>Table 1. Sites of cyanobacteria and microcystin public health monitoring in Upper Klamath Lake, Keno Reservoir, J.C Boyle Reservoir, Copco Reservoir, Iron Gate Reservoir, and the Klamath River during 2016.</b>			
Location	Approximate River Mile	Sampling Entity	Site ID
Upper Klamath Lake at Eagle Ridge County Park	N/A	ODEQ	UKEP
Upper Klamath Lake at Howard's Bay Park	N/A	ODEQ	UKHP
Upper Klamath Lake at Moore Park	N/A	ODEQ	UKMP
Keno Reservoir at Keno Park	234.0	ODEQ	KEKP
J.C. Boyle Reservoir at Topsy Campground	225.0	ODEQ	BRTC
Copco Reservoir at Mallard Cove	201.5	PacifiCorp	CRMC
Copco Reservoir at Copco Cove	200.0	PacifiCorp	CRCC
Iron Gate Reservoir at Camp Creek	192.8	PacifiCorp	IRCC
Iron Gate Reservoir at John Williams Campground	192.4	PacifiCorp	IRJW
Klamath River below Iron Gate dam near Hatchery Bridge	189.7	PacifiCorp	KRBI

Samples are planned to be taken at shoreline locations in the reservoirs once in May and twice per month in June, July, August, September, October, and November. Samples to be collected from the river site below Iron Gate Dam are scheduled to be collected according to the discretion of the sampling entity (PacifiCorp) based on river conditions.

In addition to public health sampling, monthly and bi-monthly baseline sampling for microcystin is conducted by PacifiCorp and the U.S. Bureau of Reclamation (BOR) from May through October at 14 locations extending from Link Dam to below Iron Gate Reservoir (Table 2).

<b>Table 2. Sites of microcystin baseline monitoring in J.C. Boyle, Copco, and Iron Gate reservoirs and the Klamath River during 2016.</b>				
Site Description	Approximate River Mile	Depth (m)	Sampling Entity	Site ID
Link Dam	254.4	0.5	BOR	KR254.4
Keno Reservoir at Miller Island	246.0	0.5	BOR	KR246.0
Klamath River below Keno Dam near a USGS Gage	231.8	0.5	BOR	KBK
Klamath River above JC Boyle Reservoir	228.2	0.5	PacifiCorp	KR22822
JC Boyle Reservoir at Log Boom (surface)	224.8	0.5	PacifiCorp	KR22478
Klamath River below JC Boyle Reservoir	224.6	0.5	PacifiCorp	KR22460
Klamath River at USGS Gage	219.5	0.5	PacifiCorp	KR21950
Klamath River above Shovel Creek	206.4	0.5	PacifiCorp	KR20642
Copco Reservoir at Buoy Line (surface)	198.7	0.5	PacifiCorp	KR19874
Copco Reservoir at Buoy Line (integrated)	198.7	0-8	PacifiCorp	KR19874
Klamath River below Copco 2 Reservoir	196.5	0.5	PacifiCorp	KR19645
Iron Gate Reservoir at Log Boom (surface)	190.2	0.5	PacifiCorp	KR19019
Iron Gate Reservoir at Log Boom (integrated)	190.2	0-8	PacifiCorp	KR19019
Klamath River below Hatchery Bridge	189.7	0.5	PacifiCorp	KR18973

Public health samples are taken as grab samples offshore according to the standard operating procedure (SOP) developed by the Klamath Blue Green Algae Working Group ([www.kbmp.net/collaboration/klamath-hydroelectric-settlement-agreement-monitoring](http://www.kbmp.net/collaboration/klamath-hydroelectric-settlement-agreement-monitoring)). Samples collected for potentially toxic phytoplankton are preserved in Lugol's solution and sent to Aquatic Analysts in Friday Harbor, Washington for analysis. The samples are labeled "Rush" for timely analysis and only potentially toxic cyanobacteria are identified and enumerated. However, once a reservoir or river reach is posted with health advisories signs, the samples are collected but not rushed until it visually appears that the algae bloom conditions have waned. Results for cyanobacteria species are reported as individual cells per milliliter.

Samples for determination of microcystin toxin are placed in a cooler on ice and shipped to the U.S. Environmental Protection Agency (EPA) Region 9 Laboratory in Richmond, California. The samples are analyzed using the competitive Enzyme-Linked ImmunoSorbent Assay (ELISA) method based on the EnviroLogix QuantiPlate Kit for microcystins through June 22, 2016 and the Abraxis Kit thereafter. For samples analyzed through June 22, 2016 the detection limit for microcystin using this method was 0.15 µg/L or parts per billion (ppb) while the quantitation limit was 0.18 µg/L or ppb. For samples analyzed starting on June 23, 2016, the detection limit was changed to 0.10 µg/L and the quantitation limit was 0.15 µg/L. This test method does not distinguish between the specific microcystin congeners, but detects their presence to differing degrees. That is, ELISA test results yield one value as the sum of measurable microcystin variants.

## Results

Public health samples (Table 3) were collected as planned, except for sample KEKP16010. Baseline microcystin and phytoplankton samples were also collected as planned (Tables 4 and 5). Appendix 3 includes the raw phytoplankton results for the samples reported in Table 3 and Table 5.

**Table 3. Summary of public health laboratory algal identification and enumeration and microcystin results from sampling October through November, 2016.**

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE <sup>(1)</sup>	AFA <sup>(2)</sup>	DKFA <sup>(3)</sup>	Other <sup>(4),(5),(6),(7),(8),(9),(10), or (11)</sup>	Microcystin (µg/L)
10/25/16	12:50	CRMC	201.5	PacifiCorp	KR16850	SG	*	*	*	*	1800
10/25/16	12:20	CRCC	200.0	PacifiCorp	KR16851	SG	*	*	*	*	74
10/25/16	12:00	IRCC	192.8	PacifiCorp	KR16852	SG	*	*	*	*	1.4
10/25/16	11:45	IRJW	192.4	PacifiCorp	KR16853	SG	*	*	*	*	2.3
10/25/16	11:05	KRBI	189.7	PacifiCorp	KR16854	SG	*	*	*	*	3
10/25/16	10:52	UKEP	N/A	ODEQ	UKEP16010	SG	0	2,255	0	0	0.64
10/25/16	10:34	UKHP	N/A	ODEQ	UKHP16010	SG	*	*	*	*	0.75
10/25/16	11:22	UKMP	N/A	ODEQ	UKMP16010	SG	0	85	0	0	0.46
10/25/16	NS	KEKP	234.0	ODEQ	KEKP16010	SG	CLOSED FOR SEASON				NS
10/25/16	10:00	BRTC	225.0	ODEQ	BRTC16010	SG	0	0	0	0	ND
11/08/16	15:00	CRMC	201.5	PacifiCorp	KR16855	SG	*	*	*	*	0.31
11/08/16	13:45	CRCC	200.0	PacifiCorp	KR16856	SG	*	*	*	*	8
11/08/16	11:00	IRCC	192.8	PacifiCorp	KR16857	SG	*	*	*	*	1.6
11/08/16	10:45	IRJW	192.4	PacifiCorp	KR16858	SG	*	*	*	*	0.15
11/08/16	15:30	KRBI	189.7	PacifiCorp	KR16859	SG	*	*	*	*	0.1 <sup>J</sup>
11/21/16	15:00	CRMC	201.5	PacifiCorp	KR16860	SG	*	*	*	*	ND
11/21/16	14:30	CRCC	200.0	PacifiCorp	KR16861	SG	*	*	*	*	ND
11/21/16	14:00	IRCC	192.8	PacifiCorp	KR16862	SG	*	*	*	*	0.14 <sup>J</sup>
11/21/16	13:45	IRJW	192.4	PacifiCorp	KR16863	SG	*	*	*	*	0.1 <sup>J</sup>
11/21/16	10:50	KRBI	189.7	PacifiCorp	KR16864	SG	*	*	*	*	ND

<sup>1</sup>MSAE = *Microcystis aeruginosa* (cells/mL)

<sup>2</sup>AFA = *Aphanizomenon flos-aquae* (cells/mL)

<sup>3</sup>DKFA = *Dolichospermum flos-aquae*

Other = Cells/mL of either <sup>4</sup>*Planktothrix (Oscillatoria) sp.*, <sup>5</sup>*Gloeotrichia echinulata*, <sup>6</sup>*Dolichospermum sp.*, <sup>7</sup>*Lyngbya sp.*,

<sup>8</sup>*Dolichospermum circinalis*, <sup>9</sup>*Dolichospermum planctonica*, <sup>10</sup>*Planktothrix (Oscillatoria) limosa*, or <sup>11</sup>*Pseudanabaena spp.*

“NS” value indicates not sampled

“0” value indicates non-detect by analytical laboratory

“\*” value indicates no result available

“ND” value indicates a result less than the laboratory analytical detection limit, which was originally 0.15 µg/L and was changed to 0.1 µg/L as of June 23, 2016

<sup>J</sup>The reported result for this analyte should be considered an estimated value because although the result was above the laboratory detection limit it was below the laboratory quantitation limit. The laboratory detection limit was originally 0.15 µg/L and was changed to 0.1 µg/L as of June 23, 2016. The laboratory quantitation limit for was originally 0.18 µg/L and was changed to 0.15 µg/L as of June 23, 2016.

**Table 4. Summary of October and November 2016 baseline laboratory microcystin results for samples collected in Oregon.**

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth (m)	Microcystin (µg/L)
10/25/16	8:30	KR254.4	254.4	BOR	2016KHSA-79	0.5	0.18 <sup>AT, K</sup>

<sup>K</sup>The reported result for this analyte should be considered an estimated value

"AT" indicates the sample was received above the recommended temperature range

**Table 5. Summary of October 2016 baseline laboratory algal identification and enumeration and microcystin results for samples collected in California.**

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE <sup>(1)</sup>	AFA <sup>(2)</sup>	DKFA <sup>(3)</sup>	Other <sup>(4),(5), (6), (7), (8), (9), (10), or (11)</sup>	Microcystin (µg/L)
10/25/16	9:30	KR19019	190.2	PacifiCorp	KR16183	0.5	0	14,734	0	0	5.2
10/25/16	9:45	KR19019	190.2	PacifiCorp	KR16184	0-8	*	*	*	*	1.2
10/25/16	11:15	KR18973	189.7	PacifiCorp	KR16196	0.5	*	*	*	*	1.9

<sup>1</sup>MSAE = *Microcystis aeruginosa* (cells/mL)

<sup>2</sup>AFA = *Aphanizomenon flos-aquae* (cells/mL)

<sup>3</sup>DKFA = *Dolichospermum flos-aquae*

Other = Cells/mL of either <sup>4</sup>*Planktothrix (Oscillatoria) sp.*, <sup>5</sup>*Gloeotrichia echinulata*, <sup>6</sup>*Dolichospermum sp.*, <sup>7</sup>*Lyngbya sp.*,

<sup>8</sup>*Dolichospermum circinalis*, <sup>9</sup>*Dolichospermum planctonica*, <sup>10</sup>*Planktothrix (Oscillatoria) limosa*, or <sup>11</sup>*Pseudanabaena spp.*

"0" value indicates non-detect by analytical laboratory

"\*\*" value indicates no result available

## References

California SWRCB 2016. Draft Statewide Voluntary Guidance on CyanoHABs in Recreational Waters. Available online at:

[http://www.mywaterquality.ca.gov/monitoring\\_council/cyanohab\\_network/docs/triggers.pdf](http://www.mywaterquality.ca.gov/monitoring_council/cyanohab_network/docs/triggers.pdf)

Oregon Health Authority. 2016. Oregon Harmful Algal Bloom Surveillance (HABS) Program – Public Health Advisory Guidelines, Harmful Algae Blooms in Freshwater Bodies. 27 pp.

[https://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms/Pages/resources\\_for\\_samplers.aspx](https://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms/Pages/resources_for_samplers.aspx)

## Appendix 1 Cyanobacteria Species and Microcystin Data for 2016 Public Health Samples

<b>Table A1. Summary of 2016 public health laboratory algal identification and enumeration microcystin results.</b>											
Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE <sup>(1)</sup>	AFA <sup>(2)</sup>	DKFA <sup>(3)</sup>	Other <sup>(4),(5), (6), (7), (8), (9), (10), or (11)</sup>	Microcystin (µg/L)
05/23/16	14:05	CRMC	201.5	PacifiCorp	KR16800	SG	0	0	0	0	ND
05/23/16	13:15	CRCC	200.0	PacifiCorp	KR16801	SG	0	0	0	0	ND
05/23/16	12:45	IRCC	192.8	PacifiCorp	KR16802	SG	0	0	0	0	ND
05/23/16	12:25	IRJW	192.4	PacifiCorp	KR16803	SG	0	0	0	0	ND
05/23/16	11:55	KRBI	189.7	PacifiCorp	KR16804	SG	0	0	0	0	ND
06/14/16	11:47	UKEP	N/A	ODEQ	UKEP16001	SG	0	349,320	0	0	0.76
06/14/16	11:24	UKHP	N/A	ODEQ	UKHP16001	SG	100,686	296,927	0	0	14
06/14/16	11:10	UKMP	N/A	ODEQ	UKMP16001	SG	0	302,081	0	55,817 <sup>(5)</sup>	0.56
06/14/16	10:38	KEKP	234.0	ODEQ	KEKP16001	SG	0	0	46,979	587 <sup>(6)</sup>	0.23
06/14/16	10:09	BRTC	225.0	ODEQ	BRTC16001	SG	0	0	0	0	ND
06/08/16	16:15	CRMC	201.5	PacifiCorp	KR16805	SG	0	0	0	0	ND
06/08/16	13:10	CRCC	200.0	PacifiCorp	KR16806	SG	0	0	503	0	3.7
06/08/16	11:40	IRCC	192.8	PacifiCorp	KR16807	SG	0	0	0	0	ND
06/08/16	11:20	IRJW	192.4	PacifiCorp	KR16808	SG	0	0	0	0	ND
06/08/16	17:00	KRBI	189.7	PacifiCorp	KR16809	SG	0	0	0	0	ND
06/28/16	11:17	UKEP	N/A	ODEQ	UKEP16002	SG	163,293	10,103,761	0	0	56
06/28/16	11:34	UKHP	N/A	ODEQ	UKHP16002	SG	0	43,439,500	0	0	130
06/28/16	11:50	UKMP	N/A	ODEQ	UKMP16002	SG	1,485,481	3,157,000	0	0	32
06/28/16	10:35	KEKP	234.0	ODEQ	KEKP16002	SG	18,090	279,025	0	0	3.2
06/28/16	10:07	BRTC	225.0	ODEQ	BRTC16002	SG	490	456,392	0	0	0.53
06/20/16	16:40	CRMC	201.5	PacifiCorp	KR16810	SG	68,407	0	807	0	25
06/20/16	15:20	CRCC	200.0	PacifiCorp	KR16811	SG	496,424	0	17,034	0	61
06/20/16	14:40	IRCC	192.8	PacifiCorp	KR16812	SG	12,272	0	0	0	14
06/20/16	14:25	IRJW	192.4	PacifiCorp	KR16813	SG	4,940	0	859	658 <sup>(6)</sup> , 403 <sup>(9)</sup>	1
06/20/16	13:50	KRBI	189.7	PacifiCorp	KR16814	SG	0	0	16	0	ND
07/12/16	11:58	UKEP	N/A	ODEQ	UKEP16003	SG	*	*	*	*	0.51
07/12/16	12:32	UKHP	N/A	ODEQ	UKHP16003	SG	*	*	*	*	79
07/12/16	12:46	UKMP	N/A	ODEQ	UKMP16003	SG	*	*	*	*	3.4
07/12/16	10:59	KEKP	234.0	ODEQ	KEKP16003	SG	0	20,528	0	78 <sup>(6)</sup>	0.55
07/12/16	10:42	BRTC	225.0	ODEQ	BRTC16003	SG	0	775	0	0	0.31
07/12/16	16:55	CRMC	201.5	PacifiCorp	KR16815	SG	9,601	0	793	0	9.1
07/12/16	15:00	CRCC	200.0	PacifiCorp	KR16816	SG	91,883	183	0	0	21
07/12/16	12:40	IRCC	192.8	PacifiCorp	KR16817	SG	13,917	1,450	13,981	28,993 <sup>(5)</sup>	6.4
07/12/16	12:30	IRJW	192.4	PacifiCorp	KR16818	SG	4,050	6,259	153	16,015 <sup>(5)</sup>	2.5
07/12/16	18:00	KRBI	189.7	PacifiCorp	KR16819	SG	0	0	0	0	0.15
07/26/16	12:34	UKEP	N/A	ODEQ	UKEP16004	SG	0	150,457	0	0	1.9
07/26/16	12:08	UKHP	N/A	ODEQ	UKHP16004	SG	3,545,070	20,177,880	0	0	37
07/26/16	13:14	UKMP	N/A	ODEQ	UKMP16004	SG	0	1,082,400	0	0	0.54
07/26/16	11:37	KEKP	234.0	ODEQ	KEKP16004	SG	0	30,067	0	0	0.29
07/26/16	11:17	BRTC	225.0	ODEQ	BRTC16004	SG	0	0	0	0	0.20
07/26/16	11:15	CRMC	201.5	PacifiCorp	KR16820	SG	*	*	*	*	870

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**Table A1 (cont.)**

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE <sup>(1)</sup>	AFA <sup>(2)</sup>	DKFA <sup>(3)</sup>	Other <sup>(4),(5), (6), (7), (8), (9), (10), or (11)</sup>	Microcystin (µg/L)
07/26/16	12:15	CRCC	200.0	PacifiCorp	KR16821	SG	*	*	*	*	34000
07/26/16	12:45	IRCC	192.8	PacifiCorp	KR16822	SG	*	*	*	*	73
07/26/16	13:10	IRJW	192.4	PacifiCorp	KR16823	SG	*	*	*	*	380
07/26/16	13:40	KRBI	189.7	PacifiCorp	KR16824	SG	241	0	0	62 <sup>(5)</sup>	0.38
08/08/16	11:15	UKEP	N/A	ODEQ	UKEP16005	SG	0	168,251	0	0	4.9
08/08/16	11:38	UKHP	N/A	ODEQ	UKHP16005	SG	*	*	*	*	170
08/08/16	11:56	UKMP	N/A	ODEQ	UKMP16005	SG	0	277,381	0	0	3.4
08/08/16	10:22	KEKP	234.0	ODEQ	KEKP16005	SG	0	16,955	0	0	0.28
08/08/16	10:03	BRTC	225.0	ODEQ	BRTC16005	SG	0	1,115	0	0	0.21
08/10/16	16:20	CRMC	201.5	PacifiCorp	KR16825	SG	16,236,000	99,485	0	689,765 <sup>(5)</sup>	5000
08/11/16	9:00	CRCC	200.0	PacifiCorp	KR16826	SG	21,169,275	548,963	0	0	3400
08/10/16	13:10	IRCC	192.8	PacifiCorp	KR16827	SG	3,720,750	10,738	0	0	790
08/10/16	12:45	IRJW	192.4	PacifiCorp	KR16828	SG	2,956,887	0	0	0	2500
08/10/16	17:00	KRBI	189.7	PacifiCorp	KR16829	SG	6,792	0	0	0	ND
08/22/16	8:00	CRMC	201.5	PacifiCorp	KR16830	SG	*	*	*	*	430
08/22/16	9:00	CRCC	200.0	PacifiCorp	KR16831	SG	*	*	*	*	7600
08/22/16	9:40	IRCC	192.8	PacifiCorp	KR16832	SG	*	*	*	*	30
08/22/16	10:00	IRJW	192.4	PacifiCorp	KR16833	SG	*	*	*	*	72
08/22/16	10:15	KRBI	189.7	PacifiCorp	KR16834	SG	*	*	*	*	0.38
08/30/16	12:13	UKEP	N/A	ODEQ	UKEP16006	SG	0	0	0	0	0.33
08/30/16	12:33	UKHP	N/A	ODEQ	UKHP16006	SG	11,776	0	0	0	1.2
08/30/16	12:52	UKMP	N/A	ODEQ	UKMP16006	SG	0	0	0	0	0.17
08/30/16	11:28	KEKP	234.0	ODEQ	KEKP16006	SG	64,845	2,708	0	0	10
08/30/16	11:07	BRTC	225.0	ODEQ	BRTC16006	SG	3,391	0	0	0	2.9
09/06/16	19:50	CRMC	201.5	PacifiCorp	KR16835	SG	654,054	127,157	4,228	0	86
09/06/16	19:20	CRCC	200.0	PacifiCorp	KR16836	SG	73,887	4,810,667	19,191	0	5.6
09/06/16	18:35	IRCC	192.8	PacifiCorp	KR16837	SG	3,240,556	10,067	0	0	780
09/06/16	18:00	IRJW	192.4	PacifiCorp	KR16838	SG	895,235	36,080	0	0	420
09/07/16	12:10	KRBI	189.7	PacifiCorp	KR16839	SG	0	2,582	0	0	4.9
09/13/16	11:45	UKEP	N/A	ODEQ	UKEP16007	SG	976	976	0	0	0.67
09/13/16	11:58	UKHP	N/A	ODEQ	UKHP16007	SG	*	*	*	*	1.4
09/13/16	12:20	UKMP	N/A	ODEQ	UKMP16007	SG	430	0	0	0	0.31
09/13/16	10:56	KEKP	234.0	ODEQ	KEKP16007	SG	1,203	0	0	0	5.8
09/13/16	10:38	BRTC	225.0	ODEQ	BRTC16007	SG	573	0	0	107 <sup>(4)</sup>	0.92
09/26/16	16:45	CRMC	201.5	PacifiCorp	KR16840	SG	737,532	145,595	0	0	250
09/26/16	17:25	CRCC	200.0	PacifiCorp	KR16841	SG	415,467	102,500	44,417	0	220
09/26/16	17:50	IRCC	192.8	PacifiCorp	KR16842	SG	15,201,921	644,286	0	0	490
09/26/16	18:10	IRJW	192.4	PacifiCorp	KR16843	SG	1,713,800	1,488,300	0	0	850
09/26/16	18:30	KRBI	189.7	PacifiCorp	KR16844	SG	0	186	0	0	0.25
09/27/16	12:37	UKEP	N/A	ODEQ	UKEP16008	SG	2,092	490	0	0	2.0 <sup>AT</sup>
09/27/16	12:57	UKHP	N/A	ODEQ	UKHP16008	SG	1,077,630	25,044	0	0	470 <sup>AT</sup>
09/27/16	13:17	UKMP	N/A	ODEQ	UKMP16008	SG	0	3,398	0	0	3.0 <sup>AT</sup>
09/27/16	11:47	KEKP	234.0	ODEQ	KEKP16008	SG	904	0	0	0	0.46 <sup>AT</sup>
09/27/16	11:28	BRTC	225.0	ODEQ	BRTC16008	SG	0	0	0	0	0.21 <sup>AT</sup>
10/11/16	14:30	CRMC	201.5	PacifiCorp	KR16845	SG	67,650	0	6,168	0	15
10/11/16	12:30	CRCC	200.0	PacifiCorp	KR16846	SG	144,972,763	27,060,000	0	0	11000

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**Table A1 (cont.)**

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE <sup>(1)</sup>	AFA <sup>(2)</sup>	DKFA <sup>(3)</sup>	Other <sup>(4),(5), (6), (7), (8), (9), (10), or (11)</sup>	Microcystin (µg/L)
10/11/16	NS	IRCC	192.8	PacifiCorp	KR16847	SG	NS	NS	NS	NS	NS
10/11/16	11:15	IRJW	192.4	PacifiCorp	KR16848	SG	2,461	12,684	0	0	15
10/11/16	10:40	KRBI	189.7	PacifiCorp	KR16849	SG	0	2,563	0	0	2.9
10/11/16	12:22	UKEP	N/A	ODEQ	UKEP16009	SG	*	*	*	*	0.17
10/11/16	12:42	UKHP	N/A	ODEQ	UKHP16009	SG	*	*	*	*	5.0
10/11/16	13:02	UKMP	N/A	ODEQ	UKMP16009	SG	*	*	*	*	0.15
10/11/16	11:35	KEKP	234.0	ODEQ	KEKP16009	SG	*	*	*	*	0.25
10/11/16	11:17	BRTC	225.0	ODEQ	BRTC16009	SG	*	*	*	*	0.17
10/25/16	12:50	CRMC	201.5	PacifiCorp	KR16850	SG	*	*	*	*	1800
10/25/16	12:20	CRCC	200.0	PacifiCorp	KR16851	SG	*	*	*	*	74
10/25/16	12:00	IRCC	192.8	PacifiCorp	KR16852	SG	*	*	*	*	1.4
10/25/16	11:45	IRJW	192.4	PacifiCorp	KR16853	SG	*	*	*	*	2.3
10/25/16	11:05	KRBI	189.7	PacifiCorp	KR16854	SG	*	*	*	*	3
10/25/16	10:52	UKEP	N/A	ODEQ	UKEP16010	SG	0	2,255	0	0	0.64
10/25/16	10:34	UKHP	N/A	ODEQ	UKHP16010	SG	*	*	*	*	0.75
10/25/16	11:22	UKMP	N/A	ODEQ	UKMP16010	SG	0	85	0	0	0.46
10/25/16	NS	KEKP	234.0	ODEQ	KEKP16010	SG	CLOSED FOR SEASON				NS
10/25/16	10:00	BRTC	225.0	ODEQ	BRTC16010	SG	0	0	0	0	ND
11/08/16	15:00	CRMC	201.5	PacifiCorp	KR16855	SG	*	*	*	*	0.31
11/08/16	13:45	CRCC	200.0	PacifiCorp	KR16856	SG	*	*	*	*	8
11/08/16	11:00	IRCC	192.8	PacifiCorp	KR16857	SG	*	*	*	*	1.6
11/08/16	10:45	IRJW	192.4	PacifiCorp	KR16858	SG	*	*	*	*	0.15
11/08/16	15:30	KRBI	189.7	PacifiCorp	KR16859	SG	*	*	*	*	0.1 <sup>J</sup>
11/21/16	15:00	CRMC	201.5	PacifiCorp	KR16860	SG	*	*	*	*	ND
11/21/16	14:30	CRCC	200.0	PacifiCorp	KR16861	SG	*	*	*	*	ND
11/21/16	14:00	IRCC	192.8	PacifiCorp	KR16862	SG	*	*	*	*	0.14 <sup>J</sup>
11/21/16	13:45	IRJW	192.4	PacifiCorp	KR16863	SG	*	*	*	*	0.1 <sup>J</sup>
11/21/16	10:50	KRBI	189.7	PacifiCorp	KR16864	SG	*	*	*	*	ND

<sup>1</sup>MSAE = *Microcystis aeruginosa* (cells/mL)

<sup>2</sup>AFA = *Aphanizomenon flos-aquae* (cells/mL)

<sup>3</sup>DKFA = *Dolichospermum flos-aquae*

Other = Cells/mL of either <sup>4</sup>*Planktothrix (Oscillatoria)* sp., <sup>5</sup>*Gloeotrichia echinulata*, <sup>6</sup>*Dolichospermum* sp., <sup>7</sup>*Lyngbya* sp., <sup>8</sup>*Dolichospermum circinalis*, <sup>9</sup>*Dolichospermum planctonica*, <sup>10</sup>*Planktothrix (Oscillatoria) limosa*, or <sup>11</sup>*Pseudanabaena* spp.

"ND" value indicates a result less than the laboratory analytical detection limit, which was originally 0.15 µg/L and was changed to 0.1 µg/L as of June 23, 2016

"0" value indicates non-detect by analytical laboratory

"\*" value indicates no result available

"NS" value indicates not sampled

"AT" indicates the sample was received above the recommended temperature range

<sup>J</sup>The reported result for this analyte should be considered an estimated value because although the result was above the laboratory detection limit it was below the laboratory quantitation limit. The laboratory detection limit was originally 0.15 µg/L and was changed to 0.1 µg/L as of June 23, 2016. The laboratory quantitation limit for was originally 0.18 µg/L and was changed to 0.15 µg/L as of June 23, 2016.



## Appendix 2

### Microcystin Data for 2016 Baseline Samples

<b>Table A2-1. Summary of 2016 baseline laboratory algal identification and microcystin results for samples collected in Oregon.</b>											
Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE <sup>(1)</sup>	AFA <sup>(2)</sup>	DKFA <sup>(3)</sup>	Other <sup>(4),(5), (6), (7), (8), (9), (10), or (11)</sup>	Microcystin (µg/L)
05/10/16	10:00	KR246.0	246.0	BOR	2016-KHSA-22	0.5	*	*	*	*	0.15 <sup>J</sup>
05/10/16	7:45	KBK	231.8	BOR	2016-KHSA-23	0.5	*	*	*	*	0.19
05/10/16	9:50	KR22822	228.2	PacifiCorp	KR16062	0.5	*	*	*	*	0.16 <sup>J</sup>
05/10/16	12:35	KR22478	224.8	PacifiCorp	KR16064	0.5	*	*	*	*	ND
05/10/16	13:15	KR22460	224.6	PacifiCorp	KR16061	0.5	*	*	*	*	0.16 <sup>J</sup>
05/10/16	11:20	KR21950	219.5	PacifiCorp	KR16063	0.5	*	*	*	*	0.16 <sup>J</sup>
06/07/16	10:15	KR246.0	246.0	BOR	2016KHSA-32	0.5	*	*	*	*	ND
06/07/16	8:00	KBK	231.8	BOR	2016KHSA-33	0.5	*	*	*	*	ND
06/07/16	11:00	KR22822	228.2	PacifiCorp	KR16084	0.5	*	*	*	*	0.15 <sup>J</sup>
06/07/16	14:10	KR22478	224.8	PacifiCorp	KR16086	0.5	*	*	*	*	ND
06/07/16	14:30	KR22460	224.6	PacifiCorp	KR16083	0.5	*	*	*	*	0.15 <sup>J</sup>
06/07/16	15:00	KR22460	224.6	PacifiCorp	KR16089	0.5	*	*	*	*	ND
06/07/16	13:10	KR21950	219.5	PacifiCorp	KR16085	0.5	*	*	*	*	ND
06/21/16	7:45	KR254.4	254.4	BOR	2016KHSA-35	0.5	3,341	682,903	0	0	NS
07/12/16	8:30	KR254.4	254.4	BOR	2016KHSA-40	0.5	0	876,954	0	0	0.74
07/12/16	10:30	KR246.0	246.0	BOR	2016KHSA-43	0.5	*	*	*	*	0.13 <sup>J</sup>
07/12/16	7:40	KBK	231.8	BOR	2016KHSA-44	0.5	0	33,162	0	0	SL
07/11/16	9:40	KR22822	228.2	PacifiCorp	KR16107	0.5	*	*	*	*	0.2
07/11/16	12:35	KR22478	224.8	PacifiCorp	KR16109	0.5	*	*	*	*	0.12 <sup>J</sup>
07/11/16	11:50	KR22460	224.6	PacifiCorp	KR16106	0.5	*	*	*	*	0.13 <sup>J</sup>
07/11/16	12:00	KR22460	224.6	PacifiCorp	KR16112	0.5	*	*	*	*	0.1 <sup>J</sup>
07/11/16	11:10	KR21950	219.5	PacifiCorp	KR16108	0.5	*	*	*	*	ND
07/26/16	9:00	KR254.4	254.4	BOR	2016KHSA-46	0.5	*	*	*	*	0.34 <sup>AT</sup>
08/09/16	8:00	KR254.4	254.4	BOR	2016KHSA-51	0.5	0	576,336	0	0	0.38
08/09/16	9:40	KR246.0	246.0	BOR	2016KHSA-54	0.5	*	*	*	*	0.19
08/09/16	7:15	KBK	231.8	BOR	2016KHSA-55	0.5	0	294	0	0	0.15
08/09/16	10:40	KR22822	228.2	PacifiCorp	KR16130	0.5	*	*	*	*	0.11 <sup>J</sup>
08/09/16	13:20	KR22478	224.8	PacifiCorp	KR16132	0.5	*	*	*	*	0.1 <sup>J</sup>
08/09/16	12:55	KR22460	224.6	PacifiCorp	KR16129	0.5	*	*	*	*	0.14 <sup>J</sup>
08/09/16	12:50	KR22460	224.6	PacifiCorp	KR16135	0.5	*	*	*	*	0.11 <sup>J</sup>
08/09/16	12:00	KR21950	219.5	PacifiCorp	KR16131	0.5	*	*	*	*	ND
08/23/16	8:30	KR254.4	254.4	BOR	2016KHSA-57	0.5	*	*	*	*	0.10 <sup>AT,J</sup>
09/05/16	11:00	KR22822	228.2	PacifiCorp	KR16153	0.5	*	*	*	*	1.1
09/05/16	13:00	KR22460	224.6	PacifiCorp	KR16152	0.5	*	*	*	*	0.56
09/05/16	13:20	KR22460	224.6	PacifiCorp	KR16158	0.5	*	*	*	*	0.71
09/05/16	12:30	KR21950	219.5	PacifiCorp	KR16154	0.5	*	*	*	*	0.43
09/13/16	8:30	KR254.4	254.4	BOR	2016KHSA-62	0.5	0	0	0	0	0.14 <sup>J</sup>
09/13/16	9:45	KR246.0	246.0	BOR	2016KHSA-65	0.5	*	*	*	*	0.22
09/13/16	7:45	KBK	231.8	BOR	2016KHSA-66	0.5	0	0	0	0	0.40
09/21/16	15:45	KR22478	224.8	PacifiCorp	KR16155	0.5	*	*	*	*	*
09/26/16	14:45	KR22478	224.8	PacifiCorp	KR16155	0.5	*	*	*	*	0.16
09/27/16	9:00	KR254.4	254.4	BOR	2016KHSA-68	0.5	*	*	*	*	0.20

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**Table A2-1 (cont.)**

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE <sup>(1)</sup>	AFA <sup>(2)</sup>	DKFA <sup>(3)</sup>	Other <sup>(4),(5), (6), (7), (8), (9), (10), or (11)</sup>	Microcystin (µg/L)
10/10/16	10:50	KR22822	228.2	PacifiCorp	KR16176	0.5	*	*	*	*	ND
10/10/16	13:45	KR22478	224.8	PacifiCorp	KR16178	0.5	*	*	*	*	ND
10/10/16	13:00	KR22460	224.6	PacifiCorp	KR16175	0.5	*	*	*	*	0.14 <sup>J</sup>
10/10/16	13:20	KR22460	224.6	PacifiCorp	KR16180	0.5	*	*	*	*	ND
10/10/16	13:30	KR22460	224.6	PacifiCorp	KR16181	0.5	*	*	*	*	1
10/10/16	12:30	KR21950	219.5	PacifiCorp	KR16177	0.5	*	*	*	*	ND
10/11/16	8:30	KR254.4	254.4	BOR	2016KHSA-73	0.5	0	0	0	0	0.18
10/11/16	7:50	KR246.0	246.0	BOR	2016KHSA-76	0.5	*	*	*	*	ND
10/11/16	10:00	KBK	231.8	BOR	2016KHSA-77	0.5	0	0	0	0	ND
10/25/16	8:30	KR254.4	254.4	BOR	2016KHSA-79	0.5	*	*	*	*	0.18 <sup>AT, K</sup>

<sup>1</sup>MSAE = *Microcystis aeruginosa* (cells/mL)

<sup>2</sup>AFA = *Aphanizomenon flos-aquae* (cells/mL)

<sup>3</sup>DKFA = *Dolichospermum flos-aquae*

Other = Cells/mL of either <sup>4</sup>*Planktothrix (Oscillatoria) sp.*, <sup>5</sup>*Gloeotrichia echinulata*, <sup>6</sup>*Dolichospermum sp.*, <sup>7</sup>*Lyngbya sp.*, <sup>8</sup>*Dolichospermum circinalis*, <sup>9</sup>*Dolichospermum planctonica*, <sup>10</sup>*Planktothrix (Oscillatoria) limosa*, or <sup>11</sup>*Pseudanabaena spp.*

<sup>J</sup>The reported result for this analyte should be considered an estimated value because although the result was above the laboratory detection limit it was below the laboratory quantitation limit. The laboratory detection limit was originally 0.15 µg/L and was changed to 0.1 µg/L as of June 23, 2016. The laboratory quantitation limit for was originally 0.18 µg/L and was changed to 0.15 µg/L as of June 23, 2016.

"ND" value indicates a result less than the laboratory analytical detection limit, which was originally 0.15 µg/L and was changed to 0.1 µg/L as of June 23, 2016

"SL" indicates sample loss

"\*" value indicates no result available

"NS" indicates not sampled

"AT" indicates the sample was received above the recommended temperature range

<sup>K</sup>The reported result for this analyte should be considered an estimated value

**Table A2-2. Summary of 2016 baseline laboratory microcystin results for samples collected in California.**

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE <sup>(1)</sup>	AFA <sup>(2)</sup>	DKFA <sup>(3)</sup>	Other <sup>(4),(5), (6), (7), (8), (9), (10), or (11)</sup>	Microcystin (µg/L)
05/11/16	15:10	KR20642	206.4	PacifiCorp	KR16078	0.5	*	*	*	*	ND
05/11/16	12:50	KR19874	198.7	PacifiCorp	KR16074	0.5	*	*	*	*	0.15 <sup>J</sup>
05/11/16	13:00	KR19874	198.7	PacifiCorp	KR16075	0-8	*	*	*	*	ND
05/11/16	12:05	KR19645	196.5	PacifiCorp	KR16073	0.5	*	*	*	*	0.17 <sup>J</sup>
05/11/16	9:45	KR19019	190.2	PacifiCorp	KR16069	0.5	*	*	*	*	ND
05/11/16	9:55	KR19019	190.2	PacifiCorp	KR16070	0-8	*	*	*	*	ND
05/11/16	16:35	KR18973	189.7	PacifiCorp	KR16068	0.5	*	*	*	*	ND
05/23/16	11:50	KR18973	189.7	PacifiCorp	KR16082	0.5	*	*	*	*	ND
06/08/16	15:25	KR20642	206.4	PacifiCorp	KR16100	0.5	*	*	*	*	ND
06/08/16	13:30	KR19874	198.7	PacifiCorp	KR16096	0.5	0	0	0	0	ND
06/08/16	13:40	KR19874	198.7	PacifiCorp	KR16097	0-8	*	*	*	*	ND
06/08/16	12:20	KR19645	196.5	PacifiCorp	KR16095	0.5	*	*	*	*	ND
06/08/16	9:10	KR19019	190.2	PacifiCorp	KR16091	0.5	0	0	0	0	ND
06/08/16	9:20	KR19019	190.2	PacifiCorp	KR16092	0-8	*	*	*	*	ND
06/08/16	16:50	KR18973	189.7	PacifiCorp	KR16090	0.5	0	0	0	0	ND
06/08/16	17:20	KR18973	189.7	PacifiCorp	KR16103	0.5	*	*	*	*	ND
06/20/16	13:40	KR18973	189.7	PacifiCorp	KR16105	0.5	0	0	77	0	ND
07/12/16	16:40	KR20642	206.4	PacifiCorp	KR16123	0.5	*	*	*	*	0.1 <sup>J</sup>
07/12/16	14:20	KR19874	198.7	PacifiCorp	KR16119	0.5	9,279	0	0	0	6.2
07/12/16	14:30	KR19874	198.7	PacifiCorp	KR16120	0-8	*	*	*	*	3.2
07/12/16	13:40	KR19645	196.5	PacifiCorp	KR16118	0.5	*	*	*	*	0.89
07/12/16	10:30	KR19019	190.2	PacifiCorp	KR16114	0.5	0	293	0	0	0.2
07/12/16	10:50	KR19019	190.2	PacifiCorp	KR16115	0-8	*	*	*	*	0.36
07/12/16	17:20	KR18973	189.7	PacifiCorp	KR16113	0.5	*	*	*	*	0.13 <sup>J</sup>
07/12/16	17:40	KR18973	189.7	PacifiCorp	KR16126	0.5	*	*	*	*	0.18
07/12/16	13:30	KR18973	189.7	PacifiCorp	KR16128	0.5	*	*	*	*	0.3
08/10/16	15:50	KR20642	206.4	PacifiCorp	KR16146	0.5	*	*	*	*	ND
08/11/16	9:30	KR19874	198.7	PacifiCorp	KR16142	0.5	206,202	13,530	614	0	22
08/11/16	9:50	KR19874	198.7	PacifiCorp	KR16143	0-8	*	*	*	*	3.6
08/10/16	14:30	KR19645	196.5	PacifiCorp	KR16141	0.5	*	*	*	*	3.6
08/10/16	10:30	KR19019	190.2	PacifiCorp	KR16137	0.5	37,639	572	0	808 <sup>(5)</sup>	15
08/10/16	10:40	KR19019	190.2	PacifiCorp	KR16138	0-8	*	*	*	*	3.7
08/10/16	16:55	KR18973	189.7	PacifiCorp	KR16136	0.5	*	*	*	*	2.3
08/10/16	17:20	KR18973	189.7	PacifiCorp	KR16149	0.5	*	*	*	*	1.4
08/22/16	10:10	KR18973	189.7	PacifiCorp	KR16151	0.5	*	*	*	*	0.42
09/06/16	20:05	KR20642	206.4	PacifiCorp	KR16169	0.5	*	*	*	*	0.53
09/07/16	10:00	KR19874	198.7	PacifiCorp	KR16165	0.5	0	12,435	3,245	0	0.99
09/07/16	10:10	KR19874	198.7	PacifiCorp	KR16166	0-8	*	*	*	*	0.44
09/06/16	19:00	KR19645	196.5	PacifiCorp	KR16164	0.5	*	*	*	*	0.44
09/06/16	12:20	KR19019	190.2	PacifiCorp	KR16160	0.5	7,281	34,577	224	0	6.4

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**Table A2-2 (cont.)**

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE <sup>(1)</sup>	AFA <sup>(2)</sup>	DKFA <sup>(3)</sup>	Other <sup>(4),(5), (6), (7), (8), (9), (10), or (11)</sup>	Microcystin (µg/L)
09/06/16	12:30	KR19019	190.2	PacifiCorp	KR16161	0-8	*	*	*	*	3
09/07/16	12:00	KR18973	189.7	PacifiCorp	KR16159	0.5	*	*	*	*	2.7
09/07/16	12:25	KR18973	189.7	PacifiCorp	KR16172	0.5	*	*	*	*	2.1
09/26/16	18:20	KR18973	189.7	PacifiCorp	KR16174	0.5	*	*	*	*	0.23
10/11/16	15:00	KR20642	206.4	PacifiCorp	KR16192	0.5	*	*	*	*	ND
10/11/16	13:10	KR19874	198.7	PacifiCorp	KR16188	0.5	3,101	67,086	226	0	1.1
10/11/16	13:20	KR19874	198.7	PacifiCorp	KR16189	0-8	*	*	*	*	3.3
10/11/16	12:00	KR19645	196.5	PacifiCorp	KR16187	0.5	*	*	*	*	0.6
10/11/16	10:00	KR18973	189.7	PacifiCorp	KR16182	0.5	*	*	*	*	2.6
10/11/16	10:30	KR18973	189.7	PacifiCorp	KR16195	0.5	*	*	*	*	2.8
10/25/16	9:30	KR19019	190.2	PacifiCorp	KR16183	0.5	0	14,734	0	0	5.2
10/25/16	9:45	KR19019	190.2	PacifiCorp	KR16184	0-8	*	*	*	*	1.2
10/25/16	11:15	KR18973	189.7	PacifiCorp	KR16196	0.5	*	*	*	*	1.9

<sup>1</sup>MSAE = *Microcystis aeruginosa* (cells/mL)

<sup>2</sup>AFA = *Aphanizomenon flos-aquae* (cells/mL)

<sup>3</sup>DKFA = *Dolichospermum flos-aquae*

Other = Cells/mL of either <sup>4</sup>*Planktothrix (Oscillatoria) sp.*, <sup>5</sup>*Gloeotrichia echinulata*, <sup>6</sup>*Dolichospermum sp.*, <sup>7</sup>*Lyngbya sp.*,

<sup>8</sup>*Dolichospermum circinalis*, <sup>9</sup>*Dolichospermum planctonica*, <sup>10</sup>*Planktothrix (Oscillatoria) limosa*, or <sup>11</sup>*Pseudanabaena spp.*

<sup>j</sup> The reported result for this analyte should be considered an estimated value because although the result was above the laboratory detection limit it was below the laboratory quantitation limit. The laboratory detection limit was originally 0.15 µg/L and was changed to 0.1 µg/L as of June 23, 2016. The laboratory quantitation limit was originally 0.18 µg/L and was changed to 0.15 µg/L as of June 23, 2016.

"ND" value indicates a result less than the laboratory analytical detection limit, which was originally 0.15 µg/L and was changed to 0.1 µg/L as of June 23, 2016

"NS" value indicates not sampled

## Appendix 3 Laboratory Phytoplankton Results

**Note:** To reflect current taxonomic decisions, the genus for *Anabaena* was changed to *Dolichospermum* in the summary data presented in the body of this memo but not in the actual lab results presented in this appendix.

### Phytoplankton Sample Analysis

Sample: Klamath Basin  
 Sample Site: KHSA-35  
 Sample Depth:  
 Sample Date: 21-Jun-16 745

Total Density (#/mL): 31,292  
 Total Biovolume (um<sup>3</sup>/mL): 43,098,172  
 Trophic State Index: 77.0

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	31,041	99.2	43,022,894	99.8
2 Ankistrodesmus falcatus	84	0.3	2,088	0.0
3 Navicula pupula	56	0.2	15,033	0.0
4 Nitzschia palea	28	0.1	5,011	0.0
5 Achnanthes lanceolata	28	0.1	10,022	0.0
6 Melosira ambigua	28	0.1	16,397	0.0
7 Microcystis aeruginosa	28	0.1	26,726	0.1

Aphanizomenon flos-aquae cells/mL = 682,903

Microcystis aeruginosa cells/mL = 3,341

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample Site:** KHSA-40  
**Sample Depth:**  
**Sample Date:** 12-Jul-16 830

**Total Density (#/mL):** 38,387  
**Total Biovolume (um<sup>3</sup>/mL):** 55,290,491  
**Trophic State Index:** 78.8

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	38,128	99.3	55,248,102	99.9
2 Fragilaria construens venter	129	0.3	6,197	0.0
3 Fragilaria construens	43	0.1	4,820	0.0
4 Synedra parasitica	43	0.1	6,025	0.0
5 Melosira ambigua	43	0.1	25,347	0.0

Aphanizomenon flos-aquae cells/mL = 876,954

**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample Site: KHSA-44  
 Sample Depth:  
 Sample Date: 12-Jul-16 740

Total Density (#/mL): 3,703  
 Total Biovolume (um<sup>3</sup>/mL): 2,950,679  
 Trophic State Index: 57.6

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	1,326	35.8	2,089,191	70.8
2 Cryptomonas erosa	995	26.9	517,324	17.5
3 Rhodomonas minuta	276	7.5	5,527	0.2
4 Ankistrodesmus falcatus	249	6.7	6,218	0.2
5 Scenedesmus quadricauda	193	5.2	37,722	1.3
6 Nitzschia palea	166	4.5	29,846	1.0
7 Selenastrum minutum	138	3.7	2,763	0.1
8 Cyclotella meneghiniana	83	2.2	31,504	1.1
9 Melosira granulata	55	1.5	151,991	5.2
10 Chlamydomonas sp.	55	1.5	17,963	0.6
11 Navicula minima	28	0.7	1,216	0.0
12 Cocconeis placentula	28	0.7	12,712	0.4
13 Gomphonema angustatum	28	0.7	4,974	0.2
14 Nitzschia acicularis	28	0.7	7,738	0.3
15 Melosira varians	28	0.7	17,963	0.6
16 Nitzschia constricta	28	0.7	16,028	0.5

Aphanizomenon flos-aquae cells/mL = 33,162

**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample Site: KHSA-51  
 Sample Depth: 800  
 Sample Date: 9-Aug-16

Total Density (#/mL): 28,537  
 Total Biovolume (um<sup>3</sup>/mL): 37,177,346  
 Trophic State Index: 75.9

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	27,445	96.2	36,309,171	97.7
2 Fragilaria construens venter	219	0.8	10,488	0.0
3 Fragilaria construens	219	0.8	39,157	0.1
4 Stephanodiscus astraea minutula	131	0.5	45,887	0.1
5 Asterionella formosa	87	0.3	19,229	0.1
6 Fragilaria pinnata	87	0.3	5,244	0.0
7 Stephanodiscus niagarae	87	0.3	699,225	1.9
8 Nitzschia microcephala	44	0.2	4,370	0.0
9 Navicula cryptocephala	44	0.2	8,085	0.0
10 Nitzschia frustulum	44	0.2	5,244	0.0
11 Navicula cascadenis	44	0.2	2,622	0.0
12 Pinnularia sp.	44	0.2	17,481	0.0
13 Fragilaria capucina mesolepta	44	0.2	11,144	0.0

Aphanizomenon flos-aquae cells/mL = 576,336



**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample Site: KHSA-55  
 Sample Depth:  
 Sample Date: 9-Aug-16 715

Total Density (#/mL): 3,553  
 Total Biovolume (um<sup>3</sup>/mL): 931,714  
 Trophic State Index: 49.3

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Cryptomonas erosa	1,174	33.1	610,729	65.5
2 Ankistrodesmus falcatus	529	14.9	13,213	1.4
3 Nitzschia palea	499	14.0	89,848	9.6
4 Selenastrum minutum	264	7.4	5,285	0.6
5 Rhodomonas minuta	264	7.4	5,285	0.6
6 Chlamydomonas sp.	176	5.0	57,256	6.1
7 Scenedesmus quadricauda	176	5.0	42,369	4.5
8 Nitzschia paleacea	88	2.5	8,632	0.9
9 Nitzschia capitellata	59	1.7	21,141	2.3
10 Cyclotella meneghiniana	29	0.8	11,158	1.2
11 Achnanthes minutissima	29	0.8	1,468	0.2
12 Fragilaria construens	29	0.8	3,289	0.4
13 Fragilaria capucina mesolepta	29	0.8	7,487	0.8
14 Aphanizomenon flos-aquae	29	0.8	18,498	2.0
15 Gomphonema angustatum	29	0.8	5,285	0.6
16 Navicula cryptocephala	29	0.8	5,432	0.6
17 Asterionella formosa	29	0.8	6,460	0.7
18 Fragilaria construens venter	29	0.8	1,409	0.2
19 Caloneis ventricosa	29	0.8	7,194	0.8
20 Stephanodiscus astraea minutula	29	0.8	10,277	1.1

Aphanizomenon flos-aquae cells/mL = 294

### Phytoplankton Sample Analysis

**Sample:** Klamath Basin  
**Sample Site:** KHSA-62  
**Sample Depth:**  
**Sample Date:** 13-Sep-16                      830

**Total Density (#/mL):**                      2,663  
**Total Biovolume (um<sup>3</sup>/mL):**                      467,691  
**Trophic State Index:**                      44.4

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Ankistrodesmus falcatus	533	20.0	13,317	2.8
2 Fragilaria construens	444	16.7	49,717	10.6
3 Fragilaria construens venter	414	15.6	19,887	4.3
4 Cryptomonas erosa	266	10.0	138,496	29.6
5 Rhodomonas minuta	148	5.6	2,959	0.6
6 Synedra parasitica	118	4.4	16,572	3.5
7 Fragilaria capucina mesolepta	89	3.3	45,278	9.7
8 Navicula pupula	89	3.3	23,970	5.1
9 Stephanodiscus astraea minutula	59	2.2	20,715	4.4
10 Asterionella formosa	59	2.2	13,021	2.8
11 Navicula cryptocephala veneta	59	2.2	5,623	1.2
12 Melosira granulata	30	1.1	32,552	7.0
13 Fragilaria brevistriata	30	1.1	4,883	1.0
14 Nitzschia palea	30	1.1	5,327	1.1
15 Stephanodiscus hantzschii	30	1.1	3,551	0.8
16 Gomphonema angustatum	30	1.1	5,327	1.1
17 Fragilaria pinnata	30	1.1	1,776	0.4
18 Scenedesmus quadricauda	30	1.1	7,694	1.6
19 Selenastrum minutum	30	1.1	592	0.1
20 Achnanthes lanceolata	30	1.1	5,327	1.1
21 Sphaerocystis schroeteri	30	1.1	8,286	1.8
22 Amphora ovalis	30	1.1	17,105	3.7
23 Caloneis ventricosa minuta	30	1.1	8,286	1.8
24 Melosira ambigua	30	1.1	17,430	3.7

**Sample Depth:**  
**Sample Date:** 13-Sep-16 745

**Total Density (#/mL):** 9,187  
**Total Biovolume (um<sup>3</sup>/mL):** 2,652,270  
**Trophic State Index:** 56.9

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Rhodomonas minuta	3,062	33.3	61,247	2.3
2 Cryptomonas erosa	2,366	25.8	1,230,506	46.4
3 Stephanodiscus hantzschii	1,253	13.6	150,333	5.7
4 Ankistrodesmus falcatus	487	5.3	12,180	0.5
5 Scenedesmus quadricauda	348	3.8	108,574	4.1
6 Unidentified flagellate	278	3.0	5,568	0.2
7 Melosira granulata	209	2.3	803,866	30.3
8 Fragilaria construens venter	209	2.3	10,022	0.4
9 Sphaerocystis Schroeteri	139	1.5	48,719	1.8
10 Nitzschia palea	139	1.5	25,056	0.9
11 Cyclotella meneghiniana	139	1.5	52,895	2.0
12 Cocconeis placentula	70	0.8	32,015	1.2
13 Fragilaria construens	70	0.8	7,795	0.3
14 Nitzschia amphibia	70	0.8	6,681	0.3
15 Stephanodiscus astraea minutula	70	0.8	24,360	0.9
16 Amphora ovalis	70	0.8	40,228	1.5
17 Nitzschia paleacea	70	0.8	6,821	0.3
18 Navicula cryptocephala veneta	70	0.8	6,612	0.2
19 Navicula pupula	70	0.8	18,792	0.7

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample Site:** KHSA-73  
**Sample Depth:**  
**Sample Date:** 11-Oct-16 830

**Total Density (#/mL):** 688  
**Total Biovolume (um<sup>3</sup>/mL):** 138,398  
**Trophic State Index:** 35.6

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Rhodomonas minuta	155	22.5	3,090	2.2
2 Cryptomonas erosa	139	20.2	72,308	52.2
3 Ankistrodesmus falcatus	85	12.4	2,124	1.5
4 Fragilaria construens venter	77	11.2	4,450	3.2
5 Nitzschia palea	39	5.6	6,953	5.0
6 Asterionella formosa	31	4.5	6,798	4.9
7 Fragilaria construens	23	3.4	2,596	1.9
8 Nitzschia capitellata	23	3.4	8,343	6.0
9 Navicula cryptocephala veneta	15	2.2	1,468	1.1
10 Fragilaria capucina mesolepta	15	2.2	7,880	5.7
11 Stephanodiscus astraea minutula	15	2.2	5,408	3.9
12 Fragilaria brevistriata	8	1.1	1,275	0.9
13 Navicula cryptocephala	8	1.1	1,429	1.0
14 Navicula pupula	8	1.1	2,086	1.5
15 Nitzschia acicularis	8	1.1	2,163	1.6
16 Stephanodiscus hantzschii	8	1.1	927	0.7
17 Melosira ambigua	8	1.1	4,550	3.3
18 Nitzschia dissipata	8	1.1	2,078	1.5
19 Synedra parasitica	8	1.1	1,082	0.8
20 Gomphonema angustatum	8	1.1	1,391	1.0

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample Site:** KHSA-77  
**Sample Depth:**  
**Sample Date:** 11-Oct-16 1000

**Total Density (#/mL):** 4,838  
**Total Biovolume (um<sup>3</sup>/mL):** 1,637,245  
**Trophic State Index:** 53.4

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent	
1	Stephanodiscus hantzschii	1,353	28.0	162,360	9.9
2	Cryptomonas erosa	1,148	23.7	596,960	36.5
3	Ankistrodesmus falcatus	328	6.8	8,200	0.5
4	Cyclotella meneghiniana	246	5.1	93,480	5.7
5	Stephanodiscus astraea minutula	205	4.2	71,750	4.4
6	Asterionella formosa	205	4.2	54,120	3.3
7	Fragilaria construens venter	164	3.4	7,872	0.5
8	Nitzschia palea	164	3.4	29,520	1.8
9	Fragilaria construens	123	2.5	17,909	1.1
10	Nitzschia amphibia	82	1.7	7,872	0.5
11	Chlamydomonas sp.	82	1.7	26,650	1.6
12	Cocconeis placentula	82	1.7	37,720	2.3
13	Fragilaria vaucheria	41	0.8	11,808	0.7
14	Epithemia sorex	41	0.8	46,740	2.9
15	Gomphonema angustatum	41	0.8	7,380	0.5
16	Sphaerocystis schroeteri	41	0.8	22,960	1.4
17	Achnanthes lanceolata	41	0.8	7,380	0.5
18	Gomphonema subclavatum	41	0.8	24,600	1.5
19	Synedra parasitica	41	0.8	5,740	0.4
20	Rhodomonas minuta	41	0.8	820	0.1
21	Melosira granulata	41	0.8	270,600	16.5
22	Navicula cryptocephala veneta	41	0.8	3,895	0.2
23	Selenastrum minutum	41	0.8	820	0.1
24	Navicula minima	41	0.8	1,804	0.1
25	Fragilaria capucina mesolepta	41	0.8	10,455	0.6
26	Synedra radians	41	0.8	14,760	0.9
27	Synedra ulna	41	0.8	81,590	5.0
28	Nitzschia acicularis	41	0.8	11,480	0.7

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16090  
**Sample Depth:**  
**Sample Date:** 8-Jun-16 1650

**Total Density (#/mL):** 865  
**Total Biovolume (um<sup>3</sup>/mL):** 1,204,263  
**Trophic State Index:** 51.2

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Melosira granulata	664	76.8	1,132,365	94.0
2 Rhodomonas minuta	39	4.5	772	0.1
3 Nitzschia frustulum	31	3.6	4,448	0.4
4 Ankistrodesmus falcatus	23	2.7	579	0.0
5 Stephanodiscus hantzschii	23	2.7	2,780	0.2
6 Fragilaria vaucheria	15	1.8	4,448	0.4
7 Cryptomonas erosa	8	0.9	4,016	0.3
8 Melosira ambigua	8	0.9	18,194	1.5
9 Fragilaria capucina mesolepta	8	0.9	7,877	0.7
10 Asterionella formosa	8	0.9	3,398	0.3
11 Amphora perpusilla	8	0.9	1,282	0.1
12 Fragilaria crotonensis	8	0.9	19,461	1.6
13 Navicula viridula	8	0.9	3,475	0.3
14 Cyclotella stelligera	8	0.9	425	0.0
15 Nitzschia amphibia	8	0.9	741	0.1

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16091  
**Sample Depth:**  
**Sample Date:** 8-Jun-16 910

**Total Density (#/mL):** 717  
**Total Biovolume (um<sup>3</sup>/mL):** 812,305  
**Trophic State Index:** 48.3

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Melosira granulata	413	57.6	772,553	95.1
2 Rhodomonas minuta	172	24.0	3,443	0.4
3 Ankistrodesmus falcatus	52	7.2	1,291	0.2
4 Cryptomonas erosa	17	2.4	8,951	1.1
5 Cocconeis placentula	11	1.6	5,279	0.6
6 Synedra rumpens	11	1.6	1,607	0.2
7 Melosira ambigua	6	0.8	10,139	1.2
8 Stephanodiscus hantzschii	6	0.8	689	0.1
9 Sphaerocystis Schroeteri	6	0.8	3,213	0.4
10 Chromulina sp.	6	0.8	115	0.0
11 Asterionella formosa	6	0.8	3,787	0.5
12 Nitzschia amphibia	6	0.8	551	0.1
13 Nitzschia frustulum	6	0.8	689	0.1

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16096  
**Sample Depth:**  
**Sample Date:** 8-Jun-16 1330

**Total Density (#/mL):** 1,110  
**Total Biovolume (um<sup>3</sup>/mL):** 1,002,348  
**Trophic State Index:** 49.9

<b>Species</b>	<b>Density #/mL</b>	<b>Density Percent</b>	<b>Biovolume um<sup>3</sup>/mL</b>	<b>Biovolume Percent</b>
1 Melosira granulata	755	68.0	954,515	95.2
2 Rhodomonas minuta	199	18.0	3,990	0.4
3 Ankistrodesmus falcatus	78	7.0	1,951	0.2
4 Cryptomonas erosa	26	2.3	13,530	1.3
5 Stephanodiscus hantzschii	17	1.6	2,082	0.2
6 Nitzschia frustulum	9	0.8	1,041	0.1
7 Melosira ambigua	9	0.8	20,434	2.0
8 Stephanodiscus astraea minutula	9	0.8	3,036	0.3
9 Pediastrum duplex	9	0.8	1,769	0.2



**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16105  
**Sample Depth:**  
**Sample Date:** 20-Jun-16 1340

**Total Density (#/mL):** 541  
**Total Biovolume (um<sup>3</sup>/mL):** 388,941  
**Trophic State Index:** 43.0

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Cryptomonas erosa	170	31.4	88,347	22.7
2 Rhodomonas minuta	108	20.0	2,162	0.6
3 Ankistrodesmus falcatus	62	11.4	1,545	0.4
4 Melosira granulata	54	10.0	169,473	43.6
5 Melosira ambigua	15	2.9	40,938	10.5
6 Gomphonema subclavatum	15	2.9	9,267	2.4
7 Chromulina sp.	15	2.9	309	0.1
8 Cymbella minuta	8	1.4	2,857	0.7
9 Nitzschia paleacea	8	1.4	757	0.2
10 Stephanodiscus hantzschii	8	1.4	927	0.2
11 Asterionella formosa	8	1.4	13,592	3.5
12 Nitzschia frustulum	8	1.4	927	0.2
13 Dolichospermum flos-aquae	8	1.4	5,174	1.3
14 Nitzschia capitellata	8	1.4	2,780	0.7
15 Melosira varians	8	1.4	25,098	6.5
16 Cocconeis placentula	8	1.4	3,552	0.9
17 Chlamydomonas sp.	8	1.4	2,510	0.6
18 Navicula cryptocephala	8	1.4	1,429	0.4
19 Diatoma vulgare	8	1.4	15,136	3.9
20 Cocconeis klamathensis	8	1.4	2,162	0.6

Dolichospermum flos-aquae cells/mL = 77



**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16119  
**Sample Depth:**  
**Sample Date:** 12-Jul-16 1420

**Total Density (#/mL):** 1,626  
**Total Biovolume (um<sup>3</sup>/mL):** 258,437  
**Trophic State Index:** 40.1

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	928	57.1	74,235	28.7
2 Cryptomonas erosa	309	19.0	160,843	62.2
3 Rhodomonas minuta	220	13.5	4,390	1.7
4 Ankistrodesmus falcatus	80	4.9	1,996	0.8
5 Chlamydomonas sp.	40	2.5	12,971	5.0
6 Selenastrum minutum	10	0.6	200	0.1
7 Stephanodiscus hantzschii	10	0.6	1,197	0.5
8 Nitzschia amphibia	10	0.6	958	0.4
9 Schroederia sp.	10	0.6	449	0.2
10 Nitzschia frustulum	10	0.6	1,197	0.5

Microcystis aeruginosa cells/mL = 9,279

**Phytoplankton Sample**

**Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16815  
**Sample Depth:**  
**Sample Date:** 12-Jul-16 1655

**Total Density (#/mL):** 1,004  
**Total Biovolume (um<sup>3</sup>/mL):** 129,927  
**Trophic State Index:** 35.2

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	960	95.6	76,811	59.1
2 Dolichospermum flos-aquae	44	4.4	53,116	40.9

Microcystis aeruginosa cells/mL = 9,601  
 Dolichospermum flos-aquae cells/mL = 793

Note: Toxic Algae  
 Only

**Phytoplankton Sample**

**Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16816  
**Sample Depth:**  
**Sample Date:** 12-Jul-16 1500

**Total Density (#/mL):** 2,880  
**Total Biovolume (um<sup>3</sup>/mL):** 746,582  
**Trophic State Index:** 47.7

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	2,871	99.7	735,061	98.5
2 Aphanizomenon flos-aquae	9	0.3	11,522	1.5

Microcystis aeruginosa cells/mL = 91,883  
 Aphanizomenon flos-aquae cells/mL = 183

Note: Toxic Algae  
 Only

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16817  
**Sample Depth:**  
**Sample Date:** 12-Jul-16 1240

**Total Density (#/mL):** 1,852  
**Total Biovolume (um<sup>3</sup>/mL):** 3,110,901  
**Trophic State Index:** 58.0

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	1,160	62.6	111,333	3.6
2 Gloeotrichia echinulata	387	20.9	1,971,514	63.4
3 Dolichospermum flos-aquae	226	12.2	936,727	30.1
4 Aphanizomenon flos-aquae	81	4.3	91,328	2.9

Microcystis aeruginosa cells/mL = 13,917  
 Gloeotrichia echinulata cells/mL = 28,993  
 Dolichospermum flos-aquae cells/mL = 13,981  
 Aphanizomenon flos-aquae cells/mL = 1,450

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16818  
**Sample Depth:**  
**Sample Date:** 12-Jul-16 1230

**Total Density (#/mL):** 1,058  
**Total Biovolume (um<sup>3</sup>/mL):** 1,526,006  
**Trophic State Index:** 52.9

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Gloeotrichia echinulata	445	42.0	1,089,027	71.4
2 Microcystis aeruginosa	337	31.9	32,398	2.1
3 Aphanizomenon flos-aquae	261	24.6	394,303	25.8
4 Dolichospermum flos-aquae	15	1.4	10,278	0.7

Microcystis aeruginosa cells/mL = 4,050  
 Gloeotrichia echinulata cells/mL = 16,015  
 Aphanizomenon flos-aquae cells/mL = 6,259  
 Dolichospermum flos-aquae cells/mL = 153

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16137  
**Sample Depth:**  
**Sample Date:** 10-Aug-16 1030

**Total Density (#/mL):** 4,667  
**Total Biovolume (um<sup>3</sup>/mL):** 605,249  
**Trophic State Index:** 46.2

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	3,422	73.3	301,115	49.8
2 Nitzschia palea	1,043	22.4	187,804	31.0
3 Ankistrodesmus falcatus	45	1.0	1,122	0.2
4 Chlamydomonas sp.	45	1.0	14,585	2.4
5 Gloeotrichia echinulata	45	1.0	54,928	9.1
6 Aphanizomenon flos-aquae	34	0.7	36,046	6.0
7 Sphaerocystis Schroeteri	11	0.2	3,141	0.5
8 Cocconeis placentula	11	0.2	5,161	0.9
9 Nitzschia frustulum	11	0.2	1,346	0.2

Microcystis aeruginosa cells/mL = 37,639  
 Aphanizomenon flos-aquae cells/mL = 572  
 Gloeotrichia echinulata cells/mL = 808



**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample ID: KR16142  
 Sample Depth:  
 Sample Date: 11-Aug-16 930

Total Density (#/mL): 21,752  
 Total Biovolume (um<sup>3</sup>/mL): 2,973,256  
 Trophic State Index: 57.7

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	18,746	86.2	1,649,617	55.5
2 Nitzschia palea	2,301	10.6	414,184	13.9
3 Aphanizomenon flos-aquae	644	3.0	852,390	28.7
4 Cryptomonas erosa	31	0.1	15,954	0.5
5 Dolichospermum flos-aquae	31	0.1	41,112	1.4

Microcystis aeruginosa cells/mL = 206,202  
 Aphanizomenon flos-aquae cells/mL = 13,530  
 Dolichospermum flos-aquae cells/mL = 614

**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample ID: KR16825  
 Sample Depth:  
 Sample Date: 10-Aug-16 1620

Total Density (#/mL): 961,691  
 Total Biovolume (um<sup>3</sup>/mL): 183,059,574  
 Trophic State Index: 87.4

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	902,000	93.8	129,888,000	71.0
2 Gloeotrichia echinulata	53,059	5.5	46,904,000	25.6
3 Aphanizomenon flos-aquae	6,632	0.7	6,267,574	3.4

Microcystis aeruginosa cells/mL = 16,236,000  
 Gloeotrichia echinulata cells/mL = 689,765  
 Aphanizomenon flos-aquae cells/mL = 99,485

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample ID: KR16826  
 Sample Depth:  
 Sample Date: 11-Aug-16 900

Total Density (#/mL): 1,678,311  
 Total Biovolume (um<sup>3</sup>/mL): 203,938,873  
 Trophic State Index: 88.2

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	1,628,406	97.0	169,354,197	83.0
2 Aphanizomenon flos-aquae	49,906	3.0	34,584,676	17.0

Microcystis aeruginosa cells/mL = 21,169,275  
 Aphanizomenon flos-aquae cells/mL = 548,963

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample ID: KR16827  
 Sample Depth:  
 Sample Date: 10-Aug-16 1310

Total Density (#/mL): 338,787  
 Total Biovolume (um<sup>3</sup>/mL): 30,442,500  
 Trophic State Index: 74.5

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	338,250	99.8	29,766,000	97.8
2 Aphanizomenon flos-aquae	537	0.2	676,500	2.2

Microcystis aeruginosa cells/mL = 3,720,750  
 Aphanizomenon flos-aquae cells/mL = 10,738

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample Site:** KR16828  
**Sample Depth:**  
**Sample Date:** 10-Aug-16 1245

**Total Density (#/mL):** 49,281  
**Total Biovolume (um<sup>3</sup>/mL):** 23,655,099  
**Trophic State Index:** 72.7

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	49,281	100.0	23,655,099	100.0

Microcystis aeruginosa cells/mL = 2,956,887

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

Klamath  
**Sample:** Basin  
**Sample ID:** KR16160  
**Sample Depth:**  
**Sample Date:** 6-Sep-16 1220

**Total Density (#/mL):** 2,457  
**Total Biovolume (um<sup>3</sup>/mL):** 2,312,923  
**Trophic State Index:** 55.9

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	1,503	61.2	2,178,330	94.2
2 Microcystis aeruginosa	662	26.9	58,249	2.5
3 Ankistrodesmus falcatus	79	3.2	1,963	0.1
4 Cryptomonas erosa	67	2.7	35,003	1.5
5 Nitzschia palea	67	2.7	12,116	0.5
6 Chlamydomonas sp.	22	0.9	7,292	0.3
7 Dolichospermum flos-aquae	22	0.9	15,033	0.6
8 Sphaerocystis Schroeteri	22	0.9	4,712	0.2
9 Rhodomonas minuta	11	0.5	224	0.0

Microcystis aeruginosa cells/mL = 7,281  
 Aphanizomenon flos-aquae cells/mL = 34,577  
 Dolichospermum flos-aquae cells/mL = 224

**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample ID: KR16165  
 Sample Depth: 1000  
 Sample Date: 7-Sep-16

Total Density (#/mL): 957  
 Total Biovolume (um<sup>3</sup>/mL): 1,124,491  
 Trophic State Index: 50.7

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	592	61.9	783,402	69.7
2 Rhodomonas minuta	170	17.8	3,407	0.3
3 Cryptomonas erosa	57	5.9	29,526	2.6
4 Dolichospermum flos-aquae	41	4.2	217,388	19.3
5 Nitzschia palea	24	2.5	4,380	0.4
6 Melosira granulata	24	2.5	80,304	7.1
7 Rhoicosphenia curvata	8	0.8	949	0.1
8 Meridion circulare	8	0.8	3,123	0.3
9 Fragilaria construens	8	0.8	908	0.1
10 Kephyrion sp.	8	0.8	511	0.0
11 Fragilaria construens venter	8	0.8	389	0.0
12 Ankistrodesmus falcatus	8	0.8	203	0.0

Aphanizomenon flos-aquae cells/mL = 12,435

Dolichospermum flos-aquae cells/mL = 3,245

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16835  
**Sample Depth:**  
**Sample Date:** 6-Sep-16 1950

**Total Density (#/mL):** 55,957  
**Total Biovolume (um<sup>3</sup>/mL):** 13,526,607  
**Trophic State Index:** 68.6

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	46,718	83.5	5,232,435	38.7
2 Aphanizomenon flos-aquae	9,083	16.2	8,010,888	59.2
3 Dolichospermum flos-aquae	157	0.3	283,284	2.1

Microcystis aeruginosa cells/mL = 654,054  
 Aphanizomenon flos-aquae cells/mL = 127,157  
 Dolichospermum flos-aquae cells/mL = 4,228

Note: Toxic Algae Only



**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16836  
**Sample Depth:**  
**Sample Date:** 6-Sep-16 1920

**Total Density (#/mL):** 303,545  
**Total Biovolume (um<sup>3</sup>/mL):** 304,948,928  
**Trophic State Index:** 91.1

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	300,667	99.1	303,072,000	99.4
2 Microcystis aeruginosa	2,239	0.7	591,098	0.2
3 Dolichospermum flos-aquae	640	0.2	1,285,830	0.4

Aphanizomenon flos-aquae cells/mL = 4,810,667

Microcystis aeruginosa cells/mL = 73,887

Dolichospermum flos-aquae cells/mL = 19,191

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

Klamath  
**Sample:** Basin  
**Sample ID:** KR16837  
**Sample Depth:**  
**Sample Date:** 6-Sep-16 1835

**Total Density (#/mL):** 112,247  
**Total Biovolume (um<sup>3</sup>/mL):** 26,558,665  
**Trophic State Index:** 73.5

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	111,743	99.6	25,924,446	97.6
2 Aphanizomenon flos-aquae	503	0.4	634,219	2.4

Microcystis aeruginosa cells/mL = 3,240,556  
 Aphanizomenon flos-aquae cells/mL = 10,067

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

Klamath  
**Sample:** Basin  
**Sample ID:** KR16838  
**Sample Depth:**  
**Sample Date:** 6-Sep-16 1800

**Total Density (#/mL):** 91,779  
**Total Biovolume (um<sup>3</sup>/mL):** 9,434,920  
**Trophic State Index:** 66.0

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	89,524	97.5	7,161,880	75.9
2 Aphanizomenon flos-aquae	2,255	2.5	2,273,040	24.1

Microcystis aeruginosa cells/mL = 895,235  
 Aphanizomenon flos-aquae cells/mL = 36,080

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

Klamath  
**Sample:** Basin  
**Sample ID:** KR16839  
**Sample Depth:**  
**Sample Date:** 7-Sep-16 1210

**Total Density (#/mL):** 172  
**Total Biovolume (um<sup>3</sup>/mL):** 162,670  
**Trophic State Index:** 36.8

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	172	100.0	162,670	100.0

Aphanizomenon flos-aquae cells/mL = 2,582

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16188  
**Sample Depth:**  
**Sample Date:** 11-Oct-16 1310

**Total Density (#/mL):** 4,510  
**Total Biovolume (um<sup>3</sup>/mL):** 4,772,172  
**Trophic State Index:** 61.1

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	3,354	74.4	4,226,434	88.6
2 Chlamydomonas sp.	733	16.3	238,184	5.0
3 Rhodomonas minuta	141	3.1	2,819	0.1
4 Nitzschia palea	85	1.9	15,221	0.3
5 Cryptomonas erosa	75	1.7	39,087	0.8
6 Ankistrodesmus falcatus	38	0.8	940	0.0
7 Microcystis aeruginosa	28	0.6	24,805	0.5
8 Fragilaria crotonensis	19	0.4	205,205	4.3
9 Dolichospermum flos-aquae	19	0.4	15,109	0.3
10 Navicula cryptocephala veneta	9	0.2	893	0.0
11 Cymbella minuta	9	0.2	3,476	0.1

Aphanizomenon flos-aquae cells/mL = 67,086  
 Microcystis aeruginosa cells/mL = 3,101  
 Dolichospermum flos-aquae cells/mL = 226

**Phytoplankton Sample**

**Analysis**

**Sample:** Klamath Basin  
**Sample ID:** KR16845  
**Sample Depth:**  
**Sample Date:** 11-Oct-16 1430

**Total Density (#/mL):** 5,709  
**Total Biovolume (um<sup>3</sup>/mL):** 954,473  
**Trophic State Index:** 49.5

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	5,638	98.7	541,200	56.7
2 Dolichospermum flos-aquae	72	1.3	413,273	43.3

Microcystis aeruginosa cells/mL = 67,650  
 Dolichospermum flos-aquae cells/mL = 6,168

Note: Toxic Algae  
 Only

**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample ID: KR16846  
 Sample Depth:  
 Sample Date: 11-Oct-16 1230

Total Density (#/mL): 19,007,276  
 Total Biovolume (um<sup>3</sup>/mL): 2,864,562,105  
 Trophic State Index: 107.3

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Microcystis aeruginosa	14,497,276	76.3	1,159,782,105	40.5
2 Aphanizomenon flos-aquae	4,510,000	23.7	1,704,780,000	59.5

Aphanizomenon flos-aquae cells/mL = 27,060,000

Microcystis aeruginosa cells/mL = 144,972,763

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

Klamath  
**Sample:** Basin  
**Sample ID:** KR16848  
**Sample Depth:**  
**Sample Date:** 11-Oct-16 1115

**Total Density (#/mL):** 850  
**Total Biovolume (um<sup>3</sup>/mL):** 818,802  
**Trophic State Index:** 48.4

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	604	71.1	799,116	97.6
2 Microcystis aeruginosa	246	28.9	19,687	2.4

Microcystis aeruginosa cells/mL = 2,461  
 Aphanizomenon flos-aquae cells/mL = 12,684

Note: Toxic Algae Only



**Phytoplankton Sample Analysis**

Klamath  
**Sample:** Basin  
**Sample ID:** KR16849  
**Sample Depth:**  
**Sample Date:** 11-Oct-16 1040

**Total Density (#/mL):** 142  
**Total Biovolume (um<sup>3</sup>/mL):** 161,438  
**Trophic State Index:** 36.7

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	142	100.0	161,438	100.0

Aphanizomenon flos-aquae cells/mL = 2,563

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

Klamath  
**Sample:** Basin  
**Sample ID:** KR16183  
**Sample Depth:**  
**Sample Date:** 25-Oct-16 930

**Total Density (#/mL):** 974  
**Total Biovolume (um<sup>3</sup>/mL):** 1,049,824  
**Trophic State Index:** 50.2

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	641	65.8	928,266	88.4
2 Nitzschia palea	120	12.3	21,525	2.1
3 Nitzschia frustulum	34	3.5	4,100	0.4
4 Cryptomonas erosa	26	2.6	13,325	1.3
5 Cocconeis placentula	26	2.6	11,788	1.1
6 Fragilaria construens venter	26	2.6	36,900	3.5
7 Fragilaria construens	26	2.6	13,489	1.3
8 Synedra rumpens	17	1.8	2,392	0.2
9 Rhodomonas minuta	9	0.9	171	0.0
10 Asterionella formosa	9	0.9	1,879	0.2
11 Fragilaria capucina mesolepta	9	0.9	2,178	0.2
12 Gomphonema subclavatum	9	0.9	5,125	0.5
13 Stephanodiscus astraea minutula	9	0.9	2,990	0.3
14 Melosira granulata	9	0.9	4,698	0.4
15 Rhoicosphenia curvata	9	0.9	999	0.1

Aphanizomenon flos-aquae cells/mL = 14,734

**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample Site: UKHP  
 Sample Depth:  
 Sample Date: 28-Jun-16 1134

Total Density (#/mL): 3,341,500  
 Total Biovolume (um<sup>3</sup>/mL): 2,736,688,500  
 Trophic State Index: 106.9

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	3,341,500	100.0	2,736,688,500	100.0

Aphanizomenon flos-aquae cells/mL = 43,439,500

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample Site: UKMP  
 Sample Depth:  
 Sample Date: 26-Jul-16 1314

Total Density (#/mL): 45,100  
 Total Biovolume (um<sup>3</sup>/mL): 68,191,200  
 Trophic State Index: 80.3

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	45,100	100.0	68,191,200	100.0

Aphanizomenon flos-aquae cells/mL = 1,082,400

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample Site:** UKHP  
**Sample Depth:**  
**Sample Date:** 26-Jul-16 1208

**Total Density (#/mL):** 1,482,357  
**Total Biovolume (um<sup>3</sup>/mL):** 1,299,566,988  
**Trophic State Index:** 101.6

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	1,186,934	80.1	1,271,206,430	97.8
2 Microcystis aeruginosa	295,422	19.9	28,360,558	2.2

Aphanizomenon flos-aquae cells/mL = 20,177,880

Microcystis aeruginosa cells/mL = 3,545,070

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample Site: UKEP  
 Sample Depth:  
 Sample Date: 26-Jul-16 1234

Total Density (#/mL): 6,839  
 Total Biovolume (um<sup>3</sup>/mL): 9,478,763  
 Trophic State Index: 66.1

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	6,839	100.0	9,478,763	100.0

Aphanizomenon flos-aquae cells/mL = 150,457

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

**Sample:** Klamath Basin  
**Sample Site:** UKHP  
**Sample Depth:**  
**Sample Date:** 30-Aug-16 1233

**Total Density (#/mL):** 1,071  
**Total Biovolume (um<sup>3</sup>/mL):** 94,209  
**Trophic State Index:** 32.9

<b>Species</b>	<b>Density #/mL</b>	<b>Density Percent</b>	<b>Biovolume um<sup>3</sup>/mL</b>	<b>Biovolume Percent</b>
-	-	-	-	-
1 Microcystis aeruginosa	1,071	100.0	94,209	100.0

Microcystis aeruginosa cells/mL = 11,776

Note: Toxic Algae Only

**Phytoplankton Sample Analysis**

Sample: Klamath Basin  
 Sample Site: UKMP  
 Sample Depth:  
 Sample Date: 25-Oct-16 1122

Total Density (#/mL): 5  
 Total Biovolume (um<sup>3</sup>/mL): 5,381  
 Trophic State Index: 13.4

Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	5	100.0	5,381	100.0

Aphanizomenon flos-aquae cells/mL = 85

Note: Toxic Algae Only