EPA’s Draft Aluminum Criteria

Published: July 28, 2017

Comments Due: Sept. 20, 2017

1988 Aluminum Criteria

- Acute criteria = 750 *u*g/L (1 hour exposure)
- Chronic criteria = 87 *u*g/L (4 day exposure)
- Not adopted as a water quality objective
  - Not in Santa Ana Basin Plan
  - Not in California Toxics Rule or National Toxics Rule
  - Sometimes used as narrative translator (ex. 303d)
- Many known problems with the 1988 criteria

2017 Draft Aluminum Criteria

- Variable criteria, adjusted for:
  - pH
  - Hardness
  - Dissolved Organic Carbon (DOC)
- EPA provides spreadsheet tool to calculate **<u>Total Recoverable Aluminum</u>** concentration
- Not binding until the state approves the criteria as a water quality standard.

Comparison: New vs. Old

Table 1: 2017 Draft Aluminum Aquatic Life Criteria Compared to Current 1988 Criteria[a]

Version	**Freshwater Acute** (1 day, total aluminum)	**Freshwater Chronic** (4-day, total aluminum)
2017 Draft AWQC Criteria (MLR normalized to pH = 7, hardness = 100 mg/L, DOC = 1 mg/L)	1,400 µg/L	390 µg/L
1988 AWQC Criteria (pH 6.5 – 9.0, across all hardness and DOC ranges)	750 µg/L	87 µg/L

[a] Values are recommended not to be exceeded more than once every three years on average.
Note: Values will be different under differing water chemistry conditions as identified in this document.

U.S. EPA. Fact Sheet: Draft Aquatic Life Ambient Water Quality Criteria for Aluminum in Freshwaters. July, 2017

Alum Application Program

- Alum (aluminum sulfate) is 9% aluminum
- 40 mg/L of Alum = 3,600 *u*g/L of aluminum

  (40 mg/L (ppm) = 40,000 *u*g/L (ppb)
- Binds with phosphorus to form aluminum phosphate (inert and insoluble)
- Site-specific testing demonstrated that alum was <u>not</u> <u>toxic</u> in Canyon Lake water

Estimated Criteria for Canyon Lake

EPA Spreadsheet Tool*	ACUTE (CMC)	CHRONIC (CCC)
Constrained Input Values *pH=8.2, Hardness=150, DOC=5.0*	4,400 ug/L	2,300 ug/L
Unconstrained Input Values *pH=8.2, Hardness=300, DOC=20.0*	8,000 ug/L	2,800 ug/L
Table K-7 & Table K-8 Values (draft) *Ph=8.0, Hardness=300, DOC=5.0*	4,700 ug/L	2,000 ug/L

EPA advises discretion in applying spreadsheet tool when site-specific input values are outside the range of values used to develop the model equation.

**EPA Aluminum Criteria Calculator V.1.0.xlsx*

Focus of Comment Letter

- Develop separate warm & cold water criteria.
- Expand model domain to include higher hardness values (>150 mg/L) common to arid west waters.
- Expand model domain to include higher DOC values (>5 mg/L) common in warm water lakes.
- Affirm ability to use the Water Effects Ratio (WER) procedure to develop site-specific aluminum criteria.
- Special consideration/exception for Alum applications; at a minimum, only the acute criteria should be applied to applications made in accordance with label.

Lake Elsinore and Canyon Lake TMDL Water Quality Monitoring Update – 2016-17 Summary

amec foster wheeler

ALTA ENVIRONMENTAL

August 15, 2017

Lake Elsinore and Canyon Lake TMDL Water Quality Monitoring Update – 2016-17 Summary

Watershed Monitoring

Summary of 2016-2017 Watershed Monitoring and Nutrient Loads

Number and Location Description	Annual Flow (Mgal)	Annual Event Mean Storm Concentration (mg/L)		Estimated Annual Load (kg)	
		Total Nitrogen	Total Phosphorus	Total Nitrogen	Total Phosphorus
Site 3 - Salt Creek at Murrieta Road	1,596	2.07	0.62	12,366	4,026
Site 4 - San Jacinto River at Goetz	2,802	2.03	1.23	21,651	14,403
Site 6 - San Jacinto River at Ramona Expressway	0	-	-	-	-
Site 30 - Canyon Lake Spillway	4,850	1.85	0.36	33,759	6,637
Site 1 - San Jacinto River at Cranston Guard Station	6,194	Not Measured	Not Measured	Not Measured	Not Measured

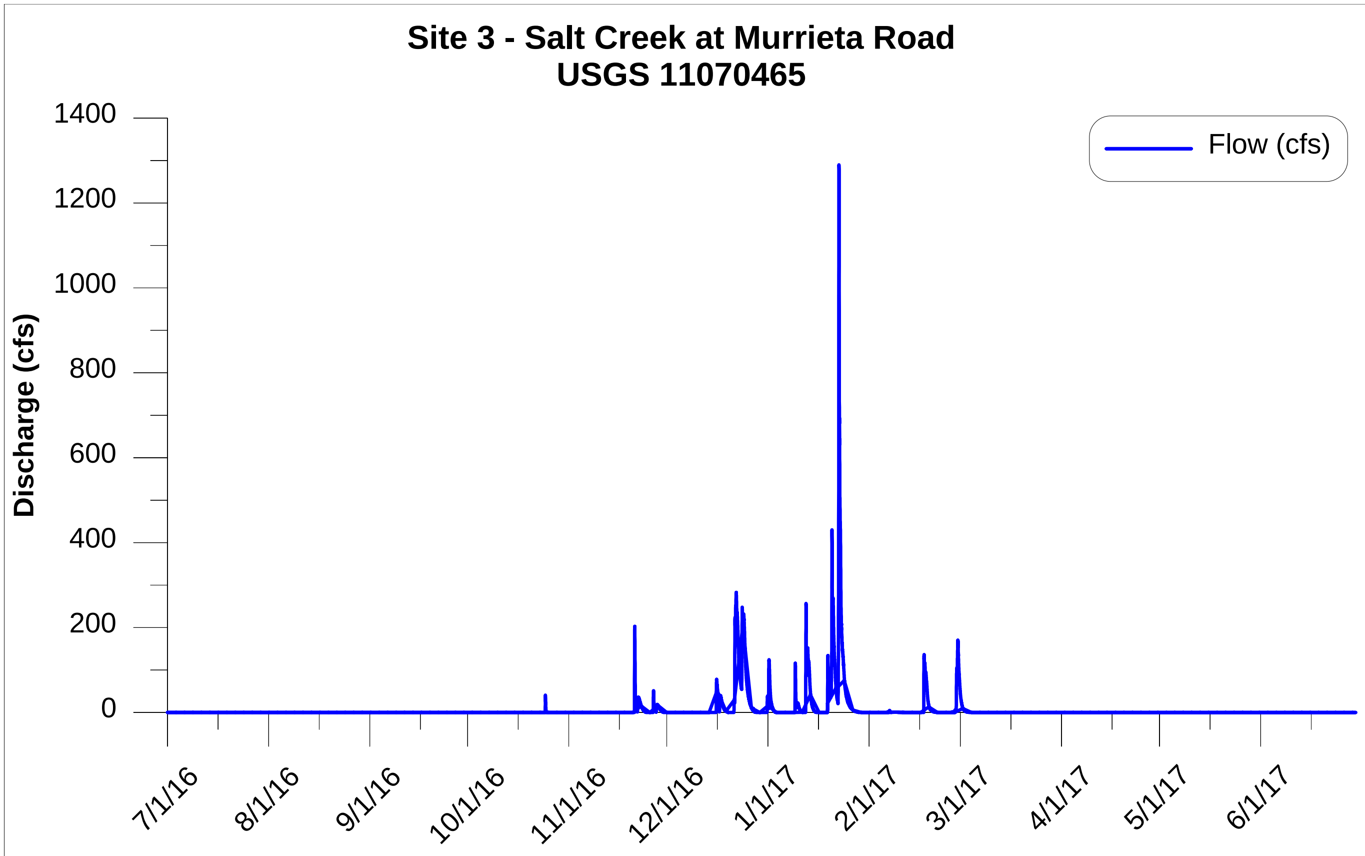
Summary of 2016-2017 Monthly Flow

Mean Monthly Flow (cfs)	Site 3 - Salt Creek	Site 4 - San Jacinto River	Site 6 - San Jacinto River at Ramona Expressway	Site 30 - Canyon Lake Spillway	Site 1 - San Jacinto River at Cranston Guard Station
July	0.00	0.00	-	3.10	0.05
August	0.00	0.00	-	2.89	0.03
September	0.00	0.00	-	0.16	0.01
October	0.17	0.00	-	0.15	0.02
November	3.67	3.01	-	0.67	0.05
December	23.51	32.95	-	25.80	14.41
January	43.55	90.61	-	176.06	72.75
February	9.01	14.48	-	25.04	125.53
March	0.73	0.31	-	6.39	86.86
April	0.00	0.00	-	1.03	15.60
May	0.00	0.00	-	2.98	5.71
June	0.00	0.00	-	0.27	0.84
Mean Annual Flow (cfs)	**6.98**	**12.26**	**-**	**20.56**	**27.77**

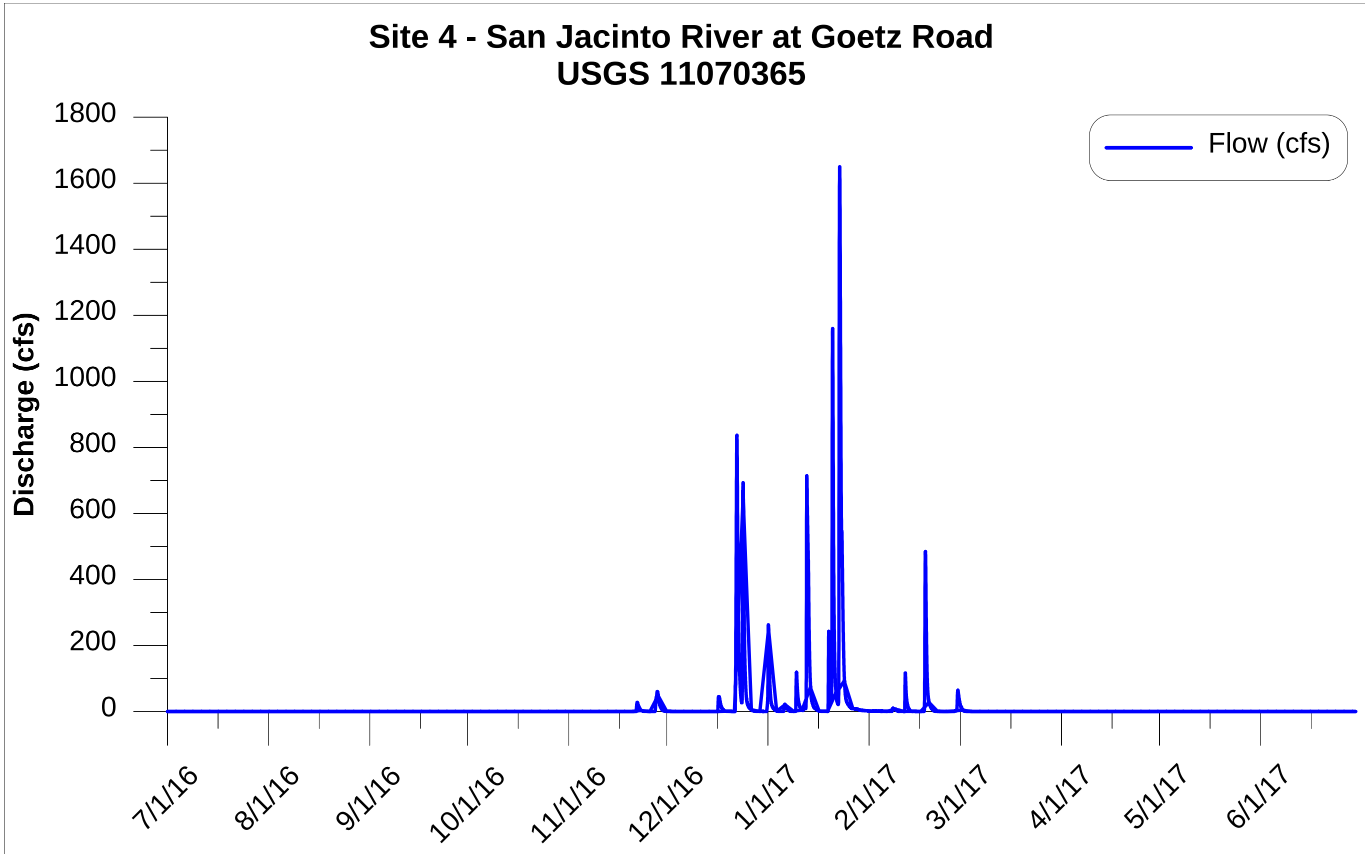
Summary of 2016-2017 Rainfall

Monthly Rainfall (inches)	Lake Elsinore	Perris CDF	Pigeon Pass	Hemet / San Jacinto	Winchester
Jul	0.00	0.00	0.00	0.00	0.00
Aug	0.00	0.00	0.00	0.00	0.00
Sep	0.08	0.08	0.00	0.16	0.12
Oct	0.24	0.35	0.78	0.34	0.28
Nov	0.98	0.90	1.35	1.09	1.03
Dec	3.60	3.21	3.94	3.20	3.17
Jan	6.68	6.04	6.78	6.23	4.86
Feb	3.02	2.06	2.61	2.86	2.31
Mar	0.03	0.02	0.16	0.21	0.06
Apr	0.02	0.00	0.02	0.00	0.00
May	0.27	0.06	0.26	0.25	0.08
Jun	0.00	0.00	0.00	0.00	0.02
Annual Rainfall (Inches)	**14.92**	**12.72**	**15.90**	**14.34**	**11.93**

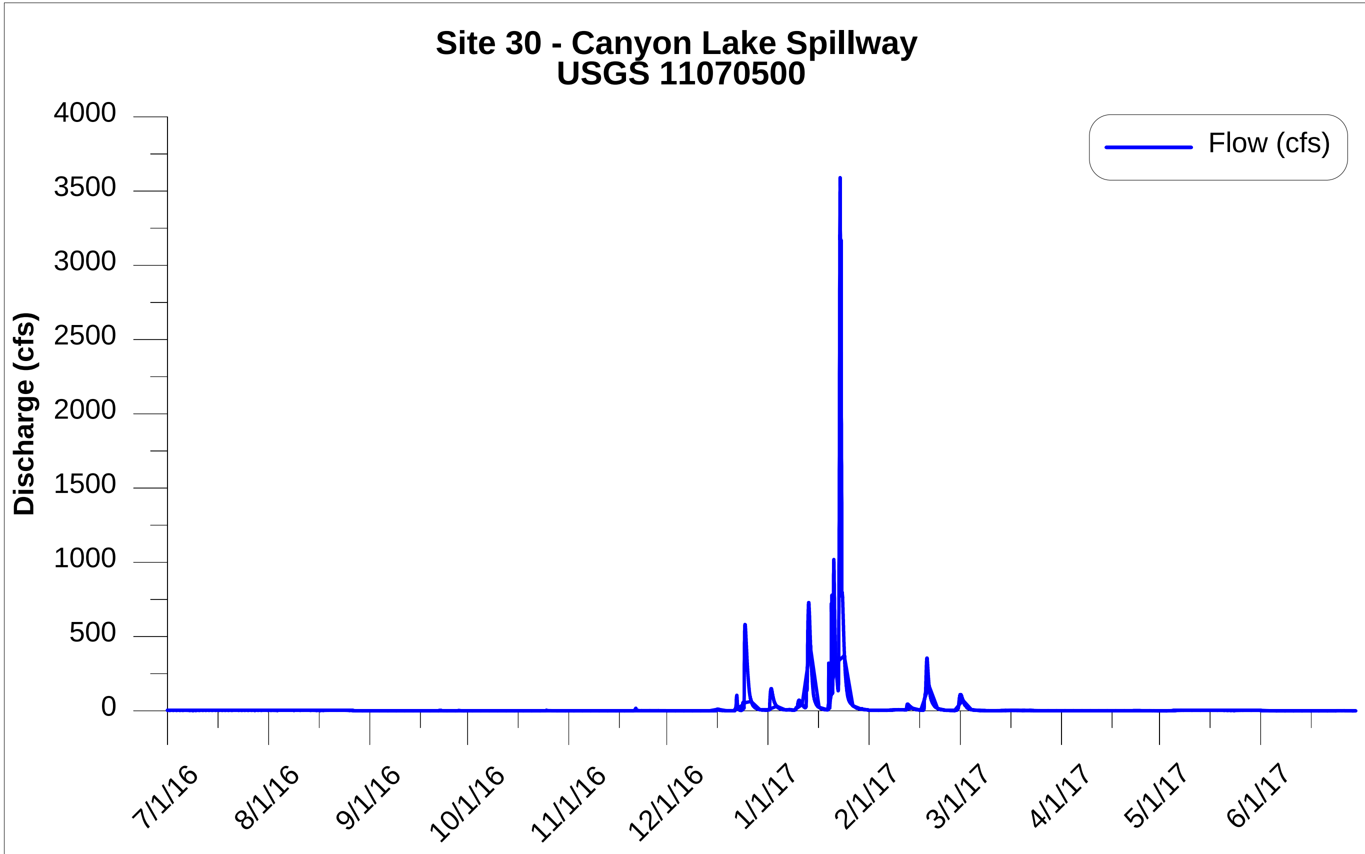
2016-2017 Annual Hydrograph



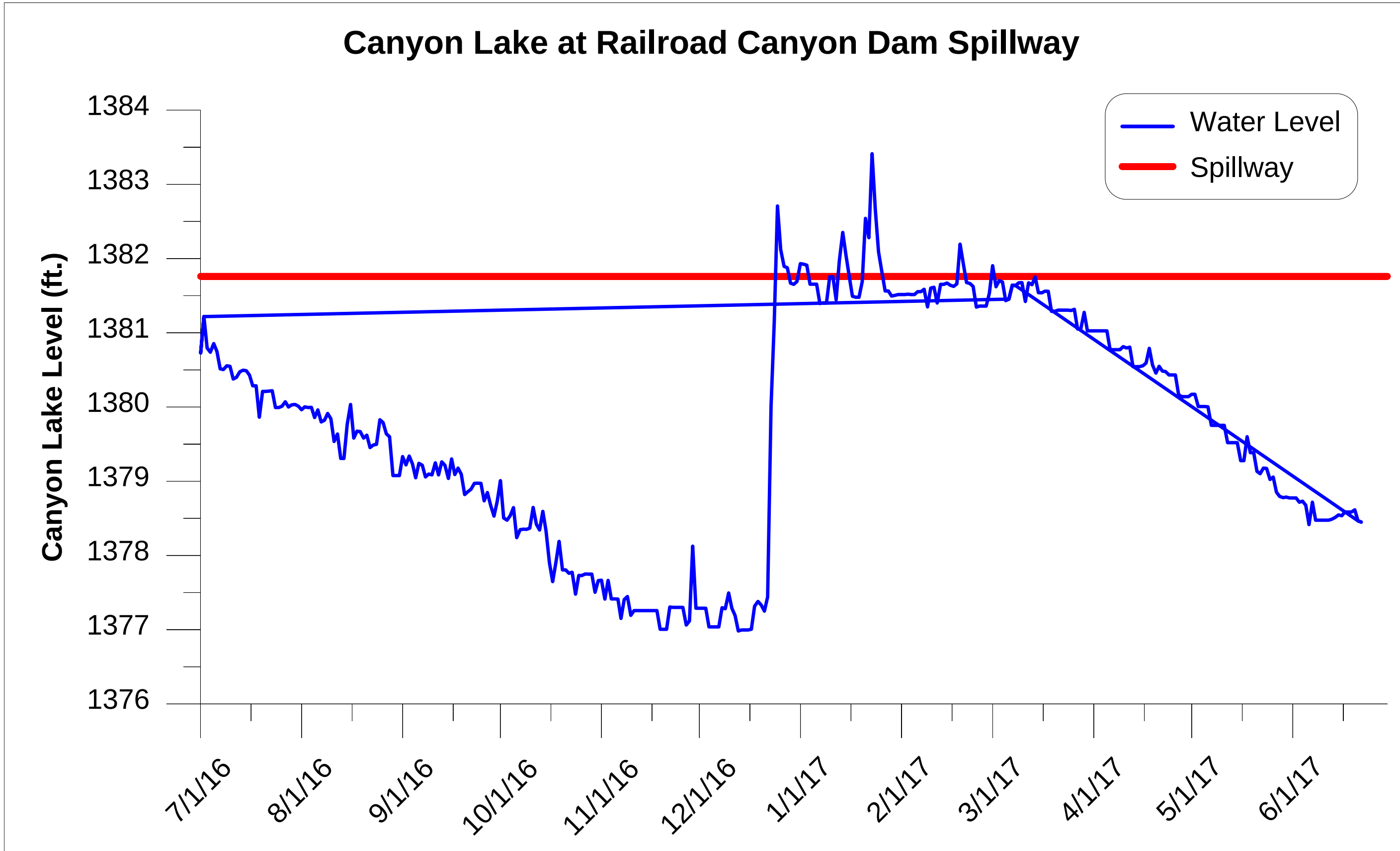
2016-2017 Annual Hydrograph



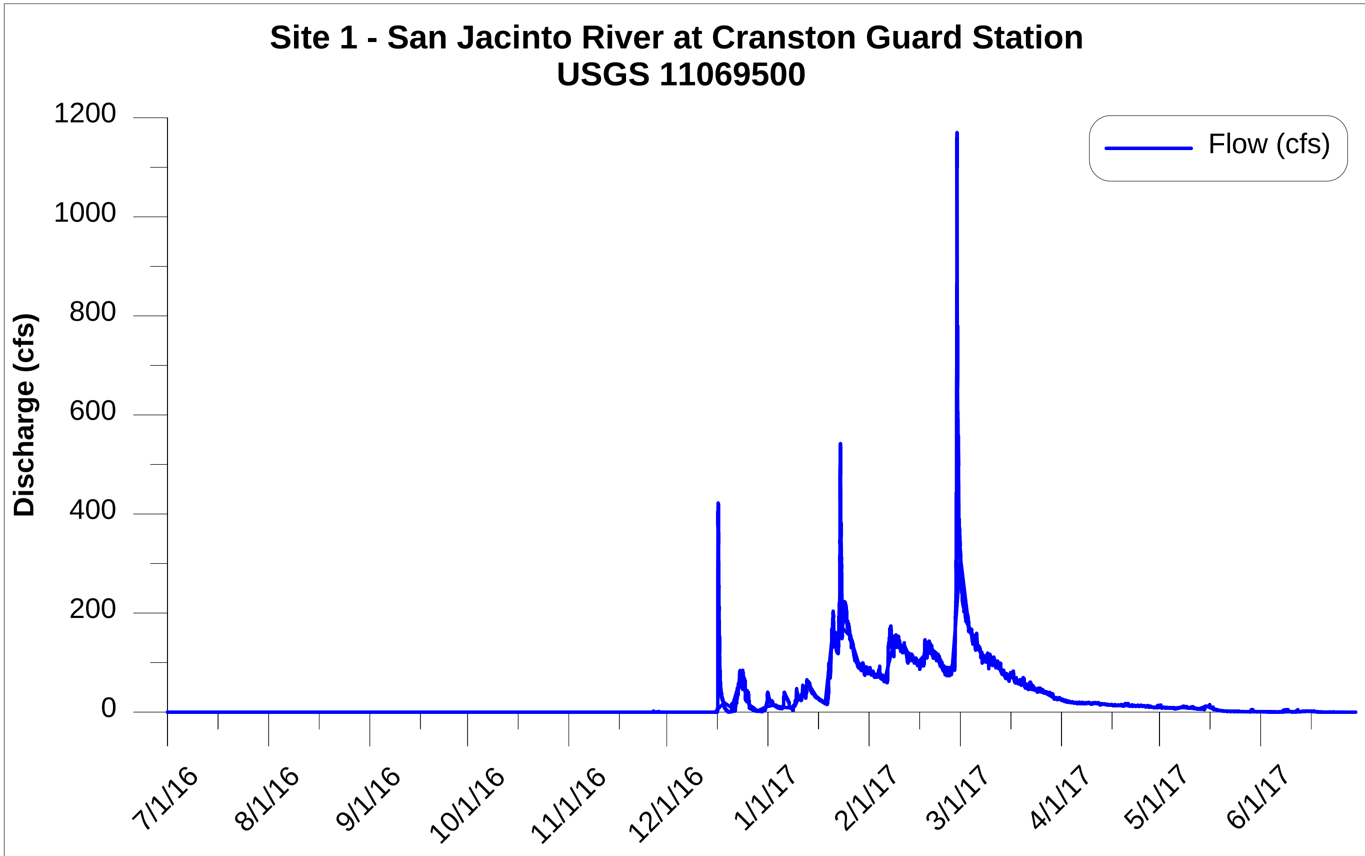
2016-2017 Annual Hydrograph

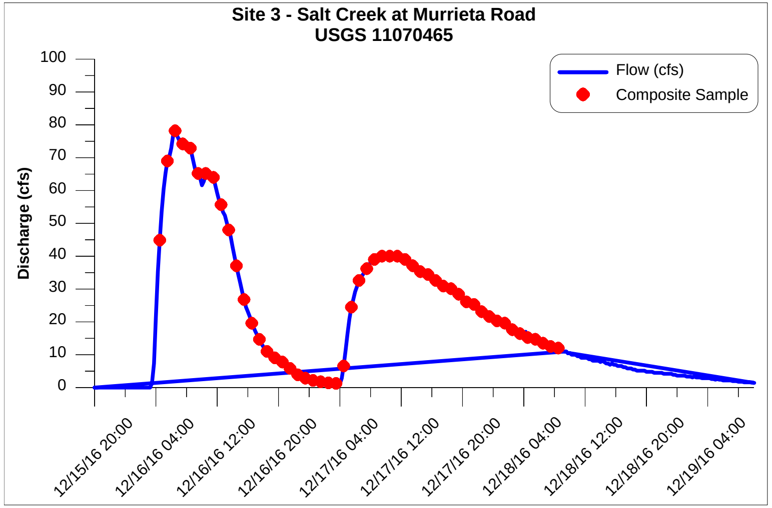


2016-2017 Annual Hydrograph



2016-2017 Annual Hydrograph



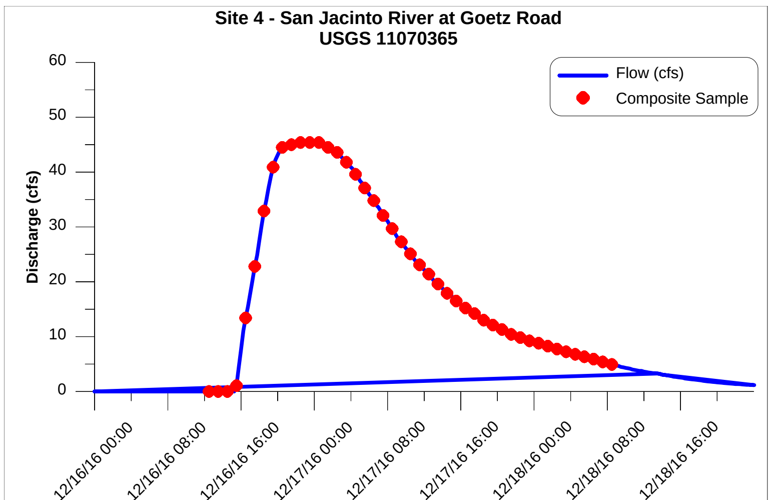


Wet Event #1

December 16-18, 2016

Rainfall: 0.43 to 0.78 inches

Sites: Salt Creek and San Jacinto

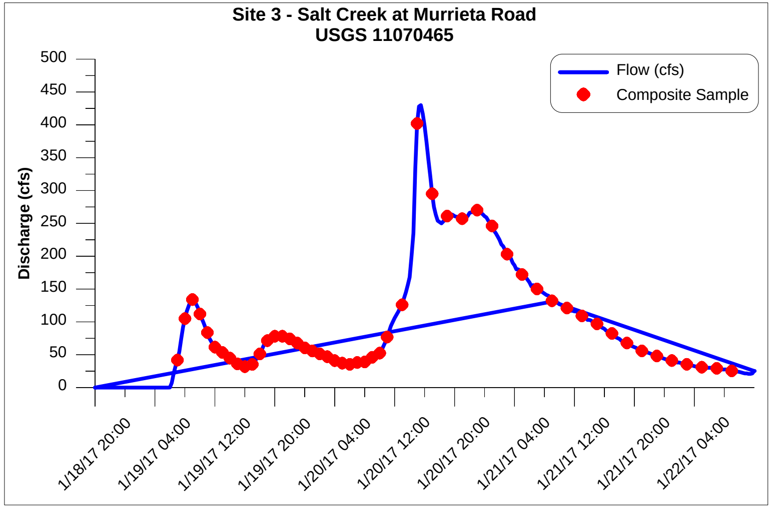


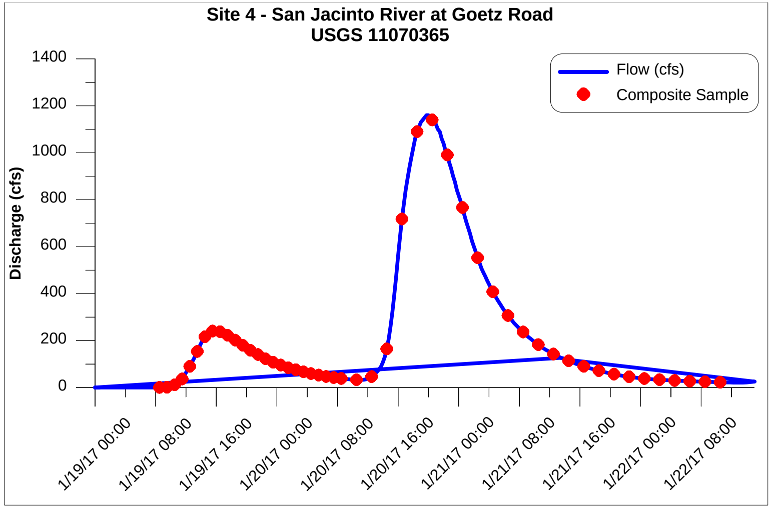
Wet Event #2

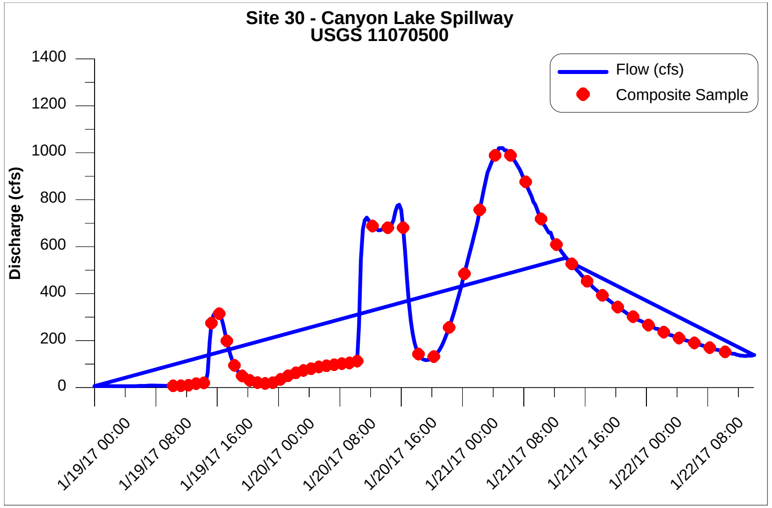
January 19-22, 2017

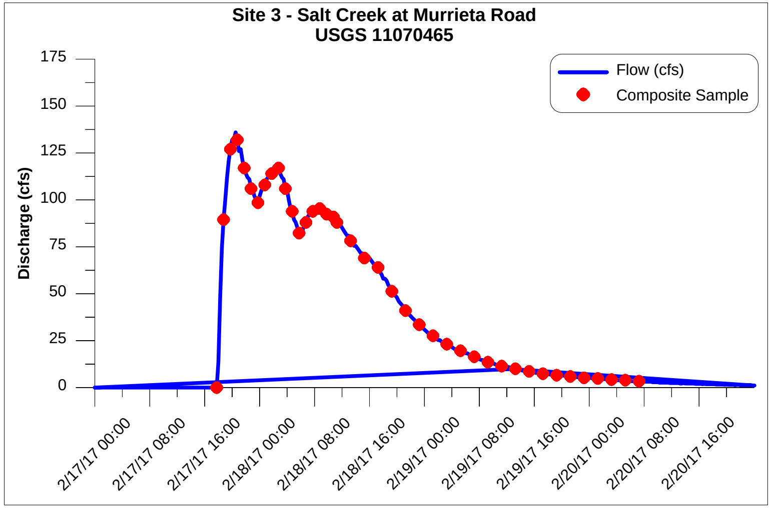
Rainfall: 1.32 to 2.0 inches

Sites: Salt Creek, San Jacinto, and Canyon Lake







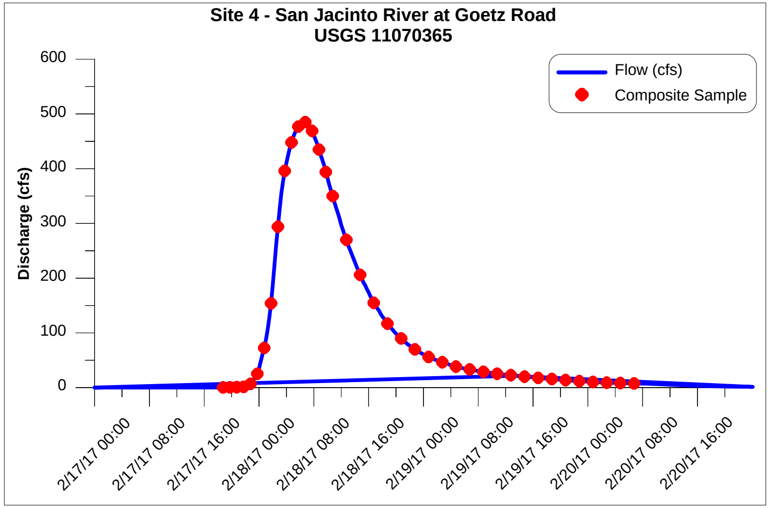


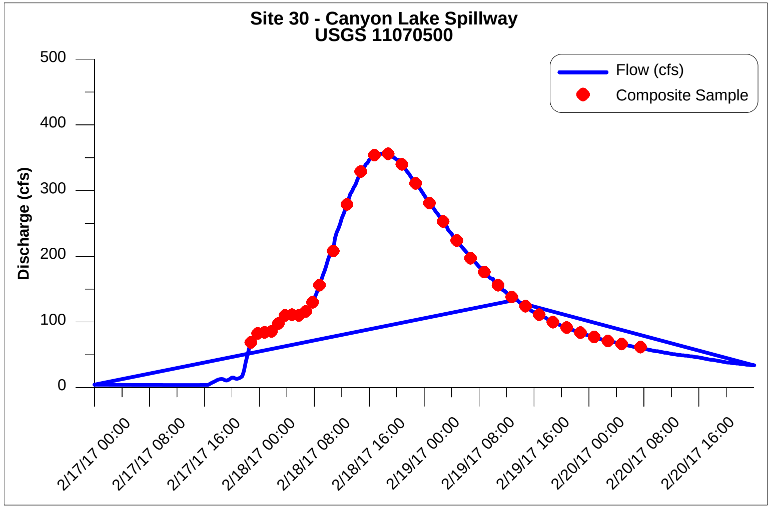
Wet Event #3

February 17-20, 2017

Rainfall: 0.97 to 1.66 inches

Sites: Salt Creek, San Jacinto, and Canyon Lake





Summary of 2008-2017 Nutrient Concentrations

Monitoring Year	Site 3 - Salt Creek		Site 4 - San Jacinto River		Site 30 - Canyon Lake Spillway	
	TN (mg/L)	TP (mg/L)	TN (mg/L)	TP (mg/L)	TN (mg/L)	TP (mg/L)
2008-2009*	3.0/3.1	0.8/1.3	1.4/3.1	0.7/1.5	NS	NS
2009-2010*	1.5/1.9	0.6/1.0	1.6/3.2	0.5/1.2	0.7/1.3	0.6/0.8
2010-2011*	1.5/2.2	0.4/0.5	1.4/2.2	0.7/1.9	0.9/1.5	0.5/0.9
2011-2012	1.9	0.3	2.2	0.5	NS	NS
2012-2013	1.9	0.3	2.1	0.5	NS	NS
2013-2014	2.7	0.9	1.8	0.6	NS	NS
2014-2015	2.2	0.5	1.8	0.4	NS	NS
2015-2016	2.5	0.5	2.4	1.4	NS	NS
2016-2017	2.1	0.6	2.0	1.2	1.9	0.4

*Values shown for nutrient concentrations are minimum/maximum
NS-Not sampled

Summary of 2008-2017 Nutrient Loads

Monitoring Year	Site 3 - Salt Creek			Site 4 - San Jacinto River			Site 30 - Canyon Lake Spillway		
	Flow (Mgal)	TN (kg)	TP (kg)	Flow (Mgal)	TN (kg)	TP (kg)	Flow (Mgal)	TN (kg)	TP (kg)
2008-2009*	529	6,085/6,125	1,541/2,642	1,042	5,323/12,145	2,682/5,954	NA	NS	NS
2009-2010*	1,282	7,474/9,180	2,960/4,804	2,681	14,716/32,680	4,668/12,382	62	167/294	137/188
2010-2011*	1,946	5,112/7,484	1,370/1,704	3,269	7,690/12,124	4,041/10,664	1,302	2,035/3,556	1,029/2,102
2011-2012	249	1,843	238	277	2,338	542	133	NS	NS
2012-2013	147	1,025	180	424	3,341	822	114	NS	NS
2013-2014	411	4,268	1,409	484	3,252	1,178	148	NS	NS
2014-2015	511	4,661	1,257	570	3,932	1,041	196	NS	NS
2015-2016	515	5,647	1,447	872	7,926	4,624	476	NS	NS
2016-2017	1,596	12,366	4,026	2,802	21,651	14,403	4,850	33,759	6,637

*Values shown for nutrient loads are minimum/maximum
NS-Not Sampled
NA-Not Available

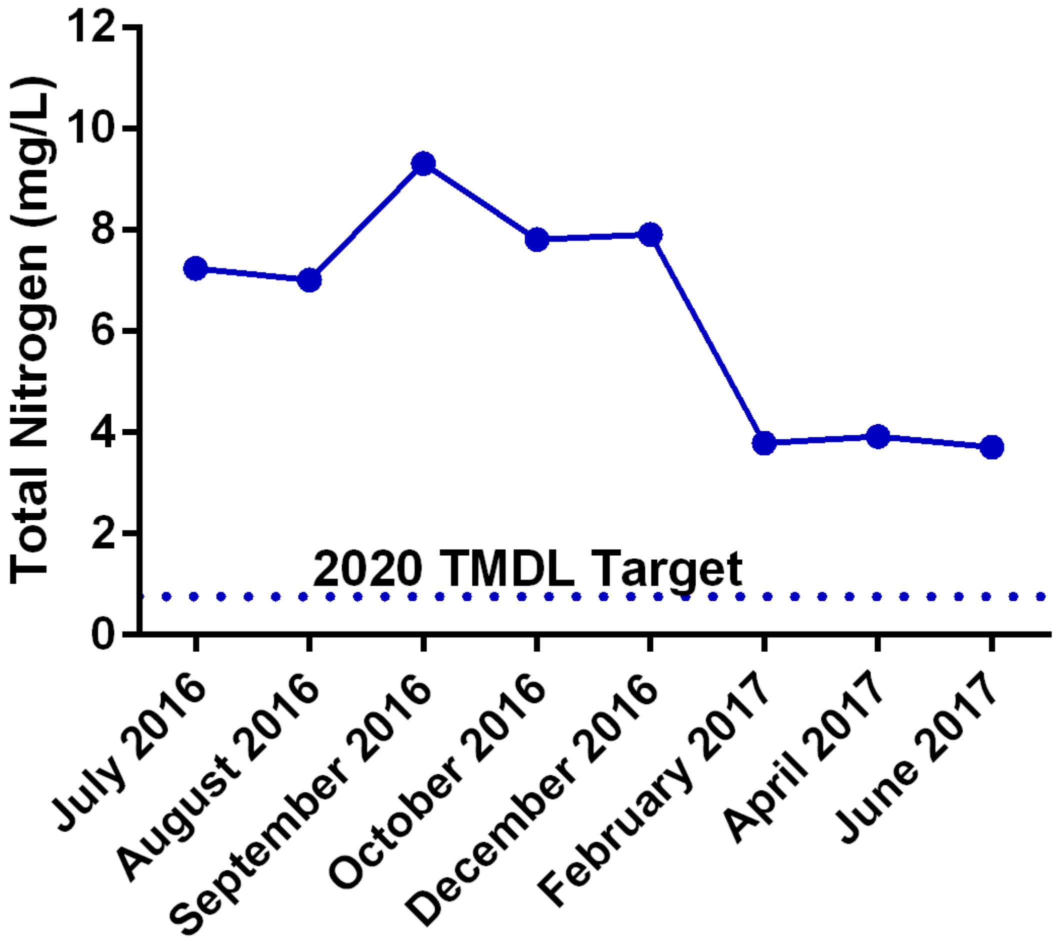
Lake Elsinore and Canyon Lake TMDL Water Quality Monitoring Update – 2016-17 Summary

In-Lake Monitoring

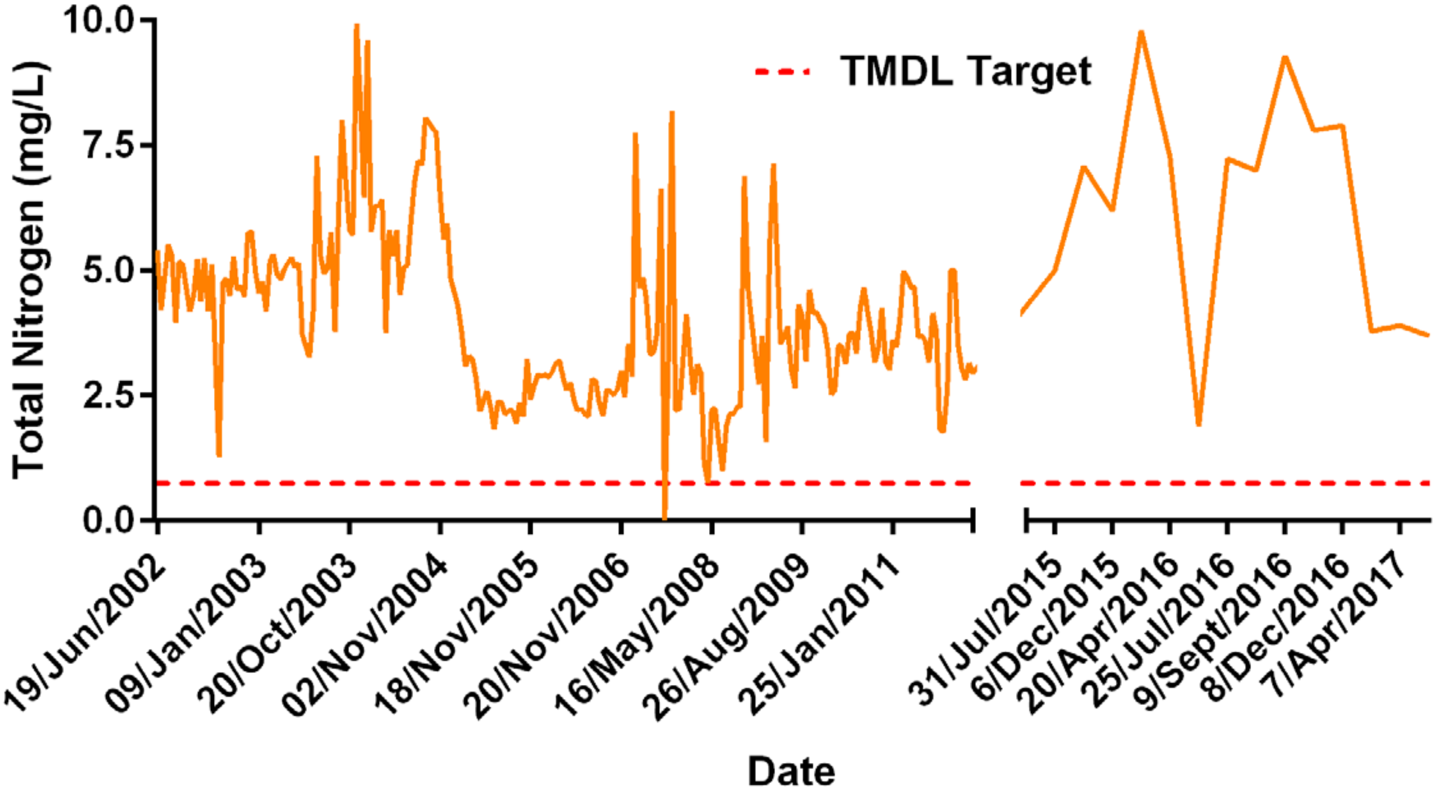
Station Locations – Lake Elsinore

Station Locations – Canyon Lake

Total Nitrogen – Lake Elsinore 2016-2017



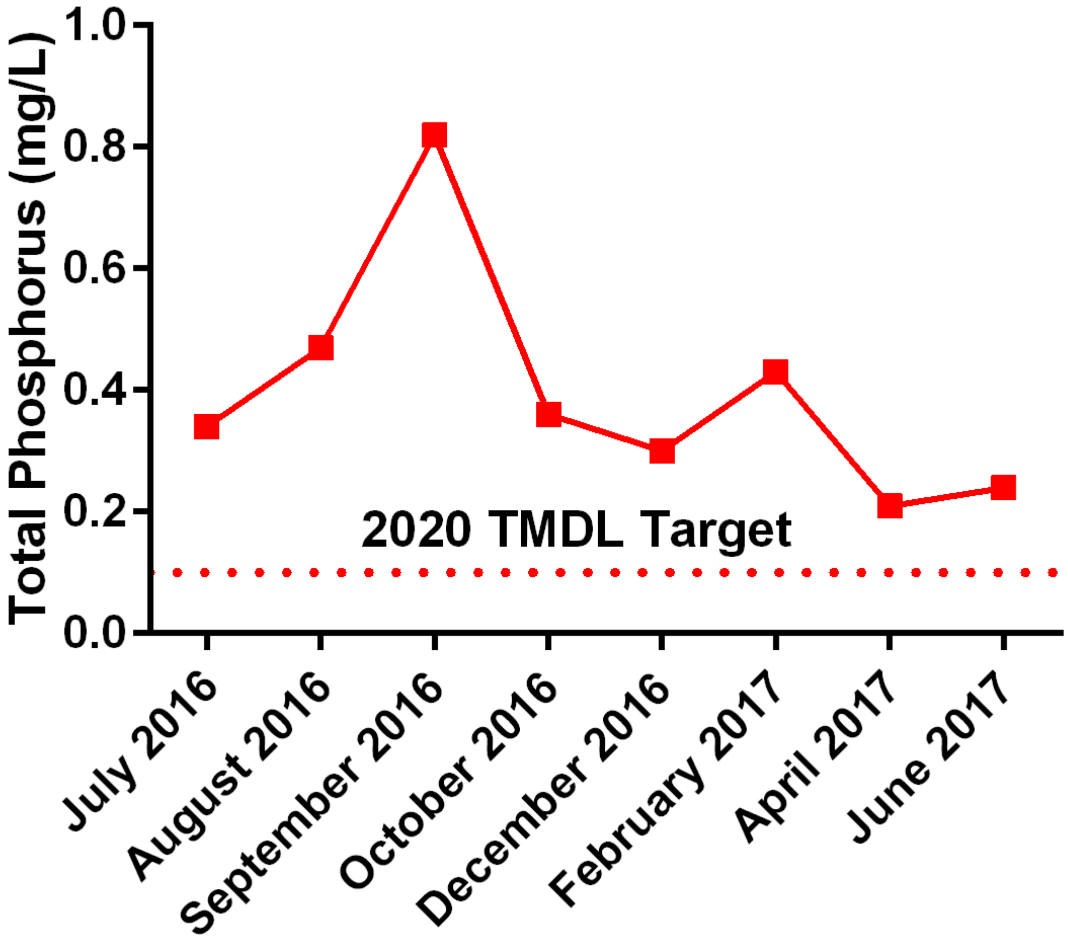
Total Nitrogen – Lake Elsinore Historic Data



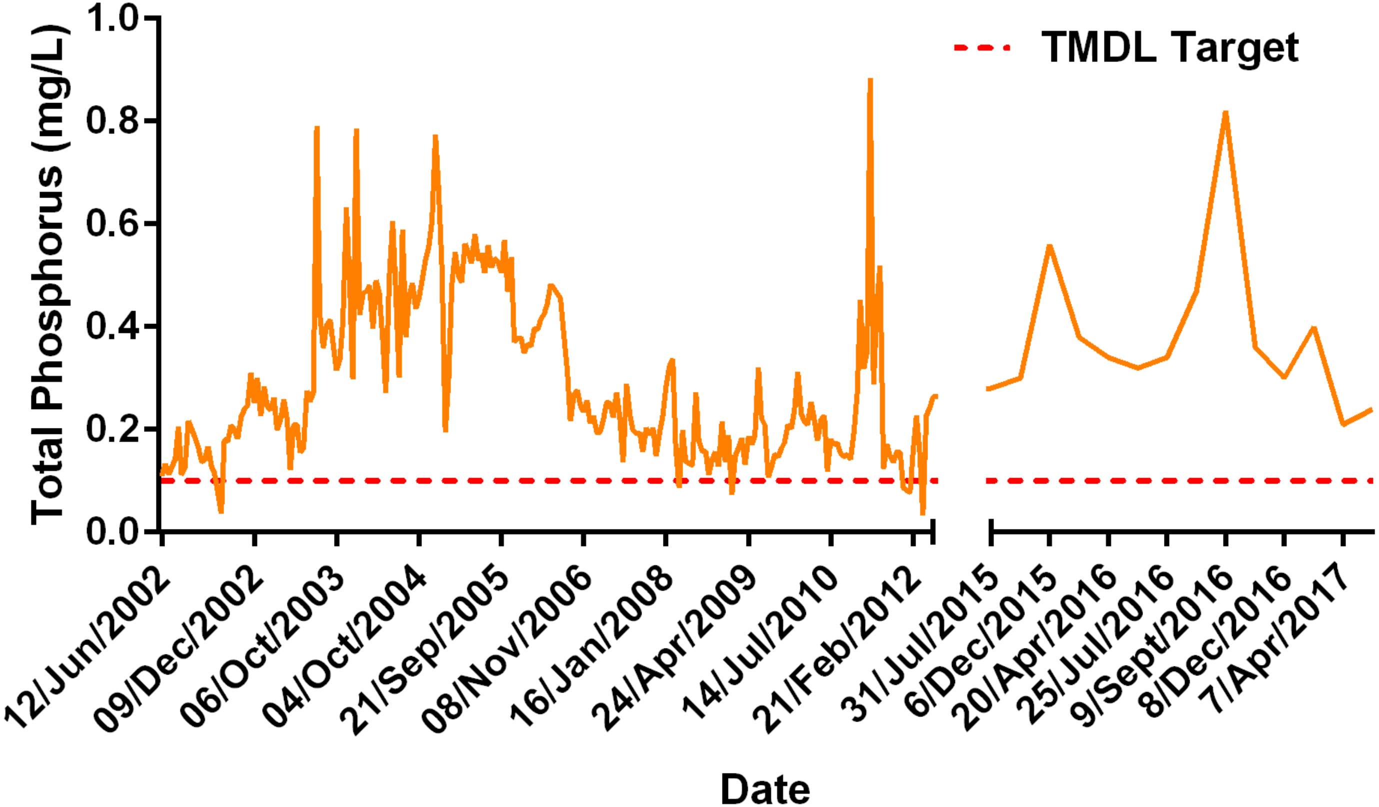
No data available from June 2012-July2015

TMDL target of 0.75 mg/L is annual average to be attained by 2020

Total Phosphorus – Lake Elsinore 2016-2017



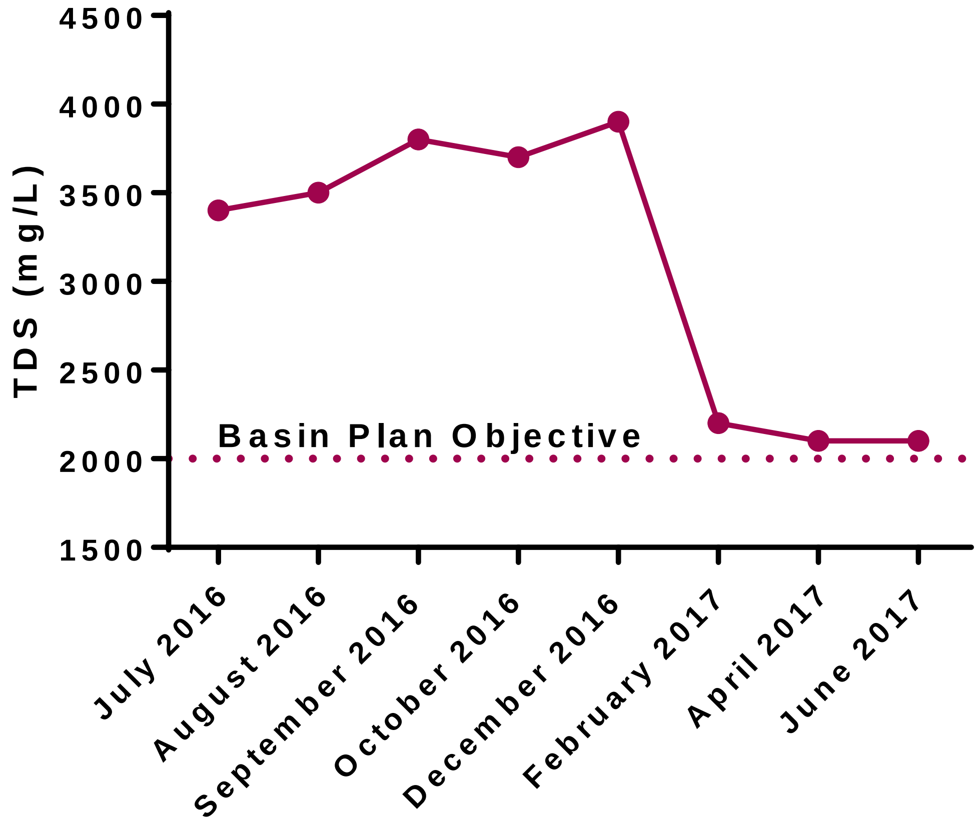
Total Phosphorus – Lake Elsinore Historic Data



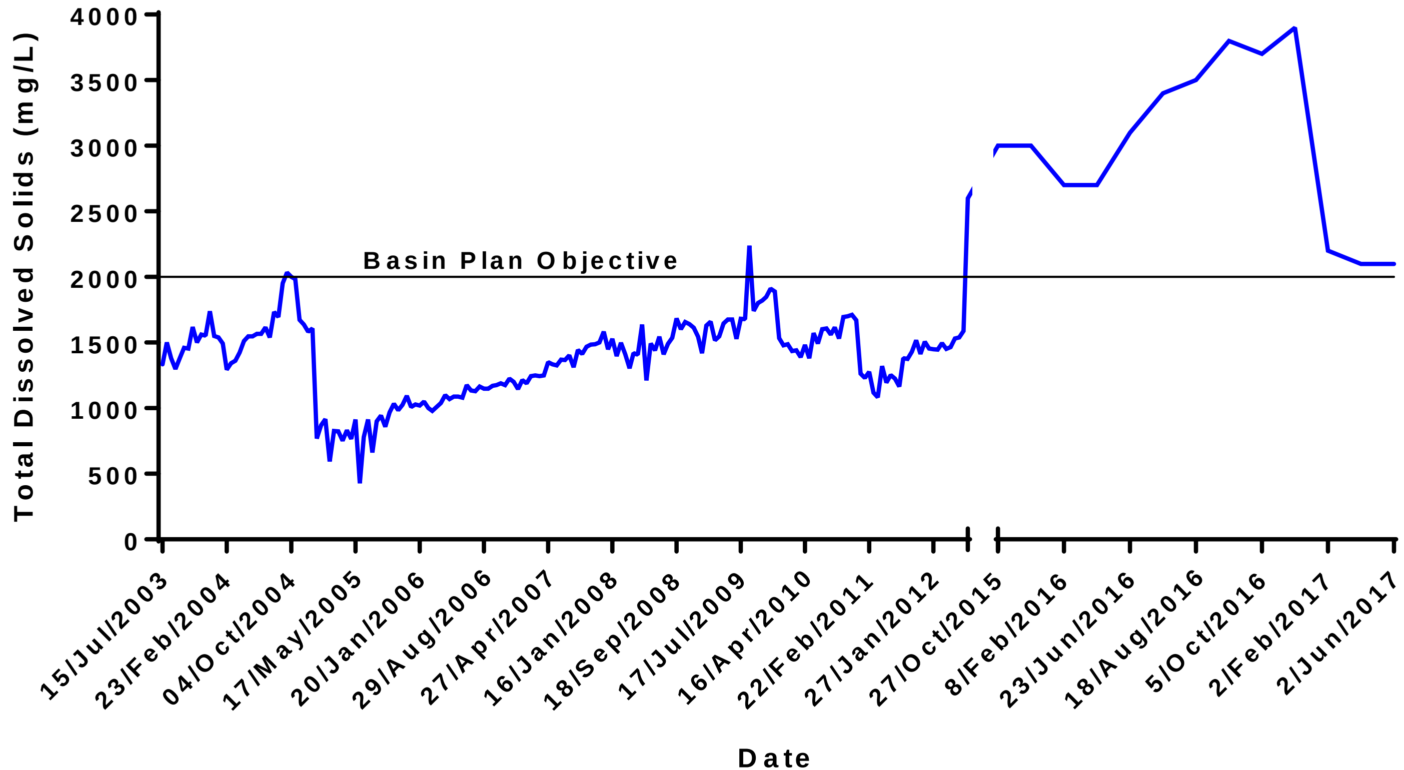
No data available from June 2012-July2015

TMDL target of 0.1 mg/L is annual average to be attained by 2020

Total Dissolved Solids– Lake Elsinore 2016-2017

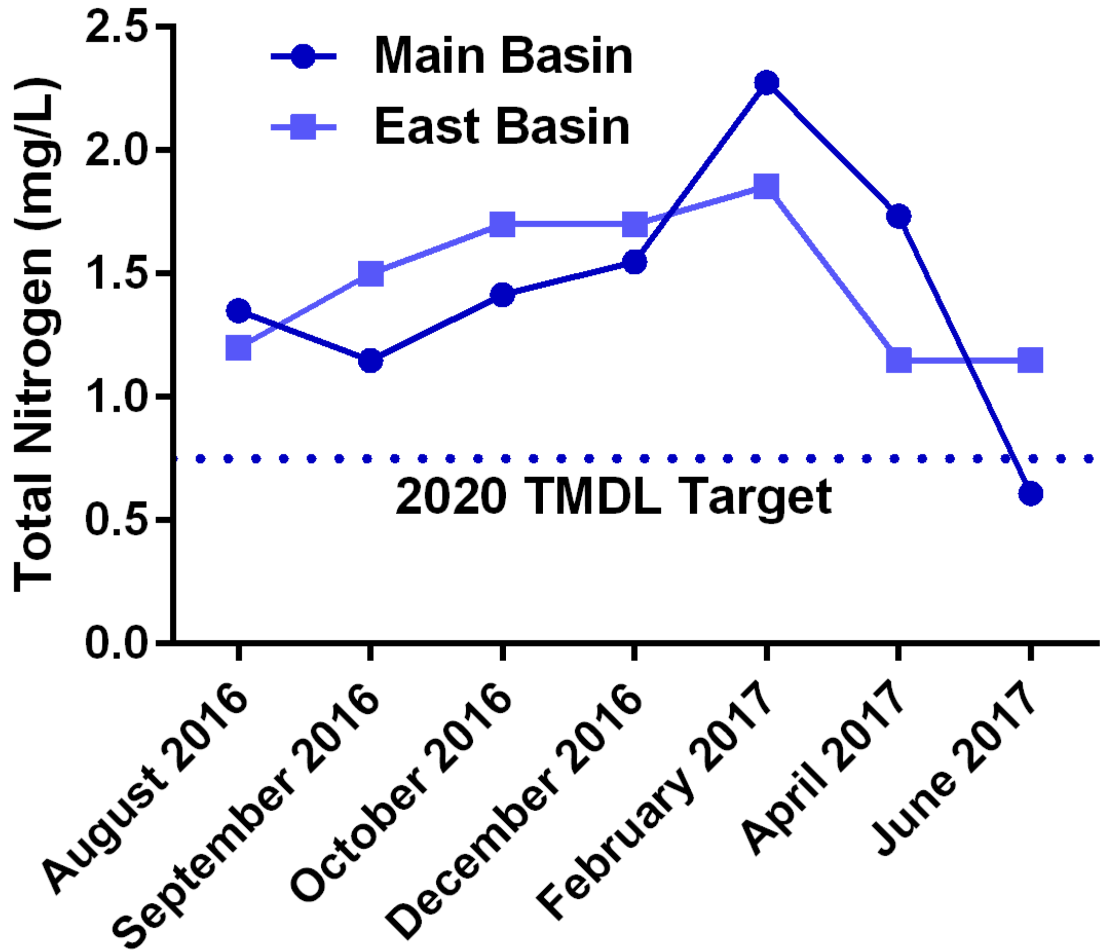


Total Dissolved Solids– Lake Elsinore Historic Data

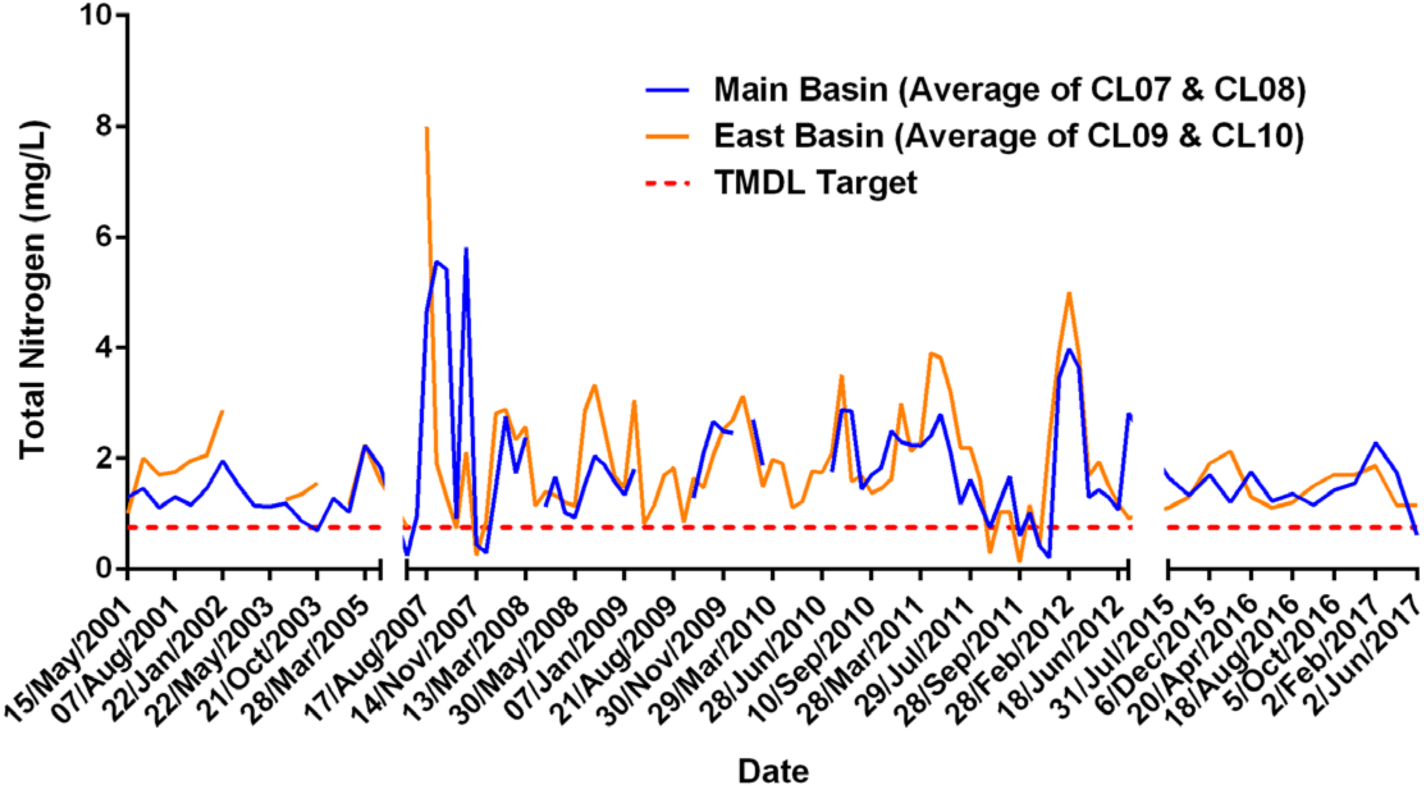


No data available from June 2012-July 2015

Total Nitrogen – Canyon Lake 2016-2017



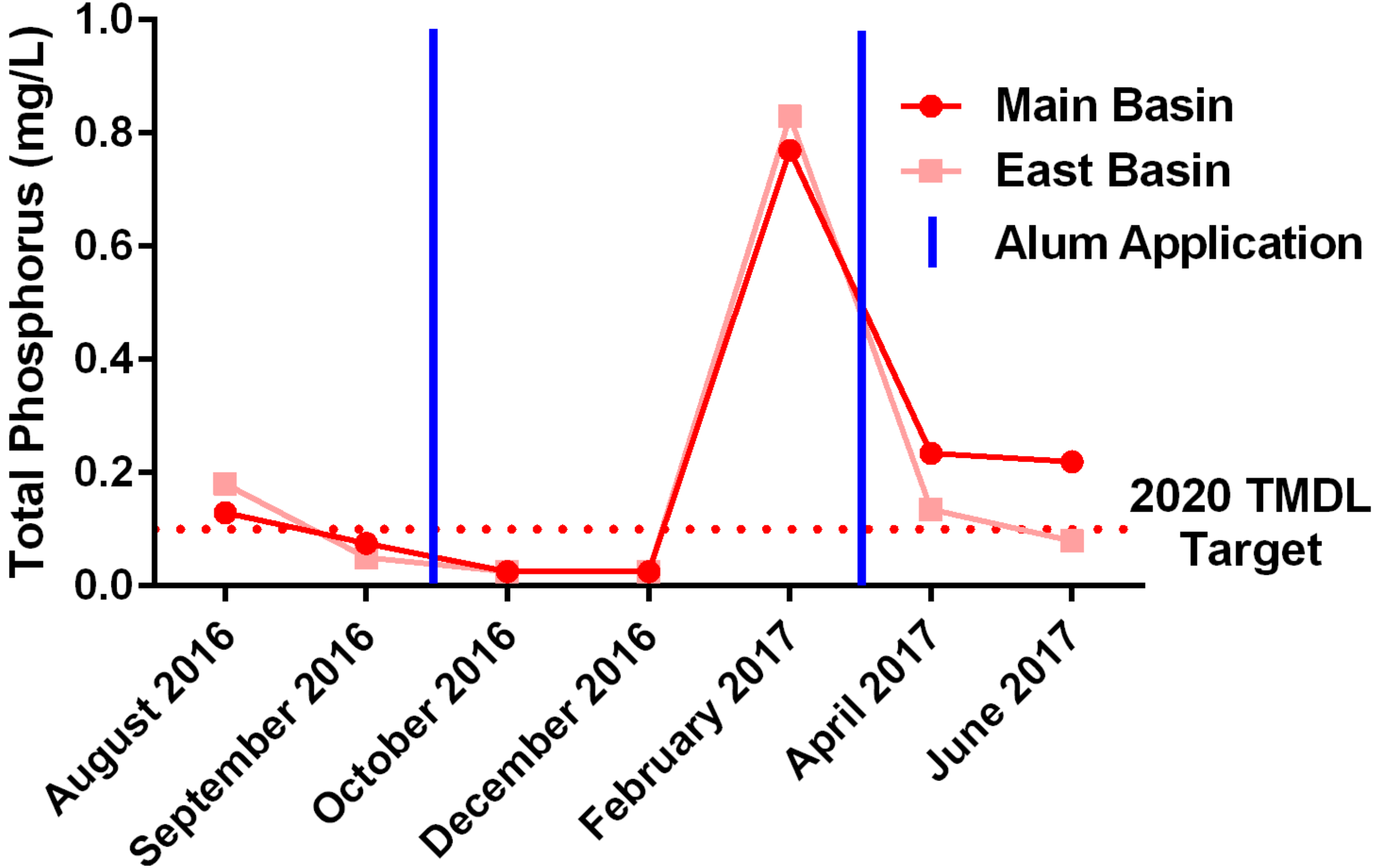
Total Nitrogen – Canyon Lake Historic Data



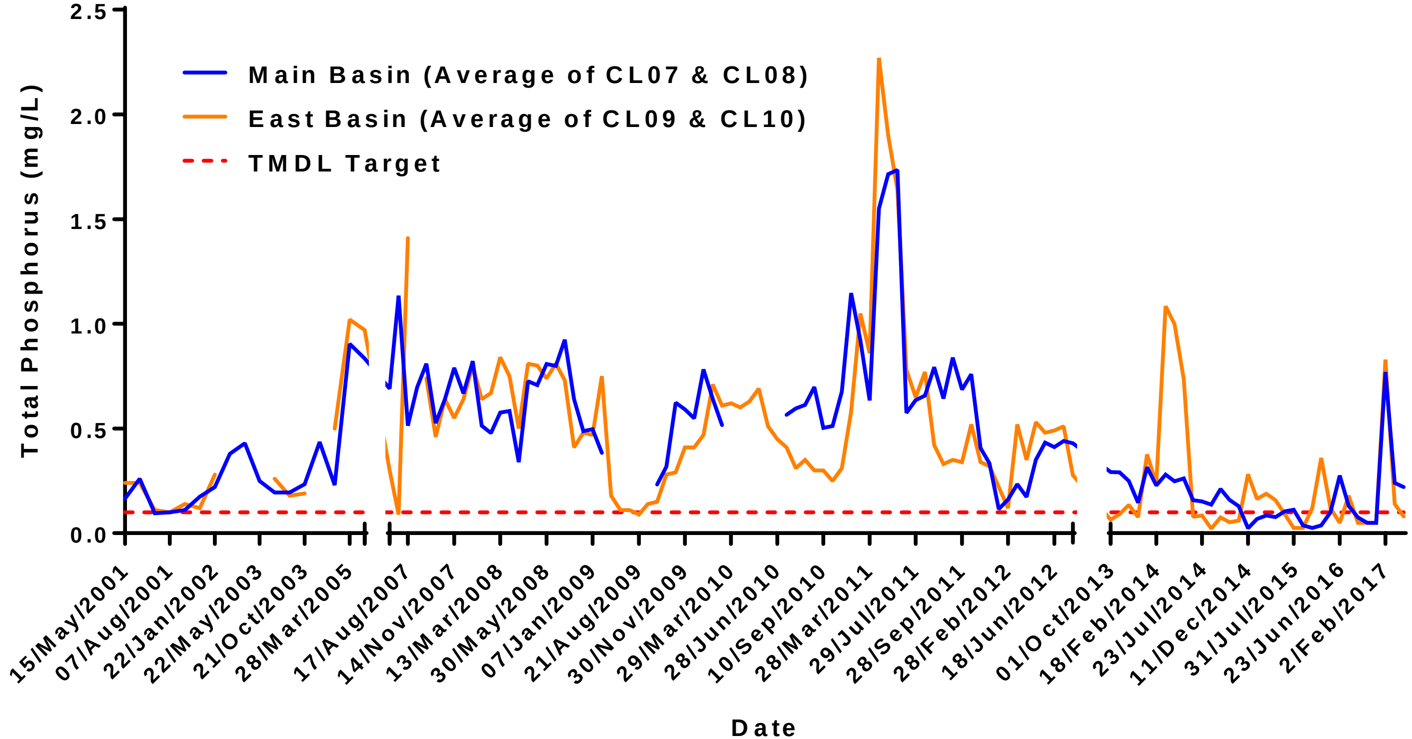
No data available from May 2005-July 2007; June 2012-July2015

TMDL target of 0.75 mg/L is annual average to be attained by 2020

Total Phosphorus – Canyon Lake 2016-2017



Total Phosphorus – Canyon Lake Historic Data

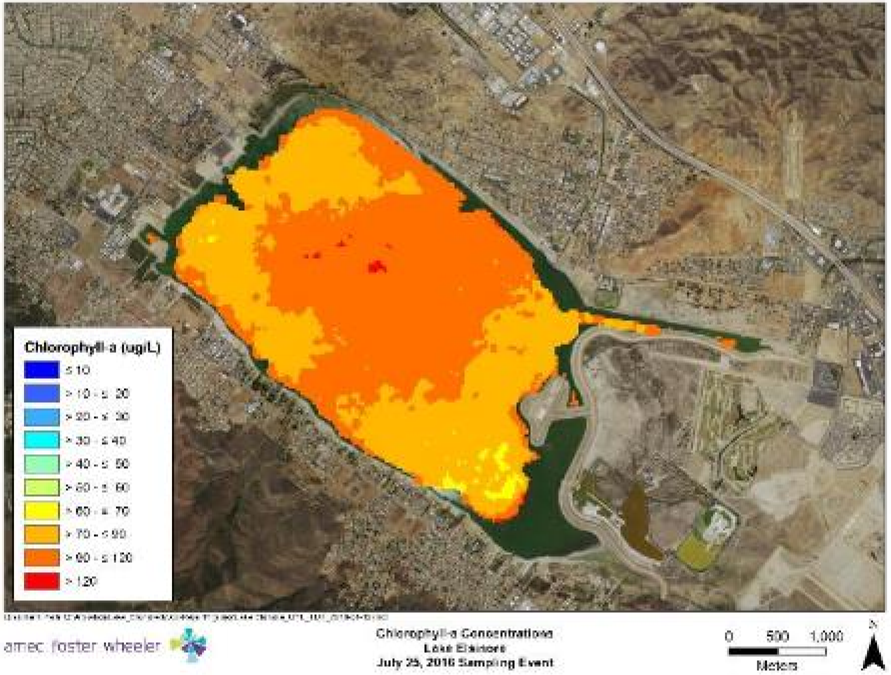


No data available from May 2005-July 2007; June 2012-Sept 2013

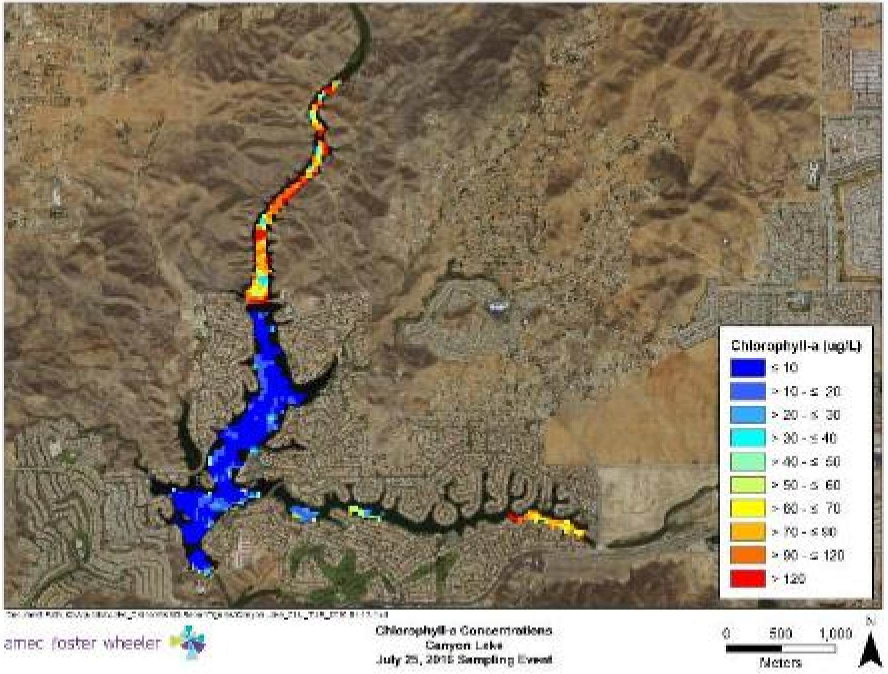
TMDL target of 0.1 mg/L is annual average to be attained by 2020

Satellite Imagery – Chlorophyll July 2016

Lake Elsinore



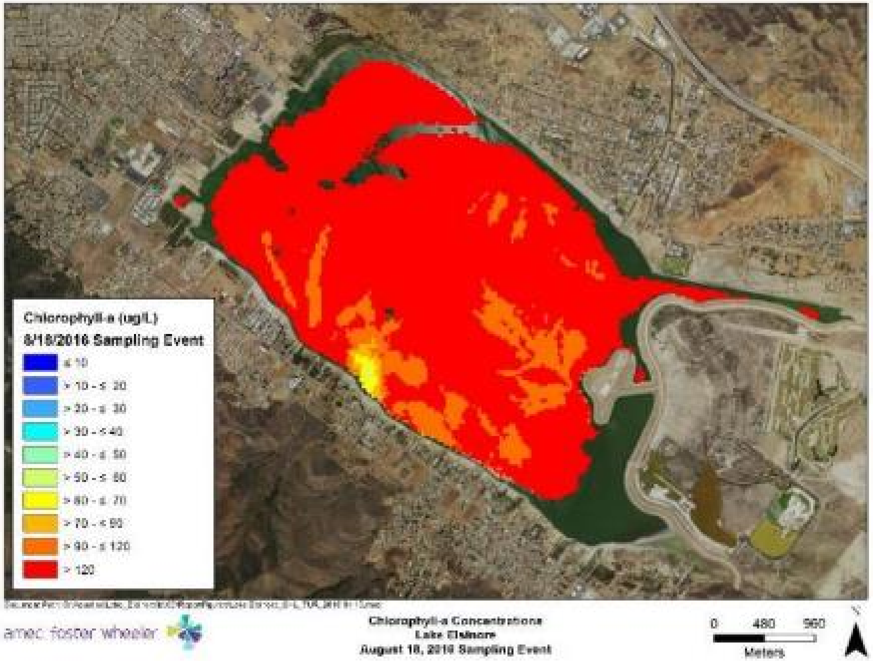
Canyon Lake



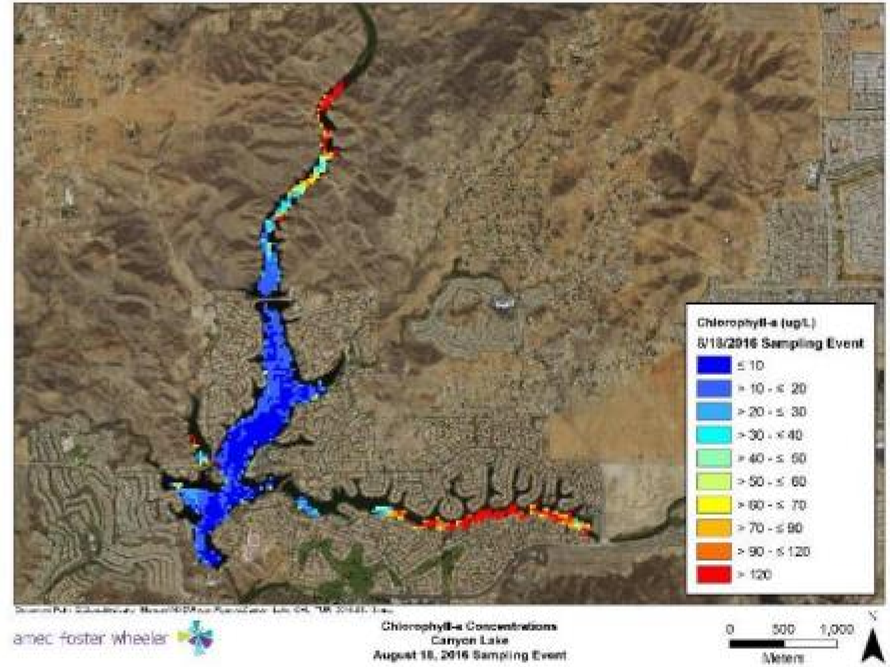
**Data gaps in eastern arm due to high cirrus clouds

Satellite Imagery – Chlorophyll August 2016

Lake Elsinore



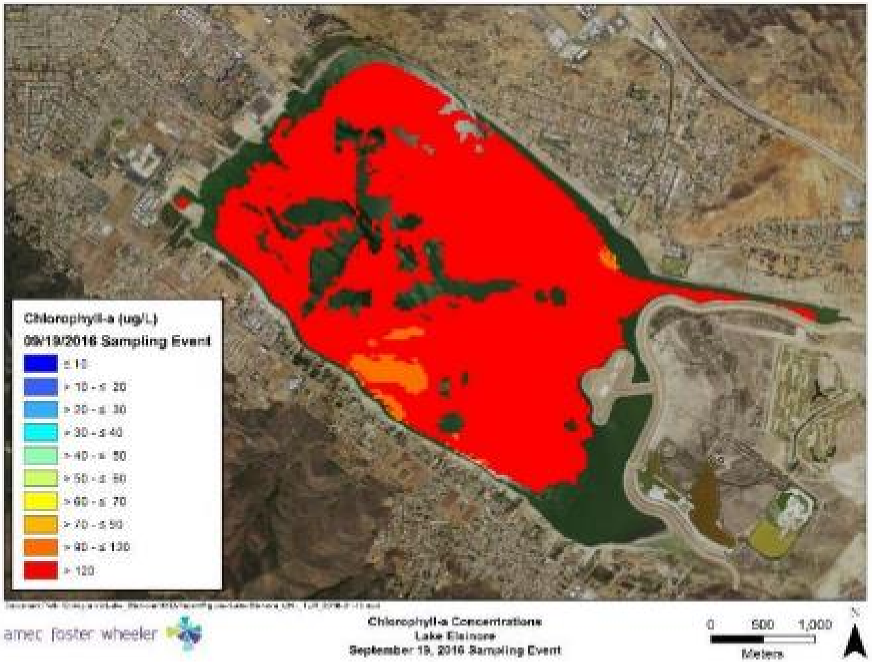
Canyon Lake



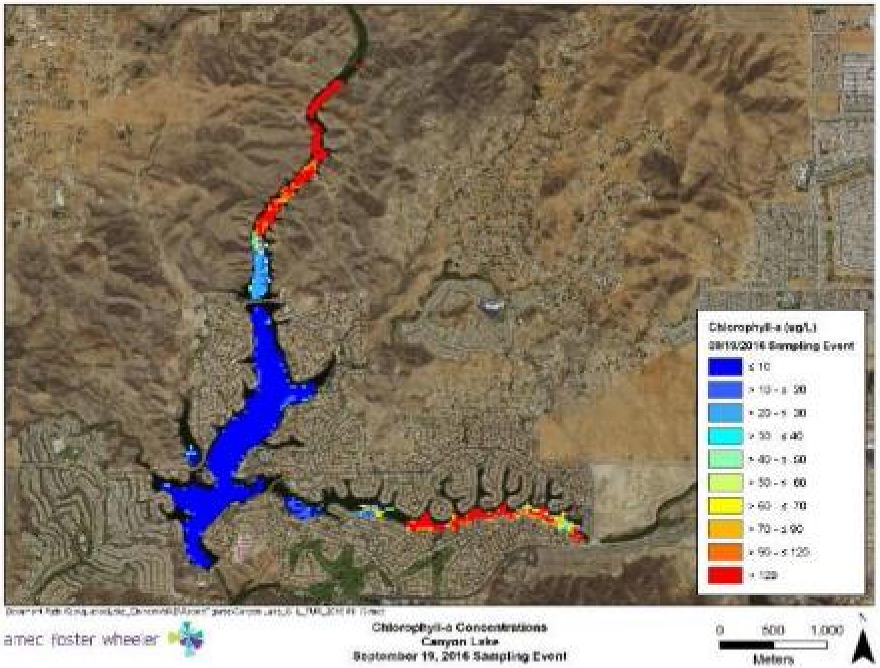
**Data gaps due to large floating cyanobacterial slicks

Satellite Imagery – Chlorophyll September 2016

Lake Elsinore



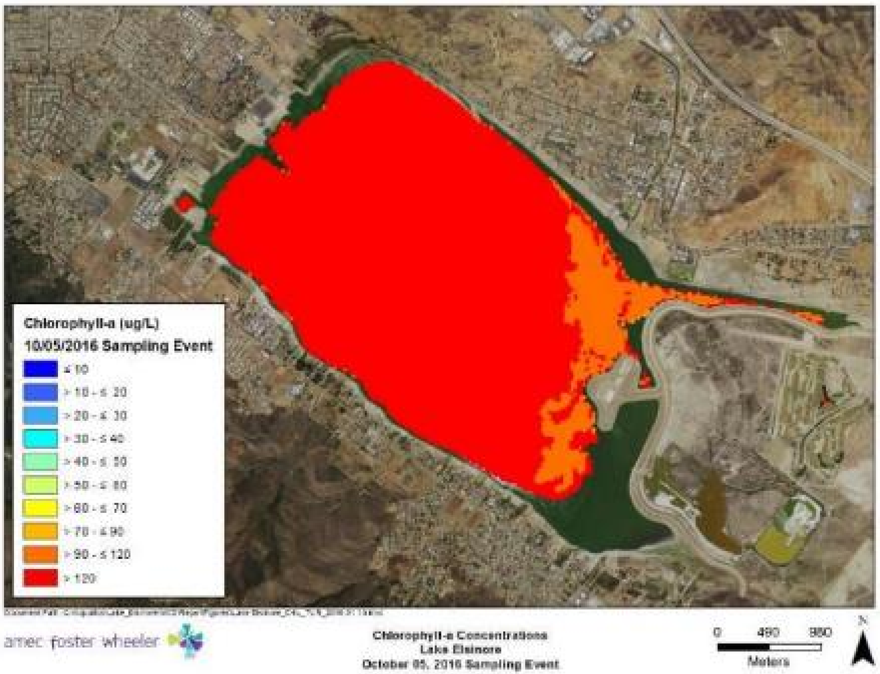
Canyon Lake



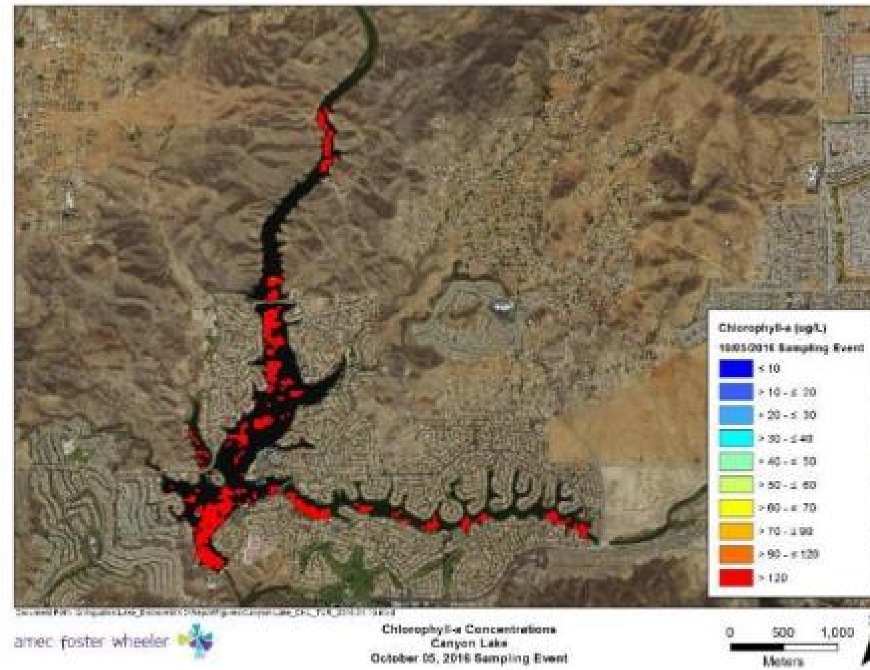
**Data gaps due to large floating cyanobacterial slicks

Satellite Imagery – Chlorophyll October 2016

Lake Elsinore



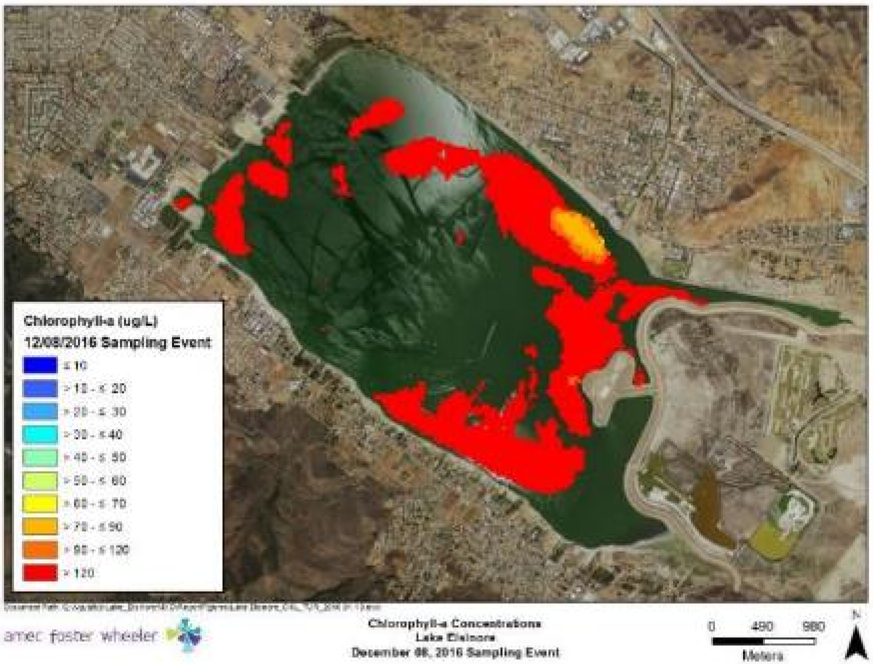
Canyon Lake



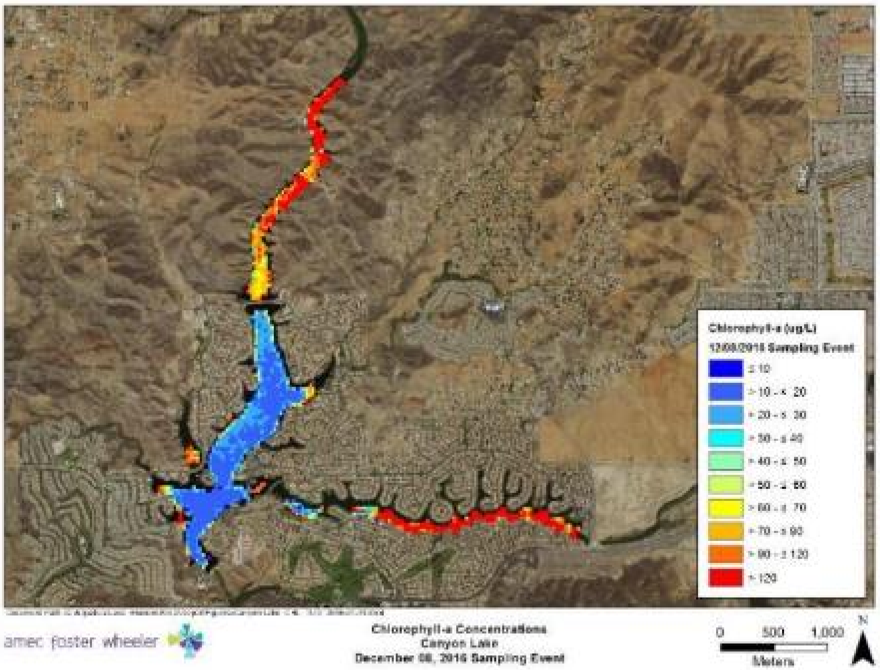
**Data gaps in eastern arm due to high cirrus clouds

Satellite Imagery – Chlorophyll December 2016

Lake Elsinore



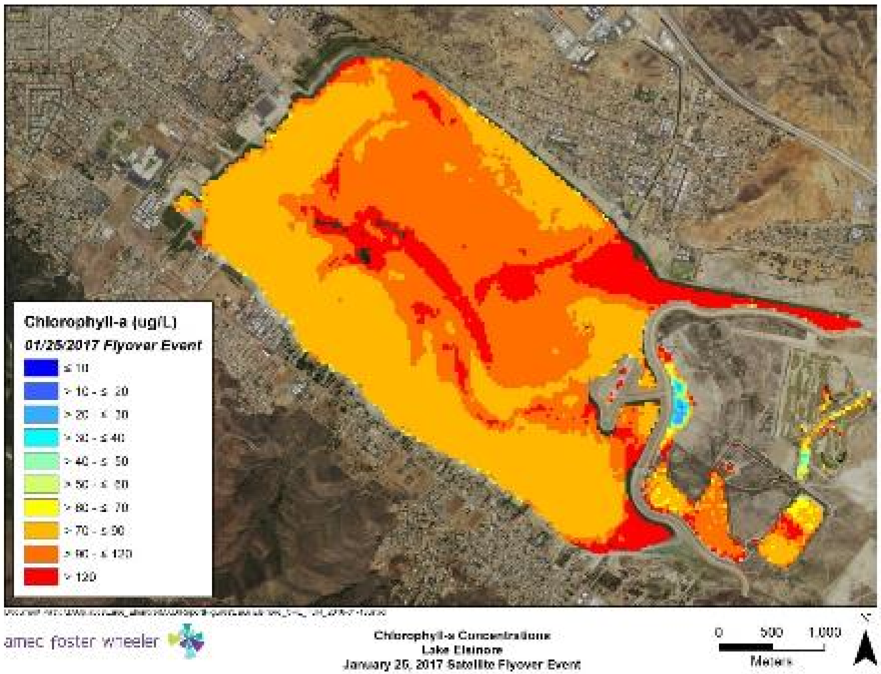
Canyon Lake



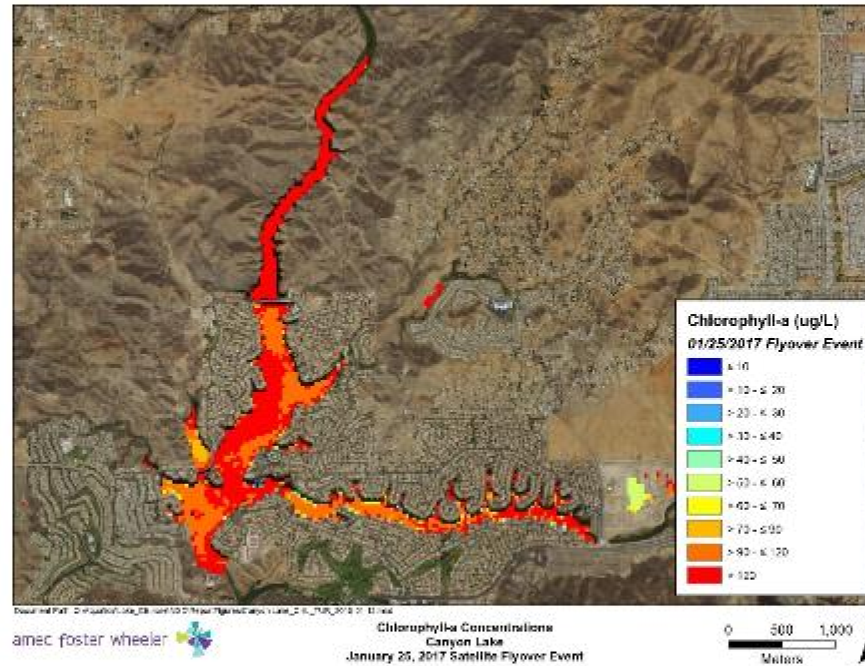
**Data gaps due to large floating cyanobacterial slicks

Satellite Imagery – Chlorophyll February 2017

Lake Elsinore



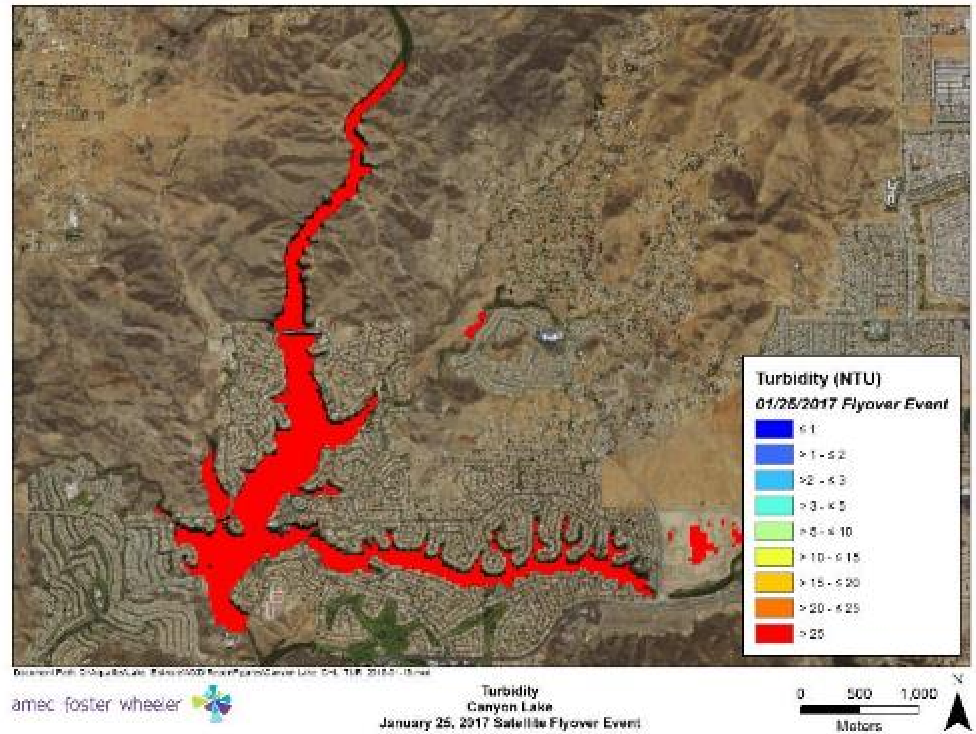
Canyon Lake



**High chlorophyll-a readings in Canyon Lake due to turbidity interference

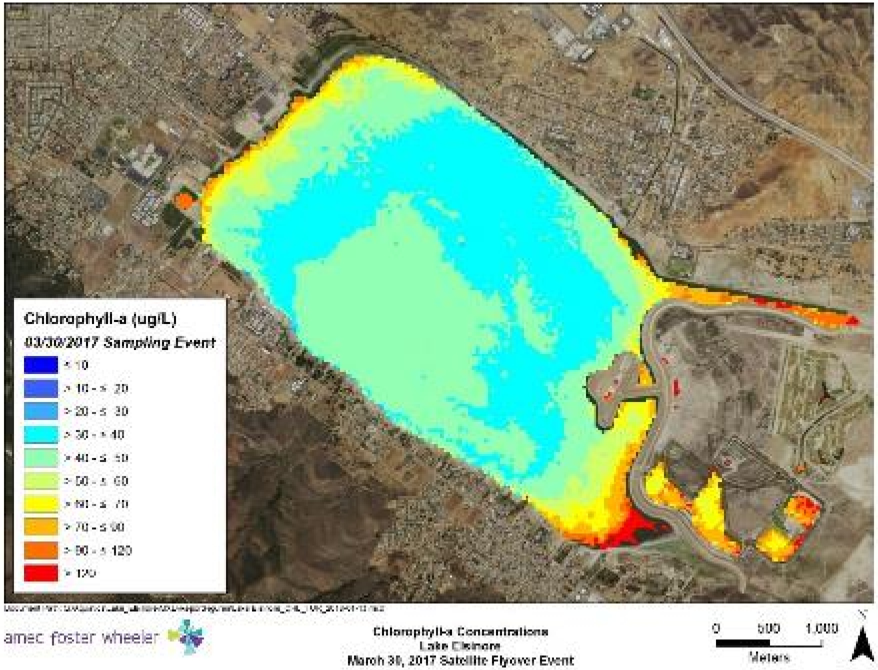
Satellite Imagery – Turbidity after January Storms

Canyon Lake

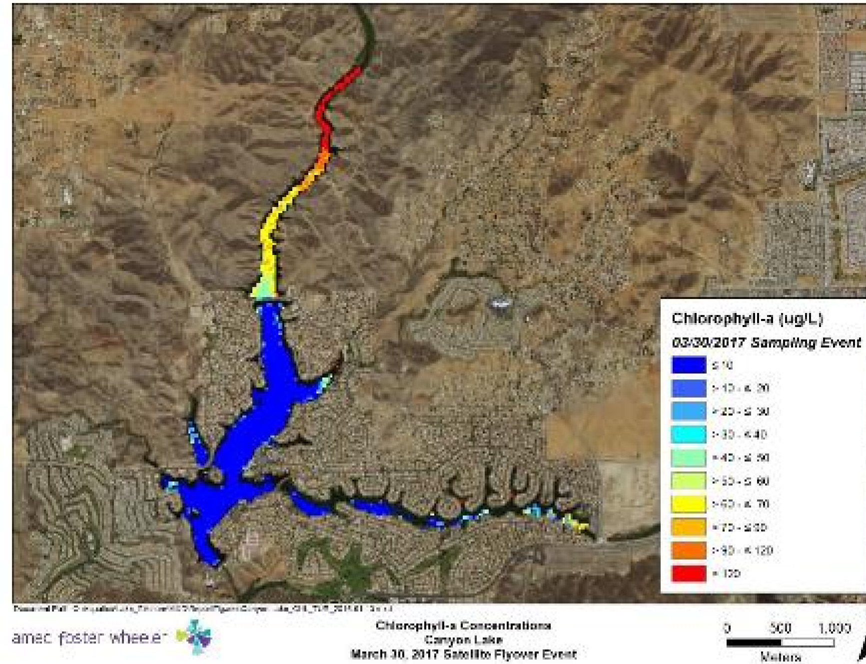


Satellite Imagery – Chlorophyll April 2017

Lake Elsinore

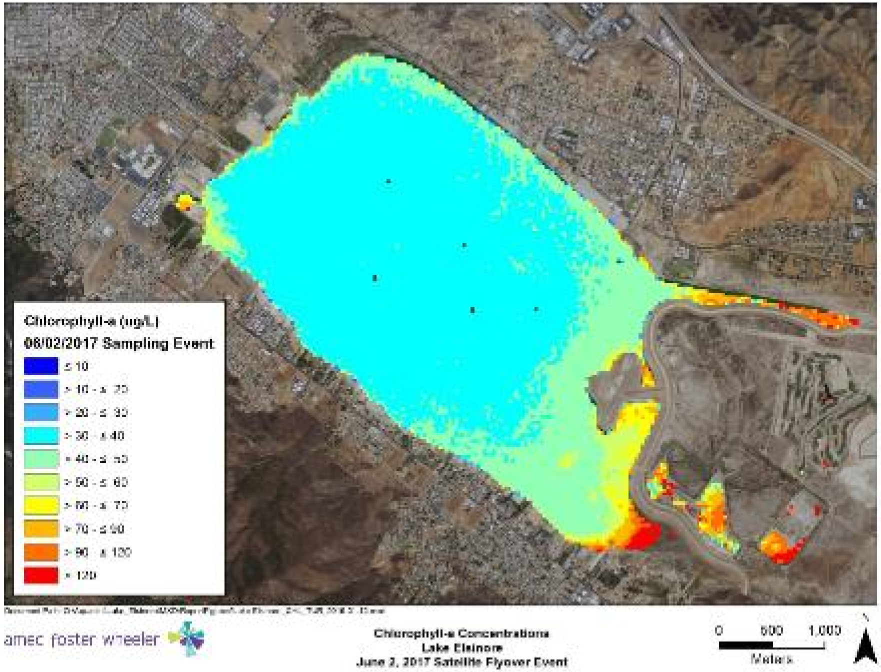


Canyon Lake

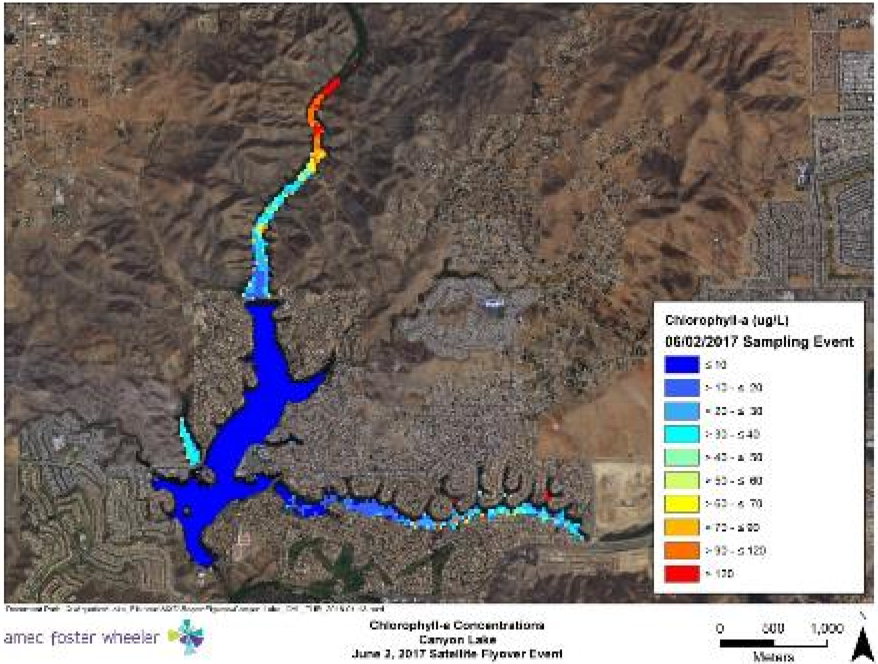


Satellite Imagery – Chlorophyll June 2017

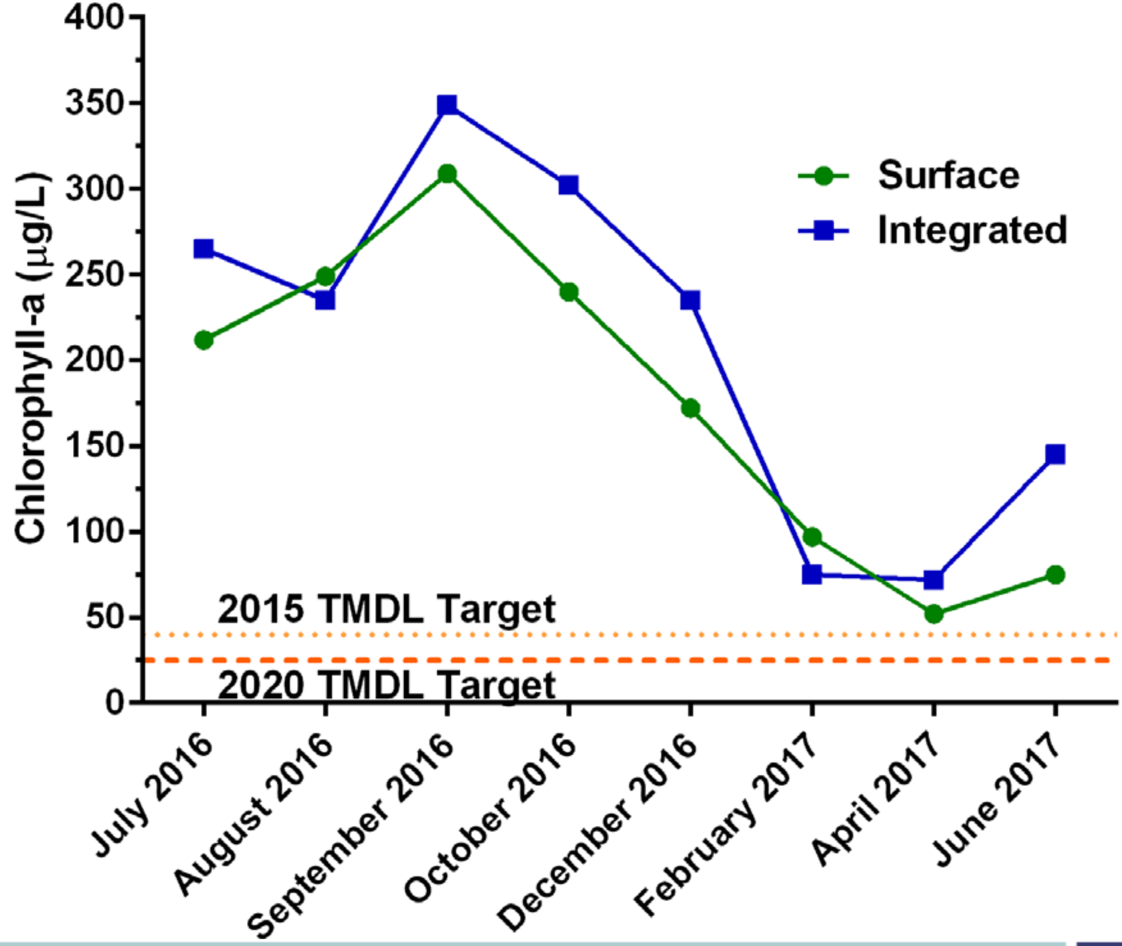
Lake Elsinore



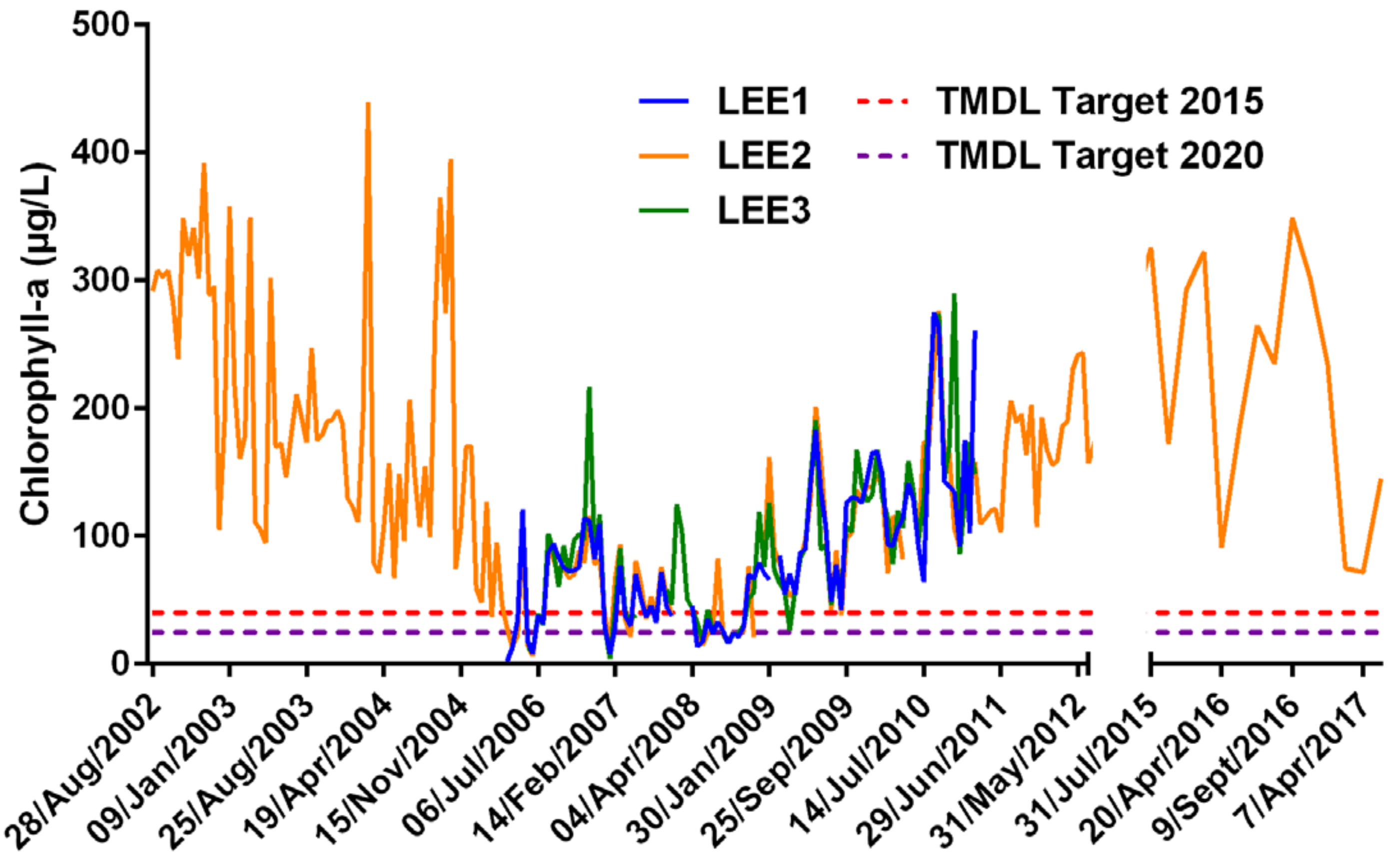
Canyon Lake



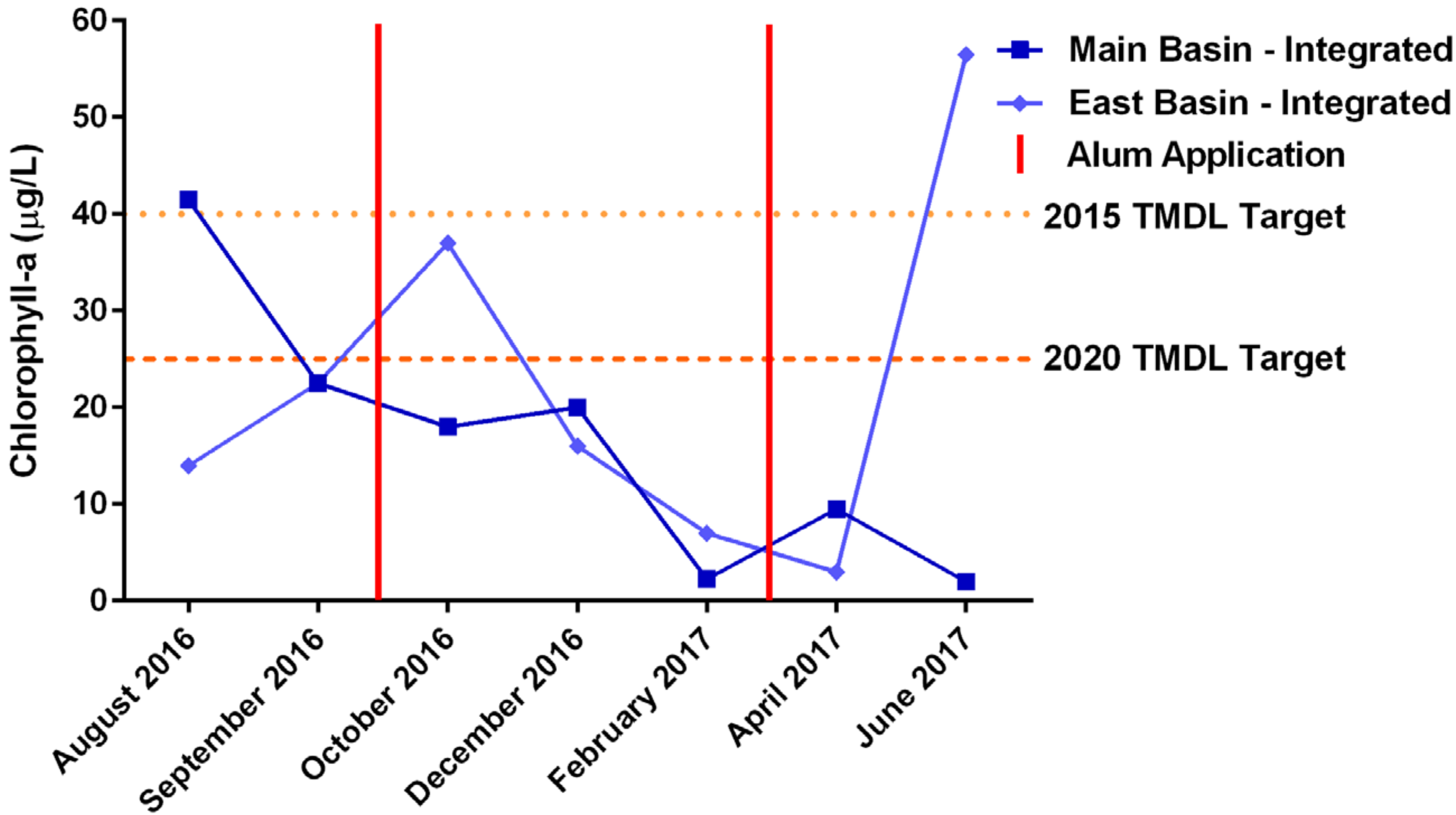
Lake Elsinore Chlorophyll – 2016-2017



Lake Elsinore Chlorophyll – Integrated Historic Data



Canyon Lake Chlorophyll – 2016-2017



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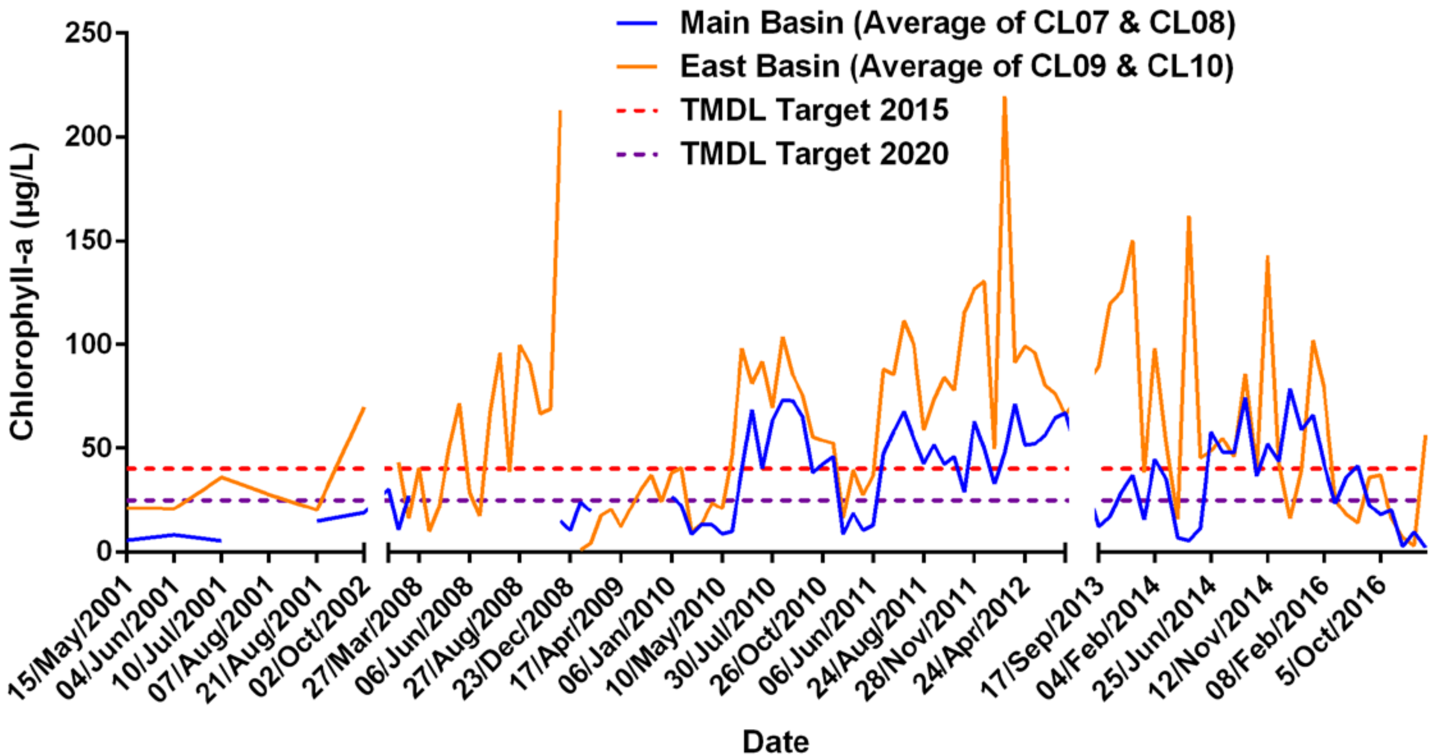


No data available from October 2002-August 2007; June 2012-Sept 2013

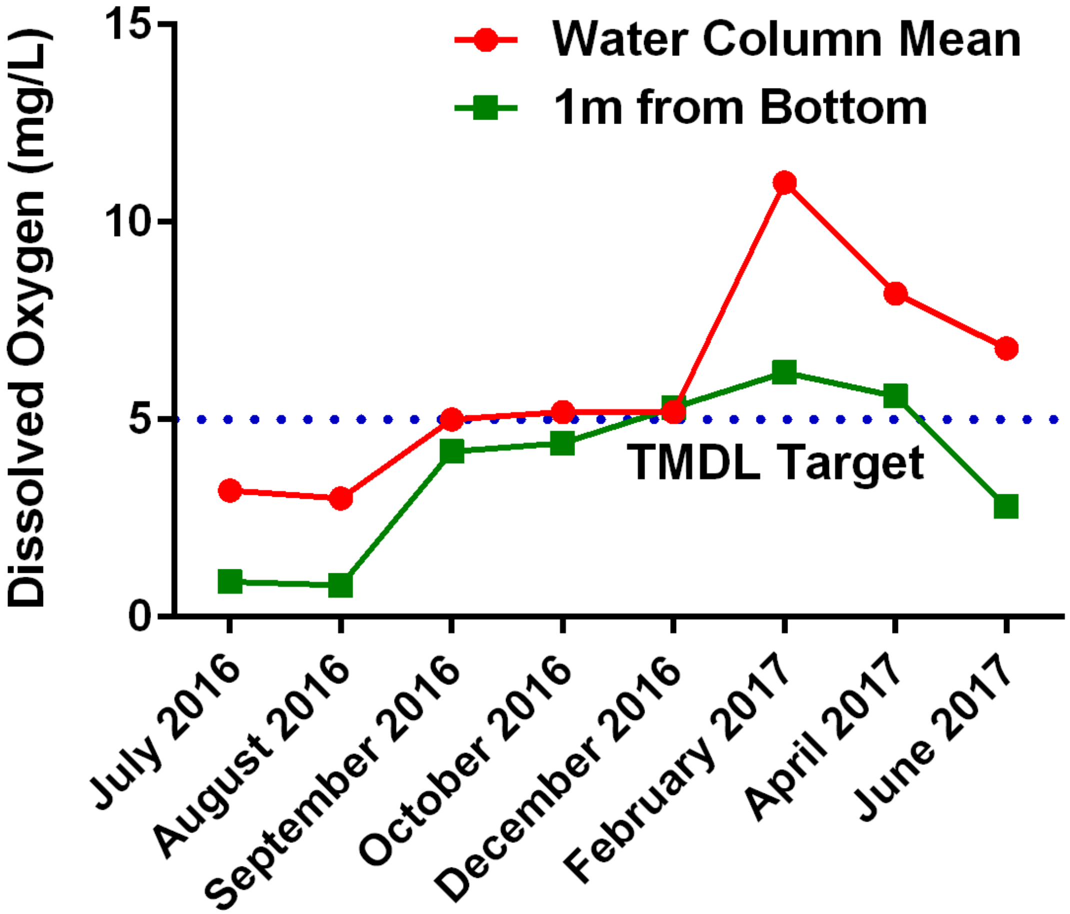
2015 TMDL target of 40 µg/L is annual average to be attained by 2015

2020 TMDL target of 25 µg/L is annual average to be attained by 2020

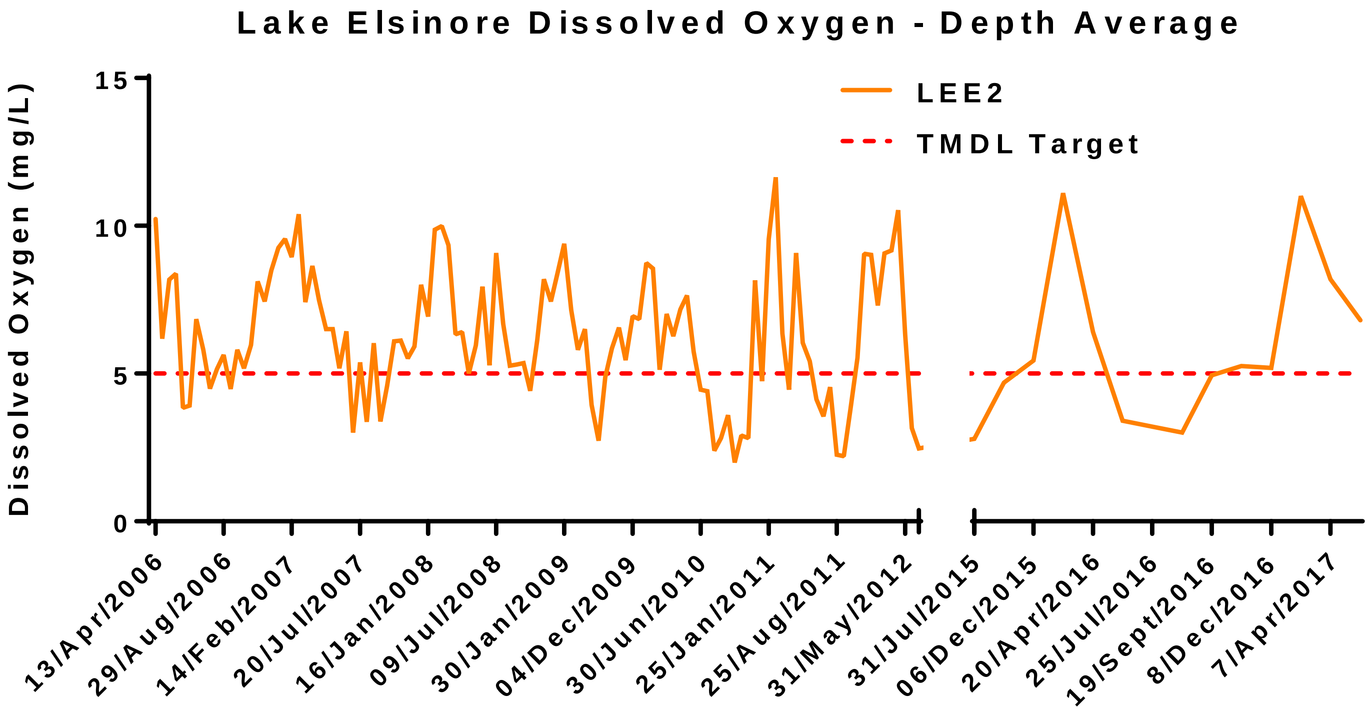
Lake Elsinore and Canyon Lake TMDL Water Quality Monitoring Update – 2016-17 Summary

Dissolved Oxygen Monitoring

Lake Elsinore Dissolved Oxygen – LE02 Water Column Mean vs. 1m from Bottom 2016-2017



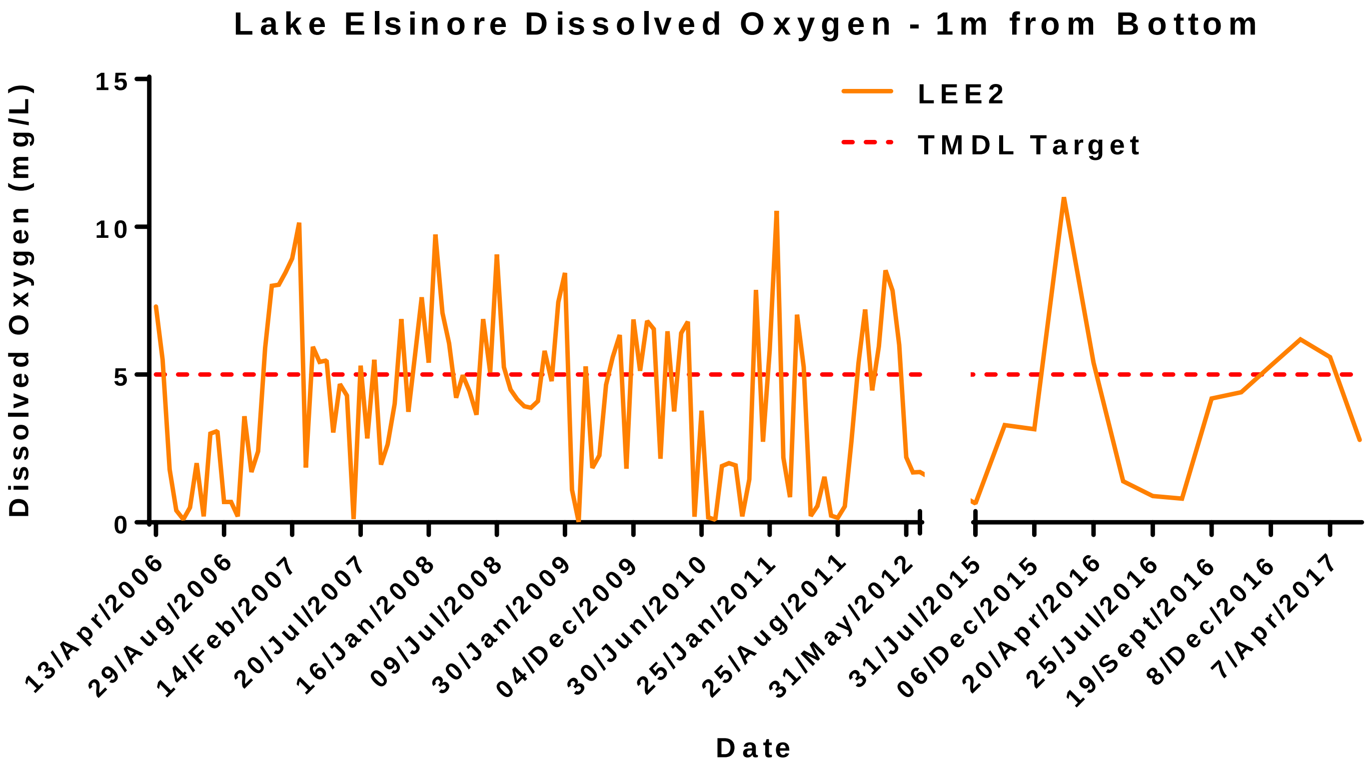
Lake Elsinore Dissolved Oxygen – LE02 Water Column Mean Historic Data



No data available from June 2012-July2015

TMDL target of 5 mg/L is depth average to be attained by 2015

Lake Elsinore Dissolved Oxygen – LE02 1m from Bottom Historic Data

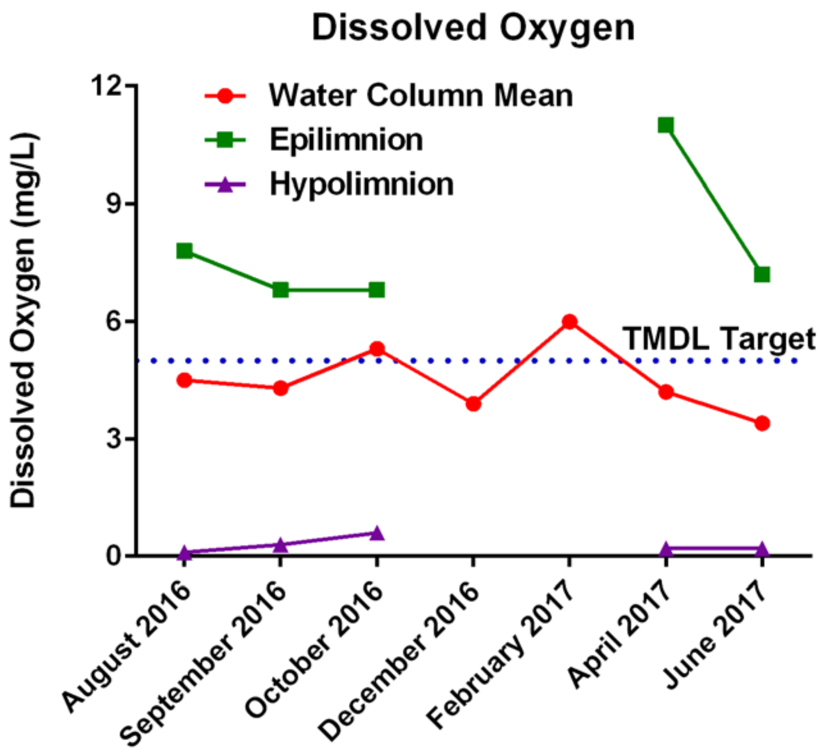


No data available from June 2012-July2015

TMDL target of 5 mg/L is 1m off lake bottom to be attained by 2020

Canyon Lake Dissolved Oxygen – Main Basin Epilimnion vs. Hypolimnion 2016-2017

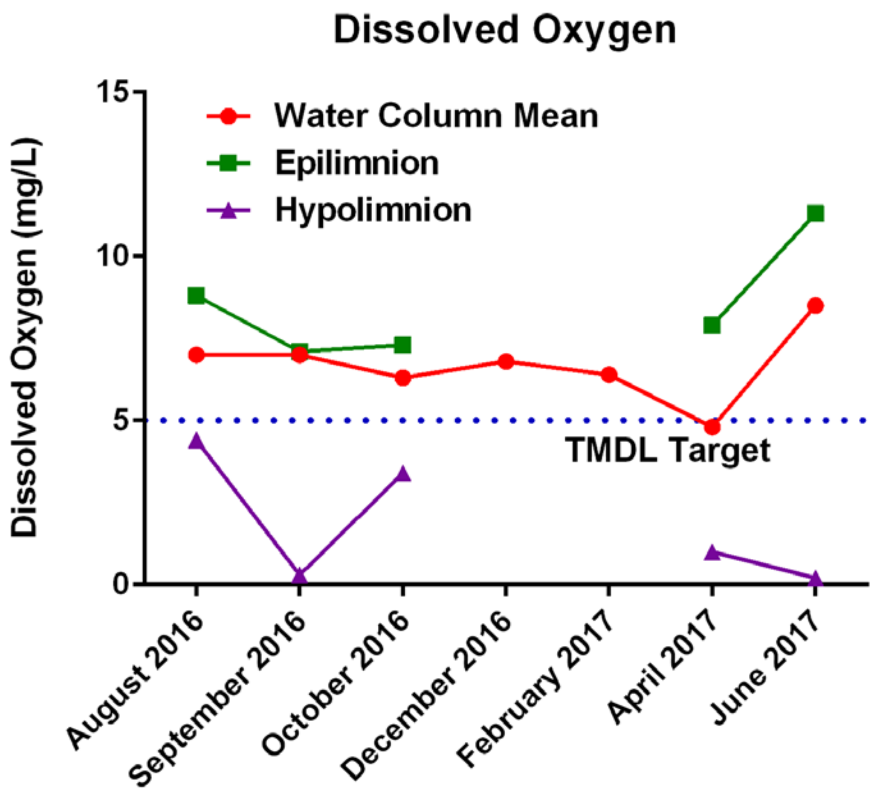
Mean of Sites CL07 & CL08



No stratification in December-February
Not sampled in July 2016

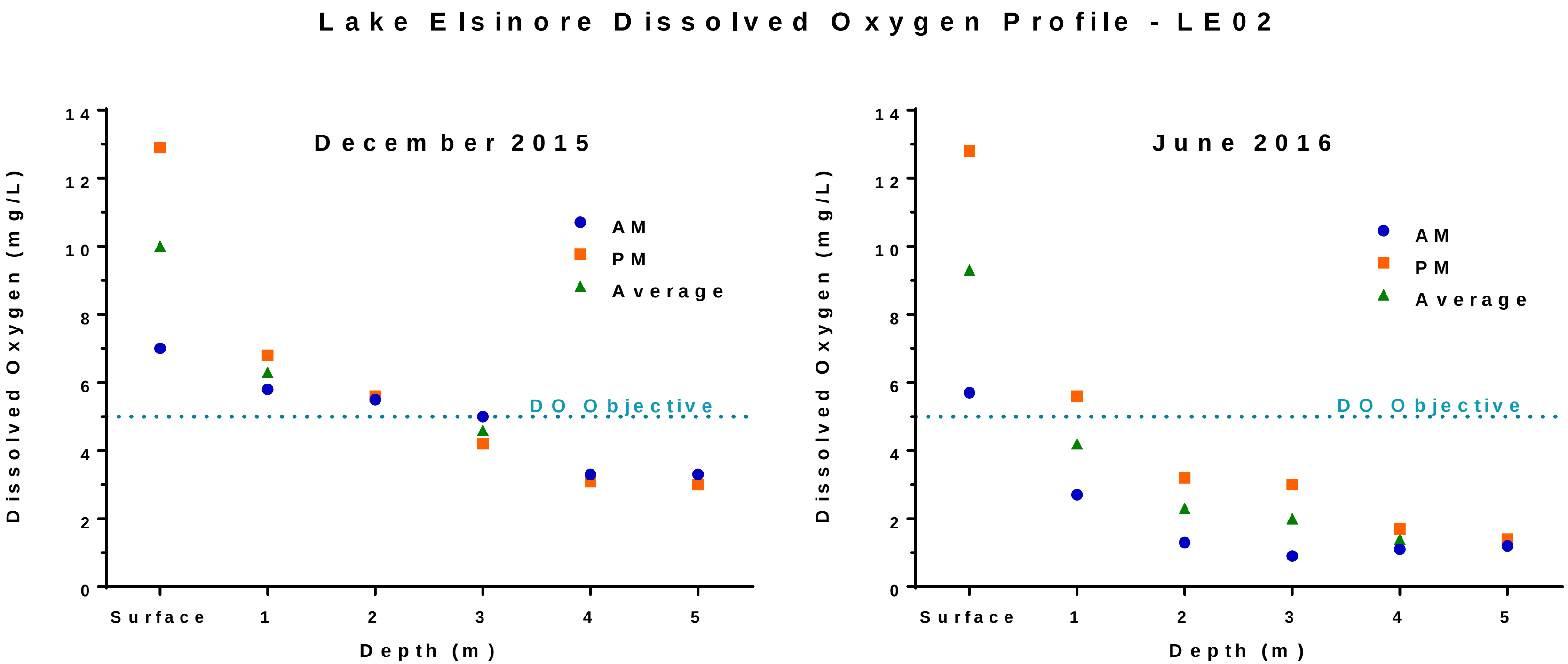
Canyon Lake Dissolved Oxygen – East Basin Epilimnion vs. Hypolimnion 2016-2017

Mean of Sites CL09 & CL10



No stratification in Sept (CL10) & Dec/Feb (both)
Not sampled in July 2016

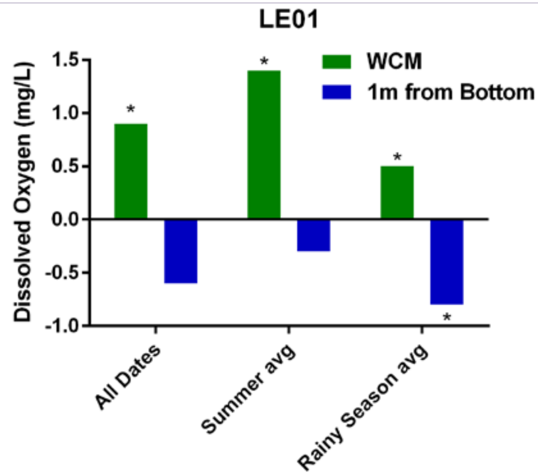
Dissolved Oxygen – Diurnal Variability

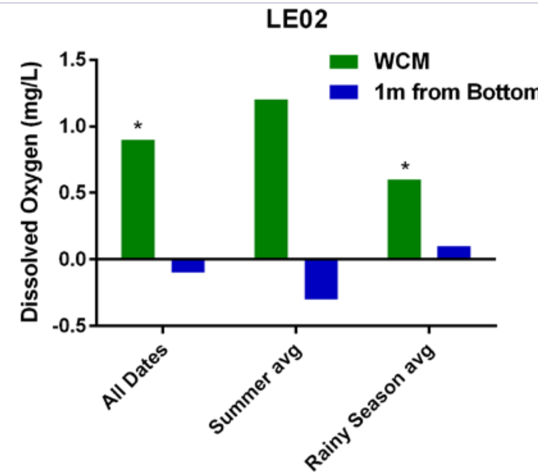


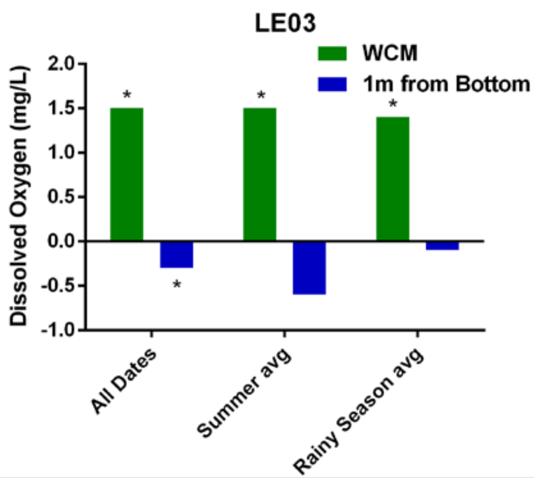
Lake Elsinore Dissolved Oxygen – Morning vs. Afternoon TMDL Compliance July 2015 to June 2017

Site	TMDL DO Target	Time of Measurement	# of Events	# Events in Compliance	Percent of Events in Compliance
LE01	2015 Water Column Mean	Morning	14	9	64%
		Afternoon	13	10	77%
	2020 1m from Bottom	Morning	14	6	43%
		Afternoon	13	5	38%
LE02	2015 Water Column Mean	Morning	14	7	50%
		Afternoon	13	9	69%
	2020 1m from Bottom	Morning	14	7	50%
		Afternoon	13	5	38%
LE03	2015 Water Column Mean	Morning	14	9	64%
		Afternoon	14	10	71%
	2020 1m from Bottom	Morning	14	7	50%
		Afternoon	14	7	50%

Lake Elsinore Dissolved Oxygen – Morning vs. Afternoon TMDL Compliance by Season July 2015 to June 2017







Plotting mean difference in Morning vs. Afternoon DO values

*** = Statistically Significant Morning vs. Afternoon**

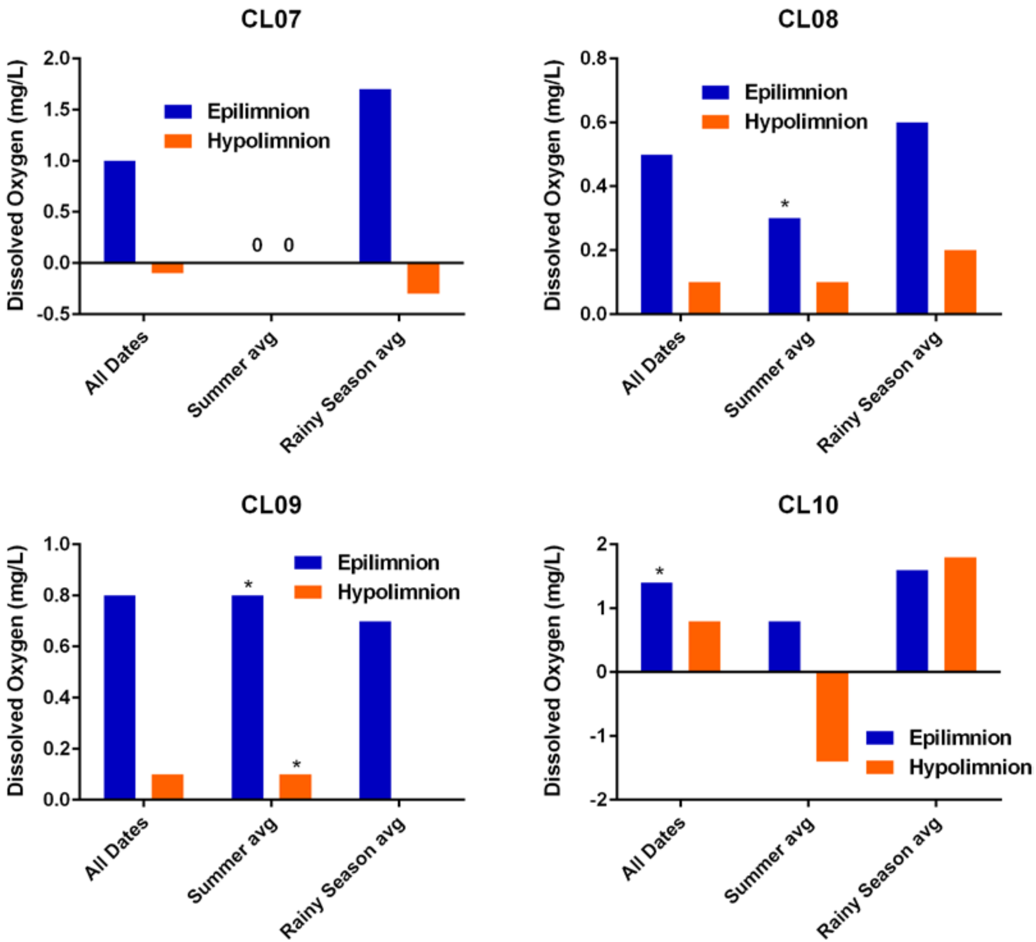
Note: Positive values represent periods when DO increased from morning to afternoon, negative values indicate a decrease in DO from morning to afternoon

Canyon Lake Dissolved Oxygen – Morning vs. Afternoon TMDL Compliance July 2015 to June 2017

Site	TMDL DO Target	Time of Measurement	# of Events	# Events in Compliance	Percent of Events in Compliance
CL07	2015 Epilimnion	Morning	11	10	91%
		Afternoon	9	9	100%
	2020 Hypolimnion	Morning	11	0	0%
		Afternoon	9	0	0%
CL08	2015 Epilimnion	Morning	11	11	100%
		Afternoon	9	9	100%
	2020 Hypolimnion	Morning	11	1	9%
		Afternoon	9	2	22%
CL09	2015 Epilimnion	Morning	11	11	100%
		Afternoon	9	9	100%
	2020 Hypolimnion	Morning	11	2	18%
		Afternoon	9	1	11%
CL10	2015 Epilimnion	Morning	8	8	100%
		Afternoon	8	8	100%
	2020 Hypolimnion	Morning	7	3	43%
		Afternoon	8	5	63%

Note: Only events shown are those when thermal stratification was present at the time of monitoring.
No measurements were taken in the afternoon for October 2015 or September 2016 events.

Canyon Lake Dissolved Oxygen – Morning vs. Afternoon TMDL Compliance by Season July 2015 to June 2017



Plotting mean difference in Morning vs. Afternoon DO values

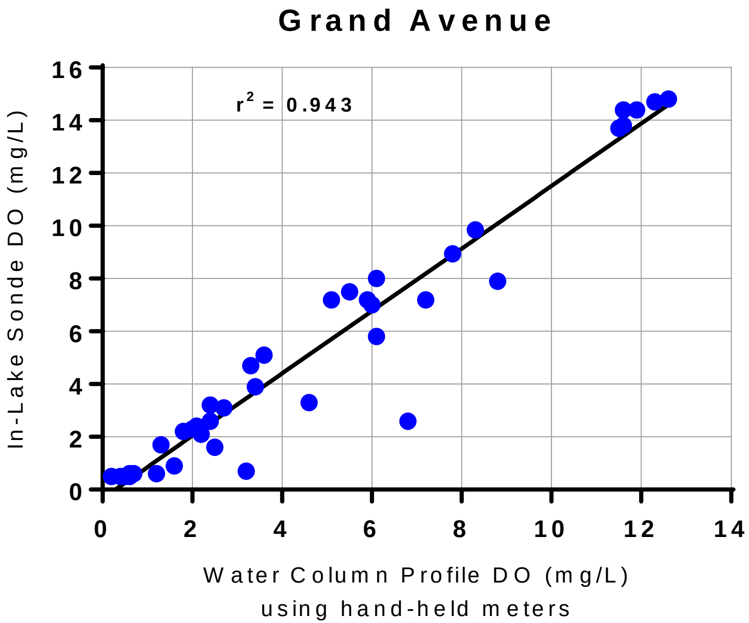
*** = Statistically Significant Morning vs. Afternoon**

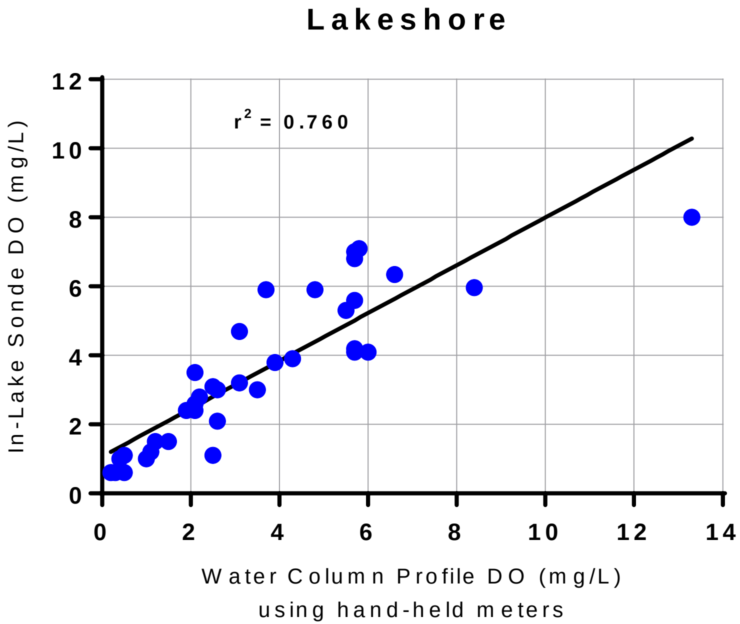
Note: Positive values represent periods when DO increased from morning to afternoon, negative values indicate a decrease in DO from morning to afternoon

No difference in mean DO was observed between morning and afternoon in epilimnion or hypolimnion at Site CL07 during summer periods

Lake Elsinore Dissolved Oxygen
Do In-Lake Sondes Represent Lake-wide Conditions?

Hand-held Profiles vs. In-lake Sondes July 2015 to June 2017

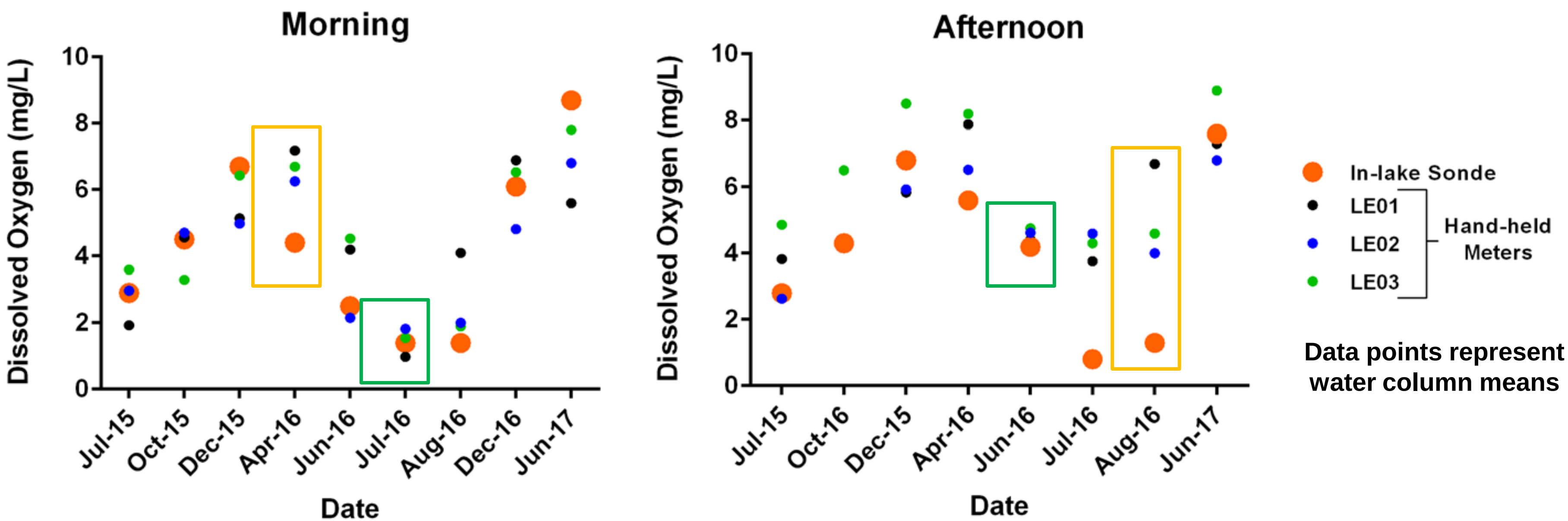




- Data points represent individual 1-m depth readings
- Hand-held meter readings were taken immediately adjacent to in-lake sondes with maximum 30-minute time difference

Lake Elsinore Dissolved Oxygen – July 2015 to June 2017
Do In-Lake Sondes Represent Lake-wide Conditions?

Grand Avenue Sonde



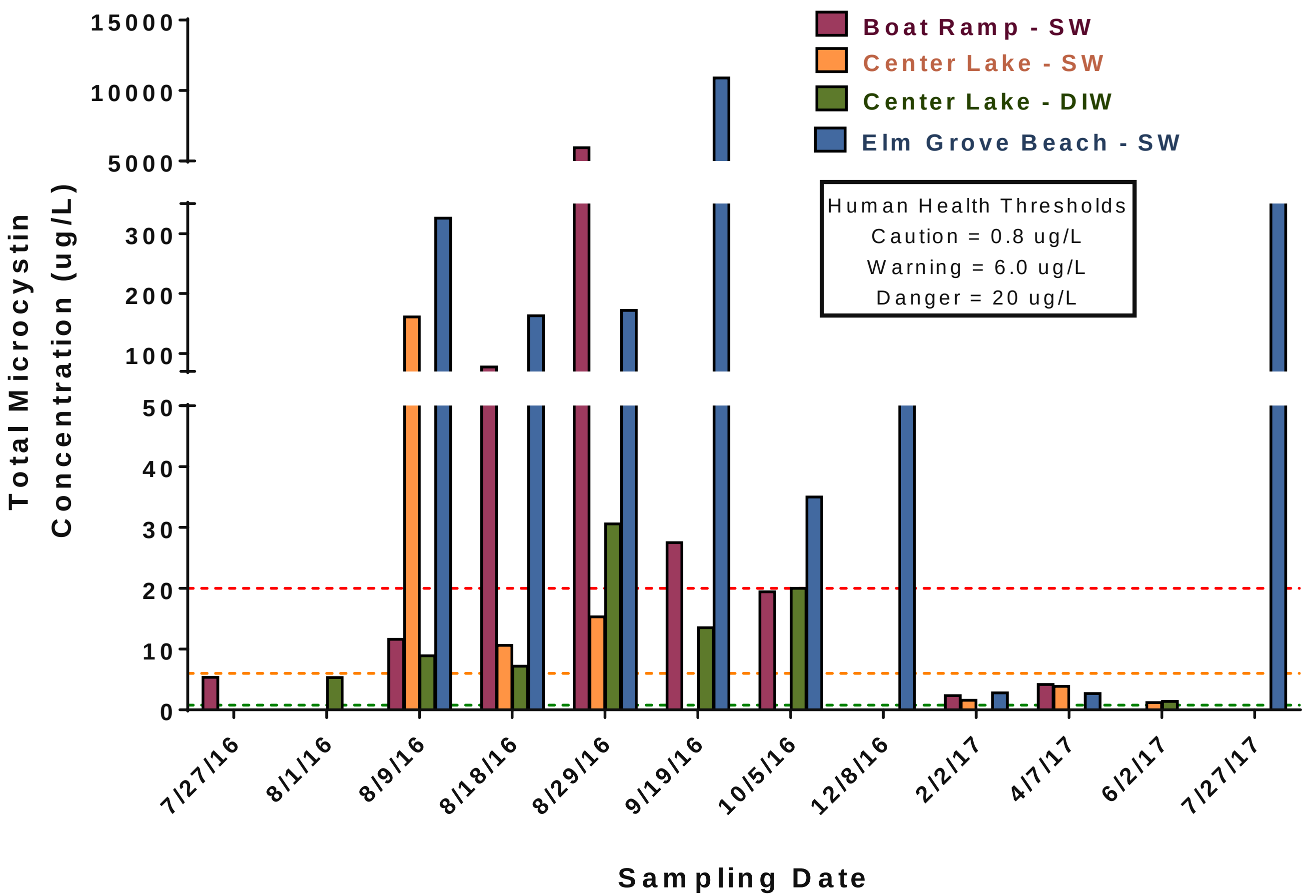
Hand-held meter and In-lake sonde in general agreement

Hand-held meter and In-lake sonde not in agreement

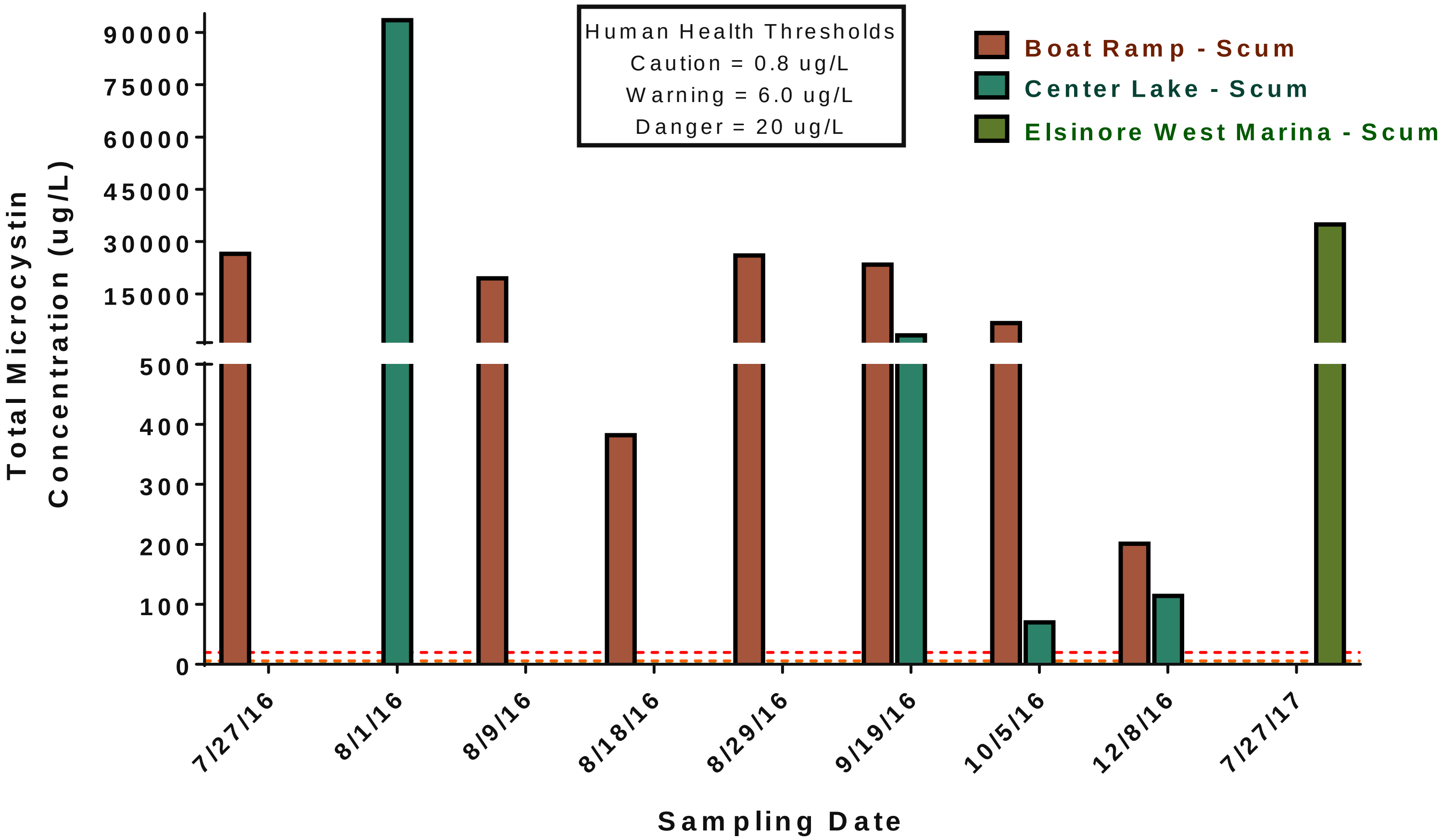
Lake Elsinore and Canyon Lake TMDL Water Quality Monitoring Update – 2016-17 Summary

Cyanobacterial Toxin Monitoring

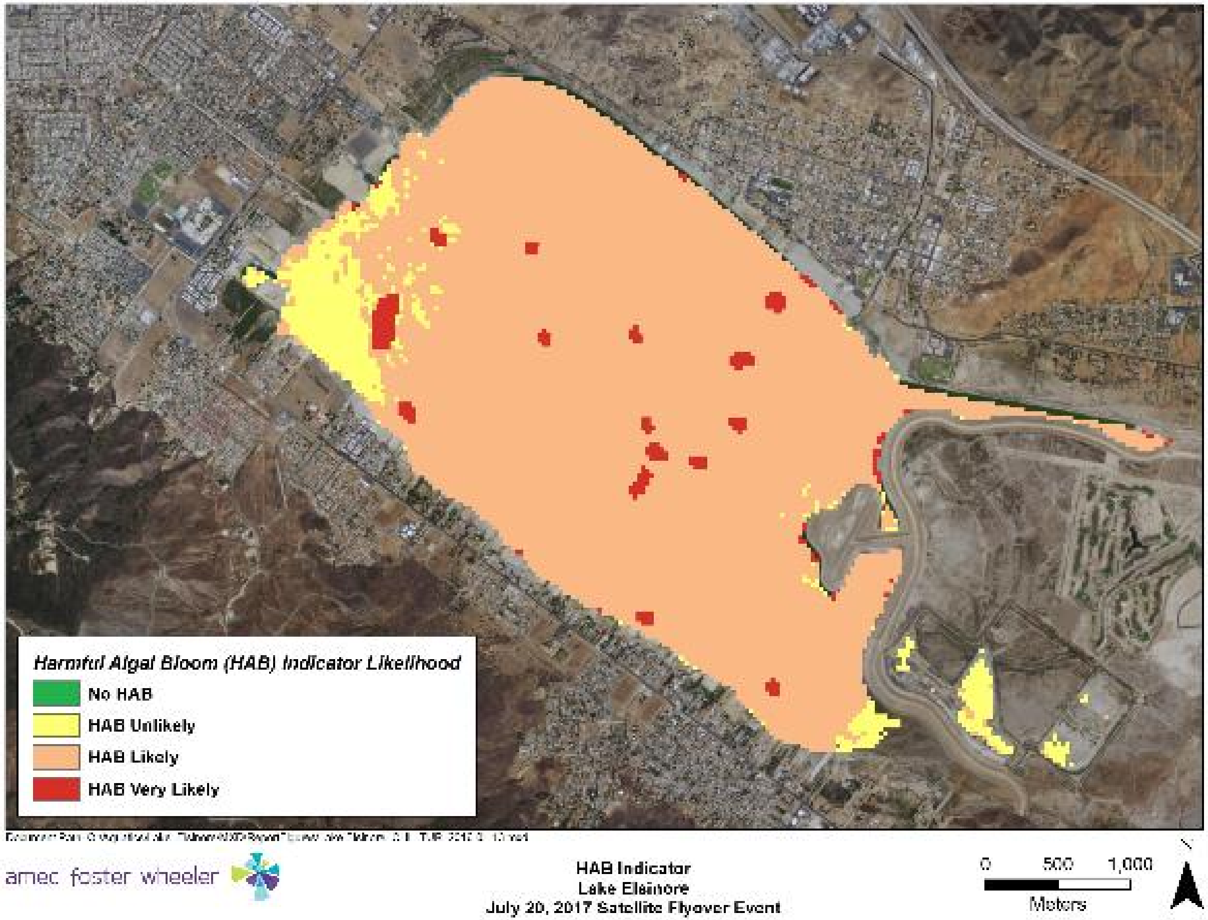
Lake Elsinore Cyanotoxin Bloom Water Samples 2016-2017



Lake Elsinore Cyanotoxin Bloom Scum Samples 2016-2017



Satellite Imagery Cyanotoxin Indicator – July 2017



Questions?

Back Up Slides

Cyanotoxin Concentrations– Lake Elsinore 2016-2017

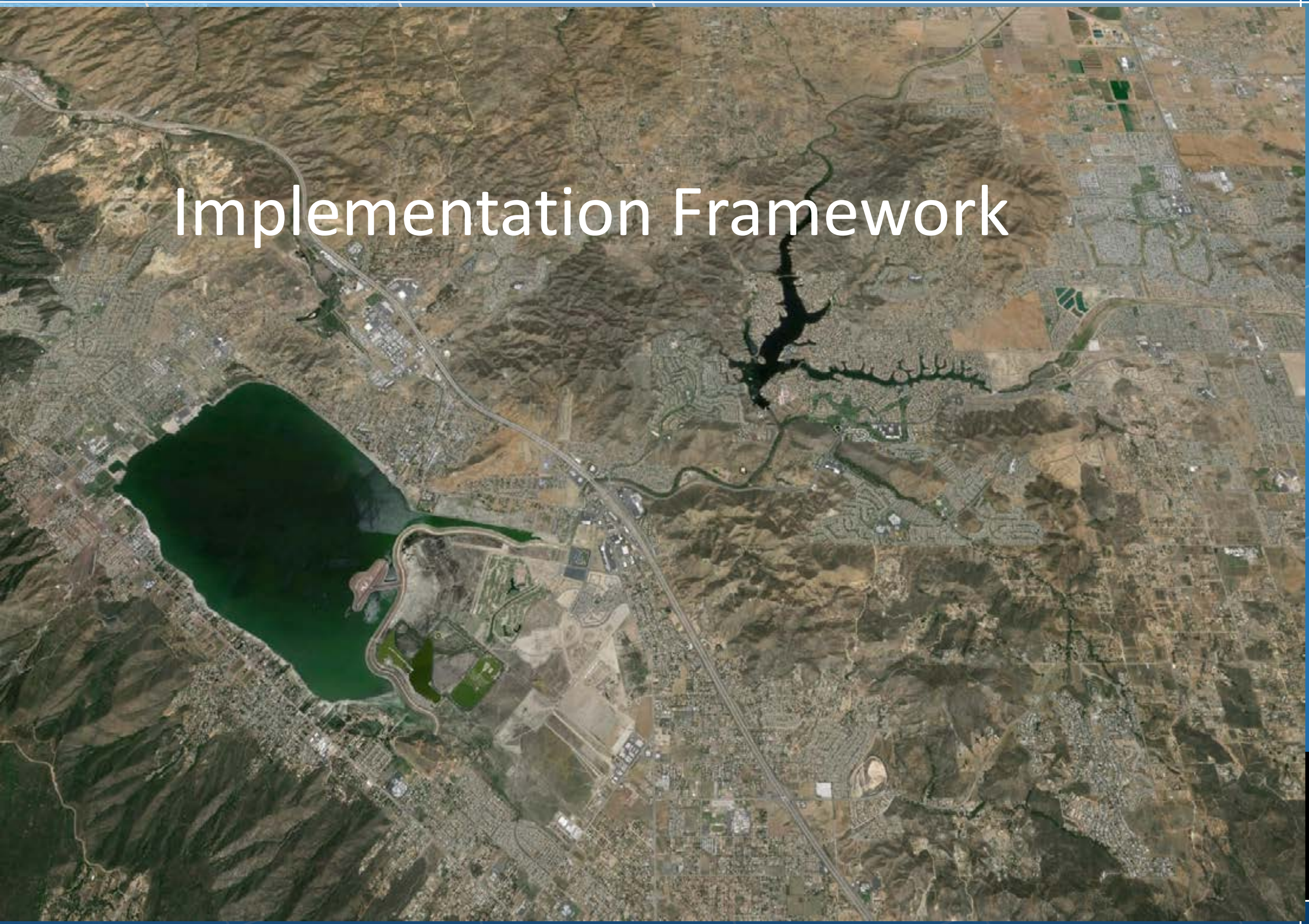
Analytes	Microcystin Concentration (ug/L)										
	July 27	Aug 1	Aug 9	Aug 18	Aug 29	Sept 19	Oct 5	Dec 8	Feb 2	Apr 7	Jun 2
La Laguna Boat Ramp - Scum	26500		19450	382	26000	23425	6600	201			
La Laguna Boat Ramp - Surface Water	5.36		11.6	77.5	5950	27.5	19.4		2.35	4.19	
Center Lake - Depth Integrated Water		5.3	8.9	7.2	30.6	13.5	20				1.4
Center Lake - Scum		93500				3110	70	114			
Center Lake - Surface Water			161	10.6	15.3				1.59	3.87	1.2
Elm Grove Beach - Surface Water			326	163	172	10900	35	56	2.79	2.7	

California CyanoHAB Trigger Levels for Human Health (ug/L)			
Toxin	Caution – Action Trigger	Warning – Tier 1	Danger – Tier 2
Microcystin	0.8	6.0	20

Revision of the Lake Elsinore & Canyon Lake Nutrient TMDL

CDM Smith
Team & Risk
Sciences

Implementation Framework



August 16, 2017

Lake Elsinore/Canyon Lake
Task Force Meeting

RISK SCIENCES

CDM Smith

Presentation Outline

- Review of completed draft TMDL elements
- Consideration of concentration based allocations
- Implementation framework
- Supplemental project options
- Schedule

Completed Draft TMDL Elements

TMDL Elements

- Draft chapters 1-6 submitted to Task Force
- Remaining elements for TMDL include implementation and monitoring

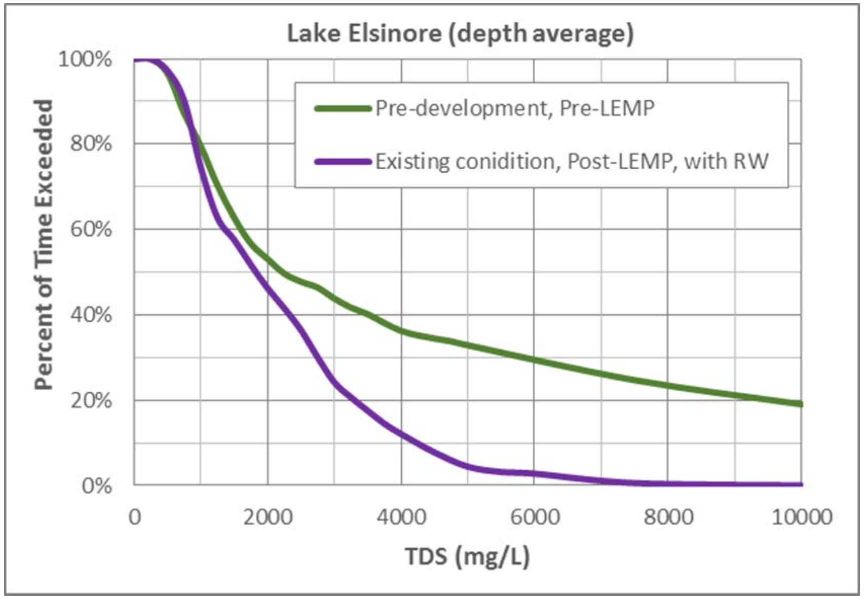
Allocations

Allocations

- 2004 TMDL
  - 10 year average mass
- Draft TMDL revision
  - Hydrology representative of reference watershed (zero imperviousness)
- Concentration-based approach to TMDL revision
  - Demonstrate with lake models that natural mass based allocation is not best water quality
  - Allows for managed lake condition – prevent future Lake Elsinore desiccation

Concentration-Based Allocations

- Allows current runoff volumes at reference concentrations
- Encourages delivery of more water volume to lakes
  - Recycled water and stormwater runoff
- Water quality benefit of higher lake levels, flushing, dilution of TDS
- Linkage analysis to compare in lake response for mass and concentration based allocations
- Which allocation approach yields highest attainable use (HAU)



Preliminary results from Anderson, 2016.

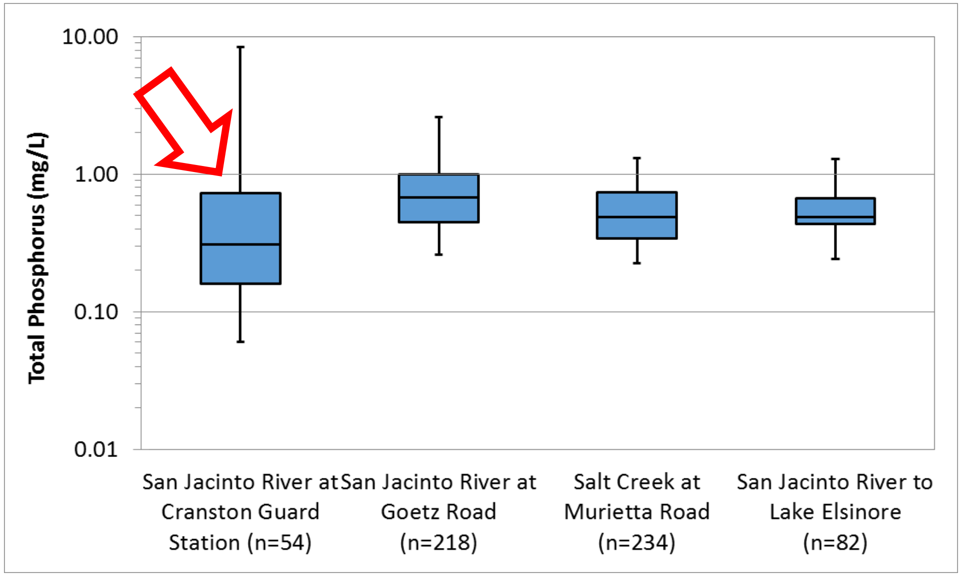
Concentration-Based Allocations

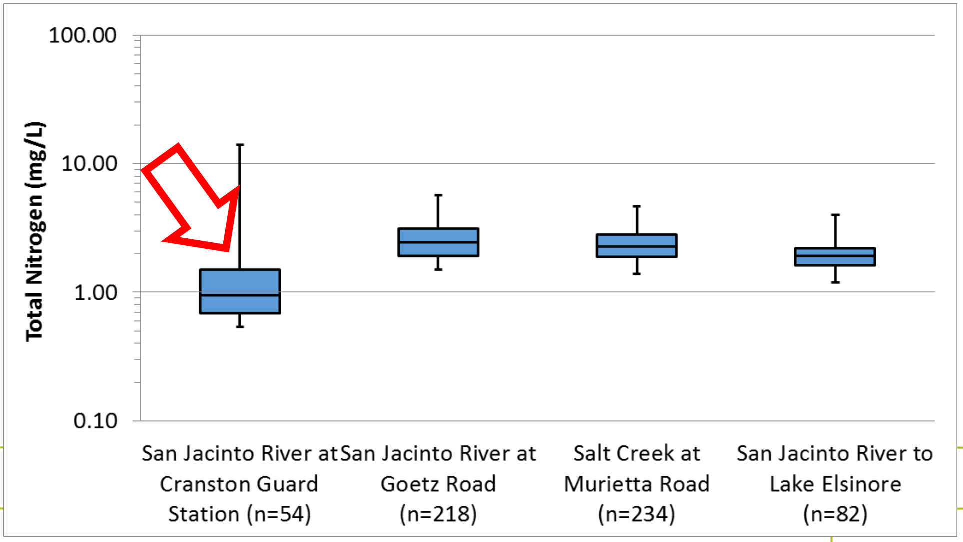
- Increased volume with watershed development

Lake Segment	Average Reference Volume (AFY)	Average Current Volume (AFY)	Ratio
Canyon Lake (Main Lake)	3,997	5,802	1.452
Canyon Lake (East Bay)	1,797	2,546	1.417
Lake Elsinore	6,903	9,087	1.316

Concentration-Based Allocations

- Reference concentration from Cranston Guard Station data
- Comparable to grab samples from other mostly undeveloped sites in SJR watershed





CDM Smith

Concentration-Based Allocations

- Reference concentration versus reference mass based allocations
- Allowable TP as kg/yr

Lake Segment	Reference Volume, Reference TP Concentration	Current Volume, Reference TP Concentration
Canyon Lake (Main Lake)	1,528	2,219
Canyon Lake (East Bay)	687	974
Lake Elsinore	2,640	3,475

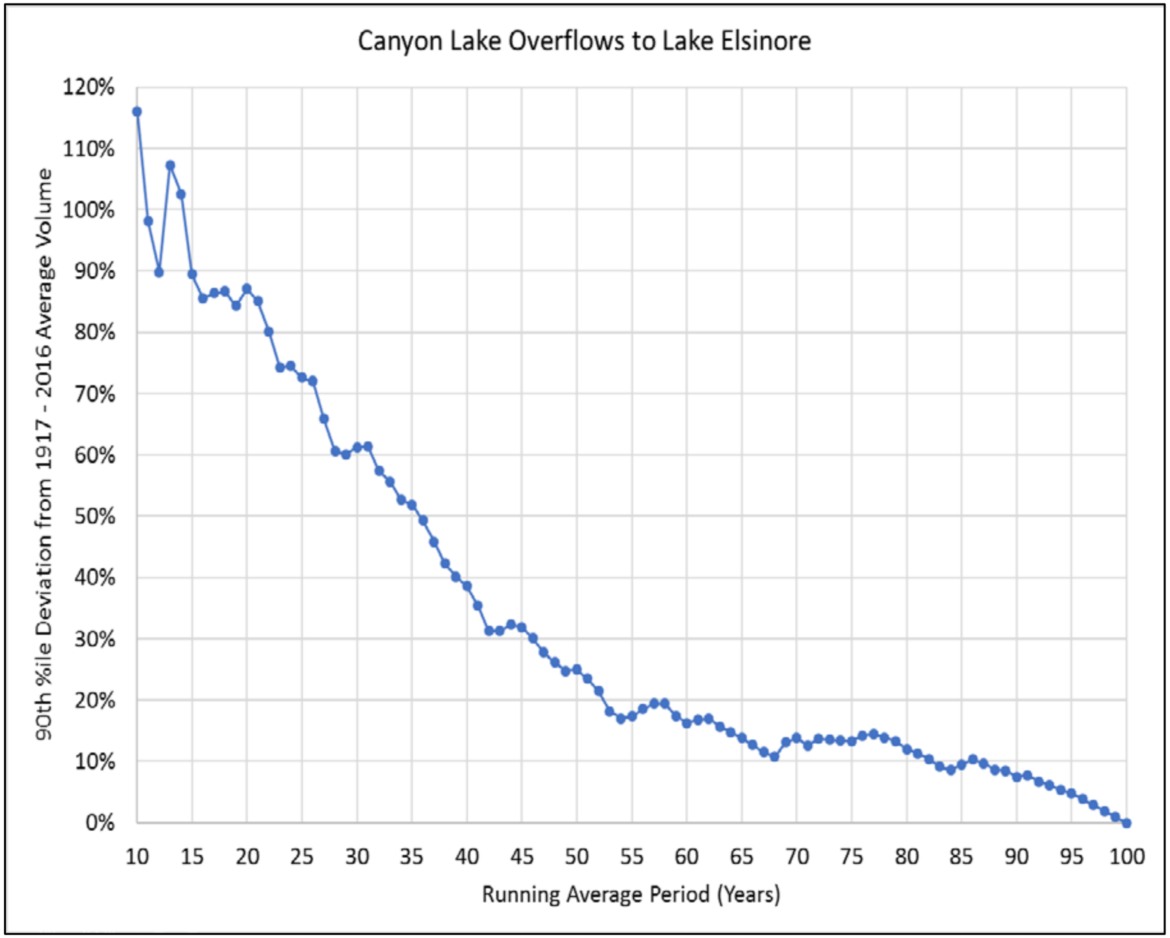
Concentration-Based Allocations

- Reference concentration versus reference mass based allocations
- Allowable TN as kg/yr

Lake Segment	Reference Volume, Reference TN Concentration	Current Volume, Reference TN Concentration
Canyon Lake (Main Lake)	4,684	6,800
Canyon Lake (East Bay)	2,106	2,984
Lake Elsinore	8,090	10,650

Concentration-Based Allocations

- Multi-decadal hydrologic average needed to represent Lake Elsinore inflows
- Concentration-based allocation would remove hydrology from allowable mass calculation



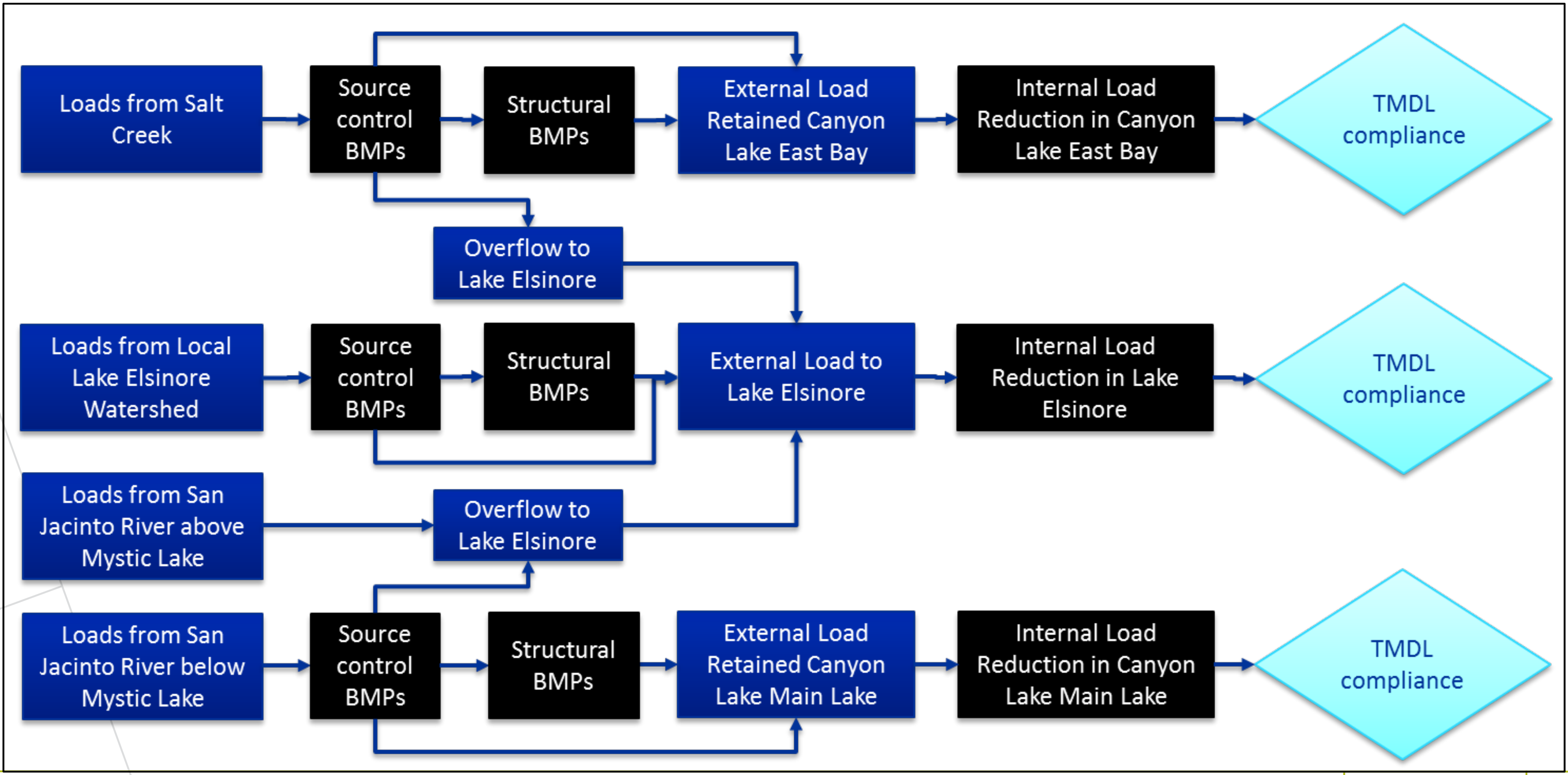
Implementation Framework

Implementation Framework

- Load reduction required = current minus allowable
- Allowable is increment attributable to anthropogenic influence
  - Hydrology
  - Nutrient concentrations
- Quantify reduction credits from ongoing implementation of existing controls
- Supplemental projects needed if existing controls do not provide required load reduction

Nutrient Load Reduction Credits

- Demonstration of Load Reductions from source control, structural, and in-lake nutrient controls



CDM Smith

Existing controls

- Summary of nutrient reduction credits to each lake segment with ongoing implementation of existing controls
- Table based on 2015 deployment data

Controls	TP (kg/yr)			TN (kg/yr)		
	CL – East Bay	CL – Main Lake	Lake Elsinore	CL – East Bay	CL – Main Lake	Lake Elsinore
Source Control (street sweeping, CB cleaning)	163	414	488	543	1380	2661
Structural (WQMPs)	63	263	236	105	689	515
Agriculture CWAD (projected deployments)	166	289	1	357	639	3
In-Lake (Alum, LEAMS)	419	858	7,000	0	0	44,000
Total	811	1,824	7,725	1,005	2,708	47,179

Conformance Assessment

Conformance assessment for 2015 Deployments

- Supplemental projects needed if existing controls do not provide required load reduction

Conformance assessment for 2015 Deployments

- Canyon Lake – East Bay
- Further load reductions may not be required if response targets achieved

Canyon Lake – East Bay	TP (kg/yr)		TN (kg/yr)	
	Mass-based	Concentration-based	Mass-based	Concentration-based
Current External Load without BMPs	1,858		7,763	
Allowable Load	687	974	2,106	2,984
Load Reduction Required	1,171	884	5,657	4,779
Load Reductions Achieved (2015)	811		1,005	
Unmet Load Reductions	360	70	4,652	3,774

Conformance assessment for 2015 Deployments

- Canyon Lake - Main Lake
- Further load reductions may not be required if response targets achieved

Canyon Lake – Main Lake	TP (kg/yr)		TN (kg/yr)	
	Mass-based	Concentration-based	Mass-based	Concentration-based
Current External Load without BMPs	3,621		16,959	
Allowable Load	1,528	2,219	4,684	6,800
Load Reduction Required	2,093	1,402	12,275	10,159
Load Reductions Achieved (2015)	1,824		2,708	
Unmet Load Reductions	269	-422	9,567	7,451

Conformance assessment for 2015 Deployments

- Lake Elsinore quantitative conformance assessment is still being developed
- Internal load accounts for majority of nutrients in water column
- Reducing external loads to reference levels requires much less credits than estimated to be achieved from ongoing in-lake controls

Supplemental Project Concepts

Alternatives Analysis

- Numerous prior broad scale alternatives analysis
  - CDM, 2013. CNRP and AgNMP
  - Risk Sciences, 2007. In-Lake Nutrient Reduction Plans
  - CH2MHILL, 2004. Lake Elsinore Nutrient Removal Study
  - Tetra Tech, 2004. San Jacinto Nutrient Management Plan
  - Horne, 2002. Restoration of Canyon Lake and Benefits to Lake Elsinore
  - Black and Veatch, 1994. Lake Elsinore Water Quality Management Plan
- TMDL revision summarize findings of prior analyses and characterize options
- Different controls for Canyon Lake and Lake Elsinore
- Numerous project specific studies
  - Alum, aeration, HOS, recycled water, dredging, levee, fishery management, well augmentation, etc.

Water Quality Strategies

- General categories
  - Nutrient reduction
  - Algae control
  - Oxygenation
  - Hydrologic Flushing
- Projects use one or more water quality strategies
- Quantification of benefits with lake models

EVMWD Effluent Polishing

- Reduce EVMWD effluent to 0.1 mg/L with additional chemical addition
- Currently permit for ~0.5 mg/L for 6000 AFY
- Achieving ~0.35 mg/L
- Increment below reference level is credit in concentration based approach
- Increase P reduction by ~1500 kg/yr

Alum in Lake Elsinore

- Already done for recycled water
- Via surface spreading or with inflows
- Ideally to be applied when pH is low
- Grand Lake St Mary's – Ohio largest inland lake
  - Alum treatment over entire 12,680 acre lake surface
  - ~50 percent reduction in TP lakewide
- Treatment in San Jacinto River

Back Bay Wetlands

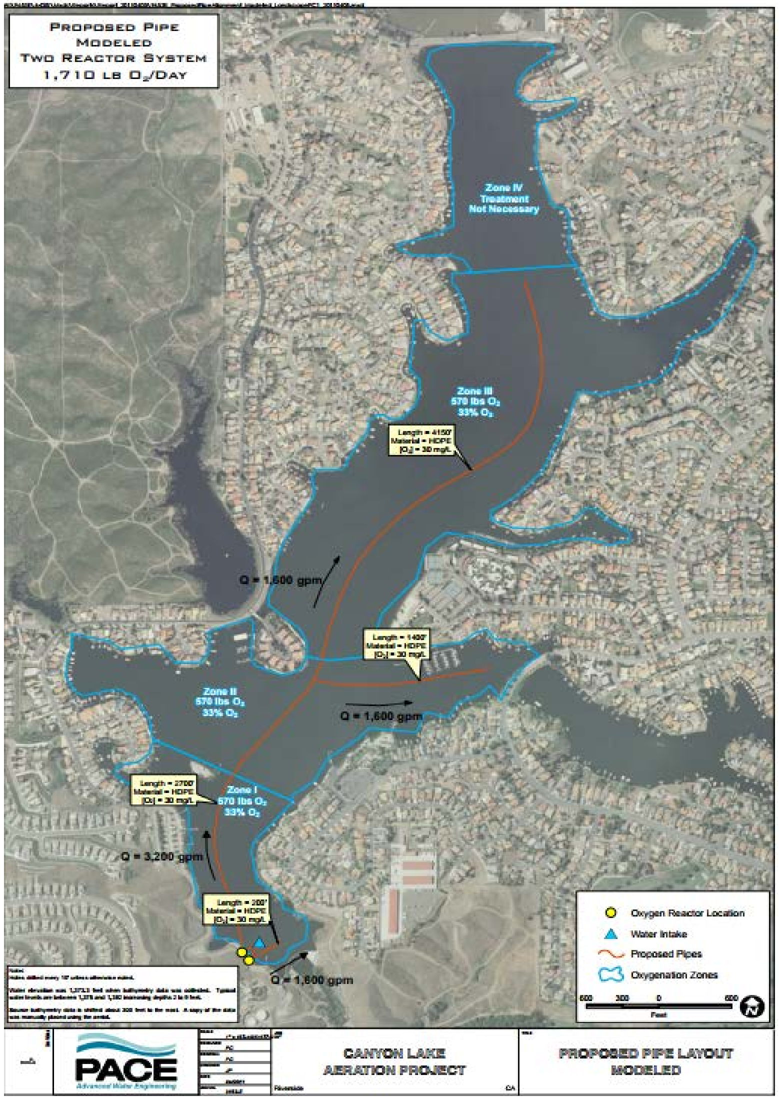
- Prior study involved routing of wet weather inflow through Back Bay wetland area
- Recirculation alternative to have continuous treatment of Lake Elsinore

Alum Treatment of Canyon Lake Inflows

- Continuous alum treatment of lake inflows
- More efficient flocculation with lower pH
- Eliminates timing decisions of winter/spring surface spreading
- Treated runoff may overflow to Lake Elsinore
- Prior concept level design
  - 5,000 gallon storage tank w/secondary spill containment
  - 15 gpm dual feed flow paced pumps w/telemetry
  - 1,000 ft 2” PVC feed pipe w/ anchors
  - Submerged downward emitter(s) w/screening
  - Order of magnitude capital cost - $100,000/station
  - Alum chemical cost and O&M

Hypolimnetic Oxygenation System

- Oxygenate Canyon Lake bottom waters
- Improves DO
- Reduce internal nutrient loads by ~70% phosphorus and 35% ammonia-N
- Limited benefit to East Bay



Dredging

- Remove sediment and source of internal nutrient load
- Cost prohibitive for a large treatment area
- Restores storage capacity filled in from decades of sedimentation
  - Canyon Lake sedimentation has reduced storage capacity from 13,000 AF to 8,000 AF
- Dry dredging in East Bay more efficient and cost effective

Indirect Potable Reuse

- Would add treated wastewater effluent near inflows of Canyon Lake to allow increased diversion at the existing intake by EVMWD
- Mutual water quality benefits
  - Enhanced flushing
  - Deeper water depths
  - Dilution of nutrients with AWT water
- Review Feasibility Study recommendations

Artificial Circulation in Canyon Lake

- Larger conveyance system
- SWP/Colorado River water
- IPR discharge
- Prior concept level design
  - Flow capacity: 8,000 gpm (or 11.5 mgd)
  - 16,350-ft, 30-inch pipeline
  - 400 HP Pump Station
  - Riser Intake with mechanical sluice gates
  - Riser Outfall
  - Rock protection at Intake/Outfall areas and over submerged pipe within lake

Biomanipulation

- Introduce fish species or zooplankton that feed on most problematic algae
- Fishery Management Plan
- Must account for TDS in update to FMP

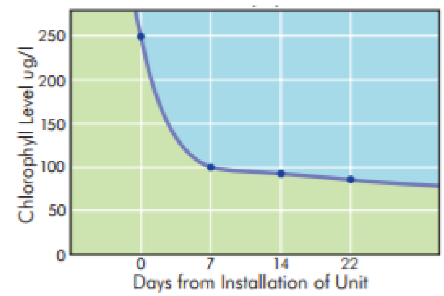
Vegetation Management

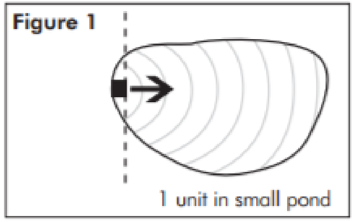
- Active vegetation management
- Macrophyte along shoreline
- Lake level stabilization
- Floating islands

Ultrasonic Algae Control

- Uses ultrasonic waves to destroy algae cells
- Low ongoing operational cost, after initial capital cost
- Requires continuous operation to prevent growth
- Limited treatment area
- Potential for release of toxins into water column from dead algae cells
- Further study needed to assess impacts to non-target organisms

Sources: SonicSolutions and Wagner, 2004.





Pond prior to sonication treatment
(provided by D. Taylor of Sonic Solutions)

Pond after sonication treatment
(provided by D. Taylor of Sonic Solutions)

Algaecide

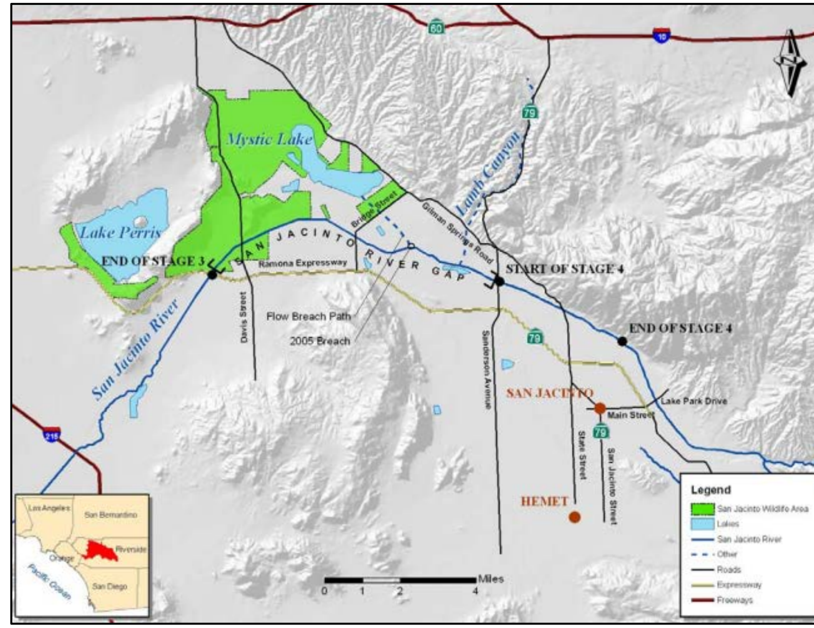
- Use of copper sulfate or hydrogen peroxide to temporarily reduce algae
- Improves effectiveness of other nutrient reduction strategies

Physical Harvesting

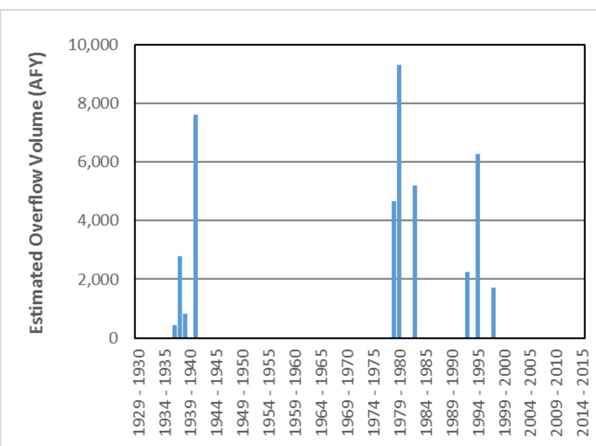
- Reduce algae in lake
- Removes nutrients and toxins in algae from system

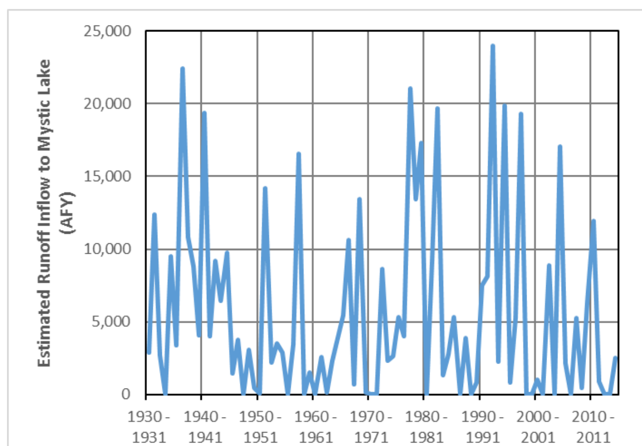
San Jacinto River Gap

- Significant increase in annual average runoff volume
- Incentive upstream communities currently benefiting from Mystic Lake retention



Source: Tetra Tech, 2007. San Jacinto Gap Feasibility Study.





Diversion/Retention of Runoff

- Increased watershed runoff retention
- Bypass flows in San Jacinto River to Temescal Creek
- Effectively eliminate nutrient load, but also source of most water to Lake Elsinore
- Water rights considerations

Allowing Lakebed Desiccation

- Allow for natural reset mechanism

Other Ideas?

Next Steps

TMDL Implementation Chapter

- Characterization of water quality strategies
- Estimation of water quality benefits with lake models
- Provides basis for updating CNRP and AgNMP
- Does not rank or recommend specific projects

Schedule

- Implementation chapter draft – October 15
- Monitoring chapter draft – November 1