

Harmful Algal Blooms and Lake Management

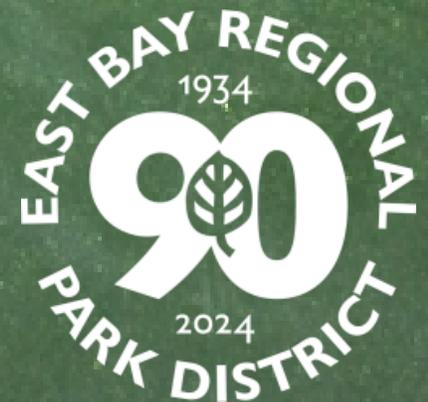
Joe Sullivan

Fisheries Program Manager

East Bay Regional Park District

Natural and Cultural Resources Committee

February 13, 2024

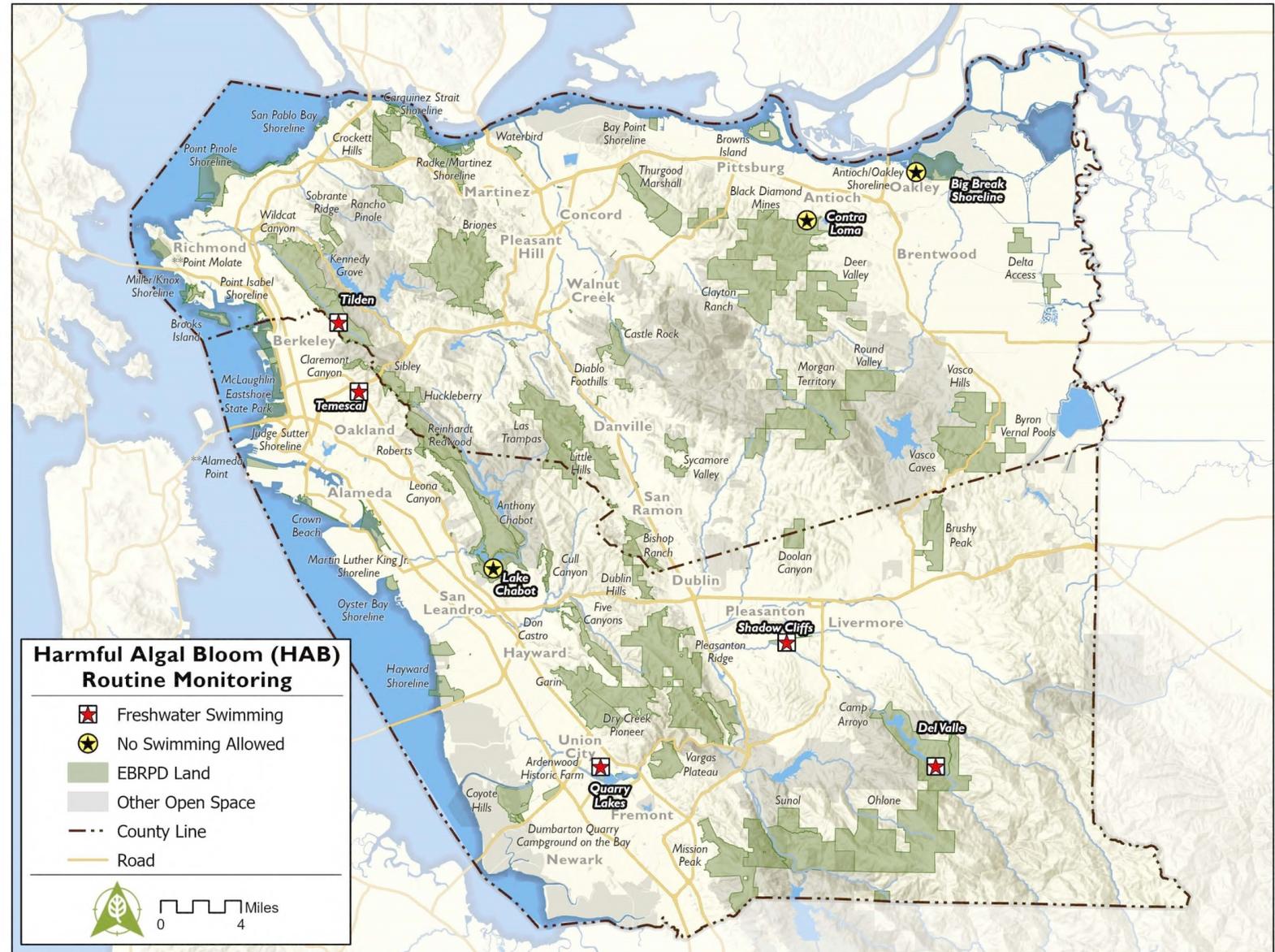


Overview

- 1. Introduction to Lakes and Reservoirs**
- 2. Monitoring for Harmful Algal Blooms (HABs)**
- 3. Management Practices for HABs**
- 4. Looking Toward the Future**



- 8 Lakes
- 5 Swim Beaches
- 3 Swim Lagoons
- 2 Shoreline Swim Beaches



Types of Lake Uses

1. Scenic - Aesthetics
2. Spiritual - Tribal Activities
3. Life - Water Supply
 - Irrigation
 - Drinking
4. Safety - Flood Control
5. Health - Recreation
 - Fishing
 - Boating/Kayak/Paddle Boarding
 - Swimming



Lakes and Reservoirs Age

- *Sediment = NUTRIENTS*
- *Reservoirs are designed to die...*

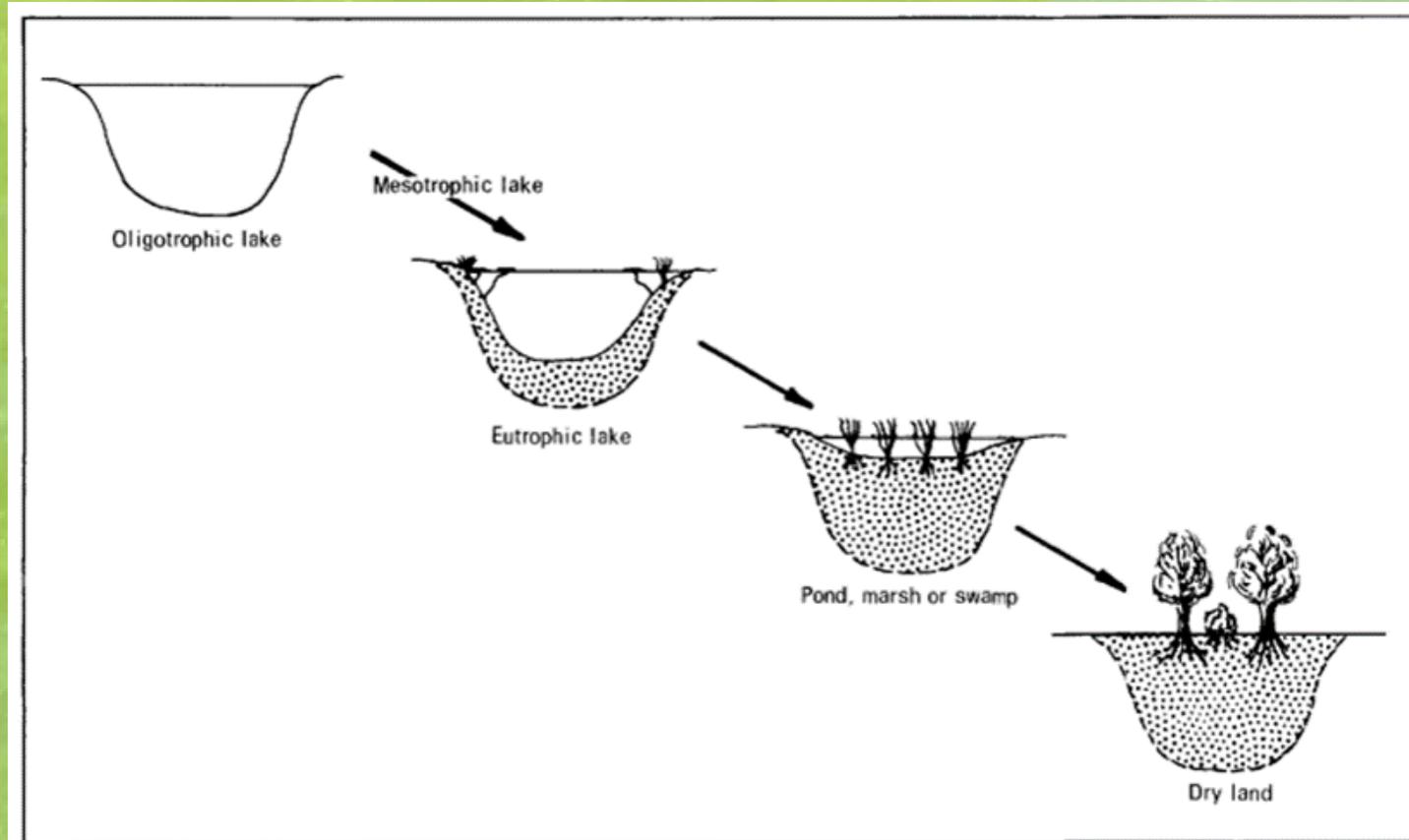
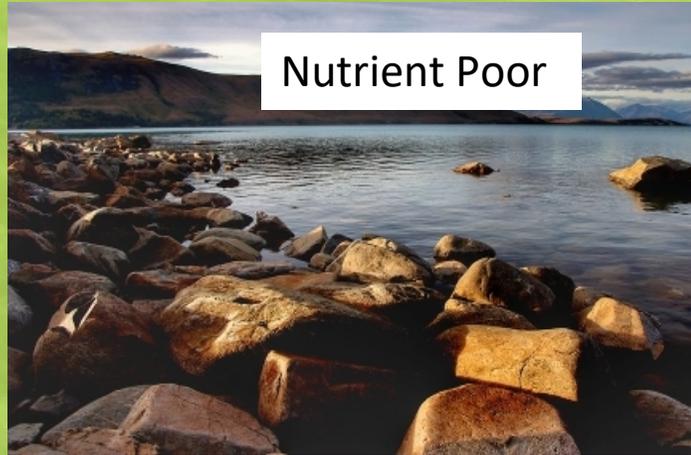


Figure 2. Eutrophication--the process of aging by ecological succession.

Aquatic Ecological Succession



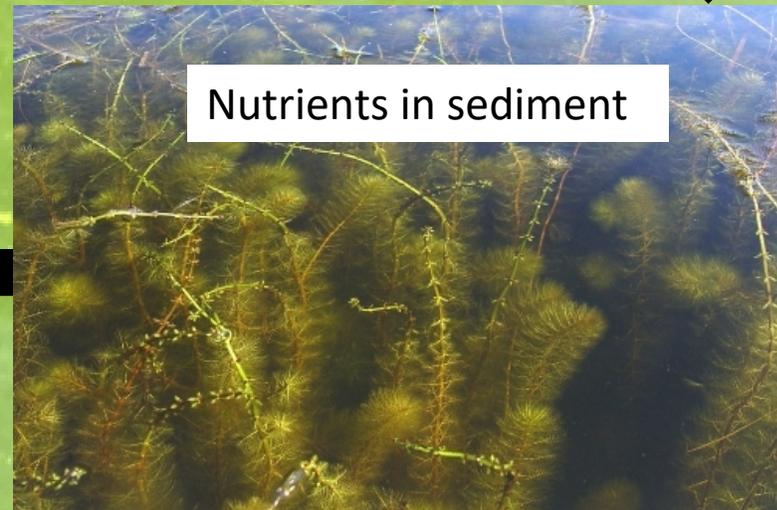
Nutrient Poor



Nutrient along shore



Nutrients in water



Nutrients in sediment



Nutrients everywhere

Lakes and Reservoirs Age



Types of Lake Issues from HABs

- 1. Poor Water Quality*
- 2. Recreation Limitations*
- 3. Human and Pet Injuries*
- 4. Fish Kills*
- 5. Loss of Revenue and Reputation*



Recreational Waters



Monitoring for HABs

Anja Brey

Acting Ecological Services Coordinator

Lake Management

East Bay Regional Park District



Cyanobacteria 101

- What We Know

- Found worldwide
- One of oldest known organisms
- Unique traits
- Some release toxins causing health effects – dogs are more susceptible than humans
- Thrive in areas with low oxygen, high nutrients, warmer and slower moving waters – outcompete other food web members

- What We Don't Know

- What triggers a bloom
- Why only some cyanobacteria have toxins
- Guaranteed treatment results

Footwork – Ground Observations



IDENTIFYING A HARMFUL ALGAL BLOOM (HAB)

This quick guide provides a visual comparison of appearance and color and odor that can be helpful in distinguishing non-toxic green algae and aquatic plants from potentially toxic cyanobacteria blooms or harmful algal blooms (HABs).

Non-toxic Algae & Plants

Cyanobacteria/HAB

APPEARANCE



Rooted Plants



Floating Plants



Paint or Soup

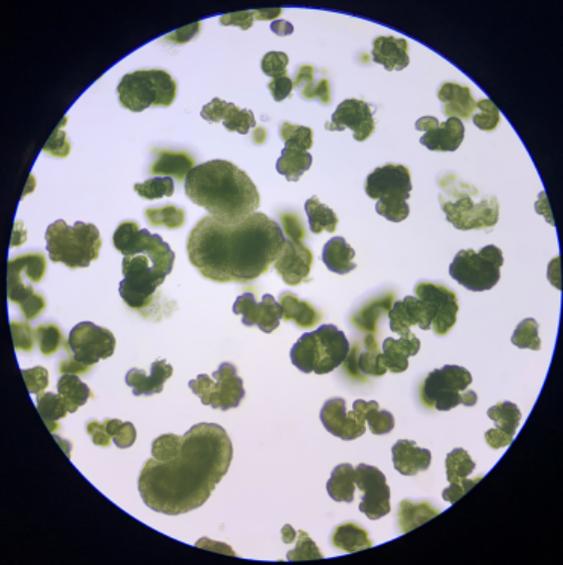


Scum, Bubbling or Spit-like Floating Foam

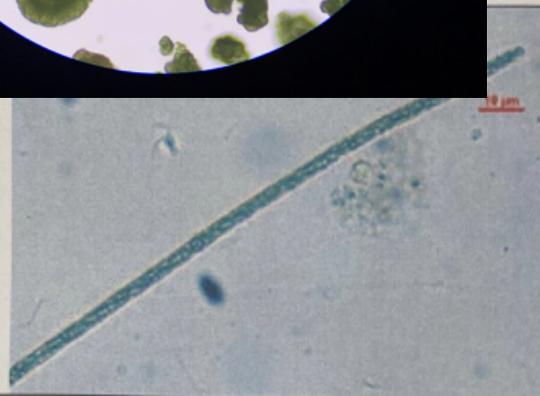


- The water management team runs the HABs monitoring program
- Visual monitoring is conducted weekly from April through October and twice monthly from November through March
- Structures and downwind areas can accumulate cyanobacteria and scums
- Cyanobacteria presence can vary throughout the day
- Samples are collected from the worst areas

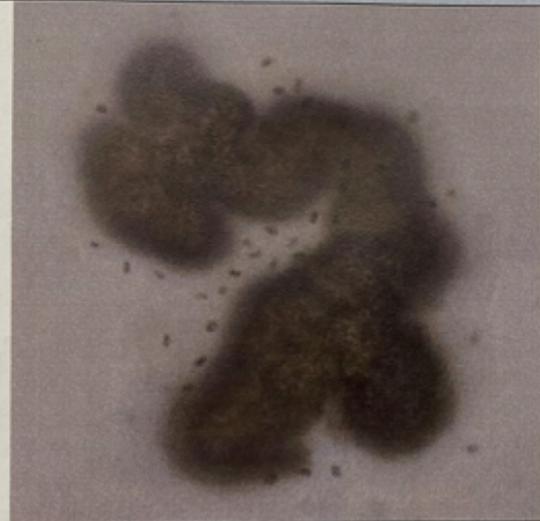
Sample Identification



aquatic analysis ... research .



Planktothrix



Woronichinia naegeliana



Sample ID & Toxin Potential

Table 1: Toxins produced by cyanobacteria: their effects and primary targets
(Table taken from the Report "Algal Bloom and its economic impact", JRC Technical Report, 2016¹)

Toxin classification	Toxins	Most common cyanobacteria genera producing toxins	Main organ affected	Effects	Main targets
Hepatotoxins	Microcystins	<i>Microcystis</i> , <i>Anabaena</i> , <i>Anabaenopsis</i> , <i>Aphanizomenon</i> , <i>Planktothrix</i> , <i>Oscillatoria</i> , <i>Phormidium</i>	Liver	Diarrhea, vomiting, weakness liver inflammation, liver hemorrhage, pneumonia, dermatitis	Serine/ threonine protein phosphatases
	Nodularin	<i>Nodularia</i> , <i>Nostoc</i>	Liver	Diarrhea, vomiting, weakness liver inflammation, liver hemorrhage, pneumonia, dermatitis	Serine/ threonine protein phosphatases
Cytotoxins	Cylindrospermopsin	<i>Cylindrospermopsis</i> , <i>Anabaena</i> , <i>Aphanizomenon</i> , <i>Raphidiopsis</i> , <i>Oscillatoria</i> , <i>Lyngbya</i> , <i>Umezakia</i>	Liver	Gastroenteritis, liver inflammation, liver hemorrhage, pneumonia, dermatitis	Protein synthesis

Toxin Testing



Bend Genetics, LLC
 87 Scripps Drive, Ste. 108
 Sacramento, CA 95825
 Tel: (916) 550-1048

SAMPLE RESULTS

Sample ID	Method	Target Analyte
DV-1	ELISA	Anatoxin-a
DV-1	ELISA	Cylindrospermopsin
DV-1	ELISA	Microcystin/Nod.
DV-1	ELISA	Saxitoxin
DV-2	ELISA	Anatoxin-a
DV-2	ELISA	Cylindrospermopsin
DV-2	ELISA	Microcystin/Nod.
DV-2	ELISA	Saxitoxin
DV-3	ELISA	Anatoxin-a
DV-3	ELISA	Cylindrospermopsin
DV-3	ELISA	Microcystin/Nod.
DV-3	ELISA	Saxitoxin
DV-4	ELISA	Anatoxin-a
DV-4	ELISA	Cylindrospermopsin
DV-4	ELISA	Microcystin/Nod.
DV-4	ELISA	Saxitoxin

6/13/23
 Del Valle Boat Launch
 Mic Result = ND

6/13/23
 Del Valle South end
 Mic Result = ND

6/13/23
 Quarry Lakes Swim Beach
 Mic Result = 2.5 ppb

Park District modified cyanotoxin trigger levels based on California Cyanobacteria and Harmful Algal Bloom Network guidance.

	Caution Action Trigger	Danger/Closure Action Trigger
Primary Tiggers		
Total Microcystins	0.8 µg/L	6 µg/L
Anatoxin-A	Detection	20 µg/L
Cylindrospermop sin	1 µg/L	4 µg/L
Secondary Tiggers		
	Blooms, scums, mats, etc.	

No regulations – Rely on State and Expert Guidance

CAUTION

Harmful algae may be present in this water.

-  **STAY AWAY** from algae and scum while swimming.
- DO NOT** let pets go into or drink the water.
-  **DO NOT** drink this water or use it for cooking.
-  For fish caught here, **throw away guts and clean fillets** with tap water or bottled water before cooking.

Call your doctor or veterinarian if you or your pet get sick after going in the water.

For more information, call East Bay Regional Park District: (510) 544-2328
Or visit the California Department of Public Health online: www.cdph.ca.gov/Programs/CCDC/PID/EOD/DC/EHIB/EAS/Pages/HABs.aspx
For more information on harmful algae, go to: www.mywaterquality.ca.gov/habs

East Bay Regional Park District
Healthy Parks Healthy People

DANGER

Toxins from algae in this water can harm people and animals.

-  **STAY OUT OF THE WATER UNTIL FURTHER NOTICE**
DO NOT touch scum in the water or on shore.
-  **DO NOT** let pets go into or drink the water or go near the scum.
-  **DO NOT** drink this water or use it for cooking. Boiling or filtering will not make the water safe.
-  Small Watercraft and Float Tubes are **NOT RECOMMENDED**
-  For fish caught here, **throw away guts and clean fillets** with tap water or bottled water before cooking.

Call your doctor or veterinarian if you or your pet get sick after going in the water.

For more information, call East Bay Regional Park District: (510) 544-2328
Or visit the California Department of Public Health online: www.cdph.ca.gov/Programs/CCDC/PID/EOD/DC/EHIB/EAS/Pages/HABs.aspx
For more information on harmful algae, go to: www.mywaterquality.ca.gov/habs

East Bay Regional Park District
Healthy Parks Healthy People

Lake and Website Postings and Brochures

Water Advisory

Water may contain blue-green algae that is harmful to humans and animals. Please check the indicator for current levels.

LOW RISK
Check for algae.

CAUTION
Harmful algae may be present in this water.

DANGER
Toxic blue-green algae in this water can harm people and animals.

CAUTION:
DO NOT drink this water or use it for cooking. DO NOT allow this water to come in contact with your mouth, nose, or eyes. DO NOT allow this water to come in contact with your skin. DO NOT allow this water to come in contact with your pets. DO NOT allow this water to come in contact with your livestock. DO NOT allow this water to come in contact with your horses. DO NOT allow this water to come in contact with your birds. DO NOT allow this water to come in contact with your bees. DO NOT allow this water to come in contact with your fish. DO NOT allow this water to come in contact with your shellfish. DO NOT allow this water to come in contact with your shellfish. DO NOT allow this water to come in contact with your shellfish.

DANGER:
DO NOT drink this water or use it for cooking. DO NOT allow this water to come in contact with your mouth, nose, or eyes. DO NOT allow this water to come in contact with your skin. DO NOT allow this water to come in contact with your pets. DO NOT allow this water to come in contact with your livestock. DO NOT allow this water to come in contact with your horses. DO NOT allow this water to come in contact with your birds. DO NOT allow this water to come in contact with your bees. DO NOT allow this water to come in contact with your fish. DO NOT allow this water to come in contact with your shellfish. DO NOT allow this water to come in contact with your shellfish.

If you or your animal become sick after water contact, call your doctor or veterinarian.

For more information, call East Bay Regional Park District: (510) 544-2328. Or visit the California Department of Public Health online: www.cdph.ca.gov/Programs/CID/DCDC/Pages/Immunization/Pages/Algae.aspx

East Bay Regional Park District

Cyanobacteria Blue-Green Algae IN THE EAST BAY REGIONAL PARK DISTRICT

East Bay Regional Park District
Healthy Parks Healthy People

NEWS RELEASE

EAST BAY REGIONAL PARK DISTRICT: PUBLIC AFFAIRS DIVISION
Contact: Public Information Supervisor Dave Mason (510) 544-2217

Del Valle Regional Park Reopening With Limited Capacity Day Use, Boating, and Camping

Blue-Green Algae (Cyanobacterial) Warning in Effect

Thursday, October 1, 2020 (Oakland) – Limited day use, boating, and camping are returning to Del Valle Regional Park on Friday, October 2. However, there will be strict capacity restrictions in place to limit overcrowding and maintain social distancing among visitors. **A Blue-Green Algae "Cyanobacterial" Danger Warning has also been issued for Lake Del Valle as recent tests showed elevated levels of toxins in the water.**

Due to Blue-Green Algae, water contact is not recommended, especially for small children and pets, who are most likely to be affected by toxins. Eating fish is also not recommended, nor is kayaking, paddleboarding, or use of other small watercraft. Swimming is not currently permitted at Del Valle due to COVID-19 restrictions.

NOTICE NO SWIMMING

Toxic Algae is Present in Lake Anza

- No bodily contact with the water. Supervise children and pets at all times—they are particularly vulnerable.
- Keep pets, especially dogs, out of the water.
- Skin in contact with algae should be rinsed with tap water.
- Fish may be consumed after removing gills, scales, and rinsing fillets in tap water.
- For the latest water quality information please visit www.ebayparks.org/activities/swimming/brochures

East Bay Regional Park District

Alert Level	Parks	Description
Danger Advisory Posted	Del Valle	<p>Del Valle Boat Launch Water Quality Conditions</p> <ul style="list-style-type: none"> There is a Danger Advisory posted for blue-green algae. See Blue-Green Algae Information for additional details. Swim Beach Conditions (PDF) Monitoring Program
Danger Advisory Posted	Shadow Cliffs	<p>Shadow Cliffs Lake Water Quality Conditions</p> <ul style="list-style-type: none"> A Danger Advisory for blue-green algae is posted at Shadow Cliffs. See the Blue-Green Algae Information page for additional details. Swim Beach Conditions (PDF) Monitoring Program

CAUTION

Harmful algae may be present in this water.

DO NOT drink this water or use it for cooking. DO NOT allow this water to come in contact with your mouth, nose, or eyes. DO NOT allow this water to come in contact with your skin. DO NOT allow this water to come in contact with your pets. DO NOT allow this water to come in contact with your livestock. DO NOT allow this water to come in contact with your horses. DO NOT allow this water to come in contact with your birds. DO NOT allow this water to come in contact with your bees. DO NOT allow this water to come in contact with your fish. DO NOT allow this water to come in contact with your shellfish. DO NOT allow this water to come in contact with your shellfish.

Call your doctor or veterinarian if you or your pet get sick after going in the water.

East Bay Regional Park District

Benthic Algae Advisory Signage

Figure 1. General awareness sign.

CHECK FOR ALGAE

Toxic algal mats may be present in this water

Mats can be attached to the bottom, detached and floating, or washed up on shore



If you see algal mats:



Do NOT let children or adults touch, eat, or swallow any algal mats.



Do NOT let dogs eat algal mats or drink from the water.

Call your doctor or veterinarian if you or your pet get sick after contacting or ingesting algae. For more information on toxic algae visit: mywaterquality.ca.gov/habs

For local information, contact:

Figure 2. Trigger level sign

TOXIC ALGAE ALERT

Toxic algal mats ARE present in this water

Mats can be attached to the bottom, detached and floating, or washed up on shore



Do NOT let children or adults touch, eat, or swallow any algal mats.



Do NOT let dogs eat algal mats or drink from the water.



Call your doctor or veterinarian immediately if you or your pet get sick after contacting or ingesting algae. For more information on toxic algae visit: mywaterquality.ca.gov/habs

For local information, contact:

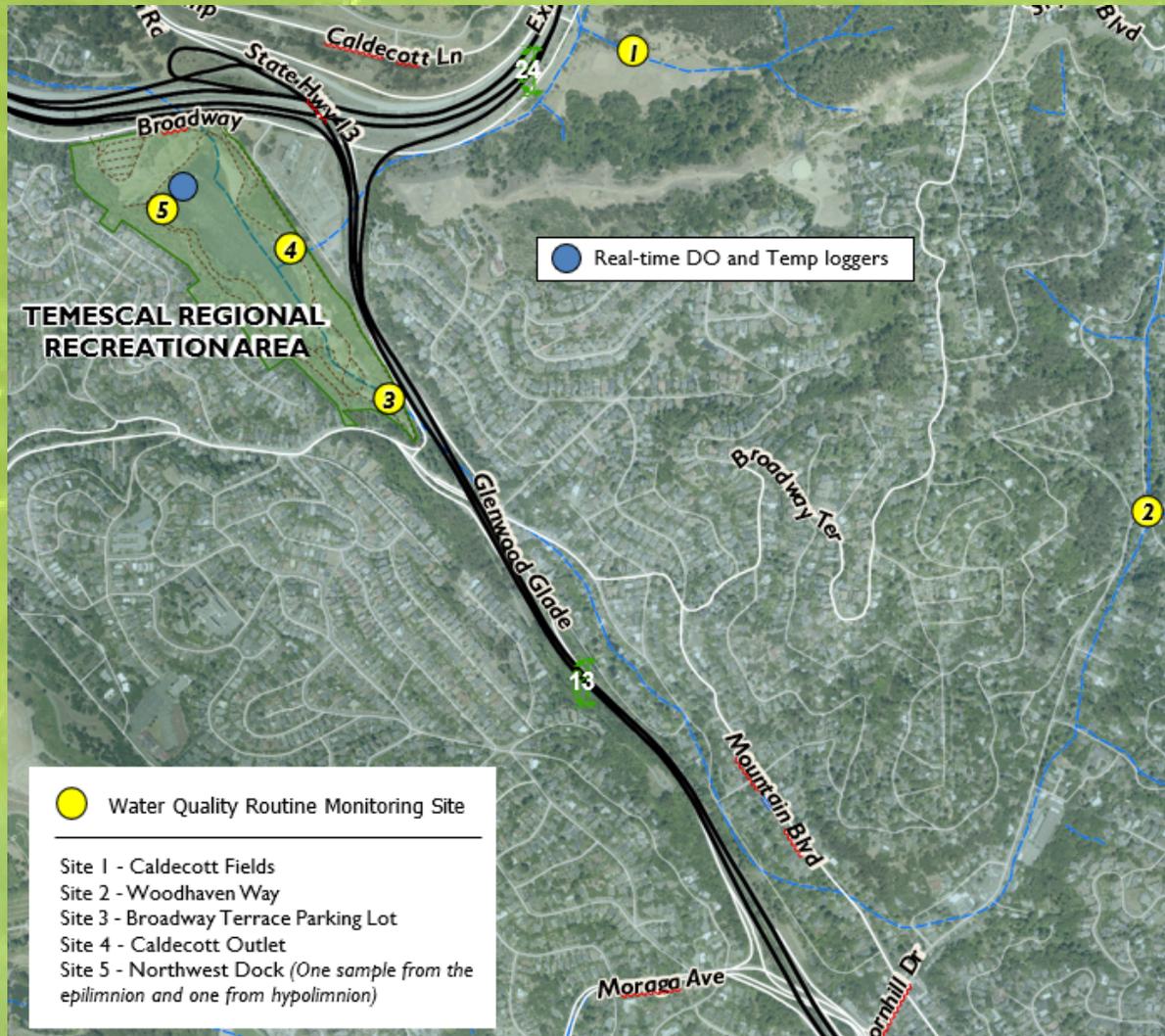
Date posted:

Fish Tissue Testing

- Largemouth bass (LMB) were collected at Contra Loma, Del Valle, Horseshoe Lake at Quarry Lakes, Shadow Cliffs, and Temescal
- Liver and filet samples from each fish analyzed for Microcystins
- Results detected toxins in most liver samples, but no toxins were detected in the filet samples

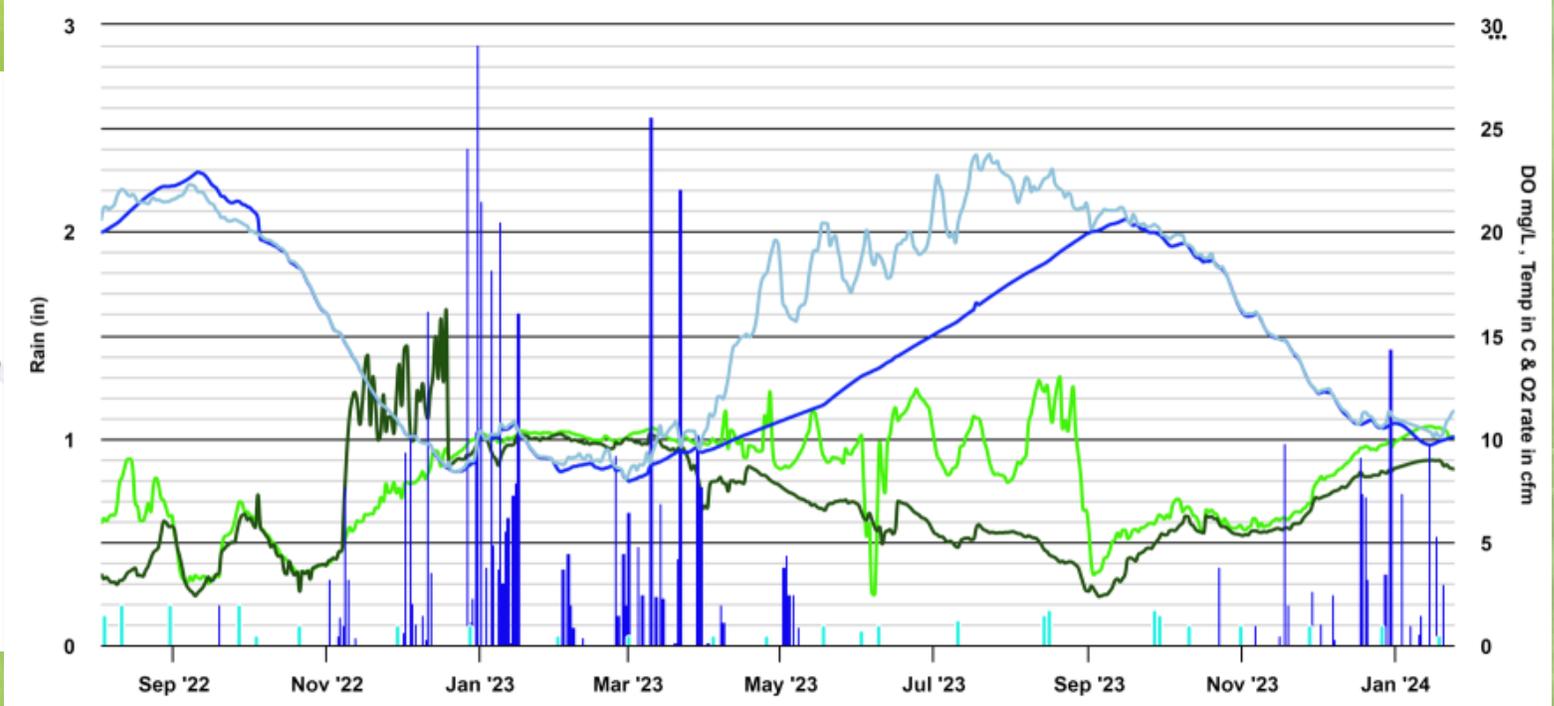
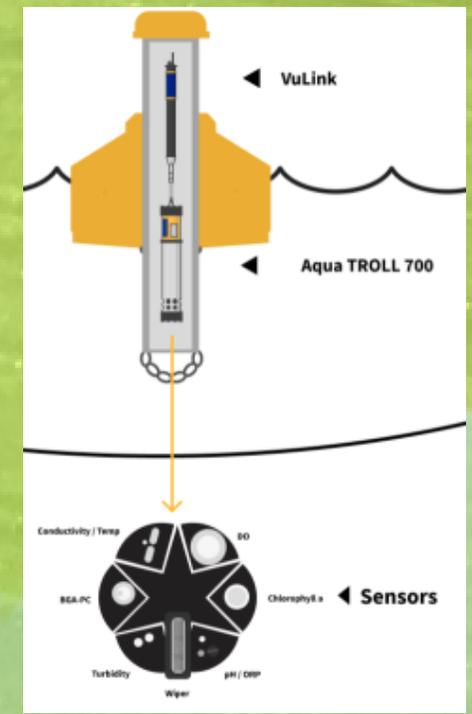


Monthly nutrients monitoring program at Lake Anza and Lake Temescal



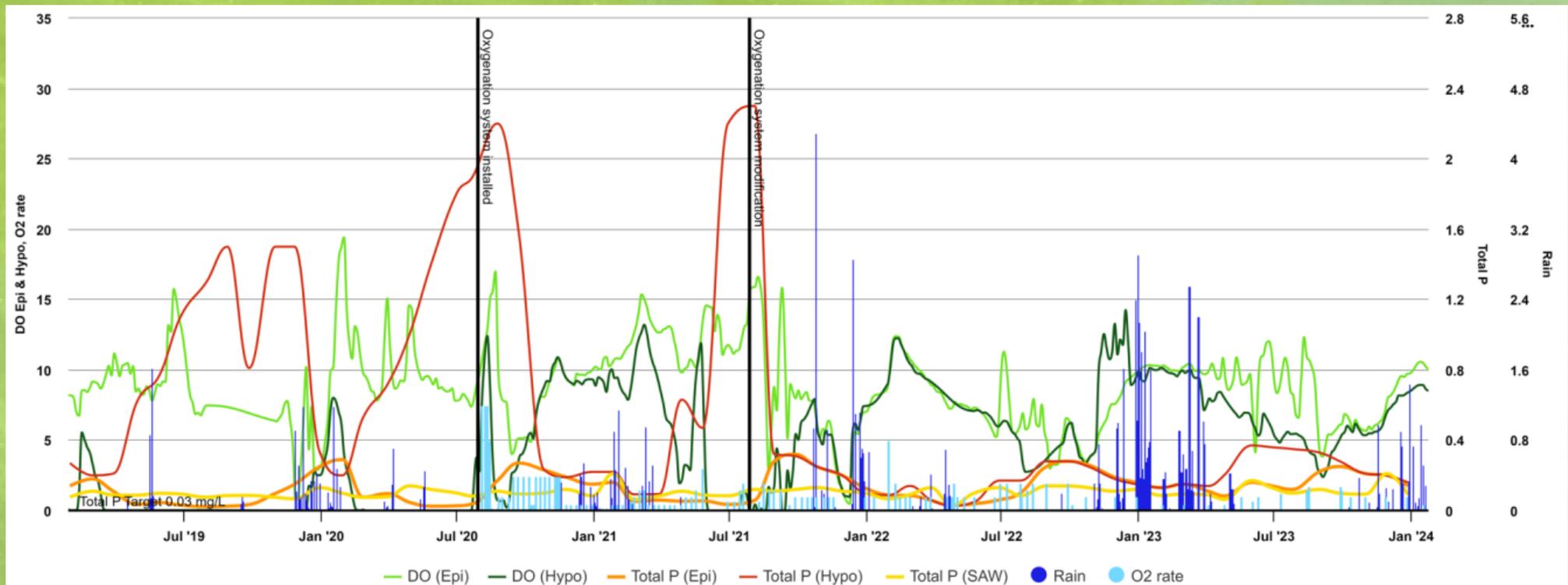
Real-time water quality monitoring at Lake Anza and Lake Temescal

- Continuous temperature and dissolved oxygen monitoring through in-situ sensors
- Provides valuable information such as:
 - Lake mixing or stratification (thermal layers)
 - Is there oxygen at the lake bottom
 - Determine the amount of oxygen added to Lake Anza through the oxygenation system



Annual subscription to LakeTech Water Management Software

- Helpful tool to integrate past, current monitoring data and outside data (rain) into one platform
- Easy data management
- Nice graphs for presentations and reports
- Custom water quality parameter alerts



Managing for HABs

- Monthly nutrients monitoring program
- Real-time water quality monitoring
- Annual subscription to LakeTech Water Management Software
- Nutrient Remediation
- Aeration
- Harvesting
- Dredging

Nutrient Mitigation



Lake Anza Oxygenation



Lake Temescal Nanobubbler Pilot Project



Harvesting



Lake Temescal Feasibility Study

Cost Estimate: \$25 – \$80 Million



January 2019
Lake Temescal Dredging and Restoration Project



Lake Temescal Dredging and Restoration Project Feasibility Assessment

Prepared for the East Bay Regional Park District

Managing for the Future

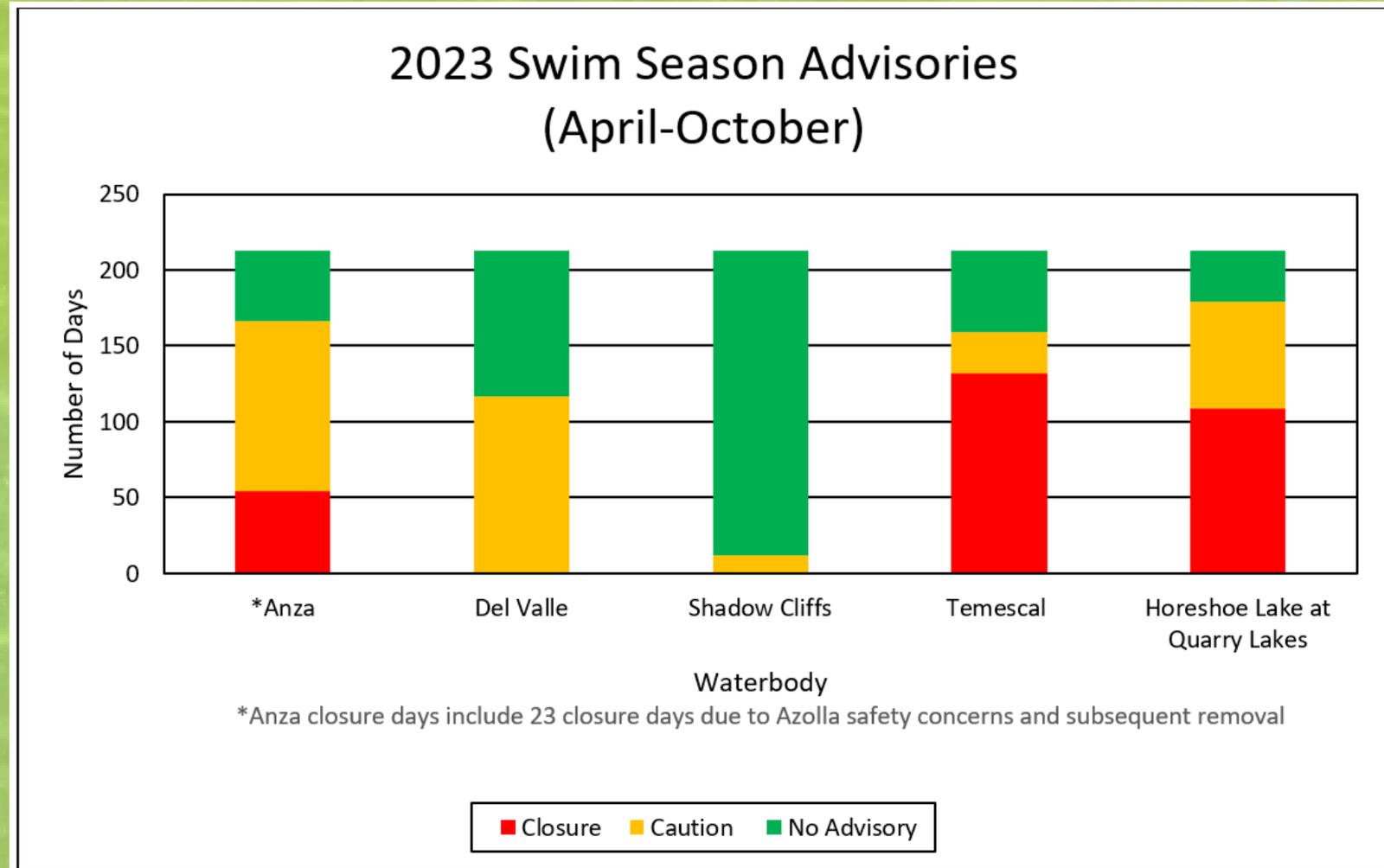
- Do Nothing = Swamp
- Dredging = \$\$\$
- Restore Stream = Sustainable**

**Where feasible



Metric for success - number of open swim days?

- Difficult metric
- District manages aged eutrophic lakes/reservoirs
- Urban impacts
- Even success in nutrient remediation does not prevent HABs (Lake Anza)



The Next 100 Years: Resiliency!

- Continue Monitoring
- Continue Treatments
- Embrace New Technology
- Think Outside the Box - Pools



Managing Lakes for Recreation is Expensive!

Discussion & Questions?

Joe Sullivan

jsullivan@ebparks.org

Anja Brey

abrey@ebparks.org

