



Draft Response Plans to HABs for Recreation and Drinking Water

November 5, 2015

Mindi May
Colorado Parks and Wildlife



COLORADO
Parks and Wildlife
Department of Natural Resources

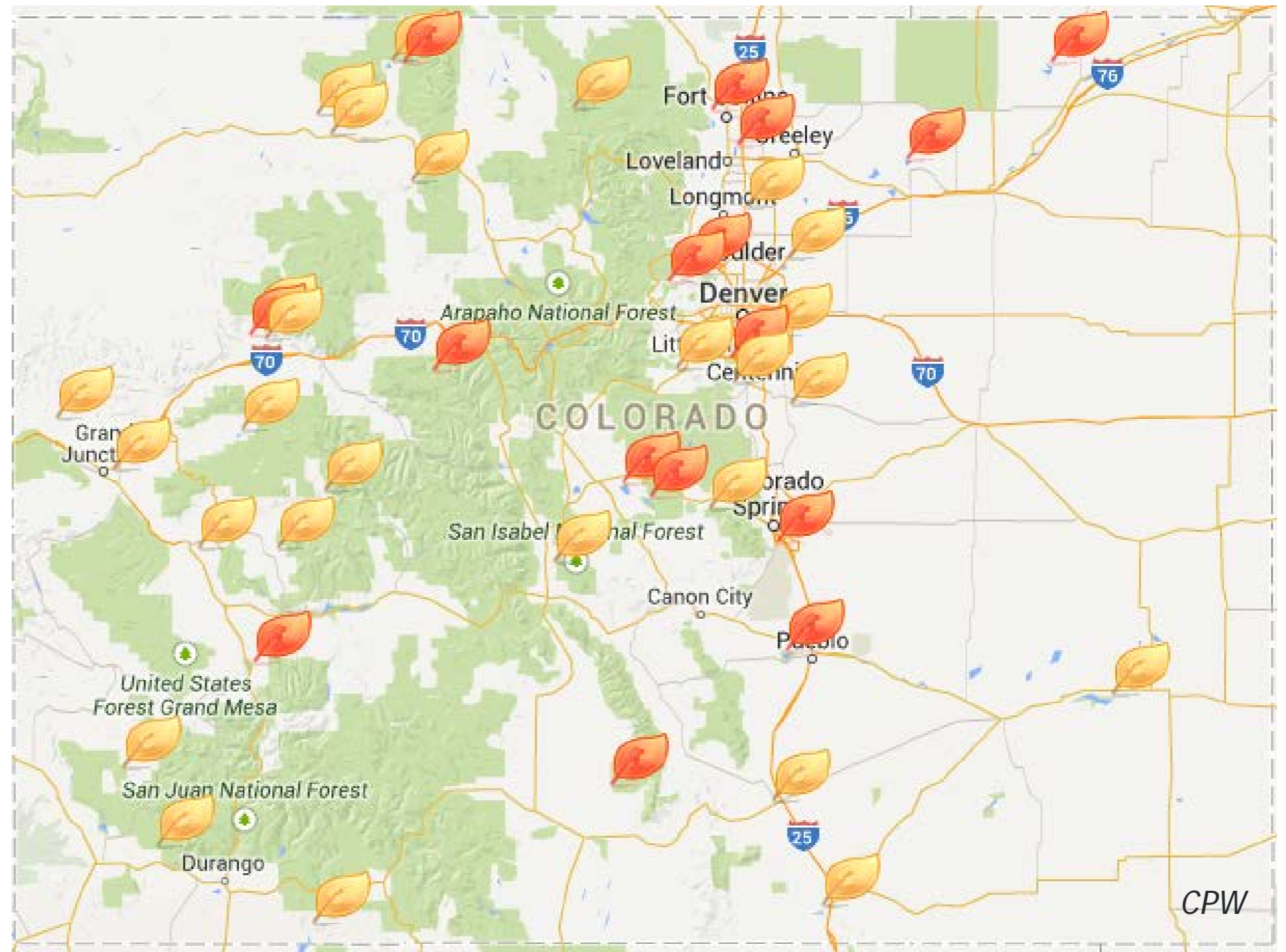
David Dani
Water Quality Control Division



COLORADO
Department of Public
Health & Environment

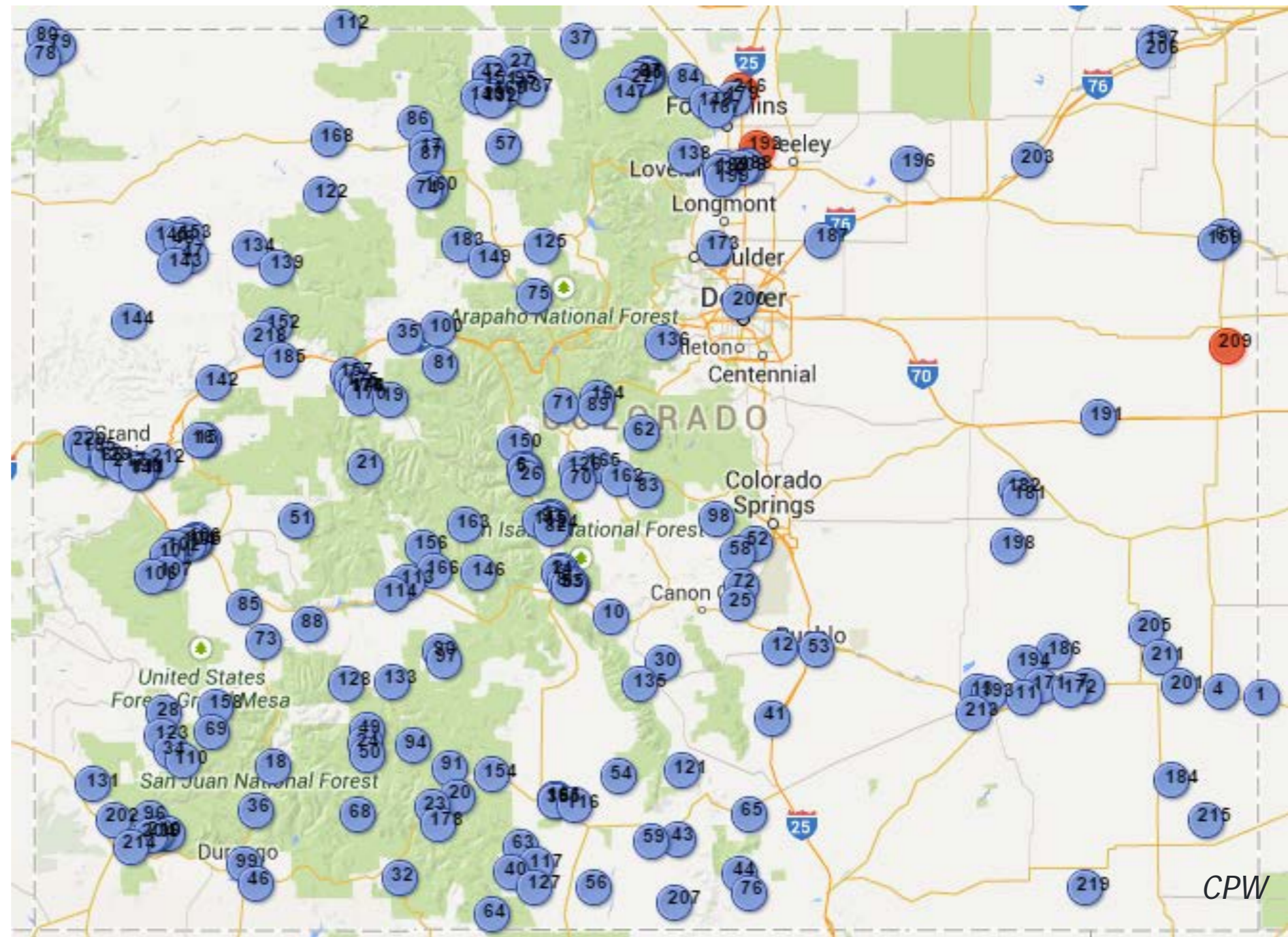
State Parks

42 State Parks



State Wildlife Areas

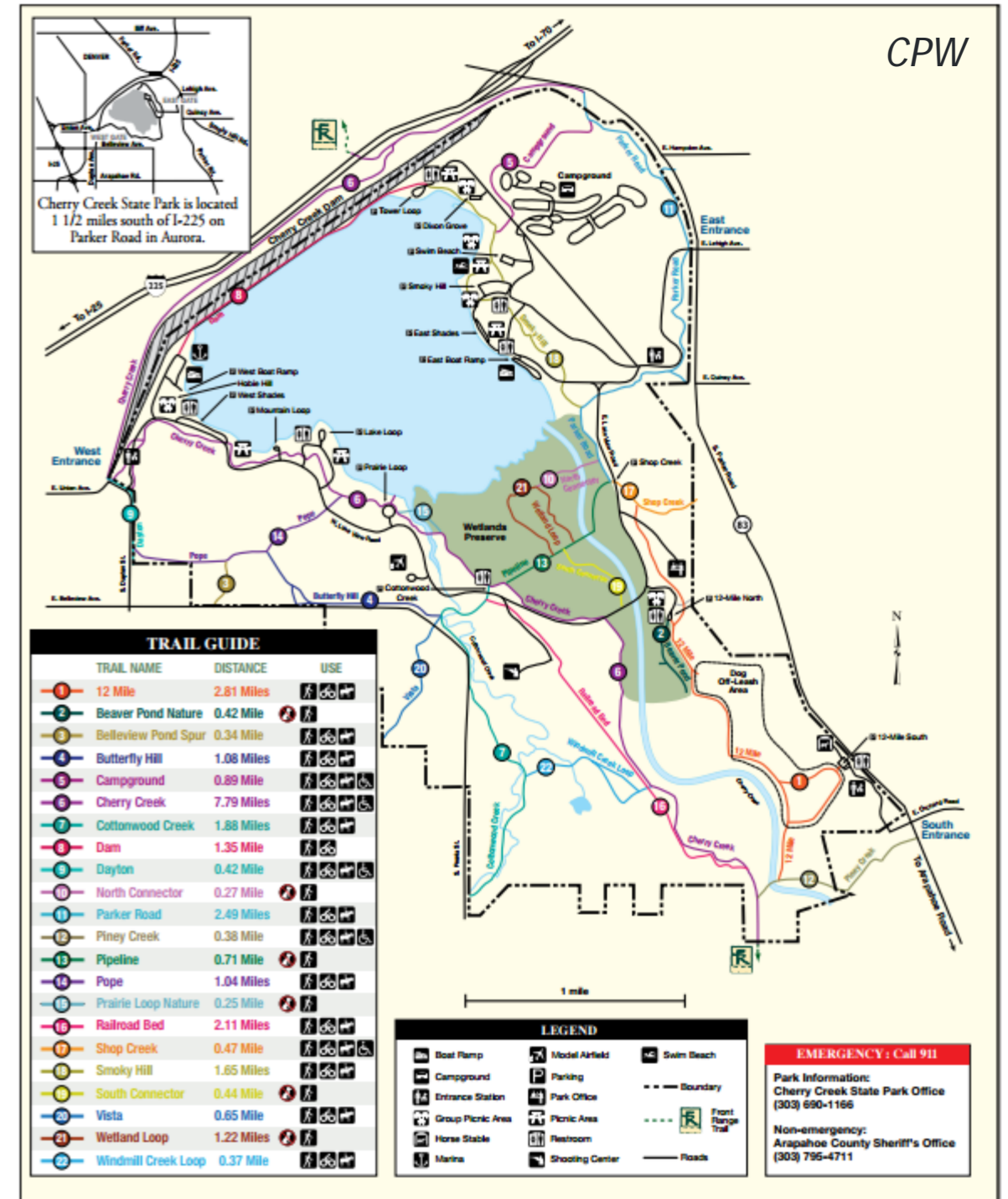
220 SWAs with
fishing or
boating access



Cherry Creek Reservoir

Most visited State Park

- Swim Beach
- Marina
 - Boating
 - Fishing
 - Water Skiing
 - Jet Skiing
- Dog Park

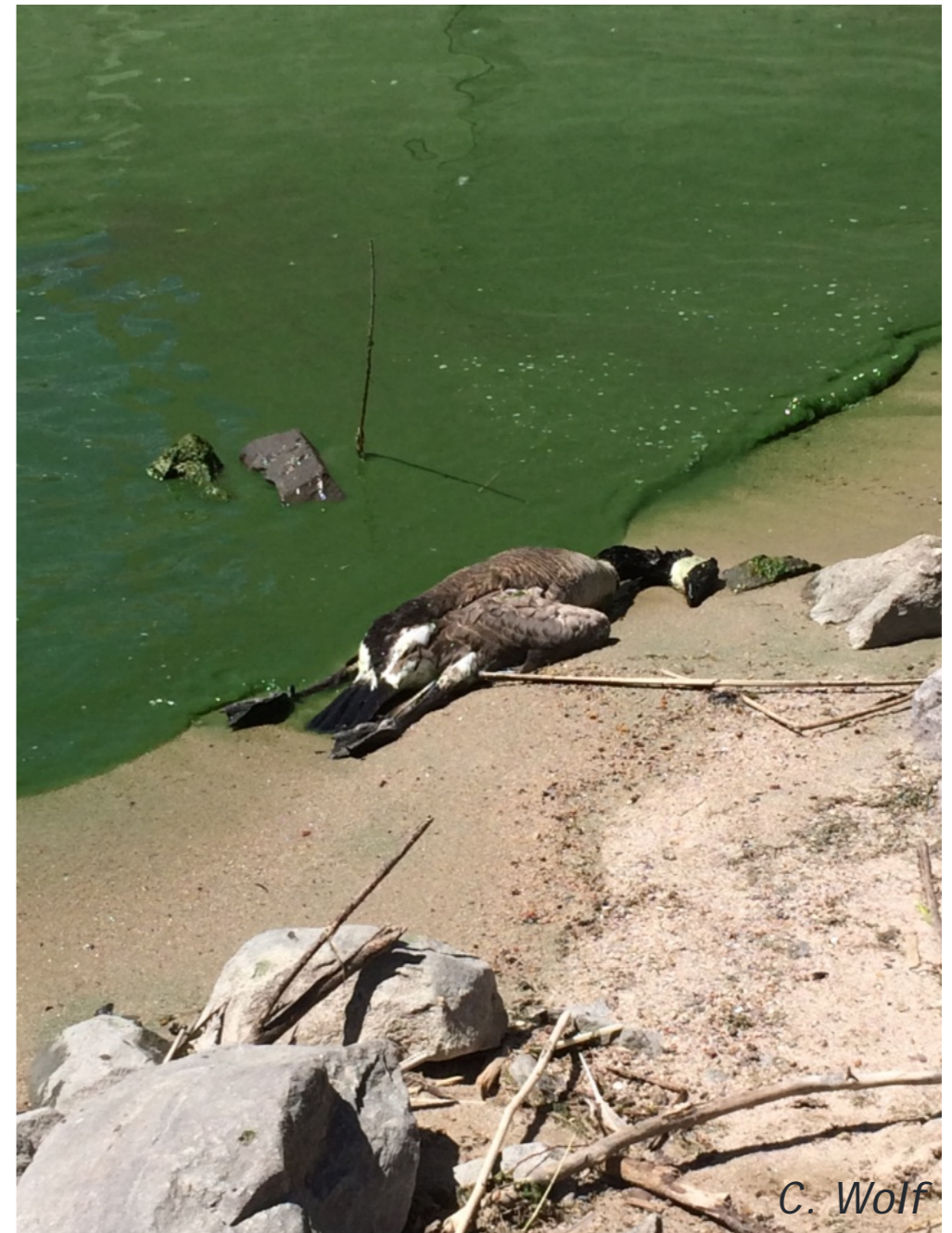


Cherry Creek Reservoir HAB

Cherry Creek Basin Authority

June 2014

Microcystin 10-25 ug/L



What do we do?

- Is it safe for the public to swim?
- Is it safe to eat fish caught from the lake?
- Is it safe for dogs?
- How should we communicate with the public?



ADVISORY

TOXIC ALGAE MAY BE PRESENT

Cherry Creek reservoir is experiencing a higher than normal algae bloom. This algae bloom is potentially toxic to humans and animals.

- **Avoid contact with visible surface scums. Showers are located at the swim beach restroom facility for free, and in the campground for a small fee.**
- **Keep pets away.**
- **Clean fish well and discard guts.**

The Cherry Creek Basin Water Quality Authority and Colorado Parks and Wildlife will continue to monitor the water quality of Cherry Creek reservoir. If the algae conditions worsen additional precautions will be posted.

For additional information please visit cpw.state.co.us or www.cherrycreekbasin.org



Stagecoach Reservoir

- Drinking water system (seasonal)
- Swim Beach
- Marina
 - Boating
 - Fishing
 - Water Skiing
 - Jet Skiing



Stagecoach Reservoir HAB

CPW tested September 2014

Microcystin 1.21 ug/L

Cylindrospermopsin 0.22 ug/L



Draft Algal Toxin Response

- Monitoring Plan
 - Visual bloom monitoring
 - Bottle and stick tests
 - Testing
 - Microcystin field test
 - Four-toxin lab test
- Action plan for notifying the public of health risks
 - Communication plan
 - Caution action level
 - Warning action level



Prioritize lakes by assessing risk

- Phytoplankton cell count data
- WHO cell count threshold
- 100,000 cells potentially toxic species



Visual Bloom Monitoring

- What do cyanobacteria blooms look like?
- High Risk 3-days
- Moderate Risk 14-days



Bloom Identification

- Bottle Test



Cyanobacteria float to the surface or remain suspended in the water column

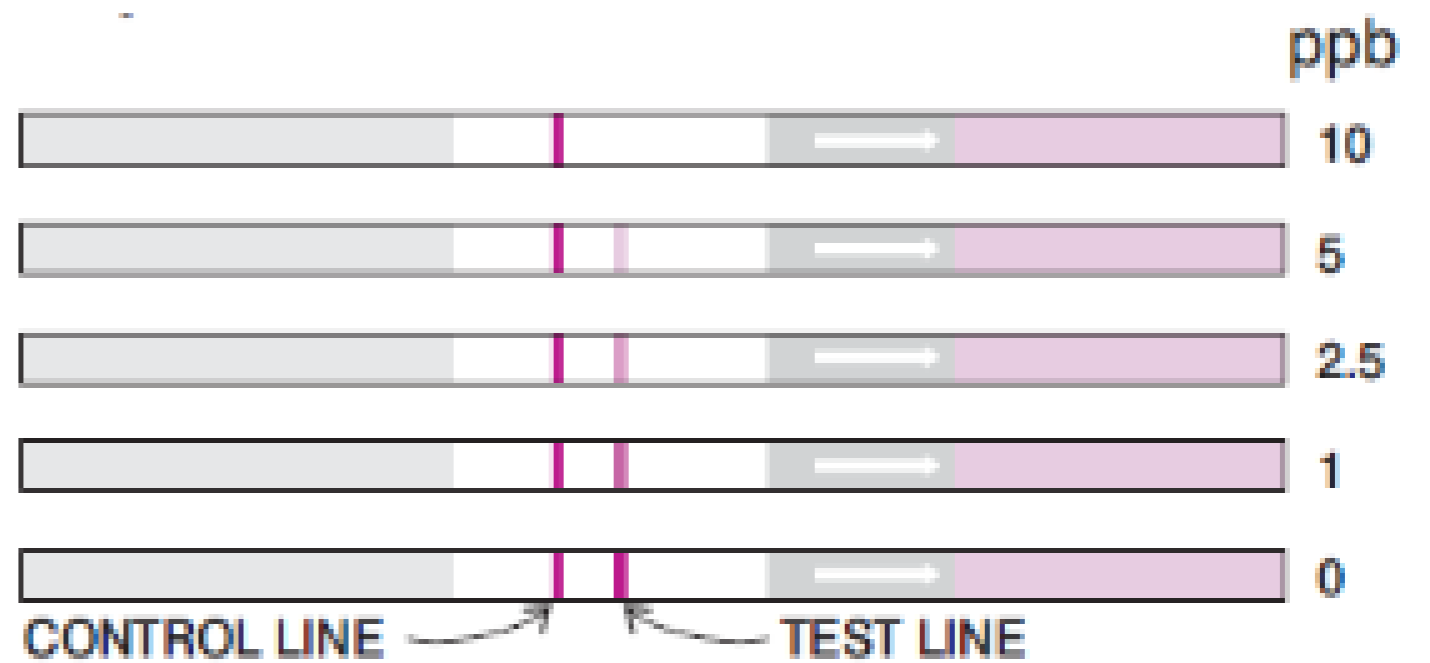
Bloom Identification

- Stick Test
- Long strands are probably NOT cyanobacteria



Testing

- Abraxis test strips
- Easy to use
- \$26-36 per test
- Microcystin only



INTERPRET TEST

CONTROL LINE	TEST LINE	INTERPRETATION
NO CONTROL LINE PRESENT	NO TEST LINE PRESENT	INVALID RESULT
CONTROL LINE PRESENT	NO TEST LINE PRESENT	>10 ppb
CONTROL LINE PRESENT	MODERATE INTENSITY TEST LINE PRESENT	BETWEEN 0 AND 10 ppb



Testing

- Lab Testing
- Tests 4 toxins
- \$600 per test



LC-MS/MS ANTX-A

Liquid chromatography/ mass spectrometry/ mass spectrometry (LC-MS/MS) was utilized for the determination of ANTX-A. The $[M+H]^+$ ion for ANTX-A (166 m/z) was fragmented and the product ions (91, 106, 131 & 149 m/z) were monitored. The current LOD is 0.1 $\mu\text{g/L}$ for ANTX-A.

Summary of Results ($\mu\text{g/L}$)

<u>Sample</u>	<u>MC</u> (ELISA)	<u>CYN</u> (ELISA)	<u>STX</u> (ELISA)	<u>ANTX-A</u> (LC-MS/MS)
CC515F-1	ND	ND	ND	ND
CC515F-2	ND	ND	ND	ND
CC515F-3	ND	ND	ND	ND
<i>Detection Limits ($\mu\text{g/L}$)</i>	<i>0.15</i>	<i>0.10</i>	<i>0.05</i>	<i>0.05</i>

ND = Not detected above detection limit



Caution Level

CAUTION

Toxic Algae May be Present

- No pets in water!
- Do not drink lake water
- Avoid contact with floating algae mats



- **Fishing Permitted** - rinse fish well and discard guts
- **Boating Permitted** - avoid algae mats

Call your doctor or veterinarian if you or your animals have nausea, vomiting, diarrhea, rash, irritated eyes, seizures or breathing problems.

Poison Control Center 1-800-222-1222



Caution Level

- Posted when bloom first observed
- Testing at least once per week
- Removed after two tests are below “Caution” thresholds (ex. Microcystin 10 ug/l) or bloom subsides
- Upgraded to Warning if single test is above “Warning” threshold (ex. Microcystin 20 ug/l)



Warning Level

WARNING

Toxic Algae Present

AREA IS CLOSED TO FULL-BODY CONTACT

- No Pets in Water!
- Do Not Drink Lake Water
- No Swimming or Body Contact
- No Water Skiing
- No Jet Skiing
- No Paddle Boarding



- Boating Permitted** - avoid algae mats
- Fishing Permitted** - rinse fish well and discard guts

Call your doctor or veterinarian if you or your animals have nausea, vomiting, diarrhea, rash, irritated eyes, seizures or breathing problems.

Poison Control Center 1-800-222-1222



Warning Level

- Posted when toxin levels exceed “Warning” thresholds
- Testing at least twice per week
- Removed or downgraded to “Caution” when two tests are below thresholds



Communication Plan

- Internal chain-of command
- Other state agencies
- Local health departments
- Local livestock producers
- Water providers
- Watershed groups
- Press release
- Educational materials



What else have we learned?

- Blooms change very quickly
- Blooms can be distributed unevenly
- Looks can be deceiving



Blooms can be patchy

July 24, 2015

Marina/swim beach location

Microcystin ~1 ug/L



Blooms can be patchy

July 24, 2015

Dam location

Microcystin ~1 ug/L



Blooms can be patchy

July 24, 2015

Cove location

Microcystin ~2.5 ug/L



Blooms can be patchy

Swim beach/marina



Dam



Cove



Blooms can be deceiving

July 28, 2015

Algae accumulation
near boat ramp

Microcystin= 82 ug/L

Anatoxin<0.05

Cyclindrospermopsin<0.05

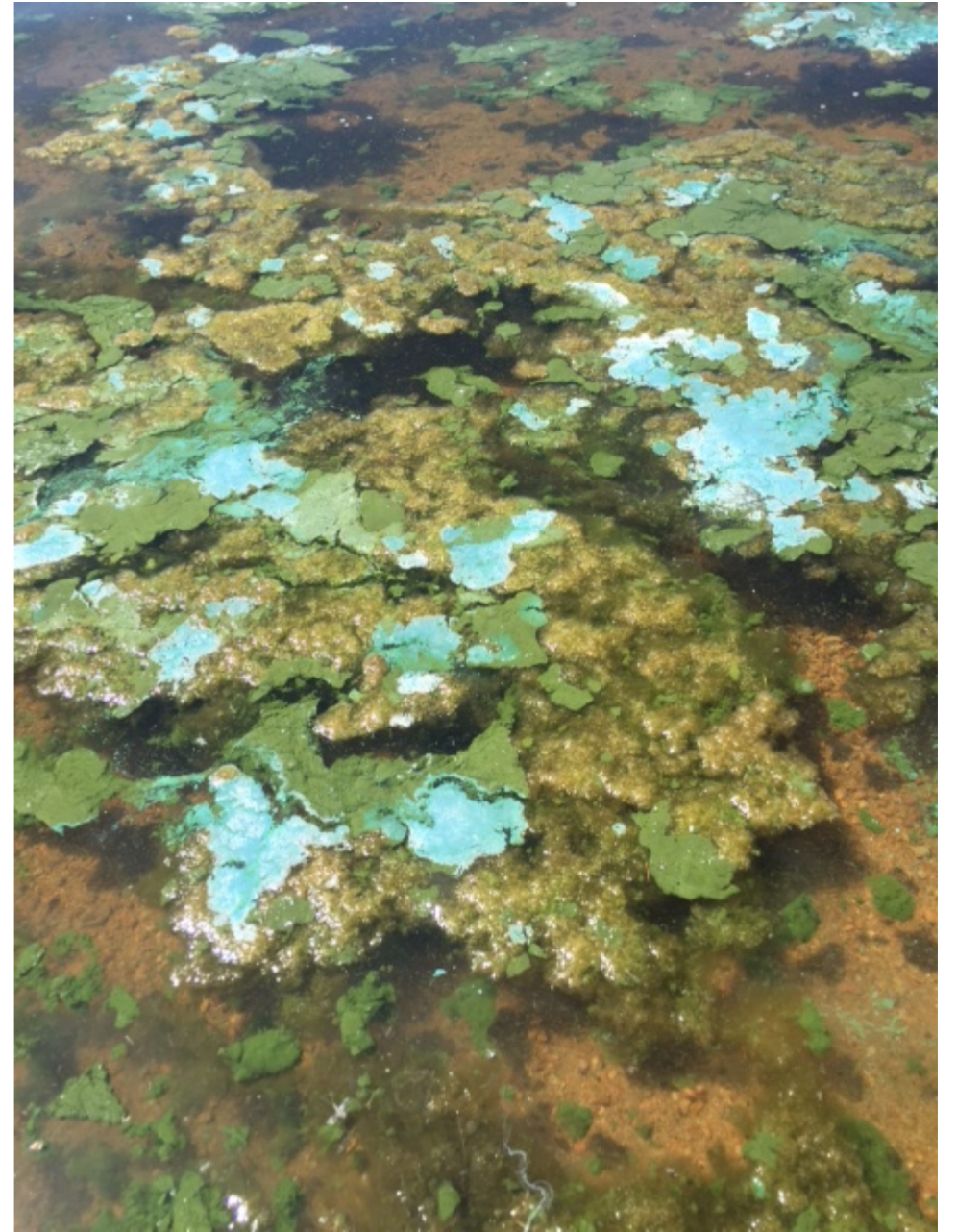
Saxitoxin<0.05

No widespread bloom



Blooms can be deceiving

- DeWeese Reservoir
- Aug 13, 2015
- Widespread algae bloom reported by EPA
- Looks terrible!
- Microcystin < 0.175 ug/L
- No other toxins tested



Blooms can be deceiving

- DeWeese Reservoir
- Sept 24, 2015
- Widespread algae bloom reported by CPW manager
- Distressed fish reported by locals
- Looks terrible!
- Microcystin = 0.19 ug/L
- Anatoxin = ND
- Cylindrospermopsin= ND
- Saxitoxin=ND



Euglena sanguinea

July 2, 2014

Boyd Lake State
Park



Drinking Water Solution

- Collaboration between Colorado Drinking Water Program, Colorado Water Utility Council and now others
- Guidance by systems for systems
- Resources to help systems large and small
 - Guidance, trainings, troubleshooting, lab support, data sharing
- Created an avenue to share successes and challenges and a library to share information



Drinking Water Guidance

<p>Step 1: Observe and prepare</p>	<p>Visually inspect source waters for algae bloom (at least weekly during bloom season). Taste and odor events, shorter filter runs, changes in source water quality may indicate presence of a bloom. If source waters are susceptible to algae blooms, be prepared and order toxin field tests before bloom season starts.</p> <p><i>*If bloom observed near intake continue to step 2</i></p>	<p>Resources: CLRMA (www.clrma.org) can assist with bloom identification</p>
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Drinking Water Guidance

Step 2: Blue-green algae identification	Use bottle test, microscopic identification, or Hach BART test to identify presence of blue-green algae in bloom (immediately after observing bloom and then at least weekly during presence of bloom). <i>*If blue-green algae are present continue to step 3</i>	Resources: CLRMA (www.clrma.org) can assist with algae identification
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Drinking Water Guidance

<p>Step 3: Toxin presence in raw water</p>	<p>Monitor raw water at intake for presence of microcystins using a field test such as Abraxis Microcystins Strip Test for source drinking water (immediately after identifying blue-green algae and then at least weekly during presence of blue-green algae). Make treatment adjustments. Be prepared and identify and contact lab in advance about sampling procedures and sample turnaround time in case toxins are detected in finished water.</p> <p><i>*If microcystins are present in raw water continue to step 4</i></p>	<p>Resources: CDPHE (1-877-518-5608) can assist with toxin sampling in raw water and treatment strategies</p>
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Drinking Water Guidance

<p>Step 4: Toxin presence in finished water</p>	<p>Monitor finished water at entry point for presence of microcystins using a field test such as Abraxis Microcystins Strip Test for finished drinking water (immediately after detecting presence of microcystins in raw water and then at least weekly during presence of microcystins in raw water). Make treatment adjustments.</p> <p><i>*If microcystins are present in finished water continue to step 5</i></p>	<p>Resources: CDPHE (1-877-518-5608) can assist with toxin sampling in finished water and treatment strategies</p>
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Drinking Water Guidance

Step 5:
Quantitative
lab analysis
of finished
water

Send finished water sample to lab for microcystin and cylindrospermopsin quantification (immediately after detecting presence of microcystins in finished water and then at least weekly during presence of microcystins in finished water). Make treatment adjustments.

**If microcystin values are above 0.3 ug/L and/or cylindrospermopsin values are above 0.7 ug/L (EPA's health advisory values) take a confirmation sample of the finished water within 24 hours and send to lab. If confirmation sample results are above health advisory values consult CDPHE (1-877-518-5608). Consider monitoring for toxins at various points throughout distribution to look for toxin degradation and extent of impacted area using a field test such as Abraxis Microcystins Strip Test for finished drinking water.*

Questions?

Mindi May

melynda.may@state.co.us

303-291-7124



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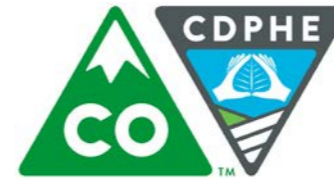
Parks and Wildlife

Department of Natural Resources

David Dani

David.dani@state.co.us

303-692-3605



COLORADO

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