CWD Source Water Protection Program Updates

9/19/2024
Fresh Pond Advisory Board

Hobbs Brook Reservoir

Photo credit: Philip Greenspun, 2015

New (and old) Staff – we've grown!

Jamie O'Connell - Watershed Protection Supervisor

Anna Van Dreser – Watershed Technical Supervisor

Emily Maynard – Watershed Management Assistant

Source Water Protection Program Overview

- **Water Quality Monitoring**

- Site Monitoring and Dam Management

- Hazmat and Emergency Response

- Natural Resources Restoration

- Partnership Development

Fresh Pond, 10/23/2015

CWD Water Quality Monitoring Program

HB @ KG on February 17, 2022

CWD Water Quality Monitoring

- 12 Tributary Sites, 3 Reservoirs

- Sample 6-8x/year per site

- Analyze >20 physical, chemical, and biological parameters

- USGS JFA

HB @ Upper, 7/25/2023

New & In Development

- Biological monitoring updates
  - Algae and cyanobacteria
  - Asian clam study

- Interactive Source Water Quality Report updates

Collection

Source Water Quality Report

Results from the Cambridge Water Department Source Water Quality Monitoring Program

Updated through calendar year 2023

Get started

1 Introduction

2 Standards and Guidelines

3 Land Cover

4 Reservoir Retention Time

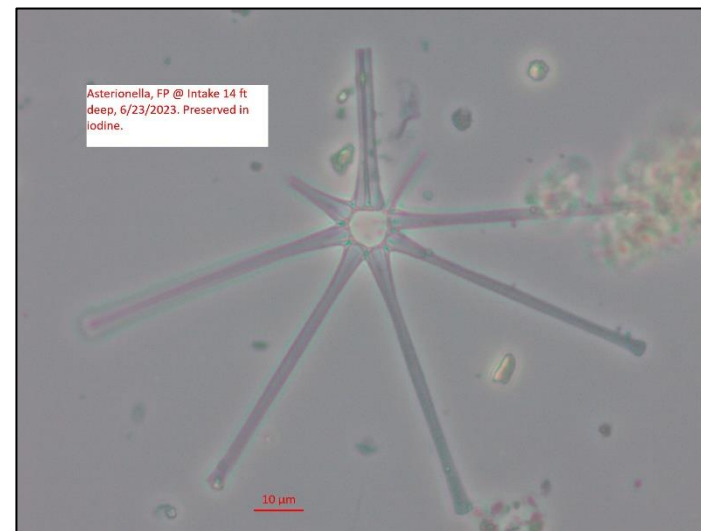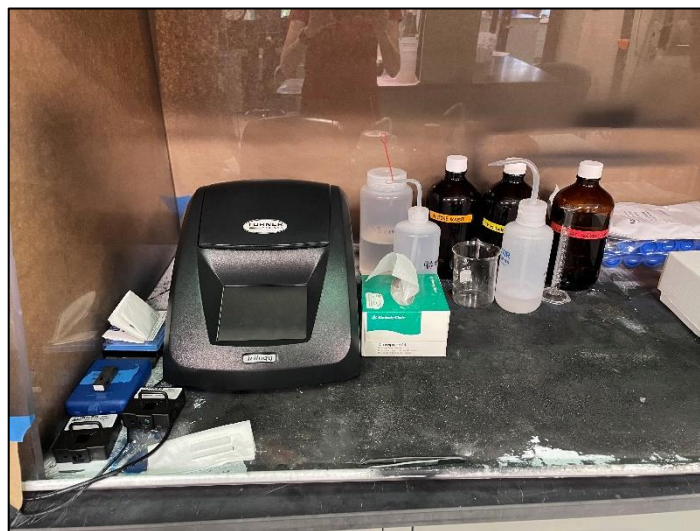5 Temperature and Dissolved Oxygen

6 pH

7 Bacteria

8 Salts

9 Nutrients

10 Metals

11 Macroinvertebrates (2019 pdf)

12 Algae (2019 pdf)

Asterionella, FP @ Intake 14 ft deep, 6/23/2023. Preserved in iodine.

10 µm

Algae and Cyanobacteria Monitoring

- Why are algae and cyanobacteria noteworthy?
  - Some algae and cyanobacteria can cause taste and odor problems
  - Cyanobacteria can also contain harmful toxins

- Are we concerned about algae/cyanobacteria in Fresh Pond (FP)?
  - Currently, no impact on water treatment operations
  - FP already has an aeration system, a tool to help to prevent blooms
  - Yet, anecdotally, bloom activity has been increasing
  - Climate change could increase the risk of serious blooms (warmer weather, more intense rainfall)

- Why develop an algae/cyanobacteria monitoring program?
  - ✓ Prepare for future conditions
  - ✓ Understand ecosystem dynamics & develop bloom risk prediction tools
 - ✓ Develop reservoir management plans w/ specific action levels

Note: Cyanobacteria are sometimes called "blue-green algae." However, they are bacteria, not algae.

Fresh Pond with green patches of algae/cyanobacteria, October 12, 2021

Algae and Cyanobacteria Monitoring

Program History

- May 2022
  - USGS phycocyanin buoy installed near FP intake

- 2023
  - In-house analysis of chl-*a* (2023)
  - Algae ID training (2023)

- ~2016 – present
  - In-house and contract lab algal ID & enumeration at various locations
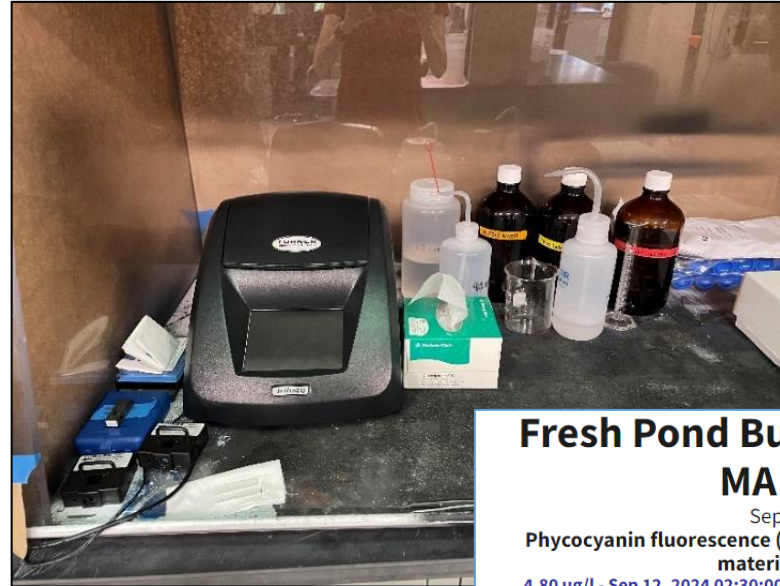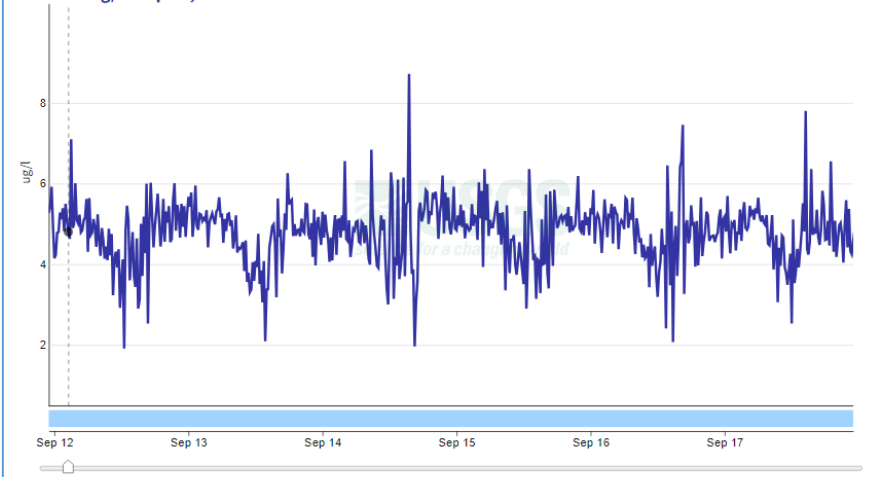

Fresh Pond Buoy, Near Intake at Cambridge, MA - 422303071084301

September 11, 2024 - September 18, 2024

Phycocyanin fluorescence (fPC), water, in situ, concentration estimated from reference material, micrograms per liter as phycocyanin
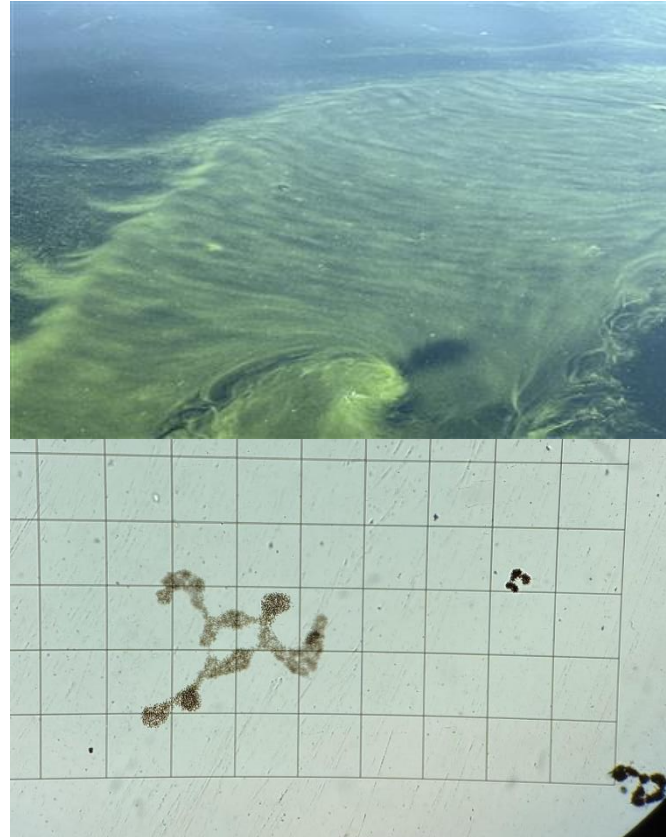
4.80 ug/l - Sep 12, 2024 02:30:00 AM EDT

IMPORTANT Data may be provisional

Algae and Cyanobacteria Monitoring

2024 Program Development

- Focus on Fresh Pond

- Bi-weekly visual bloom surveys

- Bi-weekly monitoring at FP @ Intake:
  - ID & enumeration at surface and 4m deep (intake pipe)
  - Phycocyanin and chlorophyll-*a* (surface, 4m, integrated samples, & Bloom Forming Cyanobacteria (BFC))
  - Toxin testing (preliminary)

- Developing protocol for in-house phycocyanin analysis

- Creating guides to ID common genera of algae/cyanos under microscope

Microcystis blooming in Fresh Pond and as viewed under a microscope

Algae and Cyanobacteria Monitoring

- Future goals
    - Engage consultant to help us:
        - ➢ Improve monitoring and analysis protocols
        - ➢ Understand impact on water treatment
        - ➢ Predict blooms and cyanotoxin levels
        - ➢ Develop action criteria

    - Expand program to additional reservoirs

    - Continue developing in-house algae, cyanobacteria, and phycocyanin analysis capacity
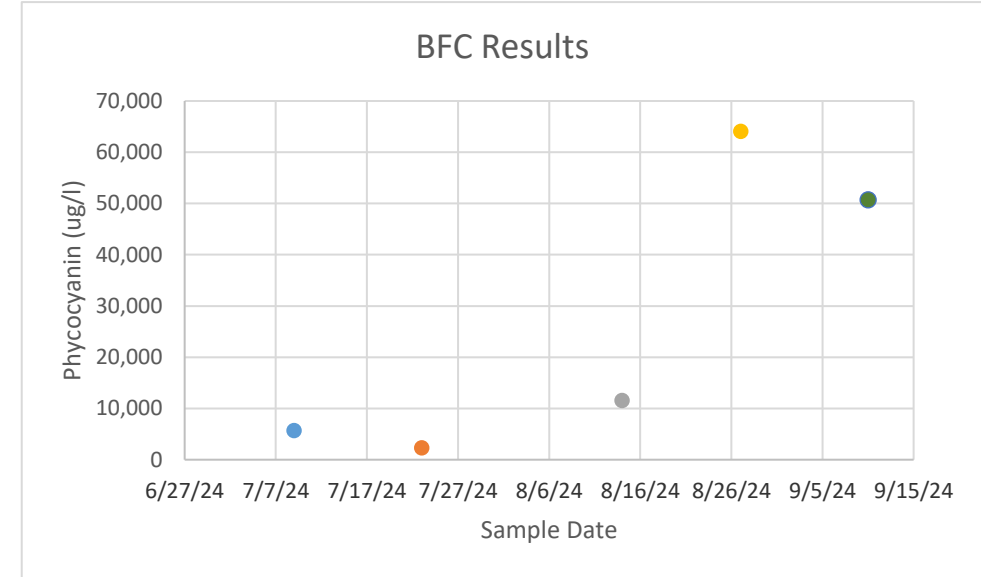
Example of how BFC* samples may help predict bloom activity

*BFC = Bloom Forming Cyanobacteria. This is a highly concentrated sample and not reflective actual lake phycocyanin conditions.

Asian clam study

- ## What are Asian clams?
  - Invasive clams, likely present since the 1970s
  - ~2.5cm or smaller
  - Larvae easily spread through waterways by boats and birds
  - Prefer soft, sandy or silty substrate, warm and low DO water.
  - Live in water <25-30ft deep

- ## Why do we care about them?
  - ➢ **Ecological problem causers:**
    - Can release (instead of filter) excess phosphorus
    - Out-compete and take over the niche of native mussels
  - ➢ **Physical problem causers:**
    - Grow on and block intakes and pipes (although not common)

Asian clamshells found in Cambridge reservoirs.

Asian Clam Study

- ## How are we monitoring them?
  - First confirmed near Stony Brook Reservoir inlet in April 2024
  - Surveyed Fresh Pond, August 2024:
    - Visually surveyed the full shoreline to ~15 ft deep
    - Collected substrate grab samples
    - Found live and dead clams throughout
      - Highest concentrations near conduit outlet, where the substrate is the softest and the water shallow

- ## Future goals
  - Perform presence/absence surveys at upstream reservoirs
  - Survey tributaries to the reservoirs until we find the extent of their range in the watershed

Substrate grab sample from Fresh Pond, 8/13/2024

Interactive Source Water Quality Report

Source Water Quality Report (arcgis.com) or
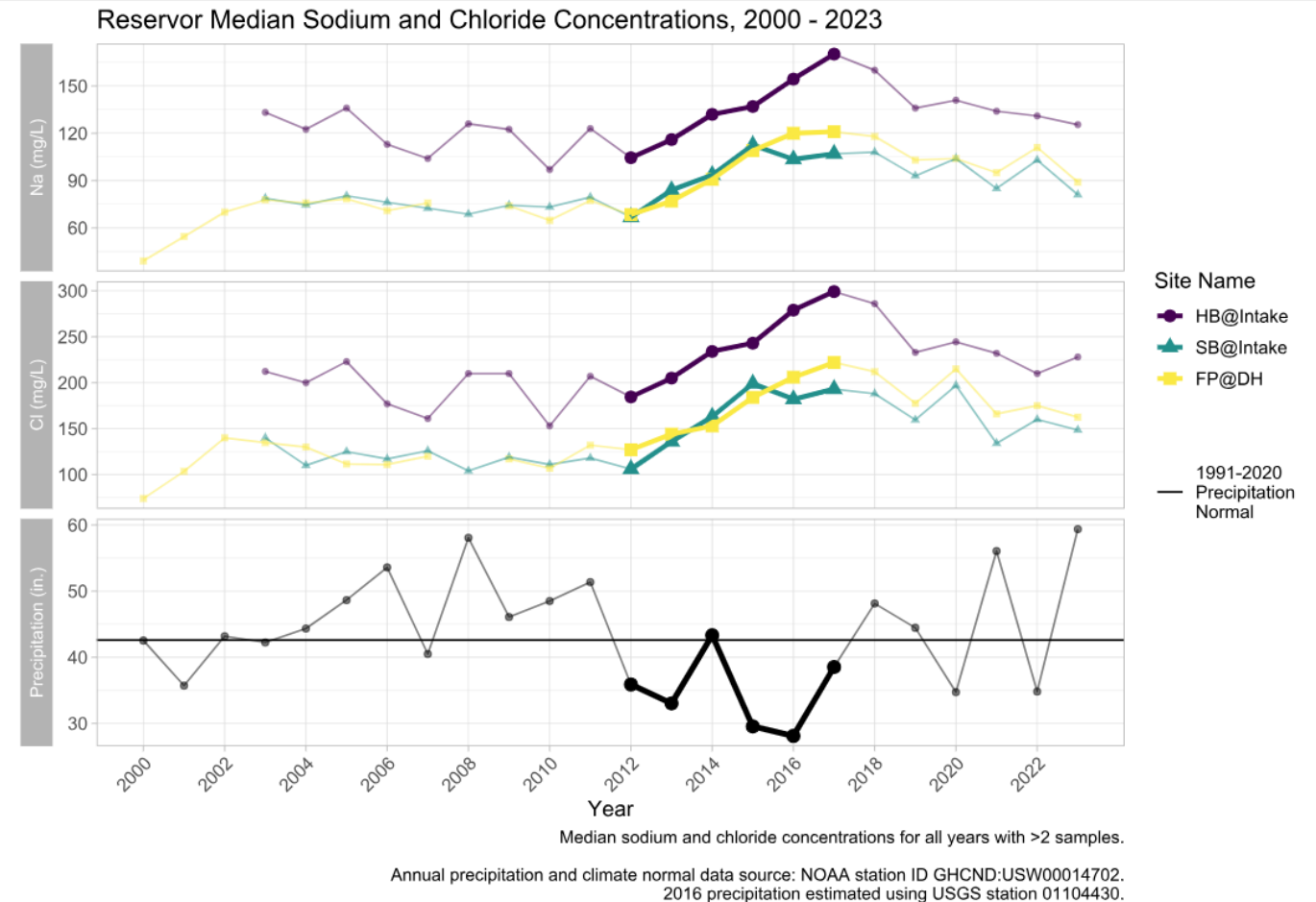Reports and Research - Water - City of Cambridge, Massachusetts

- Report updated with 2023

- Future Goals:
  - Simplify modules, focusing on plain language and accessible summaries

  - Update Macroinvertebrate and Algae modules

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Interactive Source Water Quality Report

- ## Trend Highlight: Na$^+$ and Cl$^-$
  - Lack of rain 2012 – 2017 may have caused salt concentrations to increase

  - Recent wet years likely diluted salt in reservoirs, decreasing concentrations

Reservoir Median Sodium and Chloride Concentrations, 2000 - 2023

Site Name
- HB@Intake
- SB@Intake
- FP@DH

1991-2020 Precipitation Normal

Median sodium and chloride concentrations for all years with >2 samples.

Annual precipitation and climate normal data source: NOAA station ID GHCND:USW00014702. 2016 precipitation estimated using USGS station 01104430.

Questions?

Fresh Pond, 10/5/2015