



**2023 Water Quality Report**  
**Fresh Pond Reservation: Class B Ponds, Cambridge, MA**  
**October 25, 2023**

The Cambridge Water Department monitors three ponds on the Fresh Pond Reservation: Little Fresh Pond, Black's Nook, and North Pond (figure 1). Water quality samples from each pond are collected quarterly. These shallow ponds have no surface water connections to the Fresh Pond water supply reservoir, and as such, they have negligible influence over water quality in the Cambridge water supply. Gated pipes between Little Fresh Pond and Fresh Pond Reservoir are kept closed under normal operating conditions but are opened as needed in controlled conditions to supply irrigation water to Little Fresh Pond. All three ponds drain the City of Cambridge Municipal Golf Course and the reservation's wooded areas, with overflow connections to the City's storm drain system. Stormwater in the developed areas surrounding the reservation is diverted away to further protect drinking water quality at Fresh Pond Reservoir. Groundwater communication between the ponds, the surrounding developed area, and the reservoir is minimized by keeping the reservoir elevation higher than the water table. This report includes data from the reporting period of July 1, 2022 to June 30, 2023 (reporting year 2023).



**Figure 1: Fresh Pond Reservation Waterbodies**



Massachusetts Class B waters are designated for fish, other aquatic life and wildlife habitat, and for primary and secondary contact recreation. Class B water quality standards include numeric and narrative standards for dissolved oxygen, temperature, pH, bacteria, solids, color and turbidity, oil and grease, and taste and odor. In this study period, four dry-weather water quality sampling events were conducted. Samples were taken at the surface of each pond using extended poles or hand-grabbing samples after wading in from the shoreline. *In-situ* parameters were measured with a calibrated multi-probe concurrently with grab samples.

### 2023 Results

**Black’s Nook**- Listed in the 2022 Massachusetts Integrated List of Waters as a Category 5 impaired water for transparency/clarity, nutrient/eutrophication biological indicators, and water chestnut (*Trapa natans*). However, recent studies conducted by the Cambridge Water Department indicate that, while non-native aquatic plants continue to be an issue at Black’s Nook, few if any water chestnut plants remain. The reduction in water chestnut density is the result of a multi-year volunteer effort to manually remove the invasive plant.

All four samples calculated Carlson’s trophic state index (TSI) numbers during reporting year 2023 were in the eutrophic or hypereutrophic range. This indicates that productivity was high at Black’s Nook, a finding supported by an overgrowth of plants in the pond (photograph A).

#### 1. Dissolved Oxygen (DO)

- Of the four surface DO measurements collected during the reporting period, two fell below the Class B standard ( $\geq 5$  mg/L). Respiration from microbial organic matter decomposition and algae and plant growth likely contributed to the low DO concentration during the 7/21/2022 sampling event. Decomposition likely contributed to the low DO during the 11/3/2022 event.

Date Below Class B Standard	Time	Result
7/21/2022	9:15 AM	2.91 mg/L
11/3/2022	10:00 AM	4.08 mg/L

#### 2. Temperature

- No exceedances associated with warm-water fisheries were observed. The Class B standard requires temperatures not to exceed 28.3°C.

#### 3. pH

- No excursions from the Class B pH range; all laboratory and field pH readings were between 6.5 and 8.3.

#### 4. Bacteria



## 2023 Fresh Pond Reservation Class B Waters

- All four *E. coli* samples were collected more than 30 days apart. Each sample was compared individually against the Class B 30-day rolling geomean water quality standard of 126 colony forming units (cfu/100mL) and the 30-day statistical threshold value (STV) of 410 cfu/100 mL (no more than 10% of samples may exceed 410 cfu/100mL in a 30-day period). Although the 30-day period may be extended to 90-days outside of the bathing season, CWD opted to conservatively compare results against the rolling geomean and STV values for the 30-day window year-round.
- One sample taken on 2/15/2023 exceeded the 30-day geomean (126 cfu/100 mL). No samples exceeded the 30-day STV (410 cfu/100mL).
- CWD measures *E. coli* using a technique that reports results of the Most Probable Number of cfu /100 ml (MPN/100mL)

Date Above Rolling 30-day Geomean	Time	Result
2/15/2023	10:10 AM	276 MPN/100mL

### 5. Solids

- There are no numeric criteria for solids, but visual observations suggest that floating aquatic vegetation might have presented conditions for impairment at Black’s Nook on 7/21/2022, 11/3/2022, and 5/31/2023. In addition, aquatic plant growth limited the potential for swimming and boating, though neither activity is permitted at Black’s Nook (photograph A).

### 6. Color and Turbidity

- There are no numeric criteria for color and turbidity. However, the standard dictates that water bodies must be free from aesthetically objectionable conditions. Measured color and turbidity at Black’s Nook were never higher than 31 c.u. and 2.99 NTU during the reporting period, although color data is missing for 5/31/2023 (Table 1). On that date, the water was noted as cloudy.

### 7. Taste and Odor

- No objectionable odors observed.

### 8. Oil and Grease

- No samples taken, but no visible oil and grease sheens observed.

**Little Fresh Pond (LFP)**- Not assessed as part of the 2022 Massachusetts Integrated List of Waters survey. TSI values calculated from chl-*a* results ranged from oligotrophic in October (11/3/2022) to eutrophic in May (5/31/2023) (figure 2). These results indicate that LFP is a productive pond, with higher levels of productivity during the growing seasons.



Specific conductance readings and sodium and chloride concentrations are consistently among the highest of the reservation ponds (table 1). The values for these parameters closely mirror those of Fresh Pond Reservoir, reflecting the hydrological connectivity via pipes and groundwater communication.

1. Dissolved Oxygen (DO)

- One sample during the reporting period fell below the Class B standard ( $\geq 5$  mg/L). On 7/21/2022, milfoil and lily pads were noted along the banks. High productivity on this date might have contributed to low respiration and DO.

Date Below Class B Standard	Time	Result
7/21/2022	8:30 AM	3.98 mg/L

2. Temperature

- No exceedances associated with warm-water fisheries were observed. The Class B standard requires temperatures not to exceed 28.3°C.

3. pH

- There was one excursion from the Class B pH range of 6.5 – 8.3. On 5/31/2023, the in situ and lab pH readings were 9.3 and 9.34 respectively. High primary productivity on this date may have led to the results.

Date Outside of Class B Range	Time	Result (in situ)	Result (lab)
5/31/2023	9:17 AM	9.3	9.34

4. Bacteria

- All bacteria samples were collected more than 30 days apart. There was one exceedance of the Class B *E. coli* 30-day geomean ( $< 126$  cfu/100mL) but no exceedances of the 410 cfu/100mL STV. On 7/21/2022, the *E. coli* sample indicated 387 MPN/100mL. The *E. coli* hit was likely from animal sources.

Date Above Class B Standard	Time	Result
7/21/2022	8:30 AM	387 MPN/100mL

5. Solids

- There are no numeric criteria for solids, but visual observations suggest that neither floating nor suspended solids were an impairment for LFP. However, aquatic plant growth may limit the potential for swimming and boating at LFP, though neither activity is currently permitted for humans. Dogs are permitted to swim at LFP from a designated dog swim platform.



6. Color and Turbidity

- There are no numeric criteria for color and turbidity. However, the standard dictates water bodies must be free from aesthetically objectionable conditions. Aside from aquatic plant growth, CWD did not observe objectionable color or turbidity issues in the 2022 reporting year.

7. Taste and Odor

- No objectionable odors observed.

8. Oil and Grease

- No samples taken, but no visible oil and grease sheens observed.

**North Pond-** Not assessed as part of the 2022 Massachusetts Integrated List of Waters survey. During the growing season, this pond fills with floating and rooted aquatic plants. All four chl-*a* results from the 2023 reporting year were consistent with a Carlson’s TSI for a highly-productive, eutrophic or hypereutrophic pond (figure 2). North Pond had the highest average and median TSI readings in the reporting period and was the most eutrophic of the three ponds (figure 2).

1. Dissolved Oxygen (DO)

- All four DO measurements collected during the 2023 reporting year were less than the 5 mg/L Class B minimum allowable concentration. Respiration of algae and plants could account for the low DO. Although low DO is less common in winter since cold water can hold more DO than warm water, and microbial respiration tends to slow down, the low DO could reflect the high organic matter load and microbial respiration during decomposition.

Date Below Class B Standard	Time	Result
7/21/2022	8:50 AM	0.6 mg/L
11/3/2022	9:32 AM	3.57 mg/L
2/15/2023	9:45 AM	1.35 mg/L
5/31/2023	9:40 AM	2.26 mg/L

2. Temperature

- No exceedances associated with warm-water fisheries were observed; temperature remained below 28.3 degrees C.

3. pH

- No excursions from the Class B pH range; all laboratory and field pH readings were between 6.5 and 8.3.





## 2023 Fresh Pond Reservation Class B Waters

### 4. Bacteria

- All bacteria samples were collected more than 30 days apart. There was one exceedance of the Class B 30-day *E. coli* geometric mean water quality standard (< 126 cfu/100 mL). There were no exceedances of the STV (410 cfu/100 mL). On 7/21/2022, the *E. coli* result was 156 MPN/100mL. The high concentration might be due to favorable summer growth conditions following animal input.

Date Above Class B Standard	Time	Result
7/21/2022	8:50 AM	156 MPN/100 mL

### 5. Solids

- There are no numeric standards for solids. Visual observations suggested that mats of floating or suspended organic matter were a source of impairment for the pond that would discourage swimming and boating (if allowed) and created aesthetically objectionable conditions (photographs B, C).

### 6. Color and Turbidity

- The hypereutrophic state and water turbidity would discourage swimming and boating, although these activities are not currently permitted at North Pond; during the summer, North Pond becomes choked with aquatic vegetation and suspended organic matter impairing the water for those uses (photograph B). Measured turbidity and color are often high compared to the other ponds, likely due to decomposition of organic matter. Turbidity was also observed visually.

### 7. Taste and Odor

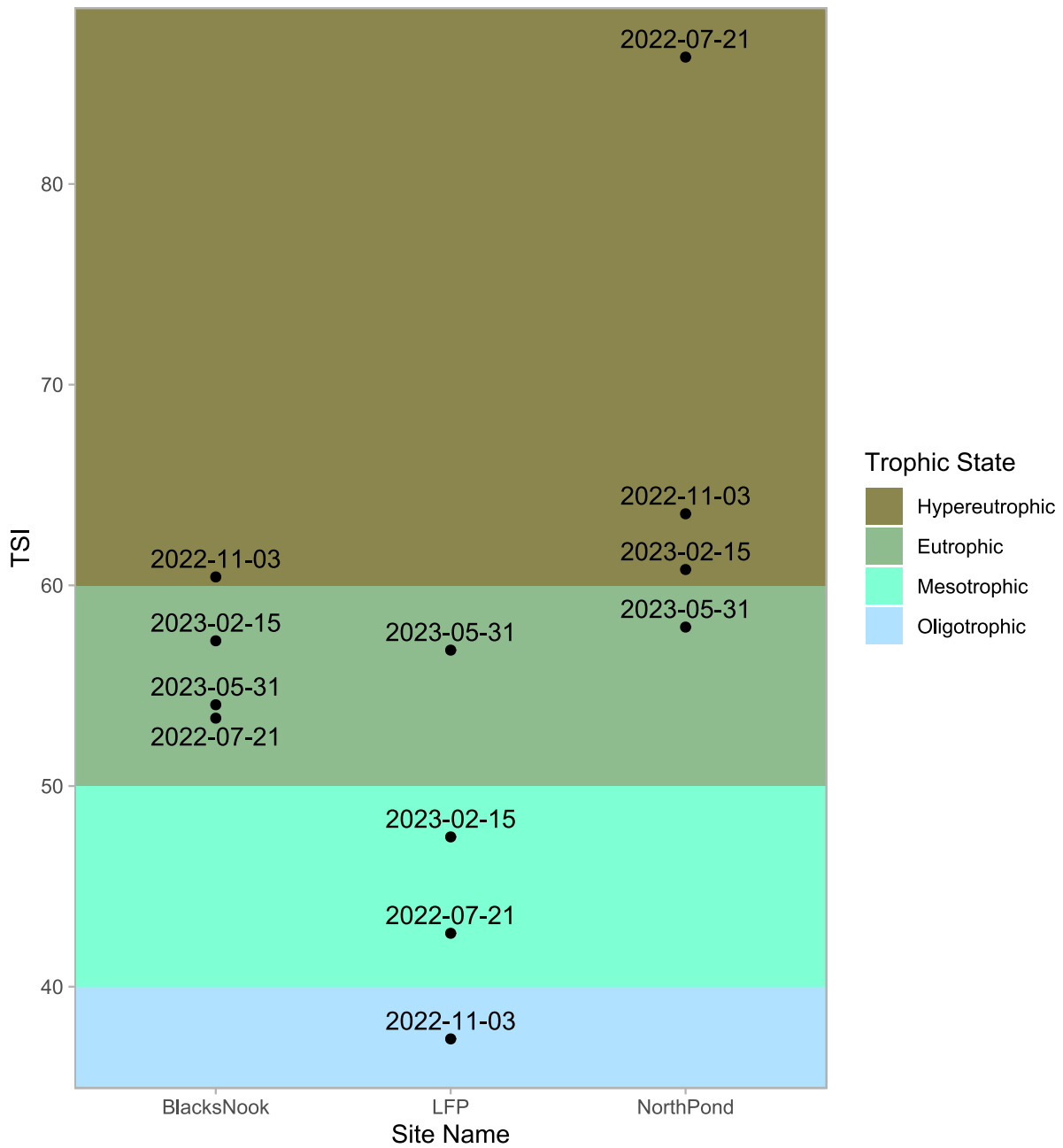
- No objectionable odors observed.

### 8. Oil and Grease

- No samples taken, but no visible sheens observed.



## 2023 Fresh Pond Reservation Class B Waters



**Figure 2: Reservation Pond Trophic State Index derived from Chlorophyll-*a*, July 1, 2022 – June 30, 2023**

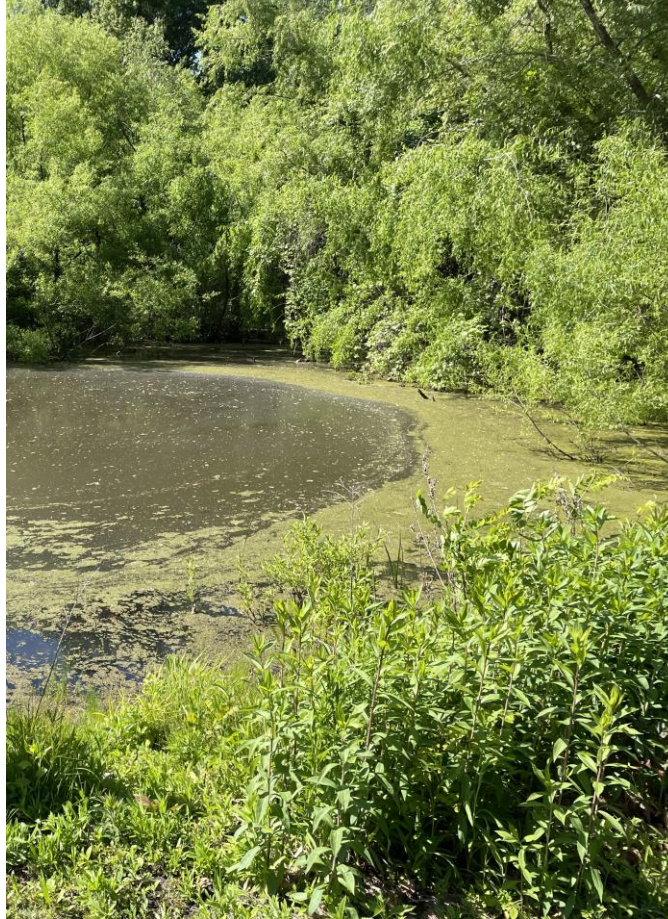


**Photograph A: Blacks Nook, view looking northwest, showing dense macrophyte growth on 7/21/2022**



**Photograph B: North Pond, view looking south, showing complete coverage of duckweed on 7/21/2022**





**Photograph C: North Pond, view looking south, showing macrophyte growth, turbidity, and suspended solids on 5/31/2023**



**Table 1: Water Quality Results**

Date	Site	Total Alkalinity (mg CaCO <sub>3</sub> /L)	Al (mg/L)	Ca (mg/L)	Cl (mg/L)	Chl- <i>a</i> (mg/m <sup>3</sup> )	Color (CU)	HDO (mg/L)	<i>E. coli</i> (cfu/100 mL)	Fe (mg/L)	Lab pH	<i>In situ</i> probe pH	Mn (mg/L)	Na (mg/L)
7/21/2022	Black's Nook	45	0.05	14.9	11.9	10.2	18	2.91	118	0.46	6.96	6.84	0.04	7
7/21/2022	LFP	50	0.05	23.9	171	3.42	18	3.98	387	0.34	7.39	7.45	0.021	113
7/21/2022	North Pond	130	0.35	44.6	22.9	293	167	0.6	156	8.09	6.88	6.88	1.17	16
11/3/2022	Black's Nook	53	0.01	16	18.1	20.9	31	4.08	28	0.78	6.8	6.81	0.148	10
11/3/2022	LFP	50.5	0.01	19.2	143	< 2	11	8.3	18	0.23	7.47	7.35	0.018	89
11/3/2022	North Pond	127	0.04	46.9	30.9	28.8	77	3.57	55	3.45	7.05	6.98	0.783	18
2/15/2023	Black's Nook	49.5	0.03	16	21.8	15.11	29	11.04	276	0.76	6.89	7.22	0.052	10
2/15/2023	LFP	52	0.07	23.6	116	5.58	14	13.7	< 1	0.43	7.91	8.24	0.034	71
2/15/2023	North Pond	109	0.1976	37.9	28.8	21.7	220	1.35	51	9.17	6.72	6.84	1.67	15
5/31/2023	Black's Nook	54	0.01	17.1	19	10.92	NA	5.66	8	1.14	7.09	7.33	0.152	9
5/31/2023	LFP	40	0.19	24.2	134	14.41	NA	7.87	41	0.6	9.34	9.3	0.04	99
5/31/2023	North Pond	113	0.01	39.6	24.2	16.2	NA	2.26	50	3.09	7.18	7.42	0.537	13



**Table 1: Water Quality Results cont.**

Date	Site	NH <sub>3</sub> -N (mg/L)	NO <sub>3</sub> -N (mg/L)	Lab SpC (uS/cm)	<i>In situ</i> probe SpC (uS/cm)	Total Dissolved Solids (mg/L)	Water Temperature (degrees C)	TKN (mg/L)	Total Organic Carbon (mg/L)	Total Phosphorus (mg/L)	Turbidity (NTU)
7/21/2022	Black's Nook	NA	< 0.01	133	140.3	89.8	26.09	0.84	6.2	0.073	0.9
7/21/2022	LFP	NA	< 0.01	723	748	478.7	26.91	0.55	4.5	0.035	0.53
7/21/2022	North Pond	NA	< 0.01	330	348	222.7	25.36	2.2	16.3	0.21	23.9
11/3/2022	Black's Nook	NA	< 0.01	162	174.3	111.5	9.26	0.49	5.6	0.1	1.8
11/3/2022	LFP	NA	< 0.01	608	617.1	394.9	11.88	0.38	3.2	0.016	0.5
11/3/2022	North Pond	NA	< 0.01	358	367.5	235.2	9.96	1.6	16.8	0.13	5.38
2/15/2023	Black's Nook	0.145	< 0.01	164	175.5	112.3	4.35	0.646	5.6	0.0584	2.99
2/15/2023	LFP	0.0856	< 0.01	475	511.8	327.5	4.59	0.261	3.5	0.0244	1.44
2/15/2023	North Pond	0.351	< 0.01	295	321	205.4	3.33	2.15	19.7	0.337	12
5/31/2023	Black's Nook	0.197	< 0.01	163	176.5	NA	21.04	0.505	6.5	0.0786	2.77
5/31/2023	LFP	0.142	< 0.01	510	566.6	NA	20.92	0.504	4.3	0.0244	1.15
5/31/2023	North Pond	0.148	< 0.01	286	310.4	NA	20.36	1.14	17.2	0.101	6.33