

# Cecil M. Harden Lake (CHL) Water Quality Summary

## Summary of 2020 Water Quality Results

Harden Lake had no exceedances of Indiana's water quality criteria at the tailwater (CHL10000). Total phosphorus and total nitrogen levels at all sample locations exceeded the USEPA nutrient criteria. The mean TSI category for all three indices classified the lake as hypereutrophic, indicating a very high level of biological activity. Finally, our sampling showed cyanobacteria cell counts over 100,000 cells/mL in all but one of the samples at the time of sampling, and four samples exceeded 1,000,000 cells/mL. The elevated nutrient levels and hypereutrophic TSI classification indicate there is a high potential for HAB development in the lake.

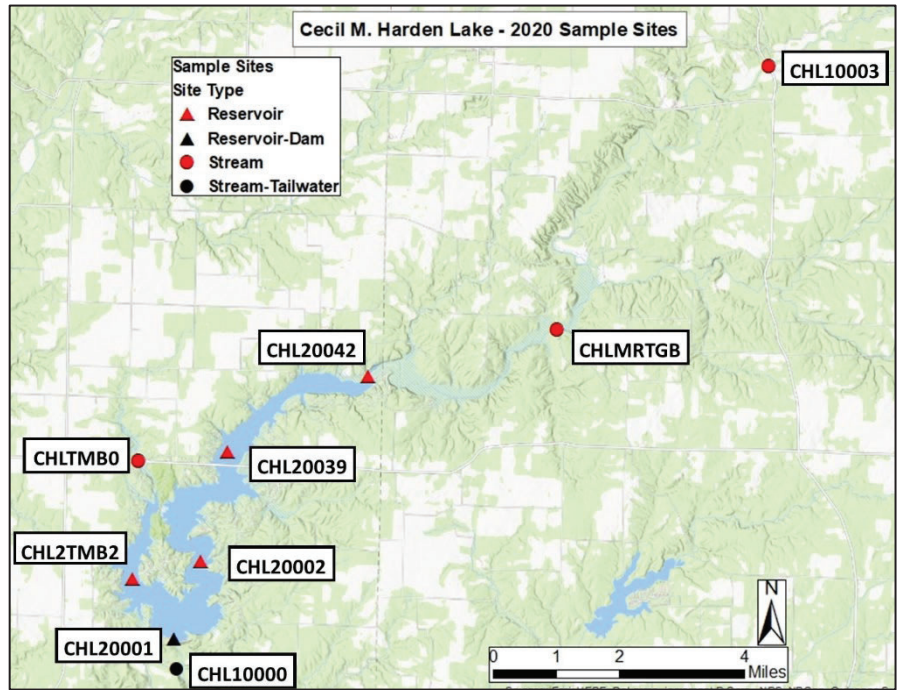


Figure 1. Water quality sampling locations for Harden Lake in 2020.

## 2020 Activities

In 2020, one sampling event was conducted at Harden Lake. Field data and chemical samples were collected at all sites (Figure 1). Chlorophyll and phytoplankton were collected at five sites, and zooplankton samples were collected at the damsite (CHL20001).

Additionally, temperature and dissolved oxygen (DO) profiles were collected by the project staff at the damsite and tailwater approximately every two weeks from early May through late December.

## Exceedances of IN State Water Quality Criteria

There were no exceedances of IN state water quality criteria at the tailwater.

## Tailwater Temperature and DO Conditions

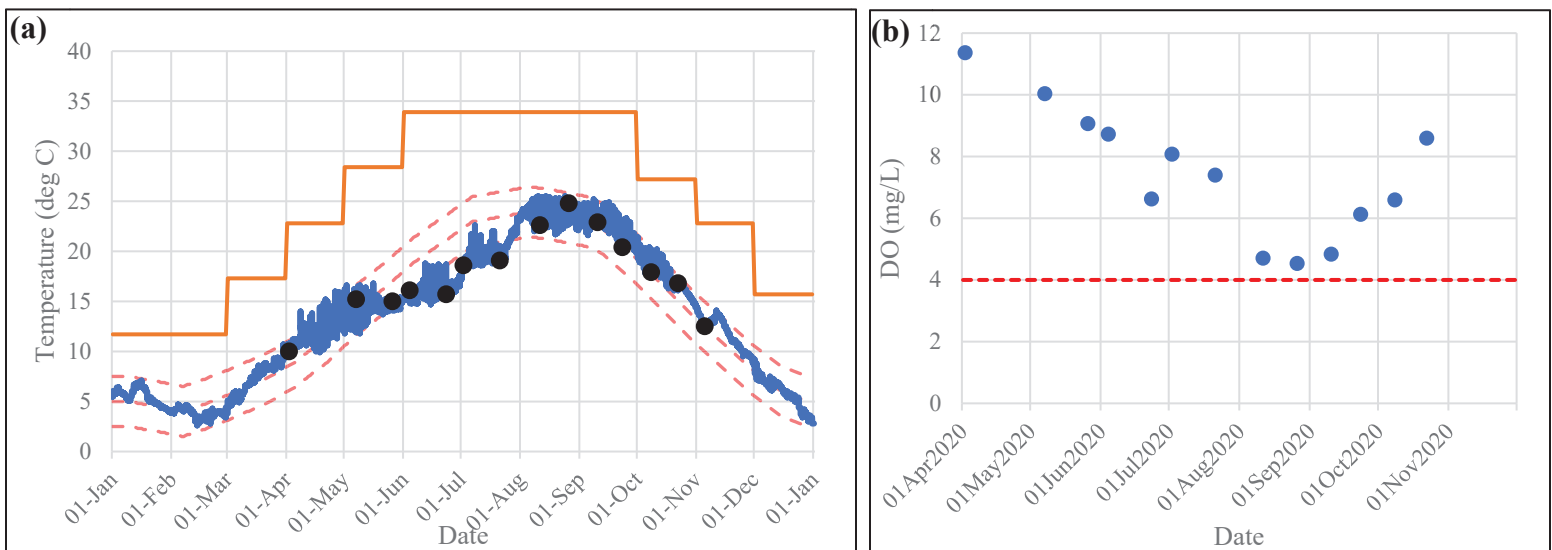


Figure 2. Harden Lake tailwater temperature and DO data. (a) Tailwater temperature data collected by project staff in 2020 is represented by the black dots. The blue line represents USGS gage data (provisional) from a gage downstream from the project. The temperature guide curve is represented by the dashed red lines, and the orange line represents the IN water quality criteria for temperature. (b) Tailwater dissolved oxygen data collected in 2020 is represented by the blue dots. The IN water quality criteria for DO is represented by the dashed red line.

Tailwater data was compared to IN state water quality criteria for temperature and to the Louisville District's temperature guide curve for Harden Lake (Figure 2a). Tailwater temperature did not exceed the state criteria for temperature at any time, but it did fall below guide curve late May through late July. The WQ Program will use these findings to inform future operational decisions to improve performance of downstream temperature management wherever possible. Tailwater dissolved oxygen levels (Figure 2b) did not exceed state criteria at any time throughout the year.

### Nutrient Analyses

Nutrient data, including total nitrogen (TN) and total phosphorus (TP) data, were collected at all sample sites in 2020. The 2020 TP and TN values were compared to historical data from 2012 through 2019 (Figure 3). The TP and TN values at each site were compared to their respective USEPA recommended criteria. Nutrient levels are an area of concern because elevated nutrients can lead to high biological activity, especially with respect to HABs.

#### Total Phosphorus

2020 TP values at all sites at Harden Lake were above the historical medians and the USEPA recommended nutrient criteria.

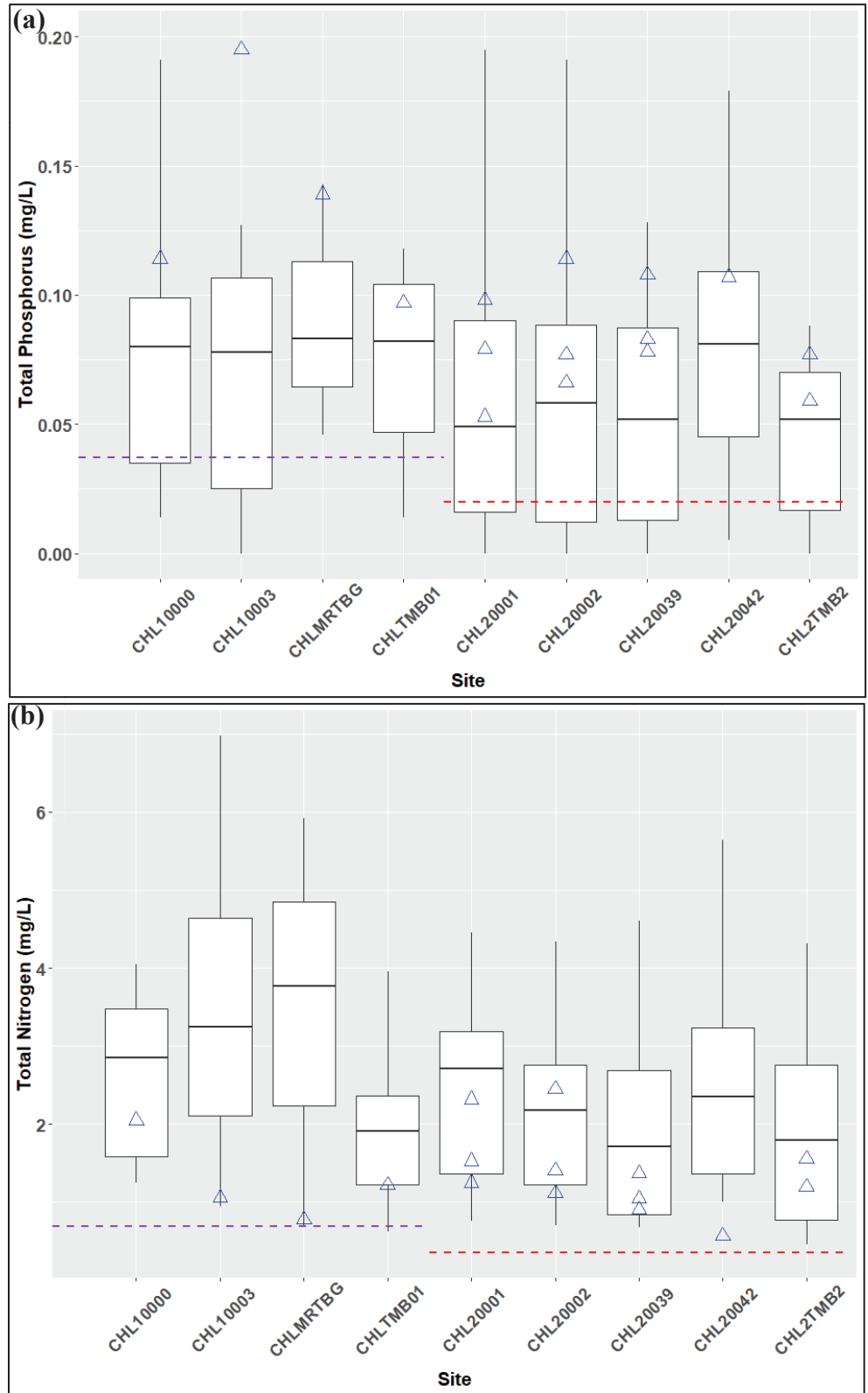
#### Total Nitrogen

2020 TN values at Harden Lake were near or below the historical medians for all but one sample, and 2020 values fell within or below the historical distribution for TN values. Also, 2020 TN levels at all sites were above the USEPA recommended nutrient criteria for the respective locations.

### Cyanobacteria Data, HABs and Trophic State Index

#### Cyanobacteria Data

17 phytoplankton samples were collected at various depths from 5 sites. Total cyanobacteria cell counts exceeded



**Figure 3. Comparison of 2020 nutrients data to historical samples and nutrient criteria. Boxplots represent data collected in 2012-2019 and blue triangles represent 2020 data. Purple and red dotted lines represent USEPA recommended nutrient criteria for streams and reservoirs, respectively. (a) Comparison of total phosphorus data. Four outliers (values ranging from 0.427-0.465 mg/L) were excluded to make graph easier to interpret. (b) Comparison of total nitrogen data.**

100,000 cells/mL (guideline value for moderate health risk from the World Health Organization’s Guidelines for Safe Recreational Water Environments [2003]) in 16 out of 17 samples collected from 5 sites. Four of these samples exceeded 1,000,000 cells/mL. These results indicate Harden Lake had cell count levels potentially indicative of a HAB at the time of sampling.

*Harmful Algal Bloom (HAB) Response*

Indiana Department of Environmental Management (IDEM) is the lead agency for HAB response in Indiana. IDEM samples State Recreation Areas (SRA) biweekly during the recreation season and issues appropriate HAB alert level based on the results. IDEM issued HAB Advisory alert levels at the Raccoon Lake SRA from 5/22/20 through 6/12/20 and from 7/2/20 through 9/4/20. The Advisory alert level indicates that cell counts were over 100,000 cells/mL, but toxin levels did not meet thresholds for the Caution or Closed alert levels. At an Advisory alert level, the following precautions apply: swimming and boating permitted; avoid contact with algae; don’t drink the water; and shower after you swim.

*TSI*

The trophic state indices for Secchi depth [TSI(SD)], chlorophyll-*a* [TSI(CHL)], and total phosphorus [TSI(TP)] were calculated for five reservoir sites at Harden Lake (Table 1). The mean category of all three indices was hypereutrophic, indicating a very high level of biological activity.

***Table 1. Summary of calculated trophic state indices at Harden Lake.***

	<b>Mean Score (range)</b>	<b>Mean Category (range)</b>
<b>TSI(SD)</b>	66 (61-73)	<b>Hypereutrophic</b> (Eutrophic-Hypereutrophic)
<b>TSI(CHL)</b>	67 (64-72)	<b>Hypereutrophic</b> (Eutrophic-Hypereutrophic)
<b>TSI(TP)</b>	66 (61-72)	<b>Hypereutrophic</b> (Eutrophic-Hypereutrophic)