

# Carr Creek Lake (2018)

## Water Quality Takeaways

- High potential for harmful algal blooms
- Did not operate closely to the established temperature guide curve
- No exceedances of state water quality criteria

## General Information and Water Quality

Carr Creek Lake (CFK) is located in Knott County, Kentucky. The dam was built and is operated by the Louisville District US Army Corps of Engineers (LRL). The primary purpose of the lake is flood control and secondarily water supply. At summer pool, the surface area of CFK is 710 acres.

Water quality (WQ) in the tailwater is assessed by analyzing 2018 data for exceedances of WQ criteria established by the KY Division of Water (KDOW). No criteria were exceeded in the tailwater (2CFK10000; Figure 1). However, CFK exceeded the USEPA's recommended criteria for total phosphorus and turbidity. This is common among KY lakes but can contribute to harmful algal blooms.

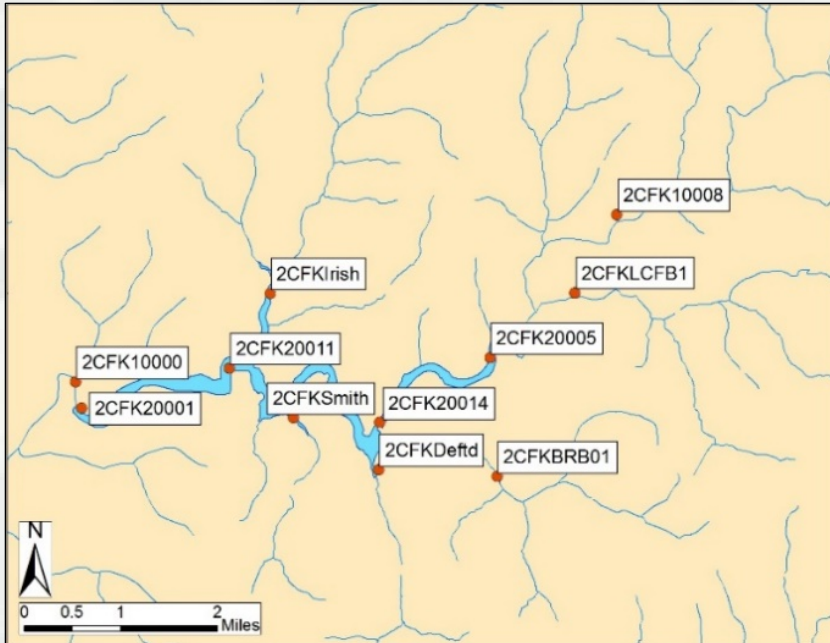


Figure 1. CFK sample sites in 2018 for field and chemical data.

## Tailwater Conditions

Temperature and dissolved oxygen (DO) profile data are regularly collected from LRL lakes and tailwaters. This data informs water control engineers on how to best use existing selective withdrawal capabilities to meet downstream WQ targets. WQ targets are established by each lake's Water Control Plan (WCP) and state criteria. Figure 2a shows a time series graph of the 2018 tailwater (2CFK10000) water temperature compared with the guide curve from the lake's WCP. CFK did not operate closely to the established temperature guide curve in 2018. Figure 2b shows a 2018 time series graph of the lake's tailwater DO data with the applicable state criteria (blue line). CFK met the state's criteria for dissolved oxygen.

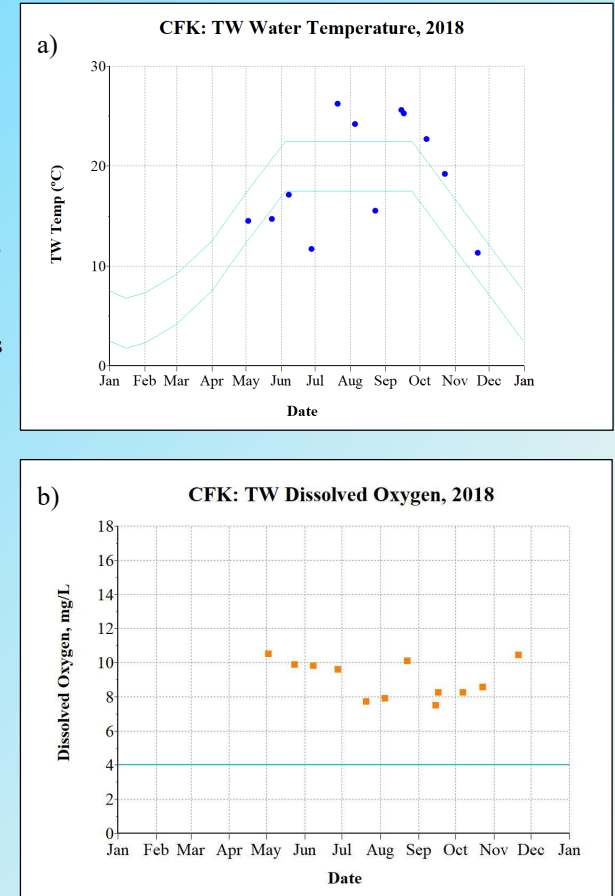


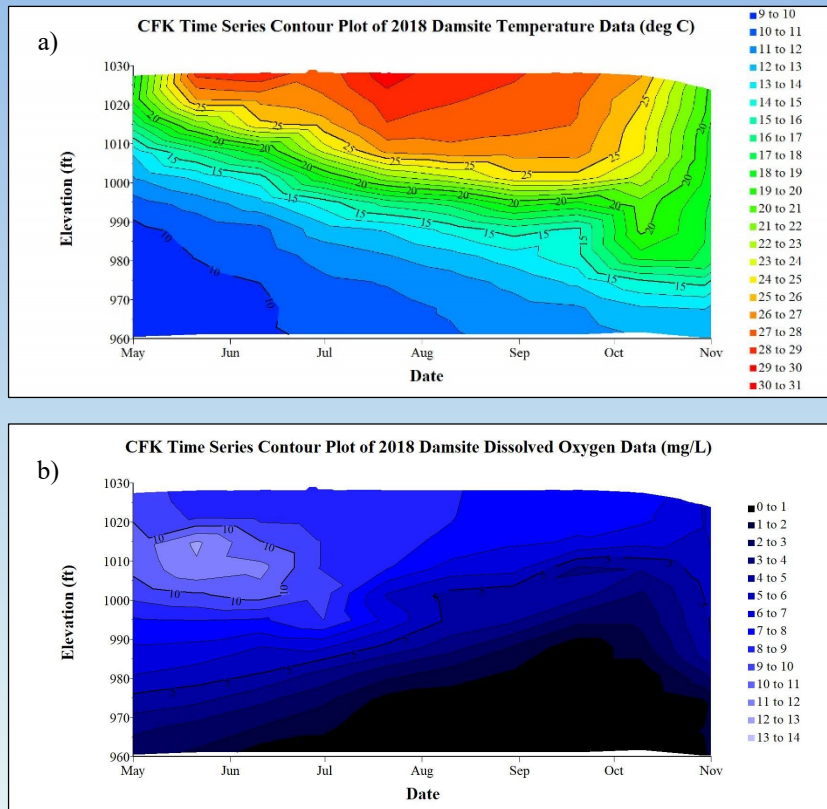
Figure 2. CFK time series data collected from the tailwater (2CFK10000; Figure 1) a) water temperature; and b) dissolved oxygen.



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## Reservoir Conditions and Operations

Below (Figures 3a and b) are time series contour plots of CFK profile data collected at the damsite (2CFK20001; Figure 1) in 2018. The figures show the progression of temperature and dissolved oxygen availability in the lake throughout the year. The CFK temperature profile data collected in 2018 (Figure 3a) indicates that the reservoir contained the proper temperatures necessary to meet the established temperature guide curve. While Figure 3b indicates that the reservoir may have dissolved oxygen limitations later in the fall, actual data from the tailwater indicates that it is adequately oxygenated.



**Figure 3.** CFK time series data collected from the damsite (2CFK20001; Figure 1) during 2018: a) water temperature; and b) dissolved oxygen.

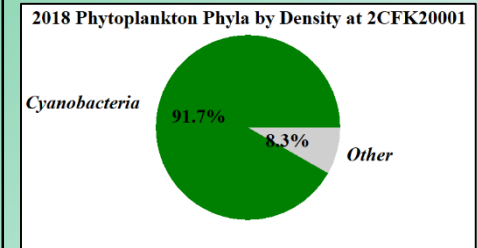
## Reservoir Biological Conditions

The Trophic State Index (TSI) was calculated using the data from the Secchi Depth, Chlorophyll-a, and Total Phosphorus analyses. The TSI values below were calculated for multiple sites with the 2018 data. The results shown in Table 1 suggest that CFK is eutrophic (TSI score from 51-69). This means that CFK has a high concentration of nutrients, which can be detrimental to life in the lake in multiple ways.

**Table 1.** TSI scores and trophic states for samples collected at CFK in 2018.

Site	TSI Score	Trophic State
2CFK20001	54	Eutrophic
2CFK20005	58	Eutrophic
2CFK20011	56	Eutrophic
2CFK20014	59	Eutrophic

Phytoplankton (algae and cyanobacteria) and green plants are the base of the food chain in aquatic ecosystems. Phytoplankton also have a large impact on humans via harmful algal blooms (HABs) which are caused by an over-abundance of cyanobacteria.



**Figure 4.** 2018 phytoplankton community at 2CFK20001.

Figure 4 illustrates the abundance of cyanobacteria relative to the other types of phytoplankton collected from the damsite in summer 2018. The chart shows that cyanobacteria dominated the phytoplankton community in density (cells/L). These results indicate that HABs have the potential to be problematic at CFK.

**Harmful Algal Blooms (HABs) in KY** are addressed by the KDOW as they are the lead agency for HAB response. The KDOW has adopted HAB toxin sampling for posting public recreational advisories/cautions. The LRL WQ Program coordinates with, complies with, and supports the state agency's efforts to implement a statewide HAB response plan.

