



Water Quality Monitoring, Fiscal Year 2020

Overview

The Cumberland Piedmont Inventory and Monitoring Network began long-term water-quality monitoring at Fort Donelson National Battlefield (FODO) in 2004. Water quality is measured quarterly on alternate years at five sites: Lake Barkley at the FODO overlook (FDLB), Hickman (EMHC) and Indian Creek Embayments (EMIC), Hickman Spring (HSHS), and Indian Creek at Graves Battery (GBIC; see map on page 2). While the park is nearly surrounded by water (the spillway elevation of the Lake Barkley Dam defines the boundary along the U.S. Army Corps of Engineers operated lake), Hickman Spring and Indian Creek at Graves Battery are the only perennial waters within park boundaries. The Cumberland Piedmont Network also monitors waters outside the boundary due to their proximity and immediate aesthetic.

Based upon program requirements and findings of the water quality inventory, a set of parameters was chosen for long-term monitoring. These parameters include the field measures of water temperature, specific conductance (SpC), pH, and dissolved oxygen (DO). Samples were also analyzed for *Escherichia coli* (*E. coli*) and nitrate.

This brief summarizes data collected from October 1, 2019 through September 30, 2020 (FY20). Sample collection was shortened and only two sampling trips were completed in WY20 due to restrictions and limitations associated with COVID19. Water quality data are available upon request to the Cumberland Piedmont Network and past reports are available at <https://www.nps.gov/im/cupn/monitoring-reports.htm>.

Significant Findings

Dissolved oxygen at Hickman Spring on November 5, 2019 was 1.69 mg/L, below the state standard of 5.0 mg/L. This is the lowest recorded DO measurement at Fort Donelson NB since CUPN monitoring began in 2004. However, DO levels at this site often fall below the state standard (Figure 1) and it is likely attributed to seasonally natural occurrences. On February 10, 2020, *E. coli* values exceeded Tennessee standards of 487 MPN/100mL at Indian Creek Embayment, Hickman

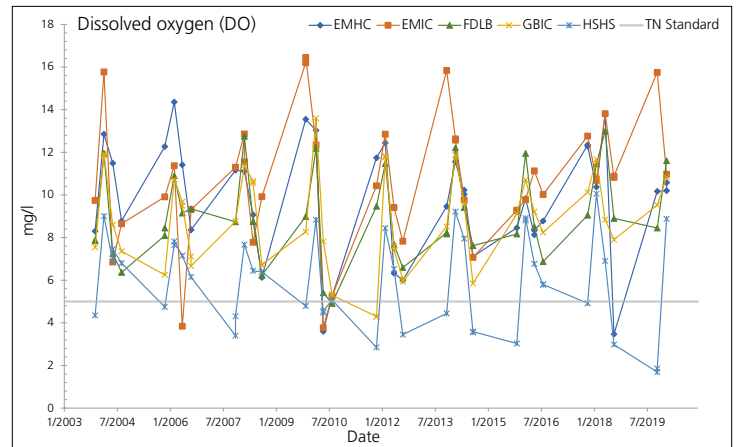


Figure 1. Dissolved oxygen levels at Fort Donelson from 2004 to 2020. EMHC=Hickman Creek Embayment; EMIC=Indian Creek Embayment; FDLB=Lake Barkley at FODO overlook; GBIC=Indian Creek at Graves Battery; and HSHS=Hickman Spring.

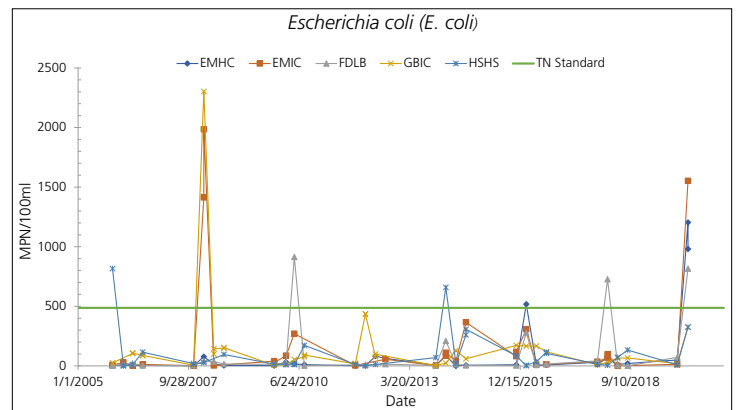


Figure 2. *E. coli* levels at Fort Donelson from 2004 to 2020. EMHC=Hickman Creek Embayment; EMIC=Indian Creek Embayment; FDLB=Lake Barkley at FODO overlook; GBIC=Indian Creek at Graves Battery; and HSHS=Hickman Spring.

Creek Embayment, and Lake Barkley (Figure 2). Although rainfall the week prior was not exceptionally high at 3.4 centimeters (1.3 inches), it is evident from site photos that water levels and turbidity were high (Figure 3). Increased water levels and potential runoff likely contributed to elevated *E. coli* levels.



Figure 3. From left to right: Hickman Creek Embayment, Indian Creek Embayment, and Hickman Creek Embayment on Feb. 10, 2020

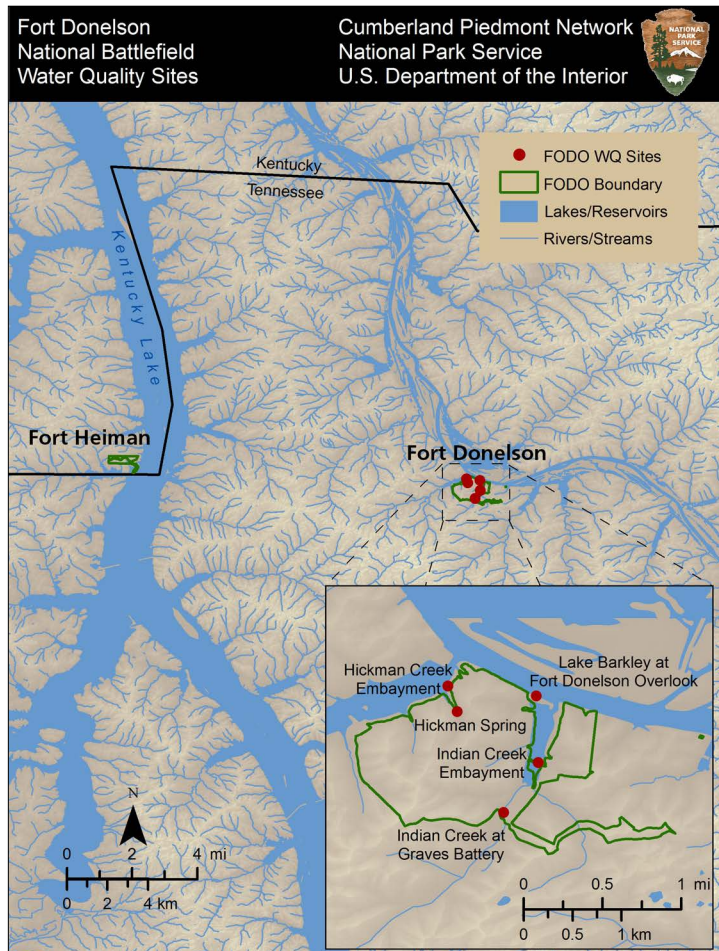
Water Quality Standards

All park waters are considered “Exceptional Tennessee Waters.” This designation prohibits discharge and other pollution sources. Criteria are defined as Tennessee’s “Fish & Aquatic Life and Recreational” standards, a combination of the highest standards under the Clean Water Act as promulgated by the state.

Parameter	Standard
Water temperature	Less than 31.7°C (89.1°F)
Dissolved oxygen	Greater than 4.0 mg/L (warm water) Greater than 5.0 mg/L (cold water)
pH	Between 6.0 and 9.0 SU
<i>Escherichia coli</i>	Less than 576 MPN/100 mL
Specific conductance	No standard
Nitrate	Less than 90 mg/L

Future Monitoring

Water quality sampling is scheduled to resume in fiscal year 2022.



Sites at Fort Donelson National Battlefield in FY 2020.



Indian Creek Embayment (left) and Indian Creek at Graves Battery (right) sampling sites on Nov. 5, 2019.

About the CUPN

In 1999, the National Park Service initiated a long-term ecological monitoring program, known as “Vital Signs Monitoring,” to provide the minimum infrastructure to allow more than 270 national park system units to identify and implement long-term monitoring of their highest-priority measurements of resource condition. The overarching purpose of natural resource monitoring in parks is to develop scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and to determine how well current management practices are sustaining those ecosystems.

The NPS Vital Signs Monitoring Program addresses five goals for all parks with significant natural resources:

- Determine the status and trends in selected indicators of the condition of park ecosystem,
- Provide early warning of abnormal conditions,
- Provide data to better understand the dynamic nature and condition of park ecosystems,
- Provide data to meet certain legal and Congressional mandates, and
- Provide a means of measuring progress towards performance goals.

Effective long-term management and stewardship of natural resources in the Cumberland Piedmont Network begins with baseline knowledge of these resources. To acquire this knowledge, an inventory program was established by the National Park Service with the goals of acquiring baseline information for a variety of resources, from bibliographic information to species occurrence and distribution.

For More Information

CUPN Home Page:

<https://www.nps.gov/im/cupn/index.htm>

CUPN Reports & Publications:

<https://www.nps.gov/im/cupn/reports-publications.htm>

About the NPS Inventory & Monitoring Program:

<https://www.nps.gov/im/index.htm>

Data Downloads via the Natural Resource Information Portal:

<https://irma.nps.gov/Portal/>

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