

Ecology Completes Deep Lake Report

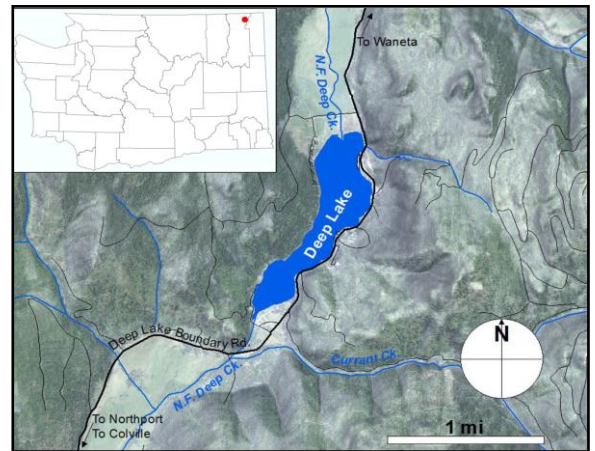
This report summarizes field and laboratory water quality data and streamflow data collected by the state Department of Ecology (Ecology) at Deep Lake in Stevens County during 2014. The purpose of the study was to provide baseline water quality data in response to citizen complaints about water quality in the lake.

The report, *Deep Lake (Stevens County) Water Quality Monitoring Study*, is available online at <https://fortress.wa.gov/ecy/publications/SummaryPages/1503028.html>

Study Location

Deep Lake is located approximately 10 miles southeast of Northport, Washington. The lake has a surface area of 0.32 square miles and a maximum depth of about 45 feet.

The lake is located along North Fork Deep Creek, which drains a mostly forested area along the western slope of a north-south range of the western Rocky Mountains. North Fork Deep Creek flows into Deep Lake at the north end of the lake, and flows out at the south end. From the outlet of Deep Lake, the creek flows southwest to join South Fork Deep Creek, forming Deep Creek, which empties to Lake Roosevelt near the town of Northport.



Much of Deep Lake is surrounded by residential development including vacation homes. The surrounding landscape is primarily forestland. For about four miles upstream of Deep Lake, North Fork Deep Creek flows along a fairly level valley bottom, which is dominated by livestock grazing for a part of the year.

Background

There have been a number of complaints from local residents about water quality in Deep Lake, representing a perception that water quality in Deep Lake has been declining. Residents also expressed concerns about blue-green algae. One blue-green algae bloom was confirmed by Ecology in November 2012. Local residents have expressed a desire for monitoring of the lake. Potential sources of nutrients, fecal coliform bacteria, and sediment include upstream livestock activities as well as possible residential sources adjacent to the lake.

For this study, Ecology collected samples at Deep Lake as well as at the inlet and outlet streams of the lake. Field data included pH, conductivity, dissolved oxygen, water temperature, Secchi depth, and streamflow. Laboratory data included ammonia-nitrogen, nitrite-nitrate nitrogen, orthophosphate, total phosphorus, total persulfate nitrogen, fecal coliform, and total suspended solids.

Contact us

If you have questions, contact Tighe Stuart at 509-329-3476 or Tighe.Stuart@ecy.wa.gov.

Report Summary

Study results indicated that Deep Lake acts as a sink for sediment, nutrients, and fecal coliform, trapping the vast majority of sediment, nutrients, and fecal coliform that enter the lake via the inlet stream. Sediment trapping during the springtime is particularly notable. During May sampling, approximately 10,000 kilograms per day (11 US tons per day) of suspended sediment were being trapped by Deep Lake. In other words, most of the sediment being delivered to the lake through the inlet stream permanently settles out in the lake.

The study found that the lower layer of water in Deep Lake, called the hypolimnion, became anoxic, or devoid of oxygen, during late spring/early summer, and remained so for the remainder of the summer. During the first sampling run on May 21, the very bottom layer of the lake was anoxic, with progressively higher dissolved oxygen levels above that. During all other sampling runs, the hypolimnion was entirely anoxic below a water depth of 8 to 10 meters.

Both dissolved oxygen levels and temperature of the lake were found to exceed (not meet) the numeric Washington State water quality criteria, set to protect fresh water. During the study, Ecology found Deep Lake to have dissolved oxygen levels of less than 9.5 mg/L and temperatures higher than 16°C (60.8° F). For cases such as this, the water quality criteria for both dissolved oxygen and temperature include a natural conditions provision. However, it was not in the scope of this study to determine a natural condition for dissolved oxygen or temperature.

Fecal coliform results in the North Fork Deep Creek inlet stream were found to exceed water quality criteria. These criteria specify that Deep Lake should meet a geometric mean of 50 colony forming units (cfu) per 100 milliliters, and a 90th percentile (or highest measured result) of 100 cfu per 100 milliliters. In the inlet stream, a geometric mean of 219 cfu per 100 milliliters and a high measurement of 1,200 cfu per 100 milliliters were observed. However, fecal coliform results at the sites measured in the lake and in the outlet stream did not exceed (met) water quality criteria.

Fecal Coliform Bacteria	
Washington State water quality criteria	North Fork Deep Creek inlet
50 cfu/100 mL	219 cfu/100 mL
Highest result: 100 cfu/100 mL	Highest result: 1,200 cfu/100 mL

Nutrient concentrations in the inlet stream and in the upper layer of water in the lake, called the epilimnion, were moderately low:

- Nitrate-nitrite concentrations ranged from 14 to 41 micrograms (ug) per liter in the inlet stream and ranged from non-detectable to 16 ug per liter in the epilimnion of the lake.
- Total phosphorus concentrations ranged from 13.6 to 54.8 ug per liter in the inlet stream and ranged from 7.3 to 18.4 ug per liter in the epilimnion of the lake.

However, nutrient concentrations in the hypolimnion (lower level) of the lake showed an increasing trend throughout the summer, reaching maximum values of 369 ug per liter of ammonia and 236 ug per liter of total phosphorus during October. It is likely these nutrients will be distributed through the water column during the lake's fall turnover, creating a risk of increasing algae blooms.

Overall, the 2014 results are very comparable to the 1989-1998 results. The hypolimnetic anoxia appears to be much the same now as it was previously. Also, the trophic status, which indicates the algal activity or nutrient levels in the lake, appears to be much the same.

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