



## **PART OF Budd Inlet WATERSHED**

**LENGTH OF LAKE:** 0.33 miles

**MAXIMUM DEPTH:** 10 feet

### **GENERAL DESCRIPTION:**

Barnes Lake is located within the City of Tumwater. The approximate altitude of the lake is 156 feet. It is a very small, private lake with no surface inlet or outlet.

### **GENERAL WATER QUALITY:**

(Excellent, Good, Fair, Poor)

Poor – Water clarity is poor, nutrient levels are high, the dissolved oxygen level is very low.

### **MAJOR ISSUES:**

- Low dissolved oxygen is an impediment to sustaining a fishery in this lake.
- Dense aquatic plant growth along the shoreline impairs recreational uses of the lake by lake residents.

### **FUNDING FOR MONITORING:**

Barnes Lake – Lake Management District managed by the City of Tumwater.

## **WATER QUALITY MONITORING METHODS:**

Water quality monitoring of Barnes Lake was conducted once per month from May through October 2006 as part of the Barnes Lake – Lake Management District. There was one sampling site located in the open water in the approximate center of the lake. The lake was accessed by row boat off Lake Terrace Drive.

Field measurements were made for the following parameters:

- Temperature
- pH
- Dissolved Oxygen
- Conductivity

These parameters were measured at one meter increments from the surface to the bottom of the lake using the Yellow Springs Instrument multi-parameter field instrument. Water clarity was also measured. Clarity was measured using a secchi disk, which is a standard black and white quadrant disk lowered into the water until it is not visible.

Water samples were collected and analyzed for the following:

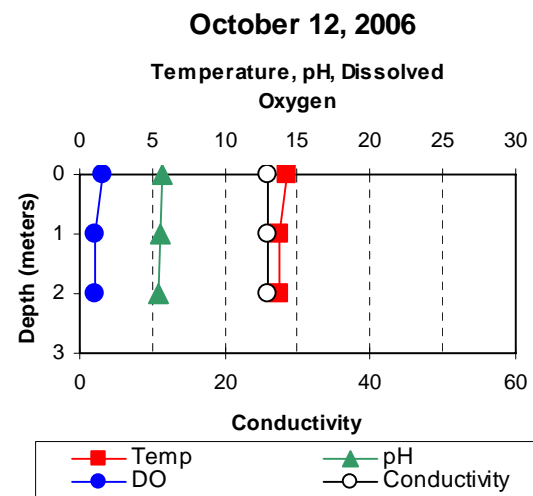
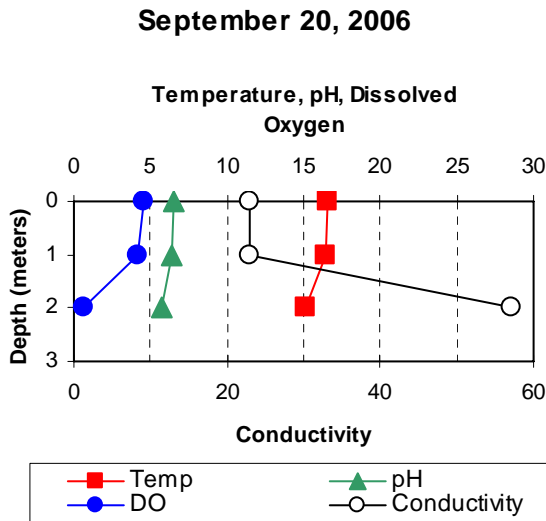
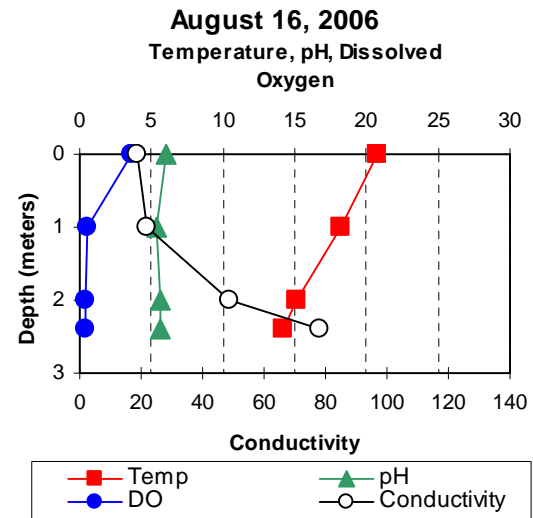
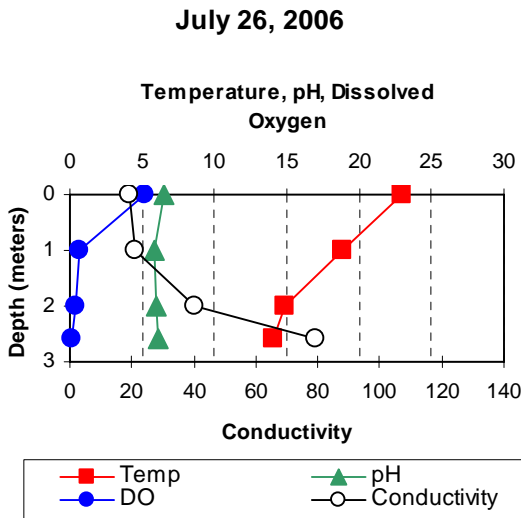
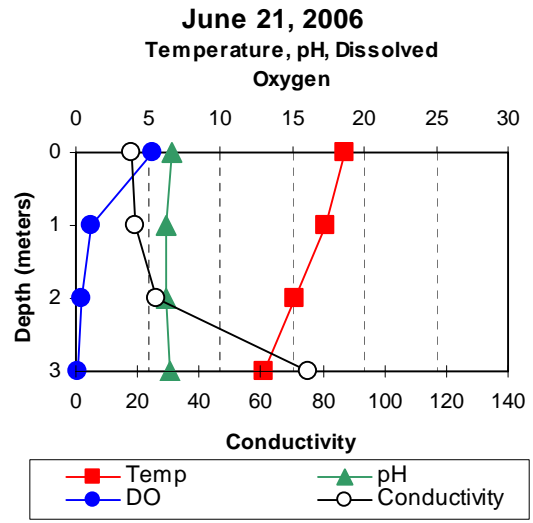
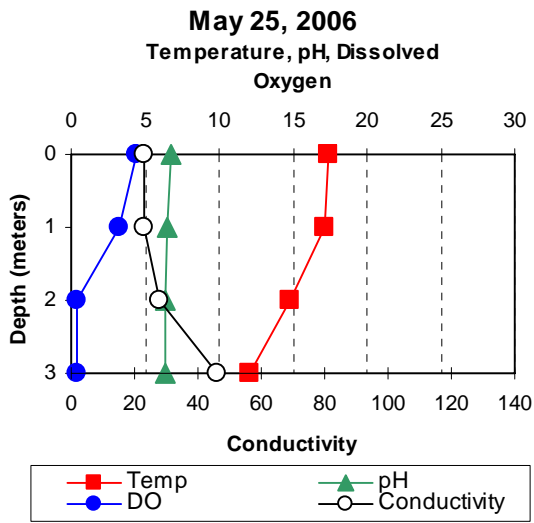
- Total Phosphorus
- Total Nitrogen
- Chlorophyll *a*
- Algae species (present and dominant)

The nutrients (total phosphorus and total nitrogen) were sampled near the surface and near the bottom. The bottom samples were collected using a Kemmerer sampler. Chlorophyll *a* and algae samples were taken as composite samples from the warm surface layer or the photic zone (the surface area where sunlight can penetrate).

## **MONITORING RESULTS:**

Profile graphs of temperature, pH, dissolved oxygen, and conductivity data are shown on the following page. Even though Barnes Lake is very shallow, it does thermally stratify during the mid-summer months. In July and August, the surface temperature was six to eight degrees Celsius warmer than it was at the bottom, 8.5 feet down. Barnes Lake has an orange to dark brown water color. The dark-colored water absorbs solar radiation, and the poor water clarity prevents light from penetrating very far into the water column. These conditions allow the lake to stratify into a distinct warm surface layer and a cold bottom layer despite its shallow depth.

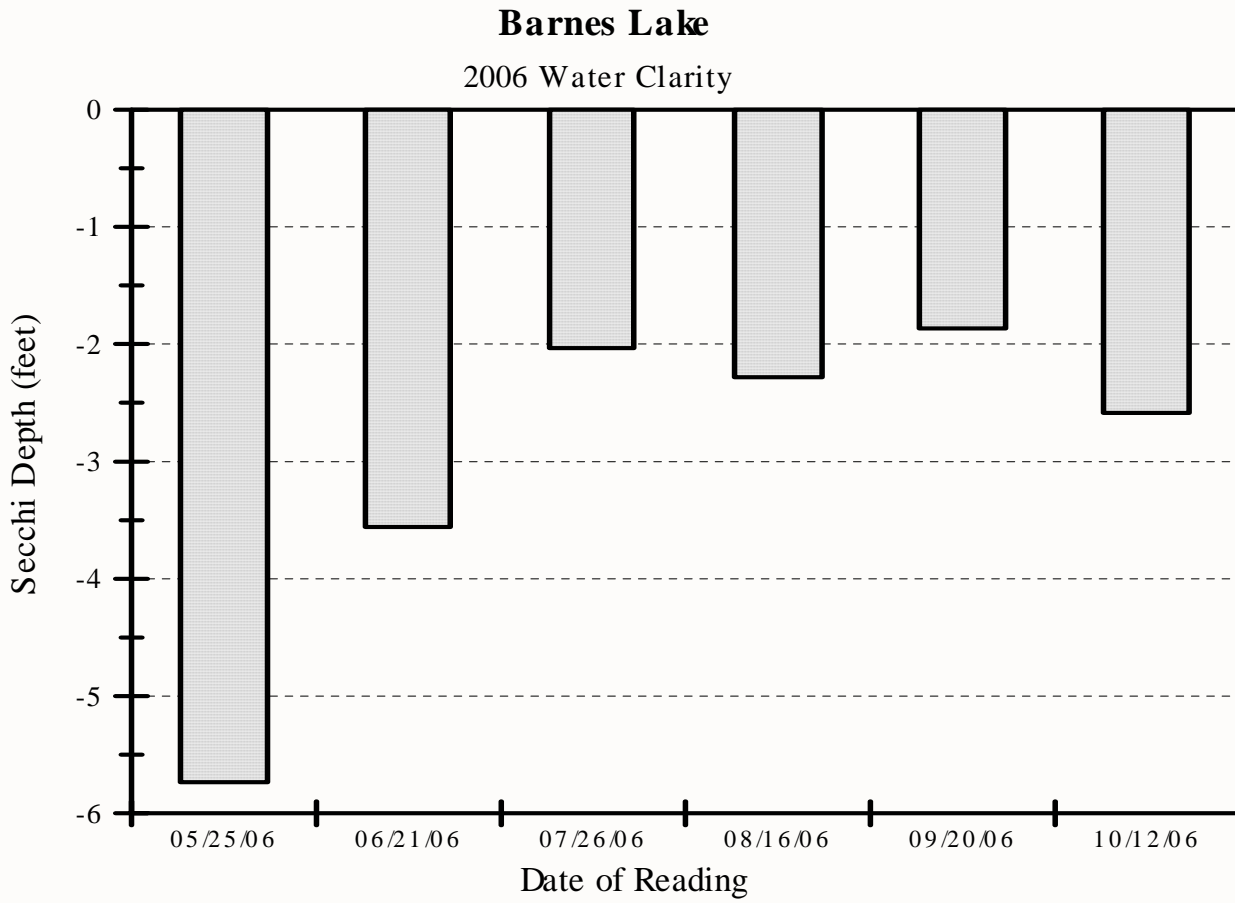
The pH and conductivity in Barnes Lake are lower than most lakes in Thurston County. The dissolved oxygen concentrations in the lake are very low, and are generally below levels that can sustain fish. Profile graphs of the field measurements are shown on the following page.



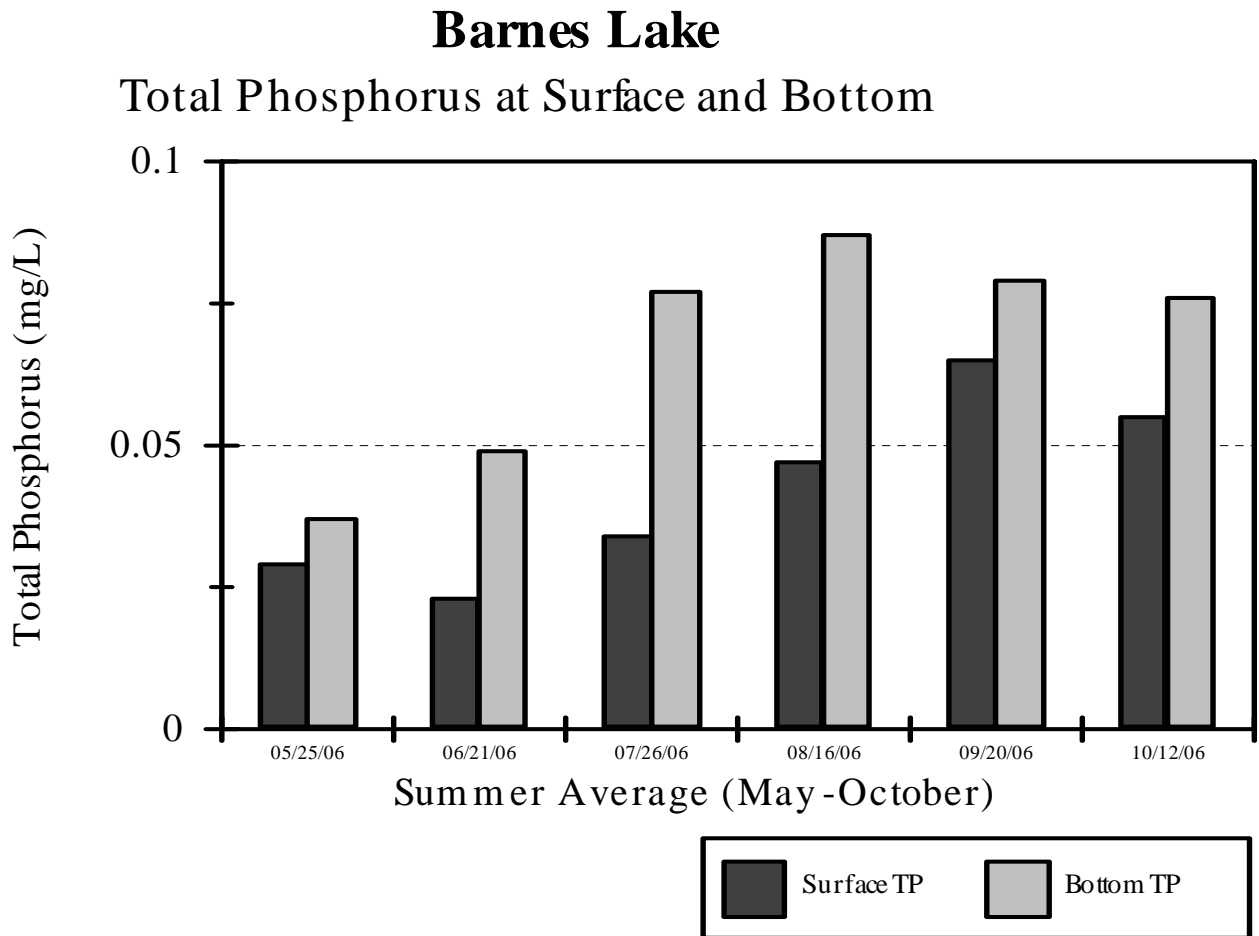
## Barnes Lake

---

The water clarity in Barnes Lake is low. As a frame of reference, the accepted standard for a public swimming beach is a visibility of 4 feet. In May the reading was 5.7 feet, and it was the only month when the clarity was greater than 4 feet. The season average water clarity was 3 feet. Below is a graph of the monthly water clarity measurements.



The amount of nutrients, phosphorus and nitrogen, in the lake water is a major factor in the amount of algae growth in the lake. Total phosphorus concentrations in surface samples averaged 0.042 milligrams per liter (mg/L). This is well over the state water quality standard of 0.020 mg/L for Puget Sound lowland lakes. The chlorophyll *a* concentration averaged 24.7  $\mu\text{g/L}$ . Chlorophyll is an indication of the amount of algae growth in the water column. The May sample had a low chlorophyll concentration. The other months showed fairly high algae production, especially July, August, and September. A graph of the total phosphorus concentrations at the lake surface and near the bottom is shown below. Phosphorus concentrations are usually higher at the bottom as it is released from the lake sediments.



#### TROPHIC STATE:

The *Carlson trophic state indices (TSI)* are used to express the degree of productivity, or plant and algae growth, in a lake. The average summer total phosphorus and chlorophyll *a* concentrations and secchi disk measurements are used to calculate the *Carlson trophic state indices*. Average summer total phosphorus concentrations, chlorophyll *a* concentrations, and secchi disk transparency are each used to calculate a TSI for the lake. A TSI of 0 to 40 indicates an oligotrophic, or low productivity, lake. A TSI of 41 to 50 indicates a mesotrophic, or moderately productive lake. A TSI of greater than 50 indicates a eutrophic, or highly productive lake.

In Barnes Lake, the TSI's for chlorophyll *a*, total phosphorus, and secchi disk visibility were 62, 58, and 61, respectively. These are all in the eutrophic range, indicating high productivity in this lake. These levels are much higher than most lakes in Thurston County. Below is a graph of the three trophic state indices.

