Three Rivers Park District – 2008 Lake Monitoring

Fish Lake:

The Three Rivers Park District in-lake phosphorus concentration goal for Fish Lake to support direct contact recreational use is 36µg/L (micrograms per liter). The Minnesota Pollution Control Agency (MPCA) impaired water criteria for the lake is 40µg/L. The average phosphorus concentration for Fish Lake in 2008 was 47µg/L (Figure 1). The highest phosphorus concentrations in 2008 coincided with lake turnover cycles, which occur in the spring and fall of the year. The process of lake turnover re-suspends nutrients throughout the water column and contributes to high total phosphorus concentrations at the end of April and late September (Figure 4). Throughout the remaining portion of the year, the total phosphorus levels fluctuated between 32µg/L and 66.0µg/L (Figure 4).

The excess in-lake phosphorus concentrations were conducive for the development of algae blooms. In 2008, the Fish Lake average chlorophyll-a concentration was 16.48µg/L (Figure 2). This is slightly higher than the water quality goal of 14µg/L, but an improvement from 2007 when chlorophyll-a concentrations were 31µg/L. The water clarity was not as significantly impaired in 2008. The average secchi depth transparency of 1.86 m in 2008 met the water clarity goal of 1.4 m for recreational use (Figure 3). During the month of June chlorophyll-a concentrations were at their lowest (5.4µg/L), resulting in the highest secchi depth transparency of the year at 4.4m (Figure 5). The water clarity in Fish Lake did not begin to degrade significantly until mid-July when conditions were more conducive for algae growth. The secchi depth transparency ranged between 0.72m to 2.61m between July and September. Consequently, the warmer weather conditions resulted in slightly elevated chlorophyll-a concentrations that persisted throughout the summer.

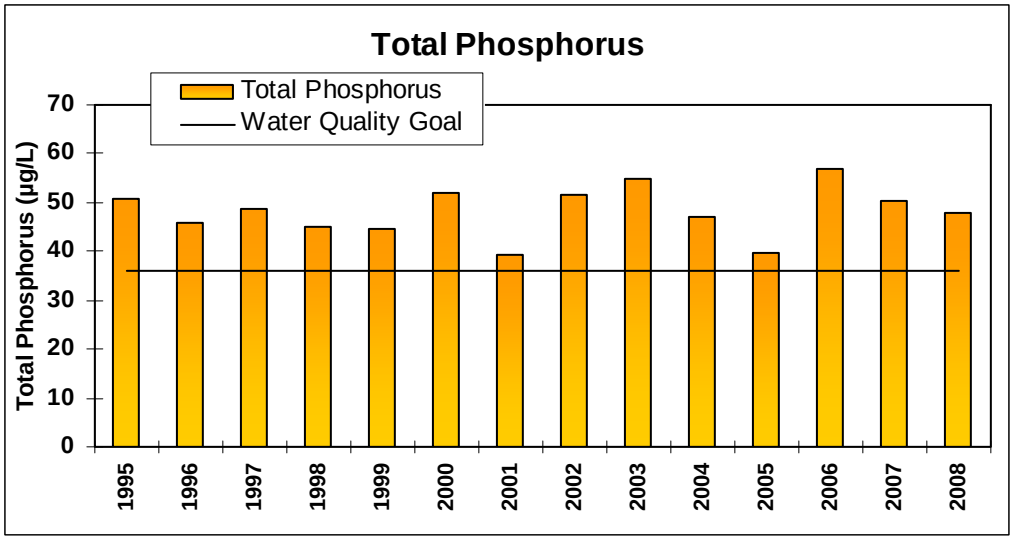

Figure 1: Fish Lake annual changes in total phosphorus data for 1995-2008. Values are the growing season average from May through September.

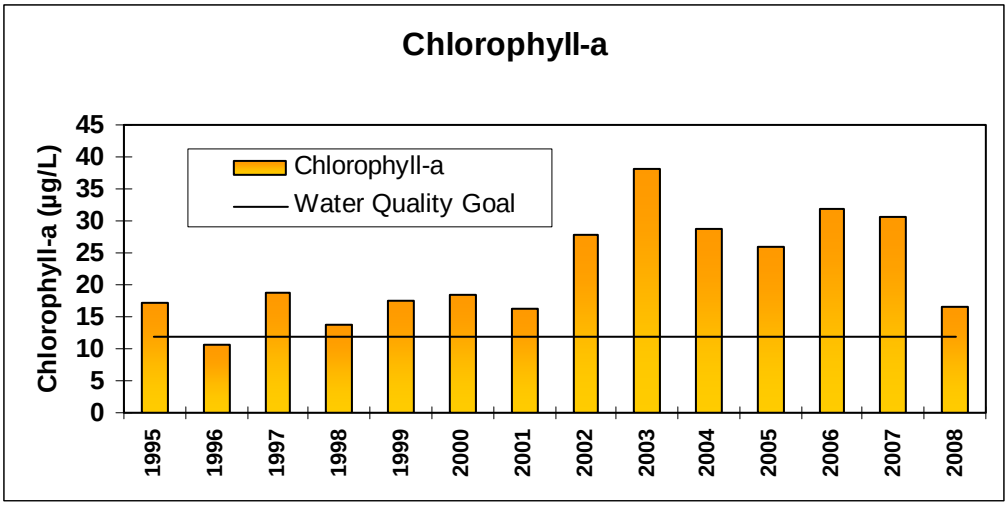

Figure 2: Fish Lake chlorophyll-*a* data for 1995-2008.
Values are the growing season average from May through September.

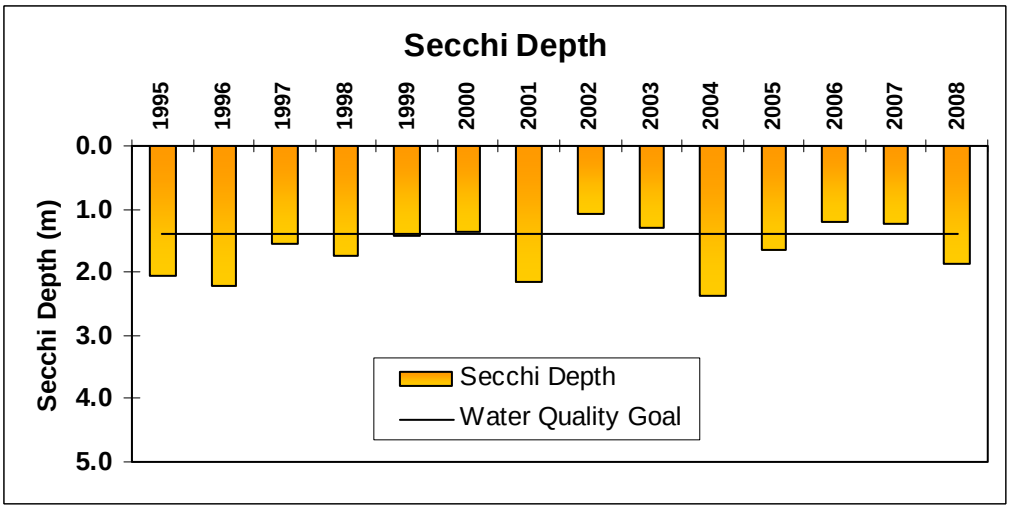

Figure 3: Fish Lake secchi depth data for 1995-2008.
Values are the growing season average from May through September.

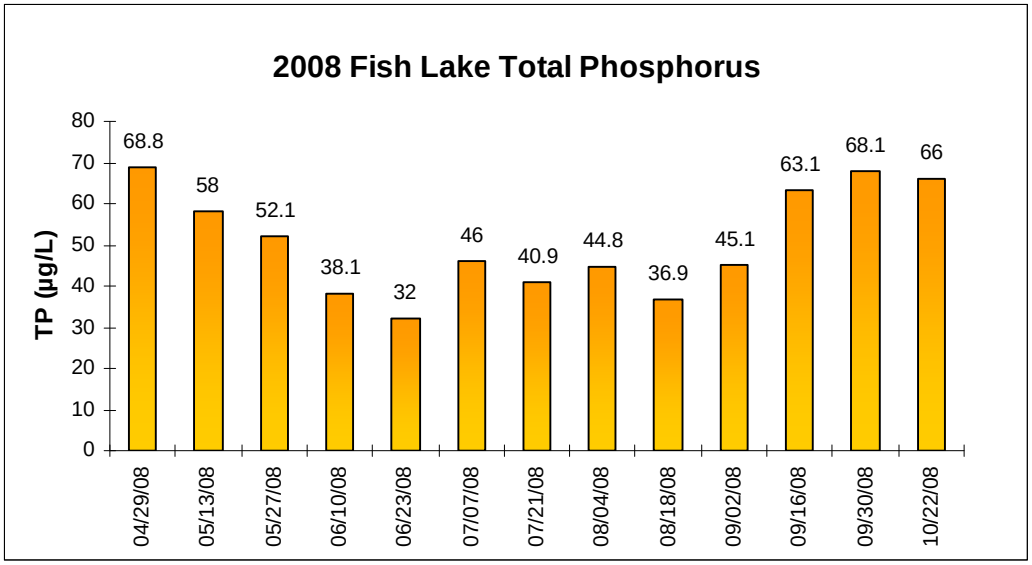

Figure 4: Seasonal changes in total phosphorus concentrations for Fish Lake in 2008.

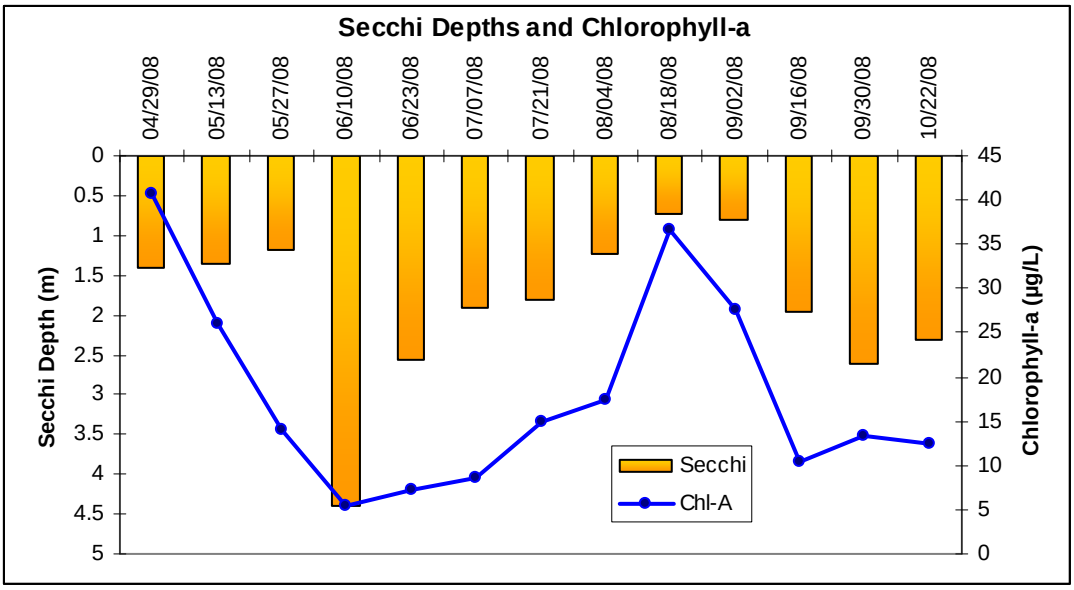

Figure 5: Seasonal changes in secchi depth and chlorophyll-*a* concentrations for Fish Lake in 2008.

Weaver Lake:

The Weaver Lake water quality in 2008 achieved the in-lake goal to support full contact recreational use of 40µg/L with an average phosphorus concentration of 30µg/L (Figure 6). Weaver Lake summer phosphorus concentrations have ranged between 21.5 and 37.2µg/L through the growing season (Figure 9). Overall, the yearly concentrations were below the MPCA impaired water criteria of 40µg/L. The low phosphorus concentrations resulted in reductions in algae production in 2008 with an average chlorophyll-a concentration of 7.73µg/L (Figure 7). Consequently, Weaver Lake had good wa-

ter clarity conditions in 2008. The average secchi depth transparency for Weaver Lake was 2.43 m (Figure 8). A clear water phase that developed in late May and early June, with water clarity transparencies between 4.5 and 5.3m, helped to increase the yearly average secchi depth. Throughout the growing season, secchi depth measurements fluctuated between 1.6 m and 5.3 m (Figure 10). Average secchi depth has shown a steady decrease since 2005, but compared to the past ten years, secchi measurements remain high.

The Weaver Lake water quality conditions over the past few years have significantly improved relative to the overall declining water quality trend that has occurred in the past ten years. Several factors may have contributed to the improvement in water quality conditions. A significant influence to Weaver Lake water quality is the amount of watershed nutrient loading that the lake receives from the surrounding area. The variation in watershed nutrient loading is mainly due to changes in the annual precipitation and from limiting the use of phosphorus fertilizer throughout the seven county metropolitan area. Weaver Lake may have received less phosphorus loading because of the ban on phosphorus fertilizer, in combination with the low precipitation.

A possible additional influence on the Weaver Lake water quality is the presence of curlyleaf pondweed. Weaver Lake has a substantial amount of curlyleaf pondweed that inhibits potential recreational use. Consequently, a substantial amount of internal loading is due to the senescence of this invasive. The released nutrients from the senescence often results in an algae bloom that persists throughout the summer. In 2005 through 2008, annual whole-lake Fluoridone herbicide treatments were completed in an attempt to control curlyleaf pondweed, resulting in significantly less curlyleaf pondweed during these years.

The reductions of phosphorus fertilizers and curly leaf pondweed may have significantly influenced the water quality conditions in Weaver Lake between 2005 and 2008. Unfortunately, it is difficult to determine the influence that each potential factor may have had on improving water quality conditions. Additional monitoring efforts would be necessary to determine the influence each factor may have had on the water quality conditions. Consequently, it becomes critical to continue monitoring Weaver Lake to determine potential changes in water quality conditions.

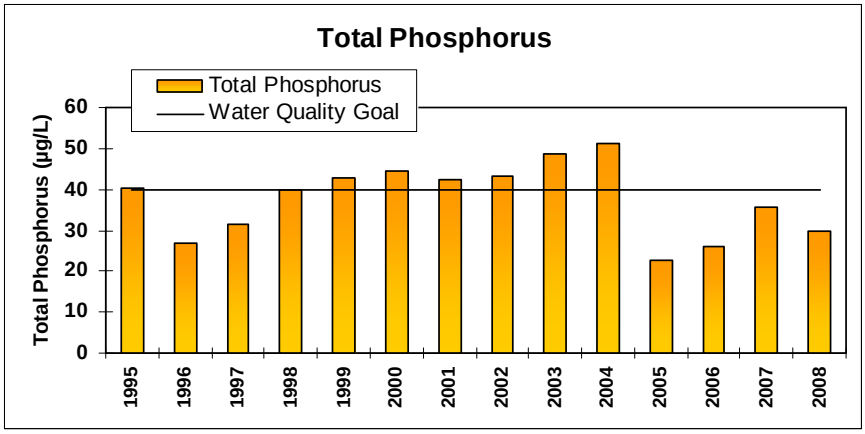

Figure 6: Weaver Lake annual changes in total phosphorus data for 1995-2008.

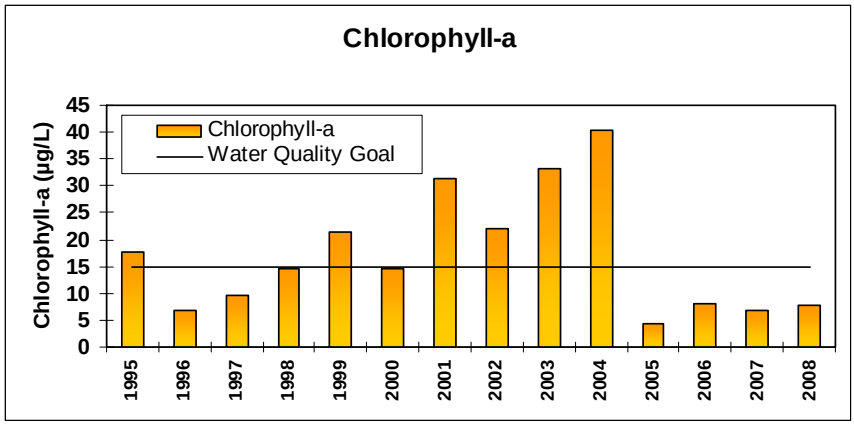

Figure 7: Weaver Lake chlorophyll-*a* data for 1995-2008.
Values are the growing season average from May through September.

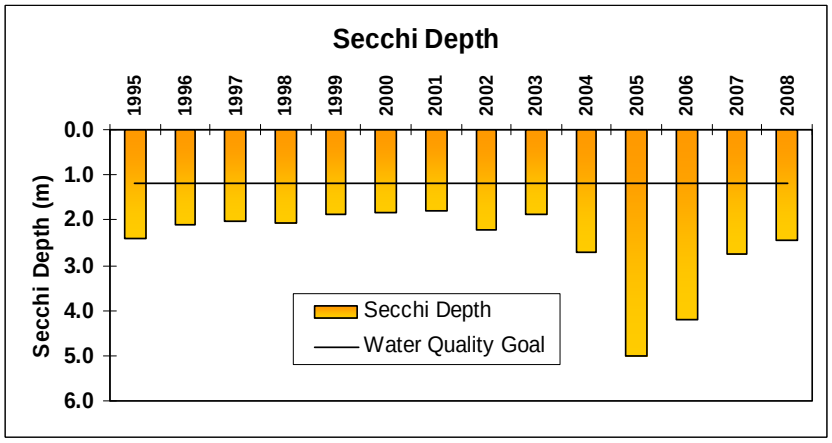

Figure 8: Weaver Lake secchi depth data for 1995-2008.
Values are the growing season average from May through September.

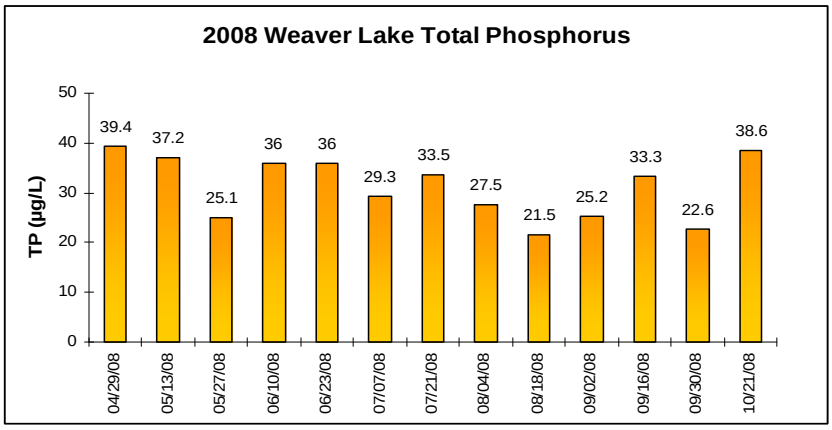

Figure 9: Seasonal changes in total phosphorus concentrations for Weaver Lake in 2008.

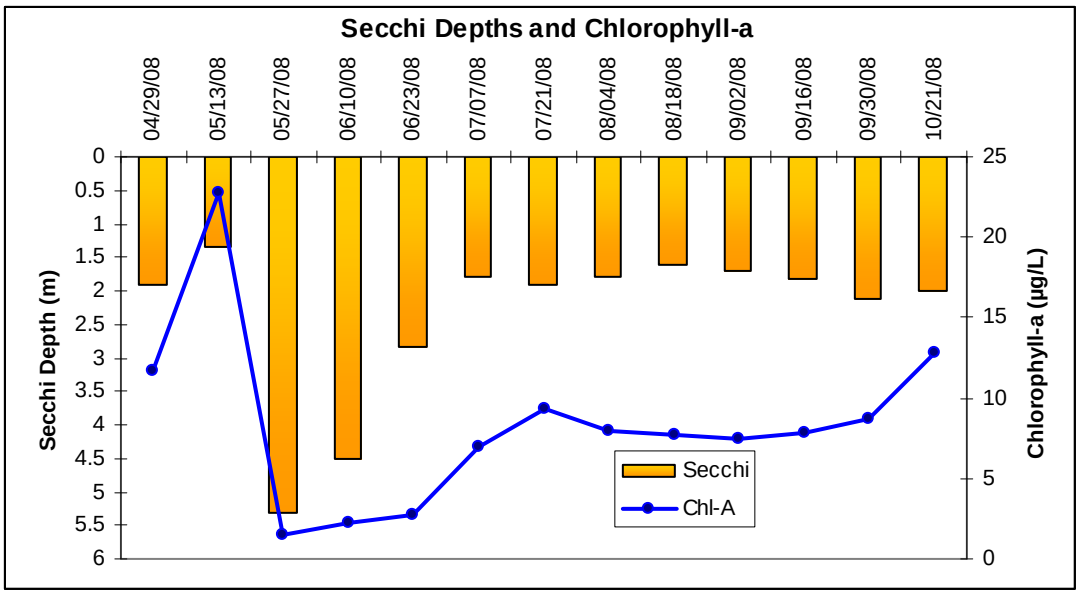

Figure 10: Seasonal changes in secchi depth and chlorophyll-*a* concentrations for Weaver Lake in 2008.

Diamond Lake:

Diamond Lake consistently has total phosphorus concentrations above the shallow lake MPCA standard of 60µg/L, resulting in it being considered an impaired water body. The lake is extremely eutrophic with phosphorus concentrations consistently above 100µg/L during the growing season. The average phosphorus concentration in 2008 was 206µg/L with values ranging between 106.3µg/L to 297.4µg/L between May and September 2008 (Figures 11 and 15). The excessive amount of phosphorus in the lake is conducive for severe algae blooms. The average chlorophyll-a concentration was 71.28µg/L in 2008 which also exceeds the MPCA water quality standard of 20µg/L for shallow lakes (Figure 12). Seasonal variation in chlorophyll-a concentrations ranged from a low concentration of 9.4µg/L in September to the highest concentration of 172.8µg/L in mid-July. Consequently, water clarity conditions were extremely poor with secchi depth measurements ranging from 0.4 to 1.82 with a summer average of 0.78 meters, which is below the MPCA water quality standard for shallow lakes of 1.0 meter (Figures 13 and 14).

Typically, the severe algae blooms that occur in Diamond Lake during the summer provide a shading effect that inhibits the development of aquatic macrophytes. Without the presence of aquatic plants, algae often take up the excess nutrients, creating poor water clarity. The poor water quality conditions are also partially due to large amounts of watershed nutrient loading from surrounding agricultural areas. In addition, the shallow morphology of the lake is extremely conducive for internal loading of nutrients that re-suspend from the sediments. The lake is frequently vulnerable to winter and summer fish kills due to the extreme eutrophic conditions.

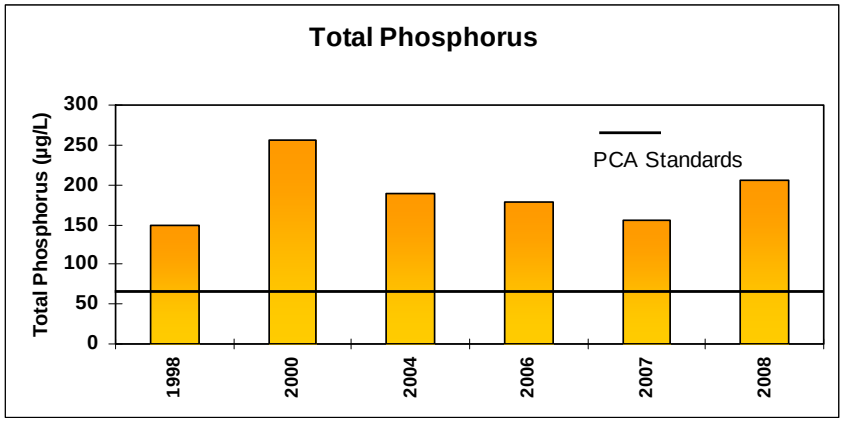

Figure 11: Diamond Lake annual changes in total phosphorus data.
Values are the growing season average from May through September.

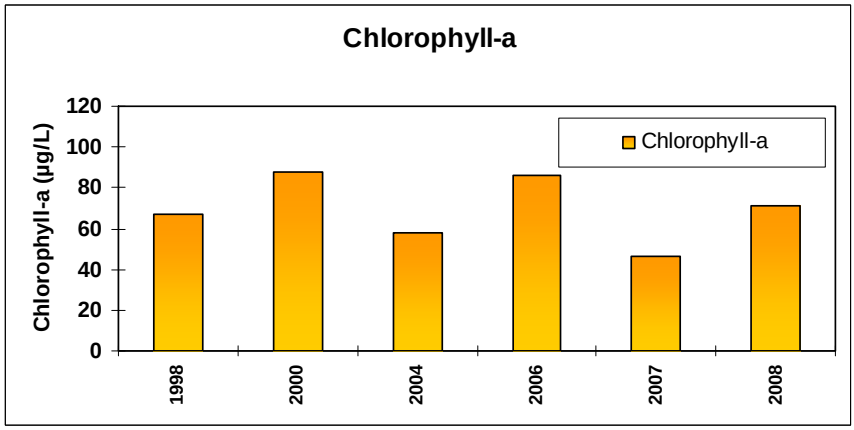

Figure 12: Diamond Lake chlorophyll-*a* data.
Values are the growing season average from May through September.

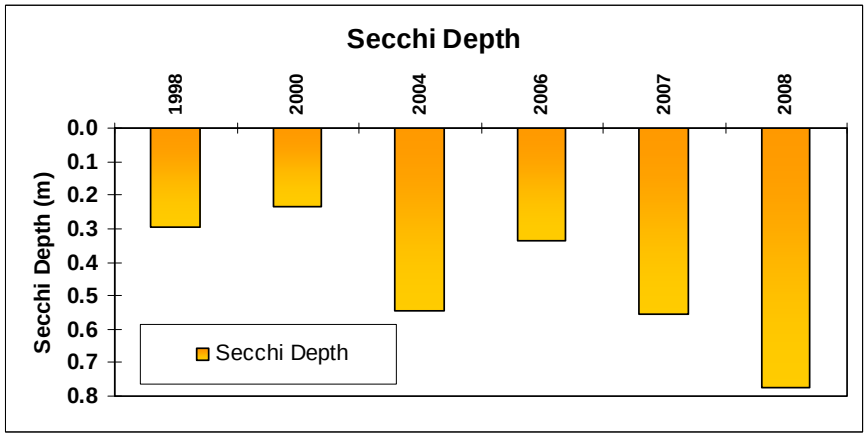

Figure 13: Diamond Lake secchi depth data.
Values are the growing season average from May through September.

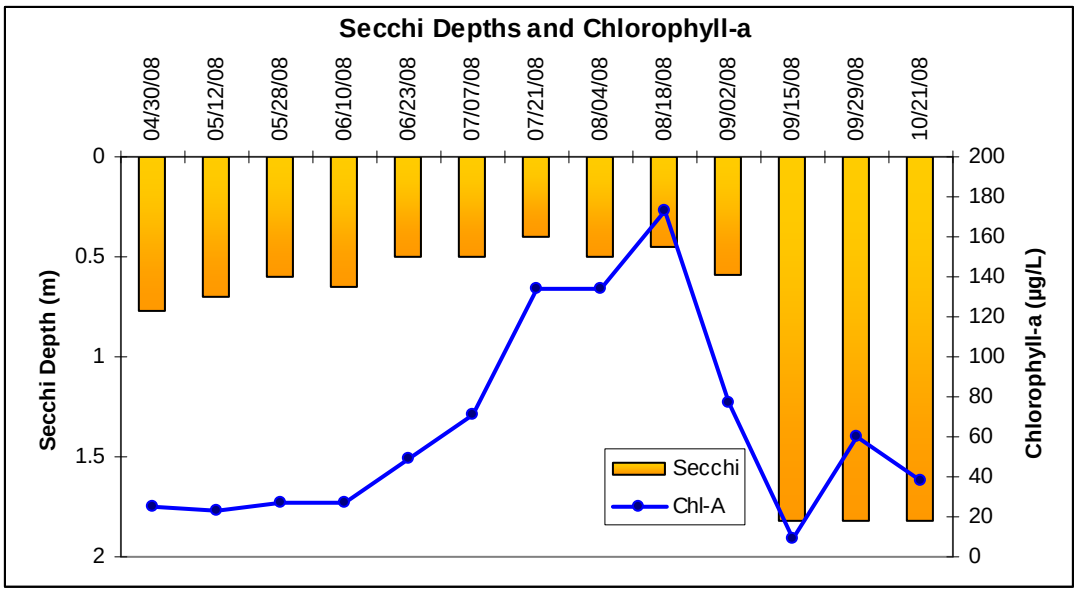

Figure 14: Seasonal changes in secchi depth and chlorophyll-*a* concentrations for Diamond Lake in 2008.

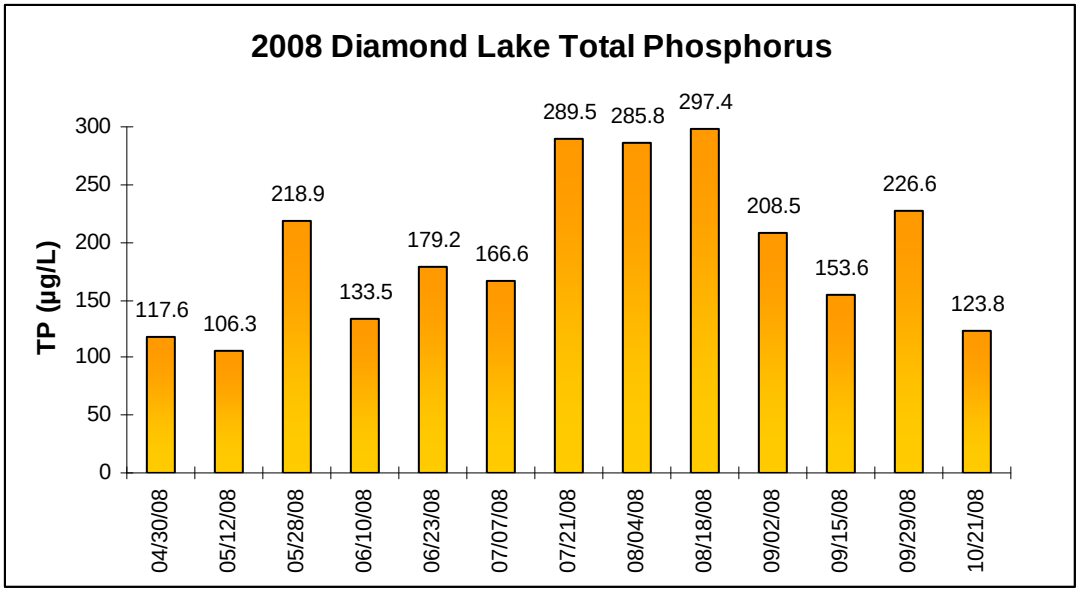

Figure 15: Seasonal changes in phosphorus concentrations for Diamond Lake in 2008