Afton Lake monitoring and management issues, summer 2012

W.N. Harman, M.F. Albright and H.A. Waterfield

SAMPLING ACTIVITIES

Site visits were made to Afton Lake on 21 June, 18 July, and 26 September 2012. Water samples were collected over the deepest part of the lake from the surface to 16 meters in depth at 4 m intervals. These were analyzed for nutrients, major ions, algae groups and abundance. Anecdotal review indicates minimal algal concentrations in open water over the course of the summer. Measurements were recorded on-site for temperature, dissolved oxygen, specific conductance, pH, chlorophyll $a$ (a proxy for algal abundance) and Secchi disk transparency (water clarity). Methods are the same as indicated in the 2011 final report.

FINDINGS

While the lake’s physical and chemical characteristics were similar between the sampling dates in 2011 and 2012, the lake’s water quality seemed notably better during the summer of 2012 than it had over 2011 (Harman et al. 2012). Secchi transparency averaged about 4 m, as opposed to 0.5 m in 2011. The primary difference between the years was the predominance of blue green algae (= cyanobacteria) during the former year. No planktonic blooms were noted during our site visits, nor were any widespread blooms noted by lake association members; though there were colonies of filamentous benthic (bottom) green algae along the shoreline in selected localities that some lake users considered a nuisance. These algae, which were tentatively identified as *Spirogyra* on site, turned out to be *Rhizoclonium* sp., another green algae which is typically of little concern.

In general, planktonic algal populations were very low with no single species dominating the community. There were a very few colonies of *Anabaena spiroides* (a cyanobacterium), a species that has been problematic elsewhere on occasion. We observed a large diversity of rotifers and small water fleas (cladocerans), which are organisms that typically graze on algal cells. Overall, the situation appeared sustainable. Water quality profiles (surface to 18m in depth) generated data similar to previously documented information.

**Short-term management:** The marked differences in algal conditions noted between summer 2011 and 2012 indicate a year to year variability that makes it difficult to anticipate conditions that warrant aggressive targeted management actions. Continued monitoring and collection of water samples to anticipate potential cyanobacteria blooms is an option to consider. If persistence of filamentous algae continues to be a concern, physical means of removal, such as raking out of the water, should mitigate the concern. If that does not help, spot applications of a contact herbicide directly on colonies may be warranted. Having permits enabling this action

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1 This report was prepared for the Afton lake Association as part of a contractual agreement.
ahead of time is suggested so that timely applications, should they be deemed appropriate, could be made. However, don’t consider that a recommendation unless conditions worsen.

ANALYTICAL METHODS

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<th>Parameter</th>
<th>Minimum Detection Level</th>
<th>Method</th>
<th>Reference</th>
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RESULTS

Nutrient profiles from Afton Lake are summarized in Table 1. Tables 2-4 summarize profiles of water quality data collected over the course of 2012. These analyses document conditions that in 2012 were similar to those of 2011 (Harman et al. 2012). Temperature and dissolved oxygen profiles indicate that Afton Lake experiences strong thermal stratification during the summer months, meaning that there is a warm surface layer floating on top of the cold deep water. This has major implications for the amount of dissolved oxygen in the water column – and in turn, for habitat available to fish and other aquatic organisms, and very importantly to your concerns, internal nutrient cycling. The entire water column below 7m (24 feet) was anoxic (essentially devoid of free oxygen), meaning that these depths do not provide habitat for fish or invertebrates (fish food organisms). These conditions also lead to internal phosphorus loading (the release of phosphorus from the bottom sediments). Late season phosphorus concentrations were approaching 600 µg/l (Table 1).

Despite the consistent water quality conditions, the algae community composition and the amount growing (“standing crop”) differed markedly between the two years. Secchi disk
transparency averaged over 4 m (about 13 feet) over 2012, while it was 0.5 m on the two dates measured in 2011. The conditions perceived by the lakeside community were much more favorable in 2012 (Johnson, 2012). Chlorophyll<sub>a</sub> concentration, a measure of algal pigments used to estimate algal abundance, were consistently less than 10 µg/l in the warmer, surface waters. (Chlorophyll<sub>a</sub> did accumulate in mid-depth levels over the course of both summers, likely following the senescence and death of algae cells, though at depths not influencing the recreational use of the lake). In July 2011, the algal community was dominated by *Anabaena* and *Oscillatoria*, both cyanobacteria. By October 2011, *Aphanizomenon*, another cyanobacterium, dominated. In general, cyanobacteria are *not* desirable components of a lake’s ecosystem. They are a poor food source for zooplankton (the microscopic animals fed upon by forage fish), they contribute to unsightly scums, produce noxious odors, and under certain conditions some produce toxins that can jeopardize human health and have killed livestock and pets. Many cyanobacteria are able to fix atmospheric nitrogen and as such they are at a competitive advantage in lakes having low concentrations of dissolved nitrate (as is the case in Afton Lake). Over 2012, cyanobacteria were observed, but never at nuisance levels. It is not fully understood why a lake like Afton experiences nuisance blooms one year (i.e., 2011) and not the next.

If patchy colonies of filamentous green algae are a perceived problem, physical removal with rakes may effectively control this issue. If this is not effective, spot treatments of a contact herbicide should yield satisfactory results. If cyanophyte blooms in the open water persist in the future, Afton Lake seems an ideal candidate for treatment with aluminum sulfate (alam). Alum removes free phosphorus from the water column and locks it in the sediments, reducing internal loading of the nutrient. Because of anticipated low watershed inputs of phosphorus, an alum treatment would likely improve conditions for a number of years.

Table 1. Afton Lake nutrient concentrations, summer 2012.

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Table 3. Water quality data collected on Afton Lake, 18 July 2012. SD = Secchi Disk Transparency.

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Table 3. Water quality data collected on Afton Lake, 18 July 2012.

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