

Monitoring of total phosphorus and total suspended solids during and after the use of the Aqua Cleaner™ in a Fly Creek pond

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INTRODUCTION

Many property owners that have ponds or other waterfront fight a constant battle with congesting aquatic vegetation. Methods to control or eliminate these macrophyte populations range from chemical application and excavation by dredging or harvesting, to the introduction of herbivorous organisms.

The Aqua Cleaner™ is an underwater vacuum system that is advertised as being able to remove aquatic vegetation by the roots, leaving no remains. Divers selectively uproot plants and feed them into a vacuum hose. The pontoon-mounted machine sucks the weeds to the surface, where they are bagged while the water flows back into the pond or lake (Universal Water Solutions 2004). This study provides preliminary information on the effect of the resulting sediment disturbance from this plant removal technique on a pond's water quality.

METHODS AND MATERIALS

The body of water being monitored was a pond located in Fly Creek, in the town of Otsego. The water body is < 1ha and has a mean depth of < 2 m. By late spring 2004 it had become choked with *Elodea canadensis* to the point of being unusable for recreation. A crew using several Aqua Cleaner systems removed aquatic vegetation from the pond on weekdays during the study period, finishing on 11 August. After an initial sampling on 13 July, water samples were taken daily from 19 July to 13 August 2004. Plant removal had begun prior to the onset of sampling. A kayak was used to access the west side of the pond. On July 26-28, samples were collected from the eastern shore of the pond due to the absence of the kayak.

Each day, two 500mL samples were collected, the first at the central west side of the pond and the second approximately 5 meters north of the first. To collect the samples, 500mL Nalgene® bottles were held under the water at a depth of approximately 0.5 meters until full. They were then turned upside down, to prevent contamination, and brought to the surface. Upon returning to the Biological Field Station, the bottles were labeled with the site and date and stored in a refrigerator until further processing.

Total phosphorus was analyzed using persulfate digestion followed by single reagent ascorbic acid method (APHA 1992). Total suspended solids were measured by calculating the difference between the initial and final weight of a standard glass-fiber filter after filtration of a 250mL sub-sample (APHA 1992). The only departure from this methodology was that the tray, label, and filter were weighed both initially and after sample filtration, instead of just the filter by itself. The two samples from each day were processed as duplicates.

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RESULTS AND DISCUSSION

Figure 1 illustrates and compares the total phosphorus (TP) and total suspended solids (TSS) data. The data points for 13 July were collected before the Aqua Cleaner crew reached the west side of the pond, and for the purposes of this study represent a glimpse of the average state of the pond's water. There is no data for 31 July and 1 August due to researcher error. The maximum values for both TP and TSS were recorded on 29 July. The TP concentration was 88 $\mu\text{g/L}$ and the TSS concentration was 31.6 mg/L . The minimum value for total phosphorus was 18 $\mu\text{g/L}$ on 26 July. On 10 August, the lowest TSS concentration was recorded at 3.0 mg/L . Both minimum values were similar to the initial 13 July data points. The correlation between total phosphorus and total suspended solids was strong, with an r^2 value of 0.72. This implies that most of the phosphorus in the water column was associated with particulate material.

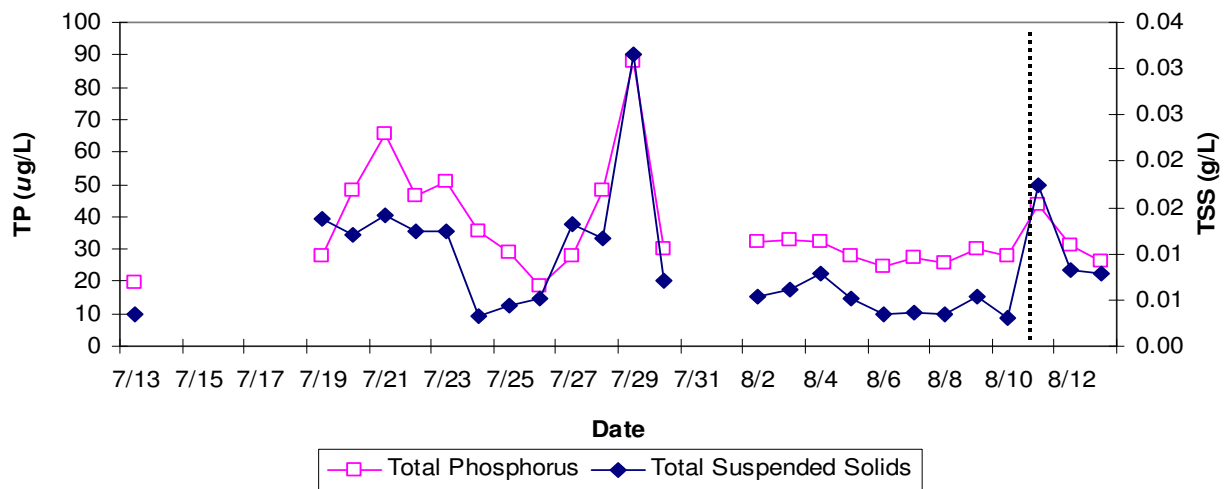


Figure 1. Total Phosphorus (TP) and Total Suspended Solids (TSS), with a vertical dotted line on 11 August indicating the final date the Aqua Cleaner crew removed vegetation from the pond.

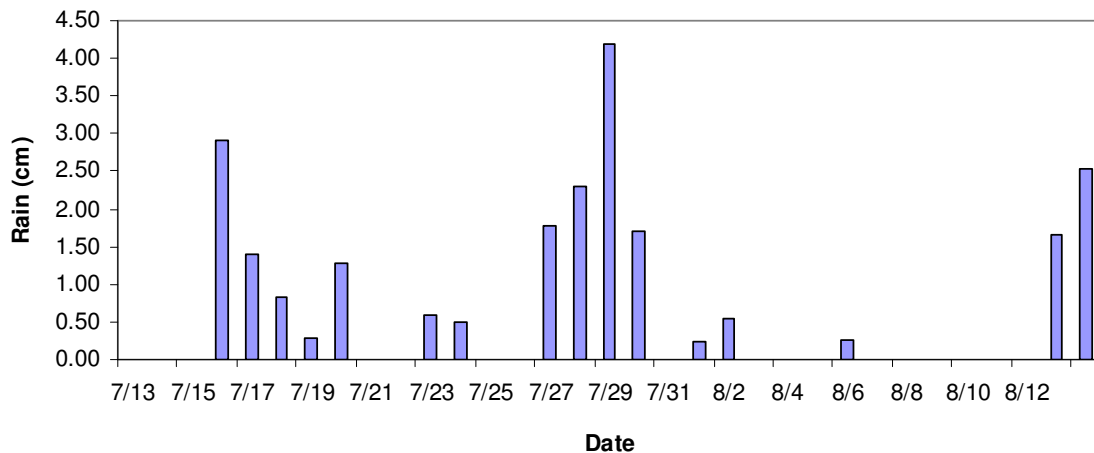


Figure 2. Daily rainfall over the study period (Blechman 2004).

Rainfall over the study period was well above average, with 23.1 cm of rain falling over the four week period; average rainfall for the interval is 10.3 cm (Blechman 2004). It seems likely that precipitation-induced suspended sediment and total phosphorus obscured that which was related to plant removal activities. Figures 1 and 2 illustrate that peaks in the measured parameters corresponded with precipitation events. While this situation makes it difficult to ascribe water quality to the plant removal activities by the Aqua Cleaner, it seems reasonable to infer that increased suspension of sediments and phosphorous is less than that resulting from precipitation events. Some synergistic effects between the temporarily de-stabilized substrate and heavy precipitation might be an issue.

REFERENCES

- APHA, AWWA, WPCF. 1992. Standard methods for the examination of water and wastewater, 18th edition. American Public Health Association. Washington, D.C.
- Blechman, A. 2004. National weather observer. Cooperstown, NY.
- Universal Water Solutions. 2004. Introducing the Aqua Cleaner water front restoration. Advertising brochure. Rochester, NY.