ST. ANTHONY
FALLS LABORATORY

Project Report No. 587

Assessment of Internal Phosphorus Loading in Swimming Pool Pond and Point of France Pond, City of Edina

Final Report

By

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1. Introduction

Stormwater ponds are widely implemented stormwater control measures (SCMs) for runoff quantity and quality control in urban areas. They are primarily used to remove solids and associated pollutants such as phosphorus from runoff. There is increasing evidence, however, that some ponds are no longer retaining phosphorus, and have become potential source of phosphorus (Song et al. 2015). In the Twin Cities area, a water quality survey conducted in 98 stormwater ponds in the Riley Purgatory Bluff Creek Watershed District (RPBCWD) showed <0.010 mg/L to 8.1 mg/L total phosphorus in the ponds (Forster et al. 2012; RPBCWD 2014). Further examination of the data showed that 39% of the 98 ponds contained median TP greater than 0.38 mg/L, the 95% confidence interval (CI) of expected TP in the Twin Cities Metro Area (Janke et al. 2017; Taguchi et al. 2018b). The high phosphorus level in the ponds above typical runoff concentration was hypothesized to be due to internal phosphorus release from the sediments. Laboratory sediment cores and field-scale monitoring of phosphorus mass inputs and outputs in five ponds provided evidences of internal loading in those ponds (Olsen 2017; Taguchi et al. 2018b). Since ponds are part of the watershed network that delivers runoff with phosphorus to lakes and streams, high phosphorus load and algae in ponds present increased risks of harmful algal bloom occurrences and water quality degradation in the receiving waterbodies. Therefore, there is a need to assess stormwater ponds so that management strategies to control phosphorus pollution from ponds can be developed.

This project was originally proposed as a two-part study to assess and treat internal phosphorus loading in two stormwater ponds in the City of Edina, the Swimming Pool Pond and the Point of France Pond. The objective of the first part of the study was to investigate internal phosphorus release from the pond sediments by measuring phosphorus release from pond sediment cores incubated in the laboratory and monitoring the *in situ* water quality. If internal loading was found to be substantial, the objective of the second part of the study was to chemically-inactivate the sediment phosphorus by treatment. This report presents results of the first part of the study, i.e., internal phosphorus loading assessment in the two ponds, and provides recommendations for pond phosphorus treatment.

2. Methods

2a. Site description

The Swimming Pool Pond (area = 0.0125 km^2; depth = 0.305 – 2.13 m) and the Point of France Pond (area = 0.0257 km^2; depth = 0.305 – 2.44 m) are located south of Hwy 62 in the City of Edina (Figure 1). The ponds are located in a heavily-urbanized area, consisting of commercial and high-density residential land use, in the north Lake Cornelia watershed (part of Lower Minnesota River watershed), in the Nine Mile Creek Watershed District. Outflows from the Point of France Pond are routed to the Swimming Pool Pond, which in turn discharges into north

Lake Cornelia, a 303(d) list impaired lake due to eutrophic conditions. Toxic algae were reported in the lake in summer 2016 and 2017.

Figure 1. Locations of the Swimming Pool Pond and Point of France Pond in the City of Edina, Hennepin County, MN. (source: <www.maps.google.com>)

2b. Laboratory phosphorus (P) release study

i. Pond sediment coring

Sediment cores were collected from the Swimming Pool Pond in February 2018. Six intact cores, containing approximately 0.2 m sediment and 0.8 m overlying pond water, were collected by driving a piston corer through holes drilled in ice (Figure 2a). Five sediment cores from the Point of France Pond were collected from a canoe in July 2018 (Figure 2b). The P release study on the Point of France Pond sediments was conducted based on the Swimming Pool Pond study results, hence the sediment coring was performed in the later part of summer.

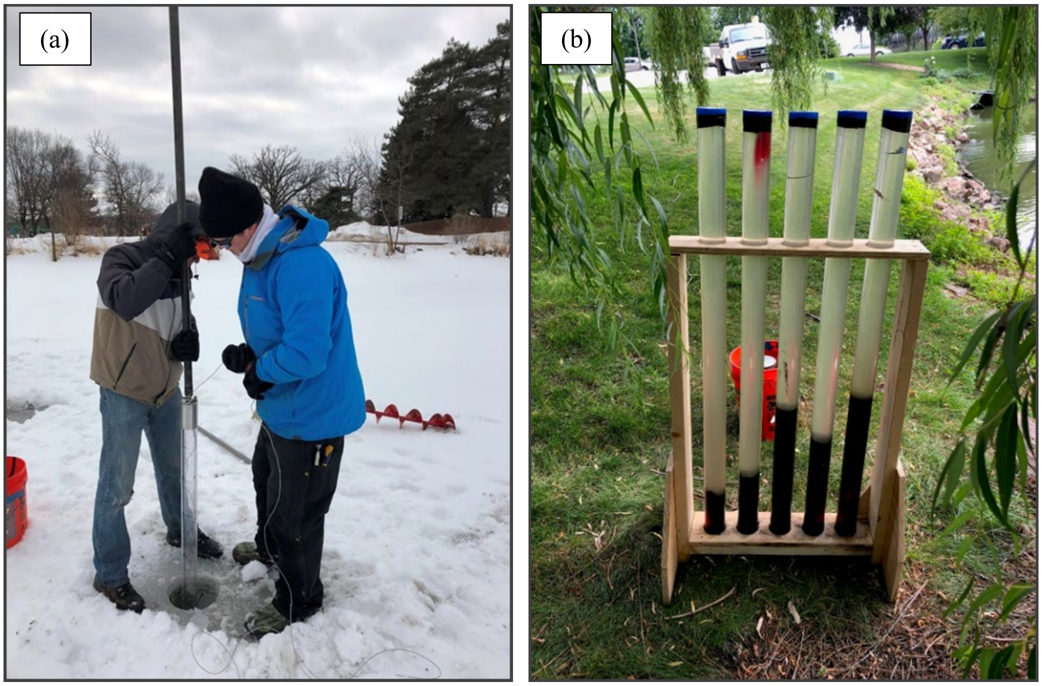

Figure 2. Sediment core collection from the (a) Swimming Pool Pond in February 2018, and (b) Point of France Pond in July 2018.

ii. Sediment-water columns

The cores collected from the ponds were incubated at 20 °C at the St. Anthony Falls Laboratory (SAFL). The water column above the sediment was drained, filtered to remove particulates and refilled into the columns. In the first phase of the P release experiments, the water column was mixed by air bubbling to determine if oxic P release occurred from the sediments. Then, air bubbling was switched off, and the dissolved oxygen (DO) concentration in the water 8 cm above the sediment, and the concomitant P release were monitored. In the final phase, P release was measured under an anoxic water column created by bubbling ultrapure nitrogen gas (DO < 1 mg/L). When the water column was kept mixed with air or nitrogen gas, water samples for P measurements were drawn from the center of the water columns, on an approximately weekly basis. In the unmixed phase (air off), one water sample was taken ~8 cm above the sediment and a second sample at the center of the total water column height. Two sampling points were necessary because a concentration gradient can develop during unmixed state, and the two measurements were used to estimate the average P concentration in the entire water column. The frequency of water sampling was adjusted from 1 day to 7 days during the unmixed phase to observe the rate of change of P mass in the water column. The increase in ortho-phosphorus (ortho-P) mass (where, mass = concentration × water volume) during a given incubation period was used to determine the P release rate (mg/m^2/day, i.e., P mass per sediment surface area of the core per time). P flux during the unmixed phase was determined using data from the first 15 days. The mean P release and 67% confidence interval (CI) of the mean was calculated for each phase. As a measure of the sediment oxygen demand (SOD), the Michaelis-Menten kinetic model was fit to the DO levels in the unmixed water column (air off phase) (Olsen 2017):

$$S = \frac{S_{max}[C_{O2}]}{K_M + [C_{O2}]}$$

where S is the substrate consumption rate, S_{max} is the maximum dissolved oxygen consumption rate, C_{O2} is the substrate (oxygen) concentration, and K_M is the half-consumption concentration. A constant K_M of 1.4 mg/L was used for all cores. The assumption is that all DO reduction comes from the microbial oxygen demand of the sediments, so K_M represents the surface of the sediments.

iii. Sediment phosphorus fractionation

At the end of core incubation, the top 10 cm of the sediments was extruded from the columns and analyzed for P species using the sequential chemical extraction procedure (Engstrom 2010). The amounts of loosely-bound P, iron-bound P, aluminum-bound P, mineral-bound P, labile organic P and residual organic P in the sediments were determined at 1-cm interval for the 0 – 5 cm depth and at 2- or 3-cm interval for the 5 – 10 cm depth. The P forms were used to understand the potential for P release under changing environmental conditions (loosely-bound P is dissolved or easily disassociated from a solid; iron-bound P is attached to an iron compound in the sediments; aluminum-bound P is attached to an aluminum compound in the sediments; mineral-bound P is attached to other minerals (typically calcium) in the sediments; labile organic P is the organic P that is available for microbial degradation, and residual organic P is not available for microbial degradation). Water content and organic matter content (loss on ignition at 550 °C) were also determined in the sediment samples.

2c. *In-situ* water quality sampling

Water quality of the ponds was sampled on a bi-weekly basis from May through September 2018. Surface grab water samples were collected from 5 to 6 locations (Figure 3) using a Van Dorn sampler, and analyzed for total phosphorus, dissolved phosphorus, and soluble reactive phosphorus concentrations (Standard Methods 4500-P, APHA AWWA, WPCF 1995) using a spectrophotometer (detection limit = 10 µg/L P). If stratification was detected, an additional water sample was collected below the stratification depth. The surface to bottom profiles of DO, temperature and conductivity were also taken at 25-cm intervals using a Hach WQ40D handheld meter with DO and conductivity sensors.

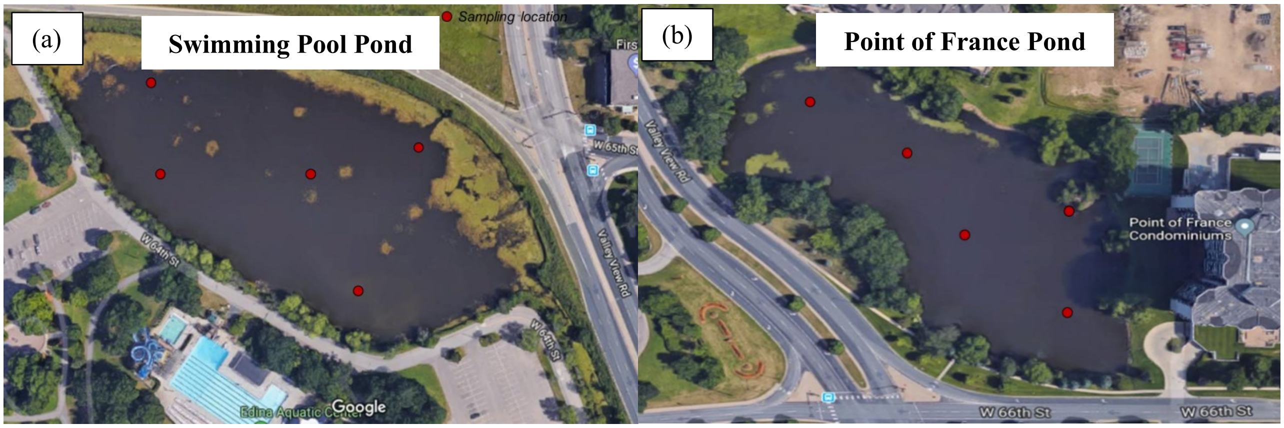

Figure 3. Locations of water sample collection and DO, temperature and conductivity profile monitoring (red circles) in the (a) Swimming Pool Pond and (b) Point of France Pond.

3. Results

3a. Oxic and anoxic phosphorus release rates

Under aerated (oxic) conditions, the Swimming Pool Pond sediment cores maintained low ortho-P levels in the water columns (Figure 4a). The average P release rate of -0.14 ± 0.08 (67% CI) mg/m^2/day suggested a small decrease in the water column ortho-P concentration occurred under oxic conditions. Once the air supply was switched off, the water column DO levels started decreasing due to the sediment oxygen demand (Figure 5a). The DO concentrations dropped below 1 mg/L after ~5 days in most cores. S_{max}, the maximum oxygen consumption by the biologically active sediments, ranged between 1.76 and 4.2 g/m^2/day in the six cores. As DO was consumed, the pond sediments started releasing P resulting in increased ortho-P concentrations in the water columns. However, measurable P increase occurred in only three out of the six cores. The average P release from the six cores was thus relatively small at 1.16 ± 0.45 mg/m^2/day during the first 15 days of the 22-day unmixed phase. In the next phase with an anoxic mixed water column, ortho-P release continued to occur at 1.09 ± 0.36 (67% CI) mg/m^2/day. The sediment cores that appeared to be sandy (collected near the pond inlets) showed minimal P release under the two anoxic phases.

Similar results were obtained for the Point of France Pond sediment cores (Figure 4b). A very small release of sediment P occurred under oxic conditions (0.83 ± 0.23 mg/m^2/day), which can be attributed to the mineralization of labile organic phosphorus in the sediments (Jensen and Andersen 1992). After the air supply was turned off, it took almost 7 days for the DO levels to reach below 1 mg/L, and the S_{max} ranged between 2.0 and 4.9 g/m^2/day in the five cores (Figure 5b). Once again, responses to low DO conditions were highly variable among the five cores, yielding an average P release rate of 4.09 ± 3.21 mg/m^2/day during the air off phase (note the 67% CI). This average P release under anoxic conditions is relatively high. In contrast, the following phase with an anoxic mixed water column had an anoxic P release from these sediments that was relatively low at 0.39 ± 0.17 mg/m^2/day.

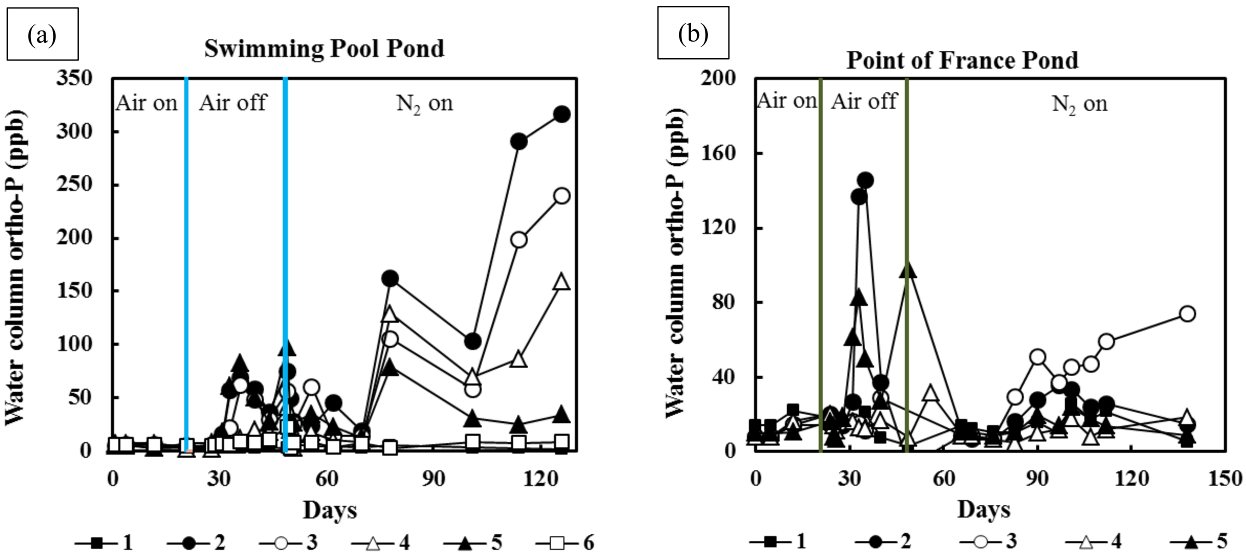

Figure 4. Phosphorus (ortho-P) release from the (a) Swimming Pool Pond and (b) Point of France Pond sediment cores under oxic (air bubbling), air off, and anoxic (N_2 bubbling) phases at 20 °C. Solid lines separate the three phases of the P release study.

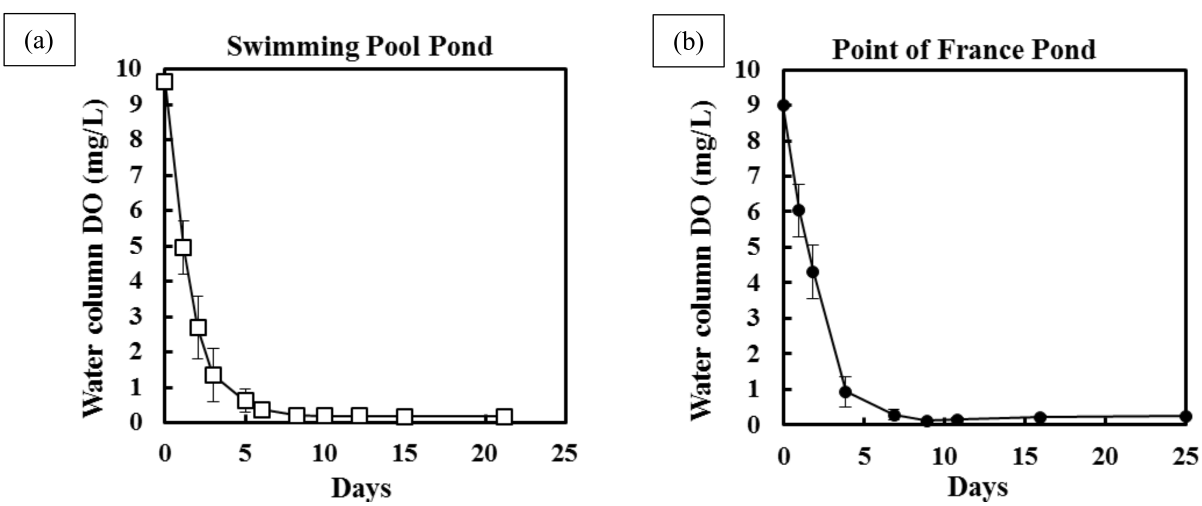

Figure 5. Average water column dissolved oxygen (DO) concentrations after air supply was switched off in the sediment cores from the (a) Swimming Pool Pond and (b) Point of France Pond. Measurements were taken at 8 cm above the sediment surface. Error bars are 67% confidence interval (CI) of the mean measurements.

The P release rates for the two Edina pond sediments were compared to other ponds in the Twin Cities Metro area (Table 1; Taguchi et al. 2018b). The anoxic P release rates and the DO depletion rates for the Swimming Pool Pond and Point of France Pond are relatively low when compared to some of the high P release-ponds. Low sediment microbial activity, which is supported by the lower sediment oxygen demand and organic matter content, is related to the P release rate from the sediments. This is because oxygen demand is indicative of opportunistic aerobic respiration by microbes and organic matter present a source of microbial food (Taguchi et al. 2018b).

Table 1. Comparison of internal phosphorus release from sediments of the Swimming Pool Pond and Point of France Pond with other stormwater ponds in the Twin Cities Metro area (data from Taguchi et al. 2018b).

Pond	Oxic Flux Rate (mg/m^2/day)	Anoxic Flux Rate (mg/m^2/day)	S_{max} (g/m^2/day)	Organic matter content (%)*
A	-1.27 ± 0.71	7.51 ± 2.93	4.21 ± 0.47	30%
B	-0.14 ± 0.76	5.62 ± 1.80	4.23 ± 0.95	86%
C	-4.38 ± 2.89	1.09 ± 0.26	1.94 ± 0.19	15%
D	-5.80 ± 1.94	2.27 ± 0.49	1.85 ± 0.63	16%
E	-19.78 ± 3.37	3.18 ± 2.76	5.19 ± 0.59	27%
Swimming Pool Pond	-0.14 ± 0.08	1.16 ± 0.45	3.07 ± 0.48	19%
Point of France Pond	0.83 ± 0.23	4.09 ± 3.21	2.51 ± 0.53	24%

*upper 11 or 10 cm sediments

3b. Sediment phosphorus fractions

The water content in the Swimming Pool Pond sediments ranged from 71 – 91% in the four cores analyzed, and these cores contained an average of 23% dry weight organic matter content in the upper 10 cm depth. One core, which was collected near the pond inlet, was predominantly sandy in appearance and contained 15% moisture content and 2% organic matter content. The sediment core collected near the inlet in the Point of France contained 40% moisture content and 7% organic matter content. The other sediment core samples contained 66 – 91% water content and an average of 27% organic matter content.

The sediment P pool in the Swimming Pool Pond and Point of France Pond cores provided an indication of the relationship between the observed P release in the laboratory cores and the releasable phosphorus fractions. The average concentrations of the various phosphorus species in the upper 10 cm sediment depth of the cores from the two ponds is plotted in Figure 6. In the Swimming Pool Pond, the average total P pool in the top 4 cm of sediments was composed of <0.05% loosely-bound P, 11% iron-bound P, 14% aluminum-bound P, 28% mineral-bound P, 32% labile organic P and 15% residual P. The Point of France Pond sediment's total P fractionation consisted of 0.18% loosely-bound P, 9.3% iron-bound P, 22% aluminum-bound P, 29% mineral-bound P, 21% labile organic P and 19% residual P, on average. The cores with sandier appearance varied from other cores in the P composition; they generally contained a large fraction of mineral-bound P and were low in organic P (data not shown). Overall, more P was tied up in the relatively unavailable forms in the sediments (i.e., Al- and mineral-bound) than the P present in the easily-releasable forms (i.e., loosely-bound and iron-bound). Labile organic P, that has the potential to become bioavailable after being broken down by microbacteria, was the more substantial mobile P form in the pond sediments.

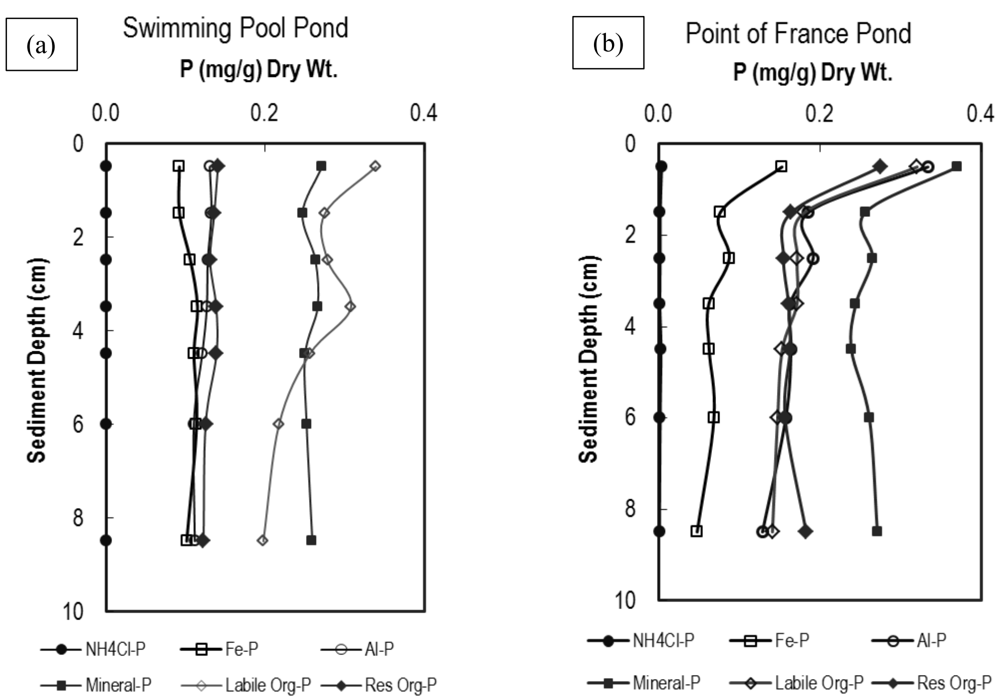

Figure 6. Phosphorus fractions in the upper 10 cm of sediments in the (a) Swimming Pool Pond and (b) Point of France Pond sediment cores. Average concentrations in five sediment cores are plotted. For each depth interval, concentration is plotted at the mid-point of the depth interval (for example, concentration for 0 – 1 cm depth is plotted at 0.5 cm).

Comparison to other stormwater ponds sampled by Taguchi et al. (2018) provides a perspective on the mobilization of phosphorus from the pond sediments (Figure 7). The upper 4 cm of sediments from the Edina ponds contained relatively low amounts of the redox-sensitive forms of phosphorus, i.e., the loosely-bound and iron-bound fractions. The potentially-releasable labile organic P in the Edina pond sediments was lower than ponds A and B that exhibited high anoxic P release rates (Table 1). Phosphorus was mostly associated with aluminum and calcium in the Edina pond sediments, and this phosphorus is not influenced by changes in oxygen conditions.

The low anoxic P releases measured from the Edina ponds are thus explained by the relatively low concentrations of redox-P and organic P species.

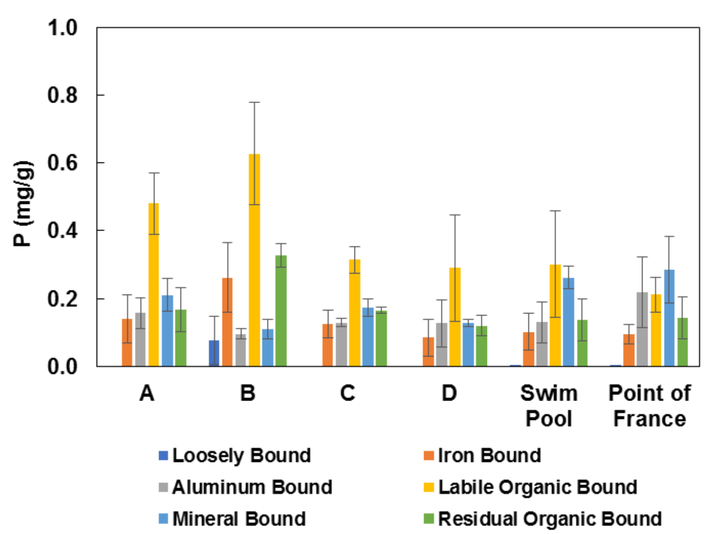

Figure 7. Sediment phosphorus fractions in the upper 4 cm of sediment cores collected from the Swimming Pool Pond and Point of France Pond along with other stormwater ponds in the Twin Cities Metro area (data from Taguchi et al. 2018b) (Error bars are standard deviations). Loosely-bound P is primarily dissolved P in the pore water, labile organic bound P can be converted into ortho-P over time, mineral-bound is primarily associated with calcium, and residual organic bound P is considered refractory.

3c. *In situ* water quality

The water quality data collected in 2018 are provided in Appendix A (Table A- 1 and Table A-2). The phosphorus concentrations in the pond water were generally in the low to moderate range during the growing season (Figure 8). In the Swimming Pool Pond, the average concentrations in the epilimnion grab water samples contained 59 – 167 µg/L total phosphorus, 10 – 44 µg/L dissolved phosphorus and 1 – 22 µg/L soluble reactive phosphorus. Concentrations in the Point of France Pond were in a similar range; 69 – 135 µg/L total phosphorus, 10 – 85 µg/L dissolved phosphorus and 1 – 34 µg/L soluble reactive phosphorus. The May to September average was 94 ± 35 (Std. Dev.) µg/L total phosphorus, 32 ± 11 µg/L dissolved phosphorus and 13 ± 6 µg /L soluble reactive phosphorus in the Swimming Pool Pond. Point of France Pond contained 97 ± 23 µg/L total phosphorus, 36 ± 21 µg/L dissolved phosphorus and 15 ± 10 µg /L soluble reactive phosphorus during summer.

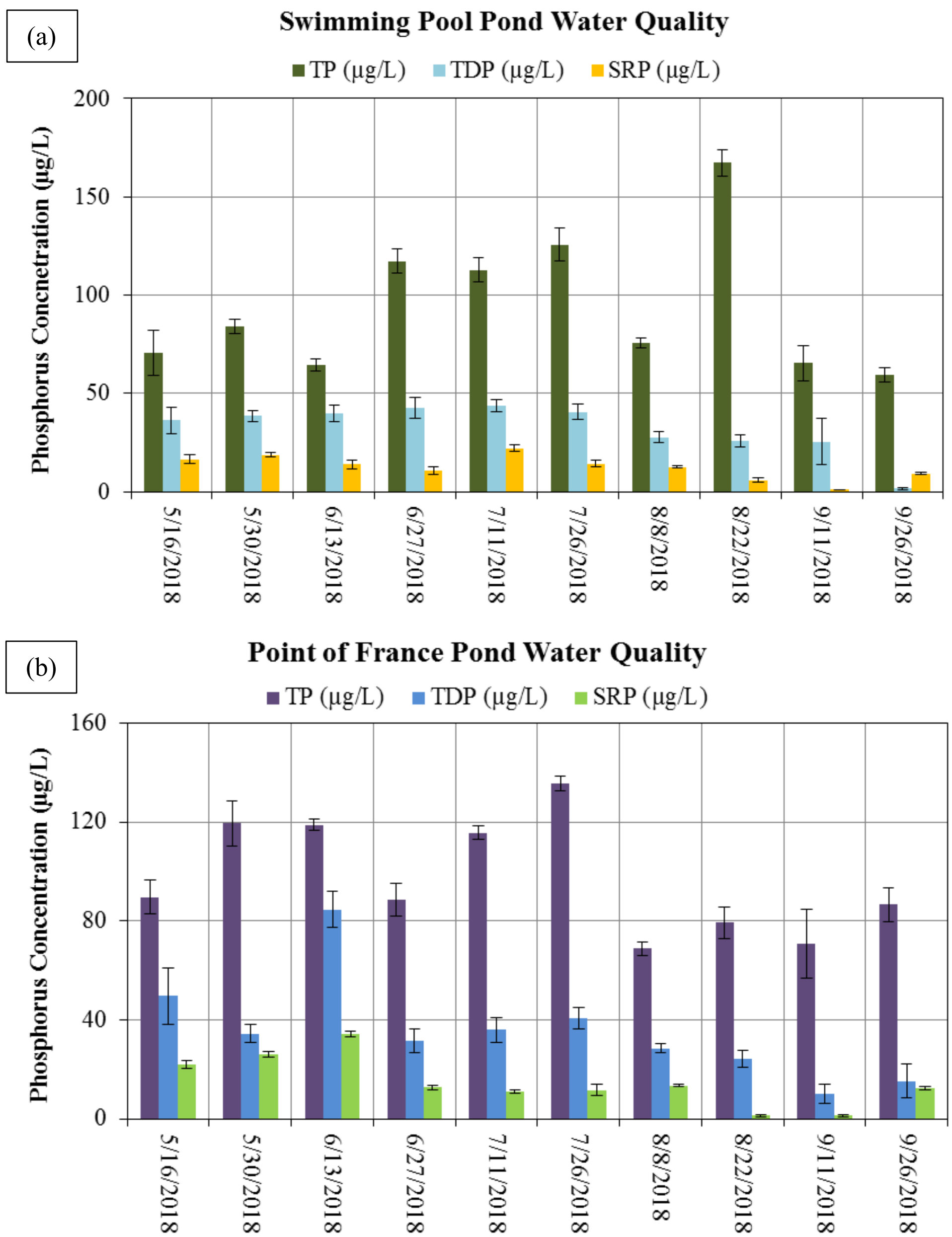

Figure 8. *In situ* phosphorus water quality from May to September 2018 in the (a) Swimming Pool Pond and (b) Point of France Pond. Average phosphorus concentrations in the epilimnion water samples collected from five locations in the pond are shown. Error bars are 67% CI of the mean measurements. Water samples were collected on a biweekly basis.

The median TP concentrations in the Swimming Pool Pond and Point of France Pond are compared to five other stormwater ponds intensively monitored by Taguchi et al. (2018b), who also developed the probability exceedance distribution of TP concentrations in the RPBCWD ponds (Figure 9). The TP concentrations in the Swimming Pool Pond and Point of France Pond were much lower than 0.38 mg/L, the upper 95% CI of expected runoff TP in the Twin Cities

Metro Area (Janke et al. 2017). The TP levels were also much lower than the median concentrations monitored in other stormwater ponds in the area.

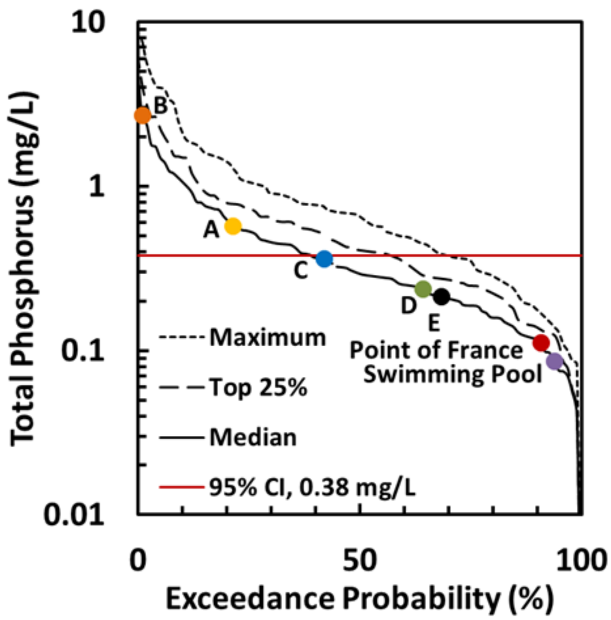

Figure 9. Median epilimnion grab sample values in the Swimming Pool Pond and Point of France Pond plotted along with stormwater ponds monitored by Taguchi et al. (2018b) (colored circles) in the exceedance probability distribution of total phosphorus concentrations in the RPBCWD ponds (figure adapted from Taguchi et al. 2018b). Red line is the upper 95% confidence interval (CI) of the expected TP in runoff in the Twin Cities Metro area.

The DO, temperature, and conductivity measured in the ponds over the entire summer period are summarized in Appendix A (Table A- 3 and Table A- 4). The *in situ* DO concentrations and water temperature presented evidence of mixed water column conditions in the ponds, which could be a reason for the low to moderate phosphorus levels in the pond water. The Swimming Pool Pond was mixed and oxic during most of the summer (Figure 10a). Bottom DO lower than 1 mg/L was detected only during two instances in August 2018 (see 8/8/18 and 8/22/18 data in Table A- 3), although it is possible that the DO probe was in the sediments at those low depths and recorded very low DO concentration. In the Point of France Pond, thermal stratification and low bottom DO were observed intermittently (Figure 10b), although DO less than 1 mg/L was not recorded anytime (Table A- 4). Nonetheless, strong thermal stratification that could cause the pond bottom to turn anoxic was not observed in both pond during summer 2018.

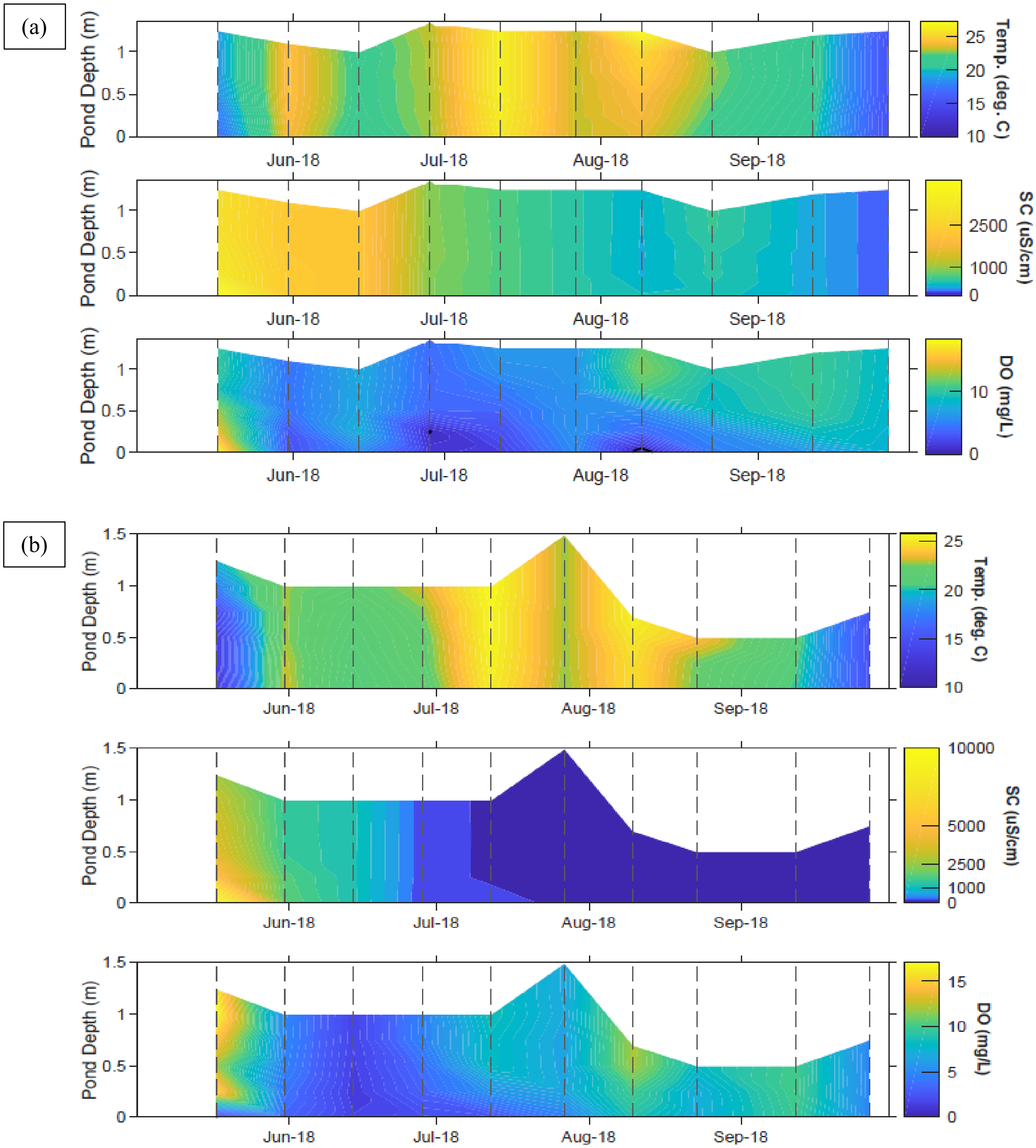

Figure 10. Time series contour plots of temperature, specific conductivity (SC), and dissolved oxygen (DO) concentrations in the (a) Swimming Pool Pond and (b) Point of France Pond from May to September 2018. Vertical lines show times when profiles were taken at the ponds; linear interpolation is used to fill the time series between pond visits. A 1 mg/L DO threshold is indicated by black line, which is visible only in the DO plot for the Swimming Pool Pond during August 2018.

High conductivity was measured from the beginning of monitoring in May 2018, and was likely high prior to May sampling. Such high specific conductivity values are attributed to chlorides contributed by road salt input (Taguchi et al. 2018b). Conductivity gradually decreased from May through August as chloride was flushed out of the pond, although it took longer for the chloride levels to drop in the Swimming Pool Pond, which is downstream of the Point of France Pond. Chemostratification is a phenomenon that has been observed in some ponds that exhibited strong summertime stratification and low bottom DO (Taguchi et al. 2018b). However, such stratification due to high chloride concentrations did not appear to be strong and impact DO levels in the Edina ponds.

The maintenance of primarily oxic and well-mixed water column *in situ* suggests that conditions are less favorable for internal P release to occur from the sediments during the warmer months. Under oxic conditions, the sediments exhibited very low or no release of P (Table 1), which means P contribution from internal loading can be expected to be negligible in both ponds. In addition to mixing due to stormwater inflows, it is hypothesized that low sheltering from trees around the ponds was a factor in aiding wind mixing of the pond water column and thus preventing a sustained stratification that could have led to anoxia.

4. Summary and Recommendations

a) The Swimming Pool Pond sediments did not release P under oxic conditions. Low P release occurred under anoxic conditions, at a rate of 1.16 ± 0.45 mg/m^2/day.
b) In the Point of France Pond, very low oxic P release was measured (0.83 ± 0.23 mg/m^2/day). Anoxic P release rate was relatively low and highly variable among the sediment cores, at 4.09 ± 3.21 mg/m2/day.
c) The impact of water column dissolved oxygen concentrations on the P release behavior was variable among the sediment cores, indicating the influence of sediment microbial activity and sediment characteristics on the potential for sediment P release.
d) Characterization of the sediment P fractions showed majority of P in the redox insensitive aluminum- and mineral-bound pool, i.e., not releasable under low oxygen conditions. The readily-mobile form of redox-P and potentially-mobile organic P were present in low (redox-P) to moderate (labile organic P) concentrations when compared to other stormwater ponds in the Twin Cities. The sediment P composition supports the low anoxic P release rates measured in the laboratory cores.
e) *In situ* monitoring showed low to moderate total phosphorus concentrations in the ponds during the growing season.
f) Surface to bottom profiles of DO and temperature were indicative of a mixed water column in the ponds during most of summer 2018, with intermittent stratification that lasted only for a brief amount of time.
g) High conductivity was measured in the ponds in May 2018, likely due to chlorides from road salt input. Gradual decrease in conductivity was noticed due to the mixing of pond water and flushing out of chloride in the pond discharge.

h) Together, these data suggest that conditions in the ponds are such that the water columns are mixed and primarily oxic during warmer months, indicating little to no internal P release and a minor impact on the pond water column phosphorus concentration.
i) Present conditions in the Swimming Pool Pond and Point of France Pond suggest that the ponds are providing treatment of phosphorus. Thus, chemical treatment of sediment to reduce internal phosphorus loading is currently not recommended.
j) Should conditions change to favor the development of anoxia in the pond, the potential for internal P release from the pond sediments could increase. One scenario would be increase in sheltering around the ponds that would result in poor mixing and stronger stratification causing low DO in the bottom of the pond. It is recommended that the sheltering around the pond be kept minimal to allow wind mixing of the pond.

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Appendix A

Table A- 1. Phosphorus water quality data for the Swimming Pool Pond from May to September 2018.

	5/16/18	5/16/18	5/16/18	5/30/18	5/30/18	5/30/18	6/13/18	6/13/18	6/13/18	6/27/18	6/27/18	6/27/18	7/11/18	7/11/18	7/11/18
	TP (µg/L)	TDP (µg/L)	SRP (µg/L)	TP (µg/L)	TDP (µg/L)	SRP (µg/L)	TP (µg/L)	TDP (µg/L)	SRP (µg/L)	TP (µg/L)	TDP (µg/L)	SRP (µg/L)	TP (µg/L)	TDP (µg/L)	SRP (µg/L)
Site 1 Epi	57	42	13	74	45	19	58	29	8	131	58	16	115	37	20
Site 1 Hypo				71	34	19									
Site 2 Epi	61	39	17	83	42	21	68	36	14	126	53	16	110	34	18
Site 2 Hypo				90	32	21				134	51	6	120	45	18
Site 3 Epi	84	53	13	89	45	19	66	53	23	99	25	6	100	42	22
Site 3 Hypo	76	6	13	67	22	15									
Site 4 Epi	117	17	27	94	40	19	53	38	16	132	38	12	127	52	20
Site 4 Hypo				85	44	23				117	35	10			
Site 5 Epi	57	20	13	74	32	21	71	48	10	107	40	8	130	50	22
Site 5 Hypo				126	49	17									
Site 6 Epi	47	49	17	91	29	15	71	33	12	109	40	6	96	47	30
Site 6 Hypo				76	29	21									

	7/26/18	7/26/18	7/26/18	8/8/18	8/8/18	8/8/18	8/22/18	8/22/18	8/22/18	9/11/18	9/11/18	9/11/18	9/26/18	9/26/18	9/26/18
	TP (µg/L)	TDP (µg/L)	SRP (µg/L)	TP (µg/L)	TDP (µg/L)	SRP (µg/L)	TP (µg/L)	TDP (µg/L)	SRP (µg/L)	TP (µg/L)	TDP (µg/L)	SRP (µg/L)	TP (µg/L)	TDP (µg/L)	SRP (µg/L)
Site 1 Epi	108	40	14	86	27	13									
Site 1 Hypo				102	24	14									
Site 2 Epi	110	45	10	76	27	14	169	32	6	64	38	1	70	10	10
Site 2 Hypo															
Site 3 Epi	158	53	18	76	39	11	181	32	3	84	12	1	54	10	9
Site 3 Hypo															
Site 4 Epi	128	43	14	71	21	13	158	22	5	83	9	1	54	10	10
Site 4 Hypo				89	27	13									
Site 5 Epi	136	33	18	72	29	13	150	27	6	42	61	1	63	10	9
Site 5 Hypo				101	31	14	152	20	1						
Site 6 Epi	116	30	12	71	24	13	180	17	10	55	6	1	56	10	9

Table A- 2. Phosphorus water quality data for the Point of France Pond from May to September 2018.

	5/16/18	5/16/18	5/16/18	5/30/18	5/30/18	5/30/18	6/13/18	6/13/18	6/13/18	6/27/18	6/27/18	6/27/18	7/11/18	7/11/18	7/11/18
	TP	**TDP**	**SRP**	**TP**	**TDP**	**SRP**	**TP**	**TDP**	**SRP**	**TP**	**TDP**	**SRP**	**TP**	**TDP**	**SRP**
Site 1 Epi	83	33	25	106	27	27	120	83	35	91	10	10	118	50	10
Site 1 Hypo	207	22	27	118	27	23									
Site 2 Epi				109	32	23	115	118	35	73	40	10	125	37	10
Site 2 Hypo										86	56	12	133	34	14
Site 3 Epi	100	63	21	136	34	25	128	76	37	78	38	12	116	40	12
Site 3 Hypo	67	14	19	95	25	25	133	73	37				137	32	12
Site 4 Epi				91	25	25	115	78	37	81	35	14	114	45	14
Site 4 Hypo							138	78	35				167	37	18
Site 5 Epi	86	53	21	142	44	30	120	71	35	94	35	16	117	26	10
Site 5 Hypo	96	33	17	84	59	28	135	73	31	101	33	18			
Site 6 Epi				133	44	28	116	83	29	115	30	14	105	19	10
Site 6 Hypo				91	47	27	133	83	38	84	45	21	127	29	12

	7/26/18	7/26/18	7/26/18	8/8/18	8/8/18	8/8/18	8/22/18	8/22/18	8/22/18	9/11/18	9/11/18	9/11/18	9/26/18	9/26/18	9/26/18
	TP	**TDP**	**SRP**	**TP**	**TDP**	**SRP**	**TP**	**TDP**	**SRP**	**TP**	**TDP**	**SRP**	**TP**	**TDP**	**SRP**
Site 1 Epi	133	43	8	73	29	13	99	17	1	68	6	3	78	38	12
Site 1 Hypo				72	24	18	87	25	1						
Site 2 Epi	143	33	14	76	29	14	82	25	3	61	1	1	80	16	12
Site 2 Hypo				64	26	16									
Site 3 Epi	132	48	16	61	36	14	70	34	1	120	22	1	109	12	14
Site 3 Hypo															
Site 4 Epi	145	55	8	64	24	14	66	18	1	58	9	1	92	10	10
Site 4 Hypo				81	24	14									
Site 5 Epi	132	38	18	71	27	13									
Site 5 Hypo															
Site 6 Epi	128	28	6	67	26	13	80	27	1	48	12	1	75	9	12
Site 6 Hypo															

Table A- 3. Dissolved oxygen (DO), temperature (T), and specific conductivity (SC) data for the Swimming Pool Pond from May to September 2018. H is the depth of sampling in the water column.

	SITE 1				SITE 2				SITE 3			
Sampling date	H (m)	DO (mg/L)	T °C	SC (µs/cm)	H (m)	DO (mg/L)	T °C	SC (µs/cm)	H (m)	DO (mg/L)	T °C	SC (µs/cm)
5/16/18	0.00	9.6	18.8	2972	0.00	10.4	18.7	2969	0.00	10.1	19.1	2955
	0.25	12.7	18.1	2992	0.25	10.4	18.9	2964	0.25	10.2	19.0	2953
	0.50	15.7	17.0	3263	0.50	10.3	19.0	2959	0.50	10.4	19.0	2963
	0.75				0.75	10.5	19.0	2961	0.75	15.1	18.5	2952
	1.00								1.00	18.3	18.2	3379
	1.25											
5/30/18	0.00	4.4	23.9	2430	0.00	4.2	24.2	2350	0.00	5.3	24.2	2210
	0.25	3.9	24.3	2430	0.25	4.0	24.1	2153	0.25	5.1	24.3	2199
	0.50	2.8	23.8	2040	0.50	4.1	24.3	2160	0.50	5.1	24.3	2200
	0.60	1.4	23.8	2067	0.75	3.5	24.2	2290	0.75	5.0	24.3	2200
					1.00	4.3	24.2	2037	1.00	2.9	24.3	2220
									1.05	2.57	24.4	2220
6/13/18	0.00	6.4	21.5	2200	0.00	6.8	21.8	2230	0.00	8.1	21.7	2230
	0.25	6.7	21.4	2163	0.25	6.8	21.8	2230	0.25	7.3	21.7	2220
	0.40	6.6	21.3	2154	0.50	7.4	21.7	2210	0.50	6.9	21.6	2220
					0.75	5.6	21.7	2230	0.75	6.6	21.6	2220
									1.00	5.5	21.5	2220
6/27/18	0.00	3.7	22.8	949	0.00	3.3	23.2	1044	0.00	4.3	23.2	1001
	0.25	3.4	22.9	939	0.25	3.4	23.2	1058	0.25	4.3	23.2	980
	0.50	2.8	22.9	929	0.50	3.5	23.2	1061	0.50	4.4	23.1	977
	0.60	1.7	22.7	914	0.75	1.7	22.9	975	0.75	4.4	23.2	972
					1.00	1.1	22.9	987	1.00	3.2	23.0	975
									1.10	2.8	23.0	833
7/11/18	0.00	5.3	25.8	726	0.00	5.4	26.1	723	0.00	5.7	26.2	730
	0.25	5.0	26.1	724	0.25	5.3	26.3	722	0.25	5.7	26.3	729
	0.50	3.6	25.8	719	0.50	5.0	26.2	722	0.50	5.6	26.3	727
	0.60	3.1	25.9	725	0.75	4.7	26.1	719	0.75	5.5	26.3	721
					1.00	1.8	25.9	657	1.00	4.8	26.2	724
7/26/18	0.00	5.5	22.5	554	0.00	5.5	23.0	547	0.00	6.1	23.3	557
	0.25	5.3	22.9	550	0.25	5.5	23.2	546	0.25	6.0	23.6	556
	0.50	5.2	22.9	549	0.50	5.6	23.1	545	0.50	5.9	23.5	555
					0.75	5.4	23.2	545	0.75	5.9	23.5	555
									1.00	5.8	23.5	553
8/8/18	0.00	8.5	25.1	368	0.00	11.7	25.6	384	0.00	12.2	25.8	385
	0.25	6.1	24.1	359	0.25	11.6	25.5	384	0.25	12.3	25.4	382
	0.47	6.1	23.9	358	0.50	8.9	24.5	382	0.50	9.6	24.6	382
					0.75	10.6	24.9	382	0.75	7.2	24.4	386
					1.00	7.9	24.2	384	1.00	5.2	24.3	393
8/22/18					0.00	9.5	22.8	683	0.00	9.4	23.1	687
					0.25	9.5	23.0	683	0.25	7.8	22.7	598

	SITE 1				SITE 2				SITE 3			
Sampling date	H (m)	DO (mg/L)	T °C	SC (µs/cm)	H (m)	DO (mg/L)	T °C	SC (µs/cm)	H (m)	DO (mg/L)	T °C	SC (µs/cm)
					0.50	8.9	22.7	607	0.50	5.3	22.4	542
					0.75	6.0	22.1	520	0.75	5.0	22.3	531
					1.00	5.7	22.1	516				
9/11/18					0.00	10.6	21.1	331	0.00	10.7	21.1	331
					0.25	10.5	21.1	331	0.25	10.7	21.0	331
					0.50	10.5	21.1	331	0.50	10.4	21.0	331
					0.75	10.5	21.1	330	0.75	10.3	20.9	331
									0.95	10.6	20.9	333
9/26/18					0.00	8.8	15.7	147	0.00	8.9	15.2	149
					0.25	8.8	15.6	147	0.25	8.8	15.4	148
					0.50	8.8	15.5	147	0.50	8.7	15.4	148
									0.75	8.5	15.3	148
									1.00	8.5	15.3	148

Table A- 4. Continued: Data for sampling sites 4, 5 and 6 in the Swimming Pool Pond.

	SITE 4				SITE 5				SITE 6			
Sampling date	H (m)	DO (mg/L)	T °C	SC (µs/cm)	H (m)	DO (mg/L)	T °C	SC (µs/cm)	H (m)	DO (mg/L)	T °C	SC (µs/cm)
5/16/18	0.00	10.3	19.1	2960	0.00	10.8	19.0	2973	0.00	9.7	19.6	2984
	0.25	10.5	19.0	2957	0.25	10.8	19.0	3017	0.25	10.2	19.4	2964
	0.50	9.5	19.0	2971	0.50	11.8	18.8	3053	0.50	11.8	19.1	3070
	0.75	12.8	18.6	3116	0.75	15.3	18.9	3148	0.75	14.2	18.9	3161
	1.00	14.8	17.8	3250	1.00	16.9	18.0	3267				
	1.25	18.3	17.1	4075	1.25	17.6	17.3	3507				
5/30/18	0.00	4.4	24.4	2340	0.00	5.1	24.6	2420	0.00	4.3	25.0	2670
	0.25	4.5	24.5	2310	0.25	5.0	24.8	2400	0.25	2.9	25.2	2680
	0.50	4.7	24.5	2300	0.50	5.0	24.7	2410	0.50	3.0	25.1	2840
	0.75	4.5	24.5	2300	0.75	4.3	24.7	2700	0.75	1.5	25.1	2830
	1.00	3.2	24.4	2350	1.00	3.9	25.1	2770	0.85	0.53	25.1	2840
	1.10	2.9	24.2	2350	1.25	1.3	24.9	2860				
6/13/18	0.00	7.6	22.0	2230	0.00	6.9	22.3	2230	0.00	9.5	22.4	2220
	0.25	7.4	22.1	2230	0.25	8.2	21.8	2220	0.25	8.9	22.0	2220
	0.50	7.4	22.1	2230	0.50	7.9	21.8	2230	0.50	6.5	21.7	2220
	0.75	8.0	22.0	2230	0.75	7.1	21.7	2240	0.73	4.3	21.5	2230
	1.00	5.7	21.6	2230	1.00	7.0	21.6	2240				
					1.25	6.0	21.7	2240				
6/27/18	0.00	4.3	23.3	953	0.00	5.9	23.2	960	0.00	5.5	23.6	1115
	0.25	4.2	23.2	948	0.25	5.0	23.2	960	0.25	4.3	23.5	1154
	0.50	4.0	23.1	950	0.50	4.3	23.1	956	0.50	2.2	23.4	1251
	0.75	4.1	23.1	958	0.75	4.0	23.1	968	0.75	1.9	23.2	1250
	1.00	3.8	23.0	967	1.00	2.8	23.2	954				
	1.25	1.0	23.0	932	1.25	1.1	23.3	1230				

	SITE 4				SITE 5				SITE 6			
Sampling date	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**
	1.35	1.5	22.9	931	1.35	0.9	23.3	1100				
7/11/18	0.00	6.51	26.4	726	0.00	5.3	26.5	726	0.00	5.84	26.4	725
	0.25	6.15	26.4	724	0.25	5.6	26.5	727	0.25	5.21	26.6	723
	0.50	4.94	26.4	730	0.50	5.6	26.6	725	0.50	3.67	26.5	723
	0.75	3.87	26.4	734	0.75	4.7	26.5	725	0.75	4.76	26.6	724
	1.00	2.86	26.3	733	1.00	3.1	26.5	727				
	1.25	1.95	26.1	733	1.13	2.6	26.5	729				
7/26/18	0.00	6.4	23.3	552	0.00	5.8	23.4	560	0.00	5.6	23.5	553
	0.25	6.3	23.4	552	0.25	5.7	23.5	560	0.25	5.4	23.5	554
	0.50	6.3	23.4	552	0.50	5.7	23.6	569	0.50	5.5	23.5	552
	0.75	6.3	23.4	552	0.75	5.6	23.6	569	0.75	5.4	23.5	553
	1.00	6.3	23.4	552	1.00	5.7	23.6	559				
	1.25	5.7	23.4	552	1.15	5.5	23.6	559				
8/8/18	0.00	11.8	27.2	385	0.00	13.2	26.2	384	0.00	12.7	26.7	393
	0.25	12.4	25.3	375	0.25	13.4	25.3	384	0.25	11.7	25.4	392
	0.50	11.2	24.9	375	0.50	11.3	24.8	388	0.50	10.5	25.0	391
	0.75	5.9	24.4	369	0.75	9.3	24.5	396	0.75	7.8	24.6	395
	1.00	4.1	24.2	371	1.00	4.7	24.3	402				
	1.25	0.2	23.8	462	1.25	0.5	24.0	426				
8/22/18	0.00	9.7	22.8	628	0.00	8.3	23.1	677	0.00	9.8	23.2	701
	0.25	9.1	22.9	621	0.25	7.6	22.8	665	0.25	6.7	22.8	625
	0.50	8.9	22.7	550	0.50	6.2	22.6	637	0.50	4.2	22.7	628
	0.75	5.8	22.4	554	0.75	5.6	22.4	621				
	1.00	5.0	22.0	497	1.00	4.9	22.3	608				
					1.20	0.2	22.3	639				
9/11/18	0.00	10.8	21.1	331	0.00	9.9	21.1	332	0.00	9.8	21.4	332
	0.25	10.8	21.0	331	0.25	10.2	21.1	331	0.25	9.6	21.2	333
	0.50	10.8	21.0	331	0.50	10.3	21.0	331	0.50	9.4	21.2	332
	0.75	10.5	20.9	331	0.75	8.7	21.0	332				
	1.00	9.3	20.6	333	1.00	7.9	20.8	334				
	1.20	6.6	20.4	336	1.20	6.9	20.6	337				
9/26/18	0.00	8.8	15.4	147	0.00	8.8	15.3	148	0.00	9.0	15.2	149
	0.25	8.7	15.5	147	0.25	8.8	15.4	148	0.25	9.0	15.4	148
	0.50	8.7	15.5	147	0.50	8.8	15.4	148	0.50	8.9	15.4	148
	0.75	8.5	15.5	147	0.75	8.3	15.4	148	0.75	8.9	15.4	149
	1.00	8.3	15.4	147	1.00	8.2	15.4	148				
	1.25	8.1	15.4	148	1.25	8.2	15.5	148				

Table A- 5. Dissolved oxygen (DO), temperature (T), and specific conductivity (SC) data for the Point of France Pond from May to September 2018. H is the depth of sampling in the water column.

		SITE 1				SITE 2				SITE 3		
Sampling date	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**
	0.00	16.2	19.9	2826					0.00	16.1	19.7	2827
	0.25	15.7	16.7	3250					0.25	17.1	17.8	3350
	0.50	14.9	15.1	3501					0.50	14.8	14.5	3661
	0.75	13.8	13.7	4037					0.75	12.1	13.5	3921
5/16/18	1.00	13.2	13.1	4875					1.00	15.8	13.5	5137
	1.25	0.85	13.1	>10,000					1.25	0.93	13.1	10,000
	1.50	0.19	11.4	>10,000								
	1.75	0.11	9.7	>10,000								
	1.95	0.08	8.4	>10,000								
	0.00	5.0	22.8	1535	0.00	5.01	22.8	1640	0.00	5.17	23.0	1591
	0.25	4.9	22.9	1587	0.25	4.78	23.0	1659	0.25	5.1	23.0	1599
	0.50	4.1	22.8	1554	0.50	4.36	23.0	1655	0.50	4.9	23.0	1625
	0.75	3.0	22.8	1587	0.75	4.46	23.2	1800	0.75	4.2	23.3	1930
5/30/18	1.00	1.6	22.5	2000	1.00	3.16	23.0	1860	1.00	3.65	23.4	2057
	1.25	0.97	22.3	2000								
	1.50	0.51	21.9	2520								
	1.75	0.06	21.4	3330								
	2.00	0.02	20.3	4300								
	0.00	2.5	22.8	1329	0.00	2.39	22.3	1334	0.00	2.0	22.2	1327
	0.25	2.3	22.3	1326	0.25	2.29	22.2	1329	0.25	1.9	21.5	1317
	0.50	2.0	21.6	1310	0.50	1.7	21.3	1320	0.50	1.8	21.2	1313
6/13/18	0.75	1.4	21.0	1300	0.75	1.56	20.9	1323	0.75	1.6	20.9	1311
	1.00	1.2	20.7	1250	1.00	1.5	20.6	1306	1.00	1.9	20.7	1321
	1.25	0.34	19.9	1145	1.12	1.43	20.6	1270				
	1.50	0.12	19.3	1110								
	0.00	5.1	23.1	365	0.00	4.86	23.1	361	0.00	4.9	23.4	362
	0.25	5.1	22.7	365	0.25	5.23	22.7	365	0.25	4.9	22.8	367
	0.50	3.8	22.4	368	0.50	4.36	22.4	365	0.50	4.0	22.4	366
6/27/18	0.75	3.4	22.2	369	0.75	3.91	22.3	360	0.75	3.5	22.3	364
	1.00	2.8	21.6	326	1.00	1.83	22.0	358	1.00	2.4	21.9	332
	1.25	2.5	21.4	317								
	1.50	2.2	20.9	299								
	0.00	7.6	25.4	265	0.00	8.7	25.8	263	0.00	8.8	25.9	265
	0.25	7.6	25.5	265	0.25	8.2	25.7	264	0.25	8.4	25.7	264
7/11/18	0.50	6.7	25.6	265	0.50	8.1	25.7	265	0.50	8.4	25.7	264
	0.75	5.4	25.4	272	0.75	3.9	25.4	273	0.75	5.9	25.6	264
	1.00	3.6	25.1	291	1.00	2.3	25.2		1.00	2.8	25.4	366
	0.00	7.6	22.3	251	0.00	7.2	22.8	249	0.00	6.8	23.0	257
7/26/18	0.25	7.5	22.6	249	0.25	7.1	22.9	249	0.25	6.8	23.0	250
	0.50	7.4	22.7	249	0.50	7.0	22.9	249	0.50	6.9	23.0	250

		SITE 1				SITE 2				SITE 3		
Sampling date	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**
	0.75	7.3	22.8	249	0.75	7.0	22.9	249	0.75	6.7	23.0	250
	1.00	7.2	22.9	249	1.00	7.0	22.9	249	1.00	6.7	23.0	249
					1.25	6.4	22.9	250	1.25	6.87	23.0	249
									1.50	4.73	22.9	251
8/9/18	0.00	11.2	25.2	215	0.00	11.7	25.3	214	0.00	12.2	25.6	214
	0.25	11.7	25.3	217	0.25	11.4	25.2	214	0.25	12.2	25.2	214
	0.50	10.6	25.2	221	0.50	10.2	25.2	214	0.50	10.3	24.9	216
	0.75	4.86	24.3	260	0.75	5.7	24.1	239	0.70	9.1	24.9	217
					1.00	2.8	23.6	246				
8/22/18	0.00	7.5	23.3	298	0.00	8.6	23.4	292	0.00	8.3	24.1	295
	0.25	7.0	22.6	296	0.25	7.2	22.7	292	0.25	7.1	22.7	291
	0.50	5.5	22.2	295	0.50	5.7	22.3	293	0.50	7.1	22.6	291
	0.75	4.6	22.1	295	0.75	5.3	22.2	293				
	1.00	4.1	22.1	299	0.95	4.9	22.1	294				
	1.25	3.8	22.1	302								
	1.50	3.6	22.0	299								
	1.75	3.5	22.0	297								
	2.00	0.14	22.0	330								
9/11/18	0.00	9.8	21.0	188	0.00	9.7	20.4	187	0.00	10.4	21.1	183
	0.25	9.6	20.6	187	0.25	9.7	20.4	187	0.25	10.5	20.8	183
	0.50	9.4	20.1	187	0.50	9.5	20.4	187	0.50	10.1	20.5	182
	0.75	8.8	20.1	192	0.75	9.0	20.3	186				
	1.00	7.4	19.8	200	1.00	7.1	20.1	187				
	1.25	6.5	19.7	208								
9/26/18	0.00	5.0	15.2	101	0.00	5.0	15.1	101	0.00	5.2	15.1	100
	0.25	4.9	15.2	101	0.25	5.0	15.1	101	0.25	5.1	15.2	100
	0.50	4.9	15.2	101	0.50	5.0	15.1	101	0.50	5.1	15.2	100
	0.75	4.8	15.2	101	0.75	4.9	15.1	101	0.75	5.0	15.2	100
	1.00	4.5	15.2	101	0.90	4.8	15.1	102				
	1.25	4.4	15.2	101								
	1.50	4.3	15.2	102								
	1.75	4.3	15.2	102								

Table A- 6. Continued: Data for sampling sites 4, 5 and 6 in the Point of France pond.

		SITE 4				SITE 5				SITE 6		
Sampling date	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**
5/16/18					0.00	17.7	19.3	2806				
					0.25	18.6	18.1	3275				
					0.50	20.6	15.3	3910				
					0.75	15.6	14.0	4278				
5/30/18	0.00	5.22	22.9	1609	0.00	6.6	23.1	1813	0.00	5.25	23.2	1724

		SITE 4				SITE 5				SITE 6		
Sampling date	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**	**H (m)**	**DO (mg/L)**	**T °C**	**SC (µs/cm)**
	0.25	5.12	22.9	1594	0.25	5.6	23.3	1808	0.25	5.09	23.3	1729
	0.50	4.87	22.9	1588	0.50	5.4	23.3	1798	0.50	5.14	23.3	1732
	0.75	4.64	22.9	1594	0.75	4.7	23.3	1796	0.75	4.56	23.3	1786
									1.00	3.86	23.3	1830
6/13/18	0.00	2.19	22.6	1330	0.00	1.8	22.4	1350	0.00	1.88	23.0	1330
	0.25	2.08	22.7	1327	0.25	1.6	21.7	1331	0.25	1.1	21.7	1316
	0.50	2.11	22.5	1325	0.50	1.4	21.3	1331	0.50	1.45	21.3	1325
	0.75	1.96	21.3	1310					0.75	1.94	21.0	1320
6/27/18	0.00	5.18	22.9	362	0.00	4.5	23.5	366	0.00	4.77	23.5	366
	0.25	4.48	22.6	363	0.25	3.5	22.8	366	0.25	2.53	22.7	367
	0.50	4.02	22.4	360	0.50	2.4	22.5	367	0.50	2.53	22.4	357
	0.75	2.89	22.2	357	0.75	0.1	22.3	354	0.75	1.62	22.1	332
	0.90	2.24	22.1	357								
7/11/18	0.00	8.0	26.3	266	0.00	10.4	26.5	262	0.00	10.0	26.8	262
	0.25	8.0	25.9	266	0.25	9.9	26.4	261	0.25	10.1	26.7	262
	0.50	7.1	25.7	265	0.50	9.8	26.3	261	0.50	9.5	26.5	262
	0.75	3.9	25.4	273	0.65	8.8	26.2	261	0.75	6.7	25.8	262
	1.00	3.7	25.3	300					1.00	5.52	25.6	495
7/26/18	0.00	7.4	22.9	250	0.00	7.6	23.0	248	0.00	8.1	23.2	247
	0.25	7.5	23.0	250	0.25	7.5	23.1	248	0.25	6.8	23.1	248
	0.50	7.5	23.0	249	0.50	7.5	23.1	248	0.50	6.7	23.1	248
	0.75	7.4	22.9	249	0.65	7.4	23.1	247	0.75	6.3	23.0	248
8/9/18	0.00	11.9	25.5	214	0.00	10.6	25.9	212	0.00	11.1	26.7	213
	0.25	10.8	25.4	213	0.25	14.2	25.5	214	0.25	13.4	25.7	215
	0.50	11.1	25.2	216	0.50	13.8	25.2	214	0.50	14.3	25.4	215
	0.75	9.1	24.3	220	0.75	10.7	24.6	218	0.70	10.5	25.0	367
	1.00	1.5	23.7	228								
8/22/18	0.00	9.6	23.5	292					0.00	9.7	23.4	291
	0.25	9.3	22.9	290					0.25	9.6	22.7	289
	0.50	8.1	22.3	290					0.50	8.8	22.4	289
	0.75	5.9	22.1	291					0.75	6.0	22.0	291
	0.76	5.3	22.0	292					1.00	5.4	22.0	292
9/11/18	0.00	10.3	21.0	186					0.00	10.3	21.5	184
	0.25	10.3	20.9	185					0.25	10.2	21.2	183
	0.50	10.3	20.7	184					0.50	10.3	21.1	183
	0.75	10.3	20.5	183.9					0.75	10.2	20.7	183
	1.00	9.7	20.3	182.9					1.00	8.3	20.2	184
9/26/18	0.00	5.2	15.1	101					0.00	5.2	15.2	101
	0.25	5.1	15.1	101					0.25	4.9	15.1	100
	0.50	5.0	15.1	101					0.50	4.9	15.1	101
	0.75	5.0	15.1	101					0.75	4.8	15.1	101
	1.00	4.3	15.1	101					1.00	4.4	15.1	101