



ENVIRONMENTAL CONSULTANTS

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January 12, 2021

Dennis Overfield
Co-Chairman
Rogers Lake Authority
119 Shore Drive
Lyme, CT 06371

Re: 2020 Summary of Rogers Lake Water Quality

Dear Mr. Overfield:

SWCA Environmental Consultants (SWCA) is pleased to provide a summary of water quality associated with sampling services completed for the Rogers Lake Authority in 2020. As per our proposal, grab quality water samples were collected three times during the season and analysis of all results is provided in this document. The goal of the sampling and analysis is to provide information that will enable the Towns of Old Lyme and Lyme as well as the Association to make decisions to improve the water quality, recreational value, and the aquatic habitat of Rogers Lake.

If you have any questions or require additional information, please do not hesitate to contact me by phone at (413) 658-2056, or via email at sfisher@swca.com.

Sincerely,

A handwritten signature in black ink, appearing to read "Scott Fisher".

Scott Fisher
Office Manager

A handwritten signature in black ink, appearing to read "Matt Lewis".

Matt Lewis
Restoration Specialist, Lake & Pond Manager

OVERVIEW

Water quality has been monitored within Rogers Lake since 2014. A Quality Assurance Protection Plan (QAPP) was developed in 2015 to ensure consistent water quality data collection standards throughout the project. The QAPP included a robust set of water quality standards to be assessed and a relatively frequent collection schedule and included an abundance of sampling across the entire depth of the lake. These data provided ample detail of changes in water quality across Rogers Lake.

Following a review of the 2019 Rogers Lake assessment report, lake and pond specialists determined that the frequency and quantity of sampling events within Rogers Lake should be reduced. This was determined based on the consistency of past water quality sampling results and is being implemented as a cost-savings measure. Therefore, the results described in this report are not precisely consistent with the developed QAPP but include the same water sampling analytes and provide the same analysis and summary of results.

SWCA proposed during the middle and end of the growing season on three sampling dates: July 1, August 5, and September 3, 2020. These three sampling events provide sufficient data to inform decision makers regarding water quality changes. A grab sample was collected at a shallow and deep sampling depth at each of the two deep pool sampling locations within the lake.

1.0 WATER QUALITY SAMPLING

SWCA collected grab samples on July 1, August 5, and September 3, 2020. Samples were taken at predetermined locations within Rogers Lake (see Figure 1) at two different depths, which is sufficient for the monitoring program at Rogers Lake. At each location, one sample was collected at approximately 1.6 feet (0.5 meters) below the surface and the second was collected at approximately 1.6 feet from the bottom. The water samples were sent to SePRO Research and Technology Campus for analysis of the following parameters.

- Dissolved oxygen
- pH
- Conductivity
- Total phosphorus
- Orthophosphate
- Ammonia
- Nitrite and Nitrate
- Total Kjeldahl Nitrogen (TKN)
- Alkalinity

Sample Site (SS) 1 is located just southeast of 116 Lake Shore Drive in a large open water portion of the lake with recorded depths of over 60 feet. SS-2 is in the southwestern portion of lake due west of 21–27 Rogers Lake Trail. Results of the water quality analysis from these two locations are summarized below and presented in Tables 1 and 2.

1.1 WATER QUALITY ANALYSIS RESULTS

The chemistry analysis of Rogers Lake at the shallow grab sample at SS-1 contained good water quality that is typical for freshwaters, as seen in Table 1a. The pH was identified as near neutral (6.8, 6.1, and 7.1 SU) on each sampling date, which is standard for freshwaters. The dissolved oxygen levels were also acceptable for fish and other aquatic life throughout the season (6.0, 8.3, and 8.0 mg/L). Any recordings above 5.0 mg/L are deemed safe and acceptable for fish and invertebrates.

However, this location did present as having a low buffering capacity on each sampling, which means the lake may be susceptible to shifts in pH. The pH did vary slightly throughout the season but was well within the standard range for freshwater. The ionic concentrations were low but typical of conductivity in freshwater ecosystems. In general, conductivity measures the ability of water to transfer electrical current. The temperature and concentrations of ions influence the level of conductivity. The warmer the water and higher the concentration of dissolved substances such as salts, chemicals, and minerals; the higher the conductivity. The visibility below the surface in this location was very good all season as it ranged from 6.0 – 7.0 feet. Typical visibility management for swim management areas is a minimum of 4.0 feet below surface.

This location of the lake can be classified as oligotrophic, as it contains low to moderate levels of Total and Free Reactive Phosphorus. These values ranged from <10.0–12.6 ug/L throughout the growing season. Phosphorus presence is often an indicator of the potential for excessive growth of algae and nuisance plant populations. As previous vegetative surveys have indicated, problematic plant and algae growth is generally low overall and Rogers Lake contains healthy aquatic habitat. Nitrogen and Ammonia levels were considered low and typical of freshwater systems. Ammonia (in an aquatic environment) is a form of nitrogen that may pose potential toxic effects on aquatic life. In this form it is most likely present but low due to the low presence of organic material.

Table 1a: SS-1 Shallow Sample Results

Parameter	7-1-20 taken 1.6 meters (3.6 feet) below	8-5-20 taken 1.6 meters (3.6 feet) below	9-3-20 taken 1.6 meters (3.6 feet) below	Notes
Dissolved O2 (mg/L)	6.0	8.3	8.4	Supports most aquatic life
pH (SU)	6.2	6.2	7.1	Near neutral –typical for freshwaters
Conductivity (µS/cm)	62.2	75.0	58.7	Typical of freshwaters
Total Phosphorus (µg/L)	12.6	11.0	<10.0	Moderate-oligotrophic
Free Reactive Phosphorus (µg/L)	5.0	5.0	<5.0	See Total Phosphorus
Ammonia (µg/L)	170.3	24.8	38.1	Acceptable for freshwaters
Nitrite (mg/L)	<0.02	<0.02	<0.02	Low – typical of freshwaters
Nitrate (mg/L)	<0.02	<0.02	<0.02	Low – typical of freshwaters
Total Kjeldahl Nitrogen	0.4	0.1	0.3	Low – typical of freshwaters
Alkalinity (mg/L as CaCO3)	<10	<10	10.1	Low buffered
Secchi Deck (visibility below surface)	6.0	7.0	7.0	Acceptable for freshwaters

The deep sample from SS-1 maintained a near neutral pH (0.2, 6.2, and 7.1 SU) throughout the season as well – similar to the shallow SS-1 sample. The dissolved oxygen levels were acceptable for fish and other aquatic life throughout the season (7.7, 8.5, and 8.1 mg/L), as was the case in the shallow sample. This location also had a low buffering capacity on each sampling although there was little shift in pH recorded. The ionic concentrations were low but typical of conductivity in freshwater ecosystems.

This deep location of the lake is also oligotrophic and maintains similar low to moderate levels of Total and Free Reactive Phosphorus; ranging from <10.0–13.8 ug/L. Nitrogen and Ammonia levels were considered low and typical of freshwater systems. The August 5 sampling did record an elevated level of Ammonia comparatively (264.5 ug/L) likely due to the warm time of year and most typical period for the presence of organic material. Overall, there are many similarities between the shallow and deep samples

form SS-1. The most marked difference is the marginally higher average dissolved oxygen content in the deeper sample than the shallow sample, which is to be expected.

Table 1b: SS-1 Deep Sample Results

Parameter	7-1-20 taken 41 feet below	8-5-20 taken 41 feet below	9-3-20 taken 36 feet below	Notes
Dissolved O ₂ (mg/L)	7.7	8.5	8.1	Supports most aquatic life
pH (SU)	6.2	6.2	7.1	Near neutral –typical for freshwaters
Conductivity (µS/cm)	59.3	72.2	57.8	Typical of freshwaters
Total Phosphorus (µg/L)	13.1	<10	13.8	See Total Phosphorus
Free Reactive Phosphorus (µg/L)	5.0	5.0	<5.0	Acceptable for freshwaters
Ammonia (µg/L)	22.3	264.5	12.6	Low – typical of freshwaters
Nitrite (mg/L)	<0.02	<10	<0.02	Low – typical of freshwaters
Nitrate (mg/L)	0.1	<10	<0.02	Low – typical of freshwaters
Total Kjeldahl Nitrogen	0.2	0.6	0.3	Low – typical of freshwaters
Alkalinity (mg/L as CaCO ₃)	<10	<10	11.3	Low buffered
Secchi Deck	n/a	n/a	n/a	Supports most aquatic life

The results form SS-2 are very similar to those from SS-1, for both the deep and shallow samples. The shallow sample at SS-2 also maintained a very consistent near neutral pH throughout the season (6.6–6.8 SU). The dissolved oxygen levels were similarly acceptable for fish and other aquatic life with readings of 5.8–8.7 mg/L. This location also had a low buffering capacity on each sampling although there was little shift in pH recorded. The pH was consistent throughout the season and well within the standard range for freshwater. The visibility below the surface in this location was also very good all season as it ranged from 6.0–8.0 feet. This deep location of the lake can also be classified as an oligotrophic state as it maintained similar low-moderate levels of Total and Free Reactive Phosphorus ranging from <10.0–13.0 µg/L. Nitrogen and Ammonia levels were considered low and typical of freshwater systems.

Table 2a: SS-2 Shallow Sample Results

Parameter	7-1-20 taken 1.6 meters (3.6 feet) below	8-5-20 taken 1.6 meters (3.6 feet) below	9-3-20 taken 1.6 meters (3.6 feet) below	Notes
Dissolved O ₂ (mg/L)	5.9	8.8	8.7	Supports most aquatic life
pH (SU)	6.6	6.7	6.8	Near neutral –typical for freshwaters
Conductivity (µS/cm)	62.0	60.5	58.0	Typical of freshwaters
Total Phosphorus (µg/L)	13.0	10.4	<10.0	Oligotrophic to mesotrophic
Free Reactive Phosphorus (µg/L)	5.0	5.0	<5.0	Acceptable for freshwaters
Ammonia (µg/L)	103	26.9	31.3	Low – typical of freshwaters
Nitrite (mg/L)	<0.02	<0.02	<0.02	Low – typical of freshwaters
Nitrate (mg/L)	<0.02	<0.02	<0.02	Low – typical of freshwaters
Total Kjeldahl Nitrogen	0.5	0.3	0.2	Low – typical of freshwaters
Alkalinity (mg/L as CaCO ₃)	<10	<10	10.7	Low buffered
Secchi Deck	6.0	6.0	8.0	Supports most aquatic life

The chemistry analysis of Rogers Lake at the deep sample of SS-2 contained a near neutral pH on July 1, August 5 and September 3 (6.5, 6.2, 6.3 SU) and the dissolved oxygen levels were observed as 8.2, 8.5, 7.7 mg/L, respectively. Both parameters are deemed acceptable for fish and other aquatic life throughout the season. This sampling location also had a low buffering capacity during each sampling event. However, like the other locations, the lake fluctuated very little in pH.

This portion of the lake did record the highest nutrient and Ammonia levels although they were all relatively low overall and typical of freshwater systems. The Phosphorus levels (<10.0–19.3) can be considered low to moderate, along with all other samples. During September, the water at deep sampling location at SS-2 was observed as mesotrophic state in this location. This means that this portion of the lake contained a higher concentration of phosphorous available to algae than concentrations at other parts

of the year. Nitrogen levels were low overall, but TKN on September 3 was recorded as having slight potential for harm, or more ability for an algae bloom to form.

While traversing the lake during sampling events, SWCA observed that SS-2 is adjacent to a long, steady decrease in water depth that leads to shallower water on the southwest shore of Rogers Lake that seems to accumulate organic matter. It is possible that this area could be contributing organic plant material to the deeper location of SS-2. Decomposition of organic matter could easily influence the results of the sampling parameters.

Table 2b: SS-2 Deep Sample Results

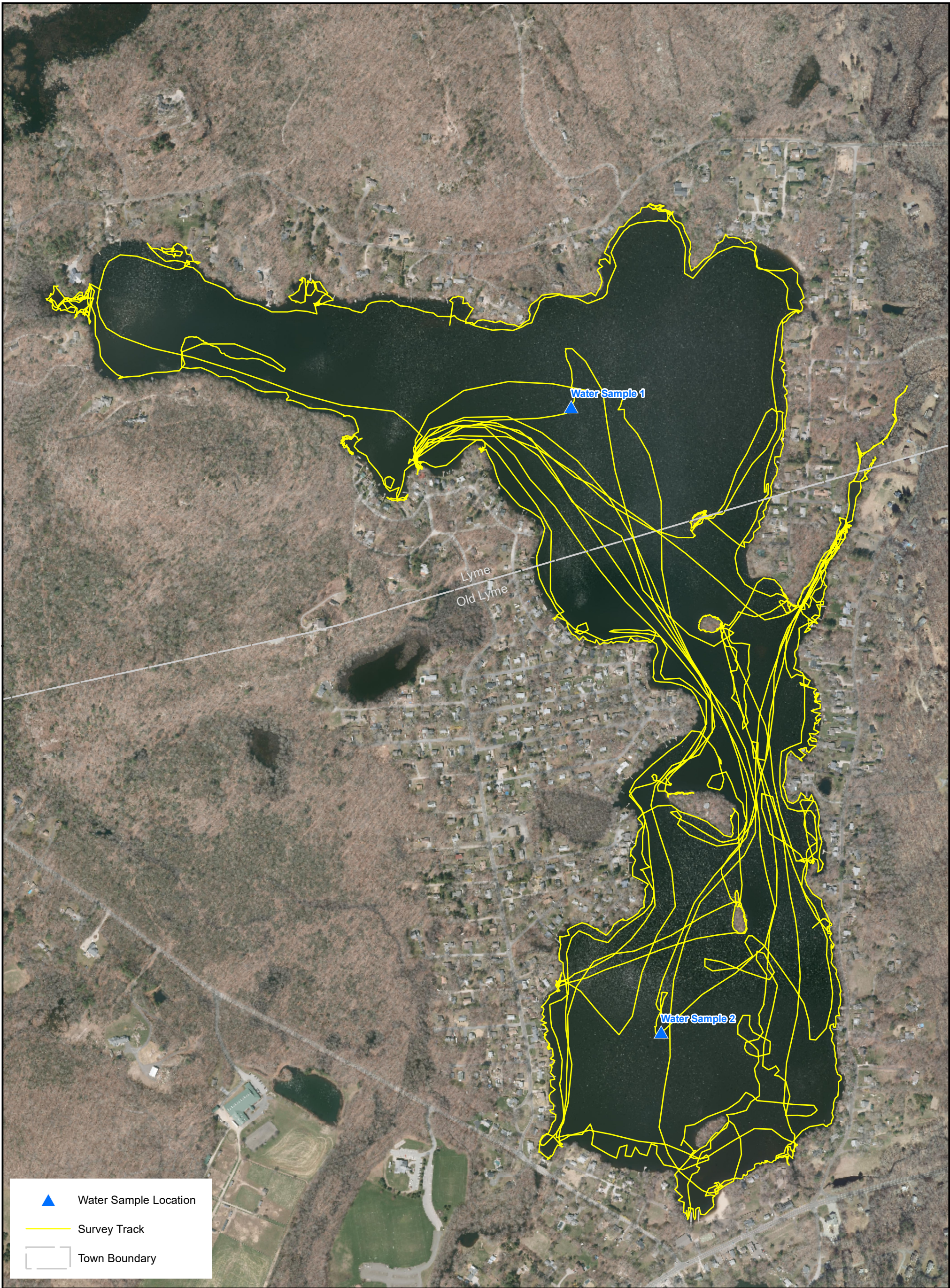
Parameter	7-1-20 taken 36 feet below	8-5-20 taken 36 feet below	9-3-20 taken 32 feet below	Notes
Dissolved O ₂ (mg/L)	8.2	8.5	7.7	Supports most aquatic life
pH (SU)	6.5	6.2	6.3	Near neutral –typical for freshwaters
Conductivity (µS/cm)	59.6	72.2	72.3	Typical of freshwaters
Total Phosphorus (µg/L)	14.3	<10	19.3	Moderate-oligotrophic
Free Reactive Phosphorus (µg/L)	6.0	5.0	<5.0	Acceptable for freshwaters
Ammonia (µg/L)	73.6	264.5	575.5	Low – typical of freshwaters
Nitrite (mg/L)	<0.02	<0.02	<0.02	Low – typical of freshwaters
Nitrate (mg/L)	<0.02	<0.02	<0.02	Low – typical of freshwaters
Total Kjeldahl Nitrogen	0.5	0.6	1.1	Low buffered
Alkalinity (mg/L as CaCO ₃)	<10	<10	26.2	Low
Secchi Deck	n/a	n/a	n/a	Supports most aquatic life




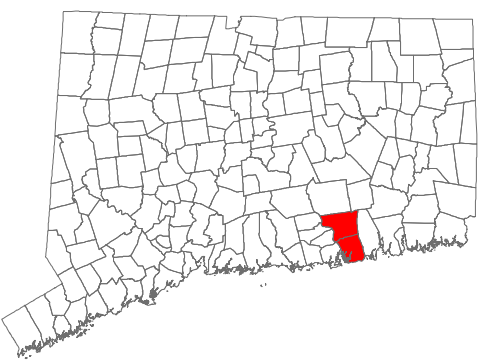
2.0 CONCLUSION AND RECOMMENDATIONS

The water quality sampling data collected during the 2020 season indicates that the water quality of Rogers Lake is consistent and represents a typical healthy lake in New England. While one sampling event at SS-2 indicated mesotrophic water conditions, the waterbody displayed oligotrophic conditions in every other sampling event at both sampling locations. This indicates both good water quality and functioning in a freshwater system and low risk for algal blooms. Furthermore, these results are consistent with previous water quality sampling. These continued results would indicate that Rogers Lake appears to be unaffected by annual vegetation management protocols and remains in good health.

As additional types of management will continue in 2021, SWCA recommends continuing this seasonal sampling protocol combined with the vegetative and mussel surveys, as both provide thorough information on the current state of the lake.

Figures



 <p>SWCA ENVIRONMENTAL CONSULTANTS</p> <p>15 Research Drive Amherst, MA 01002</p> <p>Phone: 413.256.0202</p>	<p>Figure 1 2020 Survey Tracks and Water Sampling</p> <p>Rogers Lake Lyme & Old Lyme, CT</p> <p>15 Jul 2020 SWCA Job # 48737</p>	<p>Data Source: Connecticut Environmental Conditions Online</p> <p>6-in Color Digital Ortho Image 2019 Tiled Service</p> <div><div><p>0 500 Feet</p></div><div><p>N</p></div><div><p>Latitude 41° 21' 36" N Longitude 72° 18' 4" W</p></div></div>	
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