MEMBERS SUMMARY – 2020 LAKE SAMPLING EVENT #2 PERFORMED BY PRINCETON HYDRO, JULY 6, 2020

BACKGROUND: The Water Quality Committee (WQC) recommended to the LLPOA Board retaining a professional lake advisor to guide the management of Lake Latonka to support the desired broad range of uses, including swimming, boating, water skiing, fishing, and aesthetics. After an extensive review of potential advisor firms and evaluation of proposals, the Board accepted the WQC's recommendation and retained Princeton Hydro (PH) to serve as our community's professional lake advisor. Their services will include 15 specific tasks focused on fully understanding the lake's water quality throughout the primary recreation season, culminating with a lake management plan. Over the course of the summer, PH will be conducting five sampling events that also will include observations by the Project Manager/Senior Limnologist (fresh water pond/lake scientist).

The aerial image to the left shows the locations where PH is sampling during each of the five sampling events (2 **I**nlet stations, 3 **L**ake stations + 1 **B**each station, and 1 **O**utlet station).

SUMMARY OF SAMPLING EVENT #2 – JULY 6, 2020:

In-Situ (In-place) Sampling

Clarity – On July 6, the lake had acceptable clarity (transparency), with visibility to about 3.6 feet at the deeper lake stations (L-2 and L-3), based on Secchi disc transparency. This is about half of June's results.

Thermal Stratification - The Lake exhibited more pronounced thermal stratification than in June (temperature variability with depth). At the deepest station, L-3, the surface water temperature was 86.7°F, while the temperature at 25' deep was 53.3°F. Temperature zones were defined as the top 3' of warm water (the epilimnion), the thermocline from 7 to 16' separating warmer surface water from coolest deep water, and the hypolimnion below 16' containing the coolest water. Thermal stratification prevents water mixing and negatively impacts dissolved oxygen at depth.

Dissolved Oxygen (DO) – Aquatic organisms require oxygen dissolved in the water for survival. PH suggests a minimum 4 mg/l to sustain the warm-water fish in our lake. At L-3, DO was high within the upper 10'. However, at 20' the DO was less than the suggested 4 mg/l. DO was less than 1 mg/l (anoxic) within the bottom 2.6'. In June, anoxic conditions were limited to the very bottom of the lake at the sediment interface.

pH – The lake has gone from slightly acidic in June, consistent with low early-season rates of algal productivity to mildly basic (increasing photosynthesis generally leads to basic water conditions with pH > 7.0). July pH's ranged from 7.35 to 8.62 and was higher near the surface.

Laboratory Water Quality Results

Chlorophyll *a* – Chlorophyll is the pigment plants use to convert sunlight to energy. Chlorophyll *a* is the primary photosynthetic pigment in algae and is an indicator of algal biomass. PH typically recommends that this value remain below 20 µg/l. Measured results ranged from a minimum of 11 µg/l to a maximum of 19.0 µg/l, up from June, but within an acceptable range for Lake Latonka so far, but close to the recommended upper threshold near the surface at L-1.

Total phosphorus (TP) – TP includes inorganic, organic, dissolved and particulate forms of phosphorus. In freshwater ecosystems, TP is monitored as it typically controls the amount of vegetative and phytoplankton growth. PH recommends TP concentrations in natural lakes to remain below 0.03 mg/l to preclude nuisance algal growth, especially blue-green algae. In man-made lakes, such as Lake Latonka, an initial threshold value of 0.05 mg/l is somewhat acceptable given larger tributary areas and agricultural runoff. TP concentrations were at or a little above this 0.05 mg/l threshold at L-1, L-2, and O-1. However, TP was far above the suggested threshold at depth at L-3 (.46 mg/l -- 9 times the threshold value). Data from this event suggest large-scale internal phosphorus loading from lake sediments at the time of sampling.

Soluble Reactive Phosphorus (SRP) – SRP is the dissolved, inorganic portion of phosphorus which is most readily assimilated by algae for growth. PH recommends that SRP concentrations remain below 0.005 mg/l; however, one sample exceeded this recommendation by a wide margin. The deep sample at L-3 was 0.152 mg/l, or 30 times the recommended maximum. This SRP value is another strong initial indicator of internal phosphorus loading.

Nitrogen Compounds (Ammonia [NH_3] and Nitrates [NO_3]) – Nitrogen is a nutrient that can lead to eutrophication of water bodies. Ammonia can be converted to nitrate (NO_3) by bacteria, and then used by plants. Nitrate and ammonia are the most common forms of nitrogen in aquatic systems. Both nitrogen and ammonia levels were found to be low except in deep water at L-3 where the lack of oxygen likely prevented oxidation of ammonia to the less toxic nitrate (NO_3).

Total suspended solids (TSS) – TSS represents the inorganic and organic particulates in the water column. TSS measures in lakes should remain below 10 mg/l to preclude turbid conditions. TSS measures at Latonka ranged from 2 mg/l to 6 mg/l. Therefore no TSS measures at the Lake stations were excessive, but inlet I-2 had TSS at 11 mg/l.

Plankton Data (Phytoplankton is aquatic plants, Zooplankton is small aquatic animals)

Princeton Hydro collected three phytoplankton grab samples (two near the dam, one at the beach); these samples were subsequently identified and enumerated (cells/ml). Zooplankton also was collected near the dam for taxonomic analysis and enumeration (organisms/ml). Additionally, samples for cyanotoxins (toxins from cyanobacteria, a.k.a. blue-green algae), specifically, total microcystin, and cylindrospermopsin, were collected at the Beach.

Phytoplankton results - Phytoplankton grab samples showed moderate densities of algae ranging from 47,169 cells/ml at L-3 mid-depth to 68,072 cells/ml at L-3 surface. The cyanobacteria were the dominant group at all sampling stations and comprised 97% of the community at L-3 surface and L-3 mid-depth and 91% at the beach. The colonial genus Woronichinia was dominant at L-3, while the filamentous genus Aphanizomenon was dominant at the beach. Cyanobacteria of either genus are capable of producing cyanotoxins; therefore samples were analyzed for cyanotoxins.

Zooplankton results - Samples showed an aquatic herbivore community comprised of the order Cladocera (water fleas - *Daphnia* and *Bosmina*) and various rotifers. In June, large-bodied Daphnia predominated. Zooplankton community dynamics often shift when cyanobacteria proliferate, as evidenced by more Bosmina and rotifers in the zooplankton samples. Zooplankton consumes phytoplankton and is important as a primary consumer supporting fish populations.

Cyanotoxins – Cyanobacteria (blue-green algae) can release natural toxins into water bodies. PH sampled at the Beach for common toxins from algae blooms; they analyzed for total microcystins and cylindrospermopsin (both are hepatotoxins that can impact the liver and kidneys). The good news is results were negative again for both toxins at the Beach.

Overall Comparison of June and July Sampling Events

Many water quality parameters showed the impacts of the hot weather that began to impact the lake in late June and early July. Likely most noticeable to lake residents was the decrease in water clarity, falling to about half of what it was a month earlier. The surface temperature of the lake jumped to nearly 87 degrees. Sampling at the deep lake location (L-3) showed total phosphorus 9 times the value PH suggests, and soluble reactive phosphorus at 30 times the value that PH suggests. Elevated TP and SRP indicated phosphorous is feeding algal blooms, requiring algal control measures.

Although water quality generally diminished since June, the sampling at the beach showed no cyanotoxins were present (total microcystins and cylindrospermopsins); both samples were zero ppb. The next sampling event by PH is scheduled for August 10.