AQUA SIERRA INC.

# Aquatic Resource Water Quality Summary

# Lake in the Aspens Ranch

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Prepared for:

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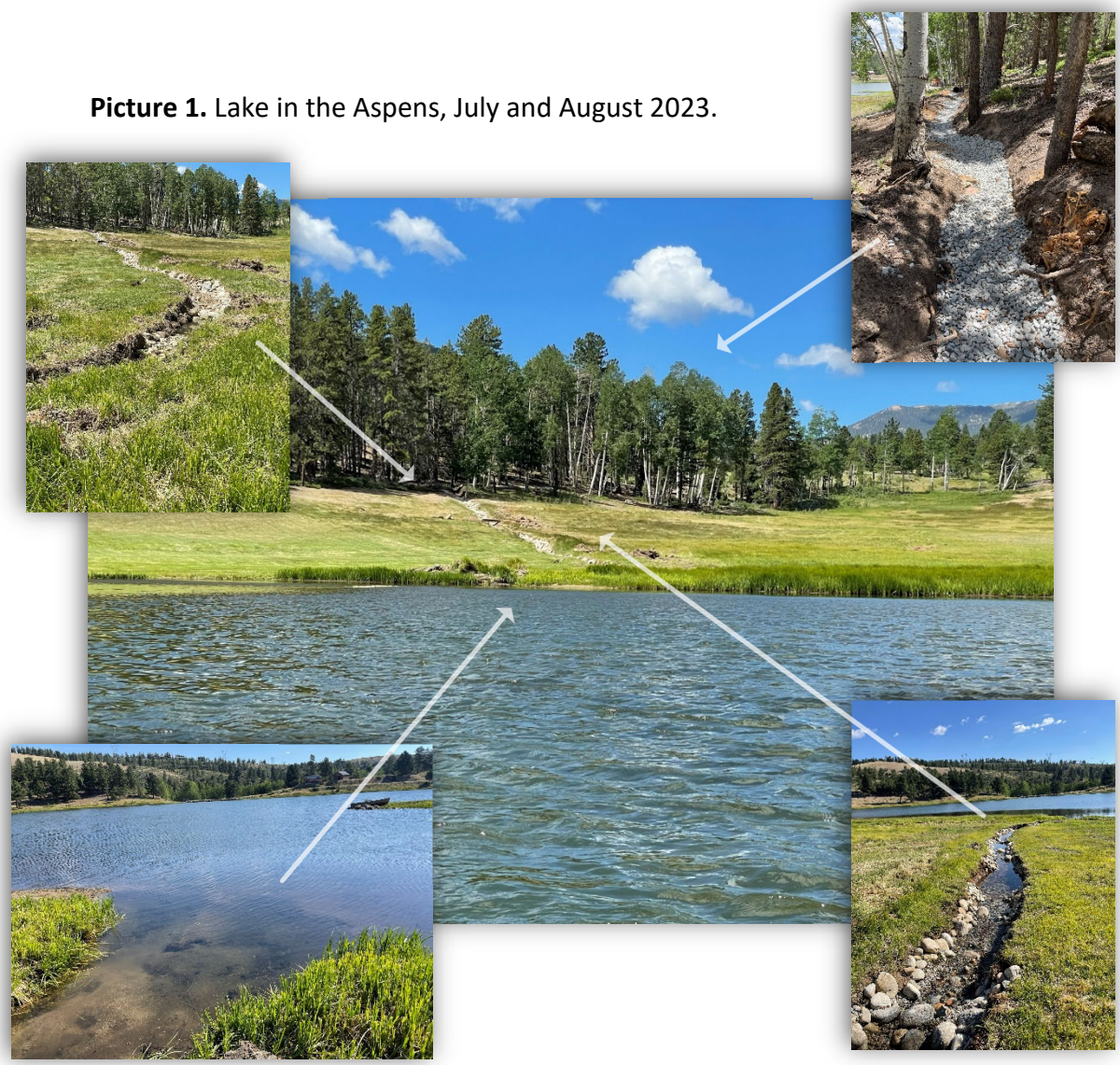
## Introduction

Aqua Sierra, Inc. offers aquatic management services to Lake in the Aspens to improve lake health after years of degradation caused by cattle in the adjacent fields. Nuisance vegetation and algal blooms occasionally plague the lake, diminishing angling opportunities. The lake is fed by an adjacent stream controlled by a headgate. This streambed was restored by removing organics and redirecting flow through a designated channel. Aeration was also installed, and grass carp were stocked. A water sample was collected during the spring assessment, and a seasonal bacterial augmentation plan implemented.

**Picture 1.** Lake in the Aspens, July and August 2023.



## Water Quality Overview

The chemical makeup of the water is vital to ecological health and preserving aesthetics. The most common problems, such as excess weeds, poor clarity, offensive odors, rapid sludge accumulation, and fish kills, can be traced to water chemistry. A water sample was collected during the spring visit to evaluate the health and chemical makeup of the lake. Results from this assessment (Table 1.) identify driving factors for challenges and implement data-driven management decisions centered on the problem's source.

**Table 1.** Water Chemistry Results for Lake in the Aspens

| PARAMETER | 2020 | 2022 | 2023 | IDEAL RANGE |
|---|---|---|---|---|
| Temperature* | 64.0 | 67.0 | 62.0 | < 70.0 |
| pH* | 6.7 | 7.1 | 7.0 | 6.7 – 9.0 |
| Copper | 0.047 | 0.012 | < 0.1 | < 0.01 |
| Iron | 0.197 | 0.121 | 0.329 | < 0.5 |
| Zinc | 0.30 | 0.28 | < 0.1 | < 0.5 |
| Hardness | 60.0 | 58.0 | 55.5 | > 100 |
| Alkalinity | 98.9 | 91.4 | 87.6 | > 100 |
| Sulfate | 13.3 | 13.6 | 3.49 | < 50 |
| Nitrogen | 1.10 | 1.21 | *not detected* | < 0.1 |
| Phosphorous, Ortho | *not detected* | *not detected* | *not detected* | < 0.001 |
| Phosphorous, Total | 0.142 | 0.151 | *not detected* | < 0.1 |
| Potassium | 2.4 | 2.8 | 1.6 | < 5.0 |

*All results in this table are in reported mg/L except for temperature and pH.
*Temperature is reported in $^{0}$F and pH is in standard units.

The disturbance to the inlet channel was suspected of causing temporary concerns with water quality; however, improvements are apparent. Primary nutrients were undetected and fully utilized, although aquatic vegetation flourished in the late season, indicating a nutrient source in the lake sediments. The clarity of the water also decreased throughout the summer, similar to previous years, due to the movement of planktonic algae in the water column. Two pesticide treatments were performed to regain aesthetics.

The lake's buffering capacity and pH remain low, demonstrating a high mountain waterbody. Buffering capacity is critical when drastic pH swings may be induced by excessive algae or aquatic vegetation growth or die-off, leading to fish stress or loss. During photosynthesis, pH rises throughout the day and lowers at night. Soft, acidic waters may lead to metal leaching and toxicity of some aquatic species.

Nutrients are necessary for a robust, healthy aquatic ecosystem but are also the root cause of nuisance algal blooms and excessive vegetation. Phosphorous and nitrogen inputs from natural decomposition, fertilizers, animal waste, or resuspension of bottom sediments are the most common vectors for introduction. A waterbody remains stable when nutrients are in limited supply, but excessive nutrients increase the carrying capacity for weed growth and algae. Although nutrient levels appear to be decreasing, values should be monitored.

## Ongoing Management Planning

As lakes age and are impacted by humans, active management strategies are necessary to achieve the desired outcomes. Management efforts should focus on nutrient mitigation to protect the aquatic ecosystem; however, reactive techniques utilizing pesticides may be useful to regain recreational use faster.

- *Aeration*

  Aeration does not inject oxygen into the waterboy but circulates and exposes the water to the atmosphere for efficient gas transfer. Ideally, the water should be turned over at least four times and operated to reduce heating during the summer season. Aeration in arid environments functions best when programmed to run at night when water temperatures begin to exceed $60^0$F. However, winter aeration schedules should be modified to reduce ice buildup and maintain oxygen concentrations. Aeration is not a cure but is most often implemented as the basis of treatment for common aquatic problems and assists the efficacy of other best practices.

- *Beneficial Bacteria*

  Bacterial augmentation is a natural way to combat nutrient loading by stimulating positive shifts in the base of the food chain and building natural competition. Non-pathogenic probiotics for lakes and ponds consist of denitrifiers, enzymes, and biological catalysts. In addition to the pelletized bacteria that target the sludge layer at the bottom, liquid bacteria support nutrient reduction in the water column entering from the landscape. Liquid bacteria can be poured directly over the aeration modules while the system is on or diluted and applied via a spray over the water surface. Probiotic applications should begin when water temperatures exceed $55^0$F for the best results.

- *Water Quality Monitoring*

  An ongoing water quality monitoring program is the best way to proactively adjust management strategies and track trends in water chemistry. A minimal annual water sample evaluates the lake's changing needs and identifies nutrient mitigation success. Maintaining good water quality is the key to successful aquatic resource management as it greatly affects aesthetics, fish health, and ecological balance.

- *Fish Stocking*

  When stocked at the proper density, grass carp are excellent at biologically minimizing nuisance aquatic weeds. As young fish, they consume more than their weight in vegetation but this declines with age. Low numbers of grass carp are initially introduced with additional stockings suggested depending on the level of control seasonally.