September 14, 2005

Providence Lake
P.O. Box 1011
Alpharetta, GA 30009

RE: Lake Fishery and Water Quality Survey

Aquatic Environmental Services, Inc. conducted an electrofishing survey on August 29, 2005 at 10:00am. We performed the fish analysis using an electroshock boat that stuns most fish species, but has a very low mortality. Additionally, a water quality analysis was performed.

The data collected from this study was analyzed and used to describe the current conditions of the fishery. Management recommendations are based on the current fish population in the pond and are made to improve the fishery by providing insight into the proper management of the pond to achieve the desired fishing goals.

Methods

Electrofishing is the most scientifically advanced method of analyzing fish populations in freshwater lakes and ponds in the southeastern United States. A 4-stroke engine emitting little, if any, pollutants into the water powered the boat. This boat effectively shocks a range of up to 10 feet in front of the boat and to a depth of 8 feet. It is biased toward elongated species such as largemouth bass due to higher conductivity. It also shocks larger fish better than small fish, and is not as efficient shocking catfish species.

We sampled all habitat types found in the lake, including open water, shallow points, wood structure, shallow covers, and deeper drop-offs. By sampling all habitats, all species present can be collected. Water conditions, such as visibility and temperature, were sufficient for the capture of fish.

An additional pond assessment we conduct is a relative weight index (Wr) on adult bass. This is a comparison of the standard weight of a bass at a given length to the actual weight of the collected bass at the same length. It determines the "plumpness" of the specimens. Values over 90% indicate a healthy bass population and adequate forage base. Relative weights below this level indicate limited "ideal" food sources for bass.

Table 1. Electrofishing Results

Species	Size	Quantity
Bluegill	2-3 Inch	Numerous
Bluegill	3-4 Inch	
Bluegill	4-5 Inch	
Bluegill	5-7 Inch	6
Bluegill	7-9 Inch	
Bluegill	>9 Inch	
Shellcracker	<4 Inch	
Shellcracker	4-6 Inch	
Shellcracker	6-9 Inch	4
Shellcracker	>9 Inch	
Bass	<4 Inch	1
Bass	4-8 Inch	8
Bass	8-10 Inch	6
Bass	10-12 Inch	9
Bass	12-14 Inch	1
Bass	>14 Inch	1
Average Relative Weight		86%
Other Species		
Crappie	9-11	3

The lake contains a good balance of the preferred species: Bluegill, redear, and bass. Upon visual inspection all species appeared healthy. These fish provide great fishing enjoyment for the pond owners and their guests. In order to achieve optimal bass growth we encourage the proper harvesting of fish. Exact recommendations are outlined at the end of report.

While the pond does contain bluegill, the absence of intermediate bluegill indicates that the larger bass do not have the “ideal” food source. Bass feed efficiently on bream 1/3 their length. When this ideal food source is unavailable the bass are forced to forage on a larger number of smaller fish. This causes the bass to expend more energy and weight gain is sacrificed. In this case, a good harvest plan will result in a better balance between the bass population and the ideal food supply.

Crappie are present in the pond and should be harvested when caught. The species is predatory and will compete with bass for forage. Crappie have two marked advantages in

this predatory competition because they begin the reproductive process at lower water temperatures than bass and therefore can spawn weeks earlier. This makes the first advantage the fact that bluegill, which supply forage for both bass and slightly older crappie, do not spawn until later in the year forcing the fingerlings of both predator species to compete for a limited supply of food. The second being that, while bass will feed on crappie 1/3 their size, the crappie are given a natural "head start" and outgrow the bass before they become a useful food supply. These advantages make population control of the crappie extremely difficult and a "takeover" immanent. Harvesting all crappie caught will not only be an enjoyable way to fish but will help to maintain a healthy balance for your pond while providing a delicious meal for your fisherman.

The Wr average for Providence Lake is calculated to be 86% with the biggest bass captured measuring 24 inches. This is due to the pond being "bass heavy" and this one bass reaching a size where he will begin to eat smaller bass. Goals should be set for an average Wr of 100% when managing for quality bass fishing. This means the lake is currently not experiencing maximum growth but can be improved by following recommendations.

Table 2. Water Quality Results

Parameter	Results
Conditions	85° F Cloudy
Water Temperature	82° F
PH	7.6
Dissolved Oxygen	6.9 mg @ 28°C 91% saturation
Visibility	5 ft
Hardness	7mg/L Total as $CaCO_3$
Alkalinity	10 as $CaCO_3$

Water Quality Parameter Descriptions

Dissolved Oxygen
Dissolved oxygen (DO) is a measure of the amount of oxygen available to aquatic organisms, and is reported as mg/l or percent saturation. Percent saturation is a representation of how much oxygen is dissolved in the water relative to the amount of oxygen that can be held at a specific temperature. Colder water can hold more oxygen than warm water. Dissolved oxygen fluctuates daily with it being at its lowest levels in the early morning hours. DO does not pose a problem for most fish until levels fall below 3 mg/l. A dissolved oxygen profile shows how stratification affects DO levels as depth changes.

pH
The pH measures the concentration of the hydrogen ions present in the water, and is usually thought of as the measurement of acidic or alkaline conditions. A pH of 7 is neutral with lower values being acidic and higher values being alkaline. Most organisms

in a lake prosper when the pH is maintained between 6.5 and 9. The pH cycles daily due to a complex interaction of alkalinity, hardness, carbon dioxide, and photosynthesis and respiration. The lake is more acidic in the mornings, and will also vary according to depth. When pH levels are out of the desired range for long periods, detrimental affects may occur.

Temperature

The temperature affects many other parameters making it critical to determine and report. It is also a major factor in the reproduction strategies of many fish species. When measured as a depth profile it indicates the possibility of year around trout habitat.

Hardness

Hardness is a measure of the quantity of divalent ions in water. Generally in Georgia, calcium and magnesium carbonate account for the majority of the hardness. Hardness levels affect the toxicity of some algaecides, limit phytoplankton formation, and play a role in fish growth. Levels below 15 mg/l should be increased with the addition of 2-3 tons per acre of agricultural lime.

Alkalinity

Alkalinity is defined as the quantity of base present in water. The most common bases include carbonates, bicarbonates, hydroxides, and phosphates. Total alkalinity is closely related to hardness with both being reported as mg/l $CaCO_3$. Alkalinity basically determines the buffering capacity of a lake. A good buffering capacity will absorb introductions of acids and bases with less change in pH levels. By maintaining the desired pH levels nutrients are more available to phytoplankton resulting in a lake that has an increased carrying capacity.

Visibility

Visibility is measured with the use of a secchi disc. The white/black disc 20-cm in diameter is lowered vertically through the water until it can no longer be seen. Suspended particles reduce this visibility level. Therefore, in the absence of turbidity from silt or mud the secchi disc serves as an international standard to indicate phytoplankton abundance.

Water Quality Results

The results fall within a normal range for a community pond. The visibility measured 5 ft, which is above of the preferred 18-24 inches for maximum fish production. The alkalinity is low but this is not a concern unless maximizing fish production. The oxygen and pH levels were adequate and normal. Fecal coliform results are submitted separately.

Goals

Many community ponds desire good quality fishing for bass, bream, and additional species. In addition to your individual goals, it is the goal in most lakes to have a balanced relationship between the predator (bass) and the prey (bluegill) populations. When these populations are balanced the prey are reproducing at high enough numbers to serve as forage for the predator, and the predator has a population large enough to limit

the number of prey. As a result, the pond produces catchable size bass and bluegill. In order to achieve all of these goals as listed above see management recommendations below.

Management Recommendations

1. **Harvesting –** Currently the lake is "bass heavy". In addition to enjoying the pond on a catch-and-release program fisherman may now be allowed to remove as many as 390 bass less than 12 inches and still maintain a good balance. It is not recommended to remove bluegill at this time. Any crappie should be removed when caught. Many community ponds find a logbook, placed at a public access point, useful in tracking harvested fish when multiple parties use the pond.

2. **Stocking –** We recommend stocking 3250 bluegill in the 4-6 inch range at a cost of $1950.00. Catfish provide a good game fish for children and families. We would stock the lake with 130 catfish in either the 7-9 inch size priced at $0.65 each or the 8-11 inch costing $1.00 each.

3. **Supplemental Feeding –** Feeding the bluegill floating fish food creates healthier bluegill that reproduce at higher rates therefore increasing the bluegill population. More importantly, feeding bluegill increases their weight, which consequently increases the weight of the bass. This is one of the easiest and most efficient methods for improving the pond. Having a feeder in the pond provides a great food source on a continuous basis. The feeders also concentrate bluegill for easier fishing.

4. **Fertilizing –** Because the community recreational use and high water flow regimes exist, fertilizing is not recommended at this time.

5. **Pond Habitat –** Weeds and algae were treated this year and at last visit all appeared in check. The overall conditions of the lake were good, but can be improved by the addition of more cover in the middle and aeration.

   The cover around the edges of lake is sufficient for those areas; however, more is needed in the center. Cover will attract bluegill and allow bass more opportunity for ambush points when foraging, as well as concentrate fish for successful fishing. There are many products available to provide cover ranging in size and price. We have both large and small habitat boxes at a cost of $5.00 or $2.00 each. A new addition to our product line is the O-NO Hang Fish Attractor, which provides a large amount of cover and the benefit of its no hang design for $30.00. A picture can be provided upon request.

   Aeration offers numerous benefits by providing increased oxygen to the water. These include increasing the fish holding capacity, reducing algae and undesirable plant growth, decreasing reproduction of mosquitoes, and the

elimination or prevention of odors. There are a number of ways to aerate. Submersed aeration offers the maximum impact by oxygenating the critical bottom waters. Bottom aeration is also the most energy efficient method. Surface aeration, while not as efficient in energy and impact as its submersed counterpart, offers an immediate oxygen increase, this is especially important during poor water quality situations. Fountains also improve aeration effects but have additional aesthetic and melodic values. Lighting options for fountains are also available.

Conclusion

The fishing and aesthetic value of the pond should continue to improve when implementing the above recommendations. Harvesting, stocking, supplemental feeding, and habitat improvement will produce the results that you desire. Please feel free to call with any questions or to place an order.

Sincerely,
Aquatic Environmental

Greg Grimes
President

Aquatic Environmental

August 5, 2005

RE: Providence Lake Fecal Coliform Bacterial Testing

Dear Lakeowners:

The fecal coliform sample taken on 7/13/2005 had results of 180 colonies/100 ml. This is below the limit set by EPD for this contaminant. Below is some background information to better explain this test.

Fecal coliform is the measure of the concentration of the bacteria *Escherichia coli*, which is specific to the guts of birds and mammals. The bacteria itself resides in the gut of humans, and is not harmful unless in high numbers. It serves as an indicator of possible sewage contamination because it persists longer than most other harmful pathogens associated with sewage, and it does not prosper or reproduce outside its host animal. Fecal coliform can originate from human or animal sources, and is usually higher after rains.

Ambient water quality standards exist to protect water quality for many purposes including human recreation and ecological protection. Human health risks from direct contact are evaluated by use of the fecal coliform bacterial test. These bacteria, normally found in the intestine of warm-blooded animals, are cultured and quantified to assess the potential exposure to disease causing organisms. Other ambient water quality standards exist to protect aquatic organisms and to protect humans that consume some of these organisms.

Fecal Coliforms were once thought only to be persistent for 24-48hrs after leaving their host warm-blooded animal or birds. But, in warm, moist climates such as here in the Georgia these organisms may bind with the sediments, nutrients and other bacteria of the soil and remain there dormant for several months until say a ground disturbance or rain event transport this contaminated sediments to streams and lakes. These bacteria will then register upon a fecal coliform test, if sampled after said rain event, in elevated high levels of maybe between 500 to 10,000 colonies but not as high as a sewer spill which would be somewhere between 10,000 and Too numerous to Count (TNTC). For this reason, erosion and sedimentation activities are also an important factor along with possible sources of pathogens and bacteria to monitor within your respective watershed basin upstream of your lake.

Land disturbing activities and subsequent changes in land use can cause dramatic alterations of the stream and lake environments. For this reason, Best Management Practices (BMP's) must be enthusiastically performed along side with an adequate monitoring program of lake head-waters for possible pollutants by testing for fecal coliforms.

The fecal coliform analysis does not test for all potential pathogens, but rather serves as an indicator test. It tests for the presence of E.coli. Elevated levels could be attributed to

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many sources. Some of the more common are leaking sewer lines or failed septic systems, animal waste in the watershed or excessive waterfowl use.

<table>
<tr><td colspan="6">Georgia Department of Natural Resources Rules and Regulations for Water Quality Control
Chapter 391-3-6 (Revised May 22, 1997)</td></tr>
<tr><td rowspan="2">Water Usage</td><td colspan="2">Bacteria/100 mL *
geometric mean</td><td colspan="2">Dissolved Oxygen:
average not less than</td><td rowspan="2">pH</td><td rowspan="2">Temperature °F:
not to exceed</td></tr>
<tr><td>May - Oct</td><td>Nov - Apr</td><td>Trout</td><td>Others</td></tr>
<tr><td>Drinking Water Supplies</td><td>200</td><td>1,000 (1)</td><td rowspan="3">6.0
never
<5.0</td><td rowspan="3">5.0
never
<4.0</td><td rowspan="6">6.0 to 8.5</td><td rowspan="6">90°</td></tr>
<tr><td>Recreation</td><td colspan="2">200</td></tr>
<tr><td>Fishing</td><td>200</td><td>1,000 (1)</td></tr>
<tr><td>Agricultural</td><td colspan="2">5,000</td><td colspan="2" rowspan="3">never <3.0</td></tr>
<tr><td>Industrial</td><td colspan="2">NA</td></tr>
<tr><td>Navigation</td><td colspan="2">5,000</td></tr>
<tr><td>Wild River</td><td colspan="5" rowspan="2">No Alteration of Natural Water Quality from any Source</td></tr>
<tr><td>Scenic River</td></tr>
<tr><td>Urban Stream</td><td colspan="2">2,000 (2)</td><td colspan="2">never <3.0</td><td>6.0 to 8.5</td><td>90°</td></tr>
</table>

*Based on at least 4 samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours

(1) not to exceed 4,000 colonies/100 mL for any one day

(2) not to exceed 5,000 colonies/100 mL for any one day

Please feel free to contact us with additional questions.

Sincerely,
Aquatic Environmental

Greg Grimes
President

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