ACRT 1990

Lake Management Consulting Progress Report
for
Rome Rock Lake Association
September, 1990

Prepared by

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INTRODUCTION

A nuisance algal bloom has plagued Rome Rock Lake for the past two summers and possibly longer. Algal blooms occur in water where there is an abundance of nutrients (primarily phosphorus) to support a large biomass of algae and where the water flow is slow enough to allow the algae time to grow and become established. Both of these conditions occur in Rome Rock Lake.

The possible sources of phosphorus to a lake or reservoir include: agricultural runoff, lawn fertilizers, incoming streams, septic systems, direct sewage discharges, animal waste, waterfowl and internal recycling from the lake sediments. Internal generation can also provide a major source of nutrients to a lake.

Internal release of nutrients from the sediments occurs when the oxygen content in the water drops to low levels. The phosphorus which has been chemically bound to the sediment particles is released under these conditions and will be made available to the algae cells. There are several different ways to stop the internal release of phosphorus. However, these treatment methods may not make an observable difference to the water quality unless the internal sources are contributing a large proportion of the total nutrient load to the reservoir.

The first step in determining whether internal loading is a problem in Rome Rock Lake is to determine the extent of the anoxic water during stratification.

METHODOLOGY

On August 20, 1990, Mr. Monroe Frados accompanied Diane Conyers-Rizzo on a dissolved oxygen survey of Rome Rock reservoir. Temperature and oxygen profiles along with Secchi disk measurements were taken at eight sites beginning at the dam and ending at the head of the reservoir. A water sample was also collected for a phytoplankton (algae) analysis to determine specifically what algae was "blooming" the day of our visit.

RESULTS AND DISCUSSION

Phytoplankton Analysis

The results of the phytoplankton (algae) analysis are shown in Attachment A. The dominant algae in the reservoir was Aphanizomenon flos-aquae. This is the same algae found to be dominant in 1989 by ACRT and in 1979 by Dr. Cooke.

Aphanizomenon is a nuisance bluegreen algae with short cylindrical or barrel-shaped cells. The cells contain pseudovacuoles which give this algae great buoyancy. This accounts for the fact that profuse growths become concentrated at the surface resulting in floating scums. Blooms of Aphanizomenon are not uncommon in nutrient rich, eutrophic lakes.

Aphanizomenon produces endotoxins which have been shown to cause fish kills and harm pets/livestock. The endotoxins are released as the algae cells die and decompose. This apparently is not a problem in Rome Rock Lake perhaps because this lake is a reservoir and water residence time is too short to allow a significant buildup of toxins in the water at any one time. However, in coves and inlets where the water does not readily mix with the main body of the reservoir, this may become a concern.

Other algal species identified in the sample, such as Cryptomonas, Trachelomonas and Euglena, are also commonly found in very nutrient waters. The presence of these species and other bluegreen algae (e.g., Microcystis and Anabaena) and the high total biovolume calculation of 7,604,486 cubic uM/ml indicates eutrophic conditions.

Dissolved Oxygen Survey

The results of the dissolved oxygen (D.O.) survey indicate that nearly the entire length of the lake area is anoxic; that is, that there is no or very little oxygen in the water below five meters (15 feet) **during the summer stratification period (Figures 1-8)**. If the oxygen levels at the sediment/water interface are very low, nutrients and metals that were chemically bound to the sediment particles are released into the water column. The nutrients (phosphorus) and metals (iron, manganese) become distributed throughout the water column during fall and spring turnover.

In addition to the problems of taste and odor which iron and manganese can cause to drinking water, and the algal populations that are supported by high phosphorus levels, an absence of oxygen in deep water poses a threat to the aquatic life.

Although the standards are written for streams, it should be noted that the Ohio EPA enforces 4 ppm (mg/l) as the minimum concentration of DO allowable in a warmwater habitat. A warmwater habitat is one capable of supporting balanced reproducing populations of warmwater fish and associated vertebrate and invertebrate organisms and plants. If this standard is used, the water below 5 meters in Rome Rock reservoir is unsuitable for fish other than those tolerant to low oxygen conditions such as carp and catfish.

RECOMMENDATIONS

1. **Winter Field Monitoring**

Dissolved oxygen and temperature profiles should be taken at the dam one time when the reservoir is under ice cover. A phosphorus profile (at a minimum of 5 depths) should be done simultaneously.

Rationale

Winter sampling is necessary to:

* determine if anoxia is a problem during the winter months, thus affecting the fish and aquatic invertebrates;
* determine if nutrients are being released during winter, thus contributing to the spring algal blooms; and
* begin to develop a time frame as to when an aeration system would need to be operating.

2. **Summer Field Monitoring**

Dissolved oxygen and temperature profiles should be taken at the three in-lake sites once a month from May through October. During the same visits, surface measurements of chlorophyll, phosphorus, Secchi disk and algae should be made at these three in-lake sites. In addition, water samples should be collected to determine phosphorus concentrations at different depths in the water column at the deep hole (dam site).

Rationale

These parameters are used to determine the trophic state of a lake. When these values are plugged into Carlson's trophic state index, the condition of the lake at the present time is determined. This condition can be compared with the 1978 data set and can be used a baseline to evaluate lake treatments.

The monitoring of these parameters will be key in identifying the extent of certain problems (such as internal nutrient loading, loss of fisheries habitat, and taste/odor problems in drinking water). Ultimately, this information will be used to determine the best in-lake treatments.

In particular, the dissolved oxygen data is needed to consider the feasibility of using certain treatments (e.g. hypolimnetic aeration) to inhibit internal release of phosphorus, iron and manganese.

3. **Watershed Study**

The watershed should be studied to determine land uses and potential impacts. Aerial photos are the test and most efficient way to determine the land use around a lake or reservoir. The ASCS office in Ashtabula has aerial photographs of the area. These can be used in conjunction with USGS maps and site visits to outline the watershed and determine areas of potential impact.

Rationale

A watershed study will show the potential sources of nutrients, organic and silt loads to the reservoir. Until these sources are identified, they can not be diverted and/or treated. The photographs will reveal the magnitude of the area contributing to the problems within the reservoir.

4. **Macrophyte Survey and Harvesting Strategy**

The macrophyte community should be mapped and the plant species identified. This task can be done with a boat, a rake, and a measuring tape.

Rationale

This information is important when planning a harvesting strategy for the lake. Keeping fish spawning and boat access in mine, a harvesting time table can be prepared for Rome Rock once areas plagued with early spring plants and later plants are identified.

5. Analysis of Aeration Options

There are several types of aeration systems that can be used to retard the release of nutrients from the sediment. These include: aerators, circulators, and hypolimnetic aeration systems. An analysis of these various systems in light of Rome Rock's current limnological data is necessary.

Rationale

Research is required to study the cost, effectiveness, and the side-effects of each system. Case histories of how the various systems have worked in similar lakes/reservoirs need to be studied before a system can be chosen for Rome Rock Lake.

COST PROPOSAL FOR ACRT SERVICES RECOMMENDED FOR 1991

1. Winter Field Sampling to monitor dissolved oxygen, temperature and phosphorus at 5 depths at the deep hole. Cost per trip includes time, travel, data analysis and report. One trip recommended during ice cover sometime in January or February of 1991 . . . . $520 per trip

2. Summer Monitoring (May-October) at three surface stations on the reservoir for chlorophyll, phosphorus, algae, dissolved oxygen, temperature and Secchi. A phosphorus profile will be taken at 5 depths at the deep hole. Cost per trip includes time, travel, data analysis and report . . . . $970 per trip

   Monthly monitoring is recommended from May to October
   Six trips @ $970 per trip $5,820

3. Watershed Study $1,500

4. Macrophyte Survey and Harvesting Strategy $1,500

5. Analysis of Aeration Options . . . . $ 680

Miscellaneous Consulting Time for Other Tasks $40/hour

Attachment A
PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Roaming Rock Lake

SAMPLE DATE: 90-08-21

TOTAL DENSITY (#/ml): 6862

TOTAL BIOVOLUME (cu.uM/ml): 7604486

TROPHIC STATE INDEX: 64.5

DIVERSITY INDEX: 1.08

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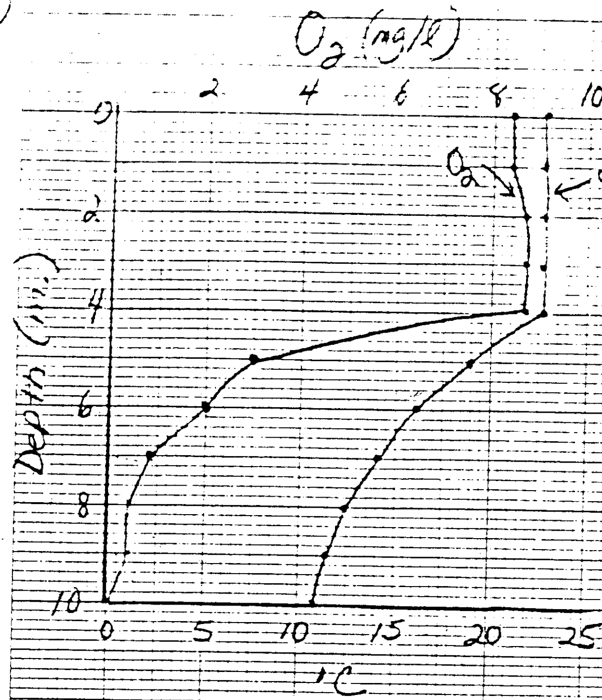
1	Aphanizomenon flos-aquae	5799	84.5	6958286	91.5
2	Rhodomonas minuta	354	5.2	9001	0.1
3	Cryptomonas erosa	226	3.3	117260	1.5
4	Trachelomonas volvocina	97	1.4	182172	2.4
5	Mallomonas sp.	64	0.9	24483	0.3
6	Chlamydomonas sp.	64	0.9	20939	0.3
7	Trachelomonas hispida	64	0.9	135300	1.8
8	Cyclotella stelligera	32	0.5	1772	0.0
9	Sphaerocystis schroeteri	32	0.5	4510	0.1
10	Euglena sp.	32	0.5	18684	0.2
11	Microcystis aeruginosa	32	0.5	3221	0.0
12	Trachelomonas sp.	32	0.5	64429	0.8
13	Anabaena flos-aquae	32	0.5	64429	0.8

August 20, 1990 [illegible]

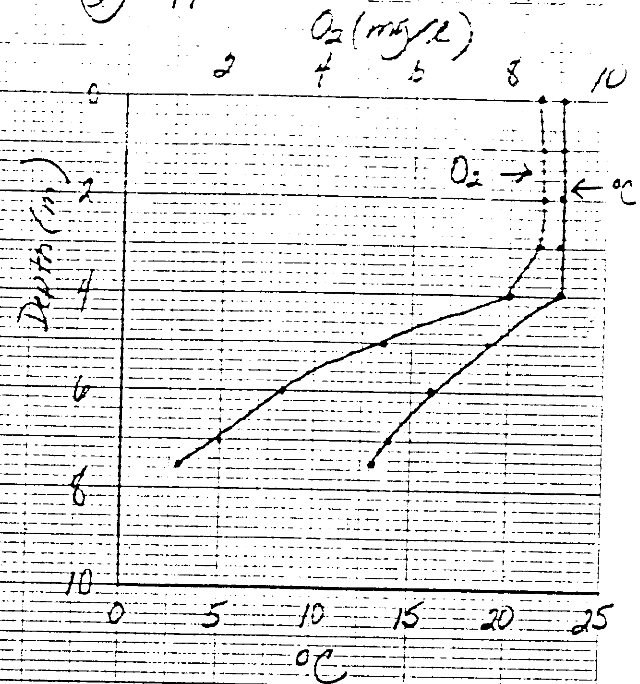
near the dam — Rome Rock Lake

①



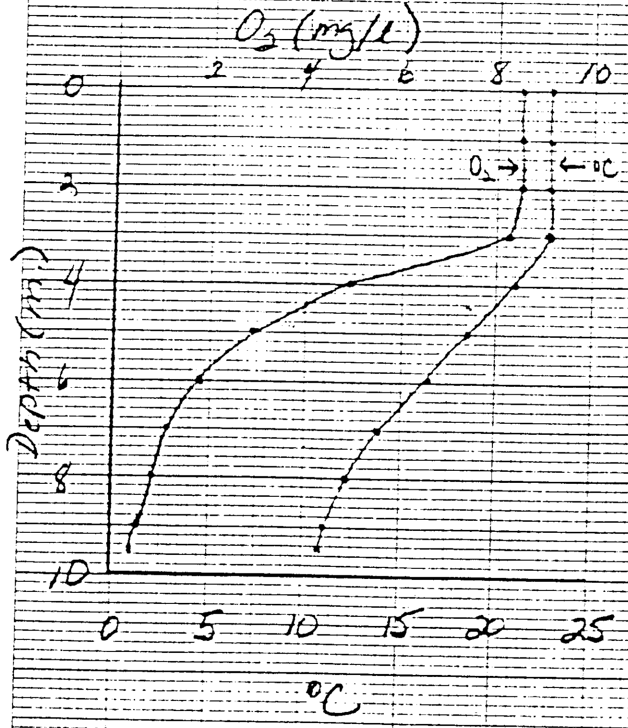
Secchi Depth = 2'6"

② Opp. Frados + Culvert



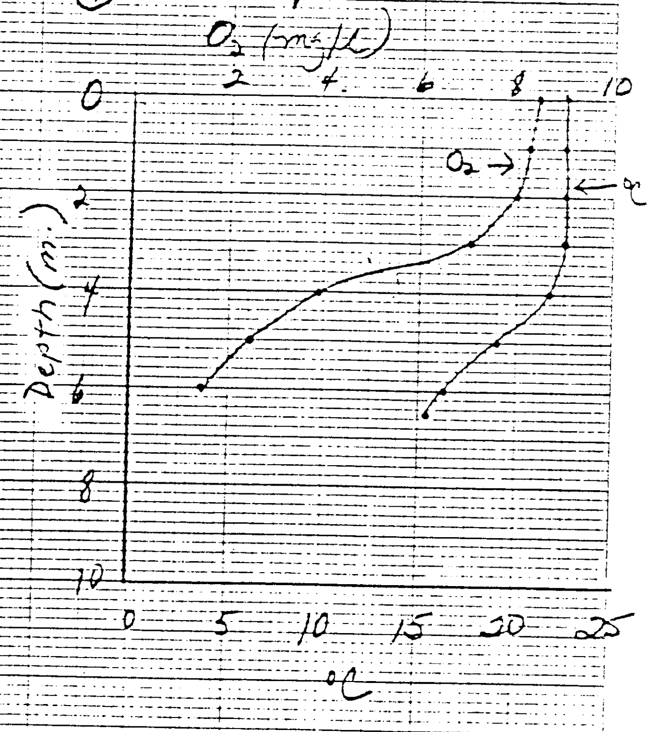
Secchi Depth = 2'6"

③ Near Bakley's at entrance to Plum Crk.



Secchi Depth 2'6½"

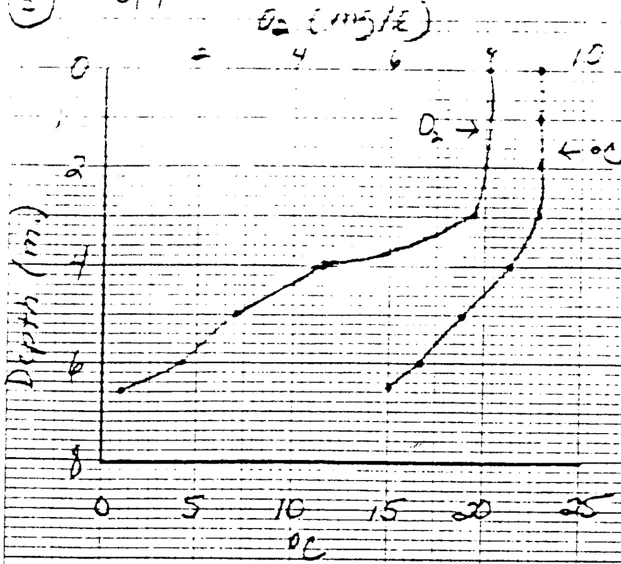
④ (See map for location)



Secchi Depth 2'11"

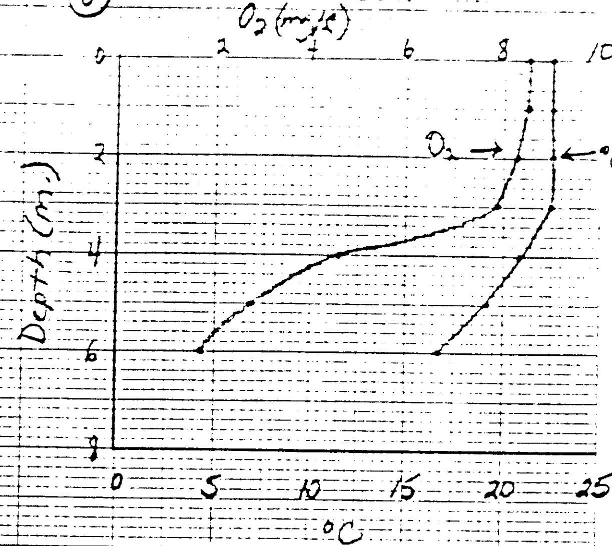
20 Squares to the Inch

(5) opposite swim beach



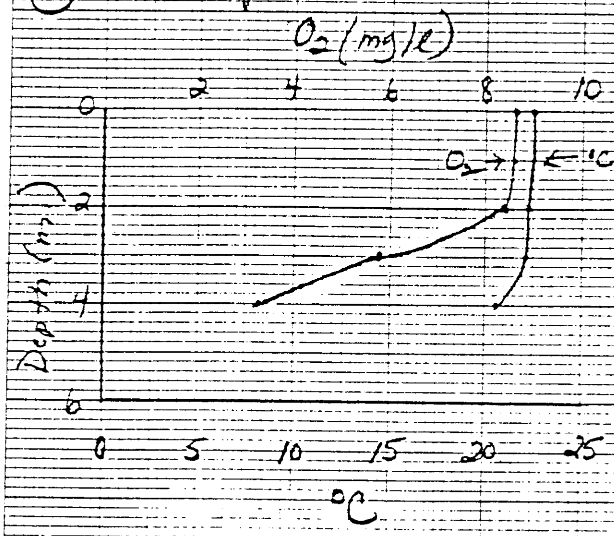
Secchi Depth 2'7"

(6) Between Blue House + Island



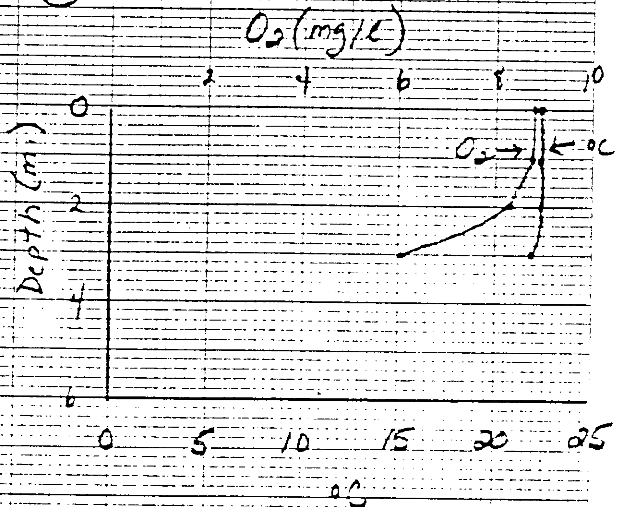
Secchi Depth 2'4"

(7) See map for location



Secchi Depth = 1'11"

(8) No wake buoy



Secchi Depth =

20 Squares to the Inch