LAKE WATER QUALITY ASSESSMENT REPORT

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF WATER RESOURCES

LAKE CARASALJO

LAKEWOOD, OCEAN COUNTY

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PREFACE

The 1986 revisions to the Clean Water Act requires states to provide the United States Environmental Protection Agency (USEPA) with water quality information on public lakes. This information is a prerequisite for eligibility in the USEPA Clean Lakes Program.

The New Jersey Department of Environmental Protection obtained a grant to assess the water quality of the State's lakes during 1989. The objectives of the FY 89 Project were to acquire limited limnological data for 21 lakes. The data was analyzed to determine the trophic status for each lake.

Lakes were selected based on several criteria which included; the amount of public access the lake provided, it's recreational usage (e.g. swimming, fishing, ...) and it's value as a local resource. The following lakes were surveyed during 1989:

COUNTY	LAKE
Burlington	Lake Absegami
	Crystal Lake
	Evans Pond
	Indian Mills Lake
	Jefferson Lake
	Smithville Lake
Camden	Cooper River Lake
Cape May	East Creek Pond
	Lake Nummy
Gloucester	Greenwich Lake
	Iona Lake
	Narriticon Lake
Mercer	Mercer County Park Lake
	Rosedale Lake
Middlesex	Brainerd Lake
	Farrington Lake
Monmouth	Mac's Pond
Morris	Lake Ames
	Mount Hope Pond
Ocean	Lake Carasaljo
Passaic	Shepherds Lake

CONTENTS

SCOPE OF SURVEY

The quality of a lake's water is determined by many factors. These factors may be found within the lake itself or they may come from the watershed surrounding it. The collection of data through sampling and measurements can help to determine what may be influencing the lake's water quality. Although the scope covered by this report is somewhat limited, the following data may be found:

1. Limited Historical Data
2. Geology
3. Morphology and Hydrology
4. Physical & Chemical Data Results
5. Biological Data

All lakes in the program were monitored three times during the year; once each during the spring, summer and fall. Samples were taken at the major inlets and at sites deemed representative of the entire lake. Samples were taken above the outlet when a boat was unavailable. The samples were analyzed for the following parameters:

In-situ analysis:

1. Temperature
2. Dissolved Oxygen
3. pH
4. Depth and Secchi readings
5. Visual check of Macrophytes

Laboratory Analysis (NJ Department of Health):

1. Bacterial Analysis
2. Alkalinity
3. Nutrients

Biological Analysis (Bio-Monitoring Unit of the NJDEP):

1. Chlorophyll a
2. Algal Scan (Microscopic)
3. Macrophyte Survey

EXPLANATION OF PARAMETERS SAMPLED

PHYSICAL AND CHEMICAL PARAMETERS

1. TEMPERATURE AND DISSOLVED OXYGEN (D.O.):
The temperature of a shallow lake generally follows climatic changes. As the temperature of the water increases the dissolved oxygen level of the water decreases. A deeper lake will usually stratify thermally, during the summer. A warmer, less dense layer of water (epilimnion) will float on a cooler, denser layer of water (hypolimnion). These two layers are separated by a zone of rapidly changing temperature and density called the metalimnion. The metalimnion, can form a barrier, which can keep the hypolimnion from being reoxygenated from the atmosphere. In a productive (eutrophic) lake this can cause anoxic conditions in the hypolimnion as oxygen is used up by animals and decomposers (bacteria).

2. ALKALINITY AND pH:
Alkalinity is a measurement that indicates the degree to which an aquatic system can buffer pH changes that can occur during photosynthesis and/or by the introduction of pollutants. The toxicity of certain pollutants can be reduced by this buffering action. A minimum of 20 mg/L $CaCO_3$ has been recommended, except where natural conditions are lower (Quality Critera for Water, 1986, EPA 440/5-86-001). The Pine Barrens are an example of an area where natural conditions favor low alkalinity.
PH is a measurement of hydrogen ion activity or the acid-base equilibruim in natural waters. The pH can be raised by the photosynthetic processes of algae and/or macrophytes.

EXPLANATION OF PARAMETERS SAMPLED

3. NUTRIENT ANALYSIS:
Phosphorus and nitrogen are the major nutrients required by algae for growth. In New Jersey's lakes, phosphorus is the nutrient most often responsible for limiting algal growth. Dissolved orthophosphorus is believed to approximate the solid reactive phosphorus used by all photosynthetic organisms (aquatic plants/ algae). However, all forms of total phosphorus can become reactive through biological decomposition and can be used as nutrients to enhance weed growth and/or algae blooms.

Nutrients can enter a lake or it's watershed via point (i.e. sewerage treatment plant) or nonpoint sources (i.e. fertilizer runoff from lawns). Nutrients may also be recycled from the sediments in the lake.

4. SECCHI DISC TRANSPARENCY:
A greater depth of light transmission generally indicates good water quality (low algal growth). However, heavy macrophyte growth can also keep the water clear. The macrophytes may outcompete the algae for nutrients and therefore, restrict most algal growth. Erosion from the watershed or upwelling of the lake's sediments, from adverse weather conditions, could also decrease the water's transparency. To determine the transparency of a lake's water a secchi disk is used. The secchi disk is an 8 inch black and white disk. Measurements are taken by lowering the disk until it is no longer visible.

EXPLANATION OF PARAMETERS SAMPLED

BIOLOGICAL DATA

1. BACTERIAL ANALYSIS:

Bacterial samples for Total coliform, Fecal coliform (FC) and Fecal streptococcus (FS) were taken at the inlets and in-lake. While sources are difficult to determine with 3 sampling runs, the ratio of FC/FS can imply whether the source is from human or animal waste.

FC/FS	Possible Bacterial source (Millipore Corp. 1972)
>4	-Human wastes
2-4	-Mainly human wastes and other sources
1-2	-Inconclusive
0.7-1	-Mainly animal wastes and other sources
<.7	-Animal wastes

A lake's water is considered unsafe for swimming when Fecal coliform levels exceed 200 mpn/100ml.

2. CHLOROPHYLL a/ALGAE

Chlorophyll a is a pigment that is present in all types of algae. The chlorophyll a content of the water can indicate the amount of planktonic algae present in the lake. Algae are an important part of a lake ecosystem because they are a vital part of the food chain. However, an excessive amount of algae can negatively impact a lake. Excessive algae growth can inhibit the growth of other plants, cause aesthetic problems and curtail recreational uses. Through the processes of photosynthesis, increased algal growth can raise the dissolved oxygen level in a lake during the daytime (sunlight) and decrease the dissolved oxygen level during the night (dark). Depressed dissolved oxygen levels, if extreme, could cause fishkills.

EXPLANATION OF PARAMETERS SAMPLED

3.ALGAL SURVEY:
As the growing season proceeds, a succession of algal communities typically occurs in a lake. During the spring and fall, diatoms are usually dominant. In the early summer, chlorophytes (green algae) become dominant. As available nutrients change during the summer, filamentous green or blue-green algae may become dominant. These may float to the surface forming mats that can cause aesthetic and recreational problems.

High chlorophyll a levels with little algal species diversity are indicative of nutrient rich water.

4.MACROPHYTE SURVEY:
Macrophytes are also a vital part of a lake. They provide cover for fish and food for wildlife. However, excessive macrophyte growth can limit the recreational uses of a lake including swimming, fishing and boating. A visual survey was done to identify and determine areal coverage of macrophytes.

LAKE TROPHIC STATES

Lake eutrophication (aging) is a natural process resulting from the gradual accumulation of nutrients, increased productivity, and filling in from sediments, silt and organic matter.

Lakes usually follow a progression through a series of trophic states, which are the following:

1. Oligotrophic
   - -nutrient poor and low biological productivity.

2. Mesotrophic
   - -intermediate levels of nutrients and biological productivity.

3. Eutrophic
   - -nutrient rich and highly productive.

Accelerated or cultural eutrophication occurs to a lake when nutrients, silt and organic matter inputs are increased by activity in the watershed. Several examples of increased inputs include; a sewage treatment plant discharging into a lake, runoff of fertilizers from farms or lawns, and erosion from new construction sites. Because of New Jersey's large population, all lakes in the State are considered to be threatened by accelerated eutrophication.

INTRODUCTION

Lake Carasaljo is a 67 acre body of water located in Lakewood Township, Ocean County. It is fed by one stream which is the South Branch of the Metedeconk. Several storm sewer pipes also drain into the lake. Lake Carasaljo has a maximum depth of about eleven feet. All land adjacent to the lake is township property which includes a park and a large beach with guarded swimming area. The lake is accessible to fishing from many points along the shoreline but it is hampered by aquatic vegetation.

LAKE NUM. AND NAME: #6048 LAKE CARASALJO

STUDY PERIOD: SPRING, SUMMER, FALL 1989

LOCATION: LAKEWOOD TWP., OCEAN CO.

U.S.G.S. QUAD: #24 LAKEWOOD

LAKE AREA: 67 ACRES

LAKE MAXIMUM DEPTH: 11 ft.

GEOLOGIC DESIGNATION: TKW KIRKWOOD SAND AND OCEAN CAPE MAY SAND SURFACE.

TRIBUTARIES: SO. BRANCH METEDECONK

LAKE USE AND HISTORICAL NOTES: SWIMMING, FISHING AND BOATING. SAMPLED 1975, 1976, 1977 AND 1980.

COMMENTS: UPPER LAKE AND SIDES CHOKED BY MYROPHYLLIUM, CABOMBA AND ELODEA. POTENTIAL RUNOFF FROM STORM SEWERS, PARK AND HOMES.

RESULTS

PHYSICAL/CHEMICAL PARAMETERS

Temperature and Dissolved Oxygen

The temperatures and dissolved oxygen levels were uniform throughout the water column during each of the sampling runs. The dissolved oxygen levels were never below 7.2 mg/l during the monitoring period.

Secchi Disk

Transparency of the lake's water ranged between 2.0 feet and 2.5 feet.

Alkalinity and pH

The alkalinity of the water ranged from 5 mg/l to 7 mg/l and therefore, offered poor buffering capacity. The pH ranged from 6.10 to 6.39.

Nutrients

Total phosphorus levels, in the water column, ranged from 0.04 mg/l to 0.06 mg/l.

RESULTS

BIOLOGICAL DATA

Chlorophyll a/Algae

Chlorophyll a levels for the summer and fall were 18.97 mg/m^3 and 8.21 mg/m^3 respectively. No analysis for the spring sample due to a lab malfunction. Species diversity was minimal during the spring and summer with Euglenophytes present both times. Species diversity increased during the fall.

Macrophytes

The upper third of Lake Carasaljo was completely overgrown with aquatic macrophytes. Water milfoil (Myriophyllum spp.), fanwort (Cabomba caroliniana) and elodia (Elodia canadensis) were the dominant species. In the central and lower portions of the lake aquatic vegetation grew out from the shoreline and only the middle area of the lake and the bathing area were weed free. About 60% of the central and lower area of the lake was inundated by macrophytes. The dominant species were water milfoil and bladderwort (Utricularia spp.).

Bacteria

Fecal coliform counts were less than 20 mpn/100ml for all three samplings, indicating safe swimming conditions on these dates.

CONCLUSION

Lake Carasaljo is considered to be eutrophic because of several factors. Total Phosphorus levels in the water column were moderately high and chlorophyll a levels during the summer were elevated but the largest problem affecting the lake was the proliferation of aquatic macrophytes throughout it's boundaries.

Some of the lake's recreational uses were negatively impacted by the heavy growth of macrophytes. Because the boat launching area was located at the upper end of the lake, where the macrophyte growth was heaviest, access to the open (weed free) areas of the lake was difficult. Fishing was also impacted by the macrophyte growth. Since the shallow areas along the shoreline were inundated with aquatic plant growth, bank fishing was severely hampered. Except for stray, floating pieces of macrophytes, the swimming area appeared to be unaffected.

The ecology of the lake could be negatively affected by the extensive growth of macrophytes. As they die and accumulate on the lake bottom, the depth of the lake over time will decrease and the nutrients present in the sediments will increase, creating more area for macrophyte growth.

A permit was acquired from the State of New Jersey to apply herbicides to Lake Carasaljo during the spring of 1989. Two hundred pounds of Sonar were applied to a twelve acre area of the lake. Minimal results were attained due to flushing from heavy rains. The application of herbicides addresses the problem on only a short term basis and does not address the causes of the problem.

REFERENCES

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Lake and Reservoir Restoration Guidance Manual. 1988. North American Lake Management Society. First Edition.

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Trudeau, Philip N. 1982. Nuisance Aquatic Plants and Aquatic Plant Management Programs in The United States.

USEPA 1980. Clean Lakes Program Guidance Manual. EPA 440/5-81-003.

Wetzel, Robert G. 1983. Limnology. Saunders College Publishing, New York.

APPENDIX

	DATE	TEMP	D O	pH	ALK	TOT P	ORTHO P	F COLI	F STREP	TOT COLI	FC/FS	SECCHI (feet)
INLET	05/04/89	15.5	10.2	5.50	3	.05	.05	<20	13	NA		
	06/29/89	20.2	8.1	5.93	5	.06	.01	330	130	490	2.54	
	09/06/89	16.9	7.8	6.33	5	.05	.03	330	920	460	.36	
UPPER LAKE	05/04/89	14.0	9.8	5.60	3	.05	<.01	20	49	NA	NA	
	06/29/89	23.2	6.4	6.15	6	.04	<.01					2.0
	09/06/89	21.0	8.2	6.42	6	.04	.01					
LOWER LAKE	05/04/89	15.5	8.8	6.10	5	.06	<.01	<20	49	NA	NA	
	06/29/89	24.2	7.8	6.39	7	.04	<.01	<20	17	50	NA	2.5
	09/06/89	21.1	7.2	6.24	7	.04	.01	<20	130	20	NA	2.0

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/06/29
Sample No. 76007
Lakes Management
Carasaljo Lake (lower lake), NJ

Plankton Identification

EUGLENOPHYCEAE (motile green)
Euglena caudata
E. hemichromata

CHRYSOPHYCEAE (golden or brown)
Synura uvella

CRYPTOPHYCEAE (colorless or brownish)
Cryptomonas ovata

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Macrophyte Identification

Cabomba caroliniana
Elodea sp.
Myriophyllum sp.

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Chlorophyll Analysis

Chlorophyll "a" (mg/m^3) = 18.97

Analyst(s)/Unit _____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/09/06
Sample No. 69335
Lakes Management
Lake Carasaljo (lower lake), NJ

Plankton Identification

CHLOROPHYCEAE (green)
- Ankistrodesmus falcatus
- Arthrodesmus octocornis
- Chlorella vulgaris
- Cosmarium sp.
- Nannochloris sp.
- Staurastrum limneticum
- S. manfeldtii
- S. subcruciatum

BACILLARIOPHYCEAE (diatom)
- Eunotia sp.
- Melosira sp.
- Navicula cryptocephala
- Synedra ulna
- Tabellaria sp.

DINOPHYCEAE (dinoflagellate)
- Glenodinum penardiforme

MYXOPHYCEAE (blue-green or other color)
- Oscillatoria minima
- Pseudoanabaena sp.

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Macrophyte Identification

Cabomba caroliniana
Myriophyllum sp.
Utricularia purpurea
Vallisneria americana

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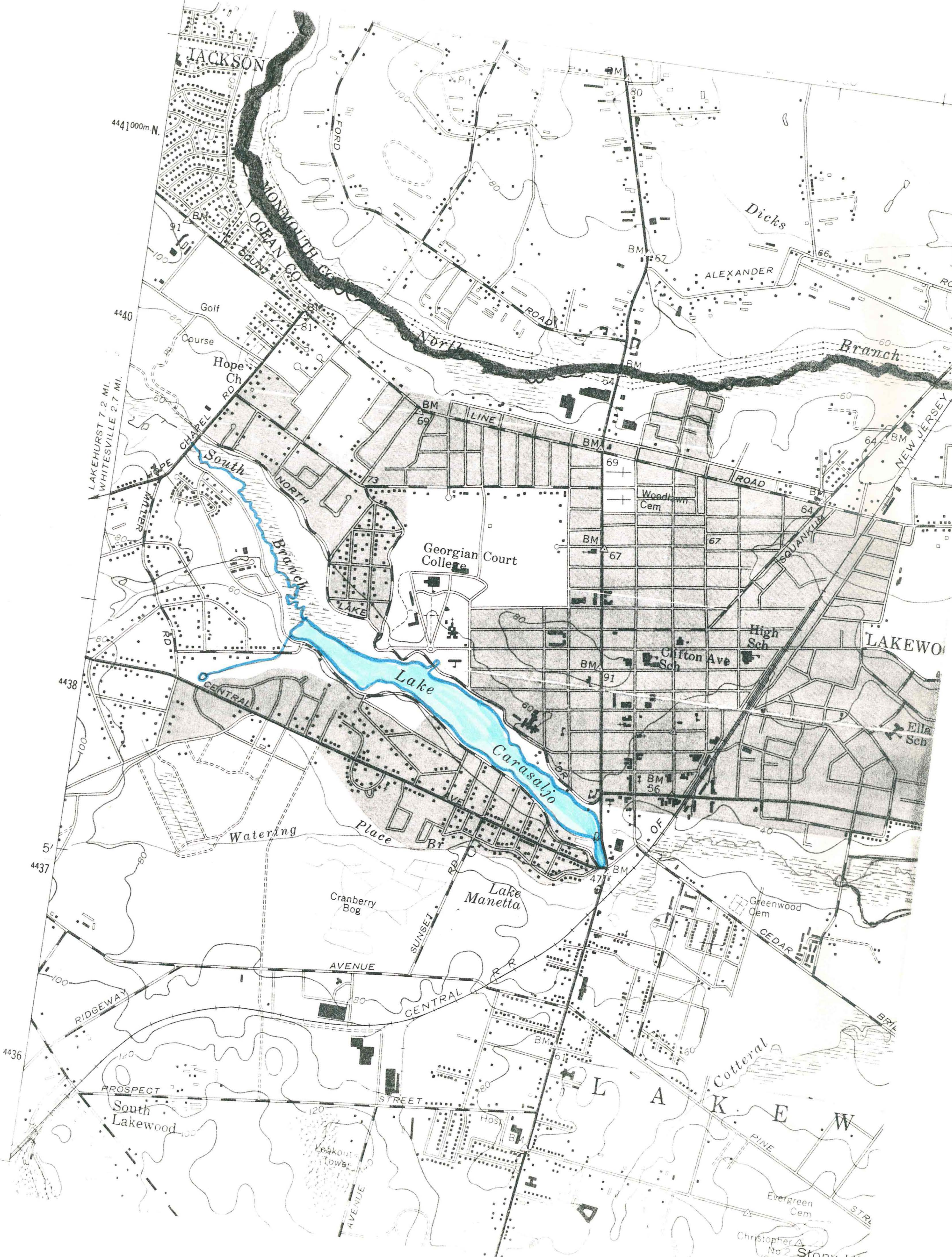
Chlorophyll Analysis

Chlorophyll "a" (mg/m^3) = 8.21

Analyst(s)/Unit _____



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LAKEHURST 7.2 MI.
WHITESVILLE 2.7 MI.
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SQUANKUM
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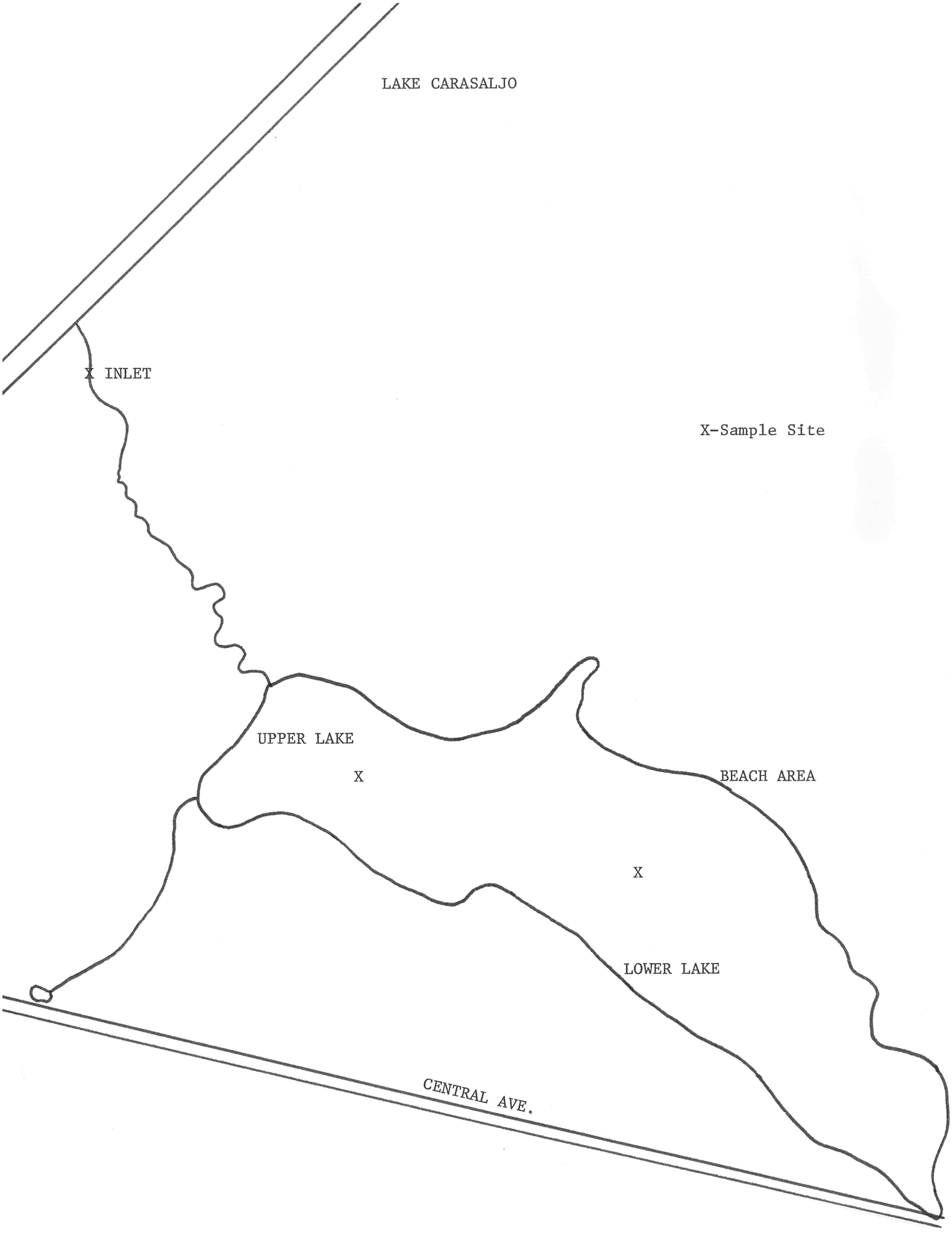
LAKE CARASALJO
X INLET
X-Sample Site
UPPER LAKE
X
BEACH AREA
X
LOWER LAKE
CENTRAL AVE.