LAKE WATER QUALITY ASSESSMENT REPORT

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF WATER RESOURCES

EVANS POND

EVESHAM TOWNSHIP, BURLINGTON COUNTY

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Management

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

Evans Pond is an eight acre body of water located in Evesham Township, Burlington County. It was formed in the late 1700's by the damming of two streams. The pond is fed by two streams, Powell Mill Creek and Cold Spruce Run which combine just before they enter the lake. There are no areas for swimming or launching a boat but much of the lake is accessible to fishing from the shoreline. It is a shallow lake with a maximum depth of three and one-half feet, with much of the upper portion only about one foot deep.

LAKE NUM. AND NAME: #1776 EVANS POND

STUDY PERIOD: SPRING, SUMMER, FALL 1989

LOCATION: EVESHAM TWP., BURLINGTON CO.

U.S.G.S. QUAD: #26 CLEMENTON

LAKE AREA: 8 ACRES

LAKE MAXIMUM DEPTH: 3.5 ft.

GEOLOGIC DESIGNATION: TKW KIRKWOOD SAND

TRIBUTARIES: 1) POWELS MILL CREEK
2) COLD SPRUCE RUN

LAKE USE AND HISTORICAL NOTES: FISHING. SAMPLED 1975 AND 1976.

RESULTS

PHYSICAL/CHEMICAL PARAMETERS

Temperature and Dissolved Oxygen

Due to the shallow depth of the lake, temperatures and dissolved oxygen levels were uniform throughout the water column. The dissolved oxygen level of the water was only 4.0 mg/l when sampled during the summer.

Secchi Disk

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

Alkalinity and pH

The alkalinity of the water was low ranging from 16 mg/l to 21 mg/l and therefore, offered little buffering capacity. The pH varied from 6.49 in the summer to 7.31 in the spring.

Nutrients

Total phosphorus levels in the water column were 0.04 mg/l for each monitoring run.

RESULTS

BIOLOGICAL DATA

Chlorophyll a/Algae

Chlorophyll a levels for the summer and fall were 5.69 mg/m^3 and 13.88 mg/m^3 respectively (analysis was not performed on spring sample due to lab malfunction). A filamentous blue-green algae (Oscillatoria) was growing on the bottom and submerged substrates. It was also collecting in floating mats along the shoreline.

Macrophytes

Spatterdock (Nuphar spp.) growing in the upper portion and along the sides, covered about 20% of the lake. Arrowhead (Sagittaria latifolia) covered about 70% of the lake's shoreline.

Bacteria

Fecal coliform levels were less than 20 mpn/100ml, 70 mpn/100ml and 3500 mpn/100ml for the spring, summer and fall respectively. The fall sample is above accepted limits for swimming and may have been caused by heavy rains the preceding night. Evans Pond is not utilized for swimming.

CONCLUSION

Evans Pond is considered to be in a eutrophic state because of heavy blue-green algae growth and low dissolved oxygen levels. The dominant algae Oscillatoria is often associated with nutrient-rich or polluted waters. Evans Pond was also experiencing a sedimentation problem with a maximum depth of only 3.5 feet.

The recreational use of the pond was impacted by the algae growth. Fishing from parts of the shoreline was prevented due to floating mats of blue-green algae.

The ecology of the pond may also have been affected by the algae growth. Several factors may have contributed to the low dissolved oxygen levels in Evans Pond during the summer sampling run. The low dissolved oxygen levels during the morning, when the pond was sampled, may have been due to the oxygen demand of the large quantity of algae in a small, shallow body of water in combination with the respiration of other lake organisms. The organisms present may have included oxygen consuming bacteria that breakdown algae that has died and settled on the lake bottom. Dissolved oxygen levels under 4.0 mg/l can be stressful to certain organisms inhabiting the lake including favorable fish species.

REFERENCES

Aquatic Vegetation of New Jersey. 1965. Rutgers Extension Service Bulletin # 382.

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

NJDEP. 1987. Water Resources Field Procedures Manual.

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

STATION	DATE	TEMP	D.O.	pH	ALK.	TOT P	ORTHO P	F COLI	F STREP	T COLI	FC/FS	SECCHI (feet)
INLET	04/20/89	13.7	10.0	7.14	17	.05	<.01	2530	240	2530	10.54	
	07/10/89	27.0	5.4	6.62	25	.05	.01	460	350	16000	1.31	
	09/20/89	20.7	6.1	6.63	22	.05	<.01	3500	>2400	>24000	NA	
LAKE	04/20/89	13.0	10.3	7.31	18	.04	<.01	<20	49	110	NA	2.5
	07/10/89	26.8	4.0	6.49	21	.04	.01	70	240	9200	.29	2.5
	09/20/89	21.3	6.0	6.63	16	.04	<.01	3500	>2400	5400	NA	2.0

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/04/20
Sample No. 76788
DWR/Lakes Management
Evans Pond

Plankton Identification

CHLOROPHYCEAE (green)
Chlamydomonas sp.
Spirogyra sp.

CHRYSOPHYCEAE (golden or brown)
Dinobryon sp.
Synura uvella
Trachelomonas sp.

MYXOPHYCEAE (blue-green)
Spirulina sp.

Analyst/Unit _____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/07/10
Sample No. 76834
Lakes Management
Evans Lake, NJ

Plankton Identification

CHLOROPHYCEAE (green)
- Ankistrodesmus falcatus
- Closterium acutum
- C. venus
- Coelastrum cambricum
- Palmella mucosa
- Scenedesmus quadricauda
- Spondylosium planum
- Staurastrum apiculatum
- S. cingulum

EUGLENOPHYCEAE (motile green)
- Trachelomonas robusta

BACILLARIOPHYCEAE (diatom)
- Neidium iridis
- Nitzschia palea
- Rhizosolenia eriensis
- Stauroneis anceps
- Synedra ulna

DINOPHYCEAE (dinoflagellate)
- Peridinium sp.

MYXOPHYCEAE (blue-green or other color)
- Oscillatoria minima
- O. princeps
- O. redekei

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Chlorophyll Analysis

Chlorophyll "a" (mg/m^3) = 5.69

Analyst(s)/Unit _____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/09/20
Sample No. 76028
Lakes Management
Evans Pond, NJ

Plankton Identification

CHLOROPHYCEAE (green)
- Ankistrodesmus falcatus
- Chlamydomonas sp.
- Chlorella vulgaris
- Closterium sp.
- Nannochloris sp.
- Staurastrum chaetoceras
- S. orbiculare

BACILLARIOPHYCEAE (diatom)
- Navicula sp.
- Nitzschia acicularis
- Synedra ulna

MYXOPHYCEAE (blue-green or other color)
- Chroococcus varius

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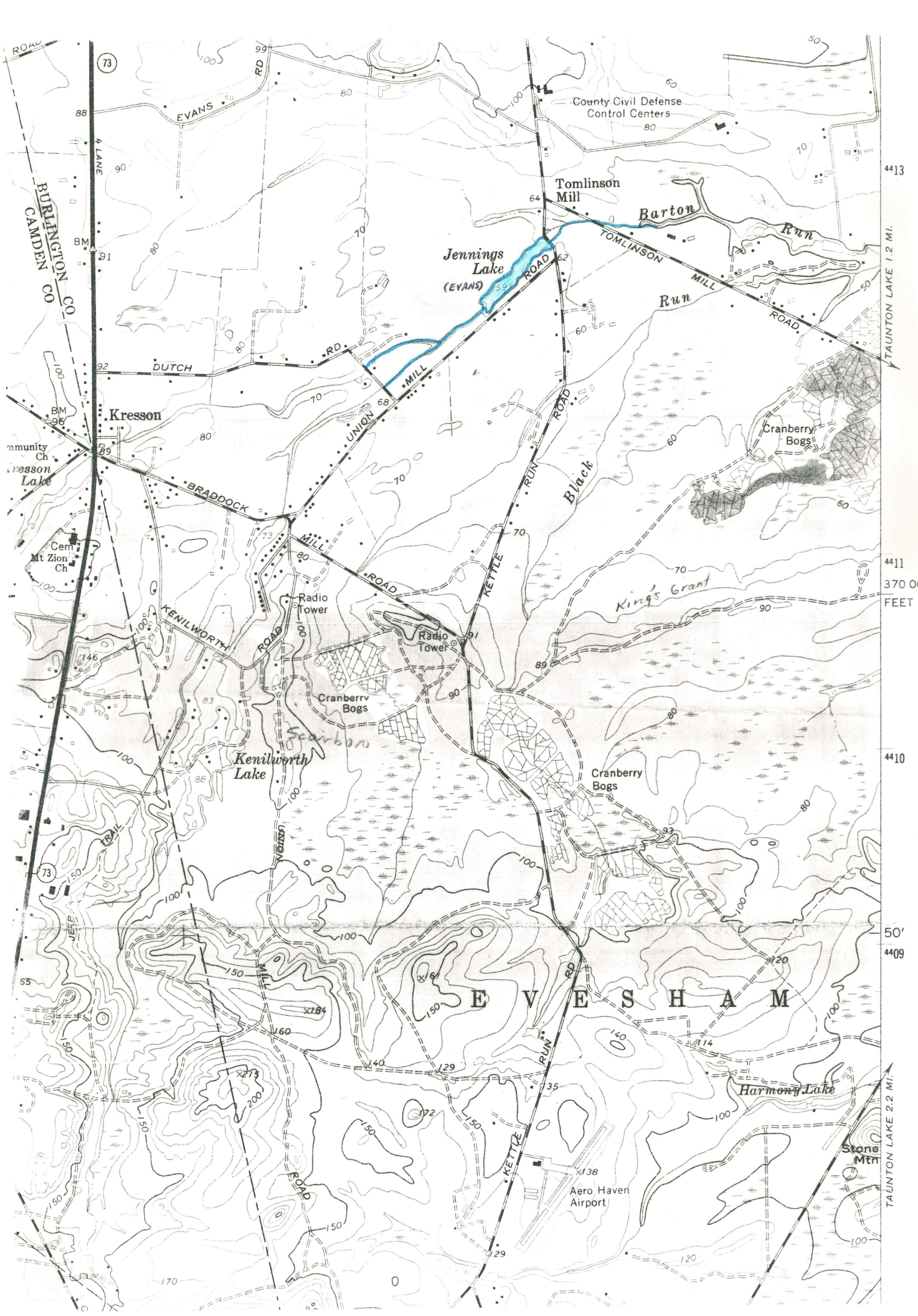
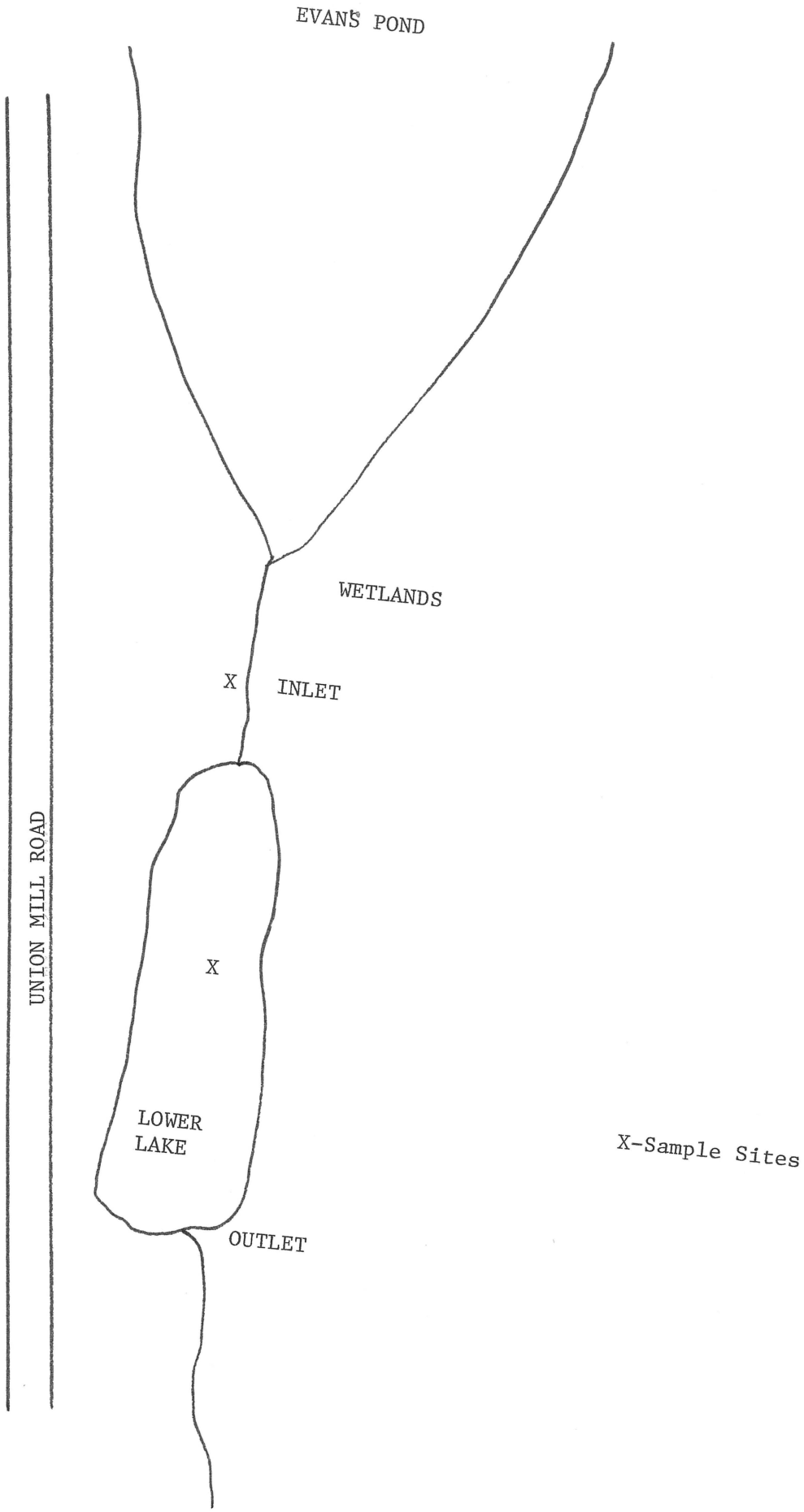
Chlorophyll Analysis

Chlorophyll "a" (mg/m^3) = 13.88

Analyst/Unit _____


County Civil Defense Control Centers
Tomlinson Mill
Barton Run
Jennings Lake
(EVANS)
TOMLINSON MILL ROAD
Run
EVANS RD
4 LANE
BURLINGTON CO
CAMDEN CO
DUTCH RD
MILL
UNION
Kresson
BRADDOCK
ROAD
Black Run
KETTLE RUN
Cranberry Bogs
Cemy
Mt Zion Ch
Radio Tower
KENILWORTH ROAD
King's Grant
Kenilworth Lake
Scarboro
TRAIL
JEEP
E V E S H A M
Harmony Lake
Stone Mtn
Aero Haven Airport
TAUNTON LAKE 1.2 MI.
TAUNTON LAKE 2.2 MI.
4413
4411
4410
4409
370 000 FEET
50'


EVANS POND
WETLANDS
X
INLET
X
LOWER
LAKE
OUTLET
UNION MILL ROAD
X-Sample Sites