LITTLE ISLAND POND
PELHAM, NEW HAMPSHIRE

ENVIRONMENTAL ANALYSIS
AND
BIOLOGICAL SURVEY

JULY, 1979

Done in Aug. 1978

CONTENTS

I LIFE CYCLE OF LAKES AND PONDS

Lakes and ponds have a life cycle just as people, animals, or any organism. The biological term for the life cycle of a lake is called eutrophication. Any type of ecosystem whether it be a tree, a field, a marsh, or a lake undergoes an aging process called senescence. In particular, a lake is like a living object: It is born, it lives, and it dies. Lakes are made in a variety of ways, but most have been gouged out by the retreating ice sheet at the end of the Ice Age. However, even man-made lakes undergo this aging process - although they may be created at a later stage in the life cycle.

Often, when a lake or pond is born, it is very deep and has few nutrients so that there is little animal or plant life that can be supported. This first stage of a lake's life cycle is called oligotrophic. It is characterized by high levels of oxygen, great depth of clarity and rocky shores and bottoms. As years and years go by - in some cases hundreds, in others only decades - the lake will begin to obtain more nutrients from the life processes that go on inside the lake (birth, life, death, and decomposition of all living things).

As a result of increased nutrients the population of plants can increase, then the population of fish that feed on plants increase and then the animals that feed on the fish are allowed to increase because of their greater food supply. At this point the lake is thriving with plant and animal life - this stage is called eutrophic. However, the amount of oxygen decreases (there are more and more plants and animals that require it); the clarity of the lake decreases (it becomes filled with algae, other plant life and settling sediments from the decomposition of dead organisms); the rocky shores and bottoms become covered with this decomposed or decomposing matter commonly referred to as muck.

As more time passes, the populations increase until they become limited for some reason (not enough food, light,oxygen, etc.) and the death rate increases. There is more dead matter to be rid of. The bacteria that decompose this dead organic matter usually need oxygen. They will consume the oxygen provided so that they may live in an effort to decompose the dead into nutrients. Oxygen is further limited - there is more death and more organic build-up. This is the dystrophic stage of eutrophication and the lake may begin to take on the characteristics of a bog or marsh. Eventually it will disappear altogether becoming terrestrial. The lake dies and turns into land completing it's life cycle.

II PRESENT CONDITION OF LITTLE ISLAND POND

Little Island Pond, Pelham, NH is a natural pond raised by damming. It covers an area of 72 acres. At its deepest point it is approximately 50-55 feet deep. According to the State of New Hampshire Biological Survey of Little Island Pond completed during the month of August 1978, the pond is generally in good shape. There is a good quantity of oxygen available keeping the pond in a healthy condition. But there has been a change in the type of fish. No longer as in 1956 are there the cold water, high oxygen requiring trout. These have been replaced by low oxygen tolerating perch and kibbi. Visibility is still good, however depth of clarity has decreased five feet since the year of 1956. This may be due to the increased use of motor boats that tend to keep the sediments circulating.

Algae content is relatively low although there is an abundance of the genus Zygnema. These are the clumps of filamentous algae that are commonly seen around the entire shoreline. At the present time they present no problem. However, the water may become clouded by these green clumps of algae, if they are allowed to accumulate in large numbers. This could result in an overabundance of the filamentous algae reaching a point where further increase is limited by some factor such as light or oxygen. Because of overpopulation and hence a limitation, algae will die in great numbers. The rate of decomposition will have to increase in an effort to return the dead and dying material to nutrients. This reduces the oxygen content of the water adversely affecting other pond life including fish.

Planktonic algae are not abundant but are dominated by two types that have caused problems in other lakes. The types that were abundant were of the blue green algae group. Although one cannot be sure as to what problems may arise in any one particular lake, these types of algae are sometimes toxin producing. In the course of their life cycle they fix sulfur. That is they use it in their metabolism in that form and release the toxic hydrogen sulfide. If this hydrogen sulfide is allowed to accumulate in large quantities because of an overabundance of the blue green algae, the water may become toxic to other pond life causing the death of many organisms. Again, there is no threat of any immediate problem. However, any future input of added nutrients will probably be seen in an increase in the dominant plankton which could be detremental.

Higher plants, such as grasses, weeds and pond lilies, are not a problem. One hundred percent of the shoreline is developed and the shores are rocky so that the bottom areas are not conducive to plant growth. Neither is bacteria a current problem: The bacterial count is at a desirable level. Nutrient levels also appear to be at an optimum level.

Little Island Pond is estimated to be in an intermediate stage of its 3-stage life cycle; somewhere between the first stage (oliogotrophic) and the second (eutrophic). As stated before, as of 1978, the pond is in good condition.

III LITTLE ISLAND POND IN THE FUTURE

At the present time Little Island Pond is not in trouble but added nutrients, could start the ball rolling. Pollutants added to a water body speed up the aging process resulting in what is called cultural eutrophication. The pollutants that are most dangerous to any form of lake, stream, pond, etc. are those that contain the nutrients that are vital to plant life. If these types of pollutants are added, plants increase, insect larva increase, fish increase, etc. until there is overcrowding and some factor becomes limiting. As explained before, there are large death rates and oxygen is further decreased by the decomposing bacteria.

A sign of increasing age is the decrease in plant and animal diversity. Already Zygnema is a dominant type of filamentous algae where as two types of blue green algae dominate the phytoplankton. Diversity has decreased but populations of remaining organisms are increasing. This is not good.

Diversity means that all organisms are living in balance with their environments. A lot of diversity indicates harmony within the ecosystem. If there is some sharp change in the environment such as the continual input of pollutants, the balance will be thrown off. When this happens usually many plants and animals that were only suited to a particular and/or optimal environment are forced to leave or die. When this occurs, the surviving few types can become dominant. It is hard to recover from this type of situation for if one type is knocked out of dominancy another takes over.

Preventative measures may be taken now to slow down the process of eutrophication. For example decrease the use of fertilizers on lawns and gardens; discharge of any waste-water, including washing machines, dish washers, showers, etc. should not be directly routed to the pond; septic systems and leech fields should be far enough away from the pond so that the water is filtered before reaching the pond itself.

Specifically most fertilizers contain the elements potassium, nitrogen and phosphorus. The latter two are most important to plant life and are the first to become limiting. This is the reason you fertilize your lawns - to give the grass its "vitamins" so that it grows hardy and thick. In a sense, the same thing happens to plants of water origin. When rain water washes fertilizers into the pond the plants can capitalize on their availability and increase in numbers.

Waste-water in the form of detergents plays as a culprit. Many are noted for their high phosphate content among other sudsing and cleaning agents. As stated previously plants depend on the phosphorus nutrients to survive. If more phosphorus is added plants are allowed to increase. Many have the reputation of being bio-degradable. This means that it's ingredients can be broken down into simpler compounds by natural means. In a sense this is a good quality, but the nutrients are still being added destroying the natural balance.

Sewage escaping into the pond from leech fields may stifle the pond causing the bacteria to use available oxygen in an effort to decompose this organic material. Plants and animals suffocate and die further complicating matters. Sewage also may cause diseases in humans and other animals. It plays host for a number of pathogenic bacteria and viruses.

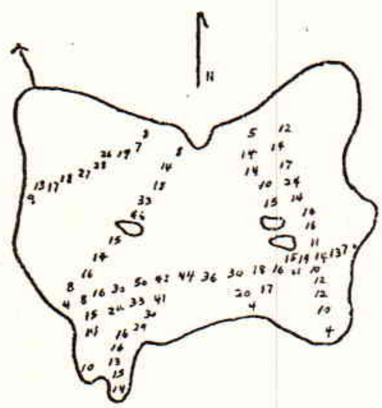
Little Island Pond property owners can help to prevent the pollution of their most valuable asset by limiting the use of fertilizers on lawn and gardens near the water; making sure no waste-water enters the pond; and that their sewage system is adequate and functioning properly.

ISLAND POND, LITTLE — PELHAM

SURVEY DATES: 7-15-38, 7-9-47, 6-23-49, 7-27-56.
PHYSICAL DATA: A natural pond raised by damming. **Altitude:** 150 feet. **Area:** 72 acres. **Watershed:** Merrimack. **Tributary to:** Island Pond Brook M-4-5-1. **River System:** Beaver Brook. **Inlets:** None. **USGS Quad:** Windham, Mass.-N.H. **Max. Depth Sounded:** 55 feet. **Av. Depth:** 18 feet. **Color of Water:** Colorless. **Shoal Areas:** 15 percent. **Shores:** 50 percent rocky, 50 percent wooded. **Bottom:** 70 percent muck, 20 percent gravel, 10 percent rock. **Emergent Vegetation:** Scant. **Submerged Vegetation:** Scant. **Dam Condition:** Fair. **Transparency:** 21 feet. **Time:** 1:10 p.m. **Weather:** Clear.

CHEMICAL DATA:

Date	Sta.	Air Temp.	Depth of Sample	Temp. of Sample	pH	O_2 p.p.m.	Alkalinity M.O.p.p.m.	CO_2 p.p.m.
6-23-49	A	80	Surface	76	6.6	7.8	7	2
			10	76	6.5	7.7	6	2
			20	68	6.3	8.7	6	3
			30	61	6.2	8.1	6	2
			40	56	5.6	6.7	6	7
			48	57	5.7	7.0	6	4



ISLAND POND, LITTLE

HISTORY: The following stockings have been made in this pond: yellow perch (mixed sizes) in 1938; smallmouth bass (mixed sizes) in 1938, 1949, and 1952; horned pout (mixed sizes) in 1946 and 1949; golden trout (mixed sizes) in 1946; brook trout yearlings in 1939; rainbow trout (mixed sizes) in 1941; brown trout yearlings in 1949; sea-run adult alewives in 1953.
CONCLUSIONS AND RECOMMENDATIONS: Salmonoid water. This is some of the best trout water in the entire southeast section of the state and, if at all possible, it should be reclaimed. If the camp owners cannot be convinced that reclamation would be for the benefit of a very large area and a worthy project, smallmouth bass should be encouraged. When the prolific nature of this species is taken into consideration, further stocking seems undesirable. A public right-of-way to this pond is needed.

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September 29, 1978

Mr. Frank Traynor
Range Road
Windham, NH 03087

Subject: Biological survey of Little Island Pond, Pelham

Dear Mr. Traynor:

Per request of Miss Kathy Barlow, I have sent you the data on Little Island Pond. Generally the pond is in good shape. There is good oxygen and visibility, and low algae and rooted plant growth. The main problem appears to be a filamentous green algae that is found in clumps around most of the shore.

If you have any questions concerning this data, please call (271-3233) or write.

Sincerely,

Robert H. Estabrook

Robert H. Estabrook
Biologist

RHE/mbl

TROPHIC CLASSIFICATION OF N.H. LAKES AND PONDS

NAME Island Pond, Little TOWN Pelham CO Hillsborough RIVER BASIN Merrimack

I. POTENTIAL FOR NUTRIENT ENRICHMENT

A. NATURAL PHYSICAL FACTORS

1. Area (ha) 62.73
2. Max. depth (m) 16.8
3. Mean depth (m) 4.9
4. Elevation (ft) 145
5. Shore length (m) 2600
6. Volume (m^3) 3,064,000
7. Volume/shore length 1170
8. % Stratification
9. Watershed area (ha) 373.0
10. Watershed area / Volume .2
11. Bottom slope 1.9
12. Shore config. ? (<1)
13. Flushing rate 0.6
14. Water renewal time 1.7
15. Drainage density
16. % Watershed ponded
17. Phos. retent. coeff. R .76

B. CULTURAL FACTORS

1. % Shore developed 100% (1963)
2. Number nearshore homes
3. # nearshore homes/mile shore
4. Volume lake/# nearshore homes
5. Estimate of non-point Tot-P loading:
   a. Land Use
   b. Precipitation
   c. Subsurface disposal
   d. Other

II. INDICATORS OF TROPHIC CONDITION (mg/l unless indicated otherwise)

A. Winter Data:

Date 8 MAR. 1976 Weather Partly Cloudy, windy & cold

Depth(m)	1.0	
Alkalinity	4.0	
PO_4-P	.001	
Total-P	.012	
NO_2+NO_3-N	.17	
Kjeld-N	.20	
Total-N	.37	
Tot-N/Tot-P	31	
NO_2+NO_3-N/PO_4-P	170	

Bottom: Depth 8.2m D.O. 9.4 % Sat. 72%

% Organic matter sediment 21.9%

Dom. Phytopl. 1. Dinobryon (50%)
2.

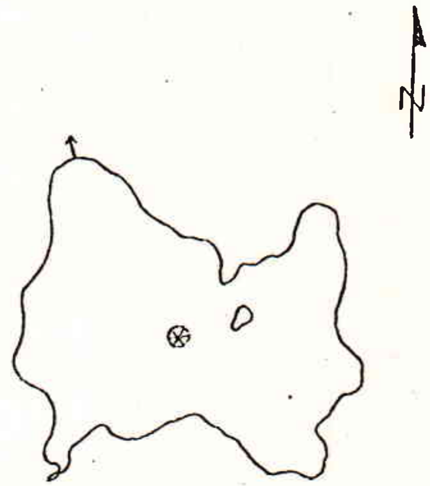
Dom. Zoopl. 1. Nauplii larvae (15%)
2.

3. Summer Data:

Date 28 AUG. 1978 Weather LIGHT SPRINKLE; SURFACE CALM; 17.0°

	Mid-ep	Mid-therm	Mid-hyp
Depth (M)	3.0	6.5	9.0
Alkalinity	6.0	5.0	5.0
PO_4-P	<.001	<.001	<.001
Total-P	.005	.005	.015
NO_2+NO_3-N	<.05	<.05	<.05
Kjeld-N	.28	.22	.25
Total Residue	27	29	32
Color (units)	20	15	20
Turb. (NTU)	4.7	5.0	4.1
Spec. Conduct. (μMhos/cm)	73.7	72.3	71.3
Tot. Org. Carbon	7.0	—	—
Chloride	12	12	11
Mg	.77	—	—
Ca	3.6	—	—
Na	7.1	—	—
K	0.8	—	—
[Mg+Ca] / [Na+K]	.55	—	—
Tot-N/Tot-P	<66	<66	<20
NO_2+NO_3-N/PO_4-P	50	50	50

Station Location



Bottom: Depth 11.5 m D.O. 3.4 %Sat. 32 %

Epilimnetic alkalinity decrease -2.0

PO_4-P ratio: epi/hyp 1.00

Total-P ratio: epi/hyp .33

Secchi disk transparency (M) 5.5 m

% organic Matter sediment —

Vascular Plants SCATTERED

Dom. Vasc. Plants: 1. PONTEDERIA

2. JUNCUS

3.

Ash-Free Dry Weight —

Chlorophyll a 3.18 mg/m²

Tot. Zoopl. Cnts. 350 cells/ℓ

Dom. Phytopl. 1. ANABAENA (35%)

2. COELOSPHAERIUM (20%)

Dom. Zoopl. 1. VORTICELLA (90%)

2.

TROPHIC CLASSIFICATION 1978 :

	D.O.	S.D.	Vasc. Plants	Chl a	Total	Class.
Classification Points:	2	1	1	0	4	1

COMMENTS:

1. 100 % OF THE SHORELINE IS DEVELOPED.
2. MOST OF THE SHORELINE IS ROCKY, THEREFORE ROOTED PLANTS ARE NOT A PROBLEM NOW AND WILL PROBABLY NOT BE A PROBLEM IN THE FORESEEABLE FUTURE; HOWEVER, CLUMPS OF THE FILAMENTOUS GREEN ALGA ZYGNEMA ARE COMMON AROUND THE ENTIRE SHORELINE.
3. THE PLANKTONIC ALGAE WAS NOT ABUNDANT AT THIS TIME, BUT WAS DOMINATED BY 2 BLUE-GREEN GENERA THAT HAVE CAUSED PROBLEMS IN OTHER LAKES.

AQUATIC PLANT SURVEY

LAKE Island Pd., Little TOWN Pelham DATE 28 AUG 1978 BY Estabrook & Barlow

No.	PLANT NAME: GENERIC	PLANT NAME: COMMON	ABUNDANCE
E	ERIOCAULON SEPTANGULARE	Pipewort	SPARSE
P	PONTEDERIA CORDATA	Pickerelweed	SCATTERED
U	UTRICULARIA	Bladderwort	SPARSE
N	NYMPHAEA	Water Lily	SPARSE
Y	NUPHAR	Yellow Water Lily	SPARSE
J	JUNCUS	Rush	SCATTERED
A	PELTANDRA VIRGINICA	Arrow Arum	SPARSE
S	SAGITTARIA	Arrowhead	SPARSE
D	DECODON VERTICILLATUS	Swamp Loosestrife	SPARSE
a	ZYGNEMA	filamentous algae	COMMON

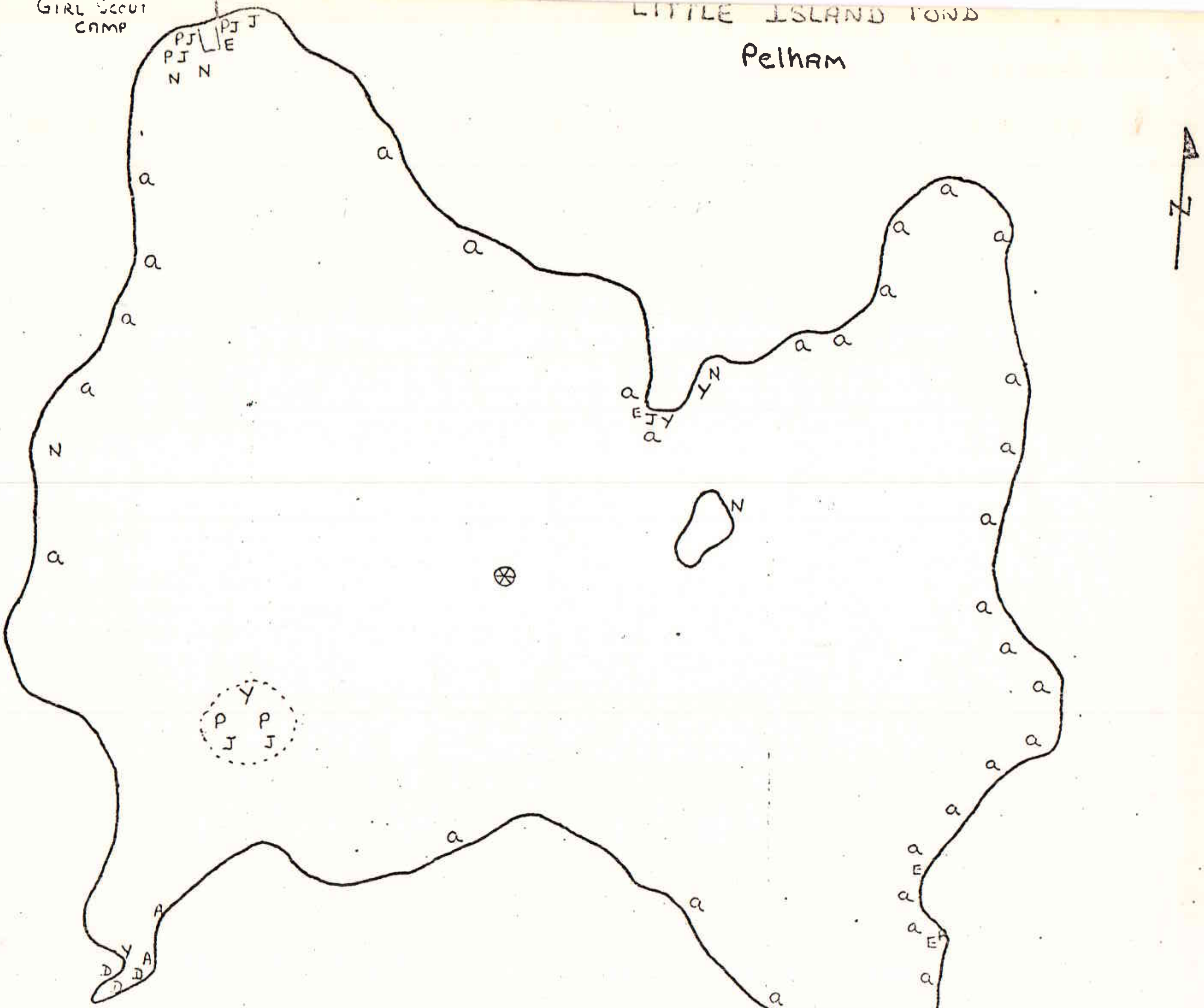
OVERALL ABUNDANCE SCATTERED

GENERAL OBSERVATIONS:

1. LAKE VERY DEVELOPED - 100% OF SHORE
2. MANY LARGE MOTOR BOATS ON POND
3. MUCH OF SHORELINE IS ROCKY - NOT CONDUCIVE TO ROOTED PLANT GROWTH
4. Zygnema IS COMMON AROUND THE ENTIRE SHORELINE; the MACROPHYTES ARE MOSTLY SPARSE, but I have LISTED THE OVERALL ABUNDANCE AS 'SCATTERED' because OF THE Zygnema PROBLEM; DUE TO THE ROCKY SHORE, ROOTED MACROPHYTES WILL PROBABLY NOT BE A PROBLEM IN THE FORESEEABLE FUTURE - INCREASED NUTRIENT INPUT WILL LIKELY MANIFEST ITSELF IN THE FORM OF INCREASED FILAMENTOUS ALGAL GROWTH.

LITTLE ISLAND POND

Pelham



AUG 28 1978

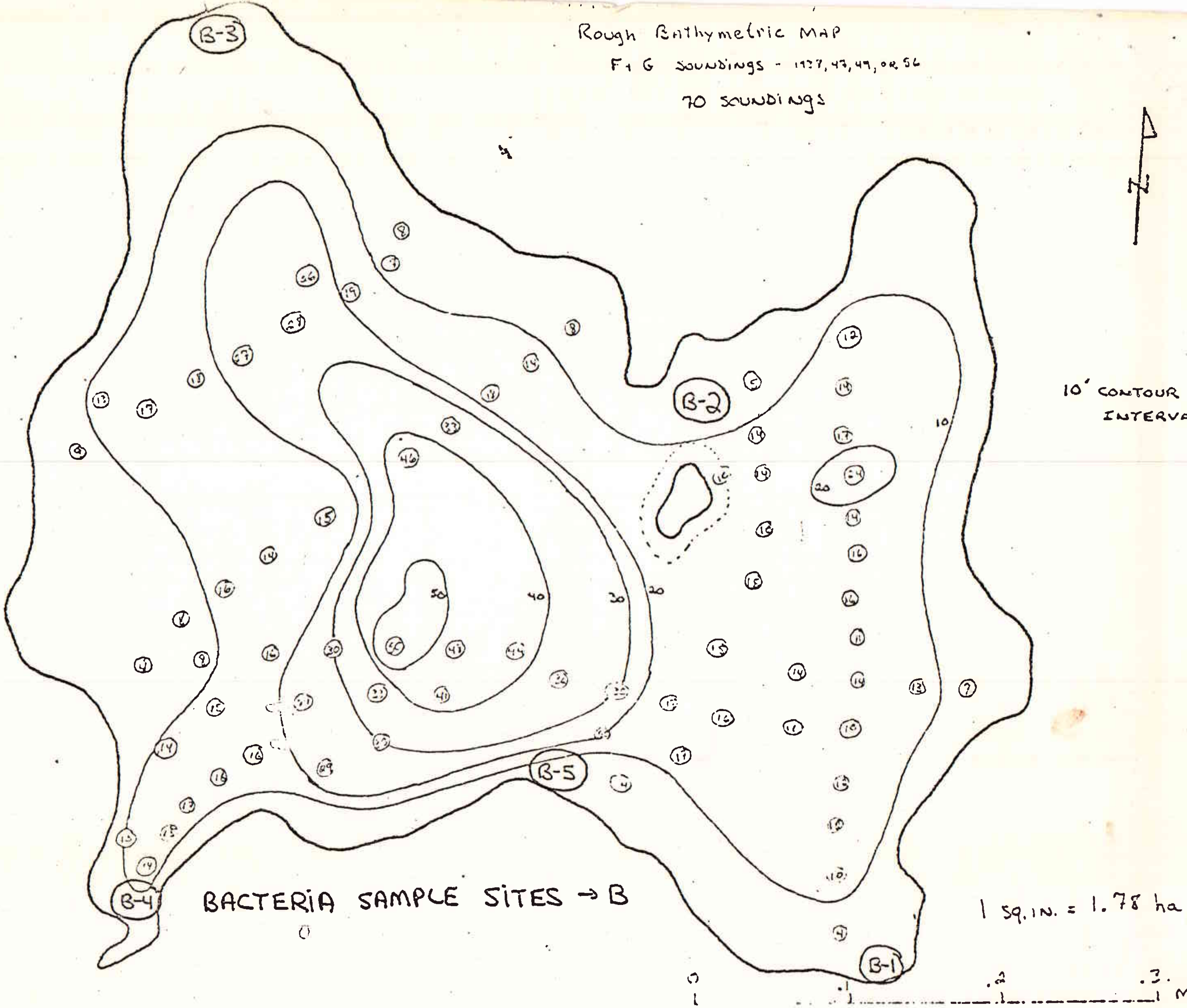
BACTERIOLOGICAL EXAMINATION

Bio. Lab - NHWS&PCC - Concord, N.H.

Source of samples: Little Island Pond, Pelham Collected by: Estabrook + Barlow Date: 7/25/78

STATION	1Ø	1	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}		M.P.N / 100 ML.
B-1 81721										< 30	
B-2 81722										< 30	
B-3 81723										39	
B-4 [illegible]1724										< 30	
B-5 81725										43.	
											SEP 05 1978

SEP 05 1978


Rough Bathymetric MAP
F + G SOUNDINGS - 1937, 47, 49, OR 56
70 SOUNDINGS
10' CONTOUR INTERVAL
BACTERIA SAMPLE SITES → B
B-1
B-2
B-3
B-4
B-5
10
20
30
40
50
1 sq. IN. = 1.78 ha
0
.1
.2
.3
MI