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LIMNOLOGICAL STUDY OF

LONG LAKE, WAUSHARA COUNTY

NOVEMBER 1979 THROUGH OCTOBER 1980

by.

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Submitted December 5, 1980

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INTRODUCTION AND DISCUSSION

In compliance with Chapter 33 of the Wisconsin Statutes, and Chapter NR60 Wisconsin Administrative Code, the Long Lake Protection and Rehabilitation District, contracted with Northern Lake Service, Inc. of Crandon, Wisconsin, on April 27, 1979 to carry out data collection survey as outlined in Department of Natural Resources specifications of 1979. The purpose of this data collection survey was to provide hydrological and limnological information on which personnel from DNR's Office of Inland Lake Renewal may base lake protection, management, and/or rehabilitation alternatives.

This final report contains data collected during the twelve month study and general interpretations of the data. The lake district furnished a minimal portion of the study labor needs as in-kind help. Two of five alternate Secchi disc and chlorophyll samples were collected by the district. Thus, nearly all of the study was conducted by Northern Lake Service personnel. All changes in the study design were approved by the Office of Inland Lake Renewal.

The following discussion will follow the specifications of the study.

Groundwater Survey

A series of groundwater wells were installed at various sites around the lakes in an attempt to determine ground-water gradients and quality. In addition, seepage meters were used during the ice-free period of the study to determine in-flow rates along shallow shoreline areas.

Three test wells were installed at site "D" on the west end of the lake to augment wells installed by USGS which represent the other three shores of the lake. An additional back well was to be installed at site "B", however an easement was not obtained in this area. Well A-L, which had been damaged by a snowplow was repaired prior to sampling. All wells were surveyed to a spike in a tree at the north boatlanding with an assumed elevation of 100.00 feet.

Seepage meters were to be installed at points where recharge was expected, however only site A was a potential recharge area. Two meters were installed at different depths at this site, but seepage rates were so low that testing was discontinued after two months.

Groundwater levels, when compared to lake levels, suggest poor communication between groundwater and lake water. Average well levels were lower than the average lake level in all wells except well A-L where a slight recharge was apparent. A slight vertical recharge was noted at site A-H, however the gradient was away from the lake at this site. The other three piezometric nest sites demonstrated both vertical and horizontal discharges.

In summary, Long Lake is apparently "perched" with little influence from local groundwater, at least at present groundwater levels.

Groundwater sampling from the wells was conducted monthly with field filtering samples for phosphorus analyses during the final six months of the survey. Groundwater was generally hard and alkaline with low phosphorus levels. The deeper wells were not analysed after the first month, except for D-P. It is interesting to note the abnormally high ammonia nitrogen, conductivity, and hardness in the deeper wells. It appears that groundwater originating from the local area is of higher purity than that of the deeper aquafer. This is of little significance to Long Lake, however since groundwater-lakewater transfer appears minimal.

In-lake

The in-lake survey of Long Lake included several different areas of study.

Lake samples were collected from surface and near bottom on a monthly basis. The data provides nutrient levels typical of fertile lakes. Phosphorus levels one to two times the threshhold level for excessive weed and/or algae production. The moderate alkalinities, when compared to the higher hardness levels of the groundwater, further suggest that the main source of water to the lake is from precipitation, not groundwater influx. Conductivity differences also bear this out.

Severe winter oxygen depletion, which is probably a common occurance, did not occur during the winter of 1979-80. Indeed oxygen levels remained high throughout the winter, due to clear ice and little snow which allowed photosynthetic oxygen production.

The depth of sediment survey conducted through the ice resulted in rather surprising information. It was assumed that this "dishpan" lake located in a relatively flat, sandy, area of the state might never have been very deep. Probing

the soft sediments indicated an original depth of over thirty feet. Thus the original lake basin has filled in about 75% during the last 10,000 years or so. Sedimentation is apparently autochthomous material resulting from partially decomposed plants and animals produced in the lake. This material typically has a high oxygen demand, so oxygen depletion is probably high during snowy winters.

Chlorophyll samples were collected semi-monthly between late April and mid-August, monthly thereafter. Levels were relatively low; nutrients were apparently utilized mainly by the dense macrophyte population in the lake. Secchi disc visibilities were of little value because the disc dissappeared into soft sediment at about five feet. Secchi disc readings are estimated to have ranged from 10-20 feet, had there been a spot deep enough for a measurement.

A single macrophyte study was conducted in mid-July. Macrophyte growths were found at all but two of the 79/sites on the lake. Twenty-three taxa were identified. Major stands of white lily and watershield were present in floating leaf communities.

The submergents typically found in profusion in extremely fertile waters were relatively sparce. Millfoil and elodea were present and coontail absent on the diverse list of ten submergents. Potamogeten gramineus, P. amplifolius, and Charra were the dominent submergents.

In summary, Long Lake is a shallow, fertile lake with minimal communication with groundwater. The lake has undergone eutrophication (natural lake aging) to the point at which sediment accumulation accounts for a major portion of the original basin volume. Macrophyte growth is profuse, interfering with recreational pursuits in some areas. Winter fish kills can be expected during long periods of snow cover.

GENERAL LAKE MANAGEMENT SUGGESTIONS

Although it is not a responsibility of Northern Lake Service to offer detailed management alternatives, it is difficult to conduct a data collection survey for that purpose without having developed some thoughts in this regard. Three categories of alternatives might be considered: lake rehabilitation, lake management, and lake protection.

Lake protection is usually best accomplished by lake community residents and users at minimal cost through

"common sense" practices. Lawn fertilizing where run-off can reach the lake, burning brush on the ice, high speed motorboating in shallow silty areas, disturbing near shore vegitation and major excavations near the lake are all practices which should be avoided. The lake district should support county zoning and might ask the county zoning committee to advise the commissioners of any variance requests within the district. A working relationship with the township and county governments can result in district participation in land use decisions within the lake district.

Lake management activities might include winter aeration if fish mortalities are a concern to district residents. Macrophyte (weed) control either chemical or mechanical would reduce nuisance growths in swimming and docking areas.

Long Lake would be a prime candidate for a major dredging project as a rehabilitation alternative. While total removal of 700,000 cubic yards would probably be prohibitively expensive at \$1.50 to \$2.00 per yard, a smaller project might be within the district's grasp, should the district members be willing to make a large monitary committment. This would require a major effort to obtain necessary permits. Unfortunately, the DNR's Lake Michigan District, through which the lake district would apply, has been reluctant to allow even small scale rehabilitation projects within its jurisdiction.

Local residents have shown concern over lake level fluctuations. Although the level fluctuated only about five inches during the survey period, it was apparent that greater fluctuations occur over long periods of time. Any plan to raise or maintain the lake level using high capacity wells should be preceded by a chemical analysis of the well water. The chemistry of the water taken from well D-P would likely cause major ecological changes in the lake.

Daily Precipitation Data from Hancock Experimental Farm

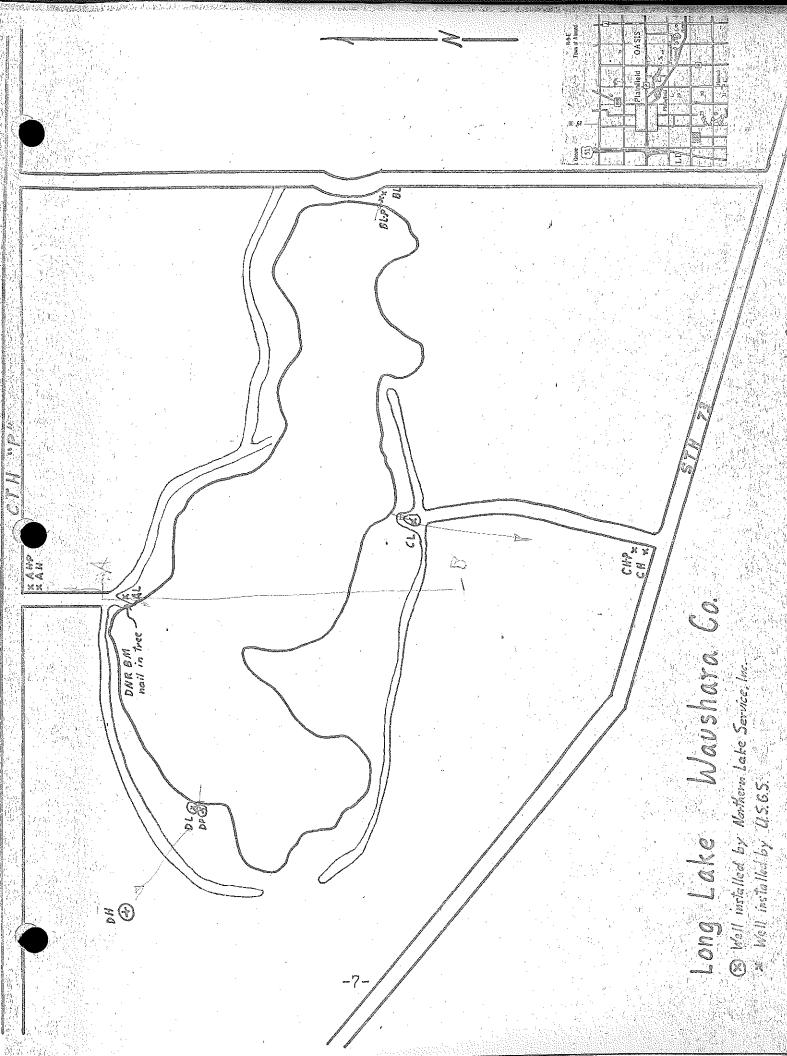
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13-14 15 16-20 21	.50 t .14	18-20 21 22 23 24	t .01	13 14 15-21 22	.22 .07
22 23 24 25 26 27 28 29	.28 t t	24 25 26-27 28 29	.07 .02 t	23 24-26 27 28-31	.28 t
20 27 28 29 30-31	.52 .02 .01	30 31 Feb.	t	April 1-2 3 4	. 25
Dec. 1-6	.16	1-4 5 6 7-8	.03	5 6 7 8	.03 .10 .40 .49
8-15 16 17-21 22	.03	9 10 11 12 13	t t t	9 10 11–13 14	.54 .03 .03
23 24 25 26 27-31	.39 .07	14	t .07	15-28 29 30 May	.11 .05
Jan. 1980 1-3		15 16-19 20 21 22 23 24-25 26 27 28 29	.01 t	1-9 10 11 12	.02 •35
5 6	.11	27 28 29	t .02	13 14	.18

Daily Precipitation Data from Hancock Experimental Farm

t=trace, - = no record, x=amount included in following measurement. Precipitation given in inches.

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29 30	.08				
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9-13 14	.68	r .			
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20-27 28	. 18				



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	1-100	300		

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	Study Long L	ake					
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LONG LAKE WELL SITE SOIL ANALYSIS

	Percent	Retention On Si	eves
Well No.	D-H	D-L	D-P
The state of the s		and the second s	5
Sieve No.	3.0	1.2	1.1
10	5.7	4.1	5.4
20	42.7	36.4	47.0
60	37.9	41.4	37.3
·80	6.2	10.8	6.0
100	1.6	3.2	1.5
Pan	2.9	2.9	1.7
Permeability gal./day/ft.2	384	403	448

Slug tests were run on wells A-L, AH-P, B-L, B-P, and C-L, the data for which has been sent to Jim Vennie of the Office of Inland Lake Renewal who will be using a computor program to determine permeabilities. The remianing three wells could not be slug tested because they were too deep to pump and recovered too fast to draw down by bailing.

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Balling	Total-PO $_{\mu}$ -P		0.009	0.013		0,008	0.001	0.005	0.005	,0,005			0,007	0,002	500.0			
Sampled By Bailing	Total-N		0.83	64.0		0.82	0.81	09.0	0.39	99°0	, in		0.72	1,13	0,82			
117.98	NO2+NO3-N		0.05	0.07		90.0	0.03	0.01	0.02	0.02			0.02	0,04	70.0	から 一般		· 我们是一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个
Elevation 117.98	NH3-N		0,27	0,10		0,13	70.0	96.0	0.22	0, 18			0.22	0.27	0.20		为1000000000000000000000000000000000000	· 新加州 医克里克氏
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USGS No.	ΗQ		9.10	8,85		8,40	20 00 00	6.00	9.40	8.60	sample	9.10	8,50	8.40	9.2%			化多数 法国际的
Well A-H	Cond.		186	265		285	158	160	175	210	no sa	182	240	240	265		行うながられている。	
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LONG LAKE	Date	1979	Nov. 12	Dec. 11	1980	Jan. 14	Feb. 12	Mar, 18	Apr. 14	11 May 13	June 16	Ju1y 14	Aug. 11	Sept. 15	0ct. 13,	· 1985年 · 新文明 · 阿西西斯克斯克斯克斯克斯克斯克斯克斯克斯克斯克斯克斯克斯克斯克斯克斯克斯克斯克斯		信のないのかのないと言う

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Barling	Total PO_{μ} -P	900.0	1700.0		0.005				0,005	600.0	0.007	0.009	0.0	0.002
Sampled By Bailing	Total-N	96.0	0,68		0.19				0,48	75.0	0.12	0.08	0.75	0.51
110,45	NO2+NO3-N	60.0	0.01		0.05				0.03	0.03	0,01	0.02	0.05	60.0
Elevation 110.45	NH3-N	0,13	0.06		0.14				0.14	0.21	0,08	0,08	0,15	00.0
Well	D	٠ <u>٠</u>	2,0		0.5	sample.			2.0	2.5	1.0	0,	ν°ς γ°	1.0
No. WS-29	Hard	134	124		122	could not			122	114	124	110	112	- 130
USGS No	Ηď	8 50 50	8,00		7.70	Frost in well co	frost in well.		7.85	8.75	7.75	7.75	7.75	8,18
Well A-L	Cond	7.7.7. 7.7.7.	290		295	Frost	frost	n well.	200	170	220	205	210	225
LONG LAKE Well	Elev.	24.77	58.46		84.78	68.46	94,81	Frost 1	95.46	95.55	95,13	95.07	95.37	95.20
LONG	Date	1979 Nov. 12	Dec. 11	1980	Jan. 14	Feb. 12	Mar. 18	Apr. 14	c'r May 13	June 16	July 14	Aug. 11	Sept. 15	0ct, 13

	Po _l -P		0,002	100°0		·700°0	000	700.0	ή00°0	1700,00	700 0	0,008	800	0.012	000
y <u>Pumping</u>	Total Po		0	Ô		Ő	0	0	0	,0	Ö	o	0.008	0	0000
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107.0	$NO_2 + NO_3 - N$		- 0.02	00.00	j	0.02	0.0	0.02	0.00	0.03	00.00	0.01	0.05	0.02	0.02
Elevation 107:01	NH3-N		0.4-0	0,35	が変え	0.29	0.28	0.27	0,42	0.46	0,50	0.56	0,18	0.50	0.55
Well	Q ₁		ر د د	0.0		0 بر	0.0	1.0	0,5	1.0	1.0	1,0	٠ <u>.</u> بر	5.0	ń
S-/-99	Hard.		176	172		150	178	122	162	170	1.16	80	124	102	77.
USGS No.	Hd		8,00	8,25		8,56	8,30	9,10	8	8.05	0.6	07.6	8,92	9,20	02.8
Well B-I	Cond.		244	370		335	228	170	242	260	175	150	215	190	250
	Elev.		94,21	94,18		70.76	20.46	60,46	77,76	94,28	42.46	93.96	94,11	96.46	47.76
LONG DAKE	Date	1979	Nov, 12	Dec. 11	1980	Jan. 14	Feb. 12	Mar, 18	Apr. 14	1 May 13	June 16	July 14	Aug. 11	Sept. 15	00.t.

LONG L	LONG LAKE Well B-P		USGS No.	Q-999	Well E	levation	107,01	Sampled By	By No t	t Sampled	H
Date	Elev.	Cond.	pH	Hard.	CII	NH3-N	NO2+NO3-N	Total-N		Total PO $_{ m L}$ -P	
1979-										75.1. 17.2. 17.2. 17.1.	John Park
Nov. 12	93.05										
Dec. 11	92.95										
1980					y Y						
Jan: 14	92.76										1
Hebo, C	92.78										
Mar. 18	92,59										
Apr. 14	92,89	A CARLON CONTRACTOR OF THE CARLON CONTRACTOR O									
15 May 13	92.79										: " .
1 June 16	92.67										-
July 14	92,18										
Aug. 11	92,10										2.17 14
Sept. 15	92.48										10.0
0ct, 13	92,68							行うな 人名			

5n	OO	1/70	\ \ →		
/ Bailin	Total DO D		0.015 0.014	0.015	0.004 0.005 0.015 0.004 0.014 0.001
Sampled By Bailing	Total-N		1.37	1.56	1.04 0.84 0.73 0.72 0.70 0.80
	NO TNO T-N		70°0	0.02	0.00 0.00 0.03 0.03 0.03
Well Elevation 120.31	NH2-N		0,36	0.21	0.24 0.45 0.15 0.07 0.52 0.29 0.27
	J		, v	, ,	2.5 2.0 2.0 3.0 5.0
Vo. 669-S	Hard		58	80	88 92 74 104 80 86 90 110
USGS No.	pH		9.75	9.20	9.70 9.80 10.65 9.20 9.48 9.40 9.40
11 C.H	Cond		173	205	162 135 155 180 no san 140 160 160 160
LONG LAKE Well C.H	Elev.		92,56 92,49	92.27	92,23 92,07 92,37 92,19 94,92 91,66 91,66
LONG	Date	1979	Dec. 11	Jan. 14	Feb. 12 Mar. 18 Apr. 14 1 May 13 1 June 16 July 14 Aug. 11 Sept. 15 0ct. 13

Not Sampled	tal Pou-P									
Sampled By Not	Total-N ⊈o					· · · · · · · · · · · · · · · · · · ·				
	NO2+NO3-N									
Well Elevation 120,5	NH ₃ -N									
668 <u>-D</u> well	c						\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \			
USGS No. 66	рн наг									
Well_CH-P	Gond									
	Elev.	92,52	92.46	92.27	92,26	92.37	91.79	91.93	91.68	91.99
LONG DAKE	Date 1979	Nov. 12	Dec. 11	1700 Jan. 14	Feb. 12 Mar. 18	Apr. 14	May 13 June 16	July 14-	Aug. 11	Sept. 15

Bailing	Total PO, -P	0.002	600.0	interferance 0.003 0.004	0.012 0.006 0.015 0.007 0.003
Sampled By Bailing	V Total-N	3.59	1.05	2.66 2.80 2.97	5.07 3.97 3.00 3.40 3.40
	$NO_2 + NO_3 - N$	0.01	00.0	00000	0.03 0.02 0.03 0.01
Well Elevation 112,78	NH3-N	2.25	0.73	1.89 2.27 2.37	2.28 2.18 2.63 2.21 2.35 2.17
Well	T.	. t. o.	0	0 0 5	0 1 1 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
No. 673	Hard.	310	212	308	360 238 346 346 350
USGS No.	HQ.	7.40	7.86	7 7 8 0 0 8 0 8	99°.2 04°.2 04°.2 04°.2
Well C-L	Cond	730	500		522 520 515 560 590
	Elev.	94.31 94.30	94.28	94.37 94.56	94.57 94.59 94.39 94.34 94.61
LONG LAKE	Date	1979 Nov. 12 Dec. 11 1980	Jan. 14	Feb. 12 Mar. 18 Apr. 14	May 13 June 16 July 14 Aug. 11 Sept. 15 Oct. 13

Pumped	Total PO,-P		900.0	0.008		900.0		0.000	0.003	900.0	0.0	0.00	900.0	0.008	00.00	0.006
Sampled By Fumped	Total-N		0,0	0.91		1, 19		0.85	0.62	0°.78	79.0	0,39	97.0	64.0	0,62	79.0
	N-con+con	The second secon	0.02	0 0 0 1		0.01		0.01	00.00	00.00	0.02	00"0	0,01	0.01	00.0	0,02
Elevation 106.61	N-ÇHN	Alliana and a series of the common state of th	0,40	67.0	3- 3-	0.53	:	0,38	0.32	0.55	97.0	0.29	0.17	0.03	0.43	0.08
Well	CIL		1,	0.5		1.0		1.0	1,0	1.5	0.0	٥. ر.	7, 1	U, O	2,5	1,0
	Hard.		228	236		727		220	212	212	216	212	208	190	184	172
USGS No.	HQ.		7.52	7.70		7.38		7.70	7.82	09"8	8,00	7.80	7,98	8.02	7.85	8,12
Well D-H	Cond		545	500	V.	200		362	340	378	4.18	007	315	403	340	315
	EIev.		94.26	94,23		20°46		90 76	93,91	66.46	94,26	90 ° 76	93.88	93.81	94.10	93.99
LONG DAKE	Date	1979	Nov. 12	Dec. 11	1980	Jan. 14		Feb. 12	Mar. 18	Apr. 14	May 13	June 16	July 14	Aug. 11	Sept. 15	0ct. 13

Pumping	Total Po P			π α ο ο ο ο ο ο ο ο ο ο ο ο ο ο ο ο ο ο		0.014	- - - - -	C	T 00 ° 0	0000	0.011	0,00%	0.00	, xxx		<u>.</u> .		O, OIZ
Sampled By <u>Pumping</u>	I Total-N	7	010	, r. O		0.27		₩ α •		2	0,45	7770	92.0	07*0	, ги У	, z z z z z z z z z z z z z z z z z z z	71 O	o}.°
1.01,63	NO,+NO,-N	Contraction of the contraction o	0,00	00.0		0.02		0.0	, C		00.00	0.02	0.01	0,01	0.01	0 0	j C	•
Well Elevation 101,69	NH ² -N	The state of the s	, O	0,06		0.22		0.47	0	1	0,20	0.15	0.11	90 ° 0	0.10	0.27	0.13	^ H)
Nel	01		\ 0	0.0		0.0		0.0	0.0	1 1	٥. ک	0.0	0.0	0.0	0,5	0 0	0.0	
i No	Hard		106	108) 110		114	118			110		06	65		96) () ()
USGS	Hd		7.80	7.90		7.50		7.80	7.90	0	0	0,15	8,15	8,30	8,10	8,00	8.34	
Well D-L	. Cond.			16 230		T 245		520	3 210	α, τ		9 210	9 220	0 170	5 200	2 160	2 170	
LONG LAKE	Blev	6		91,46		77.76		94°46	1, 94,43	07. 70		94.59	69°46	06.46	94.46	5 94.72	94.52	
LON	Date	1979	Nov. 12	Dec. 11	1980	Jan, 14		Feb. 12	Mar. 18	Anr. 14	- ((· · · · · · · · · · · · · · · · ·	, May 13	Ö June 16	July 14	Aug. 11	Sept. 15	0ct, 15	

	ρ,				10 e								
Bailing	Total ${\tt PO}_{\mu}-$	0.011		900°0	interferance	700.0	0,005	0,011	0.005	0.007	0.018	0.015	900.0
Sampled By	Total=N	0 0 7	ੇ ਜ ਜ ਜ	2,95	3,29	3.64	3.98	4.57	4,24	3,89	3.73	00°ħ	4.05
102,12	NO2+NO3-N	0 0 0	i)	0.01	0.01	00.00	0.01	0,01	0.01	0.03	0.01	00°0	0.02
Elevation 102,12	NH3-N	49.0		2.03	2.66	3.04	3.37	3,46	3.68	3,53	3,47	3,79	3,42
	70	0 0		0	2.0	1,0	1.5	0,5	0 0 0	1.0	0 1	0.0	₹.
Section for the section of the secti	Hard.	1 1 2 2 2 2 3 3 3		206	942	250	270	272	280	272	274	268	992
USGS No.	#1 d.	8.10	7	7.40	7.48	7.50	8.70	2.60	7.52	7.80	7.65	7.64	7.70
Well D-P	Cond	305) (495	380	395	760	550	0 7 7	0847	520	505	475
	Elev.	94,07		77. 70	93.74	93,59	93 88	93.74	93.97	93.43	93.37	79.64	93.70
LONG LAKE	Date 1979	Nov. 12 Dec. 11	1980	UZII.	Feb. 12	Mar. 18	Apr. 19	Nay 14	T June 16	July 14	Aug. 11	Sept. 15	0ct. 13

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LESSON TO THE SECOND PROPERTY OF THE SECOND P

LONG LAKE SEEPAGE METER INSTILATION AND DATA

Direction of flow information obtained from the well sampling indicated that the only site of groundwater influx to the lake is a localized area near the boat landing. Therefore two seepage meters were placed in differing depths at this location rather than at three seperate sites around the lake. This change in the study was suggested by Mr. James Vennie of the DNR office of inland lake renewal.

Although there is a net flow into the lake at this site, it is very slow and the smaple size obtained during a practical sampling period does not lend itself to any confident analysis.

The sediment type at this location is sand with an overlying layer of silt.

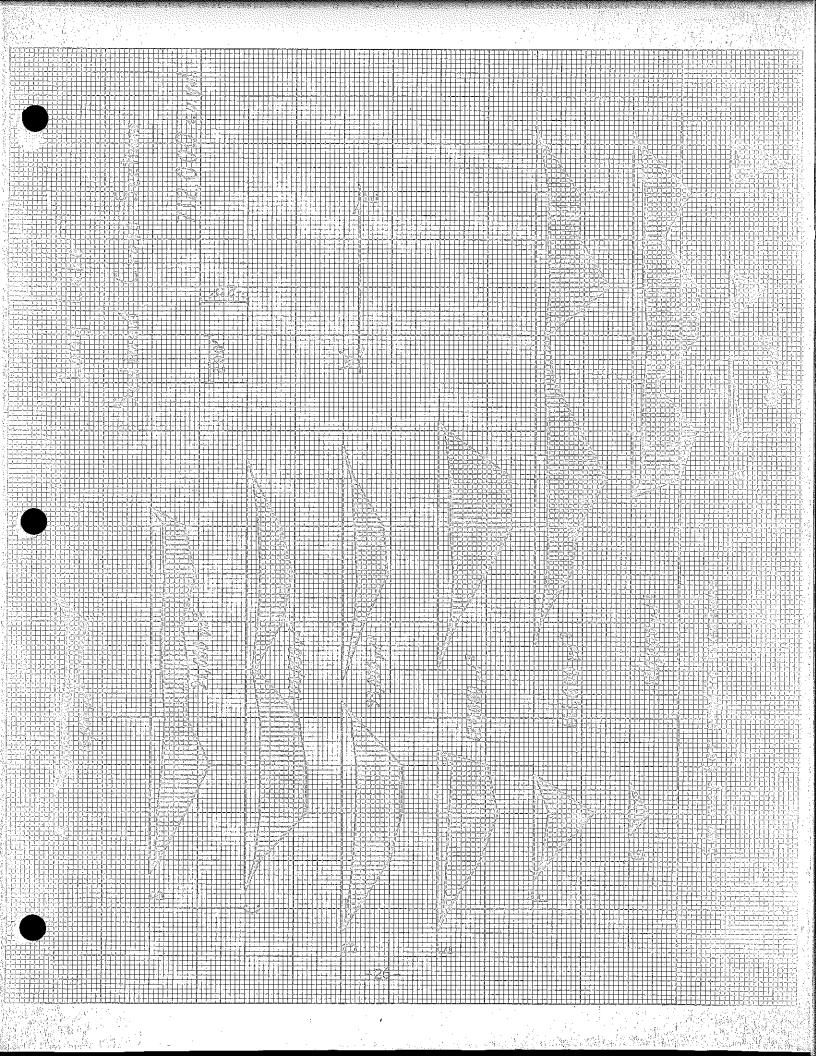
Date	Meter	Depth (in.)	Vol. (L)	Time (Hrs.)	Velocity (µM/sec.)
6/16/80	shallow	10	0.055	5.0	0.012
	deep	18 .	0.114	5.0	0.024
7/17/80	shallow	9	0.068	5.6	0.013
	deep	16	0.092	5.6	0.018

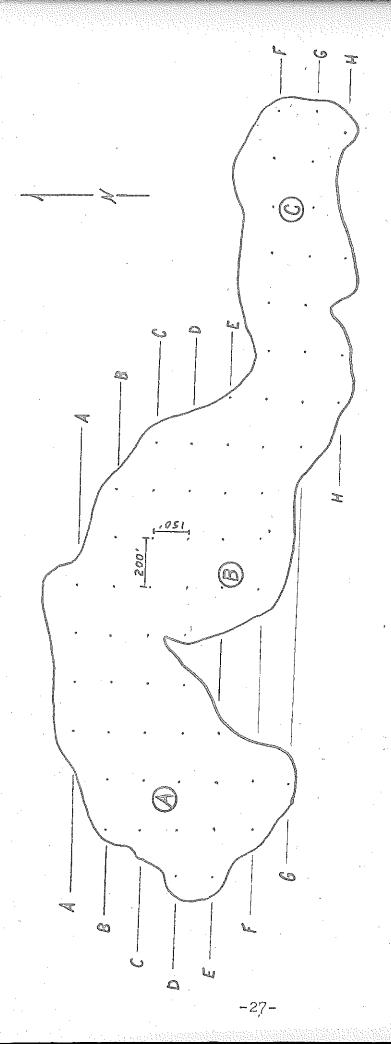
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Surface	A CONTRACTOR OF THE PARTY OF TH
Inlake	
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										mg/l.			,	,			
Total ${ m PO}_{\mu}$ -P			0.011		0.017	:	0.014	0.013	0,013	solids = 2.4 m_{\odot}	-	0.021	0.032	980.0	0,023	0,018	0.016
TKN			0.76		1.63		0.84	0,86	06.0	sus.		1.04	1,12	1,20	1,23	0,70	1,26
NO2+NO3-N		:	0.02		£0°0		00°0	0,10	00.00	std. units,		0,01	00°0	0.03	00.00	00 0	0.00
$N = \frac{1}{2}$	N		00.00	, 1	20.0	. '	00.00	70.0	0.13	color = 13 s	` `	0.14	20°0	0.45	0,11	90°0	0 08
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AJ		t safe.	847	44.	58		09	54	77	S MHO		竹竹	77	38	947	077	947
ΗÇ		Ice no	7.90		7.52	-	7.64	7.90	8.34			8.30	8.30	8,15	8,20	8,04	8.60
Elev		64.473	94,55				76.76	69°46	£8°776	Cond. =		94.52	69.46	94.39	75°46	94.78	99.46
Date	1979	Nov. 12	Dec. 11	1980	Jan. 14		Feb. 12	Mar, 18	ADE, 14	•I		May 13	June 16	July 14	Aug. 11	Sept. 15	0ct. 13

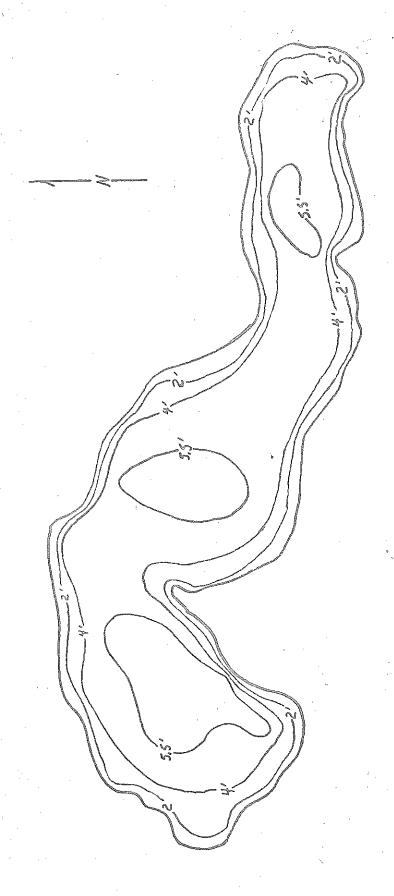
	i							ng/l	\$ *	,		. ′		,
	Total POL -P	of GRIPTIC ACT CAC ACT ACT ACT ACT ACT ACT ACT AC		0.012	0.025	0.014	0.016	0.019 $solids = 3.2 \text{ mg/l}$	0,025	760.0	. 460.0	0.027	0.023	0.020
	TKN	CATANATA REPRESENTATION OF THE PROPERTY.		1, 18	1.01	1.34	0.76	0.73 total sus.	1.04	0.95	78.0	1. 18	0.81	06 ° 0
	No2+No3-N	Omention with the contract of		0.02	0.01	0.01	0.03	o.o1 units,	0,01	00.00	00.00	0.01	00.00	0.01
	NH3-N			00 0	0.10	0.17	00.00	0,00 color = 22 std,	0.07	90 ° 0	0。24	00.00	90.0	0.17
Bottom	Alk.		t safe	84	58	09	54	36	ተተ	77	ተተ	94	75	ተተ
Inlake Ba	Hď		Ice not	7.90	7.18	7.58	7.60	8.20 80 microWHO	8,30	8,55	017 8 8 . ;	8.22	7.80	8,52
	Elev.		-5 £t.	√. √.	īU	7	1,	-4,5 cond. = 8	-5	-5.5	٠ :	•	ı.	
LONG LAKE	Date	1979	Nov. 12	Dec. 11 1980	Jan, 14	Feb. 12	Mar, 18	Apr. 14	May 13	June 16	July 14	Aug. 11	Sept. 15	0ct. 13



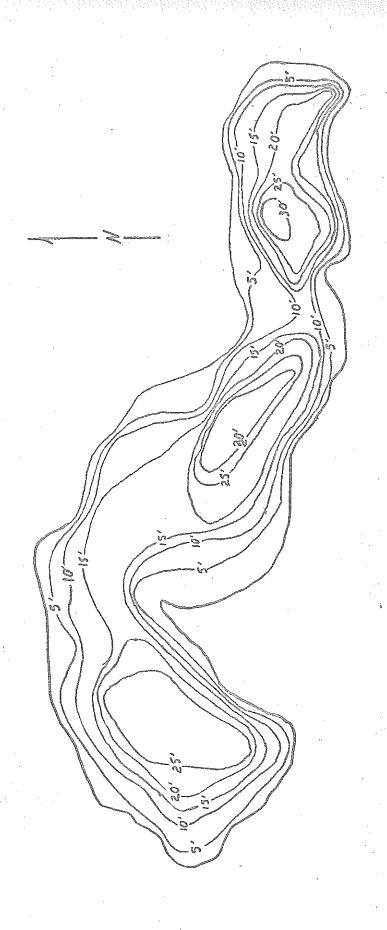


Long Lake Sediment Survey Transects

J = core collection sites



Long Lake Water Depths



Long Lake Depths to Hard Bottom

LONG LAKE SEDIMENT CORES

See map for core locations.

Core	% Water	% Organic Matter	% Nitrogen	% Phosphorus
A	95.3	63.6	2.5	0.019
В	91.4	51.4	1.7	0.016
C	92.2	59.2	2.3	0.037

%s organic matter, nitrogen, and phosphorus are given on a dry weight basis.

LONG LAKE CHLOROPHYLL DATA

ÉNTE OF COMPUTATION- 12/4/80
PROTOSYNTHETIC PIGNENTS IN NICROGRAMS FER LITER-

SECCHI DISC READING IN METERS

사용하다 시민 사람들은 그리고 있다.						一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个
SAIPLE	TRI-CHLA	CEHLA	PHEOFT	CHLB	CHLC	(6658)/(665A) SECÇHI DIŞC
The second second						
LL 4/28/80	3. 88274	3. 88752	ଥି	1. 51299	5. 60394	1.7 September 2015
11L 5/13/80	2. 52348	. 75294	2. 93647	321658	2. 04535	1.14286 > EDITION
LL 5/27/80 X	1.98104	1. 80492	. 236928	. 25584	. 249288	1.61905 > 60TTON
LL 6/16/80	4. 37866	3. 26274	1.83216	1. 23469	1. 17378	1.44828 > EQITON > 5
LL 7/2/80 🗴	2. 1827	1. 79424	. 627984	. 622848	. 396768	1.51852 → 60170N
TLL 7/14/60	5. 8835	5.87811	239478	1 4142	. 982665	1. 72973 > BOTTON > 3
/ LL 8/11/80	3. 74374	2. 99277	1. 19311	. 645446	. 854023	1.5 > BOTTON (%)
ILL 9/15/80	2. 36612	1.6821	1,09336	. 44685	49419	1.42424 > 60TTOH
LL 11/13/80	5, 77773	9. 08334	-5. 78642	. 889568	3. 2062	2. 92857 > EUTTON
V 12 iii 1					•	

* Collected, filtered, and frozen by district.

Samples on or about 8/1, 9/1, and 10/1, were to be collected by the district, however samplings were not taken on the first two dates and the early October sample had not been delivered as of the date of computation.

Secchi disc readings were always greater than the depth to bottom.

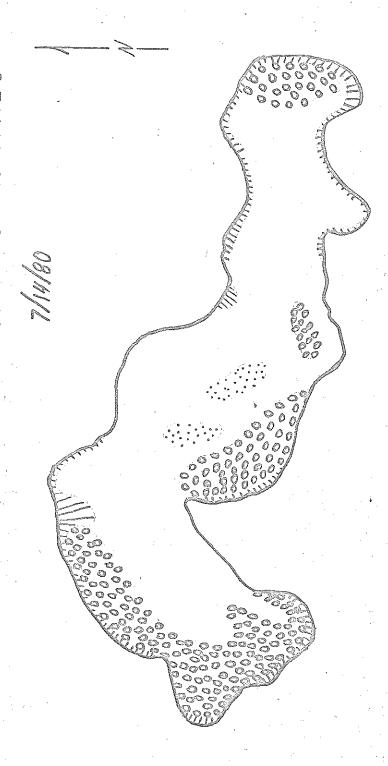
LONG LAKE	1980	-	PLANKTONIC	ALGAE	IDENTIFICATION
			AND ENUMER	ATION	

		1.9		•			
Name	units counted	<u>May 13</u>	<u>Jun 16</u>	Jul 14	<u>Aug 11</u>	<u>Sep 15</u>	<u>Oct 13</u>
CHLOROPHYTA							14 M/4
Ankistrodesmus falcatus	cells		•	80 ;	e de la composition della comp		3
Chlorogonium elongatum	cells			51	30		
Oocystis borgei	cells		1,621				
Scenedesmus sp.	cells		20			40	10
Scenedesmus abundans	cells			81			
Scenedesmus bijuga	cells				71		
Sphaerocystis schroteri	cells		853	11,666			
Tetraedron sp.	cells				35		
CRYPTOPHYTA		· `					
Chroomonas nordstedtii	cells	192		51		35 .	30
Cryptomonas erosa	cells	51		167	146	25	33
Cryptomonas ovata	cells	5	40				28
 PYRRHOPHYTA		•					
Ceratium hirundinella	cells			15			
Gymnodinium sp.	cells			5			
CYANOPHYTA		•	. 5				
Anabaena sp.	cells		51				
Anabaena macrospora	cells					404	
Aphanothece sp.	colonies	5	20	10	40	15	
				$(-1)^{-1} \left(\left(-1\right) \left(\alpha + \beta \right) \right) = 0.$	Some that he is that		

LONG LAKE (2) 1980 - PLANKTONIC ALGAE IDENTIFICATION AND ENUMERATION

	units	_	• •			
Name		13 Jun 16	Jul 14	<u>Aug 11</u>	Sep 15	Oct 13
CYANOPHYTA (co	ntinued)			And the second of the second o		
Chroococcus dispersus	cells 6	57	1,242	364	. 20 .	40
Coelosphaerium naegelianum	colonies	20		15	5	3
Dactylococcops sp.	is Colonies	•		5		
Merismopedia glauca	cells	•				101
Microcystis aeruginosa	colonies	15	10	' 25	40	5
Oscillatoria sp.	trichomes			20	8	
CHRYSOPHYTA						
Acnanthes sp.	cells			20		
Cocconeis sp.	cells	¥		·	10	3
Dinobryon cylindricum	cells 1,10	00		· · · · · · · · · · · · · · · · · · ·		61
Dinobryon sociale	cells			e de la companya de l		146
Fragillaria sp. Mallomonas	cells		•			25
sp.	cells		10	20	15	
Navicula sp.	cells	10				
UNKNOWN	cells 11	6	Post		104	967

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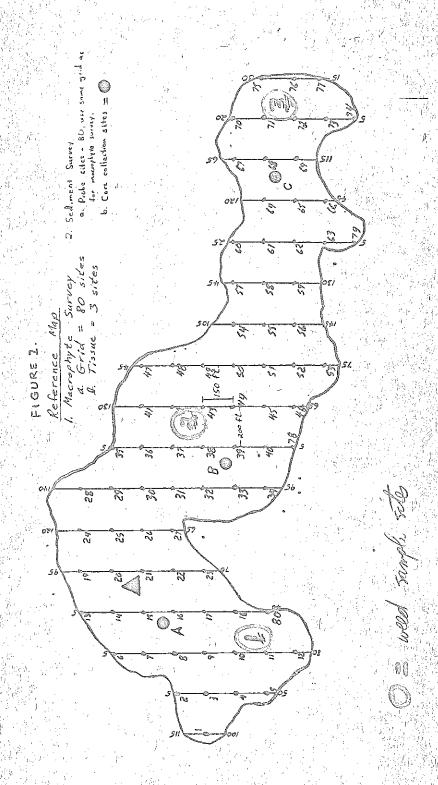
Major Community Types

mostly submergent, non-surfacing, light to moderate

soo Floating leaf mostly Potamogoten amplifolius

emergent

William Lake Service, Inc



A SAMPLING SITE FOR: WATER CHEMISTRY, DISSOLVED OXYGEN, TEMPERATURE, SECCHI DISC, CHLOROPHYLL a, AND ALGAE.

LONG LAKE MACROPHYTE SURVEY

Date 7/14/80

Species	Frequency	Average	Depth of
(common name)	(% occurance)	Density	Growth (ft.)
Polygonum natans	6.5	2.2	.5- 3
P. coccineum pratincola	6.5	1.4	.5 - 3
Brasenia Schreberi	24.6	3.2	.5 - 4.5
Nuphar variegatum	6.5	1.6	.5 - 4.5
Nympheae tuberosa	24.6	2.8	.5 - 4.5
Carex sp.	2.6	3.0	.5
Juncus pelocarpus	2.6	3.0	.5
Sagittaria sp.	15.6	2.6	.5 - 4
Dulichium arundinaceum	5.2	1.8	.5 - 2.5
Scirpus validus	3.9	2.0	.5 - 1
S. subterminalis	2.6	2.5	.5 - 2
Eleocharis acicularis	23.4	3.9	.5 - 4.5
Isoetes sp.	1.3	2.0	1.5
Myriophyllum exalbescens	5.2	2.0	1 - 4
M. alterniflorum	1.3	1.0	2.5
Elodea canadensis	11.7	2.4	3 - 5
Charra sp.	27.3	3.7	2.5 - 5
Megalodonta Beckii	2.6	3,0	3.5 - 4
Potamogeten praelongus	3.9	2.7	3.5 - 5
P. foliosus	10.4	3.5	1 7 5
P. gramineus	35.1	3.2	.5 - 4.5
P. amplifolius	23.4	2.9	2.5 - 5
P. Richardsonii	1.3	2.0	2.5
			and the second of the second o

LONG LAKE MACROPHYTE TISSUE ANALYSIS

June 16, 1980

Site (see map)	Species	%Phos.
#1	Brazenia Shreberi (watershield)	0.098
#2	Potamogeton amplifolius (largeleaf pondweed)	0.083
#3	Potamogeton gramineus (variable pondweed)	0.075
#3	Vallisneria americana (eel grass)	0.067
#3	Chara sp. (chara)	0.065
Aug. 11, 1980		
<i>#</i> 1	Chara sp.	0.13
#1	Brazenia Shreberi	0.12
#2	Myriophyllum sp. (milfoil)	0.22
#2	Potamogeton gramineus (variable pondweed)	0.30
#3	Valisneria americana	0.19
#3	Potamogeton gramineus	0.16
Sep. 15, 1980		
#1	Sediments	0.10
#2	Sediments	0.08
#3	Sediments	0.09

	MACROPHYTE SURVEY DA	ATA		Lake	- <u>-</u>	<u> </u>	ules	3 9					17			Section by Department and American	
	Transect						700	<u> </u>		New Di	ate;	Shaq T	19-				
	Station		12	3	4		15	77	18	79			(n.y., 95)				enemic Per
	Brazenia Shreberi	4	12	4	4		3	15			10		1/6			150	Page 2
	ZCarex		4				_ 3	12					13				
	Ceratophyllum demersum						<u></u>										
No.	Chard Dr. M	14		4								2.3			_		
The state of the s	Eleocharis <u>acicularis</u>		3			5				3		4					
No.	Elodea canadensis				-												Teamper
and the second	isoetes sa		172		-			_				F671					Azzare)
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	I. Trisulça									1966							
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and the second	M. enablescens		1	-						13	-				Park Joseph Ministra	vii ja isasa <u>ninai</u> s.	
	3 Janeus sp. (relocarous?)		13			3			20	13						rsy casacatal name.	
A Programma	Wajas flekilis		13										rice production of the second		Naise. Wasii		
	No. 2																
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	Polygonum Patays		3				Ta	1,,,	1.11.2		Transia.		2				i g
New Yorkship of	Pontederia cordata	^															
	Potamogeten crispus						1		a						1 100 mg		
On the state of	P. amplifolius	promote de la company	Contraction of the							y 1179		1000		1			
	P. gramineus,	ij.		13		5	4	1		12.50	Carrya.		1				
	P. natans								1.5%		18000 37.				<u> </u>		
	P. pectinatus	ai areanida men															
- A 5	Richardsonil				1				2								
	P. zosteriformis						177			7.5%							
-ten	Bir Missaledovia Rockii								3				1 1 5 W		1000		
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	Valisheria americana						0 4										
	White excluding com		2				7.5			A _p Agric				179		The expense	å.
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	eter depth (ft)	3]	.5	4	3.5	.5	2,5	2	35	24	4	2,5	3	<u>allanda</u>	7		Stress St.
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Niscetes (Clause)					- 4					-A	IJ				1	
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L. vrisulca														.7		
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Ranunculus			- The state of the													
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	Eleocharis acicularis			2	-			1	3			3				4			
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