

**WHITE POND WATER QUALITY DATA  
1989**

**prepared for**

**White Pond Advisory Committee  
and  
Board of Health  
Concord, Massachusetts**

**by**

**William W. Walker, Jr., Ph.D.  
Environmental Engineer  
1127 Lowell Road  
Concord, Massachusetts 01742**

**and**

**George P. Ploetz  
Consultant  
85 Holden Wood Road  
Concord, Massachusetts 01742**

**March 1990**

# WHITE POND WATER QUALITY DATA - 1989

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## Discussion

Attached are results of water quality monitoring conducted in an around White Pond in 1989. The monitoring is a continuation of a program initiated in 1987 to evaluate eutrophication and related water quality problems. Previous reports ("White Pond Preliminary Diagnostic Study", January 1988, and "White Pond Water Quality Studies - 1988", July 1989) describe the rationale for the monitoring program and results of 1987 and 1988 monitoring. The following comments are based upon review of the 1989 data:

- (1) White Pond water quality in 1989 was similar to that observed in 1987 and 1988 with respect to phosphorus and transparency:

Summer Median Values	1987	1988	1989
Total Phosphorus (ppm)	.022	.020	.020 (<=35 ft)
Transparency (feet)	15	21	21

Nuisance algal blooms were not reported in 1989.

- (2) Not reflected in the above median values is the period of relatively low transparency (~10 feet) which was experienced in July 1989 (Figure 4). Depletion of dissolved oxygen at depths greater than 35 feet also occurred approximately one month earlier in 1989, as compared with 1987 and 1988 (Figure 3). Accumulation of phosphorus in the bottom waters was also greater in September 1989 (.035-.054 ppm), as compared with September 1987 (.032 ppm) and September 1988 (.013-.04 ppm). All of these results are consistent with higher algal productivity in early Summer 1989, as compared with previous years.
- (3) Figure 5 shows that precipitation was above normal in Summer 1989, but below normal in the Summers of 1987 and 1988. The lower transparency in July, higher rate of oxygen depletion in early summer, and greater phosphorus accumulation in bottom waters in late summer may have been related to increased surface runoff from the watershed in 1989, particularly in June & July. As described in previous reports, surface runoff contributes nutrients, turbidity, and organic materials which can stimulate algal growth, reduce transparency, and increase rates of oxygen depletion from the pond bottom waters.
- (4) The 1989 program included profile measurements at 2 stations and surface measurements at 5 stations (Figure 1). Generally, station-to-station variations at given depth and date are small and consistent with the relatively small dimensions of the pond.

Monitoring at the deepest point (Station 1) is sufficient to track pond water quality.

- (5) Extremely low pH levels (<6) detected in 1988 were not repeated in 1989. May and August 1989 pH levels (6.3-7.1) and surface alkalinities (3-4 ppm) were typical of groundwater-fed ponds in sandy soils. Results indicate a general susceptibility to acid rain, but no immediate biological threat.
- (6) Follow-up sampling of the shoreline well at 55-57 White Avenue was conducted on three dates in 1989 (Table 3). Well water elevations were above Pond elevations by .5 to .88 inches, indicating a flow direction towards the Pond. Phosphorus concentrations (.03 to .160 ppm) were generally below values measured in 1988 (.005 to 1.8 ppm) at the same location. Extremely high total iron concentrations (30 to 155 ppm) were found in 1989 well samples (not analyzed in 1988). High iron levels most likely reflect dissolution of iron-bearing minerals in soils exposed to anaerobic groundwaters. Onsite sewage disposal systems probably contribute to the loss of oxygen from groundwaters and resulting release of iron. High iron levels in groundwaters would tend to buffer impacts of groundwater phosphorus loadings because of adsorption/precipitation reactions which occur when the anaerobic plumes reach pond surface waters and are aerated.
- (7) Recommended measures for further diagnosing and protecting pond water quality include:
  - (a) further diagnosis of groundwater flows and quality in shoreline areas; quantification of inputs from onsite sewage disposal systems; these features will be studied using a network of shoreline wells to be installed in 1990.
  - (b) design and implementation of measures to control surface runoff; specific problem areas identified in previous reports include the State boat ramp, Seymour Street drainage system, and Town Conservation area.
  - (c) close tracking of future land development in the watershed, in order to insure that such development is designed, constructed, and operated so as not to contribute additional nutrient loading to the Pond.

- (d) continued tracking of the Pond by lay monitors; transparency measurements should be taken at Station 1 every two weeks from June 1 through September 15; weather conditions and apparent water quality problems (algal blooms, scums, foams, odors) should also be noted. A reduced profile monitoring program (oxygen, temperature, phosphorus) will be proposed for 1990.

Table 1  
White Pond Sampling Dates - 1989

Date	Transparency Feet	Thermocline Depth	Bottom Oxygen	Oxygen	Notes
May 9	21	20	11.40	1.40	Sunny, Light W Wind
July 7	10	20	12.80	0.20	Sunny, Light W Wind
July 23	10	24	13.70	0.15	Sunny, Calm
July 24	12*				Sunny, Hot
August 1	21*				Sunny
August 9	25*				Sunny
August 10	21	25	12.60	0.20	Sunny, Hot, S1 Fishy Odor
August 18	27*				Sunny
August 31	>30*				Sunny, Very Windy
Sept 6	>30*				Sunny
Sept 8	25	25	12.00	0.40	Sunny, Calm

-----  
Depths in feet, Dissolved Oxygen in ppm

\* Measurements by Lay Monitors, Alan Aronie & Gail Jewell

Table 2  
Surface Total Phosphorus (ppm) vs. Station and Date  
White Pond - 1989

Date	Station				
	1	2	3	4	5
Location	W Hole	E Hole	White	Av Cons L	Beach
May 9	<.01	-	-	-	-
July 7	0.01	-	0.02	0.02	0.03
July 23	0.02	0.03	0.03	0.02	0.02
August 8	<.01	<.01	<.01	<.01	<.01
Sept 8	<.02	<.02	<.02	<.02	0.024

Table 3  
Shoreline Well Measurements - 1988 & 1989  
55-57 White Avenue

Date	Total P ppm	Ortho P ppm	Conduct uhos	T. Iron ppm	TKN ppm	Head in
08/13/88	0.005					
09/24/88	0.404					0.25
09/24/88	0.024					
10/31/88	1.800	0.38				0.50
05/09/89	0.130					0.88
08/08/89	0.060	0.03	162	72		0.50
08/08/89	0.030	0.02	171	30		0.50
09/08/89	0.160	<.02		155	1.1	0.75
09/08/89	0.075	<.02		78	1.1	0.75

Table 4  
White Pond Water Chemistry Measurements - 1989

Stations:

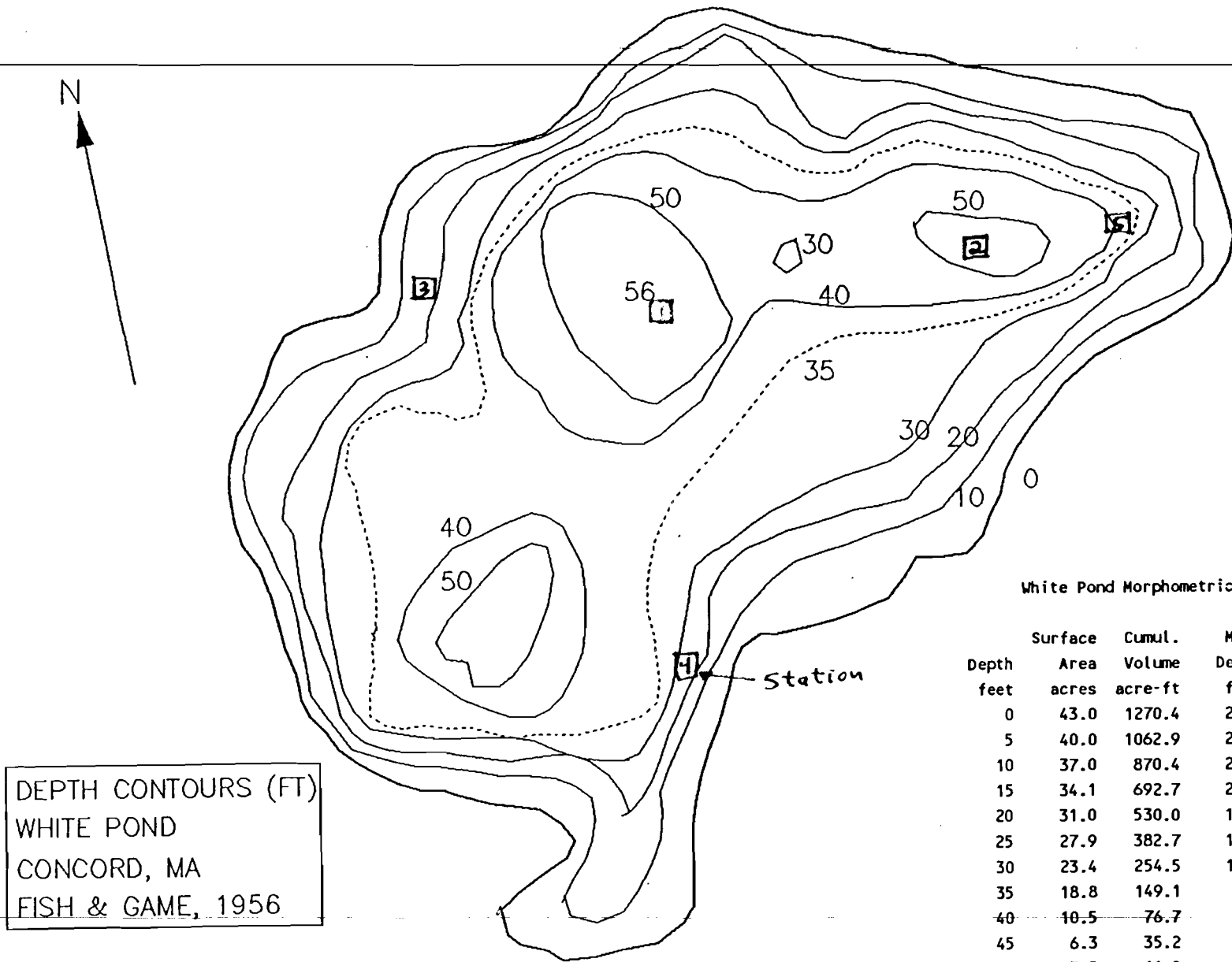
- 1 West Hole
- 2 East Hole
- 3 White Avenue
- 4 Town Conservation Land
- 5 Association Beach
- 6 Shoreline Well @ 55-57 White Avenue

Date	Sample	Station	Depth	Total P	Ortho P	pH	Alk	Cond	Iron
May 9	1	1	10	<.01		7.1	3.0		
May 9	2	1	30	<.01		6.5	3.5		
May 9	3	1	50	<.01					
May 9	4	6	0	0.13					
July 7	1	1	0	0.01					
July 7	2	1	10	0.03					
July 7	3	1	20	0.05					
July 7	4	1	30	0.03					
July 7	5	1	40	0.02					
July 7	6	1	48	0.03					
July 7	7	3	0	0.02					
July 7	8	4	0	0.02					
July 7	9	5	0	0.03					
July 23	1	1	10	0.02					
July 23	2	1	30	0.02					
July 23	3	1	50	0.04					
July 23	4	3	0	0.03					
July 23	5	4	0	0.02					
July 23	6	5	0	0.02					
July 23	7	2	0	0.03					
Aug 8	1	2	10	<.01					
Aug 8	2	2	25	<.01					
Aug 8	3	2	41	0.02					
Aug 8	4	2	50	<.01					0.93
Aug 8	5	1	10	<.01		6.8	4	41	
Aug 8	6	1	25	<.01		6.8	4	41	
Aug 8	7	1	50	0.02		6.3	7	45	0.85
Aug 8	8	3	0	<.01				41	
Aug 8	9	6	0	0.06	0.03			162	72
Aug 8	10	6	0	0.03	0.02			171	30
Aug 8	11	4	0	<.01					
Aug 8	12	5	0	<.01					
Sept 8	1	2	10	<.02					
Sept 8	2	2	25	0.016					
Sept 8	3	2	50	0.054					
Sept 8	4	2	36	0.019					
Sept 8	5	1	10	<.02					
Sept 8	6	1	25	<.02					
Sept 8	7	1	50	0.035					
Sept 8	8	3	0	<.02					
Sept 8	9	4	0	<.02					
Sept 8	10	5	0	0.024					
Sept 8	11	6	0	0.16	<.02				155
Sept 8	12	6	0	0.075	<.02				78.2

Depths in feet;

Concentrations in ppm, except pH & conductivity (uhos/cm)





DEPTH CONTOURS (FT)  
 WHITE POND  
 CONCORD, MA  
 FISH & GAME, 1956

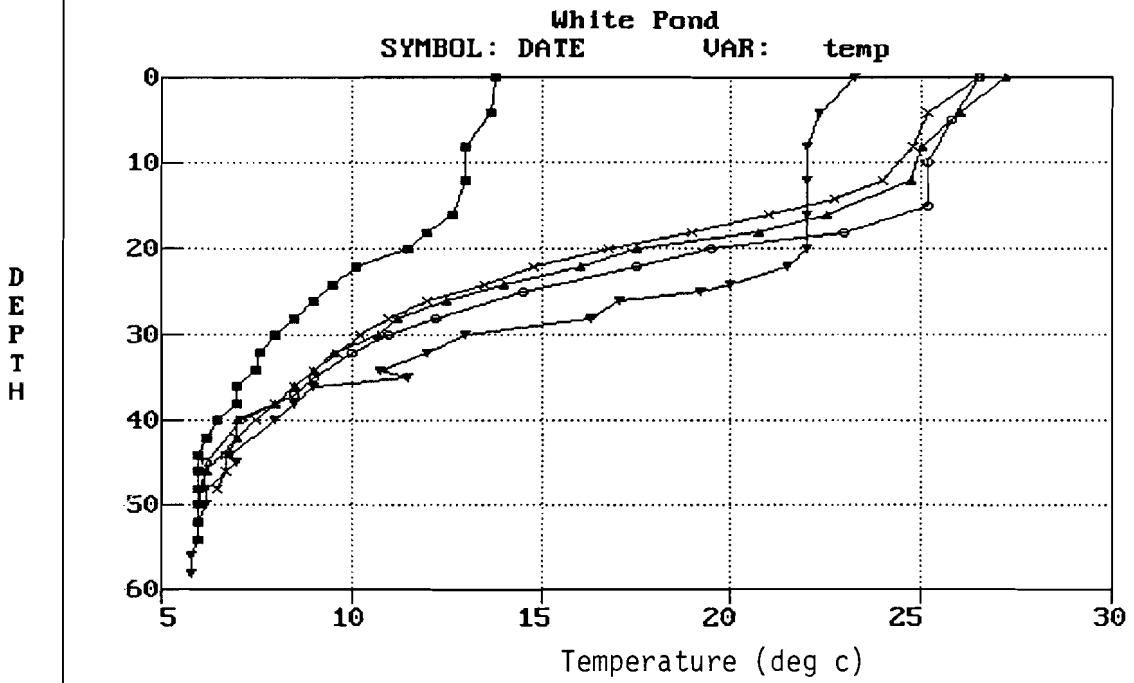
.1 MILES

White Pond Morphometric Data

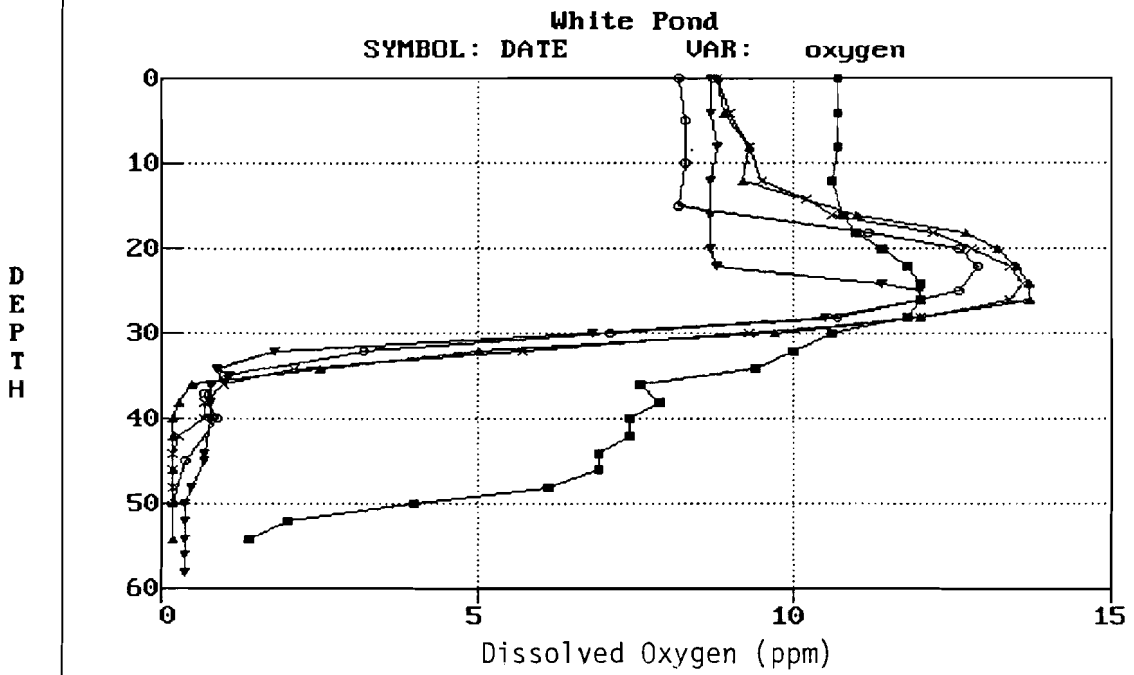
Depth feet	Surface Area acres	Cumul. Volume acre-ft	Mean Sediment Depth feet	Contact acres
0	43.0	1270.4	29.5	3.0
5	40.0	1062.9	26.6	3.0
10	37.0	870.4	23.5	2.9
15	34.1	692.7	20.3	3.1
20	31.0	530.0	17.1	3.1
25	27.9	382.7	13.7	4.5
30	23.4	254.5	10.9	4.5
35	18.8	149.1	7.9	8.3
40	10.5	76.7	7.3	4.2
45	6.3	35.2	5.6	2.8
50	3.5	11.2	3.2	2.4
55	1.1	0.4	0.3	1.1
56	0.0	0.0	0.0	0.0

Figure 1  
 Station Map

Figure 2  
 Temperature and Dissolved Oxygen Profiles - 1989

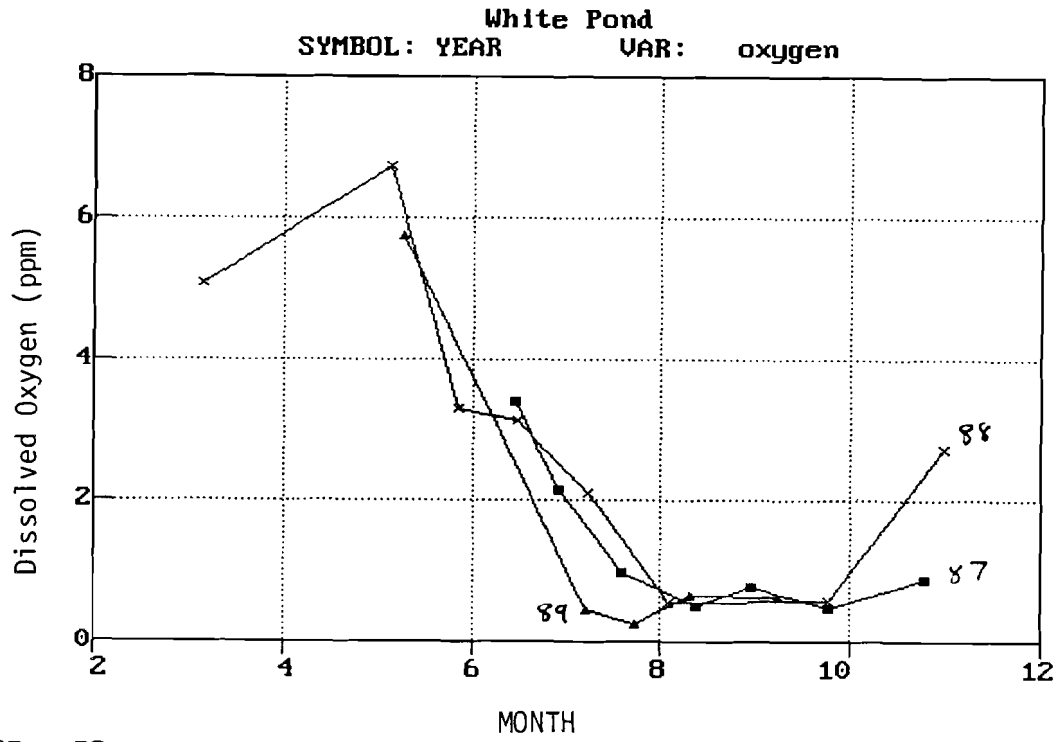


■ 890509 × 890707 ▲ 890723 ○ 890810 ▼ 890908



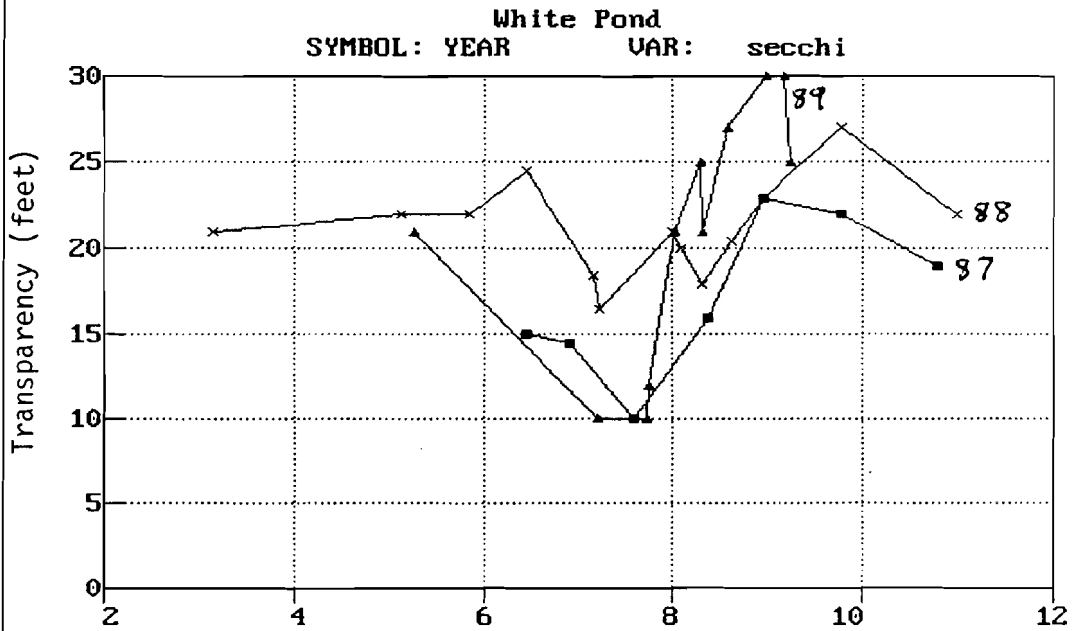
■ 890509 × 890707 ▲ 890723 ○ 890810 ▼ 890908

Figure 3  
Bottom Dissolved Oxygen - 1987 thru 1989  
Average of Measurements at or Below 35 Feet Depth

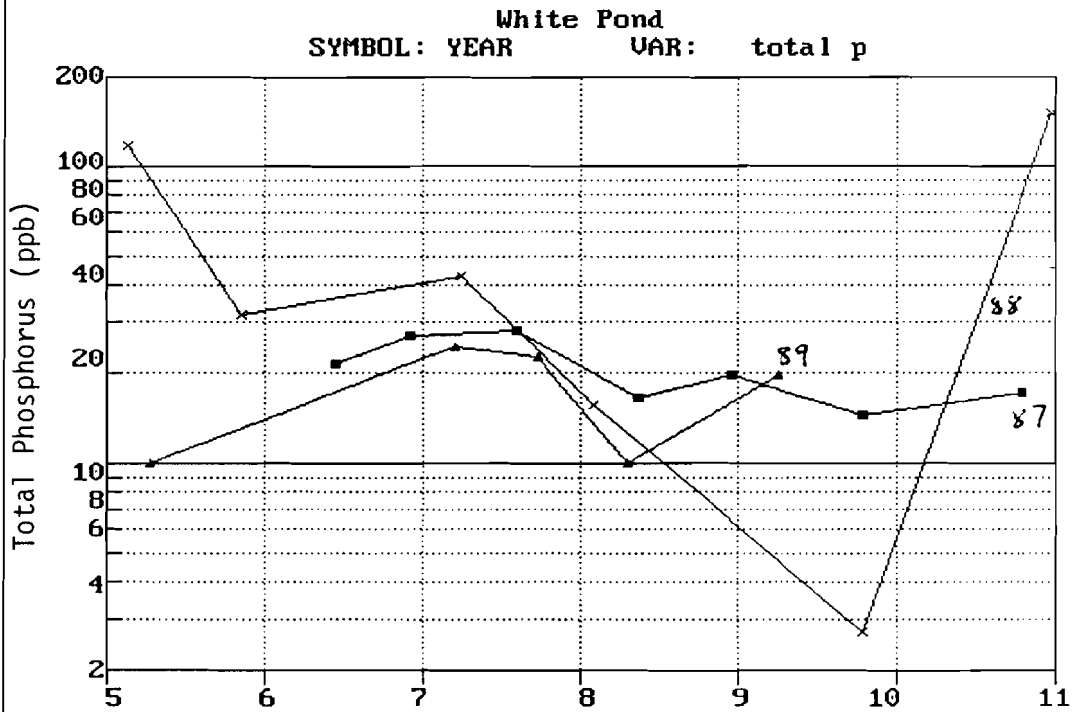


• 87 x 88 • 89

Figure 4  
 Transparency and Total Phosphorus - 1987 thru 1989



■ 87 × 88 ▲ 89



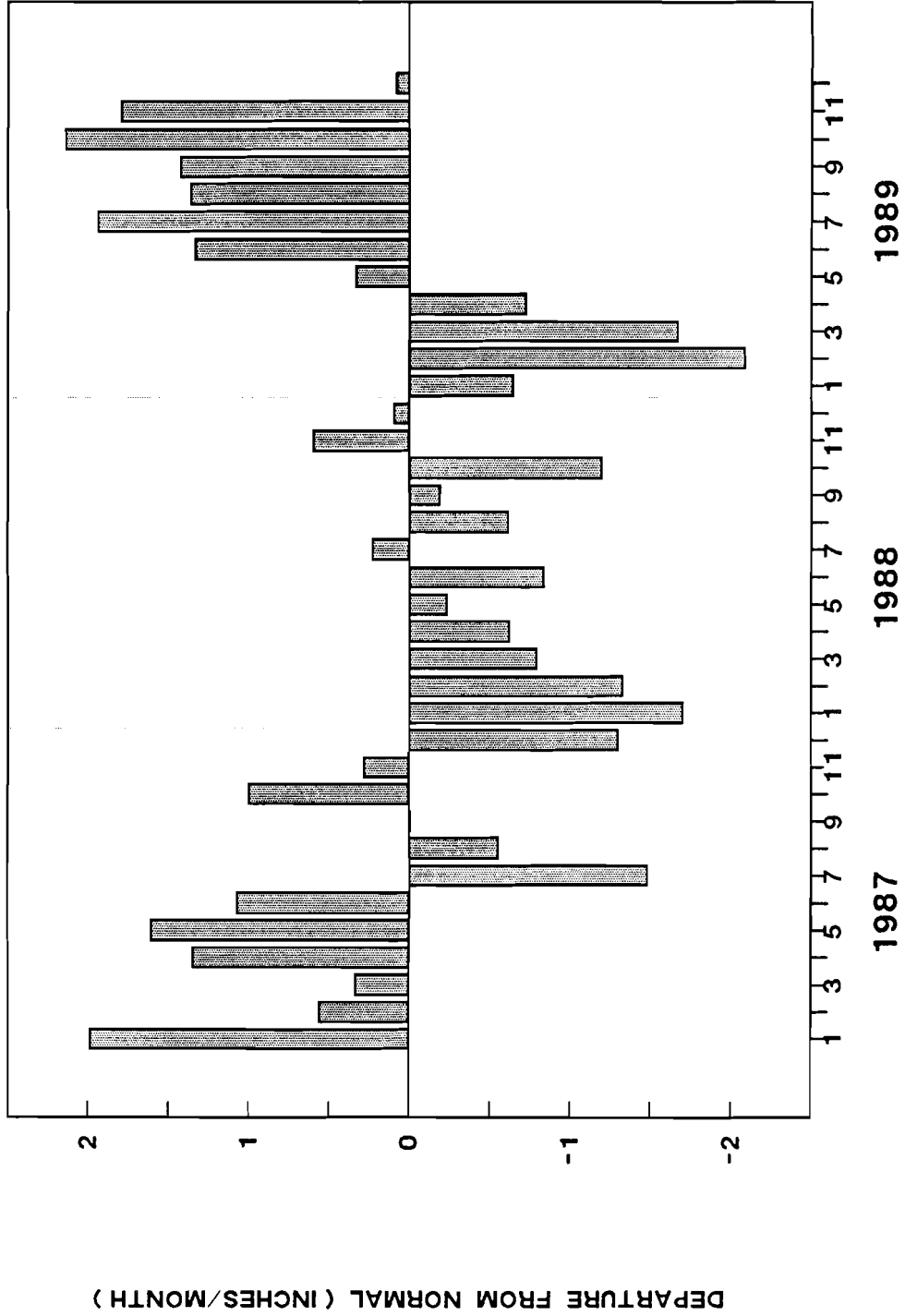
■ 87 × 88 ▲ 89

depths ≤ 30 ft

Figure 5  
 Worcester Airport Precipitation - 1987 thru 1989

**WORCESTER AIRPORT PRECIPITATION**

3-MONTH MOVING AVERAGES



APPENDIX

Oxygen and Temperature Profiles

Laboratory Reports\*

\* Sample numbers identified in Table 4

White Pond Monitoring Data - 1989

ST = STATION

- 1 = West Hole
- 2 = East Hole
- 3 = Off White Avenue
- 4 = Off Conservation Land
- 5 = Off Association Beach

DEPTH = Sample Depth (ft)

temp = temperature (deg-c)

oxygen = dissolved oxygen (ppm)

secchi = Secchi Disk transparency (feet)

total p = total phosphorus (ppb)

ST	DATE	DEPTH	temp	oxygen	secchi	total p
1	890509	.0	13.8	10.7	21.0	
1	890509	4.0	13.7	10.7		
1	890509	8.0	13.0	10.7		
1	890509	10.0				10.0
1	890509	12.0	13.0	10.6		
1	890509	16.0	12.7	10.8		
1	890509	18.0	12.0	11.0		
1	890509	20.0	11.5	11.4		
1	890509	22.0	10.1	11.8		
1	890509	24.0	9.5	12.0		
1	890509	26.0	9.0	12.0		
1	890509	28.0	8.5	11.8		
1	890509	30.0	8.0	10.6		10.0
1	890509	32.0	7.6	10.0		
1	890509	34.0	7.5	9.4		
1	890509	36.0	7.0	7.6		
1	890509	38.0	7.0	7.9		
1	890509	40.0	6.5	7.4		
1	890509	42.0	6.2	7.4		
1	890509	44.0	6.0	6.9		
1	890509	46.0	6.0	6.9		
1	890509	48.0	6.0	6.1		
1	890509	50.0	6.0	4.0		10.0
1	890509	52.0	6.0	2.0		
1	890509	54.0	6.0	1.4		
1	890707	.0	26.5	8.8	10.0	10.0
1	890707	4.0	25.2	9.0		
1	890707	8.0	24.8	9.3		
1	890707	10.0				30.0
1	890707	12.0	24.0	9.5		
1	890707	14.0	22.7	10.2		
1	890707	16.0	21.0	10.6		
1	890707	18.0	19.0	12.2		
1	890707	20.0	16.8	12.8		50.0
1	890707	22.0	14.8	13.4		
1	890707	24.0	13.5	13.6		
1	890707	26.0	12.0	13.4		

ST	DATE	DEPTH	temp	oxygen	secchi	total p
1	890707	28.0	11.0	12.0		
1	890707	30.0	10.2	9.3		30.0
1	890707	32.0	9.6	5.7		
1	890707	34.0	9.0	2.1		
1	890707	36.0	8.5	1.0		
1	890707	38.0	8.0	.7		
1	890707	40.0	7.5	.7		20.0
1	890707	42.0	7.0	.3		
1	890707	44.0	6.7	.2		
1	890707	46.0	6.7	.2		
1	890707	48.0	6.5	.2		30.0
1	890723	.0	27.2	8.8	10.0	
1	890723	4.0	26.0	8.9		
1	890723	8.0	25.0	9.3		
1	890723	10.0				20.0
1	890723	12.0	24.7	9.2		
1	890723	16.0	22.5	11.0		
1	890723	18.0	20.7	12.7		
1	890723	20.0	17.5	13.2		
1	890723	22.0	16.0	13.5		
1	890723	24.0	14.0	13.7		
1	890723	26.0	12.5	13.7		
1	890723	28.0	11.2	12.0		
1	890723	30.0	10.7	9.7		20.0
1	890723	32.0	9.5	5.0		
1	890723	34.0	9.0	2.5		
1	890723	36.0	8.5	.5		
1	890723	38.0	8.0	.3		
1	890723	40.0	7.0	.2		
1	890723	42.0	7.0	.2		
1	890723	46.0	6.2	.2		
1	890723	50.0	6.0	.2		40.0
1	890723	54.0	6.0	.2		
1	890810	.0	26.2	8.2	21.0	
1	890810	5.0	25.8	8.2		
1	890810	10.0	25.5	8.2		10.0
1	890810	15.0	25.2	8.2		
1	890810	18.0	23.0	11.2		
1	890810	20.0	20.0	12.3		
1	890810	22.0	17.8	12.6		
1	890810	25.0	14.5	12.6		10.0
1	890810	28.0	12.8	11.6		
1	890810	30.0	11.3	7.7		
1	890810	32.0	10.0	5.2		
1	890810	35.0	9.0	1.7		
1	890810	37.0	8.5	.7		
1	890810	40.0	7.5	.4		
1	890810	45.0	6.5	.3		
1	890810	50.0	6.0	.2		20.0



ST	DATE	DEPTH	temp	oxygen	secchi	total p
1	890908	10.0				20.0
1	890908	25.0	19.2	12.0		20.0
1	890908	35.0	11.5	1.1		
1	890908	40.0	8.0	.8		
1	890908	45.0	7.0	.7		
1	890908	50.0	6.2	.4		35.0
1	890908	54.0	6.0	.4		
2	890723	.0				30.0
2	890810	.0	26.5	8.2		
2	890810	5.0	25.8	8.3		
2	890810	10.0	25.2	8.3		10.0
2	890810	15.0	25.3	8.3		
2	890810	18.0	23.0	11.5		
2	890810	20.0	19.5	12.6		
2	890810	22.0	17.5	12.9		
2	890810	25.0	15.8	12.7		10.0
2	890810	28.0	12.2	10.7		
2	890810	30.0	11.0	7.1		
2	890810	32.0	10.0	3.2		
2	890810	35.0	9.0	1.0		
2	890810	40.0	7.1	.9		20.0
2	890810	45.0	6.2	.4		
2	890810	50.0	6.0	.3		10.0
2	890908	.0	23.3	8.7	25.0	
2	890908	4.0	22.3	8.7		
2	890908	8.0	22.0	8.8		
2	890908	10.0				20.0
2	890908	12.0	22.0	8.7		
2	890908	16.0	22.0	8.7		
2	890908	20.0	22.0	8.7		
2	890908	22.0	21.5	8.8		
2	890908	24.0	20.0	11.4		16.0
2	890908	26.0	17.1	12.0		
2	890908	28.0	16.3	10.5		
2	890908	30.0	13.0	6.8		
2	890908	32.0	12.0	1.8		
2	890908	34.0	10.8	.9		
2	890908	36.0	9.0	.8		19.0
2	890908	38.0	8.5	.8		
2	890908	40.0	8.0	.8		
2	890908	44.0	6.8	.7		
2	890908	48.0	6.2	.5		
2	890908	52.0	6.0	.4		54.0
2	890908	56.0	5.8	.4		
2	890908	58.0	5.8	.4		

ST	DATE	DEPTH	temp	oxygen	secchi	total p
3	890707	.0				20.0
3	890723	.0				30.0
3	890810	.0				10.0
3	890908	.0				20.0
4	890707	.0				20.0
4	890723	.0				20.0
4	890810	.0				10.0
4	890908	.0				20.0
5	890707	.0				30.0
5	890723	.0				20.0
5	890810	.0				10.0
5	890908	.0				24.0



CONAM INSPECTION

# Arnold Greene Testing Laboratories

East Natick Industrial Park  
6 Huron Drive • Natick, MA 01760-1383  
(617) 235-7330, (508) 653-5950  
Fax (508) 651-2974

Nondestructive • Chemical • Pollution • Metallurgical  
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Auburn, MA 01501-3204 (508) 832-5500

a unit of **CONAM INSPECTION, INC.**  
California, Texas, Illinois, Pennsylvania, Ohio

To: WILLIAM W. WALKER

Date: 5/10/89

Material: LAKE WATER

1127 LOWELL ROAD

Job Number: 23234-1

Book Number: 410-31-MH

CONCORD MA 01742

Lab Number: A89050905

SPECIFICATIONS:

Order No.: WHITE POND

Sample ID: 4 samples of LAKE WATER

Date received: 5/ 9/89

Page: 1

Analysis Comments: RESULTS IN MG/L UNLESS OTHERWISE NOTED.

	#1	#2	#3	#4
Alkalinity	3.0	3.5	--	--
pH	7.1	6.5	--	--
Total Phosphate	<0.01	<0.01	<0.01	0.13

IN WITNESS WHEREOF, I HAVE HEREUNTO SET MY HAND THIS  
10TH DAY OF MAY 1989  
ARNOLD GREENE TESTING LABORATORIES  
DIVISION OF CONAM INSPECTION

Donald B. Cowan, Manager



# Arnold Greene Testing Laboratories

Nondestructive • Chemical • Pollution • Metallurgical  
Inspection • Evaluation • Analysis  
Research • Development



East Natick Industrial Park  
6 Huron Drive • Natick, MA 01760-1383  
(617) 235-7330, (508) 653-5950  
Fax (508) 651-2974

Branch Laboratories:  
Springfield, MA 01109-2425      Auburn, MA 01501-3204  
(413) 734-6548      (508) 832-5500

a unit of **CONAM INSPECTION, INC.**  
California, Texas, Illinois, Pennsylvania, Ohio

To: WILLIAM W. WALKER

Date: 7/27/89

Material: LAKE WATER

1127 LOWELL ROAD

Job Number: 25981-1

Book Number: 418-4-DS

CONCORD MA 01742

Lab Number: A89072404

SPECIFICATIONS:

Order No.: NONE

Sample ID: 16 samples of LAKE WATER

Date received: 7/24/89

Page: 1

Analysis Comments: RESULTS IN MG/L.

	7/7/89 #1	7/7/89 #2	7/7/89 #3	7/7/89 #4	7/7/89 #5	7/7/89 #6	7/7/89 #7
Total Phosphate	0.01	0.03	0.05	0.03	0.02	0.03	0.02
	7/7/89 #8	7/7/89 #9	7/23/89 #1	7/23/89 #2	7/23/89 #3	7/23/89 #4	7/23/89 #5
Total Phosphate	0.02	0.03	0.02	0.02	0.04	0.03	0.02
	7/23/89 #6	7/23/89 #7					
Total Phosphate	0.02	0.03					

IN WITNESS WHEREOF, I HAVE HEREUNTO SET MY HAND THIS  
27TH DAY OF JULY 1989  
ARNOLD GREENE TESTING LABORATORIES  
DIVISION OF CONAM INSPECTION

Donald B. Cowan, Manager



CONAM INSPECTION

# Arnold Greene Testing Laboratories

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(413) 734-6548                      (508) 832-5500

a unit of CONAM INSPECTION, INC.  
California, Texas, Illinois, Pennsylvania, Ohio

To: WILLIAM W. WALKER

Date: 8/14/89

Material: LAKE WATER

1127 LOWELL ROAD

Job Number: 26546-1

Book Number: 422-10-MH

CONCORD MA 01742

Lab Number: A89081101

SPECIFICATIONS:

Order No.: WHITE POND

Sample ID: 12 samples of LAKE WATER

Date received: 8/11/89

Page: 1

Analysis Comments: RESULTS IN MG/L UNLESS OTHERWISE NOTED.

	1	2	3	4	5	6	7
Iron	--	--	--	0.93	--	--	0.85
Alkalinity	--	--	--	--	4.0	4.0	7.0
pH	--	--	--	--	6.8	6.8	6.3
Specific Conductance umho	--	--	--	--	41	41	45
Ortho Phosphate	--	--	--	--	--	--	--
Total Phosphate	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	0.02
	8	9	10	11	12		
Iron	--	72.0	30.0	--	--		
Alkalinity	--	--	--	--	--		
pH	--	--	--	--	--		
Specific Conductance umho	41	162	171	--	--		
Ortho Phosphate	--	0.03	0.02	--	--		
Total Phosphate	<0.01	0.06	0.03	<0.01	<0.01		

IN WITNESS WHEREOF, I HAVE HEREUNTO SET MY HAND THIS  
14TH DAY OF AUGUST 1989  
ARNOLD GREENE TESTING LABORATORIES  
DIVISION OF CONAM INSPECTION

Donald B. Cowan, Manager



CONAM INSPECTION

# Arnold Greene Testing Laboratories

Nondestructive • Chemical • Pollution • Metallurgical  
Inspection • Evaluation • Analysis  
Research • Development



East Natick Industrial Park  
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Fax (508) 651-2974

Branch Laboratories:  
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(413) 734-6548  
Auburn, MA 01501-3204  
(508) 832-5500

a unit of CONAM INSPECTION, INC.  
California, Texas, Illinois, Pennsylvania, Ohio

To: WILLIAM W. WALKER

Date: 9/19/89

Material: WATER

1127 LOWELL ROAD

Job Number: 27558-1

Book Number: 418-38-ds

CONCORD MA 01742

Lab Number: A89090804

SPECIFICATIONS:

Order No.: WHITE POND

Sample ID: 12 samples of WATER

Date received: 9/ 8/89

Page: 1

Analysis Comments: RESULTS IN MG/L.

	1	2	3	4	5	6	7
Iron	--	--	--	--	--	--	--
Total Kjeldahl Nitrogen	--	--	--	--	--	--	--
Ortho Phosphate	--	--	--	--	--	--	--
Total Phosphate	<0.02	0.016	0.054	0.019	<0.02	<0.02	0.035
	8	9	10	11	12		
Iron	--	--	--	155.0	78.2		
Total Kjeldahl Nitrogen	--	--	--	1.1	1.1		
Ortho Phosphate	--	--	--	<0.02	<0.02		
Total Phosphate	<0.02	<0.02	0.024	0.16	0.075		

IN WITNESS WHEREOF, I HAVE HEREUNTO SET MY HAND THIS  
19TH DAY OF SEPTEMBER 1989  
ARNOLD GREENE TESTING LABORATORIES  
DIVISION OF CONAM INSPECTION

Donald B. Cowan, Manager