TECHNICAL MEMORANDUM

LAKE OKEECHOBEE WATER QUALITY MONITORING PROGRAM

ANNUAL REPORT

YEAR THREE

OCTOBER 1985 - SEPTEMBER 1986

In Partial Fulfillment of Specific Condition (VI E) of Florida Department of Environmental Regulation Permit No. 50-0679349

February 1988

This public document was promulgated at an annual cost of $749.00 or $1.49 per copy to inform the public regarding water resource studies of the District. RP 1189 5C

Water Quality Division

Resource Planning Department

South Florida Water Management District

EXECUTIVE SUMMARY

This annual report on the Lake Okeechobee water quality monitoring program covers the period of October 1, 1985 to September 30, 1986. This is the fourth year of the District's Operating Permit issued by the Florida Department of Environmental Regulation for water control structures discharging to the lake. Included are: (1) water quality summaries for the lake, its inflows and outflows, and pump discharges to the Water Conservation Areas; (2) phosphorus and nitrogen inputs from each major lake tributary; (3) an update on the lake's trophic state; (4) results of pesticide monitoring at water control structures in the Everglades Agricultural Area; and (5) an annual report for the Taylor Creek/Nubbin Slough BMP monitoring program.

One of the most significant findings from the 1985-86 water quality data was the decline in the average lake phosphorus concentration. The total phosphorus concentration had doubled from 1973 to 1984, but in the next two years it decreased to the lowest level since 1977. The mean total nitrogen concentration also remained relatively low. These data indicate that the lake, despite recent fluctuations in nutrient concentrations, remained in a moderately eutrophic state.

Despite a massive summer algal bloom, the average lake chlorophyll a concentration, a measure of phytoplankton biomass, remained at the same level as the historical average concentration of 23 mg/m^3. The bloom, composed of the blue-green species Anabaena circinalis, occurred in July and August, and was concentrated on the lake's western shore by strong winds.

Lake inflows were below normal in 1985-86, as they have been throughout the Operating Permit period. Total nutrient loadings from those inflows identified in the Permit were below the target loading rates. Individually, all inflows met their 5-year target loads except the lower Kissimmee River and Taylor Creek/Nubbin Slough (S-191) basins. Although S-191 did not meet the 5-year targets, its nutrient inputs were below the interim 3-year target loads. The Interim Action Plan kept

EAA nutrient inputs well below target levels. This Plan, however, forced greater discharges to the Water Conservation Areas. The S-154 basin, which is impacted by agricultural operations and discharges to the Kissimmee River below S-65E, contributed a significant amount of phosphorus for its size.

Preliminary trend analysis indicates that phosphorus concentrations in the Taylor Creek/Nubbin Slough basin are declining. Best Management Practices were implemented in 78 percent of the critical acreage by the end of 1986. However, S-191 still has not met the 3-year target concentrations of 0.67 mg P/L and 1.72 mg N/L.

Meanwhile, phosphorus concentrations in the lower Kissimmee River (C-38) basin appear to be increasing. Average values for the last three years have been higher than the 1973-79 base period average, and the 1985-86 value was over four times the historical average. This suggests that phosphorus runoff is increasing in the lower part of the basin where agricultural activity is most intense.

Routine pesticide monitoring conducted at District EAA pump stations in February and June 1986 found no detectable residues in water samples, but detectable residues of aldrin, diazinon, and malathion in some of the sediment samples taken in February. The aldrin could be a relic residue from previous use since this compound has been banned since 1974. The other two compounds are non-restricted use insecticides which have no water quality or health standards for agricultural chemical residues in the sediment. Monitoring will continue to determine any trends in the data.

A separate investigation of the rodenticide zinc phosphide was conducted in September 1986 at the same stations to determine if detectable quantities were present in water samples during the period of application to sugar cane fields. Small quantities were detected at five of the six sites. No State of Florida standards or EPA guidelines exist for this compound.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

LAKE OKEECHOBEE WATER QUALITY MONITORING PROGRAM

YEAR THREE - OCTOBER 1985 - SEPTEMBER 1986

Lake Okeechobee is a shallow, eutrophic lake that is impacted by agricultural runoff. As part of its management of this lake, the South Florida Water Management District has been monitoring the water quality of Lake Okeechobee and its inflows and outflows since 1973. The first seven years of study (April 1973-March 1980) were summarized in SFWMD Technical Publication No. 81-2 (Federico et al., 1981) and are referred to here as the 1973-79 base period.

In response to recommendations of the 1981 report, nutrient loading allocations were assigned to each watershed within the Okeechobee basin on the basis of drainage area (SFWMD 1982). In September 1983, the Florida Department of Environmental Regulation issued a five-year permit to the South Florida Water Management District for the operation of its inflow structures around Lake Okeechobee. Specific Condition (V) of this permit establishes nutrient loading targets for each major watershed (Table 5). Overall, these targets call for a 24 percent reduction in the average phosphorus load and 39 percent reduction in average nitrogen load relative to the 1973-79 base period. To ensure that nutrient reductions are uniformly achieved, the target loads for each inflow cannot be exceeded by more than 10 percent when the permit expires in September 1988. Further limitations on nutrient loads were set for those basins that were deemed critical to the District's nutrient control strategy. S-2 and S-3 are thus required to achieve their loading targets in three, rather than five, years. Likewise, S-191 is restricted to three-year target loads of 139 tons of phosphorus and 388 tons of nitrogen, and maximum allowable concentration limits of 0.67 mg P/L and 1.72 mg N/L.

These target levels were designed to substantially reduce the loads from those basins with the highest nutrient runoff rates, while setting attainable goals for the five-year duration of the permit. Thus, the S-2 and S-3 basins were required to meet the District's loading allocations for nitrogen and phosphorus, whereas the Taylor Creek/Nubbin Slough and lower Kissimmee River basins are required to reduce their nutrient inputs to the lake, but these reductions are not as stringent as the loading allocations established by the District. The permit does not require nutrient loading reductions from the other sub-basins.

This report provides an update on the effectiveness of the South Florida Water Management District's Lake Okeechobee Water Quality Management Plan in reducing tributary nutrient loads to the target levels. This report covers the third year (October 1, 1985 to September 30, 1986) of implementation. Active nutrient control options have been implemented in the S-2 and S-3 basins by using the Interim Action Plan, and in the Taylor Creek/Nubbin Slough basin by utilizing Best Management Practices (BMP's) (Table 1). The management strategy for water quality in lower-priority basins during these first three years consisted of regulatory control of new drainage systems to improve the quality of water being delivered off site. This form of regulatory control is effective only when land use intensifies and new drainage systems are needed. Except for the Taylor Creek/Nubbin Slough BMP program, there has been no retrofitting of existing drainage systems for the purpose of improving water quality. The Governor's Lake Okeechobee Technical Advisory Committee (LOTAC) recommended several other management options to improve the water quality of the lake's inflows or divert nutrient-rich water from the lake and these are being evaluated.

TABLE 1. SUMMARY OF WATER QUALITY MANAGEMENT STRATEGY FOR LAKE OKEECHOBEE INFLOW STRUCTURES

Structure	Management Strategy
S-2	Interim Action Plan (July 1979)
S-3	Interim Action Plan (July 1979)
S-4	Regulatory Control of New Drainage Systems
S-191	Best Management Practices (1981)
S-65E	Regulatory Control of New Drainage Systems Pending Results of Kissimmee River Survey Review
S-84	Regulatory Control of New Drainage Systems
S-71	Regulatory Control of New Drainage Systems
S-72	Regulatory Control of New Drainage Systems
S-127	Regulatory Control of New Drainage Systems
S-129	Regulatory Control of New Drainage Systems
S-131	Regulatory Control of New Drainage Systems
S-133	Regulatory Control of New Drainage Systems
S-135	Regulatory Control of New Drainage Systems

MATERIALS AND METHODS

Taylor Creek/Nubbin Slough

Water quality data from 26 tributary stations in the Taylor Creek/Nubbin Slough basin are summarized in a separate report (Appendix A - 1986 Annual Report, Rural Clean Water Program, January 1988).

Lake Okeechobee

Eight stations were monitored in the limnetic zone of Lake Okeechobee along with 17 inflow/outflow structures and Fisheating Creek (Figure 1). The frequency of monitoring and the parameters measured are given in Table 2. Water quality in the lake was measured monthly. Sampling of inflows and outflows around the lake was conducted every two to four weeks, depending on discharge. In a few cases, data were not collected for a longer period if there had been no discharge. Sampling and analytical procedures have been described by Federico et al. (1981).

Water Conservation Areas

Water quality data from three pump stations discharging into the WCA's from the Everglades Agricultural Area (EAA) are also included in this report.

Pesticide Monitoring

The South Florida Water Management District routinely monitors pesticides and herbicides semi-annually at six pump stations (S-2, S-3, S-4, S-6, S-7, and S-8) that discharge from the Everglades Agricultural Area. Water and sediment samples were taken on February 11-12 and June 25-26, 1986. The water samples were surface grab samples and the sediment samples were collected with a petite Ponar dredge.

On September 23, samples were again collected at the six pump stations to monitor zinc phosphide, the active ingredient in a rodenticide used to control cotton rats in sugarcane. The objective was to determine if detectable quantities of zinc phosphide were present in the water during a typical application season.

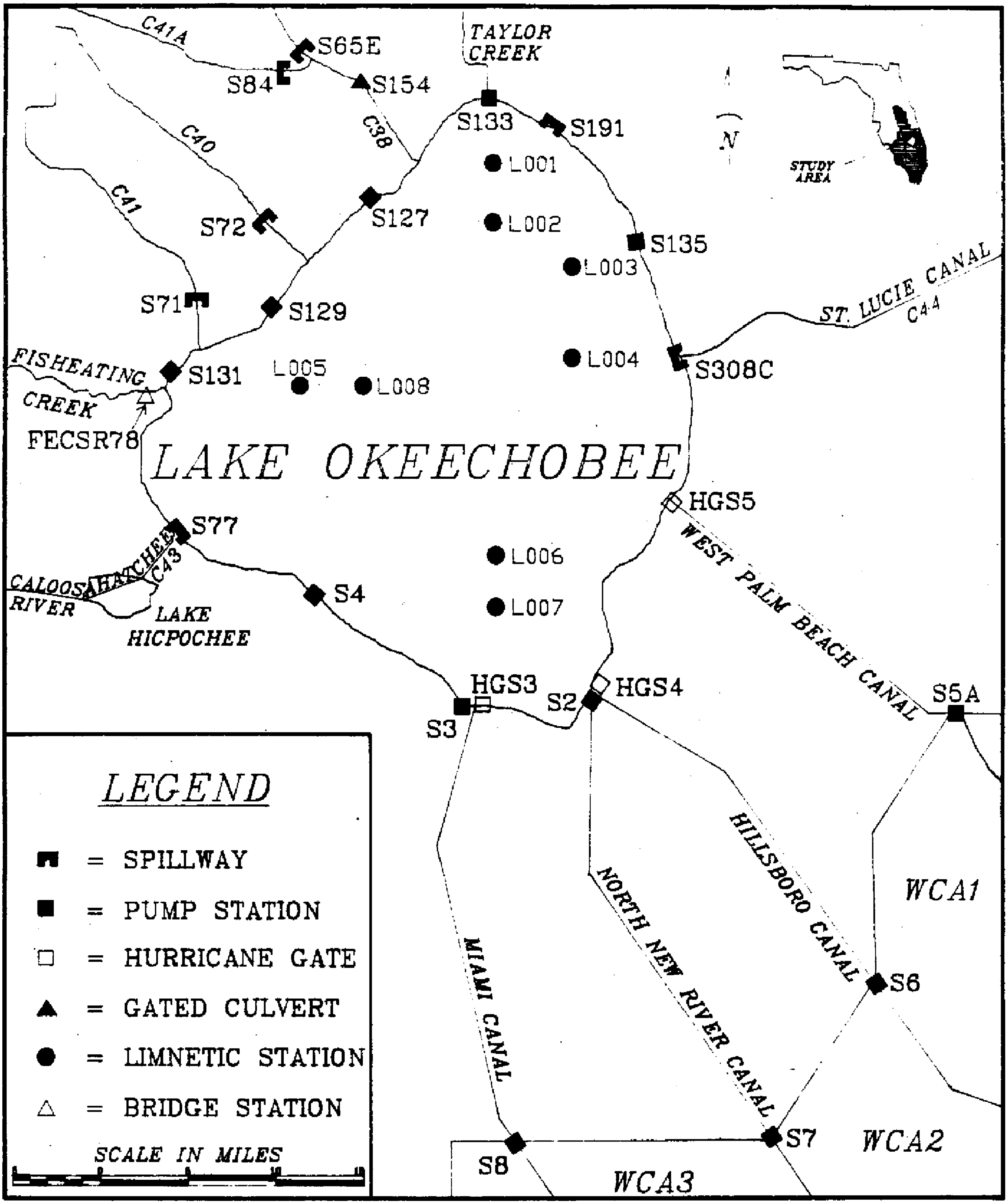


FIG. 1.–Lake Okeechobee Operation Permit Sampling Stations

TABLE 2. WATER QUALITY PARAMETERS

Sampling Frequency	Parameter
Monthly	Temperature
Monthly	Dissolved Oxygen
Monthly	Specific Conductance
Monthly	pH
Monthly	Turbidity
Monthly	Color
Monthly	Nitrite
Monthly	Nitrate
Monthly	Ammonia
Monthly	Total Nitrogen
Monthly	Total Kjeldahl Nitrogen
Monthly	Ortho Phosphorus
Monthly	Total Phosphorus
Monthly	Total Suspended Solids
Monthly	Alkalinity
Monthly	Chloride
Quarterly	Total Iron

All sample bottles were teflon-capped glass and were supplied by the contract laboratory (Enviropact, Inc. of Miami, Certification No. 86119, for February samples; Orlando Laboratories, Inc. of Orlando, Certification No. 83141, for June samples; Everglades Laboratories, Inc. of West Palm Beach, Certification No. 86109, for September samples). All samples were placed on ice and shipped to the lab. Analyses were performed in accordance with EPA, ASTM, Standard Methods, or other approved methods.

Nutrient Loadings

Measured nutrient loading rates for the major lake inflows are compared to target loading rates later in this report. Target loads deal only with portions of the lake basin identified as "controllable sources" by the District's Lake Okeechobee Water Quality Management Plan. Consequently, inputs from the Upper Kissimmee Basin and the Lake Istokpoga Basin are not included in the target loads for S-65E, S-71, S-72, and S-84. In Table 5 (see Results section), the discharge and nutrient loads from the outflow of Lake Kissimmee (S-65) were subtracted from those at S-65E to obtain values for the Lower Kissimmee Basin. Likewise, the discharge and loads from the Lake Istokpoga outflow (S-68) were subtracted from the values at S-71, S-72, and S-84. The discharge from S-68 was divided among S-71, S-72, and S-84 in proportion to the amount of water that these three structures discharged into Lake Okeechobee.

RESULTS AND DISCUSSION

Water Quality Data Summary

Table 3 summarizes the water quality at each station in Lake Okeechobee and the lake average for the year. Water quality did not vary substantially between stations and measurements were generally within the range of values reported in previous years.

Although the lake phosphorus concentration doubled from 1973 to 1984, it declined in the next two years. The 1985-86 average total phosphorus concentration was 0.063 mg/L. This is the lowest mean concentration since 1977 (Figure 2). No definitive reason can be given for this trend, but the decline coincides with two years of relatively low phosphorus inputs and lower lake stage. The same pattern was observed during the 1980-81 drought.

Mean annual total nitrogen values have remained relatively low since declining from a high of 2.62 mg/L in 1980 (Figure 2). The 1985-86 mean value (1.54 mg/L) is similar to levels measured during 1973-75.

The average chlorophyll a concentration, a measure of phytoplankton biomass, did not deviate from the historical average even though a massive algal bloom appeared on the lake in July and August. Stations L005 and L008, which were closest to the bloom area, had the highest mean chlorophyll values for 1985-86. This algal bloom consisted primarily of Anabaena circinalis, a blue-green species, and formed offshore and was then blown to the west where it accumulated on the outer edge of the littoral vegetation and decomposed. The resulting bacterial growth consumed dissolved oxygen and raised ammonia concentrations. Virtually all invertebrates (fish apparently escaped) within a band 100-200 yards wide and 13 miles long were killed. Stations L005 and L008 were not in the most concentrated part of this bloom.

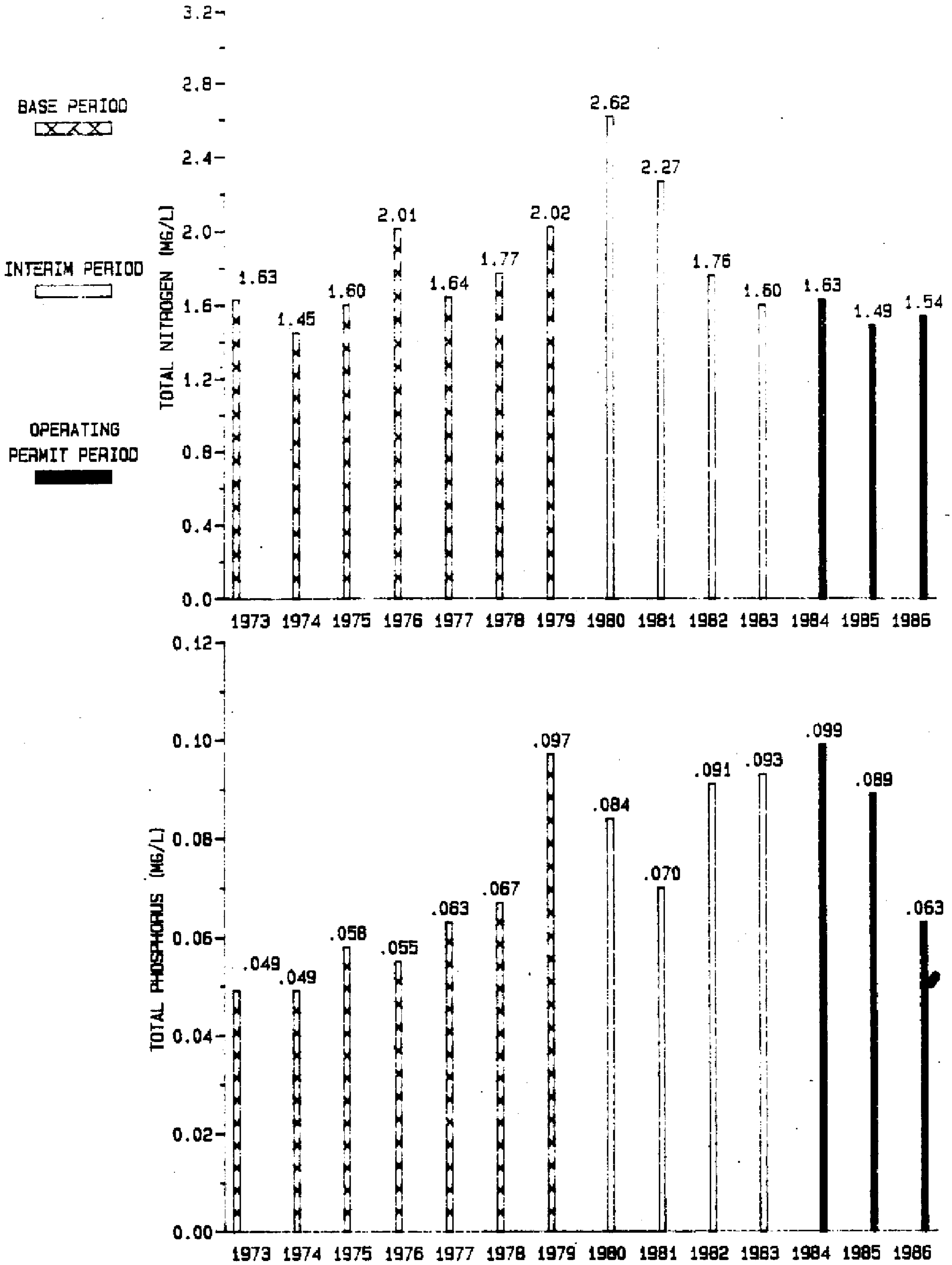
TABLE 3. LAKE OKEECHOBEE AVERAGE WATER QUALITY DATA

October 1985 - September 1986

Station	Temp (Celsius)	D.O. (mg/L)	Sp Conduct (micromhos/cm)	pH	Turbidity	Color	Tot. Sus. Solid (mg/L)	NO_2-N (mg/L)	NO_3-N (mg/L)
L001	24.1	8.6	532	8.0	11	47	13	0.008	0.038
L002	24.3	8.9	616	8.0	14	29	15	0.005	0.020
L003	25.9	8.7	625	7.9	20	27	15	0.005	0.078
L004	25.8	8.7	622	7.9	22	27	14	0.006	0.074
L005	25.1	9.0	587	8.3	11	33	11	0.005	0.007
L006	25.3	8.6	627	7.9	17	25	12	0.005	0.108
L007	25.3	8.6	615	7.9	9	27	7	0.005	0.088
L008	25.1	9.0	626	8.1	21	28	19	0.005	0.041
Lakewide Average	25.1	8.8	606	8.0	16	30	13	0.006	0.057

Station	NH_4-N (mg/L)	Total N (mg/L)	Ortho-P (mg/L)	Total P (mg/L)	Total Alk (mg/L $CaCo_3$)	Chloride (mg/L)	Total Fe (mg/L)	Chlorophyll a (mg/m^3)	Secchi Depth (meters)
L001	0.02	1.47	0.017	0.071	108	78.7	0.23	25.9	0.5
L002	0.02	1.39	0.010	0.063	127	84.7	0.19	27.8	0.5
L003	0.01	1.48	0.014	0.064	128	87.5	0.20	19.7	0.5
L004	0.03	1.56	0.015	0.071	128	86.2	0.24	18.4	0.4
L005	0.02	1.61	0.006	0.040	118	84.3	0.16	31.2	0.7
L006	0.02	1.61	0.022	0.069	134	88.8	0.25	13.4	0.5
L007	0.02	1.44	0.017	0.055	132	89.0	0.14	11.4	0.9
L008	0.02	1.75	0.007	0.071	129	87.3	0.26	35.0	0.4
Lakewide Average	0.02	1.54	0.014	0.063	126	85.8	0.21	22.9	0.5

FIGURE 2. MEAN ANNUAL LAKE OKEECHOBEE TOTAL N AND TOTAL P CONCENTRATIONS



The maximum chlorophyll value obtained from these stations was 57 mg/mm3, but concentrations of 167 mg/m^3 were measured in the thickest part of the bloom nearer to shore. Phosphorus and nitrogen concentrations preceding this bloom were at normal summertime levels.

Lake inflow and outflow water quality is shown in Table 4. Water quality data for major pump stations (S-6, S-7, and S-8) that discharge into the Water Conservation Areas from the EAA also appear in this table.

Discharges, Nutrient Loads, and Flow-Weighted Nutrient Concentrations

Table 5 compares discharges from Lake Okeechobee and the Water Conservation Area inflows during the first three years of the permit period to the 1973-1979 base period. Inflows from controllable-source basins have been below average during the permit period, especially in 1984-86. Total inflow from controllable-source basins in the latest year was 64 percent below the annual average inflow during the base period. Individually, all inflows were below normal. The Interim Action Plan was in effect all year, so S-2 and S-3 inputs were greatly reduced. (Appendix B summarizes the backpumping activity at these structures and the criteria used to determine whether or not to pump.) However, discharges from S-6, S-7, and S-8 were above average due to the diversion of EAA runoff to the Water Conservation Areas.

The 1985-86 phosphorus and nitrogen loads from controllable sources were 4 and 38 percent below the Operating Permit target loads, respectively. Taylor Creek/Nubbin Slough, the lower Kissimmee River, the Harney Pond Canal (S-71), and Fisheating Creek were the major nutrient contributors. Except for the lower Kissimmee River and S-191, all inflows to Lake Okeechobee met their 5-year target loads. The lower Kissimmee River exceeded the target load for phosphorus, and S-191 exceeded the targets for both phosphorus and nitrogen. Although S-191 did

TABLE 4. MEAN WATER QUALITY DATA FOR LAKE OKEECHOBEE TRIBUTARIES AND WATER CONSERVATION AREA INFLOWS AND OUTFLOWS OCTOBER 1985 - SEPTEMBER 1986

Station	Temperature (Celsius)	Dissolved Oxygen (mg/L)	Specific Conductance (micromhos/cm)	pH	Turbidity (NTU)	Color (PTU)	Total Suspended Solids (mg/L)
Lake Inflows							
S-2	23.7	3.9	577	7.2	9.7	112	13
S-3	25.2	5.3	521	7.3	11.0	94	11
S-4	24.2	4.5	620	7.2	4.6	105	5
S-127	25.4	6.8	779	7.6	4.0	83	5
S-129	24.5	6.1	644	7.5	3.7	97	4
S-131	25.3	5.6	689	7.5	2.1	107	2
S-133	26.7	7.7	560	7.6	3.3	73	5
S-135	26.2	8.1	687	7.9	4.2	71	5
S-71	24.3	4.9	271	6.6	2.6	157	2
S-72	25.3	3.8	335	6.6	2.7	182	2
S-84	25.7	6.3	204	6.6	2.3	107	1
S-65E	24.4	5.0	174	6.7	2.1	126	4
S-154	24.8	4.7	451	6.7	11.2	216	3
S-191	24.0	5.0	523	7.1	2.1	166	2
Fisheating Creek	23.9	5.9	198	6.5	2.7	231	2
Lake Outflows							
HGS-3	22.8	6.4	746	7.9	15.6	43	20
HGS-4	21.3	7.1	704	8.2	22.8	35	28
HGS-5	22.5	6.5	687	7.5	30.3	40	25
S-77	23.0	6.4	677	7.6	34.3	38	30
S-308C	28.9	4.9	563	7.4	5.5	150	5
WCA Inflows							
S-6	24.1	2.9	1227	7.0	4.1	141	5
S-7	24.1	4.1	980	6.9	3.4	128	5
S-8	24.8	5.0	749	7.5	20.8	130	26

TABLE 4. (CONTINUED)

Station	NO_2-N (mg/L)	NO_3-N (mg/L)	NH_4-N (mg/L)	Total N (mg/L)	Ortho-P (mg/L)	Total P (mg/L)	Total Alkalinity (mg/L $CaCO_3$)	Chloride (mg/L)	Total Iron (mg/L)
Lake Inflows									
S-2	0.086	1.062	0.497	4.28	0.076	0.135	307.3	193.4	0.16
S-3	0.060	1.386	0.336	3.95	0.045	0.133	195.8	140.6	0.08
S-4	0.029	0.095	0.239	2.18	0.129	0.197	196.8	116.6	0.17
S-127	0.005	0.009	0.063	1.91	0.028	0.093	143.5	123.9	0.11
S-129	0.006	0.026	0.035	1.84	0.043	0.136	126.5	71.8	0.15
S-131	0.007	0.039	0.056	1.82	0.042	0.086	154.0	105.2	0.14
S-133	0.012	0.049	0.063	1.67	0.138	0.207	123.2	77.6	0.08
S-135	0.007	0.019	0.050	1.72	0.022	0.069	164.4	98.2	0.10
S-71	0.030	0.511	0.219	2.10	0.114	0.168	21.2	28.4	0.81
S-72	0.019	0.210	0.211	2.03	0.132	0.202	36.7	32.7	0.75
S-84	0.012	0.107	0.097	1.61	0.027	0.065	10.6	23.9	0.78
S-65E	0.010	0.726	0.096	1.53	0.089	0.166	34.9	22.9	0.13
S-154	0.022	0.074	0.207	1.92	0.447	0.589	36.1	118.0	1.00
S-191	0.038	0.568	0.148	2.07	0.618	0.714	83.4	129.2	0.20
Fisheating Creek	0.012	0.015	0.042	1.71	0.097	0.151	16.4	41.1	0.20
Lake Outflows									
HGS-3	0.006	0.006	0.080	1.68	0.004	0.038	141.6	108.3	
HGS-4	0.004	0.018	0.027	1.84	0.004	0.039	141.6	100.9	
HGS-5	0.010	0.169	0.105	2.19	0.036	0.102	145.1	126.9	0.38
S-77	0.009	0.032	0.063	1.77	0.034	0.071	93.4	59.7	0.39
S-308C	0.040	0.198	0.175	2.20	0.199	0.269	121.0	70.6	
WCA Inflows									
S-6	0.064	0.931	0.22	3.70	0.042	0.082	344.0	175.7	0.18
S-7	0.052	1.398	0.14	4.07	0.060	0.097	317.1	122.3	0.16
S-8	0.013	1.297	0.03	3.97	0.069	0.203	242.6	86.7	0.61

TABLE 5 DISCHARGES AND NUTRIENT LOAD COMPARISONS FOR LAKE OKEECHOBEE AND THE WATER CONSERVATION AREAS

Structure or Basin	Average 1973-79	1983-84	1984-85	1985-86
Discharge (ac-ft/yr)				
S-2	195,880	51,047	164,863	11,648
S-3	55,733	23,171	145,422	6,153
S-4	34,887	74,580	4,036	11,669
S-127	10,886	33,685	1,769	9,006
S-129	11,169	14,682	1,964	1,009
S-131	5,277	5,607	960	1,751
S-133	15,680	50,384	7,652	5,528
S-135	17,432	32,947	7,476	14,479
S-71 (minus S-68 input)	81,408	67,760	14,935	66,274
S-72 (minus S-68 input)	17,432	6,727	49	9,068
S-84 (minus S-68 input)	68,442	61,586	12,452	22,504
S-65E (minus S-65 input)	589,326	244,275	82,826	128,440
S-154	-	25,785	12,202	31,689
S-191	153,586	108,073	71,304	100,272
Fisheating Creek	203,449	230,128	67,184	101,211
TOTAL	1,460,727	1,004,652	582,894	520,701
WCA Inflows				
S-6	140,966	161,437	89,802	279,829
S-7	134,819	326,829	185,987	286,269
S-8	263,967	492,227	265,511	488,786

NOTES:

Discharges for S-71, S-72, and S-84 do not include inputs from Lake Istokpoga through S-68. Discharges from S-65E do not include inputs from the Upper Kissimmee Basin through S-65E.

Discharge data for S-154 unavailable prior to November 1983.

TABLE 5. (CONTINUED)

Structure or Basin	Average 1973-79	Target	1983-84	1984-85	1985-86
Total Phosphorus Loads (tons/yr)					
S-2	35	[18]	18.6	45.1	3.6
S-3	7	[7]	11.8	37.3	2.1
S-4	15	15	58.1	2.1	2.8
S-127	7	7	15.3	0.4	2.9
S-129	3	3	2.3	0.3	0.1
S-131	1	1	0.6	0.1	0.2
S-133	7	7	26.7	2.3	1.9
S-135	4	4	3.9	1.0	1.3
S-71 (minus S-68 input)	47	47	33.5	12.0	36.5
S-72 (minus S-68 input)	8	11	3.7	0.1	6.0
S-84 (minus S-68 input)	6	13	8.2	0.3	5.0
S-65E (minus S-65 input)	108	86	111.5	27.5	104.3
S-154	-	-	33.4	10.1	50.0
S-191	189	98 (139)	146.2	88.5	115.7
Fisheating Creek	65	65	82.9	32.6	32.6
TOTAL	503	382	523.3	249.6	365.0

NOTES:

Nutrient loads for S-71, S-72, and S-84 do not include inputs from Lake Istokpoga through S-68. Nutrient loads from S-65E do not include inputs from the Upper Kissimmee Basin through S-65E.

[ ] Target loads for S-2 and S-3 to be met in three years.

( ) Three-year target load for S-191.

- Data not available.

TABLE 5. (CONTINUED)

Structure or Basin	Average 1973-79	Target	1983-84	1984-85	1985-86
Total Nitrogen Loads (tons/yr)					
S-2	1,548	[156]	485.6	1,243.9	114.3
S-3	373	[95]	255.3	852.3	59.5
S-4	142	142	275.4	22.8	33.0
S-127	34	34	100.5	5.3	25.1
S-129	33	33	30.8	4.5	3.1
S-131	13	13	12.2	1.8	4.6
S-133	41	41	144.8	18.4	14.4
S-135	51	51	74.5	20.3	36.9
S-71 (minus S-68 input)	323	323	238.9	105.4	326.2
S-72 (minus S-68 input)	86	132	24.7	0.1	51.9
S-84 (minus S-68 input)	110	258	132.1	34.0	103.7
S-65E (minus S-65 input)	997	838	295.1	33.4	432.5
S-154	-	-	-	-	92.6
S-191	479	258 (388)	283.6	209.1	279.4
Fisheating Creek	575	575	432.0	151.4	257.4
TOTAL	4,805	2,949	2,785.5	2,702.8	1,834.6

NOTES:

Nutrient loads for S-71, S-72, and S-84 do not include inputs from Lake Istokpoga through S-68. Nutrient loads from S-65E do not include inputs from the Upper Kissimmee Basin through S-65E.

[ ] Target loads for S-2 and S-3 to be met in three years.

( ) Three-year target load for S-191.

- Data not available.

not meet the 5-year targets, its nutrient inputs were below the interim 3-year target loads.

No target loads are designated for the S-154 basin by the Operating Permit, but the basin does contribute a significant amount (5 percent) of the total lake phosphorus loading even though its drainage area is relatively small. The District's phosphorus allocation for this basin is 4 tons per year. This allocation has been greatly exceeded in the three years since reliable discharge data has become available. Phosphorus input was 50 tons in 1985-86.

Table 6 summarizes the flow-weighted nutrient concentrations for selected inflows. The average phosphorus concentration from all inflows combined was 0.515 mg/L in 1985-86, which is twice the value for the base period. The difference reflects the domination of three relatively phosphorus-rich inflows: (1) the lower Kissimmee River (C-38), (2) Taylor Creek/Nubbin Slough, and (3) the Harney Pond Canal.

The phosphorus concentration in the Kissimmee River at S-65E is usually higher than at the outlet from Lake Kissimmee upstream at S-65. In 1985-86, phosphorus averaged 0.149 mg/L at S-65E verses 0.034 mg/L at S-65. Agricultural activity in the C-38 basin (especially in Pools D and E) contributes to progressively higher phosphorus levels downstream in the canal (Federico, 1982). Total phosphorus was especially high (0.35-0.45 mg/L) at S-65E in July and August 1986. Values this high have rarely been measured at this structure and concentrations have since returned to the normal range.

Flow-weighted concentrations for the C-38 basin are calculated after subtracting the phosphorus load from S-65. In 1985-86, the concentration was nearly 0.6 mg/L, which is over four times the base period average for this basin. Concentrations were also higher in the previous two years, which suggests a trend toward increasing phosphorus contributions from agricultural operations in the basin.

TABLE 6. COMPARISON OF FLOW - WEIGHTED CONCENTRATIONS

Structure of Basin	Average 1973-79	1983-84	1984-85	1985-86
Total Phosphorus				
S-2	0.132	0.268	0.201	0.227
S-3	0.095	0.374	0.188	0.251
S-4	0.314	0.573	0.388	0.176
S-65E (Lower Kissimmee Basin Only)	0.135	0.336	0.244	0.597
S-191*	0.906	0.995	0.913	0.848
S-71 (excluding S-68 input)	0.425	0.364	0.591	0.405
Fisheating Creek	0.235	0.265	0.357	0.237
S-154		0.953	0.609	1.160
Average for Total Lake Inflow from all Controllable-Source Basins (Except S-154)	0.253	0.383	0.315	0.515
Total Nitrogen				
S-2	5.82	7.00	5.55	7.22
S-3	4.92	8.10	4.31	7.11
S-4	2.56	2.72	4.16	2.08
S-65E (Lower Kissimmee Basin Only)	1.24	0.89	0.30	2.48
S-191**	2.29	1.93	2.16	2.05
S-71 (excluding S-68 input)	2.92	2.59	5.19	3.62
Fisheating Creek	2.08	1.38	1.66	1.87
S-154				2.15
Average for Total Lake Inflow from all Controllable-Source Basins	2.42	2.04	3.41	2.59

* Target Concentrations for S-191 are 0.670 mg P/L by Third Year of Operating Permit

** Target Concentrations for S-191 are 1.72 mg N/L by Third Year of Operating Permit

The flow-weighted phosphorus concentration for Taylor Creek/Nubbin Slough at S-191 is the highest of all the major inflows (0.848 mg/L in 1985-86). It has decreased slightly in the last two years. A preliminary trend analysis also indicates a downward trend in phosphorus levels since 1978 (Appendix A). BMP's had been implemented on 78 percent of the critical acreage by the end of 1986, but S-191 did not meet the three-year target concentrations of 0.67 mg P/L and 1.72 mg N/L.

The flow-weighted phosphorus concentration for the Harney Pond Canal was also relatively high (0.405 mg/L), but within the range of the historical record. Outflow from Lake Istokpoga acts to dilute phosphorus runoff from this basin, so actual concentrations measured at S-71 are usually not as high as this flow-weighted value.

Although not a major inflow, the S-154 basin was a major contributor of phosphorus in 1985-86. Its flow-weighted concentration was 1.16 mg P/L.

Flow-weighted phosphorus values at S-2 and S-3 remained high relative to the period of record and nitrogen concentrations were also slightly elevated. In contrast, the phosphorus concentration at S-4 was much lower (0.176 mg/L) than in recent years. It is difficult to determine the significance of these differences because these pump stations all discharged very low volumes during 1985-86 (Table 5).

Trends in flow-weighted concentrations for individual inflows must be regarded with caution, especially in years of low flow. This is because discharge events in low flow years are important to water quality, but are rare, and are less likely to be sampled adequately in such years. Therefore, only flow-weighted concentrations for the major inflows are reported in Table 6.

In summary, phosphorus and nitrogen loads to the lake were below the target loads in 1985-1986. This was mainly due to low discharges, although the Interim Action Plan and the BMP implementation in the Taylor Creek/Nubbin Slough basin had some effect. The lower Kissimmee River has shown a significant increase in phosphorus runoff. The S-154 basin and, possibly, the Harney Pond Canal basin are also areas of concern. In the third year of the Operating Permit, only the lower

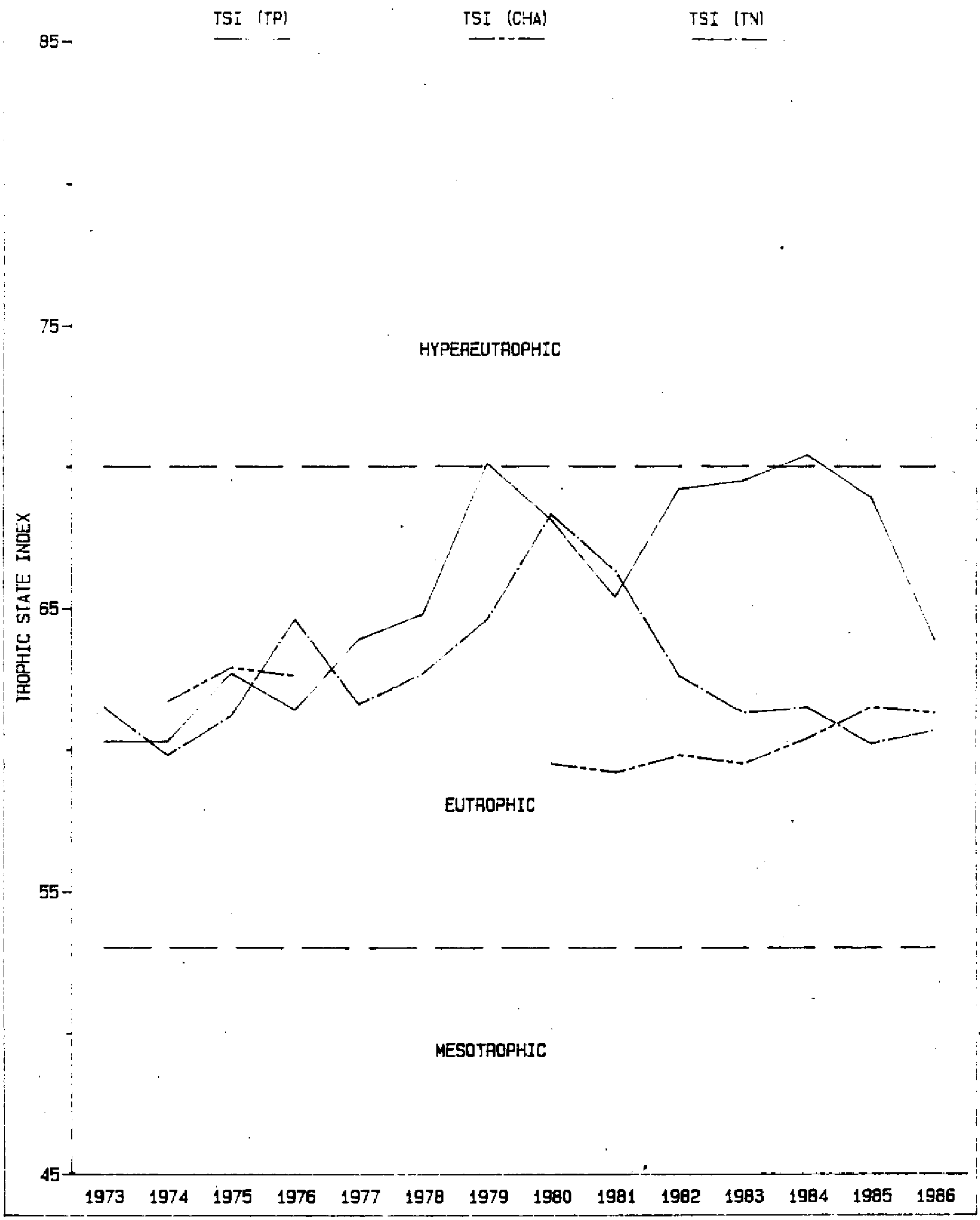
Kissimmee River and Taylor Creek/Nubbin Slough were above their target phosphorus loads. However, annual loadings are strongly dependent on the amount of runoff and targets may not be met in years with greater discharge. Consequently, the targets are more appropriately viewed as long-term average goals. Except where diversion is used to reduce nutrient loading, as in the EAA, any progress in nutrient reductions may be better indicated by trends in nutrient concentrations.

Lake Okeechobee Trophic Status

Trophic state indices (TSI's) based on total phosphorus, total nitrogen, and chlorophyll a concentrations have been used to evaluate Lake Okeechobee's trophic status over the years. Federico et al. (1981) explained how these indices are derived from the water quality data. The indices range from zero to 100, with zero to 53 being classified as oligotrophic to mesotrophic, 53 to 70 being eutrophic, and above 70 being considered hypereutrophic. These indices provide a convenient way of classifying the lake and charting trends in trophic state, but are not precise indicators of a lake's actual trophic condition. It is also important to recognize that the categories cited rely heavily on data from northern temperate-zone lakes outside of Florida.

Over the period of record for water quality data, Lake Okeechobee has been classified as eutrophic (Figure 3). In recent years though, the TSI based on phosphorus levels (but no other TSI) indicates that the lake borders on the hypereutrophic classification. This TSI moved back to the middle of the eutrophic range in 1985-86. The chlorophyll TSI, meanwhile, remained in the mid-eutrophic range. Phytoplankton biomass (as indicated by the chlorophyll TSI) did not follow the increase in total phosphorus.

FIGURE 3: ANNUAL TROPHIC STATE INDICES FOR LAKE OKEECHOBEE



Pesticides

The compounds analyzed from water and sediment samples collected February 11-12, 1986 are listed in Table 7. The majority are registered pesticides, with 9 of the 44 compounds currently banned in the United States. Approximately one-half of these registered compounds are routinely used in South Florida agriculture.

The water samples collected on February 11-12 did not have any pesticide residues present. Sediment samples taken at S-6 and S-7 did not have any pesticide residues, either. However, sediment residues of diazinon, malathion, and/or aldrin were present at S-2, S-3, S-4, and S-8 (Table 8).

The aldrin residue at S-4 could be a relic residue from previous use since this compound has been banned since 1974. Previous sampling in other District programs has occasionally detected aldrin in the sediment in an apparently random pattern.

Diazinon and malathion are non-restricted use insecticides registered for pest control on sod and row crops grown in the EAA. Neither of these compounds has been found before in the sediment or water column. These compounds rapidly decay in the water, and significant widespread use would be required for detectable concentrations to occur at these sampling stations. Sources of these compounds could be from runoff, with the compound in solution and/or adsorbed on suspended particles, or from overspray and drift. No water quality or health standards exist for agricultural chemical residues in the sediment. Monitoring will continue to determine if there are any trends in the concentrations of these chemicals.

For the June 25-26 samples, the compounds analyzed in the water column (W-mg/L) and sediment (S-mg/kg), followed by the minimum detection limit are listed in Table 9. Neither the water or sediment samples obtained at any of the stations had any detectable pesticide residues. As with the February analyses, the

TABLE 7 COMPOUNDS ANALYZED IN WATER AND SEDIMENT SAMPLES COLLECTED ON FEBRUARY 11-12, 1986

Alachlor	Ethion
Aldicarb	Guthion (Azinphos Methyl)
Aldrin	Heptachlor
Ametryn	Heptachlor Epoxide
Atrazine	Kelthane (Dicofol)
Alpha BHC	Malathion
Beta BHC	Methomyl
Gamma BHC (Lindane)	Methoxychlor
Delta BHC	Parathion
Carbamate	PCB 1016
Carbaryl	PCB 1221
Carbofuran	PCB 1232
Chlordane	PCB 1242
PP-DDD	PCB 1248
OP-DDD	PCB 1254
PP-DDE	PCB 1260
OP-DDE	Perthane
PP-DDT	Prometryn
OP-DDT	Propham
Diazinon	Simazine
Dieldrin	Tedion
Endosulfan-Alpha	Triazine
Endosulfan-Beta	Trifluralin
Endosulfan Sulfate	Trithion (Carbophenothion)
Endrin	Toxaphene
Endrin Aldehyde	

TABLE 8 PESTICIDE RESIDUES (MG/KG) IN SEDIMENT SAMPLES COLLECTED ON FEBRUARY 11 - 12, 1986

	Station			
Pesticide	S-2	S-3	S-4	S-8
Aldrin	ND	ND	0.6	ND
Diazinon	1.1	1.4	1.0	1.1
Malathion	3.2	2.6	3.8	3.3

ND = Not Detected

majority of these compounds are registered pesticides, with 14 of the 59 compounds completely banned in the United States. About one-half of these registered compounds are routinely used in south Florida agriculture.

Of the six stations sampled for zinc phosphide, five had positive results (Table 10). The detected values are not very high. However, based on the structure of the compound and its anticipated rapid degradation in water, it is surprising that detectable quantities were found.

The aerial application of the carrier bait to the edge of the sugarcane field enhances the possibilities of zinc phosphide entering the water. Sampling was performed during the period of the year when rats were likely to be a problem and the potential for zinc phosphide use was the greatest. At the time of sampling, pump stations S-6, S-7, and S-8 were discharging and the samples taken at these stations could have contained water that was recently exposed to zinc phosphide.

No State of Florida surface water quality standards or EPA guidelines exist for zinc phosphide. Although the potential for bioaccumulation is small, zinc phosphide is acutely toxic. It is possible to calculate the level of a contaminant in drinking water at which adverse health effects would not be anticipated. Using an EPA developed verified reference dose (this is compatible to an ADI or acceptable

TABLE 9. COMPOUNDS ANALYZED IN SAMPLES COLLECTED ON JUNE 25 - 26, 1986 WITH DETECTION LIMITS FOR WATER SAMPLES (W) IN MG/L AND SEDIMENT SAMPLES (S) IN MG/KG

Compound Name	Detection Limit		Compound Name	Detection Limit	
2,4-D	W	0.01	Fonofos	S	0.05
	S	0.1			
2,4,5-T	W	0.001	Guthion (Azinphos Methyl)	S	0.01
2,4,5-TP (Silvex)	S	0.01	Heptachlor	S	0.01
Alachlor	W	0.02	Heptachlor Epoxide	S	0.01
	S	0.2			
Aldicarb	S	0.05	Kelthan (Dicofol)	S	0.01
Aldrin	S	0.01	Malathion	S	0.01
Ametryn	W	0.01	Methomyl	S	5.0
	S	0.1			
Atrazine	W	0.01	Methyl Bromide	S	0.001
	S	0.1			
Alpha BHC	S	0.01	Methyl Parathion	S	0.01
Beta BHC	S	0.01	Methoxychlor	S	0.1
Gamma BHC (Lindane)	S	0.01	Metolachlor	S	0.2
Delta BHC	S	0.01	Metribuzin	W	0.01
				S	0.1
Carbaryl	S	10.0	Mevinphos	S	0.1
Carbofuran	S	0.5	Oxamyl	S	0.1
Chlordane	S	0.01	Parathion	S	0.01
Chloropicrin	S	0.01	PCB 1016	S	0.01
Chlorpyrifos	S	0.01	PCB 1221	S	0.01
Chlorothalonil	S	0.3	PCB 1232	S	0.01
PP-DDD	S	0.01	PCB 1242	S	0.01
PP-DDE	S	0.01	PCB 1248	S	0.01
PP-DDT	S	0.01	PCB 1254	S	0.01
Diazinon	S	0.01	PCB 1260	S	0.01
Dieldrin	S	0.01	Perthane	S	0.01
Endosulfan-Alpha	S	0.01	Phorate	S	0.1
Endosulfan-Beta	S	0.01	Prometryn	W	0.005
				S	0.05
Endosulfan Sulfate	S	0.01	Simazine	W	0.007
				S	0.07
Endrin	S	0.01	Trifluralin	W	0.02
				S	0.2
Endrin Aldehyde	S	0.01	Trithion (Carbophenothion)	S	0.01
Ethoprop	S	0.05	Toxaphene	S	0.05
Ethion	S	0.01			

TABLE 10. ZINC PHOSPHIDE RESIDUES IN WATER SAMPLES
SEPTEMBER 23, 1986

Station	Zinc Phosphide (mg/L)
S-2	0.006
S-3	0.002
S-4	<0.001
S-6	0.005
S-7	0.005
S-8	0.003

daily intake value) of 0.0004 mg/kg/day for aluminum phosphide (AlP), an outdoor fumigant for burrowing rodent control, a 0.014 ppm contaminant level can be calculated. This value represents the maximum contaminant level in drinking water at which adverse health effects would not be anticipated in the average adult, based on a 70 kg body weight and ingesting 2 liters of water a day. This value is close to the values from the field data. However, if this calculation is performed for a small child of 10 kg body weight who consumes one liter of water per day, the maximum contaminant level is 0.004 ppm. This value is similar to the field results and represents a possible adverse health effect if a small child ingests this water on a routine basis.

Copies of the original data sheets for the results described in this section can be found in Appendix C.

REFERENCES

Federico, A. C. 1982. Water quality characteristics of the lower Kissimmee River Basin, Florida. South Florida Water Management District, West Palm Beach, Tech. Pub. No. 82-3.

Federico, A. C., K. G. Dickson, C. R. Kratzer, and F. E. Davis. 1981. Lake Okeechobee water quality studies and eutrophication assessment. South Florida Water Management District, Tech. Pub. No. 81-2.

South Florida Water Management District. 1982. Lake Okeechobee water quality management plan--alternatives evaluation. Technical Report, August 1982.

APPENDIX A

1986 ANNUAL REPORT FOR

RURAL CLEAN WATERS PROGRAM,

TAYLOR CREEK/ NUBBIN SLOUGH

TECHNICAL MEMORANDUM

1986 ANNUAL REPORT
RURAL CLEAN WATERS PROGRAM

by

Gary J. Ritter
and
Eric G. Flaig

January 1988

Water Quality Division
Resource Planning Department
South Florida Water Management District

EXECUTIVE SUMMARY

The objective of the Florida Rural Clean Water Program (RCWP) is to identify the effectiveness of BMPs based on observed changes in water quality. Because a water quality monitoring network existed prior to the inception of the RCWP project, four years of baseline data were available before BMP implementation. The availability of this data base enabled researchers to divide the program into three phases to better evaluate water quality concurrently with the scheduled implementation of BMPs. These phases are identified as the pre-BMP, transition, and post-BMP periods. From a basin-wide perspective the program is moving out of the transition period into the post-BMP period. Approximately 78 percent of the 63,109 critical acres in the Taylor Creek/ Nubbin Slough basin are covered by BMPs, and all but two landowners with holdings representing seven percent of the projects critical acres, are under contract to implement BMPs. The majority (greater than 40 percent) of BMP implementation has occurred during 1986, therefore, the impact on water quality to date may be minimal. The primary objective of this report is to provide a preliminary data evaluation of total phosphorus concentration data using seasonal Kendall Tau non-parametric trend analysis and relating these trends to the observed changes in land use practices on a sub-watershed and basin level.

MAJOR FINDINGS

A preliminary analysis using a non-parametric Seasonal Kendall Tau trend test was performed on total phosphorus concentrations to determine if there has a significant change during the period of BMP implementation. A non-parametric method was selected due to the abnormal characteristic of the total phosphorus concentration data. Typical frequency distributions are positively skewed with high peakedness and seem to occur at stations that do not have continuous flow. This situation exists in the small tributaries. However, more normal distributions exist

in the larger branch of Taylor Creek and in the L-63N interceptor canal, because a greater amount of mixing occurs in these areas.

The trend test was conducted on data from 14 stations for a period of record from 1978 to October 1986. Significant trends in water quality at the 5 percent level were detected at nine of the fourteen stations. These stations were located in the following subwatersheds: N.W. Taylor Creek, Otter Creek, Williamson East Lateral, Taylor Creek Main Branch, Mosquito Creek upstream, Mosquito Creek downstream, Taylor Creek Headwaters Confluence, Henry Creek, and S-191. At seven of these nine stations: Otter Creek, Williamson East Lateral, Taylor Creek Main Branch, Taylor Creek Headwaters Confluence, Mosquito Creek upstream, Mosquito Creek downstream, and S-191, the long term total phosphorus concentrations exhibited a decreasing trend.

Where corrected for covariance, only data at three stations (Otter Creek, Mosquito Creek upstream and downstream) showed significant trends at the 5 percent level. Only one site, Otter Creek, exhibited a significant trend at the 1 percent level. This was attributed to a dairy barn shutdown in the fall of 1981.

In successive tests at each station, the data were also stratified into 26, 23, 8, 4, and 2 seasons for each year based on either the calendar year or a seasonal year. Lower significance levels resulted where more seasons were considered, and where the seasons were adjusted to coincide with the wet-season dry-season behavior. The estimated values for trend slope varied arbitrarily with the number of seasons. The probability levels were higher for all calculations when serial dependence was considered.

Emphasis on efficient waste water utilization, diversion of direct runoff from high intensity pastures, timing of pasture fertilization, and fencing cows out of the major water courses throughout the basin can be attributed to observed improvements in water quality at six of the seven stations that exhibited a significant downward trend through the period of record. Decreasing trends in total phosphorus concentrations at the seventh station, S-191, is probably reflecting a cumulative effect of the land use and land management changes that have occurred at the upstream stations. However, it should be noted that this analysis is preliminary and that the concentration data have not been corrected for variation in flow. Because flow is a function of the antecedent rainfall and ground water conditions, the variability of these parameters from year to year could also affect the long term water quality trends.

CONCLUSIONS

Based on the results of the Seasonal Kendall Tau trend analysis, the following points can provide further insight into the cause and effect of the long term water quality trends experienced at nine of the fourteen test stations:

1. Long term variations in rainfall, depth of ground water, and flow can influence changes in water quality and must be considered when evaluating changes in land use and land management practices and their impact on water quality.

2. More efficient use of dairy waste water and effective management of waste storage lagoons will result in improvements in downstream water quality.

3. The shutdown of the dairy operation in Otter Creek is a major factor for the significant downward water quality trend observed in this sub-watershed. However, this situation has also resulted in a masking effect for determining impacts of other BMPs implemented in Otter Creek.

4. Effective timing of fertilizer on beef cattle and dairy operations seems to have a positive impact on water quality.

5. Fencing cows out of the streams is an example of a more passive BMP. External factors, such as increased cow numbers, changes in fertilizer applications, and point sources of runoff from high intensity grazing pastures, seem to mask any short term effects of fencing.

RECOMMENDATIONS

It is apparent that due to the short time period during which the present level of BMP coverage has been in place, preliminary findings, no matter how positive, must be carefully scrutinized. The following recommendations for future evaluation and reporting are:

1. Future water quality analysis should adjust for variations in flow and ground water and also take into account changes in cow numbers during the study period. This will involve developing a simple model to account for these major variables.

2. Loading data should be analyzed on a sub -watershed scale where flow data is available. Using available rainfall data, flow data can be interpolated for sub-watersheds where flow measurements are not available.

3. BMPs that require more active management such as dairy waste water utilization, timing of fertilizer applications on dairy and beef operations, and controlling the release of high intensity area runoff seem to have the greatest impact on water quality. Future recommendations for BMPs should stress these types of activities. Active agricultural land use management and on farm water control hold the key to continued water quality improvements throughout the basin.

4. Farm owners should take a more active role in educating their barn managers on matters concerning maintenance and upkeep of BMPs as well as provide rational for implementing BMPs.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

This report is the first in a series of reports that will evaluate, both statistically and intuitively the long term impacts of BMPs in terms of reducing the amount of phosphorus entering Lake Okeechobee from the Taylor Creek/ Nubbin Slough basin. The water quality and hydrologic data provided in this report was generated over many years of intensive research by state and federal agencies. Preceding evaluations and research on this continuous data base have provided great insight for the development of agricultural management strategies to control phosphorus runoff on beef and dairy operations throughout the basin.

The authors wish to recognize the efforts of the following agencies for their continued technical and research support in the Taylor Creek/ Nubbin Slough basin: the Soil Conservation Service, the Agricultural Stabilization and Conservation Service, the University of Florida (IFAS), the County Extension Service, and the Agricultural Research Service (USDA). Without this unique blend of local, state, and federal support, and without the unyielding cooperative support of the local landowners this program could not have progressed to the present stage of evaluation.

A special thanks go to all those who provided their careful critique of this manuscript and to the dedicated data collection efforts of field technicians, Boyd Gunsalus, Elaine Rankin, and Steve Magee.

ABSTRACT

As of October 1986, 78 percent of the critical acres in the Taylor Creek/ Nubbin Slough basin were covered by BMPs. Emphasis on efficient waste water utilization, diversion of direct runoff from high intensity pastures, timing of pasture fertilization and fencing throughout the basin has resulted in improved water quality in Mosquito Creek, Otter Creek, and Williamson Ditch. The cumulative effect of these changes in land use practices has resulted in decreasing total phosphorus concentrations at S191. The time series of biweekly total phosphorus concentration data were analyzed for long term trend using the non parametric Seasonal Kendall Tau trend test corrected for serial correlation. The trend test was conducted from 14 stations for a period of record from 1978 to present. Significant trends in total phosphorus at the 5 percent level were detected at nine of the fourteen stations. Long term total phosphorus concentrations were found to have decreased at seven of the nine stations. These trends were significant without considering serial dependence. Only one site, Otter Creek, had a significant trend at the one percent level. This was probably attributable to the shutdown of an upstream dairy barn in the fall of 1981. In computing the test statistic selection of the seasons for stratifying the data, significance levels were lower when the seasons were adjusted to coincide with the wet season - dry season behavior, and the estimated values for trend slope varied arbitrarily with the number of seasons. The probability levels were higher for all calculations when the serial dependence was considered.

Key words: BMPs, non-parametric, Seasonal Kendall Tau, Taylor Creek/ Nubbin Slough, S-191.

INTRODUCTION

Encouraging progress has been made toward completing best management practice (BMP) implementation during 1986. Approximately 78 percent of the project's 63,109 critical acres are covered by BMPs, and all but two landowners with holdings representing 7 percent of the project's critical acres, are under contract to implement BMPs. The objectives of this year's water quality evaluation are:

1. Update annual mean and maximum values during 1985 and 1986 for all water quality stations.
2. Provide a summary of weekly rainfall and ground water stage (from 1978 through 1986) at four stations located in the Upper Taylor Creek watershed.
3. Update wet season time series graphs at the nine major tributaries to include the 1986 wet season data.
4. Provide preliminary data evaluation of total phosphorus concentration data using seasonal Kendall Tau non-parametric trend analysis and comparing these trends on a sub-watershed and basin level.

Products for objectives one and three will be provided in an appendix following the text.

MATERIALS AND METHODS

Water quality samples are collected biweekly.throughout the Taylor Creek/ Nubbin Slough watershed. Methodology of sample collection and storage is presented in Ritter and Allen (1982). Water quality samples are analyzed for the following chemical constituents: total-p, ortho-p, nitrate, nitrite, ammonia, and total kjeldahl nitrogen. Samples are also analyzed for pH, specific conductivity, turbidity (NTU), and color. Procedures for sample analysis are presented in Ritter and Allen (1982).

RAINFALL AND GROUNDWATER

Rainfall and groundwater levels are monitored at four stations throughout Upper Taylor Creek. Two rainfall stations are also monitored in Lower Nubbin Slough (Figure 1). Analysis performed by Heatwole (1986), Capece (1984), and Konyha (1982) have indicated that a strong physical relationship exists between water table depth and the volume of rainfall runoff. It is also believed that water quality is strongly related to the volume of rainfall runoff and water table depth in this area. The possible relationships between rainfall volume, water table depth, and water quality needs to be analyzed more closely. This report will summarize the weekly rainfall volumes and water table depths from 1978 through 1986 and interpret the water quality data. This hydrologic data will eventually be incorporated into future trend analysis to explain the variability in the water quality data base, and in turn, interpret changes in water quality due to implementation of BMPs.

Figures 2 through 5 depict weekly rainfall and water table depths at four stations located in the Upper Taylor Creek Basin (Figure 1), and biweekly total phosphorus concentrations at corresponding water quality stations. These figures illustrate the weekly variability in rainfall that existed throughout the study period. Also illustrated are corresponding weekly water table depths. Water table response to rainfall depends on the amount of rainfall, soil moisture conditions, and existing surface water conditions. There may be a direct relationship between surface water and shallow ground water in this area. It appears that during periods where the water table depths are less than two feet below the surface phosphorus concentrations seem to increase, affecting.water quality concentrations, For this reason a closer examination of relationship between water table depth and water quality is needed. While this is beyond the scope of this report, we will later attempt to integrate rainfall and depth of water table and compare them to the present level of trend analysis. No attempt will be made.at this time to physically incorporate this data into the trend analysis.

FIGURE 1 TAYLOR CREEK/NUBBIN SLOUGH WATERSHED

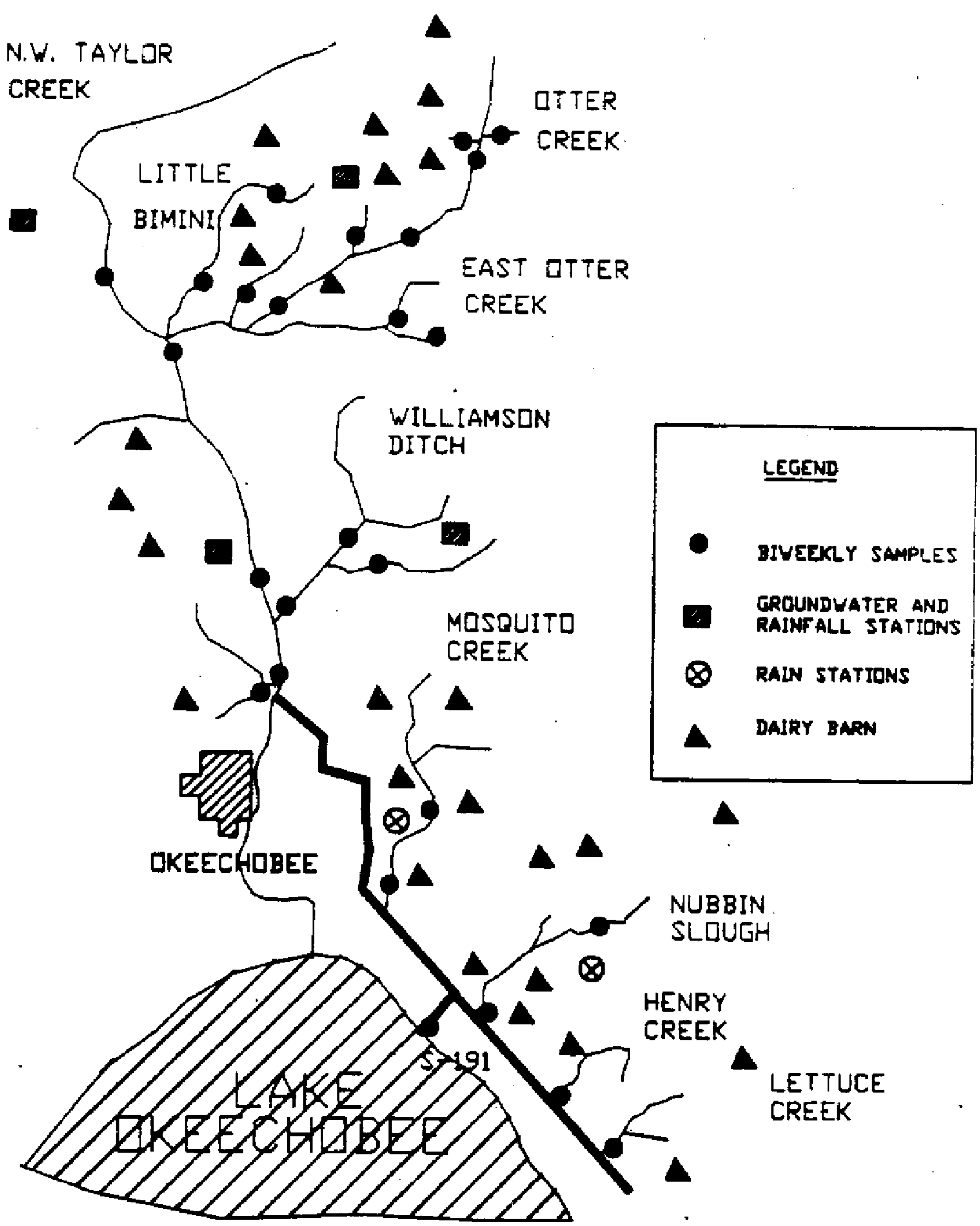
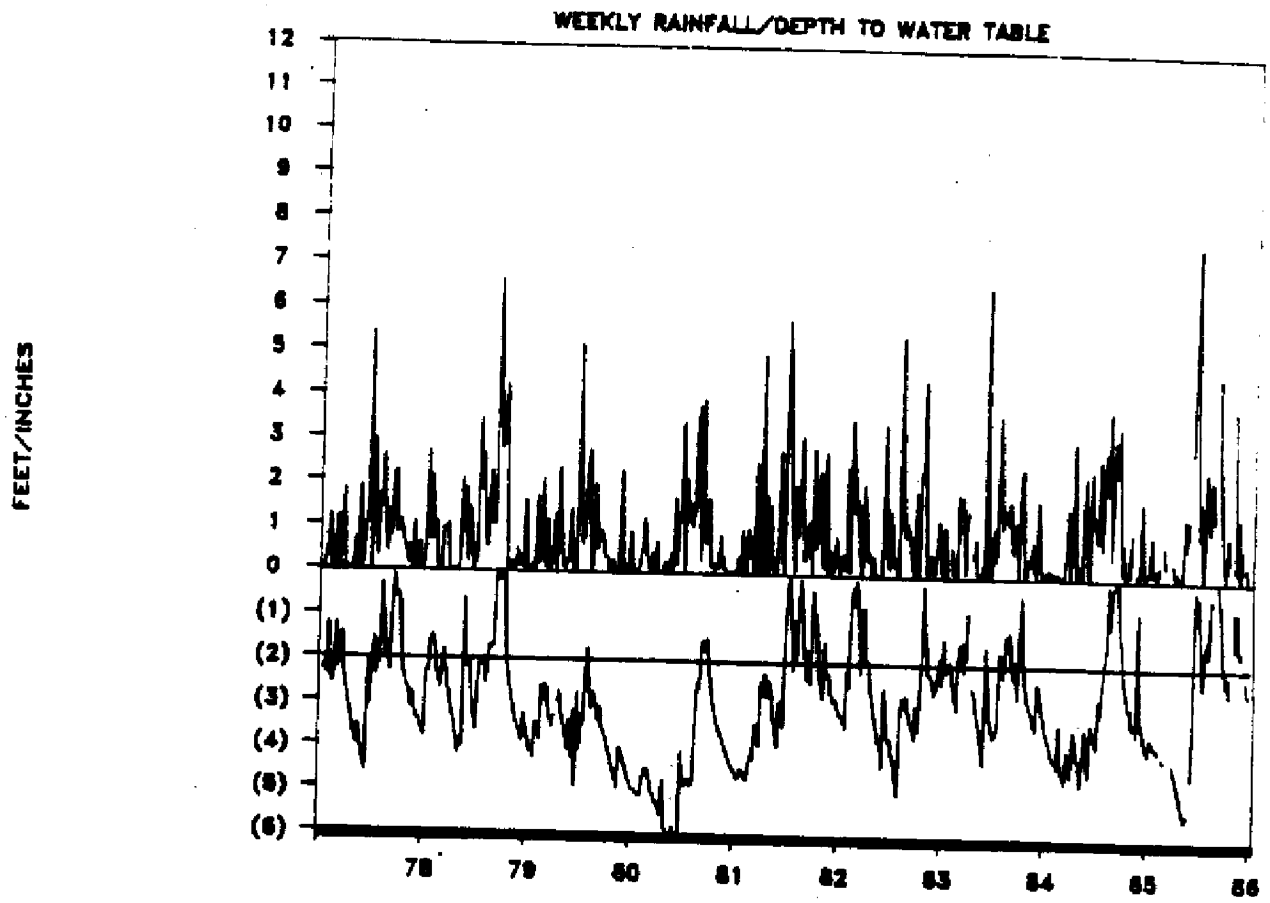


FIGURE 2. JUDSON 65.00 FT MSL



OTTER CREEK WATER QUALITY

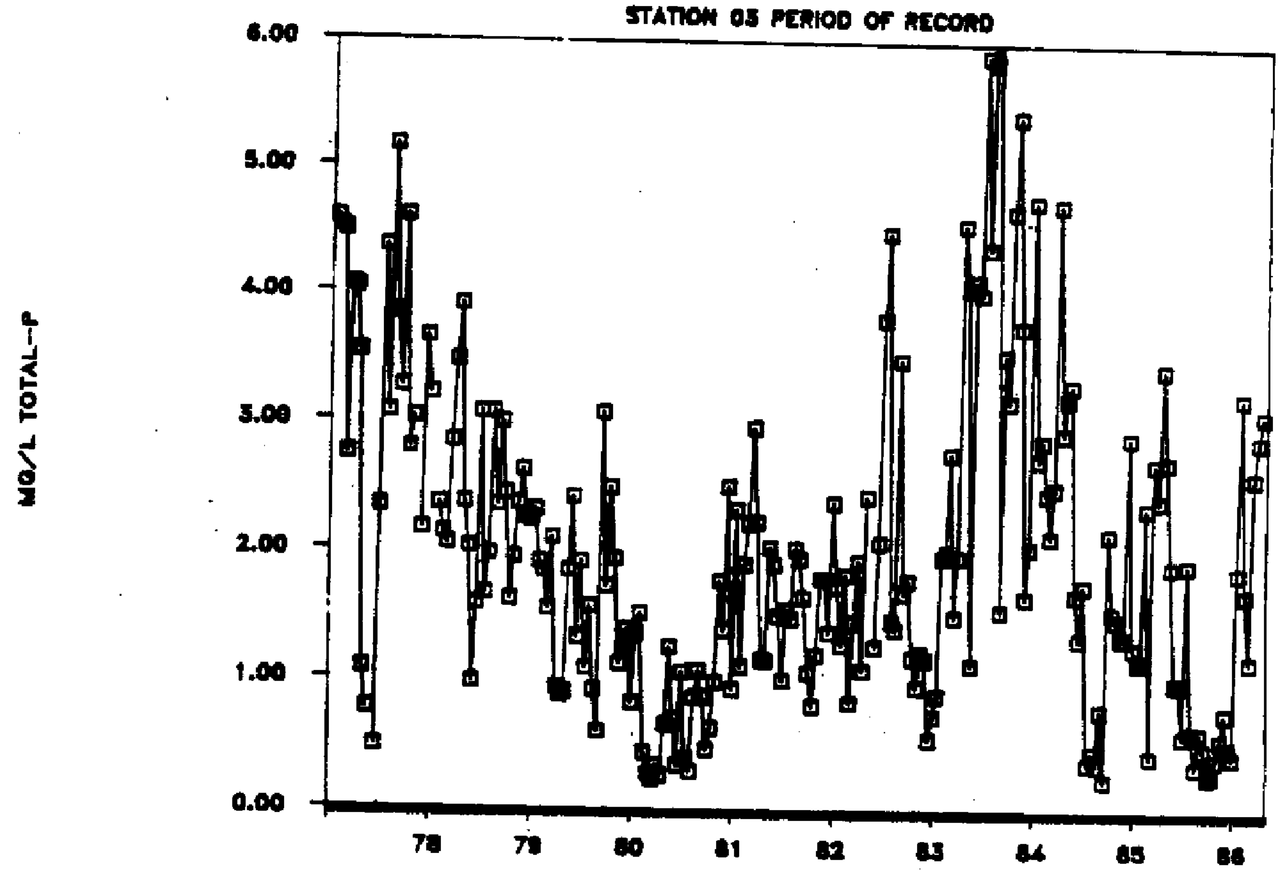
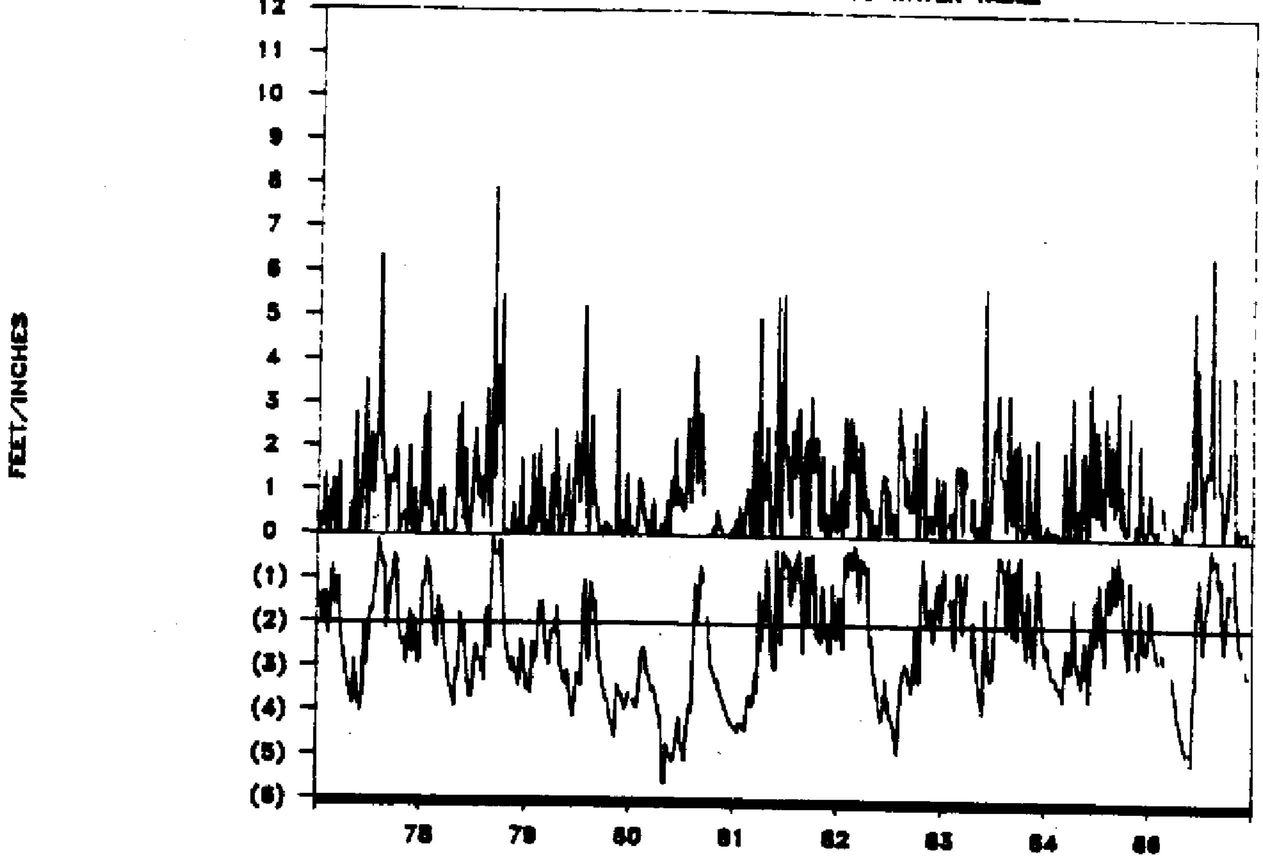


FIGURE 3. BASSETT 45.00 FT MSL

WEEKLY RAINFALL/DEPTH TO WATER TABLE



N.W. TAYLOR CREEK WATER QUALITY

STATION 01 PERIOD OF RECORD

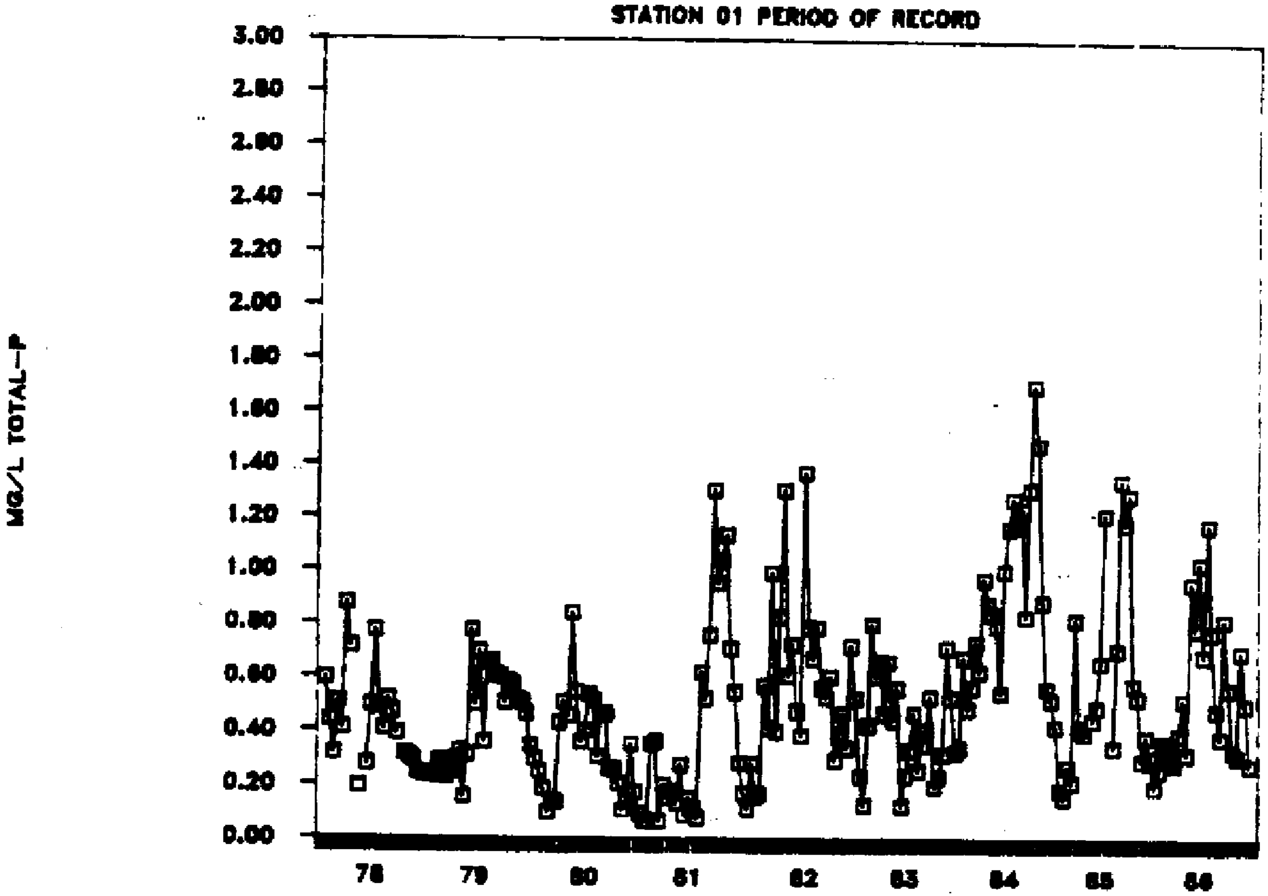
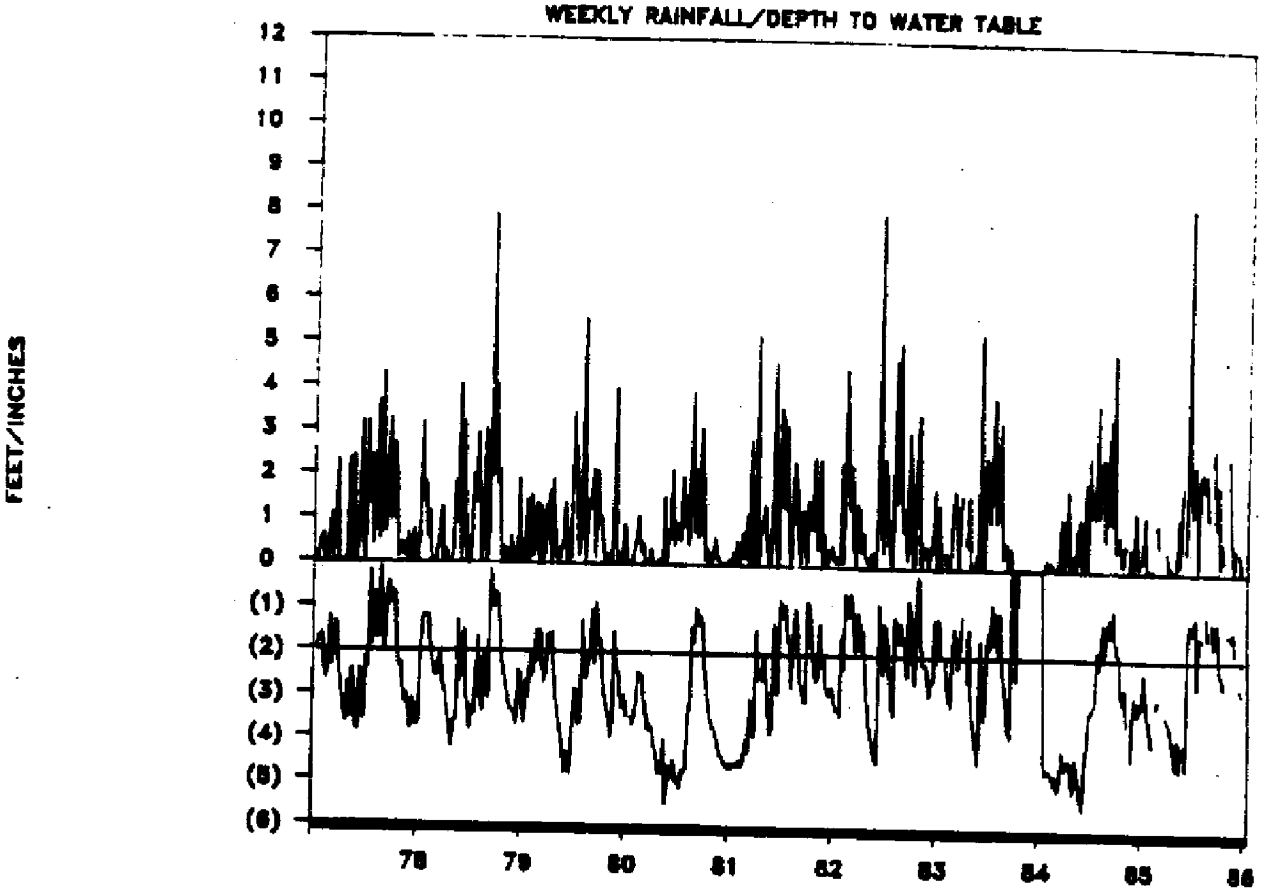


FIGURE 4. OPAL 35.26 FT MSL



WILLIAMSON DITCH STATION 08

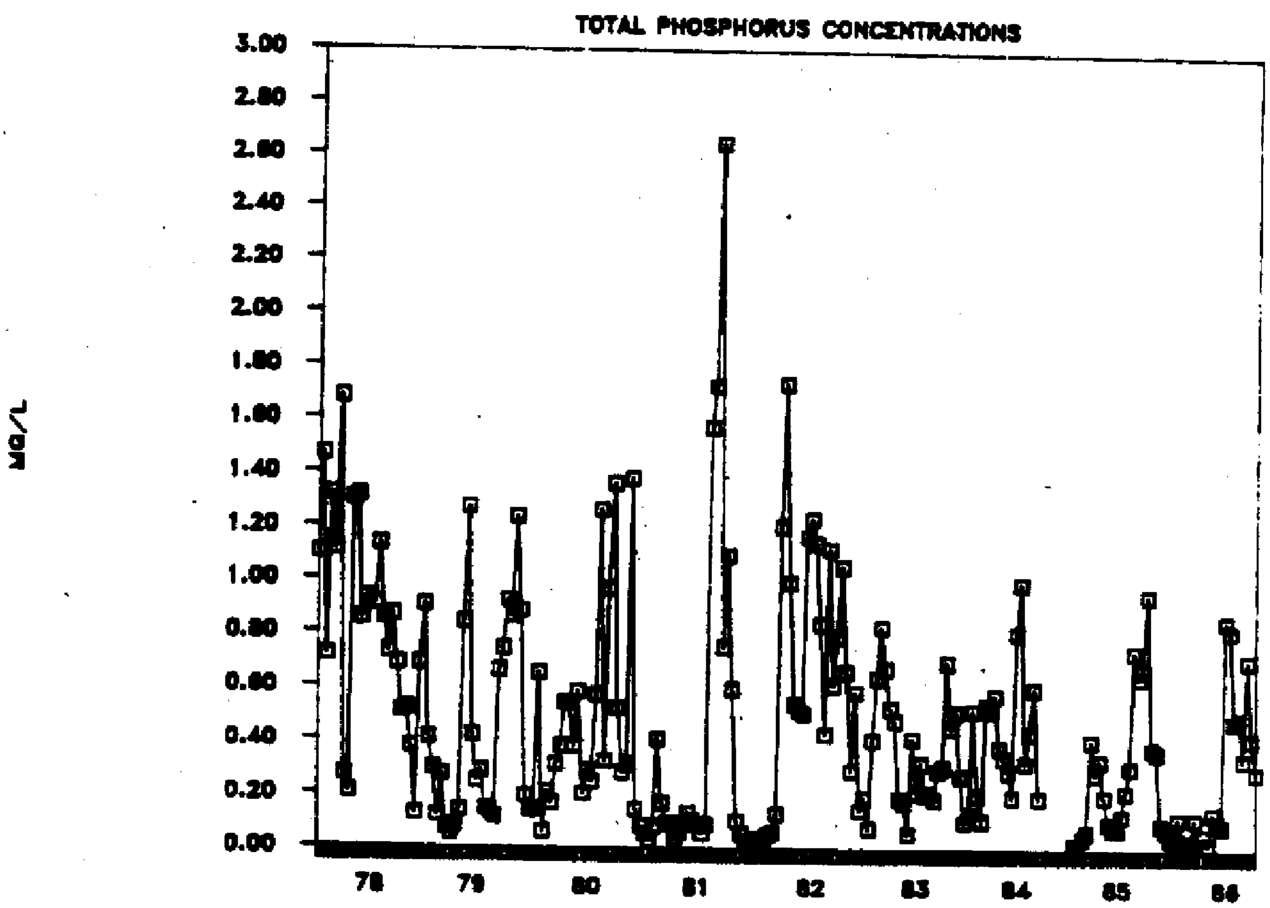
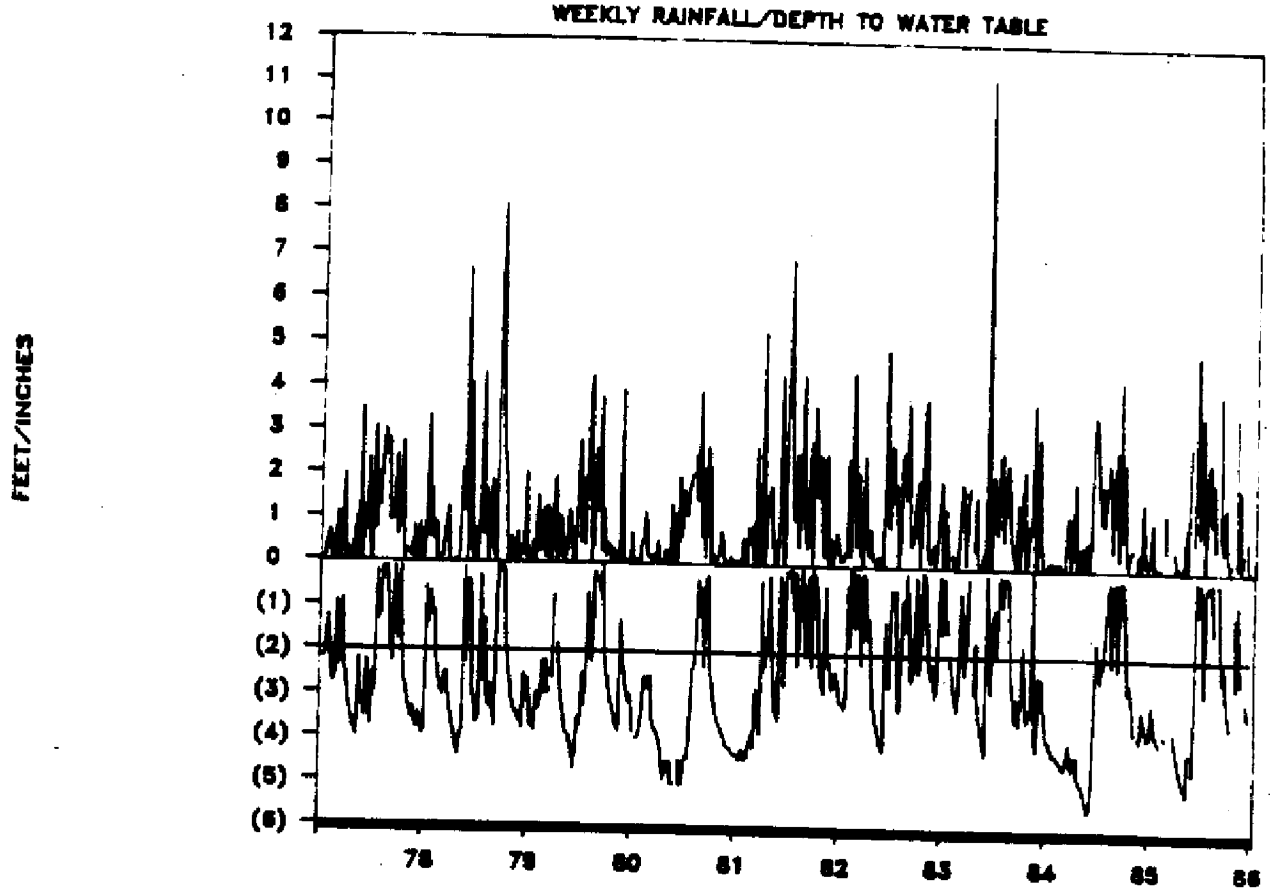
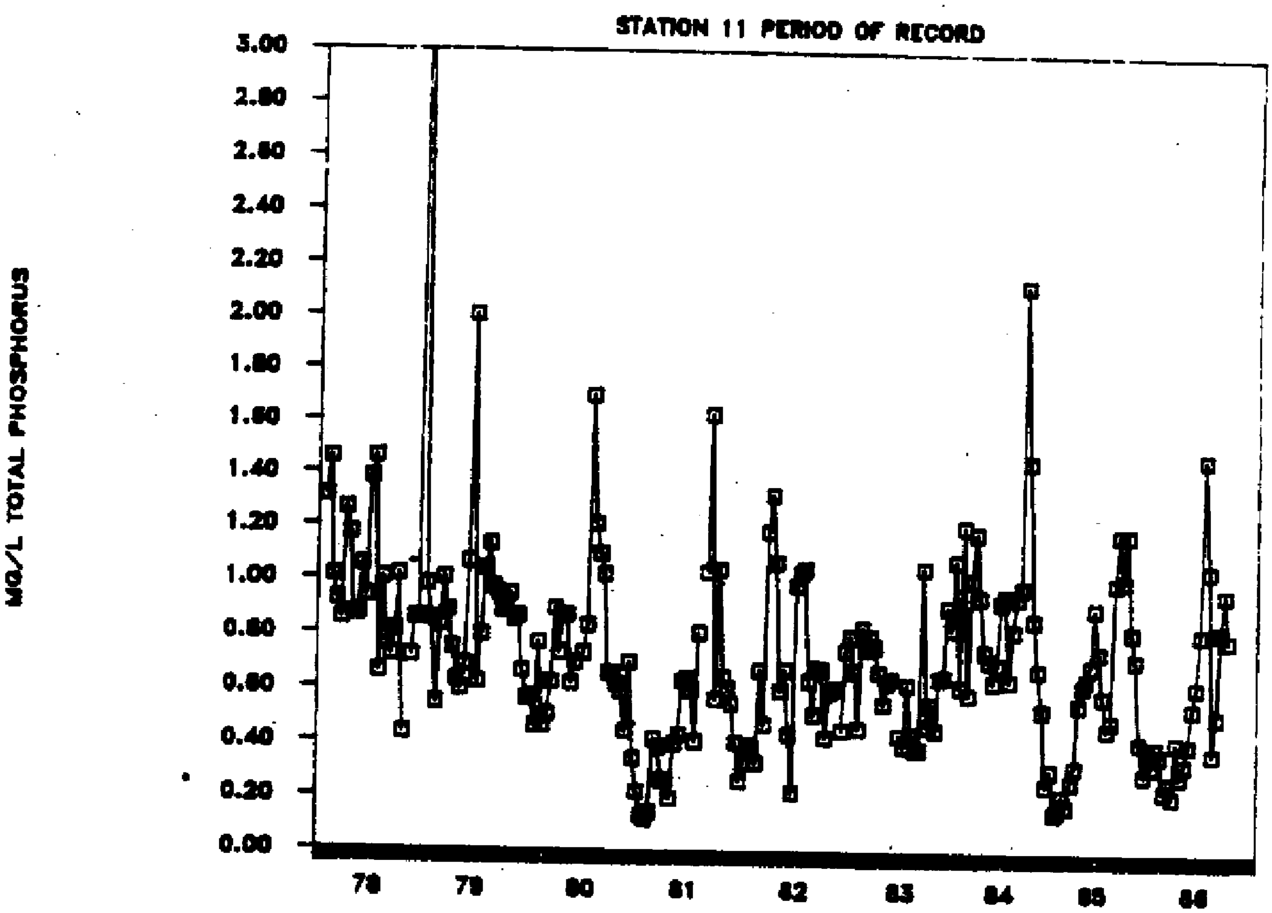


FIGURE 5. WELL LINE B 25.80 FT MSL





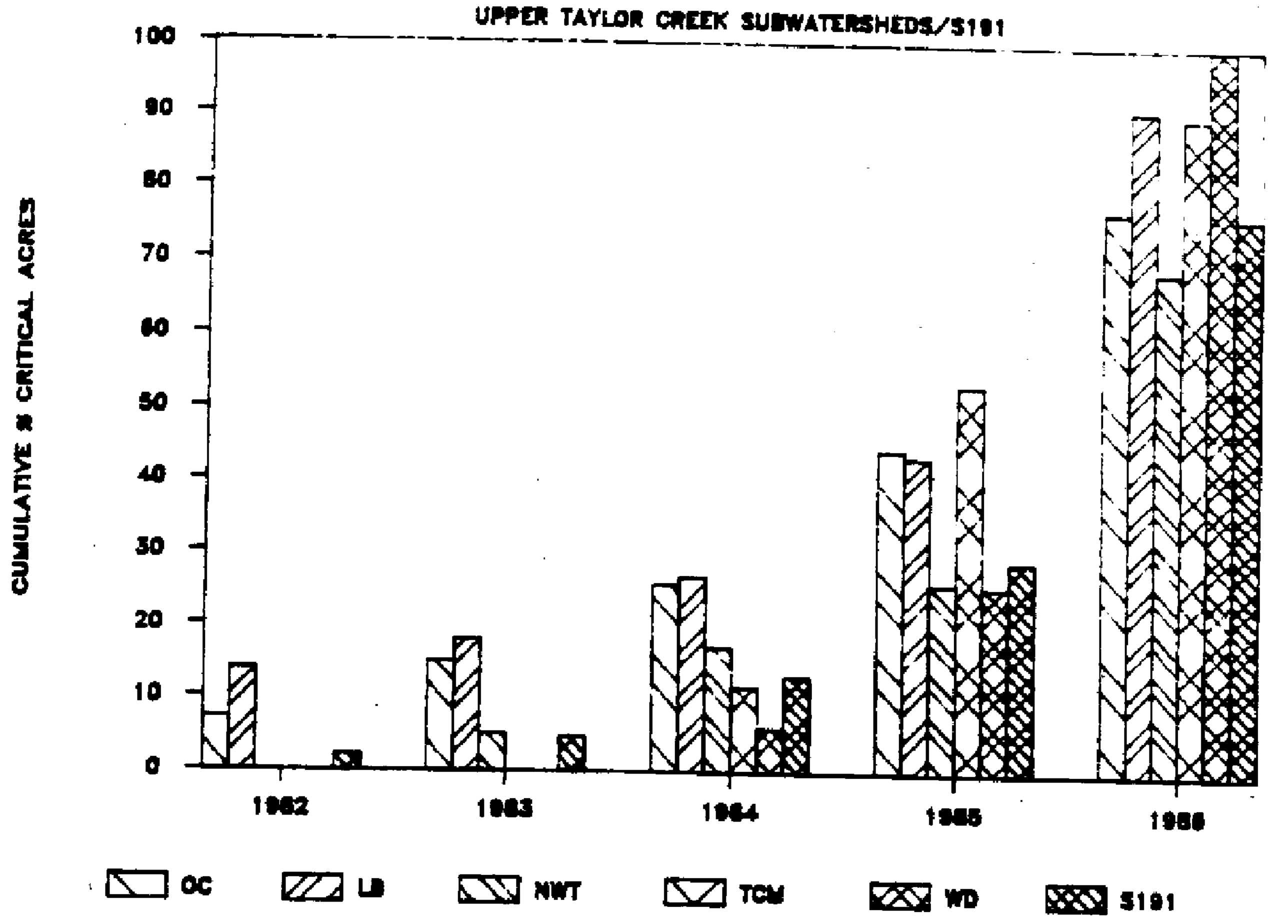
DATA ANALYSIS

Since the beginning of the Rural Clean Water Program (RCWP), evaluation of the water quality data has been limited to reporting annual means and wet season concentrations. Visual trends existing in either of these formats were evaluated on a sub-watershed scale based on existing conditions and changes observed in land use. By design this program has been divided into three phases (pre-, transition, and post-BMP) in order to adequately qualify the data base during each phase.

Currently, the program is moving out of the transition phase into the post-BMP phase (in the case of the Williamson sub-watershed, the program is three months into the post-BMP phase) . As of October, 78 percent of all prescribed BMPs have been implemented throughout the Taylor Creek/ Nubbin Slough watersheds. The percentage of BMP implementation, based on critical acres covered, for each of the nine major sub-watersheds {Otter Creek (OC), Little Bimini (LB), N.W. Taylor (NWT), Taylor Creek Main (TCM), Williamson Ditch (WD), Mosquito Creek (MC), Nubbin Slough (NS), Henry Creek (HC), and Lettuce Creek (LC)} is illustrated in Figure 6. The majority (greater than 40 percent) of BMP implementation throughout each of the sub-watersheds has occurred during 1986. For this reason, the water quality data base will probably not reflect more recent BMP implementation. Cumulative implementation of BMPs over time including a total basin percentage identified as S-191 is presented in Figure 7.

Because the program is now rapidly moving into the post-BMP phase, the general time series compilations in each of the sub-watersheds have exhibited some subtle changes. This year's analysis will incorporate a preliminary trend evaluation using the seasonal Kendall Tau test for significance. The results of this evaluation will be presented in their respective sub-watershed sections along with an explanation of the observed trend.

FIGURE 6. BMP IMPLEMENTATION



BMP IMPLEMENTATION

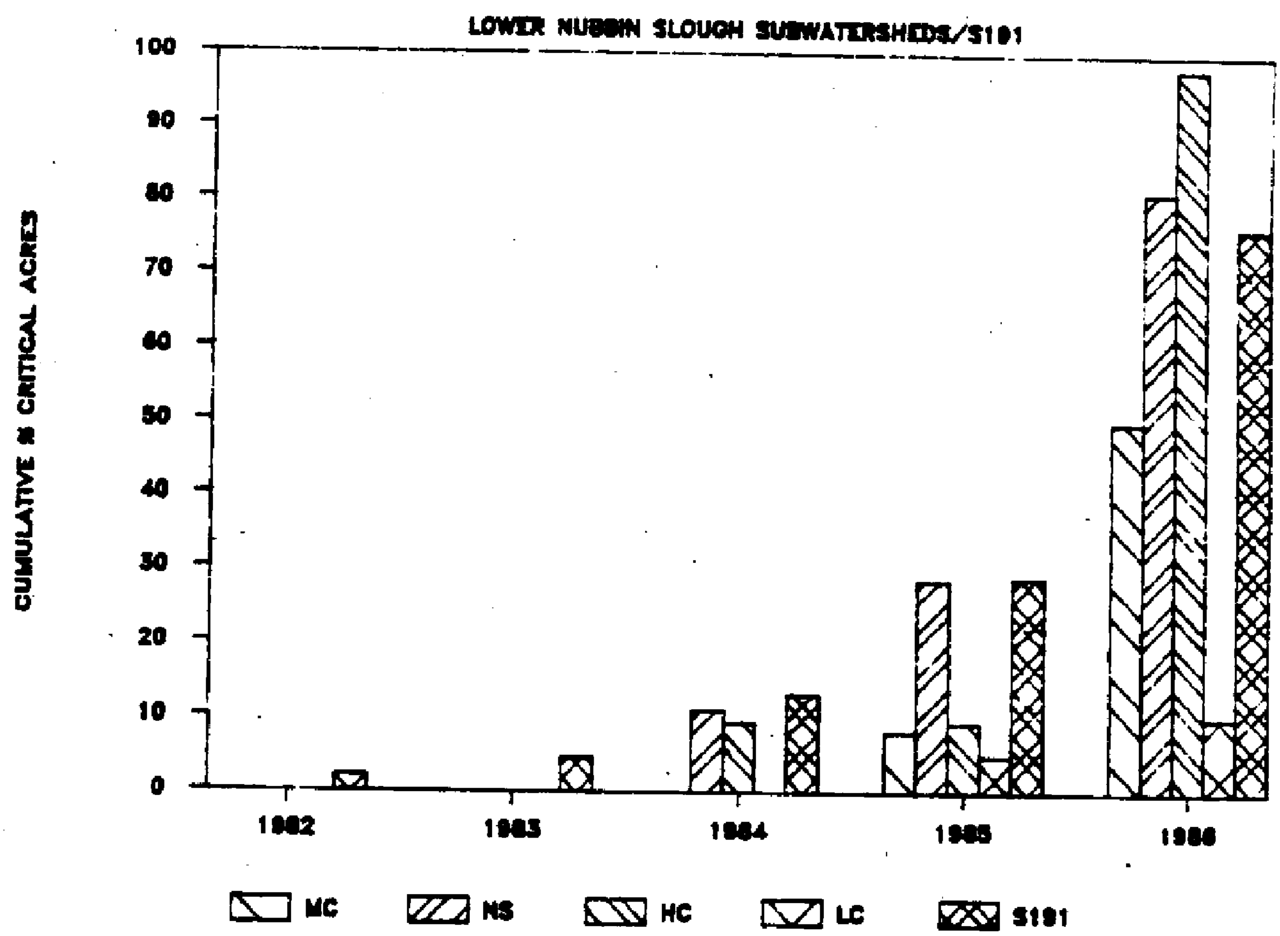
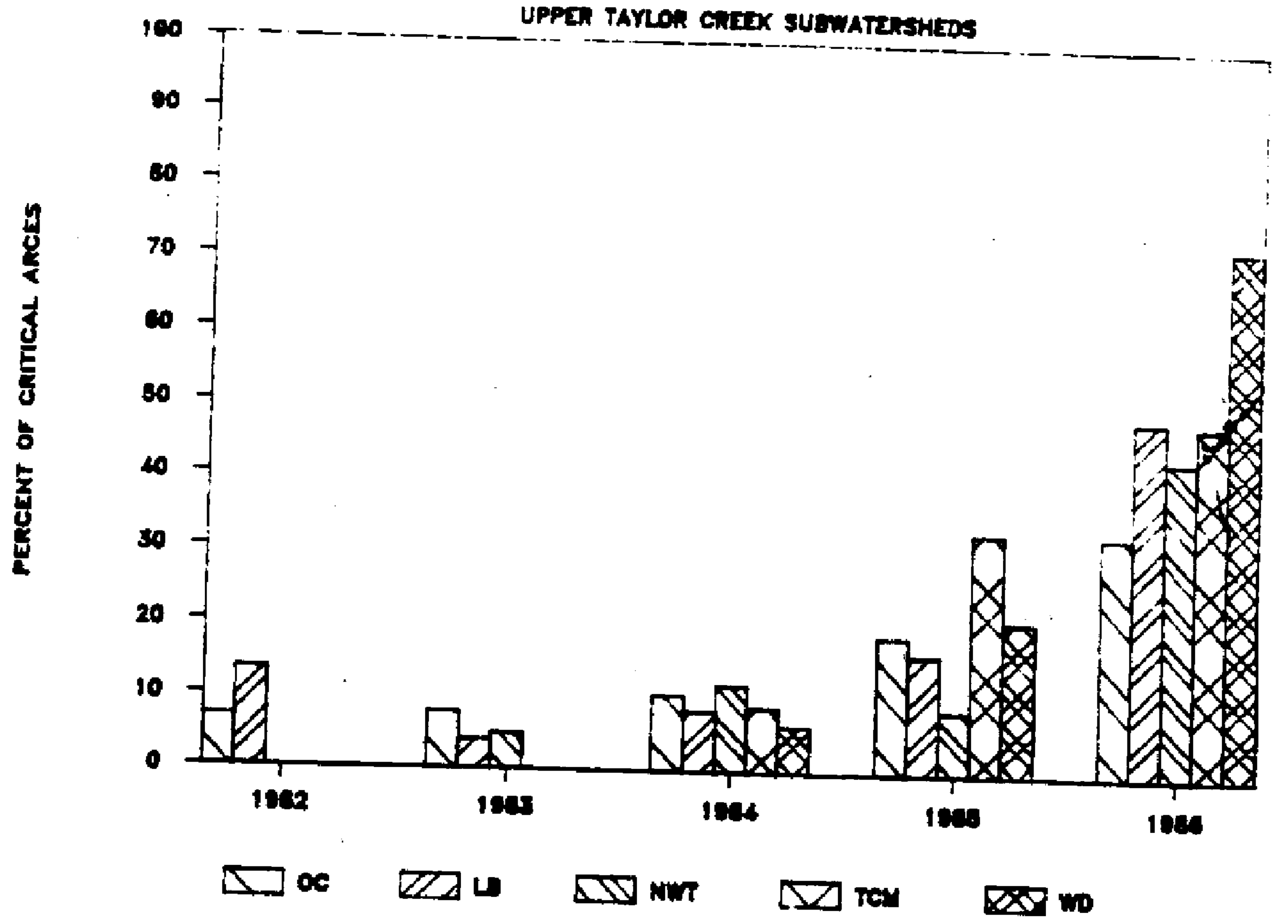
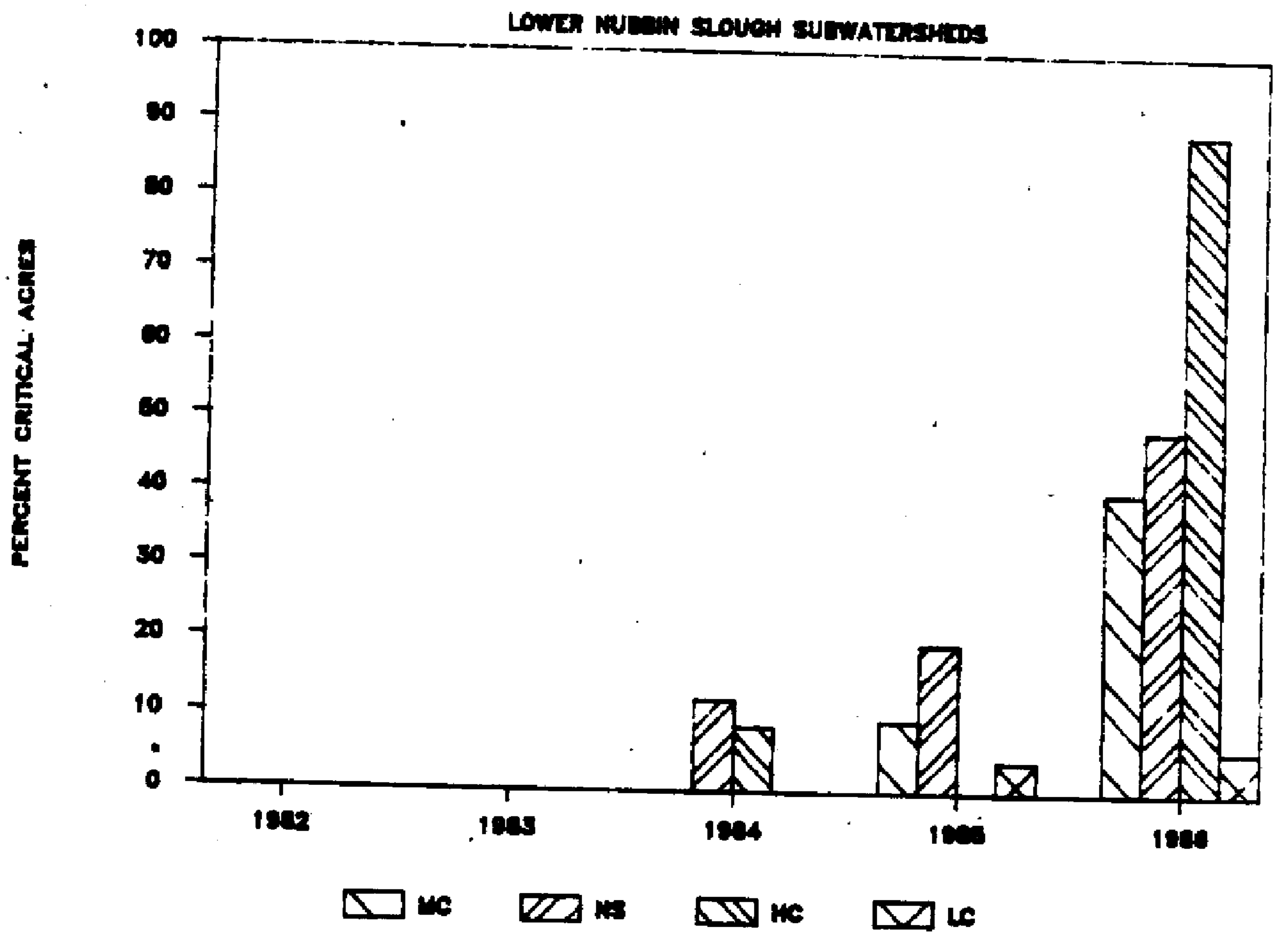


FIGURE 7. SUMMARY OF ANNUAL BMP IMPLEMENTATION



SUMMARY OF ANNUAL BMP IMPLEMENTATION

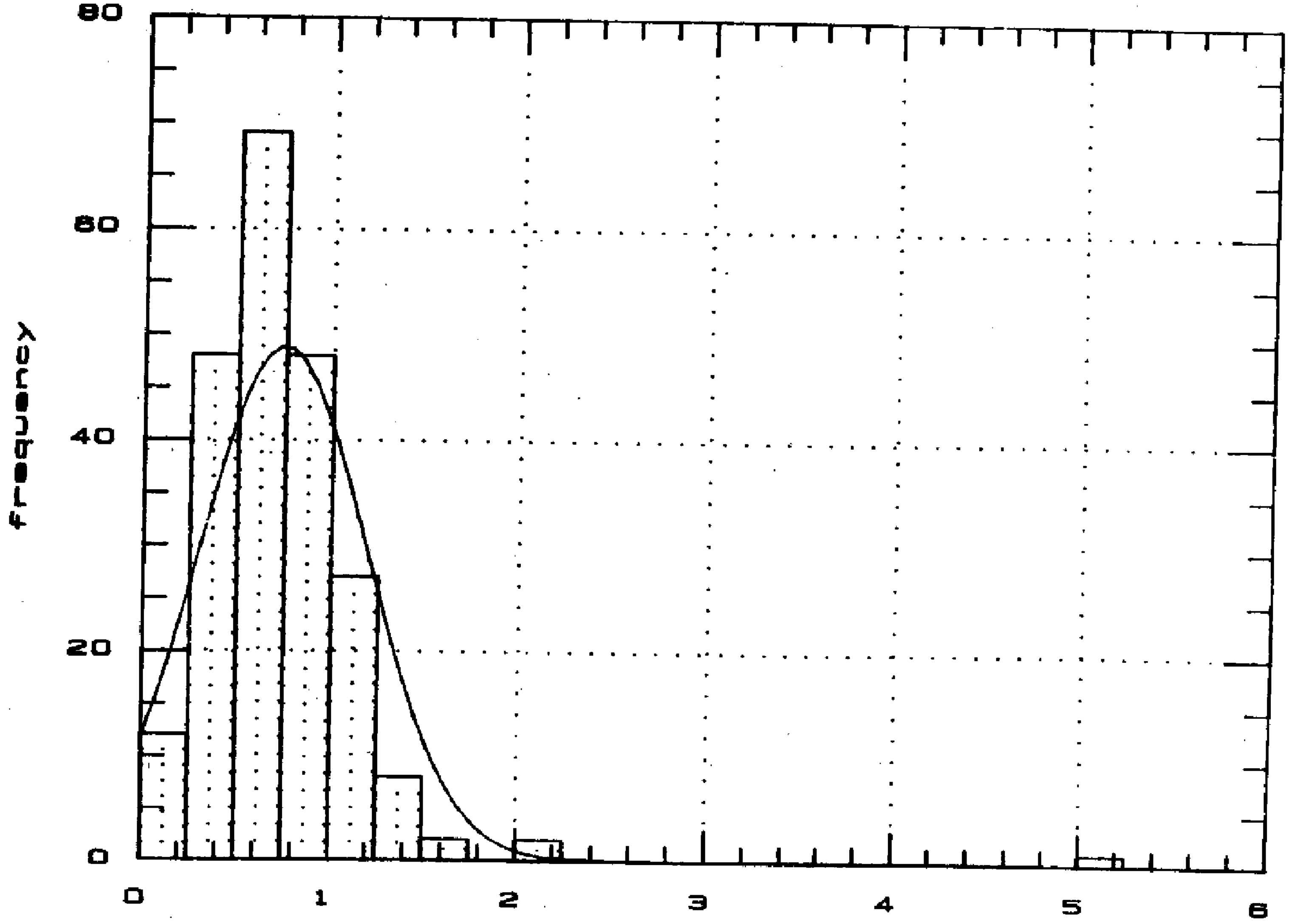


TREND ANALYSIS

A preliminary analysis was performed on phosphorus concentrations to determine if there has been a significant change for the period of implementation of BMPs. A non-parametric test for trend, the Seasonal Kendall test (Hirsch and Slack 1984, Hirsch et. al. 1982) was applied to the total phosphorus data from biweekly grab samples. The analysis is preliminary; the concentration data have not been corrected for variation in flow.

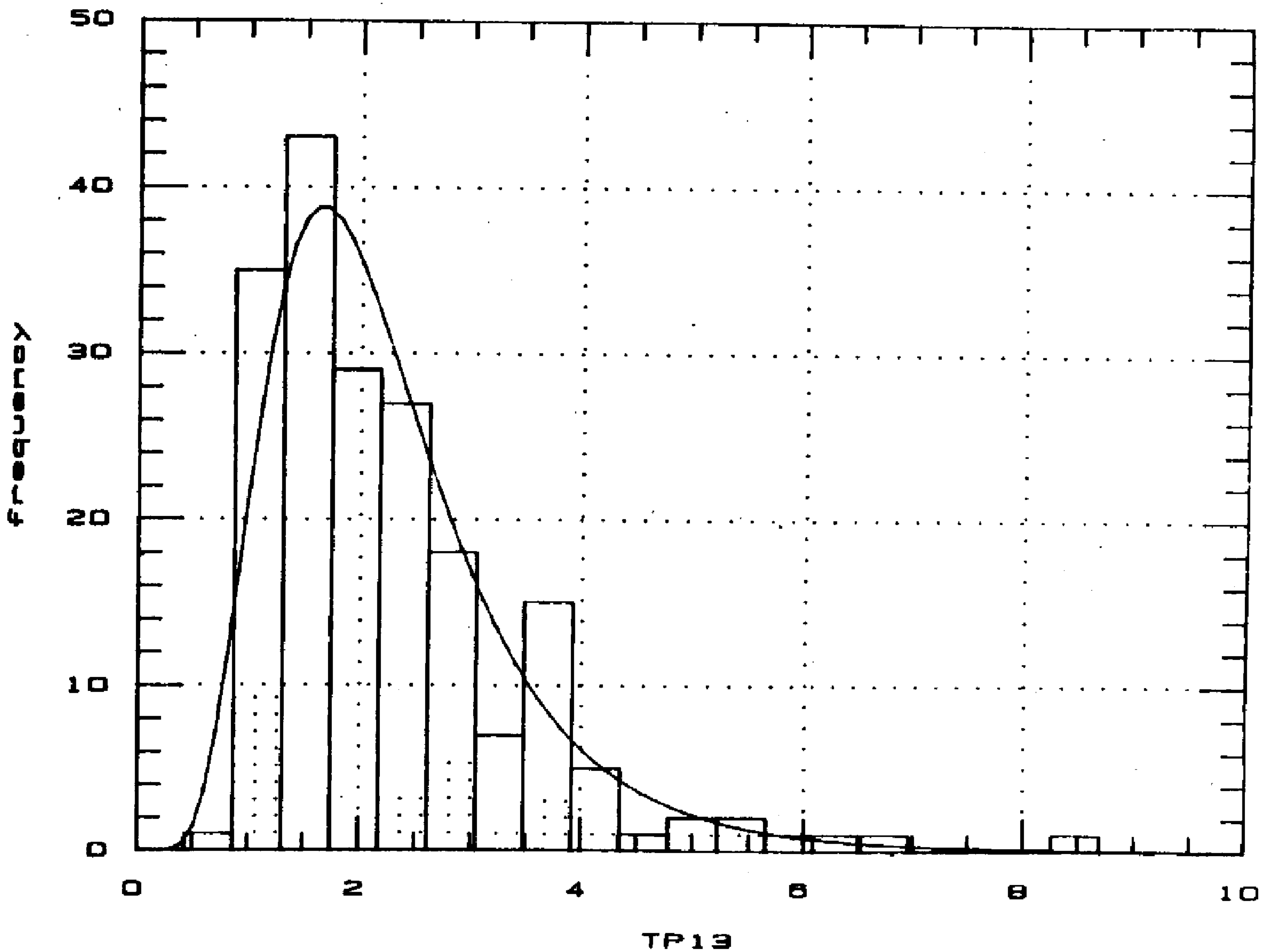
The seasonal Kendall Tau test is a non-parametric, seasonally adjusted trend evaluator that can be adjusted to be robust to serial correlation. A non-parametric method was selected due to the abnormal characteristic of the P concentration data. Typical frequency distributions are positively skewed with high peakedness (Figures 8 and 9), while Figure 10 depicts a more normal distribution. Distributions that exhibit positive skewness seem to occur at stations that do not have continuous flow. This exists in the small tributaries during the dry season when the flow is minimal or non-existant. Stations that exhibit more normal distributions are located in the main branch of Taylor Creek or in the case of S-191, the large L-63N interceptor canal. This situation provides for greater mixing and actually acts as a buffer diluting higher concentrated water generated from smaller upstream tributaries. Consequently, the larger volume of water passing through these stations tends to eliminate or minimize the occurrence of extreme outlier values. In the case of Figure 9, a single outlier value has caused this distribution to be positively skewed. Removing this outlier would create a cleaner statistical environment especially if the value cannot be explained. However, if the value is justified, it should not be removed despite the fact that it creates a lognormal situation in the data base. Although a lognormal distribution can be fitted to the

FIGURE 8. Frequency Histogram



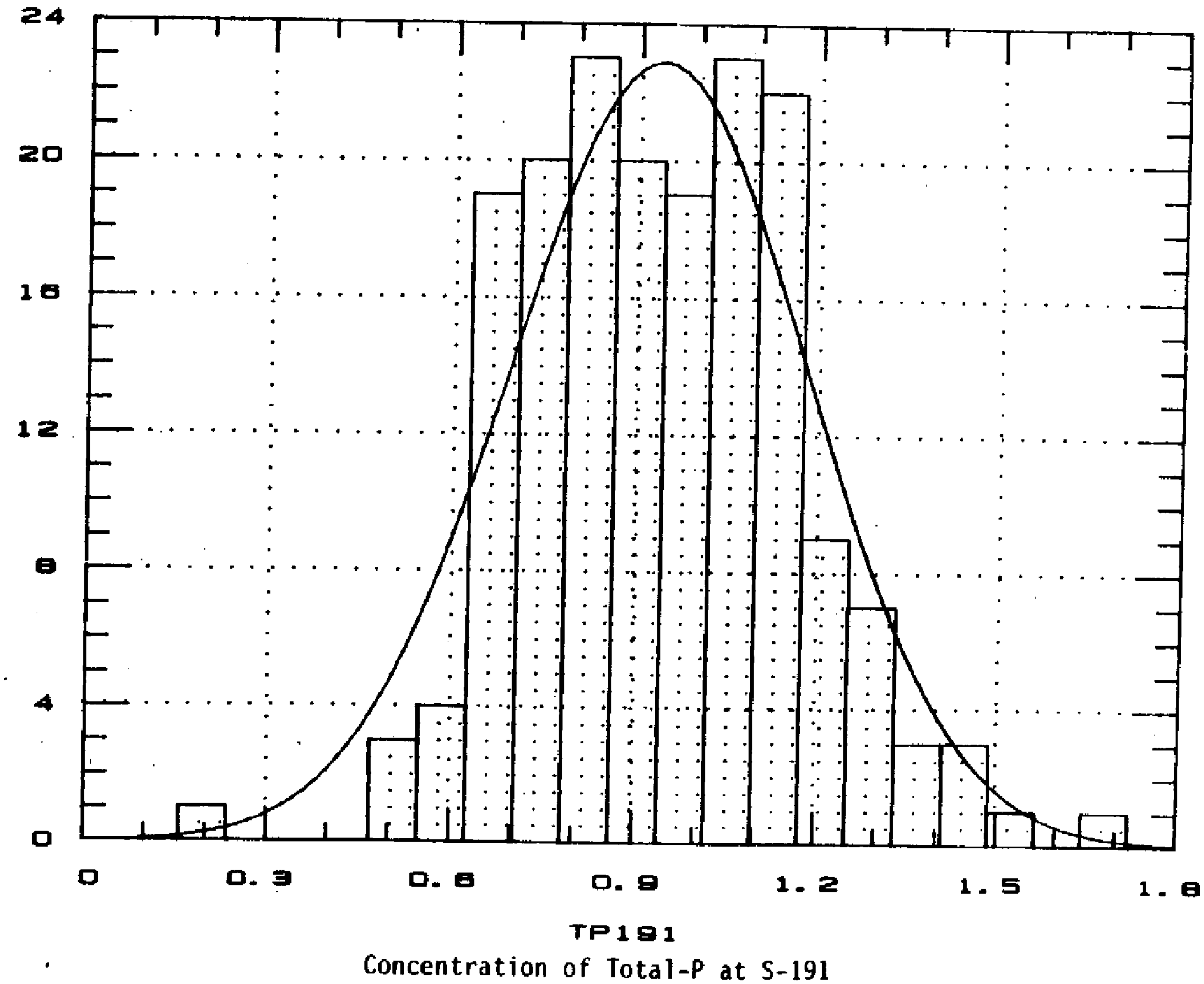
Concentration of Total-P at station 11

FIGURE 9. Frequency Histogram



Concentration of Total-P at station 13

FIGURE 10. Frequency Histogram



data, the empirical distribution is controlled by a few outlier values. Comparison in a non-parametric method provides robustness to outliers for the estimation of trend.

This Kendall Tau has been corrected for seasonal effects by Hirsch and Slack (1984). The year can be divided into 12 monthly seasons or 2 climatic seasons; the wet season (May 15 to October 15) and the dry season. The Kendall Tau then is calculated from comparisons of median P concentration values for each season over the period of record.

Mann Kendall test statistic:

$$S_g = \sum_{i<j} sgn(X_{jg} - X_{ig}) \quad g = 1, 2, \cdots, p$$

for p seasons and n years.

Seasonal Kendall test statistic:

$$S' = \sum_{g=1}^{p} S_g$$

The Tau values for each season are then averaged to determine the overall Tau.

This non-parametric test was also selected based on resistance to error introduced by strong time series dependence. Hirsch and Slack (1984) presented a method for accounting for the effect of serial dependence. Where long term persistence of an autocorrelative process (ARMA) may indicate the presence of trend, the test for trend must be adjusted. The adjustment is made to the estimation of the variance of the Seasonal Kendall test statistic. The test statistic is asymptotically normal with mean O and the following variance:

$$var[S'] = \sum_{g} \sigma_g^2 + \sum_{\substack{g,h \\ g \neq h}} \sigma_{gh}$$

The long term persistence is accounted for in the covariance term gh = cov (Sg. Sh). The covariance is added to the estimate of the variance to provide a measure of the normal variate. This effectively increases the Tau value required to obtain the same level of significance compared to the case where serial dependence does not occur.

A final criteria in selection of a non-parametric test is the type of test. There are two types of non-parametric tests available: a test for a step change in behavior and a test for long term trend. The trend test was selected for this analysis as the implementation of BMPs in the Taylor Creek/ Nubbin Slough basin has occurred over a period of years. The gradual implementation would make analysis as a step change difficult. In the situation where a dairy barn is shut down, e.g., Otter Creek, the effective change in water quality may be sufficiently abrupt to be analyzed as a step change.

However, since there are more years of pre-BMP data than transition period or post-BMP data, significant trends resulting from BMPs may be missed in this analysis. In the future, the data will also be analyzed by a form of non-parametric step change test.

Method

The time series of total phosphorus concentration data were analyzed for long term trend using the Seasonal Kendall Tau trend test corrected for serial correlation. This analysis was conducted using a series of FORTRAN routines developed by Slack (1985). The data was supplied in two fields as decimal time by year and concentration.

The trend test was conducted on data from 14 stations (Figure 11) for a period of record from 1978 to present (Table 1). In successive tests at each station, the data were stratified into 26, 23, 8, 4, and 2 seasons for each year based on either the calendar year or a seasonal year. The seasonal year began May 15, which is the approximate beginning of the yearly wet season.

Results of the trend analysis for water quality stations that exhibited a significant change in total phosphorus concentrations are presented in Table 2.

FIGURE 11 TAYLOR CREEK/NUBBIN SLOUGH WATERSHED TREND TEST STATIONS

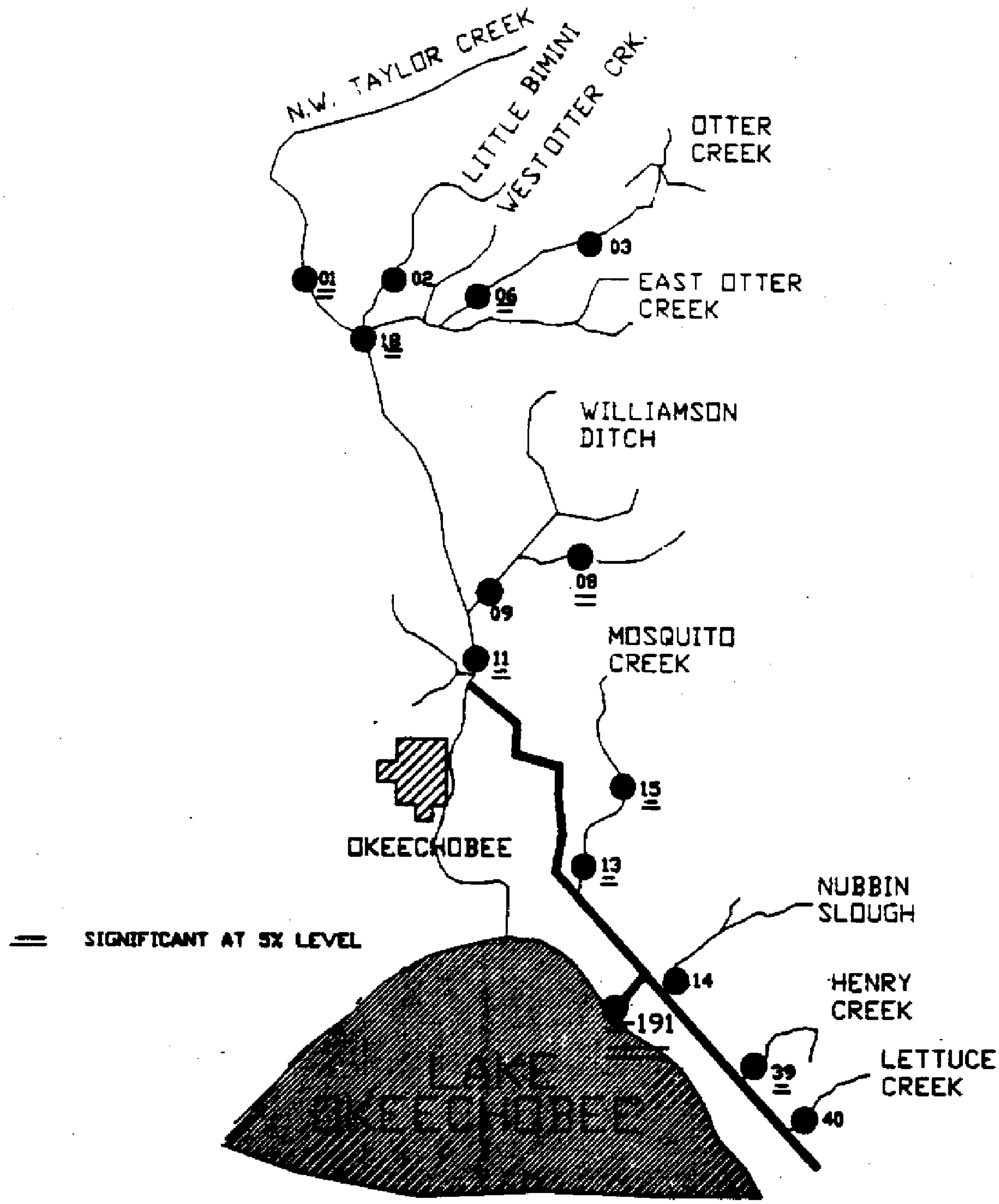


TABLE 1. IDENTIFICATION OF TREND TEST STATIONS

Water Quality Stations	Location		Trend
Station 01	NW Taylor Creek	Significant	Increasing
Station 02	Little Bimini	Not Significant	No Change
Station 03	Upstream Otter Creek	Not Significant	No Change
Station 06	Downstream Otter Creek	Significant	Decreasing
Station 08	Williamson East Lateral	Significant	Decreasing
Station 09	Downstream Williamson	Not Significant	No Change
Station 11	Upper Taylor Creek	Significant	Decreasing
Station 13	Downstream Mosquito Creek	Significant	Decreasing
Station 15	Upstream Mosquito Creek	Significant	Decreasing
Station 14	Downstream Nubbin Slough	Not Significant	No Change
Station 18	Headwater Confluence	Significant	Decreasing
Station 39	Henry Creek	Significant	Increasing
Station 40	Lettuce Creek	Not Significant	No Change
Station S-191	Lake Okeechobee	Significant	Decreasing

TABLE 2. RESULTS OF TREND ANALYSIS FOR SELECTED WATER QUALITY STATIONS IN TAYLOR CREEK/ NUBBIN SLOUGH EXHIBITING A SIGNIFICANT CHANGE IN TOTAL PHOSPHORUS

Station	Seasonal Kendall Tau	Probability Level		Trend
		WOS	WS	[TP] / YR
01	0.273	0.0007	0.07	0.033
06	-0.446	0.0000	0.014	-0.27
08	-0.36	0.0000	0.0091	-0.0508
11	-0.265	0.0008	0.025	-0.034
13	-0.234	0.005	0.11	-0.096
15	-0.291	0.0004	0.054	-0.131
18	-0.322	0.0014	0.032	-0.07
39	0.259	0.027	0.19	0.203
S-191	-0.452	0.0000	0.014	-0.048

NOTE: WOS - PROBABILITY CALCULATED WITHOUT ADJUSTMENT FOR SERIAL CORRELATION. S - PROBABILITY WITH SERIAL CORRELATION.

Descriptive variables for each of these stations are listed in Table 3.

TABLE 3. DESCRIPTIVE VARIABLES OF WATER QUALITY STATIONS THAT EXHIBITED A SIGNIFICANT CHANGE IN TOTAL PHOSPHORUS CONCENTRATIONS

Variable	Station 01	Station 06	Station 18
Sample Size	209	199	139
Average	0.51	2.19	0.95
Median	0.46	2.01	0.80
Standard Deviation	0.32	1.15	0.59
Minimum	0.06	0.40	0.06
Maximum	1.71	5.86	3.21
Skewness	1.15	0.51	1.31
Kurtosis	1.15	-0.27	2.30
K-S Significance*	0.0082	0.31	0.041

Variable	Station 08	Station 13	Station 15
Sample Size	206	189	198
Average	0.47	2.27	2.14
Median	0.33	1.97	1.78
Standard Deviation	0.43	1.19	1.43
Minimum	0.01	0.86	0.15
Maximum	2.65	8.61	12.96
Skewness	1.45	1.82	3.04
Kurtosis	2.84	5.08	16.96
K-S Significance*	0.0004	0.01	0.0005

Variable	Station 11	Station 39	Station S-191
Sample Size	217	123	180
Average	0.74	2.41	0.93
Median	0.67	1.84	0.93
Standard Deviation	0.44	1.87	0.25
Minimum	0.12	0.17	0.00
Maximum	5.03	10.78	1.67
Skewness	4.53	1.80	-0.36
Kurtosis	40.04	3.62	1.90
K-S Significance*	0.0035	0.0009	0.999

*KS SIGNIFICANCE: SIGNIFICANCE LEVEL AT WHICH THE OVERALL KOLMOGOROU-SMIRNOU GOODNESS - OF FIT TEST INDICATES THAT THE EMPIRICAL DISTRIBUTIONS ARE DIFFERENT FROM THE NORMAL DISTRIBUTIONS

Significant trends in water quality at the 5 percent level were detected at nine of the 14 stations (Figure 11). Of these nine stations the long term TP concentrations were found to decrease at seven stations. These trends were significant without considering serial dependence. Where corrected for covariance, only data at three stations showed significant trends at the 5 percent level (06, 13, 15). Finally, only one site had a significant trend at the 1 percent level. This occurred at station 6 on Otter Creek where a dairy barn shut down occurred in fall 1981. This resulted in a substantial decrease in TP concentrations.

In computing the test statistic selection of the seasons for stratifying the data affects both the significance level and trend estimate. The calculated significance levels were lower where more seasons were considered and the seasons adjusted to coincide with the wet season-dry season behavior. The effect of the greater number of seasons may reflect a more detailed representation of seasonal change and a more accurate description of the serial dependence. The estimated values for trend slope varied arbitrarily with number of seasons. The probability levels were higher for all calculations when the serial dependence was considered.

DISCUSSION OF WATER QUALITY DATA BY SUB-WATERSHED

Otter Creek

General Information - Critical Acres - 10,753

1	Land Use	Acres	% Critical Acres
	Dairy	6,518	61
	Beef	4,235	39
2	Farms	Average Acres	Approx. Animal Units
	Dairy - 9	931	6,400
	Beef - 8	529	1,000
3	Water Quality Sampling Sites	Site #	Sampling Frequency
	Open Channel Grab	26 Upstream	Biweekly
		03 Intermediate	Biweekly
		06 Downstream	Biweekly
		19	Biweekly
	Runoff Grab	25	Biweekly
		27	Biweekly
		20	Biweekly

Time series trends of wet season total and ortho phosphorus, total and inorganic nitrogen concentrations for Stations 03 and 06 upstream and downstream, respectively, are presented in Appendix I. A summary of 1985 and 1986 annual means, minimum, and maximum values for the remaining sites are also presented in Appendix I.

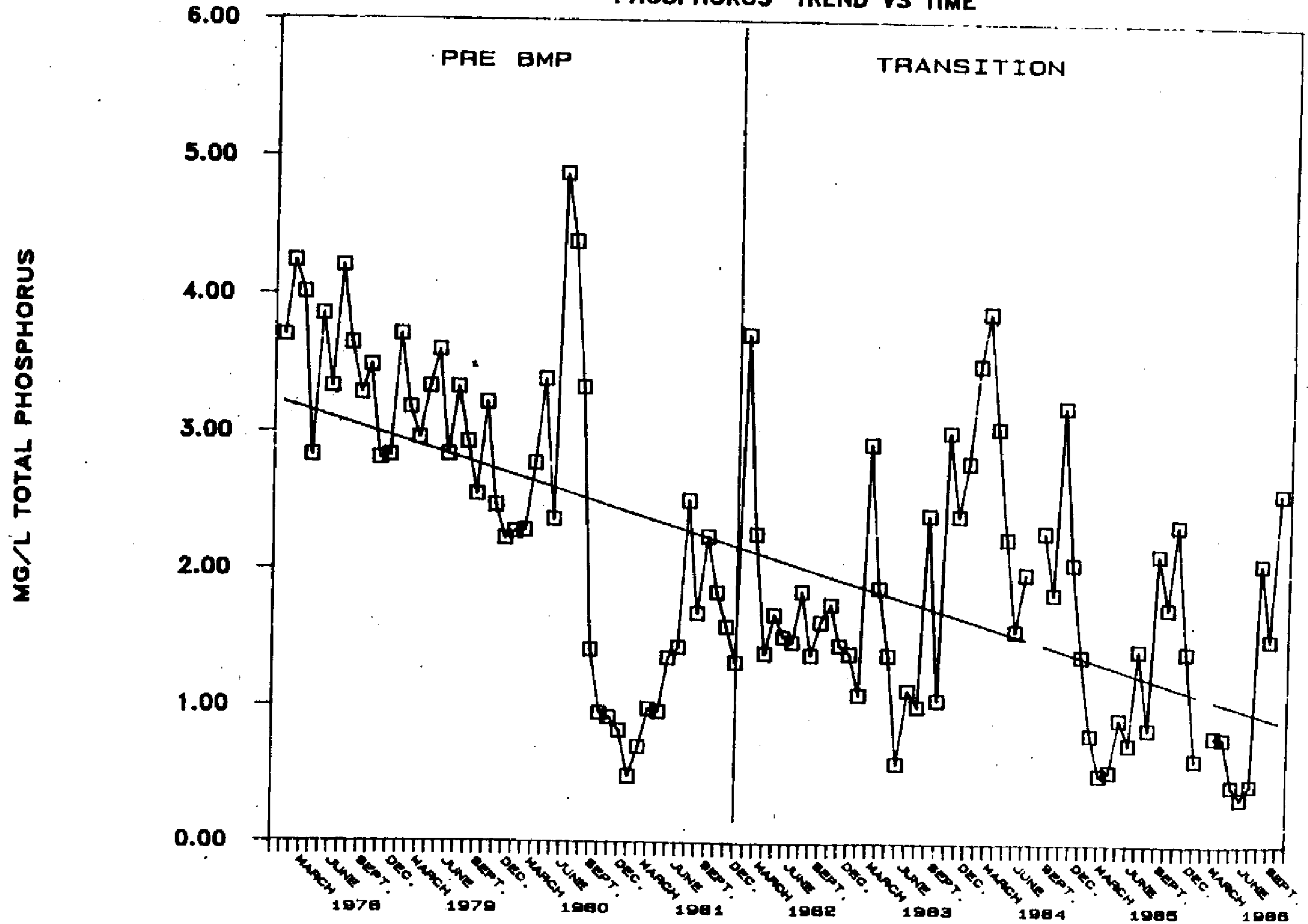
Discussion

As of October 30, 1986, 77 percent of prescribed BMPs were implemented throughout the critical area of Otter Creek (10,753 acres). Presented in Figure 12 is the total phosphorus trend over time generated from the seasonal Kendall Tau analysis. This test was conducted on data from station 03 and station 06 in Otter Creek. Station 06 (downstream) total P concentration data had a significant (at the 5 percent level) downward trend while data from the upstream station 03 showed no significant trend.

Much of the improvement in total phosphorus concentrations observed at station 06 can be attributed to the shutdown of F and R Dairy in September of 1981. This

FIGURE 12. OTTER CREEK DOWNSTREAM STATION 06

PHOSPHORUS TREND VS TIME



operation was changed from a highly intensive dairy system to a very low density beef operation (less than one cow per three acres).

Total phosphorus concentrations at station 03 have yet to show any significant improvement due to continued surface water runoff from upstream dairy operations (Figure 13). Future plans for existing drainage from high intensity pastures as to reroute flows back into detention areas. The majority of the prescribed BMPs implemented throughout the Otter Creek sub-watershed have been fencing, diversion, and waste water utilization (i.e., spray irrigation and wash water recycling). With additional emphasis placed on diversion of high intensity runoff from pastures upstream of station 03, water quality at this site should begin to exhibit some improvement.

Little Bimini

General Information - Cricital Acres 4,050

1	Land Use		Acres	% Critical Acres
	Dairy		2,903	72
	Beef		1,128	27.5
	Hog		19	0.5
2	Farms		Average Acres	Approx. Animal Units
	Dairy - 3		968	3,800
	Beef - 6		188	480
	Hog - 1		19	75
3	Water Quality Sampling Sites		Site #	Sampling Frequency
	Open Channel Grab	02	Upstream	Biweekly
		104	Downstream	Biweekly

Time series trends of wet season total and ortho phosphorus, total and inorganic nitrogen concentrations for stations 02 and 104 are presented in Appendix I. A summary of 1985 and 1986 annual means, minimum, and maximum values for the remaining sites are also presented in Appendix I.

<u>Discussion</u>

As of October 30, 1986, 91 percent of the prescribed BMPs were implemented throughout the critical area of Little Bimini (4,050 acres) Figure 14. The seasonal

FIGURE 13. OTTER CREEK WATER QUALITY

UPSTREAM DOWNSTREAM AND MCARTHUR #1

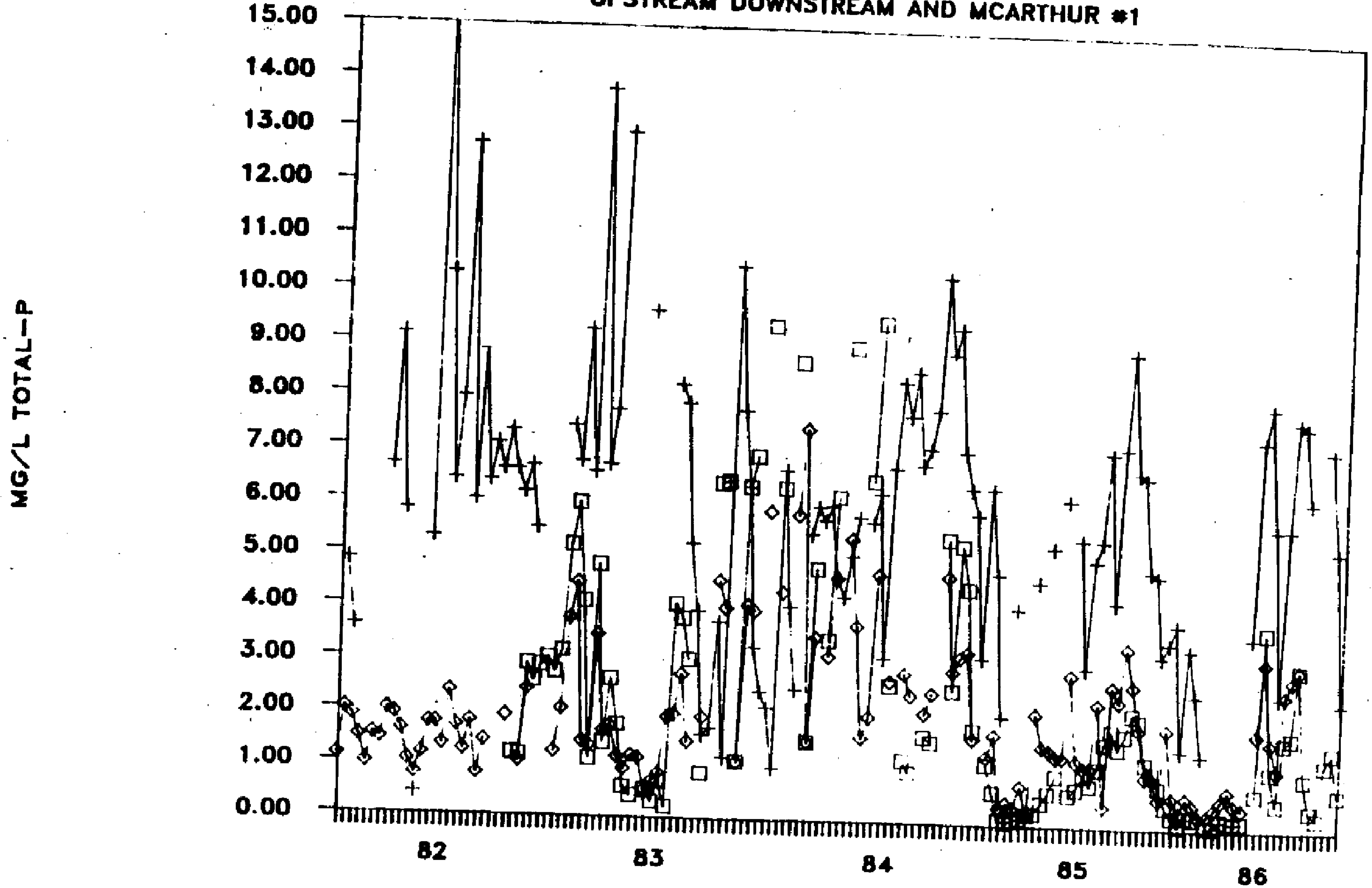
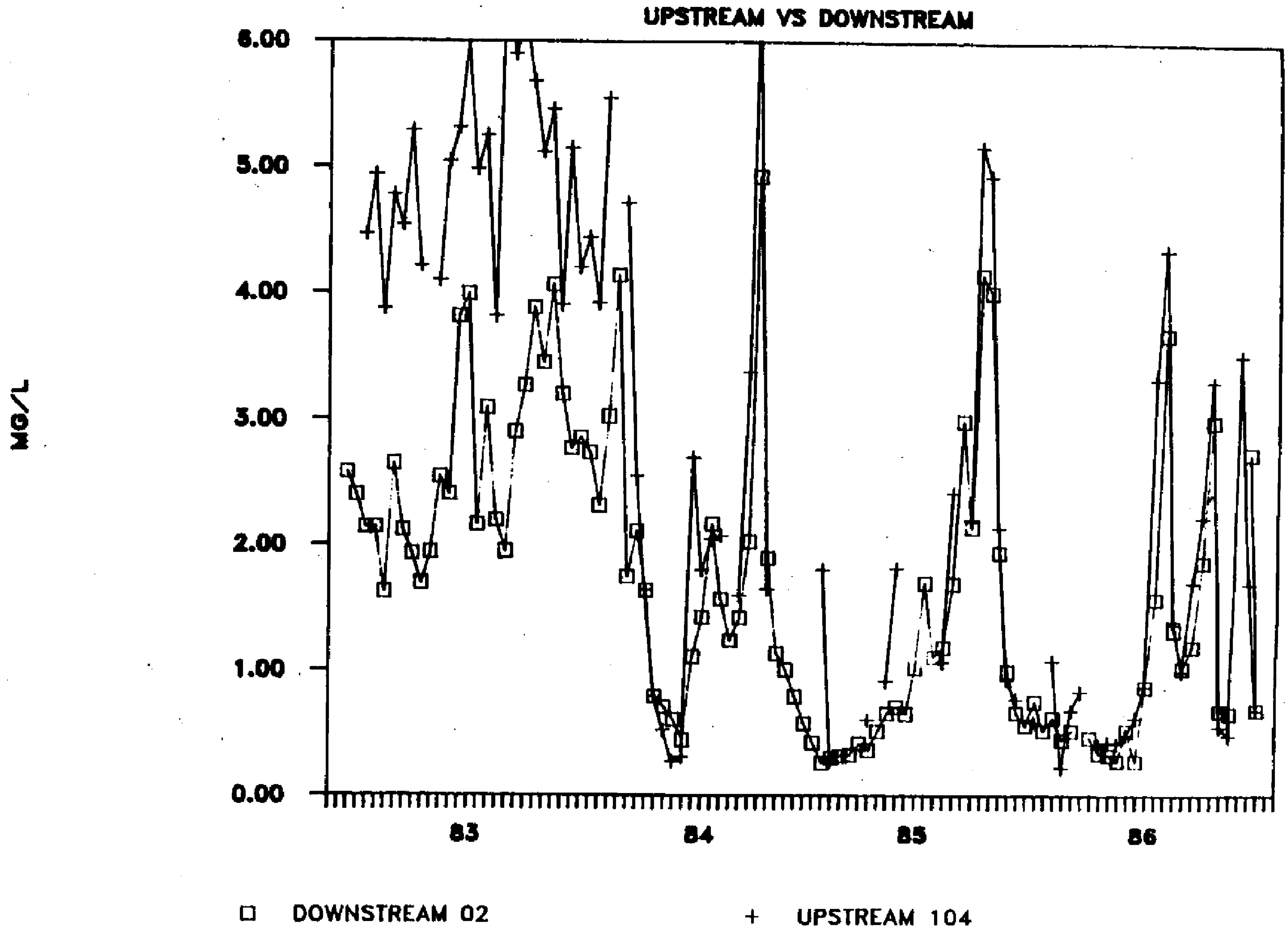


FIGURE 14. LITTLE BIMINI TOTAL PHOSPHORUS



Kendall Tau test for trend significance was performed using data from the downstream water quality station (02) in Little Bimini. At this time there was no indication of any increasing or decreasing trends in total phosphorus concentrations. Improvement of existing phosphorus concentrations will depend a great deal on our ability to handle pasture runoff from the high intensity areas located in the headwaters drainage of Little Bimini. In addition to the fencing that has been performed along these high intensity areas, diversion of runoff also needs to be addressed to improve surface water quality. The results of the Kendall Tau test can be substantiated by examining the time trend of wet season concentrations at station 02. This illustration is provided in Appendix I.

N. W. Taylor Creek

General Information - Critical Acres 11,865

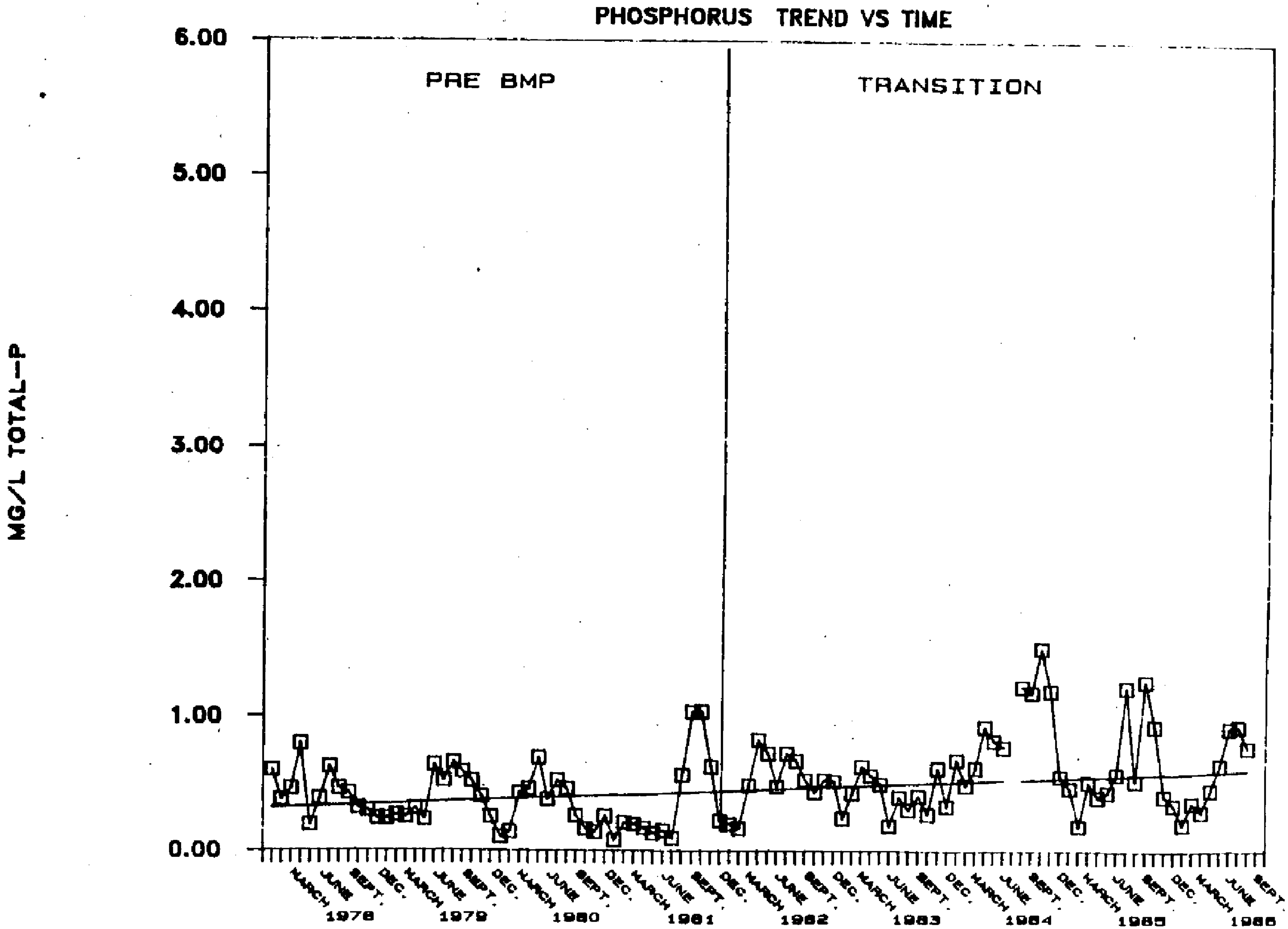
1	Land Use	Acres	% Critical Acres
	Dairy	9,142	77
	Beef	1,813	15
	Citrus	910	8
2	Farms	Average Acres	Approx. Animal Units
	Dairy - 1	9,142	6,500
	Beef - 1	1,813	600
	Citrus - 1	910	
3	Water Quality Sampling Sites	Site #	Sampling Frequency
	Open Channel Grab	01	Biweekly

Presented in Appendix I are time series trends of wet season total and ortho phosphorus and total and inorganic nitrogen concentrations for station 01. Mean, minimum, and maximum values for selected parameters during 1985 and 1986.

Discussion

There has been a slight increase in total phosphorus in the N.W. Taylor Creek sub-watershed. Although 90 percent of the prescribed BMPs have been implemented, results of the Kendall Tau test suggest that there is a slight, but significant trend, over the last eight years (Figure 15). The upward trend may be a

FIGURE 15. N.W.TAYLOR CREEK STATION 01



response to the expansion of a large cow/ calf operation during 1981. The water quality has yet to respond to the primary BMP, fencing cows out of the stream.

Headwaters Summary

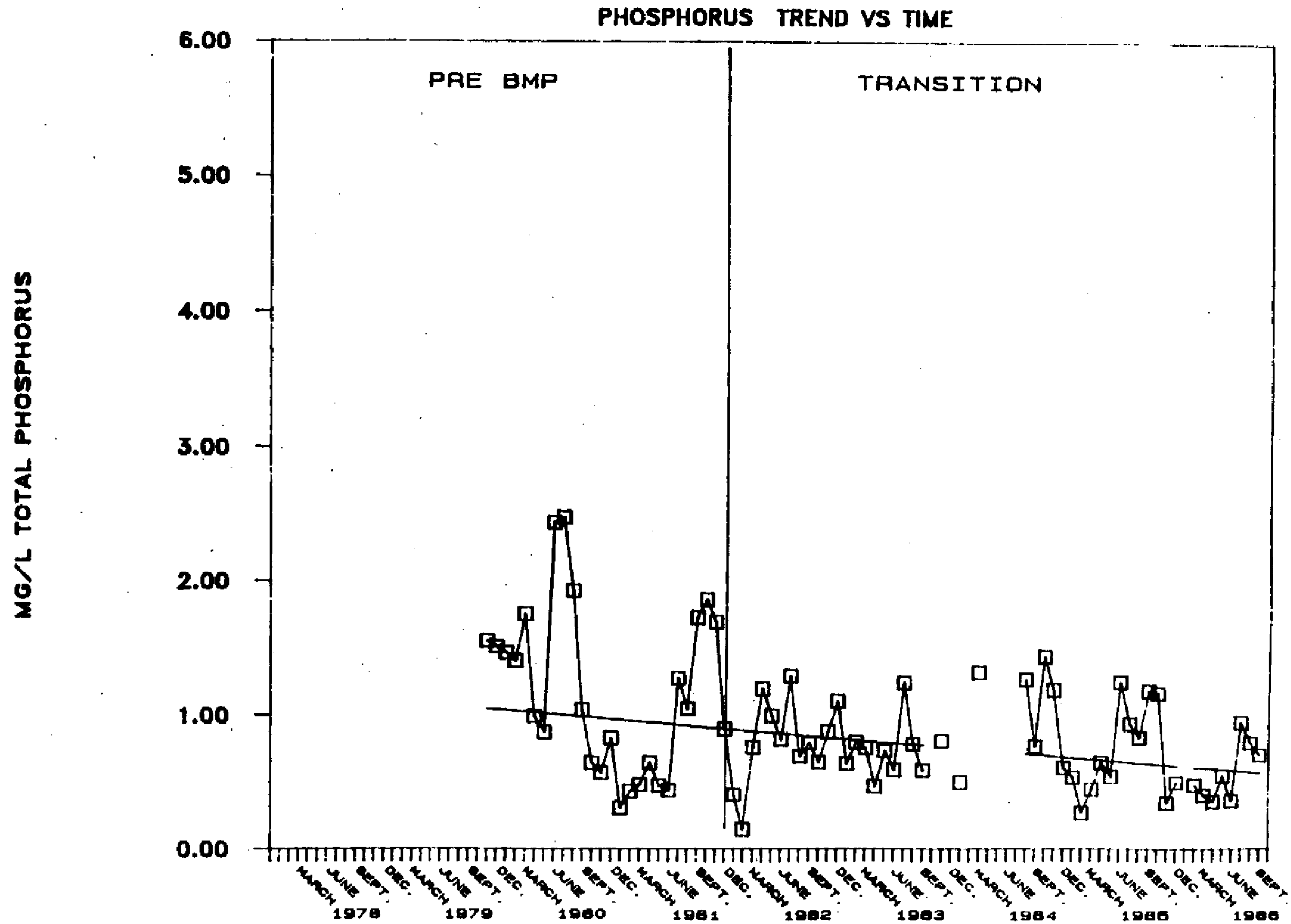
The headwaters of the upper Taylor Creek Basin is represented by input from three tributaries, Otter Creek, Little Bimini, and N. W. Taylor Creek. The major tributaries throughout the headwaters are complete in terms of implementation of the fencing component of the program. Water quality station 18 is located at the confluence of these three tributaries and represents the sum of land use changes in these three sub-watersheds. Results of the Kendall Tau test at station 18 indicate a slight improvement in total phosphorus concentrations from 1979 through 1986 (Figure 16). Events point toward the shutdown of F and R Dairy as the major influence on these downstream concentrations at station 18. Results from Little Bimini and N. W. Taylor Creek, two sub-watersheds that have yet to exhibit any improvement, substantiate the dairy shutdown conclusion due to the significant water quality improvements observed in Otter Creek. Wet season nutrient concentrations presented in Appendix I substantiate the results of the Kendall Tau test exhibiting a decreasing trend in total phosphorus concentrations.

Taylor Creek Main

General Information - Critical Acres 6,464

1	Land Use	Acres	% Critical Acres
	Dairy	2,765	42.5
	Beef	3,694	57
	Hog	5	.5
2	Farms	Average Acres	Approx. Animal Units
	Dairy - 1	922	2,500
	Beef - 6	616	1,500
	Hog - 1	5	100
3	Water Quality Sampling Sites	Site #	Sampling Frequency
	Open Channel Grab	18 Upstream	Biweekly
		12 Intermediate	Biweekly
		11 Downstream	Biweekly

FIGURE 16. TAYLOR CRK. HEADWATERS STATION 18



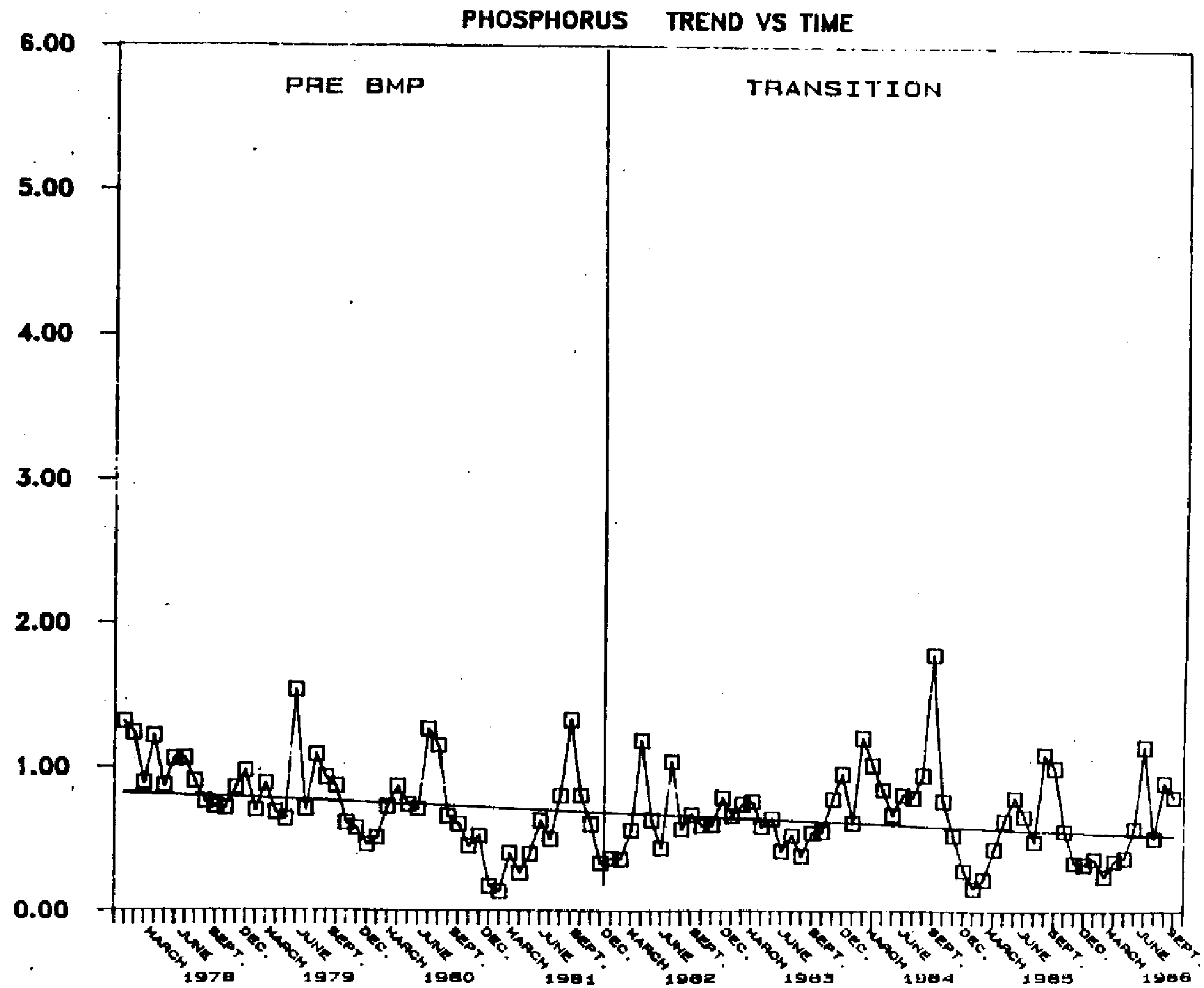
Time series trends of wet season total phosphorus ortho phosphorus and total and inorganic nitrogen are presented in Appendix I for stations 18 and 11. Mean, minimum, and maximum values for selected parameters during 1985 and 1986 are also presented in Appendix I for stations 18, 12, and 11.

Discussion

The water quality appears to have improved for Upper Taylor Creek. The outflow of this area, and the entire upper Taylor Creek watershed is represented at station 11 (Figure 17). The Kendall Tau test for station 11 indicates a slight decreasing trend in total phosphorus concentrations from 1978 to present. This trend also exists in the wet season time series for total phosphorus and total nitrogen concentrations. Much of the improvement observed at station 11 may, however, be directly attributed to the improvement in water quality exhibited at the headwaters station 18 where mean annual total phosphorus concentrations have decreased 50 percent from 1978 through 1986.

Much of the BMP implementation throughout the main branch of Taylor Creek has been to fence cows out of the major water course and tributary drainage. Ninety-one percent of the prescribed BMPs have been implemented over the critical area surrounding the main branch of Taylor Creek. Due to low beef cow densities around Taylor Creek Main, much of the BMP implementation, dealing with dairy effluent and the high intensity dairy pasture runoff, in the headwaters area will have a greater initial impact on the improvement of water quality at the stations along Taylor Creek Main. In contrast, the impact of fencing on water quality throughout Taylor Creek Main will be more subtle.

FIGURE 17. TAYLOR CREEK MAIN STATION 11



Williamson Ditch

General Information - Critical Acres 9,774

1	Land Use	Acres	% Critical Acres
	Beef	8,774	90
	Citrus	1,000	10
2	Farms	Average Acres	Approx. Animal Units
	Beef - 1	1,462	3,000
	Citrus - 1	1,000	
3	Water Quality Sampling Sites	Site #	Sampling Frequency
	Open Channel Grab	07 W Upstream	Biweekly
		08 E Upstream	Biweekly
		09 Downstream	Biweekly

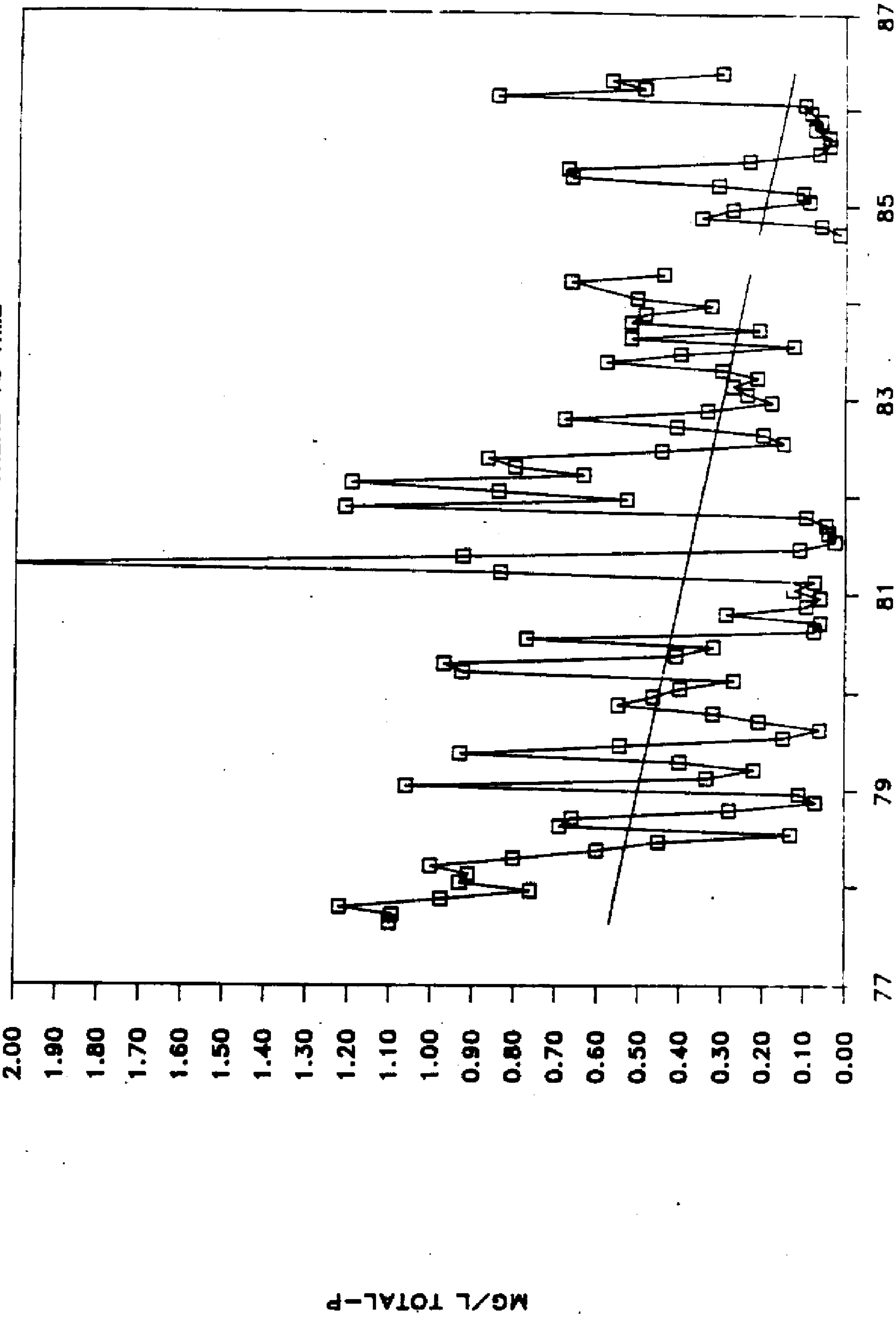
Time series trends of wet season total phosphorus and ortho phosphorus, total nitrogen, and inorganic nitrogen for stations 07, 08, and 09 are presented in Appendix I. Mean, minimum, and maximum values for selected parameters during 1985 and 1986 for stations 07, 08, and 09 are reported in Appendix I.

Discussion

There appears to be little change in the overall water quality in the Williamson sub-watershed. Results of the Kendall Tau test indicate that no significant trend exists for total phosphorus concentrations at station 09, the most downstream site. However, a significant decreasing trend has occurred at the east lateral site 08(Figure 18) . Wet season time series illustrations at stations 08 and 09 indicate some improvement in nitrogen and phosphorus concentration has occurred since 1983. Nitrogen concentrations in particular have exhibited less variability throughout the wet season from 1978 to present. In contrast, station 07, which represents input from the west lateral of this sub-watershed, has exhibited little change in nitrogen and phosphorus concentrations since 1978. Total phosphorus and total nitrogen concentrations at this site are the lowest recorded over the entire Taylor Creek/ Nubbin Sough watershed (< 0.2 mg/L TP and <3.0 mg/L TN respectively).

FIGURE 18. WILLIAMSON DITCH STATION 08

PHOSPHORUS TREND VS TIME



The majority of BMP implementation throughout the Williamson sub-watershed has consisted of fencing cows out of the major drainage. One-hundred percent of the prescribed BMPs have been implemented in the Williamson sub-watershed. The practice of fencing cows out of the stream alone has eliminated the potential of approximately 3,000 cows having access to this drainage. There has also been an interesting change in management philosophy dealing with seasonal fertilizer applications coupled with the use of legumes for supplemental nitrogen fertilization and cattle forage. These practices have been incorporated into the scheme of the largest cattle operation in the Williamson sub-watershed, and one of the largest in the Taylor Creek/ Nubbin Slough watershed, over the last eight years. The most significant management changes have taken place beginning in 1982 and have been progressively implemented over the past five years.

These management changes have been:

1. To shift the normal fertilizer application of 250 to 300 pounds of 20/10/10 per acre from the summer to a late winter/ early spring application.
2. Eliminate all nitrogen fertilization in the summer, relying on legumes to provide nitrogen to forage grasses. (Minimal phosphorus fertilization in the summer consists of a 0/10/30 application).
3. Progressively shift grazing pastures from pangola to a legume-pangola mix providing a natural source of nitrogen to grasses using legumes. This virtually eliminates the need for extensive nitrogen fertilizing during the summer months.

This change in management strategy explains the declining nitrogen concentrations exhibited at station 08 and in turn, downstream at station 09. The seasonal shift in the application of phosphorus fertilizers seems to have helped improve wet season phosphorus concentrations, eliminating slugs of phosphorus during extreme wet periods where high water table/ runoff conditions exist.

Mosquito Creek

General Information - Critical Acres 4,101

1	Land Use	Acres	% Critical Acres
	Dairy	3,663	89
	Beef	438	11
2	Farms	Average Acres	Approx. Animal Units
	Dairy - 4	916	4,000
	Beef - 2	219	150
3	Water Quality Sampling Sites	Site #	Sampling Frequency
	Open Channel Grab	15 Upstream	Biweekly
		13 Downstream	Biweekly

Time series trends of wet season total and ortho phosphorus, total and inorganic nitrogen concentrations for stations 13 and 15 are presented in Appendix I. Mean, minimum, and maximum values for selected parameters during 1985 and 1986 are also presented in Appendix I.

Discussion

BMP implementation along Mosquito Creek has resulted in a significant improvement in downstream nitrogen and phosphorus concentrations as depicted in the wet season time series provided in Appendix I. This downward trend was also apparent in the Kendall Tau trend analysis as illustrated in Figure 19. Fifty percent of the prescribed BMPs have been implemented in the Mosquito Creek sub-watershed, the majority of which has occurred on three dairies located upstream of station 15. Much of the improvement can be attributed to the following on-farm improvements on prescribed BMPs that were implemented after a change in management had taken place at these three barns:

1. More efficient use of barn wash water, reducing from 300,000 gallons per day to 150,000 gallons per day.
2. Fencing all 3,000 cows out of all upstream drainage.
3. Improvement of effluent disposal at a 500 head calf operation.

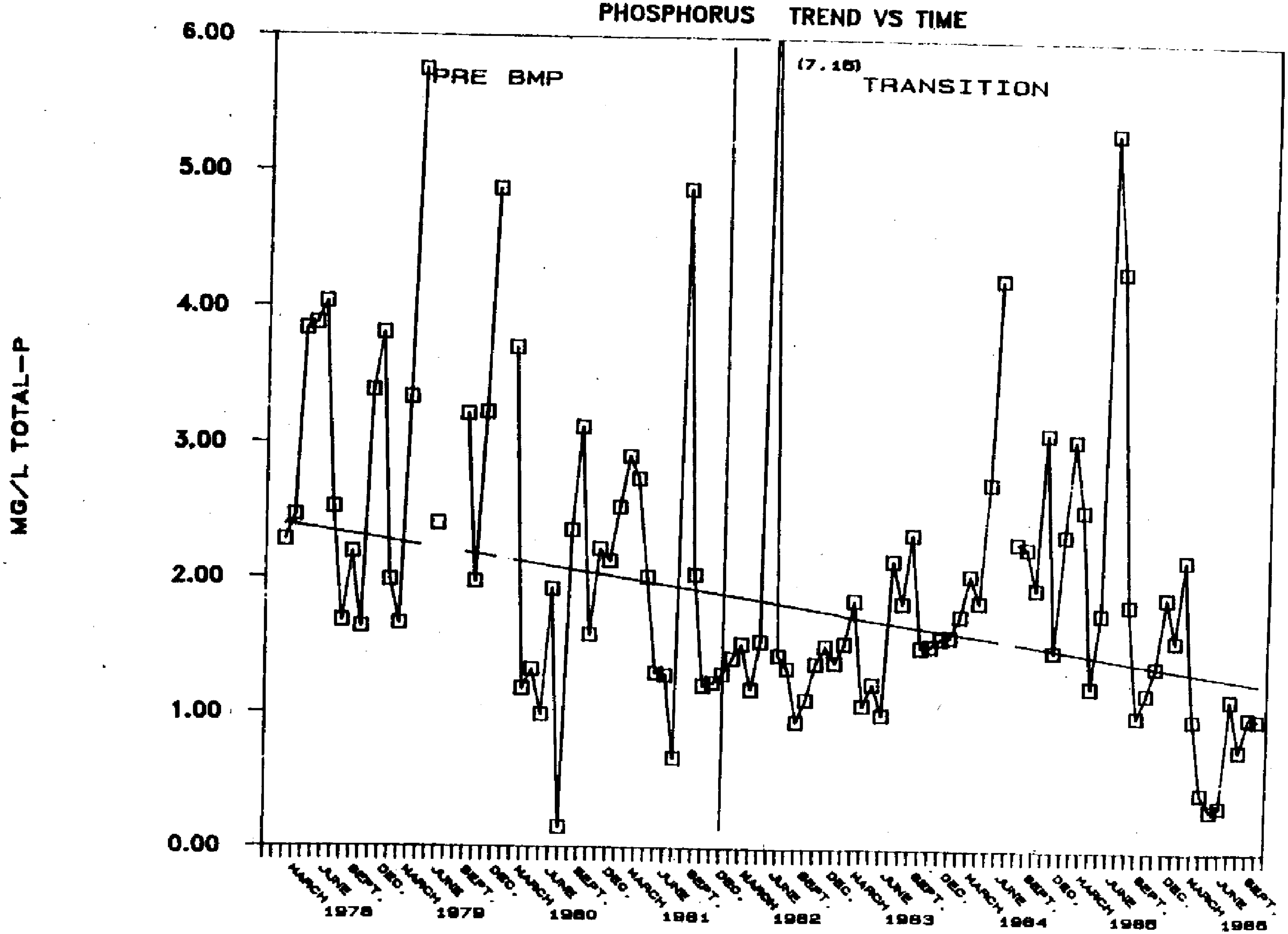
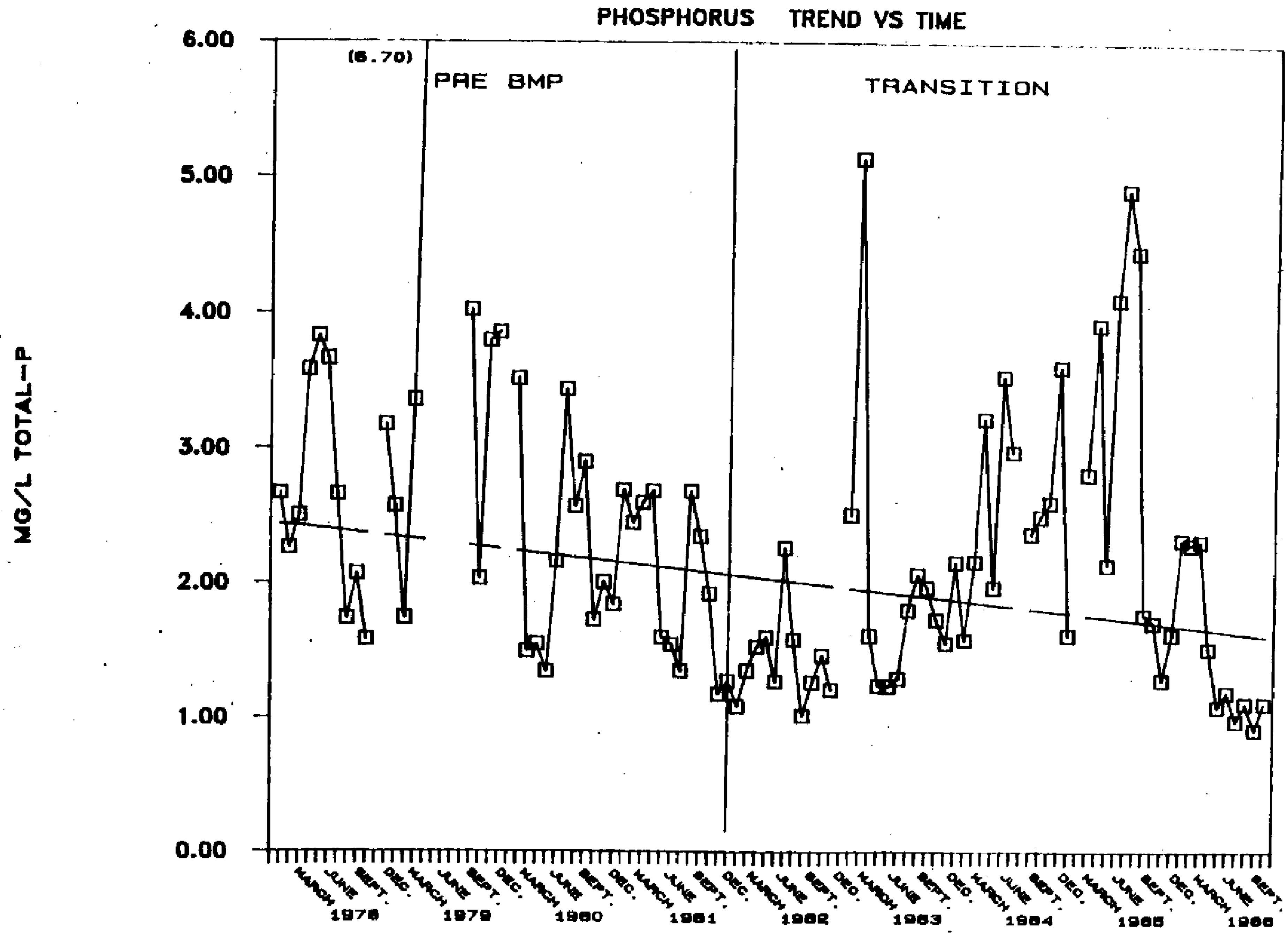


FIGURE 19. MOSQUITO CREEK UPSTREAM STATION 15

4. Improvement of existing seepage disposal fields plugging off all direct drainage to Mosquito Creek.
5. Reshaping and smoothing high intensity pastures and eliminating many on-farm drainage ditches from entering Mosquito Creek.

Additional plans for 1987 are to implement a series of spray irrigation facilities on hay pastures using secondary lagoon effluent from the three barns. This will provide relief for overworked seepage ditches. Little BMP implementation between stations 13 and 15 has occurred over the past year. Much of the improvement in water quality exhibited at station 13 (downstream Mosquito Creek) can be directly attributed to land use changes upstream of station 15, Larson Dairy (Figure 20). However, despite a significant downward trend in phosphorus concentrations at station 13, total and ortho phosphorus concentrations were approximately 10 percent higher in 1986 than those exhibited at station 15 (upstream). This can be attributed to the lack of BMP implementation on the high intensity pastures and lagoons at the White Dairy located directly upstream of station 13 and two miles downstream of station 15. Additional BMP implementation at this dairy and completion of the water quality plans at the three upstream dairies upstream of station 15 should provide additional water quality improvements in this watershed.

FIGURE 20. MOSQUITO CREEK DOWNSTREAM STATION 13



Nubbin Slough

General Information - Critical Acres 7,091

1	Land Use	Acres	% Critical Acres
	Dairy	4,244	60
	Beef	2,058	40
2	Farms	Average Acres	Approx. Animal Units
	Dairy - 6	706	5,000
	Beef - 8	357	950
3	Water Quality Sampling Sites	Site #	Sampling Frequency
	Open Channel Grab	17 Upstream	Biweekly
		14 Downstream	Biweekly

Time series trends of wet season total and ortho phosphorus, total and inorganic nitrogen concentrations are presented in Appendix I. Mean, minimum, and maximum values for selected parameters during 1985 and 1986 for stations 17 and 14 are reported in Appendix I. Mean annual total phosphorus concentrations at station 17 have typically ranged from 0.5 to 0.7 mg/L, while mean annual concentrations at the downstream station have been as high as 3.63 mg/L (reported in 1986).

Discussion

There may be a slight increase in nitrogen and phosphorus constituents in Nubbin Slough. The Kendall Tau test suggests that no significant trends in total phosphorus exist at this time. However, wet season time series trends suggest a slight increase in nitrogen and phosphorus constituents despite the 80 percent BMP implementation. Observed increases in concentrations at station 14 are a result of the downstream site being directly influenced by dairy effluent discharge occurring 700 yards upstream. Midsummer increases in nitrogen and phosphorus concentrations observed during 1986 can also be attributed to a breach in an upstream sediment basin in July. This basin was used to collect high intensity pasture runoff from an upstream dairy. Eighty percent of the prescribed BMPs have been implemented in the Nubbin Slough sub-watershed. Five of the six dairies located in the critical area of Nubbin Slough are downstream of station 17 and upstream of station 14 (Figure 1). The remaining dairy is located approximately three miles upstream of station 17. Runoff from the back pastures of this operation drain into the project area while the dairy and associated high intensity areas drain away from the project area. Until the water quality plan is completely implemented on Red Top Dairy (September 1987), effluent from this operation will continue to mask any water quality improvements resulting from BMP implementation at upstream dairy operations.

Henry Creek

General Information - Critical Acres 4,255

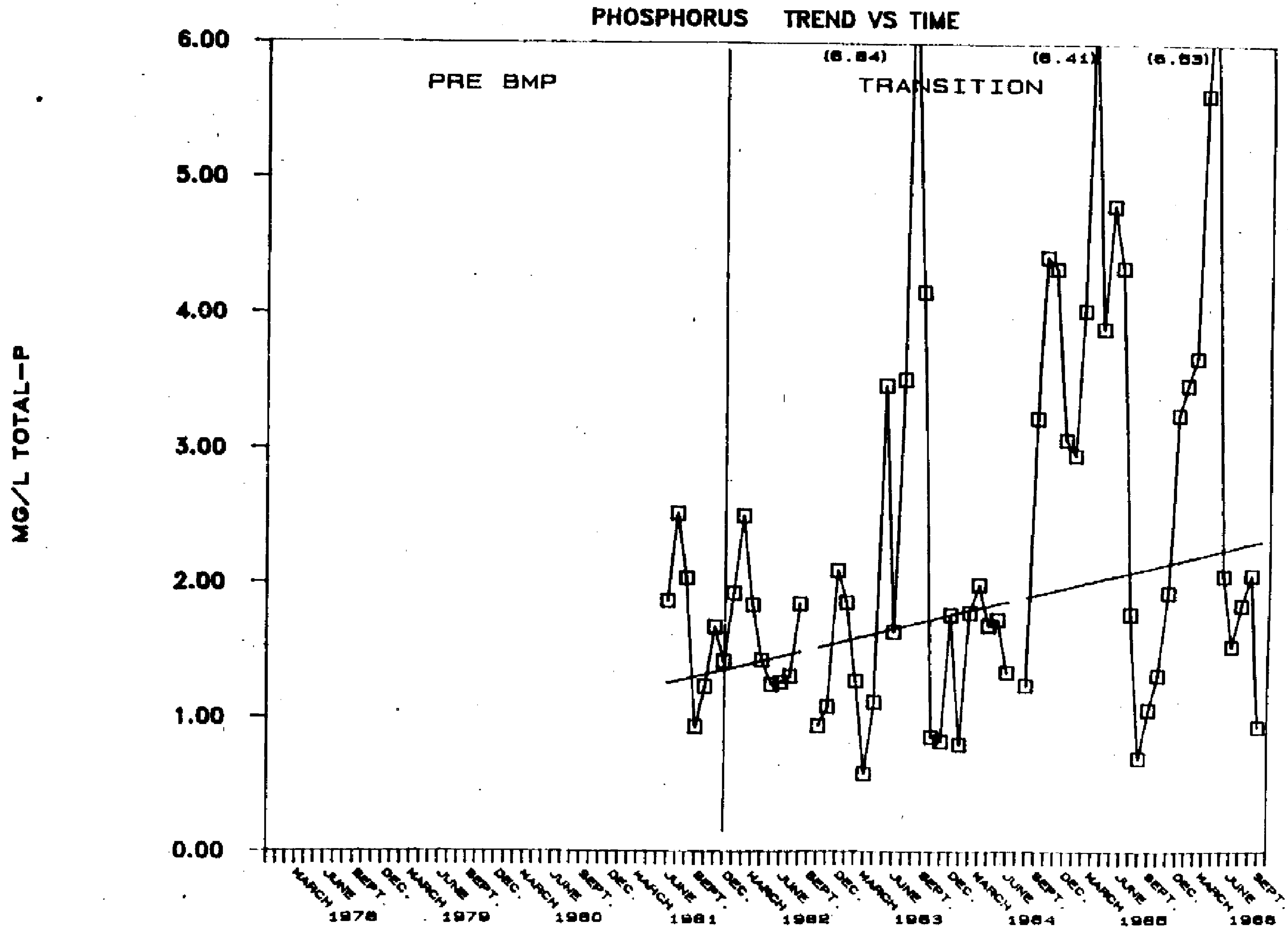
1	Land Use	Acres	% Critical Acres
	Dairy	2,445	57
	Beef	1,810	43
2	Farms	Average Acres	Approx. Animal Units
	Dairy - 1	2,445	1,500
	Beef - 2	905	250
3	Water Quality Sampling Sites	Site #	Sampling Frequency
	Open Channel Grab	39 Downstream	Biweekly

Time series trends of wet season total and ortho phosphorus, total and inorganic nitrogen concentrations are presented in Appendix I. Mean, minimum, and maximum values for selected parameters during 1985 and 1986 for station 39 are reported in Appendix I.

Discussion

Water quality constituents concentrations appear to be increasing in Henry Creek. Ninety-eight percent of the prescribed BMPs have been implemented throughout the Henry Creek sub-watershed. The Kendall Tau test for significance indicated increasing total phosphorus concentrations since 1981 (Figure 21). This trend can be identified in the wet season time series depicted in Appendix I. Secondary lagoon effluent and high intensity runoff from a calf operation have been

FIGURE 21. HENRY CREEK STATION 39



discharged into Henry Creek from Enrico Dairy, upstream, for several years. Because of excessive runoff from these sources they were re-addressed in the SCS water quality work plan and corrected during the latter half of 1986. An interesting note: wet season total and inorganic nitrogen concentrations seemed to decrease during 1986. Recent improvements in the secondary lagoon and calf operation runoff should improve instream phosphorus concentrations in Henry Creek during the 1987 wet season.

Lettuce Creek

General Information - Critical Acres 4,756

1	Land Use	Acres	% Critical Acres
	Dairy	1,143	24
	Beef	3,613	76
2	Farms	Average Acres	Approx. Animal Units
	Dairy - 2	572	1,700
	Beef - 3	1,204	1,000
3	Water Quality Sampling Sites	Site #	Sampling Frequency
	Open Channel Grab	40 Downstream	Biweekly

Time series trends depicting wet season total and ortho phosphorus, total and inorganic nitrogen concentrations are presented in Appendix I. Mean, minimum, and maximum values for selected parameters during 1985 and 1986 for station 40 are reported in Appendix I.

Discussion

Water quality constituent concentrations have exhibited little change in Lettuce Creek. Ten percent of the prescribed BMPs have been implemented in the Lettuce Creek sub-watershed. The majority of this BMP implementation has taken place on one of the dairy operations in the sub-watershed. Results from the Kendall Tau trend analysis for station 40 indicated no significant trend in total phosphorus concentrations since 1981.

BMP implementation in the Lettuce Creek sub-watershed has centered around a spray irrigation system using effluent from a large secondary lagoon for irrigation water. Wet season time series analysis also indicated no significant water quality improvement resulting from the present level of BMP implementation.

S-191 Summary

General Information - Critical Acres 63,109

1	Land Use	Acres	% Critical Acres
	Dairy	32,812	52
	Beef	28,363	45
	Citrus	1,910	3
	Hog	24	>.05
2	Farms	Average Acres	Approx. Animal Units
	Dairy - 29	1,131	31,400
	Beef - 42	675	8,930
	Citrus - 2	955	N/A
	Hog - 2	12	175
3	Water Quality Sampling Sites	Site #	Sampling Frequency
	Open Channel Grab	S-191 Downstream	Biweekly

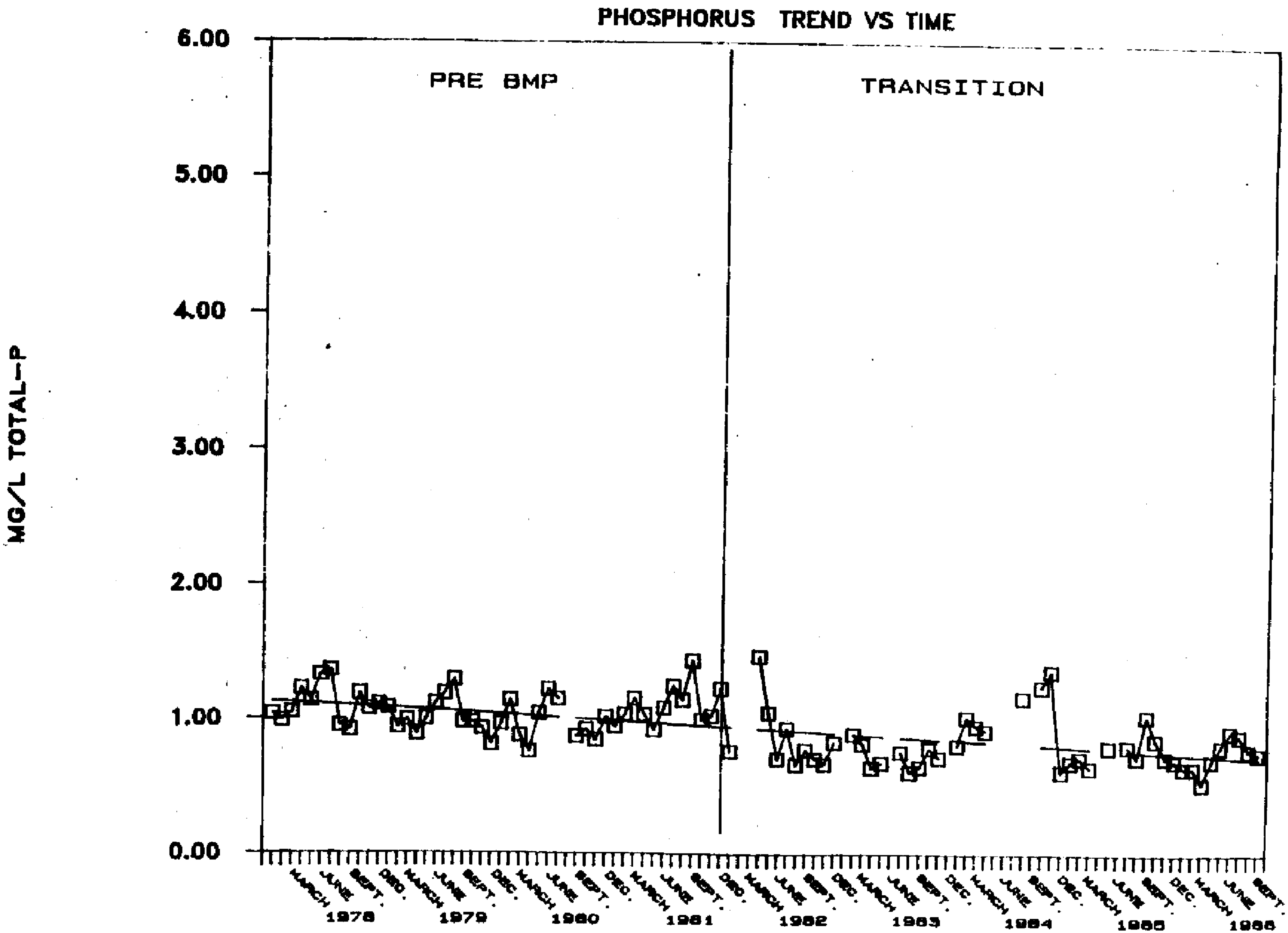
Time series trends depicting wet season total and ortho phosphorus, total and inorganic nitrogen concentrations are presented in Appendix I. Mean, minimum, and maximum values for selected parameters during 1985 and 1986 for station S-191 are reported in Appendix I.

Discussion

Seventy-eight percent of the prescribed BMPs have been implemented throughout the entire Taylor Creek/ Nubbin Slough watershed. Results of the Kendall Tau test at S-191 indicate a slight decreasing trend in total phosphorus concentrations since 1978 (Figure 22). This trend is also apparent in examination of wet season time series data for nitrogen and phosphorus (Appendix I).

In review, the sub-watersheds displaying significant trends in total phosphorus concentrations were: N.W. Taylor Creek, Otter Creek, Mosquito Creek, Henry Creek, Taylor Creek Main, and the outflow of the Taylor Creek/ Nubbin Slough

FIGURE 22. S191 AT LAKE OKEECHOBEE



basin, S-191. N.W. Taylor Creek and Henry Creek exhibited a significant increasing trend in total phosphorus concentrations. The remaining sub-watersheds exhibited an improvement or decrease in total phosphorus concentrations. Decreasing trends in total phosphorus concentrarions observed at Taylor Creek Main (station 11) and the headwaters (station 18) seem to reflect similar decreases exhibited in Otter Creek after the F and R Dairy shutdown. The elimination of point discharges seems to mask potential effects of fencing, a major BMP along the main branch of Taylor Creek and sub-watersheds throughout the Taylor Creek/ Nubbin Slough Basin. External factors that seem to be affecting our ability to determine the water quality impacts of fencing cows out of the major water courses are:

1. The increase in animal densities in the N.W. Taylor Creek sub-watershed has had a negative affect on water quality. Increased cow densities seem to create high intensity areas which, in turn, generate significantly higher amounts of nutrients during runoff and thus negate the effect of fencing cow out of the major water courses.
2. Changes in fertilizer practices and timing of applications override the fencing effect in a positive manner by decreasing concentrations.
3. Point sources of discharge from high intensity grazing pastures mask the effects of fencing on a sub-watershed scale.

The cumulative effect of changes in land use practices on concentrations at S-191 has been positive. Emphasis on efficient waste water utilization (Otter Creek, Mosquito Creek), diversion of direct runoff from high intensity pastures (Mosquito Creek) timing of pasture fertilization (Williamson Ditch) and fencing throughout the watershed seem to have positively influenced total phosphorus concentrations at S-191.

REFERENCES

Bottcher, A.B., L.B. Baldwin, K.L. Campbell, C.D. Heatwole, R.S. Mansell, and B.A. Burgoa. 1986. Development and Verification of an Analytical Model for Assessing the Impact of Agricultural Practices on Water Quality and Quantity. Final Report submitted to South Florida Water Management District, West Palm Beach, Florida. 196p.

Capece, J.C., K.L. Campbell, and L.B. Baldwin (1986). Estimation of Runoff Peak Rates and Volumes from Flatwoods Watersheds, Final Report submitted to South Florida Water Management District, West Palm Beach, Florida. 128p.

Hirsch, R.M., J.R. Slack. 1984. A Non-Parametric Trend Test for Seasonal Data with Serial Dependence. Water Resources Research , 20(6): 727-732.

Hirsch, R.M., J.R. Slack and R.A. Smith. 1982. Techniques of Trend Analysis for Monthly Water Quality Data. Water Resources Research, 18(1), 107-121.

Konyha, M.D., K.L. Campbell, and L.B. Baldwin. 1982. Runoff Estimation from Flat High-Water-Table Watersheds. Coordinating Council on the Restoration of the Kissimmee River Valley and Taylor Creek/ Nubbin Slough Basin, Tallahssee, Florida.

Ritter, G.J., L.H. Allen Jr. 1982. Taylor Creek Headwaters Project Phase I: Water Quality. South Florida Water Management District Technical Publication 82-8. 138 pages. Appendix.

APPENDIX

MEAN, MINIMUM, AND MAXIMUM, WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS IN OTTER CREEK FOR 1985

Parameters		Station 03	Station 06	Station 26
$O\text{-}PO_4$	X	1.30	.92	0.72
	Min - Max	0.28 - 3.05	0.024 - 2.73	0.07 - 2.08
$T\text{-}PO_4$	X	1.49	1.16	0.91
	Min - Max	0.25 - 3.44	0.42 - 3.01	0.09 - 2.19
NO_3	X	1.44	0.86	0.24
	Min - Max	0.004 - 9.85	0.004 - 6.00	0.004 - 1.45
NH_4	X	2.94	0.86	8.52
	Min - Max	0.01 - 7.67	0.01 - 4.01	0.22 - 14.13
Inorganic N	X	4.32	1.75	8.09
	Min - Max	0.12 - 10.14	0.01 - 6.92	0.01 - 14.14
Total N	X	5.68	3.07	9.88
	Min - Max	0.50 - 12.58	0.26 - 7.31	1.50 - 16.74
Lab Cond (µmhos/cm)	X	669	443	791
	Min - Max	387 - 1070	220 - 778	194 - 1080
Lab pH	X	7.23	7.17	7.27
	Min - Max	6.66 - 7.79	6.72 - 7.70	6.53 - 7.81
Turbidity (NTU)	X		6.2	9.2
	Min - Max	2.1 - 47.0	1.9 - 16.0	1.0 - 126.0
Color	X	113	91	115
	Min - Max	42 - 309	14 - 212	49 - 208
Number of Samples		25	25	25

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE DAIRY RUNOFF STATIONS IN OTTER CREEK FOR 1985

Parameters		Station 25	Station 23	Station 19
O-PO_4	X	4.08	1.17	0.12
	Min - Max	0.17 - 8.74	0.31 - 4.54	0.007 - 0.46
T-PO_4	X	5.21	1.56	0.35
	Min - Max	2.09 - 9.05	0.42 - 4.61	0.07 - 1.45
NO_3	X	0.29	0.34	0.03
	Min - Max	0.004 - 4.40	0.02 - 1.18	0.004 - 0.38
NH_4	X	4.78	3.61	0.11
	Min - Max	0.03 - 11.20	0.02 - 8.30	0.01 - 0.56
Inorganic N	X	5.11	4.04	0.14
	Min - Max	0.04 - 11.25	0.05 - 8.33	0.01 - 0.57
Total N	X	8.35	7.33	1.67
	Min - Max	1.41 - 16.28	1.65 - 11.12	0.32 - 3.25
Lab Cond (µmhos/cm)	X	1173	377	155
	Min - Max	910 - 1350	185 - 443	99 - 900
Lab pH	X	7.41	7.30	7.10
	Min - Max	6.46 - 7.86	6.38 - 8.05	5.75 - 8.36
Turbidity (NTU)	X	29.4	32.9	9.9
	Min - Max	1.4 - 113.0	1.8 - 335.0	2.2 - 39.0
Color	X	162	296	117
	Min - Max	79.0 - 406.0	200 - 523	22 - 366
Number of Samples		21	19	24

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR BEEF CATTLE RUNOFF STATIONS IN OTTER CREEK FOR 1985

Parameters		Station 20
O-PO_4	X	0.23
	Min - Max	0.04 - 0.49
T-PO_4	X	0.34
	Min - Max	0.10 - 0.65
NO_3	X	0.007
	Min - Max	0.004 - 0.024
NH_4	X	0.05
	Min - Max	0.03 - 0.08
Inorganic N	X	0.07
	Min - Max	0.05 - 0.12
Total N	X	1.68
	Min - Max	0.79 - 2.88
Lab Cond (µmhos/cm)	X	245
	Min - Max	92 - 1045
Lab pH	X	6.97
	Min - Max	6.65 - 7.46
Turbidity (NTU)	X	4.0
	Min - Max	1.4 - 6.8
Color	X	301
	Min - Max	35 - 449
Number of Samples		9

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATION AT WEST OTTER CREEK (111) FOR 1985

Parameters		Station 111
O-PO_4	X	0.45
	Min - Max	0.036 - 1.14
T-PO_4	X	0.89
	Min - Max	0.17 - 4.80
NO_3	X	0.006
	Min - Max	0.004 - 0.023
NH_4	X	0.12
	Min - Max	0.01 - 0.48
Inorganic N	X	0.13
	Min - Max	0.01 - 0.52
Total N	X	1.83
	Min - Max	0.50 - 3.72
Lab Cond (µmhos/cm)	X	122
	Min - Max	83 - 170
Lab pH	X	6.89
	Min - Max	6.00 -8.35
Turbidity (NTU)	X	9.1
	Min - Max	2.0 - 33.0
Color	X	214
	Min - Max	69 -391
Number of Samples		24

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES
FOR THE OPEN CHANNEL STATIONS IN N.W. TAYLOR CREEK (01)
AND LITTLE BIMINI (02 AND 104) FOR 1985

Parameters		Station 01	Station 02	Station 104
$O\text{-}PO_4$	X	0.42	1.01	1.37
	Min - Max	0.12 - 1.26	0.23 - 3.60	0.17 - 4.92
$T\text{-}PO_4$	X	0.56	1.16	1.83
	Min - Max	0.16 - 1.35	0.26 - 4.14	0.28 - 5.16
NO_3	X	0.04	2.62	0.004
	Min - Max	0.004 - 0.17	0.20 - 7.60	0.004 - 0.008
NH_4	X	0.04	0.38	3.84
	Min - Max	0.01 - 0.17	0.02 - 1.90	0.16 - 8.35
Inorganic N	X	0.09	3.15	3.31
	Min - Max	0.01 - 0.32	0.50 - 7.70	0.01 - 8.36
Total N	X	1.47	4.83	8.03
	Min - Max	0.24 - 3.23	1.78 - 9.35	1.46 - 18.36
Lab Cond (µmhos/cm)	X	207	373	543
	Min - Max	121 - 659	285 - 424	392 - 638
Lab pH	X	7.33	7.30	6.76
	Min - Max	6.93 - 7.87	6.88 - 7.81	6.36 - 7.26
Turbidity (NTU)	X	3.8	8.2	14.1
	Min - Max	0.5 - 8.1	1.3 - 136.0	0.8 - 70.0
Color	X	155	140	184
	Min - Max	37 - 380	63 - 317	77 - 347
Number of Samples		25	26	14

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS IN THE MAIN BRANCH OF TAYLOR CREEK FOR 1985

Parameters		Station 11	Station 12	Station 18
O-PO_4	X	0.48	0.34	0.54
	Min - Max	0.14 - 1.09	0.27 - 0.44	0.20 - 1.29
T-PO_4	X	0.57	0.44	0.69
	Min - Max	0.15-1.19	0.40 - 0.53	0.27 - 1.45
NO_3	X	0.28	1.05	0.81
	Min - Max	0.004 - 1.23	0.64 - 1.22	0.15 - 2.14
NH_4	X	0.07	0.05	0.22
	Min - Max	0.01 - 0.19	0.01 - 0.11	0.01 - 2.30
Inorganic N	X	0.37	1.12	1.08
	Min - Max	0.01 - 1.35	0.78 - 1.27	0.30 -3.09
Total N	X	1.66	2.43	2.59
	Min - Max	0.75 - 3.10	1.83 - 3.28	0.93 - 4.49
Lab Cond (µmhos/cm)	X	886	349	411
	Min - Max	289 - 2100	225 - 424	194 - 950
Lab pH	X	7.31	7.52	7.26
	Min - Max	6.80 - 7.70	7.31 - 7.74	6.88 - 7.74
Turbidity (NTU)	X	3.2	7.0	6.8
	Min - Max	0.7 - 7.2	4.8 - 10.6	3.1 - 22.0
Color	X	137	116	137
	Min - Max	31 - 351	77 - 179	43 - 267
Number of Samples		26	4	15

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS AT WILLIAMSON DITCH FOR 1985

Parameters		Station 07	Station 08	Station 09
O-PO_4	X	0.09	0.18	0.20
	Min - Max	0.004 - 0.22	0.004 - 0.81	0.05 - 0.43
T-PO_4	X	0.20	0.27	0.37
	Min - Max	0.07 - 0.61	0.006 - 0.96	0.12 - 0.99
NO_3	X	0.025	0.04	0.06
	Min - Max	0.004 - 0.125	0.004 - 0.37	0.004 - 0.36
NH_4	X	0.07	0.10	0.07
	Min - Max	0.11 - 0.34	0.01 - 0.63	0.01 - 0.28
Inorganic N	X	0.10	0.15	0.14
	Min - Max	0.01 - 0.42	0.01 - 0.67	0.01 - 0.50
Total N	X	1.54	1.64	1.36
	Min - Max	0.22 - 2.91	0.62 - 2.97	0.52 - 3.11
Lab Cond (µmhos/cm)	X	1594	3255	1659
	Min - Max	420 - 3300	335 - 5000	399 - 3850
Lab pH	X	7.26	7.14	7.20
	Min - Max	6.68 - 7.76	6.48 - 7.87	6.66 - 7.69
Turbidity (NTU)	X	5.9	3.1	5.6
	Min - Max	0.9 - 33	0.1 - 10.1	1.2 -35.0
Color	X	147	120	128
	Min - Max	16 - 380	7 - 378	33 - 366
Number of Samples		24	24	26

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS IN MOSQUITO CREEK FOR 1985

Parameters		Station 13	Station 15
O-PO_4	X	2.34	1.99
	Min - Max	1.03 - 5.13	0.68 - 5.17
T-PO_4	X	2.69	2.23
	Min - Max	1.22 - 5.66	0.83 - 5.50
NO_3	X	1.87	0.92
	Min - Max	0.004 - 9.62	0.14 - 6.72
NH_4	X	1.72	2.82
	Min - Max	0.01 - 10.20	0.01 - 7.88
Inorganic N	X	3.73	3.51
	Min - Max	0.57 - 11.43	0.10 - 8.11
Total N	X	5.69	5.22
	Min - Max	1.70 - 13.71	0.50 - 17.46
Lab Cond (µmhos/cm)	X	988	715
	Min - Max	245 - 1800	234 - 1300
Lab pH	X	7.06	7.14
	Min - Max	6.57 - 7.47	6.78 - 7.66
Turbidity (NTU)	X	3.8	3.8
	Min - Max	1.9 - 8.9	1.2 - 9.2
Color	X	150	143
	Min - Max	49 - 380	48 - 369
Number of Samples		26	26

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS IN NUBBIN SLOUGH FOR 1985

Parameters		Station 17	Station 14
O-PO_4	X	0.45	1.65
	Min - Max	0.05 - 1.97	0.70 - 7.91
T-PO_4	X	0.66	2.52
	Min - Max	0.09 - 2.73	1.01 - 10.92
NO_3	X	0.007	0.20
	Min - Max	0.004 - 0.04	0.004 - 0.78
NH_4	X	1.14	4.26
	Min - Max	0.01 - 8.75	0.73 - 21.05
Inorganic N	X	1.16	4.50
	Min - Max	0.03 - 8.77	0.97 - 21.53
Total N	X	3.78	8.59
	Min - Max	0.58 - 18.87	3.10 - 23.73
Lab Cond (µmhos/cm)	X	83	431
	Min - Max	52 - 190	198 - 1199
Lab pH	X	6.47	7.05
	Min - Max	4.94 - 7.65	6.50 - 7.55
Turbidity (NTU)	X	20.5	22.0
	Min - Max	0.7 - 167.0	1.50 - 80.0
Color	X	284	234
	Min - Max	107 - 1875	130 - 398
Number of Samples		20	26

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS AT HENRY CREEK (39) AND LETTUCE CREEK (40) FOR 1985

Parameters		Station 39	Station 40
O-PO_4	X	1.92	0.12
	Min - Max	0.19 - 5.15	0.006 - 0.67
T-PO_4	X	2.99	0.26
	Min - Max	0.63 - 7.47	0.06 - 0.93
NO_3	X	0.32	0.04
	Min - Max	0.004 - 2.19	0.004 - 0.16
NH_4	X	5.37	0.14
	Min - Max	0.11 - 15.68	0.01 - 0.99
Inorganic N	X	5.51	0.19
	Min - Max	0.21 - 16.62	0.01 - 1.01
Total N	X	7.23	1.84
	Min - Max	0.76 - 28.02	0.48 - 5.66
Lab Cond (µmhos/cm)	X	744	397
	Min - Max	285 - 1279	138 - 730
Lab pH	X	7.14	6.96
	Min - Max	6.48 - 7.52	6.24 - 7.50
Turbidity (NTU)	X	12.5	6.3
	Min - Max	1.3 - 51.0	1.5 - 60.0
Color	X	290	211
	Min - Max	152 - 566	86 - 546
Number of Samples		26	26

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM
WATER QUALITY VALUES FOR S-191
AT LAKE OKEECHOBEE FOR 1985

Parameters		Station 191
$O\text{-}PO_4$	X	0.42
	Min - Max	0.015 - 0.70
$T\text{-}PO_4$	X	0.79
	Min - Max	0.65 - 1.19
NO_3	X	0.46
	Min - Max	0.004 - 1.11
NH_4	X	0.15
	Min - Max	0.01 - 0.50
Inorganic N	X	0.64
	Min - Max	0.02 - 1.20
Total N	X	2.32
	Min - Max	1.47 - 4.38
Lab Cond (µmhos/cm)	X	
	Min - Max	
Lab pH	X	
	Min - Max	
Turbidity (NTU)	X	2.2
	Min - Max	0.9 - 3.9
Color	X	190
	Min - Max	84 - 348
Number of Samples		15

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS IN OTTER CREEK FOR 1986

Parameters		Station 03	Station 06	Station 26
$O\text{-}PO_4$	X	1.00	0.97	0.72
	Min - Max	0.16 - 3.08	0.23 - 2.49	0.014 - 3.67
$T\text{-}PO_4$	X	1.17	1.10	0.83
	Min - Max	0.27 - 3.23	0.30 - 2.71	0.08 - 3.80
NO_3	X	0.70	0.97	0.15
	Min - Max	0.004 - 2.99	0.005 - 3.25	0.004 - 0.85
NH_4	X	1.76	0.69	3.48
	Min - Max	0.01 - 5.15	0.01 - 2.71	0.05 - 9.54
Inorganic N	X	2.44	1.78	3.50
	Min - Max	0.01 - 6.20	0.02 - 3.85	0.07 - 9.61
Total N	X	4.09	3.26	6.29
	Min - Max	0.89 - 7.76	0.66 - 5.55	0.94 - 12.37
Lab Cond (µmhos/cm)	X	496	421	589
	Min - Max	203 - 740	209 - 1560	125 - 1196
Lab pH	X	6.86	6.77	6.91
	Min - Max	6.62 - 7.14	6.47 - 7.03	6.61 - 7.31
Turbidity (NTU)	X	4.8	5.9	4.3
	Min - Max	1.8 - 13.0	2.0 - 10.1	1.0 - 12.7
Color	X	134	122	134
	Min - Max	52 - 336	37 - 293	67 - 341
Number of Samples		23	24	22

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE DAIRY RUNOFF STATIONS IN OTTER CREEK FOR 1986

Parameters		Station 25	Station 23	Station 19
O-PO_4	X	4.24	2.74	0.21
	Min - Max	0.51 - 7.50	0.73 - 6.76	0.007 - 1.91
T-PO_4	X	4.86	3.00	0.37
	Min - Max	1.44 - 8.08	0.68 - 7.40	0.04 - 1.97
NO_3	X	0.40	4.96	0.10
	Min - Max	0.004 - 1.44	0.005 - 43.45	0.004 - 1.11
NH_4	X	3.58	4.58	0.38
	Min - Max	0.26 - 6.41	0.06 - 39.92	0.01 - 5.95
Inorganic N	X	3.78	9.76	0.48
	Min - Max	0.32 - 6.58	0.12 - 51.36	0.01 - 7.09
Total N	X	7.06	13.54	2.21
	Min - Max	1.58 - 10.26	3.46 - 60.87	0.81 - 10.23
Lab Cond (μmhos/cm)	X	914	485	130
	Min - Max	370 - 1210	308 - 1220	105 - 215
Lab pH	X	7.23	6.98	6.33
	Min - Max	6.93 - 7.48	6.55 - 7.74	5.47 - 7.46
Turbidity (NTU)	X	9.2	5.2	9.9
	Min - Max	2.1 - 31.0	1.5 - 15.9	1.6 - 95.0
Color	X	269	282	120
	Min - Max	114 - 521	192 - 374	15 - 378
Number of Samples		16	18	22

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR BEEF CATTLE RUNOFF STATIONS IN OTTER CREEK FOR 1986

Parameters		Station 20
$O\text{-}PO_4$	X	0.28
	Min - Max	0.11 - 0.50
$T\text{-}PO_4$	X	0.44
	Min - Max	0.15 - 0.69
NO_3	X	0.02
	Min - Max	0.004 - 0.10
NH_4	X	0.10
	Min - Max	0.01 - 0.27
Inorganic N	X	0.13
	Min - Max	0.03 - 0.38
Total N	X	1.90
	Min - Max	1.44 - 2.55
Lab Cond (µmhos/cm)	X	110
	Min - Max	87 - 145
Lab pH	X	6.54
	Min - Max	5.99 - 7.09
Turbidity (NTU)	X	3.8
	Min - Max	2.0 - 7.4
Color	X	280
	Min - Max	172 - 389
Number of Samples		12

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS IN N.W. TAYLOR CREEK (01) AND LITTLE BIMINI (02 AND 104) FOR 1986

Parameters		Station 01	Station 02	Station 104
O-PO_4	X	0.35	1.02	1.21
	Min - Max	0.12 - 1.02	0.20 - 3.49	0.14 - 4.01
T-PO_4	X	0.54	1.10	1.36
	Min - Max	0.26 - 1.18	0.27 - 3.67	0.22 - 4.35
NO_3	X	0.05	1.52	0.08
	Min - Max	0.004 - 0.21	0.04 - 3.10	0.004 - 0.93
NH_4	X	0.05	0.35	4.72
	Min - Max	0.01 - 0.29	0.01 - 2.22	0.01 - 9.62
Inorganic N	X	0.11	1.98	4.78
	Min - Max	0.01 - 0.31	0.12 - 3.22	0.03 - 9.62
Total N	X	1.66	3.71	8.25
	Min - Max	0.67 - 4.84	1.59 - 5.21	5.30 - 16.25
Lab Cond (µmhos/cm)	X	237	382	555
	Min - Max	69 - 840	290 - 439	337 - 734
Lab pH	X	6.98	6.96	6.54
	Min - Max	6.04 - 7.65	6.69 - 7.24	6.31 - 6.83
Turbidity (NTU)	X	6.4	2.5	8.1
	Min - Max	2.3 - 12.9	1.0 - 5.0	2.9 - 39.0
Color	X	157	148	162
	Min - Max	50 - 389	73 - 312	90 - 317
Number of Samples		24	23	21

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS IN THE MAIN BRANCH OF TAYLOR CREEK FOR 1986

Parameters		Station 11	Station 12	Station 18
$O\text{-}PO_4$	X	0.53	0.75	0.52
	Min - Max	0.16 - 1.42	0.19 - 1.86	0.004 - 1.23
$T\text{-}PO_4$	X	0.60	0.84	0.66
	Min - Max	0.22 - 1.48	0.25 - 2.03	0.33 - 1.44
NO_3	X	0.29	0.53	0.61
	Min - Max	0.004 - 1.10	0.004 - 1.85	0.004 - 3.19
NH_4	X	0.12	0.12	0.22
	Min - Max	0.01 - 0.63	0.01 - 0.52	0.01 - 2.80
Inorganic N	X	0.45	0.71	0.87
	Min - Max	0.01 - 1.82	0.01 - 1.91	0.01 - 3.66
Total N	X	1.85	2.25	2.59
	Min - Max	1.10 - 3.22	1.01 - 3.28	0.89 - 7.12
Lab Cond (μmhos/cm)	X	735	372	326
	Min - Max	76 - 1550	144 - 800	99 - 582
Lab pH	X	7.17	7.21	7.11
	Min - Max	6.65 - 7.59	6.55 - 7.94	6.29 - 7.72
Turbidity (NTU)	X	4.2	6.0	5.4
	Min - Max	1.3 - 23.0	1.2 - 33.0	1.3 - 13.5
Color	X	156	154	166
	Min - Max	49 - 323	39 - 309	56 - 355
Number of Samples		24	24	24

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS AT WILLIAMSON DITCH FOR 1986

Parameters		Station 07	Station 08	Station 09
$O\text{-}PO_4$	X	0.10	0.23	0.17
	Min - Max	0.008 - 0.23	0.004 - 0.80	0.02 - 0.39
$T\text{-}PO_4$	X	0.16	0.29	0.23
	Min - Max	0.05 - 0.38	0.03 - 0.86	0.08 - 0.50
NO_3	X	0.05	0.08	0.09
	Min - Max	0.004 - 0.32	0.004 - 1.32	0.004 - 0.26
NH_4	X	0.07	0.13	0.09
	Min - Max	0.01 - 0.20	0.01 - 0.50	0.01 - 0.22
Inorganic N	X	0.12	0.22	0.19
	Min - Max	0.01 - 0.36	0.01 - 1.54	0.01 - 0.40
Total N	X	1.47	1.79	1.58
	Min - Max	0.64 - 2.34	1.06 - 3.48	0.60 - 2.91
Lab Cond (μmhos/cm)	X	1292	2487	1393
	Min - Max	80 - 2570	72 - 4930	80 - 3030
Lab pH	X	7.13	7.08	7.04
	Min - Max	6.29 - 7.60	5.90 - 7.97	6.16 - 7.31
Turbidity (NTU)	X	3.9	3.0	3.5
	Min - Max	0.9 - 10.0	0.9 - 6.3	1.0 - 13.1
Color	X	158	147	147
	Min - Max	49 - 342	45 - 344	40 - 335
Number of Samples		24	24	24

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS IN MOSQUITO CREEK FOR 1986

Parameters		Station 13	Station 15
$O\text{-}PO_4$	X	1.17	0.89
	Min - Max	0.54 - 2.94	0.14 - 2.34
$T\text{-}PO_4$	X	1.31	1.01
	Min - Max	0.86 - 3.39	0.20 - 2.57
NO_3	X	1.63	0.64
	Min - Max	0.19 - 5.51	0.004 - 2.32
NH_4	X	0.69	1.46
	Min - Max	0.02 - 3.00	0.01 - 6.02
Inorganic N	X	2.41	2.16
	Min - Max	0.36 - 6.72	0.02 - 8.37
Total N	X	3.96	5.02
	Min - Max	1.38 - 7.86	0.94 - 33.79
Lab Cond (µmhos/cm)	X	814	656
	Min - Max	262 - 1900	90 - 1199
Lab pH	X	6.90	6.74
	Min - Max	6.32 - 7.34	5.77 - 7.14
Turbidity (NTU)	X	3.7	6.3
	Min - Max	1.7 - 7.8	1.0 - 21.0
Color	X	162	158
	Min - Max	60 - 374	54 - 368
Number of Samples		22	24

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS IN NUBBIN SLOUGH FOR 1986

Parameters		Station 17	Station 15
O-PO_4	X	0.46	2.35
	Min - Max	0.08 - 1.06	0.83 - 10.06
T-PO_4	X	0.65	3.32
	Min - Max	0.27 - 1.45	0.97 - 14.65
NO_3	X	0.016	0.31
	Min - Max	0.004 - 0.074	0.004 - 0.86
NH_4	X	0.46	4.12
	Min - Max	0.01 - 4.20	0.35 - 17.04
Inorganic N	X	0.49	4.49
	Min - Max	0.02 - 4.22	0.46 - 17.17
Total N	X	3.60	11.75
	Min - Max	0.76 - 14.15	2.94 - 57.26
Lab Cond (µmhos/cm)	X	95	459
	Min - Max	54 - 334	115 - 1350
Lab pH	X	5.94	6.81
	Min - Max	5.20 - 6.86	6.07 - 7.70
Turbidity (NTU)	X	16.0	18.0
	Min - Max	1.3 - 49.0	4.3 - 55.0
Color	X	211	243
	Min - Max	97 - 345	89 - 425
Number of Samples		19	24

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATIONS AT HENRY CREEK (39) AND LETTUCE CREEK (40) FOR 1986

Parameters		Station 39	Station 40
O-PO_4	X	2.14	0.25
	Min - Max	0.0 - 5.66	0.027 - 1.08
T-PO_4	X	2.79	0.32
	Min - Max	0.0 - 8.25	0.06 - 1.17
NO_3	X	0.32	0.03
	Min - Max	0.004 - 1.62	0.004 - 0.24
NH_4	X	2.23	0.23
	Min - Max	0.01 - 17.60	0.01 - 2.59
Inorganic N	X	2.58	0.28
	Min - Max	0.05 - 19.03	0.03 - 2.61
Total N	X	6.28	1.99
	Min - Max	2.06 - 33.95	1.03 - 5.89
Lab Cond (µmhos/cm)	X	787	294
	Min - Max	23-0 - 1660	105 - 539
Lab pH	X	7.09	6.66
	Min - Max	6.38 - 7.65	6.13 - 7.27
Turbidity (NTU)	X	4.5	3.9
	Min - Max	1.4 - 12.7	1.3 - 12.8
Color	X	275	236
	Min - Max	119 - 461	102 - 442
Number of Samples		22	24

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR S-191 AT LAKE OKEECHOBEE FOR 1986

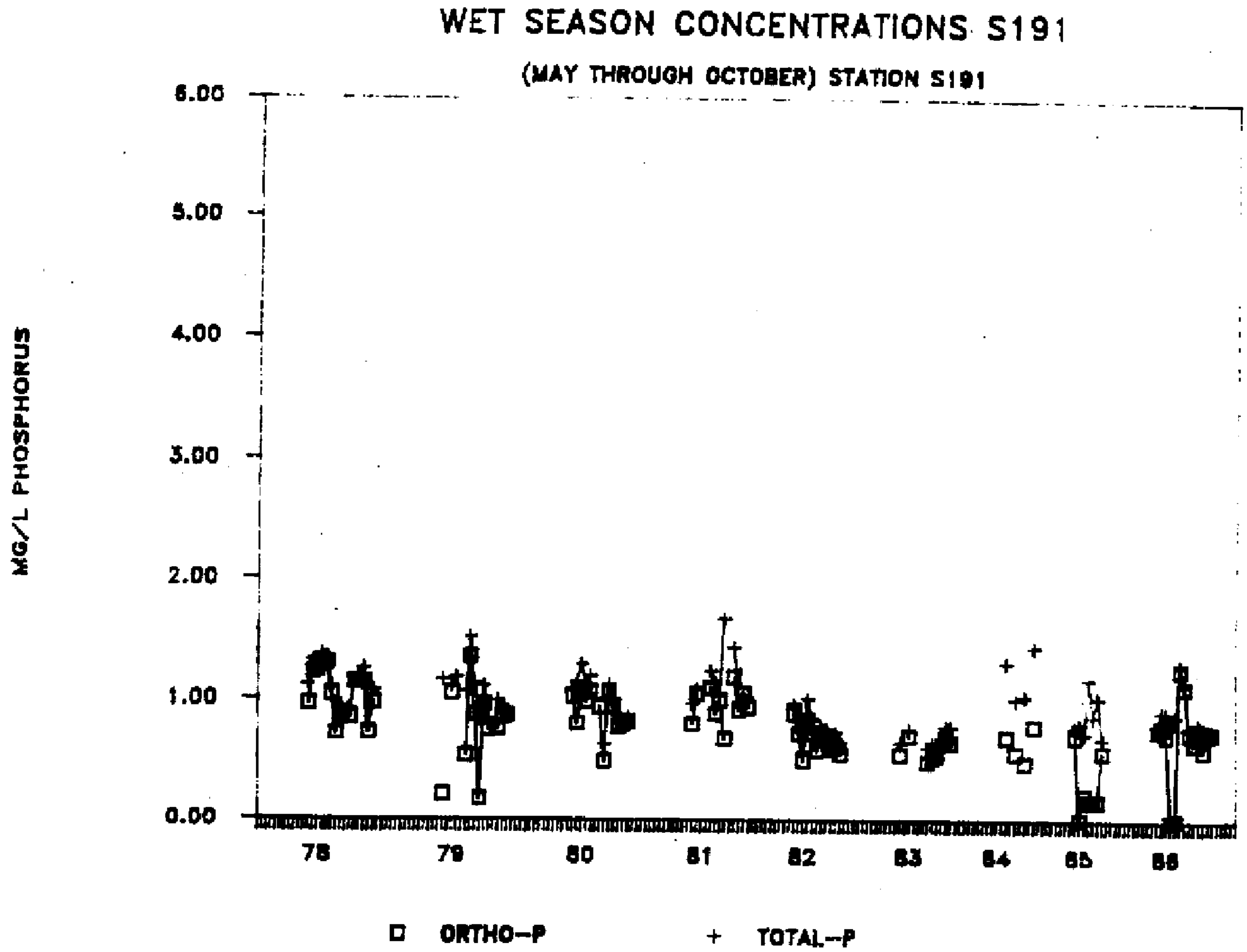
Parameters		Station 191
$O\text{-}PO_4$	X	0.63
	Min - Max	0.004 - 1.27
$T\text{-}PO_4$	X	0.78
	Min - Max	0.45 - 1.31
NO_3	X	0.28
	Min - Max	0.004 - 1.71
NH_4	X	0.22
	Min - Max	0.01 - 0.54
Inorganic N	X	0.53
	Min - Max	0.02 - 1.97
Total N	X	2.02
	Min - Max	1.21 - 2.96
Lab Cond (μmhos/cm)	X	
	Min - Max	
Lab pH	X	
	Min - Max	
Turbidity (NTU)	X	2.4
	Min - Max	1.4 - 4.6
Color	X	179
	Min - Max	70 - 398
Number of Samples		25

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L

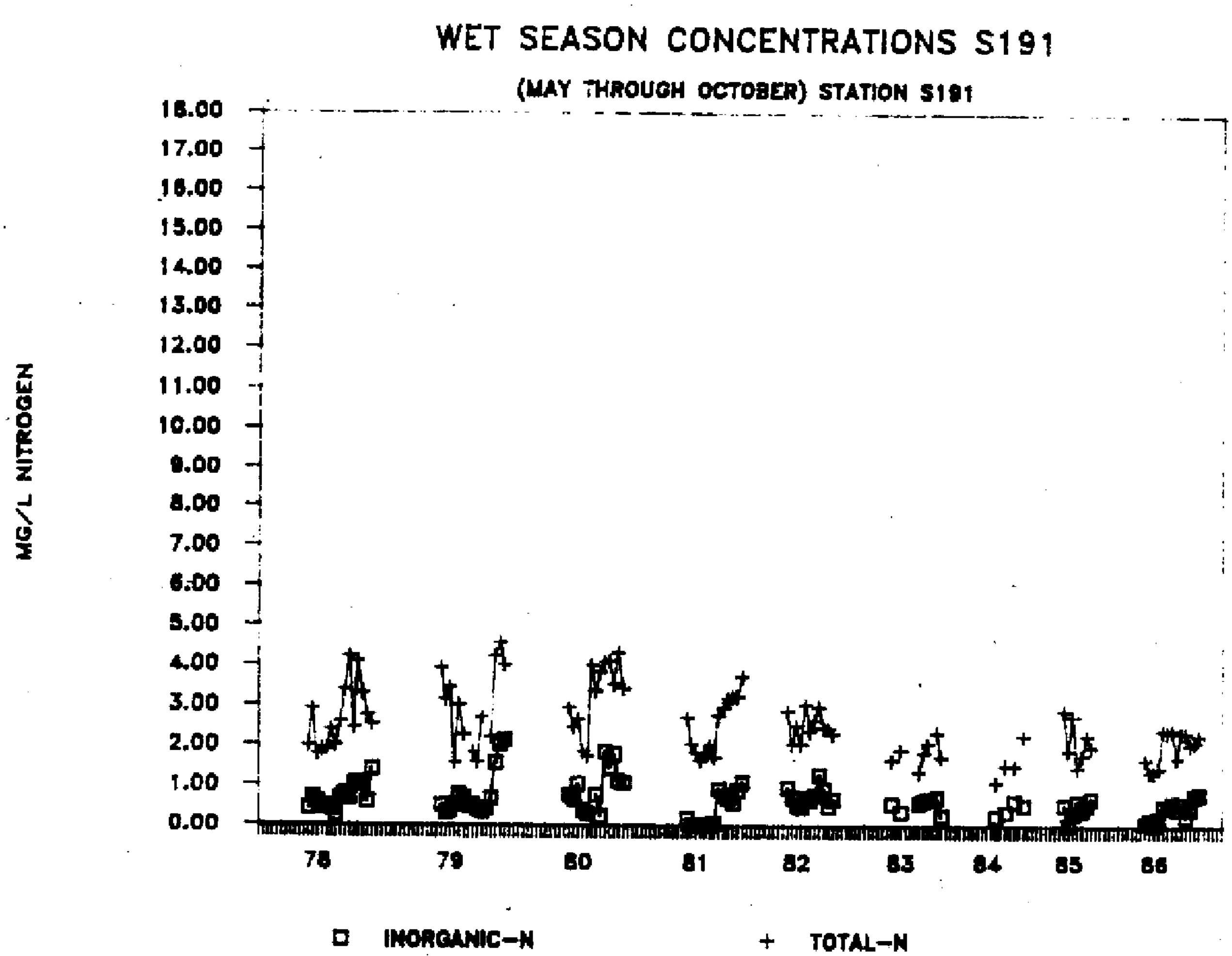
MEAN, MINIMUM, AND MAXIMUM WATER QUALITY VALUES FOR THE OPEN CHANNEL STATION AT WEST OTTER CREEK (111) FOR 1986

Parameters		Station 111
$O\text{-}PO_4$	X	1.44
	Min - Max	0.03 - 4.49
$T\text{-}PO_4$	X	2.33
	Min - Max	0.11 - 18.29
NO_3	X	0.038
	Min - Max	0.004 - 0.75
NH_4	X	1.64
	Min - Max	0.01 - 13.23
Inorganic N	X	1.70
	Min - Max	0.01 - 13.26
Total N	X	5.80
	Min - Max	0.91 - 28.41
Lab Cond (µmhos/cm)	X	321
	Min - Max	116 - 1380
Lab pH	X	6.82
	Min - Max	5.91 - 8.30
Turbidity (NTU)	X	15.2
	Min - Max	1.8 - 177.0
Color	X	263
	Min - Max	71 - 530
Number of Samples		38

CHEMICAL PARAMETERS ARE EXPRESSED IN MG/L



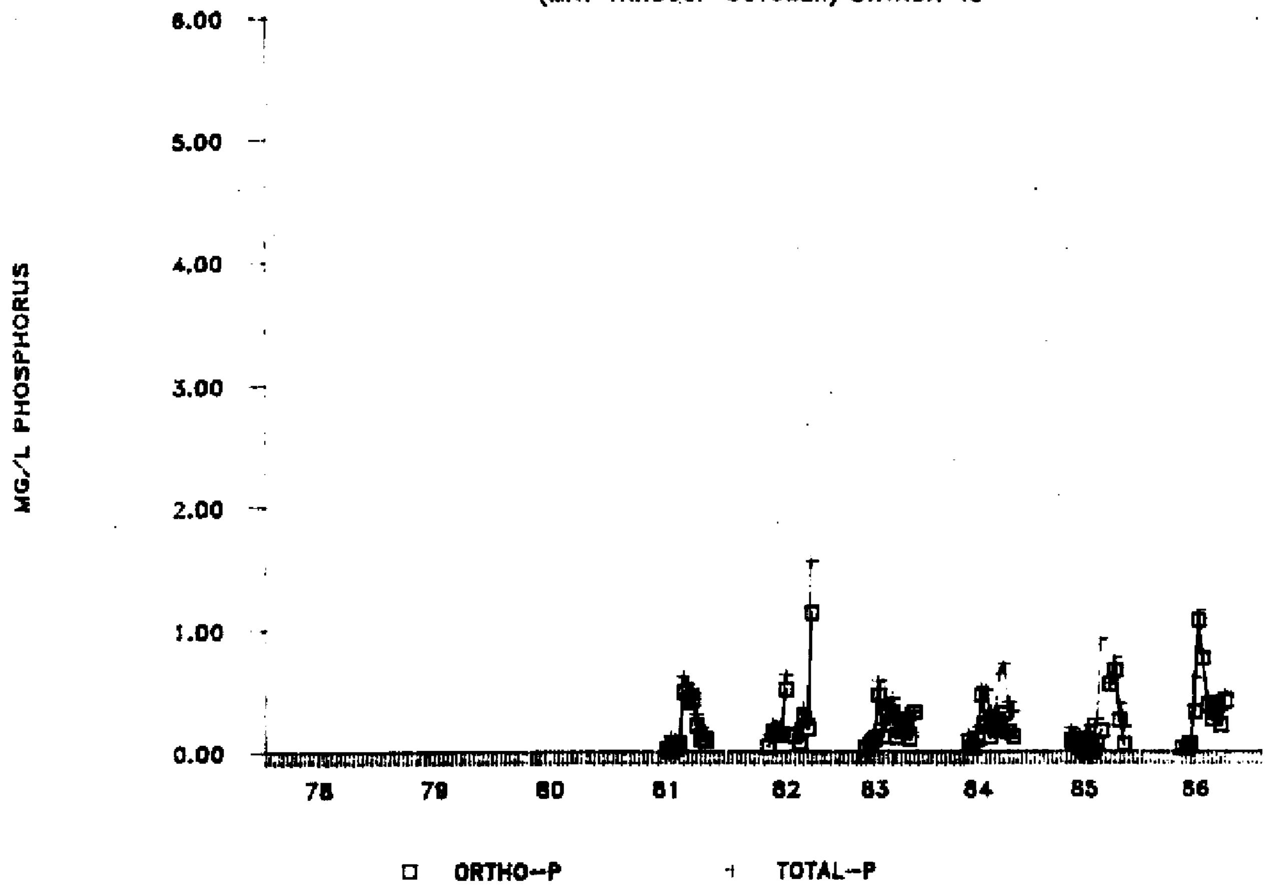
WET SEASON CONCENTRATIONS S191
(MAY THROUGH OCTOBER) STATION S191
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO-P
TOTAL-P



WET SEASON CONCENTRATIONS S191
(MAY THROUGH OCTOBER) STATION S191
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC-N
TOTAL-N

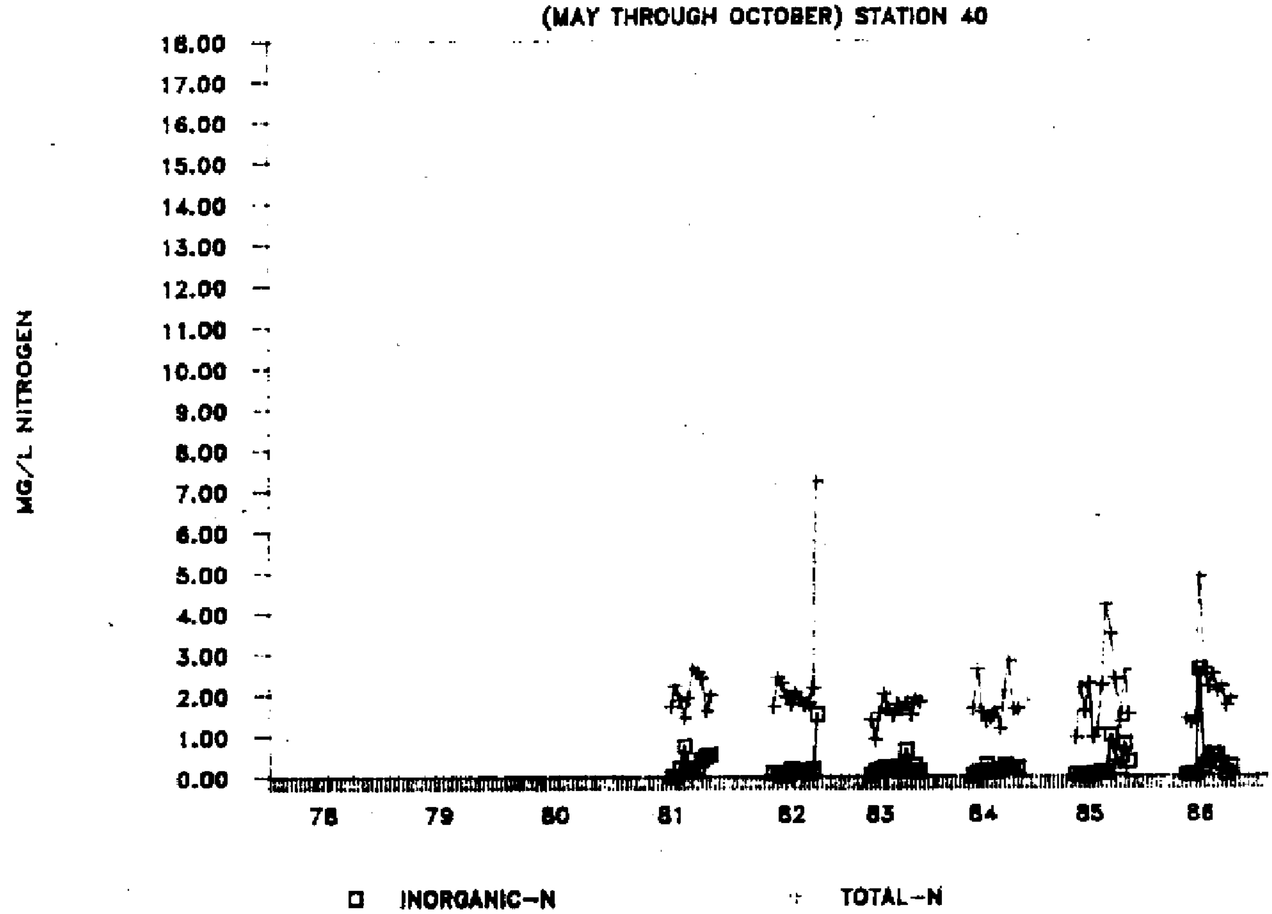
WET SEASON LETTUCE CREEK

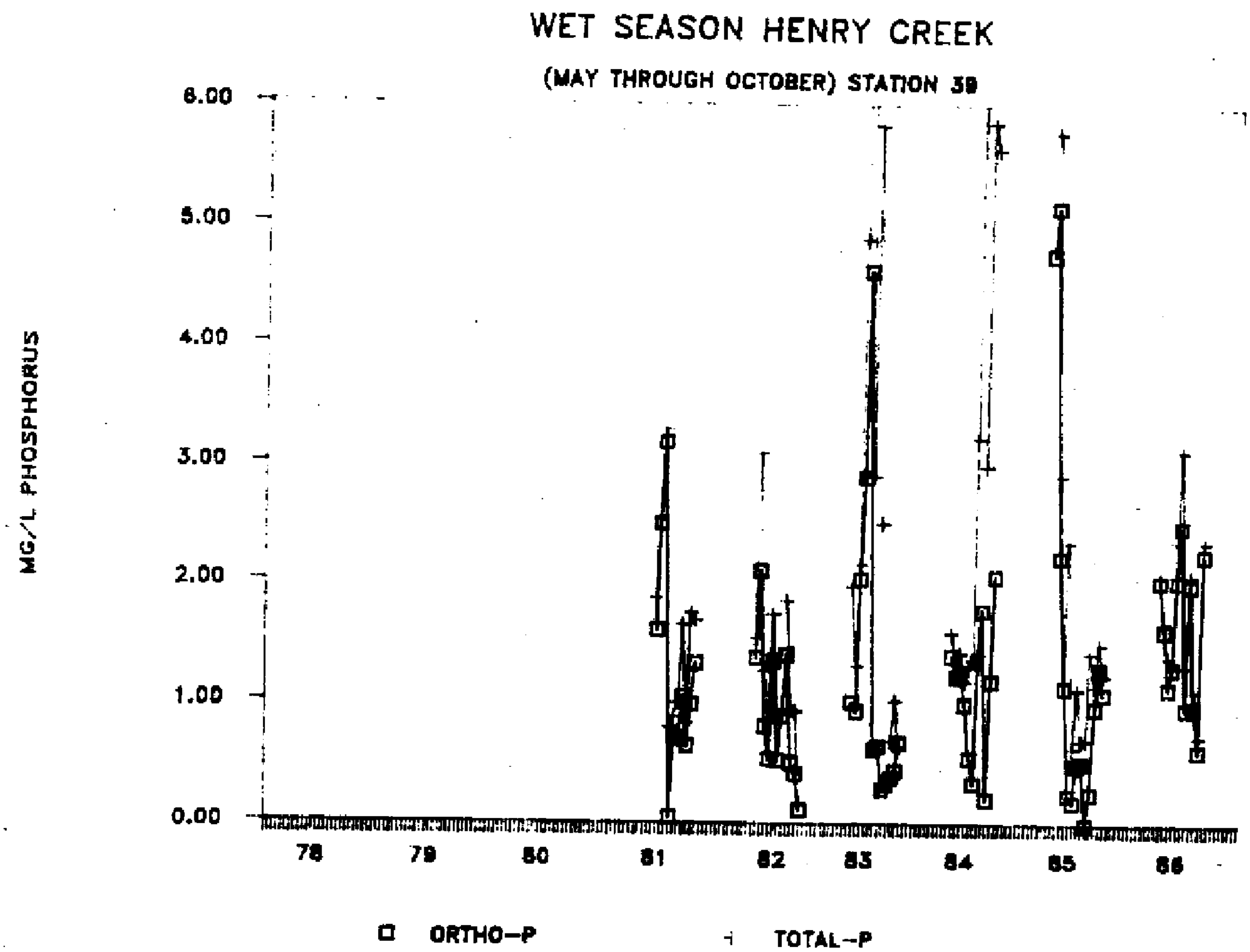
(MAY THROUGH OCTOBER) STATION 40

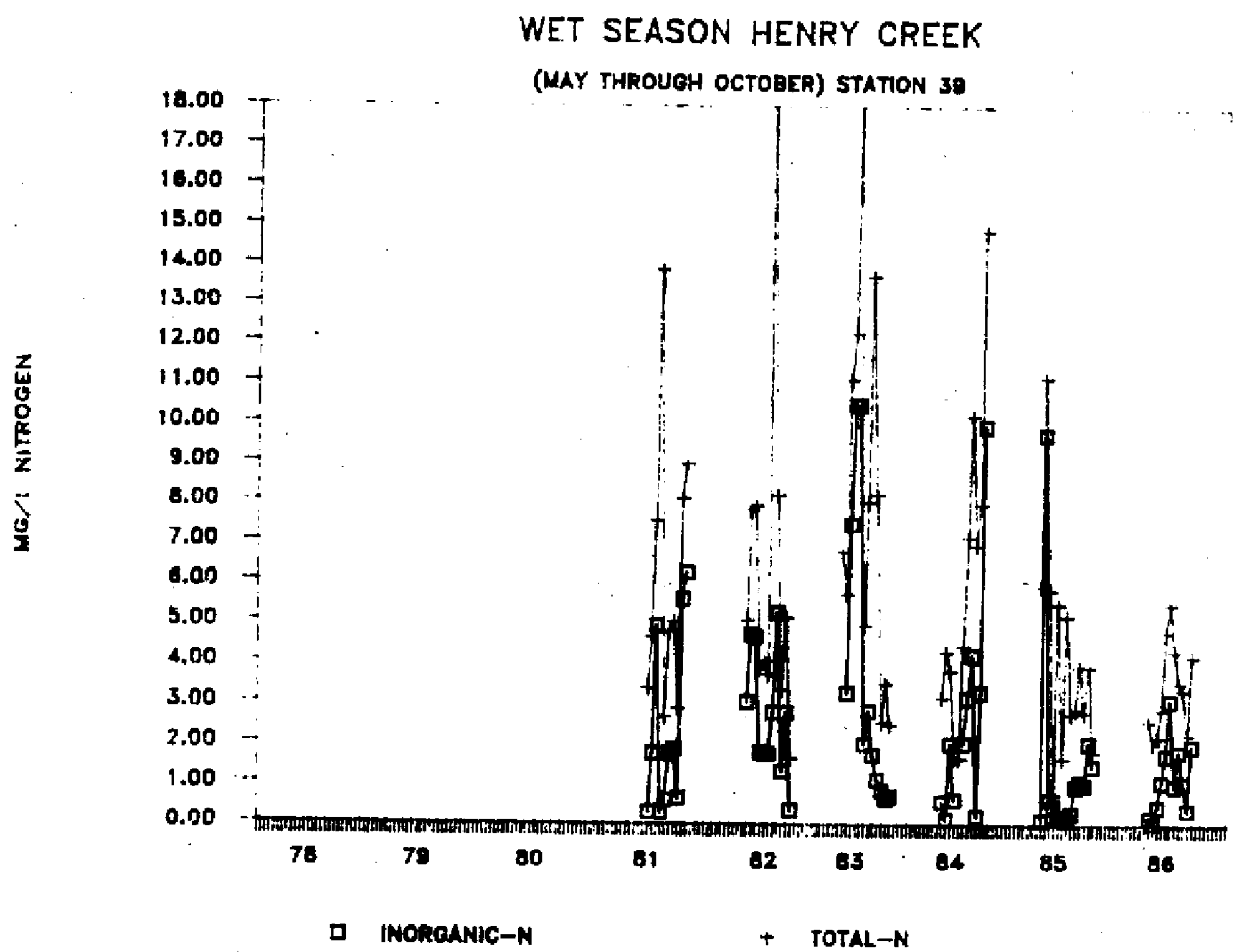


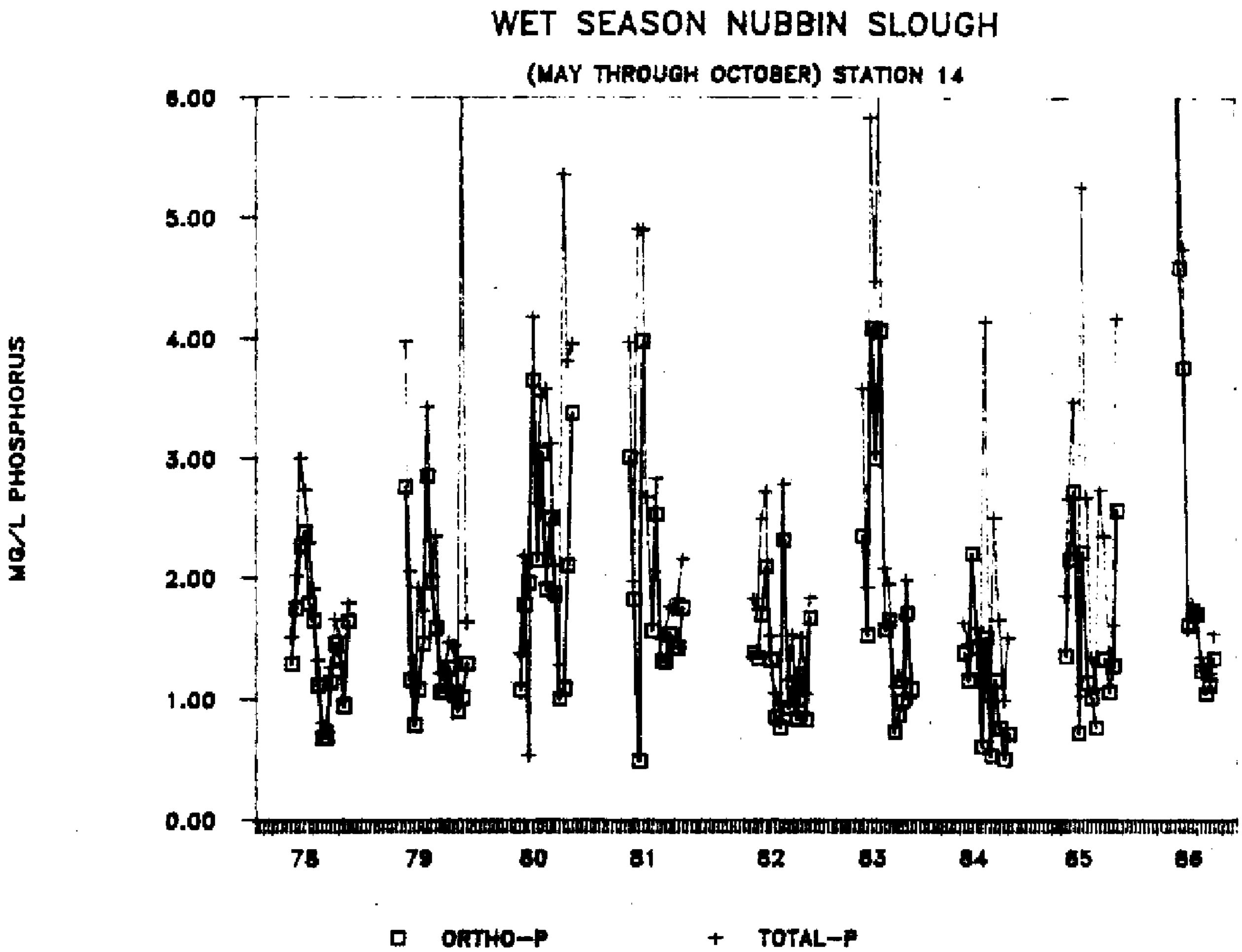
WET SEASON LETTUCE CREEK

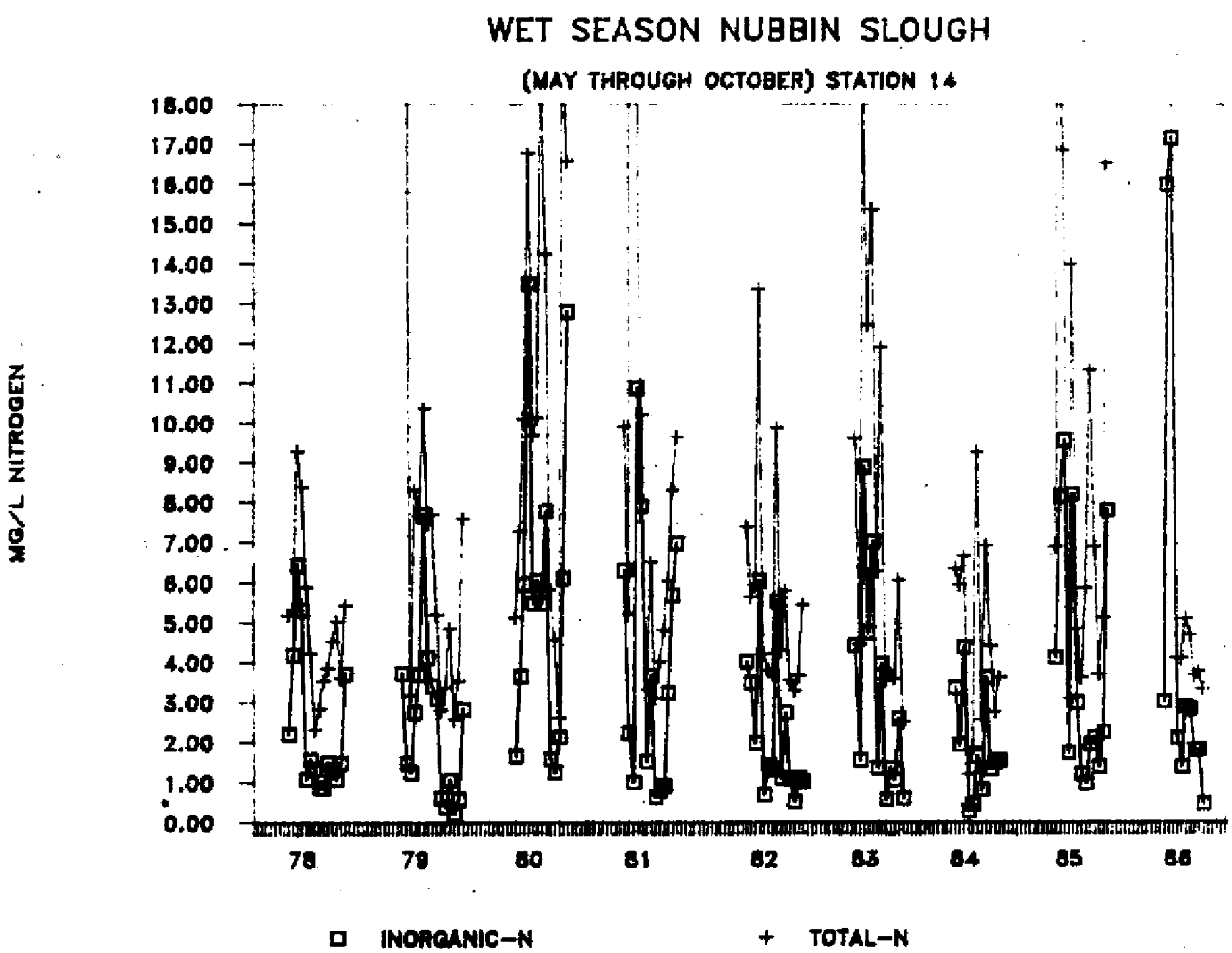
(MAY THROUGH OCTOBER) STATION 40

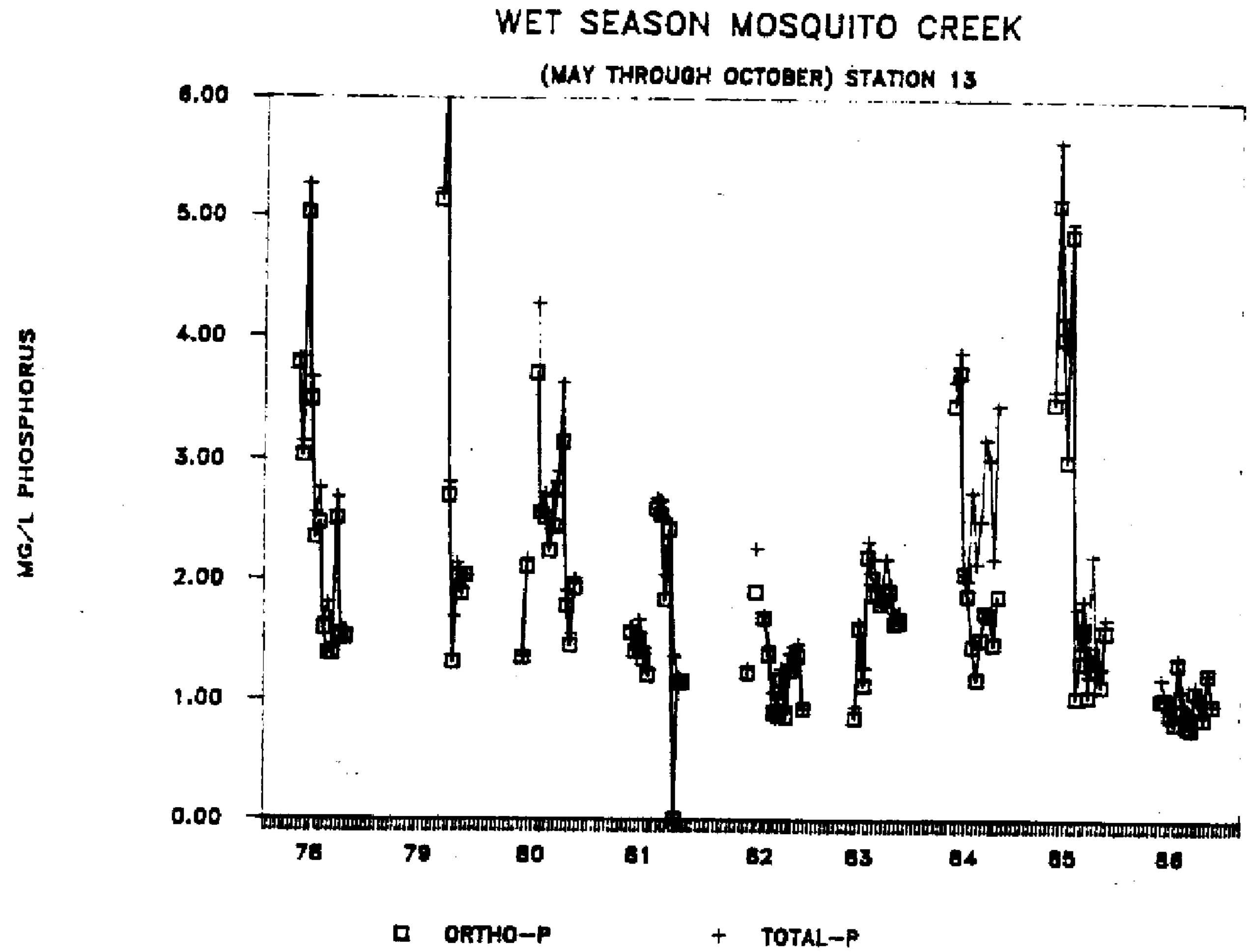



WET SEASON HENRY CREEK
(MAY THROUGH OCTOBER) STATION 39
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO-P
TOTAL-P

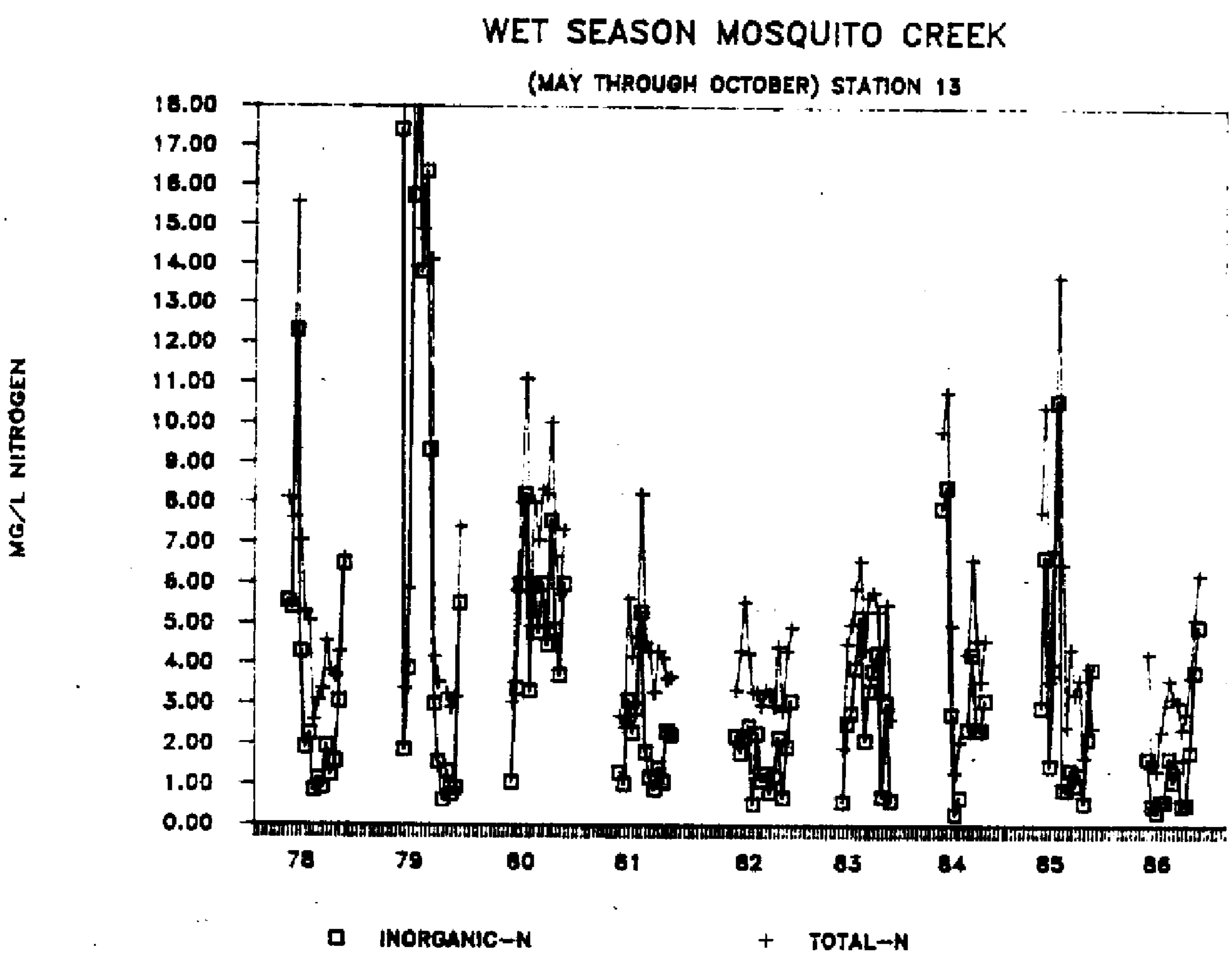

WET SEASON HENRY CREEK
(MAY THROUGH OCTOBER) STATION 39
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC-N
TOTAL-N


WET SEASON NUBBIN SLOUGH
(MAY THROUGH OCTOBER) STATION 14
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO-P
TOTAL-P

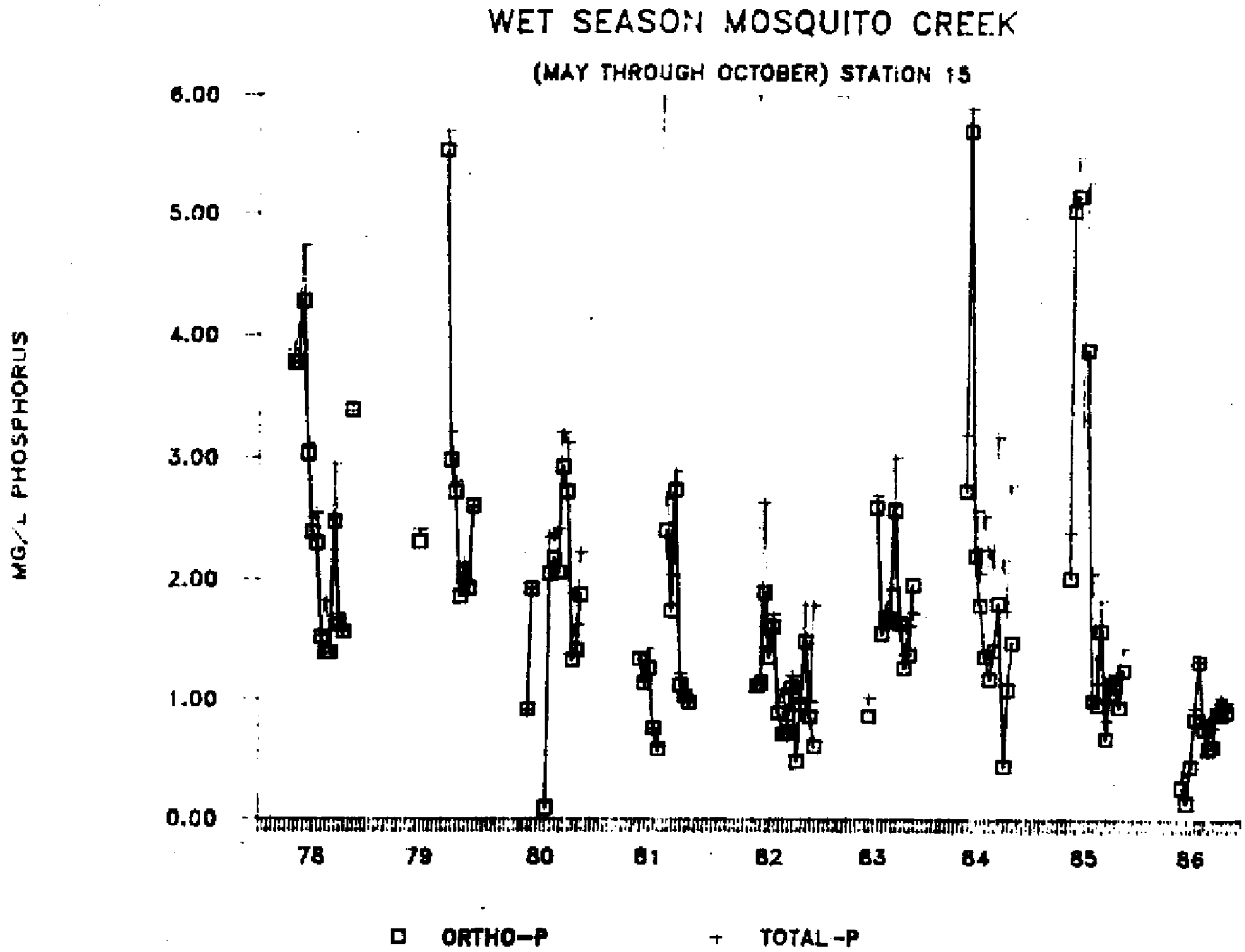

WET SEASON NUBBIN SLOUGH
(MAY THROUGH OCTOBER) STATION 14
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC-N
TOTAL-N



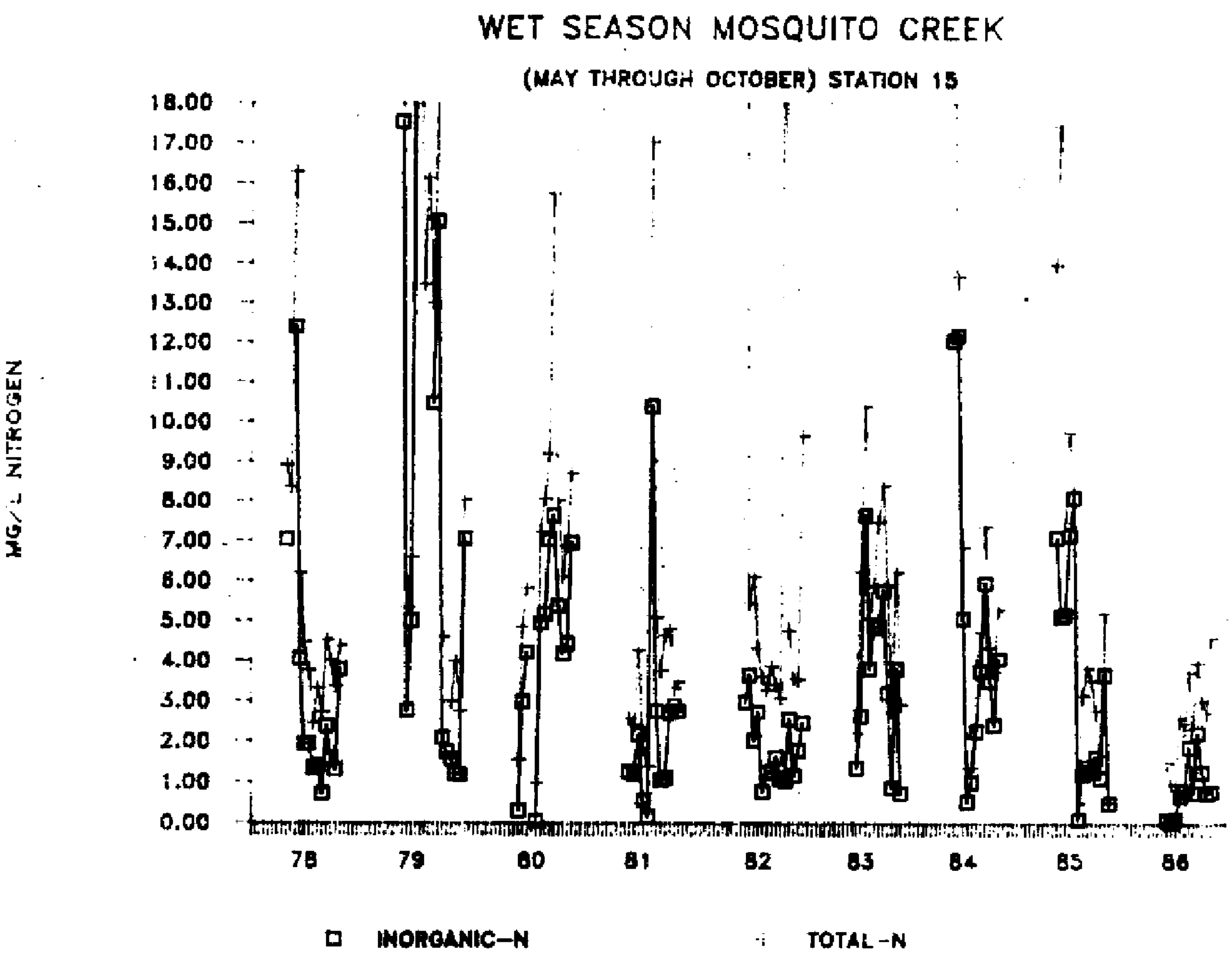
WET SEASON MOSQUITO CREEK
(MAY THROUGH OCTOBER) STATION 13
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO-P
TOTAL-P



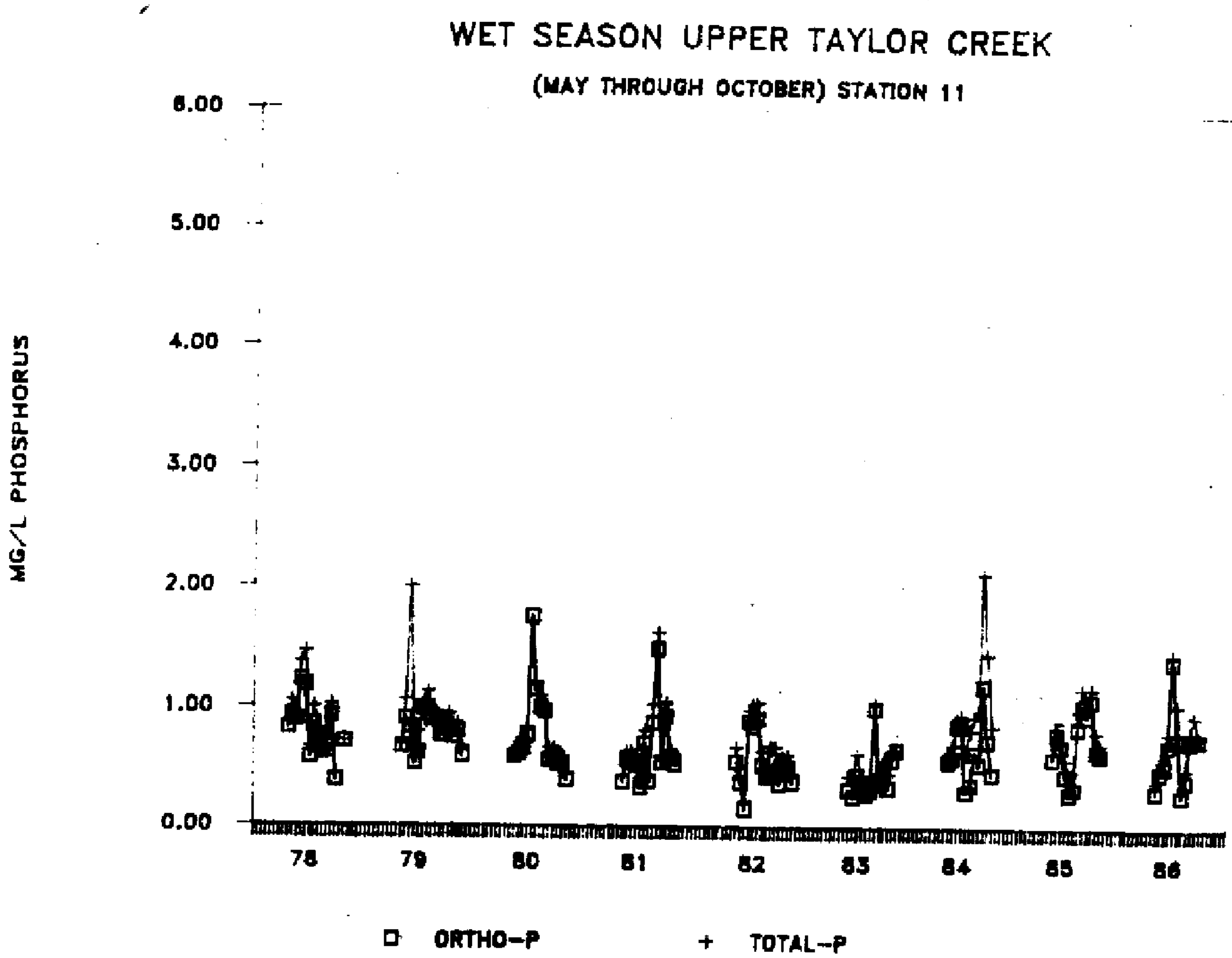
WET SEASON MOSQUITO CREEK
(MAY THROUGH OCTOBER) STATION 13
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC-N
TOTAL-N



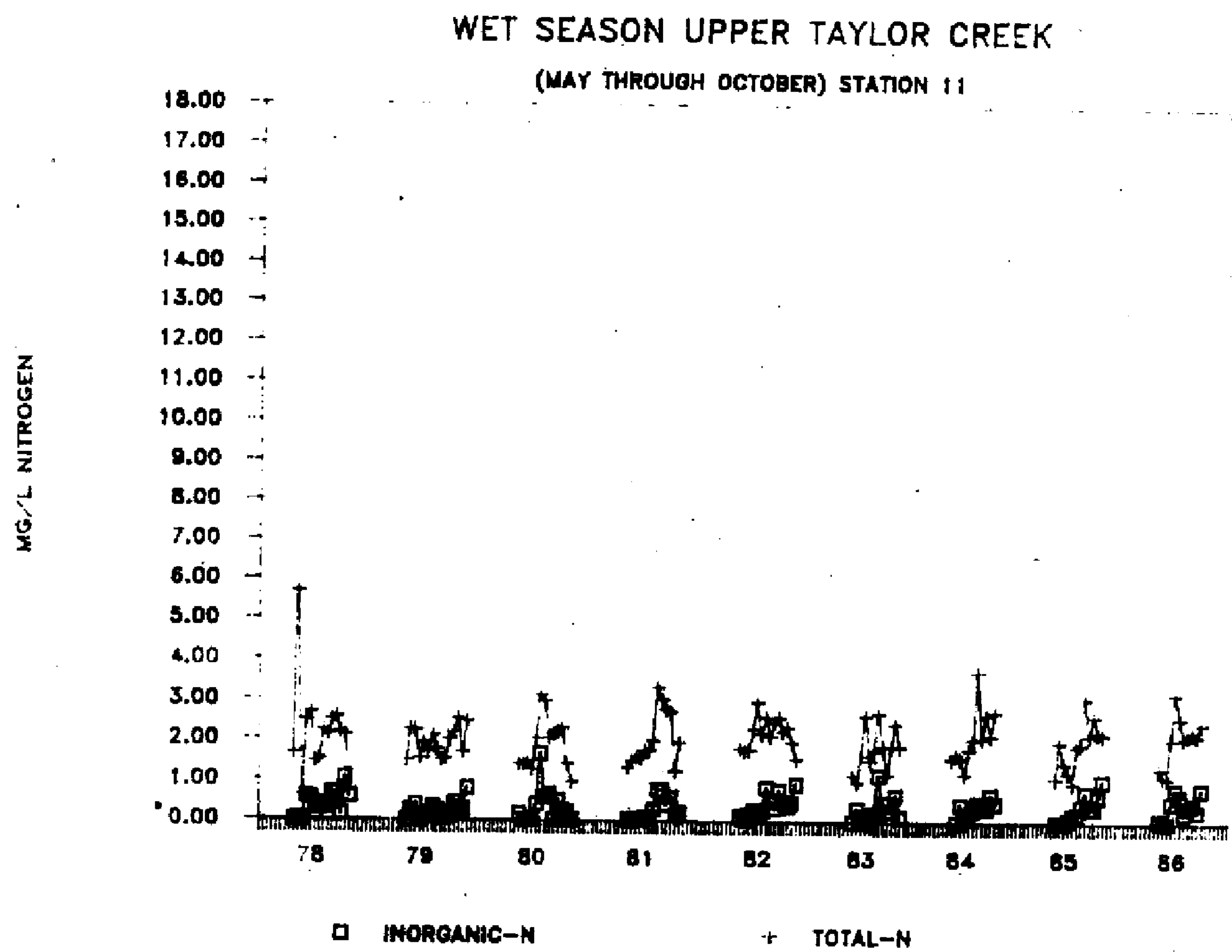
WET SEASON MOSQUITO CREEK
(MAY THROUGH OCTOBER) STATION 15
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO—P
TOTAL-P



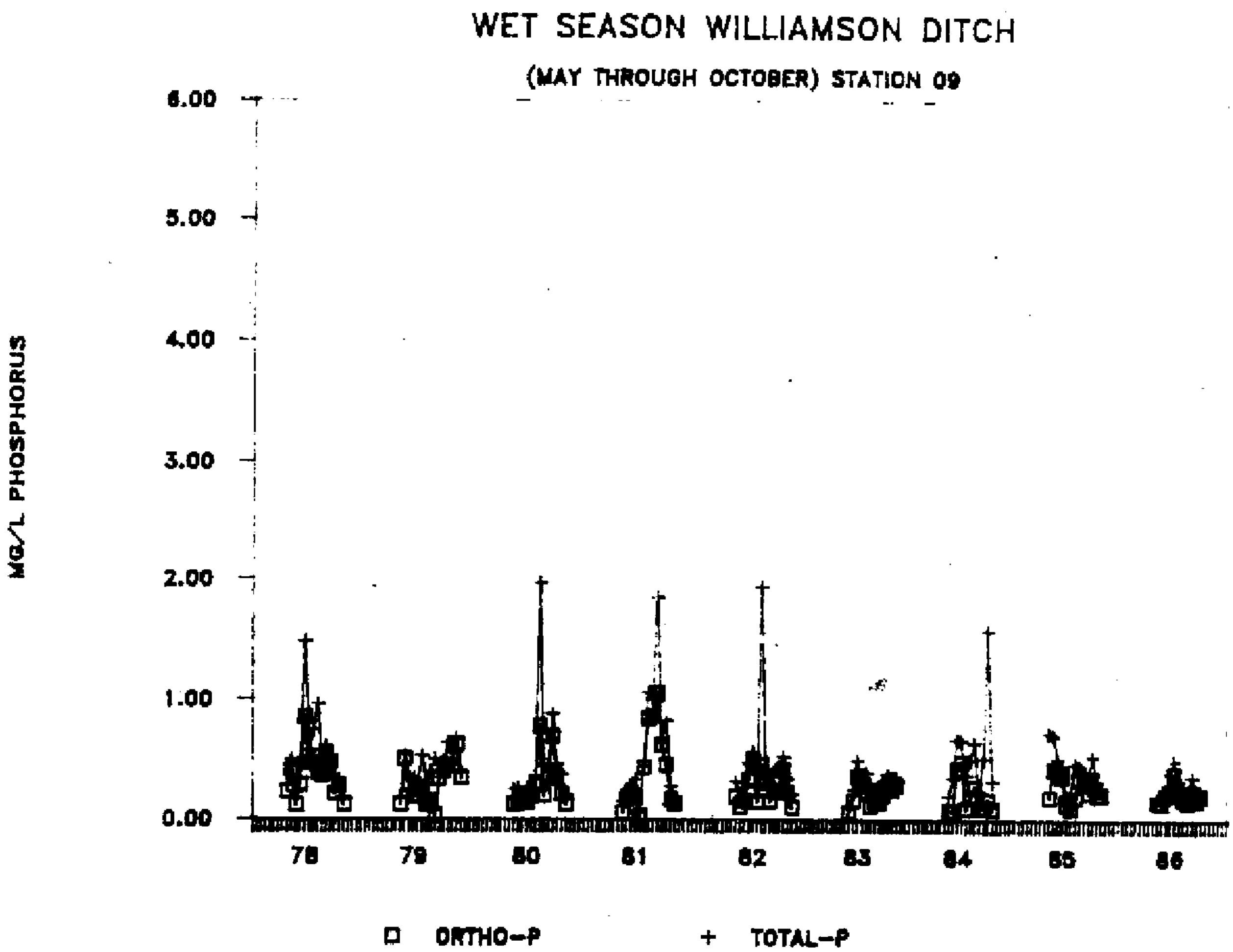
WET SEASON MOSQUITO CREEK
(MAY THROUGH OCTOBER) STATION 15
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC—N
TOTAL-N



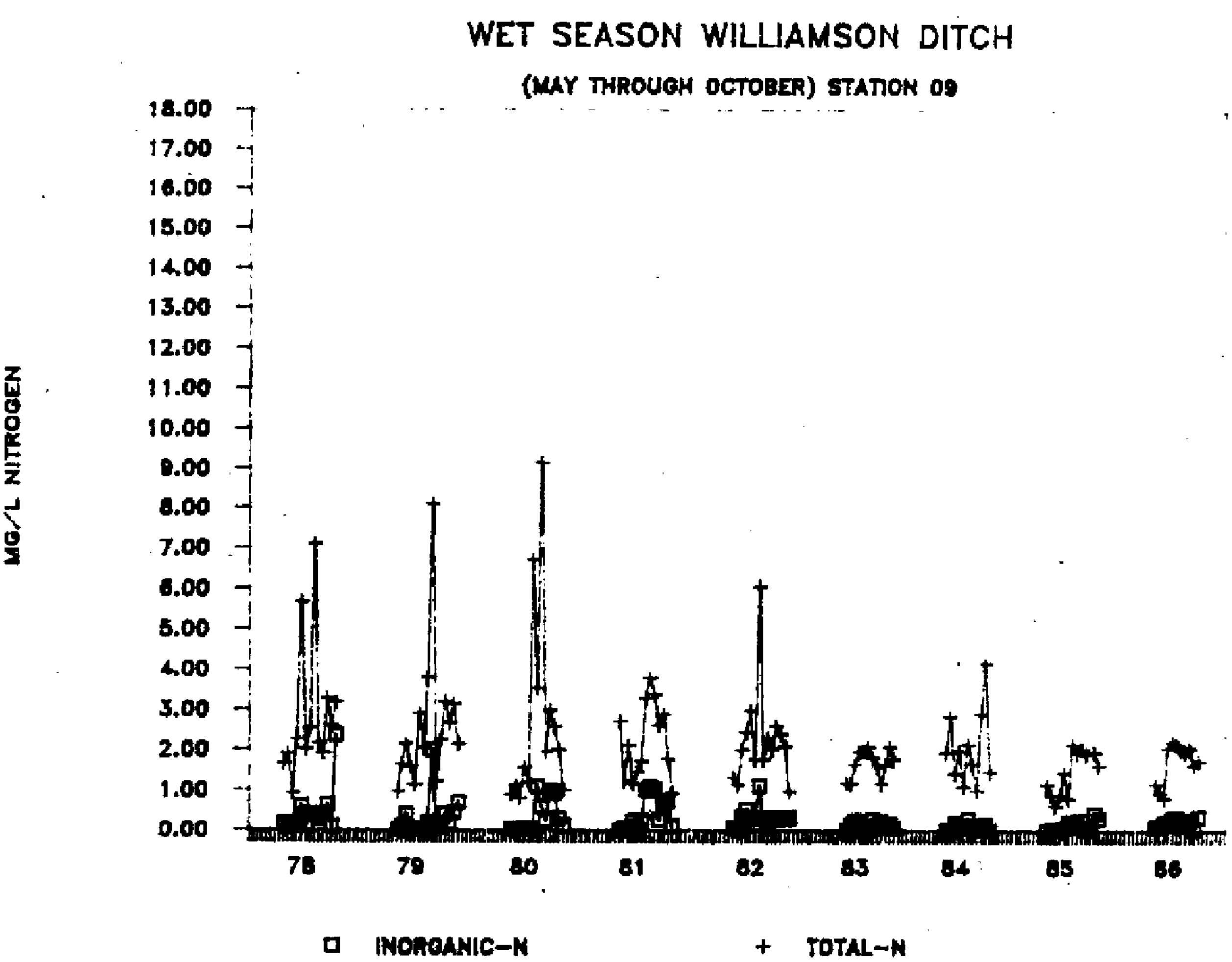
WET SEASON UPPER TAYLOR CREEK
(MAY THROUGH OCTOBER) STATION 11
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO-P
TOTAL-P



WET SEASON UPPER TAYLOR CREEK
(MAY THROUGH OCTOBER) STATION 11
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC-N
TOTAL-N



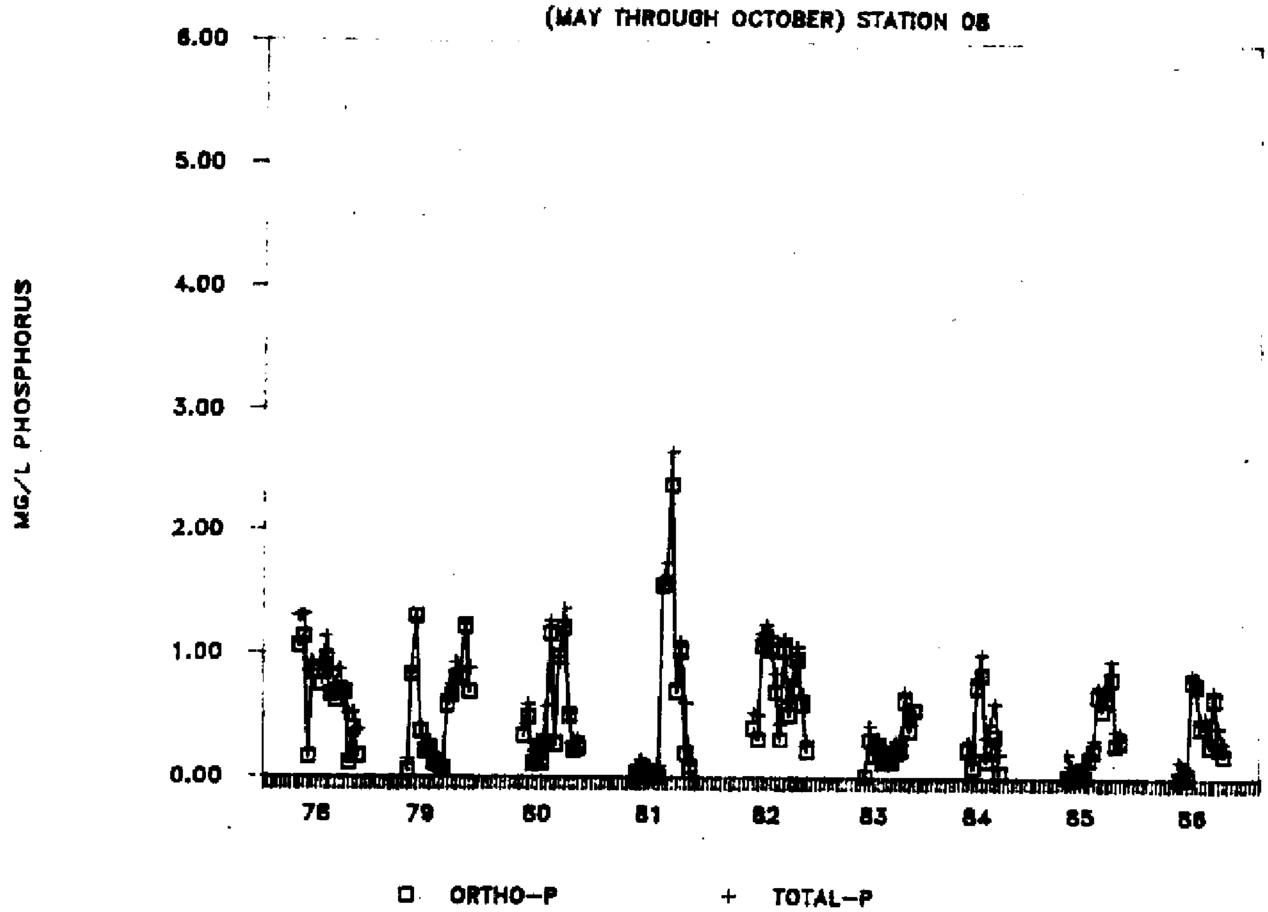
WET SEASON WILLIAMSON DITCH
(MAY THROUGH OCTOBER) STATION 09
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO-P
TOTAL-P



WET SEASON WILLIAMSON DITCH
(MAY THROUGH OCTOBER) STATION 09
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC-N
TOTAL-N

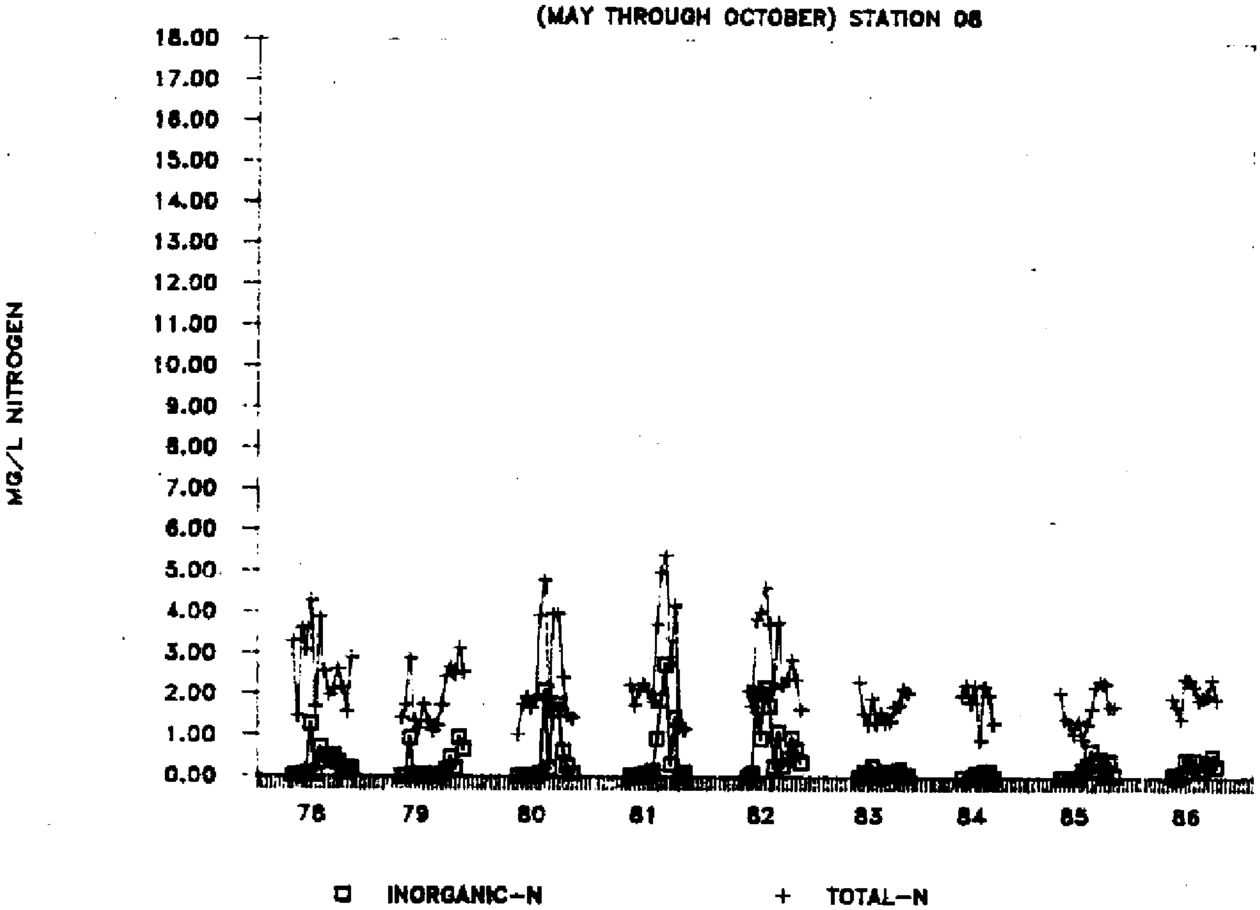
WET SEASON WILLIAMSON DITCH

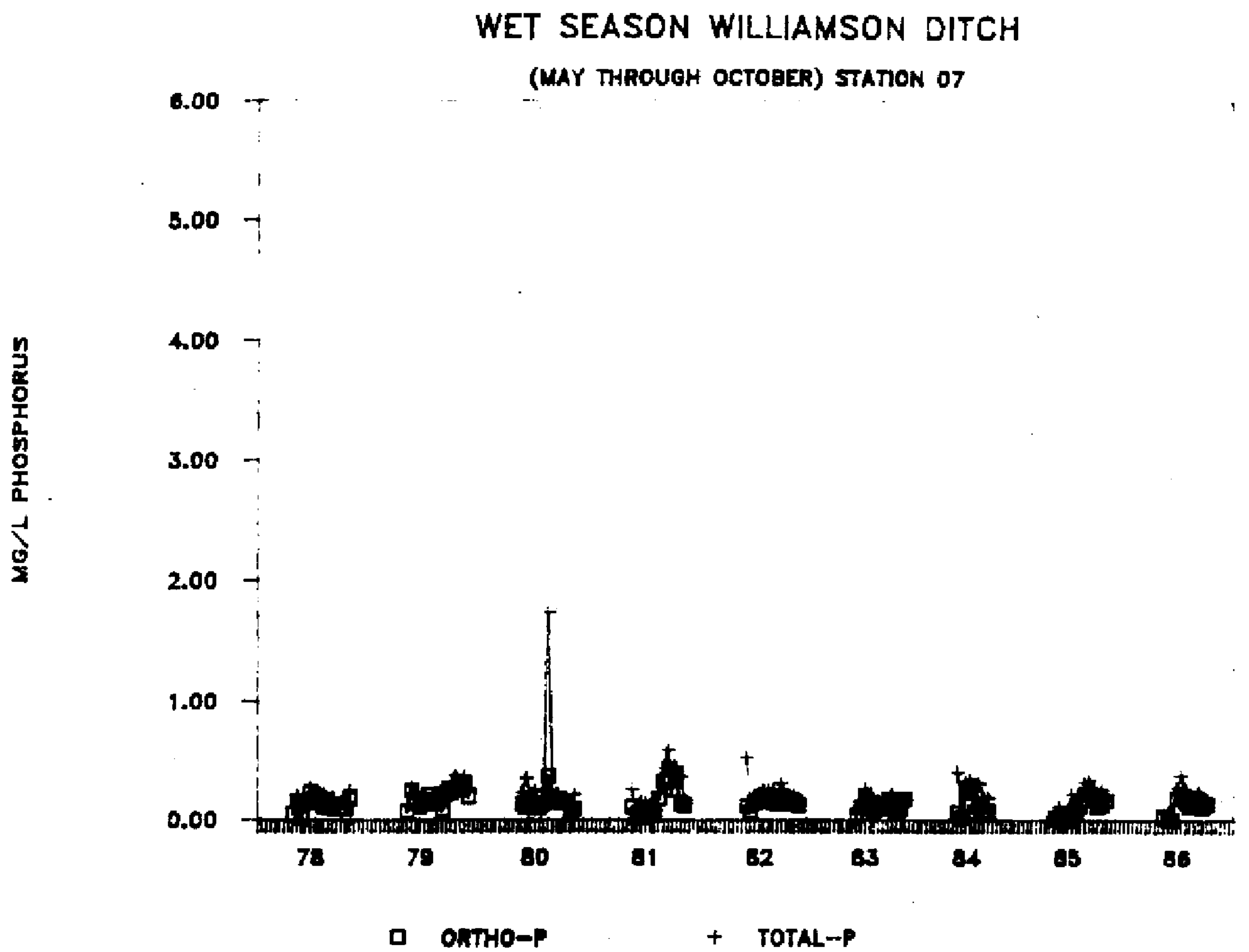
(MAY THROUGH OCTOBER) STATION 08

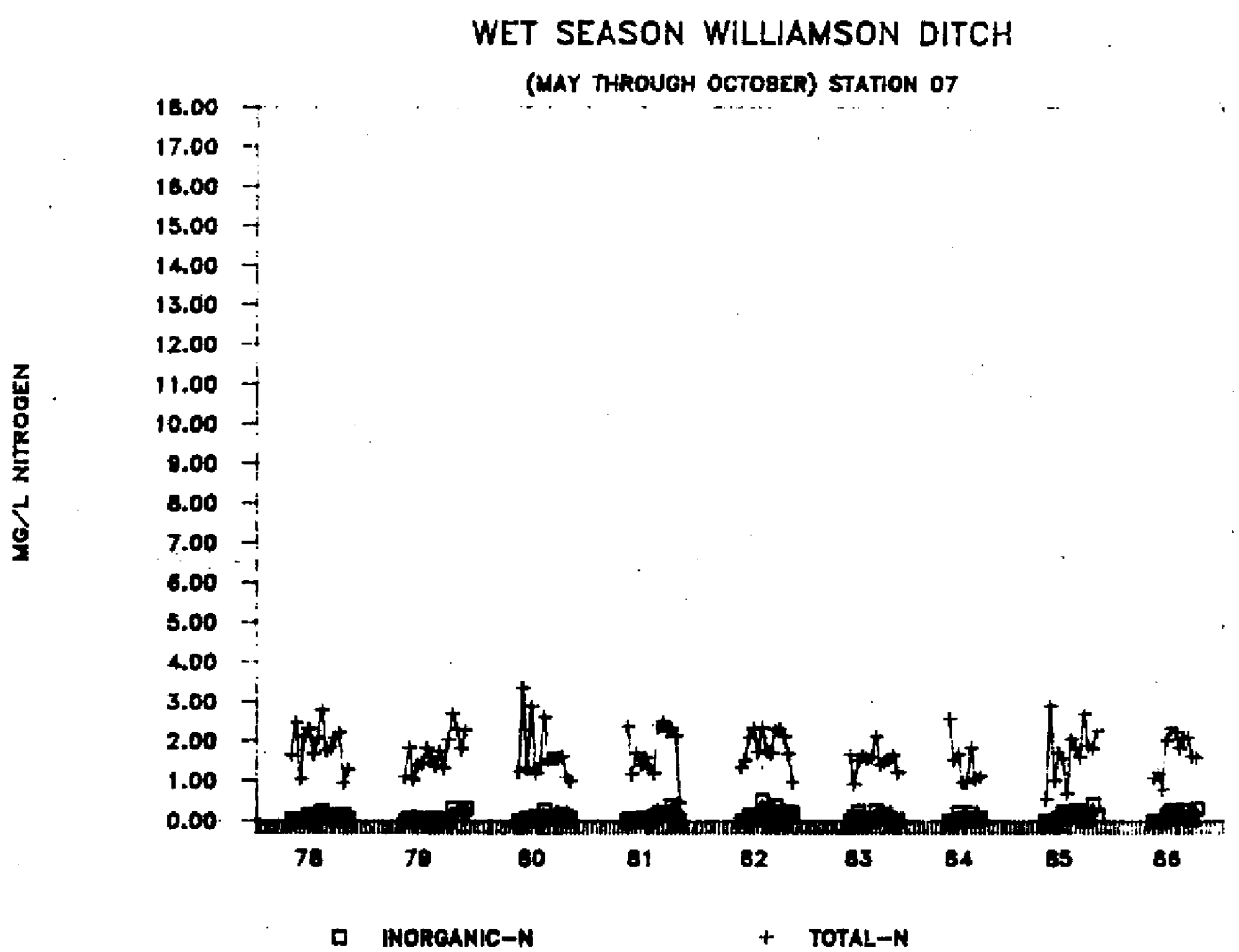


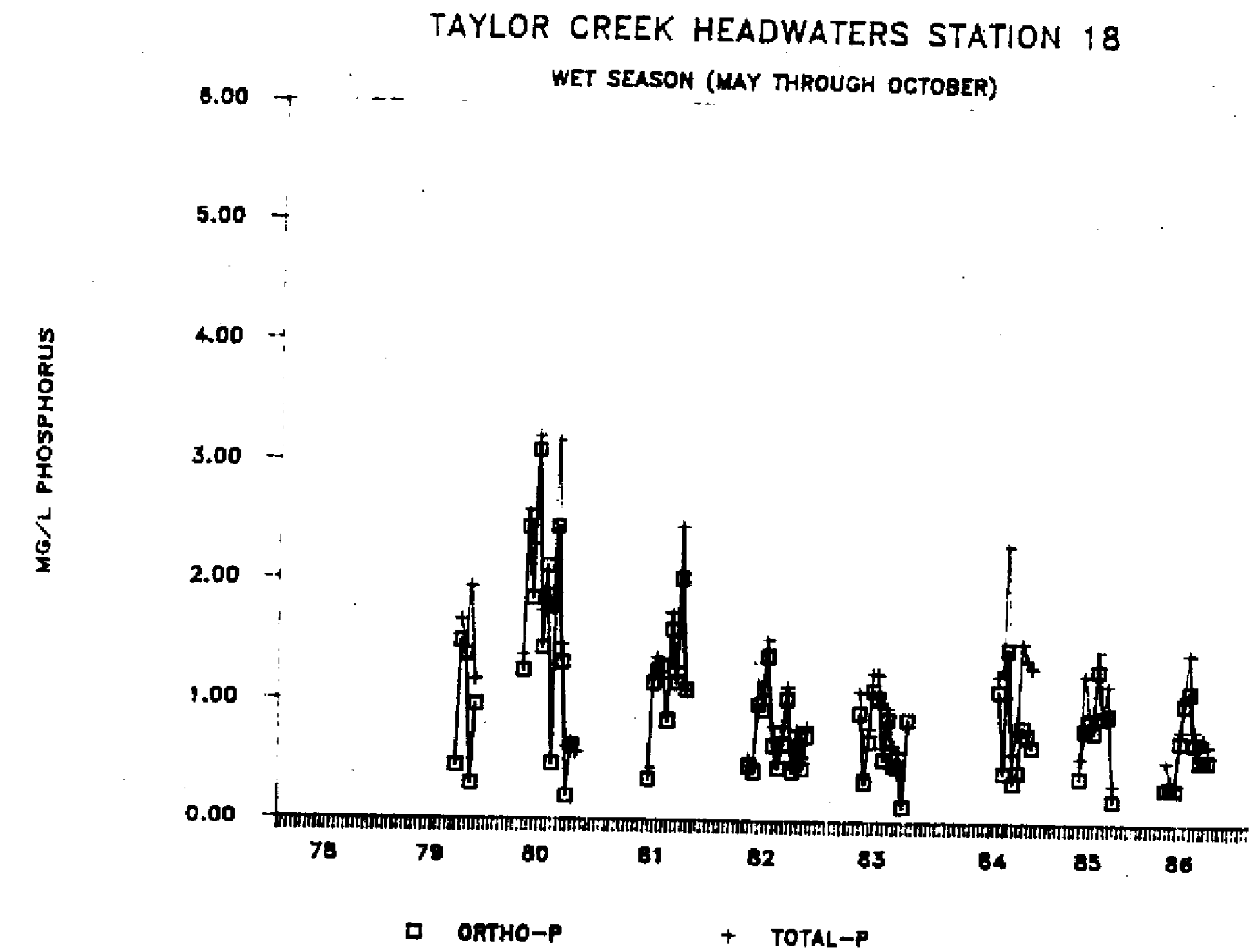
WET SEASON WILLIAMSON DITCH

(MAY THROUGH OCTOBER) STATION 08

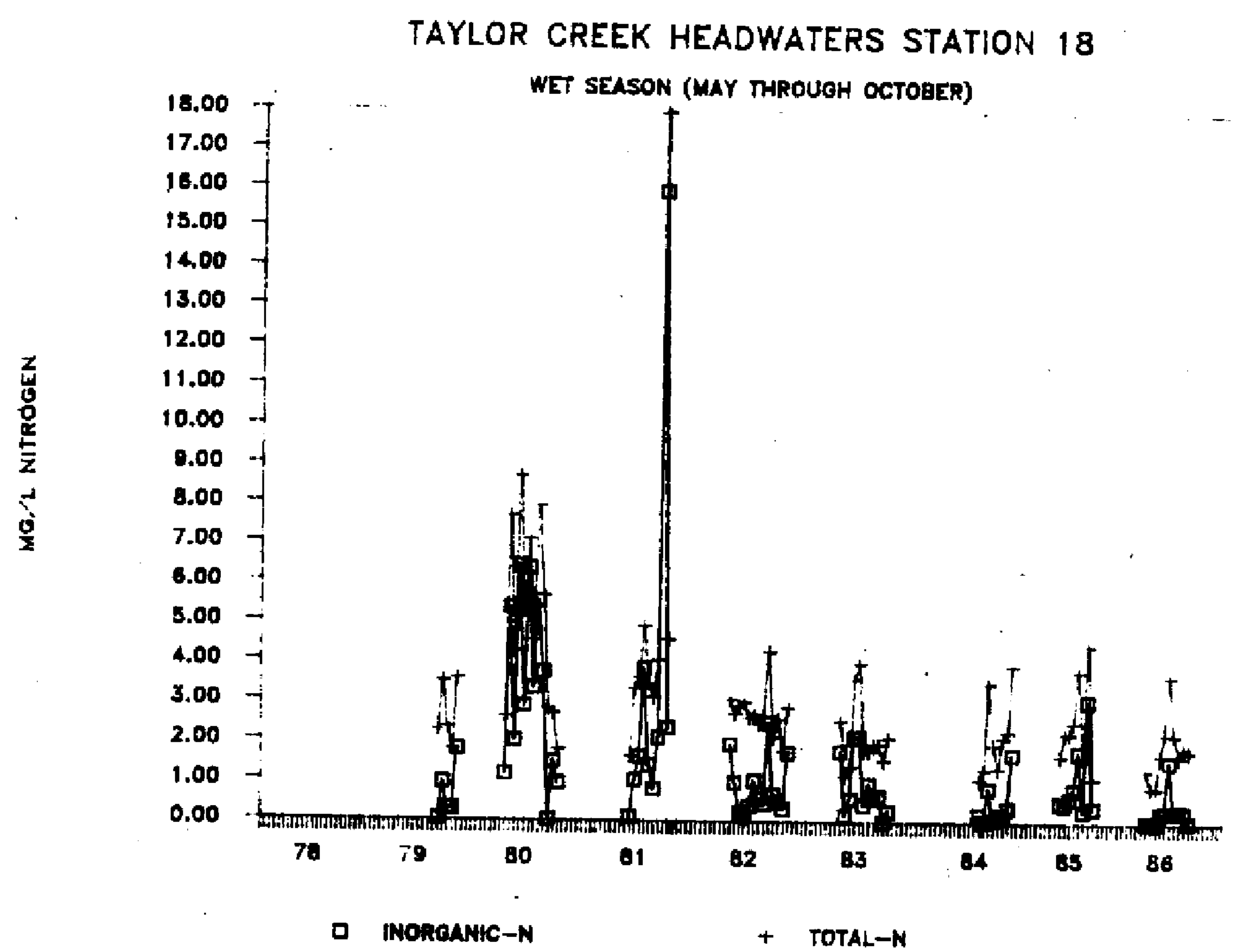



WET SEASON WILLIAMSON DITCH
(MAY THROUGH OCTOBER) STATION 07
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO-P
TOTAL-P

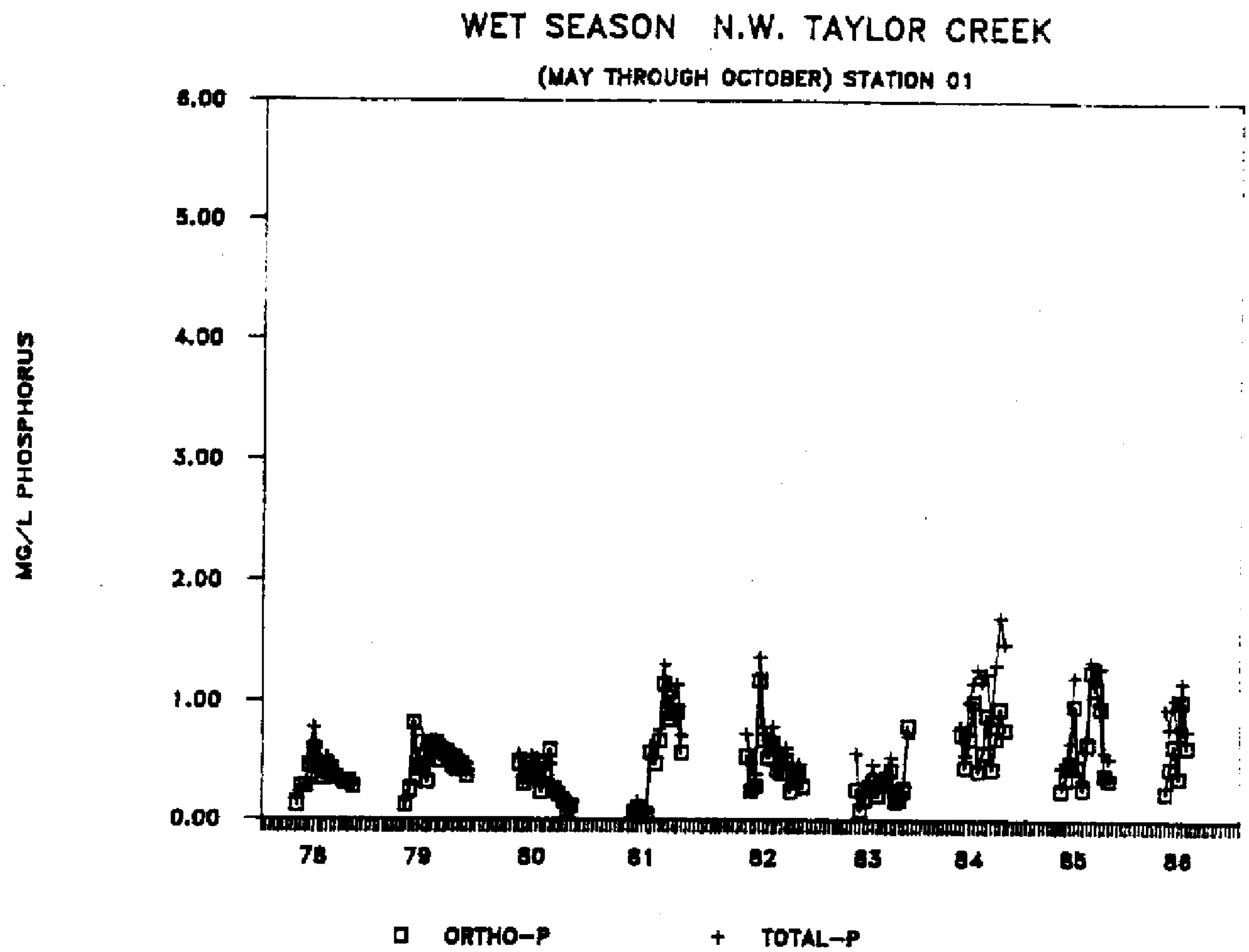

WET SEASON WILLIAMSON DITCH
(MAY THROUGH OCTOBER) STATION 07
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC-N
TOTAL-N

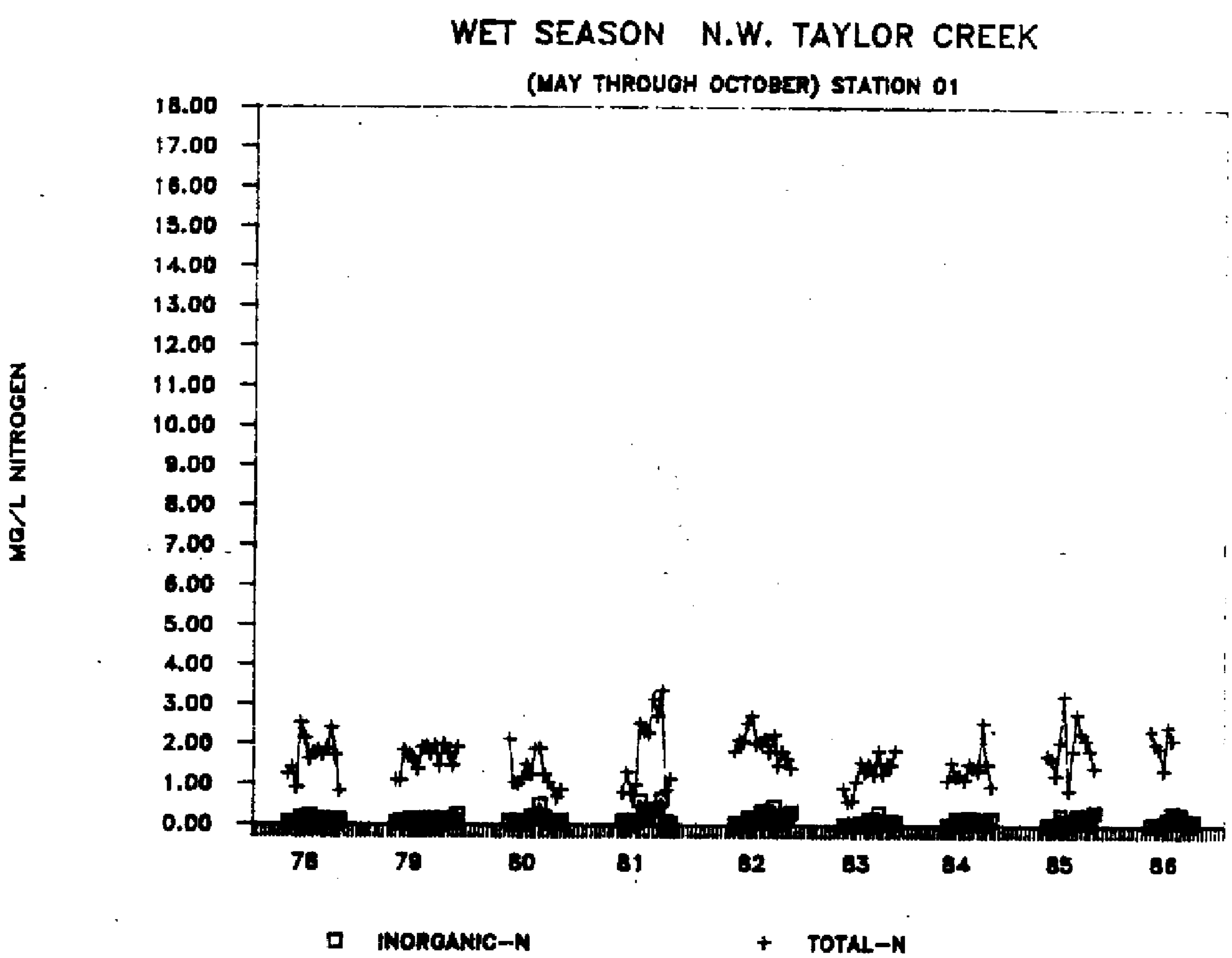


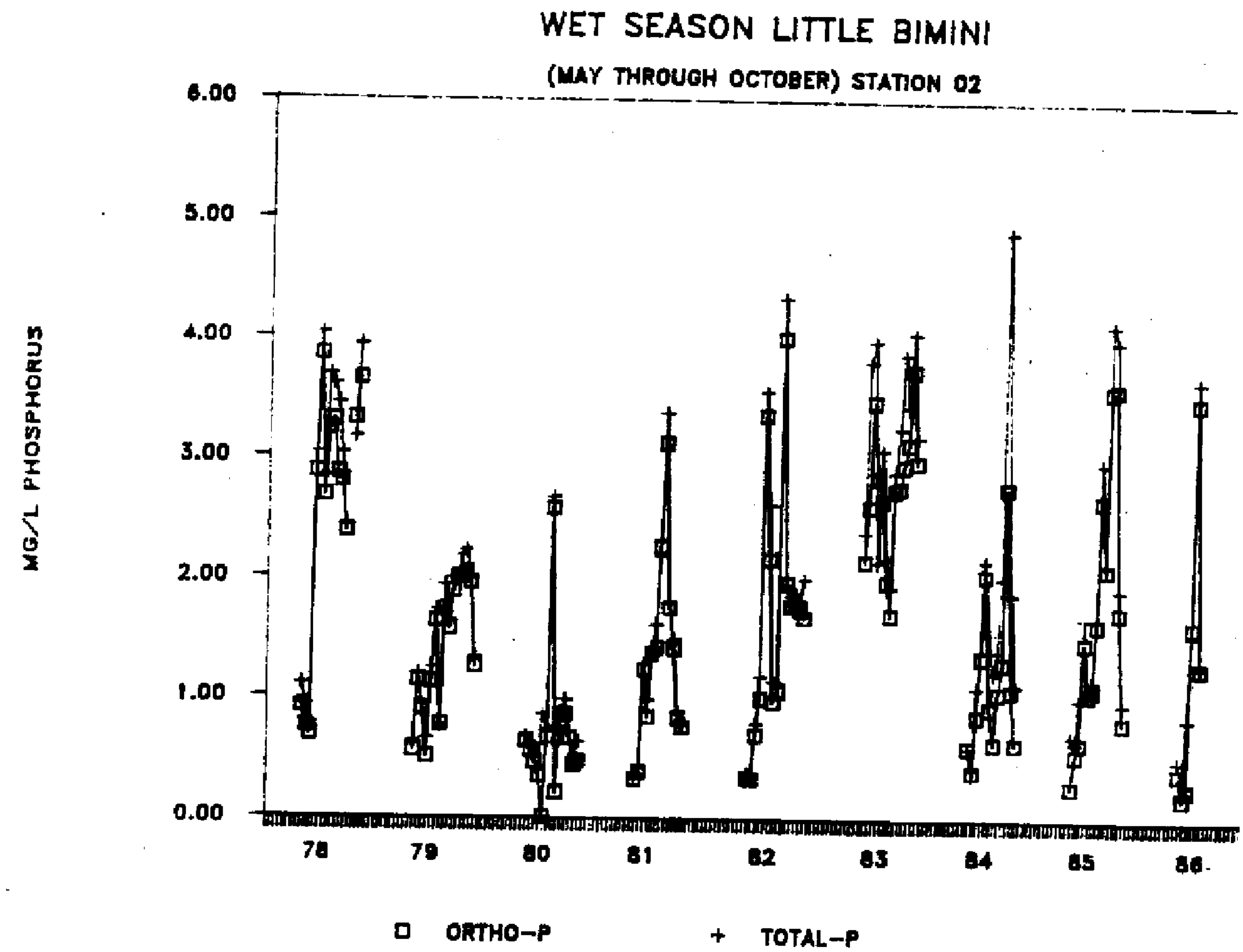
TAYLOR CREEK HEADWATERS STATION 18
WET SEASON (MAY THROUGH OCTOBER)
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO-P
TOTAL-P



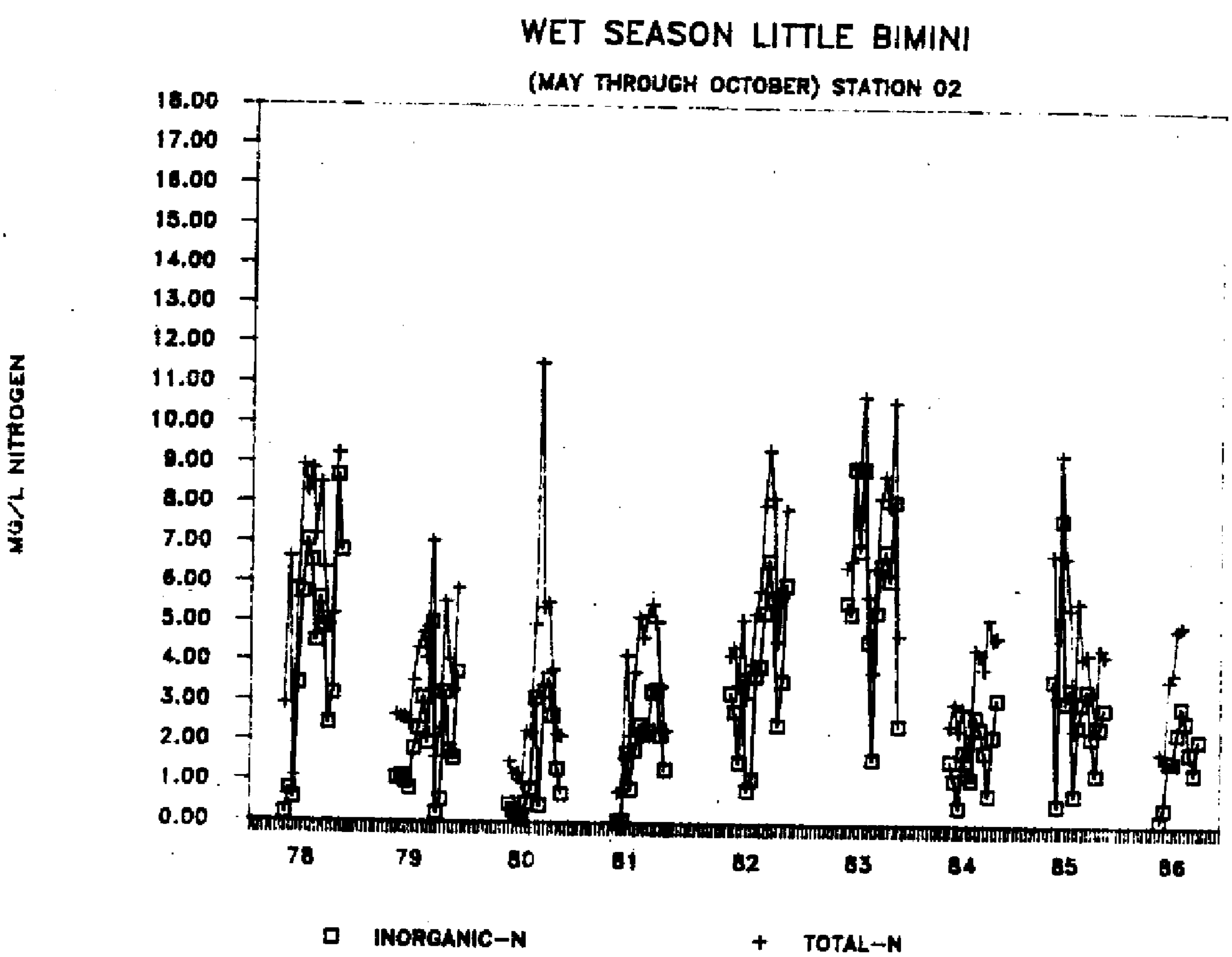
TAYLOR CREEK HEADWATERS STATION 18
WET SEASON (MAY THROUGH OCTOBER)
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC-N
TOTAL-N


WET SEASON N.W. TAYLOR CREEK
(MAY THROUGH OCTOBER) STATION 01
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO-P
TOTAL-P

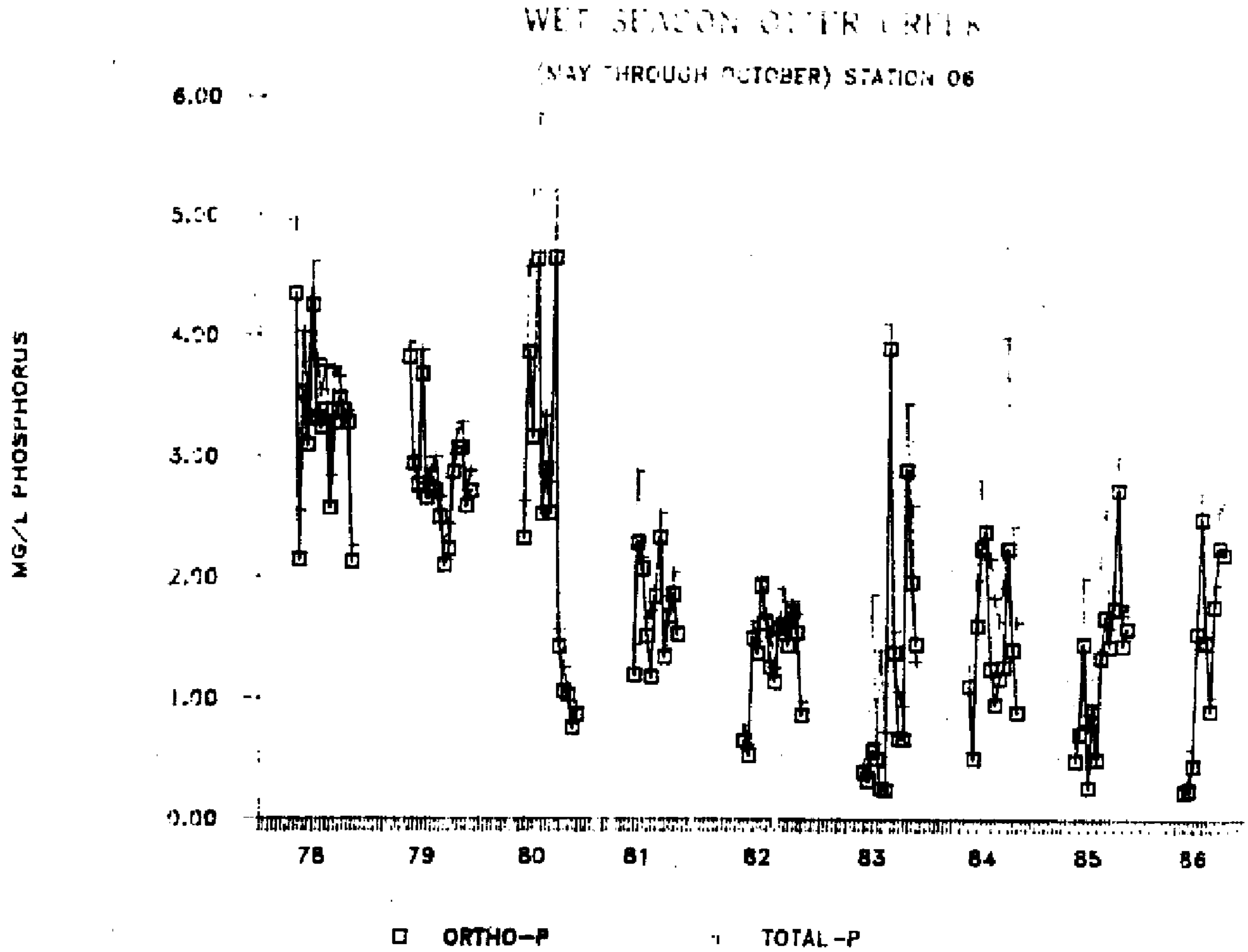

WET SEASON N.W. TAYLOR CREEK
(MAY THROUGH OCTOBER) STATION 01
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC-N
TOTAL-N

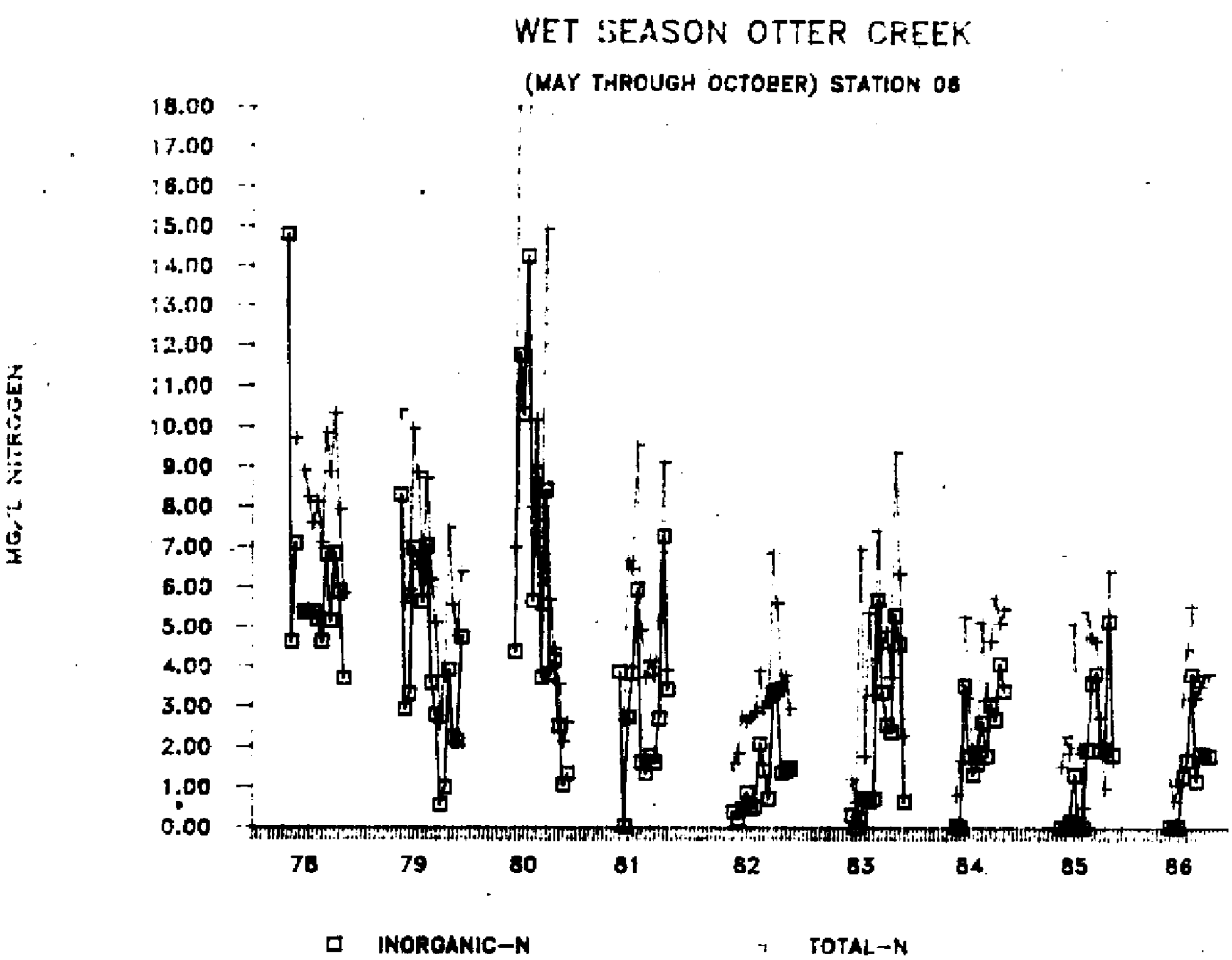


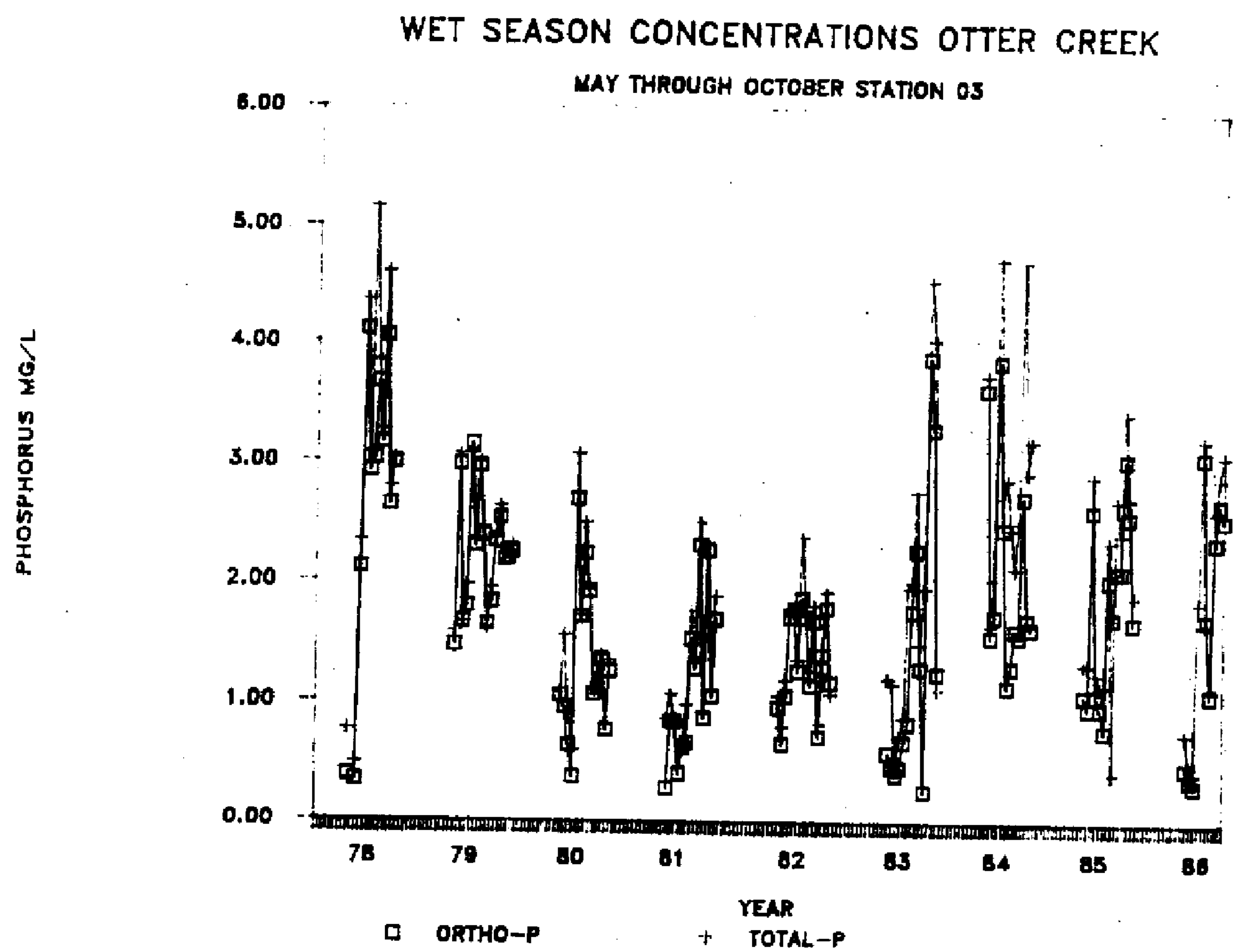
WET SEASON LITTLE BIMINI
(MAY THROUGH OCTOBER) STATION 02
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO-P
TOTAL-P

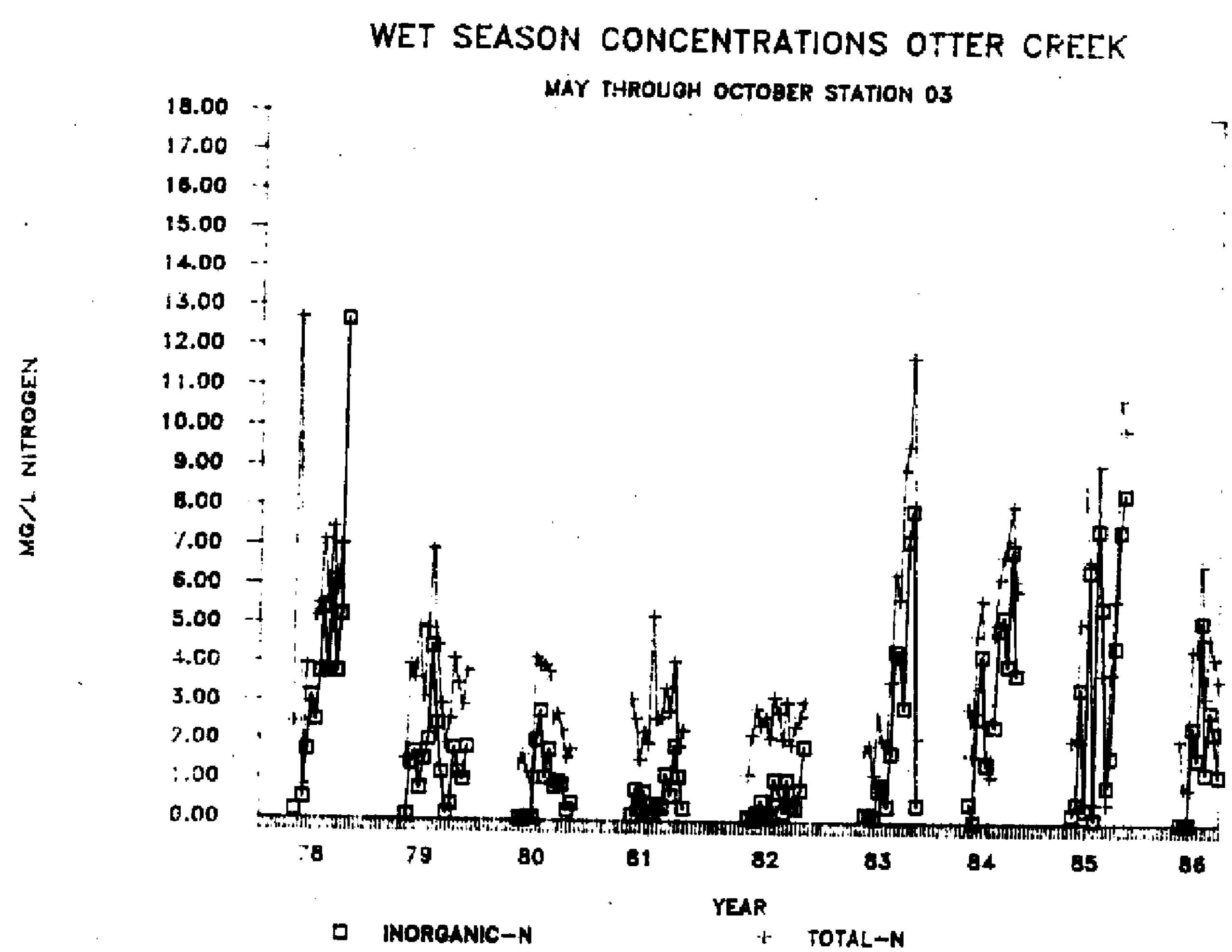


WET SEASON LITTLE BIMINI
(MAY THROUGH OCTOBER) STATION 02
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC-N
TOTAL-N


WET SEASON OTTER CREEK
(MAY THROUGH OCTOBER) STATION 06
MG/L PHOSPHORUS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
ORTHO-P
TOTAL-P


WET SEASON OTTER CREEK
(MAY THROUGH OCTOBER) STATION 06
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
INORGANIC-N
TOTAL-N


WET SEASON CONCENTRATIONS OTTER CREEK
MAY THROUGH OCTOBER STATION 03
PHOSPHORUS MG/L
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
YEAR
ORTHO-P
TOTAL-P


WET SEASON CONCENTRATIONS OTTER CREEK
MAY THROUGH OCTOBER STATION 03
MG/L NITROGEN
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
78
79
80
81
82
83
84
85
86
YEAR
INORGANIC-N
TOTAL-N

APPENDIX B

S-2 AND S-3 BACKPUMPING,

1985 - 86

M E M O R A N D U M

TO: Tony Federico, Director, Water Quality Division

FROM: George Hwa, Asst. Director of Operations
Department of Resource Operations

DATE: November 2, 1987

SUBJECT: Backpumping from October 1, 1985 until September 30, 1986

The attached are the Interim Action Plan Points Summany and the Flood Control Backpumping Volume Summary at S-2 and S-3 from October 1, 1985 until September 30, 1986 as you requested.

If you have any questions, please call me.

GJH/c

cc: T. MacVicar
R. Slyfield

INTERIM ACTION PLAN POINTS SUMMARY, MARCH 11, 1986

POINT FACTOR CATEGORIES	S-2 (Hillsboro/NNRC)		S-3 (Miami Canal)	
	STATUS	POINTS	STATUS	POINTS
Current canal level	> 13'	6		
Change in level	< .25'/hr.	1		
Pump notification	> 100K GPM	4		
Rainfall, last 2 hours	0	0		
Rainfall, last 2-48 hours	< 4"	1		
Raining now	no	0		
Rainfall predicted, next 6 hours	1 - 2"	2		
Time of Day	1800	1		
Day of week	Tuesday	2		
Total Points		17		

INTERIM ACTION PLAN POINTS SUMMARY, JUNE 30, 1986

POINT FACTOR CATEGORIES	S-2 (Hillsboro/NNRC)		S-3 (Miami Canal)	
	STATUS	POINTS	STATUS	POINTS
Current canal level	> 13'	6	> 13'	6
Change in level	< .25'/hr.	1	< .25'/hr.	1
Pump notification	> 100K GPM	4	> 100K GPM	4
Rainfall, last 2 hours	0	0	0	0
Rainfall, last 2-48 hours	< 4"	1	< 4"	1
Raining now	no	0	no	0
Rainfall predicted, next 6 hours	> 2"	4	> 2"	4
Time of Day	1000	3	1000	3
Day of week	Friday	3	Friday	3
Total Points		22		22

FLOOD CONTROL BACKPUMPING SUMMARY

DATE	S-2 (Hillsboro/NNRC) Volume (Acre/Ft.)	S-2 (Hillsboro/NNRC) Points	S-3 (Miami Canal) Volume (Acre/Ft.)	S-3 (Miami Canal) Points
3/11/86	422	17		
3/12/86	3,144			
6/20/86	1,755	22	1,515	22
6/21/86	3,527		2,216	
6/22/86	2,235		2,102	
Total	11,083		5,833	

APPENDIX C

PESTICIDE/ HERBICIDE

ANALYTICAL RESULTS

1985 - 86

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation:SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S2		UNITS
ENDRIN	< 0.1	ppm
METHOXYCHLOR	< 0.1	ppm
PARATHION	< 0.1	ppm
T.O.C	8,051	ppm
TOXAPHENE	< 0.1	ppm
GUTHION	< 0.1	ppm
ALDRIN	< 0.1	ppm
DIELDRIN	< 0.1	ppm
ENDRIN ALDEHYDE	< 0.1	ppm
HEPTACHLOR	< 0.1	ppm
HEPTACHLOR-EPOXIDE	< 0.1	ppm
ALPHA BHC	< 0.1	ppm
BETA BHC	< 0.1	ppm
GAMMA BHC	< 0.1	ppm
DELTA BHC	< 0.1	ppm
ENDOSULFAN SULFATE	< 0.1	ppm
CHLORDANE	< 0.1	ppm
MALATHION	3.2	ppm
4,4'-DDD	< 0.1	ppm
4,4'-DDE	< 0.1	ppm
4,4'-DDT	< 0.1	ppm
ENDOSULFAN-ALPHA	< 0.1	ppm
ENDOSULFAN-BETA	< 0.1	ppm
ETHION	< 0.1	ppm

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S2		UNITS
TRITHION	< 0.1	ppm
O,P-DDE	< 0.1	ppm
O,P-DDD	< 0.1	ppm
O,P-DDT	< 0.1	ppm
TEDION	< 0.1	ppm
DIAZINON	1.1	ppm
KELTHANE	< 0.1	ppm
ALDICARB	< 0.1	ppm
PCB 1016	< 0.1	ppm
PCB 1221	< 0.1	ppm
PCB 1232	< 0.1	ppm
PCB 1242	< 0.1	ppm
PCB 1248	< 0.1	ppm
PCB 1254	< 0.1	ppm
PCB 1260	< 0.1	ppm
METHOMYL	< 0.5	ppm
PERTHANE	< 0.1	ppm
TRIAZINE	< 0.5	ppm
AMETRYN	< 0.5	ppm
ATRAZINE	< 0.5	ppm
PROMETRYN	< 0.5	ppm
SIMAZINE	< 0.5	ppm
ALACHLOR	< 0.5	ppm
TRIFLURALIN	< 0.5	ppm
CARBAMATE	< 0.5	ppm

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S2		UNITS
CARBARYL	< 0.5	ppm
CARBOFURAN	< 0.5	ppm
PROPHAM	< 0.5	ppm

Analyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

Enviropact Inc.

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S3		UNITS
ENDRIN	< 0.1	ppm
METHOXYCHLOR	< 0.1	ppm
PARATHION	< 0.1	ppm
T.O.C	1,676	ppm
TOXAPHENE	< 0.1	ppm
GUTHION	< 0.1	ppm
ALDRIN	< 0.1	ppm
DIELDRIN	< 0.1	ppm
ENDRIN ALDEHYDE	< 0.1	ppm
HEPTACHLOR	< 0.1	ppm
HEPTACHLOR-EPOXIDE	< 0.1	ppm
ALPHA BHC	< 0.1	ppm
BETA BHC	< 0.1	ppm
GAMMA BHC	< 0.1	ppm
DELTA BHC	< 0.1	ppm
ENDOSULFAN SULFATE	< 0.1	ppm
CHLORDANE	< 0.1	ppm
MALATHION	2.6	ppm
4,4'-DDD	< 0.1	ppm
4,4'-DDE	< 0.1	ppm
4,4'-DDT	< 0.1	ppm
ENDOSULFAN-ALPHA	< 0.1	ppm
ENDOSULFAN-BETA	< 0.1	ppm
ETHION	< 0.1	ppm

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S3		UNITS
TRITHION	< 0.1	ppm
O,P-DDE	< 0.1	ppm
O,P-DDD	< 0.1	ppm
O,P-DDT	< 0.1	ppm
TEDION	< 0.1	ppm
DIAZINON	1.4	ppm
KELTHANE	< 0.1	ppm
ALDICARB	< 0.1	ppm
PCB 1016	< 0.1	ppm
PCB 1221	< 0.1	ppm
PCB 1232	< 0.1	ppm
PCB 1242	< 0.1	ppm
PCB 1248	< 0.1	ppm
PCB 1254	< 0.1	ppm
PCB 1260	< 0.1	ppm
METHOMYL	< 0.5	ppm
PERTHANE	< 0.1	ppm
TRIAZINE	< 0.5	ppm
AMETRYN	< 0.5	ppm
ATRAZINE	< 0.5	ppm
PROMETRYN	< 0.5	ppm
SIMAZINE	< 0.5	ppm
ALACHLOR	< 0.5	ppm
TRIFLURALIN	< 0.5	ppm
CARBAMATE	< 0.5	ppm

Enviropact, Inc.

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S3		UNITS
..RBARYL	< 0.5	ppm
CARBOFURAN	< 0.5	ppm
PROPHAM	< 0.5	ppm

Analyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn

Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S4		UNITS
ENDRIN	< 0.1	ppm
METHOXYCHLOR	< 0.1	ppm
PARATHION	< 0.1	ppm
T.O.C	3,800	ppm
TOXAPHENE	< 0.1	ppm
GUTHION	< 0.1	ppm
ALDRIN	0.6	ppm
DIELDRIN	< 0.1	ppm
ENDRIN ALDEHYDE	< 0.1	ppm
HEPTACHLOR	< 0.1	ppm
HEPTACHLOR-EPOXIDE	< 0.1	ppm
ALPHA BHC	< 0.1	ppm
BETA BHC	< 0.1	ppm
GAMMA BHC	< 0.1	ppm
DELTA BHC	< 0.1	ppm
ENDOSULFAN SULFATE	< 0.1	ppm
CHLORDANE	< 0.1	ppm
MALATHION	3.8	ppm
4,4'-DDD	< 0.1	ppm
4,4'-DDE	< 0.1	ppm
4,4'-DDT	< 0.1	ppm
ENDOSULFAN-ALPHA	< 0.1	ppm
ENDOSULFAN-BETA	< 0.1	ppm
ETHION	< 0.1	ppm

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S4		UNITS
TRITHION	< 0.1	ppm
O,P-DDE	< 0.1	ppm
O,P-DDD	< 0.1	ppm
O,P-DDT	< 0.1	ppm
TEDION	< 0.1	ppm
DIAZINON	1.0	ppm
KELTHANE	< 0.1	ppm
ALDICARB	< 0.1	ppm
PCB 1016	< 0.1	ppm
PCB 1221	< 0.1	ppm
PCB 1232	< 0.1	ppm
PCB 1242	< 0.1	ppm
PCB 1248	< 0.1	ppm
PCB 1254	< 0.1	ppm
PCB 1260	< 0.1	ppm
METHOMYL	< 0.5	ppm
PERTHANE	< 0.1	ppm
TRIAZINE	< 0.5	ppm
AMETRYN	< 0.5	ppm
ATRAZINE	< 0.5	ppm
PROMETRYN	< 0.5	ppm
SIMAZINE	< 0.5	ppm
ALACHLOR	< 0.5	ppm
TRIFLURALIN	< 0.5	ppm
CARBAMATE	< 0.5	ppm

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S4		UNITS
CARBARYL	< 0.5	ppm
CARBOFURAN	< 0.5	ppm
PROPHAM	< 0.5	ppm

Analyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S6		UNITS
ENDRIN	< 0.1	ppm
METHOXYCHLOR	< 0.1	ppm
PARATHION	< 0.1	ppm
T.O.C	2,698	ppm
TOXAPHENE	< 0.1	ppm
GUTHION	< 0.1	ppm
ALDRIN	< 0.1	ppm
DIELDRIN	< 0.1	ppm
ENDRIN ALDEHYDE	< 0.1	ppm
HEPTACHLOR	< 0.1	ppm
HEPTACHLOR-EPOXIDE	< 0.1	ppm
ALPHA BHC	< 0.1	ppm
BETA BHC	< 0.1	ppm
GAMMA BHC	< 0.1	ppm
DELTA BHC	< 0.1	ppm
ENDOSULFAN SULFATE	< 0.1	ppm
CHLORDANE	< 0.1	ppm
MALATHION	< 0.1	ppm
4,4'-DDD	< 0.1	ppm
4,4'-DDE	< 0.1	ppm
4,4'-DDT	< 0.1	ppm
ENDOSULFAN-ALPHA	< 0.1	ppm
ENDOSULFAN-BETA	< 0.1	ppm
ETHION	< 0.1	ppm

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S6		UNITS
TRITHION	< 0.1	ppm
O,P-DDE	< 0.1	ppm
O,P-DDD	< 0.1	ppm
O,P-DDT	< 0.1	ppm
TEDION	< 0.1	ppm
DIAZINON	< 0.1	ppm
KELTHANE	< 0.1	ppm
ALDICARB	< 0.1	ppm
PCB 1016	< 0.1	ppm
PCB 1221	< 0.1	ppm
PCB 1232	< 0.1	ppm
PCB 1242	< 0.1	ppm
PCB 1248	< 0.1	ppm
PCB 1254	< 0.1	ppm
PCB 1260	< 0.1	ppm
METHOMYL	< 0.5	ppm
PERTHANE	< 0.1	ppm
TRIAZINE	< 0.5	ppm
AMETRYN	< 0.5	ppm
ATRAZINE	< 0.5	ppm
PROMETRYN	< 0.5	ppm
SIMAZINE	< 0.5	ppm
ALACHLOR	< 0.5	ppm
TRIFLURALIN	< 0.5	ppm
CARBAMATE	< 0.5	ppm

Envir...

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S6		UNITS
CARBARYL	< 0.5	ppm
CARBOFURAN	< 0.5	ppm
PROPHAM	< 0.5	ppm

Analyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn

Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation:SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S7		UNITS
ENDRIN	< 0.1	ppm
METHOXYCHLOR	< 0.1	ppm
PARATHION	< 0.1	ppm
T.O.C	3,478	ppm
TOXAPHENE	< 0.1	ppm
GUTHION	< 0.1	ppm
ALDRIN	< 0.1	ppm
DIELDRIN	< 0.1	ppm
ENDRIN ALDEHYDE	< 0.1	ppm
HEPTACHLOR	< 0.1	ppm
HEPTACHLOR-EPOXIDE	< 0.1	ppm
ALPHA BHC	< 0.1	ppm
BETA BHC	< 0.1	ppm
GAMMA BHC	< 0.1	ppm
DELTA BHC	< 0.1	ppm
ENDOSULFAN SULFATE	< 0.1	ppm
CHLORDANE	< 0.1	ppm
MALATHION	< 0.1	ppm
4,4'-DDD	< 0.1	ppm
4,4'-DDE	< 0.1	ppm
4,4'-DDT	< 0.1	ppm
ENDOSULFAN-ALPHA	< 0.1	ppm
ENDOSULFAN-BETA	< 0.1	ppm
ETHION	< 0.1	ppm

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S7		UNITS
TRITHION	< 0.1	ppm
O,P-DDE	< 0.1	ppm
O,P-DDD	< 0.1	ppm
O,P-DDT	< 0.1	ppm
TEDION	< 0.1	ppm
DIAZINON	< 0.1	ppm
KELTHANE	< 0.1	ppm
ALDICARB	< 0.1	ppm
PCB 1016	< 0.1	ppm
PCB 1221	< 0.1	ppm
PCB 1232	< 0.1	ppm
PCB 1242	< 0.1	ppm
PCB 1248	< 0.1	ppm
PCB 1254	< 0.1	ppm
PCB 1260	< 0.1	ppm
METHOMYL	< 0.5	ppm
PERTHANE	< 0.1	ppm
TRIAZINE	< 0.5	ppm
AMETRYN	< 0.5	ppm
ATRAZINE	< 0.5	ppm
PROMETRYN	< 0.5	ppm
SIMAZINE	< 0.5	ppm
ALACHLOR	< 0.5	ppm
TRIFLURALIN	< 0.5	ppm
CARBAMATE	< 0.5	ppm

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S7		UNITS
CARBARYL	< 0.5	ppm
CARBOFURAN	< 0.5	ppm
PROPHAM	< 0.5	ppm

Analyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S8		UNITS
ENDRIN	< 0.1	ppm
METHOXYCHLOR	< 0.1	ppm
PARATHION	< 0.1	ppm
T.O.C	4,765	ppm
TOXAPHENE	< 0.1	ppm
GUTHION	< 0.1	ppm
ALDRIN	< 0.1	ppm
DIELDRIN	< 0.1	ppm
ENDRIN ALDEHYDE	< 0.1	ppm
HEPTACHLOR	< 0.1	ppm
HEPTACHLOR-EPOXIDE	< 0.1	ppm
ALPHA BHC	< 0.1	ppm
BETA BHC	< 0.1	ppm
GAMMA BHC	< 0.1	ppm
DELTA BHC	< 0.1	ppm
ENDOSULFAN SULFATE	< 0.1	ppm
CHLORDANE	< 0.1	ppm
MALATHION	3.3	ppm
4,4'-DDD	< 0.1	ppm
4,4'-DDE	< 0.1	ppm
4,4'-DDT	< 0.1	ppm
ENDOSULFAN-ALPHA	< 0.1	ppm
ENDOSULFAN-BETA	< 0.1	ppm
ETHION	< 0.1	ppm

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S8		UNITS
TRITHION	< 0.1	ppm
O,P-DDE	< 0.1	ppm
O,P-DDD	< 0.1	ppm
O,P-DDT	< 0.1	ppm
TEDION	< 0.1	ppm
DIAZINON	1.1	ppm
KELTHANE	< 0.1	ppm
ALDICARB	< 0.1	ppm
PCB 1016	< 0.1	ppm
PCB 1221	< 0.1	ppm
PCB 1232	< 0.1	ppm
PCB 1242	< 0.1	ppm
PCB 1248	< 0.1	ppm
PCB 1254	< 0.1	ppm
PCB 1260	< 0.1	ppm
METHOMYL	< 0.5	ppm
PERTHANE	< 0.1	ppm
TRIAZINE	< 0.5	ppm
AMETRYN	< 0.5	ppm
ATRAZINE	< 0.5	ppm
PROMETRYN	< 0.5	ppm
SIMAZINE	< 0.5	ppm
ALACHLOR	< 0.5	ppm
TRIFLURALIN	< 0.5	ppm
CARBAMATE	< 0.5	ppm

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: SEDIMENT

Collected By: YOUR REP.

REPORT OF ANALYSIS : S8		UNITS
CARBARYL	< 0.5	ppm
CARBOFURAN	< 0.5	ppm
PROPHAM	< 0.5	ppm

nalyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S2 - WATER COLUMN SAMPLE		UNITS
ENDRIN	< 0.01	µg/l
METHOXYCHLOR	< 0.3	µg/l
PARATHION	< 1	µg/l
TOXAPHENE	< 0.05	µg/l
GUTHION	< 1	µg/l
ALDRIN	< 0.005	µg/l
DIELDRIN	< 0.01	µg/l
ENDRIN ALDEHYDE	< 0.03	µg/l
HEPTACHLOR	< 0.005	µg/l
HEPTACHLOR-EPOXIDE	< 0.005	µg/l
ALPHA BHC	< 0.005	µg/l
BETA BHC	< 0.005	µg/l
GAMMA BHC	< 0.005	µg/l
DELTA BHC	< 0.005	µg/l
ENDOSULFAN SULFATE	< 0.3	µg/l
CHLORDANE	< 0.05	µg/l
MALATHION	< 1	µg/l
4,4'-DDD	< 0.03	µg/l
4,4'-DDE	< 0.03	µg/l
4,4'-DDT	< 0.03	µg/l
ENDOSULFAN-ALPHA	< 0.01	µg/l
ENDOSULFAN-BETA	< 0.01	µg/l
ETHION	< 1	µg/l
TRITHION	< 1	µg/l

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation:WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S2 - WATER COLUMN SAMPLE		UNITS
O,P-DDE	< 0.01	µg/l
O,P-DDD	< 0.01	µg/l
O,P-DDT	< 0.03	µg/l
TEDION	< 1	µg/l
DIAZINON	< 1	µg/l
KELTHANE	< 1	µg/l
ALDICARB	< 1	µg/l
PCB 1016	< 0.001	µg/l
PCB 1221	< 0.001	µg/l
PCB 1232	< 0.001	µg/l
PCB 1242	< 0.001	µg/l
PCB 1248	< 0.001	µg/l
PCB 1254	< 0.001	µg/l
PCB 1260	< 0.001	µg/l
METHOMYL	< 5	µg/l
PERTHANE	< 1	µg/l
TRIAZINE	< 5	µg/l
AMETRYN	< 5	µg/l
ATRAZINE	< 5	µg/l
PROMETRYN	< 5	µg/l
SIMAZINE	< 5	µg/l
ALACHLOR	< 5	µg/l
TRIFLURALIN	< 5	µg/l
CARBAMATE	< 5	µg/l
CARBARYL	< 5	µg/l

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation:WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S2 - WATER COLUMN SAMPLE		UNITS
CARBOFURAN	< 5	µg/l
PROPHAM	< 5	µg/l

Analyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S3 - WATER COLUMN SAMPLE		UNITS
ENDRIN	< 0.01	µg/l
METHOXYCHLOR	< 0.1	µg/l
PARATHION	< 1	µg/l
TOXAPHENE	< 0.05	µg/l
GUTHION	< 1	µg/l
ALDRIN	< 0.005	µg/l
DIELDRIN	< 0.01	µg/l
ENDRIN ALDEHYDE	< 0.03	µg/l
HEPTACHLOR	< 0.005	µg/l
HEPTACHLOR-EPOXIDE	< 0.005	µg/l
ALPHA BHC	< 0.005	µg/l
BETA BHC	< 0.005	µg/l
GAMMA BHC	< 0.005	µg/l
DELTA BHC	< 0.005	µg/l
ENDOSULFAN SULFATE	< 0.3	µg/l
HLORDANE	< 0.05	µg/l
ALATHION	< 1	µg/l
4,4'-DDD	< 0.03	µg/l
4,4'-DDE	< 0.01	µg/l
4,4'-DDT	< 0.03	µg/l
ENDOSULFAN-ALPHA	< 0.01	µg/l
ENDOSULFAN-BETA	< 0.01	µg/l
ETHION	< 1	µg/l
TRITHION	< 1	µg/l

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Collected By: YOUR REP.
Sample Designation: WATER COLUMN SAMPLE

REPORT OF ANALYSIS : S3 - WATER COLUMN SAMPLE		UNITS
O,P-DDE	< 0.01	µg/l
O,P-DDD	< 0.01	µg/l
O,P-DDT	< 0.03	µg/l
TEDION	< 1	µg/l
DIAZINON	< 1	µg/l
KELTHANE	< 1	µg/l
ALDICARB	< 1	µg/l
PCB 1016	< 0.001	µg/l
PCB 1221	< 0.001	µg/l
PCB 1232	< 0.001	µg/l
PCB 1242	< 0.001	µg/l
PCB 1248	< 0.001	µg/l
PCB 1254	< 0.001	µg/l
PCB 1260	< 0.001	µg/l
METHOMYL	< 5	µg/l
PERTHANE	< 1	µg/l
TRIAZINE	< 5	µg/l
AMETRYN	< 5	µg/l
ATRAZINE	< 5	µg/l
PROMETRYN	< 5	µg/l
SIMAZINE	< 5	µg/l
ALACHLOR	< 5	µg/l
TRIFLURALIN	< 5	µg/l
CARBAMATE	< 5	µg/l
CARBARYL	< 5	µg/l

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S3 - WATER COLUMN SAMPLE		UNITS
CARBOFURAN	< 5	µg/l
PROPHAM	< 5	µg/l

Analyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S4 - WATER COLUMN SAMPLE		UNITS
ENDRIN	< 0.01	µg/l
METHOXYCHLOR	< 0.1	µg/l
PARATHION	< 1	µg/l
TOXAPHENE	< 0.05	µg/l
GUTHION	< 1	µg/l
ALDRIN	< 0.005	µg/l
DIELDRIN	< 0.01	µg/l
ENDRIN ALDEHYDE	< 0.03	µg/l
HEPTACHLOR	< 0.005	µg/l
HEPTACHLOR-EPOXIDE	< 0.005	µg/l
ALPHA BHC	< 0.005	µg/l
BETA BHC	< 0.005	µg/l
GAMMA BHC	< 0.005	µg/l
DELTA BHC	< 0.005	µg/l
ENDOSULFAN SULFATE	< 0.3	µg/l
CHLORDANE	< 0.05	µg/l
MALATHION	< 1	µg/l
4,4'-DDD	< 0.03	µg/l
4,4'-DDE	< 0.01	µg/l
4,4'-DDT	< 0.03	µg/l
ENDOSULFAN-ALPHA	< 0.01	µg/l
ENDOSULFAN-BETA	< 0.01	µg/l
ETHION	< 1	µg/l
TRITHION	< 1	µg/l

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation:WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S4 - WATER COLUMN SAMPLE		UNITS
O,[illegible]-DDE	< 0.01	µg/l
O,P-DDD	< 0.01	µg/l
O,P-DDT	< 0.03	µg/l
TEDION	< 1	µg/l
DIAZINON	< 1	µg/l
KELTHANE	< 1	µg/l
ALDICARB	< 1	µg/l
PCB 1016	< 0.001	µg/l
PCB 1221	< 0.001	µg/l
PCB 1232	< 0.001	µg/l
PCB 1242	< 0.001	µg/l
PCB 1248	< 0.001	µg/l
PCB 1254	< 0.001	µg/l
PCB 1260	< 0.001	µg/l
METHOMYL	< 5	µg/l
[illegible]THANE	< 1	µg/l
[illegible]INE	< 5	µg/l
AMETRYN	< 5	µg/l
ATRAZINE	< 5	µg/l
PROMETRYN	< 5	µg/l
SIMAZINE	< 5	µg/l
ALACHLOR	< 5	µg/l
TRIFLURALIN	< 5	µg/l
CARBAMATE	< 5	µg/l
CARBARYL	< 5	µg/l

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S4 - WATER COLUMN SAMPLE		UNITS
CARBOFURAN	< 5	µg/l
PROPHAM	< 5	µg/l

Analyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Collected By: YOUR REP.
Sample Designation:WATER COLUMN SAMPLE

REPORT OF ANALYSIS : S6 - WATER COLUMN SAMPLE		UNITS
ENDRIN	< 0.01	µg/l
METHOXYCHLOR	< 0.3	µg/l
PARATHION	< 1	µg/l
TOXAPHENE	< 0.05	µg/l
GUTHION	< 1	µg/l
ALDRIN	< 0.005	µg/l
DIELDRIN	< 0.01	µg/l
ENDRIN ALDEHYDE	< 0.03	µg/l
HEPTACHLOR	< 0.005	µg/l
HEPTACHLOR-EPOXIDE	< 0.005	µg/l
ALPHA BHC	< 0.005	µg/l
BETA BHC	< 0.005	µg/l
GAMMA BHC	< 0.005	µg/l
DELTA BHC	< 0.005	µg/l
ENDOSULFAN SULFATE	< 0.3	µg/l
CHLORDANE	< 0.05	µg/l
MALATHION	< 1	µg/l
4,4'-DDD	< 0.03	µg/l
4,4'-DDE	< 0.03	µg/l
4,4'-DDT	< 0.03	µg/l
ENDOSULFAN-ALPHA	< 0.01	µg/l
ENDOSULFAN-BETA	< 0.01	µg/l
ETHION	< 1	µg/l
TRITHION	< 1	µg/l

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Collected By: YOUR REP.
Sample Designation: WATER COLUMN SAMPLE

REPORT OF ANALYSIS : S6 - WATER COLUMN SAMPLE		UNITS
O,P-DDE	< 0.01	µg/l
O,P-DDD	< 0.01	µg/l
O,P-DDT	< 0.03	µg/l
TEDION	< 1	µg/l
ZINON	< 1	µg/l
KELTHANE	< 1	µg/l
ALDICARB	< 1	µg/l
PCB 1016	< 0.001	µg/l
PCB 1221	< 0.001	µg/l
PCB 1232	< 0.001	µg/l
PCB 1242	< 0.001	µg/l
PCB 1248	< 0.001	µg/l
PCB 1254	< 0.001	µg/l
PCB 1260	< 0.001	µg/l
METHOMYL	< 5	µg/l
ERTHANE	< 1	µg/l
TRIAZINE	< 5	µg/l
AMETRYN	< 5	µg/l
ATRAZINE	< 5	µg/l
PROMETRYN	< 5	µg/l
SIMAZINE	< 5	µg/l
ALACHLOR	< 5	µg/l
TRIFLURALIN	< 5	µg/l
CARBAMATE	< 5	µg/l
CARBARYL	< 5	µg/l

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation:WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S6 - WATER COLUMN SAMPLE		UNITS
CARBOFURAN	< 5	µg/1
PROPHAM	< 5	µg/1

Analyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation:WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S7 - WATER COLUMN SAMPLE		UNITS
ENDRIN	< 0.01	µg/l
METHOXYCHLOR	< 0.3	µg/l
PARATHION	< 1	µg/l
TOXAPHENE	< 0.05	µg/l
GUTHION	< 1	µg/l
ALDRIN	< 0.005	µg/l
DIELDRIN	< 0.01	µg/l
ENDRIN ALDEHYDE	< 0.03	µg/l
HEPTACHLOR	< 0.005	µg/l
HEPTACHLOR-EPOXIDE	< 0.005	µg/l
ALPHA BHC	< 0.005	µg/l
BETA BHC	< 0.005	µg/l
GAMMA BHC	< 0.005	µg/l
DELTA BHC	< 0.005	µg/l
ENDOSULFAN SULFATE	< 0.3	µg/l
CHLORDANE	< 0.05	µg/l
MALATHION	< 1	µg/l
4,4'-DDD	< 0.03	µg/l
4,4'-DDE	< 0.03	µg/l
4,4'-DDT	< 0.03	µg/l
ENDOSULFAN-ALPHA	< 0.01	µg/l
ENDOSULFAN-BETA	< 0.01	µg/l
ETHION	< 1	µg/l
TRITHION	< 1	µg/l

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Collected By: YOUR REP.
Sample Designation: WATER COLUMN SAMPLE

REPORT OF ANALYSIS : S7 - WATER COLUMN SAMPLE		UNITS
O,P-DDE	< 0.01	µg/l
O,P-DDD	< 0.01	µg/l
O,P-DDT	< 0.03	µg/l
TEDION	< 1	µg/l
DIAZINON	< 1	µg/l
KELTHANE	< 1	µg/l
ALDICARB	< 1	µg/l
PCB 1016	< 0.001	µg/l
PCB 1221	< 0.001	µg/l
PCB 1232	< 0.001	µg/l
PCB 1242	< 0.001	µg/l
PCB 1248	< 0.001	µg/l
PCB 1254	< 0.001	µg/l
PCB 1260	< 0.001	µg/l
METHOMYL	< 5	µg/l
P[illegible]RTHANE	< 1	µg/l
[illegible]IAZINE	< 5	µg/l
[illegible]TRYN	< 5	µg/l
ATRAZINE	< 5	µg/l
PROMETRYN	< 5	µg/l
SIMAZINE	< 5	µg/l
ALACHLOR	< 5	µg/l
TRIFLURALIN	< 5	µg/l
CARBAMATE	< 5	µg/l
CARBARYL	< 5	µg/l

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S7 - WATER COLUMN SAMPLE		UNITS
CARBOFURAN	< 5	µg/l
PROPHAM	< 5	µg/l

Analyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation:WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S8 - WATER COLUMN SAMPLE		UNITS
ENDRIN	< 0.01	µg/l
METHOXYCHLOR	< 0.3	µg/l
PARATHION	< 1	µg/l
TOXAPHENE	< 0.05	µg/l
GUTHION	< 1	µg/l
ALDRIN	< 0.005	µg/l
DIELDRIN	< 0.01	µg/l
ENDRIN ALDEHYDE	< 0.03	µg/l
HEPTACHLOR	< 0.005	µg/l
HEPTACHLOR-EPOXIDE	< 0.005	µg/l
ALPHA BHC	< 0.005	µg/l
BETA BHC	< 0.005	µg/l
GAMMA BHC	< 0.005	µg/l
DELTA BHC	< 0.005	µg/l
ENDOSULFAN SULFATE	< 0.3	µg/l
CHLORDANE	< 0.05	µg/l
MALATHION	< 1	µg/l
4,4'-DDD	< 0.03	µg/l
4,4'-DDE	< 0.03	µg/l
4,4'-DDT	< 0.03	µg/l
ENDOSULFAN-ALPHA	< 0.01	µg/l
ENDOSULFAN-BETA	< 0.01	µg/l
ETHION	< 1	µg/l
TRITHION	< 1	µg/l

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Collected By: YOUR REP.
Sample Designation: WATER COLUMN SAMPLE

REPORT OF ANALYSIS : S8 - WATER COLUMN SAMPLE		UNITS
,P-DDE	< 0.01	µg/l
O,P-DDD	< 0.01	µg/l
O,P-DDT	< 0.03	µg/l
TEDION	< 1	µg/l
DIAZINON	< 1	µg/l
KELTHANE	< 1	µg/l
ALDICARB	< 1	µg/l
PCB 1016	< 0.001	µg/l
PCB 1221	< 0.001	µg/l
PCB 1232	< 0.001	µg/l
PCB 1242	< 0.001	µg/l
PCB 1248	< 0.001	µg/l
CB 1254	< 0.001	µg/l
CB 1260	< 0.001	µg/l
METHOMYL	< 5	µg/l
PERTHANE	< 1	µg/l
TRIAZINE	< 5	µg/l
AMETRYN	< 5	µg/l
ATRAZINE	< 5	µg/l
PROMETRYN	< 5	µg/l
SIMAZINE	< 5	µg/l
ALACHLOR	< 5	µg/l
TRIFLURALIN	< 5	µg/l
RBAMATE	< 5	µg/l
ARBARYL	< 5	µg/l

2482

SOUTH FLORIDA WATER MANAGEMENT
P.O. BOX V
W. PALM BEACH, FL 33402

April 4, 1986
Report 16267
LAB I.D. 86119

Sample Received: 2/12/86
Sample Designation: WATER COLUMN SAMPLE

Collected By: YOUR REP.

REPORT OF ANALYSIS : S8 - WATER COLUMN SAMPLE		UNITS
CARBOFURAN	< 5	µg/l
PROPHAM	< 5	µg/l

Analyses performed in accordance with E.P.A., A.S.T.M., Standard Methods or other approved methods.

Respectfully Submitted,

Lawrence J. Korn
Lawrence J. Korn
Laboratory Supervisor
Enviropact, Inc.

REPORT OF ANALYSIS

South Fla. Water Management District
Attn: Richard Pfeuffer
3301 Gun Club Road
West Palm Beach, Fla. 33402

Report #: 47504 (9551)
Sampled by: Client(R.P./L.G.)
Date sampled: 06-26-86
Date received: 06-30-86
Date reported: 10-27-86

IDENTIFICATION: #9. S6 #9 @ 0945 hrs. #10. S2 #10 @ 1045 hrs. #11. S3 #11 @ 1110 hrs. #12. S4 #12 @ 150 hrs.

Results expressed in mg/kg.

RESULTS OF ANALYSIS

ORGANOCHLORINE PESTICIDES & PCB's	#9	#10	#11	#12
Aldrin	<0.01	<0.01	<0.01	<0.01
Alpha-BHC	<0.01	<0.01	<0.01	<0.01
Beta-BHC	<0.01	<0.01	<0.01	<0.01
Delta-BHC	<0.01	<0.01	<0.01	<0.01
Gamma-BHC	<0.01	<0.01	<0.01	<0.01
Chlordane	<0.01	<0.01	<0.01	<0.01
Para-DDD	<0.01	<0.01	<0.01	<0.01
Para-DDE	<0.01	<0.01	<0.01	<0.01
Para-DDT	<0.01	<0.01	<0.01	<0.01
Dieldrin	<0.01	<0.01	<0.01	<0.01
Endosulfan I	<0.01	<0.01	<0.01	<0.01
Endosulfan II	<0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	<0.01	<0.01	<0.01	<0.01
Endrin	<0.01	<0.01	<0.01	<0.01
Endrin aldehyde	<0.01	<0.01	<0.01	<0.01
Heptachlor	<0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	<0.01	<0.01	<0.01	<0.01
Kelthane (Dicofal)	<0.01	<0.01	<0.01	<0.01
Toxaphene	<0.05	<0.05	<0.05	<0.05

Results expressed in mg/l unless otherwise designated. < = Less Than.
Our Florida Department of Health & Rehabilitative Service Identification Number is 83141.

Respectfully submitted,
ORLANDO LABORATORIES, INC.

Laboratory Manager

Quality Control

REPORT OF ANALYSIS

South Fla. Water Management District
Attn: Richard Pfeuffer
3301 Gun Club Road
West Palm Beach, Fla. 33402

Report #: 47504 (9551)
Sampled by: Client(R.P./L.G.)
Date sampled: 06-26-86
Date received: 06-30-86
Date reported: 10-27-86

IDENTIFICATION: #9. S6 #9 @ 0945 hrs. #10. S2 #10 @ 1045 hrs. #11. S3 #11 @ 1110 hrs. #12 S4 #12 @ 1150 hrs.

Results expressed in mg/kg.

RESULTS OF ANALYSIS

POLYCHLORINATED BIPHENYLS, PCB's	#9	#10	#11	#12
PCB 1016	<0.01	<0.01	<0.01	<0.01
PCB 1221	<0.01	<0.01	<0.01	<0.01
PCB 1232	<0.01	<0.01	<0.01	<0.01
PCB 1242	<0.01	<0.01	<0.01	<0.01
PCB 1248	<0.01	<0.01	<0.01	<0.01
PCB 1254	<0.01	<0.01	<0.01	<0.01
PCB 1260	<0.01	<0.01	<0.01	<0.01
ORGANOPHOSPHOROUS PESTICIDES				
Diazinon	<0.01	<0.01	<0.01	<0.01
Ethion	<0.01	<0.01	<0.01	<0.01
Guthion (Azinphos methyl)	<0.01	<0.01	<0.01	<0.01
Malathion	<0.01	<0.01	<0.01	<0.01
Parathion	<0.01	<0.01	<0.01	<0.01
Trithion (Carbophenothion)	<0.01	<0.01	<0.01	<0.01

Results expressed in mg/l unless otherwise designated. < = Less Than.
Our Florida Department of Health & Rehabilitative Service Identification Number is 83141.

Respectfully submitted,
ORLANDO LABORATORIES, INC.

Laboratory Manager

Quality Control

REPORT OF ANALYSIS

South Fla. Water Management District
Attn: Richard Pfeuffer
3301 Gun Club Road
West Palm Beach, Fla. 33402

Report #: 47504 (9551)
Sampled by: Client(R.P./L.G.)
Date sampled: 06-26-86
Date received: 06-30-86
Date reported: 10-27-86

IDENTIFICATION: #13. L28I #13 @ 1445 hrs. #15. S7 #15 @ 1355 hrs.
#14. S8 #14 @ 1405 hrs.

Results expressed in mg/kg.

RESULTS OF ANALYSIS

ORGANOCHLORINE PESTICIDES & PCB's	#13	#14	#15
Aldrin	<0.01	<0.01	<0.01
Alpha-BHC	<0.01	<0.01	<0.01
Beta-BHC	<0.01	<0.01	<0.01
Delta-BHC	<0.01	<0.01	<0.01
Gamma-BHC	<0.01	<0.01	<0.01
Chlordane	<0.01	<0.01	<0.01
Para-DDD	<0.01	<0.01	<0.01
Para-DDE	<0.01	<0.01	<0.01
Para-DDT	<0.01	<0.01	<0.01
Dieldrin	<0.01	<0.01	<0.01
Endosulfan I	<0.01	<0.01	<0.01
Endosulfan II	<0.01	<0.01	<0.01
Endosulfan sulfate	<0.01	<0.01	<0.01
Endrin	<0.01	<0.01	<0.01
Endrin aldehyde	<0.01	<0.01	<0.01
Heptachlor	<0.01	<0.01	<0.01
Heptachlor epoxide	<0.01	<0.01	<0.01
Kelthane (Dicofal)	<0.01	<0.01	<0.01
Toxaphene	<0.05	<0.05	<0.05

Results expressed in mg/l unless otherwise designated. < = Less Than.
Our Florida Department of Health & Rehabilitative Service Identification Number is 83141.

Respectfully submitted,
ORLANDO LABORATORIES, INC.

Laboratory Manager

Quality Control

REPORT OF ANALYSIS

South Fla. Water Management District
Attn: Richard Pfeuffer
3301 Gun Club Road
West Palm Beach, Fla. 33402

Report #: 47504 (9551)
Sampled by: Client(R.P./L.G.)
Date sampled: 06-26-86
Date received: 06-30-86
Date reported: 10-27-86
Page 8 of 20

IDENTIFICATION: #13. L28I #13 @ 1445 hrs.
#14. S8 #14 @ 1405 hrs.
#15. S7 #15 @ 1355 hrs.

Results expressed in mg/kg.

RESULTS OF ANALYSIS

POLYCHLORINATED BIPHENYLS, PCB's	#13	#14	#15
PCB 1016	<0.01	<0.01	<0.01
PCB 1221	<0.01	<0.01	<0.01
PCB 1232	<0.01	<0.01	<0.01
PCB 1242	<0.01	<0.01	<0.01
PCB 1248	<0.01	<0.01	<0.01
PCB 1254	<0.01	<0.01	<0.01
PCB 1260	<0.01	<0.01	<0.01

ORGANOPHOSPHOROUS PESTICIDES	#13	#14	#15
Diazinon	<0.01	<0.01	<0.01
Ethion	<0.01	<0.01	<0.01
Guthion (Azinphos methyl)	<0.01	<0.01	<0.01
Malathion	<0.01	<0.01	<0.01
Parathion	<0.01	<0.01	<0.01
Trithion (Carbophenothion)	<0.01	<0.01	<0.01

Results expressed in mg/l unless otherwise designated. < = Less Than.
Our Florida Department of Health & Rehabilitative Service Identification Number is 83141.

Respectfully submitted,
ORLANDO LABORATORIES, INC.

Laboratory Manager

Quality Control

REPORT OF ANALYSIS

South Fla. Water Management District
Attn: Richard Pfeuffer
3301 Gun Club Road
West Palm Beach, Fla. 33402

Report #: 47504 (9551)
Sampled by: Client(R.P./L.G.)
Date sampled: 06-26-86
Date received: 06-30-86
Date reported: 10-27-86

IDENTIFICATION: #9. S6 #9
#10. S2 #10
#11. S3 #11
#12. S4 #12.

Results expressed in mg/kg.

RESULTS OF ANALYSIS

MISCELLANEOUS	#9	#10	#11	#12
2,4-DP*	----	----	----	----
Alachlor	<0.20	<0.20	<0.20	<0.20
Aldicarb	<0.05	<0.05	<0.05	<0.05
Ametryn	<0.10	<0.10	<0.10	<0.10
Atrazine	<0.1	<0.1	<0.1	<0.1
Benomyl*	----	----	----	----
Carbaryl	<10.0	<10.0	<10.0	<10.0
Carbofuran	<0.50	<0.50	<0.50	<0.50
Chloropicrin	<0.01	<0.01	<0.01	<0.01
Chloropyrifos	<0.01	<0.01	<0.01	<0.01
Chlorothalonil	<0.30	<0.30	<0.30	<0.30
Ethoprop	<0.05	<0.05	<0.05	<0.05
Fonofos	<0.05	<0.05	<0.05	<0.05
Glyphosate*	----	----	----	----
Methamidophos*	----	----	----	----
Methomyl	<5.0	<5.0	<5.0	<5.0
Methyl Bromide	<0.001	<0.001	<0.001	<0.001
Methyl parathion	<0.01	<0.01	<0.01	<0.01
Metolachlor	<0.20	<0.20	<0.20	<0.20
Metribuzin	<0.1	<0.1	<0.1	<0.1
Mevinphos	<0.1	<0.1	<0.1	<0.1
Monocrotophos*	----	----	----	----
Oxamyl	<0.1	<0.1	<0.1	<0.1
Paraquat*	----	----	----	----
Perthane	<0.01	<0.01	<0.01	<0.01
Phorate	<0.1	<0.1	<0.1	<0.1
Prometryn	<0.05	<0.05	<0.05	<0.05
Simazine	<0.07	<0.07	<0.07	<0.07
Trifluralin	<0.20	<0.20	<0.20	<0.20

*** Unable to perform analysis at this time.**

Results expressed in mg/l unless otherwise designated. < = Less Than.
Our Florida Department of Health & Rehabilitative Service Identification Number is 83141.

Respectfully submitted,
ORLANDO LABORATORIES, INC.

Laboratory Manager

Quality Control

REPORT OF ANALYSIS

South Fla. Water Management District
Attn: Richard Pfeuffer
3301 Gun Club Road
West Palm Beach, Fla. 33402

Report #: 47504 (9551)
Sampled by: Client(R.P./L.G.)
Date sampled: 06-26-86
Date received: 06-30-86
Date reported: 10-27-86

IDENTIFICATION: #13. L28I #13
#14. S8 #14
#15. S7 #15.

Results expressed in mg/kg.

RESULTS OF ANALYSIS

MISCELLANEOUS	#13	#14	#15
2,4-DP*	----	----	----
Alachlor	<0.20	<0.20	<0.20
Aldicarb	<0.05	<0.05	<0.05
Ametryn	<0.10	<0.10	<0.10
Atrazine	<0.1	<0.1	<0.1
Benomyl*	----	----	----
Carbaryl	<10.0	<10.0	<10.0
Carbofuran	<0.50	<0.50	<0.50
Chloropicrin	<0.01	<0.01	<0.01
Chloropyrifos	<0.01	<0.01	<0.01
Chlorothalonil	<0.30	<0.30	<0.30
Ethoprop	<0.05	<0.05	<0.05
Fonofos	<0.05	<0.05	<0.05
Glyphosate*	----	----	----
Methamidophos*	----	----	----
Methomyl	<5.0	<5.0	<5.0
Methyl Bromide	<0.001	<0.001	<0.001
Methyl parathion	<0.01	<0.01	<0.01
Metolachlor	<0.20	<0.20	<0.20
Metribuzin	<0.1	<0.1	<0.1
Mevinphos	<0.1	<0.1	<0.1
Monocrotophos*	----	----	----
Oxamyl	<0.1	<0.1	<0.1
Paraquat*	----	----	----
Perthane	<0.01	<0.01	<0.01
Phorate	<0.1	<0.1	<0.1
Prometryn	<0.05	<0.05	<0.05
Simazine	<0.07	<0.07	<0.07
Trifluralin	<0.20	<0.20	<0.20

*** Unable to perform analysis at this time.**

Results expressed in mg/l unless otherwise designated. < = Less Than.
Our Florida Department of Health & Rehabilitative Service Identification Number is 83141.

Respectfully submitted,
ORLANDO LABORATORIES, INC.

Laboratory Manager

Quality Control

REPORT OF ANALYSIS

South Fla. Water Management District
Attn: Richard Pfeuffer
3301 Gun Club Road
West Palm Beach, Fla. 33402

Report #: 47504 (9551)
Sampled by: Client(R.P./L.G.)
Date sampled: 06-26-86
Date received: 06-30-86
Date reported: 10-27-86

IDENTIFICATION: #1. S6 #1 @ 0935 hrs.
#2. S2 #2 @ 1040 hrs.
#3. S3 #3 @ 1105 hrs.
#4. S4 #4 @ 1145 hrs.
#5. S8 #5 @ 1400 hrs.
#6 S7 #6 @ 1350 hrs.

RESULTS OF ANALYSIS

MISCELLANEOUS	#1	#2	#3	#4	#5	#6
2,4-D	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,4,5-T	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Alachlor	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Ametryn	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Atrazine	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Metribuzin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Prometryn	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Simazine	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
Trifluralin	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Results expressed in mg/l unless otherwise designated. < = Less Than.
Our Florida Department of Health & Rehabilitative Service Identification Number is 83141.

Respectfully submitted,
ORLANDO LABORATORIES, INC.

Laboratory Manager

Quality Control

PRIMARY DRINKING WATER REGULATIONS ANALYSIS (ORG. & INORG.)

South Fla. Water Management District
Attn: Richard Pfeuffer
3301 Gun Club Road
West Palm Beach, Fla. 33402

Report #: 47504 (9551)
Sampled by: Client(R.P./L.G.)
Date Sampled: 06-30-86
Date Received: 06-30-86
Date Reported: 10-27-86

Identification: #9. S6 #9 — #10. S2 #10 — #11. S3 #11 — #12. S4 #12.

Results expressed in mg/kg.

METHODS & LIMITS: In accordance with Federal Register-Vol. 40, No. 248, Part IV-Wednesday, December 24, 1975. U.S. Environmental Protection Agency, National Interim Primary Drinking Water Regulations.

CONTAMINANT	*MCL	#9	#10	#11	#12
ORGANIC:	"ORGANIC ANALYSES BY GAS CHROMATOGRAPHIC SCREENING"				
Endrin	0.0002	<0.001	<0.001	<0.001	<0.001
Lindane	0.004	<0.01	<0.01	<0.01	<0.01
Methoxychlor	0.1	<1.0	<1.0	<1.0	<1.0
Toxaphene	0.005	<0.05	<0.05	<0.05	<0.05
2,4-D	0.1	<2.0	<2.0	<0.2	<0.2
2,4,5-TP (Silvex)	0.01	<0.2	<0.2	<0.02	<0.02

Results are expressed in mg/l (ppm). *MCL - Maximum Contaminant Levels.
Our Florida Department of Health & Rehabilitative Services Laboratory Identification Number is 83141.

Respectfully Submitted,
ORLANDO LABORATORIES, INC.

Laboratory Manager

Quality Control

PRIMARY DRINKING WATER REGULATIONS ANALYSIS (ORG. & INORG.)

South Fla. Water Management District	Report #: 47504 (9551)
Attn: Richard Pfeuffer	Sampled by: Client(R.P./L.G.)
3301 Gun Club Road	Date Sampled: 06-30-86
West Palm Beach, Fla. 33402	Date Received: 06-30-86
	Date Reported: 10-27-86
	Page 18 of 20

Identification: #13. L28I #13 #15. S7 #15.
#14. S8 #14

Results expressed in mg/kg.

METHODS & LIMITS: In accordance with Federal Register-Vol. 40, No. 248, Part IV-Wednesday, December 24, 1975. U.S. Environmental Protection Agency, National Interim Primary Drinking Water Regulations.

CONTAMINANT	*MCL	#13	#14	#15
ORGANIC:	"ORGANIC ANALYSES BY GAS CHROMATOGRAPHIC SCREENING"			
Endrin	0.0002	<0.001	<0.001	<0.001
Lindane	0.004	<0.01	<0.01	<0.01
Methoxychlor	0.1	<1.0	<1.0	<1.0
Toxaphene	0.005	<0.05	<0.05	<0.05
2,4-D	0.1	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	0.01	<0.02	<0.02	<0.02

Results are expressed in mg/l (ppm). *MCL - Maximum Contaminant Levels. Our Florida Department of Health & Rehabilitative Services Laboratory Identification Number is 83141.

Respectfully Submitted,
ORLANDO LABORATORIES, INC.

Laboratory Manager

Quality Control

EVERGLADES LABORATORIES, INC. 1602 CLARE AVENUE • WEST PALM BEACH, FL 33401 • 305/833-4200

REPORT TO: SOUTH FLORIDA WATER MANAGEMENT DISTRICT
P O BOX V
WEST PALM BEACH, FLORIDA 33402

SUBJECT: ZINC PHOSPHIDE ANALYSIS
DATE/TIME RECEIVED: 09-23-86 1557
COLLECTED BY: RICHARD PFEUFFER

SAMPLE #	DATE COLLECTED	SAMPLE LOCATION	ZINC PHOSPHIDE RESULT, mg/L
23462	09-23-86 1400	#1 STATION CODE S4	<0.001
23463	09-23-86 0930	#2 STATION CODE S3	0.002
23464	09-23-86 1015	#3 STATION CODE S2	0.006
23465	09-23-86 1100	#4 STATION CODE S6	0.005
23466	09-23-86 1130	#5 STATION CODE S7	0.005
23467	09-23-86 1200	#6 STATION CODE S8	0.003

DATE 11-28-86 BY [signature] LAB ID 86109, 86122