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WATER QUALITY AND NUTRIENT LOADINGS OF THE MAJOR INFLOWS FROM THE EVERGLADES AGRICULTURAL AREA TO THE CONSERVATION AREAS, SOUTHEAST FLORIDA

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By

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INTRODUCTION

The S-5A, S-6, S-7 and S-8 pump stations represent major links in the water conveyance system from Lake Okeechobee and the Everglades Agricultural Area to the Conservation Areas which indirectly supply a large part of the water needs of the populated lower east coast. As a major source of water to the Conservation Areas these pump stations influence the water quality and ecology of the Areas.

This sampling program was undertaken to characterize the water quality at each of the pump stations and provide baseline information on the quantity (loading) of selected chemical constituents entering the Conservation Areas. The baseline loadings from the S-5A, S-6, S-7 and S-8 pump stations provide a background against which the proposed backpumping to the Conservation Areas can be assessed.

Pump station S-5A, the largest of the four stations, with a design capacity of 4800 cfs, serves a 204 square mile (52,795 hectares) agricultural basin removing excess water and discharging it into Conservation Area 1 (Fig. 1). The S-6 pump station, located on the Hillsboro Canal (Fig. 1), drains a 137 square mile (35,445 hectares) portion of the Everglades Agricultural Area. This pump station, with a design capacity of 2925 cfs, also discharges into Conservation Area 1. A 129 square mile (33,372 hectares) portion of the Everglades Agricultural Area, drained by the North New River Canal, is served by the S-7 pump station. The S-7 station discharges into Conservation Area 2A (Fig. 1) with a design capacity of 2490 cfs. Located on the Miami Canal, the S-8 pump station serves a 199 square mile (51,587 hectares) portion of the Everglades Agricultural Area. Discharges from S-8 enter C-123 at the northwestern corner of Conservation Area 3 (Fig. 1). S-8 has a design capacity of 4160 cfs.

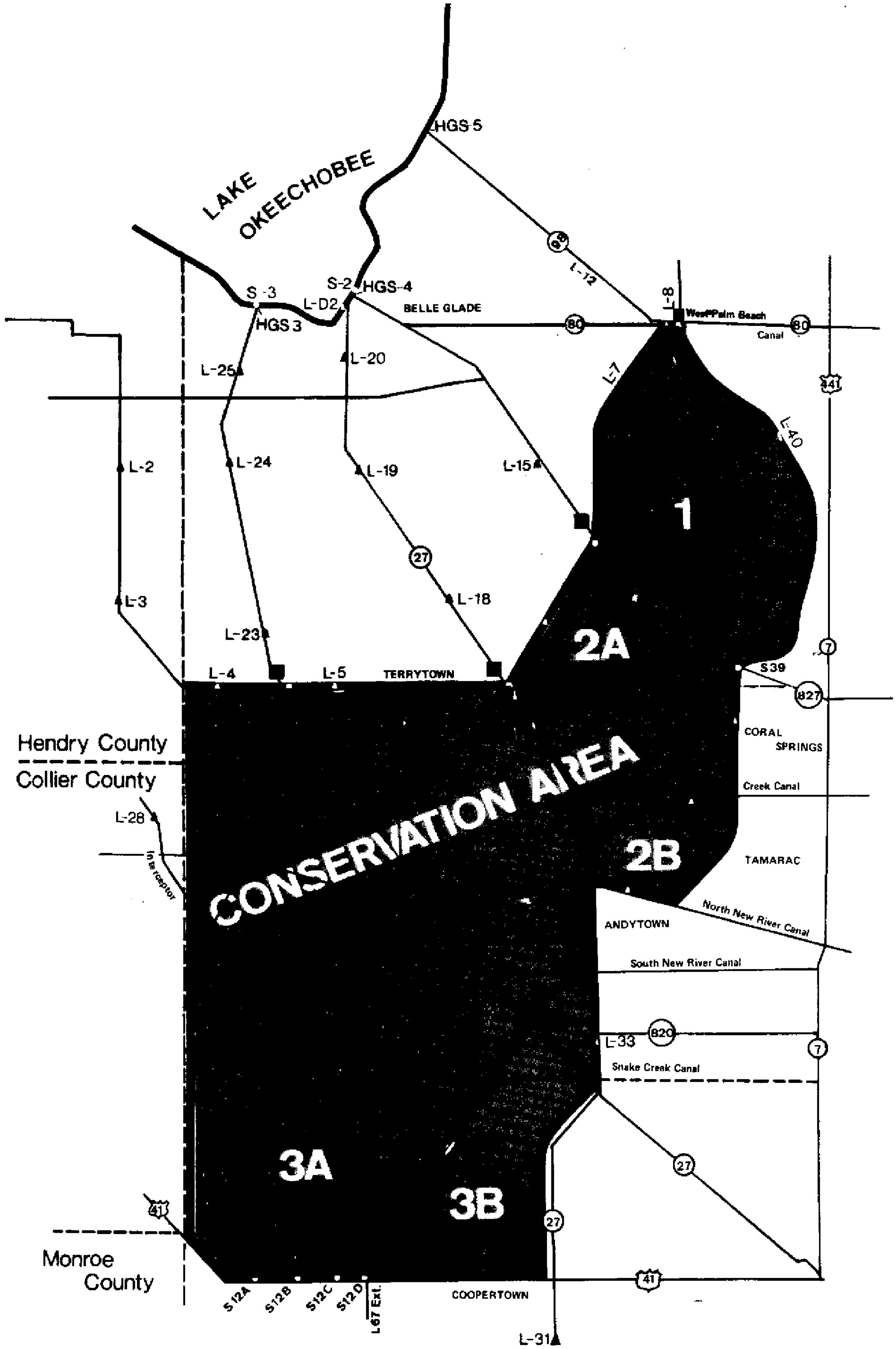

Figure 1 Location of Sampling Stations ■

MATERIALS AND METHODS

Sampling and Analytical Methods

Samples for chemical analyses were collected from the S-5A, S-6, S-7 and S-8 pump stations (Fig. 1) at intervals varying from one week to one month for the period from June 1974 through March 1976. Sampling at the S-8 station was discontinued in December 1975. Water was collected from the surface at the intake side of each of the pump stations using a polyethylene container. Aliquots for total nutrient analyses were then placed directly into 500 ml acid rinsed polyethylene bottles. Samples for dissolved nutrient analyses, cation and anion analyses were field filtered using a .45 μ Nuclepore(R) filters with Nuclepore(R) prefilters. Concentrated nitric acid was added (10 drops/100 ml) to the samples for cation analysis. All samples were iced and transported to the laboratory where they were stored at 4° C until the analyses were run, usually 1 week.

Samples were routinely analyzed for dissolved nutrients (ortho-phosphorus, nitrate plus nitrite, nitrite and ammonia), total phosphorus, total Kjeldahl nitrogen, major constituents (sodium, potassium, calcium, magnesium, chloride and silicate), alkalinity, pH and conductivity. All nutrients, chloride, silicate, and alkalinity analyses were performed using Technicon Industrial Systems II AutoAnalyzers. Cation analyses were run on a Perkin Elmer Model 306 Atomic Absorption Spectrophotometer. Specific analytical methods used for each analysis (Appendix A) were either recommended or approved by the U. S. Environmental Protection Agency or the American Public Health Association.

Loading Calculations

Constituent loads passing through each of the pump stations were calculated using the following formula:

$$Lm = \sum_{i=1}^{n} Q_{sp} \left(\frac{C_1 + C_2}{2}\right)_n$$

where

Lm = Monthly nutrient load from the pump station

n = Number of sampling periods in a given month

Qsp = Flow through the pump station from the first sampling date to the day prior to the next sampling

C_1 = Concentration of nutrient constituent on 1st sampling date

C_2 = Concentration of nutrient constituent on 2nd sampling date

The volume of water (Qsp) passing through each of the pump stations was obtained using the hydrology records of the South Florida Water Management District (formerly the Central and Southern Florida Flood Control District).

Statistical Analysis

The statistical analyses presented in this report were performed using the SPSS statistical package (Nie *et al.*, 1975) available at Florida State University. All analyses of variance (ANOVA's) were done using a fixed effects model (Model 1) with a factorial design. All tests were performed at the .05 significance level.

RESULTS

Water Quality Characteristics

Total Phosphorus concentrations (Table 1) ranged from a low of 0.005 mg/l to a high of 0.268 mg/l and ortho-phosphorus ranged from below the detection limit (<0.002 mg/l) to 0.264 mg/l. The individual pump stations had total phosphorus concentrations (Table 1) which averaged from 0.042 mg/l at S-7 to 0.084 mg/l at S-5A. S-6 and S-8 had nearly the same averages, 0.055 mg/l and 0.053 mg/l respectively. Average ortho-phosphorus concentrations (Table 1) at each of the stations followed the same trend, the highest (0.056 mg/l) being at S-5A the lowest (0.026 mg/l) at S-7 and intermediate levels of 0.034 mg/l and 0.032 mg/l at S-6 and S-8.

Levels of total nitrogen (Table 1) had a large range of variability, the highest value (17.04 mg/l) being nearly 30 times higher than the lowest (0.60 mg/l). Organic nitrogen as well as inorganic nitrogen concentrations varied even more than the totals (Table 1). The range of organic nitrogen concentrations measured was between 14.16 mg/l and 0.15 mg/l. Inorganic nitrogen displayed the largest range with concentrations varying between 8.93 mg/l and 0.03 mg/l. On a station by station basis the average concentrations of total nitrogen (Table 1) varied from 4.58 mg/l at S-5A to 2.47 mg/l at S-7. Organic nitrogen concentrations (Table 1) averaged 3.01 mg/l at S-5A, 2.73 mg/l at S-6, 2.14 mg/l at S-8 and 2.08 mg/l at S-7. The S-5A station also had the highest average inorganic nitrogen concentration (1.60 mg/l) while S-7 had the lowest, 0.63 mg/l. S-6 and S-8 had averages of 0.98 mg/l and 0.93 mg/l respectively.

Chloride concentrations (Table 2) were moderately high at all four stations ranging from 38.9 mg/l to 436.01 mg/l. Averages for each of the stations indicate that S-6 had the highest average (186.4 mg/l) and S-8 the lowest average (97.9

TABLE 1. NUTRIENT CONCENTRATION RESULTS* FROM EACH OF THE PUMP STATIONS

Station	Total PO_4	Ortho PO_4	Total N	Organic N	Inorganic N
S-5A					
Average	0.084	0.056	4.58	3.01	1.60
High	0.194	0.191	15.54	13.53	7.70
Low	0.026	< 0.002	1.02	0.15	0.08
S-6					
Average	0.055	0.034	3.54	2.73	0.98
High	0.268	0.220	17.04	14.16	4.92
Low	< 0.010	< 0.002	0.60	0.84	0.03
S-7					
Average	0.042	0.026	2.47	2.08	0.63
High	0.212	0.175	8.25	9.59	2.51
Low	0.006	< 0.002	0.98	0.79	0.05
S-8					
Average	0.053	0.032	2.93	2.14	0.93
High	0.263	0.264	17.40	8.49	8.93
Low	0.005	< 0.002	1.01	0.77	0.06

*All results are reported in mg/l.

TABLE 2. MAJOR CONSTITUENT AND CONDUCTIVITY RESULTS* FROM EACH OF THE PUMP STATIONS

Station	Cl	Na	K	Ca	Mg	Cond.
S-5A						
Average	177.3	131.77	6.25	74.99	25.79	1030
High	436.0	324.30	11.80	127.28	45.22	2000
Low	48.2	32.60	1.10	40.60	6.70	170
S-6						
Average	186.4	130.50	6.16	86.49	31.52	1112
High	298.2	200.50	18.28	120.94	50.50	1550
Low	54.4	15.00	3.40	42.40	13.50	240
S-7						
Average	151.6	102.19	4.54	88.30	31.34	1025
High	258.2	163.50	6.65	123.58	40.00	1700
Low	71.8	42.00	3.36	44.00	13.20	165
S-8						
Average	97.9	59.38	3.65	80.20	18.98	750
High	188.4	116.56	6.10	122.80	38.00	1450
Low	38.9	24.00	1.58	30.60	7.56	200

* All results in mg/l except conductivity which is μmhos/cm

mg/l), S-5A (177.3 mg/l) and S-7 (151.6 mg/l) had intermediate values. Conductivities, which normally follow cation and anion concentrations closely also had the highest values at the S-6 station (1112 μmhos/cm). The lowest conductivities were at the S-8 station (750 μmhos/cm), S-5A and S-7 again had intermediate average values 1030 μmhos/cm and 1025 μmhos/cm respectively. The S-8 station had the lowest average concentrations for all the major cations except calcium (Table 2) which was lowest at S-5A, however, average calcium concentrations were fairly constant from station to station.

Statistical Comparisons

Generally the S-5A and S-6 pump stations tended to have higher concentrations of total phosphorus, ortho-phosphorus, total nitrogen and chlorides than the S-7 and S-8 stations. A statistical comparison of the four stations for the parameters listed above was conducted using one-way analysis of variance (ANOVA) techniques and the Tukey HSD procedure as described in the Materials and Methods Section. The results (Table 3) indicate that the observed trend of higher concentrations at the S-5A and S-6 stations is statistically significant only with respect to chlorides. All of the 4 parameters tested, however, were significantly higher at S-5A than at the S-7 pump station.

Constituent Loadings

The chemical concentrations have been used to compute mass loadings for several constituents. The term "loading" in this case, refers to the mass or amount of a constituent, such as phosphorus, entering the Conservation Areas via one of the pump stations. The load is calculated by multiplying the concentration of the constituent by the amount of water passing through the structure and is reported in metric tons.

The mass loadings from each of the pump stations (Table 4) indicate that

TABLE 3. STATISTICAL RESULTS OF TUKEY'S TESTS FOR SIGNIFICANCE DIFFERENCES* BETWEEN STATIONS.

Parameter	Station			
$T\text{-}PO_4$	S-5A	S-6	S-8	S-7
	.084	.055	.053	.042
$O\text{-}PO_4$	S-5A	S-6	S-8	S-7
	.056	.034	.032	.026
Total Nitrogen	S-5A	S-6	S-8	S-7
	4.58	3.54	2.93	2.47
Chloride	S-6	S-5A	S-7	S-8
	184.0	177.9	148.4	97.1

*Station results underlined by a single line are not significantly different. All other results are significantly different.

TABLE 4. MASS LOADINGS* OF SELECTED PARAMETERS FROM THE FOUR PUMP STATIONS

		Parameter			
Station	Period	Phosphorus	Nitrogen	Sodium	Chloride
S-5A	6/74-12/74	38	2487	45,465	57,778
	1975	32	2001	45,470	61,056
	1/76-3/76	4	194	6,487	8,758
	Total	74	4682	97,422	127,592
S-6	6/74-12/74	20	919	23,981	34,606
	1975	8	563	19,166	27,346
	1/76-3/76	1	187	3,256	4,593
	Total	29	1669	46,403	66,545
S-7	6/74-12/74	13	974	20,101	30,882
	1975	4	226	8,387	12,448
	1/76-3/76	< 1	11	373	583
	Total	17	1210	28,861	43,913
S-8	6/74-12/74	32	1503	15,981	32,298
	1975	26	1030	24,763	37,448
	Total	58	2533	40,744	69,746

* All values are reported in metric tons

S-5A had the highest mass loadings for all the constituents considered. Hydrological data (Table 5) from the pump stations shows that the S-5A station had greater flows than the other three stations. Since the mass loading is a function of both the concentration and the flow, the higher loadings reported at S-5A are partially due to the greater volumes of water.

A comparison between the four stations can be made if the loadings are normalized according to flow. Dividing the mass loading by the volume of water gives a normalized loading or flow weighted concentration. The flow weighted concentrations computed for each of the stations (Table 6) show a somewhat large range of variability when compared between stations and to the average concentrations for the same station.

Nitrogen varied in concentration from a high of 6.61 mg/l at the S-5A station to a low of 3.24 mg/l at S-8 when calculated on a flow weighted basis (Table 6). These values are somewhat higher compared to the average concentrations of 4.58 mg/l and 2.93 mg/l at the respective stations. Flow weighted total phosphorus concentrations (Table 6) were highest (0.125 mg/l) at S-6 and the lowest (0.054 mg/l) at the S-7 station and compared to average concentrations of 0.055 mg/l and 0.042 mg/l at the two stations.

Sodium and chloride, both conservative elements, varied largely between stations; but the flow weighted concentrations did not differ greatly from the straight average concentrations at the same stations (Tables 2 and 6). Sodium concentrations on a flow weighted basis, were higher than the average concentrations at S-5A and S-8 and lower than the average concentrations at S-6 and S-7. Flow weighted chloride concentrations were higher than the average concentrations at S-5A and S-6 but lower at S-7 and S-8.

TABLE 5. TOTAL DISCHARGES* FROM THE S-5A, S-6, S-7 AND S-8 PUMP STATIONS

Period	Station			
	S-5A	S-6	S-7	S-8
6/1/74-12/31/74	282,040	160,490	189,018	305,292
1975	265,270	112,050	62,350	327,850
1/1/76-3/5/76	26,680	15,080	2,384	
Total	573,990	287,620	253,752	633,142

* Discharges are all reported in acre-feet.

TABLE 6. FLOW WEIGHTED CONCENTRATIONS* FOR THE S-5A, S-6, S-7 AND S-8 PUMP STATIONS

		Parameter			
Station	Period	Phosphorus (mg/l)	Nitrogen (mg/l)	Sodium (mg/l)	Chloride (mg/l)
S-5A	6/74-12/74	0.109	7.15	130.7	166.1
	1975	0.098	6.11	139.0	186.6
	1/76-3/76	0.109	5.90	197.1	266.1
	Combined	0.104	6.61	137.6	180.2
S-6	6/74-12/74	0.102	4.64	121.1	174.8
	1975	0.059	4.07	138.7	197.8
	1/76-3/76	0.048	10.03	174.9	246.7
	Combined	0.082	4.70	130.7	187.4
S-7	6/74-12/74	0.055	4.18	86.2	132.4
	1975	0.055	2.94	109.0	161.9
	1/76-3/76	0.017	3.64	126.8	199.2
	Combined	0.054	3.87	140.3	92.2
S-8	6/74-12/74	0.086	3.99	42.4	85.8
	1975	0.063	2.55	61.2	92.6
	1/76-3/76	-	-	-	-
	Combined	0.074	3.24	52.2	89.3

DISCUSSION

The S-5A, S-6, S-7 and S-8 pump stations are the largest sources of surface water inflow into the Conservation Areas, accounting for 49% (SFWMD Hydrology Records) of all the surface water inflows during the period from 1970 through 1975. When the inflows from these pump stations are viewed on an Area by Area basis their significance becomes even more pronounced. The S-5A and S-6 stations accounted for nearly 100% of the total surface water inflows to Conservation Area 1 over the 14 year period from 1963 through 1976. The S-7 pump station contributes all of the surface water inflows entering Area 2A from sources other than Area 1. During the 13 year period from 1963 through 1975 the S-7 station contributed 36% of the surface water inflow to Area 2A the remaining 64% coming from Area 1 via the S-10 structures. The period of record for Conservation Area 3 with the present inflows dates back to 1969; but in the seven year period through 1975 S-8 contributed 27% of the surface water inflows, more than any single structure except the S-11 structures.

The water budget of the Conservation Areas for the period from 1974 to 1976 consisted of approximately 57% rainfall and 43% surface water inflows. Area by Area the percentage of the water budget contributed by rainfall varied from 49% in Area 2A up to 63% in Area 3A during the same 1974 to 1976 period.

The relatively large volumes of water discharged from the S-5A, S-6, S-7 and S-8 pump stations makes these stations important sources of nutrient loadings to the Conservation Areas. Estimated nutrient loadings computed using water quality data from the United States Geological Survey and the South Florida Water Management District (formerly the Central and Southern Florida Flood Control District), for calendar year 1974, indicate that the S-5A, S-6, S-7 and

S-8 pump stations contributed 76% of the phosphorus and 90% of the nitrogen loads entering the Conservation Areas from external surface water sources (Table 7), however, these pump stations accounted for approximately 60% by volume, of the surface water inflows.

Due to the design of these pump stations and the receiving bodies, much of the water passing through the structure does not impact the areas of the marsh immediately adjacent to the discharges. The flow from S-5A, as evidenced by chloride concentrations, is confined mainly to the perimeter canals (L-40 and L-7) and a narrow band of marsh along the canals (Waller, B. G. and Earle, J. E. 1975). The southern portion of Area 1 (Fig. 1) north of the S-10 structures is the point where the discharges from both S-5A and S-6 penetrate most deeply into the marsh. The discharge from the S-7 station is confined mostly to the L-38E conveyance channel and has very little penetration into the marsh itself. Similarly the S-8 pump station discharges are largely confined to the C-123 canal and have a very limited penetration into the marsh areas.

One method of comparing the relative contributions of the four pump stations with other water nutrient loadings is to compare the flow weighted nutrient concentrations of all the sources. These flow weighted concentrations (Table 8) show that the S-5A, S-6, S-7 and S-8 pump stations contributed more nitrogen per volume of water discharged than all but one other station. The S-5A and S-6 stations also contributed relatively high amounts of phosphorus per volume of water discharged. The relatively high flow weighted nutrient concentrations at the S-5A, S-6, S-7, and S-8 pump stations accentuates the disproportionate loadings contributed by these stations.

Relationship between Discharge and Concentration

The differences evident between the average concentrations (Table 1) and

TABLE 7. LOADING ESTIMATES AND PERCENT OF THE TOTAL LOADINGS FROM ALL SURFACE WATER INFLOWS TO THE CONSERVATION AREAS IN 1974.*

Source	Phosphorus Load Metric Tons	% of Total	Nitrogen Load Metric Tons	% of Total
S-5A	39	28	2535	37
S-6	20	14	930	14
S-7	14	10	1055	15
S-8	34	24	1643	24
S-9	3	2	193	3
S-140	21	15	286	4
S-150	2	1	113	2
S-190	6	4	93	1
Total	139		6848	

* Water quality data for loading calculations from USGS 1975, 1976.

TABLE 8. FLOW WEIGHTED NUTRIENT CONCENTRATIONS FOR ALL MAJOR EXTERNAL SURFACE WATER INFLOWS INTO THE CONSERVATION AREAS IN 1974

		Flow Weighted Concentration (mg/l)	
Source	Flow (Acre-Feet)	Phosphorus	Nitrogen
S-5A	293,690	.11	7.0
S-6	164,500	.10	4.6
S-7	220,330	.05	3.9
S-8	344,400	.08	3.9
S-9	89,270	.03	1.8
S-140	137,050	.12	1.7
S-150	18,250	.08	5.0
S-190	59,210	.08	1.3

the flow weighted concentrations (Table 8) indicate a possible relationship between the water chemistry and the discharge of water through the structures. Graphical presentation of the discharges and concentrations of selected parameters vs time (Figs. 2 through 13) also indicates a discharge-concentration relationship may exist for several of the parameters.

Since discharges from the pump stations are essentially the result of rainfall and its subsequent runoff or, at the S-7 and S-8 stations, releases of water from Lake Okeechobee through the hurricane gate structures, relationships between water chemistry and discharges from the pump stations not due to releases from the Lake, can be used to infer the effect of runoff on the water chemistry. This approach (discharge vs water chemistry) is more desirable than using the rainfall vs water chemistry approach because the water management practices of the agricultural areas make the relationship between rainfall and runoff extremely complex.

The analysis of variance approach was selected to test for any statistically significant differences in constituent concentrations between periods of discharge due to runoff from the basin, discharge due to releases from Lake Okeechobee and periods of no discharge. Samples were considered to correspond to a period of discharge due to releases from the lake if they were collected on days when releases from the hurricane gates exceeded 50% of the discharge from the pump station or less than 50% when no rainfall occurred in the week prior to the sampling date.

The two factor analysis of variance approach, using discharge and station as factors, was used to assure that the test results applied to each of the four stations. The two factor approach allows for the evaluation of a discharge-station interaction term which will be significant if the effect of the discharge factor on the constituent concentration is not a parallel event across all four stations.

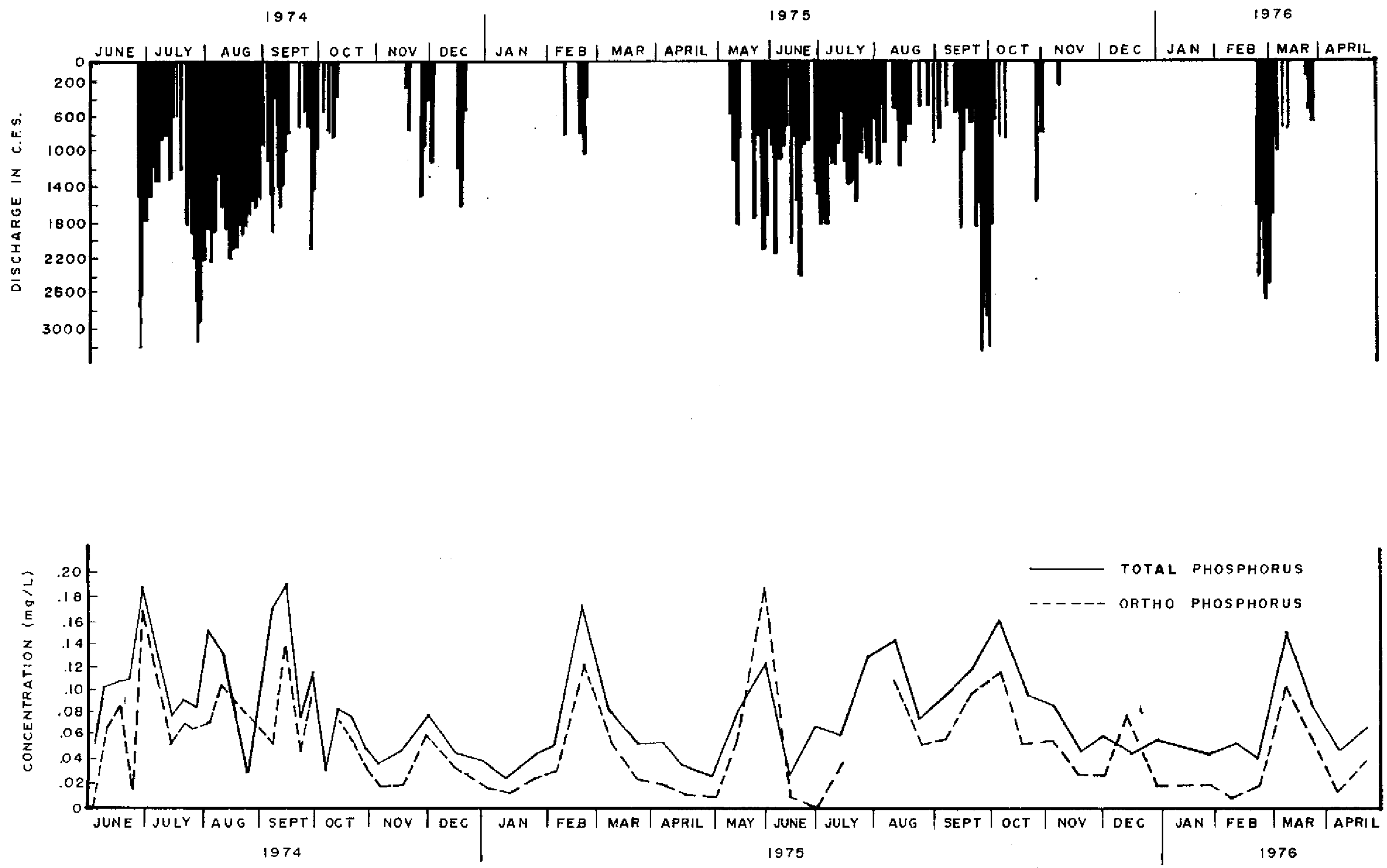

Figure 2 PHOSPHORUS CONCENTRATION VS DISCHARGE AT S-5A

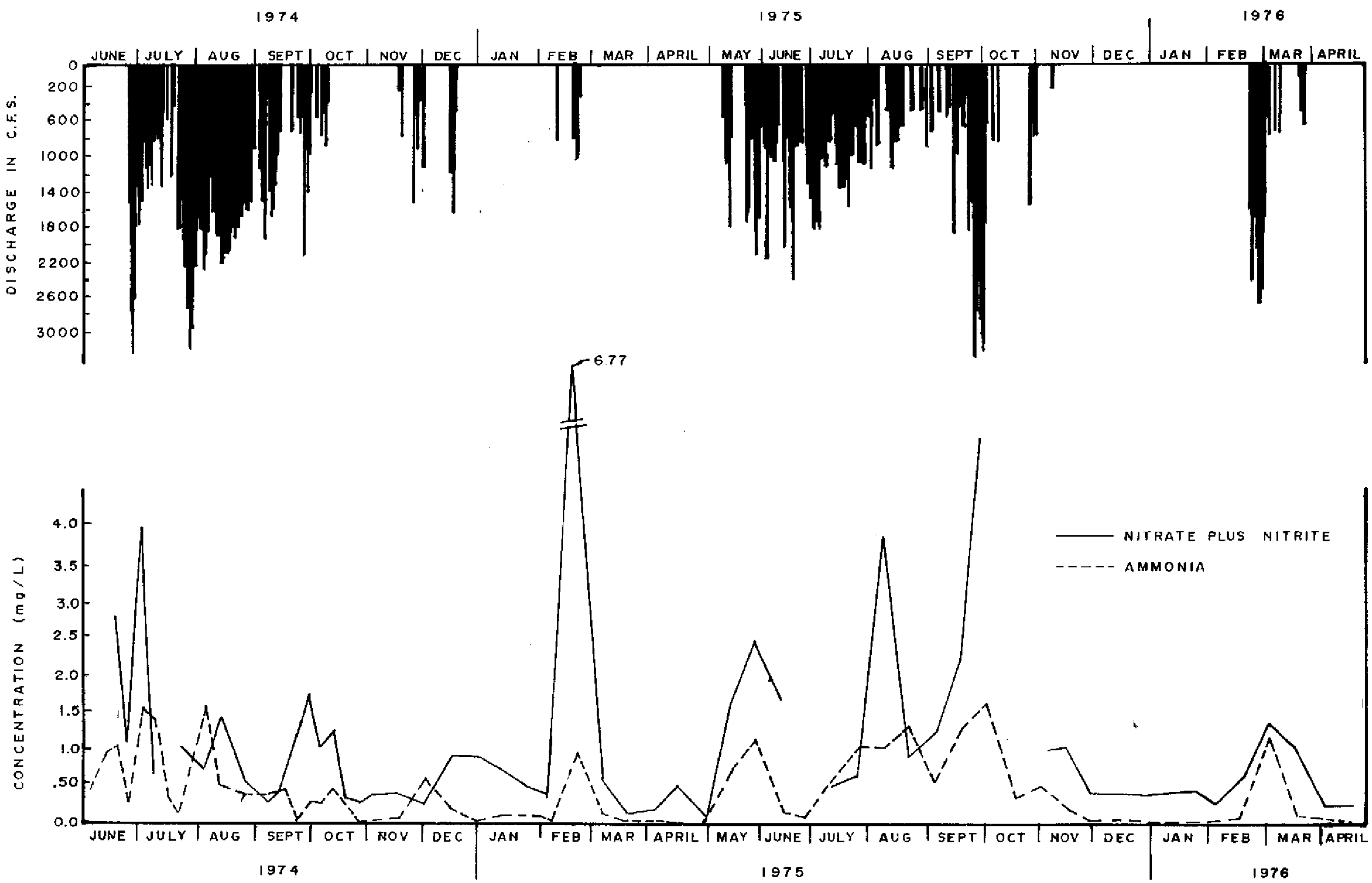

Figure 3 INORGANIC NITROGEN SPECIES VS DISCHARGE AT S-5A

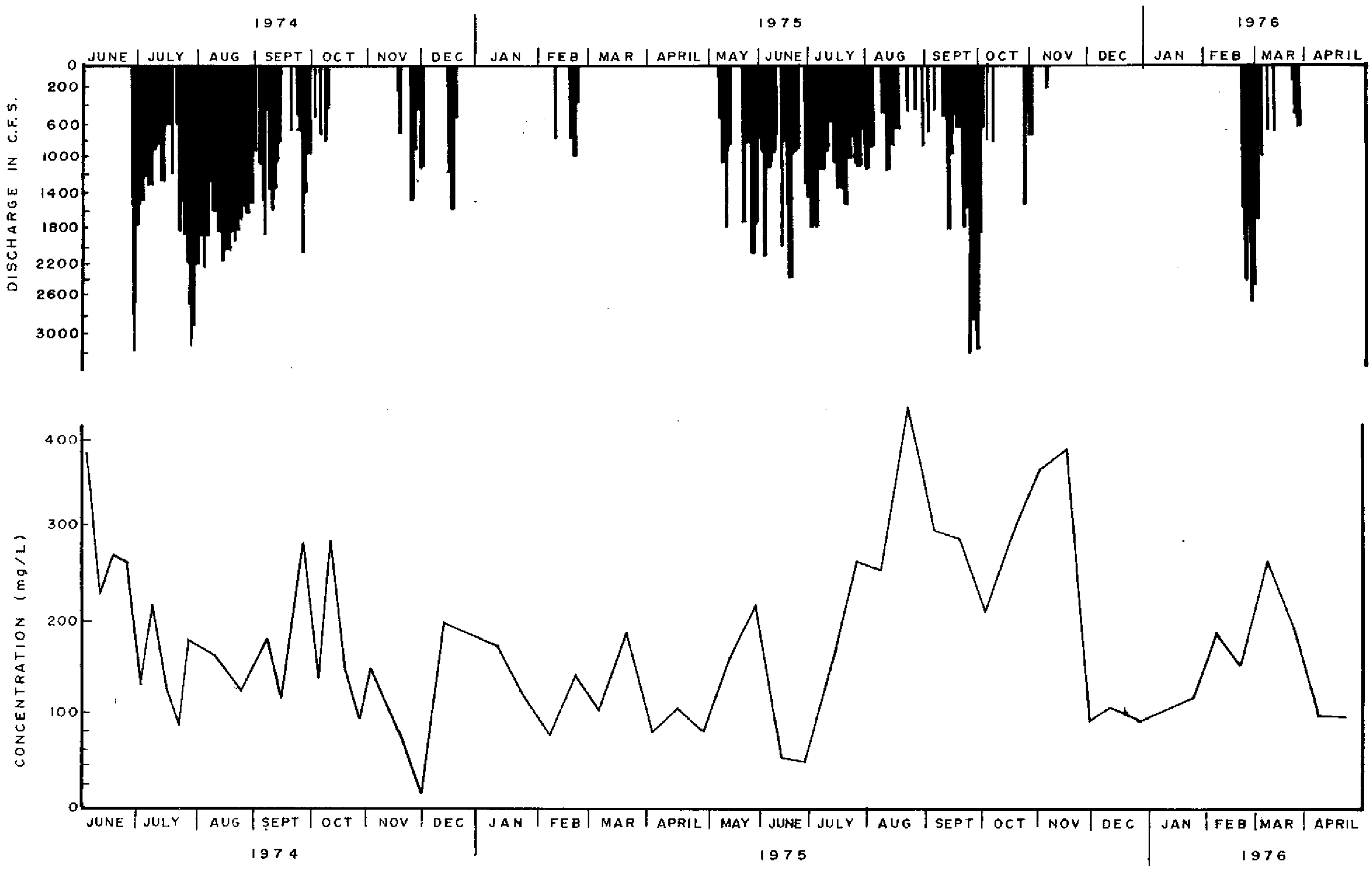

Figure 4 CHLORIDE CONCENTRATION VS DISCHARGE AT S-5A

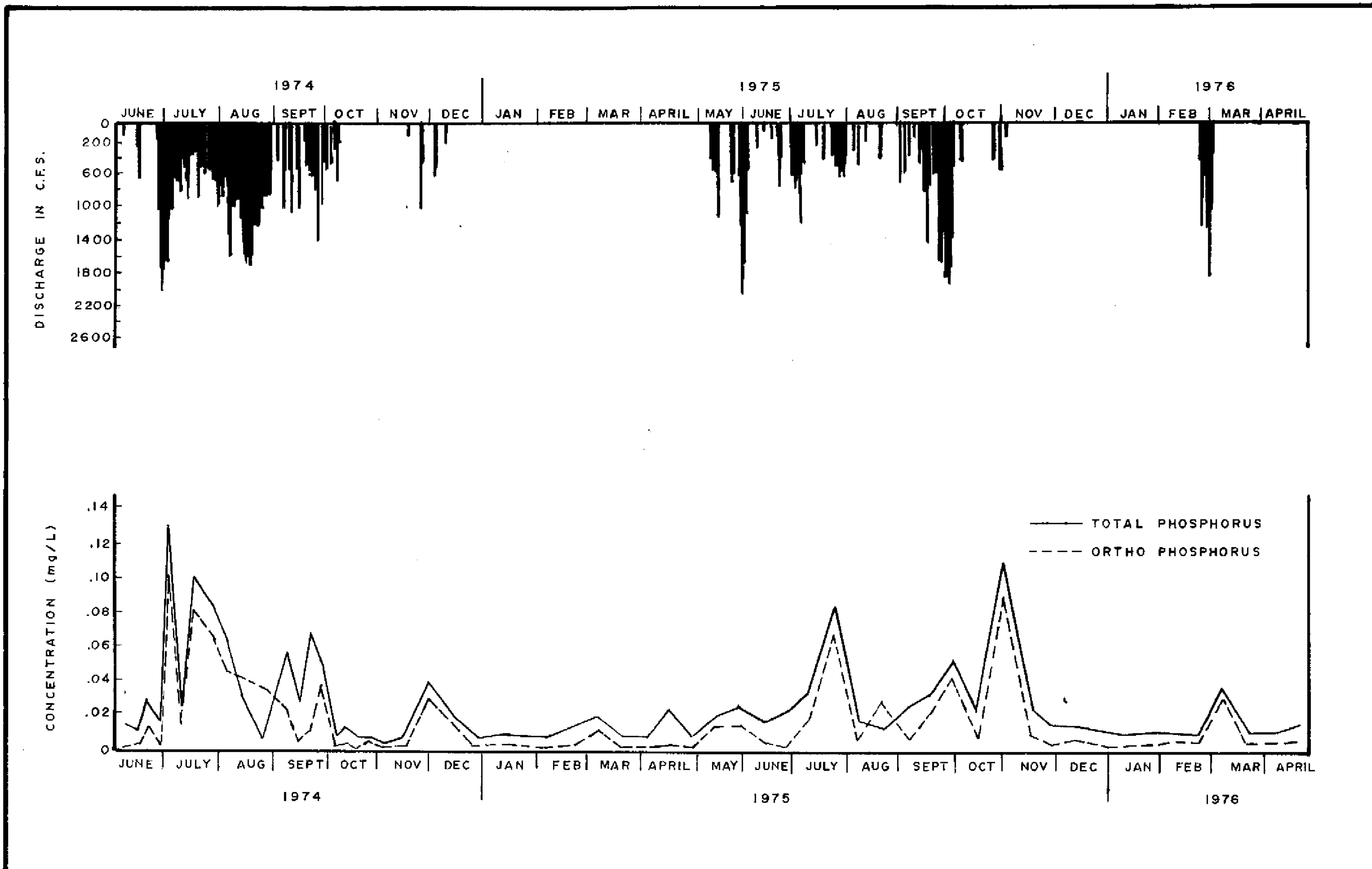

Figure 5 PHOSPHORUS CONCENTRATION VS DISCHARGE AT S-6

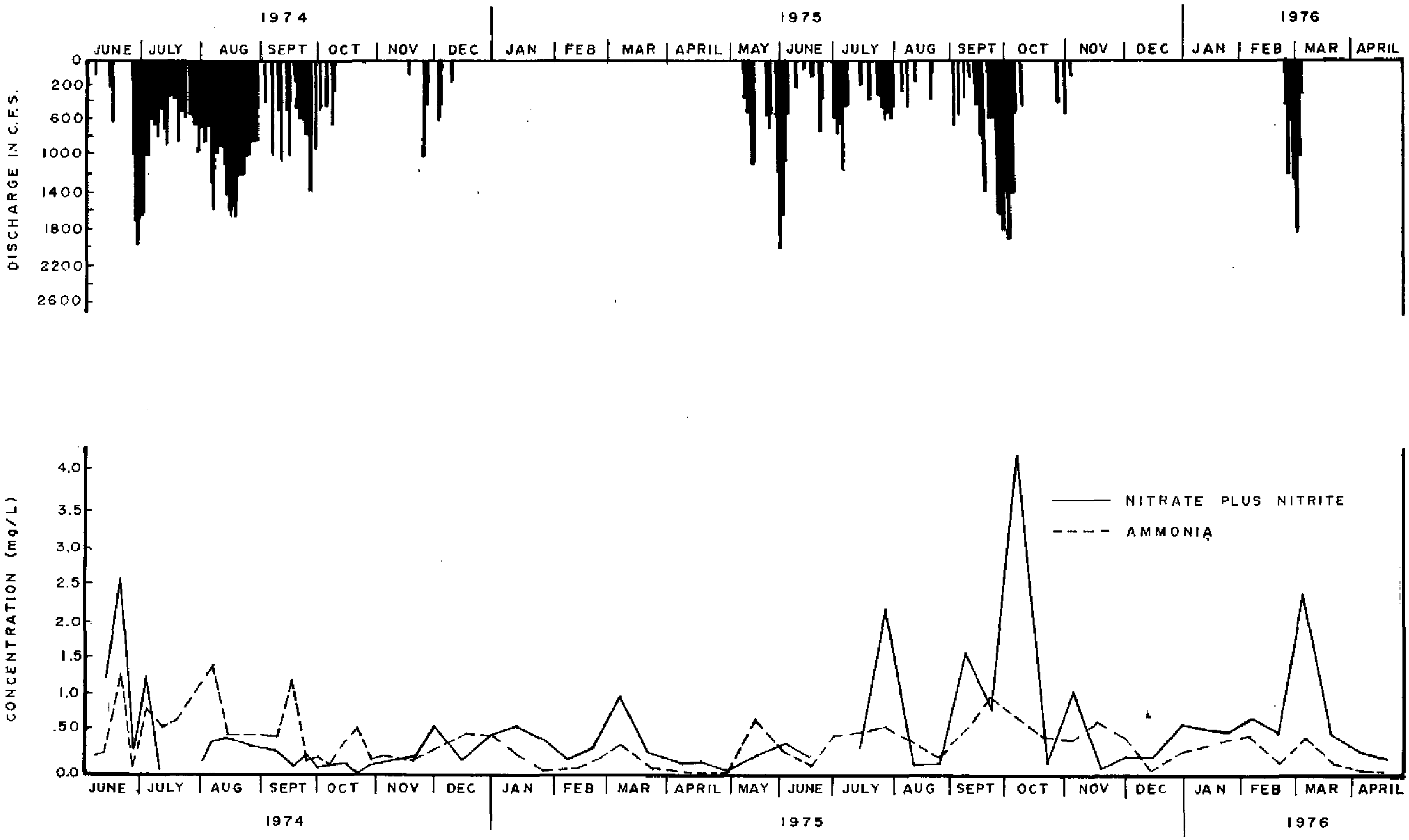

Figure 6 INORGANIC NITROGEN SPECIES VS DISCHARGE AT S-6

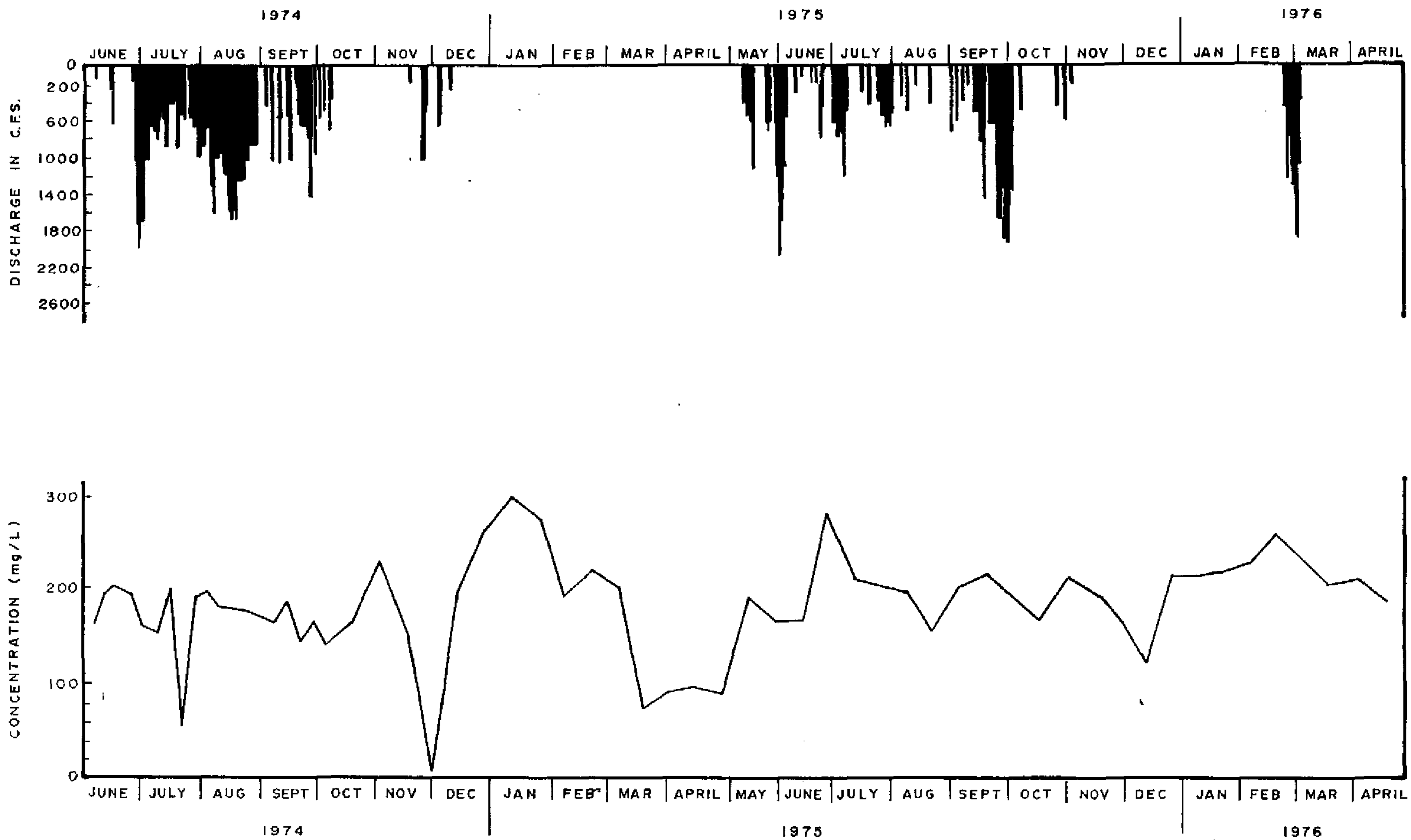

Figure 7 CHLORIDE CONCENTRATION VS DISCHARGE AT S-6

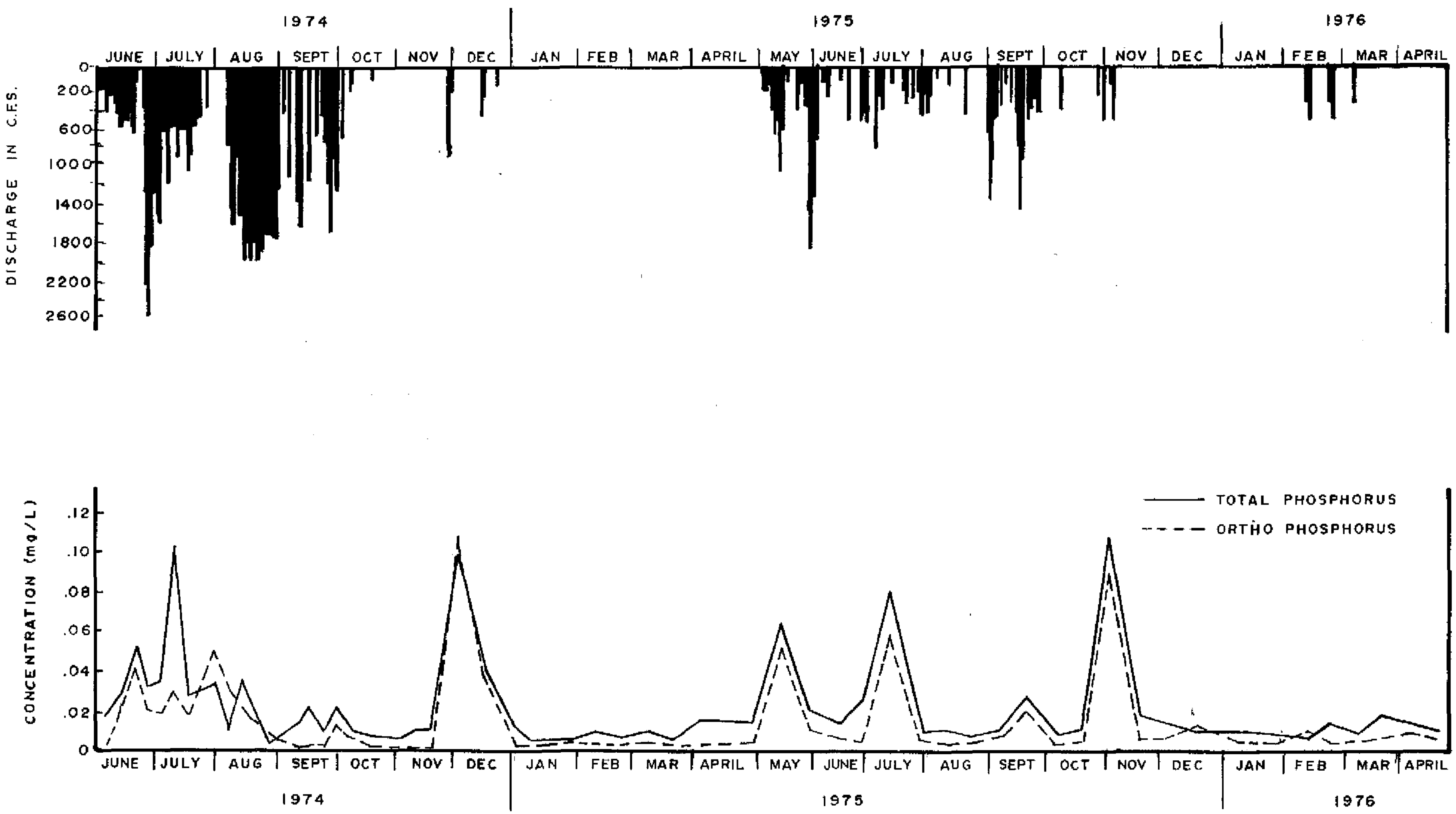

Figure 8 PHOSPHORUS CONCENTRATION VS. DISCHARGE AT S-7

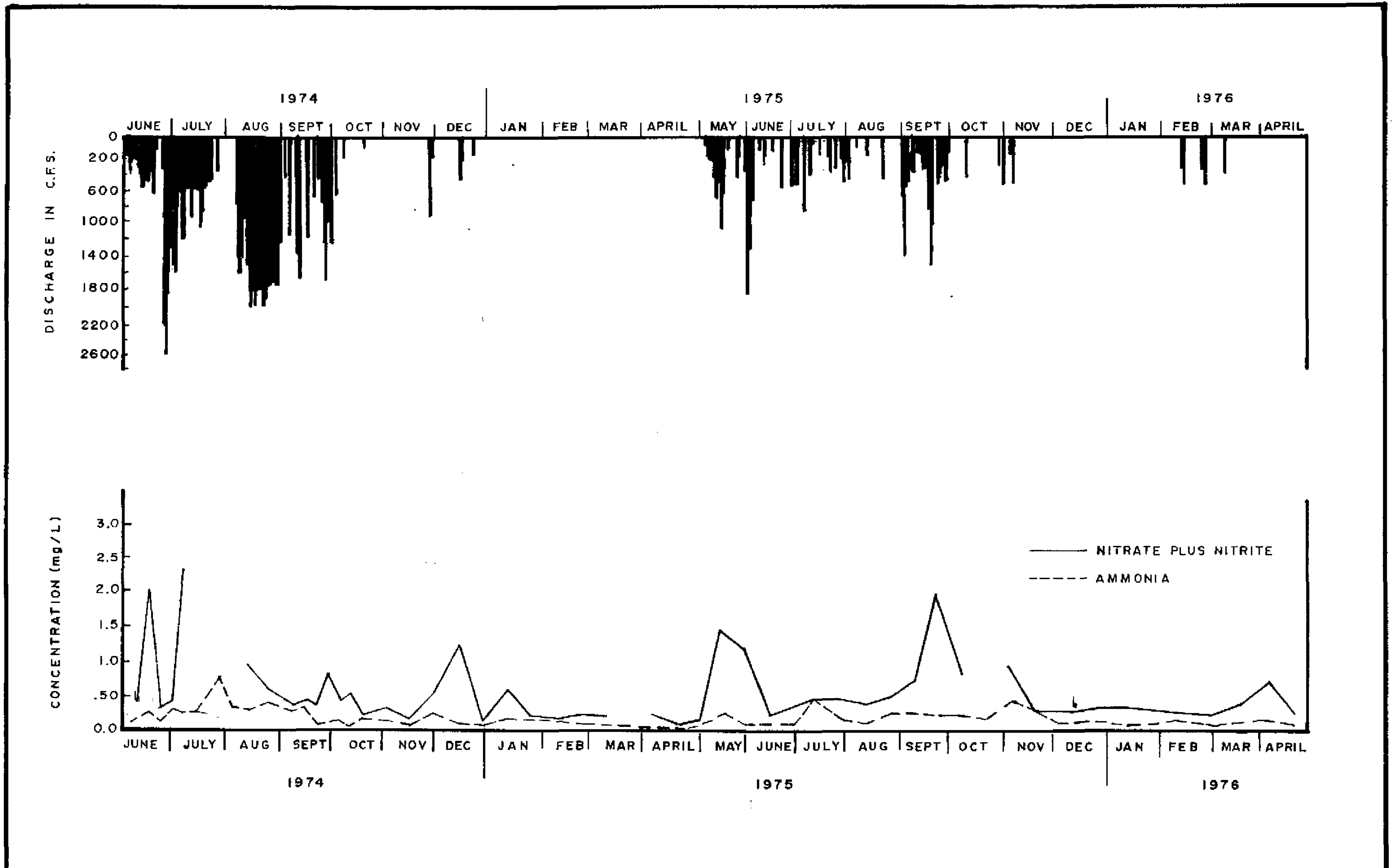

Figure 9 INORGANIC NITROGEN SPECIES VS DISCHARGE AT S-7

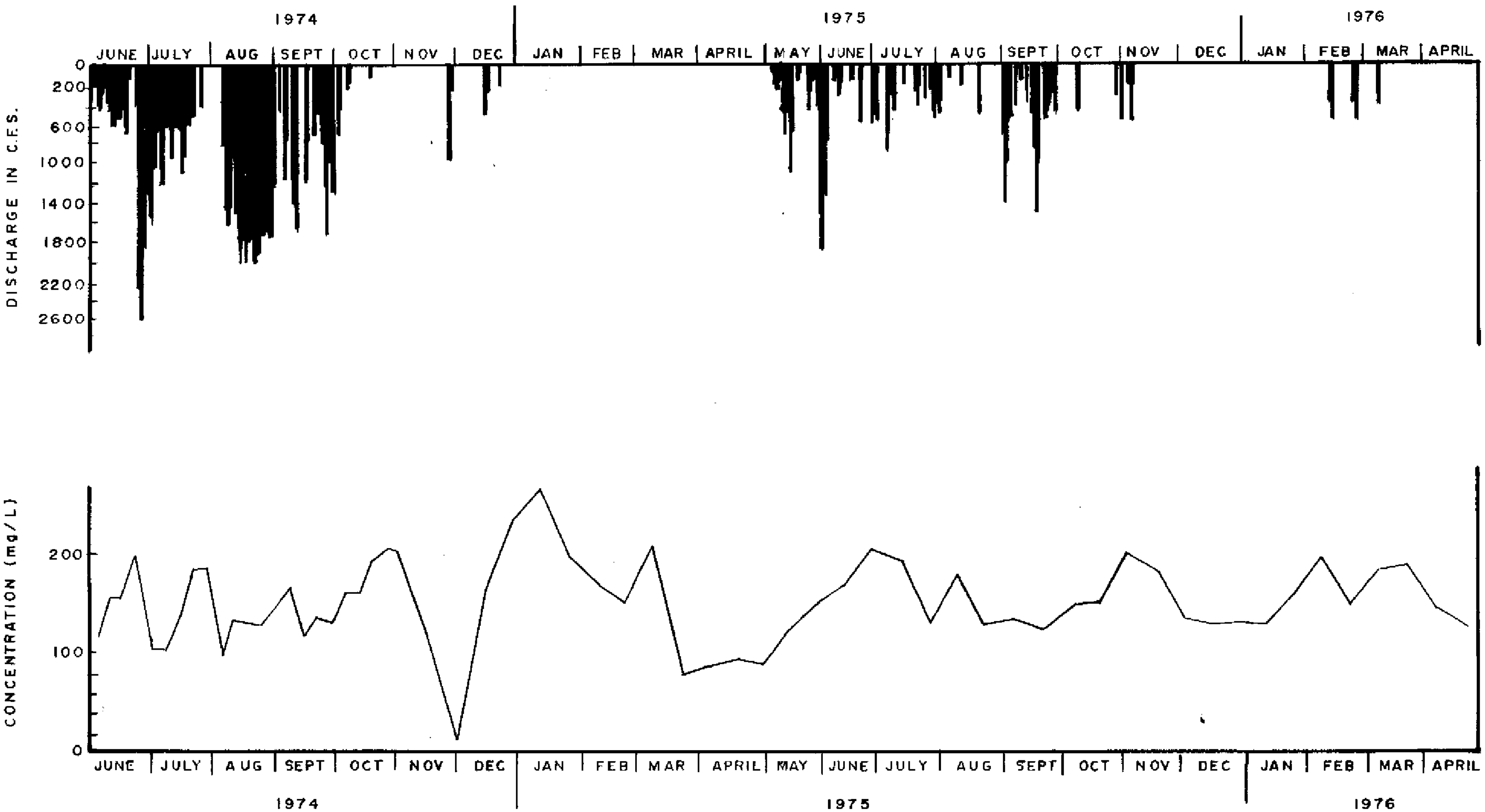

Figure 10 CHLORIDE CONCENTRATION VS. DISCHARGE AT S-7

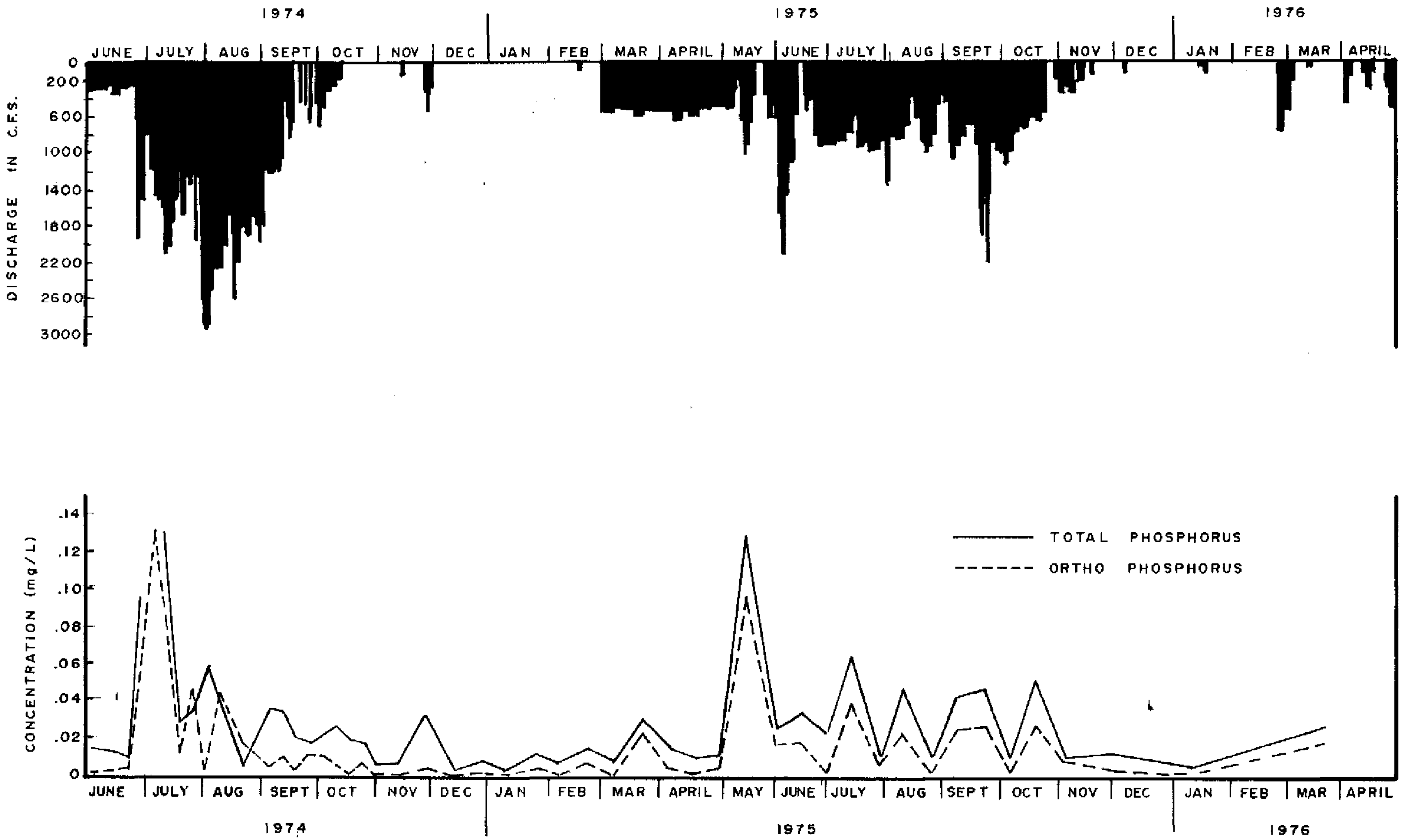

Figure 11 PHOSPHORUS CONCENTRATION VS DISCHARGE AT S-8

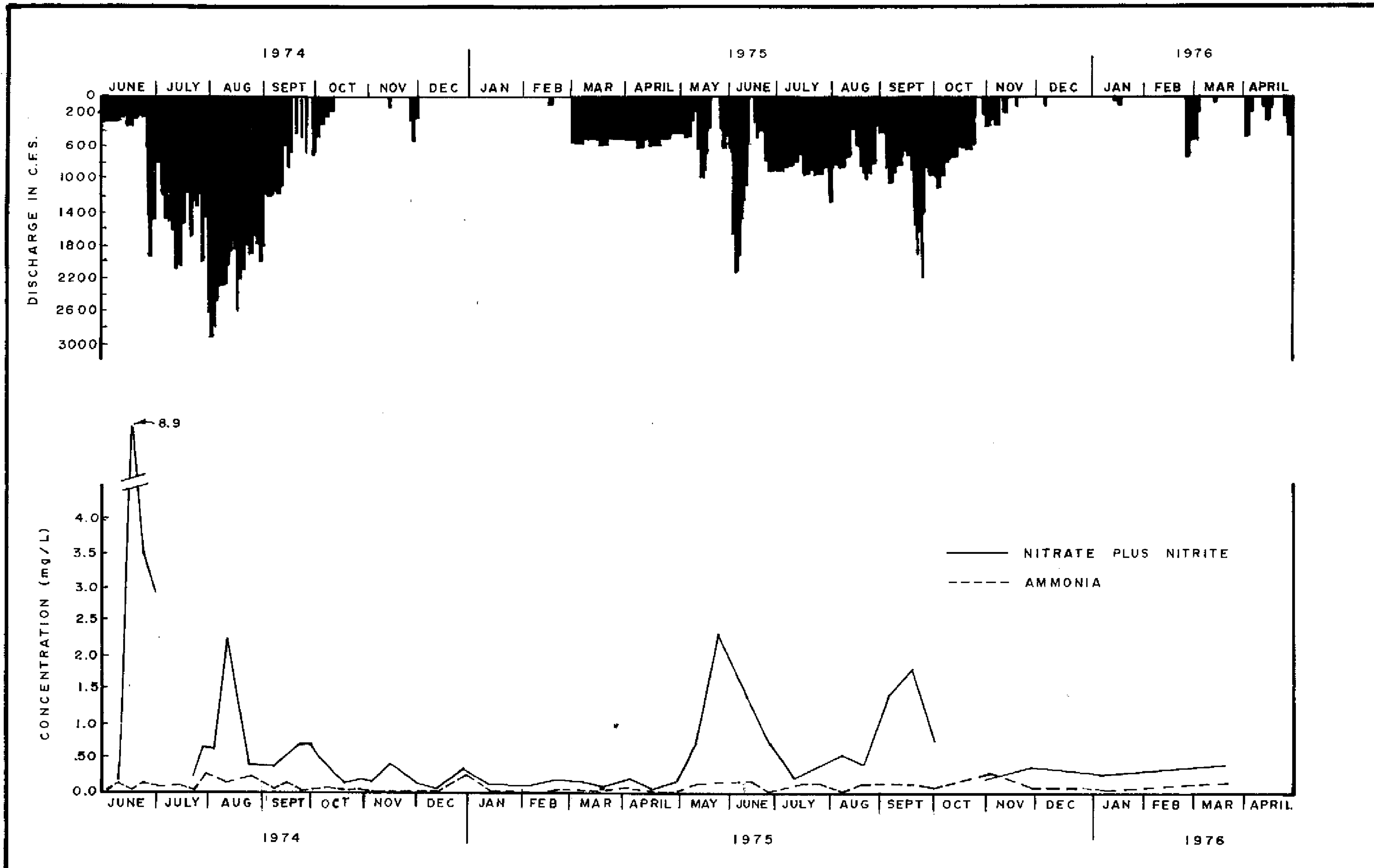

Figure 12 INORGANIC NITROGEN SPECIES VS DISCHARGE AT S-8

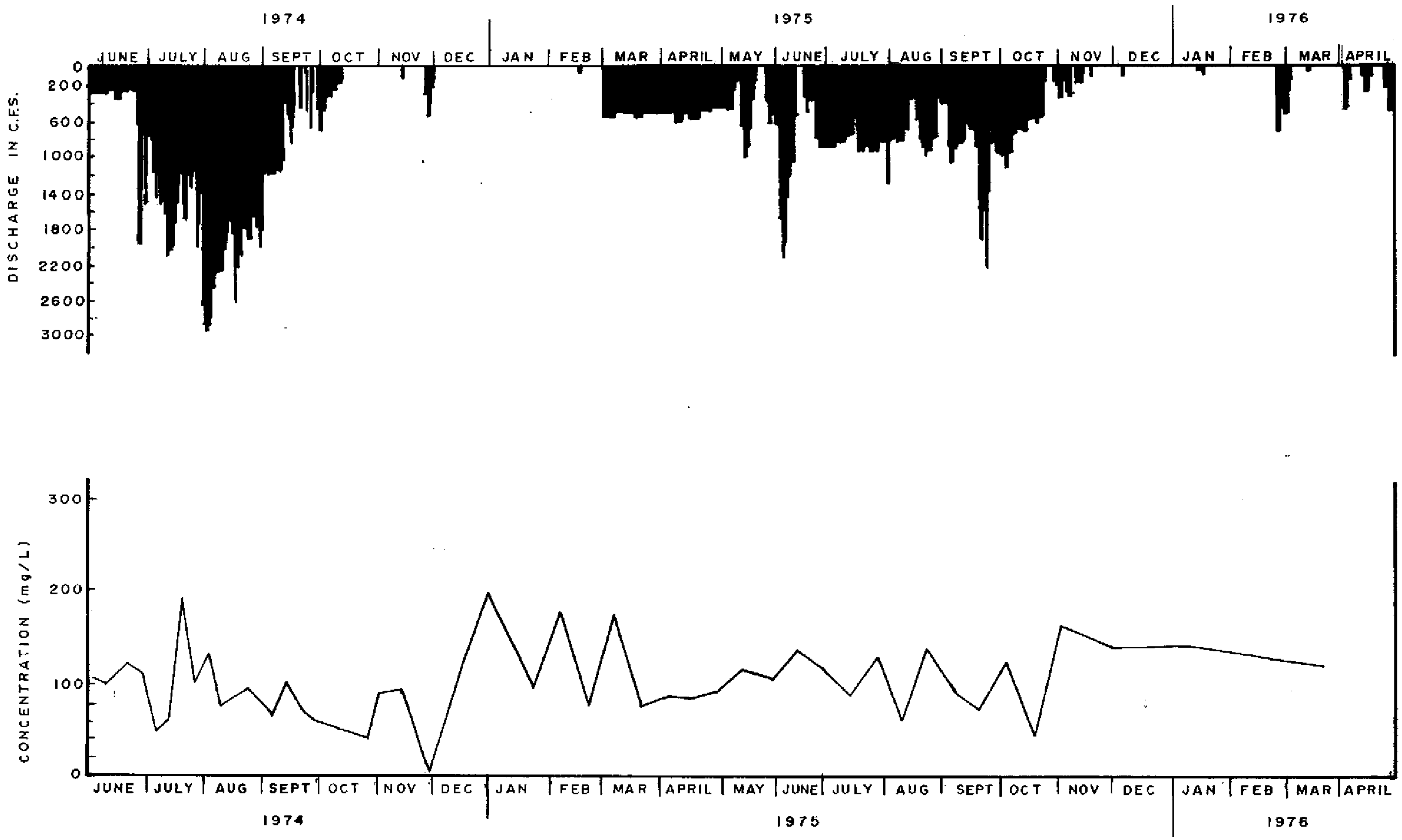

Figure 13 CHLORIDE CONCENTRATION VS DISCHARGE AT S-8

The effects of discharges on the concentration of total nitrogen, inorganic nitrogen, total phosphorus, ortho-phosphorus, sodium, chloride and alkalinity were examined using the two-way analysis of variance approach. The results of these tests are shown in Table 9 and can be interpreted using the first and last columns of the table. Column one shows the two factors (discharge and station) and the interaction term (discharge-station). The last column indicates whether or not the factor in column one has a significant effect on the concentration of the parameter in question; all values in this column less than .050 (95% confidence level) can be considered as indicating significance. Three of the seven parameters tested (total nitrogen, inorganic nitrogen, total phosphorus, and ortho-phosphorus) had significantly higher concentrations during periods of discharge due to runoff with periods of no discharge and discharge due to lake water releases (Table 10). The discharge by station interaction term was insignificant at the 95% confidence level for each of these parameters, indicating that the effect of discharge on chemical concentration was consistent from station to station. Discharge also had a significant effect on total nitrogen concentrations, however, a significant discharge-station interaction term prohibits drawing specific conclusions about the effect of the discharge on this parameter.

Alkalinities were significantly affected by periods of discharge due to runoff and periods of discharge due to releases from the Lake, however, the significant interaction term (Table 9) makes interpretation of these effects difficult. The remaining three parameters (sodium, chloride, and alkalinity) which were statistically tested did not show changes in concentration which could be related to periods of discharge. These three parameters did, however, tend to decrease in concentration during periods of discharge. Although not statistically significant the trend shown by these constituents can be

TABLE 9. STATISTICAL RESULTS OF TWO-WAY ANALYSIS OF VARIANCE (DISCHARGE BY STATION) FOR SELECTED PARAMETERS.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F Value	Significance of F
		Total Nitrogen			
Discharge	182.274	2	91.137	13.008	.001
Station	131.944	3	43.941	6.277	.001
Discharge-Station	92.318	6	15.386	2.196	.045
Residual	1296.165	185	7.006		
Total	1696.014	196	8.653		
		Inorganic Nitrogen			
Discharge	50.887	2	25.443	21.246	.001
Station	25.118	3	8.373	6.991	.001
Discharge-Station	14.480	6	2.413	2.015	.065
Residual	233.526	195	1.198		
Total	325.133	206	1.578		
		Total Phosphorus			
Discharge	.135	2	.067	32.544	.001
Station	.056	3	.019	9.023	.001
Discharge-Station	.017	6	.003	1.353	.235
Residual	.439	212	.002		
Total	.648	223	.003		
		Ortho Phosphorus			
Discharge	.091	2	.046	24.886	.001
Station	.032	3	.011	5.818	.001
Discharge-Station	.016	6	.003	1.458	.194
Residual	.386	211	.002		
Total	.522	222	.002		

TABLE 9 (Continued)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F Value	Significance of F
		Sodium			
Discharge	6.106	2	3.053	.002	.998
Station	172894.602	3	57631.534	32.544	.001
Discharge-Station	18562.801	6	3093.800	1.747	.112
Residual	374492.609	215	1741.826		
Total	571245.695	222	2573.179		
		Chloride			
Discharge	3131.567	2	1565.784	.413	.662
Station	237260.495	3	79086.832	20.852	.001
Discharge-Station	24514.242	6	4085.707	1.077	.377
Residual	815430.853	215	3792.702		
Total	1093200.530	226	4837.170		
		Alkalinity			
Discharge	198.376	2	99.188	5.012	.007
Station	339.738	3	113.246	5.722	.001
Discharge-Station	1329.505	6	221.584	11.197	.001
Residual	4116.249	208	19.790		
Total	5920.868	219	27.036		

TABLE 10. MEAN CONCENTRATIONS OF SELECTED PARAMETERS DURING PERIODS OF DISCHARGE AND NO DISCHARGE FROM THE S-5A, S-6, S-7 and S-8 PUMP STATIONS.

	Parameter						
Condition	Total N (mg/l)	Inorganic N (mg/l)	Total P (mg/l)	Ortho P (mg/l)	Na (mg/l)	Cl (mg/l)	Alkalinity (mg/l)
Discharge due to runoff	4.55	1.65	0.09	0.06	103.6	150.2	5.4
Discharge due to Lake releases	3.62	0.93	0.06	0.05	100.6	133.0	8.2
No Discharge	2.55	0.59	0,04	0.02	113.4	160.85	5.6

reasonably explained. During periods of no discharge the water in the canals becomes ponded, evaporative losses combined with groundwater seepage becomes large relative to the rainfall and cause the more conservative parameters, i.e. sodium, chloride and alkalinity, to increase in concentration. Rainfall becomes large relative to the groundwater inflows and evaporative losses during periods of discharge and results in a dilution or decrease in the concentrations of the conservative parameters.

The significant differences in nutrient concentrations associated with no discharges, discharges due to Lake Okeechobee releases and discharges due to basin runoff suggested the possibility of a direct relationship between discharge volume and nutrient concentration. Definition of such a relationship may provide the basis for management practices which could be used to control a portion of the nutrient loadings to the Conservation Areas. A simple bivariate regression analysis was performed using discharge volume (second-foot-days) and nutrient concentration as the independent and dependent variables respectively. Data were selected for the regression analyses for only those days on which there was a discharge attributable to basin runoff.

The results of the regressions indicate a significant linear relationship between the independent variable, discharge volume, and total nitrogen, ortho phosphorus, and total phosphorus. Values of r^2 for these regressions, are all fairly low (.07 to .21) indicating that a majority of the variation in concentrations is not accounted for by the linear relationship with discharge volume.

Nutrient Exports

The land use breakdowns for the S-5A, S-6, S-7 and S-8 drainage basins (Appendix C) show a range of 30% to 93% of the basin areas in agricultural type land uses. Urban land use types on the other hand make up only very small portions of the land uses ranging from zero to less than 2% of the total basin areas. The remaining land uses in these basins consist mainly of relatively natural type environments such as forested uplands and wetlands. The large percentage of agricultural land uses relative to other intensively managed land uses suggest that the areal exports of nutrients from these basins would be characterized by the high export rates typically associated with agricultural land uses (Brezonik and Shannon, 1971).

Areal rates of nutrient exports were calculated for the year beginning June 1, 1974 and ending May 31, 1975. This time frame was selected for the export calculations because it coincides exactly with the period for which similar figures were computed for several canals on the lower east coast of Florida (Lutz, 1977). The areal export rates for nitrogen and phosphorus from the S-5A, S-6, S-7 and S-8 basins (Table 11) ranged from 5.01 g/m^2-yr. to 2.70 g/m^2-yr. and 0.077 g/m^2-yr. to 0.041 g/m^2-yr. respectively.

If the nutrient export rates were directly proportional to the percentage of land in agriculture the basins would be listed in the following order according to decreasing nutrient export rates: S-6 > S-5A > S-7 > S-8. This order of ranking, however, does not hold true for either the nitrogen or phosphorus export rates. Ranking in decreasing order the nitrogen export rates of the drainage basins yields S-5A > S-8 > S-7 > S-6 and phosphorus, S-5A > S-8 > S-6 > S-7. The reason for these unexpected results is unclear at this time, however, it is possible that the June 1974 to May 1975 year was not a typical year, further studies now planned should help clarify this.

The nutrient export rates obtained for these four basins can be directly compared with those reported for several of the lower east coast basins (Lutz, 1977). As shown (Table 11) the nitrogen export rates are much higher for the S-5A, S-6, S-7 and S-8 basins than for any of the four lower east

TABLE 11. NUTRIENT EXPORT RATES FOR EIGHT SOUTH FLORIDA DRAINAGE BASINS FROM JUNE 1974 - MAY 1975

Basin	Phosphorus Export (g/m^2-yr)	Nitrogen Export (g/m^2-yr)
S-5A	0.077	5.01
S-6	0.058	2.70
S-7	0.041	3.03
S-8	0.075	3.23
C-51 Canal	0.057	0.99
Hillsboro Canal	0.085	0.66
North New River	0.012	1.99
Tamiami Canal	0.025	0.59

coast basins. Phosphorus export rates were in the same range as those found on C-51 and the Hillsboro Canal. Land uses on these lower east coast basins consisted of a higher percentage of urban land uses (22% to 49%, compared to 0% to 2% for the pump station drainage basins) and a generally smaller percentage of agricultural land uses.

CONCLUSIONS

1. The S-5A, S-6, S-7 and S-8 pump stations contribute approximately 49% of the water, 90% of the nitrogen, and 76% of the phosphorus introduced into the Conservation Areas by surface water inflows.
2. Concentrations of nitrogen and phosphorus increase during periods of discharge relative to periods of no discharge. The increases in nutrient concentrations are attributed primarily to the effect of basin runoff.
3. Areal nutrient exports from the four basins studied do not appear to be directly related to the percentage of urban plus agricultural land use within the basin as was the case for most of the basins studied by the EPA (Omernik 1976).
4. The areal export rates of nitrogen from the four study basins were high in comparison to literature values (Brezonik and Shannon, 1971; Omernik 1976), and compared to export rates found on more urban basins on the southeast Florida coast. Phosphorus export rates were within the range reported for Hillsboro and C-51 Canals which are located on the coast.

BIBLIOGRAPHY

Brezonik, P. and E. Shannon, 1971. Trophic State of Lakes in North Central Florida, Water Resources Research Center, University of Florida, Pub. 13.

Lutz, J., 1977. Water Quality Characteristics of Several Southeast Florida Canals. South Florida Water Management District, Technical Publication #77-4.

Nie, N. H., C. H. Hull, J. G. Jenkins, K. Steinbrenner and D. H. Bent. 1975. Statistical Package for the Social Sciences. McGraw-Hill, New York.

Omernik, J. M., 1976. The Influence of Land Use on Stream Nutrient Levels. U. S. Environmental Protection Agency. EPA-600/3-76-014.

Waller, B. G., and J. E. Earle. 1975. Chemical and Biological Quality of Water in Part of the Everglades, Southeastern Florida. U. S. Geological Survey, Water-Resources Investigations 56-75.

APPENDIX A

ANALYTICAL METHODS

AUTOANALYZER

Determination	Method	Range	Sensitivity
Alkalinity	1. Methyl Orange; Technicon AutoAnalyzer II, method #111-71W	0-10 meq/l	0.10 meq/l 2% of full scale
	2. Potentiometric titration Ref. Standard Methods, 13th Edition, p. 52-56.	0-10 meq/l	0.3 meq/l
Ammonia	Berthelot reaction Technicon AA II, method #154-71W Ref: D. D. Van Slyke & A. J. Hillen, Bio Chem. 102, p. 499, 1933; S. Kallman, Presentation, April 1967, San Diego, Calif.; W. T. Bolleter, C. J. Bushman & P. N. Tidwell, Anal. Chem. 33, p. 592, 1961; J. A. Tellow & A. L. Wilson, Analyst, 89, p. 453, 1964; A. Tarugi & F. Lenci, Boll Chim Farm, 50, p. 907, 1912; FWPCA Methods of Chem. Anal. of Water & Waste Water. Nov. 1969, p.137.	0-0.50 ppm	0.010 ppm 2% of full scale
Chloride	Ferric Thiocyanate complex Technicon AA II, method #99-70W Ref: Automatic Analysis of Chlorides in Sewage, James E. O'Brien, Wastes Engineering, Dec. 1962; D. M. Zall, D. Fisher & M. D. Garner, Anal. Chem. 28, 1956, p. 1665	0-200 ppm	4.0 ppm 2% of full scale
Nitrite	Diazotization method which couples with N-1-naphthylene-diamine dihydrochloride. Technicon AA II; method #120-70W, modified for linear sensitivity. Ref. <u>Standard Methods</u>, 12th edition, 1965, p. 205	0-0.200 ppm	.004 ppm 2% of full scale
Nitrate	Same as Nitrite with Cadmium Reduction column Technicon AA II, method #100-70W, modified for linear sensitivity.	0-0.200 ppm	.004 ppm 2% of full scale
Nitrogen, Total Kjeldahl	Digestion with H_2SO_4 and HgO catalyst followed by Ammonia determination as described above, modified diluent reagent to neutralize Kjeldahl digestion mixture. Technicon AA II, method #146-71A Ref. <u>Standard Methods</u>, 13th edition, p. 244	0-3.0 ppm	0.06 2% of full scale

AUTOANALYZER

Determination	Method	Range	Sensitivity
Ortho-Phosphate	Phosphomolybdenum blue complex with ascorbic acid reduction. Technicon AA II; method #155-71W Ref. J. Murphy & J. P. Riley, Anal. Chim. Acta, 27, p. 30, 1962.	0-0.100 ppm	.002 2% of full scale
Phosphate, Total	Same as Ortho-Phosphate with persulfate digestion. Modified Standard Methods procedure: 13th edition, p. 525, 1971. Technicon AA II; method #93-70W.	0-0.100 ppm	.002 2% of full scale
Silicate	Ascorbic acid reduction of silicomolybdate complex to "Molybdenum blue", Technicon AA II, method #105-71W.	0-20 ppm	0.4 ppm 2% of full scale
Sulfate	Barium chloride, Methylthymol Blue chelation, Technicon AA II, method #118-71W	0-250 mg/l	5 mg/l 2% of full scale

ATOMIC ABSORPTION

Parameter	Wavelength	Flame	Comments
Sodium	589.0 nm-vis. (SLIT 1.4 nm)	Air and acetylene	Dual capillary system (DCS) as described by T.H. Miller and W. H. Edwards, Atomic Absorption Newsletter 15, No. 3 (1976).
Potassium	766.5 nm-vis. (SLIT 1.4 nm)	Air and acetylene	Sample treatment as described for sodium.
Calcium	422.7 nm-vis. (SLIT 0.7 nm)	Air and acetylene	Same
Magnesium	285.2 nm-uv (SLIT 0.7 nm)	Air and acetylene	Same

APPENDIX B

WATER CHEMISTRY DATA FROM THE S-5A, S-6, S-7 AND S-8 PUMP STATIONS

Units in mg/l except as follows:

Nutrient forms: mg N or P/l
Alkalinity: meq/l

Blank indicates missing data

< indicates results less than quoted limit of sensitivity.

APPENDIX B. WATER QUALITY RESULTS FOR ALL SAMPLING DATES

1. Pump Station S-5A

DATE MO/DA/YR	NOX MG/L	NO2 MG/L	NH4 MG/L	TKN MG/L	O-PO4 MG/L	T-PO4 MG/L
6/ 3/74		0.105	0.52		< 0.002	0.053
6/10/74		0.191	0.90	2.23	0.067	0.103
6/17/74	3.150	0.230	1.04	11.30	0.091	0.108
6/24/74	1.260	0.166	0.25	2.84	0.010	0.111
7/ 1/74	4.025	0.012	1.65	9.60	0.180	0.190
7/ 8/74	0.676	0.056	1.43	8.92	0.110	0.134
7/15/74			0.40	7.72	0.057	0.079
7/22/74	1.120	0.059	0.22	2.83	0.072	0.092
7/29/74	0.936	0.118	1.07	14.60	0.067	0.084
8/ 5/74	0.740	0.163	1.51	8.36	0.073	0.153
8/12/74	1.490	0.083	0.56	7.76	0.108	0.130
8/26/74	0.620	0.078	0.41	2.86	0.081	0.027
9/ 9/74	0.292	0.058	0.38	2.98	0.050	0.172
9/16/74	0.470	0.122	0.56		0.140	0.194
9/23/74	1.040	0.532	0.08	1.91	0.045	0.077
9/30/74	1.770	0.099	0.31	< 3.00	0.099	0.118
10/ 7/74	1.040	0.175	0.32	0.47		0.027
10/14/74	1.312	0.504	0.52	2.78	0.076	0.085
10/21/74	0.362	0.161	0.34	2.81	0.054	0.075
10/29/74	0.325	0.019	0.03	1.31	0.028	0.049
11/ 4/74	0.397	0.016	0.06	1.55	0.018	0.037
11/18/74	0.433	0.010	0.08	0.85	0.018	0.048
12/ 2/74	0.281	0.143	0.65		0.061	0.078
12/16/74	0.922	0.117	0.26	1.57	0.033	0.047
12/31/74	0.949	0.118	0.03	2.28	0.017	0.040
1/13/75	0.792	0.033	0.11	1.35	0.012	0.026
1/26/75	0.506	0.012	0.06	1.44	0.020	0.046
1/28/75	0.551	0.039	0.13	1.23	0.024	0.043
2/10/75	0.397	0.004	0.05	1.10	0.030	0.053
2/25/75	6.777	0.217	0.92	5.01	0.121	0.175
3/10/75	0.627	0.020	0.13	1.25	0.053	0.080
3/24/75	0.172	< 0.004	0.03	1.00	0.026	0.054
4/ 7/75	0.213	0.004	0.07	0.81	0.022	0.057
4/21/75	0.053	0.006	0.05	1.46	0.014	0.038
5/ 5/75	0.071	< 0.004	0.01	1.24	0.012	0.031
5/19/75	1.551	0.120	0.73	3.14	0.065	0.087
6/ 2/75	2.477	0.174	1.17	4.40	0.191	0.132
6/16/75	1.638	0.032	0.15	1.89	0.011	0.030
6/30/75		0.021	0.09	1.82	0.002	0.072
7/14/75	0.505	0.054	0.58	2.32	0.038	0.065

APPENDIX B-1 (Continued)

DATE MO/DA/YR	NA MG/L	K MG/L	CA MG/L	MG MG/L	CL MG/L	SO4 MG/L
6/ 3/74	201.00		73.60	27.60	385.2	
6/10/74	148.00	7.30	42.60	17.40	233.2	
6/17/74	205.00		80.00	31.40	278.8	
6/24/74	175.00	8.20	68.00	25.20	271.2	
7/ 1/74	150.00		98.20	33.00	132.4	
7/ 8/74	107.00	6.40	87.60	28.20	219.5	
7/15/74	98.00	5.70	72.80	17.80	131.3	
7/22/74					84.7	
7/29/74	115.00		85.40	31.70	182.7	
8/ 5/74	122.00		82.80	33.20	175.2	
8/12/74	161.00		68.00	21.80	165.3	
8/26/74	89.00		67.80	27.60	125.8	
9/ 9/74	169.00		88.80	39.80	165.0	
9/16/74	105.00		82.40	31.20	113.2	66.7
9/23/74	138.00	6.20	74.40	25.60	207.2	
9/30/74	200.00	10.00	104.80	39.40	294.2	94.2
10/ 7/74	256.00	1.10	94.00	41.00	137.7	165.9
10/14/74	186.00	7.00	90.00	30.50	285.6	
10/21/74	120.00	4.30	70.00	17.00	143.9	48.2
10/29/74	64.00	4.20	50.40	16.20	91.7	
11/ 4/74	76.00	4.30	47.60	15.20	146.4	
11/18/74	53.00	4.10	40.60	13.80	82.7	
12/ 2/74	135.00	6.90	74.60	25.20	< 4.0	
12/16/74	150.00	6.60	74.20	24.00	197.5	81.5
12/31/74	137.10	6.80	79.60	25.00	185.6	
1/13/75	130.00	5.90	69.40	22.00	177.3	
1/26/75	104.07	6.43	59.44	20.25	116.3	
1/28/75	87.00	4.60	53.40	16.70	120.5	
2/10/75	49.20	4.10	47.20	15.20	76.2	
2/25/75	94.20	7.50	89.20	25.40	144.1	
3/10/75	69.40	4.90	47.30	18.60	103.7	
3/24/75	51.50	4.20	48.20	15.80	185.5	
4/ 7/75	58.20	4.20	43.00	15.00	81.7	
4/21/75	72.10	4.30	53.00	6.70	104.6	
5/ 5/75	54.90	4.30	46.30	17.10	84.2	
5/19/75	104.20	6.60	78.30	26.00	159.5	
6/ 2/75	165.90	8.60	101.30	37.50	222.2	
6/16/75	38.70	2.80	52.10	9.30	54.4	
6/30/75	32.60		45.80	6.70	48.2	
7/14/75	113.05	4.42	68.98	18.64	145.3	

APPENDIX B-1 (Continued)

DATE MO/DA/YR	ALK MEQ/L	SIO2 MG/L
6/ 3/74	7.12	16.9
6/10/74	7.42	23.2
6/17/74	6.69	26.9
6/24/74	7.11	23.2
7/ 1/74	4.13	24.4
7/ 8/74	1.44	27.2
7/15/74	4.24	15.7
7/22/74	0.54	8.5
7/29/74	0.60	17.8
8/ 5/74		33.2
8/12/74	3.91	18.6
8/26/74	4.59	21.6
9/ 9/74	5.54	27.6
9/16/74	4.90	19.5
9/23/74	2.50	11.2
9/30/74	8.93	25.6
10/ 7/74	3.94	35.2
10/14/74	6.52	33.4
10/21/74	4.24	11.4
10/29/74	3.06	8.8
11/ 4/74	2.21	9.2
11/18/74	2.45	8.6
12/ 2/74	5.82	2.1
12/16/74	4.55	16.2
12/31/74	4.84	16.0
1/13/75	4.32	12.8
1/26/75	3.34	9.0
1/28/75	3.59	10.2
2/10/75	2.48	8.5
2/25/75	4.76	17.6
3/10/75	3.16	12.1
3/24/75	2.36	9.0
4/ 7/75	2.51	7.6
4/21/75	3.13	7.9
5/ 5/75	2.59	5.3
5/19/75	5.74	19.3
6/ 2/75	6.95	25.6
6/16/75	2.62	9.2
6/30/75	2.58	12.2
7/14/75	4.56	13.0

APPENDIX B-1 (Continued)

DATE MO/DA/YR	NOX MG/L	NO2 MG/L	NH4 MG/L	TKN MG/L	O-PO4 MG/L	T-PO4 MG/L
7/28/75	0.695	0.095	1.04	4.91		0.134
8/11/75	3.879	0.149	1.04	6.50	0.111	0.148
8/25/75	0.863	0.116	1.31	4.14	0.055	0.078
9/ 8/75	1.233	0.171	0.52	5.15	0.063	0.098
9/22/75	2.144	0.152	1.23	4.59	0.101	0.121
10/ 6/75	5.190	0.165	1.59	7.04	0.117	0.161
10/20/75			0.33	4.17	0.056	0.099
11/ 4/75	0.949	0.131	0.48	3.69	0.059	0.090
11/18/75	1.015	0.119	0.18	2.75	0.030	0.050
12/ 1/75	0.391	0.006	< 0.01	1.49	0.029	0.062
12/15/75	0.391	0.009	0.02	1.56	0.077	0.048
12/29/75	0.445	0.009	0.02	1.31	0.020	0.069
12/29/75	0.267	< 0.004	0.02	1.58	0.014	0.045
2/ 9/76	0.309	0.014	0.04	2.23	0.009	0.056
2/23/76	0.687	0.027	0.11	2.33	0.018	0.041
3/ 8/76	1.393	0.280	1.18	5.44	0.103	0.150
3/22/76	1.013	0.048	0.10	1.74	0.058	0.090

APPENDIX B-1 (Continued)

DATE MO/DA/YR	NA MG/L	K MG/L	CA MG/L	MG MG/L	CL MG/L	SO4 MG/L
7/28/75	209.25	10.20	133.62	48.68	269.0	
8/11/75	199.16	8.27	118.06	36.65	258.0	
8/25/75	314.79		113.80	37.32	436.0	
9/ 8/75	225.22	10.28	114.56	45.22	300.0	
9/22/75	218.70		117.48	40.00	290.8	
10/ 6/75	150.50	9.69	127.28	42.92	209.8	
10/20/75	232.39	8.71	123.51	39.31	289.8	
11/ 4/75	269.21	11.80	112.52	44.33	367.7	97.6
11/18/75	324.30	11.38	100.64	39.09	394.3	
12/ 1/75	70.61	4.74	49.04	20.60	92.3	
12/15/75	80.74	4.43	53.88	21.45	106.4	
12/29/75	60.14	5.01	46.44	19.27	93.4	
12/29/75	70.69	4.30	43.63	18.77	93.6	
2/ 9/76	143.94	7.52	67.85	26.98	192.6	
2/23/76	99.68	6.93	71.23	23.70	152.1	
3/ 8/76	139.62	8.04	87.14	29.03	269.4	
3/22/76	137.14	6.58	86.01	27.74	196.9	

APPENDIX B-1 (Continued)

DATE MO/DA/YR	ALK MEQ/L	SIO2 MG/L
7/28/75	8.18	43.4
8/11/75	7.17	30.4
8/25/75	8.64	27.1
9/ 8/75	8.19	27.0
9/22/75	7.35	31.8
10/ 6/75	8.53	31.7
10/20/75	8.12	34.0
11/ 4/75	10.89	26.4
11/18/75	8.41	18.8
12/ 1/75	2.95	12.4
12/15/75	3.15	10.3
12/29/75	2.77	10.2
12/29/75	2.82	9.0
2/ 9/76	4.71	12.2
2/23/76	4.07	10.7
3/ 8/76	6.18	29.0
3/22/76	5.48	13.8

APPENDIX B. WATER QUALITY RESULTS FOR ALL SAMPLING DATES

2. Pump Station S-6

DATE MO/DA/YR	NOX MG/L	NO2 MG/L	NH4 MG/L	TKN MG/L	O-PO4 MG/L	T-PO4 MG/L
6/ 3/74		0.024	0.25		< 0.002	0.033
6/10/74	1.240	0.034	0.29	1.65	0.007	0.025
6/17/74	2.575	0.178	1.36	10.10	0.031	0.067
6/24/74	0.167	0.014	0.11	1.70	< 0.002	0.036
7/ 1/74	1.320	0.005	0.97	7.16	0.220	0.268
7/ 8/74	0.054	< 0.004	0.66	2.90	0.025	0.035
7/15/74			0.69	9.44	0.171	0.215
7/22/74						
7/29/74	0.216	0.063	1.18	2.98	0.130	0.170
8/ 5/74	0.444	0.072	1.45	3.04	0.097	0.137
8/12/74	0.500	0.076	0.52	9.12	0.093	0.080
8/26/74	0.359	0.067	0.51	2.82	0.078	0.018
9/ 9/74	0.308	0.086	0.49	2.82	0.050	0.118
9/16/74	0.140	0.036	1.27		0.010	0.051
9/23/74	0.276	0.091	0.15	3.95	0.030	0.141
9/30/74	0.051	0.016	0.21	3.12	0.078	0.102
10/ 7/74	0.112	0.024	0.12	1.71	0.008	0.016
10/14/74	0.145	0.040	0.43	2.41	0.011	0.030
10/21/74	0.017	0.009	0.61	0.58	< 0.002	0.019
10/29/74	0.102	0.011	0.19	1.73	0.012	0.018
11/ 4/74	0.190	0.008	0.26	1.93	< 0.002	< 0.010
11/18/74	0.203	0.020	0.16	1.41	< 0.002	0.020
12/ 2/74	0.630	0.044	0.33		0.065	0.082
12/16/74	0.168	0.026	0.52	1.76	0.036	0.043
12/31/74	0.517	0.093	0.51	3.06	< 0.002	0.019
1/12/75	0.620	0.061	0.34	2.93	0.003	0.016
1/13/75	0.637	0.043	0.26	2.18	< 0.002	0.020
1/26/75	0.570	0.080	0.48	2.58	0.003	0.018
1/28/75	0.459	0.008	0.04	1.16	0.007	0.018
2/10/75	0.181	0.005	0.07	1.42	< 0.002	0.017
2/25/75	0.330	0.022	0.22	2.03	0.008	0.029
3/10/75	1.000	0.061	0.38	2.12	0.026	0.042
3/24/75	0.294	0.007	0.11	1.58	0.004	0.019
4/ 7/75	0.042	< 0.004	0.02	0.86	0.004	0.017
4/21/75	0.072	0.014	< 0.01	1.56	0.007	0.050
5/ 5/75	0.017	< 0.004	< 0.01	1.41	< 0.002	0.017
5/19/75	0.236	0.040	0.72	2.66	0.028	0.042
6/ 2/75	0.402	0.076	0.33	2.40	0.029	0.052
6/17/75	0.193	0.013	0.10	1.82	0.007	0.033
6/30/75		0.129	0.47	3.41	< 0.002	0.044

APPENDIX B-2 (Continued)

DATE MO/DA/YR	NA MG/L	K MG/L	CA MG/L	MG MG/L	CL MG/L	SO4 MG/L
6/ 3/74	110.00		61.00	22.80	161.1	
6/10/74	105.00	4.60	62.00	22.20	193.5	
6/17/74	112.00		91.40	28.70	203.6	
6/24/74	116.00	4.90	67.40	24.00	194.5	
7/ 1/74	102.00		42.40	15.60	162.0	
7/ 8/74	97.00	4.50	85.60	35.40	152.9	
7/15/74	15.00	9.90	104.40	40.00	200.2	
7/22/74					54.4	
7/29/74	131.00		90.00	36.20	188.4	
8/ 5/74	112.00		91.60	35.60	194.5	
8/12/74	168.00		62.00	37.20	179.8	
8/26/74	120.00		87.80	36.40	175.5	
9/ 9/74	131.00		106.40	50.50	164.2	
9/16/74	133.00		96.00	40.80	188.0	31.9
9/23/74	166.00	9.00	103.60	46.50	145.4	
9/30/74	150.00	7.00	96.40	40.20	167.4	50.5
10/ 7/74	92.00	3.80	66.00	24.40	140.9	24.8
10/14/74	99.00	3.90	82.00	27.20	154.2	
10/21/74	126.00	4.40	81.60	26.40	166.1	11.6
10/29/74	124.00	3.40	91.40	31.20	196.8	
11/ 4/74	110.00	3.60	94.20	33.00	232.4	
11/18/74	96.00	4.70	64.40	24.40	153.6	
12/ 2/74	132.00	6.20	70.80	25.60	< 4.0	
12/16/74	141.40	5.90	87.40	34.20	197.5	33.9
12/31/74	185.70	6.50	94.20	30.20	261.8	
1/12/75	163.11	6.27	90.99	32.72	218.0	
1/13/75	200.50	7.30	90.80	31.20	298.2	
1/26/75	180.20	6.76	101.57	31.81	221.6	
1/28/75	163.00	3.90	88.60	39.20	273.6	
2/10/75	122.80	4.80	90.00	34.60	192.0	
2/25/75	160.80	5.80	85.60	28.00	219.7	
3/10/75	137.00	6.30	81.60	28.10	203.1	
3/24/75	146.20	6.50	79.80	26.40	72.7	
4/ 7/75	67.40	4.40	50.50	18.30	91.3	
4/21/75	65.40	4.10	54.00	13.50	97.6	
5/ 5/75	59.50	4.40	49.20	18.90	92.2	
5/19/75	120.00	7.80	80.20	24.00	192.5	
6/ 2/75	123.30	5.90	82.50	26.20	167.8	
6/17/75	116.70	5.20	77.00	30.90	166.7	
6/30/75	153.30		99.70	31.30	281.6	

DATE MO/DA/YR	ALK MEQ/L	SIO2 MG/L
6/ 3/74	2.26	12.0
6/10/74	6.07	15.5
6/17/74	6.58	20.6
6/24/74	5.80	18.6
7/ 1/74	5.69	20.4
7/ 8/74	1.54	15.8
7/15/74	7.00	15.9
7/22/74		
7/29/74	0.80	23.1
8/ 5/74		26.0
8/12/74	6.79	29.4
8/26/74	8.10	23.8
9/ 9/74	6.75	26.0
9/16/74	7.08	24.0
9/23/74	5.66	17.3
9/30/74	8.30	26.2
10/ 7/74	6.45	19.7
10/14/74	6.00	24.1
10/21/74	6.50	15.8
10/29/74	7.24	14.5
11/ 4/74	5.96	15.9
11/18/74	4.70	15.0
12/ 2/74	6.32	20.4
12/16/74	6.67	21.3
12/31/74	7.17	16.0
1/12/75	8.30	18.5
1/13/75	7.51	17.2
1/26/75	7.33	14.9
1/28/75	9.06	19.0
2/10/75	6.53	12.4
2/25/75	6.52	13.6
3/10/75	5.85	15.1
3/24/75	3.16	15.7
4/ 7/75	3.39	5.5
4/21/75	3.09	8.5
5/ 5/75	2.86	6.0
5/19/75	6.36	16.6
6/ 2/75	6.46	17.5
6/17/75	5.77	19.3
6/30/75	9.73	32.9

APPENDIX B-2 (Continued)

DATE MO/DA/YR	NOX MG/L	NO2 MG/L	NH4 MG/L	TKN MG/L	O-PO4 MG/L	T-PO4 MG/L
7/14/75	0.325	0.058	0.54	2.53	0.034	0.071
7/28/75	2.165	0.130	0.64	4.49	0.136	0.165
8/11/75	0.124	0.035	0.40	2.57	0.008	0.030
8/25/75	0.133	0.020	0.19	1.83	0.056	0.021
9/ 8/75	1.611	0.139	0.54	2.99	0.010	0.044
9/22/75	0.799	0.073	0.97	3.06	0.039	0.060
10/ 6/75	4.201	0.133	0.72	5.25	0.081	0.102
10/20/75	0.080	0.068	0.43	2.81	< 0.002	0.041
11/ 4/75	1.013	0.101	0.41	3.54	0.174	0.214
11/18/75	0.018	0.014	0.66	3.13	0.013	0.043
12/ 1/75	0.176	0.040	0.45	2.85	0.003	0.027
12/15/75	0.191	0.010	0.01	1.77	0.007	0.025
12/29/75	0.537	0.052	0.24	2.38	0.004	0.020
2/ 9/76	0.774	0.084	0.48	2.85	0.009	0.017
2/23/76	0.562	0.033	0.15	2.58	0.006	0.016
3/ 8/76	2.392	0.173	0.49	14.65	0.062	0.073
3/22/76	0.547	0.033	0.16	1.68	< 0.002	0.017

DATE MO/DA/YR	NA MG/L	K MG/L	CA MG/L	MG MG/L	CL MG/L	SO4 MG/L
7/14/75	143.42	6.93	92.55	35.95	212.9	
7/28/75	168.45	11.39	135.78	48.08	204.7	
8/11/75	144.76	5.41	95.08	32.49	200.0	
8/25/75	107.96		105.38	32.32	157.2	
9/ 8/75	147.70	6.68	94.83	37.38	205.1	
9/22/75	165.27		109.62	38.78	220.0	
10/ 6/75	145.25	7.72	120.94	41.56	195.3	
10/20/75	125.67	5.63	95.29	28.99	174.2	
11/ 4/75	151.99	7.62	99.42	33.75	219.4	42.1
11/18/75	163.97	6.25	93.98	33.79	198.6	
12/ 1/75	134.46	18.28	89.15	30.03	172.8	
12/15/75	87.66	4.32	71.81	27.10	123.7	
12/29/75	144.25	6.26	83.73	30.31	214.1	
2/ 9/76	159.36	6.68	98.11	33.93	230.6	
2/23/76	178.48	7.89	98.34	34.57	262.1	
3/ 8/76	173.03	8.86	114.83	38.41	233.9	
3/22/76	139.48	5.14	97.54	35.73	206.5	

APPENDIX B-2 (Continued)

SAMPLE NUMBER	DATE MO/DA/YR	ALK MEQ/L	SIO2 MG/L
H - 165	7/14/75	7.34	25.3
H - 169	7/28/75	8.83	27.1
H - 173	8/11/75	7.04	22.0
H - 177	8/25/75	6.48	16.3
H - 181	9/ 8/75	7.98	22.8
H - 185	9/22/75	8.17	25.3
H - 189	10/ 6/75	8.85	17.7
H - 193	10/20/75	6.48	22.9
H - 197	11/ 4/75	10.24	23.3
H - 207	11/18/75	8.12	18.8
H - 210	12/ 1/75	7.73	17.4
H - 214	12/15/75	4.93	11.9
H - 217	12/29/75	7.72	16.1
H - 227	2/ 9/76	8.23	20.6
H - 230	2/23/76	8.20	18.5
H - 233	3/ 8/76	8.48	21.7
H - 236	3/22/76	7.44	14.7

APPENDIX B. WATER QUALITY RESULTS FOR ALL SAMPLING DATES

3. Pump Station S-7

DATE MO/DA/YR	NOX MG/L	NO2 MG/L	NH4 MG/L	TKN MG/L	O-PO4 MG/L	T-PO4 MG/L
6/ 3/74		0.004	0.02		0.005	0.034
6/10/74	0.308	0.031	0.11	1.41	0.035	0.056
6/17/74	2.010	0.091	0.24	3.03	0.089	0.107
6/24/74	0.208	0.020	0.09	1.44	0.044	0.060
7/ 1/74	0.420	< 0.004	0.25	2.18	0.040	0.069
7/ 8/74	2.300	0.068	0.21	2.87	0.062	0.212
7/15/74			0.23	7.04	0.036	0.054
7/22/74						
7/29/74	0.116	0.060	0.74	2.54	0.103	0.070
8/ 5/74		0.150	0.29	9.88	0.065	0.023
8/12/74	0.970	0.075	0.24	7.28	0.042	0.074
8/26/74	0.570	0.047	0.37		0.016	0.006
9/ 9/74	0.308	0.031	0.23	2.58	< 0.002	0.025
9/16/74	0.370	0.058	0.30		0.005	0.044
9/23/74	0.344	0.041	0.03	1.68	< 0.002	0.015
9/30/74	0.760	0.089	0.08	2.42	0.026	0.043
10/ 7/74	0.380	0.045	0.08	1.96	0.013	0.020
10/14/74	0.492	0.025	0.02	1.93	0.007	0.016
10/21/74	0.176	0.018	0.15	1.46	< 0.002	0.014
10/29/74	0.247	0.013	0.10	1.60	< 0.002	0.011
11/ 4/74	0.291	0.005	0.12	1.76	0.002	0.017
11/18/74	0.141	0.007	0.05	1.53	< 0.002	0.020
12/ 2/74	0.479	0.028	0.23		0.219	0.202
12/16/74	1.247	0.022	0.07	1.35	0.085	0.090
12/31/74	0.145	0.013	0.04	2.20	< 0.002	0.025
1/12/75	0.347	0.008	< 0.01	1.75	< 0.002	0.019
1/13/75	0.558	0.008	0.15	1.14	< 0.002	0.008
1/26/75	0.253	0.007	0.05	1.42	< 0.002	0.013
1/28/75	0.171	0.008	0.15	1.30	0.008	0.009
2/10/75	0.130	0.006	0.10	1.30	0.003	0.018
2/25/75	0.209	0.006	0.07	1.17	0.004	0.012
3/10/75	0.192	0.004	0.03	0.92	0.004	0.018
3/24/75		< 0.004	0.05	0.97	0.003	0.009
4/ 7/75	0.182	0.008	0.01	0.80	< 0.002	0.028
4/21/75	0.040	0.004	0.01	1.35	< 0.002	0.027
5/ 5/75	0.107	0.006	0.03	1.30	0.007	0.026
5/19/75	1.457	0.099	0.20	2.03	0.107	0.125
6/ 2/75	1.114	0.045	0.05	2.10	0.019	0.036
6/17/75	0.165	0.010	0.05	1.59	0.008	0.024
6/30/75		0.068	0.05	2.62	< 0.002	0.047

DATE MO/DA/YR	NA MG/L	K MG/L	CA MG/L	MG MG/L	CL MG/L	SO4 MG/L
6/ 3/74	77.00		43.60	21.20	116.0	
6/10/74	94.00	5.10	64.60	24.40	155.4	
6/17/74	100.00		80.80	23.00	156.3	
6/24/74	93.00	3.90	56.00	25.00	196.1	
7/ 1/74	42.00		44.00	13.20	101.2	
7/ 8/74	77.00	5.90	104.20	32.20	101.2	
7/15/74	91.00	5.60	117.80	39.20	130.3	
7/22/74					182.7	
7/29/74	133.00		37.20	36.00	182.0	
8/ 5/74	83.00		107.60	32.60	96.0	
8/12/74	95.00		103.40	36.60	132.4	
8/26/74	83.00		104.20	34.80	126.0	
9/ 9/74	96.00		108.00	37.80	158.2	
9/16/74	103.00		106.40	40.00	111.6	41.8
9/23/74	85.00	3.60	111.20	32.40	133.3	
9/30/74	83.00	3.70	110.40	36.00	129.2	46.4
10/ 7/74	95.00	3.80	94.00	33.20	155.7	40.6
10/14/74	94.00	3.50	98.00	33.20	157.2	
10/21/74	144.00	3.70	97.20	37.40	188.5	20.4
10/29/74	132.00	4.20	104.40	38.20	200.8	
11/ 4/74	103.00	4.90	74.20	28.60	194.6	
11/18/74	66.00	4.80	53.40	20.50	102.6	
12/ 2/74	116.00	6.20	74.60	28.20	< 4.0	
12/16/74	100.00	4.10	92.00	30.20	148.8	60.0
12/31/74	153.60	4.30	99.00	39.00	227.0	
1/12/75	102.33	4.63	79.11	31.58	139.8	
1/13/75	163.50	4.30	100.60	39.90	258.2	
1/26/75	123.57	4.08	99.11	32.51	161.7	
1/28/75	124.00	4.40	84.20	34.80	191.5	
2/10/75	106.20	5.00	81.20	30.70	164.5	
2/25/75	103.80	4.60	76.10	29.40	143.7	
3/10/75	121.00	4.80	84.80	33.50	194.5	
3/24/75	107.20	4.60	71.20	29.10	71.8	
4/ 7/75	55.80	4.40	46.40	16.30	84.5	
4/21/75	59.70	4.10	50.60	18.00	89.5	
5/ 5/75	56.70	4.40	48.10	17.90	86.6	
5/19/75	71.30	4.70	89.10	24.80	119.8	
6/ 2/75	103.50	5.00	79.70	28.30	145.5	
6/17/75	111.60	4.30	93.50	33.40	165.3	
6/30/75	135.50		88.40	33.10	200.2	

DATE MO/DA/YR	ALK MEQ/L	SIO2 MG/L
6/ 3/74	4.21	6.0
6/10/74	4.96	13.9
6/17/74	5.07	14.6
6/24/74	6.01	18.1
7/ 1/74	2.17	13.4
7/ 8/74	1.58	13.7
7/15/74	4.71	15.7
7/22/74		
7/29/74	0.80	23.1
8/ 5/74		9.7
8/12/74	7.00	19.4
8/26/74	4.70	16.8
9/ 9/74	6.90	16.6
9/16/74	2.66	19.8
9/23/74	5.19	15.6
9/30/74	5.51	17.6
10/ 7/74	7.35	16.7
10/14/74	6.96	15.4
10/21/74	7.27	12.5
10/29/74	8.92	12.1
11/ 4/74	4.56	13.3
11/18/74	3.60	11.7
12/ 2/74	6.38	18.5
12/16/74	75.00	12.8
12/31/74	7.55	13.7
1/12/75	6.41	13.4
1/13/75	7.98	15.2
1/26/75	6.71	10.4
1/28/75	7.60	15.0
2/10/75	5.31	10.7
2/25/75	4.96	11.3
3/10/75	5.97	12.9
3/24/75	3.21	13.0
4/ 7/75	2.92	7.1
4/21/75	2.90	5.6
5/ 5/75	2.76	6.4
5/19/75	5.74	10.8
6/ 2/75	6.19	13.3
6/17/75	6.32	15.9
6/30/75	9.11	26.2

DATE MO/DA/YR	NOX MG/L	NO2 MG/L	NH4 MG/L	TKN MG/L	O-PO4 MG/L	T-PO4 MG/L
7/14/75	0.427	0.065	0.43	2.24	0.113	0.153
7/28/75	0.422	0.020	0.15	1.56	0.008	0.014
8/11/75	0.350	0.012	0.04	1.74	< 0.002	0.016
8/25/75	0.458	0.028	0.19	1.85	< 0.002	0.011
9/ 8/75	0.682	0.044	0.20	1.79	0.006	0.018
9/22/75	1.999	0.064	0.17	2.56	0.037	0.048
10/ 6/75	0.749	0.026	0.15	1.65	< 0.002	0.011
10/20/75		0.031	0.11	1.93	< 0.002	0.017
11/ 4/75	0.841	0.065	0.35	2.87	0.175	0.211
11/18/75	0.192	0.016	0.21	1.79	0.006	0.029
12/ 1/75	0.185	0.013	0.02	1.84	0.005	0.022
12/15/75	0.205	0.012	0.02	1.69	0.019	0.013
1/12/76	0.186	0.010	0.04	1.57	< 0.002	0.015
2/ 9/76	0.200	0.007	0.12	1.57	0.013	0.009
2/23/76	0.153	0.006	0.05	1.73	< 0.002	0.023
3/ 8/76	0.253	0.008	0.03	5.73	0.003	0.012
3/22/76	0.381	0.015	0.07	1.54	0.008	0.029

DATE MO/DA/YR	NA MG/L	K MG/L	CA MG/L	MG MG/L	CL MG/L	SO4 MG/L
7/14/75	129.98	6.01	90.13	33.54	190.2	
7/28/75	83.55	4.05	107.80	24.77	128.7	
8/11/75	114.30	3.90	111.08	33.70	174.0	
8/25/75	89.70		118.89	35.95	125.5	
9/ 8/75	87.84	3.89	116.64	34.62	132.2	
9/22/75	79.58		123.58	35.32	123.0	
10/ 6/75	106.72	3.36	111.43	32.63	147.2	
10/20/75	107.56	3.91	112.58	34.52	151.8	
11/ 4/75	133.44	6.65	87.45	31.05	200.4	25.7
11/18/75	129.75	3.91	85.66	31.53	182.3	
12/ 1/75	92.71	4.59	72.68	28.92	133.2	
12/15/75	91.28	4.71	75.22	29.97	127.3	
1/12/76	93.06	5.13	67.39	28.16	126.0	
2/ 9/76	136.43	5.15	95.44	39.26	200.5	
2/23/76	98.67	5.53	84.30	33.63	152.7	
3/ 8/76	117.66	4.32	52.49	32.99	185.3	
3/22/76	123.08	4.63	109.58	43.41	192.1	

DATE MO/DA/YR	ALK MEQ/L	SIO2 MG/L
7/14/75	6.43	18.0
7/28/75	7.28	13.1
8/11/75	7.58	16.9
8/25/75	7.18	15.3
9/ 8/75	8.09	15.4
9/22/75	8.27	14.0
10/ 6/75	8.74	10.9
10/20/75	7.57	15.1
11/ 4/75	10.14	18.6
11/18/75	7.67	15.7
12/ 1/75	6.64	11.9
12/15/75	4.85	11.7
1/12/76	5.68	11.0
2/ 9/76	8.06	15.5
2/23/76	5.74	12.3
3/ 8/76	7.30	12.6
3/22/76	8.05	13.3

APPENDIX B. WATER QUALITY RESULTS FOR ALL SAMPLING DATES

4. Pump Station S-8

DATE MO/DA/YR	NOX MG/L	NO2 MG/L	NH4 MG/L	TKN MG/L	O-PO4 MG/L	T-PO4 MG/L
6/ 3/74		< 0.004	0.05		0.003	0.028
6/10/74	0.172	0.014	0.12	1.45	0.002	0.024
6/17/74	8.900	0.175	0.03	8.50	0.004	0.023
6/24/74	3.510	0.182	0.15	2.19	0.007	0.016
7/ 1/74	3.050	0.004	0.12	2.42	0.140	0.190
7/ 8/74		0.040	0.10	2.98	0.264	
7/15/74			0.15	8.64	0.157	0.263
7/22/74	0.216	0.034	0.05	1.26	0.023	0.054
7/29/74	0.744	0.083	0.32	2.42	0.090	0.070
8/ 5/74	0.516	0.045	0.27	1.40	0.002	0.122
8/12/74	2.300	0.070	0.19	6.92	0.090	0.080
8/26/74	0.660	0.054	0.26		0.033	0.011
9/ 9/74	0.428	0.031	0.10	2.56	0.010	0.074
9/16/74	0.570	0.040	0.16		0.021	0.072
9/23/74	0.728	0.057	0.03	2.17	0.007	0.040
9/30/74	0.750	0.029	0.04	2.51	0.024	0.035
10/ 7/74	0.500	0.037	0.08	2.49	0.023	0.044
10/14/74	0.304	0.025	0.06	1.49	0.010	0.053
10/21/74	0.189	0.019	0.04	1.76	0.002	0.039
10/29/74	0.205	0.015	0.06	1.83	0.015	0.032
11/ 4/74	0.192	0.015	< 0.01	2.13	< 0.002	0.011
11/18/74	0.478	0.034	0.04	1.94	< 0.002	0.014
12/ 2/74	0.172	< 0.004	0.03		0.007	0.063
12/16/74	0.030	0.006	0.03	1.51	< 0.002	0.005
12/31/74	0.397	0.011	0.31	1.98	< 0.002	0.015
1/12/75	0.276	0.007	0.07	1.66	< 0.002	0.011
1/13/75	0.193	0.005	0.06	1.40	< 0.002	0.007
1/28/75	0.128	0.009	0.04	1.34	0.008	0.021
2/10/75	0.136	0.005	0.07	1.24	< 0.002	0.013
2/25/75	0.192	0.006	0.06	0.90	0.014	0.028
3/10/75	0.167	< 0.004	0.03	1.16	0.003	0.014
3/24/75	0.085	< 0.004	0.03	0.97	0.045	0.059
4/ 7/75	0.185	0.004	0.05	0.82	0.008	0.029
4/21/75	0.045	0.005	0.01	1.27	< 0.002	0.018
5/ 5/75	0.139	0.005	< 0.01	1.29	0.004	0.022
5/19/75	0.741	0.043	0.14	1.98	0.199	0.260
6/ 2/75	2.346	0.127	0.14	3.00	0.034	0.043
6/17/75	1.432	0.110	0.15	2.75	0.034	0.067
6/30/75	0.703	0.018	< 0.01	1.72	< 0.002	0.045
7/14/75	0.197	0.037	0.07	1.92	0.075	0.124

DATE MO/DA/YR	NA MG/L	K MG/L	CA MG/L	MG MG/L	CL MG/L	SO4 MG/L
6/ 3/74	68.00		35.40	18.40	105.8	
6/10/74	42.00	3.30	30.60	15.00	100.2	
6/17/74	64.00		76.60	15.20	107.5	
6/24/74	52.00	4.90	83.40	19.00	119.8	
7/ 1/74	24.00		61.80	11.40	107.6	
7/ 8/74	32.00	4.90	47.60	8.60	48.1	
7/15/74	43.00	5.90	87.80	15.20	63.6	
7/22/74					188.4	
7/29/74	62.00		87.80	18.00	96.2	
8/ 5/74	55.00		111.20	22.80	132.9	
8/12/74	51.00		86.60	16.20	75.3	
8/26/74	59.00		95.80	17.80	94.7	
9/ 9/74	42.00		78.00	14.00	64.2	
9/16/74	36.00		74.00	12.40	99.6	28.5
9/23/74	47.00	2.90	88.80	15.60	72.9	
9/30/74	41.00	3.00	86.00	13.80	60.0	27.4
10/ 7/74	37.00	2.60	76.00	12.40	56.3	20.8
10/14/74	33.00	2.50	68.00	9.50	50.0	
10/21/74	36.00	2.00	71.20	9.60	46.5	12.9
10/29/74	33.00	2.00	73.80	9.00	39.2	
11/ 4/74	37.00	2.10	78.40	11.80	87.9	
11/18/74	57.00	3.50	99.40	17.60	92.6	
12/ 2/74	50.00	5.10	46.00	14.80	< 4.0	
12/16/74	56.40	4.30	80.40	14.40	90.1	59.6
12/31/74	113.60	3.00	103.60	35.80	173.7	
1/12/75	95.78	3.79	86.04	30.31	141.9	
1/13/75	105.00	2.80	106.60	30.40	157.5	
1/28/75	61.50	4.70	60.60	20.40	92.1	
2/10/75	107.80	4.60	86.00	32.10	171.1	
2/25/75	51.50	4.60	47.10	16.10	75.6	
3/10/75	100.20	4.50	73.40	28.90	167.9	
3/24/75	52.10	4.30	47.90	16.80	73.5	
4/ 7/75	51.70	4.40	45.60	15.60	84.3	
4/21/75	56.10	3.80	48.80	16.30	82.5	
5/ 5/75	59.20	4.10	47.00	17.20	88.2	
5/19/75	71.00	4.70	88.30	17.60	110.9	
6/ 2/75	61.10	5.00	100.90	38.00	100.7	
6/17/75	89.80	6.10	122.80	35.10	130.7	
6/30/75	74.70	2.40	103.20	24.70	109.8	
7/14/75	50.10	2.84	89.16	14.90	81.0	

APPENDIX B-4 (Continued)

DATE MO/DA/YR	ALK MEQ/L	SIO2 MG/L
6/ 3/74	2.05	6.0
6/10/74	2.52	5.9
6/17/74	4.07	8.0
6/24/74	5.10	6.8
7/ 1/74	< 0.10	5.8
7/ 8/74	0.72	6.6
7/15/74	4.01	7.5
7/22/74	2.63	8.0
7/29/74	5.20	10.2
8/ 5/74		15.9
8/12/74	4.68	7.6
8/26/74	2.18	9.0
9/ 9/74	4.46	7.7
9/16/74	2.59	8.1
9/23/74	3.56	7.9
9/30/74	5.09	6.9
10/ 7/74	4.74	8.3
10/14/74	4.39	7.6
10/21/74	4.12	4.3
10/29/74	4.13	5.4
11/ 4/74	4.08	6.6
11/18/74	6.78	8.5
12/ 2/74	< 0.10	18.1
12/16/74	4.13	8.2
12/31/74	7.85	13.1
1/12/75		12.9
1/13/75	8.61	9.4
1/28/75	3.91	7.4
2/10/75	5.67	10.1
2/25/75	2.70	5.9
3/10/75	5.26	11.3
3/24/75	3.18	5.3
4/ 7/75	2.89	7.2
4/21/75	2.78	3.5
5/ 5/75	2.95	6.5
5/19/75	5.96	12.3
6/ 2/75	4.90	6.5
6/17/75	6.26	15.6
6/30/75	6.36	14.2
7/14/75	4.45	7.1

APPENDIX B-4 (Continued)

DATE MO/DA/YR	NOX MG/L	NO2 MG/L	NH4 MG/L	TKN MG/L	O-PO4 MG/L	T-PO4 MG/L
7/28/75	0.374	0.022	0.10	1.53	0.007	0.013
8/11/75	0.537	0.018	< 0.01	1.89	0.040	0.089
8/25/75	0.369	0.020	0.10	1.79	< 0.002	0.012
9/ 8/75	1.348	0.031	0.10	2.17	0.045	0.079
9/22/75	1.817	0.037	0.12	2.41	0.051	0.079
10/ 6/75	0.653	0.022	0.05	1.38	< 0.002	0.012
10/20/75		0.017	0.15	1.97	0.048	0.099
11/ 4/75	0.207	0.018	0.29	2.15	0.012	0.017
12/ 1/75	0.353	0.015	0.06	1.89	< 0.002	0.019
3/22/76	0.435	0.018	0.17	1.86	0.036	0.052

APPENDIX B-4 (Continued)

DATE MO/DA/YR	NA MG/L	K MG/L	CA MG/L	MG MG/L	CL MG/L	SO4 MG/L
7/28/75	81.86	4.26	111.30	26.65	122.9	
8/11/75	33.84	1.87	71.31	7.56	47.6	
8/25/75	89.38		116.35	36.85	130.2	
9/ 8/75	57.28	3.74	94.83	14.83	84.0	
9/22/75	41.92		88.33	13.72	64.8	
10/ 6/75	77.40	1.85	113.24	26.08	115.3	
10/20/75	25.50	1.58	60.53	8.83	38.9	
11/ 4/75	116.56	3.57	105.81	30.88	150.9	26.9
12/ 1/75	99.21	4.08	92.65	29.98	137.4	
3/22/76	78.15	6.10	99.71	25.06	119.1	

DATE MO/DA/YR	ALK MEQ/L	SIO2 MG/L
7/28/75	7.11	14.4
8/11/75	3.71	5.7
8/25/75	6.77	13.9
9/ 8/75	4.87	7.5
9/22/75	4.60	6.9
10/ 6/75	8.16	8.8
10/20/75	3.14	4.7
11/ 4/75	10.74	13.9
12/ 1/75	7.26	12.9
3/22/76	5.82	6.5

APPENDIX C

LAND USE BREAKDOWNS FOR THE S-5A, S-6, S-7 AND S-8 DRAINAGE BASINS

SOURCE: South Florida Water Management District
Land Resources Division

APPENDIX C

S-5A BASIN LAND COVER ANALYSIS - SFWMD LAND RESOURCES DIVISION

	Acres	Percent of Total
1. Urban and Built-Up Land		
Residential		
Low Density	384	
Medium Density	364	
Multi-family	107	
Mobile Home	9	
Total	864	1%
Commercial & Service		
Sales & Service	120	
Total	120	.09%
Industrial	270	.21%
Institutional		
Education	40	
Government	16	
	56	.04%
Transportation		
Grass Airport	12	
Sewerage Plant	40	
	52	.04%
Open & Others		
Recreation	80	
Parks	18	
Under Development	11	
Open & Undeveloped	68	
Total	177	
Urban Total	1,539	1.2%
2. Agriculture		
Cropland	2,390	1.8%
Sugar Cane	92,915	71.2%
Truck Crops	6,066	4.6%
Sod Farms	1,870	1.4%
Improved Pasture	11,636	8.9%
Total	114,877	88.1%
3. Forested and Wetland		
Rangeland		
Grass	4,536	
Total	4,536	3.5%

S-5A BASIN LAND COVER ANALYSIS - SFWMD LAND RES. DIV. (CONTINUED)

Wetlands		
Non-forested Fresh	8,954	
	8,954	6.9%
Water		
Canals	340	
Open	13	
	353	.27%
Barren Land		
Gravel Pits	102	
Levees	98	
	200	.15%
Total Area	130,459	

APPENDIX C

S-6 BASIN LAND COVER ANALYSIS - SFWMD LAND RESOURCES DIVISION

	Acres	Percent of Total
1. Urban and Built-Up		
Transportation		
Sewage Plant	46	
Airstrip	14	
Total	60	.07%
2. Agriculture		
Sugarcane	31,187	36%
Truck Crops	12,765	15%
Improved Pasture	37,509	43%
Total	81,461	93%
3. Forested and Wetland		
Forested Upland		
Old Fields	112	.13%
Total	112	.13%
Wetlands		
Non-forested	5,638	6%
Water		
Canals	316	.36%
Total Forested & Wetland	6,066	7%
Total Area	87,587	

APPENDIX C

S-7 BASIN LAND COVER ANALYSIS - SFWMD LAND RESOURCES DIVISION

	Acres	Percent of Total
1. Urban and Built-Up Land		
Transportation	1	
Industrial	47	
Urban Total	48	.06%
2. Agriculture		
Sugarcane	56,930	69%
Improved Pasture	7,055	9
Total	63,985	78%
3. Forested and Wetland		
Forested Uplands		
Old Fields	2,001	2.4%
Wetlands		
Non-forested	16,120	19.6%
Water		
Canals	298	
Open	12	
	310	.38%
Forested and Wetland Total	18,431	22%
Total Area	82,464	

APPENDIX C

S-8 BASIN LAND COVER ANALYSIS - SFWMD LAND RESOURCES DIVISION

	Acres	Percent of Total
1. Agriculture		
Sugar Cane	33,563	26.3%
Sod Farms	1,340	1.0%
Improved Pasture	4,016	3.2%
Total	38,919	30.5%
2. Forested and Wetland		
Wetlands		
Non-forested	88,315	69.3%
Water		
Canal	236	
Open	4	
	240	.19%
Total Area	127,474	