EIGHTH ANNUAL REPORT OF THE CONTINUING SURFACE WATER QUALITY MONITORING PROGRAM FOR THE PALMER RANCH JANUARY - DECEMBER, 1992 SARASOTA COUNTY, FLORIDA

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF TABLES

LIST OF APPENDIX B TABLES

EIGHTH ANNUAL REPORT OF THE CONTINUING SURFACE WATER QUALITY MONITORING PROGRAM THE PALMER RANCH SARASOTA COUNTY, FLORIDA

1.0 INTRODUCTION

A master development plan for the Palmer Ranch is being implemented pursuant to the terms and conditions of the **Amended and Restated Master Development Order** (Amended MDO) for the Palmer Ranch Development of Regional Impact (DRI) which was adopted on July 12, 1991, by the Board of County Commissioners of Sarasota County. The amended and original MDO's call for planning and developing the 5,119-acre Palmer Ranch DRI in incremental developments. Construction of the first incremental development (Prestancia) was initiated in 1986. The Palmer Ranch is located in west-central Sarasota County as shown in Figure 1.1.

Pursuant to the conditions of the original MDO, a "Continuing Surface Water Quality Monitoring Program" was required to be performed prior to and during construction, except during the period in which a "Pollutant Loading Monitoring Program" was to be performed as specified in the Agreement of Understanding between Sarasota County and Palmer Venture established during August 1987.

The original monitoring program, which was initiated in May 1984 by GeoScience, Inc., employed a bimonthly sampling frequency as required for the first year of monitoring. Subsequently, the scope of the monitoring program for the following two-year period was revised during an agency review meeting in June 1985. The meeting

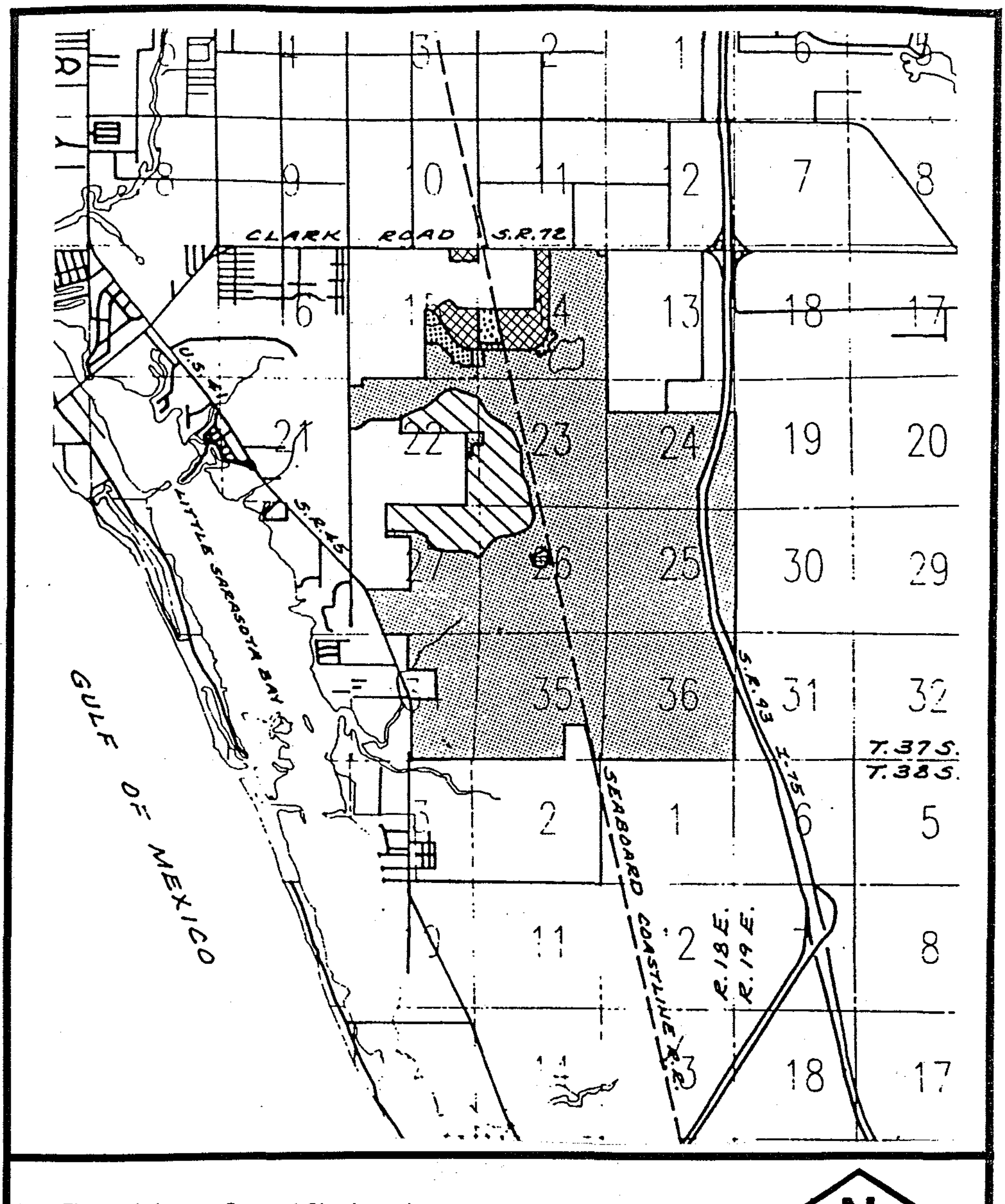


Figure 1.1 General Site Location.

involved the developer's representative, Mr. T. W. Goodell, and Mr. Russ Klier of Sarasota County Pollution Control Division (personal communication with Mr. T. W. Goodell). The revised workscope entailed a 13 station network with a quarterly sampling frequency for the parameters monitored during the first year, except trace elements and organochlorine pesticides which would receive annual audits (refer to July 24, 1986 correspondence of Mr. T. W. Goodell to Mr. Russ Klier).

Palmer Venture contracted Conservation Consultants, Inc. (CCI) to implement the "Continuing Surface Water Quality Monitoring Program" during the second year of the monitoring program. CCI began monitoring on September 16, 1985, pursuant to the instructions provided by Palmer Venture. Except for an annual sampling event conducted in September 1988, the "Continuing Surface Water Quality Monitoring Program" was suspended in June 1988, due to the initiation of the "Pollutant Loading Monitoring Program". The Stormwater Pollutant Loading Monitoring Program was performed between June 1988 and December 1989 and a report submitted to Sarasota County on May 29, 1992. Subsequent to an agreement between the Sarasota County Pollution Control Division and Palmer Venture, the "Continuing Surface Water Quality Monitoring Program" was resumed in December 1989 with a single annual sampling event conducted during the fifth monitoring year. After resumption of monitoring in December 1989, the surface water quality monitoring was performed on a quarterly basis at all stations until December 10, 1991.

With adoption of **Exhibit "E" to the Amended and Restated Master Development Order for the Palmer Ranch Development of Regional Impact** (Appendix A), a revised water quality monitoring program was implemented. This revised monitoring program consists of quarterly water quality measurements and grab sample collection in Catfish Creek, North Creek and South Creek at a total of 10 monitoring stations. In accordance with Exhibit "E", monitoring in the South Creek Basin was suspended until one month prior to any development activity occurring in the basin. Upon intent to re-initiate monitoring of the South Creek Basin, Sarasota County Pollution Control Division is to be notified of dates of sampling and stations to be sampled. As specified in Exhibit "E", this pre-development monitoring event will include water quality grab sampling and *in situ* measurements at four (4) monitoring stations along South Creek. Following this initial monitoring event, all subsequent monitoring shall be performed on a quarterly basis during the development phase. During development, all stations located downstream of an area under development shall be monitored. Additionally, one sampling site located upstream of a development area shall also be monitored in order to determine baseline water quality conditions. Once an area is substantially developed as agreed to by the Sarasota County Pollution Control Division and the Palmer Ranch, a modification of the monitoring program shall be subject to discussion for change in water quality monitoring frequency from quarterly to semi-annually or to be discontinued.

Under the amended and approved monitoring plan as stated in Exhibit "E", monitoring of Catfish Creek and North Creek is to continue on a quarterly basis for a maximum of two years or until substantial development occurs. Once substantial development or a two-year period occurs and is agreed to by both Sarasota County Pollution Control Division and the Palmer Ranch, the monitoring frequency for sites located in

Catfish Creek and North Creek shall be subject to change from quarterly to semi-annually depending on results obtained up to that time. Because no development activity has occurred in the South Creek Basin, water quality monitoring for 1992 was performed only in Catfish Creek and North Creek.

The water quality conditions recorded during the period from January through December 1992 are reported herein. This report includes a discussion of the results with respect to applicable water quality criteria, observed spatial and temporal trends, and comparisons with results obtained during previous monitoring events.

2.0 GENERAL ENVIRONMENTAL SETTING

2.1 Climate

Prevailing climatic conditions in west-central Florida are sub-tropical, characterized by abundant rainfall and moderate temperatures. Average monthly temperatures derived from two separate 30-year periods of record are provided in Table 2.1 below :

TABLE 2.1 AVERAGE MONTHLY AIR TEMPERATURES (NATIONAL WEATHER SERVICE, TAMPA, FL.).

	AIR TEMPERATURE			
	1941-1970[a]		1931-1960[b]	
MONTH	°C	°F	°C	°F
January	16.4	61.6	16.9	62.4
February	17.2	62.9	17.7	63.8
March	19.4	66.9	19.4	67.0
April	22.3	72.1	22.1	71.8
May	24.8	76.7	24.9	76.8
June	26.8	80.3	26.9	80.4
July	27.6	81.6	27.6	81.6
August	27.7	81.9	27.8	82.0
September	26.9	80.5	27.0	80.6
October	23.9	75.0	23.9	75.1
November	19.8	67.7	19.9	67.9
December	17.1	62.8	17.4	63.4
Annual Average	22.5	72.5	22.6	72.7

[a]Thompson, 1976
[b]Bradley, 1974

Based on a 30-year period of record, rainfall in Bradenton, Florida (NOAA, 1977) averages 56 inches per year. The minimum annual rainfall recorded during the 30-year period was 29 inches while the maximum was 93 inches. Historical rainfall trends for this area show that a wet season occurs during the period of June through September followed by a dry season during the period of October through January. On the average 62 percent (35 inches) of the annual rainfall occurs during the summer with only 13 percent (7 inches) during the fall. The dry season is followed by a short wet period during February and March and subsequently a short dry period during April and May.

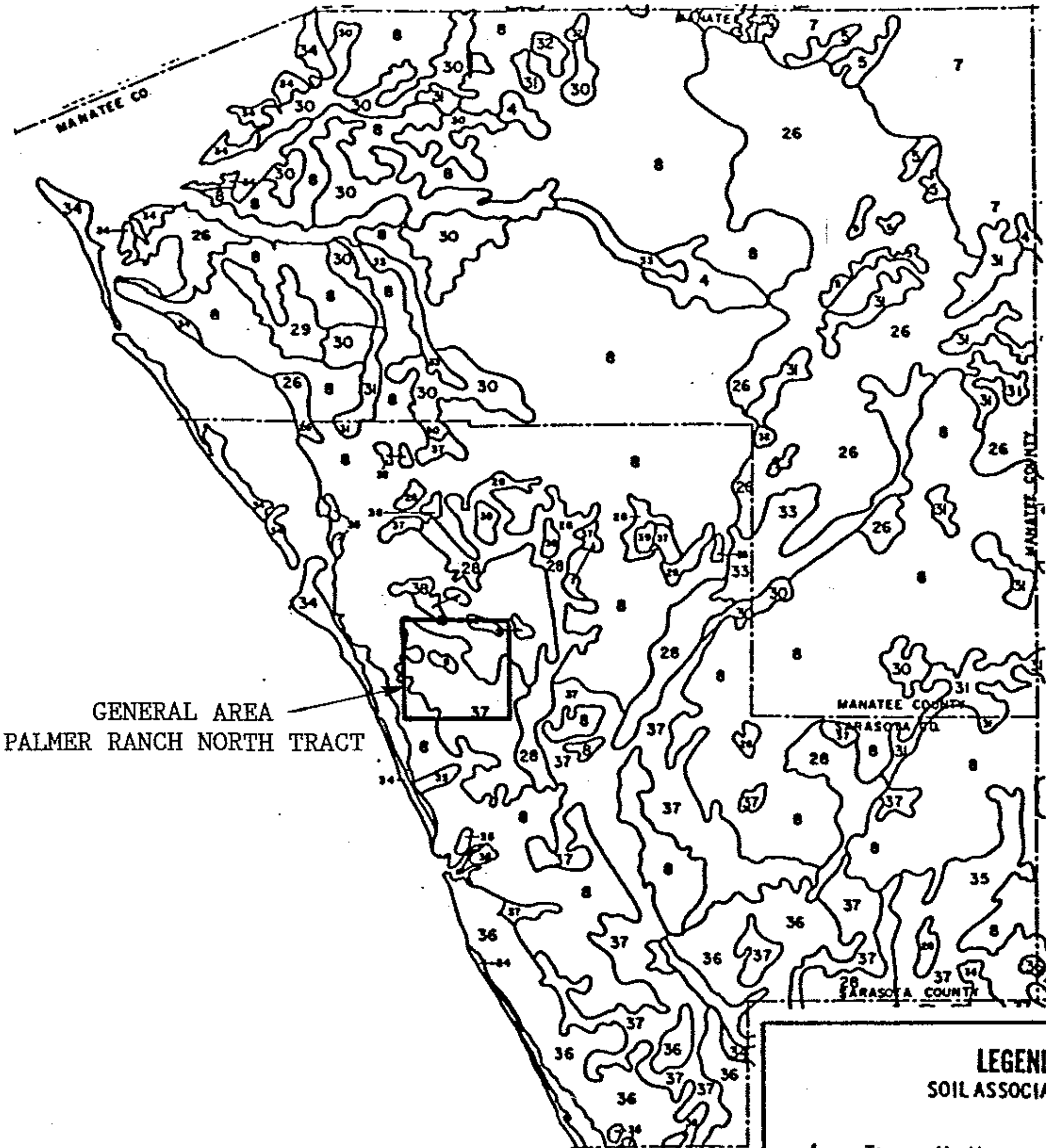
2.2 Soils

Soils in the area of the Palmer Ranch are generally sandy except in areas of low relief and poor drainage where peaty mucks are common (Florida Division of State Planning, 1975). Upland soils found throughout the Palmer Ranch are predominately of the Myakka-Immokalee-Basinger Association. This soil association is defined as being nearly level with poorly drained sandy soils (Florida Division of State Planning, 1975).

Along the well-incised banks of several drainage ditches traversing the Palmer Ranch (*e.g.* lower reach of Catfish Creek), it is evident that a natural marine deposit exists a few feet below the ground surface. This marine deposit contains a thin layer of shells and shell fragments. Figure 2.1 and Table 2.2 provide the locations and descriptions of the soil associations that occur in the area of the Palmer Ranch.

2.3 Land Use and Vegetation

Historically, the primary land use within the Palmer Ranch has been cattle ranching. However, recent changes in land uses on the Palmer Ranch have included the following: construction of a surface water management system; construction of roads, golf courses, homes, and wastewater treatment facilities and associated domestic



LEGEND
SOIL ASSOCIATIONS

4	Tavares-Myakka
5	Pomello-St. Lucie
7	Myakka-Pomello-Basinger
8	Myakka-Immokalee-Basinger
26	Immokalee-Pomello
28	Pompano-Charlotte-Delray
30	Wabasso-Bradenton-Myakka
31	Placid-Basinger
32	Delray-Manatee-Pompano
33	Fresh Water Swamp & Marsh
34	Tidal Marsh & Swamp-Coastal Beach Ridges
35	Pomello-Paola-St. Lucie
36	Immokalee-Myakka-Pompano
37	Adamsville-Pompano
38	Scranton, var.-Ona-Placid
39	Terra Cela

Source: The Florida General Soils Atlas, Florida Division of State Planning (1975)

Figure 2.1 Soil Associations in Region

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TABLE 2.2 DESCRIPTIONS OF SOIL ASSOCIATIONS.

Area Definition	Map Unit No.	Soil Association Description
Areas dominated by moderately well to poorly drained soils not subject to flooding	4	Tavares-Myakka association: Nearly level to gently sloping, moderately well-drained soils sandy throughout and poorly drained sandy soils with weakly cemented sub-soils.
	5	Pomello-St. Lucie association: Nearly level to sloping, moderately well drained, sandy soils with weakly cemented sandy subsoil and excessively drained soils sandy throughout.
	7	Myakka-Pomello-Basinger association: Nearly level, poorly and moderately well drained, sandy soils with weakly cemented sandy subsoil and poorly drained sandy soils throughout.
	8	Myakka-Immokalee-Basinger association: Nearly level, poorly drained, sandy soils with weakly cemented sandy subsoil and poorly drained sandy soils throughout.
	26	Imokalee-Pomello association: Nearly level to gently sloping, poorly and moderately well drained, sandy soils with weakly cemented sandy subsoil.
	30	Wabasso-Bradenton-Myakka association: Nearly level, poorly drained, sandy soils with a weakly cemented sandy subsoil layer underlain by loamy subsoil; poorly drained soils with thin, sandy layers over loamy subsoil and poorly drained soils with weakly cemented sand subsoil.

TABLE 2.2 DESCRIPTIONS OF SOIL ASSOCIATIONS (Continued).

Area Definition	Map Unit No.	Soil Association Description
Areas dominated by moderately well to poorly drained soils subject to flooding (continued)	35	Pomello-Paola-St. Lucie association: Nearly level to sloping, moderately well drained sandy soils with weakly cemented sandy not subsoil and excessively drained soils, sandy throughout.
	36	Imokalee-Myakka-Pompano association: Nearly level, poorly drained, sandy soils with weakly cemented sandy subsoil and poorly drained soils, sandy throughout.
	37	Adamsville-Pompano association: Nearly level, somewhat poorly and poorly drained, soils, sandy throughout.
	38	Scranton, var.-Ona-Placid association: Nearly level, somewhat poorly drained, dark surface soils, sandy throughout; poorly drained soils with thin, sandy layers over weakly cemented sandy subsoil and very poorly drained soils, sandy throughout.
Areas dominated by poorly and very poorly drained soils subject to flooding.	28	Pompano-Charlotte-Delray association: Nearly level, poorly drained soils, sandy throughout, and very poorly drained soils with thick sandy layers over loamy sub-soil.
	31	Placid-Bassinger association: Nearly level, very poorly and poorly drained soils, sandy throughout.

TABLE 2.2 DESCRIPTIONS OF SOIL ASSOCIATIONS (Continued).

Area Definition	Map Unit No.	Soil Association Description
Areas dominated by poorly and very poorly drained soils subject to flooding (continued)	32	Delray-Manatee-Pompano association: Nearly level, very poorly drained soils with thick, sandy layers over loamy subsoil; very poorly drained sandy soils, with loamy subsoil and poorly drained soils, sandy throughout.
	33	Fresh Water Swamp and Marsh association: Nearly level, very poorly drained soils subject to prolonged flooding.
	34	Tidal Marsh and Swamp-Coastal Beach Ridges/Dune association: Nearly level, very poorly drained soils subject to frequent tidal flooding, high-lying coastal dune-like ridges and deep, draughty sands.
	39	Terra Ceia association: Nearly level, very poorly drained, well-decomposed, organic soils 40-91 cm (16-36 inches) thick over loamy material.

wastewater spray effluent fields; and, land disposal of sludge. During the second monitoring year (April 1985 - March 1986), the land application of sludge wastes on the Palmer Ranch was discontinued and construction of the Central County Utilities Regional Treatment Plant and an adjacent golf course was completed. Subsequently, construction of a residential development was initiated during the third monitoring year.

Land uses adjacent to the ranch which are located upstream in several drainage basins covering portions of the ranch include golf courses, roads and highways, residential developments, a mobile home park, commercial businesses, a dairy farm which was changed to a sod farm (effective August 1, 1987), light industry, and a metal salvage operation.

The primary vegetation associations found on the undeveloped areas of the ranch include pine flatwoods, improved and semi-improved pastures, wet prairies, marshes and sloughs, swamps, and wetland fringing hammocks.

2.4 Drainage

The Palmer Ranch DRI is divided into six primary drainage basins which ultimately discharge into Drymond Bay. Two basins, the Catfish Creek\Trunk Ditch Basin and the South Creek Basin, drain the majority of the North Tract. Approximately 2,590 acres of the Catfish Creek-Trunk Ditch Basin which has a total drainage area of 3,700 acres and approximately 1,770 acres of the South Creek Basin which has a total drainage area of approximately 12,000 acres are located on the North Tract. Four minor basins also drain portions of the property. These include Matheny Creek Basin

(40 acres), Elligraw Bayou Basin (180 acres), North Creek Basin (460 acres), and Clower Creek Basin (80 acres). A general description of the major streams in these basins is provided in the following sections.

2.4.1 *Catfish Creek*

Catfish Creek within the limits of the Palmer Ranch DRI was a man-made ditch/channel system which flowed southwest to the southern boundary of the property, intersecting Trunk Ditch, a straight man-made canal, at five locations. The upper portion of Catfish Creek receives off-site drainage from commercial and industrial areas near Clark Road. Many of these commercial and industrial areas lack stormwater management systems. The lower portion of the Catfish Creek drainage system receives stormwater run-off from various stormwater management systems located throughout the Palmer Ranch residential development.

Immediately downstream of the Palmer Ranch, the Catfish Creek drainage system receives drainage and at times "overflow" from the wastewater treatment ponds associated with a mobile home park. Farther downstream, drainage from residential areas and run-off from U.S. Highway 41 enter the creek. Beyond U.S. Highway 41, Catfish Creek is affected by tidal changes from Little Sarasota Bay.

2.4.2 *Trunk Ditch*

Trunk Ditch was originally constructed to improve drainage. Initially, it extended from the northern boundary of the Palmer Ranch property to North Creek producing in scouring velocities during major storm events. These high velocities resulted in out-of-bank flooding and sediment transport. During early 1986, a segment of Trunk Ditch was re-constructed in association with the Development of Prestancia. This re-construction resulted in an improved channel and the placement of two water level control weirs. As a result of these two weirs, lentic conditions occur during the dry season. Vegetation in Trunk Ditch is dominated by Hydrilla, Elodea, cattail, and other aquatic weeds. As mentioned earlier, Catfish Creek intersects Trunk Ditch at five locations.

Runoff entering the upper reaches of Trunk Ditch originates along Clark Road, including the adjacent commercial and industrial areas. Downstream, runoff enters Trunk Ditch from Prestancia's golf course and residential development, the Country Club of Sarasota and associated residential area, as well as pine flatwoods, improved pastures, and wetlands of the Palmer Ranch.

Subsequently, three (3) additional weirs were added in the re-constructed portion of the Trunk Ditch during 1988 to 1991. Also, a drainage-basin divide between Catfish Creek and North Creek was created at that time with the construction of Central Sarasota Parkway.

2.4.3 *North Creek*

North Creek is connected to Trunk Ditch by a dredged tributary located near the southern boundary of the North Tract. The banks of this tributary are vegetated with grasses and trees resulting in a partially overhanging canopy. Most of the drainage into this dredged tributary originates from improved pasture, idle agricultural land, a marsh/slough system, and an off-site metal salvage operation. Downstream of the North Tract, Trunk Ditch enters the main channel of North Creek, which subsequently flows into Little Sarasota Bay. Residential areas, U. S. Highway 41, and pine flatwoods drain into the downstream reach of North Creek.

2.4.4 *South Creek*

South Creek within the Palmer Ranch is largely a shallow ditch system constructed through historic, broad sloughs or interconnecting previously isolated marshes. The banks of South Creek are vegetated with grasses and occasional pines, while its channel is generally void of aquatic vegetation. Upstream of the Palmer Ranch, South Creek receives drainage in its western tributary from a golf course and a mobile home park. At its eastern boundary, it receives drainage from agricultural and recreational land uses as well as Interstate I-75. Before mid-1987, much of the area upstream of I-75 was used as a dairy farm.

Within the Palmer Ranch, South Creek receives drainage primarily from improved pastures and pine flatwoods. Downstream of the ranch, South Creek flows through the Oscar Scherer State Recreational Area and subsequently into the tidal waters of Drymond Bay.

2.4.5 *Elligraw Bayou*

Elligraw Bayou is a channelized stream that flows southwesterly to Drymond Bay. The banks of Elligraw Bayou are sloped and vegetated with grasses and trees. On the ranch, Elligraw Bayou receives drainage from Increment II development areas and Prestancia (Increment I). Downstream of the Palmer Ranch, Elligraw Bayou flows through Ballantrae and several other residential areas before entering Drymond Bay.

2.4.6 *Matheny Creek*

Matheny Creek is a channelized stream that originates in the marshes and sloughs northwest of the Palmer Ranch. It flows southwest and eventually discharges into Drymond Bay. The banks of Matheny Creek are steep and vegetated with grasses and some trees. Drainage enters Matheny Creek from residential developments, commercial and industrial areas, and golf courses.

2.4.7 *Clower Creek*

Clower Creek forms the south border of the 70-acre Sarasota Square Mall. A 1.6 acre wet prairie located east of the mall on the Palmer Ranch most likely represents the headwaters of Clower Creek during the wet season. Drainage conveyed by Clower Creek flows westerly for 1,350 feet, and subsequently, through an underground pipeline along the north and west borders of a trailer park adjacent to the Sarasota Square Mall. After flowing underground for about 650 feet, drainage enters the mall's stormwater management system. Subsequently, discharge from the mall's stormwater management system drains through swales into culverts and underneath U.S. 41 to Drymond Bay.

2.5 Water Quality Classification

The segments of the streams traversing the North Tract of the Palmer Ranch are non-tidal freshwater systems which have been designated by the State as Class III waters pursuant to Sub-section 17-302.400(1) of the Florida Administrative Code (FAC). Downstream, these streams flow into an estuarine system (Drymond Bay) which is classified as an Outstanding Florida Water (OFW). In addition, the segment of South

Creek which flows through the Oscar Scherer State Recreational Area is classified as an OFW. State and Sarasota County water quality standards applicable to the "Continuing Water Quality Monitoring Program" (*i.e.*, those applicable to Class III, predominantly fresh surface waters) are listed in Table 2.3.

TABLE 2.3 APPLICABLE STATE AND COUNTY WATER QUALITY CRITERIA FOR CLASS III, PREDOMINATELY FRESH WATERS.

Parameter	State of Florida FAC 17-302	Sarasota County Ord. No. 72-37
Arsenic	Not >50 μg/L	Not >100 μg/L
BOD-5	Not to be increased in a manner that would depress Dissolved Oxygen levels below criteria.	Same as FAC 17-3
Coliform, Fecal	Not >800/100 mL	----
Coliform, Total	Not >2,400/100 mL	Not >2,400/100 mL
Specific Conductance	Shall not be increased more than 50% above background or to 1275 umhos/cm, whichever is greater, in predominantly fresh waters.	+100% above background, or to max. of 500 umhos/cm in fresh water streams.
Copper	Not >12.8 μg/L at a Total Hardness of 110 mg/L	Not >10 μg/L
Dissolved Oxygen	Not <5 mg/L	Not <4 mg/L
Lead	Not >3.6 μg/L at a Total Hardness of 110 mg/L	Not >10 μg/L
Nutrients	Concentrations in a body of Water shall not be altered in such a manner as to cause an imbalance in natural populations of aquatic flora or fauna.	-----
Nitrogen, Ammonia (ionic plus non-ionic)	See Nutrients	Only applies to non-ionic Ammonia
Nitrogen, Nitrite	See Nutrients	-----
Nitrogen, Nitrate	See Nutrients	-----
Nitrogen, Total	See Nutrients	-----

TABLE 2.3 APPLICABLE STATE AND COUNTY WATER QUALITY CRITERIA FOR CLASS III, PREDOMINATELY FRESH WATERS (Continued).

Parameter	State of Florida FAC 17-302	Sarasota County Ord. No. 72-37
Nitrogen, Organic	See Nutrients	-----
Oil and Greases	Not >5 mg/L	Not >15 mg/L
Phosphate, Ortho	See Nutrients	-----
Phosphorus, Total	See Nutrients	-----
pH	6 - 8.5	6 - 8.5
Solids, Total Suspended	-----	-----
Turbidity	Not >29 NTU above background	Not >25 JTU above background
Zinc	Not >115 μg/L	Not >10 μg/L

3.0 FIELD AND LABORATORY PROCEDURES

3.1 Station Locations and General Descriptions

The "Continuing Surface Water Quality Monitoring Program" employs a network of 10 sampling stations located at various sites along South Creek, Catfish Creek, North Creek, and Trunk Ditch (Figure 3.1). A general description of the characteristics of the 10 sampling stations is provided in Table 3.1.

Pursuant to Resolution 91-170, South Creek was not monitored during 1992. Future monitoring of South Creek shall depend on the commencement of any development activity in the South Creek Basin within the Palmer Ranch property.

In Catfish Creek, inflow into the Palmer Ranch was monitored at Station CC-1 while outflow was monitored at Station CC-5. Station CC-1 receives drainage from Clark Road, McIntosh Road, and various commercial/industrial developments. Two tributaries of Catfish Creek were also monitored near their confluences with Trunk Ditch (Stations CC-2 and CC-3). These two stations represent stream segments which receive drainage from Prestancia and backwater effects of Trunk Ditch.

Trunk Ditch was monitored within its realigned segment within the Catfish Creek-Trunk Ditch Drainage Basin at Station CC-4. This site lies adjacent to and receives drainage from both the Country Club of Sarasota and Prestancia and sources farther upstream, as well as pine flatwoods, improved pastures, and wetlands of the Palmer Ranch. Farther to the South, Trunk Ditch was monitored at a location within the North Creek Basin, *i.e.*, Station NC-6.

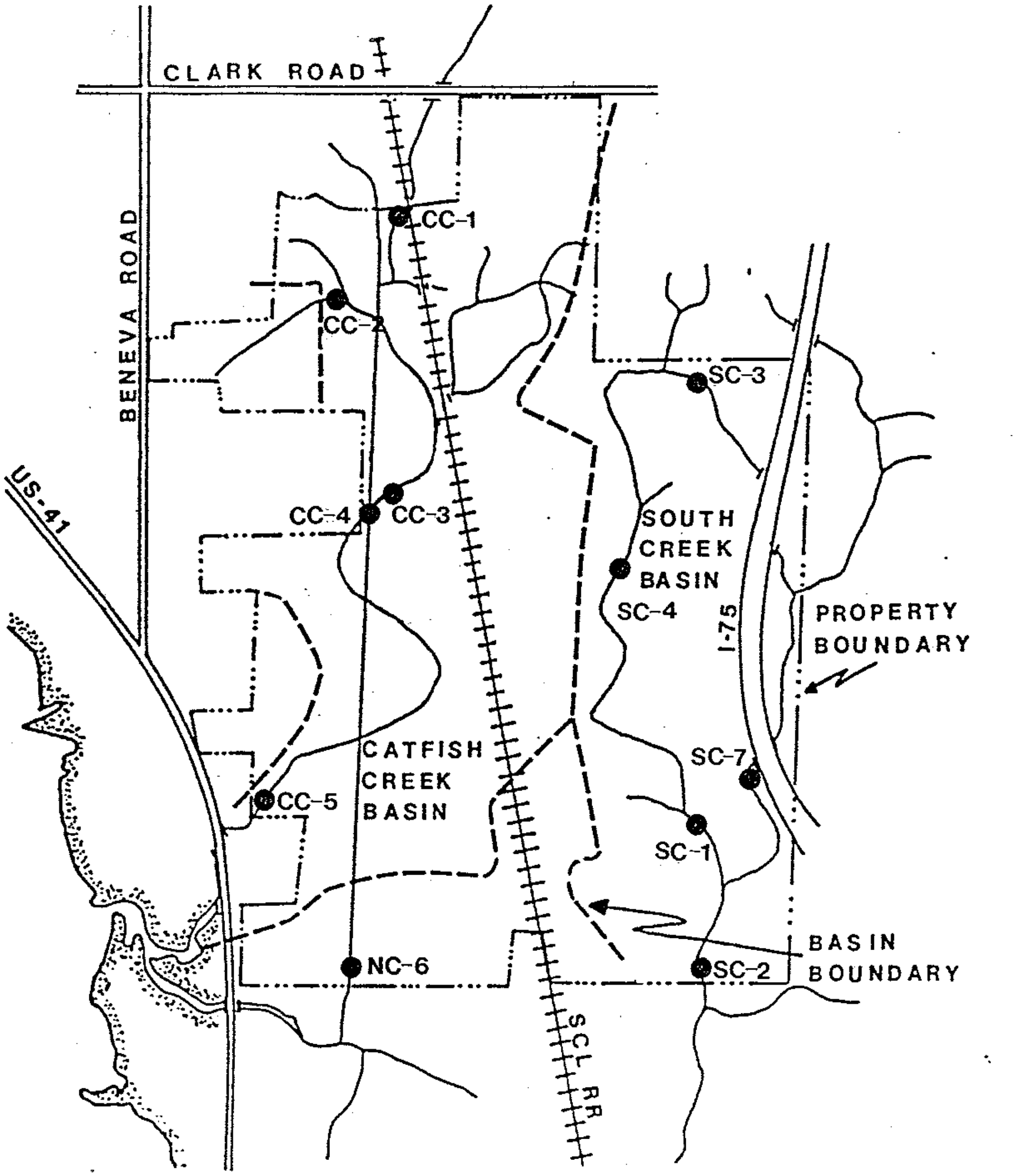

Figure 3.1 Locations of Surface Water Monitoring Stations.

TABLE 3.1 GENERAL DESCRIPTIVE CHARACTERISTICS OF SURFACE WATER QUALITY SAMPLING STATIONS.

Station	General Location	Water Depth (ft)[a]	Channel Width (ft)	Habitat
CC-1	Catfish Creek Site Entry	1.0-1.6	10	75-100% Canopy of *Salix*, Rooted Emergents, Incised Banks.
CC-2	Catfish Creek Upstream of Trunk Ditch	0.0-0.45	12	Aquatic Vegetation, Shallow Sloped Banks.
CC-3	Catfish Creek Upstream of Trunk Ditch	0.3-0.6	6	Aquatic Vegetation, Incised Banks.
CC-4[b]	Trunk Ditch Downstream of Catfish Creek Confluence	0.6-2.2	50	Sodded Banks, Rooted Emergents.
CC-5	Catfish Creek Outfall from Site	0.3-0.8	50	Shading in by Oaks, Willows, and Wax Myrtle, Sodded Banks.
NC-6	Trunk Ditch Downstream of Catfish Creek	1.7-2.7	12	Aquatic Vegetation.
SC-1	South Creek Mid-property	0.6-0.7	12	Sand covered with Organic Matter.
SC-2	South Creek at Site Exit	0.5-1.2	17	Rooted Emergents, Floating Aquatics, Palm Trees Shade Channel in A.M.
SC-3	South Creek Outfall from Large Wetland	0.0-0.7	10	Shallow banks, Aquatic Vegetation.
SC-4	South Creek near Honore Avenue	0.7-1.2	8	Rooted Emergents Cover 33% of Channel, Canopy of Pine.

[a]Range in Depth recorded during monitoring period of April, 1987 - March, 1988.
[b]Depths reported are depths at sampling location - total depth at site averages 8.0 feet.

3.2 Parameters and Sampling Frequency

Quarterly sampling was performed during March, June, September, and December 1992. In addition, samples were collected for analysis of the annual parameters during the September 1992 monitoring event. The dates and times of all sample collections are provided in Table 3.2.

Surface water quality monitoring from January through December 1992 was performed by: (1) the use of field instrumentation and *in situ* measurements; and (2) the collection of grab samples for subsequent laboratory analyses. A digital readout Hydrolab multi-parameter water quality meter was used for *in situ* measurements of dissolved oxygen, pH, specific conductance, and water temperature. Prior to deployment in the field, the Hydrolab was calibrated according to the manufacturer's recommended procedures. All *in situ* measurements were taken at approximate mid-depth at each station. Grab samples were collected at each station during the four quarterly events, preserved, and analyzed in the laboratory within the recommended hold times for the following parameters:

- Ammonia Nitrogen
- Nitrate Nitrogen
- Nitrite Nitrogen
- Organic Nitrogen[1]
- Total Nitrogen
- Orthophosphate
- Total Phosphorus
- Oil and Grease
- Total Suspended Solids
- Turbidity
- Biochemical Oxygen Demand
- Fecal Coliform Bacteria
- Total Coliform Bacteria

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[1] Organic Nitrogen = Total Kjeldahl Nitrogen - Ammonia-Nitrogen

TABLE 3.2 DATE AND TIME OF SAMPLING FOR THE EIGHTH ANNUAL MONITORING PERIOD OF JANUARY THROUGH DECEMBER, 1992

Quarter No.	Date of Sampling	Monitoring Stations					
		CC-1	CC-2	CC-3	CC-4	CC-5	NC-6
1	23-Mar-92	13:59	11:44	13:14	13:30	10:59	11:30
2	16-Jun-92	10:30	10:59	11:30	12:09	13:14	13:59
3	08-Sep-92	10:45	11:30	11:55	12:24	13:25	12:49
4	01-Dec-92	11:00	11:20	11:40	11:50	12:10	12:30

Additional surface water grab samples were collected at each of the 6 monitoring stations during the September 1992 monitoring event for the laboratory analysis of the following parameters:

- Arsenic
- Copper
- Lead
- Zinc

All sampling was performed in accordance with CCI's Comprehensive Quality Assurance Plan (CompQAP No. 87201G) on file with the Florida Department of Environmental Regulation. All laboratory analyses were performed in accordance with the procedures described in the 16th edition of *Standard Methods for the Examination of Water and Wastewater* (APHA, 1985), *Methods for Chemical Analysis of Water and Wastes* (USEPA, 1983) or other FDER/USEPA approved methodology. The method used in the collection, preservation, handling, storage, and analysis of all surface water samples are provided by parameter in Table 3.3.

Laboratory analyses were performed by the CCI's laboratory which is certified by Florida Department of Health and Rehabilitative Services for the analyses of environmental and drinking water samples. Copies of the laboratory reports of results for the 1992 monitoring events are provided in Appendix C.

Two additional parameters, stream flow and stream depth, were monitored at each sampling point concurrently with water quality monitoring as an aid in evaluating the water quality data although not part of the "Continuing Surface Water Quality Monitoring Program." Water velocity was determined using a Marsh McBirney model 201D flow meter. Stream flows were subsequently determined in accordance with

TABLE 3.3 COLLECTION AND ANALYTICAL METHODS USED DURING THE CONTINUING SURFACE WATER QUALITY MONITORING PROGRAM.

Parameter	Sample Type	Field Handling	Hold Time	Laboratory Handling	Analytical Method	Method Reference
Total Arsenic	Grab	HNO_3 to pH <2, Stored on Ice	6 Months	Stored at Room Temperature	Digestion, Atomic Absorption - Furnace Technique	EPA 206.2
Fecal Coliform Bacteria	Grab	Stored on Ice	30 Hours	Immediate Analysis	Multiple Tube Fermentation	APHA 908 C
Total Coliform Bacteria	Grab	Stored on Ice	30 Hours	Immediate Analysis	Multiple Tube Fermentation	APHA 908 A
Biochemical Oxygen Demand Electrode (BOD-5 Day)	 APHA 507	Grab	Stored on Ice	48 Hours	Immediate Analysis	Membrane
Conductivity	*In situ*	----	----	----	Hydrolab - Wheatstone Bridge	APHA 205
Total Copper	Grab	HNO_3 to pH <2, Stored on Ice	6 Months	Stored at Room Temperature	Digestion, Atomic Absorption	EPA 220.1
Total Lead	Grab	HNO_3 to pH <2, Stored on Ice	6 Months	Stored at Room Temperature	Digestion/PDCA Extraction, Atomic Absorption	EPA 239.1
Ammonia Nitrogen	Grab	H_2SO_4 to pH <2, Stored on Ice	28 Days	Stored at 4 °C	Automated Phenate	EPA 350.1
Nitrate + Nitrite Nitrogen	Grab	H_2SO_4 to pH <2, Stored on Ice	28 Days	Stored at 4 °C	Automated Cadmium Reduction	EPA 353.2
Nitrite Nitrogen	Grab	Stored on Ice	48 Hours	Stored at 4 °C	Automated Autoanalyzer	EPA 353.2
Nitrate Nitrogen	Grab	----	----	----	Calculation	EPA 353.2
Total Kjeldahl Nitrogen	Grab	H_2SO_4 to pH <2, Stored on Ice	28 Days	Stored at 4 °C	Automated Block Digestion, Autoanalyzer	EPA 351.2
Total Nitrogen	Grab	----	----	----	Calculation	EPA 351.2
Oil and Grease	Grab	H_2SO_4 to pH <2, Stored on Ice	28 Days	Stored at 4 °C	Gravimetric	EPA 413.1

TABLE 3.3 COLLECTION AND ANALYTICAL METHODS USED DURING THE CONTINUING SURFACE WATER QUALITY MONITORING PROGRAM (Continued).

Parameter	Sample Type	Field Handling	Hold Time	Laboratory Handling	Analytical Method	Method Reference
Dissolved Oxygen	*In situ*	----	----	----	Hydrolab - Membrane Electrode	APHA 421 B
pH	*In situ*	----	----	----	Hydrolab - Electrometric	APHA 423
Orthophosphate	Grab	Stored on Ice	48 Hours	Immediate Analysis	Automated, Ascorbic Acid	EPA 365.1
Total Phosphorus	Grab	H_2SO_4 to pH <2, Stored on Ice	28 Days	Stored at 4 °C	Automated Block Digestion, Autoanalyzer	EPA 365.4
Total Suspended Solids (TSS) Filtration,	APHA 209B	Grab	Stored on Ice	7 Days	Stored at 4 °C Dried at 105 °C	Glass Fiber
Temperature	*In situ*	----	----	----	Hydrolab - Thermistor	APHA 212
Turbidity (NTU)	Grab	Stored on Ice	48 Hours	Stored at 4 °C	Nephelometric	APHA 214A
Total Zinc	Grab	HNO_3 to pH <2, Stored on Ice	6 Months	Stored at Room Temperature	Digestion, Atomic Absorption	EPA 289.1
Flow/Direction	*In situ*	----	----	----	Marsh-McBirney Flow Meter - Electromagnetic Sensor	Manufacturer's Specifications

APHA - American Public Health Association, American Water Works Association and Water Pollution Control Federation, 1985. *Standard Methods for the Examination of Water and Wastewater*, 16th Edition. American Public Health Association.

EPA - U.S. Environmental Protection Agency, 1983. *Methods for Chemical Analysis of Water and Wastes*, EPA - 600/4-79-020, National Environmental Research Center, Cincinnati, Ohio.

the USGS two-point (*i.e.* area/velocity) method (USGS, 1982). Stream depth was measured with a weighted fiberglass tape at each point of water quality sampling.

4.0 RESULTS AND DISCUSSION

During the eighth year of the "Continuing Surface Water Quality Monitoring Program" (*i.e.*, January through December 1992) quarterly surface water quality monitoring was conducted by CCI. This sampling was conducted in compliance with the conditions of the Amended and Restated Master Development Order for the Palmer Ranch Development of Regional Impact (Appendix A). Monitoring events were performed on March 23, June 16, September 8, and December 1, 1992.

Individual results for the four quarterly events performed during the 1992 monitoring year for the "Continuing Surface Water Quality Monitoring Program" are tabulated by parameter in Appendix B. For each parameter, statistics (*i.e.*, mean, range, standard deviation, and number of observations) are calculated across sampling events and sampling locations. Also, applicable water quality criteria are footnoted below each table.

Copies of the laboratory reports of analytical results for the samples collected during the 1992 monitoring year are provided in Appendix C. Comparison of the data with previous results and general conclusions are included with the discussion for each parameter or group of related parameters.

4.1 Rainfall and Hydrology

4.1.1 *Rainfall*

Greater than the normal amount of rainfall occurred on the Palmer Ranch during the eighth year of the "Continuing Surface Water Quality Monitoring Program." The rainfall amount recorded during 1992 is approximately two inches more than the average annual rainfall of approximately 54 inches based on a 30-year period of record (NOAA, 1982). During the 1992 monitoring year, approximately 56 inches of precipitation were recorded (Table 4.1) in comparison to 38 to 52 inches recorded during previous monitoring years (CCI, 1988a, 1988b, 1991, and 1992a).

Figure 4.1 provides a comparison of the monthly distribution of rainfall measured on the Palmer Ranch during the 1992 monitoring year with the monthly distribution of historical rainfall for the 30-year period of record (NOAA, 1982). The distribution of rainfall in 1992 generally followed expected seasonal trends for this region of Florida as observed during previous monitoring years. During the 1992 monitoring year, below-normal rainfall occurred during nine months, whereas above-normal rainfall occurred only during February, April, and June. The highest monthly rainfall during 1992 was recorded for June when 21.60 inches were recorded compared to the historical average for June of approximately 7.41 inches.

As provided in Table 4.1, the seasonal amounts of rainfall recorded on-site during the spring and summer quarters were 25.95 and 16.73 inches, respectively. During the winter and fall quarters, 9.50 and 3.68 inches were recorded, respectively. During the four-month period in which the wet season normally occurs (*i.e.*, June through September) 38.33 inches (*i.e.*, 69% of the annual rainfall) was recorded on the Palmer Ranch, while only 4.63 inches (*i.e.*, 8.3% of the annual rainfall) was recorded during the four-month period in which the dry season normally occurs (*i.e.*, October through January). The percentage of the total annual rainfall recorded for the 1992 dry

TABLE 4.1 RAINFALL RECORDED ON THE PALMER RANCH DURING THE PERIOD OF JANUARY THROUGH DECEMBER, 1992.

Date	Monthly Rainfall (inches)	Seasonal Rainfall[a] (inches)	Pre-event Rainfall (inches)		
			2 Month	2 Week	2 Day
January, 1992	0.95				
February, 1992	6.25				
March, 1992	2.30		7.98	1.53	0.90
Winter		9.50			
April, 1992	3.30				
May, 1992	1.15				
June, 1992	21.60		4.05	0.80	0.00
Spring		25.95			
July, 1992	3.60				
August, 1992	5.90				
September, 1992	7.23		13.48	6.18	0.68
Summer (wet season)		16.73			
October, 1992	2.58				
November, 1992	0.65				
December, 1992	0.45		3.23	0.40	0.00
Fall (dry season)		3.68			
Yearly Total		55.86			

[a] Primary Wet Season (June - September) - 38.33
Primary Dry Season (October - January) - 4.63
Secondary Wet Season (February - March) - 8.78
Secondary Dry Season (April - May) - 4.45

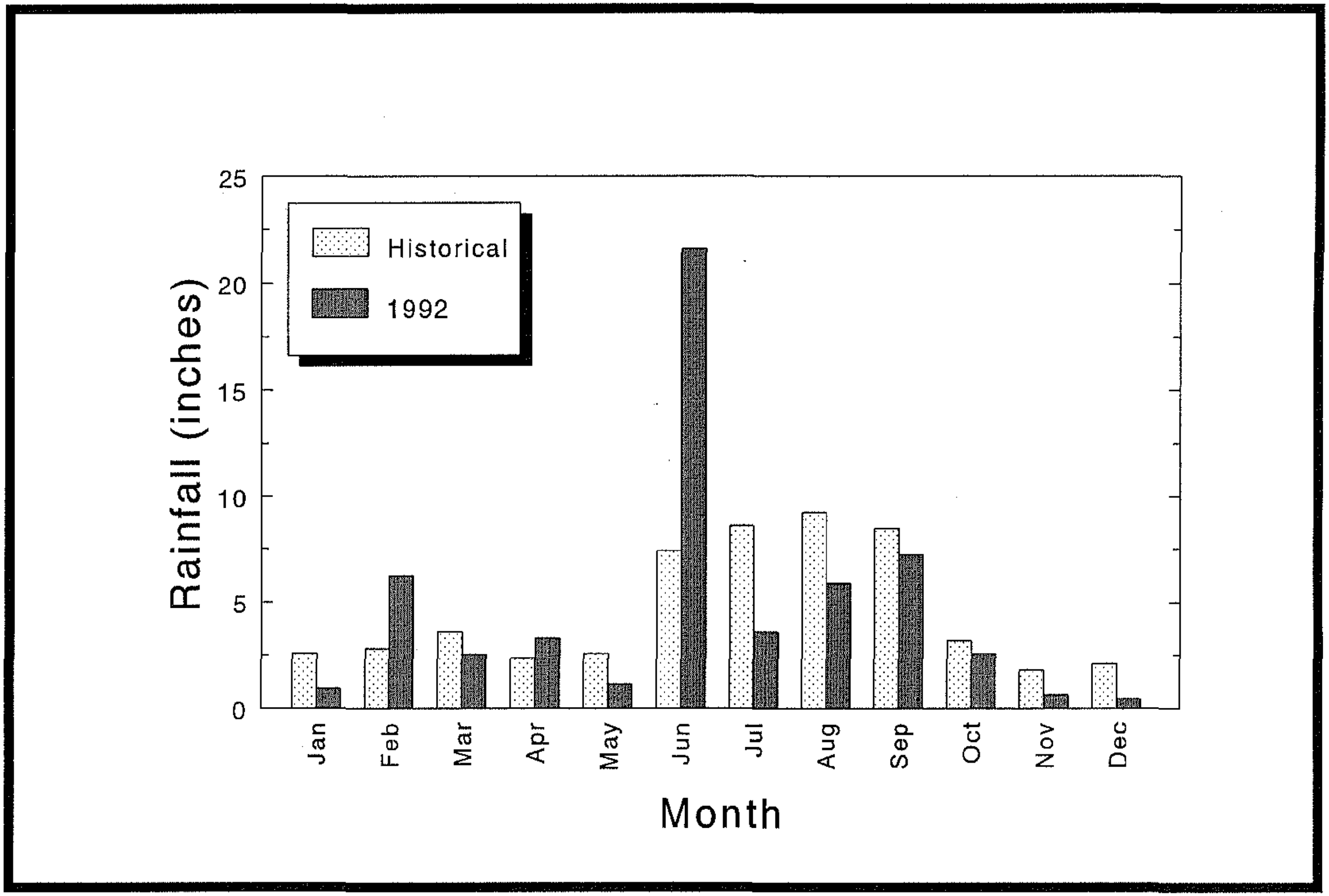


Figure 4.1 Historic Rainfall for Sarasota County Versus Actual Rainfall Recorded on the Palmer Ranch During January Through December 1992.

season was below that reported during previous years due to the relatively lower amounts of rainfall that occurred in January, November, and December.

Antecedent rainfall accumulations during a 2-week period before each quarterly monitoring event, also 2-month and 2-day antecedent accumulations, are given in Table 4.1. As evident in the table, rainfall was only recorded during the 2-day antecedent period for the March and September 1992 monitoring events. Additionally, rainfall occurred during the 2-week antecedent periods for all events performed during the 1992 monitoring year. Before the December quarterly event, a minimal rainfall accumulation of 0.4 inches was recorded during the 2-week antecedent period. In contrast, 1.53 and 6.18 inches of rainfall were recorded during the 2-week period before the March and September quarterly events, respectively.

4.1.2 *Stream Stage*

Water depths measured at each station during the four quarterly sampling events performed during 1992 are tabulated in Appendix Table B-1. As expected, the stream stages determined during 1992 are generally higher than those measured during the 1991 monitoring year due to the greater amount of precipitation that was received during 1992. In general, stream stage averaged 1.0 feet with a range of 0.2 to 3.1 feet compared to an average of 0.8 feet recorded during the previous monitoring year (CCI, 1992a).

In general, the Trunk Ditch exhibits the deepest waters of the streams traversing the North Tract of the Palmer Ranch with a depth of approximately 8 feet near the center of its reconstructed segment. This segment of Trunk Ditch runs adjacent to the

Country Club of Sarasota and Prestancia. Although Station CC-4 is located on the reconstructed segment of Trunk Ditch, it exhibited an average depth of 0.49 feet because the depth measurements are taken in the littoral zone of the ditch. The stream stage at Station CC-4 was lower than observed at most other stations. The most upstream station in Catfish Creek (Station CC-1) exhibited the highest average stream stage during 1992 with a mean depth of 2.3 feet.

The lowest stream levels in Catfish Creek and North Creek were observed during the June 1992 quarterly monitoring event due to the relatively low 2-day and 2-week antecedent rainfall amounts (*i.e.*, 0.00 and 0.80 inches, respectively). Average stream stages for stations CC-2, CC-3, CC-4, and NC-6 were all under 1.0 feet during the 1992 monitoring period (Appendix Table B-1).

4.1.3 *Stream Flow*

As evident in Appendix Table B-2, positive stream flows were recorded for 23 of 24 measurements (*i.e.*, 96%) taken during the eighth year of monitoring. As expected, the percentage of positive flows measured during 1992 is higher than the 70 percent positive flow measurements observed during the 1991 monitoring year (CCI, 1992a). These higher stream flows recorded during the 1992 monitoring year are a result of the wetter conditions reported for 1992.

However, stream flows recorded during the 1992 monitoring year were only measured for Catfish Creek and North Creek stations while the 1991 stream flow data includes South Creek and Elligraw Bayou. Approximately 91 percent of the stream flow measurements collected in the Catfish Creek and North Creek Basins during the 1991 monitoring year showed positive flows. The relatively higher percentage of positive flows in these two basins can be attributed to improved basin geometry and hydraulic residence time in the watershed resulting in a more efficient drainage system compared to that for South Creek. In general, stream flows recorded in Catfish Creek and North Creek Basins for previous monitoring years were lower than for the 1992 monitoring year. The lower percentage of positive flows recorded in both Catfish Creek and North Creek Basins during previous monitoring years probably resulted from lower rainfall and drainage improvement operations in these basins.

The highest steam flows during 1992 occurred during the September monitoring event with an average flow for Catfish Creek of 2,019 gallons per minute (GPM). High stream flows measured in September coincide with the end of the wet season and the highest 2-week antecedent rainfall amount (Table 4.1). The higher rainfall amounts reported for this period resulted in an elevated groundwater table and a higher percentage of runoff, both of which increased stream flow. Stream flows recorded for the six monitoring stations during the 1992 monitoring year are illustrated in Figure 4.2.

As noted during the past four years of monitoring, it is apparent that low flow conditions have prevailed in various stream segments. During the eighth year of monitoring, low flow conditions were most frequently observed in the Catfish Creek/Trunk Ditch Basin at Station CC-2. Similar results were obtained during the 1990 and 1991 monitoring years (CCI, 1991 and 1992a). In general, stream flows

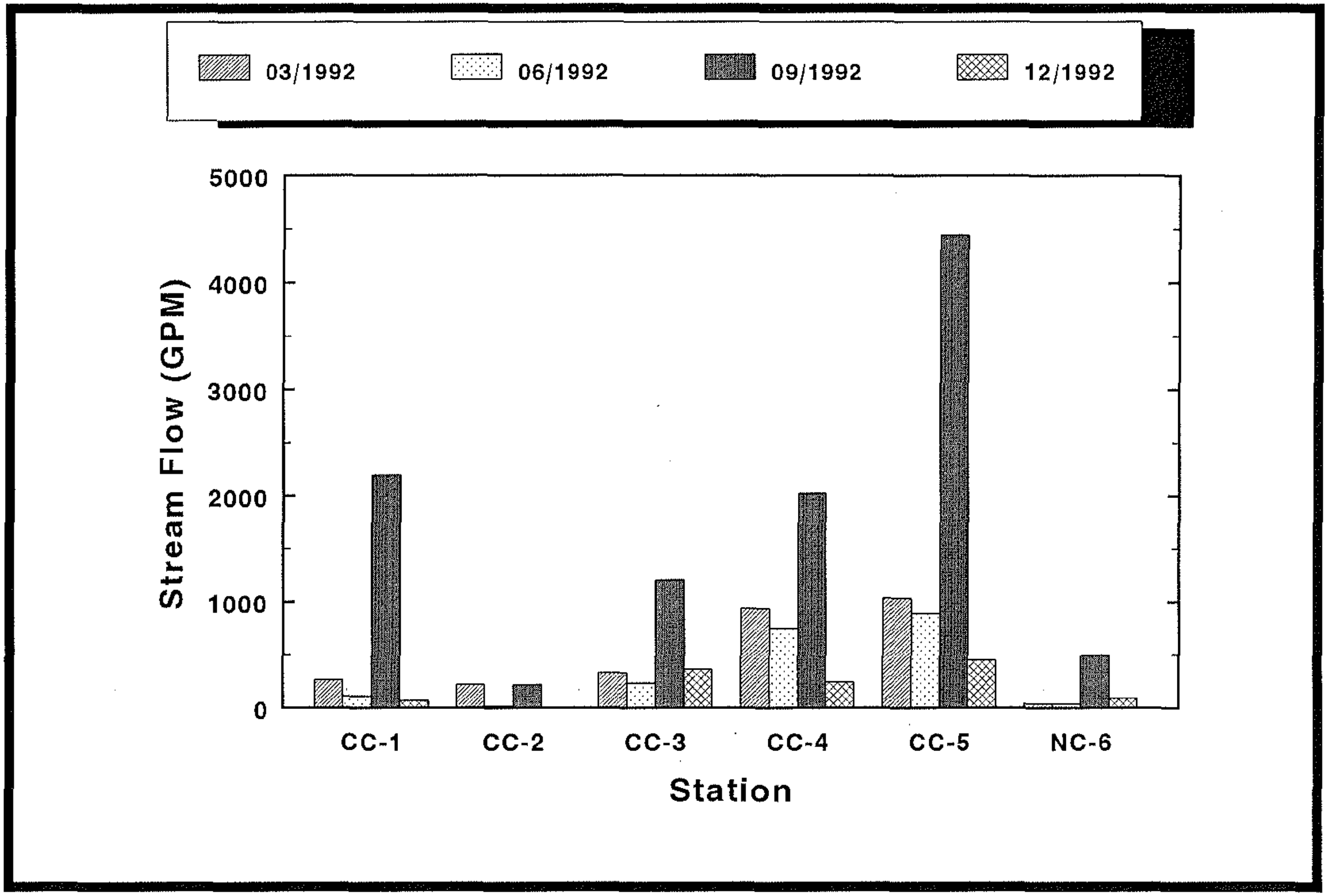


Figure 4.2 Stream Flows Measured During Each Quarterly Sampling From January to December 1992 at the Palmer Ranch, Sarasota County.

measured during the 1992 monitoring year for Catfish and North Creeks were greater than measured in previous years.

During the eighth year of monitoring, stream flows in the Catfish Creek/Trunk Ditch Basin ranged from 0 to 2,195 GPM in its upper reaches (CC-1 and CC-2) and from 233 to 2,029 GPM in its mid-reach (CC-3 and CC-4). Overall, stream flows measured during the 1992 monitoring year for all six stations ranged from 0 to 4,448 GPM. Because the June monitoring event occurred in the first half of the month, the results obtained were not skewed by the 21.6-inch rainfall that occurred at the end of the month.

4.2 Physical Water Quality Parameters

4.2.1 *Water Temperature*

Appendix Table B-3 presents the surface water temperature measurements acquired during the 1992 monitoring year. Results indicate that the water temperature of the streams of the North Tract of the Palmer Ranch ranged from 14.4 to 29.1°C during the four monitoring events. This range is similar to those recorded during previous years of monitoring (Palmer Venture, 1986 and CCI, 1986, 1988a, 1988b, 1991, 1992a).

As expected, the lowest water temperatures were recorded in the streams of the North Tract during the December 1992 quarterly event with the highest water temperatures recorded during the June and September monitoring events. During the September monitoring event, an average temperature of 27.4°C was recorded, while an average temperature of 16.6°C was observed during the December event.

Average temperatures for Catfish Creek and North Creek for each event are very similar with differences among stations generally being 4°C or less.

An evaluation of diurnal variations in water temperature in the Catfish Creek and South Creek Basins was performed during the 1985 dry season and the 1986 wet season (CCI, 1987). Results of the diurnal evaluation showed increases in water temperature to maximum levels by mid-afternoon followed by declines during the evening to minimal levels by early morning. The results of the diurnal study are provided in the report prepared by CCI (CCI, 1987).

4.2.2 *Specific Conductance*

As evidenced in Appendix Table B-4, Catfish Creek and North Creek exhibited a range in specific conductance of 431 to 1,459 micromhos per centimeter (μmhos/cm) as compared with ranges of 567 to 1,625 and 626 to 1,332 μmhos/cm during the sixth and seventh monitoring years, respectively (CCI, 1991 and 1992a). The higher range observed during the sixth monitoring year probably resulted from the relatively low amount of rainfall that occurred during 1990. As discussed in the previous annual reports (CCI, 1988a, 1988b, and 1991), during times of drought, such as occurred during the second and sixth monitoring years, the lack of precipitation resulted in minimal runoff of low conductivity stormwater thereby allowing the conductivity in the streams of the ranch to increase due to evaporation. In addition, a larger portion of the streams' surface waters probably originated from groundwater exfiltration. Since groundwater normally has a higher conductivity than rainwater and surface runoff, an increase in the conductivity of the streams would be expected.

The lowest conductivities recorded during the 1992 monitoring year occurred during the June and September monitoring events with conductivity averaging 655 and 519 µmhos/cm, respectively. As described above, these lower conductivities most likely resulted from the cumulative effects of increased surface runoff of low conductivity stormwater during the periods of highest rainfall (refer to Table 4.1). Specific conductance levels measured at the six monitoring stations during the 1992 monitoring year are illustrated in Figure 4.3.

In a comparison of both streams monitored during 1992 within the Palmer Ranch, the overall annual mean conductivities for North Creek and Catfish Creek Basins were 606 and 790 µmhos/cm, respectively. As with the annual mean conductivities, Catfish Creek exhibited higher conductivities than North Creek during the March, June, and December monitoring events, with the highest conductivities occurring in Catfish Creek during the December event.

As observed during the previous years of monitoring (CCI, 1988a, 1988b, 1991, and 1992a), no apparent spatial trends were observed in conductivity within the two monitored basins of the Palmer Ranch (Appendix Table B-4 and Figure 4.3). In the Catfish Creek/Trunk Ditch Basin, conductivities in the upper reaches averaged 789 µmhos/cm, compared to an average of 754 µmhos/cm observed for the mid-reach.

The State specific conductance criterion applicable to the streams of the Palmer Ranch allows an increase of not more than 50 percent above background levels or to a level of 1,275 µmhos/cm whichever is greater. Only one of the 24 conductivity measurements made during the 1992 monitoring year exceeded the 1,275 µmhos/cm

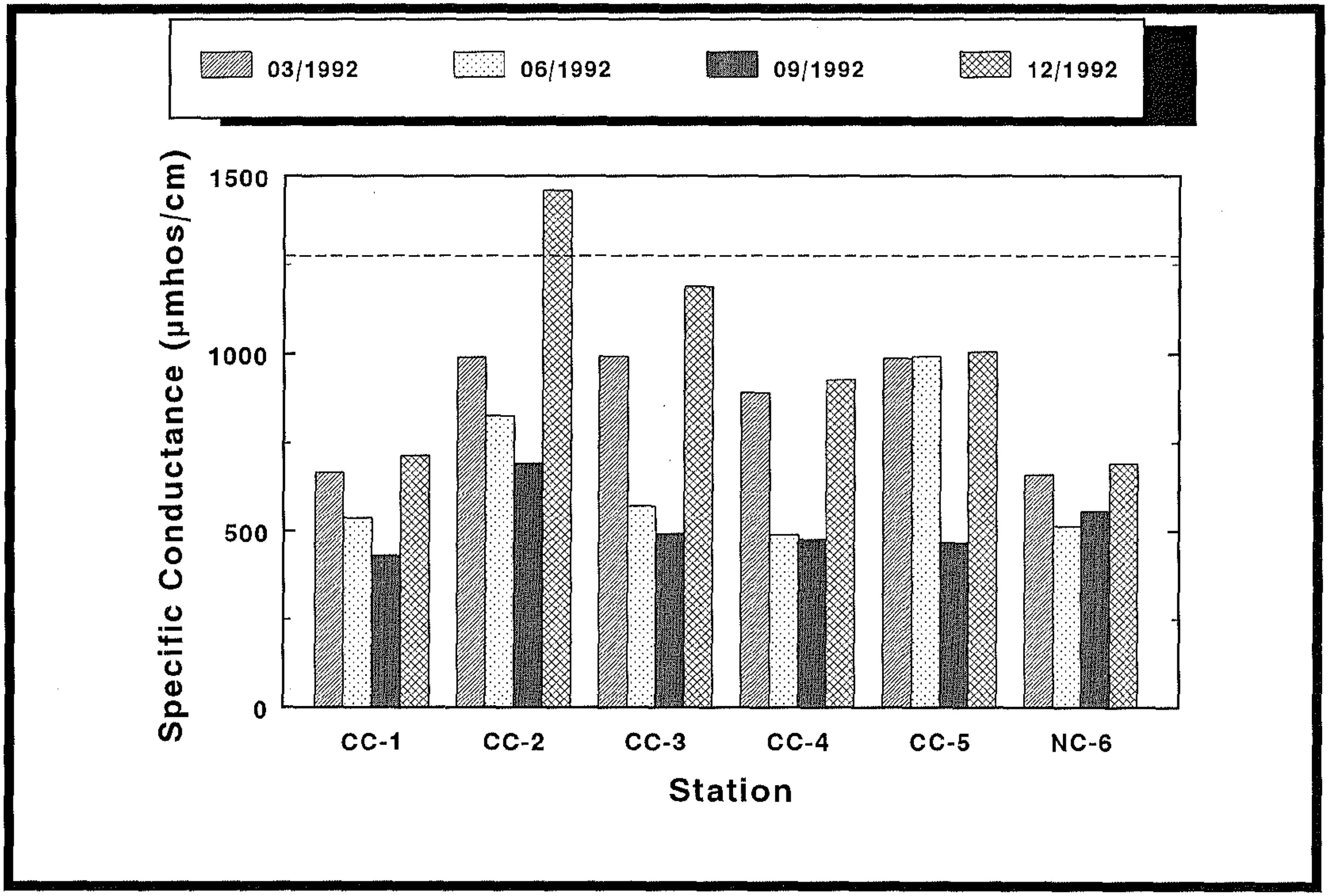


Figure 4.3 Specific Conductance Levels Measured During Quarterly Sampling from January to December 1992 at the Palmer Ranch, Sarasota County. Dotted Line Depicts State Standard.

threshold (Figure 4.3). The conductivity measured at Station CC-2 during the December monitoring event slightly exceeded the 1,275 State Standard. However, since the conductivity levels observed at Station CC-2 during the 1992 monitoring year are similar to those reported during previous years, the levels measured for 1992 are not considered to be more than 50 percent above background levels. Therefore, no violations of the State criteria for specific conductivity occurred during 1992.

The Sarasota County criterion for specific conductance (Ordinance No. 72-37) is similar to, but more stringent than, the State criteria. The County standard allows up to a 100 percent increase above background to a maximum level of 500 μmhos/cm in freshwater streams. Therefore, 19 of the 24 conductivity measurements made in the streams of the Palmer Ranch during 1992 were out of compliance with the County criteria. Ubiquitous non-compliance conductivities were also observed during the past years of monitoring (CCI, 1986, 1988a, 1988b, 1991, 1992a).

4.2.3 *Total Suspended Solids*

During the eighth year of monitoring, Catfish Creek and North Creek in the Palmer Ranch exhibited a range of total suspended solids (TSS) from <1 to 31 mg/L with a yearly average of approximately 5 mg/L (Appendix Table B-5). Figure 4.4A illustrates the distribution of TSS levels during the 1992 monitoring year for Catfish Creek and North Creek. In general, the TSS levels observed during the 1992 monitoring year are comparable to those recorded during previous monitoring years (Palmer Venture, 1986; CCI, 1986, 1987, 1988a, 1988b, 1990, and 1991).

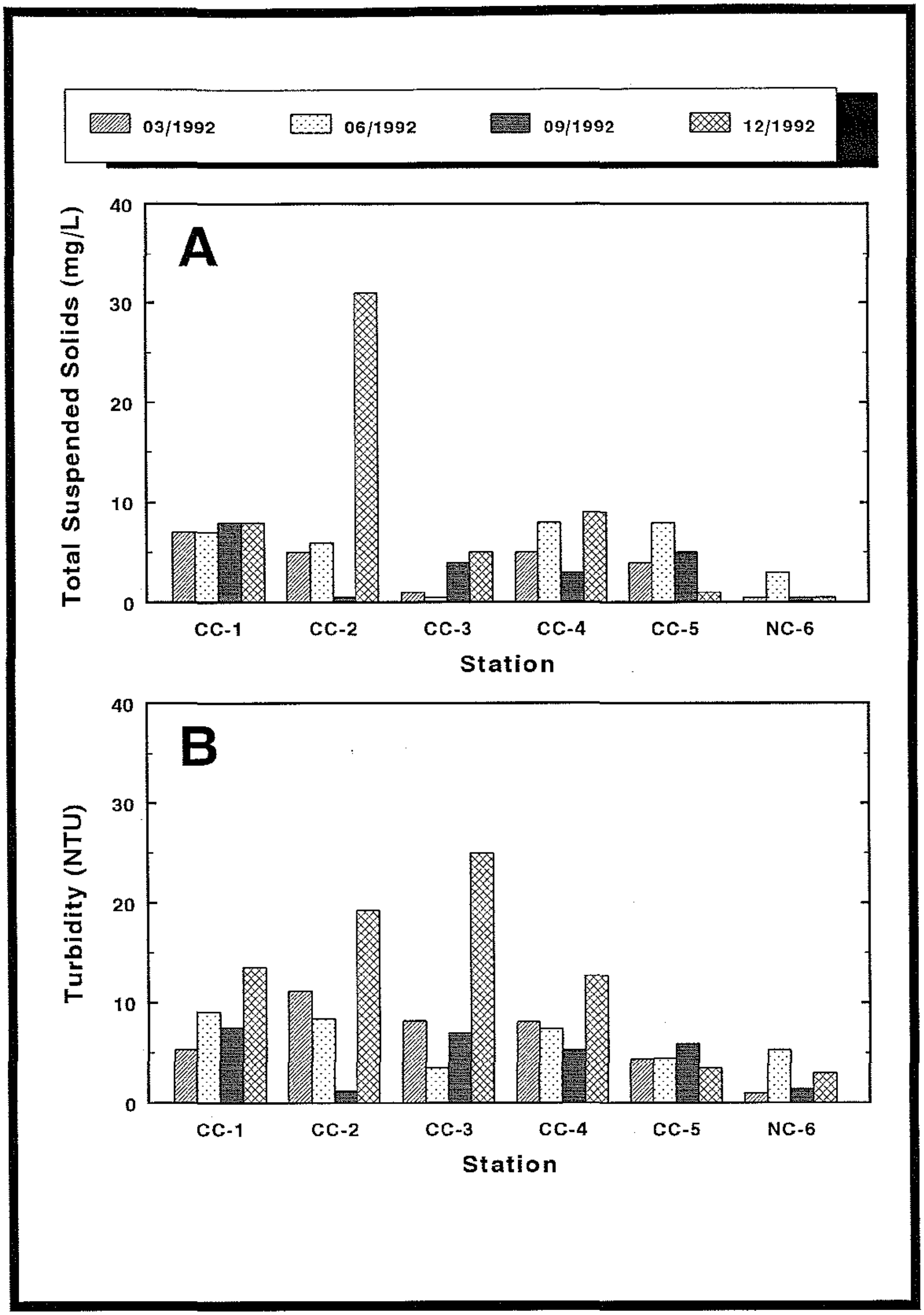


Figure 4.4 **(A) Total Suspended Solids and (B) Turbidity Levels Measured During Quarterly Samplings from January to December 1992 at the Palmer Ranch, Sarasota County.**

The highest TSS levels during 1992 were recorded at the upper-reach of Catfish Creek (CC-2). The lowest TSS levels were recorded in the mid reaches of Catfish Creek (CC-3). This spatial difference in TSS levels can be attributed to greater density of aquatic plants present at CC-2 as compared with CC-3. During the normal annual cycle, plants grow and die off. As the plants die off, plant debris in the stream will increase resulting in an increased TSS load. As expected, the highest TSS levels, averaging 11 mg/L, were recorded for the December monitoring event during which low plant productivity occurred. Although 6.18 inches of rainfall occurred in the 2-week antecedent period to the September sampling event, suspended materials averaged 4 mg/L for both Catfish Creek and North Creek. This lower mean concentration of TSS recorded during the September 1992 monitoring event may be attributed to well-established littoral zones around the Catfish Creek, especially at CC-2, as well as the storm water management system in Prestancia.

During the 1991 monitoring year TSS levels in Catfish Creek and North Creek ranged from <1 to 87 mg/L with an annual average of 9 mg/L (CCI, 1992a). Lower TSS levels were reported for these two Creeks during the 1990 monitoring year with a range from <1 to 13 mg/L (CCI, 1991). Total suspended solid levels reported for the third and fourth monitoring years ranged from 3 to 57 and from <1 to 46 mg/L, respectively, with a yearly average of approximately 13 mg/L during each of the two monitoring years (CCI, 1988a and 1988b). During the second year of monitoring, these two streams of the Palmer Ranch exhibited a much wider range in TSS (*i.e.*, 1 to 103 mg/L) and a higher yearly average (*i.e.*, 25 mg/L) (CCI, 1986). Moreover, high TSS levels were recorded in the vicinity of the Prestancia construction site in Catfish

Creek (CC-3), and Trunk Ditch (CC-4). These elevated TSS levels observed near Prestancia were attributed to construction activities including the excavation of Trunk Ditch.

During the first year of monitoring, TSS was reported to be much lower than observed during the past four years of the monitoring program, perhaps as a result of low mass transport rates associated with drought conditions or differences in sampling and analytical procedures (Palmer Venture, 1986). Overall, the surface waters of the ranch showed a range of approximately 1 to 12 mg/L during the first year of monitoring.

4.2.4 *Turbidity*

As in previous years, turbidity and TSS levels measured during the 1992 monitoring year were found to be positively correlated (*i.e.*, correlation coefficient (r) = 0.60). Also, turbidity exhibited the same seasonal trends observed for TSS with the highest mean turbidity level (*i.e.*, 12.9 NTU) occurring in December 1992 while the lowest mean level (*i.e.*, 4.7 NTU) was determined for the September event (Appendix Table B-6). Intermediate averages of 6.4 NTU were observed for both the March and June events, respectively. The overall distribution of stream turbidity levels measured during the 1992 monitoring year in Catfish Creek and North Creek is shown in Figure 4.4B.

During the eighth year of the monitoring program, turbidity levels measured in Catfish Creek and North Creek ranged from 1.0 to 25.0 NTU with an overall average of 7.6 NTU (Appendix Table B-6). In comparison, similar turbidity ranges of 2.8 to 36 NTU, 1.0 to 27.0 NTU, 1.7 to 24 NTU, and 0.8 to 29.0 NTU were exhibited during the third, fourth, sixth, and seventh monitoring years, respectively, with positive correlations with TSS during all years (CCI, 1988a, 1988b, 1991, and 1992a).

During the second year of monitoring, CCI (1986) reported higher turbidities in Catfish Creek and North Creek of 1.5 to 61.0 NTU, while during the first year of monitoring, much lower turbidities (*i.e.*, less than 6 NTU) were reported (Palmer Venture, 1986). Differences between the first and second year have been attributed to a combination of the droughty conditions in the first year resulting in lower pollutant loadings, and the initiation of construction including the reconstructed of Trunk Ditch during the second year of monitoring.

The General Water Quality Criteria for all surface waters (FAC Chapter 17-302) specifies that turbidity shall not exceed 29 NTU above natural background. Based on turbidity measurements taken during previous years of monitoring, natural background turbidity levels are expected to be less than 25 NTU (mean plus one standard deviation), although higher background turbidities might occur because of natural processes, *e.g.*, organic decay and import of particulate matter via stormwater runoff. Therefore, all turbidity measurements performed during the 1992 monitoring year were in compliance with the applicable state water quality criteria.

Sarasota County Ordinance (No. 72-37) allows a maximum increase of 25 Jackson units above background. Analysis of turbidity samples, however, was performed in accordance with FAC Chapter 17-302 criteria that is based on the Nephelometric procedure. Therefore, a comparison of the turbidity results to the County criteria cannot be made.

4.3 Oxygen Demand and Related Parameters

4.3.1 *Biochemical Oxygen Demand*

As presented in Appendix Table B-7, the 5-day biochemical oxygen demand (BOD_5) recorded in the two streams of the North Tract averaged 1.8 mg/L and ranged from 0.2 to 5.3 mg/L during the 1992 monitoring year. Biochemical oxygen demand levels in Catfish Creek averaged approximately 2.0 mg/L with a range of 0.2 to 5.3 mg/L. The highest mean BOD_5 levels were determined for Stations CC-2 and CC-4. Additionally, a slightly positive correlation between BOD_5 and TSS was noted (*i.e.*, correlation coefficient (r) = 0.40), and is attributed to decaying vegetation and other organic matter in the water column. The highest BOD_5 levels were recorded for the June, September, and December events. Figure 4.5 illustrates the distribution of BOD_5 concentrations measured in Catfish Creek and North Creek during the 1992 monitoring year.

During the 1991 monitoring year, BOD_5 concentrations were lower than those measured in 1992 and averaged 1.3 mg/L (CCI, 1992a). By comparison, similar results were obtained in Catfish Creek and North Creek for the 1990 monitoring year to those observed during the eighth year of monitoring with an overall average BOD_5 concentration of 1.7 mg/L (CCI, 1991). Slightly higher results were obtained during the third and fourth years of monitoring (CCI, 1988a and 1988b) when BOD_5 in these streams of the Ranch averaged 3.0 and 2.6 mg/L, respectively. Similar trends were

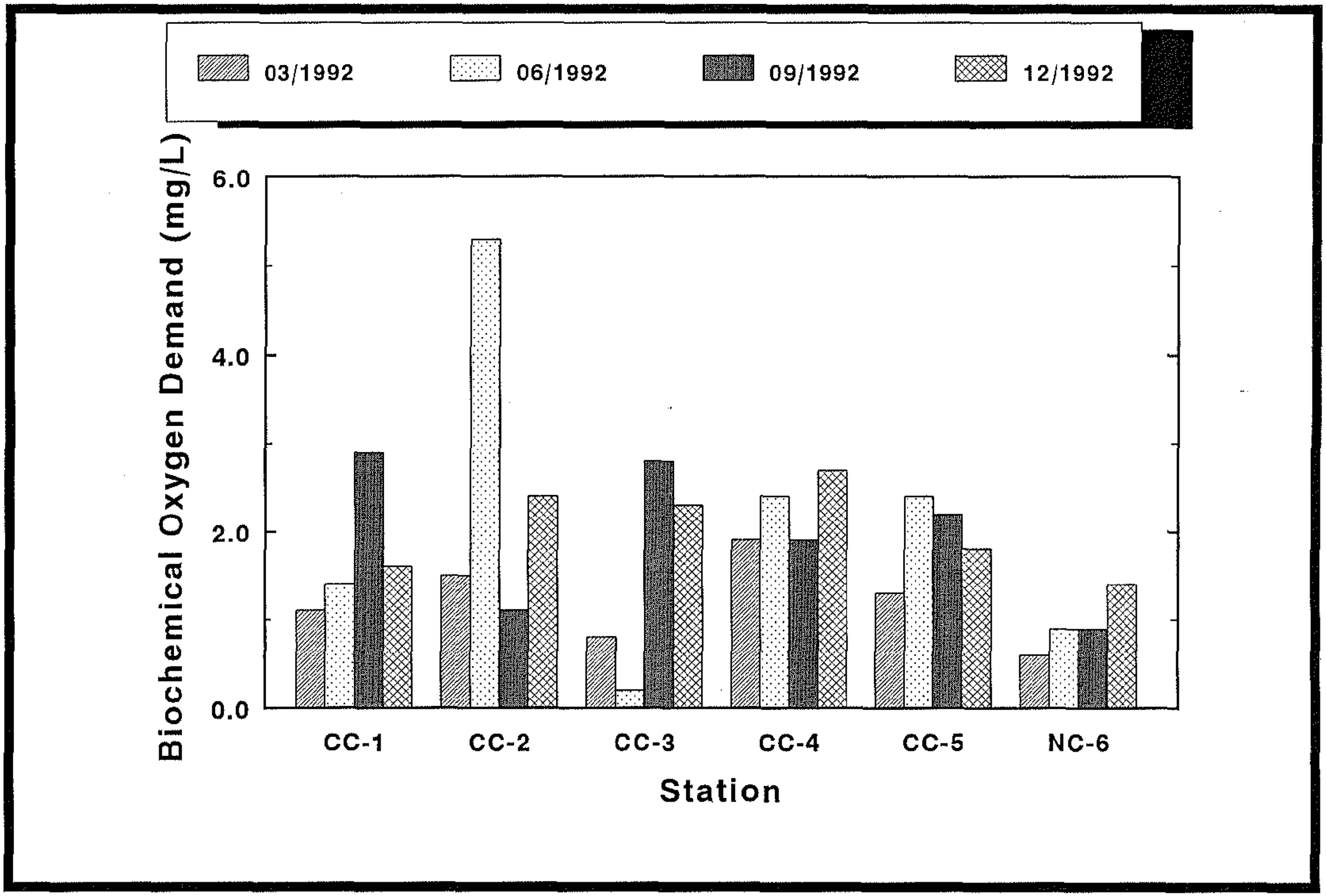


Figure 4.5 Biochemical Oxygen Demand Measured During Quarterly Samplings from January to December 1992 at the Palmer Ranch, Sarasota County.

observed during the second year of monitoring when a higher average BOD_5 concentration of 4.5 mg/L was recorded for these two Creeks (CCI, 1986).

During the first year of monitoring, Palmer Venture (1986) reported a range in BOD_5 of 1.2 to 6.5 mg/L in Catfish Creek/Trunk Ditch. At the Trunk Ditch-North Creek juncture, BOD_5 was reported to range from 2 to 6 mg/L.

According to Hynes (1966), a BOD_5 of 3 mg/L suggests "fairly clean" water while a BOD_5 of 5 mg/L suggests "doubtful" quality water. In addition, a BOD_5 screening level of greater than 3.3 mg/L has been established for Florida waters to indicate potential water quality problems (FDER, 1990). Therefore, North Creek and Catfish Creek generally exhibited fairly clean water with only one of the 24 measurements being over the 3.3 mg/L screening level. The highest BOD_5 concentration was recorded at CC-2 (Figure 4.5) where Creek waters pass through a densely vegetated underbrush. Biochemical oxygen demand can be defines as: *the amount of oxygen required by bacteria while stabilizing organic matter under aerobic conditions* (Sawyer and McCarthy, 1978). The decomposable organic matter present in Catfish Creek is mostly attributed to decaying vegetation and hydrocarbon input (*i.e.*, automobile emission, oil leakage, *etc.*).

The General Criteria for BOD_5 in all surface waters as designated by FAC Chapter 17-302, "Rules and Regulations of the Department of Environmental Regulation," as well as Sarasota County Ordinance No. 72-37, specifies that BOD_5 shall not be increased to levels that would result in violations of dissolved oxygen. The BOD_5 concentrations recorded in Catfish Creek and North Creek of the Palmer Ranch only once exceeded the 3.3 mg/L screening level that the FDER (1990) considers to suggest potential water quality problems. Also during the eighth year of monitoring, only one of the 24 BOD_5 measurements exceeded the 5 mg/L level which Hynes (1966) considered to be "doubtful" or between "fairly clean" and "bad" water quality. This measurement was made at CC-2 (5.3 mg/L) during the June 1992 monitoring event.

4.3.2 *Dissolved Oxygen*

Appendix Table B-8 provides the results of dissolved oxygen measurements acquired during the eighth year of monitoring. Temporal and spatial distributions of dissolved oxygen concentrations measured at six monitoring stations within Catfish Creek and North Creek during the 1992 monitoring year are presented in Figure 4.6A. Overall, dissolved oxygen was found to average 4.8 mg/L, with a range of 1.1 to 8.3 mg/L. The highest dissolved oxygen concentrations were recorded in the Catfish Creek/Trunk Ditch Basin with dissolved oxygen concentrations averaging 5.2 mg/L. The lowest dissolved oxygen levels were recorded in the southern end of Trunk Ditch (North Creek-Trunk Ditch Basin at Station NC-6) where dissolved oxygen averaged 2.9 mg/L. Seasonally, the highest average dissolved oxygen levels were observed for the December 1992 monitoring event with the lowest levels occurring for the September monitoring event in conjunction with the highest average water temperatures and relatively high BOD_5 levels. Similar seasonal trends have been observed during previous monitoring years (CCI, 1988a, 1988b, 1991, and 1992a) and reflect the changes in the solubility of dissolved oxygen in the water column with changes in water temperature.

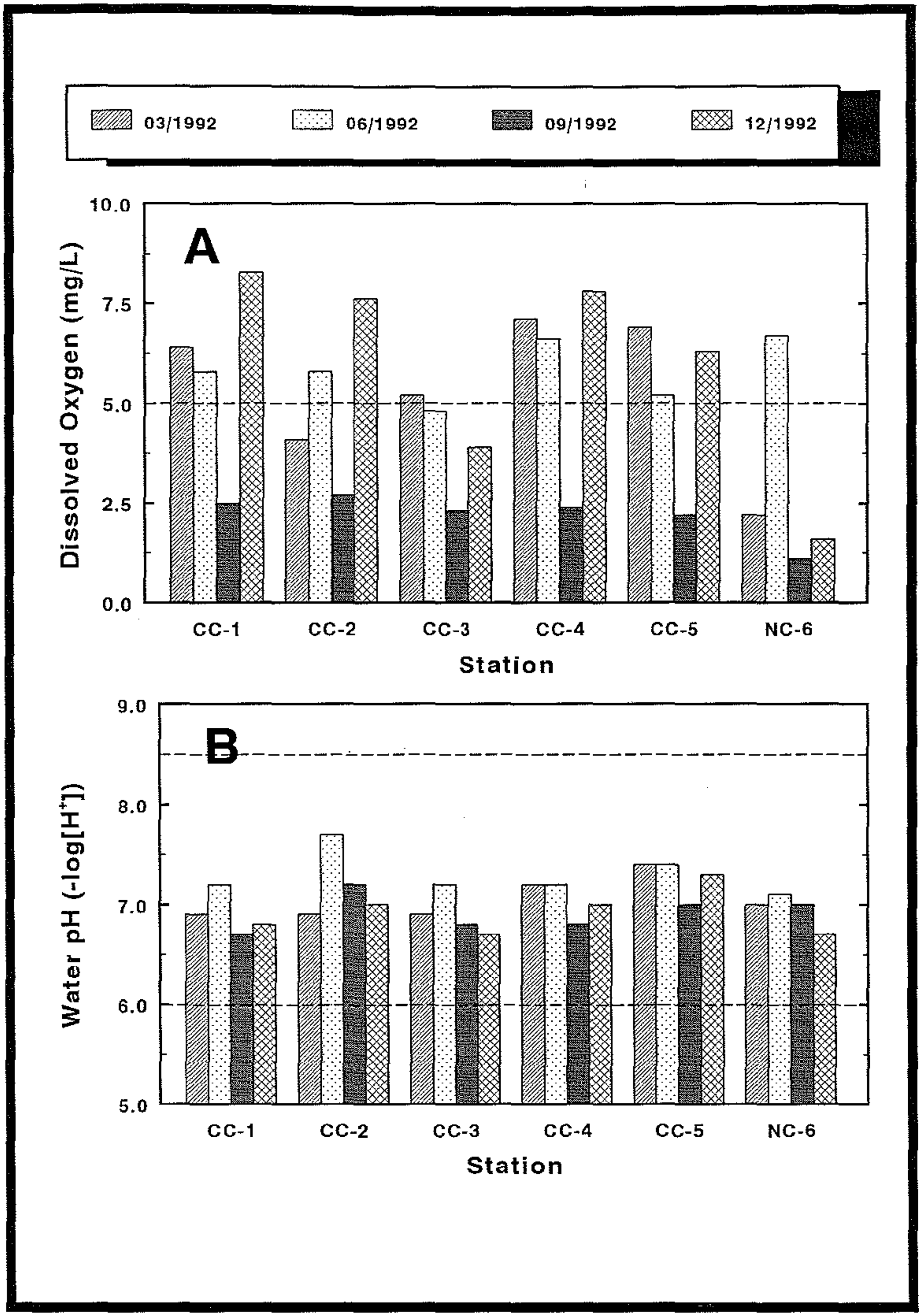


Figure 4.6 (A) Dissolved Oxygen and (B) Water pH Levels Measured During Quarterly Samplings from January to December 1992 at the Palmer Ranch, Sarasota County. Dotted Lines Depict State Standards for both Dissolved Oxygen and Water pH.

The results obtained for dissolved oxygen concentrations during the 1992 monitoring year for Catfish and North Creeks are generally comparable to those measured during the third, fourth, sixth, and seventh monitoring years (CCI 1988a, 1988b, 1991, and 1992a) but slightly higher than the concentrations determined during the first two years of the monitoring program (Palmer Venture, 1986 and CCI, 1986). During the third, fourth, sixth and seventh monitoring years (CCI, 1988a, 1988b, 1991, and 1992a), dissolved oxygen was found to average 5.3, 7.7, 5.4, and 4.5 mg/L, respectively. The seasonally highest dissolved oxygen concentrations were recorded in Catfish and North Creek occurred during the early spring of the third year with dissolved oxygen concentrations averaging 8.4 mg/L (CCI, 1988a). Meanwhile, the lowest seasonal levels of dissolved oxygen recorded for Catfish and North Creeks occurred during late summer of the first year of monitoring with dissolved oxygen concentrations averaging 2.5 mg/L (Palmer Venture, 1986; CCI, 1986). In addition, 58% of the dissolved oxygen measurements made during the first year of monitoring were less than 4.0 mg/L (Palmer Venture, 1986).

An evaluation of diurnal variations in dissolved oxygen in Catfish Creek and South Creek was performed during the dry season of 1985 and the wet season of 1986. The results of the diurnal evaluation showed typical increases in dissolved oxygen during the day to maximum levels by midafternoon and declines during the night to minimal levels by midmorning, as well as diurnal trends characteristic of the stream community. A summary of the results of the diurnal study is provided in the report prepared by CCI (1987).

During the eighth monitoring year, dissolved oxygen concentrations in the two streams of the North Tract frequently occurred at levels below the 5.0 mg/L criteria specified by FAC Chapter 17-302 and the 4.0 mg/L standard specified by Sarasota County Ordinance 72-37 for predominantly freshwater. Of the 24 dissolved oxygen measurements made during the 1992 monitoring year, 11 were below the 5.0 mg/L state criteria with nine of the measurements being below the 4.0 mg/L County Criteria.

4.3.3 *Water pH*

Results of pH monitoring in Catfish Creek and North Creek during 1992 are given in Appendix Table B-9 with temporal and spatial distributions shown in Figure 4.6B. During the 1992 monitoring year, these two streams of the Palmer Ranch exhibited pH levels ranging from 6.7 to 7.7. In comparison to other years of monitoring, the range of pH observed during the 1992 monitoring year was similar to that observed during the first through seventh monitoring years (Palmer Venture, 1986 and CCI, 1986, 1988a, 1988b, 1991, and 1992a).

During the eighth year, the lowest pH levels were observed at CC-2 and CC-3 with pH levels averaging 6.9 units at both stations. The highest pH levels were recorded at Station CC-5. These differences are attributed primarily to spatial variations in community metabolism. Differences or changes in pH are indicative of the effects of net community metabolism on the level of carbon dioxide and pH. During periods of net community respiration, carbon dioxide (CO_2) is produced faster than it is assimilated. When CO_2 is dissolved in water, carbonic acid (H_2CO_3) is formed in the following reaction:

$$H_2O + CO_{2_{(g)}} \rightleftharpoons H_2CO_{3_{(aq)}} \rightleftharpoons H^+ + HCO_3^- \qquad (1)$$

As a result of CO_2 production during respiration, water pH is depressed is due to the release of hydrogen ions (H^+) as H_2CO_3 dissociates. In contrast, carbon dioxide is consumed faster than produced during periods of net community photosynthesis (primary production). Thus, equation 1 will shift toward the left, thereby removing CO_2 and increasing pH.

Therefore, pH typically exhibits a diel trend of increases during the day and decreases during the night. The amplitude of the cycle normally depends on the rate of production and consumption and to a lesser extent on the buffering capacity, *i.e.*, alkalinity, of the water and atmospheric exchange of carbon dioxide.

In a diurnal evaluation of Catfish Creek and South Creek, which was conducted during the dry season of 1985 and the wet season of 1986, CCI (1987) reported changes in pH characteristic of the different biological communities. During the day, Catfish Creek and South Creek exhibited changes in pH ranging up to a 1 to 2 unit increase with maximum diurnal changes observed in the lower reach of Catfish Creek (*i.e.*, CC-5) where the greatest metabolic rates were encountered.

As specified in the General Criteria for all surface waters (FAC Chapter 17-302) and in the Sarasota County Ordinance No. 72-37, the allowable variation in pH is 1.0 units above or below the normal pH provided that the pH is not lowered or elevated outside the range of 6.0 to 8.5. Additionally, if natural background is less than 6.0, the pH shall not vary below the natural background or vary more than one unit above natural background. Similarly, if natural background is above 8.5, pH shall not vary above natural background or vary more than one unit below background. During the eighth year of monitoring, all pH measurements in Catfish Creek and North Creek were within the allowable range of 6.0 to 8.5 (Figure 4.6B).

4.4 Macronutrients

4.4.1 *Total Nitrogen*

Appendix Table B-10 provides the results of total nitrogen measurements acquired during the 1992 monitoring year for Catfish Creek and North Creek. Spatial and temporal distributions of total nitrogen concentrations for the 1992 monitoring year are provided in Figure 4.7. Although slightly higher than during previous monitoring years, the spatial and compositional trends in total nitrogen were similar to the trends observed previously. During the eighth monitoring year, the upper reaches of Catfish Creek exhibited higher total nitrogen levels than observed in the other stream segments of the Palmer Ranch. The highest total nitrogen concentrations for 1992 were observed at Station CC-2 which exhibited an average total nitrogen concentration of 1.94 mg/L for the four monitoring events and generally decreased in a downstream direction. Average concentrations of 1.24 and 1.23 mg/L were observed at the downstream property boundaries in Catfish Creek and Trunk Ditch, respectively.

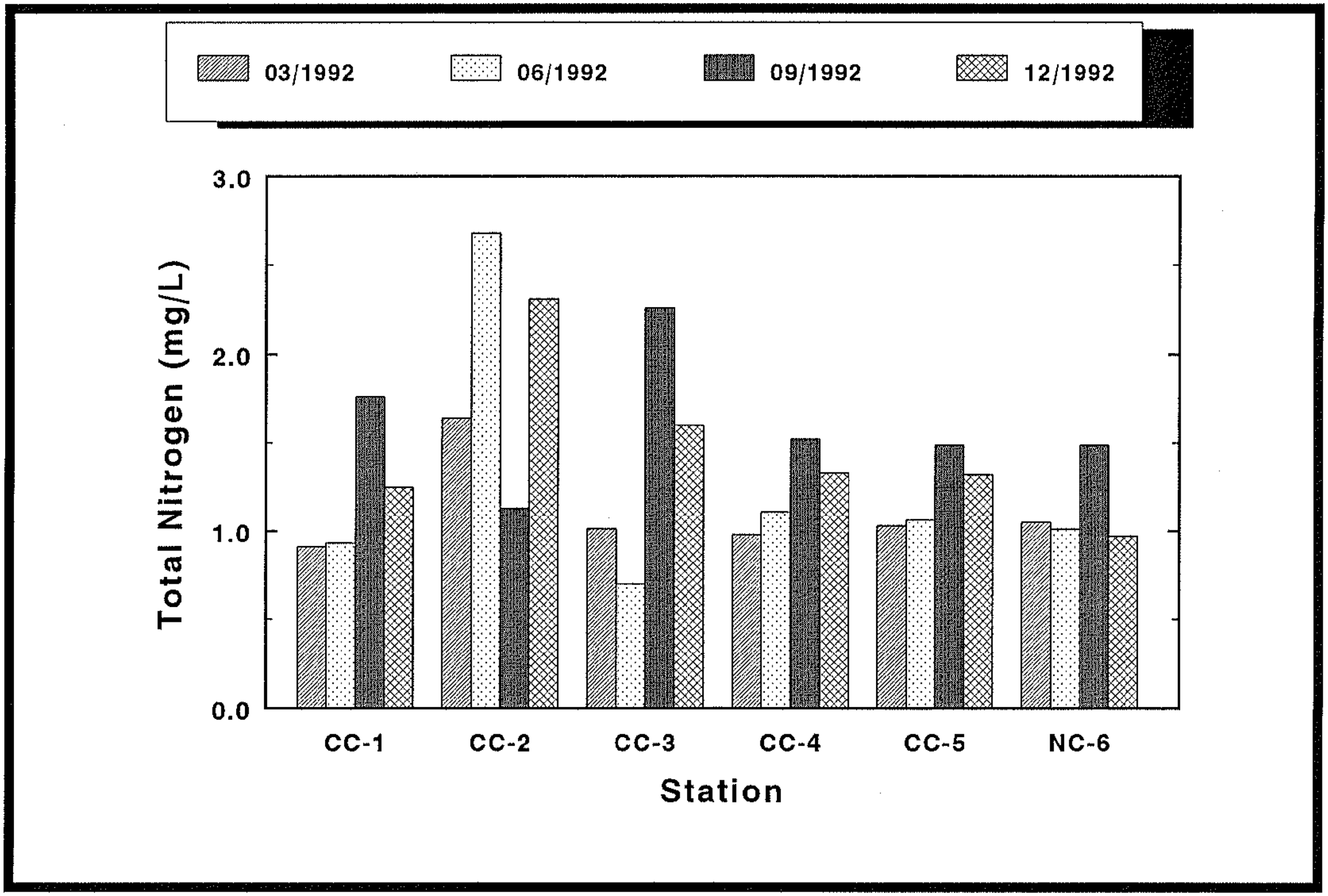


Figure 4.7 Total Nitrogen Levels Measured During Quarterly Samplings from January to December 1992 at the Palmer Ranch, Sarasota County.

The highest total nitrogen concentrations were observed for the September and December monitoring events. The high total nitrogen levels observed during September 1992 correspond to the wettest conditions and period of the greatest runoff and stream flows. During the December 1992 monitoring event, the high total nitrogen concentrations observed are attributed to low productivity and a high rate of plant decomposition.

Overall, total nitrogen levels in Catfish Creek and North Creek averaged 1.36 mg/L during the 1992 monitoring year as compared to higher averages of 1.86, 1.42, and 1.44 mg/L observed for the second, third, and fourth years of monitoring, respectively (CCI, 1986, 1988a, and 1988b). Average total nitrogen concentrations in Catfish Creek and North Creek during the sixth and seventh monitoring years (*i.e.*, 1.18 mg/L during both years) were lower than for the eighth year (CCI, 1991 and 1992a). Overall, total nitrogen levels measured in Catfish Creek during the eighth monitoring year were comparable to levels measured in previous years. However, the higher total nitrogen concentrations recorded at CC-2 during the eighth monitoring year contributed to an overall higher mean total nitrogen concentration than reported for the 1990 and 1991 monitoring years.

Figure 4.8 provides the mean total nitrogen concentrations observed for the streams traversing the Palmer Ranch during the second, third, fourth, sixth, seventh, and eighth monitoring years. Also included in Figure 4.8 is the average total nitrogen concentration measured in Catfish Creek during the "Stormwater Pollutant Loading Monitoring Program" performed at the Palmer Ranch (CCI, 1992b). The mean

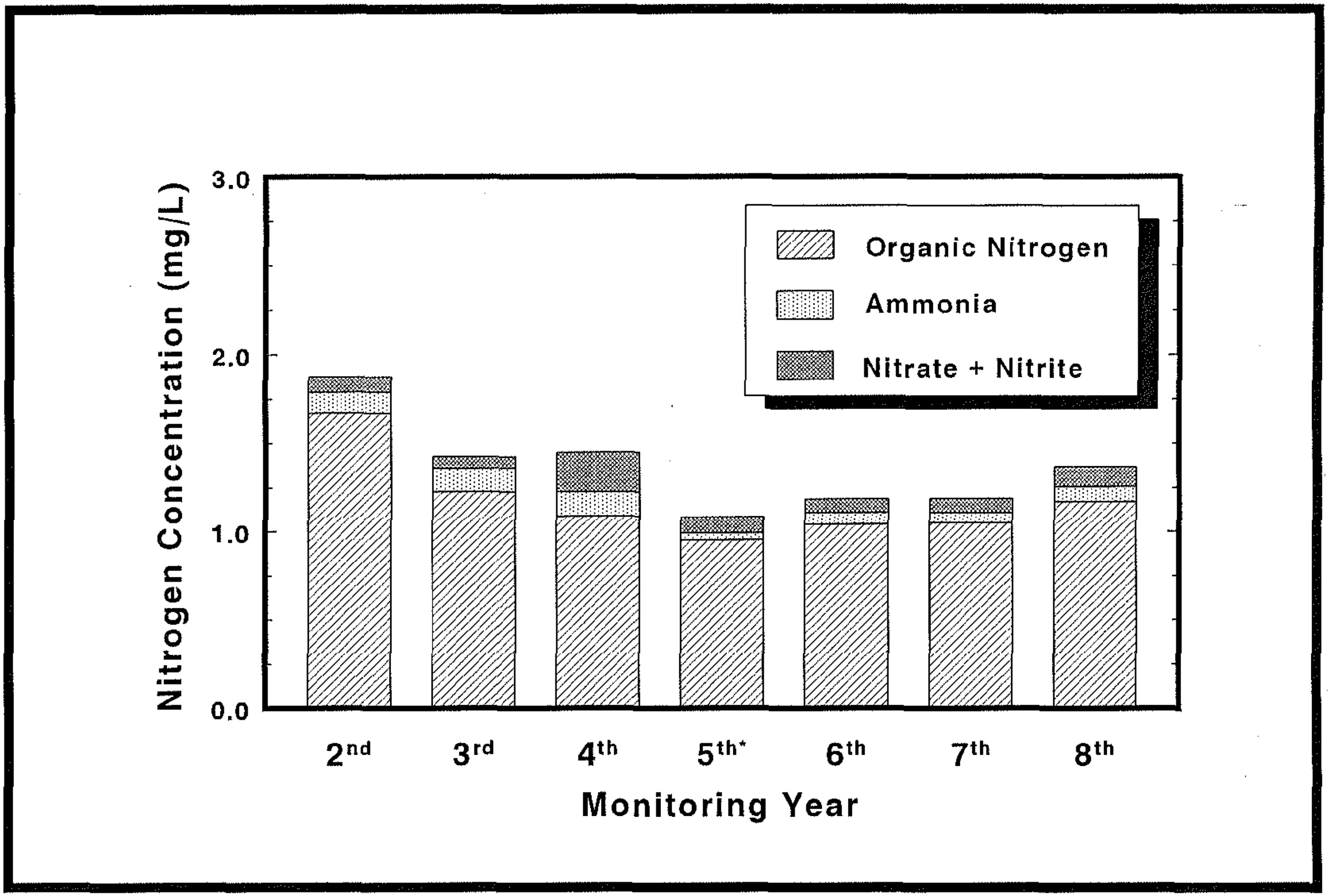


Figure 4.8 Average Nitrogen Concentrations from the Second Through the Eighth Year of Monitoring at the Palmer Ranch, Sarasota County. *Fifth year data collected at the Palmer Ranch during the "Pollutant Loading Monitoring Program".

concentrations for each component of total nitrogen (*i.e.*, ammonia, nitrate + nitrite, and organic nitrogen) are also depicted in Figure 4.8 in order compare the relative importance of each nitrogen fraction. In general, average total nitrogen concentrations for the six monitoring stations has exhibited a continual decrease over the past several years and may be indicative of a general improvement in water quality in these two streams of the North Tract of the Palmer Ranch. Not only has total nitrogen decreased, the forms of nitrogen that are readily assimilated by algae and plants (*i.e.*, ammonia and nitrate + nitrite) have also declined.

The largest fraction of total nitrogen observed during the entire monitoring program is organic nitrogen. During the eighth monitoring year, organic nitrogen represented approximately 86 percent of total nitrogen and averaged 1.17 mg/L. The second most abundant form of nitrogen was ammoniacal nitrogen (ionized plus un-ionized ammonia) which represented approximately 7 percent of the total nitrogen with an average concentration of 0.09 mg/L. Nitrate also represented approximately 7 percent of the total nitrogen with an average level of 0.09 mg/L. As expected, the smallest fraction of total nitrogen was found to be nitrite that represented approximately one (1) percent of the total nitrogen concentration.

Similarly, CCI (1986, 1988a, 1988b, 1991, and 1992a) reported comparable breakdowns of total nitrogen in Catfish Creek and North Creek during previous years of monitoring. The largest fraction of total nitrogen observed during the previous years of monitoring also occurred in the form of organic nitrogen. Organic nitrogen represented from 76 to 90 percent of the total and averaged from 1.04 to 1.67 mg/L during this period. Similarly, the second most abundant form of nitrogen was ammoniacal nitrogen that represented from 6 to 10 percent of the total with average levels of 0.06 to 0.14 mg/L over the same period. Nitrate represented approximately from 4 to 15 percent of the total with average levels ranging from 0.06 to 0.21 mg/L during the previous years of monitoring. As during the 1992 monitoring year, the smallest fraction of total nitrogen during previous years of monitoring was nitrite, which represented less than 1 percent of the total nitrogen present during all years.

During the first year monitoring, however, Palmer Venture (1986) reported a significantly different breakdown and a substantially lower total nitrogen concentration (0.8 mg/L) than during the following monitoring years. During the first year, total nitrogen averaged 69 percent organic nitrogen, 8 percent ammonia-nitrogen, 23 percent nitrate-nitrogen, and less than 1 percent nitrite-nitrogen. The lower total nitrogen during the first year versus the latter years cannot be explained based on the available information, but may be associated with the extremely droughty conditions experienced during the first monitoring year. Also, it is not completely understood why nitrate levels exceeded ammonia levels during the first year since nitrate is normally assimilated by denitrifying bacteria under conditions of depressed oxygen levels, a condition that prevailed throughout the first year.

As specified in FAC Chapter 17-302, nutrients, including total nitrogen, shall not be elevated to levels causing an imbalance in the natural flora and fauna, a condition characteristic of eutrophic or nutrient-rich streams. In this respect, there were some implications in the data acquired during the second, third, and fourth monitoring years that linked the observed total nitrogen levels to eutrophic conditions even though there appeared to be a general trend of decreasing nitrogen levels as previously discussed (CCI, 1986, 1988a, 1988b, 1991, and 1992a). Results obtained during the 1992 monitoring year indicate that total nitrogen rarely exceeded the screening level of 2.0 mg/L considered by the FDER (1990) to be characteristic of eutrophic conditions. Only three of the 24 total nitrogen measurements made during 1992 exceeded the 2.0 mg/L screening level. The total nitrogen levels exceeding the screening level were recorded during the June and December events at Station CC-2 and Station CC-3 during the September monitoring event.

4.4.2 *Nitrite*

Nitrite levels observed in Catfish Creek and North Creek during the eighth year of monitoring are provided in Appendix Table B-11. Also, spatial and temporal distributions of nitrite concentrations measured during the 1992 monitoring year are presented in Figure 4.9A. As expected, nitrite concentrations throughout these two streams traversing the North Tract were much lower than the other forms of nitrogen, and too low to be a significant nutrient source. Of the 24 samples collected during the 1992 monitoring year, only five samples contained nitrite concentrations above the 0.01 mg/L analytical detection limit. Overall, nitrite observations averaged 0.02 mg/L with a range of <0.01 to 0.14 mg/L. The highest nitrite concentration was reported at Station CC-2 during the June 1992 monitoring event and corresponds to overall elevated nitrogen concentrations at this site. During the previous monitoring years, nitrite concentrations measured in Catfish Creek and North Creek averaged

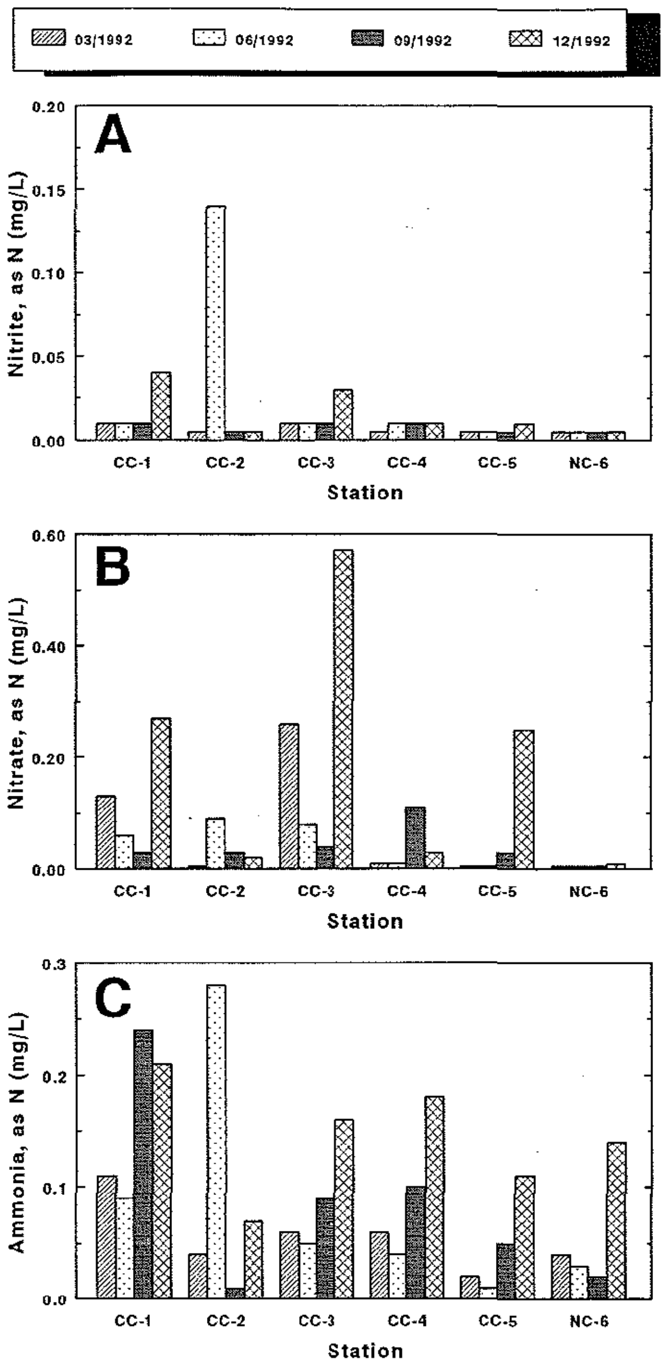


Figure 4.9 (A) Nitrite, (B) Nitrate, and (C) Ammonia Concentrations Measured During Quarterly Samplings from January to December 1992 at the Palmer Ranch, Sarasota County.

<0.01 to 0.01 mg/L and had a range from <0.01 to 0.04 mg/L (CCI, 1987, 1988a, 1988b, 1991, and 1992a).

As a nutrient, nitrite is considered to be covered by the general water quality standard (FAC Chapter 17-302). Due to the observed low concentrations, however, nitrite was generally found to be of little importance as a nutrient in the streams of the Palmer Ranch. For all practical purposes, nitrite is considered to meet desired standards.

4.4.3 *Nitrate*

As shown in the results provided in Appendix Table B-12 and Figure 4.9B, nitrate levels observed for Catfish Creek and North Creek in the Palmer Ranch during 1992 exhibited a yearly average of 0.09 mg/L with a range of <0.01 to 0.57 mg/L. These results are much lower than those determined during the fourth monitoring year for Catfish Creek and North Creek when nitrate averaged 0.21 mg/L and ranged from <0.01 to 1.30 mg/L (CCI, 1988b). More comparable nitrate concentrations were reported for the second, third, sixth, and seventh monitoring years when nitrate exhibited yearly averages from 0.06 to 0.08 mg/L and ranges from <0.01 to 0.45 mg/L (CCI, 1987, 1988a, 1991, and 1992a).

Similar to the previous years, the highest mean nitrate levels of 0.07 and 0.17 mg/L were recorded during the March and December 1992 monitoring events, respectively. This temporal trend is attributed to lower rates of nitrate assimilation and/or higher rates of nitrification during the fall and winter seasons as primary production declines to minimal rates. Additionally, nitrate loading rates might have increased during the fall and winter seasons in association with increased fertilization of the adjacent golf courses along Trunk Ditch along with decreased gross production.

Overall, the Catfish Creek/Trunk Ditch Basin exhibited the highest nitrate levels recorded during the eighth monitoring year with an average of 0.10 mg/L. The highest average nitrate concentration of 0.14 mg/L was recorded in the mid-reach (Stations CC-3 and CC-4) of Catfish Creek. Station CC-3 had the highest contribution to the average nitrate level during the eighth monitoring year with nitrate concentrations ranging from 0.04 to 0.57 mg/L (Figure 4.9B). Nitrate concentrations were comparable in both the upper reach (Stations CC-1 and CC-2) and lower reach (Station CC-5) of Catfish Creek averaging 0.08 and 0.07 mg/L, respectively.

Very low nitrate levels were also recorded at the juncture of Trunk Ditch and the North Creek Basin as evidenced by the annual mean concentrations of 0.01 mg/L determined for Station NC-6. Low stream flow was also measured at this site indicating minimal nitrate import. Furthermore, the North Creek site exhibited anaerobic conditions, as evidenced by low dissolved oxygen concentrations, which are conducive to denitrification and minimal nitrate concentrations.

As a nutrient, nitrate is designated as a parameter covered by the general water quality criteria (FAC Chapter 17-302), and is an important limiting nutrient in the streams of the Palmer Ranch. Therefore, increases in nitrate availability from anthropogenic sources would accelerate production rates of aquatic plants resulting in an imbalance in the flora and fauna that would be considered a violation of the nutrient standard. However, the nitrate concentrations determined during the 1992 monitoring year were among the lowest recorded during the eight-year monitoring program and are not thought to represent an important source of nitrogen in the streams of the Palmer Ranch. Therefore, nitrate is considered to meet desired criteria.

4.4.4 *Ammoniacal Nitrogen*

Appendix Table B-13 provides the results of ammoniacal nitrogen measurements (ionized plus un-ionized ammonia) recorded during the eighth year of monitoring. Also, spatial and temporal distributions of ammoniacal nitrogen are illustrated in Figure 4.9C. As described previously, ammoniacal nitrogen represented 7 percent of the total nitrogen measured during the 1992 monitoring year. Overall, ammoniacal nitrogen exhibited an average of 0.09 mg/L with a range from <0.02 to 0.28 mg/L.

Although ammoniacal nitrogen is a potentially important nutrient to the primary producers in the streams of the Palmer Ranch, the results suggest that nitrate might be the preferred nitrogen source. This indication is based on two annual trends observed during the 1992 monitoring year as well as previous monitoring years as related to normal plant production and decay. First, nitrate declined to minimal levels during the late spring (*i.e.*, June), in association with the peak of the growing season while the concentration of ammoniacal nitrogen was higher, *i.e.*, 0.08 mg/L, during the June monitoring event. Second, ammoniacal nitrogen peaked during December (*i.e.*, 0.15 mg/L) at a time when nitrate levels also peaked (*i.e.*, 0.19 mg/L). Since December is considered to be the beginning of the winter season when net (primary) production is minimal, assimilation of nutrients should also be minimal. Since nutrients should be more available when they are assimilated at minimal rates, and vice versa, their concentrations should be elevated during December and depressed during June. Furthermore, nitrification (biological oxidation of organic nitrogen to nitrate) is expected to increase in association with the die-off and decay of plant material under aerobic conditions. Moreover, die-off and decay of plant material are expected to increase immediately following the period in which its standing crop peaks. This can occur in the streams of the Palmer Ranch from October to December. Since it was evident that the streams of the Palmer Ranch followed these trends of primary production, decay, nitrification, and minimal levels of nitrate during the growing season, it is concluded that nitrate is the preferred nitrogen source. Other freshwater studies (Wetzel, 1975) have also concluded that aquatic vegetation, including algae, prefer nitrate to ammonia.

During the previous years of monitoring (Palmer Venture, 1986 and CCI, 1986, 1988a, 1991, and 1992a), ammonia concentrations were comparable to those measured during the 1992 monitoring year. However, during the fourth year, ammonia ranged from 0.04 to 0.32 mg/L with an annual average of 0.14 mg/L (CCI, 1988b). The largest range in ammoniacal nitrogen concentrations was observed during the 1990 monitoring year from <0.02 to 0.65 mg/L (CCI, 1991).

Although ammoniacal nitrogen is a nutrient and therefore has the potential to influence the growth of the primary producers (plants) and their balance with the consumers (bacteria and animals), FAC Chapter 17-302 does not provide a quantitative nutrient standard for ammoniacal nitrogen. Although it might be less preferred than nitrate, increases in ammonia have the potential to accelerate plant production, and, in turn, influence the balance between the flora and fauna of the streams traversing the Palmer Ranch. However, the concentrations of ammoniacal nitrogen determined during the 1992 monitoring year were among the lowest recorded during the eight-year monitoring program and are not thought to represent an important source of nitrogen in the streams of the Palmer Ranch. Therefore, ammonia is considered to meet desired criteria. Since the non-ionized fraction of ammoniacal nitrogen was not evaluated independently, comparisons to County and State criteria for non-ionized ammonia were not made.

4.4.5 *Organic Nitrogen*

Organic nitrogen[2] concentrations determined in Catfish Creek and North Creek within the Palmer Ranch during the 1992 monitoring year are provided in Appendix Table B-14 and graphically depicted in Figure 4.10. Overall, an average organic nitrogen concentration of 1.17 mg/L was measured in these streams of the Palmer Ranch during the eighth year of monitoring with a range from 0.56 to 2.22 mg/L. Slightly lower average organic nitrogen concentrations (*i.e.*, 1.04 mg/L) were reported for the sixth and seventh monitoring years in both Catfish and North Creeks (CCI, 1991 and 1992a). Comparable average organic nitrogen concentrations of 1.10 and 1.23 mg/L were reported for the third and fourth monitoring years for stations located along Catfish and North Creeks within the Palmer Ranch, respectively (CCI, 1988a and 1988b). However, during the second year of monitoring (CCI, 1986 and 1988a), the organic nitrogen averaged 1.67 mg/L. Overall, the organic nitrogen data indicates a

[2] Organic Nitrogen = Total Kjeldahl Nitrogen - Ammoniacal nitrogen.

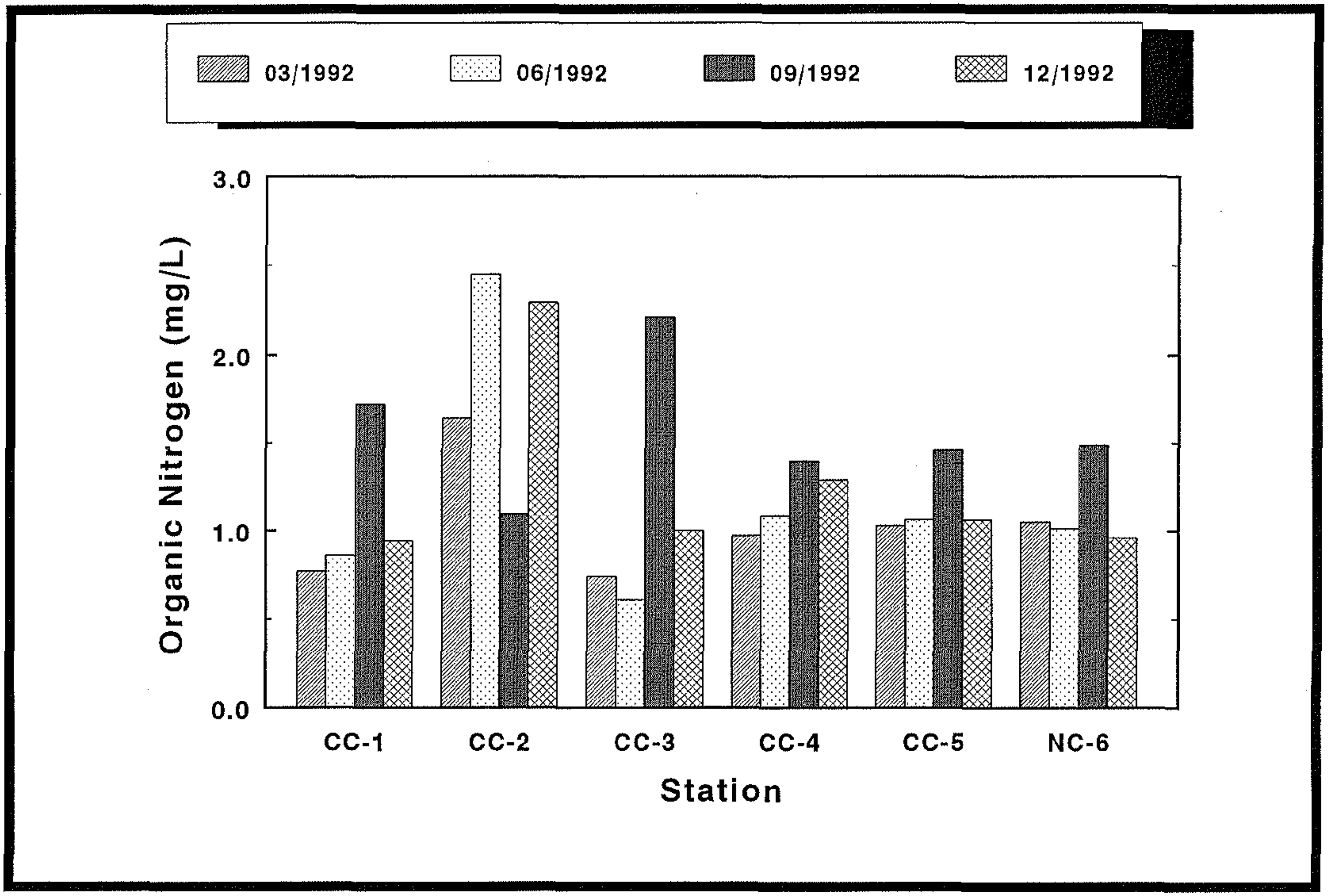


Figure 4.10 **Organic Nitrogen Concentrations Measured During Quarterly Samplings from January to December 1992 at the Palmer Ranch, Sarasota County.**

gradual improvement or non-degradation in water quality over the past eight years with respect to nitrogen. Also, channel maintenance in Trunk Ditch during the fourth monitoring year, as well as the aquatic community changes resulting from the "reconstruction" of a segment of the Catfish Creek/Trunk Ditch Basin during the second year, may contribute to the declining trend in organic nitrogen.

The concentration of organic nitrogen followed a seasonal trend similar to that observed during previous monitoring years with the level of organic nitrogen increasing through the spring and summer to a maximum during the late summer (*i.e.*, September 1992a) then declined during the fall to lower concentrations in December. During the September 1992 monitoring event, organic nitrogen levels in both Catfish and North Creeks averaged 1.48 mg/L compared to the 0.98 mg/L observed during the March 1992 event.

The peak in organic nitrogen during September is apparently associated with peaks in the standing crop of aquatic vegetation and stormwater loadings, since September represents the end of the summer wet season. During the fall and winter, the standing crop of vegetation declined in association with low production rates and the decay of plant material. During this period, organic nitrogen exhibited a concomitant decline as the plant material was depleted by the microbial heterotrophs. Additionally, stormwater loading rates most likely declined in association with minimal runoff during the dry months of October through January.

4.4.6 *Total Phosphorus*

During the 1992 monitoring year, total phosphorus in the Catfish Creek/Trunk Ditch Basin of the Palmer Ranch averaged 0.38 mg/L and a range of 0.06 to 2.22 mg/L (Appendix Table B-15). The highest total phosphorus level (2.2 mg/L) was recorded at Station CC-3 during the September monitoring events (Figure 4.11). The lowest mean total phosphorus concentration was observed at NC-6. Overall, the average total phosphorus concentration in the Catfish Creek/Trunk Ditch and North Creek Basins was 0.43 mg/L (Appendix B-15).

Slightly lower total phosphorus concentrations were recorded for the 1991 monitoring year with an overall yearly average of 0.15 mg/L for the six monitoring stations in the Catfish Creek/Trunk Ditch and North Creek Basins (CCI, 1992a). Lower total phosphorus concentrations were also observed during the sixth monitoring year with concentrations in the Catfish Creek/Trunk Ditch and North Creek Basins averaging 0.12 mg/L (CCI, 1991). During the third and fourth monitoring years, total phosphorus levels averaged 0.26 mg/L for each year (CCI, 1988a and 1988b). The highest total phosphorus levels occurred during the second monitoring year with an average of 0.46 mg/L (CCI, 1986). The source of this phosphorus was attributed to cleared lands and construction activities associated with the development of Prestancia.

The higher mean total phosphorus concentration recorded during the eighth year of monitoring in the Catfish Creek/Trunk Ditch and North Creek Basins is attributed to 38.33 inches of rainfall that fell during the primary wet season (Table 4.1). In

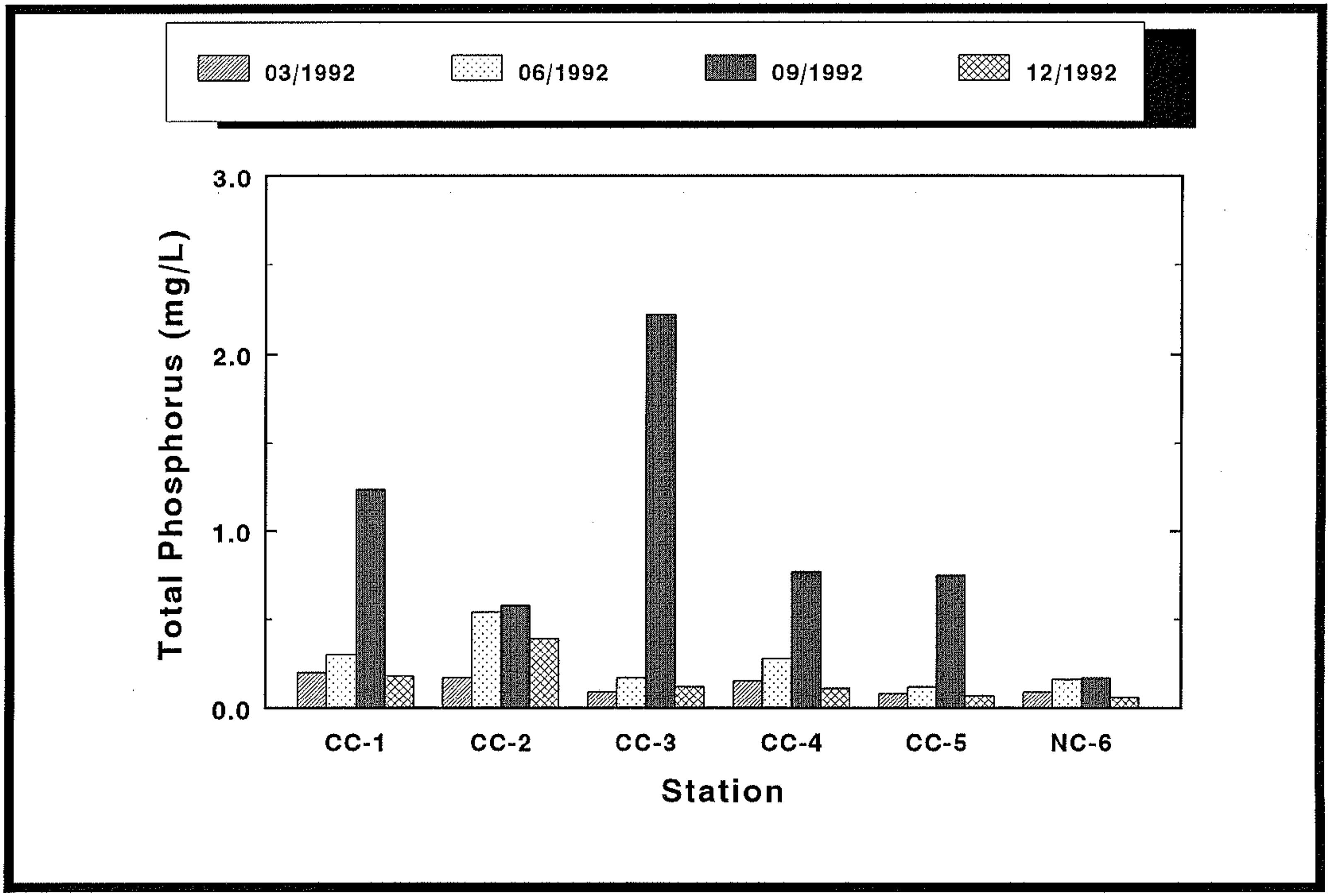


Figure 4.11 Total Phosphorus Concentrations Measured During Quarterly Samplings from January to December 1992 at the Palmer Ranch, Sarasota County.

addition to the high rainfall amounts reported for the primary wet season, maintenance activities of the Catfish Creek Ditch upstream of the Palmer Ranch may have contributed elevated phosphorus concentrations measured in September 1992.

Overall, average phosphorus concentrations in the Catfish Creek/Trunk Ditch and North Creek Basins declined during the second, third, fourth, fifth, sixth and seventh year of monitoring, as illustrated in Figure 4.12. However, average phosphorus levels recorded for the eighth year of monitoring were higher than recorded for previous years. As discussed earlier, this observed increase in phosphorus levels is attributed to the high rainfall amount recorded during the primary wet season. For comparison, the fractionation of orthophosphate and organic phosphorus levels is also provided in Figure 4.12.

As a nutrient, phosphorus is required by algae and other plants for the primary production of organic matter and, therefore, as specified in FAC Chapter 17-302, shall not be elevated to levels that will cause an imbalance in the natural flora and fauna. The results of the eighth year of monitoring indicate that the total phosphorus concentrations in the streams of the Palmer Ranch only occasionally exceeded the FDER screening level of 0.46 mg/L (FDER, 1990) which is considered to be indicative of water quality problems. The majority of these exceedances occurred at the end of the primary wet season as a result of increased runoff. The total phosphorus concentrations were more often above the 0.09 mg/L level determined to be the median concentration for Florida streams (FDER, 1990).

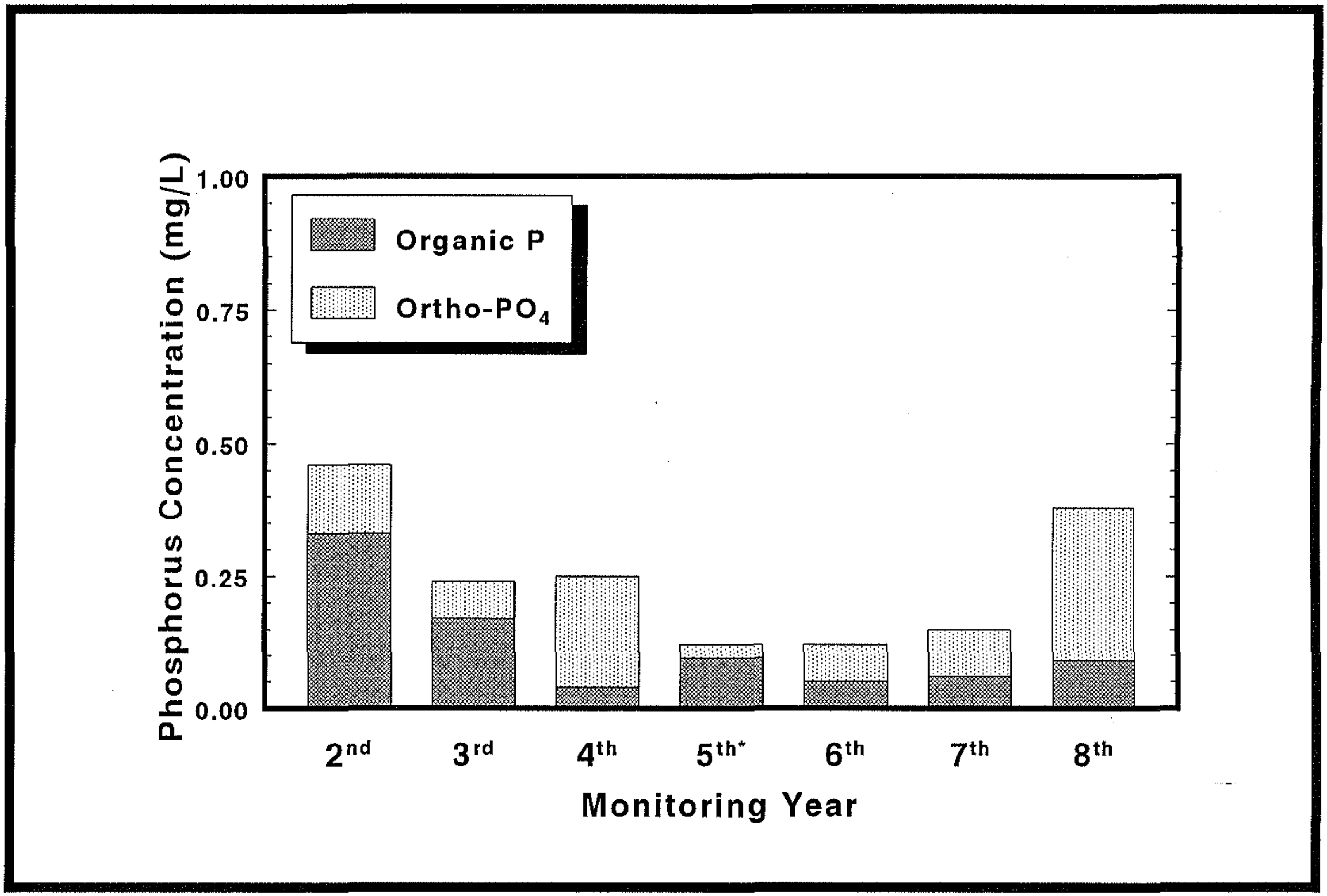


Figure 4.12 **Average Phosphorus Concentrations from the Second through the Eighth Year of Monitoring at the Palmer Ranch, Sarasota County. *Fifth year data collected at the Palmer Ranch during the "Pollutant Loading Monitoring Program".**

Similar concentrations are normally found in west-central Florida because of the widespread deposits of naturally occurring phosphate (Sheldon, 1982). Interestingly, well drillers' logs show that phosphates exist in shallow deposits on the Palmer Ranch (Patton and Associates, 1984). As in the past years, a correlation between the total phosphorus concentrations and TSS concentrations suggests the controlling role of naturally occurring phosphate deposits on the phosphorus concentrations in the streams of the Palmer Ranch. In addition, Palmer Venture (1986) noted that the phosphate levels in the streams of the Palmer Ranch were significantly influenced by groundwater during periods when stream flow was augmented by groundwater exfiltration (*i.e.*, low flow conditions). Consequently, phosphates originating from these naturally occurring deposits within, or upstream of, the Palmer Ranch should not be considered violations even though they exhibit the potential for contributing to high rates of primary production and a concomitant imbalance in the flora and fauna.

4.4.7 *Orthophosphate*

Orthophosphate (total reactive phosphate) concentrations determined in the streams traversing the Palmer Ranch during the 1992 monitoring year are provided in Appendix Table B-16. Overall, the Catfish Creek/Trunk Ditch and North Creek Basins of the Palmer Ranch exhibited an average orthophosphate concentration of 0.29 mg/L during the eighth year of monitoring with a range from 0.01 to 2.04 mg/L (Figure 4.13). As with total phosphorus, the highest orthophosphate concentrations observed during the 1992 monitoring year occurred in September at the end of the primary wet season (Figure 4.13). Average orthophosphate levels recorded for the Catfish Creek/Trunk Ditch and North Creek Basins during the 1990 and 1991 monitoring years were

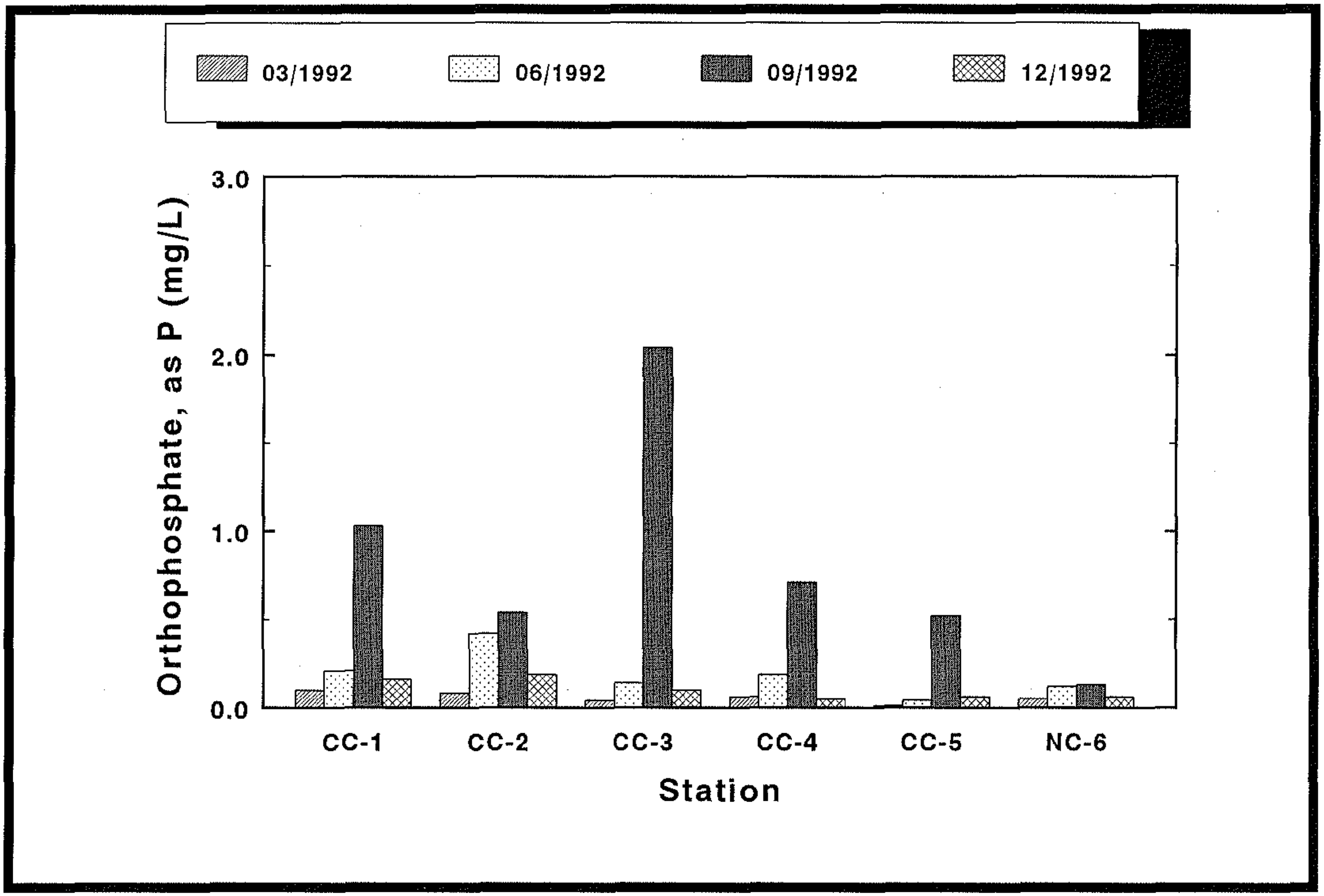


Figure 4.13 Orthophosphate Concentrations Measured During Quarterly Samplings from January to December 1992 at the Palmer Ranch, Sarasota County.

significantly lower than recorded during the eighth year of monitoring. The annual mean orthophosphate concentrations determined during 1990 and 1991 were 0.07 and 0.09 mg/L, respectively (CCI, 1991 and 1992a). However, during the fourth year orthophosphate averaged 0.20 mg/L with a range of from 0.02 to 0.88 mg/L (CCI, 1988b). An annual mean orthophosphate concentration of 0.07 mg/L and range of <0.01 to 0.15 mg/L was recorded during the third year of monitoring (CCI, 1988b). The orthophosphate concentrations recorded during the second monitoring year ranged from 0.04 to 0.36 mg/L with an annual mean concentration of 0.13 mg/L (CCI, 1986).

Although the phosphorus concentrations have varied considerably over the last four years, the percentage of total phosphorus consisting of orthophosphate has remained relatively constant. In general, orthophosphate represented approximately 76 percent of the total phosphorus during 1992 compared to 58 to 77 percent recorded for previous four years of monitoring.

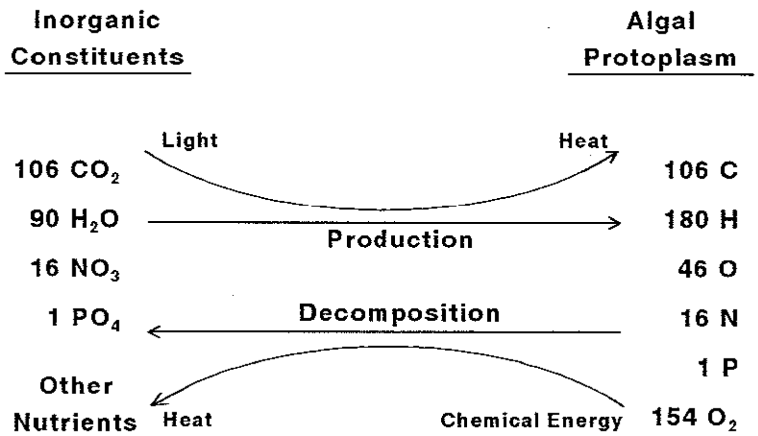
During the eighth year of monitoring, an apparent spatial and temporal trend in orthophosphate suggests that orthophosphate levels in the Catfish Creek/Trunk Ditch and North Creek Basins generally decrease in a downstream direction (Figure 4.13). Increased orthophosphate concentrations were observed during the September monitoring event (*i.e.*, end of the primary wet season), as expected (Figure 4.13). Similar trends were observed during the previous years of monitoring for the South Creek Basin. This spatial decline is attributed to the following: (1) downstream dilution of the runoff within the Catfish Creek/Trunk Ditch and North Creek Basins;

and (2) phosphate uptake by biological and physicochemical processes. The temporal increase in orthophosphate concentrations recorded at the end of the primary wet season is attributed to increased runoff during the primary wet season.

As a nutrient, orthophosphate is designated by FAC Chapter 17-302 as a general water quality parameter. This criterion specifies that the discharge of nutrients, such as orthophosphate, shall be limited to prevent an imbalance in the natural populations of aquatic flora and fauna. Although the observed levels are occasionally above the threshold considered to indicate eutrophic conditions as defined by FDER (1983), orthophosphate has been found to occur naturally on the North Tract. Consequently, other factors, such as nitrogen availability, are probably more growth limiting than orthophosphate. Therefore, the phosphate levels found during the 1992 monitoring year is not likely to have caused an imbalance in the aquatic flora and fauna.

4.4.8 *Nutrient Ratios*

Nitrate and phosphate are required by aquatic plants in proportions of approximately 6.8:1 (on a weight basis or 16:1 N:P on a molar basis) (Odum, 1959 and GESAMP, 1987). Nitrogen and phosphorus are assimilated in this proportion by the primary producers (rooted aquatic plants and algae) and converted into protoplasm during the process of photosynthesis. Conversely, the (unresistant or digestible) organic forms of nitrogen and phosphate are oxidized back into their biogenic salts during the process of aerobic respiration, *e.g.*, organic decomposition, heterotrophic activity. This relationship can be illustrated as:



The primary forms of these biogenic salts are nitrate and orthophosphate. However, nitrate may be substituted by some plants for other forms of nitrogen, such as ammonia. Also of importance, orthophosphate may be accumulated and stored as polyphosphates by some algae, thereby alleviating a potential future phosphate limiting condition.

Importantly, other limiting factors such as low light and low dissolved oxygen could play as important, if not more important, roles in limiting the rate of primary production and decomposition in the streams of the Palmer Ranch, respectively. For example, if the availability of inorganic nitrogen is high and the N_i:P_i ratio is low, *e.g.*, 2:1, it would indicate that some factor other than inorganic nitrogen is the real limiting factor. Even so, determinations and the use of nutrient ratios in light of other important and potentially limiting factors is helpful in evaluating the results of long-term monitoring programs when nutrient loading and its consequences are major concerns, such as for the "Continuing Surface Water Quality Monitoring Program."

Results of the eighth year of monitoring were used to determine the molar ratios of nitrogen to phosphorus in the streams of the Palmer Ranch (Figures 4.14A and 4.14B). Total nitrogen to total phosphorus ratios (N_t:P_t) are provided in Appendix Table B-17 with ratios of inorganic nitrogen (ammonia, nitrite, and nitrate) to orthophosphate (N_i:P_i) being given in Appendix Table B-18.

The N_i:P_i ratios are consistently low and found to average approximately 2:1, indicative of conditions in which fixed inorganic nitrogen would limit plant growth before orthophosphate (Figure 4.14B). In contrast, N_t:P_t ratios were found to average 7:1 indicating a balanced system (Figure 4.14A). In a nutrient-balanced system, neither nitrogen nor phosphorus limit plant growth because both are present in the proper proportions for plant growth. The lower N_i:P_i ratios calculated from the 1992 data are attributed to the naturally high levels of orthophosphate, as well as the high percentage of total phosphorus represented by orthophosphate (76 percent of total phosphorus) while approximately 14 percent of the total nitrogen is comprised of inorganic nitrogen.

The most meaningful ratio in assessing nutrient limiting conditions is based on the inorganic forms (biogenic salts as previously discussed) since these constituents are immediately available to the primary producers whereas even the unresistant organic forms must be chemically transformed into the inorganic forms prior to photosynthesis. During the eighth year of monitoring, the N_i:P_i ratios found were generally indicative of excess phosphorus with respect to nitrogen during the four quarterly events. In June, N_i:P_i ratios averaged approximately 0.8:1 and decreased to 0.2:1

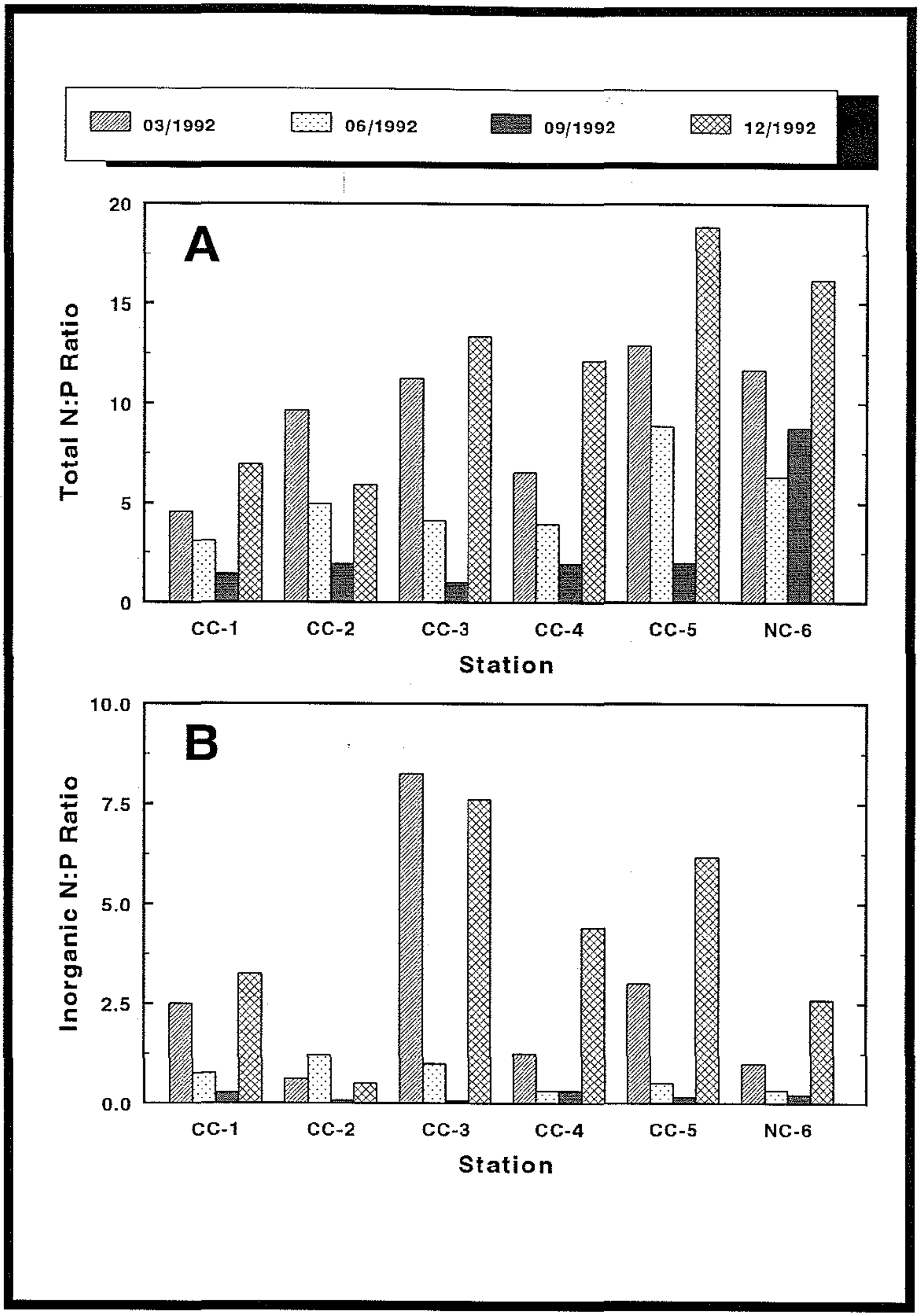


Figure 4.14 (A) Total Nitrogen to Phosphorus Ratios and (B) Inorganic Nitrogen to Phosphorus Ratios determined from Quarterly Data Collected from January to December 1992 at the Palmer Ranch, Sarasota County.

during September (Figure 4.14B). The N_i:P_i ratio for the March and December monitoring events was approximately 3:1 and 4:1, respectively (Figure 4.14B).

4.5 Oils and Greases

As provided in Appendix Table B-19, the concentration of oil and grease in the streams of the Palmer Ranch was found to range from <1.0 mg/L to 7.6 mg/L during the eighth year of monitoring. Only one of the 24 measurements during the past year of monitoring (*i.e.*, Station NC-6 for the June 1992 event) exceeded the State standard of 5 mg/L specified in FAC Chapter 17-302 (Figure 4.15). None of the 24 measurements exceeded the Sarasota County standard of 15 mg/L.

Most of the oil and grease measurements above the 1.0 mg/L detection limit were observed during the June and December 1992, monitoring events with only two measurements for the March and September 1992, monitoring events being above 1.0 mg/L. The elevated oil and grease levels coincide with the period of lowest stream flows that occurred for the June and December events (Figures 4.2 and 4.15).

The elevated oils and greases concentrations are attributed to sources of oils and greases on and/or upstream of the Palmer Ranch and are probably associated with the natural decay of vegetation during extended dry periods followed by their removal by the storm water runoff that occurred in the two weeks preceding the monitoring events.

The concentrations of oils and greases reported in the streams of the Palmer Ranch during the previous years of the monitoring program (Palmer Venture, 1986, and CCI,

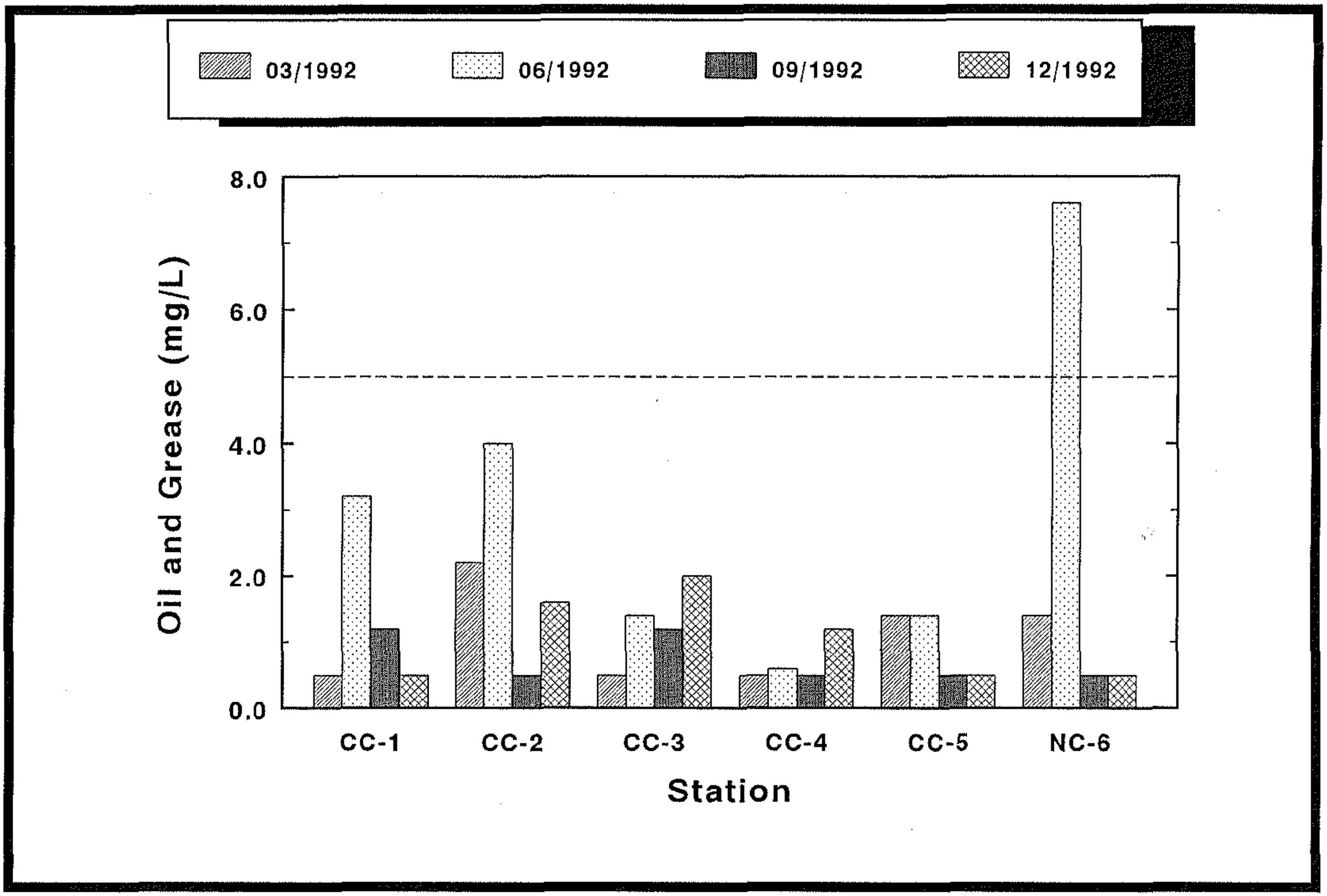


Figure 4.15 Oil and Grease Levels Measured During Quarterly Samplings from January to December 1992 at the Palmer Ranch, Sarasota County.

1986, 1988a, 1988b, 1991, and 1992a), ranged from less than 1 mg/L to 17 mg/L. Most of the observations (100 of 104) were found to be less than the maximum allowable State criteria of 5 mg/L and only one was found greater than the maximum allowable County criteria of 15 mg/L.

4.6 Bacteriological Parameters

4.6.1 *Total Coliform*

As indicated in Appendix Table B-20, the streams traversing the Palmer Ranch were found to exhibit frequent violations of the State and County standards for total coliform bacteria during the 1992 monitoring year. Both the State and County standards, which allow up to 2,400 colonies/100 mL, were exceeded in 15 of the 24 samples (*i.e.*, 63 percent) collected during the 1992 monitoring year (Figure 4.16A). Highest concentrations were observed in the upper reach of the Catfish Creek/Trunk Ditch Basin at Stations CC-1 and CC-2 (Figure 4.16A) as was also observed during 1990 and 1991 monitoring years.

During the third, fourth, sixth, and seventh monitoring years (CCI, 1988a, 1988b, 1991, and 1992a), the total coliform concentrations in the Catfish Creek/Trunk Ditch Basin were also found to commonly exceed the State and County standards with 52, 53, 43, and 78 percent of the results being higher than the 2,400 colonies/100 mL criteria, respectively. Similar coliform densities and frequency of violations were observed during the second year of monitoring. During the second year (CCI, 1986) 67 percent of the samples taken were determined to exceed the 2,400 colonies/100 mL standard.

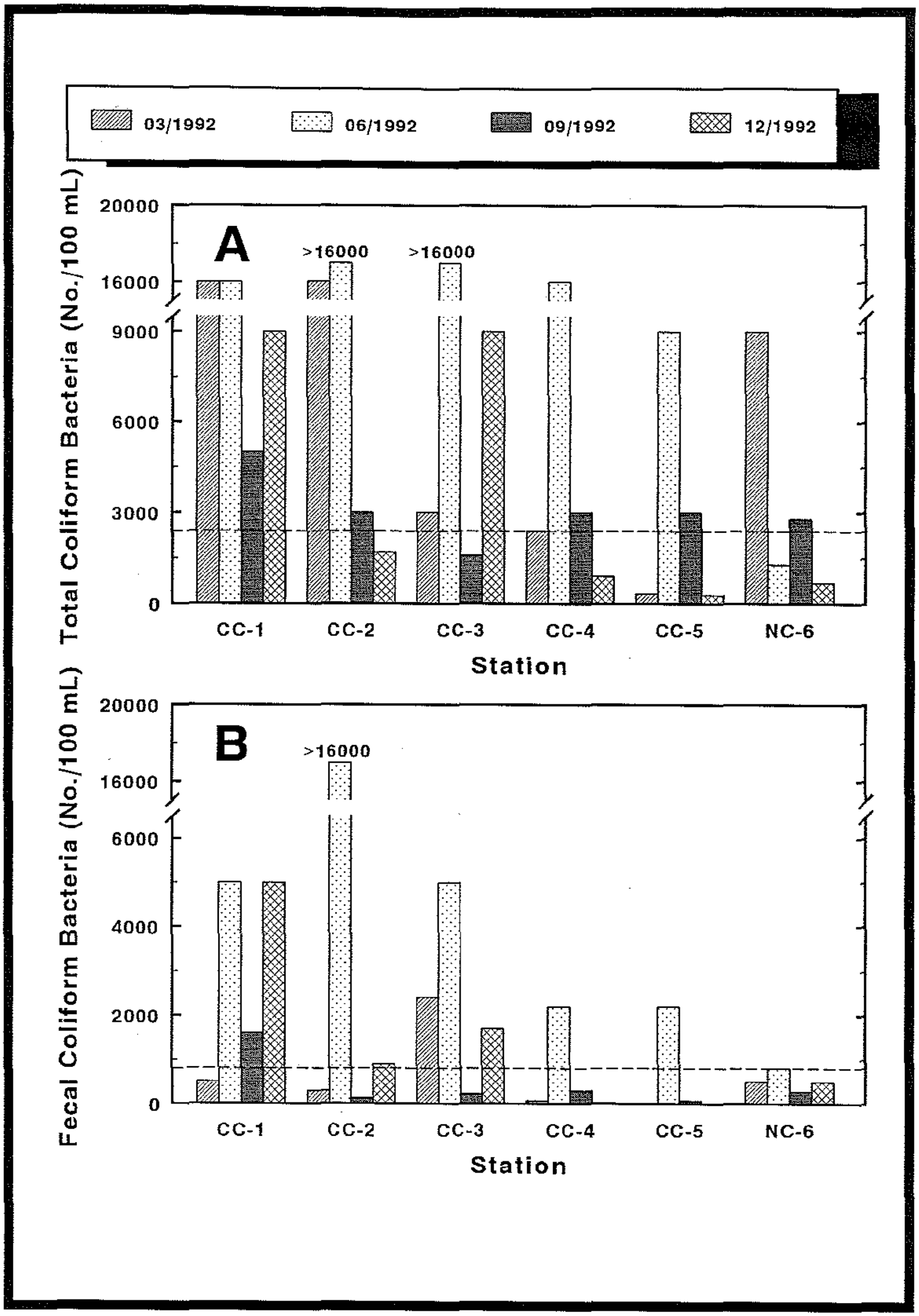


Figure 4.16 (A) Total Coliform Bacteria and (B) Fecal Coliform Bacteria Counts Measured During Quarterly Samplings from January to December 1992 at the Palmer Ranch, Sarasota County. Dotted Lines Depict State Standards.

As during previous years, the highest number of total coliform colonies was observed during the 1992 wet season with a mean level of 14,600 colonies/100 mL being observed for the June 1992 monitoring event. This trend is expected since the primary mode of transport of the coliform bacteria to the streams traversing the ranch is surface runoff, consequently resulting in seasonal trends associated with the amount of rainfall.

As noted in previous years (CCI, 1988a, 1988b, 1991, and 1992a), these data show that several sources of coliform bacteria exist on and upstream of the Palmer Ranch. A primary source is expected to be the naturally occurring coliform bacteria of the soils and vegetation on and upstream of the ranch. During periods of land clearing coupled with significant runoff, this source is expected to be exacerbated. Such a condition probably occurred during the second and third monitoring years in the Catfish Creek/Trunk Ditch Basin as the construction of Prestancia was initiated. Another source of coliform bacteria is represented by the warm-blooded animals inhabiting the watershed, including cattle, birds, feral hogs, deer, and rodents.

4.6.2 *Fecal Coliform*

During the seventh year of monitoring, the streams of the Palmer Ranch exhibited fecal coliform densities that ranged from 11 to >16,000 colonies/100 mL (Appendix Table B-21) as compared to a range of 9 to >16,000 colonies/100 mL during the seventh year (CCI, 1992a). Of the 24 samples that were collected during the eighth year of monitoring, eight (*i.e.*, 33 percent) exceeded the Class III State and County Standard of 800 colonies/100 mL (Figure 4.16B). The percentage of exceedances recorded during the third, fourth, sixth, and seventh monitoring years ranged from 26 to 43 percent. However, it is important to note that fewer samples were collected during the fourth year than during other years of monitoring.

The highest number of fecal coliform colonies and the greatest number of exceedances during the 1992 monitoring year generally occurred in the upper reach of the Catfish Creek/Trunk Ditch Basin (Figure 4.16B) probably due to a greater number of warm blooded animals in the stream communities associated with the developed portion of the Palmer Ranch. The high fecal coliform bacteria levels which were observed both upstream and internal to the Palmer Ranch, indicate significant sources of fecal coliform bacteria originating both upstream and within the ranch, with birds, cattle, and other warm-blooded wild animals considered the primary sources.

4.7 Trace Elements

During the September 1992 monitoring event, samples were collected for the analyses of trace elements (*i.e.*, arsenic, copper, lead, mercury, nickel, and zinc). The results of these analyses are provided in Appendix Table B-22 along with the applicable State and County Standards for each element. The concentrations of arsenic and lead were below the analytical detection limits at all monitoring locations. Therefore, the concentrations of these metals found in the streams of the Palmer Ranch during the 1992 monitoring year are in compliance with all applicable State and County water quality criteria.

Copper concentrations measured in the Catfish Creek/Trunk Ditch Basin during the 1992 monitoring period averaged 3.9 μg/L and ranged from 0.5 to 7.0 μg/L (Appendix

B-22). None of the measured copper concentrations exceeded the State standard of 12.8 μg/L[3], or the more stringent 10 μg/L criteria of Sarasota County. Possible sources of copper in the surface waters of the Palmer Ranch include the use of copper containing herbicides, fertilizers, algicides, and pesticides.

The concentration of zinc determined for the six monitoring stations during 1992 ranged from 16 to 29 μg/L with an average of 22 μg/L. None of the six zinc concentrations determined during the September 1992 monitoring event exceeded the State standard of 115 μg/L[4], with all measured concentrations being in excess of the more stringent 10 μg/L criteria of Sarasota County. Possible sources of zinc include the use of zinc containing fertilizers and runoff from roads and parking areas on and upstream of the Palmer Ranch.

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[3] Based on a total hardness of 110 mg/L.

[4] *Ibid.*

5.0 SUMMARY

During the eighth year of the "Continuing Surface Water Quality Monitoring Program", sampling was performed at six stations located in the Catfish Creek/Trunk Ditch Basin of the Palmer Ranch over the period from January through December 1992. Quarterly monitoring events were performed during March, June, September, and December 1992. Monitoring during the previous seven years was performed at approximately the same six locations in the Catfish Creek/Trunk Ditch Basin. However, monitoring was performed bimonthly during the first year and subsequently changed to a quarterly frequency at the beginning of the second year of monitoring. The results of the first seven years of monitoring may be reviewed in the annual reports prepared by Palmer Venture (1986) and CCI (1986, 1988a, 1988b, 1990, 1991, and 1992a). In addition, results from the "Stormwater Pollutant Loading Monitoring Program" for the Palmer Ranch performed from August 1988 to April 1990 can be reviewed in a final report prepared by CCI (1992b).

Monitoring of the Palmer Ranch streams entailed measurements of specific conductance, water temperature, suspended solids, turbidity, dissolved oxygen, pH, biochemical oxygen demand, macronutrients, oil and greases, and bacteriological quality during each quarterly sampling event. The results of the eighth year of monitoring is summarized in Table 5.1. In addition, samples for the determination of trace elements were collected at all six sites on the Palmer Ranch on an annual basis. A complete tabulation of results is provided in Appendix B.

TABLE 5.1 SUMMARY OF RESULTS FOR THE PALMER RANCH WATER QUALITY MONITORING PROGRAM FOR THE PERIOD FROM JANUARY THROUGH DECEMBER, 1992.

Parameter	CC-1 Mean	CC-2 Mean	CC-3 Mean	CC-4 Mean	CC-5 Mean	Catfish Creek Basin Mean	N	Min	Max	Applicable Criteria
PHYSICAL										
Depth (ft)	2.30	0.50	0.73	0.49	1.44	1.02	20	0.20	3.08	---
Flow (GPM)	652.8	111.1	529.0	980.1	1689.8	687.9	20	0.0	4405.1	---
Temperature (°C)	23.0	23.1	22.7	24.4	23.9	23.0	20	14.9	29.1	---
Conductivity (μmhos/cm)	587	992	812	696	863	759	20	431	1459	+50%, +100%[a]
Total Suspended Solids (mg/L)	7.5	10.6	2.6	6.3	4.5	5.4	20	<1.0	31.0	---
Turbidity (NTU)	8.9	10.0	10.9	8.4	4.6	7.6	20	1.2	25.0	+29, +25[b]
OXYGEN DEMAND AND RELATED PARAMETERS										
Biochemical Oxygen Demand, 5-Day (mg/L)	1.8	2.6	1.5	2.2	1.9	1.8	20	0.2	5.3	---
Dissolved Oxygen (mg/L)	5.8	5.1	4.1	6.0	5.2	4.8	20	2.2	8.3	≥5, ≥4[c]
pH (-log[H+])	6.9	7.2	6.9	7.1	7.3	7.0	20	6.7	7.7	6.0 - 8.5
MACRONUTRIENTS										
Nitrite Nitrogen (mg/L)	0.02	0.04	0.02	0.01	0.01	0.02	20	<0.01	0.14	---
Nitrate Nitrogen (mg/)	0.12	0.04	0.24	0.04	0.07	0.09	20	<0.01	0.57	---
Ammonia Nitrogen[d] (mg/L)	0.16	0.10	0.09	0.10	0.05	0.09	20	<0.02	0.28	---[e]
Organic Nitrogen (mg/L)	0.91	1.77	1.05	1.09	1.11	1.19	20	0.56	2.22	---
Total Nitrogen (mg/L)	1.21	1.94	1.39	1.24	1.23	1.36	20	0.70	2.68	---
Orthophosphate (mg/L)	0.38	0.31	0.58	0.25	0.16	0.29	20	0.01	2.04	---
Total Phosphorus (mg/L)	0.48	0.42	0.65	0.33	0.26	0.38	20	0.07	2.22	---
ORGANIC CONSTITUENTS										
Oil and Greases (mg/L)	1.4	2.1	1.3	0.7	1.0	1.5	20	<1.0	4.0	≤5, ≤15
BIOLOGICAL										
Total Coliform Bacteria (count/100 mL)	11500	9175	7400	5575	3163	6710	20	300	>16000	≤2400
Fecal Coliform Bacteria (count/100 mL)	3025	4333	2330	649	576	1905	20	11	>16000	≤800

[a] State Criteria allows 50% increase above background to 1275 μmhos/cm and County Ordinance No. 72-37 allows 100% increase above background to 500 μmhos/cm.
[b] State Criteria allows a maximum increase of 29 NTU above background and County Ordinancce 72-37 allows a maximum increase of 25 JTU above background.
[c] State and County Criteria, respectively.
[d] Ionized plus un-ionized ammonia.
[e] State Criteria allows a maximum of 0.02 mg/L unionized ammonia, County ordinance allows a maximum un-ionized ammonia concentration of 0.2 to 2.0 mg/L depending on pH.

TABLE 5.1 SUMMARY OF RESULTS FOR THE PALMER RANCH WATER QUALITY MONITORING PROGRAM FOR THE PERIOD FROM JANUARY THROUGH DECEMBER, 1992 (Continued).

Parameter	NC-6 Mean	All Stations				Applicable Criteria
		Mean	N	Min	Max	
PHYSICAL						
Depth (ft)	0.69	1.02	24	0.20	3.08	---
Flow (GPM)	308.6	458.7	24	89.8	1382.4	---
Temperature (°C)	20.9	23.0	24	14.4	29.1	---
Conductivity (µmhos/cm)	606	759	24	431	1459	+50%, +100%
Total Suspended Solids (mg/L)	1.1	5.4	24	<1	31.0	---
Turbidity (NTU)	2.7	7.6	24	1.0	25.0	+29, +25
OXYGEN DEMAND AND RELATED PARAMETERS						
Biochemical Oxygen Demand, 5-Day (mg/L)	1.0	1.8	24	0.2	5.3	---
Dissolved Oxygen (mg/L)	2.9	4.8	24	1.1	8.3	≥5, ≥4.0
pH (-log[H+])	7.0	7.0	24	6.7	7.7	6.0 - 8.5
MACRONUTRIENTS						
Nitrite Nitrogen (mg/L)	0.01	0.02	24	<0.01	0.14	---
Nitrate Nitrogen (mg/)	0.01	0.09	24	<0.01	0.57	---
Ammonia Nitrogen (mg/L)	0.06	0.09	24	<0.02	0.28	---
Organic Nitrogen (mg/L)	1.13	1.26	24	0.61	2.45	---
Total Nitrogen (mg/L)	1.13	1.36	24	0.70	2.68	---
Orthophosphate (mg/L)	0.09	0.29	24	0.01	2.04	---
Total Phosphorus (mg/L)	0.12	0.38	24	0.06	2.22	---
ORGANIC CONSTITUENTS						
Oil and Greases (mg/L)	2.5	1.5	24	<1.0	7.6	≤5, ≤15
BIOLOGICAL						
Total Coliform Bacteria (count/100 mL)	3450	6710	24	300	>16000	≤2400
Fecal Coliform Bacteria (count/100 mL)	520	1905	24	11	>16000	≤800

[a] State Criteria allows 50% increase above background to 1275 µmhos/cm and County Ordinance No. 72-37 allows 100% increase above background to 500 µmhos/cm.
[b] State Criteria allows a maximum increase of 29 NTU above background and County Ordinancce 72-37 allows a maximum increase of 25 JTU above background.
[c] State and County Criteria, respectively.
[d] Ionized plus un-ionized ammonia.
[e] State Criteria allows a maximum of 0.02 mg/L unionized ammonia, County ordinance allows a maximum un-ionized ammonia concentration of 0.2 to 2.0 mg/L depending on pH.

The eighth year of monitoring exhibited more than normal amounts of rainfall with a total of 56 inches of precipitation occurring on the Palmer Ranch. During the sixth and seventh monitoring years only 38 and 44 inches of rainfall were record, respectively. Meanwhile, 51 and 52 inches of rainfall were reported during the third and fourth years of monitoring, respectively. A drought was experienced during much of the second year resulting in only 33 inches of rainfall being recorded. The historical amount of rainfall for the region based on a 30-year record is 54 inches per year (NOAA, 1982). Consequently, the streams of the Palmer Ranch exhibited above normal stream flows during much of the eighth monitoring year.

The specific conductance measured in the Catfish Creek/Trunk Ditch Basin ranged from 431 to 1,459 μmhos/cm, as compared with ranges of 567 to 1,625 μmhos/cm and 626 to 1,332 μmhos/cm during the sixth and seventh monitoring years, respectively. The lower range in specific conductance measured during the eighth year may have been associated to the wetter conditions and the subsequent increase in of low conductivity rainfall and stormwater runoff entering the streams.

Seasonally lower conductivities were recorded during the quarterly surveys performed in June and September 1992. These lower conductivities most likely resulted from the cumulative effects of increased surface runoff of low conductivity stormwater during the early spring wet period.

During the previous years of monitoring, the streams of the Palmer Ranch have exhibited an annual cycle of suspended solids. Unlike previous years, the highest TSS levels were observed during drier periods of the year. In December 1992, TSS levels in the Catfish Creek/Trunk Ditch Basin averaged 11 mg/L compared to only 4 mg/L during the September 1992 monitoring event. This is a reversal from the annual TSS cycling trend observed during the past years of monitoring. The observed reversal in TSS trends is attributed to: (1) only the Catfish Creek/Trunk Ditch system being monitored during 1992; (2) well-established littoral zones around the Catfish Creek; and (3) the stormwater management system in place at Prestancia.

Because of the well-established littoral zone, less erosion of stream banks occurs during storm events resulting in lower TSS levels during the primary growing season (*i.e.*, primary wet season). In addition, the stormwater management system at Prestancia will also improve water quality during storm periods by removing suspended solids from the storm generated runoff. For example, during the past years of monitoring, quarterly sampling was performed at stations along South Creek. Because the banks along South Creek are barren of dense vegetation, greater suspended solid loads are expected during periods of high runoff. In addition, no stormwater management system is in place along South Creek.

However, as a result of the well-established littoral zone in the Catfish Creek/Trunk Ditch Basin, higher TSS concentrations are expected during drier periods of the year during when plant productivity is lowest. As the plants die off, plant debris in the stream will in effect increase the TSS concentration. Higher TSS concentrations were measured in the Catfish Creek/Trunk Ditch and North Creek Basins during the 1991 monitoring year than during 1992. During the 1990 monitoring year, total suspended solid concentrations were lower and probably associated to the lower rainfall amounts recorded for that year.

Turbidity levels also followed the same seasonal trends as TSS. As in previous years, turbidity and TSS levels measured during 1992 were found to be positively correlated (*i.e.*, r = 0.60).

Five-day biochemical oxygen demand was found to average 1.8 mg/L for the two streams of the North Tract. The BOD_5 levels measured in the Catfish Creek/Trunk Ditch and North Creek Basins during 1992 averaged slightly higher than during the 1991 monitoring year. As observed during prior monitoring years, a slightly positive correlation was found between BOD_5 and TSS (*i.e.*, r = 0.40) indicating decay of vegetation and other organic matter in the water column.

Dissolved oxygen levels were found to average 4.8 mg/L with a range from 1.1 to 8.3 mg/L. The results obtained for dissolved oxygen concentrations during the 1992 monitoring year for Catfish and North Creeks are generally comparable to those reported during the third, fourth, sixth and, seventh monitoring years. Of the 24 dissolved oxygen measurements made during 1992, 11 were below the 5.0 mg/L State standard.

Although there has been a steady decline of nutrients during the previous monitoring years, nutrient concentrations during the 1992 monitoring year occasionally exceeded the threshold levels characteristic of eutrophic conditions. During the eighth year of monitoring, Catfish and North Creeks exhibited annual average total nitrogen and total phosphorus concentrations of 1.36 and 0.38 mg/L, respectively. During the sixth and seventh years of monitoring, total nitrogen and total phosphorus levels were slightly lower than measured during 1992. Total nitrogen and phosphorus levels recorded during the second, third, and fourth monitoring years were generally higher than those measured in 1992. The relatively higher nutrient levels measured in Catfish and North Creeks during 1992 may have resulted from maintenance activities by Sarasota County and the Florida Department of Transportation (FDOT) in late August early September 1992. These maintenance activities occurred in the Catfish Creek ditch upstream of the Palmer Ranch property.

Inorganic nitrogen and phosphorus fractions that are required by plants during the process of photosynthesis were also found to be readily available. Orthophosphate comprised 76 percent of the total phosphorus concentration while inorganic nitrogen represented only 14 percent of the total nitrogen content. Although the availability of inorganic nitrogen was found to be substantial, its low ratio to orthophosphate implies that inorganic nitrogen should become limiting to primary producers in the streams on the Palmer Ranch before orthophosphate. Ratios of inorganic nitrogen to inorganic phosphorus (*i.e.*, orthophosphate) were found to average 2:1 (by weight), as compared to algal protoplasm that is approximately 6.8:1 (by weight). Interestingly, the average ratio of total nitrogen to total phosphorus determined from 1992 nutrient concentrations was 7:1 indicative of a balanced system with respect to nutrient limitation.

During prior years of monitoring, inorganic phosphorus comprised 58 to 77 percent of the total phosphorus. In addition, the inorganic nitrogen fraction constituted 10 to 23 percent of the total nitrogen content for during the first seven years. The ratios of inorganic nitrogen and inorganic phosphorus averaged 1:1 to 4.6:1 during the previous years of monitoring.

Potential sources of nutrients to Catfish Creek upstream of the Palmer Ranch are surface runoff originating in the commercial-industrial strip development along Clark Road and from the country club and development located in the western part of the Catfish Creek/Trunk Ditch Basin. Further, nutrients may have also been introduced into Catfish Creek during maintenance of stream banks by Sarasota County and the FDOT which occurred upstream of the Palmer Ranch property. Within the ranch, potential sources of nutrients include Prestancia (golf course and residential development) and active pastures. Additionally, rainfall and surficial phosphate deposits represent two ubiquitous sources of phosphate and fixed nitrogen throughout the ranch.

During the eighth year of monitoring, oils and greases exceeded the State standard of 5.0 mg/L only on one occasion (*i.e.*, at Station NC-6 during the June 1992 event). Overall, oil and grease concentrations ranged from <1.0 to 7.6 mg/L during 1992. Approximately 50 percent of the observations for oils and greases showed less than detectable levels. Sources of oils and greases into the Catfish and North Creeks include runoff from the golf course, roads, and natural vegetation. During previous years of monitoring in the Catfish and North Creeks, oils and greases ranged from <1 to 17 mg/L with only four of the 104 observations (*i.e.*, less than 4 percent) exceeding the State standard, with only one measurement exceeding the 15 mg/L County standard.

The bacteriological quality of the streams on the Palmer Ranch was found to be poor, as total coliform and fecal coliform counts were frequently in excess of the applicable standards. Of the 24 total coliform analyses, 15 exceeded the maximum allowable limit of 2,400 colonies/100 mL. Similarly, eight of the 24 fecal coliform counts were found to exceed the maximum allowable limit of 800 colonies/100 mL. The primary sources of coliform bacteria on within the Palmer Ranch are expected to include cattle and birds as well as naturally occurring soil bacteria.

During storm events that frequently occur in the early spring through late summer, it is likely that more fecal and non-fecal coliform bacteria are transported by surface runoff to the streams of the Palmer Ranch than at other times of the year. However, during drier periods of the year, it is likely that birds, cattle, and other warm-blooded animals, which are sources of fecal coliform bacteria, are attracted to the streams to water and feed, thereby resulting in an increase in fecal coliform counts.

Annual samples for the analyses of trace elements (*i.e.*, arsenic, copper, lead, and zinc) were collected during the September 1992 sampling event. Concentrations of arsenic and lead were below the analytical detection limits for all monitoring sites. Therefore, concentrations of these metals for the 1992 monitoring year were found to be in compliance with both State and County water quality criteria.

Copper concentrations measured in the Catfish Creek/Trunk Ditch Basin during the 1992 monitoring year averaged 3.9 μg/L and ranged from 0.5 to 7.0 μg/L. All of the copper concentrations measured for the Catfish Creek/Trunk Ditch basin were in compliance with both State and County standards. Possible sources of copper in the surface waters of the Palmer Ranch include the use of copper containing herbicides, fertilizers, algicides, and pesticides.

The concentration of zinc determined for the six monitoring stations during 1992 ranged from 16 to 29 μg/L and averaged 22 μg/L. All six zinc concentrations were in compliance of the State standard. However, all six zinc concentrations were in excess of the more stringent 10μg/L criteria of Sarasota County. Possible sources of zinc include the use of zinc containing fertilizers and runoff from roads and parking areas on and upstream of the Palmer Ranch.

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APPENDIX A:
EXHIBIT "E"

Exhibit "E" to the Amended and Restated
Master Development Order for the Palmer Ranch
Development of Regional Impact

(An Exhibit Containing Surface
Water Monitoring Program and
Consisting of Pages E-1 through E-5)

SURFACE WATER MONITORING PROGRAM

Locations

Water quality measurements and grab samples shall be performed in Catfish Creek, North Creek and South Creek. Sampling and measurements shall be made at a total of 10 monitoring stations (refer to FIGURE 5). Five stations are located in Catfish Creek (CC-1, CC-2, CC-3, CC-4 and CC-5); one station is located in North Creek (NC-6); and four stations are located in South Creek (SC-1, SC-2, SC-3 and SC-4)

Procedures

Monitoring shall be accomplished within a two-day period. At the time of grab sampling, simultaneous in situ measurements of dissolved oxygen, pH, temperature and specific conductance shall be made and flow rates shall be determined using velocity-area measurements. Additionally, water depths and pre- and post-event weather conditions shall be recorded. All sample collections and in situ measurements shall be made at approximate mid-depth and mid-stream at each of the ten stations.

Frequency

Due to the wealth of baseline monitoring data which currently exists, baseline monitoring of all South Creek sites shall be suspended until one month before development begins. One month prior to the commencement of sampling the Palmer Ranch will notify the Sarasota County Pollution Control Division the dates of sampling and stations to be sampled. At the time of sampling, water quality grab samples will be collected and in situ measurements made at all monitoring stations along South Creek. Following this initial monitoring event, all subsequent monitoring shall be performed on a quarterly basis during the development phase. During development, all stations located downstream of an area under development shall be monitored. In addition, one sampling site upstream of a development area shall be maintained for baseline determination. Once an area is substantially developed as agreed to by the Sarasota County Pollution Control Division and Palmer Ranch, a modification of the monitoring program shall be subject to discussion at any time to change the frequency of water quality monitoring from quarterly to semi-annual or to discontinue the monitoring.

Monitoring of Catfish and North Creeks shall continue on a quarterly basis for a maximum of two years or until substantial development takes place. Once substantial development or a two-year period occurs as agreed to by the Sarasota County Pollution Control Division and Palmer Ranch, monitoring frequency for sites located in Catfish and North Creeks shall be subject to change from quarterly to a semi-annual depending on the monitoring results obtained up to that time. Semi-annual sampling, for both basins, shall be performed during a dry and wet season allowing for monitoring of low and high flow conditions.

<u>Parameters</u>

All water quality grab samples shall be analyzed for the following parameters:

- Biochemical Oxygen Demand, 5-day
- Nitrite
- Ortho-phosphate
- Total Suspended Solids
- Ammonia Nitrogen
- Fecal Coliform
- pH
- Conductivity
- Total Kjeldahl Nitrogen
- Nitrate
- Total Nitrogen
- Total Phosphorus
- Turbidity
- Oils and Greases
- Total Coliform
- Dissolved Oxygen

Additionally, analysis shall be done for the following parameters on an annual basis (the first analysis done for South Creek sites will be in conjunction with the initial monitoring event):

- o Copper
- o Arsenic
- o Lead
- o Zinc

No pesticide or mercury, chromium, cadmium and nickel analysis shall be performed because results obtained from the Palmer Ranch Continuous Water Quality Monitoring Program during April 1985 through June 1990 on sites along Catfish Creek indicate that these parameters have consistently been below detection limits and/or state and county standards. Therefore, it may be more important to monitor those parameters which have exhibited higher concentrations than those set by the state.

Methods

All laboratory analyses and in situ measurements shall be performed in accordance with procedures described in the 17th edition of Standard Methods (APHA, 1989) or the Methods for Chemical Analysis of water and Wastes (USEPA, 1993). Methods used for in situ measurements, sample collection, sample preservation and storage and sample analysis are provided in Table A. As changes in technology advance, the methods used in laboratory analysis may be modified to reflect these state-of-the-art procedures. The surface water monitoring program for Catfish Creek, North Creek and South Creek shall be performed on a continuous basis.

Additional Studies

In considering the water quality of lakes on the Palmer Ranch, the Aquatic Center of the University of Florida has expressed interest in conducting limnological research on the Palmer Ranch. One of the objectives of the research would be to develop state-of-the-art strategies in the control of hydrilla and water hyacinth that can be applied on a nation-wide basis.

Since the borrow pit lake in Parcel C has an overabundance of hydrilla, this area has been selected for research. The borrow pit lake was conditioned in the MDO to undergo limnological study as a result of a previous commitment by the Palmer Ranch. Its characters are similar to other borrow pit lakes located on the Palmer Ranch, as well as other borrow pit lakes in Sarasota County. Management of the lake will comply with the newly adopted earth-moving ordinance (Ordinance No. 89-112) which became effective March 13, 1990. This ordinance has provisions to deal with borrow pit lakes uniformly throughout the County. This lake will be used for stormwater management purposes which will be enhanced by the creation of a littoral shelf. The creation of a littoral shelf would promote improved water quality as desirable vegetation would utilize nutrients and lower BOD and TSS levels. Additionally, the Palmer Ranch has made application for a permit from the Florida Game and Fresh Water Fish Commission for the introduction of Triploid Grass Carp. These measures, along with other biological or chemical controls that may be implemented as part of the University of Florida research project for control of hydrilla and lake rehabilitation, would indicate that a further limnological study is unwarranted. Consequently, it is recommended that the future limnological study of the borrow pit as conditioned in the MDO be deleted.

Further, the MDO required the monitoring of an off-site dairy farm to determine the source and significance of water quality problems contributed to surface water. As a result of the water quality data collected from Station SC-7, which is the site used to monitor this off-site contribution, pollutants have significantly decreased. This is no doubt a result of the elimination of the dairy farm which has been converted to residential development (Serenoa). Therefore, it is recommended that monitoring of the site be terminated.

Reporting

A data report shall be submitted to the Sarasota County Pollution Control Division following each sampling event. The report will include: (1) a map of the monitoring stations; (2) narrative and/or tabulation of methods used in collecting, handling, storing and analyzing all samples; (3) a tabulation of all measurement and results of analyses; and (4) the signature(s) of the individual(s) responsible for the authenticity, precision and accuracy of t he data presented. Brief summaries of the responsibility an credentials of the project team members shall be included. In addition, an annual report of the interpretation of the data shall be prepared following each year of monitoring. The annual report will include hydrological information derived from in situ measurements as well as interpretation of the chemical parameters measured over the year. Also included in the annual report shall be tabular representations of all the data collected over the previous year for all of the sites and graphical representation of some of the chemical trends discovered over the year of monitoring.

APPENDIX B:
WATER QUALITY DATA

Appendix Table B-1
Continuing Surface Water Quality Monitoring Program
Stream Stage (ft)[a]
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	2.80	0.80	0.70	0.40	0.80	1.10	0.40	0.98	0.91	0.40	2.80	6
16-Jun-92	1.30	0.30	0.60	0.20	0.70	0.62	0.65	0.63	0.39	0.20	1.30	6
08-Sep-92	3.08	0.60	0.85	0.95	2.50	1.60	1.00	1.50	1.03	0.60	3.08	6
01-Dec-92	2.00	0.30	0.75	0.40	1.75	1.04	0.70	0.98	0.72	0.30	2.00	6
Mean	2.30	0.50	0.73	0.49	1.44		0.69					
Minimum	1.30	0.30	0.60	0.20	0.70		0.40					
Maximum	3.08	0.80	0.85	0.95	2.50		1.00					
Std. Deviation	0.81	0.24	0.10	0.32	0.85		0.25					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	1.40	1.11	0.30	3.08	8
CC-3, CC-4 (mid reach)	0.61	0.26	0.20	0.95	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	1.09	0.87	0.20	3.08	20
All Six Stations	1.02	0.81	0.20	3.08	24

[a] Stream Stage measured at sampling site for each station. 0.00 = Station dry.
STD - Standard deviation
N - Number of observations

Appendix Table B-2
Continuing Surface Water Quality Monitoring Program
Stream Flow (GPM)
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	260	220	332	934	1037	557	40	471	411	40	1037	6
16-Jun-92	112	13	233	754	889	400	36	340	383	13	889	6
08-Sep-92	2195	215	1207	2029	4448	2019	494	1765	1535	215	4448	6
01-Dec-92	69	0	364	242	452	225	94	203	179	0	452	6
Mean	659	112	534	990	1706		166					
Minimum	69	0	233	242	452		36					
Maximum	2195	220	1207	2029	4448		494					
Std. Deviation	1027	122	452	752	1845		220					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	386	738	0	2195	8
CC-3, CC-4 (mid reach)	762	624	233	2029	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	800	1062	0	4448	20
All Six Stations	695	998	0	4448	24

STD - Standard deviation
N - Number of observations

Appendix Table B-3
Continuing Surface Water Quality Monitoring Program
Water Temperature (°C)
January - December, 1992

Sampling Date	Catfish Creek/Trunk Ditch CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	All Stations Mean	STD	Min	Max	N
23-Mar-92	21.3	20.7	20.9	24.7	20.9	21.7	17.7	21.0	2.2	17.7	24.7	6
16-Jun-92	28.9	29.1	24.7	25.8	27.0	27.1	25.6	26.9	1.8	24.7	29.1	6
08-Sep-92	26.7	27.3	27.4	28.5	28.6	27.7	25.8	27.4	1.1	25.8	28.6	6
01-Dec-92	14.9	15.1	17.7	18.6	19.1	17.1	14.4	16.6	2.1	14.4	19.1	6
Mean	23.0	23.1	22.7	24.4	23.9		20.9					
Minimum	14.9	15.1	17.7	18.6	19.1		14.4					
Maximum	28.9	29.1	27.4	28.5	28.6		25.8					
Std. Deviation	6.2	6.4	4.3	4.2	4.6		5.7					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	23.0	5.9	14.9	29.1	8
CC-3, CC-4 (mid reach)	23.5	4.0	17.7	28.5	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	23.4	4.7	14.9	29.1	20
All Six Stations	23.0	4.8	14.4	29.1	24

STD - Standard deviation
N - Number of observations

Appendix Table B-4
Continuing Surface Water Quality Monitoring Program
Specific Conductance (μmhos/cm)[a]
January - December, 1992

Sampling Date	Catfish Creek/Trunk Ditch CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	All Stations Mean	STD	Min	Max	N
23-Mar-92	666	990	993	891	987	905	660	865	161	660	993	6
16-Jun-92	536	826	573	489	992	683	513	655	206	489	992	6
08-Sep-92	431	692	492	477	466	512	558	519	94	431	692	6
01-Dec-92	714	1459	1189	927	1006	1059	692	998	293	692	1459	6
Mean	587	992	812	696	863		606					
Minimum	431	692	492	477	466		513					
Maximum	714	1459	1189	927	1006		692					
Std. Deviation	128	334	334	246	265		84					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	789	319	431	1459	8
CC-3, CC-4 (mid reach)	754	279	477	1189	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	790	281	431	1459	20
All Stations	759	266	431	1459	24

[a] Applicable surface water quality criteria:

State - Maximum allowable increase of 50% above background or to 1,275 μmhos/cm which ever is greater;

Sarasota County - Maximum allowable increase of 100% above background to a maximum of 500 μmhos/cm.

STD - Standard deviation
N - Number of observations

Appendix Table B-5
Continuing Surface Water Quality Monitoring Program
Total Suspended Solids (mg/L)
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	7	5	1	5	4	4	<1	4	3	<1	7	6
16-Jun-92	7	6	<1	8	8	6	3	5	3	<1	8	6
08-Sep-92	8	<1	4	3	5	4	<1	4	3	<1	8	6
01-Dec-92	8	31	5	9	1	11	<1	9	11	<1	31	6
Mean	8	11	3	6	5		1					
Minimum	7	<1	<1	3	1		<1					
Maximum	8	31	5	9	8		3					
Std. Deviation	1	14	2	3	3		1					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	9	9	<1	31	8
CC-3, CC-4 (mid reach)	4	3	<1	9	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	6	6	<1	31	20
All Stations	5	6	<1	31	24

STD - Standard deviation
N - Number of observations

Appendix Table B-6
Continuing Surface Water Quality Monitoring Program
Turbidity (NTU)[a]
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	5.3	11.2	8.2	8.1	4.4	7.4	1.0	6.4	3.6	1.0	11.2	6
16-Jun-92	9.1	8.4	3.5	7.4	4.5	6.6	5.3	6.4	2.3	3.5	9.1	6
08-Sep-92	7.5	1.2	7.0	5.3	5.9	5.4	1.4	4.7	2.8	1.2	7.5	6
01-Dec-92	13.6	19.3	25.0	12.7	3.5	14.8	3.0	12.9	8.7	3.0	25.0	6
Mean	8.9	10.0	10.9	8.4	4.6		2.7					
Minimum	5.3	1.2	3.5	5.3	3.5		1.0					
Maximum	13.6	19.3	25.0	12.7	5.9		5.3					
Std. Deviation	3.5	7.5	9.6	3.1	1.0		2.0					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	9.5	5.4	1.2	19.3	8
CC-3, CC-4 (mid reach)	9.7	6.7	3.5	25.0	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	8.6	5.7	1.2	25.0	20
All Six Stations	7.6	5.7	1.0	25.0	24

[a] Applicable surface water quality criteria: State - Allows a maximum increase of 29 NTU
Sarasota County - Allows a maximum increase of 25 JTU above background

STD - Standard deviation
N - Number of observations

Appendix Table B-7
Continuing Surface Water Quality Monitoring Program
5-Day Biochemical Oxygen Demand (mg/L)
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	1.1	1.5	0.8	1.9	1.3	1.3	0.6	1.2	0.5	0.6	1.9	6
16-Jun-92	1.4	5.3	0.2	2.4	2.4	2.3	0.9	2.1	1.8	0.2	5.3	6
08-Sep-92	2.9	1.1	2.8	1.9	2.2	2.2	0.9	2.0	0.8	0.9	2.9	6
01-Dec-92	1.6	2.4	2.3	2.7	1.8	2.2	1.4	2.0	0.5	1.4	2.7	6
Mean	1.8	2.6	1.5	2.2	1.9		1.0					
Minimum	1.1	1.1	0.2	1.9	1.3		0.6					
Maximum	2.9	5.3	2.8	2.7	2.4		1.4					
Std. Deviation	0.8	1.9	1.2	0.4	0.5		0.3					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	2.2	1.4	1.1	5.3	8
CC-3, CC-4 (mid reach)	1.9	0.9	0.2	2.8	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	2.0	1.1	0.2	5.3	20
All Stations	1.8	1.0	0.2	5.3	24

STD - Standard deviation
N - Number of observations

Appendix Table B-8
Continuing Surface Water Quality Monitoring Program
Dissolved Oxygen (mg/L)[a]
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	6.4	4.1	5.2	7.1	6.9	5.9	2.2	5.3	1.9	2.2	7.1	6
16-Jun-92	5.8	5.8	4.8	6.6	5.2	5.6	6.7	5.8	0.7	4.8	6.7	6
08-Sep-92	2.5	2.7	2.3	2.4	2.2	2.4	1.1	2.2	0.6	1.1	2.7	6
01-Dec-92	8.3	7.6	3.9	7.8	6.3	6.8	1.6	5.9	2.6	1.6	8.3	6
Mean	5.8	5.1	4.1	6.0	5.2		2.9					
Minimum	2.5	2.7	2.3	2.4	2.2		1.1					
Maximum	8.3	7.6	5.2	7.8	6.9		6.7					
Std. Deviation	2.4	2.1	1.3	2.4	2.1		2.6					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	5.4	2.1	2.5	8.3	8
CC-3, CC-4 (mid reach)	5.0	2.1	2.3	7.8	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	5.2	2.0	2.2	8.3	20
All Six Stations	4.8	2.2	1.1	8.3	24

[a] Applicable surface water quality criteria: State - Minimum allowable concentration of 5.0 mg/L
Sarasota County - Minimum allowable concentration of 4.0 mg/L

STD - Standard deviation
N - Number of observations

Appendix Table B-9
Continuing Surface Water Quality Monitoring Program
Water pH (-log[H^+])[a]
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	6.9	6.9	6.9	7.2	7.4	7.1	7.0	7.1	0.2	6.9	7.4	6
16-Jun-92	7.2	7.7	7.2	7.2	7.4	7.3	7.1	7.3	0.2	7.1	7.7	6
08-Sep-92	6.7	7.2	6.8	6.8	7.0	6.9	7.0	6.9	0.2	6.7	7.2	6
01-Dec-92	6.8	7.0	6.7	7.0	7.3	7.0	6.7	6.9	0.2	6.7	7.3	6
Mean	6.9	7.2	6.9	7.1	7.3		7.0					
Minimum	6.7	6.9	6.7	6.8	7.0		6.7					
Maximum	7.2	7.7	7.2	7.2	7.4		7.1					
Std. Deviation	0.2	0.4	0.2	0.2	0.2		0.2					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	7.1	0.3	6.7	7.7	8
CC-3, CC-4 (mid reach)	7.0	0.2	6.7	7.2	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	7.1	0.3	6.7	7.7	20
All Six Stations	7.0	0.3	6.7	7.7	24

[a] Applicable surface water quality criteria: State and Sarasota County - Allowable range of 6.0 - 8.5
STD - Standard deviation
N - Number of observations

Appendix Table B-10
Continuing Surface Water Quality Monitoring Program
Total Nitrogen (mg/L)
January - December, 1992

Sampling Date	Catfish Creek/Trunk Ditch CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	All Stations Mean	STD	Min	Max	N
23-Mar-92	0.91	1.64	1.01	0.98	1.03	1.11	1.05	1.10	0.27	0.91	1.64	6
16-Jun-92	0.93	2.68	0.70	1.11	1.06	1.30	1.01	1.25	0.72	0.70	2.68	6
08-Sep-92	1.76	1.13	2.26	1.52	1.49	1.63	1.49	1.61	0.38	1.13	2.26	6
01-Dec-92	1.25	2.31	1.60	1.33	1.32	1.56	0.97	1.46	0.46	0.97	2.31	6
Mean	1.21	1.94	1.39	1.24	1.23		1.13					
Minimum	0.91	1.13	0.70	0.98	1.03		0.97					
Maximum	1.76	2.68	2.26	1.52	1.49		1.49					
Std. Deviation	0.40	0.69	0.69	0.24	0.22		0.24					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	1.58	0.65	0.91	2.68	8
CC-3, CC-4 (mid reach)	1.31	0.48	0.70	2.26	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	1.40	0.52	0.70	2.68	20
All Six Stations	1.36	0.49	0.70	2.68	24

STD - Standard deviation
N - Number of observations

Appendix Table B-11
Continuing Surface Water Quality Monitoring Program
Nitrite (mg/L as N)
January - December, 1992

Sampling Date	Catfish Creek/Trunk Ditch CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	All Stations Mean	STD	Min	Max	N
23-Mar-92	0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	0.01	0.00	<0.01	0.01	6
16-Jun-92	0.01	0.14	0.01	0.01	<0.01	0.04	<0.01	0.03	0.05	<0.01	0.14	6
08-Sep-92	0.01	<0.01	0.01	0.01	<0.01	0.01	<0.01	0.01	0.00	<0.01	0.01	6
01-Dec-92	0.04	<0.01	0.03	0.01	0.01	0.02	<0.01	0.02	0.01	<0.01	0.04	6
Mean	0.02	0.04	0.02	0.01	0.01		<0.01					
Minimum	0.01	<0.01	0.01	<0.01	<0.01		<0.01					
Maximum	0.04	0.14	0.03	0.01	0.01		<0.01					
Std. Deviation	0.02	0.07	0.01	0.00	0.00		0.00					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	0.03	0.05	<0.01	0.14	8
CC-3, CC-4 (mid reach)	0.01	0.01	<0.01	0.03	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.02	0.03	<0.01	0.14	20
All Six Stations	0.02	0.03	<0.01	0.14	24

STD - Standard deviation
N - Number of observations

Appendix Table B-12
Continuing Surface Water Quality Monitoring Program
Nitrate (mg/L as N)
January - December, 1992

Sampling Date	Catfish Creek/Trunk Ditch CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	All Stations Mean	STD	Min	Max	N
23-Mar-92	0.13	<0.01	0.26	0.01	<0.01	0.08	<0.01	0.07	0.11	<0.01	0.26	6
16-Jun-92	0.06	0.09	0.08	0.01	<0.01	0.05	<0.01	0.04	0.04	<0.01	0.09	6
08-Sep-92	0.03	0.03	0.04	0.11	0.03	0.05	<0.01	0.04	0.04	<0.01	0.11	6
01-Dec-92	0.27	0.02	0.57	0.03	0.25	0.23	0.01	0.19	0.22	0.01	0.57	6
Mean	0.12	0.04	0.24	0.04	0.07		0.01					
Minimum	0.03	<0.01	0.04	0.01	<0.01		<0.01					
Maximum	0.27	0.09	0.57	0.11	0.25		0.01					
Std. Deviation	0.11	0.04	0.24	0.05	0.12		0.00					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	0.08	0.09	<0.01	0.27	8
CC-3, CC-4 (mid reach)	0.14	0.19	0.01	0.57	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.10	0.14	<0.01	0.57	20
All Six Stations	0.09	0.13	<0.01	0.57	24

STD - Standard deviation
N - Number of observations

Appendix Table B-13
Continuing Surface Water Quality Monitoring Program
Ammoniacal Nitrogen (mg/L as N)
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	0.11	0.04	0.06	0.06	0.02	0.06	0.04	0.06	0.03	0.02	0.11	6
16-Jun-92	0.09	0.28	0.05	0.04	<0.02	0.09	0.03	0.08	0.10	<0.02	0.28	6
08-Sep-92	0.24	<0.02	0.09	0.10	0.05	0.10	0.02	0.09	0.08	<0.02	0.24	6
01-Dec-92	0.21	0.07	0.16	0.18	0.11	0.15	0.14	0.15	0.05	0.07	0.21	6
Mean	0.16	0.10	0.09	0.10	0.05		0.06					
Minimum	0.09	<0.02	0.05	0.04	<0.02		0.02					
Maximum	0.24	0.28	0.16	0.18	0.11		0.14					
Std. Deviation	0.07	0.12	0.05	0.06	0.05		0.06					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	0.13	0.10	<0.02	0.28	8
CC-3, CC-4 (mid reach)	0.09	0.05	0.04	0.18	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.10	0.08	<0.02	0.28	20
All Six Stations	0.09	0.07	<0.02	0.28	24

STD - Standard deviation
N - Number of observations

Appendix Table B-14
Continuing Surface Water Quality Monitoring Program
Organic Nitrogen (mg/L)[a]
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	0.66	1.60	0.68	0.91	1.01	0.97	1.01	0.98	0.34	0.66	1.60	6
16-Jun-92	0.77	2.17	0.56	1.05	1.06	1.12	0.98	1.10	0.56	0.56	2.17	6
08-Sep-92	1.48	1.10	2.12	1.30	1.41	1.48	1.47	1.48	0.34	1.10	2.12	6
01-Dec-92	0.73	2.22	0.84	1.11	0.95	1.17	0.82	1.11	0.56	0.73	2.22	6
Mean	0.91	1.77	1.05	1.09	1.11		1.07					
Minimum	0.66	1.10	0.56	0.91	0.95		0.82					
Maximum	1.48	2.22	2.12	1.30	1.41		1.47					
Std. Deviation	0.38	0.53	0.72	0.16	0.21		0.28					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	1.34	0.63	0.66	2.22	8
CC-3, CC-4 (mid reach)	1.07	0.49	0.56	2.12	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	1.19	0.51	0.56	2.22	20
All Six Stations	1.17	0.47	0.56	2.22	24

[a] Organic Nitrogen = Total Kjeldahl Nitrogen - Ammoniacal Nitrogen
STD - Standard deviation
N - Number of observations

Appendix Table B-15
Continuing Surface Water Quality Monitoring Program
Total Phosphorus (mg/L)
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	0.20	0.17	0.09	0.15	0.08	0.14	0.09	0.13	0.05	0.08	0.20	6
16-Jun-92	0.30	0.54	0.17	0.28	0.12	0.28	0.16	0.26	0.15	0.12	0.54	6
08-Sep-92	1.24	0.58	2.22	0.77	0.75	1.11	0.17	0.96	0.71	0.17	2.22	6
01-Dec-92	0.18	0.39	0.12	0.11	0.07	0.17	0.06	0.16	0.12	0.06	0.39	6
Mean	0.48	0.42	0.65	0.33	0.26		0.12					
Minimum	0.18	0.17	0.09	0.11	0.07		0.06					
Maximum	1.24	0.58	2.22	0.77	0.75		0.17					
Std. Deviation	0.51	0.19	1.05	0.30	0.33		0.05					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	0.45	0.36	0.17	1.24	8
CC-3, CC-4 (mid reach)	0.49	0.73	0.09	2.22	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.43	0.52	0.07	2.22	20
All Six Stations	0.38	0.49	0.06	2.22	24

STD - Standard deviation
N - Number of observations

Appendix Table B-16
Continuing Surface Water Quality Monitoring Program
Orthophosphate (mg/L as P)
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	0.10	0.08	0.04	0.06	0.01	0.06	0.05	0.06	0.03	0.01	0.10	6
16-Jun-92	0.21	0.42	0.14	0.19	0.04	0.20	0.12	0.19	0.13	0.04	0.42	6
08-Sep-92	1.03	0.54	2.04	0.71	0.52	0.97	0.13	0.83	0.66	0.13	2.04	6
01-Dec-92	0.16	0.19	0.10	0.05	0.06	0.11	0.06	0.10	0.06	0.05	0.19	6
Mean	0.38	0.31	0.58	0.25	0.16		0.09					
Minimum	0.10	0.08	0.04	0.05	0.01		0.05					
Maximum	1.03	0.54	2.04	0.71	0.52		0.13					
Std. Deviation	0.44	0.21	0.97	0.31	0.24		0.04					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	0.34	0.32	0.08	1.03	8
CC-3, CC-4 (mid reach)	0.42	0.69	0.04	2.04	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.33	0.48	0.01	2.04	20
All Six Stations	0.29	0.45	0.01	2.04	24

STD - Standard deviation
N - Number of observations

Appendix Table B-17
Continuing Surface Water Quality Monitoring Program
Total Nitrogen to Total Phophorus Ratios (N_t:P_t)
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	5	10	11	7	13	9	12	9	3	5	13	6
16-Jun-92	3	5	4	4	9	5	6	5	2	3	9	6
08-Sep-92	1	2	1	2	2	2	9	3	3	1	9	6
01-Dec-92	7	6	13	12	19	11	16	12	5	6	19	6
Mean	4	6	7	6	11		11					
Minimum	1	2	1	2	2		6					
Maximum	7	10	13	12	19		16					
Std. Deviation	2	3	6	4	7		4					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	5	3	1	10	8
CC-3, CC-4 (mid reach)	7	5	1	13	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	7	5	1	19	20
All Six Stations	7	5	1	19	24

STD - Standard deviation
N - Number of observations

Appendix Table B-18
Continuing Surface Water Quality Monitoring Program
Inorganic Nitrogen to Inorganic Phosphorus Ratios (N_i:P_i)
January - December, 1992

Sampling Date	Catfish Creek/Trunk Ditch							All Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	2.5	0.6	8.3	1.3	3.0	3.1	1.0	2.8	2.8	0.6	8.3	6
16-Jun-92	0.8	1.2	1.0	0.3	--	0.8	0.3	0.7	0.4	0.3	1.2	5
08-Sep-92	0.3	0.1	0.1	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.3	6
01-Dec-92	3.3	0.5	7.6	4.4	6.2	4.4	2.6	4.1	2.6	0.5	7.6	6
Mean	1.7	0.6	4.2	1.6	3.1		1.0					
Minimum	0.3	0.1	0.1	0.3	0.2		0.2					
Maximum	3.3	1.2	8.3	4.4	6.2		2.6					
Std. Deviation	1.4	0.5	4.3	1.9	3.0		1.1					
N	4	4	4	4	3		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	1.2	1.1	0.1	3.3	8
CC-3, CC-4 (mid reach)	2.9	3.4	0.1	8.3	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	2.2	2.6	0.1	8.3	19
All Six Stations	2.0	2.4	0.1	8.3	23

STD - Standard deviation
N - Number of observations

Appendix Table B-19
Continuing Surface Water Quality Monitoring Program
Oil and Greases (mg/L)
January - December, 1992

Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
	Catfish Creek/Trunk Ditch							All Stations				
23-Mar-92	<1.0	2.2	<1.0	<1.0	1.4	1.0	1.4	1.1	0.7	<1.0	2.2	6
16-Jun-92	3.2	4.0	1.4	0.6	1.4	2.1	7.6	3.0	2.6	0.6	7.6	6
08-Sep-92	1.2	<1.0	1.2	<1.0	<1.0	0.8	<1.0	0.7	0.4	<1.0	1.2	6
01-Dec-92	<1.0	1.6	2.0	1.2	<1.0	1.2	<1.0	1.1	0.7	<1.0	2.0	6
Mean	1.4	2.1	1.3	0.7	1.0		2.5					
Minimum	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0					
Maximum	3.2	4.0	2.0	1.2	1.4		7.6					
Std. Deviation	1.3	1.5	0.6	0.3	0.5		3.4					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	1.7	1.3	<1.0	4.0	8
CC-3, CC-4 (mid reach)	1.0	0.5	<1.0	2.0	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	1.3	1.0	<1.0	4.0	20
All Six Stations	1.5	1.6	<1.0	7.6	24

[a] Applicable surface water criteria: State - Maximum allowable concentration of 5.0 mg/L
Sarasota County - Maximum allowable concentration of 15.0 mg/L

STD - Standard deviation
N - Number of observations

Appendix Table B-20
Continuing Surface Water Quality Monitoring Program
Total Coliform Bacteria (count/100 mL)[a]
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	16000	16000	3000	2400	350	7550	9000	7792	6980	350	16000	6
16-Jun-92	16000	>16000	>16000	16000	9000	14600	1300	12383	6109	1300	>16000	6
08-Sep-92	5000	3000	1600	3000	3000	3120	2800	3067	1093	1600	5000	6
01-Dec-92	9000	1700	9000	900	300	4180	700	3600	4208	300	9000	6
Mean	11500	9175	7400	5575	3163		3450					
Minimum	5000	1700	1600	900	300		700					
Maximum	16000	>16000	>16000	16000	9000		9000					
Std. Deviation	5447	7899	6571	7006	4091		3804					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	10338	6403	1700	>16000	8
CC-3, CC-4 (mid reach)	6488	6363	900	>16000	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	7363	6358	300	>16000	20
All Six Stations	6710	6124	300	>16000	24

[a] Applicable surface water criteria: State and Sarasota County - Maximum of 2400/100 mL

STD - Standard deviation
N - Number of observations

Appendix Table B-21
Continuing Surface Water Quality Monitoring Program
Fecal Coliform Bacteria (count/100 mL)[a]
January - December, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
23-Mar-92	500	300	2400	70	13	657	500	631	891	13	2400	6
16-Jun-92	5000	>16000	5000	2200	2200	6080	800	5200	5551	800	>16000	6
08-Sep-92	1600	130	220	300	80	466	280	435	577	80	1600	6
01-Dec-92	5000	900	1700	27	11	1528	500	1356	1893	11	5000	6
Mean	3025	4333	2330	649	576		520					
Minimum	500	130	220	27	11		280					
Maximum	5000	>16000	5000	2200	2200		800					
Std. Deviation	2324	7785	1999	1041	1083		214					
N	4	4	4	4	4		4					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	3679	5365	130	>16000	8
CC-3, CC-4 (mid reach)	1490	1727	27	5000	8
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	2183	3685	11	>16000	20
All Six Stations	1905	3409	11	>16000	24

[a] Applicable surface water criteria: State and Sarasota County - Maximum of 800/100 mL
STD - Standard deviation
N - Number of observations

Appendix Table B-22
Continuing Surface Water Quality Monitoring Program
Trace Metals (µg/L)[a]
September 8, 1992

	Catfish Creek/Trunk Ditch							All Stations				
Parameter	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
Arsenic, Total	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	0.0	<5.0	<5.0	6
Copper, Total	3.0	4.0	3.0	7.0	6.0	4.6	0.5	3.9	2.3	0.5	7.0	6
Lead, Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.0	<1.0	<1.0	6
Zinc, Total	25	16	16	25	29	22	18	22	6	16	29	6

[a] Applicable surface water criteria:

State - Maximum allowable concentrations of 50 µg/L for arsenic, 12.8 µg/L for copper, 3.6 µg/L for lead, and 115 µg/L for zinc

Sarasota County - Maximum allowable concentrations of 100 µg/L for arsenic, 10 µg/L for copper, 10 µg/L for lead, and 15 µg/L for zinc

STD - Standard deviation
N - Number of observations

APPENDIX C:
LABORATORY REPORTS

LABORATORY REPORT

CONSERVATION CONSULTANTS, INC.

5010 U.S. HIGHWAY 19 NORTH
POST OFFICE BOX 35
PALMETTO, FLORIDA 34220

ENVIRONMENTAL BIOLOGISTS, CHEMISTS,
AND WATER RESOURCE SCIENTISTS

Palmetto (813) 722-6667 Bradenton (813) 747-0006
Tampa (813) 229-3516 FAX (813) 722-8384

REPORT FOR:	Mr. Jim Paulmann	Report Number:	375/APR0792
	PALMER VENTURE	Project Number:	0380-084
	7184 Beneva Road	Sampling Date:	03-23-92
	Sarasota, Florida 34238	Sample Source:	Surface Water
		Sampled By:	Shindehette

RESULTS OF ANALYSIS:	CC-1	CC-2	CC-3	Units
Laboratory Number	05595	05599	05596	-----
Sample Time	14:00	11:45	13:15	24 hours
ANALYSIS PERFORMED BY CCI				
Oil and Grease	<1.0	2.2	<1.0	mg/l
Biochemical Oxygen Demand	1.1	1.5	0.8	mg/l
Fecal Coliform Bacteria	500	300	2400*	No./100ml
Total Coliform Bacteria	16000*	16000*	3000*	No./100ml
Ammonia Nitrogen	0.11	0.04	0.06	mg/l
Nitrate Nitrogen	0.13	<0.01	0.26	mg/l
Nitrite Nitrogen	0.01	<0.01	0.01	mg/l
Total Kjeldahl Nitrogen	0.77	1.64	0.74	mg/l
Total Nitrogen	0.91	1.64	1.01	mg/l
Total Phosphorus	0.20	0.17	0.09	mg/l
Total Reactive Phosphate	0.10	0.08	0.04	mg/l
Total Suspended Solids	7	5	1	mg/l
Turbidity	5.3	11.2	8.2	NTU
Dissolved Oxygen (field)	6.4	4.1*	5.2	mg/l
pH (field)	6.9	6.9	6.9	pH units
Specific Conductivity, (field)	666*	990*	993*	μmhos/cm
Temperature (field)	21.3	20.7	20.9	°C

*Noncompliance with Florida Administrative Code 17-302 and/or Sarasota County Ordinance 72-37, Class III surface waters.

LABORATORY REPORT

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AND WATER RESOURCE SCIENTISTS

Palmetto (813) 722-6667 Bradenton (813) 747-0006
Tampa (813) 229-3516 FAX (813) 722-8384

REPORT FOR: Mr. Jim Paulmann
PALMER VENTURE
7184 Beneva Road
Sarasota, Florida 34238

Report Number: 375/APR0792
Project Number: 0380-084
Sampling Date: 03-23-92
Sample Source: Surface Water
Sampled By: Shindehette

RESULTS OF ANALYSIS:	CC-4	CC-5	NC-6	Units
Laboratory Number	05597	05598	05600	-----
Sample Time	13:30	11:00	11:30	24 hours
ANALYSIS PERFORMED BY CCI				
Oil and Grease	<1.0	1.4	1.4	mg/l
Biochemical Oxygen Demand	1.9	1.3	0.6	mg/l
Fecal Coliform Bacteria	70	13	500	No./100ml
Total Coliform Bacteria	2400	350	9000*	No./100ml
Ammonia Nitrogen	0.06	0.02	0.04	mg/l
Nitrate Nitrogen	0.01	<0.01	<0.01	mg/l
Nitrite Nitrogen	<0.01	<0.01	<0.01	mg/l
Total Kjeldahl Nitrogen	0.97	1.03	1.05	mg/l
Total Nitrogen	0.98	1.03	1.05	mg/l
Total Phosphorus	0.15	0.08	0.09	mg/l
Total Reactive Phosphate	0.06	0.01	0.05	mg/l
Total Suspended Solids	5	4	<1	mg/l
Turbidity	8.1	4.4	1.0	NTU
Dissolved Oxygen (field)	7.1	6.9	2.2*	mg/l
pH (field)	7.2	7.4	7.0	pH units
Specific Conductivity, (field)	891*	987*	660*	µmhos/cm
Temperature (field)	24.7	20.9	17.7	°C

* Noncompliance with Florida Administrative Code 17-302 and/or Sarasota County Ordinance 72-37, Class III surface waters.

Joni L. Macy
Laboratory Supervisor

FDHRS Drinking Water Certification # 84243
FDHRS Environmental Certification # E84017

Analysis performed in accordance with E.P.A., Standard Methods or other FDHRS approved methodology.

LABORATORY REPORT

CONSERVATION CONSULTANTS, INC.

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Palmetto (813) 722-6667 Bradenton (813) 747-0006
Tampa (813) 229-3516 FAX (813) 722-8384

REPORT FOR: Mr. Jim Paulmann
PALMER VENTURE
7184 Beneva Road
Sarasota, Florida 34238

Report Number: 609/JUL1092
Project Number: 0380-084
Sampling Date: 06-16-92
Sample Source: Surface Water
Sampled By: Shindehette

RESULTS OF ANALYSIS:	CC-1	CC-2	CC-3	Units
Laboratory Number	06425	06426	06427	-----
Sample Time	10:30	11:00	11:30	24 hours
ANALYSIS PERFORMED BY CCI				
Oil and Grease	3.2	4.0	1.4	mg/l
Biochemical Oxygen Demand	1.4	5.3	0.2	mg/l
Fecal Coliform Bacteria	5000*	≥16000*	5000*	No./100ml
Total Coliform Bacteria	16000*	≥16000*	16000*	No./100ml
Ammonia Nitrogen	0.09	0.28	0.05	mg/l
Nitrate Nitrogen	0.06	0.09	0.08	mg/l
Nitrite Nitrogen	0.01	0.14	0.01	mg/l
Total Kjeldahl Nitrogen	0.86	2.45	0.61	mg/l
Total Nitrogen	0.93	2.68	0.70	mg/l
Total Phosphorus	0.30	0.54	0.17	mg/l
Total Reactive Phosphate	0.21	0.42	0.14	mg/l
Total Suspended Solids	7	6	<1	mg/l
Turbidity	7.4	4.5	5.3	NTU
Dissolved Oxygen (field)	6.6	5.2	6.7	mg/l
pH (field)	7.2	7.4	7.1	pH units
Specific Conductivity, (field)	489	992*	513*	μmhos/cm
Temperature (field)	25.8	27.0	25.6	°C

*Noncompliance with Florida Administrative Code 17-302 and/or Sarasota County Ordinance 72-37, Class III surface waters.

FDHRS Drinking Water Certification # 84243
FDHRS Environmental Certification # E84017

Analysis performed in accordance with E.P.A., Standard Methods or other FDHRS approved methodology

LABORATORY REPORT

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REPORT FOR: Mr. Jim Paulmann
PALMER VENTURE
7184 Beneva Road
Sarasota, Florida 34238

Report Number: 609/JUL1092
Project Number: 0380-084
Sampling Date: 06-16-92
Sample Source: Surface Water
Sampled By: Shindehette

RESULTS OF ANALYSIS:	CC-4	CC-5	NC-6	Units
Laboratory Number	06428	06429	06430	-----
Sample Time	12:10	13:15	14:00	24 hours
ANALYSIS PERFORMED BY CCI				
Oil and Grease	0.6	1.4	7.6	mg/l
Biochemical Oxygen Demand	2.4	2.4	0.9	mg/l
Fecal Coliform Bacteria	2200*	2200*	800*	No./100ml
Total Coliform Bacteria	16000*	9000*	1300*	No./100ml
Ammonia Nitrogen	0.04	<0.02	0.03	mg/l
Nitrate Nitrogen	0.01	<0.01	<0.01	mg/l
Nitrite Nitrogen	0.01	<0.01	<0.01	mg/l
Total Kjeldahl Nitrogen	1.09	1.06	1.01	mg/l
Total Nitrogen	1.11	1.06	1.01	mg/l
Total Phosphorus	0.28	0.12	0.16	mg/l
Total Reactive Phosphate	0.19	0.04	0.12	mg/l
Total Suspended Solids	8	8	3	mg/l
Turbidity	9.1	8.4	3.5	NTU
Dissolved Oxygen (field)	5.8	5.8	4.8*	mg/l
pH (field)	7.2	7.7	7.2	pH units
Specific Conductivity, (field)	536*	826*	573*	µmhos/cm
Temperature (field)	28.9	29.1	24.7	°C

*Noncompliance with Florida Administrative Code 17-302 and/or Sarasota County Ordinance 72-37, Class III surface waters.

Nenad Iricanin for
Joni L. Macy/Laboratory Supervisor

FDHRS Drinking Water Certification # 84243
FDHRS Environmental Certification # E84017

Analysis performed in accordance with E.P.A., Standard Methods or other FDHRS approved methodology.

LABORATORY REPORT

CONSERVATION CONSULTANTS, INC.

5010 U.S. HIGHWAY 19 NORTH
POST OFFICE BOX 35
PALMETTO, FLORIDA 34220

ENVIRONMENTAL BIOLOGISTS, CHEMISTS,
AND WATER RESOURCE SCIENTISTS

Palmetto (813) 722-6667 Bradenton (813) 747-0006
Tampa (813) 229-3516 FAX (813) 722-8384

REPORT FOR: Mr. Jim Paulmann
PALMER VENTURE
7184 Beneva Road
Sarasota, Florida 34238

Report Number: 803/OCT1292
Project Number: 0380-084
Sampling Date: 09-08-92
Sample Source: Surface Water
Sampled By: Schindehette

RESULTS OF ANALYSIS:	CC-1	CC-2	CC-3	Units
Laboratory Number	07193	07194	07195	-----
Sample Time	10:45	11:30	11:55	24 hours
ANALYSIS PERFORMED BY CCI				
Oil and Grease	1.2	<1.0	1.2	mg/l
Biochemical Oxygen Demand	2.9	1.1	2.8	mg/l
Fecal Coliform Bacteria	1600*	130	220	No./100ml
Total Coliform Bacteria	5000*	3000*	1600	No./100ml
Ammonia Nitrogen	0.24	<0.02	0.09	mg/l
Nitrate Nitrogen	0.03	0.03	0.04	mg/l
Nitrite Nitrogen	0.01	<0.01	0.01	mg/l
Total Kjeldahl Nitrogen	1.72	1.10	2.21	mg/l
Total Nitrogen	1.76	1.13	2.26	mg/l
Total Phosphorus	1.24	0.58	2.22	mg/l
Total Reactive Phosphate	1.03	0.54	2.04	mg/l
Total Suspended Solids	8	<1	4	mg/l
Turbidity	7.5	1.2	7.0	NTU
Dissolved Oxygen (field)	2.5*	2.7*	2.3*	mg/l
pH (field)	6.7	7.2	6.8	pH units
Specific Conductivity, (field)	431	692*	492	µmhos/cm
Temperature (field)	26.7	27.3	27.4	°C

*Noncompliance with Florida Administrative Code 17-302 and/or Sarasota County Ordinance 72-37, Class III surface waters.

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REPORT FOR: Mr. Jim Paulmann
PALMER VENTURE
7184 Beneva Road
Sarasota, Florida 34238

Report Number: 803/OCT1292
Project Number: 0380-084
Sampling Date: 09-08-92
Sample Source: Surface Water
Sampled By: Schindehette

RESULTS OF ANALYSIS:	CC-1	CC-2	CC-3	Units
Laboratory Number	07193	07194	07195	-----
Sample Time	10:45	11:30	11:55	24 hours

ANALYSIS PERFORMED BY CCI

Copper, Total	0.003	0.004	0.003	mg/l
Lead, Total	<0.001	<0.001	<0.001	mg/l
Zinc, Total	0.025	0.016	0.016	mg/l

ANALYSIS PERFORMED BY SUBCONTRACT LABORATORY[a]

Arsenic, Total	<0.005	<0.005	<0.005	mg/l

*Noncompliance with Florida Administrative Code 17-302 and/or Sarasota County Ordinance 72-37, Class III surface waters.

[a]DHRS environmental cert. #E83079.
DHRS drinking water cert. #83160.

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REPORT FOR: Mr. Jim Paulmann
PALMER VENTURE
7184 Beneva Road
Sarasota, Florida 34238

Report Number: 803/OCT1292
Project Number: 0380-084
Sampling Date: 09-08-92
Sample Source: Surface Water
Sampled By: Schindehette

RESULTS OF ANALYSIS:	CC-4	CC-5	NC-6	Units
Laboratory Number	07196	07197	07198	-----
Sample Time	12:25	13:25	12:50	24 hours
ANALYSIS PERFORMED BY CCI				
Oil and Grease	<1.0	<1.0	<1.0	mg/l
Biochemical Oxygen Demand	1.9	2.2	0.9	mg/l
Fecal Coliform Bacteria	300	80	280	No./100ml
Total Coliform Bacteria	3000*	3000*	2800*	No./100ml
Ammonia Nitrogen	0.10	0.05	0.02	mg/l
Nitrate Nitrogen	0.11	0.03	<0.01	mg/l
Nitrite Nitrogen	0.01	<0.01	<0.01	mg/l
Total Kjeldahl Nitrogen	1.40	1.46	1.49	mg/l
Total Nitrogen	1.52	1.49	1.49	mg/l
Total Phosphorus	0.77	0.75	0.17	mg/l
Total Reactive Phosphate	0.71	0.52	0.13	mg/l
Total Suspended Solids	3	5	<1	mg/l
Turbidity	5.3	5.9	1.4	NTU
Dissolved Oxygen (field)	2.4*	2.2*	1.1*	mg/l
pH (field)	6.8	7.0	7.0	pH units
Specific Conductivity, (field)	477	466	558*	μmhos/cm
Temperature (field)	28.5	28.6	25.8	°C

*Noncompliance with Florida Administrative Code 17-302 and/or Sarasota County Ordinance 72-37, Class III surface waters.

FDHRS Drinking Water Certification # 84243
FDHRS Environmental Certification # E84017

Analysis performed in accordance with EPA, Standard Methods or other FDHRS approved methodology

LABORATORY REPORT

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REPORT FOR: Mr. Jim Paulmann
PALMER VENTURE
7184 Beneva Road
Sarasota, Florida 34238

Report Number: 803/OCT1292
Project Number: 0380-084
Sampling Date: 09-08-92
Sample Source: Surface Water
Sampled By: Schindehette

RESULTS OF ANALYSIS:	CC-4	CC-5	NC-6	Units
Laboratory Number	07196	07197	07198	-----
Sample Time	12:25	13:25	12:50	24 hours

ANALYSIS PERFORMED BY CCI

Copper, Total	0.007	0.006	<0.001	mg/l
Lead, Total	<0.001	<0.001	<0.001	mg/l
Zinc, Total	0.025	0.029	0.018	mg/l

ANALYSIS PERFORMED BY SUBCONTRACT LABORATORY[a]

Arsenic, Total	<0.005	<0.005	<0.005	mg/l

*Noncompliance with Florida Administrative Code 17-302 and/or Sarasota County Ordinance 72-37, Class III surface waters.

[a]DHRS environmental cert. #E83079.
DHRS drinking water cert. #83160.

Nenad Tucanin for
Joni L. Macy/Laboratory Supervisor

LABORATORY REPORT

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Tampa (813) 229-3516 FAX (813) 722-8384

REPORT FOR: Mr. Jim Paulmann
PALMER VENTURE
7184 Beneva Road
Sarasota, Florida 34238

Report Number: 977/DEC1792
Project Number: 0380-084
Sampling Date: 12-01-92
Sample Source: Surface Water
Sampled By: Schindehette

RESULTS OF ANALYSIS:	CC-1	CC-2	CC-3	Units
Laboratory Number	07867	07868	07869	-----
Sample Time	11:00	11:20	11:40	24 hours
ANALYSIS PERFORMED BY CCI				
Oil and Grease	<1.0	1.6	2.0	mg/l
Biochemical Oxygen Demand	1.6	2.4	2.3	mg/l
Fecal Coliform Bacteria	5000*	900*	1700*	No./100ml
Total Coliform Bacteria	9000*	5000*	9000*	No./100ml
Ammonia Nitrogen	0.21	0.07	0.16	mg/l
Nitrate Nitrogen	0.27	0.02	0.57	mg/l
Nitrite Nitrogen	0.04	<0.01	0.03	mg/l
Total Kjeldahl Nitrogen	0.94	2.29	1.00	mg/l
Total Nitrogen	1.25	2.31	1.60	mg/l
Total Phosphorus	0.18	0.39	0.12	mg/l
Total Reactive Phosphate	0.16	0.19	0.10	mg/l
Total Suspended Solids	8	31	5	mg/l
Turbidity	13.6	19.3	25	NTU
Dissolved Oxygen (field)	8.3	7.6	3.9*	mg/l
pH (field)	6.8	7.0	6.7	pH units
Specific Conductivity, (field)	714*	1459*	1189*	μmhos/cm
Temperature (field)	14.9	15.1	17.7	°C

*Noncompliance with Florida Administrative Code 17-302 and/or Sarasota County Ordinance 72-37, Class III surface waters.

FDHRS Drinking Water Certification # 84243
FDHRS Environmental Certification # E84017

Analysis performed in accordance with E.P.A., Standard Methods or other FDHRS approved methodology.

CCI

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LABORATORY REPORT

REPORT FOR: Mr. Jim Paulmann
PALMER VENTURE
7184 Beneva Road
Sarasota, Florida 34238

Report Number: 977/DEC1792
Project Number: 0380-084
Sampling Date: 12-01-92
Sample Source: Surface Water
Sampled By: Schindehette

RESULTS OF ANALYSIS:	CC-4	CC-5	NC-6	Units
Laboratory Number	07870	07871	07872	-----
Sample Time	11:50	12:10	12:30	24 hours
ANALYSIS PERFORMED BY CCI				
Oil and Grease	1.2	<1.0	<1.0	mg/l
Biochemical Oxygen Demand	2.7	1.8	1.4	mg/l
Fecal Coliform Bacteria	27	11	500	No./100ml
Total Coliform Bacteria	900	300	700	No./100ml
Ammonia Nitrogen	0.18	0.11	0.14	mg/l
Nitrate Nitrogen	0.03	0.25	0.01	mg/l
Nitrite Nitrogen	0.01	0.01	<0.01	mg/l
Total Kjeldahl Nitrogen	1.29	1.06	0.96	mg/l
Total Nitrogen	1.33	1.32	0.97	mg/l
Total Phosphorus	0.11	0.07	0.06	mg/l
Total Reactive Phosphate	0.05	0.06	0.06	mg/l
Total Suspended Solids	9	1	<1	mg/l
Turbidity	12.7	3.5	3.0	NTU
Dissolved Oxygen (field)	7.8	6.3	1.6*	mg/l
pH (field)	7.0	7.3	6.7	pH units
Specific Conductivity, (field)	927*	1006*	692*	µmhos/cm
Temperature (field)	18.6	19.1	14.4	°C

*Noncompliance with Florida Administrative Code 17-302 and/or Sarasota County Ordinance 72-37, Class III surface waters.

Nenad Tiesanin for

Joni L. Macy/Laboratory Supervisor
FDHRS Drinking Water Certification # 84243
FDHRS Environmental Certification # E84017

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APPENDIX D: MONITORING TEAM

NENAD IRICANIN, Ph.D.

Environmental Scientist

Fields of Competence

Computer Simulations and Mathematical Modeling of Water and Wetland Resources, Pollutant Loadings, Interstitial Water Chemistry, Data Acquisition and Interpretation, Computer Programming.

Experience Summary

Dr. Nenad Iricanin has eight years of applied research and consulting experience in the field of water resource science. His applied research experience includes particulate nutrient investigations in Florida waters, pollutant loading evaluations for both fresh water and marine systems, bulk sediment analyses for trace metals and nutrients, interstitial water analyses for trace metals and nutrients and *in situ* measurements of trace metals, sediment oxygen demand and nutrient fluxes from sediments using cores and chambers.

At Conservation Consultants, Inc., Dr. Iricanin's responsibilities include mathematical modeling of land surface/atmospheric interactions, sediment geochemistry and water/sediment interactions, pollutant loading evaluations, waste load allocations, conceptual stormwater management plans, nutrient exchange rates and nutrient budget determinations. Additionally, he performs statistical analyses and data interpretations of water resources and ecological assessments.

Education

Year	School
1990	Florida Institute of Technology Ph.D - Chemical Oceanography
1984	Florida Institute of Technology M.S. - Chemical Oceanography
1982	Florida Institute of Technology B.S. - Chemical Oceanography

NENAD IRICANIN, Ph.D. **Environmental Scientist**

Employment History

1990 - Present — Conservation Consultants, Inc.
Staff Scientist

Key Projects

City of Tampa: Quantified sedimentation and pollution in the lower Hillsborough River. Tampa, Florida.

Florida Department of Environmental Regulation: Particulate nutrient investigations and computer simulation of the Turkey Creek watershed. Brevard County, Florida.

National Oceanic and Atmospheric Administration (NOAA): Pollutant-particle relationships in the marine environment (P-Prime), interstitial water chemistry.

Department of Interior/U.S. Fish and Wildlife Service: The second joint U.S.A.-U.S.S.R. ecosystem investigation of the Bering Sea; sediment geochemistry.

St. Johns River Water Management District: Investigated the quantity, composition, and sources of suspended matter loading to Turkey Creek. Computer simulation of pollutant loadings from urban and rural watersheds. Brevard County, Florida.

Walt Disney EPCOT (The Living Seas): Monthly trace metal and major cation chemistry of artificial seawater to ensure aquaria stability. Orange County, Florida.

King Engineering Associates: Lake Tarpon SWIM Study. Project Scientist for the evaluation of stormwater quality and pollutant loading for the Lake Tarpon watershed. Responsibilities include a bathymetric survey of the lake, sediment nutrient exchange rates, sediment oxygen demand, and evaluation of a nutrient budget for Lake Tarpon. Pinellas County, Florida.

Smally, Wellford & Nalven, Inc.: Project Scientist for a Water Quality Based Effluent Limitation (WQBEL) Study involving stormwater runoff and discharge entering Sarasota Bay. Sarasota, Florida.

Royster Phosphates, Inc.: Responsible for synthesizing water quality data from a Water Quality Based Limitation (WQBEL) study into an "Intensive Survey" document. Manatee County, Florida.

Palmer Venture: Responsible for pollutant loading analysis for pre- and post-development of Palmer East-side property. Sarasota County, Florida.

Key Projects (Continued)

Palmer Venture: Project Manager for Storm Event Pollutant Loading Monitoring program in Catfish and South Creeks on Palmer Ranch. Sarasota County, Florida.

Selected Publications

Iricanin, N., Seasonal trends and benthic fluxes of interstitial manganese. (1984). M.S. Thesis.

Gu, D., N. Iricanin, and J.H. Trefry (1987), The geochemistry of interstitial water for a sediment core from the Indian River Lagoon, Florida, Florida Scient., 50, 99 - 110.

Iricanin, N., J.H. Trefry, R.P. Trocine, T.W. Vetter, and S. Metz, Seasonal and spatial variations of interstitial Mn and Fe in Mississippi Delta Sediments, Geochimica Cosmochimica Acta.

Iricanin, N., The role of storms in the transport and composition of particles in a Florida creek. Ph.D. Dissertation.

Memberships

American Society of Limnology and Oceanography
American Geophysical Union
The Oceanography Society

G. GARRY PAYNE, Ph.D. — Senior Environmental Scientist

Fields of Competence

Chemical Analysis and Quality Control of Water, Sediment, Microbial and Solid Waste Samples, Stormwater Quality and Drainage Impact Assessments, Pollutant Loading Evaluations, Groundwater Quality Monitoring and Evaluations, Environmental Permitting and Monitoring, Soil Chemistry, Data Acquisition and Interpretation, Statistical Analysis of Data, and Computer Programming.

Experience Summary

Dr. G. Garry Payne has eight years of applied research and environmental chemistry experience. Applied research has included effects of common land use practices on water quality and environmental quality in general. He has supervised an analytical laboratory conducting analyses of plant, soil and water samples. Experience includes teaching applied chemistry procedures at the college level, and supervision of lab and field personnel.

Before joining CCI, Dr. Payne worked with research teams from 1981 to 1989, where he investigated nutrient chemistry from field research sites and was responsible for quality control and maintenance of modern analytical equipment. He has investigated the effects of metal-rich wastes on soil chemistry. He has considerable experience in the experimental design of field, greenhouse and lab studies, including effects of acidity and nutrients on plants. After obtaining his doctorate in agronomy with an emphasis in soil chemistry, Dr. Payne's work has centered on applied chemical research and methods of minimizing detrimental environmental impacts resulting from nutrient losses, in Florida.

At CCI, Dr. Payne serves as Director of the Water Resource Management Division and oversees professional staff involved with water quality monitoring, data management and laboratory services. He is directly involved with planning, monitoring and permitting studies for industries, utilities, municipalities, land developers and water management authorities. Many of these projects involve groundwater monitoring programs, pollutant loading evaluations and stormwater impact assessment and management, monitoring of potable water supplies, NPDES permitting, development of nutrient and hydrologic budgets, and diagnostic studies of freshwater and estuarine water bodies.

Education

Year	School
1986	Virginia Polytechnic Institute & State University Ph.D. - Agronomy (Soil Chemistry)
1983	University of Georgia M.S. - Agronomy (Soil Fertility)
1981	Christopher Newport College B.S. - Biology

G. GARRY PAYNE, Ph.D. **Senior Environmental Scientist**

Employment History

1989 - Present	Conservation Consultants, Inc. Senior Scientist
1987 - 1989	University of Florida Agricultural Research Center: Postdoctoral Fellow
1983 - 1987	Virginia Polytechnic Institute & State University Research & Teaching Assistant
1981 - 1983	University of Georgia: Research Assistant

Key Projects

City of Sarasota: Project Manager for the design and implementation of a FDER-approved Plan of Study for a Water Quality Based Effluent Limitation Study (WQBEL) for the City's Reverse Osmosis Plant and Ion Exchange Facility. Sarasota, Florida.

Palmer Venture: Project Scientist for Storm Event Pollutant Loading Monitoring program in Catfish and South Creeks on Palmer Ranch. Sarasota County, Florida.

Hatchett Creek Development, Ltd.: Project Manager for the implementation of agency approved workscopes for various water resource assessments specified by the DRI Development Order prior to construction of the Hatchett Creek Development. Venice, Florida.

Gulfstream Development Corporation: Project Manager for the implementation of agency approved workscopes for various water resource assessments and construction monitoring programs required by the DRI Development Orders prior to initiating construction of Woodmere Community Center and Woodmere Village. Venice, Florida.

Palmer Venture: Project Manager for an Assessment of Post-Development Pollutant Loading Rates including predictions of stormwater loadings from planned residential, transportation, and other land uses and predictions of pollutant removal rates for planned grassed swales, extended detention basins with long-term residence times and biological filters. Palmer Ranch. Increment VI and East Side. Sarasota County, Florida.

Power Corporation: Project Manager for the implementation of agency approved workscopes for various water resource assessments specified by the DRI Development Order during construction of the Tara Development. Bradenton, Florida.

IMC Fertilizer: Project Manager for the design and implementation of a FDER-approved Plan of Study for a Water Quality Based Effluent Limitation (WQBEL) study for the Hopewell Mining Facility. Study was in support of NPDES permit application. Hillsborough County, Florida.

Key Projects (Continued)

Lake Tarpon Swim Study: Task manager for the assessment of the impacts of groundwater inputs on the quality of Lake Tarpon and the analyses and mapping of sediments to determine their impact on lake quality. Also evaluated stormwater quality and pollutant loadings, sediment nutrient exchange rates, sediment oxygen demand, and nutrient budgets. Pinellas County, Florida.

Selected Publications

Payne, G.G. and J.E. Rechcigl. 1989. Influence of various drying techniques on the extractability of plant nutrients from selected soils. Soils Science.

Payne, G.G. and M.E. Sumner. 1986. Yield and composition of soybeans as influenced by soil pH, phosphorus, zinc and copper. Communications in Soil Science and Plant Analysis 17:257-273.

Payne, G.G. and D.C. Martens. 1988. Form and availability of Cu and Zn following long-term $CuSO_4$ and $ZnSO_4$ applications to a Rhodic Paleudult. Journal of Environmental Quality 17:707-711.

Rechcigl, J.E., P. Mislevy and G.G. Payne. In press. Fertilization of stargrass. In Proceedings of the Internat. Conference on Livestock in the Tropics. Univ. of Florida, Gainesville.

Payne, G.G. and D.C. Martens. 1986. Lead in soils. p. 78-89. In Soils. Brooklyn Botanic Garden, Inc., Brooklyn, NY.

Martens, D.C., G.G. Payne, C. Winarko, E.T. Kornegay and M.D. Lindemann. 1985. Crop response to high levels of copper application. Internat. Copper Research Association, Research Report 292(F). 38 p.

Payne, G.G., J.E. Rechcigl and A.B. Bottcher. 1988. Development of fertilization practices for beef cattle pastures to minimize nutrient loss in runoff. Annual Report. South Florida Water Management District. 125 p.

Payne, G.G., J.E. Rechcigl and R.J. Stephenson. 1990. Development of DRIS norms for bahiagrass. Agronomy Journal 82:711-715.

Payne, G.G. and J.E. Rechcigl. 1989. Influence of phosphorus fertilization on bahiagrass and water quality. p. 43-46. In Proceedings of the XVI International Grassland Congress, Nice, France.

JONI L. MACY

Environmental Chemist

Fields of Competence

Chemical analysis of surface and groundwater, drinking water, wastewater, sludge, and soil samples in accordance with EPA, ASTM, NIOSH, APHA, AWWA, and WPCF approved methodologies; Water Quality Sample Collection; Quality Control/Quality Assurance; Laboratory Supervision and Management.

Experience Summary

Ms. Joni Macy has six years experience in environmental chemistry including proficiency in a wide range of laboratory analyses, sampling techniques, quality control/quality assurance procedures, and laboratory supervision. She worked with Hillsborough County Utilities Laboratory for three years where she was involved with field sampling, bacteriology, biochemical and chemical oxygen demands, solids analyses, and nutrient analyses. Ms. Macy was also responsible for initiating and maintaining a quality control program for this department.

Ms. Macy expanded her expertise in environmental chemistry while working with a private environmental laboratory where she served as both Supervisor and Scientist II. She was responsible for the daily operation and supervision of the Wet Chemistry Department and its seven analysts.

At CCI, Ms. Macy serves as Laboratory Supervisor and Chemist. She is responsible for the daily operation of the laboratory including; sample analyses and reporting, sample tracking, equipment maintenance, and quality control/quality assurance procedures. Additionally, she maintains the laboratory's State certifications. She is responsible for metals analysis by Atomic Absorption Spectrometry and Furnace Analysis for trace levels of metals.

Education

Year	School
1986	University of South Florida B.S. - Zoology

Employment History

1990 - Present	Conservation Consultants, Inc. Environmental Chemist
1989 - 1990	Post, Buckley, Schuh, and Jernigan Environmental Laboratory Supervisor/Scientist, Wet Chemistry Department
1986 - 1989	Hillsborough County Department of Utilities Environmental Scientist
Spring 1985	Florida Department of Environmental Regulation Biological Scientist

Key Projects

Well Monitoring: Project Manager responsible for analysis and reporting of numerous private well systems for compliance with Southwest Florida Water Management District Consumptive Use permitting requirements.

Manatee County: Project Manager for Industrial Compliance Division.

City of Sarasota WTP: Project Manager for City of Sarasota WTP monitoring events; included 29 monitoring wells, WTP influent and effluent, and bay sites monitoring.

City of Bradenton WWTP: Project Manager for City of Bradenton WWTP influent and effluent monitoring.

Professional Membership:

Florida Society of Environmental Analysts (FSEA), 1991 to present.

STEVEN L. SCHINDEHETTE — Environmental Scientist

Fields of Competence

Water Quality Monitoring and Analyses, Surface Water Hydrologic Monitoring, Installation and Maintenance of Water Level and Water Quality Field and Laboratory Instrumentation, Project Management.

Experience Summary

Mr. Schindehette has three years experience in environmental technical services. He is experienced with various aspects of surface water investigations including *in-situ* measurements, surface water level instrumentation, flow determination, and grab/composite sampling techniques. He has monitored groundwater quality via water level measurements and grab samples. Mr. Schindehette is responsible for the implementation, operation and maintenance of water quality sampling equipment and instrumentation and serves as Project Manager for several projects involving surface water, water level and groundwater investigations. Additionally, he assists in the day-to-day operations of CCI's analytical laboratory, including routine analyses of surface and ground waters. Prior to joining CCI, Mr. Schindehette worked for the Florida Department of Natural Resources where he was involved with all aspects of fish mariculture, including water quality sampling and analyses.

Education

Year	School
1987	University of North Carolina at Wilmington B.S. - Marine Biology
1985	Elgin Community College, Illinois Associate of Science - Biology

Employment History

1990 - Present	Conservation Consultants, Inc. Environmental Scientist
1989 - 1990	Florida Department of Natural Resources Science Technician III

Key Projects

Coastal Communities & Resorts: Project Scientist for the sampling and analysis of tidally influenced waters. Manatee County, Florida.

Lake Tarpon SWIM Study: Activities include mobilization, implementation and routine maintenance of water quality and water level instrumentation, stratigraphic and bathymetric profiles of water and sediment parameters. Principal diver for retrieving sediment cores for Nutrient Exchange Rates/Sediment Oxygen Demand (NER/SOD) determination as well as deployment and retrieval of sedimentation traps. Pinellas County, Florida.

Smally Wellford & Nalven, Inc.: Project Scientist for Water Quality Based Effluent Limitation (WQBEL) study involving discharge entering Sarasota Bay from the City of Sarasota's Water Treatment Plant. Duties included collection of water samples and hydrographic and flow measurements. Sarasota County, Florida.

Tierra Verde Yacht & Tennis Club: Project Scientist in environmental monitoring program. Activities included mobilization and construction of hydrographic instrumentation, water quality and sediment sampling, and a basin flushing analysis using dye marker study. Pinellas County, Florida.

IMC Fertilizer (Hopewell Mine): Project Scientist and Field Team Leader for WQBEL survey. Duties included mobilization and implementation of a plan of study for an evaluation of the potential impacts resulting from the discharge of a phosphate mining operation. Hillsborough County, Florida.

IMC Fertilizer (Multi-site): Project Scientist and Field Team Leader for WQBEL survey. Duties included mobilization and implementation of a plan of study for an evaluation of the potential impacts resulting from the discharge from six phosphate mining operations. Hillsborough, Polk and Manatee Counties, Florida.

Power Corporation: Project Manager for a construction monitoring program required by the DRI Development Order for the Tara Development. Responsibilities include a monthly sample collection, surface water level recording, analysis and reporting of water quality. Manatee County, Florida.

Pittway Real Estate: Project Manager for a construction monitoring program required by the DRI Development Order for the Saddlebrook Development. Duties include wetland water level/hydroperiod recording, surface and groundwater monitoring. Pasco County, Florida.

Pasadena Yacht & Country Club: Project Scientist and Field Team Leader for a water quality monitoring program as required in support of permit modification. Responsibilities include water quality monitoring, sediment collection via SCUBA, sedimentation rate analysis, and basin flushing analysis. Pinellas County, Florida.

Sarabay Marina: Project Scientist and Field Team Leader for a WQBEL survey required for Wetland Resource Managment Permit. Duties include mobilization and implementation of water level and water quality instrumentation, water quality and basin flushing analysis using a dye marker study. Manatee County, Florida.