Sixteenth Annual Report of the Continuing Surface Water Quality Monitoring Program for Catfish, North and South Creeks on the Palmer Ranch Sarasota County, Florida January - December, 2000

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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, Resolution No. 91-170) 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 before 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.

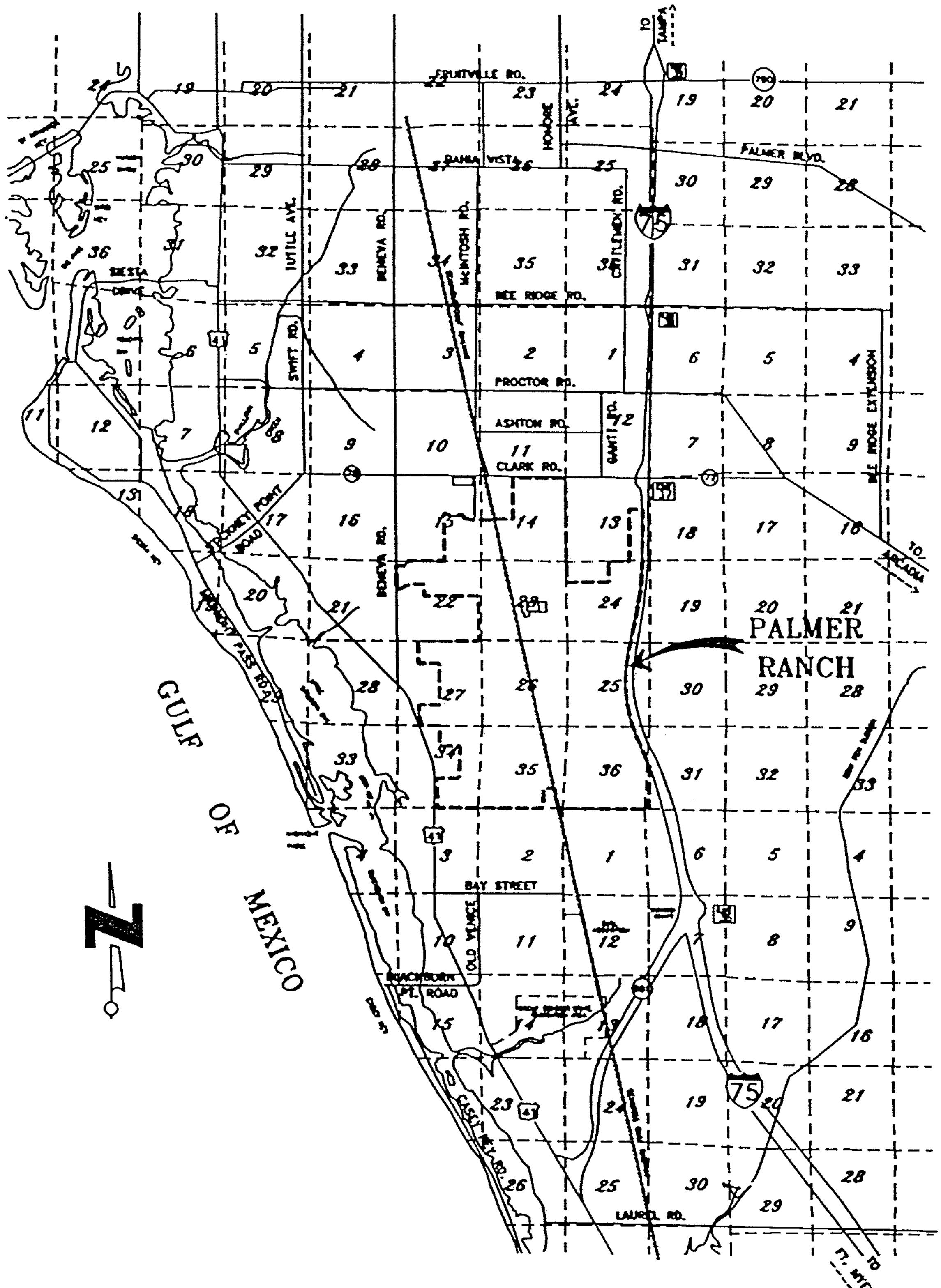


FIGURE 1.1. GENERAL SITE LOCATION

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. This meeting 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 work scope entailed a 13-station network with a quarterly sampling frequency for the parameters monitored during the first year, except trace elements and organochlorine pesticides that would receive annual audits (refer to July 24, 1986 correspondence of Mr. T. W. Goodell to Mr. Russ Klier).

Palmer Ranch Holdings, Ltd. (*f.k.a.* Palmer Venture and Palmer Ranch Development, Ltd.) contracted Vanasse Hangen Brustlin, Inc. (*f.k.a.* CCI Environmental Services, Inc. and Conservation Consultants, Inc.) to implement the "Continuing Surface Water Quality Monitoring Program" during the second year of the monitoring program. Vanasse Hangen Brustlin, Inc. (VHB) began monitoring on September 16, 1985, pursuant to the instructions provided by Palmer Ranch Holdings, Ltd. Except 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 Ranch Holdings, Ltd., 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 quarterly 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 in 1992. This revised monitoring program consisted 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 before any development activity occurring in the basin. Upon intent to reinitiate monitoring of the South Creek Basin, Sarasota County Pollution Control Division was notified of dates of sampling and stations to be sampled. Monitoring of the South Creek Basin was reinitiated with the first quarterly sampling occurring on January 13, 1994. As specified in Exhibit "E", this pre-development monitoring event included 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 quarterly 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 to determine baseline water quality conditions. Once an area is substantially developed as agreed to by the Sarasota County Pollution Control Division and Palmer Ranch Development, Ltd., 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 quarterly for a maximum of two years or until substantial development occurs. On April 29, 1994, Mr. Kent Kimes of the Sarasota County Pollution Control Division approved a reduction in sampling frequency for the Catfish Creek and North Creek monitoring stations from quarterly to semi-annually.

The water quality conditions recorded during sampling events conducted during the period from January through December 2000 in the Catfish Creek, North Creek and South Creek basins 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 subtropical, 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, FLORIDA)

Month	Air Temperature			
	1941-1970[a]		1931-1960[b]	
	°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

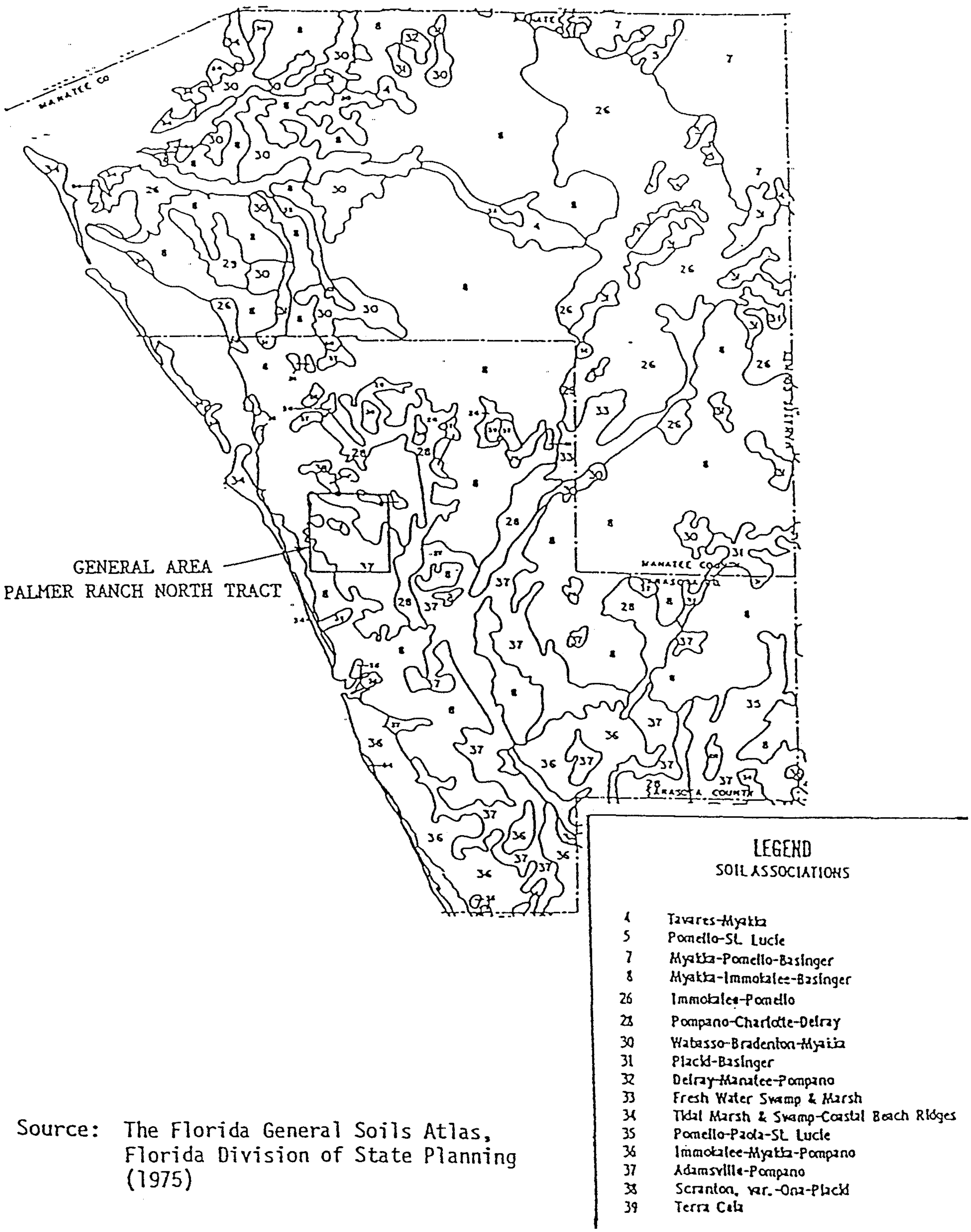
[a]Thompson, 1976
[b]Bradley, 1974

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 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.



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

FIGURE 2.1. SOIL ASSOCIATIONS IN THE REGION

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-Bassinger association: Nearly level, poorly and moderately well drained, sandy soils with weakly cemented sandy subsoil and poorly drained sandy soils throughout.
	8	Myakka-Immokalee-Bassinger association: Nearly level, poorly drained, sandy soils with weakly cemented sandy subsoil and poorly drained sandy soils throughout.
	26	Immokalee-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.
Areas dominated by moderately well to poorly drained soils subject to flooding.	35	Pomello-Paola-St. Lucie association: Nearly level to sloping, moderately well drained sandy soils with weakly cemented sandy not subject to flooding (continued)subsoil and excessively drained soils, sandy throughout.

TABLE 2.2. (CONTINUED)

Area Definition	Map Unit No.	Soil Association Description
	36	Immokalee-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.
	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.
Areas dominated by poorly and very poorly drained soils subject to flooding (continued)	33	Fresh Water Swamp and Marsh association: Nearly level, very poorly drained soils subject to prolonged flooding.

TABLE 2.2. (CONTINUED)

Area Definition	Map Unit No.	Soil Association Description
	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, droughty sands.
	39	Terra Ceia association: Nearly level, very poorly drained, well-decomposed, organic soils 40-91 cm (16-36 inches) thick over loamy material.

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, wastewater treatment facilities and associated domestic 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 located upstream of the ranch include golf courses, roads and highways, residential developments, a mobile home park, commercial businesses, a dairy farm that 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 mesic hammocks.

2.4 Drainage

The Palmer Ranch DRI is divided into six primary drainage basins that ultimately discharge into Little Sarasota Bay and Drymond Bay. Two basins, the Catfish Creek/Trunk Ditch Basin and the South Creek Basin, drain most of the North Tract. Approximately 2,590 acres of the Catfish Creek-Trunk Ditch Basin, that has a total drainage area of 3,700 acres, and approximately 1,770 acres of the South Creek Basin, that 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 that 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 runoff 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 runoff 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 and resulted 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 reconstructed in association with the Development of Prestancia. This reconstruction resulted in an improved channel and the placement of two water level control weirs. Because of these two weirs, lentic conditions occur during the dry season. Vegetation in Trunk Ditch is dominated by hydrilla, water-weed, 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 reconstructed 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 residential development, roadways, 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, pine flatwoods and the newly constructed residential developments. Downstream of the Ranch, South Creek flows through Oscar Scherer State Park and subsequently into the tidal waters of Drymond Bay.

2.4.5 *Elligraw Bayou*

Elligraw Bayou is a channelized stream that flows southwesterly to Little Sarasota 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 Little Sarasota 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 Little Sarasota 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 Little Sarasota Bay.

2.5 Water Quality Classification

The segments of the streams traversing the North Tract of the Palmer Ranch are non-tidal freshwater systems designated by the State as Class III waters pursuant to Subsection 62-302.400(1) of the Florida Administrative Code (FAC). Downstream, these streams flow into an estuarine system (Little Sarasota and Drymond Bays) which is classified as an Outstanding Florida Waters (OFW). In addition, the segment of South Creek that flows through Oscar Scherer State Park 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	Water Quality Standard[a]
Arsenic	Not >50 ug/L at a Total Hardness of 110 mg/L
Biochemical Oxygen Demand	Not to be increased in a manner that would depress Dissolved Oxygen levels below criteria.
Fecal Coliform Bacteria	Not >800/100 mL
Total Coliform Bacteria	Not >2,400/100 mL
Specific Conductance	Shall not be increased more than 50% above background or to 1,275 umhos/cm, whichever is greater, in predominantly fresh waters.
Copper	Not >12.8 ug/L at a Total Hardness of 110 mg/L
Dissolved Oxygen	Not <5 mg/L
Lead	Not >3.6 ug/L at a Total Hardness of 110 mg/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.
Ammonia Nitrogen (ionic plus non-ionic)	See Nutrients
Nitrite Nitrogen	See Nutrients
Nitrate Nitrogen	See Nutrients

TABLE 2.3. (CONTINUED)

Parameter	Water Quality Standard[a]
Total Nitrogen	See Nutrients
Organic Nitrogen	See Nutrients
Oil and Greases	Not >5 mg/L
Orthophosphate	See Nutrients
Total Phosphorus	See Nutrients
pH	6.0 - 8.5
Total Suspended Solids	-----
Turbidity	Not >29 NTU above background
Zinc	Not >115 ug/L at a Total Hardness of 110 mg/L

[a]State surface water quality criteria as listed in Chapter 62-302, Florida Administrative Code, and Sarasota County Ordinance No. 98-066.

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.**

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 that 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 lays 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. South Creek was monitored at four (4) locations. These include one point of outflow (SC-2) and one point of inflow (SC-3), as well as in the interior of the North Tract at Stations SC-

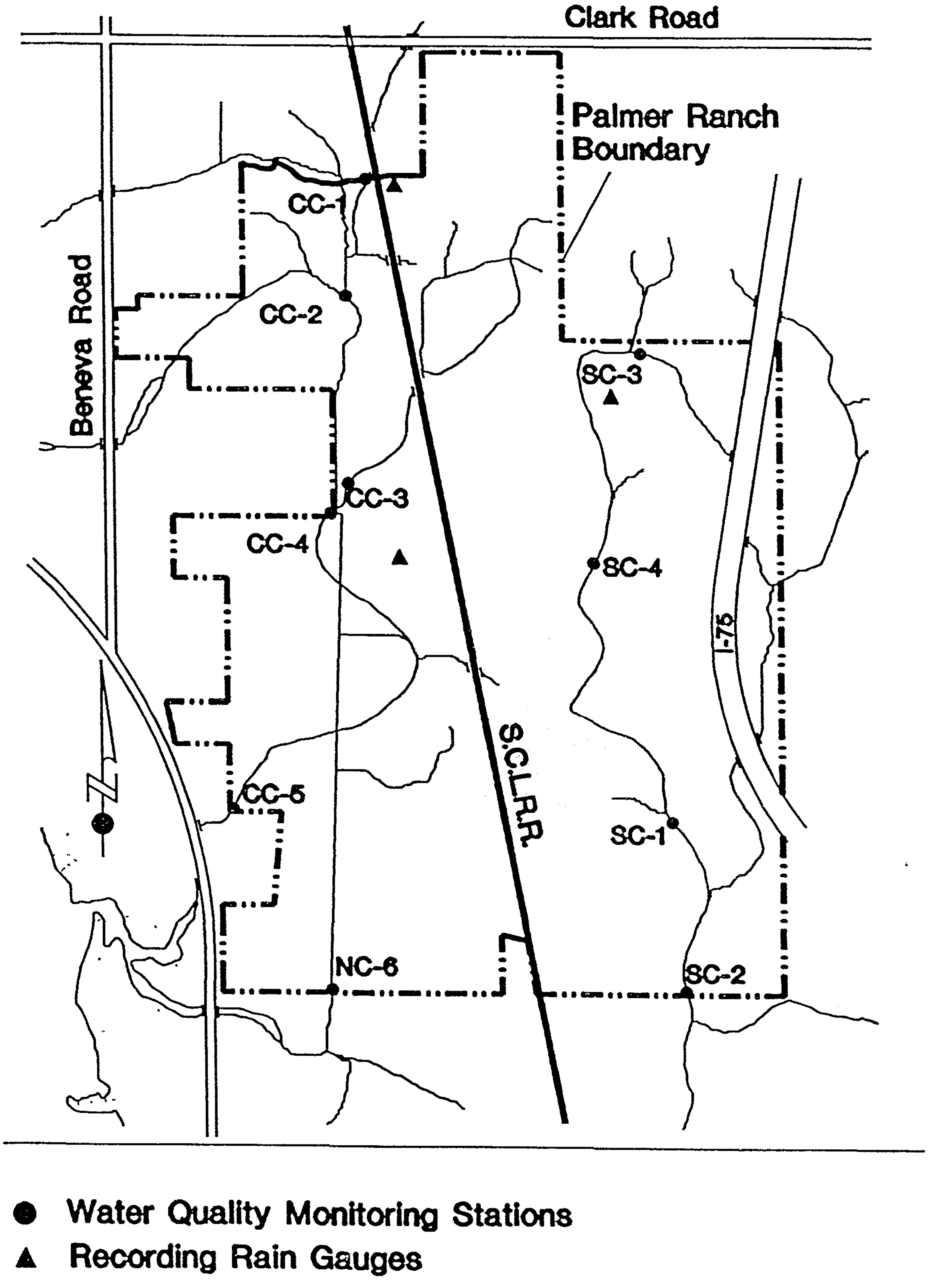


FIGURE 3.1. LOCATION OF SURFACE WATER MONITORING STATIONS

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

Station	General Location	Water Depth[a] (ft)	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.

4 and SC-1. Station SC-3 is upstream of any development underway presently in the South Creek Basin. During some previous monitoring years, only Stations SC-1, SC-2, and SC-4 were monitored because no construction extended beyond Station SC-4. Sampling at Station SC-3 was reinitiated in October 1996 when construction activity moved upstream of Station SC-4.

3.2 Parameters and Sampling Frequency

Semi-annual sampling of Catfish and North Creeks was performed during March and September 2000, and quarterly sampling was performed during January, April, July, and October 2000 in South Creek. The analysis of the annual parameters was performed for samples collected during the wet season events (i.e. September and October 2000). The dates and times of all sample collections are provided in **Table 3.2a**. Weather conditions at the time of monitoring are provided in **Table 3.2b**.

Surface water quality monitoring from January through December 2000 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 or YSI/Endeco 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, all instrumentation was calibrated according to the manufacturer's recommended procedures. All *in situ* measurements were taken at approximate midstream and mid-depth at each station.

TABLE 3.2a DATE AND TIME OF SAMPLING FOR THE SIXTEENTH ANNUAL MONITORING PERIOD OF JANUARY THROUGH DECEMBER 2000

West Side

Event No.	Date of Sampling	Monitoring Stations					
		CC-1	CC-2	CC-3	CC-4	CC-5	NC-6
1	March 17, 2000	7:10	DRY	9:20	10.15	7:30	8:35
2	September 14, 2000	12:00	12:45	13:00	13:15	13:30	14:00

East Side

Event No.	Date of Sampling	Monitoring Station			
		SC-1	SC-2	SC-3	SC-4
1	January 10, 2000	10:30	10:45	10:00	10:15
2	April 6, 2000	DRY	DRY	DRY	DRY
3	July 31, 2000	11:24	11:01	10:20	10:43
4	October 10, 2000	12:35	12:17	11:30	11.50

TABLE 3.2b WEATHER CONDITIONS OBSERVED DURING SAMPLING FOR THE SIXTEENTH ANNUAL MONITORING PERIOD OF JANUARY THROUGH DECEMBER 2000

Date	Air Temperature (F)	Cloud Cover (%)	Speed	Wind Direction	Rain
January 10, 2000	Mid 70's	65	3-10	N	No
March 17, 2000	N/A	N/A	N/A	N/A	N/A
April 6, 2000	Low 80's	60	0-5	N	No
July 31, 2000	High 80's	65	0	-	No
September 14, 2000	High 80's	15	0-5	NW	No
October 10, 2000	Low 70's	10	5-20	SW	No

N/A – Not Available

Grab samples were collected at each station during the six monitoring 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

Additional surface water grab samples were collected at each of the ten monitoring stations during the September or October 2000 monitoring events for the laboratory analysis of the following parameters:

- Arsenic
- Lead
- Copper
- Zinc

All sampling was performed in accordance with VHB's Comprehensive Quality Assurance Plan (CompQAP #990136) on file with the Florida Department of Environmental Protection. Laboratory analyses were performed in accordance with the procedures described in the 18th edition of *Standard Methods for the Examination of Water and Wastewater* (APHA, 1992), *Methods for Chemical Analysis of Water and Wastes* (USEPA, 1983) or other FDEP/USEPA approved methodology. The methods used in the collection, preservation, handling, storage, and analysis of all surface water samples are provided by parameter in **Table 3.3**.

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[1]Organic Nitrogen = Total Kjeldahl Nitrogen - Ammoniacal Nitrogen.

Laboratory analyses were performed by Benchmark EnviroAnalytical's laboratory who are certified by Florida Department of Health and Rehabilitative Services for the analyses of environmental and drinking water samples.

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 formally 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 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.

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 9222 D
Total Coliform Bacteria	Grab	Stored on Ice	30 Hours	Immediate Analysis	Multiple Tube Fermentation	APHA 9222 B
Biochemical Oxygen Demand (BOD-5 Day)	Grab	Stored on Ice	48 Hours	Immediate Analysis	Membrane Electrode	APHA 5210 B
Conductivity	*In situ*	----	----	----	Hydrolab - Wheatstone Bridge	APHA 2510 B
Total Copper	Grab	HNO_3 to pH <2, Stored on Ice	6 Months	Stored at Room Temperature	Digestion, Atomic Absorption	EPA 220.2
Total Lead	Grab	HNO_3 to pH <2, Stored on Ice	6 Months	Stored at Room Temperature	Digestion, 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 350.2
Nitrate + Nitrite Nitrogen	Grab	H_2SO_4 to pH <2,	28 Days	Stored at 4 °C Stored on Ice	Automated Cadmium Reduction	EPA 353.2
Nitrite Nitrogen	Grab	Stored on Ice	48 Hours	Stored at 4 °C	Automated Autoanalyzer	APHA 4500NO2B
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,	28 Days	Stored at 4 °C Stored on Ice	Gravimetric	EPA 1664

TABLE 3.3. (CONTINUED)

Parameter	Sample Type	Field Handling	Hold Time	Laboratory Handling	Analytical Method	Method Reference
Dissolved Oxygen	*In situ*	----	----	----	Hydrolab - Membrane Electrode	APHA 4500 G
pH	*In situ*	----	----	----	Hydrolab - Electrometric	APHA 4500-H^+
Orthophosphate	Grab	Stored on Ice	48 Hours	Immediate Analysis	Automated, Ascorbic Acid	EPA 365.3
Total Phosphorus	Grab	H_2SO_4 to pH <2, Stored on Ice	28 Days	Stored at 4 °C	Automated Block Digestion, Autoanalyzer	EPA 365.3
Total Suspended Solids (TSS)	Grab	Stored on Ice	7 Days	Stored at 4 °C	Glass Fiber Filtration, Dried at 105 °C	EPA 160.2
Temperature	*In situ*	----	----	----	Hydrolab - Thermistor	APHA 2550 B
Turbidity	Grab	Stored on Ice	48 Hours	Stored at 4 °C	Nephelometric	EPA 180.1
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, 1992. *Standard Methods for the Examination of Water and Wastewater*, 18th 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.

4.0 RESULTS AND DISCUSSION

During the sixteenth year of the "Continuing Surface Water Quality Monitoring Program" (*i.e.*, January through December 2000) six surface water quality monitoring events were conducted by VHB. Sampling of Catfish and North Creeks was conducted on March 17 and September 14, 2000 and sampling of South Creek was conducted on January 10, April 6, July 31 and October 10, 2000. All monitoring 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**).

Individual results for the six events performed during the 2000-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 data tables for the samples collected during the 2000-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.

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During previous years, surface water quality monitoring results were provided in two annual reports, one for the west side of Palmer Ranch (i.e. Catfish Creek and North Creek) and one for the east side of Palmer Ranch (i.e. South Creek). Although the water quality results will continue to be discussed by basin, the results are now provided in a single report.

4.1 Rainfall and Hydrology

4.1.1 *Rainfall*

The annual rainfall amount recorded at Oscar Scherer State Park, located to the south of the Palmer Ranch, during the sixteenth year of the "Continuing Surface Water Quality Monitoring Program" is much lower than the historic average annual rainfall of approximately 54.8 inches (based on a 30-year period of record, NOAA, 1982). In addition, in a year plagued with severe drought conditions, it is lower than the 23-year period of record average of 46.21 inches for Oscar Scherer State Park. Approximately 35.73 inches of precipitation were recorded during the November 1999 to October 2000 (**Table 4.1**) time period at Oscar Scherer State Park in comparison to a range of 24 to 74 inches recorded during the period of record. On Palmer Ranch, 38 to 65 inches were recorded during previous monitoring years (CCI, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995, 1996, 1997, 1998 and 1999).

TABLE 4.1. RAINFALL RECORDED ON THE PALMER RANCH DURING THE PERIOD OF OCTOBER 1999 THROUGH OCTOBER 2000

Date	Monthly Rainfall (Inches)	Seasonal Rainfall (Inches)	Pre-Event Rainfall (Inches)		
			2 Day	2 Week	2 Month
October 1999	4.22				
November 1999	0.81				
December 1999	2.57				
Fall (Dry Season)		**7.60**			
January 2000	1.10		0.00	0.25	2.58
February 2000	0.59				
March 2000	1.57		0.50	0.50	2.19
Winter		**3.26**			
April 2000	3.03		0.00	0.46	1.94
May 2000	-----				
June 2000	2.84				
Spring		**5.87**			
July 2000	8.95		2.40	3.57	9.19
August 2000	6.59				
September 2000	7.53		0.00	2.97	23.15
Summer (Wet Season)		**23.07**			
October 2000	0.15		0.00	0.15	14.21
Yearly Total (11/99 – 10/00)		**35.73**			

[a]Seasonal Rainfall (inches):

Primary Wet Season (June - September):	25.91
Primary Dry Season (October 1999 - January 2000):	8.70
Secondary Wet Season (February - March):	2.16
Secondary Dry Season (April - May):	3.03

----May 2000 Rain Data Not Available

Figure 4.1 provides a comparison of the monthly distribution of rainfall measured in Oscar Scherer State Park from October 1999 through October 2000 with the average monthly distribution of historic rainfall for the 23-year period of record. Rainfall recorded during the 2000 monitoring year exhibited the typical seasonal trend for this region of Florida. The cumulative amount of precipitation for the primary wet season (*i.e.*, June - September) was 25.91 inches, which is 0.81 inches below the period of record average. Recorded rainfall amounts during the primary wet season could not compensate for below average rainfall during the winter and spring and consequently contributed to an annual rainfall total below historic levels (**Figure 4.1**). During the 2000 monitoring year, below-normal rainfall was observed during seven months of the year (*i.e.*, November 1999, and January, February, March, June, August and October 2000), whereas above-normal rainfall occurred during October and December 1999, and April, July and September 2000 (**Figure 4.1**). The highest monthly rainfall totals during 2000 were observed in July and September when 8.95 and 7.53 inches of precipitation were recorded, respectively. Historically, 6.23 and 6.94 inches of rainfall occur during July and September, respectively.

As provided in **Table 4.1**, the seasonal amounts of rainfall recorded at Oscar Scherer State Park during the fall and winter quarters totaled 7.60 and 3.26 inches, respectively. Rainfall amounts recorded during the spring and summer quarters were 5.87 and 23.07 inches, respectively. In the four-month period from June through September, when the primary wet season normally occurs, 25.91 inches (or 73 percent of the total annual rainfall) was recorded

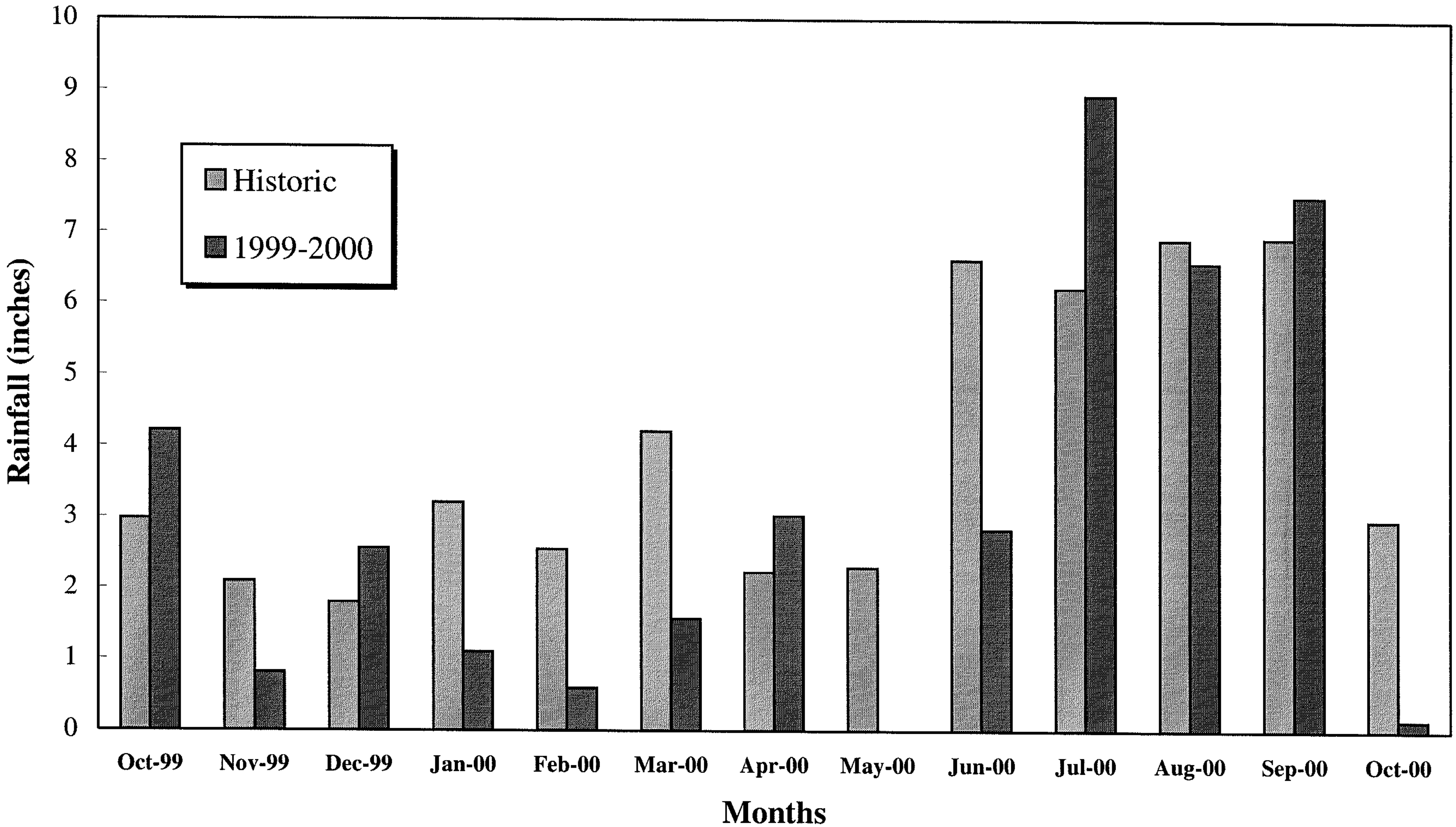


FIGURE 4.1. **HISTORIC RAINFALL VERSUS ACTUAL RAINFALL RECORDED AT OSCAR SCHERER STATE PARK DURING JANUARY THROUGH DECEMBER 2000.**

at Oscar Scherer State Park. The total rainfall recorded during the primary wet season for 2000 was substantially lower than the previous year of 41.59 inches, which accounted for one of the highest records observed in Oscar Scherer State Park during the sixteen-year monitoring period.

Antecedent rainfall accumulations during 2-day, 2-week and 2-month periods before each quarterly monitoring event are also presented in **Table 4.1**. As evident in this table, only the March and July monitoring events had rain recorded during the 2-day antecedent period prior to monitoring. The July and September monitoring events had the highest rainfall recorded during the 2-week antecedent period, with 3.57 and 2.97 inches, respectively. The 2000 wet season sampling events (*i.e.*, September and October) exhibited substantially different rainfall amounts during the 2-month antecedent period (23.15 and 14.21 inches, respectively). The March and April sampling events had the lowest two-month antecedent period rainfall amounts.

4.1.2 *Stream Stage*

Water depths measured at each station during the sampling events performed during 2000 are tabulated in **Appendix Table B-1**.

West Side

Stream stages on the west side of the ranch during 2000 averaged 1.2 feet and ranged from 0.0 to 3.2 feet. Overall, stream stages measured during 2000 are higher than those measured during 1997 and 1998, but are comparable to those measured during the 1999 monitoring year. During 1999, stream stages for the Catfish Creek and North Creek monitoring stations averaged 1.5 feet with a range of 0.0 to 2.6 feet (VHB, 1999) compared with an average of 1.2 feet recorded during the 2000 monitoring year. The lower stream stages reported during the 2000-monitoring year are not unexpected considering that below average rainfall amount recorded.

The deepest waters of the streams traversing the west side of the Palmer Ranch are located in Trunk Ditch. Here, depths of approximately 8 feet can be found near the center of its reconstructed segment that runs adjacent to the Country Club of Sarasota and Prestancia. Station CC-4 is located on the reconstructed segment of Trunk Ditch and exhibited an average depth of 2.8 feet. Station CC-3, which is also located in Trunk Ditch, had the second highest average stream stage during the 2000 monitoring year at 2.1 feet.

The lowest stream levels in Catfish Creek were observed during the September 2000 monitoring event and reflect the dry conditions and lack of rainfall associated with severe drought conditions which occurred throughout most of 2000. Average stream stages for Stations CC-1, CC-2, CC-5 and NC-6 were all below 1.0 foot during the year (Appendix

Table B-1). The lowest average stream stage was recorded in Station CC-2. Station CC-2 has exhibited dry conditions (*i.e.*, stream stage of 0.0 feet) for one of the sampling events (March) during the 1996, 1997, 1998, 1999 and 2000 monitoring years.

East Side

Although rainfall recorded during the 2000 monitoring year was substantially below normal, stream stages measured in South Creek are comparable to those observed for previous monitoring years. The observed stream stage was below 1998 levels because of the abnormal seasonal rainfall trends (*El Nino*) which occurred at the end of 1997 and continued into 1998. During the 2000 monitoring year, stream stages at the four monitoring stations in South Creek averaged 0.6 feet with a range from 0.0 to 1.7 feet (**Appendix Table B-1**) compared to an average stream stage of 1.3 feet determined during 1998. Average stream stages recorded from 1985 through 1999 ranged from 0.4 to 1.5 feet (CCI, 1986, 1988a, 1988b, 1990, 1991, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 1999).

Spatially, Station SC-1 exhibited the greatest water depths during the 2000 monitoring year. The shallowest stream stages were exhibited by Station SC-3 which averaged only 0.4 feet deep for all sampling events. Station SC-3 is located at upper reach of the South Creek basin. Seasonally, the highest water levels at the four South Creek monitoring stations were recorded during the July and October 2000 monitoring events which followed 9.19 and 14.21 inches of rainfall during a 2-month period preceding the sampling event, respectively. The lowest water level was determined for the April sampling event when all sites were dry. This water level trend is similar to the seasonal trends reported during previous monitoring years (CCI, 1986, 1988a, 1988b, 1990, 1991, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 1999), except for 1998 which reflects the *El Nino* climatic event.

4.1.3 *Stream Flow*

West Side

As evident in **Appendix Table B-2**, stream flows measured during the 2000 monitoring year for all six monitoring stations in Catfish and North Creeks ranged from 0.0 to 8235.5 gallons per minute (GPM) and averaged 985.0 GPM. During the sixteenth year of monitoring, stream flows in the Catfish Creek/Trunk Ditch Basin ranged from 0.0 to 170.5 GPM in its upper reaches (CC-1 and CC-2) and from 0.0 to 67.3 GPM in its mid-reach (CC-3 and CC-4). Stream flows recorded for the six monitoring stations during the 2000 monitoring year are illustrated in **Figure 4.2**.

Seasonally, the highest steam flows during 2000 occurred during the September monitoring event with stream flows in Catfish Creek averaging 1899.9 GPM. High stream flows measured in September coincide with the high 2-month 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.

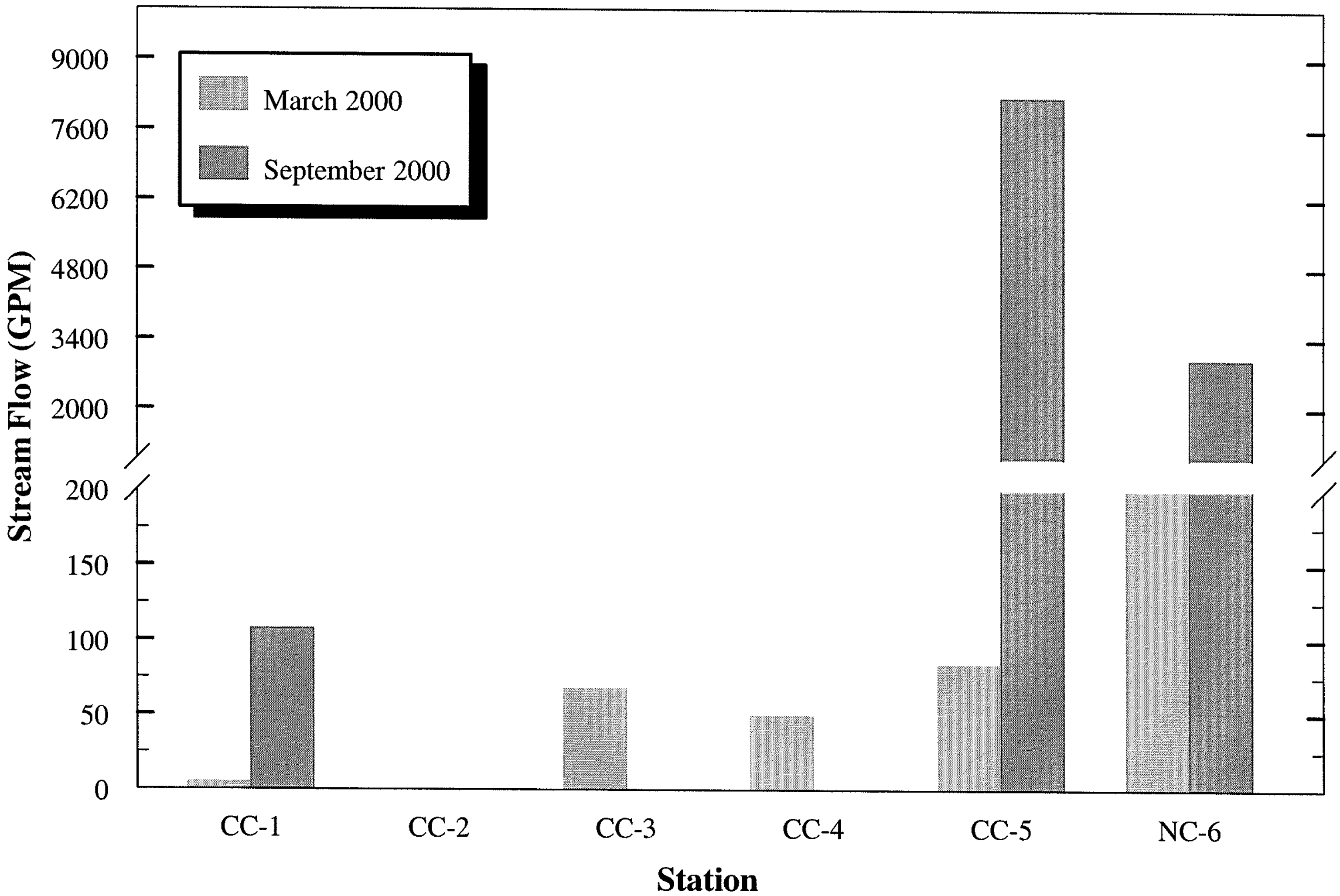


FIGURE 4.2. **STREAM FLOWS MEASURED DURING MONITORING EVENTS CONDUCTED ON THE WEST SIDE OF THE PALMER RANCH FROM JANUARY THROUGH DECEMBER 2000.**

Spatially, low flow conditions were observed in the Catfish Creek/Trunk Ditch Basin at Stations CC-1, CC-2, CC-3 and CC-4. During 2000, there was no discernable flow at Station CC-2. Station CC-2 has also exhibited the lowest flow conditions during the previous monitoring years. The highest stream flows were determined for Station CC-5 with an average of 4139.5 GPM and range from 83.5 to 8235.5 GPM.

During the 2000 monitoring year, positive stream flows (*i.e.*, measurable flows) were recorded for 8 of the 12 measurements (*i.e.*, 67 percent) taken. The percentage of positive flows measured during 2000 is lower than most of those reported for previous monitoring years (CCI, 1986, 1988a, 1988b, 1990, 1991, 1992a, 1993, 1994, 1997, 1998, 1999 and VHB 1999). A higher incident of positive flows (*i.e.*, 100 percent) was observed during the 1995 monitoring year and is directly attributed to the wetter conditions reported with the annual rainfall being 28 inches higher than the 23-year average. The historic high 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. However, the substantial lack of rain witnessed in 2000 has negatively affected the current stream flow percentage on both Catfish and North Creeks.

<u>East Side</u>

As evident in **Appendix Table B-2**, positive stream flows (*i.e.*, measurable flows) were recorded for only 5 of 16 measurements (*i.e.*, 31 percent) taken during the 2000 monitoring year in the South Creek Basin. The percentage of positive flows measured during 2000 is lower than the 56 to 100 percent positive flow measurements observed during the 1991 through 1999 monitoring years (CCI, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 1999). During 2000, stream flow in South Creek averaged 34.7 gallons per minute (gpm) and ranged from 0.0 to 223.1 gpm. Stream flows measured during 2000 are presented in **Figure 4-3**. Due to below average rainfall amounts recorded during 2000, the mean stream flows were lower than those recorded during the previous monitoring years (CCI, 1986, 1988a, 1988b, 1990, 1991, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 2000). The low average stream flows are attributable to the below average rainfall and subsequent drought conditions that occurred at the beginning of and throughout the year.

Seasonally, stream flows followed the same general trends described for stream stage with the highest flows being observed during the October 2000 monitoring event when stream flows averaged 55.76 GPM (**Appendix Table B-2**). The higher stream flows measured in October 2000 probably resulted from saturated soil conditions caused by the only substantial rainfall amounts that occurred during the summer of 2000. Saturated soil conditions can result in an elevated groundwater table and a higher percentage of surface runoff, and therefore, increased stream flow.

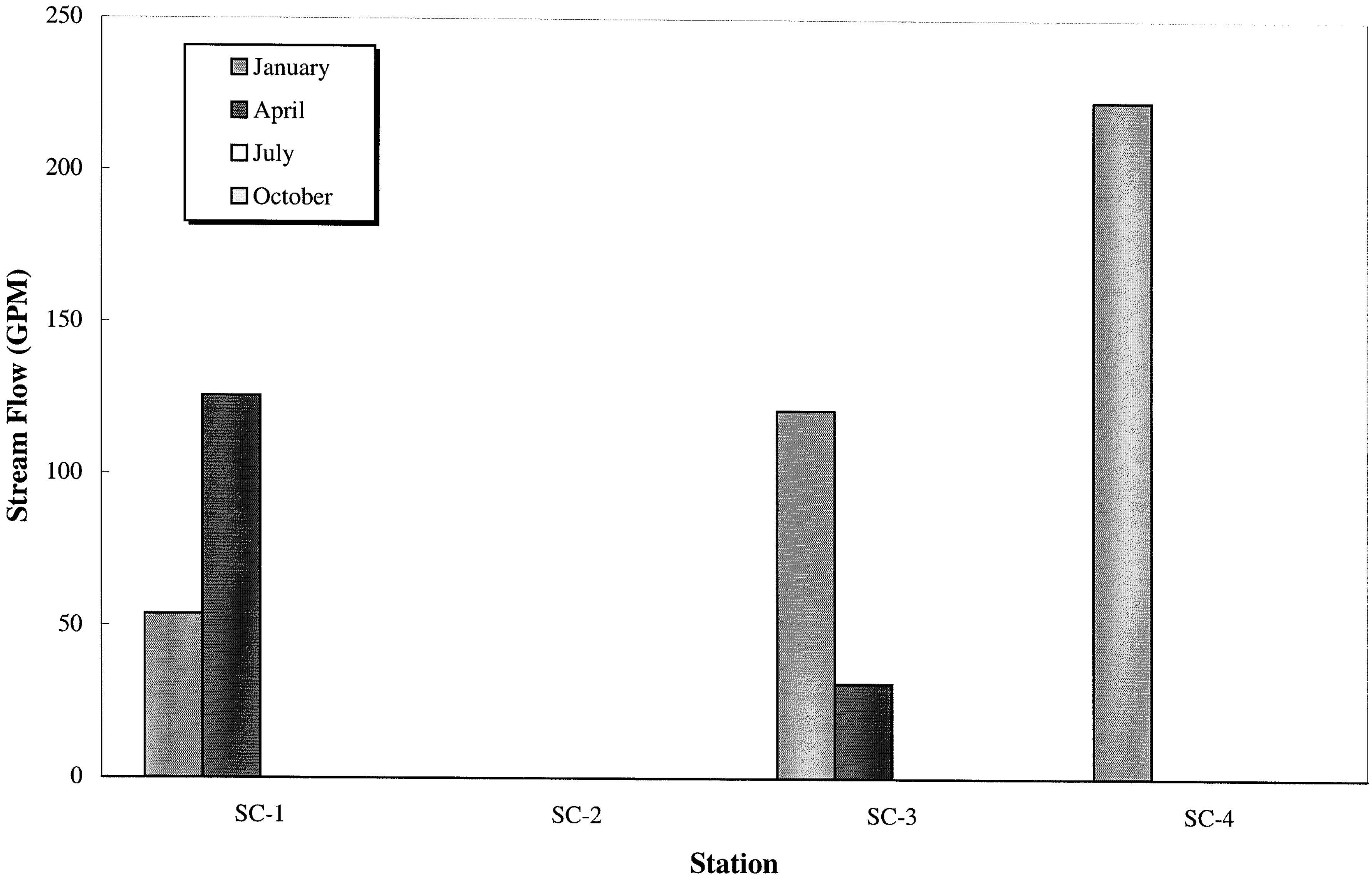


FIGURE 4.3. STREAM FLOWS MEASURED DURING MONITORING EVENTS CONDUCTED ON THE EAST SIDE OF THE PALMER RANCH FROM JANUARY THROUGH DECEMBER 2000

Spatially, stream flows followed expected trends with flows generally increasing in a downstream direction. Stream flows in the upper reaches (*i.e.*, Stations SC-3 and SC-4) exhibited no flow while the lower reach (SC-1 and SC-2) ranged from 0 to 223.05 GPM.

4.2 Physical Water Quality Parameters

4.2.1 *Water Temperature*

Appendix Table B-3 presents the surface water temperature measurements acquired during the 2000 monitoring year.

West Side

Results indicate that the water temperature of the streams of the west side of the Palmer Ranch averaged 25.5°C and ranged from 20.1 to 30.0°C during the two monitoring events. This range is similar to those recorded during previous years of monitoring (Palmer Venture, 1986; and CCI, 1986, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995, 1996, 1997, 1998, 1999 and VHB, 1999).

As expected, the lowest water temperatures were recorded in the streams of the west side during the March 2000 event with the highest water temperatures recorded during the September monitoring event. Water temperatures averaged 28.9°C during the September 2000 event, while an average temperature of 21.3°C was observed during the March event.

Average temperatures for Catfish Creek and North Creek for each event are very similar with differences among stations generally being 2°C or less.

East Side

Results indicate that the water temperature in South Creek on the Palmer Ranch averaged 22.5 °C and ranged from 18.5 to 28.3°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, 1995, 1996, 1997, 1998, 1999 and VHB, 1999).

Unexpectedly, the lowest water temperatures averaging 19.6°C were recorded in the streams of the east side during the fall quarterly event (*i.e.*, October 2000), with higher water temperatures recorded during the January and July monitoring events. The highest water temperatures, averaging 27.3°C, were recorded during the July 2000 (*i.e.*, summer) monitoring event. Water temperatures recorded for the January event averaged 20.8°C. Average water temperatures determined for each station in the South Creek basin are very similar with temperature differences among stations being less than 2°C.

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. 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*

West Side

As evidenced in **Appendix Table B-4**, Catfish Creek and North Creek exhibited an average specific conductance of 852 micromhos per centimeter (µmhos/cm) with a range from 342 to 1,283 µmhos/cm during 2000. In previous studies, Catfish Creek and North Creek exhibited specific conductance ranges of 366 to 1,625 µmhos/cm (CCI, 1991, 1992a, 1993, 1994, 1995, 1996, 1997, 1998, 1999 and VHB, 1999). A higher range of conductivity levels (567 to 1,625 µmhos/cm) was reported for the sixth monitoring year and probably resulted from the relatively low amount of rainfall that occurred during 1990.

Seasonally, the lowest average conductivity of 739 µmhos/cm was recorded for the September 2000 event with a higher average conductivity of 973 µmhos/cm determined for the March sampling event. The lower conductivity levels measured in September most likely resulted from the cumulative effects of greater rainfall and subsequent increases in surface runoff of low conductivity storm water (refer to **Table 4.1**).

In a comparison of both streams monitored during 2000 within the west side of Palmer Ranch, the overall annual mean conductivities for North Creek and Catfish Creek Basins were 1,097 and 798 µmhos/cm, respectively. Spatially, the lowest conductivity levels in the Catfish Creek/Trunk Ditch Basin were determined in the upper reaches of the basin with higher conductivities in the mid- and lower portions of the basin. Specific conductivities in the upper reaches of Catfish Creek averaged 578 µmhos/cm compared with an average of 927 µmhos/cm observed for the mid-reach.

East Side

South Creek exhibited a range in specific conductance of 616 to 1,276 µmhos/cm compared with conductivity levels ranging from 289 to 1,497 µmhos/cm during the fourth through the fifteenth monitoring years (CCI, 1988b, 1991, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 1999). Above normal rainfall in 1995 resulted in the lowest specific conductance levels ranging from 289 to 1,100 µmhos/cm. The highest values were observed during the sixth monitoring year and resulted from the relatively low amount of rainfall that occurred during 1990. However, the highest average conductivity values observed to date occurred this year (933 µmhos/cm). Seasonally, the lowest conductivities recorded during 2000 occurred during the October monitoring event when conductivities averaged 734 µmhos/cm. As described above, these lower conductivities can be correlated to lack of precipitation (drought conditions) and are most likely resulted from cumulative effects of increased surface runoff of low conductivity storm water during a period of high rainfall (refer to **Table 4.1**). Specific conductivity levels at the four sampled stations averaged 915, 1,152 and

734 µmhos/cm during the January, July and October sampling events, respectively. South Creek was dry during the April 2000 monitoring event.

Average conductivities measured in the South Creek Basin for the upper and lower reaches were 910 and 957 µmhos/cm, respectively. A slight trend for higher conductivity values in the upper reach of South Creek was indicated in the 1999 annual report (VHB, 1999). However, the 2000 data indicates a slightly higher conductivity in the lower reach and these results are similar to those observed during the previous years of monitoring (CCI 1988a, 1988b, 1991, 1992a, 1995, 1996, 1997, 1998 and 1999). During these years, no apparent spatial trends in conductivity were evident within the South Creek Basin of the Palmer Ranch. The higher conductivity in the lower reach could reflect the effects of dewatering for construction.

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 12 conductivity measurements made during the 2000 monitoring year on the east side exceeded the 1,275 µmhos/cm.

4.2.3 *Total Suspended Solids*

During the sixteenth year of monitoring, Catfish Creek and North Creek in the Palmer Ranch exhibited a range of total suspended solids (TSS) from 0.3 to 17.2 mg/L with an annual average of approximately 8.4 mg/L (**Appendix Table B-5**). Total suspended solid levels observed during 2000 were comparable to those determined in 1994 and 1995 (CCI, 1995 and 1996) and generally higher than those recorded during other previous monitoring years (Palmer Venture, 1986; CCI, 1986, 1987, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1996, 1997, 1998, 1999 and VHB, 1999).

The highest TSS levels during 2000 were recorded in the upper-reach of Catfish Creek (*i.e.*, CC-1). The lowest TSS levels were also recorded in the upper-reach of Catfish Creek (*i.e.*, CC-2). The highest average TSS level (*i.e.*, 11.4 mg/L) was recorded for the September sampling event. The higher TSS values reported for the September sampling event are probably due to higher rainfall recorded at the end of summer wet season, after a period of lower rainfall, and the subsequent increase in surface water runoff which carries particular into the creek. The high concentrations of TSS recorded during 2000 monitoring year may be attributed to below average rainfall. Overall, the observed TSS range of approximately 0.3 to 17.2 is slightly higher then the 1999 monitoring data (1.0 to 13.0) and represents some of the highest levels observed to date.

East Side

During the 2000 monitoring year, stations along South Creek on the Palmer Ranch exhibited a range of total suspended solids (TSS) from 0.6 to 47.0 mg/L, with an annual average of 13.1 mg/L (**Appendix Table B-5**). Overall, the TSS levels observed are comparable to those recorded during previous monitoring years (Palmer Venture, 1986; CCI, 1986, 1987, 1988a, 1988b, 1991, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 1999), and exhibit a slightly higher average than those observed last year.

The highest TSS levels of 47.0 and 43.0 mg/L were recorded in the upper reach of the creek at Stations SC-4 and SC-3, respectively, during the October 2000 monitoring event. The elevated TSS level probably resulted from higher organic matter content (*i.e.*, aquatic plants) because of low water levels at these sites and/or from upstream construction within the basin. The lowest TSS level was recorded at Station SC-1 (*i.e.*, lower reach) during the July 2000 event. Overall, lower TSS concentrations were observed at most monitoring stations during the July event.

4.2.4 *Turbidity*

West Side

During the 2000 monitoring year, turbidity levels measured in Catfish Creek and North Creek ranged from 1.1 to 22.0 NTU and averaged 6.4 NTU (**Appendix Table B-6**). Similar turbidity levels were observed during 1992 and 1994 (CCI, 1993 and 1995). In comparison, a turbidity range of 0.3 to 36 NTU was exhibited during the previous nine years of monitoring (CCI, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998, 1999 and VHB, 1999).

The highest mean turbidity level (*i.e.*, 7.9 NTU) occurred September 2000 while the lowest mean level (*i.e.*, 4.5 NTU) was determined for the March event (**Appendix Table B-6**). This seasonal variation typically results from differences in rainfall amounts and the subsequent changes in storm water inputs to the surface waters.

<u>East Side</u>

During the sixteenth year of the monitoring program, turbidity levels measured in South Creek ranged from 0.8 to 11.1 NTU with an overall average of 4.2 NTU (**Appendix Table B-6**). The turbidity levels measured in 2000 were significantly lower than those observed in 1998 and 1999. Slightly lower turbidity levels were measured during the 1995 and 1997 monitoring years. Turbidity levels ranged from 1.7 to 11.8 NTU, and from 1.0 to 5.3 NTU during 1995 and 1997, respectively (CCI, 1996 and 1998).

Seasonally, the highest mean turbidity level (*i.e.*, 5.8 NTU) occurred during the October sampling event while the lowest turbidity level (*i.e.*, 2.5 NTU) was determined for the July event (**Appendix Table B-6**).

The General Water Quality Criteria for all surface waters (FAC Chapter 62-302) 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 2000 monitoring year were in compliance with the applicable water quality criteria.

4.3 Oxygen Demand and Related Parameters

4.3.1 *Biochemical Oxygen Demand*

Biochemical oxygen demand can be defined as "*the amount of oxygen required by bacteria while stabilizing organic matter under aerobic conditions* "(Sawyer and McCarthy, 1978).

West Side

The decomposable organic matter present in Catfish Creek is mostly attributed to decaying vegetation and hydrocarbon inputs (*i.e.*, automobile emission, oil leakage, *etc.*). As presented in **Appendix Table B-7**, the 5-day biochemical oxygen demand (BOD_5) recorded in the two streams of the west side averaged 1.8 mg/L and ranged from <2.0 to 5.9 mg/L during the 2000 monitoring year.

Seasonally, the highest BOD_5 levels were recorded for the September event. This is different than previous year of monitoring when March had higher BOD_5 levels. September corresponds to the end of the summer-wet season when storm water runoff is high which typically results in more organic material being transported to the surface waters.

Biochemical oxygen demand levels in Catfish Creek averaged 1.8 mg/L with a range of <2.0 to 5.9 mg/L. Spatially, lower mean BOD_5 levels were observed among the mid to upper reach stations in the basin (**Appendix Table B-7**). A similarly low mean BOD_5 level of <2.0 mg/L was observed for the North Creek sampling station.

The BOD_5 levels measured during the 2000 monitoring year are comparable to levels reported for 1999 and are slightly higher than those reported in the 1995, 1996 and 1997 monitoring years.

<u>East Side</u>

The decomposable organic matter present in South Creek is mostly attributed to decaying vegetation with a minor contribution hydrocarbon input (*i.e.*, automobile emission, oil leakage, *etc.*) resulting from runoff from Interstate-75. As presented in **Appendix Table B-7**, the 5-day biochemical oxygen demand (BOD_5) recorded in the South Creek Basin during the 2000 monitoring year averaged 1.6 mg/L and ranged from <2.0 to 4.0 mg/L. Seasonally, the highest mean BOD_5 levels were determined during the July 2000 sampling event. Spatially, the highest BOD_5 levels were measured in samples collected in both the upper and mid-reach's of South Creek (*i.e.*, Stations SC-1 and SC-3). Overall, lower BOD_5 levels were observed at Stations SC-4 and SC-2 and were consistent between events.

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). Based on BOD_5 measurements made in North Creek and Catfish Creek during the 2000 monitoring year, the surface water of the west side generally exhibited clean conditions with 9 of the 11 measurements below the 3.3 mg/L screening level. South Creek generally exhibited very clean water with eleven of the twelve measurements performed in 2000 being under the 3.3 mg/L screening level. The BOD_5 concentrations exceeding the 3.3 mg/L screening level were measured during the July and September 2000 monitoring events when decaying plant material was abundant and water levels were minimal, again as a result of drought conditions.. Because of low flow conditions exhibited for these monitoring events, a build-up of detritus probably occurred resulting in elevated BOD_5 concentration throughout the creeks.

The General Criteria for BOD_5 in all surface waters as designated by FAC Chapter 62-302, “Rules and Regulations of the Department of Environmental Protection,” as well as Sarasota County Ordinance No. 98-066, as amended, specifies that BOD_5 shall not be increased to levels that would result in violations of dissolved oxygen. Only three of the 23 BOD_5 concentrations measured in Catfish Creek, North Creek and South Creek during 2000 exceeded the 3.3 mg/L screening level that the FDER (1990) considers to suggest potential water quality problems. Also during the sixteenth year of monitoring, none of the 12 BOD_5

measurements on the east side and only one of the 11 BOD_5 measurements on the west side exceeded the 5 mg/L level which Hynes (1966) considered "doubtful" or between "fairly clean" and "bad" water quality.

4.3.2 *Dissolved Oxygen*

West Side

Appendix Table B-8 provides the results of dissolved oxygen measurements acquired during the sixteenth year of monitoring. Overall, dissolved oxygen was found to average 5.1 mg/L, with a range of 1.8 to 8.6 mg/L.

Seasonally, the highest average dissolved oxygen levels were observed for the September monitoring event with concentrations averaging 5.6 mg/L. Typically, higher dissolved oxygen levels are associated with the lower water temperatures observed during the March event. In contrast, dissolved oxygen concentrations for the March monitoring event averaged 4.5 mg/L in conjunction with the lower average water temperatures. The 2000 monitoring year seasonal trends are different than those observed for dissolved oxygen during previous monitoring years (CCI, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998, 1999 and VHB, 1999) which reflect the changes in the solubility of dissolved oxygen throughout the water column with changes in water temperature. Spatially, average dissolved oxygen concentrations were higher for stations within the Catfish Creek Basin with lower concentrations recorded for Station NC-6 in the North Creek Basin.

The dissolved oxygen concentrations obtained during the 2000 monitoring year for Catfish and North Creeks are generally comparable to those measured during the previous monitoring years (CCI, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998, 1999 and VHB, 1999) but slightly higher than the concentrations determined during the initial two years of the monitoring program (Palmer Venture, 1986; and CCI, 1986). During the third through fifteenth monitoring years, dissolved oxygen was found to average from 4.5 to 6.3 mg/L (CCI, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998, 1999 and VHB, 1999).

During the 2000 monitoring year, dissolved oxygen concentrations in the two streams of the west side sometimes occurred at levels below the 5.0 mg/L criteria specified by FAC Chapter 62-302 for predominantly freshwater. Of the 11 dissolved oxygen measurements made during 2000, only three were below the 5.0 mg/L state criteria.

<u>East Side</u>

Appendix Table B-8 provides the results of dissolved oxygen measurements acquired during the 2000 monitoring year in South Creek. Overall, dissolved oxygen was found to average 5.3 mg/L and range from 2.5 to 8.0 mg/L. The highest dissolved oxygen concentration (8.0 mg/L) was recorded at Station SC-2 during the July event. The lowest average dissolved oxygen level (*i.e.*, 2.5 mg/L) was recorded in the upper-reach of South Creek (at Station SC-3).

Seasonally, the highest average dissolved oxygen levels were observed for the January 2000 monitoring event with the lowest levels occurring during the October event. This is different than the seasonal trends observed during 1998, but is similar to the previous monitoring years (CCI, 1988a, 1988b, 1991, 1992a, 1993, 1996, 1997, 1998 and VHB, 1999) which reflect the changes in the solubility of dissolved oxygen in the water column with changes in water temperature. During 2000, the average dissolved oxygen levels followed seasonal trends and were lower during the warmer events, except for the October event. During the sixteenth monitoring year, dissolved oxygen concentrations in South Creek occurred at levels below the 5.0 mg/L criteria specified by FAC Chapter 62-302 for predominantly freshwater approximately 33.3% of the time. Of the twelve dissolved oxygen measurements made during the 2000 monitoring year, four measurements were below the 5.0 mg/L state criteria.

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 mid-afternoon 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).

4.3.3 *Water pH*

West Side

Results of pH monitoring in Catfish Creek and North Creek during 2000 are provided in **Appendix Table B-9**. During the 2000 monitoring year, pH levels in these two streams of the Palmer Ranch ranged from 6.8 to 7.6. Similar pH ranges were observed during the first through fifteenth monitoring years (Palmer Venture, 1986; and CCI, 1986, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998, 1999 and VHB, 1999).

During 2000, the lowest pH levels were observed at CC-1 and NC-6 with pH levels averaging 6.9, respectively. The highest pH levels were recorded at Stations CC-5 and CC-2 which exhibited average pH levels of 7.5 and 7.6, respectively. These minimal differences are attributed primarily to spatial variations in community metabolisms.

East Side

Results of pH monitoring in South Creek during 2000 are given in **Appendix Table B-9**. During the 2000 monitoring year, surface water quality stations along South Creek exhibited pH levels ranging from 6.2 to 7.4. The range of pH observed during the 2000 monitoring year was similar to that observed during previous years of monitoring (Palmer Venture, 1986; and CCI, 1986, 1988a, 1988b, 1991, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 1999).

Seasonally, slightly higher pH levels were recorded for the October sampling event. These higher pH levels are probably associated with the less input of low pH stormwater runoff and greater accumulation of algae and plants due to lower stream flows resulting in a greater level of photosynthetic activity. Spatially, the lowest pH levels were observed at SC-3 with pH levels averaging 6.4 units. The highest pH levels were recorded at Station SC-2 with an average of 7.1. These slight differences in pH distributions in South Creek are primarily attributed to spatial variations in community metabolisms.

Differences or changes in pH are indicative of the effects of net community metabolisms 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:

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

As a result of CO_2 production during respiration, water pH is depressed due to the release of hydrogen ions (H^+) as H_2CO_3 dissociates. In contrast, carbon dioxide is consumed faster than it is produced during periods of net community photosynthesis (primary production). Thus, the reaction 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 62-302) and in Sarasota County Ordinance No. 98-066, as amended, the allowable variation in pH is 1.0 units above or below the normal pH if 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 backgrounds 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 sixteenth year of monitoring, all pH measurements in Catfish Creek, North Creek and South Creek were within the allowable range of 6.0 to 8.5.

4.4 Macronutrients

4.4.1 *Total Nitrogen*

West Side

Appendix Table B-10 provides the results of total nitrogen measurements acquired during the 2000 monitoring year for Catfish Creek and North Creek. Overall, total nitrogen levels in Catfish Creek and North Creek ranged from 0.91 to 2.32 mg/L and averaged 1.49 mg/L during the 2000 monitoring year. The 2000 total nitrogen level is the second highest average ever recorded. Similar average total nitrogen concentrations of 1.42, 1.44, 1.36 and 1.31 mg/L were observed for the third, fourth, eighth and ninth years of monitoring, respectively (CCI, 1988a, 1988b, 1993 and 1994). An even higher mean concentration of 1.86 was observed in the second year of monitoring during 1986. A slightly lower average total nitrogen concentration of 1.00, 0.97 and 1.20 mg/L was observed during the tenth, thirteenth and fourteenth years of monitoring (CCI, 1995b, 1998 and 1999).

Figure 4.4 provides the mean total nitrogen concentrations observed for the streams traversing the west side of the Palmer Ranch during the Second through Sixteenth monitoring years. Also included in **Figure 4.4** 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 concentrations for each component of total nitrogen (*i.e.*, ammonia, nitrate + nitrite, and organic nitrogen) are also depicted in **Figure 4.4** in order to compare the relative importance of each nitrogen fraction. The average total

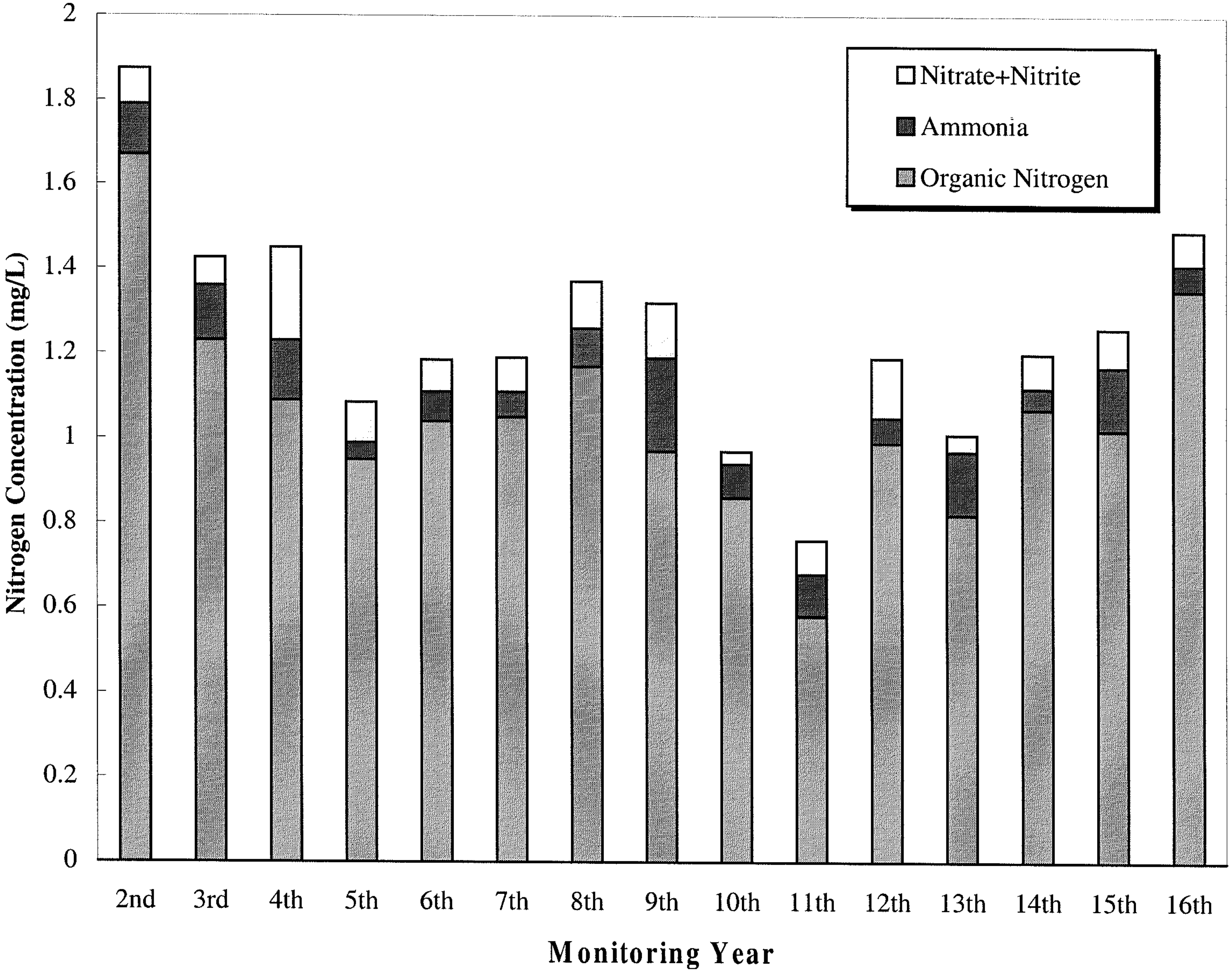


FIGURE 4.4. AVERAGE NITROGEN CONCENTRATIONS MEASURED ON THE WEST SIDE OF THE PALMER RANCH FROM THE SECOND THROUGH THE SIXTEENTH MONITORING YEARS

nitrogen concentrations for the six monitoring stations in these two streams of the west side of the Palmer Ranch increased in 2000. Of forms of nitrogen that are readily assimilated by algae and plants (*i.e.*, nitrate + nitrite, ammonia), ammonia nitrogen decreased this year and nitrate and nitrite nitrogen remained stable.

Seasonally, total nitrogen concentrations in September were higher than those observed during the March semi-annual monitoring event at all stations. During 2000, the upper, middle and lower reaches of Catfish Creek exhibited nearly identical average total nitrogen levels. In Catfish Creek the highest average total nitrogen concentration of 1.55 mg/L was observed at Station CC-2. The lowest average total nitrogen concentration in Catfish Creek was 1.35 mg/L, and was recorded at Station CC-3. The average total nitrogen levels determined in North Creek were significantly above the average level reported for the stations located in Catfish Creek.

As has been reported for all previous monitoring years, the largest fraction of total nitrogen observed during 2000 is organic nitrogen. During the sixteenth monitoring year, organic nitrogen represented approximately 90.6 percent of total nitrogen and averaged 1.35 mg/L. The second most abundant form of nitrogen was nitrate nitrogen that represented approximately 4.7 percent of the total nitrogen with an average concentration of 0.07 mg/L. Ammoniacal nitrogen (*i.e.*, ionized plus unionized ammonia) represented approximately 4.0 percent of the total nitrogen with an average level of 0.06 mg/L. As expected, the smallest fraction of total nitrogen was found to be nitrite with an average concentration of 0.01 mg/L that represented 0.7 percent of the total nitrogen concentration.

Similarly, CCI (1986, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998, 1999 and VHB, 1999) reported generally 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 as organic nitrogen. Organic nitrogen represented from 76 to 91 percent of the total nitrogen content and averaged from 0.58 to 1.67 mg/L during these periods. The second most abundant form of nitrogen has generally been ammoniacal nitrogen that represented from 4 to 10 percent of the total, with concentrations averaging 0.04 to 0.22 mg/L over the same period. However, in the fourth, twelfth and fourteenth years, nitrate nitrogen represented a higher percent of the total nitrogen. Nitrate represented approximately 4 to 15 percent of the total nitrogen content with average nitrate levels ranging from 0.04 to 0.21 mg/L during the previous years of monitoring. As during the 2000 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 most years of monitoring.

East Side

Total nitrogen measurements acquired during the 2000 monitoring year in South Creek are provided in **Appendix Table B-10**. During the four 2000 sampling events, total nitrogen concentrations in South Creek averaged 1.32 mg/L and ranged from 0.84 to 2.01 mg/L. Spatially, the highest average total nitrogen concentration of 1.71 mg/L was observed at Station SC-4. Station SC-2 exhibited the lowest average total nitrogen concentration at 0.94 mg/L during the 2000 monitoring year. Seasonally, the highest mean total nitrogen concentration (1.34 mg/L) was observed for the July monitoring event. The total nitrogen concentration measured during the July event was just slightly above the January and October results, which were both 1.31 mg/L, respectively. In addition, the July monitoring results were comparable to the average total nitrogen concentration recorded in July of 1999 (VHB, 1999).

Overall, total nitrogen concentrations measured during 2000 were only higher than those determined during ninth, eleventh and twelfth years when total nitrogen averaged 1.17, 1.06 and 1.05 mg/L, respectively (CCI, 1995, 1997 and 1998). The results for year 2000 stopped a possible trend that occurred for the two previous years, where total nitrogen levels had increased from 1.05 to 1.54 in 1998, and up to 1.89 in year 1999 (CCI, 1999, VHB, 1999).

Figure 4.5 provides the mean total nitrogen concentrations observed for South Creek during the second, third, fourth, fifth, sixth, seventh, tenth, eleventh, twelfth, thirteenth, fourteenth, fifteenth and sixteenth monitoring years. Also included in **Figure 4.5** is the average total nitrogen concentration measured in South Creek during the "Stormwater Pollutant Loading

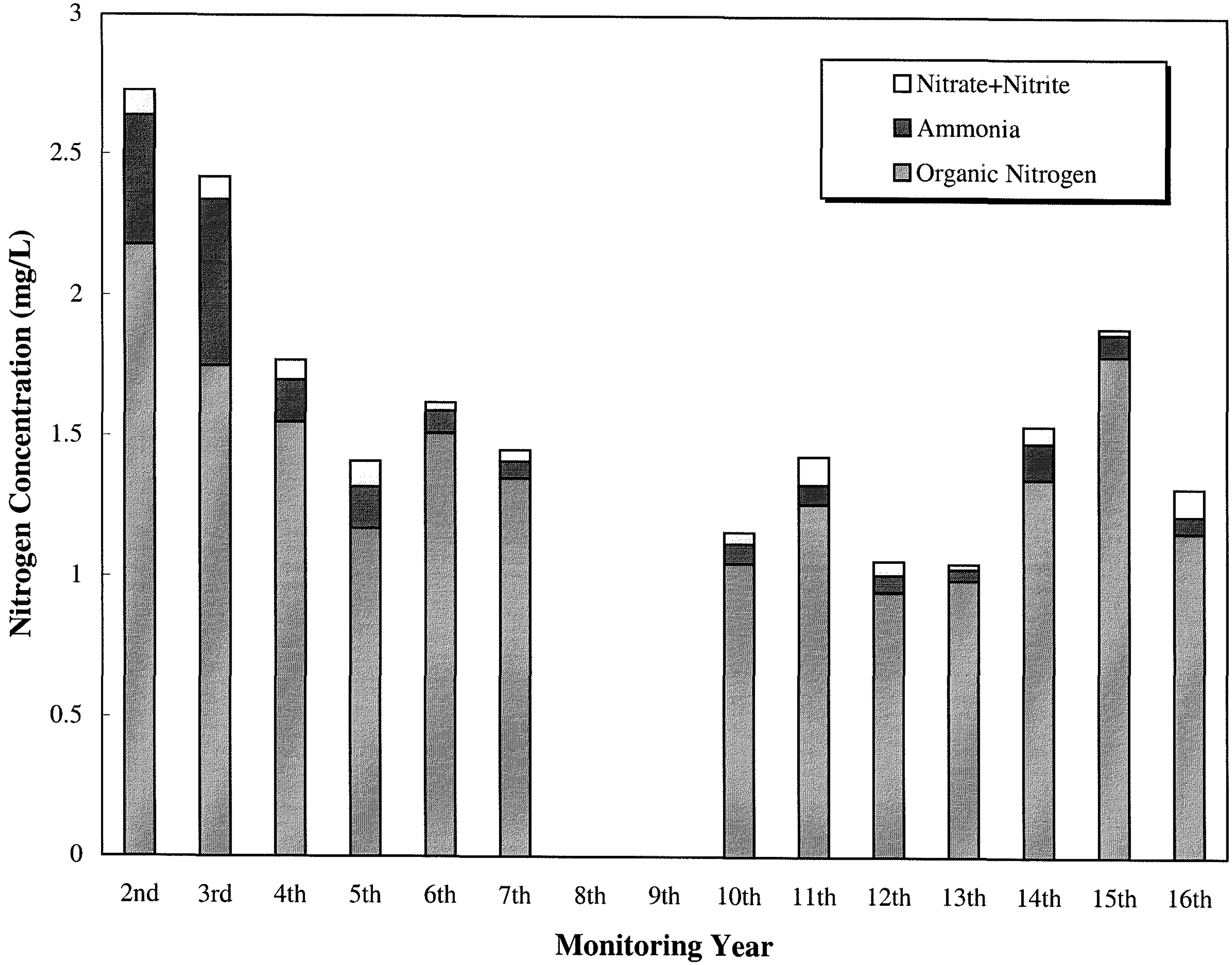


FIGURE 4.5. AVERAGE NITROGEN CONCENTRATIONS MEASURED ON THE EAST SIDE OF THE PALMER RANCH FROM THE SECOND THROUGH THE SIXTEENTH MONITORING YEARS

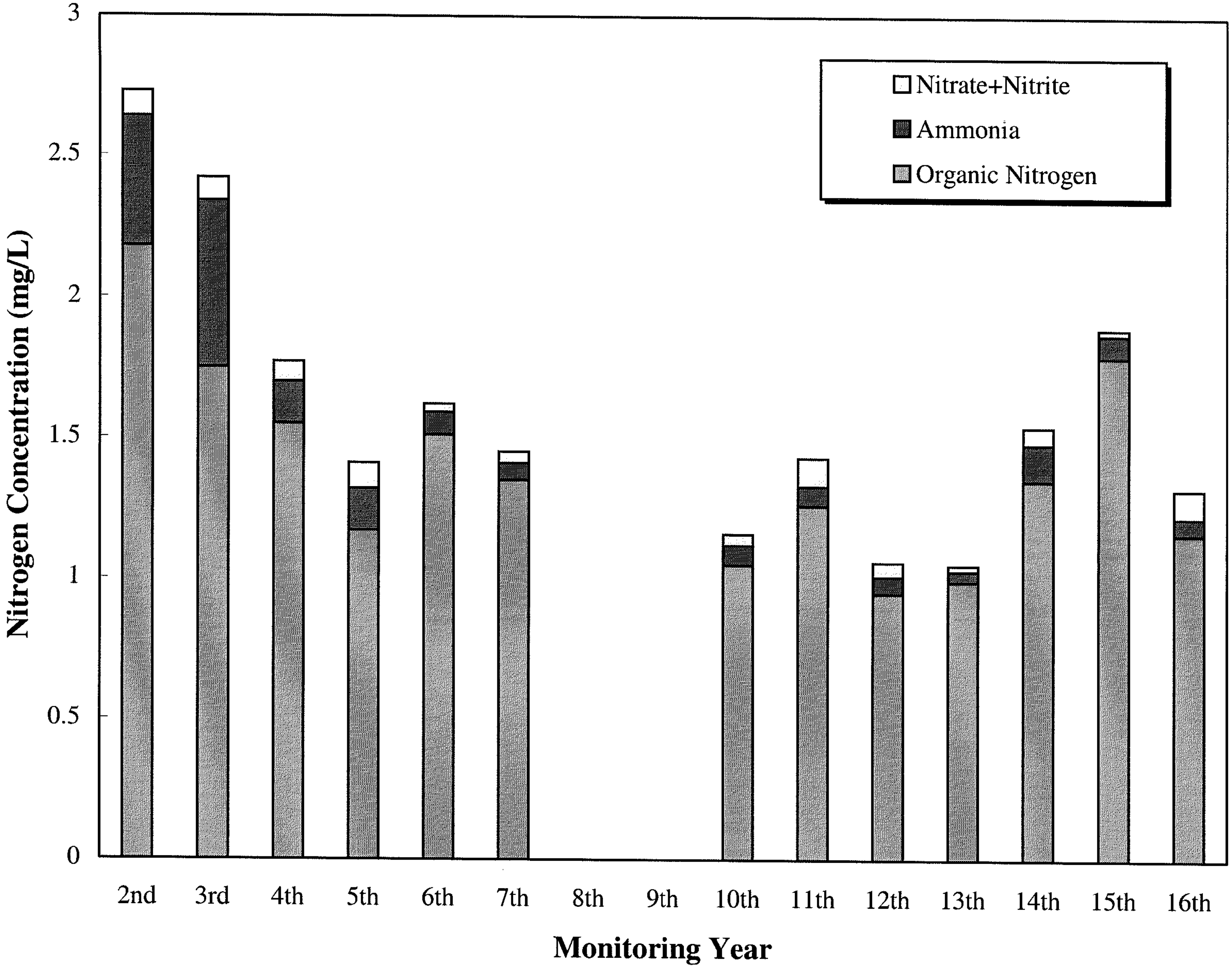


FIGURE 4.5. **AVERAGE NITROGEN CONCENTRATIONS MEASURED ON THE EAST SIDE OF THE PALMER RANCH FROM THE SECOND THROUGH THE SIXTEENTH MONITORING YEARS**

Monitoring Program" performed at the Palmer Ranch (CCI, 1992b). In addition, mean concentrations for each component of total nitrogen (*i.e.*, ammonia, nitrate + nitrite, and organic nitrogen) are also depicted in **Figure 4.5** in order to compare the relative importance of each nitrogen fraction. Prior to 1998 and 1999, average total nitrogen concentrations in South Creek had decreased. The average total nitrogen concentration measured during the 2000 monitoring year is below the average recorded during the 15 years of monitoring. The most pronounced decrease in nitrogen content occurred after the third monitoring year (*i.e.*, 1987) (**Figure 4.5**). At that time, an area located upstream of the eastern branch of South Creek on the Palmer Ranch property was used as a dairy farm (August 1987). Before the deactivation of the dairy farm, ammoniacal nitrogen comprised from 11 to 25 percent of the total nitrogen. After the deactivation of the dairy farm, 4 to 6 percent of the total nitrogen content of South Creek was in the form of ammonia. Not only have total nitrogen levels decreased, the forms of nitrogen that are readily assimilated by algae and plants (*i.e.*, nitrate + nitrite and ammonia) have also declined. The largest fraction of total nitrogen observed during the entire monitoring program is organic nitrogen. During the sixteenth monitoring year, organic nitrogen represented approximately 87.9 percent of total nitrogen and averaged 1.16 mg/L. The second most abundant form of nitrogen during 2000 was nitrate nitrogen, which represented approximately 7.3 percent of the total nitrogen with an average concentration of 0.10 mg/L. Ammoniac nitrogen (*i.e.*, ionized and un-ionized ammonia) represented approximately 4.5 percent of the total nitrogen with an average level of 0.06 mg/L. As expected, the smallest fraction of total nitrogen was found to be nitrite with the concentration in all samples collected during 2000 being below the 0.01 mg/L analytical detection limit. Therefore, nitrite represented approximately 0.4 percent of the total nitrogen concentration.

As stated previously, different breakdowns of total nitrogen were reported for South Creek during previous monitoring years (CCI, 1986, 1988a, 1988b, 1991 and 1992a). The largest fraction of total nitrogen observed during the previous years of monitoring also occurred in the form of organic nitrogen. Prior to 1988, organic nitrogen represented from 71 to 84 percent of the total nitrogen content and averaged from 1.08 to 2.18 mg/L. After the fourth monitoring year, organic nitrogen comprised ≥88 percent of the total nitrogen measured in South Creek. Similarly, the second most abundant form of nitrogen prior to 1988 was ammoniacal nitrogen that represented from 11 to 24 percent of the total nitrogen content with average levels of 0.15 to 0.59 mg/L. Ammoniacal nitrogen also represented the second most abundant form of nitrogen after 1988. However, generally only 4 to 5 percent of the nitrogen was present in the ammonia fraction. Nitrate and nitrite represented approximately from 2 to 7 percent of the total nitrogen content with an average nitrate concentration ranging from 0.02 to 0.10 mg/L during the previous years of monitoring. As during the 2000 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.

As specified in FAC Chapter 62-302, 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, 1992a, 1993, 1994, 1995b, 1996, 1997 and 1998). Total nitrogen results obtained during the 2000 were about the average measured during the sixteen years of the monitoring program and only one of the 11 total nitrogen samples collected on the west side of the Palmer Ranch exhibited concentrations above the 2.0 mg/L screening level (considered by the FDEP (FDER, 1990) to be characteristic of eutrophic conditions). Only two of the twelve total nitrogen samples collected on the east side of the Palmer Ranch met and/or exceeded the screening level of 2.0 mg/L considered to be characteristic of eutrophic conditions. Both of these east side samples were collected at Station SC-4, where low water levels were observed throughout the year.

4.4.2 *Nitrite*

West Side

Nitrite levels observed in Catfish Creek and North Creek during the sixteenth year of monitoring are provided in **Appendix Table B-11**. As expected, nitrite concentrations throughout these two streams traversing the west side were much lower than for other forms of nitrogen, and too low to be a significant nutrient source. Four of the 11 samples collected during the 2000 monitoring year contained nitrite concentrations at or above the 0.01 mg/L analytical detection limit. During the previous monitoring years, nitrite concentrations measured in Catfish Creek and North Creek averaged <0.01 to 0.03 mg/L and had a range from <0.01 to 0.20 mg/L (CCI, 1987, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1997, 1998 ,1999 and VHB, 1999).

East Side

Nitrite levels observed in South Creek during the sixteenth year of monitoring are also provided in **Appendix Table B-11**. Nitrite concentrations throughout South Creek were much lower than the other forms of nitrogen, and too low to be a significant nutrient source. None of the twelve samples collected during the 2000 monitoring year contained nitrite concentrations above the analytical detection limit. During the previous monitoring years, nitrite concentrations measured in South Creek averaged <0.01 to 0.02 mg/L and had a range from <0.01 to 0.13 mg/L (CCI, 1986, 1987, 1988a, 1988b, 1991, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 1999).

As a nutrient, nitrite is covered by the general water quality standard (FAC Chapter 62-302). However, due to the observed low concentrations, nitrite was generally 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*

West Side

As shown in the results provided in **Appendix Table B-12**, nitrate levels observed for Catfish Creek and North Creek in the Palmer Ranch during 2000 exhibited a yearly average of 0.07 mg/L with a range of 0.01 to 0.22 mg/L. Similar nitrate concentrations were reported for the second, third, sixth, seventh, eighth, tenth, eleventh, thirteenth, fourteenth and fifteenth monitoring years. During these years average nitrate concentrations ranged from 0.04 to 0.10 mg/L (CCI, 1987, 1988a, 1991, 1992a, 1993, 1994, 1995b, 1996, 1998, 1999 and VHB, 1999). Slightly higher nitrate levels were reported for the ninth and twelfth monitoring years when nitrate averaged 0.10 and 0.13 mg/L, respectively (CCI, 1988b and 1997).

Nitrate levels were higher during the September monitoring event averaging 0.08 mg/L in Catfish and North Creeks compared to an average of 0.06 mg/L determined for the March sampling. The higher average nitrate level recorded during the September monitoring event resulted from elevated nitrate concentrations at Station CC-1 whose nitrate content was 0.22 mg/L. Nitrate concentrations of 0.16 and 0.12 mg/L were recorded at Station CC- 3 during both March and September monitoring events, with the concentration at the other monitoring stations being at lower levels (**Appendix Table B-12**). Spatially, the highest average nitrate concentration of 0.14 mg/L was observed at Station CC-3. Due to the very low levels of nitrate generally found during 2000 no other spatial trends could be discerned.

East Side

As shown in the results provided in **Appendix Table B-12**, nitrate levels observed for South Creek the Palmer Ranch during 2000 exhibited a yearly average of 0.10 mg/L with a range of <0.01 to 0.93 mg/L. This is the highest average value recorded to date and is solely attributed to the 0.93 mg/L determined at Station CC-4. Without the high nitrate level recorded at Station SC-4, the 2000 nitrate concentrations are comparable to those determined during the second, third, fifth and eleventh monitoring years when nitrate exhibited yearly averages from 0.02 to 0.04 mg/L and ranged from <0.01 to 0.21 mg/L (CCI, 1986, 1988, 1990 and 1995b).

Seasonally, the highest nitrate levels for the four monitoring sites during 2000 were observed during the July sampling event. Generally, slightly higher nitrate levels occur in October when higher rainfall amounts result in an increase of stormwater runoff, which occurs during the summer. Nitrate concentrations observed during the January and October events at almost all monitoring sites in the South Creek basin were just above the detection limits. These low concentrations of nitrate probably are a result of low inputs of nutrients in the form of stormwater runoff as well as higher nutrient uptake by aquatic vegetation.

Spatially, the highest average nitrate concentration of 0.32 mg/L was recorded for the upper reach (Station SC-4) of the creek (**Appendix Table B-12**).

As a nutrient, nitrate is designated as a parameter covered by the general water quality criteria (FAC Chapter 62-302), 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, without the elevated value determined at SC-4, the nitrate concentrations determined during the 2000 monitoring year were lower than or similar to those recorded during the previous years of monitoring 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 *Ammoniacal Nitrogen*

West Side

Appendix Table B-13 provides the results of ammoniacal nitrogen measurements (ionized plus un-ionized ammonia) recorded during the sixteenth year of monitoring on the west side of Palmer Ranch. As described previously, ammoniacal nitrogen represented approximately 4.0 percent of the total nitrogen measured during the 2000 monitoring year. Overall, ammoniacal nitrogen exhibited an average of 0.06 mg/L with a range from <0.01 to 0.17 mg/L. Ammonia concentrations measured during 2000 were within the range determined for the previous years of monitoring (Palmer Venture, 1986; and CCI, 1986, 1988a, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998, 1999 and VHB, 1999).

Seasonally, ammoniacal nitrogen concentrations in Catfish Creek and North Creek averaged 0.12 and 0.01 mg/L during the March and September sampling events, respectively. Spatially, the highest average ammoniacal nitrogen concentrations occurred in the mid and lower reaches of Catfish Creek with the ammonia concentrations averaging 0.10, 0.08 and 0.07 mg/L at Stations CC-3, CC-4 and CC-5, respectively.

East Side

Appendix Table B-13 provides the results of ammoniacal nitrogen measurements (ionized plus un-ionized ammonia) recorded during the sixteenth year of monitoring at South Creek. As described previously, ammoniacal nitrogen represented 4.5 percent of the total nitrogen measured during the 2000 monitoring year. Overall, ammoniacal nitrogen exhibited an average of 0.06 mg/L with a range from <0.01 to 0.16 mg/L. Similar ammoniacal nitrogen concentration were observed during 1996, 1997, 1998 and 1999. During these years, ammoniacal nitrogen levels ranged from <0.02 to 0.41 mg/L and averaged from 0.04 to 0.13 mg/L (CCI, 1997, 1998, 1999 and VHB, 1999). During the previous years of monitoring (Palmer Venture, 1986; and CCI, 1986, 1988a, and 1988b), ammonia concentrations were much higher than those measured during the 1996, 1997,1998, 1999 and 2000 monitoring years. These higher levels can be attributed to runoff originating from a dairy farm upstream of the Palmer Ranch property. In contrast, ammoniacal nitrogen concentrations measured for the sixth, seventh, tenth, and eleventh monitoring years were comparable to those measured during the last four monitoring years (CCI, 1991, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 1999).

The highest ammoniacal nitrogen concentrations in South Creek were recorded during the January 2000 sampling event averaging 0.12 mg/L. These higher ammoniacal nitrogen concentrations are believed to be associated with the decay of vegetation in the creek. Additional ammoniacal nitrogen input is also associated with stormwater runoff entering the creek, which occurs during prolonged and/or heavy amounts of precipitation.

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 62-302 does not provide a quantitative nutrient standard for ammoniacal nitrogen. Even though ammoniacal nitrogen is a potentially important nutrient to the primary producers in the streams of the Palmer Ranch, results obtained during the monitoring program suggest that nitrate might be the preferred nitrogen source. This indication is based on trends observed during previous monitoring years as related to normal plant production and decay (CCI, 1996). Other freshwater studies (Wetzel, 1975) have also concluded that aquatic vegetation, including algae, prefer nitrate to ammonia. Although it might be less preferred than nitrate, increases in ammonia have the ability to accelerate plant production, and, in turn, influence the balance between the flora and fauna of the streams traversing the Palmer Ranch. Concentrations of ammoniacal nitrogen determined during the

2000 monitoring year were generally similar to those previously recorded during the previous years of monitoring. These levels 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 un-ionized fraction of ammoniacal nitrogen was not evaluated independently, comparisons to County and State criteria for un-ionized ammonia were not made.

4.4.5 *Organic Nitrogen*

West Side

Organic nitrogen[2] concentrations determined in Catfish Creek and North Creek within the Palmer Ranch during the 2000 monitoring year are provided in **Appendix Table B-14**. Overall, an average organic nitrogen concentration of 1.35 mg/L was measured in these streams on the west side during the 2000 monitoring year with a range from 0.81 to 2.28 mg/L. Similar average organic nitrogen concentrations were observed during the second, third and fourteenth monitoring years (CCI, 1987, 1988 and 1999) with concentrations of 1.67, 1.23 and 1.35, respectively. Lower organic nitrogen concentrations were reported for the 1993 through 1997 monitoring years. Organic nitrogen concentrations for these five years averaged 0.97, 0.86, 0.58, 0.99 and 0.82 mg/L, respectfully (CCI, 1994, 1995b, 1996, 1997 and 1998). In the past three years, organic nitrogen data has increased in average. However, a stabilizing or gradual improvement in water quality with respect to nitrogen is

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

documented over the past eleven years. 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 have contributed to the stabilizing /declining trend in organic nitrogen.

The concentration of organic nitrogen followed the expected seasonal trends as observed during previous monitoring years when organic nitrogen levels increased from the spring through the summer. As during most of the monitoring years, higher organic nitrogen concentrations were recorded during the September 2000 monitoring event as compared to the March sampling event. Organic nitrogen levels in Catfish and North Creeks averaged 0.93 and 1.70 mg/L during the March and September 2000 monitoring events, respectively.

Typically, peaks in organic nitrogen during September are apparently associated with peaks in the standing crop of aquatic vegetation and storm water loadings, since this month represents the primary wet season. During the fall and winter, the standing crop of vegetation declines in association with low production rates and the decay of plant material. In past monitoring years, organic nitrogen concentrations have exhibited a concomitant decline as the plant material was depleted by the microbial heterotrophs during this period. Additionally, storm water loading rates most likely declined in association with minimal runoff during the relatively drier months of October through May.

East Side

Organic nitrogen concentrations determined in South Creek within the Palmer Ranch during the 2000 monitoring year are provided in **Appendix Table B-14**. An average organic nitrogen concentration of 1.16 mg/L was measured in this stream of the Palmer Ranch during the sixteenth year of monitoring with a range from 0.74 to 1.98 mg/L. The average organic nitrogen level during the 2000 monitoring year was lower than those observed during the last two monitoring events, yet is comparable to the data recorded in 1991, 1994 and 1995 where organic nitrogen levels were 1.17, 1.05 and 1.26, respectively.

Seasonally, organic nitrogen concentrations were highest during the January and October events with organic nitrogen concentrations averaging 1.19 and 1.27 mg/L, respectively. Lower organic nitrogen levels were observed in the July event with an average concentration 1.04 mg/L, (**Appendix Table B-14**). The lower organic nitrogen concentration probably resulted from greater flushing of the creek by increases in rainfall and subsequent stormwater runoff causing less accumulation of decaying vegetation.

4.4.6 *Total Phosphorus*

West Side

During the 2000 monitoring year, total phosphorus in the Catfish Creek/Trunk Ditch basin of the Palmer Ranch averaged 0.15 mg/L and a range of 0.03 to 0.35 mg/L (**Appendix Table B-15**). The highest total phosphorus levels, 0.35 and 0.22 mg/L, were recorded at Stations

CC-1 and CC-3, respectively, during the September monitoring event. The lowest mean total phosphorus concentrations were observed at Stations CC-4, CC-5 and NC-6 (**Appendix Table B- 15**).

Similar total phosphorus distributions were observed during the 1989, 1990, 1991, 1995, 1996 and 1998 monitoring years, with concentrations averaging 0.12, 0.12, 0.15, 0.18, 0.17 and 0.12 mg/L, respectively (CCI, 1990, 1991, 1992, 1996, 1997 and 1999). During the 1992 monitoring year, higher total phosphorus concentrations were observed with an average concentration of 0.38 mg/L and a range of 0.06 to 2.22 mg/L (CCI, 1993). **Figure 4.6** provides the average phosphorus levels recorded for the second through the sixteenth years of monitoring. For comparison, the fractionation of orthophosphate and organic phosphorus levels is also provided in **Figure 4.6**. Average phosphorus concentrations in the Catfish Creek/Trunk Ditch and North Creek Basins declined during the third, fourth, fifth, sixth, seventh, ninth, eleventh, twelfth and fourteenth years of monitoring, as illustrated in **Figure 4.6**. However, average phosphorus levels recorded for the eighth year of monitoring were higher than recorded for previous years. This observed increase in phosphorus was attributed to a high rainfall amount of 41.59 inches recorded during the primary wet season. Additionally, the average phosphorus level increased slightly during the thirteenth and fifteenth monitoring years. These increases are primarily due to an increase in organic phosphorus which may have resulted from the drier conditions experienced during much of

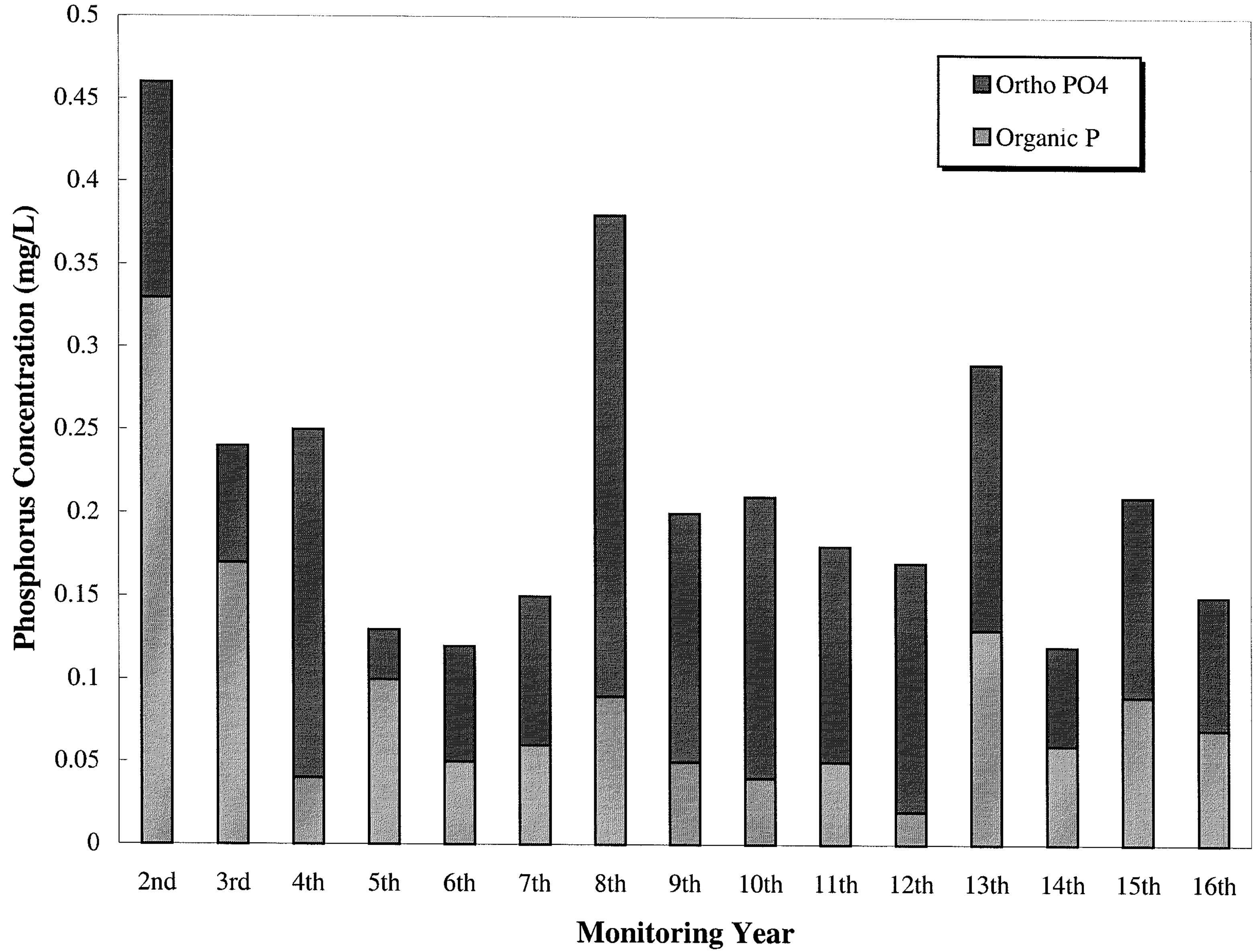


FIGURE 4.6. **AVERAGE PHOSPHORUS CONCENTRATIONS MEASURED ON THE WEST SIDE OF THE PALMER RANCH FROM THE SECOND THROUGH THE SIXTEENTH MONITORING YEARS**

the year and the subsequent die-off and decay of vegetation. The total phosphorous levels observed during the sixteenth year of monitoring were below the average recorded to date.

East Side

During the 2000 monitoring year, total phosphorus in South Creek averaged 0.25 mg/L with a range of 0.04 to 0.52 mg/L (**Appendix Table B-15**). Total phosphorus concentrations during 1997, 1998 and 1999 were similar, averaging 0.23, 0.19 and 0.24 mg/L, respectively (CCI, 1998, 1999 and VHB, 1999). Total phosphorus levels observed during the eleventh and twelfth year of monitoring averaged 0.46 and 0.28 mg/L, respectively (CCI, 1996 and 1997). The highest total phosphorus levels were reported for the second monitoring year with concentrations averaging 1.63 mg/L (CCI, 1986). The source of this phosphorus in the South Creek basin of Palmer Ranch during the second year of monitoring was attributed to runoff originating from the dairy farm draining into the eastern tributary of the creek. A pronounced decrease in total phosphorus concentration was observed after the deactivation of the dairy farm located upstream of the Palmer Ranch property.

Generally, average phosphorus concentrations in the South Creek basin have declined during the third through the sixteenth years of monitoring, as illustrated in **Figure 4.7**. However, total phosphorus concentrations increased slightly during the eleventh year of monitoring. This increase was attributed to higher nutrient input to South Creek in the form of runoff resulting from higher than normal rainfall recorded for the 1995 monitoring year. For

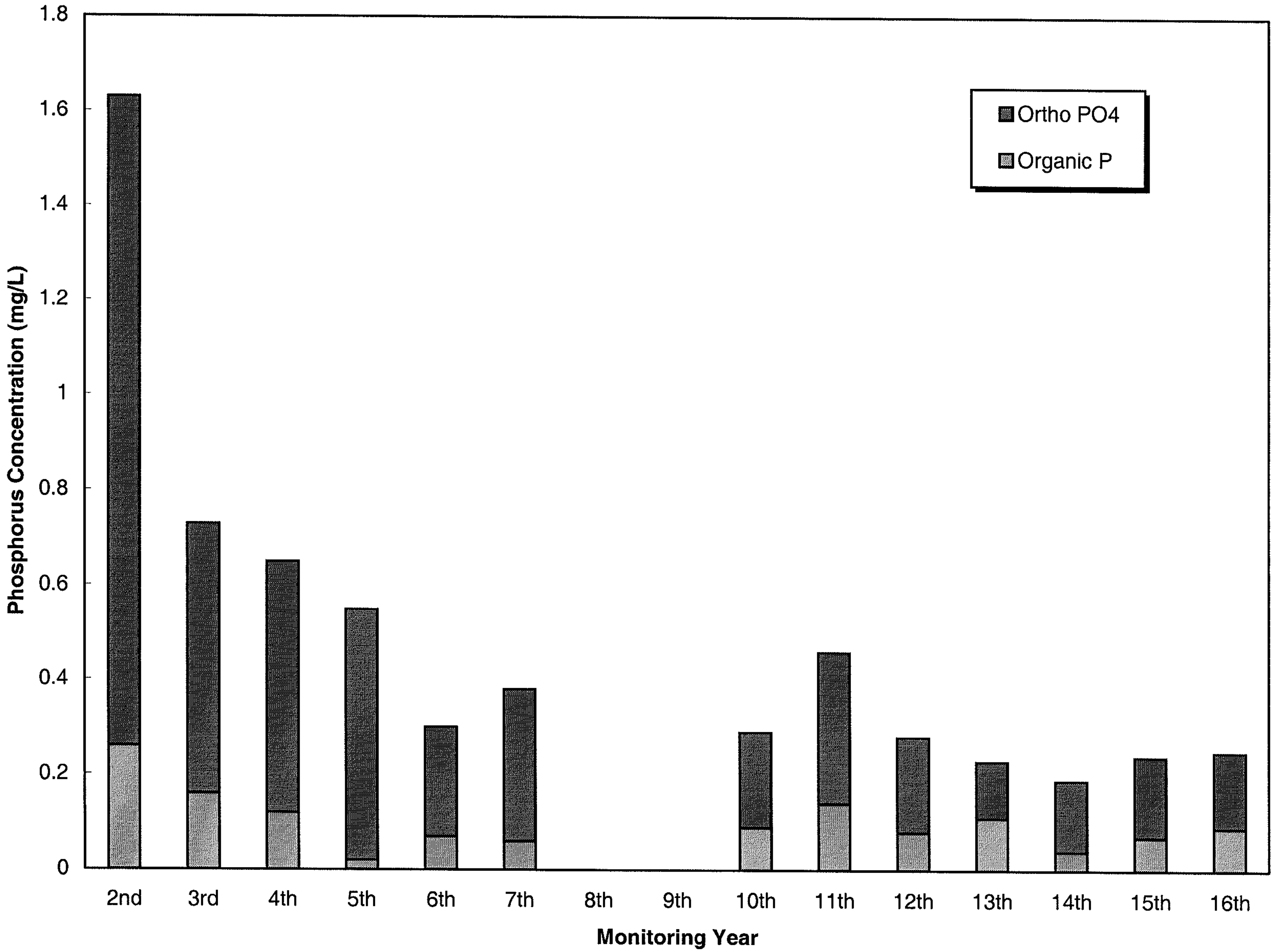


FIGURE 4.7. **AVERAGE PHOSPHORUS CONCENTRATIONS MEASURED ON THE EAST SIDE OF THE PALMER RANCH FROM THE SECOND THROUGH THE SIXTEENTH MONITORING YEARS**

comparison, the fractionation of orthophosphate and organic phosphorus levels is also provided in **Figure 4.7**. In general, orthophosphate comprised greater than 60 percent of the total phosphorus content in South Creek.

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 62-302, shall not be elevated to levels that will cause an imbalance in the natural flora and fauna. The results of the 2000 monitoring year indicate that none of the 11 samples collected on the west side of Palmer Ranch exhibited a total phosphorus concentration that exceeded the FDEP screening level of 0.46 mg/L (FDER, 1990). Only one of the twelve total phosphorus concentrations measured in South Creek exceeded the FDEP screening level. The total phosphorus concentrations measured in Catfish Creek, North Creek and South Creek were consistently above the 0.09 mg/L level determined to be the median concentration for Florida streams (FDER, 1990).

Similar phosphorus concentrations are normally found in west central Florida because of the widespread deposits of naturally occurring phosphate (Sheldon, 1982). Interestingly, well driller's logs show that phosphates exist in shallow deposits on the Palmer Ranch (Patton and Associates, 1984). In the past years, a relatively high correlation was found between the total phosphorus concentrations and turbidity levels which 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*

West Side

Orthophosphate concentrations determined in the streams traversing the west side of Palmer Ranch during the 2000 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 0.08 mg/L with a range from <0.01 to 0.36 mg/L. As expected, orthophosphate concentrations during 2000 exhibited spatial and seasonal trends similar to those observed for total phosphorus.

Similar orthophosphate concentrations were reported during the 1987, 1990, 1991 and 1998 monitoring years (CCI, 1988, 1991, 1992 and 1999). Orthophosphate concentrations measured during these monitoring years averaged from 0.06 to 0.09 mg/L. The 2000 average orthophosphate level was among the lowest averages recorded for the Catfish Creek/Trunk

Ditch and North Creek basins to date. The highest averages occurred during the fourth and eighth monitoring years, where orthophosphate concentrations averaged 0.21 and 0.29 mg/L, respectively.

Although the phosphorus concentrations have varied considerably over the last seven years, the percentage of total phosphorus consisting of orthophosphate has remained relatively constant averaging 54 percent for the past four years. In general, orthophosphate represented approximately 50 to 88 percent of the total phosphorus recorded for previous ten years of monitoring.

Seasonally, higher orthophosphate concentrations were observed during the September monitoring event. This is expected and likely reflects the high rainfall experienced prior to the September event. This temporal increase in orthophosphate concentrations recorded at the end of the primary wet season is attributed to increased runoff during the primary wet season.

<u>**East Side**</u>

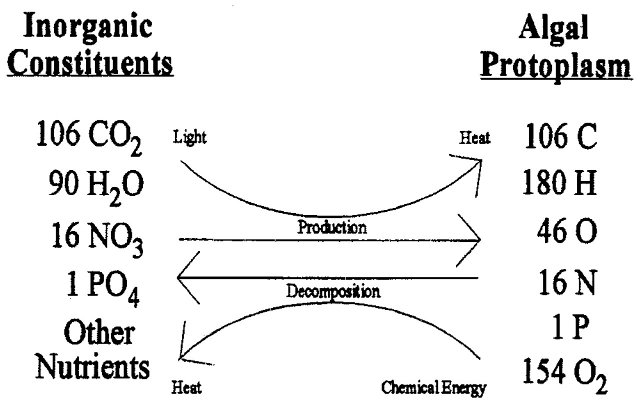
Orthophosphate concentrations determined in South Creek traversing the Palmer Ranch during the 2000 monitoring year are provided in **Appendix Table B-16**. Overall, the South Creek basin of the Palmer Ranch exhibited an average orthophosphate concentration of 0.16 mg/L during the sixteenth year of monitoring with a range from 0.01 to 0.44 mg/L. As with total phosphorus, the highest orthophosphate concentrations observed during the 2000 monitoring year occurred in January 2000. Historically, similar orthophosphate levels were observed during 1998 (0.15 mg/L) and 1999 (0.17 mg/L), but higher orthophosphate concentrations were observed during the previous years of monitoring. Orthophosphate concentrations averaged 0.20 mg/L during both the 1994 and 1996 monitoring years (CCI, 1995 and 1997). Slightly higher orthophosphate concentrations from 0.23 and 0.32 mg/L were recorded during the sixth, seventh, and eleventh monitoring years (CCI, 1991, 1992a, and 1995). Significantly higher orthophosphate concentrations were reported for the third through fifth monitoring years. During these monitoring periods, orthophosphate concentrations averaged from 0.53 to 0.57 mg/L (CCI, 1988a, 1988b and 1990). These higher orthophosphate levels reported for previous monitoring years were attributed to runoff that originated from a deactivated dairy farm that discharged into the eastern tributary of South Creek.

The percentage of total phosphorus consisting of orthophosphate has remained relatively constant in South Creek, ranging from 71 to 95 percent, except for 1997 when it represented 55 percent. In 2000, orthophosphate represented approximately 64 percent of the total phosphorus. The lower percentage of orthophosphate determined in 1997 may be associated with the overall lower phosphorus levels observed and the relatively dry antecedent conditions for most sampling events. The drier conditions would result in less orthophosphate being transported to the surface waters. Therefore, a greater percentage of the orthophosphate in the creek would be organic phosphorus resulting from decaying vegetation.

As a nutrient, orthophosphate is designated by FAC Chapter 62-302 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 FDEP (FDER, 1983), orthophosphate has been found to occur naturally on the Palmer Ranch. Consequently, other factors, such as nitrogen availability, are probably more growth limiting than orthophosphate. Therefore, the phosphate levels found during the 2000 monitoring year are 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 are 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."

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 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.

West Side

The N_i:P_i ratios determined from September 2000 nutrient data are generally low and found to average approximately 1.36:1. However, a high average ratio was observed for the March event (i.e. 26.48:1) because of large ratios observed at Stations CC-3, CC-4 and NC-6. The generally low N_i:P_i ratios are indicative of conditions in which fixed inorganic nitrogen would limit plant growth before orthophosphate. Nutrient data collected at Station CC-3, CC-4 and NC-6 during the March monitoring event yielded N_i:P_i ratios of 68.0:1, 44.0:1 and 16.0:1, respectively. These high ratios suggest surface waters at these stations may be limiting with respect to phosphorus. Further, this ratio indicates that additional input of nitrogen to Station CC-3, CC-4 and NC-6 may be associated with increased decomposition of organic matter in conjunction with decreased gross primary productivity.

The N_t:P_t ratios determined from 2000 nutrient data in the Catfish and North Creeks exhibited an overall average of 14.03:1 (**Appendix Table B-17**). Because this ratio is a little higher than 6.8:1, it would be indicative of a system out of balance with respect to nitrogen and phosphorus. Since the N_t:P_t ratio is higher than 6.8:1(algal protoplasm, by weight) it indicates a condition in which phosphorus would limit plant growth before nitrogen. However, it is important to note that this average N_t:P_t ratio is skewed with respect to the March 2000 monitoring event. During this event, the N_t:P_t ratio calculated for Stations CC-3, CC-4 and NC-6 were, 20.8:1, 26.0:1 and 36.7:1, respectively, suggesting that there may be additional nitrogen input in the vicinity of Stations CC-3, CC-4 and NC-6 (Meybeck, 1982).

Overall, the generally low N_i:P_i ratios calculated from the 2000 data are attributed to the naturally high levels of orthophosphate, while total nitrogen is comprised of approximately 9 percent inorganic nitrogen. The slightly higher N_t:P_t ratios determined during the 2000 monitoring events are indicative of the abundance of aquatic vegetation in the creeks and the high percentage of organic nutrients present.

East Side

The N_i:P_i ratios determined during 2000 for South Creek are generally low and found to average approximately 2.46:1. This is indicative of conditions in which fixed inorganic nitrogen would limit plant growth before orthophosphate (**Appendix Table B-18**). Conversely, the N_t:P_t ratios for South Creek were found to average 8.32:1 indicating a different balance with respect to nitrogen and phosphorus (**Appendix Table B-17**). 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 2000 data are attributed to the naturally high levels of orthophosphate, as well as the high percentage of total phosphorus represented by orthophosphate (64 percent of total phosphorus) while approximately 12 percent of the total nitrogen is comprised of inorganic nitrogen.

During the sixteenth year of monitoring, the N_i:P_i ratios in South Creek were generally indicative of excess phosphorus with respect to nitrogen (*i.e.*, nitrogen limited system). During January, N_i:P_i ratios averaged 0.92:1 and the N_i:P_i ratios averaged 0.30:1 during the October event. The N_i:P_i ratios for the July monitoring event were higher averaging approximately 6.2:1.

4.5 Oils and Greases

__West Side__

As provided in **Appendix Table B-19**, the concentration of oil and grease in the streams on the west side of the Palmer Ranch all were below the analytical detection limit of <1.4 mg/L during the 2000 monitoring year. Additionally, all oil and grease measurements made during 2000 were below the State and County standard of 5.0 mg/L specified in FAC Chapter 62-302. The concentrations of oils and greases reported in the streams of the west side during the previous years of the monitoring program (Palmer Venture, 1986; and CCI, 1986, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998 and 1999), ranged from less than 0.1 mg/L to 17 mg/L. Most of the historic observations (253 of 260) were found to be less than the maximum allowable State criteria of 5.0 mg/L.

East Side

Eleven of the twelve oil and grease concentrations determined for water samples collected in the South Creek during the 2000 monitoring year were at or below analytical detection limits (**Appendix Table B-19**). Overall, oil and grease content in South Creek averaged 0.8 mg/L and ranged from <1.0 to 2.2 mg/L. All of the twelve measurements made during 2000 were below the State standard of 5.0 mg/L specified in FAC Chapter 62-302.

The concentrations of oils and greases reported in South Creek during the previous years of the monitoring program ranged from <0.2 mg/L to 11 mg/L. Over 99 percent of the observations (*i.e.*, 140 of 141) in the Palmer Ranch portion of South Creek were found to be lower than the maximum allowable State criteria of 5 mg/L.

4.6 Bacteriological Parameters

4.6.1 *Total Coliform*

West Side

As indicated in **Appendix Table B-20**, the streams traversing the west side were found to exhibit concentrations of total coliform bacteria ranging from 110 to 12,200 colonies/100 mL with an average of 3,206 colonies/100 mL. Of the 11 samples collected during the 2000 monitoring year, four exceeded the State and County water quality standards which allow up to 2,400 colonies/100 mL. The highest bacteria concentrations were observed in the upper reach of the Catfish Creek/Trunk Ditch basin. During the second, third, fourth, sixth, seventh and fourteenth monitoring years (CCI, 1986, 1988a, 1988b, 1991, 1992a and 1999), the total coliform concentrations in the Catfish Creek/Trunk Ditch basin were also found to commonly exceed the State and County standards with 67, 52, 53, 43, 78, 32 and 55 percent of the results being higher than the 2,400 colonies/100 mL criteria, respectively.

During previous years of monitoring, the highest number of total coliform bacteria colonies have generally been observed after periods of rainfall, typically during the primary wet season. This, however, was not the case during the 2000 monitoring year, when the highest total coliform bacteria levels were observed during the March monitoring event. The mean total coliform level recorded for the March monitoring event in Catfish and North Creeks was 3,440 colonies/100 mL compared to an average of 3,012 colonies/100 mL for the September event. This is different than the temporal trend identified in previous monitoring reports. The primary mode by which coliform bacteria are transported to the streams traversing the ranch is surface runoff. Consequently, seasonal trends with respect to coliform bacteria levels are typically associated with rainfall.

East Side

As indicated in **Appendix Table B-20**, South Creek was found to exhibit total coliform bacteria concentrations ranging from 300 to 3,800 colonies/100 mL and averaging 1,325 colonies/100 mL. Only one of the total coliform bacteria levels measured during 2000 exceeded the State water quality criteria, which allow up to 2,400 colonies/100 mL.

Higher total coliform bacteria levels were observed in South Creek during the 1994 through the 1996 monitoring years. During these monitoring years, total coliform bacteria levels for monitoring stations in South Creek averaged 2,293; 2,704; and 1,448 colonies/100 mL, respectively (CCI, 1995, 1996, and 1997). Higher total coliform bacteria levels were also observed during the 1990 and 1991 monitoring years when total coliform bacteria averaged 3,946 and 4,984 colonies/100 mL, respectively (CCI, 1991 and 1992a).

The highest total coliform bacteria levels observed during 2000 occurred during stagnant water conditions in October (average of 1,925 colonies/mL) with the second highest levels at the end of the primary dry season (*i.e.*, January) with bacteria levels averaging 1,150 colonies/100 mL.

Spatially, the highest average bacteria concentration (*i.e.*, 2,233-colonies/100 mL) was observed at Station SC-4 of the South Creek Basin. The cattle and wild animals using the area around Station SC-4 probably represent the most significant source of bacteria in the area.

As noted in previous years (CCI, 1988a, 1988b, 1991, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 1999), 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 dogs, cats, cattle, birds, feral hogs, deer, and rodents.

4.6.2 *Fecal Coliform*

West Side

During the 2000 monitoring year, the streams on the west side of the Palmer Ranch exhibited fecal coliform densities ranged from <10 to 6,400 colonies/100 mL and averaged 1,476 colonies/100 mL (**Appendix Table B-21**). With the exception of last year, this year is comparable to the range of <10 to 12,725 colonies/100 mL observed during the previous six years of monitoring (CCI, 1994, 1995b, 1996, 1997, 1998 and 1999). Only three of the 11 samples (27 percent) collected during 2000 contained fecal coliform bacteria densities exceeding the 800 colonies/100 mL maximum allowed by State and County water quality criteria for Class III surface waters. Exclusive of 1999 (9%), results reported this year are at the lower end of the range for the previous monitoring years, which exhibited 18 to 73 percent of the samples collected exceeding the 800 colonies/100 mL standard.

Spatially, the highest number of fecal coliform colonies during the 2000 monitoring year occurred in the upper reach of the Catfish Creek/Trunk Ditch basin at Station CC-1. This indicates that the fecal coliform bacteria are primarily associated with runoff draining into the Catfish Creek/Trunk Ditch basin from off-site. As described for total coliform bacteria, higher fecal coliform levels have typically been observed in Catfish and North Creeks during the September monitoring event (*i.e.*, end of the summer wet season). This trend held true during the 2000 monitoring year. The highest mean fecal coliform level of 1,727 colonies/100 mL was observed during the September monitoring event compared with an average of 1,175 colonies/100 mL determined for the March sampling. During the September sampling event, large concentrations (6,400 and 2,600 colonies/mL) observed at Stations CC-1 and NC-6, respectively, were primarily responsible for the high seasonal average. The high fecal coliform bacteria levels observed upstream of the Palmer Ranch in Catfish Creek indicate significant sources of fecal coliform bacteria originating upstream the ranch.

East Side

During the sixteenth year of monitoring, the South Creek basin of the Palmer Ranch exhibited fecal coliform densities that ranged from 30 to 700 colonies/100 mL and averaged 203 colonies/100 mL (**Appendix Table B-21**). Similar bacteria levels with averages ranging from <10 to 1,000 colonies/100 mL were reported for the 1995, 1996, 1997 and 1998 monitoring years (CCI, 1996, 1997, 1998 and 1999). Of the twelve samples collected during 2000, none exceeded the Class III State and County Standard of 800 colonies/100 mL. The previous low range was from 15 to 29 percent, which was recorded during the third, fourth, sixth, seventh and fourteenth monitoring years.

Spatially, Station SC-4 had the highest average concentration of fecal coliform colonies during the 2000 monitoring year. The higher bacteria levels in this portion of the creek probably reflect the greater number of warm-blooded animals in the stream communities associated with the upstream areas of the creek.

Primary sources of fecal coliform bacteria are considered to be dogs, cats, birds, cattle, and other warm-blooded wild animals inhabiting the basin.

4.7 Trace Elements

West Side

During 2000, samples were collected for the analyses of trace elements (*i.e.*, arsenic, copper, lead, and zinc) during the September monitoring event. The results of these analyses are provided in **Appendix Table B-22** along with the applicable State and County Standards for each element.

Arsenic concentrations during the 2000 monitoring year ranged from 2.7 to 6.7 µg/L and averaged 4.8 µg/L (**Appendix Table B-22**). The concentrations of copper ranged from 1.1 to 6.8 µg/L and averaged 4.5 µg/L. Total lead concentrations measured in the streams on the west side of the Palmer Ranch during 2000 averaged 1.9 µg/L and ranged from <1.0 to 4.5 µg/L. The concentration of zinc determined for the six monitoring stations during 2000 averaged 10 µg/L and ranged from 10 to 20 µg/L.

East Side

During the 2000 monitoring event, samples were collected in South Creek for the analyses of trace elements (*i.e.*, arsenic, copper, lead, and zinc) during the October event. The results of these analyses are provided in **Appendix Table B-22** along with the applicable State Standards for each element.

Arsenic concentrations during the 2000 monitoring year ranged from 2.9 to 6.3 µg/L and averaged 4.3 µg/L (**Appendix Table B-22**). Concentrations of total copper in the South Creek basin during the 2000 monitoring period averaged 5.1 µg/L and ranged from 1.9 to 8.0 µg/L. Total lead concentrations measured on the east side of the Palmer Ranch during 2000 averaged 1.3 µg/L and ranged from <1.0 to 1.7 µg/ L (**Appendix Table B-22**). The concentration determined for zinc samples collected in South Creek during 2000 averaged 48, with a range of 30 to 80 µg/L.

All arsenic concentrations measured during the 2000 monitoring year on Palmer Ranch were below the State standard of 50 µg/L[3]. Possible sources of arsenic include naturally occurring minerals and the use of arsenic-based pesticides on and upstream of the Palmer Ranch. None of the copper concentrations on the ranch exceeded the State and County standard of 12.8 µg/L[4]. Possible sources of copper in the surface waters of the Palmer Ranch include the use of copper containing herbicides, fertilizers, algicides, and pesticides. All of the measured lead concentrations in streams on Palmer Ranch were in compliance with the State and County standard of 3.6 µg/L[5]. Possible anthropogenic sources of lead in the surface waters of the Palmer Ranch included automobile emissions, roads and parking areas, and runoff from light industrial land uses located upstream of the Palmer Ranch property. None of the zinc

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

[4]*Ibid.*

[5]*Ibid.*

concentrations determined during the 2000 monitoring events exceeded the State and County standard of 115 μg/L[6]. Possible sources of zinc include the use of zinc containing fertilizers and runoff from roads on and upstream of the Palmer Ranch.

[6] *Ibid.*

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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.

Parameters

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, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	1.1	0.0	2.8	2.3	2.1	1.7	0.2	1.4	1.2	0.0	2.8	6
September 14, 2000	0.4	0.2	1.4	3.2	0.3	1.1	0.3	1.0	1.2	0.2	3.2	6
Mean	0.8	0.1	2.1	2.8	1.2		0.3					
Minimum	0.4	0.0	1.4	2.3	0.3		0.2					
Maximum	1.1	0.2	2.8	3.2	2.1		0.3					
Std. Deviation	0.5	0.1	1.0	0.6	1.3		0.1					
N	2	2	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	0.4	0.5	0.0	1.1	4.0							
CC-3, CC-4 (mid reach)	2.4	0.8	1.4	3.2	4.0							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	1.4	1.2	0.0	3.2	10.0							
All six stations	1.2	1.1	0.0	3.2	12.0							

[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, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	4.5	0.0	67.3	49.4	83.5	40.9	216.3	70.2	79.0	70.2	216.3	6
September 14, 2000	170.5	0.0	0.0	0.0	8235.5	1681.2	2993.5	1899.9	3321.3	0.0	8235.5	6
Mean	87.5	0.0	33.7	24.7	4159.5		1604.9					
Minimum	4.5	0.0	0.0	0.0	83.5		216.3					
Maximum	170.5	0.0	67.3	49.4	8235.5		2993.5					
Std. Deviation	117.4	0.0	47.6	34.9	5764.3		1963.8					
N	2	2	2	2	2		2					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	43.8	84.6	0.0	170.5	4.0
CC-3, CC-4 (mid reach)	29.2	34.5	0.0	67.3	4.0
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	861.1	2591.7	0.0	8235.5	
All six stations	985.0	2435.2	0.0	8235.5	12.0

STD - Standard deviation
N - Number of observations

Appendix Table B-3
Continuing Surface Water Quality Monitoring Program
Water Temperature (°C)
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	20.1		20.7	22.5	23.1	21.6	20.3	21.3	1.4	20.1	23.1	5
September 14, 2000	27.0	29.7	29.8	29.2	30.0	29.1	27.6	28.9	1.3	27.0	30.0	6
Mean	23.6	29.7	25.3	25.9	26.6		24.0					
Minimum	20.1	29.7	20.7	22.5	23.1		20.3					
Maximum	27.0	29.7	29.8	29.2	30.0		27.6					
Std. Deviation	4.9	--	6.4	4.7	4.9		5.2					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	25.6	5.0	20.1	29.7	3							
CC-3, CC-4 (mid reach)	25.6	4.6	20.7	29.8	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	25.8	4.2	20.1	30.0	9							
All six stations	25.5	4.1	20.1	30.0	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-4
Continuing Surface Water Quality Monitoring Program
Specific Conductance (umhos/cm)[a]
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	716		1,283	952	1,014	991	973	988	202	716	1,283	5
September 14, 2000	342	675	696	776	725	643	1,220	739	282	342	1,220	6
Mean	529	675	990	864	870		1,097					
Minimum	342	675	696	776	725		973					
Maximum	716	675	1,283	952	1,014		1,220					
Std. Deviation	264	--	415	124	204		175					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	578	205	342	716	3							
CC-3, CC-4 (mid reach)	927	260	696	1,283	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	798	263	342	1,283	9							
All six stations	852	270	342	1,283	11							

[a] Applicable State surface water quality criteria: Maximum allowable increase of 50% above background or to 1,275 umhos/cm which ever is greater.
STD - Standard deviation
N - Number of observations

Appendix Table B-5
Continuing Surface Water Quality Monitoring Program
Total Suspended Solids (mg/L)
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	6.4		6.2	4.8	5.8	5.8	0.3	4.7	2.6	0.3	6.4	5
September 14, 2000	15.0	6.0	7.6	14.0	8.8	10.3	17.2	11.4	4.6	6.0	17.2	6
Mean	10.7	6.0	6.9	9.4	7.3		8.7					
Minimum	6.4	6.0	6.2	4.8	5.8		0.3					
Maximum	15.0	6.0	7.6	14.0	8.8		17.2					
Std. Deviation	6.1	--	1.0	6.5	2.1		12.0					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	9.1	5.1	6.0	15.0	3							
CC-3, CC-4 (mid reach)	8.2	4.1	4.8	14.0	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	8.3	3.7	4.8	15.0	9							
All six stations	8.4	5.0	0.3	17.2	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-6
Continuing Surface Water Quality Monitoring Program
Turbidity (NTU)[a]
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	8.5		5.2	3.6	4.0	5.3	1.1	4.5	2.7	1.1	8.5	5
September 14, 2000	6.3	1.1	4.3	8.5	5.4	5.1	22.0	7.9	7.3	1.1	22.0	6
Mean	7.4	1.1	4.8	6.1	4.7		11.6					
Minimum	6.3	1.1	4.3	3.6	4.0		1.1					
Maximum	8.5	1.1	5.2	8.5	5.4		22.0					
Std. Deviation	1.6	--	0.6	3.5	1.0		14.8					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	5.3	3.8	1.1	8.5	3							
CC-3, CC-4 (mid reach)	5.4	2.2	3.6	8.5	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	5.2	2.4	1.1	8.5	9							
All six stations	6.4	5.7	1.1	22.0	11							

[a] Applicable State surface water quality criteria: Maximum allowable increase of 29 NTU 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, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.0	<2.0	<2.0	5
September 14, 2000	<2.0	<2.0	<2.0	5.9	4.9	2.8	<2.0	2.5	2.3	<2.0	5.9	6
Mean	<2.0	<2.0	<2.0	3.5	3.0		<2.0					
Minimum	<2.0	<2.0	<2.0	<2.0	<2.0		<2.0					
Maximum	<2.0	<2.0	<2.0	5.9	4.9		<2.0					
Std. Deviation	0.0	--	0.0	3.5	2.8		0.0					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	<2.0	0.0	<2.0	<2.0	3							
CC-3, CC-4 (mid reach)	2.2	2.5	<2.0	5.9	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	2.0	2.0	<2.0	5.9	9							
All six stations	1.8	1.8	<2.0	5.9	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-8
Continuing Surface Water Quality Monitoring Program
Dissolved Oxygen (mg/L)[a]
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	5.5		3.0	5.3	5.3	4.8	3.2	4.5	1.2	3.0	5.5	5
September 14, 2000	5.1	7.0	5.0	5.8	8.6	6.3	1.8	5.6	2.3	1.8	8.6	6
Mean	5.3	7.0	4.0	5.6	7.0		2.5					
Minimum	5.1	7.0	3.0	5.3	5.3		1.8					
Maximum	5.5	7.0	5.0	5.8	8.6		3.2					
Std. Deviation	0.3	--	1.4	0.4	2.3		1.0					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	5.9	1.0	5.1	7.0	3							
CC-3, CC-4 (mid reach)	4.8	1.2	3.0	5.8	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	5.6	1.5	3.0	8.6	9							
All six stations	5.1	1.9	1.8	8.6	11							

[a] Applicable State surface water quality criteria: Minimum allowable concentration of 5.0 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, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	6.8		7.2	7.6	7.4	7.3	7.0	7.2	0.3	6.8	7.6	5
September 14, 2000	7.0	7.6	6.8	7.1	7.6	7.2	6.8	7.2	0.4	6.8	7.6	6
Mean	6.9	7.6	7.0	7.4	7.5		6.9					
Minimum	6.8	7.6	6.8	7.1	7.4		6.8					
Maximum	7.0	7.6	7.2	7.6	7.6		7.0					
Std. Deviation	0.1	--	0.3	0.4	0.1		0.1					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	7.1	0.4	6.8	7.6	3							
CC-3, CC-4 (mid reach)	7.2	0.3	6.8	7.6	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	7.2	0.3	6.8	7.6	9							
All six stations	7.2	0.3	6.8	7.6	11							

[a] Applicable State surface water quality criteria: Allowable range of 6.0 to 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, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	0.91		1.25	1.30	1.04	1.13	1.10	1.12	0.16	0.91	1.30	5
September 14, 2000	1.90	1.55	1.45	1.76	1.84	1.70	2.32	1.80	0.31	1.45	2.32	6
Mean	1.41	1.55	1.35	1.53	1.44		1.71					
Minimum	0.91	1.55	1.25	1.30	1.04		1.10					
Maximum	1.90	1.55	1.45	1.76	1.84		2.32					
Std. Deviation	0.70	--	0.14	0.33	0.57		0.86					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	1.45	0.50	0.91	1.90	3							
CC-3, CC-4 (mid reach)	1.44	0.23	1.25	1.76	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	1.44	0.35	0.91	1.90	9							
All six stations	1.49	0.43	0.91	2.32	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-11
Continuing Surface Water Quality Monitoring Program
Nitrite Nitrogen (mg/L)
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	<0.01		0.01	0.01	<0.01	<0.01	0.01	<0.01	0.00	<0.01	0.01	5
September 14, 2000	0.05	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	0.02	<0.01	0.05	6
Mean	0.03	<0.01	<0.01	<0.01	<0.01		<0.01					
Minimum	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01					
Maximum	0.05	<0.01	0.01	0.01	<0.01		0.01					
Std. Deviation	0.03	--	0.00	0.00	0.00		0.00					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	0.02	0.03	<0.01	0.05	3							
CC-3, CC-4 (mid reach)	<0.01	0.00	<0.01	0.01	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.01	0.01	<0.01	0.05	9							
All six stations	0.01	0.01	<0.01	0.05	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-12
Continuing Surface Water Quality Monitoring Program
Nitrate Nitrogen (mg/L)
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	0.01		0.16	0.06	0.01	0.06	0.06	0.06	0.06	0.01	0.16	5
September 14, 2000	0.22	0.07	0.12	0.03	0.01	0.09	0.03	0.08	0.08	0.01	0.22	6
Mean	0.12	0.07	0.14	0.05	0.01		0.05					
Minimum	0.01	0.07	0.12	0.03	0.01		0.03					
Maximum	0.22	0.07	0.16	0.06	0.01		0.06					
Std. Deviation	0.15	--	0.03	0.02	0.00		0.02					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	0.10	0.11	0.01	0.22	3							
CC-3, CC-4 (mid reach)	0.09	0.06	0.03	0.16	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.08	0.08	0.01	0.22	9							
All six stations	0.07	0.07	0.01	0.22	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-13
Continuing Surface Water Quality Monitoring Program
Ammoniacal Nitrogen (mg/L)
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	0.09		0.17	0.15	0.10	0.13	0.09	0.12	0.04	0.09	0.17	5
September 14, 2000	<0.01	<0.01	0.03	<0.01	0.03	0.02	0.01	0.01	0.01	<0.01	0.03	6
Mean	0.05	<0.01	0.10	0.08	0.07		0.05					
Minimum	<0.01	<0.01	0.03	<0.01	0.03		0.01					
Maximum	0.09	<0.01	0.17	0.15	0.10		0.09					
Std. Deviation	0.06	--	0.10	0.10	0.05		0.06					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	0.03	0.05	<0.01	0.09	3							
CC-3, CC-4 (mid reach)	0.09	0.08	<0.01	0.17	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.07	0.06	<0.01	0.17	9							
All six stations	0.06	0.06	<0.01	0.17	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-14
Continuing Surface Water Quality Monitoring Program
Organic Nitrogen (mg/L)[a]
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	0.81		0.91	1.08	0.93	0.93	0.94	0.93	0.10	0.81	1.08	5
September 14, 2000	1.63	1.48	1.30	1.73	1.80	1.59	2.28	1.70	0.34	1.30	2.28	6
Mean	1.22	1.48	1.11	1.40	1.37		1.61					
Minimum	0.81	1.48	0.91	1.08	0.93		0.94					
Maximum	1.63	1.48	1.30	1.73	1.80		2.28					
Std. Deviation	0.58	--	0.28	0.46	0.62		0.95					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	1.30	0.43	0.81	1.63	3							
CC-3, CC-4 (mid reach)	1.25	0.35	0.91	1.73	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	1.30	0.38	0.81	1.80	9							
All six stations	1.35	0.47	0.81	2.28	11							

[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, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	0.17		0.06	0.05	0.09	0.09	0.03	0.08	0.05	0.03	0.17	5
September 14, 2000	0.35	0.20	0.22	0.20	0.17	0.23	0.16	0.22	0.07	0.16	0.35	6
Mean	0.26	0.20	0.14	0.13	0.13		0.10					
Minimum	0.17	0.20	0.06	0.05	0.09		0.03					
Maximum	0.35	0.20	0.22	0.20	0.17		0.16					
Std. Deviation	0.13	--	0.11	0.11	0.06		0.09					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	0.24	0.10	0.17	0.35	3							
CC-3, CC-4 (mid reach)	0.13	0.09	0.05	0.22	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.17	0.09	0.05	0.35	9							
All six stations	0.15	0.09	0.03	0.35	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-16
Continuing Surface Water Quality Monitoring Program
Orthophosphate (mg/L)
January - December 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	0.07		<0.01	<0.01	0.04	0.03	0.01	0.03	0.03	<0.01	0.07	5
September 14, 2000	0.17	0.36	0.08	0.02	0.03	0.13	0.05	0.12	0.13	0.02	0.36	6
Mean	0.12	0.36	0.04	0.01	0.04		0.03					
Minimum	0.07	0.36	<0.01	<0.01	0.03		0.01					
Maximum	0.17	0.36	0.08	0.02	0.04		0.05					
Std. Deviation	0.07	--	0.05	0.01	0.01		0.03					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	0.20	0.15	0.07	0.36	3							
CC-3, CC-4 (mid reach)	0.03	0.04	<0.01	0.08	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.09	0.11	<0.01	0.36	9							
All six stations	0.08	0.11	<0.01	0.36	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-17
Continuing Surface Water Quality Monitoring Program
Total Nitrogen to Total Phosphorus Ratios
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	5.35		20.83	26.00	11.56	15.94	36.67	20.08	12.25	5.35	36.67	5
September 14, 2000	5.43	7.75	6.59	8.80	10.82	7.88	14.50	8.98	3.28	5.43	14.50	6
Mean	5.39	7.75	13.71	17.40	11.19		25.58					
Minimum	5.35	7.75	6.59	8.80	10.82		14.50					
Maximum	5.43	7.75	20.83	26.00	11.56		36.67					
Std. Deviation	0.05	--	10.07	12.16	0.52		15.67					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	6.18	1.36	5.35	7.75	3							
CC-3, CC-4 (mid reach)	15.56	9.36	6.59	26.00	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	11.46	7.23	5.35	26.00	9							
All six stations	14.03	9.95	5.35	36.67	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-18
Continuing Surface Water Quality Monitoring Program
Inorganic Nitrogen to Inorganic Phosphorus Ratios
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	1.50		68.00	44.00	2.88	29.09	16.00	26.48	28.82	1.50	68.00	5
September 14, 2000	1.62	0.22	1.94	2.00	1.50	1.46	0.90	1.36	0.68	0.22	2.00	6
Mean	1.56	0.22	34.97	23.00	2.19		8.45					
Minimum	1.50	0.22	1.94	2.00	1.50		0.90					
Maximum	1.62	0.22	68.00	44.00	2.88		16.00					
Std. Deviation	0.08	--	46.71	29.70	0.97		10.68					
N	2	1	2	2	2		2					

Stations	Mean	STD	Min	Max	N
CC-1, CC-2 (upper reach)	1.11	0.77	0.22	1.62	3
CC-3, CC-4 (mid reach)	28.98	32.70	1.94	68.00	4
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	13.74	24.71	0.22	68.00	9
All six stations	12.78	22.46	0.22	68.00	11

STD - Standard deviation
N - Number of observations

Appendix Table B-19
Continuing Surface Water Quality Monitoring Program
Oil and Grease (mg/L)[a]
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	<1.4		<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	0.0	<1.4	<1.4	5
September 14, 2000	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	0.0	<1.4	<1.4	6
Mean	<1.4	<1.4	<1.4	<1.4	<1.4		<1.4					
Minimum	<1.4	<1.4	<1.4	<1.4	<1.4		<1.4					
Maximum	<1.4	<1.4	<1.4	<1.4	<1.4		<1.4					
Std. Deviation	0.0	--	0.0	0.0	0.0		0.0					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	<1.4	0.0	<1.4	<1.4	3							
CC-3, CC-4 (mid reach)	<1.4	0.0	<1.4	<1.4	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	<1.4	0.0	<1.4	<1.4	9							
All six stations	<1.4	0.0	<1.4	<1.4	11							

[a] Applicable State surface water quality criteria: Maximum allowable concentration of 5.0 mg/L
STD - Standard deviation
N - Number of observations

Appendix Table B-20
Continuing Surface Water Quality Monitoring Program
Total Coliform Bacteria (colonies/100 mL)
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	12,200		3,700	300	110	4,078	890	3,440	5,105	110	12,200	5
September 14, 2000	10,300	900	670	400	500	2,554	5,300	3,012	4,036	400	10,300	6
Mean	11,250	900	2,185	350	305		3,095					
Minimum	10,300	900	670	300	110		890					
Maximum	12,200	900	3,700	400	500		5,300					
Std. Deviation	1,344	--	2,143	71	276		3,118					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	7,800	6,051	900	12,200	3							
CC-3, CC-4 (mid reach)	1,268	1,629	300	3,700	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	3,231	4,696	110	12,200	9							
All six stations	3,206	4,315	110	12,200	11							

a Applicable State surface water quality criteria: Maximum allowable density of 2,400 colonies/100mL
STD - Standard deviation
N - Number of observations

Appendix Table B-21
Continuing Surface Water Quality Monitoring Program
Fecal Coliform Bacteria (colonies/100 mL)[a]
January - December, 2000

Sampling Date	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
March 17, 2000	5,300		560	<10	<10	1,468	<10	1,175	2,318	<10	5,300	5
September 14, 2000	6,400	700	170	380	110	1,552	2,600	1,727	2,470	110	6,400	6
Mean	5,850	700	365	193	58		1,303					
Minimum	5,300	700	170	<10	<10		<10					
Maximum	6,400	700	560	380	110		2,600					
Std. Deviation	778	--	276	265	74		1,835					
N	2	1	2	2	2		2					
Stations	Mean	STD	Min	Max	N							
CC-1, CC-2 (upper reach)	4,133	3,024	700	6,400	3							
CC-3, CC-4 (mid reach)	279	242	<10	560	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	1,514	2,485	<10	6,400	9							
All six stations	1,476	2,299	<10	6,400	11							

[a] Applicable State surface water quality criteria: Maximum allowable density of 800 colonies/100mL
STD - Standard deviation
N - Number of observations

Appendix Table B-22
Continuing Surface Water Quality Monitoring Program
Trace Metals (ug/L)[a]
January - December, 2000

Parameters	Catfish Creek/Trunk Ditch							All West Side Stations				
	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	STD	Min	Max	N
Arsenic	2.7	3.7	6.7	5.8	6.3	5.0	3.6	4.8	1.7	2.7	6.7	6
Copper	1.1	2.5	4.5	6.7	5.5	4.1	6.8	4.5	2.3	1.1	6.8	6
Lead	4.5	2.5	1.6	1.2	<1.0	2.1	1.1	1.9	1.5	<1.0	4.5	6
Zinc	20	10	10	10	10	10	10	10	10	10	20	6

[a]Applicable State surface water quality criteria: Maximum allowable concentrations of 50 µg/L for arsenic, 12.8 µg/L for copper, 3.6 µg/L for lead, and 115 ug/L for zinc based on a hardness of 110mg/L.
STD - Standard deviation
N - Number of observations

Appendix Table B-1
Continuing Surface Water Quality Monitoring Program
Stream Stage (ft)[a]
January – December 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	0.8	0.3	0.2	0.7		0.5	0.3	0.2	0.8	4
April 6, 2000	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	4
July 31, 2000	1.7	0.5	0.5	0.4		0.8	0.6	0.4	1.7	4
October 10, 2000	1.7	1.2	0.9	0.8		1.2	0.4	0.8	1.7	4
Mean	1.1	0.5	0.4	0.5						
Minimum	0.0	0.0	0.0	0.0						
Maximum	1.7	1.2	0.9	0.8						
Std. Deviation	0.8	0.5	0.4	0.4						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	0.4	0.0	0.9	0.4	8					
SC-1, SC-2	0.8	0.0	1.7	0.7	8					
SC-4, SC-1, SC-2, SC-3 (entire basin)	0.6	0.0	1.7	0.6	16					

[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 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	53.86	125.66	0.00	0.00		44.88	59.54	0.00	125.66	4
April 6, 2000	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	4
July 31, 2000	121.18	31.42	0.00	0.00		38.15	57.30	0.00	121.18	4
October 10, 2000	223.05	0.00	0.00	0.00		55.76	111.53	0.00	223.05	4
Mean	99.52	39.27	0.00	0.00						
Minimum	0.00	0.00	0.00	0.00						
Maximum	223.05	125.66	0.00	0.00						
Std. Deviation	96.12	59.47	0.00	0.00						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	0.00	0.00	0.00	0.00	8					
SC-1, SC-2	69.40	0.00	223.05	75.49	8					
SC-4, SC-1, SC-2, SC-3 (entire basin)	34.70	0.00	223.05	65.75	16					

STD - Standard deviation
N - Number of observations

Appendix Table B-3
Continuing Surface Water Quality Monitoring Program
Water Temperature (□C)
January - December, 2000

	South Creek				All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**	**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	21.6	21.3	20.4	19.7	20.8	0.9	19.7	21.6	4
April 6, 2000									
July 31, 2000	27.0	28.1	25.7	28.3	27.3	1.2	25.7	28.3	4
October 10, 2000	19.9	19.7	18.5	20.1	19.6	0.7	18.5	20.1	4
Mean	22.8	23.0	21.5	22.7					
Minimum	19.9	19.7	18.5	19.7					
Maximum	27.0	28.1	25.7	28.3					
Std. Deviation	3.7	4.5	3.7	4.9					
N	3	3	3	3					

Stations	Mean	Min	Max	STD	N
SC-4, SC-3	22.1	18.5	28.3	3.9	6
SC-1, SC-2	22.9	19.7	28.1	3.3	6
SC-4, SC-1, SC-2, SC-3 (entire basin)	22.5	18.5	28.3	3.6	12

STD - Standard deviation
N - Number of observations

Appendix Table B-4
Continuing Surface Water Quality Monitoring Program
Specific Conductance (umhos/cm)[a]
January - December, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	705	873	1,097	986		915	167	705	1,097	4
April 6, 2000										
July 31, 2000	1,276	1,270	1,116	944		1,152	157	944	1,276	4
October 10, 2000	801	819	698	616		734	95	616	819	4
Mean	927	987	970	849						
Minimum	705	819	698	616						
Maximum	1,276	1,270	1,116	986						
Std. Deviation	306	246	236	203						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	910	616	1,116	208	6					
SC-1, SC-2	957	705	1,276	229	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	933	616	1,276	221	12					

[a] Applicable surface water quality criteria state: Maximum allowable increase of 50% above background or to 1,275 μmhos/cm which ever is greater

STD - Standard deviation

N - Number of observations

Appendix Table B-5
Continuing Surface Water Quality Monitoring Program
Total Suspended Solids (mg/L)
January - December, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	4.3	2.9	31.1	3.5		10.5	13.8	2.9	31.1	4
April 6, 2000										
July 31, 2000	0.6	1.8	14.8	3.6		5.2	6.5	0.6	14.8	4
October 10, 2000	2.8	1.6	43.0	47.0		23.6	24.8	1.6	47.0	4
Mean	2.6	2.1	29.6	18.0						
Minimum	0.6	1.6	14.8	3.5						
Maximum	4.3	2.9	43.0	47.0						
Std. Deviation	1.9	0.7	14.2	25.1						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	23.8	3.5	47.0	19.3	6					
SC-1, SC-2	2.3	0.6	4.3	1.2	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	13.1	0.6	47.0	17.2	12					

STD - Standard deviation
N - Number of observations

Appendix Table B-6
Continuing Surface Water Quality Monitoring Program
Turbidity (NTU)[a]
January - December 2000

	South Creek				All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**	**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	2.4	2.7	10.4	2.1	4.4	4.0	2.1	10.4	4
April 6, 2000									
July 31, 2000	1.1	1.7	4.5	2.6	2.5	1.5	1.1	4.5	4
October 10, 2000	1.1	0.8	11.1	10.1	5.8	5.6	0.8	11.1	4
Mean	1.5	1.7	8.7	4.9					
Minimum	1.1	0.8	4.5	2.1					
Maximum	2.4	2.7	11.1	10.1					
Std. Deviation	0.7	1.0	3.6	4.5					
N	3	3	3	3					
Stations	Mean	Min	Max	STD	N				
SC-4, SC-3	6.8	2.1	11.1	4.2	6				
SC-1, SC-2	1.6	0.8	2.7	0.7	6				
SC-4, SC-1, SC-2, SC-3 (entire basin)	4.2	0.8	11.1	3.9	12				

[a]Applicable State and County surface water quality criteria allows a maximum increase of 29 NTU.
STD - Standard deviation

Appendix Table B-7
Continuing Surface Water Quality Monitoring Program
5-Day Biochemical Oxygen Demand (mg/L)
January - December, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	2.7	<2.0	2.1	<2.0		1.7	0.8	<2.0	2.7	4
April 6, 2000										
July 31, 2000	<2.0	<2.0	4.0	<2.0		1.8	1.5	<2.0	4.0	4
October 10, 2000	<2.0	<2.0	<2.0	2.0		1.3	0.5	<2.0	2.0	4
Mean	1.6	1.0	2.4	1.3						
Minimum	<2.0	<2.0	<2.0	<2.0						
Maximum	2.7	<2.0	4.0	2.0						
Std. Deviation	1.0	0.0	1.5	0.6						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	1.9	<2.0	4.0	1.2	6					
SC-1, SC-2	1.3	<2.0	2.7	0.6	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	1.6	<2.0	4.0	1.0	12					

STD - Standard deviation
N - Number of observations

Appendix Table B-8
Continuing Surface Water Quality Monitoring Program
Dissolved Oxygen (mg/L)[a]
January - December, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	5.5	6.5	4.8	6.3		5.8	0.8	4.8	6.5	4
April 6, 2000										
July 31, 2000	5.1	8.0	2.5	5.9		5.4	2.3	2.5	8.0	4
October 10, 2000	3.2	5.1	4.3	6.5		4.8	1.4	3.2	6.5	4
Mean	4.6	6.5	3.9	6.2						
Minimum	3.2	5.1	2.5	5.9						
Maximum	5.5	8.0	4.8	6.5						
Std. Deviation	1.2	1.5	1.2	0.3						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	5.1	2.5	6.5	1.5	6					
SC-1, SC-2	5.6	3.2	8.0	1.5	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	5.3	2.5	8.0	1.5	12					

[a] Applicable surface water quality criteria: Minimum allowable concentration of 5.0 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, 2000

Sampling Date	South Creek SC-1	South Creek SC-2	South Creek SC-3	South Creek SC-4		All East Side Stations Mean	All East Side Stations STD	All East Side Stations Min	All East Side Stations Max	All East Side Stations N
January 10, 2000	7.2	7.4	6.2	6.6		6.9	0.6	6.2	7.4	4
April 6, 2000										
July 31, 2000	6.7	6.8	6.4	6.6		6.6	0.2	6.4	6.8	4
October 10, 2000	7.0	7.1	6.7	7.0		7.0	0.2	6.7	7.1	4
Mean	7.0	7.1	6.4	6.7						
Minimum	6.7	6.8	6.2	6.6						
Maximum	7.2	7.4	6.7	7.0						
Std. Deviation	0.3	0.3	0.3	0.2						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	6.6	6.2	7.0	0.3	6					
SC-1, SC-2	7.0	6.7	7.4	0.2	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	6.8	6.2	7.4	0.3	12					

[a]Applicable surface water quality criteria: 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, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	1.35	1.04	1.73	1.13		1.31	0.31	1.04	1.73	4
April 6, 2000										
July 31, 2000	0.84	0.85	1.64	2.01		1.34	0.59	0.84	2.01	4
October 10, 2000	1.03	0.93	1.29	2.00		1.31	0.48	0.93	2.00	4
Mean	1.07	0.94	1.55	1.71						
Minimum	0.84	0.85	1.29	1.13						
Maximum	1.35	1.04	1.73	2.01						
Std. Deviation	0.26	0.10	0.23	0.51						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	1.63	1.13	2.01	0.36	6					
SC-1, SC-2	1.01	0.84	1.35	0.17	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	1.32	0.84	2.01	0.43	12					

STD - Standard deviation
N - Number of observations

Appendix Table B-11
Continuing Surface Water Quality Monitoring Program
Nitrite Nitrogen (mg/L)
January - December, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	<0.01	<0.01	<0.01	<0.01		<0.01	0.00	<0.01	<0.01	4
April 6, 2000										
July 31, 2000	<0.01	<0.01	<0.01	<0.01		<0.01	0.00	<0.01	<0.01	4
October 10, 2000	<0.01	<0.01	<0.01	<0.01		<0.01	0.00	<0.01	<0.01	4
Mean	<0.01	<0.01	<0.01	<0.01						
Minimum	<0.01	<0.01	<0.01	<0.01						
Maximum	<0.01	<0.01	<0.01	<0.01						
Std. Deviation	0.00	0.00	0.00	0.00						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	<0.01	<0.01	<0.01	0.00	6					
SC-1, SC-2	<0.01	<0.01	<0.01	0.00	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	<0.01	<0.01	<0.01	0.00	12					

STD - Standard deviation
N - Number of observations

Appendix Table B-12
Continuing Surface Water Quality Monitoring Program
Nitrate Nitrogen (mg/L)
January - December, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	0.01	0.01	0.02	0.01		0.01	0.01	0.01	0.02	4
April 6, 2000										
July 31, 2000	0.02	<0.01	0.02	0.93		0.24	0.46	<0.01	0.93	4
October 10, 2000	0.07	0.03	0.02	0.01		0.03	0.03	0.01	0.07	4
Mean	0.03	0.02	0.02	0.32						
Minimum	0.01	<0.01	0.02	0.01						
Maximum	0.07	0.03	0.02	0.93						
Std. Deviation	0.03	0.01	0.00	0.53						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	0.17	0.01	0.93	0.37	6					
SC-1, SC-2	0.02	<0.01	0.07	0.02	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	0.10	<0.01	0.93	0.26	12					

STD - Standard deviation
N - Number of observations

Appendix Table B-13
Continuing Surface Water Quality Monitoring Program
Ammoniacal Nitrogen (mg/L)
January - December, 2000

	South Creek				All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**	**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	0.16	0.09	0.13	0.08	0.12	0.04	0.08	0.16	4
April 6, 2000									
July 31, 2000	0.08	0.04	0.05	0.06	0.06	0.02	0.04	0.08	4
October 10, 2000	<0.01	<0.01	0.02	0.01	0.01	0.01	<0.01	0.02	4
Mean	0.08	0.05	0.07	0.05					
Minimum	<0.01	<0.01	0.02	0.01					
Maximum	0.16	0.09	0.13	0.08					
Std. Deviation	0.08	0.04	0.06	0.04					
N	3	3	3	3					

Stations	Mean	Min	Max	STD	N
SC-4, SC-3	0.06	0.01	0.13	0.04	6
SC-1, SC-2	0.06	<0.01	0.16	0.05	6
SC-4, SC-1, SC-2, SC-3 (entire basin)	0.06	<0.01	0.16	0.05	12

STD - Standard deviation
N - Number of observations

Appendix Table B-14
Continuing Surface Water Quality Monitoring Program
Organic Nitrogen (mg/L)[a]
January - December, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	1.18	0.94	1.58	1.04		1.19	0.28	0.94	1.58	4
April 6, 2000										
July 31, 2000	0.74	0.81	1.57	1.02		1.04	0.38	0.74	1.57	4
October 10, 2000	0.96	0.90	1.25	1.98		1.27	0.50	0.90	1.98	4
Mean	0.96	0.88	1.47	1.35						
Minimum	0.74	0.81	1.25	1.02						
Maximum	1.18	0.94	1.58	1.98						
Std. Deviation	0.22	0.07	0.19	0.55						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	1.41	1.02	1.98	0.37	6					
SC-1, SC-2	0.92	0.74	1.18	0.14	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	1.16	0.74	1.98	0.37	12					

[a]Organic Nitrogen = Total 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, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	0.15	0.22	0.52	0.45		0.34	0.18	0.15	0.52	4
April 6, 2000										
July 31, 2000	0.04	0.05	0.17	0.15		0.10	0.07	0.04	0.17	4
October 10, 2000	0.17	0.17	0.38	0.47		0.30	0.15	0.17	0.47	4
Mean	0.12	0.15	0.36	0.36						
Minimum	0.04	0.05	0.17	0.15						
Maximum	0.17	0.22	0.52	0.47						
Std. Deviation	0.07	0.09	0.18	0.18						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	0.36	0.15	0.52	0.16	6					
SC-1, SC-2	0.13	0.04	0.22	0.07	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	0.25	0.04	0.52	0.17	12					

STD - Standard deviation
N - Number of observations

Appendix Table B-16
Continuing Surface Water Quality Monitoring Program
Orthophosphate (mg/L)
January - December, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	0.08	0.14	0.30	0.44		0.24	0.16	0.08	0.44	4
April 6, 2000										
July 31, 2000	0.01	0.01	0.05	0.13		0.05	0.06	0.01	0.13	4
October 10, 2000	0.14	0.13	0.25	0.20		0.18	0.06	0.13	0.25	4
Mean	0.08	0.09	0.20	0.26						
Minimum	0.01	0.01	0.05	0.13						
Maximum	0.14	0.14	0.30	0.44						
Std. Deviation	0.07	0.07	0.13	0.16						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	0.23	0.05	0.44	0.14	6					
SC-1, SC-2	0.09	0.01	0.14	0.06	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	0.16	0.01	0.44	0.13	12					

STD - Standard deviation
N - Number of observations

Appendix Table B-17
Continuing Surface Water Quality Monitoring Program
Total Nitrogen to Total Phosphorus Ratios (Nt:Pt)
January - December, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	9.00	4.73	3.33	2.51		4.89	2.89	2.51	9.00	4
April 6, 2000										
July 31, 2000	21.00	17.00	9.65	13.40		15.26	4.86	9.65	21.00	4
October 10, 2000	6.06	5.47	3.39	4.26		4.79	1.20	3.39	6.06	4
Mean	12.02	9.07	5.46	6.72						
Minimum	6.06	4.73	3.33	2.51						
Maximum	21.00	17.00	9.65	13.40						
Std. Deviation	7.92	6.88	3.63	5.85						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	6.09	2.51	13.40	4.41	6					
SC-1, SC-2	10.54	4.73	21.00	6.23	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	8.32	2.51	21.00	5.95	12					

STD - Standard deviation
N - Number of observations

Appendix Table B-18
Continuing Surface Water Quality Monitoring Program
Inorganic Nitrogen to Inorganic Phosphorus Ratios (Ni:Pi)
January - December, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	2.19	0.75	0.52	0.22		0.92	0.87	0.22	2.19	4
April 6, 2000										
July 31, 2000	10.50	5.00	1.50	7.65		6.16	3.84	1.50	10.50	4
October 10, 2000	0.57	0.31	0.18	0.13		0.30	0.20	0.13	0.57	4
Mean	4.42	2.02	0.73	2.66						
Minimum	0.57	0.31	0.18	0.13						
Maximum	10.50	5.00	1.50	7.65						
Std. Deviation	5.33	2.59	0.69	4.32						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	1.70	0.13	7.65	2.96	6					
SC-1, SC-2	3.22	0.31	10.50	3.62	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	2.46	0.13	10.50	3.43	12					

STD - Standard deviation
N - Number of observations

Appendix Table B-19
Continuing Surface Water Quality Monitoring Program
Oils and Grease (mg/L)[a]
January - December, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	<1.0	<1.0	<1.0	2.2		0.9	0.9	<1.0	2.2	4
April 6, 2000										
July 31, 2000	<1.4	<1.4	<1.4	<1.4		<1.4	0.0	<1.4	<1.4	4
October 10, 2000	<1.4	<1.4	<1.4	<1.4		<1.4	0.0	<1.4	<1.4	4
Mean	0.6	0.6	0.6	1.2						
Minimum	<1.0	<1.0	<1.0	<1.4						
Maximum	<1.4	<1.4	<1.4	2.2						
Std. Deviation	0.1	0.1	0.1	0.9						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	0.9	<1.0	2.2	0.6	6					
SC-1, SC-2	0.6	<1.0	<1.4	0.1	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	0.8	<1.0	2.2	<1.0	12					

[a]Applicable surface water quality criteria: Maximum allowable concentration of 5.0 mg/L.
STD - Standard deviation
N - Number of observations

Appendix Table B-20
Continuing Surface Water Quality Monitoring Program
Total Coliform Bacteria (counts/100 mL)[a]
January - December 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	1,500	300	500	2,300		1,150	929	300	2,300	4
April 6, 2000										
July 31, 2000	300	600	600	2,100		900	812	300	2,100	4
October 10, 2000	600	1,000	3,800	2,300		1,925	1,445	600	3,800	4
Mean	800	633	1,633	2,233						
Minimum	300	300	500	2,100						
Maximum	1,500	1,000	3,800	2,300						
Std. Deviation	624	351	1,877	115						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	1,933	500	3,800	1,234	6					
SC-1, SC-2	717	300	1,500	422	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	1,325	300	3,800	1,092	12					

[a]Applicable surface water criteria: Maximum of 2,400/100 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, 2000

	South Creek					All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**STD**	**Min**	**Max**	**N**
January 10, 2000	100	100	100	<100		88	25	<100	100	4
April 6, 2000										
July 31, 2000	200	100	600	700		400	294	100	700	4
October 10, 2000	50	30	190	220		123	96	30	220	4
Mean	117	77	297	323						
Minimum	50	30	100	<100						
Maximum	200	100	600	700						
Std. Deviation	76	40	267	337						
N	3	3	3	3						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3	310	<100	700	272	6					
SC-1, SC-2	97	30	200	54	6					
SC-4, SC-1, SC-2, SC-3 (entire basin)	203	30	700	218	12					

[a]Applicable surface water criteria: Maximum of 800/100 mL.

STD - Standard deviation

N - Number of observations

Appendix Table B-22
Continuing Surface Water Quality Monitoring Program
Trace Metals (ug/L)[a]
January - December, 2000

	South Creek				All East Side Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**	**Mean**	**STD**	**Min**	**Max**	**N**
Arsenic	4.5	3.6	6.3	2.9	4.3	1.5	2.9	6.3	4
Copper	7.0	1.9	3.5	8.0	5.1	2.9	1.9	8.0	4
Lead	1.5	<1.0	1.7	1.5	1.3	0.5	<1.0	1.7	4
Zinc	40	30	40	80	48	22	30	80	4

[a] Applicable surface water criteria: 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 at a hardness of 110 mg/L.

STD - Standard deviation

N - Number of observations

APPENDIX C

Quarterly Data Tables

TABLE C-2. SUMMARY OF WATER QUALITY DATA COLLECTED IN THE CATFISH AND NORTH CREEK BASIN OF PALMER RANCH ON MARCH 17, 2000, SARASOTA COUNTY, FLORIDA

Parameters	Stations				Water Quality Standards
	CC-1	CC-2	CC-3	CC-4	
Time	7:10	Dry	9:15	9:45	-----
Stream flow (cfs)	0.01		15	0.11	-----
Water depth (feet)	1.1		2.8	2.3	-----
Temperature (°C)	20.1		20.7	22.5	-----
pH (-log[H^+])	6.8		7.2	7.6	6.0 – 8.5
Dissolved oxygen (mg/L)	5.5		3.0*	5.3	5.0
Specific conductivity (µmhos/cm)	716		1283*	952	1275
Total coliform bacteria (No./100 mL)	12,200*		3700*	300	2,400
Fecal coliform bacteria (No./100 mL)	5300*		560	<10	800
Nitrite nitrogen (mg/L)	<0.01		0.01	0.01	-----
Nitrate nitrogen (mg/L)	0.01		0.16	0.06	-----
Ammonia nitrogen (mg/L)	0.09		0.17	0.15	-----
Total Kjeldahl nitrogen (mg/L)	0.90		1.08	1.23	-----
Organic nitrogen (mg/L)	0.81		0.92	1.08	-----
Total nitrogen (mg/L)	0.91		1.25	1.30	-----
Orthophosphate (mg/L)	0.07		<0.01	<0.01	-----
Total phosphorus (mg/L)	0.17		0.06	0.05	-----
Total suspended solids (mg/L)	6.4		6.2	4.8	-----
Turbidity (NTU)	8.5		5.2	3.6	+29 NTU
Oil and grease (mg/L)	<1.4		<1.4	<1.4	5
Biochemical oxygen demand (mg/L)	<2.0		<2.0	<2.0	-----

[a] Based on a hardness of 110 mg/L.
*Non-compliance with water quality standards specified by FAC 62-302 and Sarasota County Ordinance 98-066, as amended, for Class III fresh waters.

TABLE C-2. SUMMARY OF WATER QUALITY DATA COLLECTED IN THE CATFISH AND NORTH CREEK BASIN OF PALMER RANCH ON MARCH 17, 2000, SARASOTA COUNTY, FLORIDA (CONTINUED)

Parameters	Stations		Water Quality Standards
	CC-5	NC-6	
Time	7:50	8:35	-----
Stream flow (cfs)	0.19	0.48	-----
Water depth (feet)	2.1	0.2	-----
Temperature (°C)	23.1	20.3	-----
PH (-log[H^+])	7.4	7.0	6.0 – 8.5
Dissolved oxygen (mg/L)	5.3	3.2*	5.0
Specific conductivity (µmhos/cm)	1014	973	1275
Total coliform bacteria (No./100 mL)	110	890	2,400
Fecal coliform bacteria (No./100 mL)	<10	<10	800
Nitrite nitrogen (mg/L)	<0.01	0.01	-----
Nitrate nitrogen (mg/L)	0.01	0.06	-----
Ammonia nitrogen (mg/L)	0.10	0.09	-----
Total Kjeldahl nitrogen (mg/L)	1.03	1.03	-----
Organic nitrogen (mg/L)	0.13	0.94	-----
Total nitrogen (mg/L)	1.04	1.10	-----
Orthophosphate (mg/L)	0.04	0.01	-----
Total phosphorus (mg/L)	0.09	0.03	-----
Total suspended solids (mg/L)	5.8	<0.5	-----
Turbidity (NTU)	4.0	1.1	+29 NTU
Oil and grease (mg/L)	<1.4	<1.4	5
Biochemical oxygen demand (mg/L)	<2.0	<2.0	-----

*Non-compliance with water quality standards specified by FAC 62-302 and Sarasota County Ordinance 98-066 as amended, for Class III fresh waters.

TABLE C-3. SUMMARY OF WATER QUALITY DATA COLLECTED IN THE SOUTH CREEK BASIN OF PALMER RANCH ON APRIL 6, 2000, SARASOTA COUNTY, FLORIDA

Parameters	Stations				Water Quality Standards
	SC-1	SC-2	SC-3	SC-4	
Time	DRY	DRY	DRY	DRY	-----
Stream flow (cfs)					-----
Water depth (feet)					-----
Temperature (°C)					-----
pH (-log[H^+])					6.0 – 8.5
Dissolved oxygen (mg/L)					5.0
Specific conductivity (µmhos/cm)					1275
Total coliform bacteria (No./100 mL)					2,400
Fecal coliform bacteria (No./100 mL)					800
Nitrite nitrogen (mg/L)					-----
Nitrate nitrogen (mg/L)					-----
Ammonia nitrogen (mg/L)					-----
Total Kjeldahl nitrogen (mg/L)					-----
Organic nitrogen (mg/L)					-----
Total nitrogen (mg/L)					-----
Orthophosphate (mg/L)					-----
Total phosphorus (mg/L)					-----
Total suspended solids (mg/L)					-----
Turbidity (NTU)					+29 NTU
Oil and grease (mg/L)					5
Biochemical oxygen demand (mg/L)					-----

*Non-compliance with water quality standards specified by FAC 62-302 and Sarasota County Ordinance 98-066, as amended, for Class III fresh waters.

TABLE C-4. SUMMARY OF WATER QUALITY DATA COLLECTED IN THE SOUTH CREEK BASIN OF PALMER RANCH ON JULY 31, 2000, SARASOTA COUNTY, FLORIDA

Parameters	Stations				Water Quality Standards
	SC-1	SC-2	SC-3	SC-4	
Time	11:24	11:01	10:52	10:43	-----
Stream flow (cfs)	0.0	121.1	0.0	0.0	-----
Water depth (feet)	1.7	0.5	0.5	0.4	-----
Temperature (°C)	27.0	28.1	25.7	28.3	-----
pH (-log[H^+])	6.7	6.8	6.4	6.6	6.0 – 8.5
Dissolved oxygen (mg/L)	5.1	8.0	2.5*	5.9	5.0
Specific conductivity (umhos/cm)	1276	1270	1116	944	1275
Total coliform bacteria (No./100 mL)	300	600	600	2100	2,400
Fecal coliform bacteria (No./100 mL)	200	100	600	700	800
Nitrite nitrogen (mg/L)	<0.01	<0.01	<0.01	<0.01	-----
Nitrate nitrogen (mg/L)	0.02	<0.01	0.02	0.93	-----
Ammonia nitrogen (mg/L)	0.08	0.04	0.05	0.06	-----
Total Kjeldahl nitrogen (mg/L)	0.82	0.85	1.62	1.08	-----
Total nitrogen (mg/L)	0.84	0.85	1.64	2.01	-----
Orthophosphate (mg/L)	0.01	0.01	0.05	0.13	-----
Total phosphorus (mg/L)	0.04	0.05	0.17	0.15	-----
Total suspended solids (mg/L)	0.6	1.8	14.8	3.6	-----
Turbidity (NTU)	1.1	1.7	4.5	2.6	+29 NTU
Oil and grease (mg/L)	<1.4	<1.4	<1.4	<1.4	5
Biochemical oxygen demand (mg/L)	<2.0	<2.0	4.0	<2.0	-----

*Non-compliance with water quality standards specified by FAC 62-302 and Sarasota County Ordinance 98-066, as amended, for Class III fresh waters.

TABLE C-5. SUMMARY OF WATER QUALITY DATA COLLECTED IN THE CATFISH AND NORTH CREEK BASIN OF PALMER RANCH ON SEPTEMBER 14, 2000, SARASOTA COUNTY, FLORIDA

Parameters	Stations				Water Quality Standards
	CC-1	CC-2	CC-3	CC-4	
Time	12:00	12:45	13:00	13:15	-----
Stream flow (cfs)	107.5	0.0	0.0	0.0	-----
Water depth (feet)	0.4	0.2	1.4	3.2	-----
Temperature (°C)	27.0	29.7	29.8	29.2	-----
pH (-log[H^+])	7.0	7.6	6.8	7.1	6.0 – 8.5
Dissolved oxygen (mg/L)	5.1	7.0	5.0	5.8	5.0
Specific conductivity (umhos/cm)	342	675	696	776	1275
Total coliform bacteria (No./100 mL)	10300	900	670	400	2,400
Fecal coliform bacteria (No./100 mL)	6400	700	170	380	800
Nitrite nitrogen (mg/L)	0.5	<0.01	<0.01	<0.01	-----
Nitrate nitrogen (mg/L)	0.22	0.07	0.12	0.03	-----
Ammonia nitrogen (mg/L)	<0.01	<0.01	0.03	<0.01	-----
Total Kjeldahl nitrogen (mg/L)	1.63	1.48	1.33	1.73	-----
Organic nitrogen (mg/L)	1.63	1.48	1.30	1.73	-----
Total nitrogen (mg/L)	1.90	1.55	1.45	1.76	-----
Orthophosphate (mg/L)	0.17	0.36	0.08	0.02	-----
Total phosphorus (mg/L)	0.35	0.20	0.22	0.20	-----
Total suspended solids (mg/L)	15.0	6.0	7.6	14.0	-----
Turbidity (NTU)	6.3	1.1	4.3	8.5	+29 NTU
Oil and grease (mg/L)	<1.4	<1.4	<1.4	<1.4	5
Biochemical oxygen demand (mg/L)	<2.0	<2.0	<2.0	5.9	-----
Arsenic as As (μg/L)	2.7	3.7	6.7	5.8	<50[a]
Copper as Cu (μg/L)	1.1	2.5	4.5	6.7	<12.8[a]
Lead as Pb (μg/L)	4.5	1.9	1.6	1.2	<3.6[a]
Zinc as Zn (μg/L)	20	10	10	10	<115[a]

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

*Non-compliance with water quality standards specified by FAC 62-302 and Sarasota County Ordinance 98-066, as amended, for Class III fresh waters.

TABLE C-5. SUMMARY OF WATER QUALITY DATA COLLECTED IN THE CATFISH AND NORTH CREEK BASIN OF PALMER RANCH ON SEPTEMBER 14, 2000, SARASOTA COUNTY, FLORIDA (CONTINUED)

Parameters	Stations		Water Quality Standards
	CC-5	NC-6	
Time	13:30	14:00	-----
Stream flow (cfs)	8235.5	2993.5	-----
Water depth (feet)	0.3	0.3	-----
Temperature (°C)	30.0	27.6	-----
pH (-log[H^+])	7.6	6.8	6.0 – 8.5
Dissolved oxygen (mg/L)	8.6	1.8	5.0
Specific conductivity (umhos/cm)	725	1220	1275
Total coliform bacteria (No./100 mL)	500	5300	2,400
Fecal coliform bacteria (No./100 mL)	110	2600	800
Nitrite nitrogen (mg/L)	<0.01	<0.01	-----
Nitrate nitrogen (mg/L)	0.01	0.03	-----
Ammonia nitrogen (mg/L)	0.03	0.01	-----
Total Kjeldahl nitrogen (mg/L)	1.83	2.29	-----
Organic nitrogen (mg/L)	1.80	2.28	-----
Total nitrogen (mg/L)	1.84	2.32	-----
Orthophosphate (mg/L)	0.03	0.05	-----
Total phosphorus (mg/L)	0.17	0.16	-----
Total suspended solids (mg/L)	8.8	17.2	-----
Turbidity (NTU)	5.4	22.0	+29 NTU
Oil and grease (mg/L)	<1.4	<1.4	5
Biochemical oxygen demand (mg/L)	4.9	<2.0	-----
Arsenic as As (μg/L)	6.3	3.6	<50[a]
Copper as Cu (μg/L)	5.5	6.8	<12.8[a]
Lead as Pb (μg/L)	<1.0	1.1	<3.6[a]
Zinc as Zn (μg/L)	10	90	<115[a]

[a] Based on a hardness of 110 mg/L.
*Non-compliance with water quality standards specified by FAC 62-302 and Sarasota County Ordinance 98-066, as amended, for Class III fresh waters.

TABLE C-6. SUMMARY OF WATER QUALITY DATA COLLECTED IN THE SOUTH CREEK BASIN OF PALMER RANCH ON OCTOBER 10, 2000, SARASOTA COUNTY, FLORIDA

Parameters	Stations				Water Quality Standards
	SC-1	SC-2	SC-3	SC-4	
Time	12:35	12:17	11:30	11:50	-----
Stream flow (cfs)	223.1	0.0	0.0	0.0	-----
Water depth (feet)	1.7	1.2	0.9	0.8	-----
Temperature (°C)	19.9	19.7	18.5	20.1	-----
pH (-log[H^+])	7.0	7.1	6.7	7.0	6.0 - 8.5
Dissolved oxygen (mg/L)	3.2	5.1	4.5	6.5	5.0
Specific conductivity (µmhos/cm)	801	819	698	616	1,275
Total coliform bacteria (No./100 mL)	600	1000	3800	2300	2,400
Fecal coliform bacteria (No./100 mL)	50	30	190	220	800
Nitrite nitrogen (mg/L)	<0.01	<0.01	<0.01	<0.01	-----
Nitrate nitrogen (mg/L)	0.07	0.03	0.02	0.01	-----
Ammonia nitrogen (mg/L)	<0.01	<0.01	0.02	0.01	-----
Total Kjeldahl nitrogen (mg/L)	0.96	0.90	1.27	1.99	-----
Organic nitrogen (mg/L)	0.96	0.90	1.25	1.98	-----
Total nitrogen (mg/L)	1.03	0.93	1.29	2.00	-----
Orthophosphate (mg/L)	0.14	0.13	0.25	0.20	-----
Total phosphorus (mg/L)	0.17	0.17	0.38	0.47	-----
Total suspended solids (mg/L)	2.8	1.6	43.0	47.0	-----
Turbidity (NTU)[a]	1.1	0.8	11.1	10.1	+29 NTU
Oil and grease (mg/L)	<1.4	<1.4	<1.4	<1.4	5
Biochemical oxygen demand (mg/L)	<2.0	<2.0	<2.0	2.0	-----
Arsenic as As (µg/L)	4.5	3.6	6.3	2.9	<0.50[a]
Copper as Cu (µg/L)	7.0	1.9	3.5	8.0	<12.8[a]
Lead as Pb (µg/L)	1.5	<1.0	1.7	1.5	<3.6[a]
Zinc as Zn (µg/L)	40	30	40	80	<115[a]

[a]Based on a hardness of 110 mg/L.
*Non-compliance with water quality standards specified by FAC 62-302 and/or Sarasota County Ordinance 98-066 for Class III fresh waters.

APPENDIX D

Project Team

Gary M. Serviss

Senior Environmental Scientist

Mr. Gary Serviss is a senior member of the VHB Environmental Services Division staff. He is responsible for the management and direction of projects and staff for qualitative and quantitative vegetation and wildlife assessments, wildlife management plan formulation and natural system restoration and mitigation plans. He also serves as a task manager and client liaison for environmental resource permitting.

Mr. Gary Serviss has over seventeen years of technical and project management experience in environmental assessments and permitting. He has extensive experience in wetlands evaluation/classification, mitigation design, wildlife evaluations, and habitat mapping. He has designed and coordinated numerous environmental investigations to serve as a basis for environmental permit applications and Development of Regional Impact Applications. He has served as an expert witness on environmental constraints, bald eagles and wetland impacts related to dredge and fill activities. Mr. Serviss has been certified by the U. S. Army Corps of Engineers as a Wetland Delineator.

His recent project experience includes

University Lakes at Lakewood Ranch (2300 ± ac.), Sarasota Co., FL
Task Manager to conduct an ecological site assessment for the Development of Regional Impact Application. Assessment involved individual wetland inventory for jurisdiction and mitigation potential and an Endangered and Threatened species survey. Assisted in the development and refinement of the Master Development Plan to minimize adverse ecological consequences. Coordinated detailed habitat mapping, gopher tortoise and other wildlife surveys. Prepared responses to DRI questions and sufficiency questions relative to vegetation communities, wildlife and wetlands.

Pelican Point (968 ac.), Sarasota Co., FL
Designed and supervised habitat mapping, wetland and SHW/NP delineation, and protected species surveys for bald eagle, red-cockaded woodpeckers, gopher tortoise and scrub jays. Assisted in the preparation of environmental permit applications to Sarasota County, ACOE and SWFWMD for approval of the golf course and initial phases of development. Designed mitigation areas and supervised the construction and mulch transfer process. Prepared a Gopher tortoise and Scrub jay management plan and obtained FGFWFC and USFWS approval.

Tampa Bay Water, South Central Hillsborough Regional Wellfield, Hillsborough Co., FL
Project Manager for a three-year project to monitor the ecological condition of the wellfield and surrounding areas to detect possible ecological effects attributable to wellfield pumpage. Water level and wildlife information were collected monthly at 27 sites. Qualitative vegetative information was collected bi-annually from the 27 sites. Quantitative data on species composition and percent cover was collected bi-annually for herbaceous and shrub vegetation and annually for trees at six sites. Infrared aerial photography was analyzed twice a year for land use and hydrologic changes. Prepared progress reports bi-annually and a comprehensive annual report.

Palmer Ranch "Eastside" Development (2746± ac.), Sarasota Co., FL
Project Scientist for Environmental Analysis. Supervised site assessments of vegetation communities and threatened/endangered species occurrence. Assisted with preparation of impact assessment report and development of master drainage plan for purposes of maintaining wetland hydroperiod. Assisted with preparation and processing of wetland resource permit and conceptual MSSW permit application for entire tract.

Cypress Lakes Development, Polk Co., FL
Task Manager to conduct field surveys to flag wetland limits and to mark the seasonal high water and normal pool elevations within the wetlands. Obtained agency verifications of wetland jurisdiction and assisted in the permit application preparation and processing. Approval was obtained from the Florida Game and Fresh Water Fish Commission of a recipient site to relocate gopher tortoises and eleven tortoises were relocated.

Wellington Commons (466± ac.), Palm Beach Co., FL
Project Scientist for the preparation and processing of a Development of Regional Impact application. Also assisted in the preparation and processing of an ERP application for the project through the ACOE and a Conceptual Environmental Resource Permit through SFWMD. Permitting involved impacts to 9.87 acres of wetland, mitigation plan preparation, restoration plans for the hydroperiod of preserved wetlands and a preservation plan for a protected plant (Hand Adder's tongue fern).

Little Sarasota Bay Study, Sarasota Co., FL
Project Scientist to coordinate the Biological, Hydrological and Water Quality assessment of Little Sarasota Bay. Analyzed the biological data (including seagrass, macroalgae, benthic infauna, fish fauna and phytoplankton) and co-authored the "Ecological Status of Little Sarasota Bay with reference to Midnight Pass" report. Also coordinated the biological assessment of the permit to dredge Midnight Pass. Involved the delineation of marine habitats, benthic infauna monitoring, fish fauna monitoring and sediment analysis.

University Place Development of Regional Impact (1,500 ac.), Sarasota Co., FL
Project Scientist for implementation of a site assessment of 1,500 acres. Assessment included mapping of habitats by APOXSEE nomenclature; individual inventory of each wetland for size, function, habitat value, mitigation potential and agency jurisdiction; and an Endangered and Threatened species survey. Developed environmental methodology for wetlands and protected species and obtained County approval. Coordinated the field surveys of wetlands and wildlife and prepared DRI responses and sufficiency responses. Prepared wildlife management plan for submission to FGFWFC.

Matthews, Hutton and Eastmore, Sarasota Co., FL
Project manager to attend a deposition of a bald eagle expert relative to a condemnation hearing for a county park acquisition. Conducted a field survey of the site in question, reviewed the project history, bald eagle articles and assisted in establishing hearing strategies. Expert testimony was presented relative to bald eagle constraints, native habitats and potential impacts to Lemon Bay.

Estero River Bay(1,269 ac.), Lee Co., FL
Project Scientist involved in the habitat mapping, wetland delineation and protected species survey. Coordinated the quantitative survey for Lee County Listed Species on the 691 acre portion of the site proposed for development. Prepared responses for the Environmental Impact Assessment portion of the rezone application including the Protected Species Survey report.

PUBLICATIONS

Sauers, S. and G. Serviss. 1985. Ecological Status of Little Sarasota Bay with reference to Midnight Pass. County of Sarasota, Florida. 92 pp.

Alevizon, W., R. Richardson, P. Pitts, and G. Serviss. 1985. Coral Zonations and Patterns of Community Structure in Bahamian Reef Fishes. Bull. Mar. Sci. 36(2): 304-318.

Education	M.S., Florida Institute of Technology, Melbourne, FL, 1982 (Biological Sciences) B.S., Florida Institute of Technology, Melbourne, FL, 1979 (Marine Biology)
Affiliations	Sarasota Bay National Estuary Program's Artificial Habitat Enhancement Task Force Sea Grant Marine Advisory Committee Sarasota County Artificial Reef Committee
Certification	Certified Wetland Delineator

Thomas D. Dostal

Environmental Scientist

Mr. Dostal is a field scientist with the VHB Environmental Services Division and has two years experience with ecological data collection, wetland mitigation monitoring and water quality compliance monitoring.

Mr. Thomas Dostal has conducted qualitative and quantitative vegetation monitoring, threatened and endangered species surveys, and water quality monitoring and sampling programs. He has assisted with habitat mapping and classification. Additionally, he has assisted with wetland jurisdictional delineation's and wetland hydroperiod determinations.

His recent project experience includes:

FPC Transmission Line, Osceola and Orange Counties, FL
Field Scientist to assist with wetland delineation along 22 miles of proposed powerline corridor. Utilized specific criteria (hydrology, soil type, and vegetation present) to determine natural wetland boundaries.

Duette Park (21,000 ± ac.), Manatee Co., FL
Field Scientist on habitat mapping survey at Duette Park. Also served as a field team member for threatened and endangered flora surveys on site.

Pinellas County Public Works Department, Pinellas Co., FL
Conducted monthly status monitoring events of planted lake littoral zones and mitigation areas for multiple roadway projects. Qualitative and quantitative monitoring of mitigation areas was also conducted. Results were summarized in technical reports.

South Central Hillsborough Regional Wellfield, Hillsborough Co., FL
Performed monthly surface water and groundwater level monitoring at 14 sites adjacent to the wellfield. Assisted in qualitative and quantitative vegetation surveys.

Palmer Ranch, Sarasota Co., FL
Conducted semi-annual water quality monitoring and sampling at 6 stations within Catfish Creek and North Creek. Prepared semi-annual data reports discussing water quality analyses and an annual interpretive report.

Lennar Homes, Sarasota Co., FL
Project Scientist to ensure environmental compliance at the Hamptons, a large residential construction site. Services included observations of wetland mulch transfer, daily erosion control measures inspections, success monitoring of two enhanced wetland mitigation areas and lake littoral zones and monitoring of bald eagle behavior relative to construction activities.

The Williams Company, Polk Co., FL
Assisted with Threatened and Endangered flora and fauna surveys which included small mammal and herpetofaunal trapping and pedestrian transects, conducted American kestral survey and collected water quality samples in response to DRI questions for Saddle Creek site.

Cargill Fertilizer, Hillsborough Co., FL
Assisted with jurisdictional wetland delineation's, habitat mapping and tree survey. Information was used to prepare Consolidated Development Application for gypsum disposal area.

Florida Power Corp., Marion Co., FL
Conducted jurisdictional wetland delineation and preparation for submittal to ACOE for the Ross Prairie Substation.

Manatee County, Manatee Co., FL
Assisted with habitat mapping using the Florida Natural Areas Inventory's Guide to the Natural Communities of Florida, community type characterization, and threatened and endangered flora surveys at the Manatee River Headwaters property (2100 acres) and Duette Park (21,300 acres).

Education BA, University of South Florida, Tampa Florida
Interdisciplinary Natural Sciences; Biology concentration

Mr. McDonald is a field scientist with the VHB Environmental Services Division and has two years experience with ecological data collection, wetland mitigation monitoring and water quality compliance monitoring.

Field and Laboratory Research Experience

Research Assistant, Tagging Right Whales – Grand Manan, N.B., Canada

Assisted on a project to attach telemetry devices to right whales to determine movement patterns, dive durations, and other characteristics. Helped maintain and repair equipment, piloted the research vessel, and assisted in tag testing and construction.

Research Assistant, Tagging of Humpback Whales – Petersburg, AK

Provided field assistance on a project to determine humpback whale reactions to acoustic stimuli via telemetry devices. Aided in maintaining and repairing boats and equipment, took identification photographs and video, and piloted the research boat during both tagging and photography.

Marine Mammal Stranding Volunteer, Florida Department of Environmental Protection – Melbourne, FL

Assisted FDEP/FMRI biologists in recovery, necropsy, disposal, and/or rescue of cetaceans and manatees in Brevard and Volusia Counties, FL. Aided in equipment maintenance and repair, and provided any assistance required by FDEP staff.

Observer on Right Whale Aerial Survey Team, Florida Department of Environmental Protection – Jacksonville, FL

Observer on board a NOAA aircraft during offshore right whale aerial surveys in south Georgia/north Florida. Enhanced my observation techniques and my skill at identifying several cetacean, turtle, and fish species, and gained experience with the NMFS data recording computer program. Also took video and still photography for later identification of individual whales.

Endangered Species Observer Aboard Dredging Vessels – St. Augustine, FL and Brunswick, GA

Monitored and recorded the impact of hopper dredge ships on sea turtles, right whales, and manatees, and any physical taking of sea turtles by the dredge.

Field Assistant, Satellite Transmitter Tragging of Blue Whales – Santa Barbara, CA

Member of a research team from Oregon State University's Hatfield Marine Science Center, Newport, OR. The research goal was to attach satellite transmitters to blue whales to track their movements and diving behaviors for extended time periods. Took identification photographs of individual whales. Observed and recorded dive times, and surface behaviors of whales. Assisted in the maintenance and operation of the research vessels and lived on board the primary vessel for three months.

Laboratory Research Assistant – Auburn, AL

Assisted on a project involving the production of monoclonal antibodies at the Auburn

University

Cell Science Center. Maintained live animals (mice), aided in cell fusion and cell cloning procedures, performed Western blots and dissections, and prepared cell cultures and growth media.

Research Internship – Pacific Whale Foundation, Australia
Member of research team in Hervey Bay, Queensland, Australia that studied ecology and behavior of humpback whales. Learned small boat handling, hydrophone use, and techniques to measure several aspects of the water environment, including salinity and turbidity.

Teaching, Supervisory and Other Experience:

R'Club Child Care, Inc. – St. Petersburg, FL
Responsible for processing and maintaining client information pertaining to accounts receivable and billing using the computer database program ProCare. Other duties include production of reports and billing statements to support budgets, grants and proposals; reviewing and records for compliance and accuracy; and development and maintenance of procedures and forms to collect necessary client information.

University of British Columbia
Instructor for the laboratory portion of first-year Biology courses. Led students on field trips, evaluated their performance through lab reports and exams, and assisted them in developing their own scientific research projects.

Florida Institute of Technology
Taught the laboratory portion of Comparative Vertebrate Anatomy, a senior –level zoology course. Demonstrated to students and assisted them in dissections; created, administered and graded examinations; and taught them basic microscopy techniques.

Outdoor Education Instructor, Blue Ridge Outdoor Education – Toccoa, GA
Taught and helped develop a variety of courses about the natural environment and Native American history in northeast Georgia for children ages 6-18. Led whitewater rafting trips and hikes. Maintained and handled live animals (including reptiles, amphibians and fish) for teaching displays.

Undergraduate Teaching Assistant – Auburn, AL
Prepared, taught, and evaluated student performance in the laboratory portion of the invertebrate zoology course at Auburn University. Improved my communication skills, my knowledge of invertebrates, and my animal handling techniques with arachnids, arthropods, polychaetes, mollusks, protozoans, and others.

Intern supervisor with James River Corp. – Green Bay, WI
Employed as a supervisor in the paper-converting department at the James River Corporation Paper Mill. Assigned weekly positions to employees, teamed with maintenance engineers to keep product lines running, and aided in decisions involving production schedules.

Honors, Activities and Memberships:
Natural Resources Law Scholarship to Northwestern School of Law, Lewis and Clark College (1994)

National Merit and Auburn Presidential Scholarships (1987).
Beta Beta Beta Biological Honor Society and Phi Kappa Phi Honor Society at Auburn University.
Named to Auburn University Dean's List seven times. Varsity letterman for Auburn swim team (1989).
A Southeastern Conference Outstanding Student-Athlete (1989).
Society for Marine Mammalogy (1995-present)

Certifications:
U.S. Coast Guard Auxiliary Boating Skills and Seamanship Course (1996)
SCUBA (NAUI-1991).

Education

University of British Columbia – Vancouver, B.C., Canada
Candidate for Master's of Science degree in Zoology. Thesis project: characterization of the heart rates of free-swimming gray whales (Eschrichtius robustus). Sept. 1998- Oct. 1999

Florida Institute of Technology – Melbourne, FL
Candidate for Master's of Science degree in Biological Sciences. GPA: 4.00/4:00. Transferred to U.B.C. after funding sources for the thesis project withdrew. Jan. 1996-Dec. 1997

Auburn University – Auburn, AL
Bachelor's or Science degree in Marine Biology in December 1992. Graduated Summa Cum Laude. GPA: 3.82/4.00. Sept. 1987 – 1992

Oregon Institute of Marine Biology – Charleston, OR
Course in marine invertebrate zoology and directed readings on humpback whales. Sept. 1987- Aug. 1991

Affiliations

Registration