21ST 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 2005

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SARASOTA COUNTY, FLORIDA

1.0 INTRODUCTION

A master development plan for the Palmer Ranch is being implemented pursuant to the terms and conditions of the *Amended and Restated Master Development Order* (Amended MDO, 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.

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

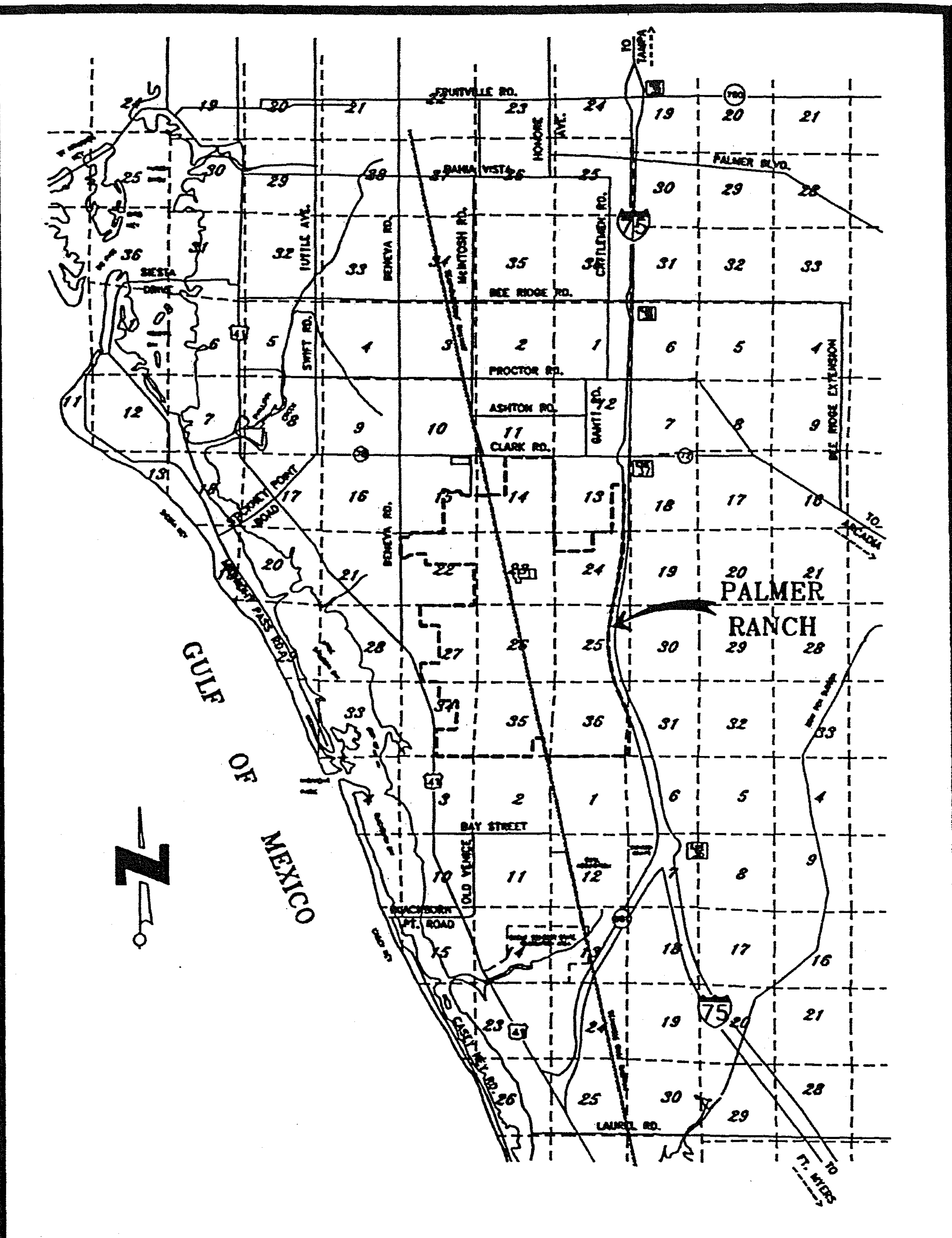


Figure 1.1. General Site Location.

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 for an annual sampling event conducted in September 1988, the "Continuing Surface Water Quality Monitoring Program" was suspended in June 1988, due to the initiation of the "Pollutant Loading Monitoring Program". The Stormwater Pollutant Loading Monitoring Program was performed between June 1988 and December 1989 and a report submitted to Sarasota County on May 29, 1992. Subsequent to an agreement between the Sarasota County Pollution Control Division and Palmer 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 2005 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			
	1941-1970A		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

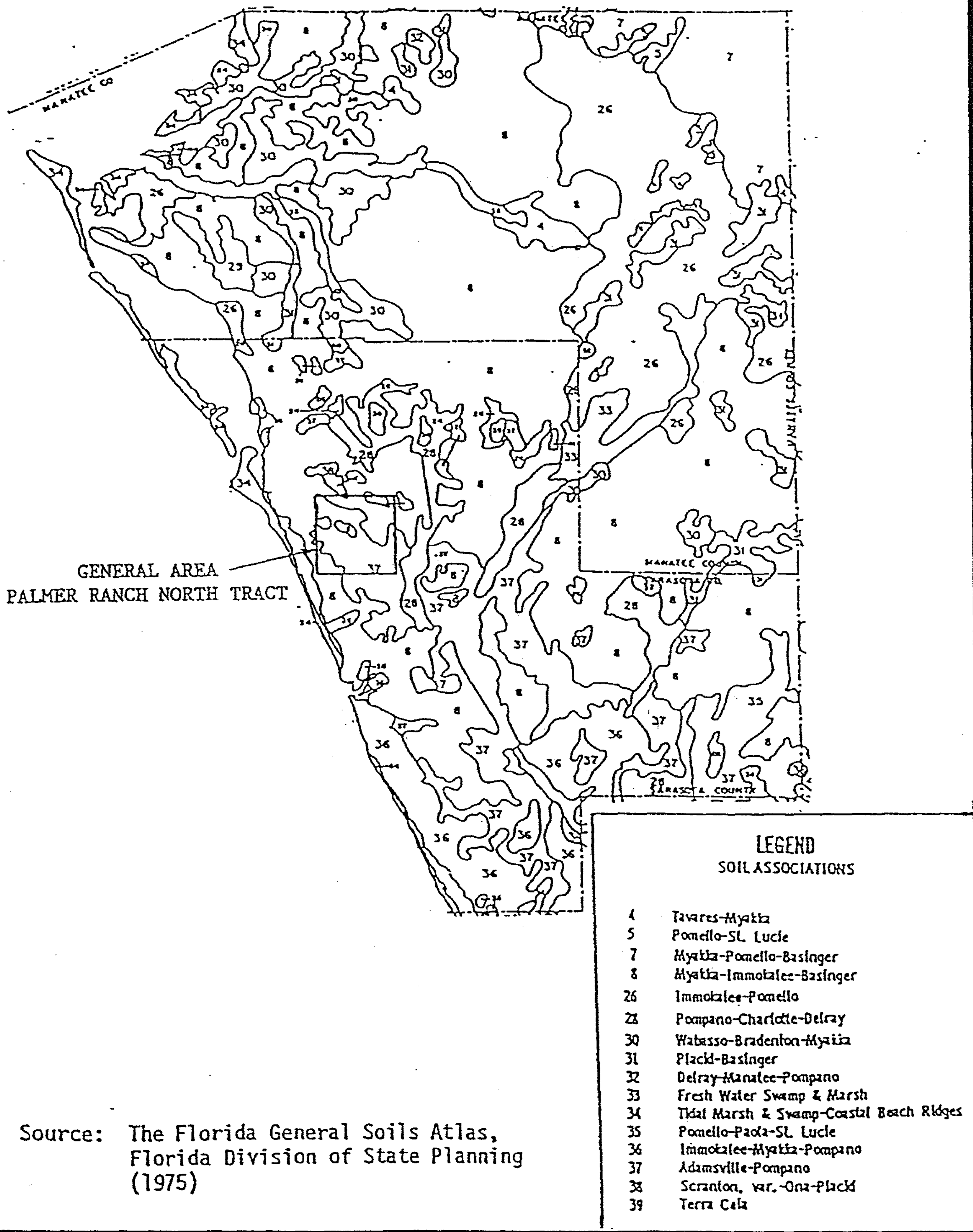
Soils of the Palmer Ranch are generally sandy except in areas of low relief and poor drainage where peaty mucks are common (Florida Division of State Planning, 1975). Upland soils of Palmer Ranch are predominately of the Myakka-Immokalee-Basinger Association. This soil association is defined as nearly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

2.3 Land Use and Vegetation

Historically, the primary land use within the Palmer Ranch has been cattle ranching. However, changes in land uses on the Palmer Ranch have included the following: construction of surface water management systems; 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.



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 not 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.
	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.

Table 2.2 (Continued)

Area Definition	Map Unit No.	Soil Association Description
	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.
	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.

2.4 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 at times and "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, 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. Portions of the creek and associated wetlands have been restored in association with adjacent development. 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 ft, 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 ft, 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 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 µg/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 µmhos/cm, whichever is greater, in predominantly fresh waters.
Copper	Not >12.8 µg/L at a Total Hardness of 110 mg/L
Dissolved Oxygen	Not <5 mg/L
Lead	Not >3.6 µg/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
Total Nitrogen	See Nutrients
Organic Nitrogen	See Nutrients
Oil and Greases	Not >5 mg/L
Orthophosphate	See Nutrients

Table 2.3 (Continued)

Parameter	Water Quality Standard[a]
Total Phosphorus	See Nutrients
pH	6.0 – 8.5
Total Suspended Solids	-----
Turbidity	Not >29 NTU above background
Zinc	Not >115 µg/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 residential areas, 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-4 and SC-1. Station SC-3 is upstream of any development 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 2005, and quarterly sampling was performed during January, April, July, and October 2005 in South Creek. The analysis of the annual parameters was performed for samples collected during the wet season events (*i.e.* September and October 2005). 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.

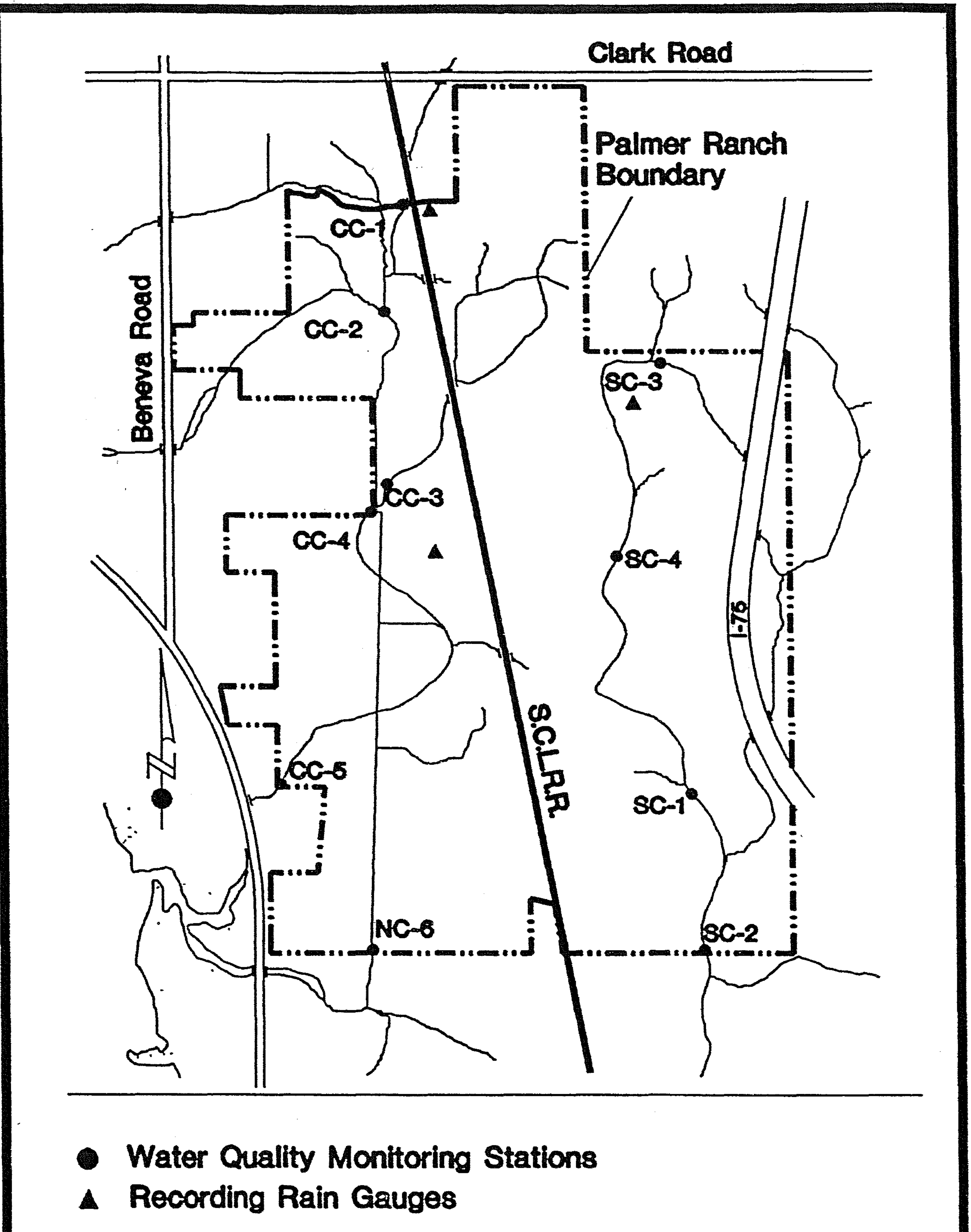


Figure 3.1. Location of Surface Water Monitoring Stations.

Table 3.1 General Descriptive Characteristics of Surface Water Quality Sampling Stations

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

Table 3.2a Date and Time of Sampling for the 21st Annual Monitoring Period of January through December 2005

West Side

Event No.	Date of Sampling	Monitoring Stations					
		CC-1	CC-2	CC-3	CC-4	CC-5	NC-6
1	March 29, 2005	1024	1106	1132	1139	1204	1246
2	September 29, 2005	1232	1302	1315	1321	1333	1431

East Side

Event No.	Date of Sampling	Monitoring Stations			
		SC-1	SC-2	SC-3	SC-4
1	January 20, 2005	1137	1235	1444	1423
2	April 4, 2005	1234	1110	1357	1323
3	July 15, 2005	1234	1127	1337	1323
4	October 3, 2005	1152	1126	1226	1211

Table 3.2b Weather Conditions Observed During Sampling for the 21st Annual Monitoring Period of January through December 2005

Date	Air Temperature (F)	Cloud Cover (%)	Wind Speed	Wind Direction	Rain
January 20, 2005	50-60	100	0-10	NE	Yes
March 29, 2005	-	-	-	-	-
April 4, 2005	75-80	0-5	0-5	SE	No
July 15, 2005	-	-	-	-	-
September 29, 2005	80-91	15-65	0-5	SSW	No
October 3, 2005	85-90	10-45	5-10	ENE	No

Surface water quality monitoring from January through December 2005 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 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. 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
- 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 2005 monitoring events for the laboratory analysis of the following parameters:

- Arsenic
- Lead
- Copper
- Zinc

All sampling was performed in accordance with the Florida Department of Environmental Protection standard operating procedures. 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.

TABLE 3.3 COLLECTION AND ANALYTICAL METHODS USED DURING THE SURFACE WATER QUALITY MONITORING EVENT

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

Table 3.3 (Continued)

Parameter	Sample Type	Field Handling	Hold Time	Laboratory Handling	Analytical Method	Method Reference
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
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.

Laboratory analyses were performed by Benchmark EnviroAnalytical's laboratory which is certified 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.

4.0 RESULTS AND DISCUSSION

During the 21st year of the "Continuing Surface Water Quality Monitoring Program" (*i.e.*, January through December 2005), six surface water quality monitoring events were conducted by VHB. Sampling of Catfish and North Creeks was conducted on March 29 and September 29, 2005 and sampling of South Creek was conducted on January 20, April 4, July 15 and October 3, 2005. 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 2005 monitoring year for the "Continuing Surface Water Quality Monitoring Program" are tabulated by parameter in Appendix B and C for the Catfish Creek/North Creek and South Creek sites, respectively. 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 2005 monitoring year are provided in Appendix D. Comparison of the data with previous results and general conclusions are included with the discussion for each parameter or group of related parameters.

4.1 Rainfall and Hydrology

4.1.1 *Rainfall*

Rainfall data for telemetry sites near the Palmer Ranch (Oscar Scherer State Park, Laurel Park, and Osprey Stations) were not used because evaluation of data revealed numerous inconsistencies, and rainfall data collection for Oscar Scherer State Park was discontinued by the Southwest Florida Water Management District (SWFWMD). Consequently, determining antecedent rainfall accumulations during the 2-day, 2-week and 2-month periods prior to sampling were not possible. The Manasota Region Average Rainfall reported by the SWFWMD is used to summarize hydrologic conditions for the water quality monitoring period. The annual rainfall amount recorded for the Manasota Region during the 21st year of the "Continuing Surface Water Quality Monitoring Program" is higher than the historic average annual rainfall of approximately 54.8 inches (based on a 30-year period of record, NOAA, 1982). Approximately 60.1 inches of precipitation were recorded during the period from October 1, 2004 through September 30, 2005 (Table 4.1) in comparison to a range of 24 to 74 inches recorded during the period of record. On Palmer Ranch, totals of 38 to 65 inches were recorded during previous monitoring years (CCI, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995, 1996, 1997, 1998 and 1999, and VHB, 1999, 2000, 2001, 2002, 2004, and 2005).

Table 4.1 Comparison of Monthly Rainfall for Manasota Region with Historical Rainfall for the Period of October 2004 through October 2005

Date	Monthly Rainfall (Inches)	Historical Rainfall (Inches)	Percent of Historic
October 2004	1.85	3.23	57
November 2004	1.60	1.91	84
December 2004	3.31	2.09	158
January 2005	1.93	2.44	79
February 2005	4.09	2.77	148
March 2005	4.92	3.07	160
April 2005	4.19	2.44	172
May 2005	4.87	3.09	158
June 2005	15.2	7.47	203
July 2005	9.43	8.45	112
August 2005	5.48	8.79	62
September 2005	3.23	7.82	41
October 2005	6.43	3.22	200
Water Year (October 2004 through September 2005)			
Annual Total	60.1	53.6	120
Dry Season (October - May)	26.8	21.0	127
Wet Season (June - September)	33.3	32.5	105

Rainfall recorded during the 2005 monitoring year exhibited the typical seasonal trend for this region of Florida. Figure 4.1 provides a comparison of the monthly distribution of rainfall measured for the period from October 2004 through October 2005 with the average monthly distribution of historic rainfall for the Manasota Region. Dry Season Rainfall (October 2004 through May 2005) was 26.8 inches, or 27% above the historic average (Table 4.1). Wet Season Rainfall (June 2005 through September 2005) was 33.3 inches, or 2% higher than the historic average. Consequently, the 2004-2005 monitoring period would be generally considered as a wet year with substantially above-normal rainfall during the dry season and slightly above-normal rainfall during the wet season.

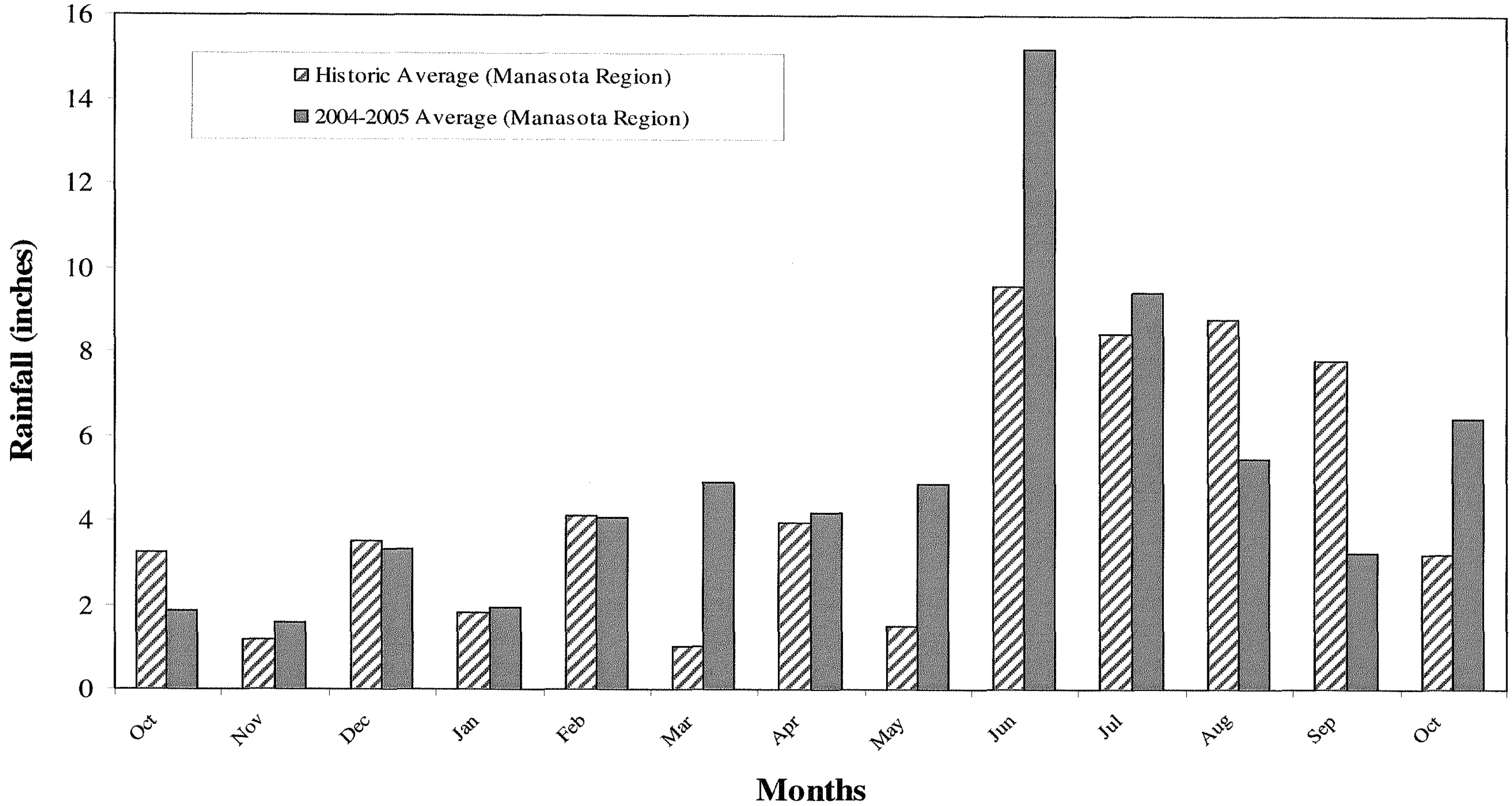


Figure 4.1 Historic Rainfall for the Period of Record and Average Rainfall for the Manasota Region for the Period October 2004 through October 2005

4.1.2 *Stream Stage*

West Side (Catfish and North Creeks)

Stream stages on the West Side of the Ranch during 2005 averaged 0.8 ft and ranged from 0.0 to 3.0 ft (Appendix Table B-1). Overall, stream stages measured during 2005 are higher than last year (0.3 ft), but lower than preceding years since the 1998 Monitoring Year. Average stream stages in 2005 for Catfish and North Creeks are comparable to those measured during 1997 (0.8 ft) and 1998 (0.7 ft).

The deepest waters of the streams traversing the west side of the Palmer Ranch are located in Trunk Ditch. Here, depths of approximately 8 ft can be found near the center of its reconstructed segment that runs adjacent to the Country Club of Sarasota and Prestancia. Station CC-4, located on the reconstructed segment of Trunk Ditch, exhibited an average depth of 1.7 ft. Although typically less than those reported in former years, this depth was greater than those recorded for 1997 and 1998.

The lowest stream levels in Catfish Creek during the 2005 monitoring year were observed during the September 2005 monitoring event when station CC-2 lacked standing water and could not be sampled.

East Side (South Creek)

During the 2005 monitoring year, stream stages at the four monitoring stations in South Creek averaged 1.4 ft with a range from 0.1 to 2.4 ft (Appendix Table C-1). The average stream stages during 2005 were higher than those for 2003 (1.1 ft), 2002 (0.8 ft), 2001 (1.3 ft), 2000 (0.6 ft), and 1999 (0.9 ft), but slightly less than the annual average for 2004 (1.5 ft).

Station SC-4 exhibited the greatest water depths (average, 1.9 ft) when all sites were compared for the 2005 monitoring year. The shallowest stream stage was exhibited by Station SC-1, which averaged 0.9 ft deep for the four sampling events. Station SC-1 is located at the lower reach of the South Creek basin. Seasonally, the highest average water levels at the four South Creek monitoring stations were recorded during the April and July monitoring events. The lowest water level sampled (0.1 ft) was during the October sampling event at Station SC-1.

4.13 *Stream Flow*

West Side (Catfish and North Creeks)

As evident in Appendix Table B-2, stream flows measured during the 2005 monitoring year for all six monitoring stations in Catfish and North Creeks ranged from 0.0 to 2,692.8 gallons per minute (GPM) and averaged 350.1 GPM. During the 21st year of monitoring, stream flows in the Catfish Creek/Trunk Ditch Basin ranged from 0.0 to 538.6 GPM in its upper reaches (CC-1 and CC-2), and no flow was recorded in its mid-reach (CC-3 and CC-4).

Seasonally, the highest stream flows during 2005 occurred during the March monitoring event with stream flows in Catfish Creek/Trunk Ditch averaging 613.4 GPM. Higher stream flows typically coincide with the higher rainfall amounts (usually at the end of the wet season). 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. No water was observed in the Catfish Creek/Trunk Ditch Basin at Station CC-2 during the September event, and no discernable flow was observed at Stations CC-3 and CC-4 during either event. Stream flows were consistently higher for CC-5 (downstream station in Catfish Creek) when comparing the six West Side monitoring stations during the 2005 monitoring year (Figure 4.2). Station CC-5 flows averaged of 1,559.1 GPM and a range of 425.5 to 2,692.8 GPM.

During the 2005 monitoring year, positive stream flows (*i.e.*, measurable flows) were recorded for 7 of the 12 measurements (*i.e.*, 58.3 percent) taken. The percentage of positive flows measured during 2005 is lower than those reported for previous monitoring years (CCI, 1986, 1988a, 1988b, 1990, 1991, 1992a, 1993, 1994, 1997, 1998, 1999 and VHB, 1999, 2000, 2001, 2002, 2004, and 2005). 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, low rainfall during the months of August and September 2005 reduced the stream flow percentage in Catfish Creek for the September monitoring event.

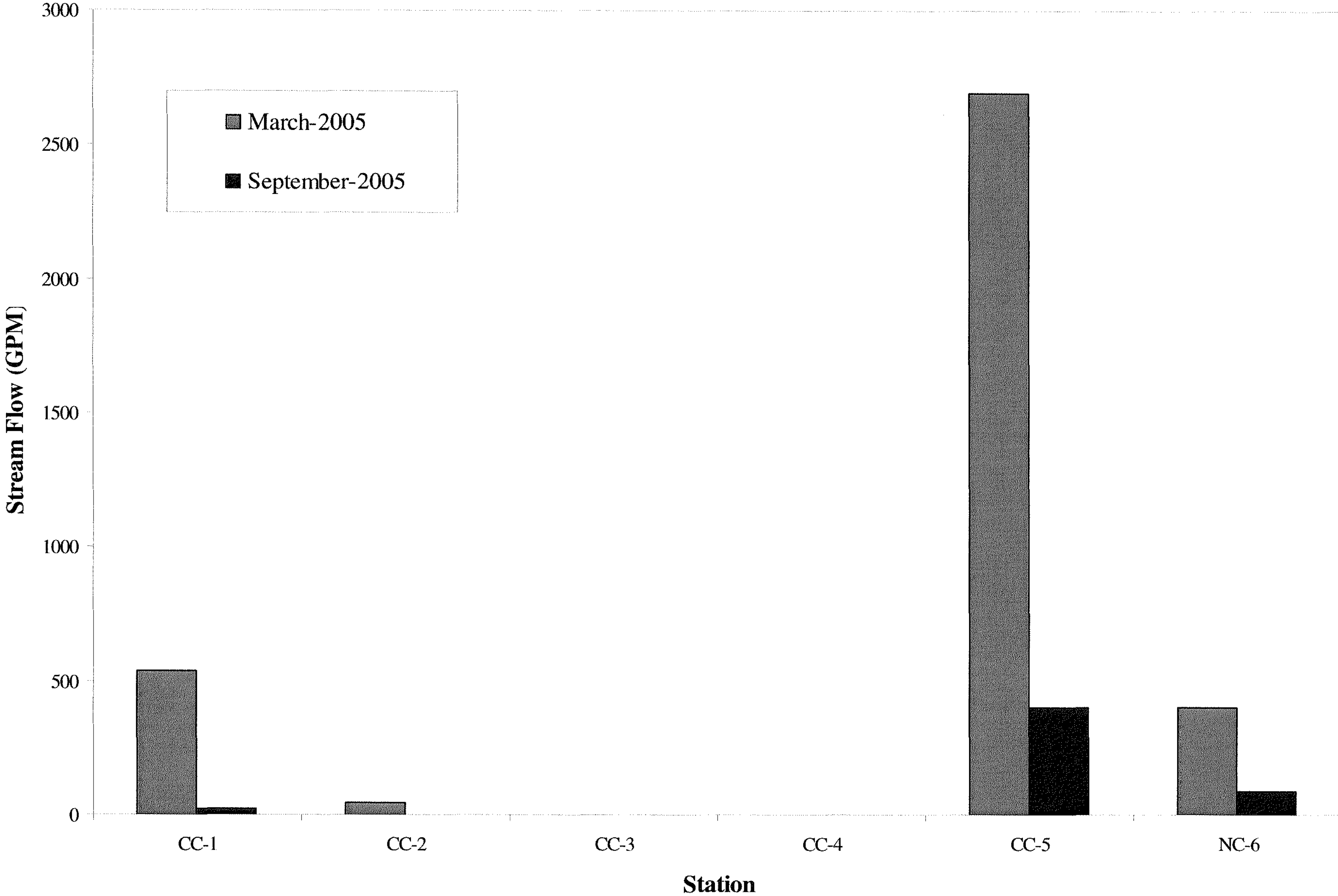


Figure 4.2 Stream Flows Measured During Monitoring Events Conducted on the West Side of the Palmer Ranch from January through December 2005

East Side (South Creek)

As evident in Appendix Table C-2, positive stream flows (*i.e.*, measurable flows) were recorded for 11 of 16 measurements (*i.e.*, 68.8 percent) taken during the 2005 monitoring year in the South Creek basin. The percentage of positive flows measured during 2005 is within the 50 to 100 percent range of positive flow measurements observed during most of the previous monitoring periods (CCI, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 1999, 2000, 2001, 2002, 2004, and 2005). During 2005, stream flow in South Creek averaged 1,552.3 GPM and ranged from 0.0 to 11,938.1 GPM. The 2005 average was greater than those reported for 2004 (125.4 GPM), 2003 (1202.5 GPM), 2002 (409.7 GPM), 2001 (627.17 GPM), 2000 (34.70 GPM), and 1999 (279.4 GPM).

Seasonally, the highest flows were observed during the July 2005 monitoring event when stream flows averaged 4,454.3 GPM (Appendix Table C-2).

Downstream stations (SC-1 and SC-2) had consistently higher flows than other stations (Figure 4-3). 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) averaged 291.7 GPM, while the lower reach (SC-1 and SC-2) averaged 2,813.0 GPM.

4.2 Physical Water Quality Parameters

4.2.1 *Water Temperature*

West Side (Catfish and North Creeks)

Water temperatures of the streams on the West Side of the Palmer Ranch averaged 26.2°C and ranged from 20.3 to 30.6°C during the two monitoring events (Appendix Table B-3). 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, 2000, 2001, 2002, 2004, and 2005).

As expected, the lowest water temperatures were recorded in the streams on the west side during the March 2005 event with the highest water temperatures recorded during the September monitoring event. Water temperatures averaged 28.6°C during the September 2005 event, while an average

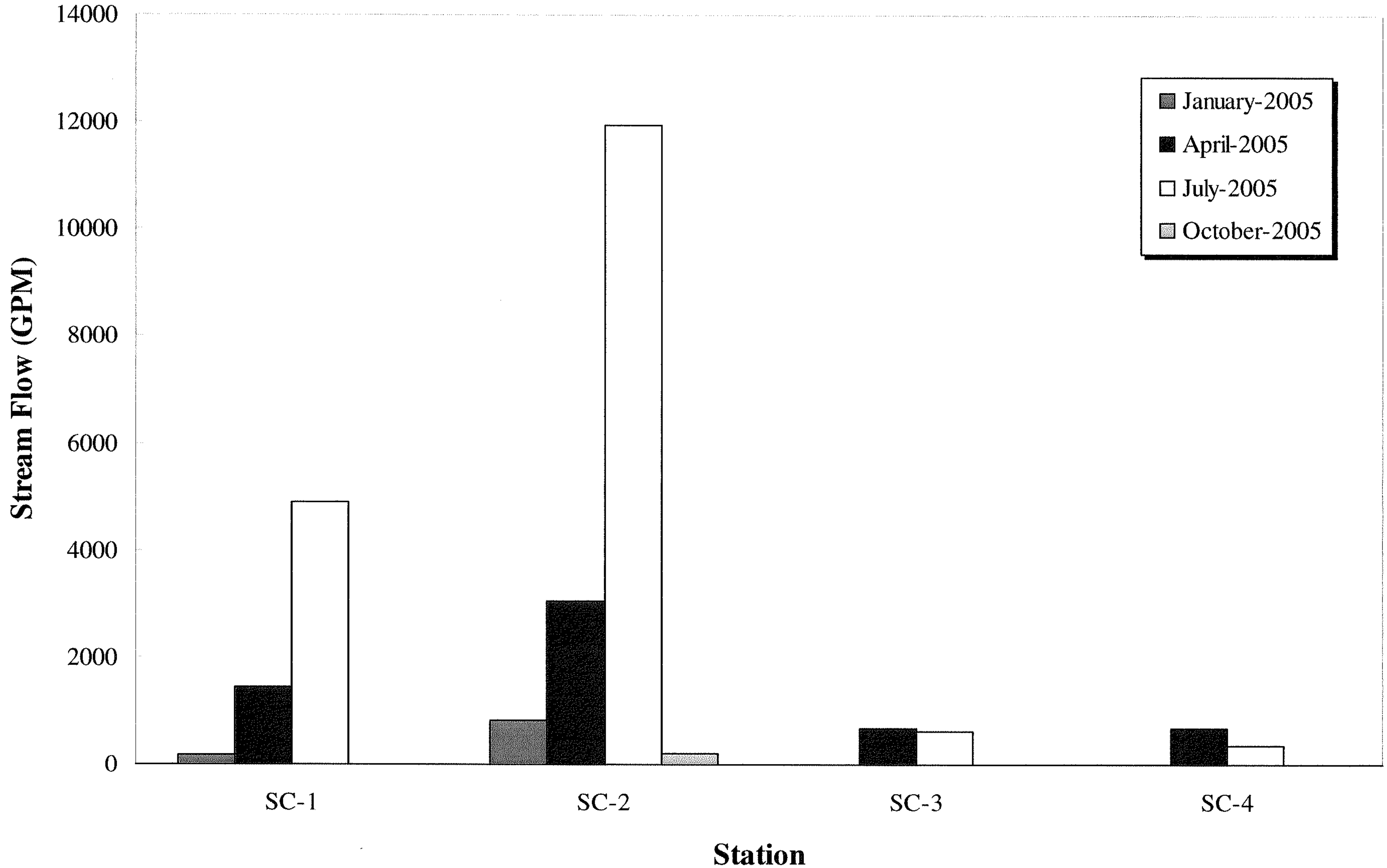


Figure 4.3 Stream Flows Measured During Monitoring Events Conducted on the East Side of the Palmer Ranch from January through December 2005

temperature of 24.3°C was observed during the March event. Average temperatures for Catfish Creek and North Creek for each event are very similar with differences among the respective creeks generally being less than 3°C., with 2 notable exceptions. Water temperatures at CC-1 were over 2.9°C lower than all other stations during both the March and September monitoring events (except NC-6 in September), and the water temperature at CC-2 was unusually high (29.8°C) in March 2005 when compared to the other March readings (20.3- 24.4°C). A notably high temperature was also recorded at CC-2 during the March 2004 sampling event (VHB 2005).

East Side (South Creek)

Water temperature in South Creek on the Palmer Ranch averaged 22.6°C and ranged from 13.1 to 29.1°C during the four monitoring events (Appendix Table C-3). The range in water temperatures for the four monitoring periods is broader than those reported from most previous monitoring reports (Palmer Venture, 1986; and CCI, 1986, 1988a, 1988b, 1991, 1992a, 1995, 1996, 1997, 1998, and VHB, 1999, 2000, 2001, 2002, 2004, and 2005).

As expected, the lowest water temperatures were recorded in the streams of the East Side during the winter quarterly event (January 2005 average 14.2°C), with higher water temperatures recorded during the other monitoring events. The highest average water temperatures, averaging 28.9 °C, were recorded during the July 2005 (*i.e.*, summer) monitoring event. Water temperatures recorded for the April and October event averaged 20.3 and 27.1°C, respectively. Average water temperatures determined for each station in the South Creek basin generally exhibited temperature differences among stations of approximately 2°C or less.

An evaluation of diurnal variations in water temperature in the Catfish Creek and South Creek Basins was performed during the 1985 dry season and the 1986 wet season. 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 (Catfish and North Creeks)

Catfish Creek and North Creek exhibited an average specific conductance of 830 µmhos per centimeter (µmhos/cm) with a range from 496 to 1,303 µmhos/cm during 2005 (Appendix Table B-4). The average specific conductance was comparable to those for the recent monitoring years 2004 (766 µmhos/cm), 2003 (813 µmhos/cm), 2001 (803 µmhos/cm), and 2000 (852 µmhos/cm), but higher than those for the previous years 1999 (723 µmhos/cm), 1998 (663 µmhos/cm), and 1997 (780 µmhos/cm). 2002 demonstrated a higher specific conductance than other years at 1070 µmhos/cm.

In a comparison of both streams within the west side of Palmer Ranch, the 2005 annual mean conductivities for North Creek and Catfish Creek Basins were 1155 and 757 µmhos/cm, respectively. Spatially, average conductivity levels in the mid reach of Catfish Creek Basin (814 µmhos/cm) were higher than the levels in the upper reach (639 µmhos/cm).

East Side (South Creek)

The specific conductance for South Creek averaged 582 µmhos/cm and ranged from 234 to 1149 µmhos/cm during the 2005 monitoring events (Appendix Table C-4). The 2005 levels were within the period of record (CCI, 1988b, 1991, 1992a, 1995, 1996, 1997, 1998, 1999 and VHB, 1999, 2000, 2001, 2002, 2004, and 2005). The relatively low conductivity measurements recorded are likely the result of above average rainfall received prior to the monitoring events. Surface runoff of low conductivity storm water during a period of high rainfall usually translates to lower specific conductance of stream water.

Average conductivities measured in the South Creek Basin for the upper reaches (SC-3 and SC-4) and lower reaches (SC-1 and SC-2) during the 2005 monitoring period were 581 and 583 µmhos/cm, respectively. This difference was relatively minor in magnitude and insignificant.

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. None of the South Creek basin conductivity measurements exceeded this criterion.

4.2.3 *Total Suspended Solids*

West End (Catfish and North Creeks)

During the 2005 monitoring, Catfish Creek and North Creek in the Palmer Ranch exhibited a range of total suspended solids (TSS) from 3.4 to 12.6 mg/L with an annual average of approximately 6.2 mg/L (Appendix Table B-5). Total suspended solid levels observed during 2005 are within the range of previous levels monitored during 2004 (13.6), 2003 (6.3 mg/L), 2002 (1.5 mg/L), 2001 (9.7 mg/L), 2000 (8.4 mg/L), 1999 (5.6 mg/L), 1998 (6.5 mg/L), and 1997 (3.3 mg/L).

The highest TSS levels were recorded in the mid-reach of Catfish Creek where CC-3 and CC-4 averaged 7.7 mg/L. The lowest TSS levels during 2005 were recorded in the upper-reach of Catfish Creek, where TSS for CC-1 and CC-2 averaged 4.3 mg/L.

East Side (South Creek)

During the 2005 monitoring year, stations along South Creek on the Palmer Ranch exhibited a range of total suspended solids from <0.570 to 23.3 mg/L, with an annual average of 4.8 mg/L (Appendix Table C-5). Overall, the TSS levels observed are lower than those recorded during 2004 (8.2 mg/L), 2003 (27.6 mg/L), 2002 (13.6 mg/L), 2001 (11.3 mg/L), 2000 (13.1 mg/L), and 1999 (12.2 mg/L).

The highest TSS level (23.3 mg/L) was recorded in the lower reach of the creek at Station SC-1 during the October 2005 monitoring event. The elevated TSS level probably resulted from higher organic matter content (*i.e.*, aquatic plants) because of low water levels at this site and/or from upstream construction within the basin. The lowest TSS level was recorded at SC-1 (*i.e.*, lower reach) during January 2005 and SC-3 (*i.e.*, upper reach) during July 2005. Overall, the lowest average TSS concentration was observed during the January and April events.

4.2.4 *Turbidity*

West Side (Catfish and North Creeks)

During the 2005 monitoring year, turbidity levels measured in Catfish Creek and North Creek ranged from 2.2 to 8.2 NTU and averaged 4.4 NTU (Appendix Table B-6). In comparison, a turbidity range of 0.3 to 37 NTU was exhibited since 1988 (CCI, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998 and VHB, 1999, 2000, 2001, 2002, 2004, and 2005).

The lowest mean turbidity level (2.2 NTU) occurred at Station CC-2 in the upper reach, and the highest mean level (5.7 NTU) occurred at North Creek Station NC-6 (Appendix Table B-6). Seasonally, the highest mean turbidity levels were observed during the September event (5.1 NTU). This seasonal variation typically results from differences in rainfall amounts and the subsequent changes in storm water inputs to the surface waters.

East Side (South Creek)

During the 21st year of the monitoring program, turbidity levels measured in South Creek ranged from 0.8 to 13.2 NTU with an overall average of 3.3 NTU (Appendix Table C-6). The turbidity levels measured in 2005 were lower than those observed in 2004 (4.8 NTU), 2003 (69.6 NTU), 2002 (8.4 NTU), 2001 (5.0 NTU), 2000 (4.2 NTU), and 1999 (6.3 NTU). The lowest mean turbidity level (1.1 NTU) occurred during the January sampling event while the highest mean turbidity level (7.1 NTU) was determined for the October event.

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.

4.3 Oxygen Demand and Related Parameters

4.3.1 *Biochemical Oxygen Demand*

West Side (Catfish and North Creeks)

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). 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 2.9 mg/L and ranged from <2.0 to 9.0 mg/L during the 2005 monitoring year (Appendix Table B-7). The average BOD_5 levels for the March 2005 and September 2005 were 3.9 and <2.0 mg/L, respectively. In previous reports, a relatively higher BOD_5 was reported during the September event, presumably a result of higher storm water runoff during the summer-wet season. Higher runoff typically results in more organic material being transported to the surface waters.

Biochemical oxygen demand levels in Catfish Creek averaged 3.3 mg/L with a range of <2.0 to 9.0 mg/L. BOD_5, with the upper and mid reach stations averaging <2.0 and 4.7 mg/L, respectively. A similarly low mean BOD_5 level of <2.0 mg/L was observed for the North Creek sampling station.

East Side (South Creek)

The decomposable organic matter present in South Creek is mostly attributed to decaying vegetation with a minor contribution of hydrocarbon input (*i.e.*, automobile emission, oil leakage, *etc.*) resulting from runoff from Interstate-75. As presented in Appendix Table C-7, the BOD_5 recorded in the South Creek Basin during the 2005 monitoring year averaged 2.7 mg/L and ranged from <2.0 to 13.5 mg/L. Seasonally, the highest mean BOD_5 levels were determined during the October 2005 sampling event. Spatially, the mean BOD_5 levels for the lower reach (SC-1 and SC-2) were slightly higher than the upper reach (SC-3 and SC-4).

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. 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/Catfish Creek and South Creek during the 2005 monitoring year, the surface water of the West Side and East Side generally exhibited clean conditions where a collective 20 of the 28 measurements were found below the 3.3 mg/L screening level. Also, during the 21st year of monitoring, only 4 of the 28 BOD_5 measurements collected from the East Side and 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 (Catfish and North Creeks)

Dissolved oxygen concentrations for the West Side averaged 7.5 mg/L and ranged from 0.6 to 14.4 mg/L for the 2005 monitoring event (Appendix Table B-8). Dissolved oxygen concentrations in 2005 were comparable with those reported in previous monitoring years (CCI, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998 and VHB, 1999, 2000, 2001, 2002, 2004, and 2005). Historical average dissolved oxygen concentrations ranged from 4.5 to 8.5 mg/L.

Seasonally, the highest average dissolved oxygen levels were observed for the March monitoring event with concentrations averaging 9.0 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 September monitoring event averaged 5.8 mg/L. The 2005 monitoring year seasonal trends are similar to those observed for dissolved oxygen during previous monitoring years (CCI, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998 and VHB 2001, 2002, 2004, and 2005). Spatially, average dissolved oxygen concentrations were generally higher for stations within the Catfish Creek Basin (8.3 mg/L) with lower concentrations recorded for Station NC-6 in the North Creek Basin (4.2 mg/L).

Dissolved oxygen concentrations in the two streams of the West Side have previously documented levels below the 5.0 mg/L criteria specified by FAC Chapter 62-302 for predominantly freshwater.

Similarly, 2 of the 12 dissolved oxygen measurements made during 2005 were below the 5.0 mg/L state criteria.

East Side (South Creek)

Overall, dissolved oxygen in South Creek was found to average 3.9 mg/L and range from 0.3 to 10.1 mg/L (Appendix Table C-8). The highest dissolved oxygen concentration (10.1 mg/L) was recorded at Station SC-3 during the January event. The lowest average dissolved oxygen level (*i.e.*, 0.3 mg/L) was also recorded at Station SC-3, but during the October event.

During 2005, the average dissolved oxygen levels followed seasonal trends and were lower during the warmer events. Seasonally, the highest average dissolved oxygen levels were observed for both the January and April 2005 monitoring events with the lowest levels occurring during the July and October 2005 events. This is similar to the previous monitoring years (CCI, 1988a, 1988b, 1991, 1992a, 1993, 1996, 1997 and VHB, 1999, 2000, 2001, 2002, 2004, and 2005). Most of the variability in dissolved oxygen levels is likely attributed to changes in the solubility of dissolved oxygen in the water column with changes in water temperature, but other factors may have also affected the solubility. During the 2005 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 both freshwater and saltwater stations during the warmer events. Of the 16 dissolved oxygen measurements made during the 2005 monitoring year, 9 measurements were below the 5.0 mg/L state criterion.

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 (Catfish and North Creeks)

Results of pH monitoring in Catfish Creek and North Creek during 2005 indicate little variability during the two monitoring events and among the six different stations (Appendix Table B-9). During the 2005 monitoring year, pH levels in these two streams of the Palmer Ranch ranged from 6.9 to 8.8 and averaged 7.7. Similar pH measurements were observed during previous monitoring years (Palmer Venture, 1986; and CCI, 1986, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1996, 1997, 1998, 1999 and VHB, 1999, 2000, 2001 2002, 2004, and 2005). Slight differences in pH distributions in South Creek are primarily attributed to spatial variations in community metabolisms. Of the 11 measurements taken during the 2005 monitoring year, one measurement was outside the allowable 6.0 – 8.5 range designated by the state criteria, which occurred at Station CC-3 during the March event.

East Side (South Creek)

Results of pH monitoring in South Creek during 2005 indicated a similar consistency to that found in Catfish/North Creek (Appendix Table C-9). During the 2005 monitoring year, surface water quality stations along South Creek exhibited pH levels ranging from 6.6 to 8.0. The range of pH observed during the 2005 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, 2000, 2001, 2002, 2004, and 2005). 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 2005 monitoring event, all pH measurements in South Creek were within the allowable range of 6.0 to 8.5.

4.4 Macronutrients

4.4.1 *Total Nitrogen*

<u>West Side (Catfish and North Creeks)</u>

Overall, total nitrogen levels in Catfish Creek and North Creek ranged from 0.64 to 3.29 mg/L and averaged 1.42 mg/L during the 2005 monitoring year (Appendix Table B-10). Similar average total nitrogen concentrations of between 1.00 and 1.49 mg/L were reported since 1997 (CCI, 1997, 1998, and VHB, 1999, 2000, 2001, 2002, 2004, and 2005). Mean total nitrogen concentrations for the West

Side have relatively little variation during the last 19 years (Figure 4.4). 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) also remained fairly consistent over the period of record.

Seasonally, average total nitrogen concentrations in September (2.05 mg/L) were higher than the average concentrations for March (0.90 mg/L). In Catfish Creek, the highest average total nitrogen concentration of 1.78 mg/L was observed at Station CC-4. The lowest average total nitrogen concentration in Catfish Creek was 0.83 mg/L, and was recorded at Station CC-5.

As has been reported for all previous monitoring years, the largest fraction of total nitrogen observed during 2005 is organic nitrogen. During the 2005 monitoring year, organic nitrogen represented approximately 64.8 percent of total nitrogen and averaged 0.92 mg/L. For the period of record, organic nitrogen represented from 65 to 91 percent of the total nitrogen content and averaged from 0.58 to 1.67 mg/L. The second most abundant form of nitrogen was nitrate nitrogen, which represented 21.1 percent of the total nitrogen with an average concentration of 0.30 mg/L during the 2005 monitoring event. During the period of record, nitrate nitrogen represented approximately 4 to 21 percent of the total nitrogen content with average nitrate levels ranging from <0.01 to 0.98 mg/L. Ammoniacal (*i.e.*, ionized plus unionized ammonia) nitrogen represented approximately 13.4 percent of the total nitrogen with an average level of 0.19 mg/L. During the period of record, ammoniacal nitrogen represented from 4 to 13 percent of the total, with concentrations averaging 0.01 to 0.22 mg/L. Nitrite nitrogen concentrations during 2005 averaged 0.01 mg/L, or 0.7 percent of the total nitrogen concentration. During the period of record, nitrite represented 1.6 percent of the total nitrogen present.

East Side (South Creek)

During the four 2005 sampling events, total nitrogen concentrations in South Creek averaged 1.92 mg/L and ranged from 0.74 to 4.84 mg/L (Appendix Table C-10). When compared to the period of record, overall total nitrogen concentrations measured during 2005 were only lower than those

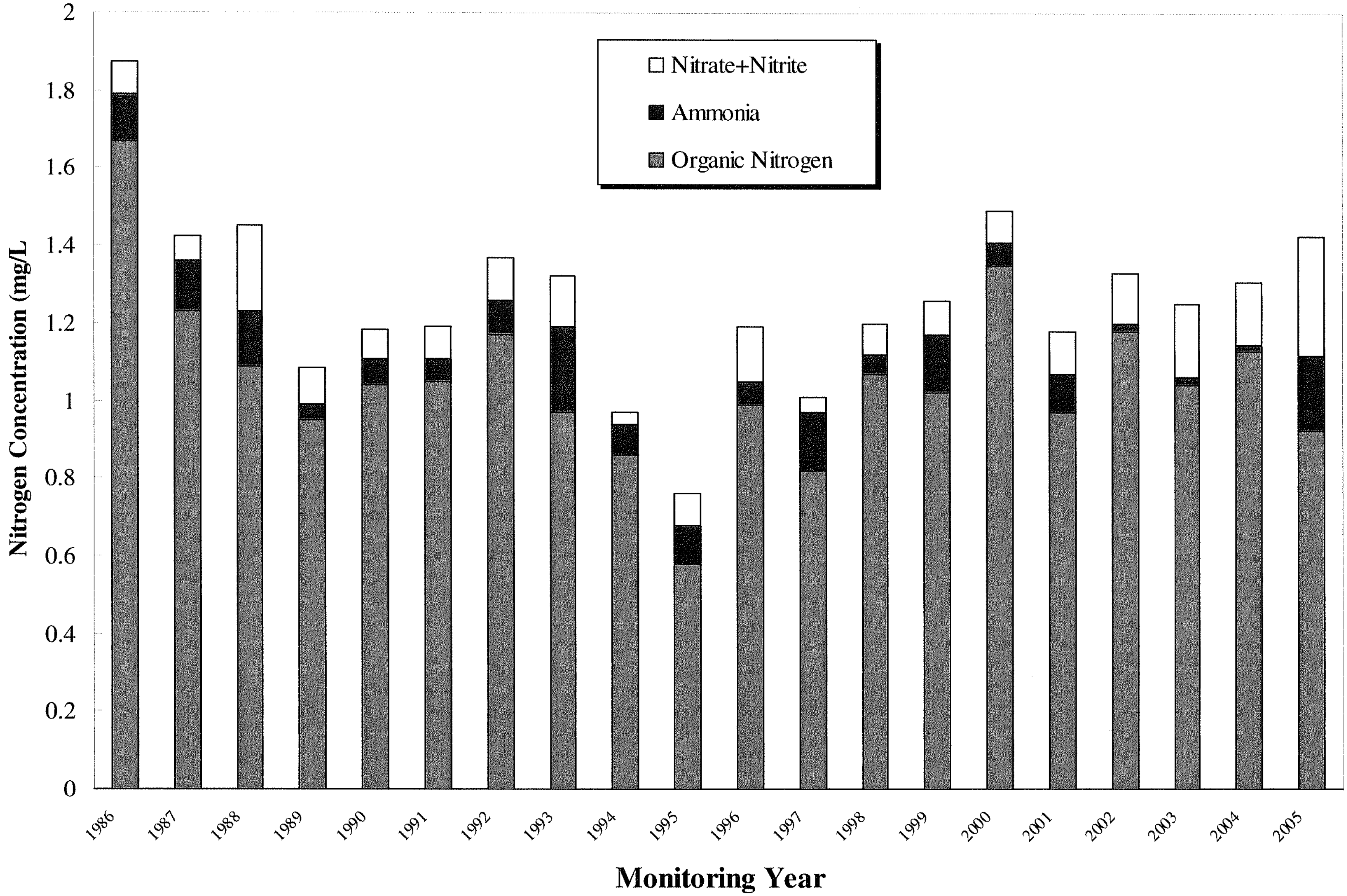


Figure 4.4 Average Nitrogen Concentrations Measured on the West Side of the Palmer Ranch from 1986 to 2005

determined during the 1986 and 1987 when total nitrogen averaged 2.73 and 2.42 mg/L, respectively (Figure 4.5). Prior to 1998, average total nitrogen concentrations in South Creek had generally decreased. 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.

Spatially, the highest average total nitrogen concentration of 2.30 mg/L was observed at Station SC-2 during the 2005 monitoring year. Station SC-3 exhibited the lowest average total nitrogen concentrations at 1.68 mg/L. Seasonally, the highest mean total nitrogen concentration (3.62 mg/L) was observed for the April monitoring event.

The mean concentrations for each component of total nitrogen (*i.e.*, ammonia, nitrate + nitrite, and organic nitrogen) also remained fairly consistent over the period of record. The largest fraction of total nitrogen observed during the entire monitoring program is organic nitrogen. During the 2005 monitoring year, organic nitrogen represented approximately 92.7 percent of total nitrogen and averaged 1.78 mg/L. Ammoniacal, nitrate, and nitrite nitrogen made up 3.6, 2.6, and 0.3% of the total nitrogen respectively. 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. The smallest fraction of total nitrogen for the period of record was nitrite, which represented less than 1 percent of the total nitrogen present for all monitored years.

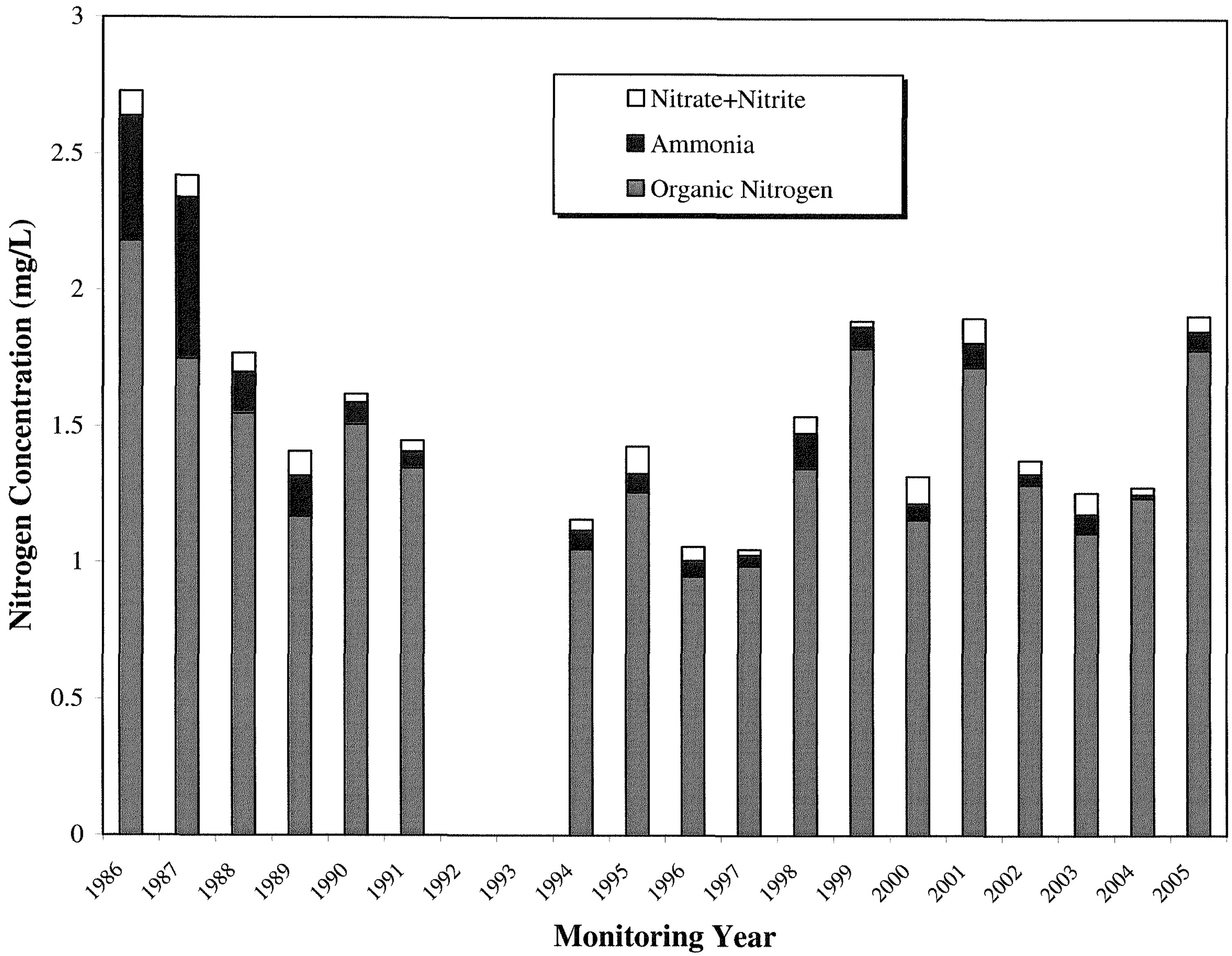


Figure 4.5 Average Nitrogen Concentrations Measured on the East Side of the Palmer Ranch from 1986 to 2005

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 2005 were above the average measured during the twenty years of the monitoring program, but the average concentration for the year (1.92 mg/L) did not exceed the 2.0 mg/L screening level (considered by the FDEP (FDER, 1990) to be characteristic of eutrophic conditions). Three of the 11 total nitrogen samples collected on the west side and 7 of the 16 total nitrogen samples collected on the east side of the Palmer Ranch exceeded the screening level of 2.0 mg/L considered to be characteristic of eutrophic conditions.

4.4.2 *Nitrite*

West Side (Catfish and North Creeks)

Nitrite levels observed in Catfish Creek and North Creek averaged 0.010 mg/L and ranged from <0.003 to 0.029 mg/L (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. Three of the 11 samples collected during the 2005 monitoring year contained nitrite concentrations below the 0.003 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 (CCI, 1987, 1988a, 1988b, 1991, 1992a, 1993, 1994, 1995b, 1997, 1998 and VHB, 1999, 2000, 2001, 2002, 2004, and 2005).

East Side (South Creek)

Nitrite levels in South Creek during the 2005 monitoring period averaged 0.006 mg/L (Appendix Table C-11). Nitrite concentrations throughout South Creek were much lower than the other forms of nitrogen, and too low to be a significant nutrient source. Eight of the 16 samples collected during the 2005 monitoring year contained nitrite concentrations below the analytical detection limit. During the previous monitoring years, nitrite concentrations measured in South Creek averaged

<0.01 to 0.02 mg/L (CCI, 1986, 1987, 1988a, 1988b, 1991, 1992a, 1995, 1996, 1997, 1998 and VHB, 1999, 2000, 2001, 2002, 2004, and 2005).

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 (Catfish and North Creeks)

Nitrate levels observed for Catfish Creek and North Creek in the Palmer Ranch during 2005 exhibited a yearly average of 0.30 mg/L with a range of <0.004 to 1.23 mg/L (Appendix Table B-12). Nitrate concentrations for the West Side during 2005 were higher than those reported for the period of record, which historically averaged 0.10 mg/L and ranged from 0.03 to 0.22 mg/L. The 2005 monitoring year also exhibited a seasonal variation with average nitrate levels ranging from 0.08 mg/L in March to 0.56 mg/L in September.

East Side (South Creek)

Nitrate levels from South Creek during 2005 averaged 0.05 mg/L and ranged from <0.004 to 0.20 mg/L (Appendix Table C-12). The 2005 nitrate concentrations are comparable to those determined for the period of record. Nitrate concentrations for South Creek also varied little seasonally and spatially.

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. 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. The nitrate concentrations determined during the 2005 monitoring year are not thought to represent an important source of nitrogen in the streams of the Palmer Ranch. Therefore, nitrate is considered to meet desired criteria.

4.4.4 *Ammoniacal Nitrogen*

West Side (Catfish and North Creeks)

Overall, ammoniacal nitrogen for the West Side exhibited an average of 0.19 mg/L with a range from 0.30 to 1.05 mg/L (Appendix Table B-13). As discussed previously, ammoniacal nitrogen represented approximately 13.4 percent of the total nitrogen measured during the 2005 monitoring year. Ammonia concentrations measured during 2005 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 and VHB, 1999, 2000, 200, 2002, 2004, and 2005). Seasonally, ammoniacal nitrogen concentrations in Catfish Creek and North Creek averaged 0.08 and 0.33 mg/L during the March and September sampling events, respectively.

East Side (South Creek)

Overall, ammoniacal nitrogen for South Creek exhibited an average of 0.07 mg/L with a range from <0.006 to 0.28 mg/L (Appendix Table C-13). As described previously, ammoniacal nitrogen represented 3.6 percent of the total nitrogen measured during the 2005 monitoring year. Higher levels reported during the mid 1980s can be attributed to runoff originating from a dairy farm upstream of the Palmer Ranch property. Seasonally, the July readings were consistently higher than the other monitoring events. 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 2005 monitoring year were generally similar to those 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. Because 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 (Catfish and North Creeks)

Overall, an average organic nitrogen[1] concentration of 0.92 mg/L was measured in these streams on the West Side during the 2005 monitoring year with a range from 0.41 to 1.95 mg/L (Appendix Table B-14). The average organic nitrogen concentration for Catfish and North Creeks during the 2005 monitoring period is within the range of the period of record averages (0.58 to 1.67 mg/L). Organic nitrogen in 2005 was lower in March than in September with average concentrations of 0.73 and 1.15 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.

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

East Side (South Creek)

Organic nitrogen concentrations in South Creek within the Palmer Ranch during the 2005 monitoring year averaged 1.78 mg/L and ranged from 0.69 to 4.68 mg/L (Appendix Table C-14). The average organic nitrogen concentration for South Creek during the 2005 monitoring period is within the range of the period of record averages (0.95 to 2.18 mg/L). Seasonally, organic nitrogen concentrations were highest during the April and October events with organic nitrogen concentrations averaging 3.44 and 2.05 mg/L, respectively. Lower organic nitrogen levels were observed in the January and July events with average concentrations 0.80 and 0.85 mg/L, respectively. This seasonal trend is not typical of previous years. Lower organic nitrogen concentration usually result from greater flushing of the creek by increases in rainfall and subsequent storm water runoff causing less accumulation of decaying vegetation.

4.4.6 *Total Phosphorus*

West Side (Catfish and North Creeks)

During the 2005 monitoring year, total phosphorus in the Catfish Creek/Trunk Ditch basin of the Palmer Ranch averaged 0.16 mg/L and a range of 0.06 to 0.28 mg/L (Appendix Table B-15). Similar total phosphorus distributions were observed during the 1989, 1990, 1991, 1995, 1996, 1998, 2000, 2001, 2002, 2003, and 2004 monitoring years, with concentrations averaging 0.12, 0.12, 0.15, 0.18, 0.17, 0.12, 0.15, 0.15, 0.15, 0.19, and 0.13 mg/L, respectively (CCI, 1990, 1991, 1992, 1996, 1997 and VHB 2000, 2001, 2002, 2004, and 2005). The average total phosphorus concentration for 2005 for the West Side streams was below the historical average for the period of record (Figure 4.6). The highest average total phosphorus concentrations were reported for CC-1 (0.22 mg/L) and CC-2 (0.28 mg/L). Both sites are in the upper reaches of Catfish Creek. The lowest mean total phosphorus concentrations were observed at Station CC-3 (0.08 mg/L).

Typically, increases in phosphorus can be attributed to higher rainfall amounts recorded during the wet season, but this was not the case in the Catfish Creek/North Creek Basins during 2005. Greater phosphorus concentrations during the March monitoring event may be attributed to the higher amount of rainfall that occurred during March 2005 than September 2005, though the greatest amounts of rainfall for 2005 occurred during the early summer months prior to September.

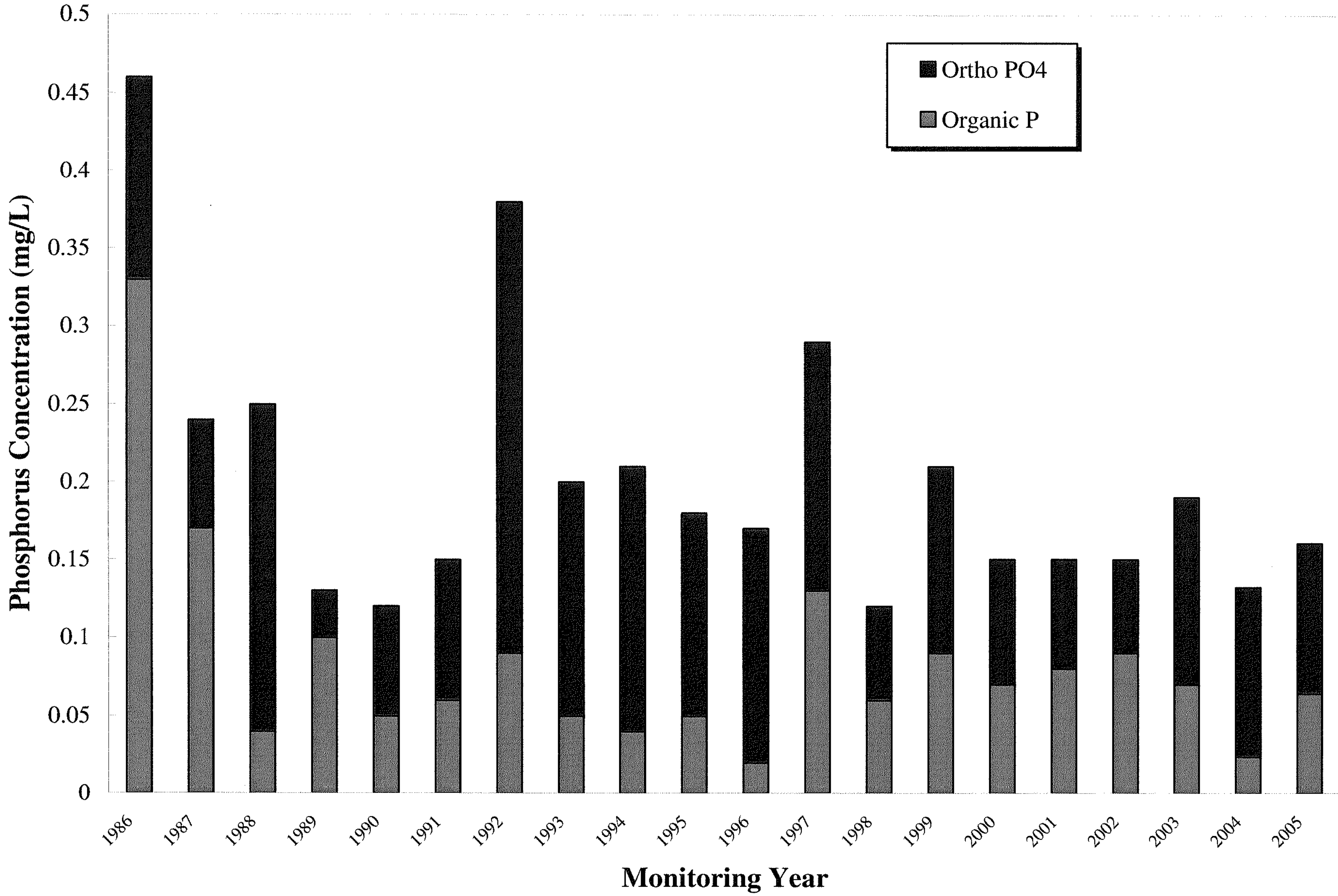


Figure 4.6 Average Phosphorus Concentrations Measured on the West Side of the Palmer Ranch from 1986 to 2005

East Side (South Creek)

During the 2005 monitoring year, total phosphorus in South Creek averaged 0.19 mg/L with a range of 0.04 to 0.38 mg/L (Appendix Table C-15). Mean total phosphorus for 2005 was lower than those for all other years in the period of record except 1998 and 2004 (Figure 4.7). The range for the period of record is 0.16 to 1.63 mg/L. A pronounced decrease in total phosphorus concentration from the early 1980s was observed after the deactivation of the dairy farm located upstream of the Palmer Ranch property.

Typically, increases in phosphorus can be attributed to higher rainfall amounts recorded during the wet season, and the highest concentrations of total phosphorus in the South Creek Basin for 2005 were found during the July and October monitoring events.

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 2005 monitoring year indicate that none of the samples collected on the West Side and East Side of Palmer Ranch exhibited a total phosphorus concentration that exceeded the FDEP screening level of 0.46 mg/L (FDER, 1990). Almost 15% of all of the total phosphorus concentrations measured in Catfish Creek, North Creek and South Creek in 2005 were at or below 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

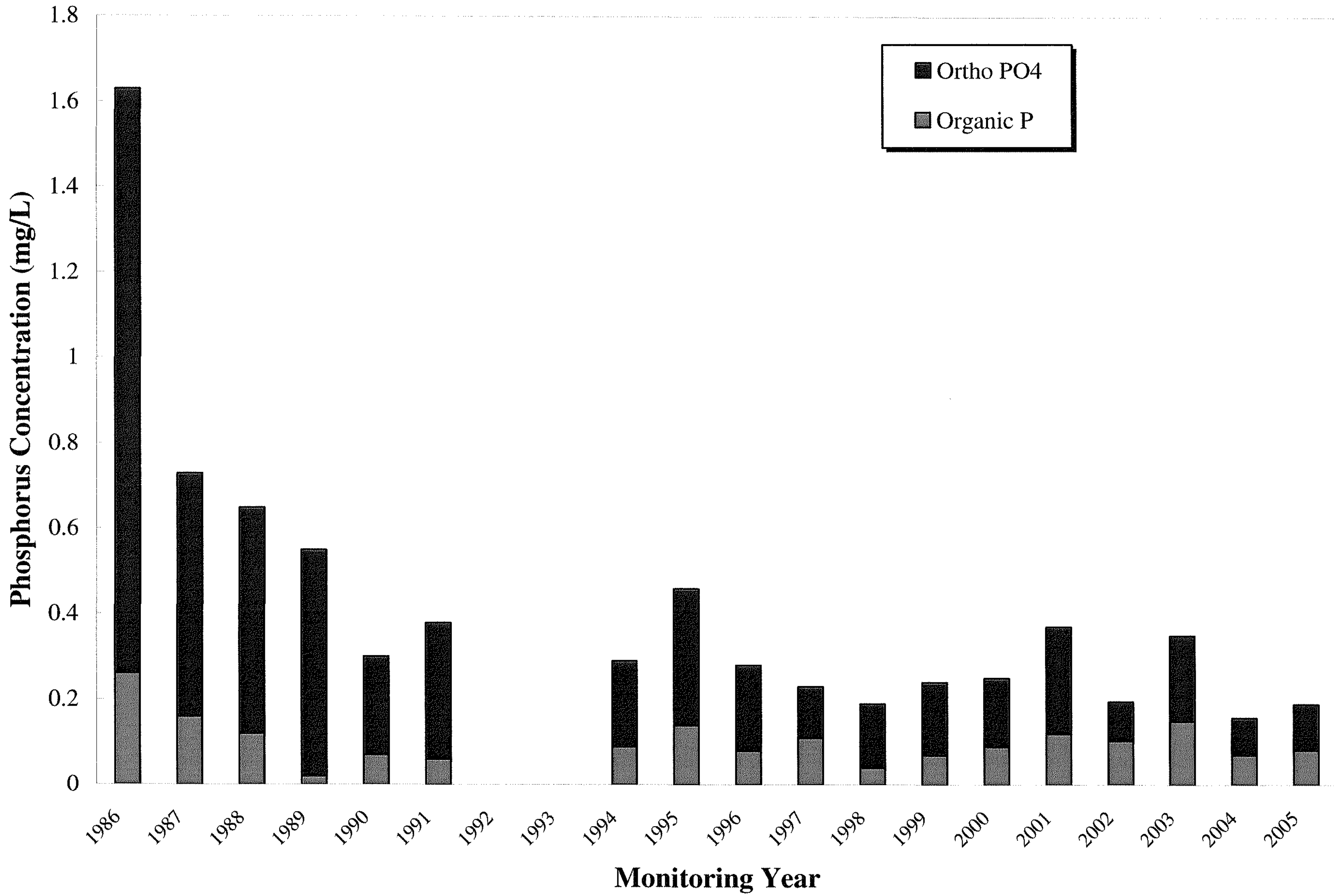


Figure 4.7 Average Phosphorus Concentrations Measured on the East Side of the Palmer Ranch from 1986 to 2005

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 (Catfish and North Creeks)

Overall, the Catfish Creek/Trunk Ditch and North Creek basins of the Palmer Ranch exhibited an average orthophosphate concentration of 0.096 mg/L with a range from 0.023 to 0.190 mg/L (Appendix Table B-16). The average orthophosphate concentrations for 2005 were well within the historical data range for average orthophosphate concentrations (0.03 to 0.29 mg/L). In 2005, orthophosphate made up 60.0% of the total phosphate found in the water column of West Side streams, and within the period of record averages which ranged from 23 to 88 percent.

Orthophosphate concentrations during 2005 exhibited spatial trends similar to those observed for total phosphorus with greater concentrations in the upper reach of Catfish Creek (CC-1 and CC-2) than the mid reach (CC-3 and CC-4). Seasonally, there was very little variation in orthophosphate concentrations during the March and September monitoring events, which is not consistent with previous years. Generally, higher orthophosphate concentrations are observed during the September event and reflect the high rainfall experienced prior to monitoring. This temporal increase in orthophosphate concentrations recorded at the end of the wet season is typically attributed to increased runoff during the wet season.

East Side (South Creek)

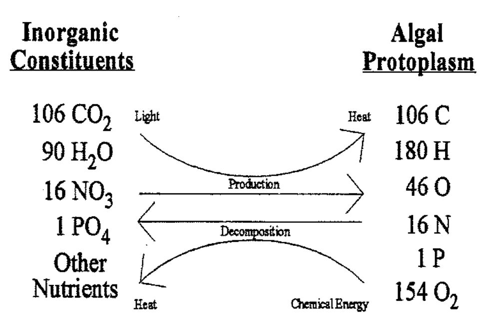
Orthophosphate concentrations for South Creek during the 2005 monitoring year averaged 0.108 mg/L and ranged from 0.003 to 0.255 mg/L (Appendix Table C-16). Historically, the only average orthophosphate concentrations lower than those for 2005 were observed in 2002 and 2004. Higher orthophosphate levels reported for the mid 1980s were attributed to runoff that originated from a deactivated dairy farm that discharged into the eastern tributary of South Creek. The highest orthophosphate concentrations observed during the 2005 monitoring year occurred in October 2005.

In 2005, orthophosphate represented approximately 56.8 percent of the total phosphorus. The percentage of total phosphorus consisting of orthophosphate has ranged from 47 to 96 percent for the period of record. Lower percentages like those found in 1997 (52 percent), 2002 (47 percent), and 2004 (56%) probably reflect the lower concentration total phosphorus in the creek and dry antecedent conditions.

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 2005 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 Tables B-17 and C-17 with ratios of inorganic nitrogen (ammonia, nitrite, and nitrate) to orthophosphate (N_i:P_i) being given in Appendix Tables B-18 and C-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 (Catfish and North Creeks)

The N_t:P_t ratios determined from 2005 nutrient data in the Catfish and North Creeks exhibited an overall average of 11.14:1 (Appendix Table B-17). Because this ratio is 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. The N_t:P_t ratio was consistently higher for the September 2005 monitoring event. During this event, the N_t:P_t ratio calculated for Stations CC-3 and CC-4 were 23.86 and 28.67 respectively, suggesting that there may be additional nitrogen input in the mid reach of Catfish Creek (Meybeck, 1982).

The N_i:P_i ratios determined from March 2005 nutrient data are found to average approximately 2.31:1 (Appendix Table B-18). A higher average ratio was observed for the September event (*i.e.*, 12.60:1) primarily because of large ratio observed at Stations CC-3 and CC-4. Generally, a low N_i:P_i ratio would be indicative of conditions in which fixed inorganic nitrogen would limit plant growth before orthophosphate. Nutrient data collected at Stations CC-3 and CC-4 during the September monitoring event yielded a N_i:P_i ratio 19.46:1 and 27.44:1, respectively. These high ratios suggest that surface waters at this station may be limiting with respect to phosphorus. Further, this ratio indicates that additional input of nitrogen to Stations CC-3 and CC-4 may be associated with increased decomposition of organic matter in conjunction with decreased gross primary productivity.

Overall, the generally low N_i:P_i ratios calculated from the 2005 data are attributed to the naturally high levels of orthophosphate, while total nitrogen is comprised of approximately 35.2 percent inorganic nitrogen. The higher N_t:P_t ratios determined during the 2005 monitoring events are indicative of the abundance of aquatic vegetation in the creeks and the high percentage of organic nutrients present.

East Side (South Creek)

The N_i:P_i ratios determined during 2005 for South Creek are generally low and found to average approximately 2.13:1. This is indicative of conditions in which fixed inorganic nitrogen would limit plant growth before orthophosphate (Appendix Table C-18). Conversely, the N_t:P_t ratios for South Creek were found to average 13.11:1 indicating a different balance with respect to nitrogen and phosphorus (Appendix Table C-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 2005 data are attributed to the naturally high levels of orthophosphate, as well as the high percentage of total phosphorus represented by orthophosphate (56.8 percent of total phosphorus) while approximately 7.3 percent of the total nitrogen is comprised of inorganic nitrogen.

During the 2005 monitoring event, the N_i:P_i ratios in South Creek were generally indicative of excess inorganic phosphorus with respect to inorganic nitrogen (*i.e.*, nitrogen limited system). The highest N_i:P_i ratio average was 4.02:1 observed during the April event. The N_i:P_i ratios averaged 2.38:1, 0.32:1, and 1.82:1 during the January, July, and October events, respectively.

4.5 Oils and Greases

<u>**West Side (Catfish and North Creeks)**</u>

The concentration of oil and grease in the streams on the West Side averaged 1.8 mg/L during the 2005 monitoring year (Appendix Table B-19). All oil and grease measurements for Catfish and North Creeks made during 2005 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 VHB, 1999, 2000, 2001, 2002, 2004, and 2005) ranged from <0.1 mg/L to 17 mg/L. Most of the historic observations (300 of 307) were found to be less than the maximum allowable State criteria of 5.0 mg/L.

<u>**East Side (South Creek)**</u>

Overall, oil and grease content in South Creek averaged 2.5 mg/L and ranged from 1.4 to 6.0 mg/L (Appendix B-19). Fourteen of the 16 measurements for South Creek made during 2005 fell 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. Ninety-nine percent of the observations in previous years (*i.e.*, 230 of 231) in the Palmer Ranch portion of South Creek were found to be lower than the maximum allowable State criteria of 5.0 mg/L.

4.6 Bacteriological Parameters

4.6.1 *Total Coliform*

<u>**West Side (Catfish and North Creeks)**</u>

The streams of the West Side during the 2005 monitoring year had concentrations of total coliform bacteria ranging from 100 to 6,000 colonies/100 mL with an average of 1,358 colonies/100 mL (Appendix Table B-20). Of the 12 samples collected during the 2005 monitoring year, 3 exceeded the State and County water quality standards which allow up to 2,400 colonies/100 mL, and all 3 samples were from the upper reach of Catfish Creek (CC-1 and CC-2).

During previous years of monitoring, the highest number of total coliform bacteria colonies have generally been observed after periods of rainfall, typically during the wet season. This trend continued during the 2005 monitoring year. The mean total coliform level recorded for the September monitoring event in Catfish and North Creeks was 1528 colonies/100 mL compared to an average of 1217 colonies/100 mL for the March event.

East Side (South Creek)

The streams of the East Side during the 2005 monitoring year had concentrations of total coliform bacteria ranging from 40 to 2,300 colonies/100 mL with an average of 556 colonies/100 mL (Appendix Table C-20). None of the 16 total coliform bacteria levels measured during 2005 exceeded the State water quality criteria, which allows up to 2,400 colonies/100 mL.

Although the upper reach of South Creek had less water flow during all four sampling events, the lower reach of South Creek during 2005 had relatively higher average total coliform concentrations (659 colonies/100 mL) than the upper reach (453 colonies/100 mL). In previous years, cattle and wild animals using the area around Station SC-3 were likely to represent the most significant source of bacteria in the area, but SC-3 reported the lowest average total coliform bacteria concentration (175 colonies/mL) of all the monitoring stations during 2005.

As noted in previous years (CCI, 1988a, 1988b, 1991, 1992a, 1995, 1996, 1997, 1998 and VHB, 1999, 2000, 2001, 2002, 2004, and 2005), 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 (Catfish and North Creeks)

During the 2005 monitoring year, the streams on the West Side exhibited fecal coliform densities ranged from 10 to 4,000 colonies/100 mL and averaged 744 colonies/100 mL (Appendix Table B-21). Two of the 12 samples collected during 2005 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.

Spatially, the highest number of fecal coliform colonies during the 2005 monitoring year occurred in the upper reach of the Catfish Creek/Trunk Ditch basin at Stations CC-1 and CC-2. The mean fecal coliform densities for the September event (908 colonies/100 mL) was greater than for the March event (607 colonies/100 mL), and all stations in Catfish Creek followed this seasonal trend. NC-6, in North Creek, reported a greater density in March than September.

East Side (South Creek)

During the 21st year of monitoring, the South Creek basin of the Palmer Ranch exhibited fecal coliform densities that ranged from <10 to 810 colonies/100 mL and averaged 250 colonies/100 mL (Appendix Table C-21). Of the 16 samples collected during 2005, only one exceeded the fecal coliform density of 800 colonies/100 mL allowed by the Class III State and County Standard.

Spatially, Station SC-4 had the highest average concentration of fecal coliform colonies during the 2005 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. The highest average concentration (510 colonies/100 mL) was observed during the October monitoring event, which also reported the least flow during 2005.

4.7 Trace Elements

West Side (Catfish and North Creeks)

During 2005, samples were collected for the analyses of trace elements (*i.e.*, arsenic, copper, lead, and zinc) during the September monitoring event. Arsenic concentrations during the 2005 monitoring year ranged from <6.02 to 18.6 µg/L and averaged 10.4 µg/L (Appendix Table B-22). The concentrations of copper ranged from 12.2 to 41.9 µg/L and averaged 19.7 µg/L. Total lead concentrations measured in the streams on the West Side during 2005 ranged from <3 to 3.5 µg/L and averaged <3 µg/L or below the detection limit for this parameter. The concentration of zinc determined for the six monitoring stations during 2005 ranged from 2.6 to 8.0 µg/L and averaged 5.2 µg/L.

East Side (South Creek)

Arsenic concentrations during the 2005 monitoring year ranged from <6.02 to 13.6 µg/L and averaged 9.3 µg/L (Appendix Table C-22). All concentrations of total copper measured in the South Creek basin during the 2005 monitoring period were <4 µg/L and below the detection limit. All total lead concentrations measured on the east side of the Palmer Ranch during 2005 were <3 µg/L. The concentrations of zinc samples collected in South Creek during 2005 ranged from <1.9 to 5.2 µg/L and averaged 2.5 µg/L.

All arsenic concentrations measured during the 2005 monitoring year on Palmer Ranch were below the State standard of 50 µg/L[2]. Possible sources of arsenic include naturally occurring minerals and the use of arsenic-based pesticides on and upstream of the Palmer Ranch. Four of the five copper concentrations sampled from Catfish Creek and North Creek exceeded the State and County standard of 12.8 µg/L[3]. None of the samples from South Creek exceeded the State and County standard. 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[4].

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

[3]*Ibid.*

[4]*Ibid.*

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. All of the zinc concentrations during the 2005 monitoring events at both Catfish/North Creek and South Creek streams were below the State and County standard of 115 µg/L based upon a hardness of 110 mg/L. Possible sources of zinc include the use of zinc containing fertilizers and runoff from roads on and upstream of the Palmer Ranch.

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Appendix A

Exhibit "E"

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

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

SURFACE WATER MONITORING PROGRAM

Locations

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

Procedures

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

Frequency

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

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

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

Catfish and North Creek Water Quality Data

Appendix Table B-1
Continuing Surface Water Quality Monitoring Program
Stream Stage (ft)[a]
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	1.1	0.1	1.7	3.0	0.7	1.3	0.3	1.2	0.1	3.0	1.1	6
September 29, 2005	1.3	0.0	0.3	0.4	0.3	0.5	0.1	0.4	0.0	1.3	0.5	6
Mean	1.2	0.1	1.0	1.7	0.5		0.2					
Minimum	1.1	0.0	0.3	0.4	0.3		0.1					
Maximum	1.3	0.1	1.7	3.0	0.7		0.3					
Standard Deviation	0.1	-	1.0	1.8	0.3		0.1					
N	2	2	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	0.6	0.0	1.3	0.7	4							
CC-3, CC-4 (mid reach)	1.4	0.3	3.0	1.3	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.9	0.0	3.0	0.9	10							
All six stations	0.8	0.0	3.0	0.9	12							

a Stream Stage measured at sampling site for each station.
STD - Standard deviation
N - Number of observations

Appendix Table B-2
Continuing Surface Water Quality Monitoring Program
Stream Flow (gpm)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations					
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	538.6	44.9	0.0	0.0	2692.8	655.2	403.9	613.4	0.0	2692.8	1714.4	6
September 29, 2005	22.4	0.0	0.0	0.0	425.5	89.6	73.6	86.9	0.0	425.5	1660.6	6
Mean	280.5	22.4	0.0	0.0	1559.1		238.8					
Minimum	22.4	0.0	0.0	0.0	425.5		73.6					
Maximum	538.6	44.9	0.0	0.0	2692.8		403.9					
Standard Deviation	365.0	-	0.0	0.0	1603.2		233.6					
N	2	2	2	2	2		2					

Stations	Mean	Min	Max	STD	N
CC-1, CC-2 (upper reach)	151.5	0.0	538.6	258.7	4
CC-3, CC-4 (mid reach)	0.0	0.0	0.0	0.0	4
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	372.4	0.0	2692.8	839.2	10
All six stations	350.1	0.0	2692.8	764.1	12

STD - Standard deviation
N - Number of observations

Appendix Table B-3
Continuing Surface Water Quality Monitoring Program
Water Temperature (^{o}C)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	20.3	29.8	24.4	23.2	23.9	24.3	23.9	24.3	20.3	29.8	3.1	6
September 29, 2005	26.2	-	30.6	29.5	29.3	28.9	27.4	28.6	26.2	30.6	30.1	5
Mean	23.3	29.8	27.5	26.3	26.6		25.7					
Minimum	20.3	29.8	30.6	23.2	23.9		23.9					
Maximum	26.2	29.8	30.6	4.4	29.3		27.4					
Standard Deviation	4.2	29.8	4.4	4.4	3.8		2.5					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	25.4	20.3	29.8	4.8	3							
CC-3, CC-4 (mid reach)	26.9	23.2	30.6	3.7	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	26.4	20.3	30.6	3.6	9							
All six stations	26.2	20.3	30.6	3.3	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-4
Continuing Surface Water Quality Monitoring Program
Specific Conductance (µmhos/cm)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	496	868	657	733	628	676	1006	731	496	1006	182	6
September 29, 2005	554	-	908	959	1014	859	1303*	948	554	1303	268	5
Mean	525	868	783	846	821		1155					
Minimum	496	868	657	733	628		1006					
Maximum	554	868	908	959	1014		1303					
Standard Deviation	41	-	177	160	273		210					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	639	496	868	200	3							
CC-3, CC-4 (mid reach)	814	657	959	143	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	757	496	1014	187	9							
All six stations	830	496	1303	241	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-5
Continuing Surface Water Quality Monitoring Program
Total Suspended Solids (mg/L)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations					
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	3.4	4.4	7.2	12.6	6.4	6.8	4.0	6.3	3.4	12.6	3.4	6
September 29, 2005	5.0	-	6.7	4.2	6.4	5.6	8.3	6.1	4.2	8.3	1.6	5
Mean	4.2	4.4	7.0	8.4	6.4		6.2					
Minimum	3.4	4.4	6.7	4.2	6.4		4.0					
Maximum	5.0	4.4	7.2	12.6	6.4		8.3					
Standard Deviation	1.2	-	0.4	5.9	0.0		3.0					
N	2	1	2	2	2		2					

Stations	Mean	Min	Max	STD	N
CC-1, CC-2 (upper reach)	4.3	3.4	5.0	0.8	3
CC-3, CC-4 (mid reach)	7.7	4.2	12.6	3.5	4
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	6.3	3.4	12.6	2.7	9
All six stations	6.2	3.4	12.6	2.6	11

STD - Standard deviation
N - Number of observations

Appendix Table B-6
Continuing Surface Water Quality Monitoring Program
Turbidity (NTU)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	3.0	2.2	3.8	6.3	4.0	3.9	3.2	3.8	2.2	6.3	1.4	6
September 29, 2005	4.4	-	5.0	3.8	4.3	4.4	8.2	5.1	3.8	8.2	1.8	5
Mean	3.7	2.2	4.4	5.1	4.2		5.7					
Minimum	3.0	2.2	3.8	3.8	4.0		3.2					
Maximum	4.4	2.2	5.0	6.3	4.3		8.2					
Standard Deviation	1.0	-	0.8	1.8	0.2		3.5					
N	2	1	2	2	2		2					

Stations	Mean	Min	Max	STD	N
CC-1, CC-2 (upper reach)	3.2	2.2	4.4	1.1	3
CC-3, CC-4 (mid reach)	4.7	3.8	6.3	1.2	4
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	4.1	2.2	6.3	1.2	9
All six stations	4.4	2.2	8.2	1.7	11

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 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	Min	Max	STDev	N
March 29, 2005	<2	3.8	6.3	9.0	2.1	4.5	<2	3.9	<2	9.0	3.2	6
September 29, 2005	<2	-	<2	2.4	2.8	1.8	<2	1.6	<2	2.8	0.9	5
Mean	<2	3.8	3.7	5.7	2.5		<2					
Minimum	<2	3.8	<2	2.4	2.1		<2					
Maximum	<2	3.8	6.3	9.0	2.8		<2					
Standard Deviation	0.0	-	3.7	4.7	0.5		0.0					
N	2	1	2	2	2		2					

Stations	Mean	Min	Max	STD	N
CC-1, CC-2 (upper reach)	1.9	<2	3.8	1.6	3
CC-3, CC-4 (mid reach)	4.7	<2	9.0	3.7	4
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	3.3	<2	9.0	2.7	9
All six stations	2.9	<2	9.0	2.6	11

STD - Standard deviation
N - Number of observations

Appendix Table B-8
Continuing Surface Water Quality Monitoring Program
Dissolved Oxygen (mg/L)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	Min	Max	STDev	N
March 29, 2005	6.2	14.4	8.5	7.0	10.1	9.2	7.7	9.0	6.2	14.4	3.0	6
September 29, 2005	9.5	-	6.7	4.5*	7.6	7.1	0.6*	5.8	0.6	9.5	3.4	5
Mean	7.9	14.4	7.6	5.8	8.9		4.2					
Minimum	6.2	14.4	6.7	4.5	7.6		0.6					
Maximum	9.5	14.4	8.5	7.0	10.1		7.7					
Standard Deviation	2.3	-	1.3	1.8	1.8		5.0					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	10.0	6.2	14.4	4.1	3							
CC-3, CC-4 (mid reach)	6.7	4.5	8.5	1.7	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	8.3	4.5	14.4	2.9	9							
All six stations	7.5	0.6	14.4	3.4	11							

STD - Standard deviation
N - Number of observations
*Violation of Water Quality Standards

Appendix Table B-9
Continuing Surface Water Quality Monitoring Program
Water pH (-Log[H+])
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	Min	Max	STDev	N
March 29, 2005	7.1	8.5	8.8*	8.0	8.1	8.1	7.8	8.1	7.1	8.8	0.6	6
September 29, 2005	6.9	-	7.4	7.2	7.7	7.3	6.9	7.2	6.9	7.7	0.3	5
Mean	7.0	8.5	8.1	7.6	7.9		7.4					
Minimum	6.9	8.5	7.4	7.2	7.7		6.9					
Maximum	7.1	8.5	8.8	8.0	8.1		7.8					
Standard Deviation	0.1	-	1.0	0.6	0.3		0.6					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	7.5	6.9	8.5	0.9	3							
CC-3, CC-4 (mid reach)	7.9	7.2	8.8	0.7	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	7.7	6.9	8.8	0.7	9							
All six stations	7.7	6.9	8.8	0.6	11							

STD - Standard deviation
N - Number of observations
*Violation of Water Quality Standards

Appendix Table B-10
Continuing Surface Water Quality Monitoring Program
Total Nitrogen (mg/L)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	Min	Max	STDev	N
March 29, 2005	0.72	1.11	0.64	0.97	0.71	0.83	1.24	0.90	0.64	1.24	0.25	6
September 29, 2005	2.04	-	1.36	2.58	0.96	1.73	3.29	2.05	0.96	3.29	0.93	5
Mean	1.38	1.11	1.00	1.78	0.83		2.27					
Minimum	0.72	1.11	1.36	0.97	0.71		1.24					
Maximum	2.04	1.11	1.36	1.14	0.96		3.29					
Standard Deviation	0.93	-	0.51	1.14	0.17		1.45					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	1.29	0.72	2.04	0.68	3							
CC-3, CC-4 (mid reach)	1.39	0.64	2.58	0.85	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	1.23	0.64	2.58	0.66	9							
All six stations	1.42	0.64	3.29	0.86	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-11
Continuing Surface Water Quality Monitoring Program
Nitrite Nitrogen (mg/L)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	Min	Max	STDev	N
March 29, 2005	0.025	0.009	0.005	0.009	0.006	0.011	0.029	0.014	0.005	0.029	0.010	6
September 29, 2005	<0.003	-	<0.003	0.010	<0.003	0.004	0.008	0.005	<0.003	0.010	0.004	5
Mean	0.013	0.009	0.003	0.010	0.004		0.019					
Minimum	<0.003	0.009	<0.003	0.009	<0.003		0.008					
Maximum	0.025	0.009	0.005	0.010	0.006		0.029					
Standard Deviation	0.017	-	0.002	0.001	0.003		0.015					
N	2	1	2	2	2		2					

Stations	Mean	Min	Max	STD	N
CC-1, CC-2 (upper reach)	0.012	<0.003	0.025	0.012	3
CC-3, CC-4 (mid reach)	0.006	<0.003	0.010	0.004	4
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.008	<0.003	0.025	0.007	9
All six stations	0.010	<0.003	0.029	0.009	11

STD - Standard deviation
N - Number of observations

Appendix Table B-12
Continuing Surface Water Quality Monitoring Program
Nitrate Nitrogen (mg/L)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	Min	Max	STDev	N
March 29, 2005	0.16	<0.004	<0.004	<0.004	<0.004	0.04	0.28	0.08	<0.004	0.28	0.11	6
September 29, 2005	1.23	-	0.18	1.10	0.03	0.64	0.28	0.56	0.03	1.23	0.56	5
Mean	0.70	<0.004	0.09	0.55	0.02		0.28					
Minimum	0.16	<0.004	<0.004	<0.004	<0.004		0.28					
Maximum	1.23	<0.004	0.18	1.10	0.03		0.28					
Standard Deviation	0.75	-	0.12	0.77	0.02		0.00					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	0.47	<0.004	1.23	0.67	3							
CC-3, CC-4 (mid reach)	0.32	<0.004	1.10	0.52	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.30	<0.004	1.23	0.49	9							
All six stations	0.30	<0.004	1.23	0.44	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-13
Continuing Surface Water Quality Monitoring Program
Ammoniacal Nitrogen (mg/L)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	0.12	0.08	0.07	0.04	0.04	0.07	0.13	0.08	0.04	0.13	0.04	6
September 29, 2005	0.04	-	0.27	0.26	0.03	0.15	1.05	0.33	0.03	1.05	0.42	5
Mean	0.08	0.08	0.17	0.15	0.03		0.59					
Minimum	0.04	0.00	0.27	0.26	0.03		1.05					
Maximum	0.12	0.08	0.27	0.16	0.04		1.05					
Standard Deviation	0.06	-	0.14	0.16	0.01		0.65					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	0.08	0.04	0.12	0.04	3							
CC-3, CC-4 (mid reach)	0.16	0.04	0.27	0.12	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.11	0.03	0.27	0.09	9							
All six stations	0.19	0.30	1.05	0.30	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-14
Continuing Surface Water Quality Monitoring Program
Organic Nitrogen (mg/L)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	0.41	1.02	0.57	0.93	0.67	0.72	0.81	0.73	0.41	1.02	0.23	6
September 29, 2005	0.77	-	0.91	1.21	0.89	0.95	1.95	1.15	0.77	1.95	0.48	5
Mean	0.59	1.02	0.74	1.07	0.78		1.38					
Minimum	0.41	1.02	0.91	0.93	0.67		0.81					
Maximum	0.77	1.02	0.91	0.20	0.89		1.95					
Standard Deviation	0.25	-	0.24	0.20	0.16		0.81					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	0.73	0.41	1.02	0.31	3							
CC-3, CC-4 (mid reach)	0.90	0.57	1.21	0.26	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.82	0.41	1.21	0.24	9							
All six stations	0.92	0.41	1.95	0.40	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-15
Continuing Surface Water Quality Monitoring Program
Total Phosphorus (mg/L)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	0.24	0.28	0.10	0.24	0.12	0.20	0.09	0.18	0.09	0.28	0.08	6
September 29, 2005	0.21	-	0.06	0.09	0.12	0.12	0.23	0.14	0.06	0.23	0.07	5
Mean	0.22	0.28	0.08	0.16	0.12		0.16					
Minimum	0.21	0.28	0.10	0.09	0.12		0.09					
Maximum	0.24	0.28	0.10	0.10	0.12		0.23					
Standard Deviation	0.02	-	0.03	0.10	0.00		0.10					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	0.24	0.21	0.28	0.04	3							
CC-3, CC-4 (mid reach)	0.12	0.06	0.24	0.08	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.16	0.06	0.28	0.08	9							
All six stations	0.16	0.06	0.28	0.08	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-16
Continuing Surface Water Quality Monitoring Program
Orthophosphate (mg/L)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	0.169	0.190	0.031	0.061	0.054	0.101	0.063	0.095	0.031	0.190	0.067	6
September 29, 2005	0.168	-	0.023	0.050	0.070	0.078	0.177	0.098	0.070	0.177	0.070	5
Mean	0.169	0.190	0.027	0.056	0.062		0.120					
Minimum	0.168	0.190	0.031	0.050	0.054		0.063					
Maximum	0.169	0.190	0.031	0.008	0.070		0.177					
Standard Deviation	0.001	-	0.006	0.008	0.011		0.081					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	0.176	0.168	0.190	0.012	3							
CC-3, CC-4 (mid reach)	0.041	0.023	0.061	0.017	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	0.091	0.023	0.190	0.066	9							
All six stations	0.096	0.023	0.190	0.065	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 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	3.03	3.95	6.12	4.08	6.14	4.66	14.42	6.29	3.03	14.42	4.17	6
September 29, 2005	9.90	-	23.86	28.67	7.84	17.57	14.56	16.97	7.84	28.67	8.99	5
Mean	6.47	3.95	14.99	16.37	6.99		14.49					
Minimum	3.03	3.95	23.86	4.08	6.14		14.42					
Maximum	9.90	3.95	23.86	17.39	7.84		14.56					
Standard Deviation	4.86	-	12.55	17.39	1.21		0.10					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	5.63	3.03	9.90	3.73	3							
CC-3, CC-4 (mid reach)	15.68	4.08	28.67	12.41	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	10.40	3.03	28.67	9.31	9							
All six stations	11.14	3.03	28.67	8.49	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 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	1.85	0.49	2.68	0.97	1.00	1.40	6.87	2.31	0.49	6.87	2.37	6
September 29, 2005	7.59	-	19.46	27.44	0.92	13.85	7.56	12.60	0.92	27.44	10.65	5
Mean	4.72	0.49	11.07	14.20	0.96		7.22					
Minimum	1.85	0.49	19.46	0.97	0.92		6.87					
Maximum	7.59	0.49	19.46	18.72	1.00		7.56					
Standard Deviation	4.06	-	11.86	18.72	0.06		0.49					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	3.31	0.49	7.59	3.77	3							
CC-3, CC-4 (mid reach)	12.64	0.97	27.44	12.92	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	6.93	0.49	27.44	9.81	9							
All six stations	6.98	0.49	27.44	8.78	11							

STD - Standard deviation
N - Number of observations

Appendix Table B-19
Continuing Surface Water Quality Monitoring Program
Oil and Grease (mg/L)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations					
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	2.2	1.9	2.5	1.3	2.0	2.0	1.6	1.9	1.3	2.5	0.4	6
September 29, 2005	1.0	-	<0.992	1.4	4.2	1.8	1.8	1.8	<0.992	4.2	1.4	5
Mean	1.6	1.9	1.5	1.4	3.1		1.7					
Minimum	1.0	1.9	<0.992	1.3	2.0		1.6					
Maximum	2.2	1.9	2.5	1.4	4.2		1.8					
Standard Deviation	0.8	-	1.4	0.0	1.6		0.2					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	1.7	1.0	2.2	0.6	3							
CC-3, CC-4 (mid reach)	1.4	<0.992	2.5	0.8	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	1.9	<0.992	4.2	1.1	9							
All six stations	1.8	<0.992	4.2	1.0	11							

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 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	3500*	3000*	100	200	400	1440	100	1217	100	3500	1587	6
September 29, 2005	6000*	-	140	200	300	1660	1000	1528	140	6000	2524	5
Mean	4750	3000	120	200	350		550					
Minimum	3500	3000	100	200	300		100					
Maximum	6000	3000	140	200	400		1000					
Standard Deviation	1768	-	28	0	71		636					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	4167	3000	6000	1607	3							
CC-3, CC-4 (mid reach)	160	100	200	49	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	1538	100	6000	2131	9							
All six stations	1358	100	6000	1958	11							

STD - Standard deviation
N - Number of observations
*Violation of Water Quality Standards

Appendix Table B-21
Continuing Surface Water Quality Monitoring Program
Fecal Coliform Bacteria (colonies/100 mL)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Sampling Date	**CC-1**	**CC-2**	**CC-3**	**CC-4**	**CC-5**	**Mean**	**NC-6**	**Mean**	**Min**	**Max**	**STD**	**N**
March 29, 2005	2500*	800	30	10	200	708	100	607	10	2500	973	6
September 29, 2005	4000*	-	120	140	210	1118	70	908	70	4000	1729	5
Mean	3250	800	75	75	205		85					
Minimum	2500	800	30	10	200		70					
Maximum	4000	800	120	140	210		100					
Standard Deviation	1061	-	64	92	7		21					
N	2	1	2	2	2		2					
Stations	Mean	Min	Max	STD	N							
CC-1, CC-2 (upper reach)	2433	800	4000	1601	3							
CC-3, CC-4 (mid reach)	75	10	140	65	4							
CC-1, CC-2, CC-3, CC-4, CC-5 (entire basin)	890	10	4000	1409	9							
All six stations	744	10	4000	1302	11							

STD - Standard deviation
N - Number of observations
*Violation of Water Quality Standards

Appendix Table B-22
Continuing Surface Water Quality Monitoring Program
Trace Metals (µg/L)
January - December 2005

	Catfish Creek/Trunk Ditch							All Stations				
Trace Metal	CC-1	CC-2	CC-3	CC-4	CC-5	Mean	NC-6	Mean	Min	Max	STD	N
Arsenic	6.7	-	18.6	8.0	15.9	12.3	<6.02	10.4	<6.02	18.6	6.5	5
Copper	14.5*	-	41.9*	15.7*	14.0*	21.5	12.2	19.7	12.2	41.9	12.5	5
Lead	<3	-	<3	<3	3.5	2.0	<3	<3	<3	3.5	0.9	5
Zinc	8.0	-	5.2	4.7	5.3	5.8	2.6	5.2	2.6	8.0	1.9	5

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.

STD - Standard deviation
N - Number of observations
*Violation of Water Quality Standards

Appendix C

South Creek Water Quality Data

Appendix Table C-1
Continuing Surface Water Quality Monitoring Program
Stream Stage (ft)[a]
January - December 2005

		South Creek				All Stations			
Sampling Date	SC-1	SC-2	SC-3	SC-4	Mean	Min	Max	STD	N
January 20, 2005	0.2	0.9	1.6	2.4	1.3	0.2	2.4	0.9	4
April 4, 2005	1.3	2.2	2.2	2.1	2.0	1.3	2.2	0.4	4
July 15, 2005	2.0	2.4	1.3	2.4	2.0	1.3	2.4	0.5	4
October 3, 2005	0.1	0.2	0.4	0.6	0.3	0.1	0.6	0.2	4
Mean	0.9	1.4	1.4	1.9					
Minimum	0.1	0.2	0.4	0.6					
Maximum	2.0	2.4	2.2	2.4					
Std. Deviation	0.9	1.1	0.8	0.9					
N	4	4	4	4					
Stations	Mean	Min	Max	STD	N				
SC-4, SC-3 (upper reach)	1.6	0.4	2.4	0.8	8				
SC-1, SC-2 (lower reach)	1.2	0.1	2.4	0.9	8				
SC-1, SC-2, SC-3, SC-4 (entire basin)	1.4	0.1	2.4	0.9	16				

a Stream Stage measured at sampling site for each station. 0.0 = Station dry.
STD - Standard deviation
N - Number of observations

Appendix Table C-2
Continuing Surface Water Quality Monitoring Program
Stream Flow (gpm)
January - December 2005

	South Creek					All Stations				
Sampling Date	SC-1	SC-2	SC-3	SC-4		Mean	Min	Max	STD	N
January 20, 2005	170.5	807.8	0.0	0.0		244.6	0.0	807.8	384.0	4
April 4, 2005	1436.2	3051.8	673.2	673.2		1458.6	673.2	3051.8	1121.4	4
July 15, 2005	4891.9	11938.1	628.3	359.0		4454.3	359.0	11938.1	5403.9	4
October 3, 2005	0.0	207.3	0.0	0.0		51.8	0.0	207.3	103.7	4
Mean	1624.7	4001.3	325.4	258.1						
Minimum	0.0	207.3	0.0	0.0						
Maximum	4891.9	11938.1	673.2	673.2						
Std. Deviation	2270.4	5431.0	376.2	324.4						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3 (upper reach)	291.7	0.0	673.2	327.2	8					
SC-1, SC-2 (lower reach)	2813.0	0.0	11938.1	4057.6	8					
SC-1, SC-2, SC-3, SC-4 (entire basin)	1552.3	0.0	11938.1	3070.5	16					

STD - Standard deviation
N - Number of observations

Appendix Table C-3
Continuing Surface Water Quality Monitoring Program
Water Temperature (°C)
January - December 2005

	South Creek					All Stations				
Sampling Date	SC-1	SC-2	SC-3	SC-4		Mean	Min	Max	STD	N
January 20, 2005	14.6	13.1	15.0	14.1		14.2	13.1	15.0	0.8	4
April 4, 2005	21.0	19.8	19.8	20.6		20.3	19.8	21.0	0.6	4
July 15, 2005	29.1	28.7	28.7	28.9		28.9	28.7	29.1	0.2	4
October 3, 2005	28.4	25.8	28.1	26.0		27.1	25.8	28.4	1.4	4
Mean	23.3	21.9	22.9	22.4						
Minimum	14.6	13.1	15.0	14.1						
Maximum	29.1	28.7	28.7	28.9						
Std. Deviation	6.8	6.9	6.7	6.5						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3 (upper reach)	22.7	14.1	28.9	6.1	8					
SC-1, SC-2 (lower reach)	22.6	13.1	29.1	6.4	8					
SC-1, SC-2, SC-3, SC-4 (entire basin)	22.6	13.1	29.1	6.0	16					

STD - Standard deviation
N - Number of observations

Appendix Table C-4
Continuing Surface Water Quality Monitoring Program
Specific Conductance (µmhos/cm)
January - December 2005

	South Creek				All Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**	**Mean**	**Min**	**Max**	**STD**	**N**
January 20, 2005	616	749	562	713	660	562	749	86	4
April 4, 2005	467	634	354	548	501	354	634	119	4
July 15, 2005	393	439	234	340	352	234	439	88	4
October 3, 2005	493	873	745	1149	815	493	1149	273	4
Mean	492	674	474	688					
Minimum	393	439	234	340					
Maximum	616	873	745	1149					
Std. Deviation	93	184	226	343					
N	4	4	4	4					

Stations	Mean	Min	Max	STD	N
SC-4, SC-3 (upper reach)	581	234	1149	292	8
SC-1, SC-2 (lower reach)	583	393	873	166	8
SC-1, SC-2, SC-3, SC-4 (entire basin)	582	234	1149	230	16

STD - Standard deviation
N - Number of observations

Appendix Table C-5
Continuing Surface Water Quality Monitoring Program
Total Suspended Solids (mg/L)
January - December 2005

	South Creek					All Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**Min**	**Max**	**STD**	**N**
January 20, 2005	<0.570	1.5	5.8	1.5		2.3	<0.570	5.8	2.4	4
April 4, 2005	3.2	1.4	1.6	0.6		1.7	0.6	3.2	1.1	4
July 15, 2005	3.2	12.2	<0.570	1.6		4.3	<0.570	12.2	5.4	4
October 3, 2005	23.3	1.5	15.8	3.4		11.0	1.5	23.3	10.4	4
Mean	7.5	4.1	5.9	1.8						
Minimum	<0.570	1.4	<0.570	0.6						
Maximum	23.3	12.2	15.8	3.4						
Std. Deviation	10.6	5.4	7.0	1.2						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3 (upper reach)	3.8	<0.570	15.8	5.1	8					
SC-1, SC-2 (lower reach)	5.8	<0.570	23.3	8.0	8					
SC-1, SC-2, SC-3, SC-4 (entire basin)	4.8	<0.570	23.3	6.6	16					

STD - Standard deviation
N - Number of observations

Appendix Table C-6
Continuing Surface Water Quality Monitoring Program
Turbidity (NTU)
January - December 2005

	South Creek					All Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**Min**	**Max**	**STD**	**N**
January 20, 2005	0.8	0.8	1.3	1.5		1.1	0.8	1.5	0.3	4
April 4, 2005	3.3	2.1	1.3	1.0		1.9	1.0	3.3	1.0	4
July 15, 2005	1.8	8.3	1.5	1.2		3.2	1.2	8.3	3.4	4
October 3, 2005	13.2	2.2	6.8	6.1		7.1	2.2	13.2	4.6	4
Mean	4.8	3.4	2.7	2.5						
Minimum	0.8	0.8	1.3	1.0						
Maximum	13.2	8.3	6.8	6.1						
Std. Deviation	5.7	3.4	2.7	2.4						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3 (upper reach)	2.6	1.0	6.8	2.4	8					
SC-1, SC-2 (lower reach)	4.1	0.8	13.2	4.4	8					
SC-1, SC-2, SC-3, SC-4 (entire basin)	3.3	0.8	13.2	3.5	16					

STD - Standard deviation
N - Number of observations

Appendix Table C-7
Continuing Surface Water Quality Monitoring Program
5-Day Biochemical Oxygen Demand (mg/L)
January - December 2005

	South Creek						All Stations			
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**Min**	**Max**	**STD**	**N**
January 20, 2005	<2.0	<2.0	<2.0	<2.0		1.0	<2.0	<2.0	0.0	4
April 4, 2005	<2.0	3.5	4.0	<2.0		2.4	<2.0	4.0	1.6	4
July 15, 2005	<2.0	<2.0	<2.0	<2.0		1.0	<2.0	<2.0	0.0	4
October 3, 2005	13.5	<2.0	9.7	<2.0		6.3	<2.0	13.5	6.3	4
Mean	4.1	1.6	3.9	1.0						
Minimum	<2.0	<2.0	<2.0	<2.0						
Maximum	13.5	3.5	9.7	1.0						
Std. Deviation	6.3	1.3	4.1	0.0						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3 (upper reach)	2.5	<2.0	9.7	3.1	8					
SC-1, SC-2 (lower reach)	2.9	<2.0	13.5	4.4	8					
SC-1, SC-2, SC-3, SC-4 (entire basin)	2.7	<2.0	13.5	3.7	16					

STD - Standard deviation
N - Number of observations

Appendix Table C-8
Continuing Surface Water Quality Monitoring Program
Dissolved Oxygen (mg/L)
January - December 2005

	South Creek				All Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**	**Mean**	**Min**	**Max**	**STD**	**N**
January 20, 2005	5.2	5.8	10.1	6.2	6.8	5.2	10.1	2.2	4
April 4, 2005	3.9*	3.7*	6.6	5.6	5.0	3.7	6.6	1.4	4
July 15, 2005	0.6*	0.9*	4.1*	1.1*	1.7	0.6	4.1	1.6	4
October 3, 2005	5.5	0.7*	0.3*	1.5*	2.0	0.3	5.5	2.4	4
Mean	3.8	2.8	5.3	3.6					
Minimum	0.6	0.7	0.3	1.1					
Maximum	5.5	5.8	10.1	6.2					
Std. Deviation	2.2	2.4	4.1	2.7					
N	4	4	4	4					

Stations	Mean	Min	Max	STD	N
SC-4, SC-3 (upper reach)	4.4	0.3	10.1	3.3	8
SC-1, SC-2 (lower reach)	3.3	0.6	5.8	2.2	8
SC-1, SC-2, SC-3, SC-4 (entire basin)	3.9	0.3	10.1	2.8	16

*Violation of State Water Quality Standard
STD - Standard deviation
N - Number of observations

Appendix Table C-9
Continuing Surface Water Quality Monitoring Program
Water pH (-Log[H+])
January - December 2005

	South Creek					All Stations				
Sampling Date	SC-1	SC-2	SC-3	SC-4		Mean	Min	Max	STD	N
January 20, 2005	7.3	7.2	8.0	7.4		7.5	7.2	8.0	0.4	4
April 4, 2005	7.6	7.0	7.7	7.6		7.5	7.0	7.7	0.3	4
July 15, 2005	6.8	6.6	6.7	6.7		6.7	6.6	6.8	0.1	4
October 3, 2005	7.6	7.0	7.1	7.1		7.2	7.0	7.6	0.3	4
Mean	7.3	7.0	7.4	7.2						
Minimum	6.8	6.6	6.7	6.7						
Maximum	7.6	7.2	8.0	7.6						
Std. Deviation	0.4	0.3	0.6	0.4						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3 (upper reach)	7.3	6.7	8.0	0.5	8					
SC-1, SC-2 (lower reach)	7.1	6.6	7.6	0.4	8					
SC-1, SC-2, SC-3, SC-4 (entire basin)	7.2	6.6	8.0	0.4	16					

STD - Standard deviation
N - Number of observations

Appendix Table C-10
Continuing Surface Water Quality Monitoring Program
Total Nitrogen (mg/L)
January - December 2005

Sampling Date	SC-1	South Creek SC-2	SC-3	SC-4		Mean	All Stations Min	Max	STD	N
January 20, 2005	1.03	1.14	0.80	0.85		0.96	0.80	1.14	0.16	4
April 4, 2005	3.05	4.84	2.65	3.95		3.62	2.65	4.84	0.98	4
July 15, 2005	0.93	1.09	0.74	0.77		0.88	0.74	1.09	0.16	4
October 3, 2005	2.74	2.14	2.52	1.50		2.23	1.50	2.74	0.54	4
Mean	1.94	2.30	1.68	1.77						
Minimum	0.93	1.09	0.74	0.77						
Maximum	3.05	4.84	2.65	3.95						
Std. Deviation	1.11	1.76	1.05	1.49						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3 (upper reach)	1.72	0.74	3.95	1.19	8					
SC-1, SC-2 (lower reach)	2.12	0.93	4.84	1.38	8					
SC-1, SC-2, SC-3, SC-4 (entire basin)	1.92	0.74	4.84	1.26	16					

STD - Standard deviation
N - Number of observations

Appendix Table C-11
Continuing Surface Water Quality Monitoring Program
Nitrite Nitrogen (mg/L)
January - December 2005

	South Creek					All Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**		**Mean**	**Min**	**Max**	**STD**	**N**
January 20, 2005	<0.003	<0.003	<0.003	<0.003		<0.003	<0.003	<0.003	0.000	4
April 4, 2005	0.007	0.007	0.016	0.006		0.009	0.006	0.016	0.005	4
July 15, 2005	<0.003	<0.003	<0.003	<0.003		<0.003	<0.003	<0.003	0.000	4
October 3, 2005	0.018	0.007	0.010	0.010		0.011	0.007	0.018	0.005	4
Mean	0.007	0.004	0.007	0.005						
Minimum	<0.003	<0.003	<0.003	<0.003						
Maximum	0.018	0.007	0.016	0.010						
Std. Deviation	0.008	0.003	0.007	0.004						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3 (upper reach)	0.006	<0.003	0.016	0.006	8					
SC-1, SC-2 (lower reach)	0.006	<0.003	0.018	0.006	8					
SC-1, SC-2, SC-3, SC-4 (entire basin)	0.006	<0.003	0.018	0.005	16					

STD - Standard deviation
N - Number of observations

Appendix Table C-12
Continuing Surface Water Quality Monitoring Program
Nitrate Nitrogen (mg/L)
January - December 2005

Sampling Date	SC-1	South Creek SC-2	SC-3	SC-4		Mean	All Stations Min	Max	STD	N
January 20, 2005	0.18	0.20	<0.004	<0.004		0.09	<0.004	0.20	0.11	4
April 4, 2005	0.02	0.04	0.06	0.03		0.04	0.02	0.06	0.02	4
July 15, 2005	0.02	0.02	0.05	0.02		0.03	0.02	0.05	0.01	4
October 3, 2005	0.04	<0.004	0.03	0.07		0.03	<0.004	0.07	0.03	4
Mean	0.06	0.07	0.04	0.03						
Minimum	0.02	<0.004	<0.004	<0.004						
Maximum	0.18	0.20	0.06	0.07						
Std. Deviation	0.07	0.09	0.03	0.03						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3 (upper reach)	0.03	<0.004	0.07	0.03	8					
SC-1, SC-2 (lower reach)	0.06	<0.004	0.20	0.08	8					
SC-1, SC-2, SC-3, SC-4 (entire basin)	0.05	<0.004	0.20	0.06	16					

STD - Standard deviation
N - Number of observations

Appendix Table C-13
Continuing Surface Water Quality Monitoring Program
Ammoniacal Nitrogen (mg/L)
January - December 2005

	South Creek				All Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**	**Mean**	**Min**	**Max**	**STD**	**N**
January 20, 2005	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.00	4
April 4, 2005	0.14	0.11	0.16	0.14	0.14	0.11	0.16	0.02	4
July 15, 2005	<0.006	<0.006	<0.006	0.02	0.01	<0.006	<0.006	0.01	4
October 3, 2005	0.08	0.07	0.10	0.28	0.13	0.07	0.28	0.10	4
Mean	0.06	0.05	0.07	0.11					
Minimum	<0.006	<0.006	<0.006	<0.006					
Maximum	0.14	0.11	0.16	0.28					
Std. Deviation	0.07	0.05	0.08	0.13					
N	4	4	4	4					

Stations	Mean	Min	Max	STD	N
SC-4, SC-3 (upper reach)	0.09	<0.006	0.28	0.10	8
SC-1, SC-2 (lower reach)	0.05	<0.006	0.14	0.06	8
SC-1, SC-2, SC-3, SC-4 (entire basin)	0.07	<0.006	0.28	0.08	16

STD - Standard deviation
N - Number of observations

Appendix Table C-14
Continuing Surface Water Quality Monitoring Program
Organic Nitrogen (mg/L)
January - December 2005

	South Creek					All Stations			
Sampling Date	SC-1	SC-2	SC-3	SC-4	Mean	Min	Max	STD	N
January 20, 2005	0.79	0.88	0.74	0.79	0.80	0.74	0.88	0.06	4
April 4, 2005	2.88	4.68	2.41	3.77	3.44	2.41	4.68	1.00	4
July 15, 2005	0.90	1.06	0.69	0.74	0.85	0.69	1.06	0.17	4
October 3, 2005	2.62	2.06	2.39	1.14	2.05	1.14	2.62	0.65	4
Mean	1.80	2.17	1.56	1.61					
Minimum	0.79	0.88	0.69	0.74					
Maximum	2.88	4.68	2.41	3.77					
Std. Deviation	1.11	1.75	0.97	1.45					
N	4	4	4	4					

Stations	Mean	Min	Max	STD	N
SC-4, SC-3 (upper reach)	1.58	0.69	3.77	1.14	8
SC-1, SC-2 (lower reach)	1.98	0.79	4.68	1.37	8
SC-1, SC-2, SC-3, SC-4 (entire basin)	1.78	0.69	4.68	1.24	16

STD - Standard deviation
N - Number of observations

Appendix Table C-15
Continuing Surface Water Quality Monitoring Program
Total Phosphorus (mg/L)
January - December 2005

	South Creek					All Stations				
Sampling Date	SC-1	SC-2	SC-3	SC-4		Mean	Min	Max	STD	N
January 20, 2005	0.04	0.12	0.10	0.10		0.09	0.04	0.12	0.03	4
April 4, 2005	0.10	0.18	0.30	0.10		0.17	0.10	0.30	0.09	4
July 15, 2005	0.17	0.38	0.26	0.23		0.26	0.17	0.38	0.09	4
October 3, 2005	0.24	0.27	0.32	0.12		0.24	0.12	0.32	0.08	4
Mean	0.14	0.24	0.24	0.14						
Minimum	0.04	0.12	0.10	0.10						
Maximum	0.24	0.38	0.32	0.23						
Std. Deviation	0.08	0.11	0.10	0.06						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3 (upper reach)	0.19	0.10	0.32	0.10	8					
SC-1, SC-2 (lower reach)	0.19	0.04	0.38	0.11	8					
SC-1, SC-2, SC-3, SC-4 (entire basin)	0.19	0.04	0.38	0.10	16					

STD - Standard deviation

N - Number of observations

Appendix Table C-16
Continuing Surface Water Quality Monitoring Program
Orthophosphate (mg/L)
January - December 2005

	South Creek					All Stations				
Sampling Date	SC-1	SC-2	SC-3	SC-4		Mean	Min	Max	STD	N
January 20, 2005	0.032	0.120	0.097	0.003		0.063	0.003	0.120	0.055	4
April 4, 2005	0.022	0.157	0.207	0.029		0.104	0.022	0.207	0.093	4
July 15, 2005	0.062	0.201	0.146	0.112		0.130	0.062	0.201	0.058	4
October 3, 2005	0.075	0.255	0.119	0.088		0.134	0.075	0.255	0.083	4
Mean	0.048	0.183	0.142	0.058						
Minimum	0.022	0.120	0.097	0.003						
Maximum	0.075	0.255	0.207	0.112						
Std. Deviation	0.025	0.058	0.048	0.051						
N	4	4	4	4						
Stations	Mean	Min	Max	STD	N					
SC-4, SC-3 (upper reach)	0.100	0.003	0.207	0.064	8					
SC-1, SC-2 (lower reach)	0.116	0.022	0.255	0.083	8					
SC-1, SC-2, SC-3, SC-4 (entire basin)	0.108	0.003	0.255	0.072	16					

STD - Standard deviation
N - Number of observations

Appendix Table C-17
Continuing Surface Water Quality Monitoring Program
Total Nitrogen to Total Phosphorus Ratios (Nt:Pt)
January - December 2005

	South Creek				All Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**	**Mean**	**Min**	**Max**	**STD**	**N**
January 20, 2005	24.52	9.58	8.12	8.85	12.77	8.12	24.52	7.86	4
April 4, 2005	29.61	26.45	8.80	39.50	26.09	8.80	39.50	12.80	4
July 15, 2005	5.41	2.85	2.91	3.35	3.63	2.85	5.41	1.21	4
October 3, 2005	11.61	8.05	7.80	12.30	9.94	7.80	12.30	2.35	4
Mean	17.79	11.73	6.91	16.00					
Minimum	5.41	2.85	2.91	3.35					
Maximum	29.61	26.45	8.80	39.50					
Std. Deviation	11.20	10.23	2.70	16.09					
N	4	4	4	4					
Stations	Mean	Min	Max	STD	N				
SC-4, SC-3 (upper reach)	11.46	2.91	39.50	11.74	8				
SC-1, SC-2 (lower reach)	14.76	2.85	29.61	10.45	8				
SC-1, SC-2, SC-3, SC-4 (entire basin)	13.11	2.85	39.50	10.87	16				

STD - Standard deviation
N - Number of observations

Appendix Table C-18
Continuing Surface Water Quality Monitoring Program
Inorganic Nitrogen to Inorganic Phosphorus Ratios (Ni:Pi)
January - December 2005

	South Creek				All Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**	**Mean**	**Min**	**Max**	**STD**	**N**
January 20, 2005	5.61	1.68	0.07	2.17	2.38	0.07	5.61	2.33	4
April 4, 2005	7.86	1.01	1.15	6.03	4.02	1.01	7.86	3.47	4
July 15, 2005	0.46	0.13	0.37	0.31	0.32	0.13	0.46	0.14	4
October 3, 2005	1.71	0.30	1.21	4.08	1.82	0.30	4.08	1.61	4
Mean	3.91	0.78	0.70	3.15					
Minimum	0.46	0.13	0.07	0.31					
Maximum	7.86	1.68	1.21	6.03					
Std. Deviation	3.43	0.71	0.57	2.46					
N	4	4	4	4					

Stations	Mean	Min	Max	STD	N
SC-4, SC-3 (upper reach)	1.92	0.07	6.03	2.11	8
SC-1, SC-2 (lower reach)	2.35	0.13	7.86	2.84	8
SC-1, SC-2, SC-3, SC-4 (entire basin)	2.13	0.07	7.86	2.43	16

STD - Standard deviation
N - Number of observations

Appendix Table C-19
Continuing Surface Water Quality Monitoring Program
Oils and Grease (mg/L)
January - December 2005

	South Creek					All Stations			
Sampling Date	SC-1	SC-2	SC-3	SC-4	Mean	Min	Max	STD	N
January 20, 2005	3.2	1.6	1.4	2.4	2.2	1.4	3.2	0.8	4
April 4, 2005	1.5	1.6	2.6	1.9	1.9	1.5	2.6	0.5	4
July 15, 2005	1.4	2.2	2.4	1.9	2.0	1.4	2.4	0.4	4
October 3, 2005	5.2*	6.0*	3.7	1.4	4.1	1.4	6.0	2.0	4
Mean	2.8	2.8	2.5	1.9					
Minimum	1.4	1.6	1.4	1.4					
Maximum	5.2	6.0	3.7	2.4					
Std. Deviation	1.8	2.1	0.9	0.4					
N	4	4	4	4					
Stations	Mean	Min	Max	STD	N				
SC-4, SC-3 (upper reach)	2.2	1.4	3.7	0.7	8				
SC-1, SC-2 (lower reach)	2.8	1.4	6.0	1.8	8				
SC-1, SC-2, SC-3, SC-4 (entire basin)	2.5	1.4	6.0	1.4	16				

STD - Standard deviation
N - Number of observations
*Violation of State and County Water Quality Criteria

Appendix Table C-20
Continuing Surface Water Quality Monitoring Program
Total Coliform Bacteria (counts/100 mL)
January - December 2005

	South Creek				All Stations				
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**	**Mean**	**Min**	**Max**	**STD**	**N**
January 20, 2005	140	250	40	80	128	40	250	91	4
April 4, 2005	110	290	130	250	195	110	290	89	4
July 15, 2005	230	250	430	790	425	230	790	259	4
October 3, 2005	1,700	2,300	100	1,800	1,475	100	2,300	954	4
Mean	545	773	175	730					
Minimum	110	250	40	80					
Maximum	1,700	2,300	430	1,800					
Std. Deviation	772	1,019	174	775					
N	4	4	4	4					
Stations	Mean	Min	Max	STD	N				
SC-4, SC-3 (upper reach)	453	40	1,800	599	8				
SC-1, SC-2 (lower reach)	659	110	2,300	845	8				
SC-1, SC-2, SC-3, SC-4 (entire basin)	556	40	2,300	716	16				

STD - Standard deviation
N - Number of observations

Appendix Table C-21
Continuing Surface Water Quality Monitoring Program
Fecal Coliform Bacteria (count/100 mL)
January - December 2005

		South Creek				All Stations			
Sampling Date	**SC-1**	**SC-2**	**SC-3**	**SC-4**	**Mean**	**Min**	**Max**	**STD**	**N**
January 20, 2005	40	70	10	50	43	10	70	25	4
April 4, 2005	80	<10	40	160	71	<10	160	67	4
July 15, 2005	210	230	390	670	375	210	670	213	4
October 3, 2005	490	810*	60	680	510	60	810	328	4
Mean	205	279	125	390					
Minimum	40	<10	10	50					
Maximum	490	810	390	680					
Std. Deviation	203	367	178	332					
N	4	4	4	4					

Stations	Mean	Min	Max	STD	N
SC-4, SC-3 (upper reach)	258	10	680	284	8
SC-1, SC-2 (lower reach)	242	<10	810	277	8
SC-1, SC-2, SC-3, SC-4 (entire basin)	250	<10	810	271	16

*Violation of State water criteria.
STD - Standard deviation
N - Number of observations

Appendix Table C-22
Continuing Surface Water Quality Monitoring Program
Trace Metals (µg/L)
January - December 2005

	South Creek				All Stations				
Sampling Date	SC-1	SC-2	SC-3	SC-4	Mean	Min	Max	STD	N
Arsenic	13.6	<6.02	8.0	12.4	9.3	<6.02	13.6	4.8	4
Copper	<4	<4	<4	<4	<4	<4	<4	0.0	4
Lead	<3	<3	<3	<3	<3	<3	<3	0.0	4
Zinc	5.2	<1.9	2.7	<1.9	2.5	<1.9	5.2	2.0	4

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 for zinc.

STD - Standard deviation
N - Number of observations

Appendix D

Quarterly Data Tables

Table D-1 Summary of Water Quality Data Collected in the South Creek Basin of Palmer Ranch on January 20, 2005 Sarasota County, Florida

Parameters	Stations SC-1	SC-2	SC-3	SC-4	Water Quality Standards State
Time	11:37	12:35	14:44	14:23	-----
Stream flow (cfs)	0.38	1.80	0	0	-----
Water depth (feet)	0.24	0.9	1.6	2.4	-----
Temperature (°C)	14.6	13.1	15.0	14.1	-----
pH (-log[H^+])	7.3	7.2	8.0	7.4	6.0 - 8.5
Dissolved oxygen (mg/L)	5.2	5.8	10.1	6.2	≥5.0
Specific conductivity (µmhos/cm)	616	749	562	713	≤1275
Total coliform bacteria (No./100 mL)	140	250	40	80	≤2,400
Fecal coliform bacteria (No./100 mL)	40	70	10	50	≤800
Nitrite nitrogen (mg/L)	<0.003	<0.003	<0.003	<0.003	-----
Nitrate nitrogen (mg/L)	0.175	0.197	<0.004	<0.004	-----
Ammonia nitrogen (mg/L)	<0.006	<0.006	<0.006	<0.006	-----
Total Kjeldahl nitrogen (mg/L)	0.852	0.943	0.804	0.850	-----
Organic nitrogen (mg/L)	0.790	0.880	0.740	0.790	-----
Total nitrogen (mg/L)	1.03	1.14	0.804	0.850	-----
Orthophosphate (mg/L)	0.032	0.120	0.097	0.003	-----
Total phosphorus (mg/L)	0.042	0.119	0.099	0.096	-----
Total suspended solids (mg/L)	<0.570	1.50	5.75	1.50	-----
Turbidity (NTU)	0.76	0.84	1.30	1.46	≤29 NTU Increase
Oil and grease (mg/L)	3.23	1.62	1.41	2.35	≤15
Biochemical oxygen demand (mg/L)	<2.0	<2.0	<2.0	<2.0	-----

*Non-compliance with water quality standards specified by FAC 62-302 and Sarasota County Ordinance 72-37, as amended for Class III fresh waters.

Table D-2 Summary of Water Quality Data Collected in the Catfish and North Creek Basins of Palmer Ranch on March 29, 2005 Sarasota County, Florida.

Parameters	Stations				Water Quality Standards
	CC-1	CC-2	CC-3	CC-4	
Time	1024	1106	1132	1139	-----
Stream flow (cfs)	1.2	0.1	0.0	0.0	-----
Water depth (meters)	1.1	0.1	1.7	3.0	-----
Temperature (□C)	20.3	29.8	24.4	23.2	-----
pH (-log[H^+])	7.1	8.5	8.8*	8.0	6.0 - 8.5
Dissolved oxygen (mg/L)	6.2	14.4	8.5	7.0	≥5.0
Specific conductivity (μmhos/cm)	496	868	657	733	≤1,275
Total coliform bacteria (No./100 mL)	3500*	3000*	100	200	≤2,400
Fecal coliform bacteria (No./100 mL)	2500*	800	30	10	≤800
Nitrite nitrogen (mg/L)	0.025	0.009	0.005	0.009	-----
Nitrate nitrogen (mg/L)	0.163	<0.004	<0.004	<0.004	-----
Ammonia nitrogen (mg/L)	0.124	0.077	0.070	0.042	-----
Total Kjeldahl nitrogen (mg/L)	0.534	1.10	0.636	0.970	-----
Organic nitrogen (mg/L)	0.410	1.02	0.566	0.928	-----
Total nitrogen (mg/L)	0.722	1.11	0.636	0.970	-----
Orthophosphate (mg/L)	0.169	0.190	0.031	0.061	-----
Total phosphorus (mg/L)	0.238	0.281	0.104	0.238	-----
Total suspended solids (mg/LJ)	3.40	4.40	7.20	12.6	-----
Turbidity (NTU)	3.0	2.2	3.8	6.3	≤+29 NTU
Oil and grease (mg/L)	2.16	1.86	2.45	1.33	≤5
Biochemical oxygen demand (mg/L)	<2	3.84	6.30	9.02	-----

* - Non-compliance with water quality standards specified by FAC 62-302 and Sarasota County Ordinance 96-020, as amended, for Class III fresh waters.

Table D-2 Summary of Water Quality Data Collected in the Catfish and North Creek Basins of Palmer Ranch on March 29, 2005 Sarasota County, Florida (continued)

Parameters	Stations CC-5	NC-6	Water Quality Standards
Time	1204	1246	-----
Stream flow (cfs)	6.0	0.9	-----
Water depth (meters)	0.7	0.3	-----
Temperature (□C)	23.9	23.9	-----
pH (-log[H^+])	8.1	7.8	6.0 - 8.5
Dissolved oxygen (mg/L)	10.1	7.7	≥5.0
Specific conductivity (µmhos/cm)	628	1006	≤1,275
Total coliform bacteria (No./100 mL)	400	100	≤2,400
Fecal coliform bacteria (No./100 mL)	200	100	≤800
Nitrite nitrogen (mg/L)	0.006	0.029	-----
Nitrate nitrogen (mg/L)	<0.004	0.276	-----
Ammonia nitrogen (mg/L)	0.040	0.128	-----
Total Kjeldahl nitrogen (mg/L)	0.712	0.935	-----
Organic nitrogen (mg/L)	0.672	0.807	-----
Total nitrogen (mg/L)	0.712	1.24	-----
Orthophosphate (mg/L)	0.054	0.063	-----
Total phosphorus (mg/L)	0.116	0.086	-----
Total suspended solids (mg/L)	6.40	4.00	-----
Turbidity (NTU)	4.0	3.2	≤+29 NTU
Oil and grease (mg/L)	1.96	1.55	≤5
Biochemical oxygen demand (mg/L)	2.13	<2	-----

* - Non-compliance with water quality standards specified by FAC 62-302 and Sarasota County Ordinance 96-020, as amended, for Class III fresh waters.

Table D-3. **Summary of Water Quality Data Collected in the South Creek Basin of Palmer Ranch on April 4, 2005, Sarasota County, Florida**

Parameters	Stations				Water Quality Standards
	SC-1	SC-2	SC-3	SC-4	
Time	1234	1110	1357	1323	-----
Stream flow (cfs)	3.2	6.8	1.5	1.5	-----
Water depth (feet)	1.3	2.2	2.2	2.1	-----
Temperature (°C)	21.0	19.8	19.8	20.6	-----
pH (-log[H^+])	7.6	7.0	7.7	7.6	6.0 - 8.5
Dissolved oxygen (mg/L)	3.9*	3.7*	6.6	5.6	≥5.0
Specific conductivity (μmhos/cm)	467	634	354	548	≤1275
Total coliform bacteria (No./100 mL)	110	290	130	250	≤2,400
Fecal coliform bacteria (No./100 mL)	80	<10	40	160	≤800
Nitrite nitrogen (mg/L)	0.007	0.007	0.016	0.006	-----
Nitrate nitrogen (mg/L)	0.024	0.040	0.060	0.030	-----
Ammonia nitrogen (mg/L)	0.142	0.112	0.162	0.139	-----
Total Kjeldahl nitrogen (mg/L)	3.02	4.79	2.57	3.91	-----
Organic nitrogen (mg/L)	2.88	4.68	2.41	3.77	-----
Total nitrogen (mg/L)	3.05	4.84	2.65	3.95	-----
Orthophosphate (mg/L)	0.022	0.157	0.207	0.029	-----
Total phosphorus (mg/L)	0.103	0.183	0.301	0.100	-----
Total suspended solids (mg/L)	3.20	1.40	1.60	0.600	-----
Turbidity (NTU)	3.30	2.10	1.25	1.04	≤29 NTU Increase
Oil and grease (mg/L)	1.53	1.55	2.55	1.92	≤5
Biochemical oxygen demand (mg/L)	<2	3.51	3.97	<2	-----

*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 D-4 **Summary of Water Quality Data Collected in the South Creek Basin of Palmer Ranch on July 15, 2005, Sarasota County, Florida**

Parameters	Stations				Water Quality Standards
	SC-1	SC-2	SC-3	SC-4	
Time	1234	1127	1337	1323	-----
Stream flow (cfs)	10.9	26.6	1.4	0.8	-----
Water depth (feet)	2.0	2.4	1.3	2.4	-----
Temperature (°C)	29.1	28.7	28.7	28.9	-----
pH (-log[H^+])	6.8	6.6	6.7	6.7	6.0 - 8.5
Dissolved oxygen (mg/L)	0.6*	0.9*	4.1*	1.1*	≥5.0
Specific conductivity (umhos/cm)	393	439	234	340	≤1275
Total coliform bacteria (No./100 mL)	230	250	430	790	≤2,400
Fecal coliform bacteria (No./100 mL)	210	230	390	670	≤800
Nitrite nitrogen (mg/L)	<0.003	<0.003	<0.003	<0.003	-----
Nitrate nitrogen (mg/L)	0.024	0.021	0.049	0.016	-----
Ammonia nitrogen (mg/L)	<0.006	<0.006	<0.006	0.017	-----
Total Kjeldahl nitrogen (mg/L)	0.906	1.07	0.694	0.758	-----
Organic Nitrogen (mg/L)	0.900	1.06	0.688	0.741	-----
Total nitrogen (mg/L)	0.930	1.09	0.743	0.774	-----
Orthophosphate (mg/L)	0.062	0.201	0.146	0.112	-----
Total phosphorus (mg/L)	0.172	0.383	0.255	0.231	-----
Total suspended solids (mg/L)	3.20	12.2	<0.570	1.60	-----
Turbidity (NTU)	1.77	8.3	1.51	1.23	≤29 NTU Increase
Oil and grease (mg/L)	1.41	2.22	2.42	1.92	≤5
Biochemical oxygen demand (mg/L)	<2.0	<2.0	<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 D-5. Summary of Water Quality Data Collected in the Catfish and North Creek Basin of Palmer Ranch on September 29, 2005, Sarasota County, Florida

Parameters	Stations				Water Quality Standards
	CC-1	CC-2	CC-3	CC-4	
Time	1232	1302	1315	1321	-----
Stream flow (cfs)	0.05	0.0	0.0	0.0	-----
Water depth (feet)	1.3	0.0	0.3	0.4	-----
Temperature (°C)	26.2	-	30.6	29.47	-----
pH (-log[H^+])	6.9	-	7.4	7.2	6.0 - 8.5
Dissolved oxygen (mg/L)	9.5	-	6.7	4.5*	≥5.0
Specific conductivity (umhos/cm)	554	-	908	959	≤1275
Total coliform bacteria (No./100 mL)	6000*	-	140	200	≤2,400
Fecal coliform bacteria (No./100 mL)	4000*	-	120	140	≤800
Nitrite nitrogen (mg/L)	<0.003	-	<0.003	0.010	-----
Nitrate nitrogen (mg/L)	1.23	-	0.176	1.10	-----
Ammonia nitrogen (mg/L)	0.044	-	0.270	0.262	-----
Total Kjeldahl nitrogen (mg/L)	0.813	-	1.18	1.47	-----
Organic nitrogen (mg/L)	0.769	-	0.91	1.21	-----
Total nitrogen (mg/L)	2.04	-	1.36	2.58	-----
Orthophosphate (mg/L)	0.168	-	0.023	0.050	-----
Total phosphorus (mg/L)	0.206	-	0.057	0.090	-----
Total suspended solids (mg/L)	5.04	-	6.70	4.23	-----
Turbidity (NTU)	4.40	-	5.00	3.8	≤29 NTU Increase
Oil and grease (mg/L)	1.0	-	<0.992	1.4	≤5
Biochemical oxygen demand (mg/L)	<2	-	<2	2.39	-----
Arsenic as As (µg/L)	6.7	-	18.6	8.00	<50[a]
Copper as Cu (µg/L)	14.5	-	41.9	15.7	<12.8[a]
Lead as Pb (µg/L)	<3	-	<3	<3	<3.6[a]
Zinc as Zn (mg/L)	8.00	-	5.2	4.70	<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 D-5. **Summary of Water Quality Data Collected in the Catfish and North Creek Basin of Palmer Ranch on September 29, 2005, Sarasota County, Florida (Continued)**

Parameters	Stations		Water Quality Standards
	CC-5	NC-6	
Time	1333	1431	-----
Stream flow (cfs)	0.9	0.2	-----
Water depth (feet)	0.3	0.1	-----
Temperature (°C)	29.3	27.4	-----
pH (-log[H^+])	7.7	6.9	6.0 - 8.5
Dissolved oxygen (mg/L)	7.6	0.6*	≥5.0
Specific conductivity (µmhos/cm)	1014	1303*	≤1275
Total coliform bacteria (No./100 mL)	300	1000	≤2,400
Fecal coliform bacteria (No./100 mL)	210	70	≤800
Nitrite nitrogen (mg/L)	<0.003	0.008	-----
Nitrate nitrogen (mg/L)	0.034	0.281	-----
Ammonia nitrogen (mg/L)	0.029	1.05	-----
Total Kjeldahl nitrogen (mg/L)	0.923	3.00	-----
Organic nitrogen (mg/L)	0.894	1.95	-----
Total nitrogen (mg/L)	0.957	3.29	-----
Orthophosphate (mg/L)	0.070	0.177	-----
Total phosphorus (mg/L)	0.122	0.226	-----
Total suspended solids (mg/L)	6.43	8.30	-----
Turbidity (NTU)	4.30	8.20	≤29 NTU Increase
Oil and grease (mg/L)	4.2	1.80	≤5
Biochemical oxygen demand (mg/L)	2.77	<2	-----
Arsenic as As (µg/L)	15.9	<6.02	<50[a]
Copper as Cu (µg/L)	14.0	12.2	<12.8[a]
Lead as Pb (µg/L)	3.50	<3	<3.6[a]
Zinc as Zn (µg/L)	5.30	2.60	<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 D-6. Summary of Water Quality Data Collected in the South Creek Basin of Palmer Ranch on October 3, 2005, Sarasota County, Florida

Parameters	Stations				Water Quality Standards
	SC-1	SC-2	SC-3	SC-4	
Time	1152	1126	1226	1211	-----
Stream flow (cfs)	0.0	0.46	0.0	0.0	-----
Water depth (feet)	0.1	0.2	0.4	0.6	-----
Temperature (°C)	28.4	25.8	28.1	26.0	-----
pH ($-\log[H^+]$)	7.6	7.0	7.1	7.1	6.0 - 8.5
Dissolved oxygen (mg/L)	5.5*	0.7*	0.29*	1.5*	≥5.0
Specific conductivity (µmhos/cm)	493	873	745	1149	≤1275
Total coliform bacteria (No./100 mL)	1700	2300	100	1800	≤2,400
Fecal coliform bacteria (No./100 mL)	490	810*	60	680	≤800
Nitrite nitrogen (mg/L)	0.018	0.007	0.010	0.010	-----
Nitrate nitrogen (mg/L)	0.035	<0.004	0.031	0.068	-----
Ammonia nitrogen (mg/L)	0.075	0.068	0.103	0.281	-----
Total Kjeldahl nitrogen (mg/L)	2.69	2.13	2.49	1.42	-----
Organic nitrogen (mg/L)	2.62	2.06	2.39	1.14	-----
Total nitrogen (mg/L)	2.74	2.14	2.52	1.50	-----
Orthophosphate (mg/L)	0.075	0.255	0.119	0.088	-----
Total phosphorus (mg/L)	0.236	0.266	0.323	0.122	-----
Total suspended solids (mg/L)	23.3	1.47	15.8	3.41	-----
Turbidity (NTU)[a]	13.2	2.20	6.80	6.10	≤29 NTU Increase
Oil and grease (mg/L)	5.2*	6.0*	3.7	1.4	≤5
Biochemical oxygen demand (mg/L)	13.5	<2	9.74	<2	-----
Arsenic as As ((µg/L)	13.6	<6.02	8.00	12.4	<50 [a]
Copper as Cu ((µg/L)	<4	<4	<4	<4	<12.8 [a]
Lead as Pb (µg/L)	<3	<3	<3	<3	<3.6 [a]
Zinc as Zn (µg/L)	5.20	<1.9	2.70	<1.9	<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 E

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 twenty-two 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 well-field 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.

Melton, R. B., and G. Serviss. 2000. Florida Power Corporation – Anclote Power Plant Entrainment Survival of Zooplankton. Environmental Science & Policy 3:S233-S248.

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 Technical Advisory Committee
Sarasota County's Environmentally Sensitive Lands Oversight Committee
Sea Grant Marine Advisory Committee
Sarasota County Artificial Reef Committee

Certification

Certified Wetland Delineator

James Warren McGavic

Environmental Scientist

Mr. McGavic is an environmental scientist in VHB's Palmetto office. He has three years of field experience in a variety of ecological and hydrological monitoring projects, which include sampling shallow monitor wells, collecting water quality samples, and conducting qualitative vegetation and wildlife surveys. A representative summary of Mr. McGavic's experience is as follows:

Mr. McGavic has experience in a variety of ecological and hydrological monitoring projects, which include sampling shallow monitor wells, collecting water quality samples and conducting qualitative vegetation and wildlife surveys.

T. Mabry Carlton, Jr., Memorial Reserve Wellfield
Task manager for the collection of monthly water level data from 46 wetlands and 27 wells as well as 6 manual rain gages. Also conducts water quality monitoring on a quarterly basis at 17 wells and annually uses a Trimble GPS unit to delineate wetland boundaries, Sarasota County, FL.

City of Bradenton
Conducted quarterly water quality monitoring associated with the City's Wastewater Treatment Plant effluent. Three sites were sampled within the Manatee River and at the Outfall. Quarterly data reports of results and an annual interpretive report were prepared. Manatee County, Florida.

Brandon Urban Dispersed Wells Project, Hillsborough County, FL
Project scientist conducting bimonthly water level observations at staff gages and piezometers at 23 stations. Assisted in the collection of wetland assessment procedure (WAP) and quantitative data. Responsible for site mobilization and data QA/QC.

Creekwood Development, Ltd.
Conducted semi-annual water quality monitoring program. Performed *in-situ* measurements and collected samples for laboratory analysis from five surface water and four groundwater sites. Prepared quarterly data reports and an annual summary report. Manatee County, Florida.

Pinellas County Public Works Department, Pinellas County, FL
Mr. McGavic conducts monitoring events of planted lake littoral zones and wetland mitigation areas for multiple roadway projects. Qualitative monitoring of mitigation areas is conducted as well as annual quantitative monitoring to identify species and success of planted species. Results are summarized in reports.

Cooper Creek Square
Conducted quarterly monitoring at three sites. Monitoring parameters included nutrients, physical parameters, bacteria, *in-situ* parameters, trace metals and flow. Following each monitoring event, a report of results was prepared for submittal to Manatee County. Also prepared an annual interpretative report following the completion of each year of monitoring. Monitoring was performed to satisfy DRI Development Order Condition.

Palmer Ranch Development, Ltd.
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. Sarasota County, Florida.

Conducted quarterly water quality monitoring and sampling at 4 stations within South Creek (Eastside). Prepared quarterly reports discussing water quality analyses and an annual interpretive report. Sarasota County, Florida.

South Central Hillsborough Regional Wellfield, Hillsborough County, FL
Performs monthly surface water and groundwater level monitoring at 14 sites located within the wellfields. Assists in qualitative and quantitative vegetation surveys. Enters water level data in a computerized database. Hillsborough County, FL

Field Research Experience:

Honors Thesis- Pocket Gopher Study
Research study of the effects of the pocket gopher (*Geomys pinetis*) as an engineer in fire adapted longleaf pine-turkey oak sandhill communities.

Education

B.S. (with honors), Wildlife Ecology and Conservation, University of Florida, Gainesville, FL, December 2000

A.A., Biology, Manatee Community College, Bradenton, FL, May 1997

Professional Culinary Arts Study, Culinary Institute of America, Hyde Park, NY, 1984-1985

Affiliations

Golden Key National Honor Society
Ducks Unlimited
The Wildlife Society
The Rocky Mountain Elk Foundation

Justin C. Ballotte

Environmental Scientist

Justin Ballotte joined Vanasse Hangen Brustlin's (VHB) Environmental Services Division in March of 2005. Serving as a Environmental Scientist in VHB's Palmetto, FL office, Mr. Ballotte has field experience in a variety of ecological and hydrological monitoring projects, which include sampling shallow monitor wells, collecting water quality samples, and conducting qualitative vegetation and wildlife surveys.

Mr. Ballotte's experience includes the following.

Ocean Surveys, Inc., Old Saybrook, CT
As a Project Engineer, Mr. Ballotte assisted in data collection during oceanographic, hydrographic, and geophysical surveys of fresh and salt water bodies throughout the country. He specialized in sediment sampling using various techniques and was responsible for managing projects, mobilizing survey equipment and vessels for specific projects, vessel operation, and equipment maintenance.

Harbor Master / Shellfish Department, Orleans, MA
Serving as a Deputy Harbormaster, Mr. Ballotte conducted boat patrols to enforce safety requirements and other town and state regulations. He also enforced local shell fishing laws and maintained town landings and piers.

Wheelabrator Lisbon, Inc., Lisbon, CT
During an internship, Mr. Ballotte served as Assistant to the Environmental, Health & Safety Director. He was responsible for compiling operational data for regulatory reports on emissions and safety. Mr. Ballotte also completed inspections of plant safety equipment and collected samples for data management of water quality for compliance purposes.

Resource Options, Inc., Needham, MA
Serving as a Hazardous Waste Field Technician Mr. Ballotte was assisted in the setup and operation of Household Hazardous Waste Days in various communities. He received, categorized, and disposed of hazardous chemicals in accordance with State and Federal regulations.

Mr. Ballotte is a Environmental Scientist in the Environmental Services Division of VHB's Palmetto, FL office. His recent experience includes serving as a project engineer conducting oceanographic, hydrographic, and geophysical surveys of fresh and salt water bodies throughout the United States.

Education

Massachusetts Maritime Academy
B.S. Marine Safety/Environmental Protection *(Cum Laude)*
Platoon Leader/Company Adjutant
Sea Term: Safety Training Officer, T/S Empire State

Certifications

USCG 100 Gross Ton Master's License
OSHA 40
Oil Pollution Act of 1990 Qualified Individual
First Aid/CPR

Adam K. Olenoski

Environmental Scientist

Mr. Olenoski has experience in a variety of ecological and hydrological monitoring projects, which include sampling shallow monitor wells, collecting water quality samples and conducting qualitative vegetation and wildlife surveys.

Mr. Olenoski is an environmental scientist in VHB's Palmetto office. He has field experience in a variety of ecological and hydrological monitoring projects, which include sampling shallow monitor wells, collecting water quality samples, and conducting qualitative vegetation and wildlife surveys. A representative summary of Mr. Olenoski's recent experience is as follows:

T. Mabry Carlton, Jr., Memorial Reserve Wellfield
Project scientist for the collection of monthly water level data from 46 wetlands and 27 wells as well as 6 manual rain gages. Also conducts water quality monitoring on a quarterly basis at 17 wells and annually uses a Trimble GPS unit to delineate wetland boundaries, Sarasota County, FL.

Palmer Ranch Development, Ltd.
Project scientist conducting semi-annual water quality monitoring and sampling at 6 stations within Catfish Creek and North Creek. Prepares semi-annual data reports discussing water quality analyses and an annual interpretive report. Sarasota County, Florida.

Conducts quarterly water quality monitoring and sampling at 4 stations within South Creek (Eastside). Prepares quarterly reports discussing water quality analyses and an annual interpretive report. Sarasota County, Florida.

City of Bradenton
Project scientist conducting quarterly water quality monitoring associated with the City's Wastewater Treatment Plant effluent. Three sites are sampled within the Manatee River and at the Outfall. Quarterly data reports of results and an annual interpretive report are prepared. Manatee County, Florida.

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Brandon Urban Dispersed Wells Project, Hillsborough County, FL
Project scientist conducting bimonthly water level observations at staff gages and piezometers at 23 stations. Assisted in the collection of wetland assessment procedure (WAP) and quantitative data. Responsible for site mobilization and data QA/QC.

Field Research Experience:

Centers for Disease Control and Prevention, New York City, New York
As Research Scientist, collected data on serial conversions of West Nile Virus between birds and mosquitoes in urban residential areas; trapped, handled, banded, aged, and took blood samples from wild birds; trapped and collected mosquitoes in microhabitats; cared for and took blood samples from captive birds.

National Marine Fisheries Service, Anchorage, Alaska and Honolulu, Hawaii
As Research Scientist, observed and documented incidental interactions of protected species with fishing gear; processed specimen samples of protected species and selected fish species; handled, collected, and released protected species; recorded fishing effort of commercial fishing vessels; collected data on incidental takes of target, bycatch, and prohibited fish species; bird, marine mammal, crab, and fish identification; worked unsupervised on commercial fishing vessels at sea in unpredictable conditions and schedules; reported illegal violations; computer data entry.

Education Bachelor of Science in Wildlife and Fisheries Science
The Pennsylvania State University