WATER QUALITY IN THE WITHERS SWASH BASIN, WITH EMPHASIS ON ENTERIC BACTERIA, MYRTLE BEACH, SOUTH CAROLINA, 1991-93

By Wladmir B. Guimaraes

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CONTENTS

CONTENTS--Continued

ILLUSTRATIONS

TABLES

TABLES--Continued

TABLES--Continued

CONVERSION FACTORS, VERTICAL DATUM, ABBREVIATED WATER-QUALITY UNITS, AND ACRONYMS

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
	Area	
square mile (mi^2)	2.590	square kilometer
	Flow	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32$$

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Specific conductance of water is expressed in microsiemens per centimeter (µS/cm) at 25 degrees Celsius (25 °C).

Chemical concentration in water is expressed in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Colonies per 100 milliliters is expressed as col/100 mL.

micrometer - µm.

CONVERSION FACTORS, VERTICAL DATUM, ABBREVIATED WATER-QUALITY UNITS, AND ACRONYMS--Continued

Acronyms used in the tables and text of this report:

AA	atomic absorption
AAS	atomic absorption spectrometry
ABN	acid and base/neutral
ADR	automatic data recorder
AE	atomic emission
BHC	benzene hexachloride
BMP	best management practices
DC	direct current
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
FID	flame ionization detector
GC/FID	gas chromatograph/flame ionization detector
GC/MS	gas chromatograph/mass spectrometry
HPLC	high-performance liquid chromatography
IC	ion chromatography
ICP	inductively coupled plasma
MF	membrane filtration
NTU	nephelometric turbidity unit
PCB	polychlorinated biphenyls
PCN	polychlorinated naphthalene
SCDHEC	South Carolina Department of Health and Environmental Control
SFH	shellfish harvesting
TCDD	tetrachlorodibenzodioxin
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WATSTORE	Water Data Storage and Retrieval System

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ABSTRACT

Water samples were collected in 1991-93 from Withers Swash and its two tributaries (the Mainstem and KOA Branches) in Myrtle Beach, S.C., and analyzed for physical properties, organic and inorganic constituents, and fecal coliform and *streptococcus* bacteria. Samples were collected during wet- and dry-weather conditions to assess the water quality of the streams before and after storm runoff.

Water samples were analyzed for over 200 separate physical, chemical, and biological constituents. Concentrations of 11 constituents violated State criteria for shellfish harvesting waters, and State Human Health Criteria. The 11 constituents included concentrations of dissolved oxygen, arsenic, lead, cadmium, mercury, chlordane, dieldrin, 1,1,1-trichloroethane, 1,1-dichloroethylene, trichloroethylene, and fecal coliform bacteria.

Water samples were examined for the presence of enteric bacteria (fecal coliform and fecal *streptococcus*) at 46 sites throughout the Withers Swash Basin and 5 sites on the beach and in the Atlantic Ocean. Water samples were collected just upstream from all confluences in order to determine sources of bacterial contamination. Temporally and spatially high concentrations of enteric bacteria were detected throughout the Withers Swash Basin; however, these sporadic bacteria concentrations made it difficult to determine a single source of the contamination. These enteric bacteria concentrations are probably derived from a number of sources in the basin including septic tanks, garbage containers, and the feces of waterfowl and domestic animals.

INTRODUCTION

The City of Myrtle Beach is a resort area located in the northern part of coastal South Carolina (fig. 1). Rapid growth in the area has caused rural land to be replaced by residential homesites, hotels, motels, shopping centers, paved parking areas, and other facilities. The increase in population growth and urbanization has resulted in a decrease in pervious land for infiltration of rainfall, and an increase in the potential for point- and nonpoint-source pollution on the land surface and in watercourses. Many pollutants are primarily anthropogenic in origin and include a variety of organic debris, sediments, petroleum products, and potentially toxic compounds such as trace elements and pesticides. Most of these pollutants are assumed to be produced in large volumes in the Myrtle Beach area during the summer months because of the large seasonal population and motor traffic associated with tourism, the largest industry in the area.

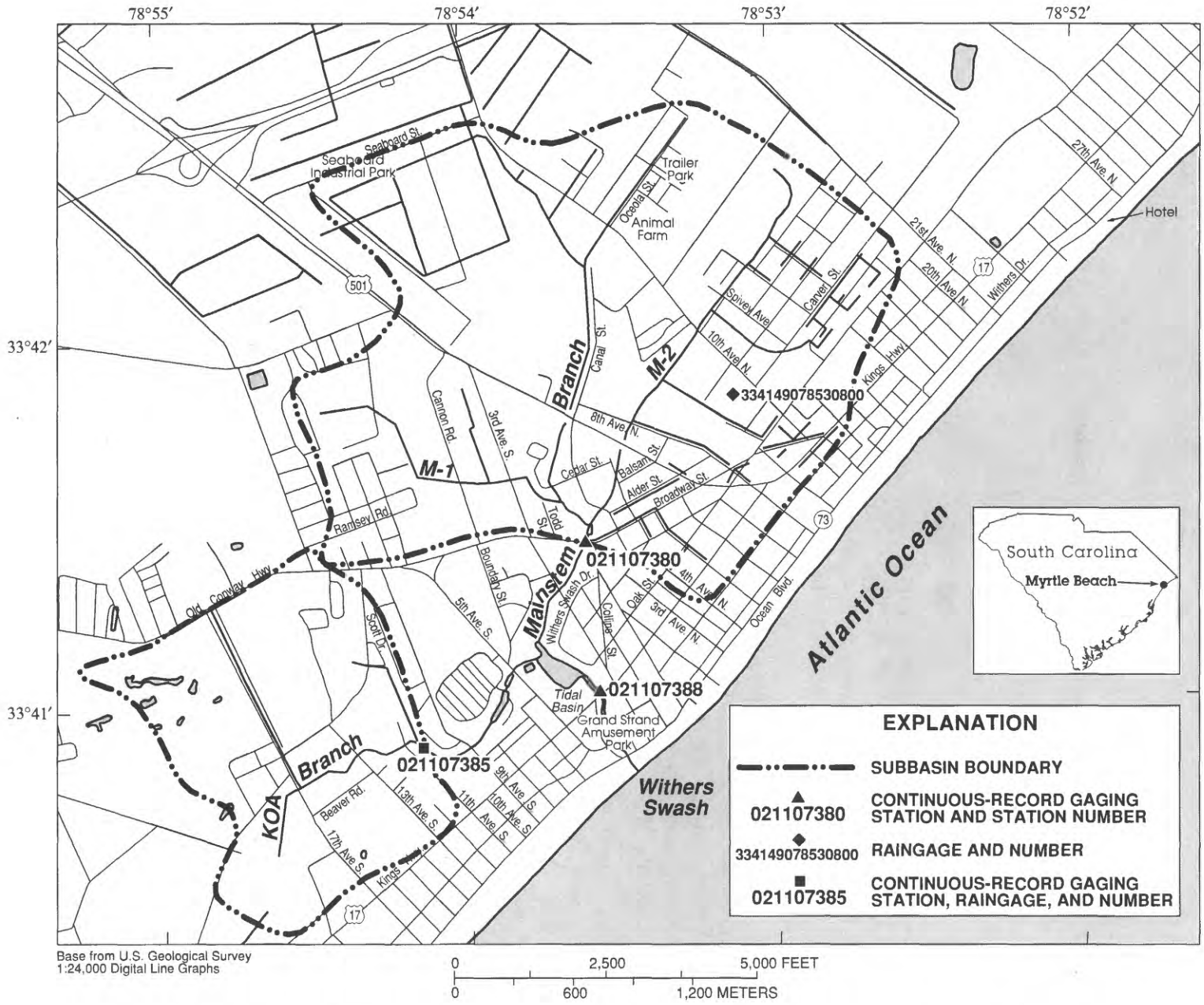

Figure 1. Location of the Mainstem and KOA subbasins of the Withers Swash basin, and gaging stations in the study area, Myrtle Beach, S.C.

The Withers Swash Basin is a large drainage basin in the City of Myrtle Beach, S.C. The basin covers approximately 4.1 mi^2 (Espy, Huston & Associates, Inc., 1988, p. 2) and includes industrial, residential, commercial, agricultural, recreational, and undeveloped land uses.

As part of a long-term water-quality management plan, the City of Myrtle Beach foresees developing the Withers Swash Basin into a commercial area. Because of concerns about water quality in the Withers Swash Basin, the U.S. Geological Survey (USGS), in cooperation with the City of Myrtle Beach, initiated an investigation during the summer months of 1991, 1992, and 1993 to characterize the chemical, physical, and biological quality of streamflow in the Withers Swash Basin and to identify, if possible, the principal sources of enteric bacteria contamination.

Purpose and Scope

The purpose of this report is to present data collected between 1991 and 1993 that characterizes the water quality of the Withers Swash Basin in Myrtle Beach, S.C. Data collected for this investigation reflect base- and high-flow water-quality sampling and intensive bacteria sampling. Specifically, the report includes discussions of the following data: (1) streamflow, (2) rainfall amounts, (3) values of physical properties, (4) inorganic constituent concentrations, and (5) organic compound concentrations. The report also extensively discusses results of a large-scale sampling effort for documentation of enteric bacteria counts in the Withers Swash Basin and the near-shore Atlantic Ocean. Discussions of the data are limited to statistical characterization of analytical results and constituents that violated South Carolina Department of Health and Environmental Control (SCDHEC) Quality Standards for Shellfish Harvesting (SFH) waters and Criteria for Protection of Human Health (South Carolina Department of Health and Environmental Control, 1993). A discussion of best management practices that reduce nonpoint-source pollution in the basin also is included.

The Criteria for class SFH waters and for Protection of Human Health (hereafter referred to as Human Health Criteria) are used as a standard for comparison purposes. Although the most current standards and criteria (1993) were used, they are subject to revision by State regulatory agencies. The SCDHEC publishes other criteria that were not used in this report. These include the Water-Quality Criteria Based on Organoleptic Data (Prevention of Undesirable Taste and Odor) and the Criteria to Protect Aquatic Life (South Carolina Department of Health and Environmental Control, 1993), a generally more stringent criteria for all constituents except arsenic.

Description of Study Area

The Withers Swash Basin is characterized by relatively flat coastal topography. Elevations within the basin range from sea level at the mouth of Withers Swash, where it empties into the Atlantic Ocean, to about 30 ft above sea level in the upper reaches of the basin. The soils within the basin are classified as Brookman-Bladen and Lakeland-Leon-Newhan. Brookman-Bladen soils have a loamy surface layer with a clayey subsoil and are poorly drained. Lakeland-Leon-Newhan soils are sandy throughout and poorly drained (U.S. Department of Agriculture, 1986).

The Mainstem and KOA Branches of Withers Swash converge at a natural tidal basin between 5th Avenue South and Withers Swash Drive; this tidal basin discharges from Withers Swash to the Atlantic Ocean near Grand Strand Amusement Park (fig. 1). The Mainstem Branch

has two major tributaries, M-1 and M-2; these two tributaries converge with the Mainstem Branch just upstream of Broadway Street. The Mainstem and KOA subbasins are located north and south, respectively, of Withers Swash.

The Mainstem subbasin is more urbanized than the KOA subbasin. The Mainstem subbasin drains an area that includes commercial, single- and multi-family residential, and undeveloped land uses. In addition to these land uses, the KOA subbasin also includes some industrial land use.

Previous Investigations

Espy, Huston & Associates, Inc., (1988) discussed 1972 and 1976 studies that indicated that Myrtle Beach storm-water runoff contained high enteric-bacteria counts. Moore, Gardner & Associates, Inc. completed a study in 1980 to determine the magnitude of water-quality problems in Withers Swash. The study identified water-quality problems, and recommended solutions to reduce the amount of pollutants entering the ocean from storm-water runoff. These solutions included many engineered options, such as the discharging of storm water into the nearby Intracoastal Waterway, and discharges to the Atlantic Ocean through a diffuser pipe.

Acknowledgments

The author is grateful to the personnel of the City of Myrtle Beach, S.C., for providing storm-sewer maps, topographic maps, reports and materials from previous studies, and technical support. Steve Moore, Street Superintendent, is acknowledged for his assistance in delineating the drainage areas of the Mainstem and KOA subbasins.

DATA-COLLECTION METHODS

Data collection included streamflow, rainfall amounts, and water-quality and bacteria sampling, although not all these types of data were gathered at each station. The water-quality data collected included measurements of physical properties, chemical analysis (inorganic and organic constituents), and bacterial data (fecal coliform and fecal *streptococcus* bacteria).

Three gaging stations in the Withers Swash Basin (fig. 1), each equipped with an automatic data recorder (ADR), continuously recorded water levels at 5-minute intervals. These three USGS stations were 021107380 (Mainstem Branch of Withers Swash at Broadway Street), 021107385 (KOA Branch of Withers Swash near 10th Avenue South), and 021107388 (Withers Swash at U.S. Highway 17), and will be referred to as the gaging stations on the Mainstem Branch, KOA Branch, and Withers Swash, respectively, when discussing data collection in the study area. Information on the stations and the type of data collected at each station are listed in table 1. Rainfall also was collected at two stations, 334149078530800 (rain gage behind Chapin Ace Hardware near 10th Avenue North), and 021107385 (KOA Branch near 10th Avenue South) (fig. 1). The latter rain gage was located near the stage gage on the KOA Branch. Stations 334149078530800 and 021107385 recorded rainfall at 5-minute intervals in the Mainstem and KOA subbasins, respectively.

Table 1.--*Summary of data collection at the gaging stations in the Withers Swash Basin, Myrtle Beach, S.C.*

[USGS, U.S. Geological Survey; B, bacteria; Q, streamflow; St, stage (water level); O, organic; I, inorganic; P, physical properties; Ave., avenue; S, south; R, rainfall; N, north]

USGS station number (fig. 1)	Station name	Sampling dates	Type of data collected
021107380	Mainstem of Withers Swash at Broadway Street, Myrtle Beach, S.C.	08/01/91	B, Q, St
		09/10/91	B, Q, St
		09/19/91	B, Q, St
		09/20/91	B, Q, St
		09/24/91	B, Q, St, O, I, P
		06/04/92	B, Q, St
		06/15/92	B, Q, St
		07/18/92	B, Q, St
		07/20/92	B, Q, St, O, I, P
		08/03/92	B, Q, St, O, I, P
		08/04/92	B, Q, St
		08/05/92	B, Q, St
		06/22/93	B, Q, St
021107385	KOA Branch of Withers Swash near 10th Ave. S., Myrtle Beach, S.C.	08/01/91	B, Q, St
		09/10/91	B, Q, St
		09/19/91	B, Q, St
		09/20/91	B, Q, St
		09/24/91	B, Q, St, O, I, P
		11/08/91	B, Q, St
		06/04/92	B, Q, St
		07/18/92	B, Q, St
		07/20/92	B, Q, St, O, I, P
		08/03/92	B, Q, St, O, I, P
		06/22/93	B, Q, St
021107385	KOA Branch of Withers Swash near 10th Ave. S., Myrtle Beach, S.C.	08/01/91 through 05/01/93	R
021107388	Withers Swash at Highway 17, Myrtle Beach, S.C.	09/19/91	B, St
		09/20/91	B, St
		09/24/91	B, St, O, I, P
		06/04/92	B, St
		06/15/92	B, St
		06/16/92	B, St
		08/05/92	B, St
		06/22/93	B, St
334149078530800	Rain gage behind Chapin Ace Hardware near 10th Ave. N., Myrtle Beach, S.C.	08/01/91 through 05/01/93	R

The sampling strategy was designed to characterize water quality under base-flow conditions and during storm-water runoff, with emphasis on the bacterial water quality of the streams. Water samples were collected at the gaging stations during periods of base flow prior to rainfall to determine the concentrations of selected water-quality constituents prior to storm runoff. Runoff-water samples were collected at the gaging stations prior to peak, during peak, and following peak streamflow. After an initial runoff was sampled at Withers Swash, sampling was shifted to the upstream gaging stations on the Mainstem and KOA Branches, because Withers Swash was constantly influenced by the tides. Samples for fecal coliform and fecal *streptococcus* bacteria analysis were collected at 51 sites throughout the Withers Swash Basin, on the beach, and at its confluence with the Atlantic Ocean, at selected streamflow rates in an effort to determine sources of enteric-bacteria contamination.

Streamflow

Streamflow was determined at gaging stations on the Mainstem and KOA Branches using a stage-discharge relation as described by Kennedy (1984). The stage-discharge relation at Withers Swash was not developed because of streamflow reversal at high tides, but water levels at the station were used to indicate tidal influence in the basin. During the runoff event of September 24, 1991, the stage-discharge relation at the Mainstem Branch was tidally affected, and the streamflow was measured using stream-gaging techniques modified from Rantz and others (1982). The modifications included taking velocity readings at less than 20 observation verticals in the measurement cross section, because the stream was narrow. Velocities were determined at 20-second, rather than 40-second intervals, because the stage was changing rapidly.

Water Quality

Water-quality samples were collected at gaging stations and analyzed for selected inorganic and organic constituents, physical properties, and bacteria. Samples were collected at the center of the streamflow, processed, and preserved. To ensure representative water-quality sampling, physical properties including water temperature, pH, specific conductance, and dissolved-oxygen concentrations were measured at each site when the samples were collected.

Procedures used in this study for water-quality sampling are described in Guy and Norman (1970), Stevens and others (1975), Wershaw and others (1983), and Fishman and Friedman (1985). Sample-volume requirements, processing and preservation methods, and analysis of inorganic constituents are summarized in table 2, and analysis of organic constituents and bacteria are summarized in table 3. All analyses were done by the USGS National Water Quality Laboratory in Denver, Colo., except for enteric-bacteria analyses, which were done by the USGS in Columbia, S.C.

Inorganic analyses included physical properties such as water temperature, pH, specific conductance, and dissolved-oxygen concentrations, and constituents such as total nitrogen and phosphorus (nutrients), major ions, trace elements, and cyanide. Organic analyses included gas chromatograph/mass spectrometric (GC/MS) quantification of detectable concentrations of acid- and base/neutral-extractable (ABN) and volatile compounds. Selected GC/MS spectrograms for ABN and volatile constituents were further researched using spectral libraries maintained by the National Institute of Standards and Technology. Water samples also were analyzed for the presence of organochlorine pesticide compounds. Analytical methods, reporting units, and detection limits are listed in tables 4 and 5 at the end of the report.

Table 2.--*Summary of processing and preservation methods for the analysis of inorganic compounds in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C.*

[L, liters; °C, degrees Celsius; mL, milliliters; ICP, inductively coupled plasma; <, less than; AA, atomic absorption; >, greater than; μm, micrometers]

Bottle volume[1]	Analyses made	Filtered[2]	Preservation method
1 L	Alkalinity Turbidity Total suspended solids	No	Chilled to 4 °C
500 mL	Sulfate, dissolved Chloride, dissolved	Yes	Chilled to 4 °C
250 mL (acid rinsed)	Total trace elements using ICP method	No	1 mL HNO_3 to pH < 2; chilled to 4 °C
250 mL (acid rinsed)	Dissolved trace elements using ICP method Sodium, dissolved	Yes	Add HNO_3 to pH < 2; chilled to 4 °C
500 mL (acid rinsed)	Magnesium, dissolved Calcium, dissolved Potassium, dissolved	Yes	Add HNO_3 to pH < 2; chilled to 4 °C
500 mL (acid rinsed)	Total trace elements using AA method	No	Add HNO_3 to pH < 2; chilled to 4 °C
250 mL (amber)	Cyanide	No	Add NaOH to pH > 12; chilled to 4 °C
250 mL (amber)	Nutrients	No	Add H_2SO_4 to pH < 2; chilled to 4 °C

[1]All bottles are clear polyethylene plastic unless otherwise specified.

[2]Filtered through 0.45 μm pore-size filter.

Table 3.--*Summary of processing and preservation methods for the analysis of organic compounds in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C.*

[L, liters; °C, degrees Celsius; mL, milliliters]

Bottle volume[1]	Analyses made	Filtered	Preservation technique
Four 1 L	Acid- and base/neutral-extractable organic compounds	No	Chilled to 4 °C
	Organochlorine pesticides	No	Chilled to 4 °C
125 mL	Total organic carbon	No	Chilled to 4 °C
Two 40 mL septum vials	Volatile organic compounds	No	Chilled to 4 °C
200 mL	Fecal coliform bacteria	No	Chilled to 4 °C
200 mL	Fecal *streptococcus* bacteria	No	Chilled to 4 °C

[1]All bottles are glass, cleaned of all organic contaminants, and baked at 300 °C overnight. Lids are lined with teflon.

Bacteria

Samples for fecal coliform and fecal *streptococcus* bacteria analyses were collected during wet- and dry-weather periods at 46 sites near confluences along stream reaches within the Withers Swash Basin and an additional five sites outside the basin. Three of the five sites were located in the ocean near the mouth of Withers Swash and two sites were located north of Withers Swash at a storm-water-discharge culvert on the beach. The membrane filtration (MF) method of analysis was used because its direct enumeration yields statistically better results than other methods (Britton and Greeson, 1988). The MF method also can be done in the field, and the results are available within 24 to 48 hours after incubation. The ideal colony count for fecal coliform and fecal *streptococcus* is 20 to 60 col/100 mL and 20 to 100 col/100 mL, respectively. To obtain ideal counts of colonies, the range of enteric-bacteria counts should be known in order to prepare a proper dilution. Because enteric-bacteria counts were not known initially, selected dilutions were occasionally not of proper dilution; therefore, some counts were determined from a non-ideal count of colonies. The procedures used in sampling, filtering, incubating, and counting colonies are described by Britton and Greeson.

WATER QUALITY IN THE WITHERS SWASH BASIN

The results of over 200 chemical, physical, and biological constituents analyzed in water samples collected in the Withers Swash Basin are discussed in this section. Concentrations are compared to specific criteria listed in State criteria for class SFH waters and State Human Health Criteria. These criteria are used to evaluate water-quality data in two basic groups of characteristics: (1) physical properties, major ions, nutrients, trace elements, and cyanide; and (2) volatile organic, acid- and base/neutral-extractable organic, and organochlorine pesticide compounds. Discussion of analytical results are confined to the USGS gaging stations on the Mainstem and KOA Branches where the streams are not influenced by tides, except for the event of September 24, 1991, where samples also were collected in Withers Swash. Water quality of the Withers Swash Basin varied from well within to violating State criteria. Most of the violations of criteria occurred during storms.

Water samples collected at Withers Swash showed that high concentrations detected at the upstream stations on the Mainstem and KOA Branches were attenuated by the tidal basin. The tidal basin acts as a detention pond, in which some nonconservative constituents settle out of the water column. Other nonconservative constituents are degraded by biological processes. Conservative constituents that do not settle out are diluted within the tidal basin. Although some constituents were detected at Withers Swash, the concentrations were far below concentrations detected at the upstream stations and did not violate State criteria.

Fecal coliform and fecal *streptococcus* bacteria were examined at 15 sites on the Mainstem and KOA Branches on August 1, 1991, during dry-weather conditions. Enteric-bacteria counts were high and spatially sporadic. Eleven of the same fifteen sites were sampled on September 10, 1991, during dry-weather conditions. The results of the two sampling events indicated that the high enteric-bacteria counts also were temporally sporadic. Because these high counts were temporally and spatially sporadic, 149 water samples were synoptically collected at 51 sites throughout the Withers Swash Basin, on the beach, and in the Atlantic Ocean near the mouth of Withers Swash, and examined for enteric bacteria.

Physical Properties, Major Ions, Nutrients, Trace Elements, and Cyanide

The water samples collected in the Withers Swash Basin were examined for physical properties, major ions, nutrients, trace elements, and cyanide (tables 6, 7, and 8; appendixes 1, 2, and 3). Results indicate that nutrients and trace elements were detected at the gaging stations on the Mainstem and KOA Branches, and Withers Swash. Major ions were detected at the gaging stations on the Mainstem and KOA Branches, but no data on major ions were obtained in Withers Swash. Instantaneous streamflows at the gaging stations during each sampling event also were determined.

Withers Swash Basin is classified as SFH waters by the SCDHEC (Zach Corontzes, oral commun., January 24, 1995). Class SFH waters are classified as tidal saltwaters protected for shellfish harvesting, suitable for primary- and secondary- contact recreation, fishing, crabbing, and the survival and propagation of a balanced indigenous aquatic community of marine fauna an flora (South Carolina Department of Health and Environmental Control, 1993).

Table 6.--*Statistical summary of physical properties, oxygen demand, total organic carbon, residue, turbidity, hardness, alkalinity, and major ion concentrations in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[°C, degrees Celsius; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; NTU, nephelometric turbidity units; <, less than; --, no data]

WAT-STORE[1] parameter code	Constituent or property	Units	Station 021107380 (Mainstem Branch)				Station 021107385 (KOA Branch)				Station 021107388 (Withers Swash)			
			Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median
00010	Water temperature	°C	12	28.0	23.0	25.3	12	27.0	23.5	25.3	3	27.0	25.0	25.0
00403	pH, lab	Standard	12	8.1	7.2	7.5	12	10.4	3.2	7.3	3	7.9	7.7	7.7
00095	Specific conductance, field	µS/cm	12	629	88	385	12	1,200	82	326	3	66,000	46,000	46,200
90095	Specific conductance, lab	µS/cm	12	657	98	434	12	1,200	87	330	3	45,200	36,600	38,000
00300	Oxygen, dissolved	mg/L	12	6.0	3.5	4.5	12	5.3	2.6	4.4	3	7.6	5.9	6.2
00301	Oxygen, dissolved percent saturation	Percent	12	74.2	40.9	53.7	12	66.6	31.4	52.9	3	113	85	89
00310	Biochemical oxygen demand	mg/L	9	20.5	6.5	11.5	9	23.5	6	9.5	3	12	6	7

Table 6.--*Statistical summary of physical properties, oxygen demand, total organic carbon, residue, turbidity, hardness, alkalinity, and major ion concentrations in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[°C, degrees Celsius; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; NTU, nephelometric turbidity units; <, less than; --, no data]

WATSTORE[1] parameter code	Constituent or property	Units	Station 021107380 (Mainstem Branch)				Station 021107385 (KOA Branch)				Station 021107388 (Withers Swash)			
			Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median
00340	Chemical oxygen demand	mg/L	11	99	15	30	12	120	23	60	3	810	620	730
00680	Total organic carbon	mg/L	8	42	10	17	7	50	13	19	--	--	--	--
00515	Residue at 105 °C, dissolved	mg/L	4	399	97	257	5	213	90	129	3	34,700	28,100	29,900
00530	Residue at 105 °C, suspended	mg/L	12	231	<1	29	12	168	1	41	3	14	2	8
70300	Solids residue at 180 °C, dissolved	mg/L	8	370	68	301	7	640	73	222	--	--	--	--
00076	Turbidity	NTU	4	67	5.5	39.5	5	60	3	7	3	10	2.2	8.4
00900	Hardness, total	mg/L	8	220	35	165	7	240	28	67	--	--	--	--
90410	Alkalinity as $CaCo_3$	mg/L	12	272	37	152	12	232	<1	43	3	129	116	117

Table 6.--*Statistical summary of physical properties, oxygen demand, total organic carbon, residue, turbidity, hardness, alkalinity, and major ion concentrations in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[°C, degrees Celsius; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; NTU, nephelometric turbidity units; <, less than; --, no data]

WAT-STORE[1] parameter code	Constituent or property	Units	Station 021107380 (Mainstem Branch)				Station 021107385 (KOA Branch)				Station 021107388 (Withers Swash)			
			Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median
00915	Calcium, dissolved	mg/L	8	83	13	61.5	7	88	10	24	--	--	--	--
00925	Magnesium, dissolved	mg/L	8	3.4	.68	2.8	7	6.1	.72	1.7	--	--	--	--
00930	Sodium, dissolved	mg/L	8	50	4.0	35	7	180	4.5	34	--	--	--	--
00935	Potassium, dissolved	mg/L	8	4.1	1.1	2.8	7	4.4	2.1	2.7	--	--	--	--
00940	Chloride, dissolved	mg/L	8	45	4.2	35	7	270	4.7	68	--	--	--	--
00945	Sulfate, dissolved	mg/L	8	34	8.2	28	7	53	7.6	33	--	--	--	--
70301	Solids, sum of dissolved constituents	mg/L	8	353	54.0	258	6	544	46	191	--	--	--	--

[1]National Water Data Storage and Retrieval System of the U.S. Geological Survey.

Table 7.--*Statistical summary of nutrient concentrations in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[All concentrations in milligrams per liter; <, less than; --, no data]

WAT-STORE[1] parameter code	Constituent	Station 021107380 (Mainstem Branch)				Station 021107385 (KOA Branch)				Station 021107388 (Withers Swash)			
		Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median
00600	Nitrogen, total	12	3.3	0.67	1.05	12	7.1	0.75	1.8	--	--	--	--
00605	Nitrogen, organic, total	12	1.4	.26	.57	12	3.1	.34	.91	3	0.35	0.33	0.34
00610	Nitrogen, NH_3, total	12	.28	.01	.13	12	1.6	.07	.62	3	.07	.05	.06
00615	Nitrogen, nitrite, total	12	.1	.01	.02	12	.07	.01	.03	3	.01	<.01	<.01
00620	Nitrogen, nitrate, total	12	1.81	.064	.29	12	3.13	.054	.310	--	--	--	--
00625	Nitrogen, organic + NH_3, total	12	1.5	.5	.65	12	3.9	.60	1.6	3	.40	.40	.40
00630	Nitrogen, NO_2+NO_3, total	12	1.9	.074	.340	12	3.20	.064	.350	3	<.05	<.05	<.05
71945	Nitrogen, NH_3, total	12	.36	.01	.17	12	2.1	.03	.30	3	.09	.06	.08

Table 7.--*Statistical summary of nutrient concentrations in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[All concentrations in milligrams per liter; <, less than; --, no data]

WAT-STORE[1] parameter code	Constituent	Station 021107380 (Mainstem Branch)				Station 021107385 (KOA Branch)				Station 021107388 (Withers Swash)			
		Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median
71887	Nitrogen, total	12	15	3	4.7	12	31	3.3	7.7	--	--	--	--
00665	Phosphorus, total	12	1.3	.19	.24	12	1.7	.10	.30	3	.09	.07	.09
70507	Phosphorus, ortho, total	4	.17	.11	.14	5	.07	.05	.07	3	.05	.04	.08
00650	Phosphate, total	4	.52	.34	.43	5	.20	.20	.20	3	.15	.12	.12

[1]National Water Data Storage and Retrieval System of the U.S. Geological Survey.

Table 8.--*Statistical summary of trace-element concentrations in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[All concentrations in micrograms per liter; <, less than]

WAT-STORE[1] parameter code	Constituent	Station 021107380 (Mainstem Branch)				Station 021107385 (KOA Branch)				Station 021107388 (Withers Swash)			
		Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median
01097	Antimony, total	4	2	<1	1	5	2	<1	2	3	<1	<1	<1
01002	Arsenic, total	12	6	<1	2	12	7	<1	3	3	3	2	2
01012	Beryllium, total	12	<10	<10	<10	12	<10	<10	<10	3	<10	<10	<10
01027	Cadmium, total	12	2	<1	<1	12	7	<1	.5	3	<10	<10	<10
01034	Chromium, total	12	27	<1	1	12	9	<1	1	3	4	<4	<4
01042	Copper, total	12	51	1	9.5	12	62	3	23.5	3	<10	1	3
00720	Cyanide, total	12	<.01	<.01	<.01	11	<.01	<.01	<.01	3	<.01	<.01	<.01
01051	Lead, total	12	140	<1	9	12	450	4	109	3	<10	<10	<10
71900	Mercury, total	12	.5	<1	.2	12	.3	<.1	.1	3	.2	.1	.1

Table 8.--*Statistical summary of trace-element concentrations in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[All concentrations in micrograms per liter; <, less than]

WAT-STORE[1] parameter code	Constituent	Station 021107380 (Mainstem Branch)				Station 021107385 (KOA Branch)				Station 021107388 (Withers Swash)			
		Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median
01067	Nickel, total	12	8	<1	1	12	65	1	4.5	3	1	<1	<1
01147	Selenium, total	12	<2	<1	<1	12	<2	<1	<1	3	<1	<1	<1
01077	Silver, total	12	<1	<1	<1	12	45	<1	3	3	<1	<1	<1
01092	Zinc, total	12	310	10	60	12	2,300	20	145	3	30	<10	20

[1]National Water Storage and Retrieval System of the U.S. Geological Survey.

Values of pH were within State criteria for class SFH waters (pH between 6.0 and 8.5 standard pH units) for all but two samples. Two samples were collected at different times from the KOA Branch on July 20, 1992; pH values were 10.4 standard pH unit and 3.2 standard pH unit, whereas alkalinity concentrations for the same samples were 232 mg/L and less than 1.0 mg/L as $CaCO_3$, respectively. These data are suspect due to possible field and (or) laboratory contamination.

Specific conductance at the gaging stations on the Mainstem and KOA Branches ranged from 82 to 1,200 µS/cm, whereas values in Withers Swash ranged from 36,600 to 45,200 µS/cm. The values at the downstream gaging station clearly show the influence of seawater carried into Withers Swash by the incoming tide.

Dissolved-oxygen concentrations ranged from 2.6 to 7.6 mg/L at the three gaging stations. Of the 27 samples collected, 6 of these were below the minimum concentration of 4.0 mg/L suggested by the State criteria for class SFH waters, and concentrations in 12 other samples were below the required daily average of not less than 5.0 mg/L. Dissolved-oxygen concentrations at the gaging stations on the KOA Branch ranged from 2.6 to 5.3 mg/L. These concentrations are based on instantaneous measurements; more data would have to be collected to determine whether the daily mean concentration was greater than 5.0 mg/L. However, based on these data, the KOA Branch does not contain adequate dissolved-oxygen concentrations as suggested by State criteria for class SFH waters.

Water samples were examined for major ion concentrations including dissolved calcium, magnesium, sodium, potassium, chloride, and sulfate. Concentrations of these ions were detected at the gaging stations on the Mainstem and KOA Branches. Dissolved chloride concentrations ranged from 4.2 to 270 mg/L, with the highest value detected in the KOA Branch. For other major ions detected in the water samples, the highest concentrations were detected in the KOA Branch. No comparisons were made to criteria, because major ions were not included in State criteria for class SFH waters or Human Health.

Nutrients were detected in almost every water sample collected at the three gaging stations. Results of analysis for 12 nutrients indicate that the highest concentrations of nutrients were detected at the gaging stations on the KOA Branch and concentrations were reduced in Withers Swash. No State criteria for nitrogen and phosphorus as nutrients were listed.

Water samples collected at the three gaging stations were examined for trace elements and cyanide. Trace elements were detected at all stations, but cyanide was not detected above the detection limit of 0.01 mg/L in the 26 samples collected. Also, concentrations of antimony, beryllium, and selenium were not detected or were near detection limits. The detection limit for beryllium of 10.0 µg/L is much higher than the State Human Health criteria of 1.17 µg/L; therefore, it is not known if beryllium exceeds the State Human Health criteria. Thallium, asbestos, and 2, 3, 7, 8-TCDD (dioxin) were not examined in water samples collected in the Withers Swash Basin (table 9).

Arsenic, lead, cadmium, and mercury were detected at concentrations that violated State Human Health criteria (table 9). Arsenic concentrations ranged from below the detection limit of 1 to 7 µg/L. The State Human Health criteria suggests a maximum arsenic concentration of 1.4 µg/L. Lead concentrations exceeded the State Human Health criteria of 5 µg/L in 6 of 12 samples collected from the KOA Branch and 2 of 12 samples collected from the Mainstem Branch. The highest lead concentrations were in samples collected from the KOA Branch. Lead

Table 9.--*Trace element, cyanide, asbestos, and dioxin compounds listed in the South Carolina Department of Health and Environmental Control Criteria for Protection of Human Health and the maximum concentrations detected within the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[SCDHEC, South Carolina Department of Health and Environmental Control; all values are in micrograms per liter unless otherwise noted; <, less than; --, no data; TCDD, tetrachlorodibenzodioxin]

Constituents	Maximum allowable concentration in SCDHEC Human Health criteria[1]	Maximum concentration detected in the Withers Swash Basin
Antimony	4,308	2
Arsenic	1.4	7
Beryllium	1.17	<10
Cadmium	5	7
Chromium (III)	673,077	--
Chromium (VI)	50	--
Lead	50	450
Mercury	.153	.5
Nickel	4,584	65
Selenium	10	<2
Silver	50	45
Thallium	48	--
Cyanide	200	<10
Asbestos	[2]7,000,000 f/L	--
2,3,7,8-TCDD	[3]1 2 ppq	--

[1]Values taken from Criteria for Protection of Human Health (South Carolina Department of Health and Environmental Control, 1993).

[2]Number of fibers per liter of water - based on consumption of water only.

[3]Parts per quadrillion.

concentrations that exceeded State Human Health criteria ranged from 170 to 450 µg/L. Cadmium was detected in 6 of 12 samples collected from the KOA Branch. Two samples contained cadmium concentrations of 7 µg/L. The State Human Health criteria suggests a maximum concentration of 5 µg/L. Cadmium also was detected in 1 of 12 samples collected from the Mainstem Branch with a concentration of 2 µg/L. Cadmium was not detected in any samples collected from Withers Swash. Mercury concentrations ranged from less than the detection limit of 0.1 to 0.5 µg/L, and generally were higher in the Mainstem Branch than in the KOA Branch. Maximum contaminant concentration of mercury under State Human Health criteria is 0.153 µg/L.

The State Human Health criteria lists Chromium III, and Chromium VI, but these constituents were not examined in the Withers Swash Basin. The highest measured value for total chromium was 27 µg/L, which is below State Human Health criteria for Chromium III and Chromium VI of 673,077 µg/L and 50 µg/L, respectively.

The trace-element data indicate a pattern of higher concentrations of arsenic, cadmium, copper, lead, nickel, silver, and zinc in the KOA Branch than in the Mainstem Branch. Arsenic, cadmium, copper, and silver occur in various agricultural and household pesticides and also are used in the manufacturing of electronic devices (Lucius and others, 1992). Mercury is used in pharmaceutical and agricultural chemicals (Lucius and others, 1992).

Organic Compounds

The water samples collected at the three gaging stations in the Withers Swash Basin were examined for detectable concentrations of 61 volatile organic compounds, 55 acid- and base/neutral-extractable organic compounds, and 36 organic pesticide compounds (appendixes 4, 5, and 6). Results of analysis indicate that 12 compounds were detected in water from the Mainstem Branch, 19 in the KOA Branch, and 7 in Withers Swash (tables 10 and 11). The compounds, the number of water samples collected at each station, and the number of water samples in which compounds violate State Human Health criteria are listed in table 11.

The volatile organic compounds, 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethylene, 1,2-dichloroethane,1,2-trans-dichloroethene, cis-1,2-dichloroethene, chlorobenzene, chloroethane, chloroform, ethylbenzene, methylenechloride, p-isopropyltoluene, toluene, trichloroethylene, vinyl chloride, and xylene were detected in samples collected from the KOA Branch, while 1,2-trans-dichloroethene, chloroform, cis-1,2-dichloroethene, and vinyl chloride were detected in samples collected from the Mainstem Branch (table 11). In samples collected from Withers Swash, 1,1,1-trichloroethane, 1,2-trans-dichloroethene, benzene, tetrachloroethylene, and trichloroethylene were detected (table 11). Benzene and tetrachloroethylene were the only volatile organic compounds detected in Withers Swash that were not detected at either the Mainstem or KOA Branches. All other volatile organic compounds were detected at much lower concentrations in Withers Swash than in the Mainstem and (or) the KOA Branches. The KOA Branch contained the largest number of and the highest concentrations of volatile organic compounds of all water samples that were collected.

Some concentrations of 1,1-dichloroethylene, 1,1,1-trichloroethane, and trichloroethylene that were detected in water samples collected from the KOA Branch violated State Human Health criteria (table 12). In addition, the detection limit for acrylonitrile of 20.0 µg/L is higher than the State Human Health criteria of 6.65 µg/L; therefore, it is not known if acrylonitrile exceeds State Human Health criteria. The volatile organic compounds and highest allowable concentration listed in the State Human Health criteria along with the maximum concentrations detected in samples collected within the Withers Swash Basin are listed in table 12.

Table 10.--*Statistical summary of volatile organic compounds, acid- and base/neutral-extractable organic compounds, and pesticides in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[µg/L, micrograms per liter; <, less than; mg/L, milligrams per liter; --, no data; DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane]

WAT-STORE[1] code	Compounds	Units	Station 021107380 (Mainstem Branch)				Station 021107385 (KOA Branch)				Station 021107388 (Withers Swash)			
			Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median
			Volatile organic compounds											
34506	1,1,1-Tri-chloroethane	µg/L	8	<0.2	<0.2	<0.2	8	350	27	87.5	3	0.6	<0.2	0.2
34496	1,1-Dichloro-ethane	µg/L	8	<.2	<.2	<.2	8	4.3	1.2	2.8	3	<.2	<.2	<.2
34501	1,1-Dichloro-ethylene	µg/L	8	<.2	<.2	<.2	8	26	.6	2.5	3	<.2	<.2	<.2
34030	Benzene	µg/L	8	<.2	<.2	<.2	8	<.2	<.2	<.2	3	.6	<.2	<.2
34301	Chloro-benzene	µg/L	8	<.2	<.2	<.2	8	.2	<.2	<.2	3	<.2	<.2	<.2
34311	Chloro-ethane	µg/L	8	<.2	<.2	<.2	8	.6	<.2	.4	3	<.2	<.2	<.2
34546	1,2-trans-Dichloro-ethene	µg/L	8	.8	<.2	<.2	8	13	<.2	3.8	3	2	1	1.9
32103	1,2-Dichloro-ethane	µg/L	8	<.2	<.2	<.2	8	.4	<.2	<.2	3	<.2	<.2	<.2

Table 10.--*Statistical summary of volatile organic compounds, acid- and base/neutral-extractable organic compounds, and pesticides in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[µg/L, micrograms per liter; <, less than; mg/L, milligrams per liter; --, no data; DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane]

WAT-STORE[1] code	Compounds	Units	Station 021107380 (Mainstem Branch)				Station 021107385 (KOA Branch)				Station 021107388 (Withers Swash)			
			Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median
			Volatile organic compounds--Continued											
32106	Chloroform	µg/L	8	0.3	<0.2	<0.2	8	1	<0.2	0.6	3	<0.2	<0.2	<0.2
77356	p-Isopropyl-toluene	µg/L	4	<.2	<.2	<.2	3	.3	<.2	<.2	--	--	--	--
77093	cis-1,2-Di-chloroethene	µg/L	4	.9	<.2	.85	3	14	4.7	5.8	--	--	--	--
34371	Ethylben-zene	µg/L	8	<.2	<.2	<.2	8	.2	<.2	<.2	3	<.2	<.2	<.2
34423	Methylene chloride	µg/L	8	<.2	<.2	<.2	8	.8	<.2	<.2	3	<.2	<.2	<.2
34475	Tetrachloro-ethylene	µg/L	8	<.2	<.2	<.2	8	<.2	<.2	<.2	3	.3	.2	.2
34010	Toluene	µg/L	8	<.2	<.2	<.2	8	.9	<.2	.3	3	<.2	<.2	<.2
39180	Trichloro-ethylene	µg/L	8	<.2	<.2	<.2	8	48	5.2	9.4	3	2.6	1.2	<.4
39175	Vinyl chloride	µg/L	8	0.2	<0.2	<0.2	8	1.2	<0.2	0.3	3	<0.2	<0.2	<0.2
81551	Xylene	µg/L	8	<.2	<.2	<.2	8	.5	<.2	<.2	3	<.2	<.2	<.2

Table 10.--*Statistical summary of volatile organic compounds, acid- and base/neutral-extractable organic compounds, and pesticides in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[µg/L, micrograms per liter; <, less than; mg/L, milligrams per liter; --, no data; DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane]

WAT-STORE[1] code	Compounds	Units	Station 021107380 (Mainstem Branch)				Station 021107385 (KOA Branch)				Station 021107388 (Withers Swash)			
			Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median	Number	Maximum	Minimum	Median
	Acid- and base/neutral-extractable organic compounds													
00556	Oil and grease	mg/L	8	3	<1	<1	8	2	<1	1	3	1	<1	1
34376	Fluoranthene	µg/L	4	7	<5	<5	5	5	<5	<5	3	<5	<5	<5
32730	Phenols, total	µg/L	4	3	1	2.5	5	3	1	3	3	1	1	1
	Organic pesticide compounds													
39350	Chlordane	µg/L	7	.3	<.1	<.1	7	<.1	<.1	<.1	3	<.1	<.1	<.1
39360	DDD	µg/L	4	.03	<.01	.01	5	<01	<01	<.01	3	<.01	<.01	<.01
39365	DDE	µg/L	4	.02	<.01	.01	5	<01	<01	<.01	3	<.01	<.01	<.01
39370	DDT	µg/L	4	.03	<.01	<.01	5	<01	<01	<.01	3	<.01	<.01	<.01
39380	Dieldrin	µg/L	7	.01	<.02	.01	7	<02	<01	<.01	3	<.01	<.01	<.01

[1]National Water Storage and Retrieval System of the U.S. Geological Survey.

Table 11.--*Summary of organic compounds detected in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., and number of water samples in which concentrations exceed the South Carolina Department of Health and Environmental Control Human Health criteria, September 1991 through August 1992*

[SCDHEC, South Carolina Department of Health and Environmental Control; --, no data; DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane]

Compound	Number of water samples collected	Number of water samples in which compounds were detected	Number of water samples in which concentrations exceed the SCDHEC Human Health criteria
Station 021107380 (Mainstem Branch)			
1,2-trans-Dichloroethene	8	2	0
Chlordane	7	3	3
Chloroform	8	3	0
cis-1,2-Dichloroethene	4	3	--[1]
DDD	4	2	--[1]
DDE	4	2	--[1]
DDT	4	1	--[1]
Dieldrin	7	2	2
Fluoranthene	4	1	0
Oil and grease	8	4	--[1]
Phenols	4	4	0
Vinyl chloride	8	3	0
Station 021107385 (KOA Branch)			
1,1,1-Trichloroethane	8	8	2
1,1-Dichloroethane	8	8	--[1]
1,1-Dichloroethylene	8	8	1
1,2-Dichloroethane	8	1	0
1,2-trans-Dichloroethene	8	5	0
cis-1,2-Dichloroethene	3	3	--[1]
Chlorobenzene	8	2	0
Chloroethane	8	7	--[1]

Table 11.--*Summary of organic compounds detected in water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., and number of water samples in which concentrations exceed the South Carolina Department of Health and Environmental Control Human Health criteria, September 1991 through August 1992*--Continued

[SCDHEC, South Carolina Department of Health and Environmental Control; --, no data; DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane]

Compound	Number of water samples collected	Number of water samples in which compounds were detected	Number of water samples in which concentrations exceed the SCDHEC Human Health criteria
Station 021107385 (KOA Branch)--Continued			
Chloroform	8	7	0
Ethylbenzene	8	1	0
Fluoranthene	5	1	0
Methylene chloride	8	3	0
Oil and grease	8	6	--[1]
Phenols	5	5	0
p-Isopropyltoluene	3	1	--[1]
Toluene	8	6	0
Trichloroethylene	8	8	8
Vinyl chloride	8	6	0
Xylene	8	3	--[1]
Station 021107388 (Withers Swash)			
1,1,1-Trichloroethane	3	2	0
1,2-trans-Dichloroethene	3	3	0
Benzene	3	1	0
Oil and grease	3	2	--[1]
Phenols	3	3	0
Tetrachloroethylene	3	3	0
Trichloroethylene	3	3	0

[1]Compound not listed in SCDHEC Human Health criteria.

Table 12.--*Volatile organic compounds listed in the South Carolina Department of Health and Environmental Control Criteria for Protection of Human Health and the maximum concentrations detected within the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[SCDHEC, South Carolina Department of Health and Environmental Control; all values are in micrograms per liter unless otherwise noted; <, less than]

Constituents	Maximum allowable concentration in SCDHEC Human Health criteria[1]	Maximum concentration detected in the Withers Swash Basin
Acrolein	780	<20
Acrylonitrile	6.65	<20
Benzene	5	.6
Bromoform	100	<.2
Carbon tetrachloride	5	<.2
Chlorobenzene	488	.2
Chlorodibromomethane	100	<.2
2-Chloroethylvinyl ether	176	<1
Chloroform	100	1
Dichlorobromomethane	100	<.2
1,2-Dichloroethane	5	.4
1,1-Dichloroethylene	7	26
1,3-Dichloropropylene (cis & trans)	1,691	<.2
Ethylbenzene	28,718	.2
Methyl bromide	4,708	<.2
Methyl chloride	4,708	<.2
Methylene chloride	15,780	.8
1,1,2,2-Tetrachloroethane	108	<.2
Tetrachloroethylene	88.5	.3
Toluene	1,000	.9
1,2-trans-Dichloroethene	136,319	13
1,1,1-Trichloroethane	200	350

Table 12.--*Volatile organic compounds listed in the South Carolina Department of Health and Environmental Control Criteria for Protection of Human Health and the maximum concentrations detected within the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[SCDHEC, South Carolina Department of Health and Environmental Control; all values are in micrograms per liter unless otherwise noted; <, less than]

Constituents	Maximum allowable concentration in SCDHEC Human Health criteria[1]	Maximum concentratior detected in the Withers Swash Basin
1,1,2-Trichloroethane	419.9	<.2
Trichloroethylene	5	48
Vinyl chloride	2	1.2

[1]Values taken from Criteria for Protection of Human Health (South Carolina Department of Health and Environmental Control, 1993).

The volatile organic compounds detected in the highest concentrations are members of a family of organic compounds that are commonly used as degreasers and as solvents to remove fats, waxes, resins, oil, rubber, paint, and varnishes. Specifically, trichloroethylene is used as a metal degreaser. In the environment, trichloroethylene can be transformed abiotically and biotically to compounds containing fewer chlorine atoms, such as dichloroethylene and vinyl chloride. Trichloroethylene can be transformed to its degradation products through photocatalytic dechlorination in surface-water systems (Ollis, 1985), but is more commonly dechlorinated by a community of anaerobic bacteria in shallow ground-water systems (Wood and others, 1985). The extent of the contamination in the vicinity of the sampling sites is not known, because sampling of ground water was not included within the scope of this study. The presence of dichloroethylene and vinyl chloride in the KOA Branch during periods where streamflow was at base-flow conditions (ground-water discharge into the stream) raises the possibility that a substantial source of these products exists in the subsurface and is affecting the water quality of surface waters.

Results of analyses for acid- and base/neutral-extractable organic compounds indicated that only oil and grease, total phenols, and fluoranthene were detected. Concentrations of oil and grease ranged from less than the detection limit of 1 to 3 mg/L. Oil and grease is not listed in the State Human Health criteria. The highest concentration of fluoranthene detected (7.0 µg/L) is less than the State Human Health criteria of 370 µg/L; the highest concentration of total phenol (3 µg/L) is less than the State Human Health criteria of 3,500 µg/L (tables 13 and 14). Ten base/neutral-extractable organic compounds (benzidine, benzo(a)anthracene, benzo(a)pyrene, 3,4-benzofluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, hexachlorobenzene, indeno(1,2,3-cd)pyrene, and phenanthrene) were all below detection limits, but detection limits were higher than State Human Health criteria. It is not known if these compounds exceed State Human Health criteria. The highest allowable concentrations of acid-base/neutral-extractable organic compounds listed in the State Human Health criteria along with the maximum concentrations detected in samples collected within the Withers Swash Basin are listed tables 13 and 14.

Table 13.--*Acid-extractable organic compounds listed in the South Carolina Department of Health and Environmental Control Criteria for Protection of Human Health and the maximum concentrations detected within the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[SCDHEC, South Carolina Department of Health and Environmental Control; all values are in micrograms per liter unless otherwise noted; <, less than; --, no data]

Compounds	Maximum allowable concentration in SCDHEC Human Health criteria[1]	Maximum concentration detected in the Withers Swash Basin
2,4-Dichlorophenol	3,090	<5
2-Methyl-4,6 dinitrophenol	765	--
2,4-Dinitrophenol	14,264	<20
Pentachlorophenol	81.6	<30
Phenol	3,500	3
2,4,6-Trichlorophenol	36	<20

[1]Values taken from Criteria for Protection of Human Health (South Carolina Department of Health and Environmental Control, 1993).

Results of analyses for 36 selected organic pesticides and non-specific polychlorinated naphthalenes indicated that most concentrations were below detection limits in the KOA Branch and Withers Swash (tables 10, 11, and 15; appendix 6). However, total DDD, DDE, and DDT were detected in some samples collected at the Mainstem Branch; concentrations ranged below the detection limit of 0.01 to 0.03 µg/L. Dieldrin was detected in some samples at concentrations equal to the detection limit of 0.01 µg/L and chlordane at concentrations ranging from less than detection limit of 0.1 to 0.3 µg/L. Dieldrin and chlordane were only detected at the gaging station on the Mainstem Branch. The pesticides DDD, DDE, and DDT were not included in State Human Health criteria, but dieldrin and chlordane violated State Human Health criteria of 0.00144 µg/L and 0.00588 µg/L, respectively. Although chlordane and DDT are no longer produced within the United States, these pesticides and the by-products of DDT (DDD and DDE) are persistent. There were no detections of polychlorinated naphthalenes in any of the samples. The detection limits for aldrin, p-p'-DDT, heptachlor, heptachlor epoxide, the PCB's and toxaphene were all greater than the State Human Health criteria; therefore, it is not known if these pesticide and PCB compounds exceed State Human Health criteria. The maximum allowable concentrations of pesticide and PCB compounds listed in the State Human Health criteria along with the maximum concentrations detected in samples collected within the Withers Swash Basin are listed in table 15.

Table 14.--*Base/neutral-extractable organic compounds listed in the South Carolina Department of Health and Environmental Control Criteria for Protection of Human Health and the maximum concentrations detected within the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[SCDHEC, South Carolina Department of Health and Environmental Control; all values are in micrograms per liter unless otherwise noted; <, less than; --, no data]

Compounds	Maximum allowable concentration in SCDHEC Human Health criteria[1]	Maximum concentration detected in the Withers Swash Basin
Anthracene	110,000	<5
Benzidine	.00535	<40
Benzo(a)anthracene	.311	<10
Benzo(a) pyrene	.311	<10
3,4-Benzofluoranthene	.311	<10
Benzo(k)fluoranthene	.311	<10
Bis(2-chloroethyl) ether	14.2	<5
Bis(2-chloroisopropyl)ether	174,400	<5
Bis(2-ethylhexyl)phthalate	59.2	<5
Butylbenzylphthalate	5,202	<5
Chrysene	.311	<10
Dibenz(a,h)anthracene	.311	<10
1,2-Dichlorobenzene	17,432	--
1,3-Dichlorobenzene	2,600	--
1,4-Dichlorobenzene	75	--
3,3′-Dichlorobenzidine	.77	--
Diethyl phthalate	118,019	<5
Dimethyl phthalate	2,900,000	<5
Di-n-butyl phthalate	12,100	<5
2,4-Dinitrotoluene	91	<5
1,2-Diphenylhydrazine	5.4	<5
Fluoranthene	370	7
Fluorene	14,000	<5

Table 14.--*Base/neutral-extractable organic compounds listed in the South Carolina Department of Health and Environmental Control Criteria for Protection of Human Health and the maximum concentrations detected within the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[SCDHEC, South Carolina Department of Health and Environmental Control; all values are in micrograms per liter unless otherwise noted; <, less than; --, no data]

Compounds	Maximum allowable concentration in SCDHEC Human Health criteria[1]	Maximum concentration detected in the Withers Swash Basin
Hexachlorobenzene	0.0077	<5
Hexachlorobutadiene	497	<5
Hexachlorocyclopentadiene	206	<5
Hexachloroethane	88.5	<5
Indeno(1,2,3-cd)pyrene	.311	<10
Isophorone	6,000	<5
Nitrobenzene	1,863	<5
N-Nitrosodimethylamine	81.2	<5
N-Nitrosodiphenylamine	162	<5
Phenanthrene	.311	<5
Pyrene	11,000	<5

[1]Values taken from Criteria for Protection of Human Health (South Carolina Department of Health and Environmental Control, 1993).

A screening technique for the determination of organic substances in water was used on 24 water samples during late 1991 and 1992 (table 16). The gas chromatograph/flame ionization detector (GC/FID) analysis or FID scan provided semi-quantitative data that were used to determine presence and magnitude of organic substances. The technique does not identify specific organic compounds. However, FID scans from samples showing high concentrations of non-specific organic compounds were further analyzed to identify the specific organic compounds.

Table 15.--*Pesticide and PCB compounds listed in the South Carolina Department of Health and Environmental Control Criteria for Protection of Human Health and the maximum concentrations detected within the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[SCDHEC, South Carolina Department of Health and Environmental Control; all values are in micrograms per liter unless otherwise noted; <, less than; BHC, benzene hexachloride; DDT, dichlorodiphenyltrichlorethane; PCB, polychlorinated biphenyls]

Compounds	Maximum allowable concentration in SCDHEC Human Health criteria[1]	Maximum concentration detected in the Withers Swash Basin
Aldrin	0.0136	<0.04
alpha-BHC	.131	<.03
beta-BHC	.46	<.03
delta-BHC	.625	<.09
Chlordane	.00588	.3
p-p´-DDT	.0059	<.1
Dieldrin	.00144	.01
alpha-Endosulfan	1.99	<.1
beta-Endosulfan	1.99	<.04
Endrin	.2	<.06
Heptachlor	.00214	<.03
Heptachlor epoxide	.001	<.8
PCB-1242	.00045	<.1
PCB-1254	.00045	<.1
PCB-1221	.00045	<1
PCB-1232	.00045	<.1
PCB-1248	.00045	<.1
PCB-1260	.00045	<.1
PCB-1016	.00045	<.1
Toxaphene	.0075	<2

[1]Values taken from Criteria for Protection of Human Health (South Carolina Department of Health and Environmental Control, 1993).

Table 16.--*Results of gas chromatograph/flame ionization detector (GC/FID) analyses of water samples collected in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[ft^3/s, cubic feet per second; µg/L, micrograms per liter; ND, none detected; --, no data]

Station number (identifier) (fig. 2)	Date	Time (hours)	Instantaneous flow (ft^3/s)	Concentration of non-specific organic compounds detected (µg/L)
021107380	09-20-91	0300	1.1	25
(Mainstem Branch)	09-24-91	1330	.60	ND
	09-24-91	1635	17	50
	09-24-91	1655	11	9
	07-18-92	1845	.60	17
	07-20-92	1720	1.3	7
	07-20-92	1725	1.8	16
	07-20-92	1745	2.4	63
	08-03-92	1412	10	120
	08-03-92	1538	65	19
	08-03-92	2100	6.2	76
021107385	09-20-91	0305	2.1	30
(KOA Branch)	09-24-91	1330	1.5	ND
	09-24-91	1640	5.2	1,000
	09-24-91	1715	5.3	450
	09-24-91	1805	3.2	9
	07-18-92	1830	1.6	382
	07-20-92	1805	2.1	562
	07-20-92	1840	2.5	159
	08-03-92	1430	17	263
	08-03-92	1610	71	26
021107388	09-24-91	1315	--	ND
(Withers Swash)	09-24-91	2104	--	ND
	09-24-91	2154	--	ND

Nine of the 24 samples were analyzed for identification of specific organic compounds. In these 9 samples, 42 organic compounds were identified: four organic compounds were identified by type of compound only (table 17). The four unidentifiable organic compounds were classified as an alkane, an alkene, an organic acid, and an unknown compound. Three organic compounds were identified at concentrations higher than 40 µg/L in water samples collected from the KOA Branch. These were an ester of bis(1-methylpropyl) carbonic acid, 2-butoxyethanol (butylcellosolve), and alpha-terpineol. These compounds can be attributed to a variety of sources. The concentrations of alpha-terpineol can come from natural oils from pine forests (Verschueren, 1983). Butylcellosolve is used as a solvent for nitrocellulose, resins, grease, oil and albumin, and in the dry cleaning process (Stecher and others, 1960). The esters of carbonic acid are used in numerous manufacturing processes.

Analysis of the data indicates that the majority of detections and the highest concentrations of organic compounds were in water samples collected from the KOA Branch. Unidentifiable organic compounds also were detected at concentrations of 200 µg/L and 300 µg/L in two water samples collected from the KOA Branch.

Enteric Bacteria

Fecal coliform and fecal *streptococcus* bacteria are enteric bacteria indigenous to the intestines of humans and other warm-blooded animals. Fecal coliform bacteria are considered a reliable indicator of fecal contamination in streams, and can multiply in water under some environmental conditions. Fecal *streptococcus* bacteria do not multiply in water; therefore, the presence of fecal *streptococcus* bacteria in water indicates fecal pollution with a density equal to or less than that originally present (Clark and others, 1977). The presence of either of these indicator bacteria reflects the potential for contamination by pathogenic enteric microorganisms.

In every water sample collected from the three gaging stations during a storm, enteric-bacteria concentrations increased as streamflow began to increase (tables 18 and 19). The Mainstem and KOA Branches exhibited an initial increase of enteric-bacteria counts that can be attributed to the initial washoff of pollutants from impervious surfaces. However, enteric-bacteria counts within the Withers Swash Basin were not depleted after the initial washoff of pollutants, but continued to rise throughout the storm.

A possible explanation to high bacteria counts at peak streamflow may be that as streamflow increased, the high velocities created turbid conditions, suspending small sediment particles. Fecal coliform are present as discrete cells, and as part of large aggregates of fecal materials, storm-water debris and other suspended solids (Schillinger and Gannon, 1982). Auer and Niehaus (1993) observed that on the average, 90.5 percent of fecal coliform bacteria were associated with sediment particles ranging in size from 0.45 to 10 µm, and 9.5 percent were associated with sediment particles greater than 10 µm in size. The smaller particles arrive at the sampling station during the high streamflow period where velocities are at maximum values.

In some cases, enteric-bacteria counts increased as streamflow was receding. For example, on September 24, 1991, as streamflow increased on the Mainstem Branch from 0.6 to 17 ft^3/s, fecal coliform counts increased from 3,800 to 92,000 col/100 mL; but as the streamflow receded to 11 ft^3/s, the counts continued to increase to 1,500,000 col/100 mL (table 18). Fecal coliform bacteria attached to larger streambed sediments are rolled along the streambed by rapid, turbulent streamflow, and arrive at the downstream point as streamflow is receding (McDonald and Kay, 1981; McDonald and others, 1982; Kay and McDonald, 1983). However, the enteric bacteria adsorbed onto large particles alone do not account for the high enteric-bacteria counts.

Table 17.--*Results of National Institute of Standards and Technology library search of chromatograms from gas chromatograph/flame ionization detector analyses of water samples collected from the Withers Swash Basin, Myrtle Beach, S.C., September 1991*

[All concentrations in micrograms per liter; ( ), date; [ ], time, hour; --, no data; <, less than]

Constituent	Station 021107380			Station 021107385				Station 021107388	
	(9-20-91) [0300]	(9-24-91) [1635]	(9-24-91) [1655]	(9-20-91) [0305]	(9-24-91) [1640]	(9-24-91) [1715]	(9-24-91) [1805]	(9-24-91) [2104]	(9-24-91) [2154]
Alkane	--	10	4	--	10	--	--	--	--
Alkene	--	--	--	2	1	2	<1	--	--
Acenaphthene	--	<1	--	--	--	--	--	--	--
Anthracene	--	<1	--	--	<1	--	--	--	--
Anthracene	--	--	<1	--	--	<1	--	--	--
9,10-Anthracenedione	<1	3	2	--	2	1	--	--	--
Atrazine	--	--	--	--	--	1	2	--	--
Benzaldehyde, 4-hydroxy-3-methoxy	--	--	--	--	1	<1	--	--	--
1,2-Benzenedicarboxylic acid	<1	<1	--	--	--	2	--	--	--
Benzo (a) anthracene	--	1	1	--	1	<1	--	--	--
Benzo (b) fluoranthene	--	2	1	--	2	1	1	--	--
Benzo (k) fluoranthene	--	1	1	--	2	1	1	--	--
Benzoic acid	1	--	--	--	--	2	--	--	--
Benzo (g,h,i) perylene	--	6	4	--	5	4	--	--	--
Benzo (a) pyrene	--	3	2	--	2	2	--	--	--
Benzo (h) quinoline	--	<1	--	--	<1	--	--	--	--
2 (3H)-Benzothiazolone	--	<1	--	--	--	--	--	--	--
Bis (2-ethylhexyl)phthalate	--	3	--	--	--	--	--	--	--
Caffeine	3	<1	--	--	--	1	1	--	--
9H-Carbazole	--	1	--	--	<1	--	--	--	--
Carbonic acid, bis(1-methylpropyl) ester	--	--	--	--	100	100	--	--	--
Chrysene	<1	4	2	--	2	2	1	<1	4
Decanoic acid	--	<1	3	--	--	--	--	--	<1

Table 17.--*Results of National Institute of Standards and Technology library search of chromatograms from gas chromatograph/flame ionization detector analyses of water samples collected from the Withers Swash Basin, Myrtle Beach, S.C., September 1991*--Continued

[All concentrations in micrograms per liter; ( ), date; [ ], time, hour; --, no data; <, less than]

Constituent	Station 021107380			Station 021107385				Station 021107388	
	(9-20-91) [0300]	(9-24-91) [1635]	(9-24-91) [1655]	(9-20-91) [0305]	(9-24-91) [1640]	(9-24-91) [1715]	(9-24-91) [1805]	(9-24-91) [2104]	(9-24-91) [2154]
Ethanol, 2-butoxy	--	--	--	--	600	--	--	--	--
Ethanol, 2-[2-(2-butoxyethoxy)ethoxy]-	--	--	--	--	3	--	--	--	--
Ethanol, 2-butoxy-, phosphate (3:1)	9	--	--	--	9	10	4	--	--
Fluoranthene	1	7	5	<1	5	3	1	<1	<1
Fluorene	--	<1	--	--	--	--	--	--	--
Hexadecanoic acid	--	20	--	--	8	4	--	--	--
Indeno (1,2,3-cd)pyrene	--	6	5	--	5	5	--	--	--
1,3-Isobenzofurandione	--	--	--	--	<1	--	--	--	--
1(3H)-Isobenzofuranone	1	--	--	--	--	--	--	--	--
Isoterpinolene	--	--	--	--	2	--	--	--	--
Organic acid	9	<2	--	1	--	--	1	--	--
Phenanthrene	<1	2	1	--	<1	<1	<1	--	--
Phenol, 3-(1,1-dimethylethyl)-	--	--	--	--	--	<1	--	--	--
Phenol, 4-(1-methylpropyl)-	--	--	--	--	--	<1	--	--	--
Phenol, nonyl-	--	--	--	--	3	2	--	--	--
Propanoic acid, 2,2-dimethyl-	--	--	--	--	5	--	--	--	--
Pyrene	<1	5	3	--	4	2	1	<1	<1
Pyrene, 1-methyl-	--	--	--	--	--	1	--	--	--
Sulfur, mol. (S8)	--	5	<1	--	8	4	--	--	--
alpha-Terpineol	--	--	--	--	40	--	--	--	--
cis-beta-Terpineol	--	--	--	--	--	1	--	--	--
Tetradecanoic acid	--	5	--	--	--	--	--	--	--
Unknown	--	--	--	--	200	300	--	--	--

Table 18.--*Summary of sampling conditions and enteric-bacteria counts for station 021107380, Mainstem Branch of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*

[ft^3/s, cubic feet per second; col/100 mL, colonies per 100 milliliters; --, no data]

Sampling date	Weather condition	Number of dry days prior to rainfall	Rainfall amount (inches)	Streamflow (ft^3/s)	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)
08/01/91	dry	0	--	0.78	--	2,500	1,300
09/10/91	dry	0	--	--	--	--	1,800
09/19/91	wet	17	0.05	.60	1310	1,400	[1]100
09/20/91	wet	0	.07	1.1	0300	220,000	[1]600
				1.6	0330	640,000	4,400
				1.2	0700	800,000	[1]550
09/24/91	wet	0	.42	.60	1330	3,800	2,400
				17	1635	92,000	71,000
				11	1655	1,500,000	165,000
06/04/92	wet	4	.46	9.1	--	10,000	--
06/15/92	dry	0	--	7.2	--	2,700	3,500
07/18/92	dry	20	--	.60	1845	6,000	[1]14,000
07/19/92	wet	21	.05	.85	1430	59,000	15,000
07/20/92	wet	0	.16	1.3	1720	[1]5,300	300
				1.8	1725	[1]5,000	300
				2.4	1745	[1]34,000,000	880,000
				1.5	1835	[1]27,000,000	[1]190,000

Table 18.--*Summary of sampling conditions and enteric-bacteria counts for station 021107380, Mainstem Branch of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*--Continued

[ft^3/s, cubic feet per second; col/100 mL, colonies per 100 milliliters; --, no data]

Sampling date	Weather condition	Number of dry days prior to rainfall	Rainfall amount (inches)	Streamflow (ft^3/s)	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)
08/03/92	wet	7	2.68	10	1412	55,000	88,000
				65	1535	38,000	58,000
				6.2	2100	31,000	35,000
08/04/92	dry	0	--	7.9	--	13,000	56,000
08/05/92	dry	1	--	2.8	--	2,000	1,400
06/22/93	dry	[2]--	--	--	--	32	36
				--	--	30	30

[1]Non-ideal count.
[2]Number of dry days and streamflow were not determined because gages were removed.

Table 19.--*Summary of sampling conditions and enteric-bacteria counts for station 021107385, KOA Branch of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*

[ft^3/s, cubic feet per second; col/100 mL, colonies per 100 milliliters; --, no data; <, less than; >, greater than]

Sampling date	Weather condition	Number of dry days prior to rainfall	Rainfall amount (inches)	Streamflow (ft^3/s)	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)
08/01/91	wet	0	0.56	1.4	--	3,900	<20
					--	3,000	<20
09/10/91	dry	8	--	1.6	--	--	[1]2,300
09/19/91	dry	17	--	1.6	1315	1,200	<50
09/20/91	wet	18	.08	2.1	0305	21,000	<50
				2.3	0345	19,000	[1]50
				1.7	0700	12,000	<50
09/24/91	wet	0	.35	1.5	1330	1,900	2,400
				5.2	1640	45,000	37,000
				5.3	1715	100,000	50,000
				3.2	1805	27,000	28,000
11/08/91	dry	23	--	1.9	--	1,600	1,000
06/04/92	wet	4	.92	4.0	--	2,800	--
07/18/92	dry	15	--	1.6	1830	5,500	>10,000
07/19/92	dry	16	--	1.6	1445	8,000	13,000

Table 19.--*Summary of sampling conditions and enteric-bacteria counts for station 021107385, KOA Branch of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*--Continued

[ft^3/s, cubic feet per second; col/100 mL, colonies per 100 milliliters; --, no data; <, less than; >, greater than]

Sampling date	Weather condition	Number of dry days prior to rainfall	Rainfall amount (inches)	Streamflow (ft^3/s)	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)
07/20/92	wet	17	.12	2.1	1805	[1]60	4,400
				2.5	1840	[1]250	70,000
				2.2	1930	1,200	1,000
08/03/92	wet	4	1.36	17	1430	12,000	200,000
				71	1610	58,000	130,000
				6.7	2035	25,000	120,000
06/22/93	dry	[2]--	--	--	--	--	[1]124

[1]Non-ideal count.
[2]Number of dry days and streamflow were not determined because gaging stations were removed.

There are several other reasons for high bacteria counts in receding streamflow during storms. The soils in the Myrtle Beach area consist of a sandy topsoil and clayey subsoil (U.S. Department of Agriculture, 1986). As rainfall infiltrates the topsoil and reaches the subsoil, the clayey subsoil material retards infiltration; the topsoil quickly becomes saturated, and the excess rainfall runs off into the receiving streams. The high-water table in Myrtle Beach also acts as an impervious area (U.S. Department of Agriculture, 1986). After a time lag, the subsurface flow carrying fecal materials reaches streams during the receding streamflow. The high water table also can flood septic tanks that have drain fields connected to streams.

McDonald and Kay (1981) observed elsewhere that enteric-bacteria counts increase as river discharge increases. The relations of fecal coliform and fecal *streptococcus* bacteria counts to streamflow were plotted for stations on the Mainstem and KOA Branches (figs. 2 and 3). Enteric-bacteria counts at both stations tended to increase with increasing streamflow. The relations were weak, and factors other than streamflow could cause the relation to be complex. These factors include the number of dry days prior to a rain, climatic factors, and possible sources of contamination such as leaking septic tanks that release bacteria to the stream during dry weather. The relations did indicate that high enteric-bacteria counts were present at base-flow conditions in the Mainstem and KOA Branches.

During the initial summer wet-weather sampling at the three gaging stations, fecal coliform counts violated the State criteria for the class SFH waters in the water samples collected. To determine the bacterial distribution, sampling was expanded to include additional sites in the Withers Swash Basin and 5 sites in the ocean and at a storm-water pipe that discharges directly on the beach that were sampled synoptically (fig. 4; table 20 at end of report). These data were needed to determine the source of high bacteria counts in the streams. Water samples were collected and examined for fecal coliform and fecal *streptococcus* bacteria.

The results of the additional data collection at the 51 sampling sites indicate that high enteric-bacteria counts are present during wet and dry weather. The highest counts were detected in water samples collected at the three gaging stations during high-flow conditions. The remaining 48 sites were sampled during dry weather or within a day after a storm. The specific locations of the high counts varied spatially and temporally, thus making it difficult to determine the source of the bacteria. However, elevated bacteria counts are prevalent throughout the Withers Swash Basin.

Enteric-bacteria counts exceeding 2,000 col/100 mL were detected in almost every tributary of the basin (fig. 5). Enteric-bacteria counts exceeding 5,000 col/100 mL were detected at fewer locations (fig. 6). Along the KOA Branch, station 021107385 (site 41) was the only sampling site in which enteric-bacteria counts exceeded 5,000 col/100 mL. The Mainstem Branch contained the most sampling sites that exceeded 5,000 col/100 mL of enteric bacteria. Enteric-bacteria counts exceeding 10,000 col/100 mL were detected at the three gaging stations, along the Mainstem Branch, and at a sampling site located at the north end of Todd Street on tributary M-1 (figs. 4 and 7). The sites where enteric-bacteria counts exceeded 10,000 col/100 mL were all located near Canal Drive near the Mainstem Branch.

No single source of fecal contamination was identified. High counts of fecal *streptococcus* indicate the contamination is relatively recent and large. Throughout the South Carolina coast, many potential sources of fecal contamination exist, including pet, livestock and waterfowl feces, raw sewage from broken or leaking sewer lines, and liquids leaking from garbage containers (Lineback, 1986). It has long been suspected that failing septic tanks, improperly sited and maintained, are major sources of fecal coliform in the coastal zones even during periods between rains. Because the soils have a low permeability and the water table is high, the Myrtle

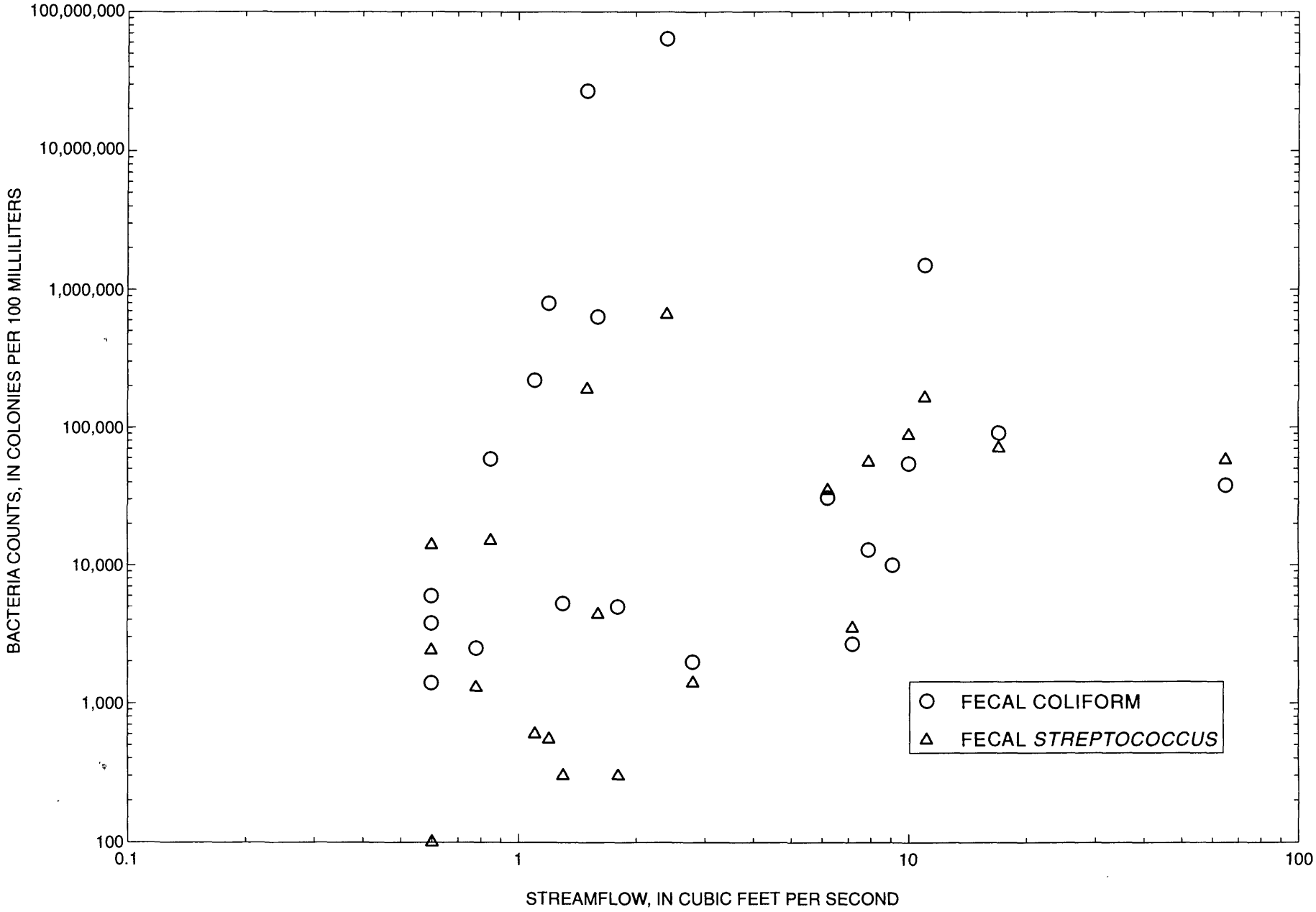

Figure 2. Relation of fecal coliform and fecal *streptococcus* bacteria counts to streamflow for station 021107380, Mainstem Branch of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993.

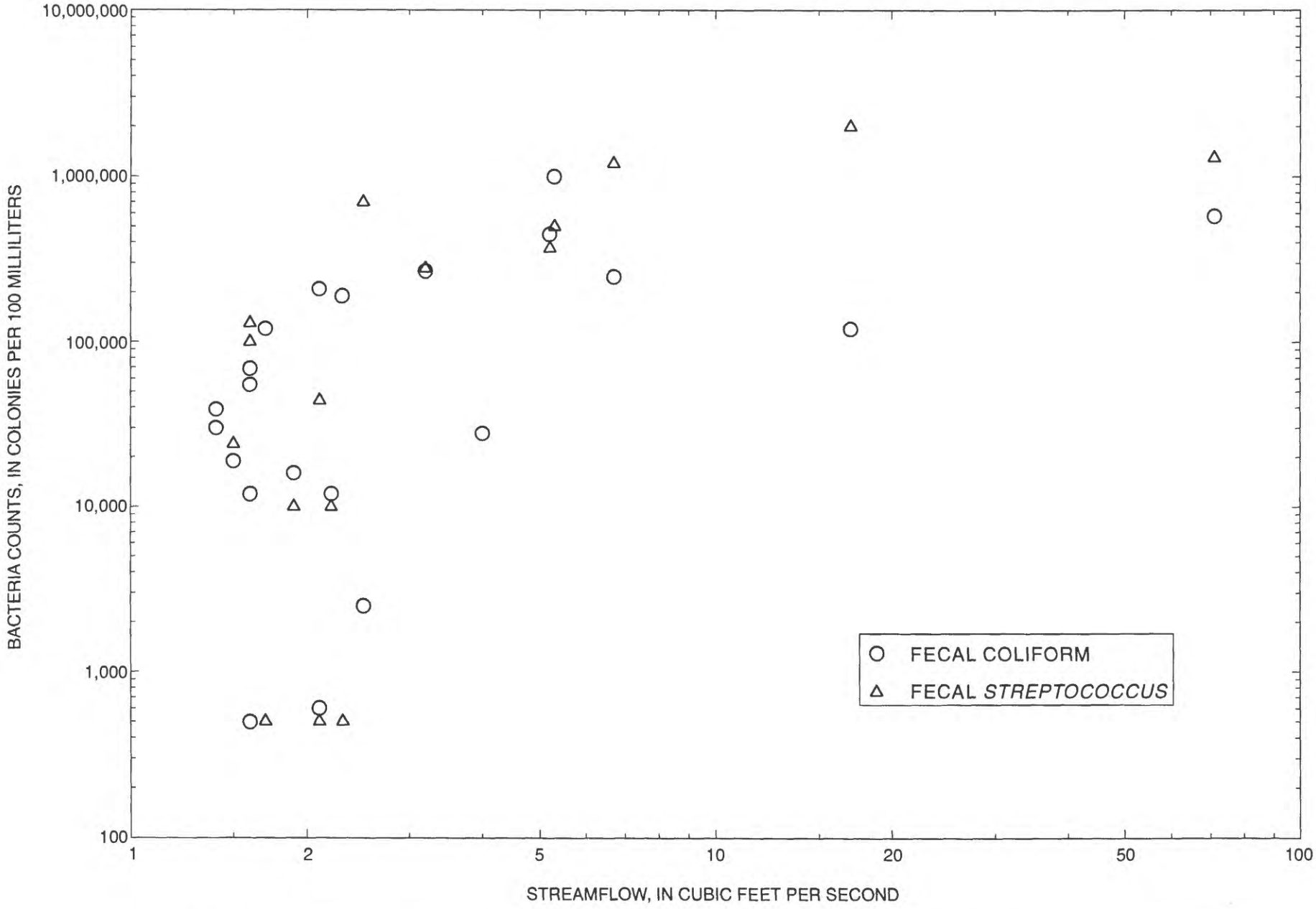

Figure 3. Relation of fecal coliform and fecal *streptococcus* bacteria counts to streamflow for station 021107385, KOA Branch of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993.

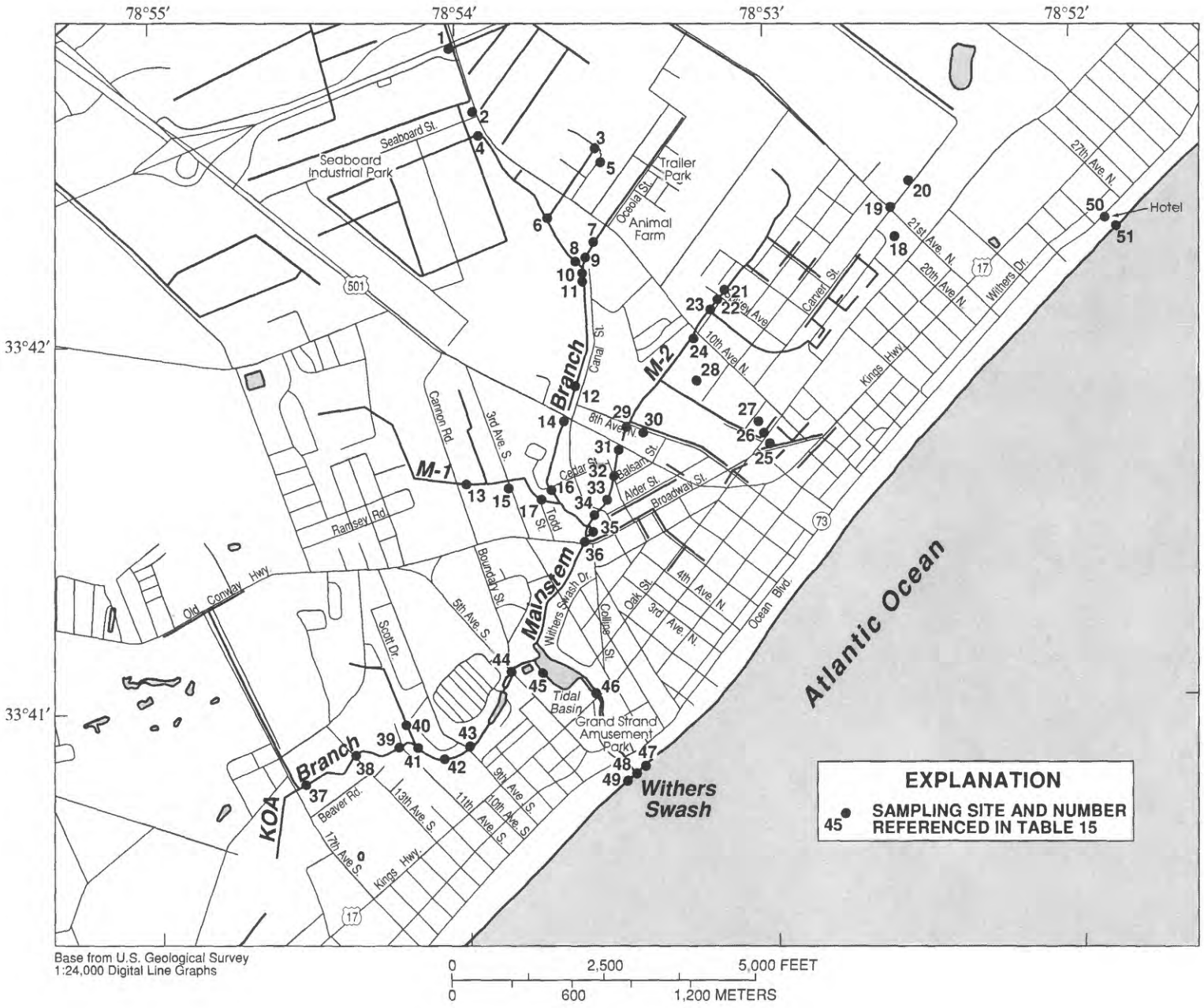

Figure 4. Location of enteric-bacteria sampling sites in Myrtle Beach, S.C.

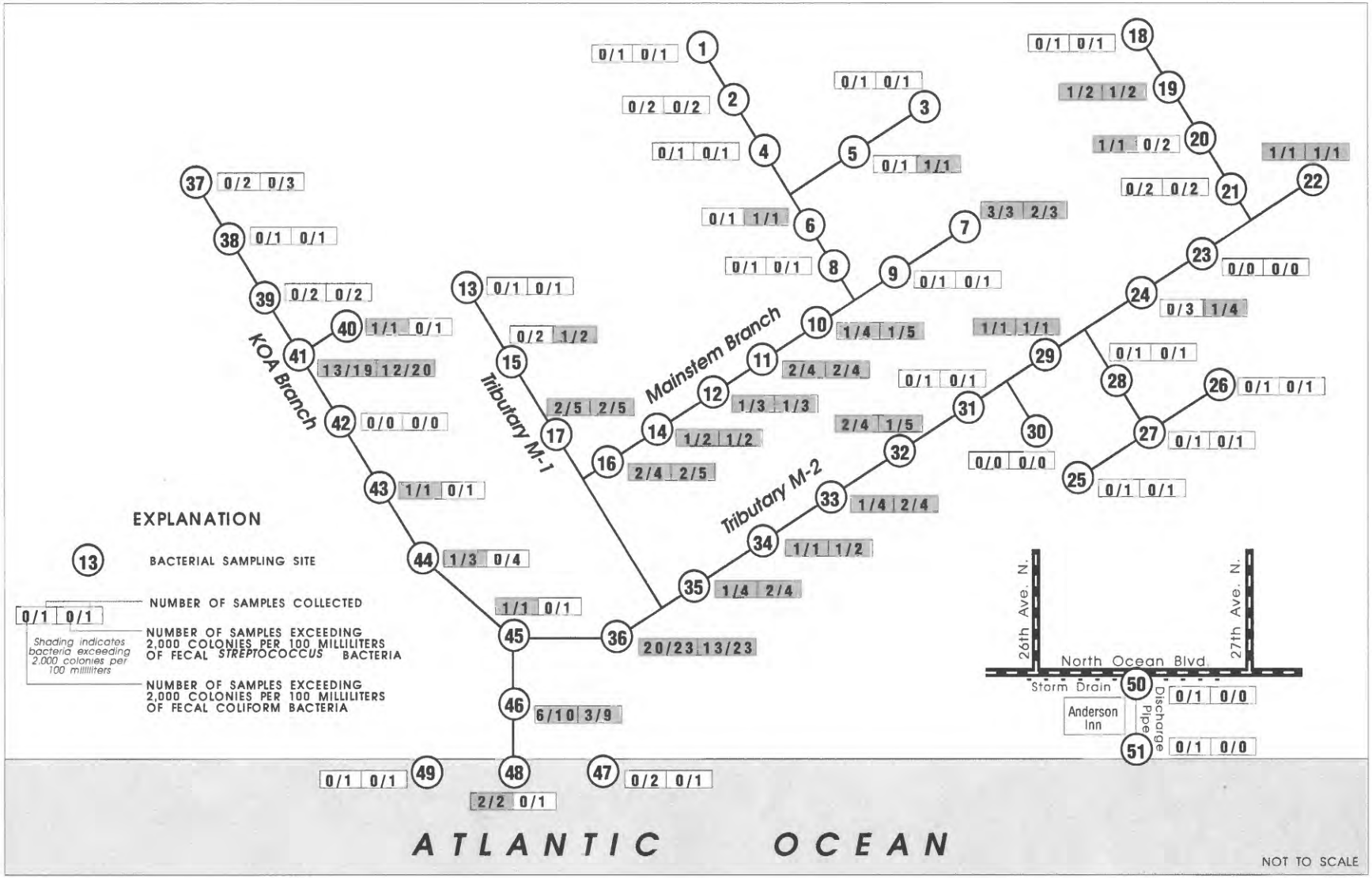

Figure 5. The enteric-bacteria sampling sites, the number of samples collected, and the number of samples with enteric-bacteria counts greater than 2,000 colonies per 100 milliliters, Withers Swash area, Myrtle Beach, S.C., August 1991 through June 1993.

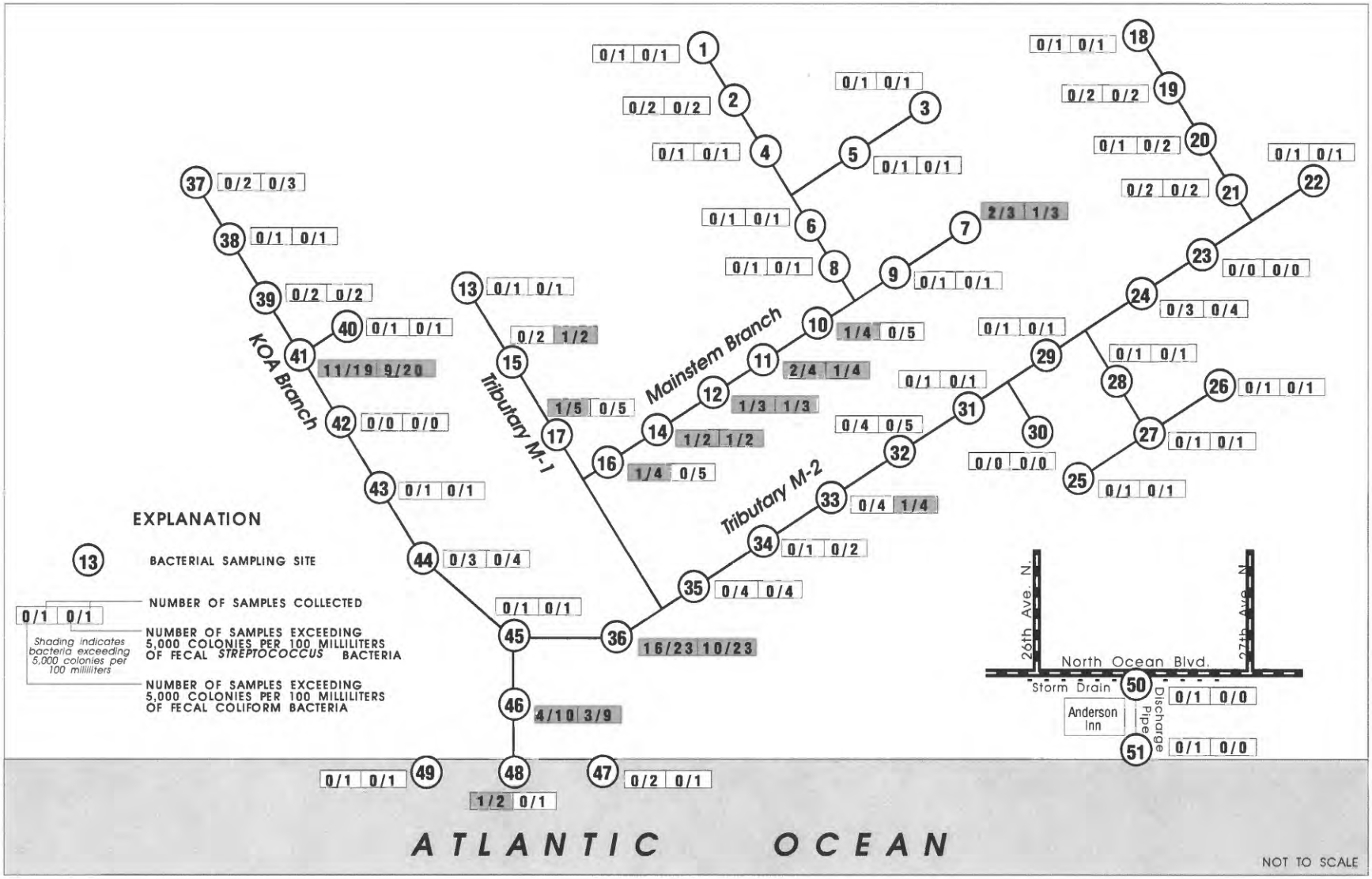

Figure 6. The enteric-bacteria sampling sites, the number of samples collected, and the number of samples with enteric-bacteria counts greater than 5,000 colonies per 100 milliliters, Withers Swash area, Myrtle Beach, S.C., August 1991 through June 1993.

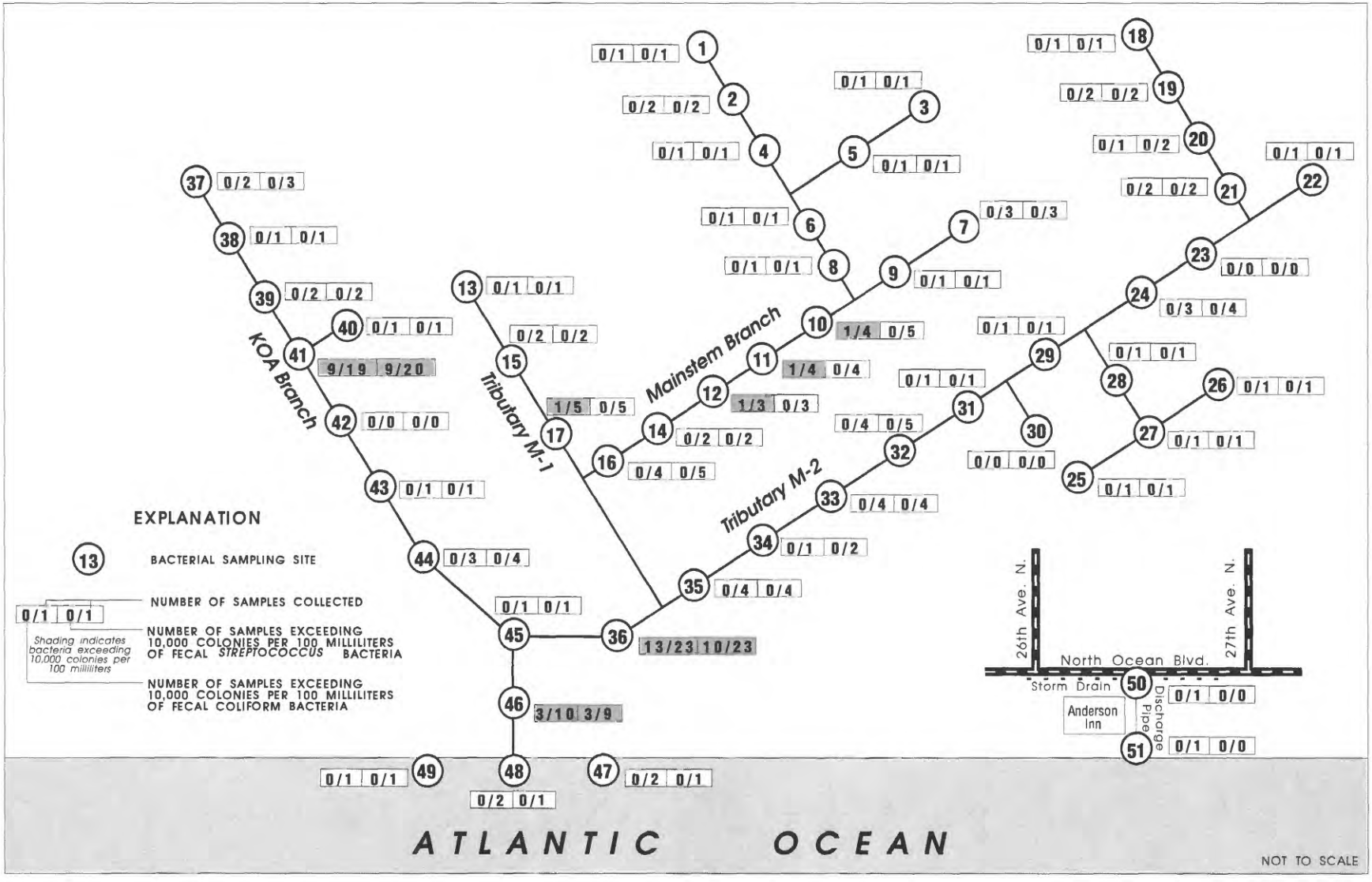

Figure 7. The enteric-bacteria sampling sites, the number of samples collected, and the number of samples with enteric-bacteria counts greater than 10,000 colonies per 100 milliliters, Withers Swash area, Myrtle Beach, S.C., August 1991 through June 1993.

Beach area is generally unsuited for septic fields (U.S. Department of Agriculture, 1986). The locations and number of septic tanks throughout the Withers Swash Basin were not available; therefore, it was not determined if septic tanks were the source of the fecal contamination. However, the high water table can create saturated zones within the soils that can harbor fecal coliform bacteria and allow them to multiply. In most water samples collected at the 51 sites, fecal coliform counts were higher than fecal *streptococcus* counts (tables 18, 19, and 20).

Fecal coliform counts violated State criteria for class SFH waters in almost every sample collected; fecal *streptococcus* is not listed in State criteria for class SFH waters. If the source of fecal contamination is removed, fecal coliform and fecal *streptococcus* bacteria will eventually die off. The data suggest that fecal contamination in the Withers Swash Basin is extensive, and no one source is responsible. Septic tanks, illicit dischargers, and runoff from impervious areas are probably the major contributors of fecal contamination to the Withers Swash Basin.

Best Management Practices For Improved Water Quality

The implementation of best management practices (BMP's) can improve the water quality of a basin. There are source and structural control BMP's that are designed to prevent or remedy a problem that can lead to poor water quality. Reduced erosion, improved water quality, and protection of sensitive areas are some results of BMP's. This report can not adequately cover the numerous BMP's; therefore, the following discussion presents some basic strategies.

Source-control BMP's can include any practice that attacks the source of pollutants by reducing pollutant amounts accumulated on land surfaces, decreasing the amount of impervious areas within the basin to reduce runoff, and reduce or eliminate illicit discharges into storm drains and streams. The accumulation of pollutants on street surfaces can be minimized through education, regulations, and street cleaning. Educating the public in the proper disposal of household chemicals, oils, pesticides, and pet feces can be an effective starting point for a watershed-management plan. The enforcement of leash law, pet-waste cleanup, suburban livestock-control, and anti-dumping ordinances designed to reduce waste accumulation can help reduce pollutants washed into receiving waters. The cleaning of impervious areas also can help reduce accumulated pollutants. The cleaning may be done by sweeping, vacuuming, or flushing. Streetsweepers have been shown to redistribute the finer material to the gutters (Sartor and Boyd, 1972). By using a gutter broom and vacuum, some of the finer materials may be removed. If the streets are flushed, the water and contaminants should be removed before they enter the receiving streams. The catch basins also should be cleaned on regular basis. Zoning can be useful for restricting land development adjacent to stream banks, eliminating septic tanks near streams, or requiring vegetative buffer strips along stream banks. One of the most important source control is the elimination of illicit connections (U.S. Environmental Protection Agency, 1989). A survey of the entire basin can locate direct sanitary-sewer connections to the streams and sanitary-sewer leaks. Source controls are the easiest BMP's to implement as part of an overall watershed-management plan, although they are probably the least effective.

Structural controls can include detention and retention ponds, and vegetative controls. Detention and retention ponds are the most effective structures for reduction of nonpoint-source pollution into the receiving waters. These ponds reduce peak-flow rates, delay the release of runoff, reduce stream-bank erosion, and reduce pollutant concentration by dilution and bioremediation (U.S. Environmental Protection Agency, 1989). Vegetative controls are less costly than detention and retention ponds, and can be adequate in pretreating runoff in order to improve the effectiveness of other BMPs (U.S. Environmental Protection Agency, 1989). Vegetative controls can include basin landscaping, wetlands, grassed swales, and filter strips. As the only runoff-control practice, vegetative controls usually are inadequate.

A realistic approach to a watershed-management plan can include the application of BMP's to reduce nonpoint sources to a level at which water quality is improved or future degradation of the water resources is stopped. The Withers Swash Basin has similar characteristics to other swash basins near Myrtle Beach, and BMP's application to Withers Swash could be transferable to other basins.

SUMMARY

The objectives of this study were to investigate the water quality in Withers Swash, with emphasis on enteric bacteria, during the summer months of 1991, 1992, and 1993. Withers Swash is located in the City of Myrtle Beach on the northern part of coastal South Carolina. The Withers Swash Basin is characterized by relatively flat coastal topography and includes two tributaries; the Mainstem and the KOA Branches. The Mainstem Branch is more urbanized than the KOA Branch, and drains commercial, single- and multi-family residential, and undeveloped land uses.

Three water-level gaging stations and two raingages were established in the study area. Stations were established on the Mainstem Branch, KOA Branch, and in the Withers Swash. A raingage was established on each of the two subbasins. Streamflow was determined by developing stage-discharge relations for the two upstream stations (Mainstem and KOA Branch). The downstream station, Withers Swash, had streamflow reversal at high tides; a stage-discharge relation was not developed. Water samples were collected and examined for over 200 chemical, physical, and biological constituents during base- and high-flow conditions. An intensive synoptic sampling for enteric bacteria at 51 sites also was completed. The results are presented as constituent values or concentrations at individual sampling sites and compared with State criteria for shellfish harvesting waters, and State Human Health criteria.

Some analytical results did not meet State criteria for shellfish harvesting waters or State Human Health criteria; these include some concentrations of dissolved oxygen, arsenic, lead, cadmium, mercury, 1,1,1-trichloroethane, 1,1-dichloroethylene, trichloroethylene, chlordane, dieldrin, and fecal coliform bacteria. Dissolved-oxygen concentrations were less than the State criterion for shellfish harvesting waters of 4.0 mg/L in 6 samples, and were lower than the daily minimum average of 5.0 mg/L in 18 of 27 samples. These concentrations are based on instantaneous measurements; data were insufficient to determine whether the mean concentration for each day was lower than 5.0 mg/L.

Concentrations of some trace elements detected at gaging stations violated State Human Health criteria. Arsenic was detected at a concentration of 7 µg/L in one sample, which exceeds the criterion of 1.4 µg/L. Six of 12 samples collected at the gaging station on the KOA Branch, and 2 of 12 samples collected at the gaging station on the Mainstem Branch violated the criterion for lead of 50 µg/L. Two of 12 samples collected from the gaging station on the KOA Branch violated the criterion for cadmium of 5 µg/L. Cadmium was detected in both samples at a concentration of 7 µg/L. Mercury concentrations exceeded the criterion (0.153 µg/L) in ten samples collected at the gaging station on the Mainstem Branch, five samples collected at the gaging station on the KOA Branch, and one sample collected at the gaging station on Withers Swash.

Volatile organic compounds and pesticides also were detected in concentrations that violated State Human Health criteria. These volatile organic compounds included 1,1,1-trichloroethane, 1,1-dichloroethylene, and trichloroethylene; the pesticides included chlordane and dieldrin. The volatile organic compounds in which concentrations violated criteria were all from water samples collected at the gaging station on the KOA Branch; whereas,

the concentrations of pesticide compounds that violated criteria were from water samples collected at the gaging station on the Mainstem Branch. Concentrations of 1,1,1-trichloroethane violated criteria in 2 of 8 samples; 1,1-dichloroethylene in 1 of 8 samples; and trichloroethylene in all 8 samples collected from the gaging station on the KOA Branch.

The presence of trichloroethylene and its degradation products (dichloroethylene and vinyl chloride) in the KOA Branch during periods of base flow raises the possibility that a source of the products exists in the subsurface and is affecting the water quality of surface waters. The extent of the contamination is not known, because sampling of ground water was not included in the scope of this study. Chlordane and dieldrin were detected at the gaging station on the Mainstem Branch in concentrations violating State Human Health criteria. DDD and its by-products (DDE and DDT) also were detected at the gaging station on the Mainstem Branch. DDT and chlordane are no longer produced in the United States.

Fecal coliform bacteria counts did not meet the State criteria for shellfish harvesting waters during wet- and dry-weather sampling periods. These enteric bacteria were common throughout the Withers Swash Basin. Fifty-one sites were sampled synoptically for enteric bacteria during wet- and dry-weather conditions throughout the Withers Swash Basin, the Atlantic Ocean, and at a culvert discharging onto the beach. High bacteria counts varied spatially and temporally and could not be traced to a single source. The highest counts of enteric bacteria were measured at gaging stations on the Mainstem and KOA Branches. Enteric bacteria counts tended to increase as streamflow increased due to storm runoff. In some cases, enteric bacteria counts continued to increase as streamflow receded.

An initial washoff of pollutants from impervious areas may account for the initial rise in enteric-bacteria counts. As the streamflow increases, high velocities create turbid conditions that suspend small sediment particles carrying adsorbed enteric bacteria. These small particles tend to arrive at a downstream site during a period of highest discharge. Enteric bacteria that are adsorbed onto larger particles tend to arrive at a downstream point as streamflow recedes.

There are other reasons for high bacteria counts during receding streamflow; these include clayey subsoils and high-water tables. Both clayey subsoils and high-water tables retard infiltration and, subsequently, increase surface runoff into receiving streams. The increased runoff that arrives at a downstream point as the stream is receding may carry fecal material from the soils and septic fields. The high water table also may flood septic tanks that have drain fields connected to streams.

Results from the synoptic-water sampling for enteric bacteria indicate that counts exceeding 10,000 col/100 mL were detected at the three gaging stations, sites along the Mainstem Branch, and at a site located at the north end of Todd Street on tributary M-1. The sites on the Mainstem Branch where counts exceeded 10,000 col/100 mL were all located near Canal Drive.

The implementation of best management practices can improve the water quality of the Withers Swash Basin. Source- and (or) structual-control best management practices can be used to prevent or remedy a problem that can lead to water-quality degradation. Source-control best management practices attack the source of pollutants by reducing pollutant amounts on land surfaces, reducing the amount of impervious areas, and reducing or eliminating illicit discharges into the storm drains and streams. These source controls can include education, regulations, and street cleaning. Structural controls include detention and retention ponds, and vegetative controls. Detention and retention ponds are the most effective structures for reduction of nonpoint-source pollution into receiving waters.

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Table 4.--*Physical, bacteria, and inorganic analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[mg/L, milligrams per liter; µg/L, micrograms per liter; ft^3/s, cubic feet per second; µm, micrometers; mL, milliliters; µS/cm, microsiemens per centimeter; NTU, nephelometric turbidity units; °C, degrees Celsius; --, no data; col/100 mL, colonies per 100 milliliters]

WATSTORE[1] parameter code	Constituent	Analytical method[2]	Method number	Units	Detection limit
	Physical				
90410	Alkalinity, as $CaCO_3$	Electrometric titration to pH 4.5	[3]I-1030-85	mg/L	0.1 mg/L
00310	Biochemical oxygen demand (5-day)	--	[7]5210B	mg/L	.1 mg/L
00340	Chemical oxygen demand	Colorimetry, $K_2Cr_2O_7$ oxidation	[3]I-3561-85	mg/L	10 mg/L
00061	Discharge, instantaneous	Manual	[4]--	ft^3/s	.01 ft^3/s
00900	Hardness, as $CaCO_3$	Calculation	[3]I-1340-85	mg/L	1 mg/L
00300	Oxygen, dissolved	Electrometric	[6]360.1	mg/L	.1 mg/L
00403	pH, laboratory	--	--	Standard	--
90095	Specific conductance, laboratory	--	--	µS/cm	--
00076	Turbidity	Nephelometric	[3]I-3860-85	NTU	1 NTU
00010	Water temperature	Manual	[3]212	°C	.1 °C

Table 4.--*Physical, bacteria, and inorganic analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[mg/L, milligrams per liter; µg/L, micrograms per liter; ft^3/s, cubic feet per second; µm, micrometers; mL, milliliters; µS/cm, microsiemens per centimeter; NTU, nephelometric turbidity units; °C, degrees Celsius; --, no data; col/100 mL, colonies per 100 milliliters]

WATSTORE[1] parameter code	Constituent	Analytical method[2]	Method number	Units	Detection limit
	Bacteria				
31625	Fecal coliform bacteria	Membrane filter, 0.7 µm, M-FC media at 44.5 °C	[5]B-0050-85	col/100 mL	10 col/100 mL
31673	Fecal *streptococcus* bacteria	Membrane filter, 0.45 µm immediate incubation, MF, KF agar	[5]B-0055-85	col/100 mL	10 col/100 mL
	Inorganic				
00610	Ammonia nitrogen, total	Colorimetry	[3]I-4522-85	mg/L	.01 mg/L
71845	Ammonia nitrogen, total, as NH_4	--	--	mg/L	.01 mg/L
00625	Ammonia plus organic nitrogen, total	Block digestion and colorimetry	[3]I-4552-85	mg/L	.2 mg/L
01097	Antimony, total	AAS	[3]I-3055-85	µg/L	1 µg/L
01002	Arsenic, total	AAS, hydride	[3]I-4062-85	µg/L	1 µg/L
01012	Beryllium, total	AAS	[3]I-3095-85	µg/L	10 µg/L
01027	Cadmium, total	AAS	[3]I-3135-85	µg/L	10 µg/L

Table 4.--*Physical, bacteria, and inorganic analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[mg/L, milligrams per liter; µg/L, micrograms per liter; ft^3/s, cubic feet per second; µm, micrometers; mL, milliliters; µS/cm, microsiemens per centimeter; NTU, nephelometric turbidity units; °C, degrees Celsius; --, no data; col/100 mL, colonies per 100 milliliters]

WATSTORE[1] parameter code	Constituent	Analytical method[2]	Method number	Units	Detection limit
	Inorganic--continued				
00915	Calcium, dissolved	AE, ICP	[3]I-1472-85	mg/L	0.02 mg/L
00940	Chloride, dissolved	IC	[3]I-2058-85	mg/L	.01 mg/L
01034	Chromium, total	DC plasma	[3]I-3229-87	µg/L	10 µg/L
01042	Copper, total	AAS	[3]I-3270-85	µg/L	10 µg/L
00720	Cyanide, total	Colorimetry, barbituric acid	[3]I-4302-85	mg/L	.01 mg/L
01051	Lead, total	AAS, graphite furnace	[3]I-3403-89	µg/L	1 µg/L
00925	Magnesium, dissolved	AE, ICP	[3]I-1472-85	mg/L	.01 mg/L
71900	Mercury, total	AAS, flameless	[3]I-3462-85	µg/L	.1 µg/L
01067	Nickel, total	AAS, graphite furnace	[3]I-3503-89	µg/L	1 µg/L
00600	Nitrogen, total	Calculation	--	mg/L	.1 mg/L
00620	Nitrate nitrogen, total	Calculation	--	mg/L	.01 mg/L
00615	Nitrite nitrogen, total	Colorimetry, diazotization	[3]I-4540-85	mg/L	0.01 mg/L

Table 4.--*Physical, bacteria, and inorganic analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[mg/L, milligrams per liter; µg/L, micrograms per liter; ft^3/s, cubic feet per second; µm, micrometers; mL, milliliters; µS/cm, microsiemens per centimeter; NTU, nephelometric turbidity units; °C, degrees Celsius; --, no data; col/100 mL, colonies per 100 milliliters]

WATSTORE[1] parameter code	Constituent	Analytical method[2]	Method number	Units	Detection limit
	Inorganic--continued				
00630	Nitrite plus nitrate nitrogen, total	Colorimetry, Cd-reduction	[3]I-4545-85	mg/L	.1 mg/L
70507	Orthophosphate, total, as P	Colorimetry, phosphomolybdate	[3]I-4601-85	mg/L	.01 mg/L
00650	Phosphate, total	--	--	mg/L	.01 mg/L
00665	Phosphorus, total	Colorimetry, phosphomolybdate	[3]I-4600-85	mg/L	.01 mg/L
00935	Potassium, dissolved	AAS	[3]I-1630-85	mg/L	.01 mg/L
00515	Residue at 105 °C, dissolved	Gravimetric	[3]I-1749-85	mg/L	1 mg/L
00530	Residue at 105 °C, suspended	Gravimetric	[3]I-3765-85	mg/L	1 mg/L
01147	Selenium, total	AAS	[3]I-4667-85	µg/L	1 µg/L
00930	Sodium, dissolved	AE, ICP	[3]I-1472-85	mg/L	.2 mg/L
01077	Silver, total	AAS, graphite furnace	[3]I-3724-89	µg/L	1 µg/L

Table 4.--*Physical, bacteria, and inorganic analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[mg/L, milligrams per liter; µg/L, micrograms per liter; ft^3/s, cubic feet per second; µm, micrometers; mL, milliliters; µS/cm, microsiemens per centimeter; NTU, nephelometric turbidity units; °C, degrees Celsius; --, no data; col/100 mL, colonies per 100 milliliters]

WATSTORE[1] parameter code	Constituent	Analytical method[2]	Method number	Units	Detection limit	
	Inorganic--continued					
70301	Solids, sum of constituents, dissolved	Calculation	[3]I-1751-85	mg/L	1	mg/L
70300	Solids, Residue at 180 °C, dissolved	Gravimetric	[3]I-1750-85	mg/L	1	mg/L
00945	Sulfate, dissolved	IC	[3]I-2058-85	mg/L	.01	mg/L
00076	Turbidity	Nephelometric	[3]I-3860-85	NTU	1	NTU
01092	Zinc, total	AAS	[3]I-5900-85	µg/L	10	µg/L

[1]National Water Data Storage and Retrieval System of the U.S. Geological Survey.

[2]AAS, atomic absorption spetrometry; AE, atomic emission; IC, ion chromatograph; ICP, inductively coupled plasma; DC, direct current; MF, membrane filtration.

[3]Fishman and Friedman, eds., (1989).

[4]Rantz and others (1982).

[5]Britton and Greeson, eds., (1988).

[6]U.S. Environmental Protection Agency (1983).

[7]American Public Health Association (1989).

Table 5.--*Organic compounds and detection limits for analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*

[All concentrations in micrograms per liter except where indicated; DDE, dichlorodiphenylchloroethylene; DDT, dichlorodiphenyltrichloroethane; DDD, dichlorodiphenyldichloroethane; PCN, polychlorinated naphthalene; PCB, polychlorinated biphenyl; BHC, benzene hexachloride]

WATSTORE[1] Code	Compounds	Detection Limit
	Gross	
00680	Total organic carbon	0.1 mg/L
00605	Organic nitrogen, total	.1 mg/L
	Acid extractables[2, 3, 4]	
34452	p-Chloro-meta-cresol	30
34586	2-Chlorophenol	5
82626	1,2-Diphenylhydrazine	5
34601	2,4-Dichlorophenol	5
34606	2,4-Dimethylphenol	5
34657	4,6-Dinitro-o-cresol	30
34616	2,4-Dinitrophenol	20
34591	2-Nitrophenol	20
34646	4-Nitrophenol	5
39032	Pentachlorophenol	30
34694	Phenol	5
34621	2,4,6-Trichlorophenol	20
32730	Phenols, total	1
	Neutral extractables[3, 4, 5]	
34396	Hexachloroethane	5
39702	Hexachlorobutadiene	5
39700	Hexachlorobenzene	5
34278	bis (2-Chloroethoxy) methane	5
34696	Naphthalene	5
34581	2-Chloronaphthalene	5

Table 5.--*Organic compounds and detection limits for analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[All concentrations in micrograms per liter except where indicated; DDE, dichlorodiphenylchloroethylene; DDT, dichlorodiphenyltrichloroethane; DDD, dichlorodiphenyldichloroethane; PCN, polychlorinated naphthalene; PCB, polychlorinated biphenyl; BHC, benzene hexachloride]

WATSTORE[1] Code	Compounds	Detection Limit
	Neutral extractables[3, 4, 5]--Continued	
34408	Isophorone	5
34447	Nitrobenzene	5
34611	2,4-Dinitrotoluene	5
34626	2,6-Dinitrotoluene	5
34636	4-Bromophenylphenyl ether	5
39100	bis (2-Ethylhexy) phthalate	5
34596	di-n-Octylphthalate	10
34341	Dimethylphthalate	5
00556	Oil and grease	1
34336	Diethylphthalate	5
39110	di-n-Butylphthalate	5
34200	Acenaphthylene	5
34205	Acenaphthene	5
34292	n-Butylbenzylphthalate	5
34381	Fluorene	5
34376	Fluoranthene	5
34320	Chrysene	10
34469	Pyrene	5
34461	Phenanthrene	5
34220	Anthracene	5
34526	Benzo (a) anthracene	10
34230	Benzo (b) fluoranthene	10
34242	Benzo (k) fluoranthene	10
34247	Benzo (a) pyrene	10
34403	Indeno (1,2,3-cd) pyrene	10

Table 5.--*Organic compounds and detection limits for analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[All concentrations in micrograms per liter except where indicated; DDE, dichlorodiphenylchloroethylene; DDT, dichlorodiphenyltrichloroethane; DDD, dichlorodiphenyldichloroethane; PCN, polychlorinated naphthalene; PCB, polychlorinated biphenyl; BHC, benzene hexachloride]

WATSTORE[1] Code	Compounds	Detection Limit
	Neutral extractables[3, 4, 5]--Continued	
34556	Dibenzo (a,h) anthracene	10
34521	Benzo (g,h,i) perylene	10
34641	4-Chlorophenylphenyl ether	5
34273	bis (2-Chloroethyl) ether	5
34386	Hexachlorocyclopentadiene	5
34283	bis (2-Chloroisopropyl)ether	5
	Base extractables[3, 4, 5]	
34631	3,3´-Dichlorobenzidine	25
39120	Benzidine	50
34433	n-Nitrosodiphenylamine	5
34438	n-Nitrosodimethylamine	5
34428	n-Nitroso-n-propylamine	5
	Organochlorine pesticides[6, 7, 8, 9]	
39330	Aldrin	.01
39380	Dieldrin	.01
39365	DDE	.01
39370	DDT	.01
39360	DDD	.01
39390	Endrin	.01
34366	Endrin aldehyde	.01
39410	Heptachlor	.01
39420	Heptachlor epoxide	.01
39350	Chlordane	.1
39400	Toxaphene	1
39250	PCN's, total	.1

Table 5.--*Organic compounds and detection limits for analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[All concentrations in micrograms per liter except where indicated; DDE, dichlorodiphenylchloroethylene; DDT, dichlorodiphenyltrichloroethane; DDD, dichlorodiphenyldichloroethane; PCN, polychlorinated naphthalene; PCB, polychlorinated biphenyl; BHC, benzene hexachloride]

WATSTORE[1] Code	Compounds	Detection Limit
	Organochlorine pesticides[6, 7, 8, 9]--Continued	
39516	PCB's, total	0.1
39337	alpha-BHC (benzene hexachloride)	.1
39338	beta-BHC (benzene hexachloride)	.1
34259	delta-BHC (benzene hexachloride)	.1
39340	Lindane (gamma-BHC)	.1
39034	Ethylan (Perthane)	.1
39755	Mirex	.01
39480	Methoxychlor	.01
39065	trans-Chlordane	.10
39062	cis-Chlordane	.10
39310	p,p´-DDD	.10
39320	p,p´-DDE	.10
39300	p,p´-DDT	.10
39388	Endosulfan	.01
34361	Endosulfan I	.1
34356	beta-Endosulfan	.04
34351	Endosulfan sulfate	.6
34671	Aroclor 1016 PCB	.1
39488	Aroclor 1221 PCB	1
39492	Aroclor 1232 PCB	.1
39496	Aroclor 1242 PCB	.1
39500	Aroclor 1248 PCB	.1
39504	Aroclor 1254 PCB	.1
39508	Aroclor 1260 PCB	.1

Table 5.--*Organic compounds and detection limits for analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[All concentrations in micrograms per liter except where indicated; DDE, dichlorodiphenylchloroethylene; DDT, dichlorodiphenyltrichloroethane; DDD, dichlorodiphenyldichloroethane; PCN, polychlorinated naphthalene; PCB, polychlorinated biphenyl; BHC, benzene hexachloride]

WATSTORE[1] Code	Compounds	Detection Limit
	Volatile organics[10]	
34010	Toluene	0.2
34030	Benzene	.2
34371	Ethylbenzene	.2
32102	Carbon tetrachloride	.2
34301	Chlorobenzene	.2
32103	1,2-Dichloroethane	.2
34506	1,1,1-Trichloroethane	.2
34704	cis-1,3-Dichloropropene	.2
34699	trans-1,3-Dichloropropene	.2
34496	1,1-Dichloroethane	.2
34501	1,1-Dichloroethylene	.2
34511	1,1,2-Trichloroethane	.2
34516	1,1,2,2-Tetrachloroethane	.2
34311	Chloroethane	.2
34576	2-Chloroethylvinylether	.2
32106	Chloroform	.2
34541	1,2-Dichloropropane	.2
34423	Methylene chloride	.2
34418	Methyl chloride	.2
34413	Methyl bromide	.2
32101	Dichlorobromomethane	.2
32105	Chlorodibromomethane	.2
34475	Tetrachloroethylene	.2
39180	Trichloroethylene	.2
39175	Vinyl chloride	.2

Table 5.--*Organic compounds and detection limits for analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[All concentrations in micrograms per liter except where indicated; DDE, dichlorodiphenylchloroethylene; DDT, dichlorodiphenyltrichloroethane; DDD, dichlorodiphenyldichloroethane; PCN, polychlorinated naphthalene; PCB, polychlorinated biphenyl; BHC, benzene hexachloride]

WATSTORE[1] Code	Compounds	Detection Limit
	Volatile organics[10]--Continued	
34546	1,2-trans-Dichloroethene	0.2
32104	Bromoform	.2
77128	Styrene	.2
81551	Xylene	.2
34536	o-Chlorobenzene	.2
34566	1,3-Dichlorobenzene	.2
34571	1,4-Dichlorobenzene	.2
77562	1,1,1,2-Tetrachloroethane	.2
77168	1,1-Dichloropropene	.2
77613	1,2,3-Trichlorobenzene	.2
77443	1,2,3-Trichloropropane	.2
34551	1,2,4-Trichlorobenzene	.2
77222	Pseudocumene	.2
77275	o-Chlorotoluene	.2
77651	1,2-Dibromoethane	.2
34561	1,3-Dichloropropene	.2
77226	Mesitylene	.2
77173	1,3-Dichloropropane	.2
77277	p-Chlorotoluene	.2
77170	2,2-Dichloropropane	.2
34210	Acrolein	.2
34215	Acrylonitrile	.2
81555	Bromobenzene	.2
77093	cis-1,2-Dichloroethene	.2
82625	Dibromochloropropane	.2

Table 5.--*Organic compounds and detection limits for analyses made on water samples collected at gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992*--Continued

[All concentrations in micrograms per liter except where indicated; DDE, dichlorodiphenylchloroethylene; DDT, dichlorodiphenyltrichloroethane; DDD, dichlorodiphenyldichloroethane; PCN, polychlorinated naphthalene; PCB, polychlorinated biphenyl; BHC, benzene hexachloride]

WATSTORE[1] Code	Compounds	Detection Limit
	Volatile organics[10]--Continued	
30217	Dibromomethane	0.2
34668	Dichlorodifluoromethane	.2
39702	Hexachlorobutadiene	.2
77223	iso-Propylbenzene	.2
77342	n-Butylbenzene	.2
77224	n-Propylbenzene	.2
34696	Naphthalene	.2
77356	p-Isopropyltoluene	.2
77350	sec-Butylbenzene	.2
77353	tert-Butylbenzene	.2
34488	Trichlorofluoromethane	.2

[1]National Water Data Storage and Retrieval System of the U.S. Geological Survey.

[2]Method 0-3117-83 (Wershaw and others, 1987).

[3]Method 625 (U.S. Environmental Protection Agency, 1984).

[4]Method 0-5116-83 (Wershaw and others, 1987).

[5]Method 0-3118-83 (Wershaw and others, 1987).

[6]Method 608 (U.S. Environmental Protection Agency, 1984).

[7]Method 0-3104-83 (Wershaw and others, 1987).

[8]Method 0-1104-83 (Wershaw and others, 1987).

[9]Method 0-5104-83 (Wershaw and others, 1987).

[10]Method 0-3115-83 (Wershaw and others, 1987).

Table 20.--*Results of bacteria sampling at various locations within the Withers Swash Basin and in the Atlantic Ocean near the mouth of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*

[Col/100 mL, colonies per 100 milliliters; W, west; Ave., avenue; N, north; S, south; US, United States; Hwy., highway; X, intersection; --, no data; (K), denotes a non-ideal count; St., Street; ft, feet; NE, northeast; SE, southeast; SW, southwest; NW, northwest; <, less than; SC, South Carolina; Rt., route; ext., extension; E, east; Rd., road; MB, Myrtle Beach; USGS, U.S. Geological Survey; >, greater than; Blvd, boulevard]

Identification number (fig. 4)	Station number	Watercourse	Site location	Date	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)	Remarks
1	021107370.970	Mainstem Branch	W side of 10th Ave. N, S side of US Hwy. 17 Bypass/10th Ave. N X	11/07/91	--	280 (K)	40 (K)	--
2	021107370.980	Mainstem Branch	N side of Seaboard St., 250 ft W of Seaboard St./10th Ave. N X	11/07/91 06/15/92	-- 	80 (K) 1,200	200 (K) 640	-- --
3	021107370.985	Unnamed tributary to Mainstem Branch	1,300 ft NE of Oceola St./10th Ave. N X; 200 ft SE of Coastal Lane/Oceola St. X	06/15/92	--	870	140	--
4	021107370.990	Mainstem Branch	400 ft W of 10th Ave. N, 500 ft SW of the Seaboard St./10th Ave. N X	06/15/92	--	1,300	1,200	--
5	021107370.995	Unnamed tributary to Mainstem Branch	On the SE side of Oceola St., 1,200 ft NE of the X of Oceola St. and 10th Ave. N	06/15/92	--	700	2,000	--
6	021107371.980	Mainstem Branch	900 ft upstream from 021107371.990; 1,000 ft SW of the X of 10th Ave. N and Oceola St.	06/15/92	--	1,500	2,500	--

Table 20.--*Results of bacteria sampling at various locations within the Withers Swash Basin and in the Atlantic Ocean near the mouth of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*--Continued

[Col/100 mL, colonies per 100 milliliters; W, west; Ave., avenue; N, north; S, south; US, United States; Hwy., highway; X, intersection; --, no data; (K), denotes a non-ideal count; St., Street; ft, feet; NE, northeast; SE, southeast; SW, southwest; NW, northwest; <, less than; SC, South Carolina; Rt., route; ext., extension; E, east; Rd., road; MB, Myrtle Beach; USGS, U.S. Geological Survey; >, greater than; Blvd, boulevard]

Identification number (fig. 4)	Station number	Watercourse	Site location	Date	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)	Remarks
7	021107371.985	Unnamed tributary to Mainstem Branch	At the N end of Canal St., just N of the end of the road	08/01/91	--	4,000 (K)	1,300	--
				06/17/92	--	7,000	2,100	--
				08/04/92	--	6,000	9,300	--
8	021107371.990	Mainstem Branch	500 ft W of Canal St., 200 ft NW of the recreation center and 75 ft W of 021107371.995	06/17/92	--	1,100 (K)	800 (K)	--
9	021107371.995	Unnamed tributary to Mainstem Branch	200 ft NW of the pool at the Canal St. recreation center, 400 ft W of Canal St. in a small tributary to the Mainstem Branch	06/17/92	--	1,300 (K)	900 (K)	--
10	021107372.950	Mainstem Branch	400 ft W of Canal St., near the middle of the W side of the recreation center; 100 ft NW of site 021107372.960, at a pipe outfall	09/10/91	--	--	2,000	Taken from small pool below pipe outflow.
				11/07/91	--	600 (K)	80 (K)	
				06/17/92	--	21,000	1,200 (K)	Taken from water dripping off soil below pipe outfall.
				06/18/92	--	<70	<70	Taken straight from pipe outfall.
				08/05/92	--	150 (K)	<50	Taken from small pool below pipe outfall.
11	021107372.960	Mainstem Branch	400 ft W of Canal St., at the SW corner of the recreation center	08/01/91	--	25,000 (K)	860	--
				06/15/92	--	3,200	8,100	--
				08/04/92	--	6,600	4,700	--
				06/23/93	--	41	36	--

Table 20.--*Results of bacteria sampling at various locations within the Withers Swash Basin and in the Atlantic Ocean near the mouth of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*--Continued

[Col/100 mL, colonies per 100 milliliters; W, west; Ave., avenue; N, north; S, south; US, United States; Hwy., highway; X, intersection; --, no data; (K), denotes a non-ideal count; St., Street; ft, feet; NE, northeast; SE, southeast; SW, southwest; NW, northwest; <, less than; SC, South Carolina; Rt., route; ext., extension; E, east; Rd., road; MB, Myrtle Beach; USGS, U.S. Geological Survey; >, greater than; Blvd, boulevard]

Identification number (fig. 4)	Station number	Watercourse	Site location	Date	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)	Remarks
12	021107372.970	Mainstem Branch	At the wooden railroad bridge, 300 ft W of Canal St., 500 ft N of the Canal St./ US Hwy. 501 X	08/04/92	--	25,000	5,500	--
				08/05/92	--	250 (K)	1,000	--
				06/23/93	--	22	20	--
13	021107372.975	M-1	600 ft W of SC Rt. 84 (3rd Ave. S ext), 1,000 ft N of Broadway St. (Old Conway Hwy.), 300 ft E of Cannon Rd.	08/05/92	--	1,200	1,100	--
14	021107372.980	Mainstem Branch	On the SW side of US Hwy. 501, 50 ft NW of the 3rd Ave. N X	08/04/92	--	8,800	7,500	--
				06/23/93	--	73	44	--
15	021107372.985	M-1	On the W side of SC Rt. 84 (3rd Ave. S ext), 1,000 ft N of the Broadway St. (Old Conway Hwy.) X in front of Municipal well facility #21	08/04/92	--	1,100 (K)	5,700	--
				08/05/92	--	1,600	1,400 (K)	--
16	021107372.990	Mainstem Branch	At the bridge on Cedar St., 500 ft W of the 3rd Ave. N X	08/01/91	--	2,500 (K)	2,000	--
				09/10/91	--	--	1,400	--
				11/06/91	--	730	230	--
				08/04/92	--	5,000	3,500	--
				06/23/93	--	81	22	--

Table 20.--*Results of bacteria sampling at various locations within the Withers Swash Basin and in the Atlantic Ocean near the mouth of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*--Continued

[Col/100 mL, colonies per 100 milliliters; W, west; Ave., avenue; N, north; S, south; US, United States; Hwy., highway; X, intersection; --, no data; (K), denotes a non-ideal count; St., Street; ft, feet; NE, northeast; SE, southeast; SW, southwest; NW, northwest; <, less than; SC, South Carolina; Rt., route; ext., extension; E, east; Rd., road; MB, Myrtle Beach; USGS, U.S. Geological Survey; >, greater than; Blvd, boulevard]

Identification number (fig. 4)	Station number	Watercourse	Site location	Date	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)	Remarks
17	021107372.995	M-1	At the N end of Todd St.	06/15/92	--	2,100	3,800	--
				08/04/92	--	40,000	3,200	--
				08/05/92	--	3,000	1,600	--
				06/23/93	--	15	32	--
				06/23/93	--	17	28	--
18	021107374.960	Unnamed tributary to M-2	At the NW end of 20th Ave. N, where the paved road ends	11/07/91	--	770	20(K)	--
19	021107374.970	Unnamed tributary to M-2	On the NE side of 21st Ave. N, across the road from the NE end of Carver St.	08/01/91	--	2,500	2,700	--
				11/07/91	--	300(K)	260(K)	--
20	021107374.980	Unnamed tributary to M-2	On the NW side of the parking lot behind the MB convention/ civic center	08/01/91	--	2,800(K)	1,100	--
				09/10/91	--	--	1,200	--
21	021107374.990	Unnamed tributary to M-2	50 ft NE of the N end of Spivey Ave.	06/15/92	--	620	840	--
				08/05/92	--	1,500	1,200	--
22	021107374.995	M-2	Open ditch on the SW side of the N end of Spivey Ave.	06/15/92	--	2,200	2,000	--
23	021107375	M-2	200 ft downstream of Spivey Ave.	06/15/92	--	--	--	Stream was dry at time of sampling.

Table 20.--*Results of bacteria sampling at various locations within the Withers Swash Basin and in the Atlantic Ocean near the mouth of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*--Continued

[Col/100 mL, colonies per 100 milliliters; W, west; Ave., avenue; N, north; S, south; US, United States; Hwy., highway; X, intersection; --, no data; (K), denotes a non-ideal count; St., Street; ft, feet; NE, northeast; SE, southeast; SW, southwest; NW, northwest; <, less than; SC, South Carolina; Rt., route; ext., extension; E, east; Rd., road; MB, Myrtle Beach; USGS, U.S. Geological Survey; >, greater than; Blvd, boulevard]

Identification number (fig. 4)	Station number	Watercourse	Site location	Date	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)	Remarks
24	021107376	M-2	Upstream side of 10th Ave. N bridge	08/01/91	--	1,800	760	--
				09/10/91	--	--	460	--
				06/15/92	--	1,500	2,000	--
				08/05/92	--	1,200	1,000	--
25	021107377.965	Unnamed tributary to M-2	On the SE side of Oak St., at the Jackson St./Oak St. X	11/06/91	--	470	860	--
26	021107377.975	Unnamed tributary to M-2	On the NW side of Oak St., 50 ft NE of the Jackson St. X	11/06/91	--	1,500	790	--
27	021107377.980	Unnamed tributary to M-2	300 ft N of the Jackson St./Oak St. X, and 400 ft W of the Oak St./10th Ave. N X.	11/06/91	--	130(K)	10(K)	--
28	021107377.990	Unnamed tributary to M-2	300 ft NW of Lumber St., 350 ft NE of Campbell St., next to a short connecting driveway between 2 large parking lots	06/15/92	--	730	1,100	--
29	021107378.940	M-2	In a storm drain 50 ft W of the Cedar St./8th Ave. N X	06/15/92	--	2,000	2,900	--

Table 20.--*Results of bacteria sampling at various locations within the Withers Swash Basin and in the Atlantic Ocean near the mouth of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*--Continued

[Col/100 mL, colonies per 100 milliliters; W, west; Ave., avenue; N, north; S, south; US, United States; Hwy., highway; X, intersection; --, no data; (K), denotes a non-ideal count; St., Street; ft, feet; NE, northeast; SE, southeast; SW, southwest; NW, northwest; <, less than; SC, South Carolina; Rt., route; ext., extension; E, east; Rd., road; MB, Myrtle Beach; USGS, U.S. Geological Survey; >, greater than; Blvd, boulevard]

Identification number (fig. 4)	Station number	Watercourse	Site location	Date	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)	Remarks
30	021107378.945	Unnamed tributary to M-2	In an open ditch, on the SW side of 8th Ave. N, 50 ft E of Cedar St./8th Ave. N X	06/15/92	--	--	--	Channel was dry at time of sampling.
31	021107378.950	M-2	On the S side of the Cedar St./US Hwy. 501 X	06/17/92	--	400 (K)	2,700	--
32	021107378.960	M-2	100 ft N of the Balsam St./4th Ave. N X, near the footbridge in the park	08/01/91	--	2,300 (K)	700	--
				09/10/91	--	--	1,600	--
				11/07/91	--	1,100 (K)	860	--
				06/17/92	--	200 (K)	2,100	--
				08/05/92	--	3,000	350 (K)	--
33	021107378.970	M-2	250 ft N of the Alder St./3rd Ave. N X	11/06/91	--	550	220	--
				11/07/91	--	130 (K)	220 (K)	--
				06/15/92	--	3,400	3,000	--
				06/16/92	--	1,800	5,800	--
34	021107378.980	M-2	On the SW side of 3rd Ave. N, 75 ft NW of the Alder St./3rd Ave. N X	09/10/91	--	--	1,600	--
				06/15/92	--	2,200	2,600	--
35	021107378.990	M-2	350 ft W of the Alder St./3rd Ave. N X	11/06/91	--	380	400	--
				06/15/92	--	3,400	3,700	--
				06/15/92	--	1,500	4,500	--
				06/23/93	--	58	180 (K)	--

Table 20.--*Results of bacteria sampling at various locations within the Withers Swash Basin and in the Atlantic Ocean near the mouth of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*--Continued

[Col/100 mL, colonies per 100 milliliters; W, west; Ave., avenue; N, north; S, south; US, United States; Hwy., highway; X, intersection; --, no data; (K), denotes a non-ideal count; St., Street; ft, feet; NE, northeast; SE, southeast; SW, southwest; NW, northwest; <, less than; SC, South Carolina; Rt., route; ext., extension; E, east; Rd., road; MB, Myrtle Beach; USGS, U.S. Geological Survey; >, greater than; Blvd, boulevard]

Identification number (fig. 4)	Station number	Watercourse	Site location	Date	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)	Remarks
36	021107380	Mainstem Branch	USGS stage gage at the bridge on Broadway St. (Old Conway Hwy.), 200 ft W of the Collins St. X	08/01/91	--	2,500	1,300	--
				09/10/91	--	--	1,800	--
				09/19/91	1310	1,400	100 (K)	--
				09/20/91	0300	220,000	600 (K)	--
				09/20/91	0330	640,000	4,400	--
				09/20/91	0700	800,000	550 (K)	--
				09/24/91	1330	3,800	2,400	--
				09/24/91	1635	92,000	71,000	--
				09/24/91	1655	1,500,000	165,000	--
				06/04/92	--	10,000	--	--
				06/15/92	--	2,700	3,500	--
				07/18/92	1845	6,000	14,000 (K)	--
				07/19/92	1430	59,000	15,000	--
				07/20/92	1720	5,300 (K)	300	--
				07/20/92	1725	5,000 (K)	300	--
				07/20/92	1745	64,000,000 (K)	660,000	--
				07/20/92	1835	27,000,000 (K)	190,000 (K)	--
				08/03/92	1412	55,000	88,000	--
				08/03/92	1535	38,000	58,000	--
				08/03/92	2100	31,000	35,000	--
				08/04/92	--	13,000	56,000	--
				08/05/92	--	2,000	1,400	--
				06/22/93	--	32	36	--
				06/22/93	--	30	30	--
37	021107384.980	KOA Branch	500 ft N of the X of Beaver Rd. and 17th Ave. S, 200 ft NE of 17th Ave. S	08/01/91	--	1,500 (K)	100 (K)	--
				09/10/91	--	--	1,800	--
				11/08/91	--	<17	<20	--

Table 20.--*Results of bacteria sampling at various locations within the Withers Swash Basin and in the Atlantic Ocean near the mouth of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*--Continued

[Col/100 mL, colonies per 100 milliliters; W, west; Ave., avenue; N, north; S, south; US, United States; Hwy., highway; X, intersection; --, no data; (K), denotes a non-ideal count; St., Street; ft, feet; NE, northeast; SE, southeast; SW, southwest; NW, northwest; <, less than; SC, South Carolina; Rt., route; ext., extension; E, east; Rd., road; MB, Myrtle Beach; USGS, U.S. Geological Survey; >, greater than; Blvd, boulevard]

Identification number (fig. 4)	Station number	Watercourse	Site location	Date	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)	Remarks
38	021107384.985	KOA Branch	On 13th Ave. S, 400 ft NW of the Beaver Rd. X	11/08/91	--	200 (K)	40 (K)	--
39	021107384.990	KOA Branch	On 11th Ave. S, 1,200 ft NW of the Oak St. X, and 400 ft from the end of 11th Ave. S	08/01/91	--	1,100	<20	--
				06/23/93	--	44	47	--
40	021107384.995	Unnamed tributary to KOA Branch	500 ft NW of the NW end of Talbot Circle	08/01/91	--	3,900	<20	--
41	021107385	KOA Branch	USGS stage gage 200 ft SW of the NW end of Talbot Circle	08/01/91	--	3,000	<20	--
				09/10/91	--	--	2,300 (K)	--
				09/19/91	1315	1,200	<50	--
				09/20/91	0305	21,000	<50	--
				09/20/91	0345	19,000	50 (K)	--
				09/20/91	0700	12,000	<50	--
				09/24/91	1330	1,900	2,400	--
				09/24/91	1640	45,000	37,000	--
				09/24/91	1715	100,000	50,000	--
				09/24/91	1805	27,000	28,000	--
				11/08/91	--	1,600	1,000	--
				06/04/92	--	2,800	--	--
				07/18/92	1830	5,500	>10,000	--
				07/19/92	1445	6,900	13,000	--
				07/20/92	1805	60 (K)	4,400	--
				07/20/92	1840	250 (K)	70,000	--
				07/20/92	1930	1,200	1,000	--
				08/03/92	1430	12,000	200,000	--
				08/03/92	1610	58,000	130,000	--
				08/03/92	2035	25,000	120,000	--
				06/23/93	--	--	124 (K)	--

Table 20.--*Results of bacteria sampling at various locations within the Withers Swash Basin and in the Atlantic Ocean near the mouth of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*--Continued

[Col/100 mL, colonies per 100 milliliters; W, west; Ave., avenue; N, north; S, south; US, United States; Hwy., highway; X, intersection; --, no data; (K), denotes a non-ideal count; St., Street; ft, feet; NE, northeast; SE, southeast; SW, southwest; NW, northwest; <, less than; SC, South Carolina; Rt., route; ext., extension; E, east; Rd., road; MB, Myrtle Beach; USGS, U.S. Geological Survey; >, greater than; Blvd, boulevard]

Identification number (fig. 4)	Station number	Watercourse	Site location	Date	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)	Remarks
42	021107385.010	KOA Branch	At the NW end of 10th Ave. S (Road ends here)	--	--	--	--	Stream was dry at time of sampling.
43	021107385.020	KOA Branch	At 9th Ave. S, 400 ft NW of the Oak St. X	11/08/91	--	3,000	1,800	--
44	021107385.030	KOA Branch	At the bridge 100 ft SE of the X of 5th Ave. S and Boundary St.	08/01/91	--	3,300	<20	--
				09/10/91	--	--	170	--
				11/08/91	--	320 (K)	40 (K)	--
				06/23/93	--	42	33	--
45	021107385.040	Tidal basin	On the W side of the main pool of the tidal basin, 900 ft NW of US Hwy. 17 (Business), and 300 ft NE of 5th Ave. S	06/17/92	--	2,000	180 (K)	--
46	021107388	Withers Swash	USGS stage gage, upstream side of the culvert, 300 ft SW of the X of US Hwy. 17 (Business) and 3rd Ave. S	09/19/91	1305	< 50	<50	--
				09/20/91	1025	150,000	50 (K)	--
				09/24/91	1315	63 (K)	96	--
				09/24/91	2104	14,000	14,000	--
				09/24/91	2154	7,200	13,000	--
				06/04/92	1610	14,000	--	--
				06/15/92	--	1,900	500 (K)	--
				06/16/92	--	2,300	440 (K)	--
				08/05/92	--	3,000	12,000	--
				06/23/93	--	24	18 (K)	--

Table 20.--*Results of bacteria sampling at various locations within the Withers Swash Basin and in the Atlantic Ocean near the mouth of Withers Swash, Myrtle Beach, S.C., August 1991 through June 1993*--Continued

[Col/100 mL, colonies per 100 milliliters; W, west; Ave., avenue; N, north; S, south; US, United States; Hwy., highway; X, intersection; --, no data; (K), denotes a non-ideal count; St., Street; ft, feet; NE, northeast; SE, southeast; SW, southwest; NW, northwest; <, less than; SC, South Carolina; Rt., route; ext., extension; E, east; Rd., road; MB, Myrtle Beach; USGS, U.S. Geological Survey; >, greater than; Blvd, boulevard]

Identification number (fig. 4)	Station number	Watercourse	Site location	Date	Time (hours)	Fecal coliform (col/100 mL)	Fecal *streptococcus* (col/100 mL)	Remarks
47	021107388.010	Atlantic Ocean	In the surf, 70 - 100 ft NE of center of Withers Swash confluence with ocean	06/04/92 08/05/92	-- --	49 (K) 700 (K)	-- 50 (K)	-- --
48	021107388.020	Atlantic Ocean	In the surf, center of Withers Swash confluence with ocean	06/04/92 08/05/92	-- --	15,000 2,200	-- 50 (K)	-- --
49	021107388.030	Atlantic Ocean	In the surf, 70 - 100 ft SW of center of Withers Swash confluence with ocean	08/05/92	--	< 50	< 50	--
50	021107400.010	Storm drain	In a street drain confluence on the SE side of N Ocean Blvd., in front of Anderson Inn, between 26th and 27th Ave. N	06/04/92	--	570	--	--
51	021107400.020	Storm discharge culvert	On the beach, 190 ft SE of the middle corrugated metal pipe outfall for storm discharge behind Anderson Inn, 300 ft SE of site 021107400.010	06/04/92	--	31 (K)	--	--

APPENDIX 1

Results of physical property, oxygen demand, total organic carbon, total residue, turbidity, hardness, major ion, and alkalinity analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

Appendix 1.--Results of physical property, oxygen demand, total organic carbon, total residue, turbidity, hardness, major ion, and alkalinity analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

[ft^3/s, cubic feet per second; °C, degrees Celsius; lab, laboratory; µS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter; NTU, nephelometric turbidity units; --, no data; <, less than]

Station number	Date	Time (hours)	Discharge, instantaneous (ft^3/s) [1](00061)	Temperature, water (°C) [1](00010)	pH, Water whole, lab (pH units) [1](00403)	Specific conductance (µS/cm) [1](00095)	Specific conductance, lab (µS/cm) [1](90095)	Oxygen, dissolved (mg/L) [1](00300)	Oxygen, dissolved (percent saturation) [1](00301)
021107380	09-20-91	0300	1.1	24.0	7.4	510	538	3.5	41
(Mainstem)	09-24-91	1330	0.60	23.0	7.5	624	657	3.5	41
	09-24-91	1635	17	26.0	7.7	235	234	6.0	74
	09-24-91	1655	11	26.0	7.5	206	278	5.7	70
	07-18-92	1845	0.60	25.0	7.6	320	601	3.9	47
	07-20-92	1720	1.3	24.5	7.5	627	590	4.5	54
	07-20-92	1725	1.8	24.5	7.4	629	549	4.5	54
	07-20-92	1745	2.4	24.5	7.3	566	425	4.4	52
	07-20-92	1835	1.5	26.0	7.3	450	444	4.2	51
	08-03-92	1412	10	28.0	8.1	103	103	5.8	74
	08-03-92	1538	65	25.5	7.7	88	98	5.2	64
	08-03-92	2100	6.2	26.0	7.2	127	133	4.8	59
021107385	09-20-91	0305	2.1	25.0	7.3	335	333	2.6	31
(KOA)	09-24-91	1330	1.5	23.5	7.3	350	336	3.4	40
	09-24-91	1640	5.2	25.0	7.2	245	183	4.3	52
	09-24-91	1715	5.3	25.0	7.4	150	133	4.4	53
	09-24-91	1805	3.2	25.0	7.3	140	132	4.4	53
	07-18-92	1830	1.6	25.0	7.6	380	369	3.8	46
	07-20-92	1805	2.1	26.5	10.4	1,000	968	4.2	52
	07-20-92	1840	2.5	26.0	6.8	1,000	986	4.1	51
	07-20-92	1930	2.2	26.5	3.2	1,200	1,200	4.5	56
	08-03-92	1430	17	27.0	6.6	317	327	5.3	67
	08-03-92	1610	71	25.5	7.2	82	87	5.1	62
	08-03-92	2035	6.7	25.5	7.8	145	150	4.9	60
021107388	09-24-91	1315	--	27.0	7.7	46,200	45,200	7.6	113
(Swash)	09-24-91	2104	--	25.0	7.9	47,000	38,000	5.9	85
	09-24-91	2154	--	25.0	7.7	46,000	36,600	6.2	89

Appendix 1 --Results of physical property, oxygen demand, total organic carbon, total residue, turbidity, hardness, major ion, and alkalinity analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; °C, degrees Celsius; lab, laboratory; µS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter; NTU, nephelometric turbidity units; --, no data; <, less than]

Station number	Date	Time (hours)	Oxygen demand, biochemical, 5 day (mg/L) [1](00310)	Oxygen demand, chemical (high level) (mg/L) [1](00340)	Carbon, organic, total (mg/L) [1](00680)	Residue at 105 °C, dissolved (mg/L) [1](00515)	Residue at 105 °C, suspended (mg/L) [1](00530)	Solids, residue at 180 °C, dissolved (mg/L) [1](70300)	Turbidity (NTU) [1](00076)	Hardness, total (mg/L as $CaCO_3$) [1](00900)
021107380	09-20-91	0300	12	86	--	353	17	--	5.5	--
(Mainstem)	09-24-91	1330	6.5	27	--	399	<1	--	24	--
	09-24-91	1635	10	80	--	97	59	--	67	--
	09-24-91	1655	12	99	--	161	30	--	55	--
	07-18-92	1845	--	27	11	--	16	358	--	210
	07-20-92	1720	7.0	--	16	--	22	370	--	220
	07-20-92	1725	7.0	30	22	--	22	363	--	220
	07-20-92	1745	--	85	42	--	40	322	--	170
	07-20-92	1835	--	28	25	--	30	281	--	160
	08-03-92	1412	21	46	18	--	231	78	--	35
	08-03-92	1538	17	15	10	--	77	68	--	36
	08-03-92	2100	15	29	11	--	28	108	--	56
021107385	09-20-91	0305	9.0	67	--	195	18	--	3.0	--
(KOA)	09-24-91	1330	6.0	32	--	213	1	--	3.0	--
	09-24-91	1640	7.5	120	--	129	97	--	37	--
	09-24-91	1715	13	62	--	90	168	--	60	--
	09-24-91	1805	9.5	41	--	90	47	--	7.0	--
	07-18-92	1830	--	59	19	--	36	218	--	79
	07-20-92	1805	7.5	110	50	--	54	568	--	50
	07 20-92	1840	--	43	13	--	36	541	--	240
	07-20-92	1930	--	87	32	--	28	640	--	240
	08-03-92	1430	24	77	25	--	126	222	--	67
	08-03-92	1610	17	23	15	--	101	73	--	28
	08-03-92	2035	13	43	18	--	28	123	--	49
021107388	09-24-91	1315	6.0	810	--	34,700	2	--	2.2	--
(Swash)	09-24-91	2104	12	730	--	29,900	8	--	8.4	--
	09-24-91	2154	7.0	620	--	28,100	14	--	10	--

Appendix 1.--Results of physical property, oxygen demand, total organic carbon, total residue, turbidity, hardness, major ion, and alkalinity analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; °C, degrees Celsius; lab, laboratory; µS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter; NTU, nephelometric turbidity units; --, no data; <, less than]

Station number	Date	Time (hours)	Alkalinity, lab (mg/L as $CaCO_3$) [1](90410)	Calcium, dissolved (mg/L) [1](00915)	Magnesium, dissolved (mg/L) [1](00925)	Sodium, dissolved (mg/L) [1](00930)	Potassium, dissolved (mg/L) [1](00935)	Chloride, dissolved (mg/L) [1](00940)	Sulfate, dissolved (mg/L) [1](00945)	Solids, sum of constituents, dissolved (mg/L) [1](70301)
021107380	09-20-91	0300	208	--	--	--	--	--	--	--
(Mainstem)	09-24-91	1330	272	--	--	--	--	--	--	--
	09-24-91	1635	96	--	--	--	--	--	--	--
	09-24-91	1655	114	--	--	--	--	--	--	--
	07-18-92	1845	235	79	3.2	48	3.0	42	32	348
	07-20-92	1720	222	83	3.4	50	4.1	45	34	353
	07-20-92	1725	203	83	3.4	49	3.1	45	34	339
	07-20-92	1745	146	65	2.9	40	2.9	39	33	270
	07-20-92	1835	159	58	2.6	31	2.6	32	25	247
	08-03-92	1412	53	13	0.68	4.6	1.1	4.4	9.1	65
	08-03-92	1538	37	13	0.76	4.0	1.3	4.2	8.2	54
	08-03-92	2100	46	20	1.5	5.7	1.8	21	12	90
021107385	09-20-91	0305	91	--	--	--	--	--	--	--
(KOA)	09-24-91	1330	95	--	--	--	--	--	--	--
	09-24-91	1640	51	--	--	--	--	--	--	--
	09-24-91	1715	36	--	--	--	--	--	--	--
	09-24-91	1805	40	--	--	--	--	--	--	--
	07-18-92	1830	99	29	1.7	44	2.4	32	35	203
	07-20-92	1805	232	19	0.72	180	2.7	150	53	545
	07-20-92	1840	19	85	6.1	34	4.3	220	35	396
	07-20-92	1930	<1.0	88	5.6	58	4.4	270	33	--
	08-03-92	1430	46	24	1.7	31	2.7	68	23	178
	08-03-92	1610	28	10	0.80	4.5	2.1	4.7	7.6	46
	08-03-92	2035	39	17	1.7	9.8	3.8	9.8	15	80
021107388	09-24-91	1315	129	--	--	--	--	--	--	--
(Swash)	09-24-91	2104	117	--	--	--	--	--	--	--
	09-24-91	2154	116	--	--	--	--	--	--	--

[1]Parameter code, National Water Data Storage and Retrieval System of the U.S. Geological Survey.

APPENDIX 2

Results of nutrient analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

Appendix 2. Results of nutrient analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

[ft^3/s, cubic feet per second; mg/L, milligrams per liter; <, less than; --, no data]

Station number	Date	Time (hours)	Discharge, intantaneous (ft^3/s) [1](00061)	Nitrogen, total (mg/L) [1](00600)	Nitrogen, organic, total (mg/L) [1](00605)	Nitrogen, ammonia, total (mg/L) [1](00610)	Nitrogen nitrite, total (mg/L) [1](00615)	Nitrogen nitrate, total (mg/L) [1](00620)
021107380	09-20-91	0300	1.1	1.5	1.1	0.070	0.030	0.270
(Mainstem)	09-24-91	1330	.60	.67	.44	.160	.010	.06
	09-24-91	1635	17	.72	.55	.050	.020	.100
	09-24-91	1655	11	.98	.75	.050	.010	.170
	07-18-92	1845	.60	.83	.26	.240	.080	.250
	07-20-92	1720	1.3	1.2	.44	.260	.100	.370
	07-20-92	1725	1.8	.96	.32	.280	.100	.260
	07-20-92	1745	2.4	3.3	1.2	.220	.090	1.81
	07-20-92	1835	1.5	1.7	.78	.220	.100	.590
	08-03-92	1412	10	2.0	1.4	.110	.020	.520
	08-03-92	1538	65	1.1	.53	.070	.020	.510
	08-03-92	2100	6.2	.93	.59	.010	.020	.310
021107385	09-20-91	0305	2.1	1.8	1.0	.670	.010	.054
(KOA)	09-24-91	1330	1.5	1.2	.34	.660	.040	.170
	09-24-91	1640	5.2	1.7	.92	.580	.030	.200
	09-24-91	1715	5.3	1.5	.97	.330	.020	.200
	09-24-91	1805	3.2	.75	.45	.150	.010	.140
	07-18-92	1830	1.6	2.8	1.4	1.10	.050	.230
	07-20-92	1805	2.1	2.8	.80	1.60	.030	.410
	07-20-92	1840	2.5	7.1	3.1	.850	.070	.13
	07-20-92	1930	2.2	3.1	.90	1.40	.020	.730
	08-03-92	1430	17	2.8	1.8	.280	.030	.670
	08-03-92	1610	71	1.2	.73	.070	.020	.400
	08-03-92	2035	6.7	1.4	.83	.070	.030	.520
021107388	09-24-91	1315	--	--	.33	.070	<.010	--
(Swash)	09-24-91	2104	--	--	.35	.050	<.010	--
	09-24-91	2154	--	--	.34	.060	.010	--

Appendix 2. Results of nutrient analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S. C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; mg/L, milligrams per liter; <, less than; --, no data]

Station number	Date	Time (hours)	Nitrogen, amonia + organic, total (mg/L) [1](00625)	Nitrogen, NO_2+NO_3, total (mg/L) [1](00630)	Nitrogen, ammonia, total (mg/L) [1](71845)	Phosphorus, total (mg/L) [1](00665)	Phosphorus, ortho, total (mg/L) [1](70507)	Phosphate, total (mg/L) [1](00650)
021107380	09-20-91	0300	1.2	0.300	0.09	0.280	0.140	0.43
(Mainstem)	09-24-91	1330	.60	.074	.21	.200	.140	.43
	09-24-91	1635	.60	.120	.06	1.30	.170	.52
	09-24-91	1655	.80	.180	.06	.840	.110	.34
	07-18-92	1845	.50	.330	.31	.190	--	--
	07-20-92	1720	.70	.470	.33	.220	--	--
	07-20-92	1725	.60	.360	.36	.190	--	--
	07-20-92	1745	1.4	1.90	.28	.370	--	--
	07-20-92	1835	1.0	.690	.28	.230	--	--
	08-03-92	1412	1.5	.540	.14	.640	--	--
	08-03-92	1538	.60	.530	.09	.260	--	--
	08-03-92	2100	.60	.330	.01	.210	--	--
021107385	09-20-91	0305	1.7	.064	.86	.160	.070	.21
(KOA)	09-24-91	1330	1.0	.210	.85	.120	.070	.21
	09-24-91	1640	1.5	.230	.75	.400	.070	.21
	09-24-91	1715	1.3	.220	.42	.360	.050	.15
	09-24-91	1805	.60	.150	.19	.130	.060	.18
	07-18-92	1830	2.5	.280	1.4	.860	--	--
	07-20-92	1805	2.4	.440	2.1	.120	--	--
	07-20-92	1840	3.9	3.20	1.1	1.70	--	--
	07-20-92	1930	2.3	.750	1.8	.590	--	--
	08-03-92	1430	2.1	.700	.36	.710	--	--
	08-03-92	1610	.80	.420	.09	.290	--	--
	08-03-92	2035	.90	.550	.09	.280	--	--
021107388	09-24-91	1315	.40	<.050	.09	.070	.050	.15
(Swash)	09-24-91	2104	.40	<.050	.08	.090	.040	.12
	09-24-91	2154	.40	<.050	.08	.090	.040	.12

[1]Parameter code, National Water Data Storage and Retrieval System of the U.S. Geological Survey.

APPENDIX 3

Results of trace element and cyanide analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

Appendix 3 Results of metal and trace element analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

[ft^3/s, cubic feet per second; µg/L, micrograms per liter; <, less than; mg/L, milligrams per liter; --, no data]

Station number	Date	Time (hours)	Discharge, instantaneous (ft^3/s) [1](00061)	Antimony, total (µg/L) [1](01097)	Arsenic, total (µg/L) [1](01002)	Beryllium, total recoverable (µg/L) [1](01012)	Cadmium, total recoverable (µg/L) [1](01027)	Chromium, total recoverable (µg/L) [1](01034)	Copper, total recoverable (µg/L) [1](01042)
021107380	09-20-91	0300	1.1	<1	2	<10	<1	4	10
(Mainstem)	09-24-91	1330	.60	<1	1	<10	<1	1	2
	09-24-91	1635	17	2	6	<10	2	27	51
	09-24-91	1655	11	1	4	<10	<1	13	16
	07-18-92	1845	.60	--	<1	<10	<1	<1	1
	07-20-92	1720	1.3	--	1	<10	<1	1	2
	07-20-92	1725	1.8	--	<1	<10	<1	<1	13
	07-20-92	1745	2.4	--	3	<10	<1	1	12
	07-20-92	1835	1.5	--	2	<10	<1	<1	9
	08-03-92	1412	10	--	2	<10	<1	11	19
	08-03-92	1538	65	--	2	<10	<1	2	7
	08-03-92	2100	6.2	--	4	<10	<1	<1	6
021107385	09-20 91	0305	2.1	<1	1	<10	<1	<1	3
(KOA)	09-24 91	1330	1.5	<1	<1	<10	<1	<1	4
	09-24 91	1640	5.2	2	3	<10	2	5	25
	09-24 91	1715	5.3	2	2	<10	3	9	30
	09 24 91	1805	3.2	2	1	<10	<1	<1	14
	07-18-92	1830	1.6	--	3	<10	<1	<1	22
	07 20-92	1805	2.1	--	7	<10	2	1	54
	07-20-92	1840	2.5	--	<1	<10	7	1	44
	07-20 92	1930	2.2	--	4	<10	7	6	62
	08-03 92	1430	17	--	6	<10	2	9	43
	08-03-92	1610	71	--	4	<10	<1	2	5
	08-03-92	2035	6.7	--	4	<10	<1	<1	4
021107388	09-24-91	1315	--	<1	2	<10	<10	4	1
(Swash)	09-24-91	2104	--	<1	2	<10	<10	<4	3
	09-24-91	2154	--	<1	3	<10	<10	<4	<10

Appendix 3.--Results of metal and trace element analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; µg/L, micrograms per liter; <, less than; mg/L, milligrams per liter; --, no data]

Station number	Date	Time (hours)	Cyanide, total (mg/L) [1](00720)	Lead, total recoverable (µg/L) [1](01051)	Mercury, total recoverable (µg/L) [1](71900)	Nickel, total recoverable (µg/L) [1](01067)	Selenium, total (µg/L) [1](01147)	Silver, total recoverable (µg/L) [1](01077)	Zinc, total recoverable (µg/L) [1](01092)
021107380	09-20-91	0300	<0.010	9	0.10	1	<1	<1	80
(Mainstem)	09-24-91	1330	< .010	2	.20	<1	<1	<1	20
	09-24-91	1635	< .010	140	.30	8	<1	<1	310
	09-24-91	1655	< .010	45	.20	3	<1	<1	120
	07-18-92	1845	< .010	<1	.20	<1	<2	<1	10
	07-20-92	1720	< .010	1	.40	<1	<2	<1	20
	07-20-92	1725	< .010	1	.20	<1	<2	<1	30
	07-20-92	1745	< .010	15	.20	4	<2	<1	80
	07-20-92	1835	< .010	8	.10	2	<2	<1	60
	08-03-92	1412	< .010	69	.50	5	<1	<1	190
	08-03-92	1538	< .010	16	.40	1	<1	<1	60
	08-03-92	2100	< .010	9	< .10	1	<1	<1	40
021107385	09-20-91	0305	< .010	4	.10	2	<1	<1	30
(KOA)	09-24-91	1330	< .010	6	.10	5	<1	<1	20
	09-24-91	1640	< .010	170	.10	14	<1	28	180
	09-24-91	1715	< .010	290	.10	14	<1	30	250
	09-24-91	1805	< .010	35	.10	4	<1	7	40
	07-18-92	1830	< .010	48	.10	4	<2	4	110
	07-20-92	1805	< .010	240	.30	2	<2	14	490
	07-20-92	1840	< .010	250	.20	65	<2	1	2,300
	07-20-92	1930	< .010	450	.20	64	<2	1	1,600
	08-03-92	1430	--	240	.30	15	<1	45	300
	08-03-92	1610	< .010	11	.30	2	<1	2	40
	08-03-92	2035	< .010	6	< .10	1	<1	<1	30
021107388	09-24-91	1315	< .010	<10	.10	<1	<1	<1	<10
(Swash)	09-24-91	2104	< .010	<10	.10	<1	<1	<1	20
	09-24-91	2154	< .010	<10	.20	1	<1	<1	30

[1]Parameter code, National Water Data Storage and Retrieval System of the U.S. Geological Survey.

APPENDIX 4

Results of volatile organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

Appendix 4.--Results of volatile organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

[All concentrations in micrograms per liter except where indicated; ft^3/s, cubic feet per second; rec, recovered; <, less than; --, no data]

Station number	Date	Time (hours)	Discharge, instantaneous (ft^3/s) [1](00061)	1,1,1,2-Tetrachloroethane, total rec [1](77562)	1,1,1-Trichloroethane, total [1](34506)	1,1,2,2-Tetrachloroethane, total rec [1](34516)	1,1,2-Trichloroethane, total [1](34511)	1,1-Dichloroethane, total [1](34496)	1,1-Dichloroethylene, total [1](34501)	1,1-Dichloropropene, total [1](77168)
021107380	09-20-91	0300	1.1	--	<0.2	<0.2	<0.2	<0.2	<0.2	--
(Mainstem)	09-24-91	1330	.60	--	< .2	< .2	< .2	< .2	< .2	--
	09-24-91	1635	17	--	< .2	< .2	< .2	< .2	< .2	--
	09-24-91	1655	11	--	< .2	< .2	< .2	< .2	< .2	--
	07-18-92	1845	.60	<0.2	< .2	< .2	< .2	< .2	< .2	<0.2
	07-20-92	1720	1.3	< .2	< .2	< .2	< .2	< .2	< .2	< .2
	07-20-92	1725	1.8	< .2	< .2	< .2	< .2	< .2	< .2	< .2
	08-03-92	1412	10	< .2	< .2	< .2	< .2	< .2	< .2	< .2
021107385	09-20-91	0305	2.1	--	44	< .2	< .2	4.3	.6	--
(KOA)	09-24-91	1330	1.5	--	55	< .2	< .2	4.2	.9	--
	09-24-91	1640	5.2	--	230	< .2	< .2	2.7	3.4	--
	09-24-91	1715	5.3	--	150	< .2	< .2	1.8	2.5	--
	09-24-91	1805	3.2	--	120	< .2	< .2	1.2	1.8	--
	07-18-92	1830	1.6	< .2	27	< .2	< .2	2.9	2.4	< .2
	07-20-92	1840	2.5	< .2	27	< .2	< .2	3.5	2.9	< .2
	08-03-92	1430	17	< .2	350	< .2	< .2	2.1	26	< .2
021107388	09-24-91	1315	--	--	.2	< .2	< .2	< .2	< .2	--
(Swash)	09-24-91	2104	--	--	< .2	< .2	< .2	< .2	< .2	--
	09-24-91	2154	--	--	.6	< .2	< .2	< .2	< .2	--

Appendix 4. Results of volatile organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[All concentrations in micrograms per liter except where indicated; ft^3/s, cubic feet per second; rec, recovered; <, less than; --, no data]

Station number	Date	Time (hours)	1,2,3-Trichlorobenzene, total rec [1](77613)	1,2,3-Trichloropropane, total [1](77443)	1,2,4-Trichlorobenzene, total rec [1](34551)	Pseudocumene, water, total rec [1](77222)	o-Chlorotoluene, total [1](77275)	1,2-Dibromoethane, total [1](77651)	o-Chlorobenzene, total rec [1](34536)	1,2-Dichloroethane, total [1](32103)	1,2-Dichloropropane, total [1](34541)
021107380	09-20-91	0300	--	--	<5.0	--	--	<0.2	<5.0	<0.2	<0.2
(Mainstem)	09-24-91	1330	--	--	<5.0	--	--	< .2	<5.0	< .2	< .2
	09-24-91	1635	--	--	<5.0	--	--	< .2	<5.0	< .2	< .2
	09-24-91	1655	--	--	<5.0	--	--	< .2	<5.0	< .2	< .2
	07-18-92	1845	<0.20	<0.2	< .20	<0.20	<0.2	< .2	< .20	< .2	< .2
	07-20-92	1720	< .20	< .2	< .20	< .20	< .2	< .2	< .20	< .2	< .2
	07-20-92	1725	< .20	< .2	< .20	< .20	< .2	< .2	< .20	< .2	< .2
	08-03-92	1412	< .20	< .2	< .20	< .20	< .2	< .2	< .20	< .2	< .2
021107385	09-20-91	0305	--	--	<5.0	--	--	< .2	<5.0	< .2	< .2
(KOA)	09-24-91	1330	--	--	<5.0	--	--	< .2	<5.0	< .2	< .2
	09-24-91	1640	--	--	<5.0	--	--	< .2	<5.0	< .2	< .2
	09-24-91	1715	--	--	<5.0	--	--	< .2	<5.0	< .2	< .2
	09-24-91	1805	--	--	<5.0	--	--	< .2	<5.0	< .2	< .2
	07-18-92	1830	< .20	< .2	< .20	< .20	< .2	< .2	< .20	< .2	< .2
	07-20-92	1840	< .20	< .2	< .20	< .20	< .2	< .2	< .20	< .2	< .2
	08-03-92	1430	< .20	< .2	< .20	< .20	< .2	< .2	< .20	.4	< .2
021107388	09-24-91	1315	--	--	<5.0	--	--	< .2	<5.0	< .2	< .2
(Swash)	09-24-91	2104	--	--	<5.0	--	--	< .2	<5.0	< .2	< .2
	09-24-91	2154	--	--	<5.0	--	--	< .2	<5.0	< .2	< .2

Appendix 4.--Results of volatile organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[All concentrations in micrograms per liter except where indicated; ft^3/s, cubic feet per second; rec, recovered; <, less than; --, no data]

Station number	Date	Time (hours)	1,3-Dichloropropene, total [1](34561)	1,2-trans-Dichloroethene, total [1](34546)	Mesitylene, total rec [1](77226)	1,3-Dichlorobenzene, total rec [1](34566)	1,3-Dichloropropane, total [1](77173)	p-Chlorotoluene, total rec [1](77277)	1,4-Dichlorobenzene, total rec [1](34571)	2,2-Dichloropropane, total [1](77170)	2-Chloroethylvinyl ether, total [1](34576)
021107380	09-20-91	0300	<0.20	0.5	--	<5.0	--	--	<5.0	--	<0.2
(Mainstem)	09-24-91	1330	< .20	.8	--	<5.0	--	--	<5.0	--	< .2
	09-24-91	1635	< .20	< .2	--	<5.0	--	--	<5.0	--	< .2
	09-24-91	1655	< .20	< .2	--	<5.0	--	--	<5.0	--	< .2
	07-18-92	1845	--	< .2	<0.20	< .20	<0.2	<0.20	< .20	<0.2	<1.0
	07-20-92	1720	--	< .2	< .20	< .20	< .2	< .20	< .20	< .2	<1.0
	07-20-92	1725	--	< .2	< .20	< .20	< .2	< .20	< .20	< .2	<1.0
	08-03-92	1412	--	< .2	< .20	< .20	< .2	< .20	< .20	< .2	<1.0
021107385	09-20-91	0305	< .20	5.1	--	<5.0	--	--	<5.0	--	< .2
(KOA)	09-24-91	1330	< .20	13	--	<5.0	--	--	<5.0	--	< .2
	09-24-91	1640	< .20	12	--	<5.0	--	--	<5.0	--	< .2
	09-24-91	1715	< .20	4.5	--	<5.0	--	--	<5.0	--	< .2
	09-24-91	1805	< .20	3.0	--	<5.0	--	--	<5.0	--	< .2
	07-18-92	1830	--	< .2	< .20	< .20	< .2	< .20	< .20	< .2	<1.0
	07-20-92	1840	--	< .2	< .20	< .20	< .2	< .20	< .20	< .2	<1.0
	08-03-92	1430	--	< .2	< .20	< .20	< .2	< .20	< .20	< .2	<1.0
021107388	09-24-91	1315	< .20	2.0	--	<5.0	--	--	<5.0	--	< .2
(Swash)	09-24-91	2104	< .20	1.0	--	<5.0	--	--	<5.0	--	< .2
	09-24-91	2154	< .20	1.9	--	<5.0	--	--	<5.0	--	< .2

Appendix 4 --Results of volatile organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C , September 1991 through August 1992--Continued

[All concentrations in micrograms per liter except where indicated; ft^3/s, cubic feet per second; rec, recovered; <, less than; --, no data]

Station number	Date	Time (hours)	Acrolein, total [1](34210)	Acrylonitrile, total [1](34215)	Benzene, total [1](34030)	Bromobenzene, total [1](81555)	Bromoform, total [1](32104)	Carbon tetrachloride, total [1](32102)	Chlorobenzene, total [1](34301)	Chlorodibromomethane, total [1](32105)	Chloroethane, total [1](34311)
021107380	09-20-91	0300	--	--	<0.2	--	<0.2	<0.2	<0.20	<0.2	<0.2
(Mainstem)	09-24-91	1330	--	--	< .2	--	< .2	< .2	< .20	< .2	< .2
	09-24-91	1635	--	--	< .2	--	< .2	< .2	< .20	< .2	< .2
	09-24-91	1655	--	--	< .2	--	< .2	< .2	< .20	< .2	< .2
	07-18-92	1845	<20	<20	< .2	<0.2	< .2	< .2	< .20	< .2	< .2
	07-20-92	1720	<20	<20	< .2	< .2	< .2	< .2	< .20	< .2	< .2
	07-20-92	1725	<20	<20	< .2	< .2	< .2	< .2	< .20	< .2	< .2
	08-03-92	1412	<20	<20	< .2	< .2	< .2	< .2	< .20	< .2	< .2
021107385	09-20-91	0305	--	--	< .2	--	< .2	< .2	< .20	< .2	.6
(KOA)	09-24-91	1330	--	--	< .2	--	< .2	< .2	.20	< .2	.4
	09-24-91	1640	--	--	< .2	--	< .2	< .2	< .20	< .2	.5
	09-24-91	1715	--	--	< .2	--	< .2	< .2	< .20	< .2	.3
	09-24-91	1805	--	--	< .2	--	< .2	< .2	< .20	< .2	.2
	07-18-92	1830	<20	<20	< .2	< .2	< .2	< .2	.20	< .2	.5
	07-20-92	1840	<20	<20	< .2	< .2	< .2	< .2	< .20	< .2	< .2
	08-03-92	1430	<20	<20	< .2	< .2	< .2	< .2	< .20	< .2	.4
021107388	09-24-91	1315	--	--	.6	--	< .2	< .2	< .20	< .2	< .2
(Swash)	09-24-91	2104	--	--	< .2	--	< .2	< .2	< .20	< .2	< .2
	09-24-91	2154	--	--	< .2	--	< .2	< .2	< .20	< .2	< .2

Appendix 4 Results of volatile organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S C , September 1991 through August 1992--Continued

[All concentrations in micrograms per liter except where indicated; ft^3/s, cubic feet per second; rec, recovered; <, less than; --, no data]

Station number	Date	Time (hours)	Chloroform, total [1](32106)	cis-1,2-Dichloroethene, total [1](77093)	cis-1,3-Dichloropropene, total [1](34704)	Dibromochloropropane, total rec [1](82625)	Dibromomethane, total rec [1](30217)	Dichlorobromomethane, total [1](32101)	Dichlorodifluoromethane, total [1](34668)	Ethylbenzene, total [1](34371)	Hexachlorobutadiene, total [1](39702)
021107380	09-20-91	0300	<0.2	--	<0.2	--	--	<0.2	<0.2	<0.2	<5.0
(Mainstem)	09-24-91	1330	< .2	--	< .2	--	--	< .2	< .2	< .2	<5.0
	09-24-91	1635	< .2	--	< .2	--	--	< .2	< .2	< .2	<5.0
	09-24-91	1655	< .2	--	< .2	--	--	< .2	< .2	< .2	<5.0
	07-18-92	1845	.2	0.9	< .2	<1.0	<0.2	< .2	< .2	< .2	<0.2
	07-20-92	1720	.3	.9	< .2	<1.0	< .2	< .2	< .2	< .2	< .2
	07-20-92	1725	.3	.8	< .2	<1.0	< .2	< .2	< .2	< .2	< .2
	08-03-92	1412	< .2	< .2	< .2	<1.0	< .2	< .2	< .2	< .2	< .2
021107385	09-20-91	0305	.8	--	< .2	--	--	< .2	< .2	< .2	<5.0
(KOA)	09-24-91	1330	1.0	--	< .2	--	--	< .2	< .2	< .2	<5.0
	09-24-91	1640	1.0	--	< .2	--	--	< .2	< .2	.2	<5.0
	09-24-91	1715	.4	--	< .2	--	--	< .2	< .2	< .2	<5.0
	09-24-91	1805	< .2	--	< .2	--	--	< .2	< .2	< .2	<5.0
	07-18-92	1830	.6	14	< .2	<1.0	< .2	< .2	< .2	< .2	< .2
	07-20-92	1840	.6	5.8	< .2	<1.0	< .2	< .2	< .2	< .2	< .2
	08-03-92	1430	.6	4.7	< .2	<1.0	< .2	< .2	< .2	< .2	< .2
021107388	09-24-91	1315	< .2	--	< .2	--	--	< .2	< .2	< .2	<5.0
(Swash)	09-24-91	2104	< .2	--	< .2	--	--	< .2	< .2	< .2	<5.0
	09-24-91	2154	< .2	--	< .2	--	--	< .2	< .2	< .2	<5.0

Appendix 4.- Results of volatile organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[All concentrations in micrograms per liter except where indicated; ft^3/s, cubic feet per second; rec, recovered; <, less than; --, no data]

Station number	Date	Time (hours)	Isopropyl-benzene, total rec [1](77223)	Methyl bromide, total [1](34413)	Methyl chloride, total [1](34418)	Methylene chloride, total [1](34423)	n-Butylbenzene, total rec [1](77342)	n-Propylbenzene, total rec [1](77224)	Naphthalene, total [1](34696)	p-Isopropyl-toluene, total rec [1](77356)	sec-Butyl-benzene, total rec [1](77350)
021107380	09-20-91	0300	--	<0.2	<0.2	<0.2	--	--	<5.0	--	--
(Mainstem)	09-24-91	1330	--	< .2	< .2	< .2	--	--	<5.0	--	--
	09-24-91	1635	--	< .2	< .2	< .2	--	--	<5.0	--	--
	09-24-91	1655	--	< .2	< .2	< .2	--	--	<5.0	--	--
	07-18-92	1845	<0.20	< .2	< .2	< .2	<0.20	<0.20	<0.2	<0.20	<0.20
	07-20-92	1720	< .20	< .2	< .2	< .2	< .20	< .20	< .2	< .20	< .20
	07-20-92	1725	< .20	< .2	< .2	< .2	< .20	< .20	< .2	< .20	< .20
	08-03-92	1412	< .20	< .2	< .2	< .2	< .20	< .20	< .2	< .20	< .20
021107385	09-20-91	0305	--	< .2	< .2	< .2	--	--	<5.0	--	--
(KOA)	09-24-91	1330	--	< .2	< .2	< .2	--	--	<5.0	--	--
	09-24-91	1640	--	< .2	< .2	.8	--	--	<5.0	--	--
	09-24-91	1715	--	< 2	< .2	.3	--	--	<5.0	--	--
	09-24-91	1805	--	< .2	< .2	.2	--	--	<5.0	--	--
	07-18-92	1830	< .20	< .2	< .2	< .2	< .20	< .20	< .2	.30	< .20
	07-20-92	1840	< .20	< .2	< .2	< .2	< .20	< .20	< .2	< .20	< .20
	08-03-92	1430	< .20	< .2	< .2	< .2	< .20	< .20	< .2	< .20	< .20
021107388	09-24-91	1315	--	< .2	< .2	< .2	--	--	<5.0	--	--
(Swash)	09-24-91	2104	--	< .2	< .2	< .2	--	--	<5.0	--	--
	09-24-91	2154	--	< .2	< .2	< .2	--	--	<5.0	--	--

Appendix 4.--Results of volatile organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[All concentrations in micrograms per liter except where indicated; ft^3/s, cubic feet per second; rec, recovered; <, less than; --, no data]

Station number	Date	Time (hours)	Styrene, total [1](77128)	tert-Butyl-benzene, total rec [1](77353)	Tetrachloro-ethylene, total [1](34475)	Toluene, total [1](34010)	trans-1,3-Di-chloropropene, total [1](34699)	Trichloro-ethylene, total [1](39180)	Trichloro-fluoromethane, total [1](34488)	Vinyl chloride, total [1](39175)	Xylene, total rec [1](81551)
021107380	09-20-91	0300	<0.2	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
(Mainstem)	09-24-91	1330	< .2	--	< .2	< .2	< .2	< .2	< .2	< .2	< .20
	09-24-91	1635	< .2	--	< .2	< .2	< .2	< .2	< .2	< .2	< .20
	09-24-91	1655	< .2	--	< .2	< .2	< .2	< .2	< .2	< .2	< .20
	07-18-92	1845	< .2	<0.20	< .2	< .2	< .2	< .2	< .2	.2	< .20
	07-20-92	1720	< .2	< .20	< .2	< .2	< .2	< .2	< .2	.2	< .20
	07-20-92	1725	< .2	< .20	< .2	< .2	< .2	< .2	< .2	.2	< .20
	08-03-92	1412	< .2	< .20	< .2	< .2	< .2	< .2	< .2	< .2	< .20
021107385	09-20-91	0305	< .2	--	< .2	.2	< .2	5.2	< .2	.3	< .20
(KOA)	09-24-91	1330	< .2	--	< .2	< .2	< .2	12	< .2	.5	< .20
	09-24-91	1640	< .2	--	< .2	.8	< .2	15	< .2	1.0	.50
	09-24-91	1715	< .2	--	< .2	.3	< .2	8.8	< .2	.2	.20
	09-24-91	1805	< .2	--	< .2	< .2	< .2	5.4	< .2	< .2	< .20
	07-18-92	1830	< .2	< .20	< .2	.9	< .2	10	< .2	1.2	< .20
	07-20-92	1840	< .2	< .20	< .2	.4	< .2	6.5	< .2	< .2	< .20
	08-03-92	1430	< .2	< .20	< .2	.3	< .2	48	< .2	.3	.20
021107388	09-24-91	1315	< .2	--	.2	< .2	< .2	2.4	< .2	< .2	< .20
(Swash)	09-24-91	2104	< .2	--	.3	< .2	< .2	1.2	< .2	< .2	< .20
	09-24-91	2154	< .2	--	.2	< .2	< .2	2.6	< .2	< .2	< .20

[1]Parameter code, National Water Data Storage and Retrieval System of the U.S. Geological Survey.

APPENDIX 5

Results of acid- and base/neutral-extractable organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

Appendix 5.--Results of acid- and base/neutral-extractable organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

[ft^3/s, cubic feet per second; rec, recovered; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than; --, no data]

Station number	Date	Time (hours)	Discharge, instantaneous (ft^3/s) [1](00061)	Oil and grease, total rec (mg/L) [1](00556)	1,2,5,6-Dibenz-anthracene, total (µg/L) [1](34556)	1,2-Diphenyl-hydrazine, total rec (µg/L) [1](82626)	2,4,6-Tri-chlorophenol, total (µg/L) [1](34621)	2,4-Di-chlorophenol, total (µg/L) [1](34601)	2,4-Di-methylphenol, total (µg/L) [1](34606)	2,4-Di-nitrophenol, total (µg/L) [1](34616)	2,4-Dinitro-toluene, total (µg/L) [1](34611)
021107380	09-20-91	0300	1.1	1	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0
(Mainstem)	09-24-91	1330	.60	<1	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0
	09-24-91	1635	17	3	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0
	09-24-91	1655	11	3	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0
	07-18-92	1845	.60	<1	--	--	--	--	--	--	--
	07-20-92	1720	1.3	<1	--	--	--	--	--	--	--
	07-20-92	1725	1.8	<1	--	--	--	--	--	--	--
	08-03-92	1412	10	1	--	--	--	--	--	--	--
021107385	09-20-91	0305	2.1	1	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0
(KOA)	09-24-91	1330	1.5	2	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0
	09-24-91	1640	5.2	2	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0
	09-24-91	1715	5.3	2	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0
	09-24-91	1805	3.2	1	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0
	07-18-92	1830	1.6	<1	--	--	--	--	--	--	--
	07-20-92	1840	2.5	<1	--	--	--	--	--	--	--
	08-03-92	1430	17	1	--	--	--	--	--	--	--
021107388	09-24-91	1315	--	1	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0
(Swash)	09-24-91	2104	--	<1	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0
	09-24-91	2154	--	1	<10.0	<5.0	<20.0	<5.0	<5.0	<20.0	<5.0

Appendix 5.--Results of acid- and base/neutral-extractable organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; rec, recovered; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than; --, no data]

Station number	Date	Time (hours)	2,6-Dinitro-toluene, total (µg/L) [1](34626)	2-Chloro-naphtalene, total (µg/L) [1](34581)	2-Chloro-phenol, total (µg/L) [1](34586)	2-Nitro-phenol, total (µg/L) [1](34591)	3,3'-Dichloro-benzidine, total (µg/L) [1](34631)	4,6-Dinitro-orthocresol, total (µg/L) [1](34657)	4-Bromophenyl phenyl ether, total (µg/L) [1](34636)	4-Chlorophenyl phenyl ether, total (µg/L) [1](34641)	4-Nitro-phenol, total (µg/L) [1](34646)	Acenaphthene, total (µg/L) [1](34205)
021107380	09-20-91	0300	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0
(Mainstem)	09-24-91	1330	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0
	09-24-91	1635	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0
	09-24-91	1655	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0
	07-18-92	1845	--	--	--	--	--	--	--	--	--	--
	07-20-92	1720	--	--	--	--	--	--	--	--	--	--
	07-20-92	1725	--	--	--	--	--	--	--	--	--	--
	08-03-92	1412	--	--	--	--	--	--	--	--	--	--
021107385	09-20-91	0305	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0
(KOA)	09-24-91	1330	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0
	09-24-91	1640	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0
	09-24-91	1715	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0
	09-24-91	1805	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0
	07-18-92	1830	--	--	--	--	--	--	--	--	--	--
	07-20-92	1840	--	--	--	--	--	--	--	--	--	--
	08-03-92	1430	--	--	--	--	--	--	--	--	--	--
021107388	09-24-91	1315	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0
(Swash)	09-24-91	2104	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0
	09-24-91	2154	<5.0	<5.0	<5.0	<5.0	<20.0	<30.0	<5.0	<5.0	<30.0	<5.0

Appendix 5.--Results of acid- and base/neutral-extractable organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; rec, recovered; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than; --, no data]

Station number	Date	Time (hours)	Acenaphthylene, total (µg/L) [1](34200)	Anthracene, total (µg/L) [1](34220)	Benzidine, total (µg/L) [1](39120)	Benzo(a)-pyrene, total (µg/L) [1](34247)	Benzo(b)-fluoranthene, total (µg/L) [1](34230)	Benzo(k)-fluoranthene, total (µg/L) [1](34242)	Benzo(a)-anthracene, total (µg/L) [1](34526)	Benzo(ghi)-perylene, total (µg/L) [1](34521)	bis(2-Chloro-ethoxy)-methane, total (µg/L) [1](34278)	bis(2-Chloroethyl) ether, total (µg/L) [1](34273)
021107380	09-20-91	0300	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0
(Mainstem)	09-24-91	1330	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0
	09-24-91	1635	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0
	09-24-91	1655	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0
	07-18-92	1845	--	--	--	--	--	--	--	--	--	--
	07-20-92	1720	--	--	--	--	--	--	--	--	--	--
	07-20-92	1725	--	--	--	--	--	--	--	--	--	--
	08-03-92	1412	-	--	--	--	--	--	--	--	--	--
021107385	09-20-91	0305	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0
(KOA)	09-24-91	1330	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0
	09-24-91	1640	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0
	09-24-91	1715	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0
	09-24-91	1805	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0
	07-18-92	1830	--	--	--	--	--	--	--	--	--	--
	07-20-92	1840	--	--	--	--	--	--	--	--	--	--
	08-03-92	1430	--	--	--	--	--	--	--	--	--	--
021107388	09-24-91	1315	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0
(Swash)	09-24-91	2104	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0
	09-24-91	2154	<5.0	<5.0	<40.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0

Appendix 5.--Results of acid- and base/neutral-extractable organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; rec, recovered; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than; --, no data]

Station number	Date	Time (hours)	bis(2-Chloro-isopropyl) ether, total (µg/L) [1](34283)	bis(2-Ethylhexyl)-phthalate, total (µg/L) [1](39100)	n-Butylbenzyl-phthalate, total (µg/L) [1](34292)	Parachlora-metacresol, total (µg/L) [1](34452)	Chrysene, total (µg/L) [1](34320)	Di-n-butyl phthalate, total (µg/L) [1](39110)	Di-n-octyl phthalate, total (µg/L) [1](34596)	Diethyl phthalate, total (µg/L) [1](34336)	Dimethyl phthalate, total (µg/L) [1](34341)
021107380	09-20-91	0300	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
(Mainstem)	09-24-91	1330	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	1635	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	1655	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
	07-18-92	1845	--	--	--	--	--	--	--	--	--
	07-20-92	1720	--	--	--	--	--	--	--	--	--
	07-20-92	1725	--	--	--	--	--	--	--	--	--
	08-03-92	1412	--	--	--	--	--	--	--	--	--
021107385	09-20-91	0305	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
(KOA)	09-24-91	1330	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	1640	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	1715	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	1805	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
	07-18-92	1830	--	--	--	--	--	--	--	--	--
	07-20-92	1840	--	--	--	--	--	--	--	--	--
	08-03-92	1430	--	--	--	--	--	--	--	--	--
021107388	09-24-91	1315	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
(Swash)	09-24-91	2104	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	2154	<5.0	<5.0	<5.0	<30.0	<10.0	<5.0	<10.0	<5.0	<5.0

Appendix 5.--Results of acid- and base/neutral-extractable organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; rec, recovered; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than; --, no data]

Station number	Date	Time (hours)	Fluoranthene, total (µg/L) [1](34376)	Fluorene, total (µg/L) [1](34381)	Hexachloro-benzene, total (µg/L) [1](39700)	Hexachloro-butadiene, total (µg/L) [1](39702)	Hexachlorocyclo-pentadiene, total (µg/L) [1](34386)	Hexachloro-ethane, total (µg/L) [1](34396)	Indeno-(1,2,3-c,d)-pyrene, total (µg/L) [1](34403)	Isophorone, total (µg/L) [1](34408)	n-Nitrosodi-propylamine, total (µg/L) [1](34428)
021107380	09-20-91	0300	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0
(Mainstem)	09-24-91	1330	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	1635	7.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	1655	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0
	07-18-92	1845	--	--	--	--	--	--	--	--	--
	07-20-92	1720	--	--	--	--	--	--	--	--	--
	07-20-92	1725	--	--	--	--	--	--	--	--	--
	08-03-92	1412	--	--	--	--	--	--	--	--	--
021107385	09-20-91	0305	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0
(KOA)	09-24-91	1330	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	1640	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	1715	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	1805	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0
	07-18-92	1830	--	--	--	--	--	--	--	--	--
	07-20-92	1840	--	--	--	--	--	--	--	--	--
	08-03-92	1430	--	--	--	--	--	--	--	--	--
021107388	09-24-91	1315	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0
(Swash)	09-24-91	2104	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0
	09-24-91	2154	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<5.0

Appendix 5.--Results of acid- and base/neutral-extractable organic compound analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; rec, recovered; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than; --, no data]

Station number	Date	Time (hours)	n-Nitrosodi-methylamine, total (µg/L) [1](34438)	n-Nitrosodi-phenylamine, total (µg/L) [1](34433)	Naphthalene, total (µg/L) [1](34696)	Nitrobenzene, total (µg/L) [1](34447)	Pentachloro-phenol, total (µg/L) [1](39032)	Phenanthrene, total (µg/L) [1](34461)	Phenol (C_6H_5-OH), total (µg/L) [1](34694)	Phenols, total (µg/L) [1](32730)	Pyrene, total (µg/L) [1](34469)
021107380	09-20-91	0300	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	2	<5.0
(Mainstem)	09-24-91	1330	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	1	<5.0
	09-24-91	1635	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	3	<5.0
	09-24-91	1655	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	3	<5.0
	07-18-92	1845	--	--	--	--	--	--	--	--	--
	07-20-92	1720	--	--	--	--	--	--	--	--	--
	07-20-92	1725	--	--	--	--	--	--	--	--	--
	08-03-92	1412	--	--	--	--	--	--	--	--	--
021107385	09-20-91	0305	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	3	<5.0
(KOA)	09-24-91	1330	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	1	<5.0
	09-24-91	1640	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	3	<5.0
	09-24-91	1715	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	3	<5.0
	09-24-91	1805	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	1	<5.0
	07-18-92	1830	--	--	--	--	--	--	--	--	--
	07-20-92	1840	--	--	--	--	--	--	--	--	--
	08-03-92	1430	--	--	--	--	--	--	--	--	--
021107388	09-24-91	1315	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	1	<5.0
(Swash)	09-24-91	2104	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	1	<5.0
	09-24-91	2154	<5.0	<5.0	<5.0	<5.0	<30.0	<5.0	<5.0	1	<5.0

[1]Parameter code, National Water Data Storage and Retrieval System of the U.S. Geological Survey.

APPENDIX 6

Results of selected pesticide analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

Appendix 6 --Results of selected pesticide analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992

[ft^3/s, cubic feet per second; µg/L, micrograms per liter; rec, recovered; DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane; PCB, polychlorinated biphenyls; <, less than; --, no data]

Station number	Date	Time (hours)	Discharge, instantaneous (ft^3/s) [1](00061)	Aldrin, total (µg/L) [1](39330)	alpha-Benzene hexachloride, total (µg/L) [1](39337)	beta-Benzene hexachloride, total (µg/L) [1](39338)	delta-Benzene hexachloride, total (µg/L) [1](34259)	Chlordane, total (µg/L) [1](39350)	trans-Chlordane, total (µg/L) [1](39065)	cis-Chlordane, total (µg/L) [1](39062)	DDD, total (µg/L) [1](39360)
021107380	09-20-91	0300	1.1	<0.010	--	--	--	<0.1	--	--	<0.010
(Mainstem)	09-24-91	1330	.60	< .010	--	--	--	< .1	--	--	< .010
	09-24-91	1635	17	< .010	--	--	--	.3	--	--	.030
	09-24-91	1655	11	< .010	--	--	--	.1	--	--	.010
	07-20-92	1720	1.3	< .040	<0.03	<0.03	<0.09	< .1	<0.10	<0.10	--
	07-20-92	1725	1.8	< .040	< .03	< .03	< .09	< .1	< .10	< .10	--
	08-03-92	1412	10	< .040	< .03	< .03	< .09	.2	< .10	< .10	--
021107385	09-20-91	0305	2.1	< .010	--	--	--	< .1	--	--	< .010
(KOA)	09-24-91	1330	1.5	< .010	--	--	--	< .1	--	--	< .010
	09-24-91	1640	5.2	< .010	--	--	--	< .1	--	--	< .010
	09-24-91	1715	5.3	< .010	--	--	--	< .1	--	--	< .010
	09-24-91	1805	3.2	< .010	--	--	--	< .1	--	--	< .010
	07-20-92	1840	2.5	< .040	< .03	< .03	< .09	< .1	< .10	< .10	--
	08-03-92	1430	17	< .040	< .03	< .03	< .09	< .1	< .10	< .10	--
021107388	09-24-91	1315	--	< .010	--	--	--	< .1	--	--	< .010
(Swash)	09-24-91	2104	--	< .010	--	--	--	< .1	--	--	< .010
	09-24-91	2154	--	< .010	--	--	--	< .1	--	--	< .010

Appendix 6.--Results of selected pesticide analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; µg/L, micrograms per liter; rec, recovered; DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane; PCB, polychlorinated biphenyls; <, less than; --, no data]

Station number	Date	Time (hours)	p,p'-DDD, total (µg/L) [1](39310)	DDE, total (µg/L) [1](39365)	p,p'-DDE, total (µg/L) [1](39320)	DDT, total (µg/L) [1](39370)	p,p'-DDT, total (µg/L) [1](39300)	Dieldrin, total (µg/L) [1](39380)	Endosulfan, total (µg/L) [1](39388)	Endosulfan, alpha, total rec (µg/L) [1](34361)	Endosulfan, beta, total (µg/L) [1](34356)	Endosulfan, sulfate, total (µg/L) [1](34351)
021107380	09-20-91	0300	--	<0.010	--	<0.010	--	<0.010	<0.010	--	--	--
(Mainstem)	09-24-91	1330	--	< .010	--	< .010	--	< .010	< .010	--	--	--
	09-24-91	1635	--	.020	--	.030	--	.010	< .010	--	--	--
	09-24-91	1655	--	.010	--	< .010	--	.010	< .010	--	--	--
	07-20-92	1720	<0.10	--	<0.04	--	<0.10	< .020	--	<0.10	<0.04	<0.60
	07-20-92	1725	< .10	--	< .04	--	< .10	< .020	--	< .10	< .04	< .60
	08-03-92	1412	< .10	--	< .04	--	< .10	< .020	--	< .10	< .04	< .60
021107385	09-20-91	0305	--	< .010	--	< .010	--	< .010	< .010	--	--	--
(KOA)	09-24-91	1330	--	< .010	--	< .010	--	< .010	< .010	--	--	--
	09-24-91	1640	--	< .010	--	< .010	--	< .010	< .010	--	--	--
	09-24-91	1715	--	< .010	--	< .010	--	< .010	< .010	--	--	--
	09-24-91	1805	--	< .010	--	< .010	--	< .010	< .010	--	--	--
	07-20-92	1840	< .10	--	< .04	--	< .10	< .020	--	< .10	< .04	< .60
	08-03-92	1430	< .10	--	< .04	--	< .10	< .020	--	< .10	< .04	< .60
021107388	09-24-91	1315	--	< .010	--	< .010	--	< .010	< .010	--	--	--
(Swash)	09-24-91	2104	--	< .010	--	< .010	--	< .010	< .010	--	--	--
	09-24-91	2154	--	< .010	--	< .010	--	< .010	< .010	--	--	--

Appendix 6.--Results of selected pesticide analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; µg/L, micrograms per liter; rec, recovered; DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane; PCB, polychlorinated biphenyls; <, less than; --, no data]

Station number	Date	Time (hours)	Endrin, total rec (µg/L) [1](39390)	Endrin aldehyde, total (µg/L) [1](34366)	Heptachlor, total (µg/L) [1](39410)	Heptachlor epoxide, total (µg/L) [1](39420)	Lindane, total (µg/L) [1](39340)	Methoxychlor, total (µg/L) [1](39480)	Mirex, total (µg/L) [1](39755)	Perthane, total (µg/L) [1](39034)	Toxaphene, total (µg/L) [1](39400)
021107380	09-20-91	0300	<0.010	--	<0.010	<0.010	<0.010	<0.01	<0.01	<0.1	<1
(Mainstem)	09-24-91	1330	< .010	--	< .010	< .010	< .010	< .01	< .01	< .1	<1
	09-24-91	1635	< .010	--	< .010	< .010	< .010	< .01	< .01	< .1	<1
	09 24-91	1655	< .010	--	< .010	< .010	< .010	< .01	< .01	< .1	<1
	07 20-92	1720	< .060	<0.20	< .030	< .80	< .030	--	--	--	<2
	07-20-92	1725	< .060	< .20	< .030	< .80	< .030	--	--	--	<2
	08-03-92	1412	< .060	< .20	< .030	< .80	< .030	--	--	--	<2
021107385	09-20-91	0305	< .010	--	< .010	< .010	< .010	< .01	< .01	< .1	<1
(KOA)	09-24-91	1330	< .010	--	< .010	< .010	< .010	< .01	< .01	< .1	<1
	09-24-91	1640	< .010	--	< .010	< .010	< .010	< .01	< .01	< .1	<1
	09-24-91	1715	< .010	--	< .010	< .010	< .010	< .01	< .01	< .1	<1
	09-24-91	1805	< .010	--	< .010	< .010	< .010	< .01	< .01	< .1	<1
	07-20-92	1840	< .060	< .20	< .030	< .80	< .030	--	--	--	<2
	08-03-92	1430	< .060	< .20	< .030	< .80	< .030	--	--	--	<2
021107388	09-24-91	1315	< .010	--	< .010	< .010	< .010	< .01	< .01	< .1	<1
(Swash)	09-24-91	2104	< .010	--	< .010	< .010	< .010	< .01	< .01	< .1	<1
	09-24-91	2154	< .010	--	< .010	< .010	< .010	< .01	< .01	< .1	<1

Appendix 6.--Results of selected pesticide analyses of water samples collected at three gaging stations in the Withers Swash Basin, Myrtle Beach, S.C., September 1991 through August 1992--Continued

[ft^3/s, cubic feet per second; µg/L, micrograms per liter; rec, recovered; DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane; PCB, polychlorinated biphenyls; <, less than; --, no data]

Station number	Date	Time (hours)	PCB, total (µg/L) [1](39516)	Aroclor 1016 PCB, total (µg/L) [1](34671)	Aroclor 1221 PCB, total (µg/L) [1](39488)	Aroclor 1232 PCB, total (µg/L) [1](39492)	Aroclor 1242 PCB, total (µg/L) [1](39496)	Aroclor 1248 PCB, total (µg/L) [1](39500)	Aroclor 1254 PCB, total (µg/L) [1](39504)	Aroclor 1260 PCB, total (µg/L) [1](39508)	Polychlorinated naphthalenes, total (µg/L) [1](39250)
021107380	09-20-91	0300	<0.1	--	--	--	--	--	--	--	<0.10
(Mainstem)	09-24-91	1330	< .1	--	--	--	--	--	--	--	< .10
	09-24-91	1635	< .1	--	--	--	--	--	--	--	< .10
	09-24-91	1655	< .1	--	--	--	--	--	--	--	< .10
	07-20-92	1720	--	<0.1	<1.0	<0.1	<0.1	<0.1	<0.1	<0.1	--
	07-20-92	1725	--	< .1	<1.0	< .1	< .1	< .1	< .1	< .1	--
	08-03-92	1412	--	< .1	<1.0	< .1	< .1	< .1	< .1	< .1	--
021107385	09-20-91	0305	< .1	--	--	--	--	--	--	--	< .10
(KOA)	09-24-91	1330	< .1	--	--	--	--	--	--	--	< .10
	09-24-91	1640	< .1	--	--	--	--	--	--	--	< .10
	09-24-91	1715	< .1	--	--	--	--	--	--	--	< .10
	09-24-91	1805	< .1	--	--	--	--	--	--	--	< .10
	07-20-92	1840	--	< .1	<1.0	< .1	< .1	< .1	< .1	< .1	--
	08-03-92	1430	--	< .1	<1.0	< .1	< .1	< .1	< .1	< .1	--
021107388	09-24-91	1315	< .1	--	--	--	--	--	--	--	< .10
(Swash)	09-24-91	2104	< .1	--	--	--	--	--	--	--	< .10
	09-24-91	2154	< .1	--	--	--	--	--	--	--	< .10

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