SUMMARY OF HYDROLOGIC CONDITIONS IN THE REEDY CREEK IMPROVEMENT DISTRICT, CENTRAL FLORIDA

By Edward R. German

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report [redacted]

84-4250

Prepared in cooperation with the

REEDY CREEK IMPROVEMENT DISTRICT

Tallahassee, Florida

1986

UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information
write to:

District Chief
U.S. Geological Survey
Suite 3015
227 North Bronough Street
Tallahassee, Florida 32301

Copies of this report can
be purchased from:

Open-File Services Section
Western Distribution Branch
U.S. Geological Survey
Box 25425, Federal Center
Denver, Colorado 80225
(Telephone: (303) 236-7476)

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS--Continued

Page

TABLES

SUMMARY OF HYDROLOGIC CONDITIONS IN THE REEDY CREEK IMPROVEMENT DISTRICT, CENTRAL FLORIDA

By Edward R. German

ABSTRACT

The Reedy Creek Improvement District is an area of about 43 square miles in southwestern Orange and northwestern Osceola Counties. A systematic program of water resources monitoring in Reedy Creek Improvement Disrict and vicinity provided data for assessing the hydrologic effects of the development of the Walt Disney World Theme Park and adjacent urbanization. Data collected include stream discharge, water quality, ground-water levels, lake levels, and climate.

The Reedy Creek Improvement District is an area of about 43 square miles in southwestern Orange and northwestern Osceola Counties. A systematic program of water resources monitoring in Reedy Creek Improvement District and vicinity provided data for assessing the hydrologic effects of the development of the Walt Disney World Theme Park and adjacent urbanization. Data collected include stream discharge, water quality, ground-water levels, lake levels, and climate.

Rainfall has been less than the long-term average in the Reedy Creek Improvement District area since development began in 1968. Mean annual rainfall for the period 1931-66 was 52.42 inches, based on records for nearby Kissimmee and Isleworth, Florida. At the end of September 1980, the accumulated rainfall deficit from the long-term mean since 1966 was nearly 95 inches in the Reedy Creek Improvement District. The deficient rainfall has reduced stream discharge, lowered ground-water and lake levels, and possibly affected water quality in the area.

The annual discharge of Reedy Creek near Loughman, Florida, was lower from 1970 through 1980 than from 1940 through 1959 (discharge was not recorded from 1960 through 1968) based on analysis of double-mass plots of annual discharge and rainfall. Also, periods of no-flow occurred frequently from 1970 through 1980, and never occurred from 1940 through 1959. This reduction in discharge may be related to basin alterations within the Reedy Creek Improvement District.

Ground-water levels and lake levels have declined since 1970, due to lack of rainfall and possibly to ground-water pumping. However, the coincidence of below-average rainfall with the period of development makes it impossible to assess the effect of pumping on declines.

Dissolved oxygen and pH in surface waters were frequently lower than Florida Department of Environmental Regulation criteria. The low dissolved oxygen and pH are characteristic of water in swampy areas and water retained by control structures, due to the long contact time of water with vegetative debris.

Concentrations of toxic metals, including mercury, zinc, cadmium, copper, silver, iron, and lead, periodically exceeded Florida Department of Environmental Regulation water-quality criteria, but their pattern of occurrence probably is not related to urban development. Concentrations of mercury, zinc, and cadmium exceeded criteria at five or more sites, and may be of atmospheric origin.

Distribution of organic compounds in water, principally insecticides and herbicides, appears to relate to urban development. Streams in undeveloped areas within and outside the Reedy Creek Improvement District had the lowest frequency of organic compound detection, and streams, canals, or lakes near, or receiving runoff from, resort areas had the highest frequency of detection. Malathion, 2,4-D, and silvex were frequently present in waters near resort areas.

Specific conductance, phosphorus, and nitrate concentrations have increased in Reedy Creek since 1970, probably due to disposal of treated wastes.

An estimated balance of dissolved solids, nitrogen, and phosphorus loads entering and leaving an undeveloped area in the southern part of the Reedy Creek Improvement District indicated that bulk precipitation may have supplied 45 percent of the nitrogen and 26 percent of the phosphorus load each year during water years (October through September) 1979 and 1980. Treated wastes from the Reedy Creek Improvement District facility contributed more than half of the phosphorus input. About 18 percent of the dissolved solids, 45 percent of the nitrogen, and 59 percent of the phosphorus input were apparently retained or assimilated within the area.

INTRODUCTION

The Reedy Creek Improvement District (RCID) is an area of about 43 mi^2 in southwestern Orange and northwestern Osceola Counties (fig. 1). Construction of the Walt Disney World complex in the RCID and commercial facilities on adjacent land changed uninhabited swampland and scrubby flatland to urbanized recreational and commercial land. Increased demands on the water resources are commensurate with this growth, particularly since October 1971 when the Theme Park of the Walt Disney World complex opened.

Many of the activities in the RCID are water related. Bay Lake, a natural shallow depression that contains an island, was drained, cleared of organic bottom deposits, isolated by dikes from adjacent swamps, and refilled with water from the Floridan aquifer. Seven Seas Lagoon was excavated and connected to Bay Lake. Several water-course attractions were built in the Theme Park to complete the lake complex. The total area of Bay Lake, the lagoon, and the Theme Park water course is about 650 acres. Canals, levees, water-control structures, and culverts provide surface drainage. The constant-head structures in the canals and streams automatically maintain a predetermined upstream water level to keep lowlands from being inundated during storms and to curtail excessive drainage of the surficial aquifer during dry periods.

The level and clarity of water in the Theme Park water courses are maintained by water from wells that tap the Floridan aquifer. Excess water from the Theme Park water courses is used to maintain the levels of the lagoon and Bay Lake. Water from the Floridan aquifer is used to irrigate a golf course, lawns, and landscaped areas essential to maintain the esthetic value of 2,500 acres of recreational area. The Floridan aquifer also supplies water for the daily needs of employees, visitors, and residents.

Wastewater is treated within the RCID, and part of the effluent from the treatment plant is used to irrigate ornamental plant stocks. The remaining effluent is discharged through oxidation and infiltration ponds and through enclosed wetlands to Reedy Creek. Storm runoff from parking lots, roads, and other impervious areas collects in canals which are linked to Reedy Creek and Bonnet Creek.

Construction and operation of the Walt Disney World complex resulted in major alterations of natural drainage, a demand for potable water, and a source of waste products, all in an area of undeveloped wetlands. Potential problems associated with this development involved all parts of the hydrologic system.

In 1966, the U.S. Geological Survey began a cooperative program with RCID to monitor quantity and quality of surface water and ground water in the RCID vicinity. The purpose of this program was to study effects of development on the hydrology of the area, and to monitor hydrologic conditions over an extended period of time.

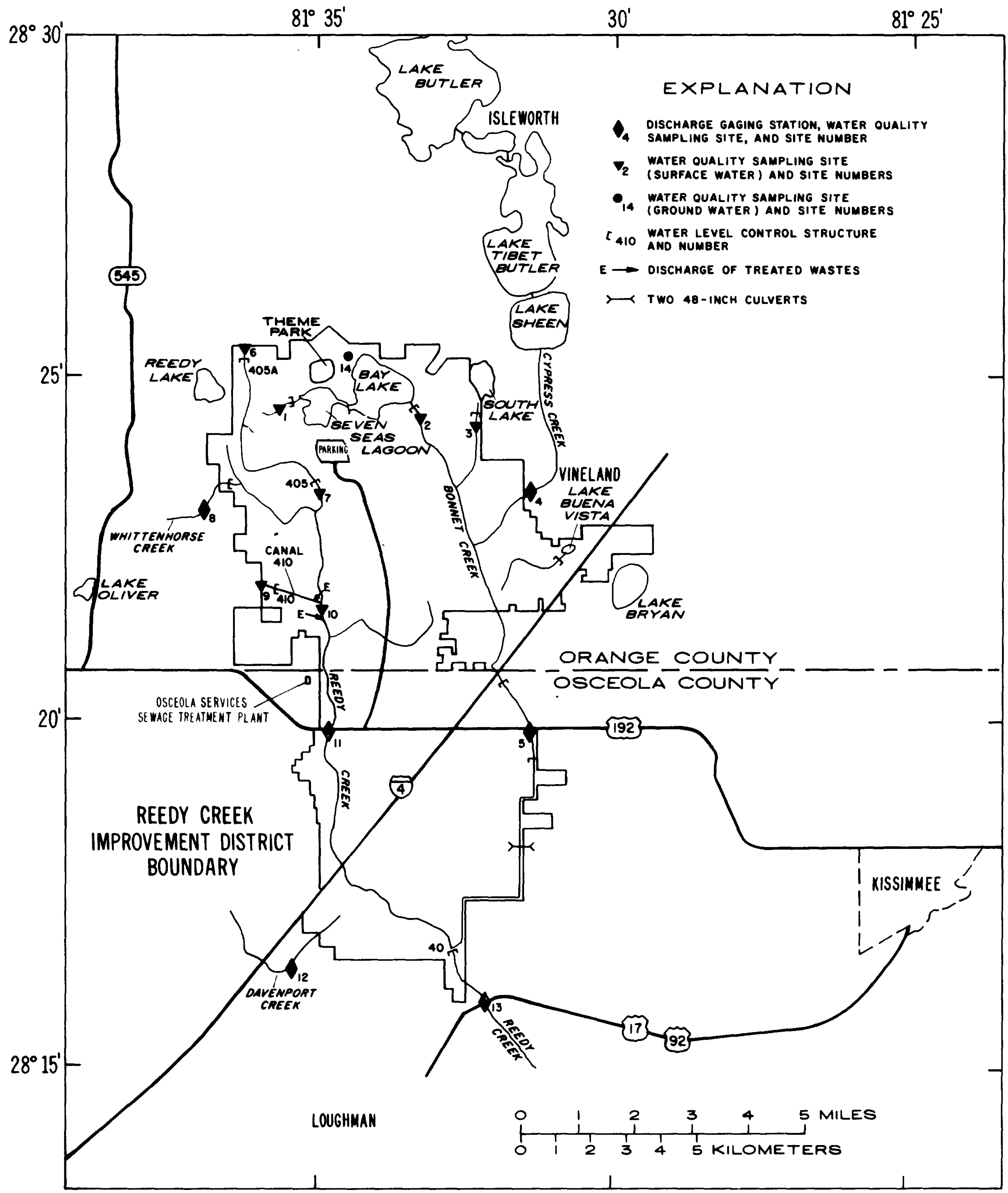


Figure 1.--Reedy Creek Improvement District and vicinity and location of discharge gaging stations and water-quality sampling sites.

Purpose and Scope

This report summarizes hydrologic conditions in the RCID from 1966 to September 1980. Some data extend to May 1981 to document any significant effects of a continuing drought. The following types of information are discussed:

1. Rainfall amount,
2. Stream discharges,
3. Lake levels,
4. Potentiometric surface in the Floridan aquifer, and
5. Surface-water quality.

Putnam (1975) described hydrologic conditions for 1966-73 and effects of development. This report updates that study using data obtained since 1973 but also includes new subject matter. Some data presented by Putnam, particularly ground-water quality, are not repeated here because no additional samples were collected.

Drainage Basin Features

The RCID is in the Reedy Creek drainage basin which is tributary to the Kissimmee River (beyond area shown in map) in the south. Major tributaries to Reedy Creek are Whittenhorse Creek, Davenport Creek, and Bonnet Creek. Cypress Creek is tributary to Bonnet Creek (fig. 1).

Drainage of the RCID is generally poor. Low undulating hills and flat, wide swampy valleys are characteristic features of the Reedy Creek basin. The many lakes and swamps retain large quantities of water. Heavy rainfall fills the surficial aquifer to land surface and water stands over a large part of the RCID. Because drainage in the swamps and marshlands is poorly developed, water remains in the basin for long periods before flowing to the creeks that drain to the south.

Lichtler and others (1968, p. 32) estimated that about 70 percent of the rainfall in Orange County returns to the atmosphere by evaporation and transpiration. These losses may be greater than 70 percent in the RCID because much of the land area is perennially wet. Parker and others, (1955, p. 513) state that "The atmosphere is by far the most effective agent of land drainage, disposing of several times as much as the waterway systems."

Drainage Basin Modifications

Since 1967, the drainage within the RCID has been altered. Canals, dikes, and automatic flow-control structures now replace the previous ill-defined swampy streams and valleys. The altered drainage system somewhat reduces detention and shortens the time that seasonal surface storage is high. However, the overall drainage is still characterized by relatively slow runoff rates and a high proportion of surface storage.

Ground water and surface water in the RCID are so closely associated that any change, whether natural or imposed by man, may affect the hydrologic system. Several alterations to the land surface topography by the development of Walt Disney World affect the water resources of the RCID.

Construction of buildings, streets, and other impervious surfaces prevents infiltration of rainfall into the ground and causes water to run off rapidly. A system of canals has been constructed to protect the RCID from floods with a recurrence interval of 50 years. This system consists of 44 miles of canals and 19 miles of dikes constructed in low-lying lands to control inflow from parts of the drainage basin upstream and outside the RCID. Dikes direct the inflow into the canals where gated structures or spillways control flow into the RCID. This drainage system was designed to protect lowlands from inundation during storms and to curtail excessive drainage of the shallow aquifer during dry periods. These facilities have provided adequate surface and subsurface drainage to thus far (1981) permit development of approximately 9,800 acres.

The modification of the 450-acre Bay Lake began in December 1968 with construction of a dike around the lake to prevent inflow of colored swamp water. The lake was then drained and kept dry until September 1970 by pumping seepage into Bonnet Creek through a gated spillway at the southeast part of the lake. While the bottom was dry, organic bottom sediments were removed to expose a relatively clean sand bottom. The 175-acre Seven Seas Lagoon was excavated southwest of Bay Lake and several water-course attractions in the Theme Park just north of the lagoon were also constructed. A gated outlet structure was installed at the northwestern part of the lagoon. From September 1970 through June 1971, the lake-lagoon complex was filled with water from wells in the Floridan aquifer. Since June 1971, the complex has been maintained at the design level of 94.5 feet.

The RCID pumps about 7 Mgal/d for use in the Walt Disney World Theme Park and other Walt Disney developments. Pumping is distributed among 11 wells positioned in the northern part of the RCID to control drawdown of the potentiometric surface in the immediate vicinity of the Theme Park. Some drawdown is desirable to prevent seepage of water into utility and Theme Park operational support facilities underlying the park, but excessive drawdown is undesirable because of the risk of land subsidence and sinkhole formation.

Wastewater

Wastewater receives primary and secondary treatment at the sewage treatment plant in the RCID. Disposal of effluent is accomplished in three different ways as follows:

1. Spray irrigation--a fixed irrigation system is utilized in production of ornamental plant stocks for landscaping in the Theme Park and on Walt Disney World property. An average of 0.371 Mgal/d of waste effluent was dispersed in this manner in 1978 (Harden, 1980).

2. Oxidation pond, infiltration pond--a 5.2-acre oxidation pond receives waste effluent from the treatment plant and discharges into a system of three 2-acre infiltration ponds. The infiltration ponds are underdrained by a circuit of pipe 150 feet from the infiltration pond perimeter which discharges into a 25-acre swampy area enclosed by a levee. Outflow from the swamp is over a weir into a swampy area adjacent to Reedy Creek. In 1978, an average of 0.716 Mgal/d of waste effluent was disposed of through this system (Harden, 1980).

3. Overland flow--effluent from the waste treatment plant is discharged into a 102-acre, enclosed swampy area, which overflows a weir into canal L-410 at the confluence of this canal with L-405 (fig. 1). An average of 2.078 078 Mgal/d of effluent were treated in this manner in 1978 (Harden, 1980).

Another wastewater treatment plant is located near Reedy Creek. This facility, the Osceola Services sewage treatment plant (fig. 1) serves commercial developments along Highway 192, west of Reedy Creek. In 1978, the plant capacity was 0.5 Mgal/d using percolation ponds to dispose of treated wastewater with no direct discharge to Reedy Creek. However, according to written communications in the files of the Florida Department of Environmental Regulation, overflows of raw or treated wastes occurred on a few occasions prior to 1979, and could have affected water quality in Reedy Creek. Also, seepage from the percolation ponds into the surficial aquifer and then into the creek could occur, though the amounts, quality, and effect of the seepage (if it occurs) have not been determined.

In 1981, the RCID area was in a state of additional extensive development. Construction of Walt Disney World's EPCOT (Experimental Prototype Community of Tomorrow) is a project of similar magnitude to the original development of the Theme Park and resort hotel areas. Additional waste-disposal and water-supply capacity is under construction. Outside the RCID, other tourist-related development is expected. These developments probably will greatly increase demands on the hydrologic system.

HYDROLOGIC CONDITIONS

Climate

Summary

Climatological conditions were monitored at a station on the north shore of Bay Lake.

Summaries of data on rainfall at this station are given in figure 2 for the period July 1966 through September 1980, and for air temperature and pan evaporation for the period October 1972 through September 1980.

Freezing or below freezing temperatures occurred during December, January, February, and March; the lowest temperature was 22°F. High temperatures of 100°F occurred during May and July. The median daily high temperatures show that temperatures above 70°F are common in the winter. Temperatures are consistently high from May through September--median daily high temperatures range from 89°F to 92°F for these months.

Pan evaporation is lowest in December and January and increases from these winter lows with the onset of warmer weather. Highest evaporation rates occur during the warmest months. July evaporation is generally lower than June and August evaporations, perhaps because of more cloud cover during July.

Monthly rainfall for July 1966 to September 1980 at Bay Lake ranged from 0.1 inch or less to 16.26 inches. The median monthly rainfalls show that the period May to September are generally the wettest months. About 66 percent of the yearly rainfall occurred from May through September. August was generally the wettest month and November the driest.

The cumulative distribution of daily rainfall plotted in figure 2 shows that most rain falls in relatively small amounts and that a few days had heavy rainfall. For example, 75 percent of the days with rainfall had 0.54 inch or less rainfall and 10 percent of the days had more than 1.18 inches. Maximum daily rainfall was 4.03 inches.

Trends

Variation in rainfall affects the entire hydrologic system and therefore affects streamflow, lake levels, ground-water levels, and water quality. It is necessary to consider variations in rainfall in assessing causes for variation in hydrologic conditions.

Long-term records of rainfall are available for two stations near the RCID. These two stations, both operated by NOAA (National Oceanic and Atmospheric Administration), are at Kissimmee (about 12 miles southeast of Bay Lake) and Isleworth (about 7 miles northeast of Bay Lake). Annual rainfall at these two stations from 1931 through 1980 (water years) is shown in figure 3. Rainfall at Bay Lake from 1967 through 1980 is also shown in figure 3. In order to compare rainfall during the period of RCID development and operation with long-term, pre-RCID rainfall, the mean annual rainfall for the period 1931 through

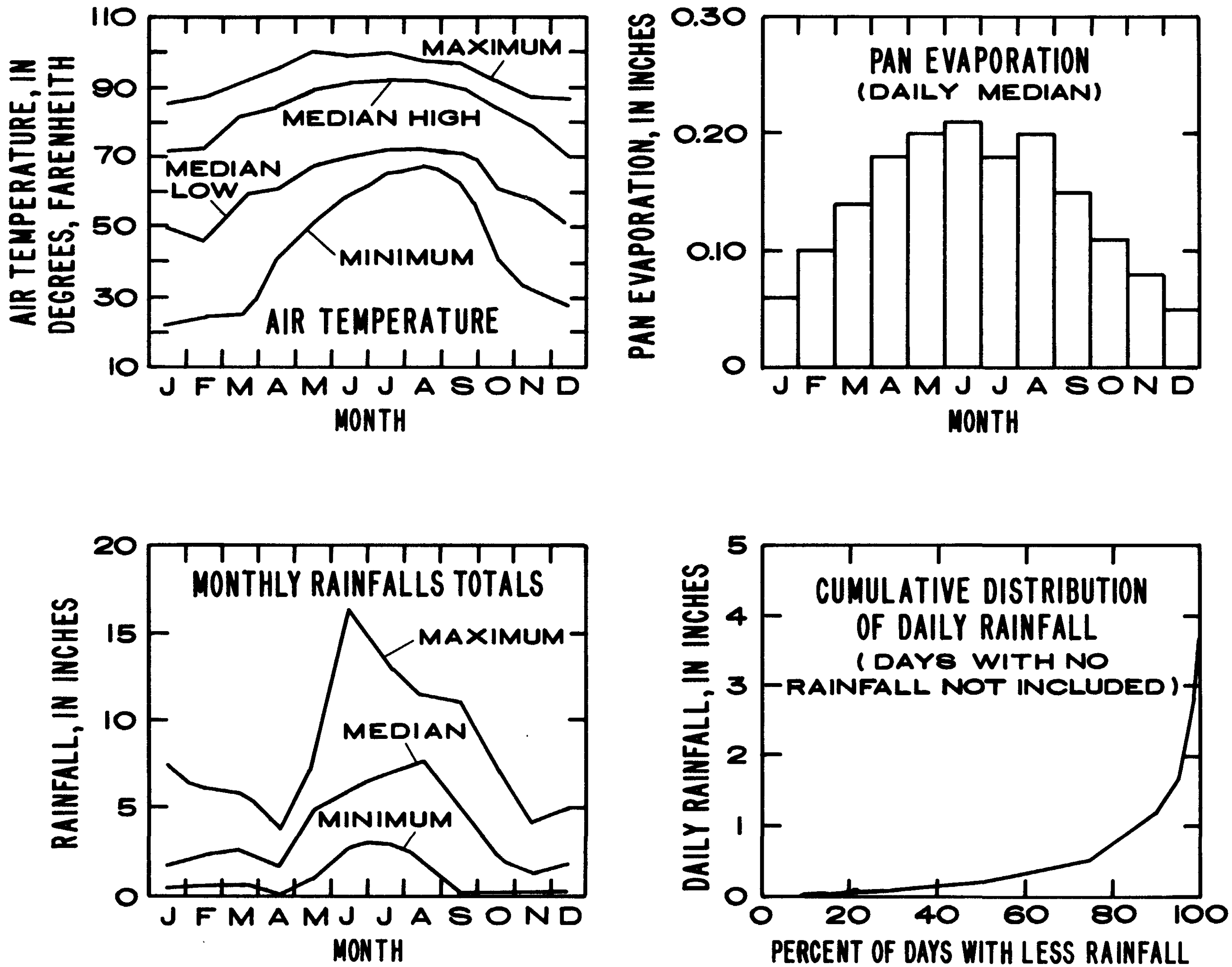


Figure 2.--Climatological data summary for Bay Lake (air temperature pan evaporation and daily rainfall for October 1972 through September 1980, monthly rainfall for July 1966 through September 1980).

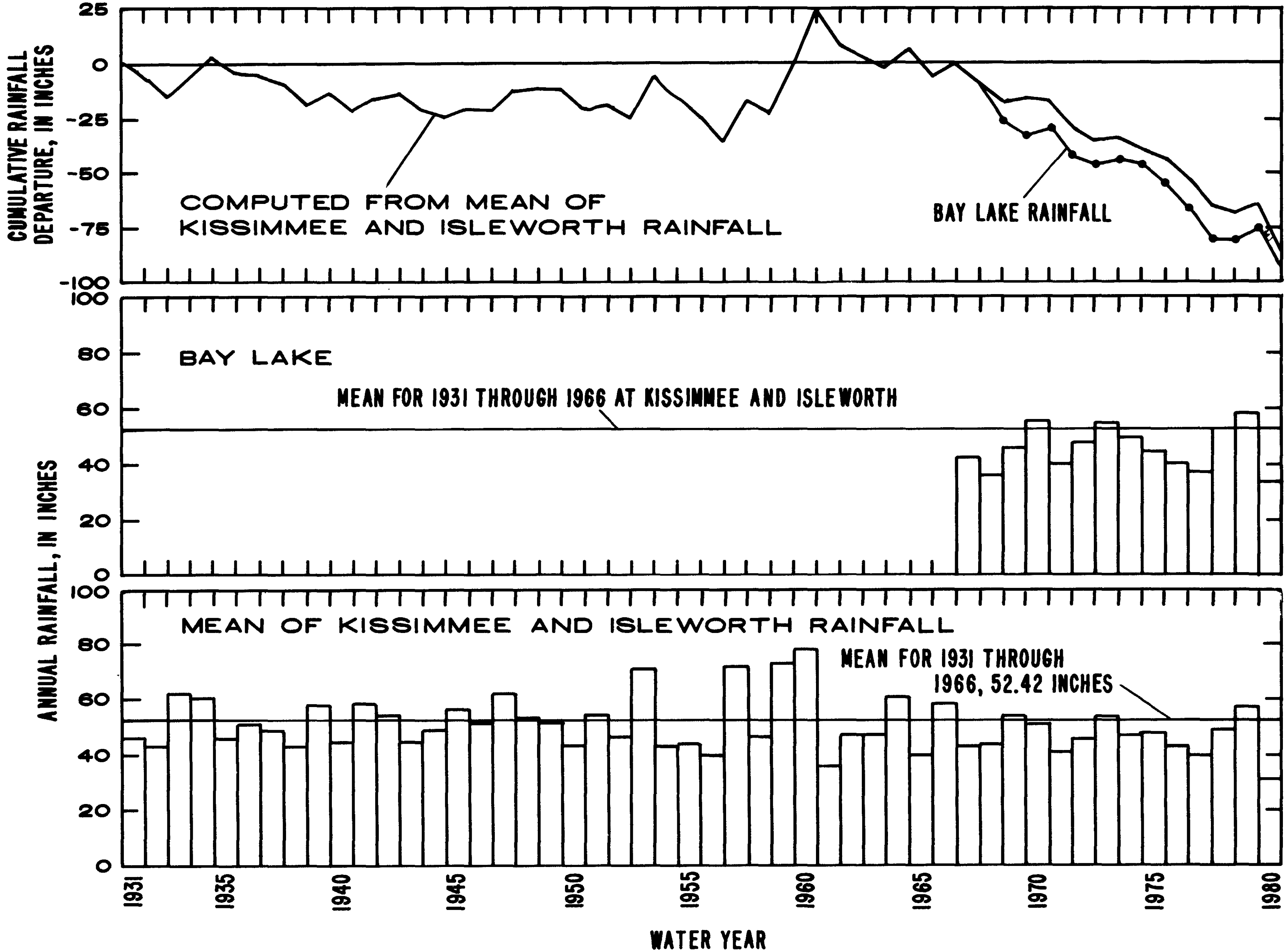


Figure 3.--Annual rainfall and departure from 1931 through 1966 mean for Kissimmee and Isleworth.

1966 was computed from the mean rainfall for Kissimmee and Isleworth. The computed mean rainfall for 1931 through 1966 at these two locations was 52.42 inches per year and is hereafter referred to as the long-term mean rainfall.

Figure 3 shows that annual rainfall over the 50-year period (1931 through 1980 water years) ranged from about 33 inches in 1961 to nearly 80 inches in 1960, based on mean rainfall for Kissimmee and Isleworth. Prior to and including 1966, 15 of 36 years (42 percent) had mean rainfalls in excess of the long-term mean; since 1966, only 3 of 14 years (21 percent) had mean rainfall in excess of the long-term mean. Records for Bay Lake (fig. 3) show 4 of 14 years (29 percent) in which rainfall exceeded the long-term mean.

Trends in rainfall are more noticeable when annual departures from the long-term mean are accumulated and plotted. A plot of cumulative rainfall departure, using 52.42 inches as the long-term mean, is given in figure 3. Departure of rainfall at Bay Lake from the long-term mean is also shown. Major features shown by the departure graph are the wet years of 1957, 1959, and 1960 which changed the accumulated rainfall departure from about a 35-inch deficit to a 25-inch excess, and the continuing accumulated-rainfall deficit since 1966. Rainfall deficiency at the end of 1980 had accumulated to nearly 85 inches (6.1 in/yr) based on the mean of Kissimmee and Isleworth rainfall, and nearly 95 inches (6.8 in/yr) at Bay Lake.

The graphical presentation of rainfall trends shown in figure 3 is somewhat dependent upon the definition of the long-term mean, because the rainfall departure will always be zero at the two ends of the period used to define the long-term mean. A more absolute way to depict trends in rainfall is through the use of a mass or accumulation curve, as shown in figure 4. Rainfall in excess of 30 inches is accumulated through water years 1931 through 1980. The datum of 30 inches is arbitrary and is used to make the graph more sensitive to changes in rainfall by reducing the range of the ordinate scale. Figure 4 shows that the slopes of the lines drawn through accumulated rainfall prior to and after 1960 are different, and that the lesser slope, indicative of a pattern of lower rainfall, is for the period 1961 through 1980.

The amount of rainfall in the RCID area was relatively low in recent years compared to rainfall during the 30-year period from 1931 through 1961. The period of development and operation of the RCID is therefore characterized by a pattern of relatively low rainfall. This pattern undoubtedly has been a contributing or dominant factor in the hydrologic trends that have occurred.

Streams

Hydrologic Description

Bonnet Creek, Cypress Creek, Davenport Creek, Reedy Creek, and Whittenhorse Creek are the major streams in the RCID and vicinity. The drainage area and period of discharge for stations on these streams are given in table 1.

The Cypress Creek basin lies northeast of the RCID (fig. 1). Cypress Creek originates at Lake Sheen (fig. 1), about 2 miles northeast of Bay Lake, and flows southward through a flat swampy valley about 0.5 to 0.75 mile wide.

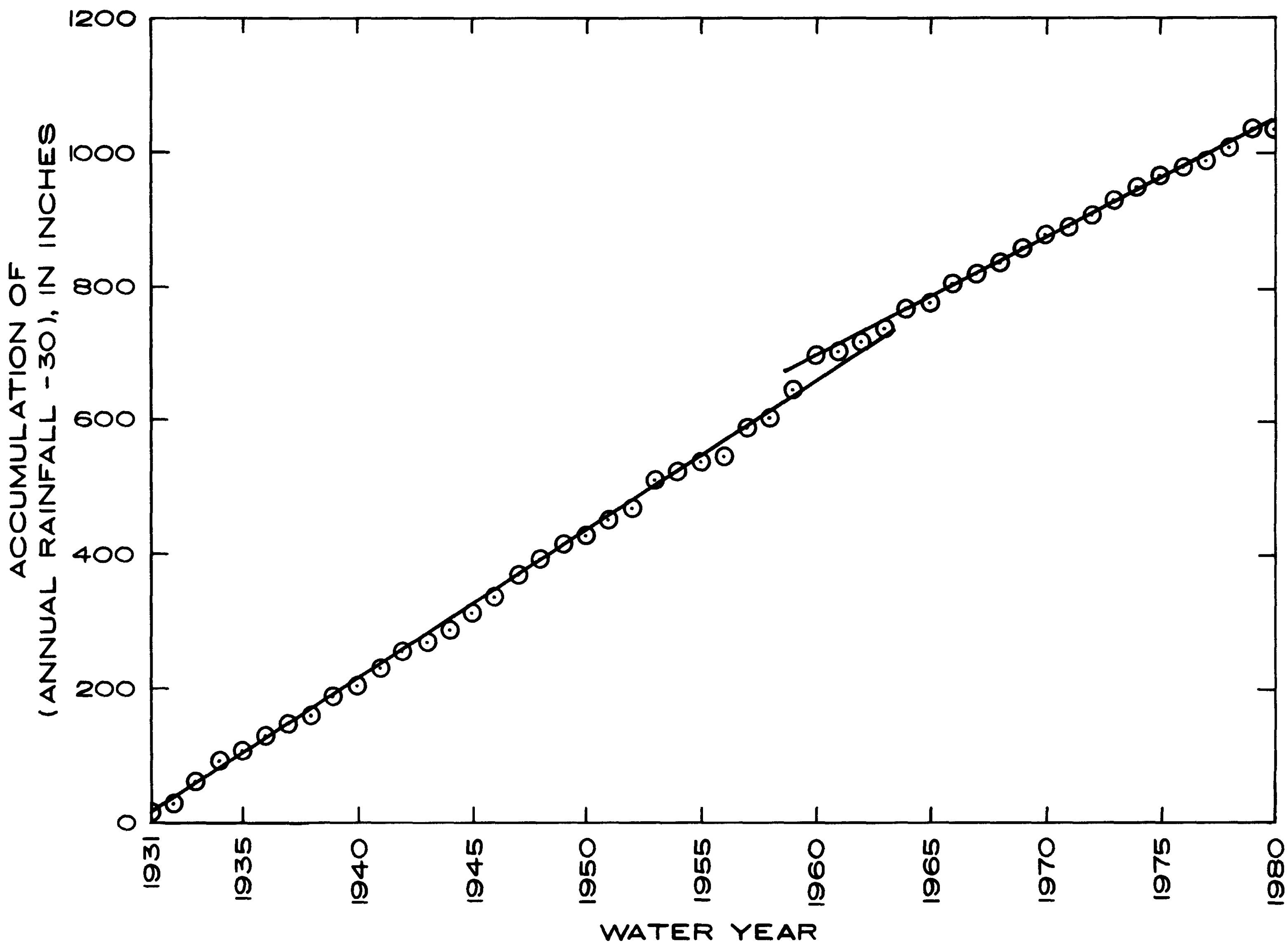


Figure 4.--Cumlative rainfall mean for Kissimmee and Isleworth, water year 1931 through 1980.

Table 1.—Drainage area and period of discharge record for Reedy Creek Improvement District area streams

Site No.	Station identification No.	Station name	Drainage area mi^2	Period of discharge record
4	02264000	Cypress Creek nr Vineland	30.3	October 1945 to September 1984
5	02264100	Bonnet Creek nr Vineland	56.1	October 1966 to September 1984
8	02266200	Whittenhorse Creek nr Vineland	12.4	Do.
11	02266300	Reedy Creek nr Vineland	75.0	Do.
12	02266480	Davenport Creek nr Loughman	23.0	October 1969 to September 1984
13	02266500	Reedy Creek nr Loughman	Undetermined	October 1939 to September 1959, October 1968 to September 1984

Streamflow in Cypress Creek is partially dependent upon outflow from Lake Sheen and connected lakes which form the Lake Butler chain, and flow will cease for weeks or even months during periods of scanty rainfall. Cypress Creek flows into the RCID and is tributary to Bonnett Creek.

The Bonnet Creek basin includes Cypress Creek and an additional 25.8 mi^2 within the RCID. The part of Bonnet Creek within the RCID was extensively modified. Numerous canals were constructed to provide for surface drainage of areas that include a shopping and hotel complex at Lake Buena Vista (fig. 1). Outflow from Bay Lake is directed into Bonnet Creek. Gated structures were installed in the channel of Bonnet Creek to retain water in the channelized reaches, to prevent excessive dewatering of adjacent areas. Bonnet Creek flows into an undeveloped area south of State Highway 192 (fig. 1). Most discharge from this area flows through structure 40 at the south boundary of the RCID and into Reedy Creek. An undetermined amount of water is released eastward through gated culverts in the north-trending levee south of State Highway 192 (fig. 1). These culverts are manually controlled to maintain levels in the upper part of the wetlands area favorable to the native vegetation.

The Whittenhorse Creek basin west of the RCID is flat and swampy, with areas of higher ground utilized for citrus production. The basin is undeveloped except for the citrus groves. Whittenhorse Creek flows into a canal along the northwest RCID boundary; gated structures on this boundary canal can admit water to the headwaters of Reedy Creek.

The Davenport Creek basin is southwest of the RCID, and like the Whittenhorse Creek basin, consists of a flat, swampy area with areas of higher ground utilized for citrus production. The basin is undeveloped except for the citrus groves. Davenport Creek flows into the southwestern part of the RCID undeveloped area.

The Reedy Creek basin is the major basin of the RCID, and conveys most surface drainage from the RCID. An area of 44 mi^2 lies outside the RCID to the west and is in the headwaters of the basin near Reedy Lake (fig. 1). The upper part of the basin that is in the RCID has been altered by construction of drainage canals and gated control structures. The stream is mostly in the original natural channel from about 1.9 miles north of State Highway 192 to the gated structure 40 at the south boundary of the RCID. Reedy Creek receives treated waste effluent from overland flow areas near canal 410 (fig. 1). Runoff from the Theme Park and parking lot reaches Reedy Creek about 0.3 mile north of the gated structure 405 (fig. 1) after passing through a system of canals and detention ponds. Discharge through structure 40 into the Reedy Creek channel south of the RCID includes most of the surface drainage from the RCID and includes discharge from the watersheds of Bonnet Creek, Cypress Creek, Davenport Creek, and Whittenhorse Creek.

There are two gaging stations on Reedy Creek, at Highway 192 (site 11), and at State Highway 17-92 (site 13) (fig. 1 and table 1). The station at Highway 192 is downstream from all points of discharge and developed area of the RCID, and represents inflow from Reedy Creek to the undeveloped area of the RCID. The station at Highway 17-92 includes most drainage from the RCID, plus drainage from an undetermined part of the swampy area east of the RCID boundary.

Streamflow Characteristics

Flow duration curves of daily discharge for streams in the RCID area are shown in figure 5. These duration curves show the percentage of days of record with a lower daily discharge. The shape of the duration curves for natural streams is determined by the hydrologic and geologic characteristics of the drainage basin (Searcy, 1959). Curves with steep slopes throughout denote highly variable streams with little storage. A flat slope at the low-discharge end indicates flows sustained by ground-water or surface-water storage, and a flat slope at the high-discharge end indicates a large amount of flood-plain storage or swampy areas. Duration curves for streams or canals with water-level control structures may be affected by variation of the gate settings.

Bonnet Creek, Cypress Creek, Reedy Creek (near Loughman), and Whittenhorse Creek have similar low-flow duration characteristics in which the slope of the low-discharge end of the curves is relatively steep. The steep slope indicates a lack of storage for sustaining low flows. Control structures on Reedy Creek and Bonnet Creek may be responsible in part for these low-flow characteristics. Gates open at high stages to permit discharge of runoff; when water levels drop, the gates close to retain water in the stream channels. This retention of water could decrease the apparent low-water storage of the basins. The Whittenhorse Creek basin is undeveloped except for citrus groves. Therefore, the small amount of storage for sustaining low flows in Whittenhorse Creek is probably a natural feature of the watershed, though the effect of ground-water withdrawal for citrus irrigation on the hydrology of Whittenhorse Creek has not been investigated.

Davenport Creek has a more sustained low flow than the other streams. The low flows are sustained by surface-water and ground-water storage, and perhaps by upward leakage of water from the Floridan aquifer.

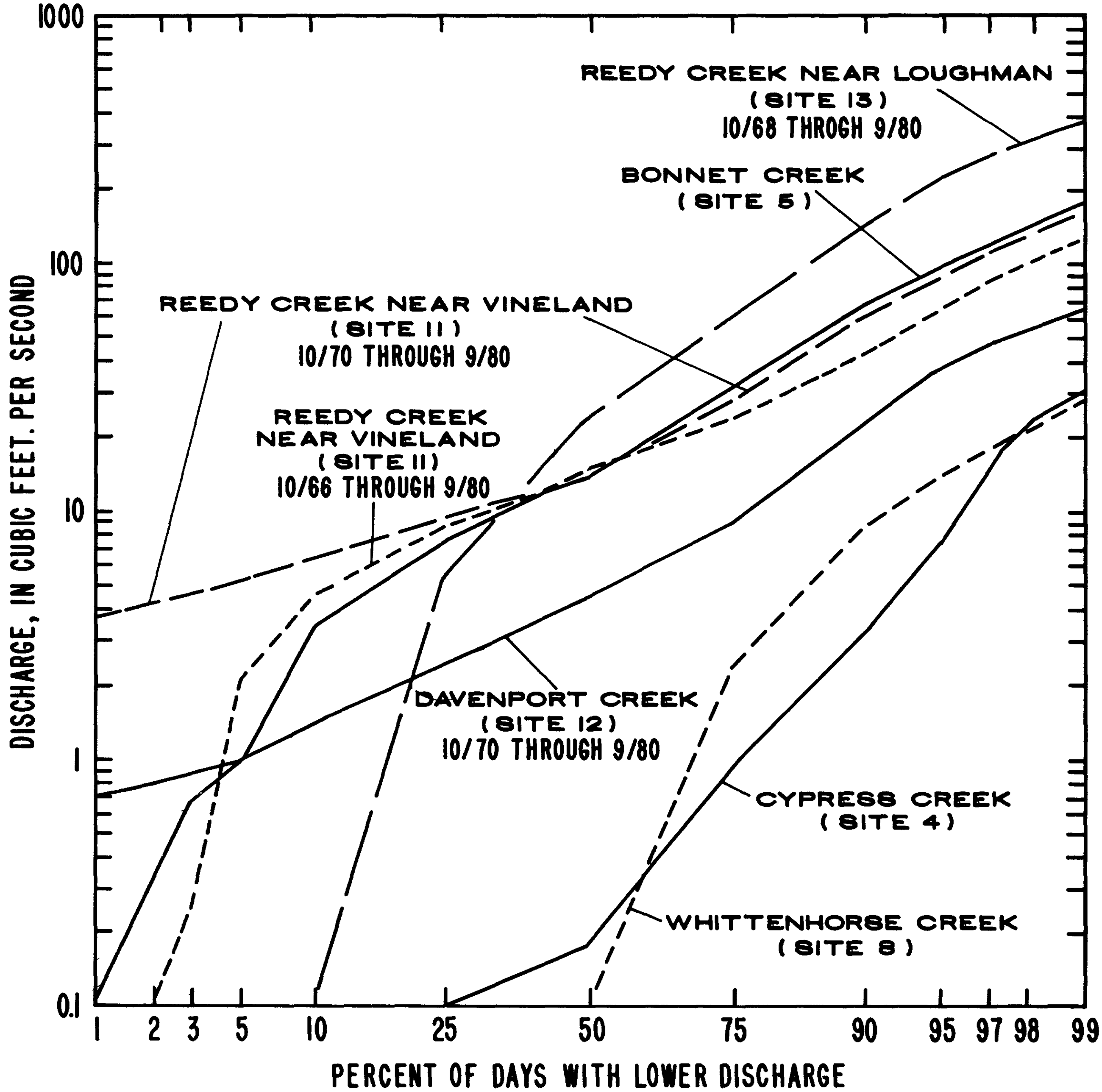


Figure 5.-- Daily discharge duration of streams in the Reedy Creek Improvement District area. (Curves computed for October 1966 through September 1980, except as indicated).

The discharge of treated wastes to Reedy Creek has changed the low-flow duration characteristics at the gaging station near Vineland. Comparison of the duration curve for the period of record (water years 1967 through 1980) with the curve for the period of waste discharge (1971 through 1980) shows that waste discharge now maintains discharge during periods when the stream would otherwise be dry.

High-flow characteristics are similar for all streams, indicating similar flood-plain storage characteristics. This is an indication that the impervious areas (parking lots, paved walkways, and so forth) of the Walt Disney developments are probably not extensive enough to affect the high-flow hydraulic characteristics of the Reedy Creek and Bonnet Creek watersheds to a significant degree. Also, changes in high-flow characteristics may be offset by the storage created by the system of canals and structures within the stream systems.

Changes in Streamflow Characteristics

Annual mean discharges for the periods of record of streams are shown in figures 6a and 6b. Rainfall departure from the long-term mean is also shown for comparison of rainfall and streamflow trends.

Cypress Creek (fig. 6a) and Reedy Creek near Loughman (fig. 6b) have relatively long periods of streamflow record. The annual mean discharges of the streams have been consistently lower since 1971 than for prior periods. The low discharge corresponds with below-average rainfall during the same period, and any effects of development on annual streamflow during this period are likely to be overshadowed by the effects of the dry weather.

Patterns and trends in the streamflow-rainfall relation can be illustrated using double-mass plots, in which accumulated annual streamflow is plotted against accumulated annual rainfall. If rainfall used in these plots is representative of the stream basin, and if basin characteristics such as contributing drainage area do not change, the double-mass plot of streamflow against rainfall should have a constant slope throughout the period of record.

A double-mass plot of annual mean discharge at Cypress Creek and rainfall in excess of 30 inches, averaged for Isleworth and Kissimmee, is shown in figure 7. The datum of 30 inches for rainfall is used to make the plot more sensitive to changes in the discharge-rainfall relation by reducing the range of the rainfall axis. Figure 7 shows that the rainfall-discharge relation is not constant, and that periods of relatively steep slope (greater amount of discharge for a given rainfall amount) alternate with periods of small slope (lesser amount of discharge for a given rainfall amount). Assuming rainfall used in figure 7 is representative of the basin, the changing slope indicates that contributing drainage area probably changes from year to year, in response to rainfall and outflow from the Lake Butler chain of lakes. During dry periods, outflow from the Lake Butler chain into Cypress Creek ceases, and that part of the basin is noncontributing to streamflow at the Cypress Creek gaging station. Since 1961, flow in Cypress Creek has generally been low in relation to rainfall, probably in response to the relatively low amounts of rainfall and periods of no outflow from the Lake Butler chain. Contributing to less streamflow is the lowering of the potentiometric surface of the Floridan aquifer during dry years. A lowering of the potentiometric surface will increase

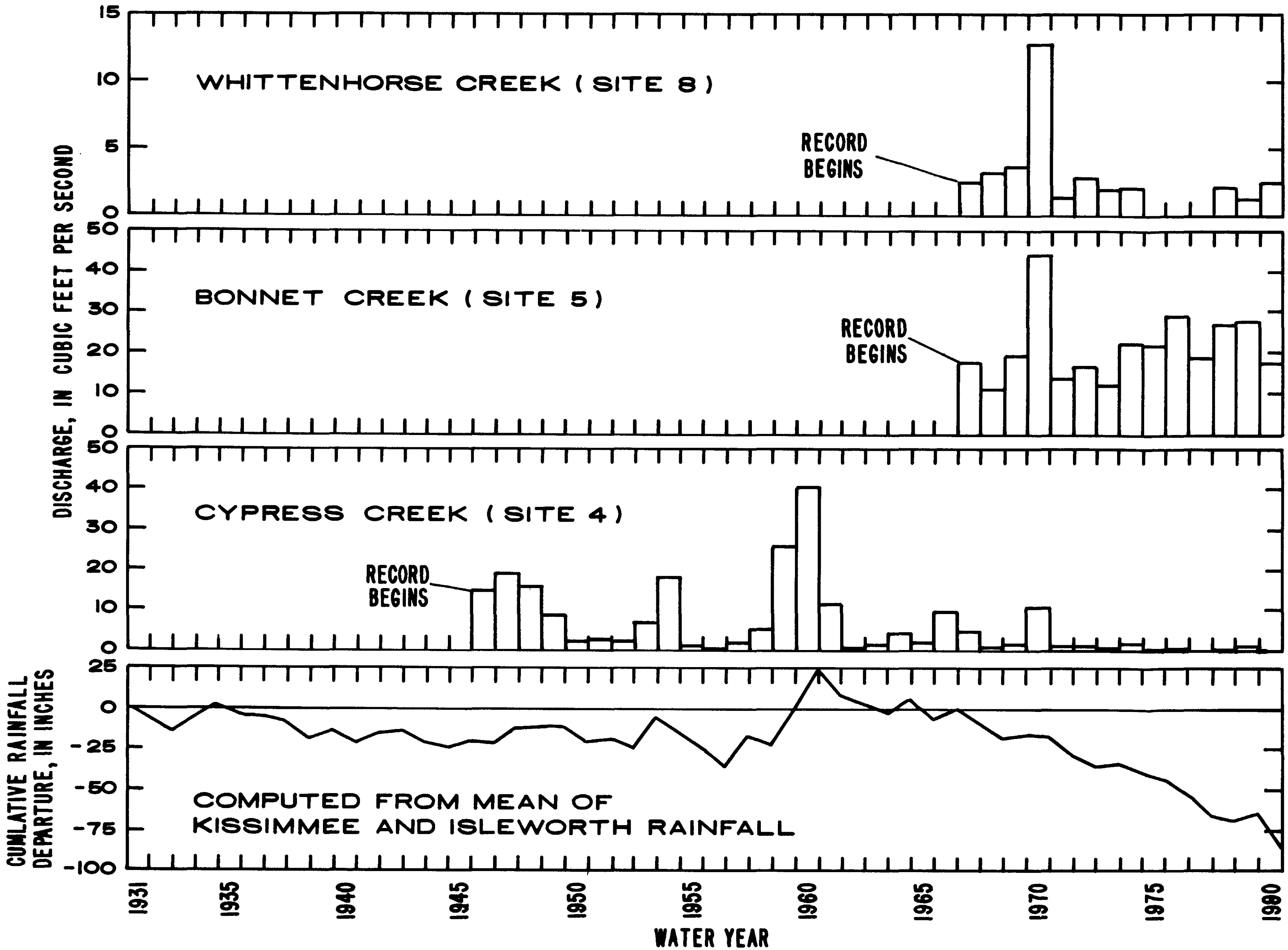


Figure 6a.--Annual mean discharges and cumulative departure from the mean of Kissimmee and Isleworth rainfall: Cypress Creek, Bonnet Creek, and Whittenhorse Creek.

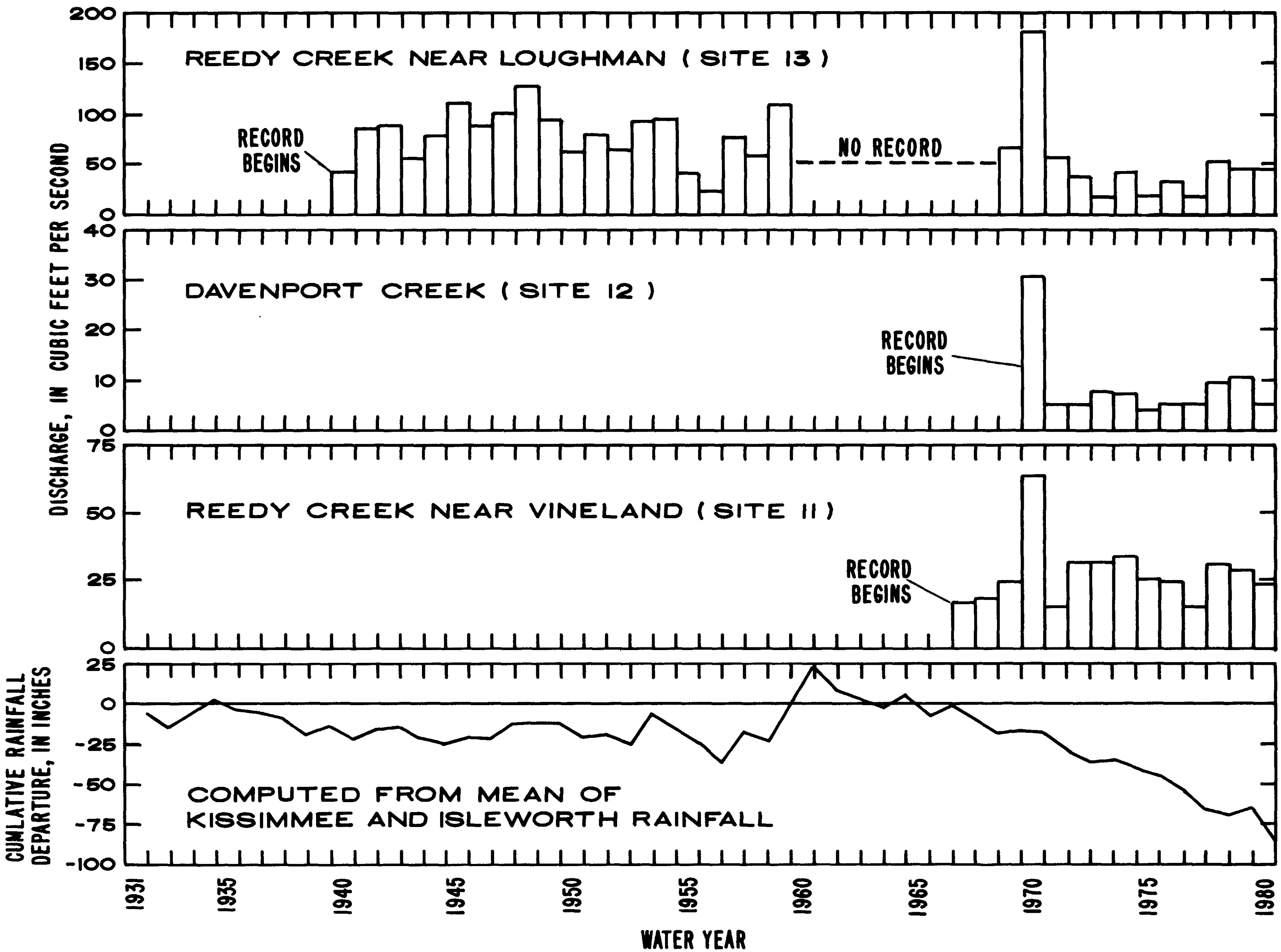


Figure 6b.--Annual mean discharges and cumulative departure from the mean of Kissimmee and Isleworth rainfall: Reedy Creek and Davenport Creek.

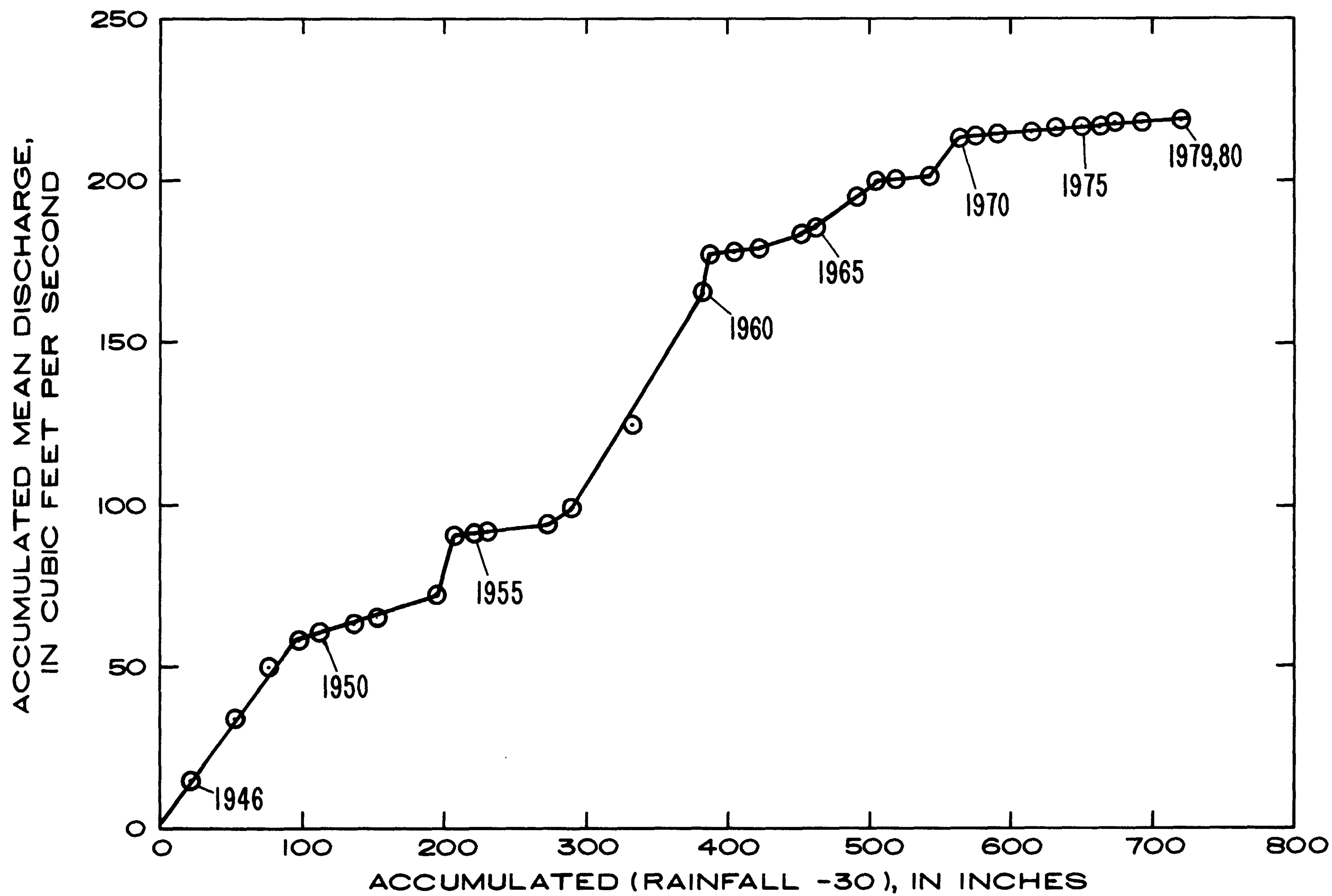


Figure 7.--Double-mass curve of annual mean discharge at Cypress Creek, and mean of Kissimmee and Isleworth annual rainfall.

rates of seepage from the lakes to the aquifer, and decrease amounts of water available to Cypress Creek. Pumpage from the Floridan aquifer for domestic use and irrigation may have affected the streamflow by lowering the potentiometric surface of the Floridan aquifer, but the effect of withdrawals on potentiometric surface levels and seepage is unknown.

A double-mass plot of annual mean discharge versus rainfall is shown in figure 8 for Reedy Creek near Loughman. This figure shows that the discharge-rainfall relation was relatively constant from 1940 through 1959. Discharge was not measured from 1960 through 1968. From 1970 to 1980 discharge was low in relation to rainfall, compared to the 1940 through 1959 period. This lower discharge in the later period is probably due in part to the alterations of the basin by the development in the RCID. Retention of water by structures increases evaporation, and water released eastward from the undeveloped area south of State Highway 192 could have bypassed the Loughman station. It is also possible that parts of the Reedy Creek watershed become noncontributing during dry years when storage capacity of swampy areas exceeds rainfall amounts.

The quantity of water released eastward from the RCID undeveloped area (south of State Highway 192) was estimated by using a water balance for the undeveloped area. Inflow to this area from Reedy Creek, Bonnet Creek, and Davenport Creek is measured, and these streams contribute most of the inflow. Water discharged at the Reedy Creek near Loughman gaging station is mostly outflow from the undeveloped area.

Table 2 shows that discharge at Reedy Creek near Loughman exceeded the inflow from Reedy Creek, Bonnet Creek, and Davenport Creek from 1969 through 1971 by about 21 to 66 percent. This extra inflow is probably due to rainfall and unmeasured inflow to the undeveloped area, and to inflow to Reedy Creek from east of the RCID. The culverts for releasing water eastward were installed in 1972. From 1972 through 1979, mean annual discharge at Reedy Creek near Loughman was less than the combined inflows from Reedy Creek, Bonnet Creek, and Davenport Creek by 22 to 63 percent. Measured inflow and outflow were nearly equal during 1980, perhaps due to the low amount of rainfall that made drainage of the wetlands through the culverts insignificant.

A comparison of inflow and outflow prior to and after the installation of the culverts shows that the difference between outflow (measured at Reedy Creek near Loughman) and measured inflow to the undeveloped area changed from about 17 ft^3/s excess outflow to about 23 ft^3/s excess inflow. These average figures were computed excluding 1970, a high-runoff year, and 1980, a dry year, because these two years are probably atypical of usual conditions. The comparison indicates the quantities of water released eastward from the RCID undeveloped area, and shows that an average of about 40 ft^3/s bypassed the gaging stations on Reedy Creek near Loughman most years, though destination of the water released eastward has not been determined.

Development in the RCID has caused changes in low-flow chracteristics of Reedy Creek. Figure 9 shows annual rainfall and the annual number of days with no flow in Cypress Creek and Reedy Creek. Flow in Cypress Creek has ceased for varying periods nearly every year since record began in 1946; Reedy Creek near Loughman (site 13) had periods of no flow only in 1970 and later years, though flow has not ceased at Reedy Creek near Vineland (site 11, upstream from Loughman) since 1968. Inflow of treated wastewater to Reedy Creek augments

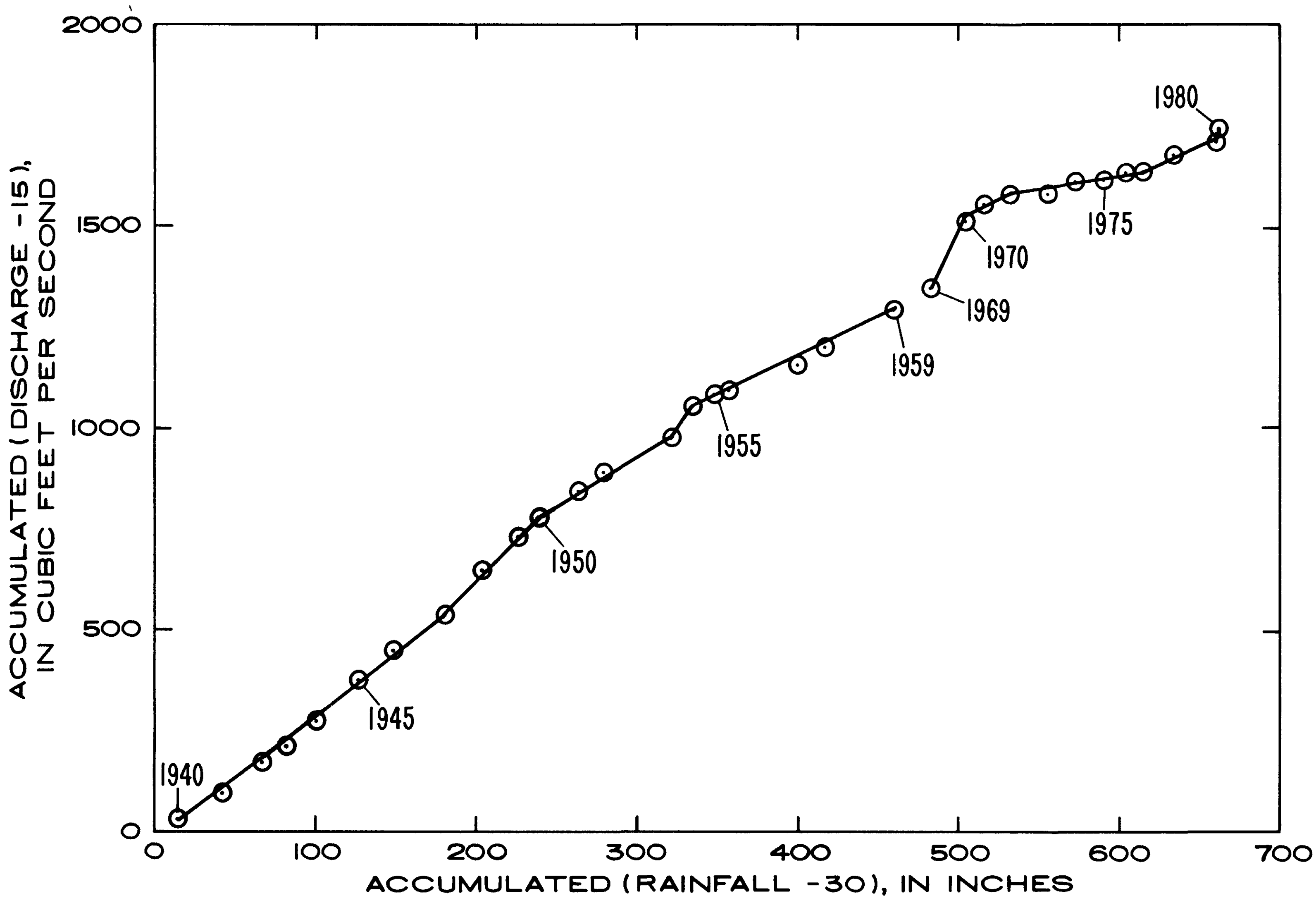


Figure 8.--Double-mass curve of annual mean discharge at Reedy Creek near Loughman, and mean of Kissimmee and Isleworth annual rainfall.

Table 2.--Annual mean discharge to and from the Reedy Creek Improvement District undeveloped area

	Discharge, in cubic feet per second						
	Source of inflow			Sum		Difference	
Year	Bonnet Creek	Davenport Creek	Reedy Creek[1/]	of inflow	Outflow[2/]	Outflow-Inflow	Percent
1969	19.4	[3/]11.4	25.1	55.9	67.7	11.8	21
1970	44.3	31.0	64.6	139.9	182.0	42.1	33
1971	13.6	5.5	15.9	35.0	58.2	23.2	66
1972	16.6	5.4	32.2	54.2	38.2	-16.0	-30
1973	11.9	7.9	32.3	52.1	19.1	-33.0	-63
1974	22.4	7.8	34.4	64.6	43.1	-21.5	-33
1975	21.7	4.5	26.1	52.3	19.6	-32.7	-63
1976	28.8	5.6	25.3	59.7	33.2	-26.5	-44
1977	18.8	5.7	16.0	40.5	18.8	-21.7	-54
1978	26.9	9.8	32.0	68.7	53.7	-15.0	-22
1979	27.9	10.9	29.3	68.1	46.9	-21.2	-31
1980	17.6	5.7	24.1	47.4	46.7	-0.7	-1

1/Measured at Reedy Creek near Vineland (site 11).
2/Measured at Reedy Creek near Loughman (site 13).
3/Estimated from regression with Whittenhorse Creek.

streamflow near Vineland, and provides flow when the stream would otherwise probably be dry. Retention of water in the undeveloped area, and release of water eastward from this area, results in periods of no flow in Reedy Creek immediately downstream from the RCID boundary (site 13).

The effect of water-level control structures on flow characteristics of Reedy Creek near Loughman is shown in figure 10, in which selected hydrographs for rainless (or nearly rainless) periods before and after RCID development are plotted. The hydrographs before development show a smooth recession curve characteristic of an unregulated stream; those after development have more abrupt declines, especially at a discharge of about 50 ft^3/s (probably caused by closing of the gates as water levels fall).

Lakes

Summary

Lake stages have been recorded for four lakes in the RCID area. Daily lake stages are available beginning in 1962 at Lake Butler, 1969 at South Lake, and 1967 at Bay Lake. Bimonthly observations of lake stage are available at Lake Bryan, beginning in 1969. Locations of the lakes are shown in figure 1.

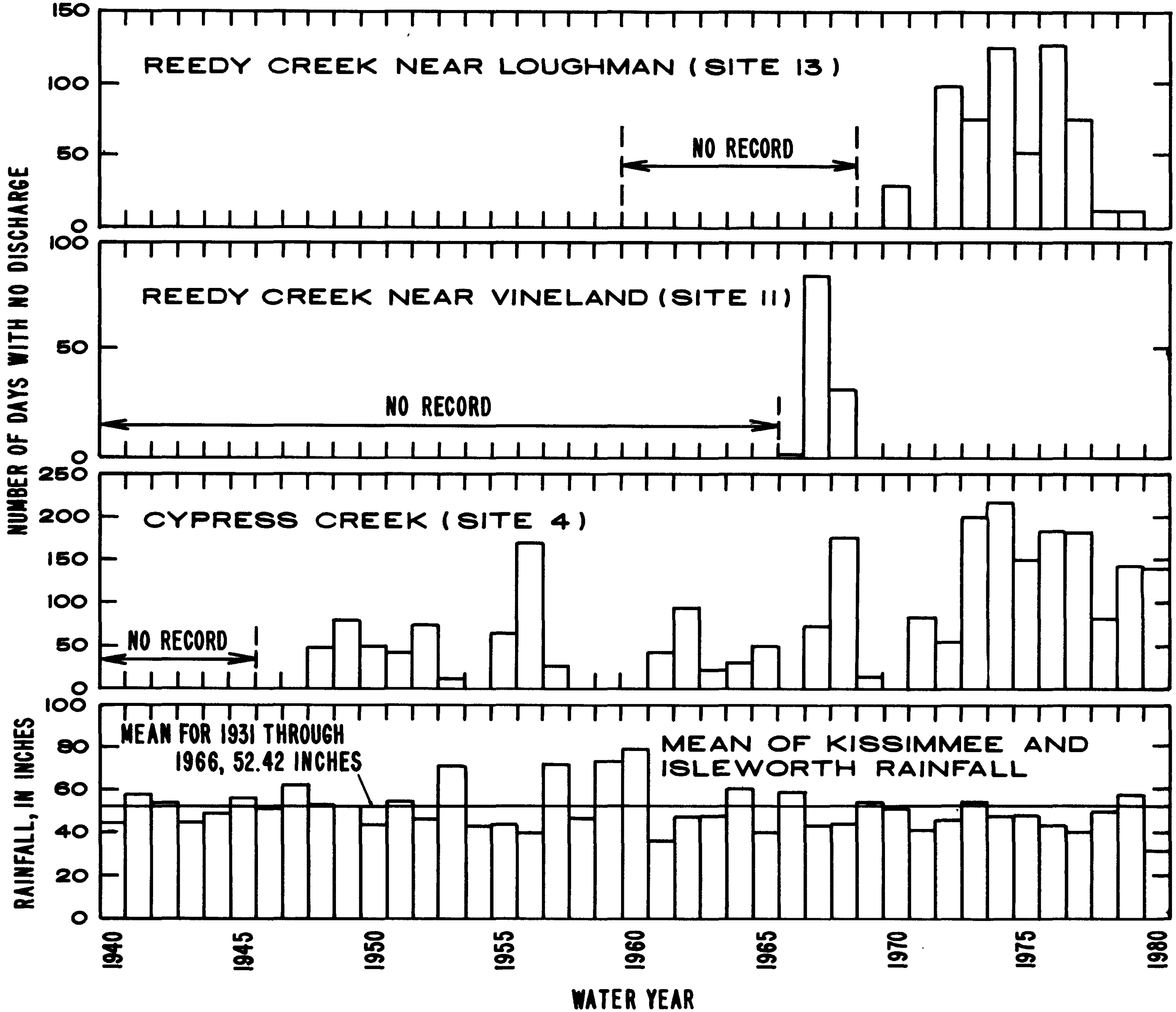


Figure 9.--Annual number of days with no flow at Cypress Creek and Reedy Creek.

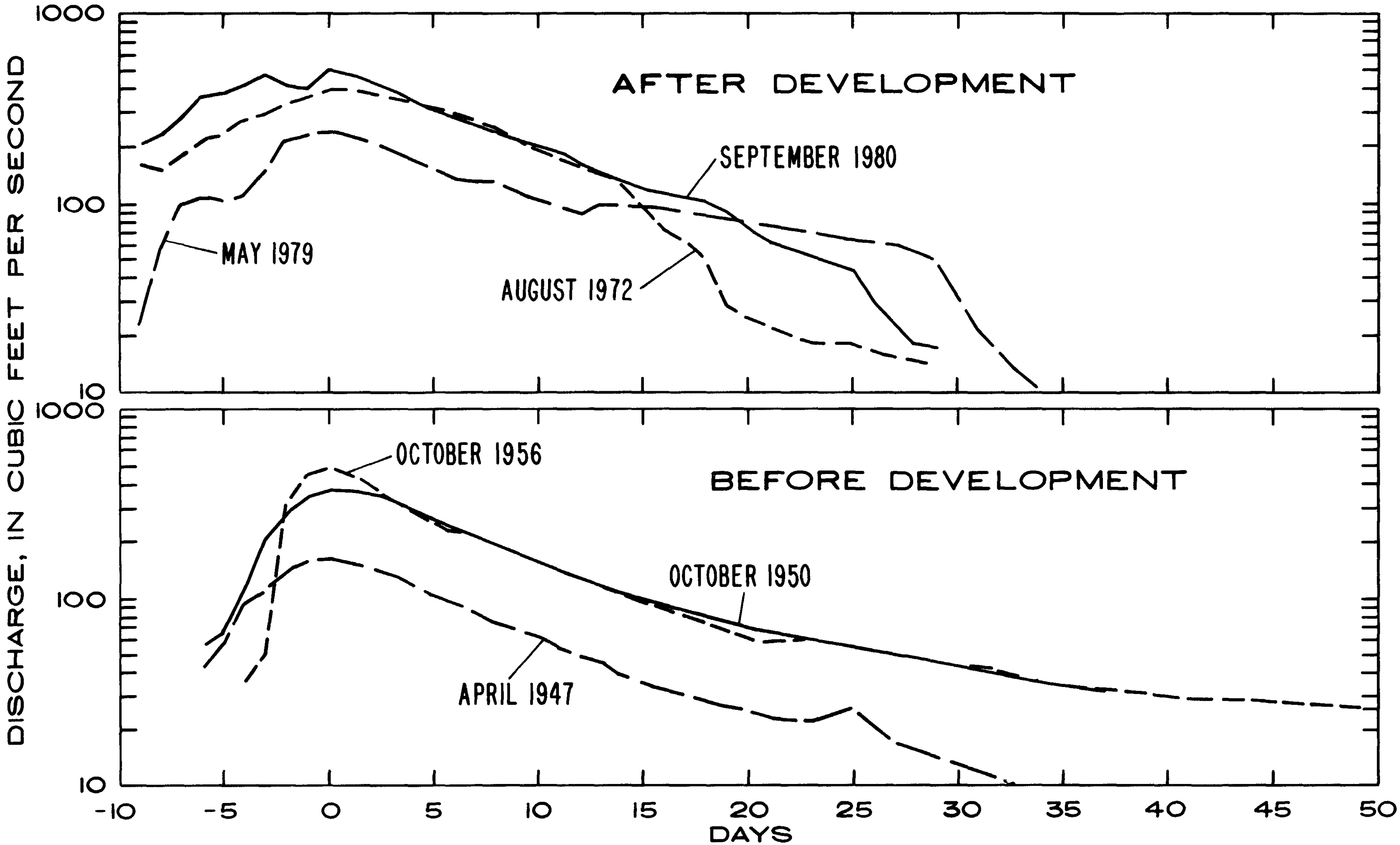


Figure 10.--Hydrographs for Reedy Creek near Loughman.

The range and seasonal variation in the lake stages are shown in figure 11 for October 1971 through September 1980. Daily mean lake stage is summarized except for Lake Bryan. The bimonthly record at Lake Bryan does not define lake stage variation as precisely as daily records, but are adequate to approximate lake-stage variation because the stages generally do not change rapidly.

Monthly variations in maximum and minimum lake stages from October 1971 through September 1980 generally differ by only 1 to 3 feet. Variation in stage is less at Bay Lake than at other lakes because the lake is regulated by gates to release excess water, and by inflow from Theme Park waterways during dry periods.

Trends

Stage hydrographs for lakes in the vicinity of the RCID are shown in figure 12. Annual mean lake stage at Lake Butler declined about 2.3 feet from 1970 through 1980. South Lake declined about 0.5 foot and Lake Bryan declined about 0.2 foot during the same period. Draining of Bay Lake began in December 1968, and since 1972 the lake has been maintained at about the 94.5 foot level. The greater decline in lake stage in Lake Butler, compared with South Lake and Lake Bryan, may be due to the combined effects of withdrawal of ground water within the RCID, the Orlando area, and citrus groves near Lake Butler. Ground-water withdrawal can affect lake stages by increasing the potential for downward leakage from lakes to the Floridan aquifer. The effect of the various sources of ground-water withdrawal on potentiometric surface in the RCID area has not been established, and quantitative data on agricultural withdrawals are needed to evaluate aquifer response to these withdrawals.

Floridan Aquifer

Summary

The configuration of the potentiometric surface of the Floridan aquifer in May 1981 is shown in figure 13. This figure indicates that the general direction of water movement near the RCID is from west to east, and that the gradient of the potentiometric surface is about 10 feet per mile or less.

Figure 14 shows water-level fluctuations in wells representative of the Floridan aquifer in and near the RCID. Well 7 (fig. 13) is in the RCID and is probably in the cone of depression formed by Floridan aquifer pumpage in the RCID. Well 5 is in a citrus grove area west of the RCID (fig. 13) and is probably not affected by withdrawals in the RCID, but may be periodically affected by pumpage for irrigation. Both wells show that the potentiometric surface declines in the normally dry spring season and rises in summer. Seasonal fluctuations average less than 2 feet at both wells, but are greater at well 7 than at well 5, probably because well 7 is closer to RCID supply wells.

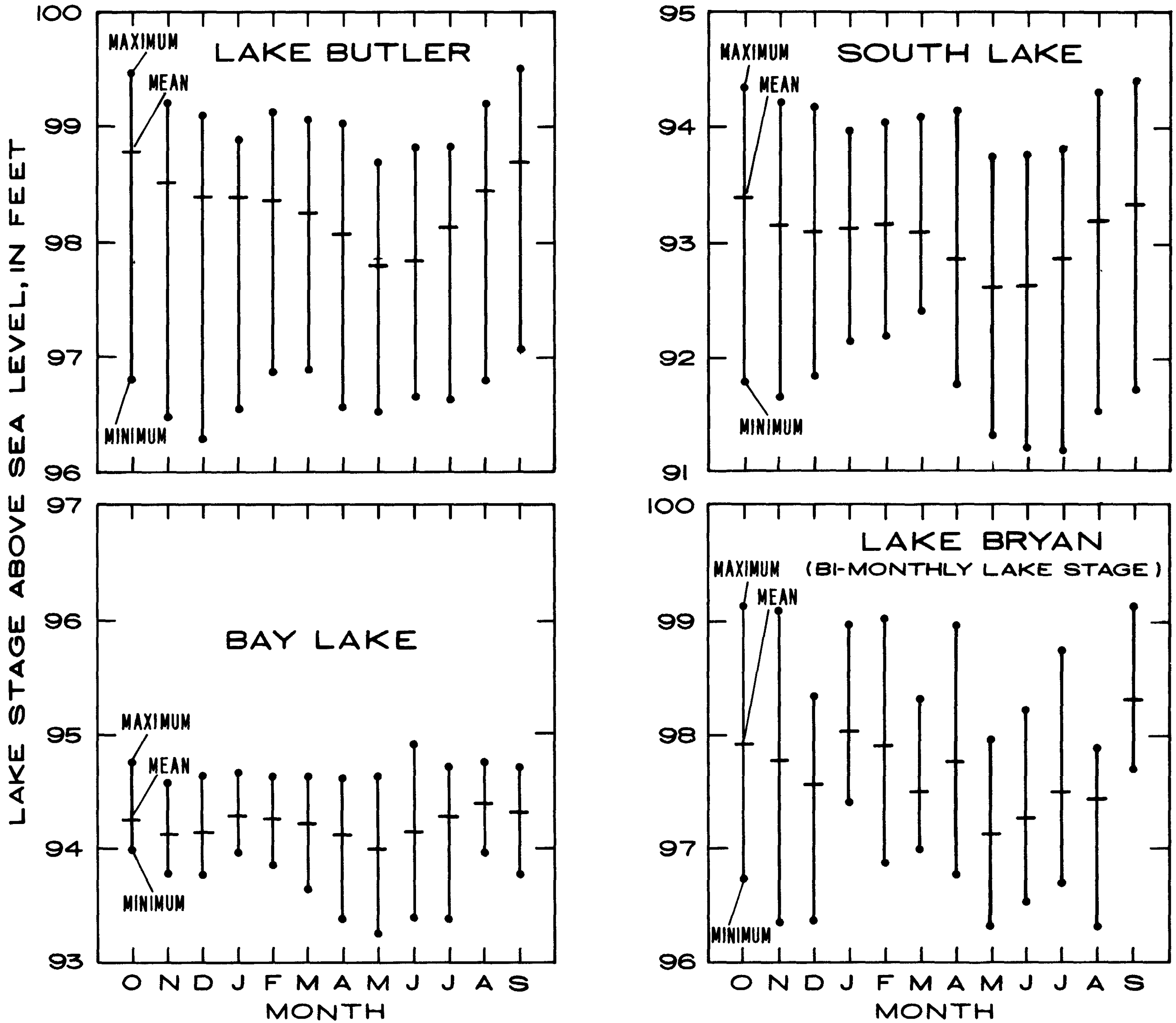


Figure 11.--Summary of monthly lake stages for Lake Butler, South Lake, Bay Lake, and Lake Bryan, October 1971 through September 1980 (summaries are for daily mean lake stages, except bimonthly at Lake Bryan).

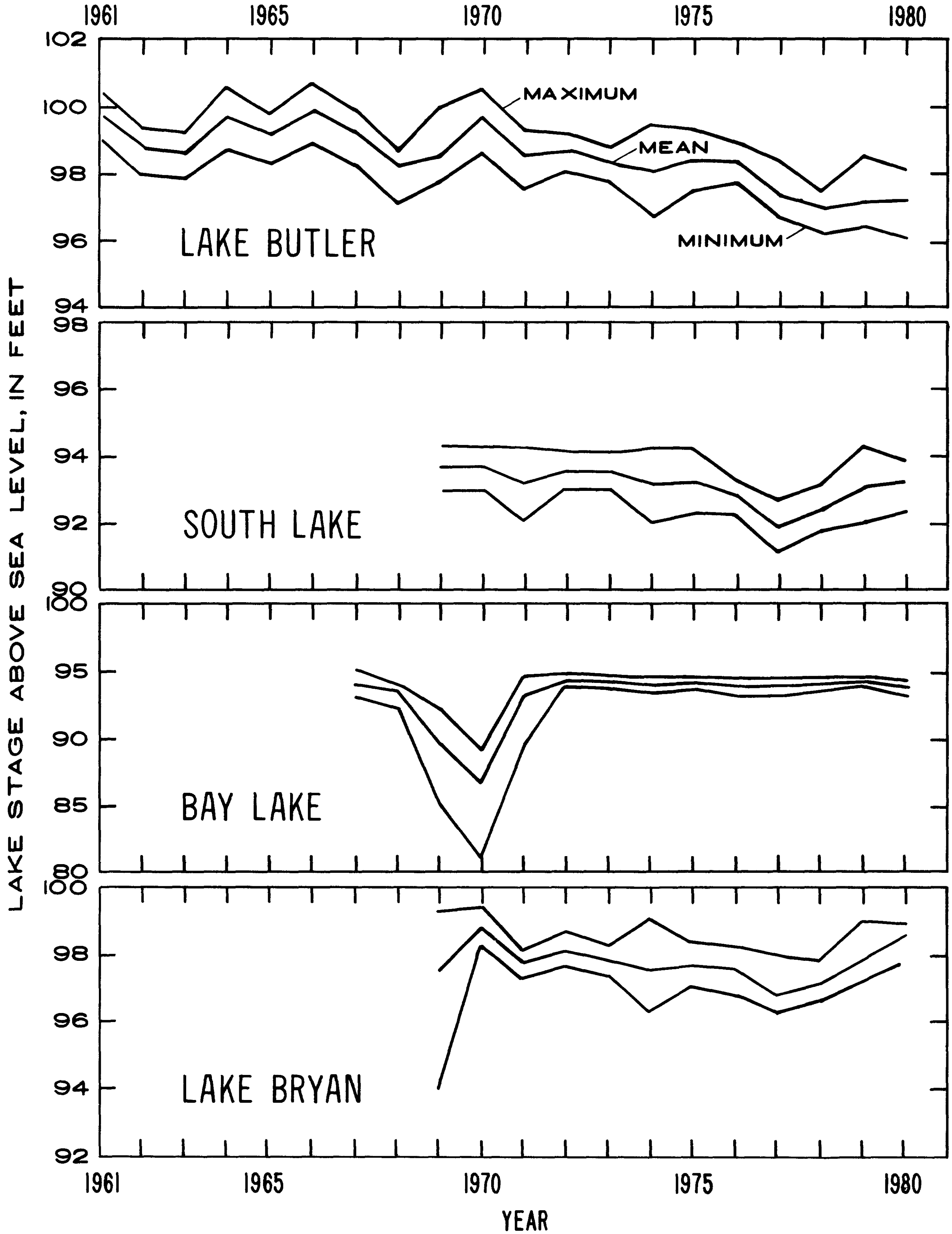


Figure 12.--Annual maximum, mean, and minimum lake stages, Lake Butler, South Lake, Bay Lake, and Lake Bryan.

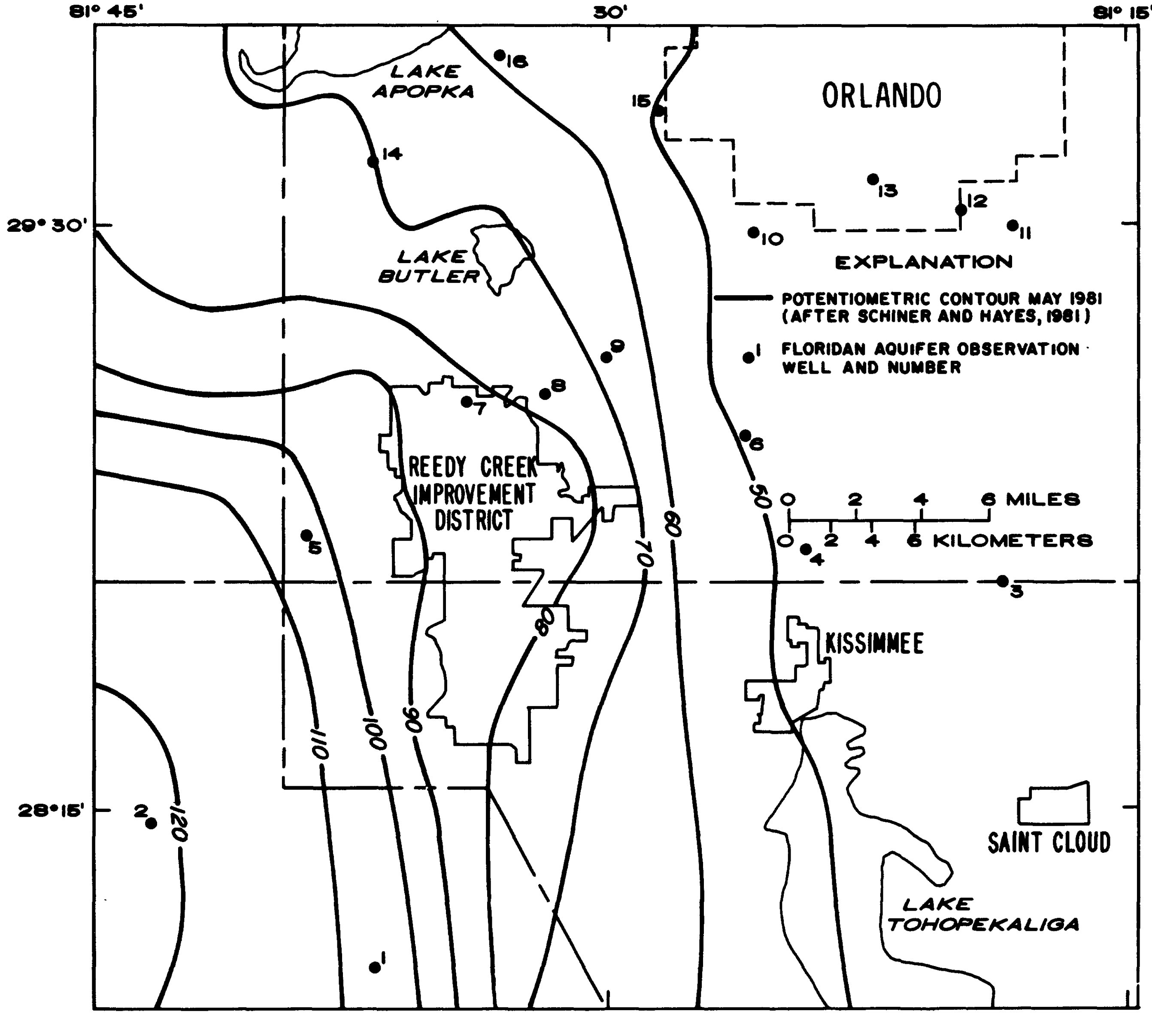


Figure 13.--Configuration of the potentiometric surface in the Reedy Creek Improvement District vicinity, May 1981, and location of selected long-term Floridan aquifer observation wells.

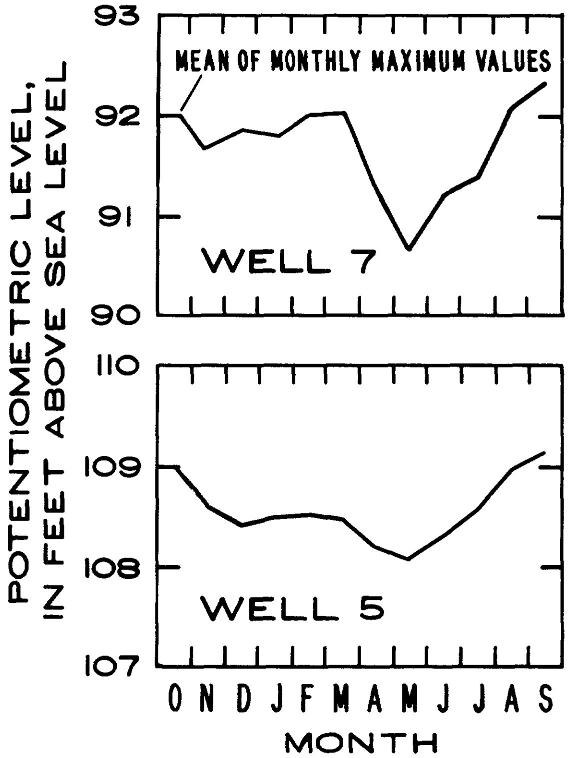


Figure 14.--Monthly variation in potentiometric level of the Floridan aquifer (based on data for October 1965 through September 1980).

Trends

Hydrographs for Floridan aquifer wells with long periods of record in the RCID and vicinity are shown in figure 15. These wells (for locations see fig. 13) are cased at least to the top of the Floridan and are 435 feet or less in depth. The mean rainfall of Kissimmee and Isleworth is included in figure 14 for comparison of rainfall trends with potentiometric surface changes.

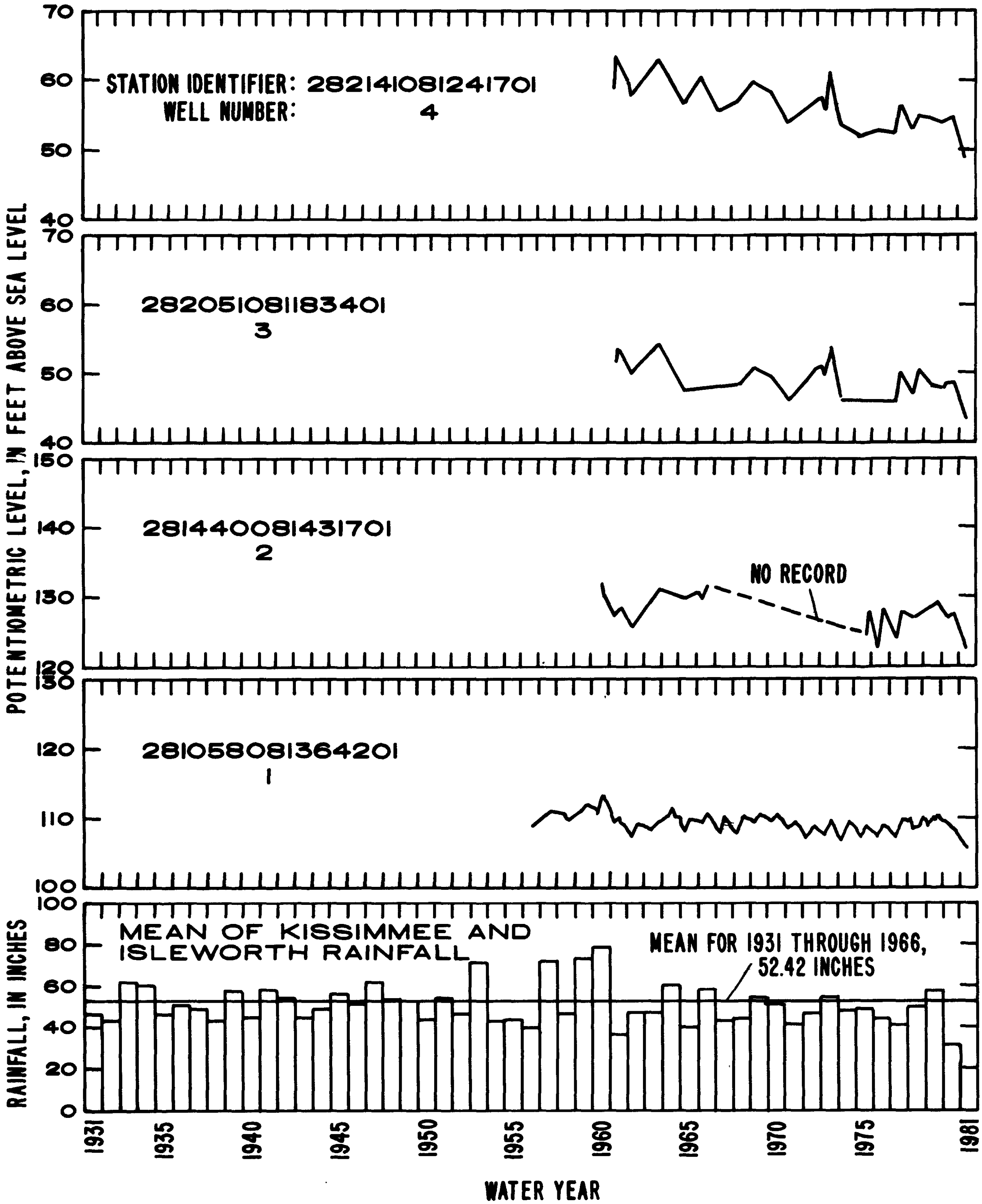


Figure 15.--Hydrographs for Floridan aquifer wells and rainfall in the Reedy Creek Improvement District area.

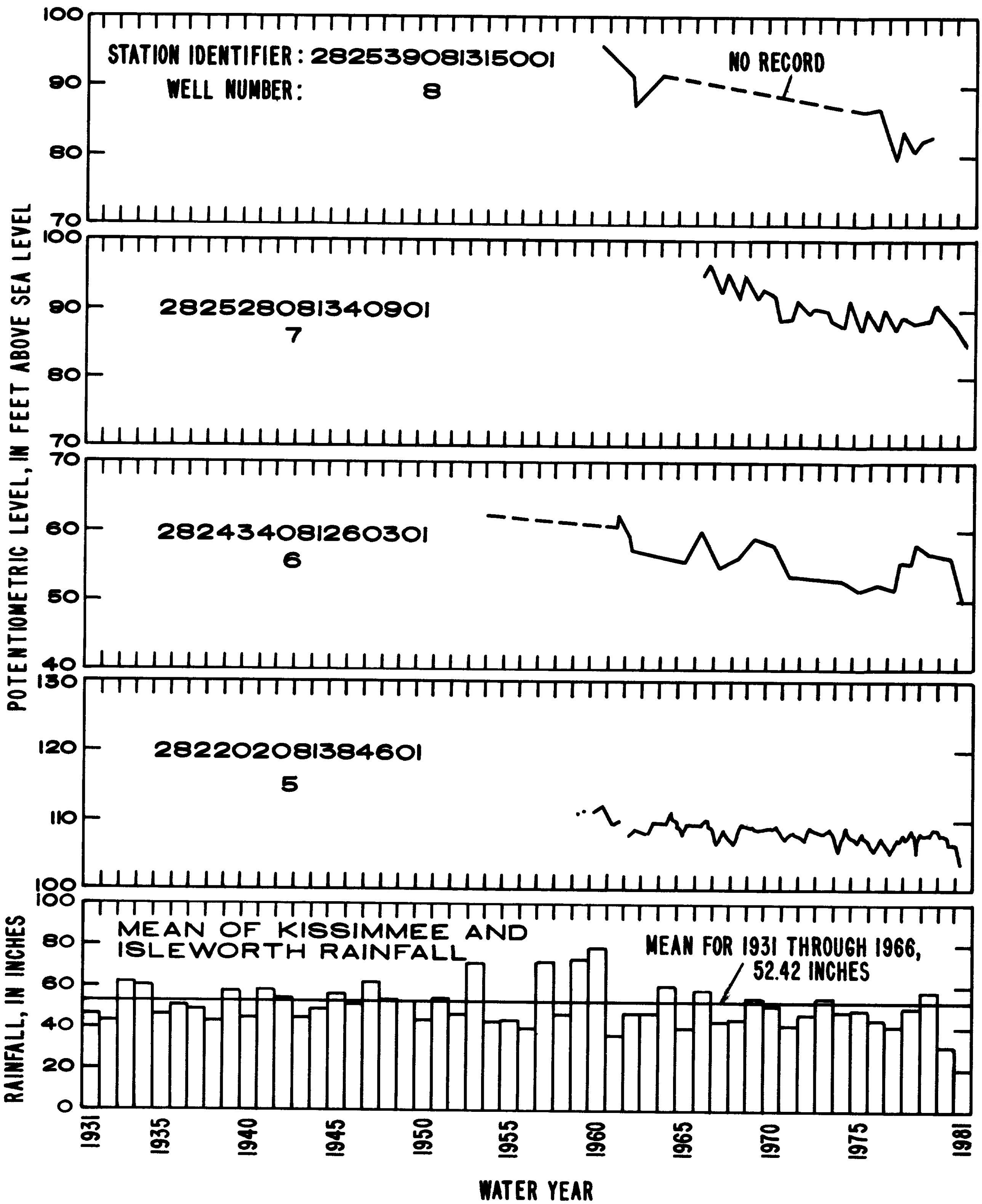


Figure 15.--Hydrographs for Floridan aquifer wells and rainfall in the Reedy Creek Improvement District area--Continued.

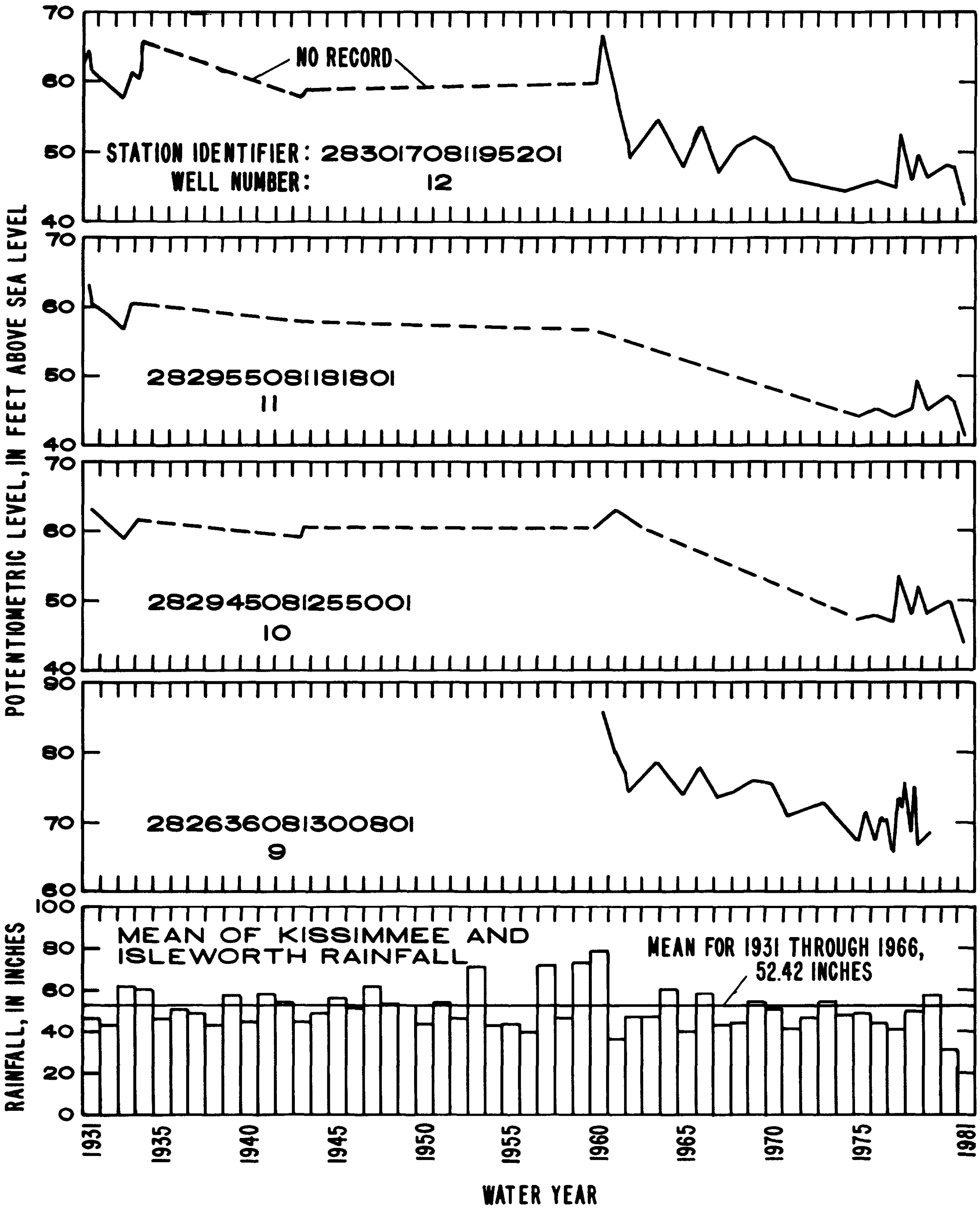


Figure 15.--Hydrographs for Floridan aquifer wells and rainfall in the Reedy Creek Improvement District area--Continued.

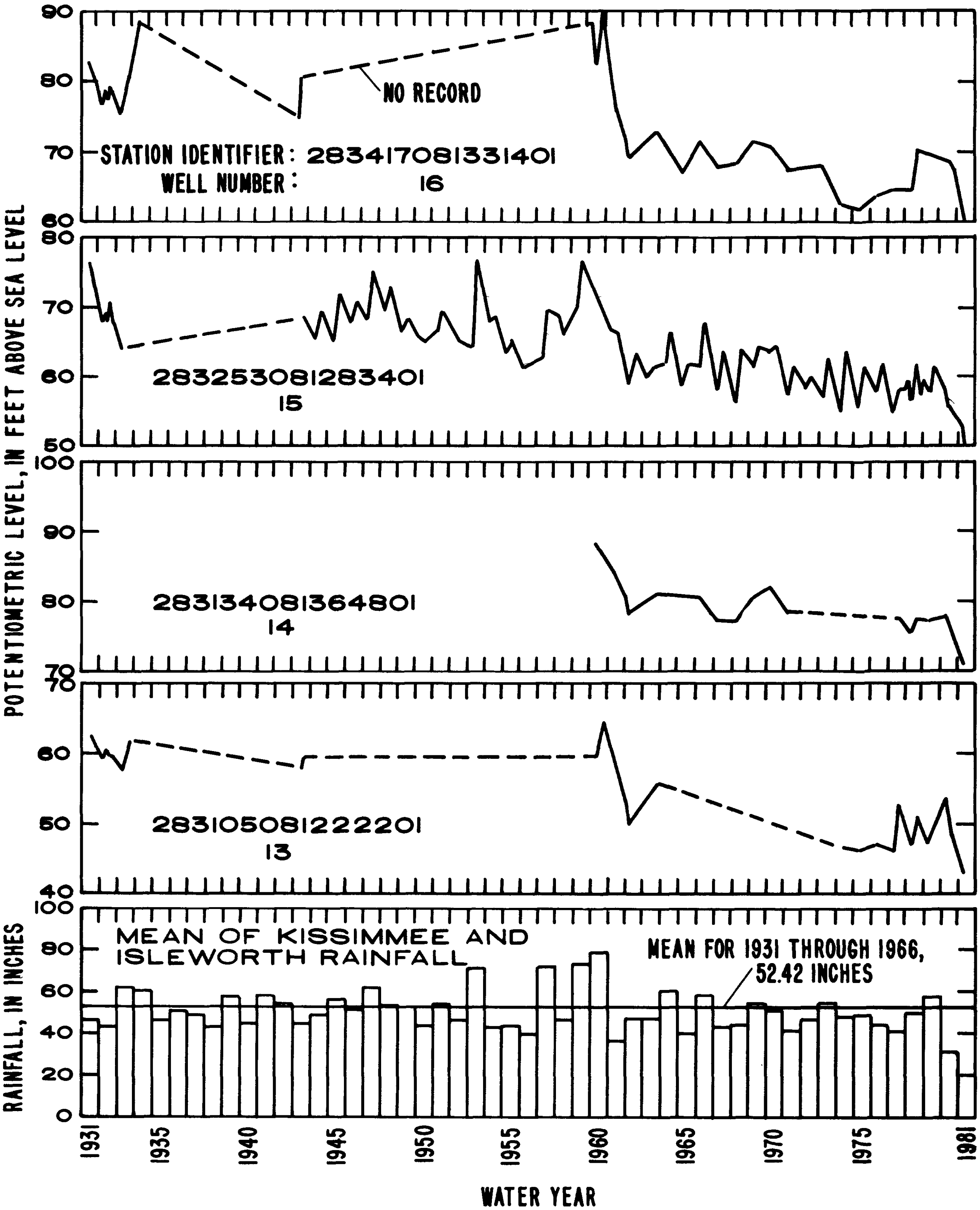


Figure 15.--Hydrographs for Floridan aquifer wells and rainfall in the Reedy Creek Improvement District area--Continued.

Six of the wells shown in figure 15 have water-level records as early as 1931, though none were measured every year. The hydrographs show that water level has fluctuated seasonally and that there is no evidence of a continuing trend toward either a higher or a lower potentiometric surface during the period 1931 through 1960. The highest water levels during the 50-year period beginning in 1931 were probably in 1960, in response to the relatively high rainfall in 1957, 1959, and 1960. The hydrographs in figure 15 show that since 1960 water levels in most wells trend downward, but in some wells the downward trend is relatively slight.

Downward trends in water levels were least at wells 1, 2, 3, and 5--less than 10 feet from May 1961 through May 1981. These wells are in undeveloped areas and are in or near areas of high recharge; these two factors probably are the reason for the relatively slight decline in the water levels that describe the potentiometric surface.

The remainder of the hydrographs plotted in figure 15 show water level declines of as much as 30 feet from May 1961 through May 1981. These wells, located closer to developed areas, are generally between the RCID, Kissimmee, and Orlando. The water-level decline in these wells is probably due to deficient rainfall and combined withdrawal of water by municipalities and agricultural operations.

Well 7 is the closest of the Floridan aquifer observation wells to the points of withdrawal for the RCID water supply. The hydrograph for well 7 shows that the water level has declined, but since the opening of the Theme Park in 1971, the decline has been relatively slight. Some of the decline prior to 1971 may have been due to pumping from the Floridan aquifer for development of the supply wells and for the refilling of Bay Lake in 1970.

It is not possible to quantify the amount of decline of the potentiometric surface of the Floridan aquifer due to pumping in the RCID. This is because the period of withdrawal, starting with urban development of the area in 1968, corresponds with a period of below-average rainfall. Also, the amounts of water withdrawn for other uses, including irrigation of citrus groves near the RCID, has not been determined. However, the decline of the potentiometric surface in the vicinity of the RCID, as indicated by record for well 7, is apparently no more than at many other locations in the surrounding area. Therefore, pumpage in the RCID has probably not had a widespread effect on the potentiometric surface of the Floridan aquifer in the surrounding areas, or at least has not noticeably lowered the potentiometric surface more than other withdrawals in the area north and northeast of the RCID.

WATER QUALITY

The data summaries and conclusions presented in this section are based primarily on periodic sampling from October 1971 through September 1980 at 13 surface-water sites in the RCID and vicinity; and thus, represent water-quality conditions after completion of most development, and opening of the Theme Park and related developments. A four-parameter water-quality monitor provides hourly measurements of specific conductance, water temperature, pH, and dissolved oxygen at Reedy Creek near Vineland (site 11). This hourly record, which began in July 1976, provides much more detailed information on short-term variations in water quality than do the periodic samples.

Data for specific conductance, nutrient concentrations, and dissolved oxygen are available for some sites prior to development of the RCID. The historical data can be used to assess changes in water quality with time, some of which are probably related to development and operation of the RCID. The time-trend analysis of water-quality data is presented in a later section of this report.

A brief description of the water-quality sampling sites is given in table 3, with a site number used to show the locations in figure 1. Also given in table 3 is the station identification number used for storage and retrieval of all hydrologic data in the U.S. Geological Survey computer data base.

Table 3.--Description of water quality sampling loctions

Site and map No.	Station identification No.[1/]	Description
1	282442081352600	Outflow from Seven-Seas Lagoon
2	02263851	Outflow from Bay Lake
3	02263869	Outflow from South Lake
4	02264000	Cypress Creek
5	02264100	Bonnet Creek
6	02266291	Canal upstream from structure S-405A
7	02266294	Canal downstream from structure S-405
8	02266200	Whittenhorse Creek
9	02266295	Canal upstream from structure S-410
10	282135081345500	Canal downstream from L-410 canal inflow
11	02266300	Reedy Creek (near Vineland)
12	02266480	Davenport Creek
13	02266500	Reedy Creek (near Loughman)

[1/] Identifier for computer data storage and retrieval.

Sites 1, 2, and 3 represent outflow from lakes in or adjacent to the RCID. Sites 1 and 2 are within the Theme Park complex and represent outflow from lakes heavily used for swimming, boating, and other forms of recreation. Hotels, swimming areas, marinas, and gardens are on the shorelines of Bay Lake and Seven Seas Lagoon. Sites 4, 8, and 12 are on streams flowing into the RCID from surrounding wetlands (Cypress Creek, site 4) or agricultural areas (Whittenhorse Creek, site 8); Davenport Creek, site 12). Sites 6 and 9 are on the canal system constructed to provide drainage of undeveloped parts of the RCID upstream from the developed areas. Site 5 is on a channelized section of Bonnet Creek, which receives inflow from several drainage canals, storm runoff from developments at Lake Buena Vista, overflow from Bay Lake and South Lake, and inflow from Cypress Creek. Site 7 is on a canal downstream from a golf complex and downstream of the inflow from holding ponds which detain storm runoff from the main parking area. Site 10 is downstream from sites 7 and 9 and about 0.2 mile downstream of the canal L-410 inflow and the discharge of treated wastes contained in the 102-acre overland-flow treatment process. Site 11 is on the natural Reedy Creek channel downstream from site 10 and both points of treated wastes discharge. Site 13 is downstream from the south boundary of the RCID and represents all surface discharge from the RCID except that diverted eastwards from the undeveloped area.

A summary of selected water-quality data is given for each of the 13 surface-water sites in the Supplemental Data section of this report. The summary includes period of record, number of samples, and maximum, mean, median, and minimum values for each of the selected parameters.

Major Constituents and Properties

The major constituents in water include the cations calcium, magnesium, sodium, and potassium, and the anions bicarbonate, chloride, and sulfate. The constituents are derived mostly from natural processes that include the dissolution of rock and soil and, generally some atmospheric deposition. Waste discharge and runoff from developed areas can affect the balance of the major dissolved constituents in a receiving body of water.

Major constituent concentrations, properties, and constituent ratios in water may be an indication of the source of the water and the hydrology of a watershed. For example, water from the Floridan aquifer in the RCID area is predominantly a calcium and bicarbonate type with low concentrations of sodium, potassium, sulfate, and chloride. Lichtler and others, (1968) reported specific conductance to range from 150 to 200 umhos/cm (micromhos per centimeter at 25° Celsius). Rainfall has a relatively low specific conductance but contains more of a mixture of constituents than water from the Floridan aquifer. Bulk precipitation samples (rainfall plus dry fallout) collected in the central Florida area at Maitland, Fla., (about 5 miles north of Orlando) from July 1972 through September 1978 had a mean specific conductance of 23 umhos/cm and none of the major cations or anions accounted for more than 45 percent of the mean concentration on a chemical equivalent basis (Irwin and Kirkland, 1980). Water from a swampy watershed in which the water is in contact with decaying plant debris for long periods of time is acidic, has a low bicarbonate concentration, and is highly colored due to leaching of organic materials from the plant debris.

Waste effluent and runoff from agricultural areas may affect the chemical makeup and properties of the receiving waters by adding constituents to the water. Domestic wastes contain the constituents in the treated water supply and additional sodium, chloride, nitrogen, and phosphorus species, from the wastes. Agricultural runoff may contain leachates from fertilizers and soil conditions and may have relatively high concentrations of calcium, magnesium, sulfate, chloride, nitrogen, and phosphorus.

Major constituent ratios for surface water in the RCID area are shown in figure 16 (sites 1-13). Also plotted in figure 16 is an analysis for a sample from one of the RCID supply wells (site 14), which taps the Floridan aquifer, and is typical of Floridan aquifer water.

Major dissolved constituents in water from the sites varied widely. The surface-water sites (sites 1-13) are in two general categories--four sites with water having a very low bicarbonate percentage (high sulfate and chloride percentage), and the remaining sites with bicarbonate concentrations accounting for at least 38 percent of the anion equivalent concentration.

Sites 3, 4, 6, and 8 represent water from areas upstream of RCID development. The low bicarbonate percentages are indicative of a swampy watershed with little or no inflow of water from the Floridan aquifer. At site 6, the water is stagnant much of the time, and in contact with accumulated plant debris; this condition contributes to an acidic water with a low bicarbonate concentration.

Bicarbonate accounts for at least 38 percent of the anionic composition at the other sites, probably because of some inflow of water from the Floridan aquifer. Sites 1, 2, 5, and 7 receive Floridan aquifer water because of outflow of water from Seven Seas Lagoon and Bay Lake. Water from the Floridan aquifer is used to maintain stages in these two lakes during dry periods. Sites 10, 11, and 13 are downstream from a source of treated wastes that are conveyed through the collection and treatment system by water from the Floridan aquifer. Sites 9 and 12 have no known direct inflow of Floridan aquifer water. However, upward seepage from the Floridan aquifer into the stream or canals upstream of the sampling points may occur, or seepage from the surficial aquifer may be, in part, Floridan aquifer water which has entered the aquifer following irrigation of the surrounding citrus groves.

A summary of selected water-quality parameters is shown in figure 17. These parameters help to illustrate differences in the hydrology of the streams or canals.

Specific conductance, a function of dissolved solids concentration, is not widely variable among the 13 sites, as shown by the relatively small range in median values. Median specific conductance ranged from 95 umhos/cm at site 8 to 169 umhos/cm at site 7. The range in specific conductance was greatest at site 4 and site 11. The highest specific conductance was 300 umhos/cm at site 4. The greater range in specific conductance at site 4 (Cypress Creek) probably is related to the fact that relatively high specific conductance water ovrflows into Cypress Creek swamp from the Butler chain. At site 11, the variation in specific conductance is probably due to relative amounts of treated wastes (higher specific conductance) and storm runoff (lower specific conductance) in the stream.

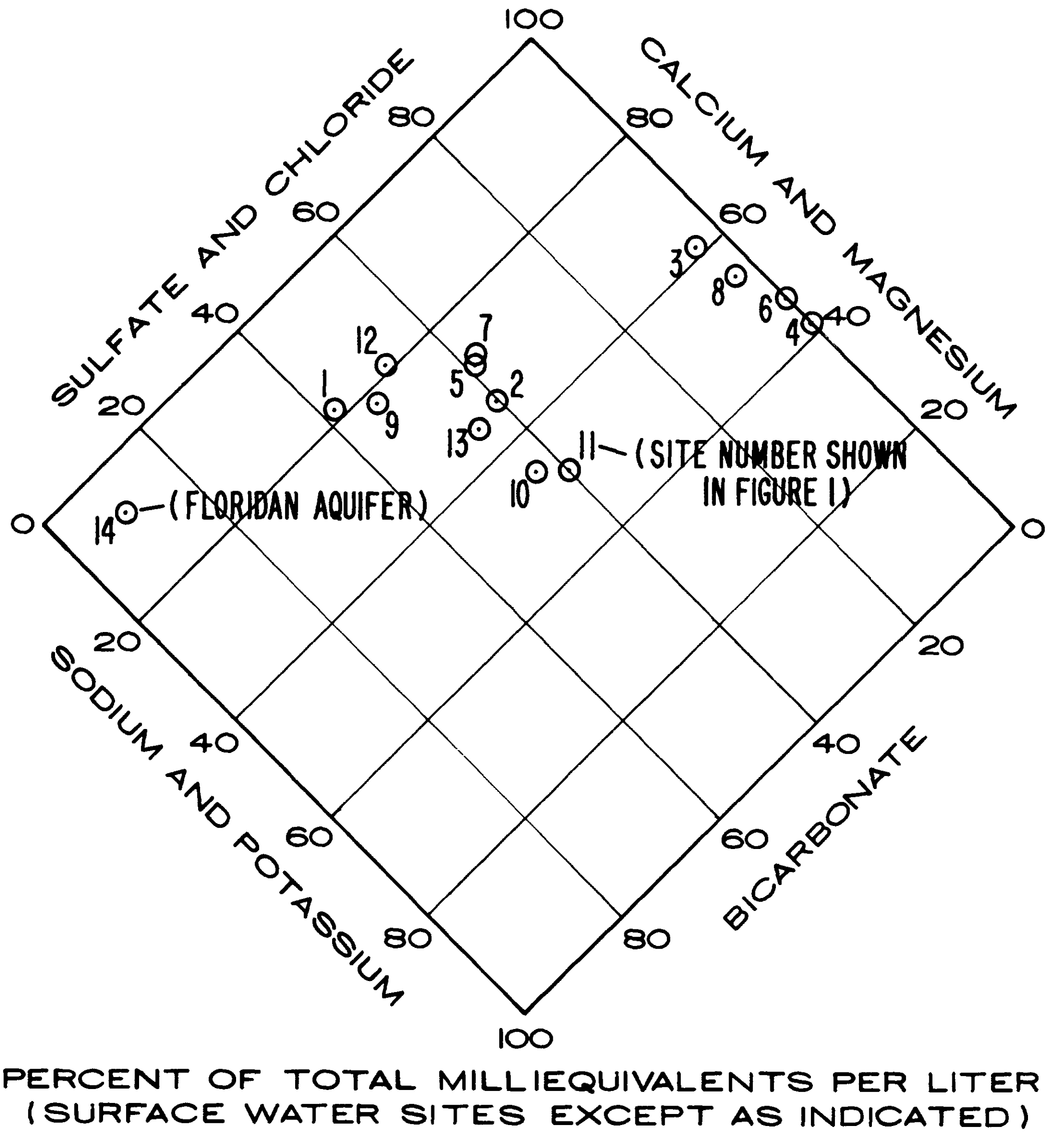


Figure 16.--Mean major-constituent ratios in waters in the Reedy Creek Improvement District area, October 1979 through June 1981.

Lowest median pH (less than 4.4 units) occurred at sites 4, 6, and 8. These sites also had the highest median color (320 or greater platnium-cobalt units, see fig. 17). The combination of low pH and high color is indicative of water standing in contact with organic debris for extended periods. Site 3 has had a relatively low pH (median pH of 5.0 units) and a low color (median color of 20 units). The low color is an indication that the water at site 3 is not affected by contact with organic debris, thus the relatively low pH is probably due to the acidic nature of rainfall in a lake with a low buffering capability. This indicates that water from the Floridan aquifer is probably not reaching the lake.

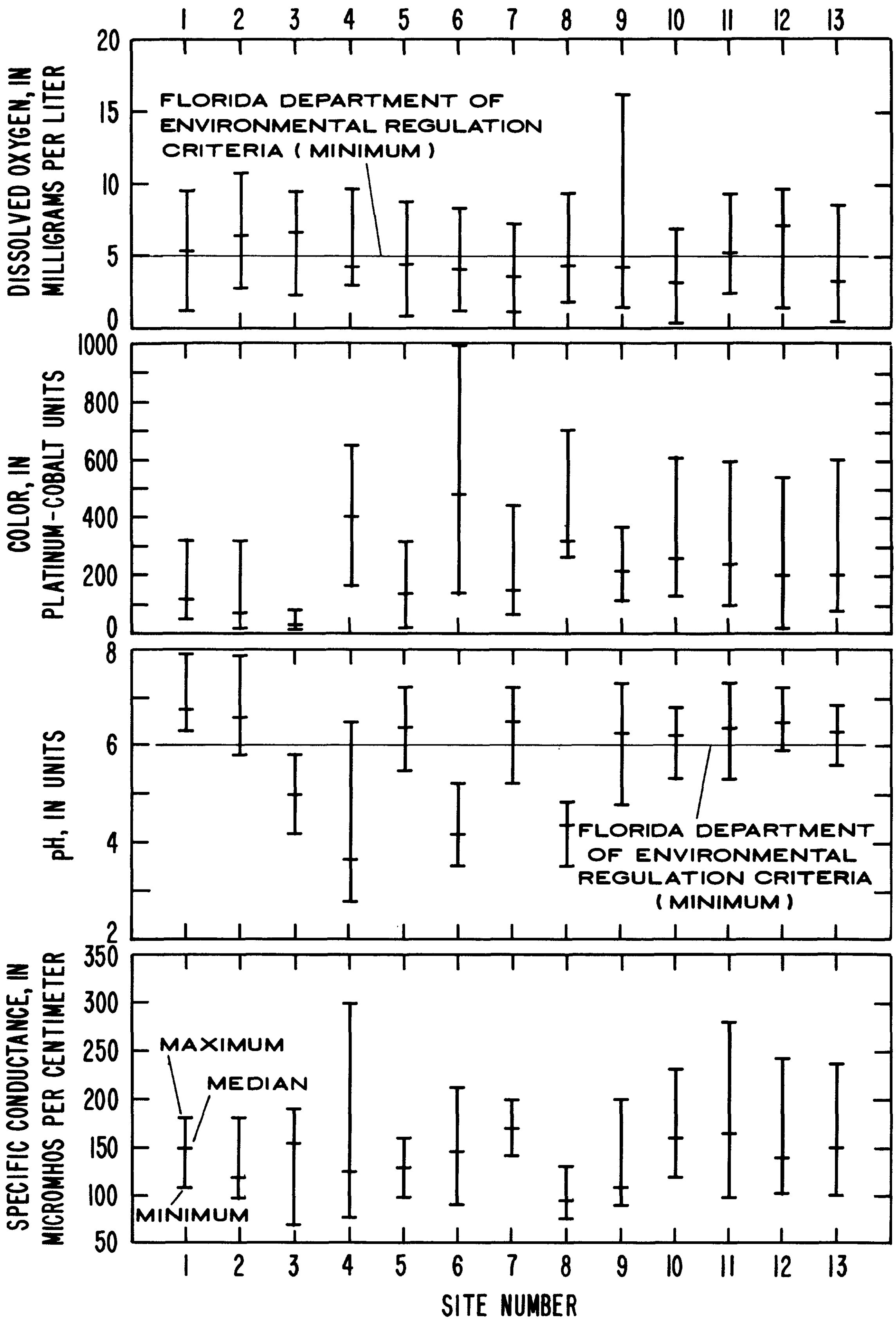


Figure 17.--Maximum, median, and minimum values for selected water-quality parameters for surface waters in the Reedy Creek Improvement District area, October 1971 through June 1981.

Water-quality standards for many parameters, including pH, have been established (Florida Department of Environmental Regulation, 1983). The criteria for pH in surface waters (except in specified zones of mixing of waste discharges with the receiving water) is "pH of receiving waters should not be caused to vary more than one (1.0) unit above or below natural background pH of the water; the lower value shall not be less than six (6.0) and the upper value shall not be more than eight and one half (8.5)." At the 13 sites, pH did not exceed 8.5 units, but at all sites except site 1 (outflow from Bay Lake), the minimum pH was less than 6.0 units (fig. 16). At sites 3, 6, and 8, pH of all samples was less then 6.0 units, and at site 4, more than half the samples had a pH of less than 4.0 units. The low pH values are probably due to natural processes, including leaching of acidic organic compounds (plant debris) at site 4, 6, and 8 and the acidity of rainfall into a lake of low buffering capacity at site 3.

DO (dissolved oxygen) concentration is also specified in the FDER (Florida Department Environmental Regulation) water-quality standards for class III waters, or waters designated for recreation, and propagation and management of fish and wildlife. According to these criteria, DO "in predominantly fresh waters * * * shall not be less than 5 milligrams per liter." This criterion applies to all RCID waters, except that a variance may be applied to a mixing zone in Reedy Creek downstream from wastes discharges. As of August 1981, the boundaries of this mixing zone had not yet been specified.

DO concentrations of surface waters in the RCID are summarized in figure 17. The DO at most sites was often less than 5 mg/L (milligrams per liter) and was less than 5 mg/L at least once at all sites. Median DO concentration was greater than 5 mg/L at sites 1, 2, 3, 11, and 12. The lowest DO concentrations (minimum = 0.3 mg/L, median = 3.2 mg/L) occurred at site 10, immediately downstream from outflow of treated wastes from the 102-acre overland-flow area at canal L-410. This waste discharge, though less than 2 mg/L in BOD (biochemical oxygen demand) is also low (2.3 mg/L mean) in DO (Harden, 1980), and could be the cause of relatively low DO at site 10.

The low DO concentration at most sites (other than site 10) is probably a natural characteristic of the streams. The sites representing canals or channelized stream segments (sites 5, 6, 7, 9, and 10) are probably affected by seepage of low DO ground water into the channel and high demand for oxygen by plant debris. Some natural streams in undeveloped areas (sites 4 and 8) have low DO concentrations probably due to high demand for oxygen by plant debris in swampy areas. The high color of many of the canals and swampy streams is indicative of two significant conditions relating to DO concentrations: first, the color is indicative of large quantities of oxygen-demanding organic debris within the basin, and second, the color and associated low pH may create conditions unfavorable for photosynthetic production of oxygen.

Water-level control structures might also affect DO concentrations because the impounded water is at times highly stratified and nearly devoid of oxygen near the bottom. Water leaking past the gates, or released by partial gate opening, may be from the bottom of the pool, and thus be a source of DO deficit to the reach downstream from the structure. This could be a contributing factor to low DO at sites 5 and 7, located in reaches just downstream of control structures.

Nutrients

Nitrogen and phosphorus compounds are nutrients which contribute to the productivity of water--that is, to the ability of the water to support plant and animal life. Excessive quantities of nutrients may stimulate some organisms to proliferate to nuisance levels at the expense of other, often more desirable, species. Excessive production may load the water with oxygen-consuming debris, to the detriment of fish. Permissible nutrient concentrations for acceptable water quality are presently not known because many factors, such as stream morphology, trace-metals concentrations, and other chemical and physical properties and constituents of water, also affect production. Therefore, the FDER has not established specific nutrient criteria, but state that "in no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna." (Florida Department of Environmental Regulation, 1983).

Ratios of the nitrogen species for the 13 surface-water sampling sites are shown in the trilinear diagram in figure 18. The surface-water sites can be grouped into 4 general regions: (1) 8 sites with 80 or more percent of the nitrogen in the organic form, (2) 2 sites with more than 20 percent ammonia nitrogen (sites 6 and 10), (3) 2 sites with more than 25 percent nitrate and nitrite nitrogen (sites 11 and 13), and (4) 1 site with nearly 50 percent nitrate and nitrite nitrogen (site 12).

Sites within each group described above have some common characteristics. The sites with more than 80 percent organic nitrogen include outflows from the three lakes (sites 1, 2, and 3) and streams or canals upstream from, or not affected by, treated waste inflow (sites 4, 5, 7, 8, and 9).

Sites 6 and 10 have the highest ammonia nitrogen percentage but represent different environments. The relatively high ammonia nitrogen at site 6 is probably from anaerobic decomposition of plant debris on the canal bottom. The relatively high ammonia nitrogen at site 10 probably results from inflow of treated wastes.

Sites 11 and 13, both on Reedy Creek, are probably relatively high in nitrate nitrogen due to the treated-wastes discharges upstream; ammonia nitrogen noted at site 10 is apparently oxidized to nitrate as the water moves downstream.

Site 12 (Davenport Creek) is unique because it represents an undeveloped watershed (except for citrus groves) and has a high proportion of nitrogen in the nitrate form. This nitrate could be due to seepage of ground water into the stream. In citrus groves, water percolating into the surficial aquifer could have high nitrate concentration from fertilizer applications. Seepage of the water from the surficial aquifer, as well as direct runoff from the citrus groves, could account for the relatively high nitrate nitrogen at site 12.

The sample of Floridan aquifer water (site 14) had most of the nitrogen in the nitrate form, and no organic nitrogen. The total nitrogen concentration was 0.08 mg/L and was low in comparison to the surface-water sites.

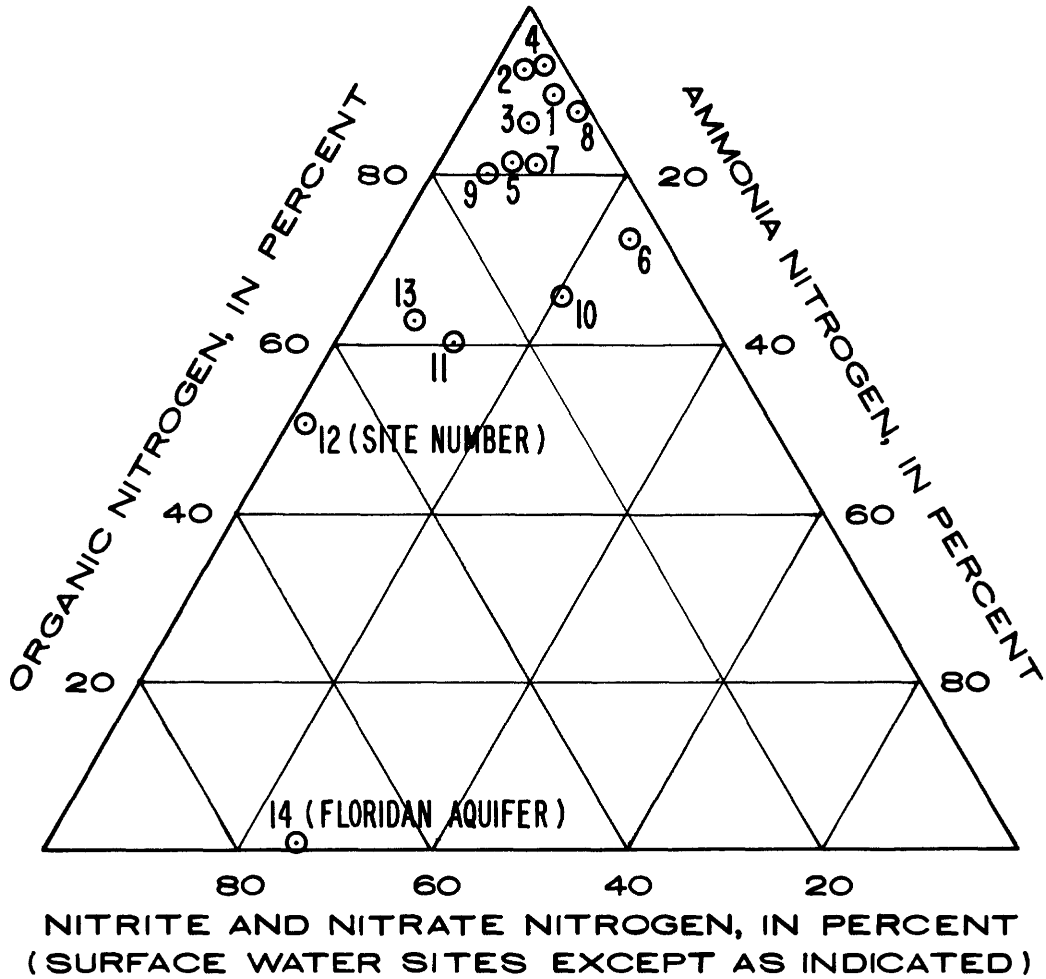


Figure 18.--Mean nitrogen species ratios in waters in the Reedy Creek Improvement District area, October 1971 through June 1981.

Maximum, median, and minimum concentrations of total, organic, and nitrate nitrogen for the surface-water sites are shown in figure 19. Median total nitrogen concentrations ranged from 2.1 mg/L at site 8 to 0.29 mg/L at site 3. Four sites (sites, 1, 2, 3, and 5) had median concentrations of less than 1 mg/L; these sites had relatively low total nitrogen concentrations because they probably do not receive treated wastes inflow or are not in areas where large quantities of fertilizer are used. The highest median total nitrogen concentrations were at sites 4, 6, 8, and 12 where median concentrations were 1.87 mg/L or greater. These four sites are in undeveloped areas or in areas of citrus groves. The relatively high nitrogen concentrations at these sites are probably due to natural sources of nitrogen, or from fertilizer in runoff and ground-water seepage from the citrus groves. Sites 10 and 11, downstream from the treated wastes inflows, occasionally had relatively high nitrogen concentrations, but median concentrations at these two sites were not higher than at many of the other sites.

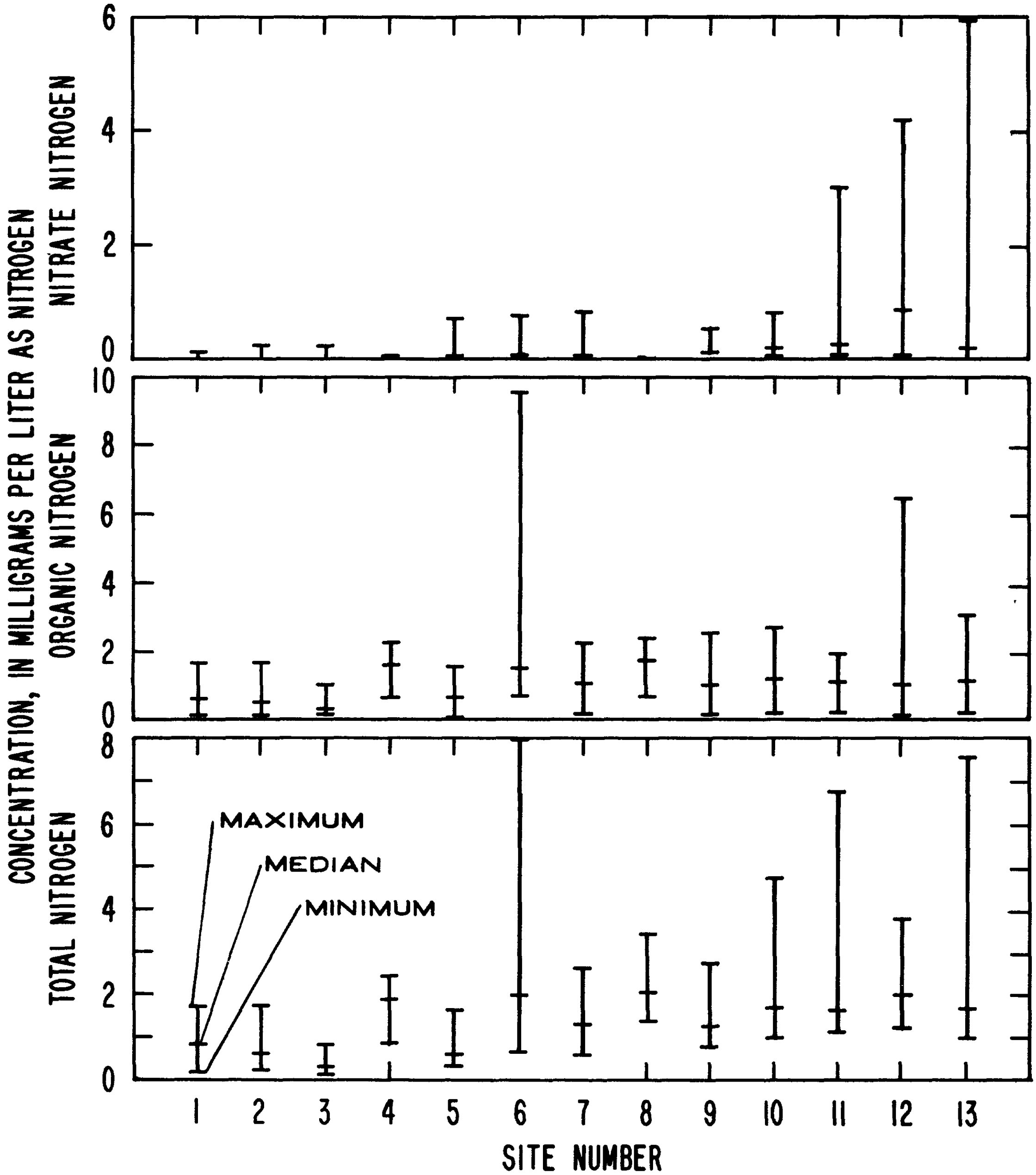


Figure 19.--Maximum, median, and minimum concentrations for selected nitrogen species in surface waters in the Reedy Creek Improvement District area, October 1971 through June 1981.

Organic nitrogen concentrations (fig. 19) had a pattern of occurrence very similar to that of total nitrogen. This similar pattern is predictable because organic nitrogen accounted for more than 60 percent of the total nitrogen at all sites except site 12. More samples were analyzed for organic nitrogen than for total nitrogen, so that maximum concentrations of organic nitrogen plotted in figure 19 are higher than maximum concentrations of total nitrogen at some sites.

Median nitrate nitrogen concentrations were 0.1 mg/L or less except at four sites (10, 11, 12, and 13). At these sites, median nitrate concentrations ranged from 0.21 to 0.88 mg/L, and at sites 11, 12, and 13, nitrate nitrogen concentrations of 3 mg/L or greater occurred. The relatively high nitrate nitrogen at sites 10 and 11 are probably related to the treated wastes discharge upstream. The discharges may possibly also contribute to the high nitrate concentrations at site 13. Site 12 had the highest median nitrate concentration, probably leached from fertilizers applied to citrus groves that entered Davenport Creek as ground-water seepage and in surface runoff. Inflow of nitrate to Reedy Creek from Davenport Creek upstream from site 13 may account, at least partly, for high nitrate concentrations at site 13.

Phosphorus concentrations at the 13 sites are summarized in figure 20. Median total phosphorus concentrations were less than 0.1 mg/L at all sites except sites 10, 11, and 13. The high phosphorus concentrations probably are due to the inflow of treated waste. Sites 9 and 12 had maximum phosphorus concentrations in excess of 0.5 mg/L. These relatively high concentrations may be due to fertilization of adjacent citrus groves. The pattern of occurrence of orthophosphate phosphorus is very similar to that of total phosphorus. This implies that most of the total phosphorus in surface waters in the RCID area is of orthophosphate origin.

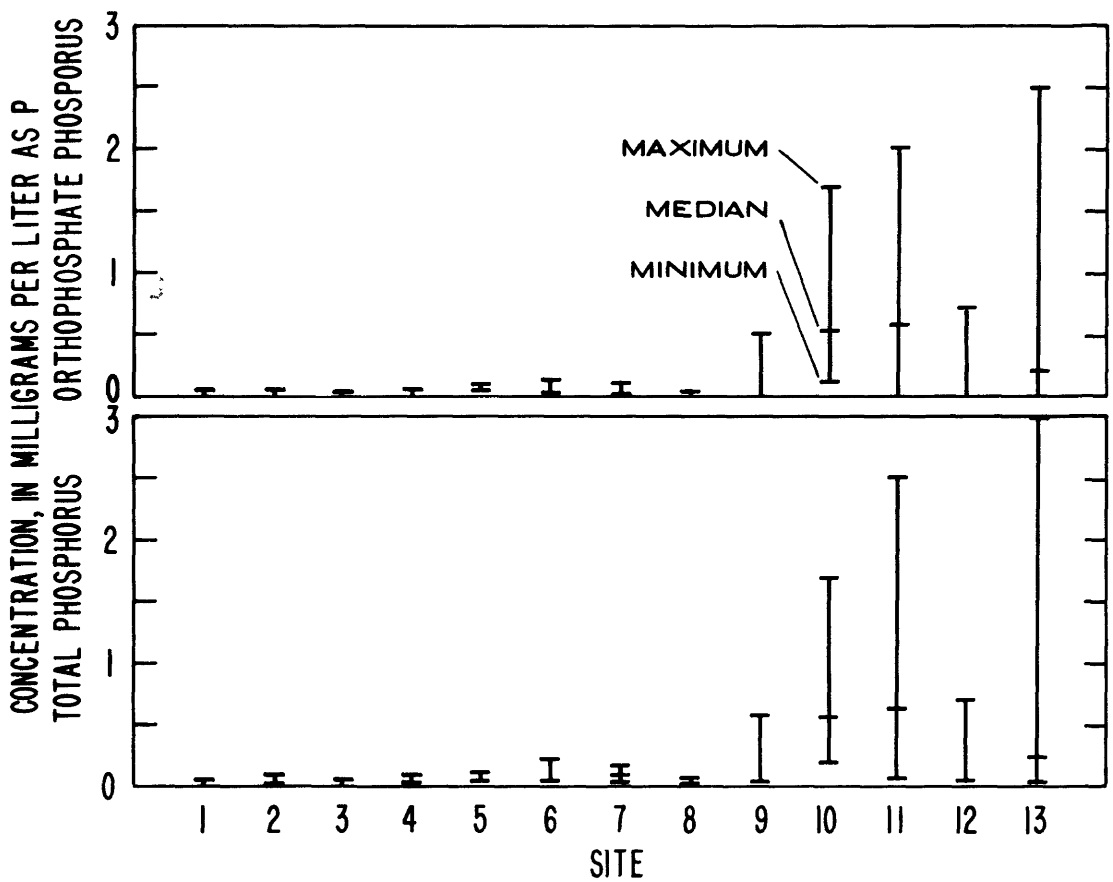


Figure 20.--Maximum, median, and minimum concentrations for phosphorus in surface waters in the Reedy Creek Improvement District area, October 1971 through June 1981.

Organic carbon is a constituent also essential to the aquatic ecosystem and may be present in high concentrations due to wastes disposal. Another source of organic carbon is decaying plant debris which accumulate in swampy watersheds and sluggish streams and canals. High organic carbon concentrations from plant debris are associated with high color due to leaching of organic compounds.

In figure 21, median color and median total organic carbon concentrations are plotted for each site, using only samples in which both color and total organic carbon were determined. The figure shows a definite relation between color and total organic carbon, indicating that the high total organic carbon concentrations which occur at several sites are derived from leaching of plant debris. Site 6 has a higher color than expected based on the total organic carbon concentrations and the relation between the two variables indicated by the other sites. This departure at site 6 from the pattern for other sites is probably due to nonlinearity of the total organic carbon-color relation rather than a difference in source of color or total organic carbon.

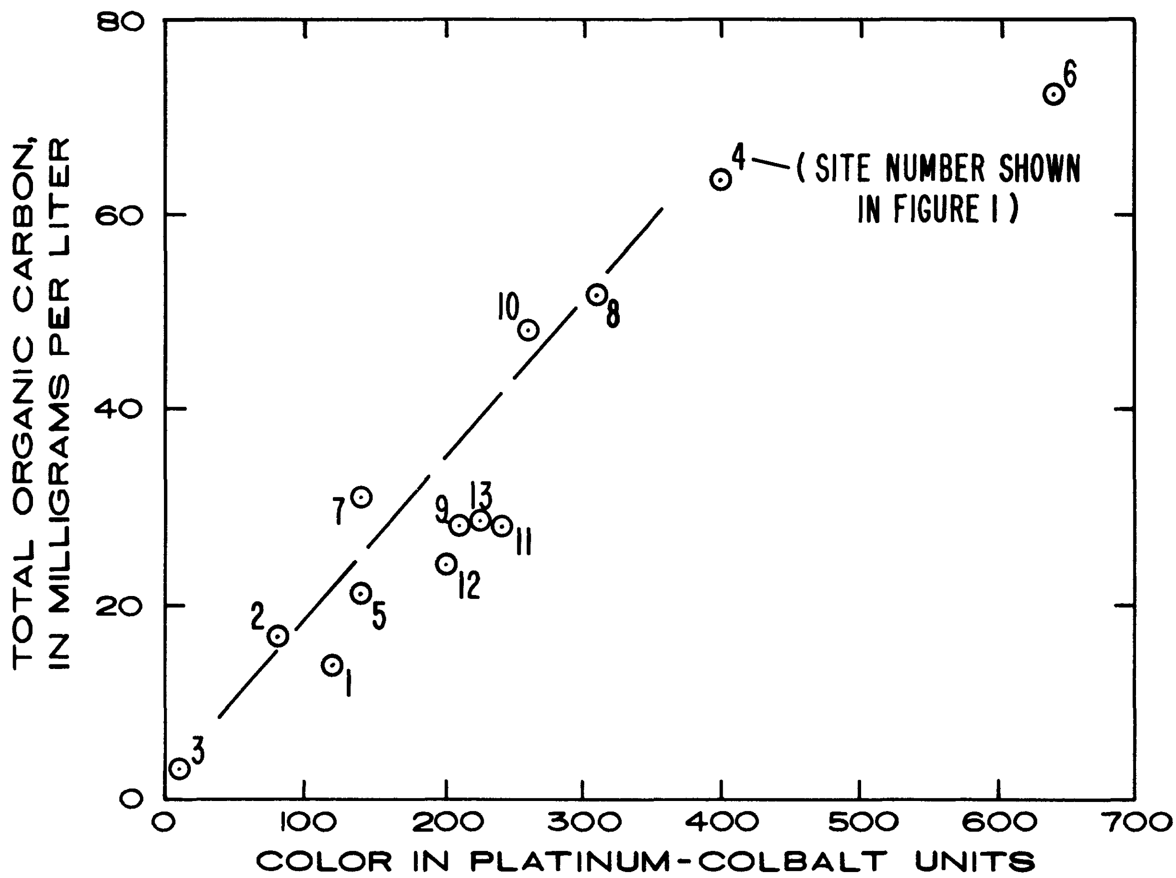


Figure 21.--Relation between color and total organic carbon for surface water in the Reedy Creek Improve District area (plotted points are median color and median total organic carbon at the 13 surface water sites, for samples in which both color and total organic carbon were analyzed.)

Trace Elements

The FDER has specified maximum allowable concentrations for several trace elements in class III waters (Florida Department of Environmental Regulation, 1983), either because of toxicity to aquatic life or, for iron, because it may form precipitates which can interfere with bottom-dwelling species. Samples for these trace elements have been collected from surface-water sites in the RCID area, but the sampling procedure and frequency of sampling has varied during the study. Prior to 1978, analyses were for dissolved elements only. In 1978, the sampling procedures were changed to include both dissolved and suspended elements.

Table 4 shows a summary of analyses of trace element and organic compound concentrations in the RCID area. The summary includes all analyses for the 13 surface-water sites. Most of the data are for samples collected since 1970. The number of qualified values, or concentrations reported as less-than a specified value, are listed in table 4. For this summary, these qualified values were assumed to be actual concentrations.

Relative magnitudes of trace element concentrations, listed in order of decreasing median values, are iron, aluminum, zinc, chromium, copper, arsenic, nickel, lead, and mercury. The elements beryllium, cadmium, selenium, and silver had a median concentration of zero. Only iron, aluminum and zinc generally exceeded concentrations of 10 ug/L (micrograms per liter), though many of the trace elements exceeded 10 ug/L at least once.

Table 5 gives a summary of trace elements criteria-exceedance frequencies for the 13 surface-water sites. This summary includes all data and does not separate total (unfiltered) concentrations and dissolved (filtered) concentrations. Some concentrations were reported to be less than the analytical detection limit; these "less-than" concentrations were assumed to be zero.

Concentrations of 7 of the 13 trace elements specified in the FDER standards never exceeded the water-quality criteria. The six elements that exceeded these criteria, in order of decreasing frequency of exceedance, are mercury, zinc, cadmium, copper, silver, iron, and lead. It is noted that the frequencies of exceedance for cadmium, mercury, and silver may be biased high because of analytical imprecision at these low concentrations. These criteria were less than the anlytical detection limits used in most of the study. Water quality criteria-exceedance frequencies for copper, iron, lead, and silver were 5 percent or less. Only one sample, from site 4 (Cypress Creek), had silver in measurable concentration.

All sites except site 9 had mercury concentrations greater than the criteria of 0.2 ug/L. The source of the mercury is not known, but the metal has been used extensively as a fungicidal agent for agricultural purposes (U.S. Environmental Protection Agency, 1976, p. 98). Agricultural use of mercury has been as a seed dressing for prevention of mildew (Wershaw, 1970, p. 30). Therefore, the source of mercury in the RCID area is probably not related to agricultural practices in this predominantly citrus-growing area. Mercury has been detected in several samples of bulk precipitation in concentrations as high as 2 ug/L (Irwin and Kirkland, 1980), therefore, atmospheric deposition of mercury may be

Table 4.--Summary of trace element and organic compound concentrations at 13 surface-water sites

Property or constituent	Samples Total	Samples Remarks[1]	Maximum	Mean	Median	Minimum	Percentile 95	Percentile 5
Trace elements in water (micrograms per liter)								
Aluminum, total recoverable	35	0	1,000	248.9	180	0	900	10
Arsenic, dissolved	91	0	50	10.0	10	0	30	0
Arsenic, total	55	0	30	5.7	2	0	20	0
Beryllium, total recoverable	31	0	10	1.9	0	0	10	0
Cadmium, dissolved	2	0	0	.0	0	0	0	0
Cadmium, total recoverable	41	0	7	.5	0	0	2	0
Chromimum, hexavalent, dissolved	94	0	8	.4	0	0	2	0
Chromium, total recoverable	53	8	30	11.3	10	0	20	0
Copper, total recoverable	39	0	10	3.1	3	0	8	0
Copper, dissolved	113	0	50	8.1	5	0	40	0
Iron, dissolved	152	0	2,700	280.6	210	0	710	20
Iron, total recoverable	43	0	1,300	392.6	350	0	1,100	110
Lead, dissolved	107	0	20	4.2	2	0	16	0
Lead, total recoverable	39	0	170	9.5	1	0	52	0
Mercury, dissolved	5	0	.9	.5	.5	.1	.9	0.1
Mercury, total recoverable	41	15	.5	.2	.2	0	.5	0
Nickel, total recoverable	39	0	33	3.7	2	0	14	0
Selenium, total	34	0	0	0	0	0	0	0
Silver, total recoverable	39	0	1	0	0	0	0	0
Zinc, dissolved	113	0	130	34.2	30	0	90	0
Zinc, total recoverable	39	0	330	26.9	20	10	40	10
Organics in water (total in micrograms per liter)								
Chlordane	99	0	0.10	0.00	0	0	0.00	0
DDD	118	0	.01	.00	0	0	.00	0
DDE	118	0	.01	.00	0	0	.00	0
DDT	118	0	.02	.00	0	0	.00	0
Diazinon	65	0	.01	.00	0	0	.00	0
Dieldrin	118	2	.01	.00	0	0	.00	0
Ethion	61	0	.07	.00	0	0	.00	0
Lindane	118	2	.02	.00	0	0	.00	0
Malathion	65	0	2.30	.12	0	0	1.00	0
Parathion	65	0	.02	.00	0	0	.00	0
PCB	100	0	.10	.00	0	0	.00	0
2,4-D	107	0	.65	.02	0	0	.15	0
Silvex	107	0	6.00	.10	0	0	.21	0
Organics in bottom material (total in micrograms per kilogram)								
Aldrin	120	0	66.00	0.90	0	0	1.30	0
Chlordane	100	0	190.00	9.14	0	0	44.00	0
DDD	120	1	12.00	.78	0	0	4.60	0
DDE	120	0	86.00	1.57	0	0	7.00	0
DDT	121	0	8.50	.34	0	0	2.00	0
Diazinon	48	0	1.10	.02	0	0	.00	0
Dieldrin	121	1	14.00	.64	0	0	3.10	0
Ethion	32	0	38.00	1.19	0	0	.00	0
Heptachlor epoxide	93	0	3.20	.04	0	0	.00	0
Methyl parathion	48	0	18.00	.74	0	0	3.80	0
PCB	101	2	760.00	11.24	0	0	15.00	0
Toxaphene	94	0	50.00	.53	0	0	.00	0
Silvex	103	0	210.00	2.42	0	0	.00	0
2,4-D	102	0	29.00	.59	0	0	.00	0

[1]Remarks indicate number of concentrations reported to be less than the reported value. The reported values were used in these summaries, so in some cases, the summary statistic may be less than the value given.

Table 5.—Summary of water quality criteria exceedance frequencies for trace elements

Trace element	Criteria[1/]	Percent of analyses exceeding criteria — Site No. 1	2	3	4	5	6	7	8	9	10	11	12	13	Number of analyses	Percent exceeding criteria
Aluminum (Al)	1,500	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0
Arsenic (As)	50	0	0	0	0	0	0	0	0	0	0	0	0	0	146	0
Beryllium (Be)	11	0	0	0	0	0	0	0	0	0	0	0	0	0	31	0
Cadmium (Cd)	0.8	0	0	0	33	33	50	0	0	0	0	14	0	38	41	20
Chromium, hexavalent (Cr)	50	0	0	0	0	0	0	0	0	0	0	0	0	0	94	0
Chromium (Cr)	50	0	0	0	0	0	0	0	0	0	0	0	0	0	53	0
Copper (Cu)	30	0	0	8	7	5	0	14	11	0	0	4	0	5	153	5
Iron (Fe)	1,000	0	0	0	5	4	15	0	7	0	0	0	4	0	195	3
Lead (Pb)	30	0	0	0	7	6	0	0	0	0	0	0	0	5	147	2
Mercury (Hg)	0.2	50	50	33	25	50	100	50	100	0	50	50	100	25	46	63
Nickel (Ni)	100	0	0	0	0	0	0	0	0	0	0	0	0	0	39	0
Selenium (Se)	25	0	0	0	0	0	0	0	0	0	0	0	0	0	34	0
Silver (Ag)	0.07	0	0	0	33	0	0	0	0	0	0	0	0	0	39	3
Zinc (Zn)	30	50	0	23	36	20	60	14	78	0	0	36	24	29	153	31
Number of analyses		26	26	94	110	156	77	56	67	32	32	214	140	176	1,206	
Percent exceeding criteria		8	4	5	10	8	14	5	16	0	3	7	6	7		

[1/] Micrograms per liter, for class III waters (Florida Department of Environmental Regulation, 1983).

a source of the metal in surface waters. The ubiquitous presence of mercury in extremely low concentrations seems to be characteristic of the RCID area, and these low concentrations, though often in excess of the FDER water-quality criteria, may represent natural, or background, conditions.

Zinc concentrations exceeded the FDER water-quality criteria of 30 ug/L at 10 of the 13 sites (table 5), and, like mercury, seems to be widespread in the area in concentrations which are at times in excess of this criteria. Hem (1970, p. 203) states that weathering of zinc-bearing minerals results in formation of soluble zinc compounds. Additionally, zinc may be widespread throughout the area due to its presence in many types of metal and may be present in relatively high concentrations in rainfall and dry fallout. Irwin and Kirkland (1980, p. 22) reported that mean zinc concentrations in rainfall and bulk precipitation samples from various locations in Florida often exceeded 30 ug/L, and at two sites exceeded 100 ug/L. Therefore, zinc in the RCID area probably is not directly related to developments either within the RCID or in agricultural areas adjacent to the RCID.

Cadmium exceeded the FDER water-quality criteria in about 20 percent of the 41 samples from 5 of the 13 sites (table 5). According to Hem (1970, p. 204), cadmium is present in rocks in quantities much less than those reported for zinc, and concentrations of cadmium in natural water are very small. However, bulk-precipitation samples in Florida (Irwin and Kirkland, 1980) often had 1 ug/L or more of cadmium, and in places more than 10 ug/L, indicating that cadmium in surface waters could originate from atmospheric sources. Cadmium occurrence does not relate strongly to development in the RCID. Two sites (4 and 6) of the five at which the cadmium criteria was exceeded are in undeveloped areas.

A summary of the water quality criteria-exceedance frequencies at each site for trace elements is given at the bottom of table 5. For example, at site 1, of 26 analyses (sum of all trace elements), 8 percent were in excess of a water-quality critera. The summary shows that sites 4, 6, and 8 had the highest criteria-exceedance frequencies for trace elements (10 percent or greater). These sites are in undeveloped areas, except for citrus groves, in or near the RCID. Therefore, the presence of trace elements in concentrations exceeding the water-quality criteria does not seem to relate to the RCID developments. There is some correlation of high trace elements concentrations with high color. Sites 4, 6, and 8 all have highly colored water--median color of 320 units or higher--(fig. 19). High color is symptomatic of a high organic compound concentration and low pH, favoring formation of soluble organic complexes.

Organic Compounds in Water

Many organic compounds were analyzed for in waters of the RCID area. These compounds include insecticides, herbicides, PCB (polychlorinated biphenyl) compounds, and PCN (polychlorinated naphalene) compounds. The compounds are toxic to aquatic life if present in excessive concentrations. The toxic concentration varies widely according to the specific compound, but many of the compounds are toxic when present in extremely low concentrations.

Table 4 summarizes data on total concentrations (dissolved plus suspended) of organic compounds at surface-water sampling sites (sites 1 to 13). The table lists only the compounds detected in at least one sample. Compounds which have been analyzed for, but not detected in RCID waters are not listed in table 4. These include: polychlorinated napthalenes, aldrin, endosulfan, endrin, heptachlor, heptachlor epoxide, methoxychlor, methyl parathion, methyl trithion, mirex, perthane, toxaphene, trithion, and 2,4,5-T.

Silvex, malathion, and 2,4-D with maximum concentrations of 6 ug/L, 2.3 ug/L, and 0.65 ug/L, respectively, were the only organic compounds with concentrations greater than 0.1 ug/L. Median concentrations of all the compounds were zero or less than analytical detection limits. The 95 percentile concentrations, listed in table 4, are the concentrations not exceeded in about 95 percent of the samples, or conversely, the concentrations exceeded in about 5 percent of the samples. Only three of the organic compounds (malathion, 2,4-D, and silvex) were present in measurable concentrations in at least 5 percent of the samples; the remaining compounds were not detected in at least 95 percent of the samples. The data summarized in table 4 show that the concentrations of these organic compounds in surface waters in the RCID area are generally zero, or at least less than the analytical detection limits.

A further summary of data on organic compounds in water is given in table 6. That table gives the number of samples, and percentage of samples with detectable concentrations at each of the 13 surface-water sites. The compounds listed previously that were never detected in water samples are not included in table 6.

Malathion, 2,4-D, and silvex were detected in 20 to 25 percent of the samples. Other compounds, including chlordane, DDT, diazinon, ethion, lindane, parathion, and PCB were detected in 1 to 5 percent of the samples. The presence of DDT, which was banned by the U.S. Environmental Protection Agency in 1972, is indicative of the stability of this compound in the aquatic environment.

All sites except site 4 (Cypress Creek) had one or more compounds in detectable concentrations. The absence of the organic compounds in Cypress Creek probably is due to the wide, swampy and undeveloped character of the basin upstream from the sampling point; this undeveloped area serves to isolate the site from areas of pesticides usage. Additionally, the water in this swampy area is spread over a relatively large area, enhancing contact of the water with soil and vegetative debris to which the compounds may become sorbed, and,thus, removed from the water.

The frequency at which organic compounds were detected in water seems related to the proximity of the sampling site to the RCID resort areas. Streams outside the RCID (sites 4, 8, and 12), and sites in undeveloped areas of the RCID (sites 3, 6, and 9) had the lowest frequency of detection (5 percent or less). The only compounds detected at site 12 (Davenport Creek) were DDT, and DDE, a derivative of DDT. However, these compounds are long-lived and their presence is probably due to past usage. Ethion, and DDD (also a DDT derivative), were detected at site 8 (Whittenhorse Creek), but were not detected at other sampling sites. Ethion is used to control citrus pests and its presence in 20 percent of the samples at site 8 is probably due to local

Table 6--Summary of organic compound detection frequencies in water

Compound	Percent of analyses in which detected: Site number 1	2	3	4	5	6	7	8	9	10	11	12	13	Number of analyses	Percent detection
Chlordane	0	0	0	0	0	0	14	0	0	0	0	0	0	99	2
DDD	0	0	0	0	0	0	0	12	0	0	0	0	0	118	<1
DDE	0	0	0	0	0	0	0	0	0	0	0	7	0	118	<1
DDT	0	0	18	0	0	0	0	12	0	0	7	13	0	118	5
Diazinon	0	0	0	0	0	0	33	0	0	0	12	0	0	65	3
Dieldrin	0	0	0	0	0	0	14	0	0	0	0	0	0	118	<1
Ethion	0	0	0	0	0	0	0	20	0	0	0	0	0	61	2
Lindane	0	0	0	0	0	0	14	0	0	0	7	0	0	118	2
Malathion	100	100	0	0	40	50	100	0	50	67	0	0	0	65	25
Parathion	0	0	0	0	0	0	0	0	0	0	12	0	0	65	2
PCB	0	0	0	0	0	0	14	0	0	0	0	0	0	100	1
2,4-D	50	60	0	0	33	11	50	0	33	38	15	0	23	107	23
Silvex	0	20	14	0	25	11	50	0	0	25	46	0	23	107	20
Number of analyses	55	64	111	96	121	97	77	74	62	63	154	158	127	1,259	
Percent detection	9	11	3	0	7	5	21	4	5	11	8	2	6		

usage within the citrus groves surrounding the site. At sites 3, 6, and 9, 2,4-D or silvex were present in 11 to 33 percent of the samples. These compounds are herbicides and their presence is probably related to control of weeds in the canal system. Malathion was detected at sites 6 and 9, and could have originated from spraying for mosquito control or from spraying of citrus groves adjacent to the sampling sites.

The other sites (1, 2, 5, 7, 10, 11, and 13), having a frequency of detection of 6 percent or higher for organic compounds, are either close to the RCID resort areas, or receive runoff from these areas. Except at sites 7 and 11, malathion and the herbicides 2,4-D and silvex account for nearly all the organic compounds detected.

Site 7 had the highest frequency of organic compound detection (21 percent), and the largest number of compounds which were detected. The only detection of PCB compounds in water was at site 7. The diversity of compounds at site 7 and the high rate of detection probably are related to at least three factors, including: (1) weed and mosquito control spraying near the site, (2) maintenance of a golf course immediately upstream from the site, and (3) runoff from the main parking lot, which discharges through detention ponds immediately upstream from the site. Direct application of pesticides to the parking area is not probable, however, the large impervious area may be a catchment for airborne materials and atmospheric fallout which could include pesticide residues that are washed from the pavement by stormwater runoff.

The FDER has set water-quality criteria for some of the organic compounds, based on toxicity of the compounds to aquatic life (Florida Department of Environmental Regulation, 1983). These water-quality criteria and a summary of the criteria-exceedance frequencies for the 13 sites are given in table 7. The maximum allowable concentrations, according to the FDER criteria, are generally 0.01 ug/L or less. Detection limits for the methods used during this study (table 7) are 0.01 ug/L except for chlordane and PCB which have a detection limit of 0.1 ug/L, and toxaphene, which has a detection limit of 1 ug/L. Therefore, any detectable concentrations of the compounds, except for lindane, malathion, methoxychlor, and parathion, are in excess of the criteria. For this reason, the summary given in table 7 can only be used as a gross indication of criteria--exceedance frequencies.

Malathion had the highest frequency of exceedance of the water quality criteria. About 15 percent, or 10 of the 65 samples for malathion, contained concentrations in excess of the 0.1 ug/L criteria. These excessive concentrations occurred at 6 of the 13 sites. Though malathion exceeded FDER water-quality criteria near the resort areas (sites 1, 2, and 7) and at other sites in the RCID (sites 5, 6, and 9), excessive concentrations are apparently confined to the immediate area of application. Malathion did not exceed criteria at sites downstream from the resort areas, and was never detected in Reedy Creek downstream from site 10.

DDT was detected (and therefore exceeded water-quality criteria) at 4 of the 13 sites, or in about 5 percent (6 samples) of the 118 samples. Though DDT is no longer used, the half-life of DDT is about 10 years. Therefore, DDT will probably continue to be found in some samples for several years.

Table 7.--Summary of water-quality criteria exceedance frequencies for organic compounds

Compound	Criteria[1]	Detection limit	Percent of analyses in which detected — Site No. 1	2	3	4	5	6	7	8	9	10	11	12	13	Number of analyses	Percent exceeding criteria
Aldrin	0.003	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	118	0
Chlordane	.01	.1	0	0	0	0	0	0	0	14	0	0	0	0	9	99	2
DDT	.001	.01	0	0	18	0	0	0	0	12	0	0	7	13	0	118	5
Dieldrin	.003	.01	0	0	0	0	0	0	14	0	0	0	0	0	0	118	<1
Endosulfan	.003	.01	0	0	0	0	0	0	0	0	0	0	0	0	0	31	0
Endrin	.004	.01	0	0	0	0	0	0	0	0	0	0	0	0	0	118	0
Heptachlor	.001	.01	0	0	0	0	0	0	0	0	0	0	0	0	0	118	0
Lindane	.01	.01	0	0	0	0	0	0	14	0	0	0	0	0	0	118	<1
Malathion	.10	.01	100	100	0	0	20	33	33	0	50	0	0	0	0	65	15
Methoxychlor	.03	.01	0	0	0	0	0	0	0	0	0	0	0	0	0	31	0
Mirex	.001	.01	0	0	0	0	0	0	0	0	0	0	0	0	0	31	0
Parathion	.04	.01	0	0	0	0	0	0	0	0	0	0	0	0	0	65	0
PCB	.001	.1	0	0	0	0	0	0	14	0	0	0	0	0	0	100	1
Toxaphene	.005	1	0	0	0	0	0	0	0	0	0	0	0	0	0	88	0
Number of analyses			55	69	109	98	115	92	74	72	64	60	143	148	119	1,218	
Percent exceeding criteria			4	4	2	0	<1	2	7	1	2	0	<1	1	<1		

[1] Micrograms per liter, for class III waters (Florida Department of Environmental Regulation, 1983).

Other organic compounds that exceeded the FDER water-quality criteria in 2 or less percent (1 or 2 samples) of the samples are chlordane, dieldrin, lindane, and PCB.

Organic Compounds in Bottom Sediments

Pesticides and other organic compounds were also sampled in bottom sediments at the 13 sites. Quality criteria have not been established for bottom sediments, but the presence of the compounds in bottom sediments indicates that the compounds reached the water body and may have at one time been present in the water. Additionally, the impact of the toxic organic compounds on aquatic life, especially bottom-dwelling organisms, could be significant. Many organic compounds are only slightly soluble in water, but may be sorbed on bottom sediments, so that areas of sediment accumulation may be sinks for the less-soluble materials.

Table 4 gives a statistical summary of data on the concentration of compounds detected in at least one sample. Other compounds, analyzed for but not detected, are not listed. These include endrin, heptachlor, lindane, malathion, methoxychlor, methyl trithion, parathion, trithion, and 2,4,5-T.

Concentrations of organic compounds in bottom sediments are expressed as ug/kg (micrograms per kilogram). This unit of concentration is equivalent, in terms of weight of compound per unit weight of substrate, to units used to report the concentrations in water (ug/L), because one liter of water weighs one kilogram.

Table 4 shows that, on a weight basis, maximum concentrations of organic compounds in bottom sediments are orders of magnitude greater than in water. The highest concentration in a single sample was for PCB (maximum concentration 760 ug/kg), a family of compounds formerly widely used in many applications, including plastics and electrical insulation. Manufacture of PCB was banned by the U.S. Environmental Protection Agency because the compounds are extremely toxic and accumulate in many species of organisms (Nebel, 1981). The origin of the PCB in bottom sediments is unknown, but whatever the source, the stability of the compounds allows for a long residence time in the area.

Other compounds found in concentrations exceeding 100 ug/kg include chlordane, and silvex. Chlordane is used in termite and ant control, and may be applied to soil around citrus root stock for pest control.

Comparison of maximum and 95th percentile concentrations of the organic compounds in bottom sediments shows that, although high concentrations of most of the compounds occurred in at least one sample, most samples had much lower concentrations. For example, one sample for silvex contained 210 ug/kg, but at least 95 percent of the samples had no silvex, or concentrations which were less than the detection limit. Median concentrations of all of the compounds in bottom sediments were less than detection limits.

Frequency of detection of organic compounds in bottom sediments is given in table 8 for the 13 sites. Some compounds, listed previously, which have not been detected in bottom sediments are not included in table 8 and the number of samples and percent detection figures by site do not include these compounds.

Seven organic compounds were detected in more than 10 percent of the bottom sediment samples. Listed in order of decreasing frequency of detection, they are: chlordane, dieldrin, DDE, DDD, DDT, PCB, and methyl parathion. These compounds were widely distributed in the area, and were detected at 7 to 12 of the sites. The compounds were not frequently detected in water except for DDT, which was present in about 5 percent of the 118 water samples (table 6). The remaining compounds were detected in 2 or less percent of the samples. All seven compounds except methyl parathion are organochlorine-type compounds, a family of chemicals characterized by resistence to degradation and low solubility in water. Therefore, most organochlorine compounds tend to be sorbed on particulate matter, and can accumulate and persist in bottom sediments.

The nearly ubiquitous presence of PCB in bottom sediment is difficult to explain--it was detected in a variety of environments including lake outflows (sites 1 and 3), a stream draining a swampy undeveloped area (site 4), and several sites in the stream and canal system of the RCID (sites 5, 6, 9, 10, 11, and 13), including those sites not near to or receiving runoff from the developed areas (sites 6 and 9). The long life and low solubility of PCB is probably a major factor in the widespread distribution; whatever the source, once released to the watershed the compounds remain in bottom sediments. The presence of PCB in one water sample of six taken at site 7 and its absence in bottom sediments at site 7 is problematical.

The frequency of detection summary given in table 8 indicates that organic compounds occurred more frequently in bottom sediments of streams that drain agricultural areas than in most other streams or canals, probably as a result of pesticide applications in the citrus groves. The frequency of detention at Reedy Creek (sites 11 and 13), Whittenhorse Creek, Cypress Creek, and Davenport Creek (sites 8, 4, and 12) was 21 to 32 percent. All the sites, except site 11 (Reedy Creek) are in or near citrus groves, or downstream from citrus groves. Reedy Creek at site 11 is not immediately adjacent to citrus areas, and although Whittenhorse Creek (which does drain a citrus area) flows into the RCID canal system upstream from site 11, the amount of water contributed by Whittenhorse Creek is small compared to discharge of Reedy Creek at site 11. The reason for the high rate of detection of organic compounds in bottom sediments at site 11 has not been determined and is unexpected because sites upstream from site 11 (except for Whittenhorse Creek) did not have high rates of detection. Sites near or downstream from the Theme Park, the parking lot, and the resort hotels (sites 1, 2, 5, and 10) had relatively low detection rates of organic compounds in bottom sediments.

Table 8.--Summary of organic compound detection frequencies in bottom sediments

Compound	Percent of analyses in which detected													Number of analyses	Percent detection
	Site No.														
	1	2	3	4	5	6	7	8	9	10	11	12	13		
Aldrin	0	0	0	0	0	0	0	12	14	0	54	0	0	120	8
Chlordane	80	86	29	43	25	50	50	0	43	50	64	30	50	100	46
DDD	0	0	18	64	33	0	0	62	29	0	53	54	54	120	34
DDE	0	14	27	45	33	0	17	88	14	0	33	77	64	120	37
DDT	0	0	18	18	0	12	17	25	0	0	33	43	27	121	18
Diazinon	0	0	0	0	25	0	0	0	0	0	0	0	0	48	2
Dieldrin	20	57	20	55	25	44	50	50	29	17	80	50	36	121	44
Ethion	0	0	0	0	0	0	0	0	0	0	0	33	0	32	3
Heptachlor epoxide	20	14	0	0	0	0	0	0	0	0	0	0	0	93	2
Methyl parathion	0	0	20	25	25	25	0	0	0	0	25	20	17	48	15
PCB	20	0	14	43	17	22	0	0	43	17	9	0	30	101	17
Toxaphene	0	0	0	0	0	11	0	0	0	0	0	0	0	94	1
Silvex	0	0	0	0	7	0	0	0	0	0	18	0	0	103	3
2,4-D	0	0	0	0	8	12	0	0	0	14	0	8	0	102	4
Number of analyses	63	82	105	103	142	104	73	69	79	77	147	143	136	1,323	
Percent detection	11	15	12	26	14	13	11	28	15	8	32	25	21		

VARIATION IN WATER QUALITY

Many natural and manmade variables affect water quality. Natural variables include climatological events (rainfall and drought) which affect streamflow, and seasonal variation in temperature which affects biological and microbiological processes. Activities of man may cause alterations to hydrological processes or changes in constituent loading of a watershed. Some variables that could affect water quality in the RCID area were investigated, and the water-quality changes attributed to them are described in this section. Historical water-quality data were examined to determine if changes in water quality of the RCID-area water bodies have occurred with time, and if these changes relate to development and operation of the RCID facilities.

Water Quality as a Function of Stream Discharge

Water quality of streams may vary with discharge due to variations in sources of streamflow or contributing drainage area. During dry periods, streamflow may be sustained by water stored in the basin in swamps, lakes, stream channels, or in the ground. Waste effluent may also sustain discharge. During wet periods, more water in a stream is surface runoff, and parts of the basin which do not contribute during dry periods may become contributive.

The relation between water quality and discharge was investigated at 6 of the 13 sites for which records of discharge are available. A regression procedure was used to relate constituent concentration, or characteristic value, to discharge in a linear relation of the type:

$$\text{concentration} = A + B * \text{discharge}$$

where A and B are constants determined by the regression method. The values of the constant B were tested for significance at the 95-percent confidence level--a nonsignificant value for B means that the 95-percent confidence interval of B includes zero and that the possibility of no relation of concentration to discharge cannot be eliminated at the selected level of confidence. The sign of B indicates that concentration tends to increase (positive B value) or decrease (negative B value) with increasing discharge.

Six aggregate measures of water quality were selected to study the concentration and discharge relation. The regressions were computed using both untransformed data and transformed data, logarithms (base 10) of concentrations and discharges. The logarithmic transformation was used because the logarithms of concentrations and discharge may more closely approximate a linear relation than do the untransformed values.

Coefficients of determination for the regression equations which tested statistically significant are given in table 9. The coefficient of determination is a measure of the amount of variation in the dependent variable associated with variation in discharge. For example, 11 percent of the variation in color at site 11 (Reedy Creek near Vineland) was associated with variation in discharge, using untransformed as well as log transformed data. Therefore, 89 percent of the variation in color was associated with factors other than discharge. Color tended to increase with discharge at site 11. Inverse relations (decreasing dependent-variable value with increasing discharge) are

Table 9.--Relation between selected properties or constituents and stream discharge

[Coefficient of determination is the square of the coefficient of correlation for simple, linear regression, and is therefore unsigned. The negative sign included for some relations is to indicate that constituent or property values vary inversely with discharge. NS means that the relation is not significant at 95 percent confidence level]

Property or constituent	Site No.	Stream name	Linear relation: Coefficient of determination	Logarithmic relation: Coefficient of determination
Color	5	Bonnet Creek	NS	0.13
	11	Reedy Creek	0.11	.11
	12	Davenport Creek	.34	.55
	13	Reedy Creek	.39	.49
Specific conductance	8	Whittenhorse Creek	NS	-.26
	11	Reedy Creek	NS	.11
	12	Davenport Creek	-.14	-.11
	13	Reedy Creek	-.23	NS
Total nitrogen	5	Bonnet Creek	.32	NS
Organic nitrogen	12	Davenport Creek	NS	.17
	13	Reedy Creek	.20	NS
Total phosphorus	11	Reedy Creek	-.29	-.39
Total organic carbon	5	Bonnet Creek	.38	.15
	11	Reedy Creek	NS	.14
	12	Davenport Creek	.42	.64
	13	Reedy Creek	.28	NS

indicated by a negative sign attached to the coefficient of determination. These signs indicate the direction of the relation; the coefficient of determination is, by definition, an unsigned number.

Table 9 shows that color, specific conductance, and total organic carbon were each related to discharge at four sites, as indicated by one or both of the regression procedures ("raw" data or log transformed data).

Color increases with discharge at the four sites for which the regressions were significant. The increases in color with discharge are probably due to contribution of water from swampy areas during rainy periods, and to the overflow of the streams into adjacent swamps and the subsequent leaching of color from the vegetative debris in the the swampy areas. The amount of variation in color associated with variation in discharge was low at sites 5 and 11 (Bonnet Creek and Reedy Creek), and higher at sites 12 and 13 (Davenport Creek and Reedy Creek). Nearly half the color variation at site 13, and more than half the variation at site 12, may be associated with variation in discharge. The lower degree of association between color and discharge at sites 5 and 11 is probably due to the more diverse hydrology of the basins upstream from the sampling sites. Reedy Creek at site 13, and Davenport Creek include extensive swampy areas upstream from the sampling sites, but Bonnet Creek and Reedy Creek at site 11 have swampy areas, lakes, drainage canals, and large impervious areas upstream from the sampling sites. Varying contributions to streamflow from these different types of land use complicate the relation between water color and discharge (and probably between other water-quality variables and discharge, as well).

Total organic carbon also increased with increasing discharge. The most variation in total organic carbon with discharge was at site 12. Total organic carbon is related to color in the RCID area, so much of the variation in total organic carbon is probably related to the same factors that affect color.

Specific conductance was only weakly associated with discharge, and except at site 11 decreased with increasing discharge.

Nitrogen concentrations, both total and organic, were not significantly associated with discharge at most sites, and at sites where the association was statistically significant, little of the variation in nitrogen was associated with discharge. Total phosphorus related significantly to discharge only at site 11. There, phosphorus concentrations decreased as discharge increased. The degree of association is not high, but is probably due to treated wastes inflow upstream from the site. During wet periods, the wastewater in the stream is diluted by runoff, with a resultant decrease in phosphorus concentration.

Seasonal Variation in Water Quality

Seasonal variation in rainfall, temperature, and vegetative life cycles can affect water quality. During the wet season (generally June to September in central Florida), stream discharges are generally largest and much of the streamflow is direct stormwater runoff. During the drier parts of the year, streamflow is maintained by water in ground or surface storage and, in some cases, by waste discharges. The varying relative contributions of storm runoff and water in storage (or waste discharges) could affect water quality. Seasonal temperature variation and vegetative growth cycles could affect nutrient concentrations. Cold water temperatures slow nutrient intraspecies conversion rates and reduce uptake of nutrients by vegetation.

The seasonal variation in water quality was investigated at the 13 sites by assigning samples into groups, as follows:

Group 1 (March 1 to June 30) represents spring, with generally low discharges at least through May, warming temperatures and resumption of the growing season.

Group 2 (July 1 to October 31) represents warm water temperatures, high discharges, and the climax of the growing season.

Group 3 (November 1 to February 28) represents cooler temperatures, moderating discharges, low rainfall, and a lower rate of vegetative growth.

These seasonal grouping are, of course, somewhat arbitrary and overlap to some degree.

Seasonal mean concentrations were tested for difference using analysis of variance with a significance level of 5 percent. This means that the test hypothesis of no seasonal differences was rejected only if the seasonal means differed by more than an amount that could be expected 5 percent of the time if the means were identical.

Five aggregate measures of water quality were selected for the seasonal-variation testing. These were specific conductance, total nitrogen, total ammonia plus organic nitrogen, total phosphorus, and color. Seasonal means for these are given in table 10 for all sites at which the analysis-of-variance test indicated significant seasonal differences among either all three seasons or any pair of seasons.

Specific conductance was seasonally variable at only one of the 13 sites (site 2). The lowest mean specific conductance (113 umhos) was for the November to February group. The higher specific conductance in the July to October group may be due to upward leakage of water from the the Floridan aquifer during these months when the potentiometric surface of the Floridan aquifer is highest.

Total nitrogen varied seasonally at three sites, but the pattern of concentrations was variable. Highest nitrogen concentrations occurred from March through June at site 3, from July through October at site 9, and from November through February at site 13.

Total ammonia plus organic nitrogen varied seasonally at five sites, and except at site 7, was highest for the July through October samples, possibly as a result of increased return of organic and ammonia nitrogen to the water from decaying vegetative debris when water temperatures are warmest.

Table 10.—Seasonal mean concentrations or values for selected constituents or properties

[Reporting units are milligrams per liter unless otherwise indicated. Difference in seasonal means was tested using analysis of variance and a significance level of 5 percent. Seasonal means not differing significantly are not included]

Property or constituent	Site No.	Location	Seasonal mean concentration or value		
			March-June	July-Oct	Nov-Feb
Specific conductance[1/]	2	Bay Lake outflow	123	150	113
Total nitrogen	3	South Lake outflow	0.55	0.19	0.38
	9	Structure S-410	1.1	2.0	1.2
	13	Reedy Creek (near Loughman)	1.5	1.8	2.9
Total ammonia plus organic nitrogen	4	Cypress Creek	1.5	2.0	1.3
	5	Bonnet Creek	.73	.84	.50
	7	Structure S-405	.92	1.2	1.7
	9	Structure S-410	.8	1.6	.9
	13	Reedy Creek (near Loughman)	1.0	1.6	1.4
Total phosphorus	3	South Lake outflow	.03	.02	.02
	8	Whittenhorse Creek	.04	.04	.02
	11	Reedy Creek (near Vineland)	.98	.54	.57
Color[2/]	4	Cypress Creek	310	430	360
	8	Whittenhorse Creek	290	470	250
	11	Reedy Creek (near Vineland)	240	410	220
	12	Davenport Creek	110	280	200
	13	Reedy Creek (near Loughman)	190	320	210

1/ In micromhos per centimeter at 25° Celsius.
2/ In platinum-cobalt units.

Total phosphorus varied seasonally at three sites, but at two of these sites, the seasonal mean concentrations differed only by 0.02 mg/L or less. Site 11 had highest phosphorus concentrations from March through June, and the mean concentration for these months was greater than for the other seasonal groups by 0.4 mg/L or more. The higher phosphrous from March through June is probably due to the treated waste inflow which accounts for much of the discharge at site 11 during dry periods which often occur in March, April, or May.

Color varied seasonally at five sites. Highest color occurred from July through October at all sites, perhaps due to increased rates of vegetative decay during these warm months, and increased runoff from swampy areas.

Daily Variation in Water Quality of Reedy Creek

The continuous records of specific conductance, pH, water temperature, and DO at site 11 provide much more insight into ranges in values and the way water quality varies in response to hydrologic events than do the periodic samples of water quality. These data have been recorded hourly beginning in June 1977. A summary of daily water quality, by month, is given in table 11. Duration curves of daily mean values are shown in figure 22.

The duration curves show that pH and DO at site 11 often did not meet Florida minimum water-quality criteria (6 units minimum for pH and 5 mg/L minimum for DO). Daily mean pH was less than 6.0 units about 30 percent of the days of record, and daily mean DO was less than 5.0 mg/L about 60 percent of the days.

Hydrographs of specific conductance, pH, water temperature, and discharge at site 11 (fig. 23) show the variation in daily water quality. Specific conductance generally varies inversely with discharge because of dilution of water in the stream by runoff. The runoff also causes lower pH, and DO (fig. 24).

Saturation concentration of DO is shown in figure 24. Saturation concentration of DO in nonsaline water depends mainly on temperature, and to a lesser degree, on atmospheric pressure. The normal range in atmospheric pressure is small enough that differences in DO saturation due to changes in pressure are probably only 0.1 or 0.2 mg/L of DO. An atmospheric pressure of 29.9 inches mercury, generally considered to be the standard pressure, was used in computing the saturation DO concentration.

DO concentrations were always less than saturation, and the difference between observed and saturation DO concentrations was smallest in winter and largest in summer. The larger DO deficit in summer is probably due to acceleration of processes such as organic material decay which consume oxygen, and to runoff of water with low DO concentration during the normally wet summers.

The relation of DO concentration to discharge at site 11 is shown in more detail in figure 25 for a selected runoff event in February 1981 following about 2.0 inches of rainfall. The inverse relation of DO to runoff at site 11 is apparent. The source of the low-DO runoff has not been confirmed, but there are at least two possibilities. One is that water standing in swampy or other low areas, depleted in DO through natural decay processes, is flushed into the

Table 11.--Summary of daily water temperature, dissolved oxygen, specific conductance, and pH at site 11 (Reedy Creek near Vineland), by month

[P-95 and P-5 are values not exceeded 95 and 5 percent of the days. Period of record is June 1977 to May 1981]

	Water temperature, in degrees Celsius					Dissolved oxygen, in milligrams per liter					Specific conductance, in micromhos per centimeter					pH, in units				
Month	Maximum	P-95	Median	P-5	Minimum	Maximum	P-95	Median	P-5	Minimum	Maximum	P-95	Median	P-5	Minimum	Maximum	P-95	Median	P-5	Minimum
January	19.0	18.5	13.5	9.5	7.5	8.9	8.4	6.4	4.0	3.6	236	226	185	128	118	7.4	7.0	6.3	5.6	5.5
February	21.0	19.5	14.5	11.5	10.0	9.3	8.9	6.7	3.7	1.5	248	231	192	150	138	6.7	6.6	6.1	5.6	5.5
March	23.0	22.0	17.5	14.5	10.5	9.8	7.8	5.6	3.3	1.9	244	234	201	158	141	7.2	7.2	6.2	5.5	5.5
April	23.5	23.0	21.0	19.0	18.5	6.7	6.3	5.0	1.7	1.2	311	304	242	202	181	7.0	7.0	6.5	6.1	6.0
May	25.5	25.0	22.5	20.5	20.0	6.5	6.1	5.0	2.8	2.3	324	315	189	115	98	7.1	7.0	6.5	5.3	5.2
June	27.0	26.5	25.0	24.0	23.0	5.5	5.4	4.0	2.6	1.9	309	304	212	175	157	7.0	6.9	6.5	5.8	5.6
July	28.5	27.5	26.0	24.5	23.5	5.6	5.2	3.5	1.0	0.5	260	253	219	144	135	6.9	6.8	6.3	5.1	4.9
August	27.0	27.0	26.0	24.5	24.0	4.8	4.6	2.8	1.7	1.1	261	252	175	129	113	6.6	6.6	5.8	5.5	5.0
September	26.5	26.5	25.5	24.5	24.0	5.0	4.7	2.5	0.7	.1	318	310	180	109	100	6.8	6.7	6.1	5.2	5.2
October	25.5	25.0	22.5	18.5	17.0	6.6	6.1	4.7	3.0	2.6	258	254	210	125	114	7.0	6.9	6.2	5.5	5.4
November	23.0	22.0	20.0	15.5	13.0	7.2	6.5	4.7	1.8	1.2	294	288	221	120	109	7.1	7.0	6.4	5.9	5.6
December	22.0	21.0	16.5	11.5	9.5	7.7	7.0	5.5	2.3	1.6	297	284	174	113	105	6.7	6.6	6.3	5.7	5.6

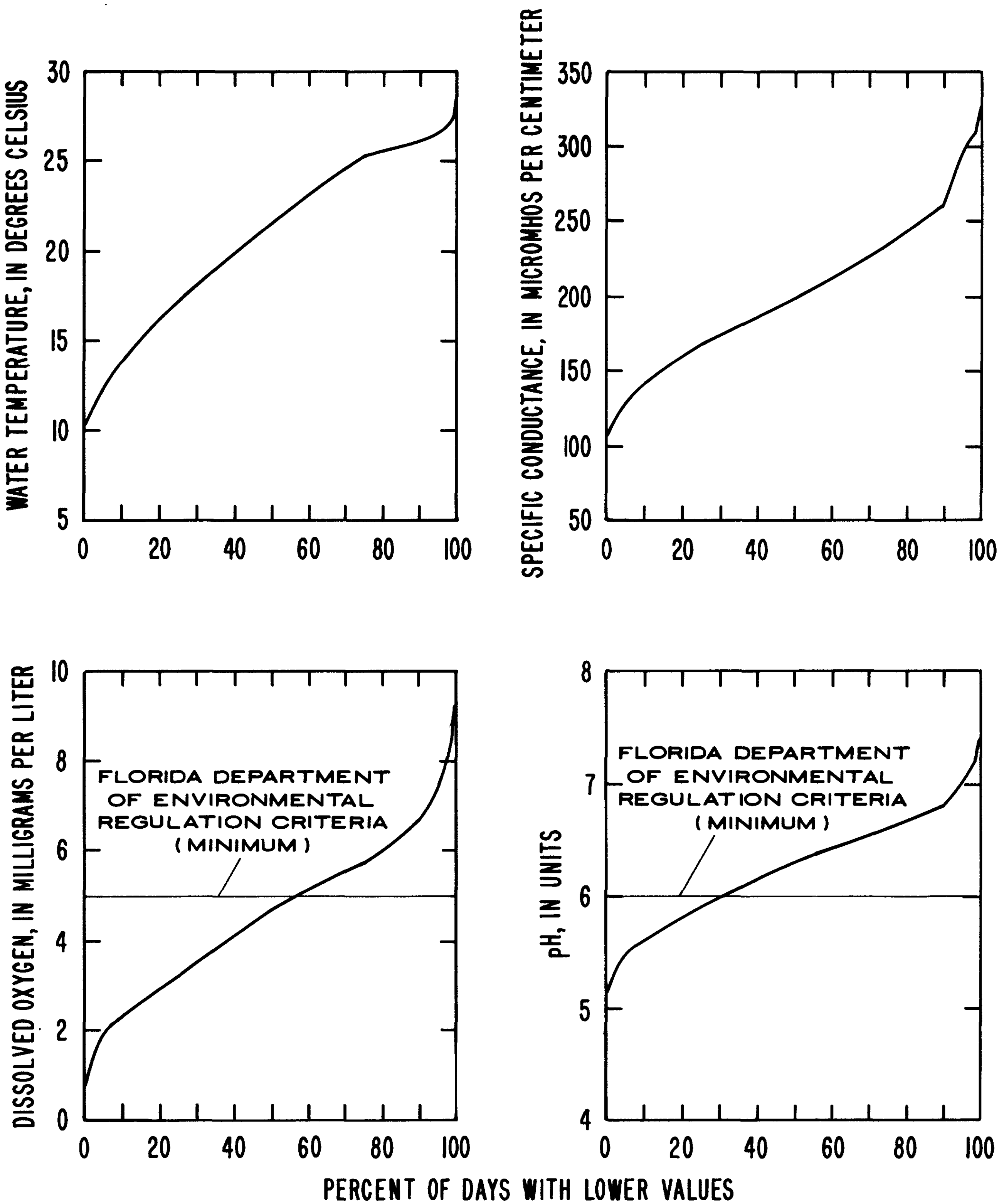


Figure 22.--Duration of daily mean water temperature, specific conductance, dissolved oxygen, and pH at site 11 (Reedy Creek near Vineland), June 1977 through May 1981).

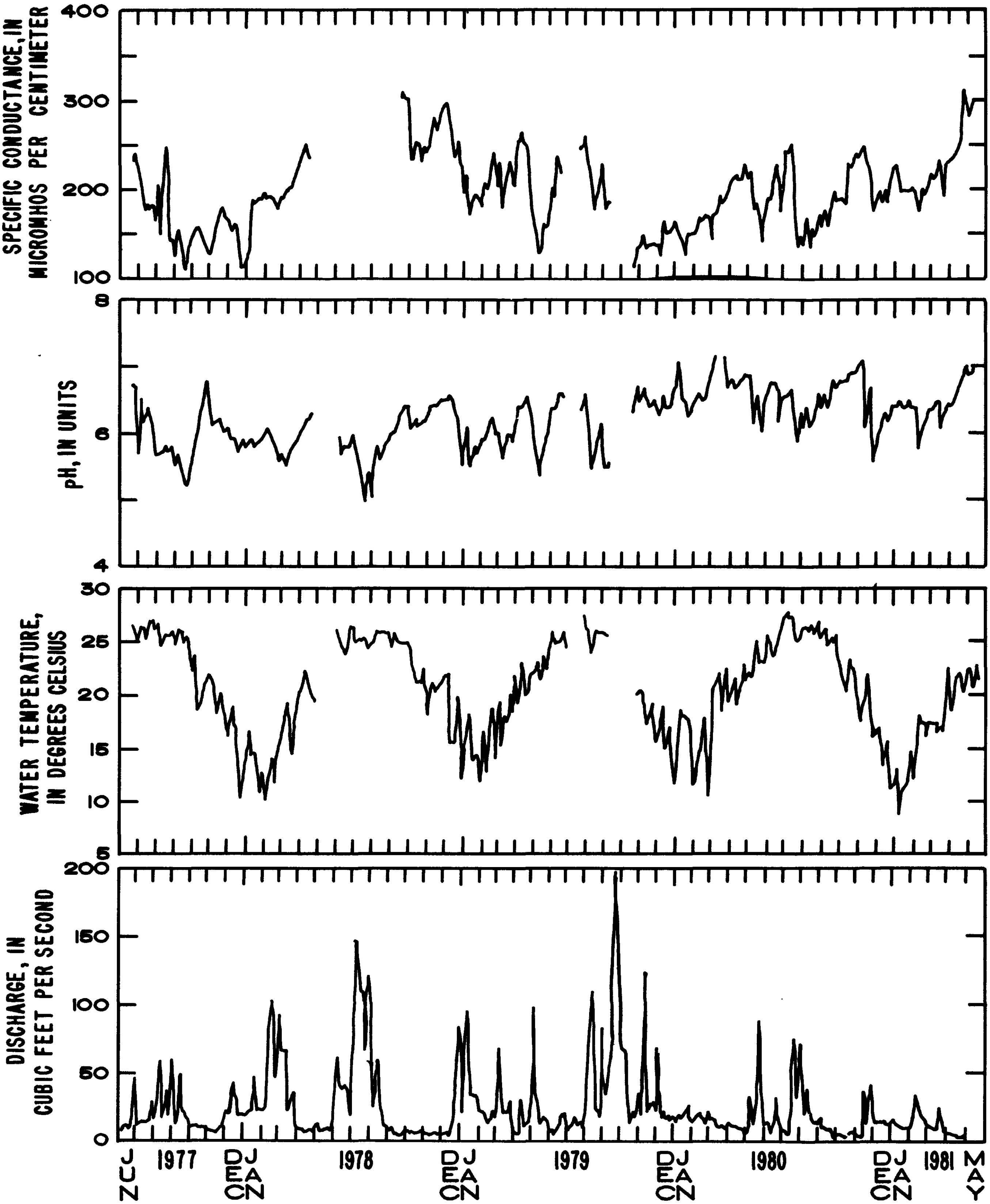


Figure 23.--Daily mean discharge, water temperature, pH, and specific conductance at site 11 (Reedy Creek near Vineland), June 1977 through May 1981.

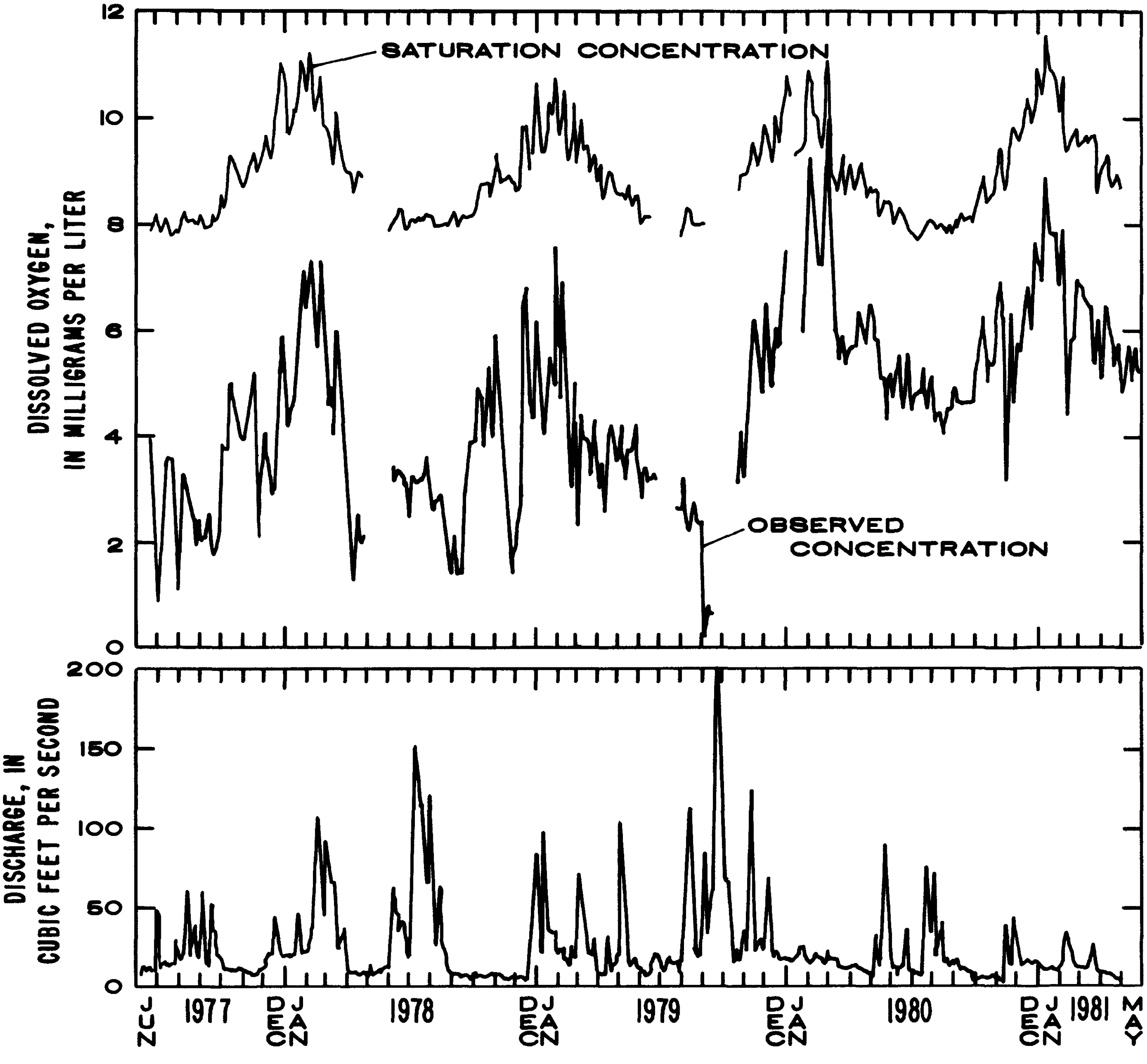


Figure 24.--Daily mean discharge and dissolved oxygen at site 11 (Reedy Creek near Vineland), June 1977 through May 1981.

upstream from site 11 by water-level control structures becomes stratified with low DO concentrations in the bottom layer. Release of this low-DO water when the structure gates open in response to rising water level could contribute to the low DO at site 11 during runoff. Additional data, including DO and discharge records for the channelized reaches controlled by the water-level control structures, would help to delineate effects of runoff from natural areas and canal storage on DO depletion in Reedy Creek.

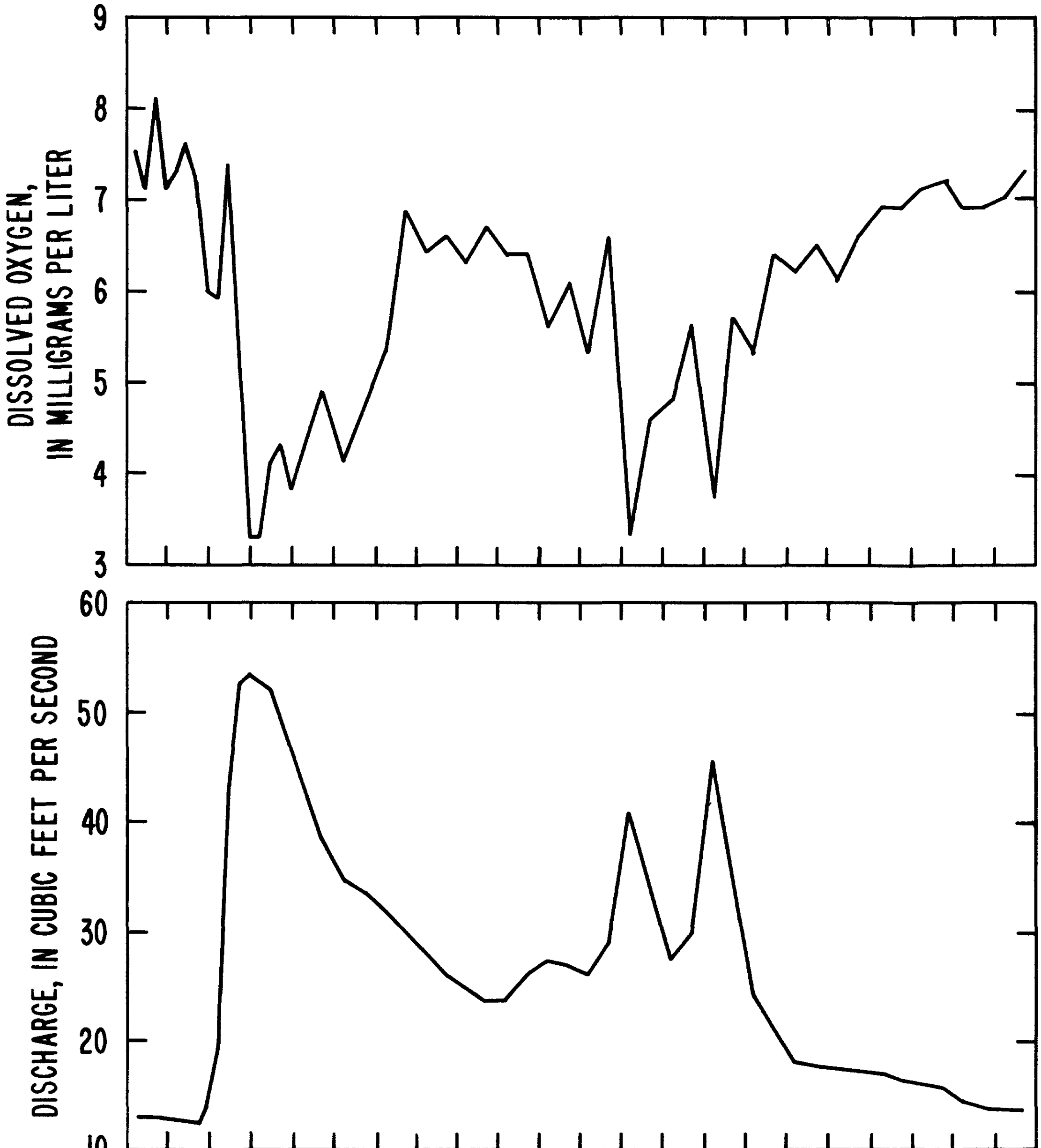


Figure 25.--Discharge and dissolved oxygen concentration at site 11 (Reedy Creek near Vineland), February 6-27, 1981.

Time Trends in Water Quality

A Kendall-Tau correlation procedure (Helwig and Council, 1979) was used to determine if water quality in the RCID had changed with time. The Kendall-Tau correlation is a nonparametric statistical method in which a correlation coefficient is computed according to the number of concordant (concentration increasing with time) and discordant (concentration decreasing with time) observations (Conover, 1971). A perfect correlation, with r (correlation coefficient) equal to 1, would indicate that each sample had a higher concentration than all preceding samples, and an r of -1 would indicate that each sample had a lower concentration than all preceding samples. An excess of concordant over discordant samples is taken as evidence of an upward trend in concentration with time, and an excess of discordant over concordant samples implies the opposite. The r value can be tested for significance to judge if the r for a set of samples is different from 0 (no correlation) at a selected level of significance.

Yearly median values of selected water-quality parameters were computed for each of the 13 sites, and the Kendall-Tau test was applied to determine if yearly median values were changing with time. Results were judged at a confidence level of 95 percent, meaning that a computed r value was significant if outside the 95-percent confidence interval centered at 0 (no correlation). Plots of the data were examined for verification of trends.

A regression procedure was also used for depicting trends for stream sites at which discharge was measured. In addition to a time variable, the regression function also included a discharge term to account for the variation of water quality with discharge, which could either obscure or account for changes in water quality with time. For example, if water quality were related to discharge, and if samples near the end of the period of record were taken when discharges were lower than earlier samples (perhaps due to relatively low rainfall in recent years), a trend in water quality might be indicated which is due merely to the lower discharges that were sampled, rather than a change in the water quality versus discharge relation, or a change in water quality loading of the stream.

Choice of a regression function to include terms related to time and discharge is subjective and an unlimited number of functions are possible. The function used here was:

$$\text{Log(Concentration)} = A + B \times \text{Log(Discharge)} + C \times \text{Date} + D \times \text{Date} \times \text{Log(Discharge)}$$

where

Log represents logarithms (base 10) of the variables

Date is the time of sampling in years, since 1970

A, B, C, and D are computed by the least squares regression procedure.

A constant of 0.01 was added to all discharges and concentrations to avoid the undefined condition of logarithms of zero. A trend was assumed to exist if the coefficient C or D in the regression function was significantly different from zero at a confidence level of 95 percent.

There are many pitfalls in the regression procedure for detecting trends, due to the assumptions of constant variance and normal distribution of residuals about the regression function probably not always being met. Also, the chosen functional relation of water quality to time and discharge may not "fit" the data over the entire range of discharges, concentrations, and time. Other assumptions are inherent in the regression procedure and are described in statistics texts such as Draper and Smith (1966). However, the procedure will probably account for discharge and detect trends not related to discharge if the trends and the effect of discharge on concentration are relatively large.

Water-quality parameters selected for time-trend analysis had a relatively large number of samples for least 10 years; data prior to development of the RCID are available for some of the parameters. Results of the Kendall Tau and the regression time-trend testing are given in table 12 for sites at which a significant time trend was indicated.

Trends in specific conductance were detected at six sites, and except at site 2, were in the direction of increasing specific conductance with time. Specific conductance of water at site 2 (Bay Lake outflow canal) has decreased markedly during the period 1972-81 (fig. 26a). This decrease in specific conductance may be due to dilution of lake water by rainfall since Bay Lake was drained and refilled with water from the Floridan aquifer in 1971. Three sites representing inflow of water to the RCID (sites 3, 4, and 12) had upward trends in specific conductance, probably due to the lower than normal rainfall during the past several years. Two sites (11 and 13), both downstream from the treated wastes inflow, had a significant increase in specific conductance since development of the RCID (figs. 26b and 26c), probably due to discharge of the treated wastes. The increase is most apparent at site 11; pre-1970 specific conductance was generally less than 100 umhos/cm, and post-1970 specific conductance often exceeded 150 umhos/cm. The regression function also indicated a time trend at the stream sites (4, 11, 12, and 13) indicating that the trend in specific conductance is probably not just a result of a trend in discharge.

Dissolved oxygen deficit (the difference between saturation DO and actual DO concentration) showed an upward trend (lower DO) with time at sites 3 and 5. This could be due in part to lack of rainfall and a predominance of groundwater seepage, low in DO, into the canals. However, similar tends in DO should have occurred at other sites. Little or no trend in DO deficit is noticeable at sites (11 and 13) downstream from the treated wastes inflow (figs. 26d and 26e). The lack of trend indicates that waste effluents are probably not a primary cause of the low DO concentrations which often occur in Reedy Creek, or if the wastes inflow affects the DO, it is not noticeable with the data available. Two samples of DO at site 11, both prior to RCID development, were greater than saturation concentrations. Both samples were taken during extremely low discharge (0.05 ft^3/s or less) and at water temperatures of 26.5° Celsius or greater. The high DO values were probably due to a high rate of production by aquatic plants in shallow and stagnant areas of the streams.

The Kendall-Tau test indicated changes in nitrogen species concentrations occurred with time at five sites. The changes were in organic nitrogen at four sites, nitrate nitrogen at three sites, and total nitrogen at two sites. The regression function contradicted the Kendall-Tau test in seven cases, either by indicating presence of a time trend where the Kendall Tau did not (nitrate

Table 12.--Kendall-Tau correlation of yearly median value with year for selected properties or constituents

[Stream sites (4, 5, 8, 11, 12, 13) were also tested for trend using regression of concentration with time and discharge. NS indicates a Kendall-Tau correlation coefficient not significantly different from 0 at a 95 percent confidence level]

Property or constituent	Kendall-Tau correlation with year, Site No.1/								
	2	3	4	5	8	9	11	12	13
Specific conductance	-0.87	0.75	0.49	NS	NS	NS	0.64	0.49	0.63
Dissolved oxygen deficit2/	NS	.51	NS	0.59	NS	NS	NS	NS	NS
Organic nitrogen	.73	NS	.66	NS	0.60	-0.50	NS	NS	NS
Nitrate nitrogen	NS	NS	3/-.56	4/NS	3/-.38	NS	.57	4/NS	NS
Total nitrogen	.80	NS	3/.49	4/NS	NS	NS	NS	4/NS	NS
Orthophosphate	NS	NS	4/NS	4/NS	NS	-.62	.62	NS	.72
Total phosphorus	.80	NS	NS	NS	NS	NS	NS	NS	3/.64

1/Sites 1, 6, 7, and 10 had no significant trends for any of the selected properties or constituents.
2/Difference of saturation dissolved oxygen and observed concentration.
3/Regression procedure did not indicate a trend at a 95-percent confidence level.
4/Regression procedure indicated a trend at a 95-percent confidence level.

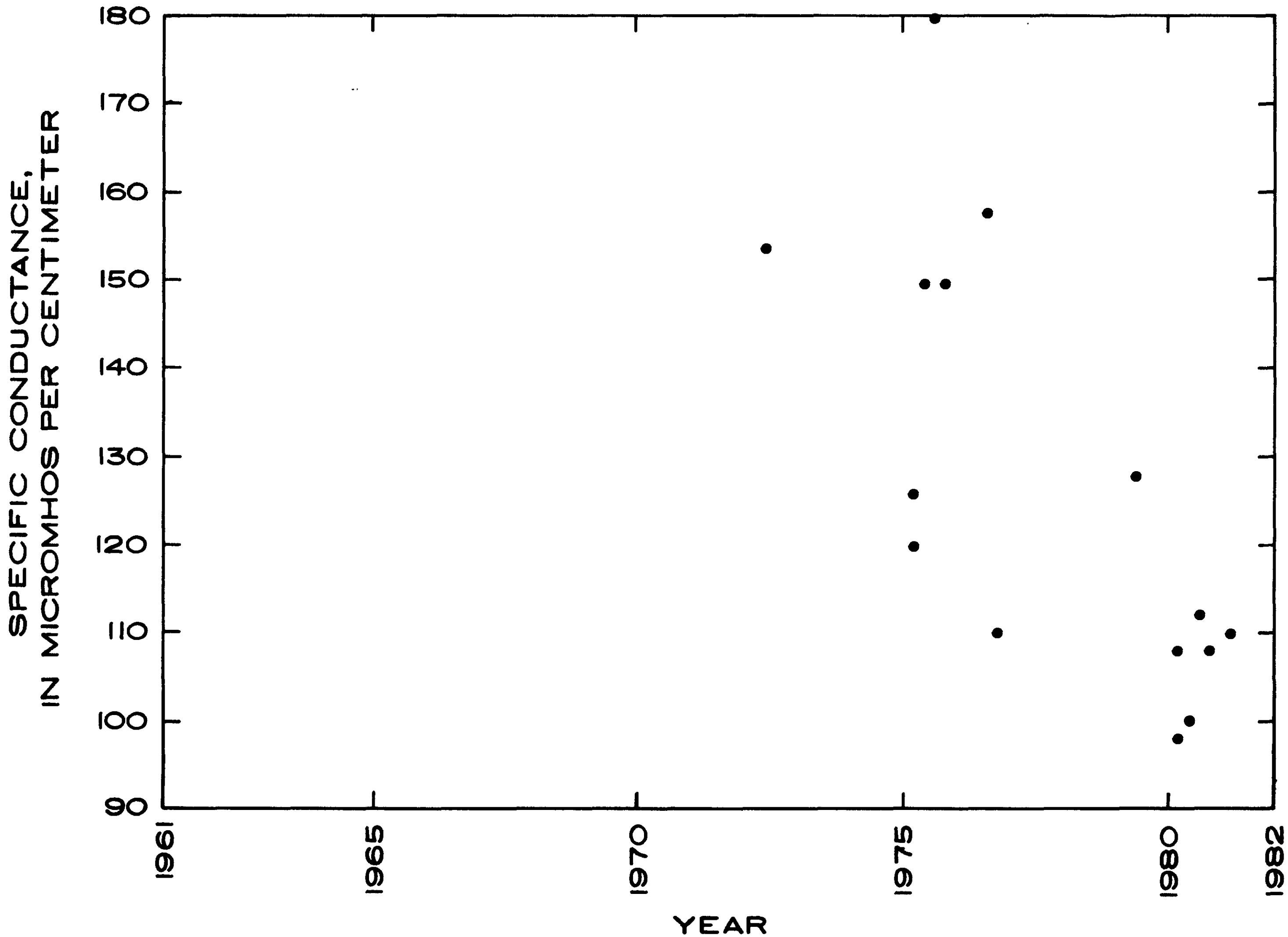


Figure 26a.--Time trend in specific conductance at site 2 (Bay Lake outflow.

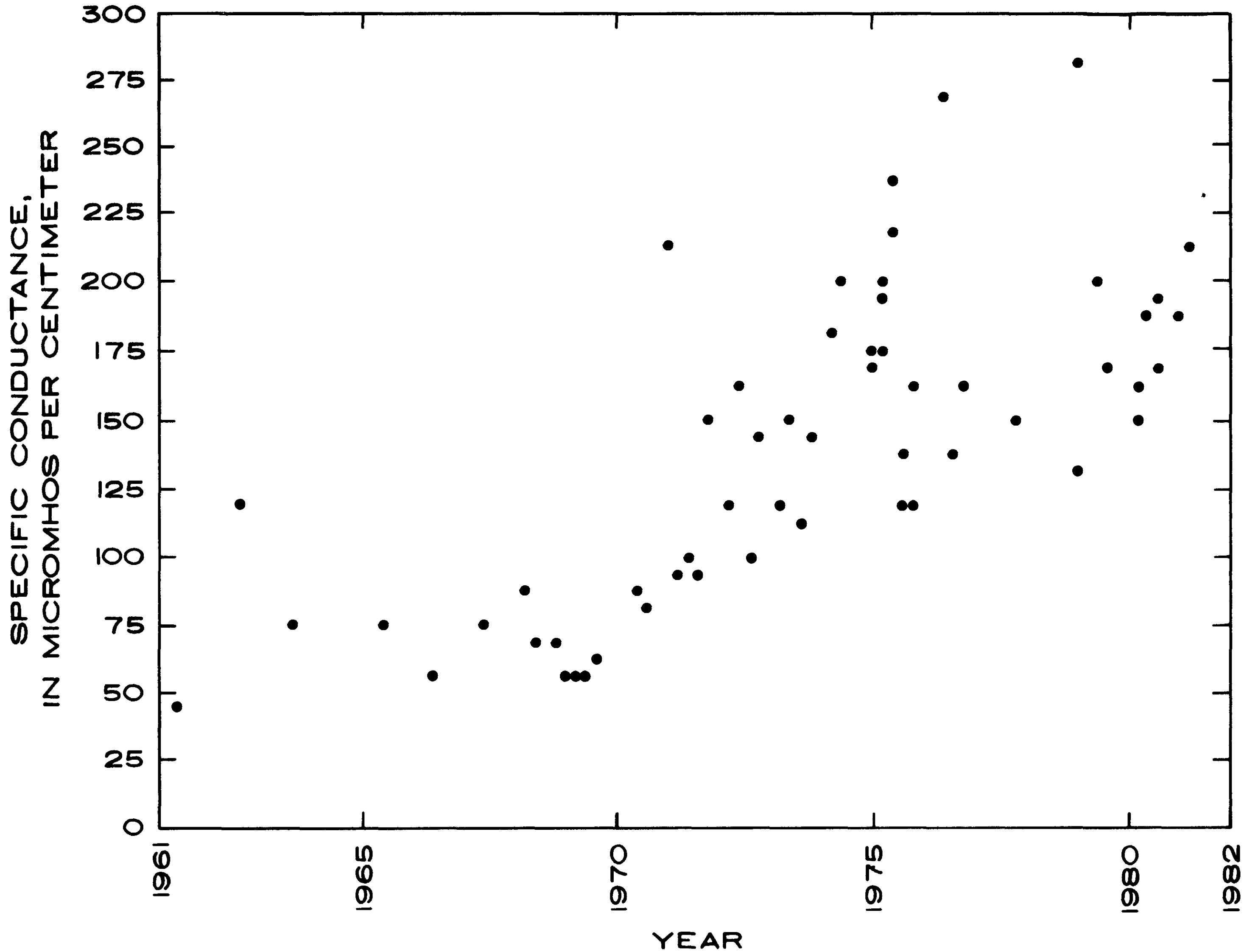


Figure 26b.--Time trend in specific conductance at site 11 (Reedy Creek near Vineland).

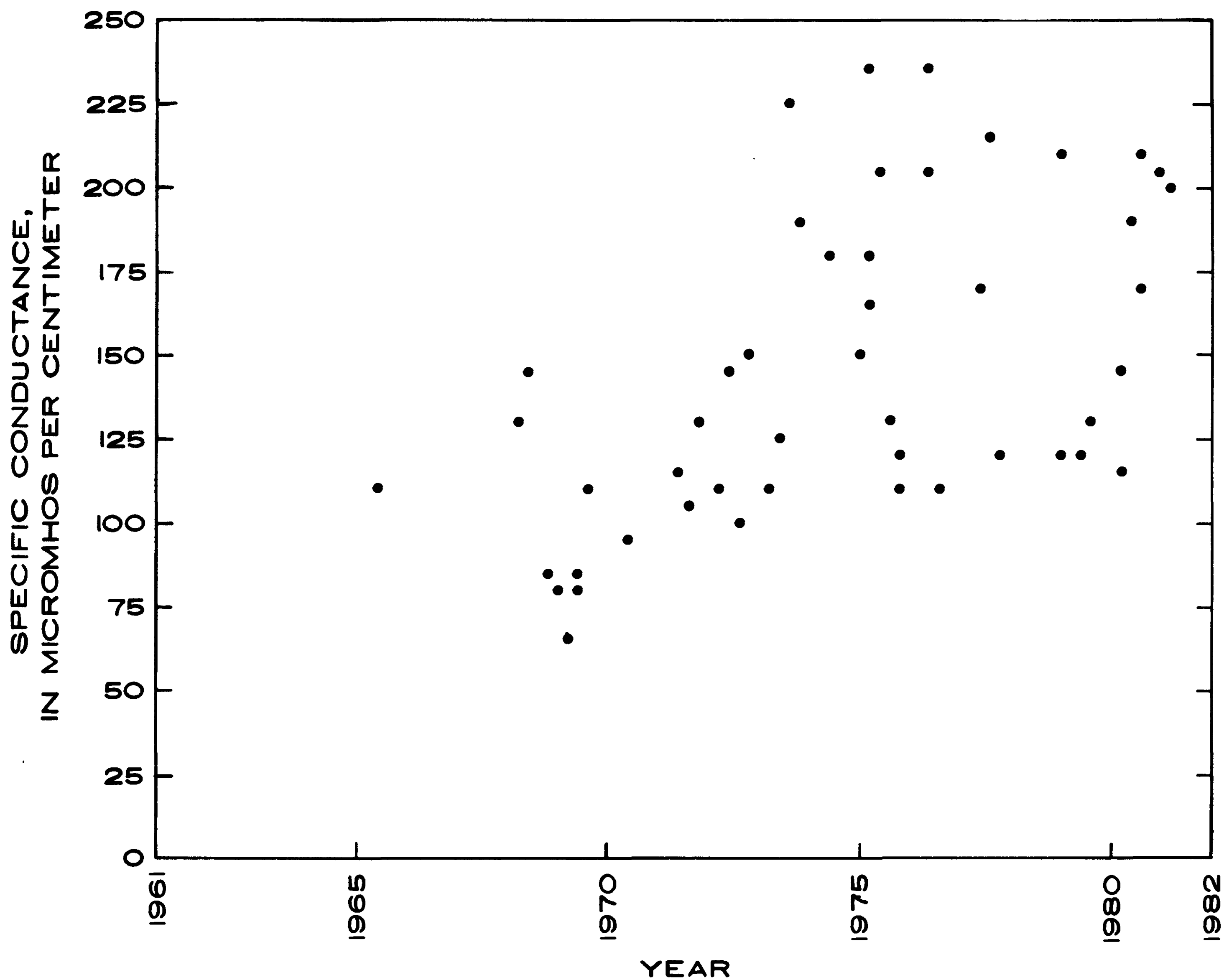


Figure 26c.--Time trend in specific conductance at site 13 (Reedy creek near Loughman.

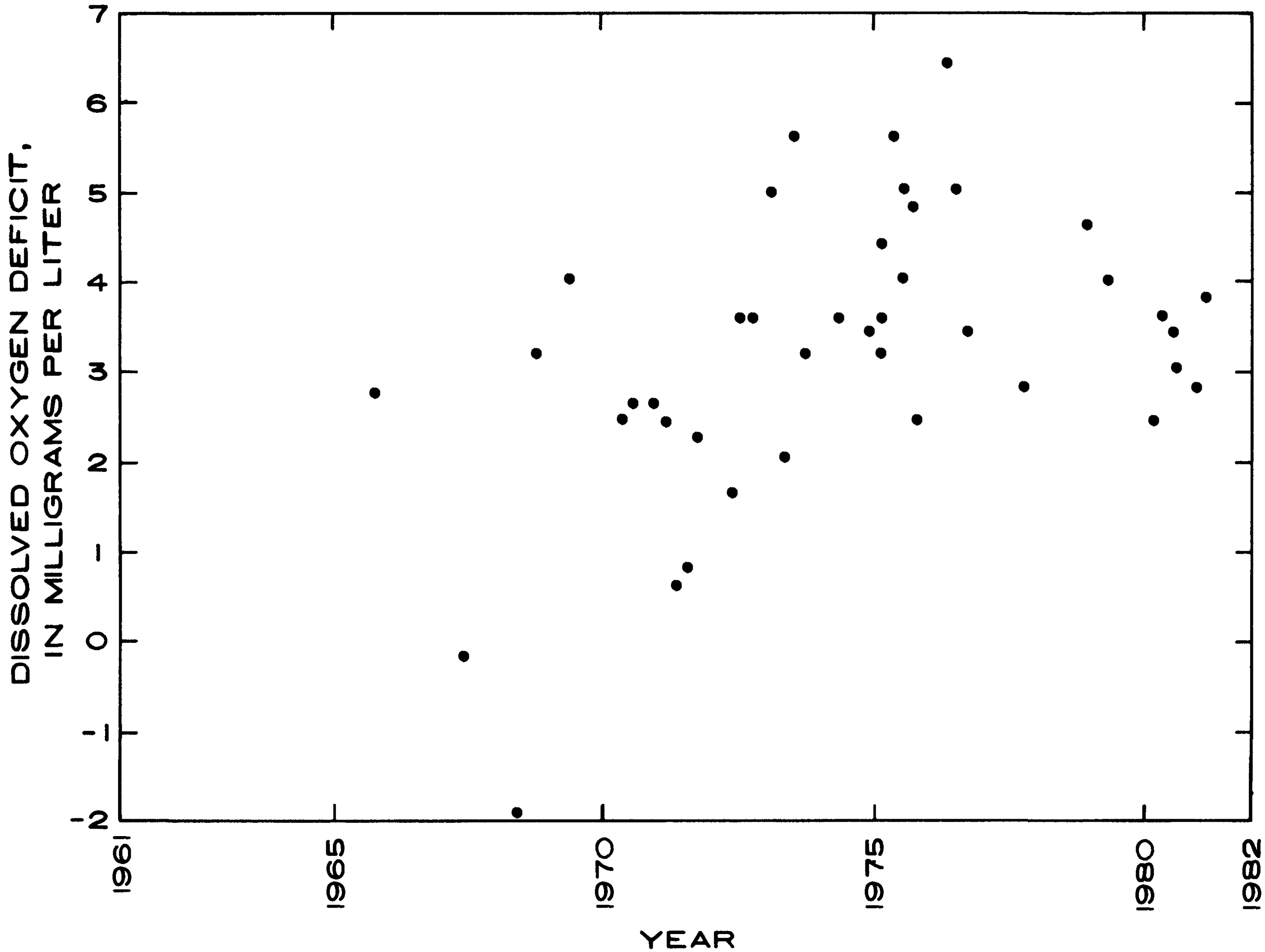


Figure 26d.--Time trend in dissolved oxygen deficit at site 11 (Reedy Creek near Vineland).

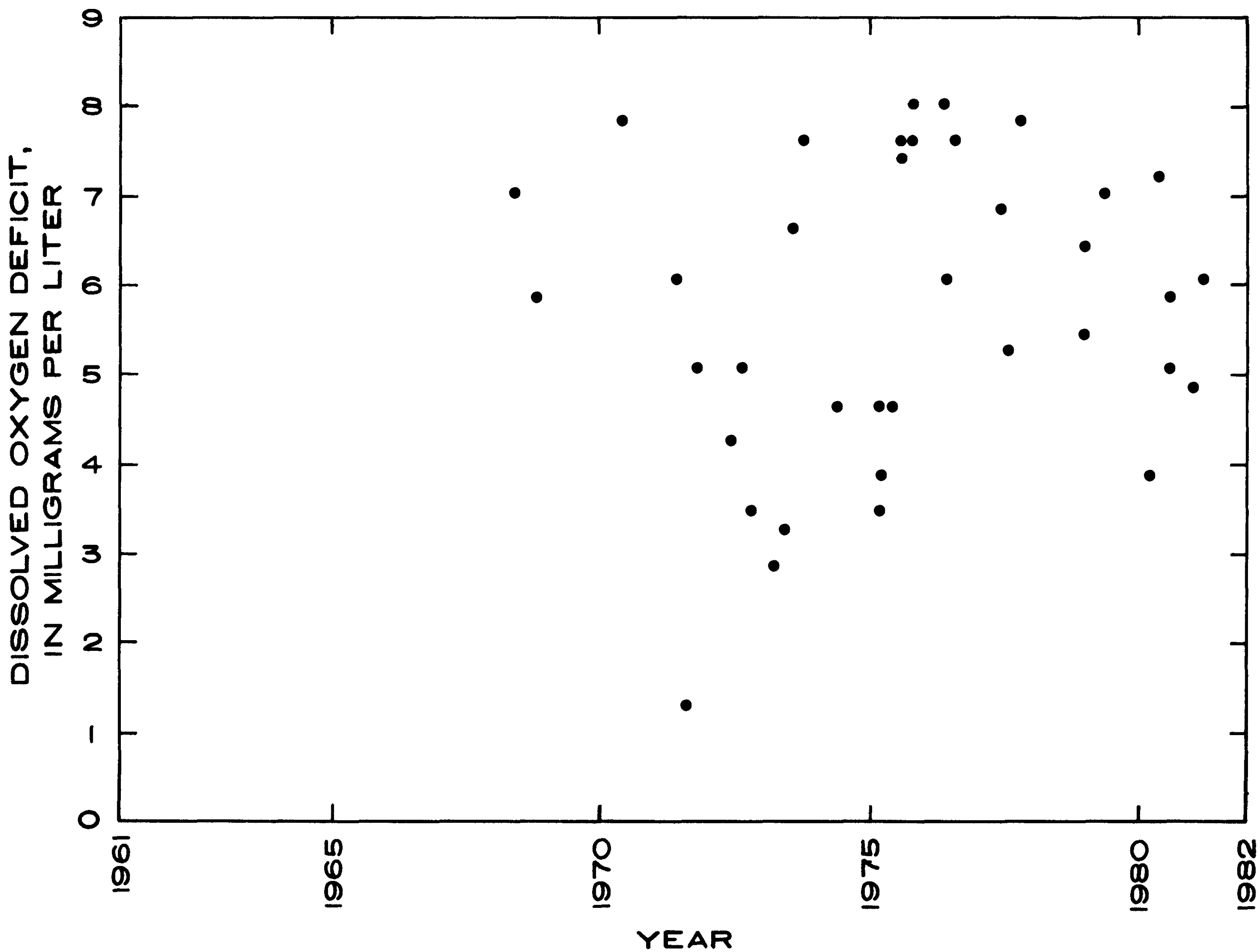


Figure 26e.--Time trend in dissolved oxygen deficit at site 13 (Reedy Creek near Loughman).

nitrogen at site 5, Bonnet Creek, for example), or by indicating no evidence of a time trend where the Kendall Tau indicated a trend (nitrate nitrogen at site 4, Cypress Creek for example). Contradictory conclusions from the two statistical tests could be an indication of a discharge effect on concentration, or could merely be the result of the different assumptions underlying the two tests.

Organic nitrogen apparently increased with time at sites 2, 4, and 8, and decreased with time at site 9. At site 2, however, only three samples were taken prior to 1979, an insufficient number to definitely indicate a trend. Plots of organic nitrogen with time, shown in figure 26f for site 4 (Cypress Creek) and figure 26g for site 8, (Whittenhorse Creek) verify the increase in organic nitrogen with time. Cypress Creek and Whittenhorse Creek are outside the RCID and the trends in organic nitrogen are therefore not related to RCID development.

Nitrate nitrogen decreased with time, according to the Kendall-Tau test, at site 4 (Cypress Creek) and site 8 (Whittenhorse Creek), and increased at site 11 (Reedy Creek near Vineland). At site 4, nitrate concentrations exceeded 0.1 mg/L in 5 of 11 samples taken from 1963 to 1971, and have not exceeded 0.1 mg/L in the 18 samples since 1971. The reason for the relatively high nitrate concentrations prior to 1971 has not been determined. The regression procedure did not indicate a significant discharge effect on nitrate concentration at site 4, nor did the procedure indicate presence of a significant time trend. A similar situation was observed at site 8, with high nitrate concentrations (ranging from 0.09 to 1.6 mg/L) for 1966 to 1968, and lower concentrations (less than 0.04 mg/L) since 1968. At site 11, downstream from the treated wastes inflow, nitrate shows an upward trend in concentration with time, but relatively low nitrate concentrations have occurred in some samples throughout the period of record (fig. 26h). The regression function for site 11 indicated that both the time trend and the effect of discharge on nitrate concentration were significant.

Trends in total nitrogen were indicated at two sites (2 and 4) by the Kendall-Tau test, and at two additional sites (5 and 12) by the regression function. At site 2, however, only two samples of total nitrogen were taken prior to 1979, an insufficient number to definitely indicate a trend. At site 4, the regression function, contrary to the Kendall-Tau test, indicated no trend change in total nitrogen and no effect of discharge on concentration.

Trends in total phosphorus or orthophosphate were indicated by the Kendall-Tau test at four sites (2, 9, 11, and 13), and except for site 9, were increasing concentration with time. At site 9, orthophosphate phosphorus concentrations were relatively high (>0.10 mg/L) in three samples prior to 1979, and excluding these samples, a trend is not apparent (fig. 26i). The regression function indicated upward trends in orthophosphate concentration at sites 4 (Cypress Creek) and 5 (Bonnet Creek) that were possibly obscured in the Kendall-Tau test by the effect of discharge. At site 2 (Bay Lake outflow), there were only two samples prior to 1979, an insufficient number to definitely indicate a trend.

A definite upward trend in orthophosphate at site 11 is noticeable beginning in 1972 (fig. 26j). There is also a tendency toward higher orthophosphate in years following 1972 at site 13 (fig. 26k). The regression function also indicated a trend in orthophosphate at site 11 and 13, indicating that the

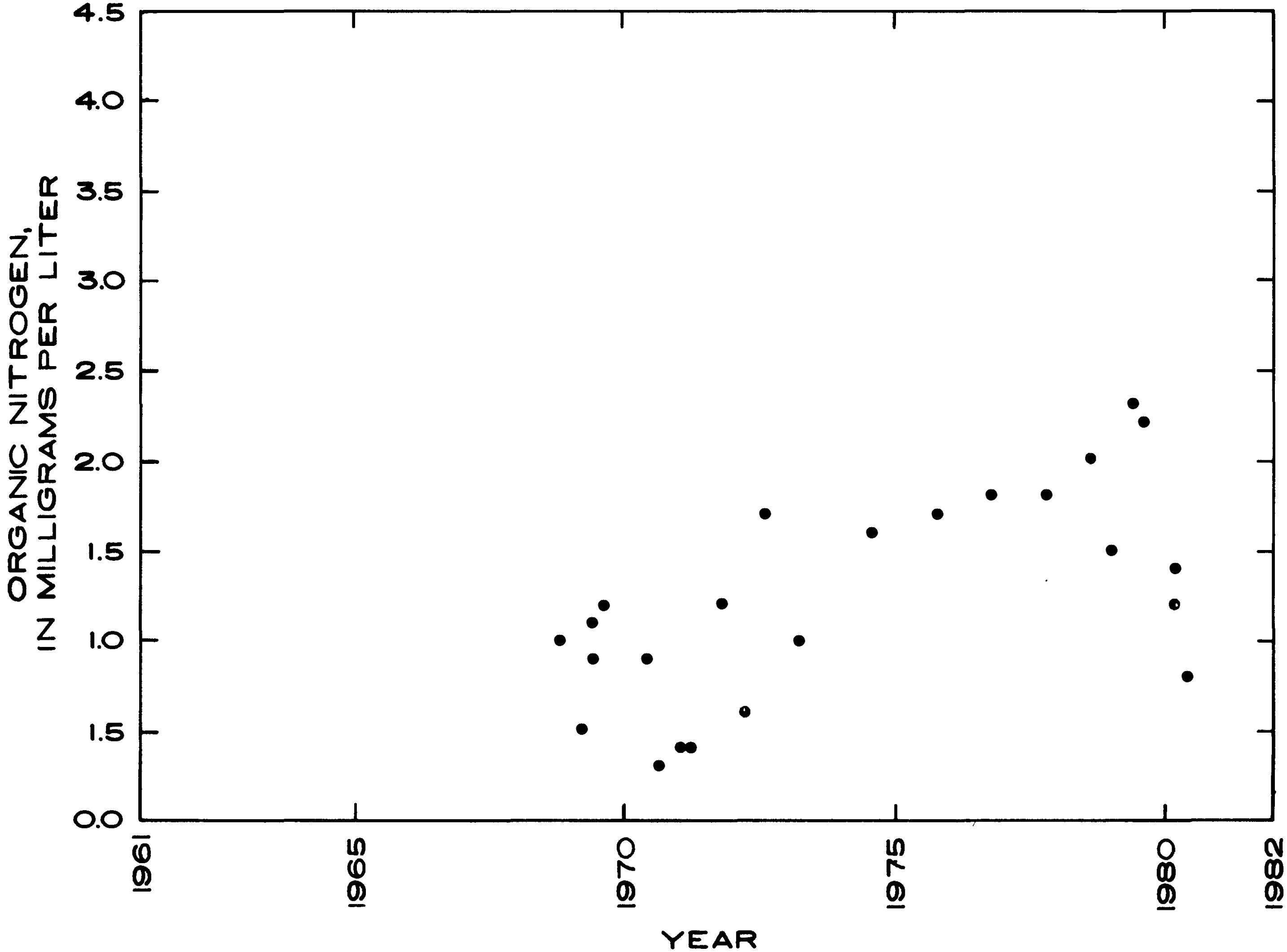


Figure 26f.--Time trend in organic nitrogen at site 4 (Cypress Creek).

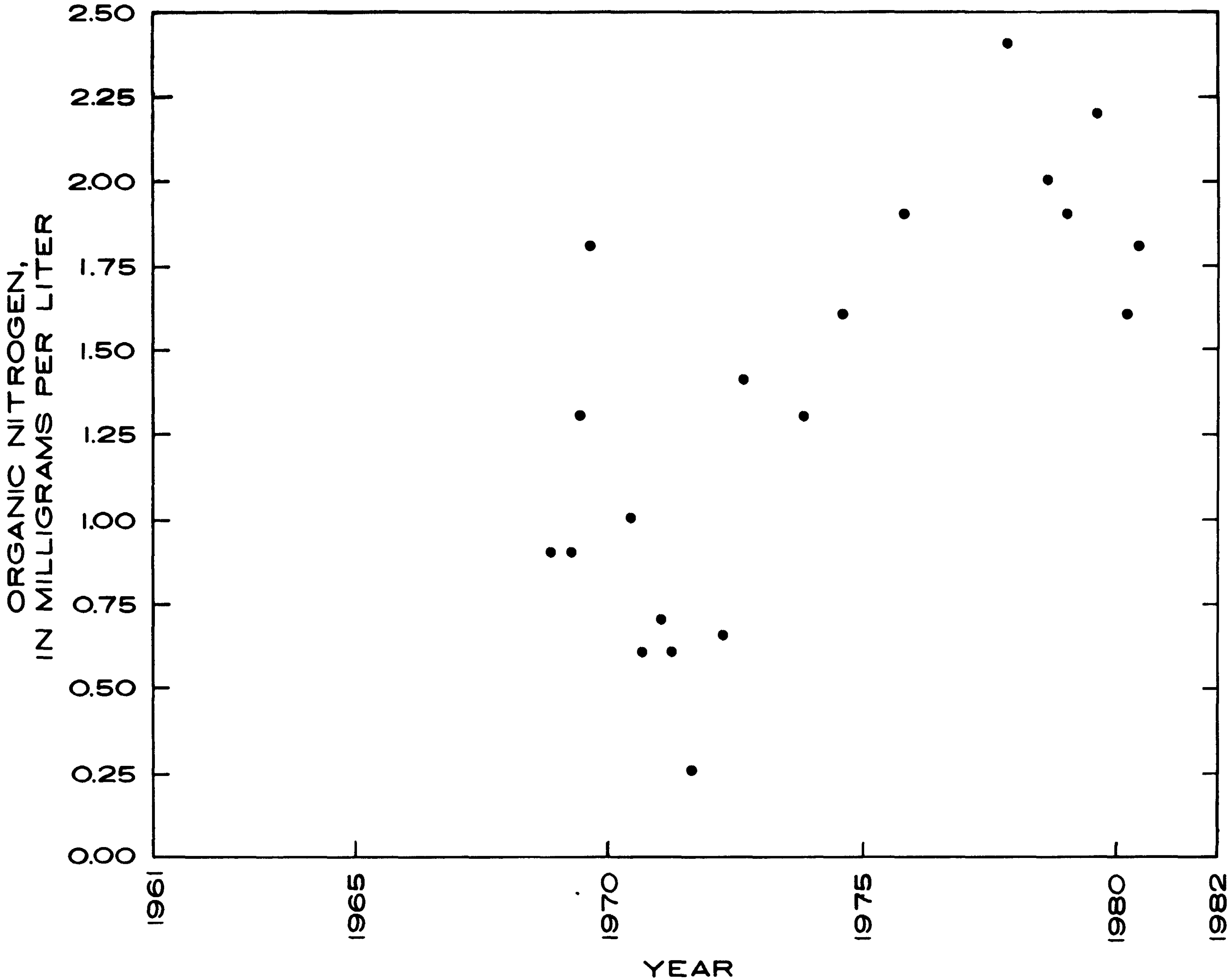


Figure 26g.--Time trend in organic nitrogen at site 8 (Whittenhorse Creek).

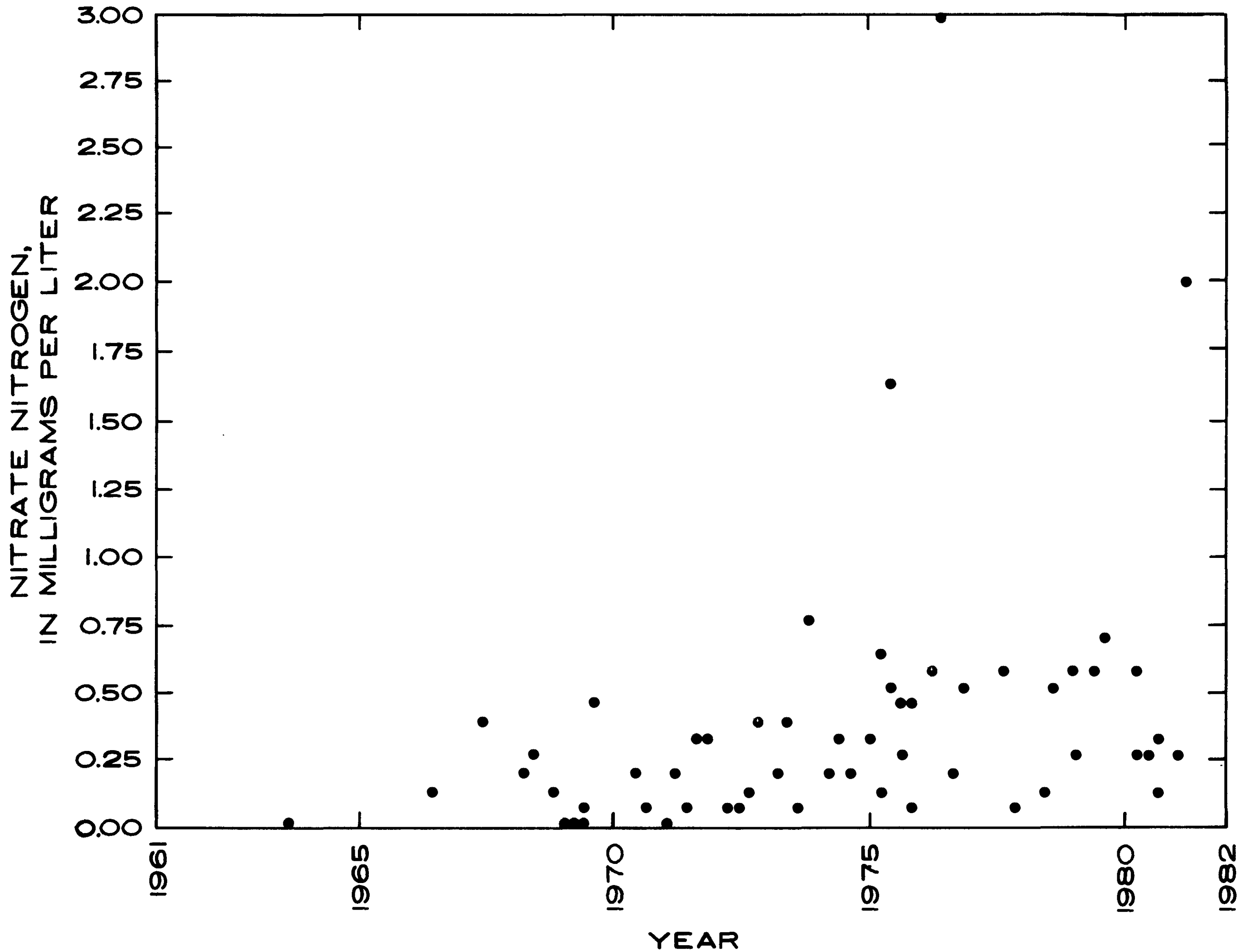


Figure 26h.--Time trend in nitrate nitrogen at site 11 (Reedy Creek near Vineland).

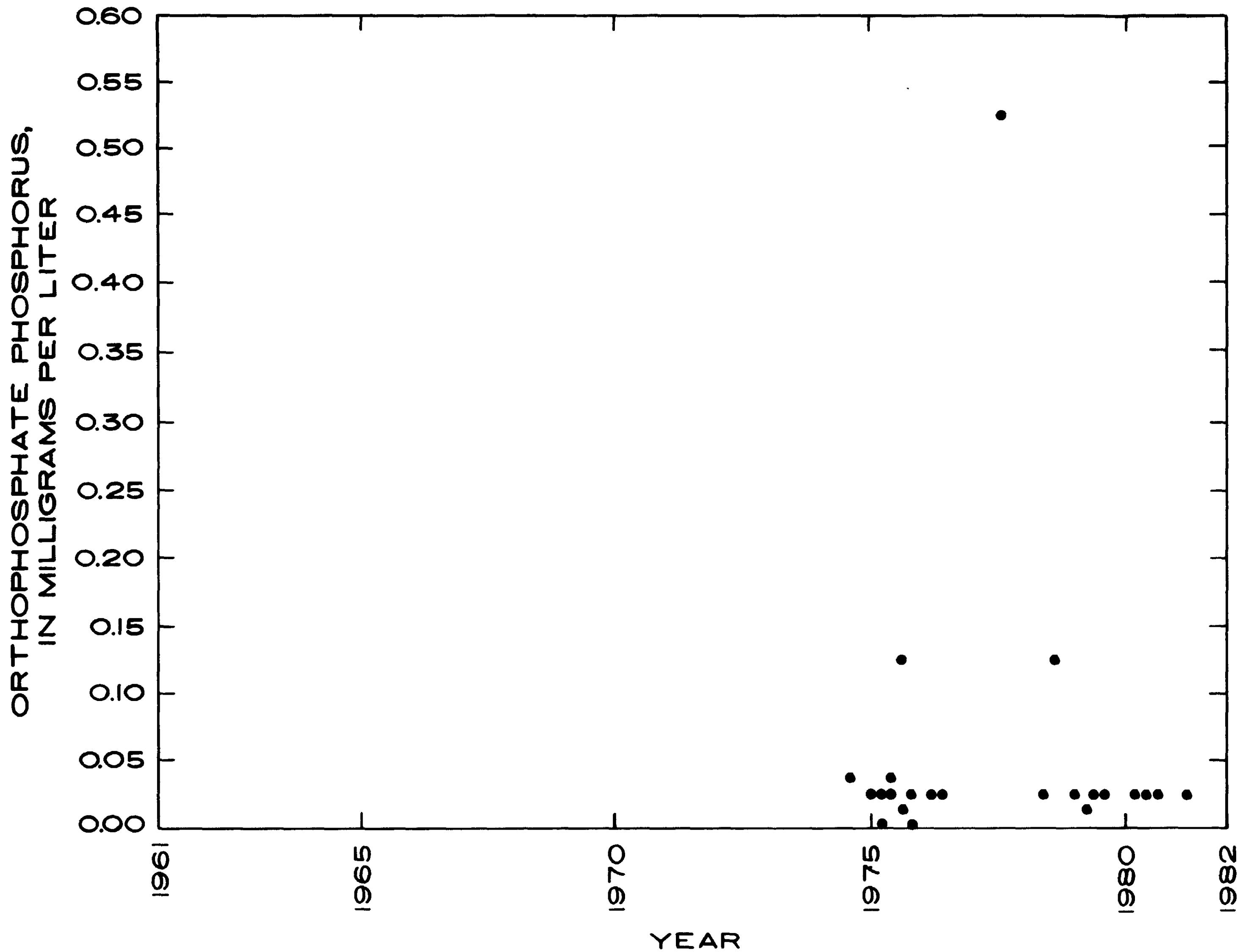


Figure 26i.--Time trend in orthophosphate phosphorus at site 9 (structure S-410).

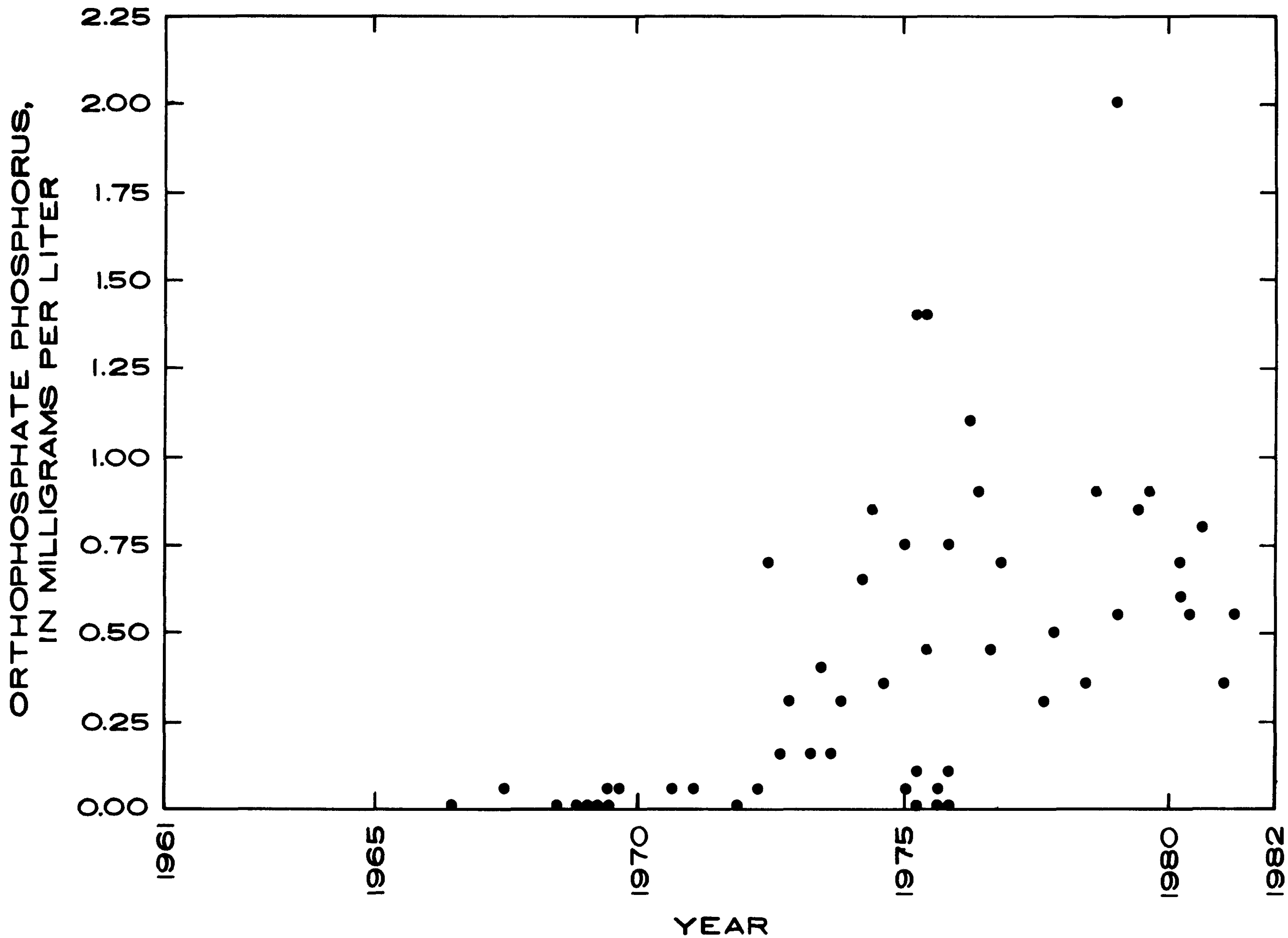


Figure 26j.--Time trend in orthophosphate phosphorus at site 11 (Reedy Creek near Vineland).

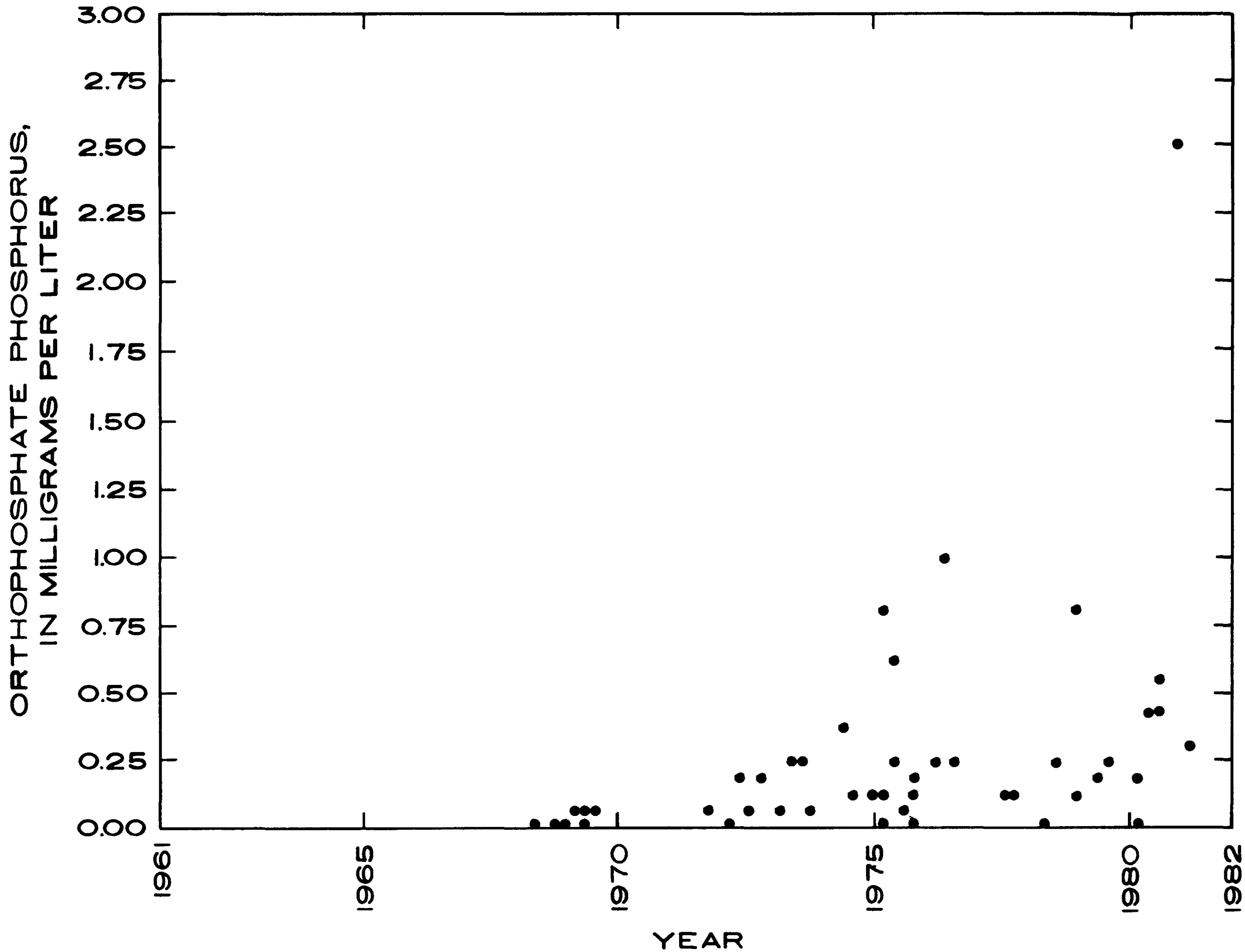


Figure 26k.--Time trend in orthophosphate phosphorus at site 13 (Reedy Creek near Loughman).

increases in concentration were probably not due only to discharge. These trends in orthophosphate concentration are probably due to discharge of the treated wastes into Reedy Creek from the RCID sewage treatment plant, and to a lesser degree, possibly also from spills or seepage of sewage from the Osceola Services sewage treatment plant near Reedy Creek north of Highway 192. Total phosphorus concentrations were not determined prior to November 1971, so pre-RCID concentrations of this constituent are not known. However, orthophosphate generally accounted for most of the phosphorus in samples where both forms were determined.

In summary, trends in water quality have apparently occurred at several sites in the RCID and vicinity. The trends have generally been in the direction of increasing constituent concentration with time. Many of the trends may be related to a continuing deficit of rainfall which allowed buildup of chemicals from the atmosphere on the land surface and in water stored in the area. The only trends in water quality that are explainable in terms of known developments are an increase in phosphorus and specific conductance at sites 11 and 13 on Reedy Creek, and possibly an increase in nitrate concentration at site 11. These upward trends in constituent concentration are probably due to disposal of treated wastes from the RCID treatment plant, and possibly, to a lesser degree from some seepage or spillage of wastes into Reedy Creek from the Osceola Services sewage treatment plant.

MASS BALANCE FOR WATER AND SELECTED CONSTITUENTS

An input-output balance for water, dissolved solids, nitrogen, and phosphorus for the undeveloped area south of Highway 192 was estimated for the period October 1978 through September 1980. The balance was calculated to determine loadings in various parts of the watershed and to quantify the effect of wetlands on the loading of Reedy Creek. Water years 1979 and 1980 were selected because of the more numerous water-quality and precipitation data as compared to other years, including estimates of quantity and quality of treated-wastes inflow furnished by the Reedy Creek Utilities Company and the RCID Environmental Services Laboratory. The water-quantity and water-quality balances were computed as follows:

- Inflow was estimated as the sum of water discharged by Bonnet Creek at site 5, Reedy Creek at site 11, and Davenport Creek at site 12. Discharges of Reedy Creek and Bonnet Creek were separated into components from within and outside the RCID.

- The quantity and quality of water in Reedy Creek originating outside the RCID was estimated by applying the yield from Whittenhorse Creek (site 8) to the entire drainage area of Reedy Creek lying outside of the RCID. According to Putnam (1975), 56.4 mi^2 of the 75 mi^2 Reedy Crek basin at site 11 is outside of the RCID, including the 12.4 mi^2 drainage area of Whittenhorse Creek.

- The quantity and quality of water in Bonnet Creek originating outside the RCID was estimated by applying the yield for Cypress Creek (site 4) to the drainage area of Bonnet Creek lying outside of the RCID. According to Putnam (1975), 41.4 mi^2 of the 56.1 mi^2 Bonnet Creek basin at site 5 is outside the RCID, including the 30.3 mi^2 drainage area of Cypress Creek.

- Treated-wastes loadings were estimated from records for the discharge from overland flow areas to Reedy Creek. Therefore, these loadings include an undetermined contribution from rainfall to the combined 125-acre overland-flow area.

- Rainfall quantity to the 14 mi^2 area south of Highway 192 was assumed to be counterbalanced by evapotranspiration and was not included in the water balance. Rainfall to this area was considered in the water-quality loadings because materials from atmospheric deposition are not removed by evapotranspiration. Estimates of rainfall quality were from composite samples of bulk precipitation (rainfall plus dry fallout) taken at Maitland, Fla., about 30 miles north of the RCID (Irwin and Kirkland, 1980). Rainfall quantity was measured at site 11.

- Outflow from the area was assumed to be from Reedy Creek (site 13) and from culverts in the levee forming the eastern boundary of the RCID, south of Highway 192. The quantity of water discharged through these culverts was not measured, but is assumed to be the difference in combined inflow from Reedy Creek, Bonnet Creek, and Davenport Creek, and outflow to Reedy Creek at site 13. Loads discharged from the culverts were estimated using water-quality samples from Bonnet Creek at site 5, because the culverts accept overflow along a channelized reach of Bonnet Creek.

Water-quality loadings were computed from periodic samples of water quality. Annual mean concentrations were used with annual mean discharge to estimate average loadings for the 1979-80 period. Dissolved-solids concentrations were estimated by multiplying specific conductance by 0.65 (Hem, 1970, p. 99). The number of samples allow only approximations of loadings, but the ranges in constituent concentrations were generally relatively low, so that the mean concentrations are probably reasonably accurate. A summary of water-quality data used in estimating stream loadings and contribution from precipitation is given in table 13. The error in rainfall quality is probably greater than the error in stream quality because rainfall quality was not actually determined in the RCID area. The rainfall-quality data used were for a station in an urbanized area. However, the rainfall-quality data probably indicate the relative magnitudes of rainfall and runoff loadings.

Confidence in the balance of the measured inflows and outflows to account for water entering and leaving the undeveloped area is supported by the data for water year 1980. During this year, the inflow from Reedy Creek (site 11), Bonnet Creek, and Davenport Creek was 47 ft^3/s, and equal to outflow to Reedy Creek (site 13). Water year 1980 was a very dry year with only 34.6 inches of rainfall recorded at site 11. Overflow of water through the culverts was probably negligible due to the low rainfall, and discharge of Reedy Creek at site 13 probably accounts for nearly all of the water leaving the area.

During the 1979 water year, 53.4 inches of rainfall were recorded at site 11, and the combined inflow from Reedy Creek, Bonnet Creek, and Davenport Creek (68 ft^3/s) exceeded outflow at site 13 (47 ft^3/s) by 21 ft^3/s, or 45 percent. The excess inflow water was assumed to have left the area through the culverts. The wetlands of the area may have stored some of the excess inflow in 1979, but that water should have been released during 1980 because in 1980 rainfall was very low. Though the possibility of errors in the water balance of the RCID undeveloped area is obvious, (not all inflow and outflow was measured, and some of the water in Reedy Creek at site 13 may originate from outside the RCID) the method described is probably adequate to approximate the hydrologic system of the undeveloped area.

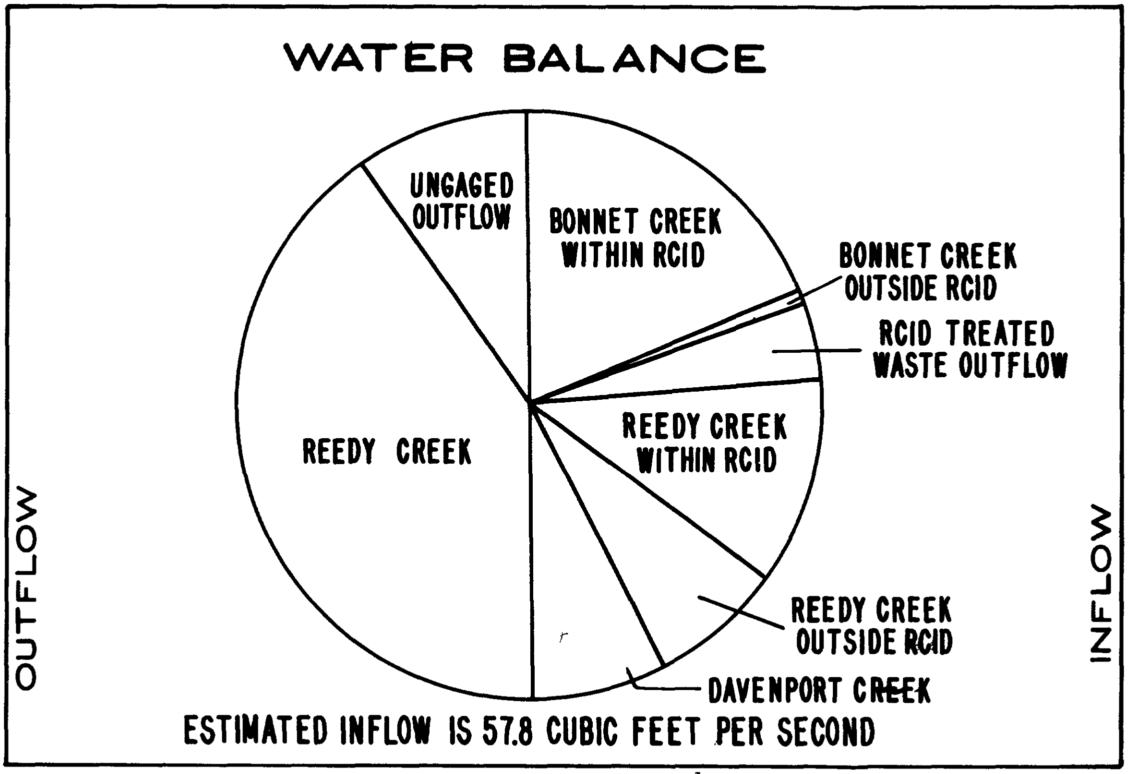
The water balance and the dissolved solids balance are shown in figure 27. Reedy Creek contributed about 46 percent of the inflow to the undeveloped area for the water years 1979-80 computation period. About 68 percent of the Reedy Creek inflow originated from within the RCID, and about 20 percent of the Reedy Creek inflow was discharge from the overland flow facilities of the RCID waste treatment process. Bonnet Creek accounted for about 39 percent of the inflow to the undeveloped area, and drainage to Bonnet Creek from the RCID accounted for nearly all (96 percent) of this inflow. Runoff from within the RCID accounted for about 69 percent of the total inflow to the undeveloped area, although the combined drainage areas of Reedy Creek and Bonnet Creek lying inside the RCID account for only about 22 percent of the total drainage area of Reedy Creek, Bonnet, and Davenport Creek.

About 81 percent of the inflow to the undeveloped area was discharged by Reedy Creek at site 13. The remaining 19 percent was assumed to have been discharged through the culverts on the east levee south of Highway 192.

Table 13.--Summary of water-quality data used in load calculations

Site	Site No.	Water year	Specific conductance, umhos/cm			Total nitrogen, mg/L			Total phosphorus, mg/L		
			Number of values	Mean	Standard deviation of mean	Number of values	Mean	Standard deviation of mean	Number of values	Mean	Standard deviation of mean
Cypress Creek	4	1979	3	164	23	3	2.06	0.27	3	0.03	0.015
		1980	3	145	10	3	1.19	0.17	3	.03	.007
Bonnet Creek	5	1979	4	119	11	4	1.08	.22	4	.07	.008
		1980	4	123	3	4	.92	.15	4	.06	.006
Whittenhorse Creek	8	1979	2	100	1	2	2.10	.18	2	.02	.005
		1980	3	92	2	3	1.87	.22	3	.03	.012
Reedy Creek nr Vineland	11	1979	1/315	220	2	4	2.41	.42	4	1.09	.31
		1980	1/334	172	2	5	1.71	.09	5	.72	.04
Davenport Creek	12	1979	4	133	12	4	2.92	.38	4	.04	.006
		1980	4	152	13	4	2.45	.53	4	.07	.03
Reedy Creek nr Loughman	13	1979	4	146	22	4	1.71	.11	4	.35	.16
		1980	5	166	17	5	2.20	.41	5	.33	.09
Maitland, Florida (bulk precipitation)2/	—	1972-78	14	23	3	14	1.60	.43	20	.18	.04

1/Daily mean values.
2/Irwin and Kirkland, 1980, p. 63.



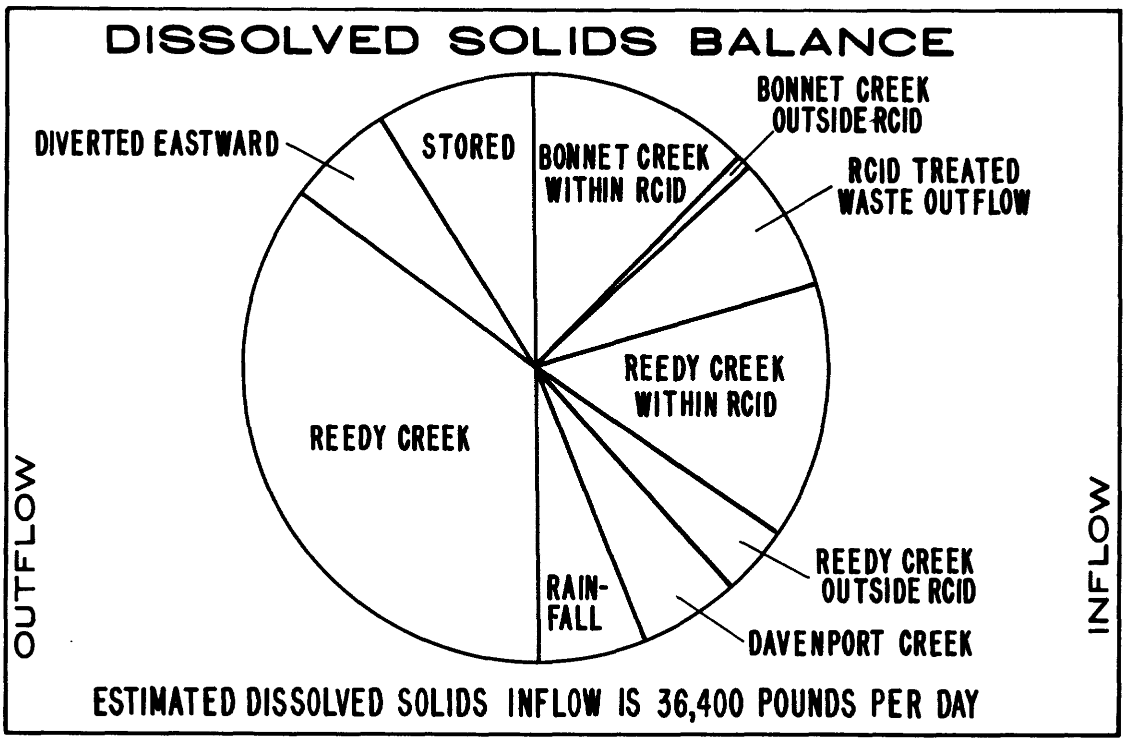


Figure 27.--Estimated water and dissolved solids balance for Reedy Creek Improvement District undeveloped area, October 1978 through September 1980 (Rainfall contribution based on average dissolved solids at Maitland, Florida (Irwin and Kirkland, 1980).

The dissolved-solids balance (fig. 27) shows that about 68 percent of the dissolved solids load to the undeveloped area was from the RCID. The high percentage of dissolved solids from the RCID is largely a result of the high runoff, rather than a source of highly mineralized water. The treated wastes accounted for about 15 percent of the dissolved solids loadings and rainfall provided about 12 percent. The estimated dissolved solids loading of the undeveloped area for the computation period is 36,400 lb/d.

About 70 percent of the dissolved-solids input to the undeveloped area was discharged by Reedy Creek. The culverts accounted for an estimated 12 percent of the dissolved-solids load. The remaining 18 percent is unaccounted for, and represents either error in the estimates of mean concentrations or discharges used to compute the loads, or storage of dissolved solids in the wetlands area. Plants require relatively large amounts of calcium, magnesium, and potassium (Nebel, 1981, p. 121), and uptake of these elements by trees and other plants could account for some of the dissolved solids, though eventually elements stored by plants would be returned to the ecosystem by death and decay.

The balance of total nitrogen and phosphorus for the undeveloped area for the 1979 and 1980 water years is shown in figure 28. The estimated bulk-precipitation contribution accounted for about 45 percent of the total nitrogen input. The treated-wastes nitrogen contribution was only about 4 percent, or considerably less than the treated wastes dissolved-solids contribution of 15 percent. Outflow from the area accounted for about 55 percent of the inflow, leaving an estimated storage of about 45 percent of the inflow nitrogen within the undeveloped area. The total nitrogen inflow to the area, including rainfall, was estimated to be 1,010 lbs per day.

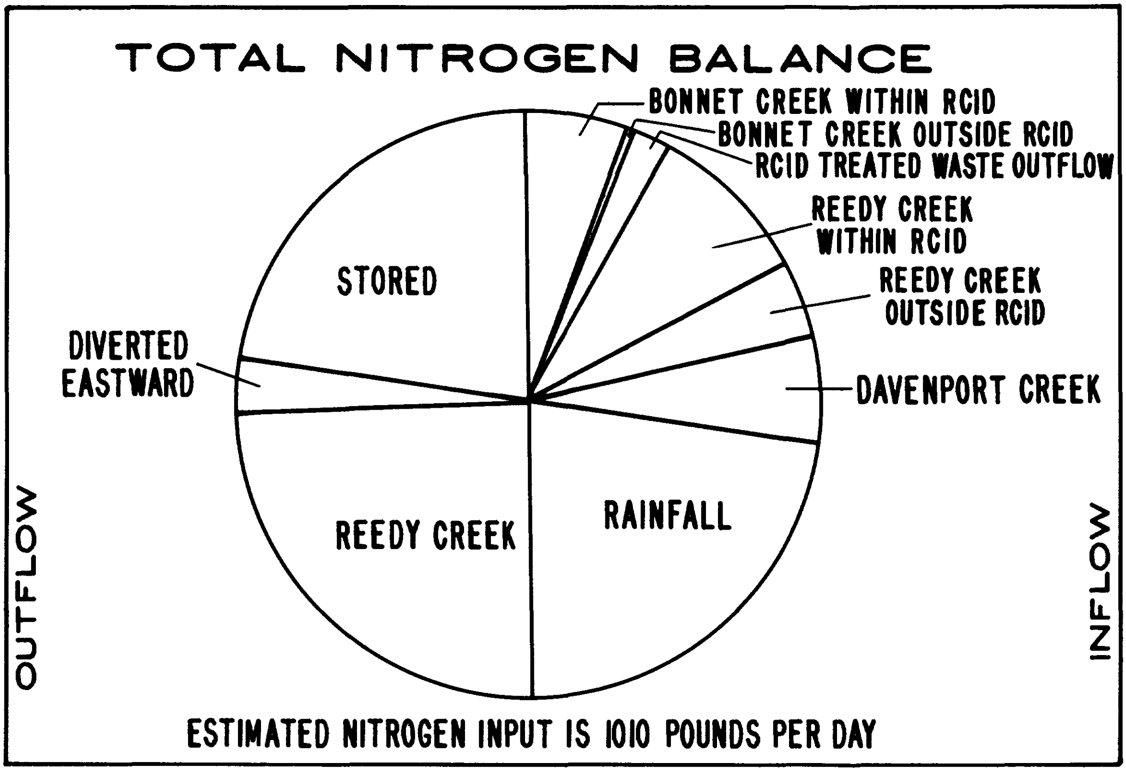
The estimated total phosphorus balance indicates that the treated-wastes outflow from the overland flow treatment facilities furnish a substantial part of the phosphorus load. The treated wastes accounted for about 53 percent of the phosphorus load in Reedy Creek at site 11, and accounted for about 36 percent of the total phosphrous load to the undeveloped area, a considerably greater proportion than for dissolved solids or nitrogen. Rainfall contributed an estimated 26 percent of the phosphorus load. The percentage of the phosphorus input stored in the undeveloped area (59 percent) was considerably greater than the storage percentage for dissolved solids (18 percent) or nitrogen (45 percent). The total phosphorus input to the area was estimated to be 193 pounds per day.

The major conclusions from these loading computations, subject to the errors inherent in the methods used, are that:

- Rainfall accounted for a considerable proportion of the nitrogen and phosphorus loading of the undeveloped area (45 and 26 percent, respectively).

- The treated wastes accounted for a significant proportion (36 percent) of the phosphorus loading.

- Storage of dissolved solids, and especially nitrogen and phosphorus, occurred in the undeveloped area.



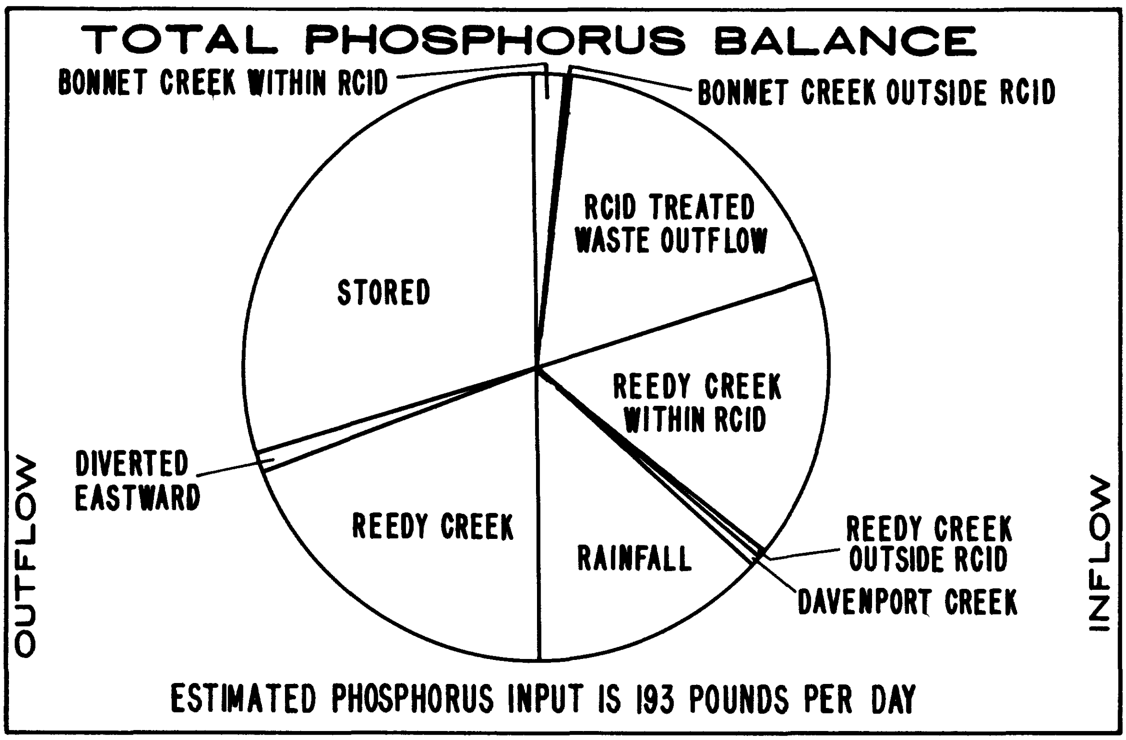


Figure 28.--Estimated nitrogen and phosphorus balance for Reedy Creek Improvement District undeveloped area, October 1978 through September 1980 (rainfall contribution based on average concentrations at Maitland, Florida (Irwin and Kirkland, 1980).

Other studies that reported on water-quality balances for lakes indicate that lakes are sinks for nitrogen and phosphrous and that rainfall is a significant source of these nutrients. Joyner (1974) found that 22 percent of the nitrogen and 36 percent of the phosphorus input to Lake Okeechobee were retained in the lake. Precipitation accounted for 30 percent of the nitrogen and 26 percent of the phosphorus entering the lake. Greeson (1971) reported that 20 percent of the nitrogen and 62 percent of the phosphorus input to Oneida Lake (in New York) is retained. This retention of material in a lake is a part of the eutrophication process, in which lakes are filled with sediment and organic debris to become marshland, and eventually, dry land. The RCID undeveloped area is not a lake, but entrapment of material (especially nutrients) in wetlands areas may be occurring in a manner similar to that in some lakes.

SUMMARY AND CONCLUSIONS

A systematic program of data collection in the RCID and vicinity has provided a data base for the determination of the hydraulic and water-quality characteristics of the area and for an assessment of the impact of development. A summary of the major findings of this investigation follows.

- Rainfall was deficient in the RCID area since development of the area commenced in 1968. Mean long-term rainfall for the period 1931-66 was 52.42 inches per year, based on records for Kissimmee and Isleworth. At the end of water year 1980, the accumulated rainfall deficit since 1966 is nearly 85 inches (6.1 in/yr) based on Kissimmee and Isleworth rainfall, and nearly 95 inches (6.8 in/yr) at Bay Lake, within the RCID. This rainfall deficiency has affected stream discharge, ground-water levels, and possibly water quality in the RCID.

- Long-term records of discharge of Cypress Creek, which drains the area north and east of the RCID, show that annual mean discharges have been consistently lower since 1971 than in previous years. The rainfall-discharge relation for Cypress Creek is variable, and during dry years, part of the Cypress Creek basin is probably noncontributing due to storage of runoff in the Lake Butler chain of lakes.

- Long-term discharge records for Reedy Creek near Loughman, downstream from the RCID, indicate that discharge from 1970 through 1980 was lower, in relation to rainfall, than for the period 1940 through 1959. The lower discharge since 1970 is probably due in part to manmade alterations of the basin within the RCID. Retention of water by control structures probably increases evaporation, and diversion of water from the undeveloped area of the RCID south of Highwy 192 may cause an average of about 40 ft^3/s of discharge to bypass the Reedy Creek gaging station. Some of the flow reduction during dry years may be due to storage of water in swampy areas which causes a reduction in the contributing drainage area.

- Low-flow characteristics have changed in the Reedy Creek basin. At the gaging station near Vineland (Highway 192 crossing), discharge has not ceased since 1968 due to discharge of treated wastes to the stream. Downstream from the RCID (near Loughman), periods of no flow have occurred only since 1970. Retention of water in the RCID wetlands area upstream from the Loughman gaging station, and possibly diversion of water from the wetlands area, are probably responsible for the periods of no discharge.

- The potentiometric surface of the Floridan aquifer has declined as much as 30 feet at some locations since 1961. Because the period of development corresponds with a period of low rainfall, it is not possible to definitely assess the impact of the RCID and associated development on the decline of the potentiometric surface. However, the hydrographs of wells both near and more distant from the RCID indicate that the declines near the RCID are no greater than declines elsewhere. Therefore, withdrawals of ground water in the RCID have probably not had a widespread effect on the potentiometric surface of the Floridan aquifer.

- The pH was lower than the FDER minimum criteria of 6.0 at 12 of the 13 water-quality sampling sites (exception was outflow from Bay Lake). The low pH values are a natural property of waters in the RCID and are generally due to leaching of organic acids from vegetative debris in canals or swamps. The low pH values are generally accompanied by high color as a result of the leaching process. However, outflow of water from South Lake generally had pH values lower than 6 but had low color. The low pH is probably the result of a combination of acidic type rainfall and a lack of buffering capability in the lake, which apparently receives no inflow of water from the Floridan aquifer.

- DO concentrations are often less than the water-quality criteria set by the FDER (5.0 mg/L). The low DO concentrations, like the low pH's, are probably due to natural processes, including oxygen consumption by decaying vegetative debris and by influx of ground water low in DO into the canals.

- The highest nitrogen concentrations, based on median values of all samples, occurred in undeveloped areas or in areas of citrus groves. The highest phosphorus concentrations were at sites downstream from treated wastes discharge.

- Mercury, zinc, cadmium, copper, silver, iron, and lead concentrations exceeded FDER criteria for aquatic life protection in some samples in the RCID and vicinity. However, criteria for cadmium, mercury, and silver are less than analytical detection limits used for most of this study and therefore, exceedance frequencies reported for these metals are somewhat arbitrary. Copper, iron, lead, and silver concentrations exceeded the water-quality criteria in only 5 percent or less of the samples. Silver was detected only once, at Cypress Creek, and probably originated from a local source. Mercury, which exceeded the criteria of 0.2 ug/L at least once at all sites except site 9 may originate from atmospheric deposition. Zinc concentrations exceeded the criteria of 30 ug/L at 10 of the 13 sampling sites. The widespread occurrence of zinc seems unrelated to development. Cadmium exceeded the criteria of 0.8 ug/L in about 20 percent of the 41 samples, and at 5 of the 13 sites. The presence of cadmium does not correlate strongly with areas of development, and may be due in part to atmospheric deposition. The overall rates at which the metals exceeded water-quality criteria does not correlate with proximity of the sampling site to developed areas, but seems to be related to the color of water. The water at sites with the highest frequency of metals criteria exceedance is also highly colored. The frequent presence of metals in highly colored water may be due to formation of soluble organometallic complexes with the organic compounds that cause color, or due to the lower pH of the highly-colored waters.

- The distribution of organic compounds, principally insecticides and herbicides, seems related to development. Streams in undeveloped areas outside and in the RCID had the lowest rate of detection of organic compounds. Malathion, 2,4-D and silvex were the compounds most commonly detected near the resort areas.

  Malathion most often exceeded FDER water-quality criteria for organic compounds (0.1 ug/L). About 15 percent of the samples for malathion exceeded the criteria. The criteria were exceeded at 6 of the 13 sites. The frequency at which organic compounds exceeded water-quality criteria correlates with proximity of the sampling site to the developed areas. The sites with the highest frequency of criteria exceedance are near the resort areas or receive runoff from them. Excessive concentrations of malathion are apparently confined to the areas of application. Malathion never exceeded water-quality criteria downstream from the resort areas where it is mostly detected and was never detected in Reedy Creek downstream from site 10.

- Organic compounds were more widespread in bottom sediments of the area's streams and canals, and on a per unit weight basis, were present in much higher concentrations in bottom sediments than in water. Compounds detected in at least 10 percent of the samples of bottom sediments in order of decreasing frequency of detection were chlordane, dieldrin, DDE, DDD, DDT, PCB, and methyl parathion. These compounds were widely distributed and were detected at 7 to 12 of the 13 sites. Except for methyl parathion, the compounds are the insoluble and highly-persistent organochlorine type, and thus, tend to accumulate and persist in bottom sediments.

  The presence of organic compounds in bottom sediments was more frequent at sites near agricultural areas than in the developed areas, probably due to their present or historical use in the agricultural areas. The widespread occurrence of PCB is unexpected because that family of compound is not used as a pesticide. DDT and its derivatives DDD and DDE have not been used for many years, but due to the longevity of these compounds, will probably continue to be detected for many years. The frequency of detection of organic compounds was unusually high in bottom sediments of Reedy Creek near Vineland (site 11), although the site is not near agricultural areas.

- Trends in water quality at several sites in the RCID and vicinity have generally been in the direction of increasing constituent concentration with time. Many of the trends may be related to a continuing deficit of rainfall which has possibly allowed a buildup of chemicals on the land surface and water stored in the area. The only trends in water quality which seem to relate to development are an increase in specific conductance, phosphorus, and possibly nitrate nitrogen in Reedy Creek. These increases are probably due to disposal of treated wastes from the RCID treatment plant and possibly to a lesser extent to spills and seepage from the Osceola Services sewage treatment plant west of Reedy Creek and north of Highway 192.

- Balances for water, dissolved solids, nitrogen, and phosphorus entering and leaving the RCID undeveloped area south of Highway 192 during water years 1979 and 1980 indicate that rainfall accounted for a considerable proportion of the nitrogen and phosphorus loading of the area (45 and 26 percent, respectively). The treated wastes from the RCID overland flow facility accounted for more than half of the phosphorus in Reedy Creek inflow to the undeveloped area (at site 11) and about 36 percent of the total phosphorus load to the area. Some dissolved solids (about 18 percent) and considerable quantities of the inflow phosphorus (59 percent) and nitrogen (45 percent) were apparently retained in the wetlands area. For the 2-year period, estimated input to the wetlands area per day was 36,400 pounds of dissolved solids, 1,010 pounds of nitrogen, and 193 pounds of phosphorus.

SELECTED REFERENCES

Conover, W. J., 1971, Practical nonparametric statistics: New York, John Wiley, 462 p.

Draper, N. R., and Smith, H., 1966, Applied regression analysis: New York, John Wiley, 407 p.

Florida Department of Environmental Regulation, 1983, Water-quality standards: chap. 17-3, in Florida Administrative Code.

Greeson, P. E., 1971, Liminology of Oneida Lake with emphasis on factors contributing to algal blooms: New York State Department of Environmental Conservation, Open-File Report.

Harden, Fred, 1980, Management of land treatment of waste water to protect ground-water quality: Southeast Conference on Ground-Water Management, Birmingham, Alabama, 1980, 18 p.

Healy, H. G., 1962, Piezometric surface and areas of artesian flow of the Floridan aquifer, July 6-17, 1961: Bureau of Geology Map Series 4, 1 sheet.

Helwig, J. T., and Council, K. A., eds., 1979, SAS Users Guide, 1979 ed.: SAS Institute Inc., Raleigh, North Carolina, 424 p.

Hem, J. D., 1970, Study and interpretation of the chemical characteristics of natural water, 2d ed.: U.S. Geological Survey Water-supply Paper 1473, 363 p.

Irwin, G. A., and Kirkland, R. T., 1980, Chemical and physical characteristics of precipitation at selected sites in Florida: U.S. Geological Survey Water-Resources Investigations 80-81, 70 p.

Joyner, B. F., Chemical and biological conditions of Lake Okeechobee, Florida, 1969-72: Florida Bureau of Geology, Report of Investigation 71, 94 p.

Lichtler, W. F., Anderson, Warren, and Joyner, B. F., 1968, Water rsources of Orange County, Florida: Florida Division of Geology Report of Investigations 50, 150 p.

Nebel, B. J., 1981, Environmental Science: The way the world works: New Jersey, Prentice-Hall, 715 p.

Parker, G. G., Ferguson, G. E., Love, S. K., and others, 1955, Water Resources of southeastern Florida: U.S. Geological Survey Water-Supply Paper 1255, 965 p.

Puri, H. S., and Vernon, R. O., 1964, Summary of geology of Florida and a guidebook to the classic exposures: Florida Division of Geology Special Publication 5, 312 p.

Putnam, A. L., 1975, Summary of hydrologic conditions and effects of Walt Disney World development in the Reedy Creek Improvement District, 1966-73: Florida Bureau of Geology Report of Investigations 79, 115 p.

Searcy, J. K., 1959, Flow-duration curves: U.S. Geological Survey Water-Supply Paper 1542-A, 33 p.

Schiner, G. R., and Hayes, E. C., 1981, Potentiometric surface of the Floridan aquifer, St. Johns River Water Management District and vicinity, Florida, May 1981: U.S. Geological Survey Open-File Report 81-1052, 1 sheet.

U.S. Environmental Protection Agency, 1976, Quality criteria for water: U.S. Environmental Protection Agency report EPA-44019-76-023, 501 p.

Wershaw, R. L., 1970, Sources and behavior of mercury in surface waters, in Mercury in the environment: U.S. Geological Survey Professional Paper 713, 67 p.

SUPPLEMENTAL DATA

Summaries of data for the 13 surface-water sites are given in this section. Organic compounds analyzed for, but never detected at any of the sites are not included in the summaries. These are polychlorinated napthalenes, aldrin, endodsulfan, endrin, heptachlor, heptachlor epoxide, methoxyclor, methyl trithion, parathion, trithion, and 2,4,5-T in bottom sediments.

The remarks column, labeled "Rmks", lists the number of qualified analyses, or those reported as less than the given concentration. The data summaries for constituents with qualified values therefore represent a maximum condition, and actual summary values could, in some cases, be less than the indicated values.

STATION 282442081352600   SITE 1: OUTFLOW FROM 7-SEAS LAGOON

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
00080	COLOR (PLATINUMCOBALT UNITS)	6	0	55	120	147	320	79-08-20	81-03-15
00400	PH (UNITS)	12	0	5.3	6.7	6.9	7.9	75-01-20	80-09-02
00010	TEMPERATURE (DEG C)	13	0	12.0	24.0	22.5	29.0	75-01-20	81-03-15
00070	TURBIDITY (JTU)	4	0	1	2	2	4	74-12-11	75-08-05
00076	TURBIDITY (NTU)	7	0	0	1	1	3	79-06-05	81-03-15
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	15	0	110	150	149	180	75-01-20	81-03-15
00300	OXYGEN, DISSOLVED (MG/L)	13	0	1.3	5.4	5.2	9.6	75-01-20	81-03-15
00915	CALCIUM DISSOLVED (MG/L AS CA)	6	0	11.0	14.5	14.5	19.0	80-02-08	81-03-15
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	6	0	4.0	4.3	4.4	5.1	80-02-08	81-03-15
00930	SODIUM, DISSOLVED (MG/L AS NA)	5	0	4.6	4.9	4.9	5.2	80-02-08	81-03-15
00935	POTASSIUM, DISSOLVED (MG/L AS K)	6	0	0.8	1.1	1.1	1.5	80-02-08	81-03-15
00410	ALKALINITY (MG/L AS CACO3)	7	0	24	50	45	66	75-02-18	80-09-02
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	9	0	1.6	12.0	9.9	15.0	75-01-20	81-03-15
00945	SULFATE DISSOLVED (MG/L AS SO4)	9	0	4.3	7.1	6.9	10.0	75-01-20	81-03-15
	NUTRIENTS, IN MILLIGRAMS PER LITER								
00610	NITROGEN, AMMONIA TOTAL	10	0	0.02	0.04	0.05	0.08	74-12-11	81-03-15
00620	NITROGEN, NITRATE TOTAL	11	0	0.00	0.01	0.02	0.07	74-12-11	81-03-15
00615	NITROGEN, NITRITE TOTAL	8	0	0.00	0.00	0.00	0.01	74-12-11	81-03-15
00605	NITROGEN, ORGANIC TOTAL	10	0	0.08	0.57	0.57	1.60	74-12-11	81-03-15
00600	NITROGEN, TOTAL	8	0	0.19	0.77	0.75	1.69	74-12-11	81-03-15
00650	PHOSPHATE, TOTAL	3	0	0.09	0.17	0.27	0.54	75-02-18	75-08-05
00660	PHOSPHATE, ORTHO, DISSOLVED	1	0	0.03	0.03	0.03	0.03	75-01-20	75-01-20
70507	PHOSPHORUS, ORTHO, TOTAL	8	0	0.00	0.01	0.02	0.04	74-12-11	81-03-15
00665	PHOSPHORUS, TOTAL	8	0	0.01	0.03	0.03	0.06	74-12-11	81-03-15
00680	CARBON, ORGANIC TOTAL	8	0	0.0	13.5	12.9	24.0	74-12-11	81-03-15
	METALS, IN MICROGRAMS PER LITER								
01105	ALUMINUM, TOTAL RECOVERABLE	2	0	110	135	135	160	80-05-12	80-09-02
01002	ARSENIC TOTAL	2	0	1	1	1	1	80-05-12	80-09-02
01012	BERYLLIUM, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01027	CADMIUM TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01034	CHROMIUM, TOTAL RECOVERABLE	2	0	10	10	10	10	80-05-12	80-09-02
01042	COPPER, TOTAL RECOVERABLE	3	1	2	2	5	10	75-08-05	80-09-02
01045	IRON, TOTAL RECOVERABLE	3	0	80	360	313	500	75-08-05	80-09-02
01051	LEAD, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
71900	MERCURY TOTAL RECOVERABLE	2	0	0.1	0.3	0.3	0.4	80-05-12	80-09-02
01067	NICKEL, TOTAL RECOVERABLE	2	0	0	1	1	2	80-05-12	80-09-02
01147	SELENIUM, TOTAL	2	0	0	0	0	0	80-05-12	80-09-02
01077	SILVER, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01092	ZINC, TOTAL RECOVERABLE	3	0	10	20	30	60	75-08-05	80-09-02
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
39350	CHLORDANE, TOTAL	5	0	0.0	0.0	0.0	0.0	75-03-18	80-09-02
39360	DDD, TOTAL	5	0	0.00	0.00	0.00	0.00	75-03-18	80-09-02
39365	DDE, TOTAL	5	0	0.00	0.00	0.00	0.00	75-03-18	80-09-02
39370	DDT, TOTAL	5	0	0.00	0.00	0.00	0.00	75-03-18	80-09-02
39570	DIAZINON, TOTAL	2	0	0.00	0.00	0.00	0.00	79-06-05	80-09-02
39380	DIELDRIN TOTAL	5	0	0.00	0.00	0.00	0.00	75-03-18	80-09-02
39398	ETHION, TOTAL	2	0	0.00	0.00	0.00	0.00	79-06-05	80-09-02
39340	LINDANE TOTAL	5	1	0.00	0.00	0.00	0.01	75-03-18	80-09-02
39530	MALATHION, TOTAL	2	0	0.55	0.98	0.98	1.40	79-06-05	80-09-02
39540	PARATHION, TOTAL	2	0	0.00	0.00	0.00	0.00	79-06-05	80-09-02
39516	PCB, TOTAL	5	0	0.0	0.0	0.0	0.0	75-03-18	80-09-02
39760	SILVEX, TOTAL	6	0	0.00	0.00	0.00	0.00	74-12-11	80-09-02
39730	2,4-D, TOTAL	5	0	0.00	0.01	0.11	0.65	74-12-11	80-09-02
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
39333	ALDRIN, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.0	0.0	75-02-20	80-09-02
39351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	5	0	0	3	8	22	75-02-20	80-09-02
39363	DDD, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.0	0.0	75-02-20	80-09-02
39368	DDE, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.0	0.0	75-02-20	80-09-02
39373	DDT, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.0	0.0	75-02-20	80-09-02
39571	DIAZINON, TOTAL IN BOTTOM MATERIAL	2	0	0.0	0.0	0.0	0.0	79-06-05	80-09-02
39383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.1	0.4	75-02-20	80-09-02
39399	ETHION, TOTAL IN BOTTOM MATERIAL	2	0	0.0	0.0	0.0	0.0	79-06-05	80-09-02
39423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	5	0	0.0	0.0	0.5	3.2	75-02-20	80-09-02
39601	METHYL PARATHION, TOT. IN BOTTOM MATL.	2	0	0.0	0.0	0.0	0.0	79-06-05	80-09-02
39519	PCB, TOTAL IN BOTTOM MATERIAL	5	0	0	0	1	3	75-02-20	80-09-02
39761	SILVEX, TOTAL IN BOTTOM MATERIAL	6	0	0.0	0.0	0.0	0.0	74-12-11	79-08-20
39403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	5	0	0	0	0	0	75-02-20	80-09-02
39731	2,4-D, TOTAL IN BOTTOM MATERIAL	6	0	0	0	0	0	74-12-11	79-08-20

STATION 02263851 SITE 2: OUTFLOW FROM BAY LAKE

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
00080	COLOR (PLATINUMCOBALT UNITS)	7	0	5	70	93	320	72-06-01	81-03-15
00400	PH (UNITS)	14	0	5.8	6.5	6.7	7.9	72-06-01	80-11-03
00010	TEMPERATURE (DEG C)	14	0	13.5	25.0	24.7	31.0	72-06-01	81-03-15
00070	TURBIDITY (JTU)	5	0	1	2	2	4	72-06-01	75-05-11
00076	TURBIDITY (NTU)	7	0	0	2	2	5	79-06-05	81-03-15
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	15	0	98	119	127	180	72-06-01	81-03-15
00300	OXYGEN, DISSOLVED (MG/L)	14	0	2.8	6.4	6.5	10.8	72-06-01	81-03-15
00915	CALCIUM DISSOLVED (MG/L AS CA)	7	0	5.6	7.4	8.4	17.0	72-06-01	81-03-15
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	7	0	3.2	4.3	4.1	4.9	72-06-01	81-03-15
00930	SODIUM, DISSOLVED (MG/L AS NA)	7	0	4.7	7.1	6.6	9.7	72-06-01	81-03-15
00935	POTASSIUM, DISSOLVED (MG/L AS K)	7	0	1.0	1.6	1.5	1.9	72-06-01	81-03-15
00410	ALKALINITY (MG/L AS CACO3)	9	0	6	22	22	49	72-06-01	80-11-03
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	10	0	2.2	11.0	9.9	15.0	72-06-01	81-03-15
00945	SULFATE DISSOLVED (MG/L AS SO4)	10	0	5.5	9.8	9.7	13.0	72-06-01	81-03-15
	NUTRIENTS, IN MILLIGRAMS PER LITER								
00610	NITROGEN, AMMONIA TOTAL	11	0	0.00	0.02	0.02	0.05	72-06-01	81-03-15
00620	NITROGEN, NITRATE TOTAL	13	0	0.00	0.01	0.04	0.19	72-06-01	81-03-15
00615	NITROGEN, NITRITE TOTAL	9	0	0.00	0.00	0.00	0.01	72-06-01	81-03-15
00605	NITROGEN, ORGANIC TOTAL	10	0	0.10	0.47	0.69	1.60	72-06-01	81-03-15
00600	NITROGEN, TOTAL	8	0	0.25	0.60	0.86	1.73	75-05-11	81-03-15
00650	PHOSPHATE, TOTAL	3	0	0.01	0.03	0.03	0.05	75-03-18	75-08-05
70507	PHOSPHORUS, ORTHO, TOTAL	9	0	0.00	0.01	0.01	0.05	72-06-01	81-03-15
00665	PHOSPHORUS, TOTAL	9	0	0.01	0.03	0.03	0.10	72-06-01	81-03-15
00680	CARBON, ORGANIC TOTAL	8	0	3.4	13.5	16.2	40.0	75-05-11	81-03-15
	METALS, IN MICROGRAMS PER LITER								
01105	ALUMINUM, TOTAL RECOVERABLE	2	0	200	210	210	220	80-05-12	80-09-02
01002	ARSENIC TOTAL	2	0	2	2	2	2	80-05-12	80-09-02
01012	BERYLLIUM, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01027	CADMIUM TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01034	CHROMIUM, TOTAL RECOVERABLE	2	0	10	15	15	20	80-05-12	80-09-02
01042	COPPER, TOTAL RECOVERABLE	3	0	0	2	2	3	75-08-05	80-09-02
01045	IRON, TOTAL RECOVERABLE	3	0	150	160	280	530	75-08-05	80-09-02
01051	LEAD, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
71900	MERCURY TOTAL RECOVERABLE	2	1	0.1	0.3	0.3	0.4	80-05-12	80-09-02
01067	NICKEL, TOTAL RECOVERABLE	2	0	0	1	1	2	80-05-12	80-09-02
01147	SELENIUM, TOTAL	2	0	0	0	0	0	80-05-12	80-09-02
01077	SILVER, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01092	ZINC, TOTAL RECOVERABLE	3	0	10	20	17	20	75-08-05	80-09-02
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
39350	CHLORDANE, TOTAL	5	0	0.0	0.0	0.0	0.0	75-05-23	80-09-02
39360	DDD, TOTAL	5	0	0.00	0.00	0.00	0.00	75-05-23	80-09-02
39365	DDE, TOTAL	5	0	0.00	0.00	0.00	0.00	75-05-23	80-09-02
39370	DDT, TOTAL	6	0	0.00	0.00	0.00	0.00	75-05-23	80-09-02
39570	DIAZINON, TOTAL	3	0	0.00	0.00	0.00	0.00	78-06-05	80-09-02
39380	DIELDRIN TOTAL	6	0	0.00	0.00	0.00	0.00	75-05-23	80-09-02
39398	ETHION, TOTAL	3	0	0.00	0.00	0.00	0.00	78-06-05	80-09-02
39340	LINDANE TOTAL	6	0	0.00	0.00	0.00	0.00	75-05-23	80-09-02
39530	MALATHION, TOTAL	3	0	0.11	1.00	1.14	2.30	78-06-05	80-09-02
39540	PARATHION, TOTAL	3	0	0.00	0.00	0.00	0.00	78-06-05	80-09-02
39516	PCB, TOTAL	5	0	0.0	0.0	0.0	0.0	75-05-23	80-09-02
39760	SILVEX, TOTAL	5	0	0.00	0.00	0.04	0.21	75-03-10	80-09-02
39730	2,4-D, TOTAL	5	0	0.00	0.02	0.07	0.23	75-03-10	80-09-02
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
39333	ALDRIN, TOTAL IN BOTTOM MATERIAL	7	0	0.0	0.0	0.0	0.0	75-02-20	80-09-02
39351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	7	0	0	7	31	160	75-02-20	80-09-02
39363	DDD, TOTAL IN BOTTOM MATERIAL	7	0	0.0	0.0	0.0	0.0	75-02-20	80-09-02
39368	DDE, TOTAL IN BOTTOM MATERIAL	7	0	0.0	0.0	0.0	0.3	75-02-20	80-09-02
39373	DDT, TOTAL IN BOTTOM MATERIAL	7	0	0.0	0.0	0.0	0.0	75-02-20	80-09-02
39571	DIAZINON, TOTAL IN BOTTOM MATERIAL	3	0	0.0	0.0	0.0	0.0	78-06-05	80-09-02
39383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	7	1	0.0	0.2	0.5	2.2	75-02-20	80-09-02
39399	ETHION, TOTAL IN BOTTOM MATERIAL	3	0	0.0	0.0	0.0	0.0	78-06-05	80-09-02
39423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	7	0	0.0	0.0	0.0	0.2	75-02-20	80-09-02
39601	METHYL PARATHION, TOT. IN BOTTOM MATL.	3	0	0.0	0.0	0.0	0.0	78-06-05	80-09-02
39519	PCB, TOTAL IN BOTTOM MATERIAL	7	0	0	0	0	0	75-02-20	80-09-02
39761	SILVEX, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.0	0.0	75-03-10	79-08-20
39403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	7	0	0	0	0	0	75-02-20	80-09-02
39731	2,4-D, TOTAL IN BOTTOM MATERIAL	5	0	0	0	0	0	75-03-10	79-08-20

STATION 02253869   SITE 3: OUTFLOW FROM SOUTH LAKE

MAJOR CONSTITUENTS AND PROPERTIES

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
00080	COLOR (PLATINUMCOBALT UNITS)	25	0	0	10	27	80	68-10-24	81-03-15
00400	PH (UNITS)	29	0	4.2	5.0	5.0	5.8	68-10-24	80-09-02
00010	TEMPERATURE (DEG C)	39	0	14.0	26.0	25.1	32.0	68-10-24	80-09-02
00070	TURBIDITY (JTU)	20	0	1	8	9	31	69-07-16	77-10-05
00076	TURBIDITY (NTU)	9	0	0	2	3	6	78-08-28	81-03-15
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	32	0	67	133	137	190	68-10-24	81-03-15
00300	OXYGEN, DISSOLVED (MG/L)	23	0	2.3	7.0	6.8	10.0	68-10-24	80-09-02
00915	CALCIUM DISSOLVED (MG/L AS CA)	20	0	2.9	4.1	4.6	6.1	68-10-24	81-03-15
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	20	0	3.1	4.3	4.9	6.9	68-10-24	81-03-15
00930	SODIUM, DISSOLVED (MG/L AS NA)	18	0	7.6	9.2	9.2	11.0	68-10-24	81-03-15
00935	POTASSIUM, DISSOLVED (MG/L AS K)	18	0	1.8	2.7	3.1	5.0	68-10-24	81-03-15
00410	ALKALINITY (MG/L AS CACO3)	21	0	0	2	2	4	69-10-24	80-11-03
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	26	0	3.7	15.5	15.0	19.0	68-10-24	81-03-15
00945	SULFATE DISSOLVED (MG/L AS SO4)	26	0	13.0	27.5	28.5	44.0	68-10-24	81-03-15

NUTRIENTS, IN MILLIGRAMS PER LITER

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
00610	NITROGEN, AMMONIA TOTAL	22	0	0.00	0.02	0.02	0.13	71-11-23	81-03-15
00620	NITROGEN, NITRATE TOTAL	23	0	0.00	0.00	0.02	0.20	71-11-23	81-03-15
00615	NITROGEN, NITRITE TOTAL	21	0	0.00	0.01	0.01	0.05	71-11-23	81-03-15
00605	NITROGEN, ORGANIC TOTAL	34	0	0.05	0.29	0.45	5.00	68-10-24	81-03-15
00600	NITROGEN, TOTAL	16	0	0.08	0.29	0.33	0.81	74-08-07	81-03-15
00650	PHOSPHATE, TOTAL	10	0	0.00	0.04	0.04	0.09	68-10-24	75-09-03
00660	PHOSPHATE, ORTHO, DISSOLVED	13	0	0.00	0.03	0.03	0.06	69-10-24	72-02-09
70507	PHOSPHORUS, ORTHO, TOTAL	21	0	0.00	0.01	0.01	0.02	71-11-23	81-03-15
00665	PHOSPHORUS, TOTAL	21	0	0.00	0.02	0.02	0.05	71-11-23	81-03-15
00680	CARBON, ORGANIC TOTAL	24	0	0.0	3.0	4.6	20.0	70-09-01	81-03-15

METALS, IN MICROGRAMS PER LITER

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
01105	ALUMINUM, TOTAL RECOVERABLE	2	0	10	55	55	100	80-05-12	80-09-02
01000	ARSENIC DISSOLVED	9	0	0	10	10	30	70-08-27	77-10-05
01002	ARSENIC TOTAL	4	0	0	1	1	1	72-05-08	80-09-02
01012	BERYLLIUM, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01027	CADMIUM TOTAL RECOVERABLE	3	1	0	0	7	20	75-09-03	80-09-02
01032	CHROMIUM, HEXAVALENT, DIS.	9	0	0	0	0	1	71-03-01	77-10-05
01034	CHROMIUM, TOTAL RECOVERABLE	3	0	0	20	13	20	70-08-27	80-09-02
01040	COPPER, DISSOLVED	11	0	0	3	8	40	70-08-27	77-10-05
01042	COPPER, TOTAL RECOVERABLE	3	0	0	1	2	4	75-08-05	80-09-02
01046	IRON, DISSOLVED	13	0	20	50	47	70	68-10-24	77-10-05
01045	IRON, TOTAL RECOVERABLE	3	0	60	120	117	170	75-08-05	80-09-02
01049	LEAD, DISSOLVED	11	0	0	0	1	5	70-08-27	77-10-05
01051	LEAD, TOTAL RECOVERABLE	2	0	1	3	3	4	80-05-12	80-09-02
71890	MERCURY DISSOLVED	1	0	0.1	0.1	0.1	0.1	70-08-27	70-08-27
71900	MERCURY TOTAL RECOVERABLE	2	1	0.1	0.2	0.2	0.2	80-05-12	80-09-02
01067	NICKEL, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01147	SELENIUM, TOTAL	2	0	0	0	0	0	80-05-12	80-09-02
01077	SILVER, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01090	ZINC, DISSOLVED	11	0	10	20	25	50	70-08-27	77-10-05
01092	ZINC, TOTAL RECOVERABLE	3	0	10	20	20	30	75-08-05	80-09-02

ORGANICS IN WATER, IN MICROGRAMS PER LITER

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
39350	CHLORDANE, TOTAL	7	0	0.0	0.0	0.0	0.0	72-02-09	80-09-02
39360	DDD, TOTAL	11	0	0.00	0.00	0.00	0.00	70-09-01	80-09-02
39365	DDE, TOTAL	11	0	0.00	0.00	0.00	0.00	70-09-01	80-09-02
39370	DDT, TOTAL	11	0	0.00	0.00	0.00	0.02	70-09-01	80-09-02
39570	DIAZINON, TOTAL	7	0	0.00	0.00	0.00	0.00	71-03-01	80-09-02
39380	DIELDRIN TOTAL	11	0	0.00	0.00	0.00	0.00	70-09-01	80-09-02
39398	ETHION, TOTAL	7	0	0.00	0.00	0.00	0.00	71-03-01	80-09-02
39340	LINDANE TOTAL	11	0	0.00	0.00	0.00	0.00	70-09-01	80-09-02
39530	MALATHION, TOTAL	7	0	0.00	0.00	0.00	0.00	71-03-01	80-09-02
39540	PARATHION, TOTAL	7	0	0.00	0.00	0.00	0.00	71-03-01	80-09-02
39516	PCB, TOTAL	7	0	0.0	0.0	0.0	0.0	72-02-09	80-09-02
39760	SILVEX, TOTAL	7	0	0.00	0.00	0.00	0.02	71-11-23	80-09-02
39730	2,4-D, TOTAL	7	0	0.00	0.00	0.00	0.00	71-11-23	80-09-02

ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
39333	ALDRIN, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.0	0.0	0.0	70-09-01	80-09-02
39351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	7	0	0	0	1	3	72-02-09	80-09-02
39363	DDD, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.0	0.5	4.6	70-09-01	80-09-02
39368	DDE, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.0	0.4	2.4	70-09-01	80-09-02
39373	DDT, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.0	0.2	1.5	70-09-01	80-09-02
39571	DIAZINON, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.0	0.0	72-02-09	80-09-02
39383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	10	0	0.0	0.0	0.1	0.7	70-09-01	80-09-02
39399	ETHION, TOTAL IN BOTTOM MATERIAL	3	0	0.0	0.0	0.0	0.0	78-08-28	80-09-02
39423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	5	0	0.0	0.0	0.0	0.0	72-08-17	80-09-02
39601	METHYL PARATHION, TOT. IN BOTTOM MATL.	5	0	0.0	0.0	0.2	1.2	72-02-09	80-09-02
39519	PCB, TOTAL IN BOTTOM MATERIAL	7	0	0	0	0	2	72-02-09	80-09-02
39761	SILVEX, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.0	0.0	71-11-23	79-08-20
39403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	5	0	0	0	0	0	72-08-17	80-09-02
39731	2,4-D, TOTAL IN BOTTOM MATERIAL	5	0	0	0	0	0	71-11-23	79-08-20

STATION 02264000 SITE 4: CYPRESS CREEK

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
00080	COLOR (PLATINUMCOBALT UNITS)	27	0	140	400	371	550	63-07-24	80-05-12
00400	PH (UNITS)	25	0	2.8	4.4	4.5	7.3	63-07-24	80-05-12
00010	TEMPERATURE (DEG C)	35	0	0.0	22.0	20.2	28.0	65-05-20	80-05-12
00070	TURBIDITY (JTU)	14	0	1	2	5	36	69-07-14	77-10-05
00076	TURBIDITY (NTU)	7	0	0	1	1	2	78-08-28	80-05-12
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	26	0	58	95	117	300	63-07-24	80-05-12
00300	OXYGEN, DISSOLVED (MG/L)	16	0	2.9	4.8	4.9	9.7	67-05-08	80-05-12
00915	CALCIUM DISSOLVED (MG/L AS CA)	22	0	0.9	1.8	4.4	35.0	65-05-20	80-05-12
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	22	0	0.9	2.2	2.5	7.4	65-05-20	80-05-12
00930	SODIUM, DISSOLVED (MG/L AS NA)	21	0	2.6	6.9	7.1	13.0	63-07-24	80-05-12
00935	POTASSIUM, DISSOLVED (MG/L AS K)	21	0	0.0	0.2	0.5	3.8	63-07-24	80-05-12
00410	ALKALINITY (MG/L AS CACO3)	23	0	0	0	4	80	63-07-24	80-05-12
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	26	0	7.8	15.0	15.1	29.0	63-07-24	80-05-12
00945	SULFATE DISSOLVED (MG/L AS SO4)	26	0	0.0	4.7	10.0	45.0	63-07-24	80-05-12
	NUTRIENTS, IN MILLIGRAMS PER LITER								
00610	NITROGEN, AMMONIA TOTAL	15	0	0.01	0.05	0.08	0.50	71-11-22	80-05-12
00620	NITROGEN, NITRATE TOTAL	15	0	0.00	0.00	0.00	0.05	71-11-22	80-05-12
00615	NITROGEN, NITRITE TOTAL	15	0	0.01	0.02	0.03	0.07	71-11-22	80-05-12
00605	NITROGEN, ORGANIC TOTAL	25	0	0.32	1.20	1.35	4.50	68-10-24	80-05-12
00600	NITROGEN, TOTAL	11	0	0.86	1.87	1.75	2.36	74-08-07	80-05-12
00650	PHOSPHATE, TOTAL	10	0	0.02	0.04	0.14	0.95	67-05-08	70-12-02
00660	PHOSPHATE, ORTHO, DISSOLVED	14	0	0.01	0.06	0.12	0.95	63-07-24	72-02-09
70507	PHOSPHORUS, ORTHO, TOTAL	15	0	0.00	0.02	0.02	0.05	71-11-22	80-05-12
00665	PHOSPHORUS, TOTAL	15	0	0.00	0.02	0.03	0.08	71-11-22	80-05-12
00680	CARBON, ORGANIC TOTAL	20	0	33.0	60.5	64.3	110.0	70-05-20	80-05-12
	METALS, IN MICROGRAMS PER LITER								
01105	ALUMINUM, TOTAL RECOVERABLE	2	0	0	90	90	180	79-08-20	80-05-12
01000	ARSENIC DISSOLVED	10	0	0	5	9	30	70-08-27	77-10-05
01002	ARSENIC TOTAL	6	0	0	1	8	30	72-08-17	80-05-12
01012	BERYLLIUM, TOTAL RECOVERABLE	2	0	0	0	0	0	79-08-20	80-05-12
01027	CADMIUM TOTAL RECOVERABLE	3	0	0	0	0	1	78-08-28	80-05-12
01032	CHROMIUM, HEXAVALENT, DIS.	9	0	0	0	0	0	71-03-01	77-10-05
01034	CHROMIUM, TOTAL RECOVERABLE	5	2	0	10	5	10	70-08-27	80-05-12
01040	COPPER, DISSOLVED	11	0	0	0	5	50	70-08-27	77-10-05
01042	COPPER, TOTAL RECOVERABLE	3	0	0	1	1	1	78-08-28	80-05-12
01046	IRON, DISSOLVED	17	0	0	380	391	900	66-05-20	77-10-05
01045	IRON, TOTAL RECOVERABLE	4	0	0	600	625	1300	63-07-24	80-05-12
01049	LEAD, DISSOLVED	11	0	0	2	3	10	70-08-27	77-10-05
01051	LEAD, TOTAL RECOVERABLE	3	0	2	6	21	56	78-08-28	80-05-12
71890	MERCURY DISSOLVED	1	0	0.2	0.2	0.2	0.2	70-08-27	70-08-27
71900	MERCURY TOTAL RECOVERABLE	3	2	0.2	0.5	0.4	0.5	78-08-28	80-05-12
01067	NICKEL, TOTAL RECOVERABLE	3	0	0	0	2	7	78-08-28	80-05-12
01147	SELENIUM, TOTAL	2	0	0	0	0	0	79-08-20	80-05-12
01077	SILVER, TOTAL RECOVERABLE	3	0	0	0	0	1	78-08-28	80-05-12
01090	ZINC, DISSOLVED	11	0	10	30	37	80	70-08-27	77-10-05
01092	ZINC, TOTAL RECOVERABLE	3	0	10	10	13	20	78-08-28	80-05-12
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
39350	CHLORDANE, TOTAL	7	0	0.0	0.0	0.0	0.0	72-02-09	79-08-2
39360	DDD, TOTAL	10	0	0.00	0.00	0.00	0.00	70-08-27	79-08-2
39365	DDE, TOTAL	10	0	0.00	0.00	0.00	0.00	70-08-27	79-08-2
39370	DDT, TOTAL	10	0	0.00	0.00	0.00	0.00	70-08-27	79-08-2
39570	DIAZINON, TOTAL	6	0	0.00	0.00	0.00	0.00	71-05-03	79-08-2
39380	DIELDRIN TOTAL	10	0	0.00	0.00	0.00	0.00	70-08-27	79-08-2
39398	ETHION, TOTAL	6	0	0.00	0.00	0.00	0.00	71-05-03	79-08-2
39340	LINDANE TOTAL	10	0	0.00	0.00	0.00	0.00	70-08-27	79-08-2
39530	MALATHION, TOTAL	6	0	0.00	0.00	0.00	0.00	71-05-03	79-08-2
39540	PARATHION, TOTAL	6	0	0.00	0.00	0.00	0.00	71-05-03	79-08-2
39516	PCB, TOTAL	7	0	0.0	0.0	0.0	0.0	72-02-09	79-08-2
39760	SILVEX, TOTAL	4	0	0.00	0.00	0.00	0.00	71-11-22	79-08-2
39730	2,4-D, TOTAL	4	0	0.00	0.00	0.00	0.00	71-11-22	79-08-2
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
39333	ALDRIN, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.0	0.0	0.0	70-08-27	79-08-2
39351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	7	0	0	0	3	15	72-02-09	79-08-2
39363	DDD, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.4	1.1	5.0	70-08-27	79-08-2
39368	DDE, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.0	1.9	9.0	70-08-27	79-08-2
39373	DDT, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.0	0.2	1.1	70-08-27	79-08-2
39571	DIAZINON, TOTAL IN BOTTOM MATERIAL	4	0	0.0	0.0	0.0	0.0	72-02-09	79-08-2
39383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.1	0.1	0.4	70-08-27	79-08-2
39399	ETHION, TOTAL IN BOTTOM MATERIAL	2	0	0.0	0.0	0.0	0.0	78-08-28	79-08-2
39423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	5	0	0.0	0.0	0.0	0.0	72-08-17	79-08-2
39601	METHYL PARATHION, TOT. IN BOTTOM MATL.	4	0	0.0	0.0	0.5	2.1	72-02-09	79-08-2
39519	PCB, TOTAL IN BOTTOM MATERIAL	7	1	0	1	12	74	72-02-09	79-08-2
39761	SILVEX, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.0	0.0	71-11-22	79-08-2
39403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	5	0	0	0	0	0	72-08-17	79-08-2
39731	2,4-D, TOTAL IN BOTTOM MATERIAL	5	0	0	0	0	0	71-11-22	79-08-2

STATION 02254100 SITE 5: BONNET CREEK

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
00080	COLOR (PLATINUMCOBALT UNITS)	37	0	10	140	153	400	63-07-24	81-03-15
00400	PH (UNITS)	40	0	4.5	6.4	6.4	7.6	61-05-23	80-09-02
00010	TEMPERATURE (DEG C)	56	0	14.0	24.0	23.4	30.0	61-05-23	80-09-02
00070	TURBIDITY (JTU)	30	0	1	14	35	180	69-07-15	77-10-05
00076	TURBIDITY (NTU)	11	0	1	2	3	6	78-06-05	81-03-15
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	43	0	62	127	125	190	61-05-23	81-03-15
00300	OXYGEN, DISSOLVED (MG/L)	30	0	0.7	4.9	5.0	11.2	67-05-08	80-09-02
00915	CALCIUM DISSOLVED (MG/L AS CA)	32	0	4.0	11.0	11.8	21.0	63-07-24	81-03-15
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	32	0	1.7	3.8	3.7	5.1	63-07-24	81-03-15
00930	SODIUM, DISSOLVED (MG/L AS NA)	32	0	1.5	6.4	6.3	9.0	63-07-24	81-03-15
00935	POTASSIUM, DISSOLVED (MG/L AS K)	32	0	0.1	1.2	1.3	2.1	63-07-24	81-03-15
00410	ALKALINITY (MG/L AS CACO3)	34	0	0	25	27	73	61-05-23	80-09-02
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	39	0	1.0	12.0	11.0	17.0	63-07-24	81-03-15
00945	SULFATE DISSOLVED (MG/L AS SO4)	39	0	0.0	15.0	13.5	21.0	63-07-24	81-03-15
	NUTRIENTS, IN MILLIGRAMS PER LITER								
00610	NITROGEN, AMMONIA TOTAL	35	0	0.00	0.04	0.05	0.20	71-11-22	81-03-15
00620	NITROGEN, NITRATE TOTAL	37	0	0.00	0.01	0.07	0.70	71-11-22	81-03-15
00615	NITROGEN, NITRITE TOTAL	33	0	0.00	0.01	0.02	0.07	71-11-22	81-03-15
00605	NITROGEN, ORGANIC TOTAL	42	0	0.02	0.59	0.69	2.00	68-10-23	81-03-15
00600	NITROGEN, TOTAL	25	0	0.27	0.62	0.78	1.64	73-11-07	81-03-15
00650	PHOSPHATE, TOTAL	11	1	0.01	0.05	0.08	0.26	67-05-08	75-08-05
00660	PHOSPHATE, ORTHO, DISSOLVED	10	0	0.02	0.04	0.09	0.26	66-05-20	72-02-08
70507	PHOSPHORUS, ORTHO, TOTAL	33	0	0.01	0.04	0.04	0.10	71-11-22	81-03-15
00665	PHOSPHORUS, TOTAL	33	0	0.02	0.06	0.05	0.12	71-11-22	81-03-15
00680	CARBON, ORGANIC TOTAL	35	0	3.0	19.0	19.8	52.0	70-05-20	81-03-15
	METALS, IN MICROGRAMS PER LITER								
01105	ALUMINUM, TOTAL RECOVERABLE	3	0	130	300	443	900	68-04-09	80-09-02
01000	ARSENIC DISSOLVED	11	0	0	2	5	30	71-08-18	77-10-05
01002	ARSENIC TOTAL	8	0	1	3	5	20	72-05-08	80-09-02
01012	BERYLLIUM, TOTAL RECOVERABLE	2	0	0	5	5	10	80-05-12	80-09-02
01027	CADMIUM TOTAL RECOVERABLE	5	0	0	0	2	7	78-06-05	80-09-02
01032	CHROMIUM, HEXAVALENT, DIS.	13	0	0	0	1	8	71-08-18	77-10-05
01034	CHROMIUM, TOTAL RECOVERABLE	7	1	0	10	11	20	68-04-09	80-09-02
01040	COPPER, DISSOLVED	14	0	0	3	8	40	68-04-09	77-10-05
01042	COPPER, TOTAL RECOVERABLE	7	0	1	3	4	10	75-08-05	80-09-02
01046	IRON, DISSOLVED	20	0	10	245	241	600	65-05-20	77-10-05
01045	IRON, TOTAL RECOVERABLE	9	0	240	410	536	1200	63-07-24	80-09-02
01049	LEAD, DISSOLVED	13	0	0	2	4	20	71-08-18	77-10-05
01051	LEAD, TOTAL RECOVERABLE	5	0	0	1	35	170	78-06-05	80-09-02
71900	MERCURY TOTAL RECOVERABLE	6	3	0.2	0.5	0.4	0.5	78-06-05	80-09-02
01067	NICKEL, TOTAL RECOVERABLE	6	0	0	5	5	17	78-06-05	80-09-02
01147	SELENIUM, TOTAL	3	0	0	0	0	0	78-11-27	80-09-02
01077	SILVER, TOTAL RECOVERABLE	5	0	0	0	0	0	78-06-05	80-09-02
01090	ZINC, DISSOLVED	14	0	0	10	21	80	68-04-09	77-10-05
01092	ZINC, TOTAL RECOVERABLE	7	0	10	20	20	40	75-08-05	80-09-02
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
39350	CHLORDANE, TOTAL	11	0	0.0	0.0	0.0	0.0	72-08-16	80-09-02
39360	DDD, TOTAL	11	0	0.00	0.00	0.00	0.00	72-08-16	80-09-02
39365	DDE, TOTAL	11	0	0.00	0.00	0.00	0.00	72-08-16	80-09-02
39370	DDT, TOTAL	11	0	0.00	0.00	0.00	0.00	72-08-16	80-09-02
39570	DIAZINON, TOTAL	5	0	0.00	0.00	0.00	0.00	72-08-16	80-09-02
39380	DIELDRIN TOTAL	11	0	0.00	0.00	0.00	0.00	72-08-16	80-09-02
39398	ETHION, TOTAL	4	0	0.00	0.00	0.00	0.00	72-08-16	80-09-02
39340	LINDANE TOTAL	11	0	0.00	0.00	0.00	0.00	72-08-16	80-09-02
39530	MALATHION, TOTAL	5	0	0.00	0.00	0.04	0.14	72-08-16	80-09-02
39540	PARATHION, TOTAL	5	0	0.00	0.00	0.00	0.00	72-08-16	80-09-02
39516	PCB, TOTAL	12	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39760	SILVEX, TOTAL	12	0	0.00	0.00	0.13	1.50	71-11-22	80-09-02
39730	2,4-D, TOTAL	12	0	0.00	0.00	0.04	0.27	71-11-22	80-09-02
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
39333	ALDRIN, TOTAL IN BOTTOM MATERIAL	12	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	12	0	0	0	4	44	72-02-08	80-09-02
39363	DDD, TOTAL IN BOTTOM MATERIAL	12	0	0.0	0.0	0.5	2.3	72-02-08	80-09-02
39368	DDE, TOTAL IN BOTTOM MATERIAL	12	0	0.0	0.0	0.2	0.9	72-02-08	80-09-02
39373	DDT, TOTAL IN BOTTOM MATERIAL	12	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39571	DIAZINON, TOTAL IN BOTTOM MATERIAL	4	0	0.0	0.0	0.3	1.1	72-02-08	80-09-02
39383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	12	0	0.0	0.0	0.1	0.4	72-02-08	80-09-02
39399	ETHION, TOTAL IN BOTTOM MATERIAL	2	0	0.0	0.0	0.0	0.0	79-06-04	80-09-02
39423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	11	0	0.0	0.0	0.0	0.0	72-08-16	80-09-02
39601	METHYL PARATHION, TOT. IN BOTTOM MATL.	4	0	0.0	0.0	1.2	4.8	72-02-08	80-09-02
39519	PCB, TOTAL IN BOTTOM MATERIAL	12	0	0	0	2	12	72-02-08	80-09-02
39761	SILVEX, TOTAL IN BOTTOM MATERIAL	13	0	0.0	0.0	1.2	15.0	71-11-22	79-08-21
39403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	11	0	0	0	0	0	72-08-16	80-09-02
39731	2,4-D, TOTAL IN BOTTOM MATERIAL	13	0	0	0	1	18	71-11-22	79-08-21

STATION 02256291 SITE 6: CANAL UPSTREAM FROM STRUCTURE S-405A

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
00080	COLOR (PLATINUMCOBALT UNITS)	18	0	60	400	491	1000	69-04-30	81-03-15
00400	PH (UNITS)	23	0	3.5	4.2	4.4	7.0	69-04-30	80-09-02
00010	TEMPERATURE (DEG C)	23	0	11.5	23.0	21.9	29.0	69-11-24	81-03-15
00070	TURBIDITY (JTU)	17	0	0	3	9	110	70-12-02	77-10-05
00076	TURBIDITY (NTU)	10	0	0	1	2	7	78-06-05	81-03-15
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	27	0	90	140	147	210	69-04-30	81-03-15
00300	OXYGEN, DISSOLVED (MG/L)	21	0	1.2	4.5	4.5	9.2	70-05-26	81-03-15
00915	CALCIUM DISSOLVED (MG/L AS CA)	16	0	3.1	3.9	4.3	9.0	69-04-30	81-03-15
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	15	0	2.3	3.9	4.0	5.4	69-04-30	81-03-15
00930	SODIUM, DISSOLVED (MG/L AS NA)	15	0	5.7	11.0	10.8	14.0	69-04-30	81-03-15
00935	POTASSIUM, DISSOLVED (MG/L AS K)	15	0	0.8	2.3	2.4	4.5	69-04-30	81-03-15
00410	ALKALINITY (MG/L AS CACO3)	12	0	0	0	2	18	69-04-30	80-09-02
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	15	0	2.6	20.5	21.5	37.0	69-04-30	81-03-15
00945	SULFATE DISSOLVED (MG/L AS SO4)	16	0	0.7	20.0	19.2	30.0	69-04-30	81-03-15
	NUTRIENTS, IN MILLIGRAMS PER LITER								
00610	NITROGEN, AMMONIA TOTAL	23	0	0.00	0.06	0.76	6.20	72-08-17	81-03-15
00620	NITROGEN, NITRATE TOTAL	25	0	0.00	0.00	0.09	0.79	72-08-17	81-03-15
00615	NITROGEN, NITRITE TOTAL	23	0	0.01	0.02	0.03	0.07	72-08-17	81-03-15
00605	NITROGEN, ORGANIC TOTAL	26	0	0.50	1.35	2.19	9.60	70-05-26	81-03-15
00600	NITROGEN, TOTAL	19	0	0.67	1.96	3.50	15.80	74-02-20	81-03-15
00650	PHOSPHATE, TOTAL	3	0	0.02	0.11	0.12	0.22	69-04-30	75-03-13
00660	PHOSPHATE, ORTHO, DISSOLVED	4	0	0.04	0.12	0.12	0.20	69-04-30	71-05-03
70507	PHOSPHORUS, ORTHO, TOTAL	23	0	0.01	0.03	0.05	0.14	72-08-17	81-03-15
00665	PHOSPHORUS, TOTAL	23	0	0.02	0.04	0.05	0.21	72-08-17	81-03-15
00680	CARBON, ORGANIC TOTAL	25	0	21.0	48.0	67.5	220.0	70-05-20	81-03-15
	METALS, IN MICROGRAMS PER LITER								
01105	ALUMINUM, TOTAL RECOVERABLE	2	0	100	500	500	900	80-05-12	80-09-02
01000	ARSENIC DISSOLVED	7	0	0	13	15	40	70-12-02	77-10-05
01002	ARSENIC TOTAL	3	0	0	2	7	20	72-08-17	80-09-02
01012	BERYLLIUM, TOTAL RECOVERABLE	2	0	0	5	5	10	80-05-12	80-09-02
01027	CADMIUM TOTAL RECOVERABLE	2	0	0	1	1	2	80-05-12	80-09-02
01032	CHROMIUM, HEXAVALENT, DIS.	7	0	0	0	1	8	72-08-17	77-10-05
01034	CHROMIUM, TOTAL RECOVERABLE	3	0	0	10	10	20	70-12-02	80-09-02
01040	COPPER, DISSOLVED	8	0	0	10	7	14	70-12-02	77-10-05
01042	COPPER, TOTAL RECOVERABLE	2	0	3	6	6	8	80-05-12	80-09-02
01046	IRON, DISSOLVED	10	0	120	445	545	1300	69-04-30	77-10-05
01045	IRON, TOTAL RECOVERABLE	2	0	880	990	990	1100	80-05-12	80-09-02
01049	LEAD, DISSOLVED	8	0	0	5	5	14	70-12-02	77-10-05
01051	LEAD, TOTAL RECOVERABLE	2	0	4	9	9	14	80-05-12	80-09-02
71900	MERCURY TOTAL RECOVERABLE	2	0	0.2	0.3	0.3	0.3	80-05-12	80-09-02
01067	NICKEL, TOTAL RECOVERABLE	2	0	1	2	2	3	80-05-12	80-09-02
01147	SELENIUM, TOTAL	2	0	0	0	0	0	80-05-12	80-09-02
01077	SILVER, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01090	ZINC, DISSOLVED	8	0	10	45	55	120	70-12-02	77-10-05
01092	ZINC, TOTAL RECOVERABLE	2	0	30	180	180	330	80-05-12	80-09-02
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
39350	CHLORDANE, TOTAL	8	0	0.0	0.0	0.0	0.0	72-08-17	80-09-02
39360	DDD, TOTAL	8	0	0.00	0.00	0.00	0.00	72-08-17	80-09-02
39365	DDE, TOTAL	8	0	0.00	0.00	0.00	0.00	72-08-17	80-09-02
39370	DDT, TOTAL	8	0	0.00	0.00	0.00	0.00	72-08-17	80-09-02
39570	DIAZINON, TOTAL	6	0	0.00	0.00	0.00	0.00	72-08-17	80-09-02
39380	DIELDRIN TOTAL	8	0	0.00	0.00	0.00	0.00	72-08-17	80-09-02
39398	ETHION, TOTAL	5	0	0.00	0.00	0.00	0.00	72-08-17	80-09-02
39340	LINDANE TOTAL	8	0	0.00	0.00	0.00	0.00	72-08-17	80-09-02
39530	MALATHION, TOTAL	6	0	0.00	0.02	0.31	1.30	72-08-17	80-09-02
39540	PARATHION, TOTAL	5	0	0.00	0.00	0.00	0.00	72-08-17	80-09-02
39516	PCB, TOTAL	8	0	0.0	0.0	0.0	0.0	72-08-17	80-09-02
39760	SILVEX, TOTAL	9	0	0.00	0.00	0.00	0.01	72-11-16	80-09-02
39730	2,4-D, TOTAL	9	0	0.00	0.00	0.01	0.13	72-11-16	80-09-02
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
39333	ALDRIN, TOTAL IN BOTTOM MATERIAL	9	0	0.0	0.0	0.0	0.0	72-08-17	80-09-02
39351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	8	0	0	1	3	15	72-08-17	80-09-02
39363	DDD, TOTAL IN BOTTOM MATERIAL	9	0	0.0	0.0	0.0	0.0	72-08-17	80-09-02
39368	DDE, TOTAL IN BOTTOM MATERIAL	9	0	0.0	0.0	0.0	0.0	72-08-17	80-09-02
39373	DDT, TOTAL IN BOTTOM MATERIAL	9	0	0.0	0.0	0.1	0.9	72-08-17	80-09-02
39571	DIAZINON, TOTAL IN BOTTOM MATERIAL	4	0	0.0	0.0	0.0	0.0	72-08-17	80-09-02
39383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	9	0	0.0	0.0	0.1	0.4	72-08-17	80-09-02
39399	ETHION, TOTAL IN BOTTOM MATERIAL	3	0	0.0	0.0	0.0	0.0	79-06-16	80-09-02
39423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	9	0	0.0	0.0	0.0	0.0	72-08-17	80-09-02
39601	METHYL PARATHION, TOT. IN BOTTOM MATL.	4	0	0.0	0.0	0.9	3.8	72-08-17	80-09-02
39519	PCB, TOTAL IN BOTTOM MATERIAL	9	0	0	0	22	110	72-08-17	80-09-02
39761	SILVEX, TOTAL IN BOTTOM MATERIAL	8	0	0.0	0.0	0.0	0.0	72-11-16	79-08-20
39403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	9	0	0	0	5	50	72-08-17	80-09-02
39731	2,4-D, TOTAL IN BOTTOM MATERIAL	8	0	0	0	0	1	72-11-15	79-08-20

TATION 02256294 SITE 7: CANAL DOWNSTREAM FROM STRUCTURE S-405

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
0080	COLOR (PLATINUMCOBALT UNITS)	11	0	70	140	173	440	71-08-19	81-03-15
0400	PH (UNITS)	20	0	5.2	6.4	6.4	7.2	71-08-19	81-03-15
0010	TEMPERATURE (DEG C)	21	0	13.5	24.0	23.4	30.0	71-08-19	81-03-15
0070	TURBIDITY (JTU)	20	0	1	5	9	40	71-08-19	77-10-05
0076	TURBIDITY (NTU)	7	0	1	2	2	3	79-06-04	81-03-15
0095	SPECIFIC CONDUCTANCE (MICROMHOS)	23	0	141	168	169	200	71-08-19	81-03-15
0300	OXYGEN, DISSOLVED (MG/L)	20	0	1.0	3.6	3.6	7.3	71-08-19	80-09-02
0915	CALCIUM DISSOLVED (MG/L AS CA)	11	0	15.0	18.0	17.7	21.0	71-08-19	81-03-15
0925	MAGNESIUM, DISSOLVED (MG/L AS MG)	11	0	3.9	4.7	4.6	5.0	71-08-19	81-03-15
0930	SODIUM, DISSOLVED (MG/L AS NA)	11	0	5.2	7.6	8.1	10.0	71-08-19	81-03-15
0935	POTASSIUM, DISSOLVED (MG/L AS K)	11	0	1.3	2.2	2.1	2.6	71-08-19	81-03-15
0410	ALKALINITY (MG/L AS CACO3)	15	0	19	45	43	83	71-08-19	80-09-02
0940	CHLORIDE, DISSOLVED (MG/L AS CL)	17	0	0.6	14.0	12.5	24.0	71-08-19	81-03-15
0945	SULFATE DISSOLVED (MG/L AS SO4)	17	0	5.5	15.0	14.4	20.0	71-08-19	81-03-15
	NUTRIENTS, IN MILLIGRAMS PER LITER								
0610	NITROGEN, AMMONIA TOTAL	23	0	0.04	0.12	0.12	0.27	71-11-23	81-03-15
0620	NITROGEN, NITRATE TOTAL	25	0	0.00	0.02	0.09	0.87	71-11-23	81-03-15
0615	NITROGEN, NITRITE TOTAL	20	0	0.01	0.01	0.02	0.04	71-11-23	81-03-15
0605	NITROGEN, ORGANIC TOTAL	25	0	0.08	1.09	1.10	2.90	71-08-19	81-03-15
0600	NITROGEN, TOTAL	17	0	0.57	1.32	1.39	2.63	75-03-18	81-03-15
0650	PHOSPHATE, TOTAL	5	1	0.01	0.09	0.22	0.85	75-03-17	75-09-02
0660	PHOSPHATE, ORTHO, DISSOLVED	4	0	0.03	0.11	0.11	0.18	71-08-19	75-01-21
0507	PHOSPHORUS, ORTHO, TOTAL	20	0	0.02	0.04	0.04	0.10	71-11-23	81-03-15
0665	PHOSPHORUS, TOTAL	20	0	0.03	0.08	0.09	0.16	71-11-23	81-03-15
0680	CARBON, ORGANIC TOTAL	22	0	5.0	24.5	23.5	62.0	71-08-19	81-03-15
	METALS, IN MICROGRAMS PER LITER								
105	ALUMINUM, TOTAL RECOVERABLE	2	0	120	160	160	200	80-05-12	80-09-02
000	ARSENIC DISSOLVED	4	0	0	3	4	10	71-08-19	77-10-05
002	ARSENIC TOTAL	3	0	7	8	12	20	72-05-08	80-09-02
012	BERYLLIUM, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
027	CADMIUM TOTAL RECOVERABLE	3	1	0	0	7	20	75-09-02	80-09-02
032	CHROMIUM, HEXAVALENT, DIS.	5	0	0	0	0	0	71-08-19	77-10-05
034	CHROMIUM, TOTAL RECOVERABLE	2	0	10	15	15	20	80-05-12	80-09-02
040	COPPER, DISSOLVED	5	0	0	20	19	40	71-08-19	77-10-05
042	COPPER, TOTAL RECOVERABLE	4	0	3	10	8	10	75-08-05	80-09-02
046	IRON, DISSOLVED	5	0	100	150	152	230	71-08-19	77-10-05
045	IRON, TOTAL RECOVERABLE	5	1	50	130	216	480	75-04-14	80-09-02
049	LEAD, DISSOLVED	5	0	0	1	2	5	71-08-19	77-10-05
051	LEAD, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
900	MERCURY TOTAL RECOVERABLE	2	0	0.1	0.2	0.2	0.3	80-05-12	80-09-02
067	NICKEL, TOTAL RECOVERABLE	2	0	0	1	1	1	80-05-12	80-09-02
147	SELENIUM, TOTAL	2	0	0	0	0	0	80-05-12	80-09-02
077	SILVER, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
090	ZINC, DISSOLVED	5	0	0	10	15	40	71-08-19	77-10-05
092	ZINC, TOTAL RECOVERABLE	3	0	10	10	13	20	75-08-05	80-09-02
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
350	CHLORDANE, TOTAL	7	0	0.0	0.0	0.0	0.1	72-02-09	80-09-02
360	DDD, TOTAL	7	0	0.00	0.00	0.00	0.00	72-02-09	80-09-02
365	DDE, TOTAL	7	0	0.00	0.00	0.00	0.00	72-02-09	80-09-02
370	DDT, TOTAL	7	0	0.00	0.00	0.00	0.00	72-02-09	80-09-02
570	DIAZINON, TOTAL	3	0	0.00	0.00	0.00	0.01	72-02-09	80-09-02
380	DIELDRIN TOTAL	7	2	0.00	0.00	0.00	0.01	72-02-09	80-09-02
398	ETHION, TOTAL	3	0	0.00	0.00	0.00	0.00	72-02-09	80-09-02
340	LINDANE TOTAL	7	0	0.00	0.00	0.00	0.02	72-02-09	80-09-02
530	MALATHION, TOTAL	3	0	0.05	0.07	0.15	0.34	72-02-09	80-09-02
540	PARATHION, TOTAL	3	0	0.00	0.00	0.00	0.00	72-02-09	80-09-02
516	PCB, TOTAL	7	0	0.0	0.0	0.0	0.1	72-02-09	80-09-02
760	SILVEX, TOTAL	9	0	0.00	0.01	0.20	1.40	71-11-23	80-09-02
730	2,4-D, TOTAL	9	0	0.00	0.02	0.05	0.17	71-11-23	80-09-02
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
333	ALDRIN, TOTAL IN BOTTOM MATERIAL	6	0	0.0	0.0	0.0	0.0	72-02-09	80-09-02
351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	6	0	0	2	2	5	72-02-09	80-09-02
363	DDD, TOTAL IN BOTTOM MATERIAL	6	1	0.0	0.0	0.0	0.0	72-02-09	80-09-02
368	DDE, TOTAL IN BOTTOM MATERIAL	6	0	0.0	0.0	0.0	0.2	72-02-09	80-09-02
373	DDT, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.0	0.1	72-02-09	80-09-02
571	DIAZINON, TOTAL IN BOTTOM MATERIAL	3	0	0.0	0.0	0.0	0.0	72-02-09	80-09-02
383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.2	0.8	3.2	72-02-09	80-09-02
399	ETHION, TOTAL IN BOTTOM MATERIAL	2	0	0.0	0.0	0.0	0.0	79-06-04	80-09-02
423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	5	0	0.0	0.0	0.0	0.0	75-05-23	80-09-02
601	METHYL PARATHION, TOT. IN BOTTOM MATL.	3	0	0.0	0.0	0.0	0.0	72-02-09	80-09-02
519	PCB, TOTAL IN BOTTOM MATERIAL	6	0	0	0	0	0	72-02-09	80-09-02
761	SILVEX, TOTAL IN BOTTOM MATERIAL	7	0	0.0	0.0	0.0	0.0	71-11-23	79-08-20
403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	5	0	0	0	0	0	75-05-23	80-09-02
731	2,4-D, TOTAL IN BOTTOM MATERIAL	5	0	0	0	0	0	71-11-23	79-08-20

STATION 02266200 SITE 8: WHITTENHORSE CREEK

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
00080	COLOR (PLATINUMCOBALT UNITS)	23	0	90	320	333	700	65-05-20	80-05-12
00400	PH (UNITS) *	22	0	3.5	4.6	4.7	5.5	65-05-20	80-05-12
00010	TEMPERATURE (DEG C)	30	0	10.5	24.0	22.4	29.0	65-05-20	80-05-12
00070	TURBIDITY (JTU)	12	0	1	2	5	28	69-07-16	77-10-05
00076	TURBIDITY (NTU)	5	0	1	2	2	3	78-08-29	80-05-12
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	23	0	58	85	99	309	65-05-20	80-05-12
00300	OXYGEN, DISSOLVED (MG/L)	13	0	0.2	3.5	4.0	9.3	67-05-08	80-05-12
00915	CALCIUM DISSOLVED (MG/L AS CA)	18	0	2.6	4.5	4.9	9.8	65-05-20	80-05-12
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	14	0	1.3	2.0	2.0	3.5	66-05-20	80-05-12
00930	SODIUM, DISSOLVED (MG/L AS NA)	15	0	5.5	7.3	7.5	12.0	66-05-20	80-05-12
00935	POTASSIUM, DISSOLVED (MG/L AS K)	15	0	0.2	0.6	1.9	9.7	65-05-20	80-05-12
00410	ALKALINITY (MG/L AS CACO3)	18	0	0	0	8	98	65-05-20	80-05-12
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	21	0	9.7	17.0	16.0	24.0	65-05-20	80-05-12
00945	SULFATE DISSOLVED (MG/L AS SO4)	20	0	0.0	1.5	4.3	22.0	65-05-20	80-05-12
	NUTRIENTS, IN MILLIGRAMS PER LITER								
00610	NITROGEN, AMMONIA TOTAL	12	0	0.03	0.06	0.21	0.97	72-02-08	80-05-12
00620	NITROGEN, NITRATE TOTAL	12	0	0.00	0.00	0.00	0.03	72-02-08	80-05-12
00615	NITROGEN, NITRITE TOTAL	12	0	0.01	0.02	0.02	0.04	72-02-08	80-05-12
00605	NITROGEN, ORGANIC TOTAL	22	0	0.26	1.35	1.35	2.40	68-10-23	80-05-12
00600	NITROGEN, TOTAL	10	0	1.36	2.09	2.10	3.41	73-11-07	80-05-12
00650	PHOSPHATE, TOTAL	12	0	0.02	0.07	0.41	3.60	65-05-20	70-12-02
00660	PHOSPHATE, ORTHO, DISSOLVED	12	0	0.01	0.05	0.38	3.60	66-05-20	72-02-08
70507	PHOSPHORUS, ORTHO, TOTAL	12	0	0.01	0.02	0.02	0.04	72-02-08	80-05-12
00665	PHOSPHORUS, TOTAL	12	0	0.01	0.03	0.03	0.05	72-02-08	80-05-12
00680	CARBON, ORGANIC TOTAL	17	0	20.0	53.0	57.9	120.0	70-05-20	80-05-12
	METALS, IN MICROGRAMS PER LITER								
01105	ALUMINUM, TOTAL RECOVERABLE	1	0	90	90	90	90	80-05-12	80-05-12
01000	ARSENIC DISSOLVED	7	0	0	10	17	50	70-08-31	77-10-05
01002	ARSENIC TOTAL	2	0	1	15	15	30	72-08-16	80-05-12
01012	BERYLLIUM, TOTAL RECOVERABLE	1	0	0	0	0	0	80-05-12	80-05-12
01027	CADMIUM TOTAL RECOVERABLE	1	0	0	0	0	0	80-05-12	80-05-12
01032	CHROMIUM, HEXAVALENT, DIS.	5	0	0	0	2	9	71-03-01	77-10-05
01034	CHROMIUM, TOTAL RECOVERABLE	3	0	0	10	7	10	70-08-31	80-05-12
01040	COPPER, DISSOLVED	8	0	0	5	9	40	70-08-31	77-10-05
01042	COPPER, TOTAL RECOVERABLE	1	0	5	5	5	5	80-05-12	80-05-12
01046	IRON, DISSOLVED	14	0	0	395	431	1100	66-05-20	77-10-05
01045	IRON, TOTAL RECOVERABLE	1	0	470	470	470	470	80-05-12	80-05-12
01049	LEAD, DISSOLVED	8	0	0	3	5	20	70-08-31	77-10-05
01051	LEAD, TOTAL RECOVERABLE	1	0	1	1	1	1	80-05-12	80-05-12
71890	MERCURY DISSOLVED	1	0	0.9	0.9	0.9	0.9	70-08-31	70-08-31
71900	MERCURY TOTAL RECOVERABLE	1	0	0.2	0.2	0.2	0.2	80-05-12	80-05-12
01067	NICKEL, TOTAL RECOVERABLE	1	0	0	0	0	0	80-05-12	80-05-12
01147	SELENIUM, TOTAL	1	0	0	0	0	0	80-05-12	80-05-12
01077	SILVER, TOTAL RECOVERABLE	1	0	0	0	0	0	80-05-12	80-05-12
01090	ZINC, DISSOLVED	8	0	20	50	61	130	70-08-31	77-10-05
01092	ZINC, TOTAL RECOVERABLE	1	0	20	20	20	20	80-05-12	80-05-12
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
39350	CHLORDANE, TOTAL	4	0	0.0	0.0	0.0	0.0	72-02-08	79-08-21
39360	DDD, TOTAL	9	0	0.00	0.00	0.00	0.01	70-08-31	79-08-21
39365	DDE, TOTAL	8	0	0.00	0.00	0.00	0.00	70-08-31	79-08-21
39370	DDT, TOTAL	9	0	0.00	0.00	0.00	0.01	70-08-31	79-08-21
39570	DIAZINON, TOTAL	5	0	0.00	0.00	0.00	0.00	71-03-01	79-08-21
39380	DIELDRIN TOTAL	8	0	0.00	0.00	0.00	0.00	70-08-31	79-08-21
39398	ETHION, TOTAL	5	0	0.00	0.00	0.01	0.07	71-03-01	79-08-21
39340	LINDANE TOTAL	8	0	0.00	0.00	0.00	0.00	70-08-31	79-08-21
39530	MALATHION, TOTAL	5	0	0.00	0.00	0.00	0.00	71-03-01	79-08-21
39540	PARATHION, TOTAL	5	0	0.00	0.00	0.00	0.00	71-03-01	79-08-21
39516	PCB, TOTAL	4	0	0.0	0.0	0.0	0.0	72-02-08	79-08-21
39760	SILVEX, TOTAL	3	0	0.00	0.00	0.00	0.00	73-11-07	79-08-21
39730	2,4-D, TOTAL	3	0	0.00	0.00	0.00	0.00	73-11-07	79-08-21
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
39333	ALDRIN, TOTAL IN BOTTOM MATERIAL	8	0	0.0	0.0	0.2	1.3	70-08-31	79-08-21
39351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	4	0	0	0	0	0	72-02-08	79-08-21
39363	DDD, TOTAL IN BOTTOM MATERIAL	9	0	0.0	0.4	0.9	3.4	70-08-31	79-08-21
39368	DDE, TOTAL IN BOTTOM MATERIAL	8	0	0.0	1.2	1.9	5.4	70-08-31	79-08-21
39373	DDT, TOTAL IN BOTTOM MATERIAL	8	0	0.0	0.0	0.2	1.0	70-08-31	79-08-21
39571	DIAZINON, TOTAL IN BOTTOM MATERIAL	3	0	0.0	0.0	0.0	0.0	72-02-08	79-08-21
39383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	8	0	0.0	0.2	0.5	2.2	70-08-31	79-08-21
39399	ETHION, TOTAL IN BOTTOM MATERIAL	1	0	0.0	0.0	0.0	0.0	79-08-21	79-08-21
39423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	3	0	0.0	0.0	0.0	0.0	72-08-16	79-08-21
39601	METHYL PARATHION, TOT. IN BOTTOM MATL.	3	0	0.0	0.0	0.0	0.0	72-02-08	79-08-21
39519	PCB, TOTAL IN BOTTOM MATERIAL	4	0	0	0	0	0	72-02-08	79-08-21
39761	SILVEX, TOTAL IN BOTTOM MATERIAL	4	0	0.0	0.0	0.0	0.0	73-11-07	79-08-21
39403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	3	0	0	0	0	0	72-08-16	79-08-21
39731	2,4-D, TOTAL IN BOTTOM MATERIAL	4	0	0	0	0	0	73-11-07	79-08-21

STATION 02256295 SITE 9: CANAL UPSTREAM FROM STRUCTURE S-410

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
00080	COLOR (PLATINUMCOBALT UNITS)	9	0	120	210	219	360	74-08-01	81-03-15
00400	PH (UNITS)	16	0	4.8	6.2	6.1	7.3	74-08-01	80-09-02
00010	TEMPERATURE (DEG C)	23	0	9.5	24.0	22.4	30.0	71-04-27	81-03-15
00070	TURBIDITY (JTU)	15	0	0	3	4	6	71-04-27	77-08-03
00076	TURBIDITY (NTU)	11	0	0	1	1	2	79-06-05	81-03-15
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	23	0	76	104	111	198	71-04-27	81-03-15
00300	OXYGEN, DISSOLVED (MG/L)	22	0	1.3	4.1	4.7	15.1	74-08-01	81-03-15
00915	CALCIUM DISSOLVED (MG/L AS CA)	7	0	9.5	11.0	11.1	14.0	74-08-01	81-03-15
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	7	0	3.8	4.4	4.4	5.1	74-08-01	81-03-15
00930	SODIUM, DISSOLVED (MG/L AS NA)	7	0	4.1	5.1	5.9	10.0	74-08-01	81-03-15
00935	POTASSIUM, DISSOLVED (MG/L AS K)	7	0	1.0	1.4	1.5	2.6	74-08-01	81-03-15
00410	ALKALINITY (MG/L AS CACO3)	13	0	10	23	25	44	74-08-01	80-11-03
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	13	0	0.8	10.0	7.9	17.0	74-08-01	81-03-15
00945	SULFATE DISSOLVED (MG/L AS SO4)	13	0	0.0	6.5	6.6	13.0	74-08-01	81-03-15
	NUTRIENTS, IN MILLIGRAMS PER LITER								
00610	NITROGEN, AMMONIA TOTAL	22	0	0.01	0.04	0.07	0.20	74-08-01	81-03-15
00620	NITROGEN, NITRATE TOTAL	25	0	0.00	0.10	0.15	0.55	74-08-01	81-03-15
00615	NITROGEN, NITRITE TOTAL	19	0	0.00	0.02	0.02	0.05	74-08-01	81-03-15
00605	NITROGEN, ORGANIC TOTAL	25	0	0.11	0.99	1.10	2.50	71-04-27	81-03-15
00600	NITROGEN, TOTAL	19	0	0.79	1.31	1.45	2.74	74-08-01	81-03-15
00650	PHOSPHATE, TOTAL	5	1	0.01	0.04	0.10	0.37	75-03-18	75-09-30
00660	PHOSPHATE, ORTHO, DISSOLVED	2	0	0.05	0.05	0.05	0.05	71-04-27	75-01-21
70507	PHOSPHORUS, ORTHO, TOTAL	19	0	0.01	0.02	0.05	0.53	74-08-01	81-03-15
00665	PHOSPHORUS, TOTAL	19	0	0.01	0.04	0.07	0.59	74-08-01	81-03-15
00680	CARBON, ORGANIC TOTAL	21	0	9.0	26.0	28.7	73.0	74-08-01	81-03-15
	METALS, IN MICROGRAMS PER LITER								
01105	ALUMINUM, TOTAL RECOVERABLE	2	0	10	15	15	20	80-05-12	80-09-02
01000	ARSENIC DISSOLVED	1	0	2	2	2	2	74-08-01	74-08-01
01002	ARSENIC TOTAL	2	0	0	1	1	1	80-05-12	80-09-02
01012	BERYLLIUM, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01027	CADMIUM TOTAL RECOVERABLE	3	1	0	0	7	20	75-09-02	80-09-02
01032	CHROMIUM, HEXAVALENT, DIS.	1	0	0	0	0	0	74-08-01	74-08-01
01034	CHROMIUM, TOTAL RECOVERABLE	2	1	10	15	15	20	80-05-12	80-09-02
01040	COPPER, DISSOLVED	1	0	7	7	7	7	74-08-01	74-08-01
01042	COPPER, TOTAL RECOVERABLE	4	1	1	6	5	10	75-08-05	80-09-02
01046	IRON, DISSOLVED	1	0	390	390	390	390	74-08-01	74-08-01
01045	IRON, TOTAL RECOVERABLE	5	1	50	210	179	310	75-04-14	80-09-02
01049	LEAD, DISSOLVED	1	0	9	9	9	9	74-08-01	74-08-01
01051	LEAD, TOTAL RECOVERABLE	2	0	0	2	2	3	80-05-12	80-09-02
71900	MERCURY TOTAL RECOVERABLE	2	1	0.1	0.1	0.1	0.1	80-05-12	80-09-02
01067	NICKEL, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01147	SELENIUM, TOTAL	2	0	0	0	0	0	80-05-12	80-09-02
01077	SILVER, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01090	ZINC, DISSOLVED	1	0	20	20	20	20	74-08-01	74-08-01
01092	ZINC, TOTAL RECOVERABLE	3	0	10	10	13	20	75-08-05	80-09-02
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
39350	CHLORDANE, TOTAL	6	0	0.0	0.0	0.0	0.0	74-08-01	80-09-02
39360	DDD, TOTAL	6	0	0.00	0.00	0.00	0.00	74-08-01	80-09-02
39365	DDE, TOTAL	6	0	0.00	0.00	0.00	0.00	74-08-01	80-09-02
39370	DDT, TOTAL	6	0	0.00	0.00	0.00	0.00	74-08-01	80-09-02
39570	DIAZINON, TOTAL	2	0	0.00	0.00	0.00	0.00	79-06-05	80-09-02
39380	DIELDRIN TOTAL	6	0	0.00	0.00	0.00	0.00	74-08-01	80-09-02
39398	ETHION, TOTAL	2	0	0.00	0.00	0.00	0.00	79-06-05	80-09-02
39340	LINDANE TOTAL	5	0	0.00	0.00	0.00	0.00	74-08-01	80-09-02
39530	MALATHION, TOTAL	2	0	0.00	0.08	0.08	0.15	79-06-05	80-09-02
39540	PARATHION, TOTAL	2	0	0.00	0.00	0.00	0.00	79-06-05	80-09-02
39516	PCB, TOTAL	6	0	0.0	0.0	0.0	0.0	74-08-01	80-09-02
39760	SILVEX, TOTAL	5	0	0.00	0.00	0.00	0.00	74-12-11	80-09-02
39730	2,4-D, TOTAL	6	0	0.00	0.00	0.00	0.01	74-12-11	80-09-02
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
39333	ALDRIN, TOTAL IN BOTTOM MATERIAL	7	0	0.0	0.0	0.0	0.1	74-08-01	80-09-02
39351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	7	0	0	0	10	55	74-08-01	80-09-02
39363	DDD, TOTAL IN BOTTOM MATERIAL	7	0	0.0	0.0	1.5	7.3	74-08-01	80-09-02
39368	DDE, TOTAL IN BOTTOM MATERIAL	7	0	0.0	0.0	1.1	8.0	74-08-01	80-09-02
39373	DDT, TOTAL IN BOTTOM MATERIAL	7	0	0.0	0.0	0.0	0.0	74-08-01	80-09-02
39571	DIAZINON, TOTAL IN BOTTOM MATERIAL	2	0	0.0	0.0	0.0	0.0	79-06-05	80-09-02
39383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	7	0	0.0	0.0	2.1	10.0	74-08-01	80-09-02
39399	ETHION, TOTAL IN BOTTOM MATERIAL	2	0	0.0	0.0	0.0	0.0	79-06-05	80-09-02
39423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	7	0	0.0	0.0	0.0	0.0	74-08-01	80-09-02
39601	METHYL PARATHION, TOT. IN BOTTOM MATL.	2	0	0.0	0.0	0.0	0.0	79-06-05	80-09-02
39519	PCB, TOTAL IN BOTTOM MATERIAL	7	0	0	0	112	760	74-08-01	80-09-02
39761	SILVEX, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.0	0.0	74-12-11	79-08-21
39403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	7	0	0	0	0	0	74-08-01	80-09-02
39731	2,4-D, TOTAL IN BOTTOM MATERIAL	5	0	0	0	0	0	74-12-11	79-08-21

STATION 282135081345500   SITE 10: CANAL DOWNSTREAM FROM L-410 CANAL

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
00080	COLOR (PLATINUMCOBALT UNITS)	8	0	130	260	284	500	77-10-05	81-03-15
00400	PH (UNITS)	12	0	5.3	6.2	6.1	6.8	74-08-01	80-09-02
00010	TEMPERATURE (DEG C)	14	0	11.5	23.5	22.4	29.0	74-08-01	81-03-15
00070	TURBIDITY (JTU)	11	0	1	4	4	7	74-08-01	77-10-05
00076	TURBIDITY (NTU)	10	0	0	2	3	7	79-06-05	81-03-15
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	16	0	120	160	170	230	74-08-01	81-03-15
00300	OXYGEN, DISSOLVED (MG/L)	14	0	0.3	3.2	3.2	6.8	74-08-01	81-03-15
00915	CALCIUM DISSOLVED (MG/L AS CA)	7	0	12.0	15.0	14.0	15.0	77-10-05	81-03-15
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	7	0	3.8	4.3	4.2	4.6	77-10-05	81-03-15
00930	SODIUM, DISSOLVED (MG/L AS NA)	7	0	11.0	15.0	17.3	31.0	77-10-05	81-03-15
00935	POTASSIUM, DISSOLVED (MG/L AS K)	7	0	2.3	2.8	3.1	5.1	77-10-05	81-03-15
00410	ALKALINITY (MG/L AS CACO3)	7	0	14	32	33	58	75-04-14	80-09-02
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	9	0	1.0	23.0	20.2	33.0	75-04-14	81-03-15
00945	SULFATE DISSOLVED (MG/L AS SO4)	9	0	5.8	12.0	12.6	24.0	75-04-14	81-03-15
	NUTRIENTS, IN MILLIGRAMS PER LITER								
00610	NITROGEN, AMMONIA TOTAL	21	0	0.05	0.22	0.37	3.50	74-08-01	81-03-15
00620	NITROGEN, NITRATE TOTAL	22	0	0.00	0.22	0.25	0.90	74-08-01	81-03-15
00615	NITROGEN, NITRITE TOTAL	19	0	0.01	0.02	0.02	0.06	74-08-01	81-03-15
00605	NITROGEN, ORGANIC TOTAL	21	0	0.15	1.20	1.20	2.70	74-08-01	81-03-15
00600	NITROGEN, TOTAL	19	0	0.98	1.72	1.89	4.73	74-08-01	81-03-15
00650	PHOSPHATE, TOTAL	3	0	0.37	0.48	0.55	0.80	75-04-14	75-09-02
70507	PHOSPHORUS, ORTHO, TOTAL	19	0	0.12	0.55	0.60	1.70	74-08-01	81-03-15
00665	PHOSPHORUS, TOTAL	19	0	0.20	0.57	0.62	1.70	74-08-01	81-03-15
00680	CARBON, ORGANIC TOTAL	21	0	13.0	32.0	36.5	77.0	74-08-01	81-03-15
	METALS, IN MICROGRAMS PER LITER								
01105	ALUMINUM, TOTAL RECOVERABLE	2	0	200	300	300	400	80-05-12	80-09-02
01000	ARSENIC DISSOLVED	1	0	1	1	1	1	77-10-05	77-10-05
01002	ARSENIC TOTAL	2	0	2	2	2	2	80-05-12	80-09-02
01012	BERYLLIUM, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01027	CADMIUM TOTAL RECOVERABLE	3	1	0	0	7	20	75-09-02	80-09-02
01032	CHROMIUM, HEXAVALENT, DIS.	1	0	0	0	0	0	77-10-05	77-10-05
01034	CHROMIUM, TOTAL RECOVERABLE	2	1	10	15	15	20	80-05-12	80-09-02
01040	COPPER, DISSOLVED	1	0	2	2	2	2	77-10-05	77-10-05
01042	COPPER, TOTAL RECOVERABLE	3	1	2	4	5	10	75-09-02	80-09-02
01046	IRON, DISSOLVED	1	0	570	570	570	570	77-10-05	77-10-05
01045	IRON, TOTAL RECOVERABLE	4	1	50	340	270	350	75-04-14	80-09-02
01049	LEAD, DISSOLVED	1	0	8	8	8	8	77-10-05	77-10-05
01051	LEAD, TOTAL RECOVERABLE	2	0	0	1	1	1	80-05-12	80-09-02
71900	MERCURY TOTAL RECOVERABLE	2	1	0.1	0.2	0.2	0.2	80-05-12	80-09-02
01067	NICKEL, TOTAL RECOVERABLE	2	0	1	2	2	3	80-05-12	80-09-02
01147	SELENIUM, TOTAL	2	0	0	0	0	0	80-05-12	80-09-02
01077	SILVER, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01090	ZINC, DISSOLVED	1	0	0	0	0	0	77-10-05	77-10-05
01092	ZINC, TOTAL RECOVERABLE	2	0	10	15	15	20	80-05-12	80-09-02
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
39350	CHLORDANE, TOTAL	5	0	0.0	0.0	0.0	0.0	74-01-01	80-09-02
39360	DDD, TOTAL	5	0	0.00	0.00	0.00	0.00	74-01-01	80-09-02
39365	DDE, TOTAL	5	0	0.00	0.00	0.00	0.00	74-01-01	80-09-02
39370	DDT, TOTAL	5	0	0.00	0.00	0.00	0.00	74-01-01	80-09-02
39570	DIAZINON, TOTAL	3	0	0.00	0.00	0.00	0.00	78-06-16	80-09-02
39380	DIELDRIN TOTAL	5	0	0.00	0.00	0.00	0.00	74-01-01	80-09-02
39398	ETHION, TOTAL	3	0	0.00	0.00	0.00	0.00	78-06-16	80-09-02
39340	LINDANE TOTAL	5	0	0.00	0.00	0.00	0.00	74-01-01	80-09-02
39530	MALATHION, TOTAL	3	0	0.00	0.01	0.02	0.05	79-06-16	80-09-02
39540	PARATHION, TOTAL	3	0	0.00	0.00	0.00	0.00	78-06-16	80-09-02
39516	PCB, TOTAL	5	0	0.0	0.0	0.0	0.0	74-01-01	80-09-02
39760	SILVEX, TOTAL	8	0	0.00	0.00	0.09	0.64	74-12-11	80-09-02
39730	2,4-D, TOTAL	8	0	0.00	0.00	0.01	0.04	74-12-11	80-09-02
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
9333	ALDRIN, TOTAL IN BOTTOM MATERIAL	6	0	0.0	0.0	0.0	0.0	74-01-01	80-09-02
9351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	6	0	0	12	44	190	74-01-01	80-09-02
9363	DDD, TOTAL IN BOTTOM MATERIAL	6	0	0.0	0.0	0.0	0.0	74-01-01	80-09-02
9368	DDE, TOTAL IN BOTTOM MATERIAL	6	0	0.0	0.0	0.0	0.0	74-01-01	80-09-02
9373	DDT, TOTAL IN BOTTOM MATERIAL	6	0	0.0	0.0	0.0	0.0	74-01-01	80-09-02
9571	DIAZINON, TOTAL IN BOTTOM MATERIAL	3	0	0.0	0.0	0.0	0.0	78-06-16	80-09-02
9383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.2	1.2	74-01-01	80-09-02
9399	ETHION, TOTAL IN BOTTOM MATERIAL	3	0	0.0	0.0	0.0	0.0	78-06-16	80-09-02
9423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	6	0	0.0	0.0	0.0	0.0	74-01-01	80-09-02
9601	METHYL PARATHION, TOT. IN BOTTOM MATL.	3	0	0.0	0.0	0.0	0.0	78-06-16	80-09-02
9519	PCB, TOTAL IN BOTTOM MATERIAL	5	0	0	0	3	20	74-01-01	80-09-02
9761	SILVEX, TOTAL IN BOTTOM MATERIAL	7	0	0.0	0.0	0.0	0.0	74-12-11	79-08-21
9403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	6	0	0	0	0	0	74-01-01	80-09-02
9731	2,4-D, TOTAL IN BOTTOM MATERIAL	7	0	0	0	4	29	74-12-11	79-08-21

STATION 02266300 SITE 11: REEDY CREEK (NEAR VINELAND)

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
00080	COLOR (PLATINUMCOBALT UNITS)	43	0	60	280	285	600	62-08-21	81-03-15
00400	PH (UNITS)	48	0	4.9	6.2	6.2	7.3	62-08-21	80-09-02
00010	TEMPERATURE (DEG C)	70	0	7.0	22.3	21.6	28.0	62-08-21	81-03-16
00070	TURBIDITY (JTU)	35	0	0	4	15	120	69-07-15	77-10-05
00076	TURBIDITY (NTU)	13	0	1	2	3	9	79-06-05	81-03-15
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	57	0	43	142	139	280	61-05-23	81-03-15
00300	OXYGEN, DISSOLVED (MG/L)	41	0	2.5	5.3	5.7	10.0	67-05-08	81-03-15
00915	CALCIUM DISSOLVED (MG/L AS CA)	40	0	3.4	11.0	10.8	17.0	63-07-24	81-01-19
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	40	0	1.4	3.5	3.4	5.6	63-07-24	81-01-19
00930	SODIUM, DISSOLVED (MG/L AS NA)	39	0	4.4	9.9	12.1	33.0	62-08-21	81-01-19
00935	POTASSIUM, DISSOLVED (MG/L AS K)	39	0	0.1	2.0	2.4	7.8	62-08-21	81-01-19
00410	ALKALINITY (MG/L AS CACO3)	45	0	0	25	25	71	62-08-21	80-09-02
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	49	0	0.3	16.0	16.4	41.0	63-07-24	81-01-19
00945	SULFATE DISSOLVED (MG/L AS SO4)	48	0	0.0	9.5	8.9	20.0	63-07-24	81-01-19
	NUTRIENTS, IN MILLIGRAMS PER LITER								
00610	NITROGEN, AMMONIA TOTAL	39	0	0.01	0.07	0.21	2.60	71-11-22	81-03-15
00620	NITROGEN, NITRATE TOTAL	42	0	0.04	0.29	0.45	3.00	71-11-22	81-03-15
00615	NITROGEN, NITRITE TOTAL	35	0	0.00	0.02	0.04	0.35	71-11-22	81-03-15
00605	NITROGEN, ORGANIC TOTAL	51	0	0.13	1.10	1.05	1.90	69-10-23	81-03-15
00600	NITROGEN, TOTAL	28	0	1.08	1.58	1.95	6.78	73-11-07	81-03-15
00650	PHOSPHATE, TOTAL	19	0	0.02	0.08	0.17	1.35	65-05-20	75-09-30
00660	PHOSPHATE, ORTHO, DISSOLVED	18	0	0.01	0.11	0.22	2.20	65-05-20	75-01-21
70507	PHOSPHORUS, ORTHO, TOTAL	35	0	0.01	0.58	0.62	2.00	71-11-22	81-03-15
00665	PHOSPHORUS, TOTAL	36	0	0.07	0.62	0.70	2.50	71-11-22	81-03-15
00680	CARBON, ORGANIC TOTAL	45	0	4.0	28.0	31.2	73.0	70-05-20	81-03-15
	METALS, IN MICROGRAMS PER LITER								
01105	ALUMINUM, TOTAL RECOVERABLE	7	0	160	420	414	1000	68-04-09	80-11-03
01000	ARSENIC DISSOLVED	16	0	0	10	10	30	70-08-27	77-10-05
01002	ARSENIC TOTAL	9	0	1	2	5	20	72-05-09	80-11-03
01012	BERYLLIUM, TOTAL RECOVERABLE	5	0	0	10	5	10	80-02-09	80-11-03
01027	CADMIUM TOTAL RECOVERABLE	8	1	0	0	3	20	75-09-02	80-11-03
01032	CHROMIUM, HEXAVALENT, DIS.	16	0	0	0	1	8	71-03-01	77-10-05
01034	CHROMIUM, TOTAL RECOVERABLE	9	2	0	10	11	20	69-04-09	80-11-03
01040	COPPER, DISSOLVED	22	0	0	8	7	40	68-04-09	77-10-05
01042	COPPER, TOTAL RECOVERABLE	8	1	1	4	5	10	75-08-05	80-11-03
01046	IRON, DISSOLVED	29	0	80	210	215	590	65-05-20	77-10-05
01045	IRON, TOTAL RECOVERABLE	10	0	220	370	355	450	63-07-24	80-11-03
01049	LEAD, DISSOLVED	19	0	0	3	4	20	70-08-27	77-10-05
01051	LEAD, TOTAL RECOVERABLE	7	0	1	2	4	8	76-05-06	80-11-03
71890	MERCURY DISSOLVED	1	0	0.5	0.5	0.5	0.5	70-08-27	70-08-27
71900	MERCURY TOTAL RECOVERABLE	7	3	0.0	0.2	0.2	0.5	75-05-06	80-11-03
01067	NICKEL, TOTAL RECOVERABLE	6	0	0	2	3	10	76-05-06	80-11-03
01147	SELENIUM, TOTAL	6	0	0	0	0	0	79-02-05	80-11-03
01077	SILVER, TOTAL RECOVERABLE	6	0	0	0	0	0	79-02-05	80-11-03
01090	ZINC, DISSOLVED	22	0	10	30	40	110	68-04-09	77-10-05
01092	ZINC, TOTAL RECOVERABLE	7	0	10	10	15	30	75-08-05	80-11-03
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
39350	CHLORDANE, TOTAL	11	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39360	DDD, TOTAL	15	0	0.00	0.00	0.00	0.00	70-08-27	80-09-02
39365	DDE, TOTAL	15	0	0.00	0.00	0.00	0.00	70-08-27	80-09-02
39370	DDT, TOTAL	15	0	0.00	0.00	0.00	0.01	70-08-27	80-09-02
39570	DIAZINON, TOTAL	8	0	0.00	0.00	0.00	0.01	71-03-01	80-09-02
39380	DIELDRIN TOTAL	15	0	0.00	0.00	0.00	0.00	70-08-27	80-09-02
39398	ETHION, TOTAL	7	0	0.00	0.00	0.00	0.00	71-03-01	80-09-02
39340	LINDANE TOTAL	15	1	0.00	0.00	0.00	0.01	70-08-27	80-09-02
39530	MALATHION, TOTAL	8	0	0.00	0.00	0.00	0.00	71-03-01	80-09-02
39540	PARATHION, TOTAL	9	0	0.00	0.00	0.00	0.02	71-03-01	80-09-02
39516	PCB, TOTAL	11	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39760	SILVEX, TOTAL	13	0	0.00	0.00	0.50	6.00	71-11-22	80-09-02
39730	2,4-D, TOTAL	13	0	0.00	0.00	0.00	0.02	71-11-22	80-09-02
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
39333	ALDRIN, TOTAL IN BOTTOM MATERIAL	13	0	0.0	0.5	8.2	66.0	70-12-02	80-09-02
39351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	11	0	0	4	12	58	72-02-08	80-09-02
39363	DDD, TOTAL IN BOTTOM MATERIAL	15	0	0.0	0.1	0.9	8.8	70-08-27	80-09-02
39368	DDE, TOTAL IN BOTTOM MATERIAL	15	0	0.0	0.0	0.2	1.5	70-08-27	80-09-02
39373	DDT, TOTAL IN BOTTOM MATERIAL	15	0	0.0	0.0	0.7	8.4	70-08-27	80-09-02
39571	DIAZINON, TOTAL IN BOTTOM MATERIAL	4	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	15	0	0.0	1.5	2.5	14.0	70-08-27	80-09-02
39399	ETHION, TOTAL IN BOTTOM MATERIAL	2	0	0.0	0.0	0.0	0.0	79-06-04	80-09-02
39423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	10	0	0.0	0.0	0.0	0.0	72-08-16	80-09-02
39601	METHYL PARATHION, TOT. IN BOTTOM MATL.	4	0	0.0	0.0	4.5	18.0	72-02-08	80-09-02
39519	PCB, TOTAL IN BOTTOM MATERIAL	11	0	0	0	0	2	72-02-08	80-09-02
39761	SILVEX, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.0	21.2	210.0	72-05-09	79-08-21
39403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	10	0	0	0	0	0	72-08-16	80-09-02
39731	2,4-D, TOTAL IN BOTTOM MATERIAL	11	0	0	0	0	0	72-05-09	79-08-21

STATION 02266480 SITE 12: DAVENPORT CREEK

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
00080	COLOR (PLATINUMCOBALT UNITS)	32	0	14	180	189	540	68-04-30	81-03-15
00400	PH (UNITS)	41	0	5.9	6.7	6.7	7.7	69-04-09	80-09-02
00010	TEMPERATURE (DEG C)	59	0	10.5	21.0	21.0	25.0	65-05-04	81-03-15
00070	TURBIDITY (JTU)	30	0	0	2	5	110	69-07-15	77-10-05
00076	TURBIDITY (NTU)	12	0	0	1	1	2	76-10-28	81-03-15
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	45	0	79	132	136	240	65-05-04	81-03-15
00300	OXYGEN, DISSOLVED (MG/L)	35	0	1.4	7.0	6.9	9.6	68-04-30	81-03-15
00915	CALCIUM DISSOLVED (MG/L AS CA)	29	0	7.0	16.0	15.4	21.0	68-04-09	80-11-03
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	29	0	2.6	4.4	4.4	6.5	68-04-09	80-11-03
00930	SODIUM, DISSOLVED (MG/L AS NA)	27	0	3.7	4.5	5.4	14.0	68-04-09	80-11-03
00935	POTASSIUM, DISSOLVED (MG/L AS K)	27	0	0.5	1.3	1.5	5.2	68-04-09	80-11-03
00410	ALKALINITY (MG/L AS CACO3)	31	0	8	32	32	46	68-04-09	80-09-02
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	34	0	1.2	11.0	11.0	20.0	69-04-09	80-11-03
00945	SULFATE DISSOLVED (MG/L AS SO4)	35	0	0.1	9.6	10.4	32.0	68-04-09	80-11-03
	NUTRIENTS, IN MILLIGRAMS PER LITER								
00610	NITROGEN, AMMONIA TOTAL	33	0	0.00	0.03	0.04	0.16	71-11-22	81-03-15
00620	NITROGEN, NITRATE TOTAL	35	1	0.03	0.88	1.05	4.20	71-11-22	81-03-15
00615	NITROGEN, NITRITE TOTAL	31	0	0.00	0.01	0.02	0.21	71-11-22	81-03-15
00605	NITROGEN, ORGANIC TOTAL	43	0	0.09	0.94	1.06	6.50	68-10-23	81-03-15
00600	NITROGEN, TOTAL	23	0	1.23	1.98	2.25	3.83	73-11-07	81-03-15
00650	PHOSPHATE, TOTAL	12	1	0.01	0.10	0.09	0.22	68-04-30	75-08-05
00660	PHOSPHATE, ORTHO, DISSOLVED	12	0	0.02	0.07	0.12	0.57	69-04-09	72-02-08
70507	PHOSPHORUS, ORTHO, TOTAL	31	0	0.01	0.03	0.05	0.71	71-11-22	81-03-15
00665	PHOSPHORUS, TOTAL	31	0	0.01	0.04	0.07	0.71	71-11-22	81-03-15
00680	CARBON, ORGANIC TOTAL	36	0	3.0	27.5	30.7	73.0	70-08-31	81-03-15
	METALS, IN MICROGRAMS PER LITER								
01105	ALUMINUM, TOTAL RECOVERABLE	2	0	70	85	85	100	80-05-12	80-09-02
01000	ARSENIC DISSOLVED	15	0	0	10	11	30	70-08-31	77-10-05
01002	ARSENIC TOTAL	4	0	1	5	8	20	72-05-09	80-09-02
01012	BERYLLIUM, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01027	CADMIUM TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01032	CHROMIUM, HEXAVALENT, DIS.	15	0	0	0	0	2	71-03-01	77-10-05
01034	CHROMIUM, TOTAL RECOVERABLE	5	0	0	10	10	20	68-04-09	80-09-02
01040	COPPER, DISSOLVED	18	0	0	4	7	20	68-04-09	77-10-05
01042	COPPER, TOTAL RECOVERABLE	4	2	2	6	6	10	75-08-05	80-09-02
01046	IRON, DISSOLVED	22	0	10	135	275	2700	68-04-09	77-10-05
01045	IRON, TOTAL RECOVERABLE	3	0	130	140	193	310	75-08-05	80-09-02
01049	LEAD, DISSOLVED	17	0	0	1	3	10	70-08-31	77-10-05
01051	LEAD, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
71890	MERCURY DISSOLVED	1	0	0.6	0.6	0.5	0.6	70-08-31	70-08-31
71900	MERCURY TOTAL RECOVERABLE	2	0	0.2	0.3	0.3	0.3	80-05-12	80-09-02
01067	NICKEL, TOTAL RECOVERABLE	2	0	0	2	2	3	80-05-12	80-09-02
01147	SELENIUM, TOTAL	2	0	0	0	0	0	80-05-12	80-09-02
01077	SILVER, TOTAL RECOVERABLE	2	0	0	0	0	0	80-05-12	80-09-02
01090	ZINC, DISSOLVED	18	0	0	20	25	60	68-04-09	77-10-05
01092	ZINC, TOTAL RECOVERABLE	3	0	20	20	23	30	75-08-05	80-09-02
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
39350	CHLORDANE, TOTAL	11	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39360	DDD, TOTAL	15	0	0.00	0.00	0.00	0.00	70-08-31	80-09-02
39365	DDE, TOTAL	15	0	0.00	0.00	0.00	0.01	70-08-31	80-09-02
39370	DDT, TOTAL	15	0	0.00	0.00	0.00	0.01	70-08-31	80-09-02
39570	DIAZINON, TOTAL	9	0	0.00	0.00	0.00	0.00	71-03-01	80-09-02
39380	DIELDRIN TOTAL	15	0	0.00	0.00	0.00	0.00	70-08-31	80-09-02
39398	ETHION, TOTAL	8	0	0.00	0.00	0.00	0.00	71-03-01	80-09-02
39340	LINDANE TOTAL	15	0	0.00	0.00	0.00	0.00	70-08-31	80-09-02
39530	MALATHION, TOTAL	9	0	0.00	0.00	0.00	0.00	71-03-01	80-09-02
39540	PARATHION, TOTAL	9	0	0.00	0.00	0.00	0.00	71-03-01	80-09-02
39516	PCB, TOTAL	11	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39760	SILVEX, TOTAL	13	0	0.00	0.00	0.00	0.00	71-11-22	80-09-02
39730	2,4-D, TOTAL	13	0	0.00	0.00	0.00	0.00	71-11-22	80-09-02
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
39333	ALDRIN, TOTAL IN BOTTOM MATERIAL	14	0	0.0	0.0	0.0	0.0	70-08-31	80-09-02
39351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	10	0	0	0	2	17	72-02-08	80-09-02
39363	DDD, TOTAL IN BOTTOM MATERIAL	13	0	0.0	0.3	1.4	7.1	70-08-31	80-09-02
39368	DDE, TOTAL IN BOTTOM MATERIAL	13	0	0.0	1.0	8.9	86.0	70-08-31	80-09-02
39373	DDT, TOTAL IN BOTTOM MATERIAL	14	0	0.0	0.0	1.0	9.5	70-08-31	80-09-02
39571	DIAZINON, TOTAL IN BOTTOM MATERIAL	5	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	14	0	0.0	0.0	0.4	3.1	70-08-31	80-09-02
39399	ETHION, TOTAL IN BOTTOM MATERIAL	3	0	0.0	0.0	12.7	38.0	79-06-16	80-09-02
39423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	9	0	0.0	0.0	0.0	0.0	72-08-16	80-09-02
39601	METHYL PARATHION, TOT. IN BOTTOM MATL.	5	0	0.0	0.0	0.5	2.5	72-02-08	80-09-02
39519	PCB, TOTAL IN BOTTOM MATERIAL	10	1	0	0	1	5	72-02-08	80-09-02
39761	SILVEX, TOTAL IN BOTTOM MATERIAL	12	0	0.0	0.0	0.0	0.0	71-11-22	79-08-21
39403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	9	0	0	0	0	0	72-08-16	80-09-02
39731	2,4-D, TOTAL IN BOTTOM MATERIAL	12	0	0	0	1	12	71-11-22	79-08-21

STATION 02266500 SITE 13: REEDY CREEK (NEAR LOUGHMAN)

CODE	PROPERTY OR CONSTITUENT	SAMPLES TOTAL	SAMPLES RMKS	MINIMUM	MEDIAN	MEAN	MAXIMUM	DATE FIRST	DATE LAST
	MAJOR CONSTITUENTS AND PROPERTIES								
00080	COLOR (PLATINUMCOBALT UNITS)	35	0	20	200	233	600	59-11-13	81-03-15
00400	PH (UNITS)	41	0	5.6	6.3	6.3	6.9	59-11-13	80-09-02
00010	TEMPERATURE (DEG C)	60	0	7.5	22.0	21.2	29.0	65-05-04	81-03-15
00070	TURBIDITY (JTU)	31	0	1	4	5	30	69-07-15	77-10-05
00076	TURBIDITY (NTU)	13	0	0	1	2	6	78-06-05	81-03-15
00095	SPECIFIC CONDUCTANCE (MICROMHOS)	49	0	49	130	143	235	59-11-13	81-03-15
00300	OXYGEN, DISSOLVED (MG/L)	37	0	0.4	2.8	3.2	8.4	69-04-30	81-03-15
00915	CALCIUM DISSOLVED (MG/L AS CA)	30	0	5.0	13.5	18.5	140.0	59-11-13	81-01-19
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)	30	0	0.5	4.0	4.0	6.9	59-11-13	81-01-19
00930	SODIUM, DISSOLVED (MG/L AS NA)	30	0	4.2	7.3	8.5	19.0	59-11-13	81-01-19
00935	POTASSIUM, DISSOLVED (MG/L AS K)	30	0	0.6	1.8	2.1	5.1	59-11-13	81-01-19
00410	ALKALINITY (MG/L AS CACO3)	33	0	0	29	30	59	59-11-13	80-09-02
00940	CHLORIDE, DISSOLVED (MG/L AS CL)	39	0	1.0	14.0	13.2	24.0	59-11-13	81-01-19
00945	SULFATE DISSOLVED (MG/L AS SO4)	39	0	0.0	10.5	11.1	48.0	59-11-13	81-01-19
	NUTRIENTS, IN MILLIGRAMS PER LITER								
00610	NITROGEN, AMMONIA TOTAL	37	0	0.01	0.07	0.12	0.42	71-11-22	81-03-15
00620	NITROGEN, NITRATE TOTAL	40	0	0.00	0.21	0.55	6.00	71-11-22	81-03-15
00615	NITROGEN, NITRITE TOTAL	34	0	0.00	0.02	0.02	0.06	71-11-22	81-03-15
00605	NITROGEN, ORGANIC TOTAL	46	0	0.18	1.15	1.32	7.10	69-10-23	81-03-15
00600	NITROGEN, TOTAL	26	0	0.96	1.70	1.94	7.57	73-11-07	81-03-15
00650	PHOSPHATE, TOTAL	13	0	0.01	0.10	0.19	0.75	69-04-30	75-09-30
00660	PHOSPHATE, ORTHO, DISSOLVED	12	0	0.02	0.10	0.13	0.44	69-04-09	72-02-08
70507	PHOSPHORUS, ORTHO, TOTAL	34	0	0.02	0.20	0.33	2.50	71-11-22	81-03-15
00665	PHOSPHORUS, TOTAL	34	0	0.03	0.23	0.39	3.00	71-11-22	81-03-15
00680	CARBON, ORGANIC TOTAL	39	0	5.0	28.5	29.9	64.0	70-05-20	81-03-15
	METALS, IN MICROGRAMS PER LITER								
01105	ALUMINUM, TOTAL RECOVERABLE	6	0	40	175	215	500	69-04-09	80-11-03
01000	ARSENIC DISSOLVED	10	0	0	10	9	20	71-08-18	77-10-05
01002	ARSENIC TOTAL	10	0	0	2	5	30	72-05-09	80-11-03
01012	BERYLLIUM, TOTAL RECOVERABLE	5	0	0	0	2	10	80-02-09	80-11-03
01027	CADMIUM TOTAL RECOVERABLE	9	1	0	0	3	20	72-05-09	80-11-03
01032	CHROMIUM, HEXAVALENT, DIS.	13	0	0	0	0	5	71-08-18	77-10-05
01034	CHROMIUM, TOTAL RECOVERABLE	8	1	0	10	14	30	68-04-09	80-11-03
01040	COPPER, DISSOLVED	14	0	0	8	9	40	69-04-09	77-10-05
01042	COPPER, TOTAL RECOVERABLE	9	2	0	3	4	10	75-08-05	80-11-03
01046	IRON, DISSOLVED	19	0	30	220	261	640	59-11-13	77-10-05
01045	IRON, TOTAL RECOVERABLE	9	0	110	250	320	640	75-08-05	80-11-03
01049	LEAD, DISSOLVED	13	0	0	6	8	20	71-08-18	77-10-05
01051	LEAD, TOTAL RECOVERABLE	7	0	1	3	11	52	78-11-27	80-11-03
71900	MERCURY TOTAL RECOVERABLE	9	3	0.0	0.2	0.2	0.5	72-05-09	80-11-03
01067	NICKEL, TOTAL RECOVERABLE	7	0	2	4	9	33	78-11-27	80-11-03
01147	SELENIUM, TOTAL	6	0	0	0	0	0	78-11-27	80-11-03
01077	SILVER, TOTAL RECOVERABLE	7	0	0	0	0	0	78-11-27	80-11-03
01090	ZINC, DISSOLVED	14	0	10	30	35	130	69-04-09	77-10-05
01092	ZINC, TOTAL RECOVERABLE	9	0	10	10	15	30	75-08-05	80-11-03
	ORGANICS IN WATER, IN MICROGRAMS PER LITER								
39350	CHLORDANE, TOTAL	11	0	0.0	0.0	0.0	0.1	72-02-08	80-09-02
39360	DDD, TOTAL	11	0	0.00	0.00	0.00	0.00	72-02-08	80-09-02
39365	DDE, TOTAL	11	0	0.00	0.00	0.00	0.00	72-02-08	80-09-02
39370	DDT, TOTAL	11	0	0.00	0.00	0.00	0.00	72-02-08	80-09-02
39570	DIAZINON, TOTAL	6	0	0.00	0.00	0.00	0.00	72-02-08	80-09-02
39380	DIELDRIN TOTAL	11	0	0.00	0.00	0.00	0.00	72-02-08	80-09-02
39398	ETHION, TOTAL	6	0	0.00	0.00	0.00	0.00	72-02-08	80-09-02
39340	LINDANE TOTAL	11	0	0.00	0.00	0.00	0.00	72-02-08	80-09-02
39530	MALATHION, TOTAL	6	0	0.00	0.00	0.00	0.00	72-02-08	80-09-02
39540	PARATHION, TOTAL	6	0	0.00	0.00	0.00	0.00	72-02-08	80-09-02
39516	PCB, TOTAL	11	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39760	SILVEX, TOTAL	13	0	0.00	0.00	0.02	0.13	71-11-22	80-09-02
39730	2,4-D, TOTAL	13	0	0.00	0.00	0.02	0.13	71-11-22	80-09-02
	ORGANICS IN BOTTOM MATERIAL, IN MICROGRAMS PER KILOGRAM								
39333	ALDRIN, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39351	CHLORDANE, TOTAL IN BOTTOM MATERIAL	10	0	0	2	5	25	72-02-08	80-09-02
39363	DDD, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.3	1.7	12.0	72-02-08	80-09-02
39368	DDE, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.9	1.5	7.0	72-02-08	80-09-02
39373	DDT, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.0	0.9	5.9	72-02-08	80-09-02
39571	DIAZINON, TOTAL IN BOTTOM MATERIAL	6	0	0.0	0.0	0.0	0.0	72-02-08	80-09-02
39383	DIELDRIN, TOTAL IN BOTTOM MATERIAL	11	0	0.0	0.0	0.1	0.6	72-02-08	80-09-02
39399	ETHION, TOTAL IN BOTTOM MATERIAL	4	0	0.0	0.0	0.0	0.0	75-04-30	80-09-02
39423	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL.	9	0	0.0	0.0	0.0	0.0	72-08-15	80-09-02
39601	METHYL PARATHION, TOT. IN BOTTOM MATL.	6	0	0.0	0.0	0.5	3.1	72-02-08	80-09-02
39519	PCB, TOTAL IN BOTTOM MATERIAL	10	0	0	0	2	15	72-02-08	80-09-02
39761	SILVEX, TOTAL IN BOTTOM MATERIAL	13	0	0.0	0.0	0.0	0.0	71-11-22	79-08-21
39403	TOXAPHENE, TOTAL IN BOTTOM MATERIAL	10	0	0	0	0	0	72-08-16	80-09-02
39731	2,4-D, TOTAL IN BOTTOM MATERIAL	13	0	0	0	0	0	71-11-22	79-08-21

*U.S. GOVERNMENT PRINTING OFFICE: 1986-631-135/20023 Region 4.