

PROGRAM FOR MONITORING
SURFACE-WATER QUALITY IN FLORIDABy
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INTRODUCTION

The U.S. Geological Survey investigates the occurrence, quantity, quality, distribution, and movement of the surface and underground waters throughout the nation. It is the principal federal water-data agency and, as such, collects and disseminates about 70 percent of the water data currently being used by numerous state, local, private, and other federal agencies to develop and manage the nation's water resources.

The purpose of this water atlas is to inform the reader of the overall operation and extent of the program for monitoring surface-water quality in Florida: the history and funding of the program, the purpose and objectives of the network of monitoring stations by hydrologic categories, the frequencies of sampling, the types of water-quality data collected, and how these data are published and used.

HISTORY AND FUNDING

The U.S. Geological Survey's program for monitoring surface-water quality in Florida began in 1939. It was part of a general investigation to determine the availability of water in the Miami area for public and private supply. That investigation was in cooperation with the Florida Geological Survey (now the Florida Bureau of Geology), Dade County, and the cities of Miami, Miami Beach and Coral Gables.

The program is constantly being revised in response to the varying needs for information to alleviate water-resource problems, and the application of new hydrologic principles and techniques. As of 1976, the monitoring program in the State of Florida was maintained in cooperation with more than 75 State, Federal, and local agencies; and water-quality information was being obtained from a network of more than 600 stations in five categories in 61 of the 67 counties in Florida.

CLASSIFICATION OF MONITORING STATIONS

Most of the stations included in the monitoring program fall within five general categories: areal assessment, eutrophic condition assessment, hydrologic benchmark, long-term trend, and water-quality accounting. The purpose of each category is defined in table 1.

Water-quality data are also collected at bulk-precipitation, storm-water runoff, morphological-limnological, and other special purpose stations to satisfy the need for information in specific problem areas or to provide additional data to water planners and users.

At morphological-limnological stations, for example, the surface and drainage area, volume, bottom contours, type of drainage, geologic setting, basin characteristics, chemical composition and nutrient concentration, transparency, sediment type and composition, degree of stratification, phytoplankton species and number and abundance of littoral vegetation are determined on a one-time-only basis by means of a late summer survey.

DISTRIBUTION OF STATIONS

The distribution of stations in the monitoring program as of April 1976 is shown on the large map. The distribution and number of stations in a given area is determined by the extent to which information is needed. This generally is the result of water-quality problems related to increasing usage by municipalities, industries, and agriculture.

TYPES AND FREQUENCIES OF DATA COLLECTED

Many of the program stations are multiple-purpose stations and are sampled as part of two or more categories. For example, the station Sopchoppy River near Sopchoppy (in Wakulla County) is sampled as a hydrologic benchmark station, an areal assessment station, and a water-quality accounting station.

The station categories, parameter coverage, and sampling frequency are subjective and quite variable, depending on the specific situation. The minimum constituent coverage and sampling frequency most commonly observed for each station category are shown on table 2.

Eighteen of the Florida Water Quality Accounting stations are also part of the U.S. Geological Survey's National Stream Quality Accounting Network. The National Stream Quality Accounting Network is a nationwide, federally and cooperatively funded program which provides systematic water-quality data for selected stations. Site selection and coverage were determined for the purpose of assessing the long-term trends in the physical, chemical, and biological characteristics of the nation's streams. The primary objectives are as follows.

1. To account for the quantity and quality of water moving within and from the United States
2. To depict areal variability in water quality
3. To detect changes in stream quality
4. To lay the groundwork for future assessments of changes in stream quality

The locations of active and planned stations in the U.S. Geological Survey's National Stream Quality Accounting Network in Florida as of April 1976 are shown on figure 1.

Of the 18 U.S. Geological Survey's National Stream Quality Accounting Network stations in Florida, 8 are also part of the National Pesticide Water Monitoring Program, operated by the Survey in cooperation with the Environmental Protection Agency. At each of these stations four water samples and two sediment samples are collected annually for pesticide analysis. The specific constituents for which analyses are made within each type of measurement are listed on table 3.

The U.S. Geological Survey has three central water-quality laboratories, in Denver, Colo., Atlanta, Ga., and Albany, N.Y. Each year the central laboratory at Atlanta and the water-quality laboratories at the Survey offices in Florida analyze nearly 20,000 samples collected from streams and lakes in Florida.

The central laboratories perform chemical analyses that range in complexity from determinations of simple inorganic constituents, such as chlorides, to complex organic compounds such as pesticides. As each analysis is completed, it is verified by laboratory personnel and then transmitted by way of a computer terminal to the central computer facilities and stored in Reston, Virginia, in the Water-Quality File, discussed later in this report.

AVAILABILITY OF THE RECORDS

All records obtained from the water-quality program in Florida, since its inception in 1939, are available to the public. Table 4 lists the annual series of U.S. Geological Survey Water-Supply Papers that give information on quality of surface waters in Florida. Data for the South Atlantic slope and eastern Gulf of Mexico basins are given in Part 2.

Beginning with the 1964 water year (October 1963-September 1964), water-quality records have been released by the U.S. Geological Survey in annual reports on a state-boundary basis. These reports are for limited distribution and are designed primarily for rapid release of data shortly after the end of each water year. These records were published later in Geological Survey Water-Supply Papers through 1971. From 1971 through 1975 only the annual reports were published. Starting with the 1976 water year the annual reports were designated an official series.

A large-scale computerized storage and retrieval system is used by the Geological Survey to store, retrieve, and disseminate water data acquired through its many activities. The Geological Survey's National Water Data Storage and Retrieval System was implemented in November 1971. In addition to its data processing, storage, and retrieval capabilities, the system has the capability of providing computer-printed tables (for example, table 5), computer-printed graphs (for example, figure 2), statistical analyses of data, and digital plots. The system is operated and maintained on the central computer facility of the Survey at its National Center, Reston, VA, and through about 50 terminals in Water Resources Division district and subdistrict offices located in major cities throughout the nation (Hutchinson, 1975).

The U.S. Geological Survey has a computer program to retrieve data from an index of water-quality, stage, and discharge-measurement stations and to list them in a format suitable for publication. Table 6 is an example of a computer-printed table generated through the station-index program.

In addition to the basic data reports already described, the Geological Survey publishes many interpretative reports in the series: Professional Papers, Bulletins, Circulars, Water-Supply Papers, Open-File Reports, Water-Resources Investigations Reports, and Hydrologic Investigations Atlases. Some Geological Survey reports are available only through the National Technical Information Service, Springfield, Va.

Geological Survey personnel also have written many interpretative reports published by the State of Florida: Bulletins, Information Circulars, Map Series (such as this report), Report of Investigations, and Special Publications.

Inquiries concerning the reports or activities of the U.S. Geological Survey may be addressed to District Chief, Water Resources Division, U.S. Geological Survey, Suite F-240, 325 John Knox Road, Tallahassee, Florida 32303; or to Chief, Bureau of Geology, Division of Interior Resources, Florida Department of Natural Resources, 903 W. Tennessee Street, Tallahassee, Florida 32304; or to Chief Hydrologist, U.S. Geological Survey, National Center, MS 420, Reston, Virginia 22092.

SELECTED REFERENCES

- Conover, C. S.
1965 (MacKichan, K. A., and Price, R. W.) *The water mapping, monitoring and research program in Florida*: State Board of Conserv., Florida Geol. Survey, Spec. Pub. 13.
- Hutchinson, N. S.
1975 *WATSTORE user's guide*: U.S. Geol. Survey open-file rept. 75-426, v. 1, p. v-viii.

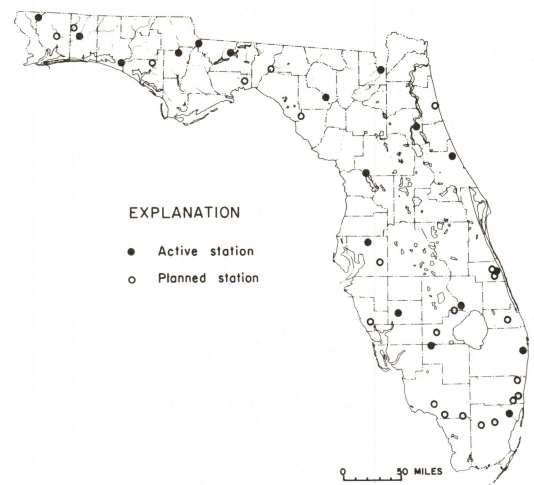


Figure 1.—Locations of active and planned stations in the U.S. Geological Survey's National Stream Quality Accounting Network in Florida as of April 1976.

TABLE 1.—Classification of stations in the monitoring program.

Category of station	Purpose
A Areal assessment	Provide basic water-quality data on a basinwide or regional basis and in various hydrogeologic environments; provide data on variations in water quality with streamflow and provide information on extremes in water-quality conditions.
B Eutrophic condition assessment	Determine trophic status of major lakes, identify problem lakes and provide early detection of deterioration.
C Hydrologic benchmark	Determine baseline quality of water in undeveloped "pristine" areas; provide a basis for determining the effects of man's activities and a basis by which to determine the pollution-load component of man-affected streams.
D Long-term trend	Provide specific conductance and temperature data at stations where streamflow or stage are measured on a repetitive basis; use these data in conjunction with data from the accounting and areal assessment stations to determine gross long-term trends in quality throughout an area.
E Water-quality accounting	Determine long-term trends in water quality; determine variations in water quality with streamflow and season; provide an accounting of the loads of organic and inorganic constituents leaving a basin; provide input to water-quality simulation models and provide baseline data for river-quality assessments. (Many of these stations are operated under the U.S. Geological Survey's National Stream Quality Accounting Network.)

TABLE 2.—The specific constituents determined as part of each type of measurement.

Type of measurement	Constituents
Specific conductance and temperature	Specific conductance and temperature
Dissolved oxygen	Dissolved oxygen
Nitrogen species	Nitrate, nitrite, ammonia, and organic nitrogen
Phosphorus species	Ortho and total phosphorus
Organic carbon	Organic carbon
5-day BOD	5-day biochemical oxygen demand
Major chemical constituents	Calcium, magnesium, sodium, potassium, bicarbonate, chloride, sulfate, silica, hardness, alkalinity, and dissolved solids (may also include pH, color, and strontium)
Trace metals	Includes all or part of the following: aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, and zinc
Pesticides	Insecticides: aldrin, chlordane, DDT, DDT, dieldrin, endrin, heptachlor, heptachlor epoxide, lindane, and toxaphene Herbicides: 2,4-D, 2,4,5-T, and Silvex
Bacteriological	Includes one or more of the following: fecal coliform, total coliform, fecal streptococci
Plankton	Plankton
Radiochemical	Discharged: Ra-226, uranium, gross alpha, and gross beta Suspended: gross alpha and gross beta
24-hour DO profile	24-hour dissolved oxygen profile
Benthic invertebrates	Benthic invertebrates
Pesticides in bottom sediment	Includes some or all of the pesticides listed above
Suspended sediment	Suspended sediment

TABLE 3.—Constituents determined, coverage and sampling frequency for station categories.

Category of station	Constituents measured and minimum annual frequency of measurements														
	Specific conductance and temperature	Dissolved oxygen	Nitrogen species	Phosphorus species	Organic carbon	5-day BOD	Major chemical constituents	Trace metals	Pesticides	Plankton	Radiochemical	24-Hour DO profile	Benthic invertebrates	Pesticides in bottom sediment	Suspended sediment
A Areal assessment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
B Benthic condition assessment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C Hydrologic/benchmark	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
D Long-term trend	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E Water quality accounting	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

*As often as station is visited.
†Unless historical constituent data are available, 365.

TABLE 4.—An example of a computer-printed table generated through the station-index program, showing the number of samples analyzed for various constituents.

Year	No. Samples	D.S.	Hardness	Major Chemical	Silica	Iron	Manganese	Phosphorus	Nitrogen	Organic Carbon	5-day BOD	CO ₂	pH	Pesticides	Radiochemical	Benthic Invertebrates	Pesticides in Bottom Sediment	Sediment-Bed
1961	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1962	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1963	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1964	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1965	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1966	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1967	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1968	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1969	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1970	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1971	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1972	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1973	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1974	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1975	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1976	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1977	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1978	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1979	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1980	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

02250000 Ochlocknee River near Havana, FL. Lat=30 33 14 Long=-84 23 03 Stream State=12 County=073 Dist.=12

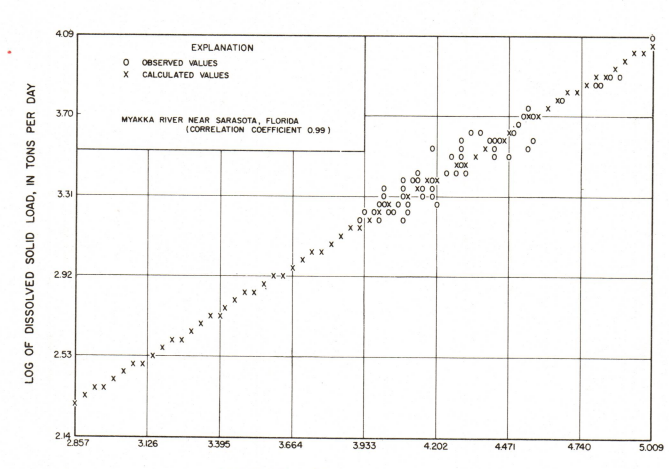


Figure 2.—Computer-printed graph, showing the log of the dissolved solid load versus the log of discharge at the Myakka River near Sarasota, Florida.

TABLE 5.—The annual series of U.S. Geological Survey Water-Supply Papers that give information on quality of surface waters in Florida.

Year	Part	Part	Year	Part	Part
1961	1	1	1969	1	1
1962	1	1	1970	1	1
1963	1	1	1971	1	1
1964	1	1	1972	1	1
1965	1	1	1973	1	1
1966	1	1	1974	1	1
1967	1	1	1975	1	1
1968	1	1	1976	1	1
1969	1	1	1977	1	1
1970	1	1	1978	1	1
1971	1	1	1979	1	1
1972	1	1	1980	1	1
1973	1	1	1981	1	1
1974	1	1	1982	1	1
1975	1	1	1983	1	1
1976	1	1	1984	1	1
1977	1	1	1985	1	1
1978	1	1	1986	1	1
1979	1	1	1987	1	1
1980	1	1	1988	1	1
1981	1	1	1989	1	1
1982	1	1	1990	1	1

A—Parts 1-4
B—in preparation

TABLE 6.—An example of a computer-printed table, showing the concentrations of various constituents in a sample collected February 24, 1976, at the Ochlocknee River near Havana, FL.

Constituent	Concentration
Temperature (deg. C) (000010)	25.0
Dissolved Oxygen (mg/l) (000011)	10.0
Turbidity (JTU) (000012)	9
Color (Pt-Co Unit) (000013)	9
Specific Conductance (Micro-mhos/cm) (000014)	196
Dissolved Oxygen (mg/l) (000015)	10.0
Percent Saturation (000016)	90
Biological Oxygen Demand 5-Day (mg/l) (000017)	1.5
pH (Unit) (000018)	7.4
Carbon Dioxide (CO ₂) (mg/l) (000019)	6.8
Alkalinity as CaCO ₃ (mg/l) (000020)	86
Total Inorganic Carbon (mg/l) (000021)	21
Total Carbon (C) (mg/l) (000022)	29
Hardness (Ca+Mg) (mg/l) (000023)	87
Non-Carbonate Hardness (mg/l) (000024)	9
Dissolved Calcium (Ca) (mg/l) (000025)	31
Dissolved Magnesium (Mg) (mg/l) (000026)	2.4
Dissolved Sodium (Na) (mg/l) (000027)	3.6
Sodium Chloride (mg/l) (000028)	2
Percent Sodium (000029)	4
Dissolved Potassium (K) (mg/l) (000030)	4
Dissolved Chloride (Cl) (mg/l) (000031)	5.8
Suspended Solids (mg/l) (000032)	0
Total Solids (mg/l) (000033)	0
Dissolved Cobalt (Co) (mg/l) (000034)	0
Suspended Cobalt (Co) (mg/l) (000035)	0
Total Cobalt (Co) (mg/l) (000036)	0
Dissolved Copper (Cu) (mg/l) (000037)	0
Suspended Copper (Cu) (mg/l) (000038)	7
Total Copper (Cu) (mg/l) (000039)	7
Total Iron (Fe) (mg/l) (000040)	350
Dissolved Iron (Fe) (mg/l) (000041)	90

EXPLANATION

(Monitoring-station program by category of sampling station as of April 1976.)

- 7 Areal assessment
- 2 Eutrophic condition assessment
- 1 Hydrologic benchmark
- 3 Long-term trend
- 4 Water quality accounting

(Number refers to the number of stations in each category currently being sampled.)

0 10 20 30 40 50 MILES