Evaluation of Chemical Data from Selected Sites in the Surface-Water Ambient Monitoring Program (SWAMP) in Florida

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CONTENTS

Figures

Tables

Conversion Factors, Abbreviations, and Acronyms

Multiply	By	To obtain
meter (m)	3.28	foot
kilometer (km)	0.62	mile

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 ˚C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

ANSCRAT = ratio of anions (in milliequivalents) to specific conductance (in microsiemens per liter)
CBE = ionic charge balance error
CATSCRAT = ratio of cations (in milliequivalents) to specific conductance (in microsiemens per liter)
DSSCRAT = ratio of dissolved solids (in milligrams per liter) to specific conductance (in microsiemens per liter)
FDEP = Florida Department of Environmental Protection
STORET = STOrage and RETreival data base maintained by the USEPA
SWAMP = Surface-Water Ambient Monitoring Program
USEPA = U.S. Environmental Protection Agency
USGS = U.S. Geological Survey
< = less than
> = greater than
µm = micron

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Abstract

A cooperative study between the Florida Department of Environmental Protection (FDEP) and the U.S. Geological Survey was conducted to assess the integrity of selected water-quality data collected at 150 sites in the FDEP Surface-Water Ambient Monitoring Program (SWAMP) in Florida. The assessment included determining the consistency of the water-quality data collected statewide, including commonality of monitoring procedures and analytes, screening of the gross validity of a chemical analysis, and quality assurance and quality control (QA/QC) procedures. Four tests were used to screen data at selected SWAMP sites to estimate the gross validity of selected chemical data: (1) the ratio of dissolved solids (in milligrams per liter) to specific conductance (in microsiemens per centimeter); (2) the ratio of total cations (in milliequivalents per liter) multiplied by 100 to specific conductance (in microsiemens per centimeter); (3) the ratio of total anions (in milliequivalents per liter) multiplied by 100 to specific conductance (in microsiemens per centimeter); and (4) the ionic charge-balance error. Although the results of the four screening tests indicate that the chemical data generally are quite reliable, the extremely small number of samples (less than 5 percent of the total number of samples) with sufficient chemical information to run the tests may not provide a representative indication of the analytical accuracy of all laboratories in the program. In addition to the four screening tests, unusually low or high values were flagged for field and laboratory pH (less than 4.0 and greater than 9.0) and specific conductance (less than 10 and greater than 10,000 microsiemens per centimeter). The numbers of flagged data were less than 1 percent of the 19,937 water samples with pH values and less than 0.6 percent of the 16,553 water samples with specific conductance values.

Thirty-four agencies responded to a detailed questionnaire that was sent to more than 60 agencies involved in the collection and analysis of surface-water-quality data for SWAMP. The purpose of the survey was to evaluate quality assurance methods and consistency of methods statewide. Information was compiled and summarized on monitoring network design, data review and upload procedures, laboratory and field sampling methods, and data practices. Currently, most agencies that responded to the survey follow FDEP-approved QA/QC protocol for sampling and have quality assurance practices for recording and reporting data. Also, most agencies responded that calibration procedures were followed in the laboratory for analysis of data, but no responses were given about the specific procedures. Approximately 50 percent of the respondents indicated that laboratory analysis methods have changed over time.

With so many laboratories involved in analyzing samples for SWAMP, it is difficult to compare water quality from one site to another due to different reporting conventions for chemical constituents and different analytical methods over time. Most agencies responded that calibration methods are followed in the field, but no specific details were provided. Grab samples are the most common method of collection.

Other data screening procedures are necessary to further evaluate the validity of chemical data collected at SWAMP sites. High variability in the concentration of targeted constituents may signal analytical problems, but more likely changes in concentration are related to hydrologic conditions. This underscores the need for accurate measurements of discharge, lake stage, tidal stage at the time of sampling so that changes in constituent concentrations can be properly evaluated and fluxes (loads) of nutrients or metals, for example, can be calculated and compared over time.

INTRODUCTION

The Surface-Water Ambient Monitoring Program (SWAMP) in Florida is composed of more than 40 Federal, State, and local agencies that collect water samples at more than 4,500 sites. The Florida Department of Environmental Protection (FDEP) established a network, in 1992, of approximately 430 fixed sampling stations, which consists of a subset of 285 sites from SWAMP (streams, lakes, and estuaries), to determine if surface-water quality is changing over time and to target waterbodies with degrading water quality. This trend network is hereafter referred to as the SWAMP network. Agencies in the program have used different procedures to collect and preserve water samples. Also, water samples have been analyzed by numerous laboratories during the program. Analytical methodologies, detection limits, and reporting conventions have not always been consistent among laboratories and have likely changed over time. Water-quality data from SWAMP are stored in the U.S. Environmental Protection Agency (USEPA) STORET (STOrage and RETrieval) data base and typically are not reviewed for (1) consistency of analytes over time at a given site or among sites, (2) quality assurance procedures (such as use of reference samples, analysis of replicate samples), or (3) the validity of the chemical analysis for each water sample.

One of the main goals of the SWAMP network in Florida is to provide technically-sound information on water quality in Florida in a cost-effective manner. Other objectives of the program are to (1) establish a permanent statewide network of sites that can be used to evaluate trends in the quality of surface water, (2) compare the quality of surface water from one basin to another, and (3) relate any differences in water quality to environmental variables, such as the predominant type of land-use in a basin, hydrology, geology, streamflow, interactions with ground water, and other basin characteristics. To be able to address these goals, the chemical validity of existing water-quality data should be assessed so that statistically significant trends can be determined or detected for selected chemical constituents. If trends are present, then factors affecting those trends can be evaluated.

Purpose and Scope

The purpose of this report is to evaluate the integrity of existing water-quality data and to provide information that will help to improve the quality of SWAMP data collected at fixed-site stations. Completion of these tasks includes evaluating the consistency of the data statewide in terms of commonality of monitoring procedures and analytes, screening of the gross validity of each analysis, and quality assurance and quality control procedures. This information is essential before decisions are made for future monitoring programs that include analysis of the data for spatial, temporal, and analyte considerations.

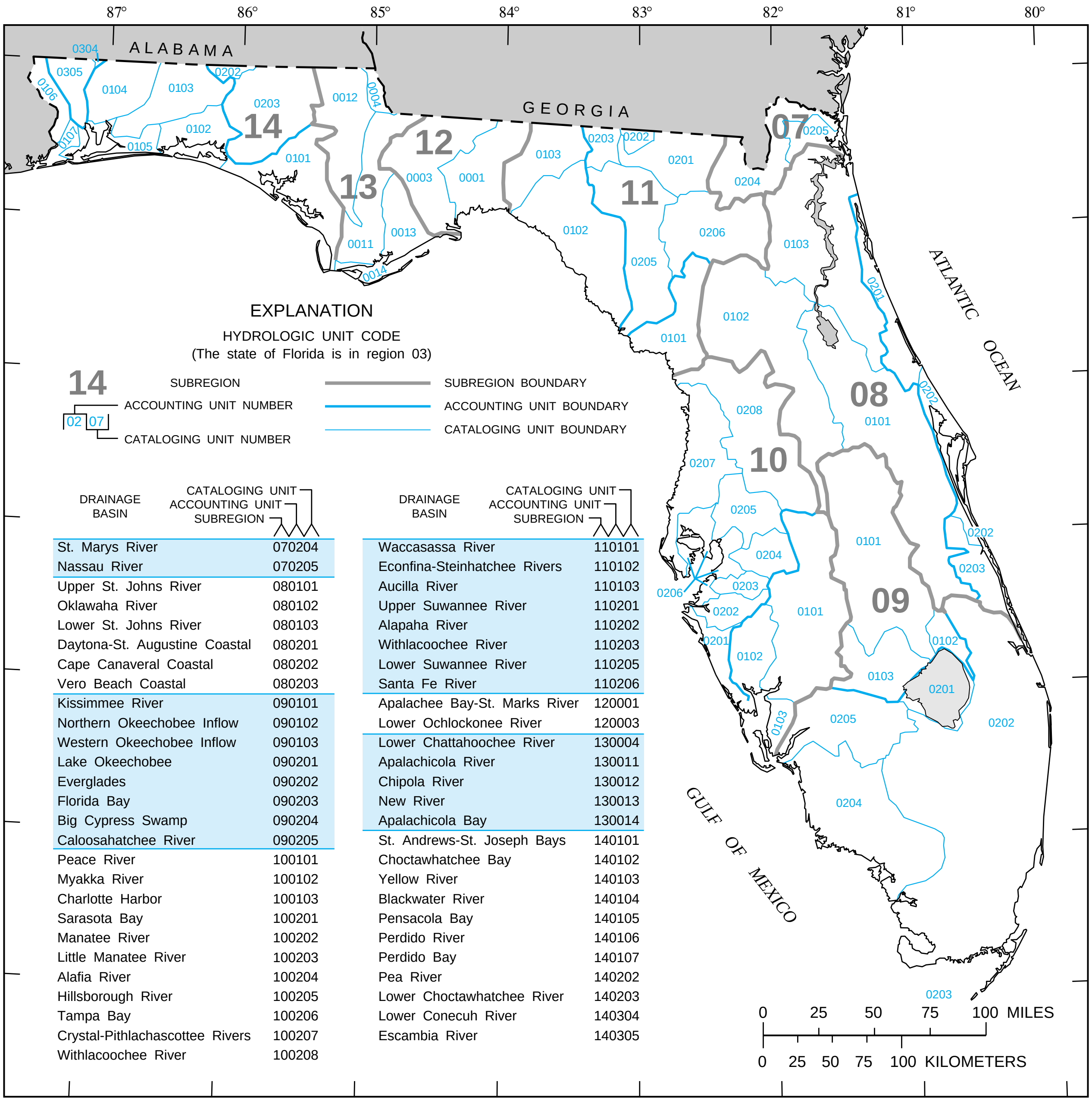
Chemical data from a subset of 150 sites were retrieved and reviewed from the approximately 430 fixed-sampling stations in the statewide SWAMP network. This subset of sites was used for the evaluation because the short duration of the study did not provide a sufficient amount of time for retrieval and analysis of water-quality data from all sites. The sites selected for retrieval are believed to be representative of the entire SWAMP network and were chosen to be evenly distributed geographically throughout the major basins of the State.

METHODS

SWAMP sites were grouped by location in hydrologic subregions of the State. Hydrologic Unit Maps were developed by the U.S. Geological Survey (USGS) (Seaber and others, 1984). These hydrologic units in Florida, which are shown in figure 1, include subregions and their subdivisions of accounting units and cataloging units that represent distinct hydrologic basins. The 53 hydrologic unit codes in Florida correspond to distinct surface water drainage basins and have been used to help delineate the FDEP's ecosystem management area boundaries.

SWAMP Data Retrieval

Approximately 80 chemical constituents and water-quality characteristics (table 1) were selected for retrieval for the 150 sites from the EPA STORET data base (where most water-quality data collected by SWAMP reside). Chemical data were retrieved from STORET by the FDEP (P. Hansard, FDEP, oral commun., 1997), reformatted and entered into a statistical analysis package by the USGS for each SWAMP site. Programs were written to evaluate the gross chemical validity of the water-quality data collected by SWAMP and to statistically summarize selected water-quality constituents by surface-water drainage basin.



DRAINAGE BASIN	CATALOGING UNIT / ACCOUNTING UNIT / SUBREGION
St. Marys River	070204
Nassau River	070205
Upper St. Johns River	080101
Oklawaha River	080102
Lower St. Johns River	080103
Daytona-St. Augustine Coastal	080201
Cape Canaveral Coastal	080202
Vero Beach Coastal	080203
Kissimmee River	090101
Northern Okeechobee Inflow	090102
Western Okeechobee Inflow	090103
Lake Okeechobee	090201
Everglades	090202
Florida Bay	090203
Big Cypress Swamp	090204
Caloosahatchee River	090205
Peace River	100101
Myakka River	100102
Charlotte Harbor	100103
Sarasota Bay	100201
Manatee River	100202
Little Manatee River	100203
Alafia River	100204
Hillsborough River	100205
Tampa Bay	100206
Crystal-Pithlachascottee Rivers	100207
Withlacoochee River	100208

DRAINAGE BASIN	CATALOGING UNIT / ACCOUNTING UNIT / SUBREGION
Waccasassa River	110101
Econfina-Steinhatchee Rivers	110102
Aucilla River	110103
Upper Suwannee River	110201
Alapaha River	110202
Withlacoochee River	110203
Lower Suwannee River	110205
Santa Fe River	110206
Apalachee Bay-St. Marks River	120001
Lower Ochlockonee River	120003
Lower Chattahoochee River	130004
Apalachicola River	130011
Chipola River	130012
New River	130013
Apalachicola Bay	130014
St. Andrews-St. Joseph Bays	140101
Choctawhatchee Bay	140102
Yellow River	140103
Blackwater River	140104
Pensacola Bay	140105
Perdido River	140106
Perdido Bay	140107
Pea River	140202
Lower Choctawhatchee River	140203
Lower Conecuh River	140304
Escambia River	140305

Figure 1. Hydrologic unit codes for Florida.

When preliminary retrievals of chemical data were made from STORET for selected sites, it was observed that water samples were often collected at several additional stations at or near a main station (in most cases, each site has a designated primary station). A SWAMP site is composed of one primary sampling station or a group of nonprimary sampling stations. In some instances, the additional stations sampled may have the same locational information (latitude and longitude) as the primary station but have different station identification and/or a different station name. To ensure that all water-quality data for a station were included, data were retrieved from STORET from an area that included the primary station and all sites within a 500-m radius of the primary station. Originally a 5-km radius was used for retrievals from STORET (Ceric and others, 1996); however, too much extraneous data were retrieved. Therefore, surface-water-quality data presented in this report are from a SWAMP site that in most cases includes the primary sampling station, but may include water-quality data from several other nearby sampling (nonprimary) stations. For each SWAMP site, the number of analyses were tabulated for each primary station and for one or more other sites, if sampled.

In addition to retrieving water-quality data for the 150 sites, all surface-water-quality data were retrieved from STORET for the St. Marks River Basin, which is shown in subregion 12 (accounting unit 00, cataloging unit 01) in figure 1 . These data were retrieved to coincide with an ongoing ecosystem management assessment of the St. Marks River Basin. Approximately 4,600 samples were collected from more than 270 sites in the basin.

Chemical Screening of Data

Where sufficient chemical data were available for a water sample from a surface-water site, four screening tests were used to evaluate the gross validity of chemical data (Hem, 1985):

(1) Ionic charge-balance error (CBE). When all the major cations (such as Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}) and anions (such as Cl^{-}, SO_4^{2-}, and HCO_3^{-}) have been analyzed carefully, the sum of cations in equivalents should equal the sum of anions in equivalents. For waters in which the sum of cations plus anions is approximately 250 to 1,000 mg/L, the difference between the two sums should typically not exceed 1 or 2 percent of the sum of cations and anions. For very dilute waters, such as rainfall or low-ionic strength (low dissolved solids) surface water, a larger charge balance error can be expected, typically $\pm$10 percent but it can be as high as $\pm$30 percent for samples with dissolved-solids concentrations less than 100 mg/L. Dissolved solids include charged and uncharged chemical species that are operationally defined as material that passes through a 0.45-µm filter. For waters with dissolved-solids concentrations much greater than 1,000 mg/L, the test of CBE only evaluates the accuracy of the constituents that have large concentrations. The CBE will have a positive value when the sum of cations exceeds the sum of anions, and have a negative value when the sum of anions is greater than the sum of cations.

(2) Ratio of dissolved-solids concentrations (in milligrams per liter) to specific conductance (in microsiemens per centimeter), DSSCRAT, generally ranges from 0.55 to 0.75 for waters with dissolved-solids concentrations less than about 3,000 mg/L. Surface waters with high bicarbonate or chloride concentrations tend to have ratios near the low end of the range; whereas waters high in sulfate may have DSSCRAT values near 0.75 or higher (Hem, 1985). Waters that contain high concentrations of silica or that are saturated with respect to gypsum may have DSSCRAT values as high as 1.0. For very dilute waters, the relation between dissolved solids and specific conductance becomes less well defined (Hem, 1985).

(3) The ratio of total cations (in milliequivalents per liter) multiplied by 100 to specific conductance (in microsiemens per centimeter), CATSCRAT, should be about 1.0, $\pm$0.2. Hem (1985) notes that this relation is not exact, but tends to be less variable than the relation between specific conductance and dissolved solids (in milligrams per liter).

(4) The ratio of total anions (in milliequivalents per liter) multiplied by 100 to specific conductance (in microsiemens per centimeter), ANSCRAT, should be close to 1.0, $\pm$0.2. Also, this relation may not be exact but does provide an indication of the relative accuracy of anion analyses and would reveal major transcription errors in specific-conductance values.

Other basic screening procedures were used to evaluate transcription errors and/or analytical errors. These procedures included flagging pH values that were reported as less than 4.0 and greater than 9.0 and specific conductance values that were reported as less than 10 and greater than 10,000 µS/cm. Gross-validity tests and screening programs are summarized by subregion.

Evaluation of Consistency of Sampling and Analytical Methods

A detailed questionnaire was prepared and sent to more than 60 agencies involved in collecting surface-water-quality data for SWAMP (see appendix). The purpose of this survey was to gather information and to evaluate quality assurance methods and consistency of methods statewide. Information was compiled and summarized on monitoring network design, laboratory and field sampling methods, data review, and procedures of loading data into STORET, and data practices. Additional information obtained from the questionnaire included: (1) consistency of sampling methods, analytical methods, and detection limits for chemical constituents, (2) the use of quality assurance samples such as reference samples, replicates, and blanks, (3) the frequency of manual and (or) computer assisted review of analytical results, (4) the ability to request reruns from the laboratory if chemical data are questionable or fail certain criteria, (5) identification of basins where chemical and hydrologic data are insufficient for analysis of water-quality trends, and (6) the accessiblity of the water-quality data to water-resource managers and other interested stakeholders.

RESULTS

The locations of selected SWAMP sites where water-quality data were retrieved are shown in figure 2 with respect to hydrologic subregion and basin number. There were an insufficient number of data for sites in two subregions; therefore, sites in subregion 07 (St. Mary's River and Nassau River Basins) were combined with those in subregion 08 (St. Johns River) and sites in subregion 13 (Appalachicola River Basin) were combined with basins in subregion 14 (Escambia River to St. Andrews-St. Joseph Bays). Site names, station numbers, and site information are listed in table 2. SWAMP site numbers grouped by basin number in table 2 are provided for cross referencing with figure 2.

The total number of samples collected at the selected SWAMP sites (fig. 1) are listed in table 3. Each sample refers to an entry in STORET that has an associated unique date and time. This may include field measurements or laboratory analyses, or both, for a water sample for selected analytes. The total number of samples represents the sum of samples collected at a given site for one or more water types (stream, canal, lake, estuary, or spring). Most SWAMP sites have a designated primary station (table 3); however, a site may have one or more stations sampled other than a primary station (within a 0.5-km radius of the primary station). The total number of stations at a given site is listed by station identification number and locational information (latitude and longitude) in table 3. If a particular SWAMP site has one or more stations, the total number of samples in table 3 may not be the same as the number of samples for the designated primary station. In those cases, table 3 lists the number of samples collected at the designated primary station and the number of samples collected at one or more stations that have the same locational information (latitude and longitude) as the designated primary station. Making the situation even more complicated is the fact that the additional sampled stations may have different station identification numbers, station names, or both. The number of samples collected at selected SWAMP sites was quite variable, ranging from no data at several sites to 11,004 at site 13 in basin 1 (table 3).

In contrast to the aforementioned primary and additional stations (within a 0.5-km radius of the primary station) sampled at a particular SWAMP site, all surface-water sites that have water-quality data in STORET for the St. Marks River Basin (basin 3, fig. 2) are listed in table 4. A total of 4,591 samples were collected from approximately 270 sites in the basin (table 4).

Chemical Screening Tests

Four tests were used to screen data at selected SWAMP sites to estimate the gross validity (a measure of analytical accuracy) of selected chemical data: CBE, DSSCRAT, CATSCRAT, and ANSCRAT. Only a small percentage of samples from each basin (fig. 2), typically less than 5 percent, had sufficient chemical data to run these four chemical screening tests. For example, in basin 2, out of the 218 samples collected, there were no samples that contained sufficient chemical data to perform any of the screening tests. In contrast, in basin 4, 4.1 and 4.2 percent of samples had sufficient chemical data (dissolved solids, specific conductance, and major cations) to run DSSCRAT and CATSCRAT screening tests, respectively (table 5).

The median DSSCRAT value for water samples from all basins with samples containing data for dissolved solids and specific conductance was 0.57 (table 6), which falls near the low end of the typical range of 0.55 to 0.75 for surface waters (Hem, 1985). This may result from surface waters that have chloride

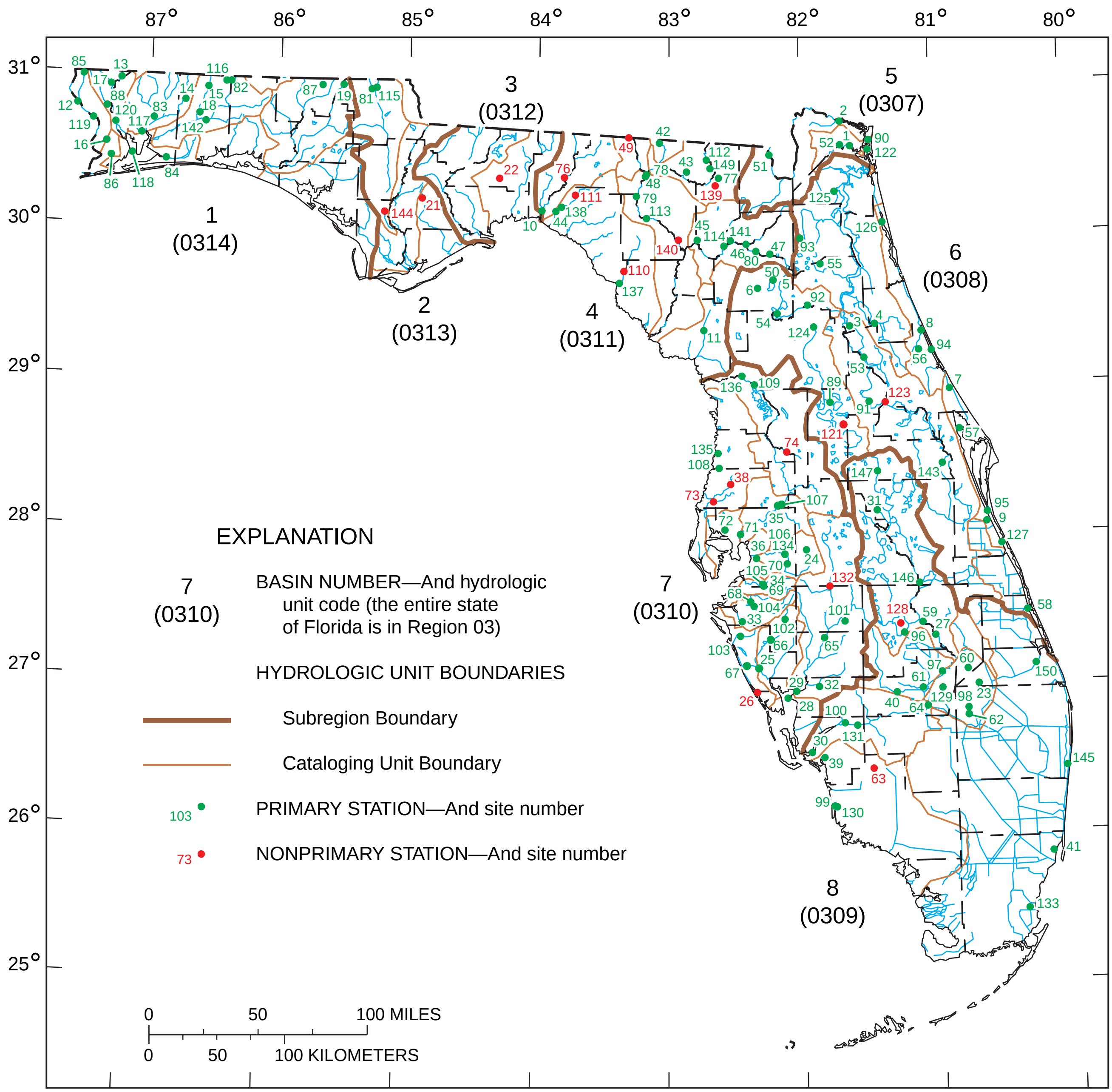


Figure 2. Boundaries of surface-water basins in Florida, and site numbers of selected SWAMP stations where water-quality data were retrieved.

or bicarbonate as their major anion (Hem, 1985). There were small differences in median DSSCRAT by basin, with values of 0.55 for water samples from basin 5 and 0.62 for samples from basin 1. However, large differences were found for mean DSSCRAT values by basin, with values ranging from 0.57 for water samples from basin 3 to 5.45 for basin 8. The anomalously high DSSCRAT values indicate that errors likely were made in reporting specific conductance, or possibly errors were made in the measurement or reporting of these two parameters by the laboratory.

The distribution of DSSCRAT values is shown in a box and whisker plot for each basin (fig. 3) For all basins, 80 percent of the DSSCRAT values (data that fall within the 10th and 90th percentiles) fall within the 0.55 to 0.75 range, indicating the likelihood that specific conductance and dissolved solids determinations were reliable and very few reporting or transcription errors occurred. DSSCRAT values tend to be more useful for screening data at a particular site over time because a rather tightly defined relation can be defined between dissolved solids and specific conduc-

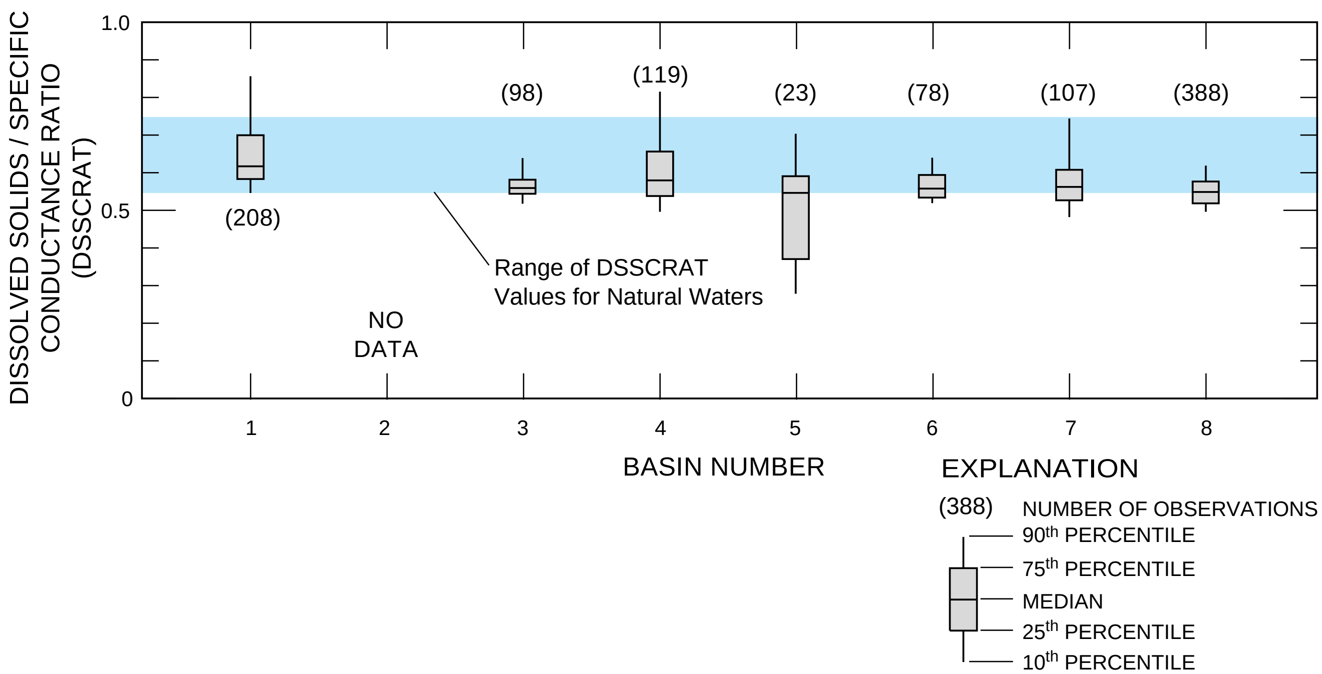


Figure 3. Ratio of dissolved solids to specific conductance for water samples collected at SWAMP stations.

tance with repeated samples at that site. The use of DSSCRAT is not as precise a screening tool for waters that are in contact with different lithologies and have varying proportions of ground-water inflow, such as in Florida.

Median values of CATSCRAT (0.98) and ANSCRAT (0.86) for water samples from all basins were well within the range of acceptable error for these ratios, 1.0 $\pm$ 0.2 (table 6). Cations (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, NH_4^{+}) were much more commonly analyzed in surface-water samples than major anions (Cl^{-}, HCO^{-}_3, F^{-}, SO_4^{2-}), thus 1,528 CATSCRAT analyses were done compared to 146 for ANSCRAT. As was the case with DSSCRAT values, there were large differences in mean CATSCRAT values by basin, ranging from 0.85 to 8.76; the high mean values most likely resulting from either incorrect values reported for the sum of cations or values of specific conductance that were measured or reported too low. In contrast, mean values of ANSCRAT did not vary as much from one basin to another, ranging from 0.76 to 0.99. This range is well within the allowable range of error. The distribution of CATSCRAT and ANSCRAT values are shown in boxplots for each basin in figures 4 and 5. A very tight distribution of CATSCRAT values is observed for surface-water samples from sites in basins 1, 3, 6, 7, and 8; whereas wider ranges in values are noted for surface-water samples from basins 4 and 5 (fig. 4). In basin 5, the wide range in CATSCRAT values may result from surface water containing high dissolved-solids concentrations (Hem, 1985), and a greater chance for analytical error. Sufficient chemical data were present to calculate ANSCRAT values for basins 1, 3, 4, and 8, and fairly tight distributions of ANSCRAT values were observed (fig. 5).

For all basins, the number of samples that had sufficient chemical data for major cations and anions that allowed the calculation of the ionic charge-balance error was equal to 146; the number of samples where ANSCRAT values were calculated (table 6). The median CBE value for water samples from all basins is 5.98 percent, indicating that analytical accuracy is quite good overall. Median values do vary considerably by basin, with values ranging from 4.34 percent for samples from basin 8 to 13.4 percent for samples from basin 6 (table 6).

The paucity of negative values for CBE indicates that analyses for one or more anionic species (for example organic anions) are probably being omitted. Water samples from blackwater streams that contain elevated concentrations of tannic acid commonly have organic anions that form complexes with metals, and the usual analytical procedures do not measure these

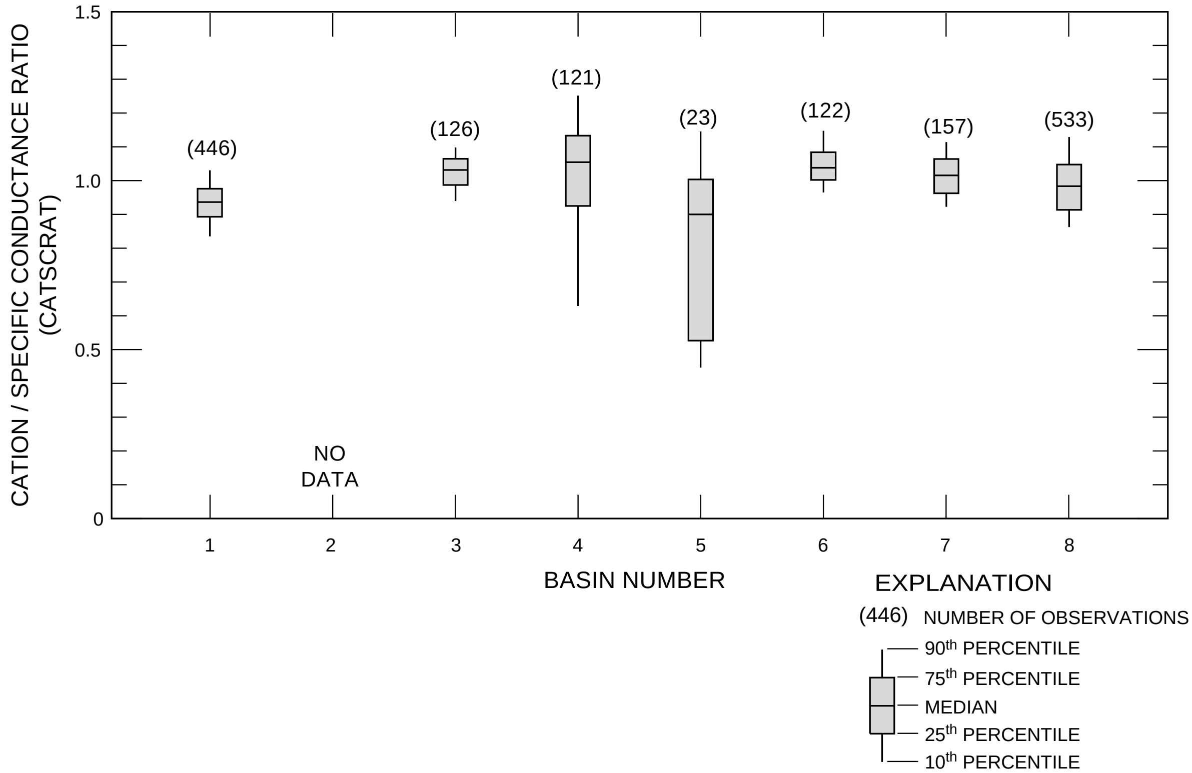


Figure 4. Ratio of cations to specific conductance for water samples collected at SWAMP stations.

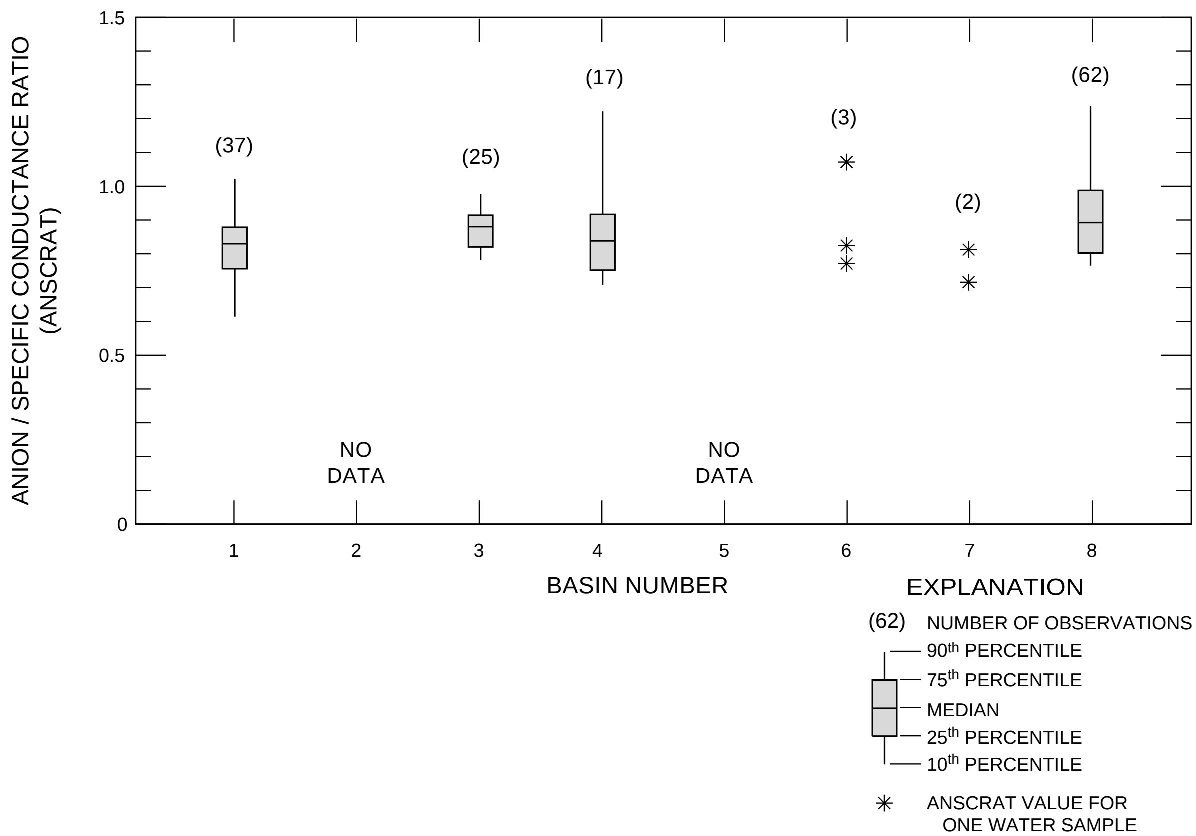


Figure 5. Ratio of anions to specific conductance for water samples collected at SWAMP stations.

organic anions (Hem, 1985). In these waters, there tends to be a positive bias in the CBE indicating that these organic anions have not been analyzed and, therefore, are not included in the sum of anions for the charge-balance calculation. Another factor that may contribute to positive bias in these samples is related to the methods of sample collection. If water samples are not filtered in the field and samples for cation analysis are acidified, suspended particles may be brought into solution and elevated concentrations of cations may result. Due to limited resources, no attempts were made to separate out filtered versus unfiltered water samples in the retrieved data.

Values of CBE were plotted against sample collection date (fig. 6) to determine if there was any bias over time in analytical procedures for determination of major ions. Sufficient chemical data to calculate CBE values were available for only two samples prior to 1974, but a positive bias in CBE values can be seen throughout the entire period of record, 1960 to 1990 (fig. 6). Also worth noting is that three samples from basin 4, which includes the Suwannee River Basin in Florida, have negative values for CBE. These values, which fall outside of the typical CBE range for acceptable analytical results, may result from the occurrence of very dilute waters in this basin. Commonly, a larger percentage error is found for surface waters where the total of anions and cations is less than about 5.0 milliequivalents per liter (Hem, 1985).

There are several important limitations that need to be noted regarding the use of these four screening tests for assessing validity of chemical analyses. First, if a laboratory consistently provides poor results, the analytical results could still be precise but not accurate. This may not be indicated by large charge-balance errors; compensating errors can go unnoticed and large errors in the determination of minor constituents may not be detected. Second, the only effective way to determine the accuracy of laboratory analytical data is by evaluating the laboratory's quality assurance

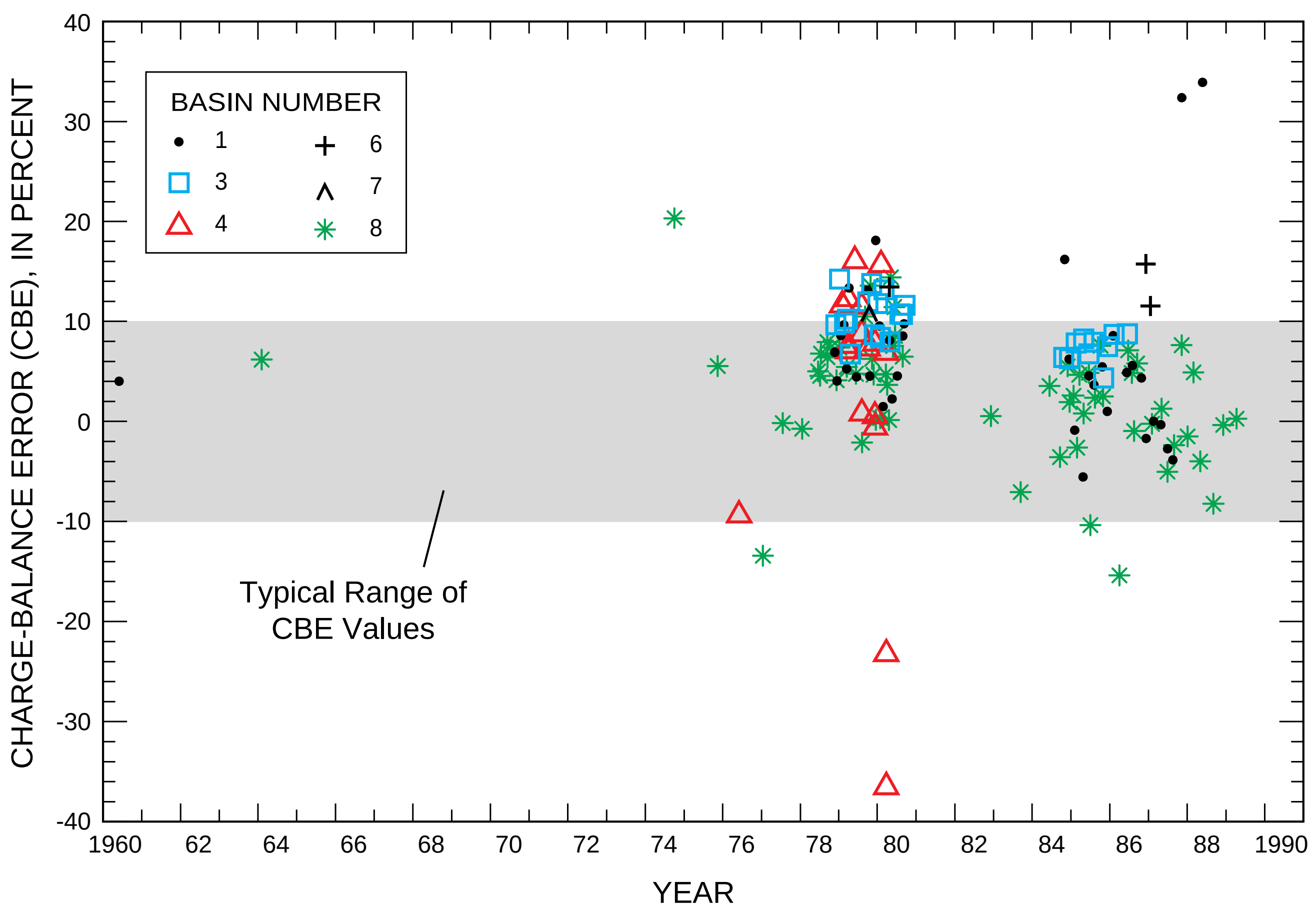


Figure 6. Charge-balance error for water samples collected at SWAMP stations.

records. Obtaining laboratory quality assurance and quality control (QA/QC) information for all SWAMP sites would be a monumental task, given the number of laboratories involved in SWAMP over time. Third, the extremely small number of samples (less than 5 percent of the total) with sufficient chemical information to run the four screening tests may not provide a representative indication of the analytical accuracy of all laboratories in the program. Obviously, other data screening procedures are necessary to further evaluate the validity of chemical data.

In addition to the four screening tests, unusual data values were flagged for field and laboratory pH (< 4.0 and > 9.0) and specific conductance (< 10 and > 10,000 uS/cm). For the entire retrieved data set, there were very few samples that had flagged values of pH or specific conductance (table 7). For the 34,559 total number of water samples from the 150 retrieved SWAMP sites, there was a total of 19,937 pH values and 16,553 specific conductance values. Of the 19,937 water samples with pH values, only 76 (0.4 percent) and 9 (0.03 percent) samples for field and laboratory pH, respectively, had values less than 4 or greater than 9. Of the 16,553 water samples with specific conductance values, only 103 (0.6 percent) and 82 (0.5 percent) samples had field and laboratory specific conductance values, respectively, that were less than 10 or greater than 10,000 μS/cm (table 7).

For future screening of chemical data from selected SWAMP sites, it would be beneficial to determine if there are unusual concentration relations among major cations or anions. For example, analyses could be screened for higher concentrations of potassium than sodium, or higher measured dissolved-solids concentrations than the sum of cations and anions in milligrams per liter. A most effective way of screening for anomalous concentrations is to plot the data against time. High variability could signal analytical problems, but more likely indicate that hydrologic conditions are changing or are variable. This underscores the need for accurate measurements of discharge, lake stage, and gage height at the time of sampling so that changes in constituent concentrations can be properly evaluated so that fluxes (loads) of nutrients or metals can be calculated and compared over time.

Consistency of Sampling and Analytical Methods

A total of 34 agencies responded to the questionnaire (app. I) designed to evaluate quality assurance methods and consistency of methods statewide. Summarized in this section are the responses to questions from the survey regarding four main areas: (1) QA/QC protocols regarding accuracy, precision, and representativeness of collected samples, (2) method of collection of data in the field, and (3) laboratory analytical methods, and (4) collection of flow data (table 8).

The majority of those agencies responding to the questionnaire indicated that steps were taken to insure accuracy, precision, comparability, and representativeness of water samples collected at SWAMP stations. Twenty-seven agencies (out of 34 total) responded that they follow the FDEP-approved QA/QC protocol for sampling. Also, a high number of agencies also responded positively to having quality assurance practices for recording data (28) and for reporting data (23). However, when asked what quality assurance practices were used for recording and reporting data, the majority of agencies (30) did not respond. There was also a low rate of response to questions regarding qualification of data at the station and sample level and for making provisions for informing users of the quality of the data.

In terms of data collection methods in the field, 30 respondents indicated that they measure field parameters, but there were no responses to questions about the list of parameters, methods of analysis, and reporting units. Most agencies (28) responded that calibration methods are followed in the field, but none responded to the question about what these methods actually are. Eleven and 13 agencies indicated that calibration methods are stored and recorded, respectively, but 19 agencies did not respond to the query about calibration methods being stored and recorded. Respondents indicated that most water samples are grab samples that are collected at individual points in the surface-water body. However, 10 agencies responded that their samples are depth or width-integrated and composited. When asked for information on how the samples were composited there was no response from 33 agencies.

Concerning the issue of laboratory analytical methods, most of the respondents (26) indicated that calibration procedures were followed in the laboratory for analysis of data, but no responses were given about the specific procedures. Approximately 50 percent of the respondents indicated that laboratory analysis methods have changed over time, but almost all agencies (32 out of 34) did not respond to the question asking if steps were taken to insure that the changes in laboratory methods did not impair data comparability. Most agencies (24-25) were able to provide a list of analytes with detection limits and laboratory reporting units for analytical methods.

Although the collection of flow data at SWAMP sites is not specifically a QA/QC issue, the importance of flow data in conjunction with water-quality samples takes on considerable importance now in terms of the estimation of total maximum daily loads. The majority of respondents indicated that gage height (22) and discharge (18) were not measured during collection of water-quality samples. Also, 17 agencies indicated that tidal stages were not being recorded for the collection of estuary samples.

The importance of collecting hydrologic data (streamflow, lake stage, freshwater inflow to estuaries, tidal stages) for interpreting and evaluating loads and trends in water quality of lakes, streams, and estuaries cannot be overstated. Nutrient loads and trends cannot be determined without hydrologic information. Seasonal variations of water chemistry in streams typically are related to changes in streamflow. For example, the concentration of nitrate in water samples from the Suwannee River, along the middle reach of the river from Dowling Park to Branford, Fla., is inversely related to discharge (Hornsby and Mattson, 1996). During low-flow conditions, nitrate concentrations in the Suwannee River are considerably higher than during high-flow conditions. This finding, along with the absence of any major stream inputs to the middle Suwannee River, indicates that ground water contributes most of the nitrogen load to the Suwannee River along this middle reach (Pittman and others, 1997). Also, climatic variables that cause changes in lake stage and salinity changes in estuaries affect the concentration of chemical species in these water bodies. In most areas of Florida, the degree of interaction between surface-water and ground-water systems also controls nutrient loading to and the fate of contaminants in surface water bodies.

The combination of information on discharge at selected SWAMP stations along with reliable and chemically valid data on nutrients and other constituents of ecological concern, is critical for evaluating variability in concentrations of these constituents over time. If concentrations of a particular analyte vary dramatically over time or show an increase or decrease over the period of record, without hydrologic data, it cannot be determined if these changes result primarily from variable hydrologic conditions, such as discharge fluctuations. At stations where surface-water flow data and chemical data exist, plots of constituent concentrations against discharge would provide important information about their relation over time and seasonal variations. This type of comparison would provide a greater measure of uncertainty when calculating a water-quality index for a stream or lake, or when estimating total maximum daily loads for a designated stream segment.

Choquette and others (1997) discuss how changes in streamflow affect water quality and the importance of knowing trends in streamflow to be able to evaluate concurrent trends in stream- water quality in the SWAMP network. They found that 71 sites in the trend network are located at active USGS gaging stations, and an additional 60 sites are located near active USGS gaging stations (as of 1996). Choquette and others (1997) also present methods that can be used to estimate instantaneous or daily mean streamflow at the SWAMP network trend sites from USGS gaged sites that coincide with water-quality sampling. The selection of an optimal method is dependent on several factors including the availability of discharge information near the SWAMP site, the needed accuracy of the estimates, the range of discharge values at the site, the correlation between target discharges at the gaged and ungaged sites, and the characteristics of the surface-water basin (Choquette and others, 1997).

Additional Inconsistencies with Retrieved Data

Several problems were observed when locational information for SWAMP sites (retrieved latitude and longitude information for sampled stations) were plotted for each site using a geographical information system (GIS) program. A number of problems that occurred fairly frequently included: (1) the site or station did not plot near a body of water when compared to USGS 1:24,000 topographic maps (using the latitude and longitude data that were retrieved from STORET), (2) the site or station plotted near a body of water but not on it, (3) primary and nonprimary stations plotted on the incorrect body of water, (4) some sites with identical location information had different station identification numbers and or station names. For example, sites 5 and 50 have identical latitude and longitude information and station numbers (table 3); however, in STORET site 5 is named Hatchet Creek near Gainesville and site 50 is named Spruce Creek near Samsula. Another example is site 52 where there are one or more sites with identical latitude and longitude, but have station names indicating two different water bodies.

Missing data were another commonly encountered problem with retrievals from STORET. There were no water-quality data retrieved from STORET for seven SWAMP sites: 20, 21, 22, 26, 37, 75, and 148 (table 3, fig. 1). It is assumed that water-quality data were not entered for these sites; however, without intensive investigation, other data-base problems cannot be ruled out. For example, retrievals would not be possible if incorrect latitude and longitude data were stored in STORET. Also, if values for latitude and longitude did not match those stored in STORET a complete set of data would not be retrieved.

Other water-quality data missing from some of the retrievals included samples collected by other agencies, such as the USGS. Water-quality data for most NASQAN stations or other USGS surface-water-quality sites were not present in the retrieved data. For example, the USGS NASQAN station name, Escambia River near Century, appears in the retrieved data set, but there are no water-quality data included. These data should have been transferred to STORET from the USGS data base. These data are either not in STORET or were not retrieved by the FDEP. Time did not permit further checking to determine if water-quality data from other NASQAN stations from other parts of the State were not in the data base.

SUMMARY AND CONCLUSIONS

A cooperative study between the Florida Department of Environmental Protection (FDEP) and the U.S. Geological Survey has evaluated the integrity of selected water-quality data collected at 150 sites in the Surface-Water Ambient Monitoring Program (SWAMP) in Florida. The assessment included determining the consistency of the data statewide in terms of commonality of monitoring procedures and analytes, screening of the gross validity of chemical analyses, and quality assurance and quality control procedures. Knowledge about the integrity of historical chemical data is essential to be able to determine trends in surface-water quality over time, to target waterbodies of degrading water quality, and to make recommendations for improving future monitoring network designs that include spatial, temporal, and analyte considerations.

Chemical data from a subset of 150 sites were retrieved from the U.S. Environmental Protection Agency (USEPA) STORET (STOrage and RETrieval) data base and reviewed from the approximately 430 fixed-sampling stations (streams, lakes, and estuaries) in the statewide SWAMP network that was established in 1992 by the FDEP. SWAMP is composed of more 40 Federal, State, and local agencies that collect water samples at more than 4,500 sites. The sites selected for retrieval of surface-water-quality data are probably representative of sites in the complete SWAMP network and were chosen to be evenly distributed geographically in the major surface-water basins of the State.

Four tests were used to screen surface-water-quality data from selected SWAMP sites to estimate the gross validity (a measure of analytical accuracy) of selected chemical data. These tests included: (1) the ratio of dissolved solids (in milligrams per liter) to specific conductance (in microsiemens per centimeter), DSSCRAT; (2) the ratio of total cations (in milliequivalents per liter) multiplied by 100 to specific conductance (in microsiemens per centimeter), CATSCRAT; (3) the ratio of total anions (in milliequivalents per liter) multiplied by 100 to specific conductance (in microsiemens per centimeter), ANSCRAT; and (4) the ionic charge-balance error, CBE. Although the results of the four screening tests indicate that the chemical data generally are quite reliable, the extremely small number of samples (less than 5 percent of the total) with sufficient chemical information to run the tests may not provide a representative indication of the performance of all laboratories involved in the program. With so many laboratories involved in SWAMP, it is difficult to compare water-quality data from one site to another due to different reporting conventions for chemical constituents and different analytical methods over time. In future monitoring programs, a reduced number of laboratories would enhance consistency in analytical methods and reporting conventions.

In addition to the four screening tests, unusually high or low values were flagged for field and laboratory pH (less than 4.0 and greater than 9.0) and specific conductance (less than 10 and greater than 10,000 μS/cm). Of the 19,937 water samples with retrieved pH values from the 150 SWAMP sites, only 76 (0.4 percent) and 9 (0.03 percent) samples had field and laboratory pH values, respectively, that were less than 4 or greater than 9. Of the 16,553 water samples with specific conductance values, only 103 (0.6 percent) and 82 (0.5 percent) samples had field and laboratory specific conductance values, respectively, that were less than 10 or greater than 10,000 μS/cm.

A detailed questionnaire was prepared and sent to more than 60 agencies involved in collecting surface-water-quality data for SWAMP and responses were received from 34 agencies. The purpose of this survey was to evaluate quality assurance methods and consistency of field and laboratory methods statewide. Information was compiled and summarized on monitoring network design, data review and upload procedures, laboratory and field sampling methods, and data practices.

Currently, most agencies responded that they follow the FDEP-approved QA/QC protocol for sampling and have quality assurance practices for recording and reporting data. A small number of agencies responded to specific questions regarding the ability to qualify data at the station and sample level and to inform users of the quality of the data. Regarding data collection methods in the field, most respondents indicated that they measure field parameters, but there were no responses to questions about the list of parameters, methods of analysis, and reporting units. Most agencies responded that calibration methods are followed in the field, but none gave specific details. Most agencies indicated that grab samples are collected at individual points in the surface-water body. However, nearly one-third of the agencies responded that their samples are depth or width integrated and composited.

Concerning the issue of laboratory analytical methods, most of the respondents indicated that calibration procedures were followed in the laboratory for analysis of data, but no responses were given about the specific procedures. Approximately 50 percent of the respondents indicated that laboratory analysis methods have changed over time, and most agencies were able to provide a list of analytes with detection limits and laboratory reporting units for analytical methods. A more centralized approach to QA/QC issues and overall project management would result in improvements to SWAMP by enhancing the consistency of sampling and analytical methods statewide.

Although the collection of flow data at SWAMP sites is not directly a QA/QC issue, the importance of flow data in conjunction with water-quality samples takes on considerable importance, particularly now in terms of estimating total maximum daily loads. The majority of respondents indicated that gage height and discharge were not measured during collection of water-quality samples. Also, about half of the agencies responded that tidal stages were not being recorded during the collection of estuary samples.

Other data screening procedures are necessary to further evaluate the validity of chemical data collected by SWAMP. High variability in the concentration of targeted constituents could signal analytical problems, but more likely may indicate variability in hydrologic conditions. This underscores the need for accurate measurements of discharge, lake stage, gage height at the time of sampling so that changes in constituent concentrations can be properly evaluated and fluxes (loads) of nutrients or metal, for example, can be calculated and compared over time.

Seasonal variations of water chemistry in streams typically are related to changes in streamflow. Recent studies have found that the concentration of nitrate in water samples from the middle reach of the Suwannee River is inversely related to discharge. The absence of any major stream inputs to the middle Suwannee River, indicates that ground water contributes most of the nitrogen load to the middle Suwannee River, particularly during low-flow conditions. Also, climatic variables that cause changes in lake stage and salinity changes in estuaries affect the concentration of chemical species in these water bodies. Several studies have demonstrated the importance of knowing trends in streamflow to be able to evaluate concurrent trends in stream water quality.

Information obtained during this study provides a framework for improving the quality and consistency of chemical data collected statewide as part of the Surface-Water Ambient Monitoring Program.

Any redesign of the trends network would benefit from the following procedures and considerations: (1) standardization of analytical methods and detection limits for all water samples collected from the network; (2) uniform surface-water sampling methods that include the use of QA/QC samples including reference samples, replicates, and blanks; (3) a centralized computer system for ease of data retrieval, computer-assisted review of analytical data, flags for questionable data, and ability to request reruns from laboratory when chemical screening critieria are not met; and (4) integration of hydrologic data (streamflow, lake stage, tidal stage) with water-quality data to calculate loads and to assess the degree of interaction between ground water and surface water. The resulting data base would be consistent and defensible, and could include data that can be used to compare the quality of surface water in basins from one part of the State to another and to identify and assess meaningful trends in water quality over time.

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Tables

Table 1. List of chemical constituents, and physical and chemical characteristics retrieved from STORET for selected SWAMP stations

[mg/L, milligrams per liter; °C, degrees Celsius; µg/L, micrograms per liter; µS/cm at 25 °C, microsiemens per centimeter at 25 degrees Celsius; ft, feet; °F, degrees Fahrenheit; TU, turbidity]

Parameter name (reporting units)	STORET code
Alkalinity, total (mg/L as $CaCO_3$)	410
Aluminum, total (µg/L as Al)	1105
Arsenic, dissolved (µg/L as As)	1000
Arsenic, total (µg/L as As)	1002
Barium, dissolved (µg/L as Ba)	1005
Bicarbonate (mg/L as HCO_3)	440
Boron, total (µg/L as B)	1022
Cadmium, dissolved (µg/L as Cd)	1025
Cadmium, total (µg/L as Cd)	1027
Calcium, dissolved (mg/L as Ca)	915
Calcium, total (mg/L as Ca)	916
Carbon, dissolved organic (mg/L as C)	681
Carbon, total (mg/L as C)	690
Carbon, total organic (mg/L as C)	680
Chloride, total in water	940
Chlorophyll-A (mg/L trichromatic uncorrected)	32210
Chromium, dissolved (µg/L as Cr)	1030
Chromium, total (µg/L as Cr)	1034
Cobalt, dissolved (µg/L as Co)	1035
Cobalt, total (µg/L as Co)	1037
Color (platinum-cobalt units)	80
Copper, dissolved (µg/L as Cu)	1040
Copper, total (µg/L as Cu)	1042
Depth of pond or reservoir (ft)	72025
Fecal coliform (colonies per 100 mL)	31616
Flow, stream, instantaneous	61
Flow, stream, mean daily	60
Fluoride, dissolved (mg/L as F)	950
Iron, dissolved (µg/L as Fe)	1046
Iron, total (µg/L as Fe)	1045
Lead, dissolved (µg/L as Pb)	1049
Lead, total (µg/L as Pb)	1051
Magnesium, dissolved (mg/L as Mg)	925
Magnesium, total (mg/L as Mg)	927
Manganese, dissolved (µg/L as Mn)	1056
Manganese, total (µg/L as Mn)	1055
Mercury, dissolved (µg/L as Hg)	71890
Mercury, total (µg/L as Hg)	71900
Nickel, dissolved (µg/L as Ni)	1065
Nickel, total (µg/L as Ni)	1067
Nitrite plus nitrate, dissolved (mg/L as N)	631

Table 1. List of chemical constituents, and physical and chemical characteristics retrieved from STORET for selected SWAMP stations (Continued)

[mg/L, milligrams per liter; °C, degrees Celsius; µg/L, micrograms per liter; µS/cm at 25 °C, microsiemens per centimeter at 25 degrees Celsius; ft, feet; °F, degrees Fahrenheit; TU, turbidity]

Parameter name (reporting units)	STORET code
Nitrite plus nitrate, total (mg/L as N)	630
Nitrogen, ammonia, dissolved (mg/L as N)	608
Nitrogen, ammonia, total (mg/L as N)	610
Nitrogen, Kjeldahl, dissolved (mg/L as N	623
Nitrogen, Kjeldahl, total, (mg/L as N)	625
Nitrogen, organic, dissolved (mg/L as N)	607
Nitrogen, organic, total (mg/L as N)	605
Oxygen, dissolved (mg/L)	300
pH (standard units)	400
pH, lab (standard units)	403
Phosphorus, dissolved orthophosphate (mg/L as P)	671
Phosphorus, total (mg/L as P)	665
Potassium, dissolved (mg/L as K)	935
Potassium, total (mg/L as K)	937
Residue, total (mg/L)	500
Residue, total nonfiltrable (mg/L)	530
Residue, volatile nonfiltrable (mg/L)	535
Residue, total filtrable (dried at 180 °C)	70300
Sampling station location, vertical (ft)	3
Selenium, dissolved (µg/L as Se)	1145
Silica, dissolved (mg/L as $Si0_2$)	955
Silver, dissolved (µg/L as Ag)	1075
Silver, total (µg/L as Ag)	1077
Sodium, dissolved (mg/L as Na)	930
Sodium, total (mg/L as Na)	929
Solids, dissolved, sum of constituents (mg/L)	70301
Specific conductance (µS/cm at 25 °C)	95
Specific conductance, field (µS/cm at 25 °C)	94
Stage, stream (ft)	65
Strontium, dissolved (µg/L as Sr)	1080
Sulfate, total (mg/L as SO_4)	945
Temperature, air (°F)	21
Temperature, water (°C)	10
Temperature, water (°C)	11
Transparency, secchi disc (inches)	77
Turbidity, hach turbidimeter (formazin TU)	76
Zinc, dissolved (µg/L as Zn)	1090
Zinc, total (µg/L as Zn)	1092

Table 2. List of SWAMP sites grouped by basin (hydrologic subregion code) for which water-quality data were retrieved, site numbers, and site information

[No., number; HUC, hydrologic unit code; T, trend site; A, active; i, inactive; Ave, Avenue; Hwy, Highway; SR, State road; R., River; Creek, Crk; L., Lake; Branch, Br.; N/A, data not available; DEP, Florida Department of Environmental Protection; GFWFC, Game & Fresh Water Fish Commission; 8024, South Florida Water Management District; 8026, St. Johns River Water Management District; 8027, Suwannee River Water Management District; BFA, Brine Fisherman's Association; 8031, Northeast DEP District]

Site No.	Site name	Station No.	County	HUC	Lati-tude	Longi-tude	Water body type	Water body	T	DEP ID	ID	Agency
					Basin 1							
12	PERDIDO R. ABV JUNC BRUSHY CR.	33010001	ESCAMBIA	3140106	304705	873400	STREAM	PERDIDO R.	A	NW01	33010001	BFA
13	ESCAMBIA R. HWY 4 BRIDGE	33020001	ESCAMBIA	3140305	305754	871403	STREAM	ESCAMBIA R.	A	NW03	33020001	BFA
14	BLACKWATER R. AT HWY 4 NW BAKER	33030001	OKALOOSA	3140104	305002	864400	STREAM	BLACKWATER R.	A	NW04	33030001	BFA
15	YELLOW R. HWY 2 EAST OF OAK GROVE	33040001	OKALOOSA	3140103	305530	863334	STREAM	YELLOW R.	A	NW05	33040001	BFA
16	11 MILE CRK AT SR 297A BR	33010011	ESCAMBIA	3140107	303229	871948	STREAM	ELEVEN MILE CRK	A	NW19	33010011	BFA
17	CANOE CR HWY 29	33020039	ESCAMBIA	3140105	305511	871848	STREAM	CANOE CRK	A	NW22	33020039	BFA
18	SHOAL R. AT HWY 85	33040031	OKALOOSA	3140303	304148	863417	STREAM	SHOAL R.	A	NW28	33040031	BFA
19	HOLMES CR HWY 2 W OF GRACEVILLE	32020003	JACKSON	3140203	305741	853050	STREAM	HOLMES CRK	A	NW09	32020003	DEP/205J
82	POND CRK AT SR 85 W OF PAXTON	33040008	WALTON	3140103	305800	862300	STREAM	POND CRK	A	NW06	33040008	BFA
83	BIG COLDWATER CR HWY 191 NE MILTON	33030005	SANTA ROSA	3140104	304227	865818	STREAM	BIG COLDWATER CRK	A	NW24	33030005	BFA
84	EAST BAY CRK AT FL 87	33030025	SANTA ROSA	3140105	302627	865200	STREAM	EAST BAY CRK	A	NW29	33030025	BFA
85	BRUSHY CRK AT NAKOMIS RD.	33010063	ESCAMBIA	3140106	305845	873142	STREAM	BRUSHY CRK	A	NW02	33010063	BFA
86	MARCUS CRK HWY 90 BRIDGE	33010030	ESCAMBIA	3140107	302652	871724	STREAM	MARCUS CRK	A	NW20	33010030	BFA
87	WRIGHTS CR HWY 2 E OF ESTO	32020002	HOLMES	3140203	305721	854036	STREAM	WRIGHTS CRK	A	NW10	32020002	DEP/205J
88	PINE BARREN CR HWY 29	33020040	ESCAMBIA	3140305	304624	872018	STREAM	PINE BARRON CRK	A	NW21	33020040	BFA
116	HORSEHEAD CRK AT FL85	33040041	OKALOOSA	3140103	305754	862517	STREAM	HORSEHEAD CRK	A	NW07	33040041	BFA
117	POND CR HWY 90 BR W MILTON	33030019	SANTA ROSA	3140104	303621	870345	STREAM	POND CRK	A	NW25	33030019	BFA
118	CARPENTERS CRK AT 9TH AVE	33020048	ESCAMBIA	3140105	302810	871240	STREAM	CARPENTERS CRK	A	NW30	33020048	BFA
119	PERDIDO R BARRINEAU PARK BR	33010002	ESCAMBIA	3140106	304125	872625	STREAM	PERDIDO R.	A	NW18	33010002	BFA
120	ESCAMBIA R. AT HWY 184 BRIDGE	33020007	ESCAMBIA	3140305	304008	871600	STREAM	ESCAMBIA R.	A	NW23	33020007	BFA
142	TRAMMEL CRK AT HWY 4	33040009	OKALOOSA	3140103	304453	863716	STREAM	TRAMMEL CRK	A	NW27	33040009	BFA
					Basin 2							
21	NEW RIVER AT SR 65	S431	LIBERTY	3130013	301311	845330	STREAM	NEW R.	A	NW50	S431	DEP/205J
81	MARSHALL CR SR2	31020016	JACKSON	3130012	305612	851745	STREAM	MARSHALL CRK	A	NW11	31020016	DEP/205J
115	COWARTS CR SR2	31020018	JACKSON	3130012	305650	851530	STREAM	COWARTS CRK	A	NW12	31020018	DEP/205J
144	DEAD LAKES AT SR22A	S334	GULF	3130012	300740	851039	LAKE	DEAD LAKES	A	NW40	S334	DEP/205J
					Basin 3							
22	MUNSON SLOUGH @ US 319	S3	LEON	3090202	302314	841849	STREAM	MUNSON SLOUGH	A	NW55	S3	DEP/205J

*For more detailed information on the St. Marks River Basin, see table 4.

Table 2. List of SWAMP sites grouped by basin (hydrologic subregion code) for which water-quality data were retrieved, site numbers, and site information (Continued)

[No., number; HUC, hydrologic unit code; T, trend site; A, active; i, inactive; Ave, Avenue; Hwy, Highway; SR, State road; R., River; Creek, Crk; L., Lake; Branch, Br.; N/A, data not available; DEP, Florida Department of Environmental Protection; GFWFC, Game & Fresh Water Fish Commission; 8024, South Florida Water Management District; 8026, St. Johns River Water Management District; 8027, Suwannee River Water Management District; BFA, Brine Fisherman's Association; 8031, Northeast DEP District]

Site No.	Site name	Station No.	County	HUC	Lati-tude	Longi-tude	Water body type	Water body	T	DEP ID	ID	Agency
					Basin 4							
10	AUCILLA R. AT US 98, MADISON CO.	AUC100C1	MADISON	3110103	300845	835822	STREAM	AUCILLA R.	A	AUC10	AUC100C1	8027\8031
11	WACCASASSA R. AT SR 24, LEVY CO.	WAC005C1	LEVY	3110101	292121	824406	STREAM	WACCASASSA R.	A	WAC00	WAC005C1	8031
42	ALAPAHA R. NEAR JENNINGS FL AT C-150	ALA010C1	HAMILTON	3110202	303553	830424	STREAM	ALAPAHA R.	A	ALA010C1	ALA010C1	8027/SWIM
43	CAMP BRANCH AT SR-132	CMP010C1	HAMILTON	3110201	302425	825154	STREAM	CAMP BRANCH	A	CMP010C1	CMP010C1	8027
44	ECONFINA R. NEAR PERRY FL	ECN010C1	TAYLOR	3110102	301015	834925	STREAM	ECONFINA R.	i	ECN010C1	ECN010C1	8027
45	ICHETUCKNEE R. 0.2 MI NORTH OF BRIDGE	ICH010C1	COLUMBIA	3110206	295716	824703	STREAM	ICHETUCKNEE R.	A	ICH010C1	ICH010C1	8027
46	OLUSTEE CRK AT SR-18	OLS010C1	UNION	3110206	295700	823149	STREAM	OLUSTEE CRK	i	OLS010C1	OLS010C1	8027
47	SAMPSON R.	SMR010C1	BRADFORD	3110206	295136	821347	STREAM	SAMPSON R.	i	SMR010C1	SMR010C1	8027
48	SUWANNEE R. AT ELLAVILLE BELOW US-90	SUW100C1	SUWANNEE	3110205	302237	831049	STREAM	SUWANNEE R.	i	SUW100C1	SUW100C1	8027
49	WITHLACOOCHEE R. AT STATE LINE AT C-	WIT010C1	MADISON	3110203	303806	831842	STREAM	WITHLACOOCHEE R.	i	WIT010C1	WIT010C1	8027
76	AUCILLA R. US 19/27, MADISON CO.	AUC050C1	MADISON	3110103	302202	834809	STREAM	AUCILLA R.	A	AUC05	AUC050C1	8027\8031
77	DEEP CRK AT US 441	DEP010C1	COLUMBIA	3110201	302155	823712	STREAM	DEEP CRK	A	DEP010C1	DEP010C1	8027
78	WITHLACOOCHEE R. ABOVE SUWANNEE R.	WIT040C1	HAMILTON	3110203	302324	831020	STREAM	WITHLACOOCHEE R.	i	WIT040C1	WIT040C1	8027
79	SUWANNEE R. AT DOWLING PARK BRIDGE	SUW120C1	LAFAYETTE	3110205	301441	831459	STREAM	SUWANNEE R.	i	SUW120C1	SUW120C1	8027
80	NEW R. NEAR WORTHINGTON SPRINGS AT C	NEW010C1	BRADFORD	3110206	295535	822440	STREAM	NEW R.	A	NEW010C1	NEW010C1	8027
110	STEINHATCHEE R. ABOVE STEINHATCHEE	STN031C1	DIXIE	3110102	294449	832032	STREAM	STEINHATCHEE R.	i	STN031C1	STN031C1	8027
111	ECONFINA R. AT US 19/27, TAYLOR CO.	ECN005C1	TAYLOR	3110103	301504	834304	STREAM	ECONFINA R.	A	ECN00	ECN005C1	8031
112	HUNTER CRK AT C-135 OR NEAR BELMONT	HNT010C1	HAMILTON	3110201	302909	824245	STREAM	HUNTER CRK	A	HNT010C1	HNT010C1	8027
113	SUWANNEE R. AT LURAVILLE FL	SUW130C1	LAFAYETTE	3110205	300556	831019	STREAM	SUWANNEE R.	i	SUW130C1	SUW130C1	8027
114	SANTA FE R. NEAR BROOKER AT SR-231	SFR020C1	BRADFORD	3110206	295243	822012	STREAM	SANTA FE R.	i	SFR020C1	SFR020C1	8027
137	STEINHATCHEE R. AT STEINHATCHEE	STN040C1	DIXIE	3110102	294004	832240	STREAM	STEINHATCHEE R.	i	STN040C1	STN040C1	8027
138	ECONFINA R. AT US 98, TAYLOR CO.	ECN015C1	TAYLOR	3110103	300831	835200	STREAM	ECONFINA R.	A	ECN01	ECN015C1	8031
139	ROBINSON BR AT C-246 OR NR SUWANNEE	ROB010C1	COLUMBIA	3110201	301856	823841	STREAM	ROBINSON BRANCH	A	ROB010C1	ROB010C1	8027
140	SUWANNEE R. AT BRANFORD	SUW140C1	SUWANNEE	3110205	295720	825540	STREAM	SUWANNEE R.	i	SUW140C1	SUW140C1	8027
141	SANTA FE R. AT OLENO ST PARK	SFR040C1	COLUMBIA	3110206	295451	823448	STREAM	SANTA FE R.	i	SFR040C1	SFR040C1	8027
149	ROARING CRK AT C-135	ROR010C1	HAMILTON	3110201	302544	824105	STREAM	ROARING CRK	A	ROR010C1	ROR010C1	8027
					Basin 5							
1	NASSAU RIV US 17	19020002	NASSAU	3070205	303428	813632	STREAM	NASSAU R.	A	SJ1	19020002	8026
2	ST MARYS R AT GA LINE US 17	19010001	NASSAU	3070204	304416	814114	STREAM	ST. MARYS R.	A	SJ3	19010001	8026\8031
51	MARYS R. AT SR-2	19010006	BAKER	3070204	303115	821348	STREAM	ST. MARYS R.	A	SJ4	19010006	8026

Table 2. List of SWAMP sites grouped by basin (hydrologic subregion code) for which water-quality data were retrieved, site numbers, and site information (Continued)

[No., number; HUC, hydrologic unit code; T, trend site; A, active; i, inactive; Ave, Avenue; Hwy, Highway; SR, State road; R., River; Creek, Crk; L., Lake; Branch, Br.; N/A, data not available; DEP, Florida Department of Environmental Protection; GFWFC, Game & Fresh Water Fish Commission; 8024, South Florida Water Management District; 8026, St. Johns River Water Management District; 8027, Suwannee River Water Management District; BFA, Brine Fisherman's Association; 8031, Northeast DEP District]

Site No.	Site name	Station No.	County	HUC	Lati-tude	Longi-tude	Water body type	Water body	T	DEP ID	ID	Agency
52	NASSAU R. NEAR ITALIA	NRI	NASSAU	3070205	303453	814109	STREAM	NASSAU R.	A	SJ2	NRI	8026
90	AMELIA R. (ICW) at CM 28, NASSAU CO.	19020005	NASSAU	3070205	303648	812800	STREAM	AMELIA R.	A	UNK1	19020005	8031
122	AMELIA R. (ICW) at CM 1, NASSAU CO.	19020013	NASSAU	3070205	303300	812830	STREAM	AMELIA R.	A	UNK2	19020013	8031
					Basin 6							
3	ST JOHNS R. CHAN MARK72	20030373	PUTNAM	3080101	292240	813743	STREAM	ST. JOHNS R.	A	SJ5	20030373	8026
4	CRESCENT LK BY MARKER NO. 9	20030411	VOLUSIA	3080103	292332	812620	LAKE	CRESCENT L.	A	SJ7	20030411	8026
5	HATCHET CRK NR GAINESVILLE	02240800	ALACHUA	3080102	294115	821224	STREAM	HATCHET CRK	A	SJ35	02240800	8026
6	SWEETWATER BRANCH	1264A1	ALACHUA	3080102	293800	821930	STREAM	SWEETWATER BR	i	SJ36	1264A1	N/A
7	INDIAN RIV N ICW CHAN MARK 60	27010460	VOLUSIA	3080202	285721	805253	STREAM	INDIAN R.	A	SJ50	27010460	8030
8	TOMOKA R OLD DIXIE HWY BR	27010024	VOLUSIA	3080201	292030	810512	STREAM	TOMOKA R.	A	SJ53	27010024	8026
9	INDIAN R. LAGOON CRANE CRK	CC03	BREVARD	3080203	280407	803721	STREAM	INDIAN R. LAGOON	A	A7	CC03	8026
50	SPRUCE CRK NR SAMSULA	2248000	ALACHUA	3080102	N/A	N/A	STREAM	SPRUCE CRK	N/A	N/A	N/A	N/A
53	ST JOHNS R. AT HWY 40 NEAR ASTOR	20010002	VOLUSIA	3080101	291005	813125	STREAM	ST. JOHNS R.	A	SJ19	20010002	8026\8030
54	ORANGE L.B118 B/T COW HAMMOCK & SAMSONS POND	OLK	ALACHUA	3080102	292749	821038	LAKE	ORANGE L.	A	SJ37	OLK	8026
55	GEORGES L. 200 YDS FROM W BANK	20030400	PUTNAM	3080103	294734	815050	LAKE	GEORGES L.	A	SJ9	20030400	8026
56	TOMOKA R. AT 11TH STREET BRIDGE	27010579	VOLUSIA	3080201	291301	810633	STREAM	TOMOKA R.	A	SJ54	27010579	8026
57	INDIAN R AT ICWW CM 12 NR HALOV	27010875	BREVARD	3080202	284112	804847	STREAM	INDIAN R.	A	SJ52	27010875	8026
58	UPSTREAM OF WEIR S50 ON C-25 ABOUT 3000	C25S50	ST. LUCIE	3080203	272818	802012	CANAL	C-25 CANAL	A	SO58	C25S50	8024
89	HAINES CRK AT LOCK & DAM	2238000	LAKE	3080102	N/A	N/A	STREAM	HAINES CRK	N/A	N/A	N/A	N/A
91	BLACKWATER CRK AT HWY 44A	20010455	LAKE	3080101	285230	812922	STREAM	BLACKWATER CRK	i	SJ22	20010455	2 agencies
92	ORANGE CRK 50 YDS. UP FROM HWY-21	20020404	PUTNAM	3080102	293109	815648	STREAM	ORANGE CRK	A	SJ38	20020404	8026
93	KINGSLEY LK CENTER	20030412	CLAY	3080103	295751	815957	LAKE	KINGSLEY LAKE	A	SJ12	20030412	8026
94	HALIFAX R 100 FT N SL BCH MEM BR	27010037	VOLUSIA	3080201	291242	810042	STREAM	HALIFAX R.	A	SJ55	27010037	8026
95	INDIAN R. 100 YDS SOUTH OF SR 518	27010511	BREVARD	3080202	280752	803701	STREAM	INDIAN R.	A	S051	27010511	8030
121	APOPKA BEAUCLAIR C. NR ASTATULA	2237700	LAKE	3080102	284320	814106	CANAL	APOPKA BEAUCLAIR C.	i	SJ47	2237700	2 agencies
123	WEKIA R. PAST FIRST SHARP TURN TO RIGHT	GFCCR0196	SEMINOLE	3080101	285209	812202	STREAM	WEKIVA R.	i	SJ23	GFCCR0196	GFWFC/CO.
124	OKLAWAHA R. AT SR 316	20020012	MARION	3080102	292223	815406	STREAM	OKLAWAHA R.	A	SJ40	20020012	8026
125	CEDAR CR BLANDING BLVD BR RT21	20030083	DUVAL	3080103	301623	814400	STREAM	CEDAR CRK	A	SJ13	20030083	8026
126	TOLOMATO R. AT SPANISH LANDING	TOL	ST. JOHNS	3080201	300359	812212	STREAM	TOLOMATO R.	i	A14	TOL	8026
127	INDIAN R AT CM 42 NR GRANT	27010480	BREVARD	3080202	275512	803056	STREAM	INDIAN R.	A	SO49	27010480	DEP
143	JIM CR AT FISH HOLE RD BRIDGE	20010521	ORANGE	3080101	282732	805649	STREAM	JIM CRK	i	SJ31	20010521	DEP

Table 2. List of SWAMP sites grouped by basin (hydrologic subregion code) for which water-quality data were retrieved, site numbers, and site information (Continued)

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Site No.	Site name	Station No.	County	HUC	Lati-tude	Longi-tude	Water body type	Water body	T	DEP ID	ID	Agency
					Basin 7							
24	ALAFIA R., NORTH PRONG	24020057	POLK	3100204	275323.4	815825.3	STREAM	ALAFIA R.	A	SO21	24020057	DEP
25	MYAKKA R. SNOOK HAVEN DOCK	25030408	SARASOTA	3100102	270601	821958	STREAM	MYAKKA R.	A	SO26	25030408	DEP
26	LEMON BAY-MARKER 23	24010664	CHARLOTTE	3100201	265536	822050	ESTUARY	LEMON BAY	A	SO31	24010664	DEP
28	CHARLOTTE HRBR AT BLACK MRKR 1	25010012	CHARLOTTE	3100103	265356	820717	ESTUARY	CHARLOTTE HARBOR	A	SO46	25010012	DEP
29	PEACE R US 41 BR	25020001	CHARLOTTE	3100101	265642	820325	STREAM	PEACE R.	A	SO47	25020001	DEP
32	SHELL CRK AT SR 764 BRIDGE	25020120	CHARLOTTE	3100101	265832	815317	STREAM	SHELL CRK	A	SO75	25020120	DEP
33	BRADEN R. AT POWERLINES	BR2	MANATEE	3100202	272446	822730	STREAM	BRADEN R.	A	SO86	BR2	COUNTY
34	N/A	24010013	Hillsborough	3100203	275940	821755	STREAM	N/A	N/A	N/A	24010013	N/A
35	HILLSB. R AB CRYSTAL SPRINGS NR ZEPHYRHI	24030013	PASCO	3100205	281102	821103	STREAM	HILLSBOROUGH R.	A	SO93	24030013	DEP
36	BULLFROG CRK AT SYMMES ROAD	24010022	Hillsborough	3100206	275038	822052	STREAM	BULLFROG CRK	A	SO102	24010022	COUNTY
38	PITHLACHASCOTEE R.	24040009	PASCO	3090203	281943	823212	STREAM	PITHLACHASCOTEE RI.I148	A	SO112	24040009	DEP
65	PEACE R AT BR 1.5 MI W OF GARDNER	25020459	DESOTO	3100101	271811	815046	STREAM	PEACE R.	A	SO76	25020459	DEP
66	MYAAKKA R - CLAY GULLY AB BRIDGE ON 780	FLO0018	MANATEE	3100102	N/A	N/A	STREAM	MYAAKKA R.	N/A	N/A	N/A	N/A
67	CURRY CRK AT ALBEE FARM	FLO0099	SARASOTA	3100201	N/A	N/A	STREAM	CURRY CRK	N/A	N/A	N/A	N/A
68	MANATEE R-GAMBLE CK AB BR GOLF COURSE	FLO0017	MANATEE	3100202	N/A	N/A	STREAM	MANATEE R.	N/A	N/A	N/A	N/A
69	LITTLE MANATEE R AT CR579	24010018	Hillsborough	3100203	273947	821804	STREAM	LITTLE MANATEE R.	A	SO91	24010018	COUNTY
70	ALAFIA R., SOUTH PRONG	24020059	Hillsborough	3100204	274748.2	820703.3	STREAM	ALAFIA R.	A	SO22	24020059	DEP
71	FLINT CR AT US 301 EAST SIDE	24030007	Hillsborough	3100205	280510	821616	STREAM	FLINT CRK	A	SO95	24030007	COUNTY
72	ROCKY CRK AT WATERS AVE	24040152	Hillsborough	3100206	280132	823451	STREAM	ROCKY CRK	A	SO103	24040152	COUNTY
73	ANCLOTE R. AT SR54	FLO0096	PASCO	3100207	N/A	N/A	STREAM	ANCLOTE R.	N/A	N/A	N/A	N/A
74	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
101	OAK CRK/SWEETWTR/FRESHWTR REF SITE	25020014	HARDEE	3100101	272443	814143	STREAM	OAK CRK	A	SO77	25020014	DEP
102	MYAKKA R ABOVE OGLEBY CK	FLO0021	MANATEE	3100102	N/A	N/A	STREAM	MYAKKA R.	N/A	N/A	N/A	N/A
103	MAIN "A" CANAL AT BAHIA VISTA	FLO0100	SARASOTA	3100201	N/A	N/A	CANAL	N/A	N/A	N/A	N/A	N/A
104	MANATEE R. RYE BRIDGE	UM1	MANATEE	3100202	273051	822202	STREAM	MANATEE R.	A	SO88	UM1	COUNTY
105	LITTLE MANATEE R., SOUTH FORK	24010017	Hillsborough	3100203	273857.7	821740	STREAM	LITTLE MANATEE R.	A	SO92	24010017	DEP
106	S PRNG ALAFIA R UPSTR CNFL N PRN	24020019	Hillsborough	3100204	275152	820812	STREAM	ALAFIA R.	A	SO23	24020019	COUNTY
107	HILLS R- ITCHEPACKASASSA CK AB BLACkWTR	FLO0014	PASCO	3100205	N/A	N/A	STREAM	HILLSBOROUGH R.	N/A	N/A	N/A	N/A
108	HUNTER LAKE	STA0053	HERNANDO	3100207	N/A	N/A	LAKE	HUNTER LAKE	N/A	N/A	N/A	N/A
109	WITHLACOOCHEE R. AT STOKES FERRY	FLO0090	CITRUS	3100208	N/A	N/A	STREAM	WITHLACOOCHEE R.	N/A	N/A	N/A	N/A

Table 2. List of SWAMP sites grouped by basin (hydrologic subregion code) for which water-quality data were retrieved, site numbers, and site information (Continued)

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Site No.	Site name	Station No.	County	HUC	Lati-tude	Longi-tude	Water body type	Water body	T	DEP ID	ID	Agency
132	AT COUNTY LINE ROAD NO. 664 HARDEE CO.	PC CANAL78	POLK	3100101	273837.2	814812	CANAL	N/A	A	SO78	PC CANAL78	COUNTY
134	N PRONG ALAFIA R UPSTRM CNFL S P	24020008	Hillsborough	3100204	275152	820812	STREAM	ALAFIA R.	A	SO24	24020008	COUNTY
135	WEEKI WACHEE R. AT ROGERS PARK	FLO0098	HERNANDO	3100207	N/A	N/A	STREAM	WEEKI WACHEE R.	N/A	N/A	N/A	N/A
136	BLUE RUN	FLO0091	MARION	3100208	N/A	N/A	STREAM	BLUE RUN	N/A	N/A	N/A	N/A
					Basin 8							
23	L.OKEE-CNTRL, 6.0 STATUTE MILES DUE WEST	L004	MARTIN	3090102	265905	804233	LAKE	LAKE OKEECHOBEE	A	SO05	L004	8024
27	41 MI DOWNSTREAM OF LAKE KISSIMMEE ON	S65D	Okeechobee	3090101	271845	810120	STREAM	KISSIMMEE R.	A	SO36	S65D	8024
30	CALOOSAHATCHEE RIV AT REDFISH PT	28020185	LEE	3090205	263203	815643	STREAM	CALOOSAHATCHEE R.	A	SO60	28020185	DEP
31	REEDY CRK AT S R 531	26010238	OSCEOLA	3090101	280900	812628	STREAM	REEDY CRK	A	SO71	26010238	N/A
39	TENMILE CANAL AT US41	28020188	LEE	3090204	262958	815113	CANAL	TENMILE CANAL	A	SO128	28020188	COUNTY
40	FISHEATING CRK S OF PALMDALE	26010592	GLADES	3090103	265600	811856	STREAM	FISHEATING CRK	A	SO139	26010592	DEP
41	LITTLE R. CANAL AT NE2 AV DAD	28040387	DADE	3090202	255110	801150	CANAL	LITTLE R. CANAL	A	SO152	28040387	COUNTY
59	32 MI DOWNSTREAM OF LAKE KISSIMMEE ON	S65C	Okeechobee	3090101	272401	810657	STREAM	KISSIMMEE R.	A	SO37	S65C	8024
60	L.OKEE-NORTH, 1.5 STATUTE MILES AT 125	L002	Okeechobee	3090102	270506	804717	LAKE	LAKE OKEECHOBEE	A	SO07	L002	8024
61	FISHEATING CRK AT SR78	26010582	GLADES	3090103	265746	810716	STREAM	FISHEATING CRK	A	SO140	26010582	DEP
62	L.OKEE-SOUTH, 1.5 STATUTE MILES DUE	L007	PALM BEACH	3090202	264635	804719	LAKE	LAKE OKEECHOBEE	A	SO01	L007	8024
63	LAKE TRAFFORD 2 BOAT RAMP	28030015	COLLIER	3090204	262522	812937	LAKE	LAKE TRAFFORD	A	SO129	28030015	DEP
64	CALOOSAHATCHEE R MOORE HAVEN LOCK	28020022	GLADES	3090205	265021	810507	STREAM	CALOSSAHATCHEE R.I186	A	SO62	28020022	DEP
96	OUTFLOW STRUCTURE ON S.E. SIDE OF LAKE	S68	HIGHLANDS	3090101	271944	811508	N/A	N/A	A	SO39	S68	8024
97	INDIAN PARIRIE CANAL AT SR78	26010583	GLADES	3090103	270401	805842	CANAL	INDIAN PRAIRIE CANAL	A	SO141	26010583	DEP
98	L.OKEE-SOUTH, SITE AT CLEWISTON LIGHT	L006	PALM BEACH	3090202	264922	804719	LAKE	LAKE OKEECHOBEE	A	SO02	L006	8024
99	GORDON R. AT FL 886	28030047	COLLIER	3090204	261024	814705	STREAM	GORDON R.	A	SO130	28030047	COUNTY
100	TELEGRAPH CR SR 78 BR E SR 31 IN	28020041	LEE	3090205	264351	814207	STREAM	TELEGRAPH CRK	A	SO64	28020041	DEP
128	LAKE ISTOKPOGA SEE MAP	ISTK7	HIGHLANDS	3090101	272335	811657	LAKE	LAKE ISTOKPOGA	A	SO41	ISTK7	8024
129	L.OKEE-CNTRL, SITE AT ABANDONED (RED)	L005	GLADES	3090202	265730	805840	LAKE	LAKE OKEECHOBEE	A	SO03	L005	8024
130	GOLDEN GATE CANAL AT CR31	28030038	COLLIER	3090204	261004	814601	CANAL	GOLDEN GATE C.	A	SO131	28030038	COUNTY
131	CALOOS R SR 78B BR	28020006	LEE	3090205	264248	813636	STREAM	CALOOSA R.	A	SO65	28020006	DEP
133	MANATEE R. SR 64 NR MYAKKA CITY	L4	MANATEE	3100202	272825	821240	STREAM	MANATEE R.	A	SO89	L4	COUNTY
145	UPSTREAM OF S40 ON C-15 ABOUT 400 FEET O	C15S40	PALM BEACH	3090202	262527	800428	CANAL	C-15 CANAL	A	SO13	C15S40	8024
146	10.5 MILES DOWNSTREAM OF L. KISSIMMEE	S65A	OSCEOLA	3090101	273944	810803	STREAM	KISSIMMEE R.	A	SO83	S65A	8024

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Site No.	Site name	Station No.	County	HUC	Lati-tude	Longi-tude	Water body type	Water body	T	DEP ID	ID	Agency
147	SHINGLE CR. AT TAFT-VINELAND RD. BRIDGE	SCC	ORANGE	3090101	282435	812602	STREAM	SHINGLE CRK	A	SO125	SCC	COUNTY
148	HENDERSON CRK CANAL AT US41, BELLE MEA	28039954	COLLIER	3090204	260446	814114	STREAM	HENDERSON CR.I158 C.	A	SO133	28039954	COUNTY
150	SUWANNEE R. AT FOWLER BLUFF - SUW170	SUW240C1	LEVY	3110205	292357	830122	STREAM	SUWANNEE R.	i	SUW240C1	SUW240C1	SRWMD

No Data Retrievable for Sites 20, 37, and 75.

Table 3. Number of stations sampled at each SWAMP site, total number of samples collected at each site by water type, and primary site information

Site No. (see fig. 1)	Total number of stations by		Total number of samples	Primary stations	Total number of samples at primary station	Primary station ID No.	Primary station Lat/Long	Total number of samples by water type					Primary station water type
	Station ID	Lat/Long						Stream	Canal	Lake	Estu-ary	Spring	
Basin 1													
12	1	1	97	YES	97	33010001	304705 873400	97	0	0	0	0	stream
13	9	6	11,004	YES		33020001	305754 871403	11004	0	0	0	0	stream
14	4	3	280	YES	202 (13)	33030001	305002 864400	280	0	0	0	0	stream
15	5	4	68	YES	44 (3)	33040001	305530 863334	68	0	0	0	0	stream
16	1	1	158	YES	158	33010011	303229 871948	158	0	0	0	0	stream
17	3	2	104	YES	76 (25)	33020039	305511 871848	104	0	0	0	0	stream
18	3	3	57	YES	30	33040031	304148 863417	57	0	0	0	0	stream
19	1	1	34	YES	34	32020003	305741 853050	34	0	0	0	0	stream
82	2	1	47	YES	33	33040008	305800 862300	47	0	0	0	0	stream
83	3	2	141	YES	53 (8)	33030005	304227 865818	141	0	0	0	0	stream
84	2	2	34	YES	18	33030025	302627 865200	16	0	0	18	18	estuary
85	1	1	12	YES	12	33010063	305845 873142	12	0	0	0	0	stream
86	2	2	86	YES	80	33010030	302652 871724	86	0	0	0	0	stream
87	1	1	32	YES	32	32020002	305721 854036	32	0	0	0	0	stream
88	3	3	107	YES	78	33020040	304624 872018	107	0	0	0	0	stream
116	1	1	12	YES	12	33040041	305754 862517	12	0	0	0	0	stream
117	2	2	87	YES	61	33030019	303621 870345	87	0	0	0	0	stream
118	2		47	YES	35	33020048	302810 870746	47	0	0	0	0	stream
119	3	3	123	YES	111	33010002	304125 872625	123	0	0	0	0	stream
120	3	2	220	YES	120 (63)	33020007	304008 871600	220	0	0	0	0	stream

Table 3. Number of stations sampled at each SWAMP site, total number of samples collected at each site by water type, and primary site information

Site No. (see fig. 1)	Total number of stations by: Station ID	Total number of stations by: Lat/Long	Total number of samples	Primary stations	Total number of samples at primary station	Primary station ID No.	Primary station Lat/Long	Total number of samples by water type: Stream	Canal	Lake	Estuary	Spring	Primary station water type
142	3	3	26	YES	19	33040009	304453 863716	26	0	0	0	0	stream
Basin 2													
21	NO DATA												
81	2	2	38	YES	34	31020016	305612 851745	38	0	0	0	0	stream
115	2	2	41	YES	34	31020018	305650 851530	41	0	0	0	0	stream
144	6	6	139	NO	NO DATA	NO DATA	NO DATA	139	0	0	0	0	NO DATA
Basin 3													
22	NO DATA						302314 841849						stream
St Marks River basin sites, see table 4.													
Basin 4													
10	2	2	50	YES	8	AUC100 C1	300900 835753	50	0	0	0	0	stream
11	3	2	37	YES	4 (5)	WAC005 C1	292115 824406	37	0	0	0	0	stream
42	2	2	91	YES	83	ALA010 C1	303553 830424	91	0	0	0	0	stream
43	2	1	95	YES	72 (23)	CMP010 C1	302425 825154	95	0	0	0	0	stream
44	3	3	75	YES	22	ECN010 C1	301015 834925	75	0	0	0	0	stream
45	3	3	491	YES	84	ICH010 C1	295716 824703	99	0	0	0	0	stream
46	3	3	101	YES	82	OLS010 C1	295700 823149	101	0	0	0	0	stream
47	2	1	92	YES	84 (8)	SMR010	295136	95	0	0	0	0	stream
48	1	1	83	YES	83	SUW100 C1	302237 831049	83	0	0	0	0	stream
49	1	1	27	NO	NO DATA	NO DATA	NO DATA	27	0	0	0	0	NO DATA
76	1	1	138	NO	NO DATA	02204002	NO DATA	138	0	0	0	0	NO DATA
77	2	2	113	YES	83	DEP010 C1	302155 823712	113	0	0	0	0	stream
78	4	4	159	YES	46	WIT040 C1	302324 831020	156	0	0	0	3	stream

Table 3. Number of stations sampled at each SWAMP site, total number of samples collected at each site by water type, and primary site information

Site No. (see fig. 1)	Total number of stations by		Total number of samples	Primary stations	Total number of samples at primary station	Primary station ID No.	Primary station Lat/ Long	Total number of samples by water type					Primary station water type
	Station ID	Lat/Long						Stream	Canal	Lake	Estu-ary	Spring	
79	2	2	109	YES	83	SUW120 C1	301441 831459	109	0	0	0	0	stream
80	2	2	85	YES	83	NEW010 C1	295535 822440	85	0	0	0	0	stream
110	2	2	25	NO	NO DATA	22050066	NO DATA	25	0	0	0	0	NO DATA
111	1	1	43	NO	NO DATA	22050026	NO DATA	43	0	0	0	0	NO DATA
112	1	1	83	YES	83	HNT010 C1	302909 824245	83	0	0	0	0	stream
113	3	3	167	YES	83	SUW130 C1	300556 831019	167	0	0	0	0	stream
114	1	1	84	YES	84	SFR020 C1	295243 822012	84	0	0	0	0	stream
137	1	1	39	YES	39	STN040 C1	294004 832240	39	0	0	0	0	stream
138	2	2	52	YES	8	ECN015 C1	300833 835158	52	0	0	0	0	stream
139	2	2	38	NO	NO DATA	02315392	NO DATA	38	0	0	0	0	NO DATA
140	3	3	368	NO	NO DATA	02320500	NO DATA	365	0	0	0	3	NO DATA
141	3	2	146	YES	83 (55)	SFR040 C1	295451 823448	146	0	0	0	0	stream
149	1	1	83	YES	83	ROR010 C1	302544 824105	83	0	0	0	0	stream
Basin 5													
1	4	3	131	YES	29	19020002	303428 813632	131	0	0	0	0	stream
2	3	3	220	YES	156	19010001	304416 814114	220	0	0	0	0	stream
51	2	2	95	YES	71	19010006	303115 821348	24	0	71	0	0	lake
52	3	1	40	YES	12 (14) (14)	NRI	303453 814109	26	0	0	0	0	stream
90	1	1	153	YES	153	19020005	303648 812800	0	0	0	153	0	estuary
122	1	1	152	YES	152	19020013	303300 812830	152	0	0	0		stream
Basin 6													
3	2	2	140	YES	125	20030373	292240 813742	140	0	0	0	0	stream
4	1	1	34	YES	34	20030411	292332 812620	0	0	34	0	0	lake

Table 3. Number of stations sampled at each SWAMP site, total number of samples collected at each site by water type, and primary site information

Site No. (see fig. 1)	Total number of stations by		Total number of samples	Primary stations	Total number of samples at primary station	Primary station ID No.	Primary station Lat/ Long	Total number of samples by water type					Primary station water type
	Station ID	Lat/Long						Stream	Canal	Lake	Estu-ary	Spring	
5	4	3	49	YES	29	02240800	294115 821224	40	0	9	0	0	stream
6	3	3	72	YES	12	1264A1	293800 821930	72	0	0	0	0	stream
7	2	2	103	YES	41	27010460	285721 805253	0	0	0	103	0	estuary
8	3	3	78	YES	56	27010024	292030 810512	1	0	0	77	0	estuary
9	3	2	130	YES	94 (35)	CC03	280407 803721	1	0	0	129	0	estuary
50	4	3	49	YES	29	02240800	294115 821224	40	0	9	0	0	stream
53	4	4	234	YES	215	20010002	291005 813125	234	0	0	0	0	stream
54	2	2	65	YES	60	OLK	292749 821038	0	0	65	0	0	lake
55	3	3	50	YES	26	20030400	294734 815050	0	0	50	0	0	lake
56	6	5	115	YES	26	27010579	291301 810632	115	0	0	0	0	stream
57	1	1	28	YES	28	27010875	284112 804847	0	0	0	28	0	estuary
58	2	2	188	YES	187	C25S50	272818 802012	188	0	0	0	0	stream
89	3	3	177	YES	97	02238000	285214 814702	177	0	0	0	0	stream
91	3	3	84	YES	7	20010455	285230 812922	84	0	0	0	0	stream
92	1	1	9	YES	9	20020404	293109 815648	9	0	0	0	0	stream
93	1	1	30	YES	30	20030412	295751 815957	0	0	30	0	0	lake
94	3	3	197	YES	156	27010037	291242 810042	0	0	0	197	0	estuary
95	3	2	59	YES	31	27010511	280752 803701	28	0	0	31	0	estuary
121	5	4	482	NO	NO DATA	NO DATA	NO DATA	252	230	0	0	0	NO DATA
123	5(part1) & 2(part2)	5 & 2	150	NO	NO DATA	NO DATA	NO DATA	75 (part1)	0	75	0	0	NO DATA
124	5	5	329	YES	195	20020012	292222 815406	329	0	0	0	0	stream
125	1	1	98	YES	98	20030083	301623 814400	98	0	0	0	0	stream

Table 3. Number of stations sampled at each SWAMP site, total number of samples collected at each site by water type, and primary site information

Site No. (see fig. 1)	Total number of stations by		Total number of samples	Primary stations	Total number of samples at primary station	Primary station ID No.	Primary station Lat/ Long	Total number of samples by water type					Primary station water type
	Station ID	Lat/Long						Stream	Canal	Lake	Estu-ary	Spring	
126	2	2	101	YES	59	TOL	300359 812212	59	0	0	42	0	stream
127	2	2	73	YES	72	27010480	275510 803054	1	0	0	72	0	estuary
143	1	1	23	YES	23	20010521	282732 805648	23	0	0	0	0	stream
Basin 7													
24	2	2	24	YES	12	24020057	275323 815825	24	0	0	0	0	stream
25	6	6	127	YES	121	25030408	270600 821959	0	0	0	121	0	estuary
26	NO DATA												
28	1	1	83	YES	83	25010012	265356 820717	0	0	0	83	0	estuary
29	4	4	217	YES	213	25020001	265642 820326	1	0	0	216	0	estuary
32	1	1	164	YES	164	25020120	265831 815316	164	0	0	0	0	stream
33	2	2	133	YES	61	BR-3	272445 822721	61	0	72	0	0	stream
34	3	3	189	YES	178	24010013	273940 821755	189	0	0	0	0	stream
35	4	4	550	YES	8	24030013	281108 821104	550	0	0	0	0	stream
36	2	2	247	YES	241	24010022	275005 822050	247	0	0	0	0	stream
38	3	3	253	NO	NO DATA	NO DATA	NO DATA	253	0	0	0	0	NO DATA
65	5	5	77	YES	27	25020459	271809 815048	44	0	0	33	0	stream
66	4	3	176	YES	17	FLO0018	271725 821445	176	0	0	0	0	stream
67	1	1	6	YES	6	FLO0099	270659 822524	6	0	0	0	0	stream
68	1	1	12	YES	12	FLO0017	273242 822332	12	0	0	0	0	stream
69	3	3	189	YES	3	24010018	273945 821804	189	0	0	0	0	stream
70	3	2	238	YES	11	24020059	274748 820703	234	0	0	0	4	stream
71	1	1	82	YES	82	24030007	275943 822756	0	0	0	82	0	estuary

Table 3. Number of stations sampled at each SWAMP site, total number of samples collected at each site by water type, and primary site information

Site No. (see fig. 1)	Total number of stations by		Total number of samples	Primary stations	Total number of samples at primary station	Primary station ID No.	Primary station Lat/Long	Total number of samples by water type					Primary station water type
	Station ID	Lat/Long						Stream	Canal	Lake	Estu-ary	Spring	
72	1	1	102	YES	102	24040152	280130 823452	102	0	0	0	0	stream
73	3	3	270	NO	NO DATA	NO DATA	NO DATA	270	0	0	0	0	NO DATA
74	1	1	7	NO	NO DATA	NO DATA	NO DATA	7	0	0	0	0	NO DATA
101	1	1	11	YES	11	25020014	272441 814136	11	0	0	0	0	stream
102	1	1	11	YES	11	FLO0021	272537 820818	11	0	0	0	0	stream
103	1	1	4	YES	4	FLO0100	271855 822811	4	0	0	0	0	stream
104	2	2	249	YES	59	UM-1	273051 822201	249	0	0	0	0	stream
105	3	3	24	YES	7	24010017	273858 821740	24	0	0	0	0	stream
106	2	2	553	YES	279	24020019	275140 820806	553	0	0	0	0	stream
107	1	1	19	YES	19	FLO0014	281136 820923	19	0	0	0	0	stream
108	5	4	126	YES	9	STA0053	282613 823723	0	0	126	0	0	lake
109	1	1	6	YES	6	FLO0090	285930 822117	6	0	0	0	0	stream
132	5	5	97	NO	NO DATA	NO DATA	NO DATA	15					
134	2	2	553	YES	274	24020008	275153 820808	553	0	0	0	0	stream
135	4	3	55	YES	6 (29)	FLO0098	283208 823749	26	0	0	29	0	stream
136	5	5	86	YES	7	FLO0091	290259 822654	86	0	0	0	0	stream
Basin 8													
23	1	1	354	YES	354	L004	265905 804233	0	0	354	0	0	lake
27	3	2	1358	YES	1309	S65D	271845 810120	49	1309	0	0	0	canal
30	2	2	83	YES	78	28020185	263203 815643	5	0	0	78	0	estuary
31	4	3	273	YES	80	26010238	280900 812628	273	0	0	0	0	stream
39	4	3	11	YES	2	28020188	262957 815116	9	2	0	0	0	canal

Table 3. Number of stations sampled at each SWAMP site, total number of samples collected at each site by water type, and primary site information

Site No. (see fig. 1)	Total number of stations by		Total number of samples	Primary stations	Total number of samples at primary station	Primary station ID No.	Primary station Lat/Long	Total number of samples by water type					Primary station water type
	Station ID	Lat/Long						Stream	Canal	Lake	Estu-ary	Spring	
40	5	4	420	YES	156 (237)	26010592	265556 811854	406	14	0			stream
41	2	2	73	YES	8	28040387	255111 801134	8	65	0	0	0	stream
59	3	2	1,383	YES	1335	S65C	272401 810657	48	1335	0	0	0	canal
60	4	3	606	YES	584	L002	270506 804717	4	0	602	0	0	lake
61	4	3	525	YES	11	26010582	265740 810722	525	0	0	0	0	stream
62	1	1	323	YES	323	L007	264635 804719	0	0	0	323	0	estuary
63	2	2	19	NO	NO DATA	NO DATA	NO DATA	0	0	0	19	0	NO DATA
64	7	6	744	YES	153 (468)	28020022	265023 810518	657	87	0	0	0	stream
96	5	5	277	YES	67	S68	271951 811510	240	0	37	0	0	stream
97	2	2	11	YES	8	26010583	270358 805843	11	0	0	0	0	stream
98	1	1	671	YES	671	L006	294922 804719	0	0	671	0	0	lake
99	3	3	174	YES	7	28030047	261024 814705	86	88	0	0	0	stream
100	3	3	22	YES	12	28020041	264349 814208	22	0	0	0	0	stream
128	1	1	31	NO	NO DATA	NO DATA	NO DATA	0	0	31	0	0	NO DATA
129	1	1	507	YES	507	L005	265730 805840	0	0	507	0	0	lake
130	4	3	204	YES	2 (93)	28030038	261003 814603	111	93	0	0	0	stream
131	4	3	341	YES	215 (9)	28020006	264248 813638	231	110	0	0	0	stream
133	1	1	79	YES	79	L4	252815 802246	79	0	0	0	0	stream
145	2	2	192	YES	187	C15S40	262527 800428	192	0	0	0	0	stream
146	5	4	510	YES	398	S65A	273944 810803		0	0	0	0	stream
147	4	4	143	YES	32	SCC	282437 812603	143	0	0	0	0	stream
148	NO DATA												
150	26	22	799	YES	105	SE 10	270646 801704	666	28	0	105	0	estuary

Table 4. Number of surface-water-quality samples collected at each site in the St. Marks River Basin

Site name	Station ID number	No. of samples	Latitude	Longitude	Water body type
11B HORN SPRING NR WOODVILLE	301909084074400	1	301909	840744	SPRING
11B KINI SPRING NR WOODVILLE	301643084203400	1	301643	842034	SPRING
AENON CHURCH ROAD	302520084223901	4	302520	842239	CANAL
AIRPORT DRIVE AT EPPES DRIVE	302559084181800	5	302559	841818	CANAL
APAKIN NENE AT EAST INDIAN HEAD DRIVE	302549084152900	6	302549	841529	STREAM
APALACHEE BAY NEAR SHELL PT	22030060	5	300319	841735	ESTUARY
AREA SWIMMING BEACH	50620	121	302418	842430	LAKE
AREA SWIMMING BEACH	50621	115	302418	842430	LAKE
BIG BOGGY BRANCH	301001084131901	8	301001	841319	STREAM
BLACK CR. C1541 BAUM RD EC0REG.65H	22030066	3	303003	840449	STREAM
BOGGY CR AT MAGAZINE RD	22030059	3	301016	841315	STREAM
BOONE BOULEVARD AT MONTICELLO DRIVE	302801084172200	2	302801	841722	CANAL
BORROW PIT 348	50656	8	301409	843210	LAKE
BORROW PIT 360	50655	8	302127	843154	LAKE
BORROW PIT 383	50664	2	301948	842819	LAKE
BRADFORD BROOK	1247A1	12	302130	841800	STREAM
BRIARWOOD WEST TRAILER PARK INFL	22021001	8	302422	841940	LAKE
BUCK LAKE ROAD	302747084101501	5	302747	841015	CANAL
CANAL STREET AT RAILROAD AVE.	302555084172400	4	302555	841724	CANAL
CANEY CREEK NR MONTICELLO	2326598	4	303052	835624	STREAM
CARRINGTON CT. IN HUNTINGDON ESTATES	303007084203601	4	303007	842036	CANAL
CENTERVILLE ROAD AT CAPITAL CIRCLE	302842084141200	7	302842	841412	CANAL
CENTERVILLE ROAD AT TARPON DRIVE	302808084150000	9	302808	841500	CANAL
CENTRAL DD AT ORANGE AVE AT TALLAHASSEE	2327015	2	302210	841820	LAKE
CITY OF TALLAHASSEE AIRPORT WELL NR TALLAHASSEE	302424084311301	3	302424	842113	STREAM
CLEAR LAKE	50617	6	302056	842446	LAKE
CLEVE JONES WELL NR TALLAHASSEE	302409084183801	2	302409	841838	STREAM
COPELAND SINK DRAIN AT LLOYD	2326800	2	302840	840051	STREAM
DALE MABRY PLANT)	1247BB	12	302530	841800	STREAM
DEER HILLS TRAILER PK STP INFL	22031013	9	302615	842158	LAKE
EIGHTMILE POND/AMES SINK-OAKRIDE RD	301926084182001	9	301926	841820	STREAM
EIGHTMILE POND NR WOODVILLE	301926084180700	1	301926	841807	LAKE
F LOST LAKE REC AREA	50630	103	302142	842307	LAKE
F LOST LAKE REC AREA	50631	14	302142	842307	LAKE
FANLEW	301624084032401	1	301624	840324	STREAM
GLEN MILLER WELL AT HILLIARDVILLE	301707084234301	2	301707	842343	STREAM
GOVERNORS SQ MALL DD AT PARK AV AT TALLAHASSEE	2326842	1	302629	841441	STREAM
GULF COAST NO 1	300618084193801	1	300618	841938	STREAM
HADLEY ROAD NEAR RAYMOND DIEHL RD	303012084141700	5	303012	841417	CANAL
HORN SPRING	301909084074401	2	301909	840744	SPRING
HUDSON WELL AT HILLIARDVILLE	301741084240301	2	301741	842403	STREAM
HWY 27 AT RAYMOND TUCKER ROAD	302516084095601	4	302516	840956	CANAL
INDIAN SPRINGS	301502084194201	2	301502	841942	SPRING
INDIAN SPRINGS NR WOODVILLE	301502084194200	1	301502	841942	SPRING

Table 4. Number of surface-water-quality samples collected at each site in the St. Marks River Basin (Continued)

Site name	Station ID number	No. of samples	Latitude	Longitude	Water body type
INF SOUTHERN BELLE MHP STP	22031051	8	302727	842230	LAKE
JOSEPH BELLAMY WELL NR MONTICELLO	303001083553401	3	303001	835534	STREAM
KINI SPRING NR WOODVILLE	301643084203401	9	301643	842034	SPRING
L MUNSON #2 DITCH DOWN DOT PLT E	22030034	4	302425	841833	STREAM
L MUNSON #3 DITCH SPRINGHILL RD	22030035	2	302409	841835	STREAM
L MUNSON #4 60 YDS FR NW CORNER	22030036	1	302220	841843	LAKE
L MUNSON #6 MID ARM NW NE CNR L	22030038	4	302215	841835	LAKE
LAKE ARROWHEAD1 IN LEON CO.	ARROWHEAD1	41	303400	841303	LAKE
LAKE ARROWHEAD2 IN LEON CO.	ARROWHEAD2	1	303400	841303	LAKE
LAKE ARROWHEAD3 IN LEON CO.	ARROWHEAD3		303400	841303	LAKE
LAKE BELMONT1 IN LEON CO.	BELMONT1	22	303301	841045	LAKE
LAKE BELMONT2 IN LEON CO.	BELMONT2	22	303301	841045	LAKE
LAKE BELMONT3 IN LEON CO.	BELMONT3	22	303301	841045	LAKE
LAKE BLAIRSTONE1 IN LEON CO.	BLAIRSTONE1	24	302450	841525	LAKE
LAKE BLAIRSTONE2 IN LEON CO.	BLAIRSTONE2	24	302450	841525	LAKE
LAKE BLAIRSTONE3 IN LEON CO.	BLAIRSTONE3	24	302450	841525	LAKE
LAKE BLUE HERON1 IN LEON CO.	BLUE HERON1	30	303602	841415	LAKE
LAKE BLUE HERON2 IN LEON CO.	BLUE HERON2	30	303602	841415	LAKE
LAKE BLUE HERON3 IN LEON CO.	BLUE HERON3	30	303602	841415	LAKE
LAKE BOCKUS1 IN LEON CO.	BOCKUS1	20	303505	841309	LAKE
LAKE BOCKUS2 IN LEON CO.	BOCKUS2	20	303505	841309	LAKE
LAKE BOCKUS3 IN LEON CO.	BOCKUS3	20	303505	841309	LAKE
LAKE BRADFORD	50660	2	302407	842010	LAKE
LAKE BRADFORD	302420084200601	3	302420	842006	LAKE
LAKE BRADFORD NR TALLAHASSEE	2327010	5	302410	842005	LAKE
LAKE BRADFORD RD STP INFL	22031005	12	302355	841935	LAKE
LAKE BRADFORD1 IN LEON CO.	BRADFORD1	73	302409	842029	LAKE
LAKE BRADFORD2 IN LEON CO.	BRADFORD2	73	302409	842029	LAKE
LAKE BRADFORD3 IN LEON CO.	BRADFORD3	73	302409	842029	LAKE
LAKE CAROLYN1 IN LEON CO.	CAROLYN1	12	303306	841225	LAKE
LAKE CAROLYN2 IN LEON CO.	CAROLYN2	12	303306	841225	LAKE
LAKE CAROLYN3 IN LEON CO.	CAROLYN3	12	303306	841225	LAKE
LAKE CASCADE1 IN LEON CO.	CASCADE1	11	302510	842138	LAKE
LAKE CASCADE2 IN LEON CO.	CASCADE2	11	302510	842138	LAKE
LAKE CASCADE3 IN LEON CO.	CASCADE3	1	302510	842138	LAKE
LAKE DIANE1 IN LEON CO.	DIANE1	33	303538	841421	LAKE
LAKE DIANE2 IN LEON CO.	DIANE2	33	303538	841421	LAKE
LAKE DIANE3 IN LEON CO.	DIANE3	33	303538	841421	LAKE
LAKE ELIZABETH1 IN LEON CO.	ELIZABETH1	7	302936	841749	LAKE
LAKE ELIZABETH2 IN LEON CO.	ELIZABETH2	7	302936	841749	LAKE
LAKE ELIZABETH3 IN LEON CO.	ELIZABETH3	7	302936	841749	LAKE
LAKE ELLA #1 SOUTH SHORE	22030051	1	302736	841648	LAKE
LAKE ELLA #2 NORTH SHORE	22030052	1	302743	841647	LAKE
LAKE ELLEN-WAKULLA CO	119	3	300240	841821	LAKE
LAKE ERIE1 IN LEON CO.	ERIE1	52	302205	840746	LAKE
LAKE ERIE2 IN LEON CO.	ERIE2	52	302205	840746	LAKE
LAKE ERIE3 IN LEON CO.	ERIE3	52	302205	840746	LAKE

Table 4. Number of surface-water-quality samples collected at each site in the St. Marks River Basin (Continued)

Site name	Station ID number	No. of samples	Latitude	Longitude	Water body type
LAKE HALL1 IN LEON CO.	HALL1	45	303114	841452	LAKE
LAKE HALL2 IN LEON CO.	HALL2	45	303114	841452	LAKE
LAKE HALL3 IN LEON CO.	HALL3	45	303114	841452	LAKE
LAKE HIAWATHA	50661	2	302457	842107	LAKE
LAKE HIAWATHA	3B3-002	1	302447	842100	LAKE
LAKE HIAWATHA1 IN LEON CO.	HIAWATHA073-1	75	302436	842053	LAKE
LAKE HIAWATHA2 IN LEON CO.	HIAWATHA073-2	75	302436	842053	LAKE
LAKE HIAWATHA3 IN LEON CO.	HIAWATHA073-3	1	302436	842053	LAKE
LAKE HORNE SPRINGS1 IN LEON CO.	HORNE SPRINGS1	23	301905	840753	LAKE
LAKE HORNE SPRINGS2 IN LEON CO.	HORNE SPRINGS2	23	301905	840753	LAKE
LAKE HORNE SPRINGS3 IN LEON CO.	HORNE SPRINGS3	23	301905	840753	LAKE
LAKE IAMONIA1 IN LEON CO.	IAMONIA1	3	303801	841448	LAKE
LAKE IAMONIA2 IN LEON CO.	IAMONIA2	3	303801	841448	LAKE
LAKE IAMONIA3 IN LEON CO.	IAMONIA3	3	303801	841448	LAKE
LAKE JACKSON AT NWFWMD STORMWATER RETENTION POND	302900084175700	3	302900	841757	LAKE
LAKE LAFAYATTE #3 WEST DIKE PINE	22030047	4	302636	841033	LAKE
LAKE LAFAYATTE #4 N DIKE ALFORD	22030048	4	302716	840910	LAKE
LAKE LAFAYETTE #5 CHAIRES ROAD C	22030049	3	302535	840705	LAKE
LAKE LAFAYETTE AB PINEY Z LAKE	302628084113101	3	302628	841131	LAKE
LAKE LAFAYETTE E SIDE SR 261	22030045	3	302715	841322	LAKE
LAKE MACLAY1 IN LEON CO.	MACLAY1	45	303057	841447	LAKE
LAKE MACLAY2 IN LEON CO.	MACLAY2	45	303057	841447	LAKE
LAKE MICCOSUKEE	303144083584101	3	303144	835841	LAKE
LAKE MICCOSUKEE-JEFFERSON CO	263	5	303614	840015	LAKE
LAKE MICCOSUKEE (0.8 MI N OF CENTER)	303420083584004	1	303420	835840	LAKE
LAKE MICCOSUKEE (1 MI S OF CENTER)	303420083584002	1	303420	835840	LAKE
LAKE MICCOSUKEE (1.5 MI S OF CENTER)	303420083584001	1	303420	835840	LAKE
LAKE MICCOSUKEE (2 MI NW OF CENTER)	303420083584005	1	303420	835840	LAKE
LAKE MICCOSUKEE (2.5 MI NW OF CENTER)	303420083584006	1	303420	835840	LAKE
LAKE MICCOSUKEE (3.5 MI NW OF CENTER)	303420083584007	1	303420	835840	LAKE
LAKE MICCOSUKEE (AT CENTER)	303420083584003	1	303420	835840	LAKE
LAKE MICCOSUKEE #1 REEVES LANDIN	22030053	2	303623	835957	LAKE
LAKE MICCOSUKEE #2 NE POINT	22030054	2	303448	835918	LAKE
LAKE MICCOSUKEE #3 PANTHER CREEK	22030055	1	303406	835900	LAKE
LAKE MICCOSUKEE #4 SOUTH WEST PO	22030056	1	303342	835824	LAKE
LAKE MICCOSUKEE NR MICCOSUKEE	2326600	18	303614	840015	LAKE
LAKE MINNIEHAHA1 IN LEON CO.	MINNIEHAHA1	74	302450	842101	LAKE
LAKE MINNIEHAHA2 IN LEON CO.	MINNIEHAHA2	74	302450	842101	LAKE
LAKE MINNIEHAHA3 IN LEON CO.	MINNIEHAHA3	1	302450	842101	LAKE
LAKE MONKEY BUSINES1 IN LEON CO.	MONKEY BUSINES1	26	303621	841356	LAKE
LAKE MONKEY BUSINES2 IN LEON CO.	MONKEY BUSINES2	26	303621	841356	LAKE
LAKE MONKEY BUSINES3 IN LEON CO.	MONKEY BUSINES3	26	303621	841356	LAKE
LAKE MOORE1 IN LEON CO.	MOORE1	23	302331	842412	LAKE
LAKE MOORE2 IN LEON CO.	MOORE2	23	302331	842412	LAKE
LAKE MOORE3 IN LEON CO.	MOORE3	23	302331	842412	LAKE
LAKE MUNSON	124701	3	302214	841847	LAKE

Table 4. Number of surface-water-quality samples collected at each site in the St. Marks River Basin (Continued)

Site name	Station ID number	No. of samples	Latitude	Longitude	Water body type
LAKE MUNSON	124702	3	302158	841808	LAKE
LAKE MUNSON-LEON CO	282	12	302209	841830	LAKE
LAKE MUNSON #1	302212084182001	26	302212	841820	LAKE
LAKE MUNSON #10 CENTER OF LAKE	22030042	4	302206	841826	LAKE
LAKE MUNSON #11 SW CORNER OF LAKE	22030043	1	302150	841859	LAKE
LAKE MUNSON #2	302214084183301	27	302214	841833	LAKE
LAKE MUNSON #3	302220084185001	27	302220	841850	LAKE
LAKE MUNSON #4	302205084185301	26	302205	841853	LAKE
LAKE MUNSON #5	302158084184001	26	302158	841840	LAKE
LAKE MUNSON #6	302202084182401	26	302202	841824	LAKE
LAKE MUNSON #7	302225084182601	26	302225	841826	LAKE
LAKE MUNSON #7 MIDDLE OF SMALL C	22030039	1	302219	841816	LAKE
LAKE MUNSON #8 50 YDS W OF BOAT DOCK	22030040	4	302213	841811	LAKE
LAKE MUNSON #9 MID COVE CORN L	22030041	1	302158	841815	LAKE
LAKE MUNSON 12 DRAIN DITCH AT SR 61	22030044	4	302130	841815	STREAM
LAKE MUNSON NEAR TALLAHASSEE SITE 101	302203084180900	1	302203	841809	LAKE
LAKE MUNSON NEAR TALLAHASSEE SITE 102	302158084180700	1	302158	841807	LAKE
LAKE MUNSON NEAR TALLAHASSEE SITE 103	302154084180500	1	302154	841805	LAKE
LAKE MUNSON NEAR TALLAHASSEE SITE 104	302204084181600	1	302204	841816	LAKE
LAKE MUNSON NEAR TALLAHASSEE SITE 105	302207084181400	1	302207	841814	LAKE
LAKE MUNSON NEAR TALLAHASSEE SITE 107	302232084183500	1	302232	841835	LAKE
LAKE MUNSON NEAR TALLAHASSEE SITE 109	302204084183800	1	302204	841838	LAKE
LAKE MUNSON NEAR TALLAHASSEE SITE 110	302145084185000	1	302145	841850	LAKE
LAKE MUNSON NEAR TALLAHASSEE SITE 111	302144084184800	1	302144	841848	LAKE
LAKE MUNSON NEAR TALLAHASSEE SITE 112	302220084184900	1	302220	841849	LAKE
LAKE MUNSON NR TALLAHASSEE	302200084183000	1	302200	841830	LAKE
LAKE MUNSON NR TALLAHASSEE	2327018	1	302210	841820	STREAM
LAKE OTTER-WAKULLA CO.	303	3	300032	841854	LAKE
LAKE OVERSTREET1 IN LEON CO.	OVERSTREET1	18	303145	841524	LAKE
LAKE OVERSTREET2 IN LEON CO.	OVERSTREET2	18	303145	841524	LAKE
LAKE OVERSTREET3 IN LEON CO.	OVERSTREET3	18	303145	841524	LAKE
LAKE PETTY GULF1 IN LEON CO.	PETTY GULF1	29	303524	841346	LAKE
LAKE PETTY GULF2 IN LEON CO.	PETTY GULF2	29	303524	841346	LAKE
LAKE PETTY GULF3 IN LEON CO.	PETTY GULF3	29	303524	841346	LAKE
LAKE SHELLY POND1 IN LEON CO.	SHELLY POND1	2	303435	841617	LAKE
LAKE SHELLY POND2 IN LEON CO.	SHELLY POND2	2	303435	841617	LAKE
LAKE SHELLY POND3 IN LEON CO.	SHELLY POND3	2	303435	841617	LAKE
LAKE SOMERSET1 IN LEON CO.	SOMERSET1	2	303426	841547	LAKE
LAKE SOMERSET2 IN LEON CO.	SOMERSET2	2	303426	841547	LAKE
LAKE SOMERSET3 IN LEON CO.	SOMERSET3	2	303426	841547	LAKE
LAKE TROUT POND1 IN LEON CO.	TROUT POND1	22	302001	842313	LAKE
LAKE TROUT POND2 IN LEON CO.	TROUT POND2	22	302001	842313	LAKE
LAKE TROUT POND3 IN LEON CO.	TROUT POND3	22	302001	842313	LAKE
LITTLE LOFTON POND	50659	2	302142	842253	LAKE
LLOYD CREEK AB UNNAMED CREEK #1	302841084003201	3	302841	840032	STREAM
LLOYD CREEK AT LLOYD	2326700	31	302841	840031	STREAM
LLOYD CREEK S.R.158A JEFFERSON CO.	22030061	7	302850	840045	STREAM

Table 4. Number of surface-water-quality samples collected at each site in the St. Marks River Basin (Continued)

Site name	Station ID number	No. of samples	Latitude	Longitude	Water body type
LOFTON PONDS	50657	3	302121	842245	LAKE
LOFTON PONDS (SOUTH)	3B3-133	1	302112	842255	LAKE
LOST CREEK	50652	3	301145	842430	STREAM
LOST CREEK AB COW SWAMP AT 374	301000084234501	4	301000	842345	STREAM
LOST CREEK AT ARRAN	2327033	1	301117	842430	STREAM
MCBRIDE SLOUGH HWY 267 WAKULLA CO.	22030062	5	301410	841620	STREAM
MCBRIDE SLOUGH NR CRAWFORDVILLE	2327020	1	301210	841535	STREAM
MCBRIDES SLOUGH AT HWY 267	301421084161201	4	301421	841612	STREAM
MCCORD PK POND DD AT CNTVL RD AT TALLAHASSEE	2326836	1	302809	841501	STREAM
MICCOSUKKEE ROAD AT I-10	302950084101601	7	302950	841016	CANAL
MING BEACH	50612	13	302110	841825	LAKE
MING BEACH	50613	13	302110	841825	LAKE
MING BEACH	50622	107	302415	842430	LAKE
MING BEACH	50623	15	302415	842430	LAKE
MING BEACH	50624	106	302330	842427	LAKE
MING BEACH	50625	15	302330	842427	LAKE
MING BEACH	50626	105	302245	842350	LAKE
MING BEACH	50627	15	302245	840350	LAKE
MING BEACH	50632	107	302110	841825	LAKE
MING BEACH	50633	14	302110	841825	LAKE
MISSION ROAD 0.25 MI N OF I-10	302858084203601	5	302858	842036	CANAL
MOORE LAKE	50658	5	302328	842426	LAKE
MOORE LAKE	3B3-176	1	302333	842415	LAKE
MUNSON SL AB LK MUNSON NR TALLAHASSEE	302230084185000	1	302230	841850	STREAM
MUNSON SLOUGH AT CAPITAL CIRCLE	302314084184901	23	302314	841849	STREAM
MUNSON SLOUGH AT CAPITAL CIRCLE	302315084184800	4	302315	841848	STREAM
MUNSON SL AT CRAWFORDVILLE HWY TALLA	302127084181100	4	302127	841811	STREAM
MUNSON SLOUGH AT EIGHTMILE SK NR TALLAHASSEE	301910084175500	2	301910	841755	STREAM
MUNSON SLOUGH AT HWY 319 BRIDGE	302127084181001	10	302127	841810	STREAM
MUNSON SLOUGH AT OAK RIDGE RD NR TALLAHASSEE	301925084180800	2	301925	841808	STREAM
MUNSON SLOUGH AT PUMP STA NR TALLAHASSEE	302414084183000	3	302414	841830	STREAM
NATURAL BRIDGE SPRING NR WOODVILLE	2326887	4	301706	840850	SPRING
NEWPORT SPRING	301245084104301	2	301245	841043	SPRING
NEWPORT SPRING NR NEWPORT	301245084104300	1	301245	841043	SPRING
NORHTEAST DD AT MICCOSUKEE RD AT TALLA	2326838	27	302750	841424	STREAM
NORTHEAST DD AT CAPITAL CIR AT TALLA	2326828	1	302842	841412	STREAM
NORTHEAST DD AT WEEMS ROAD AT TALLA	2326845	2	302719	841321	STREAM
ORANGE AVENUE AT STATE HWY 373A	302448084181800	8	302448	841818	CANAL
PANACEA MINERAL SPRINGS-A AT PANACEA	300202084232501	2	300202	842325	SPRING
PANACEA NO 4	300151084235801	2	300151	842358	STREAM
PARK AVENUE 1 MI. WEST OF STATE HWY 261	302629084144100	5	302629	841441	CANAL
REA SWIMMING BEACH	50614	13	302010	842320	LAKE
REA SWIMMING BEACH	50615	13	302010	842320	LAKE
REA SWIMMING BEACH	50628	116	302145	842235	LAKE

Table 4. Number of surface-water-quality samples collected at each site in the St. Marks River Basin (Continued)

Site name	Station ID number	No. of samples	Latitude	Longitude	Water body type
REA SWIMMING BEACH	50629	113	302145	842235	LAKE
REA SWIMMING BEACH	50634	41	302010	842320	LAKE
REA SWIMMING BEACH	50635	41	302010	842320	LAKE
RHODES SPRING NO2 NR WOODVILLE	2326889	1	301711	840936	SPRING
RHODES SPRING NO4 NR WOODVILLE	2326893	1	301701	840925	SPRING
RIGGINS RD AT MICCOSUKKEE RD & DOOMAR	302750084142400	5	302750	841424	CANAL
RIVER SINK SPRING NR IVAN	2326997	18	301636	842028	SPRING
ROBERT POSTELL WELL NR TALLAHASSEE	302326084184001	3	302326	841840	STREAM
ROBERTS AVENUE BRIDGE AT MABRY ST	302546084194600	13	302546	841946	CANAL
SALLY WARD; WAKULLA CO.	301429084183901	2	301429	841839	SPRING
SAM W SMITH	301235084184701	1	301235	841847	STREAM
SHELL POINT WELL NO.1	300500084182701	1	300500	841827	STREAM
SILVER LAKE, WAKULLA DISTRICT	50619	10	302418	842430	LAKE
SINK HOLE FLOW FROM LK LAFAYETTE	22030046	3	302711	841113	LAKE
SPRING CREEK RISE AT SPRING CREEK	300447084195000	2	300447	841950	SPRING
ST MARKS R BUOY 59 BELOW ST MARKS	645320	15	300700	840900	STREAM
ST MARKS R US 27 E OF TALLAHASSE	645380	15	302500	840600	STREAM
ST MARKS R US 98 NE ST MARKS	645360	15	301100	841300	STREAM
ST. MARKS RIVER AT FT. SAN MARCOS	300905084123501	4	300905	841235	STREAM
ST. MARKS RIVER AT HWY 98 - NEWPORT	301156084104201	8	301156	841042	STREAM
ST. MARKS RIVER AT US 27	302513084060301	6	302513	840603	STREAM
ST. MARKS RIVER NEAR NEWPORT	2326900	68	301600	840900	STREAM
ST. MARKS SPRING NR WOODVILLE	301632084085201	2	301632	840852	SPRING
TALL DEPT OF TRANSP STP INFL	22031021	2	302427	841830	LAKE
TALL MABRY RD STP INFL	22031007	9	302540	841935	LAKE
TALL SW STP SPRINGHILL RD	22031017	9	302320	841930	LAKE
TALLAHASSEE (LK BEDFORD PLANT)	1247BA	12	302530	841800	STREAM
TALLAVANA1 GADSDEN CO.	TALLAVANA1	49	303558	842752	LAKE
TALLAVANA2 GADSDEN CO.	TALLAVANA2	49	303558	842752	LAKE
TALLAVANA3 GADSDEN CO.	TALLAVANA3	49	303558	842752	LAKE
TALLAVANA4 GADSDEN CO.	TALLAVANA4	40	303558	842752	LAKE
TALQUIN1 GADSDEN CO.	TALQUIN1	6	302623	843410	LAKE
TALQUIN2 GADSDEN CO.	TALQUIN2	6	302623	843410	LAKE
TALQUIN3 GADSDEN CO.	TALQUIN3	6	302623	843410	LAKE
THREE POLE CRK W OF SR 260 0.31MI S OF US 90	22020077	1	302755	842416	STREAM
TOM GOLDEN SR WELL NR THOMAS P SMITH STP	302251084204201	2	302251	842042	STREAM
TROUT POND	50616	3	302003	842316	LAKE
UNNAMED LAKE NEAR TALLAHASSEE	302722084232500	1	302722	842325	LAKE
UNNAMED STREAM	1247B1	12	302230	841900	STREAM
USGS LS30	302206084194002	2	302206	841940	STREAM
VIRGINIA AVE AT HWY 90	302644084174400	4	302644	841744	CANAL
W. TENNESSEE STREET AT AENON CHURCH RD	302723084221401	4	302723	842214	CANAL
W. TENNESSEE STREET AT GEORGE BRETT	302718084203201	5	302718	842032	CANAL
WAKULLA R US 98 NE ST MARKS	645340	15	301000	841400	STREAM
WAKULLA R. 100 YDS ABOVE BOGGY BR	22030023	1	300950	841331	STREAM
WAKULLA RIVER AB ST MARKS R AT HWY 61	301249084154201	11	301249	841542	STREAM
WAKULLA RIVER AT US 98	301032084144201	8	301032	841442	STREAM

Table 4. Number of surface-water-quality samples collected at each site in the St. Marks River Basin (Continued)

Site name	Station ID number	No. of samples	Latitude	Longitude	Water body type
WAKULLA SPRING NR CRAWFORDVILLE	2327000	296	301405	841805	SPRING
WARD CREEK AB LAKE MICCOSUKEE	303620083534101	3	303620	835341	STREAM
WEEMS ROAD NEAR HWY 90	302719084132100	10	302719	841321	CANAL
WOLF CR HWY 158 SE MONTICELLO	645460	15	303000	835800	STREAM
TOTAL NUMBER OF SITES	277				
TOTAL NUMBER OF SAMPLES		4,591			

Table 5. Number of chemical screening tests that were performed for surface-water-quality data from selected SWAMP sites, and the period of record for water-quality samples collected from each site

[DSSCRAT denotes ratio of dissolved solids to specific conductance; ANSCRAT denotes ratio of sum of anions to specific conductance; CATSCRAT denotes ratio of sum of cations to specific conductance; CBE denotes ionic charge balance error]

Site No.	Total number of samples	Number of samples screened for				Period of record for site
		DSSCRAT	CATSCRAT	ANSCRAT	CBE	
			Basin 1			
12	97	0	0	0	0	03-20-1968 thru 03-09-1997
13	11,004	137	331	36	36	01-10-1952 thru 04-30-1997
14	280	21	21	0	0	04-04-1966 thru 05-13-1996
15	68	3	3	0	0	06-02-1966 thru 01-05-1997
16	158	0	0	0	0	03-10-1971 thru 03-09-1997
17	104	0	0	0	0	10-18-1971 thru 03-23-1997
18	57	9	9	0	0	05-12-1966 thru 03-13-1996
19	34	0	0	0	0	03-21-1971 thru 02-23-1997
82	47	0	0	0	0	05-16-1966 thru 04-06-1997
83	141	25	70	1	1	01-29-1958 thru 04-06-1997
84	34	0	0	0	0	08-23-1971 thru 03-13-1996
85	12	0	0	0	0	04-12-1995 thru 03-13-1996
86	86	6	6	0	0	01-14-1958 thru 04-20-1997
87	32	0	0	0	0	03-21-1971 thru 02-23-1997
88	107	0	0	0	0	07-20-1970 thru 03-23-1997
116	12	0	0	0	0	04-12-1995 thry 09-13-1996
117	87	0	0	0	0	04-29-1971 thru 05-27-1997
118	47	0	0	0	0	01-16-1974 thru 04-20-1997
119	123	0	0	0	0	09-25-1968 thru 03-09-1997
120	220	6	6	0	0	12-31-1957 thru 03-23-1997
142	26	3	3	0	0	01-19-1967 thru 12-03-1995
Total	12,776	210	449	37	37	
			Basin 2			
21	NO DATA					
81	38	0	0	0	0	04-12-1983 thru 02-16-1997
115	41	0	0	0	0	10-07-1987 thru 05-04-1997
144	139	0	0	0	0	05-22-1974 thru 04-26-1993
Total	218	0	0	0	0	
			Basin 3			
22	NO DATA					
St Marks*	4,591	98	126	25	25	N/A
*** St Marks River basin sites, see table 4.**						
			Basin 4			
10	50	0	0	0	0	01-18-1971 thru 05-13-1997
11	37	1	2	0	0	05-02-1956 thru 05-14-1997
42	91	0	0	0	0	01-25-1972 thru 09-09-1996
43	95	11	11	8	8	10-02-1978 thru 09-06-1996
44	75	19	19	0	0	06-05 1967 thru 02-02-1993
45	491	13	13	0	0	02-18-1917 thru 10-17-1996

Table 5. Number of chemical screening tests that were performed for surface-water-quality data from selected SWAMP sites, and the period of record for water-quality samples collected from each site (Continued)

[DSSCRAT denotes ratio of dissolved solids to specific conductance; ANSCRAT denotes ratio of sum of anions to specific conductance; CATSCRAT denotes ratio of sum of cations to specific conductance; CBE denotes ionic charge balance error]

Site No.	Total number of samples	Number of samples screened for				Period of record for site
		DSSCRAT	CATSCRAT	ANSCRAT	CBE	
46	101	0	0	0	0	01-25-1966 thru 09-04-1996
47	92	6	6	0	0	11-19-1957 thru 09-03-1996
48	83	0	0	0	0	02-10-1989 thru 09-09-1996
49	27	0	0	0	0	12-08-1970 thru 12-12-1989
76	138	0	0	0	0	03-07-1971 thru 05-14-1997
77	113	29	29	4	4	N/A
78	159	2	2	0	0	11-15-196- thru 09-09-1996
79	109	0	0	0	0	12-14-1981 thru 09-11-1996
80	85	0	0	0	0	03-13-1975 thru 09-03-1996
110	25	0	0	0	0	08-24-1987 thru 08-16-1989
111	43	0	0	0	0	01-18-1972 thru 05-14-1997
112	83	0	0	0	0	02-07-1989 thru 09-06-1995
113	167	5	5	0	0	05-12-1966 thru 09-11-1996
114	84	0	0	0	0	02-16-1989 thru 09-03-1996
137	39	0	0	0	0	02-12-1990 thru 07-29-1996
138	52	0	0	0	0	01-18-1972 thru 05-13-1997
139	38	29	30	5	5	04-07-1976 thru 07-22-1996
140	368	2	2	0	0	05-09-1914 thru 06-07-1994
141	146	2	2	0	0	02-04-1961 thru 09-04-1996
149	83	0	0	0	0	02-08-1989 thru 09-06-1996
Total	2,874	119	121	17	17	
Basin 5						
1	131	0	0	0	0	10-17-1961 thru 11-11-1996
2	220	17	17	0	0	03-12-1965 thru 05-08-1997
51	95	6	6	0	0	05-19-1958 thru 04-21-1997
52	40	0	0	0	0	12-01-1982 thru 03-17-1997
90	153	0	0	0	0	06-17-1969 thru 05-08-1997
122	152	0	0	0	0	05-22-1969 thru 05-08-1997
Total	791	23	23	0	0	
Basin 6						
3	140	0	0	0	0	03-16-1971 thru 02-26-1997
4	34	0	0	0	0	05-19-1976 thru 02-25-1997
5	49	1	1	0	0	04-10-1947 thru 03-24-1997
6	72	0	0	0	0	03-18-1973 thru 07-20-1995
7	103	0	0	0	0	06-02-1970 thru 02-17-1997
8	78	0	0	0	0	09-17-1968 thru 04-07-1997
9	130	0	0	0	0	05-15-1974 thru 03-28-1996
50	49	1	1	0	0	04-10-1947 thru 03-24-1997
53C	234	0	3	0	0	05-17-1954 thru 02-26-1997
54	65	0	0	0	0	03-13-1979 thru 03-05-1997
55	50	0	0	0	0	07-22-1975 thru 02-18-1997
56	115	17	18	0	0	10-21-1964 thru 02-04-1997

Table 5. Number of chemical screening tests that were performed for surface-water-quality data from selected SWAMP sites, and the period of record for water-quality samples collected from each site (Continued)

[DSSCRAT denotes ratio of dissolved solids to specific conductance; ANSCRAT denotes ratio of sum of anions to specific conductance; CATSCRAT denotes ratio of sum of cations to specific conductance; CBE denotes ionic charge balance error]

Site No.	Total number of samples	Number of samples screened for				Period of record for site
		DSSCRAT	CATSCRAT	ANSCRAT	CBE	
57	28	0	0	0	0	12-13-1983 thru 03-03-1997
58	188	0	1	0	0	11-21-1979 thru 02-05-1996
89	177	24	24	0	0	04-30-1956 thru 02-24-1997
91	84	11	11	1	1	04-26-1956 thru 03-31-1997
92	9	0	0	0	0	06-26-1995 thru 02-17-1997
93	30	0	0	0	0	02-24-1976 thru 02-18-1997
94	197	0	0	0	0	09-17-1968 thru 04-07-1997
95	59	0	0	0	0	01-21-1971 thru 01-06-1997
121	482	23	62	2	2	05-13-1966 thru 08-14-1996
123	150					Part 1: 02-10-71 thru 05-20-96
	329					Part 2: 01-28-91 thru 05-17-94
124	98	1	1	0	0	06-01-1970 thru 02-17-1997
125	101	0	0	0	0	07-19-1971 thru 02-19-1997
126	73	0	0	0	0	11-09-1977 thru 04-22-1997
127	23	0	0	0	0	08-10-1987 thru 05-15-1995
143	24	0	0	0	0	02-07-1978 thru 02-06-1996
Total	3,171	78	122	3	3	
Basin 7						
24	127	0	0	0	0	03-25-1956 thru 11-14-1995
26	NO DATA					
25	83	0	0	0	0	10-30-1973 thru 05-15-1996
28	217	0	0	0	0	03-28-1973 thru 06-06-1996
29	164	0	0	0	0	01-03-1951 thru 06-60-1996
32	133	0	0	0	0	04-22-1971 thru 06-12-1996
33	189	0	0	0	0	07-25-1966 thru 12-07-1994
34	550	0	0	0	0	01-27-1982 thru 12-13-1995
35	247	5	8	0	0	01-15-1934 thru 02-22-1995
36	253	0	0	0	0	05-12-1976 thru 11-29-1995
38	77	6	19	0	0	03-09-1964 thru 10-17-1995
65	176	1	2	0	0	06-12-1962 thru 06-12-1996
66	6	0	0	0	0	08-15-1977 thru 09-24-1996
67	12	0	0	0	0	07-12-1995 thru 09-25-1996
68	189	0	0	0	0	03-23-1992 thru 09-24-1996
69	238	0	0	0	0	12-09-1981 thru 06-19-1996
70	82	33	48	1	1	03-25-1965 thru 11-14-1995
71C	102	0	0	0	0	09-26-1989 thru 06-18-1996
72	270	0	0	0	0	01-06-1988 thru 06-18-1996
73	7	54	71	1	1	05-03-1956 thru 09-20-1995
74	11	0	0	0	0	09-16-1992 thru 11-14-1995
101	11	0	0	0	0	09-16-1992 thru 08-21-1996
102	4	0	0	0	0	04-02-1992 thru 09-24-1996
103	249	0	0	0	0	07-12-1995 thru 09-25-1996

Table 5. Number of chemical screening tests that were performed for surface-water-quality data from selected SWAMP sites, and the period of record for water-quality samples collected from each site (Continued)

[DSSCRAT denotes ratio of dissolved solids to specific conductance; ANSCRAT denotes ratio of sum of anions to specific conductance; CATSCRAT denotes ratio of sum of cations to specific conductance; CBE denotes ionic charge balance error]

Site No.	Total number of samples	Number of samples screened for				Period of record for site
		DSSCRAT	CATSCRAT	ANSCRAT	CBE	
104	24	0	0	0	0	12-12-1966 thru 12-13-1994
105	553	1	2	0	0	02-03-1962 thru 11-14-1995
106	19	0	0	0	0	11-13-1950 thru 06-19-1996
107	126	0	0	0	0	03-23-1992 thru 09-12-1996
108	6	0	0	0	0	06-27-1991 thru 10-02-1996
109	97	0	0	0	0	06-26-1995 thru 09-23-1996
132	553	0	0	0	0	04-28-1970 thru 07-12-1995
134	55	0	0	0	0	11-13-1950 thru 06-19-1996
135	86	4	4	0	0	05-19-1966 thru 09-19-1996
136	354	2	2	0	0	05-28-1918 thru 09-18-1996
Total	5,270	106	156	2	2	
Basin 8						
23	1358	0	0	0	0	11-06-1972 thru 02-14-1996
27	83	4	16	0	0	08-09-1971 thru 03-04-1996
30	273	0	0	0	0	01-17-1973 thru 05-16-1996
31	11	2	2	1	1	05-19-1972 thru 01-09-1996
39	420	1	1	0	0	01-17-1973 thru 09-27-1994
40	73	93	127	38	38	10-05-1961 thru 05-14-1996
41	1383	0	0	0	0	10-03-1984 thru 12-04-1995
59	606	6	21	0	0	08-09-1971 thru 03-04-1996
60	525	0	0	0	0	01-13-1969 thru 02-14-1996
61	323	14	20	0	0	09-25-1948 thru 08-08-1996
62	19	0	0	0	0	11-06-1972 thru 02-14-1996
63	744	0	0	0	0	07-25-1972 thru 10-24-1995
64C	277	0	10	0	0	02-12-1941 thru 08-08-1996
96	11	59	62	0	0	02-08-1963 thru 02-07-1996
97	671	0	0	0	0	03-17-1987 thru 08-08-1996
98	174	0	0	0	0	11-06-1972 thru 02-14-1996
99	22	25	25	0	0	10-26-1970 thru 12-19-1988
100	31	2	2	1	1	09-20-1972 thru 08-27-1996
128	507	0	0	0	0	07-14-1977 thru 04-22-1997
129	204	0	0	0	0	11-06-1972 thru 11-16-1993
130	341	40	45	0	0	11-27-1965 thru 07-10-1991
131	79	5	10	0	0	08-09-1945 thru 08-27-1996
133C	192	0	0	0	0	02-15-1989 thru 01-10-1996
145	510	4	5	0	0	03-16-1970 thru 02-06-1996
146	143	8	22	0	0	08-09-1971 thru 02-06-1996
147	799	21	27	2	2	11-03-1959 thru 03-25-1997
148	NO DATA					
150		104	126	15	15	11-20-1954 thru 10-03-1996
Total	9779	388	521	57	57	

Table 6. Summary statistics for chemical screening tests of water-quality data from selected SWAMP sites

[N denotes number of samples; NP denotes number of samples that passed screening criteria (see text); P denotes percentage of samples that passed screening criteria; DSSCRAT denotes ratio of dissolved solids to specific conductance, in µS/cm; CATSCRAT denotes ratio of cation sum in milliequivalents per liter to specific conductance; ANSCRAT denotes ratio of anion sum in milliequivalents per liter to specific conductance; and CBE denotes charge balance error in percent; --- denotes not calculated due to an insufficient number of samples]

Screening test	N	NP	P	Minimum	Maximum	Mean	Standard deviation	Median
Basin 1								
DSSCRAT	208	167	80	0.45	1.13	0.66	0.13	0.62
CATSCRAT	446	417	93	0.09	1.32	0.93	0.10	0.94
ANSCRAT	37	23	62	0.46	1.09	0.82	0.14	0.83
CBE	37	31	84	-5.56	33.9	6.71	8.26	4.89
Basin 3								
DSSCRAT	98	69	70	0.41	0.74	0.57	0.05	0.56
CATSCRAT	126	120	95	0.76	1.27	1.03	0.08	1.03
ANSCRAT	25	22	88	0.77	1.00	0.87	0.06	0.88
CBE	25	16	64	4.33	14.2	9.28	2.50	8.69
Basin 4								
DSSCRAT	119	75	63	0.41	47.6	1.57	6.13	0.58
CATSCRAT	121	84	69	0.46	97.2	2.83	11.8	1.05
ANSCRAT	17	8	47	0.65	1.29	0.87	0.16	0.84
CBE	17	10	59	-36.4	16.2	2.7	14.0	7.43
Basin 5								
DSSCRAT	23	12	52	0.26	0.76	0.51	0.14	0.55
CATSCRAT	23	16	70	0.41	1.24	0.85	0.25	0.90
ANSCRAT	---	---	---	---	---	---	---	---
CBE	---	---	---	---	---	---	---	---
Basin 6								
DSSCRAT	78	46	59	0.48	32.2	1.60	5.26	0.56
CATSCRAT	122	113	93	0.80	787	8.76	71.5	1.04
ANSCRAT	3	2	67	0.77	1.07	0.89	0.16	0.82
CBE	3	0	0	11.5	15.7	13.6	2.1	13.4
Basin 7								
DSSCRAT	107	60	56	0.05	29.2	1.35	4.60	0.57
CATSCRAT	157	143	91	0.23	52.8	1.99	7.04	1.01
ANSCRAT	2	1	50	0.72	0.81	0.76	---	0.76
CBE	2	0	0	11.3	13.8	12.5	1.77	12.5
Basin 8								
DSSCRAT	388	197	51	0.20	1,870	5.45	94.7	0.55
CATSCRAT	533	490	92	0.36	3,350	7.36	145	0.98
ANSCRAT	62	43	69	0.65	2.80	0.99	0.37	0.89
CBE	62	54	87	-15.4	20.3	2.82	6.20	4.34
All basins								
DSSCRAT	,1021	626	61	0.05	1,870	2.72	58.5	0.57
CATSCRAT	1,528	1,383	91	0.09	3,350	4.10	88.2	0.98
ANSCRAT	146	99	68	0.46	2.80	0.91	0.27	0.86
CBE	146	111	76	-36.4	33.9	5.25	8.02	5.98

Table 7. Number of samples from selected SWAMP sites with pH and specific-conductance (SC) data flagged for anomalously low or high values

Site No.	Total number of samples	Total number of pH samples	Number of flags: Field pH P_400	Number of flags: Lab pH P_403	Total number of SC samples	Number of flags: Lab SC P_94	Number of flags: Field SC P_95
Basin 1							
12	97	79	0	0	50	1	0
13	11,004	4,686	1	0	1,879	1	2
14	280	232	0	0	183	2	1
15	68	61	0	0	45	0	0
16	158	106	0	0	83	0	0
17	104	96	0	0	46	0	0
18	57	44	0	0	36	0	0
19	34	32	1	0	22	0	0
82	47	46	0	0	45	0	0
83	141	130	0	0	107	1	0
84	34	31	0	0	18	0	0
85	12	11	0	0	11	0	0
86	86	79	0	0	50	0	0
87	32	31	0	0	23	0	0
88	107	99	0	0	47	1	0
116	12	11	0	0	11	0	0
117	87	69	0	0	58	0	0
118	47	34	0	0	34	0	0
119	123	91	0	0	56	0	0
120	220	168	0	0	69	0	1
142	26	23	0	0	23	0	0
Total	12,776	6,159	2	0	2,896	6	4
Basin 2							
21	NO DATA						
81	38	36	0	0	27	0	0
115	41	40	0	0	31	0	0
144	151	104	0	0	48	0	0
Total	230	180	0	0	106	0	0
Basin 3							
22	NO DATA						
St Marks*	4,591	Not analyzed			Not analyzed		

*** St Marks River basin sites, see table 4.**

Site No.	Total number of samples	Total number of pH samples	Number of flags: Field pH P_400	Number of flags: Lab pH P_403	Total number of SC samples	Number of flags: Lab SC P_94	Number of flags: Field SC P_95
Basin 4							
10	50	48	0	0	39	0	0
11	37	33	0	0	35	0	0
42	91	89	0	0	88	0	0
43	95	88	0	0	88	0	0
44	75	60	0	0	62	0	3
45	491	111	0	0	110	0	1
46	101	100	1	1	100	0	0
47	92	90	0	0	90	0	0

Table 7. Number of samples from selected SWAMP sites with pH and specific-conductance (SC) data flagged for anomalously low or high values (Continued)

Site No.	Total number of samples	Total number of pH samples	Number of flags: Field pH P_400	Number of flags: Lab pH P_403	Total number of SC samples	Number of flags: Lab SC P_94	Number of flags: Field SC P_95
48	83	82	0	0	82	0	0
49	27	25	0	0	13	0	0
76	138	120	0	0	107	0	3
77	113	110	0	0	112	0	0
78	159	157	0	0	156	0	0
79	109	106	0	0	107	0	0
80	85	83	0	0	84	0	0
110	25	24	0	0	24	0	0
111	43	39	0	0	37	0	1
112	83	81	0	0	82	0	0
113	167	129	0	0	132	0	2
114	84	81	0	0	82	0	0
137	39	38	0	0	38	0	0
138	52	46	0	0	46	0	2
139	38	33	0	0	36	0	0
140	368	13	0	0	11	0	0
141	146	91	0	0	102	0	0
149	83	82	0	0	82	0	0
Total	2,874	1,959	1	1	1,945	0	12
Basin 6							
1	131	106	0	0	111	2	2
2	220	152	1	0	170	0	1
51	95	59	1	0	53	0	0
52	40	27	0	0	35	0	0
90	153	129	0	0	129	0	0
122	152	131	0	0	130	0	0
Total	791	604	2	0	628	2	3
Basin 7							
3	140	115	5	5	118	0	0
4	34	25	0	0	25	0	0
5	49	19	0	0	17	0	0
6	72	52	0	0	43	0	0
7	103	90	0	0	87	0	0
8	78	67	0	0	66	0	0
9	130	127	0	0	13	0	0
50	49	19	0	0	17	0	0
53	234	219	1	1	226	0	3
54	65	57	2	0	58	1	0
55	50	30	0	0	31	0	0
56	115	72	0	0	68	0	0
57	28	17	0	0	17	0	0
58	188	185	0	0	186	0	0
89	177	44	0	0	148	0	5
91	84	46	0	0	53	0	0

Table 7. Number of samples from selected SWAMP sites with pH and specific-conductance (SC) data flagged for anomalously low or high values (Continued)

Site No.	Total number of samples	Total number of pH samples	Number of flags: Field pH P_400	Number of flags: Lab pH P_403	Total number of SC samples	Number of flags: Lab SC P_94	Number of flags: Field SC P_95
92	9	2	0	0	2	0	0
93	30	22	0	0	22	0	0
94	197	172	0	0	170	0	0
95	59	58	0	0	31	0	0
121	482	281	18	0	415	5	5
123	150	131	0	0	109	0	1
124	329	275	0	0	251	0	8
125	98	71	0	0	60	0	0
126	101	87	0	0	88	0	0
127	73	66	0	0	68	0	0
143	23	21	0	0	21	0	0
Total	3,147	2,370	26	6	2,410	6	22
Basin 7							
24	24	0	0	0	12	0	0
25	127	122	1	0	123	0	0
26	NO DATA						
28	83	60	0	0	60	0	0
29	217	173	1	0	167	0	0
32	164	143	1	0	143	0	0
33	133	66	1	0	60	5	0
34	189	172	0	0	173	5	1
35	550	181	0	1	222	0	9
36	247	241	0	0	242	3	2
38	253	114	0	0	153	0	0
65	77	57	0	0	56	1	2
66	176	156	0	0	57	0	0
67	6	0	0	0	2	0	0
68	12	4	0	0	7	0	0
69	189	172	0	0	173	5	6
70	238	175	1	0	216	0	2
71	82	81	4	0	79	2	0
72	102	102	0	0	95	0	0
73	270	180	2	0	249	0	4
74	7	0	0	0	6	0	0
101	11	2	0	0	10	0	0
102	11	4	0	0	7	0	0
103	4	0	0	0	2	0	0
104	249	235	0	0	134	0	1
105	24	6	0	0	13	0	0
106	553	111	0	0	110	0	2
107	19	9	0	0	14	0	0
108	126	5	0	0	10	0	0
109	6	0	0	0	3	0	0
132	97	0	0	0	0	0	0

Table 7. Number of samples from selected SWAMP sites with pH and specific-conductance (SC) data flagged for anomalously low or high values (Continued)

Site No.	Total number of samples	Total number of pH samples	Number of flags		Total number of SC samples	Number of flags	
			Field pH P_400	Lab pH P_403		Lab SC P_94	Field SC P_95
134	553	112	0	0	111	0	1
135	55	26	0	0	51	0	0
136	86	61	0	0	70	0	0
Total	4,940	2,770	11	1	2,830	21	30
			Basin 8				
23	354	332	1	0	309	9	0
27	1,358	410	0	0	416	2	0
30	83	65	0	0	69	0	0
31	273	210	0	0	215	2	0
39	11	4	0	0	4	0	0
40	420	303	0	0	329	0	0
41	73	28	0	0	28	3	0
59	1,383	444	1	0	452	2	0
60	606	378	5	0	360	6	0
61	525	451	2	0	411	1	0
62	323	4	0	0	3	0	0
63	19	9	1	1	8	1	0
64	744	704	1	0	668	8	3
96	277	190	9	0	224	0	1
97	11	10	0	0	10	0	0
98	671	397	2	0	368	16	0
99	174	105	0	0	148	0	0
100	22	14	0	0	12	0	0
128	31	28	0	0	6	0	0
129	507	313	11	0	285	6	0
130	204	64	0	0	79	0	1
131	341	246	0	0	286	6	4
133	546	440	0	0	285	0	2
145	192	180	0	0	188	4	0
146	510	442	1	0	451	2	0
147	143	124	0	0	124	0	0
148	NO DATA						
150	NO DATA						
Total	9,801	5,895	34	1	5,738	68	11

Table 8. Summary of selected responses from agencies collecting surface-water-quality data to questionnaire on quality control/quality assurance procedures and information on flow measurements at SWAMP sites

Questionnaire

Number	Response Yes	Response No	Did not answer	Percent responded
10a Were steps taken to insure to insure accuracy,	30	2	2	94
10b precision,	30	1	3	91
10c comparability, and	29	1	4	88
10d representativeness of collected samples?	27	1	6	82
11 Do you follow a DEP-approved QA/QC protocol for sampling?	27	3	4	88
12a Do you have quality assurance practices for recording data?	28	3	3	91
12b for reporting data?	23	6	5	85
12c What quality assurance practices do you use for recording data?	2	1	30	9
12d for reporting data?	1	2	30	9
16a Do you use EPA STORET remark codes?	19	9	6	82
16b Do you use other remark codes?	5	18	11	68
16c Has your use of remark codes changed in the past?	1	11	22	35
16d How do you interpret these codes?	0	1	33	3
18a Do you qualify data at the station level?	11	12	11	68
18b at sample level?	18	6	10	71
18c Do you make provisions for informing users of the quality of data?	2	8	24	29
18d What are the provisions?	0	4	30	12
20a Do you follow calibration procedures in lab analysis of data?	26	3	5	85
20b What are they?	0	0	33	0
21a Have lab analysis methods changed over the years?	17	10	8	77
21b If yes, were steps taken to insure the changes did not impair data	13	5	14	25
21c What were the steps?	0	0	34	0
22a Provide list of analytes,	25	4	5	85
22b detection limits, and	25	4	5	85
22c reporting units for analytical methods that you use	24	3	7	79
23a Do you measure field parameters?	30	3	1	97
23b What are the parameters?	0	0	34	0
23c What are the methods of analysis?	0	0	34	0
23d the reporting units?	0	0	34	0
24a Are calibration methods followed in the field?	28	5	2	94
24b What are they?	0	0	34	0
24c Are these stored?	11	4	19	44
24d Are these stored?	13	2	19	44
27a Is gage height recorded during sample collection?	8	22	6	83
27b Is discharge measured during sample collection?	5	18	13	64
27c Are tidal stages recorded for the collection of estuary samples?	5	17	13	63
28a Are samples collected at individual points (grab samples)?	29	3	2	94
28b Or are they integrated over depth or width (composited)?	10	4	20	41
28c Describe how composited?	0	1	33	3
Total:	522	197	609	

Appendix

FDEP Surface-Water Ambient Monitoring Program (SWAMP) Questionnaire

Monitoring Network

1. Are you currently operating an ambient or regulatory surface-water-quality monitoring network? Please describe any other kind of network(s) you are currently operating.

2. How many fixed-stations or other ambient surface-water sites are being sampled as part of your program?

3. Have SWAMP sampling sites changed in the past? When?

4. How frequently do you sample each station and what criteria did you use to derive that frequency?

5. What criteria were used to select the sampling locations?

6. What criteria were used to select the variables of interest?

7. Do you have permanent staff available for sample collection and analysis?

8. Are any analyses or sampling efforts contracted out? If so, please list the name of the contract laboratory or sample-collection agency.

9. Are there any conditions under which you do not sample? Please describe.

10. What steps were taken to insure that samples are collected to insure accuracy, precision, comparability, and representativeness?

11. Do you follow a DEP-approved QA/QC protocol for sampling? If so, please provide CompQAPP number.

Data Upload

12. What quality assurance practices do you use for recording and reporting data?

13. Do you upload data to STORET? If so, for how long? < 1 yr 1-5 yr 5-10 yr > 10 yr?

14. Do you generally upload you data to STORET within one year of sample collection?

15. Do you upload data to any other databases? If so, please list.

16. Do you use the EPA STORET remark codes? Do you use other remark codes? Has you use of remark codes changed in the past? How do you interpret these codes?

18. Do you quality data at the station or sample level? What provisions do you make for informing users of the quality of the data?

19. In general, are you satisfied with STORET as a central repository for water-quality data?

Laboratory Methods

20. What calibration procedures are followed in the lab?

21. Have the methods of analysis changed over the years? What was done to insure that these changes have not impaired data comparability?

22. Please provide a list of analytes, detection limits, and reporting units for analytical methods that you use. (for example: Nitrate 0.005 mg/L as N EPA 352.1)

Field Methods

23. What parameters do you typically measure in the field?

24. What calibration methods are followed in the field? Are these recorded and stored somewhere?

25. Please provide a list of parameters you typically measure in the field. Please include the method of analysis and reporting units. (for example: Specific conductance -by probe - uSiemens/cm).

26. Are samples collected from stations in any prescribed order or time of day?

27. Is gage height recorded or discharge measured during sample collection? Are tidal stages recorded for the collection of estuary samples?

28. Are samples collected at individual points (for example grab samples) or are they integrated over depth or width (composited)? If composited, please describe.

Data Practices

29. What are the main uses of your data? Do you make management decisions with the data?

30. What kinds of reports and publications do you produce with the data? Are you producing analytical reports? Data tables?

31. Who uses the surface-water-quality information that you produce?

32. Please list the names, phone numbers, and e-mail addresses for those of your agency involved in SWAMP sample collection, lab analysis, and data management.

Appendix

FDEP Surface-Water Ambient Monitoring Program (SWAMP) Questionnaire

Monitoring Network

1. Are you currently operating an ambient or regulatory surface-water-quality monitoring network? Please describe any other kind of network(s) you are currently operating.

2. How many fixed-stations or other ambient surface-water sites are being sampled as part of your program?

3. Have SWAMP sampling sites changed in the past? When?

4. How frequently do you sample each station and what criteria did you use to derive that frequency?

5. What criteria were used to select the sampling locations?

6. What criteria were used to select the variables of interest?

7. Do you have permanent staff available for sample collection and analysis?

8. Are any analyses or sampling efforts contracted out? If so, please list the name of the contract laboratory or sample-collection agency.

9. Are there any conditions under which you do not sample? Please describe.

10. What steps were taken to insure that samples are collected to insure accuracy, precision, comparability, and representativeness?

11. Do you follow a DEP-approved QA/QC protocol for sampling? If so, please provide CompQAPP number.

Data Upload

12. What quality assurance practices do you use for recording and reporting data?

13. Do you upload data to STORET? If so, for how long? < 1 yr 1-5 yr 5-10 yr > 10 yr?

14. Do you generally upload you data to STORET within one year of sample collection?

15. Do you upload data to any other databases? If so, please list.

16. Do you use the EPA STORET remark codes? Do you use other remark codes? Has you use of remark codes changed in the past? How do you interpret these codes?

18. Do you quality data at the station or sample level? What provisions do you make for informing users of the quality of the data?

19. In general, are you satisfied with STORET as a central repository for water-quality data?

Laboratory Methods

20. What calibration procedures are followed in the lab?

21. Have the methods of analysis changed over the years? What was done to insure that these changes have not impaired data comparability?

22. Please provide a list of analytes, detection limits, and reporting units for analytical methods that you use. (for example: Nitrate 0.005 mg/L as N EPA 352.1)

Field Methods

23. What parameters do you typically measure in the field?

24. What calibration methods are followed in the field? Are these recorded and stored somewhere?

25. Please provide a list of parameters you typically measure in the field. Please include the method of analysis and reporting units. (for example: Specific conductance -by probe - uSiemens/cm).

26. Are samples collected from stations in any prescribed order or time of day?

27. Is gage height recorded or discharge measured during sample collection? Are tidal stages recorded for the collection of estuary samples?

28. Are samples collected at individual points (for example grab samples) or are they integrated over depth or width (composited)? If composited, please describe.

Data Practices

29. What are the main uses of your data? Do you make management decisions with the data?

30. What kinds of reports and publications do you produce with the data? Are you producing analytical reports? Data tables?

31. Who uses the surface-water-quality information that you produce?

32. Please list the names, phone numbers, and e-mail addresses for those of your agency involved in SWAMP sample collection, lab analysis, and data management.