Quality-Assurance Plan for Water-Quality Activities of the U.S. Geological Survey in Miami, Florida

U.S. GEOLOGICAL SURVEY

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ABBREVIATIONS AND ACRONYMS

ft/s	=	foot per second
g	=	gram
mg/L	=	milligram per liter
μg/L	=	microgram per liter
mm	=	millimeter
μS/cm	=	microsiemens per centimeter
°C	=	degrees Celsius
ACS	=	American Chemical Society
ADAPS	=	Automated Data Processing System
ASTM	=	American Society of Testing and Materials
BQS	=	Branch of Quality Systems
DIW	=	Deionized water
DQI	=	Data quality indicator
EDI	=	Equal discharge increment
EWI	=	Equal width increment
FA	=	Filtered acidified
HIF	=	Hydrologic Instrumentation Facility
ICPMS	=	Inductively coupled plasma mass spectrophotometer
ICPOE	=	Inductively coupled plasma optical emission
KDSL	=	Kentucky District Sediment Laboratory
NASQAN	=	National Stream Quality Accounting Network
NAWQA	=	National Water Quality Assessment
NFQA	=	National Field Quality Assurance
NIST	=	National Institute of Standards and Technology
NWIS	=	National Water Information System
NWQL	=	National Water Quality Laboratory
OWQ	=	Office of Water Quality
OWQRL	=	Ocala Water Quality and Research Laboratory
QA	=	Quality assurance
QC	=	Quality control
QA/QC	=	Quality assurance/quality control
RA	=	Raw acidified
RC	=	Raw chilled
SM	=	Standard methods
SOP	=	Standard operating procedures
SRS	=	Standard reference sample
USEPA	=	U.S Environmental Protection Agency
USGS	=	U.S. Geological Survey
WRD	=	Water Resources Discipline

Quality-Assurance Plan for Water-Quality Activities of the U.S. Geological Survey in Miami, Florida

Compiled by A.C Lietz

ABSTRACT

In accordance with guidelines set forth by the Office of Water Quality in the Water Resources Discipline of the U.S. Geological Survey, a quality-assurance plan has been created for use by the U.S. Geological Survey (USGS) in Miami to conduct water-quality activities. This quality-assurance plan documents the standards, policies, and procedures used by the Miami USGS for activities related to the collection, processing, storage, analysis, and publication of water-quality data. The policies and procedures that are documented in this quality-assurance plan for water-quality activities are meant to complement the Miami USGS quality-assurance plans for surface-water and ground-water activities.

1.0 INTRODUCTION

The U.S. Geological Survey (USGS) was established by an act of Congress on March 3, 1879, to provide a permanent Federal agency to perform the systematic and scientific "classification of the public lands, and examination of the geologic structure, mineral resources, and products of the national domain." The Water Resources Discipline (WRD) of the USGS is the Nation's principal water-resources information agency. The objectives of the WRD Basic Hydrologic Data Program are to collect and provide unbiased, scientifically based information that describes the quantity and quality of waters in the Nation's streams, lakes, reservoirs, and aquifers. Water-quality activities at the Miami USGS are part of the WRD's overall mission of appraising the Nation's water resources. Florida has three operational centers geographically distributed across the State, including Miami, Gainesville, and St. Petersburg. This report documents the activities of the Miami USGS under the authority of its Center Director.

To address quality-control (QC) issues that are related to water-quality activities, the WRD has implemented policies and procedures designed to ensure that all scientific work conducted by or for the WRD is consistent and of documented quality. The Office of Water Quality (OWQ) is responsible for providing a quality-assurance (QA) plan that documents the policies and procedures applicable to the water-quality activities in each office in the WRD.

A QA plan is a formal document that describes the management policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation procedures for ensuring quality. Quality assurance, quality control, and quality assessment are all components of a QA plan. The terms are defined as follows:

Quality assurance (QA)–The systematic management of data-collection systems by using prescribed guidelines and criteria for implementing technically approved methods and policies. Quality assurance incorporates a comprehensive plan that outlines the overall process for providing a product or service that will satisfy the given requirements for quality.

Quality control (QC)–The specific operational techniques and activities used to obtain the required quality of data. Quality control consists of the application of technical procedures to achieve prescribed standards of performance and to document the quality of collected data. Quality-control data that do not meet required standards are used to evaluate and implement corrective actions necessary to improve performance to acceptable levels.

Quality assessment–The overall process of assessing the quality of environmental data by reviewing: (1) the appropriate implementation of QA policies and procedures, and (2) analyzing the QC data. Quality assessment encompasses both the measurable and unmeasurable factors that affect the quality of environmental data. Assessment of these factors may indicate limitations that require modifications to protocols or standard operating procedures for sample collection and analysis, or that affect the desired interpretation and use of the environmental data.

Quality-assurance, quality-control, and quality-assessment systems complement each other by providing a comprehensive QA program that ensures quality objectives are identified and integrated into all levels of water-quality activities. By integrating these components into a discipline-wide QA guidance document, the OWQ hopes to enhance water-quality data collected by the USGS by providing for the following:

- **Consistency** in data quality across all levels of the WRD;
- **Accountability** to clients, the scientific community, regulatory agencies, and the general public;
- **Comparability** of results among samples, sites, and laboratories;
- **Traceability** from the end product back to its origins and to all supplementary information through written records;
- **Application** of appropriate and documented techniques that lead to similar results time and again;
- **Representativeness** of the data in describing the actual chemical composition of the biological or physical conditions at a sampling site for a given point or period in time; and
- **Adequacy** of the amount of data obtained to meet data objectives.

1.1 Purpose

The purpose of this QA plan for water-quality activities is to document the standards, policies, and procedures used by the Miami USGS for activities related to the collection, processing, storage, analysis, and publication of water-quality data. This plan identifies responsibilities for ensuring that stated policies and procedures are carried out. The plan also serves as a guide for all Miami USGS personnel, who are involved in water-quality activities, and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

1.2 Scope

The scope of this QA plan includes discussions of the policies and procedures followed by the Miami USGS for the collection, processing, analysis, storage, and publication of water-quality data. Although procedures and products of interpretive investigations are subject to the criteria discussed in this plan, some interpretive investigations may be required to have separate and complete QA plans. The policies and procedures documented in this QA plan for water-quality activities are intended to compliment the Miami USGS QA plan for surface-water and ground-water activities.

2.0 ORGANIZATION AND RESPONSIBILITIES

Quality assurance is an active process of achieving and maintaining high-quality standards for water-quality data. Consistent quality requires specific actions that are carried out systematically in accordance with established policies and procedures. Errors and deficiencies can result when individuals fail to carry out their responsibilities. Clear and specific statements of responsibilities promote an understanding of each person's duties in the overall process of ensuring the quality of water-quality data.

2.1 Organizational Chart

The organizational structure of the Miami USGS is similar to that of the other two USGS Centers in Florida (Gainesville and St. Petersburg), but different program requirements from one Center to another contribute to the uniqueness of these organizational structures. The following chart illustrates the organization of Miami USGS personnel in Miami as of October 2002 (fig. 1).

2.2 Responsibilities

The final responsibility for the preparation and implementation of and adherence to the QA policies that are described in this QA plan lies with the Miami USGS Center Director (Schroder and Shampine, 1992, p. 7). The following is a list of responsibilities for selected Miami USGS personnel involved in the collection, processing, storage, analysis, and publication of water-quality data:

The Miami USGS Center Director and designated management personnel are responsible for:

1. Managing and directing the Miami USGS program, including designation of personnel responsible for managing all water-quality activities;
2. Ensuring that water-quality activities in the Miami USGS meet the needs of the Federal Government, the Miami USGS, cooperating State and local agencies, and the general public;
3. Ensuring that all aspects of this QA plan are understood and followed by Miami USGS personnel, which is accomplished by direct involvement of the Miami USGS Director or through clearly stated delegation of responsibility to other personnel in the Miami USGS;
4. Providing final resolution, in consultation with the water-quality specialist, of any conflicts or disputes related to water-quality activities within the Miami USGS;

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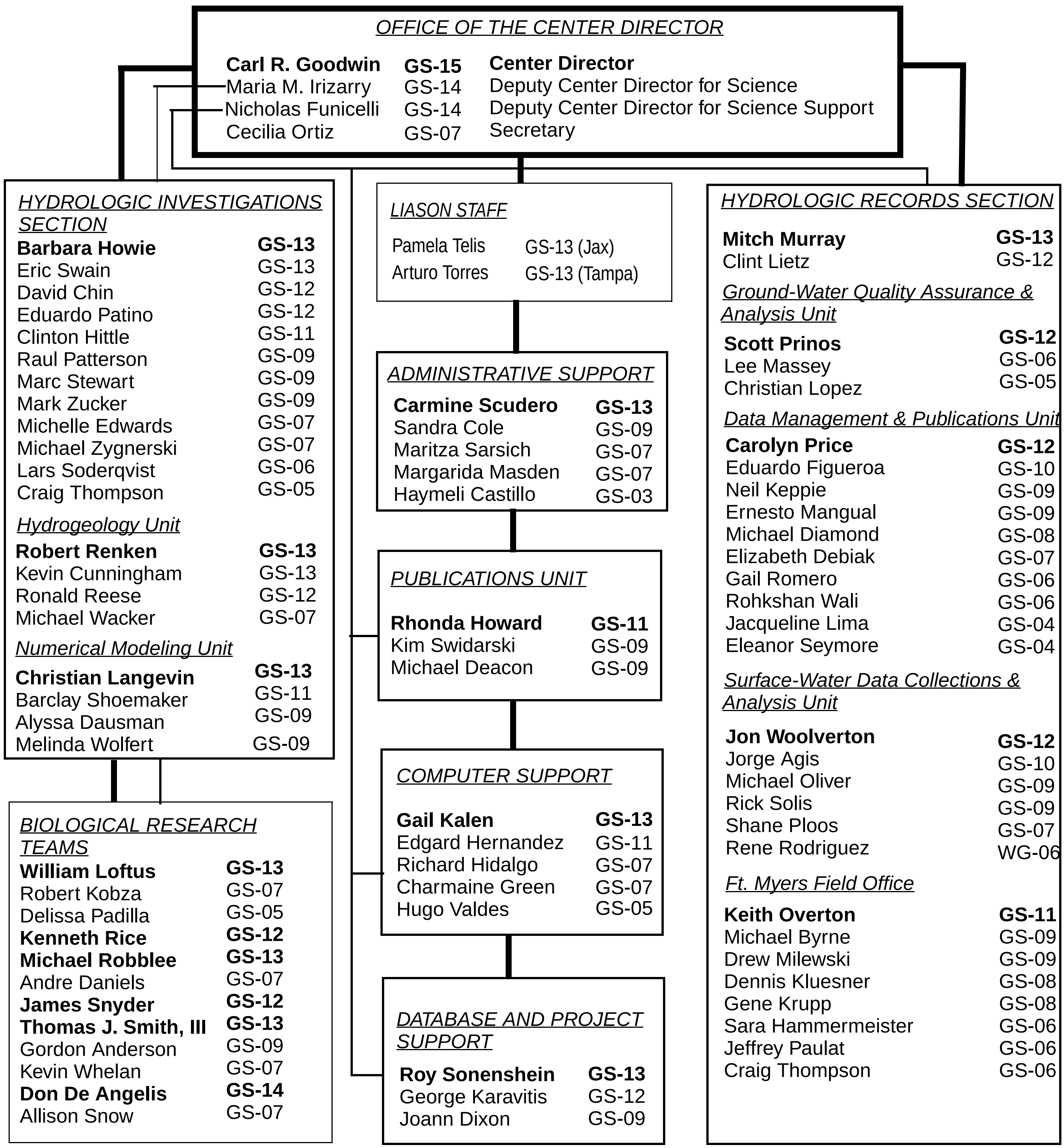


Figure 1. Organizational chart of the U.S. Geological Survey in Miami, as of October 2002.

5. Keeping subordinates briefed on procedural and technical communications from regional and Headquarters offices;
6. Participating in technical reviews of all water-quality programs on an annual cycle; and
7. Ensuring that all water-quality publications and other related technical communications released by Miami USGS personnel are accurate and comply with USGS policy.

The Miami USGS water-quality specialist or designated representative is responsible for:

1. Ensuring that water-quality activities in the Miami USGS meet the needs of the Federal Government, the Miami USGS, cooperating State and local agencies, and the general public;
2. Preparing and implementing the Miami USGS water-quality QA plan;
3. Ensuring that all aspects of this QA plan are understood and followed by Miami USGS personnel, which is accomplished by direct involvement of the water-quality specialist;
4. Keeping Miami USGS personnel briefed on procedural and technical communications from regional and Headquarters offices;
5. Participating in technical reviews of all Miami USGS water-quality programs on an annual cycle;
6. Ensuring that all water-quality publications and other related technical communications released by Miami USGS personnel are accurate and comply with USGS policy;
7. Ensuring that the Miami USGS QA plan is reviewed and revised at least once every 3 years to document current responsibilities, methodologies, and ongoing procedural improvements.

The project chief is responsible for:

1. Managing and directing the project's field and laboratory water-quality activities;
2. Ensuring that the project's field and laboratory water-quality activities meet the needs of the Federal Government, the Miami USGS, cooperating State and local agencies, and the general public;
3. Ensuring that all aspects of this QA plan that pertain to the project's field and laboratory water-quality activities are understood and followed by project personnel;
4. Obtaining guidance, as appropriate, for project quality-assurance/quality-control (QA/QC) activities from the Miami USGS water-quality specialist; and
5. Ensuring that QA/QC activities are properly carried out by the project staff.

2.3 References Used for the Organization and Responsibilities Section

Table 1 lists reports and/or memoranda referred to in this section. For the complete citation, refer to Section 13.0 in this report.

Table 1. Summary of references for organization and responsibilities related to quality assurance

Reference	Subject
Schroder and Shampine (1992)	Guidelines for preparing a quality-assurance plan
Shampine and others (1992)	Integrating quality assurance into project workplans

3.0 PROGRAM AND PROJECT PLANNING

The Miami USGS Center Director has primary responsibility for overall Miami USGS program planning and is responsible for ensuring that Miami USGS projects are supportive of Miami USGS and national priorities. All water-quality projects require review and approval prior to the commencement of work. Quality-assurance requirements should be integrated into the project proposal. Whether or not a separate QA plan will be required for a water-quality project will depend on the complexity of the work, the needs of the Miami USGS or cooperator, or other criteria as described in Shampine and others (1992).

3.1 Project Proposals

Project proposals are developed at the local level in response to requests by cooperating agencies, needs recognized by the WRD in working closely with other agencies, or national programs. The Miami USGS proposals conform to the format required by the Eastern Region – South set forth on June 7, 1996, and amended on April 16, 1999.

Each proposal must: (1) state the problem or need for the study, (2) define objectives–what will be done to help solve the problem, (3) define the approach–how work will be done to accomplish the objectives, and (4) describe the relevance of the study to the mission of the USGS. The approach consists of a detailed outline of the data-collection activities to be carried out (if new data are needed), the QA plans, the QC information needed, and the analytical techniques to be used. Project report plans, cost estimates, time schedules, and personnel requirements also are addressed. Consultation with regional and discipline specialists is encouraged in the preparation of proposals and in the execution of projects.

Review of project proposals is given high priority. Project proposals are reviewed by appropriate Miami USGS personnel, including the section supervisor and the water-quality specialist. At the discretion of the Miami USGS Center Director, proposals may be sent to other USGS offices for review. The Eastern Region – South provides final review and approval of all project proposals.

3.2 Project Workplan

Project workplans are developed from approved project proposals. The Miami USGS requirements for the content, review, and revision of workplans are outlined in the Eastern Region – South project proposal format adopted on June 7, 1996.

The project chief prepares a detailed workplan that identifies all project work elements and the related technical methods and approaches that are necessary to satisfy project objectives. The workplan links project personnel, tasks, and functions with associated funds and indicates the projected dates for on-time completion of project elements, and ultimately, the project. Workplans for water-quality programs and projects, including programs and projects with water-quality components, should clearly state how the Miami USGS “Quality-Assurance Plan for Water-Quality Activities” will be implemented.

Descriptions of the methods and approaches to be used to complete the technical elements of the project are required and include, for example, the design of environmental sample collection to meet the study objectives. The plan lists the environmental sampling locations and frequency, a description of the sample types and their expected uses, and descriptions of laboratory tests.

Workplans also include a description of the design of QC sampling that is required to document bias and variability in the environmental data. The workplan lists QC sample types, the frequency of collection, and their intended uses. The types of QC samples that typically are collected include blanks and spikes to estimate bias and replicates to estimate variability (Mueller and others, 1997).

Workplans state anticipated methods for data analysis and presentation, including report plans. Accurate cost estimates are needed for personnel, materials, and services related to planned completion dates for properly budgeting the project. Assuring the availability of project personnel is often difficult and can impose serious constraints on completing project tasks; therefore, Miami USGS management should be consulted to ensure adequate staff resources and to avoid the over-commitment of individuals to multiple projects. The project timeline lists major project elements and planned completion dates.

3.3 Project Review

Project reviews are conducted periodically by Miami USGS management, technical advisors, or discipline specialists to ensure compliance with the project workplan or proposal. Project reviews are used to ensure that data collection, analysis, and reporting are being done in accordance with the workplan and with broader Miami USGS policies and requirements. Quality-assurance activities with respect to project reviews are outlined in the next section.

3.3.1 Review Schedules

The Miami USGS has developed and implemented a review schedule for evaluating the technical development and progress of water-quality programs and projects, such as semiannual reviews or the 10-, 40-, 70-percent (10/40/70) project-completion milestones. Regularly planned reviews ensure that water-quality programs or projects are conducted efficiently to produce quality products on time. Informal reviews are part of ongoing QA, whereby problems and related issues are addressed as they arise.

3.3.2 Review Documentation

The Miami USGS has developed a method for documenting program and project reviews. The following information should be included in program and project review documentation:

- Current reporting period;
- Project number and title;
- Project chief contact;
- Cooperator contacts;
- Project begin/end dates;
- Responses to recommended action items from the last review;
- Project status including client contacts and meetings, items affecting progress, data releases and progress to date;
- Report status;
- Major problems;

- Action items for next reporting period; and
- Internal web page that documents major findings and major problems.

The Miami USGS archives all review comments that address the presence or absence of project deficiencies, all actions or recommendations for fixing deficiencies, or documentation explaining why a fix cannot be made. The files relating to review documentation are stored in the office files.

3.4 References Used in the Program and Project Planning Section

Table 2 lists reports and/or memoranda referred to in this section. For the complete citation, refer to Section 13.0 in this report.

Table 2. Summary of references for program and project planning

Reference	Subject
Mueller and others (1997)	Example of quality-control sample design used by NAWQA for surface-water sampling
Shampine and others (1992)	Integrating quality assurance into project workplans

4.0 WATER-QUALITY LABORATORIES

Two of the most critical issues for a long-term, national water-quality program are data comparability and data consistency. Because of the inherent variability among laboratories, one of the best ways to provide comparability and consistency is to use a single laboratory as much as is practical.

4.1 Selection and Use of an Analytical Laboratory

The National Water Quality Laboratory (NWQL) was established as the laboratory to meet the needs of the WRD, and it is the required laboratory for use in all WRD national water-quality programs (WRD Memorandum 92.036). However, there are conditions for selecting a laboratory other than the NWQL. The Ocala Water-Quality and Research Laboratory (OWQRL) in Ocala, Fla., is often used for Miami USGS projects and is discussed in Section 4.3.2.

4.1.1 Selection

Contract or cooperator laboratories can be used when the cooperative agreement designates a laboratory other than the NWQL or the OWQRL or when analytical services are required that cannot be provided by the NWQL or the OWQRL. Research laboratories can be used for developing analytical techniques or to provide data for research purposes, and these laboratories are generally exempt from approval requirements that other laboratories must meet (WRD Memorandum 92.035; OWQ Technical Memorandum 98.03). The Miami USGS laboratory generally can be used for chloride analyses and when analyses must be done within a few hours of sample collection and cannot be done conveniently in the field.

4.1.2 Requirements for Use

All laboratories that provide analytical services to the WRD for nonresearch purposes must meet the requirements of the WRD, as described in WRD Memorandum 92.035, before any analytical data can be stored in the WRD National Water Information System (NWIS) database (discussed in Section 10) or published by the WRD. Laboratories affected by this policy include those that provide chemical, biological, radiochemical, stable isotope, or sediment analytical services. The Miami USGS water-quality specialist is responsible for assuring that all laboratories providing analytical services to the Miami USGS have met the requirements for approval. These laboratories must do the following:

1. Use approved and published analytical methods–Analytical methods must be approved and published by one of the following sources: USGS; U.S. Environmental Protection Agency (USEPA); American Public Health Association, American Water Works Association, and Water Environmental Federation (Standard Methods); or American Society for Testing and Materials (ASTM). The publication of the method must include documentation for the analytical techniques and chemical processes plus the expected data quality. If a specific analytical method not published by the sources listed above is requested for a specific project, it is the responsibility of the WRD office requesting the analysis to have the method approved based on requirements specified in WRD Memorandum 82.028 before the analytical data from this method are published and/or stored in the USGS national database.
2. Have standard operating procedures (SOP's) for analytical methods–All analytical methods must have documented SOP's that are approved in accordance with procedures contained in the laboratory QA plan.
3. Have an approved laboratory QA plan–The laboratory must have an approved QA plan that is supplied to WRD customers upon request. The laboratory QA plan should provide internal guidance and documentation that will ensure the laboratory is operating under a standardized, rigorous QA program and is producing analytical results of a known and documented quality. The laboratory QA plan should describe QA activities, QC procedures and requirements, performance acceptance criteria, and required corrective actions that will be taken if the criteria are not met.
4. Have a documented QC program that provides the data necessary to continuously track the bias and variability of analytical data. All QC information, such as QC charts, analysis of laboratory QC samples, calibration records, and analyst bench logs should be maintained for at least 3 years and be available to WRD customers.
5. Demonstrate the ability to provide the analytical services required–Laboratories can demonstrate the ability to provide the required analytical services by participation in existing USGS or non-USGS certification/evaluation/round-robin programs or by documentation of similar projects (OWQ Technical Memorandum 98.03). The USGS Standard Reference Sample (SRS) round-robin program is required for analytes included in these samples.

4.2 Laboratories Used by the U.S. Geological Survey in Miami

The laboratories used for analytical services by Miami USGS projects are presented in table 3. The analyses provided, laboratory contact, and dates used also are presented in table 3.

Table 3. Analytical laboratories used by the U.S. Geological Survey in Miami

[OWQRL, Ocala Water Quality and Research Laboratory; ELISA, enzyme-linked immunosorbent assay screening; GC/MS, gas chromatography/mass spectrometry; NWQL, National Water Quality Laboratory]

Project	Analytical laboratory	Analyses provided (by general category)	Laboratory contact	Dates used
St. Lucie Pesticide Reconnaissance	OWQRL	ELISA screening GC/MS analysis	Khan Doan	10/00 - 09/01
Flows to Florida Bay	NWQL OWQRL	Pesticides Nutrients	Greg Mohrmann Mike Meyer	10/01 - 09/02 10/01 - 09/02
Estero Bay Flow and Water Quality	Kentucky Sediment Lab OWQRL	Suspended sediment Total suspended solids	Elizabeth Shreve Mike Meyer	10/01 - 09/04

4.3 Documentation for Laboratories Used by the U.S. Geological Survey in Miami

The methods used, laboratory QA plan, and QC program can be obtained from the laboratory contacts listed in table 3.

4.3.1 National Water-Quality Laboratory (NWQL)

1. Methods used–The NWQL uses approved methods for determination of organic, inorganic, and radioactive substances in water, sediments, and biological tissues. The methods used include methods approved by the USGS, USEPA, American Public Health Association, American Water Works Association, Water Environmental Federation, and ASTM. A list of some published reports on analytical methods currently used at the NWQL can be found on the World Wide Web at:

   http://wwwnwql.cr.usgs.gov/Public/ref_list.html

   Analytical methods from the USEPA can be found on the World Wide Web at:

   http://www.epa.gov/epahome/publications.htm

   Analytical methods from the ASTM can be found at:

   http://www.astm.org.

2. Quality-assurance (QA) plan–The NWQL QA plan is contained in Pritt and Raese (1995). A copy of this report can be obtained by sending an email request to nwqlqc@usgs.gov.

3. Quality-control (QC) program–Quality control at the NWQL is monitored by three programs: (1) the internal blind sample program, (2) the external blind sample program, and (3) bench level QC samples. Information about the internal blind sample program and bench level QC samples can be obtained by sending an email request to nwqlqc@usgs.gov. Information about the external blind sample program can be found at the following World Wide Web location: http://btdqs.usgs.gov/bsp/Fact.Sheet.html.
4. Performance evaluation studies and certification programs–The NWQL participates in performance evaluation studies and laboratory certification programs. A list of the current programs and a description of each can be found by sending an email request to nwqlqc@usgs.gov.
5. Laboratory reviews–External agencies and customer organizations audit the NWQL to assess analytical methods and QA/QC programs. Information on NWQL audits can be obtained by sending an e-mail request to nwqlqc@usgs.gov.
6. Miscellaneous services–Information about and access to other services offered by the NWQL can be found at http://wwwnwql.cr.usgs.gov/USGS/USGS_gen.html. The services offered include, but are not limited to, the following:
   - Biological unit,
   - Chain-of-custody procedures,
   - Contract services,
   - External performance evaluations,
   - Laboratory services catalog,
   - Methods Research and Development Program,
   - Organic spike kits,
   - Publications,
   - Quality assurance of selected field supplies,
   - SPiN (schedules, parameters, and network record), and
   - Technical memoranda.

4.3.2 Ocala Water-Quality and Research Laboratory (OWQRL)

1. Methods used–The OWQRL analyzes inorganic and selected organic substances in water using methods approved by the USGS, USEPA, ASTM, or Standard Methods (SM). These analyses are accomplished with autotitrators, autoanalyzers, ion chromatographs, atomic absorption instruments, inductively coupled plasma optical emission (ICPOE) instruments, and graphite furnaces. Recent equipment additions include an inductively coupled plasma mass spectrophotometer (ICPMS) and a gas chromatography/mass spectrophotometer (GC/MS). Selected organic determinations include carbon, cyanide, phenols, detergents and pesticides. The OWQRL home page can be accessed at http://owqrl.er.usgs.gov. Parameters, method numbers, and detection limits for these analyses can be accessed at:

   http://owqrl.er.usgs.gov/owqrlep02.shtml

2. Quality-assurance (QA) plan–The OWQRL maintains certification by the State of Florida, which requires annual approval of a Comprehensive Quality Assurance Plan. This plan can be accessed at http://owqrl.er.usgs.gov/owqrlcomp.shtml.

3. Quality-control (QC) program–Laboratory QA/QC is monitored by internal review, external audits, and programs of the USGS Branch of Quality Systems and OWQ. Branch of Quality Systems results may be accessed at http://btdqs.usgs.gov. Quality-assurance certificates for various supplies can be accessed at http://owqrl.er.usgs.gov/owqrlcert.shtml.
4. Performance evaluation studies and certification programs–The OWQRL participates in performance evaluation studies and laboratory certification programs. The laboratory is certified by the Florida Department of Health – Bureau of Laboratories and is also certified under the Clean Water Act for metals and general chemistry. The USGS Branch of Quality Systems (BQS) submits blind quality assurance samples to the OWQRL through offices using OWQRL services. The OWQRL also participates semiannually in the BQS Standard Reference Water Sample Program and in the USEPA Performance Evaluation program, which is part of the Florida Water Certification Program administered by the Florida Department of Health. Information on these evaluation studies are in the Tallahassee Comprehensive QA Plan ("Performance and System Audits," section 14.0)
5. Laboratory reviews–External agencies and customer organizations audit the OWQRL to access analytical methods and QA/QC programs. An external review is conducted by the Florida Department of Health on an annual basis and by the BQS every 3 years. These audits can be obtained by sending an e-mail request to wdangelo@usgs.gov.
6. Miscellaneous services–The OWQRL operates the National Field Quality Assurance (NFQA) Program in cooperation with the BQS. The NFQA Program provides annual proficiency reports on field measurements of specific conductance, pH, and alkalinity by evaluating data returned from yearly rounds of reference samples shipped to WRD field personnel and selected cooperators. Training courses in field water-quality techniques and sampling protocols are provided for the USGS and cooperators. The QA Programs Section of the OWQRL provides training in safety and chemical waste management. The Logistics Section of the OWQRL provides a supply of solutions, materials, and equipment used in environmental water-quality work for the USGS and other Federal agencies. The Logistics Section also prepares reference water samples for QA programs, conductivity standards, bacteria media kits, and custom reagent solutions for water-quality investigations. A catalog is distributed by electronic mail that lists frequently requested supplies.

4.3.3 Kentucky District Sediment Laboratory (KDSL)

1. Methods used–The Kentucky District Sediment Laboratory (KDSL) processes and analyzes fluvial sediment samples for concentrations and sand-fine separations according to the methods prescribed by Guy (1969). These procedures are accomplished by using a variety of specialized equipment in the laboratory. Two types of balances are used: a macro balance to weigh items ranging from 100 to 3,000 g (grams), and an analytical balance to weigh items less than 100 g. A convection type drying oven is used to dry sediment in crucibles and evaporating dishes. A specific conductivity meter is used for measuring the specific conductance of the sediment samples being analyzed. Decanting equipment includes a J-shaped decanting nozzle attached to rubber tubing that is connected to a vacuum system. Filtration equipment also is employed and includes crucible holders, rubber tubing, shutoff valves, a storage tank for collecting surplus water, and a vacuum device. Desiccator cabinets are used to store crucibles and evaporating dishes from the drying oven. Sieves are used to determine particle-size distribution of sediment larger than 0.062 mm (millimeters). Additionally, Pyrex Gooch crucibles with fritted discs are

used for samples with sand concentrations less than 10,000 mg/L (milligrams per liter) and clay concentrations less than 200 mg/L. Deionized water is used to prevent any increase in dissolved solids when rinsing sediments into crucibles, evaporating dishes, or during wet-sieving.

2. Quality-assurance (QA) plan–The KDSL maintains a QA plan that is documented in Sholar and Shreve (1998) and can be accessed at:

   http://ky.water.usgs.gov/projects/sed_lab/OFR_98_384.pdf

3. Quality-control (QC) program–The KDSL employs internal procedures for monitoring data quality. These procedures include analysis of QA samples, review of logbooks and computer techniques, training, equipment checks, data reviews, and documentation. Results can be accessed at:

   http://ky.water.usgs.gov/projects/sed_lab

   The laboratory also participates in the OWQ/BQS Sediment Laboratory Quality Assurance Program. Results can be accessed at:

   http://sedserv.cr.usgs.gov/

4. Performance evaluation studies and certification programs–The KDSL participates in performance evaluation studies. This information can be obtained by sending an email request to eashreve@usgs.gov.
5. Laboratory reviews–The KDSL is reviewed every 3 years by the USGS Office of Surface Water. Results of these reviews can be obtained by sending an e-mail request to eashreve@usgs.gov.
6. Miscellaneous services–The KDSL does not engage in any other services other than sediment analysis.

4.4 References Used for the Water-Quality Laboratories Section

Table 4 lists reports and/or memoranda referred to in this section. For the complete citation, refer to Section 13.0 in this report.

Table 4. Summary of references for selecting and using water-quality laboratories

Reference	Subject
Guy (1969)	Laboratory theory and methods for sediment analysis
Pritt and Raese (1995)	Quality assurance/quality control manual–NWQL
Sholar and Shreve (1998)	Quality-assurance plan–KDSL
OWQ Technical Memorandum 98.03 (USGS)	Policy for the evaluation and approval of production analytical laboratories
WRD Memorandum 82.028 (USGS)	Acceptability and use of water-quality analytical methods
WRD Memorandum 92.035 (USGS)	Policy for approval of all laboratories providing analytical services to the WRD for non-research purposes
WRD Memorandum 92.036 (USGS)	Policy of the WRD on the use of laboratories by national water-quality programs

5.0 FIELD SERVICE UNITS AND LABORATORIES, MOBILE LABS, AND FIELD VEHICLES

The Miami USGS maintains laboratory facilities, such as Field Service Units, mobile labs, and field vehicles for use in preparing equipment for field activities, processing samples, performing sample analysis, and preparing samples for shipment to analytical laboratories. This section documents Miami USGS criteria for maintaining and operating these facilities.

5.1 Field Service Units and Laboratories

The Miami USGS Water-Quality Service Unit is under the supervision of the Miami USGS water-quality specialist. This unit assists and supports water-quality activities by providing field instrumentation maintenance and calibration, preparations for sample collection, and QA for these activities. The unit also maintains a supply of instruments, equipment, and expendable supplies needed by field personnel for water-quality sample collection and analysis. Under the direction of the Miami USGS Water-Quality Service Unit is the Fort Myers Water-Quality Service Unit. This unit is headed by the supervisory hydrologist in charge of the Fort Myers field office and provides the same services as the Miami USGS Water-Quality Service Unit.

5.1.1 Facility

The Miami USGS maintains Water-Quality Service Units located in Miami and Fort Myers. The units contain laboratory benches, glassware, sinks, chemical storage cabinets, and other equipment and instruments listed in table 5. The Miami USGS water-quality specialist and the supervisory hydrologist in Fort Myers have responsibility for maintenance of the respective water-quality service units and QA of the equipment and instruments. These facilities are maintained in accordance with standards set forth in the Miami USGS chemical-hygiene plan (Branch of Operations Technical Memorandum 91.01)

Table 5. Equipment and instruments provided by the Miami and Fort Myers Water-Quality Service Units and applicable quality assurance

[OWQ, Office of Water Quality; NA, not applicable]

Laboratory equipment	Quality assurance
Laboratory balance	Calibration checked annually
Refrigerator at 4 degrees Celsius	Temperature monitored weekly
Fume hood	Calibrated annually
Supply of deionized water	Maintained per OWQ Technical Memo 92.01
Ventilated acid cabinets	Not applicable
Wash sink with drying rack	Not applicable
Vacuum pump	Not applicable
Drying oven	Currently not in use
Autoclave	Currently not in use
Incubators	Currently not in use
Freezer	Temperature monitored weekly
Specific conductivity meters	Calibrated each use

5.1.2 Procedures

The Miami and Fort Myers Water-Quality Service Units are managed by the Miami USGS water-quality specialist and the supervisory hydrologist in Fort. Myers, respectively. These persons are responsible for maintaining the laboratory space, supplies, and equipment listed in table 5. The units maintain QA records of laboratory equipment and supplies, such as calibration standards, chemical reagents, sample preservatives, and sample bottles that are provided to field personnel. The project technicians are responsible for repair and maintenance of project water-quality equipment and instruments. The chemical-hygiene officer oversees the Miami USGS waste-disposal practices to ensure that procedures are in compliance with State and Federal regulations. The unit operations comply with the Miami USGS chemical-hygiene plan and are reviewed annually by the water-quality specialist and every 3 years by the OWQ.

The Miami and Fort Myers offices maintain an extensive salinity monitoring network that requires the routine collection of chloride data. As as result, specific QA procedures have been established for the collection and analysis of these data. Prior to chloride analysis, the laboratory specific conductivity meter is calibrated and results are recorded on a form (fig. 2) in each field book.

		CALIBRATION STANDARDS				
DATE		100 µS/cm	500 µS/cm	1000 µS/cm	5000 µS/cm	10,000 µS/cm
	METER					
	METER					
	METER					
	METER					
	METER					
	METER					
	METER					
	METER					
	METER					
	METER					
	METER					
	METER					

Figure 2. Laboratory specific conductivity meter calibration form.

Chloride analyses are made according to the Mohr method (Brown and others, 1970), and results are recorded on a chloride worksheet (fig. 3). Table 6 shows the aliquot volume, silver nitrate titer strength, and factors used for chloride analyses of samples within given ranges of specific conductivity. The chloride worksheets are routinely reviewed by the field technician responsible for their specific field run and occasionally are reviewed by the water-quality specialist when analytical results indicate a problem. The Miami USGS also participates in the BQS Standard Reference Sample Program for the determination of chloride.

CHLORIDE WORKSHEET

Analyst__________

Date____________

Sample Name	Conductance	Aliquot	Titer	Initial	Final	Diff.	Factor	Chloride
QA sample								
Reruns								

Figure 3. Chloride worksheet.

Table 6. Specific conductivity ranges and corresponding aliquot volumes, titer strengths, and factors used in chloride analysis

Specific conductivity (microsiemens per centimeter)	Aliquot (milliliter)	Titer (milligrams per milliliter)	Factor
<100	100	0.5	5
101-250	50	.5	10
251-800	25	.5	20
801-2,000	10	.5	50
2,001-6,000	25	5	200
6,001-10,000	10	5	500
>10,000	5	5	1,000

5.1.3 Equipment and Supplies

It is the responsibility of the Miami USGS water-quality specialist, project chiefs, or water-quality technicians to order, store, and quality assure the field equipment and supplies as needed by field personnel (table 7).

5.2 Mobile Labs and Water-Quality Field Vehicles

Mobile labs and field vehicles refer to all vehicles that are designed, designated, and outfitted for use during water-quality sample collection and processing activities at or near sample collection sites. The Miami USGS maintains vehicles designated for water-quality sample collection and processing. If a nondesignated vehicle must be used for water-quality work, portable processing and preservation chambers are used for sample processing, and extra QC samples are collected to document that the data have not been compromised. Refer to Wilde and others (1999a; 1999b) for guidelines on procedures for collecting and processing water-quality data.

A field vehicle is designated as a water-quality field vehicle when it meets criteria to maintain a noncontaminating environment for the constituents being sampled. The work area must be maintained to eliminate sources of sample contamination. Specifications for vehicles used–when sampling for water-quality constituents–are discussed by Horowitz and others (1994) and Wilde and others (1998b) and include the following:

- Materials used for cabinets, storage, and work surfaces must be easy to maintain, made of or covered with noncontaminating materials, and such that they can be cleaned with water or solvents as appropriate. Cargo must be restricted to equipment and supplies related to water-quality sample collection unless stored in a separate compartment. No potentially contaminating equipment or supplies, such as sounding weights, solvents, fuel, and so forth, may be transported in the interior compartment of the vehicle.
- A dust barrier exists between the cab and work area of the vehicle.

Water-quality technicians are responsible for vehicle maintenance, maintaining the suitability of the vehicle for water-quality sample collection, and keeping the vehicle supplied.

Table 7. Summary of information on supplies, equipment, and instruments used by the Miami and Fort Myers Water-Quality Service Units

[OWQRL, Ocala Water Quality and Research Laboratory, QA, Quality assurance; NWQL, National Water Quality Laboratory, NIST, National Institute of Standards and Technology]

Supplies, equipment, and instruments	Source and guidelines for QA	Responsible party
Sample bottles	Purchased from OWQRL	Project chief or technician
Coolers/shipping containers	Commercially available (for QA guidelines, refer to OWQ Technical Memorandum 92.06)	Project chief or technician
Sample preservatives	Purchased from OWQRL	Project chief or technician
pH calibration standards	Commercially prepared buffers purchased from OWQRL; traceable to NIST Standard Reference Material	Project chief or technician
Specific conductivity calibration standards	Purchased from OWQRL	Water-quality specialist, project chief, or technician
Blank water for QA	Purchased from OWQRL (for QA guidelines, refer to NWQL Memorandum 92.01)	Project chief or technician
Deionized water	Prepared in Miami laboratory (for QA guidelines, refer to OWQ Technical Memorandum 92.01)	Project chief or technician
Silver nitrate solution	Purchased from OWQRL	Water-quality specialist
Potassium dichromate solution	Purchased from OWQRL	Water-quality specialist
Isokinetic water-quality samplers	Purchased from Hydrologic Instrumentation Facility	Project chief or technician
Splitting devices	Purchased from OWQRL (for QA guidelines, refer to OWQ Technical Memorandum 97.06)	Project chief or technician
Specific conductivity meters	Commercially available (for QA guidelines, refer to Wilde and others, 1998b)	Water-quality specialist, project chief, or technician
pH meters	Commercially available (for QA guidelines, refer to Wilde and others, 1998b)	Project chief or technician

5.3 References Used for the Field Service Units and Laboratories, Mobile Labs, and Field Vehicles Section

Table 8 lists reports and/or memoranda referred to in this section. For the complete citation, refer to Section 13.0 in this report.

Table 8. Summary of references for field service units and laboratories, mobile labs, and field vehicles

Reference	Subject
Brown and others (1970)	Methods for analysis of dissolved minerals and gases in water samples
Horowitz and others (1994)	Protocol for collecting and processing samples for inorganic analysis
Wilde and others (1998b)	Selection of field equipment for water sampling
Wilde and others (1999a)	Collection of water samples
Wilde and others (1999b)	Processing of water samples
Branch of Operations Technical Memorandum 91.01 (USGS)	Safety–Chemical-hygiene plan
NWQL Memorandum 92.01 (USGS)	Availability of equipment blank water for inorganics and organics
OWQ Technical Memorandum 92.01 (USGS)	Distilled/deionized water for District operations
OWQ Technical Memorandum 92.06 (USGS)	Sample shipping integrity and cost
OWQ Technical Memorandum 98.03 (USGS)	Policy for evaluation and approval of production analytical laboratories

6.0 WATER-QUALITY INSTRUMENTS

The Miami USGS complies with the WRD policy of providing personnel with high-quality field instruments and equipment that are safe, precise, accurate, durable, reliable, and capable of performing required tasks (WRD Memorandum 95.35). Accordingly, appropriate instruments for use in water-quality projects in the Miami USGS should be selected based upon the specifications described in the USGS "National Field Manual for the Collection of Water-Quality Data" (variously authored, Techniques of Water-Resources Investigations, book 9, chaps. A1-A9) and the requirements of the project. The Hydrologic Instrumentation Facility (HIF), which provides analyses of precision and bias for water-quality instruments, also should be consulted for recommendations when appropriate. Consultation with the Miami USGS water-quality specialist, HIF, NWQL, OWQRL, and the KDSL should be done if project personnel need assistance with the selection or use of equipment.

All instruments used by Miami USGS personnel for water-quality measurements are to be properly operated, maintained, and calibrated. For correct operation of any field or laboratory equipment, the manufacturer’s operating guidelines should be carefully followed. Most instruments will be calibrated in the field prior to making the sample measurements, as described in the next section. Information regarding the preparation and storage of calibration standards is provided in Section 5.0 of this QA plan.

6.1 Calibration Activities

Thorough documentation of all calibration activities associated with water-quality data collection is a critical element of the Miami USGS QA program. Calibration and maintenance records of field equipment, including the manufacturer, make, model, and serial or property number, are to be kept. Calibration data are maintained in separate files corresponding to each instrument. Similar records for Miami USGS laboratory equipment are to be kept by the Miami USGS water-quality specialist. Information that is required to be included with the calibration and maintenance records includes the date, name of the individual performing the activity, results of calibration or equipment check, and any actions taken. Calibration and maintenance records are checked for completeness and accuracy by the Miami USGS water-quality specialist.

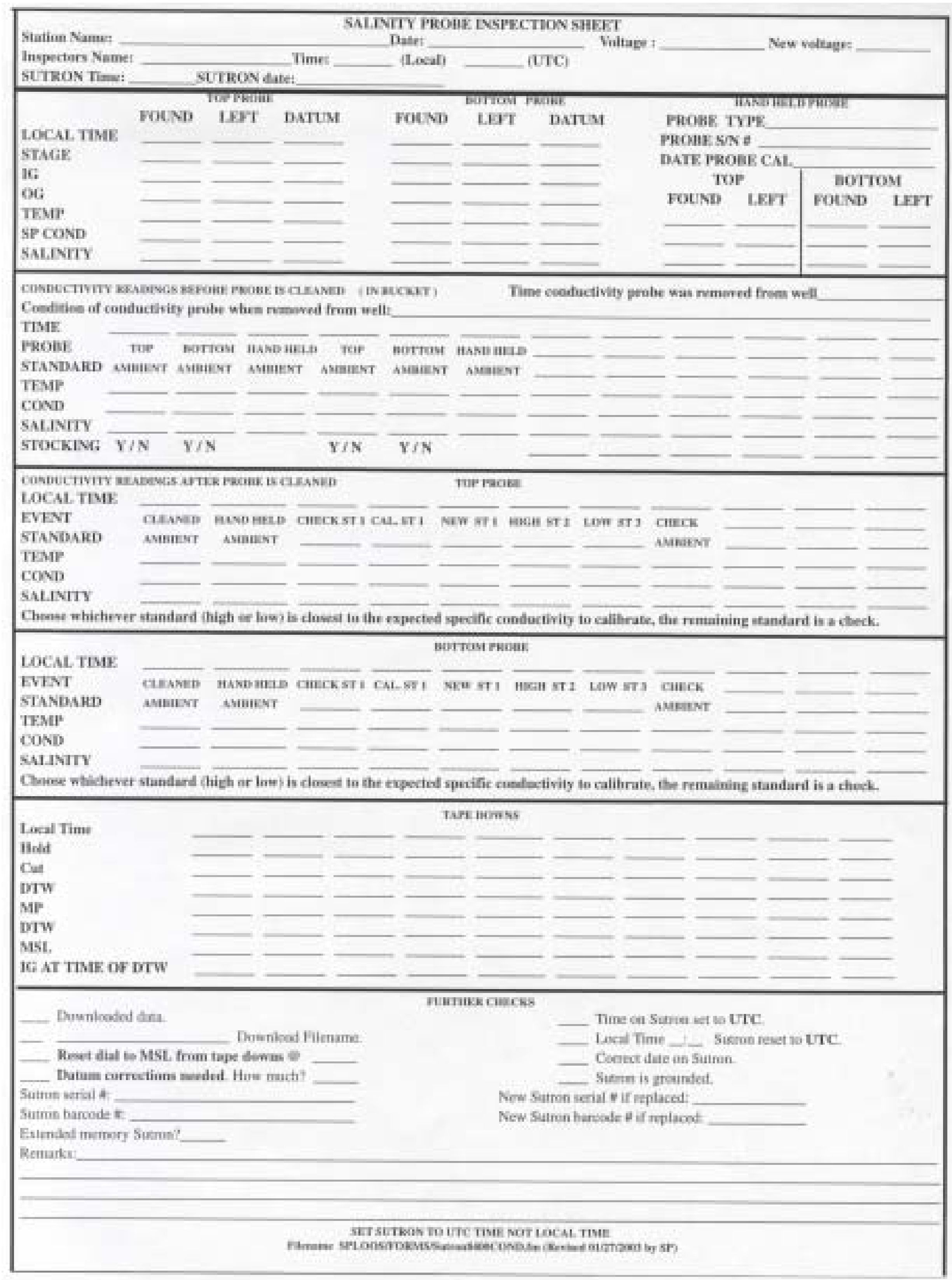
The Miami USGS operates continuous water-quality monitors for the determination of specific conductance and temperature on both surface-water and ground-water sites. Guidelines and standard procedures for the operation of continuous water-quality monitors, including site selection, field operation, calibration, record computation, and reporting, are outlined by Wagner and others (2000). A salinity probe inspection sheet is shown in figure 4. In order to properly service and maintain these monitors, reference field meters used for reference must be calibrated over a wide range of values in the office prior to use, and these calibration results must be recorded in an appropriate logbook. The field meter is calibrated with conductance standards obtained from the OWQRL. Temperature is calibrated against a National Institute of Standards and Technology (NIST) traceable thermometer. A field conductance meter calibration form is shown in figure 5. This form is used as guide in the calibration of the Orion conductivity probes used for the quality assurance of Miami office salinity sites.

The following sequence of procedures is applied when servicing continuous water-quality monitors in the field at surface-water sites:

- An initial *in situ* sensor reading is compared to a field meter reading. This comparison serves as a tool to assess environmental changes occurring during the service interval and also to assess the reasonableness of the sensor reading. In a slowly changing environment, the sensor is then cleaned and placed back into the water where it is again compared to the field meter. The fouling correction is computed based on the following formula:

$$Fouling = (sensor\ after - sensor\ before) - (field\ meter\ after - field\ meter\ before)$$

In a rapidly changing environment, such as an estuary, after the initial *in situ* comparison of the sensor with the reference meter, the probe is placed into a bucket of ambient water and the conductance value is recorded. The sensor is then cleaned for fouling and placed back into the bucket. The fouling correction is applied according to the formula described above.



SALINITY PROBE INSPECTION SHEET

Station Name: ______ Date: ______ Voltage : ______ New voltage: ______
Inspectors Name: ______ Time: ______ (Local) ______ (UTC)
SUTRON Time: ______ SUTRON date: ______

	TOP PROBE FOUND	TOP PROBE LEFT	TOP PROBE DATUM	BOTTOM PROBE FOUND	BOTTOM PROBE LEFT	BOTTOM PROBE DATUM
LOCAL TIME						
STAGE						
IG						
OG						
TEMP						
SP COND						
SALINITY						

HAND HELD PROBE
PROBE TYPE ______
PROBE S/N # ______
DATE PROBE CAL ______

TOP FOUND	TOP LEFT	BOTTOM FOUND	BOTTOM LEFT

CONDUCTIVITY READINGS BEFORE PROBE IS CLEANED (IN BUCKET) Time conductivity probe was removed from well ______
Condition of conductivity probe when removed from well: ______

TIME												
PROBE	TOP	BOTTOM	HAND HELD	TOP	BOTTOM	HAND HELD						
STANDARD	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT						
TEMP												
COND												
SALINITY												
STOCKING	Y / N	Y / N		Y / N	Y / N							

CONDUCTIVITY READINGS AFTER PROBE IS CLEANED

TOP PROBE

LOCAL TIME											
EVENT	CLEANED	HAND HELD	CHECK ST 1	CAL. ST 1	NEW ST 1	HIGH ST 2	LOW ST 3	CHECK			
STANDARD	AMBIENT	AMBIENT						AMBIENT			
TEMP											
COND											
SALINITY											

Choose whichever standard (high or low) is closest to the expected specific conductivity to calibrate, the remaining standard is a check.

BOTTOM PROBE

LOCAL TIME											
EVENT	CLEANED	HAND HELD	CHECK ST 1	CAL. ST 1	NEW ST 1	HIGH ST 2	LOW ST 3	CHECK			
STANDARD	AMBIENT	AMBIENT						AMBIENT			
TEMP											
COND											
SALINITY											

Choose whichever standard (high or low) is closest to the expected specific conductivity to calibrate, the remaining standard is a check.

TAPE DOWNS

Local Time										
Hold										
Cut										
DTW										
MP										
DTW										
MSL										
IG AT TIME OF DTW										

FURTHER CHECKS

___ Downloaded data.
___ ______ Download Filename.
___ Reset dial to MSL from tape downs @ ______
___ Datum corrections needed. How much? ______
Sutron serial #: ______
Sutron barcode #: ______
Extended memory Sutron?______
___ Time on Sutron set to UTC.
___ Local Time __:__ Sutron reset to UTC.
___ Correct date on Sutron.
___ Sutron is grounded.
New Sutron serial # if replaced: ______
New Sutron barcode # if replaced: ______
Remarks: ______

SET SUTRON TO UTC TIME NOT LOCAL TIME
Filename: SPLOGS/FORMS/SalinityINSCOND.fm (Revised 01/27/2003 by SP)

Figure 4. Salinity probe inspection sheet.

DATE

SERIAL NUMBER				
CALIBRATION				
standard	temperature	initial reading	temperature adjusted conductivity	final reading
CHECKS				
standard	temperature	conductivity reading	thermometer reading	Comments

SERIAL NUMBER				
CALIBRATION				
standard	temperature	initial reading	temperature adjusted conductivity	final reading
CHECKS				
standard	temperature	conductivity reading	thermometer reading	Comments

flmians012\Data Section\Loxahatchee_St.Lucie
orion calibration procedures.xls
spreadsheet

Figure 5. Field conductance meter calibration form.

- Following sensor cleaning, the sensor is checked with three conductance standards, which are allowed to equilibrate with the stream temperature by soaking for 15 to 30 minutes. Two standard solutions should bracket the expected range of environmental conditions, and the third standard solution should be near the ambient specific conductance of the water. The sensor, field meter probe, and measuring container are rinsed three times with a standard solution that is close to ambient conditions. Fresh solution is poured into the measurement container and the specific conductance, standard values, and temperature are read and recorded in the instrument log. The monitor termistor and the temperature recorded by the field meter must agree within ±0.2 degrees Celsius. This same procedure is repeated using second and third standard solutions (with increasing specific conductance values). The probe is calibrated with the standard closest to the ambient water specific conductance regardless of the percent difference between the two. The calibration sequence must be repeated, and if a difference of more than 3 percent occurs betwee the probe and the standard, then troubleshooting and/or replacing the sensor must be undertaken. A nonlinear error may suggest a bad or fouled probe. Additionally, a conductance probe reading in air should be included in the servicing sequence. These readings are recorded on the salinity probe inspection sheet (fig. 4).
- After calibration, the probe is placed back into the water, and a final *in situ* sensor reading is recorded and compared to the field meter reading.
- Horizontal and vertical cross-section measurements should be taken at least two times annually at each site to verify that no substantial changes have occurred in the salinity distribution throughout the stream. This scenario may not be possible at estuarine sites.

The following procedures are employed when servicing continuous monitors at ground-water sites.

- Check and record the specific conductance reading before removing the probe.
- Remove the probe, and place it into a bucket.
- Select the appropriate standards using the same criteria as mentioned above for surface-water sites, and place the standards into a bucket so they can equilibrate in water while the well is pumped.
- Perform the necessary calculations to determine the volume of water in the well, and purge the well into the bucket so that three to five casing volumes of water have been removed.
- After purging, compensate for fouling by obtaining a before cleaning sensor reading and a field meter reading; then clean the sensor appropriately and obtain an after sensor reading and a field meter reading. The fouling correction is applied according to the following formula:

$$Fouling = sensor\ after - sensor\ before$$

- To check for electronic drift, the sensor is calibrated with three standards in the same manner as outlined above for the surface-water sites.
- Return the probe to the well, and obtain a final reading.

Specific guidelines are employed for the application of corrections due to fouling and electronic drift. Corrections due to fouling are applied on a percentage basis when the difference between the after and before sensor readings are greater than ±5 µS/cm or ±3 percent. As such, if a probe reading was 5,000 µS/cm before cleaning and 5,500 µS/cm after cleaning, a 9-percent datum correction curve would be applied within a range of expected data values (for example, 9 µS/cm at 100 µS/cm to 900 µS/cm at 10,000 µS/cm). The same criteria apply for the application of corrections due to electronic drift. They may also be applied on a percentage basis or applied based on actual differences between sensor values and standards using V-diagrams. A spreadsheet for computing corrections for fouling and electronic drift is shown in figure 6. Fouling and shift corrections are applied using data correction options 1 and 2 in the Automated Data Processing System (ADAPS), respectively.

An assessment of accuracy is required for the publication of continuous water-quality records. The accuracy rating is based on data values recorded before any shifts or datums are applied. A specific conductance record is rated as excellent if the deviation is less than ±3 percent, good if it is greater than ±3 to 10 percent, fair if it is greater ±10 to 15 percent, and poor if it is greater than ±15 percent. The maximum allowable limit for publishing specific conductance data is 30 percent. Data differing by more than this value are not published. Missing record is not estimated. Data are reviewed annually before publication in the annual report. A stage, salinity, and temperature review form used for each site shown in figure 7. An example of a station analysis form for a continuous salinity recording site is shown in figure 8, and an example of a manuscript for publication in the annual report for a continuous salinity recording site is shown in figure 9.

The Miami USGS also employs multiparameter instruments for recording time-dependent data in the field. Calibration data is recorded on a multiparameter calibration form shown in figure 10. Table 9 provides summary information regarding the calibration methods, acceptance criteria, calibration frequency and location, responsible persons, and references for specific instructions for the calibration and use of water-quality instruments to measure selected parameters in the Miami USGS.

Table 9. Summary of calibration information for water-quality instruments used to measure selected parameters at the U.S. Geological Survey in Miami

[The responsible persons are field personnel. NIST, National Institute of Standards and Technology; TWRI, Techniques of Water-Resources Investigations]

Parameter	Calibration method used	Acceptance criteria and response if not acceptable	Calibration frequency and location	Reference for calibration and use
Temperature	NIST-certified thermometer	Within 0.2 degrees Celsius or replace	Semiannually in laboratory	Wilde and Radtke (1998, chap. A6.1); see manufacturer's instructions
Specific conductance	At least two standards, bracketing expected values	Within 5 percent or clean or replace probe	Daily in field, if appropriate, prior to taking measurements	Wilde and Radtke, (1998, chap. A6.3); see manufacturer's instructions
pH	Two-point calibration, bracketing expected values	Calculated slope within 5 percent of theoretical or replace probe	Daily in field, if appropriate, prior to taking measurements.	Wilde and Radtke (1998, chap. A6.4); see manufacturer's instructions
Dissolved oxygen	If Hydrolab, follow manufacturer's instructions; if other, then air calibration in water	Within 5 percent or clean or replace probe	Every 4 hours in field or laboratory, as appropriate, prior to taking measurements	Wilde and Radtke, (1998, chap. A6.2) see manufacturer's instructions
Barometric pressure	Mercury barometer	Within 5 millimeter-mercury or replace	Quarterly	See manufacturer's instructions
Multiparameter field instruments	Per calibration form	Within 5 percent or replace probes	Daily prior to field use	See manufacturer's instructions

Figure 6. Spreadsheet for fouling and drift corrections.

FILENAME eprice/DATA REPORTS/REVIEW STAGE,SALINITY_TEMP routing_sheet

2002 WATER YEAR Period of ______________________

REVIEW ROUTING SHEET FOR STAGE, SALINITY AND TEMPERATURE

PAGE 1

STATION ASSIGNED TO:	COMPUTED BY:	TURNED IN FOR REVIEW ON:
STATION		
REVIEWED BY	DATE:	

Table 1: STAGE REVIEW

	COMPLETED	REVIEWED	RETURNED FOR COMPLETION	FINAL REVIEW-ACCEPTED
MARK ALL ESTIMATED RECORD WITH 'E' IN ADAPS				
FINAL TABLES WITH CORRECT STATISTICS IN FOLDER WITH COM-PUTATIONS				
ALL COMPUTATIONS IN ORDER BY DATE IN FOLDER WITH A LIST OF DATUMS APPLIED DURING THE WATER YEAR				
ALL HYDROGRAPHS IN ORDER BY DATE IN FOLDER				
END OF YEAR SUMMARY FROM ADAPS IN THE COMPUTATIONS FOLDER FOR USE DETERMINING THE MAX, MIN STAGES FOR THE YEAR				
THE EXTREME STAGES LISTED ON MANUSCRIPT FOR PERIOD OF RECORD AND CURRENT YEAR.				
THE MAX/MIN STAGES FOR THE WATER YEAR ON SHEET IN THE SAME FOLDER				
LEVELS-IS THE LEVELS SUMMARY SHEET COMPLETE AND ACCURATE FOR ALL LEVELS RUN?				
LEVELS: ARE LEVELS CHECKED? SHOULD LEVELS HAVE BEEN RUN DURING THE YEAR?				
IS STATION DESCRIPTION CUR-RENT IF NOT WHAT IS NEEDED? DOES IT SHOW THE CORRECT EQUIPMENT, LOCATION OF BM'S AND RM'S, GOOD SKETCH? DOES IT HAVE IHA INFORMATION ADDED AFTER MAPS ?				
STATION ANALYSES: IS IT COR-RECT FOR EQUIPMENT, DATUMS APPLIED, LEVELS RUN?				

Figure 7. Stage, salinity, and temperature review form.

FILENAME eprice/DATA.REPORTS/REVIEW.STAGE,SALINITY,TEMP.routing.sheet

2002 WATER YEAR Period of ____________ REVIEW ROUTING SHEET	PAGE 2
STATION ASSIGNED TO:	
STATION	
REVIEWED BY	

Table 1: STAGE REVIEW

	COMPLETED	REVIEWED	RETURNED FOR COMPLETION	FINAL REVIEW-ACCEPTED
STATION ANALYSES:HAVE THE COMPUTATIONS BEEN SUFFICENTLY EXPLAINED FOR DATUMS APPLIED, ESTIMATED RECORD ETC.?				
MANUSCRIPT: WERE ANY RECORDS REVISED AND PUBLISHED LAST YEAR? ADD OR UPDATE REVISED RECORDS STATEMENT				
MAX, MIN EXTREME STAGE SHEET: UPDATE EXTREME STAGES FOR CURRENT YEAR AND LIST DATE THEY OCCURRED				
MANUSCRIPT: ARE ANY RECORDS BEING PUBLISHED THIS YEAR? IF SO ADD REVISIONS STATEMENT.				
MANUSCRIPT: IS STATION BEING DISCONTINUED? DOES IT STATE THIS IN PERIOD OF RECORD STATEMENT?				
HAS THE DATA BEEN FINALIZED IN ADAPS?				

Figure 7. Stage, salinity, and temperature review form (Continued).

FILENAME eprice/DATA.REPORTS/REVIEW.STAGE,SALINITY,TEMP.routing.sheet

2002 WATER YEAR Period of ____________________ REVIEW ROUTING SHEET		PAGE 3
STATION ASSIGNED TO:	COMPUTED BY:	TURNED IN FOR REVIEW ON:
STATION		
REVIEWED BY	DATE:	

Table 1: SALINITY REVIEW

	COMPLETED	REVIEWED	RETURNED FOR COMPLETION	FINAL REVIEW-ACCEPTED
Excel sheet showing fouling and drift computations for each probe				
Printout of ADAPS salinity correction curves for correction set 1 (fouling) and corrections set 2 (drift) for each probe				
Primary computations of salinity for each probe. Are they consistent with the correction curves being applied?				
Salinity plots of edited and computed unit values for each probe. Are the computed unit values consistent with the correction sets applied?				
Daily values of salinity for max, min and mean values for each probe				
Salinity plots of daily values for each probe				
Max/min salinity sheet for each probe				
Expanded data correction table from ADAPS option DI-13 for each probe for rating the record				
Station analysis using STAGE/SALINITY/TEMPERATURE SITE STATION ANALYSIS form. Is the equipment section current and complete? Does the primary records section indicate loss record and the reason for such? Is the computation section complete and indicate what correction curves were applied due to fouling or drift? Are the inspections and correction set results included?Does the remarks section include rating of the record?				
Is the manuscript consistent with the format described in WRIR 00-4252 by Wagner and others? Does it include the period of record? Does the instrumentation section include continuous monitor? Do the remarks section include record ratings? Are the extremes for period of record and extremes for current year complete?				

Figure 7. Stage, salinity, and temperature review form (Continued).

2002 WATER YEAR Period of ____________________
REVIEW ROUTING SHEET

PAGE 4

STATION ASSIGNED TO:	COMPUTED BY:	TURNED IN FOR REVIEW ON:
STATION		
REVIEWED BY	DATE:	

FILENAME eprice/DATA.REPORTS/REVIEW.STAGE,SALINITY,TEMP.routing.sheet

Table 1: TEMPERATURE REVIEW

	COMPLETED	REVIEWED	RETURNED FOR COMPLETION	FINAL REVIEW-ACCEPTED
Primary computations of temperature for each probe.				
Temperature plots of edited and computed unit values for each probe.				
Daily values of temperature for max, min and mean values for each probe				
Temperature plots of daily values for each probe				
Max/min temperature sheet for each probe				
Station analysis using STAGE/SALINITY/TEMPERATURE SITE STATION ANALYSIS form. Is the equipment section current and complete? Does the primary records section indicate loss record and the reason for such? Does the remarks section include rating of the record?				
Is the manuscript consistent with the format described in WRIR 00-4252 by Wagner and others? Does it include the period of record? Does the instrumentation section include continuous monitor? Do the remarks section include record ratings? Are the extremes for period of record and extremes for current year complete?				

4

Figure 7. Stage, salinity, and temperature review form (Continued).

2002
Florida

STAGE/SALINITY/TEMPERATURE SITE STATION ANALYSIS

Site Name. --02253800. Indian River Lagoon at Sewalls Point.

Equipment.--Station was installed August 3, 1997, and removed October 5, 2000, re-installed Sept.26, 2001.
The telemetry instrumentation consists of a Sutron 8210 DCP within the enclosure and a Sutron YAGI antenna located on a 10 ft. aluminum post attached to the outside of the enclosure. Stage is measured with a Handar encoder, installed in an 8-inch PVC stilling well. Two YSI salinity probes are installed at the site, one near the surface and the second 5 feet below the first. A solar panel charges the 75 amp hr. battery which is wired in-line with a voltage regulator for the 12V circuit which powers the DCP.

Published records.- Mean daily stage, and tidal high-high, tidal low-low, minimum, mean and maximum daily salinity and temperature.

Primary records.-- Record for the variables Temp 1 & 2, Salt 1 & 2, Stage are complete except
Temperature 1: Oct. 1-12, Jan. 1-2, May 8, 16-17 due to bad probe and missed transmit.
Temperature 2: Jan. 1-2, May 8, 16-17, June 26. due to bad probe and missed transmits.
Salinity 1: Oct. 1-12, 30, Nov. 4-27, Dec. 15, Jan. 1-2, 7-31, Feb. 1-2, 14-26, Mar. 20,27-31, Apr. 1-7, May 8-14, 16-19, June 18, 24, July 20-22, due to bad probe and missed transmits. Record from Mar. 22-27, June 12-26 exceeded maximum allowable limits and was not published.
Salinity 2: Oct. 12-24, 30, Nov. 27, Jan. 1-2, March 27-31, Apr. 1-7, May 8, 16-17, Aug. 29, due to bad probe and missed transmits.
Stage: Nov. 27, Jan. 1-2, May 8, 16-17 due to missed transmits.

Channel characteristics.--Not determined.

Stage.--Three down-to-water (DTW) measurements were made during the 2002 Water Year on Jan. 30, July 24, and Sept. 25. A prorated datum of .05 was applied for most of the year to correct for an errant off-set and parallel -0.15 datum was applied from Oct. 15, 2002 back to July 24. Recorder was set with an off-set of approx +.15 ft. On July 24 the stage was reset in error. It was found off by -.05 ft on July 24 and the technicians thought the error was 0.20 ft so they moved the wheel one spline (they did not know about the offset).

Correction set #1 — 2002 Water Year
GAGE HEIGHT STAGE, in FEET

STARTS	ENDS	INPUT	CORR.	INPUT	CORR.	INPUT	CORR.
PRV: 2000/10/05 07:45:00 EDT		0.00	0.00				
1 2002/06/26 13:15:00 EDT		-99.00	0.00				
2 2002/07/24 09:00:00 EDT		-99.00	0.05				
3 2002/07/24 09:15:00 EDT		-99.00	-0.15				
NXT: 2002/10/15 12:45:00 EDT		-99.00	-0.15				

Figure 8. Example of a station analysis for a continuous salinity monitoring station.

SPECIFIC CONDUCTANCE/SALINITY #1

Rating.--None determined.

Calibration.--Probe calibrated on June 26, 2002.

Cross-sectional measurements.--None determined.

Computations.-- Correction sets were applied using ADAPS option 1 and 2 to correct for probe fouling and calibration if differences for before and after probe readings were greater than plus or minus 3%. These correction sets were applied as a percentage of salinity from 1.0 mg/ml to 100 mg/ml. The correction sets listed below were applied due to probe fouling or calibration. Site inspections are listed below.

Inspections for specific conductance/salinity # 1.

Date/ Time	Reading Before	Reading After	% Difference due to fouling2	Calibration	% Difference[2]
10/12/01	28.42	30.00	5.6	No	
10/30/01	23.99	24.81	3.4	No	
11/27/01	lost record				
12/27/01	27.29	32.57	19.3	No	
01/30/02	31.66	34.92	10.3	No	
02/26/02	31.44	31.64	0.6	No	
03/27/02	22.97	31.75	38.2	No	
05/08/02	31.9	38.49	10.4	No	
06/26/02	31.53	47.32	50.1	Yes	-7.07
07/24/02	26.71	26.62	-0.3	No	
08/29/02	26.69	27.70	3.8	No	
09/25/02	21.89	27.85	27.2	No	

[2] Must be greater than ±3 % for datum or shift application

[3] Excellent ≤ ±3 %, good > ±3 % to 10%, fair > ±10 to 15%, poor > ±15 %

Figure 8. Example of a station analysis for a continuous salinity monitoring station (Continued).

CORRECTION SET 1

USGS 02253800 INDIAN RIVER LAGOON AT SEWALS PT STUART FL

SALINITY SAL1, in (MG/ML) WATER YEAR: 2002

DATES VALID FROM: 10/01/2001 00:00 TO 09/30/2002 23:59

START DATE TIME DATUM INPUT CORR INPUT CORR INPUT CORR

END DATE TIME DATUM COMMENT

PRV:2000/08/04 0830 EDT 0.00 0.00

2000/08/04 0831 EDT

1:2001/10/12 0741 EDT 1.00 0.06 100.0 5.60 ________ ________

/__/__ ____ ______ ____

2:2001/10/12 0800 EDT 1.00 0.00 100.0 0.00 ________ ________

/__/__ ____ ______ ____

3:2001/10/30 0830 EST 1.00 0.03 100.0 3.40 ________ ________

/__/__ ____ ______ ____

4:2001/10/30 0845 EST 1.00 0.00 100.0 0.00 ________ ________

/__/__ ____ ______ ____

5:2001/11/27 0900 EST 1.00 0.00 100.0 0.00 ________ ________

/__/__ ____ ______ ____

6:2001/12/27 1030 EST 1.00 0.19 100.0 19.30 ________ ________

/__/__ ____ ______ ____

7:2001/12/27 1045 EST 1.00 0.00 100.0 0.00 ________ ________

/__/__ ____ ______ ____

8:2002/01/30 0845 EST 1.00 0.10 100.0 10.30 ________ ________

/__/__ ____ ______ ____

9:2002/01/30 0900 EST 1.00 0.00 100.0 0.00 ________ ________

/__/__ ____ ______ ____

10:2002/02/26 1515 EST 1.00 0.00 100.0 0.00 ________ ________

/__/__ ____ ______ ____

11:2002/03/27 0930 EST 1.00 0.38 100.0 38.20 ________ ________

/__/__ ____ ______ ____

12:2002/03/27 0945 EST 1.00 0.00 100.0 0.00 ________ ________

/__/__ ____ ______ ____

13:2002/05/08 0830 EDT 1.00 0.10 100.0 10.40 ________ ________

/__/__ ____ ______ ____

Figure 8. Example of a station analysis for a continuous salinity monitoring station (Continued).

EVERGLADES AND SOUTHEASTERN COASTAL AREA

02253800 INDIAN RIVER LAGOON AT SEWALLS PT STUART FL

LOCATION.--Lat 27° 12' 19", long 80° 11' 38", in SE$^{1/4}$SW$^{1/4}$SE$^{1/4}$, sec.36, T.37S., R.41E., Martin County, Hydrologic Unit 03090202 middle of Indian River Bridge cat walk,1.6 mi west of Atlantic Ocean, 4 mi southeast of Stuart.

DRAINAGE AREA.--Indeterminate.

PERIOD OF RECORD.--
DISCHARGE: August 1997 to September 2000.
GAGE HEIGHT: August 1997 to October 2000, September 2001 to current year.
SALINITY (TOP, BOTTOM): August 1997 to October 2000, September 2001 to current year.
WATER TEMPERATURE (TOP, BOTTOM): August 1997 to October 2000, September 2001 to current year.

INSTRUMENTATION.--Satellite data collection platform with water-stage shaft encoder and water-quality monitor. Prior to October 1, 2000, an acoustic doppler velocity meter. Datum of gage is National Geodetic Vertical Datum of 1929.

REMARKS.--Salinity (top) rated excellent except for the following periods: Oct. 1-4, 24-30, Nov. 5-15, Dec. 1-8, Jan. 19-30, Mar. 1-5, Apr. 1-10, May 18-31, June 1-8, Aug. 25-29, which is rated good; Oct. 5-8, Nov. 16-23, Dec. 9-14, Mar. 6-9, Apr. 11-16, June 9-24, which is rated fair; Oct. 9-12, Nov. 24-27, Dec. 15-27, Mar. 10-20, Apr.18-30, June 25-26, which is rated poor. Data for period of Mar. 21-26 exceeded maximum allowable limits (30%) and was not published. Salinity (bottom) rated excellent except for the following periods: Oct. 1-4, 24-30, Nov. 5-15, Dec. 1-8, Jan. 19-30, Mar. 1-5, Apr. 1-10, May 18-31, June 1-8, Aug. 25-29, which is rated good; Oct. 5-8, Nov. 16-23, Dec. 9-14, Mar. 6-9, Apr. 11-16, June 9-24, which is rated fair; Oct. 9-12, Nov. 24-27, Dec. 15-27, Mar. 10-20, Apr.18-30, June 25-26, which is rated poor. Data for period of Mar. 21-26 exceeded maximum allowable limits (30%) and was not published. Temperature (top and bottom) rated excellent. Elevation of the top salinity-temperature probe -1.0 ft NGVD, bottom salinity-temperature probe -9.5 ft NGVD.

EXTREMES FOR PERIOD OF RECORD.--
DISCHARGE: Maximum discharge, 46,121 ft^3/s Nov. 5, 1998; minimum, -42,188 ft^3/s Dec. 24, 1999.
GAGE HEIGHT: Maximum gage height 3.84 ft Sept. 15, 1999; minimum, -1.83 ft Jan. 27, 1998.
SALINITY (TOP): Maximum recorded, 38.8 ppt Mar. 28, 2002 but may have been higher during period of missing record; minimum recorded, 8.0 ppt Oct. 19, 1999, but may have been lower during period of missing record.
SALINITY (BOTTOM): Maximum recorded, 43.1 ppt May 7, 2002 but may have been higher during period of missing record; minimum recorded, 13.2 ppt Mar. 26, 1998, but may have been lower during period of missing record.

Figure 9. Example of a publication manuscript for a continuous monitoring station.

WATER TEMPERATURE (TOP): Maximum recorded, 33.3 ^{o} C Aug. 2, 1998, but may have been higher during period of missing record; minimum recorded, 9.7 ^{o}C, Jan. 10, 2002, but may have been lower during periods of missing record.

WATER TEMPERATURE (BOTTOM): Maximum recorded, 32.9 ^{o}C, Aug. 2, 1998, but may have been higher during period of missing record; minimum recorded, 12.3 ^{o}C, Jan. 27, 2000, but may have been lower during periods of missing record.

EXTREMES FOR CURRENT YEAR.--

GAGE HEIGHT: Maximum gage height, 2.83 ft Nov. 16; minimum, -1.13 ft Jan. 26.

SALINITY (TOP): Maximum recorded, 38.8 ppt Feb. 28, but may have been higher during period of missing record; minimum recorded, 19.7 ppt July 11, but may have been lower during period of missing record.

SALINITY (BOTTOM): Maximum recorded, 43.1 ppt May 7, but may have been higher during period of missing record; minimum recorded, 20.9 ppt Nov. 8, but may have been lower during period of missing record.

WATER TEMPERATURE (TOP): Maximum recorded, 32.7 ^{o} C, Aug. 20, but may have been higher during period of missing record: minimum recorded, 9.7 ^{o}C, Jan. 10, but may have been lower during periods of missing record.

WATER TEMPERATURE (BOTTOM): Maximum recorded, 32.2 ^{o}C, Aug. 19, but may have been higher during period of missing record: minimum recorded, 12.9 ^{o}C, Jan. 9, but may have been lower during periods of missing record.

Figure 9. Example of a publication manuscript for a continuous monitoring station (Continued).

Multiparameter Meter Calibration Logsheet S/NorWnumber- Page No.

Date	Time	Site Name	SC Std	SC Std. Temp	SC Before Adj.	SC After Adj.	Std. or Buffer Lot number	pH Coeff. Table	Buffer Temp	pH Before Adj.	pH After Adj.	BP (mmHg)	Cell H_2O Temp	DO Table Reading	DO Before Adj.	DO After Adj.
									DO Cal. Time:							
Signature/ date:			Team/ Remarks:													
									DO Cal. Time:							
Signature/ date:			Team/ Remarks:													

Figure 10. Multiparameter instrument calibration form

6.2 References Used for the Water-Quality Instruments Section

Table 10 lists reports and/or memoranda referred to in this section. For the complete citation, refer to Section 13.0 in this report.

Table 10. Summary of references for water-quality instruments

Reference	Subject
Wagner and others (2000)	Guidelines and procedures for operation of continuous water-quality monitors
Wilde and Radtke (1998)	Calibration of water-quality instruments
WRD Memorandum 95.35 (USGS)	Instrumentation plan for the WRD and the hydrologic field instrumentation and equipment policy and guidelines

7.0 SITE SELECTION AND DOCUMENTATION

Deciding where to sample is an important initial step toward achieving project objectives and meeting Miami USGS QA/QC requirements. Once a site is selected, thorough documentation, usually in the form of a station description, is required.

7.1 Site Selection

Site selection for sampling is important to the validity of water-quality data. Selection of a suitable site can be made only after considering a number of factors, including the need for information in a particular location, the suitability of a site for sampling, and its accessibility and safety. Specific guidelines for site selection are contained in Wilde and others (1998a) and Schroder and Shampine (1995). The project chief is responsible for the selection of sampling sites, after consultation with the water-quality specialist and the surface-water or ground-water specialist, as appropriate.

7.1.1 Surface Water

If possible, water-quality stations are located at or near streamflow-gaging stations. If this is not possible, the water-quality station should be located where the stream discharge can be measured and water samples can be collected at all stages of flow to be monitored. If the water-quality station is located too close downstream from either the confluence of two or more streams or a point source of pollution, the collection of a representative sample may be difficult because of incomplete mixing. Under such conditions, the criteria for the minimum number of vertical transects sampled may need to be increased, and lateral mixing should be documented with cross-sectional surveys at various stages.

7.1.2 Ground Water

The selection of wells for ground-water sampling is dependent on many variables including location, depth and accessibility of the well, type of well completion, availability of geologic and water-use information, and sampling purpose(s). If suitable existing wells cannot be found, new wells will need to be installed.

7.1.3 Other Sites

Sampling locations at other sites, such as lakes and estuaries, need to be carefully evaluated. This process is to ensure that sampling at the designated location will result in a representative sample.

7.2 Site Documentation

The project chief constructs a site file containing descriptive information on location, conditions, purpose, and ancillary information for all new water-quality data-collection sites (Schroder and Shampine, 1995). Much of this information also is stored electronically in computerized site files maintained by the Data Management Section. The project chiefs are responsible for assuring that the site file is maintained for each data-collection site from their respective projects. Archiving of this information is discussed in Section 10.4.

7.2.1 Surface Water

A station description (to be included in the site file) is prepared for each water-quality station that is sampled on a regular or periodic basis. Sites established at existing surface-water gaging stations commonly will need only supplemental information to complete the description. Other surface-water sites, such as lakes, estuaries, and coastal waters, may require varying amounts of supplemental information to complete the station descriptions. Normally, the minimum electronically stored information required for a surface-water station record is dictated by the NWIS software used by the Miami USGS. The minimum information required for establishing electronic files in NWIS for surface water is listed in Wilde and others (1998a, table 1-1). All results of water-quality analysis as well as analytical service request (ASR) forms will be maintained in the established file for each site. Additionally, it is recommended that site photographs also be included in the site file. A surface-water site header form is required by the Miami USGS for any new surface-water station established and is shown figure 11.

7.2.2 Ground Water

A well file (analogous to a surface-water station description) is prepared for each well that is sampled on a regular or periodic basis. Normally, the minimum electronically stored information required for a ground-water-quality site is dictated by the NWIS software used by the Miami USGS. The minimum information required for establishing electronic files in NWIS is listed in Wilde and others (1998a, table 1-4). This information includes agency code, site identification number, station name, latitude, longitude, district code, state code, county code, agency use, station type, data reliability, site type, and use of site. Other information can include construction data, construction casing data, measure point data, construction lift data, and miscellaneous owner data. The first page of the ground-water site schedule form is shown in figure 12. Paper documents, such as agreements for use of the well between the well owner and the USGS, as well as ASR forms and results of water-quality analysis, will be maintained in the well file. Additionally, site photographs should be included in the well files.

ADVANCED STATION DESCRIPTION
SURFACE WATER

______________________________	____
Hydrologic Unit Number	Hydrologic Unit Name as shown in Map Series 72
______________________________	____
Station Number	Station Name

The District Hydrologic Records Section will assign the station number. Station names ordinarily consist of a specific and general name for the water feature; "at" or "near" (use near when the station is more than one mile from the political boundary of the reference town); a nearby reference town (ordinarily use one shown on the base map); a comma and FL. For example: Chipola River near Altha, FL; Lake Otis at Winter Haven, FL. If two stations have the same name, a distinctive qualifier is used. For example: Hillsborough River at Filter Plant near Tampa, FL. Two stations located above and below a control structure use "at" plus a qualifier for the discharge site and "above" or "below" plus the qualifier for the stage-only site. For example: Stinkwater Creek below S-69 near Rosewick, FL. Auxiliary gages at slope stations are given different names and numbers from the main gage.

____, 19___
Spell out month, show day

When "Discontinued" fill in above only.
When "Converted" indicate the revised items.

LOCATION.--STATION TYPE
Station Type 3= Circle what describes the type
__1=Stream, 2=Lake/Reservoir, 3=Estuary, 4=Specific Source, 5=Spring,
0=Land application, A=Aggregate Ground Water, B=Aggregate Surface Water,
C=Water Use/Place of Use

District 4=122

Country 5=US__

State 6=12

Figure 11. Surface-water station header form.

ADVANCED STATION DESCRIPTION

CONTINUED

County 7= select one

011 Broward
013 Calhoun
015 Charlotte
017 Citrus
019 Clay
021 Collier
023 Columbia
043 Glades
051 Hendry
071 Lee
085 Martin
086 Miami-Dade County new
087 Monroe
093 Okeechobee
099 Palm Beach
109 St. Johns
111 St. Lucie

lat ____°____'_____", long ____°____'_____", T._____., R.______., in ___________ 1/4 sec.

_____ (or in _______________Land Grant), __________________County,

(_________________ quadrangle), ____
List all distances in ascending order,

____
give metric equivalent in parenthesis. Show distance to reference town and

____
mouth of stream. See "Preparation of Water Resources Data Reports" for more

____
information.

MANDATORY for Tallahassee - Furnish copy of quadrangle section with station location indicated.

Figure 11. Surface-water station header form (Continued).

ADVANCED STATION DESCRIPTION
CONTINUED

Submit a field checked Drainage Area on a quad sheet (or copy) with each advanced station description for drainage areas < 10 square miles.

For drainage areas greater than 10 square miles submit a provisional area as computed from field checked sheets.

For areas you consider non-contributing, the same basic procedure should be followed.

DRAINAGE AREA.--________________ mi^2 (______________ km^2)
____________________.

SURFACE AREA.--____________________ mi^2 (______________ km^2)
or ______________ acres.

The District Hydrologic Data Section will determine the station drainage area, miles to mouth, if not known, and surface area of lakes at the time the number is assigned.

REMARKS.--____
Indicate prior records and dates, diversion, regulation,

____
effects of regulation and diversion previous names or numbers, equivalent record.

Data transmitted by ______________________ satellite via _________________ to ____________

The District Hydrologic Data Section will develop an indented downstream order list at the time the number is assigned.

TYPE AND FREQUENCY OF RECORDS.--____

____
Daily discharge, stage twice a week (not biweekly), stage twice a month (not bimonthly), bulk precipitation once a month, daily rainfall, dissolved oxygen every six hours, etc.

JUSTIFICATION.--Indicate the hydrologic reason for the station
.____

____

Figure 11. Surface-water station header form (Continued).

FORM NO. 9-1904-A
Revised April 2002

Coded by ____________ File Code ____________
Checked by ____________ Date ____________
Entered by ____________

U.S DEPT. OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

GROUND-WATER SITE SCHEDULE
General Site Data

AGENCY CODE (C4) USGS
SITE ID (C1)
PROJECT (C5)

STATION NAME (C12/900)

STATION TYPE (C802): str, lake res., estr, SS, Spr, GW, M, O, D, LA, AGW, ASW, WU

DISTRICT (C6)
STATE (C7)
COUNTRY (C41)

COUNTY or TOWN (C8) ____________ County code

LATITUDE (C9)
LONGITUDE (C10)

LAT-LONG ACCURACY (C11): H (Hndrth sec.), 1 (tenth sec.), 5 (half sec.), S (sec.), R (3 sec.), F (5 sec.), T (10 sec.), M (min.)

LAT/LONG METHOD (C35): D (DGPS), G (GPS), L (LORAN), M (map), S (survey), U (unknown)

[1] LAT/LONG DATUM (C36)

ALTITUDE (C16)
ALTITUDE ACCURACY (C18)
ALTITUDE METHOD (C17): A (altimeter), D (DGPS), G (GPS), L (Level), M (map), R (reported), U (unknown)

[2] ALTITUDE DATUM (C22)

LAND NET (C13): 1/4, 1/4, 1/4, S section, T township, R range, merid

TOPOGRAPHIC SETTING (C19): A (alluvial fan), B (playa), C (stream channel), D (depression), E (dunes), F (flat), G (flood-plain), H (hill-top), K (sink-hole), L (lake or swamp), M (mangrove swamp), O (off-shore), P (pediment), S (hill-side), T (terrace), U (undulating), V (valley flat), W (upland draw)

HYDROLOGIC UNIT CODE (C20)
DRAINAGE BASIN CODE (C801)

STANDARD TIME ZONE (C813)
DAYLIGHT SAVINGS TIME FLAG (C814) **Y** OR **N**

MAP NAME (C14)
MAP SCALE (C15)
AGENCY USE (C803): A (active), I (inactive), O (inventory only)

[3] NATIONAL WATER-USE (C39)

DATA TYPE (C804) (Place a "A" (active) an "I" (inactive) or an 'O' (inventory) in the appropriate box): WL cont, WL int, QW cont, QW int, PR cont, PR int, EV cont, EV int, wind vel., tide cont, tide int, sed. con, sed. ps, peak flo, low flo, state water use

INSTRUMENTS (C805) (Place a "Y" in the appropriate box): digital recorder, graphic recorder, telemetry land line, telemetry radio, telemetry satellite, AHDAS, crest-stage gage, tide gage, deflection meter, bubble gage, stilling well, CR type recorder, weighing rain gage, tipping bucket rain gage, acoustic velocity meter, electromagnetic flowmeter

DATE INVENTORIED (C711): month – day – year

REMARKS (C806)

WEB-READY FLAG (C32): C (conditional), P (proprietary), L (local use only)

FOOTNOTES

[1] NAD 27 (North American Datum of 1927), NAD 83 (North American Datum of 1983)

[2] NGVD 29 (National Geodetic Vertical Datum of 1929), NAVD 88 (North American Vertical Datum of 1988)

[3] WS (water supply), DO (domestic), CO (comm), IN (Indst), IR (irrigat), MI (Mining), LV (livestock), PH (Powerl -hydro-), ST (waste water treat), RE (reservoir evap), RM (\Re,ed-iation), TE (thermo-electric power), AQ (aquaculture)

Figure 12. First page of a ground-water site schedule form.

7.2.3 Other Sites

Documentation and site files are maintained for other sampling sites, such as lakes and estuaries. All analytical results and ASR forms should be stored in the site files.

7.3 References Used for the Site Selection and Documentation Section

Table 11 lists reports and/or memoranda referred to in this section. For the complete citation, refer to Section 13.0 in this report.

Table 11. Summary of references for site selection and documentation for water-quality programs

Reference	Subject
Schroder and Shampine (1992)	Guidelines for documenting new water-quality data-collection sites
Wilde and others (1998a)	Establishing electronic NWIS files for surface- and ground-water data.

8.0 SAMPLE COLLECTION AND PROCESSING

Water-quality data collected by the USGS are used by agencies throughout Federal, State, and local governments to establish laws and policies concerning the appropriate and efficient management of water resources for the Nation. Water-quality data are collected as part of such Federal programs as the National Stream-Quality Accounting Network (NASQAN) and the National Water-Quality Assessment (NAWQA) Program, as well as cooperative projects jointly funded by local or State agencies, and are a vital component of water-resources activities performed by the USGS, including the Miami USGS.

The primary objective in collecting a water-quality sample is to obtain environmental data that are representative of the system that is being studied. Sampling and processing techniques for specific constituents may vary according to the general class of compound, such as inorganic or organic chemicals. If incorrect sampling procedures produce a nonrepresentative sample, or if the sample is contaminated or degraded before analysis can be completed, the value of the sample is limited and the data are questionable. Therefore, compliance with documented and technically approved sample-collection and processing protocols is critical to ensuring the water-quality data.

The policy of the Miami USGS mandates that all personnel involved in collecting and processing water-quality data will be adequately informed and trained regarding water-quality data-collection and processing procedures established by the WRD. Because of rapid changes in technology, however, new and improved methods for sample collection and processing are continually being developed. All Miami USGS personnel, who are involved in water-quality sampling, must be aware of changing requirements and recommendations. The Miami USGS water-quality specialist is responsible for providing current information to field personnel on the correct protocols to follow in collecting and processing water-quality samples.

8.1 Constituents in Water

Most studies that are designed to evaluate the water quality of an aquatic system are based upon analyses of physical and chemical parameters associated with the water. Physical parameters generally are measured in the field, whereas most chemical parameters require laboratory analysis. This section of the QA plan includes an overview of relevant Miami USGS and WRD policies, as well as references for specific procedures pertaining to the measurement of field parameters and the collection and processing of samples for water-quality analysis. Information in this section is drawn primarily from the "National Field Manual for the Collection of Water-Quality Data" (variously authored, USGS Techniques of Water-Resources Investigations, book 9, chap. A1-A9), which describes in greater detail the policies and procedures for collecting and processing water-quality samples in the WRD. Additional sources of information include manuals published by the NAWQA Program (Shelton, 1994; Koterba and others, 1995). The project proposal and workplan also should be consulted for specific guidelines for field personnel regarding details of sample collection and processing.

8.1.1 Field Measurements

Routine field measurements include temperature, dissolved-oxygen concentration, specific conductance (conductivity), pH, and alkalinity. Other types of measurements that also may be necessary for specific projects include acid neutralizing capacity, reduction-oxidation potential (E_h), and turbidity. The Miami USGS procedures for collecting field measurements in surface- and ground-water systems are provided by Wilde and Radtke (1998). Field measurements should represent, as closely as possible, the natural conditions of the system at the time of sampling. To ensure quality of the measurements, calibration within the range of field conditions at each site is required for most instruments.

Field-measurement data must be recorded while in the field including methods, equipment, and calibration information. Field-measurement data can be stored either electronically or on paper field forms, which may be national forms (figs. 13 and 14) or customized for a particular project. The project chief or water-quality technician is responsible for reviewing field records for completeness. To avoid the loss of data because of possible instrument malfunction, the project chief or water-quality technician should ensure that backup sensors or instruments are readily available and in good working condition.

To document the quality of field measurements, all Miami USGS personnel involved in the collection of water-quality data are required to participate in the National Field Quality Assurance (NFQA) Program (Stanley and others, 1992). Results of the NFQA Program are reviewed by the Regional Hydrologist and the Miami USGS water-quality specialist. Personnel responsible for water-quality sample collection and field analysis must analyze samples annually for specific conductance, pH, and alkalinity. Only specific conductance analysis is required for personnel involved solely in the collection of data from salinity networks. Staff receiving an unsatisfactory rating will have to be retested. If performance continues to be unsatisfactory with retesting, then the analyst will receive additional training for instrument calibration and for the analytical technique to determine the parameter in question.

Version 3:rev.10/22/2001 11:27 AM

U. S. GEOLOGICAL SURVEY SURFACE-WATER QUALITY NOTES

USGS science for a changing world

NWIS RECORD NO ___ ___ ___ ___ ___ ___ ___ ___

STATION NO. ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ SAMPLE DATE ___ ___/___ ___/___ ___ ___ ___ MEAN SAMPLE TIME__ __ __ __

STATION NAME ______________________________ SAMPLE MEDIUM _____ SAMPLE TYPE _____ PURPOSE OF SITE VISIT (50280) _____

PROJECT NO. ___ ___ ___ ___-___ ___ ___ ___ ___ PROJECT NAME______________________________ SAMPLE PURPOSE (71999) _______

SAMPLING TEAM ______________________________ TEAM LEAD SIGNATURE __________________ DATE ___/___/_________

START TIME __ __ __ __ GAGE HT ________ TIME __ __ __ __ GHT _______ TIME __ __ __ __ GHT _______ TIME __ __ __ __ GHT _______ END TIME __ __ __ __ GHT ________

QC SAMPLE COLLECTED? EQUIP BLANK ___ FIELD BLANK ___ SPLIT ___ CONCURRENT___ SEQUENTIAL __ SPIKE ___ TRIP BLANK ___ OTHER ___

NWIS RECORD NOS. _____________ _____________ _____________ _____________ _____________ _________ _____________ __________

LABORATORY INFORMATION

SAMPLES COLLECTED: NUTRIENTS ___ MAJOR IONS ___ TRACE ELEMENTS: FILTERED ___ UNFILTERED ___ MERCURY ___ VOC ___ RADON ___

TPC ___ (VOL FILTERED______mL) TPC ___ (VOL FILTERED______mL) PIC ___ (VOL FILTERED______mL) DOC ___ ORGANICS: FILTERED ___ UNFILTERED ___

ISOTOPES ___ MICROBIOLOGY ____ CHLOROPHYLL ____ BOD ____ COD ____ ALGAE ____ I NVERTEBRATES ____ FISH ____ BED SED. ____

SUSP. SED. ____ CONC. S/F SIZE RADIOCHEMICALS: FILTERED ___ UNFILTERED ___ OTHER __________________ OTHER ____________________

LABORATORY SCHEDULES: _______________ _______________ _______________ _______________ _______________ _______________

LAB CODES: __________ ADD/DELETE __________ ADD/DELETE __________ ADD/DELETE __________ ADD/DELETE __________ ADD/DELETE __________ ADD/DELETE

COMMENTS: ____ DATE SHIPPED __ __ /__ __/__ __ __ __

FIELD MEASUREMENTS

GAGE HT (00065) ___________________ ft

Q, INST. (00061) ____________ cfs MEAS. RATING EST.

DIS. OXYGEN (00300) __________mg/L

BAROMETRIC PRES. (00025) _______ mm Hg

DO SAT. (00301) ______________ %

eH (00090) ___________ mvolts

pH (00400) ___________ UNITS

*See back page for codes

COND (00095) ______________ σS/cm@25 °C

TEMP, AIR (00020) ___________ °C

TEMP, WATER (00010) __________ °C

TURBIDITY (61028) _________________ ntu

ALKALINITY (   ) *_______________ mg/L

ANC (   )* ____________________ mg/L

BICARBONATE (00453) ____________ mg/L

CARBONATE (00452) ______________ mg/L

HYDROXIDE (71834) _________________ mg/L

E. COLI (   ) _________________ col/100mL

FECAL COLIFORM (31625) _____________ col/100mL

TOTAL COLIFORM (31501) ____________ col/100 mL

OTHER: __________________________________

OTHER: __________________________________

SAMPLING INFORMATION

Sampler Type (84164) _________ Sampler ID ______________ Sample Compositor/Splitter: PLASTIC TEFLON CHURN CONE OTHER _______________

Sampler Bottle/Bag Material: PLASTIC TEFLON OTHER ____________ Nozzle Material: PLASTIC TEFLON OTHER __________ Nozzle Size: 3/16" 1/4" 5/16"

Stream Width: ________ ft mi Left Bank _______ Right Bank ______ Mean Depth: _______ft Ice Cover _______% Ave. Ice Thickness _______ in.

Sampling Points: ______ ______ ______ ______ ______ ______ ______ ______ ______ ______ ______ ______ ______ ______ ______ ______ ______

Sampling Location: WADING CABLEWAY BOAT BRIDGE UPSTREAM DOWNSTREAM SIDE OF BRIDGE ________ ft mi above below gage ______________

Sampling Site: POOL RIFFLE OPEN CHANNEL BRAIDED BACKWATER Bottom: BEDROCK ROCK COBBLE GRAVEL SAND SILT CONCRETE OTHER ________________

Stream Color: BROWN GREEN BLUE GRAY CLEAR OTHER __________ Stream Mixing: WELL-MIXED STRATIFIED POORLY-MIXED UNKNOWN OTHER __________

Weather: ***SKY-*** CLEAR PARTLY CLOUDY CLOUDY ***PRECIP-*** LIGHT MEDIUM HEAVY SNOW RAIN MIST ***WIND-*** CALM LIGHT BREEZE GUSTY WINDY EST. WIND SPEED___

TEMP- VERY COLD WARM HOT ***COMMENTS***____

Sampling Method (82398): EWI [10] EDI [20] SINGLE VERTICAL [30] MULT VERTICAL [40] OTHER ________ Stage: STABLE, NORMAL STABLE, HIGH RISING FALLING PEAK

OBSERVATIONS: ____

____

COMPILED BY: ______________________ **CHECKED BY:** ______________________ **DATE:** ______________

Figure 13. Example first page of a field form for use in recording surface-water field measurements.

Version 2:10/22/2001 11:26

USGS
science for a changing world

U. S. GEOLOGICAL SURVEY GROUND-WATER QUALITY NOTES

NWIS RECORD NO ___ ___ ___ ___ ___ ___ ___ ___

STATION NO. ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ SAMPLE DATE ___ ___-___ ___-___ ___ ___ ___ SAMPLE START TIME__ __ __ __

STATION NAME ________________________ LOCAL WELL NO. ____________ END TIME __ __ __ __ MEAN SAMPLE TIME __ __ __ __

SAMPLING TEAM ____________________________ TEAM LEAD SIGNATURE ____________________ DATE___/___/_______

SAMPLE MEDIUM ______ SAMPLE TYPE ______ PURPOSE OF SITE VISIT (50280)______ SAMPLE PURPOSE (71999)_____ (15 - NAWQA)

PROJECT ACCOUNT ___ ___ ___ ___-___ ___ ___ ___ ___ PROJECT NAME ______________________________________

QC SAMPLE COLLECTED? Equip Blank _____ Field Blank _____ Sequential _____ Spike _____ Trip Blank _____ Other _______________

NWIS RECORD NOS. ____________ ____________ ____________ ____________ ____________ ____________

FIELD ID ____________________

LABORATORY INFORMATION

SAMPLES COLLECTED: NUTRIENTS ___ MAJOR IONS ___ TRACE ELEMENTS: filtered ___ unfiltered ___ MERCURY ___ MICROBIOLOGY ___

ORGANICS: filtered ___ unfiltered ____ PEST ____ VOC ___ DOC ___ RADIOCHEMICALS: filtered ___ unfiltered ___ ISOTOPES ___ OTHER ______________

RADON ___ (Radon samp coll time:__ __ __ __) TPC ___ (vol filtered _____mL) TPC ___ (vol filtered _____mL) PIC ___ (vol filtered _____ mL) OTHER ___________

LABORATORY SCHEDULES: __________ __________ __________ __________ __________ __________ __________ __________

LAB CODES: _________ ADD/DELETE _________ ADD/DELETE _________ ADD/DELETE _________ ADD/DELETE _________ ADD/DELETE _________ ADD/DELETE

COMMENTS: ____ DATE SHIPPED __ __/__ __/__ __ __ __

FIELD MEASUREMENTS

STATIC WATER LEVEL (72019) ____________ ft	pH (00400) ____________ units	BICARBONATE (00453) ___________ mg/L
FLOW RATE (00059) ____________ gpm	COND (00095) ____________ σS/cm@25 °C	CARBONATE (00452) ____________ mg/L
PUMP DEPTH (00003) ____________ ft	TEMP, AIR(00020) ____________ °C	HYDROXIDE (71834) ______________ mg/L
DIS. OXYGEN (00300) ____________ mg/L	TEMP, WATER (00010) ____________ °C	E. COLI ( ) ______________ col/100mL
BAROMETRIC PRES. (00025)____________ mm Hg	TURBIDITY (61028) ____________ NTU	FECAL COLIFORM (31625) ___________ col/100mL
DO SAT. (00301) ____________ %	ALKALINITY ( )* ____________ mg/L	TOTAL COLIFORM (31501) ___________ col/100 mL
eH (00090) __________ mvolts	ANC ( )* ________________ mg/L	OTHER: ____________________________

*See back page for codes

SAMPLING INFORMATION

Sampler Type (84164) ________________ Sampler ID ________________ Sampling Method (82398) __________ Sampling Condition (72006) ___________

Sampler Material: STAINLESS STEEL PVC TEFLON OTHER _____________ Tubing Material: TEFLON PLASTIC TYGON COPPER OTHER __________________

Aquifer name ______________________ Depth pump set at: _____________ft BLW LSD Time pumped before sampling (72004) ________ MIN.

Sampling point description ____

GW Color _________ GW Clarity _________ GW Odor _________ Sample in contact with: ATMOSPHERE OXYGEN NITROGEN OTHER _____________

Weather : ***SKY-*** CLEAR PARTLY CLOUDY CLOUDY ***PRECIP-*** LIGHT MEDIUM HEAVY SNOW RAIN MIST ***WIND-*** CALM LIGHT BREEZE GUSTY WINDY EST. WIND SPEED______

TEMP- VERY COLD WARM HOT ***COMMENTS***____

OBSERVATIONS ____

COMPILED BY ______________________ **CHECKED BY** ______________________ **DATE** _______________

SAFETY FIRST – EVERY JOB – EVERY TIME

Figure 14. Example first page of a field form for use in recording ground-water field measurements.

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8.1.2 Cleaning of Sampling and Processing Equipment

Procedures for cleaning equipment used for water-quality sampling and processing are described by Wilde and others (1998c). All new equipment acquired for water-quality sampling, as well as equipment that has been in long-term storage, must be cleaned in the office before being used in the field. Similarly, equipment must be cleaned as soon as possible after sample collection and before being used again to avoid cross-contamination between sampling sites. The field rinsing of equipment only with site water just prior to sample collection is not a substitute for proper cleaning.

Specific equipment cleaning procedures have been established for the collection of three types of water-quality samples: inorganics, organics, and both inorganics and organics (fig. 15). During each cleaning procedure, personnel should wear disposable powderless gloves. The detergent rinse involves using an 0.1- to 2-percent nonphosphate laboratory grade detergent. Acid rinse requires a 5-percent dilution of American Chemical Society (ACS) trace-element-grade hydrochloric acid in distilled/deionized water (DIW) or 10-percent solution of ACS trace-element-grade nitric acid in DIW. The acid rinse is eliminated if the equipment contains metal parts. The methanol rinse is not made when equipment will be used in the collection of total organic carbon, dissolved organic carbon, or suspended organic carbon. Equipment is cleaned with pesticide-grade blank water or volatiles and pesticide-grade blank water when sampling for organics.

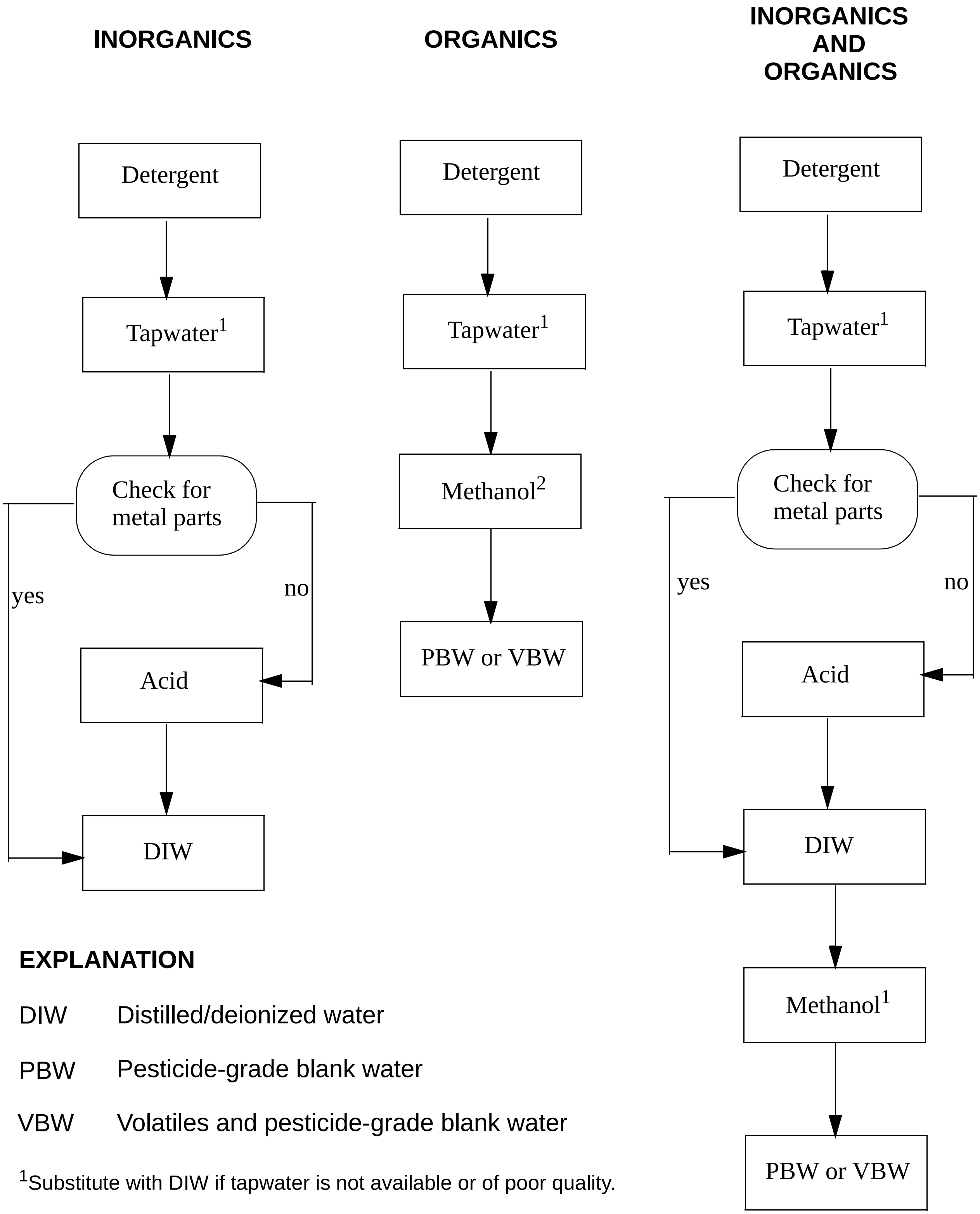
Equipment blanks are a particular type of blank sample that is used to verify that cleaning procedures (used by the field personnel) are adequate for removing contamination. These blanks ensure that individual pieces of sampling equipment are not sources of detectable concentrations of constituents to be analyzed in environmental samples. An annual equipment blank collected in the office laboratory is required for each set of equipment used to collect water-quality samples (Horowitz and others, 1994; Wilde and others, 1998c). Annual equipment blanks that indicate detectable levels of constituents require submission of blanks for individual components of the equipment to isolate the source of contamination. When the source of contamination has been determined, the necessary maintenance must be performed to eliminate contamination, or the equipment must be replaced. The water-quality specialist or project chief monitors the results of annual equipment blanks and ensures compliance with Miami USGS standards.

8.1.3 Surface-Water Sampling

Collecting surface-water samples that accurately represent the physical and chemical characteristics of the aquatic system requires the appropriate use of sampling equipment and methods to describe environmental variability and to prevent contamination or bias in the sampling process. All Miami USGS personnel involved in water-quality studies need to be well informed of the various factors that must be considered to ensure the collection of representative samples. The choice of sampling equipment and method of sample collection are based on established protocols and guidelines, depending upon the characteristics of the target constituents, study objectives, hydrologic conditions, and sampling logistics.

8.1.3.1 Equipment Selection

Guidelines for selecting equipment used to sample surface water are provided by Horowitz and others (1994) and Wilde and others (1998b). Review of equipment selection by Miami USGS technical specialists occurs during proposal and workplan review and during periodic project reviews.



EXPLANATION

DIW	Distilled/deionized water
PBW	Pesticide-grade blank water
VBW	Volatiles and pesticide-grade blank water

[1]Substitute with DIW if tapwater is not available or of poor quality.

[2]Use of methanol currently under review and not used when collecting samples for organic carbon analysis.

Figure 15. Equipment cleaning procedures for various sample types.

8.1.3.2 Sample Collection

Guidelines for the collection of surface-water samples are provided by Wilde and others (1999a). Field personnel are responsible for examining the sampling site carefully and choosing the most appropriate sampling method to generate the best sample possible under the conditions at the time of sampling. The standard procedure for stream sampling is to collect the sample through the entire depth of the water column at multiple vertical transects by either the equal-discharge increment (EDI) method or the equal-width increment (EWI) method. These procedures generate a representative cross-sectional sample that is both flow-weighted and depth- and width-integrated (Ward and Harr, 1990; Edwards and Glysson, 1999).

At times, the use of nonintegrated or nonflow-weighted methods may be appropriate for the collection of surface-water samples because of hydrologic, climatic, or safety conditions or specific project objectives. Due to the low water velocities of less than 2 ft/s (feet per second) that normally occur in southern Florida streams, surface-water sampling is normally not accomplished using isokinetic sampling equipment; instead sampling is usually made using the weighted bottle method. Sampling is performed by either the EDI or EWI method, using an open-mouth bottle placed in a weighted basket sampler. If EDI or EWI sampling cannot be made due to the inadequacies of the sampling location, alternate means of sampling such as taking grab samples, preferably near the middle of the stream, may be employed. Thorough documentation of sampling equipment and methods to be used is required in field records associated with water-quality samples. The project chief or water-quality technician is responsible for timely review of field records.

Specific procedures employing two-person sampling teams with specific designated roles in sample collection and handling are required when sampling for trace inorganic constituents at ambient concentrations less than about 10 µg/L (micrograms per liter), as described by Horowitz and others (1994). The two-person sampling protocol may be modified as appropriate for studies in which low-level trace elements are not measured. Modifications to sampling protocol can also be undertaken, depending on the sampling location and the local conditions present during sampling. For example, sampling in estuaries or lakes may require additional personnel for boat operation.

Review of surface-water sampling procedures for each Miami USGS water-quality project is performed at least annually by the water-quality specialist and is documented with a memorandum to the appropriate project chief and the Miami USGS Center Director. An independent review of field methods for at least one Miami USGS project is conducted once every 3 years during the OWQ technical review.

8.1.4 Ground-Water Sampling

The Miami USGS ground-water sampling procedures are designed to ensure that the samples collected are representative of water in the aquifer and are not contaminated by well construction material or sampling equipment, and that the composition of the samples is not altered by physical or chemical processes during sampling. It is critical that field personnel be aware of all factors that can compromise the integrity of ground-water samples and implement consistent strategies to protect sample integrity.

8.1.4.1 Equipment Selection

Guidelines for selecting appropriate equipment for ground-water sampling are provided by Wilde and others (1998b). All project personnel involved in ground-water sampling for water-quality studies must understand the advantages and disadvantages of available equipment with respect to study objectives. Because of the wide range of factors involved, the ideal equipment for sample collection under some circumstances may not exist. When compromise decisions are required, the field team must thoroughly document with field notes the compromises that are made. Review of equipment selection occurs during proposal and workplan review and during periodic project reviews by Miami USGS technical specialists.

8.1.4.2 Sample Collection

Guidelines that prevent or minimize loss of sample integrity for collecting representative water-quality samples from ground water are provided by Wilde and others (1999a). The standard procedure for ground-water sampling is to purge the well to remove at least three well volumes of standing water while monitoring field measurements for stabilization. However, exceptions to the three-well-volume rule can be made under some circumstances, depending upon project objectives or site characteristics. This sampling procedure may not be appropriate for wells that are not cased the entire depth and where large open intervals in the borehole are present (Kohout and Hoy, 1963). In this case, a downhole sampling device, such as a thief sampler or Kemmerer sampler, is more appropriate for obtaining a representative sample than pumping, which may result in mixing of water from the open interval. Because of the above-mentioned reasons, the Miami USGS employs downhole sampling devices for some wells in the salinity monitoring network. The project chief or water-quality technician is responsible for timely review of field records. A field form used by the Miami USGS for recording well-purging data from salinity networks and a ground-water summary sheet for recording water-level, conductivity, and chloride data are shown in figures 16 and 17, respectively.

As a rule, field personnel are required to follow a prescribed order of sample collection (Wilde and others, 1999a, table 4-5) to help ensure the quality of the data collected. Additionally, two-person sampling teams are to implement coordinated clean-handling techniques when collecting samples for trace elements with concentrations less than about 10 μg/L, as described by Horowitz and others (1994).

Review of ground-water sampling procedures for each Miami USGS water-quality project is performed at least annually by the water-quality specialist and documented with a memorandum to the appropriate project chief and the Miami USGS Center Director. An independent review of field methods, for at least one Miami USGS project, is conducted once every 3 years during the OWQ technical review.

8.1.5 Precipitation Sampling

Specific procedures in the Miami USGS for collecting precipitation samples are based primarily on the study objectives. Major factors that must be considered in sampling for precipitation quality include the location of the sampling station relative to human influences, the choice of sampling equipment, and special sample-handling procedures that may be necessary. Precipitation-quality sampling equipment should be composed of inert, nonabsorbent material that will not affect the typically low concentrations of ions in solution. Guidelines regarding the collection of precipitation samples are provided by Peden and others (1986), Willoughby (1995), and Dossett and Bowersox (1999).

STATION ID: ______________ SITE NAME: ________ ACTIVITY: ____ TRIP: _____

Sample Date/Time	Sample ID	Sampling method	For purged wells:								
			Total depth (ft)	Depth to water (ft)	Water column (ft)	Well diameter (in.)	Volume factor (table below)	Well volume (gallons)	Minimum purge volume (gallons)	Time pumped	Volume removed (gallons)
			(A)	(B)	(B – A)	(C)	(D)	D * (B – A)	3*D*(B – A)		

Volume Factor (D): 1.5” 0.092 2” 0.163 2.5” 0.255 3” 0.367 4” 0.653 5” 1.020 6” 1.469 8” 2.612
For other well diameters: D = (diameter) * (diameter) * 0.040809

THE MIAMI QA/QC PLAN REQUIRES **3 – 5 WELL VOLUMES** TO BE REMOVED FROM THE WELL PRIOR TO SAMPLING IF THE WELL IS SAMPLED BY PUMPING

Figure 16. Field form for recording well-purging data.

GROUNDWATER SUMMARY SHEET FOR

STATION NAME: ______ STATION ID: ______ WATER YEAR: ______

COOPERATOR: ______ STANDARD DATUM: ______ MP ELEV: ______

WELL DEPTH: ______ CASING DIAM: ______ LSD ELEV: ______

INSPECTION		INIT.	GAGE FOUND READING		GAGE LEFT READING		HOLD READINGS	CUT READINGS	D.T.W. READINGS	M.S.L. READING	P.G. ?	GAGE HEIGHT CORR.	SPEC. COND.	CL- VALUE	COMMENTS
DATE	TIME		I.G.	Recorder	I.G.	Recorder									

Notes: --; Top of base

Figure 17. Ground-water summary sheet for recording water-level, conductivity, and chloride data.

The project proposal and workplan should be consulted for specific guidelines regarding the factors that must be considered in choosing the sample location, sampling equipment and frequency, and special sample handling procedures that may be necessary based upon the study objectives. For specific questions related to precipitation sampling that are not addressed by these references, contact the appropriate unit chief at the NWQL.

8.1.6 Sample Processing

All samples collected for water-quality analysis must be processed as soon as possible following collection according to the procedures prescribed by Wilde and others (1999b). The constituents of interest and study objectives determine the specific processing procedures that are necessary, which must be described in the project workplan.

All Miami USGS water-quality studies that include the analysis of trace elements in concentrations less than 10 µg/L must use the protocols for sample processing as described by Horowitz and others (1994). These techniques require the use of processing and preservation chambers to reduce the potential for contamination from the surrounding environment during sample splitting, filtration, and preservation. For Miami USGS studies not requiring analysis of trace elements at concentrations less than 10 µg/L, less rigid processing procedures may be employed. Review of sample processing procedures for all water-quality projects occurs during proposal and workplan review and during periodic project reviews by the Miami USGS water-quality specialist or OWQ.

8.1.6.1 Sample Compositing and Splitting

Guidelines for using sample compositors and splitters are described by Wilde and others 1998b). Two types of sample splitters presently used by the WRD are the churn splitter, which also serves as a compositing device, and the cone splitter, which requires a separate compositing vessel. Each splitter has specific advantages and disadvantages as described in OWQ Technical Memorandum 97.06. Either splitting method can be applied to inorganic and organic constituents within the technical design limits of the device and as long as the equipment is constructed of appropriate materials.

8.1.6.2 Sample Filtration

Filtration is required for many water-quality samples to separate particulates from the water and constituents in solution. Selection of the appropriate filter unit and filter characteristics to be used depends on the constituent class of interest and is based on guidance provided by Wilde and others (1998b). Guidelines for filtration procedures for specific constituent groups are provided by Wilde and others (1999b). For surface water, the most common filtration system consists of a reversible, variable-speed, battery-operated, peristaltic pump and 0.45-micron pore-size disposable capsule filter. For ground water, the sample is generally pumped directly from the well through a 0.45-micron pore-size disposable capsule filter. Filtration of samples for analysis of trace elements at concentrations less than 10 µg/L must be done in a processing chamber that encloses the filtering unit and sample bottles in a protected environment.

8.1.6.3 Sample Preservation

Sample preservation techniques are required for some constituent groups to prevent reduction or loss of target analytes and to stabilize analyte concentrations for a limited time. Guidelines for sample preservation are provided by Wilde and others (1999b) and the NWQL Services Catalog (see Section 4.3.1 for location). Since some samples have very limited holding times even when preserved, field personnel must ensure that all water-quality samples are shipped to the laboratory as soon as possible and that time-sensitive samples are received in good condition within the appropriate holding time. For details on sample shipping requirements, refer to the section 9.0 of this QA plan. The OWQRL policy is to inform customers if their samples do not arrive in good condition or if samples are improperly preserved or collected. Personnel of the Miami USGS are encouraged to call other laboratories to ensure that samples have been received at the respective laboratory within the prescribed holding times. It may be advisable to enclose return postcards in coolers so the laboratory can report the temperature of the cooler when received.

8.2 Other Types of Water-Quality Samples

Many water-quality studies in the WRD employ a multidisciplinary approach that relies on data from a range of sampling media. Various types of biological, sediment, and radiochemical samples may be incorporated into a water-quality project to provide multiple lines of evidence with which to evaluate a particular aquatic system. This section of the QA plan includes an overview of standard Miami USGS QA procedures and references for detailed instructions that describe the collection of biological, sediment, and radiochemical samples.

8.2.1 Biological Sampling

The Miami USGS water-quality activities currently involve the collection of biological samples. Activities may include sampling of contaminants in benthic invertebrates (Cuffney and others, 1993), algae (Porter and others, 1993), fish (Meador and others, 1993a), stream habitat (Meador and others, 1993b), tissues (Crawford and Luoma, 1994), fecal indicator bacteria (Myers and Sylvester, 1997), and 5-day biochemical oxygen demand (Delzer and McKenzie, 1999).

8.2.2 Suspended-Sediment and Bottom-Material Samples

The Miami USGS water-quality activities may include the collection of suspended-sediment and bottom-material samples. Guidelines for the collection of sediment samples are described by Guy (1969), Knott and others (1992), Shelton (1994), Shelton and Capel (1994), Radtke (1998), Wilde and others (1999a; 1999b), and Edwards and Glysson (1999) and in WRD Office of Surface Water (OSW) Memorandum 93.01. Suspended-sediment samples are typically analyzed by the KDSL for concentration and either sand and silt distribution or complete particle-size distribution. Bottom-sediment samples are analyzed at the NWQL. Samples for both suspended sediment and bottom sediment may be analyzed for chemical constituents, including trace elements or hydrophobic organic compounds.

Field personnel must be familiar with the factors involved in the selection of sediment-sampling equipment that are based on the type of analyses to be performed and hydraulic conditions as well as special cleaning procedures that may be required when sampling sediment chemistry. The project workplan should be consulted for specific guidelines for sediment sampling, depending on project objectives.

Individuals who have questions regarding the collection and handling of sediment samples should contact the Miami USGS water-quality specialist. For particular questions concerning sediment chemistry samples, contact the KDSL or NWQL.

8.3 Quality-Control Samples

Quality-control samples must be collected as integral components of all Miami USGS water-quality studies to determine the acceptability of performance in the data-collection process and provide a basis for evaluating the adequacy of procedures that were used to obtain data. Guidelines for the collection of specific types of QC samples and the use of QC data are provided by Wilde and others (1999a). Specific guidelines for the collection and processing of QC samples must be included in the project workplan (Section 3.2). The project chief is responsible for reviewing QC data in a timely manner and implementing necessary modifications, when appropriate, to sampling and processing techniques. The Miami USGS water-quality specialist has the responsibility for advising Miami USGS personnel regarding the collection and interpretation of QC samples.

8.4 Safety Issues

Because the collection of water-quality data in the field can be hazardous at times, the safety of field personnel is a primary concern. Field teams often work in areas of high traffic, remote locations, and under extreme environmental conditions. Field work involves the transportation and use of equipment and chemicals, and commonly requires working with heavy machinery. Additionally, field personnel may come in contact with waterborne and airborne chemicals and pathogens while sampling. Beyond the obvious concerns regarding unsafe conditions for field personnel, such as accidents and personal injuries, the quality of the data also may be compromised when sampling teams are exposed to dangerous conditions.

So that personnel are aware of and follow established procedures and protocols that promote all aspects of safety, the Miami USGS communicates information and directives related to safety to all personnel. This information is communicated through in-house training, safety classes, memoranda, videotapes, and other means as appropriate. Specific policies and procedures related to safety can be found on the WRD safety home page at http://1stop.usgs.gov/safety/. Laboratory safety also is addressed in the Miami USGS chemical-hygiene plan.

An individual has been designated as Safety Officer by the Miami USGS Center Director. The responsibilities and duties of the Safety Officer are outlined in WRD Memorandum 96.26, dated May 13, 1996. Personnel who have questions or concerns pertaining to safety, or who have suggestions for improving some aspects of safety, should direct those questions, concerns, and/or suggestions to the Miami USGS Center Director, unit supervisors, or the Safety Officer. Guidelines pertaining to safety in field activities are provided by Lane and Fay (1998).

8.5 References Used for the Sample Collection and Processing Section

Table 12 lists reports and/or memoranda referred to in this section. For the complete citation, refer to Section 13.0 in this report.

Table 12. Summary of references used for collecting and processing water-quality samples

Reference	Subject
Crawford and Luoma (1994)	Collecting samples of contaminants in tissue (NAWQA)
Cuffney and others (1993)	Collecting benthic invertebrate samples (NAWQA)
Delzer and McKenzie (1999)	Five-day biochemical oxygen demand
Dossett and Bowersox (1999)	Guidelines for collecting precipitation samples
Edwards and Glysson (1999)	Field methods for measuring fluvial sediment
Guy (1969)	Laboratory theory and methods for sediment analysis
Horowitz and others (1994)	Protocol for collecting and processing inorganic constituents in filtered water
Knott and others (1992)	Quality-assurance plan for collecting and processing sediment data
Kohout and Hoy (1963)	Sampling salty ground water in coastal aquifers
Koterba and others (1995)	Collecting and processing ground-water samples (NAWQA)
Lane and Fay (1998)	Safety in field activities
Meador and others (1993a)	Collecting fish samples (NAWQA)
Meador and others (1993b)	Characterization of streambed habitat (NAWQA)
Myers and Sylvester (1997)	Measuring fecal indicator bacteria
Peden and others (1986)	Procedures for collecting precipitation samples (USEPA)
Porter and others (1993)	Collecting algal samples (NAWQA)
Radtke (1998)	Collecting and processing bottom-sediment samples
Shelton (1994)	Collecting and processing stream-water samples (NAWQA)
Shelton and Capel (1994)	Collecting and processing streambed-sediment samples (NAWQA)
Stanley and others (1992)	National field quality-assurance program
Ward and Harr (1990)	Representative sampling techniques for surface water and streambed material
Wilde and others (1998b)	Selection of equipment used to collect and process water-quality samples
Wilde and others (1998c)	Cleaning equipment used to collect and process water-quality samples
Wilde and others (1999a)	Collecting water-quality samples from surface and ground water
Wilde and others (1999b)	Processing water-quality samples
Wilde and Radtke (1998)	Well-purging procedures
Willoughby (1995)	Case study discussing methods of precipitation sampling and analysis
OSW Memorandum 93.01 (USGS)	Instrumentation and field methods for collecting suspended-sediment data
OWQ Memorandum 97.06 (USGS)	Comparison of splitting capabilities of the churn and cone splitters
WRD Memorandum 96.26 (USGS)	Responsibilities of a USGS Safety Officer

9.0 WATER-QUALITY SAMPLE HANDLING AND TRACKING

All water-quality samples must be uniquely identified, documented, handled, shipped, and tracked appropriately. Following proper protocols for sample handling, shipping, and tracking, ensure that samples are processed correctly and expeditiously to preserve sample integrity between the time of collection and the time of analysis. This section describes the procedures used by the Miami USGS for handling, shipping, and tracking samples from collection through transfer of the samples to an analytical facility. Receipt of analytical data from laboratories is covered in Section 10.0 (Water-Quality Data Management).

9.1 Preparation for Sampling

Ensuring that field personnel have the correct equipment and supplies on hand to perform the necessary sampling activities saves time and labor costs associated with repeated sampling trips that result from inadequate planning. Therefore, before commencing field activities, the project chief or water-quality technician is responsible for ensuring that the following preparations have been completed:

- Review the sampling instructions for each site and the list of sample types required.
- Ensure that the station site file is current.
- Prepare bottle labels for samples, or use grease pencils for applying sample information on bottles.
- Obtain field sheets or notebooks and ASR forms.
- Ensure that necessary supplies are available such as bottles, standards, filters, preservatives, meter batteries, waterproof markers, shipping containers, and so forth (see Section 5.1.3 – Equipment and Supplies).
- Ensure that all sampling equipment is thoroughly cleaned and prepared.
- Check meters and sensors for proper performance.
- Prepare bottles for sampling as described by Wilde and Radtke (1999b).

9.2 Onsite Sample Handling and Documentation

During a sampling trip, it is imperative that accurate notes be taken and that sample bottles be labeled and handled appropriately for the intended analysis. Otherwise, bottle mix-ups or other errors may occur, and the samples may be wasted. The project chief or water-quality technician is responsible for ensuring that all of the following sampling requirements are implemented on the labels or on the bottles with a waterproof grease pencil: sampling date and time, field sample ID, and sample type such as raw acidified (RA), filtered acidified (FA), raw chilled (RC), etc., or the laboratory code for the specific analysis. Table 13 lists sample designations, bottle descriptions, and preservation procedures for organic and inorganic samples.

Table 13. Sample designations, bottle descriptions, and preservation procedures for organic and inorganic samples

Sample designation code	Bottle description and sample preservation
Organic	
VOC	40-milliliter amber glass vials, laboratory cleaned and baked, for analysis of volatile organic compounds (VOC). Sample chilled to 4 degrees Celsius without freezing. Some programs require chemical treatment
GCC	1-liter amber glass bottle, laboratory cleaned and baked, for various types of pesticides and organic compound samples other than VOC's. Sample chilled to or below 4 degrees Celsius without freezing
TOC, DOC	125-milliliter amber glass bottle, laboratory cleaned and baked, for total organic carbon (TOC) or dissolved organic carbon (DOC). Sample chilled to 4 degrees Celsius or below without freezing
Inorganic	
RA, FA	250-, 500-, or 1,000-milliliter polyethylene bottles, acid rinsed, capped and filled with raw (RA) or filtered (FA) samples and acidified with nitric acid to pH less than 2
RU, FU	250-, 500-, or 1,000-milliliter polyethylene bottles, uncapped and filled with untreated raw (RU) and filtered (FU) samples
FCC	125-milliliter brown polyethylene bottles, uncapped and filled with filtered (FCC) sample for nutrient analysis and chilled to or below 4 degrees Celsius without freezing
WCA, FCA	125-milliliter polyethylene bottles, uncapped and filled with raw (WCA, uncolored bottle) or filtered (FCA, brown bottle) sample for nutrient analysis. Treated with sulfuric acid and chilled to or below 4 degrees Celsius without freezing
RAM, FAM	250-milliliter glass bottles, acid rinsed, capped and filled with raw (RAM) or filtered (FAM) sample for mercury analysis and treated with nitric acid/potassium dichromate solution

9.3 Sample Processing

To reduce the risk of sample contamination from different sample types, a special sequence of processing procedures must be followed. Table 14 lists the recommended sequence of sample processing to be followed for various sample types.

9.4 Sample Shipment and Documentation

Upon completion of a sampling trip, samples should be packaged and shipped to the laboratory for analysis as soon as possible, preferably using an overnight courier. Generally, the shorter the time between sample collection and processing and sample analysis, the more reliable the analytical results will be. Before shipping samples to the laboratory, the project chief or water-quality technician should complete the following:

Table 14. Recommended sequence for processing samples

Sample type	Processing sequence
Organics	Raw (wholewater or unfiltered) samples first, followed by filtered samples. **Do not rinse bottles.** Chill immediately. a. Volatile organic compounds. b. Pesticides, herbicides, polychlorinated biphenyls (PCB's), and other agricultural and industrial organic compounds. c. Total organic carbon (TOC), dissolved organic carbon (DOC), and suspended organic carbon (SOC). Chill immediately.
Inorganic constituents, trace metals, nutrients, radiochemicals, and isotopes	**For ground water**, filtered samples first, followed by raw samples. **For surface water**, raw samples first, followed by filtered samples. (Field rinse each bottle as required). a. Trace metals. b. Separate-treatment constituents (such as mercury, arsenic, selenium) and major cations. c. Major anions, alkalinity, and nutrients. Chill nutrients immediately.
Radon and chlorofluorocarbons	Process after inorganic constituents.
Microorganisms	Process last.

1. Check that sample sets are complete and that sample bottles are labeled correctly, with all required information (see Section 9.2).
2. Complete the ASR forms for all samples being sent to the NWQL. If samples are being sent to a different approved laboratory, information similar to that required on the ASR forms should be provided to the laboratory.
3. Pack samples carefully in shipping containers to avoid bottle breakage, shipping container leakage, and sample degradation. Check that bottle caps are securely sealed. Follow the packing and shipping protocols established by the USGS and the receiving laboratory (Wilde and others, 1999b; NWQL Technical Memorandum 95.04)
4. Ship samples after sample collection and the same day whenever possible. Tables that summarize sample processing requirements and a list of NWQL designation codes for commonly measured organic and inorganic constituents are presented in Wilde and others (1999b). This information may be useful as a reference guide for field personnel.

9.5 Sample Tracking Procedures

The Miami USGS maintains a record of all samples collected and shipped to a laboratory for analysis to ensure the complete and timely receipt of analytical results. The project chief or water-quality technician is responsible for recording the required information. The project chief is responsible for reviewing the tracking log to determine if analyses are missing and for taking corrective action(s) if necessary. The Miami USGS sample tracking system should include the following information: (1) date of shipment, (2) number of ice chests, (3) respective laboratory or laboratories receiving the shipment, (4) date of receipt of samples at the respective laboratories, and (5) condition of samples received. The OWQRL will inform the respective project chief if the samples do not arrive in good condition or if the samples are improperly preserved or collected.

9.6 Chain-of-Custody Procedures for Samples

When chain-of-custody procedures are appropriate or required (for example, when data may be used in legal proceedings), the project chief should establish, maintain, and document a chain-of-custody system for field samples that is commensurate with the intended use of the data. A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. Every exchange of a sample between people or places that involves a transfer of custody should be recorded on appropriate forms that document the release and acceptance of the sample. Each person involved in the release or acceptance of a sample should keep a copy of the transfer paperwork. The project chief or designee is responsible for ensuring that custody transfers of samples are performed and documented according to the requirements listed below:

- The means for identifying custody should be clearly understood (use of forms, stickers, and so forth);
- Instructions for documenting the transfer of samples and the person responsible for this documentation must be clearly defined; and
- A plan must be in place for maintaining records in a specific location for a specific period of time (for example, in the site folder).

9.7 References Used for the Water-Quality Sample Handling and Tracking Section

Table 15 lists reports and/or memoranda referred to in this section. For the complete citation, refer to Section 13.0 in this report.

Table 15. Summary of references for handling and tracking water-quality samples

Reference	Subject
NWQL Memorandum 95.04	Shipping samples to the NWQL, and instructions for filling out ASR forms
Wilde and others, 1999b	Processing water samples

10.0 WATER-QUALITY DATA MANAGEMENT

Water-quality data that are collected for hydrologic investigations are recorded on paper as well as electronically. Data that are recorded on paper include chemical, physical, biological, and ancillary data measured in the field. This information is documented on standard USGS field forms (figs. 13 and 14) and stored in site files. Data that are recorded electronically include analytical results and continuous monitoring data transmitted over the computer network or stored by an electronic data logger. Data that are recorded on paper and electronically typically are stored either in the NWIS-QWDATA database (Maddy and others, 1997) or in the NWIS-ADAPS database (Dempster, 1990). The NWIS is the storage medium for water-quality, streamflow, well, and water-use information collected by the USGS. Data that cannot be stored in these national databases may be stored in other databases, such as project databases.

10.1 Processing Data

Sampling information, field determinations, and ancillary information are recorded on a set of water-quality field notes that are considered original record. These data are combined with analytical data from the laboratory in computer data files and paper files.

10.1.1 Continuous Monitoring Data

Continuous monitoring data are water-quality records collected onsite by satellite data-collection platforms, electronic sensors, and data loggers. Two methods for electronically recording data are by: (1) transmitting data from a remote location by land line or radio telemetry to a central location where they are recorded on a disk, and (2) recording data at a remote location by an electronic data logger or collecting data real time by means of a satellite data-collection platform. Initial data processing in the office is for the purpose of obtaining a copy of the original data for archiving (see Section 10.4). Data are not manipulated by the field instrument or a computer except to convert recorded signals into data in commonly used units or to display data in a convenient format. The transfer of data from the electronic storage medium to NWIS requires thorough checking to ensure that the data have transferred successfully or that as much data as possible have been recovered and errors identified (WRD Memorandum 87.085). Data processing of continuous monitoring data can be classified into six major categories: (1) initial data evaluation, (2) application of corrections and shifts, (3) application and evaluation of cross-section corrections (for surface-water sites), (4) final data evaluation, (5) record checking, and (6) record review.

The following is the Miami USGS procedure for entering data from specific conductivity probes to the database and initial data evaluation:

1. Ensure all information on the inspection sheet matches information recorded in the field book.
2. Convert the .csv file to a .raw file manually. Renaming the file to .raw converts the file format so that the file is recognized by the ADAPS database program.
3. Copy the .raw data file to a directory named raw found in the UNIX directory (fs02sflmia/home/raw) under the main terminal.
4. After the data have been transferred and retrieved by the ADAPS program, data may be plotted to initially evaluate the data and detect any errors.

Guidelines for application of corrections and shifts, final data evaluation, record checking, and record review are outlined in Wagner and others (2000).

10.1.2 Analytical Data

Analytical data are results of field and laboratory chemical, physical, or biological determinations. Most water-quality samples are analyzed either in the field, at the NWQL, or at the OWQRL. In some instances, samples may be analyzed by research laboratories or by laboratories outside of the USGS (see Section 4.1).

To enter analytical data into the NWIS database, a site identification number must first be assigned and entered into the Miami USGS site file (see Section 7.2). Field measurements are entered into the NWIS database by the project chief or water-quality technician as soon as possible after returning from the sampling field trip. A record number is assigned by the system and is recorded in a log book (fig. 18) and on the ASR form (see Section 9.5 for sampling tracking procedures). Sampling logging is required for data from the NWQL or OWQRL to successfully transfer the data into the database. Environmental sample data and QA data are entered in two Miami USGS databases: NWIS-QWDATA database 01 (environmental samples) and NWIS-QWDATA database 02 (QA data).

Station number	Date/time	Schedules requested	NWIS record number	Lab ID number	Date shipped	Date received
0208500	Sept. 21, 1993	1043	993000025			
"	"	542	"			
0209754	Oct. 4, 1993					

Figure 18. Example page from a sample-collection log book used by the U.S. Geological in Miami.

All data from the NWQL and OWQRL are electronically transferred to the appropriate Miami USGS database by the water-quality specialist at least once a week. Hard copies of the analytical reports (WATLIST's) are forwarded to the project chiefs for storage in project files. The NWIS-QWDATA database receives daily incremental backup and weekly full backup.

Data analyzed by laboratories other than the NWQL or OWQRL must be entered into NWIS if possible (Hubbard, 1992) and identified according to the analyzing laboratory. Data entry is the responsibility of the project chief. Data are entered and stored according to procedures already described for processing NWIS analytical data. Appropriate codes are used to identify the data as originating from non-USGS sources.

10.1.3 Non-National Water Information System Databases

Sometimes data collected by Miami USGS project personnel cannot be entered into the NWIS-QWDATA database because the data are proprietary (such as data collected for some military projects) or because NWIS cannot accept the type of data that is generated by the project. In these instances, project databases that are the sole repository for project data should have a written procedure for data entry, storage, and long-term backup and archival. The respective project chief, in consultation with the database administrator and water-quality specialist, has the responsibility for developing and implementing management of project databases.

10.2 Validation (Records Review)

Data validation is the process whereby water-quality and associated data are checked for completeness and accuracy. After validation, data records are finalized in the Miami USGS database.

10.2.1 Continuous Monitoring Data

Following the entry of continuous monitoring data into NWIS, raw data and/or graphs of raw data are reviewed by the project chief or water-quality technician for anomalous values, dates, and times. Additionally, preliminary updating is done. Corrections due to fouling or drift are applied according to the guidelines outlined by Wagner and others (2000). Once the data are edited, the record is submitted to the project chief for final review and approval.

The final review package requires all information as discussed by Wagner and others (2000). Final data evaluation consists of reviewing the record, ensuring that corrections were properly applied, and making any final revisions. The data are evaluated for maximum allowable limits for reporting continuous data. After the record has been evaluated for maximum allowable limits, accuracy classifications for record publication are applied to each measured physical property–on a scale ranging from poor to excellent.

10.2.2 Analytical Data

All field notes and field measurements are reviewed for completeness and accuracy as soon as possible after returning from the field trip by the project chief. All chemical analyses are reviewed for completeness, and questionable values are noted. Prompt review is necessary to allow analytical re-analysis to be performed before sample holding times have been exceeded for accuracy and precision. Analytical results should be reviewed as soon as possible by the project chief after receiving the results in WATLIST format. Data from the OWQRL should be reviewed promptly as samples are generally retained by the laboratory for only 30 days following retrieval of the data. Every data analysis entered into NWIS-QWDATA results in output (WATLIST) that contains a copy of the analysis and a report of general validation checks (Maddy and others, 1997), including but not limited to the following:

- Comparison between determined and calculated values for dissolved solids,
- Comparison between dissolved and total constituents,
- Comparison between specific conductance with dissolved solids,

- Comparison between constituents and relevant Federal drinking-water standards, and
- Comparison between sum of cations and anions (ion balance).

Field and laboratory analyses, such as pH, specific conductance, and alkalinity, are compared to confirm agreement of independent measurements. If data from more than one sample are available for a site, the analysis also is compared with previous analyses within a hydrologic context to identify obvious errors, such as decimal errors, and possible sample mix-ups or anomalies warranting analytical re-analysis. These reports and comparisons are reviewed and noted on the analytical report (WATLIST). If necessary, corrections or re-analysis may be requested by the project chief.

Requests to the NWQL for re-analysis are made by email to denqc@usgs.gov (NWQL Memorandum 92.06). Rerun requests to the OWQRL are made by email to ocalaman@usgs.gov and must include the laboratory record number, labcodes for reruns, and original values reported. Rerun data are retrieved in one and star card format and are entered into the Miami USGS database by the water-quality specialist. Rerun requests to contract laboratories are made in writing or as stipulated in the laboratory contract. Re-analysis requests are logged and tracked by maintaining a re-analysis request form as listed below (fig. 19). Corrections to NWIS resulting from reruns by the NWQL must be made to the laboratory database as well as the Miami USGS database and are made by the project chief by email request to denap@usgs.gov.

Date requested	Lab ID number	Station number	Date	Time	Parameter number	Parameter name	Old value	New value	Update No update/ Delete

Figure 19. Example of re-analysis request form.

Project QA data, such as blanks, replicates, blind standards, and matrix spikes, periodically are tabulated or graphed by the project chief to facilitate identification of inaccuracies or systematic bias that may not be discernible when reviewing an individual analysis. As a result of this procedure, questionable or erroneous values may be deleted from the database by the project chief. The Miami USGS QA data, including NFQA sample results, are reviewed by the water-quality specialist. Unacceptable results will require corrective action in the form of retesting, review of analytical procedures, or identification of faulty instruments or instrument recalibration.

10.3 Data Storage

In accordance with WRD policy, all water data collected as part of routine data collection by the WRD are stored in the NWIS computer database. Data collected by others, such as cooperators, universities, or consultants, which are used to support published USGS documents and are not published or archived elsewhere, also should be entered into NWIS and identified according to analytical laboratory and collection organization. Other outside data may be entered into the database at the discretion of the water-quality specialist if data-collection methods and quality have been reviewed and determined to be acceptable. Electronically stored data that cannot be entered into NWIS are stored in project databases online or offline. The supervisory computer specialist is responsible for maintaining backups of data stored electronically in NWIS or online. Data stored electronically offline are maintained by the computer services section.

In addition to electronically stored data, other project data and information, including field notes, ASR forms, WATLIST's, and sampling site information, are retained in station folders and maintained by the project chief while the project is active. Water-quality data are protected by the data quality indicators (DQI's), which determine accessibility to the data. Data collected during the current and previous water years is qualified by a DQI of "S," which means the data are presumed satisfactory, may be overwritten, and are accessible to the public. The DQI's for these data, after publication, may be changed to "R," which indicates that the data have been reviewed and accepted but may not be overwritten. Historical data are qualified by a DQI of "A," which means the data are accessible to the public, but may not be overwritten unless the DQI is changed to "S." Unit value data from continuous specific conductivity recorders are maintained in ADAPS for several years and are archived offline. Daily value data, however, are marked final after review and remain accessible in ADAPS.

10.4 Records Archival

According to WRD policy, all original data that are published or support published scientific analyses shall be placed in archives (Hubbard, 1992; WRD Memorandum 92.059). Original data–from automated data-collection sites, laboratories, outside sources, and nonautomated field observations–are unmodified data as collected or received and in conventional units (engineering units, generally with a decimal). Original data should be preserved in this form, no matter how they may be modified later (Hubbard, 1992). Original data on paper include field notes, field measurements, ASR forms, WATLIST's, continuous water-quality monitoring records, and calibration notes. These data are archived when the project is completed or for ongoing data collection when the data are more than 5 years old. The Miami USGS archive administrator is responsible for ensuring that project files entered into the Miami USGS archive are organized and complete. The Miami USGS hardcopy archive is located in the Miami USGS conference room and is maintained by the Miami USGS archive administrator. Data from the Miami USGS archives may be transferred to the National Archives and Record Administration Record Center in Atlanta, Ga., as needed.

10.5 References Used for the Water-Quality Data Management Section

Table 16 lists reports and/or memoranda referred to in this section. For the complete citation, refer to Section 13.0 in this report.

Table 16. Summary of references for managing water-quality data and records

Reference	Subject
Dempster (1990)	NWIS ADAPS user's guide
Hubbard (1992)	Policy recommendations for managing and storing hydrologic data
Maddy and others (1997)	NWIS QWDATA user's guide
Wagner and others (2000)	Guidelines for record computation
NWQL Memorandum 92.06 (USGS)	District rerun requests
WRD Memorandum 87.085 (USGS)	Policy for collecting and archiving electronically recorded data
WRD Memorandum 92.059 (USGS)	Policy for the management and retention of hydrologic data

11.0 PUBLICATION OF WATER-QUALITY DATA

Water-quality data are published in hydrologic data reports or interpretive reports. The selection of the appropriate publication outlet for water-quality data will be the responsibility of the project chief. Open-File Reports may be approved at District level represented by the WRD office in Tallahassee (WRD Memorandum 92.05i). Water-Resources Investigations Reports, however, must have Regional approval (WRD Memorandum 95.18). Some regions have delegated approval authority to teams through the team review approach. A summary of USGS and WRD policies pertaining to the publication of data and interpretive reports is contained in the WRD Publications Guides (Alt and Iseri, 1986, p. 382-385; U.S. Geological Survey, 1995). Other references that should be consulted when writing reports include "Suggestions to Authors of Reports of the U.S. Geological Survey" (Hansen, 1991) and the U.S. Government Printing Office Style Manual (U.S. Government Printing Office, 2000).

11.1 Hydrologic Data Reports

All nonproprietary water-quality data collected during the water year are published in the WRD annual data report, "Water Resources Data, Florida, South Florida, Water Year ____ Volume 2," or in individual project data reports. Hydrologic data reports make water-quality data available to users, but without interpretations or conclusions. Approval of hydrologic data reports is in accordance with applicable WRD, Region, and District policy (Alt and Iseri, 1986; WRD Memorandum 92.05i). Hydrologic data reports may be approved at the District level and do not require outside colleague reviews.

11.2 Interpretive Reports

Interpretive reports include such USGS outlets as Circulars, Professional Papers, Fact Sheets, and Open-File Reports as well as such non-USGS outlets, such as scientific journals, books, and proceedings of technical conferences. The Miami USGS water-quality specialist, project supervisor, and outside technical specialists will provide guidance in ensuring that each water-quality report meets the highest technical standards. Approval of interpretive reports is in accordance with applicable WRD, Region, and District policy (WRD Memorandum 95.18) and is more technically rigorous than the required approval for noninterpretive data reports. Open-File and Water-Resources Investigations Reports must have two colleague reviews (one inside and one outside the originating office) before receiving District or Region approval.

11.3 Other Data Outlets

Article 500.14.1 of the Department of the Interior Geological Survey Manual (U.S. Department of the Interior, 1992) states that data and information are released through publications; however publication is not limited to paper media (U.S. Department of the Interior, 1993; WRD Memorandum 90.030). Electronic outlets include the Internet and computer storage media, such as CD-ROM.

The term “data” refers to uninterpreted observations or measurements, usually quantitative measurements resulting from field observations and laboratory analyses of water, sediment, or biota. Data can be released to the public after preliminary review for accuracy by appropriate WRD personnel (WRD Memorandum 90.030). Constituents in water samples collected by or for the USGS that exceed USEPA drinking-water maximum contaminant levels (MCL’s), as specified in the National Primary Drinking Water Regulations, are promptly reported by the project chief to appropriate agencies (WRD Memorandum 90.038).

The term “information” refers to interpretations of data or conclusions of investigations. Interpretive results or conclusions require colleague review and Region approval for publication. Release of preliminary interpretations prior to final approval is prohibited to avoid disseminating incomplete and/or incorrect conclusions, which are subject to change as a result of subsequent technical and policy reviews.

11.4 References Used for the Publication of Water-Quality Data Section

Table 17 lists reports and/or memoranda referred to in this section. For the complete citation, refer to Section 13.0 in this report.

Table 17. Summary of references for publishing data

Reference	Subject
Alt and Iseri (1986)	Guide for publishing WRD reports
Hansen (1991)	Suggestions to authors of USGS reports
U.S. Department of the Interior (1992)	Safeguard and release of USGS information
U.S. Department of the Interior (1993)	Policy for release of computer databases and computer programs
U.S. Geological Survey (1995)	Guidelines on writing hydrologic reports
U.S. Government Printing Office (2000)	Style manual for printed government documents
WRD Memorandum 90.030 (USGS)	Policy for release of digital data
WRD Memorandum 90.038 (USGS)	Policy for reporting maximum contaminant level exceedances
WRD Memorandum 92.05i (USGS)	Extended delegation of authority to approve reports of certain categories for open-file release
WRD Memorandum 95.18 (USGS)	Redelegation of Director’s report approval authority to Regional Hydrologists

12.0 WATER-QUALITY TRAINING AND REVIEWS

Periodic reviews of data-collection procedures are used to evaluate the effectiveness of training programs and to determine if technical work is being conducted correctly and efficiently. Such reviews also are used to identify and resolve problems before they become widespread and potentially compromise the quality of the data.

12.1 Training

Employee training is an integral part of water-quality activities, allowing current employees to maintain and enhance their technical knowledge and new employees to gain the specific skills needed to adequately perform their job. A well-documented training program not only ensures that samples are collected correctly by technically competent personnel, but also lends legal credibility to data and interpretations. Training is accomplished according to the following policies and protocols.

Individual training plans are developed by the supervisor and employee at least annually as part of the performance review process. The Miami USGS training officer is responsible for informing Miami USGS staff about the availability of training–in-house, USGS, U.S. Federal Government, and other sources of training. The water-quality specialist provides recommendations and advice to supervisors and their staff as needed. The Miami USGS Center Director or section or unit supervisors have the authority and responsibility for approving training opportunities. Additionally, staff are responsible for taking full advantage of the training provided.

Primary sources of water-quality training are USGS courses, usually taught at the National Training Center in Denver, Colo., or the Eastern Region – South in Norcross, Ga., and District and Miami USGS seminars or in-house training courses. The water-quality specialist plays an important role in providing in-house training. Training documents are maintained by the Administrative Officer in Miami USGS personnel files and by Human Resources in the Eastern Region – South.

12.2 Reviews

Reviews of water-quality data-collection activities are conducted annually for each individual in the Miami USGS who is actively involved in water-quality data collection. Reviews are conducted in the field or laboratory by the senior water-quality technician or water-quality specialist.

Reviews are completed in a timely manner, and comments are documented by the reviewer in a memorandum to the immediate supervisor with a copy to the water-quality specialist, section supervisor, and Miami USGS Center Director. Reviews address sample collection and processing techniques; compliance with WRD, OWQ, District and Miami USGS policies; the condition of the work environment (for example, the field vehicle); and any other activities pertaining to the collection of good quality data. When deficiencies are noted, the reviewer, in consultation with the water-quality specialist, is responsible for identifying corrective actions. The immediate supervisor is responsible for ensuring that, once identified, corrective actions are implemented and completed in a timely manner.

13.0 BIBLIOGRAPHY

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13.2 Internal Documents

The following USGS memoranda are available electronically on the Internet at the following site address (URL) http://water.usgs.gov/public/admin/memo/

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National Water-Quality Laboratory Memorandum 92.01, March 25, 1992, Availability of equipment blank water for inorganic and organic analysis.

National Water-Quality Laboratory Memorandum 92.06, August 12, 1992, District rerun requests.

National Water-Quality Laboratory Memorandum 95.04, December 2, 1994, Shipping samples to the National Water-Quality Laboratory.

Office of Surface Water Technical Memorandum 93.01, October 8, 1992, Summary of documentation that describes instrumentation and field methods for collecting sediment data.

Office of Water Quality Technical Memorandum 92.01, December 20, 1991, Distilled/deionized water for District operations.

Office of Water Quality Technical Memorandum 92.06, March 20, 1992, Report of committee on sample shipping integrity and cost.

Office of Water Quality Technical Memorandum 97.06, May 5, 1997 (corrected May 14, 1997), Comparison of the suspended-sediment splitting capabilities of the churn and cone splitters.

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Water Resources Division Memorandum 92.05i, December 16, 1991, Publications–Extended delegation of authority to approve reports of certain categories for release to the open file.

Water Resources Division Memorandum 92.059, October 20, 1992, Policy for management and retention of hydrologic data of the U.S. Geological Survey.

Water Resources Division Memorandum 95.18, March 14, 1995, Publications–Redelegation of Director’s report approval authority to Regional Hydrologists.

Water Resources Division Memorandum 95.35, May 15, 1995, Programs and Plans–Transmittal of an instrumentation plan for the Water Resources Division and the hydrologic field instrumentation and equipment policy and guidelines.

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