

# Status and Trend Monitoring Networks



## Sampling Manual

**Watershed Monitoring Section  
Florida Department of Environmental Protection  
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## **SECTION 1. INTRODUCTION, DESCRIPTION OF NETWORKS, TRAINING**

### **Integrated Water Resource Monitoring Networks (IWRM)**

The Florida Department of Environmental Protection (FDEP) routinely monitors the quality of Florida's fresh waters. Florida's statewide monitoring network, the Integrated Water Resource Monitoring Network (IWRM), addresses questions about statewide surface and ground water quality. This document provides the most recent FDEP Standard Operating Procedures for field collection of samples and promotes the importance of quality assurance in the statewide sampling program.

The overall goal of the IWRM Network is to provide FDEP with scientifically defensible information on chemical, physical and biological characteristics of waters of the state. This information provides the basis for advising the Environmental Protection Agency (EPA), relevant FDEP programs, partner agencies, and the Governor and Legislature on the status of Florida's water quality.

Other agencies provide monitoring support to characterize water resources in the state. Federal agencies such as the National Oceanic and Atmospheric Administration (NOAA) and the United State Geological Survey (USGS) provide data from regional and specific investigations of water quality. The Fish and Wildlife Research Institute (FWRI) monitors the state's estuarine and coastal waters. Five water management districts (WMDs) manage and allocate regional water resources. These agencies, local governments, the WMDs, FWRI and FDEP have developed productive working relationships over the years in order to more efficiently manage and protect Florida's water resources.

Florida revised its approach to monitoring in the mid 1990's. In 1996, staff from FDEP, state and federal agencies, and other interested parties established the Integrated Water Resource Monitoring Committee. Among other goals, this group assumed the task of developing the framework for a statewide monitoring network to integrate FDEP's previously separate ambient surface water, ground water and compliance monitoring programs. The IWRM monitoring plan characterizes FDEP's various water monitoring efforts as three tiers. Tier I is represented by the Status and Temporal Variability Monitoring (TV or Trend) Networks, which address "big picture" statewide and regional water quality concerns, as well as water quality changes over time. Tier II includes watershed-scale and smaller basin assessments, and the monitoring required for determining Total Maximum Daily Loads (TMDLs). Tier III primarily includes site-specific compliance monitoring tied to regulatory permits issued by FDEP and monitoring associated with evaluating the effectiveness of best management practices and TMDLs.

#### **Status Network**

The purpose of the Status Network is to characterize the environmental condition of Florida's freshwater resources and to determine how these conditions change within a region of the state, as well as statewide over the long term. This network is designed to address questions regarding the proportion of waters that meet environmental thresholds, or designated uses.

The Status Network's design is based on an annual assessment of the entire state. The state is divided into 6 reporting units ("zones") to allow a distribution of samples across geographic regions of the state. The six reporting units are shown in Figure 1. In keeping with the basics of a probabilistic design, a minimum of 30 samples needs to be collected to estimate the condition of a population within a known error envelope. Due to the scale of the state, and the number and spatial distribution of resources, the sample size has been increased to 60 sites throughout the state for each of 4 surface water resources (small lakes, large lakes, streams, and rivers), and to 120 sites each for the 2 ground water resources (unconfined and confined aquifers).

Each resource is sampled during a specific sampling period, depending upon the resource type and location (Table 3). Samplers attempt a repeat visit to each of the 60 surface water sites in an "opposite" sampling period, resulting in up to 120 samples of each surface water type every year. The analytical results from the two periods are compared to answer the question of whether a significant seasonal difference exists in the results. During cycles 1 and 2, the FDEP adopted a probabilistic design in which a resource was sampled during only one season; however, this design sometimes compounded questions concerning seasonality.

Because no seasonality is expected to occur in ground water, 120 samples from unconfined and confined aquifers each will be collected only once during the year throughout the state.

In any given year, approximately 720 samples are collected statewide and analyzed. A list of resource-specific indicators is used to characterize the health of each resource based on its designated use. These indicators consist of chemical, biological, and physical analytes and are listed in Table 1. The analytical methods are also listed in Table 1. In addition, biological measures are reported. Stream Condition Index (SCI) samples and Rapid Periphyton Surveys (RPS) are collected at appropriate river and stream sites, and Lake Vegetation Index (LVI) surveys are performed at both small and large lake sites.

FDEP continues to work closely with the EPA and others to develop and use various random site selection methodologies in order to obtain the best possible statistically valid picture of water quality conditions. At the end of each year, all reporting units have been sampled, and statewide results can be tabulated.

Because the IWRM program uses the same sampling and analytical methodologies around the state, FDEP can make statewide water quality comparisons. Water quality conditions can be evaluated over a period of time to determine if they are improving, deteriorating, or remaining relatively constant.

Status Network results are used to present a relatively unbiased assessment of current surface water and ground water conditions. Data from the Status Network provide a part of Florida's biennial Water Quality Assessment 305(b) Integrated Report to US EPA, a requirement of the Federal Clean Water Act. The 305(b) reports from all states are used by US EPA to inform Congress and citizens of state and national water quality conditions. Increasingly, Status Network data are also used by other FDEP programs to develop water quality standards and monitoring criteria.

## **Temporal Variability (TV or Trend) Network**

FDEP established a Temporal Variability (TV), or Trend Network to characterize the environmental conditions of Florida's water resources and to determine how these conditions are changing over time. The TV Network has surface water (SWTV) and ground water (GWTV) networks. The analytes are listed in Table 2. (The analytical methods are also listed in Table 2.)

The SWTV Network consists of 76 fixed sites that are sampled on a monthly basis. The sites are placed at, or close to rivers and streams entering the state near the Florida boundary with Alabama and Georgia, or at the point the river or stream exits a watershed basin. These sites enable FDEP to obtain data at the point at which waters enter the state, or at locations that exhibit water quality typical of or affected by land use activities of the watershed. Some sites are located near or adjacent to a flow gauging station, which allows calculation of loading to or from the watershed.

Data from SWTV sites are used to assist in evaluating water quality trends in Florida's surface water resources. SWTV sites are not designed to monitor point sources of pollution since TV sites are located away from known outfalls or other regulated point source inputs.

FDEP and water management district personnel (WMDs) sample the SWTV sites, with all samples analyzed in the FDEP Central Laboratory. Each site is sampled on a monthly basis for physical, chemical and biological analytes. Each site must be sampled within a 25-35 day timeframe. In addition, Stream Condition Index (SCI) samples are collected at the appropriate and applicable SWTV sites on an annual basis (refer to Sections 7 and 8), while Rapid Periphyton Surveys (RPS) are performed at each site twice a year (refer to Section 9).

The GWTV consists of 47 fixed sites. The sites are used to obtain chemistry and field analyte data in confined and unconfined aquifers. These data are used to quantify temporal variability in our ground water resources and to assist in determining whether the Status Network samples are collected during wet or dry periods.

As with the SWTV Network, GWTV sites are sampled by personnel at FDEP and WMDs, with the samples analyzed in the FDEP Central Laboratory. Since the temporal variance of water chemistry in confined aquifers is much less than that of unconfined aquifers, confined sites are sampled for field parameters quarterly and unconfined ground water resources are sampled for field parameters monthly. All GWTV sites (both confined and unconfined) are monitored for a full set of water chemistry analytes on a quarterly basis (October, January, April, July), and for heavy metals annually, in October.

## **Sampling Workshop**

Oversight of diverse agencies and staff collecting water, biological and sediment samples requires regularly scheduled training and communication to reduce variability in field collection.

The Watershed Monitoring Section (WMS) conducts a water sampling workshop for the Florida Status and Trend Monitoring Networks at least once a year. The training is based on specific FDEP SOPs as applied to the Network sampling program and is intended to ensure consistency among the participating sampling agencies. Training and regular audits minimize changes in sampling protocols over the long term of these projects.

### **FDEP Standard Operating Procedures**

The FDEP Standard Operating Procedures were revised in March 2008 and were approved in December 2008, under Chapter 62-160, F.A.C. rule requirements. The procedures in this manual are based on the FDEP SOPs, as specifically applied to the Status and Trend Monitoring Networks. Additional information is available on the web site:

<http://www.dep.state.fl.us/labs/bars/sas/sop/index.htm>

Sections of special interest for our program are:

<b>SOP Section</b>	<b>Description</b>
FA 1000	Administrative (includes Quality System, Quality Manual)
FC 1000	Field Decontamination
FD 1000	Documentation
FM 3000	Trip Planning
FM 4000	Equipment and Supply Preparation (sections in FM 1000 Field Planning and Mobilization)
FQ 1000	Quality Control
FS 1000	General Sampling
FS 2000	General Water Sampling
FS 2100	Surface Water Sampling
FS 2200	Ground Water Sampling
FS 4000	Sediment Sampling
FS 7000	General Biological Community Sampling
FT 1000	Field Testing General
FT 1100	Field pH
FT 1200	Field Conductance
FT 1400	Field Temperature
FT 1500	Field Dissolved Oxygen
FT 1600	Field Turbidity
FT 1700	Field Light Penetration (secchi depth)
FT 3000	Aquatic Habitat Characterization

Please contact the **FDEP QA Officer at (850) 245-8517** if you have any questions about the networks or the procedures outlined in this manual. You may also visit the WMS web site for the latest information on sampling schedules, sampling manuals, contacts, calendars, Q-meeting agendas, etc. at <http://water.dep.state.fl.us/status/index.htm>. The username is “water” and the password is “monitoring”.

## **SECTION 2. PROJECT PREPARATION**

### **Sampling Schedule**

Sampling schedules are prepared quarterly and list the types of projects and the numbers of samples and blanks to be collected for each project. If sampling cannot be done according to this schedule, the Project Manager should notify the FDEP QA Officer as soon as possible so that other involved parties (e.g. labs, etc.) can be notified of the change.

### **Historical Data**

Review documentation from previous visits, if available, before visiting a sampling site. This can give you important information including average purging time, calibration ranges, and expected field measurements. Take this information to the site and compare it with the current observations. If discrepancies are found, be sure to note them on the field sheet. Check to see that the information in the station file is complete and correct, or obtain additional information if necessary. Record new information in appropriate places like OGWIS/existing stations.

### **Sampling Kit Shipments**

The FDEP Central Laboratory ships containers and pre-printed Fed Ex return shipping labels for a project to the sampling agency normally 1-2 weeks before the scheduled sampling week. Inventory the coolers and containers against the sampling schedule and the inventory list on the custody sheet, to ensure that you have enough kits for samples and equipment blanks. If you do not receive the container shipment 7 days before the first day of sampling, or if items are missing, notify the FDEP QA Officer as soon as possible. All required documentation records concerning the sample kits and shipping will be maintained by the FDEP Lab.

### **Project Paperwork**

The FDEP staff will ship the paperwork needed for a sampling project to each sampling agency. Please make sure to use the most recent versions of the paperwork (field sheets and custody sheets). Check the package to make sure it contains all of the following items:

- Custody sheets (Figures 2-4)
- Station identification (bar-coded) container labels (Figure 5)
- RQ labels (Figure 6)
- FLUWID Tags (GW only) (Figure 7)
- Field sheets (Figures 11, 12, 14-17)
- Micro land use forms (once annually for GW only) (Figure 20)

### **Access and Sampling Permission**

Samplers need to gain access and sampling permission before attempting to sample on private property. Arrangements may be made prior to visiting the property for sampling (during recon, for example) or as a last resort, immediately before sampling. Either verbal or written

permission is acceptable, but it needs to be documented. See Figure 21 for an example of documentation. For circumstances which require samplers to seek permission immediately before sampling once on the property, extra copies of permission forms should be kept on hand. If permission to access the property or to sample is denied, the site can be excluded. If permission is granted through a phone conversation, please document the following information:

- First and last name of person spoken with (obtaining a signature is not required)
- Relation of person to property (owner, land manager, spouse of owner, etc.)
- Time and date of conversation
- Contact phone number
- Comments (owner requests to be on site during sampling, meet at a specific place or time, watch out for dogs, gate locked, etc.)
- Approximate date for sampling
- Address for sending requested results

For owners who request that their personal information not be officially documented for privacy reasons, samplers may document a statement such as “verbal approval granted, personal information not documented as requested” and do not have to keep their personal information on file.

### **Team Organization**

For all Trend and Status Network sampling events, a team must be comprised of at least two individuals. Every attempt must be made to secure two individuals, even if the accompanying individual is from a different agency, an intern, lab personnel, etc. This is for safety, efficiency and QA/QC reasons. However, on a case by case basis, extenuating circumstances may require individual solo sampling. In these instances when there is absolutely no one else available to accompany the solo sampler, a float plan must be in order (planned sites to visit, a field contact phone number, an office contact person, etc.), and constant communication between the solo sampler and an individual in the office must be in place throughout the sampling event. WMS is also requesting that the frequency of solo sampling events be communicated to FDEP personnel (either project manager or QA Officer). If solo sampling becomes too frequent, FDEP will attempt to resolve the issue and secure resources to get the sampling team back up to two individuals.

### **Supplies and Equipment Inventory**

Use a checklist to inventory all sampling supplies and equipment needed. Examples of checklists are shown in Figures 26-27. Always retain a copy of the current Sampling Manual in the vehicle for access in the field. If operating a boat during sampling, bring the Sampling Manual with you on the boat.

### **Preservatives**

FDEP supplies acid preservatives for both Status and TV samples. Each vial has enough pre-measured preservative to preserve one sample container. However, always have more acid vials

on hand in case the preservation verification proves that one vial was not enough to properly preserve the sample. Any time more than one vial is needed, or if the preservation protocol described on the field sheets is altered in any way, this information must be documented. To order more preservatives, call the FDEP QA Officer. Maintain at least a two months supply of acids at all times, as the supplier often requires several weeks to fill new orders.

For Stream Condition Index (SCI), the FDEP supplies buffered formaldehyde preservative, which will be distributed at Q-Meetings or as needed. To order more if your supply is running low, call the FDEP QA Officer (formaldehyde will not be shipped through the mail). Please take this into consideration, and monitor your levels accordingly to ensure you will always have plenty in stock.

### Filters

FDEP supplies filters for filtering ground water samples. For ground water TV (GWTV) samples, a 0.45µm disposable in-line filter capsule is used to filter anions, nutrients, and metals. Check inventories monthly and maintain at least a two-month supply of filters. Order additional supplies by calling the FDEP QA Officer.

### Conductance Standards

Fisher Scientific supplies RICCA conductance standards ranging from 100 to 50,000 µmhos/cm. The FDEP QA Officer will order standards in the appropriate range as needed and have them shipped directly to the sampling agency. To order conductance standards, call the FDEP QA Officer; monitor your stock closely (including expiration dates) so you will always have some available for use. Alternatively, if you have an established Fisher Scientific account and are not under FDEP contract, purchase the standards directly through Fisher without contacting the QA Officer.

### pH Buffers

Buffers used for pH calibration and verification should be purchased independently from a commercial vendor without contacting the QA Officer. Be sure to maintain a sufficient inventory of pH buffer 4.0, 7.0 and 10.0 SU, as well as buffers less than 4.0 and greater than 10.0 SU for use when ambient site conditions extend beyond the 4.0-10.0 range (see Section 3).

### Miscellaneous Supplies

All miscellaneous supplies such as pH test paper, gloves, Kimwipes, cleaning solutions, bags, brushes, DI carboys, etc. should be purchased independently from a commercial vendor without contacting the QA Officer.

### Field Reference Samples

The FDEP Tallahassee laboratory produces and ships unknown field reference samples to each sampling agency on a quarterly basis. Field reference samples are used to verify the pH and

specific conductance calibration of the meters. These samples should be checked once for every 10 actual sampling events (10% frequency). See section 13 for more details.

## SECTION 3. INSTRUMENT CALIBRATION PROCEDURES

### Definitions

**Initial Calibration (IC):** The instrument or meter electronics are adjusted (manually or automatically) to a theoretical value or a known value of a calibration standard.

**Initial Calibration Verification (ICV):** The instrument or meter calibration is checked or verified *directly following the initial calibration* by measuring a calibration standard of known value as if it were a sample and comparing the measured result to the calibration acceptance criteria.

**Continuing Calibration Verification (CCV):** The instrument or meter calibration is checked or verified by measuring a calibration standard of known value as if it were a sample and comparing the measured result to the calibration acceptance criteria.

**Chronological Calibration Bracket:** The interval of time between verifications (maximum of 24 hours) within which environmental sample measurements must occur. The instrument or meter is calibrated (or verified) before sample measurements and verified after sample measurements.

**Quantitative Calibration Bracket:** The instrument or meter is calibrated or verified at two known values that encompass the range of observed sample measurements.

**Acceptance Criteria:** The numerical limits within which calibration verifications are acceptable.

Parameter	Acceptance Criteria
pH (FT 1100)	$\pm 0.2$ Standard pH Units of buffer
Specific Conductance (FT 1200)	$\pm 5\%$ of standard value
Temperature (FT 1400)	$\pm 0.5^\circ\text{C}$ of NIST-traceable value (with correction factors) Verification over range of applicable values
Dissolved Oxygen (FT 1500)	$\pm 0.3$ mg/L of theoretical value (see Table 4)
Turbidity (FT 1600)	0.1-10 NTU: $\pm 10\%$ of standard value 11-40 NTU: $\pm 8\%$ of standard value 41-100 NTU: $\pm 6.5\%$ of standard value > 100 NTU: $\pm 5\%$ of standard value

### General Calibration Considerations

Before sampling, the field technicians must verify that the equipment is in proper working condition, calibrated and the batteries are charged. Refer to equipment manufacturer's recommendations for calibration procedures. For sonde storage, YSI recommends that short term storage of all multi parameter instruments (overnight or over the weekend) be done by placing approximately 0.5 inch of water (any type of water can be used: distilled, deionized, tap, etc.) in the calibration and/or storage cup that was supplied with the instrument, and by placing the sonde with all of the probes in place into the cup. The use of a moist sponge instead of a half inch of water is also acceptable, as long as its presence does not compromise the attachment of

the calibration cup to the sonde. The calibration cup should be sealed to prevent evaporation. Refer to the YSI user's manual for guidance on long term storage.

All field sampling measurements must be bracketed between acceptable calibration/verification results, at no more than 24 hour intervals. Calibrate the equipment before sampling following the specific procedures for pH, specific conductance and dissolved oxygen (DO). Temperature is also verified monthly. Turbidity is calibrated for groundwater sampling quarterly. The sample results are bracketed by verifying the calibration at the end of each sampling day.

Samplers are encouraged to check the calibration during the day and are required to perform an end of day check (continuing calibration verification). The frequency of additional pH and conductivity checks is contingent upon field reference sample results. If the results are not at least 95% satisfactory, then calibration checks are required every 4 hours and at the end of the sampling day, until satisfactory performance can be assured. A continuing calibration verification (end of day check) is required for each sampling day, regardless of the field reference sample results. Do not perform field reference sample readings in place of calibration verifications. Furthermore, midday verifications will be required if the end of day verifications frequently fail.

Records of each meter calibration and calibration checks must be maintained in a calibration log book (see Figure 23 for an example). Document the following information:

- unique name or code of instrument used (YSI #1, etc.),
- method used to calibrate (citation of or reference to the specific DEP SOPs used for calibration and verification procedures),
- time and date of calibration,
- time and date of initial and continuing calibration verifications,
- standard(s) used (including units, expiration date and lot number),
- resulting meter response (including units),
- indication of pass or failure,
- corrective actions,
- and analyst performing operation.

Each calibration and verification must be directly linked to affected samples (record project name and/or applicable sample sites on calibration record). Retain manufacturer instrument specifications for each meter. If provided, retain vendor assay specifications for standards or buffers not supplied by the FDEP QA Officer (only one vendor assay certificate per concentration, per lot number is needed for retention). See Section 11 for full details.

If a meter fails a calibration verification, immediately reattempt the verification (with a fresh aliquot of standard or buffer) within the chronological bracket time interval without changing the instrument calibration. If this verification on-site still fails, recalibrate the meter, perform an ICV, recollect the field readings, and perform a post verification (CCV). However, if a meter fails a calibration verification and the field readings cannot be reanalyzed, report all results between the last acceptable calibration verification and the failed verification as "estimated". Report all affected parameters with a "F" (this "F" qualifier is equivalent to the laboratory "J"). Include a description of the problem. The meter must be recalibrated and repaired if necessary.

Documentation on calibration standards (e.g., buffers, KCl, and other reagents) must be maintained in a log book (Figure 22). See section 11 for full details.

- Note the vendor, date of receipt, expiration dates, and date of first use directly on the standard container and in a log book.
- Follow expiration dates (with the exception of turbidity standards, as they can be extended).
- If reagents or standards are prepared from stock chemicals, they must be analytical reagent grade or better. All calculations used to formulate the standards, date of preparation, the procedures used, and analyst performing the preparation must also be documented. NOTE: Potassium chloride standards must be of primary standard grade.

## Calibration of Specific Meters

### pH Meters

- **Calibrated meters must read within  $\pm 0.2$  standard units of the actual buffer values.**
- Calibrate daily in the field. If meter is calibrated in the office or lab, it is recommended that you check the pH 7 buffer on-site before field readings since calibration may change during transport.
- Record all initial calibrations (IC), initial calibration verifications (ICV), continuing calibration verifications (CCV), and maintenance in the log.
- Use buffer solutions (pH of 4, 7, 10 SU) purchased from commercial vendors for calibration. Refer to FDEP SOPs if using laboratory prepared standards. Buffers that extend beyond the 4.0-10.0 SU range may be needed for sites where ambient readings are below 4.0 and above 10.0 SU. The quantitative bracket requirement still applies. If an appropriate buffer is not available, the applicable sites must be "F" qualified accordingly.
- Do not reuse buffers.
- Rinse with DI water before and between each standard. Rinse with a small portion of buffer before calibrating (or verifying) with that buffer.
- Report readings in pH units to one decimal place (ex., 7.5 SU instead of 7.46 SU).
- Always start with the pH 7 buffer. Each meter/electrode system must be calibrated at a minimum of two points, at least three pH units apart, bracketing the expected sample pH (quantitative calibration bracket). Check historical data for expected pH or use pH paper on an aliquot to estimate sample pH.
- After initial calibration with the 2 buffers, immediately perform an initial calibration verification (ICV). To do this, read a (any) buffer as a sample. Value must meet the calibration acceptance criteria.
- After sample measurements, perform a continuing calibration verification (CCV). This can be done at the end of the day or immediately after sample collection (chronological calibration bracket). To do this, read a (any) buffer as a sample (be sure to meet the quantitative bracket requirements). Value must meet the calibration acceptance criteria.
- At the end of the sampling day, if samples ended up measuring outside of the first 2 calibration standards, you may use the third standard as a CCV to extend the quantitative bracket. For example, if you calibrated with pH 7 and 4 buffers and the samples measured 8.0 SU, perform the end of the day CCV using the pH 10 buffer.

- To ensure meter performance, check the theoretical slope on a weekly basis (if available on meter) and record it in the log. It should be greater than 90%. A slope of less than 90% indicates a bad electrode. If % slope cannot be determined on your meter, or the manufacturer's optimum specifications are different, follow the manufacturer's recommendation for maintaining optimum meter performance.

### Specific Conductance Meters

- **Calibrated meters must read within  $\pm 5\%$  of the standards.**
- Record all initial calibrations (IC), initial calibration verifications (ICV), continuing calibration verifications (CCV), and maintenance in the log.
- Calibrate daily in the field using potassium chloride (KCl) standards supplied by FDEP WMS. Refer to FDEP SOPs if using lab-prepared standards. If calibration is performed at the office or lab, it is recommended that you check a standard on-site before field readings since calibration may change during transport.
- Do not reuse standards.
- Rinse with DI water before and between each standard. Rinse with a small portion of standard before calibrating (or verifying) with that standard.
- Calibrate the instrument with the first standard.
- Verify the calibration of the instrument (ICV) with a second standard (not the same as the standard used for the calibration), bracketing the range of expected sample values. Do this by rinsing with and reading the second standard.
- When the sample measurements are expected to be 100  $\mu\text{mhos/cm}$  or greater, use two standards that bracket the range of expected sample conductivities (quantitative calibration bracket). When the sample measurements are expected to be less than 100  $\mu\text{mhos/cm}$ , a lower bracket is not required, but a 100  $\mu\text{mhos/cm}$  standard needs to be used for the calibration continuing verification (CCV).
- Conductivity varies with temperature so all meters must be temperature compensated.
- The meter must be checked (CCV) with at least one conductivity standard in the sampling range (quantitative calibration bracket) at the end of the sampling day (chronological calibration bracket). The value must meet the calibration acceptance criteria. Samplers are encouraged to check a standard at each site.

### Dissolved Oxygen Meter

- **Calibrated meters must be accurate to  $\pm 0.3$  mg DO/L.** Compare results to Table 4 for the solubility of oxygen in water at various temperatures. This "Solubility of Oxygen in Water at Atmospheric Pressure" chart (or similar) must be used in order to determine the results of any and all DO verifications.
- Record all initial calibrations (IC), initial calibration verifications (ICV), continuing calibration verifications (CCV), and maintenance in the log.
- Check to make sure there are no air bubbles, wrinkles or tears in the probe membrane. If so, replace the membrane and KCl filling solution. Check the leads, contacts, etc. for corrosion and/or shorts. Record this and any other maintenance in the log book.

- Calibrate the meter daily in the field using water saturated air. If calibration is performed at the office or lab, it is recommended that you check the DO on-site since calibration may change during transport. Allow the meter to warm up before calibrating DO.
  - Wet the inside of the calibration chamber with water. Pour out the excess water (leave a few drops) and insert the sensor into the chamber (this ensures 100-percent humidity). Be sure to gently remove any droplets of water from the membrane/sensor.
  - Allow adequate time for the DO sensor and the air inside the calibration chamber to equilibrate. Make sure the probe is not in direct sunlight, which prevents proper stabilization.
  - Measure the temperature in the calibration chamber, and observe the readings until the instrument stabilizes.
  - Compare DO meter reading with value obtained from Table 4 (this is the ICV). The value must meet the calibration acceptance criteria.
- Check the calibration of the DO meter with water saturated air at the end of the sampling day (chronological calibration bracket). If a DO meter fails the calibration verification, then recalibrate the meter prior to taking any more DO measurements. Remember to qualify all DO readings with a “F” that could not be properly bracketed with an acceptable verification.

#### Thermometers/Thermistors

- **Temperatures should agree within +/- 0.5° C.** If the difference is shown to be constant (ex., + 0.7° C) over the temperature range of the thermometric device, it may still be used provided that the difference is documented for 10 degree increments, and the correcting factor is used in all measurements.
- Temperature determinations can be made with any field-grade mercury-filled, alcohol-filled, or dial-type Celsius thermometer as well as an electronic thermistor.
- Temperature sensors are verified (continuing calibration verification), not calibrated.
- On a monthly basis, temperature sensors will be checked (CCV) against a NIST-traceable (National Institute of Standards and Technology) thermometer with water of varying temperatures (minimum of two different temperatures) that are expected to be seen in the field (quantitative calibration bracket). A warm water bath, ambient room temperature bath or an ice bath are suggested. The values must meet the calibration acceptance criteria. The thermometer or thermistor should be allowed to equilibrate to the temperature of the sample before readings are recorded.
- Record all temperature CCVs and maintenance in the log.
- Record temperature readings to one decimal place (ex., 25.9° C instead of 25.86° C).

#### Turbidity

The acceptance criterion for the initial calibration (IC) or a calibration verification (ICV or CCV) depends on the range of turbidity of the standard value:

<b>0.1 - 10 NTU:</b>	<b>the response must be within 10% of the standard</b>
<b>11 - 40 NTU:</b>	<b>the response must be within 8% of the standard</b>
<b>41 – 100 NTU:</b>	<b>the response must be within 6.5% of the standard</b>
<b>&gt; 100 NTU:</b>	<b>the response must be within 5% of the standard</b>

- Calibrate the field instrument on a quarterly basis using at least two formazin primary standards. If the instrument cannot be calibrated with two standards, calibrate with one standard and verify with a second primary standard (do this by reading the second primary standard as a sample). The initial calibration can be performed either at the base of operations or in the field, but must be done quarterly.
- Use at least one formazin primary standard for the initial calibration verification (ICV). Do this by reading the standard as a sample. Results must meet the acceptance criteria above.
- Secondary gel standards can be used for continuing calibration verifications (CCV). Select at least one gel standard that will, when compared to the primary standard used for the ICV, bracket the range of field measurements (the ICV serves as one part of the bracket; the CCV serves as the other end of the bracket). For measurement of samples of very low turbidity, select the lowest standard commercially available for bracketing the lower end of the sample turbidity range or dilute higher turbidity standards with turbidity-free water (filtered, laboratory reagent water demonstrated to be free of measurable turbidity (<0.01 NTU); basically filtered DI water). Do not use turbidity-free water as a calibration verification standard. Continuing calibration verifications are all that is required each day samples are collected; calibration of the meter is only needed quarterly.
- After the instrument is calibrated every quarter with the formazin primary standards, check each secondary standard against a primary standard. This procedure must be done every time the meter is calibrated. The results must be within the manufacturer's stated tolerance range and +/- 10% of the assigned standard value. If the +/- 10% criterion is not met, assign this reading as the new value of the standard. If the reading is outside the manufacturer's stated tolerance range, discard the secondary standard.
- If provided, you may use factory-sealed primary formazin standards for all calibrations, ICVs and CCVs; in this case, the secondary gel standards are not needed.
- Turbidity standards can be used beyond the manufacturer expiration date, as long as each is verified to still meet the acceptance criteria using a properly calibrated instrument (one that is still in calibration from using standards that were *not* expired). However, if factory-sealed primary formazin standards are used, it is recommended that they *not* be used beyond their expiration date.
- Use sample cells or tubes of clear, colorless glass or plastic. Keep cells scrupulously clean, both inside and out, and discard if scratched or etched. Never handle them where the light beam strikes the sample. Clean sample cells by thorough washing with laboratory soap (inside and out) followed by multiple rinses with distilled or de-ionized water, and let air-dry.
- Wipe a very thin layer of silicone oil (with the same refractive index as the glass) on the outside surfaces to mask minor imperfections or scratches in the cells. The cell should appear to be nearly dry with little or no visible signs of oil. Because small differences between cells significantly impact measurement, use either matched pairs or the same cell for standardization and sample measurement.
- Be sure the sample cells are adequately rinsed with site water between same site readings.

## SECTION 4. GROUND WATER SAMPLING PROTOCOLS

### Introduction

Ground water sampling is intended to approximate as closely as possible actual aquifer conditions. You will:

- Document well construction and development.
- Document purge techniques.
- Collect field measurements with minimal disturbance.
- Collect samples with minimal disturbance and preserve rapidly.
- Collect samples in a known and reproducible manner.

Use maps and previous field logs to determine the number of wells to be sampled and the order in which they will be sampled. Please make every possible effort to obtain the following minimum data points before collecting a sample. Contact your project manager if any are not available.

- Station Name
- Agency
- Waterbody Type
- Water Resource
- Latitude
- Longitude
- Location Method
- Locational Datum
- Casing Diameter
- Casing Material
- Casing Depth
- Total Depth
- All Contact Information

Contact owners before visiting wells that are privately owned. Consult your manager before sampling wells that may be contaminated. When wells are known to contain low-level contamination, sampling should proceed from the least contaminated well to the most contaminated. Exclusion criteria are listed in Figure 34.

### Inventory for Sampling Needs

Before traveling to the well site, inventory:

- all paperwork coming from FDEP, including barcode labels, custody sheets, micro land use forms, and field sheets (all described below).
- sampling kits and the acids necessary for sample preservation, by using the container inventory list provided on the back of the custody sheets (Figure 3).
- equipment necessary for the well sampling, by use of an equipment inventory checklist such as that listed in Figure 26.

### At the Well

Compare the site's appearance to the description of the site in the historical records. Often, the physical appearance of a site can change dramatically between sampling events. These changes should be documented, and the written descriptions should be made part of the site file.

Several wells may be clustered at a single site. It is imperative that these wells be clearly distinguishable from one another. Each well should be marked with a Florida Unique Well Identification tag, as described below. It is very easy to confuse wells and samples at one of these sites. If you are unsure about which well to sample, measure down to the bottom of the well and compare the measured depth with the depth given in the well file. Several samplers have surprised themselves by performing this simple check.

Once you have identified the well to be sampled, you will do the following:

1. Note the land uses immediately adjacent to the well and take pictures (if not on file).
2. Take the depth to water of the well.
3. Purge the well.
4. Take field measurements of the well water.
5. Collect water samples (if scheduled).
6. Tag the well with a Florida Unique Well Identification (FLUWID) Tag and collect its Global Positioning System (GPS) location, if not done previously.
7. Document information concerning the sampling event.

### **Label Sample Containers**

Label all the sample containers for a site, including each whirlpak, prior to filling sample containers. Only one set of containers will be out and labeled at any one sample location. Wear unpowdered latex gloves while handling the containers. Place a station identification bar code label (Figure 5) vertically on each sample bottle. The labels are provided by WMS.

The FDEP Central Laboratory places two types of labels on the sample bottles prior to shipping. One identifies the sample analytes for that container (Figure 28). Write the time (24 hour format) and date at which a station is sampled on this label. The other label is a laboratory production and container bar code label (Figure 29).

### **Documentation**

The micro land use form (Figure 20) is used to document the land uses within a 300 foot radius of the well. For the TV Network, this form is completed once each sampling year and after any changes occur in the land use. The form is completed for every well sampled in the Status Network. Attach a station identification barcode label in the upper left box of the form, which contains the words “station id” and “station name”. Date the form, and then check off the major land uses seen within a 300-foot radius of the well. Next, check off all features observed within a 300-foot radius of the well. List any comments which pertain to land use immediately surrounding the well. Take a picture of the overall well site and pictures in each compass direction.

Document all information regarding purging of the well on the standardized field sheet supplied by WMS (Figure 11). Be sure that the most current version of the field sheet is used. Record the construction of the well, pumps used for purging and sampling, and all measurements and calculations on the field sheet. See Section 11 for full details. Someone other than the field samplers must complete the bottom section of the field sheet labeled “Reviewed for Completion

By:”. This signature ensures that the field sheet has been completed in its entirety **before** submitting to the WMS.

### Depth to Water Measurement

The water level relative to a known measuring point is measured using a graduated steel tape and chalk, or an electronic water-level sensor. Always measure from the same reference point or survey mark on the top of the well casing. If there is no reference mark, measure from the north side of the casing. Measure the depth to water twice (initially) to the nearest 0.01 foot and record on the field sheet. This measurement may not be possible on wells with in-place plumbing, in which case no value will be reported. Furthermore, if the well is a “flowing” well, see the section below “Measuring and Documenting Flowing Wells”. Figure 8 is a diagram illustrating the definitions for several ground water terms, including depth to water. **This initial depth to water measurement is the value that should be recorded in the Trimble unit, not the final reading after purging.**

### Equipment Used to Purge Wells

If a well does not have in-place plumbing, it may be purged with a centrifugal, peristaltic, or submersible pump. Centrifugal pumps are for purging only – do not use them to collect water samples.

- Wear unpowdered latex disposable gloves while handling the pump.
- Locate fuel driven power sources for the pumps away from the well head and downwind to minimize contamination.
- The pump housing, tubing, and delivery hoses should be composed of Teflon<sup>®</sup>, stainless steel, polyethylene, polypropylene, or polyvinyl chloride. The pump should have a check valve to prevent water from back-flushing into the well, and a flow-control valve to control the flow rate of the sample. Whenever possible, a pump that is variable-speed should be used.
- If a peristaltic pump is used, a 1-foot maximum length of silicone tubing should be installed in the peristaltic pump head assembly. Decontaminate or replace the silicon tubing for each well.

### Purge Volume

The volume of water to be purged depends upon the depth and diameter of the well, well usage, and the presence of any storage/pressure tanks between the sampling point and the pump. A single standing water volume, in gallons, can be calculated by equation 1 or 2. Multiply this by the number of well volumes you will purge to determine the total purge volume.

Equation 1                     $V = (0.041) d * d * h$   
V = volume in gallons  
d = well diameter in inches  
h = height of the water column in feet

Equation 2:

$$V = (Gfw) \times h$$

V = volume in gallons

h = height of the water column in feet

Gfw = gallons per foot of water

For wells where the above equations are not useable due to unknown variables (or for wells where the screened interval is known) the purge volume is determined by calculating the equipment volume. Calculate the total volume of the pump, associated tubing and flow cell using the following equation:

$$V = p + ((0.041) d * d * l) + fc$$

V = volume in gallons

p = volume of pump in gallons

d = tubing diameter in inches

l = length of tubing in feet

fc = volume of flow cell in gallons

Figure 9 is a diagram illustrating the proper procedure in determining well volumes by hand and by using well volume constants based on the table below.

Casing Internal Diameter	GFW (Gallons per Foot of Water)
0.75"	0.02
1"	0.04
1.25"	0.06
2"	0.16
3"	0.37
4"	0.65
5"	1.02
6"	1.47
8"	2.62
10"	4.10
12"	5.88

### Purge Water

Direct the purge hose so the water will flow away from the well head area and any nearby surface water bodies. Additionally, do not allow purge water to come into contact with uncontaminated sampling equipment or sample bottles. Generally, no special precautions apply to the treatment of purge water because the Status and Trend Networks monitor ambient ground water with no or low concentrations of contaminants. If you think the well is contaminated,

discuss this with your supervisor and FDEP staff before sampling as special disposal methods may apply.

### **Purging Procedures for Wells without Plumbing (“Conventional Purge”)**

1. Lower a submersible pump or a purge hose connected to a centrifugal or peristaltic pump slowly to just below the top of the standing water column (this is referred to as a “conventional purge”). By placing the pump in this position, you will remove the stagnant water first and then draw replacement water from the formation.
2. Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging criteria. Adjust the pumping rate so that it is equivalent to the well recovery rate to minimize drawdown (if applicable). If drawdown remains faster than recovery, reduce the pumping rate and slowly lower the tubing so it remains near the top of the water column. Furthermore, depth to water measurements must be documented at the same time interval as the stabilization readings.
3. Calculate the flow rate by measuring the time required to fill a container of known volume. (A 5 gallon bucket marked in gallon increments is recommended.) Furthermore, flow rate measurements must be documented at the same time interval as the stabilization readings.
4. Calculate the minimum purge volume and divide by the estimated flow rate to determine when to start to take field analyte measurements. Furthermore, volume purged measurements must be documented at the same time interval as the stabilization readings.
5. A minimum of one well volume must be purged before stabilization readings can be initiated. Furthermore, a minimum of 1.5 well volumes must be purged before samples can be collected. This will result in a minimum total purge volume of 1.5 well volumes. Allow at least  $\frac{1}{4}$  well volume to purge between measurements.
6. Purge until field analytes stabilize (minimum of 1.5 well volumes purged) as explained below in Purging Completion.
7. If samples will be collected using a different pump, the purge pump or hose must be slowly withdrawn from the well to remove the uppermost segment of water while still pumping. Once clear of the water, the pump and/or purge hose should be quickly retrieved to reduce backflow from the pump.
8. Reduce the flow rate to <500 mL/min (a 1/8” stream) or 0.1 gal/min before collecting samples.

### **Purging Procedure Using Equipment Volumes (“Minimizing Purge”)**

1. If applicable, place the pump intake within the screened interval.
2. Purge until the water level has stabilized (well recovery rate equals the purge rate). Then purge a minimum of 1 equipment volume (pump, tubing and flow cell) prior to collecting stabilization readings.

3. Take stabilization readings no sooner than two to three minutes apart (about every five minutes), and purge until Purging Completion Criteria are met (as explained below).
4. Purge at least 3 equipment volumes prior to collecting the sample. If stability has not been met, continue purging until stabilization.
5. Reduce the flow rate to <500 mL/min (a 1/8" stream) or 0.1 gal/min before collecting samples.

### **Purging Procedures for Wells with In-Place Plumbing**

#### Continuously Running Pumps

1. Select spigot closest to pump and before any storage tanks, if possible. Remove hoses, aerators and filters, if possible.
2. Open spigot and purge at maximum flow.
3. Purge the volume of the lines, spigot and any tank to flush stagnant water.
4. After stagnant water has been purged from the lines, spigot and tank (as applicable), collect field measurements no sooner than two to three minutes apart (about every five minutes) and purge until Purging Completion Criteria are met (as explained below).
5. Reduce the flow rate to <500 mL/min (a 1/8" stream) or 0.1 gal/min before collecting samples.
6. For wells with "closed system" in-place plumbing where the depth to water can not be monitored and therefore the water column height can not be determined, please record a comment such as, "Closed System – Continuously Running Pump Method Used" or "Closed System – Intermittently Running Pump Method Used". Recording this comment on your field sheet will explain why certain areas of the field sheet are not able to be completed. This includes water column height, the minimum purge volume determination equations, etc.

#### Intermittently Running Pumps

1. Select spigot closest to pump and before any storage tanks, if possible. Remove hoses, aerators and filters, if possible.
2. Open the spigot and purge sufficient volume at a maximum, practical flow rate to flush the lines, spigot and any tank.
3. After stagnant water has been purged from the lines, spigot and tank (as applicable), collect field measurements no sooner than two to three minutes apart (about every five minutes) and purge until Purging Completion Criteria are met (as explained below).
4. Reduce flow rate to <500 mL/min (a 1/8" stream) or 0.1 gal/min before collecting samples.

### **Purging Procedures for Large-Volume, High-Recharge Wells without Plumbing**

If a well originally constructed for high-flow-rate pumping will be sampled as a monitoring well, use these guidelines to develop a purging procedure applicable to the specific details of the well construction. Typical wells constructed for this purpose may be deep, large-diameter wells with a section of open borehole. Evaluate each well on a case-by-case basis and consider any

available information on the construction and hydraulic performance of the well. Contact your Project Manager for further guidance.

1. Place the pump at the top of the open borehole segment of the well.
2. Start purging while monitoring stabilization parameters.
3. Purge at least 1 equipment volume before measuring stabilization parameters.
4. If the well is being purged for the first time using these guidelines, monitor stabilization parameters for an extended period until confident that sufficient volume has been pumped from the open borehole to draw fresh formation water into the pump tubing and flow-through container. Use the information obtained from the first-time purging of the well to determine the pumping rate and duration of purging required for future sampling events at the well.
5. Purge at least three equipment volumes before evaluating purging completion criteria.

### Purging Completion

1) Purging is considered complete when all of the parameters listed below are within the stated limits for 3 consecutive measurements. The range between the highest and lowest values for the last three measurements for temperature, pH and specific conductance cannot exceed the stated limits. The last three consecutive measurements for dissolved oxygen and turbidity must all be at or below the stated thresholds. For example, if the last three consecutive readings for DO % saturation are less than 20%, then it does not matter if the readings for mg/L DO are within  $\pm 0.2$  mg/L of each other or not. If the last three readings are greater than 20% for DO, then you must refer to number 2, below.

- Dissolved Oxygen  $\leq 20$  % of saturation
- Turbidity  $\leq 20$  NTUs
- Temperature  $\pm 0.2^\circ$  C
- pH  $\pm 0.2$  Standard Units
- Specific Conductance  $\pm 5.0\%$  of reading

2) If dissolved oxygen remains above 20 % of saturation, or turbidity above 20 NTUs, then continue purging until 3 consecutive measurements of DO, turbidity and the other parameters stabilize within the limits below. Purging may be considered complete if the below criteria are met within the original first 3 consecutive readings, but often additional purging is required.

- Temperature  $\pm 0.2^\circ$  C
- pH  $\pm 0.2$  Standard Units
- Specific Conductance:  $\pm 5.0\%$  of reading
- Dissolved Oxygen:  $\pm 0.2$  mg/L or 10%, whichever is greater
- Turbidity:  $\pm 5$  NTUs or 10%, whichever is greater

Additionally, document and report the following, as applicable:

- Drawdown in the well, if any.
- Purging rate.
- A description of conditions at the site that may cause DO to be high.
- DO measurements made within the screened or open hole portion of the well with a downhole dissolved oxygen probe, if available.

- A description of conditions at the site that may cause the turbidity to be high.
- Any procedures that will be used to minimize turbidity in the future.

3) If field parameters do not stabilize after purging 3 well volumes, check the instrument condition and calibration, purging flow rate and all tubing connections to determine if they might be affecting the ability to achieve stable measurements. If the purging criteria have not stabilized after 5 well volumes, collect the sample and make note of the conditions, or contact your project manager.

### **Fully Dry Purge**

A fully dry purge is not recommended, but can be used if purging was attempted and if it is impossible to balance the pumping rate with the rate of recharge at very low pumping rates (< 100 mL/minute). If wells have previously and consistently purged dry when purged according to procedures, and the current depth to groundwater indicates that the well will purge dry during the current sampling event, minimize the amount of water removed from the well by using the same pump to purge and collect the sample:

- Place the pump or tubing intake within the well screened interval.
- Use very small diameter Teflon<sup>®</sup>, Polyethylene or Polypropylene tubing and the smallest possible pump chamber volume to minimize the total volume of water pumped from the well and to reduce drawdown.
- Select tubing that is thick enough to minimize oxygen transfer through the tubing walls while pumping.
- Pump at the lowest possible rate (100 mL/minute or less) to reduce drawdown to a minimum.
- Purge at least two (2) volumes of the pumping system (pump, tubing and flow cell, if used).
- Measure pH, Specific Conductance, Temperature, Dissolved Oxygen and Turbidity (the readings do not have to meet the stability requirements).
- Collect samples as soon as sufficient water is available.

### **Measuring Field Analytes**

Use a flow chamber to minimize interactions between the sample and the atmosphere when measuring field analytes. Collect readings at the appropriate intervals, depending on the purging method selected. Record the final measurement after reaching stability on the custody sheet. However the sample collection time entered on the custody sheet (and on the sample containers) needs to match the “Time Sampling Began” time recorded on the front of the Ground Water Field Sheet (see Figure 11). Report readings in pH units to one decimal place (ex., 7.5 SU instead of 7.46 SU). Record temperature readings to one decimal place (ex., 25.9 °C instead of 25.86 °C).

### **Measuring Turbidity**

See Section 3 for turbidimeter calibration procedures. To measure turbidity in samples:

- Double-rinse the sample cell or cuvette with a small amount of the sample. Discard, and pour an aliquot into the sample cell or cuvette.
- Gently dry the outside of the cuvette with lint-free paper.
- Insert the cell in the instrument and read the turbidity directly from the meter display.
- Report turbidity measurements as follows:

Turbidity Range (NTU)	Report to Nearest (NTU)
0 – 0.1	0.05
1 – 10	0.1
10 – 40	1
40 – 100	5
100 – 400	10
400 – 1000	50
> 1000	100

- If the sample contains visible bubbles or if it effervesces (as in groundwater, with changes in pressure and temperature), make a note of this in the field records.
- After the last reading, pour out the sample and double-rinse the cuvette with de-ionized water before returning to storage.

### Sample Collection

Collect the samples as soon as possible after purging and measuring field analytes. A minimum of 1.5 well volumes must be purged before samples can be collected. For wells with in-place plumbing, collect the sample from the spigot closest to the well head and before any screens, aerators, and filters, etc. If possible, collect the sample before it flows into any storage/pressure tanks. Make a note in the field log and custody sheet if a sample is collected from a spigot located after a tank.

Use a submersible or peristaltic pump for wells without in-place plumbing. Whenever possible, a pump that is variable-speed should be used. Do not use a centrifugal pump for sampling to minimize contamination. Locate the power source for a pump downwind and away from the well to minimize contamination.

The pump housing, tubing, and delivery hoses should be composed of Teflon<sup>®</sup>, stainless steel, polyethylene, polypropylene, or polyvinyl chloride. The pump should have a check valve to prevent water from back-flushing into the well, and a flow-control valve to control the flow rate of the sample. If a peristaltic pump is used, a 1-foot maximum length of silicone tubing should be installed in the peristaltic pump head assembly. Decontaminate or replace the silicon tubing for each well.

Wear clean unpowdered disposable gloves. When possible, have one person designated as “clean hands” handle the sample containers. Arrange the containers in the proper order to avoid contamination when collecting and preserving the samples. This order is listed on the back of the custody sheet (Figure 3). Adjust the water flow so it is slow and laminar while filling the

containers. Do not rinse the bottles before collecting the samples. Leave some headspace in all containers.

**For the Groundwater TV Network:**

1. Fill the sample bottles following the collection order shown on the back of the custody sheet (Figure 3).
2. To fill the whirlpaks, remove the top, hold the tabs and pull the bag open, and fill the bag to the fill line with sample water (at least 125 mL). If necessary, press out excess water to leave some airspace. Seal the bag tightly with at least three folds (do this by “whirling” the bag at least three times) at the top and the wire ties bent in half with the ends twisted together.
3. Connect a new 0.45-micron filter unit to the tubing and flush the filter with at least 250 ml of sample water. Hold filter upright with inlet and outlet in the vertical position while flushing. Fill the filtered bottle(s) with filtered water following the collection order shown on the back of the custody sheet.
4. Preserve the nutrients bottles with sulfuric acid as detailed on page 62. These samples are always preserved first, to avoid contaminating the nutrients bottle with nitric acid.
5. Preserve the metals bottle with nitric acid. See page 62.
6. Place all bottles on ice to  $\leq 6^{\circ}\text{C}$  within 15 minutes of collection. See page 63.
7. Pack and ship the samples to the Lab. See pages 69-71.

**For the Groundwater Status Network:**

1. Fill the sample bottles following the collection order shown on the back of the custody sheet (Figure 3).
2. To fill the whirlpaks, remove the top, hold the tabs and pull the bag open, and fill the bag to the fill line with sample water (at least 125 mL). If necessary, press out excess water to leave some airspace. Seal the bag tightly with at least three folds (do this by “whirling” the bag at least three times) at the top and the wire ties bent in half with the ends twisted together.
3. Preserve the nutrients bottles first using sulfuric acid as detailed on page 62. These samples are always preserved first, to avoid contaminating the nutrients bottle with nitric acid.
4. Preserve the metals bottle with nitric acid. See page 62.
5. Place all bottles on ice to  $\leq 6^{\circ}\text{C}$  within 15 minutes of collection. See page 63.
6. Pack and ship the samples to the Lab. See pages 69-71.

**Florida Unique Well Identification (FLUWID)**

Several agencies regulate wells in Florida, among them FDEP, the Department of Health (DOH), the Water Management Districts (WMDs), and the Department of Agriculture and Consumer Services (DACS). In addition, local governments and individual homeowners are interested in their wells. Each agency and program has its own way of identifying the wells that they regulate. Unfortunately, very little of the information in these databases could be shared due to an inability to cross-reference the different naming schemes. In June 1995, a plan to facilitate well identification was implemented. Wells are now labeled with “Florida Unique Well

Identification” tags (FLUWID tags). The tags uniquely identify each well with a number that does not contain any imbedded information and does not link the well to any particular agency.

The tag number is in an alphanumeric format, XXX### (Figure 7), beginning with AAA0001 and ending with ZZZ9999. Enough unique numbers exist to print tags for millions of wells. The tags are printed on durable, weatherproof Mylar and replacement tags can be printed if needed. Four tags are printed for each well. Three tags are placed on various locations at the well site and the fourth tag is put on the ground water field sheet.

1. Review GPS Procedures, Section 14.
2. Before tagging a well, check carefully to see if a Florida Unique Well ID tag has already been placed at that location to avoid double tagging a well with two different ID numbers.
3. Three of the FLUWID tags with the same alphanumeric code (the two large tags and one small tag) should be placed at the well site in different, but highly visible, locations. One large tag should be placed on the well casing or on the pump base. The other large tag should be placed on the pump discharge line or well casing cover. One of the small tags should be placed on the electrical switch box, the building entrance (if only one well is located in that building), or on the pressure tank (if it is within 10 feet of the pump). The fourth tag (last small tag) with the same alphanumeric code should be placed on the ground water field sheet.
4. FLUWID tags are printed by FDEP and will be supplied by WMS with the ground water field sheets.

### **Measuring and Documenting Flowing Wells**

A “flowing” well is defined as a well in which the water level is higher than the land surface elevation (LSE). If the top of the casing is exactly at land surface, water will flow over the top of the casing. Depending on the construction of the well, the Measuring Point Elevation (MPE) may be above, below, or exactly at LSE. If the well is uncapped and visually flowing, or if the well is capped and has a pressure gage installed that indicates a pressure (water level) greater than LSE, you may assume the well is a flowing well. Note: you may need to track down the individual or agency responsible for installing the pressure gage in order to determine how to read the gage.

For wells that are flowing, measuring the Depth to Water may not be possible. For these wells at which measurement is not possible, the Depth to Water should be recorded on the field sheet as “NA” (not applicable) in the Chemical Stability Monitoring section of the field sheet.

Additionally, a comment such as “flowing well, no Depth to Water measured” should be recorded in the Comments section of the field sheet. For the electronic data entry (Status network entry will be the Trimble data logger; Trend Network entry will be either the field data entry application, <http://tlhdwf2/ambient/field/>, or standardized format), the prompt should be left blank; do not enter “NA” or the number zero. A comment such as “flowing well, no depth to water measured” should be recorded in the Sample Comments section of the electronic data entry form. The only time the number zero should be entered is when the water level is exactly at the measuring point; not flowing over it or receded below it.

If the Depth to Water cannot be measured (this applies to flowing wells and wells for which in-place plumbing will not permit measurement), the total well depth should be used as the water column height (WCH) for determining the minimum purge volume. The Depth to Water portion of the WCH equation can be documented as “NA”. If a stickup is present, however, this measurement will need to be included as part of the determination.

For wells that are flowing and the Depth to Water **can** be measured, the value should be recorded on the field sheet and in the electronic data entry. Under most situations, the water level of a flowing well is above the MPE. If so, the Depth to Water should be recorded as a negative value. If the water level is exactly equal to the MPE, then the Depth to Water should be recorded as 0.0. Finally, if the water level is below the MPE, a “normal” situation exists. All “normal” Depth to Water readings in which the water level is below the MPE should be recorded as a positive value. For both the Status and Trend Networks, every attempt must be made to obtain a Depth to Water measurement.

**Required for the TREND network, recommended for the STATUS network:**

Flowing wells are wells that will have water flowing from them naturally without the use of a pump as long as the casing is open to the atmosphere. A hose and tape measure are required equipment for determining water levels in flowing wells. See Figure 10. These wells should be closed to the atmosphere so water is not continuously flowing from them. Therefore, there must be a spigot or valve on the casing in order to sample this type of well. To determine the water level of a flowing well connect a hose to the spigot or valve. Purge the hose until no air comes out of it. Hold the end of the hose above the casing to a point where water just stops flowing from the hose. Do not hold the hose too high or else this will result in the top of the water column being located somewhere in the hose. Water will flow out of the hose if the hose is not held high enough. Once the correct hose height is achieved, measure the vertical distance from the end of the hose down to the MPE. This measurement (in feet) will be the water column height represented as a negative number from the MPE. Lower the hose so water flows from it and then repeat the procedure for a second measurement.

The hose material, diameter, or length will not matter as long as the length is long enough to reach the top of the water column height. Always remember that water seeks its own level and therefore the hydraulic pressure of the water in the well will cause the water to flow into the hose and up to a level where the pressure comes into equilibrium with atmospheric air pressure.

## SECTION 5. SURFACE WATER SAMPLING PROTOCOLS

### Sampling Locations and Criteria

- Water must be at least 10 cm deep to collect samples for streams and rivers.
- Canals and ditches will not be sampled for Status sites beginning in 2010, until further notice.
- If a stream or river is tidally influenced, the water chemistry sample needs to be collected during a falling tide (heading toward low tide) in order to capture freshwater representative of the watershed.
- For small and large lakes, the deepest point must be at least 1 m deep. Actual sampling location may be shallower.
- Small and large lakes near the coast must be closed lakes not connected to other waters (must have no tidal influence).
- When wading into a waterbody, enter the water carefully to avoid disturbing the sediments, or allow material to settle before collecting the sample.
- Grab water upstream from your body or upstream from the boat.
- When sampling from a bridge or dock, collect samples on the upstream side whenever possible.
- In a river or stream, collect samples in an area that best represents the system in regard to flow conditions (SWTV sites, however, are collected in the same location each month).
- For small lakes, collect the sample in the middle of open water. Small lakes must be greater than or equal to 4 hectares and less than 10 hectares.
- For large lakes, collect samples at selected random location. Large lakes must be greater than or equal to 10 hectares.
- Based on the USGS National Map Accuracy Standards, a general interpretation of the horizontal accuracy of a point falling within a map as compared to its "real world" coordinate is 167 feet or approximately 50 meters for a 1:100K scale. Therefore, for streams, rivers and small lakes, if the sampling location point does not "hit in the water", you may navigate approximately 50 meters perpendicular to the random sampling location point to reach the system or open water. For example, if the sampling location point is located in a flood plain of a stream to be sampled, you may navigate approximately 50 perpendicular meters to sample in the system. However, for large lakes, if the sampling location point ends up located on dry land, the site must be excluded due to either "wrong resource" or "dry". See the discussion under "Lakes" on the following page. **If any confusion exists as to where to sample, contact the FDEP QA Officer or project manager.** Exclusion criteria are listed in Figure 34.

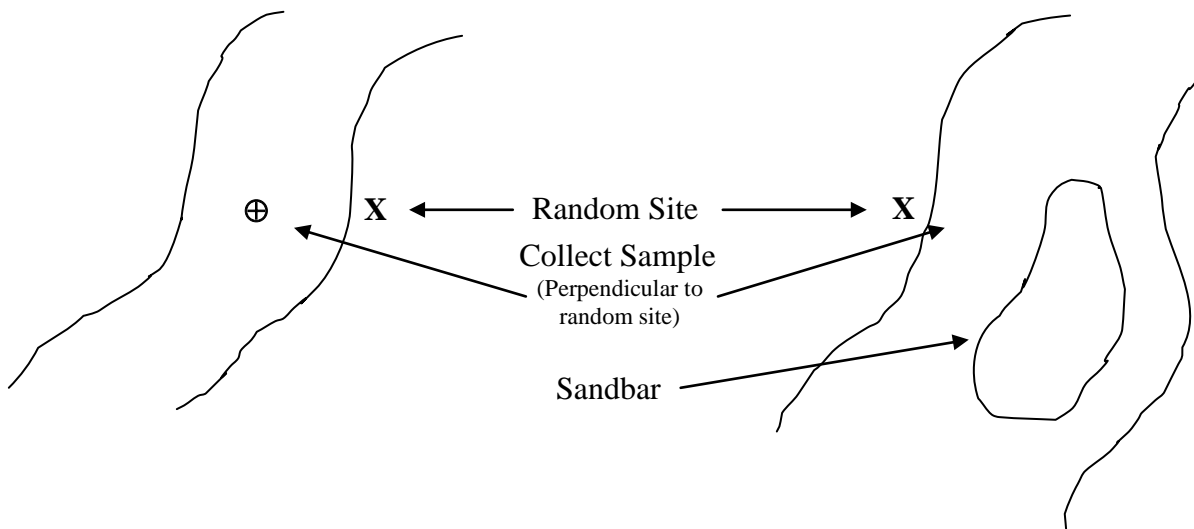
### Surface Water Trend Network

Surface water Trend sites are located using DGPS or permanent landmarks, such as a bridge or gage. This information is documented in the field notes and enables the sampler to return to the same place every month to collect field measurements and a water sample. Surface water Trend sites are sampled for water chemistry on a monthly basis.

## Surface Water Status Network

Status sites are randomly selected each year. Sampling agencies will usually inspect a status site in advance to determine if it can be sampled and what equipment will be needed. Status sites are sampled only during the scheduled sampling period (see Table 3).

Rivers and streams: Navigate to the random location and collect the field measurements and water samples in an area of the river that best represents the system in regard to flow conditions (most commonly, in the middle). For example, if there is a sandbar in the river, then go to the nearest point that can be sampled. This may be the middle of the channel nearest the random point. Record the actual site into the data logger.



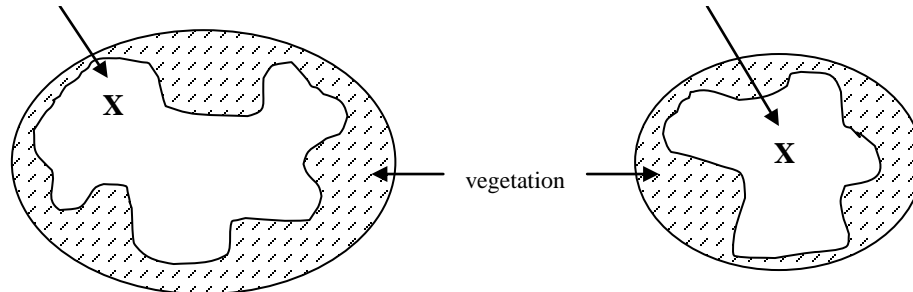
Lakes: The definition of a lake is as follows: natural bodies of standing water, and reservoirs that are designated as lakes on the NHD coverage (does not include streams/rivers impounded for agricultural use or private water supply), which are 4 hectares (about 10 acres) or greater that have at least 1000m<sup>2</sup> (about 0.25 acre or 1/10 hectare) of open water (free of emergent vegetation and woody trees), are at least 1 m deep at the deepest point and are not in direct contact with or influenced by oceanic waters. Examples of waterbodies not included in this definition include, agricultural ponds, borrow pits, stormwater treatment areas, lakes constructed for restoration projects, coastal wetland lakes, and lagoons. This means the location point for collecting samples may be shallower than 1 meter, which is acceptable as long as it is at least 10cm deep. For large lakes, navigate to the selected random location. The field measurements and samples must be collected at this site. However, if the sampling location point ends up located on dry land (exposed dry lake bed or in the upland area surrounding the lake), the site must be excluded due to either “dry” or “wrong resource”. Collect samples in the middle of open water for small lakes. **Collect surface water samples prior to collecting sediment samples.**

Large Lakes

Collect field analytes and samples as close to random location as possible

Small Lakes

Collect field analytes and samples in center of open water



Emergent vegetation: A site is deemed accessible if it can be reached by conventional means, such as a boat, airboat, wading, etc. Sample at the closest area relatively free from vegetation. This area should be at least 0.5 meter square and 10 cm deep, and allow collection of the samples without disturbing the sediments and vegetation. The requirement to have at least 0.25 acres (1/10 hectare) of open water still applies.

Inland lakes (both small and large) may be connected to other systems via inflows and/or outflows. However, lakes that are near the coast must be closed lakes not connected to other waters. In other words, a coastal lake may not be influenced by tidal fluctuations, regardless of the specific conductance reading (a high conductivity lake may still be sampled as long as it is not tidally influenced).

### Field Measurements

See Figure 13. Measure total depth to the nearest 0.1m using metric tape or an electronic measuring device. Take and average two readings to ensure accuracy. If the total depth is less than 0.1 m (10 cm), the site is excluded due to insufficient water levels and no samples or field analyte measurements (pH, DO, specific conductance, and temperature) are taken.

See Figure 13. If the total depth is equal to 0.1 m, collect field analyte measurements and water samples at 0.05 meter below the surface. If the total depth is greater than 0.1 m but less than or equal to 0.3 m, take field analyte measurements and water samples 0.1 m from the bottom. When total depth is equal to or less than 1.5 m (but greater than 0.3 m), collect field analytes and water samples at mid-depth or 0.3 m from the surface (whichever is shallower) and collect a second set of field analytes at 0.1 m from the bottom. If the total depth is more than 1.5 m, collect field analytes and the water samples at 0.3 m below the surface. Collect a second set of field analyte measurements 0.1 m from the bottom. Separate sampling times need to be recorded for surface and bottom field analyte measurements. Record the surface (“primary”) field measurement on the custody sheet. Furthermore, the sample collection time entered on the custody sheet (and on the sample containers) needs to be documented as the same time as the surface (“primary”) field measurement time. Report readings in pH units to one decimal place (ex., 7.5 SU instead of 7.46 SU). Record temperature readings to one decimal place (ex., 25.9° C instead of 25.86° C).

Secchi depth gives an indication of water clarity. The secchi disk is a circle, 20 cm in diameter, with alternating black and white quadrants on the upper surface. It is attached to a rope marked in 0.1 m increments.

1. Remove sunglasses.
2. Lower the secchi disk slowly (on the **shaded** side of a boat or with the sun to the observers back) and record the depth at which it disappears to 0.1 m.
3. Lower the disk slightly farther.
4. Raise the disk until it reappears, and record this reappearance depth to 0.1 m.
5. Average these two depths for the secchi depth.
6. In clear or shallow water, the disk may be visible to the bottom. Note this on the field sheet and qualify with an “L” indicating the actual value is known to be greater than the reported value.
7. Record any factors that might affect the accuracy of this measurement, such as choppy water, in the comments section of the field log sheet.

Record stage height if it is available. This measurement can be obtained from staff gages, continuous recording gages, wire weight gages, tape down measurements, or any existing USGS gaging stations located in close proximity to the sampling sites. Locks may have two staff gages—one from the mean sea level, one from the river bottom. Stage height should be recorded from the river bottom.

### **Label Sample Containers**

Wear unpowdered latex gloves while handling the containers. Work with only one set of containers at a time. Label all the sample containers for a site, including each whirlpak, prior to filling sample containers. Place a station identification bar code label vertically on each sample bottle (Figure 5). The Lab places two labels on the containers. Write the time (24 hour format) and date at which a station is sampled on the analyte label (Figure 28). The other label is a laboratory production and container bar code label (Figure 29).

### **Sample Collection**

Wear clean gloves to collect the samples. Use only the appropriate sample containers: do not use a sample bottle to collect and pour water into the whirlpaks. Do not rinse the bottles before collecting the samples. Leave some headspace in all bottles. The sample time for the water chemistry samples should match that of the primary field analyte measurement (for example, if field analyte measurements are taken at mid-depth and 0.1 m from the bottom, the sample collection time should match the time for the mid-depth field analyte measurement).

See Figure 13. If the total water depth is equal to 0.1 m, collect water samples directly into the sample containers 0.05 m from the bottom (mid-depth). If the total depth is 0.1 - 0.3 m, collect water samples directly into the sample containers 0.1 m from the bottom. When total water depth is equal to or less than 1.5 meters (but greater than 0.3 m), collect samples directly into the sample containers at mid-depth or 0.3 m from the surface (whichever is shallower). When the water depth is greater than 1.5 meters, collect samples directly into the containers or with a clear acrylic or polyvinyl chloride Van Dorn horizontal sampling device (Alpha or Beta bottle) at 0.3 m below the surface.

**Grab Samples (collection directly into sample containers)**

1. Fill the sample bottles following the collection order shown on the back of the custody sheet (Figure 4).
2. Slowly submerge the bottle neck first into the water to the appropriate depth.
3. Invert the bottle such that its neck is upright pointing into the water flow if any. Fill bottle, leaving some airspace.
4. Bring bottle to the surface. Pour out a little water if necessary, downstream from the sampling site. Cap tightly.
5. Repeat steps 2 through 4 for the remaining bottles. See below for the whirlpak sample.
6. Collect the chlorophyll sample quickly to avoid degradation by light.
7. Preserve the nutrients bottle with sulfuric acid and the metals bottle with nitric acid. See page 62.
8. Place all bottles on ice to  $\leq 6^{\circ}\text{C}$  within 15 minutes of collection. See page 63.
9. Pack samples and ship to Lab as detailed on pages 69-71.

**To collect a sample into a Whirlpak<sup>®</sup>:**

1. Wear unpowdered, disposable latex gloves.
2. Tear the top off of the Whirlpak<sup>®</sup> where it is perforated, and open the bag using caution not to touch the insides of the opening.
3. Immerse the bag, open end first, to the correct depth.
4. Collect the sample with one sweeping arc motion.
5. Bring a full bag to the surface to avoid collecting surface film.
6. Press out excess water from the bag until the Whirlpak<sup>®</sup> contains approximately 150 ml of sample water (at least 125 mL).
7. Seal the bag tightly with at least three folds at the top (do this by “whirling” the bag at least three times). Twist the wire ties together. Arrange the ends of the wires so they cannot puncture the bags. The bag should be firm and have ample head space.
8. Place both whirlpaks in Ziploc bag and place on ice to  $\leq 6^{\circ}\text{C}$ .

**Sample Collection with an Intermediate Collection Device**

When the water depth is more than 1.5 m, samples may be collected at 0.3 m below the surface with a Van Dorn horizontal sampling device (Alpha or Beta bottle). Place a mark on the line attached to the sampling device to collect the sample at the proper depth.

1. Lower the Van Dorn to the appropriate depth below the surface. Do not disturb the sediments.
2. Rinse the sampler with the sample water. This can be done by either allowing the opened device to flush for a few minutes (only applicable in systems with good velocity), or by deploying the device and capturing water that is representative of the sample water (same depth) and discarding the rinse water away from the sample location point. Be sure to flush some water through the spigot/stopcock. If this second method is used, after rinsing, lower the opened device back into the water in preparation for sample collection.

3. Send the messenger down to close the ends.
4. Retrieve the device slowly.
5. Fill the sample bottles following the collection order shown on the back of the custody sheet (Figure 4).
6. Pour the water directly from the Van Dorn bottle into the sample containers using the spigot/stopcock to control the flow. Leave some headspace in all bottles.
7. Collect the chlorophyll samples quickly to avoid degradation by light.
8. When filling the Whirlpaks<sup>®</sup>, begin pouring sample before collecting into the bag. Do not stop flow before or during the filling process. Fill to the line (about 150 ml). Squeeze out excess if necessary to leave some headspace. Seal each Whirlpak<sup>®</sup> tightly with at least three folds at the top and the wire ties bent in half with the ends twisted together (do this by “whirling” the bag at least three times). The bag should be firm with ample head space.
9. If using only a 2.2 or 3.2 liter Van Dorn bottle, multiple grabs will have to be taken to fill all the sample containers. Do not partially fill a bottle from one collection and complete with another collection. The best technique to follow in these instances is to collect the necessary amount of water using the Van Dorn, place all collections in a clean and rinsed bucket, and fill all sample bottles with the homogenized water. Use caution to prevent possible contamination of the water collected in the bucket, and make sure the sample water is thoroughly mixed before filling bottles. Please note that any equipment blanks will need to be collected in the same manner (including the bucket as a piece of equipment).
10. Preserve the nutrients and metals bottles, place all bottles on ice to  $\leq 6^{\circ}\text{C}$  within 15 minutes, and pack all samples as detailed on pages 62, 63, 69-71.

## Field Sheets

FDEP WMS provides field sheets (Figure 12) along with the other paperwork and labels. Be sure that the most current version of the field sheet is used by observing the date printed on the form. Enter data using waterproof ink and retain a copy of the field sheet in the field notebook. See Section 11 for full details. Someone other than the field samplers must complete the bottom section of the field sheet labeled “Reviewed for Completion By:”. This signature ensures that the field sheet has been completed in its entirety **before** submitting to the WMS. Select “water” as the matrix on the custody sheet for the water chemistry samples.

## Photo Documentation

For all Status sites, document conditions by taking photographs from the sample collection point facing north, south, east and west. For Trend sites, take photographs once a year or as needed based on changing conditions. For any sites that are excluded in the field, take photos to document the rationale (no photos are required for office recon exclusions).

## Repeat Visit Sampling Protocols

For the Status repeat sampling visits, the following protocols apply:

If 10 sites were sampled during the first sampling visit:

- return to those same 10 sites during the revisit and attempt to collect a second sample

- if able to obtain a sample from those same 10 sites, the revisit sampling event is complete
- if unable to obtain a sample from those same 10 sites due to new exclusions-- **time permitting**, begin re-evaluating the primary sites (1-10) that were excluded during the first visit due to reasons that indicate you can try again (for example, dry)
- continue evaluating the remaining sites (in numbered order) until 10 total samples have been collected; evaluation may stop when you reach the same site number in the list that was evaluated during the first sampling period

If less than 10 sites were sampled during the first sampling visit:

- return to those same X sites during the revisit and attempt to collect a second sample
- **time permitting**, begin re-evaluating the primary sites (1-10) that were excluded during the first visit due to reasons that indicate you can try again (for example, dry)
- continue evaluating the remaining sites (in numbered order) until 10 total samples have been collected; evaluation may stop when you reach the same site number in the list that was evaluated during the first sampling period

The sediments, SCI and the RPS should be attempted for all applicable sites during both the initial and repeat visits.

## SECTION 6. SEDIMENT SAMPLING PROTOCOLS

### Introduction

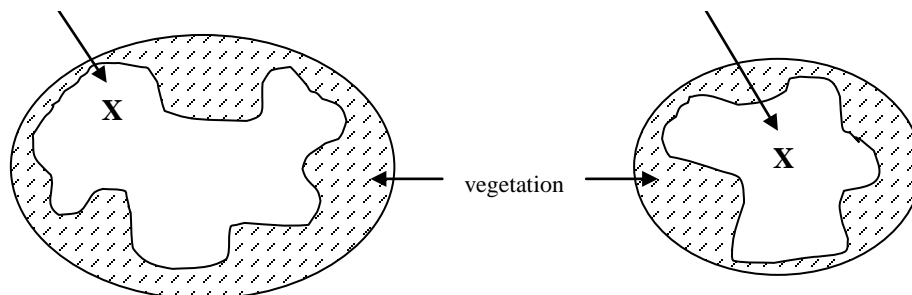
Sediment samples will be collected at each of the 10 Small Lakes and 10 Large Lakes selected each year as part of the Status Network. For large lakes, use DGPS to navigate to the random location. Collect the sediment samples at the same site as the surface water samples, and record the coordinates in the data logger. Collect sediments in the middle of open water for small lakes. Minimum water levels needed for sampling the lakes are defined using the lake definition described in Section 5, which states that the lake needs to be at least 1 m deep at its deepest point. This means the location point for collecting sediments may be shallower, which is acceptable, as long as it is at least 10 cm deep. **Collect surface water samples prior to collecting sediment samples.** If a representative sediment sample cannot be accessed where the water sample was collected (due to a rocky bottom, excessive vegetation, etc.), contact your Project Manager or QA Officer for guidance. Relocation of the sediment sample may be permitted, but not without prior guidance from your Project Manager or QA Officer.

#### Large Lakes

Collect field analytes and samples as close to random location as possible

#### Small Lakes

Collect field analytes and samples in center of open water



### Equipment and Supplies (these items will be supplied by the FDEP)

The Ekman dredge is designed for collecting samples in soft substrates (e.g., sand, silt or mud) in areas with little current. It is constructed of stainless steel, which is acceptable for sampling all analytes.

A petite ponar is better suited for harder, rocky substrates. It may be used in these circumstances or as a backup in case the Ekman is not available or not functioning properly. The petite ponar will also be constructed of stainless steel.

A non-reactive utensil, such as a stainless steel scoop or spoon, is also needed to remove the sample from the Ekman or petite ponar. Other construction materials for these utensils are acceptable, such as Teflon<sup>®</sup> (PTFE), Teflon<sup>®</sup>-coated, high density polyethylene (HDPE), or polypropylene (PP).

For shallower (approximately 1-2 m) static water sampling sites, a corer constructed of stainless steel may be appropriate to collect a sample. These sites need to be shallow enough for the corer to easily access the sediments. In this case, the Ekman or petite ponar will not be used. A stainless steel extruder will also be used to remove the sample from the corer.

For sediment samples containing debris such as leaves, root material, sticks and vegetation, the debris must be removed before sample submittal. A non-reactive utensil such as Teflon<sup>®</sup> (PTFE) forceps should be used for this purpose.

### **Field Measurements**

Field measurements are collected during the surface water sampling. No additional measurements need to be associated with sediment samples. The field measurements collected and entered on the custody sheet for the water chemistry samples are sufficient. However, a separate collection time (from the water chemistry samples) needs to be recorded, so the sediment information needs to be documented as a separate entry on the custody sheet. See the Field Sheets section below.

### **Label Sample Containers**

One 500 ml jar will be used for the sediment metals, nutrients and methyl mercury. Place a station identification bar code label vertically on the sample jar (Figure 5). The Lab places two labels on the containers. Write the time (24 hour format) and date at which a station is sampled on the analyte label (Figure 28). The other label is a laboratory production and container bar code label (Figure 29). Be sure to record a separate collection time for sediments on the Surface Water Field Sheet and Custody Sheet.

### **Sample Collection**

One 500 ml jar will be filled and submitted to the laboratory for the sediment metals, nutrients and methyl mercury. The sample container (jar) does not need to be rinsed. Wear unpowdered latex gloves to collect the samples.

#### Using a Corer:

If easily obtainable and possible, use a stainless steel corer to collect sediments from shallow water or along the margins of lakes.

1. Remove the top and bottom caps from the corer.
2. Push the corer gently into the top 3-5 cm of sediment bottom. Rotate the corer, if needed, as it is pushed into the sediment. Rotate around its axis (do not rock the coring device back and forth). Rotation improves penetration and prevents compaction of the sample as it is pushed into the corer.
3. Replace the top cap of the corer.
4. Upon withdrawal from the water surface, place a cap on the bottom to prevent the sample from sliding out.
5. The water resting above the sample can be decanted using narrow Teflon<sup>®</sup> tubing attached to a syringe. A simple siphon is created with the syringe, thus removing the

water above the sediment sample. Or, if sediments are not flocculent, you can simply decant the water prior to extruding the sample into the jar.

6. Using the extruder, carefully push and transfer the top 3-5 cm of the sediment core into the 500 ml sample jar. For flocculent sediments, the sample may be collected deeper (below) the top layer. If this is the case, please document the depth at which the sample was collected.
7. If debris is present, use Teflon<sup>®</sup> forceps to remove the debris either prior to transferring the sediments to the sample jar or directly from the sample jar. Replace the cap on the jar loosely to prevent atmospheric contamination. Be sure to leave an ample amount of head space (about 1/3 of the jar) so the lab can homogenize the sample properly. For “soupier” samples, the jar may be filled slightly fuller, but do not fill the jar all the way to the top.
8. Repeat numbers 2-7 as needed to fill the jar approximately 2/3 full. A minimum of three grabs is required to achieve a representative sample. Collect all grabs in the same general area but not right on top of each other.
9. Replace the cap on the jar firmly, carefully removing any grit from the jar threads. Use tape, such as a black electrical tape to seal jar. Place the jar back into the plastic bubble-wrap bag.
10. Preserve to  $\leq 6^{\circ}\text{C}$  with wet ice and complete field notes.

#### Using the Ekman Dredge:

The Ekman dredge is used to collect sediments in deeper water bodies and is good for soft substrates.

1. Open the spring-loaded jaws and attach the chains to the pegs at the top of the sampler.
2. Lower the dredge to the bottom, making sure it settles flat.
3. Holding the line taut, send down the messenger to close the jaws of the dredge.
4. Pull the sampler to the surface. Check to make sure the jaws are fully closed and that no sample was lost while lifting the dredge. If sample is lost due to the jaws not closing properly, redeploy the Ekman and collect another sample.
5. Carefully open the top of the Ekman. If water is resting above the sample, it should be decanted using narrow Teflon<sup>®</sup> tubing attached to a syringe. A simple siphon is created with the syringe, thus removing the water above the sediment sample.
6. Remove the top 3-5 cm of the sample with a clean, non-reactive utensil (scoop or spoon) and transfer it into the 500 ml sediment sample jar. For flocculent sediments, the sample may be collected deeper (below) the top layer. If this is the case, please document the depth at which the sample was collected.
7. If debris is present, use Teflon<sup>®</sup> forceps to remove the debris either prior to transferring the sediments to the sample jar or directly from the sample jar. Replace the cap on the jar loosely to prevent atmospheric contamination between grabs.
8. Repeat numbers 1-7 as needed to fill the jar approximately 2/3 full, ensuring that the jar has at least one scoop from each grab. A minimum of three grabs is required to achieve a representative sample. Collect all grabs in the same general area but not right on top of each other.
9. Be sure to leave ample head space (about 1/3 of the jar) so the lab can homogenize the sample properly. For “soupier” samples, the jars may be filled slightly fuller, but do not fill the jars all the way to the top.

10. Replace the cap on the jars firmly, carefully removing any grit from the jar threads. Use tape, such as a black electrical tape to seal the jars. Place the jars back into the plastic bubble-wrap bags.
11. Preserve with  $\leq 6^{\circ}\text{C}$  wet ice and complete field notes.

#### Using the Petite Ponar:

1. Open the jaws and place the cross bar into the proper notch.
2. Lower the ponar to the bottom, making sure it settles flat.
3. When tension is removed from the line (when the ponar settles on the bottom), the cross bar will drop, enabling the ponar to close as the line is pulled upward during retrieval.
4. Pull the ponar to the surface. Check to make sure the jaws are fully closed and that no sample was lost while lifting the ponar. If sample is lost due to the jaws not closing properly, redeploy the ponar and collect another sample.
5. Slide open the top panels of the ponar. If water is resting above the sample, it can be decanted using narrow Teflon<sup>®</sup> tubing attached to a syringe. A simple siphon is created with the syringe, thus removing the water above the sediment sample.
6. Remove the top 3-5 cm of the sample with a clean, non-reactive utensil (scoop or spoon) and transfer it into the 500 ml sediment sample jar. For flocculent sediments, the sample may be collected deeper (below) the top layer. If this is the case, please document the depth at which the sample was collected.
7. If debris is present, use Teflon<sup>®</sup> forceps to remove the debris either prior to transferring the sediments to the sample jar or directly from the sample jar. Replace the cap on the jar loosely to prevent atmospheric contamination between grabs.
8. Repeat numbers 1-7 as needed to fill the jar approximately 2/3 full, ensuring that the jar has at least one scoop from each grab. A minimum of three grabs is required to achieve a representative sample. Collect all grabs in the same general area but not right on top of each other.
9. Be sure to leave ample head space (about 1/3 of the jar) so the lab can homogenize the sample properly. For “soupier” samples, the jars may be filled slightly fuller, but do not fill the jars all the way to the top.
10. Replace the cap on the jars firmly, carefully removing any grit from the jar threads. Use tape, such as a black electrical tape to seal the jars. Place the jars back into the plastic bubble-wrap bags.
11. Preserve with  $\leq 6^{\circ}\text{C}$  wet ice and complete field notes.

#### **Field Sheets**

All sediment information is documented on the surface water field sheet in the section labeled “Sediment Information”. On the custody sheet, the sediment information needs to be documented as a separate entry. Underneath the entry for the water chemistry samples (noted as “water” for the matrix type), place an identical station label in the appropriate space, enter “NA” or place a dash for the field measurement information (pH, DO, etc.), record a separate collection time for the sediments, and note the matrix as “sediment”. See Section 12 for full details. Please note, the RQ used for sediment samples must match the associated water chemistry samples for each site.

**QA/QC**

At the moment, blanks will not be collected for sediment samples. However, blanks may be required at a later date. If collection frequency requires a blank to be collected at a large or small lake, collect a blank for the water chemistry samples only.

**Cleaning**

A special field cleaning protocol for the sediment sampling equipment (ponar, Ekman, corer, scoops) is required. See Section 15 pages 83-84 for more information.

## SECTION 7. AQUATIC HABITAT CHARACTERIZATION PROTOCOLS

### Introduction

The Habitat Assessment (HA) will be performed anytime a Stream Condition Index (SCI) is collected for the Small Streams and Large Rivers for the Status Network. For the surface water Trend Network (starting October 2004), the Habitat Assessment and SCI will be collected on an annual basis for each appropriate site. For the Status Network, the HA and SCI will be attempted during both sampling visits. The purpose behind Habitat Assessment is to collect key physical data components that can assist in interpreting biological community results. For example, if biological community health is impaired in a water body, is habitat disturbance or water quality degradation responsible? **This sampling procedure is used in conjunction with performing an SCI or RPS** and requires specific training and a demonstration of competency due to the expert judgment exercised during field sampling. Individuals conducting this procedure must train with FDEP staff (via workshops and/or participating in field sampling) and remain in “pass status” for field performance tests. Training should be conducted using the Habitat Assessment Training Checklist (FT3000 found in FA1000). Habitat Assessment testing will be conducted at select streams/rivers located throughout the state, and sites will change every two years or as needed. When samplers are ready to test (Habitat Assessment Training Checklist has been completed with all applicable signatures), the site locations can be obtained by contacting the Standards and Assessment Section (Russel Frydenborg (850-245-8063)) or the FDEP WMS QA Officer. All field samplers are required to participate in at least one testing event every two years. If you fall out of pass status, you will not be able to submit Habitat Assessment scores until you are once again in pass status. At all times, a minimum of one sampler from each field team must be in pass status in order to perform a Habitat Assessment and SCI. Specifics regarding criteria for the Habitat Assessment testing are included in Section 7, Appendix 1 (see page 53). Appendix 2 (page 54) is a short-form checklist that can be used to aid in the Habitat Assessment characterization.

### Equipment and Supplies

The following will be needed in order to perform a Habitat Assessment:

1. Physical/Chemical Characterization Field Sheet (Figure 14)
2. Stream/River Habitat Sketch Sheet (Figure 15)
3. Stream/River Habitat Assessment Field Sheet (Figure 16)
4. Watch or stopwatch
5. Flow Meter (optional)
6. D-frame dipnet with U.S. No. 30 mesh and handle marked in 0.1-m increments
7. Secchi disk with at least three meters of rope marked in 0.2 m sections
8. Tape measure (100 m)
9. Flagging tape
10. Multi-meter (YSI, Hydrolab, etc.)

**Methods for the Physical/Chemical Characterization Field Sheet and Habitat Sketch Sheet**

1. The stream or river must be a definable, freshwater, continuously flowing system that is functioning as a “stream” or “river” in order for a HA/SCI to be performed. For example, do not perform the HA/SCI if:
  - the system is not functioning as a stream or river (it is more like a lake, estuary, wetland, marsh, prairie, canal, ditch, etc.),
  - the system is dry or disconnected,
  - flood conditions exist and water levels are > 0.5 meter above normal,
  - the system is tidally influenced (regardless of conductivity values),
  - the system is a spring run with conductivity values  $\geq 600 \mu\text{mhos}$
  - the average velocity is  $\leq 0.05 \text{ m/s}$
  - conditions are unsafe

Please keep in mind that any time the Rapid Periphyton Survey (RPS) is performed, the HA will need to be performed; however, the RPS and the SCI do not have the same exclusion criteria. See Section 9 for more details. Samplers need to use their training and their Best Professional Judgment (BPJ) to determine if the system is functioning as a stream or river. If the stream is known to have been dry recently, exclude the site as “dry”. A minimum of three months after dry conditions have abated is required before performing a HA/SCI, but this would be out of the index period, so the site is excluded. If flood conditions are occurring but water levels are < 0.5 meter above normal, habitats are still accessible at the normal stream shoreline (normal water level), so the HA/SCI can be performed. However, if flood conditions are >0.5 meter above normal, wait 28 days or until the water recedes, normal flow returns and the habitats become accessible. Organisms are not destroyed, but their normal habitats are not accessible due to high water. Take pictures to document conditions, and record on your field sheets that the HA/SCI was not sampleable (the site is not excluded). Sampling can be reattempted within the index period. Decreasing water levels, an obvious high water mark, and flow within the normal banks are good indications that the system may be appropriate for sampling after recent flood conditions. If the system is still flooded during the reattempt to collect samples, the HA/SCI may be omitted; however, during the revisit sampling event 6 months later, reattempt to collect the HA/SCI. All tidally influenced systems, regardless of conductivity readings, should be excluded for the HA/SCI. If the system is a spring run and the conductivity is  $\geq 600 \mu\text{mhos}$ , do not perform the HA/SCI. If an inland stream or river is influenced by a facility discharge, the high conductivity levels are not natural, and an HA/SCI would be performed. Likewise, if a site has naturally high conductivity values as in the phosphate mining areas, the HA/SCI should be performed. Low flow systems with average velocity readings of  $\leq 0.05 \text{ m/s}$  routinely fail the SCI, so they should be excluded from the HA/SCI. Unsafe sampling conditions always qualify the site to be excluded due to safety concerns. Furthermore, the stream or river must be at least 10cm deep in order to collect surface water chemistry samples. If water levels are not at least 10cm deep and water chemistry can not be collected, abort the HA/SCI and exclude the system due to insufficient water levels. Any HA/SCI exclusions should be documented on the Surface Water Field Sheet and in the OGWIS comments section under the Recon Tracking tab.

2. Fill in the information requested at the top of the Physical/Chemical Characterization Field Sheet (Figure 14), including the sampling date, sampling location, field identification, and receiving body of water. Record the time of sampling as when water quality samples are first taken. Record the random latitude and longitude of the sampling location. If the sampling location point does not “hit in the stream or river,” you may navigate up to approximately 50 perpendicular meters to reach the system. If this still does not place you in the system, then exclude the point and document this information.
3. Measure and record values for standard water quality parameters, including temperature, pH, dissolved oxygen, specific conductance and Secchi depth (see Section 5). Collect the water chemistry samples at the designated random sampling point for Status and the designated historical location for Trend (see Section 5).
4. If conditions described in numbers 1-2 are appropriate for performing the HA and the water chemistry samples have been collected, the 100 meter length of the HA sampling area can be determined by measuring 50 meters upstream and 50 meters downstream from the location where water chemistry samples were collected. Mark the beginning, end and sections of appropriate length (usually 10 meters) with flagging tape. The “0 meter” mark is the downstream point and the “100 meter” mark is the upstream point. However, if the 100 meter stretch of a system is:
  - interrupted by a weir or a lock,
  - the percentage of available bank is limited due to the presence of a large tributary,
  - portions of the stretch are unsafe,
  - or similar circumstance,

the 100 meter stretch may be moved up or down as necessary in order to provide the most representative stretch for the system. However, the designated sampling point can not be relocated. Furthermore, for the Status Network, the designated sampling point must remain within the 100-meter stretch. For the Trend Network, the designated sampling point does not have to reside within the 100-meter stretch, but it must be no farther than 200 meters away from the HA stretch. For example, if a Trend site collection point is traditionally from a weir, continue to collect water chemistry samples from the same point, but you may move the 100-meter stretch upstream no more than 200 meters above the weir to safer and more representative conditions, so that the weir is not located within the stretch. If moving the HA stretch 200 meters away still does not meet the acceptable criteria for performing the HA/SCI, do not perform the HA/SCI. See Figure 18.

5. Start at the downstream end of the reach and draw a sketch of the site on the Stream/River Habitat Sketch Sheet (Figure 15). In your sketch, show the observable (by sight or touch) location and amount of each productive substrate type in the 100 m reach. Using the grid on the map form, count the number of grid spaces for each substrate type. Divide each of these substrate numbers by the total number of grid spaces contained within the site sketch. If you cannot observe portions of the system (e.g., due to depth), include only the number of grids where observations were possible as the denominator in this calculation. Record this percent coverage value for each substrate type. GPS

coordinates and photographs of the sampling area are also useful tools for documenting habitat conditions and identifying station locations.

6. Observe and estimate the percentage of land-use types in the watershed that drain to the site, including all that may potentially affect water quality. Examination of maps prior to field sampling is a necessary component of this determination. Recon tracking maps, WMD land-use maps and/or the FL Gazetteer may be used. Record this information.
7. Rate and record the potential for erosion within the portion of the watershed that affects the site.
8. “Local non-point-source pollution” refers to contamination introduced by stormwater runoff. Estimate this input and record this information.
9. Measure or estimate the width of the stream or river, from bank to bank, at a transect representative of the site. Record this information.
10. Take three measurements of water depth across this transect using the ruled dipnet handle or ruled rope of the Secchi disk and record.
11. Take three measurements of water velocity (one at each location where water depth was measured) using either a flow meter or the ruled dipnet handle, watch/stopwatch, and a floating leaf or other object. Record this information on the data sheet. If the average velocity is  $\leq 0.05$  m/s, exclude the HA/SCI (see number 3).
12. Measure or estimate the vegetated riparian buffer zone width on each side of the stream or river. This is the distance from the edge of the water to where clearing or other human activities begin. If the vegetated buffer zone width is greater than 18 m, record “>18 m”.
13. Indicate whether or not the area in the vicinity of the sampling station has been artificially channelized and to what extent the system has recovered.
14. Indicate the presence or absence of impoundments in the area of the sampling station that may alter the natural flow regime or the movement of biota.
15. Where applicable, estimate and record the vertical distance from the current water level to the peak overflow level. Peak overflow level is indicated by debris hanging in bank, floodplain vegetation, or deposition of silt or soil. (When bank overflow is rare, a high water mark may not be apparent.) Add this distance to the current water depth (see number 11 above) to determine the distance of the high water mark above the streambed and record this value.
16. Check the box for the percentage range that best describes the degree of shading (canopy cover) in the sampling area. This percentage should be an integration over the entire 100 m reach and is not influenced by the season (for example, in the fall or winter when leaves are not present on surrounding trees, this is not to be interpreted as an “open” canopy cover).

17. Note any odors associated with the bottom sediments and check the appropriate box. Note the presence or absence of oils in the sediment; for this step, it may be helpful to observe the extent of sheen on the water after the substrate has been disturbed. Finally, note any deposits in the area, including the degree of smothering by sand or silt.
18. Indicate the type of aquatic system being sampled.
19. Indicate if the water sample and/or algae sample were taken.
20. Note the presence and types of any noticeable water odors and check the appropriate box. Note the term that best describes the relative coverage of any oil on the water surface.
21. Based on visual observation, check the term that best describes the amount of turbidity in the water before it was disturbed by sampling. Using a turbidimeter is not needed for this determination.
22. Check box for the term that best describes the color of the water, indicating whether the water is tannic, green, clear or other. (If “other” is checked, indicate what the color is.)
23. Check the boxes for which assessment(s) is/are being performed. Fill in the % coverage and number of times each habitat/substrate type was sampled after completing the Habitat Assessment Sketch form.
24. Describe the weather conditions during the time of sampling, particularly the relative amount of sunshine/cloud cover, temperature, and wind speed and direction. Record any other conditions/observations that may be helpful in characterizing the site.
25. Check the box to indicate that the hydrological conditions were appropriate for sampling.
26. Check the boxes to indicate that the samples were properly preserved.
27. Estimate and record the relative abundances of the following: periphyton, fish, aquatic macrophytes and iron/sulfur bacteria. If any are absent, please do not leave the categories blank; mark the “Absent” box.
28. Sign and date the forms.

### **Methods for the Habitat Assessment Field Sheet**

1. Fill in the information requested at the top of the Stream/River Habitat Assessment Field Sheet (Figure 16), including the sampling date, sampling location, field identification, and receiving body of water. Record the time of sampling as when water quality samples are first taken or when the assessment begins.

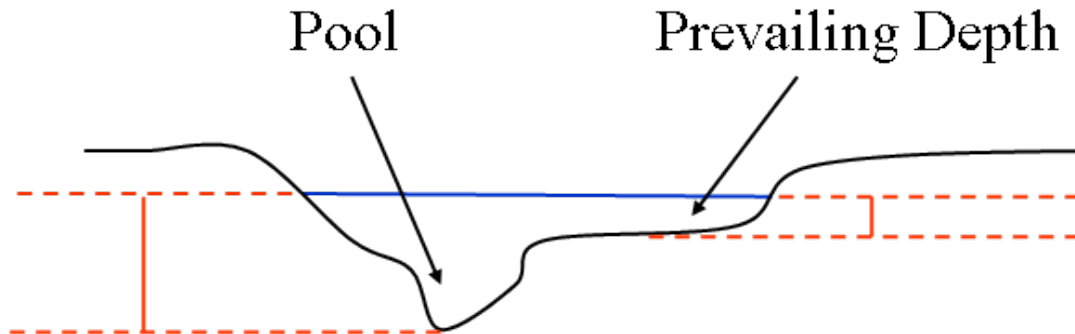
2. Score the **Substrate Diversity** by evaluating the number of productive substrates present. Refer to the Stream/River Habitat Sketch Sheet and the Physical/Chemical Characterization Field Sheet. The following substrates are considered productive:

- Snags (woody debris or logs larger than thumb diameter).
- Roots/undercut banks (less than thumb diameter, with finer roots usually being more productive).
- Aquatic vegetation (in contact with the water).
- Leaf packs/mats in association with flow (leaves must be partially decomposed to be considered habitat. Leaf mats at the bottom may be productive if sufficient oxygen is present, but anaerobic leaf mats are not considered productive habitat).
- Rocky substrate (usually limestone outcrops with rock diameters greater than 5 cm).

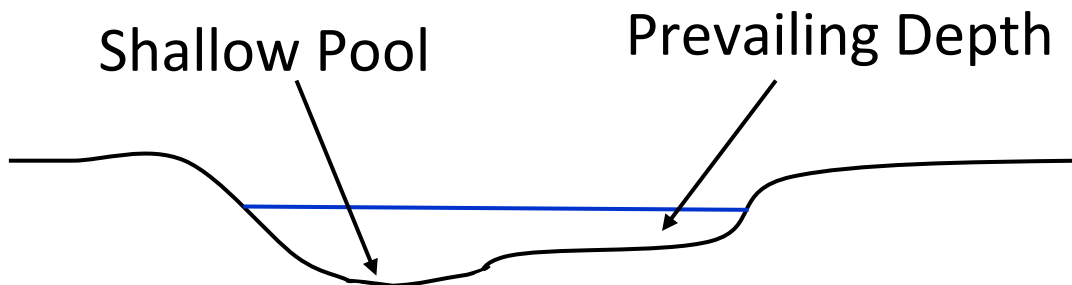
Once the number of substrates has been determined, assign a score for substrate diversity in the appropriate spot on the sheet. Higher values indicate a better condition than lower values. The quality of the substrates present should then be given consideration in the scoring process. For example, partially decomposed leaf packs and older snags are better than fresh substrates and should be given higher scores within the same category. **In order for a productive habitat to be considered present and counted in the Substrate Diversity score, a minimum occurrence of two square meters of a particular substrate in the reach is necessary.** For example, if the 100 m stretch contains only 1 square meter of snags, snags would not be considered “present” when determining the score. Snags could still be sampled, however, as a minor habitat.

3. **Substrate Availability** is the relative spatial abundance of productive habitats present. Refer to the entry on Physical/Chemical Characterization Field Sheet, as determined from the Habitat Sketch Sheet. In order for a productive habitat to be considered present and counted in the Substrate Availability score, a minimum occurrence of two square meters of a particular substrate in the reach is necessary. Include only productive “present” habitats from the mapping for the scoring process. For example, if the 100 m stretch contains only 1 square meter of snags, snags would not be considered “present” when determining the score. Score substrate availability on the data sheet based on the sum of the percentages of productive, present habitats in the stream reach.
4. Using the ranges given on the data sheet, assign a **Water Velocity** score based on the maximum velocity observed at the sampling transect of the stream or river. Note that in the majority of Florida streams, velocities over 1 m/s are considered unusually high, and should be included in the “poor” category. An exception to this policy would be in narrow or shallow areas of streams with natural limestone bottoms, where velocities approaching 1 m/s may be normal and, thus, would be scored in the “optimal” category.
5. The **Habitat Smothering** parameter is an assessment of sand and silt deposition onto what would otherwise be productive habitats. Scoring is a two-step process. Assign a habitat smothering score by adding the percent of habitats smothered as determined by the following two steps:

- First, determine (by referring to Figure 15) if adequate pools are present. For large, wide rivers it may be more appropriate to base the estimate on the actual amount of smothering on the habitats rather than the number of pools. A pool is defined as an area where the depth is at least 2 times the prevailing depth.



A natural system should have 1 to 2 pools every 12 times the width of the stream. For example, a 3 meter wide stream should have at least 1 pool every 36 meters or a total of 3-6 pools per 100 meter reach ( $100\text{m}/36\text{m} = 2.8$  segments). If there are no pools; i.e., the stream depth is nearly the same throughout the 100m reach, assign a score in the “poor” category. If there are minimal (less than 1 pool every 12 times the width) or shallow pools (a shallow pool is any pool where the depth is much less than 2 times the prevailing depth), score the stream in the “marginal” category.

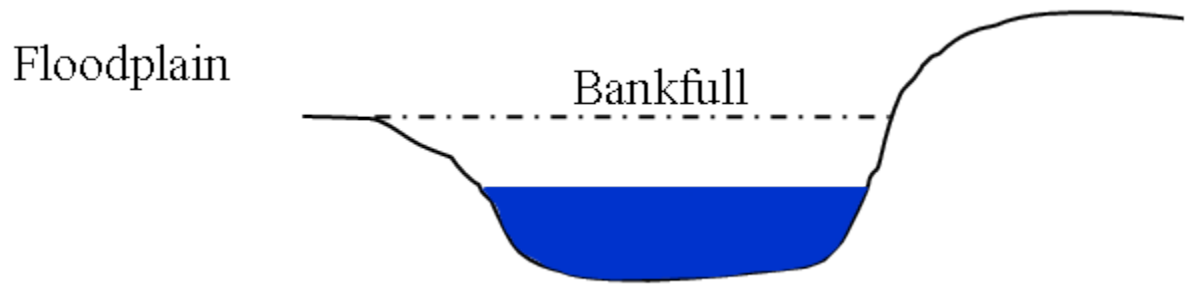


Pools should occur on the outside of curves in the stream and on the downstream side of large, woody debris. A score in the “suboptimal” or “optimal” categories should be assigned to a stream with adequate pools based on the percent smothering as described in the second step below.

- Second, check for deposition of sand or silt on visible habitats. While a light dusting of sand or silt is normal, excessively thick coatings will reduce habitability of the substrate. Sand smothering on visible habitats is indicated if sand is present on a substrate in an amount greater than a light dusting. Silt smothering is indicated if a substantial turbidity plume results from agitating the substrate, especially fine roots and leaf packs. Silt smothering can sometimes also be determined by direct observation of the silt coating. Determine a percentage

value for visible habitats that are not habitable due to sand and/or silt smothering. To score the habitat smothering category, add the percent habitats smothered as determined by these two steps.

6. Add the scores for the primary habitat components (see numbers 2-5 above) and record this primary score on the form. The primary habitat components refer to in-stream features.
7. Observe whether or not the reach of stream or river in the sampling area is artificially channelized. Assign a score for **Artificial Channelization** using the following guide:
  - Poor- A highly altered system with ALL of the following; straightened stream channel, box-cut banks and a monotypic depth. Spoil banks or other indications of dredging may be visible.
  - Marginal- An altered system with some sinuosity in stream channel, often developed within the old dredged area, OR some diversity in depth but no pools as defined in Habitat Smothering above. Spoil banks may be visible.
  - Suboptimal- Good sinuosity has developed within and outside of the old channelized area AND the bottom has a diversity of depths approaching what's expected of a non-dredged system (1 to 2 pools every 12 times the width of the stream). Spoil banks may be visible, but have established vegetation growing on them.
  - Optimal- A system with good stream channel sinuosity AND a diversity of depths as defined in Habitat Smothering above. No evidence of dredging or straightening.
8. Refer to Figure 15 for areas along the bank that have eroded or have the potential for bank sloughing. Determine the extent of erosion potential for the site and assign a **Bank Stability** score for each bank. Score artificially stable banks such as concrete according to bank stability, not according to natural vs. artificial stability. The "left bank" is on your left when you are looking upstream.
  - First, determine where "bankfull" is in relation to the height of each bank. Bankfull is defined as the stage at which channel maintenance is most effective and occurs on average every 1-2 years. For most natural Florida streams, bankfull is the height of the lowest bank, where the stream is connected to the floodplain.



Other indicators of bankfull (especially in larger systems) are the tops of point bars, staining and vegetation lines. If the substrate at bankfull is limestone, pipe clay or concrete, then automatically score the bank in the “optimal” category and skip the second and third steps below. Ideally, bankfull should be greater than 60% of the bank height or above the woody root zone. If this is the case, the bank gets a “plus” for this subcomponent. Otherwise, bankfull is less than 60% of bank height and below the woody root zone and it should receive a “minus”.

- Second, determine the slope of the bank. The more gentle the slope the more stable the bank. Score a bank with a slope less than 60° with a plus for this subcomponent. A bank with a slope of greater than 60° warrants a minus.
  - Third, determine if bankfull is above or below the root zone. If bankfull is above the root zone and there are few raw or eroded areas, score this subcomponent a plus. Otherwise, score it a minus. Woody vegetation/roots are more stable than herbaceous and should be scored accordingly.
  - Lastly, count up the number of pluses from each subcomponent (a total of 3 possible) and score within each category as described below:
    - Poor- 0 pluses
    - Marginal- 1 plus
    - Suboptimal- 2 pluses
    - Optimal- 3 pluses
9. Assign a score for the **Riparian Buffer Zone Width** that best characterizes the width of vegetation on each side of the channel. This zone is measured from the edge of the stream bank to where clearing or other adverse human activity begins. Take into account the intensity of the disturbance and score accordingly. For example, a footpath that runs along one bank for 20 meters is much less intense than a paved road that runs along the same 20 meter stretch. A native vegetated buffer zone of greater than 18 m (approximately 60 feet) is currently considered optimal.
10. Identify the plants in the riparian zone, determining the extent of coverage and whether the vegetation is native or exotic. Look for these classes of plants: bottomland or mesic hardwoods, understory shrubs and non-woody macrophytes. Assign a **Riparian Zone Vegetation Quality** score based on the classes of plants present, the degree of bank vegetative cover, and how closely the plant community at the site approaches that expected of an undisturbed community in the region.
11. Add the scores for the secondary habitat components (see numbers 7-10) and record this secondary score on the form. The secondary habitat components refer to morphological and riparian zone features.
12. Add the primary score (see number 6) and the secondary score (see number 11) to get the habitat assessment total score. Record the habitat assessment total score on the form.
13. Sign and date the form.

## **Appendix 1.**

### **Criteria for Habitat Assessment Testing**

This test is an ongoing evaluation of an individual's ability to perform habitat assessments within a predetermined range from an "expert" median. All testing is conducted in accordance with FDEP Standard Operating Procedure FT 3100.

Habitat Assessment testing will be conducted at select streams/rivers located throughout the state, and sites will change every two years or as needed. Sites should be selected throughout the year based on a range of habitat scores (optimal to poor). The 100-meter reach is evaluated and scored by a select group of "experts", and individuals are required to perform the assessments on their own time once during the year according to methods described in FT 3100. Once the assessment is completed, individuals will report their scores to the QA Officer. The expert median score, along with a thorough explanation for each category, will be provided to the individuals for follow-up and training purposes.

In order to process the scores, the median value of the expert group must first be determined. The expert group is comprised of individuals in the Standards and Assessment Section and local FDEP staff who are in "pass" status. Once this median is determined, an acceptance range is established of plus or minus 10 points from the median. This 20-point range has been established as half of the range of a 40-point category on the habitat assessment forms (Optimal, Suboptimal, Marginal and Poor).

Once the acceptable range has been determined, individuals are ranked depending on how their score compares to the acceptable range. Rankings for individual sites are "High" (>10 from median), "Low" (<10 from median), or "Ok" (+/- 10 from median). Individuals must be "Ok" on at least 3 of the 5 tests to be considered in pass status. If an individual does not pass at least 3 of the 5 tests, they should continue further training with qualified staff and retest at another time. They can either opt to test at one of the other statewide locations (an additional 5 sites) or they can wait until the new sites for their area are selected.

## Appendix 2.

### Short-form Checklist for Habitat Assessment Characterization

#### Riparian Zone and Stream Features

Walk stream the entire 100-meter segment (on the bank, if possible) to:

- Get an overview of predominant land use types and percentages that drain to the site,
- Riparian buffer zone width = width of native vegetation from stream bank edge to clearing or disturbance,
- Note areas of potential erosion within the watershed,
- Note prospective sweep locations,
- Note non-point-source pollution (only contamination introduced by storm water runoff),
- Select a representative transect for width, depth and velocity measurements.

Return downstream before beginning your assessment.

Remember to diagram the area of flowing water only. Adjust width as you assess.

**Substrate Types** – A minimum occurrence of two sq. meters required to count as productive habitat, but map all visible habitats.

Snags = woody debris or logs larger than thumb diameter

Root/Undercut banks = less than thumb diameter, with finer roots being more productive

Aquatic Vegetation = Non-terrestrial species in contact with the water

Leaf packs and Mats = partially decomposed. Anaerobic not included.

Rocky Substrate = usually lime rock outcrops with rock diameters > 5 cm.

*As you assess each 10-meter section, note any habitats that would serve as suitable sweep areas.*

**Habitat Smothering** - Sand and silt deposition onto otherwise productive habitats.

Check for reduction or elimination of pools.

Check for shifting sands (recent deposition) and for smothered habitat by probing with the dip net.

Check for deposition on visible habitats, light dusting of silt or sand O.K.

Silt smothering indicated if a turbidity plume results from agitating.

**Sweeps** - One sweep = 0.5 meters long X width of dip net

When sweeping leaf packs, collect into net, reduce amount of leaves before putting into container. Take extra care to ensure organisms are not accidentally discarded.

All 20 sweeps for one station may be placed in the same container (attempt to consolidate into no more than two 2L containers).

There should be 20 total sweeps per site.

Minor habitats include muck and/or sand.

# Productive habitats	# Prod. Habitat sweeps	# Minor Habitat Sweeps
1	10	10
2	7 of each habitat	6
3	5 of each habitat	5
4	4 of each habitat	4
5	3 of each habitat	5

## SECTION 8. STREAM CONDITION INDEX SAMPLING PROTOCOLS

### Introduction

Stream Condition Index (SCI) samples will be collected at each of the 10 Small Streams and 10 Large Rivers as part of the Status Network, for both the initial and the repeat visits. For the surface water Trend Network (beginning October 2004), the SCI will be collected on an annual basis for each appropriate site. **This biological sampling procedure is used in conjunction with the Habitat Assessment** and requires specific training and a demonstration of competency due to the expert judgment exercised during field sampling. Individuals conducting physical/chemical characterization, habitat assessment, and SCI sampling must train with FDEP staff (via workshops and/or participating in field sampling) and pass a field performance test to demonstrate competence. Training should be conducted using the SCI Training Checklist (FS7420 found in FA1000). When sufficient training is complete (SCI Training Checklist has been completed with all applicable signatures), contact Russel Frydenborg (850-245-8063) or Joy Jackson (850-245-8074) with the FDEP Standards and Assessment Section to schedule an SCI performance audit. After passing the initial performance audit, annual “check-up” audits will be scheduled by the FDEP QA Officer throughout the year to ensure that proper techniques are followed. Samplers will not be penalized if the QA Officer can not perform the check-up audit within the needed timeframe.

Surface water chemistry samples and water quality parameters (D.O., pH, etc.) will be collected before performing the SCI, just prior to the Habitat Assessment (see Sections 5 and 7). As described in Section 5, the water depth must be at least 10cm deep in order to collect water chemistry samples. If this is not the case, abort the Habitat Assessment/SCI and water chemistry samples. Please read Section 7 **thoroughly** for other circumstances when the Habitat Assessment/SCI will not be performed.

Appendix 2 in Section 7 serves as an aid to performing the Habitat Assessment/SCI.

### Equipment and Supplies

The following will be needed in order to perform an SCI:

1. Completed Physical/Chemical Characterization Field Sheet (Figure 14)
2. Completed Stream/River Habitat Sketch Sheet (Figure 15)
3. Completed Stream/River Habitat Assessment Field Sheet (Figure 16)
4. D-frame Dipnet with No. 30 mesh and handle marked in 0.1-m increments
5. Two 4-liter wide-mouth plastic jugs (take extra in case more are needed)
6. Buffered formalin (see below)
7. Brush

#### Buffered Formaldehyde:

Buffered formaldehyde (formaldehyde with sodium bicarbonate added) is necessary in preserving the organisms for laboratory identification. Buffered formaldehyde will be provided and distributed by the FDEP at Ambient Q Meetings or as necessary, and will be ready for use. To order more formaldehyde, call the FDEP QA officer. Buffered formaldehyde is considered

hazardous and will not be shipped through the mail. Please take this into consideration, and monitor your levels accordingly to ensure you will always have plenty in stock.

**Caution! Formaldehyde can cause skin, eye and breathing irritation. Wear appropriate protective gear (gloves, safety glasses and respirator, if available), and work in a well-ventilated area (preferably outside). Always transport formaldehyde containers in an upright position to prevent leakage.**

### Label Sample Containers

Place a station identification bar code label vertically on the sample jugs (Figure 5). Write the time (24 hour format) and date of sample collection on the analyte label using a permanent marker (Figure 28). Be sure to record a separate collection time for the SCI on the Surface Water Field Sheet and Custody Sheet. Furthermore, the SCI will need to be recorded as a separate entry on the custody sheet under the associated water chemistry sample. Underneath the entry for the water chemistry samples (noted as “water” for the matrix type), place an identical station label in the appropriate space, enter “NA” or place a dash for the field measurement information (pH, DO, etc.), record a separate collection time for the SCI, and note the matrix as “Biology”. Please record “SCI” in the comments section. See Section 12 for full details. Please note, the RQ used for SCI sample must match the associated water chemistry samples for each site.

### Sample Collection

1. **After following all instructions in Section 7, and determining that an SCI can be performed**, visually examine the area or reach to be sampled. Walk or boat throughout the aquatic system, paying close attention to its physical and habitat characteristics. If you are walking through the system, be very careful to not disturb aquatic habitats. In streams and rivers, the length of a discrete station consists of a 100 m stretch of stream, and the width is from bank to bank.
2. Make sure the Physical/Chemical Characterization Field Sheet (Figure 14), Stream/River Habitat Sketch Sheet (Figure 15), and Stream/River Habitat Assessment Field Sheet (Figure 16) are thoroughly completed.
3. The SCI is comprised of 20 individual sweeps. Determine the number of sweeps to perform in each habitat type out of the 20 total sweeps. First, use the Stream/River Habitat Sketch Sheet and the Physical/Chemical Characterization Field Sheet to determine the number of productive, present habitats at the site. Then, use the following conventions to determine the number of sweeps to perform in each habitat type:
  - a. If one productive habitat is present, perform ten sweeps in that habitat and ten sweeps in a minor habitat.
  - b. If two productive habitats are present, perform seven sweeps in each of those habitats and six sweeps in a minor habitat.
  - c. If three productive habitats are present, perform five sweeps in each of those habitats and five sweeps in a minor habitat.
  - d. If four productive habitats are present, perform four sweeps in each of those habitats and four sweeps in a minor habitat.

- e. If five productive habitats are present, perform three sweeps in each of those habitats and five sweeps in a minor habitat.
4. Generally, the most (to least) productive habitat types are as follows: leaf packs, snags, aquatic vegetation, roots/undercut banks, rocky outcrops, muck, and sand. All but the last two can be considered “major” or “productive.” Remember, substrates that did not have at least two square meters present in the 100 m reach can still be sampled as a minor habitat. If sufficient material is not available for performing the specified number of sweeps in a given major habitat, do as many as possible in that habitat type, and perform extra sweeps in the other habitats to total 20. Proper interpretation of benthic collections requires that samples be collected from multiple habitats that are representative of the site.
  5. Perform 20 discrete 0.5 m sweeps with the D-frame dipnet. One sweep is defined as sampling a habitat or portion of a habitat that is one dipnet width wide (0.3 m) and approximately 0.5 m long. Several passes (three or more) over the same section of habitat are recommended to make sure all organisms are captured.
    - In streams with sufficient water velocity, the most effective way to capture invertebrates is to place the bottom rim of the dipnet downstream of the area to be sampled. Disturb, agitate, or dislodge organisms (with hands and/or feet, or brush, where appropriate) from substrates (snags, etc.) working as closely to the net as possible. If you are sampling from a boat, you can get out of the boat and wade in shallow shore areas to obtain the sweeps. You can also approach a habitat with the boat from downstream, agitate and sweep the reachable portion of the habitat (typically by leaning from the bow of the boat), to capture organisms.
    - For areas with little flow, disturb an area of substrate that is one dipnet width wide and approximately 0.5 m long, and sweep the net over the area at least three times to ensure the capture of organisms which were living there.
    - For heavily vegetated areas, place the net at the base of the vegetation and dislodge organisms using your hand or a 0.5 m sweeping motion with the net. Where a continuous 0.5 m sweep is impossible, take two 0.25 m sweeps of the same habitat to attain a full 0.5 m sweep.
    - Sample leaf packs (partially decayed leaf material caught against snags, vegetation, etc. that is suspended in the water column) by disturbing leaf pack areas with hands or feet before scooping 0.5 m worth of material into the net. This is best achieved by positioning the net downstream of the leaf pack and grabbing a portion (0.5 m worth) of the leaf pack with your hand (if possible) and place it directly into the net. You will need to reduce the amount of material collected before transferring the sweep to the sample container (discussed later on). When sampling leaf mats (partially decayed leaf material, usually found settled on the substrate bottom), make sure that only the top 2 cm of material is collected, and especially make sure that anaerobic leaf material is not included.

- Sand, muck, mud, and silt (minor habitats) can be sampled by agitating the top 2 cm of substrate (with hands, feet, or brush) and taking three 0.5 m sweeps over the area. If the net is pushed into coarse sand or coarse detritus, very little of the sand or detritus will be washed through the net, resulting in a sample that contains few organisms and is hard to process, thus compromising the quality of the entire sample. Before transferring to the sample container, agitate the contents of the net in order to sift out the smaller particles.
  - Record the number of sweeps for each habitat on the Physical/Chemical Characterization Field Sheet.
6. Reduce the sample volume after each discrete sample by dislodging organisms from larger debris (but retaining invertebrates in the net) and discarding the debris. For leaf packs/mats, this means removing individual leaves and thoroughly examining them for organisms before discarding. Save finer debris plus organism mixture in large wide-mouth jugs. Make every effort to reduce enough of the sample volume in the field so that no more than four liters (2 jugs) of material are collected. If this is not possible, put the material into additional jugs. Indicate on the label in how many jugs the entire sample is contained, e.g., “1 of 2,” “2 of 2.” Please note, the RQ on each SCI jug must correspond with the RQ for the water chemistry samples collected at that site.

### **Sample Preservation and Handling**

Preserve with buffered formaldehyde (see Figure 19). Do this by adding one part of buffered formaldehyde to the jug with nine parts ambient water (see alternate preservation method below). First, add nine parts ambient water. Then add one part buffered formaldehyde, regardless of the amount of material in the jug. For example, if the container is only half full, add ambient water to fill approximately 9/10ths of the jug, and then add the formaldehyde to raise the water level approximately 1/10th. If the container is nearly full with material, add ambient water to fill approximately 9/10ths of the jug, and add in formaldehyde to raise the water level 1/10th. Be sure to not overfill the containers with material (leave enough space to add the appropriate amounts of water and formaldehyde). Also, be sure to leave an inch or two of headspace at the top of the jug. Use tape such as paraffin tape to seal the lid, and place SCI jugs in a large ziplock bag. Always transport preserved SCI samples in an upright position. Containers should be arranged in the cooler in a manner that will minimize shifting during transport. SCI samples may be submitted to the laboratory at a separate time from the water chemistry samples if it is more convenient, but be sure to include a custody sheet with a comment indicating water samples were shipped separately. Please note, the RQ used for the SCI samples must match the associated water chemistry samples for each site.

An alternate preservation method is required for using diluted buffered formaldehyde (formalin) that is prepared and supplied from the FDEP laboratory. Samplers will not use any ambient water with this formaldehyde. The formaldehyde has been recycled and is already diluted. Once the jugs are ready (filled with material), samplers will pour the diluted buffered formaldehyde in the jug to within the top 1-2 inches, regardless of the amount of material—samplers will not

follow the “nine parts ambient water and one part buffered formaldehyde” rule. This formaldehyde is already diluted and is ready to use as a straight solution. Samplers will be notified if/when they receive this diluted formaldehyde upon restocking. Be sure to follow this alternate preservation method if appropriate.

## SECTION 9. RAPID PERIPHYTON SURVEY PROTOCOLS

### Introduction

This sampling procedure requires specific training and a demonstration of competency due to the expert judgment exercised during field sampling. It is recommended that individuals conducting this survey should train with FDEP staff (via workshops and/or participating in field sampling).

The rapid periphyton survey (RPS) will be performed in conjunction for all streams and rivers in the Status Network (including during the repeat visit) and twice annually (6 months apart) for all SWTV sites. The RPS will be performed for all sites including: lake-like streams and rivers, spring runs, tidally influenced systems, and low or no flow waterbodies, regardless of conductivity values. The only time the RPS may be omitted is if the system is unsafe or there are access issues. The Habitat Assessment will need to be performed anytime the RPS is performed. Surface water chemistry samples and water quality parameters (D.O., pH, etc.) will be collected before performing the RPS, just prior to the Habitat Assessment (see Sections 5 and 7).

### Equipment and Supplies

The following will be needed in order to perform the Rapid Periphyton Survey (RPS):

1. Ruler to measure a 5 cm distance
2. Rapid Periphyton Data Sheet (Figure 17)
3. Completed Physical/Chemical Characterization Field Sheet (Figure 14)
4. Completed Stream/River Habitat Sketch Sheet (Figure 15)
5. Completed Habitat Assessment Field Sheet (Figure 16)

### Method

1. Measure a 100m segment of stream, placing flags every 10m. Conduct a standard stream habitat assessment. If desired, the following algal observations can be done during the habitat mapping process.
2. Beginning at the "0" flag, establish a transect of 9 approximately equidistant points across the stream. Point 1 would be located approximately 0.1 m from the right bank, point 5 is at the middle, and point 9 located 0.1 m from the left bank. The remaining points are sequentially distributed between these points, approximately equidistantly.
3. Each observation point, within the above distance parameters, should be chosen haphazardly. That is, choose the actual point without looking (thereby potentially biasing your selection).
4. After selecting the observation point:
  - a) If the substrate can be reached, grab a handful of material at the observation point, being careful not to lose material when bringing it to the surface. Examine the material, first out of the water, and then with the hand located approximately 2 cm below the surface. Note on the datasheet if algae are visible and measure

its average thickness, perpendicular to the substrate, with a ruler. Record these data using the rank thickness classifications on the data sheet as follows; “0” indicates a rough surface with no algae, “1” for algae less than 0.5 mm OR no algae visible but surface is slimy (including muck), “2” for 0.5 mm to 1 mm, “3” indicates an algal cover of greater than 1 mm but less than 6 mm, “4” for 6-20 mm, “5” for 2 cm to 10 cm, and “6” for algal cover greater than 10 cm. NOTE: examine the first substrate you encounter, which may not always be the stream bed (e.g., snag, plants, roots). Make your observations at the point where the hand encounters the substrate (i.e., if a 0.5 m long snag is grabbed, record the algal thickness based on where the hand touches it, not elsewhere). Take the measurement where the algae is representative of the entire amount in your hand (i.e. avoid measuring a single long filament when most of substrate has only a thin coating).

- b) Record the type of algae seen (filamentous, diatoms, or other). Please note, floating algal mats can be included in the RPS if they are encountered. However, it should be recorded as “filamentous” and commented in the comments section as a “floating algal mat”.
  - c) If the substrate cannot be seen (e.g., in tannic waters) and can not be reached with the hand (non-wadeable areas), record an “X”, for that point, indicating observations are not possible using this method.
  - d) If algae can be seen but not reached, then record as “visible” and visually estimate the average thickness perpendicular to the substrate.
  - e) If the substrate cannot be brought to the surface (e.g., a large rock or snag) but it is reachable, then rub the surface of the substrate and visually inspect to determine the presence/absence of algae and approximate thickness.
5. Additionally, at point 5 on each of the 11 transects, canopy cover should be measured using a spherical densiometer. The densiometer consists of a concave mirror with gridwork that creates 24 ¼-inch etched boxes. Each box can be subdivided into 4 smaller squares, via an imaginary dot in the center of each box, to create a total of 96 smaller squares that can be counted within the entire densiometer. Hold the instrument far enough away from the body so the operator’s head is just outside the grid. Count the number of small squares (out of a total of 96) that DO NOT have tree canopy. Subtract this number from 96 to determine the number of dots WITH tree cover. Record this number (number of dots WITH canopy cover) for each transect under the Canopy column for point 5.
6. Repeat of the above procedures every 10m, including the 100m mark, for a total of 99 periphyton observation points.

## SECTION 10. SAMPLE PRESERVATION

Samples must be preserved within 15 minutes of collection.

### Acid Preservation

The acid preservation sequence is designed to reduce cross-contamination. Exposure to the nitric acid preservative could affect the nutrient analysis, so the nutrients bottle is preserved first, and set aside, before preserving the metals. Remember:

1. Preserve nutrients with sulfuric acid first. Set aside.
2. Preserve metals with nitric acid last.

The acids will be provided in polypropylene vials by FDEP WMS. Each vial contains 1 ml of concentrated American Chemical Society grade nitric or sulfuric acid. After adding the acid, check the pH of the samples with narrow range pH paper (usually pH 0-3 range paper) to verify the pH of the samples is less than 2. If acids not supplied from FDEP WMS are used for preservation, this information must be documented on field sheets and in the appropriate log books.

1. Wear unpowdered, disposable latex gloves and eye protection when handling acids.
2. First preserve the nutrients sample with sulfuric acid. For all networks and resources, this sample is a 500 ml bottle. Use one vial of acid for each bottle.
3. Unscrew the cap on one of the concentrated sulfuric acid vials, and pour the contents into the sample bottle.
4. Discard the vial and its cap in an acid waste container.
5. Cap the sample bottle tightly and invert it to mix the acid with the sample.
6. Confirm that the pH of the sample is now less than 2. Uncap the sample bottle, pour a few milliliters of the sample from the container into a disposable cup, and place narrow range pH paper in the cup. Alternatively, pour a small amount of sample directly onto the narrow range pH paper over the acid waste container. Do not dip the pH paper into the sample bottle.
7. Discard the aliquot and disposable cup into the acid waste container after measuring the pH. Do not pour the aliquot back into the sample bottle.
8. If the pH is still over 2, add about half of a vial of acid and recheck the pH until the pH is lowered adequately. Document this deviation in typical preservation procedure on the field sheet and custody sheet.
9. Tightly cap the nutrients bottle when the pH is below 2, place in a Ziploc bag and set aside. This is important to avoid contaminating the nutrients sample with nitric acid.
10. Preserve the metals bottle with nitric acid. This is a 500 ml bottle for all networks and resources (for the October GWTV only, there will be an additional 125 ml metals bottle).
11. Follow the same procedure, using nitric acid, and check that the pH is less than 2.
12. Place the bottle in a separate Ziploc bag after preservation.

## **Storage and Disposal of Acid Preservatives**

Acid preservatives are carried in sealed vials and are not opened until the time of sampling. Store away from direct sunlight. Place empty used vials into a sealed container and dispose of in the lab. The acid should be diluted/neutralized to a pH between 5 and 9, and can then be poured down a sanitary sewer system. The vials should be rinsed several times with tap water, and the water discarded down the drain. The rinsed vials can be placed in the trash or recycled, if available.

## **Preservation on Wet Ice**

All water quality chemistry samples must be quickly bagged and placed on wet ice after collection and acid preservation.

1. Wear unpowdered, disposable latex gloves while handling sample containers.
2. Separate the nutrients and total organic carbon sample(s) from other samples and put the bottle(s) together into a zip top baggy.
3. Place the metals sample into a separate baggy. Note these two steps are an extra precaution to prevent cross-contamination.
4. Place all microbiology samples into a separate zip top baggy to prevent losing them from leakage.
5. Put all samples from a single station into a large bag.
6. Place the bag of samples into a cooler. Pack wet ice around the bag to quickly chill the samples to  $\leq 6^{\circ}\text{C}$ . Be sure to secure the cooler spigot with tape to prevent leaking.
7. Document and ship the samples as described in Sections 11 and 12.

## **Preservation for SCI Samples**

All SCI samples are preserved with buffered formaldehyde as described in Section 8. They do not need to be placed on wet ice, but doing so will not alter the sample. Use tape such as paraffin tape to seal the lid and prevent leaking. Always transport buffered formaldehyde and preserved SCI samples in an upright position.

## **Preservation for Sediment Samples**

All sediment samples need to be placed back into their bubble wrap bags and placed on wet ice to  $\leq 6^{\circ}\text{C}$ . Use tape such as paraffin tape to seal the lid and prevent leaking. They do not require acid or any other preservative.

## SECTION 11. SAMPLE DOCUMENTATION

Sample documentation is of critical importance to the objectives of the Status and Trend Monitoring Networks. Data gathered on these projects is entered into an existing statewide water quality database, and must be properly linked to historical data. The database is also a source of public information and is used for a variety of purposes. The data must be accurate to avoid incorrect evaluations and decisions on the State's water resources. All FDEP WMS documentation requirements are based on the FDEP SOPs.

Sample documentation begins in the FDEP Central Chemistry and Biology Laboratories. A label is placed on each container with the RQ number, the major analyte group, a notation if filtration is required, and the preservation method (Figure 28).

FDEP WMS provides the agencies with station identification labels (Figure 5) that are bar coded to uniquely identify a sample station. The field technicians place these labels vertically on the sample containers and also on the custody sheet. This links the station to the containers and to the custody sheet. Refer to Section 12 for more information concerning custody sheets and sample shipping.

All field sheets are supplied by FDEP WMS. Be sure that the most current versions are used by observing the date printed on the form. Agencies should retain a copy of all paperwork that is sent to the Tallahassee project manager.

All documentation records (all field sheets, all log books, etc.) must be maintained for a minimum of 5 years after the date of project completion. However, the Status and Trend projects are ongoing with no "completion date". Therefore, at this time, all records must be kept indefinitely.

### General

All paper documentation records must be recorded in waterproof ink (except the Habitat Assessment sketch map, which may be drawn in pencil). Do not erase or obliterate records. Make corrections by marking a single line through the error so that it is still legible, and include the initials of the individual performing the correction. All documentation needs to be legible.

### Standards, Buffers and Reagents

Documentation on calibration standards (e.g., buffers, KCl, and other reagents) must be maintained in a log book. See Figure 22. Record the following for each bottle:

- standard value
- vendor
- date of receipt
- expiration date
- date of first use
- lot number

For bottles that have identical information, designate each bottle with a letter or number to differentiate them from each other (“A”, “B”, “C” or “1”, “2”, “3”, etc.).

If reagents or standards are prepared in-house from stock chemicals, all calculations used to formulate the standards, date of preparation, the procedures used, and analyst performing the preparation must also be documented.

Note the date of receipt, expiration dates, and date of first use directly on the standard/buffer container. If provided, retain vendor assay specifications for standards and buffers (only one vendor assay certificate per concentration, per lot number is needed for retention).

### **Calibrations and Verifications**

Document all acceptable and non-acceptable calibrations and verifications in a log book. See Figure 23. The following information must be linked to a specific site or project and include:

- unique identifier for instrument being used
- time and date for all calibrations and verifications
- value of standard or buffer being used, including units
- lot numbers for standards or buffers used
- instrument reading, including units
- indication of pass or failure
- name of analyst(s) performing the calibration or verification
- time and date of any corrective actions

### **Equipment Maintenance**

Log all maintenance and repairs performed for each instrument or piece of sampling equipment, including routine procedures, corrective actions, and solution or parts replacement for instrument probes in a log book. For any equipment that is serviced outside of the agency, vendor service records need to be retained for all affected equipment. For rental equipment, dates of use, type and a unique description needs to be documented. Manufacturers’ operation and maintenance manuals and instructions need to be retained for all equipment and instruments. See Figure 24 for an example of a log book. The following information must be included:

- specific piece of equipment or instrument
- serial number
- unique identifier
- date
- description of procedure performed
- comments, including indication if the instrument/equipment was removed from service, maintenance performed in the field or lab, etc.
- initials of analyst performing maintenance

## Equipment Cleaning

For all equipment and supplies, document any and all cleaning procedures, whether performed in the lab or in the field, in a log book. See Figure 25. The following information must be included:

- specific piece of equipment or supplies (multiple duplicate items must be entered separately)
- unique identifier, if applicable
- date (if items are cleaned in the field, document the time of field cleaning, as well)
- indication of where the cleaning was performed (lab or field)
- step by step description of cleaning procedure; or reference specific page of sampling manual (for ex., “Dec. '05 SM pg. 67-71”)
- initials of analyst performing cleaning

If you obtain DI water from an alternate source other than your own lab, you must record the source, the date received and the inclusive dates of use for each batch of DI water.

## Surface Water and Sediment Sampling

All information listed on the current version of the surface water field sheet is required documentation, as applicable. For all relevant information, units are required. See Figure 12. Specifically, the following information must be included:

- station name (Random ID for Status, ex. Z1-SL-3001)
- date
- waterbody type
- waterbody name (if known)
- total water depth
- secchi depth
- stage reading
- stream flow
- water level
- water sample collection device
- sediment collection depth
- sediment collection time
- general sediment collection area
- sediment collection device
- sediment type
- sediment odor
- sediment color
- number of sediments grabs collected
- type of QA/QC collected and time
- weather conditions
- personnel or visitors on site
- field measurements, including: time, surface depth collected, bottom depth collected, top and bottom pH, dissolved oxygen, temperature and conductivity, unique meter ID, initials of analyst reading measurements
- preservation information, including verification
- comments
- printed samplers names and signatures
- use of fuel-powered equipment (if applicable)
- Stream Condition Index information
- Periphyton Information

## Groundwater Sampling

All information listed on the current version of the groundwater field sheet is required documentation, as applicable. For all relevant information, units are required. See Figure 11. Specifically, the following information must be included:

- sampling agency
- Status Random ID (ex. Z1-CA-3001)
- land surface elevation
- measuring point elevation
- FLUWID
- station name (originates from OGWIS)
- casing material
- casing diameter
- well owner
- project
- total depth
- waterbody
- date and time on site
- date and time off site
- water column height (two readings) and calculations
- purge method
- purge volume and calculations
- purge rate
- purge and sample pump ID
- type of purge equipment used
- type of sampling equipment used
- use of fuel-powered equipment (if applicable)
- minimum purge time
- time purge began
- time purge ended
- total purge volume
- time sampling began
- time sampling ended
- type of QA/QC samples collected and time
- well conditions
- placement depth of tubing or pump intake
- indication of drawdown
- indication of sulfur odors present
- personnel or visitors on site
- weather conditions
- preservation information, including verification
- comments
- field measurements, including: time, volume purged, purge rate, depth to water, pH, dissolved oxygen, temperature, conductivity and turbidity, unique meter ID, initials of analyst reading measurements
- printed samplers names and signatures

## Habitat Assessment and Biological Sampling

All information listed on the current versions of the Physical/Chemical Characterization Field Sheet, the Stream/River Habitat Sketch Sheet, the Stream/River Habitat Assessment Field Sheet and the Rapid Periphyton Survey form is required documentation, as applicable. For all relevant information, units are required. See Figures 14, 15, 16 and 17.

## Custody Sheets

All information listed on the current version of the custody sheet is required documentation, as applicable. For all relevant information, units are required. See Figure 2. Specifically, the following information must be included:

- sampling agency
- project
- sampler names
- shipping method
- shipping date
- lab project code
- station label
- station name
- sample collection date and time
- matrix (“water” for chemistry, “biology” for SCI samples, “sediment” for sediment samples)
- field readings including: specific conductance, pH, dissolved oxygen and temperature
- preservation information
- RQ label
- Comments (such as “added 1 ml additional acid”, “blank not filtered”, “water chemistry samples submitted separately”, etc)

The back of the custody sheet lists the analytes to be measured, the container type that will hold the water sample for a group of analytes, and the methods for preserving the water sample. If the exact bottles listed on the reverse of the custody sheet are not submitted as indicated per project, or if filtration or preservation protocols differed than what is listed, this information **must** be noted in the comments section.

## SECTION 12. SAMPLE CUSTODY AND SHIPMENT

### Custody Sheets

FDEP WMS custody sheets are to be used for all sample submittals for both the Status and Trend networks, regardless whether the Tallahassee lab has included a separate custody sheet with the sample coolers. After all information is completed, the top copy of the custody sheet (white sheet) is placed in a sealed plastic bag and taped to the inside top of the FDEP cooler for shipment back to the Central Chemistry Lab with the samples. At the FDEP Chemistry Lab, information on the sample custody sheet is used to log in the samples. The back of the custody sheet lists the analytes to be measured, the container type that will hold the water sample for a group of analytes, and the methods for preserving the water sample. If the exact bottles listed on the reverse of the custody sheet are not submitted as indicated per project, or if filtration or preservation protocols differed than what is listed, this information **must** be noted in the comments section. The yellow copy of the custody sheet can be sent to the FDEP project manager. The pink copy is for the sampling agency and should be retained and placed in the field log book.

Current custody sheets will be provided to each sampling agency near the beginning of each scheduled sampling resource. You may obtain more custody sheets at any time by contacting the FDEP QA Officer.

Select “water” as the matrix for the water chemistry samples on the custody sheet. The sediment samples should be entered as “sediment”, while the SCI should be entered as “biology”. Only the entry for the water chemistry sample must have field measurements recorded (pH, DO, temperature, etc.). Biology and sediment samples must be recorded as separate entries from the water chemistry samples. Additional field measurements are not required, but a separate collection time must be recorded. Please note, the RQs used for the SCI or sediment sample must match the associated water chemistry samples for each site.

For all surface water projects, record the “Primary” (surface) field measurements on the custody sheet. The sample collection time recorded on the custody sheet should match the “Primary” field measurement time, as well as the time recorded on the sample containers.

For all ground water projects, record the final field measurement after reaching stability on the custody sheet. However, the sample collection time recorded on the custody sheet should match the time recorded on the field sheet under the “Time Sampling Began” section. This is also the time that should be recorded on the sample containers.

### Packing and Shipping Procedures for Coolers

#### Packing the cooler:

- Line the inside of the cooler with a large garbage bag prior to filling it with ice. If the cooler has a spigot, ensure that it has been plugged to prevent it from leaking water during shipment. Most coolers have been plugged with silicon.

- Separate the sulfuric acid preserved sample(s) from other samples and put the bottle(s) together into a zip top bag.
- Place the nitric acid preserved sample(s) into a separate zip top bag.
- Place all microbiology samples into a separate zip top bag.
- Put all samples from a single station into a larger zip top bag.
- Place the bag of samples into the cooler of ice. Make sure to pack the ice completely around the samples to quickly chill them to  $\leq 6^{\circ}\text{C}$ .
- The FDEP Lab provides pre-printed FedEx airway bills to sampling agencies for use when shipping the samples back to Tallahassee. These airway bills will be pre-printed with FDEP's FedEx account number (to which the shipping charges are invoiced) and the Central Lab shipping address. Always use the pre-printed airway bills provided. Handwritten 'ship to' and account information should be avoided.
- Always fill out one FedEx airway bill per cooler. Complete the "Sender Information" section of the form, and indicate "Priority Overnight" as the desired service. The top copy of the airway bill is the "Sender" copy and should be retained for the preparer's files.
- Complete the WMS custody sheet and place the white copy of the custody sheet in a plastic zip top bag and tape it to the inside top lid of the cooler.
- Twist or tie the large cooler liner (garbage bag) at the top, and thoroughly tape the lid closed to prevent opening during shipment.
- Place the FEDEX airway bill inside the plastic sleeve provided and attach it to the top of the cooler. Securely tape the sleeve on three sides leaving the opening unobstructed. Alternatively, if provided, samplers may use the luggage-tag style airway bill sleeve as long as the handles for the cooler appear to be sturdy and in acceptable condition.

### **Shipping the cooler:**

- Ship all samples to the FDEP Central Laboratory in Tallahassee.
- Ship samples on the same day of collection. If this is not possible, be sure the samples are kept  $\leq 6^{\circ}\text{C}$  (add additional ice), and ship as soon as possible. Notify the Lab if samples will be arriving late. The Lab can watch for these samples and schedule the analyses to meet holding times.
- Samples must be shipped so they are received at the Lab Monday through Friday. The Lab does not receive or analyze samples on holidays or weekends, so samples received after Friday or on a holiday will not be analyzed within holding times. Late samples will be discarded, and samplers may be required to recollect the samples at the discretion of the Project Manager. If samples are anticipated to arrive at the lab after 3:00 p.m., be sure to contact the Lab.
- A list of available FEDEX authorized shipping centers should be researched and compiled. Be sure to have this list available at all times while in the field. Samplers should refer to this list to determine the nearest drop-off location they need to relinquish the coolers to for overnight shipment. The drop-off cut-off times for each center will vary, so samplers will need to contact the drop-off location ahead of time to find out the latest time they need to meet in order to get the overnight shipment. Do not leave any coolers at an unmanned FEDEX drop-box.
- Samplers may also call **1-800-463-3339 (1-800-GOFEDEX)** to find the nearest drop-off location. The call is received by an automated FEDEX answering system. When the options are provided, indicate "option 0" in order to speak to a representative who can give you the

locations for a staffed drop-off location. By using the automated system, you will be given locations that include unmanned drop-boxes, which are not permitted to use. Be prepared to give a zip code or phone number for the area in question. Otherwise, samplers can find all staffed locations by going online anytime at [www.fedex.com](http://www.fedex.com).

- Samplers also have the option of calling and scheduling an arranged pick-up at their base of operations. To make these arrangements, samplers should call the FEDEX Customer Service number at 1-800-463-3339 (1-800-GOFEDEX). When calls for scheduled pick-ups are routine, be sure the coolers are left in the same location consistently. Pick-ups should not be scheduled for any time after the base of operations (building) is closed to the public. Coolers that are not picked-up before the building closes to the public should either be dropped off at a FEDEX authorized shipping center (or partnered facility) or the sampler must wait at the building to ensure after-hours pick-up by FEDEX personnel.
- Samplers working at facilities where a regular daily FEDEX pick-up occurs should be aware of the normally scheduled pick-up “window” during which the FEDEX driver is scheduled to arrive. If possible, coolers should be placed at the central, designated pick-up point by the prescribed time. Shipping activities should be coordinated with other staff at the facility that may need items picked up. Wherever possible, have one pickup spot for all outbound FEDEX items.

#### **What to do if you have a problem:**

- At the first sign of a problem, samplers should call FEDEX Customer Service at **1-800-463-3339 (1-800-GOFEDEX)**.
- Samplers should then contact the WMS QA Officer and/or their FDEP Project Manager.
- Be prepared to provide: the airway bill number for the cooler, name and telephone number of the person who prepared the cooler for shipping, location where the cooler was dropped off or left for FEDEX pickup and the time of day the cooler was dropped off or left for pickup.
- Information regarding how many samples were effected, the site/station name, and the project should be transmitted immediately to the FDEP Project Manager and the WMS QA Officer to determine if resampling should occur.

#### **Important Phone Numbers:**

- |                                   |   |
|-----------------------------------|---|
| • FEDEX Customer Service          | <b>1-800-463-3339<br/>(1-800-GOFEDEX)</b> |
| • WMS QA Officer, Shannon Gerardi | <b>850-245-8517</b>                       |
| • FDEP Lab Manager, Kate Brackett | <b>850-245-8095</b>                       |

#### **Resampling**

When Watershed Monitoring samples are received out of holding time or out of temperature compliance at the Lab (due to a shipping mishap), the receiving staff notifies the WMS QA Officer of the incident. Details regarding the notification normally include the following: which analytes were received out of hold, the sample collection date and time, the received date and time, the analysis date and time (if performed), and any qualifiers or non-compliance reports (NCR) that will be attached to the analytes of concern. If samples are received exceptionally late, the receiving staff will ask the QA Officer if the analyses should be cancelled in the

Laboratory Management Information System (LIMS). If analyses are cancelled, the QA Officer will discuss with the sampling crew and the Project Manager if scheduling a resampling event would be feasible. If the sampling crew is informed about the instance prior to the lab contacting the QA Officer or Project Manager, the sampling crew should contact the QA Officer and Project Manager immediately.

The decision to resample depends on several factors. If the lost (out of hold or not analyzable) analytes are part of the Trend (TV) Network, resampling may not be an option due to time constraints with the 25-35 day sampling window. For the Status Network, resampling might be possible within the index period. Time and logistics will determine if the samplers can get back out to the site(s) to resample. Furthermore, the decision to resample also depends on the number of affected analytes for the sampling event. If only microbiological samples are lost, rescheduling the sampling event is usually not done. If additional analytes are lost (those with holding times of **48 hours or less**), resampling is advisable. The option to resample will be discussed with the samplers to determine if time and logistics will permit resampling. The chart below lists the maximum holding times (with proper preservation) for the Status and Trend analytes.

Analyte	Maximum holding time
Microbiologicals (bacteria)	6 hours; >48 hours not analyzed
Alkalinity	14 days
Ammonia	28 days
Chloride	28 days
Chlorophyll	48 hours without filtering
Color	48 hours
Fluoride	28 days
Kjeldahl and organic nitrogen (TKN)	28 days
Metals	6 months
Nitrate-nitrite	28 days
Organic Carbon (TOC)	28 days
Phosphorus, total	28 days
Residue (TSS and TDS)	7 days
Specific conductance	28 days
Sulfate	28 days
Turbidity	48 hours

Sediment and Stream Condition Index (SCI) samples are normally not affected by holding times if they are properly preserved (wet ice and formalin, respectively). Therefore, if a resampling event is scheduled, the sediments and SCI will **not** be resampled as long as these samples have been properly preserved.

Field parameters (pH, conductivity, temperature and dissolved oxygen) and Trimble GPS information is collected for each Status Network sampling event and tied to the respective analytical data. If a resampling event is scheduled, the original field parameters and Trimble GPS information should be retained; in addition, samplers will need to recollect new information during the resampling event. This will result in two separate Trimble files for the same station. In order to ensure that the original file is not overwritten, samplers will need to immediately

**rename the original** Trimble file with a “B” designation added to the end of the file name. This must be done as soon as the samplers have been notified about the resampling event and **prior** to recollecting the new information; otherwise the original file will be overwritten. The second file should be named as normal; only the original file should have the new “B” designation.

### **Delayed Sampling**

Individual RQs for each project correspond to a specific week in which the samples are scheduled for collection, and likewise expected to be received at the lab. For example, RQ2008-05-12-35 means the samples are scheduled for collection during the week of May 12, 2008 (the 2 digits at the end just signify the total number of RQs the lab has in the LIMS system for that week). If sampling is delayed by more than roughly 2 weeks from the RQ date, the FDEP QA Officer and/or Kate Brackett needs to be notified. This also includes any RQs that have samples that won't be submitted to the lab at all due to exclusions, etc. Since the lab schedules and coordinates their analytical activities (especially biological samples including bacteria, chlorophyll, SCI, etc.) based on the RQ date that is scheduled in the LIMS system, if the expected samples are delayed (or cancelled), the lab needs to be notified so other priorities can be addressed or staff schedules adjusted.

## SECTION 13. QUALITY ASSURANCE/QUALITY CONTROL

Quality control (QC) samples assess the accuracy and precision of sampling and analytical techniques. For ground water and surface water sampling in both the Status and Trend Networks, the QC samples consist of equipment or field blanks and field reference samples. The sampling program is also monitored through field audits and quarterly QA reports.

### Equipment and Field Blanks

Blanks assess the cleanliness of the entire sampling system. Samples of analyte-free (de-ionized) water are collected in the same manner as actual samples. If compounds are detected in the blank, it indicates a problem in the sampling system that may also be affecting actual samples.

The major reasons for detections in blanks are:

- The water treatment system that provides the analyte free water needs maintenance or replacement.
- The containers used to transport the analyte-free water into the field were not clean.
- The sampling equipment was not cleaned properly.
- Improper sampling equipment was used.
- The filter was contaminated (filtered samples only).
- The sample containers were contaminated.
- The preservatives were not pure.
- The sampling process itself exposed the sample to contaminants.

**Equipment blanks** are collected with precleaned and/or field cleaned equipment. Precleaned equipment refers to equipment cleaned in-house prior to sampling. Both types of blanks are prepared in the field prior to using the equipment to collect a sample. Each piece of equipment that will come in contact with the sample needs to be included in the equipment blank collection. This includes all pump tubing, buckets, etc.

**Field blanks** refer to blanks where the only sampling equipment is the sample container, such as wells with in-place plumbing, or surface water grab samples. Field blanks are also collected if analytes are detected at high levels in equipment blanks. Field blanks are not filtered at well sites with in-place plumbing. This type of blank helps determine if the contamination is a result of tainted acid preservatives or impure analyte-free water instead of unclean sampling equipment.

Equipment blank and field blank procedures consist of filling **on-site** the suite of sample containers with analyte-free water (including all equipment for equipment blanks), preserving as with actual samples, sealing the containers, documenting it as a quality assurance sample/blank, and shipping it to the laboratory as is done with actual field samples. The custody sheet and field sheet should indicate that a blank sample was collected. Note the type of blank on the field sheet for the site where the blank was collected.

Generally, one blank is scheduled for every five actual samples. The blanks should represent the type of sampling conducted during a project. If most of the samples are collected without sampling equipment, then the blanks are field blanks. If sampling equipment used is cleaned

both in the lab and in the field, the equipment blanks throughout the project should be collected to represent both lab cleaning conditions and field cleaning conditions. This is referred to as precleaned equipment blanks and field cleaned equipment blanks, and both are collected on-site in the field.

Place the QA/QC blank label vertically on the sample containers (Figure 30). Place a label on the custody sheet and field sheet. Ship the blank samples along with the actual samples collected that day to the FDEP Central Laboratory.

#### **To collect blanks for Ground Water Projects:**

1. Fill a large clean HDPE container with analyte-free water and transport it into the field. This water should be from the same source and in the same container as the analyte-free water used in the final rinse of the equipment cleaning process.
2. Fill the dedicated equipment blank container with the analyte-free water.
3. Place the pump into the equipment blank container filled with analyte-free water.
4. Pump 5 volumes of water through the equipment. A volume will depend upon the capacity of the pump and attached tubing.
5. Fill the sample containers with the analyte free water from the pump.
6. Use the same filtration and preservation methods as with an actual sample.
7. For sites with in-place pumps, collect analyte-free water directly into the containers. Unless feasible, do not filter the blank samples (filtration using the 0.45 micron in-line filter may not be possible due to insufficient pressure to flush the filter using analyte-free water from a carboy). In this case, it is advisable to collect an additional blank from a well without in-place plumbing so that any influence (contamination possibilities) from the filter can be monitored.

#### **To collect blanks for Surface Water Projects:**

1. Fill a large clean HDPE container with analyte-free water and transport it into the field. This water should be from the same source as the analyte-free water used in the final rinse of the equipment cleaning process.
2. Fill the pre-cleaned sampling device, e.g. a Van Dorn sampler, with analyte-free water, and discard the water.
3. Refill, and use this water to fill the sample containers.
4. Use the same preservation methods as for an actual sample.
5. If no sampling device is used (grab sample sites), collect analyte-free water directly into the sample containers. Use the same preservation methods as for an actual sample.

#### **Blank collection is not required for the following analytes:**

- sediments
- SCI
- chlorophyll

## Field Reference Samples

Field reference samples are water samples with unknown levels of pH and specific conductance, used to test meter calibrations. The samples are prepared by the FDEP laboratory in Tallahassee, and the mean value of each pH and conductance lot number is reported to FDEP WMS. FRS bottles will be made and shipped to each sampling agency on a quarterly basis. Begin using each new shipment at the start of each quarter. However, if you have any remaining bottles left over at the end of each quarter, please do not discard them until the new quarterly batch is in hand.

Samplers should calibrate their meters, then analyze these samples **in the field** once for every 10 actual samples collected (this is a 10% frequency, which is a decrease from 20% for previous years). Record the values on a Field Reference Sample Reporting Form (Figure 31) and phone, fax or email the results to the FDEP QA Officer or Project Manager. They will compare the results to the FDEP lab mean value and determine if the results are satisfactory, marginal or unsatisfactory. Please make every attempt to find out the results of your FRS readings as soon as possible. The pH results are acceptable if the meter reads within 0.2 units of the mean value. Conductance is acceptable within 7% of the mean value. In case of unsatisfactory performance, check the meter for problems and analyze another reference sample. Typical reasons for poor performance on field reference samples are dirty probes, low batteries, contaminated standards, faulty meters, and analyst error. If the second reading is unsatisfactory, rinse the probe adequately and read an actual buffer or standard to make sure the reference sample is not contaminated or “bad”. If the buffer or standard is reading accurately, you may continue to collect samples. **Do not analyze field reference samples in place of a calibration verification.**

## Field Audits

Internal Audits: When under contract with an agency outside the DEP, the sampling agency Project Manager and/or QA Officer will audit sampling crews as specified in the contracts. The results of the audit are documented on the Audit Review Form (Figure 32) and discussed in the Quarterly QA Report (Figure 33).

External Audits: The FDEP QA Officer and/or Project Manager also audit each sampling agency. The frequency of the audits will depend on the type of sampling and number of samples collected by the agency. Audits are an on-site review of project preparation, calibration and verification procedures and results, field measurements, site selection (SW), purging techniques (GW), sample collection and preservation, sample custody, equipment cleaning, all log books, GPS procedures, and QA measures. The auditor uses a form (Figure 32) to record and summarize the results. Any problems identified during the audit are discussed with the samplers. Copies of the completed audit report are given to the samplers, Agency Project Manager, FDEP Project Manager and QA Officer within 90 days. Furthermore, samplers must submit a written acknowledgement addressing each corrective action that will be implemented (and how it will be prevented in the future) as a result of the deficiencies stated in the final audit report within 45 days of receipt. Problem areas and corrective actions should be documented in the quarterly QA Report.

Annual SCI Audits: The FDEP QA Officer and/or Project Manager will attempt to conduct annual check-up audits for all sampling personnel collecting SCI data. These audits will be done

similar to the initial FDEP Standards and Assessment Section SCI performance audits. Samplers will not be penalized if the QA Officer can not perform the check-up audit within the needed timeframe.

### **Quality System Audits**

On an annual basis, the FDEP QA Officer will perform a quality system audit to ensure compliance with all quality assurance plans and standard operating procedures (not a field audit). This audit will be performed in an unbiased fashion originating with data selected from a randomly selected date (meaning only one or a few sampling entities may be selected). All records (including laboratory data records) from the selected date will be reviewed for compliance from moment of collection (including all associated documentation records such as calibration logs, cleaning logs, etc.) to data reporting. A report will be issued indentifying any deficiencies and recommended corrective actions. Problem areas and corrective actions concerning the affected sampling entities should be documented in the quarterly QA Report.

### **Quarterly Quality Assurance Reports**

Every quarter, the QA Officer, Project Manager or lead sampler of the sampling agency will submit a QA report summarizing the QA/QC activities for the quarter, any problems, and corrective actions (Figure 33). These reports are generally 2-3 pages and include:

- a title page
- a summary of internal audits, including steps taken to address recommendations or significant problems
- a summary of external audits, including steps taken to address recommendations or significant problems
- the number of field reference samples analyzed; the number of unsatisfactory results and corrective action
- the number of blanks collected
- the total number of samples collected per resource and, if applicable, why the total number was less than scheduled (ex. ran out of time, all sites dry, etc.)
- any other significant problems

The reports are submitted to the FDEP Project Manager and QA Officer within 30 days of the end of the quarter.

## SECTION 14. GPS PROCEDURES

### Training and Equipment

Everyone will be using the Trimble GeoXT<sup>®</sup> Global Positioning System (GPS) equipment for Status Network sampling and must receive thorough instructions on the basic operating principles of GPS and correct use of GPS equipment and software. There are critical settings in the receiver, which need to be set correctly. Failure to do so will result in data that is of poor quality and its inclusion in a database will corrupt and invalidate the database. When using GPS equipment, make every effort to collect from the actual sampling position. Accurate measuring devices and compasses must be used if offsets are made. Handheld recreational grade GPS devices may be used to navigate to a site, but data must be collected with the resource grade GPS unit supplied by WMS.

The Status Network incorporates the use of randomly selected coordinates for the identification of sample stations and which requires extensive use of GPS equipment. GPS equipment is used to navigate to randomly selected sites and for collection of locational and field data. The random coordinates or sites are selected as specified in the WMS Overview of the Florida Department of Environmental Protection's Integrated Water Resource Monitoring Efforts and the Design Plan of the Status Network. All participants of the Status Network should be using Trimble GeoXT<sup>®</sup> GPS equipment to accomplish the sampling objectives.

### Waypoints

Navigation to stations will require the creation of waypoints. The waypoint files will contain the site ID and the corresponding latitude and longitude. The GeoXT<sup>®</sup> will also require an altitude to be entered. This altitude will either be as HAE (Height Above Ellipsoid) or MSL (Mean Sea Level). Florida is a flat enough state that a default value of 30m HAE will be sufficient for accurate navigation to a station.

A waypoint file can be created in the office or field using TerraSync<sup>®</sup> software loaded on the GeoXT<sup>®</sup> unit. These files can be created in the Navigation menu of TerraSync<sup>®</sup>. The creation of waypoint files is addressed in detail in the Division of Environmental Assessment and Restoration's GPS Training.

### Navigation and Data Collection

Navigating to randomly selected ground water sites can present many problems. GPS signals are line-of-sight microwave signals that are easily blocked by any mass, including well houses and tree canopies. Navigating to surface water sites also presents many problems, especially for small streams and small lakes. Heavy tree canopies typically cover these water bodies. To correctly compensate for line-of-sight obstructions, navigate as close as possible to the random point and then read the distance-to-go and bearing to find the location of the resource.

When collecting the location of a well, it is important to make sure the GPS antenna is placed as close to the center of the wellhead as possible. If the well is located within a building, an offset will be needed. Offsets are taken by measuring a distance and bearing from some point (Point B) away from the intended point (Point A “the well”) and applying those measurements to correct back to the intended point (Point B + distance & bearing = Point A). Always remember, “The GPS knows where it is, you have to tell it where you want the point to be” and use a compass and tape measure for accuracy. The offset should be saved and the locational data collected. Once the locational data are captured, the data dictionary questions should be completed and then the file saved. There should only be one saved file per site. Offsets and navigation can be complex and are covered in the WMS GPS Basics Manual. With practice, a sampler should become quite proficient.

### **File Nomenclature**

The GPS data file (.ssf file) is named according to the resource being sampled. For example, small lake number 1 in Northwest Florida Water Management District zone 1 would be named; Z1-SL-5001 if it were to be sampled in the year 2011. The GPS site location and sample data are then recorded in the data logger in the file named Z1-SL-5001. For the revisits to Status surface water sites, the sites would be named with the letter “R” on the end. For example the site above would be called Z1-SL-5001R when it is visited the second time.

### **Data Dictionary**

The Status Network will also incorporate the use of a standard data dictionary (a Trimble electronic form) residing in the data logger memory. The data dictionary will contain all of the questions that are found on the field sheets. While collecting the locational data, you should answer the questions in the data dictionary by following the field sheets. Once the data dictionary questions have been answered, the file must be saved. Many fields in the data dictionary require input and are restricted to certain constraints. For example, the pH range that is allowed to be entered into the data logger is between 0 and 14. The default is set to 0. A value of 0 in the data will signify that a problem had occurred and no data were collected for that analyte at that site. These constraints and defaults are also in other fields throughout the data dictionary. For updated data dictionaries, please visit <http://publicfiles.dep.state.fl.us/DEAR/Watershed%20Monitoring/>.

### **Contact**

Contact **Zach Bowden at 850-245-8650** or by email at Zachary.Bowden@dep.state.fl.us for additional information.

## SECTION 15. EQUIPMENT CLEANING

### Introduction

Cleaning and decontamination procedures must remove the analytes we measure from all equipment that contacts a sample during the sample collection process. Detergents and cleaning supplies cannot contain these analytes unless they are removed in a subsequent step. Cleaning procedures will be measured with equipment blanks, which should have undetectable levels of the measured analytes. Cleaning procedures and frequencies are summarized in Table 5.

### Specifications for Cleaning Materials

Analyte-Free Water: This is water in which all analytes of interest are below the method detection limits. Use analyte-free water for final rinse of equipment and to prepare blanks. Empty and refill small containers of analyte-free water (such as squirt bottles) daily. Do not store water in larger containers for more than one week.

Detergent: Liqui-Nox is recommended, although other non-phosphate laboratory detergents may be used. Liqui-Nox may be diluted with analyte-free water and stored in a squirt bottle. Optionally, Luminox (or a non-phosphate solvent based equivalent) can be used instead of Liqui-Nox. Luminox (or equivalent) is recommended by EPA since solvent rinses can be eliminated from the cleaning process.

Solvent rinses: Pesticide grade isopropanol should be used as a rinse solvent ONLY if volatiles or extractable organics are collected. As of January 2010, we are not collecting either of these analytical groups. Therefore, isopropanol rinses should not be used at this time.

Acid Rinses: Reagent grade hydrochloric acid should be used as a rinse when metals or inorganic analytes are collected. Both of these analyte groups are being collected for both the Status and Trend networks, for all resources. Therefore, rinse all non-stainless steel equipment with 10% hydrochloric acid (1 volume concentrated hydrochloric and 3 volumes de-ionized water). You may use 10-15% nitric acid (one volume concentrated nitric acid and 5 volumes de-ionized water) as a rinse, but must follow it with a hydrochloric acid rinse to avoid influencing the nitrogen samples. Dispose of acids properly.

### Handling and Containers for Cleaning Solutions

Improperly handled cleaning solutions may easily become contaminated. Storage and application containers must be constructed of the proper materials to ensure their integrity. Following are acceptable materials used for containing the specified cleaning solutions:

- Soap must be kept in the original or clean high density polyethylene (HDPE) or polypropylene (PP) containers until used.
- Tap water may be kept in clean tanks, hand pressure sprayers, squeeze bottles, or applied directly from a hose.
- Analyte-free water must be stored in clean glass, Teflon<sup>®</sup>, HDPE or PP containers that can be closed to the environment. Place a label with the date on the container

when filling it and discard water after one week. Water can be applied from plastic squeeze bottles. Change water in squeeze bottles daily.

### **General Cleaning Requirements**

Some of the materials used to implement the cleaning procedures can be harmful if used improperly. Use caution and follow safety procedures. Wear safety glasses with splash shields or goggles, and latex gloves. Avoid touching your mouth or eyes during cleaning operations and do not eat, drink or smoke.

Clean equipment in a designated area of a controlled environment. Take precleaned equipment to the field whenever possible, so that the sampling can be conducted without cleaning equipment in the field.

Wrap clean equipment in aluminum foil, untreated butcher paper or clean plastic bags. Keep separate from used equipment. After sampling, immediately rinse all equipment with water. If necessary, clean on site, or return to base of operations for cleaning.

#### **The general cleaning procedure:**

1. Rinse with hot tap water
2. Soak in hot soapy tap water.
3. Scrub with brush to remove particulates or surface film.
4. Rinse with hot tap water.
5. Rinse with hydrochloric acid (do not use on stainless steel equipment).
6. Rinse thoroughly with analyte-free water.
7. Air dry.
8. Wrap and store properly.

For field cleaning, use ambient temperature water and omit the acid rinse. In-house cleaning with hot water and the acid rinse is recommended whenever possible. If the equipment is heavily contaminated, it may be necessary to steam clean the field equipment before cleaning with soap and water. If the equipment cannot be cleaned with these procedures, it should be discarded unless further cleaning with stronger solvents and/or oxidizing solutions are effective.

**NOTE: If metals are detected in equipment blanks after the cleaning procedure, then sampling equipment (excluding stainless steel equipment) will have to be rinsed with 10% reagent grade HCl, prior to rinsing with analyte-free water, when field cleaning.**

### **Cleaning Procedures for Specific Equipment**

#### **Water Level Measuring Devices**

Wipe down equipment body, probes, and cables with hot soapy water. Rinse with tap water, then analyte-free water and air dry. Store properly.

#### **Submersible Pumps**

Follow the general procedure above.

Clean the internal cavity and mechanism:

- a) If the pump is used for purging only, then it must be completely flushed with tap water prior to purging the next well.
- b) If the pump is used for purging and sampling, then it must be completely disassembled (if so designed) and decontaminated between each well.
- c) If the pump cannot be (practically) disassembled, then the internal cavity/mechanism must be cleaned by pumping copious amounts of lab-grade soap solution, tap water, and DI water through the pump.

#### Above Ground Pumps Used for Purging and Sampling (Peristaltic)

Follow the general procedure above. In-house cleaning is recommended.

#### Tubing (Miscellaneous Non-Inert Tubing Types (tygon, rubber, HDPE, PVC, etc.))

##### New Tubing

- a) No cleaning is necessary if the manufacturer provides certification that the tubing is clean.
- b) If not certified clean, soak in hot, sudsy water. Rinse with hot tap water and then analyte-free water.
- c) Protect new tubing by wrapping it in aluminum foil, sealing in plastic bags or in the original sealed packaging.
- d) If new tubing is exposed to potential contamination, rinse the exterior and interior with hot tap water followed by a thorough rinse with de-ionized water.
- e) If new tubing is to be used to collect samples, rinse the tubing with sample water (i.e. pump sample water through the tubing) before collecting samples.

##### Reused Tubing

- a) Follow general procedure above. In-house cleaning is recommended.
- b) Wrap tubing and cap ends in aluminum foil and seal in plastic to prevent contamination during storage and transport.

#### Field Cleaning of Pumps and Tubing:

Field cleaning is not recommended. If equipment must be cleaned in the field:

- a) Fill a dedicated cleaning container with sudsy water.
- b) Pump at least 3 complete tubing volumes of sudsy water through the tubing.
- c) Use the sudsy water to clean the outside of the tubing.
- d) Pump tap water through the tubing.
- e) Rinse the outside of the tubing with tap water.
- f) If necessary, use a separate container to pump hydrochloric acid solution through the tubing. The waste must be contained and disposed of properly.
- g) Fill cleaning container with analyte-free water and pump through tubing to thoroughly rinse tubing.
- h) Rinse outside of tubing with analyte free water.
- i) Protect ends of tubing with aluminum foil or untreated butcher paper.

### Van Dorn Sampler

Follow the general procedure above. In-house cleaning is recommended.

### Analyte-free Water Containers (In-House Cleaning Only)

#### New Containers

- a) Clean with hot tap water and lab grade soap (Liquinox or equivalent).
- b) Rinse thoroughly with hot tap water.
- c) Rinse with 10% reagent grade HCl.
- d) Rinse thoroughly with analyte-free water. Use enough water to flush all surfaces well with water.
- e) Allow to air dry as long as possible.
- f) Cap with Teflon<sup>®</sup> film, aluminum foil or the bottle cap. Note: the bottle cap shall be equipped with a Teflon<sup>®</sup> liner. Aluminum foil or Teflon<sup>®</sup> film may be used as liner material.

#### Reused Containers

- a) Cap with aluminum foil, Teflon<sup>®</sup> film or the container cap after discarding water.
- b) Wash container exterior with lab-grade detergent and hot tap water.
- c) Rinse exterior and interior thoroughly with analyte-free water.
- d) Invert and allow to drain and dry.
- e) Fill container with analyte-free water and cap tightly with aluminum foil, Teflon<sup>®</sup> film or the container cap. Note: the bottle cap shall be equipped with a Teflon<sup>®</sup> liner. Aluminum foil or Teflon<sup>®</sup> film may be used as liner material.
- f) Do not store analyte-free water for more than one week in a polyethylene container.

### **Field Cleaning Procedure for Sediment Sampling Equipment**

#### Stainless Steel Corer, Ekman Dredge, Petite Ponar and HDPE Scoops and Tweezers

In-house cleaning is recommended. However, if field cleaning is necessary, a modified version of the general procedure above needs to be used to ensure thorough decontamination of sediment sampling equipment. For field cleaning:

- a) Pre-rinse with tap water to remove the most obvious particles and film. Do this by simply pouring some tap water over the equipment.
- b) Place equipment in large tub or lidless cooler dedicated to cleaning.
- c) Fill a dedicated pump spray bottle with a Liquinox/DI water solution, and completely soak all surfaces while scrubbing with a brush to thoroughly remove particles and film. This will likely require two people-- one to spray and one to scrub. For the ponar or Ekman, be sure to repeatedly work the action of the jaws in order to reveal all surfaces and seams that might conceal hidden grime and particles.
- d) Dump soapy water. Rinse the cleaning tub/cooler if any particulates remain after dumping. Place equipment back in the tub/cooler.
- e) Rinse thoroughly with 5 gallons of tap water. Pour the tap water slowly over the equipment in the tub/cooler, and repeatedly dunk the equipment in the rinsate (at LEAST 4 or 5 times) to continually remove soap and particulates. Again, work the action of the jaws for the Ekman or ponar while rinsing in order to reveal hidden spots.
- f) Dump tap rinse water, rinse tub/cooler if particulates remain, and place equipment back in cleaning tub/cooler.

- g) Rinse thoroughly again using 5 gallons of DI water, following the same dunking procedure as the tap water rinse above.
- h) Remove equipment and store in plastic bag until ready for use.

### **Handling and Storage of Cleaned Equipment**

After cleaning, handle equipment with clean gloves to prevent re-contamination. Move the equipment away (preferably upwind) from the cleaning area to prevent recontamination. Cover with plastic sheeting or wrap in aluminum foil, after air drying to prevent re-contamination. Label clean equipment and keep it in a clean area until the next use.

### **Disposal of Cleaning Materials**

Dispose of cleaning materials properly. Used detergents may be rinsed down the drain into a sanitary sewer system. Dilute/neutralize hydrochloric acid cleaning solutions to a pH between 5 and 9, and flush down the drain. If used in the field, capture the waste material, dilute/neutralize, and flush down a sanitary sewer system. Any solvents must be collected and handled by a commercial disposal or recycling contractor.

### **Cleaning Documentation**

Document cleaning for each item of sampling equipment in a cleaning log book, whether performed in the lab or in the field. Refer to Section 11 for full details. Also see Figure 25.

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Note: Figures in this appendix are examples of labels and forms used in the Status and Trend Networks and are subject to change. Contact FDEP WMS for the current version of all forms.

**Table 1. Status Monitoring Indicator List**

T = Total sample (unfiltered sample); X = Other sample or measurement; Dash (-) indicates not applicable  
All methods, unless otherwise stated, are based on EPA 600, *Methods for Chemical Analysis of Water and Wastes*. SM= *Standard Methods for the Examination of Water and Wastewater*

Indicator	Analysis Method	Large and Small Lakes	Streams and Rivers	Confined and Unconfined Aquifers
pH	Method 150.1	X	X	X
Temperature	Method 170.1	X	X	X
Specific Conductance	Method 120.1	X	X	X
Dissolved Oxygen	Method 360.1	X	X	X
Turbidity	SOP FT 1600	-	-	X
Secchi Depth	Welch (1948); EPA 620/R-97/001	X	X	-
Total Depth	Steel tape/electronic measuring device	X	X	X
Sample Depth	Steel tape and chalk/electronic measuring device	X	X	-
Micro Land Use	WMS Sampling Manual (01/11), Section 4	-	-	X
Depth to Water	Steel tape and/or chalk	-	-	X
Chlorophyll a (suite)	SM 10200 H (modified)	T	T	-
Rapid Periphyton Survey	SOP FS 7130	-	X	-
Biological Community (SCI)	SM 10500 C (modified)	-	X	-
Habitat Assessment	SOP FT 3000	-	X	-
Lake Vegetation Index	SOP FS 7220	X	-	-
Total Coliform	SM 9222B	-	-	T
Fecal Coliform	SM 9222D	T	T	T
Enterococci	EPA 1600	T	T	-
Total Organic Carbon	SM 5310 B	T	T	T
Nitrate + Nitrite	Method 353.2	T	T	T
Ammonia	Method 350.1	T	T	T
Total Kjeldahl Nitrogen	Method 351.2	T	T	T
Total Phosphorus	Method 365.1/365.4	T	T	T
Chloride	Method 300	T	T	T
Sulfate	Method 300	T	T	T
Fluoride	SM 4500 F-C	T	T	T
Calcium	Method 200.7/200.8	T	T	T
Magnesium	Method 200.7/200.8	T	T	T
Potassium	Method 200.7/200.8	T	T	T
Sodium	Method 200.7/200.8	T	T	T
Aluminum, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Zinc	Method 200.7/200.8	-	-	T
Alkalinity	SM 2320 B	T	T	T
Turbidity (Lab)	Method 180.1	T	T	T
Specific Conductance (Lab)	Method 120.1	T	T	T
Color (True)	SM 2120 B	T	T	T
Total Suspended Solids	SM 2540 D	T	T	-
Total Dissolved Solids	SM 2540 C	T	T	T
Total Organic Carbon	In-house based on 415.1	T	-	-
Total Phosphorus	Method 365.4	T	-	-

**Table 1. Continued**

Indicator	Analysis Method	Large and Small Lakes	Streams and Rivers	Confined and Unconfined Aquifers
Sediments: Total Kjeldahl Nitrogen	Method 351.2	T	-	-
Sediments: Sulfate	Method 300 (modified)	T	-	-
Sediments: Aluminum, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Silver, Zinc	Method 6010B/6020	T	-	-
Sediments: Mercury	SOP Hg-008-3 (based on EPA 7471)	T	-	-
Sediments: Methyl Mercury	SOP Hg-003-2 (based on EPA 1630)	T	-	-

**Table 2. Trend Monitoring Indicator List**

T = Total sample (unfiltered sample); D = Dissolved sample (filtered sample); X = Other sample or measurement; Dash (-) indicates not applicable

\* Collected once a year per site.

\*\* Collected twice a year per site.

\*\*\*Collected quarterly per site. For SWTV, this applies only to SCI-suitable sites.

All methods, unless otherwise stated, are based on EPA 600, *Methods for Chemical Analysis of Water and Wastes*. SM= *Standard Methods for the Examination of Water and Wastewater*

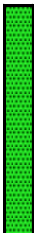

Indicator	Analysis Method	Surface Water	Ground Water
pH	Method 150.1	X	X
Temperature	Method 170.1	X	X
Specific Conductance	Method 120.1	X	X
Dissolved Oxygen	Method 360.1	X	X
Turbidity	SOP FT 1600	-	X
Secchi Depth	Welch (1948); EPA 620/R-97/001	X	-
Total Depth	Steel tape/electronic measuring device	X	X
Sample Depth	Steel tape and chalk/electronic measuring device	X	-
Micro Land Use	WMS Sampling Manual (10/09), Section 4	-	X*
Depth to Water	Steel tape and/or chalk	-	X
Chlorophyll a (suite)	SM 10200 H (modified)	T	-
Rapid Periphyton Survey	SOP FS 7130	X**	-
Biological Community (SCI)	SM 10500 C (modified)	X*	-
Habitat Assessment	SOP FT 3000	X**	-
Total Coliform	SM 9222B	-	T***
Fecal Coliform	SM 9222D	T	T***
Enterococci	SM 5310 B	T	-
Total Organic Carbon	Method 415.1	T	T***
Nitrate + Nitrite	Method 353.2	T	T***, D*
Ammonia	Method 350.1	T	T***, D*
Total Kjeldahl Nitrogen	Method 351.2	T	T***, D*
Total Phosphorus	Method 365.1/365.4	T	T***, D*
Orthophosphate	Method 365.1	-	D***
Chloride	Method 300	T	T***, D*
Sulfate	Method 300	T	T***, D*
Fluoride	SM 4500 F-C	T	T***, D*
Calcium	Method 200.7/200.8	T	T***, D*
Magnesium	Method 200.7/200.8	T	T***, D*
Sodium	Method 200.7/200.8	T	T***, D*
Potassium	Method 200.7/200.8	T	T***, D*
Arsenic, Iron, Lead	Method 200.7/200.8	-	T*
Arsenic, Cadmium, Chromium, Copper, Lead, Zinc	Method 200.7/200.8	T***	-
Alkalinity	SM 2320 B	T	T***, D*
Turbidity (Lab)	Method 180.1	T	T***
Specific Conductance (Lab)	Method 120.1	T	T***
Color (True)	SM 2120 B	T	T***
Total Suspended Solids	SM 2540 D	T	-
Total Dissolved Solids	SM 2540 C	T	T***

**Table 3. Status Network Sampling Periods**

**STATUS NETWORK SAMPLING PERIODS**

60 surface water samples per resource are split equally among 6 sampling groups (10 each): NWFWMID, SJRWMD, SR-DEP, SW-DEP, SF-PSL, SF-FTM  
120 groundwater samples per resource are split equally among 6 sampling groups (20 each): NWFWMID, SJRWMD, SR-DEP, SW-DEP, SF-PSL, SF-FTM

Month	Confined Aquifer	Unconfined Aquifer	Small Streams	Large Rivers	Small Lakes	Large Lakes
Jan					60	
Feb	120					
Mar						
Apr				60		
May			60			
Jun						60
Jul						60
Aug		120				
Sep						
Oct				60		
Nov						
Dec						60

 Primary Sampling Period  
 Revisit Sampling Period  
 \* Total does not include QA samples  
 --- Dashed line indicates current Contract Period Start/Finish

**Table 4. Solubility of Oxygen in Water at Atmospheric Pressure (760mm Hg)**

<b>TEMP</b>	<b>D.O.</b>	<b>TEMP</b>	<b>D.O.</b>	<b>TEMP</b>	<b>D.O.</b>	<b>TEMP</b>	<b>D.O.</b>	<b>TEMP</b>	<b>D.O.</b>
<b>deg C</b>	<b>mg/L</b>	<b>deg C</b>	<b>mg/L</b>	<b>deg C</b>	<b>mg/L</b>	<b>deg C</b>	<b>mg/L</b>	<b>deg C</b>	<b>mg/L</b>
0.0	14.621	17.5	9.565	21.5	8.829	25.5	8.188	29.5	7.625
1.0	14.216	17.6	9.545	21.6	8.812	25.6	8.173	29.6	7.611
2.0	13.829	17.7	9.526	21.7	8.794	25.7	8.158	29.7	7.598
3.0	13.460	17.8	9.506	21.8	8.777	25.8	8.143	29.8	7.585
4.0	13.107	17.9	9.486	21.9	8.761	25.9	8.128	29.9	7.572
5.0	12.770	18.0	9.467	22.0	8.744	26.0	8.114	30.0	7.559
6.0	12.447	18.1	9.448	22.1	8.727	26.1	8.099	30.1	7.546
7.0	12.139	18.2	9.428	22.2	8.710	26.2	8.084	30.2	7.533
8.0	11.843	18.3	9.409	22.3	8.693	26.3	8.070	30.3	7.520
9.0	11.559	18.4	9.390	22.4	8.677	26.4	8.055	30.4	7.507
10.0	11.288	18.5	9.371	22.5	8.660	26.5	8.040	30.5	7.494
11.0	11.027	18.6	9.352	22.6	8.644	26.6	8.026	30.6	7.481
12.0	10.777	18.7	9.333	22.7	8.627	26.7	8.012	30.7	7.468
13.0	10.537	18.8	9.314	22.8	8.611	26.8	7.997	30.8	7.456
14.0	10.306	18.9	9.295	22.9	8.595	26.9	7.983	30.9	7.443
15.0	10.084	19.0	9.276	23.0	8.578	27.0	7.968	31.0	7.430
15.1	10.062	19.1	9.258	23.1	8.562	27.1	7.954	32.0	7.305
15.2	10.040	19.2	9.239	23.2	8.546	27.2	7.940	33.0	7.183
15.3	10.019	19.3	9.220	23.3	8.530	27.3	7.926	34.0	7.065
15.4	9.997	19.4	9.202	23.4	8.514	27.4	7.912	35.0	6.950
15.5	9.976	19.5	9.184	23.5	8.498	27.5	7.898	36.0	6.837
15.6	9.955	19.6	9.165	23.6	8.482	27.6	7.884	37.0	6.727
15.7	9.934	19.7	9.147	23.7	8.466	27.7	7.870	38.0	6.620
15.8	9.912	19.8	9.129	23.8	8.450	27.8	7.856	39.0	6.515
15.9	9.891	19.9	9.111	23.9	8.434	27.9	7.842	40.0	6.412
16.0	9.870	20.0	9.092	24.0	8.418	28.0	7.828	41.0	6.312
16.1	9.849	20.1	9.074	24.1	8.403	28.1	7.814	42.0	6.213
16.2	9.829	20.2	9.056	24.2	8.387	28.2	7.800	43.0	6.116
16.3	9.808	20.3	9.039	24.3	8.371	28.3	7.786	44.0	6.021
16.4	9.787	20.4	9.021	24.4	8.356	28.4	7.773	45.0	5.927
16.5	9.767	20.5	9.003	24.5	8.340	28.5	7.759	46.0	5.835
16.6	9.746	20.6	8.985	24.6	8.325	28.6	7.745	47.0	5.744
16.7	9.726	20.7	8.968	24.7	8.309	28.7	7.732	48.0	5.654
16.8	9.705	20.8	8.950	24.8	8.294	28.8	7.718	49.0	5.565
16.9	9.685	20.9	8.932	24.9	8.279	28.9	7.705	50.0	5.477
17.0	9.665	21.0	8.915	25.0	8.263	29.0	7.691		
17.1	9.645	21.1	8.898	25.1	8.248	29.1	7.678		
17.2	9.625	21.2	8.880	25.2	8.233	29.2	7.664		
17.3	9.605	21.3	8.863	25.3	8.218	29.3	7.651		
17.4	9.585	21.4	8.846	25.4	8.203	29.4	7.638		

**Acceptance Criteria: +/- 0.3 mg/L**

**Table 5. Cleaning Procedures and Frequencies**

<b>Equipment</b>	<b>Cleaning Procedure</b>	<b>Frequency</b>
Water level measuring devices	FC 1000, FC 1210	Between sample sites
Pump	FC 1000, FC 1170	Between sample sites
Tubing	FC 1000, FC 1160	Between sample sites
Van Dorn	FC 1000, FC1130, FC 1140	Between sample sites
Stainless Steel Corer	FC 1000, FC 1131	Between sample sites
Stainless Steel Ekman Dredge	FC 1000, FC 1131	Between sample sites
Stainless Steel Petite Ponar	FC 1000, FC 1131	Between sample sites
HDPE Scoop	FC 1000, FC 1132	Between sample sites
Analyte-free water containers	FC 1000, FC 1180	Prior to refilling – at least weekly

We recommend all cleaning take place in a controlled environment (in-house). Field cleaning between sample sites is allowed as long as equipment blanks document that cleaning procedures are removing the analytes of interest to our sampling program. An acid rinse is not required during field cleaning unless metals are detected in equipment blanks. If metals are detected, the equipment, excluding stainless steel equipment, will have to be rinsed with 10% HCl prior to rinsing with analyte-free water.

Consult with your manager before sampling sites that appear contaminated. If you discover that you have sampled a contaminated site, identify the equipment used to sample the site from the field log sheet. Take that equipment out of circulation until it can be cleaned according to FDEP SOP FC 1120. Check the results for all other sites sampled with that equipment for the same contaminants, and if detected, mark results as possible false positive.

**Figure 1. Florida Reporting Units (Zones) for Status Network**

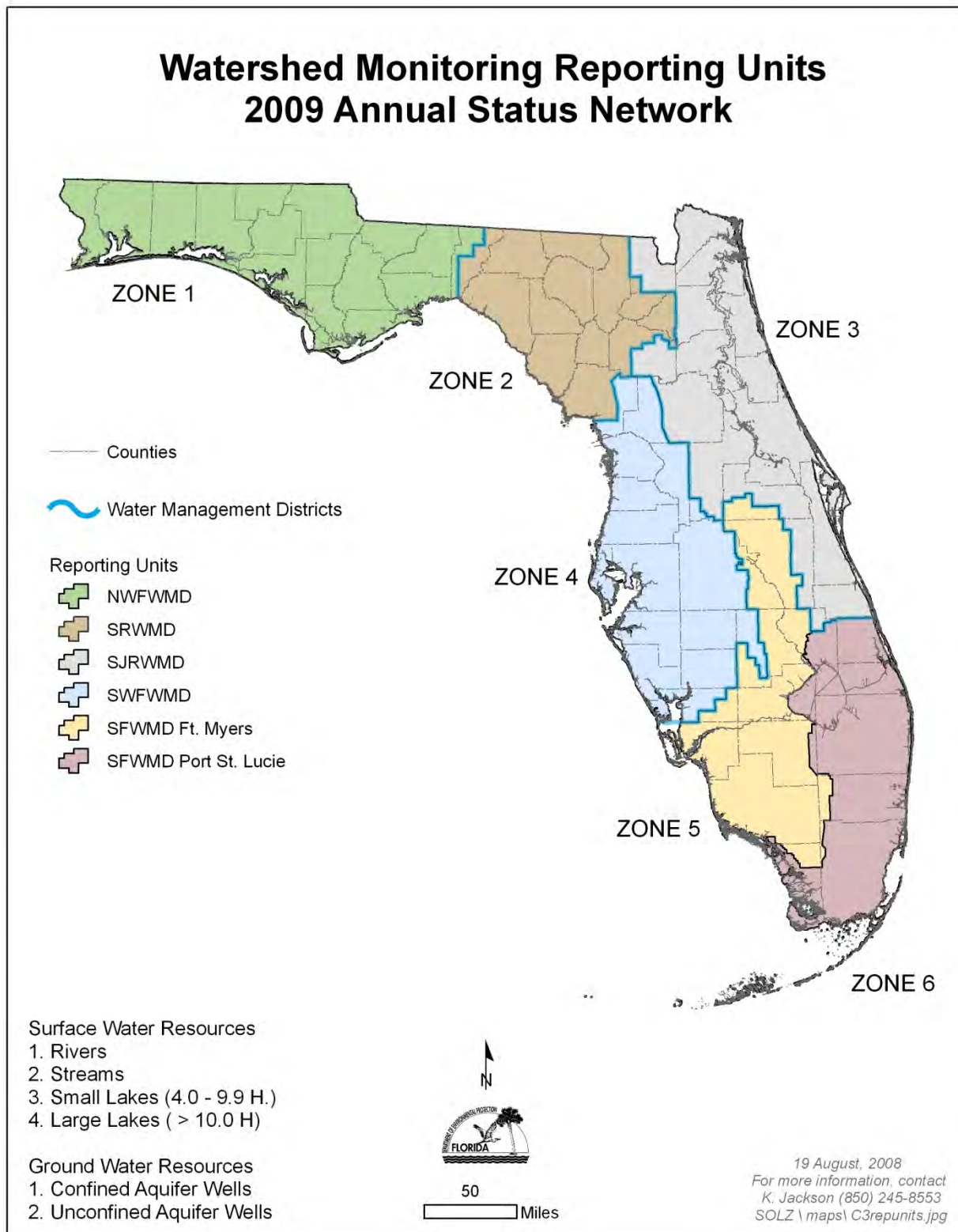



Figure 2. Custody Sheet – Example of Surface Water Front Page (example only)

 <b>FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION</b> <b>WATERSHED MONITORING PROGRAM</b> <b>SAMPLE CUSTODY RECORD</b>		January 2011
SAMPLING AGENCY:	PROJECT:	Shipping Date:
SAMPLER NAMES:		LAB PROJECT CODE
(circle one) <b>SHIPPING METHOD:</b> (circle or fill in) FedEx _____ Hand Delivered by: _____ Other Method: _____		Circle one** SW-TREND _____ SW - STATUS LAKES _____ SW STATUS _____ STREAMS _____
SAMPLE INFORMATION		
1	Station ID _____ Station Name _____  Sample Date: _____ (circle one) ETZ or CTZ _____ Matrix: Water _____ Sediment _____ Sp. Cond: _____ µmhos/cm    pH: _____ SU    DO : _____ mg/L    % Temp: _____ °C Comments: _____	Ice? _____ Y/N/NA pH acid <2 SU? _____ Y/N/NA SCI w/formalin? _____ Y/N/NA
2	Station ID _____ Station Name _____  Sample Date: _____ (circle one) ETZ or CTZ _____ Matrix: Water _____ Sediment _____ Sp. Cond: _____ µmhos/cm    pH: _____ SU    DO : _____ mg/L    % Temp: _____ °C Comments: _____	Ice? _____ Y/N/NA pH acid <2 SU? _____ Y/N/NA SCI w/formalin? _____ Y/N/NA
3	Station ID _____ Station Name _____  Sample Date: _____ (circle one) ETZ or CTZ _____ Matrix: Water _____ Sediment _____ Sp. Cond: _____ µmhos/cm    pH: _____ SU    DO : _____ mg/L    % Temp: _____ °C Comments: _____	Ice? _____ Y/N/NA pH acid <2 SU? _____ Y/N/NA SCI w/formalin? _____ Y/N/NA
4	Station ID _____ Station Name _____  Sample Date: _____ (circle one) ETZ or CTZ _____ Matrix: Water _____ Sediment _____ Sp. Cond: _____ µmhos/cm    pH: _____ SU    DO : _____ mg/L    % Temp: _____ °C Comments: _____	Ice? _____ Y/N/NA pH acid <2 SU? _____ Y/N/NA SCI w/formalin? _____ Y/N/NA
5	Station ID _____ Station Name _____  Sample Date: _____ (circle one) ETZ or CTZ _____ Matrix: Water _____ Sediment _____ Sp. Cond: _____ µmhos/cm    pH: _____ SU    DO : _____ mg/L    % Temp: _____ °C Comments: _____	Ice? _____ Y/N/NA pH acid <2 SU? _____ Y/N/NA SCI w/formalin? _____ Y/N/NA
6	Station ID _____ Station Name _____  Sample Date: _____ (circle one) ETZ or CTZ _____ Matrix: Water _____ Sediment _____ Sp. Cond: _____ µmhos/cm    pH: _____ SU    DO : _____ mg/L    % Temp: _____ °C Comments: _____	Ice? _____ Y/N/NA pH acid <2 SU? _____ Y/N/NA SCI w/formalin? _____ Y/N/NA

\*\* Selected protect correspondents directly with analytes listed on the back of this sheet. Analytes and sample containers are submitted as listed, per site, unless otherwise noted in the comment section above.

Figure 3. Custody Sheets – Back for Ground Water TV and Status Monitoring (example only)

GROUND WATER TREND NETWORK CONTAINER INVENTORY			
CONTAINER	CODE	ANALYSES	DESCRIPTION
Nutrients	W-NO2NO3, W-NH3, W-TKN, W-S-A-TP, W-TOC	Nitrite/Nitrate, Ammonia, TKN, Total Phosphorus, Total Organic Carbon	(1) 500 ml plastic
Metals	W-ICP	Cu, K, Na, Mg	(1) 500 ml plastic
Anions	TURBIDITY, W-COLOR, W-TDS, W-ALK, W-CL-IC, W-COND, W-F, W-SO4-IC	Turbidity, Color (true), Total Dissolved Solids, Alkalinity, Chloride, Specific Conductance, Fluoride, Sulfate	(1) 1 liter plastic
Bacteria	TCOLI-MF, FCOLI-MF	Total Coliform Fecal Coliform	(2) Whirlpaks 4 oz
Ortho-Phosphate	W-PO4-F	Ortho-Phosphate	(1) 125 ml plastic

GROUND WATER TREND NETWORK (GWTV) sampling event, the following analytes/bottles will be submitted:			
Nutrients	W-NO2NO3-F, W-NH3-F, W-TKN-F, W-S-A-TP-F	Nitrite/Nitrate, Ammonia, TKN, Total Phosphorus (ALL FILTERED)	Filtered (.45µm); H2SO4 vial to pH < 2; chill to ≤6°C
Metals	W-ICP-F	Cu, K, Na, Mg (ALL FILTERED)	Filtered (.45µm); HNO3 vial to pH < 2; chill to ≤6°C
Anions	W-ALK-F, W-CL-IC-F, W-F-F, W-SO4-IC-F, W-PO4-F	Alkalinity, Chloride, Fluoride, Sulfate, Ortho Phosphate (ALL FILTERED)	Filtered (.45µm); chill to ≤6°C

- The (1) 125 ml plastic bottle for the ortho-phosphate will not be used during the month of October.
- For the (1) 500 ml plastic metals bottle, the additional analytes will be added in October: W-ICP (Fe) and W-ICPMS (As, Pb).

GROUND WATER STATUS NETWORK CONTAINER INVENTORY			
CONTAINER	CODE	ANALYSES	DESCRIPTION
Nutrients	W-NO2NO3, W-NH3, W-TKN, W-S-A-TP, W-TOC	Nitrite/Nitrate, Ammonia, TKN, Total Phosphorus, Total Organic Carbon	(1) 500 ml plastic
Metals	W-ICP W-ICPMS	Al, As, Ca, Cd, Cr, Cu, Fe, K, Pb, Mg, Mn, Na, Zn	(1) 500 ml plastic
Anions	W-CL-IC, W-SO4-IC, W-F, W-ALK, TURBIDITY, W-COLOR, W-TDS, W-COND	Chloride, Sulfate, Fluoride, Alkalinity, Turbidity, Color (true), Total Dissolved Solids, Specific Conductance	(1) 1 liter plastic
Bacteria	TCOLI-MF, FCOLI-MF	Total Coliform Fecal Coliform	(2) Whirlpaks 4 oz

Figure 4. Custody Sheet – Back for Surface Water TV and Status Monitoring (example only)

SURFACE WATER TREND NETWORK CONTAINER INVENTORY				
CONTAINER	CODE	ANALYSES	DESCRIPTION	SAMPLE PREPARATION
Chlorophyll	CHLSUITE-W	Chlorophyll	(1) 1 liter opaque plastic	Unfiltered; chill to ≤6°C
Nutrients	W-TOC, W-NO2NO3, W-NH3, W-TKN, W-S-A-TP	Total Organic Carbon, Nitrite/Nitrate, Ammonia, TKN, Total Phosphorus	(1) 500 ml plastic	Unfiltered; H <sub>2</sub> SO <sub>4</sub> vial to pH < 2; chill to ≤6°C
Metals	W-ICP	Ca, K, Na, Mg	(1) 500 ml plastic	Unfiltered; HNO <sub>3</sub> vial to pH < 2; chill to ≤6°C
Anion	W-Cl-IC, W-SO4-IC, W-F, W-ALK, W-COLOR, TURBIDITY, W-TDS, W- TSS, W-COND	Chloride, Sulfate, Fluoride, Alkalinity, Color (true), Turbidity, Total Dissolved Solids, Total Suspended Solids, Specific Conductance	(1) 1 liter plastic	Unfiltered; chill to ≤6°C
Bacteria	ENT-24-MF, FCOLJMF	Enterococci, Fecal Coliform	(2) Whirlpacks 4 oz	Unfiltered; chill to ≤6°C

For the October, January, April and July SWTV sampling events, the following additional analytes will be analyzed from the above (1) 500 ml Metals bottle: W-ICP (Zn) and W-ICPMS (As, Cd, Cr, Cu, and Pb). This applies only to the 56 predetermined sites that are SCI (Stream Condition Index) suitable.

SURFACE WATER STATUS NETWORK CONTAINER INVENTORY (LAKES)				
CONTAINER	CODE	ANALYSES	DESCRIPTION	SAMPLE PREPARATION
Chlorophyll	CHLSUITE-W	Chlorophyll	(1) 1 liter opaque plastic	Unfiltered; chill to ≤6°C
Nutrients	W-TOC, W-NO2NO3, W-NH3, W-TKN, W-S-A-TP	Total Organic Carbon, Nitrite/Nitrate, Ammonia, TKN, Total Phosphorus	(1) 500 ml plastic	Unfiltered; H <sub>2</sub> SO <sub>4</sub> vial to pH < 2; chill to ≤6°C
Metals	W-ICP	Ca, K, Na, Mg	(1) 500 ml plastic	Unfiltered; HNO <sub>3</sub> vial to pH < 2; chill to ≤6°C
Anion	W-Cl-IC, W-SO4-IC, W-F, W-ALK, W-COLOR, TURBIDITY, W-TDS, W-TSS, W-COND	Chloride, Sulfate, Fluoride, Alkalinity, Color (true), Turbidity, Total Dissolved Solids, Total Suspended Solids, Specific Conductance	(1) 1 liter plastic	Unfiltered; chill to ≤6°C
Bacteria	ENT-24-MF, FCOLJ-MF	Enterococci, Fecal Coliform	(2) Whirlpacks 4 oz	Unfiltered; chill to ≤6°C
Sediments	S-CH3HG, S-ICP-TO, S-ICPMS-TO, S-HG-H, S-TP, S-TKN, S-TOC, S-SO4-IC	Methyl Mercury, Al, Fe, Ag, As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, P, TKN, TOC, Sulfate	(1) 500 ml glass jar	Chill to ≤6°C

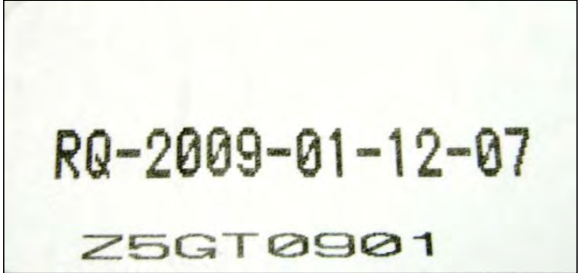
  

SURFACE WATER STATUS NETWORK CONTAINER INVENTORY (STREAMS/RIVERS)				
CONTAINER	CODE	ANALYSES	DESCRIPTION	SAMPLE PREPARATION
Chlorophyll	CHLSUITE-W	Chlorophyll	(1) 1 liter opaque plastic	Unfiltered; chill to ≤6°C
Nutrients	W-TOC, W-NO2NO3, W-NH3, W-TKN, W-S-A-TP	Total Organic Carbon, Nitrite/Nitrate, Ammonia, TKN, Total Phosphorus	(1) 500 ml plastic	Unfiltered; H <sub>2</sub> SO <sub>4</sub> vial to pH < 2; chill to ≤6°C
Metals	W-ICP	Ca, K, Na, Mg	(1) 500 ml plastic	Unfiltered; HNO <sub>3</sub> vial to pH < 2; chill to ≤6°C
Anion	W-Cl-IC, W-SO4-IC, W-F, W-ALK, W-COLOR, TURBIDITY, W-TDS, W- TSS, W-COND	Chloride, Sulfate, Fluoride, Alkalinity, Color (true), Turbidity, Total Dissolved Solids, Total Suspended Solids, Specific Conductance	(1) 1 liter plastic	Unfiltered; chill to ≤6°C
Bacteria	ENT-24-MF, FCOLJ-MF	Enterococci, Fecal Coliform	(2) Whirlpacks 4 oz	Unfiltered; chill to ≤6°C
Macroinvertebrates	MI-FW-QLDC	Macroinvertebrates	(2) 2 liter plastic jug	Buffered Formalin

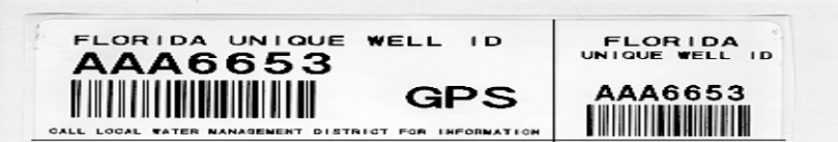
**Figure 5. Station Identification Label - Example**



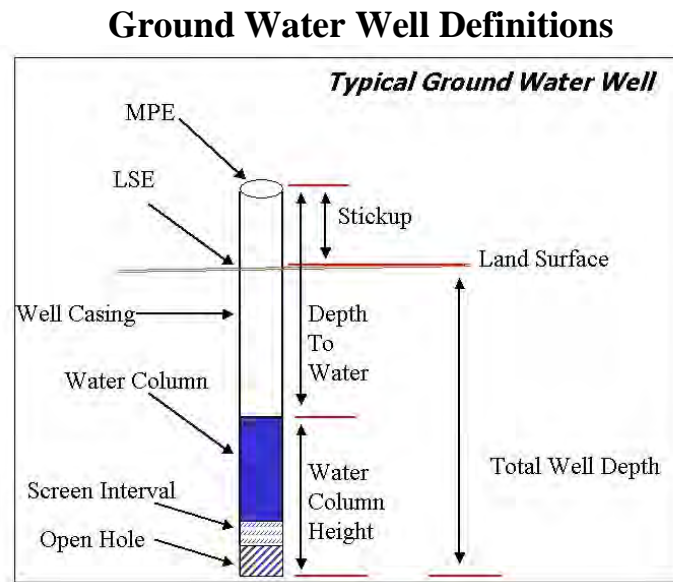
**Figure 6. RQ Label – Example of Weekly Project Request Number Label**



**Figure 7. FLUWID Tag - Florida Unique Well Identification Tag**



**Figure 8. Ground Water Well Definitions**



- MPE:** Measuring Point Elevation. A fixed mark on the well casing where depth to water measurements are taken. Usually reported in feet above mean sea level.
- LSE:** Land Surface Elevation. The general land surface elevation of the ground around the wellhead. Usually reported in feet above mean sea level.
- Depth to Water:** (DTW) Distance from measuring point elevation (MPE) to the top of the water column.
- Total Well Depth:** Distance from LSE to the bottom of the well.
- Casing Depth:** Distance from LSE to the bottom of the well casing.
- Water Column Height:** (WCH) Height (measured in feet) in the well from the bottom of the well to the top of the water column.
- Stickup:** (SU) Distance between MPE and LSE.
- Well Screen:** A perforated section of the well casing designed to keep formation sediments from collapsing into the borehole while allowing water to enter the casing.
- Screen Interval:** Distance (measured in feet) from the top to the bottom of the well screen.
- Open Hole:** The drilled area below casing and screen interval where the well continues in the rock.

**Equations**

- Potentiometric:  $\text{Total Depth} - (\text{DTW} - \text{SU}) = \text{WCH}$   
 Tape/chalk:  $\text{Total Depth} - ((\text{Held at} - \text{Wetted at}) - \text{SU}) = \text{WCH}$

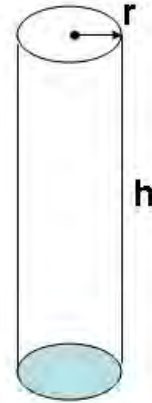
**NOTE:** These equations must be worked in the proper order according to the parentheses.

**Figure 9. Well Volume Constants**

## Well Volume Constants

Radius:  $r$   
 Volume:  $V$   
 Height:  $h$   
 $V = \pi r^2 h$

$\pi = 3.141592$      $r = \text{diameter} \div 2$



For Wells, the units for  $r$  will be inches and the units for  $h$  are feet. Therefore, you must convert in such a way that both variables are in the same unit. Typically one would convert feet into inches.

Example: How many gallons are in a 4 inch well with 10 feet of water in it?

$r = 2$  inches (Diameter = 4", so  $4 \div 2 = 2$ )

$h = 10$  feet

$\pi = 3.141592$

$V = ?$  gallons

$$V = 3.141592 \times (2 \text{ inches})^2 \times (10 \text{ feet} \times \frac{12 \text{ inches}}{1 \text{ foot}}) \rightarrow V = 3.141592 \times 4 \text{ inches}^2 \times 120 \text{ inches}$$

$$\therefore V = 1507.96 \text{ cubic inches of water}$$

1 cubic inch = 0.004329004 gallons

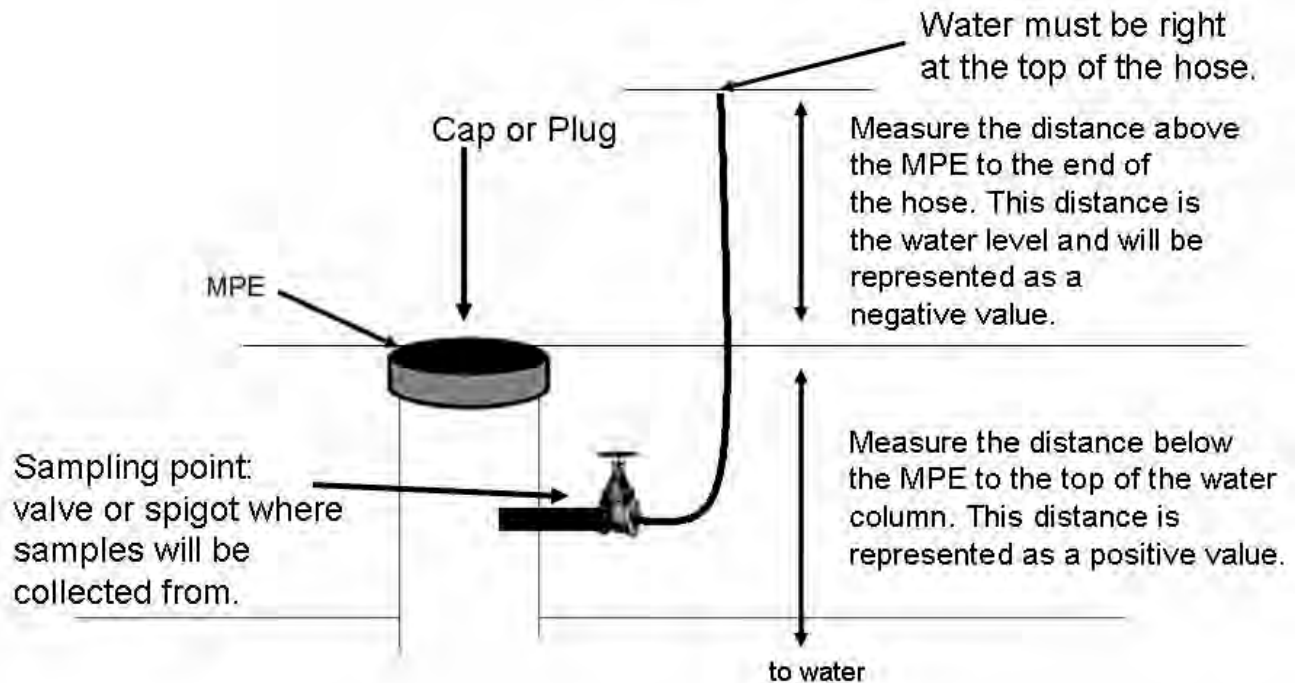
$$\therefore 1507.96 \text{ cubic inches} \times \frac{0.004329004 \text{ gallons}}{1 \text{ cubic inch}} = 6.53 \text{ gallons}$$

So, a 4 inch well with 10 feet of water contains 6.53 gallons of water.

Multiply 6.53 by 1.5 to calculate the minimum purge volume before collecting samples

6.53 gallons  $\times$  1.5 = 9.8 gallons minimum to be purged.

Figure 10. Flowing Well Water Level Measurements



For a correct measurement, the water meniscus should be bulging slightly above the end of the hose. Incorrect measurements are made when the water level is below the end of the hose or when water is allowed to flow out of the hose.

“Water seeks its own level”. Therefore the length of hose does not matter.

Figure 11. Field Sheet - Ground Water (Example only, obtain actual field sheet from FDEP WMS)



**FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION**  
**GROUND WATER SAMPLING FIELD LOG SHEET**  
**Watershed Monitoring Section**

May 2010

SAMPLING AGENCY:	FLUWID:	OWNER:
STATUS RANDOM ID:	STATION NAME:	PROJECT:
LAND SURFACE ELEV.(LSE):	CASING MATERIAL:	TOTAL DEPTH:
MEASURING POINT ELEV.(MPE):	CASING DIAMETER:	

All Times Are: ETZ or CTZ (circle one) Date/Time On Site: \_\_\_\_\_ Date/Time Off Site: \_\_\_\_\_

Field Sheet Completed By:  WQ Samples Collected By:

**POTENTIOMETRIC METHOD** (Stickup is MPE - LSE)

Total Depth - (Depth to Water - Stickup) = Water Column Height Second Reading

\_\_\_\_\_ - ( \_\_\_\_\_ - \_\_\_\_\_ ) = \_\_\_\_\_ ft \_\_\_\_\_ ft

DTW - SU = \_\_\_\_\_ (WCH) (WCH)

**TAPE / CHALK METHOD**

Total Depth - ((Held at - Wetted At) - SU) = Water Column Height

1. \_\_\_\_\_ - (( \_\_\_\_\_ - \_\_\_\_\_ ) - \_\_\_\_\_ ) = \_\_\_\_\_

2. \_\_\_\_\_ - (( \_\_\_\_\_ - \_\_\_\_\_ ) - \_\_\_\_\_ ) = \_\_\_\_\_

DTW - SU = \_\_\_\_\_

**PURGE METHOD (Check one):**

\_\_\_\_ 1) 1.5 well volumes and stability      \_\_\_\_ 2) In-place plumbing purge and stability (continuous and intermittently running wells)

\_\_\_\_ 3) More than 1.5 well volumes and stability      \_\_\_\_ 4) Fully dry purge (not recommended)

\_\_\_\_ 5) Purged 5 or more well volumes without stability (explain in comments)      \_\_\_\_ 6) Other (explain in comments)

**MINIMUM PURGE VOLUME DETERMINATION**

.041 X Diameter X Diameter X Water Column Height X # Well Purge Volumes = Purge Volume (gal.)

.041 X \_\_\_\_\_ X \_\_\_\_\_ X \_\_\_\_\_ X **1.5** = \_\_\_\_\_

Water Column Height (WCH) X Well Capacity X # Well Purge Volumes = Purge Volume (gal)

\_\_\_\_\_ X \_\_\_\_\_ X **1.5** = \_\_\_\_\_ (gal.)

1 Well Purge Volume: \_\_\_\_\_ (gal.)      1/4 Well Purge Volume: \_\_\_\_\_ (gal.)      Volume of tank (if required to purge): \_\_\_\_\_ (gal.)

Well Capacity (Gallons per ft) : .75" = .02, 1" = .04, 1.25" = .06, 2" = .16, 3" = .37, 4" = .65, 5" = 1.02, 6" = 1.47, 8" = 2.62, 10" = 4.10, 12" = 5.88

Purge Equipment Used: \_\_\_\_\_ Sample Equipment Used: \_\_\_\_\_

Please include type of pump (peristaltic, submersible, etc.) AND pump ID# (ex. Redi-flo #1, Grundfos #2, etc.)

Minimum Purge Time: (Min. Purge Volume/Purge Rate) \_\_\_\_\_ (min.)

Time Purge Begin: \_\_\_\_\_ (24hr)      Time Purge Stop: \_\_\_\_\_ (24hr)      Purge Rate: \_\_\_\_\_ (gal/min)

Total Purge Time: \_\_\_\_\_ (min.)      Total Purge Volume: \_\_\_\_\_ (gal.)  
(Purge rate X Total purge Time)

Time Sampling Begin: \_\_\_\_\_ (24 hr)      Time Sampling Stop: \_\_\_\_\_ (24 hr)

<b>PLACE FLUWID LABEL HERE (if applicable)</b>	<b>PLACE SITE LABEL HERE</b>	<b>PLACE QA/QC LABEL HERE (if applicable)</b>
--	----------------------------------	---

QA/QC Sample: <small>(Circle One)</small>	N/A	Field Blank	Equipment Blank <small>(Field-cleaned) (Lab-cleaned)</small>	Time (24hr): _____	Collected by: <span style="border: 1px solid black; display: inline-block; width: 100px; height: 15px;"></span>
--	-----	-------------	---	--------------------	---

Well Condition: \_\_\_\_\_ Fuel-Powered Equipment Used? Yes No  
(Circle One)

Placement Depth of Tubing or Pump Intake: \_\_\_\_\_

Drawdown Monitored? (Circle One) No (N/A) Yes, no drawdown Yes, drawdown noticed and corrected for  
This is verified by recording depth to water in the Chemical Stability Monitoring section.

Sulfur Odor?: (Circle One) Yes No Color: \_\_\_\_\_

Personnel/Visitors On Site: \_\_\_\_\_

Weather Conditions: \_\_\_\_\_

**PRESERVATION INFORMATION**  N/A (No samples collected, non-quarterly Trend month, etc.)

Were all appropriate samples (including QA/QC blanks) preserved within 15 minutes including the following: wet ice (<6°C); nutrient samples with 1 mL sulfuric acid; metal samples with 1 mL nitric acid; ortho-phosphate sample filtered with a .45µm filter; and anion, metal and nutrient samples filtered with a .45µm filter (for Oct. TREND network only) Yes No

Were all acidified samples verified that the pH was less than 2 SU? Yes No Preserved By:

Preservative Lot #: Sulfuric \_\_\_\_\_ Nitric \_\_\_\_\_  
(Please describe any variations to this preservation protocol in the comments section below.)

**COMMENTS:** (Include any variations from normal preservation protocols; ex. adding more than 1 ml acid, unable to monitor depth to water because..., etc.)

CHEMICAL STABILITY MONITORING				Meter ID#					Read By:		
	Time (24hr.)	Volume Purged (gallons)	Purge Rate (gal/min)	Depth to Water (feet)***	pH (SU)	Temp. (°C)	Cond. (µmhos/cm)	DO (mg/L)	DO (%)	Turbidity (NTU)	Comments
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											


\*\*\* Depth to Water needs to be documented if well diameter allows room for both tubing/pump and potentiometer. Not applicable to wells with in-place plumbing. If not applicable, please write "N/A" for this column.

Sampler Names: \_\_\_\_\_  
(Please PRINT)

Sampler Signatures: \_\_\_\_\_

OFFICE USE ONLY	
Reviewed for completion by: _____	Date: _____

Figure 12. Surface Water Field Sheet (Example only, obtain actual field sheet from FDEP WMS)



**FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION**  
**SURFACE WATER FIELD SHEET**  
**Watershed Monitoring Section**  
May 2010

**STATION INFORMATION**

Station Name: (Random ID for Station): \_\_\_\_\_ Date: \_\_\_\_\_  
(MM/DD/YYYY)

Waterbody Name: \_\_\_\_\_ All Times Are: **ETZ** or **CTZ**  
(if known) (circle one)

Waterbody Type: (Circle One) **Small Lake** ( $\geq 4$  and  $< 10$ HA)  
(collect samples in middle of open water) **Large Lake** ( $\geq 10$ HA)  
(collect samples at selected location point)

**Stream**  
(collect samples in representative area) **River**  
(collect samples in representative area)

Field Sheet Completed by: \_\_\_\_\_ WQ Sample Collected by: \_\_\_\_\_

**WATER CHARACTERISTICS**

Total Water Depth: \_\_\_\_\_ (meters) Secchi Depth: \_\_\_\_\_ (meters) Stage: \_\_\_\_\_ (feet)  
(Average of 2 measurements) (from SHADED side) (if applicable)

Stream Flow: (Circle One, if applicable) **No Flow** **Flow within Banks** **Flood Conditions**

Water Level: (Circle One) **Low** **Normal** **High**

Water Sample Collection Device: (Circle One) **Van Dorn** **Direct Grab with Sample Bottle** **Dipper** **Other** \_\_\_\_\_

**FIELD MEASUREMENTS**

		Meter ID#	Read by:			
Time (24 hr.)	Surface Depth Collected (meters)	pH (SU)	D.O. (mg/L)	D.O. (%)	Temperature (°C)	Conductivity ( $\mu$ mhos/cm)
Time (24 hr.)	Bottom Depth Collected (meters)	pH (SU)	D.O. (mg/L)	D.O. (%)	Temperature (°C)	Conductivity ( $\mu$ mhos/cm)

**PRESERVATION INFORMATION**  N/A (No samples collected, please state why in comments.)

Were all appropriate samples (including QA/QC blanks) preserved within 15 minutes including the following: wet ice ( $\leq 6^{\circ}\text{C}$ ), nutrient samples with 1 mL sulfuric acid, metal samples with 1 mL nitric acid, and SCI samples with buffered formalin? **Yes** **No**

Were all acidified samples verified that the pH was less than 2 SU? **Yes** **No**

Preservative Lot #s: Sulfuric \_\_\_\_\_ Nitric \_\_\_\_\_

Preserved by: \_\_\_\_\_

(Please describe any variations to this preservation protocol in the comments section.)

QA/QC Sample: (Circle One) **N/A** **Field Blank** **Equipment Blank** Time: \_\_\_\_\_ (24 hr.)  
(Field-cleaned) (Lab-cleaned)

Collected by: \_\_\_\_\_

Weather Conditions: \_\_\_\_\_

Personnel/Visitors On Site: \_\_\_\_\_

**Place Site Label Here**

---

**Place QA/QC Label Here**  
(if applicable)

**Sediment Information** (for Lakes only)  N/A (Site not a lake or no samples collected. If no samples collected, please state why in comments.)

Collection Depth: \_\_\_\_\_ (meters) (Total Water Depth) Collection Time: \_\_\_\_\_ (24 hr.) (Different than surface and bottom time in Field Measurements section)

Collection Interval: (Circle One) Top 3-5 cm Other: \_\_\_\_\_ (cm) (If top 3-5 is too flocculent)

General Sample Collection Area: \_\_\_\_\_ (Describe-- near shore, central, north side near dock, etc.)

Sample Collection Device: (Circle One) Corer Ekman Petite Ponar

Sediment Type: (Circle All That Apply) Clay/Silt Sand Gravel/Shell Rubble \*Organic Muck \*(very fine-grained flocculent organic material)

Sediment Odors: (Circle One) Normal Sewage Petroleum  
 Hydrogen Sulfide Other: \_\_\_\_\_

Sediment Color: \_\_\_\_\_

Number of Grabs Collected (3 minimum): \_\_\_\_\_ Collected by:

**Stream Condition Index Information** (Streams and Rivers)  N/A (Site not a stream or river or no samples collected. If no samples collected, please state why.)

Was an SCI collected? (Circle One) Yes No Collection Time: \_\_\_\_\_ (24 hr.) (Different than surface and bottom time in Field Measurements section)

If site was a stream or river but "NO" was selected, why was the SCI not collected (not due for an SCI, tidal, flooded,  $\leq 0.05$  m/s velocity, etc.)?  
 \_\_\_\_\_  
 \_\_\_\_\_

Collected by:

**Rapid Periphyton Survey Information** (Streams and Rivers)  N/A (Site not a stream or river or no samples collected. If no samples collected, please state why.)

Was the RPS performed? (Circle One) Yes No

If site was a stream or river but "NO" was selected, why was the RPS not performed (not due for an RPS, dangerous site conditions, etc.)?  
 \_\_\_\_\_  
 \_\_\_\_\_

Performed by:

**Comments:** Include information such as: estimated level of impact to the system (ex. obvious pollution, none visible, etc.), any variations from normal preservation protocols (ex. adding more than 1 ml acid, etc.), any problems experienced with collecting samples (ex. grab 1 lost due to fall-out, etc.), any site specifics (ex. had to navigate due to heavy vegetation, etc.), any site conditions (ex. recent heavy rains, etc.), description of any photos taken, etc., any qualifiers needed (ex. "F" for failed calibration verification, etc.), the use of fuel-powered equipment, etc.

	<b>Invasive Exotic Apple Snail eggs present:</b>
	Yes No
	<small>(pink, clustered, small, numerous eggs)</small>

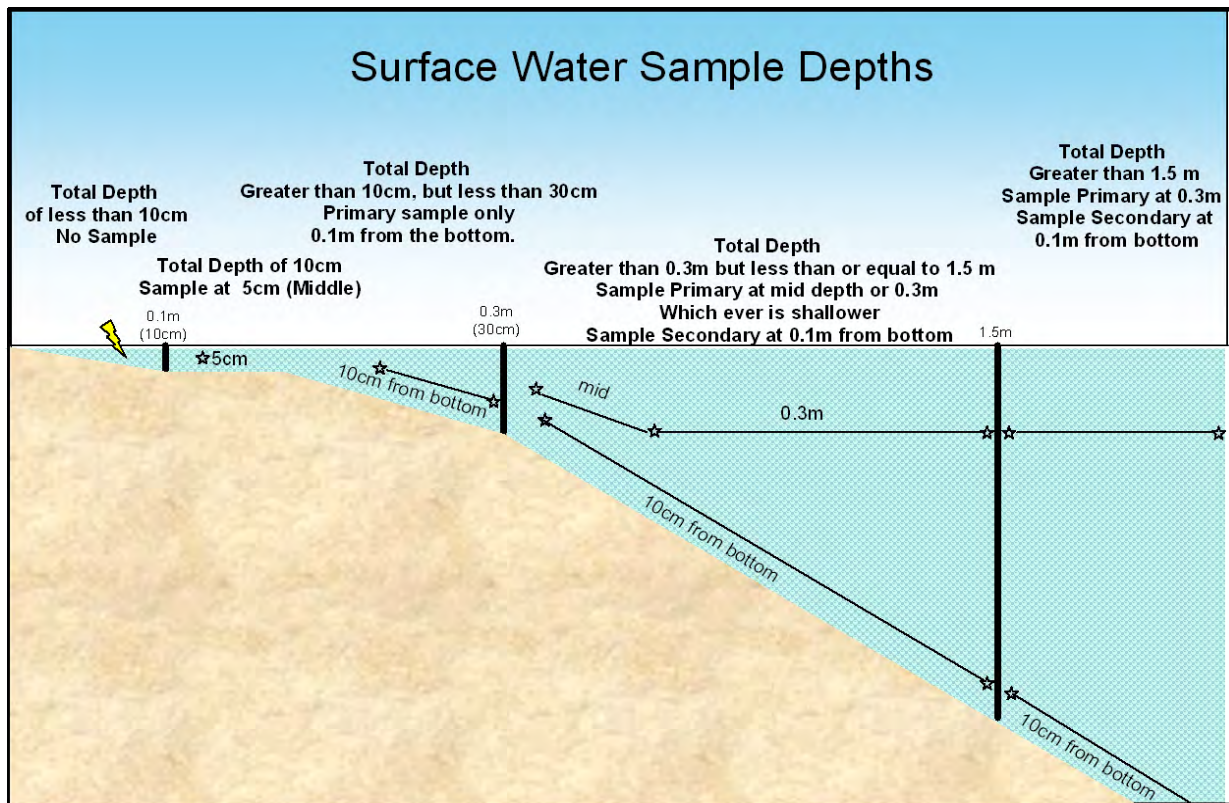
**Sampler Names: (PLEASE PRINT)** \_\_\_\_\_  
 \_\_\_\_\_

**Sampler Signatures:** \_\_\_\_\_  
 \_\_\_\_\_

OFFICE USE ONLY	
Reviewed for completion by: _____	Date: _____

Figure 13. Definition of Depth Measurements and Graphic

Definition of Depth Measurements: All Surface Water Resources				
total water depth	primary measurement	bottom measurement	total # measurement	samples collected
Less than 10 cm	-	-	0	No samples
10 cm.	.05 meter (5 cm)		1	.05 m
>10 cm but less than or equal to 30 cm.	.1 m (10 cm) from bottom		1	.1 m
>30 cm. but less than or equal to 1.5 meters	mid depth or .3 meters, which ever is shallower	.1 meter from bottom	2	mid depth or .3 meters, which ever is shallower
Greater than 1.5 meter	.3 meter below surface	.1 meter from bottom	2	.3 meter below surface



**Figure 14. Physical/Chemical Characterization Field Sheet (Example only. Use forms provided by FDEP WMS.)**

DEP-SOP-001/01: Form FD 9000-3  
**PHYSICAL/CHEMICAL CHARACTERIZATION ELECTRONIC FIELD SHEET**

SAMPLE ID : \_\_\_\_\_ ORG ID : \_\_\_\_\_  
 COUNTY : \_\_\_\_\_ STORET # : \_\_\_\_\_  
 DATE : \_\_\_\_\_ TIME : \_\_\_\_\_

Latitude : \_\_\_\_\_ Longitude : \_\_\_\_\_  
 (degrees) (minutes) (seconds) (degrees) (minutes) (seconds)

SITE NAME : \_\_\_\_\_ SAMPLE COMPLETE ? \_\_\_\_\_  
 FIELD ID/NAME : \_\_\_\_\_ RECEIVING BODY OF WATER : \_\_\_\_\_

**RIPARIAN ZONE / STREAM FEATURES**

**PREDOMINANT LAND-USE IN WATERSHED** (specify relative percent in each category) :

Forest/Natural  Silviculture  Field/Pasture  Agricultural  Residential  Commercial  Industry  Other (Specify)

Local Watershed Erosion (select one) :  None  Slight  Moderate  Heavy  
 Local Watershed NPS Pollution  No evidence  Slight  Moderate  Heavy

**Width of Riparian Vegetation (m) on Each Buffer Side**  
 Left Bank :  Right Bank :

**High Water Mark:**    =  **Artificially Impounded**  
 (m) (above present water level) (present depth) (above bed)  Yes  No

**Artificially**  No  Mostly recovered, more sinuous  
**Channelized** :  Some recovery  Recent, severe

**Canopy Cover % :**  Open  Lightly Shaded (11-45%)  
 Heavily Shaded  Moderate Shaded (46-80%)

**Typical Width (m) Depth (m)/Velocity (m/sec) Transect**  
 \_\_\_\_\_ m wide  
 \_\_\_\_\_ m/s \_\_\_\_\_ m/s \_\_\_\_\_ m/s  
 \_\_\_\_\_ m deep \_\_\_\_\_ m deep \_\_\_\_\_ m deep

**SEDIMENT / SUBSTRATE**

**Sediment Oils**  Absent  Slight  Moderate  Profuse  
**Sediment Odors**  Normal  Sewage  Petroleum  Chemical  Anaerobic  
 Other (Specify) : \_\_\_\_\_  
**Sediment Deposition**  Sludge Sand Smothering : None Slight Moderate Severe  
 Silt Smothering : None Slight Moderate Severe  
 Other (Specify) : \_\_\_\_\_

**SUBSTRATE TYPE**  
 Assessment Tool:  SCI  BioRecon  
 LCI  LVI INVERT PERI  
 % Coverage # Times Sampled # Times Sampled

Woody Debris (Snags)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Undercut Banks / Roots	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Leaf Packs or Mat .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aquatic Vegetation .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rock or Shell Rubble..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sand.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mud / Muck / Silt .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**WATER QUALITY**

	Depth (M)	Temp. (°C)	pH (SU)	D.O. (MG/L)	Cond. (UMHO/CM)	Salinity (PPT)	SECCHI (M)
Top :	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mid-Depth :	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> VOB
Bottom :	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Water Surface Oils :**  None  Sheen  Globbs  Slick  
**Water Odors :**  Normal  Sewage  Petroleum  Chemical  
 Other (Specify) : \_\_\_\_\_

Water Sample Taken ?  Yes  No  
 Algae Sample Taken ?  Yes  No

**SYSTEM TYPE**  Stream  Lake  
 Wetland  Estuary  
 Other (Specify) : \_\_\_\_\_

**Clarity**  Clear  Slightly Turbid  Turbid  Opaque  
**Color**  Tannic  Green (Algae)  Clear  Other (Specify) : \_\_\_\_\_

**WEATHER CONDITIONS / NOTES :**  
 The antecedent hydrologic conditions have been met to my best knowledge.  
 Water samples preserved ?  Yes  No pH<2  No Algae samples preserved ?  Yes  No

**ABUNDANCE**

	Absent	Rare	Common	Abundant
Periphyton :	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fish :	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aquatic Macrophytes :	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Iron/Sulfur Bacteria :	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**SAMPLING TEAM :** \_\_\_\_\_ **SIGNATURE :** \_\_\_\_\_ **DATE :** \_\_\_\_\_

Revision Date: September 5, 2008

**Figure 15: Stream/River Habitat Sketch Sheet** (Example only. Use forms provided by FDEP WMS.)

**DEP-SOP-001/01 Form FD 9000-4: Stream/River Habitat Sketch Sheet (September 2008)**

**Substrates: Code key, draw proportionate habitat abundance.**

- Snags
- Roots/undercut banks
- Leaf Packs (or mats)
- Aquatic Macrophytes
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

**Velocity:**  
 Note where velocity measures were taken.

**Habitat Smothering:**  
 Note areas (on map) where sand or silt is smothering substrates, limiting habitability.

**Bank Stability:**  
 Note areas (on map) with unstable, eroding banks.

**Riparian Buffer Width:**  
 Note areas (on map) where natural vegetation is altered or eliminated.

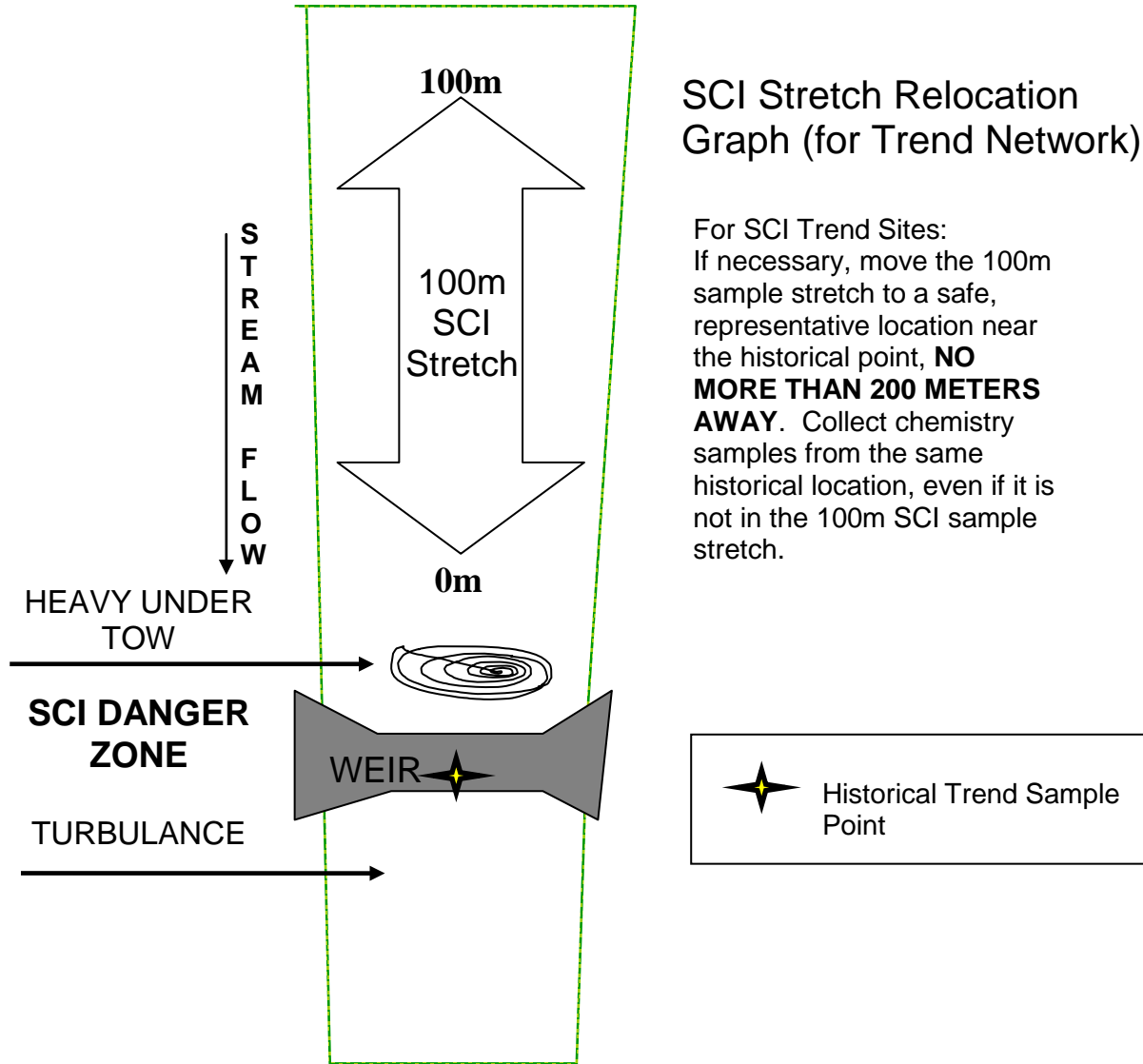
Length of grid represents 100 m of stream (not linear meters).  
 (Horizontal scale is double vertical scale, draw proportionately).

**Figure 16: Stream/River Habitat Assessment Field Sheet** (Example only. Use forms provided by FDEP WMS.)

SUBMITTING AGENCY NAME: _____		STORET STATION NUMBER: _____	DATE (MM/DD/YY): _____	RECEIVING BODY OF WATER: _____	
REMARKS: _____	COUNTY: _____	LOCATION: _____		FIELD ID/NAME: _____	
Habitat Parameter	Optimal	Suboptimal	Marginal	Poor	
Primary Habitat Components  Substrate Diversity _____	Four or more productive habitats present [snags, tree roots/undercut banks, aquatic vegetation, leaf packs (partially decayed), rock]  20 19 18 17 16	Three productive habitats present. Adequate habitat. Some substrates may be new fall (fresh leaves or snags)  15 14 13 12 11	Two productive habitats present. Less than desirable habitat, frequently disturbed or removed  10 9 8 7 6	One or less productive habitat. Lack of habitat is obvious, substrates unstable or smothered  5 4 3 2 1	
Substrate Availability _____	Greater than 30% productive habitat present at site  20 19 18 17 16	16% to 30% productive habitat, by aerial extent  15 14 13 12 11	6% to 15% productive habitat  10 9 8 7 6	Less than 5% productive habitat  5 4 3 2 1	
Water Velocity _____	Max. observed at typical transect: > 0.25 m/sec. But < 1 m/sec  20 19 18 17 16	Max. observed at typical transect: 0.1 to 0.25 m/sec  15 14 13 12 11	Max. observed at typical transect: 0.05 to 0.1 m/sec  10 9 8 7 6	Max. observed at typical transect: <0.05 m/sec; or spate occurring: > 1 m/sec  5 4 3 2 1	
Habitat Smothering _____ ----- Primary Score _____	Adequate number of pools (1-2 per 12 times width) and <25% of habitats affected by sand or silt accumulation.  20 19 18 17 16	Adequate number of pools (1-2 per 12 times width) and >25% of habitats affected by sand or silt accumulation.  15 14 13 12 11	Does not have required number of pools (1-2 per 12 times width) and/or has shallow pools (<2 times prevailing depth).  10 9 8 7 6	Pools are absent. Most habitats affected by sand or silt accumulation.  5 4 3 2 1	
Secondary Habitat Components  Artificial Channelization _____	Good sinuosity. No evidence of dredging or artificial straightening. No spoil banks. Diversity of depths.  20 19 18 17 16	Good sinuosity within old channelized area and a diversity of depths. Evidence of dredging in the past (>10 yrs) but mostly recovered.  15 14 13 12 11	Some sinuosity developed within channelized area. Some diversity of depth, but no pools (>2 times prevailing depth) present.  10 9 8 7 6	Straightened with spoil banks. Box-cut, monotypic depth with no pools.  5 4 3 2 1	
Bank Stability  Right Bank _____ Left Bank _____	Bankfull > 60% of bank height. Slope of bank ≤ 60°. Bankfull is within or above the root zone with few raw, eroded areas.  10 9	Only meets 2 of the 3 requirements for optimal bank stability.  8 7 6	Only meets 1 of the 3 requirements for optimal bank stability.  5 4	Bankfull < 60% of bank height. Slope of bank > 60°. Bankfull is below the root zone with raw, eroded areas.  3 2 1	
Riparian Buffer Zone Width  Right Bank _____ Left Bank _____	Width of native vegetation (least buffered side) greater than 18 m  10 9	Width of native vegetation (least buffered side) 12 to 18 m  8 7 6	Width of native vegetation 6 to 12 m. human activities still close to system  5 4	Less than 6 m of native buffer zone due to intensive human activities  3 2 1	
Riparian Zone Vegetation Quality  Right Bank _____ Left Bank _____ ----- Secondary Score _____	Over 80% of riparian surfaces consist of normal, expected plant community for given sunlight & habitat conditions (e.g., native plants, trees, understory shrubs, or non-woody macrophytes). Minimal disturbance  10 9	>50% to 80% of riparian zone is undisturbed (normal, expected plant community for given sunlight & habitat conditions). Some disruption in community observed.  8 7 6	25% to 50% of riparian is undisturbed (normal, expected plant community for given sunlight & habitat conditions). Disruption obvious.  5 4	Less than 25% of riparian is undisturbed (normal, expected plant community for given sunlight & habitat conditions).  3 2 1	
<b>TOTAL SCORE</b> _____					
ANALYSIS DATE: _____		ANALYST: _____		SIGNATURE: _____	




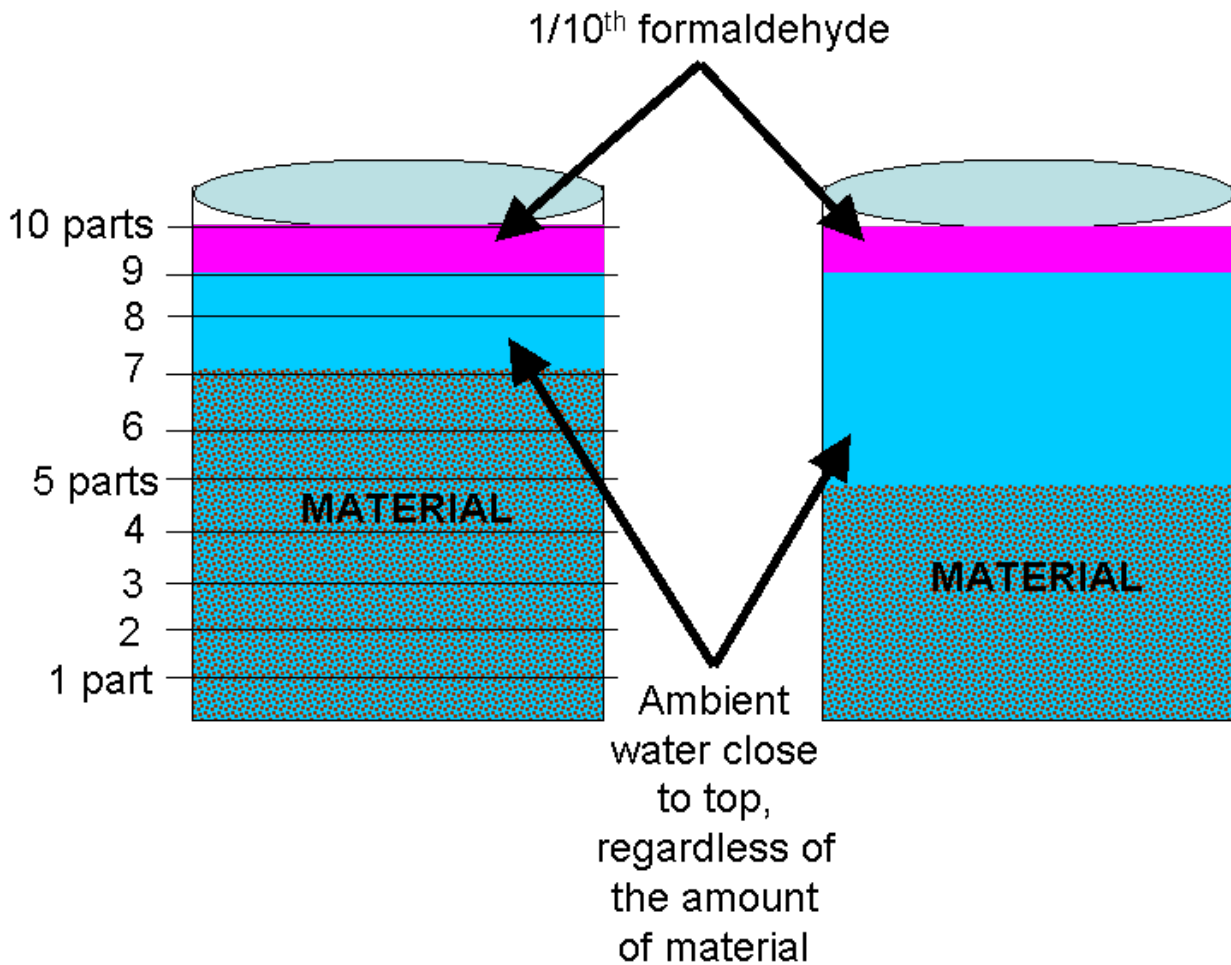
Figure 18. SCI Stretch Relocation Graph (for Trend Network)



### SCI Stretch Relocation Graph (for Trend Network)

For SCI Trend Sites:  
If necessary, move the 100m sample stretch to a safe, representative location near the historical point, **NO MORE THAN 200 METERS AWAY**. Collect chemistry samples from the same historical location, even if it is not in the 100m SCI sample stretch.

 Historical Trend Sample Point

**Figure 19. Formaldehyde Preservation**

An alternate preservation method is required for using diluted buffered formaldehyde (formalin) that is prepared and supplied from the FDEP laboratory. Samplers will not use any ambient water with this formaldehyde. The formaldehyde has been recycled and is already diluted. Once the jugs are ready (filled with material), samplers will pour the diluted buffered formaldehyde in the jug to within the top 1-2 inches, regardless of the amount of material—samplers will not follow the above “nine parts ambient water and one part buffered formaldehyde” rule. This formaldehyde is already diluted and is ready to use as a straight solution. Samplers will be notified if/when they receive this diluted formaldehyde upon restocking. Be sure to follow this alternate preservation method if appropriate.

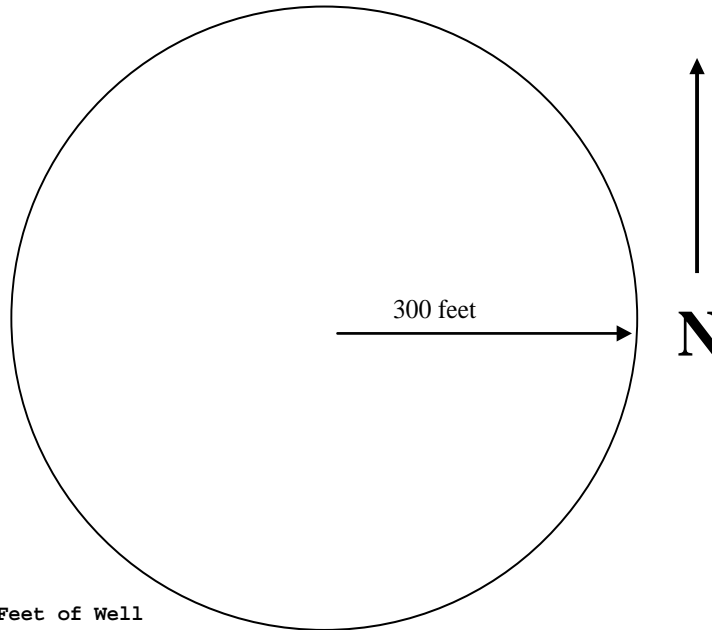
**Figure 20. Micro Land Use Sheet**

**WATERSHED MONITORING STATUS AND TREND NETWORK  
FEATURES & MICRO LAND USE SHEET**

October 2009

Status Random ID
Station Name
Date

<b>Major Land Use Group (Check one)</b>
<input type="checkbox"/> 1 Low Impact (LI)
<input type="checkbox"/> 2 Urban/Suburban (US)
<input type="checkbox"/> 3 Mining/Excavation (ME)
<input type="checkbox"/> 4 Intense Agriculture (AG)
<input type="checkbox"/> 5 Industrial (IN)



**Check All Features Observed Within 300 Feet of Well**

- |  |   |
|--|---|
| <input type="checkbox"/> (47) Agri. Chemical Mixing/Storage<br><input type="checkbox"/> (02) Airports<br><input type="checkbox"/> (52) Animal Feeding Operation<br><input type="checkbox"/> (10) Borrow Pit<br><input type="checkbox"/> (57) Campground<br><input type="checkbox"/> (21) Canal(s)<br><input type="checkbox"/> (40) Cave(s)<br><input type="checkbox"/> (03) Cemetery<br><input type="checkbox"/> (51) Crops, Field<br><input type="checkbox"/> (50) Crops, Row<br><input type="checkbox"/> (22) Ditch, Drainage<br><input type="checkbox"/> (37) Ditch, Irrigation<br><input type="checkbox"/> (55) Dry Cleaners<br><input type="checkbox"/> (41) Food Processing Plant<br><input type="checkbox"/> (12) Golf Course<br><input type="checkbox"/> (48) Groves, Citrus<br><input type="checkbox"/> (49) Groves, Other<br><input type="checkbox"/> (23) Holding Pond(s), Industrial<br><input type="checkbox"/> (24) Holding Pond(s), Urban<br><input type="checkbox"/> (45) Hospitals/Clinics<br><input type="checkbox"/> (56) Hunting Camp<br><input type="checkbox"/> (35) Junk Yard<br><input type="checkbox"/> (53) Kennel(s)<br><input type="checkbox"/> (25) Lake(s)<br><input type="checkbox"/> (04) Landfill<br><input type="checkbox"/> (11) Mine<br><input type="checkbox"/> (43) Mineral Processing Plant<br><input type="checkbox"/> (01) Nursery/Greenhouse<br><input type="checkbox"/> (20) Parking Lot(s)<br><input type="checkbox"/> (44) Petroleum Processing Plant | <input type="checkbox"/> (17) Pipeline(s) & Pump Station<br><input type="checkbox"/> (46) Power Plant<br><input type="checkbox"/> (18) Railroad(s)<br><input type="checkbox"/> (06) Repair Shops (e.g. Automotive)<br><input type="checkbox"/> (05) Residence<br><input type="checkbox"/> (26) River<br><input type="checkbox"/> (16) Roads, Major Highway<br><input type="checkbox"/> (36) Roads, Other<br><input type="checkbox"/> (13) Septic Tank(s)<br><input type="checkbox"/> (07) Service Station<br><input type="checkbox"/> (14) Sewage Treatment Plant<br><input type="checkbox"/> (15) Sewage Treatment Sprayfield<br><input type="checkbox"/> (39) Sinks/Sinkholes<br><input type="checkbox"/> (27) Spring(s)<br><input type="checkbox"/> (08) Storage Tanks (Above Ground)<br><input type="checkbox"/> (09) Storage Tanks (Below Ground)<br><input type="checkbox"/> (38) Stream(s)<br><input type="checkbox"/> (42) Timber Processing Plant<br><input type="checkbox"/> (19) Transmission Lines and Towers<br><input type="checkbox"/> (29) Water Softener<br><input type="checkbox"/> (30) Well(s), Injection<br><input type="checkbox"/> (31) Well(s), Irrigation<br><input type="checkbox"/> (32) Well(s), Oil & Gas<br><input type="checkbox"/> (33) Well(s), Private Supply<br><input type="checkbox"/> (34) Well(s), Public Supply<br><input type="checkbox"/> (28) Wetland(s)<br><input type="checkbox"/> (54) Zoos |
|--|---|

Comments or other unlisted features

**PLACE SITE LABEL HERE**

**Figure 21. Permission Form (example)**

Florida Department of Environmental Protection  
Watershed Monitoring  
Site Permission Form

**\* THIS INFORMATION IS CONFIDENTIAL AND WILL NOT BE RELEASED\***

*Please fill in or make any corrections needed and sign below.*

Owner's Name: \_\_\_\_\_

Physical Address: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Contact Phone Number: \_\_\_\_\_

Comments: (locked gates, new wells recently installed, dogs, etc.)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\*Please draw a sketch map (on the back of this form) of the site located on your property with highways and access roads leading to the site.

I hereby give the Florida Department of Environmental Protection Permission to collect water samples from the site (well, stream, river, lake) located on my property.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

I would like a copy of the analytical results. YES  NO

Please check the box below and return this form if you do not want FDEP to sample.

**I do not want my property sampled.**

Please return this form in the enclosed envelope to:

Florida Department of Environmental Protection  
Watershed Monitoring & Data Mgmt.  
Field Operations, MS 3525  
2600 Blair Stone Rd.  
Tallahassee, FL 32399-2400  
Fax (850) 245-7571

Site #:



**Figure 23. Calibration Log (Example)**

*Boldly "X" this box if there is qualified data on this page.*

**CALIBRATION LOG (FDEP SOP FT 1000-FT 1500, FD 1000-FD 4000)**

Meter ID:  September 2008 GENERAL version

Date \_\_\_\_\_ Calibration Time: \_\_\_\_\_ Project Name: \_\_\_\_\_

All Times Are: ETZ or CTZ (circle one)

Circle/Fill In: Lab Calibration or Calibration on Site \_\_\_\_\_

**Temperature (Monthly)** Date of Last Temperature Verification \_\_\_\_\_ ↓  
Pass or Fail  
P F

Ice Bath: Probe \_\_\_\_\_ °C NIST \_\_\_\_\_ °C Warm Bath: Probe \_\_\_\_\_ °C NIST \_\_\_\_\_ °C

**Dissolved Oxygen**  
*In Calibrate Mode*  
Initial Reading: \_\_\_\_\_ mg/L @ Temp. \_\_\_\_\_ °C % DO \_\_\_\_\_ P F

Calibrated Reading: \_\_\_\_\_ mg/L @ Temp. \_\_\_\_\_ °C % DO \_\_\_\_\_ P F

*In Run Mode*  
Initial Calib. Verification: \_\_\_\_\_ mg/L @ Temp. \_\_\_\_\_ °C % DO \_\_\_\_\_ P F

**Specific Conductance**

	Exp. Date	Lot #	Standard	Initial Reading	Calibrated Reading	
<i>In Calibrate Mode</i>						
Calibration:	_____	_____	_____ μmhos/cm	_____ μmhos/cm	_____ μmhos/cm	P F
<i>In Run Mode</i>						
Initial Calib. Verification:	_____	_____	_____ μmhos/cm	_____ μmhos/cm		P F

**pH**

	Exp. Date	Lot #	Initial Reading	Temperature	Calibrated Reading	Temperature	
<i>In Calibrate Mode</i>							
7.0 SU	_____	_____	_____ SU	_____ °C	_____ SU	_____ °C	P F
4.0 SU	_____	_____	_____ SU	_____ °C	_____ SU	_____ °C	P F
10.0 SU	_____	_____	_____ SU	_____ °C	_____ SU	_____ °C	P F
<i>In Run Mode</i>							
Initial Calib. Verification:			_____ SU	_____ °C			P F

**Maintenance:** Weekly PH Slope: \_\_\_\_\_ Specific Conductance Probe Cleaned? Y N  
**Notes:** Dissolved Oxygen Membrane Changed? Y N

	Site ID:
	Project:

\_\_\_\_\_  
Print name of person performing calibrations.

*Acceptance Criteria: (DO ±0.3mg/l) ( Specific Conductance ± 5%) ( pH ± 0.2SU) (Temperature ±0.5°C) Warm bath Appx. 40°C*  
**Record Temperature and pH to 1 decimal place; D.O. to 2 decimal places**

Boldly "X" this box if there is qualified data on this page.

**CONTINUING CALIBRATION LOG (FDEP SOP FT 1000-FT 1500, FD 1000-FD 4000)**

Meter ID:

September 2008 GENERAL version

Date \_\_\_\_\_ Mid-Day Time: \_\_\_\_\_ End-of-Day Time: \_\_\_\_\_

All Times Are: ETZ or CTZ (circle one)

**Temperature (Monthly)** Date of Last Temperature Verification \_\_\_\_\_

Ice Bath: Probe \_\_\_\_\_ °C NIST \_\_\_\_\_ °C Warm Bath: Probe \_\_\_\_\_ °C NIST \_\_\_\_\_ °C

↓  
Pass or Fail  
P F

**Dissolved Oxygen** *In Run Mode*

Mid-Day \_\_\_\_\_ mg/L @ Temp. \_\_\_\_\_ °C % DO \_\_\_\_\_ P F

End-of-Day \_\_\_\_\_ mg/L @ Temp. \_\_\_\_\_ °C % DO \_\_\_\_\_ P F

**Specific Conductance** *In Run Mode*

	Exp. Date	Lot #	Standard	Reading	
Mid-Day _____	_____	_____	_____ μmhos/cm	_____ μmhos/cm	P F

End-of-Day _____	_____	_____	_____ μmhos/cm	_____ μmhos/cm	P F
------------------	-------	-------	----------------	----------------	-----

**pH** *In Run Mode*

Bracketing Standard	Exp. Date	Lot #	Reading	Temperature	
Mid-Day _____ SU	_____	_____	_____ SU	_____ °C	P F

End-of-Day _____ SU	_____	_____	_____ SU	_____ °C	P F
---------------------	-------	-------	----------	----------	-----

**Notes:**

	Site ID: Project:

**Maintenance:** Specific Conductance Probe Cleaned? Y N  
Dissolved Oxygen Membrane Changed: Y N

\_\_\_\_\_ Print name of person performing calibrations.





**Figure 26. Sampling Supplies Inventory List – Ground Water****Florida Department of Environmental Protection  
Ground Water Sampling Equipment Inventory List****METERS**

GW Multiprobe \_\_\_  
 GW Data Display \_\_\_  
 Charged batteries \_\_\_  
 Backup Multiprobe \_\_\_  
 Backup Data Display \_\_\_  
 Turbidimeter \_\_\_

**CALIBRATION STANDARDS**

pH 4.0 (min. of 2 L) \_\_\_  
 pH 7.0 (min. of 2 L) \_\_\_  
 pH 10.0 (min. of 2 L) \_\_\_  
 Conductance Standards  
 High and low(min. of 2 L) \_\_\_

**Field Reference Standards (FRS)**

pH RFS \_\_\_  
 Conductance RFS \_\_\_

**PUMPS**

Primary Submersible RediFlow2/3 \_\_\_  
 Backup Submersible RediFlow2/3 \_\_\_  
 Primary Power Converter \_\_\_  
 Backup Power Converter \_\_\_  
 Tubing \_\_\_  
 Check valves \_\_\_  
 Sampling Manifolds \_\_\_  
 Water Level Tape/Potentiometer \_\_\_  
 Backup Water Level Tape \_\_\_  
 Chalk \_\_\_

**ELECTRIC POWER**

Generator \_\_\_  
 Fuel \_\_\_  
 Oil \_\_\_  
 Maintenance Log \_\_\_

**REAGENTS & PRESERVATIVES,  
CLEANING**

Sulfuric Acid Vials (min. of 10) \_\_\_  
 Nitric Acid Vails (min. of 10) \_\_\_  
 Fresh DI Water \_\_\_  
 Liquinox \_\_\_  
 Acid Waste Container \_\_\_

**Date of Inventory** \_\_\_\_\_

**Signature** \_\_\_\_\_

**GLOBAL POSITIONING SYSTEM**

Trimble Pro XR \_\_\_  
 TDC1 Data Logger \_\_\_  
 Batteries and charger \_\_\_  
 Measuring Tape \_\_\_  
 Compass \_\_\_

**SAMPLING SUPPLIES**

Coolers \_\_\_  
**Proper Sample Kits** \_\_\_  
 Unpowdered Latex Gloves \_\_\_  
**Filters (min of 10)** \_\_\_  
 pH Test Strips \_\_\_  
 Ziplock Bags \_\_\_  
 Plastic Garbage Bags \_\_\_  
 Packaging Tape \_\_\_  
 Paper Towels \_\_\_  
 Kim Wipes \_\_\_  
 DI Wash Bottles \_\_\_  
 Cleaning brushes \_\_\_  
 Sharpie Markers, Pens \_\_\_  
 Calculator \_\_\_ Watch \_\_\_  
 Camera /Floppy Disc \_\_\_  
 Bucket for flow rate \_\_\_

**PAPERWORK**

**Site Maps** \_\_\_  
 Historical Data \_\_\_  
 Field Sampling Sheets \_\_\_  
 Microlanduse Sheets \_\_\_  
 Custody Sheets \_\_\_  
 Barcode Labels \_\_\_  
 Calibration and Cleaning Logbooks \_\_\_  
 Manuals \_\_\_  
 FLUWID Labels \_\_\_

**SAMPLING VEHICLE**

Fuel \_\_\_  
 Oil Checked \_\_\_  
 Brake Fluid Checked \_\_\_  
 Coolant Checked \_\_\_  
**Transmission Fluid Checked** \_\_\_  
 Clean \_\_\_  
 Maintenance Log with Credit cards \_\_\_  
 Well Keys \_\_\_  
 Check Tires/Spare \_\_\_ \_ \_ \_ \_

**Figure 27. Sampling Supplies Inventory List – Surface Water**

<b>SURFACE WATER SAMPLING CHECKLIST</b>	
<b>SAMPLING EQUIPMENT</b>	
<input type="checkbox"/>	Sampling Truck (cleaned as necessary before sample event)
<input type="checkbox"/>	Boat (life jackets, paddles, safety flares)
<input type="checkbox"/>	Laptop computer (for Hydrolab operation)
<input type="checkbox"/>	Waders, boots, rain gear
<input type="checkbox"/>	Hydrolab/YSI multimeter (field parameters and profiling)
<input type="checkbox"/>	Hammerhead
<input type="checkbox"/>	Van Dorn sampler or similar (for non wadeable streams)
<input type="checkbox"/>	Secchi disk
<input type="checkbox"/>	50ft. fiberglass tape
<input type="checkbox"/>	Digital camera
<input type="checkbox"/>	GPS unit
<input type="checkbox"/>	Corer, Ekman, Petite Ponar and scoops (sediment sampling for lakes only)
<input type="checkbox"/>	Dipnets, brushes, 100m measuring tape, and flagging tape (SCI stream/river sampling only)
<b>SAMPLING SUPPLIES</b>	
<input type="checkbox"/>	Hydrolab meter standards and buffers
<input type="checkbox"/>	Field sheets, submittal forms, bottle labels, ball point pens, sharpie pens and pencils
<input type="checkbox"/>	TV notebook with station info. & maps
<input type="checkbox"/>	Two - 48quart ice chest one for samples and one for ice
<input type="checkbox"/>	Preservatives: H <sub>2</sub> SO <sub>4</sub> , HNO <sub>3</sub> , buffered formaldehyde (SCI stream/river sampling only) and ice
<input type="checkbox"/>	pH strips
<input type="checkbox"/>	Protective eyewear
<input type="checkbox"/>	Non-powdered latex gloves (XL size)
<input type="checkbox"/>	30ml BD syringes & disposable 0.45 um filters (ortho-PO <sub>4</sub> )
<input type="checkbox"/>	Ziploc bags for samples (sandwich - Whirlpaks <sup>®</sup> , gal. size – chemistry samples)
<input type="checkbox"/>	Laboratory supplied sample bottles
<input type="checkbox"/>	Three plastic squirt bottles for cleaning (DI, Liquinox, and HCl)
<input type="checkbox"/>	Two -5gal. Neoprene jugs with DI (one for equipment blanks and one for cleaning)
<input type="checkbox"/>	Strapping tape and cooler liners for sample shipping
Other Equipment or Supplies _____	


**Figure 28. Laboratory Project and Sample Identification Label**

RQ-2009-06-01-01		Bottle Group:A
Preservative:ICE		
TURBIDITY	W-ALK	W-CL-IC
W-COLOR	W-COND	W-F
W-S04-IC	W-TDS	W-TSS
For the test(s) listed above: Collect 1 container per sample site.		
Inorganic Analysis Grp: NUTRIENTS/ ANIONS		

**Figure 29. Laboratory Production and Container Numbers Label**

 PRODUCTION# 186122
 CONTAINER# 000372

**Figure 30. QA/QC Blank Label—Example for Ground Water**


GW QA/QC BLANK 1
25GT0901

**Figure 31. Field Reference Sample Reporting Form**

<u>FIELD QUALITY CONTROL REFERENCE SAMPLE RESULTS</u>	
<b>AGENCY:</b>	_____
<b>ANALYST:</b>	_____
<b>DATE OF ANALYSIS:</b>	_____
<b>PROJECT:</b>	_____
=====	
<b>pH</b>	
<b>SAMPLE ID:</b>	_____
<b>INSTRUMENT ID (make, model, and Id #):</b>	_____
<b>MEASURED VALUE:</b>	_____
<b>COMMENTS:</b>	_____
=====	
<b>CONDUCTANCE</b>	
<b>SAMPLE ID :</b>	_____
<b>INSTRUMENT ID (make, model, and Id #):</b>	_____
<b>MEASURED VALUE:</b>	_____
<b>COMMENTS:</b>	_____

Figure 32. Field Audit Form

# **FIELD AUDIT**

January 2011



Status and Trend Monitoring Networks  
Florida Department of Environmental Protection  
MS 3525  
2600 Blair Stone Road  
Tallahassee, Fl 32399-2400  
Telephone (850) 245-8517

---

Sampling Agency:  
Field Personnel:  
Auditor(s):  
Audit Date:  
Project Name:  
Site:  
Audit Type:  
Copies of Audit Report to:  
**Overall Sampling Performance**

- A copy of the final report will be submitted to the sampling agency within 90 days. The sampling agency recognizes that they will submit a written acknowledgement addressing each corrective action that will be implemented (and how deficiencies will be prevented in the future) as a result of the deficiencies stated in the final audit report within 45 days of receipt.

---

## **SUMMARY**

Documentation (FD1000)	Yes	No	NA
1. Used waterproof ink and corrected errors without obliteration			
2. Described sampling location (waterbody name, station name, status random ID, etc.)			
3. Recorded preservation information and verification, including any deviations from protocols described on the field sheets and custody sheet			
4. Labeled sample bottles properly (bar codes, site label, date, time)			
5. Temperature and pH were recorded to one decimal place for calibrations, verifications and sample readings			
<p>6. All sections of field sheet completed correctly, including</p> <p><u>General</u>: date/time; site location; names and/or initials; field testing measurements with units; ambient conditions; meter ID; use of fuel-powered equipment noted (if applicable); collection of blanks noted (if applicable); preservation; personnel on site</p> <p><u>Ground Water</u>: purging equipment; purging procedure; well casing compositions; well diameter; water table depth; depth of well; volume of water in well; purge volume calculations; total volume of water purged; starting and ending times for purging; purging rate; stabilization measurements; water level drawdown measurements; FLUWID; Microland use</p> <p><u>Surface Water</u>: waterbody type; flow; water level; stage; total depth; secchi depth; collection depth; equipment used (if applicable)</p> <p><u>Sediments</u>: sample collection depth; collection time; areal location of sample; collection interval; sample collection devices; sediment type, odors, and color; number of grabs collected</p> <p><u>Biology</u>: physical and chemical characterization information; stream or river habitat assessment information; rapid periphyton survey form</p>			
<p>7. Instrument calibration log:</p> <ul style="list-style-type: none"> <li>• Unique ID for meter</li> <li>• Standards concentration, lot number, date of preparation or expiration date, units</li> <li>• Date, time and results of each initial calibration and calibration verifications (link to sampling project)</li> <li>• Name of analyst performing calibration/ verification</li> <li>• Corrective actions performed on instrument, including date/time and if the instrument was removed from service</li> <li>• Citation or reference to specific calibration and verification procedures used (DEP SOPs or internal SOPs)</li> </ul>			
<p>8. Custody sheet completed properly:</p> <ul style="list-style-type: none"> <li>• Date, time, sampler names, shipping method, sites, number of samples, matrix, comments, labels</li> <li>• Notation was made if protocols listed on the bottom and reverse of custody sheet were not followed or submitted as described</li> <li>• Copies were retained and invoiced properly (white to lab, yellow to Project Manager, pink to sampling agency)</li> </ul>			
<p>9. Cleaning log:</p> <ul style="list-style-type: none"> <li>• Type and date of analyte free water</li> <li>• Date of lab cleaning</li> <li>• Time and date of field cleaning</li> <li>• Piece(s) of equipment</li> <li>• Procedure</li> <li>• Name of personnel performing cleaning</li> </ul>			
<p>10. Standards and Buffers log:</p> <ul style="list-style-type: none"> <li>• Concentration, lot numbers, date of receipt, expiration date, vendor and initial date of use recorded for all reagents, detergents, solvents, and chemicals</li> <li>• Were turbidity standards that were used beyond the expiration date verified and documented for acceptance?</li> <li>• Were certificates of assay retained for any standard, buffer or FRS <i>not</i> supplied by the DEP QA Officer (ex., pH, turbidity)?</li> </ul>			

<b>Documentation (FD1000) (continued)</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>
11. Equipment Maintenance log: <ul style="list-style-type: none"> <li>• Unique ID for equipment</li> <li>• Maintenance and repair procedures</li> <li>• Routine cleaning procedures</li> <li>• Filling solution replacement for probes</li> <li>• Parts replacements for probes</li> <li>• Date procedures performed on each unit</li> <li>• Names of personnel performing maintenance and repair</li> <li>• Descriptions of malfunctions and repair</li> <li>• Information regarding rental equipment (dates of use, type, description, etc.)</li> <li>• Vendor service (vendor, date, type of service, etc.)</li> <li>• Were manufacturer operation and maintenance manuals and instructions retained?</li> </ul>			

**\*COMMENTS:**

<b>Field Quality Control (FQ 1000)</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>
1. Blank collected in same manner as samples and represent normal sampling conditions. Circle one: a) Pre-cleaned EB b) Field cleaned EB c) Field blank (no equipment)			
2. Blanks were collected at the appropriate frequency and the correct type of blank was collected (pre-cleaned or field-cleaned equipment blank or field blank)			
3. Field reference samples were analyzed under field conditions and were acceptable			
4. Field reference samples were performed at the appropriate frequency			

<b>Field Testing and Calibration (FT 1000 - FT 1600)</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>
1. All instruments or meters met DEP SOP specifications for accuracy, reproducibility and design			
2. All applicable parameters were corrected for temperature and/or salinity (where applicable) either manually or automatically			
3. Sample measurements were chronologically bracketed between acceptable calibration verifications for all parameters			
4. Sample measurements were quantitatively bracketed for all parameters between acceptable calibration verifications (except for ambient conductivity readings that are less than 100 umhos/cm)			
5. An initial calibration verification was performed for each parameter immediately after initial calibration			
6. If the ICV fails to meet acceptance criteria, the instrument is immediately recalibrated or removed from service			
7. If any CCVs fail, additional attempts are made to meet the acceptance criteria or the instrument is recalibrated			
8. Meter was rinsed with DI water between standards and allowed to stabilize before recording readings			
9. pH was calibrated first with the 7 buffer, then a 4 or 10, depending on the expected sample range			
10. Calibration verifications for pH were within $\pm 0.2$ su			
11. Meter was checked weekly to ensure a $\geq 90\%$ theoretical slope, if applicable			
12. Calibration verifications for conductance were within $\pm 5\%$			
13. Calibration verifications for DO were within $\pm 0.3$ mg/L DO when compared to the table of theoretical values for water saturated air			
14. DO electrode was stored in a water saturated air environment when not in use			
15. Initial calibration of turbidimeter was performed quarterly using at least two primary standards (formazin) and met acceptance criteria for NTU range			
16. For turbidity, at least one primary standard was used for the initial calibration verification			
17. For turbidity, secondary gel standards were verified quarterly immediately after the initial calibration verification (if applicable)			
18. For turbidity, all continuing calibration verifications were performed using secondary gel standards (or factory-sealed primary formazin standards)			
19. Sample cells were inspected for scratches, cleaned as necessary and placed correctly in turbidimeter (fingerprints were removed with a lint-free wipe)			
20. Sample cells were rinsed and/or washed properly between calibrations and sample collections			
21. Temperature was verified monthly at a minimum of two temperatures and met acceptance criteria of $\pm 0.5$ °C			
22. Sample measurements are qualified with an "F" if instrument calibration can not be properly verified or if readings are not properly bracketed			
23. All sample measurements were not collected until meter readings stabilized			

**\*COMMENTS:**

<b>General Sampling Procedures (FS 1000, FS 2000), Miscellaneous</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>
1. Paperwork, supplies and equipment were inventoried before going into the field			
2. Most recent version of field sheets and custody sheets was used			
3. Sampling manual was in the field vehicle (and on the boat, if applicable)			
4. Sampling equipment and bottles were clean and appropriate and equipment was in working order			
5. Analyte free water was less than 1 week old (and dated)			
6. Samples were collected in the order listed on the reverse of the custody sheet			
7. Care was taken to avoid contamination of samples			
8. Samplers wore gloves and changed as necessary			
9. Containers were not prerinsed, especially if prepreserved			
10. Samples were properly preserved within 15 minutes			
11. pH was tested on preserved samples; paper was not inserted into bottle			
12. Samples were properly filtered if necessary			
13. Headspace was left in all sample containers and all samples were filled with appropriate amount of sample			
14. Samples were packed properly <ul style="list-style-type: none"> <li>• Bacteria whirlpaks packed together in bag</li> <li>• Acidified sample bottles packed separately</li> <li>• All samples placed together in large bag, protected from ice</li> <li>• Custody sheet completed, bagged and placed in cooler</li> </ul>			
15. At least one sampler on site has attended Sampler Training Workshop			

<b>Surface Water Sampling (FS 2100)</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>
1. Samples were collected upwind from power sources, if applicable			
2. Samples were collected on upstream side of bridge, body or boat without disturbing the sediments			
3. Water samples were collected prior to sediment samples (if any)			
4. Intermediate collection devices were well rinsed with sample water; rinse water was discarded away from sample site			
5. Whirlpaks were collected as grab samples by immersing the closed Whirlpak and opening it underwater; OR an open whirlpak was plunged opening downward below the surface and filled in a single continuous sweeping arc; OR collected from an intermediate collection device without interruption of the flow			
6. Sample containers were submerged neck first, inverted into flow, slowly filled and returned to surface (if sample containers were used as collection device)			
7. Field parameters were measured at appropriate depth(s)			
8. Water depth was at least 10 cm			
9. Water samples were collected at the appropriate depth and corresponded with field parameter measurement depth			
10. Sample was collected at correct location in waterbody			
11. Depth was measured to nearest 0.1m			
12. Secchi depth and stage height were accurately determined, if applicable			

**\*COMMENTS:**

<b>Sediment Sampling (FS 4000)</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>
1. Lake was at least 1m deep at its deepest point			
2. Samples were collected in the proper location			
3. Surface water samples were collected prior to sediment samples			
4. A minimum of 3 grabs were collected			
5. Standing water was siphoned off before transferring to the sample jar			
6. Only the top 3-5cm of sediments were transferred to the sample jar			
7. Sample jar was filled 2/3 full			
8. For flocculent sediments, the sample was collected from below the top layer			

<b>Groundwater Sampling (FS 2200)</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>
1. Any standing water was removed from well head			
2. Depth to water was measured to nearest 0.01 ft without sounding the bottom			
3. Well volume was correctly determined			
4. Depth to water was measured at intervals during purging; drawdown was stabilized so pumping rate matched recharge rate			
5. Pump or tubing was placed at top of water column			
6. Whenever possible, a variable-speed pump was used			
7. If a peristaltic pump was used, a 1-foot max length of silicone tubing was installed in the peristaltic pump head assembly			
8. A closed flow cell was used to measure stabilization			
9. At least one well volume was purged <b>before</b> beginning purge stabilization measurements and at least ¼ well volume was purged between measurements			
10. Purging completion was measured as: <ul style="list-style-type: none"> <li>• DO <math>\leq</math> 20%. If DO <math>\geq</math> 20%, reasons were justified and consecutive measurements were within the greater of <math>\pm</math> 0.2 mg/L or 10%</li> <li>• Turbidity <math>\leq</math> 20 NTU. If turbidity <math>\geq</math> 20 NTU, reasons were justified and consecutive measurements were within the greater of <math>\pm</math> 5NTU or 10%</li> </ul> And at least three consecutive measurements of following parameters were within stated limits: <ul style="list-style-type: none"> <li>• temperature <math>\pm</math> 0.2° C</li> <li>• pH <math>\pm</math> 0.2 su</li> <li>• specific conductance <math>\pm</math> 5.0% of reading</li> </ul>			
11. If well failed to meet stabilization criteria after 5 well volumes, all instruments, equipment, tubing, etc. were tested and found functional before collecting sample			
12. Low permeability well was purged at low flow rate. If well purged dry, well was allowed to recover before sample was collected.			
13. Pump and tubing decontaminated between wells or replaced at each well			
14. A new filter was properly flushed with sample water before collecting filtered samples			
15. For wells with in-place plumbing, purging and sampling was upstream of storage tanks where possible			
16. Flow rate was reduced to less than 500mL/minute (1/8" stream) or 0.1 gal/min before collecting samples			

**\*COMMENTS:**

**Figure 33. Quarterly Quality Assurance Report – Example**

**QUALITY ASSURANCE REPORT FOR DEP AMBIENT MONITORING PROGRAM**

**GROUND WATER AND SURFACE WATER TREND AND STATUS MONITORING NETWORKS**

**For the Time Period:**

**January 1, 2005 to March 31, 2005**

**Water Management District**

**Prepared by:**

**John Doe  
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0000 Blair Stone Road  
Tallahassee, FL 32399**

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John Doe  
Project Manager

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Date

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Jane Smith  
Quality Assurance Officer

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Date

### Internal Field Audits

One internal surface water field audit was performed by our Quality Assurance Officer during this quarter (copy attached). The sampler started to preserve the metals bottle first (not the proper order). The QA Officer stopped the procedure and explained the nutrients bottle should be preserved first to avoid possible contamination. Samplers were instructed to review the manual and the back of the custody sheet for more information.

### External Field Audits

No external field audits were performed during this quarter. One external ground water audit is scheduled with the DEP QA Officer for next quarter.

### Quality Control Samples

*NOTE: You may attach spreadsheets with this information and briefly summarize results*

Project	# Samples	# Blanks	FRS pH	FRS Conductance
GWTV	15	3	2	2
GW Status	19*	4*	3	3
SW TV	15	3	2	2
SW Status	0	0	0	0

\*Unable to collect all 20 GW Status samples and 6 blanks due to lack of time.

Equipment blanks were collected as scheduled, 1 blank approximately every 5 samples. Three blanks were collected on precleaned and 9 on field cleaned equipment.

Field reference samples were analyzed every 5-10 samples. All pH checks were satisfactory. One conductance check was unsatisfactory. The meter was recalibrated and the end of the day check was satisfactory.

### Significant QA/QC Problems and Corrective Actions

Problem: New sampler was confused about sample preservation sequence.  
 Correction: QA Officer explained proper sequence and showed sampler section in manual to refer to in future.

Problem: A FRS conductance check was unsatisfactory. The sampler did not have a second bottle to check in the sampling truck.  
 Correction: Samplers were instructed to bring extra FRS bottles in truck. Sampler recalibrated meter and end of day check was satisfactory.

Problem: Samplers could not find whirl-paks when at site and could not collect samples.  
 Correction: Samplers found whirl-paks when cleaning truck the next day and returned to site to collect samples. Samplers were instructed to inventory kits and retain containers in bag until ready to sample.

**Figure 34: Exclusion Criteria**  
 Ground Water

EXCLUSION CATEGORY	EXCLUSION CRITERIA
DRY	WELL DRY DURING INDEX PERIOD (WELL CONSISTENTLY DRY, PURGES DRY OR DOES NOT RECOVER WITHIN 6 HOURS.)
NO PERMISSION FROM OWNER	ACCESS DENIED BY PROPERTY/WELL OWNER
NO PERMISSION FROM OWNER	UNABLE TO OBTAIN PERMISSION FROM PROPERTY/WELL OWNER
OTHERWISE UNSAMPLEABLE	REQUIRED PHYSICAL AND/OR GEOLOGICAL INFORMATION NOT AVAILABLE FOR WELL
OTHERWISE UNSAMPLEABLE	WELL DAMAGED
OTHERWISE UNSAMPLEABLE	UNSAFE SAMPLING CONDITIONS
OTHERWISE UNSAMPLEABLE	SAMPLER CAN NOT RUN IN-PLACE PLUMBING
OTHERWISE UNSAMPLEABLE	SAMPLE WITHDRAWAL LOCATION AFTER FILTER OR SOFTENER
OTHERWISE UNSAMPLEABLE	WELL NONFUNCTIONAL AS SAMPLING DEVICE (WELL NO LONGER SERVES AS AQUIFER SAMPLING DEVICE (I.E., DESTROYED).)
OTHERWISE UNSAMPLEABLE	CAN NOT LOCATE WELL (WELL CAN NOT BE FOUND AFTER GROUND TRUTHING)
UNABLE TO ACCESS	UNABLE TO GET EQUIPMENT TO RANDOM LOCATION
UNABLE TO ACCESS	SAMPLER UNABLE TO GET EQUIPMENT INTO WELL
WRONG RESOURCE/NOT PART OF TARGET POPULATION	WELL TAPS WRONG RESOURCE
WRONG RESOURCE/NOT PART OF TARGET POPULATION	WELL IN ZONE OF DISCHARGE OF PERMITTED FACILITY
WRONG RESOURCE/NOT PART OF TARGET POPULATION	WELL IS NOT UPGRADIENT WELL AT FACILITY
WRONG RESOURCE/NOT PART OF TARGET POPULATION	WELL FALLS OUTSIDE OF REPORTING UNIT

**Figure 34: Exclusion Criteria (continued)**  
Surface Water

EXCLUSION CATEGORY	EXCLUSION CRITERIA
DRY	SMALL LAKE OR LARGE LAKE LESS THAN ONE METER DEEP
DRY	DRY DURING INDEX PERIOD (INCLUDING LAKE WATER LESS THAN 4 HECTARE, IF COVERAGE IN NHD AS > 4 HECTARE)
DRY	NO FLOWING WATER AT STREAM/RIVER RANDOM LOCATION FOR THREE MONTHS
DRY	STREAM/RIVER RANDOM LOCATION LESS THAN 10 CM DEEP
NO PERMISSION FROM OWNER	ACCESS DENIED BY PROPERTY OWNER
NO PERMISSION FROM OWNER	UNABLE TO OBTAIN PERMISSION FROM OWNER
OTHERWISE UNSAMPLEABLE	FLOOD CONDITIONS DURING INDEX PERIOD AT STREAM/RIVER RANDOM LOCATION.
OTHERWISE UNSAMPLEABLE	UNSAFE SAMPLING CONDITIONS
OTHERWISE UNSAMPLEABLE	OPEN WATER IN LAKE LESS THAN .1 HECTARE
UNABLE TO ACCESS	NO OPEN WATER AVAILABLE AT LAKE SAMPLING POINT
UNABLE TO ACCESS	UNABLE TO REACH RANDOM LOCATION WITHIN THREE HOURS FROM ACCESS POINT
UNABLE TO ACCESS	UNABLE TO GET EQUIPMENT TO RANDOM LOCATION (SAMPLER CANNOT GET NECESSARY SAMPLING EQUIPMENT TO SITE.
WRONG RESOURCE/NOT PART OF TARGET POPULATION	ARTIFICIALLY CREATED LAKE OTHER THAN ESTABLISHED IMPOUNDMENTS
WRONG RESOURCE/NOT PART OF TARGET POPULATION	STORMWATER TREATMENT AREAS
WRONG RESOURCE/NOT PART OF TARGET POPULATION	WETLANDS
WRONG RESOURCE/NOT PART OF TARGET POPULATION	ROADSIDE BORROW PIT
WRONG RESOURCE/NOT PART OF TARGET POPULATION	CURRENT OR HISTORIC MINING OPERATION
WRONG RESOURCE/NOT PART OF TARGET POPULATION	STREAM/RIVER ARTIFICIALLY ALTERED WITH LOSS OF SINUOSITY AND BOX CUT BANKS
WRONG RESOURCE/NOT PART OF TARGET POPULATION	ARTIFICIAL LAKE, LAGOON, OR POND USED FOR AGRICULTURAL OR AQUACULTURE OPERATIONS
WRONG RESOURCE/NOT PART OF TARGET POPULATION	ESTABLISHED LAKE SIZE IS < 4 HECTARES, VIA BEST PROFESSIONAL JUDGEMENT, (NOT "DRY")
WRONG RESOURCE/NOT PART OF TARGET POPULATION	GIS COVERAGE INCORRECT, WATERBODY NOT PRESENT AT RANDOM LOCATION
WRONG RESOURCE/NOT PART OF TARGET POPULATION	WATERBODY WITHIN FDEP PERMITTED FACILITY BOUNDARY
WRONG RESOURCE/NOT PART OF TARGET POPULATION	RANDOM LOCATION LIES AT OUTFALL OF FDEP PERMITTED FACILITY (SITE LIES AT THE OUTFALL POINT OF EFFLUENT ENTERING STATE WATERS (IN MIXING ZONE OK).)
WRONG RESOURCE/NOT PART OF TARGET POPULATION	RANDOM LOCATION FALLS OUTSIDE REPORTING UNIT
WRONG RESOURCE/NOT PART OF TARGET POPULATION	ESTUARY
WRONG RESOURCE/NOT PART OF TARGET POPULATION	CHANGING RESOURCE TYPE (INCLUDING RESTORATION AREAS) (RESOURCE TYPE WILL DEFINITELY CHANGE PRIOR TO SCHEDULED SAMPLING. EXAMPLE: IMPOUNDMENT OF A FORMER RIVER TO FORM A LAKE.)
WRONG RESOURCE/NOT PART OF TARGET POPULATION	SMALL STREAM SEGMENT IS NOT CONNECTED TO WATERS OF THE STATE (DITCHES AND CANALS NOT CONNECTED TO WATERS OF THE STATE)

**Figure 35: Qualifiers** [from 2008 QA Rule 62-160.700 Table 1 (Data Qualifier Codes)]

Legal Values:

U	Indicates that the compound was analyzed for but not detected. The reported value shall be the method detection limit.
A	Value reported is the average of two or more determinations.
B	Colony counts were outside acceptable range. The value reported is an estimated count (This code applies to microbiological tests and specifically to membrane filter colony counts.)
I	The reported value is greater than or equal to the laboratory method detection limit but less than the laboratory practical quantification limit.
T	Value reported is less than the laboratory method detection limit.
K	Off-scale low. The actual value is known to be less than the value given.
N	Presumptive evidence of presence of material; component tentatively identified based on mass spectral library search or there is an indication that the analyte is present, but quality control requirements for the confirmation were not met.
O	Sampled but analysis lost or not performed.
Q	Sample held beyond the accepted holding time.
L	Off-scale high. The actual value is known to be greater than the value given.
J	Estimate value. <b>Shall be accompanied by a detailed explanation</b> to justify the reason(s) for designating the value as estimated. Examples of situations in which a “J” code must be reported include: instances where a quality control item associated with the reported value failed to meet the established quality control criteria (the specific failure must be identified); instances when the sample matrix interfered with the ability to make any accurate determination; instances when data are questionable because of improper laboratory or field protocols (e.g., composite sample was collected instead of a grab sample); instances when the analyte was detected at or above the method detection limit in a blank other than the method blank (such as calibration blank or field-generated blanks and the value of 10 times the blank value was equal to or greater than the associated sample value); or instances when the field or laboratory calibrations or calibration verifications did not meet calibration acceptance criteria.
V	Indicates that the analyte was detected at or above the method detection limit in both the sample and the associated method blank and the value of 10 times the blank value was equal to or greater than the associated sample value.
X	Indicates, when reporting results from a Stream Condition Index Analysis (LT 7200 and FS 7420), that insufficient individuals were present in the sample to achieve a minimum of 280 organisms for identification (the method calls for two aliquots of 140-160 organisms), suggesting either extreme environmental stress or a sampling error.
Y	The laboratory analysis was from an unpreserved or improperly preserved sample. The data may not be accurate.
Z	Too many colonies were present for accurate counting. Historically, this condition has been reported as “too numerous to count” (TNTC). The “Z” qualifier code shall be reported when the total number of colonies of all types is more than 200 in all dilutions of the sample. When applicable to the observed test results, a numeric value for the colony count for the microorganism tested shall be estimated from the highest dilution factor (smallest sample volume) used for the test and reported with the qualifier code
!	Indicates that the reported value deviates from historically established concentration ranges.
?	Data are rejected and should not be used. Some or all of the quality control data for the analyte were outside criteria, and the presence or absence of the analyte cannot be determined from the data.