

Watershed Monitoring Status Network Reconnaissance Manual

**Division of Environmental Assessment and Restoration
Florida Department of Environmental Protection
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*This Reconnaissance Manual is dedicated to Margaret Murray,
our colleague and friend who made learning about site reconnaissance
and trading stories about recon really, really fun.
Margaret passed away on December 1, 2012 and is greatly missed.*

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I. Introduction

1.1 Watershed Monitoring Programs

The Florida Department of Environmental Protection (FDEP) routinely monitors the quality of Florida's fresh waters. The overall goal of the state's Watershed Monitoring Program is to provide FDEP with scientifically defensible information on chemical, physical, and biological characteristics of state waters. 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.

The Watershed Monitoring Section (WMS) oversees two monitoring networks that complement each other. In the Trend Monitoring Network, samples are taken from fixed surface and ground water sites. In the Status Monitoring Network, a list of sampling locations is chosen randomly each year. Due to this variability of site locations, it is necessary to conduct reconnaissance (recon) of Status sites.

Recon is carried out to ensure that the Status Network is fiscally, logistically, and scientifically sound. Recon is a way to ensure that the sites are valid for sampling, and are categorized as the correct resource type. For example, recent weather patterns may have caused some streams to flood or dry up, and this information may not be conveyed on the latest GIS coverage. Numerous materials including maps, aerial photos, records, web sites, and well logs, as well as people can assist in determining whether a site can be sampled for water quality data. This manual provides information on the different types of recon materials, including how and when to use them, and where to find them. The manual will be updated as needed to include new recon materials as they continue to be identified.

This document contains a basic description of the Status Network monitoring design to provide context. The remainder of the manual is divided into two primary sections, Surface Water Recon and Ground Water Recon, each containing subsections on office and field procedures. At the end of each section is a step-by-step example for a specific site. Visuals and examples are included to illustrate real-world situations that staff have encountered. The manual also discusses the importance of documentation, which is used by samplers visiting the site at a future date and by data analysts interpreting the resource. Finally, the manual provides appendices to flesh out the manual's text.

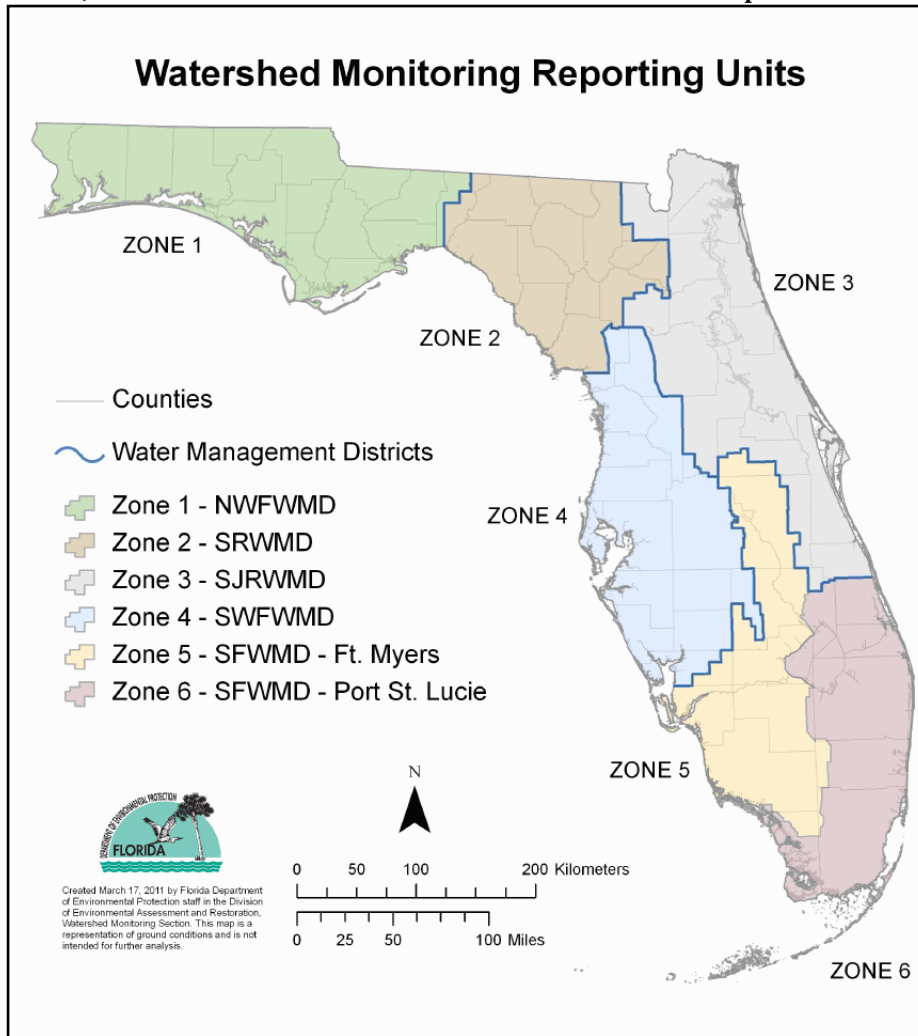
1.2 Status Network Monitoring Design

The objective of the Status Network is to estimate of the conditions of all state freshwaters on an annual basis. The Network is also designed to estimate the proportion of waters that meet the applicable water quality criteria. Because it is impossible to annually sample every well and waterbody in Florida, the Status Network uses a stratified random approach. This means that the state's waters are divided into different categories based on geography and resource type. Within each category, 15-20 samples are collected from randomly selected sites to provide a snapshot of regional and statewide conditions. The network is not designed to answer site-specific questions about coastal waters or individual wells or surface waterbodies.

All stratified random sampling networks use “strata” that divide the population of interest into two or more groups. Stratification is a way to ensure that the sampled sites are representative of the state's water. In the Status Network, the population of interest is all surface water and ground water in Florida, and the strata are as follows: the state's water is categorized into seven resource types (rivers, streams, canals, small lakes, large lakes, confined aquifers, and unconfined aquifers; these resources are described in detail in Chapters [II](#) and [III](#)). To accommodate geography, the water resources are also stratified into six reporting units or zones ([Figure 1](#)). Categorizing the state's waters in this fashion allows for a representative assessment of statewide and regional water quality.

The Status Network's design is based on conducting an annual assessment of the entire state. The state is divided into 6 reporting units (“Zones”), shown in [Figure 1](#).

Figure 1. WMS Zones, or Reporting Units. The zones correspond to the five Water Management Districts (WMDs) in Florida, with South Florida WMD divided into eastern and western portions.

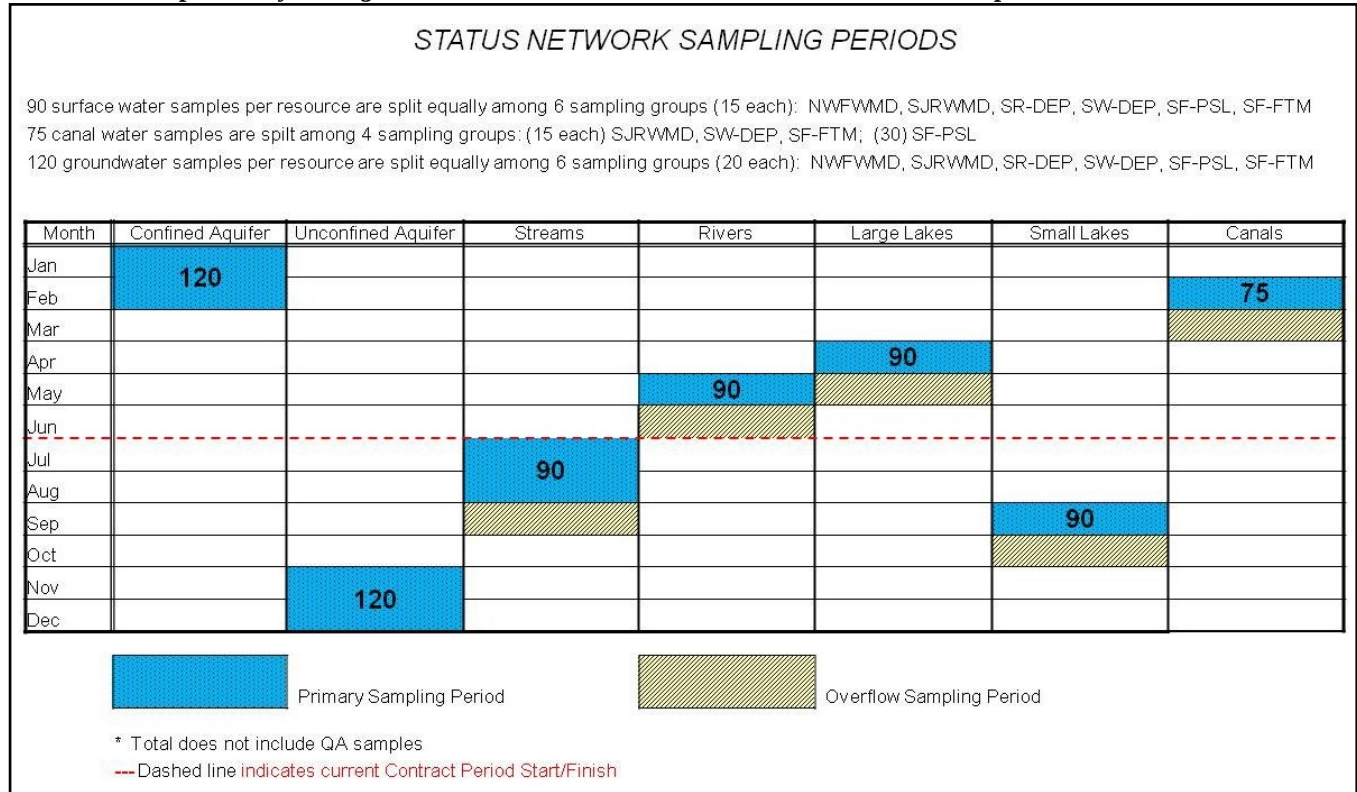


How Status Network Design Affects Recon Efforts

Status Network design affects recon efforts in two ways:

- 1) Since each resource is sampled during a specified sampling period, it is time-effective to begin recon efforts several months ahead of time. [Figure 2](#) shows the statewide sampling periods and lists the total number of samples collected from each resource type.

Figure 2. Status Network sampling periods. Samples are split evenly among the state's six zones, except for canals, which are split evenly among Zones 3-6. Note: in 2012-2013, there were 30 canal samples in Zone 6.



2) Sampling order matters in the design of the Status Network, so recon efforts should address consecutively numbered sites.

For surface water:

- Primary sites 1-15: can be sampled in any order
- Alternate/oversample sites 16-150 must be sampled in consecutive order

For ground water:

- Primary sites 1-20: can be sampled in any order
- Alternate/oversample sites 21-200: must be sampled in consecutive order

The following passage expands on this idea.

For each resource type, a list of 15-20 Primary sites and 135-180 Alternate sites is randomly generated for each zone. (There are 9 times as many Alternates as Primaries, so this is called a 9-time oversample.) Due to requirements in the statistical analyses, all primary sites require reconnaissance, regardless of order. If any of the Primary sites are found to be excluded, then the Alternate site list is used and the reconnaissance is performed in list order. Therefore, if the first

Alternate site is excluded, then the sampler should recon the second Alternate site, and so on until the required number of sites (i.e. 15 or 20) is sampled.

Let's focus on Small Lakes, for example. Let sites 1-15 be the Primary sites, and let sites 16-150 be the Alternates. Suppose that sites 1-10 are sampleable, sites 12-15 are dry, and site 11 has not been reconned. The sampler must determine the suitability of site 11 before proceeding to site 16. If the sampler does not recon site 11 and instead samples site 16, the sampler has effectively missed a lake that may have been sampleable. In this case, there is a "hole" in the data at site 11, and the data from sites 12-16 must be thrown out. The goal here is to proceed down the list until the first 15 suitable lakes are sampled. Fortunately, once all the Primary sites are reconned, the Primary lakes can be sampled in any order.

1.3 Professionalism, Courtesy, and Interacting with the Public

One of the first steps in recon is contacting property owners for permission to access their property. Always remember that you represent FDEP and the state of Florida. In fact, you may be the only state employee with whom a citizen has ever interacted. On the other hand, the citizen may have had prior negative experiences with state personnel due to a regulatory action or other circumstance. Therefore, it is very important that you remain courteous, friendly, and informative during this interaction, as your actions will likely be considered a mirror of the entire Department, and state/other government as a whole.

When speaking with a property owner or occupant, always identify yourself, and briefly explain your request to recon or collect a water sample on that parcel. Explain that this request is for research purposes to obtain an annual "snapshot" of Florida's overall water quality. If denied, remain pleasant, thank the citizen for his/her time, and move on to the next selection. Never argue, attempt to cajole, or insinuate that the denial will cause the citizen trouble with the agency or state.

When contacting a property owner or occupant in person, first introduce yourself. Even though you may be wearing clothing with the FDEP logo, carrying an FDEP badge, and traveling in a vehicle bearing a large FDEP logo, the occupant may see only an unfamiliar person. Always be pleasant, concise, and focused. Provide the occupant with your FDEP business card, the Status Network brochure ([Appendix A.1 Status Network Brochure](#)) and, the latest statewide Status Report (example at [Appendix A.2 Status Network Statewide Report](#); go to <http://www.dep.state.fl.us/water/monitoring/pubs.htm> for the latest report). Explain that the sampling is research for obtaining an annual "snapshot" of the state's overall

water quality. Be prepared to answer any questions posed by the occupant. The same rules apply here to sampling denials: remain pleasant, thank the citizen for his/her time, and move on to the next parcel. Never argue, attempt to cajole, or insinuate that the denial will cause the citizen trouble with the agency or state. If the citizen becomes angry or attempts to argue, politely disengage from the conversation, and leave.

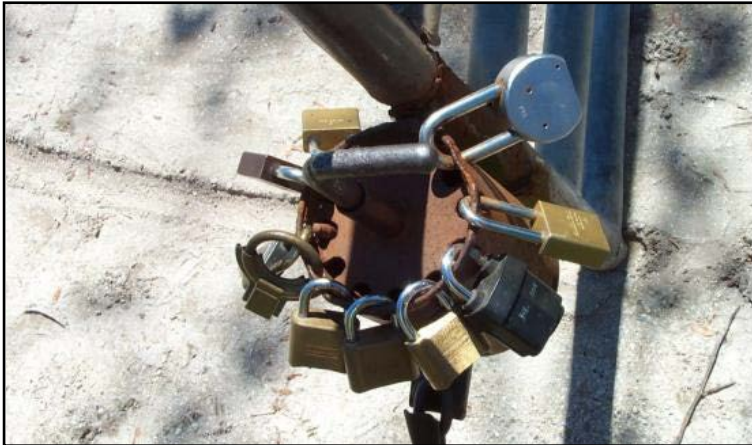
Figure 3. Do not attempt to recon if the property owner denies permission. Photo courtesy of Jessie Taft and Sarah Seitz.



If the occupant approves the sampling and requests the data, obtain or verify his/her mailing address (which may differ from the sampling location), and explain the 6-9 month timeline for receiving the sampling results. If you need to return to resample the waterbody or well at some later date, it is important to notify the owner/occupant that you or another team plan to return. This could be to collect samples for a Lake Vegetation Index (LVI), Stream Condition Index (SCI), resource resample, or drinking waters polluted with heavy metals. If the occupant requests advance notification of the follow-up visit, record his/her contact information.

If she/he has concerns that should be elevated to management or another FDEP section, let the occupant know that you will follow up on this issue, and then do so. Again, you may be the only FDEP/state employee with whom a citizen has ever interacted, or the citizen may have had a prior negative experience with the state, so it is important to represent the agency in a courteous and professional manner.

Figure 4. Example of a difficult access situation. Photo courtesy of Jessie Taft and Sarah Seitz.



1.4 Recon Tracking

It is very helpful to use a spreadsheet to track the progress of recon. This spreadsheet should contain all station information, well construction information for wells, and notes about locating the site. All contact information for the person who granted permission to sample should be contained in this spreadsheet. Typically Microsoft Excel is used for the spreadsheets and each resource is contained in a file named with the project name. [Figure 5](#) shows an example of what a recon tracking spreadsheet might look like.

Figure 5. Example recon tracking spreadsheet.

Microsoft Excel - Z3_CA_EXAMPLE.xls																
Type a question for help																
F6	STILL WAITING ON PERMISSION															
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
1	Color Key	Sampled	Ready to Sample	In Progress of getting permission	Excluded											
2	SITE	COUNTY	STATION_NAME	ALIAS	FLUWID	COMMENTS	LATITUDE	LONGITUDE	LAT DEG	LAT MIN	LAT SEC	LONG DEG	LONG MIN	LONG SEC	LOC METH	
3	Z3-CA-7001	OSCEOLA	OS0229			AIRMENS RANCH/YEEHAW JUNCTION:UB B:UN new jn 10/98	264827.243	810109.045	26	48	27.243	81	1	9.045	DGPS	
4	Z3-CA-7002	DUVAL	D-1342	City of Win at watertower	AAE1234	TMAN WATER WORKS:LB A:AC Status sampled 2/6/11 and 1/12 301802081585001	311802.000	815849.030	31	18	2.000	81	58	49.030	DGPS	V
5	Z3-CA-7003	LAKE	L-0591		AAE0001	SOMEWHERE IN THE HILLS PS #9.MB B:AC	321802.000	814640.691	31	43	31.372	81	46	40.691	DGPS	I
6	Z3-CA-7004	BREVARD	BR1932	Frank Burbanks	AA56789	STILL WAITING ON PERMISSION	292202.736	805130.257	29	22	2.736	80	51	30.257	DMAP	N
7	Z3-CA-7005	NASSAU	N-0304			Fort Clinch State Park	314211.000	812714.000	31	42	11.000	81	27	14.000	DMAP	
8	Z3-CA-7006	ALACHUA	R22T09SEC2601			Formerly Mike Boger well; Well has been sampled for Radon ;Formerly Boger well. GPS 3/96 DEP UNIT	304055.370	820432.802	30	40	55.370	82	4	32.802	MMAP	V
9	Z3-CA-7007	VOLUSIA	V-0531			PIERSON AIRPORT:VB C:IN REDUNDANT 12/95 ANOTHER FA WELL 200 YDS	301449.000	812748.000	31	14	49.000	81	27	48.000	DMAP	V

Always make sure the reason a site is excluded is documented. This includes documenting and selecting the exclusion category and exclusion criteria in GWIS (see section [B. Generalized Water Information System \(GWIS\)/Map Direct](#) below), and providing comments such as whether the exclusion was based on office or field recon, the date, and name of the person performing the recon. Photos of excluded sites should be taken if a site is excluded in the field.

Sometimes several staff may be working on a resource, and job responsibilities need to be made clear. This is very important so different employees are not working on the same tasks at the same time. Communication between staff is very important. Lack of good communication results in inefficiencies and can cause morale problems. [Figure 6](#) shows an example of how tasks can be tracked and divided among staff.

Figure 6. Example of how to distribute recon responsibilities.

Resource	Staff Responsible	Shapefile creation	% of notebook ready	Recon Spreadsheet created	Owners letter sent Date & #	# of Sites ready	# of Sites Sampled	Issues
Surface Water								
Z2LL1304	Bob	18-Feb	100%	18-Jan	18-Feb 1 letter ser	18	4	Z2-LL-7001 maybe
Z2LR1305	Sam	14-Feb	40%	1-Feb	18-Feb	5		
Z2SS1307	Bob	20-Mar	0%					
Z2SL1309	Sam							
Z2UA1311	Bob							
Ground Water								
Z2UA1311	Sam							
Z3UA1311	Bob							

II. Surface Water Resources

This chapter provides descriptions of surface water resources that are sampled, including rivers, streams, lakes, and canals. It provides definitions for Waters of the State because the WMS only collects samples in these waters, with one exception, which is discussed in the [Waters of the State](#) section. The chapter

continues with recon procedures, useful media resources, a list of exclusions, and a walk-through example of surface water recon. The WMS samples the following surface water resources:

Rivers and streams

- linear waterbodies that are Waters of the State (Chapter 403, F.S.; see [Waters of the State](#) below).
- must be continuous/not pooled and at least 10 cm deep
- water must be within banks/not flooded
- must be accessible by either public or private access (with permission).

Figure 7. An ideal river.



Figure 8. An ideal stream.



Waterbodies not included in the Rivers and Streams resource

- waterbodies that are artificially altered with loss of sinuosity and box cut banks
- stormwater conveyances
- agricultural ditches

Lakes

- natural bodies of standing water, and reservoirs that are designated as Lakes on the National Hydrography Dataset (NHD) coverage
- must be at least 4 hectares (40,000 square meters or ~10 acres) in size
- have at least 1000 square meters (0.1 hectare or ~0.25 acres) of open water (i.e., free of emergent vegetation and woody trees)
- are at least 1 meter deep at the deepest point
- are not in direct contact with or influenced by oceanic waters

Figure 9. An ideal large lake.



Waterbodies not included in the Lakes resource

- agricultural ponds
- streams/rivers impounded for agricultural use or private water supply
- borrow pits
- stormwater treatment areas
- lakes constructed for restoration projects
- coastal wetland lakes
- marine or industrial lagoons

Figure 10. Artificial lake (borrow pit). This site would be excluded as Wrong Resource/Not Part of Target Population.



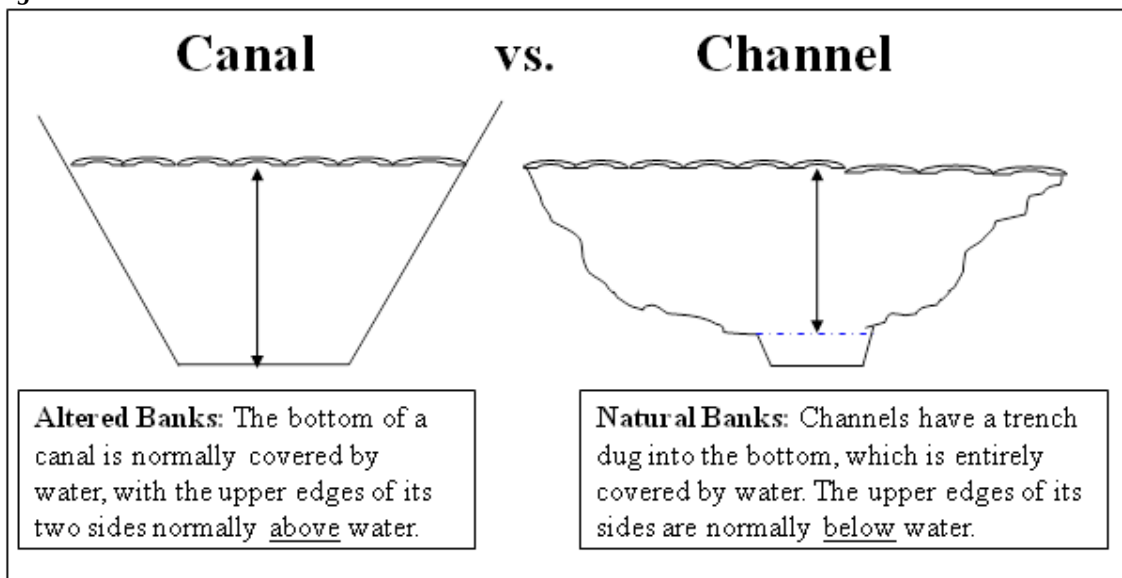
Canals

- are trenches, the bottoms of which are normally covered by water, with the upper edges of the two sides normally above water
- are at least 10 cm deep
- must have water within banks/not flooded

Waterbodies not included in the Canals resource

- waterbodies that are not included in the WMS Primary Canal GIS coverage
- stormwater conveyances
- agricultural ditches
- if there are any questions, contact your Project Manager

Figure 11. Canals vs. Channels.



The following definitions come from section 62-330.021 of the Florida Administrative Code (F.A.C.).

- "**Canal**" means a trench, the bottom of which is normally covered by water, with the upper edges of its two *sides normally above water*.
- "**Channel**" means a trench, the bottom of which is normally covered entirely by water, with the upper edges of one or both of its *sides normally below water*.
- "**Drainage ditch**" or "**irrigation ditch**" means a man-made trench which is dug for the purpose of draining water from the land or for transporting water for use on the land and which is not built for navigational purposes.

Drainage ditches and irrigation ditches should be excluded as Wrong Resource/Not Part of Target Population. Channelized systems are acceptable for sampling in the streams, rivers, and canal populations and should not be excluded.

Waters of the State

As a general rule, the WMS only collects samples in Waters of the State, because these are the waterbodies in which water quality criteria apply. There is one exception: lakes contained entirely on one person's property are not typically Waters of the State, but are still considered a part of the WMS Lakes resource. This is due to the fact that, if the property is divided into multiple parcels in the future, the lake will become a Water of the State. Lakes that lie entirely within tribal lands should be taken on a case-by-case basis; contact your Project Manager if a site falls into this category.

The following paragraph gives a strict legal definition of Waters of the State. Beneath the paragraph is an italicized translation of the legal language, with a focus on how it relates to WMS sampling.

Chapter 403.031 (13) of the Florida Statutes (F.S.) says: "Waters" include, but are not limited to, rivers, lakes, streams, springs, impoundments, wetlands, and all other waters or bodies of water, including fresh, brackish, saline, tidal, surface, or underground waters. Waters owned entirely by one person other than the state are included only in regard to possible discharge on other property or water. Underground waters include, but are not limited to, all underground waters passing through pores of rock or soils or flowing through in channels, whether manmade or natural.

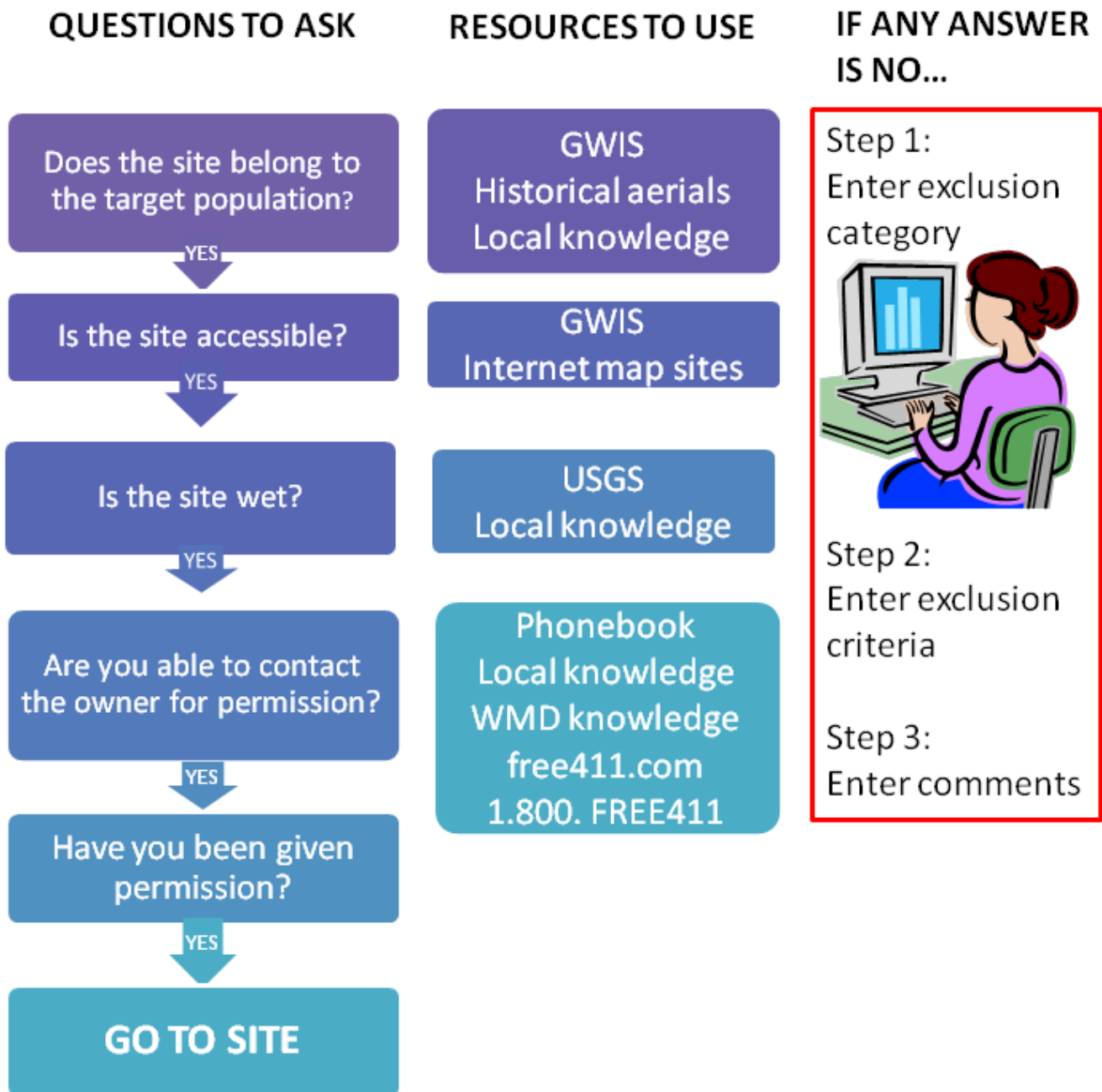
Translation: Waters of the State are any surface and ground waters in Florida, except rivers or lakes which are contained entirely on private property.

2.1 Office Reconnaissance

A. Office Recon Flowchart

The Recon flowcharts illustrate the basic decision-making that guides the recon process, both in the office and in the field. The Office Recon flowchart ([Figure 12](#)) focuses on the steps conducted away from the site, and is heavily dependent on media resources. The resources used in this process are covered in the following pages.

Figure 12. Office recon flowchart for surface water.



B. Generalized Water Information System (GWIS)/Map Direct

GWIS is an internet application that interfaces with the Department's Oracle databases. GWIS is located at <http://gwis.dep.state.fl.us/>, and can be accessed by entering your FDEP network login and password, or by using username = water and password = Monitoring1. (Note: you may be prompted to re-enter the login information multiple times.) This application was designed specifically by the WMS to manage site data for the Status Network, and is the starting point for all Status Network recon. For additional information in using this application, see: Chapter III "Reconning Sampling Sites" of the GWIS Manual, located at http://water.dep.state.fl.us/status/OGWISmanual_050610.pdf (use your FDEP network login info, or the username and password above). A Map Direct Tutorial, Users' Guide, and Quick Start guide are available at <http://ca.dep.state.fl.us/mapdirect/gateway.jsp>.

The different layers in Map Direct provide information on the following features of the sampling site:

- location: county, distance, EcoRegion ID, and proximity to other resources, such as springs and sinkholes
- imagery: United States Geological Survey (USGS) Digital Ortho Quadrangle (DOQQ) maps, current and historical aerial photos that show historical uses and current development, such as mines and land modifications
- access: roads, trails, boat ramps
- land ownership: 2011 (or most recent) cadastral layer (This shows the boundaries and ownership of land parcels)
- impediments to sampling resources: dams and military base boundaries

If available, you may wish to use ArcGIS to complement the information in MapDirect.

C. Hardcopy References

Hardcopy references include maps of Florida and the Florida Atlas & Gazetteer. A current map of Florida comes in handy for navigating to a site via major highways. The Florida Atlas & Gazetteer provides detailed topographic maps containing water features as well as boat ramps, back roads and trails, and a cities index. Guides to city and regional roads are often available in bookstores. Brochures from state and national parks provide overview maps and directions to the park. Other useful hardcopy references include canoeing and kayaking guidebooks, which provide information on maintained and informal boat ramps, and stream conditions.

D. Internet Resources

Internet sites also serve as good resources, although the quality of the information may vary widely. Listed below are commonly used web pages and resources that assist in surface water recon:

- <http://waterdata.usgs.gov/fl/nwis/rt> provides the latest river height and flow for waterbodies at which USGS gages are located
- <http://www.whitepages.ca/> Canadian white pages allow you to obtain phone numbers for free
- <http://dor.myflorida.com/dor/property/appraisers.html> Although MapDirect contains a cadastral (land ownership) layer, you may occasionally need more updated or more in-depth information on a parcel to contact the owner
- <http://www.wateratlas.usf.edu/> contains atlas of Florida lakes, as well as specific county and regional surface water resource information
- <http://www.sunbiz.org/> is the Florida Dept. of State website that allows you to access contact information on corporations, including upper management contacts, locations, and telephone numbers
- <http://www.bing.com/maps/> and <http://www.google.com/maps> provide recent close-up aerials and street level views of a site
- <http://ufdc.ufl.edu/aerials> is a great source for historical aerials, usually categorized by county
- <http://www.dot.state.fl.us/surveyingandmapping/apac.shtm> provides aerials from the 1970s and 1980s
- <http://www.fs.fed.us/r8/florida/> provides USDA national forest maps and aerials
- <http://myfwc.com/research/gis/data-maps/> gives contact information for Wildlife Management Areas under the Florida Fish & Wildlife Conservation Commission (FFWCC)
- <http://www.fws.gov/southeast/maps/fl.html> provides contact information for National Wildlife Refuges under the U.S. Fish & Wildlife Service (USFWS)
- http://www.usgs.gov/contact_us/?state=FL provides contact information for the USGS in Florida
- http://atoll.floridamarine.org/fwc_boatramps/ provides information about FFWCC boat ramps with directions

E. Historic Data

Historic data in the form of aerial imagery (see Smathers Library at University of Florida website) or published accounts of the area can be very helpful, especially if you are uncertain whether the waterbody is natural. Historic data can also include actual sampling data results from previous visits to the site or nearby sites in the same waterbody.

F. Local Knowledge

It is important to establish contacts located physically near the resources to be sampled, or whose area of expertise includes the targeted resources. These can be FDEP district or regional staff, local residents, or employees of WMDs, counties, cities, state parks, National Wildlife Refuges, national forests, etc.

Local residents can be excellent on-site resources in determining ambient surface water conditions, such as the effects of flash events, hurricanes, or drought. Also, if unable to locate the owner of a parcel, people living in the surrounding area can often assist. Examples of questions to ask: Is there open water in the lake? Is there access to the stream or lake?

G. Documentation

Verbal contact with the property owner must be documented whether or not permission is granted to access a site (see [Appendix A.3 Surface Water Permission Letter](#)). An Excel spreadsheet is useful for documenting pertinent information on the site (see [Appendix A.5 Site Tracking Spreadsheet](#)).

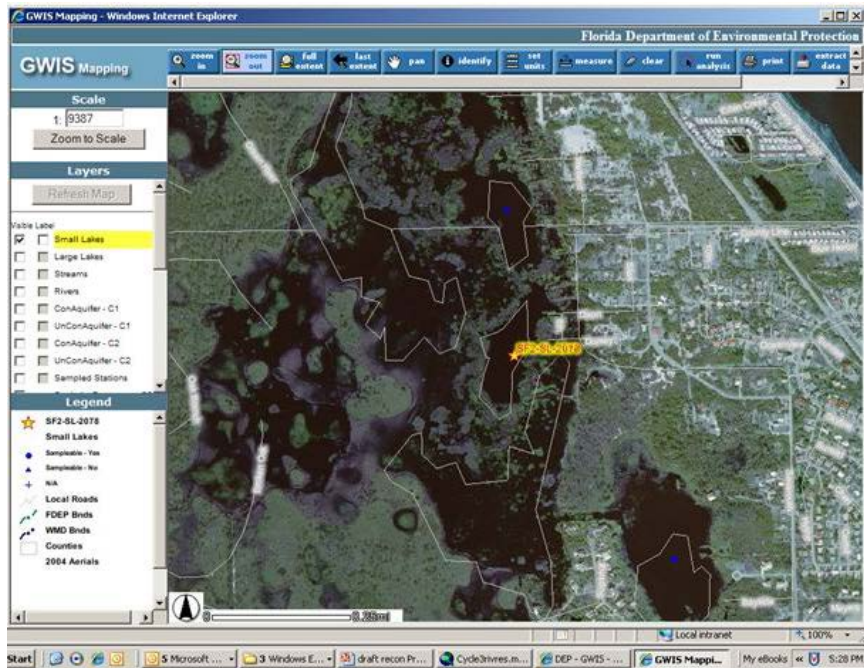


Figure 13. The Savannahs: one large, shallow lake, many small, interconnected lakes, or one big wetland?

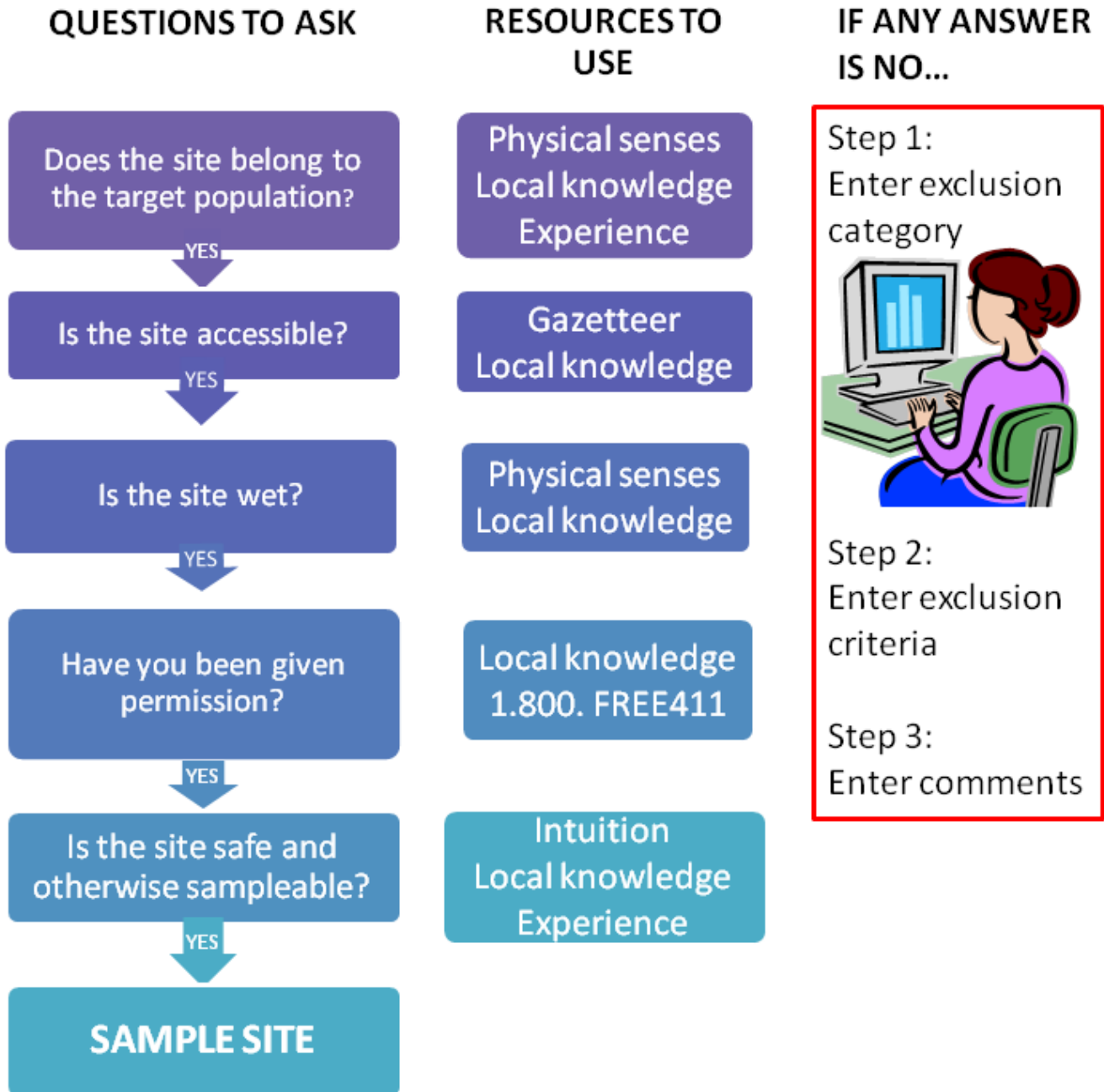
Located in St. Lucie and Martin Counties, the Savannahs were once ancient coastal lagoons that are now shallow fresh waters. Some are linked intermittently, which confounds their resource type for WMS sampling purposes. After reviewing historical documents and speaking with local experts, the WMS determined that we consider the Savannahs to be a series of small lakes, so they are sampled as such.

2.2 Field Reconnaissance

A. Field Recon Flowchart

The Recon flowcharts illustrate the basic decision-making that guides the recon process, both in the office and in the field. The Field Recon flowchart ([Figure 14](#)) focuses on the steps samplers take at or near the site. The approach used in this process is described in the following pages.

Figure 14. Field recon flowchart for surface water.



B. Planning and Conducting Site Visits

Site visits should be conducted only when needed information cannot be obtained from office recon. If field recon is deemed necessary, permission to access private sites must be obtained. If a private site can be observed from public property, no permission is necessary to recon. However, to collect a sample on private property, you will need to obtain access permission to avoid trespassing. Streams and rivers with public access points do not require access permission. Once permission to sample has been granted by the property owner, and field recon has been deemed necessary, take the proper steps to prepare for a recon

trip. Prepare a checklist (see [Appendix A.6 Field Recon Checklist](#)) with items such as keys, camera, cell phone, and maps.

C. Driving Directions

Regardless of who is doing the recon/sampling, obtain driving directions from websites like Google Maps, <http://www.drivingrouteplanner.com/>, and Rand McNally Yahoo Maps. The use of north, south, east, and west rather than left-right directions is preferable. Specific site directions should be documented from the intersection of a major road. Include as many maps from various sources as possible (owner sketch maps, Gazetteer pages, Google Maps, Map Direct maps, and so on). Always include a north-arrow and scale bar with each map. It is better to have too much information than too little.

D. Documentation

Mail or verbal contact with the property owner should be documented whether or not permission is granted to access a site (see [Appendix A.3 Surface Water Permission Letter](#)). An Excel spreadsheet is useful for documenting pertinent information on the site ([Appendix A.5 Site Tracking Spreadsheet](#)).

Refer to the current sampling manual (http://publicfiles.dep.state.fl.us/dear/watershed_monitoring/documents/WMS-SamplingManual.pdf) for inclusion requirements when determining whether a surface waterbody is sampleable. For streams, visible flowing water within a reasonable distance upstream from the site is a good indication that a sample can be obtained.

Figure 15. Example of an ideal stream.



Figure 16. Steams that become discontinuous or shallower than 10 cm deep in drought should be excluded as Dry.



E. Photographing the Site

Whether the site is to be sampled or excluded (see [Table 1. Surface Water Exclusions](#)), the Standard Operating Procedures (SOPs) require photographs for documentation of site conditions. Photographs should be taken in each direction (north, east, south, and west, in this order). If the site must be excluded, take several photographs that best represent the exclusion criteria (dry, flooded out of banks, etc.).

F. Safety

If you can't safely recon due to a temporary condition, come back another day. Safety issues include potentially dangerous animals, weather, and situational conditions. To sample safely from a highway bridge or near a busy highway, use safety equipment such as neon vests, cones, and strobe lights. Safety can also be compromised by bad weather, but you can sometimes return on another day. Exclude the site as Otherwise Unsampleable only if dangerous conditions are expected to last for the duration of the index period, or if you can't recon or sample within the Status design constraints (e.g., sampling in consecutive order).

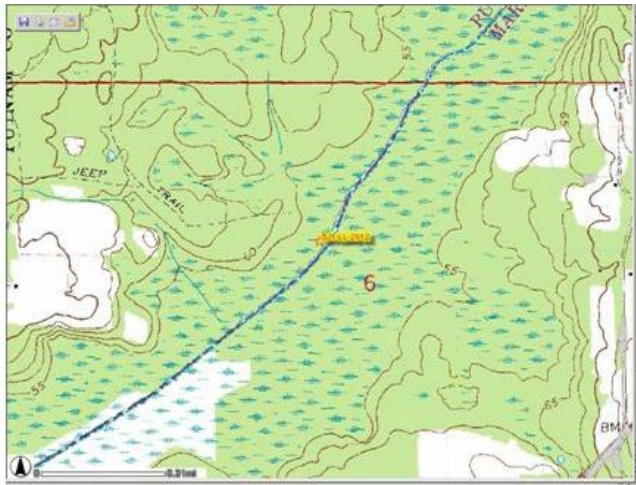
Figure 17. Water moccasins are sometimes sighted in surface waters. Photo courtesy of Jessie Taft and Sarah Seitz.



Figure 18. Other dangers may be of a more unusual origin. Photo courtesy of Jessie Taft and Sarah Seitz.



Figure 19 and Figure 20. Surface water exclusion due to incorrect resource type. This site was categorized as a small lake, but office recon showed it to be wetland. Therefore, it was excluded as Wrong Resource/Not Part of Target Population; Wetlands.



G. Contacting the Project Manager for Assistance

If you are unsure whether conditions are conducive to sampling, or desire additional input, do not hesitate to contact your Project Manager, who can discuss the question with the Administrator, the Data Manager, the QA Officer or other Project Managers. Sometimes field conditions or events are unexpected, and it takes a “village” to develop the Best Professional Judgment in context.

Table 1. Surface Water Exclusions

EXCLUSION CATEGORY	EXCLUSION CRITERIA
DRY	SMALL LAKE OR LARGE LAKE LESS THAN ONE METER DEEP
DRY	DRY DURING INDEX PERIOD, INCLUDES SMALL LAKE WATER < 4 HECTARES LARGE LAKE WATER < 10 HECTARES
DRY	STREAM/RIVER FLOW POOLED AND DISCONNECTED AT RANDOM LOCATION
DRY	STREAM/RIVER/CANAL 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 (FLOW OUT OF BANKS) AT STREAM/RIVER/CANAL 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 (NOT A PRIMARY CANAL)
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 ZONE
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	STREAM SEGMENT IS NOT CONNECTED TO WATERS OF THE STATE
WRONG RESOURCE/NOT PART OF TARGET POPULATION	DRAINAGE/IRRIGATION DITCH INCLUDED IN PRIMARY CANAL COVERAGE

2.3 Example: Recon of a Zone 4 River

OFFICE RECON

GWIS/MapDirect:

1. Open GWIS at <http://gwis.dep.state.fl.us/> (enter your FDEP login info, or enter username = water, password = Monitoring1).
2. Click “Recon Tracking”.
3. In the drop-down boxes, choose Resource Type = LARGE RIVER, Reporting Unit = ZONE 4, Reporting Cycle = 7 (for 2013). Enter the site you want to recon, or leave the Site Location Range blank to return all records. Click “Submit”.
4. To view a map of all sites, click “ShowMap(Random Cycle Location)”. (To view a map of a single site, click on the site of interest first.)
5. Zoom in and out a few times by using the  and  icons, or by changing the map scale to view the site in context of nearby roads, towns, and landmarks, and to determine the easiest route to access the site. You may also enter the lat/long of the site into <http://www.drivingrouteplanner.com/> to find the optimal route.
6. Go to the Data Layers tab on the left, and open the folder called Cadastral & Districts. Click on the most recent Cadastral layer and use the  icon to identify the property owner.
7. Check to see whether this river site lies within the boundaries of a nearby military base by clicking on the “Military Bases” coverage. This would prohibit access, or require you to contact base personnel well ahead of field recon/sampling.
8. Determine whether there are any dams below or above the site by clicking on the “EPA dams” layer. Document findings from the above on the Recon form.
9. If you see any issues that would prevent sampling, contact your Project Manager.

Gazetteer

- Use the Florida Gazetteer to identify the nearest boat ramp to the site, and to double-check the easiest route to access it. Document on the Recon form.

GWIS

- Use the most recent Cadastral layer to determine the identity of the boat ramp owner or contact. Document on the Recon form.

Internet Resources

1. Obtain contact information for the boat ramp owner based on the information in the Cadastral layer, the Canadian White Pages website, county websites, the WMD websites, the State Parks website, Fish & Wildlife Service website, or by other means.
2. Contact the party responsible (owner, resident, manager, etc.) for the boat ramp to obtain access permission. During all contact attempts, document contact name, date, permission given/denied, times available, locks, aggressive animals, and any relevant info about the area.
3. Check <http://waterdata.usgs.gov/fl/nwis/rt> to determine if there is a nearby real time gage on the river. River depth and conditions will determine the type of boat and engine you use. Document on the Recon form.

Local Knowledge

1. Contact staff from the appropriate FDEP District Office, WMD, FWC Office, County, or municipality to learn about local conditions on the river. Document on the Recon form.

FIELD RECON

1. Travel to the boat ramp selected, and determine whether the river is sufficiently deep, flowing, and safe, at the sample site.
2. If the boat ramp cannot be located or is not suitable, contact a local bait shop, outfitter, boat dealer, or other local businesses that work with the boating community to find an alternate ramp.
3. After locating a usable boat ramp, document the correct location on the Recon form.

2.4 Real-World Examples and Tips

Figure 21. From the aerial, this small lake appeared to have sufficient water.



Figure 22. Field recon showed that the site did not have at least 0.1 hectares (~0.25 acres) of open water. The site was therefore excluded as Otherwise Unsampleable; Open Water in Lake Less than 0.1 Hectare.



Figure 23. From the aerial, this small lake appeared to be in close proximity to the road.

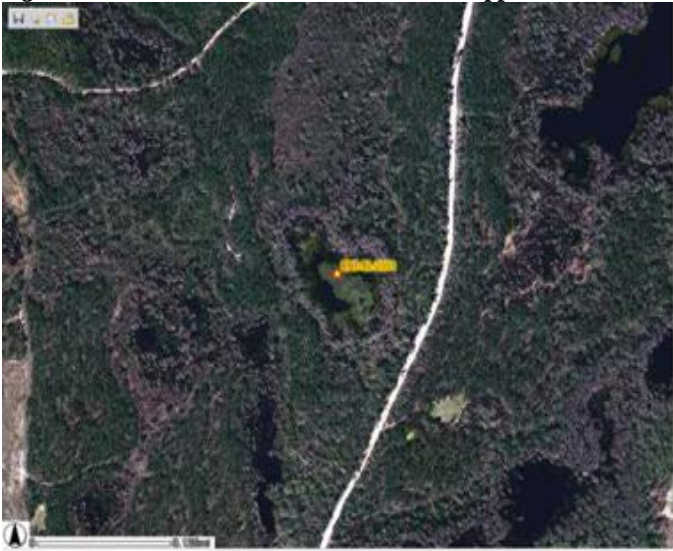


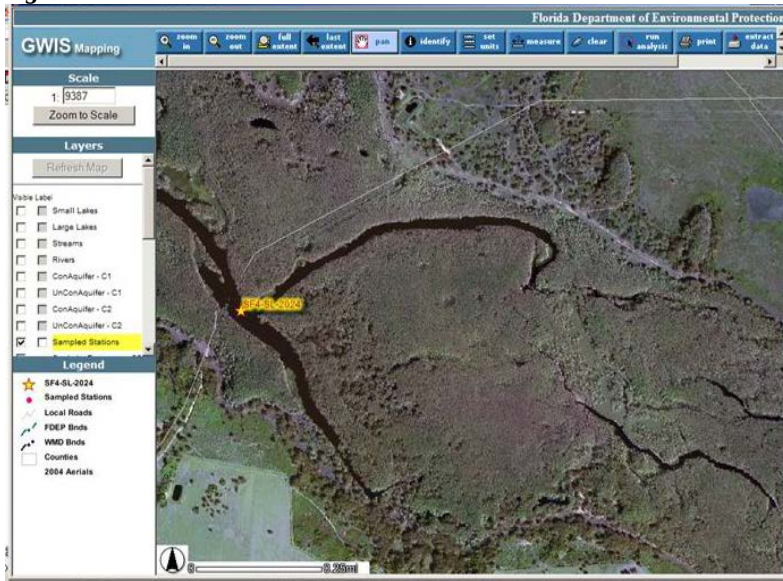
Figure 24. Field recon showed that undergrowth was so heavy the samplers were unable to get equipment to the lake. The site was therefore excluded as Unable to Access; Unable to Get Equipment to Random Location.



Lake or wide river channel?

In [Figure 25](#), this remnant of an oxbow lake could be considered either a lake or a wide river channel. The key here is whether this waterbody exchanges flow with the adjacent river. If there is flow, it should be sampled as a river resource (or excluded as Wrong Resource for the lakes population). If there is very little flow or it is just barely attached, then it should be sampled as a lake (or excluded as Wrong Resource for the river population).

Figure 25. Lake or wide river channel?



Estimating size of lakes and open water

For WMS purposes, Small Lakes are defined as being between 4 and 9.999 hectares (about 10-25 acres). Although the most recent aerial coverage can assist you in estimating the lake size, it is more difficult to determine size in the field. One way to estimate the lake's size is to compare it to the size of several football fields (see [Figure 26](#) for an illustration). One hectare is about 110 yards × 110 yards, or the size of two football fields side by side, including the end zones. Thus, 4 hectares would appear to be the size of 8 football fields side by side, or 440 yards × 440 yards or ¼ mile × ¼ mile in size. The lake must be at least 4 hectares to be sampled. If it is obviously smaller, exclude as “Dry; Dry During Index Period, Includes Small Lake Water < 4 Hectares Large Lake Water < 10 Hectares”.

Figure 26. How to estimate the size of a small lake. One hectare is about two football fields side by side. Small lakes must be at least four hectares, or eight football fields side by side.



For WMS purposes, both Small and Large Lakes must have an open area of water, free of emergent vegetation. The sampling location should be at the center of a Small Lake, and at a specific latitude and longitude for Large Lakes. At least 0.5 square meters of open water must surround the sampling point. There must also be at least 0.1 hectare (about $\frac{1}{4}$ acre) of open water in the entire lake. To determine if you have a large enough open area, estimate whether the area is the size of a baseball infield, or about 35 yards $\times$ 35 yards (see [Figure 27](#)). Alternatively, 0.1 hectare can be thought of as the area of 2 rows of 20 parking spaces, with a 2-lane road in between the rows (see [Figure 28](#)). If the area of open water is obviously smaller, exclude as Otherwise Unsampleable; Open Water in Lake Less Than 0.1 Hectare.

Figure 27. One way to estimate the size of open water in lakes. The area of open water should be at least the size of a baseball infield.

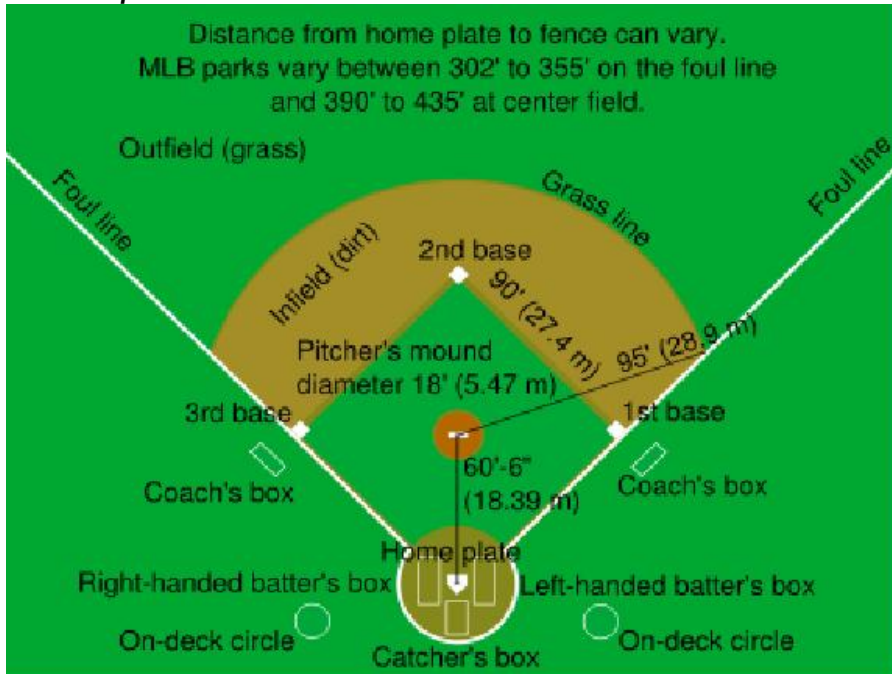
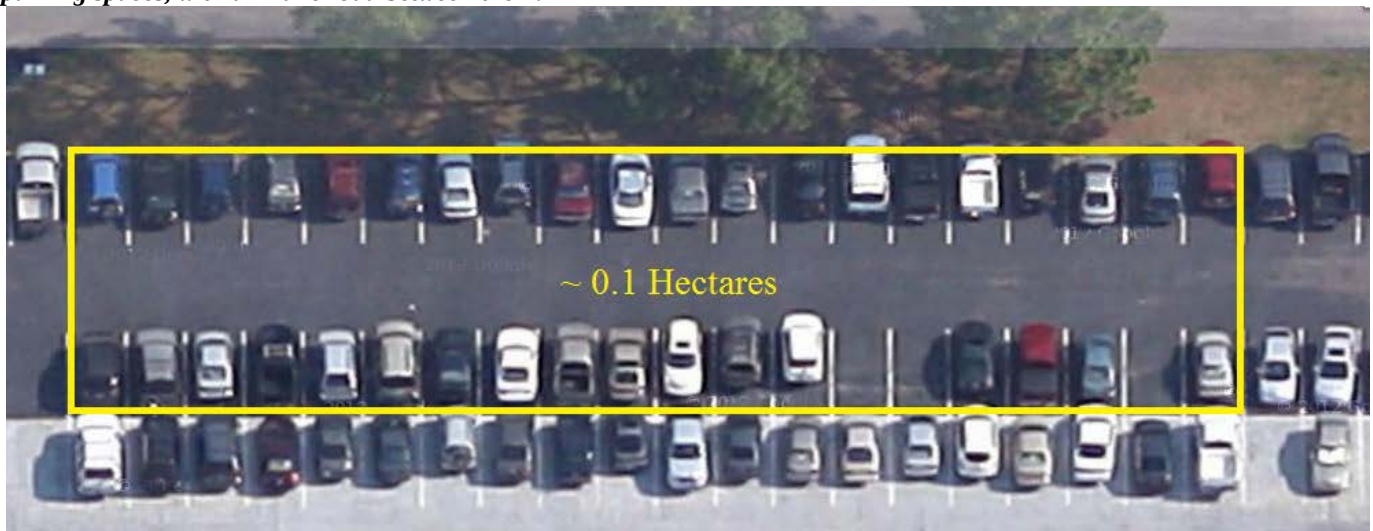


Figure 28. Another way to measure the area of open water in lakes. The area should be at least the size of 2 rows of 20 parking spaces, with a 2-lane road between them.



"Braided" areas: one large river or several small streams?

Near Lake Tsala Apopka, the Withlacoochee River widens out and contains many islands, which gives it a braided appearance ([Figure 29](#)). The question is whether the WMS considers these sites River or Streams resources. During Cycle 2 (years 2004-2008), the braided areas were considered part of the River resource, but because their functionality more resembled that of streams, the WMS began to classify them as Streams in Cycle 3 (year 2009).

Figure 29. Lake Tsala Apopka is considered a series of streams.



Large lake sites “on the shoreline”

If a Large Lake site falls on the shoreline ([Figure 30](#)), you must exclude the site. If the same situation occurs in a Small Lake, do not exclude the site, just sample in the center of the lake.

Figure 30. Large Lake sites that fall on the shoreline are excluded either as “Dry” or “Wrong Resource/Not Part of Target Population; GIS Coverage Incorrect, Waterbody Not Present at Random Location”. In either case, please be sure to provide comments.



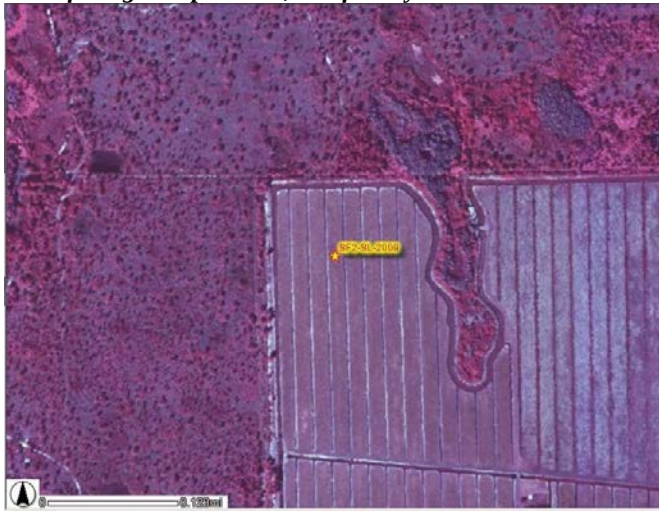
Is this a real or fake lake?

Manmade lakes are not appropriate for WMS sampling. A small lake may look natural ([Figure 31](#)), but could be an excavated wetland or strictly manmade. Historical aerial photographs ([Figure 32](#)) can show the region prior to development, thus determining whether a resource is natural or manmade. In this case, it is clear that the lake is manmade.

Figure 31. Current aerials show the presence of a lake.



Figure 32. However, historical aerials show that the lake is manmade. This site should be excluded as Wrong Resource/Not Part of Target Population; Artificially Created Lake Other than Established Impoundments.



III. Ground Water Resources

This chapter provides information about aquifers, notes on the use of Global Positioning System (GPS) units, well types, recon procedures, useful media resources, well criteria, well confirmation information, a walk-through example of ground water recon, and a list of ground water exclusions.

The Status Network samples water from both confined and unconfined aquifers in Florida. Confined aquifers, which are usually deeper, include portions of the Biscayne and Floridan Aquifers. Unconfined aquifers, often shallower than confined, are comprised of surficial aquifers and sand and gravel aquifers. For sampling purposes, the WMS considers the Intermediate Aquifer System (IAS) as a Confined Aquifer.

Due to the many ground water programs and well types and layouts, it is important to have background knowledge of the well prior to conducting recon. Wells found in the Status Network list frame include monitoring, private, and facility wells in the programs and networks listed below. For more in-depth information on these networks and aquifers, see [Appendix B. Aquifers and Ground Water Programs](#).

GPS Coordinates

GWIS provides site locations in the form of latitude and longitude along with a locational method. Beware of cases where the locational method is MMAP (Manual Map Interpolation) or DMAP (Digital Map Interpolation), because the coordinates can be significantly inaccurate. For MMAP coordinates, the actual site may be located anywhere from 50 meters to 1 kilometer from the coordinates listed in GWIS. This is known as an accuracy level of 6 (see below). For DMAP, the accuracy level is 4-6. All locational data collected for the Status Network should be collected using Trimble GPS equipment in Assisted GPS (AGPS) mode. These locations are then postprocessed in Tallahassee to result in a Differential GPS (DGPS) locational method, which has an accuracy level of 2-3.

GPS Accuracy Levels

- 1 = <0.02 meter (+/- 0.01 meter)
- 2 = 0.02 to 1.0 meter
- 3 = >1.0 to 10 meters
- 4 = >10 to 20 meters
- 5 = >20 to 50 meters
- 6 = >50 to 999.99 meters

Minimum Data Requirements for Wells

For a well to be included into the WMS database, the following minimum information as defined in the current Stations Table Data Dictionary is required:

STATION NAME
COUNTY
AGENCY
WATERBODY NAME
WATER RESOURCE
LATITUDE
LONGITUDE
LOCATION METHOD
LOCATIONAL DATUM
CASING DIAMETER
CASING MATERIAL
CASING DEPTH
TOTAL DEPTH
ALL CONTACT INFORMATION

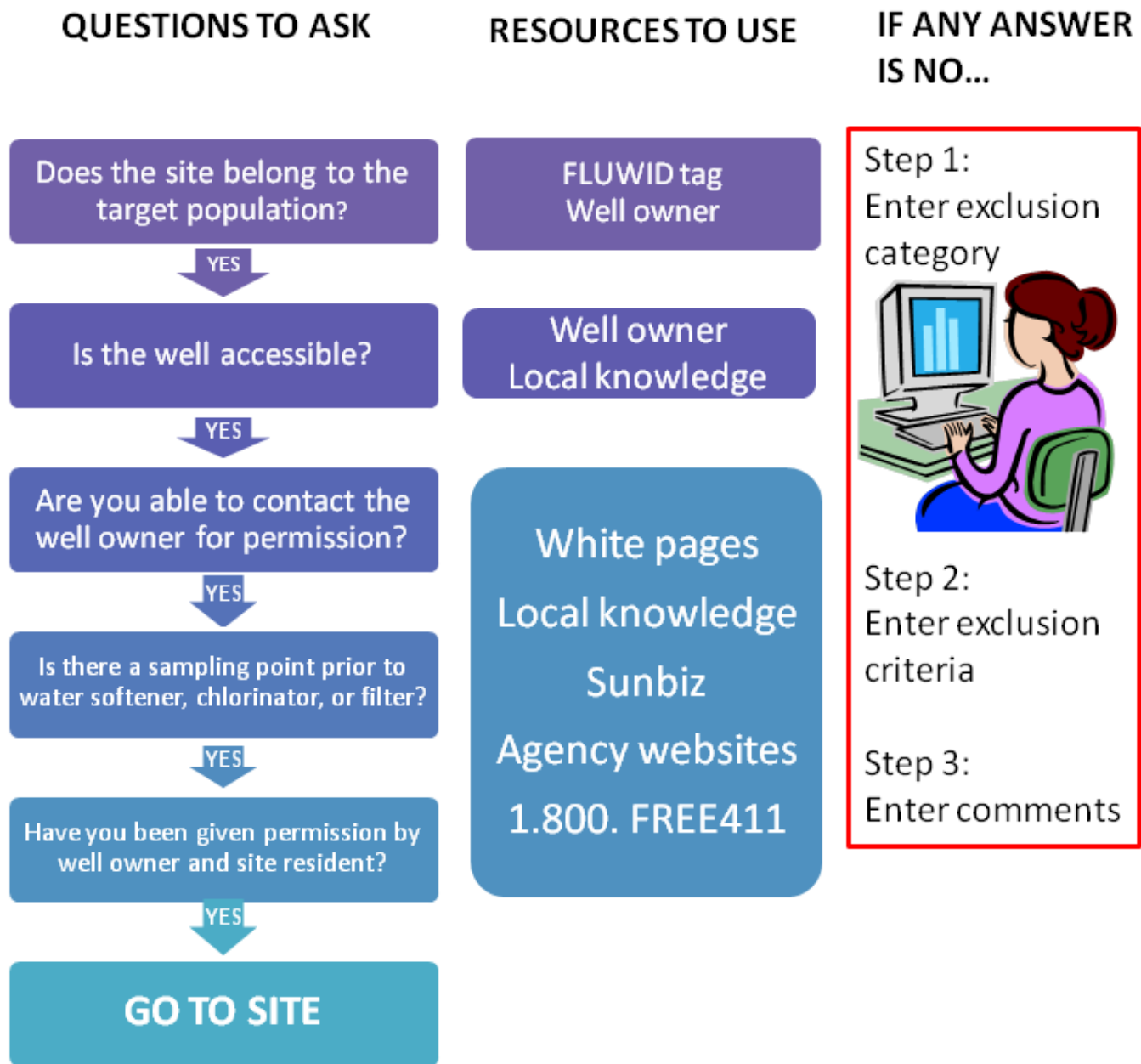
Additional research may be required to complete the underlined items. If the total depth is unknown, contact the appropriate WMD to see if they have this information or know the identity of the well driller. If a well needs to be excluded due to lack of data, enter “Otherwise Unsampleable” as the Exclusion Category and “Required Physical and/or Geological Information Not Available for Well” as the Exclusion Criteria in GWIS. Always supply further information in the Comments box.

3.1 Office Reconnaissance

A. Office Recon Flowchart

The Recon flowcharts illustrate the basic decision-making that guides the recon process, both in the office and in the field. The Office Recon flowchart ([Figure 33](#)) focuses on the steps conducted away from the site, and is heavily dependent on media resources. The resources used in this process are covered below.

Figure 33. Office recon flowchart for ground water.



B. Generalized Water Information System (GWIS)/Map Direct

GWIS is an internet application that interfaces with the Department's Oracle databases. GWIS is located at <http://gwis.dep.state.fl.us/>, and can be accessed by entering your FDEP network login and password, or by using username = water and password = Monitoring1. (Note: you may be prompted to re-enter the login information multiple times.) This application was designed specifically by the WMS to manage site data for the Status Network, and is the starting point for all Status Network recon. For additional information in using this application, see: Chapter III "Reconning Sampling Sites" of the GWIS Manual, located at http://water.dep.state.fl.us/status/OGWISmanual_050610.pdf (use your FDEP network login

info, or the username and password above). A Map Direct Tutorial, Users' Guide, and Quick Start guide are available at <http://ca.dep.state.fl.us/mapdirect/gateway.jsp>.

The different layers in Map Direct provide information on the following features of the sampling site:

- location: county, distance, and proximity to other resources
- imagery: USGS Digital Ortho Quadrangle (DOQQ) maps, current and historical aerial photos that show historical uses and current development (such as mines and land modifications)
- access: roads and trails
- land ownership: 2011 (or most recent) cadastral layer (This shows the boundaries and ownership of land parcels)
- impediments to sampling resources: military base boundaries

If available, you may wish to use ArcGIS to complement the information in MapDirect.

C. Hardcopy References

Hardcopy references include maps of Florida and the Florida Atlas & Gazetteer. A current map of Florida comes in handy for navigating to a site via major highways. The Florida Atlas & Gazetteer provides detailed topographic maps containing back roads and trails, and a cities index. Guides to city and regional roads are often available in bookstores. Brochures from state and national parks provide overview maps and directions to the parks.

D. Internet Resources

Internet sites also serve as good resources, although the quality of the information may vary widely.

Listed below are commonly used webpages and resources that assist in ground water recon:

- <http://www.whitepages.ca/> Canadian white pages allow you to obtain phone numbers for free
- <http://dor.myflorida.com/dor/property/appraisers.html> Although MapDirect contains a cadastral (land ownership) layer, you may occasionally need more updated or more in-depth information on a parcel to contact the owner
- <http://www.sunbiz.org/> is the Florida Dept. of State website that allows you to access contact information on corporations, including upper management contacts, locations, and telephone numbers
- <http://www.bing.com/maps/> and <http://www.google.com/maps> provide recent close-up aeriels and street level views of a site
- <http://ufdc.ufl.edu/aerials> is a great source for historical aeriels, usually categorized by county
- <http://www.dot.state.fl.us/surveyingandmapping/apac.shtm> provides aeriels from the 1970s and 1980s
- <http://www.fs.fed.us/r8/florida/> provides USDA national forest maps and aeriels
- Web reports for facility (wastewater and solid waste) background wells available on http://appprod.dep.state.fl.us/wafr_main/ and http://appprod.dep.state.fl.us/www_wacs/

- <http://www.fws.gov/southeast/maps/fl.html> provides contact information for National Wildlife Refuges under the U.S. Fish & Wildlife Service (USFWS)
- http://www.usgs.gov/contact_us/?state=FL provides contact information for the USGS in Florida
- <http://nwis.waterdata.usgs.gov/fl/nwis/gwlevels> gives information on USGS wells in Florida
- http://www.floridaforestservice.com/contacts_main.html links to contact information for state forests managed by the Florida Dept. of Agriculture & Consumer Services (DACS)

E. Historic Data

Historic data for a sample site can provide valuable information. Existing historic data includes access points, previous owners, photos of the site, the well drilling report, and maps (drawn or aerials). [Figure 34](#) provides an example. Historic data can be obtained from records of previous site visits by WMS, or from other agencies or entities that monitor the site. FDEP headquarters or field offices may keep previous recon notes as either hardcopy or electronic files.

Typically, historic data for old HRS and Background Network wells are kept in notebooks in Tallahassee. While some station names have changed, well information generally can be located by county, oversight agency, or drilling dates. Historical data for wastewater treatment, landfill, or water treatment facility wells are kept by the local FDEP District office. These data are accessed by contacting the local FDEP District office facility inspector. To properly identify the contact person at the district office, you will need to know the data source of the well (GWIS, WACS, Potable Water System [PWS]). Sometimes, the owner has a copy of the well drilling report, but this is the exception. Even if the owner indicates she/he knows the exact well depth, official documentation is necessary for entry into the database.

Figure 34. Examples of historic well documents, such as drilling permits and reports and prior sampling visits.

SUWANNEE RIVER WATER MANAGEMENT DISTRICT

The Suwannee River Water Management District (SRWMD) is assisting the Department of Environmental Regulation (DER) in establishing an ambient groundwater monitoring network to insure the preservation of Florida's high quality groundwater resources.

This network will consist of wells that meet the SRWMD's well construction and location criteria.

The 4 inch diameter well location is Township 15, Range 18, East, and Section 35, in Suwannee County and owned by: Tommy J. Cashmere

Address: Rt. 2 Box 248-22 L.A.

Phone: 904-362-6645

has been selected for this network.

If you will permit the DER or its agent to sample this well in 1986, and possibly in the future, please sign giving permission at the bottom of this page. The water will be sampled for the parameters on the attached sheet and the results will be made available to you.

I give the DER or its agent permission to sample my well.

Tommy J. Cashmere
1-23-86

PAUL H. BUCKNER ONE CORN, FLORIDA 32066 TELEPHONE 904/362-6645

Micro-Sandwich Field Sheet
page 3

7. LOCATION MAP:

8. PHOTOGRAPHS:

ON 12/15/87

-011435003

011435003

011435003

011435003

9

Site ID 011435003 LED Elevation 70

Well Size 4 inches HP Elevation 71

PUMP (R.P. BRAND) 5.16

CASING DEPTH 55 TOTAL DEPTH 60

MAXIMUM WATER LEVEL IN WELL 41 FT BELOW V.O.C. 31

MINIMUM WATER LEVEL IN WELL 26 FT BELOW V.O.C. 40

TOTAL DEPTH 60

- (MINUS) MAXIMUM WATER LEVEL 11

= MAXIMUM FEET OF H₂O IN WELL 49

MAXIMUM FEET OF H₂O 49 X (K) .65 = 31.7 MAX. VOL. OF H₂O IN WELL

MAXIMUM VOLUME 31.7 X 4 = 128 GALLONS TO PUMP FOR SAMPLING

SAMPLING POINT _____

WELL DIAMETER	REL	DATE SAMPLED
1 1/4	= .044	1. <u>2-11-86</u>
2	= .163	2. _____
3	= .367	3. _____
4	= .653	4. _____
6	= 1.67	5. _____
8	= 2.61	6. _____
10	= 4.08	7. _____
12	= 5.88	8. _____
		9. _____
		10. _____

OWNER - Tommy Cashmere

ADDRESS - Rt 2 Box 248-22 Lee Ok

PHONE - 904-362-6645

COMMENTS:

F. Local Knowledge

It is important to establish contacts located physically near the resources to be sampled, or whose area of expertise includes the targeted resources. These can be FDEP District or regional staff, local residents, or employees of WMDs, counties, cities, state parks, national wildlife refuges, national forests, and so on. If you are unable to locate the owner of a parcel, people living in the surrounding area can often assist.

WMDs can serve as a productive source of information on monitoring wells, since they may approve consumptive use and well-drilling permits. In addition, the USGS, drinking water and wastewater utilities, and landfills may have monitoring wells, and can be contacted for keys, access, or additional information. Most wells with a county code and a four-digit station name (e.g., V-0100 or SJ0333) are monitoring wells owned by WMDs, or public supply wells owned by utility companies. To obtain missing well information, keys, or information on who owns the well, contact the WMD or utility.

Monitoring wells are often placed in state parks, golf courses, wildlife preserves, or on school property. For public places such as a park or refuge, contact the manager or maintenance staff. For public wells owned by cities or towns, contact their public works department, which will send representatives to accompany samplers.

For cases in which the property owner/occupant differs from the well owner or manager, both parties generally must be contacted for access. For permission to sample, contact the property owner (as well as the tenant, if it is a rental property). Important questions to ask are: Is there access to the well? Is there a sample point on the well prior to any filters, softeners, or tanks? Is the well easily located? Is the well placed behind a locked gate? Are there dogs or aggressive animals at the site?

G. Documentation

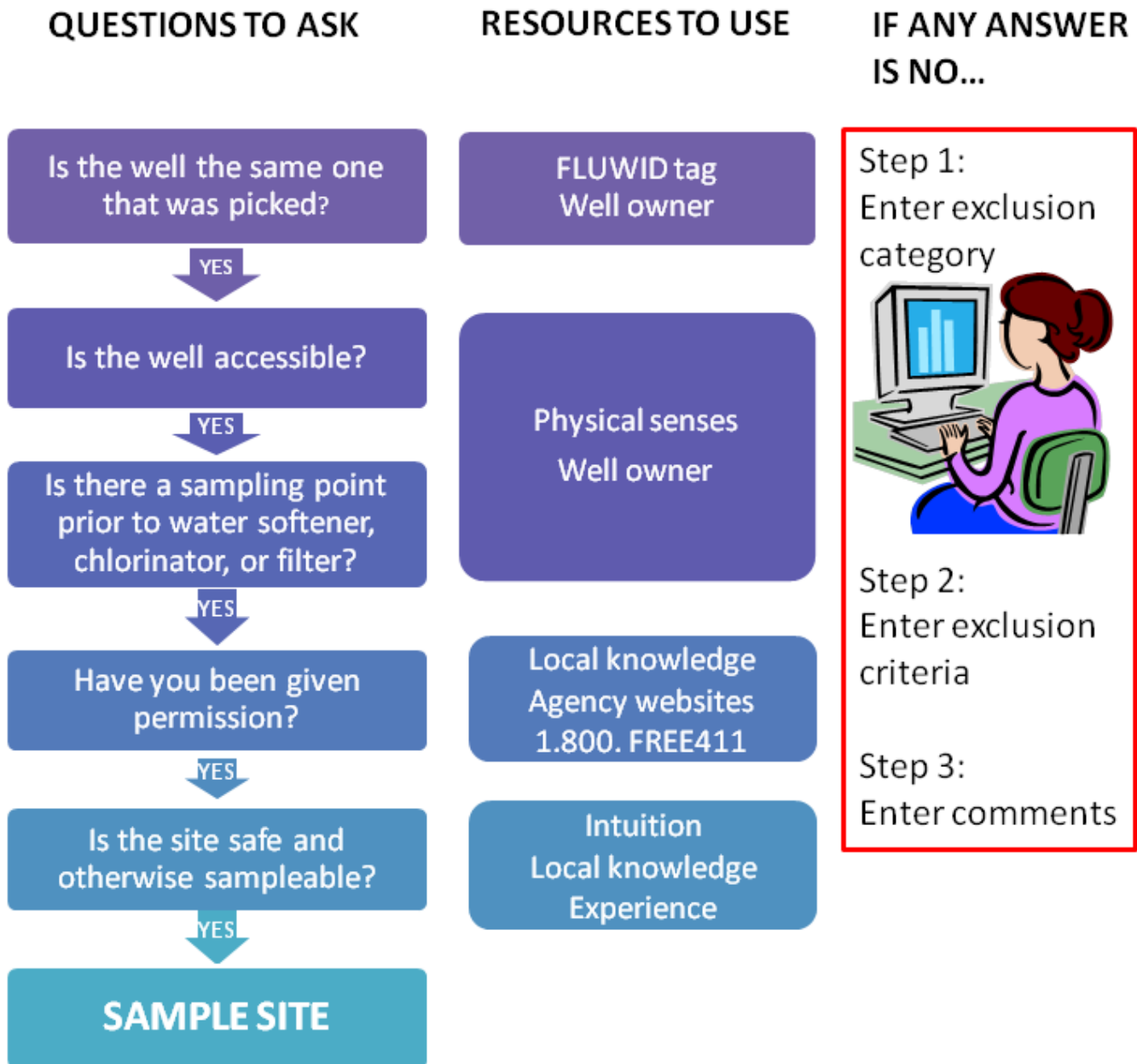
Verbal contact with the property owner must be documented whether or not permission is granted to access a site (see [Appendix A.4 Ground Water Permission Letter](#)). An Excel spreadsheet is useful for documenting pertinent information on the site (see [Appendix A.5 Site Tracking Spreadsheet](#)).

3.2 Field Reconnaissance

A. Field Recon Flowchart

The Recon flowcharts illustrate the basic decision-making that guides the recon process, both in the office and in the field. The Field Recon flowchart ([Figure 35](#)) focuses on the steps samplers take at or near the site. The approach used in this process is described in the following pages.

Figure 35. Field recon flowchart for ground water.



B. Planning and Conducting Site Visits

Site visits should be conducted only when needed information cannot be obtained from office recon. If field recon is deemed necessary, permission to access private sites must be obtained. If a private site can

be observed from public property, no permission is necessary to recon. However, to collect a sample on private property, you will need to obtain access permission to avoid trespassing. Once permission to sample has been granted by the property owner, and field recon has been deemed necessary, take the proper steps to prepare for a recon trip. Prepare a checklist (see [Appendix A.6 Field Recon Checklist](#)) with items such as keys, camera, cell phone and maps.

There are slight differences in preparation of reconnaissance for ground water versus surface water trips. For example, many surface waterbodies are easily located, whereas wells may require additional time for locating the well; samplers may need to tote several different types of pumps or PVC adapters ([Figure 36](#)) to conduct well sampling. Regardless of the resource type, try to obtain as much site-specific information as possible.

Providing different options for sampling wells, such as different pumps and fittings, is important when it is time to sample the well. During the field recon, you should note the size of the pipes and configuration so that you can capture a representative sample.

Figure 36. The addition of PVC adapters allows for sampling of certain wells.



A well such as the one in [Figure 36](#) would require an adapter for sampling. This well should be purged without the adapter; once the proper volume of water is purged, an adapter should be connected to allow for sampling.

[Figure 37](#) shows a flowing artesian well that contains a two-inch gate valve. This valve has female threads that require a threaded male PVC adapter with a reducer and hose barb fitting to allow for connecting sampling tubing to this well. The adapter should be removed in order to purge to 1.25 and 1.50 well

volumes. The adapter would then need to be reinstalled in order to collect data sonde readings at 1.00, 1.25, and 1.50 well volumes for stability determination. Another option in this case is to open the other valve for purging the well.

Figure 37. Example of a well that needs a PVC adapter. It is important to note specific requirements, such as the size of needed adapters, during field recon.



C. Driving Directions

Regardless of who is doing the recon/sampling, obtain driving directions from websites like Google Maps, <http://www.drivingrouteplanner.com/>, and Rand McNally Yahoo Maps. The use of north, south, east, and west rather than left-right directions is preferable. Specific site directions should be documented from the intersection of a major road. Include as many maps from various sources as possible (owner sketch maps, Gazetteer pages, Google Maps, Map Direct maps, and so on). Always include a north-arrow and scale bar with each map. It is better to have too much information than too little.

D. Confirmation Criteria

A well in the field can be confirmed as the correct one by using several combined characteristics:

- Florida Unique Well Identifier (FLUWID) tag
- casing depth
- casing diameter
- casing material
- well name
- Land Surface Elevation (LSE), if available

To be certain that the well is the correct one, all of these characteristics must match the documentation. Familiarity with the various forms of identification makes recon of the wells more efficient. Some wells are identified with metal tags or FLUWID tags. FLUWID tags ([Figure 38](#)) can be attached to the outside

of the well, to the inside cap or structure, or sometimes even to adjacent tanks. While some wells have identification located on the well casing, private wells may not. In some cases, the well drill date can be helpful for confirmation, especially if it was drilled recently.

WMDs' background well identification is specific to the WMD, while facility wells have identification unique to the facility. Facility wells may not be tagged and can be more problematic to identify. Facilities may sometimes name a new ambient or background well with the name of the previous background well, causing confusion. This being the case, it is very important to make good contacts with the FDEP District office and with facilities.

Figure 38. Well with a FLUWID tag.



E. Documentation

Mail or verbal contact with the property owner should be documented whether or not permission is granted to access a site (see [Appendix A.4 Ground Water Permission Letter](#)). An Excel spreadsheet is useful for documenting pertinent information on the site ([Appendix A.5 Site Tracking Spreadsheet](#)).

Refer to the current sampling manual (http://publicfiles.dep.state.fl.us/dear/watershed_monitoring/documents/WMS-SamplingManual.pdf) for inclusion requirements when determining whether a well is sampleable.

F. Photographing the Site

Whether the site is to be sampled or excluded (see [Table 2. Ground Water Exclusions](#)), the SOPs require photographs for documentation of site conditions. When on the site, photos should be taken in each

direction (north, east, south, and west, in that order). If the site must be excluded, take several photographs that best represent the exclusion rationale (damaged well, area paved over, etc.).

G. Safety

If you can't safely recon or collect the sample, come back another day. Safety issues can include potentially dangerous animals, weather, and situational conditions. To sample safely near a busy highway, use safety equipment such as neon vests, cones, and strobe lights. When safety is compromised by bad weather, return on a different day when the weather is better.

Exclude the site as Otherwise Unsampleable only if dangerous conditions are expected to last for the duration of the index period, or if you can't recon or sample within the Status design constraints (e.g., sampling in consecutive order).

Figure 39. Always address safety, whether it is a roadside well or an attack chicken.



H. Contacting the Project Manager for Assistance

If you are unsure whether conditions are conducive to sampling, or desire additional input, do not hesitate to contact your Project Manager, who can discuss the question with the Administrator, the Data Manager, the QA Officer or other Project Managers. Sometimes field conditions or events are unexpected, and it takes a “village” to develop the Best Professional Judgment in context.

Table 2. Ground Water Exclusions

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

3.3 Example: Recon of a Zone 2 Unconfined Well

OFFICE RECON

GWIS/MapDirect:

1. Open GWIS at <http://gwis.dep.state.fl.us/> (enter your FDEP login info, or enter username = water, password = Monitoring1).
2. Click “Recon Tracking”.
3. In the drop-down boxes, choose Resource Type = UNCONFINED AQUIFER, Reporting Unit = ZONE 2, Reporting Cycle = 7 (for 2013). Enter the site you want to recon, or leave the Site Location Range blank to return all records. Click “Submit”.
4. To view a map of all sites, click “ShowMap(Random Cycle Location)”. (To view a map of a single site, click on the site of interest first.)
5. Zoom in and out a few times by using the  and  icons, or by changing the map scale to view the site in context of nearby roads, towns, and landmarks, and to determine the easiest route to access the site. You may also enter the lat/long of the site into <http://www.drivingrouteplanner.com/> to find the optimal route.
6. Go to the Data Layers tab on the left, and open the folder called Cadastral & Districts. Click on the most recent Cadastral layer and use the  icon to identify the property owner.
7. Document findings from the above on the Recon form.
8. If you see any issues that would prevent sampling, contact your Project Manager.

Internet Resources

1. Obtain contact information based on the information in the Cadastral layer, the Canadian White Pages website, county websites, the WMD websites, the State Parks website, the USGS, or by other means.
2. Document on the Recon Form.

Local Knowledge

1. Contact the owner or the party responsible (owner, resident, manager, etc.) for the well to obtain access permission. During all three contact attempts, document contact name, date, permission given/denied, times available, locks, aggressive animals, and any relevant info about the well.
2. Contact staff from the nearest FDEP District Office, WMD, County, or municipality to learn about the exact location of the well, condition of the well. Document on the Recon Form.

FIELD RECON

1. Travel to the well area, and determine whether the well is the correct one, if it is in good condition, and safe and/or appropriate to sample.
2. To determine if the well is the correct one, compare the well diameter, well identification tag (if it has one), and FLUWID tag (if it has one) to the information in GWIS.
3. Note: If there is no FLUWID tag on the well, this may be because the well was never tagged before or the tag was removed in the past. Call your Project Manager and have them check GWIS to see if the well has a FLUWID number associated with it. Do not place a different FLUWID tag on the well if there is any record of it being tagged before.
4. If the well cannot be located, do the following:
 - a. If it is on company property, belongs to an agency, or is located at a facility, contact the staff to double-check the well location.
 - b. If it is on private land, exclude it as “Otherwise Unsampleable; Can Not Locate Well” and move on to the next unconfined aquifer well.
 - c. Under no circumstances should you sample a well that is not in the listframe, even if it is adjacent to near a well in your sample “pick” list
5. After locating the correct well, document the correct location on the Recon Form. Note any anomalies.

Real-World Examples and Tips

Figure 40. Be sure to ask the well or property owner if the well is easy to locate.

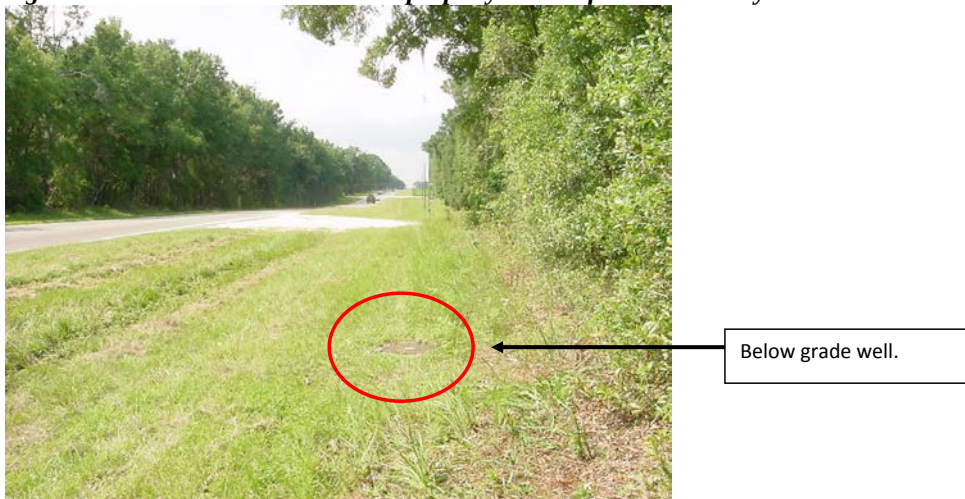


Figure 41. Which well is the correct one? It is important to ask the well owner if there are multiple wells clustered together.



Figure 42. Example of a hidden well. This well is inside a wooden structure.



Figure 43. Example of hidden well. This well is in a stand of grasses.



Some wells have softeners, filters, chlorinators, or aeration chambers. A representative sample of the aquifer cannot be obtained if collection is done after water flows through such devices. Filters and softeners look like cylinders plumbed into the water lines near the well ([Figure 44](#), [Figure 47](#)). Aeration

and chlorine chambers usually resemble round basins that rest directly on the ground. These devices may be identified during office recon, during phone calls to owners, or later documented during field recon. If you find one of these devices on a well, you must sample from a spigot or well access prior to the device. Contact your Project Manager if you encounter any device that you cannot identify before you decide a well is sampleable.

Figure 44. Private well with tank, softener, and filter.



Figure 45. Private well with tank, but no softener or filter.



Figure 46. Tanks that have a chlorinator prior to or concurrent with the spigot should be excluded as Otherwise Unsampleable; Sample Withdrawal Location After Softener or Filter.

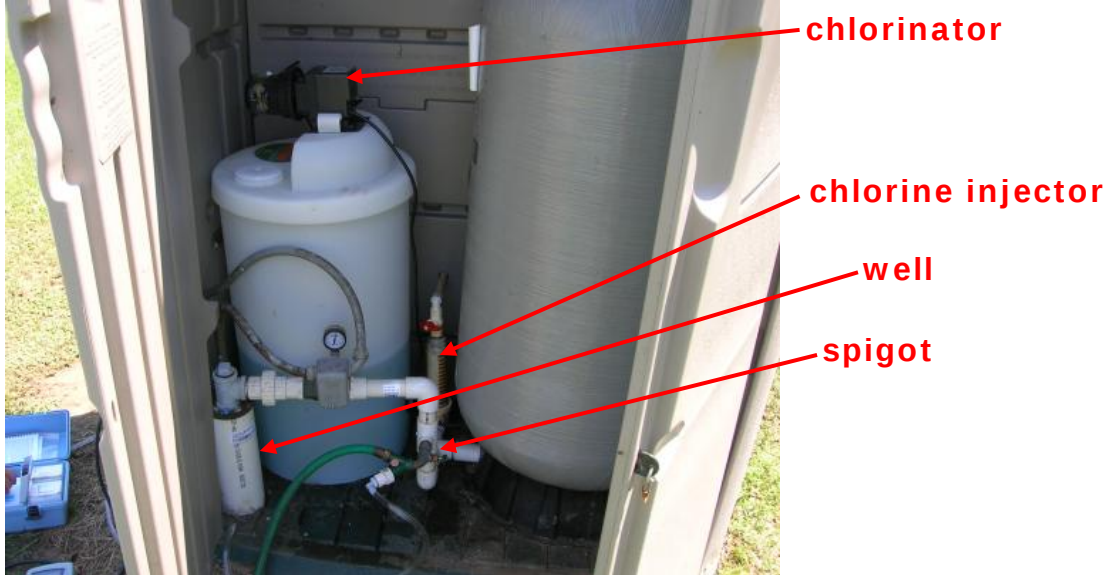


Figure 47. Look for a connection before any filters or tanks.

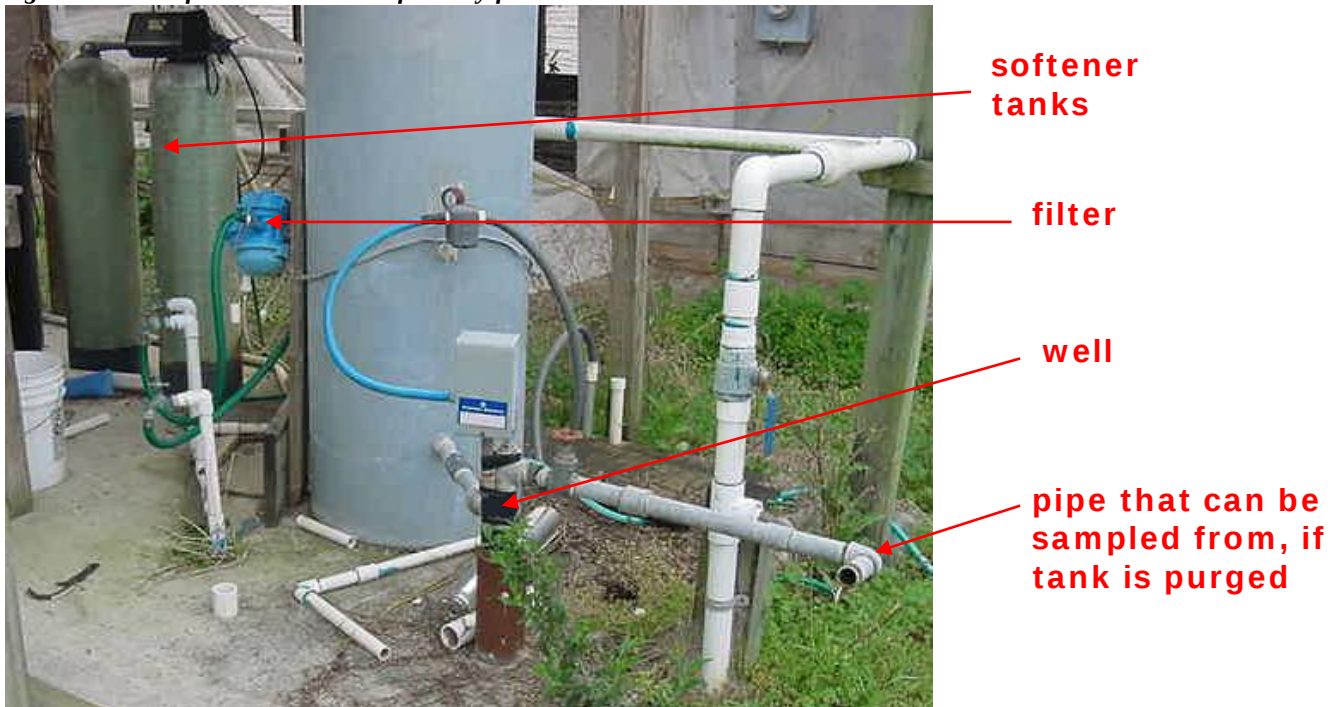


Figure 48. Sometimes a well is not where GWIS shows it to be. However, the nearest adjacent well should never be sampled in lieu of the targeted well.



Figure 49. Is this a well?



Figure 50. No, it is a faucet connected to a municipal water supply at a county park.



IV. Documentation

4.1 Field documentation

Accurate and thorough documentation on recon forms and field sheets is critical to agency efforts to obtain quality data. The WMS and its contractors use several forms for recon ([Figure 5](#), [Appendix A.5 Site Tracking Spreadsheet](#)), although there is no agreed-upon standard; sampling teams may develop region-specific recon forms if desired.

4.2 Record keeping in GWIS

Accurate and timely record-keeping is a critical part of the recon process for a variety of reasons. Record keeping:

- Verifies the accuracy of the data collected;
- Documents any anomalies that may affect the data values;
- Assists in determining the parent population of both surface water and ground water resources for the next sampling cycle;
- Provides critical information to the Standards and Assessments Section in evaluating biological metrics field-tested by samplers;
- May provide additional insight into statewide or area trends such as drought, overpumping, hurricane effects, and salt water intrusion.

The Recon Tracking area of GWIS should be updated within 30 days of completing the project so that critical details of sampling and exclusions are retained and documented. Records should be updated as described in Chapter IV of the GWIS Manual.

4.3 Exclusion documentation

Exclusion information should be completed in GWIS, including the site-specific Comment field. This field is intended for additional information for either sampling or exclusions. If the site is excluded, make sure to complete the Comments box with details such as whether the exclusion determination was made in the office or the field, date, and name of the person conducting recon. Providing a sufficient description of the surrounding site characteristics is imperative. Make every effort to fully describe the situation that is resulting in the exclusion of a site. If possible, note how far an observation or issue extends away from a particular sampling site. Photo documentation is extremely valuable for sites excluded in the field. Such documentation is critical to the Project Managers and GIS Analysts when exclusions are reviewed for the following year's sampling.

4.4 Documenting more than one exclusion

If there are multiple reasons to exclude a site, record the most important exclusion category first. For example, “Wrong Resource/Not Part of Target Population” has the highest priority, whereas “Dry” or “Unable to Access” may return the specific site to the listframe the following year. All exclusions should be documented in the site-specific Comments field in Recon Tracking. In addition, any information that would be important for other samplers, such as the presence of aggressive dogs, livestock, difficult locks, and landmarks, etc. should be added to this Comments field.

4.5 Closing the Loop: How Documentation Shapes the Next Year’s Resource Population

Documenting exclusions is critical to the Project Managers and GIS Analysts when resource exclusions are reviewed for the following year’s sampling. For the following Exclusion Categories, the following actions are taken.

- **WRONG RESOURCE** – the site will be removed from the incorrect listframe, and (if it represents a resource we sample), it will be placed into the proper listframe for the next year. **EXAMPLE:** A canal that was originally listed as a stream will be included in the next year’s Canals listframe.
- **DRY** – will be included in the next cycle, as this is usually a temporary condition.
- **UNABLE TO ACCESS** - will be included in the next cycle because the resource access might change (e.g., newly constructed roads or trails might allow access to the site).
- **OTHERWISE UNSAMPLEABLE** – depends on whether the inability to sample is a temporary or permanent condition.
- **NO PERMISSION FROM OWNER** - will be included in the next cycle, unless the owner is known to prohibit sampling on the property holding.

4.6 Well Additions to the Database

Private owners may have new wells that are not in the listframe. They may prefer for you to sample the newer well, but to maintain the integrity of the Network, the well that was selected from the listframe must be sampled. In this case, you and the owner can add the new well to next year’s listframe by completing the form in [Appendix A.7 Ground Water Well Addition Form](#).

V. Frequently Asked Questions

5.1 Streams and Canals

A. How far from the “Waters of the State” can the site be and still be considered connected to Waters of the State?

There is no set length, but as long as the streams or canals eventually connect to Waters of the State, then the entire system is considered a Water of the State. If the waterbody has a control structure, contact your Project Manager to assist in making the decision.

B. Is a stream with no or very little flow still sampleable?

If there are no interruptions in water in the feature, and it is at least 10 cm deep, the site is sampleable.

5.2 Small Lakes

A. If the shape of the lake looks natural, but it lies entirely on a single property owner's land, is it considered sampleable?

Yes, it is sampleable, although it would not be considered Waters of the State. A lake like this would need permission from the owner for access for sampling. This is one of the few exceptions to the rule that we do not sample waters that aren't Waters of the State. The rationale is that if the land were divided and sold to multiple owners, the lake would become a Water of the State.

B. If it is a natural lake but now receives storm water runoff, is it sampleable?

It depends on whether its primary function is as a lake or a stormwater feature. Many natural lakes in Florida receive some stormwater runoff, so this should not be cause for exclusion. However, the presence of outfalls, culverts, fountains or other artificial features indicate that the waterbody is manmade, and this would be a cause for exclusion. The exclusions in this case would be Wrong Resource/Not Part of Target Population; Artificially Created Lake Other than Established Impoundments.

C. When field reconning a lake site, what are some ways that one can tell it is a natural lake?

- First, conduct office recon and review historical aerials and USGS quads (Digital Raster Graphics or DRGs) to determine if the lake is natural. Consider the following in recent aerials:
 1. Shape – no hard edges; many times, just portions of a lake are square, or rectangular. It is harder to determine when only a portion of the lake has been modified. When in doubt, speak with the Project Manager
 2. Presence/absence of fountain(s), outfalls, and box culverts
- Next, during field recon, note:
 1. Presence/absence of fountain(s), outfalls, and box culverts and fences (stormwater ponds are typically fenced for safety reasons)

All of these offer clues, but are not the final determination of whether a “lake” is natural or not. Use office and field recon, as well as local knowledge, to shape your best professional judgment and always contact the Project Manager when there are questions.

D. Does the WMS collect samples on Native American Tribal lands?

Flowing waters (rivers, streams, and canals) that begin outside of tribal territory but flow through tribal lands are still considered Waters of the State. In those cases, the WMS would sample if granted permission. If a lake site falls on tribal land, consult your Project Manager.

VI. Appendix A. Helpful Forms and Documents

Appendix A.1 Status Network Brochure

Document also available at http://www.dep.state.fl.us/water/monitoring/docs/brochure_status.pdf.

Statewide data are available upon request. There is no charge for this service.

For further information, please visit our website or call us at (850) 245-8433.

<http://www.dep.state.fl.us/water/monitoring/>

We are grateful to the citizens, and public and private entities that provide us access to sample for regional and statewide water quality.

Florida Department of Environmental Protection
Watershed Monitoring Section
2600 Blair Stone Road
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Tallahassee, FL 32399-2400

2012



Division of
Environmental Assessment and
Restoration



Water Quality Status
Monitoring Network



Background

Good science is the foundation of Florida’s environmental assessment and restoration programs, and water quality monitoring serves as an important cornerstone. Since 1999, the Watershed Monitoring Section at the Florida Department of Environmental Protection (FDEP) has partnered with state agencies, counties, and water management districts to assess Florida’s water resources.



FDEP sampler collecting stream data

FDEP’s Watershed Monitoring Section (WMS) has developed two statewide water sampling networks to monitor Florida’s surface and ground water. Each network is designed to monitor ambient or background water quality. The Status Monitoring Network provides a snapshot of current water conditions in the state; the

Trend Monitoring Network measures long-term patterns in water quality. The latter is described in the brochure, “Water Quality Trend Monitoring Network”. Information collected through both networks is used to develop watershed-based aquatic resource goals and basin management action plans to protect and restore our water resources.

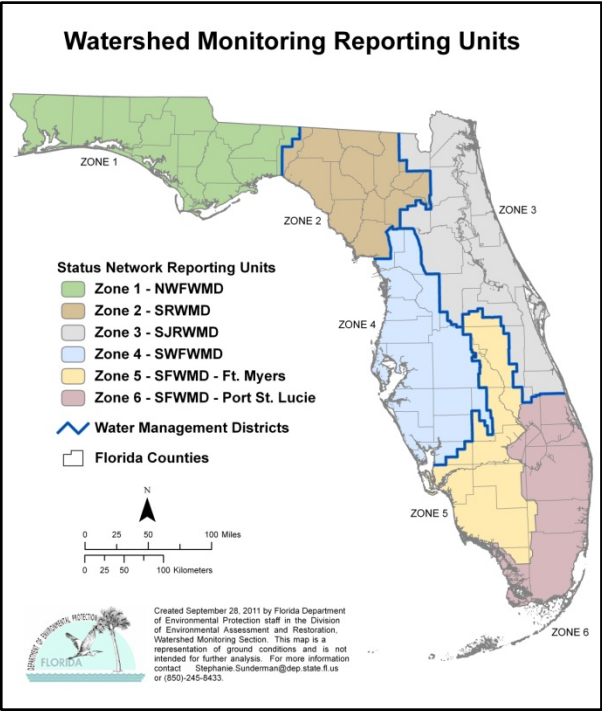


Myakka River near Sarasota

Status Monitoring Network

The objective of the Status Monitoring Network is to broadly characterize Florida’s aquatic resources with a known statistical confidence. Because it is fiscally and logistically impossible to sample every waterbody and well in Florida each year, a random-site monitoring design is a cost-effective way to accomplish this goal. In this type of design, water sampling sites are chosen in a random and unbiased manner from the state’s six reporting units, or zones (see map). In each zone, samples are collected from several water resource types:

rivers, streams, large lakes, small lakes, unconfined ground water aquifers, and confined ground water aquifers. In peninsular Florida (zones 3-6), canals are also sampled due to the prevalence of this type of waterbody.



Over 700 water samples (including quality assurance samples) are collected statewide each year. WMS then develops statistically valid estimates of water quality based upon the collected data. FDEP uses several indicators to characterize the health of each resource based on its designated use. These indicators include chemical, biological, and physical measurements (see table).

Results and Reporting

FDEP’s Watershed Monitoring Section analyzes the environmental data collected each year to estimate current surface and ground water conditions. Data from the Status Network are included in Florida’s biennial Integrated Water Quality 305(b)/303(d) Report to the U.S. Environmental Protection Agency, which informs Congress and the public about state and national water quality conditions. The data are also summarized and presented in annual reports on the condition of Florida waters. Increasingly, Status Network data are used by other FDEP programs to develop water quality standards and monitoring criteria.

Results from previous years’ monitoring are posted on the WMS web page:

www.dep.state.fl.us/water/monitoring



FDEP samplers collecting river data



Fenholloway River near Perry

Florida’s monitoring entities, citizens, and businesses are FDEP’s partners in providing scientific data necessary to assess and manage our water resources. Our partners make the annual water quality evaluations possible by providing us access to lakes, rivers, streams, canals and wells. Together we can ensure cleaner water for generations to come.



Status Network Indicators		
Indicator Group	Indicator	Sampled Resource(s)
Field Measurements	Dissolved Oxygen, pH, Specific Conductance, Temperature, Total Depth	All
	Sample Depth, Secchi Depth	Lakes, Streams, Rivers, Canals
	Depth to Water, Microland Use, Turbidity	Aquifers
Biological & Micro-biological	Fecal Coliform	All
	Chlorophyll a, Enterococci	Lakes, Streams, Rivers, Canals
	Habitat Assessment, Rapid Periphyton Survey	Streams, Rivers, Canals
	Lake Vegetation Index	Lakes
	Total Coliform	Aquifers
Organics & Nutrients	Ammonia, Nitrate + Nitrite	All
	Total Kjeldahl Nitrogen, Total Organic Carbon, Total Phosphorus	All + Lake Sediments
Metals	Aluminum, Arsenic, Cadmium, Chromium, Copper, Iron, Lead	Aquifers + Lake Sediments
	Manganese, Molybdenum, Zinc	Aquifers
	Total Mercury, Methyl Mercury, Nickel, Silver	Lake Sediments
Major Ions	Calcium, Chloride, Fluoride, Magnesium, Potassium, Sodium	All
	Sulfate	All + Lake Sediments
Physical Properties	Alkalinity, Hardness, Specific Conductance (Lab), Total Dissolved Solids, True Color, Turbidity (Lab)	All
	Total Suspended Solids	Lakes, Streams, Rivers, Canals
Additional Indicators	Boron, Sucralose	All
	Nitrogen Isotope Ratios, Oxygen Isotope Ratios	Aquifers

Appendix A.2 Status Network Statewide Report

Report also available at <http://www.dep.state.fl.us/water/monitoring/docs/statewide-ansr-2011.pdf>.

2011 Status Network Statewide Results



Florida Department of Environmental Protection

Division of Environmental Assessment and Restoration

Bureau of Assessment and Restoration Support, Watershed Monitoring Section



Good science is the foundation of the Florida Department of Environmental Protection's (FDEP) programs to assess and protect water quality. FDEP is committed to characterizing the environmental conditions of Florida's freshwater resources through several monitoring programs. The Watershed Monitoring Section administers the Status Monitoring Network, which oversees the statewide sampling of surface and ground water. This report summarizes the 2011 Status Monitoring Network results.

FDEP has worked with the water management districts, local governments, and other entities to establish an Integrated Water Resource Monitoring (IWRM) Program. This program combines surface and ground water monitoring efforts, consisting of water chemistry, biology, and sediment analyses. The IWRM Program is made up of three levels of monitoring designs: (1) the Status Monitoring Network, designed to allow statistical inferences about all state waters; (2) more intensive basin monitoring used to identify and verify impaired waterbodies that do not meet Florida's water quality standards; and (3) site-specific regulatory compliance monitoring. It is fiscally and logistically prohibitive to sample every river, stream, lake, or individual well in the state on a regular basis. A probabilistic monitoring design is a cost-effective approach to produce a statistically valid estimate of the condition of water resources.

Design of the Status Monitoring Network

The Status Monitoring Network uses a random site monitoring design to assess the state's surface and ground water quality. The objective of this design is to broadly characterize aquatic resources with a known statistical confidence. Samples are collected from randomly selected points to provide a geographic snapshot of the condition of all waters. This monitoring program is not designed to answer site-specific questions about individual lakes, rivers, streams, or wells.

Starting in 2009, DEP began annually assessing statewide water resource conditions. The Status Monitoring Network categorizes Florida's fresh waters into six different resource types. Four of these are surface water: small lakes, large lakes, rivers, and streams. The other two resources are ground water: unconfined and confined aquifers. This Status Monitoring Network design directs that 60 samples for each surface water resource type and 120 samples for each ground water resource type are collected annually to assess the condition of these waters. Based on these sample sizes, the 95% confidence interval for the estimate of statewide condition is $\pm 12\%$ for surface water and $\pm 9\%$ for ground water. Therefore, we have a 95% confidence that surface water data will be within 12% of the reported value, and similarly ground water data will be within 9% of the reported value. Detailed information on the Status Monitoring Network Design can be found on the website:

http://www.dep.state.fl.us/water/monitoring/docs/design_document_final_12_09_09.pdf.

Lakes

The state of Florida has approximately 4,166 lakes. FDEP has divided these lakes by size into two categories: small lakes of 10 to 25 acres and large lakes over 25 acres. This division allows a better characterization of the status of the basin's lake resources.

Rivers and Streams

The state has 27,078 miles of river resource. The remaining streams and tributaries are designated as the stream resource. These total about 16,914 miles, although some may be dry during periods of drought. The two resources can have different habitats and uses.

Aquifers

Aquifers are permeable layers of sand, gravel, or rock that contain water. Unconfined aquifers are near the land surface and are easily affected by human activities. Confined aquifers lie below a layer of material, such as fine-grained clay, that limits the downward flow of water. Water in confined aquifers usually filters slowly through sediment and rock layers, and is older and less affected by human activities. Ground water is monitored through wells in unconfined and confined aquifers.

Summary and Results

The tables below show the sampling carried out for each resource in the state of Florida, in terms of number of large and small lakes, miles of rivers and streams, and number of wells for confined and unconfined aquifers. Each year, the resource coverages are updated/created to incorporate documented changes, deletions or additions. Not all randomly selected stations can be sampled for various reasons. Those that can be sampled are termed accessible. Those stations that cannot be sampled are considered either dry or inaccessible. If a selected location does not represent the assigned resource it is removed from the coverage and added to the proper resource for the following year's selections. Reduced rainfall or periods of drought occur on a cyclical basis in many areas of Florida. Prolonged or intense periods of drought can adversely affect water chemistry. Annual precipitation was comparable with the 30-year annual average.

Surface Water Resource	Large Lakes (≥ 25 acres)	Small Lakes (10–25 acres)	Rivers	Streams
Resource Size (number, length)	1,725 lakes	2,441 lakes	2,707.7 miles	16,914.4 miles
Accessible	88%	50%	77%	22%
Dry	7%	25%	5 %	33%
Inaccessible	5%	25%	18%	45%
Number of Samples	60	52	60	48

Ground Water Resource	Unconfined Aquifers	Confined Aquifers
Number of Wells	308	210
Accessible	39%	53%
Inaccessible	61%	47%
Samples	119	108

Average Statewide Precipitation (1981-2010)	2011 Precipitation
55.10 inches	48.99 inches

Lakes: Dissolved oxygen (DO) is below the standard in none of the small lakes and 1.4% of the large lakes' area. Low DO can be harmful to aquatic life. Fecal coliform bacteria levels are in exceedance for 3% of large lakes' area and 10% for small lakes. pH is outside the standard range for 28% of the large lakes' area and 19% of the small lakes. Un-ionized ammonia levels are within the standard for all small lakes and large lakes' area. The Trophic State Index, a combined measure of nutrients and chlorophyll that indicates lake health, shows that 33.2% of the large lake area and 10.6% of the small lakes sampled have excess nutrients and chlorophyll.

Rivers and Streams: DO is below the standard for 18.5% of the rivers and 24% of the streams sampled. Canal/ditch construction and ground water inflows can contribute to low DO concentrations. Low DO can be harmful to aquatic life. Fecal coliform bacteria are above the standard in 0.7% of the rivers and 17% of the streams sampled. pH is outside the standard range for 10.8% of the rivers and 27.6% of the streams. Un-ionized ammonia levels are above the standard in 1% of streams. Chlorophyll exceeds the standard in 0.7% of the rivers and 10.7% of the streams sampled.

Aquifers: Exceedances of lead (2.3%), nitrate + nitrite (0.3%), and sodium (3.2%) are found in a small percentage of the unconfined wells. Sodium exceedances were found in a small percentage of both confined and unconfined wells (4.1% and 3.2%, respectively). Arsenic exceedance was found in a very small number (0.8%) of confined wells. Total coliform bacteria exceed the standard in 31.2% of the unconfined wells and 2.2% of the confined wells. These bacteria are indicators of possible human health effects if the water is used for drinking. All other analytes are within standards.

Surface Water Resource	Dissolved Oxygen	Fecal Coliform	pH	Un-ionized Ammonia	Trophic State Index
Large Lakes					
Percent In	98.6	97	72	100	66.8
Percent Out	1.4	3	28	0	33.2
Small Lakes					
Percent In	100	90	81	100	89.4
Percent Out	0	10	19	0	10.6

Surface Water Resource	Dissolved Oxygen	Fecal Coliform	pH	Un-ionized Ammonia	Chlorophyll
Rivers					
Percent In	81.5	99.3	89.2	100	99.3
Percent Out	18.5	0.7	10.8	0	0.7
Streams					
Percent In	76	83	72.4	99	89.3
Percent Out	24	17	27.6	1	10.7

Ground Water Resource	Arsenic	Cadmium	Chromium	Lead	Nitrate–Nitrite	Sodium	Fluoride	Total Coliform
Unconfined Wells								
Percent In	100	100	100	97.7	99.7	96.8	100	68.8
Percent Out	0	0	0	2.3	0.3	3.2	0	31.2
Confined Wells								
Percent In	99.2	99.7	100	99.5	100	95.9	100	97.8
Percent Out	0.8	0.3	0	0.5	0	4.1	0	2.2

Note: The gray segments of the pie charts represent the percentage of water resources that meets water quality standards. Blue segments represent the percentage that does not meet the standards. See the *Definitions and Criteria* pages for more information.

This survey does not represent a comprehensive analysis of any individual waterbody. FDEP also analyzes for other analytes that do not have threshold values. For a list of all analytes see the [2009-11 Design Document](#).

For more information, contact:

Florida Department of Environmental Protection, Watershed Monitoring Section, MS 3525
2600 Blair Stone Road, Tallahassee, FL 32399
(850) 245–8433; <http://www.dep.state.fl.us/water/monitoring/>

Surface Water Definitions and Criteria

Each indicator listed below was chosen because it has an applicable state criterion, found in *Criteria for Surface Water Quality Classifications, Rules 62-302 and 62-303, Florida Administrative Code*.

Indicators	Criterion/Threshold ¹	Designated Use
Fecal Coliform Bacteria	< 400 counts/100mL	Recreation
Dissolved Oxygen	≥ 5 mg/L	Aquatic Life
pH	≥ 6 and ≤ 8.5 SU	Aquatic Life
Un-ionized Ammonia	≤ 0.02 mg/L	Aquatic Life
Chlorophyll a	≤ 20 µg/L	Aquatic Life
Trophic State Index (TSI)	Color ≤ 40 PCUs, then TSI ≤ 40 Color > 40 PCUs, then TSI ≤ 60	Aquatic Life

¹ mL – milliliters; mg/L – milligrams per liter; SU – standard units; µg/L – micrograms per liter; PCUs – platinum cobalt units

Fecal coliform bacteria: The single-sample threshold for fecal coliform is 400 counts per 100 milliliters of water. These bacteria can enter water through the discharge of waste from mammals and birds, agricultural and stormwater runoff, and untreated human sewage. The presence of fecal coliform bacteria may indicate that the water is contaminated by other disease-causing organisms.

Dissolved oxygen (DO): The state criterion for DO is a minimum of 5 milligrams per liter to maintain healthy conditions for aquatic life. Lower levels do not affect human recreation. Algae and plants produce oxygen through photosynthesis. Oxygen is also dissolved in water by wind and wave action. Respiration by aquatic animals, decomposition, wastewater, stormwater runoff from urban streets or farmland, and failing septic tanks consume oxygen. Natural conditions—such as ground water from springs, water from swamps/wetlands, higher water temperatures, and calm and cloudy weather—can also decrease DO levels in waterbodies.

pH: The surface water criterion for pH is between 6 and 8.5 standard units. The pH scale, which ranges from 0 to 14, is a measure of the degree of acidity or alkalinity of a solution. Numbers below 7.0 indicate acidity; numbers above 7.0 indicate alkalinity. The midpoint of 7.0 on the pH scale represents neutrality—that is, a neutral solution that is neither acidic nor alkaline. pH affects many chemical and biological processes in water, and aquatic organisms are adapted to a certain range of pH. When pH levels are outside this range, it stresses these organisms' physiological systems and can reduce reproduction. Atmospheric deposition (acid rain), geology, vegetation, and pollution can cause changes in pH.

Un-ionized ammonia: The threshold for un-ionized ammonia is less than or equal to 0.02 milligrams per liter. This is calculated from total ammonia and is adjusted for temperature, salinity, and pH. Ammonia occurs in different forms; water temperature and pH affect which form predominates at any given time in an aquatic system. Un-ionized ammonia can be toxic to fish and invertebrates.

Chlorophyll a*: The threshold for chlorophyll a is less than or equal to 20 micrograms per liter. Chlorophyll is the pigment that allows algae and plants to convert sunlight into organic compounds during the process of photosynthesis. Excess nutrients, such as nitrogen and phosphorus, can stimulate algal blooms. Excess algae sink to the bottom and decay, using up the oxygen that other plants and organisms require to survive. High concentrations of chlorophyll reduce water clarity and limit the light available to shallow-water ecosystems.

Trophic State Index (TSI)*: TSI and chlorophyll are the primary measures used to assess nutrient impairment in a waterbody. There are two thresholds for TSI, based on the color of a lake. Dark-water lakes with a mean color greater than 40 platinum cobalt units (PCUs) are impaired when their annual mean TSI exceeds 60. Clear and low-color lakes with a mean color less than or equal to 40 PCUs are impaired when their annual mean TSI exceeds 40. TSI is measured using chlorophyll, nitrogen, and phosphorus concentrations. A 10-unit increase or decrease in the index represents a doubling or halving, respectively, of the number of algal cells present.

* Both TSI and chlorophyll a are not standards, but thresholds used to estimate the impairment of state waters. These thresholds are used in the analysis of Status Network data, based on single samples in a basin at a predetermined time of year. The analysis and representation of these data are not intended to infer the verification of impairment, as defined in Rule 62-303, Florida Administrative Code, in these waters.

Aquifer Definitions and Criteria

The table below shows the thresholds for eight indicators regulated under drinking water standards.

Indicators	Criterion/Threshold ¹	Designated Use
Arsenic	≤ 10 µg/L	Potable Water (drinking water)
Cadmium	≤ 5 µg/L	Potable Water (drinking water)
Chromium	≤ 100 µg/L	Potable Water (drinking water)
Lead	≤ 15 µg/L	Potable Water (drinking water)
Nitrate–Nitrite	≤ 10 mg/L	Potable Water (drinking water)
Sodium	≤ 160 mg/L	Potable Water (drinking water)
Fluoride	≤ 4 mg/L	Potable Water (drinking water)
Total Coliform Bacteria (counts per 100 milliliters)	≤ 4 (sample maximum)	Potable Water (drinking water)

¹ µg/L – micrograms per liter; mg/L – milligrams per liter

Arsenic, cadmium, chromium, and lead are all naturally occurring metals in the earth's crust. These and other metals are used in manufacturing and can be produced and used in pesticides, preservatives, and industrial operations. They may enter water as a pollutant. Florida has primary standards (criteria) for these metals to protect human health. Excess levels in drinking water can cause adverse health effects.

Nitrate–nitrite is used in fertilizer and is found in sewage and wastes from human and/or animals. Florida's drinking water standard is 10 milligrams per liter (mg/L) for nitrate and 1 mg/L for nitrite. In addition, to allow for the fact that the toxicity of nitrate and nitrite is additive, the standard for the sum of nitrate and nitrite is 10 mg/L. In the long term, nitrates and nitrites have the potential to cause serious adverse effects in humans.

Sodium (salt) has a drinking water standard to protect individuals who are susceptible to sodium-sensitive hypertension or diseases that cause difficulty in regulating body fluid volume. Sodium is monitored so that individuals on sodium-restricted diets may take the sodium in their water into account. Drinking water contributes only a small fraction (less than 10%) of an individual's overall sodium intake.

Fluoride, a natural element, is added to drinking water systems to reduce dental cavities. Prolonged exposure to levels above 4 milligrams per liter may result in crippling skeletal fluorosis, a serious bone disorder. Lower levels may cause dental fluorosis when children are developing teeth. In its moderate and severe forms, dental fluorosis is a brown staining and/or pitting of the permanent teeth.

Total coliform bacteria are common in the environment and are generally not harmful. The presence of these bacteria in drinking water, however, is an indicator that disease-causing organisms may be present. The U.S. Environmental Protection Agency and Florida have set an enforceable drinking water standard for total coliform of 4 counts per 100 milliliters to reduce the risk of adverse health effects. Drinking water that meets this standard is usually not associated with a health risk from disease-causing bacteria and is considered safe.

Appendix A.3 Surface Water Permission Letter



FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

BOB MARTINEZ CENTER
2600 BLAIRSTONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

RICK SCOTT
GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

August 30, 2012

Dear Ms. Bliss,

Site # Z2-SL-6013

In a cooperative effort, the Florida Department of Environmental Protection, the five state Water Management Districts and some county governments are working together to both effectively and efficiently monitor the State's water resources. As part of this effort, the Department is implementing its Watershed Quality Status Monitoring Network by randomly locating water resources to monitor. The purposes of this non-regulatory effort are to define the overall conditions of the state's surface water quality, and to determine if the conditions in the watershed are changing over time basin-wide.

We are seeking permission to sample a small lake located on your property. This lake is to be representative of surface water in your regional watershed. We will be sampling in September 2012. The visit will typically take four to six hours since we would also be conducting a lake vegetation index assessment to determine the various types of vegetation found in your lake.

The included brochure provides more information on our monitoring network. You also can find more information at our website at: <http://www.dep.state.fl.us/water/monitoring/status.htm>

If you are willing to allow the Florida Department of Environmental Protection's trained staff to access your property in September 2012, please sign the enclosed form and return it in the provided envelope. Keep this letter for your reference. You will be provided with a copy of the water analysis report if that box is checked on the form. The report is provided free of charge and normally would cost in excess of \$600.

Please contact me if you have any questions or want to provide verbal permission and set a specific day for our visit.

Sincerely,

Pam Novak
Environmental Specialist II, Watershed Monitoring Section
2600 Blair Stone Rd., Mail Station 3525
Tallahassee, FL 32399-2400
(850) 245-8533 Email: Pamela.Novak@dep.state.fl.us



FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

BOB MARTINEZ CENTER
2600 BLAIRSTONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

RICK SCOTT
GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

Site Permission Form

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

Please make any corrections needed and sign below.

Owner's Name: _____

Physical Address: _____

Owner's Mailing Address: _____

Contact Phone Number: _____

Contact Email Address: _____

Comments: (Is the lake dry, Dogs, Locked gates, Make appointment, etc.)

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

☐ I hereby give the Florida Department of Environmental Protection permission to collect water samples from the small lake located on my property during the month of September 2012.

Signature

Date

I would like a copy of the analytical results from my water body. YES ☐ NO ☐

Please check the box below if you do not want the Florida Department of Environmental Protection to sample your water body.

☐ I do not want my water body sampled.

Please return this form in the enclosed envelope to:

Florida Department of Environmental Protection
Watershed Monitoring Section

Appendix A.4 Ground Water Permission Letter



**FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION**

BOB MARTINEZ CENTER
2600 BLAIRSTONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

RICK SCOTT
GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

November 29, 2012

Site ID Z2-UA-5046

Dear Ms Wilson:

In a cooperative effort, the Florida Department of Environmental Protection, the five state Water Management Districts and some county governments are working together to both effectively and efficiently monitor the State's water resources. As part of this effort, the Department is implementing its Watershed Quality Status Monitoring Network by randomly locating water resources to monitor. The purposes of this non-regulatory effort are to (1) define the overall conditions of the state's ground water quality, and (2) determine if the conditions in the watershed are changing over time basin-wide.

In the year 2012 sampling will be conducted in your watershed. One of the potential sampling locations is on your property and this water resource is to be representative of ground water in your regional watershed. We are seeking permission to sample a well located on your property. We will be sampling in your area in November and December of 2012. Sampling of a site typically takes two hours. Included is a brochure on our monitoring network. And, for more information you can visit our website at: <http://www.dep.state.fl.us/water/monitoring/status.htm>

If you are willing to allow the Florida Department of Environmental Protection's trained samplers to access your property in November or December, please sign the enclosed form and return it in the provided envelope. Keep this letter for your reference. You will be provided with a copy of the water analysis report if that box is checked. This is a \$600 value report.

Please contact me if you have any questions or want to provide verbal permission and set a specific day for our visit.

Sincerely,

Joe Smith
Environmental Specialist II, Watershed Monitoring Section
2600 Blair Stone Rd., Tallahassee, FL 32399
850-245-1234 Fax: 850-245-0001
Email: Joe.Smith@dep.state.fl.us



**FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION**

BOB MARTINEZ CENTER
2600 BLAIRSTONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

RICK SCOTT
GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

Site Permission Form

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

Please make any corrections needed and sign below.

Owner's Name: _____

Physical Address: _____

Owner's Mailing Address: _____

Contact Phone Number: _____

Contact Email Address: _____

Comments: (Is the lake dry, Dogs, Locked gates, Make appointment, etc.)

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

☐ I hereby give the Florida Department of Environmental Protection permission to collect water samples from the small lake located on my property during the months of February 2011 or March 2011.

Signature

Date

I would like a copy of the analytical results from my water body. YES ☐ NO ☐

Please check the box below if you do not want the Florida Department of Environmental Protection to sample your water body.

☐ I do not want my water body sampled.

Please return this form in the enclosed envelope to:

Florida Department of Environmental Protection
Watershed Monitoring Section

Appendix A.5 Site Tracking Spreadsheet

Random ID: Z2-UA-6003

Date Sampled:

Initials:

Station ID	Station Name	County	Main Contact Name	Mailing Address	Location Address
	MAS2-11	Dixie	Jimmy Yellow	See Notes	Same

Permission Yes	Date Granted 10/4/2012	Grantor	Phone Numbers:
Written	Rcv'd by JY	Jimmy Yellow	Home
Does owner want test results? YES			352-123-1234

SAMPLING AGENCY: <u>FDEP</u>	FLUWID: <u>None</u>	OWNER: <u>Mr. Jimmy Yellow</u>
STATUS RANDOM ID: <u>Z2-UA-6003</u>	Well Type: <u>Domestic</u>	PROJECT: <u>Status</u>
LAND SURFACE ELEV. (LSE): <u>36.5 ft</u>	CASING MATERIAL: <u>Steel</u>	TOTAL DEPTH: <u>65 ft.</u>
MEASURING POINT ELEV. (MPE): <u>38.5 ft</u>	CASING DIAMETER: <u>4in.</u>	CASING DEPTH: <u>49 ft.</u>
NOTES: <u>Jimmy Yellow 12345 SE 349 Hwy. Old Town 32680</u>		

Directions: From Tallahassee take: US 19 to Old Town. Turn right (south) onto CR 349. Drive 12.3 miles. The well is on your left/east side. (See maps)

LAT / LONG: 29 26 12.000 83 02 02.000

Gazetteer Page: 98 A3

Comments To Samplers: The lat/long may be off. The well should be a 4" steel drinking water well. Need appt. Appt. time: Appt. date: Notes:

Appendix A.6 Field Recon Checklist

- ☐ GPS and cradle
- ☐ Recon notebook with field paperwork and maps
- ☐ Digital camera and charger
- ☐ Field phone and charger
- ☐ Gazetteer
- ☐ Laptop and charger
- ☐ Clipboard with...
 - ☐ Permission letters
 - ☐ Brochures
 - ☐ Envelopes
 - ☐ Business cards
- ☐ Pens
- ☐ Keys (if needed to access the site)
- ☐ Extra locks
- ☐ Boltcutters
- ☐ Small set of tools
- ☐ Potentiometer

Appendix A.7 Ground Water Well Addition Form



**FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION**

BOB MARTINEZ CENTER
2600 BLAIRSTONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

RICK SCOTT
GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

WELL ADDITION FORM

The following information is required for a well to be listed as a candidate to be randomly sampled for Florida's Ground Water Quality Status Monitoring Network.

Please enter as much of the following information as possible to have your well considered for sampling. Completion of this form does not guarantee your well will be added to the database or sampled.

Owner Information

Owner's Name:

Owner's Address:

City: _____ State: _____ Zip Code:

Owner's Phone Number: (_____) _____

Contact Person Information (if other than Owner)

Contact's Name: _____

Contact's Address: _____

City: _____ State: _____ Zip Code: _____

Contact's Phone Number: (_____) _____

Well Information

County: _____ Construction Date: _____

Well Driller's Information: Name:

Address: _____

City: _____ State: _____ Zip Code: _____

Phone Number: (_____) _____

Water Management District Permit Number:

*Location: Latitude _____ Longitude _____ Datum/Source _____

Section-Township-Range: _____

Physical Address: _____

Well Information (Continued)

Aquifer: Confined Floridan Intermediate Biscayne
(Circle one)

Sand & Gravel Unconfined Floridan Surficial Unknown

Total Well Depth (feet): _____ Total Casing Depth (feet): _____

Casing Diameter (inches): _____

Casing Material: Steel PVC Plastic Iron Rock Concrete None
(Circle one)

Tile Brick Stainless Steel Galvanized Metal Unknown

Is the Well Screened? (Circle one) Yes No Don't Know

Screen Length (feet): _____

Well Use: Private Drinking Water Irrigation Agricultural Supply Monitoring
(Circle one)

Public Drinking Water Industrial Supply Other

* Please draw a sketch map of the location of the well, roads, and other items such as gates. Also include any other comments.

Please return this form to:

Florida Department of Environmental Protection

Watershed Monitoring Section

2600 Blair Stone Road, MS 3525

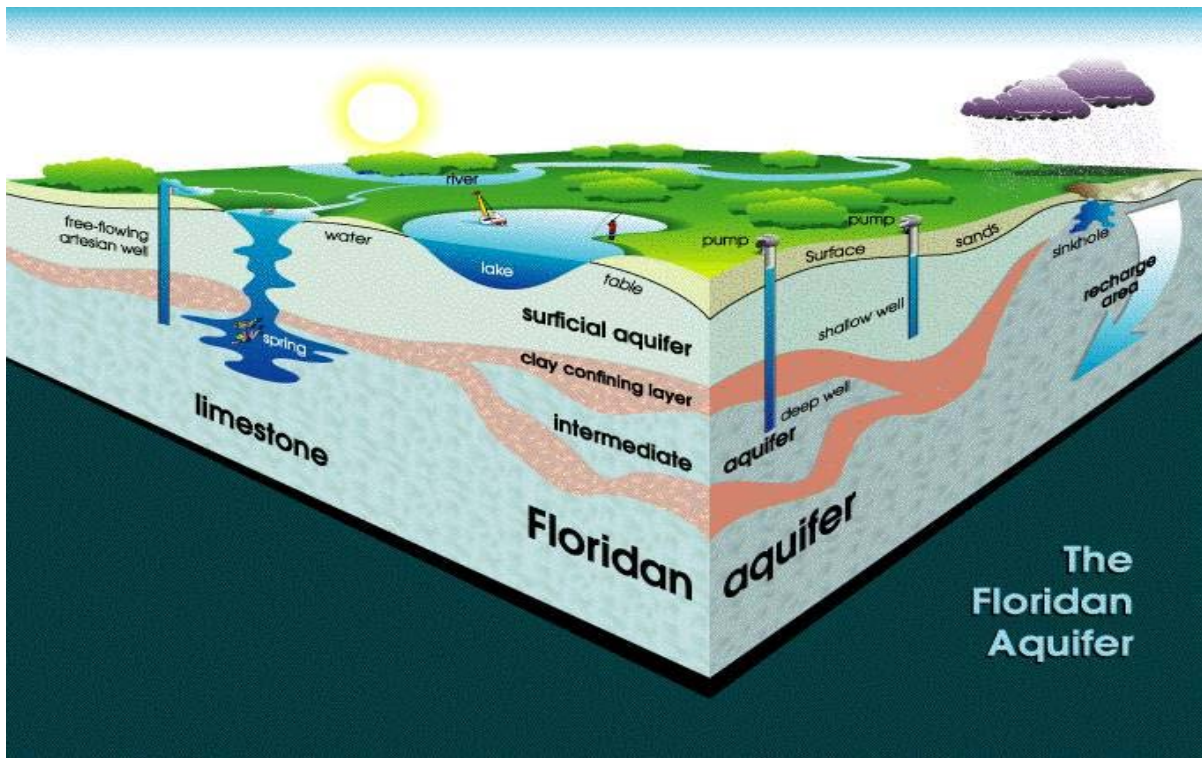
Tallahassee, Florida 32399-2400

Phone (850) 245-8533

Fax (850) 245-7601

VII. Appendix B. Aquifers and Ground Water Programs

Appendix B.1 Aquifers



Appendix B.2 Well Programs and Networks

A. Background Network

The Background Network, established in the 1980s, was designed to provide baseline ground water data from wells deemed to have very little potential for contamination. The wells for this network are comprised of water management district monitoring wells, private drinking water wells, and other wells with a low potential for contamination. Information on Background wells is stored in binders in the Watershed Monitoring Section.

B. VISA Network

The Very Intense Study Area (VISA) Network was established in the late 1980's and contained wells that were considered, based on land use, to have a high potential for contamination. The VISA Network wells were also comprised of water management district monitoring wells, private drinking water wells, and other wells having a high potential for contamination within a study area. Information on VISA wells is located in binders in the Watershed Monitoring Section.

C. HRS Network

The Human and Rehabilitative Services (HRS) Network, developed in the late 1980s and early 1990s, was designed to have at least 50 wells per county. These wells are documented with well completion reports submitted by the well drillers and kept at FDEP and water management districts. Sampling was conducted by DER (Department of Environmental Regulation, now FDEP) samplers, and analysis was performed at the HRS laboratory. A large number of the wells were never sampled and the current owner data, as with the other legacy networks, is long outdated.

D. WAFR

Wastewater Facility Regulation (WAFR) wells monitor the treatment and disposal of domestic wastewater (sanitary sewage), industrial wastewaters, and contaminated stormwater from domestic and industrial facilities. The Status Network uses a listframe that contains WAFR upgradient background wells. Information on the wells can be found in WAFR reports, the WAFR database, or by contacting the local FDEP District office. In some cases, only facility personnel or staff contracted to conduct well monitoring will have current well information.

E. WACS

Water Assurance Compliance System (WACS) wells are located at solid waste facilities, such as landfills, or solid waste recycling stations. Information on these wells can be found in WACS reports, the WACS database, or by contacting the pertinent FDEP District office. In some cases, only facility personnel or staff contracted to conduct well monitoring will have current well information.

F. USGS

United States Geological Survey (USGS) wells have been installed, maintained, and sampled for ground water studies and surface water-ground water interaction analyses. Data on these wells can be obtained by contacting the local USGS office.

G. Water Management District Well Networks

Each of the Water Management Districts (WMD) maintains a ground water network to track ground water levels and analyte values within its permitting area. The WMDs may also drill and maintain additional wells for special studies. Information on WMD well networks and individual wells can be located by contacting the appropriate WMD office.