Florida Department of Environmental Protection

Santa Fe River Basin Management Action Plan (BMAP)

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Water Quality Framework

Monitor and report progress annually

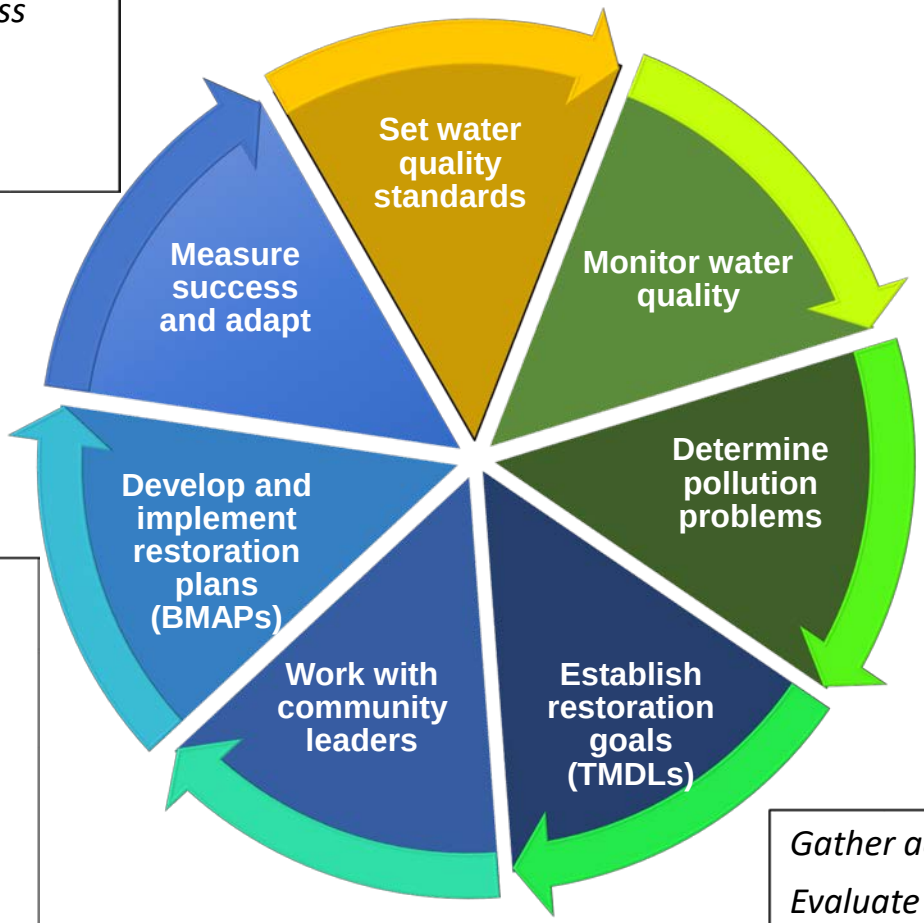
Adapt and change – new statewide annual report

Collect data

Analyze and verify

List "impaired" waters

REPEAT



Excessive nutrients

Bacteria, Metals, and Other Impairments

Allocate responsibilities

Identify projects

- *Infrastructure*
- *Best Management Practices (BMPs)*

Establish schedules

Identify success criteria

Gather additional data

Evaluate water quality

Adopt pollutant reduction targets

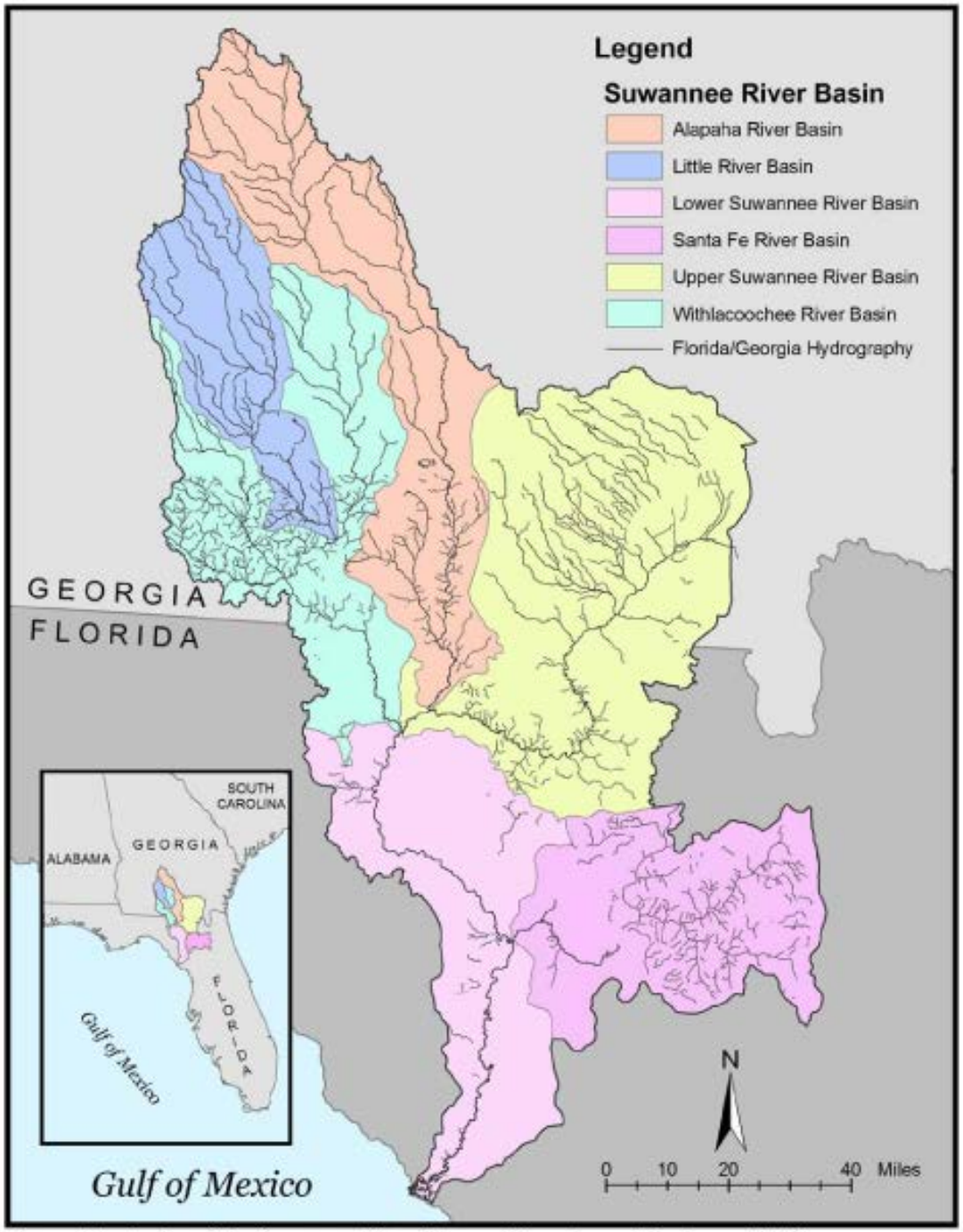


Figure 1-1. Basins of the Suwannee River System (Hornsby and Raulston, 2000).

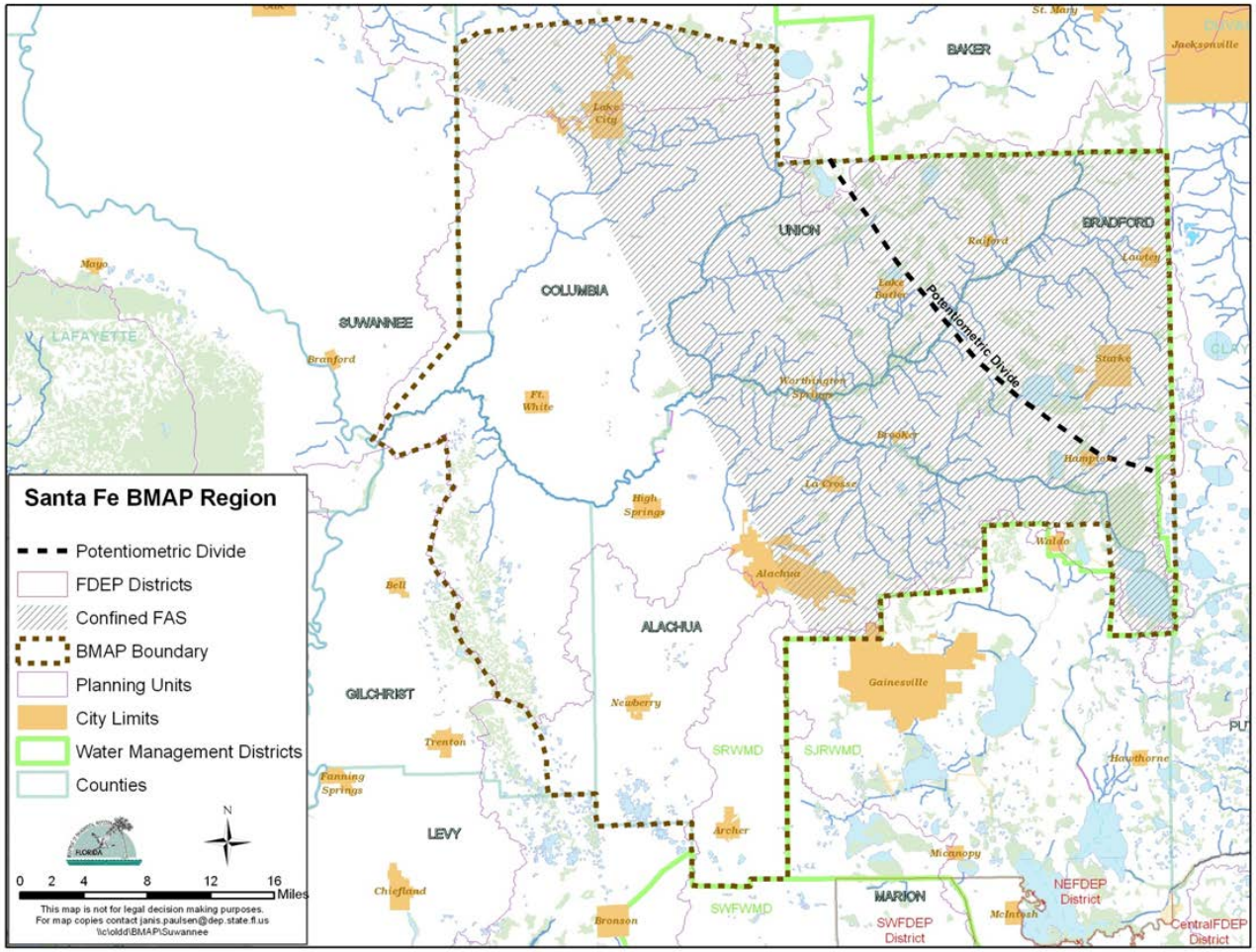
Santa Fe BMAP Area

BMAP planning area, nearly 1.1 million acres

Land Uses:

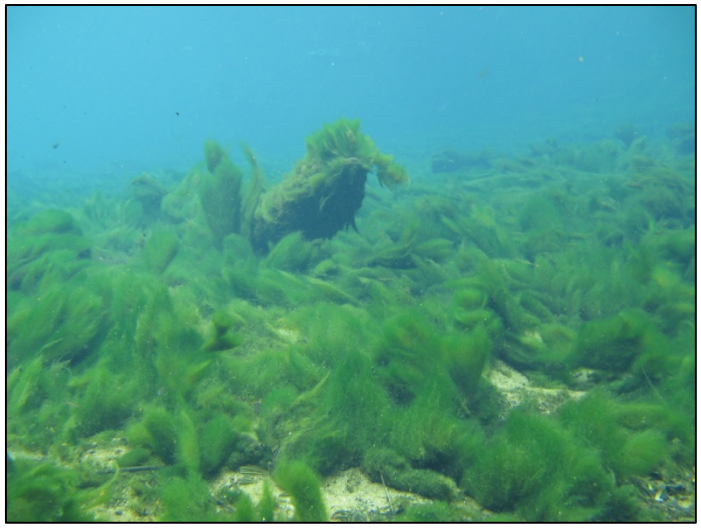
- Upland Forest (47%)
- Agricultural (22%)
- Wetland/Water (15%)
- Urban/Built-Up (11%)
- Other (5%)

Both agricultural and urban BMPs are being implemented.



Santa Fe River
Basin Total Maximum Daily Loads (TMDLs)

- TMDL Data Period of Record:
  - June 1, 2000 through June 30, 2007
- TMDL Study Results:
  - Nitrate shown to be primary factor in causing algal blooms
- TMDL:
  - 0.35 milligrams per liter (mg/L) nitrate monthly average concentration (or lower) will not cause an imbalance in the flora or fauna

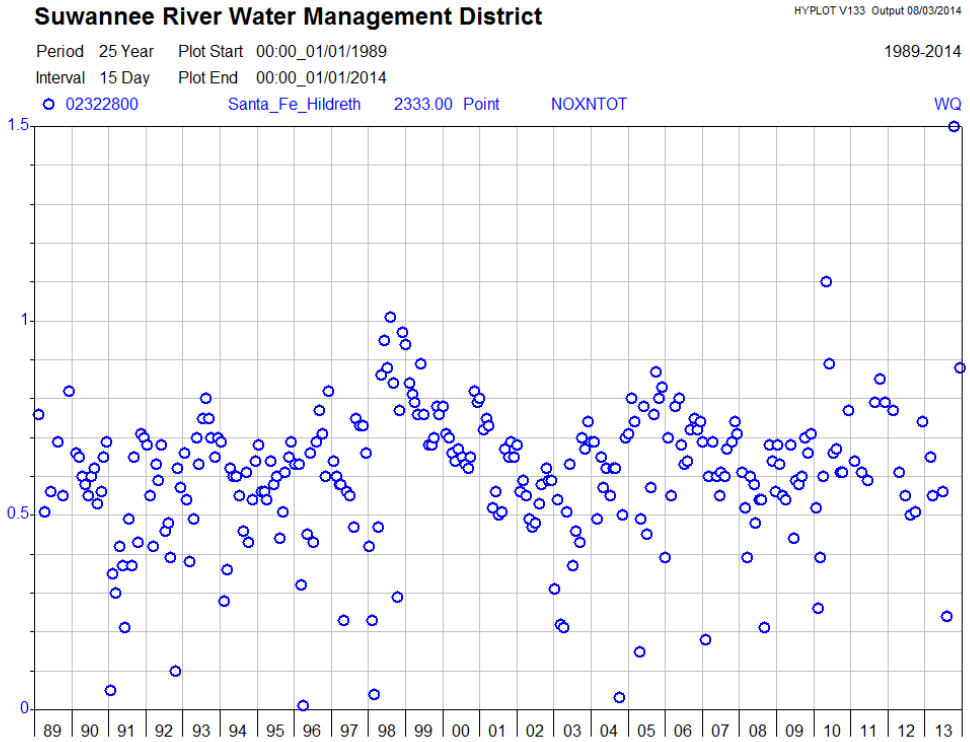


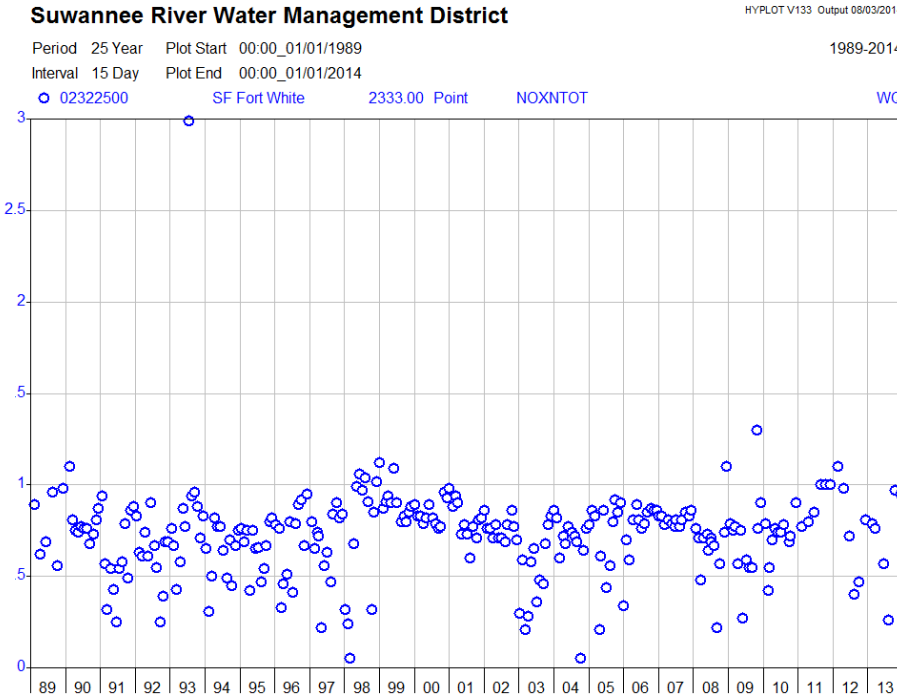
Santa Fe River Nitrate Total Maximum Daily Loads (TMDLs)

Planning Unit	Parameter	TMDL	WLA NPDES wastewater	WLA NPDES Stormwater	LA*	MOS
Middle Suwannee (WBIDs 3422J, 3422L, 3422T, 3422U, 3422Z)	Nitrate, monthly average	0.35 mg/L	N/A	N/A	51%**	Implicit
Lower Suwannee (WBIDs 3422, 3422R, 3422S)	Nitrate, monthly average	0.35 mg/L	N/A	N/A	58%**	Implicit
Lower Santa Fe (WBIDs 3605A, 3605B, 3605C)	Nitrate, Monthly average	0.35 mg/L	N/A	35%**	35%**	Implicit

WBID: Waterbody identification area.

Santa Fe River Water Quality Plots

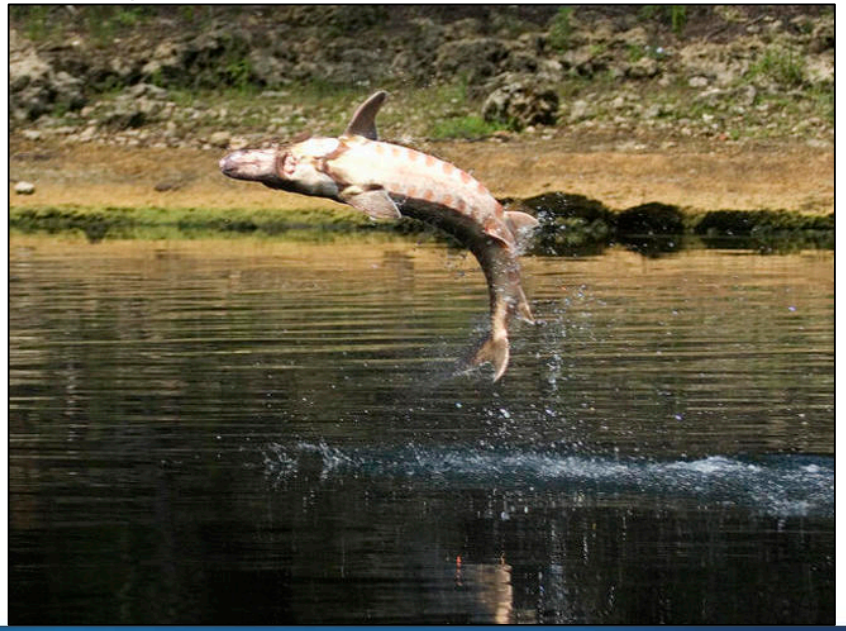




Regulatory Framework

The process for preparing BMAPs is found in:

- Section 403.067, Florida Statutes (F.S.), known as the "Florida Watershed Restoration Act"
- The 2016 Florida Springs and Aquifer Protection Act lists requirements for BMAPs for OFS
- Requirement is to achieve TMDL in 20 years
  - Plan is to achieve:
    - 30 % reduction in 5 years
    - 80 % in 10 years
    - 100 % in 15 years



2016-1 Requirements

INCLUDE:

- Priority Focus Area (PFA) delineation

  Area(s) of basin where Floridan Aquifer is generally most vulnerable

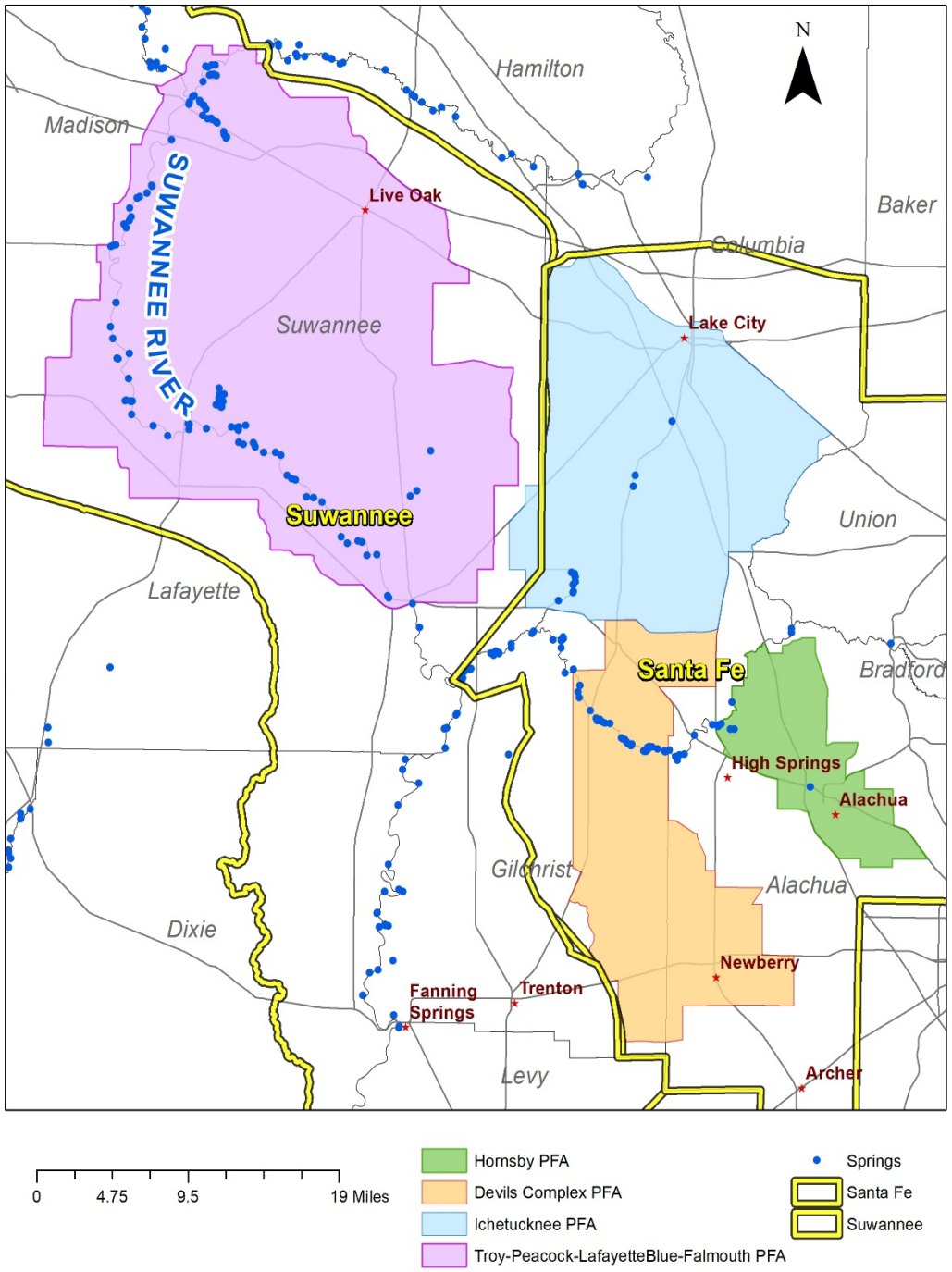
- Identification of point source or category of nonpoint sources with the estimated allocation of the load for each.
  - Nitrogen Source Inventory Loading Tool (NSILT)

PFA/NSILT

- **Priority Focus Area (PFA) –** developed for OFS(s) and used to focus restoration efforts

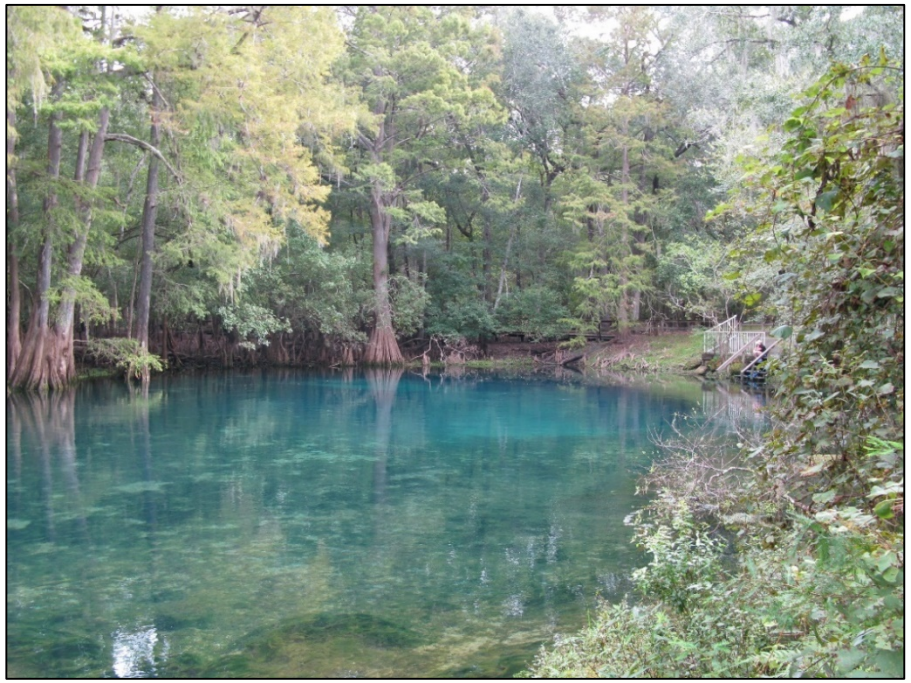
- **Nitrogen Source Inventory Loading Tool (NSILT) –** developed for OFS springsheds to estimate sources of nitrogen to groundwater

  Used to determine if >20% load is from OSTDS



Santa Fe River Basin PFAs and NSILTs

- PFAs and NSILTs completed for the following impaired OFS:
  - Devil's Spring System
  - Hornsby Spring
  - Ichetucknee Spring



Florida Department of Environmental Protection

Division of Environmental Assessment and Restoration

Nitrogen Inputs:

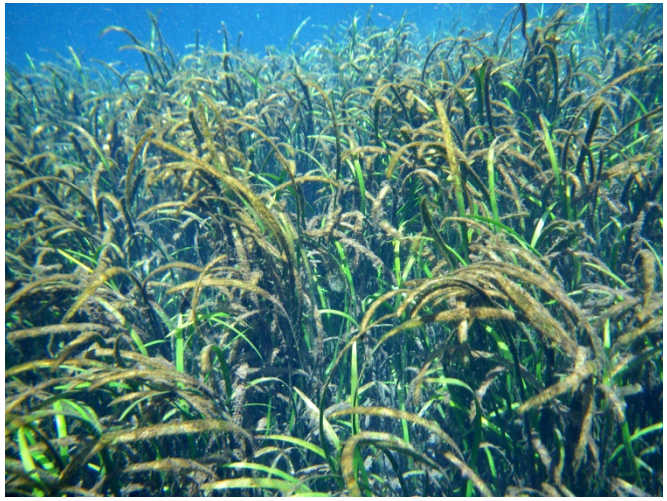
Nitrogen Source Inventory and Loading Tool for Outstanding Florida Springs of the SantaFe River Basin

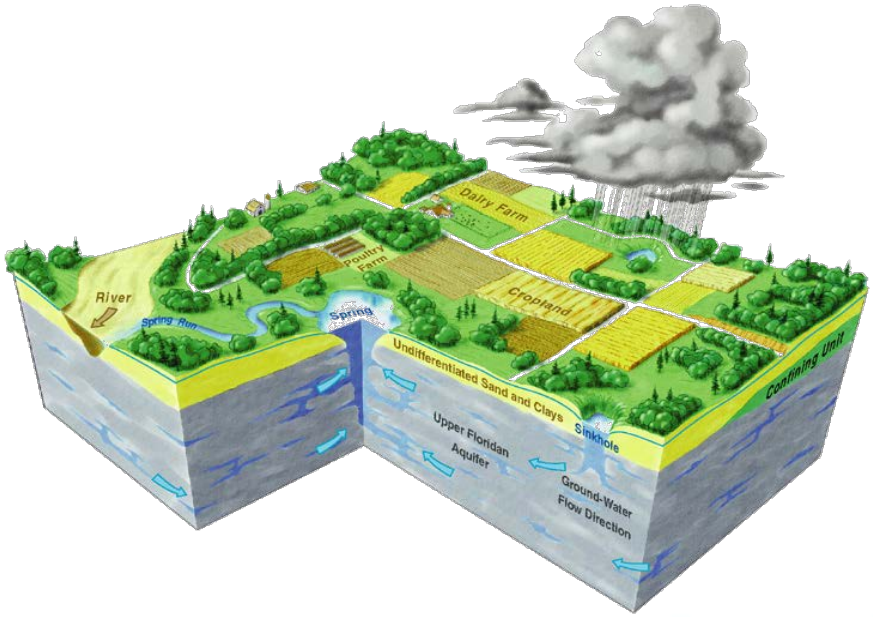
Celeste Lyon

May 15, 2018

Nitrate-Impaired Spring Waters

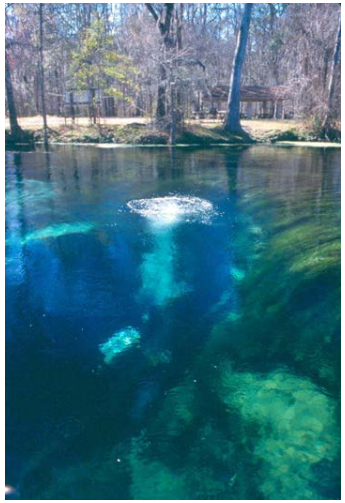
- The water quality in several Outstanding Florida Springs in the Suwannee River Basin is impaired due to elevated nitrate concentrations
- Many sources contribute nitrogen in each springshed:
  - atmospheric deposition
  - fertilizers (farm and non-farm)
  - septic tanks
  - land application of wastewater
  - livestock manure

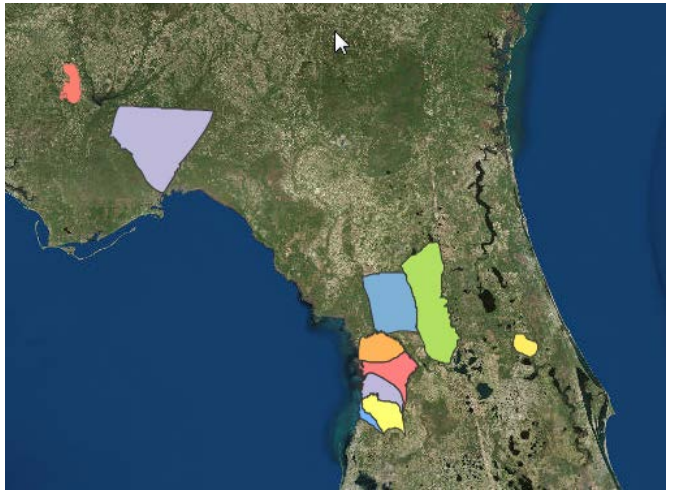




Nitrogen Source Inventory and Loading Tool

- Quantifies nitrogen sources and loading to groun water, and highlights source categories where reductions in N loading could help achieve restoration of impaired waters
- We customize the inventory for each spring basi or BMAP area to account for hydrogeologic and land use differences
- Inventories have been completed for several BMAP areas (Wakulla, Jackson Blue, Silver, Rainbow, Volusia Blue, Springs Coast Springs, Suwannee





Outstanding Florida Springs

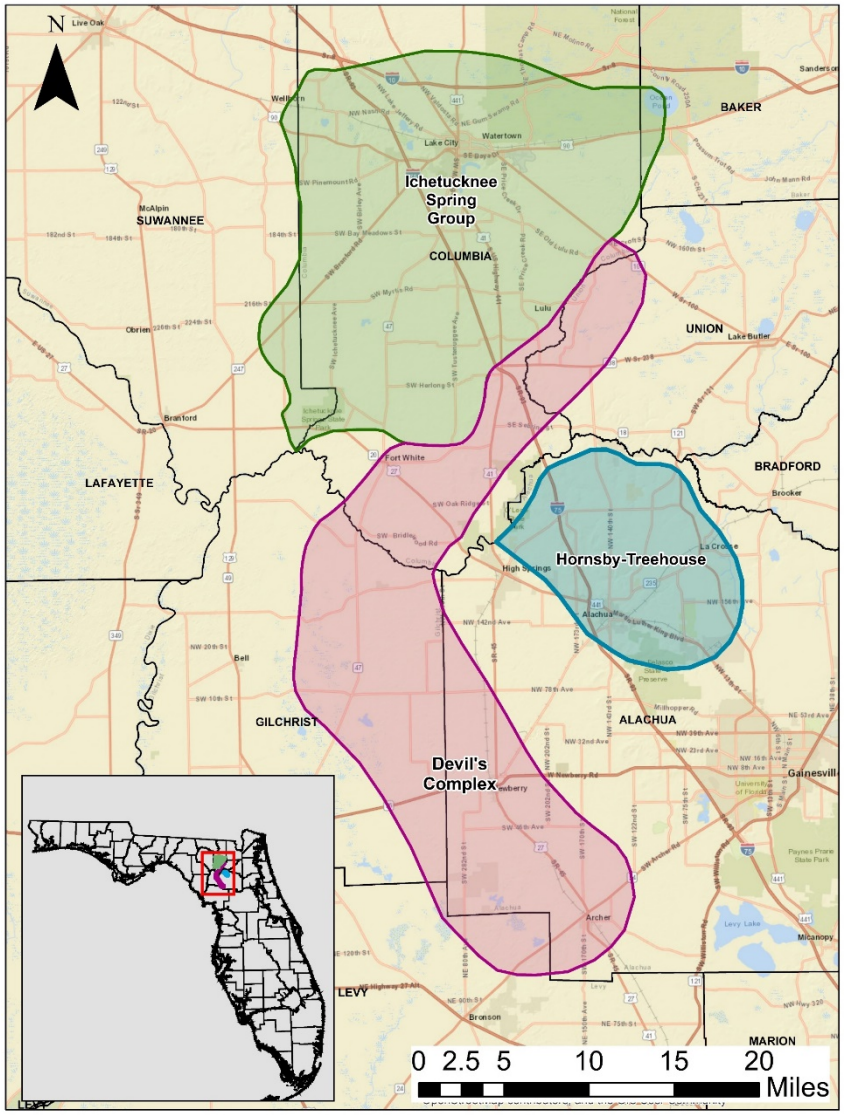
Outstanding Florida Springs in this BMAP area were aggregated into three general springshed areas to more efficiently organize information and implement restoration actions:

- **Ichetucknee Spring Group** (and associated springs of Ichetucknee River)
- **Devil's Complex** combined springshed
- **Hornsby-Treehouse Springshed**

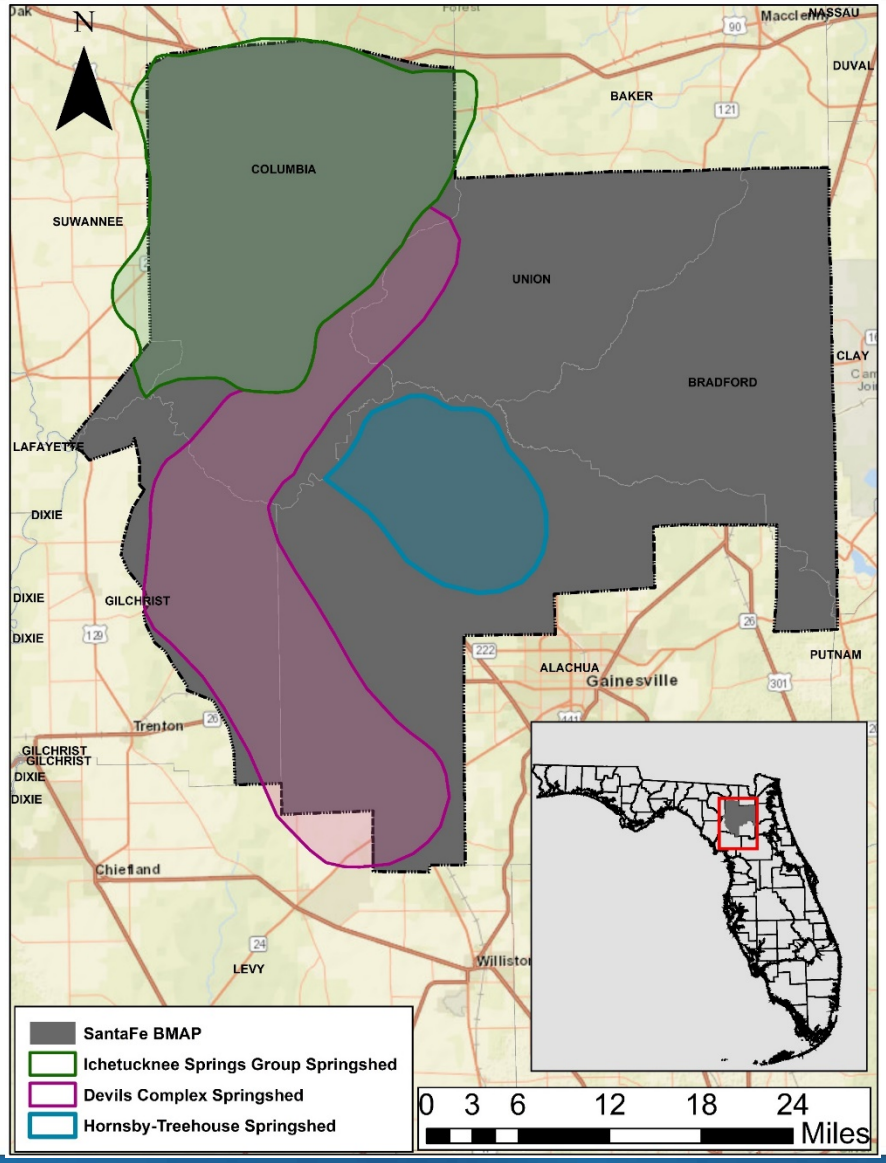
Inventories Conducted for 3 Springshed Areas

Springshed Area	County	Acres
Devil's Complex	Gilchrist	78,922
Devil's Complex	Alachua	72,982
Devil's Complex	Union	21,126
Devil's Complex	Columbia	43,853
Devil's Complex	Levy	11,781
Ichetucknee	Baker	3,817
Ichetucknee	Suwannee	13,621
Ichetucknee	Union	48
Ichetucknee	Columbia	227,927
Hornsby	Alachua	77,520
Hornsby	Columbia	31

Evaluation included portions of 7 counties



Springshed Areas

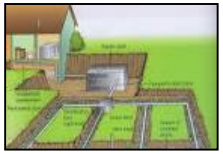


Estimating Nitrogen Loads to Groundwater

Steps:

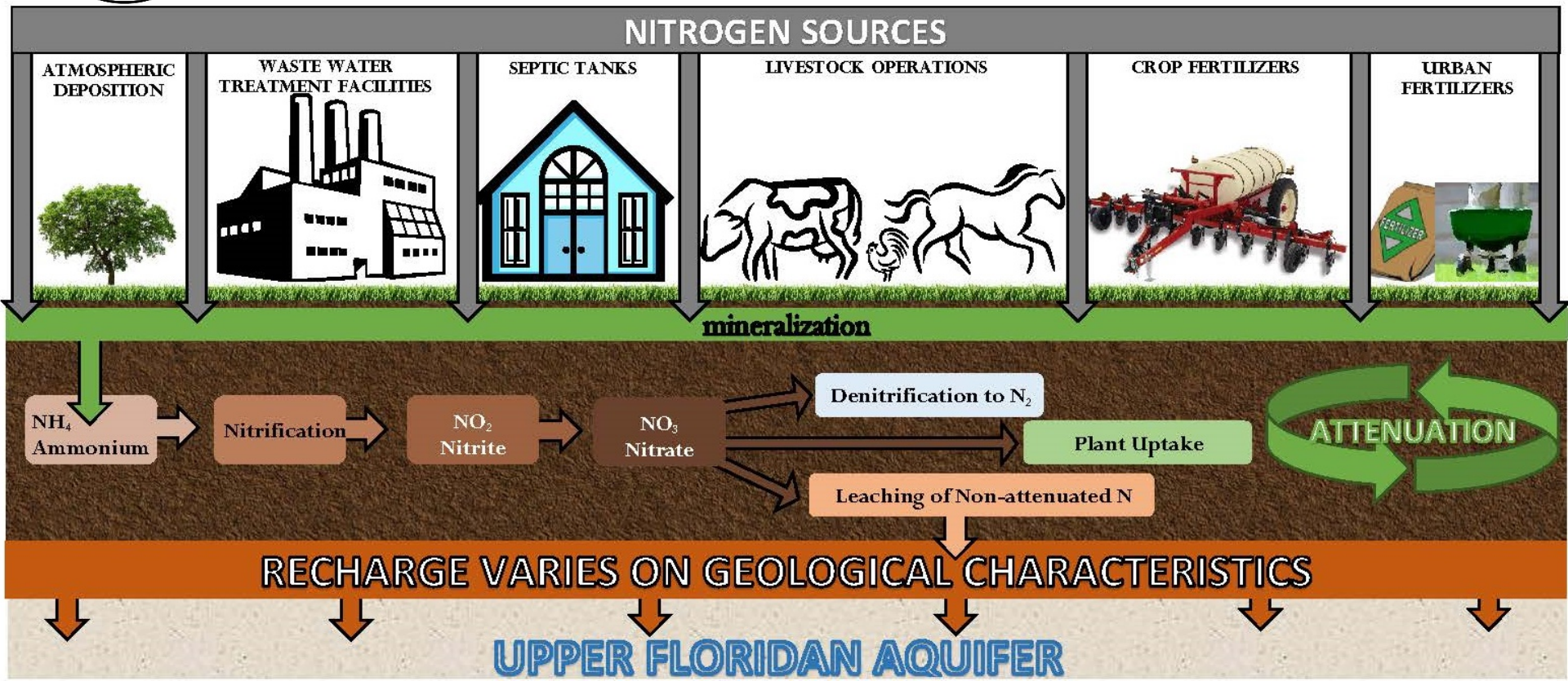
1. Estimate the inputs of nitrogen to the land surface from the source inventory information (best available and most current).
2. Apply attenuation factors based on the various environmental processes that could transform the various forms of nitrogen in the subsurface (such as denitrification, nitrification of ammonia, uptake by plants, mineralization of organic nitrogen).
3. Apply areal weighting factors that are based on the rate of recharge to groundwater to estimate nitrogen loads to groundwater.
4. Fine-tune estimates after getting feedback from stakeholders.





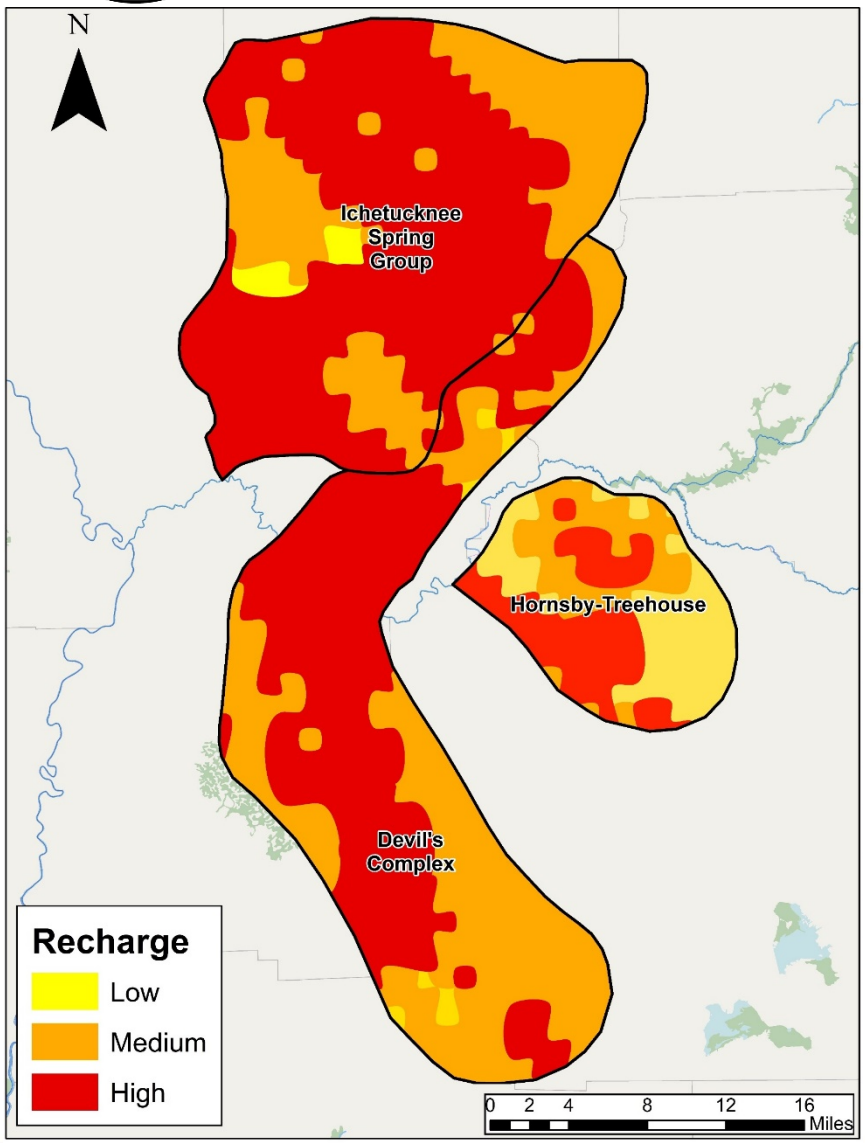



Nitrogen Cycle and Nitrogen Attenuation



LEACHING OF N TO GROUND WATER is related to many factors, such as variable soil conditions, fertilizer material, livestock type, crop types, irrigation, recharge to the aquifer.

Groundwater Recharge and Nitrogen Attenuation

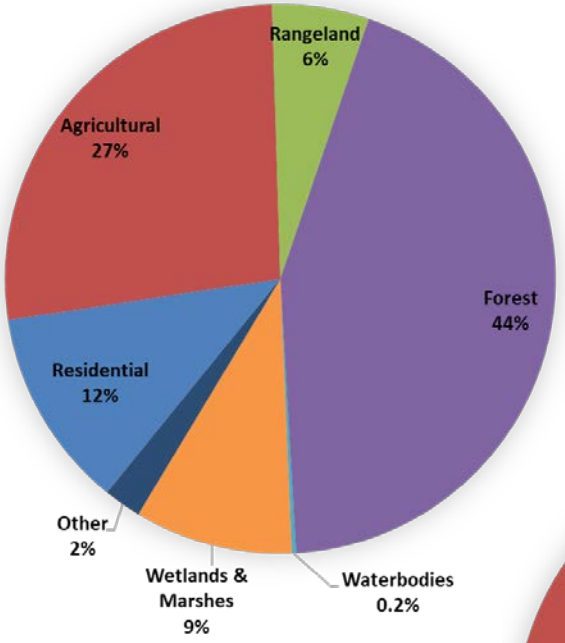


- Inputs to land and loads to groundwater are calculated by recharge region within the springshed
- USGS recharge map based on soil properties, hydrogeology, rainfall
  - **High Recharge: > 10 in/yr**
  - Medium Recharge: 3-10 in/yr
  - Low Recharge: 0-3 in/yr
- **A weighting factor is assigned to recharge category to account for additional attenuation:**
- **High, 0.9**
- **Medium, 0.5**
- **Low, 0.1**

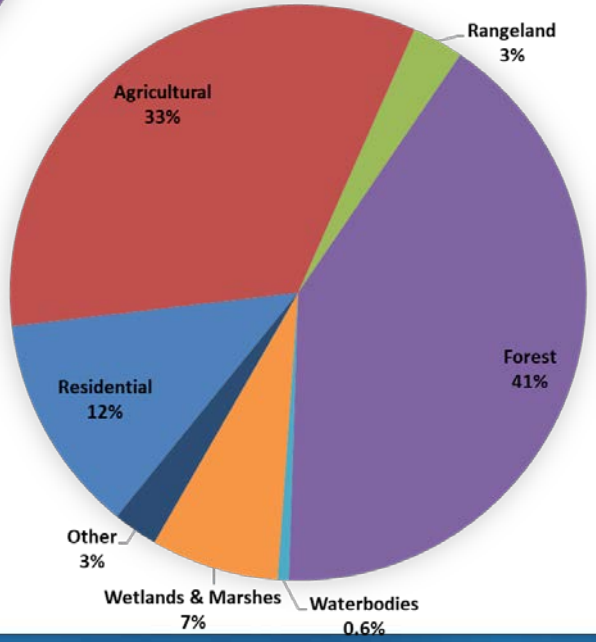
The amount of nitrate that is transported to the UFA in a given year is related to the rate of recharge to the aquifer

Land Use

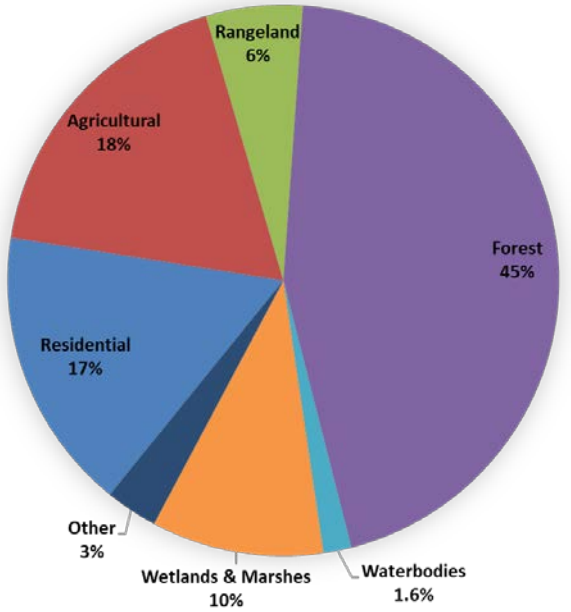
Devil's Complex



Hornsby



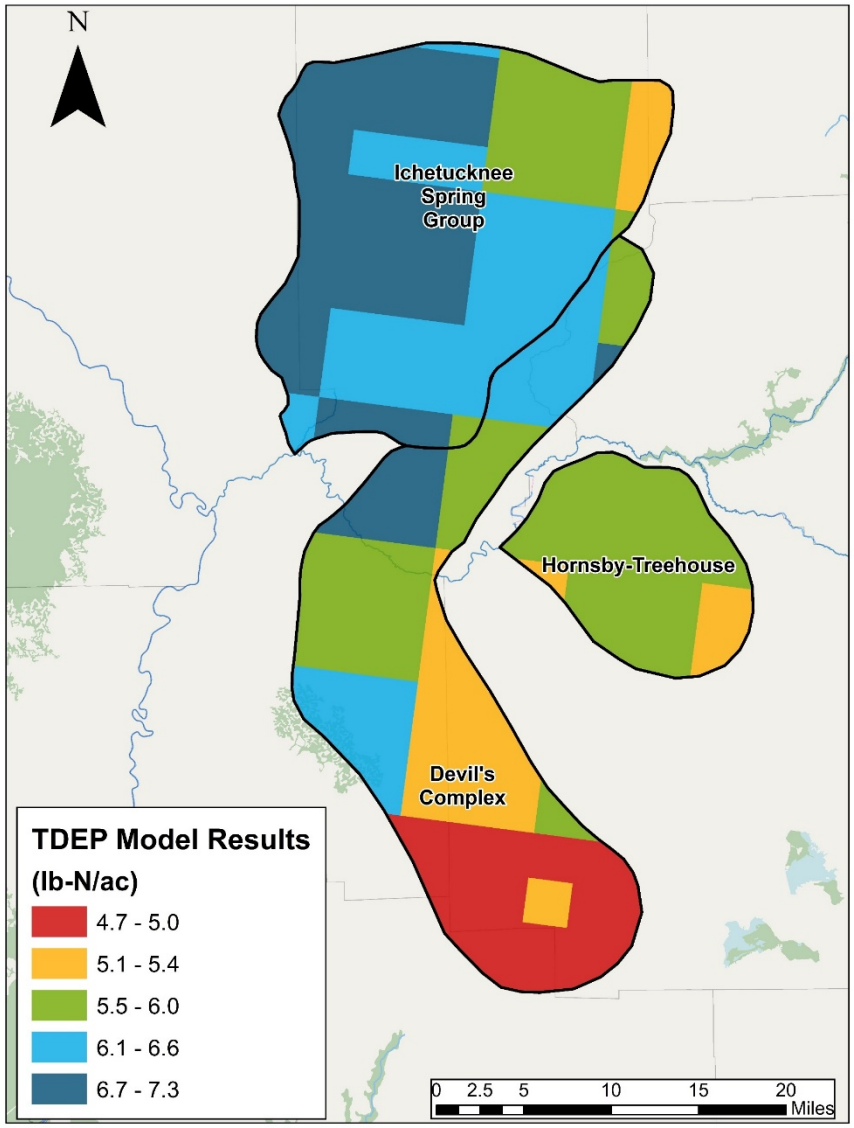
Ichetucknee



Source Categories

- Land Use evaluation provides potential groundwater sources of nitrate
  - Farm Fertilizer (FF)
  - Livestock Waste (LW)
  - Dairies
  - Urban Turfgrass Fertilizer (UTF)
  - Sports Turfgrass Fertilizer (STF)
  - Atmospheric Deposition (AD)
  - Wastewater Treatment Facilities (WWTP)
  - Onsite Treatment and Disposal Systems (OSTDS)

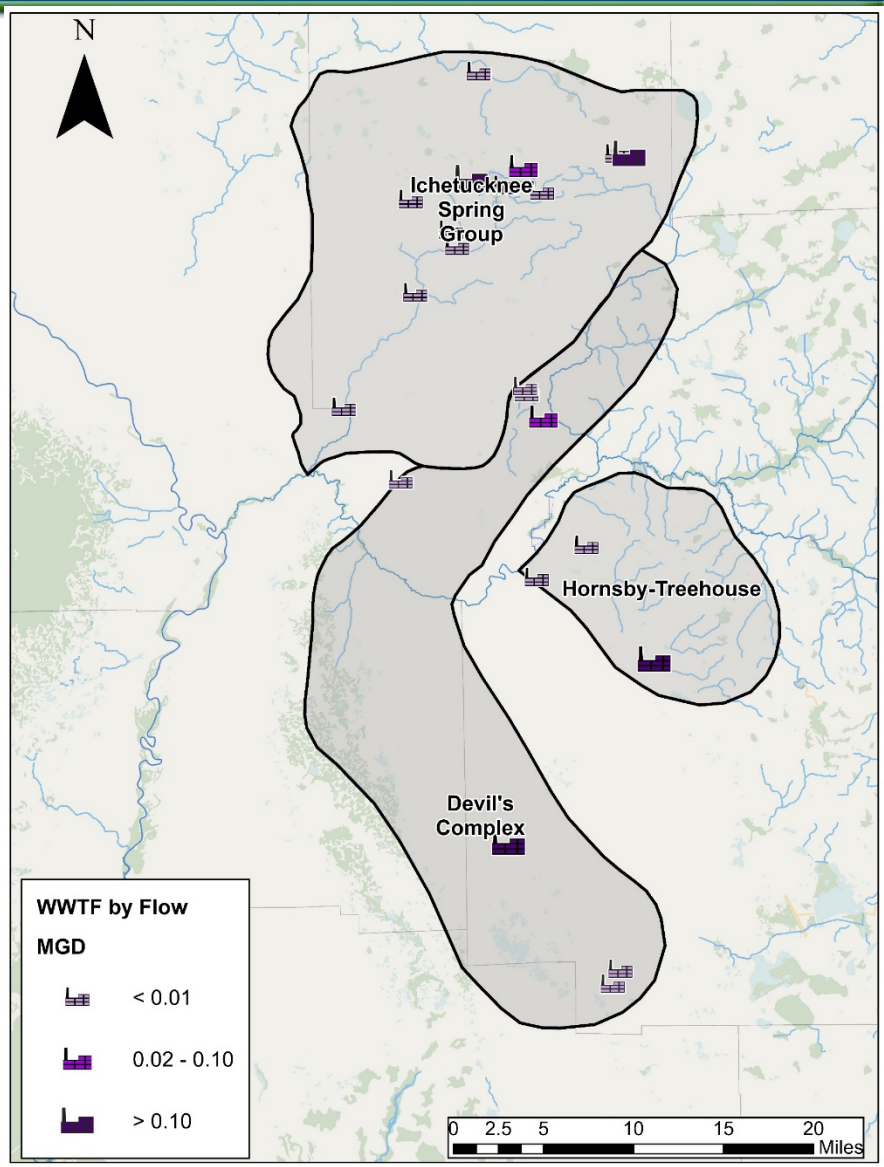
Atmospheric Deposition



- TDEP model
  - U.S. EPA method to estimate spatially continuous atmospheric deposition
  - Nationwide total deposition model for N and S
  - Estimated deposition based on monitoring stations and modeled atmospheric concentrations
  - Model year is an average from 2011 to 2013
  - Average TN deposition
    - Range 4.7 – 7.3 lb-N/ac/yr

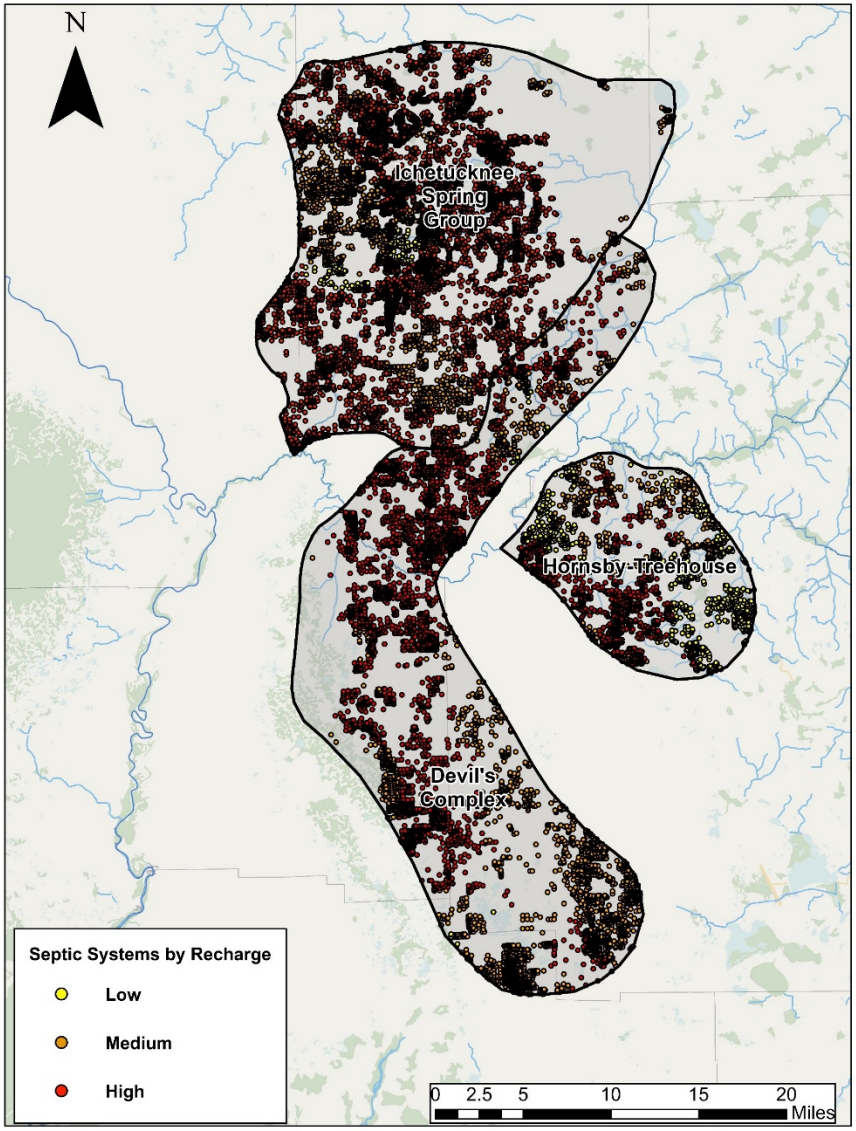
Domestic Wastewater Treatment Facilities

- TN effluent concentrations as reported to DEP
- NO_3 used to project TN data, if necessary
- Effluent data separated based on treatment type
  - RIBs, Absorption Fields
  - Sprayfields
  - Reuse
  - Wetland



Septic Systems

- Septic count taken from DOH's Florida Water Management Inventory (FLWMI)
- Calculate # of people relying on septic tanks
- Average annual input to septic tank = 9.012 lb-N/person (US EPA)



Estimating Livestock Populations and Waste

Livestock	Waste Factor (lb-N/day)
Beef Cows	0.337
Other Beef Cattle	0.31
Chicken, broilers	0.002
Chicken, layers	0.003
Calves	0.068
Equine	0.273
Goats	0.035
Hogs	0.19
Sheep	0.198
Turkeys	0.006

Literature review provided information on common livestock animals in Florida

- Animal waste factors

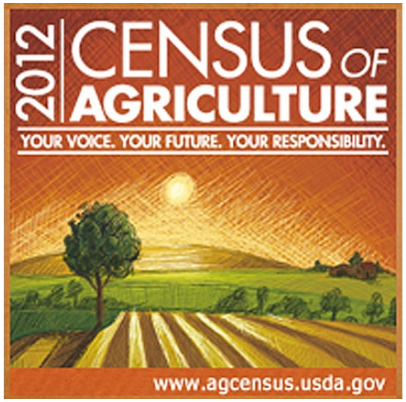
2012 Census of Agriculture (CoA)

- # of livestock (categorized by animal)
- Full county data ONLY

2016 USDA Survey

- # of beef cattle

Use County-level land use information to estimate livestock population within the springsheds.

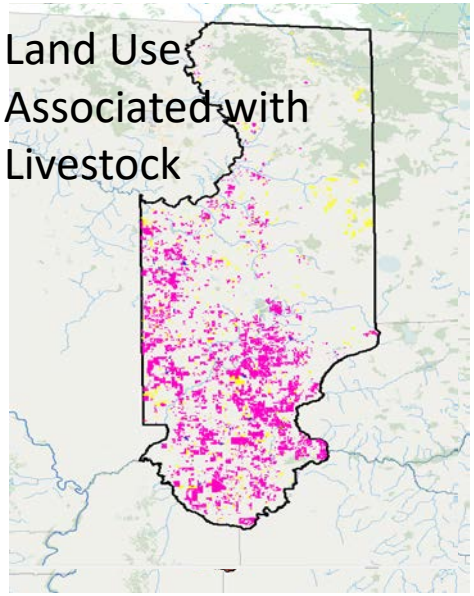


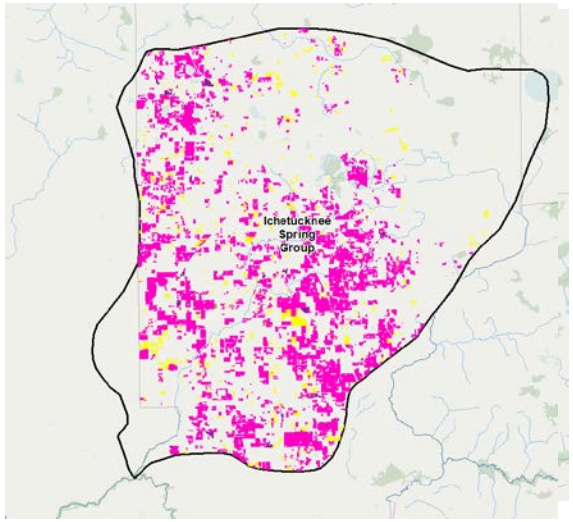
Land Use Description
Cattle Feeding Operations*
Feeding Operations*
Horse Farms
Improved Pastures*
Poultry Feeding Operations
Range Land, Herbaceous (Dry Prairie)*
Specialty Farms
Unimproved Pastures*

* Used to determine lands where beef cattle are likely to be present

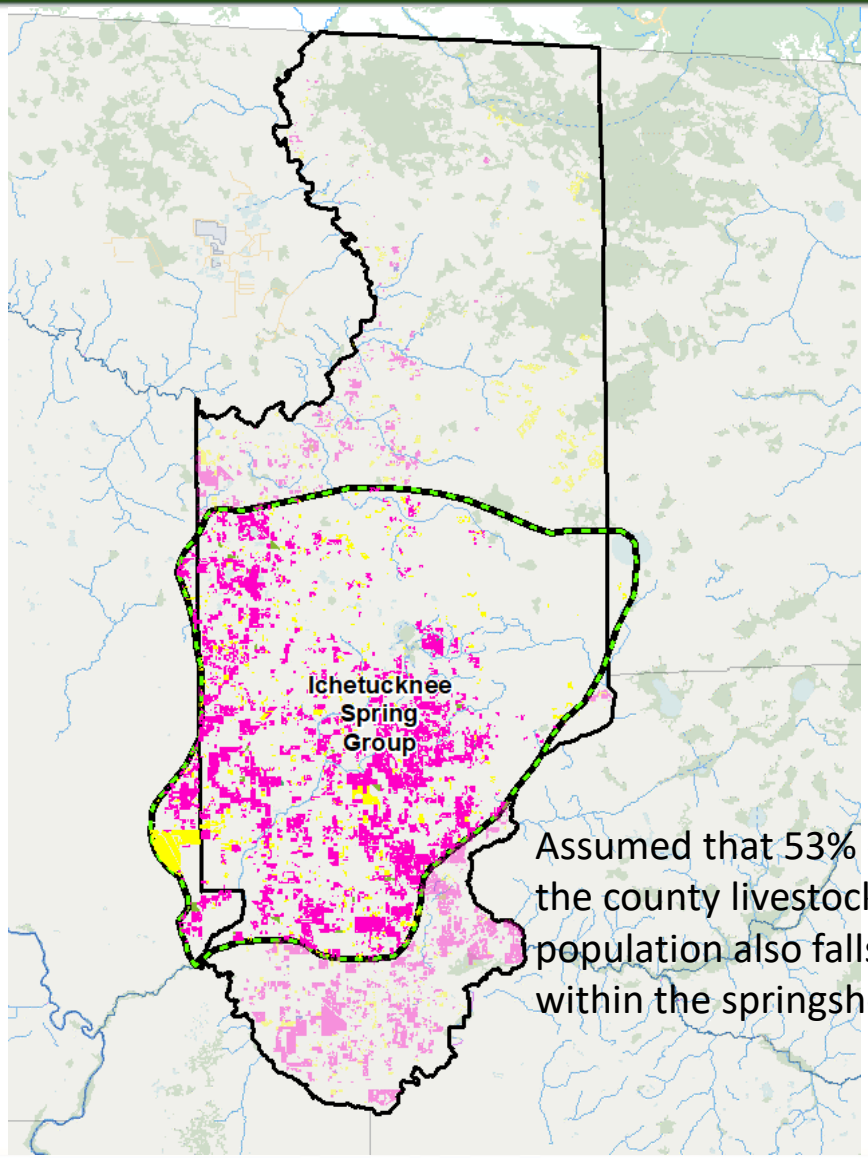
Land Use Percentages: Livestock

Land Use Associated with Livestock





53% of land use associated with livestock in Columbia County fall within the Springshed



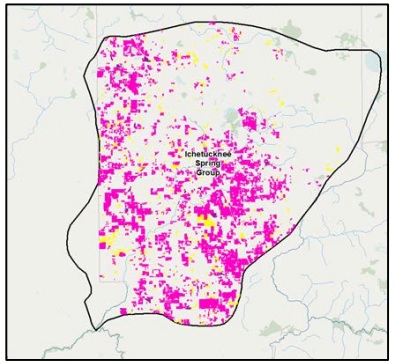
Assumed that 53% of the county livestock population also falls within the springshed

Estimating Beef Cattle (Cow/Calf) Inputs

County livestock waste land use areas

Land Use Description
Cattle Feeding Operations*
Feeding Operations*
~~Horse Farms~~
Improved Pastures*
Range Land, Herbaceous (Dry Prairie)*
~~Specialty Farms~~
Unimproved Pastures*

Identify percentage of livestock waste land use areas that fall within springsheds

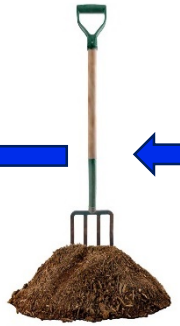


35% of Total Beef Cattle population assumed to be calves

USDA 2016 Survey County Total Cattle Population #s

Subtract known Dairy population to find Beef Cattle Population #s

Apply daily N waste factors
X 365 days



Calves = Apply daily N waste factors
X 183 days

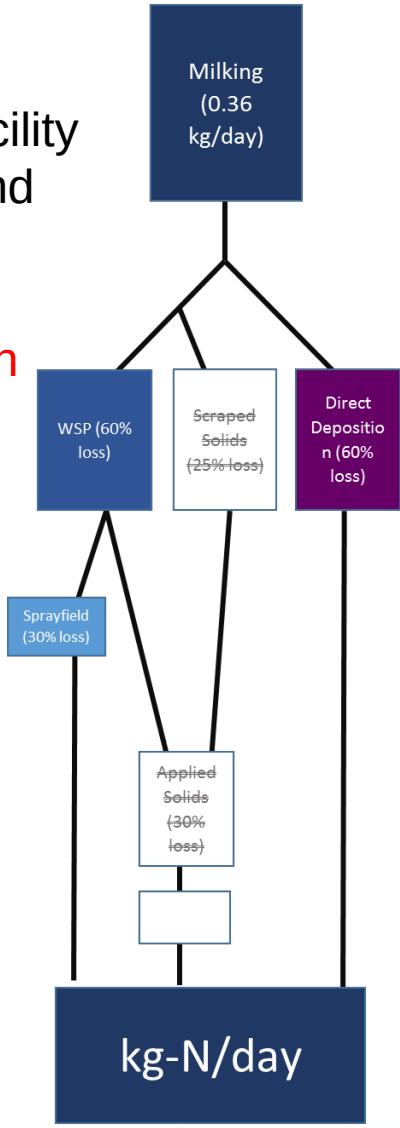
Total N input from Livestock waste

Estimating Dairy Waste Inputs

Permitted Dairy Operations

Detailed information is obtained from the DEP industrial wastewater facility permits on herd sizes, type of cows, confinement and grazing times, and waste management and disposal information

The specific waste handling process was assessed individually for each dairy because of differences in operation from site to site

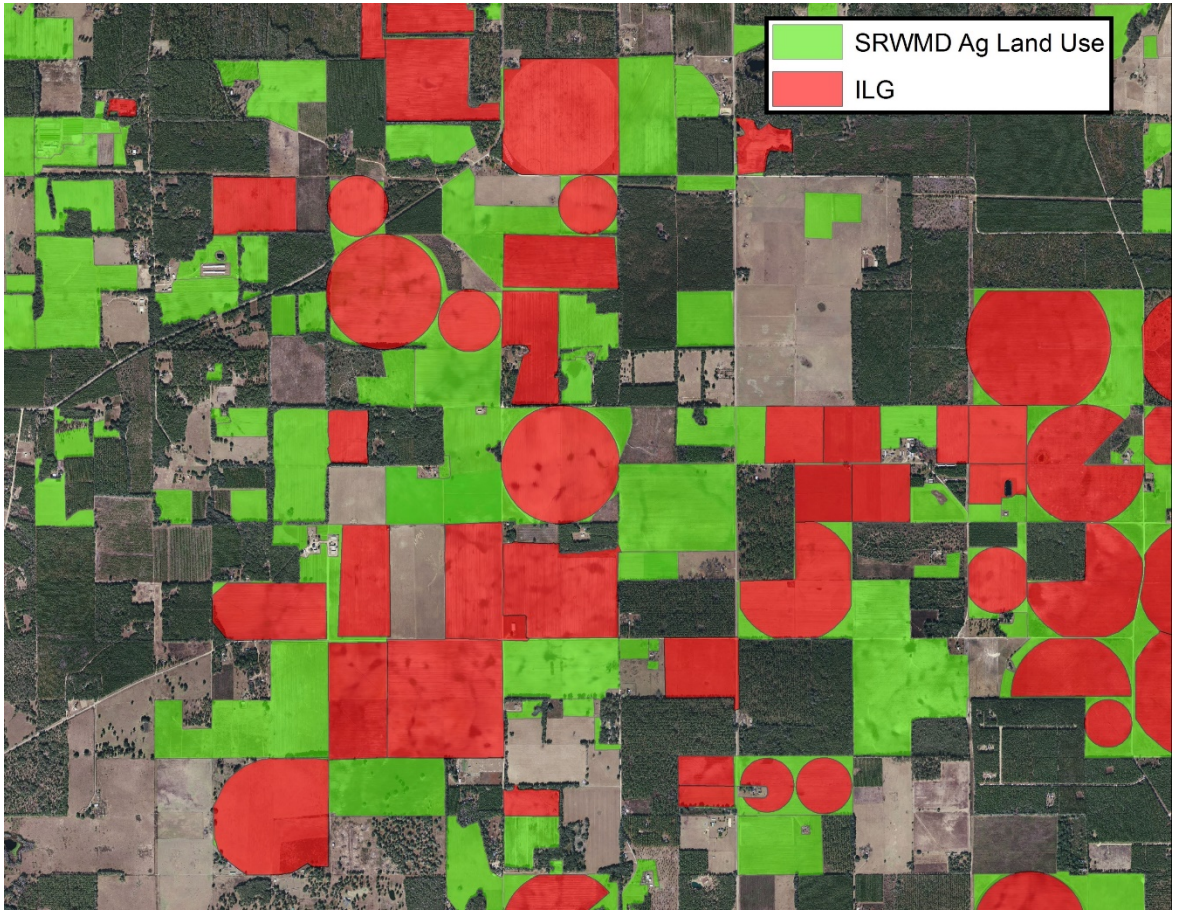


Non-Permitted Dairy Operations*

Obtained herd size, confinement and waste treatment practice information from FDACS field staff and Southeast Milk

* A dairy operation containing less than 700 mature dairy cows

Farm Fertilizer



Irrigated lands and crop type based on FSAID geodatabase.

Crop fertilizer application rates were applied to the acreages identified within springsheds based on crop type.

Application rates based on UF-IFAS recommended rates as well as producer feedback.

Urban Turfgrass Fertilizers

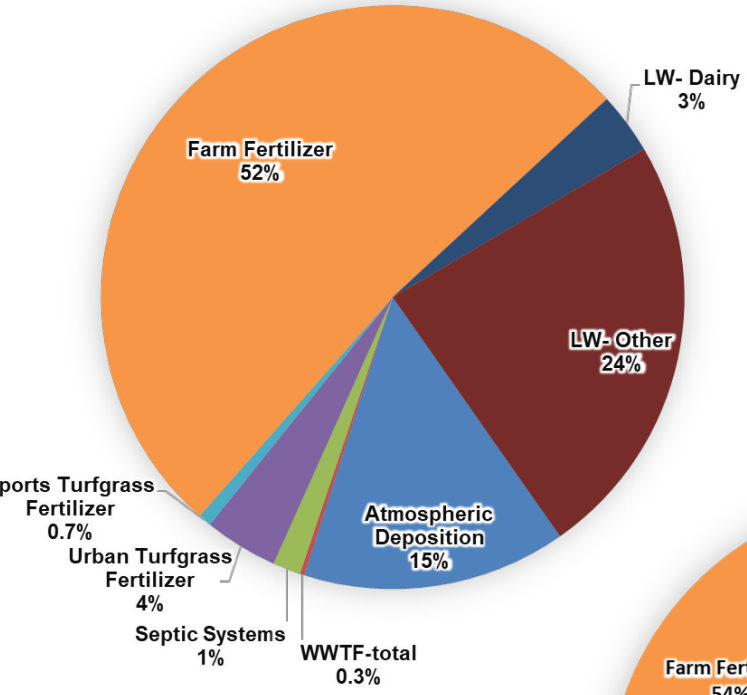
- Acreage likely to receive fertilizer estimated from PA data and property values
  - Residential
  - Non-residential
- Maximum fertilizable acreage was capped at 1 acre
- **Annual Application Rates based on SWFWMD study**
- Property values used to assess probability of fertilization

Sports Turfgrass Fertilizers

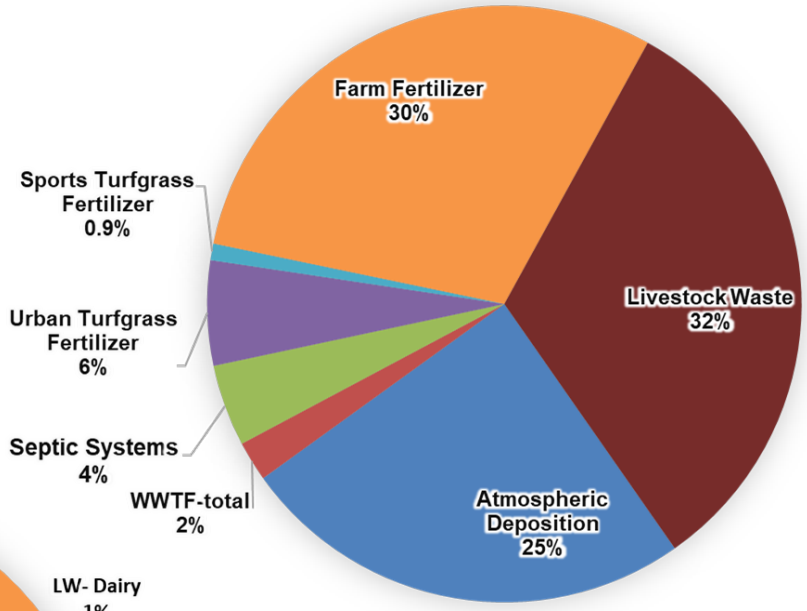
- Sports fields
  - Acreage estimates from aerial analysis of PA landuse data
  - Application rates based on lawn service company estimates
- Golf Courses
  - Acreage estimated through PA landuse data
  - Annual application rate = 4.5 lb-N/1,000 sq ft

Estimates of Nitrogen Inputs

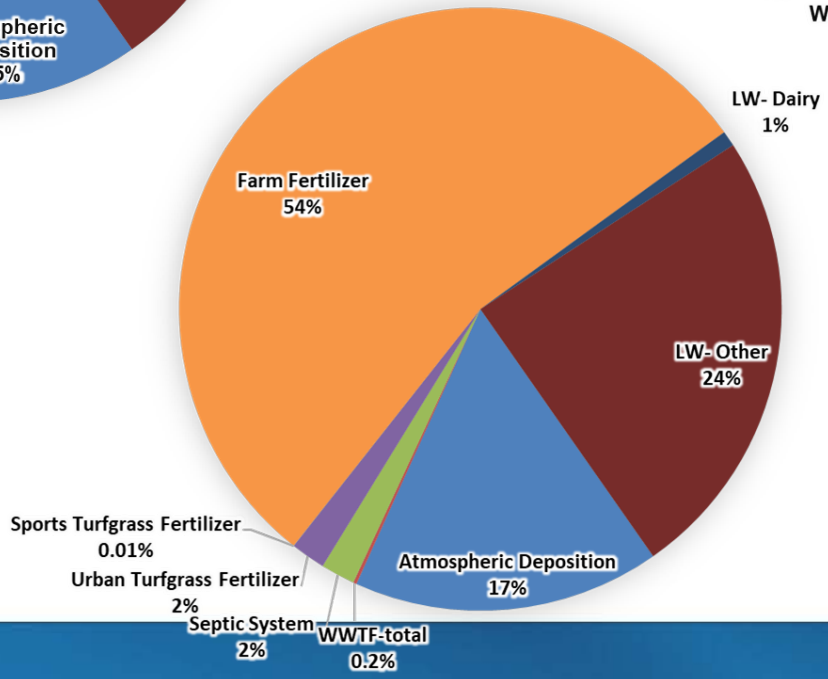
Hornsby



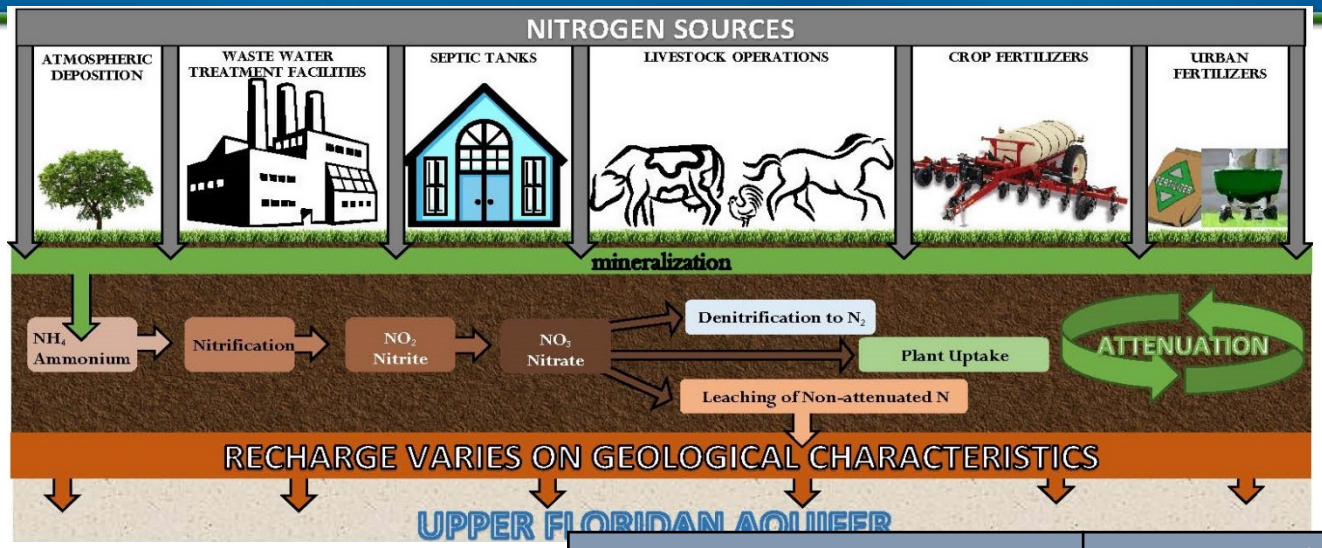
Ichetucknee



Devil's Complex



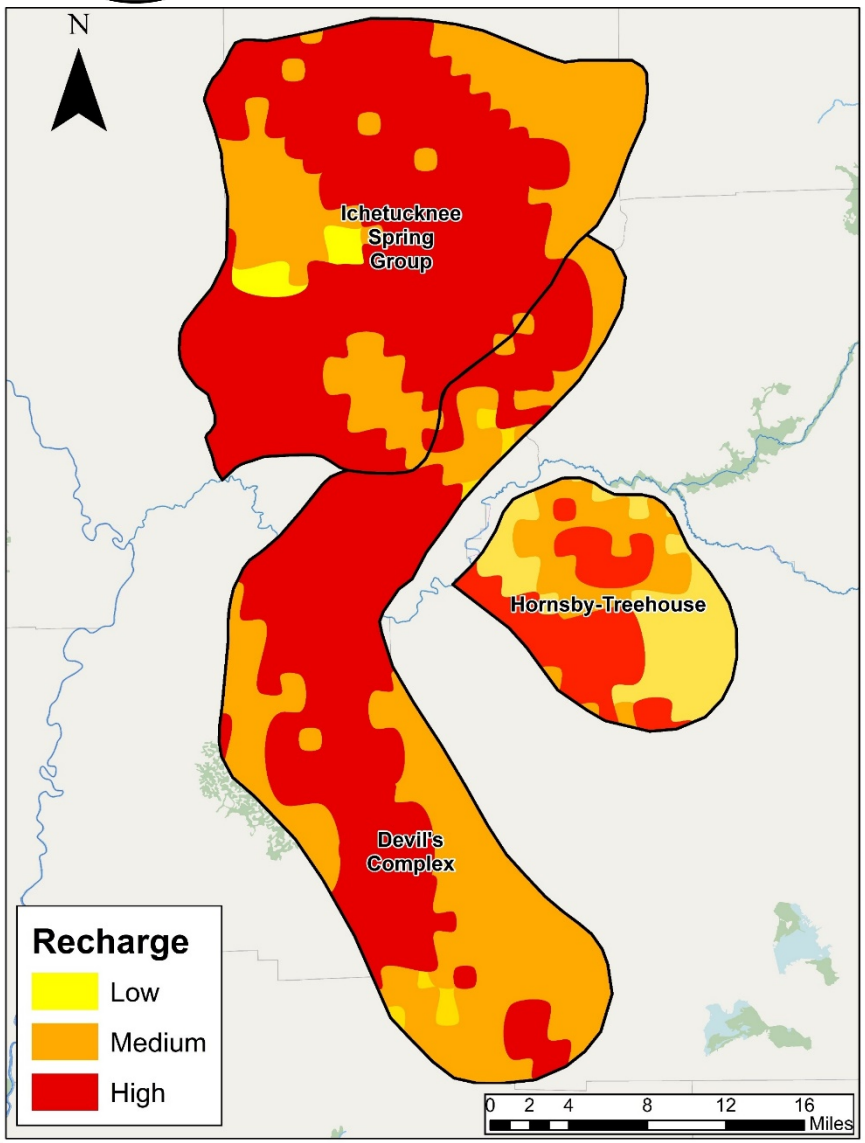
Biochemical Attenuation Factors



- Represent the percentage of N removed and therefore not available for leaching to groundwater
- Based on factors used in similar past studies and found in relevant literature

Loading Category	N Attenuation Factor	N Leaching
Atmospheric Deposition	90%	10%
Septic Systems	50%	50%
WWTF-RIB	25%	75%
WWTF-Sprayfield	60%	40%
WWTF-Reuse	75%	25%
WWTF- Wetland	85%	15%
Urban Turfgrass Fertilizers	70%	30%
Sports Turfgrass Fertilizers	70%	30%
Farm Fertilizers	80%	20%
Livestock- Dairy	85%	15%
Livestock- Other	90%	10%

Hydrogeological Attenuation Factors Based on Recharge to UFA



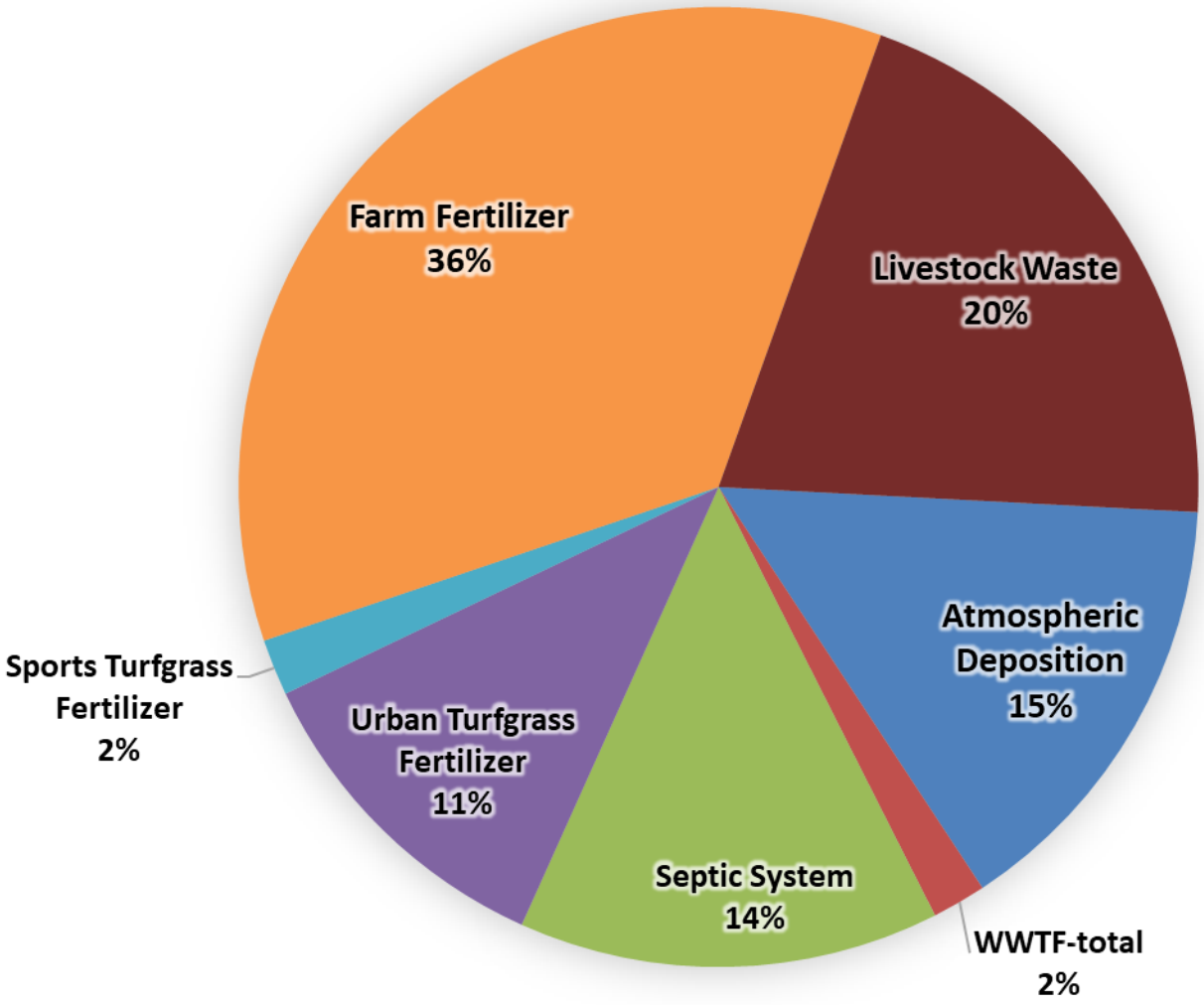
- Recharge factors are used to estimate the percentage of the non-attenuated nitrogen expected to reach the aquifer in a year

10%

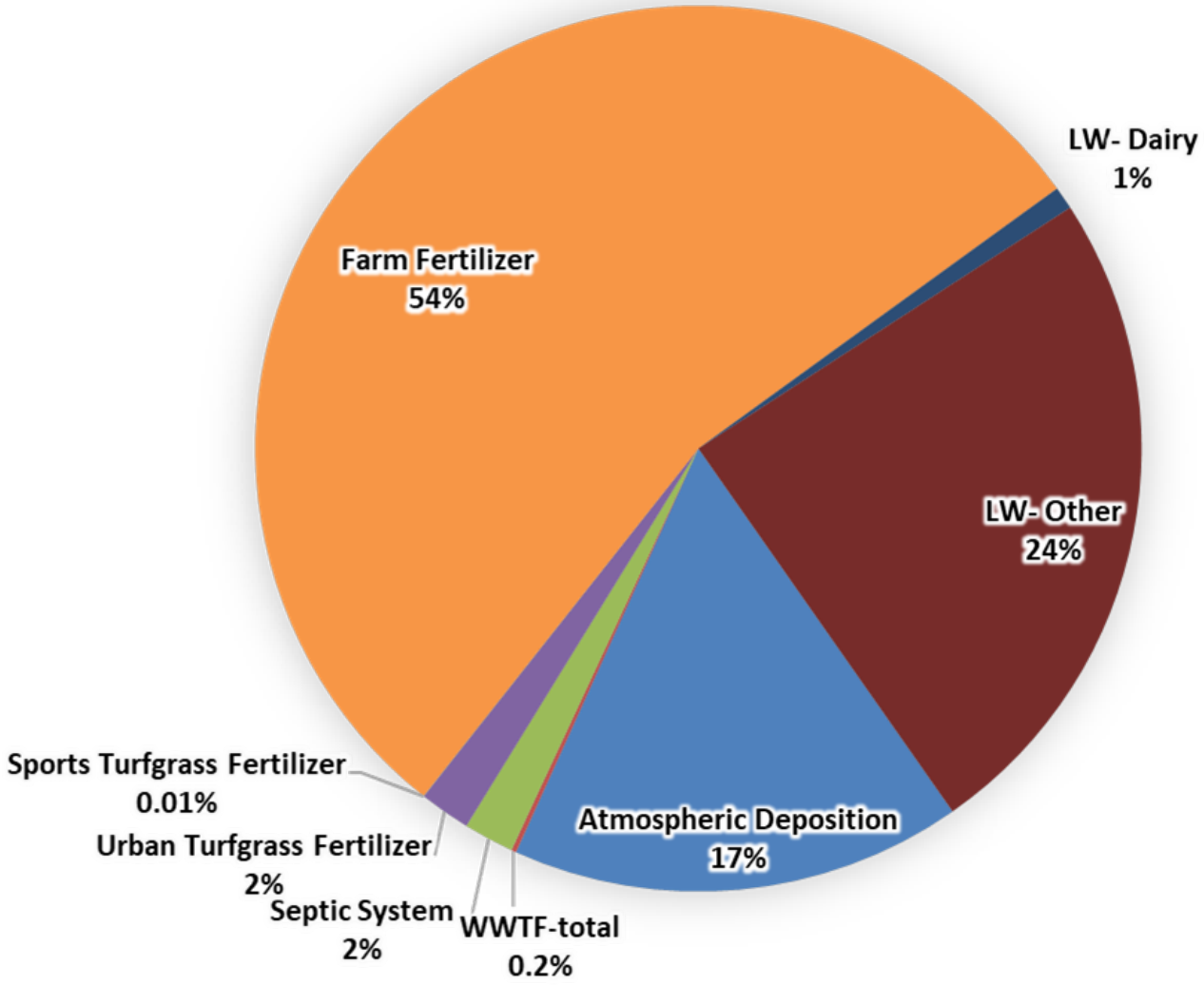
50%

90%

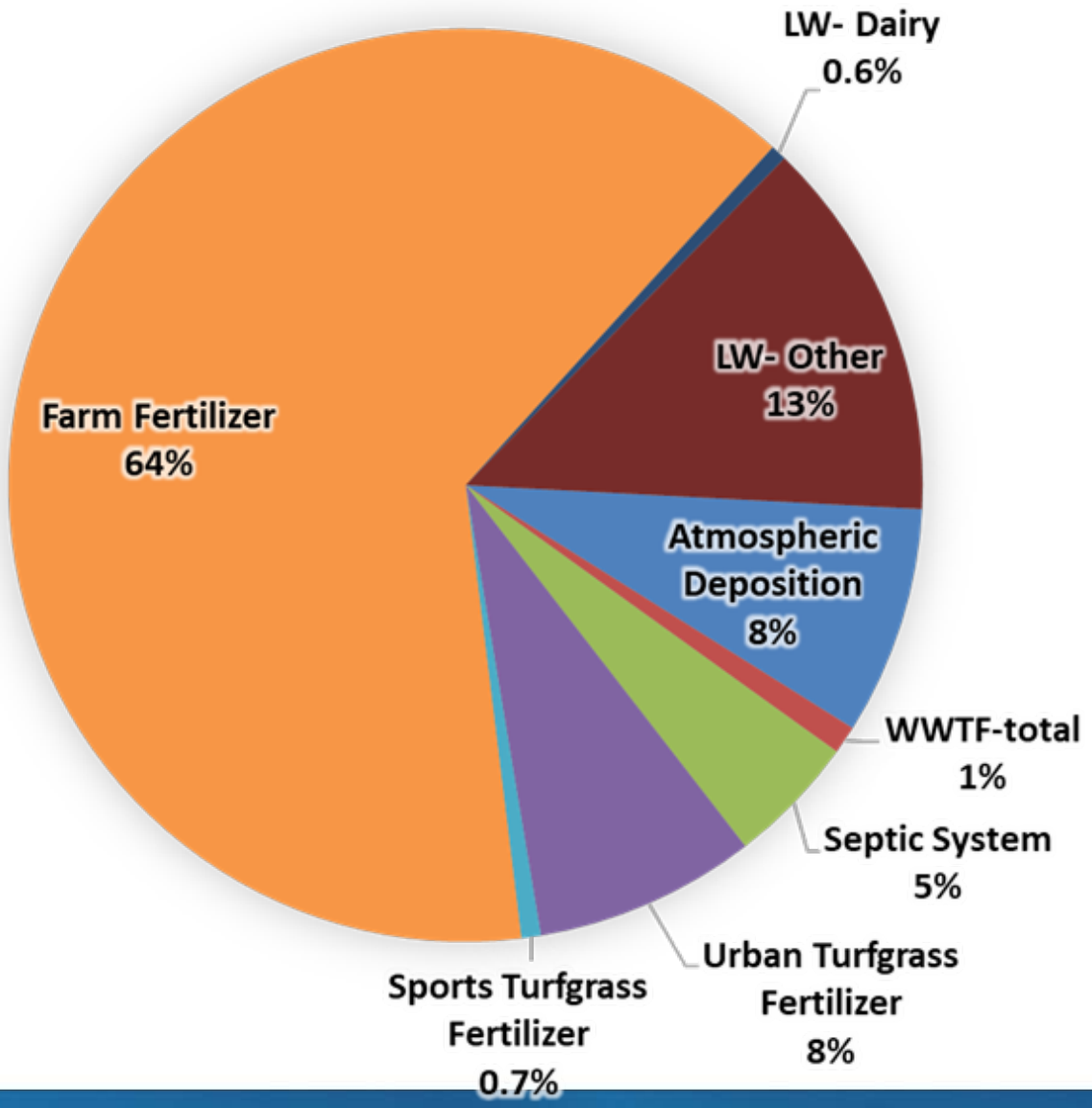
Ichetucknee- Nitrogen Load to Groundwater



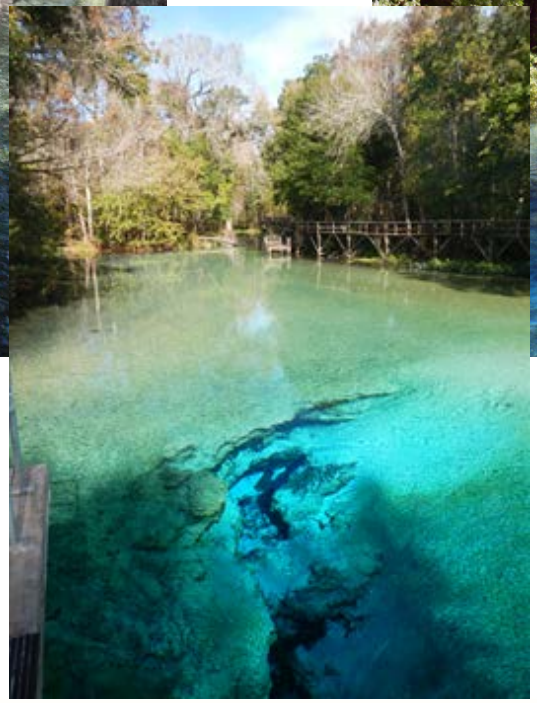
Devil's Complex- Nitrogen Load to Groundwater



Hornsby-Treehouse- Nitrogen Load to Groundwater



Questions



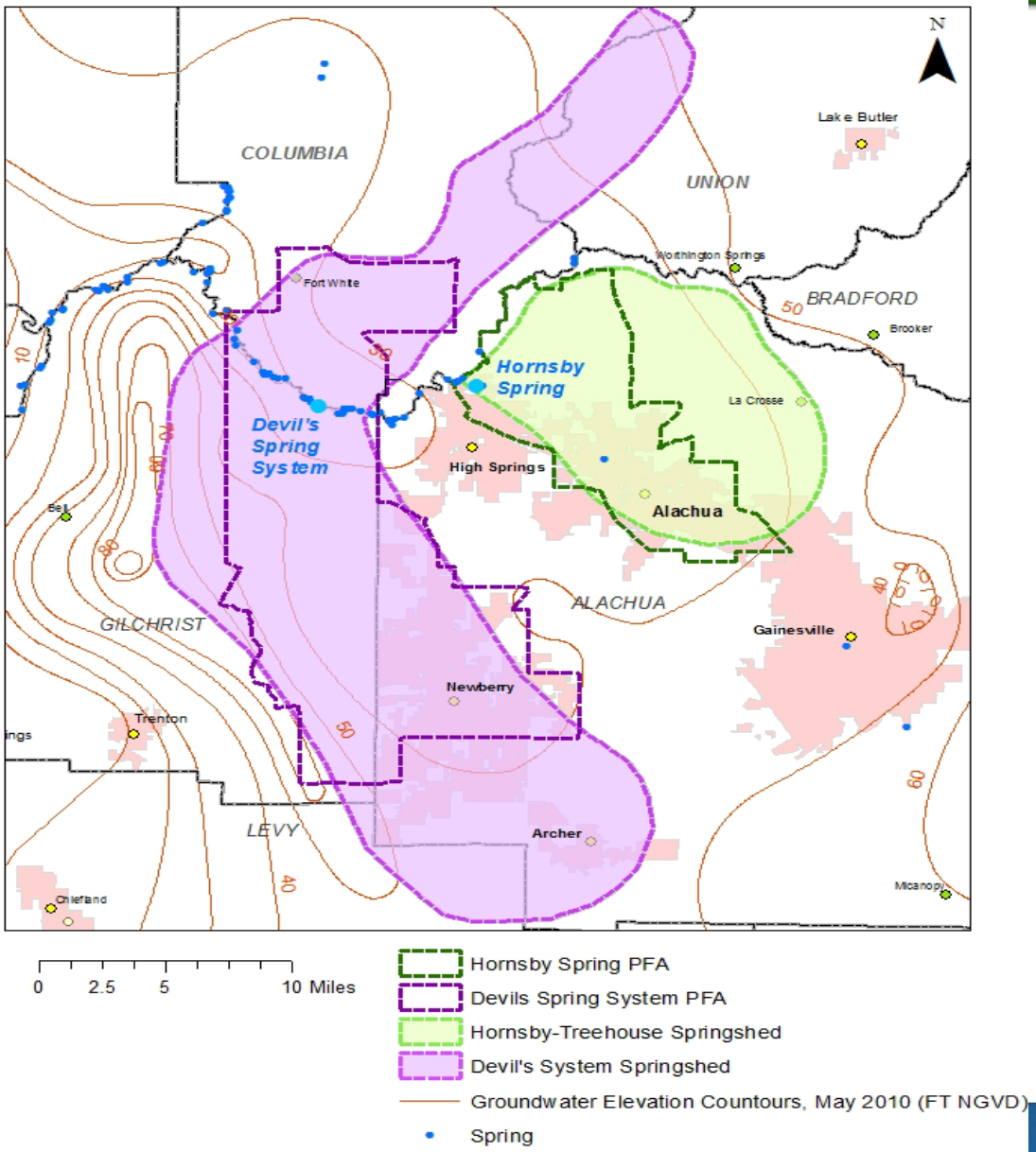
PFA Delineation

- Sub-Section 373.802, F.S.:
  - Definition: Area or areas of a basin where the Floridan Aquifer is generally most vulnerable to pollutant inputs where there is a known connectivity between groundwater pathways and an OFS
- Sub-Section 373.803, F.S.:
  - Delineation considers factors that may lead to degradation of an OFS, such as:
    - Groundwater travel time to the spring
    - Hydrogeology
    - Nutrient load, etc.

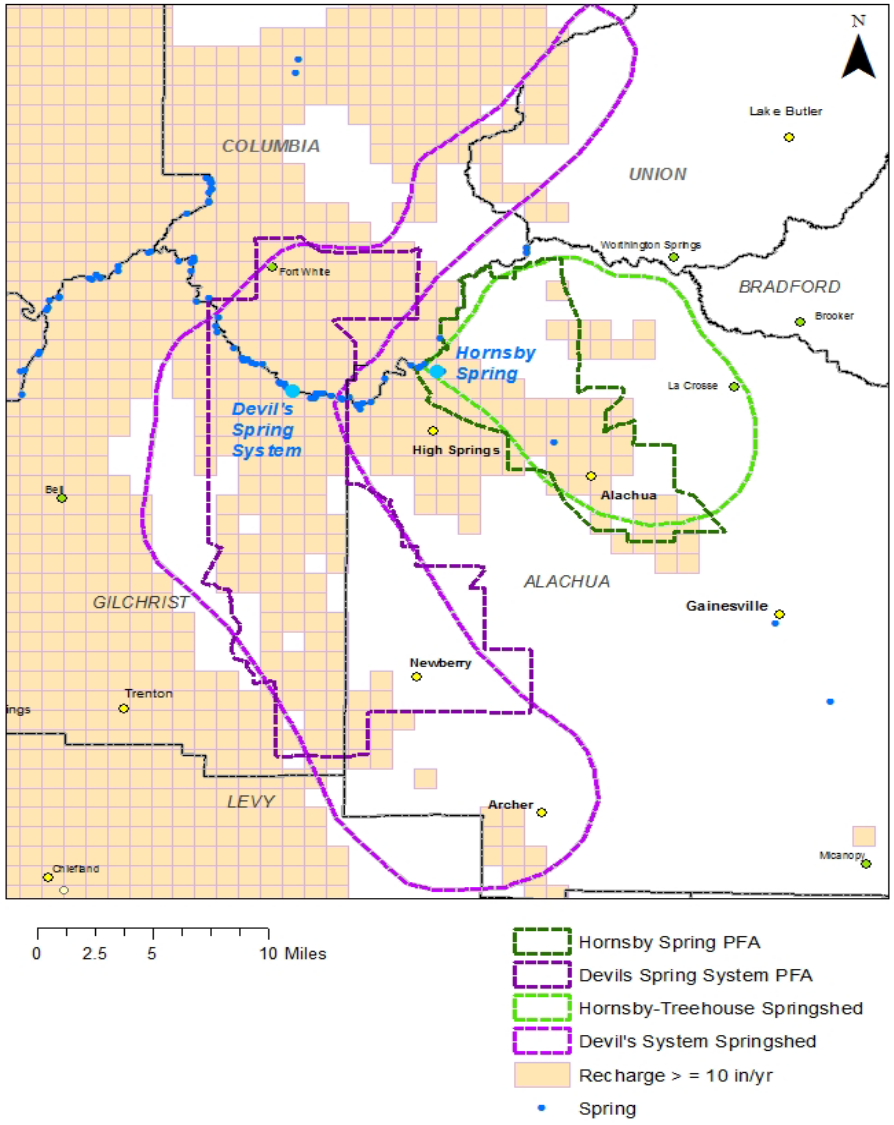
PFA Requirements

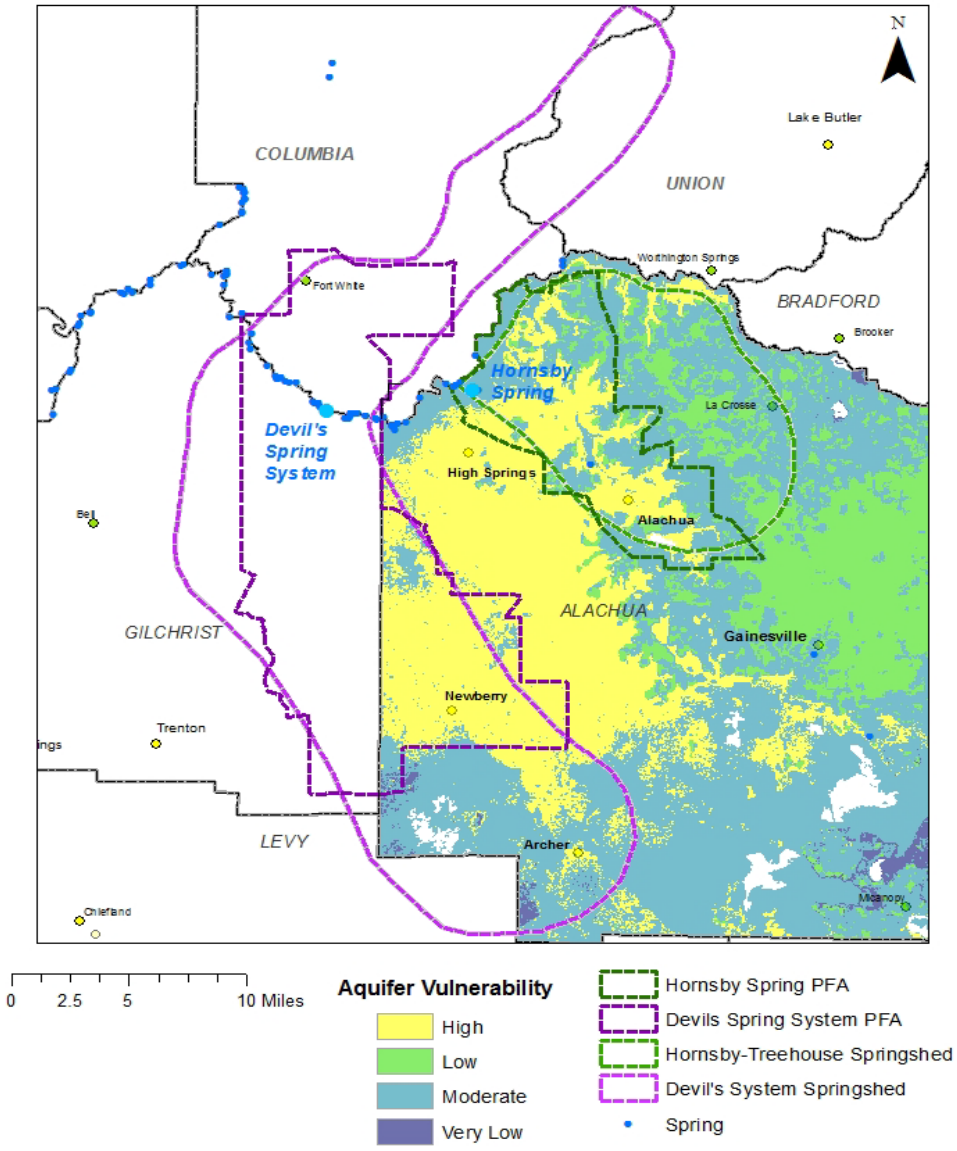
- Prohibitions
  - Wastewater treatment facilities greater than 100,000 gallons per day (GPD), UNLESS advanced wastewater treatment (AWT) is used.
  - New OSTDS on less than one-acre lots.
  - Ban on land application of biosolids.
  - Hazardous waste facilities.
- Additional Requirements for Biosolids and Septage Application Practices
  - Requirements for newly permitted sites or at renewal
  - Verified BMPs for agricultural operations
  - Effective nutrient management practices
  - Groundwater monitoring requirements

PFA – Boundaries

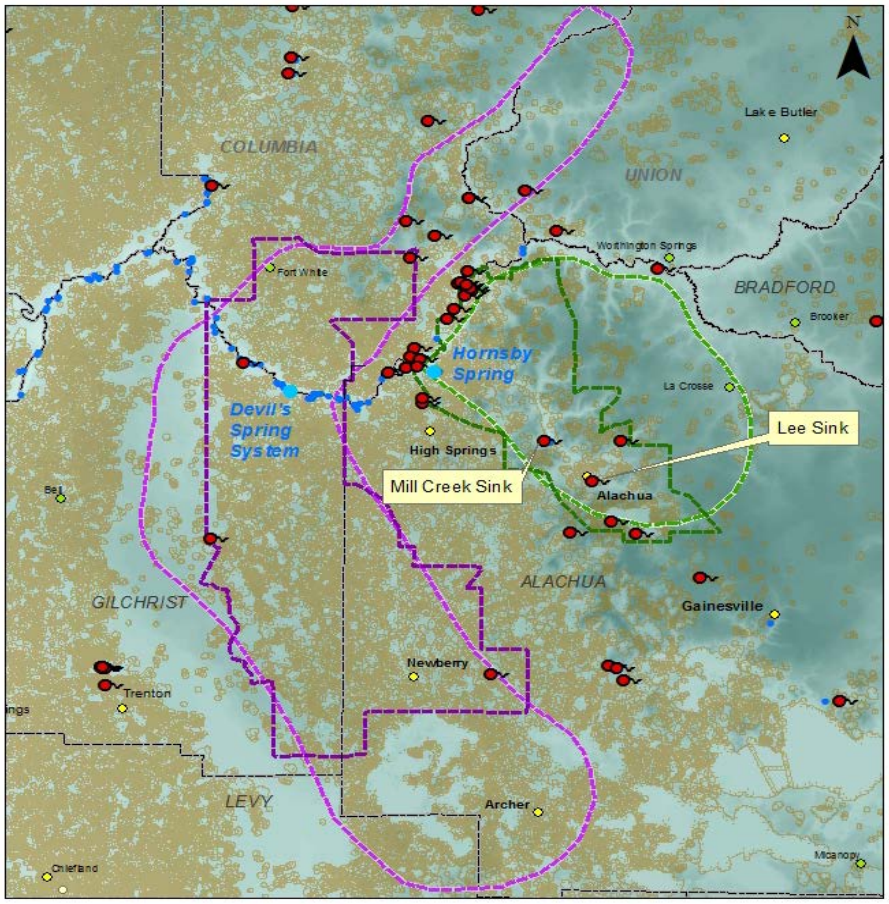


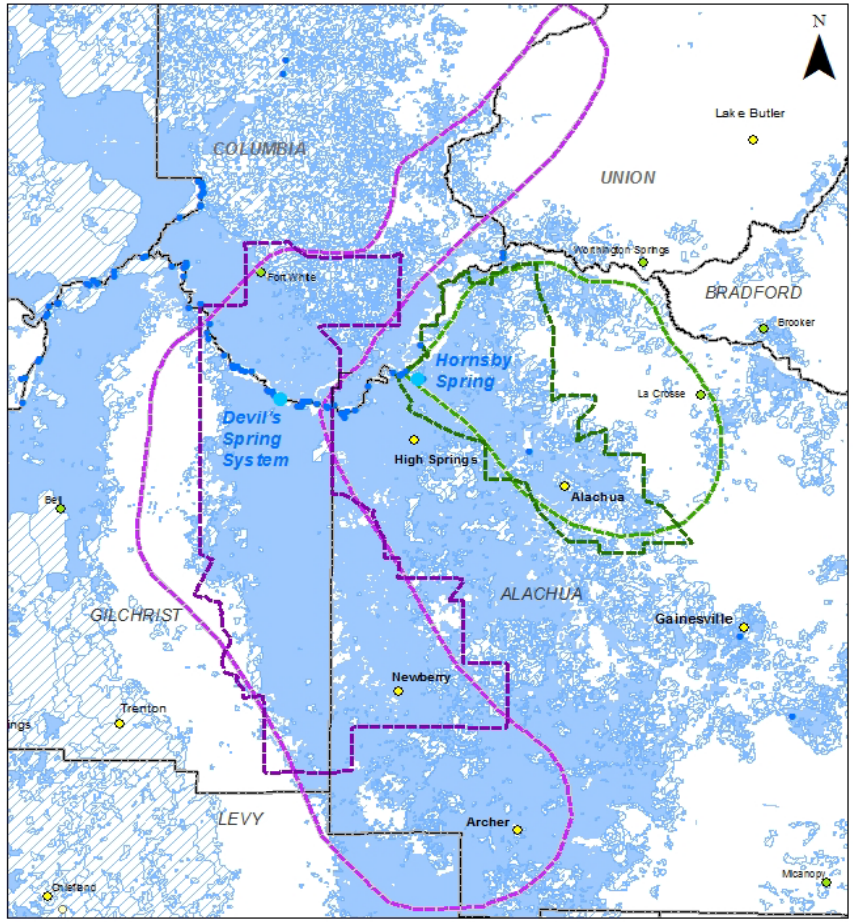
PFA – Recharge and Vulnerability





PFA – Elevation & Leaching





0 2.5 5 10 Miles

Digital Elevation Model

Topo Elevation (ft NGVD)

High : 170

Low : 0

FGS Swallets

Hornsby Spring PFA

Devils Spring System PFA

Hornsby-Treehouse Springshed

Devil's System Springshed

Closed Depressions

Spring

0 2.5 5 10 Miles

Soils with High Leaching Potential

Soils with Moderate Leaching Potential

Hornsby Spring PFA

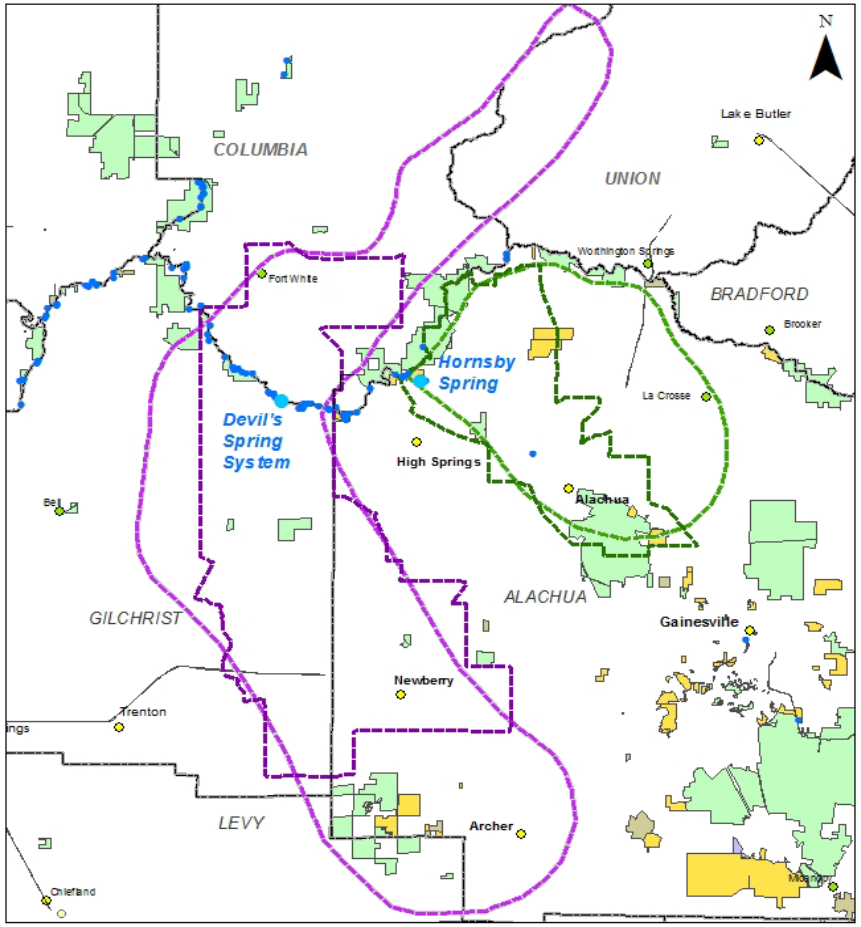
Devils Spring System PFA

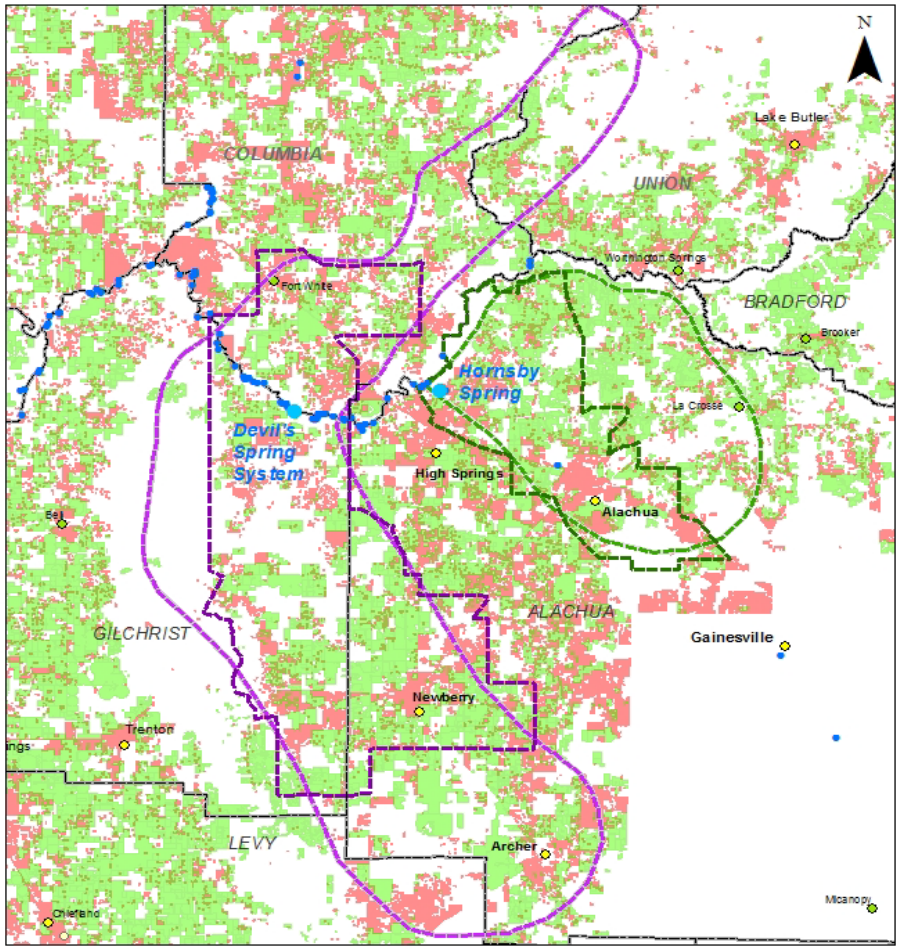
Hornsby-Treehouse Springshed

Devil's System Springshed

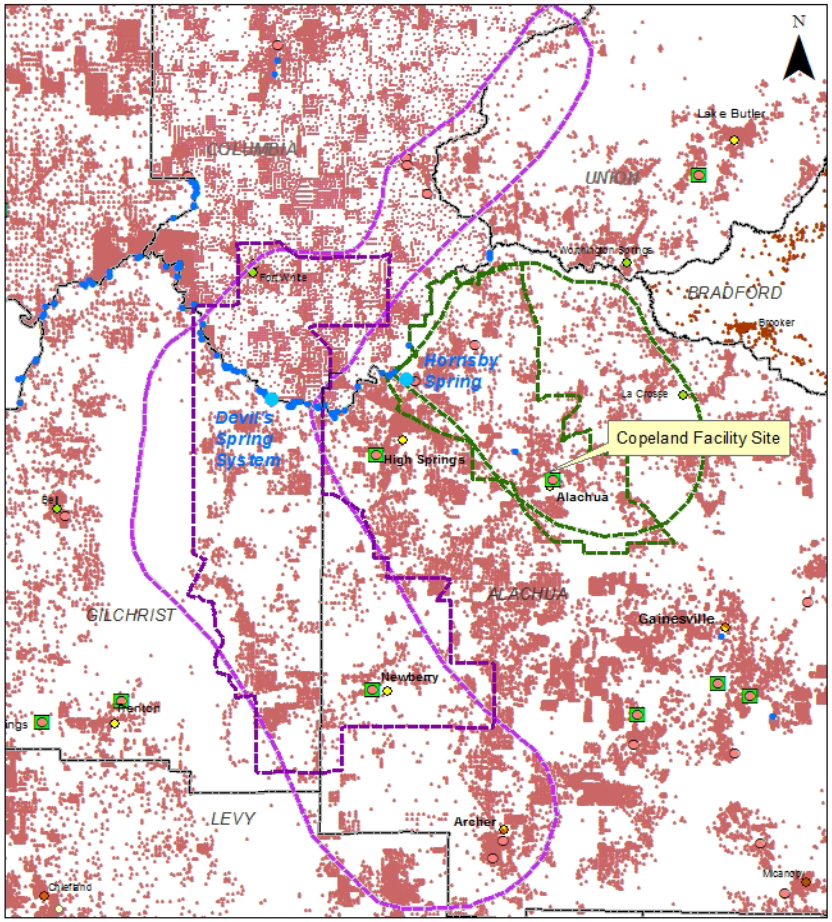
Spring

PFA – Conservation Lands & Land Use

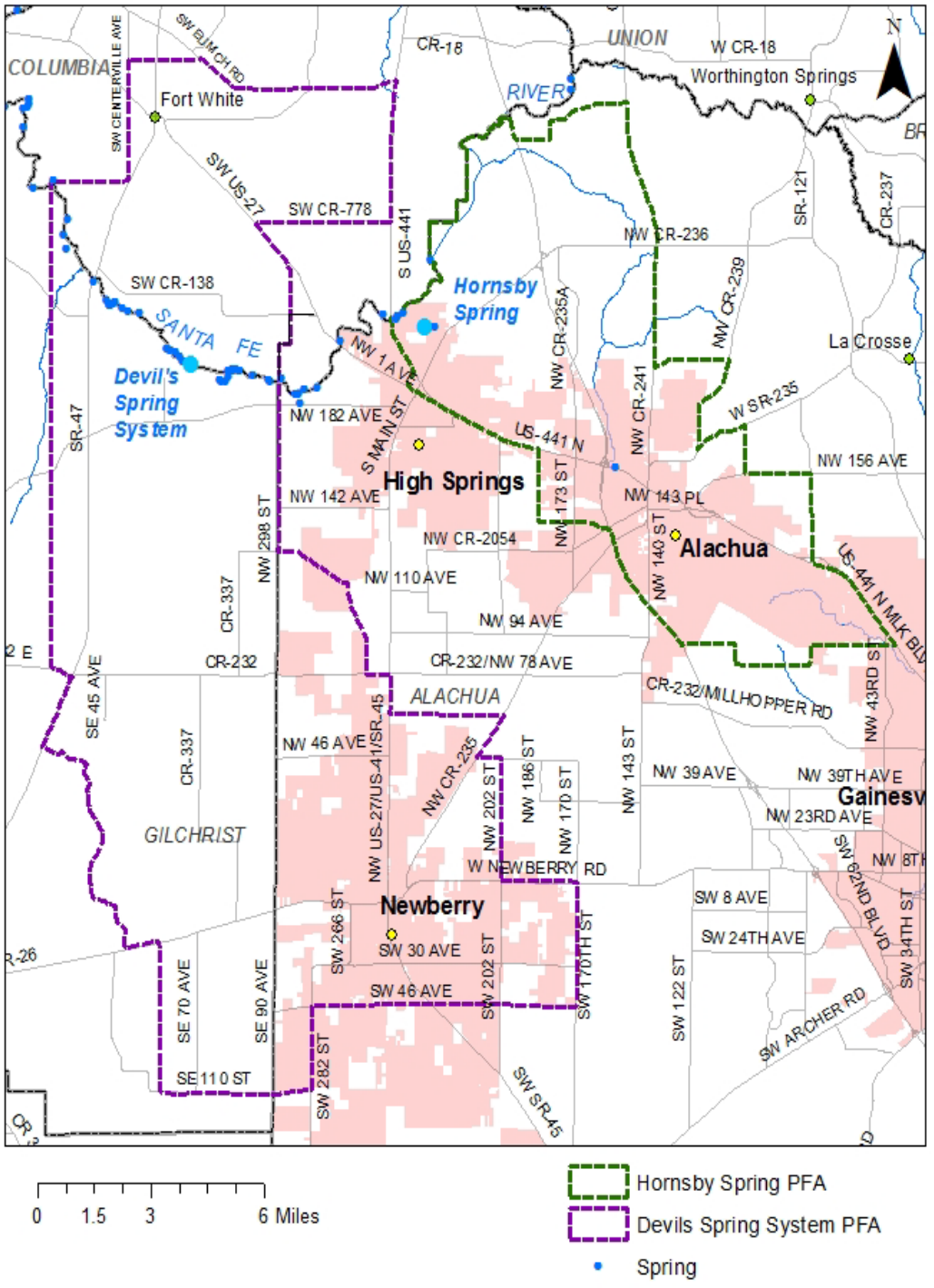




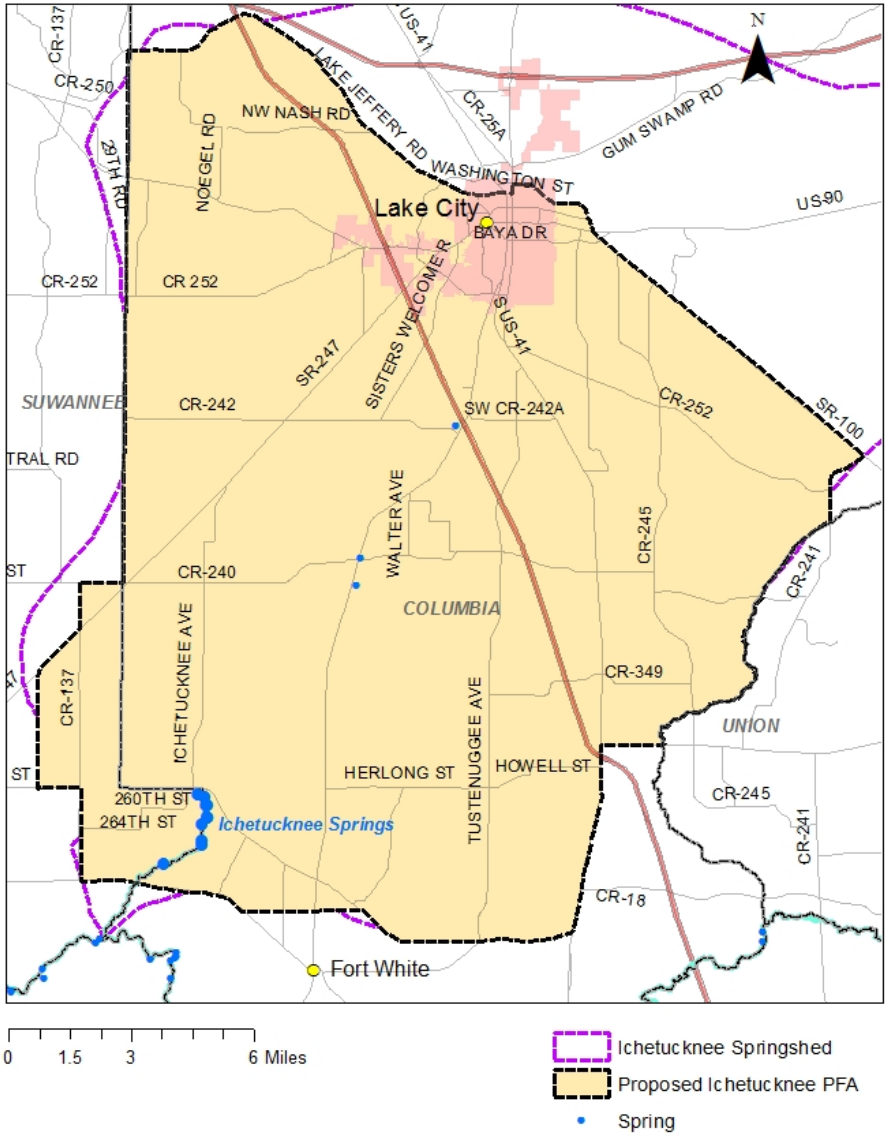
PFA – OSTDS & WWTP



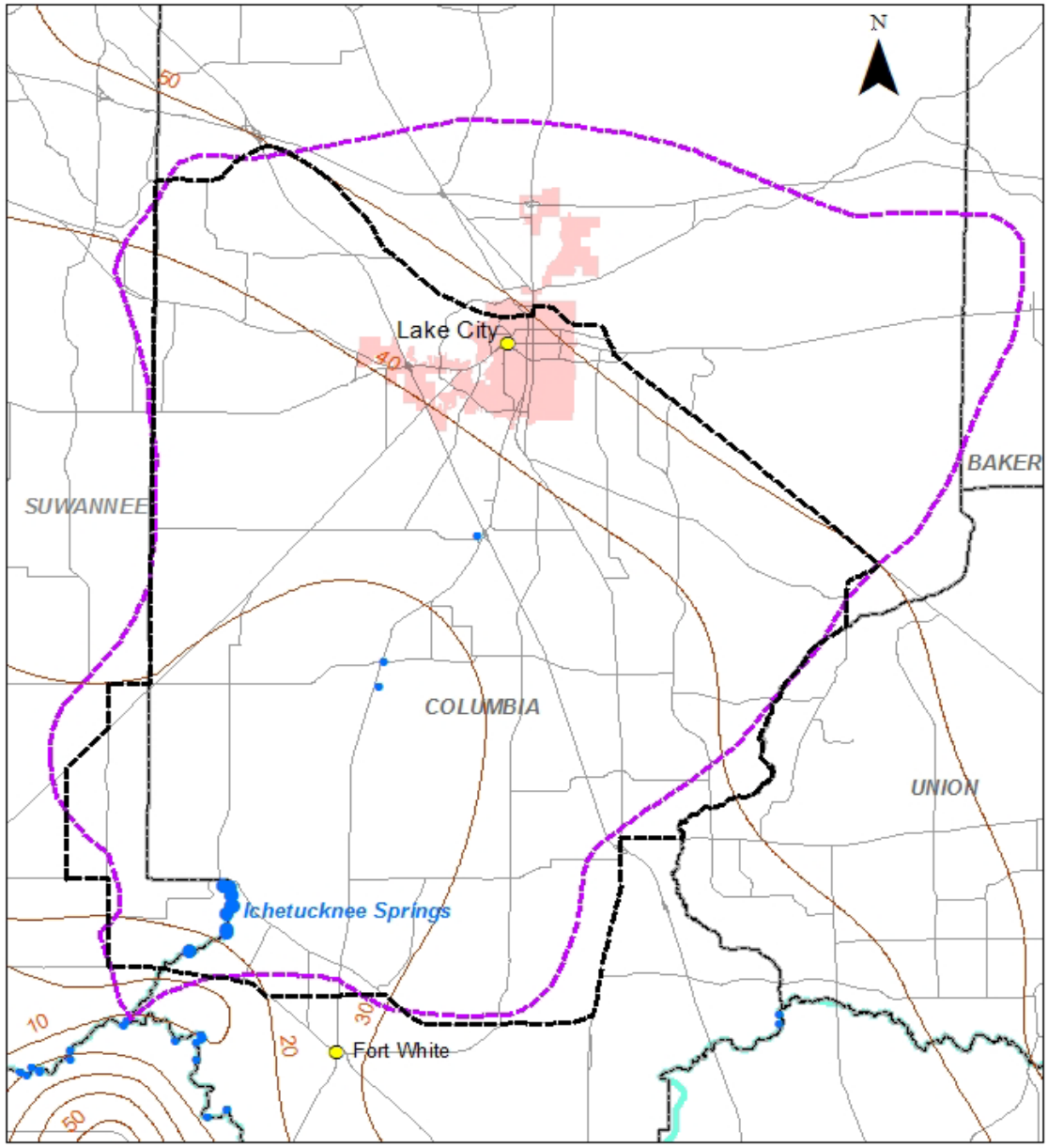
PFA – Boundaries



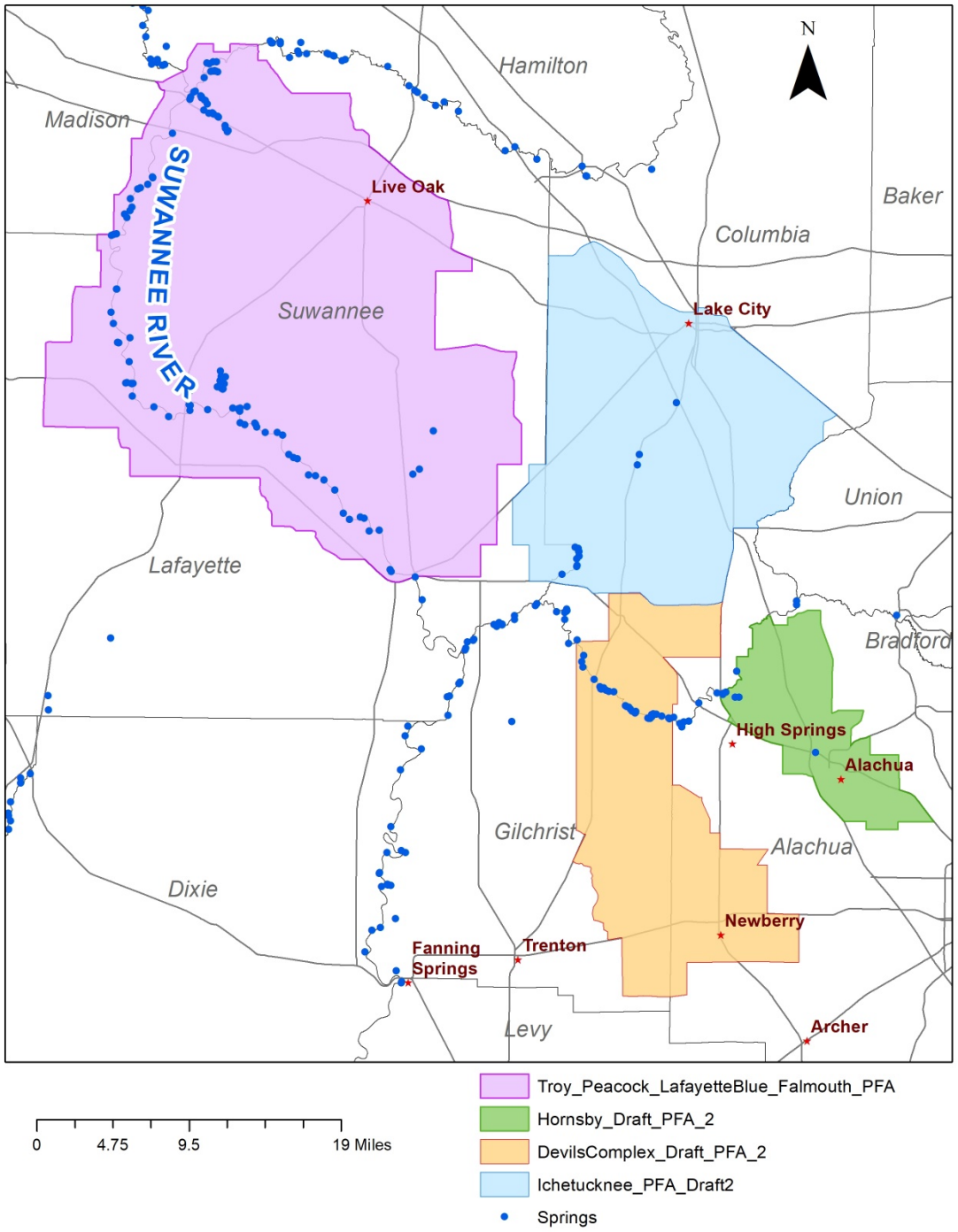
Ichetucknee PFA



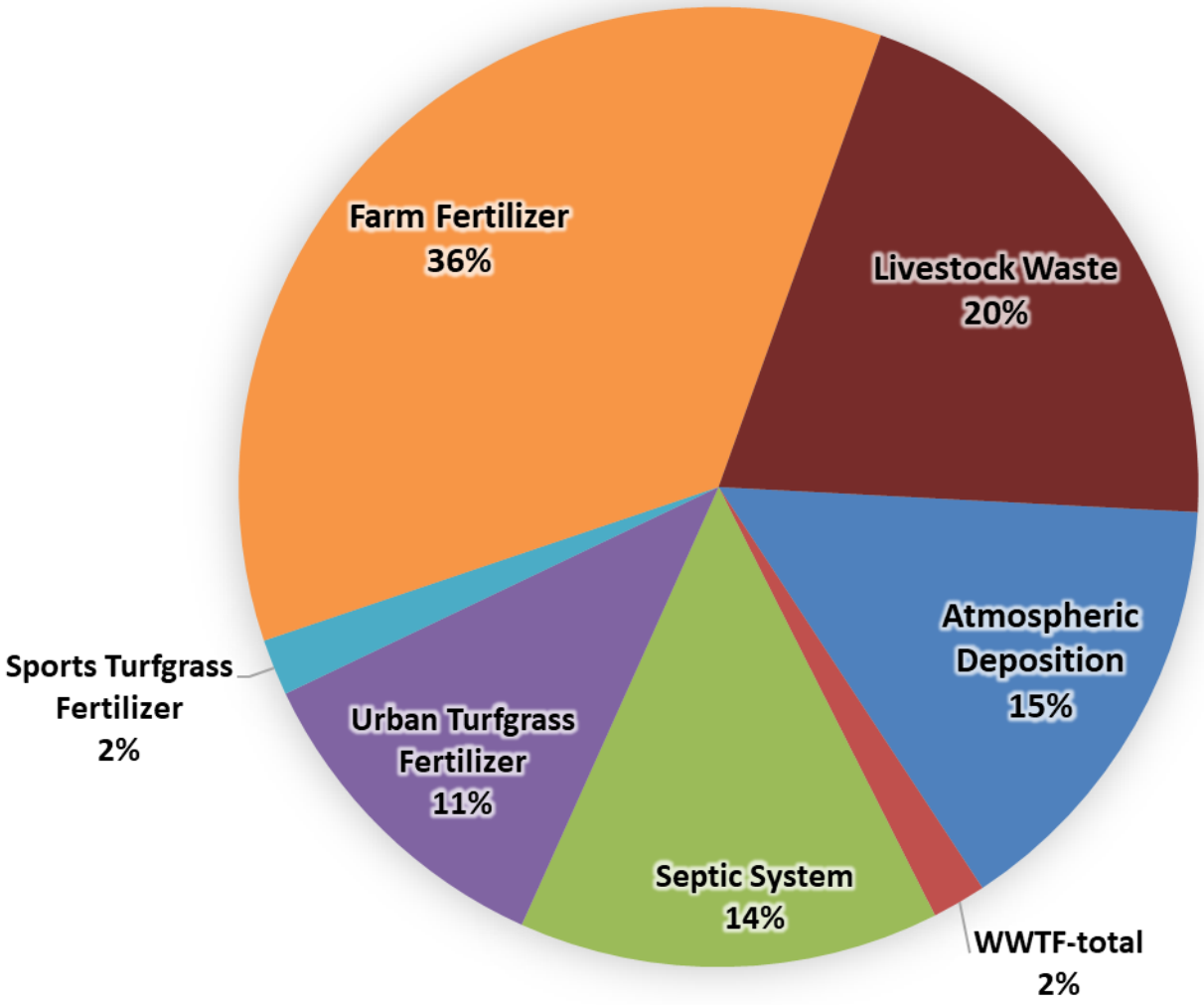
Ichetucknee PFA



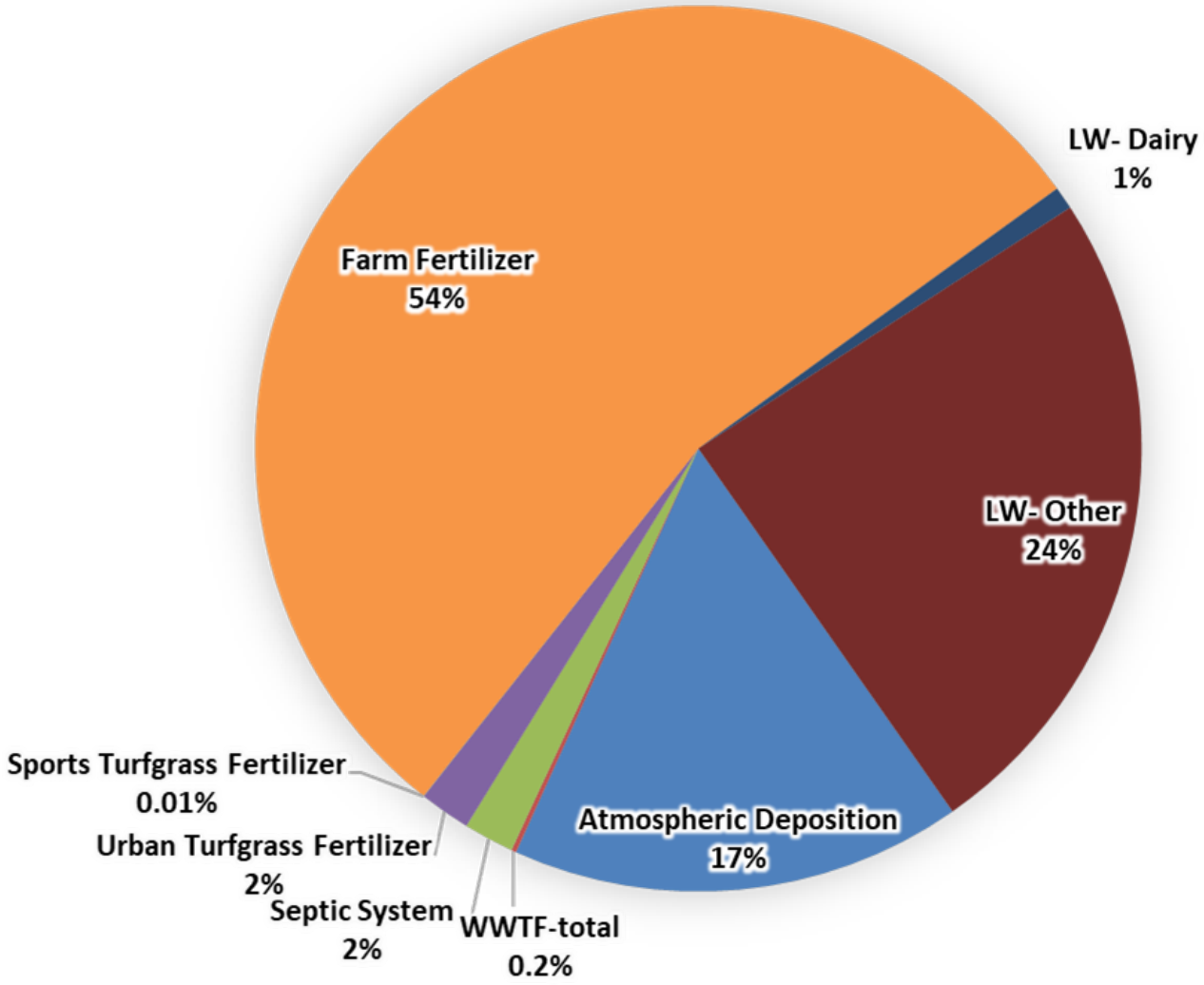
PFAs


N
Hamilton
Madison
Live Oak
SUWANNEE RIVER
Suwannee
Baker
Columbia
Lake City
Union
Lafayette
Bradford
High Springs
Alachua
Gilchrist
Alachua
Dixie
Newberry
Fanning Springs
Trenton
Levy
Archer
0
4.75
9.5
19 Miles
Troy_Peacock_LafayetteBlue_Falmouth_PFA
Hornsby_Draft_PFA_2
DevilsComplex_Draft_PFA_2
Ichetucknee_PFA_Draft2
Springs

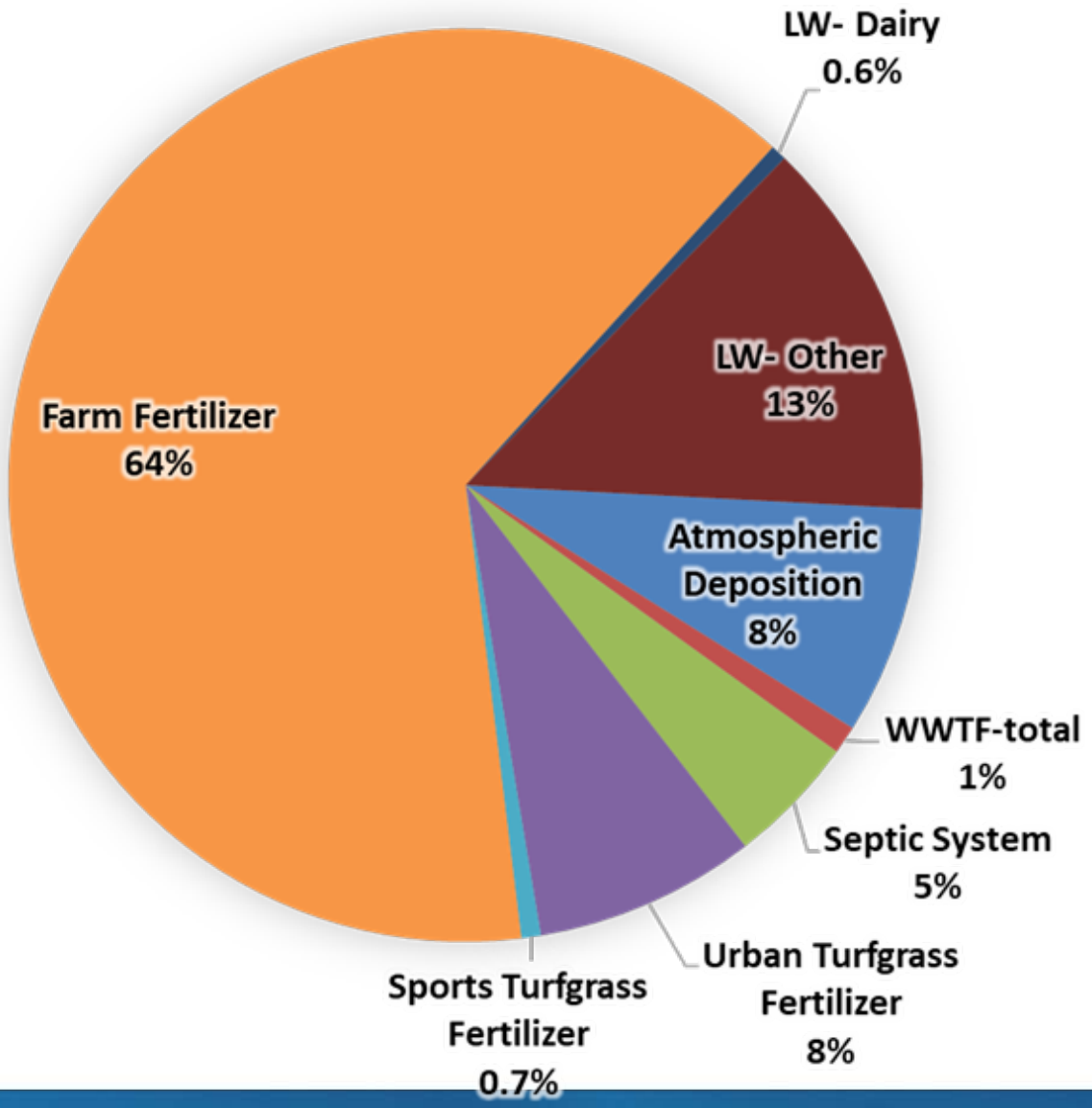
Ichetucknee- Nitrogen Load to Groundwater



Devil's Complex- Nitrogen Load to Groundwater



Hornsby-Treehouse- Nitrogen Load to Groundwater



Project Credit Analysis

Nitrogen Source	Credits to Load to Groundwater (lb-N/yr)	Description
Onsite Sewage Treatment and Disposal Systems (OSTDS)	TBD	Credits identified for stakeholder OSTDS projects (onsite enhancement or sewer)
Urban Turfgrass Fertilizer (UTF)	2,500	DEP approved credits (up to 6 %) for public education activities as well as credits identified for stakeholder stormwater projects
Atmospheric Deposition (AD)	-	No reduction
Farm Fertilizer Reductions	232,300	15 % BMP credit on FF load to groundwater, assuming 100 % owner-implemented BMPs on all fertilized lands
Sports Turfgrass Fertilizer (STF)	140	6 % BMP credit for sports fields and 10 % BMP credit for golf courses (where applicable) on STF load to groundwater, assuming 100 % BMP implementation on golf courses and sports fields
Permitted Dairy	1,080	15 % BMP credit on permitted dairy load to groundwater, assuming 100% owner-implemented BMPs at permitted dairies.
Livestock Waste	3,700	10 % BMP credit on load to groundwater, assuming 100 % owner-implemented BMPs at all livestock facilities
Wastewater Treatment Facilities (WWTF)	14,250	Achieved by BMAP WWTF policy if BMAP-wide (achieving 3 or 6 mg/L total nitrogen concentration at discharge)
Total Credits	**254,000**	

Total Santa Fe River BMAP Nitrogen Reductions

Total Reduction Required to Meet the TMDLs			
	Total Load at Spring Vents (lb-N/yr)	**TMDL Load (lb-N/yr)**	**Required Reduction to Meet TMDL (lb-N/yr)**
In Springsheds			
Ichetucknee	308,107	107,867	200,269
Devils Complex	1,899,233	664,731	1,234,501
Hornsby	435,385	152,385	152,385
		Subtotal	**1,717,771**
Outside Springsheds and in BMAP Area			
West			62,454
East			73,148
		Subtotal	**135,602**
		Total	**1,853,372**
		Project Credits	**254,000**
		Remaining Load	**1,600,000**

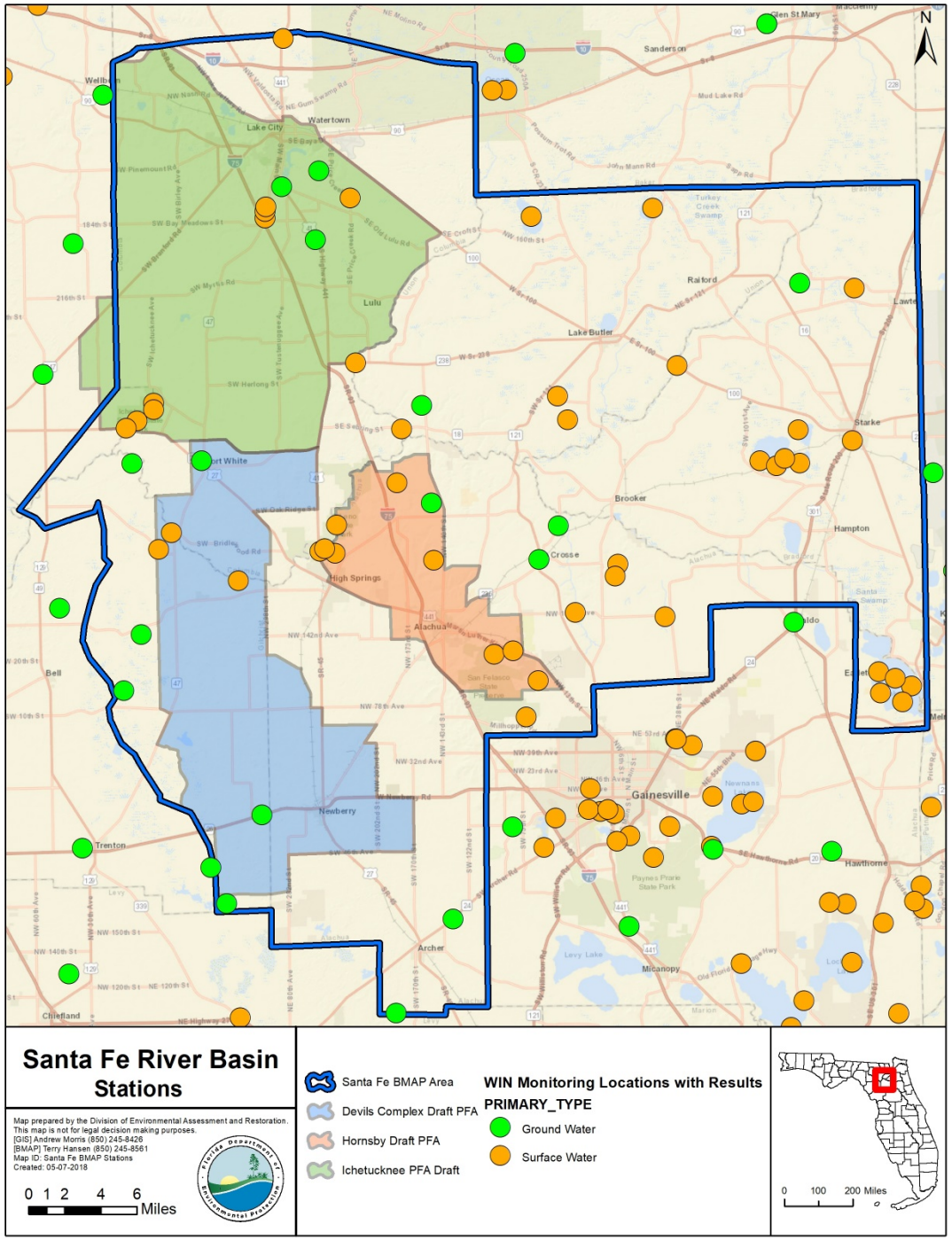
Additional Potential Reductions

Existing OSTDS in PFAs (lb-N/yr)				
	High Recharge Area		Med. Recharge Area	
	Tanks	**Credit**	**Tanks**	**Credit**
Parcels <1 ac	5,162	27,000 lbs.	718	2,100 lbs.
Parcels >1ac	13,353	71,000 lbs.	2,712	7,900 lbs.

Additional Potential Reductions

Additional Ag Practices Estimated Reduction Credit (lb-N/yr)		
Action	High Recharge Area (100%)	Med. Recharge Area (100%)
Precision Irrigation	25,530	13,072
Precision Fertilization	184,751	102,640
Soil Moisture Probes	278,046	154,470
Controlled Release Fert.	47,714	26,508
Peanut hay mix	2,695,140	1,497,300
Cover Crops	410,508	228,060
Banders	371,974	206,652

Monitoring


Santa Fe River Basin Stations
Map prepared by the Division of Environmental Assessment and Restoration.
This map is not for legal decision making purposes.
[GIS] Andrew Morris (850) 245-8426
[BMAP] Terry Hansen (850) 245-8561
Map ID: Santa Fe BMAP Stations
Created: 05-07-2018
0 1 2 4 6 Miles
Santa Fe BMAP Area
Devils Complex Draft PFA
Hornsby Draft PFA
Ichetucknee PFA Draft
WIN Monitoring Locations with Results
PRIMARY_TYPE
Ground Water
Surface Water
0 100 200 Miles
N
Lake City
Watertown
Lulu
Lake Butler
Raiford
Sanderson
Starke
Brooker
Hampton
Crosse
High Springs
Alachua
Gainesville
Newberry
Trenton
Archer
Micanopy
Hawthorne
Bell
Chiefland

Statewide TMDL, BMAP, Minimum Flows and Levels (MFLs) Annual Report

- 403.0675(1), F.S. – requires a report that will include status of MFLs, TMDLs, and BMAPs
- Replacement of individual BMAP annual progress reports
- Annual meetings will continue
- Calendar year reporting
- Report will contain project information: funding, proposed priority ranking for implementation
- Progress made towards restoration goals
- Information will be requested in late November, due by the end of January
- Info. needed will include: entity activities, compliance, project information, and milestones
- Report is due to the Governor and Florida Legislature July 1, 2018 and every year thereafter

Questions?