



Florida Department of Environmental Protection

Updates:

- **Wekiva-Area Septic Tank Study**
- **Nitrogen Source Inventory**

September 2, 2015

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Florida Department of Environmental Protection

Septic Tank Study





Pertinent research/studies- septic systems

- **Wakulla septic tank study (2008, 3 intensive study sites, lysimeters, ground water, SF6 ground water trace). Partners FSU, USGS**
- **Jacksonville backyard septic study (2007-2008, 7 intensive study sites, shallow ground water. Partner FIT**
- **Wakulla performance based septic study (2009, 30+ sites monitored, 7 intensive study sites, lysimeters, shallow ground water. Partner FSU**
- **Ichetucknee Springs experimental drainfield study (2014, ongoing) installed experimental nitrogen reducing drainfield, lysimeters, shallow ground water. Partners Park Service, DOH**
- **ArcNLET septic tank nitrogen loading modeling tool, developed by FSU (2009- ongoing)**
- **Indian River County South Relief Canal Septic Tank Loading Study, ongoing**



Pertinent research/studies- in Wekiva area

- **MACTEC 2010 nitrogen source inventory, residential lawn fertilizer study.** (1 year + ongoing monitoring, 25 residential properties and shallow ground water wells). Partners, SJRWMD, Orange County, UCF
- **Wekiva area residential well sampling\nitrogen source assessment.** (2009, 25 residential wells sampled near nurseries and other sources (2 week sampling effort)
- **Reclaimed water source sampling (2010, two mobilizations to collect samples from RIB monitoring sites, golf course irrigation systems, residential locations.**
- **Wekiva lawn fertilizer use survey, 2009. UCF**
- **Liner Source container nursery site assessment, 2010**
- **SF6 tracer work, ongoing**



Septic Tank Study Objectives

This study would help us better understand:

- Attenuation and leaching of nitrogen from existing septic systems into the soil and ground water
- Other sources of nitrogen in residential areas
- Conditions that may influence nitrogen attenuation local to this area
- **Findings can be used to help us all understand how to best prioritize efforts and money spent to reduce nitrogen loads to the system.**



History of the Study

- Discussion on data sufficiency for decision making
- Collaborative study plan development, FDEP and Coalition for Property Rights (winter 2014/2015)
- Outreach to volunteer homeowners to participate in study (Feb-March 2015)
- Hire septic tank contractor/recon 18 candidate sites (June 2015)
- Select 11 sites for instrumentation, install lysimeters (July-August 2015)
- SF6 ground water tracer study (ongoing)



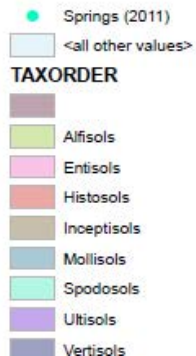
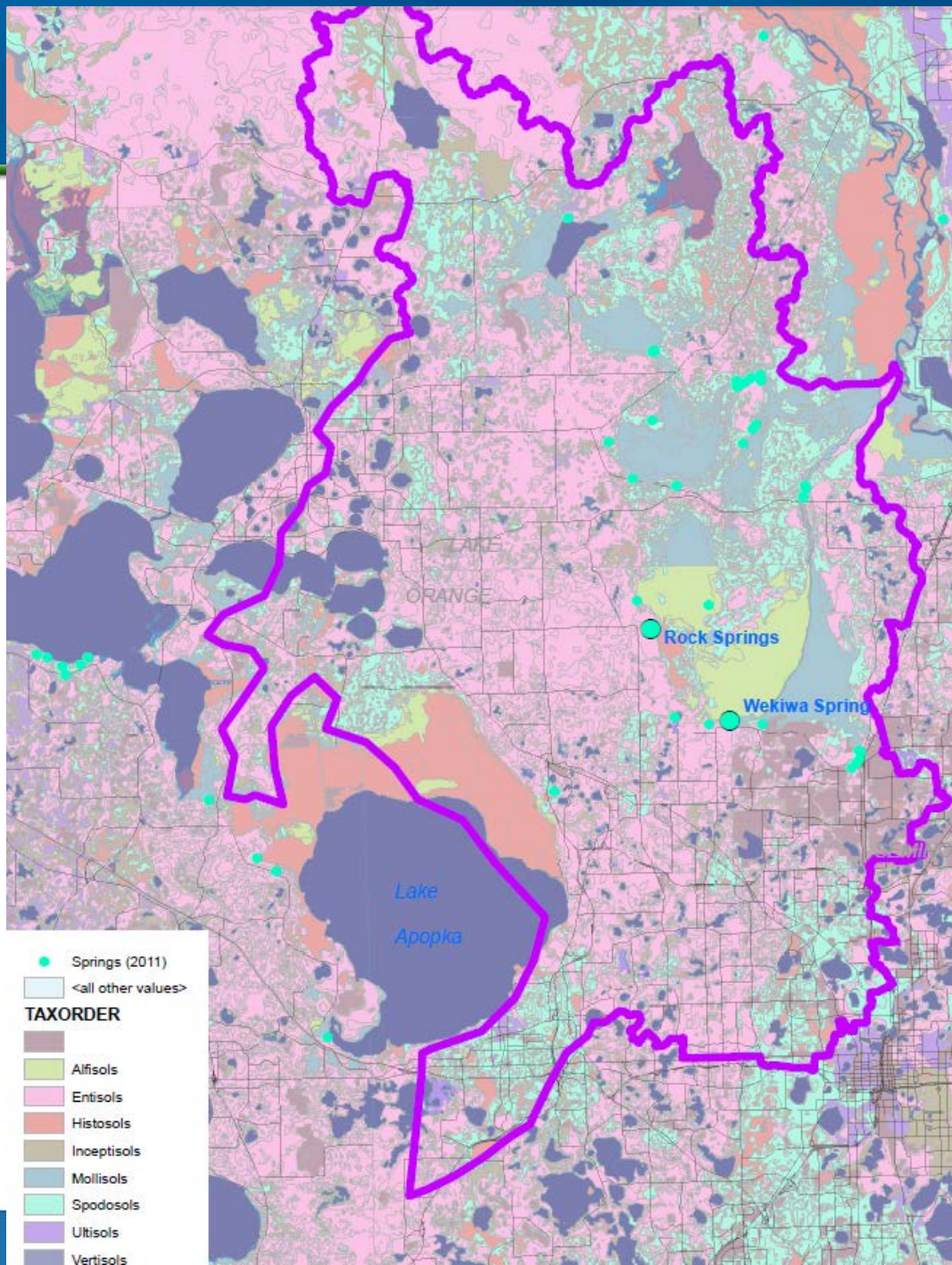
Potential factors that influence nitrogen loading

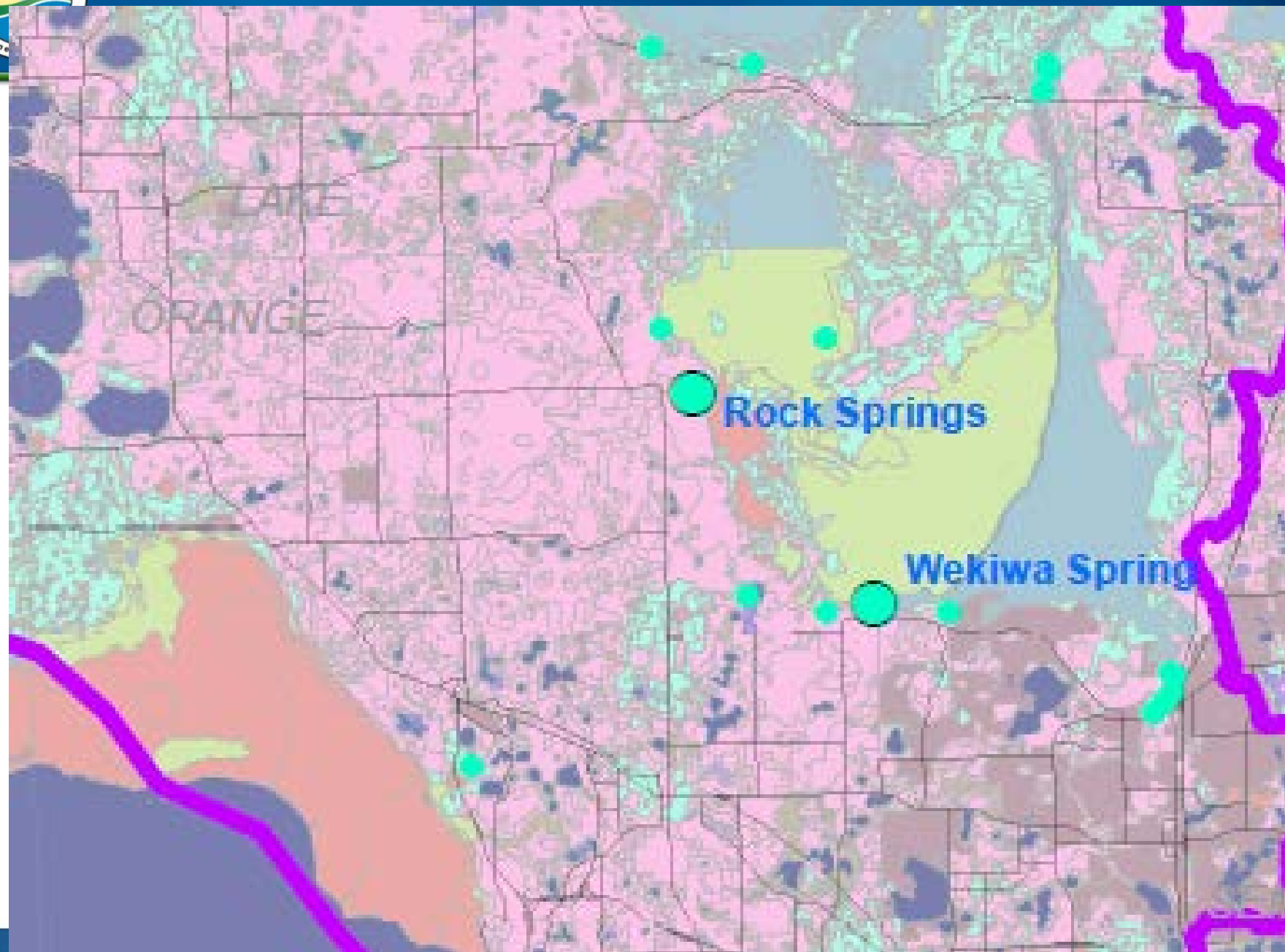
- Soil characteristics
- Geology, ground water recharge and flow pathways
- Septic system construction, age and usage
- Influence from other nitrogen sources



Soils

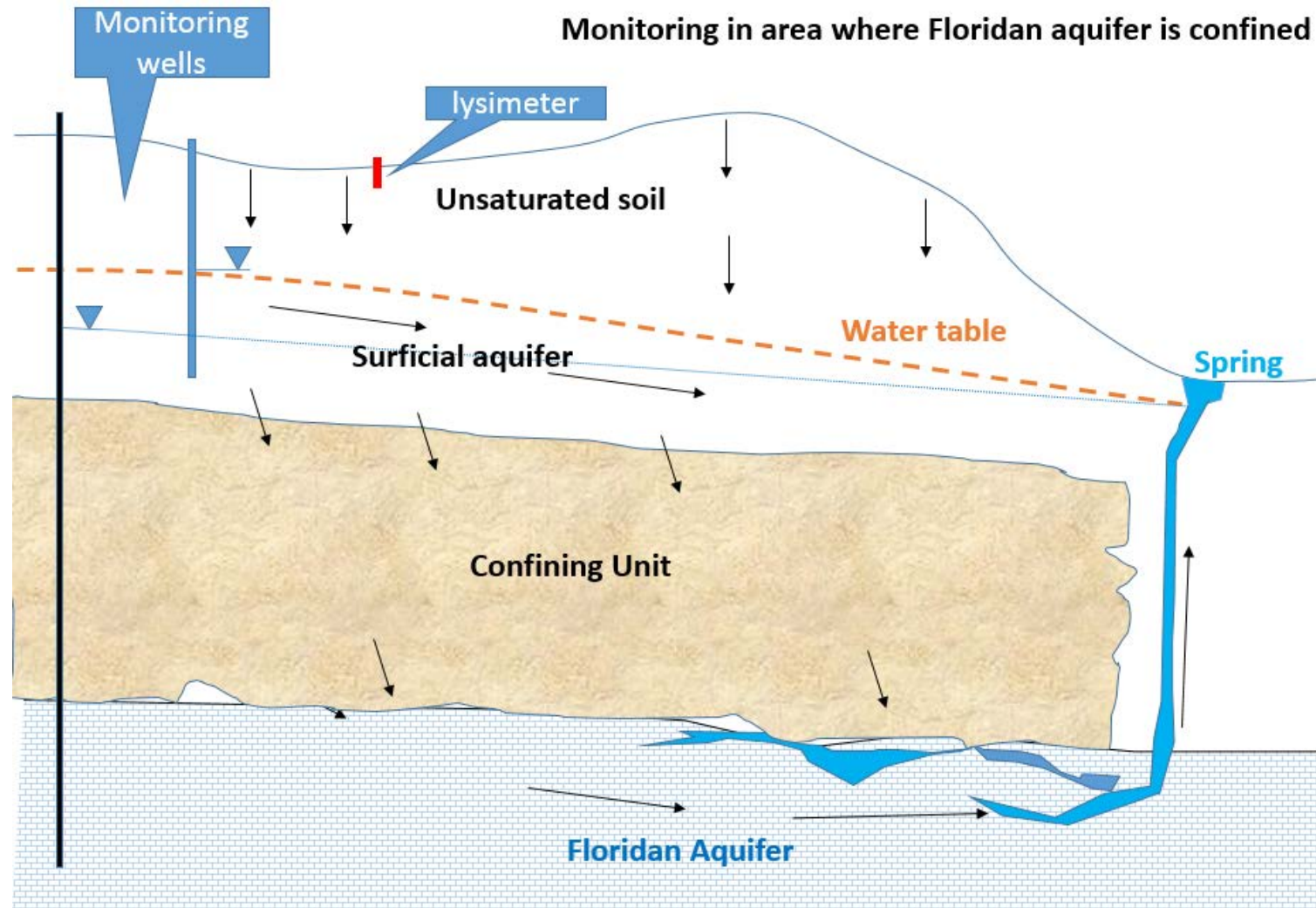
- Soil texture and organic content are major factors in conversion and utilization of nitrogen (from any source)
- Soil drainage affects nitrogen conversion, as well as treatment
- Sandy, low organic content, well drained = more nitrogen leaching
- Soils with more clay or organics and are more poorly drained = less nitrogen leaching
- Wekiva-area soil orders and drainage classes.





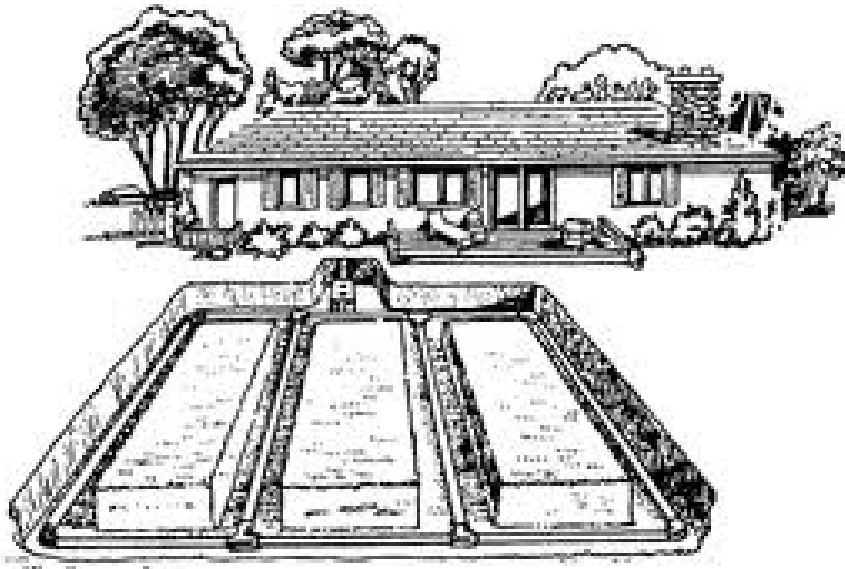


Geology and Ground Water





Septic System Design, Age and Use...and other influences



Selecting sites represent most typical septic tank construction, age, volume received

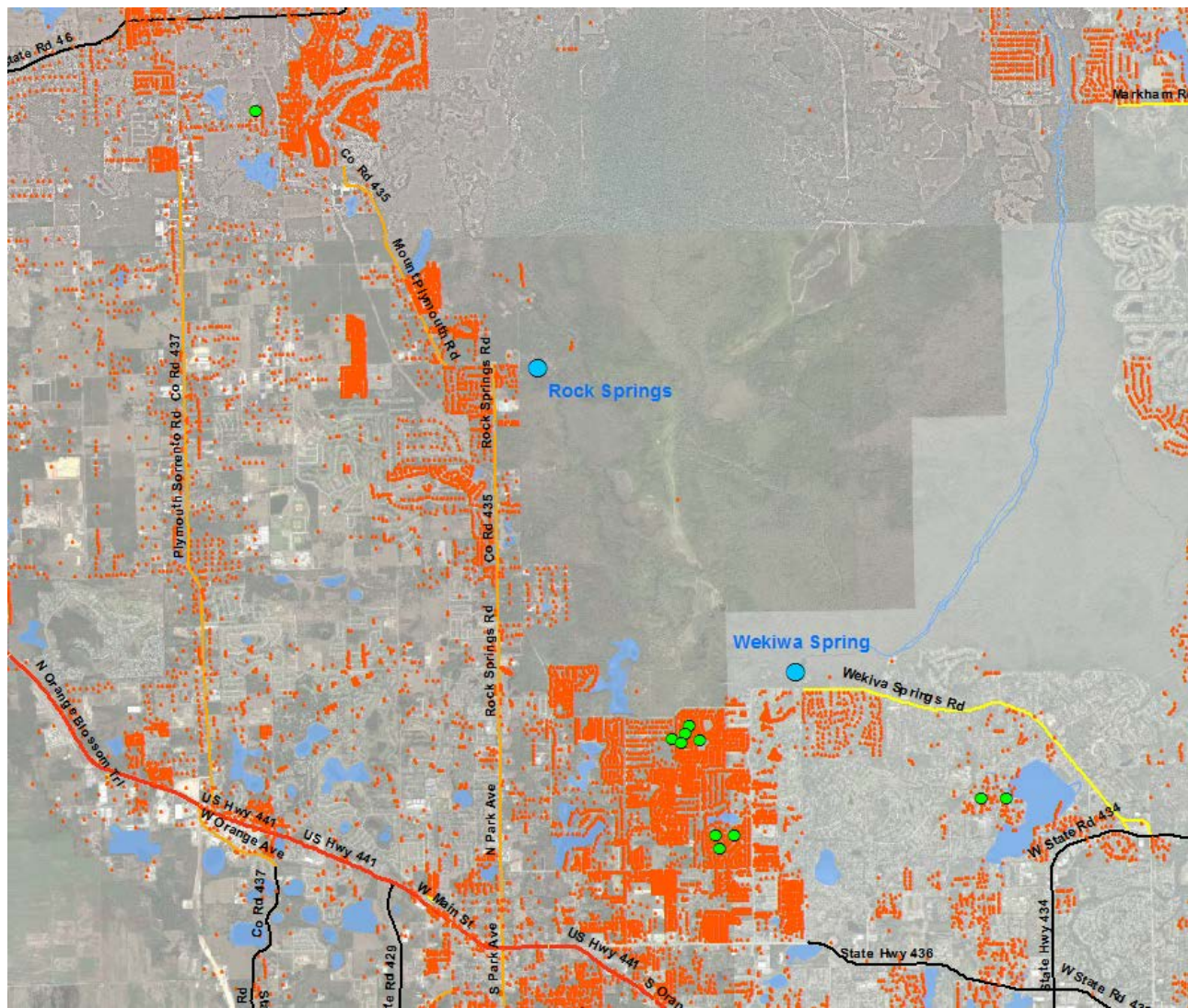


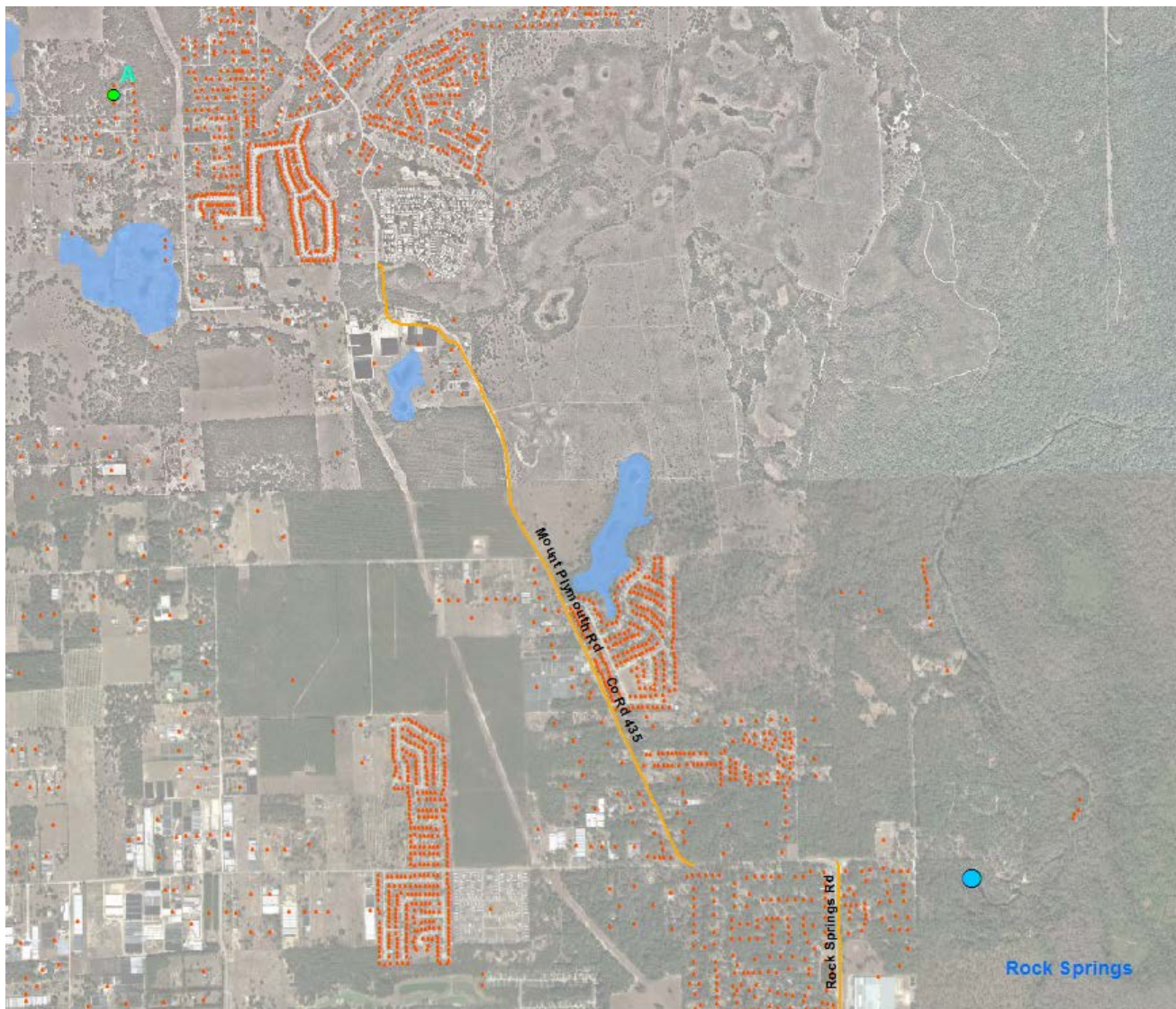
Also need to represent other conditions that would influence results (fertilizer use, irrigation, pets, etc.)

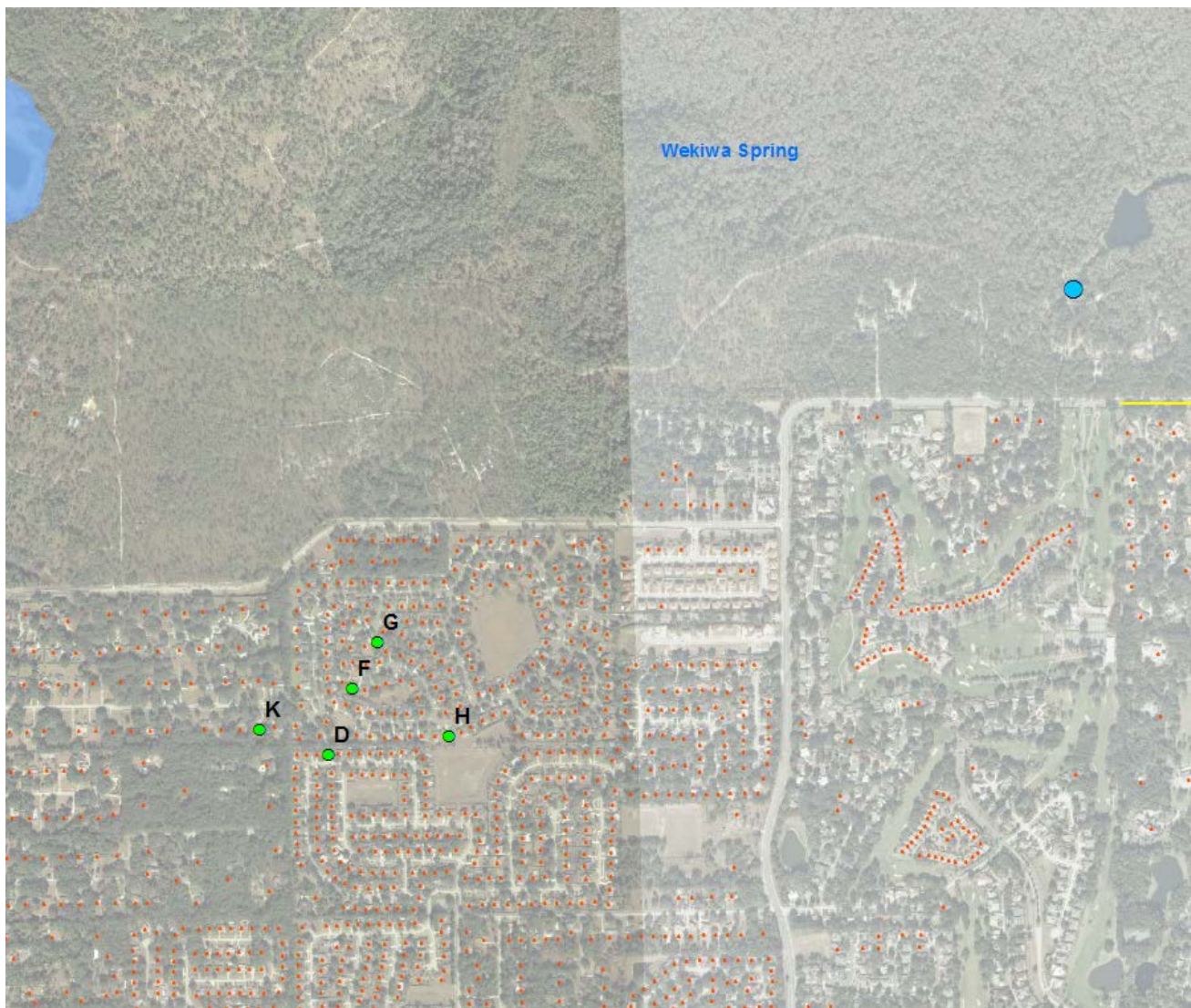


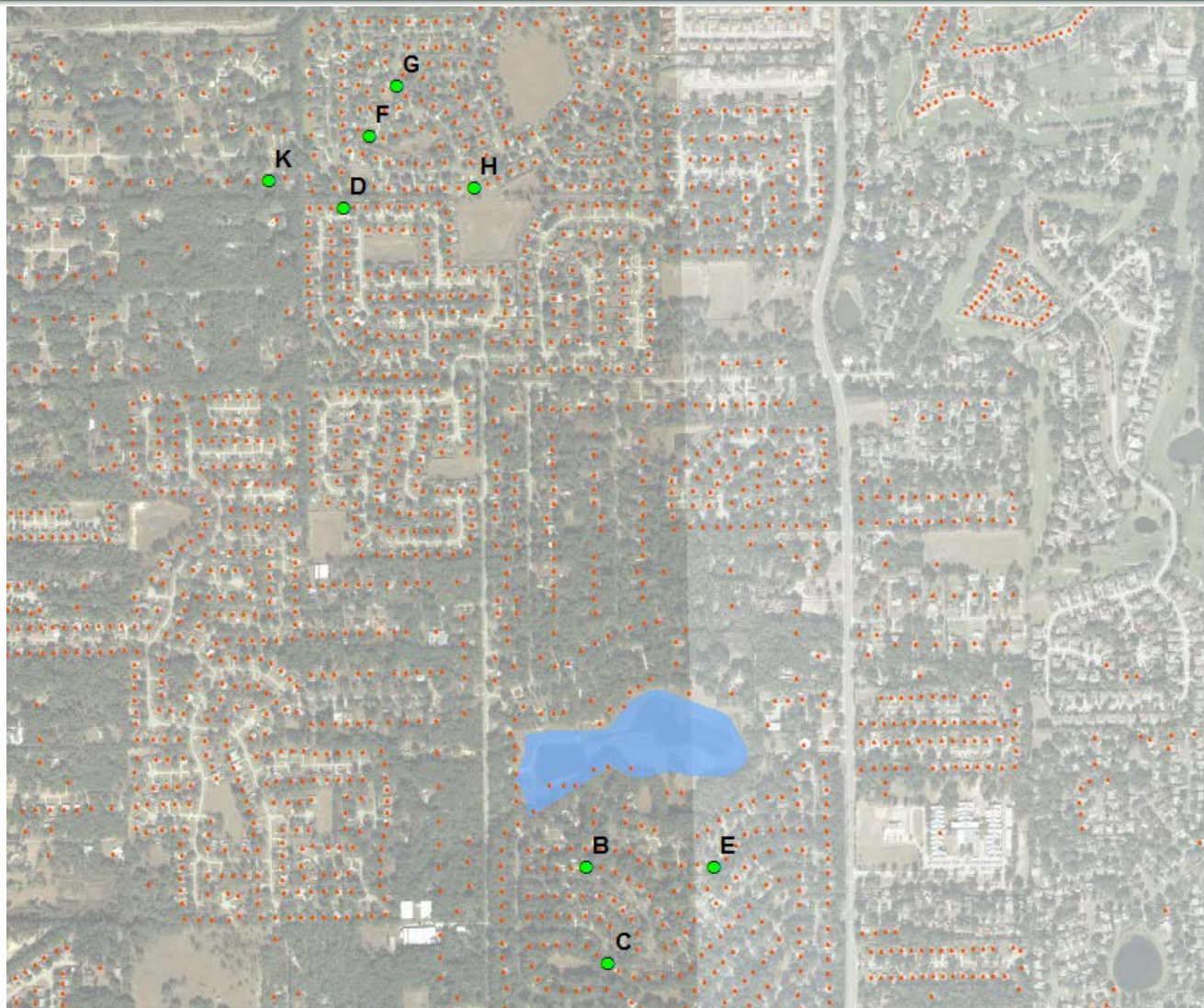
Information on Study Sites

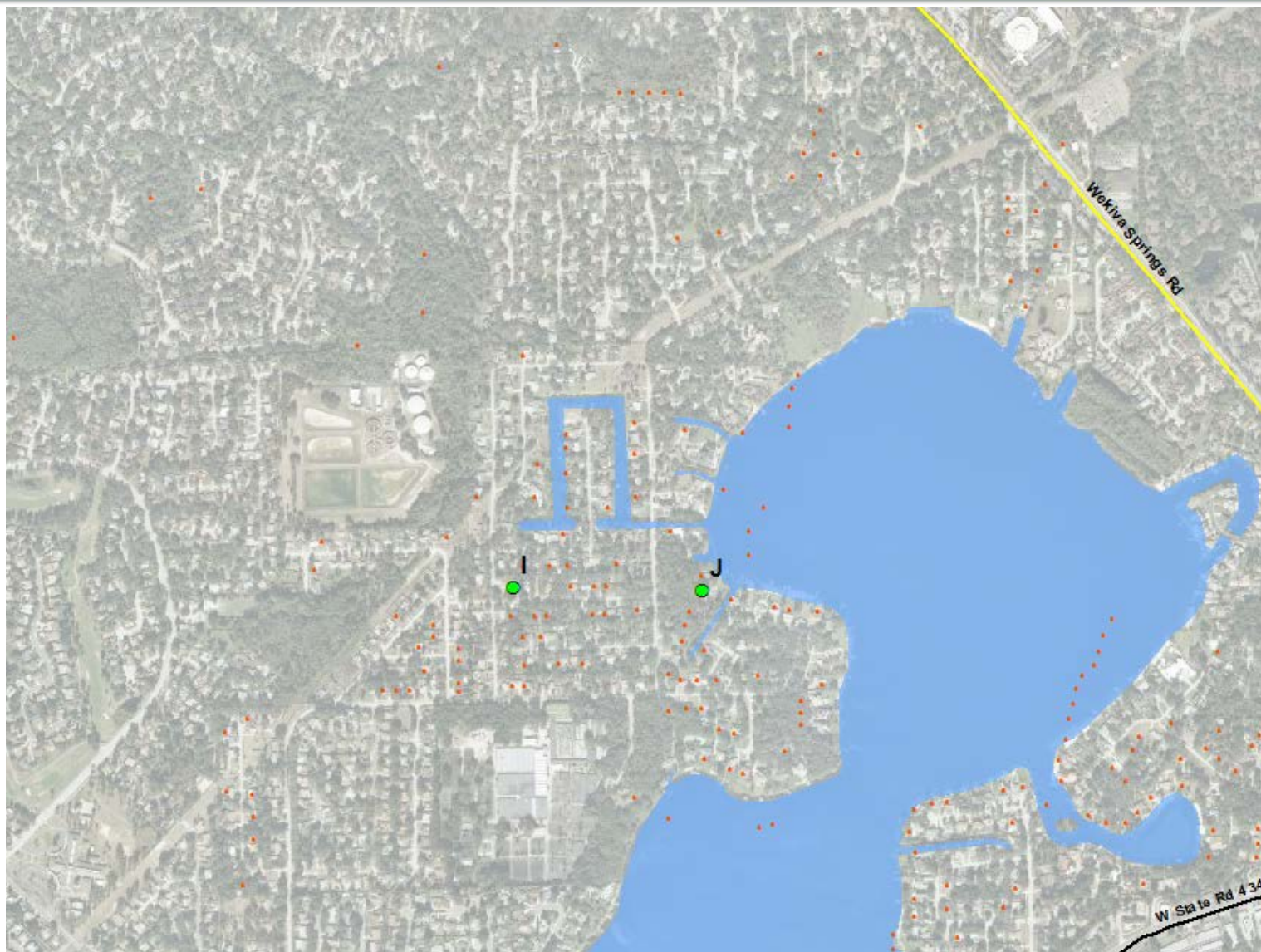
Site ID	City	No. residents	Drainfield repair/replacement history	Maintenance info	Lawn fertilizer use	Soil
A	Sorrento	2	infiltrators (original)	pumped regularly	yes, self applied	Candler fine sand
B	Apopka	3	infiltrators (2009)	pumped in 2013	yes, self applied	Candler fine sand
C	Apopka	3	infiltrators (2010)	septic tank pumped in 2013	yes, self applied	Candler fine sand
D	Apopka	2	pipe in gravel (original)	not pumped out lately	yes, commercial service	Candler fine sand
E	Apopka	2	pipe in gravel (1989)	not pumped	yard mostly mulched beds	Candler fine sand
F	Apopka	4	infiltrators (2010)	pumped in 2014	not lately	Candler fine sand
G	Apopka	3	pipe in gravel (original)	pumped in 2014	yard mostly mulched beds	Candler fine sand
H	Apopka	2	pipe in gravel (original)	not pumped	yes, commercial service	Candler fine sand
I	Longwood	2	infiltrators (1989)	pumped in 2015	yes, commercial service	Urban land
J	Longwood	2	mounded pipe in gravel bed	pumped regularly	yes, commercial service	Urban land
K	Apopka	2	pipe in gravel (original)	pumped in 2015	yard mostly mulched beds	Candler fine sand











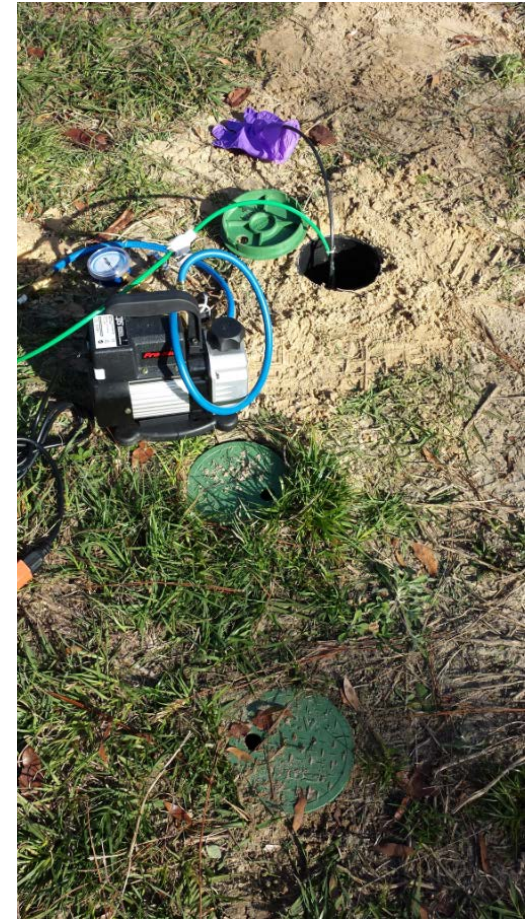


Scope

- Lysimeters to monitor soil pore water below df and background
- Riser installation and effluent monitoring
- Monitoring wells at some locations
- Collect data on water use to estimate loading



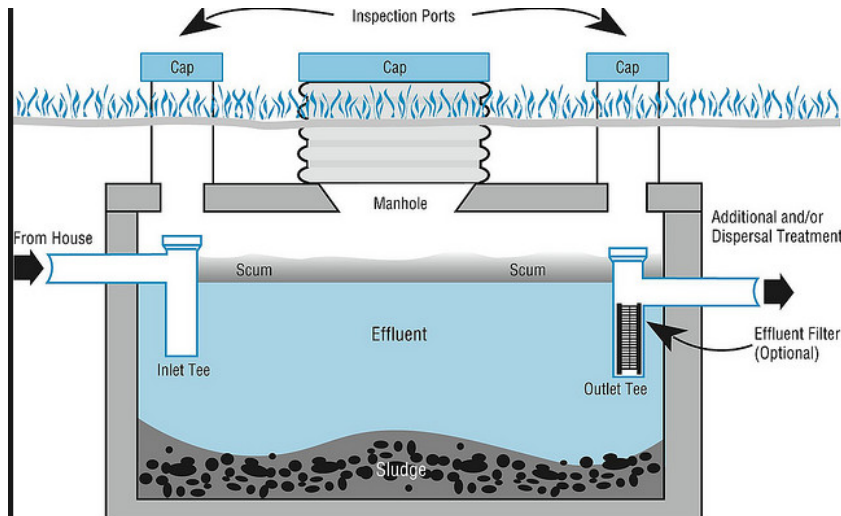
Soil pore water sampling using lysimeters







Effluent monitoring



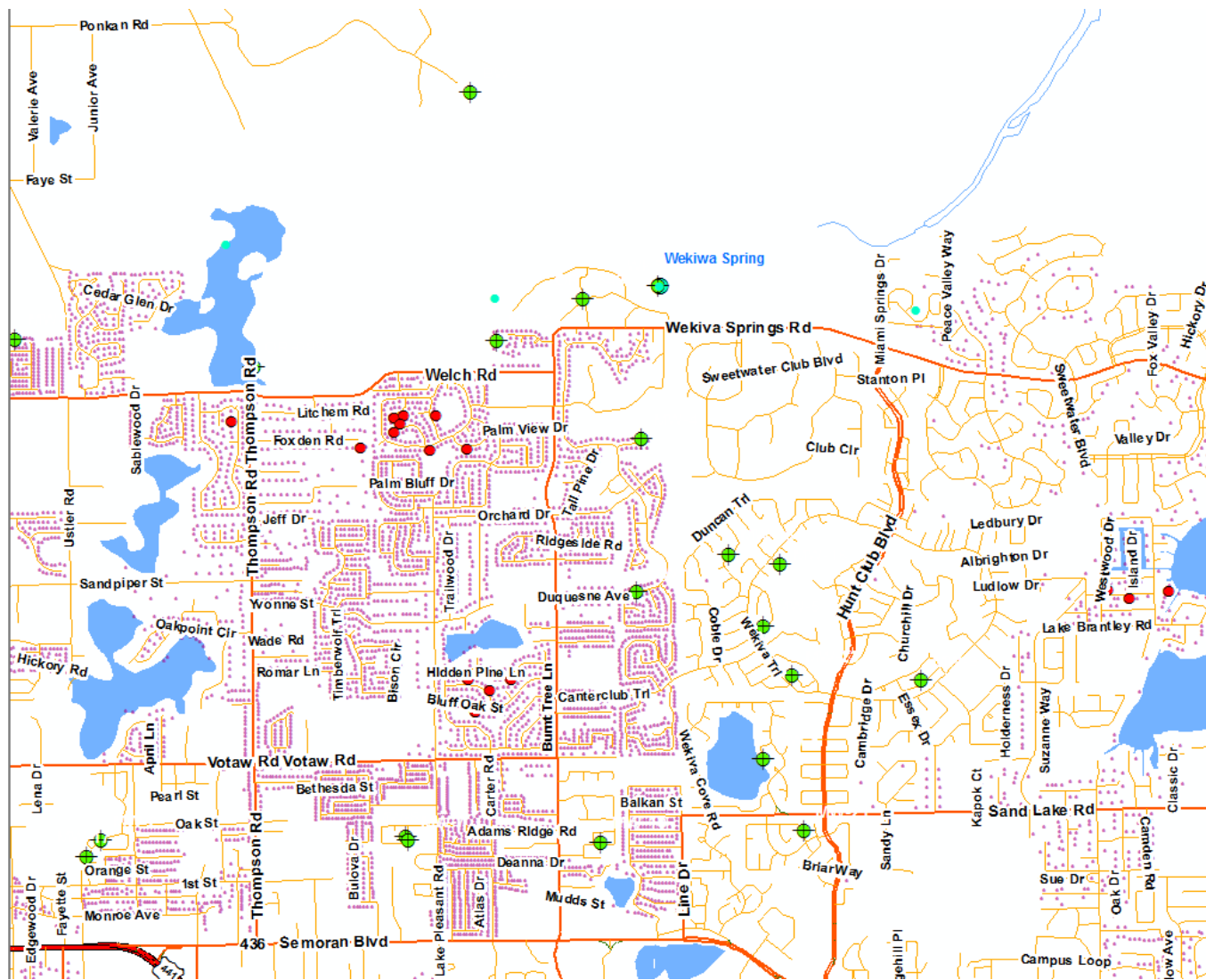


Monitoring well installation for ground water sampling, direct push rigs or auger rigs





Existing wells from 2010 fertilizer study

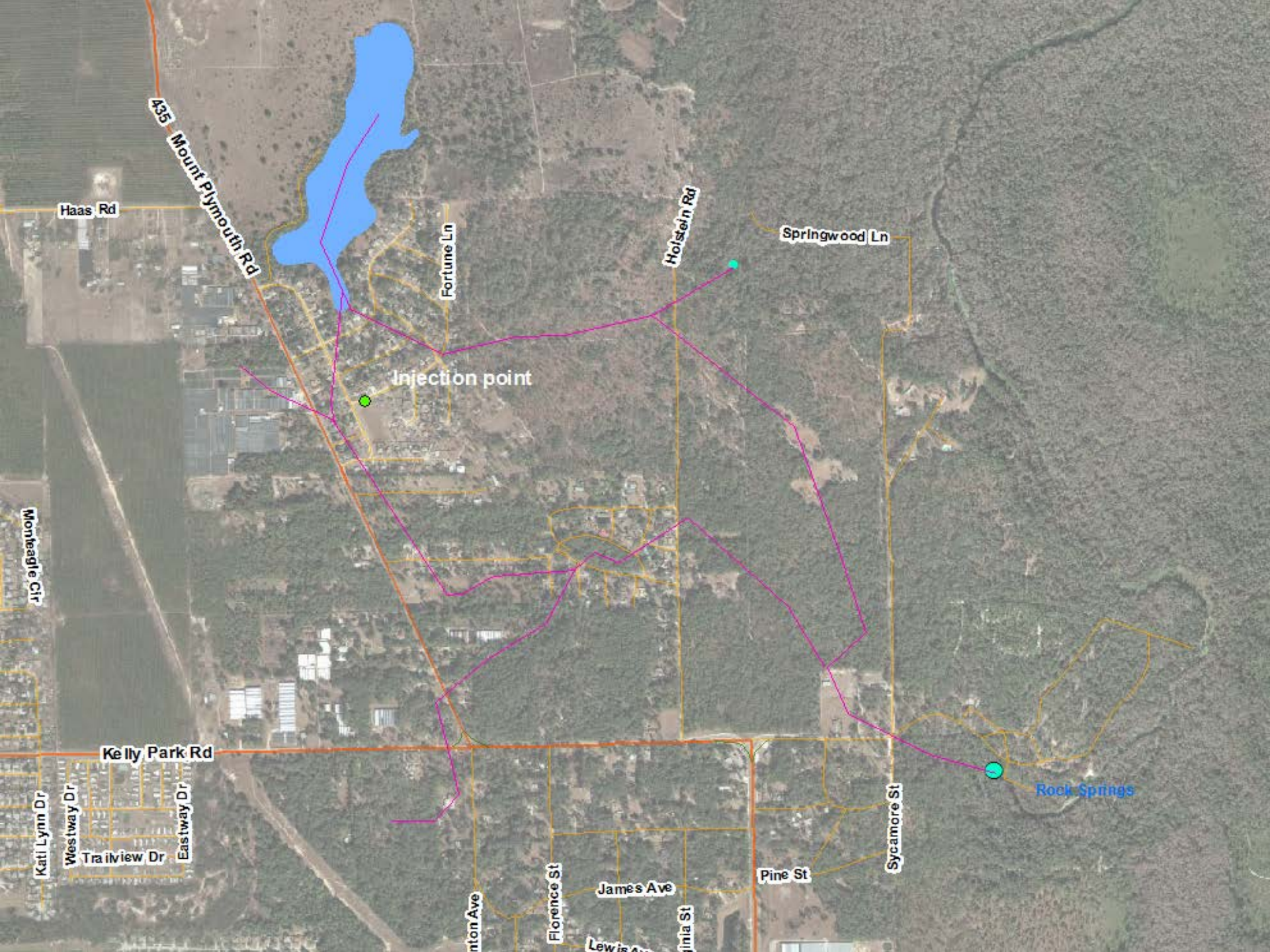


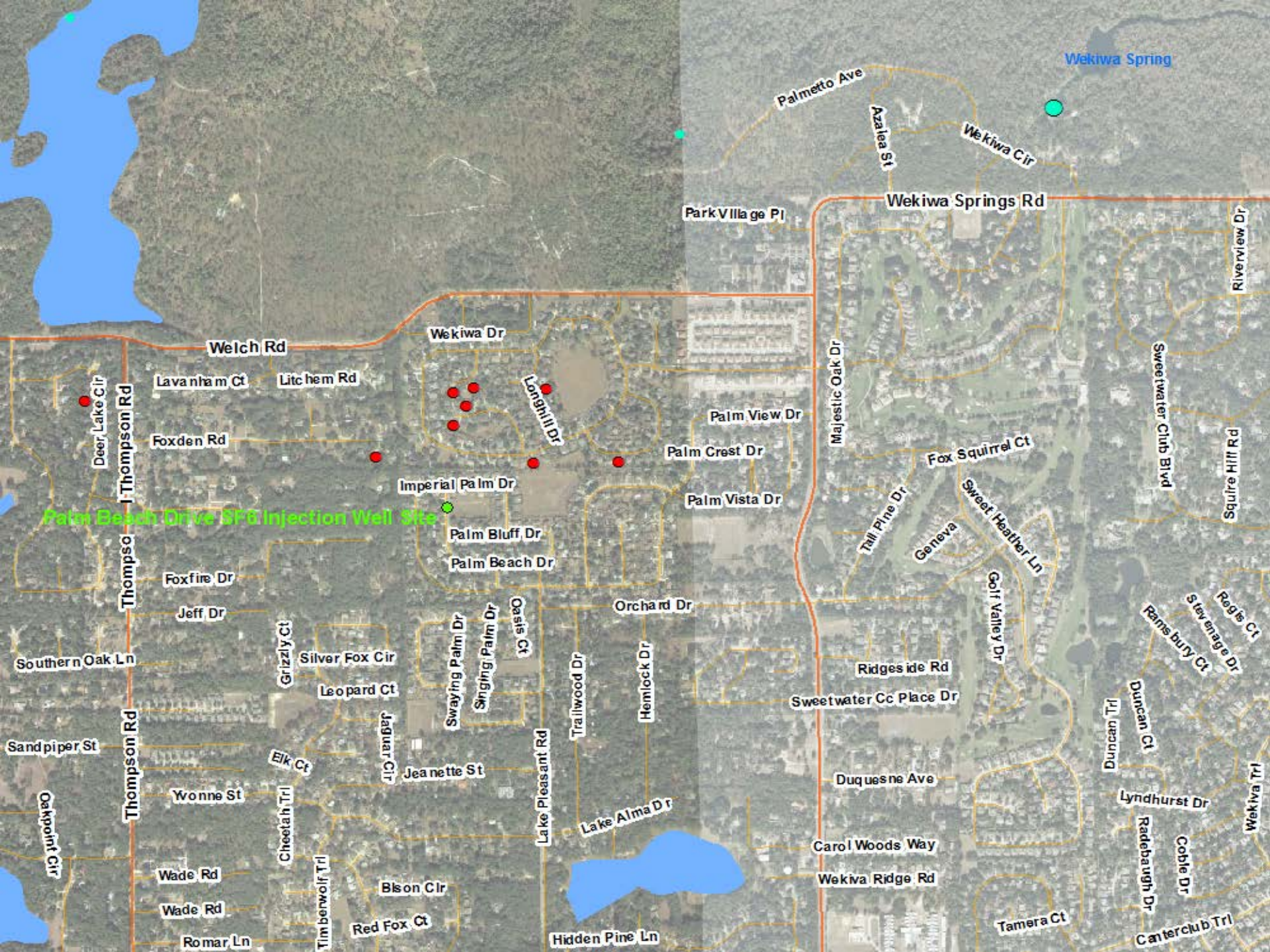
Deeper well installation, sampling of geologic material



SF6 tracer study, Fortune Lane site







Wekiwa Spring

Palmetto Ave

Azalea St

Wekiwa Cir

Park Village Pl

Wekiwa Springs Rd

Riverview Dr

Welch Rd

Wekiwa Dr

Lavanham Ct

Litchem Rd

Longhill Dr

Palm View Dr

Palm Crest Dr

Palm Vista Dr

Fox Squirrel Ct

Sweet Heather Ln

Geneva

Golf Valley Dr

Sweetwater Club Blvd

Squire Hill Rd

Palm Beach Drive SFG Injection Well Site

Imperial Palm Dr

Palm Bluff Dr

Palm Beach Dr

Foxfire Dr

Jeff Dr

Orchard Dr

Ridgeside Rd

Sweetwater Cc Place Dr

Regis Ct

Stevenage Dr

Ramsbury Ct

Duncan Ct

Duncan Trl

Lyndhurst Dr

Coble Dr

Canterclub Trl

Wekiwa Trl

Tamera Ct

Carol Woods Way

Wekiwa Ridge Rd

Lake Alma Dr

Hidden Pine Ln

Hemlock Dr

Trailwood Dr

Oasis Ct

Singing Palm Dr

Swaying Palm Dr

Jaguar Cir

Jeanette St

Leopard Ct

Silver Fox Cir

Grizzly Ct

Elk Ct

Cheetah Trl

Timberwolf Trl

Wonne St

Wade Rd

Wade Rd

Romar Ln

Red Fox Ct

Bison Cir

Southern Oak Ln

Sandpiper St

Oakpoint Cir

Thompson Rd

Thompson Rd

Deer Lake Cir



Other Activities

- **Evaluate changes in septic tank treatment after pumpouts**
 - By selectively sampling septic tank effluent, pre and post pumpout we hope to help provide some actual data on the potential benefit of tank pumping
- **Conduct alternative nitrogen reducing drainfield study**
 - Bold and Gold or other similar reactive media
 - Passive low-cost construction
 - Wekiwa Springs State Park location



Use of Data for Modeling



SSSA Onsite
Wastewater Conference
April 7-8, 2014

The Florida Onsite Sewage
Nitrogen Reduction Strategies
(FOSNRS) Project

FOSNRS 6: STUMOD-FL - A Tool for Predicting Fate and Transport of Nitrogen in Soil Treatment Units in Florida

April 7, 2014

Mengistu Geza¹, Kathryn S Lowe¹, Cliff Tonsberg¹, John McCray¹ and Eberhard Roeder²

¹Civil and Environmental Engineering, Colorado School of Mines, Golden, CO

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Florida Department of Health, Tallahassee, FL





Current Status Summary

- 11 sites selected and instrumented with shallow lysimeters, they will all be sampled by this week
- Contractor will next install risers on septic tanks
- Begin regular sampling program
- Install deeper lysimeters at some locations
- Soil borings and monitoring well installation



Nitrogen Inventory Tool



Nitrogen Inventory for Nitrate-Impaired Spring Waters

- ◇ GIS-based tool for estimating N loading to ground water, and identifying potential priority areas for BMAPs
- ◇ Estimates N loads from main source categories
- ◇ Customized for each spring basin
- ◇ Completed inventories area Wakulla, Silver, and Rainbow Springs BMAP areas
- ◇ In progress inventories include King's Bay, Weeki Wachee, Jackson Blue, and Volusia Blue





Nitrate-Impaired Spring Waters

- Many springs and spring runs have FDEP-adopted TMDLs for nitrogen because of algal growth
- Multiple non-point source contributions of nitrogen fall within these main categories:
 - atmospheric deposition
 - fertilizer (farm and non-farm)
 - septic tanks
 - land applied wastewater
 - livestock manure
 - stormwater runoff





Estimating Nitrogen Loads to Ground Water

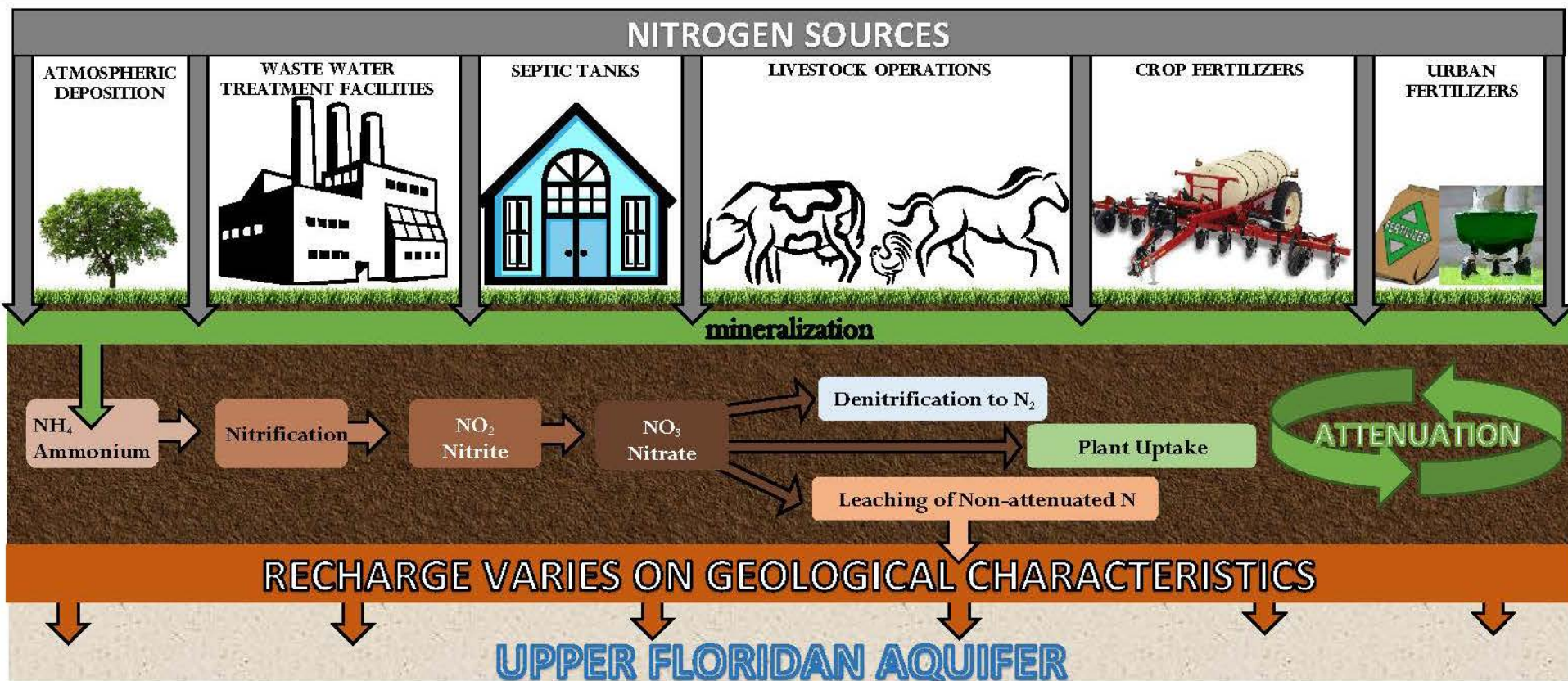
Steps:

1. Estimate the inputs of nitrogen to the land surface from the source inventory information **(best available)**.
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 weighting factors based on the rates of recharge to ground water in certain areas for estimating nitrogen loads to ground water.
4. Account for proximity of N source to spring. Fine-tune estimates after getting feedback from stakeholders.





Nitrogen Cycle and Nitrogen Attenuation



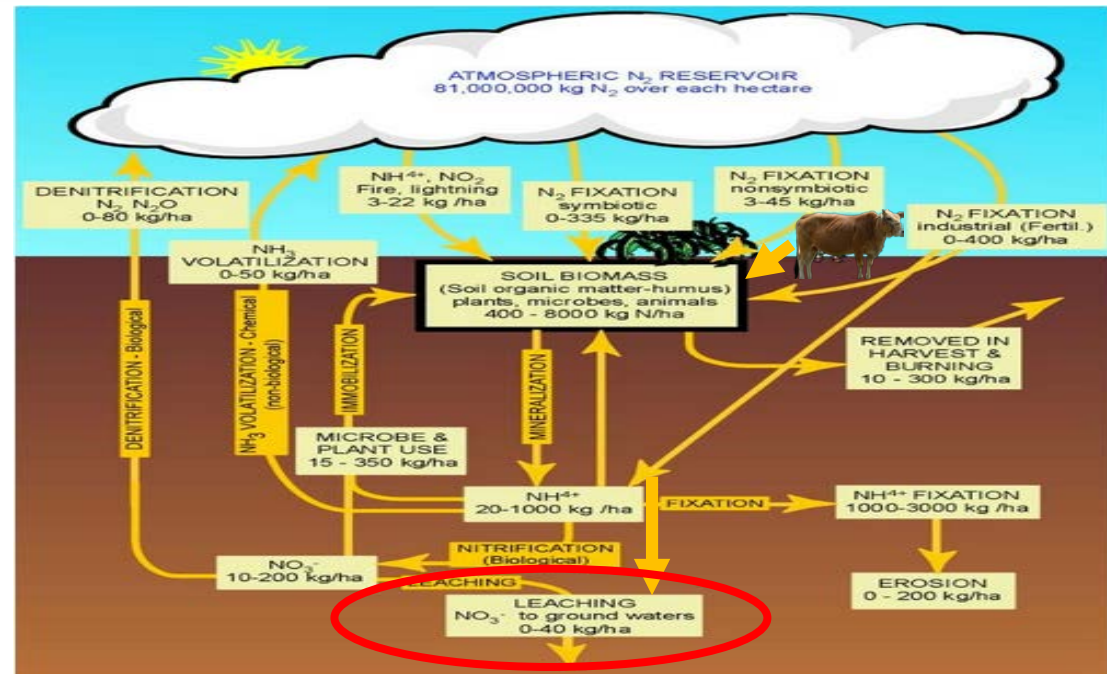
Processes that control the transformation of N in soils and the subsurface.

The wide ranges reflect variable soil conditions, fertilizer material, livestock, crop types, etc.,
ALL AFFECT LEACHING OF N TO GROUND WATER



Environmental Attenuation Factors (EAFs)

- ♦ EAFs represent the percentage of N removed and therefore not available for leaching to groundwater
- ♦ Examples
 - ♦ Volatilization
 - ♦ Plant uptake
 - ♦ Denitrification
- ♦ Based on factors used in previous studies and found in relevant literature

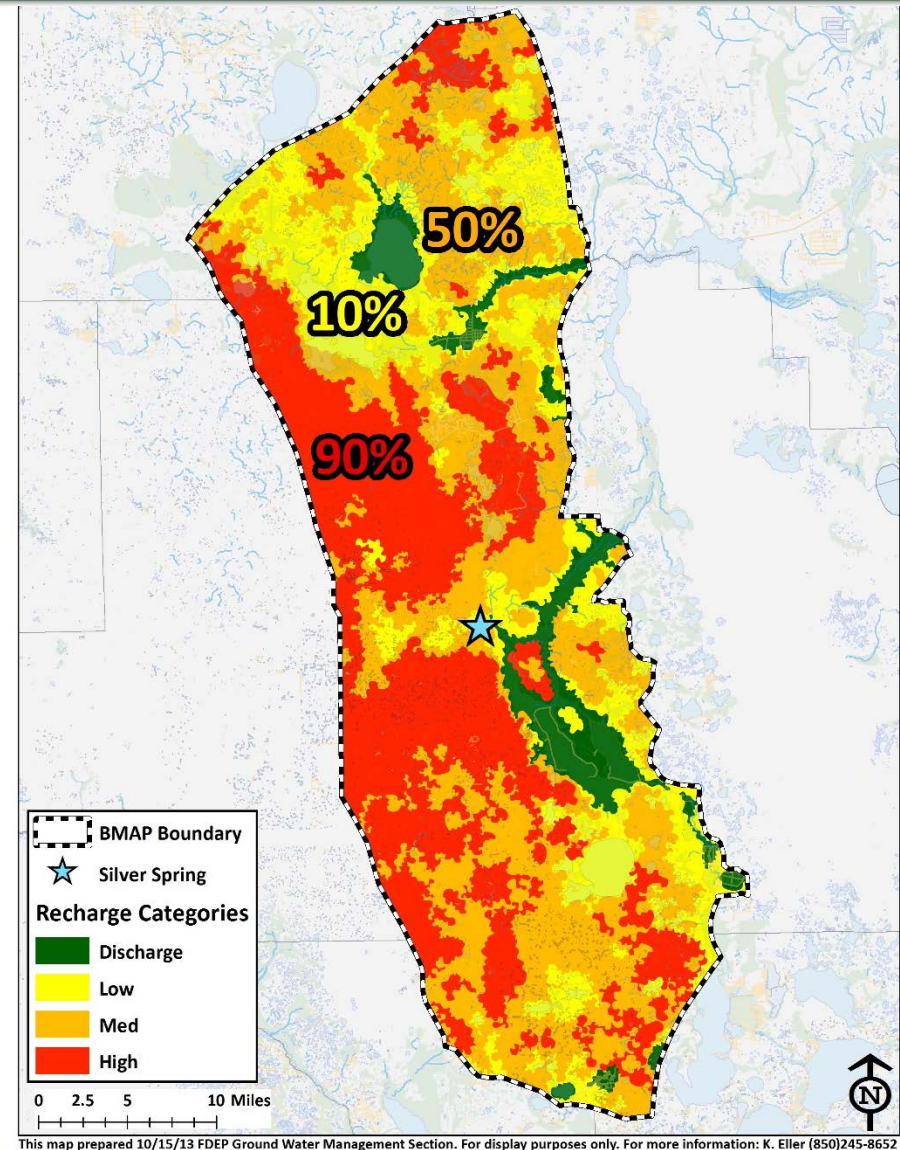


Loading Category	Attenuation Factor
Atmospheric Deposition	90%
Wastewater Treatment Facilities	60%
Septic Tanks	40%
Urban Fertilizers	80%
Crop Fertilizers	70%
Livestock	90%
Stormwater via Drainage Wells	35%



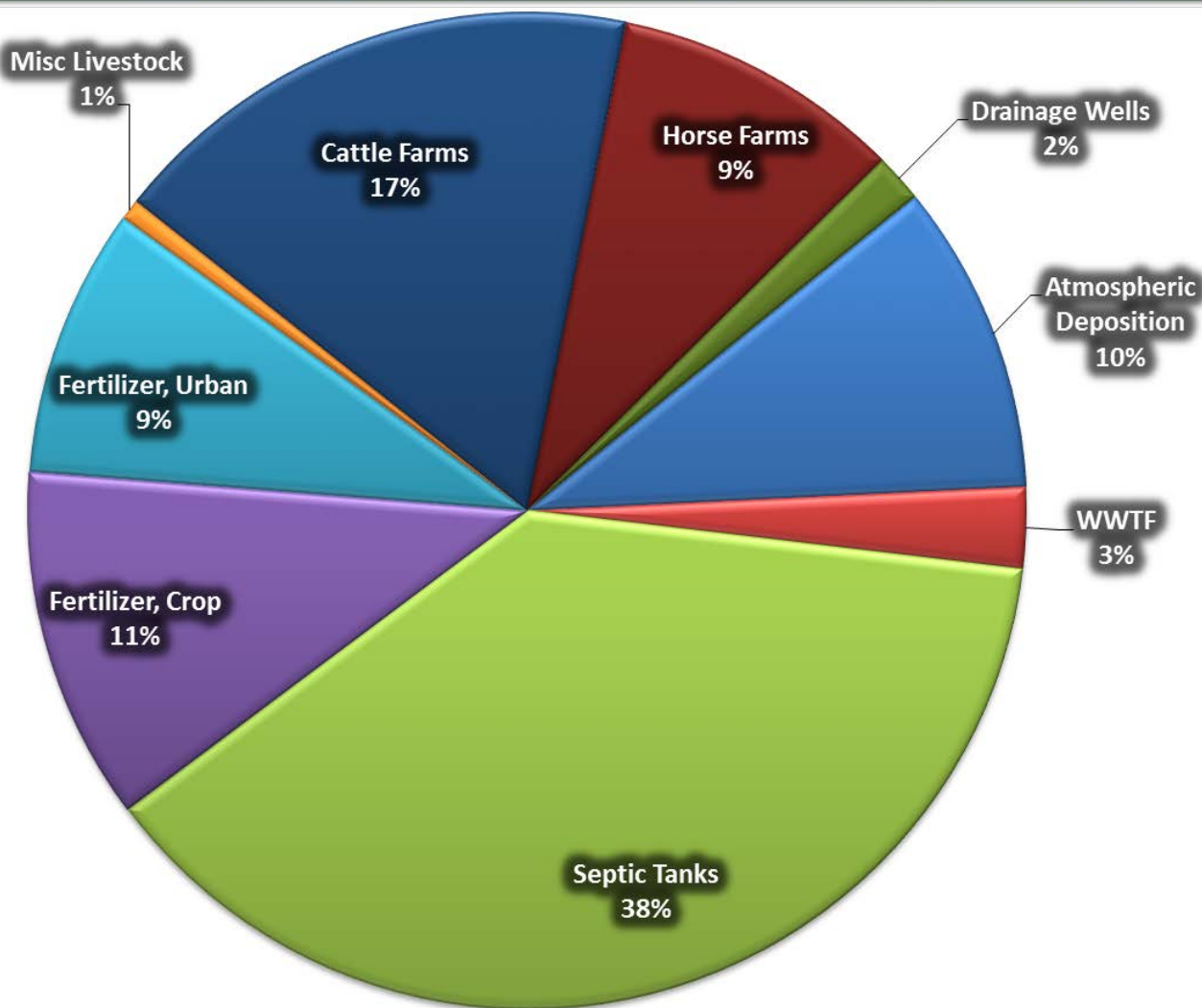
Recharge Factors

- Recharge factors are used to estimate the percentage of the non-attenuated nitrogen expected to reach the aquifer annually
- City of Ocala drainage wells are a direct conduit to the aquifer; therefore, we assume 100% recharge





Annual Average Loading to Ground Water



Silver Springs example

1,658,973 lb-N/yr



For Wekiva...

- Within the BMAP schedule, FDEP intends to develop a customized nitrogen loading tool that updates/supersedes the previous product developed by MACTEC
- Will incorporate current Wekiva-specific source information and data obtained from Wekiva-specific studies
- This can serve as a planning tool for stakeholders