

FSU Karst Symposium

1st Annual

Sinking Lakes and Streams in the
Wakulla Springshed

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Apalachee Audubon Society, Board,

Friends of Wakulla Springs, Board,

Ochlocknee River Soil and Water Conservation District, former Supervisor,

Big Bend Sierra Club, former President



A photograph of a stream with dark water and a muddy bank. The water is dark and appears to be flowing over rocks. The bank is muddy and has some green plants growing on it. The text is overlaid on the right side of the image.

Current Paper's
Nitrogen Contributions of Karst
Seepage into the Upper Floridan
Aquifer from Sinking Streams and
Sinking Lakes in the Wakulla
Springshed

Final, October 20, 2016

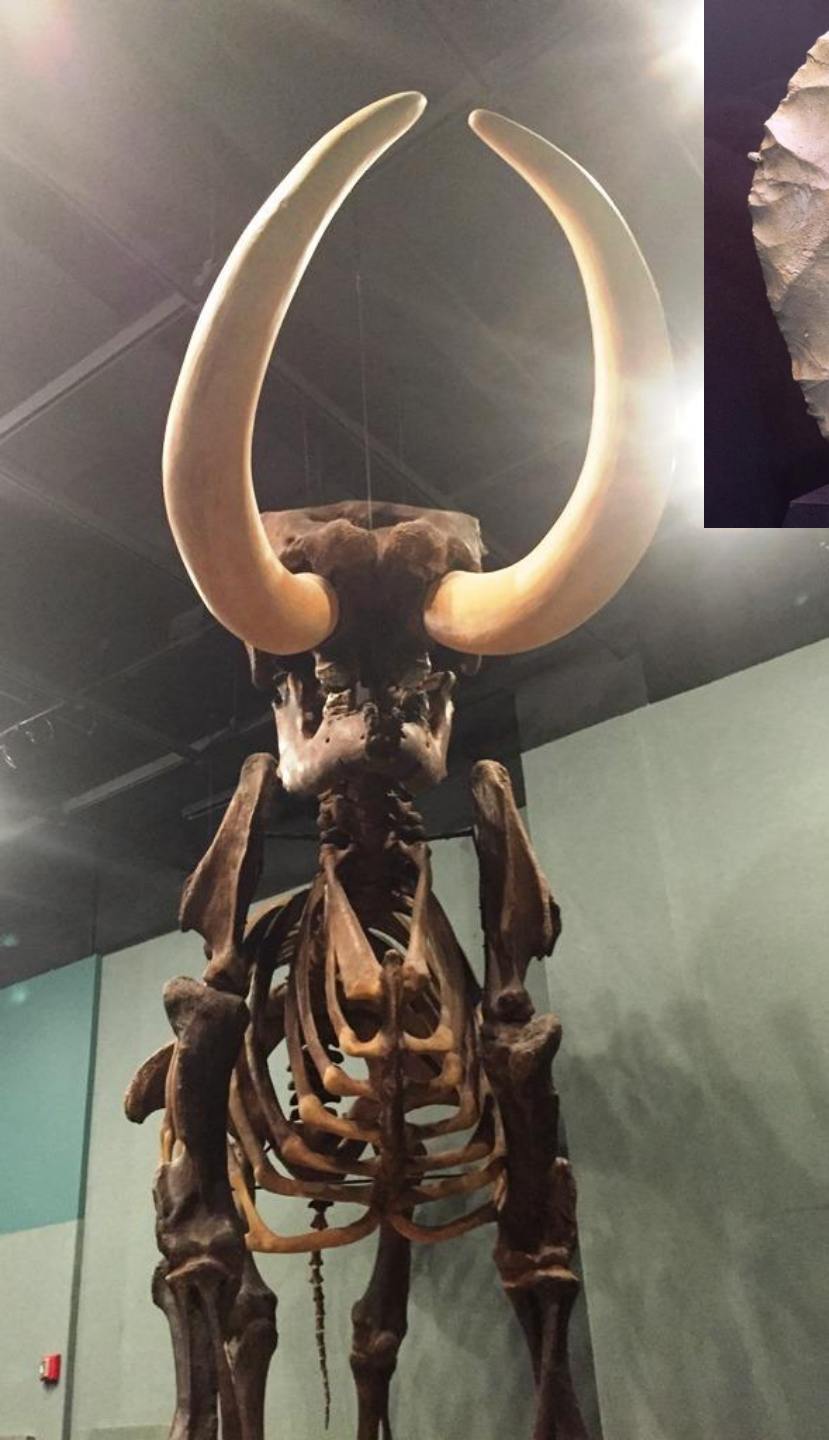
Wakulla Spring Dark Water:
Causes and Sources Phase I

Draft, February 21, 2017

Both by

Seán E. McGlynn, Principal Investigator
And Robert E. Deyle, Project Manager

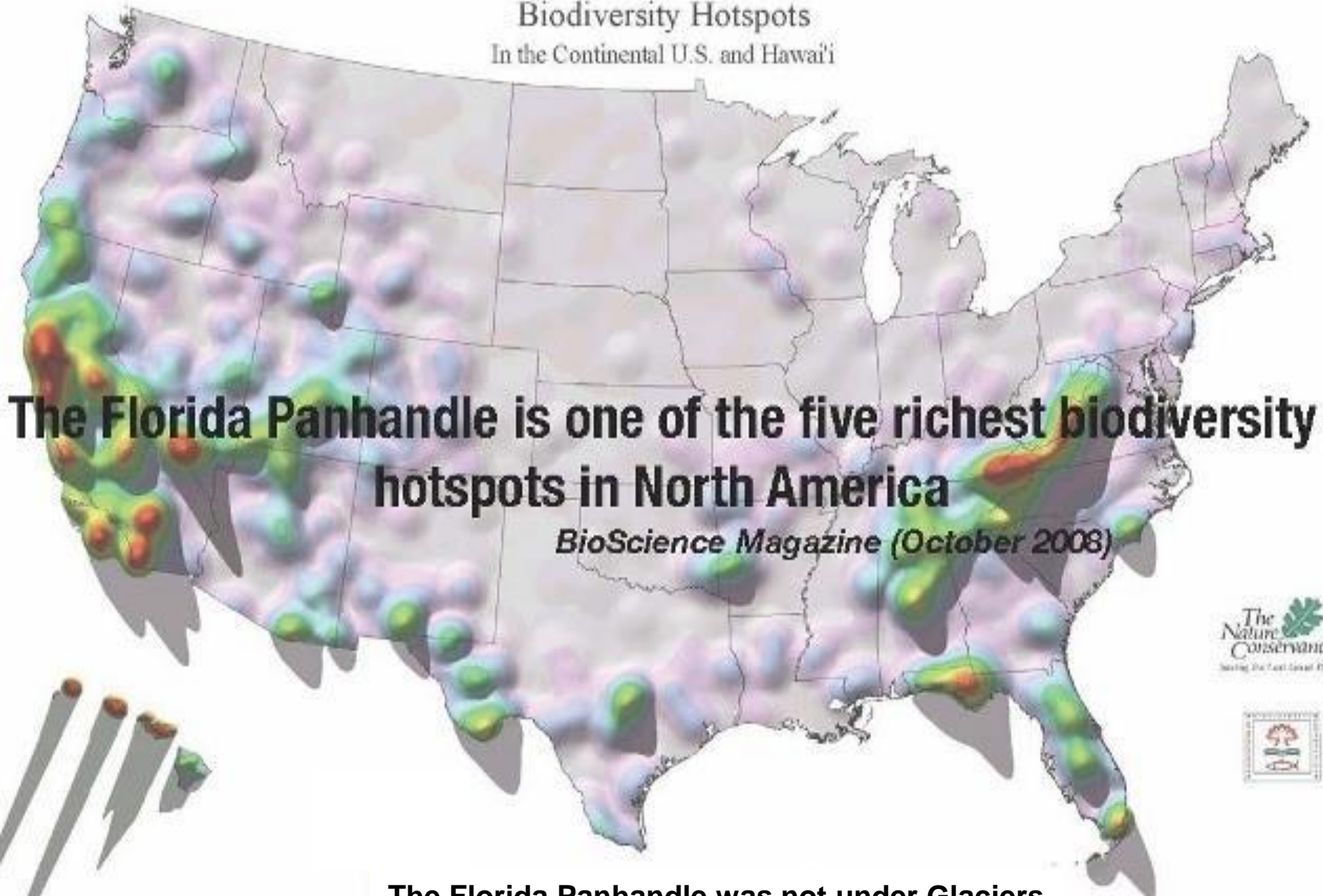
This project was developed for the Wakulla Springs Alliance by McGlynn Laboratories, Inc. with financial assistance provided by the Fish and Wildlife Foundation of Florida, Inc. through the Protect Florida Springs Tag Grant Program, project PFS #1516-02





An Ancient Landscape

Biodiversity Hotspots
In the Continental U.S. and Hawai'i



The Florida Panhandle is one of the five richest biodiversity hotspots in North America

BioScience Magazine (October 2008)



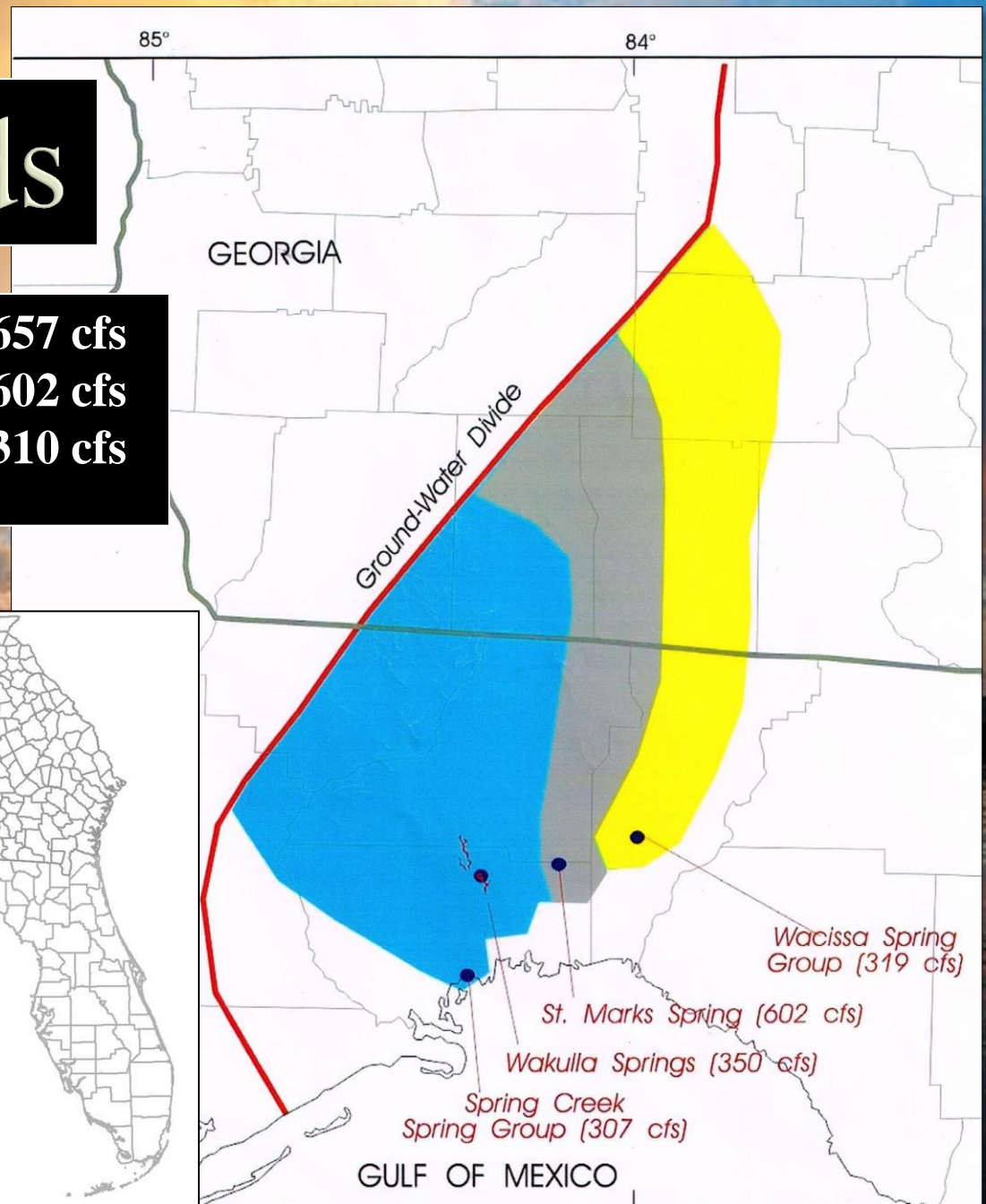
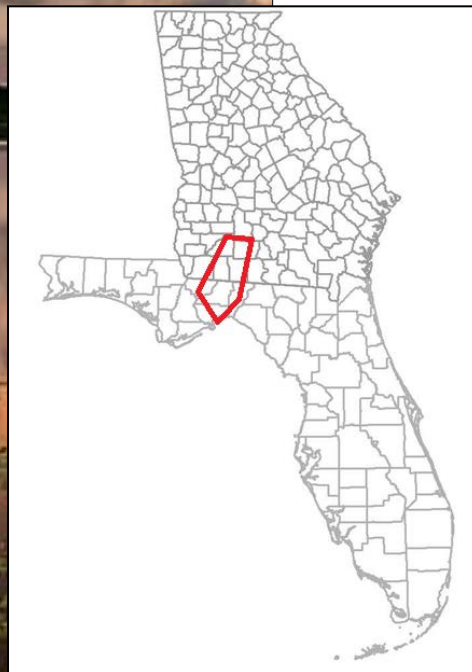
The Florida Panhandle was not under Glaciers or Salt Water during the last Ice Age

Hotspots identified from Conservation Biology: The Ecology of Endemism
by David M. Mindes and David B. Clark. Copyright © 1999. All rights reserved.
Map of the U.S. showing the five richest hotspots. All rights reserved. © 2008
© 2008 by The Nature Conservancy

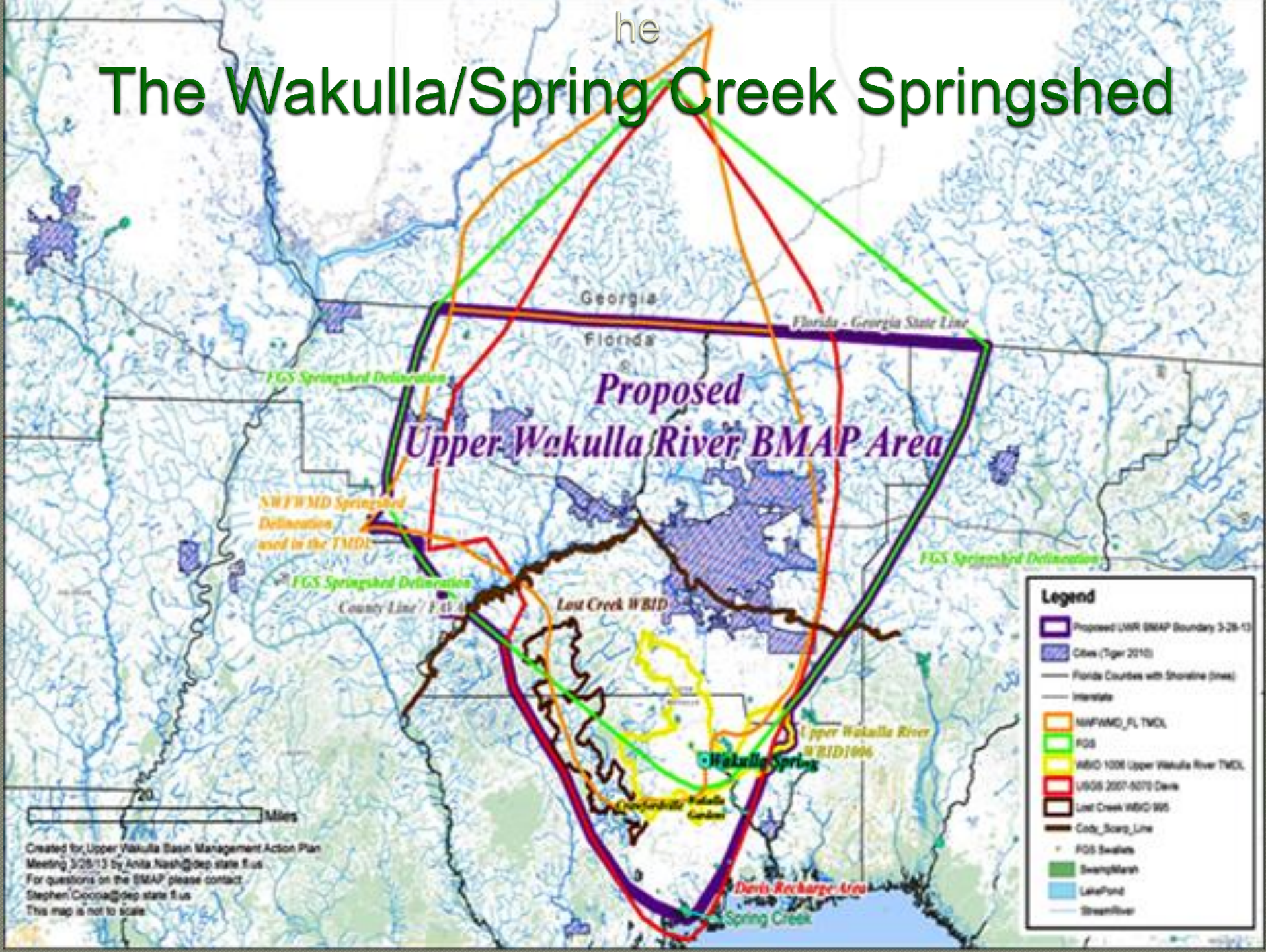


Springsheds

- **1st Wakulla/Spring Creek -657 cfs**
- **2nd St Marks -602 cfs**
- **3rd Wacissa -310 cfs**



The Wakulla/Spring Creek Springshed

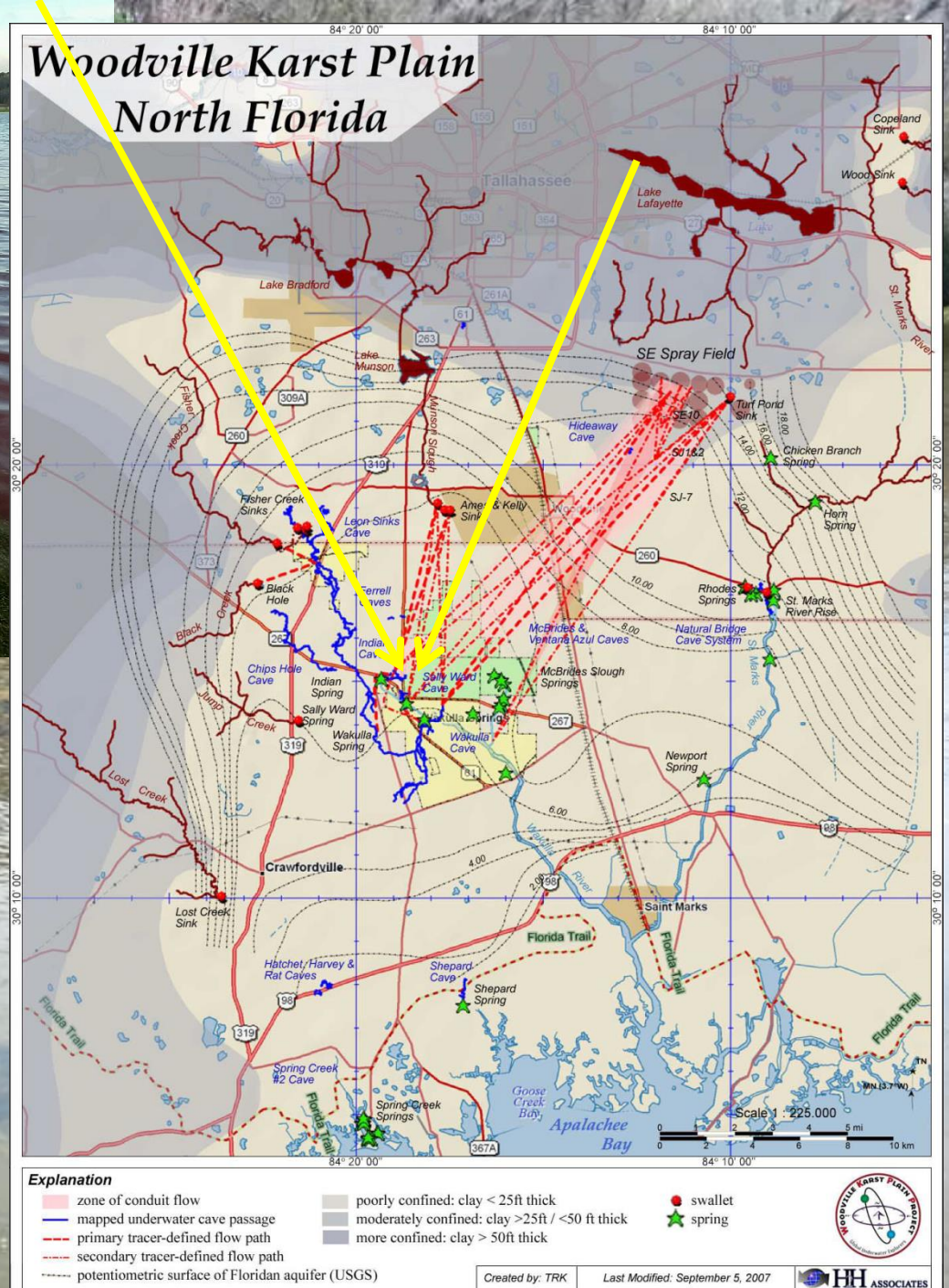


Created for Upper Wakulla Basin Management Action Plan Meeting 3/28/13 by Anita.Nash@dep.state.fl.us
For questions on the BMAP please contact Stephen.Cioccia@dep.state.fl.us
This map is not to scale



Documented dye
trace pathways

February 23, 2017
dye was detected in
Wakulla Springs,
33 days after
injection in
Lafayette Sink.

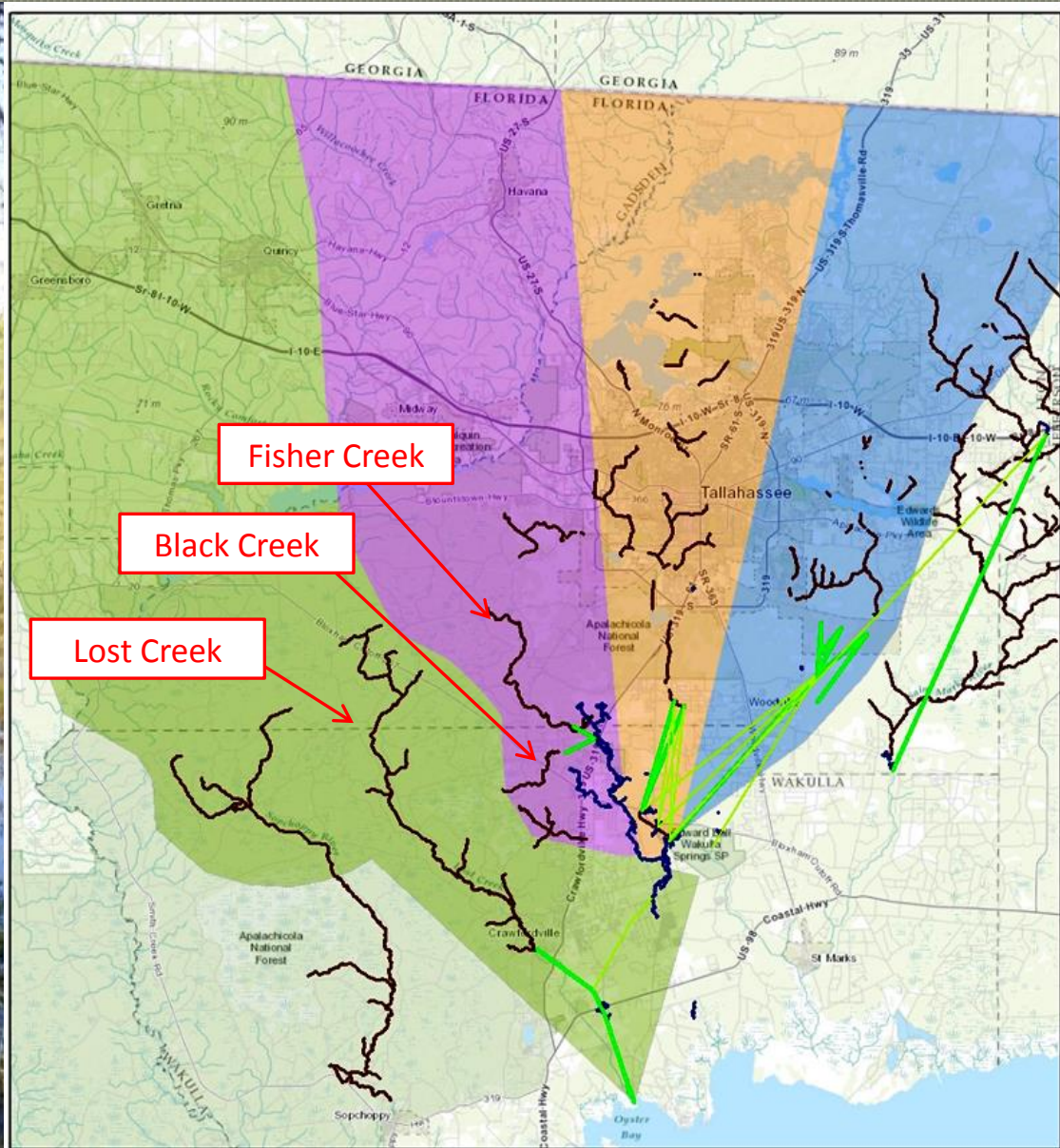


YEAR	FROM	TO	DISTANCE (MILES)	PEAK TRAVEL TIME (DAYS)	VELOCITY (FEET/DAY)	VELOCITY (MILES/DAY)
2004	Lake Munson (Ames)	Wakulla Spring	5.73	21.98	1380	0.26
2004	Lake Munson (Ames)	Wakulla Spring	5.73	22.73	1330	0.25
2017	Lake Lafayette (Fallschase)	Wakulla Spring	16.3	34.83	2471	0.47
2017	Lake Jackson (Porter)	Wakulla Spring	19.1	35.21	2864	0.54

GROUNDWATER TRACING RESULTS FROM THE WOODVILLE KARST PLAIN, NORTH FLORIDA

YEAR	FROM	TO	DISTANCE (MILES)	QUANTITY (KG)	PEAK TRAVEL TIME (DAYS)	VELOCITY (FEET/DAY)	VELOCITY (MILES/DAY)
2001	Sullivan Sink	Cheryl Sink	1.58	0.75	0.96	8680	1.644
2008/2009	Lost Creek	Spring Creek	7.5	15	5	7920	1.500
2004	Emerald Sink	Wakulla Spring via Fish Hole	10.46	3	7.09	7790	1.475
2004	Emerald Sink	Wakulla Spring via Clear Cut	10.19	3	7.09	7590	1.438
2012	Bird Sink	Rhodes Spring	15.2	100	13.01	6170	1.169
2012	Bird Sink	Natural Bridge Sink	15.2	100	13	6170	1.169
2012	Bird Sink	St. Marks River Rise	15.5	100	13.65	6000	1.136
2005	Indian Spring	Wakulla Spring	6.29	5	5.9	5630	1.066
2012	Bird Sink	Horn Spring	12.5	100	11.78	5600	1.061
2002	Fisher Creek	Emerald Sink	1.2	2	2.37	2680	0.508
2003	Black Creek	Emerald Sink	1.6	2	3.18	2660	0.504
2012	Bird Sink	Wakulla Spring	23.2	100	52.11	2350	0.445
2005	Kelly Sink (Ames)	Indian Spring	5.2	7	13.5	2030	0.384
2004	Ames Sink	Indian Spring (min)	5.2	7	15.99	1720	0.326
2005	Ames Sink	Indian Spring	5.2	7	16.6	1650	0.313
2004	Ames Sink	Indian Spring (max)	5.2	7	19.78	1390	0.263
2004	Ames Sink	Wakulla Spring (min)	5.73	7	21.98	1380	0.261
2004	Ames Sink	Wakulla Spring (max)	5.73	7	22.73	1330	0.252
2006	Spray field Turf Pond Sink	Wakulla Spring	10.9	60	56	1030	0.195
2006	Spray Field Wells (min)	Wakulla Spring	10.4	60	56	980	0.186
2008/2009	Lost Creek	Wakulla Spring	7.75	15	47	870	0.165
2006	Spray Field Wells (max)	Wakulla Spring	10.4	60	66.5	830	0.157

Tracing performed by GeoHydros, LLC and Cambrian Ground Water, Inc. with support from the Florida Geological Survey



Fisher Creek

Black Creek

Lost Creek

Wakulla Springs Estimated Contributing Areas Within Florida

Map is not intended for legal decision making.
For more information, contact FDEP
(850) 245-8555
GIS layers used with permission from
Dr. Todd Kincaid.

Legend

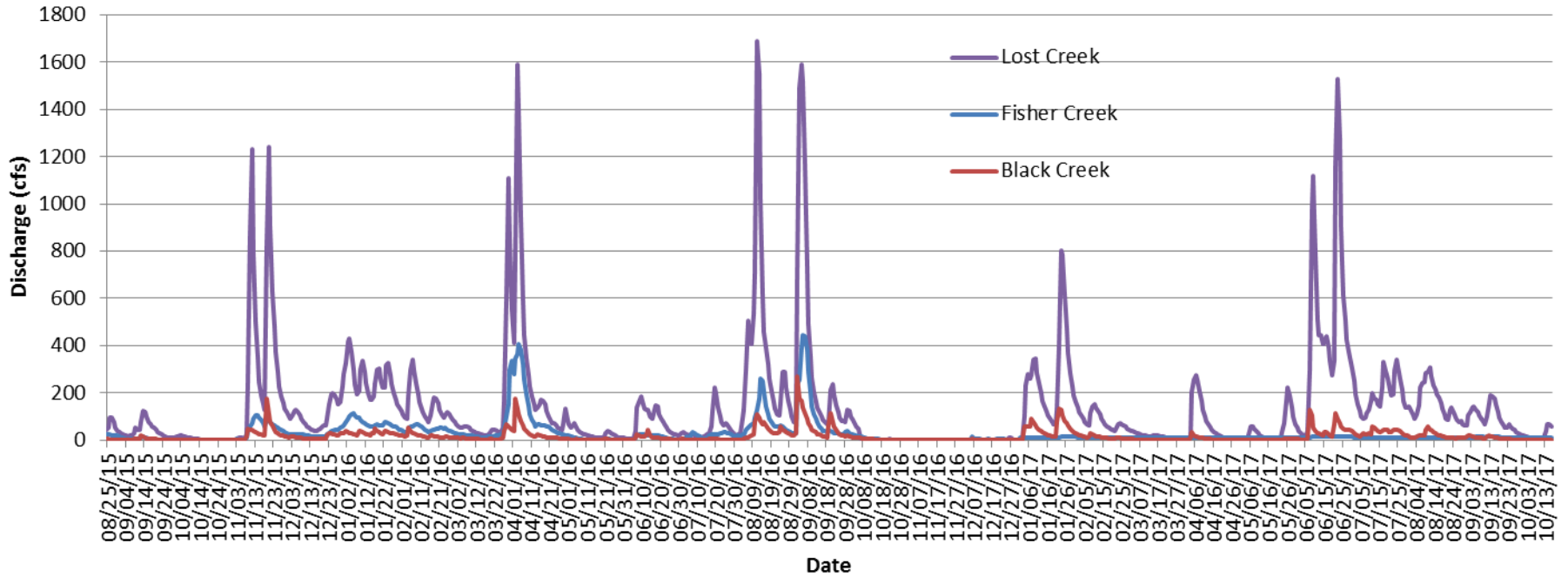
-  Underground Conduits- Mapped
-  Surface Water Creeks
-  Dye Traces

10 Miles

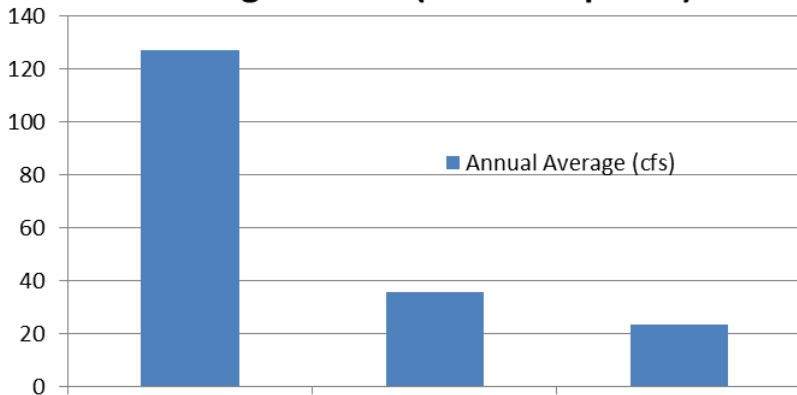
Source Water Zones

-  Central Zone
-  Lost Creek - Spring Creek Zone
-  Northeastern Zone
-  Northwestern Zone

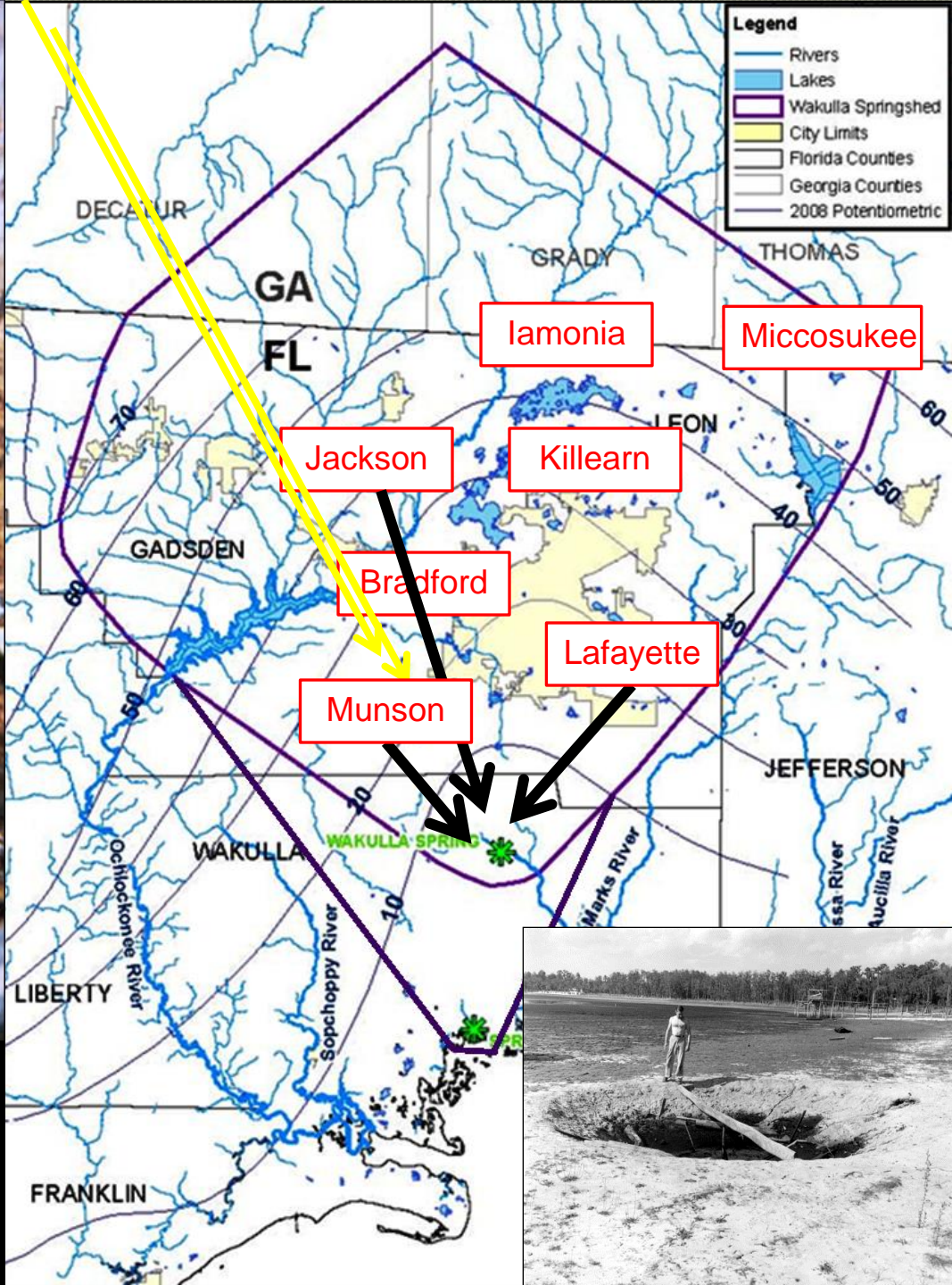
Comparison of Sinking Stream Discharges



Sinking Streams (flow to aquifer)

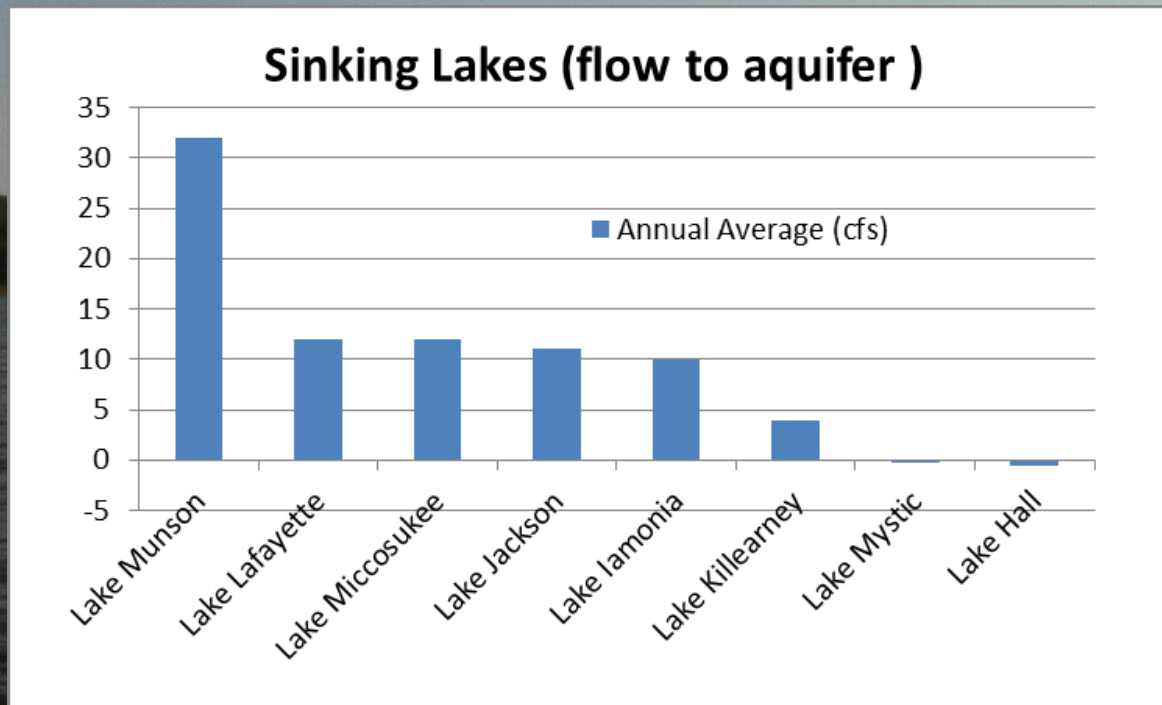


Flashy quick discharge,
event driven

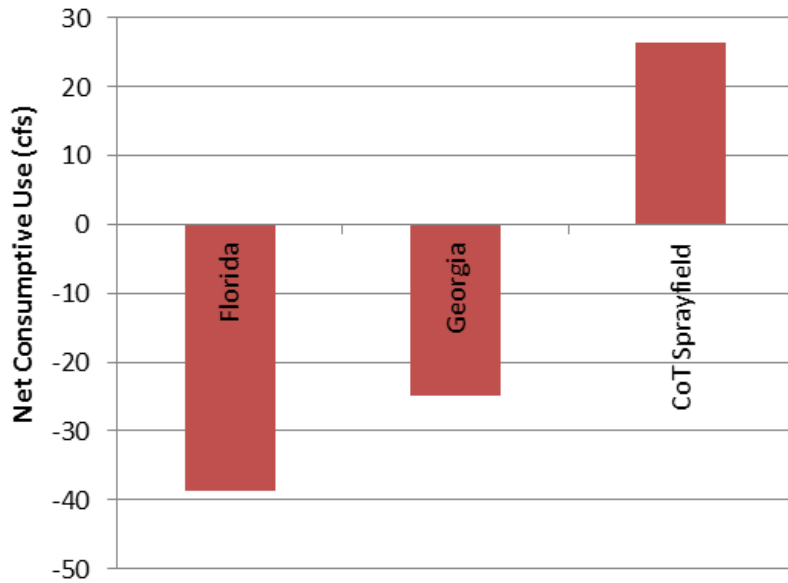


Sinking Lakes in the Wakulla Springshed

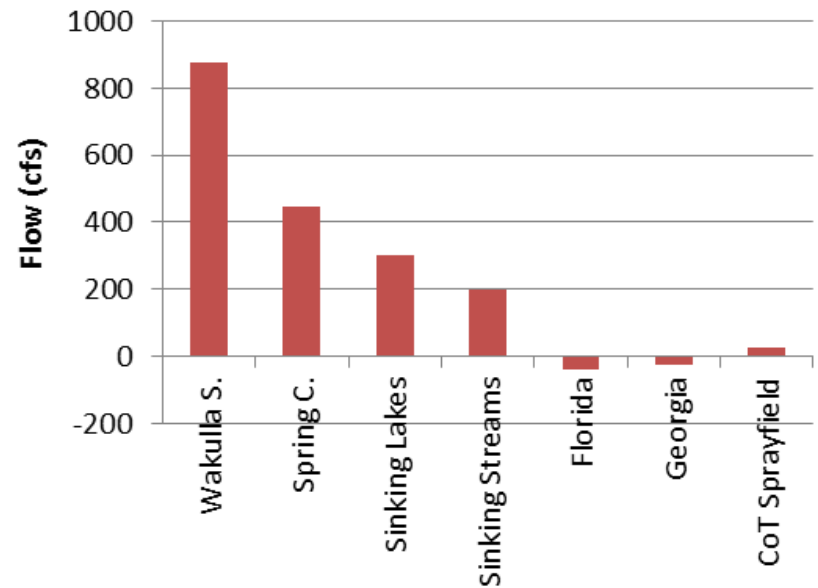
Slow draining, fairly constant discharge until desiccation



Withdrawals Wakulla Springshed (by state)



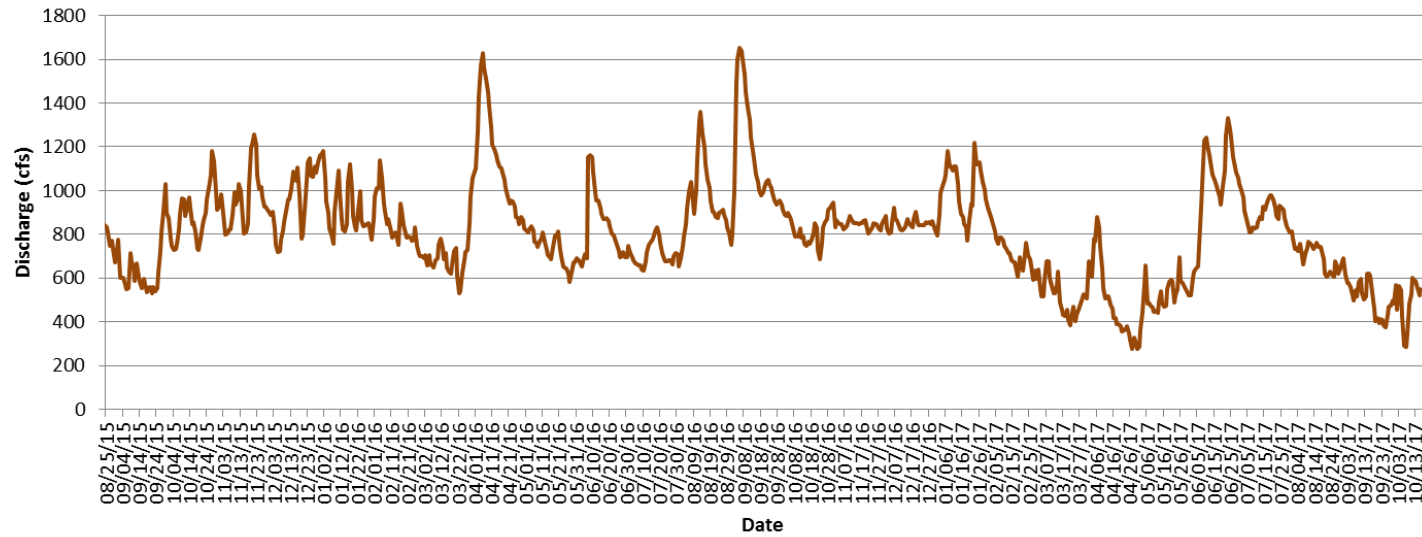
Wakulla Springshed (comparison)



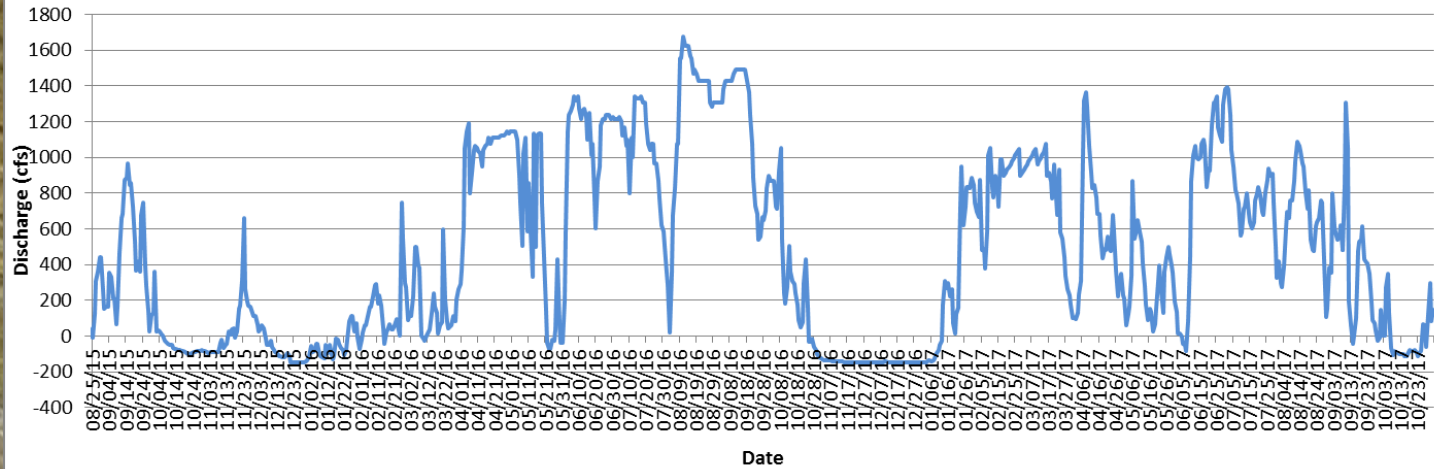
1) *Springs and sinking stream Flows (USGS, 07/01/15-09/30/16 and for Lakes and Spring Creek, McGlynn, 2017)*

2) *Georgia and Florida flows (local 2016 data)*

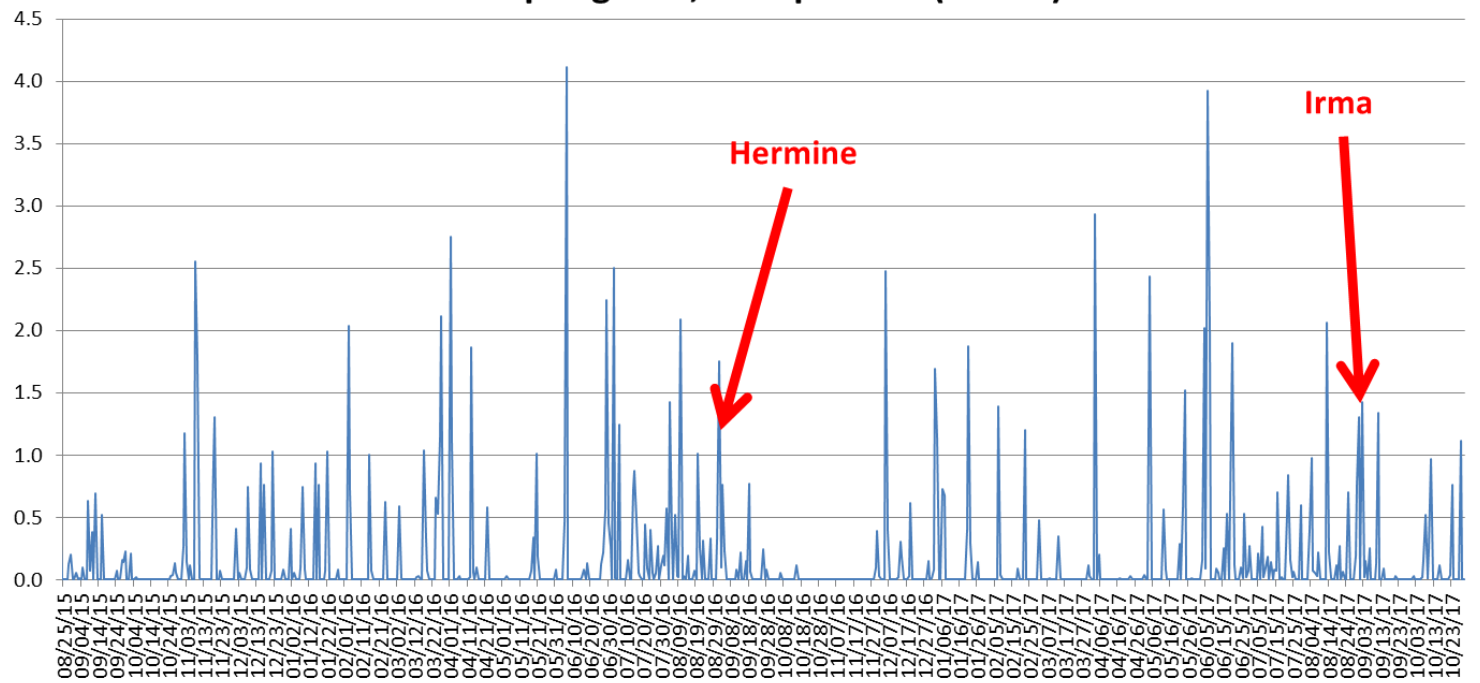
Wakulla Springs Discharge



Spring Creek Discharge



Wakulla Springshed, Precipitation (inches)





Lake Lafayette: 35.7% of Tallahassee Stormwater

Lake Jackson: 35.1% of Tallahassee's runoff



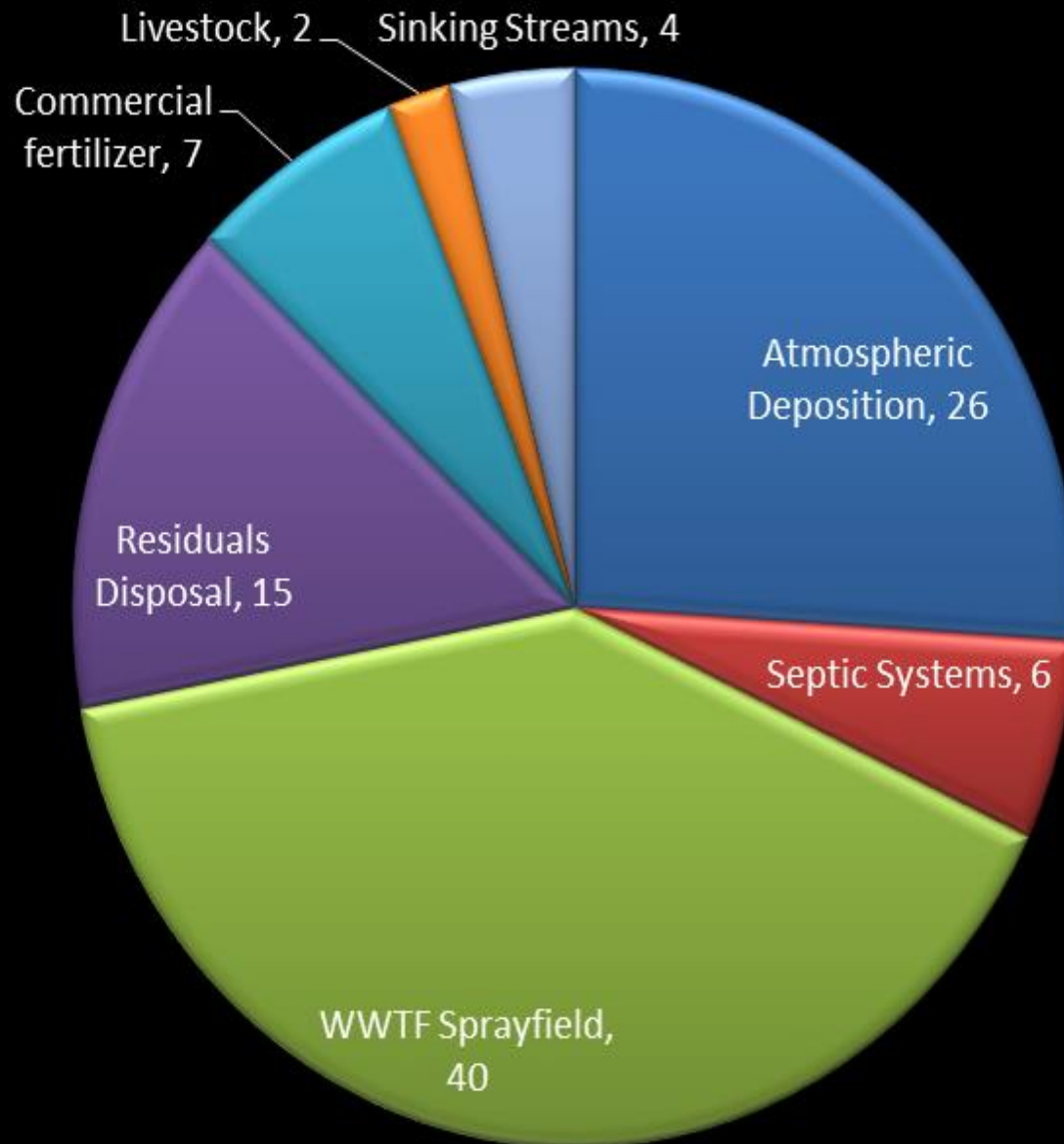
Lake Munson: 29.1% of Tallahassee's runoff





**Total
Maximum
Daily
Load**

Phase I, Nitrogen Loading to UFF (2011)



Nitrate Reduction

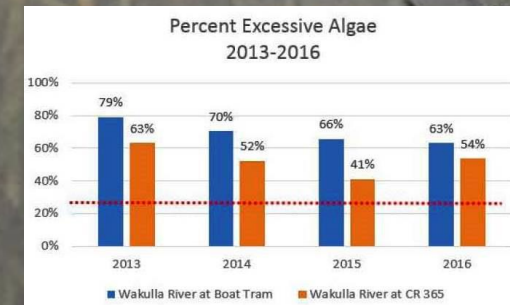
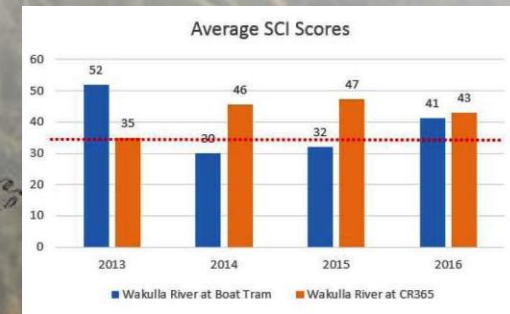
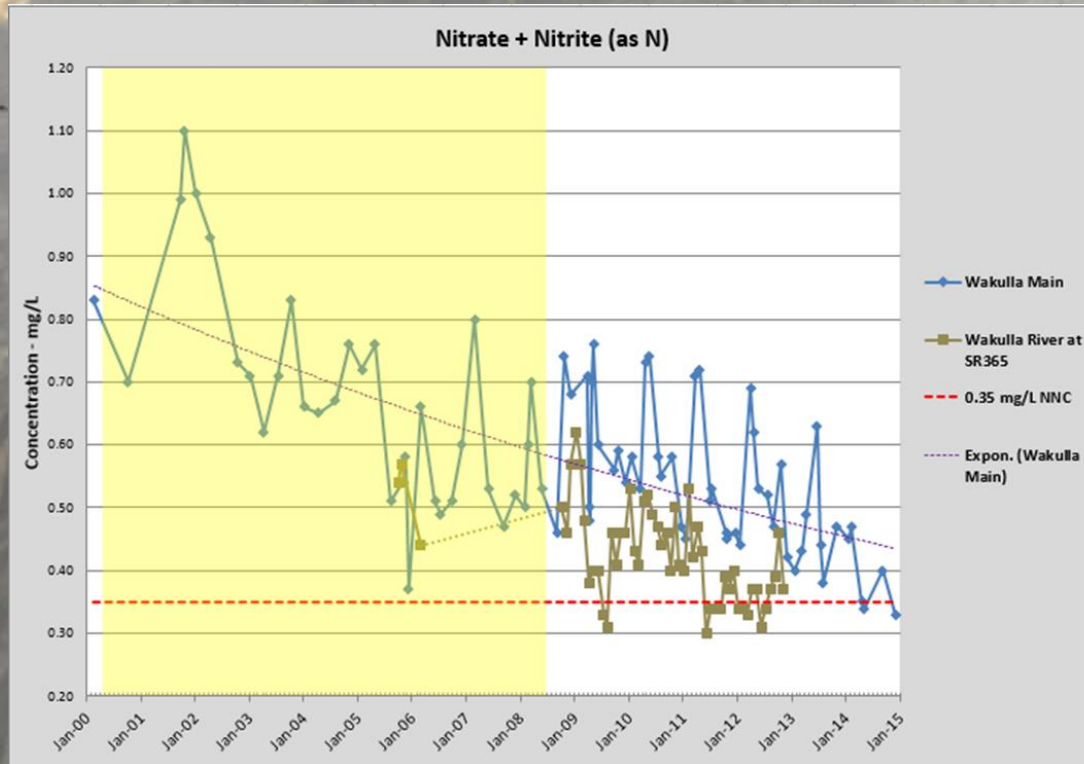
2000-2017

0.8 mg/L to 0.4 mg/L
Phase 1: 50% reduction

Cost

\$280,000,000

Nitrogen greatly reduced, Biological Indices still Fail



Phase II
Estimated
cost
\$120,000,000

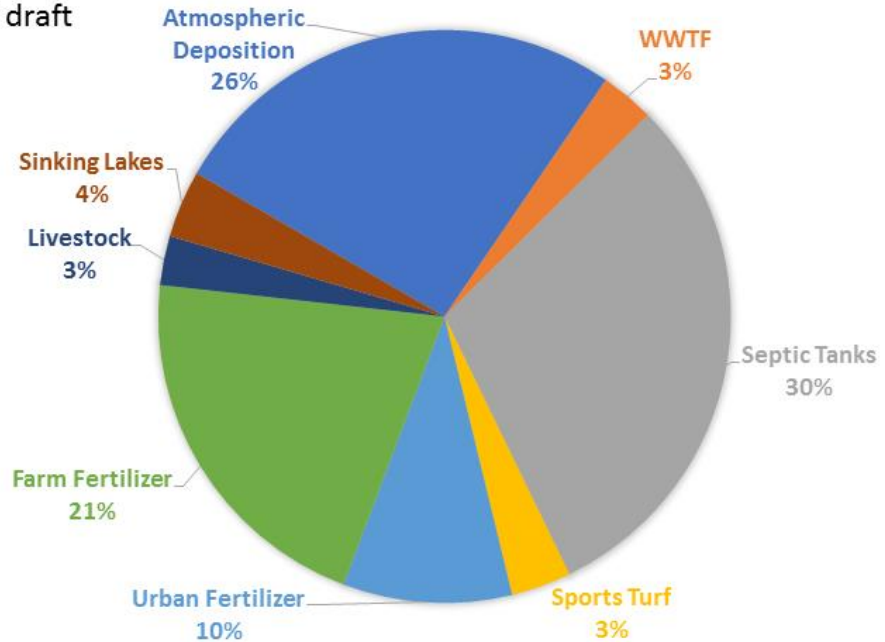
(then and now)

New Sinking Lakes
Category

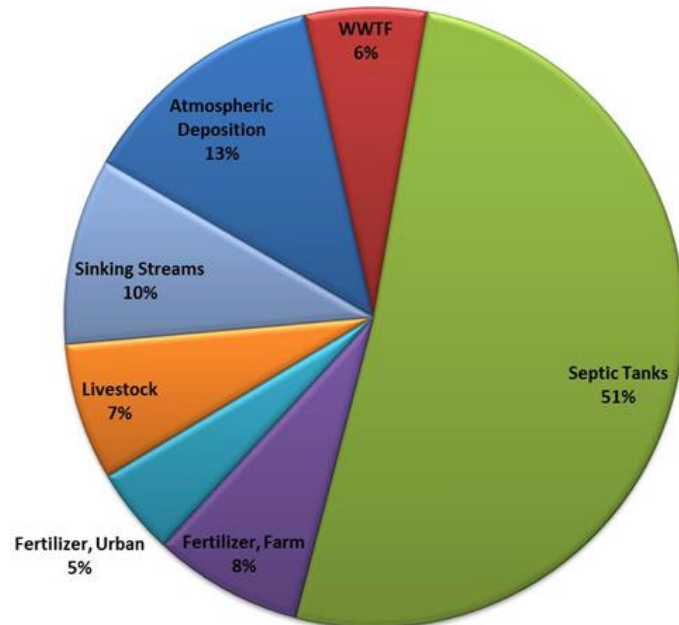
Septic Decrease

Fertilizer Increase

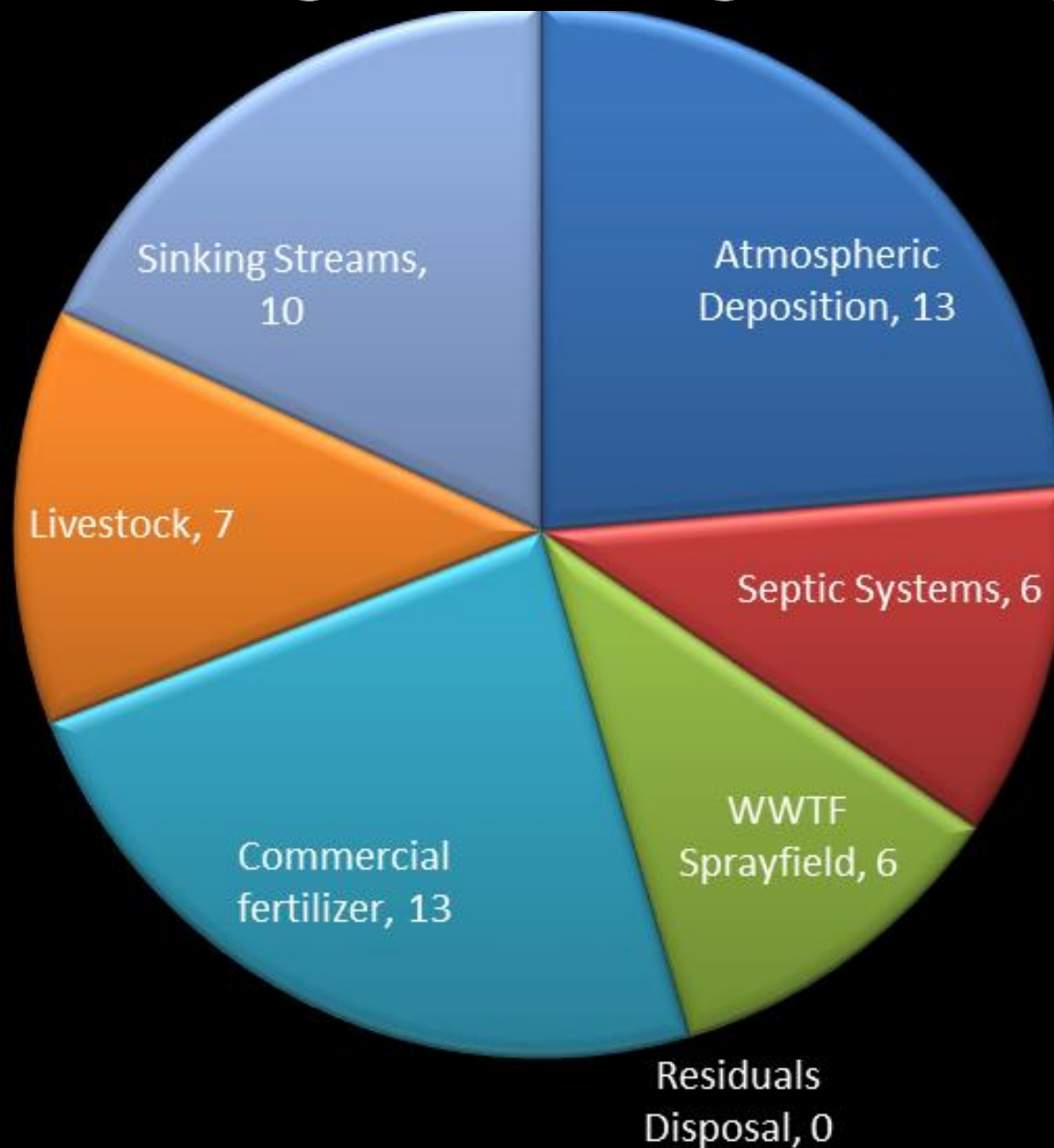
2017 draft



2014



Phase III, Nitrogen Loading to UFF (20??)

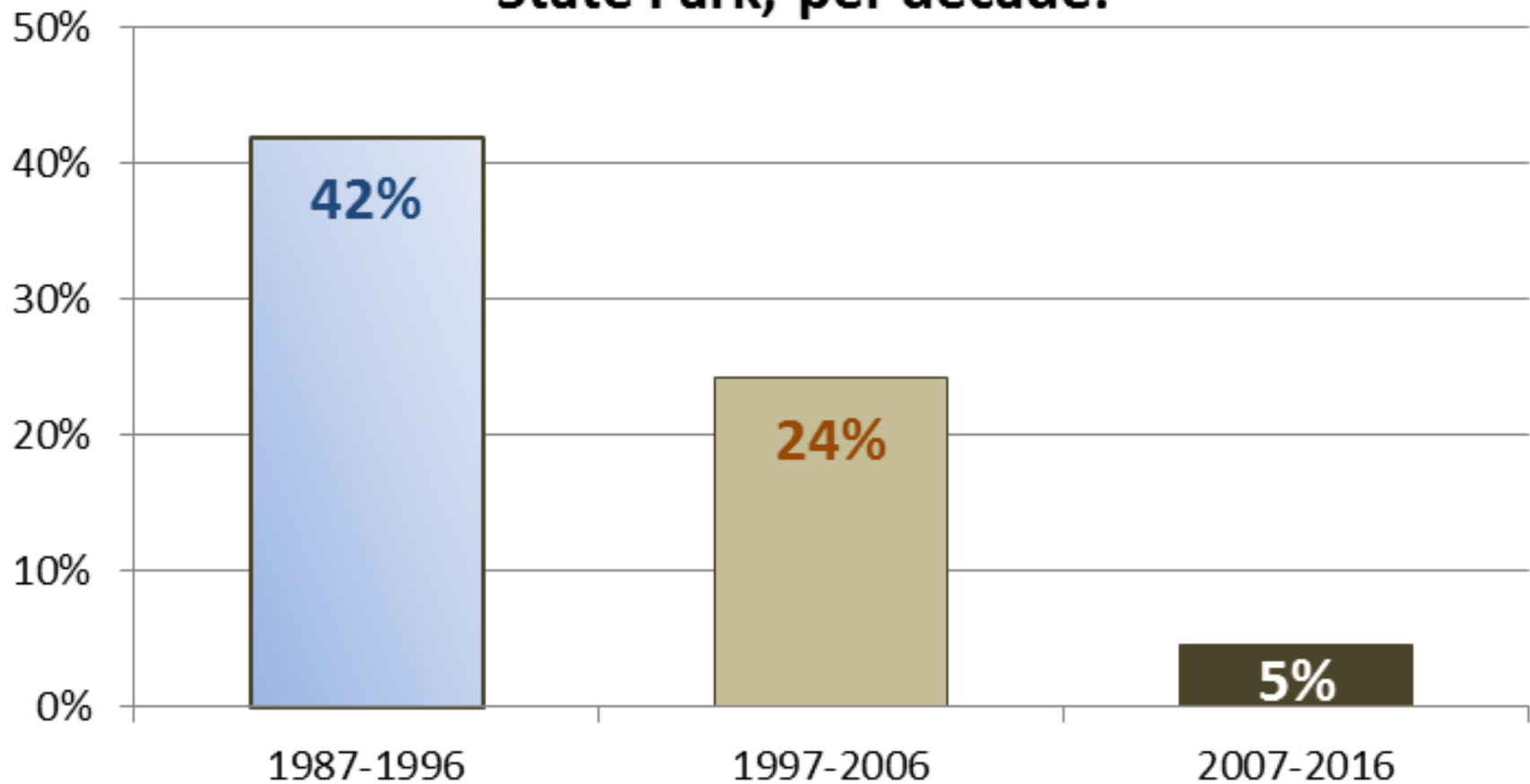




Dark Water



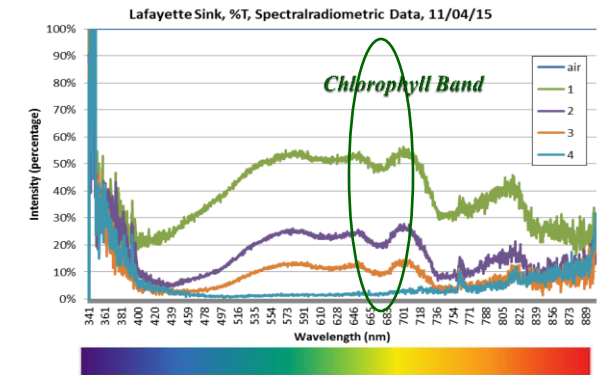
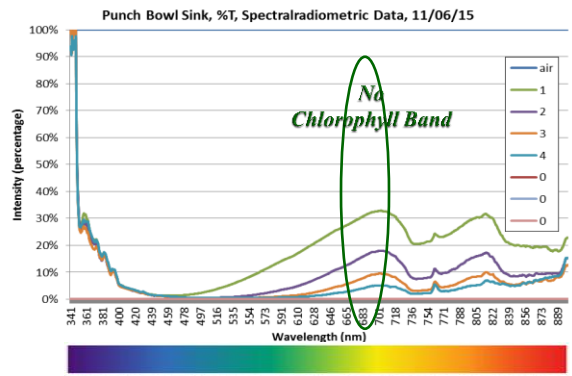
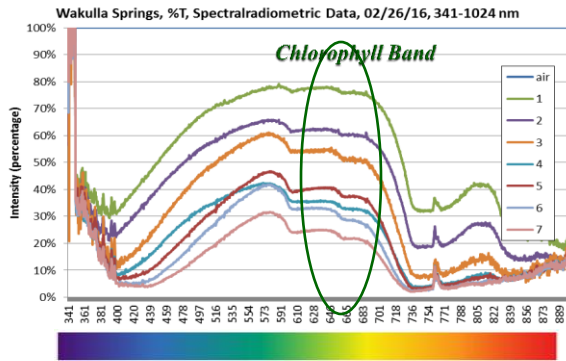
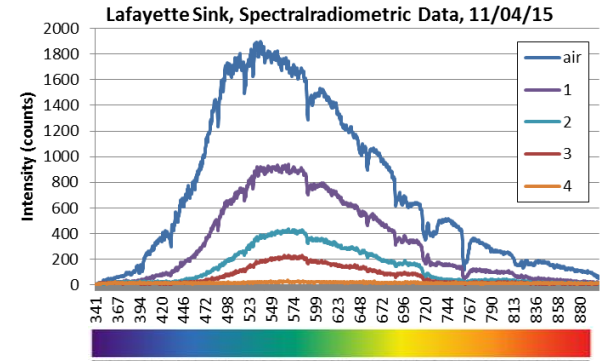
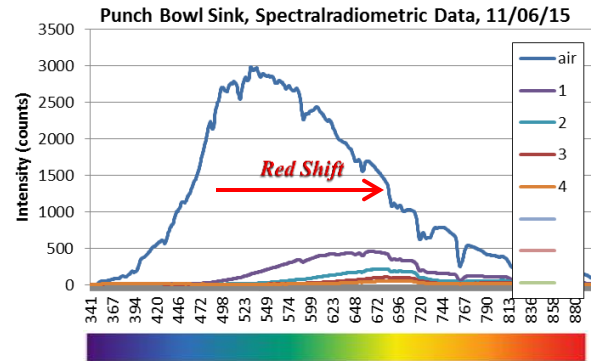
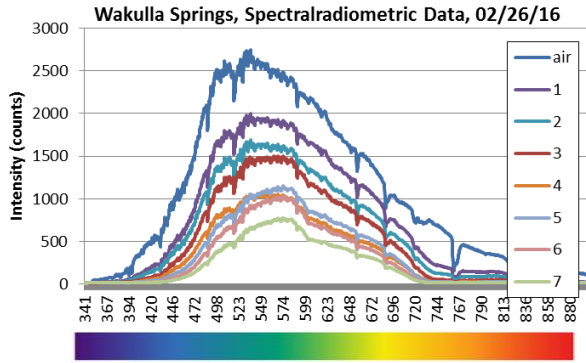
Daily Glass Bottom Boat runs at Wakulla Springs State Park, per decade.



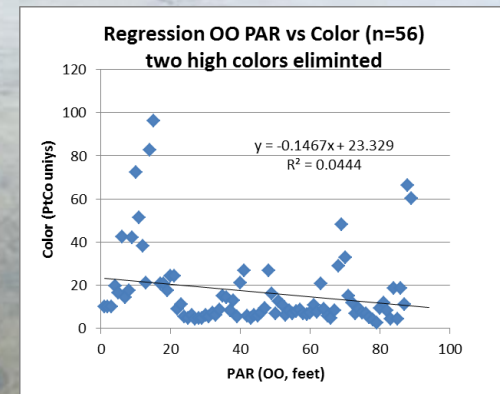
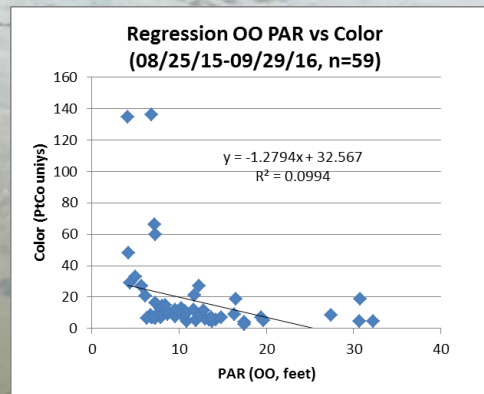
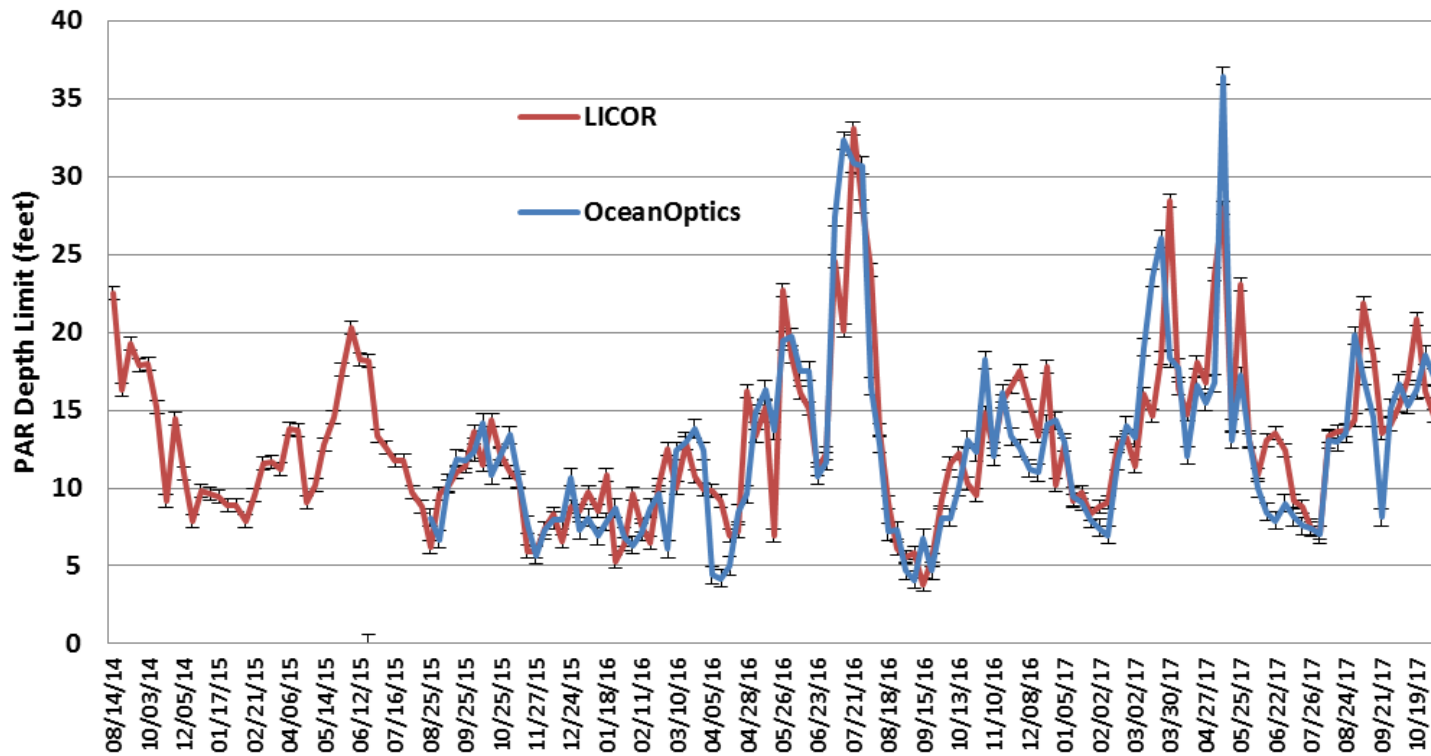
Wakulla Water

Sinking Stream Water

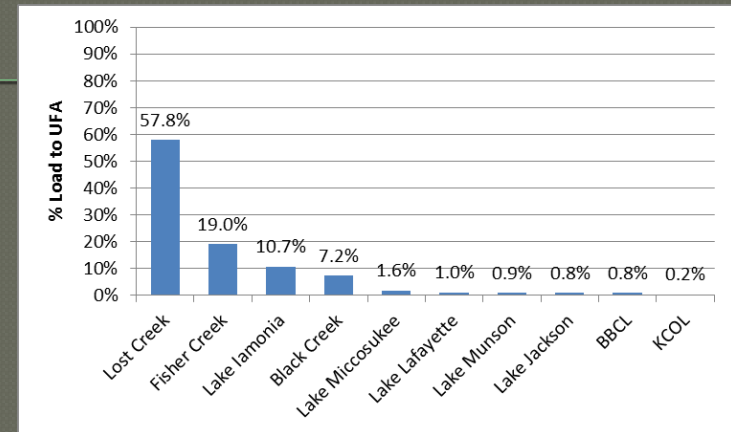
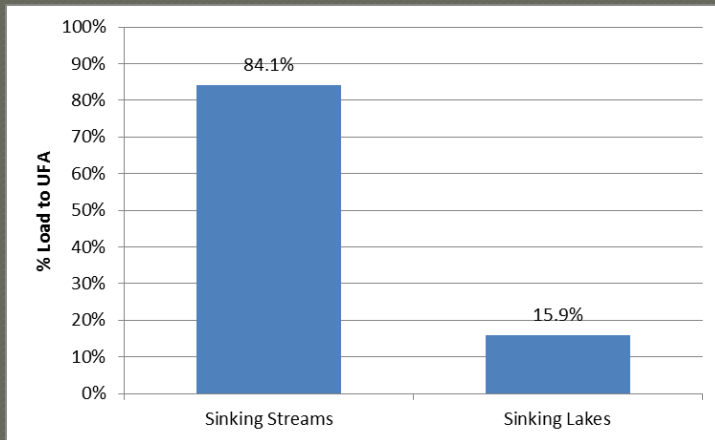
Sinking Lake Water



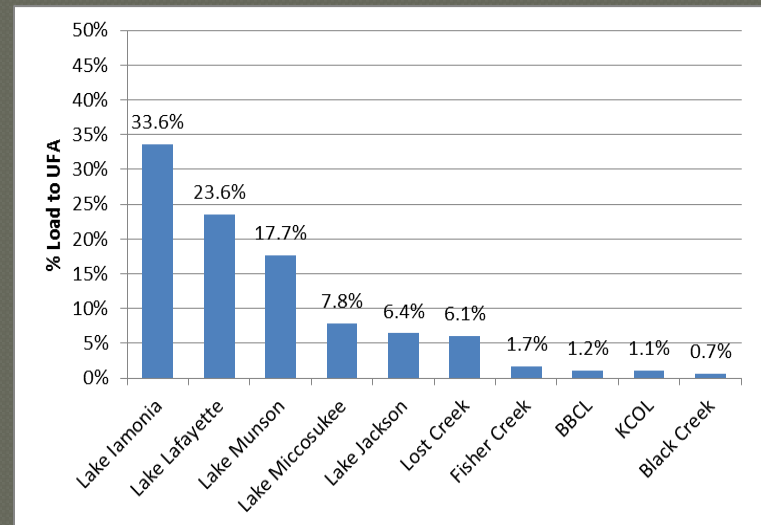
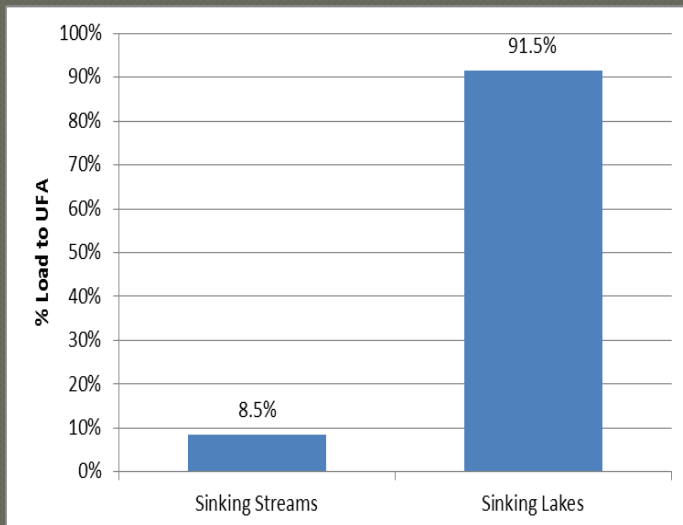
Wakulla Springs, Photic Depth, 0% PAR, 08/14/14 - 10/19/17



Color Loading

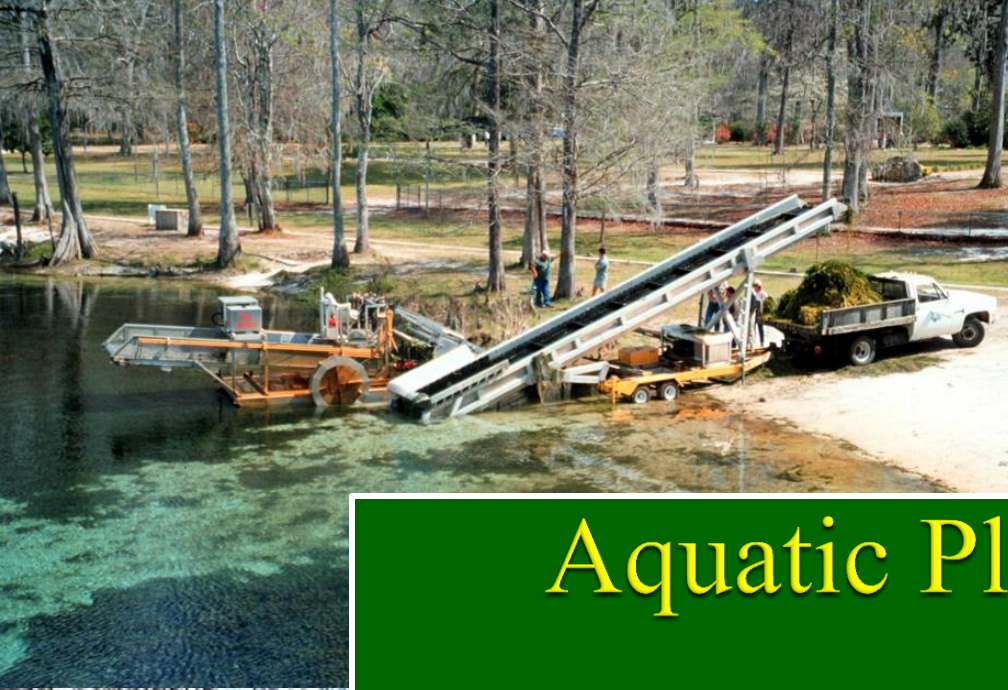


Chlorophyll Loading









Aquatic Plant Removal
The Past???

Lower nitrogen or more manatees?

Hydrilla removal
Wakulla Spring State Park
Photo by A. Murray
Copyright 2001 Univ. Florida





1960, Wakulla Spring, Healthy and Pristine



2013, Wakulla Spring, A Biological Desert









