

# Watershed Planning Lessons Learned from Florida's Springs

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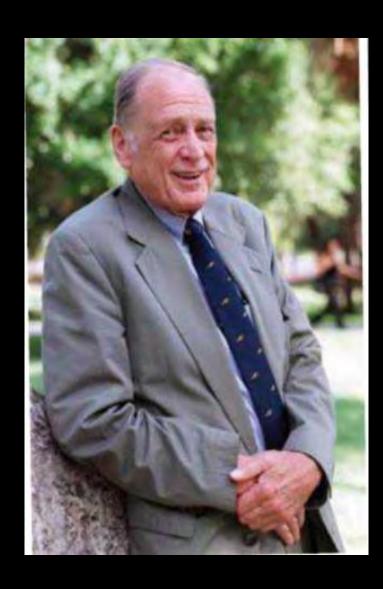
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## THIS WEBINAR:

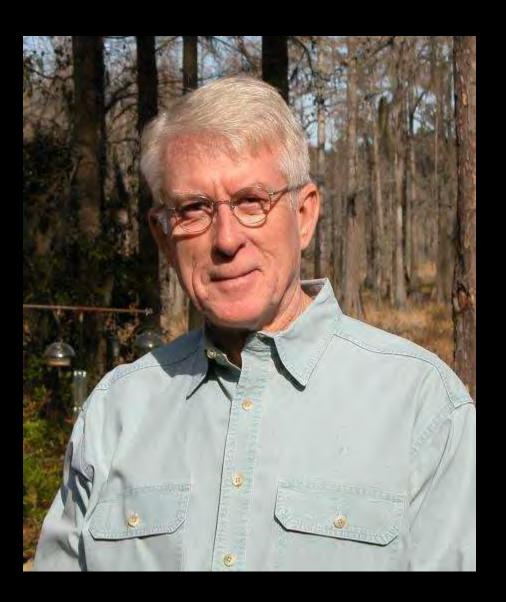
- Approved for 1.5 AICP CM for Planners - #24448
- Applied for CLE with Florida Bar – approval anticipated in October
- PowerPoint is available for downloading: www.1000friendsofflorida.org.
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## Presenters



## About Jim Stevenson



- Retired as Senior Biologist after 38-year career at the Department of Environmental Protection
- Chief Biologist for Florida State Parks System for 20 years
- Coordinated spring basin working groups for Wakulla Spring and Ichetucknee Springs for 18 years
- Chaired the Florida Springs Task Force and directed Governor's Florida Springs Initiative
- State of Florida named "Stevenson Spring" on the Suwannee River in his honor
- Governor and Cabinet dedicated the "Jim Stevenson Resource Manager of the Year Award," given annually

# About Robert L. Knight, Ph.D.

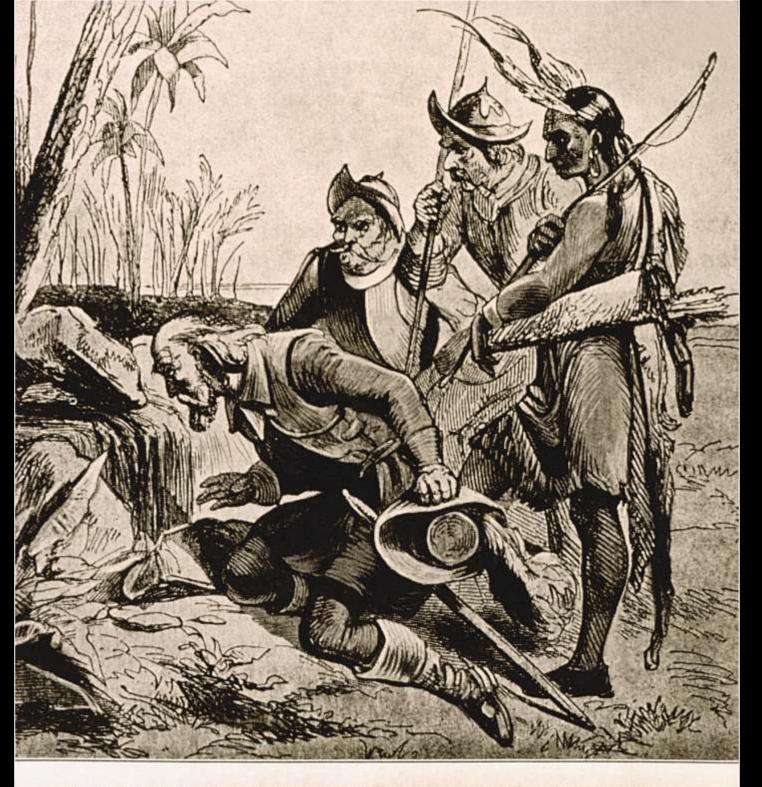


- Environmental scientist with more than 35 years of professional experience in Florida.
- Founder and president of the Howard T. Odum Florida Springs Institute
- Adjunct professor in the Department of Environmental Engineering Sciences at the University Florida
- Active on restoration efforts at the following springs: Santa Fe River, Kings Bay/Crystal River, Ichetucknee, Rainbow, Wakulla, Glen, and Silver Springs

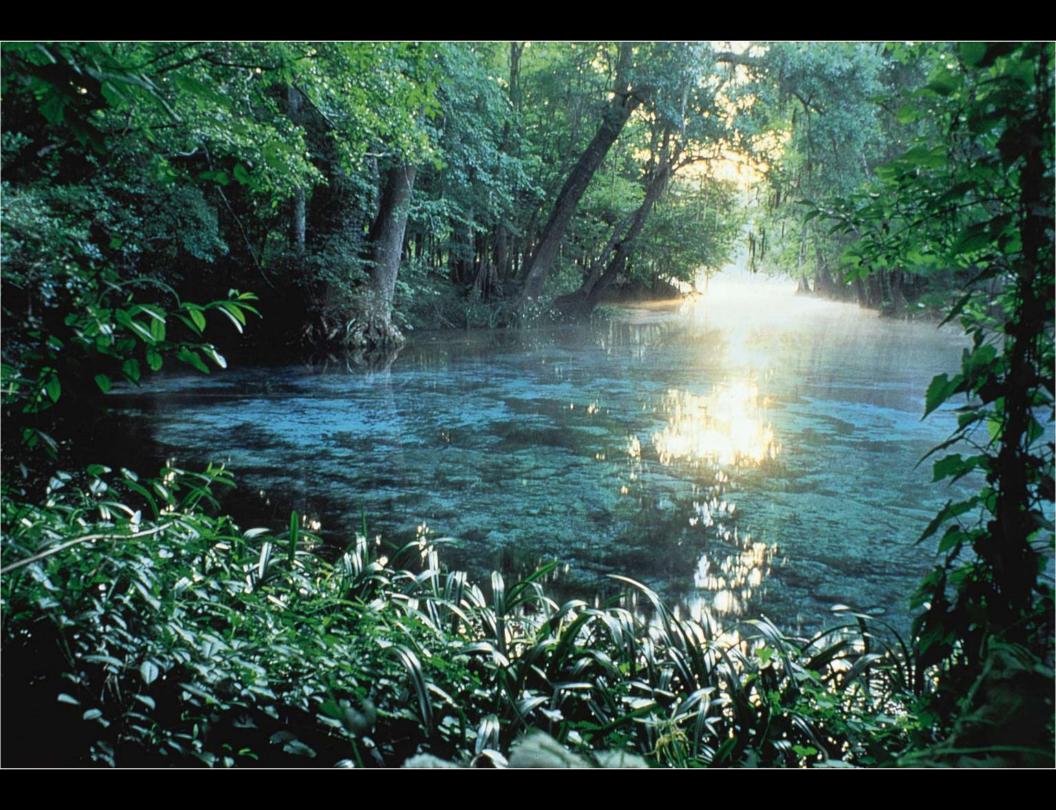


# Florida Springs

Natural Gems -- Troubled Waters



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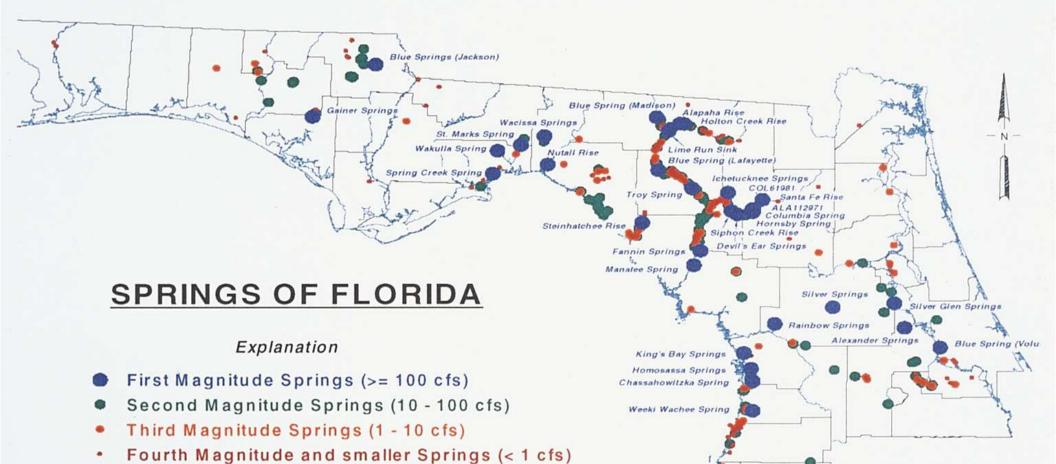




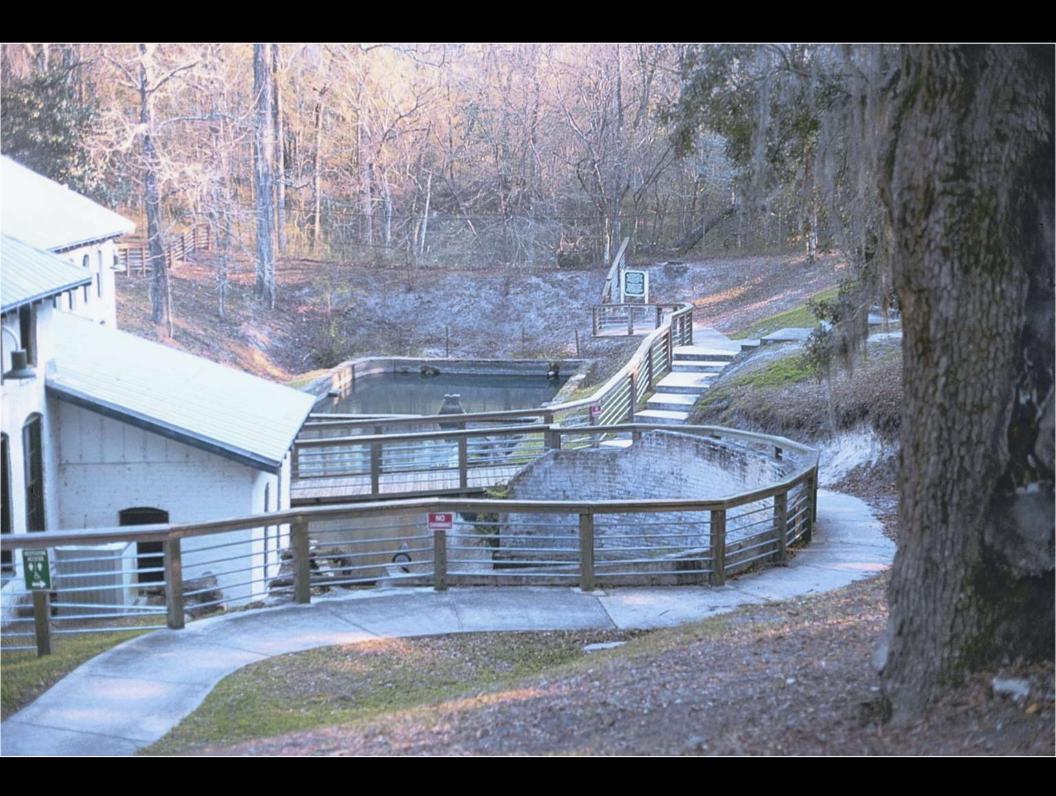








and Springs with unknown Magnitude

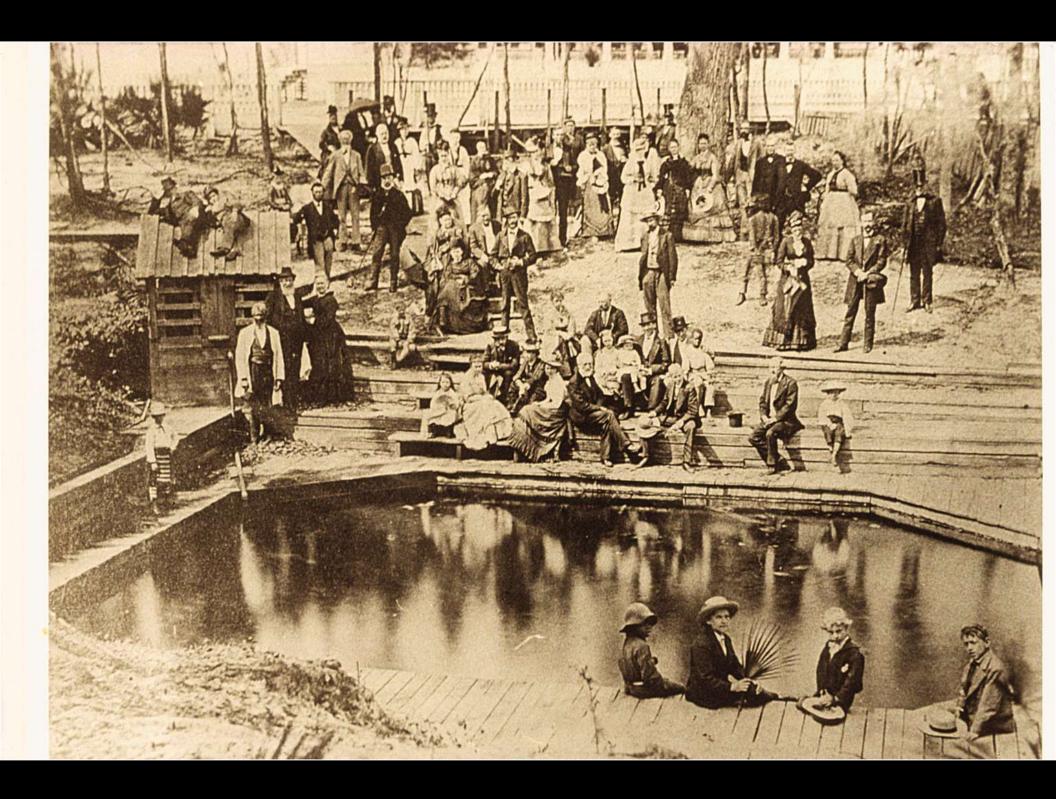






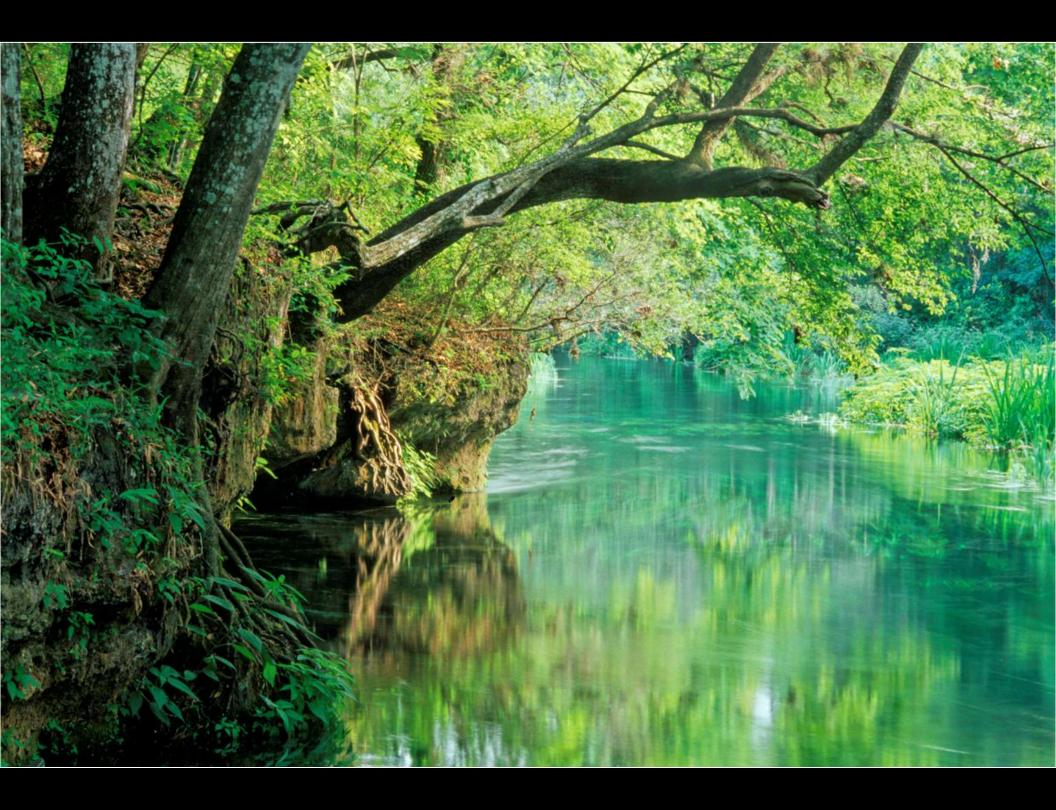
6221. SILVER SPRINGS ON THE OCKLAWAHA, FLA.

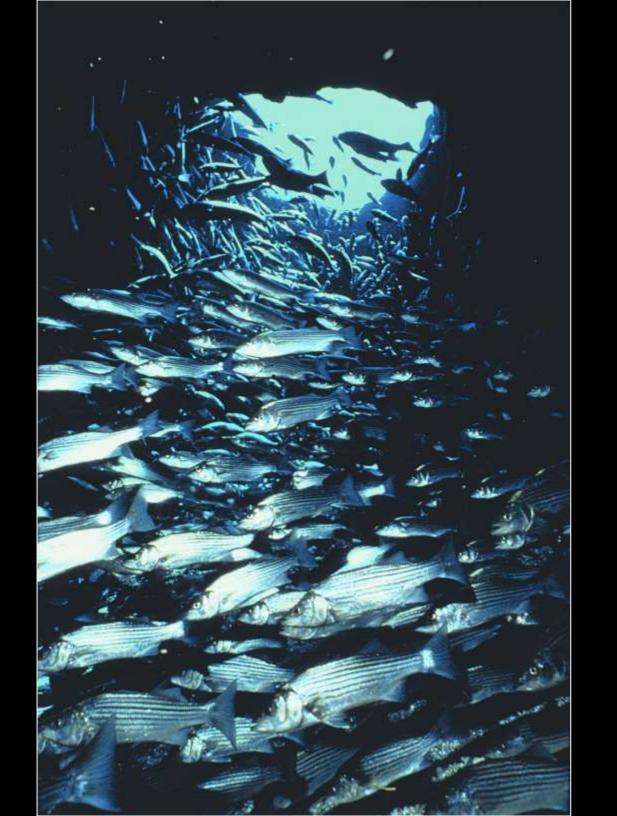






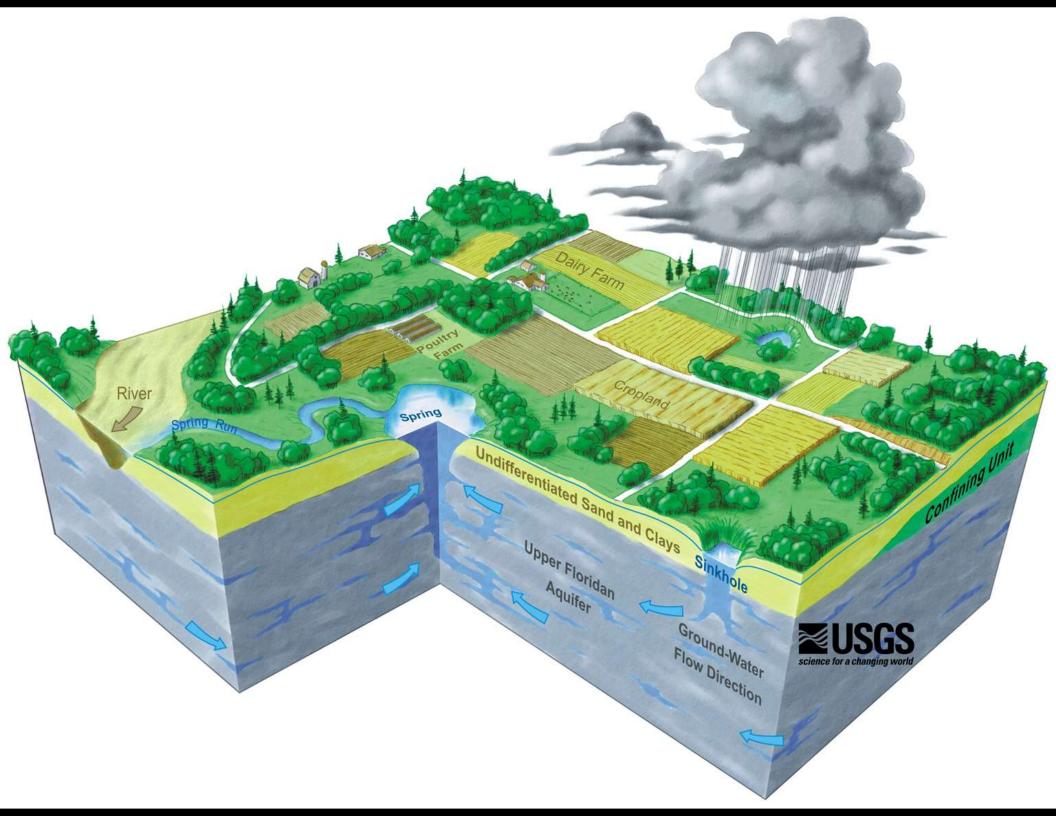


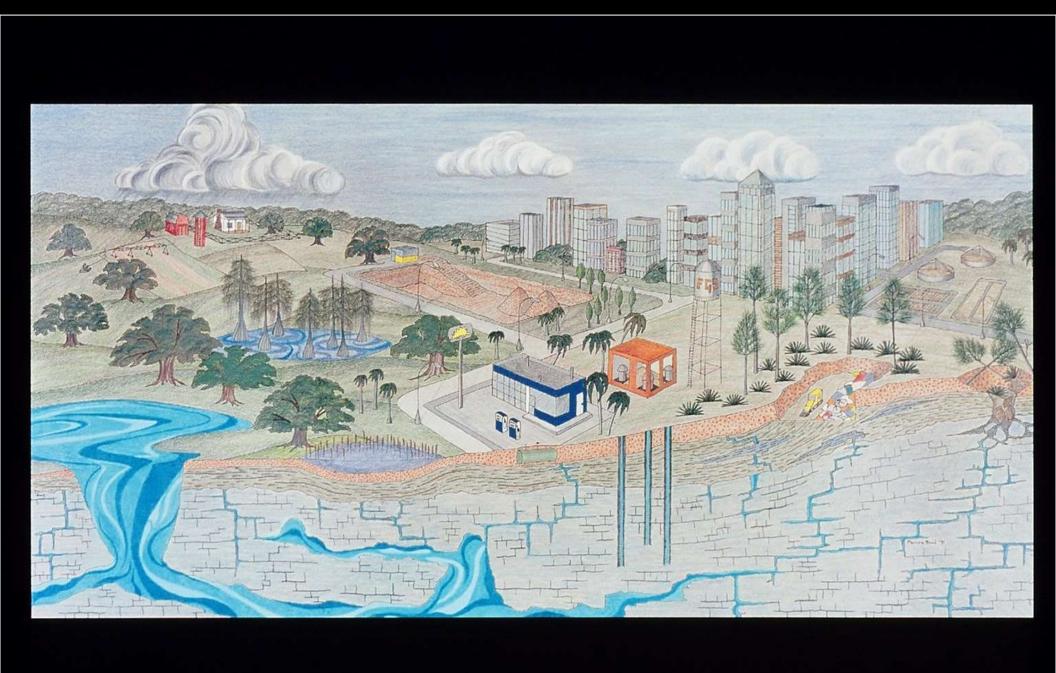


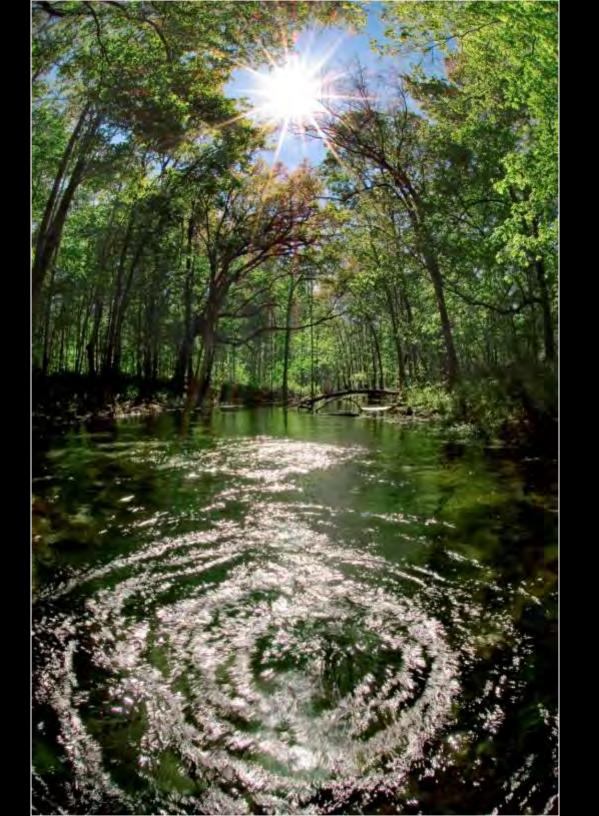


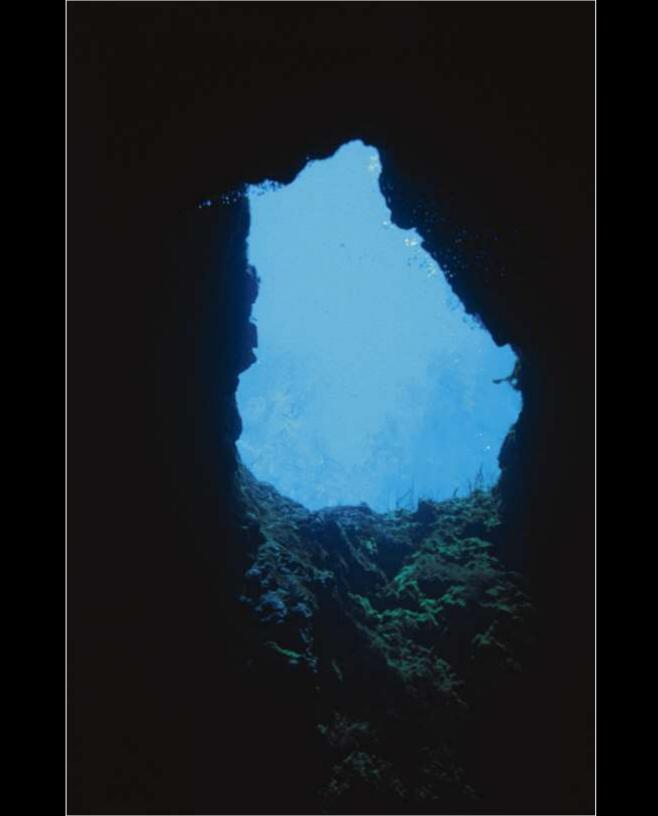


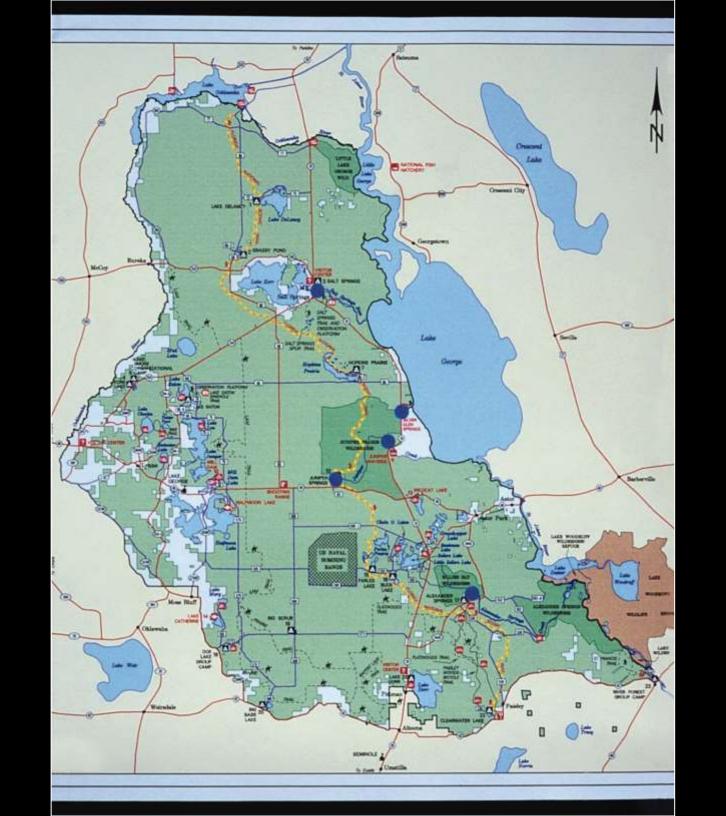




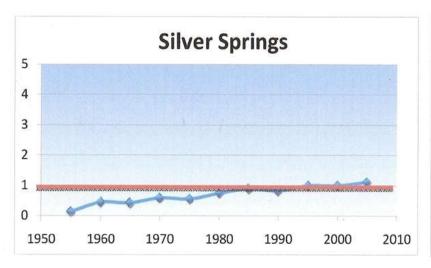


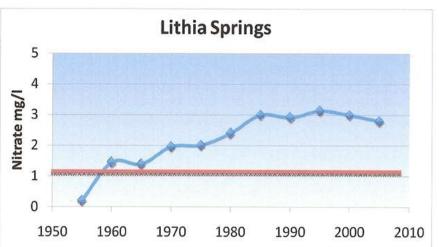


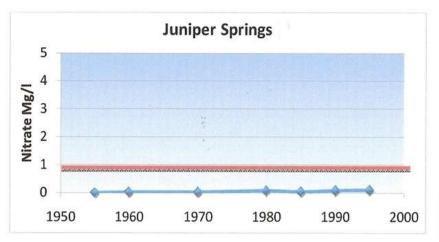


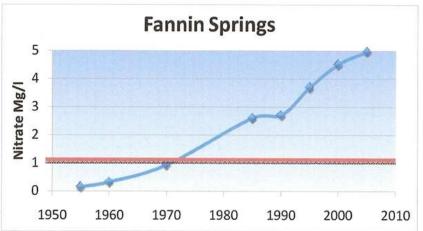


### 60 Year Nitrate Trend in 4 Florida Springs





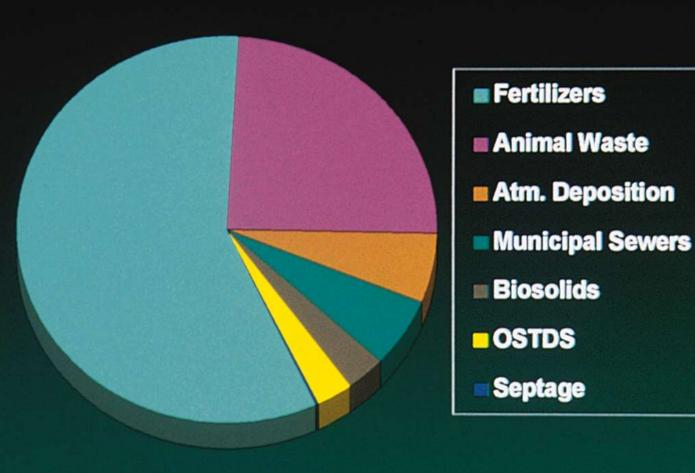






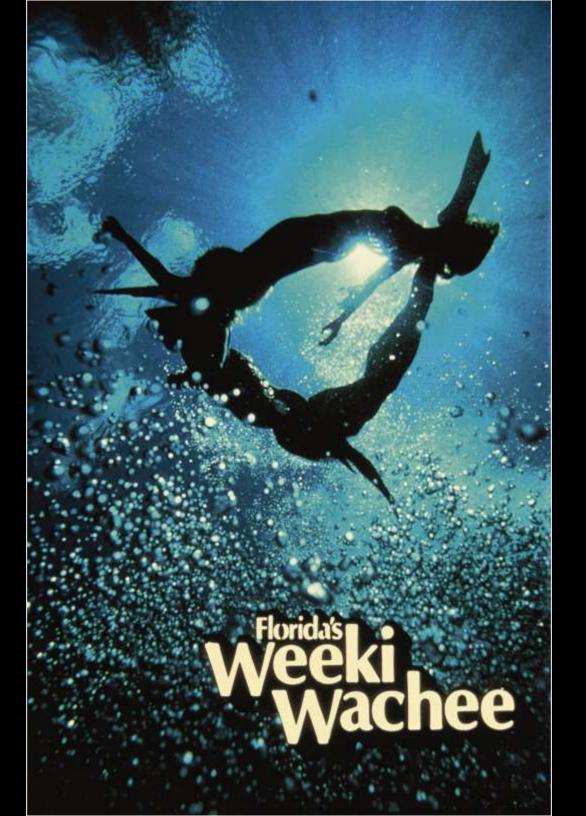
# Nitrogen Sources in Florida

source: Mayer, 1995







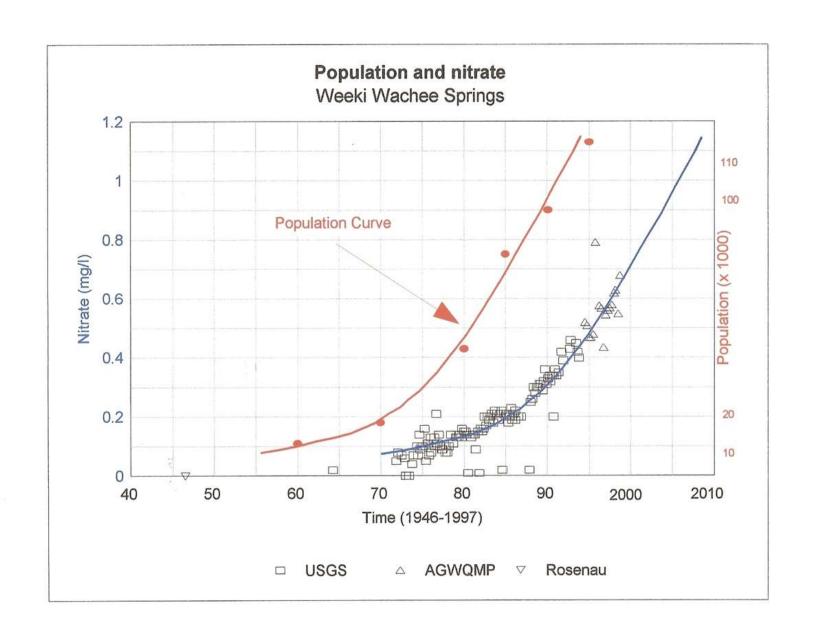


#### Weeki Wachee Springs



0.0500.08.1 Miles









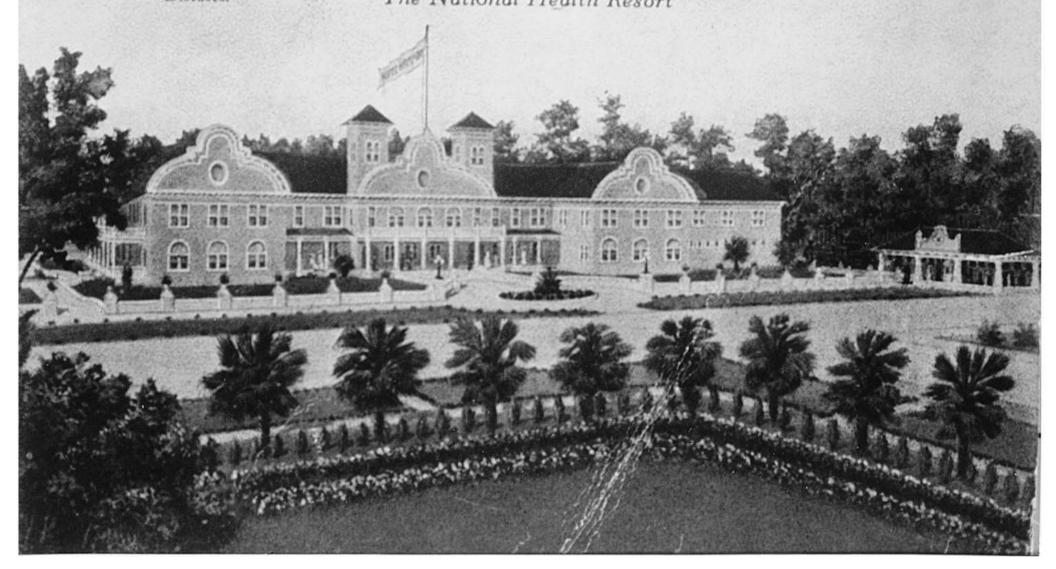




Guaranteed for Rheumatism, Indigestion, Dyspepsia, Stomach, Kidney, Bladder Troubles, Gastritis and Skin Diseases.

### HAMPTON SPRING WATER Hotel Hampton The National Health Resort

HAMPTON SPRINGS TAYLOR COUNTY FLORIDA







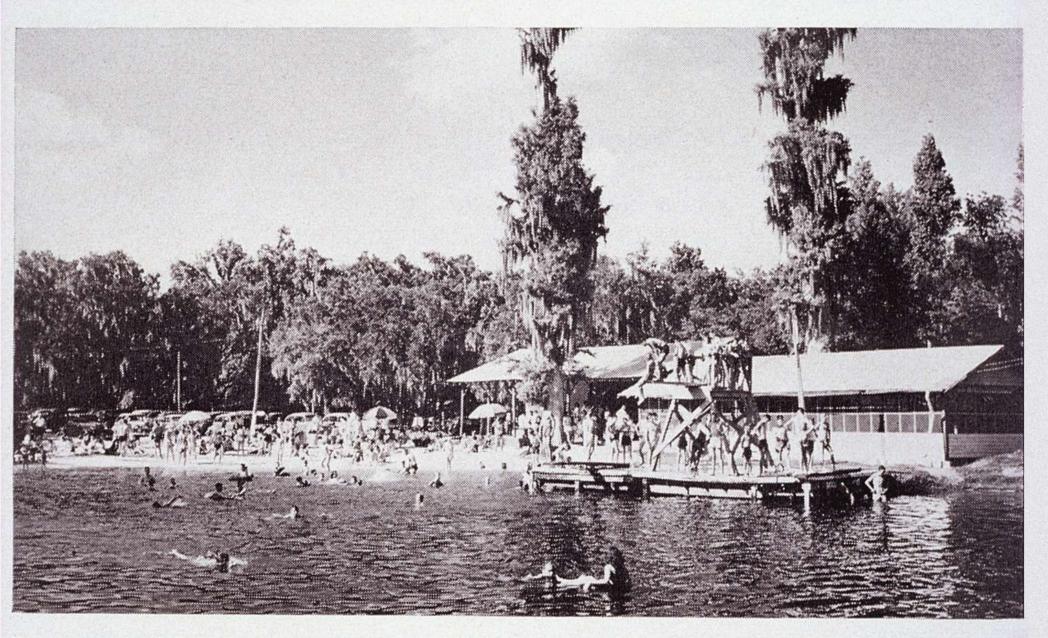


FIGURE 28. General view of recreational developments at Kissengen Springs







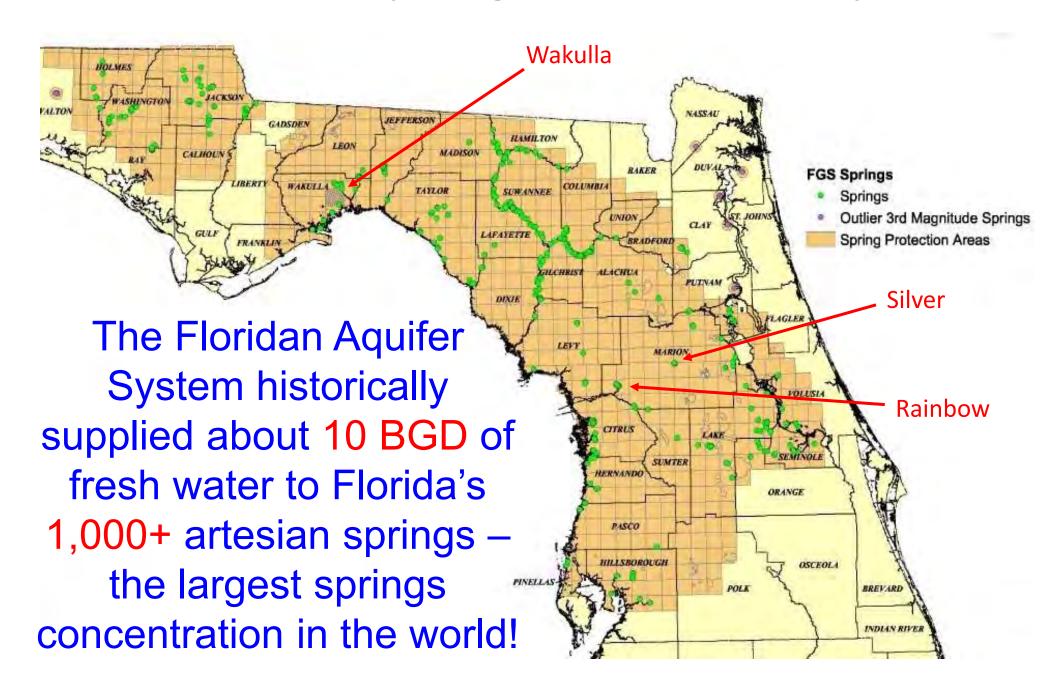
# Florida Springs Task Force Protection Strategies

- Spring Basin Work Groups
- Education
- Land Use Planning
- Land Acquisition
- Spring Flow Protection
- Best Management Practices

- Regulations
- Monitoring
- Research
- Spring Management
- Endangered Species
- Funding



#### Florida Springs Location Map



#### Springs Support a Unique Ecology

Florida's springs are essential habitat for a diverse and unique assemblage of plants and wildlife









#### **Springs Provide Economic Benefits**

The direct economic value of Florida's largest springs is estimated to be over \$300,000,000 per year









### Springs Are Protected by Law

- Outstanding Florida
   Waters
  - The standard is "no degradation"
  - Springs with declining flows often have: increasing temperature, specific conductance, and nitrate; and decreasing dissolved oxygen and water clarity- All violations of OFW requirements!



Wes Skiles photo

#### But, most springs are impaired by algal mats ...

- Kings Bay
- Volusia Blue
- Wekiwa
- Jackson Blue
- Silver Springs
- Rainbow
- WeekiWachee
- Fanning
- Manatee
- Wakulla
- etc<sub>(FDEP)</sub>



Silver



Weeki Wachee



Jackson Blue

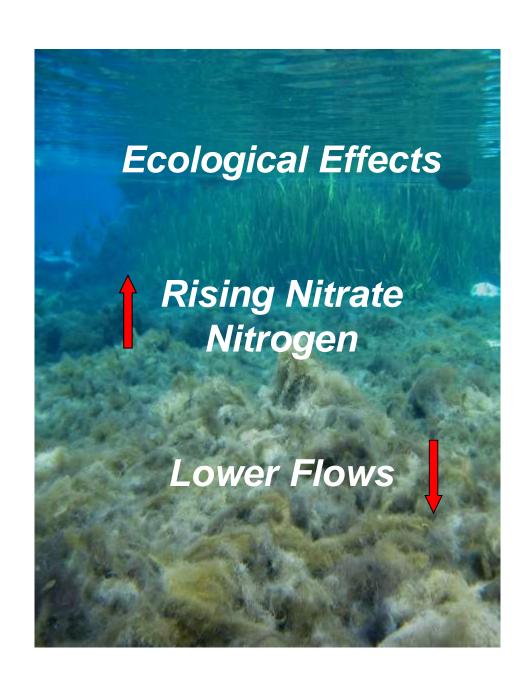


Rainbow

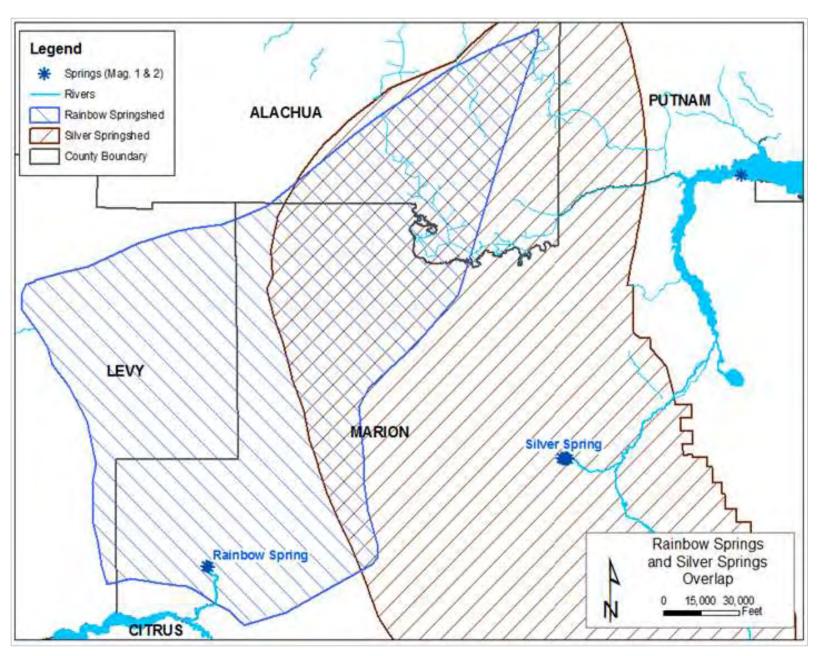
### Springs Impairments

Synergistic Effects of Decreasing Flows and Increasing Nitrate:

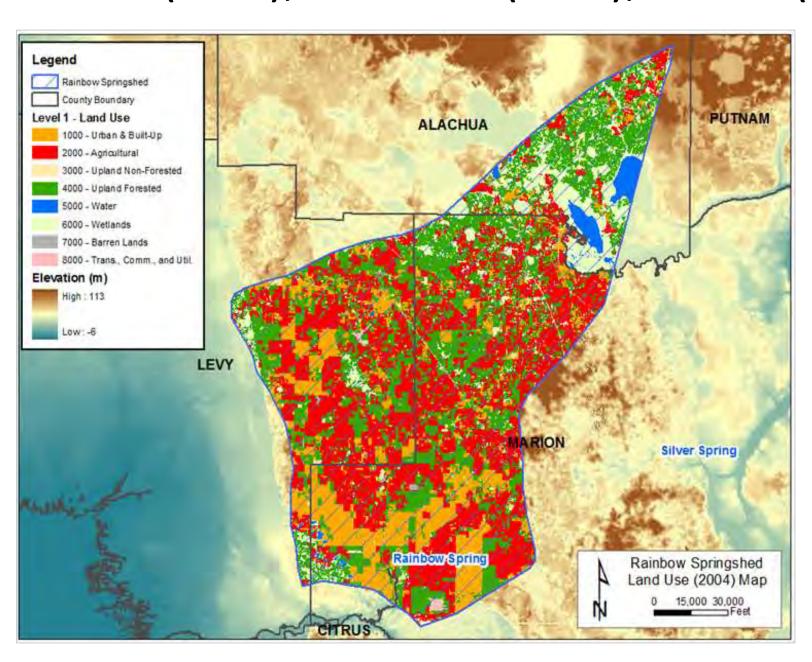
- Increased algal densities
- Declining cover of native plants
- •Reduced photosynthetic efficiencies
- Declining native fish and turtle populations
- •Invasions by exotic fish and wildlife species, etc.



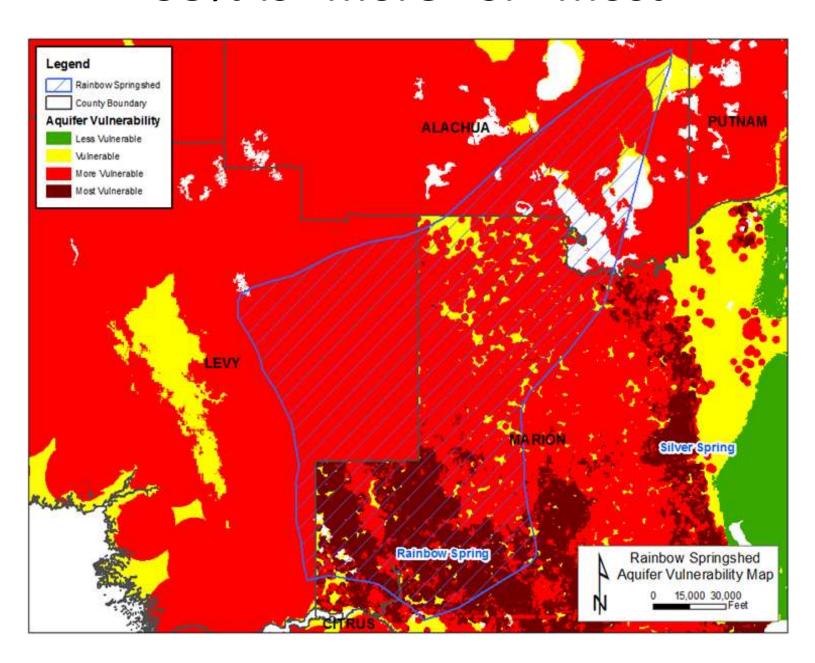
## Rainbow Springshed Maximum Extent: 472,000 acres (737 mi<sup>2</sup>)



## Rainbow Springshed 2004 Land Uses: agriculture (37%), forested (33%), urban (17%)



### Rainbow Springshed Aquifer Vulnerability: >95% is "more" or "most"



### Rainbow Springs Problem – Part I

### Groundwater resources are stressed:

- Groundwater consumption is increasing
- Groundwater levels are falling
- Spring flows are declining



Agriculture

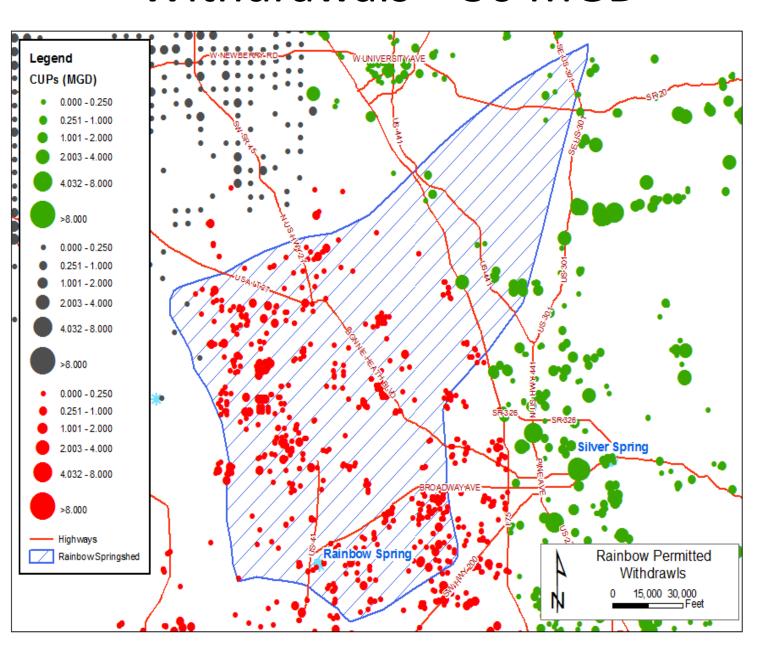


Residential



**Golf Courses** 

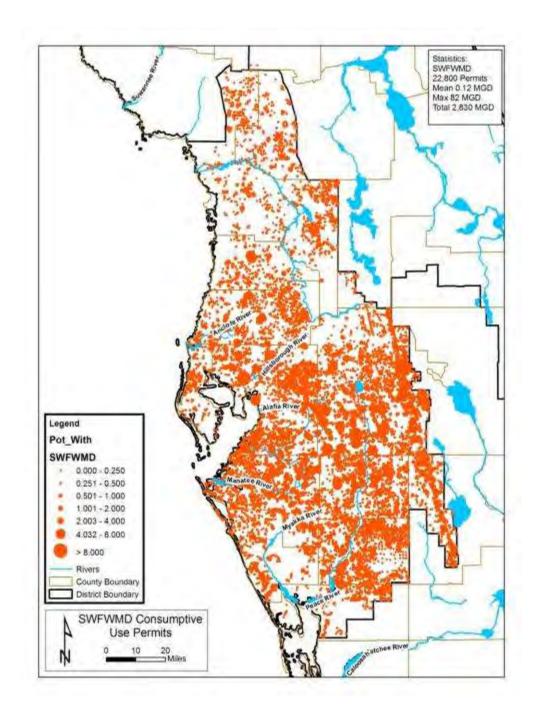
### Rainbow Springshed Permitted Groundwater Withdrawals = 50 MGD



#### **SWFWMD Groundwater Permits**

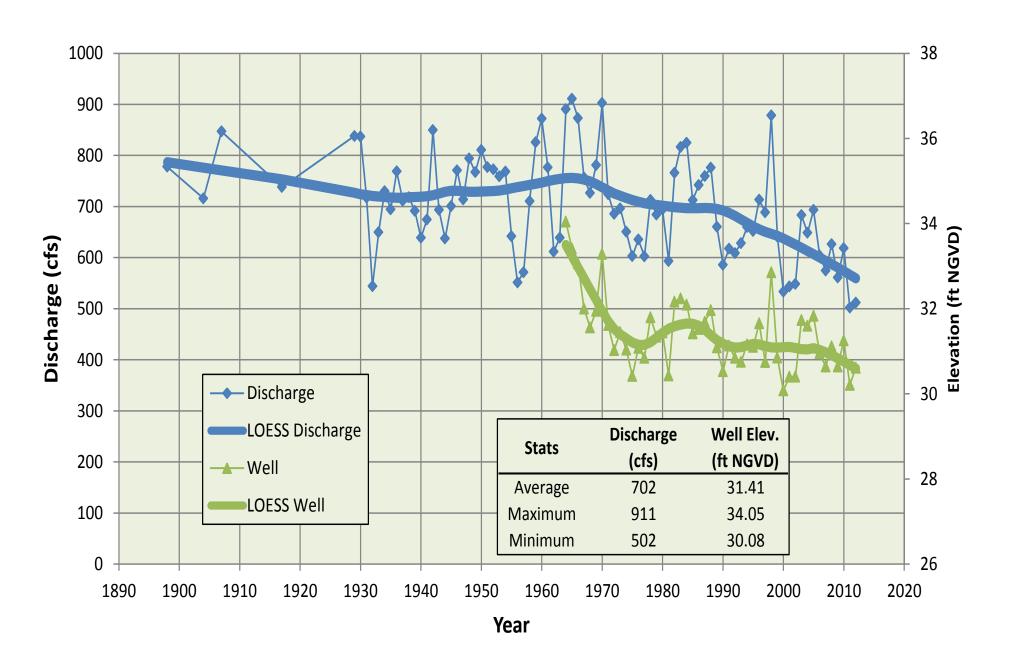
## Existing Groundwater Consumptive Use Permits:

- Total permits 22,800
- Estimated 2010
  pumping 965 MGD
  = 39% of average
  aquifer recharge
- Total allocatedgroundwater use –2,830 MGD = 116% oflocal recharge!



Water Management District data

## Declining Rainbow Springs Flows (142 MGD) and Groundwater Elevations (3 ft)





## Rainbow Spring Flows are Declining

#### Key Findings:

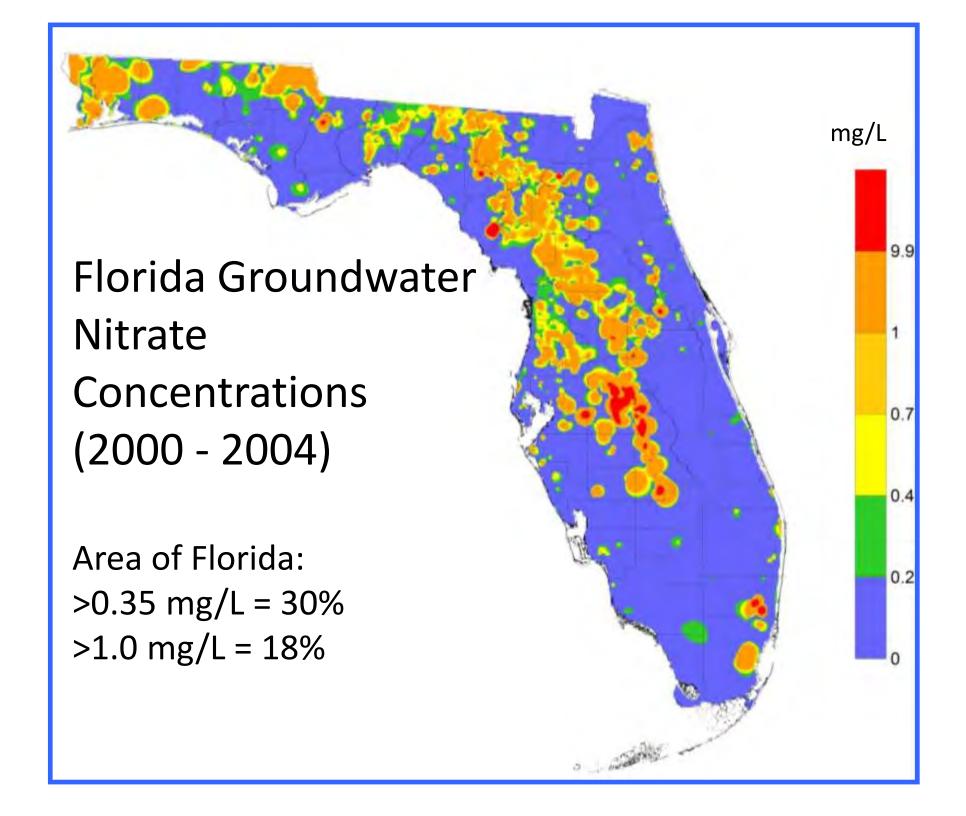
- Average flow decline at Rainbow
   Springs is estimated as 25 percent, well beyond the range typically recognized as "significant harm";
- A large fraction of this flow declines is resulting from excessive groundwater uses outside the Rainbow Springshed;
- Regional groundwater pumping will need to be reduced by about 60% to restore protective flows at Rainbow Springs.

### Rainbow Springs Problem – Part 2

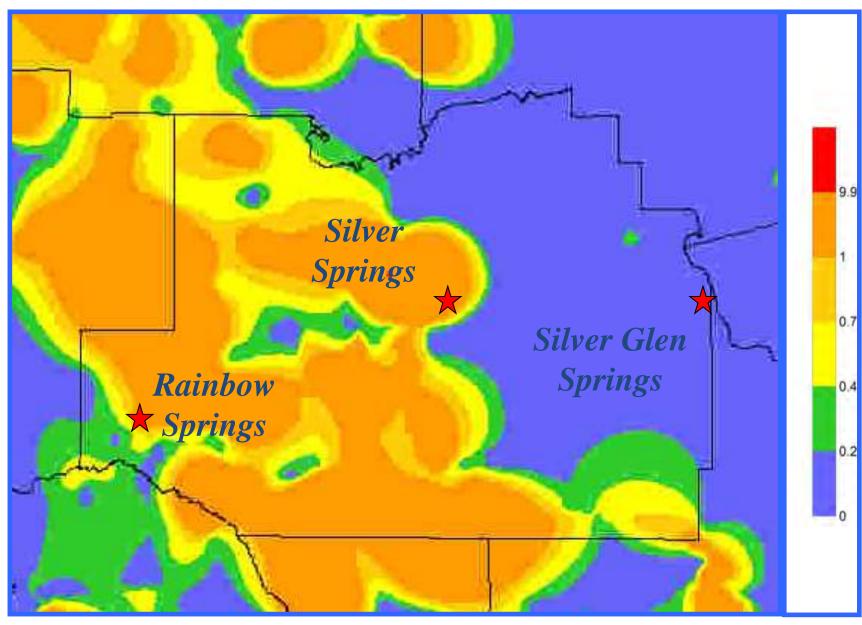
- GW nitrate nitrogen levels are increasing:
  - Nitrate contamination is widespread in the Floridan Aquifer
  - Springs are sensitive to elevated nitrate



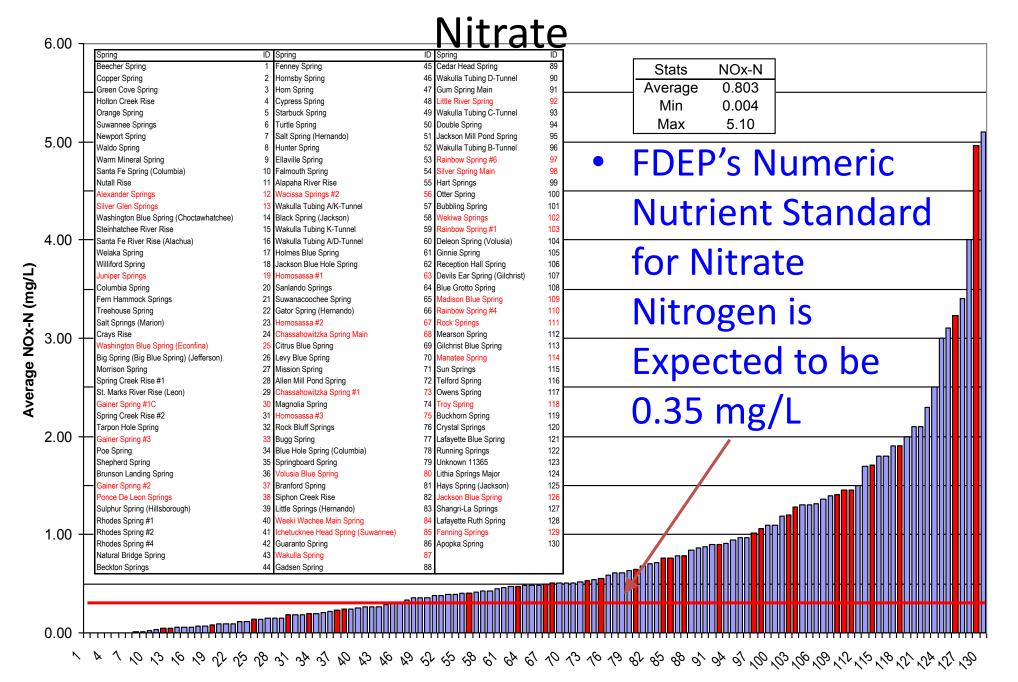




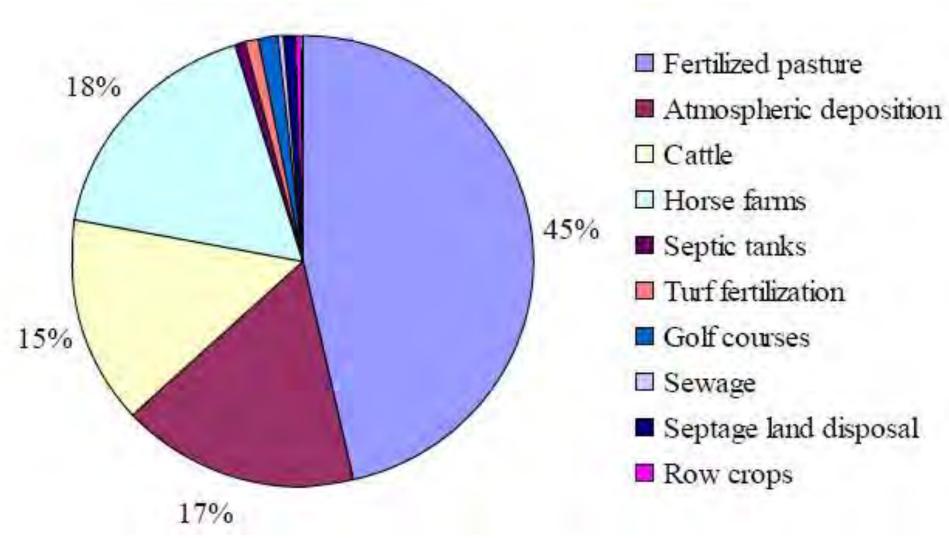
### Marion County Groundwater Nitrate Concentrations (mg N/L)



#### >60% of Florida's Springs are Impaired by



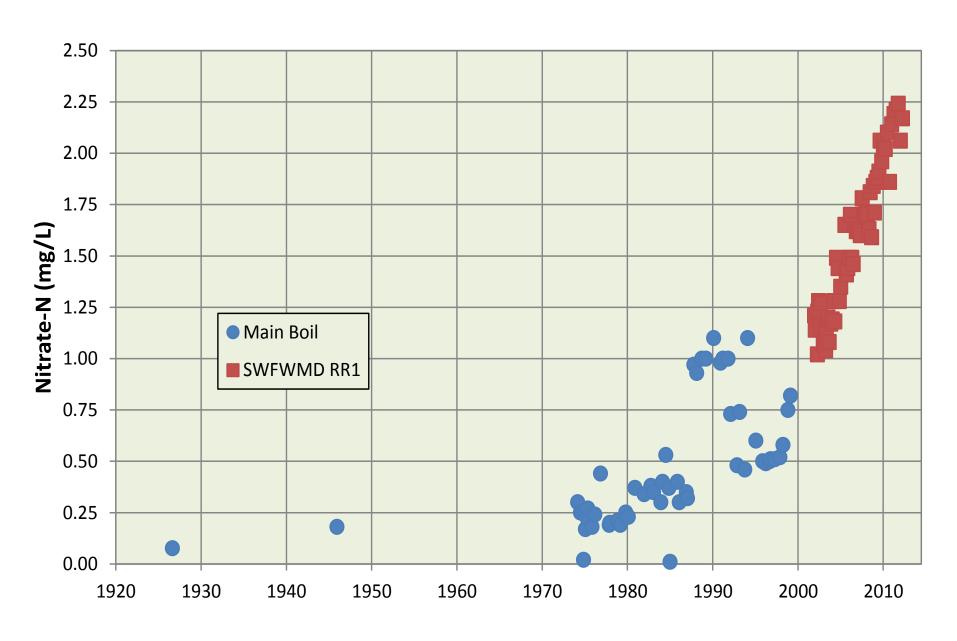
### Rainbow Springs Nitrogen Sources



(Jones et al. 1996)

Agriculture = 95%

### Rainbow Springs Nitrate Concentrations: 2,700% increase since 1920s



#### Rainbow Springs Annual Nitrate Loads

Period	Avg. Flow (cfs)	Avg. Nitrate-N (mg/L)	Nitrate-N Annual Load (MT)
1925-1934 <sup>1</sup>	719	0.08	49
1935-1944	708		
1945-1954 <sup>2</sup>	763	0.18	123
1955-1964	709		
1965-1974 <sup>2</sup>	771	0.30	207
1975-1984	693	0.26	161
1985-1994	675	0.69	415
1995-2004	653	0.97	565
2005-2012	587	1.75	917

<sup>&</sup>lt;sup>1</sup>Flow is for 1929-1934 with Nitrate-N from 1927

<sup>&</sup>lt;sup>2</sup>Only a single Nitrate-N concentration available



### Nitrate is the Principal Pollutant in Rainbow Springs

#### Key Findings:

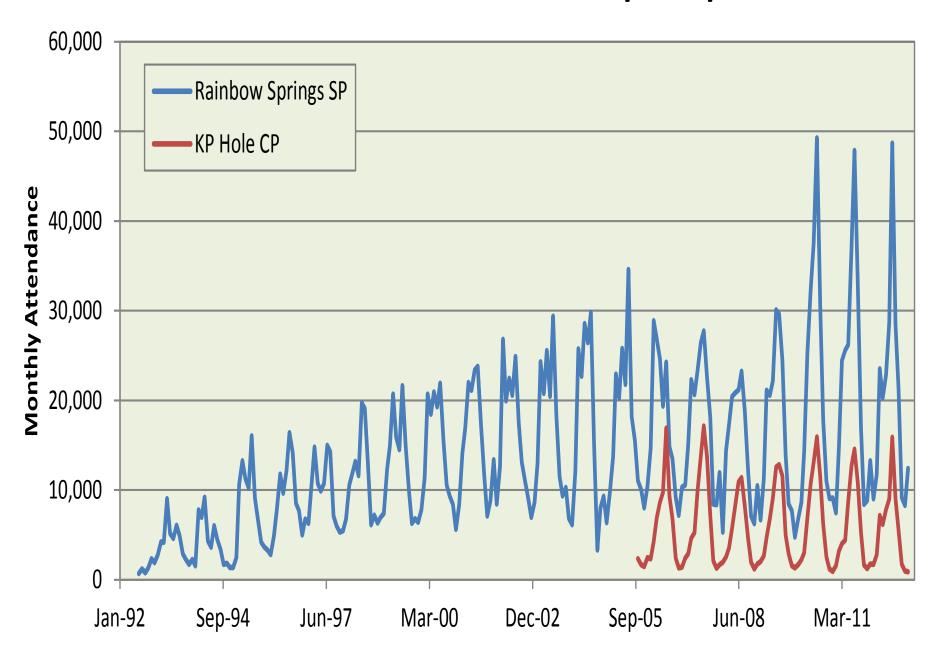
- Groundwater feeding Rainbow Springs is contaminated by nitrate nitrogen derived principally from fertilizers and human and animal waste disposal practices;
- Nitrate concentrations in Rainbow Springs are above levels considered by the State of Florida to cause nutrient impairment;
- Increased populations of filamentous algae provide visible evidence of this impairment;
- Nitrogen loading in the Rainbow
   Springshed will need to be reduced by about 82% to meet the water quality standard.

### Rainbow Springs Problem – Part 3

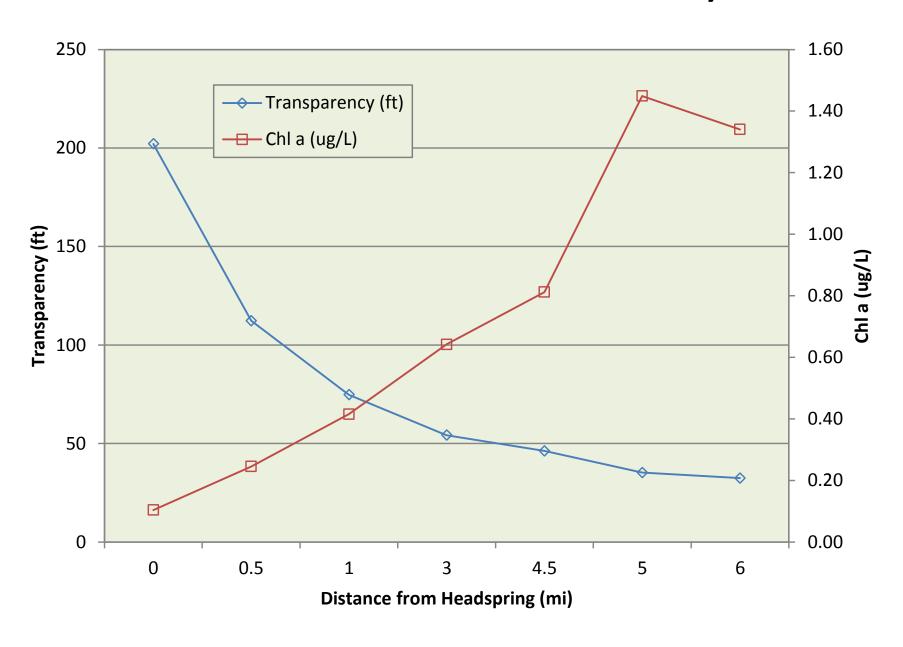
- Recreational uses are increasing:
  - Vegetation trampling and motor scarring
  - 2011-12 human uses:
    - Tubers 84,000
    - Kayaks/canoes 16,500
    - Swimmers/divers 9,000
    - Motorboats 6,600
    - Scuba boats 1,000



### Rainbow River 2011 Recreational Use: more than 334,000 people



### Rainbow River Downstream Decline in Water Clarity





# Excessive Recreation Causes Impairment at Rainbow Springs

#### Key Findings:

- Motor-boating is the most damaging recreational use in the Rainbow River due to prop scarring;
- Crowding of recreational users results in impacts to submerged aquatic vegetation;
- Water clarity suffers as a result of high recreational use;
- Motor size and tubes/kayaks/canoe use-intensity need to be reduced.

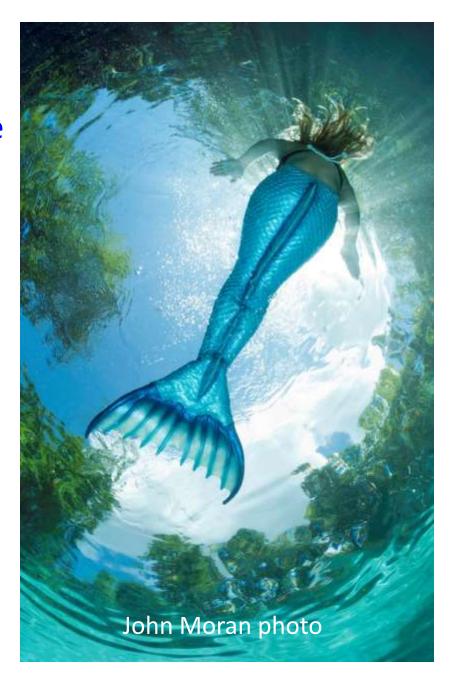
### So...What Can Be Done to Protect Rainbow Springs?



✓ As individuals, we can conserve water at home and at work



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- ✓ As professionals, we can collect the data and inform the state's water management agencies



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- ✓ As citizens we can contact our legislators and other government officials urging them to pass laws that better protect the Floridan Aquifer and our springs



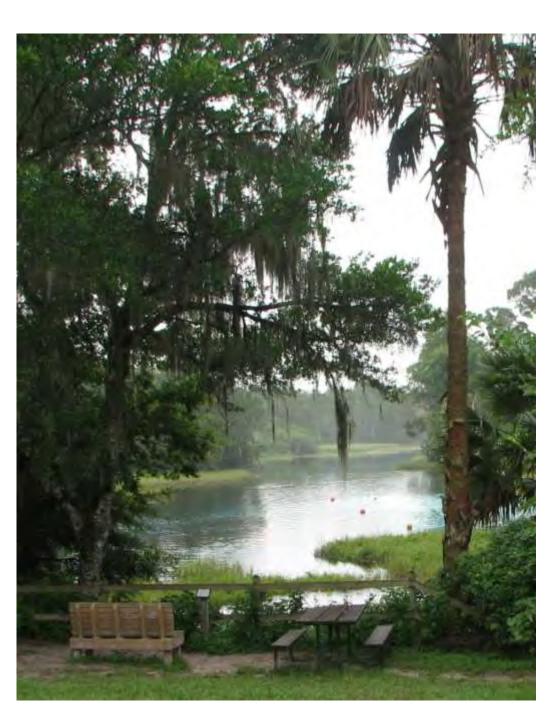
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- ✓ As professionals, we can collect the data and inform the state's water management agencies
- ✓ As citizens we can contact our legislators and other government officials urging them to pass laws that better protect the Floridan Aquifer and our springs
- ✓ We must do everything in our power to insure a sustainable water future "Springs Eternal Florida's Fragile Fountain of Youth"



### Rainbow Springs Will Heal When We:

- Reduce permitted groundwater extractions by 60%;
- Reduce nitrogen fertilizer use by 82%;
- Limit recreation to sustainable levels;
- Protect Outstanding Florida Waters!





### Be Sure to Visit the Florida Museum of Natural History Springs Eternal Exhibit



### WAKULLA SPRINGS BY JIM STEVENSON

















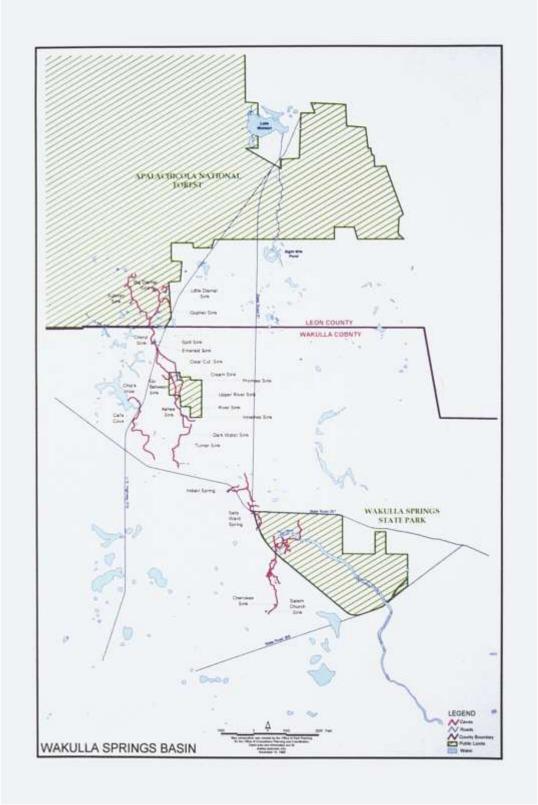


## Wakulla Spring Basin Working Group

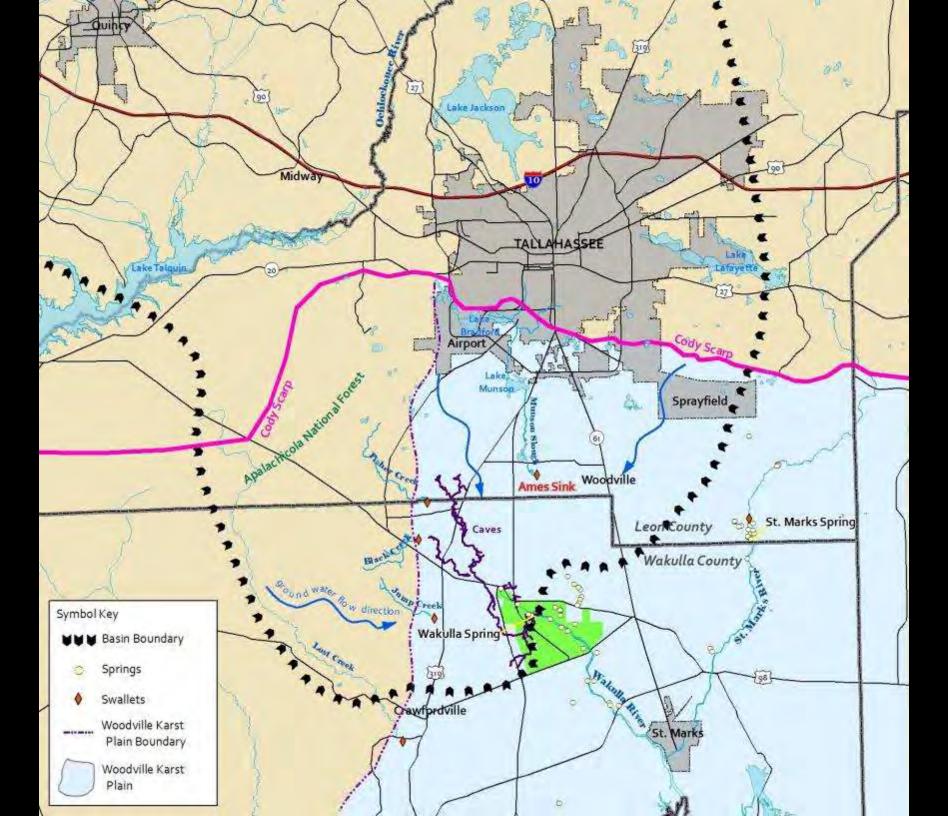
- Citizens
- City of Tallahassee
- Leon County
- Wakulla County
- Regional Planning Council
- Northwest Florida Water Management District
- Dept. of Environmental Protection
- Department of Health
- Dept. of Community Affairs

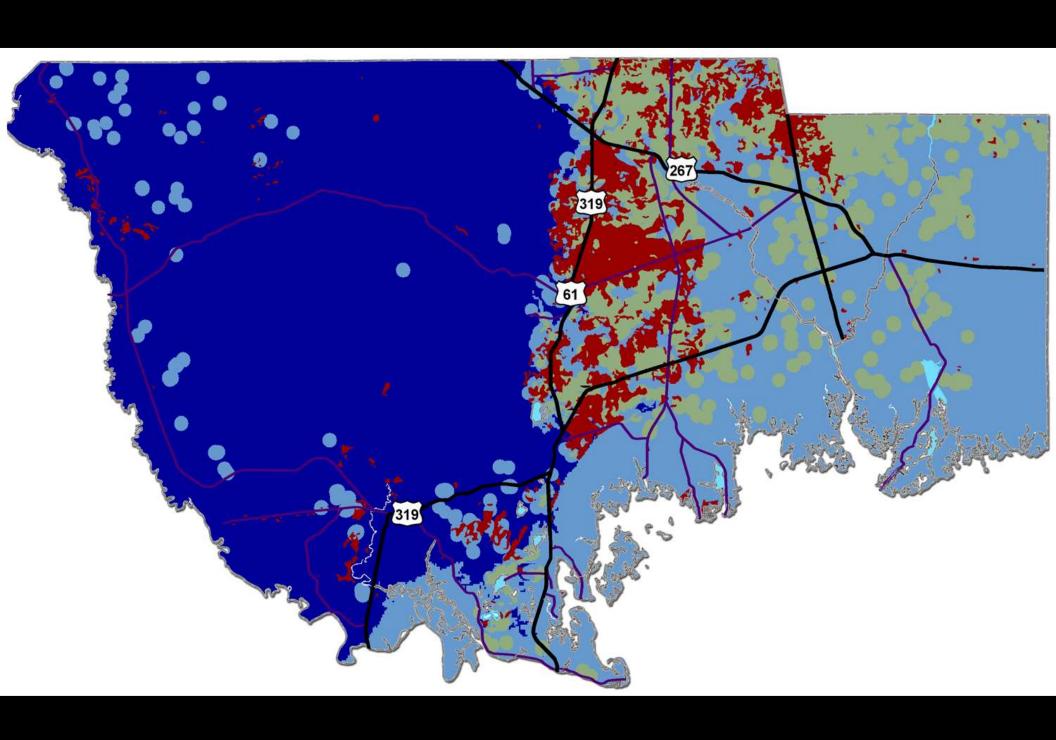
- Dept. of Transportation
- Florida State University
- U. S. Geological Survey
- U. S. Forest Service
- Friends of Wakulla Spring
- Florida Wildlife Federation
- 1000 Friends of Florida
- Global Underwater Explorers
- H2H Associates
- Tallahassee Democrat

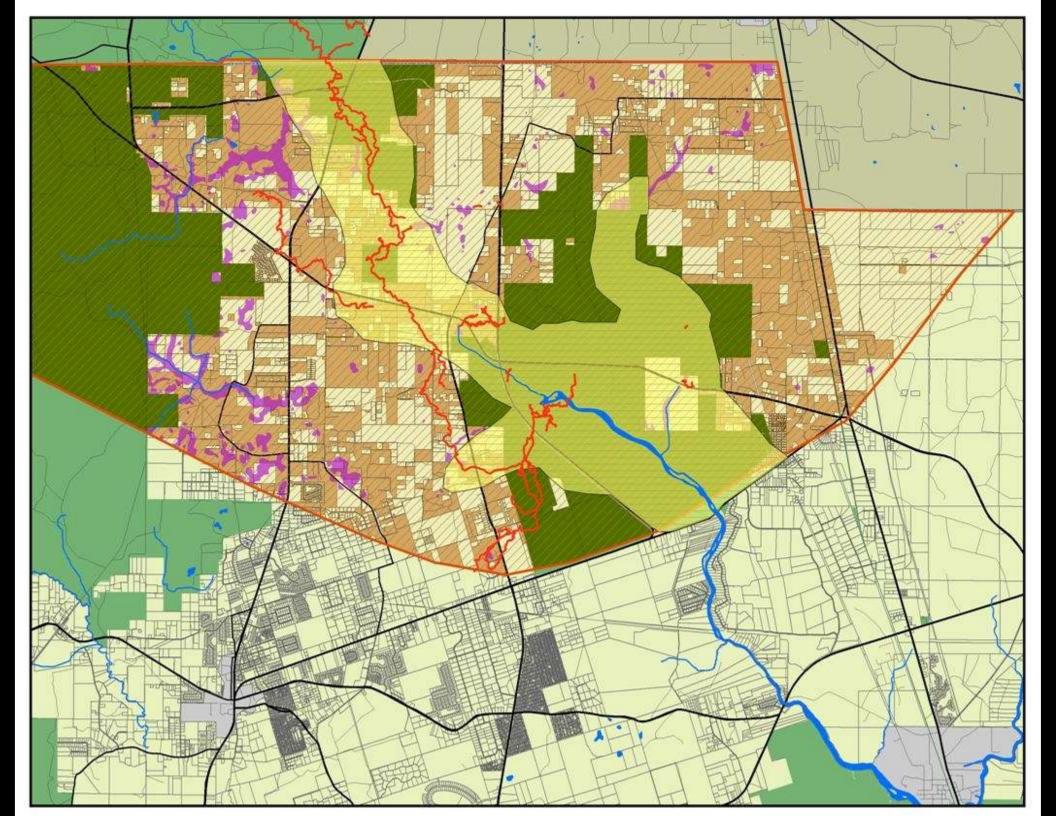




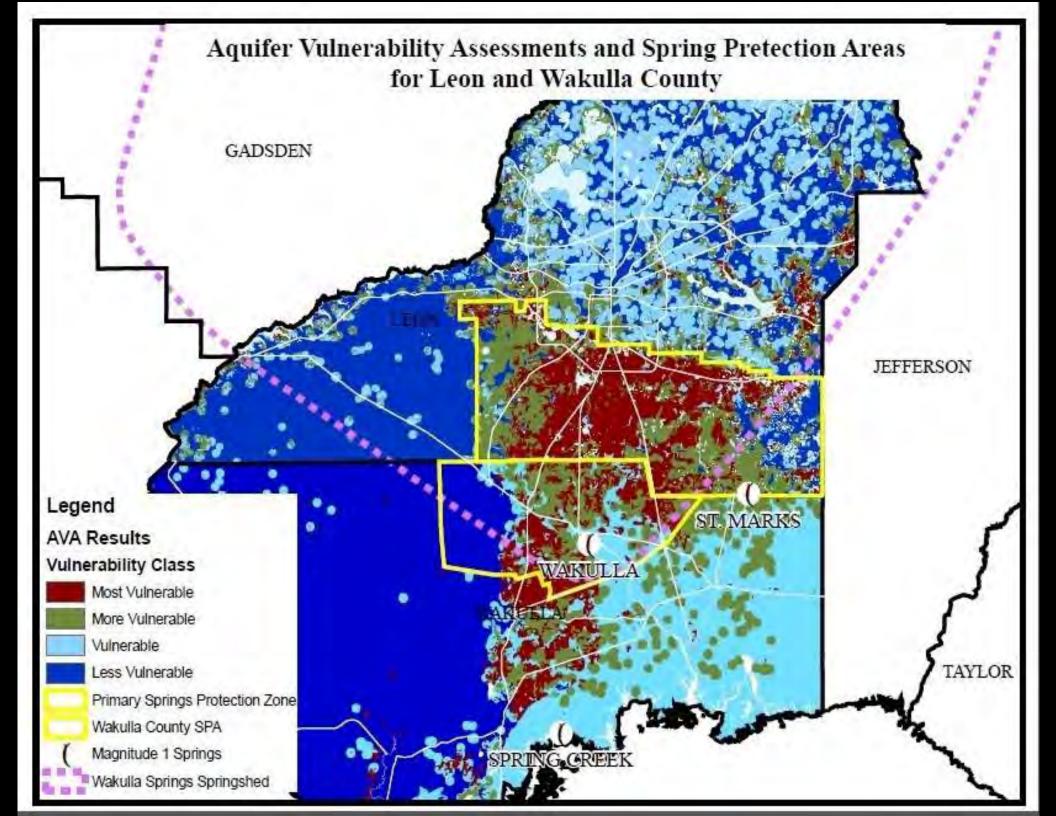


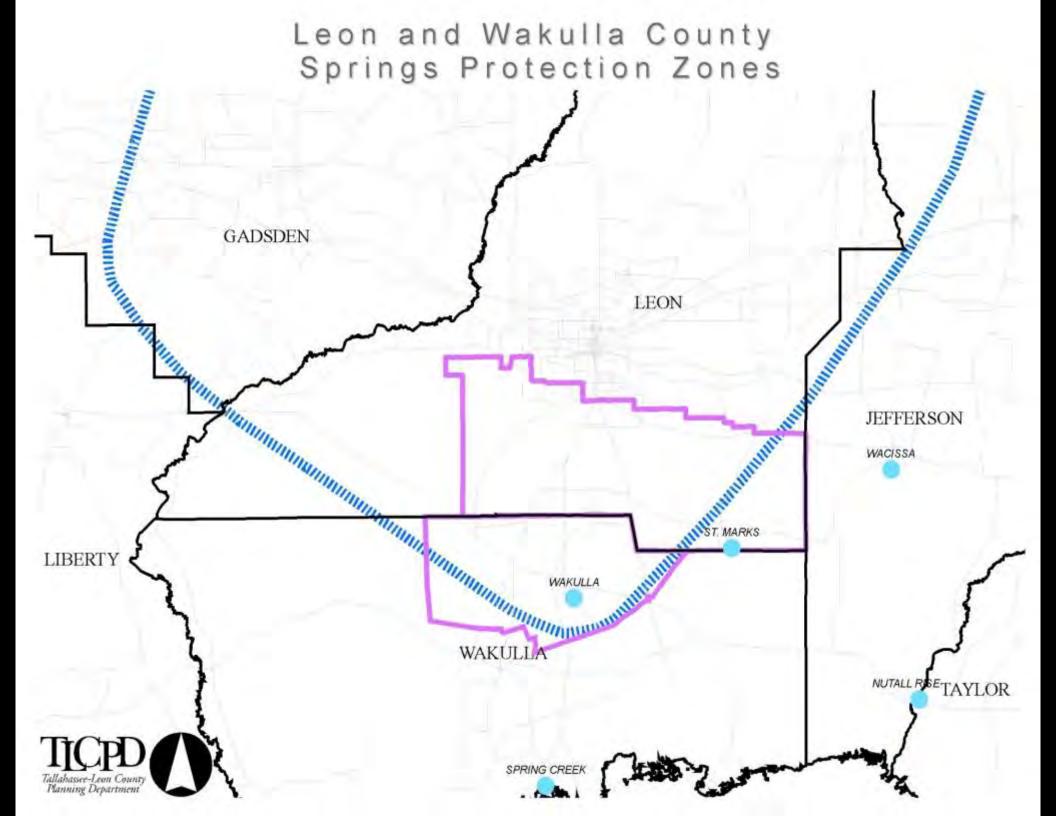






### Leon County Aquifer Vulnerability Assessment Map Primary Springs Protection Zone **LAVA Results Vulnerability Class** Most Vulnerable More Vulnerable Vulnerable Less Vulnerable

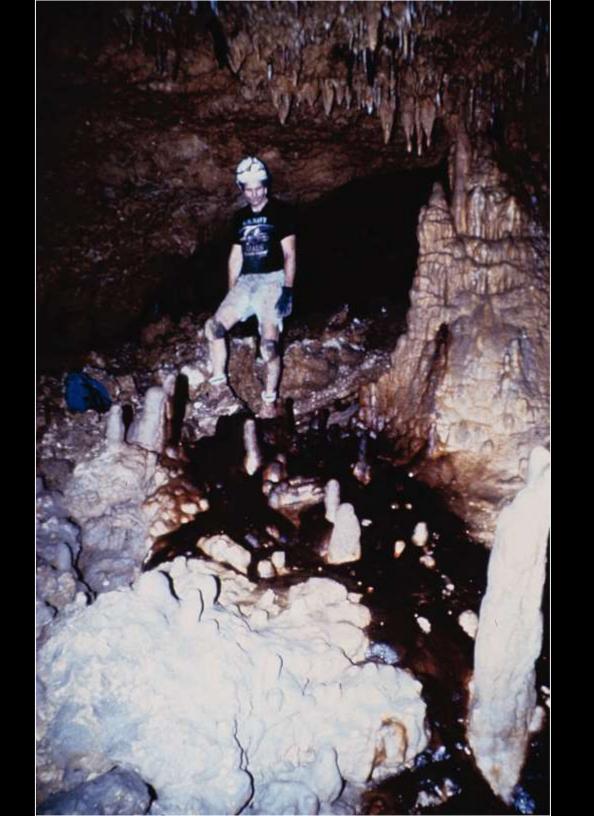








## SOIL ABSORPTION SYSTEM FOR ONSITE SEWAGE DISPOSAL IN KARST AREAS WITH SOIL MACROPORES PRODUCTION PRETREATMENT For Inset Se DISPOSAL SEPTIC TANK Soil Soil Treatment Limestone Cave - Stream











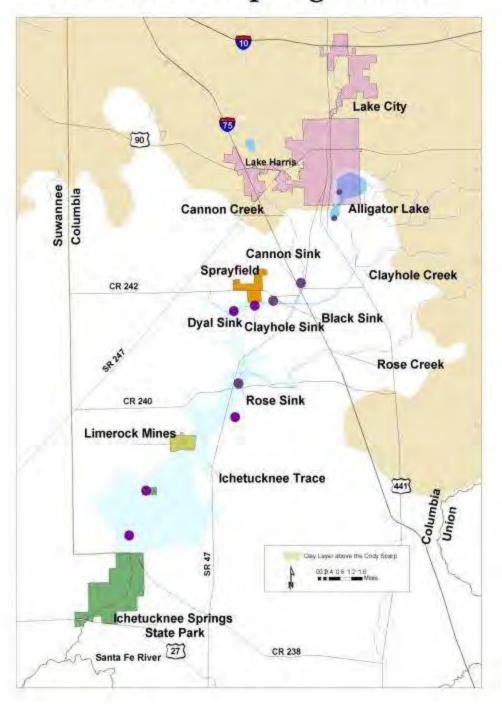






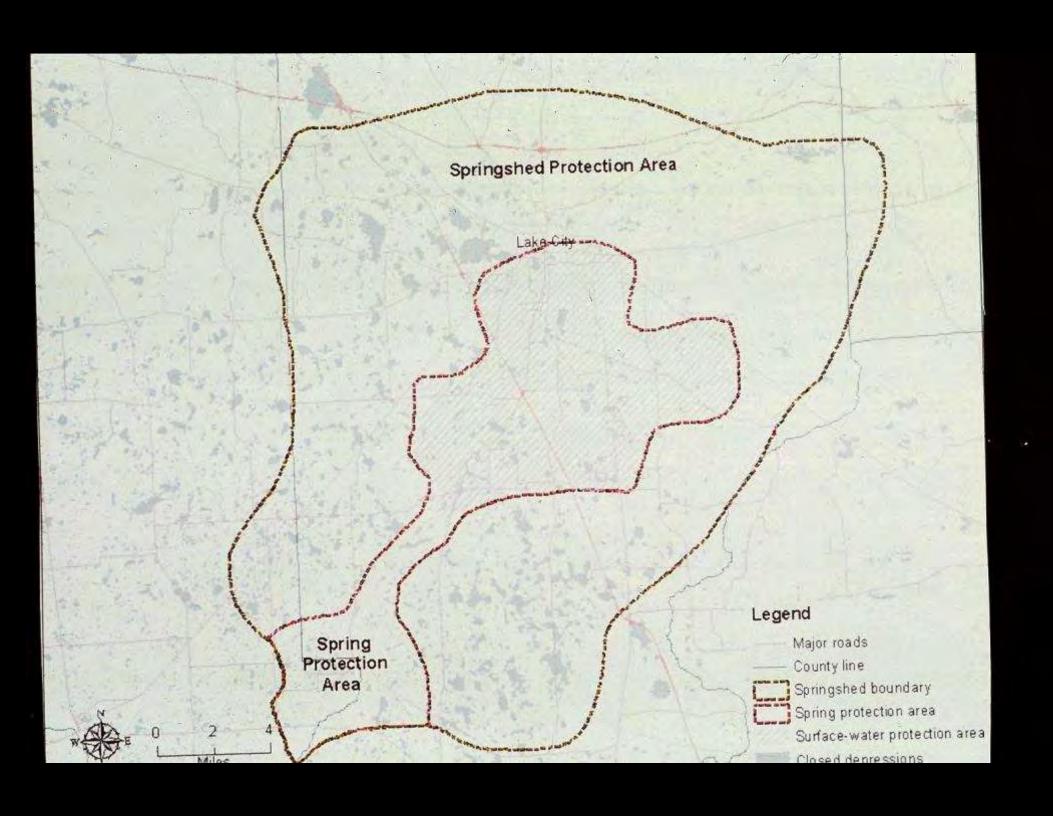


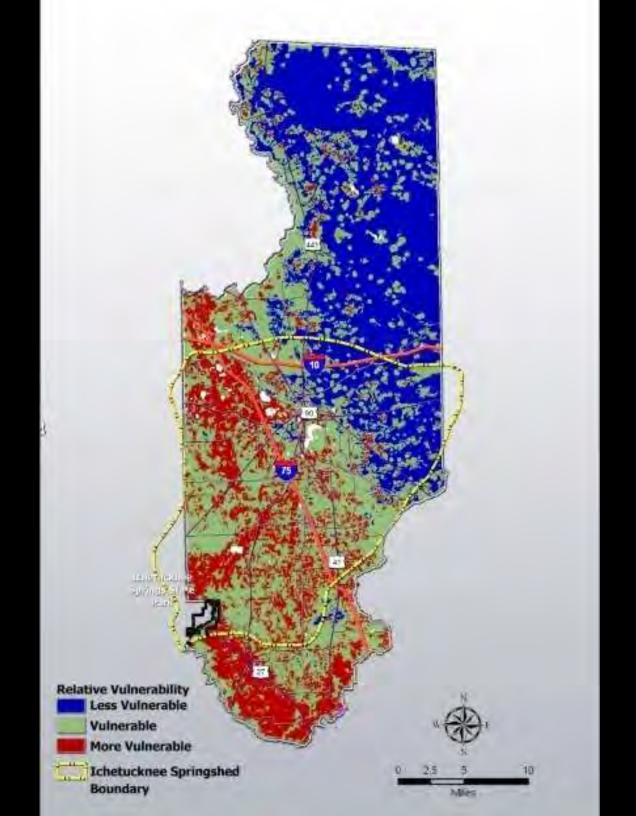
## **Ichetucknee Springs Basin**

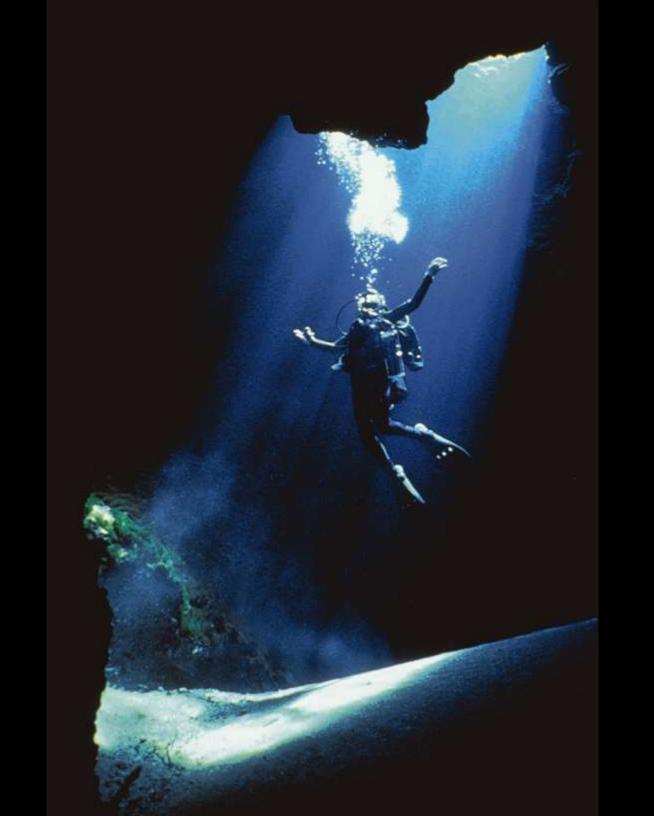












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