Agenda

4:30 p.m. Welcome, Introductions and Background Information

4:35 p.m. Presentations:

- Proposed Minimum Flow for the Rainbow River System
- Evaluation of Hydrologic Changes to the Rainbow River System

5:25 p.m. Public Comment Period

Please note: Anyone wanting to ask questions or provide comments will need to fill out a blue card. Blue cards are available in the lobby and should be turned into Melissa Gulvin. There is a limit of three minutes per speaker.

Proposed Minimum Flow for the Rainbow River System

Southwest Florida Water Management District

Melissa Gulvin
Government Affairs

Agenda

1. Welcome, Introductions and Background Information

   Melissa Gulvin, Government Affairs Program Manager

2. Proposed Minimum Flow for the Rainbow River System

   Kym Rouse Holzwart, Senior Environmental Scientist

3. Evaluation of Hydrologic Changes to the Rainbow River System

   Ron Basso, P.G., Chief Hydrogeologist

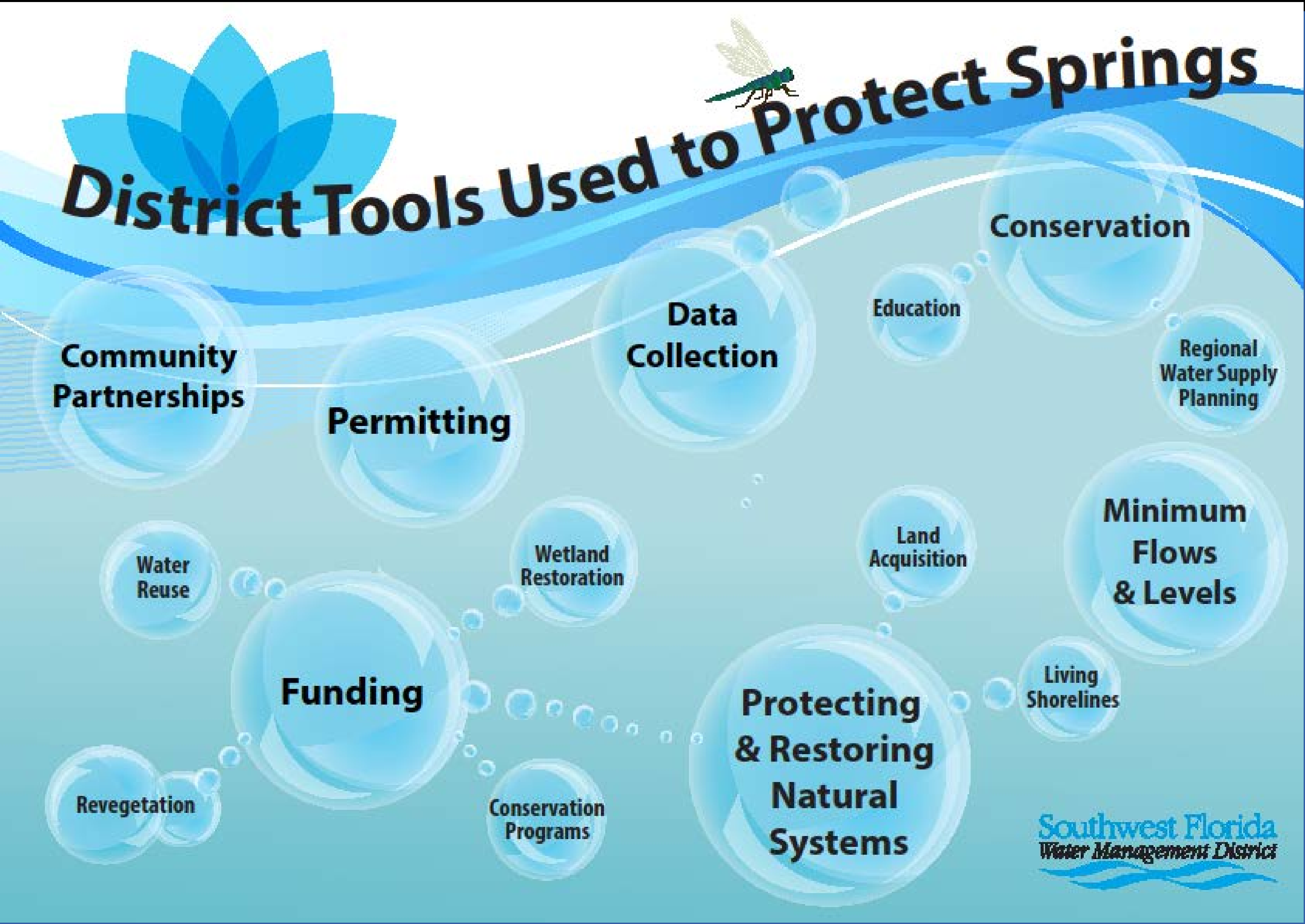
4. Public Comment Period, Facilitated by

   Melissa Gulvin, Government Affairs Program Manager

Please note: Anyone wanting to ask questions or provide comments will need to fill out a blue card. Blue cards are available in the lobby and should be turned into Melissa. There is a limit of three minutes per speaker.

Timeline

Time Frame	Activities
2005 – Ongoing	Data collection and analyses
September – November 2016	Peer review panel meets and provides evaluation of the peer review draft report
November 2016 – February 2017	District Governing Board shown the peer review feedback and staff's response; Staff prepared the draft report and posted online
Feb. 23, 2017	Public meeting to seek public input
March 28, 2017	Presentation to Governing Board and request for adoption of the proposed minimum flow
April – June 2017	Rule-making process
July 1, 2017	MFL must be adopted as required by SB552 passed by the State legislature in 2016

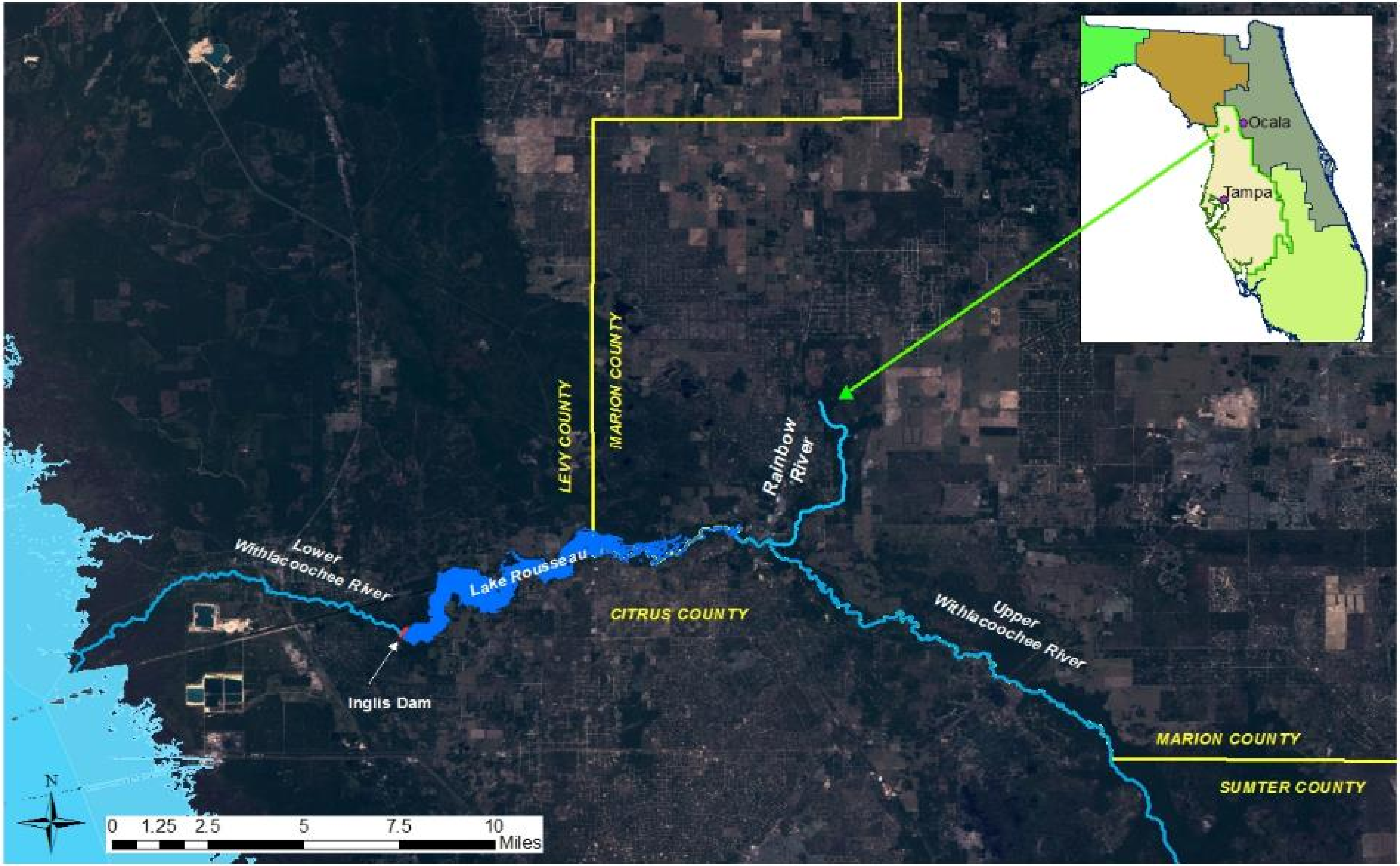

District Tools Used to Protect Springs
Conservation
Education
Regional Water Supply Planning
Data Collection
Community Partnerships
Permitting
Minimum Flows & Levels
Land Acquisition
Wetland Restoration
Water Reuse
Funding
Living Shorelines
Protecting & Restoring Natural Systems
Revegetation
Conservation Programs
Southwest Florida Water Management District

Proposed Minimum Flow for the Rainbow River System

Dunnellon City Hall
Dunnellon, Florida
February 23, 2017

Kym Rouse Holzwart
Senior Environmental Scientist
Southwest Florida Water Management District

Location of Rainbow River System



Why Establish a Minimum Flow?

- Required by state law for priority springs, streams, and rivers [Section 373.042(1), F.S.]
- Per SB552, Minimum flow for Rainbow River System must be adopted by July 1

What is a Minimum Flow?

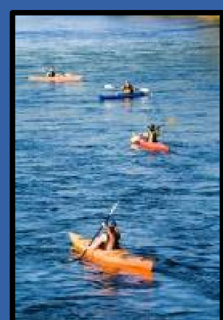
- Limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area
- Established to protect flowing systems from damage caused by ground and surface water withdrawals
- Protects from significant harm

What is a Minimum Flow?

- Must be developed using the best information available
- Tool used by the District to:
  - Protect water bodies
  - Review requests for withdrawals of ground and surface water
  - Plan for future water needs

Environmental Values Protected When Developing Minimum Flows

- Recreation in and on the water
- Fish and wildlife habitats and the passage of fish
- Estuarine resources
- Transfer of detrital material
- Maintenance of freshwater storage and supply
- Aesthetic and scenic attributes
- Filtration and absorption of nutrients and other pollutants
- Sediment loads
- Water quality
- Navigation



Minimum Flows Criteria

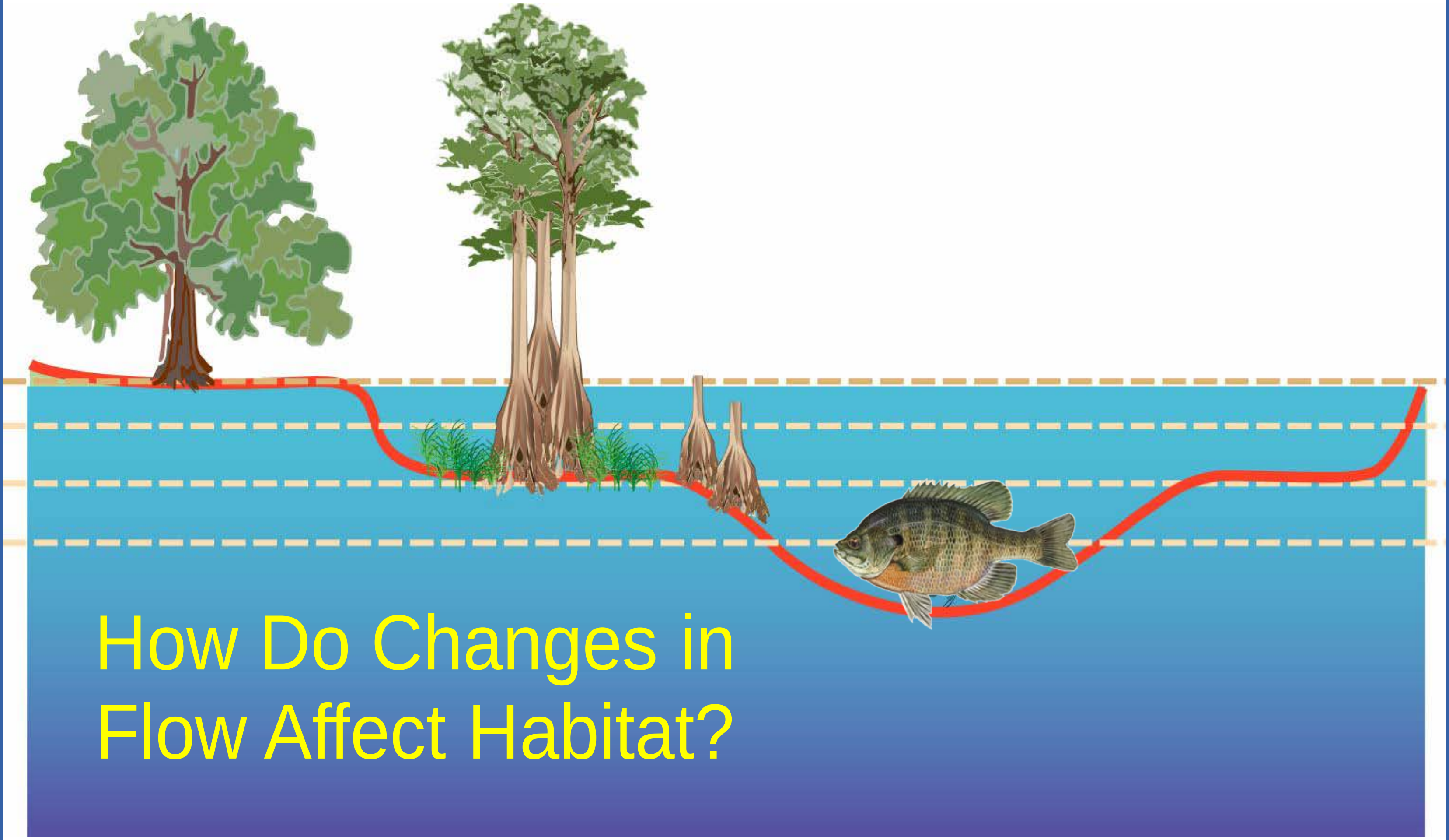
Percent of Flow – Percentage that flow can be reduced without reducing the availability of habitats or resources by more than 15% or that protects 85% of available habitats or resources

Defining Significant Harm

Significant harm threshold:

- Defined as more than a 15% decrease in available habitat or resource
- Protects 85% of available habitat or resource
- Developed at suggestion of independent scientists
- Supported by 17 panels of independent scientists reviewing proposed minimum flows for other flowing systems
- Method used in minimum flows adopted for 3 other Outstanding Florida Waters
- Well supported in the literature

Rainbow River System Minimum Flow Development: A Habitat-Based Approach



Rainbow River System
Minimum Flow Development

- Complex effort since 2005
- Conduct many studies
- Large amount of data collected
- Use best available information

Methods Used to Develop Rainbow River System Minimum Flow

- Habitat in the water for fish, crustaceans, snails, and insects
- Sticks, logs, and roots in the water







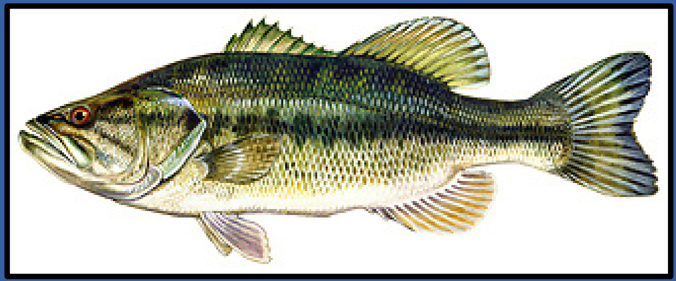

Methods Used to Develop Rainbow River System Minimum Flow

Inundated floodplain wetlands habitat

Rainbow River System Minimum Flow Development Results

Instream habitat:

- 18 functional/taxonomic groups, 3 sites
- Habitat availability at two downstream sites not sensitive to reductions in flow
- At the most upstream site, largemouth bass fry habitat was the most sensitive to reductions in flow
- Flow reduction of 9% was significantly harmful to largemouth bass fry habitat



Rainbow River System Minimum Flow Development Results

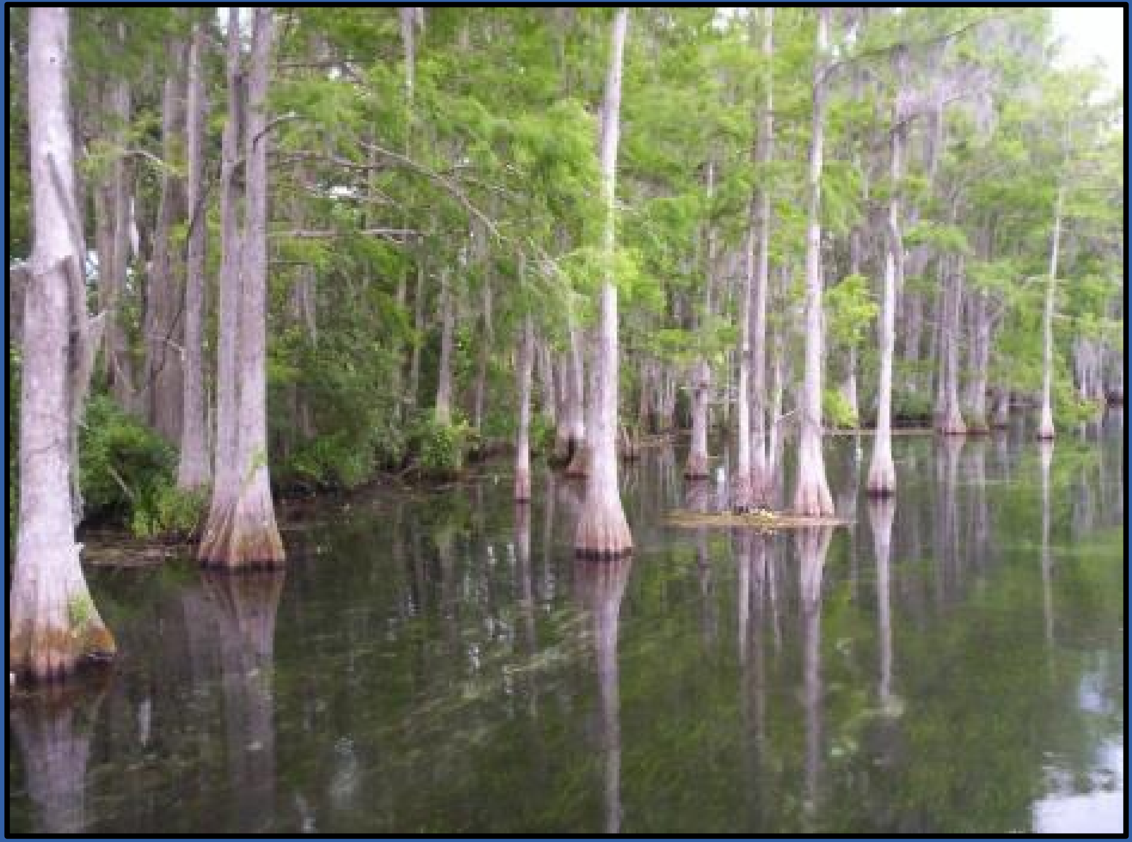
Woody habitat:

- At all 11 sites, snags not sensitive to reductions in flow
- Roots at 3 sites sensitive to reductions in flow
- For these 3 sites, an average flow reduction of 9% was significantly harmful to root habitat

Rainbow River System Minimum Flow Development Results

Inundated floodplain wetlands habitat:

- An average flow reduction of 5% is significantly harmful to inundated wetlands habitat



Rainbow River System Minimum Flow Development Results

Water quality not a limiting environmental value:

- Increased nitrate not related to flow but strongly dependent on time
- Phosphorus, dissolved oxygen, chlorophyll, and water clarity have not changed over time
- With the exception of Blue Cove, river water residence times are short, limits phytoplankton (chlorophyll) accumulation
- Research ongoing to investigate effects of Blue Cove phytoplankton accumulation on the river
- Filamentous algae abundance may be related to flow and is being investigated

Summary of Rainbow River System Minimum Flow Development Results

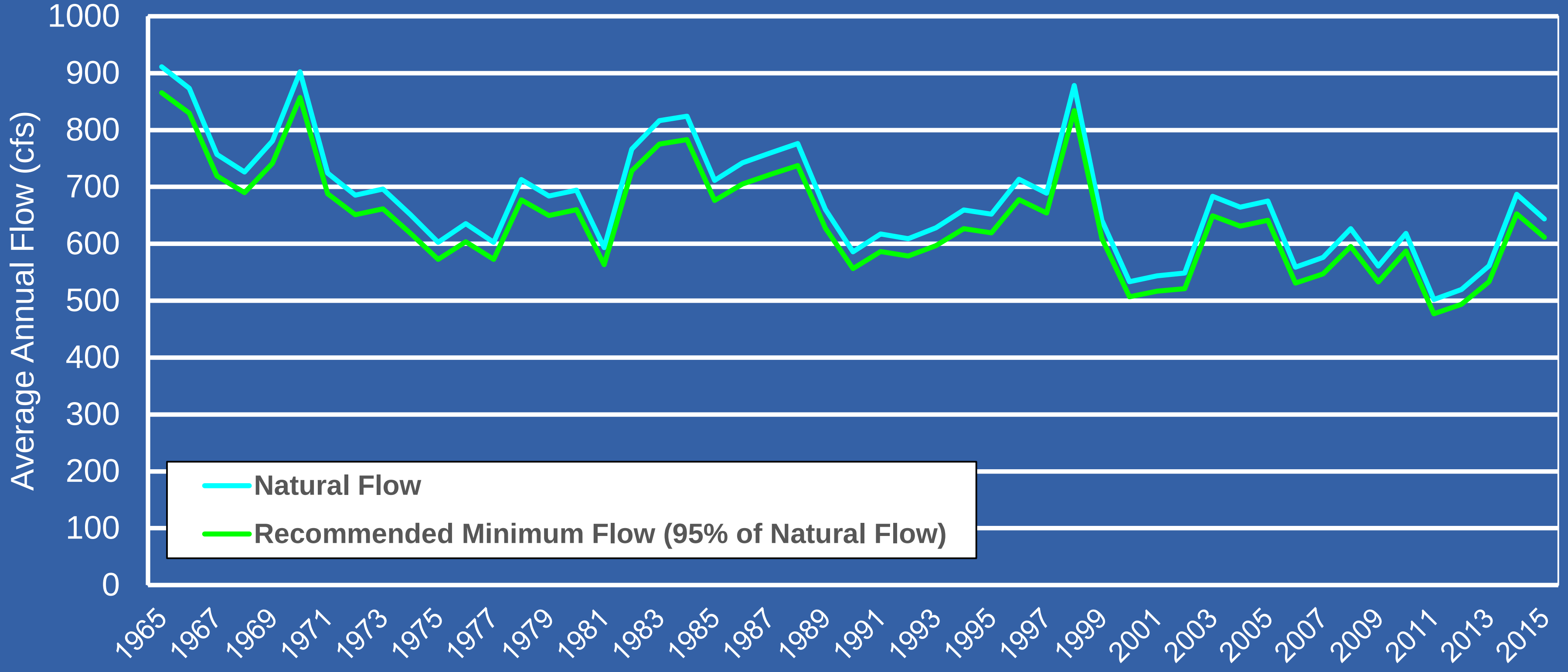
- 9% allowable flow reduction protects instream habitat

- 9% allowable flow reduction protects woody habitat

- 5% allowable flow reduction protects inundated floodplain wetlands habitat

Proposed Minimum Flow

- Protects 95% of natural flow or 5% allowable flow reduction due to withdrawals
- Based on habitat most sensitive to reductions in flow: inundated floodplain wetlands and on science
- Protects all environmental values evaluated

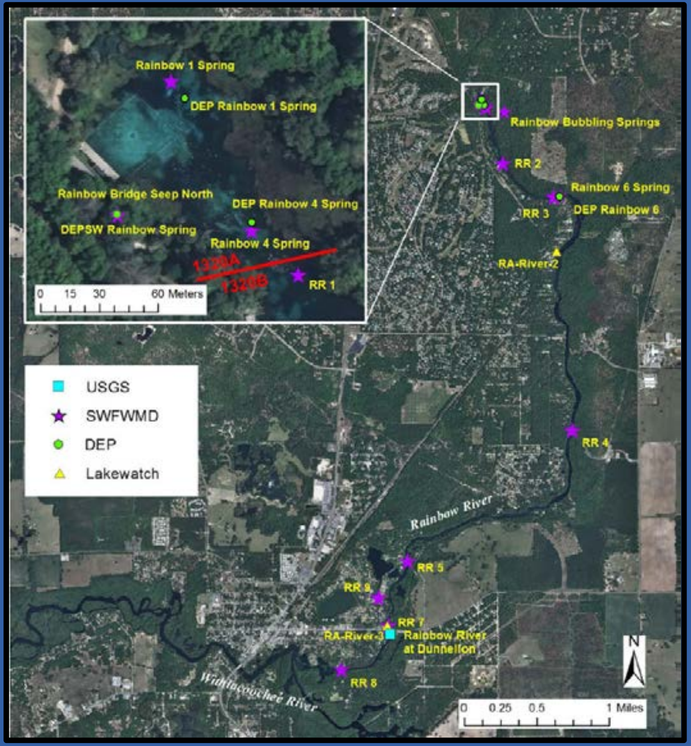


Results of Peer Review

- Voluntary peer review of earlier draft report conducted in Sept.-Nov. 2016 under the Florida Sunshine Law
  - Draft report met the requirements of the law
  - Analyses were thorough, scientifically reasonable, and based on best available data
  - Overall assessment was supportive
- Current draft report and information incorporates comments/recommendations from panel and stakeholders

Minimum Flow Status Assessments

- Recommend minimum flow re-evaluation in 10 years
- Conduct annual status assessments and 5-year assessments for regional planning
- Continue ongoing monitoring of water quality, flows, groundwater conditions, and rainfall
- Study factors affecting flows and effects of flow changes



An Evaluation of Hydrologic Changes to Rainbow Springs

By Ron Basso, P.G., Chief Hydrogeologist
Southwest Florida Water Management District

February 23, 2017

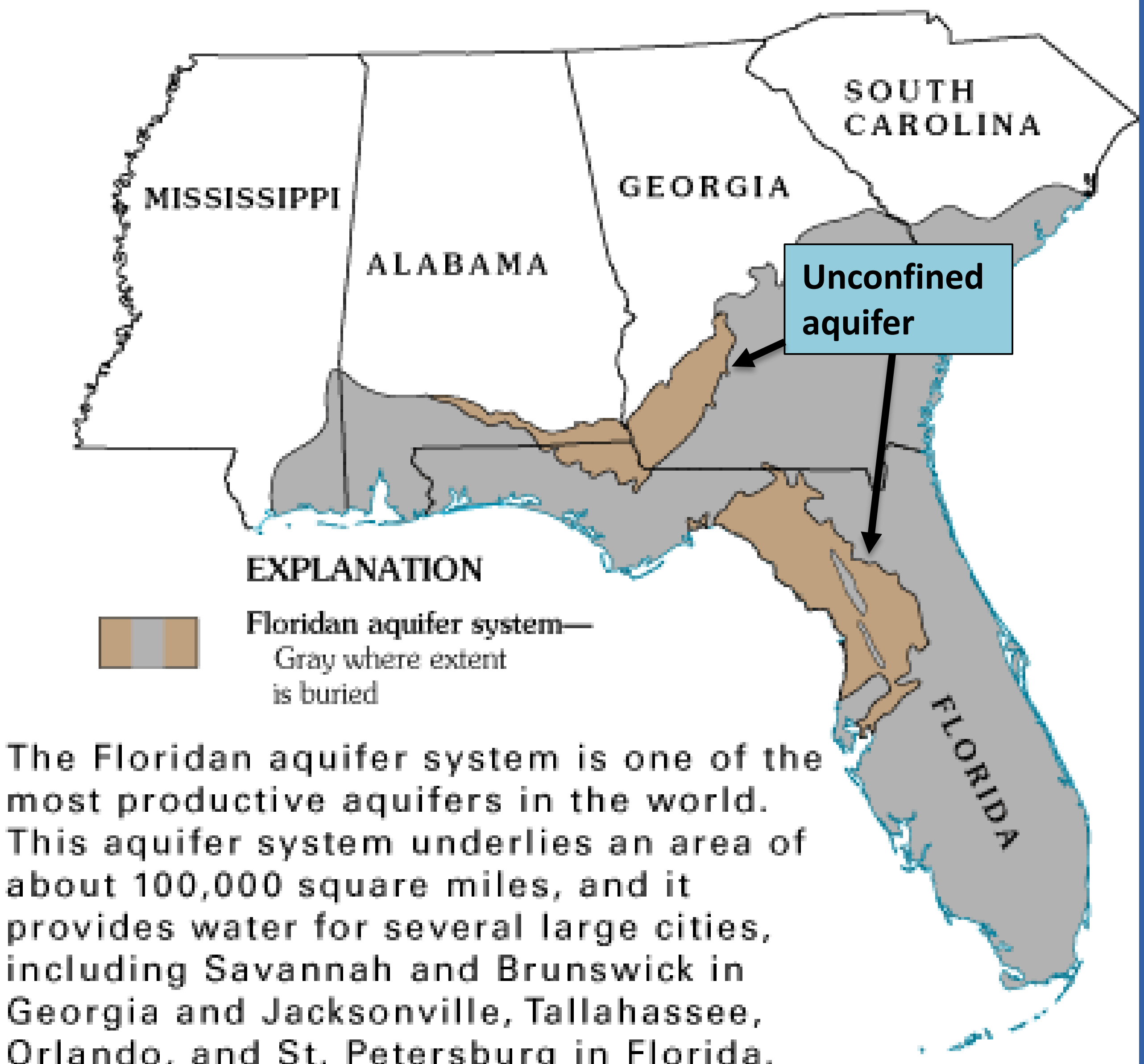
MFL Public Workshop

What is a Spring?

- A natural opening in the ground where water flows directly from the aquifer to the earth's surface
- Water exiting a spring is groundwater — rainfall that has soaked into the ground
- Springs are a common feature of karst terrain

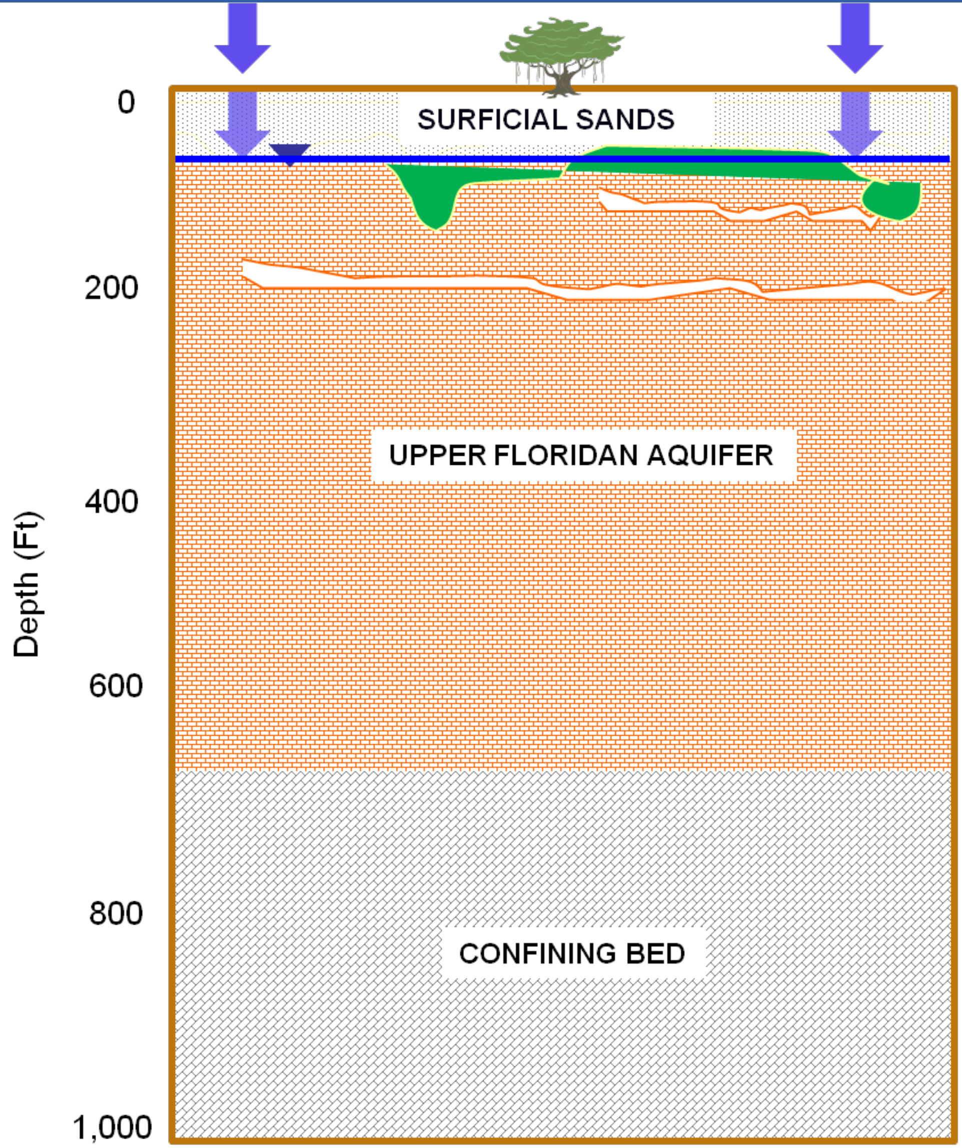
Spring vent where groundwater discharges from the aquifer

Location of the Floridan aquifer

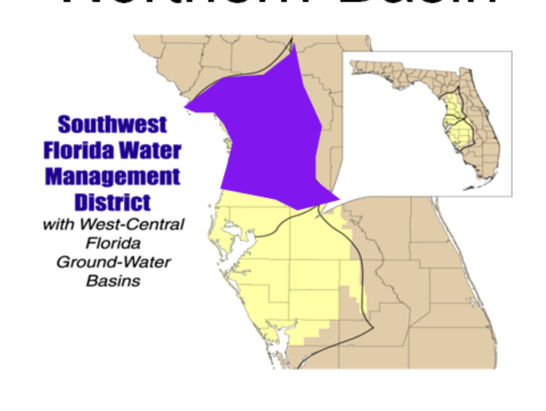


The Floridan aquifer system is one of the most productive aquifers in the world. This aquifer system underlies an area of about 100,000 square miles, and it provides water for several large cities, including Savannah and Brunswick in Georgia and Jacksonville, Tallahassee, Orlando, and St. Petersburg in Florida.

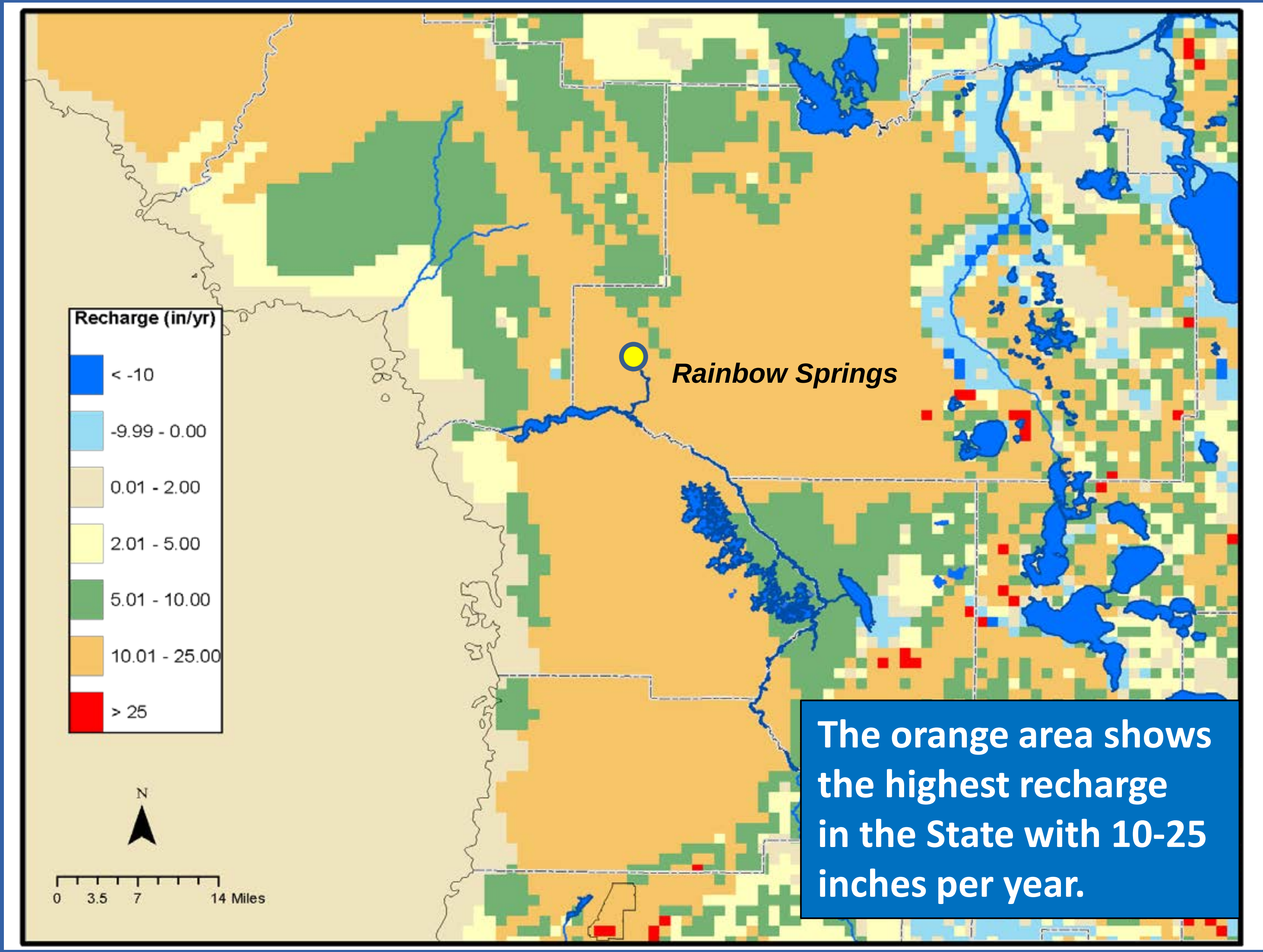
Karst Geology



Northern Basin



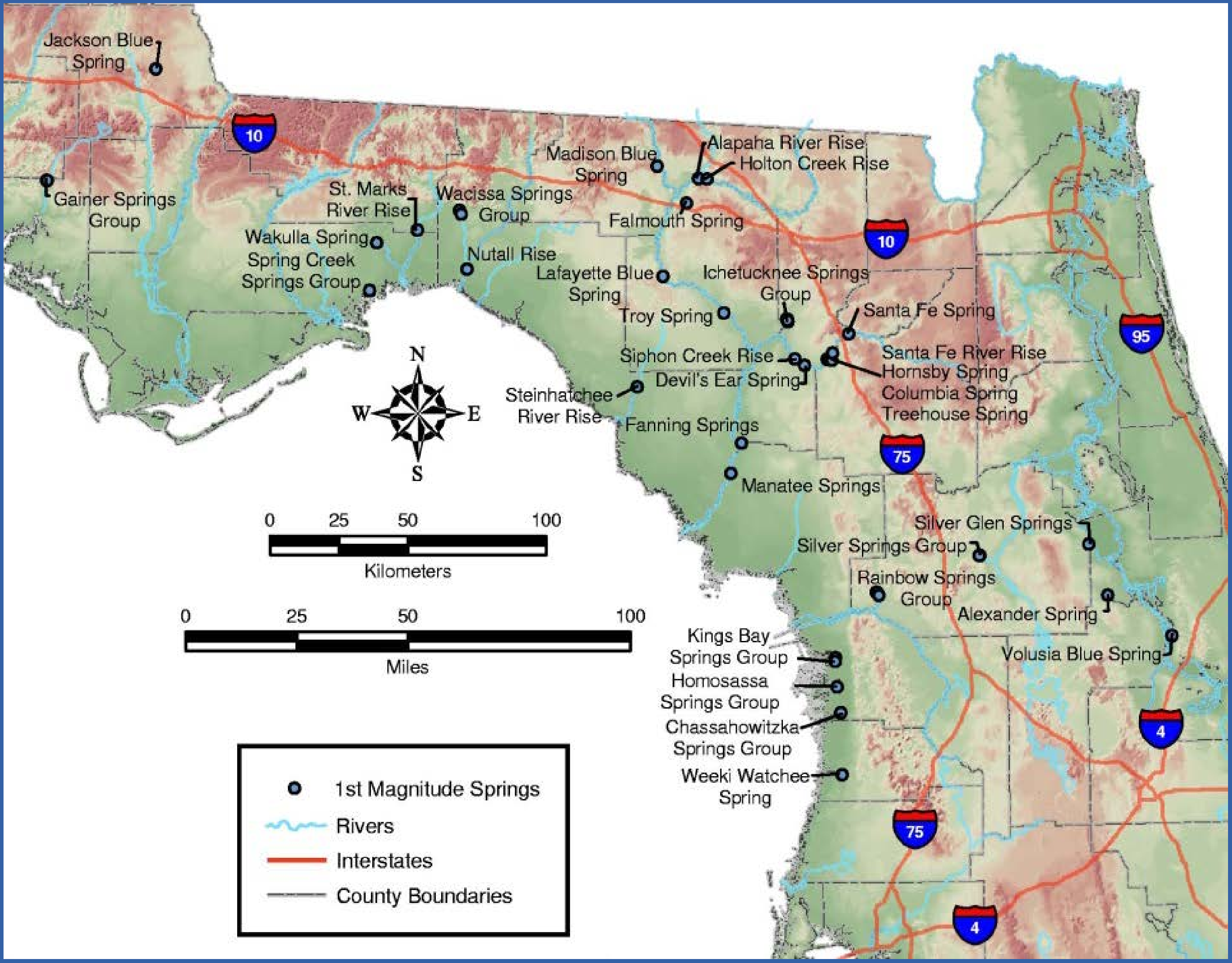
Recharge to the Floridan aquifer based on Average Rainfall Conditions (USGS Mega Model)



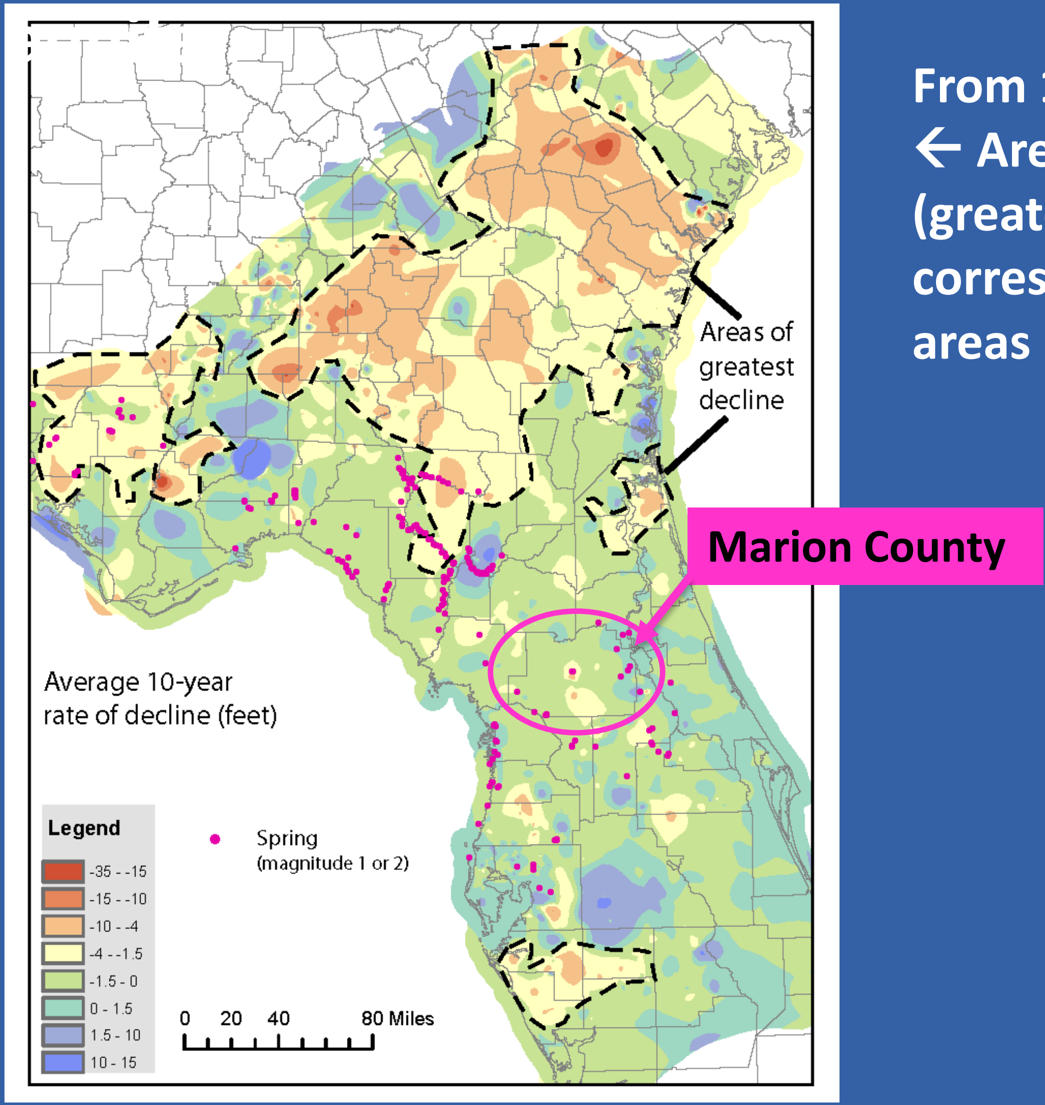
The orange area shows the highest recharge in the State with 10-25 inches per year.

Submerged Caverns

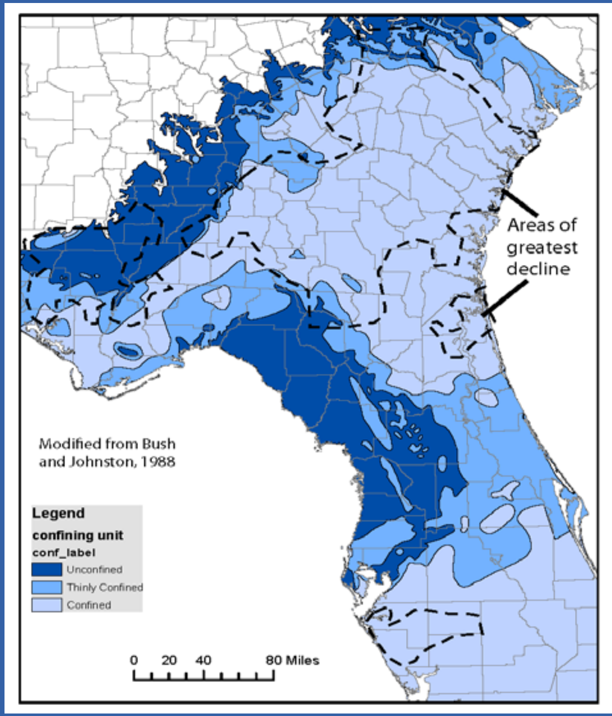
The largest springs in Florida are located in the unconfined UFA aquifer



USGS study found greatest declines in aquifer water levels in areas with well-confined Upper Floridan



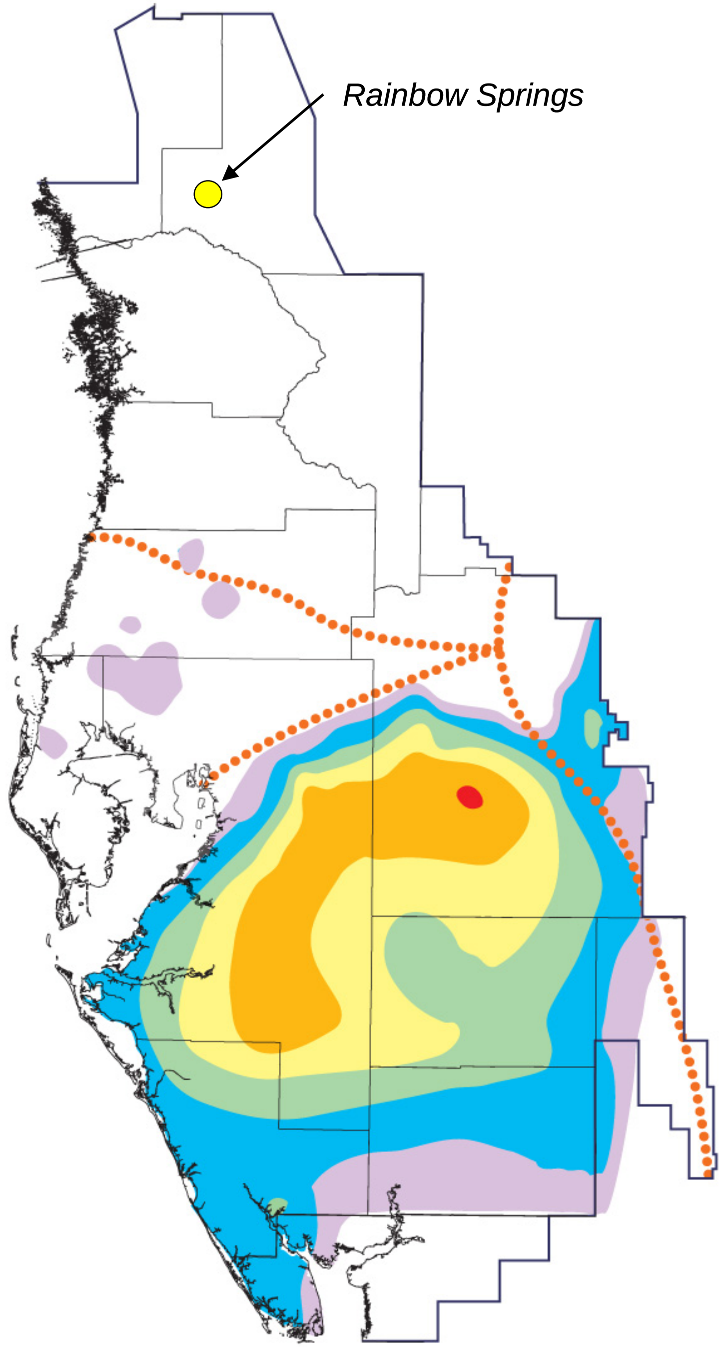
From 1970 to 2010
← Areas in reds, oranges and yellow (greatest decline in aquifer water level) corresponding to the light blue confined areas below ↓



Water Level Decline in the Upper Floridan Aquifer since the early 1930s

- 0–5 FEET
- 5–10 FEET
- 10–20 FEET
- 20–30 FEET
- 30–40 FEET
- 40–50 FEET
- > 50 FEET

Generalized delineation of major groundwater basins



Comparison of Effect of Pumping 30 MGD

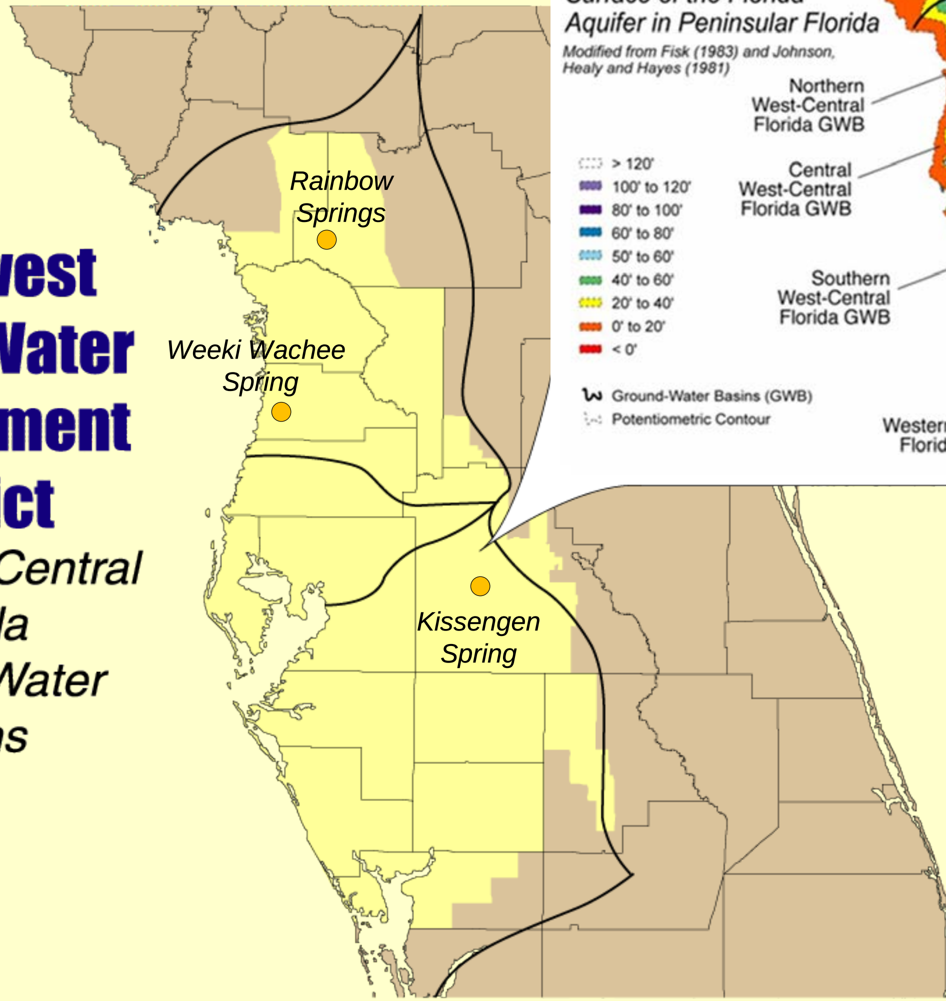
Unconfined UFA

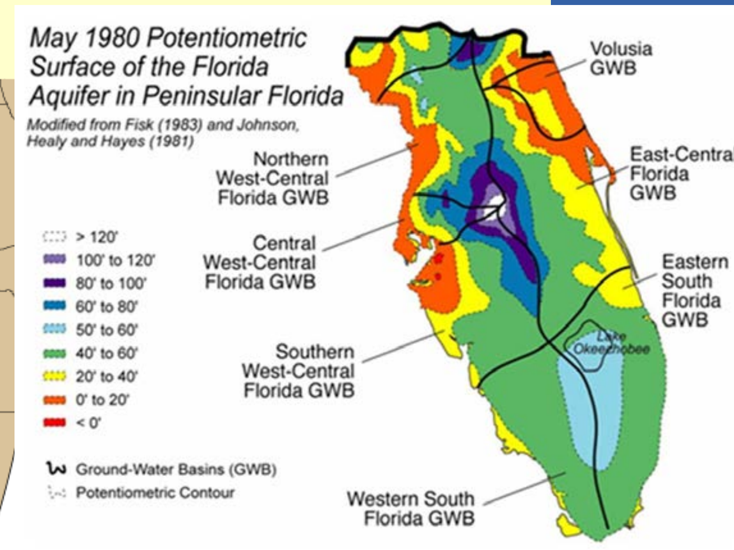
Well-Confined UFA

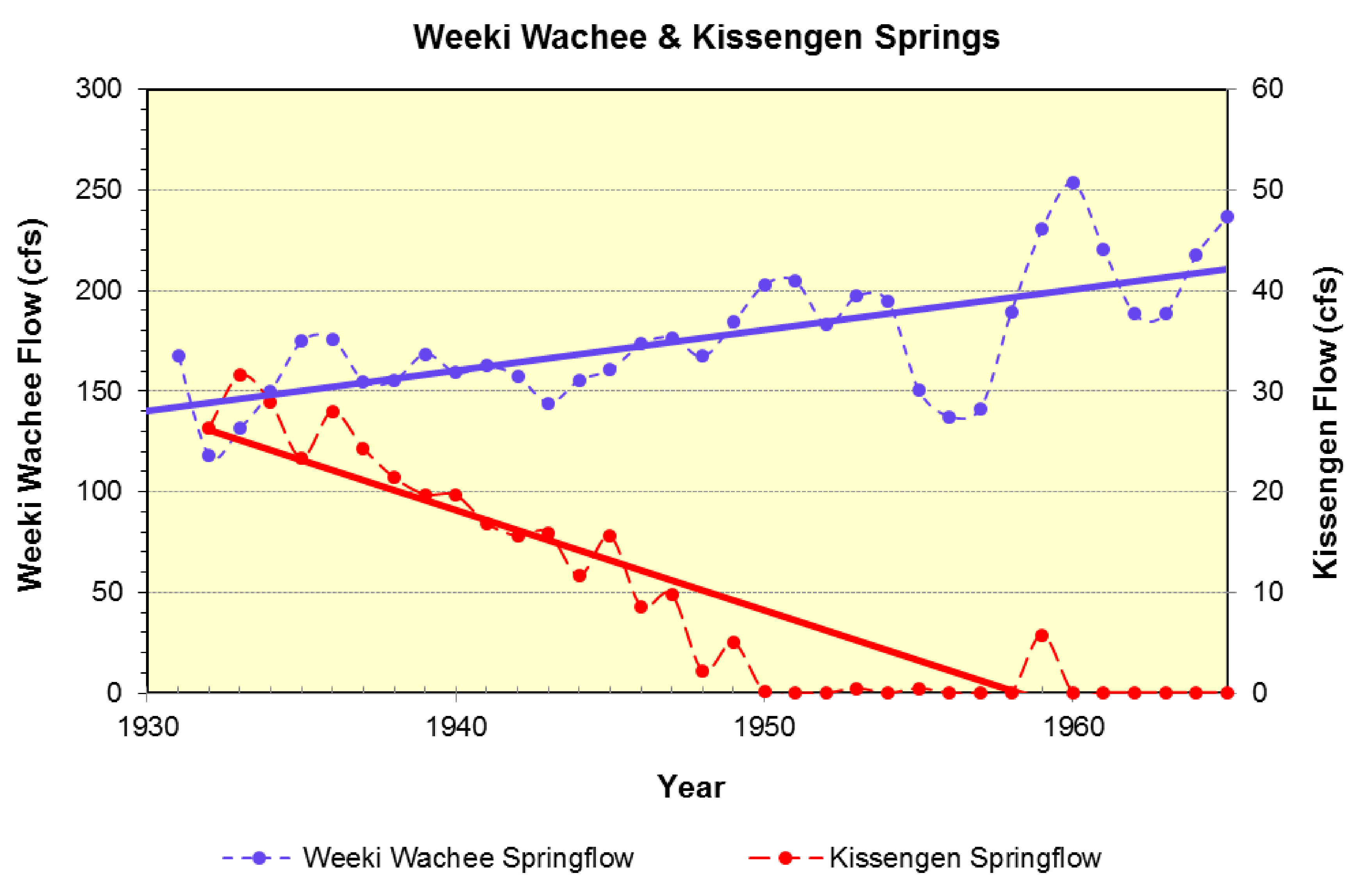
(Adapted from P.D. Ryder, 1985: USGS Professional Paper 1403-F)

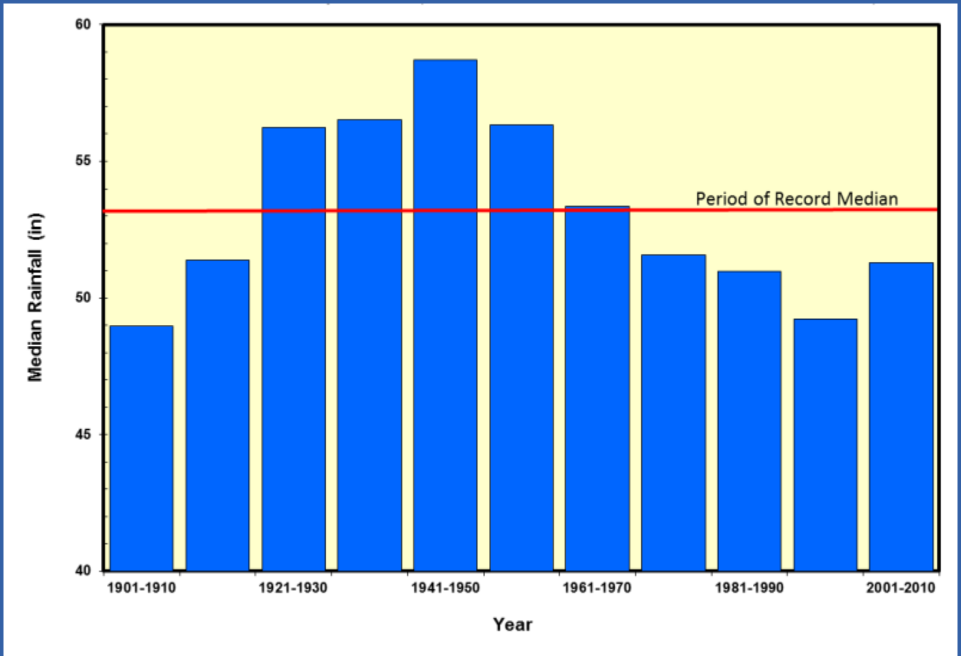
Southwest Florida Water Management District

with West-Central Florida Ground-Water Basins



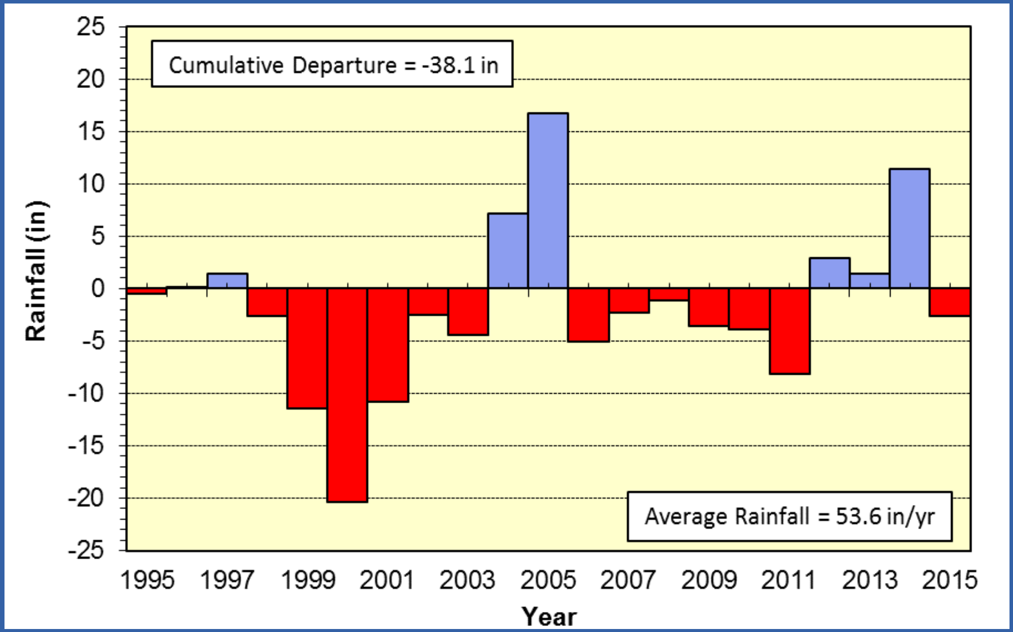



Weeki Wachee & Kissengen Springs
Weeki Wachee Flow (cfs)
Kissengen Flow (cfs)
300
250
200
150
100
50
0
60
50
40
30
20
10
0
1930
1940
1950
1960
Year
Weeki Wachee Springflow
Kissengen Springflow



Long-term rainfall trends

Annual departure in rainfall based on radar rainfall in springshed



Simple Water Budget

Recharge = Rainfall - Evapotranspiration (ET) - Runoff

In internally drained areas: Recharge = Rainfall - ET

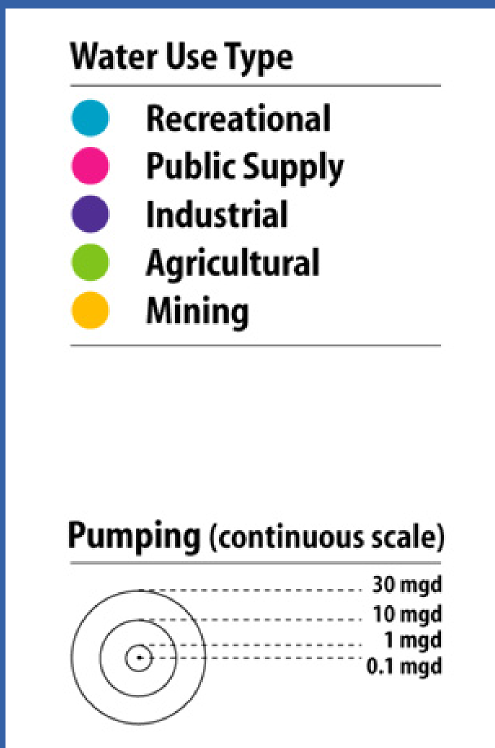
Rainfall = 53 inches ET = 37 inches Recharge = 16 inches	Rainfall = 47.7 inches ET = 35.7 inches Recharge = 12 inches

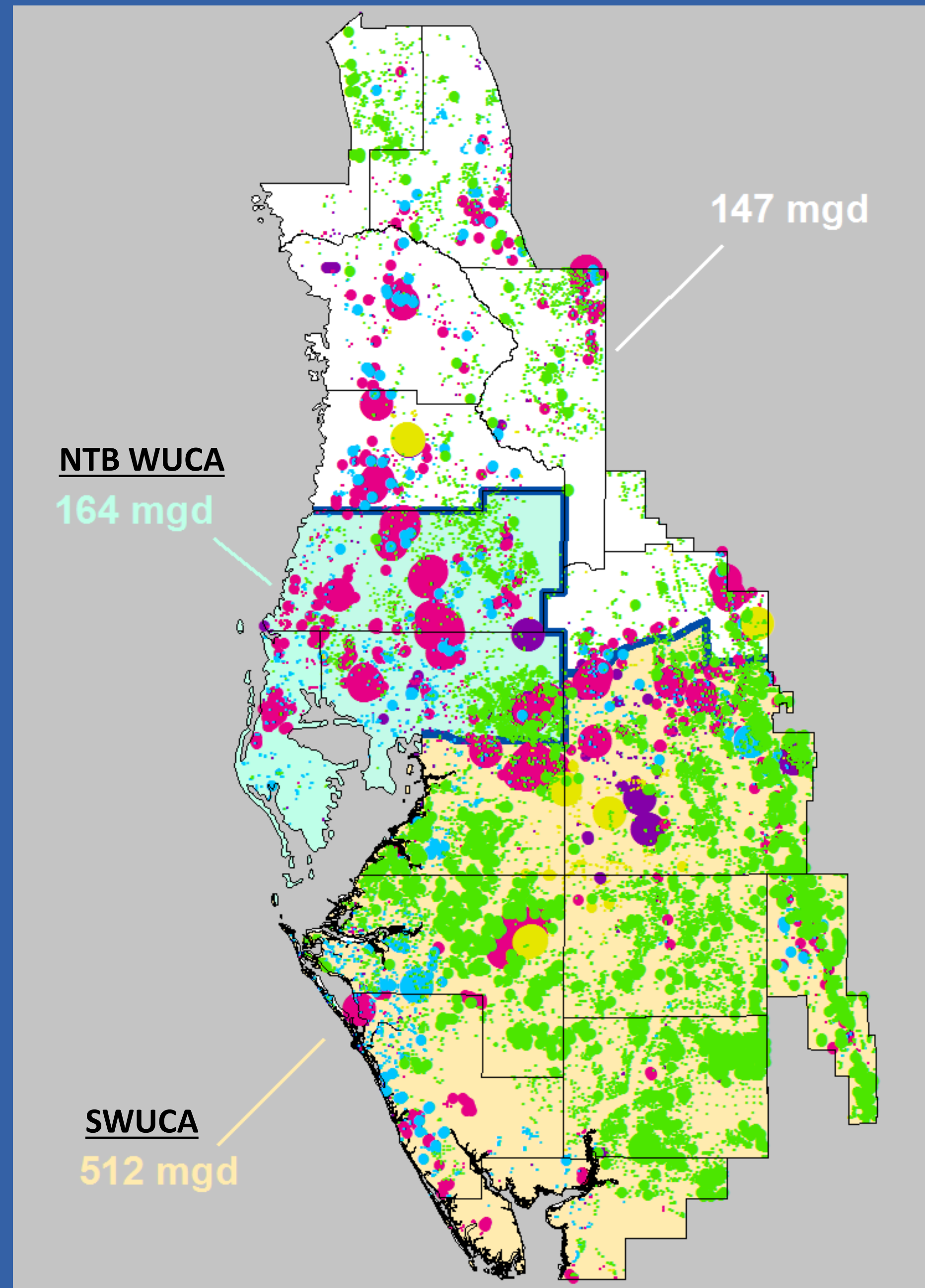
Net Result

10% decrease in rainfall (53 to 47.7 in)
25% decrease in recharge (16 to 12 in)

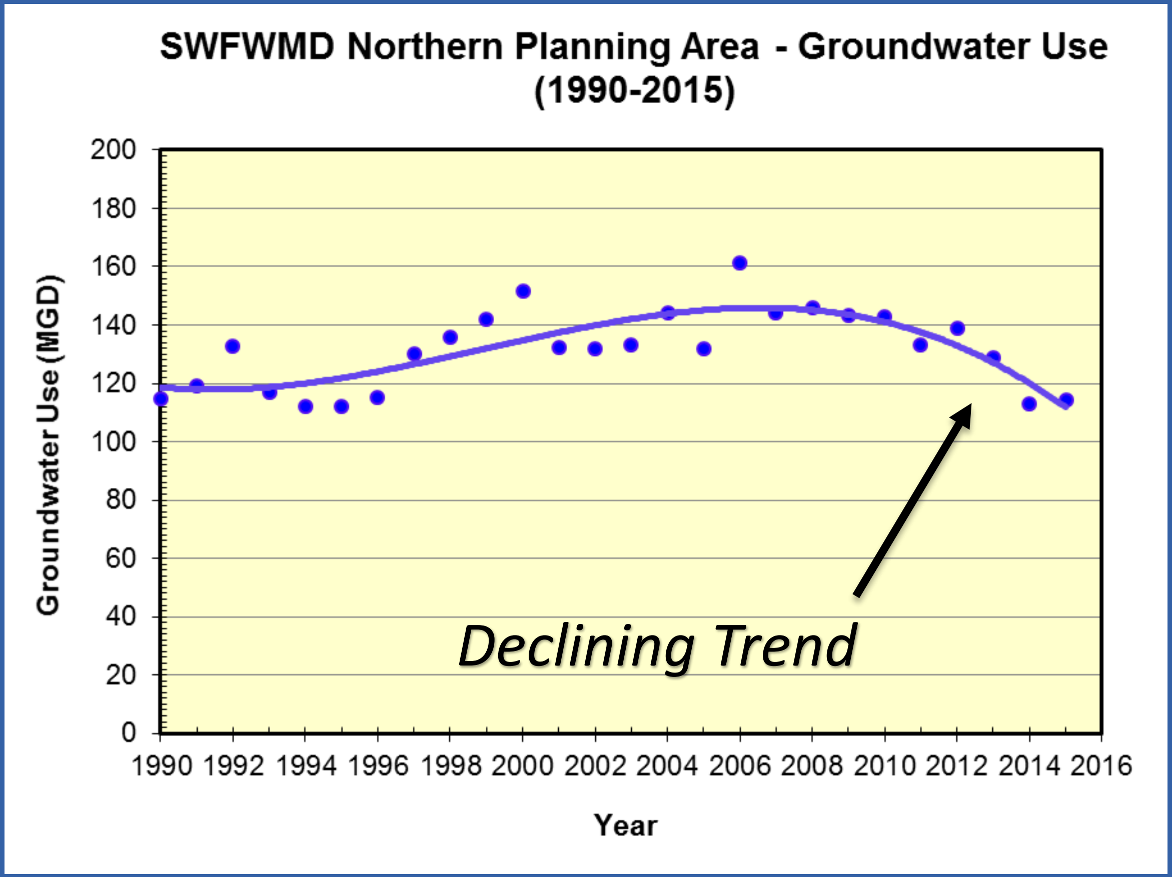
Recharge in Springshed = Springflow

2011 Estimated & Metered Groundwater Withdrawals

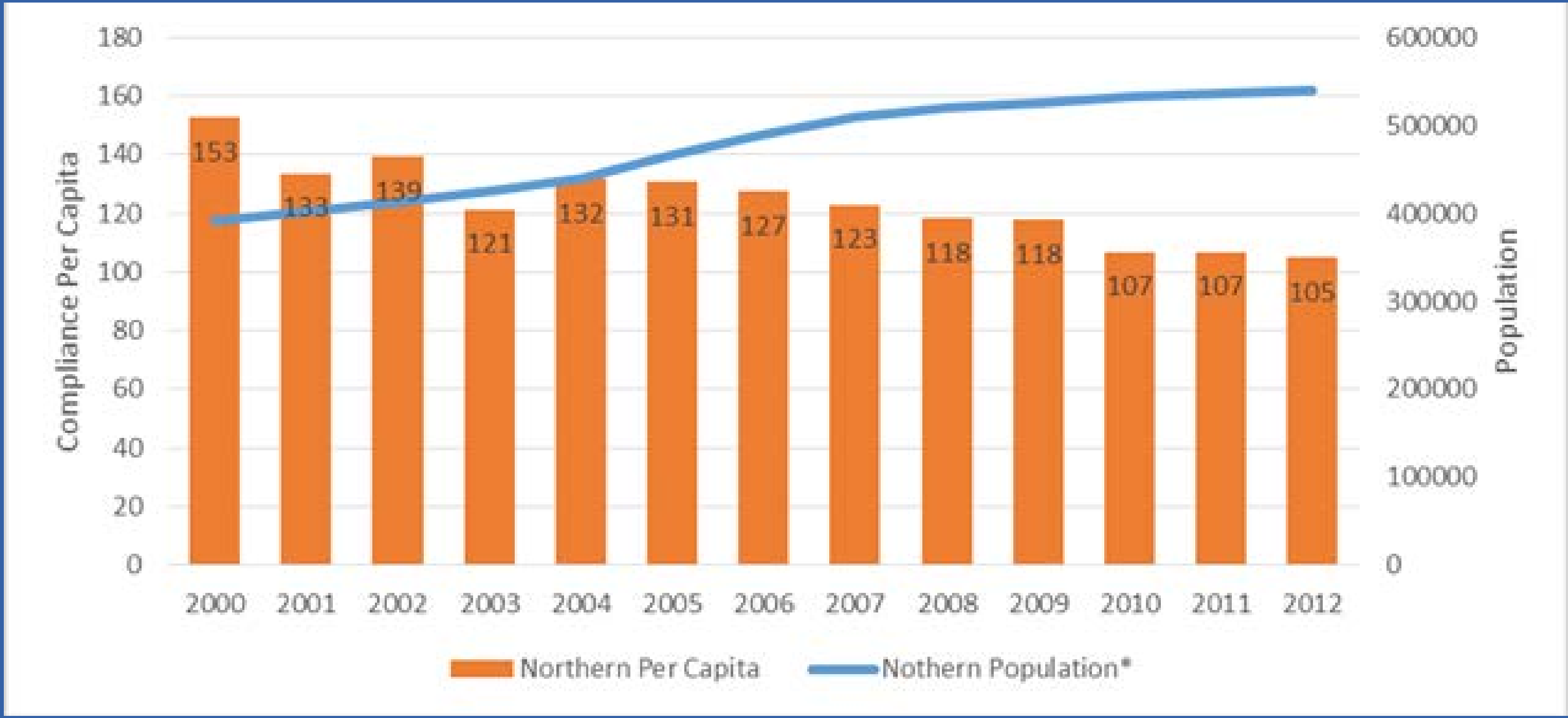




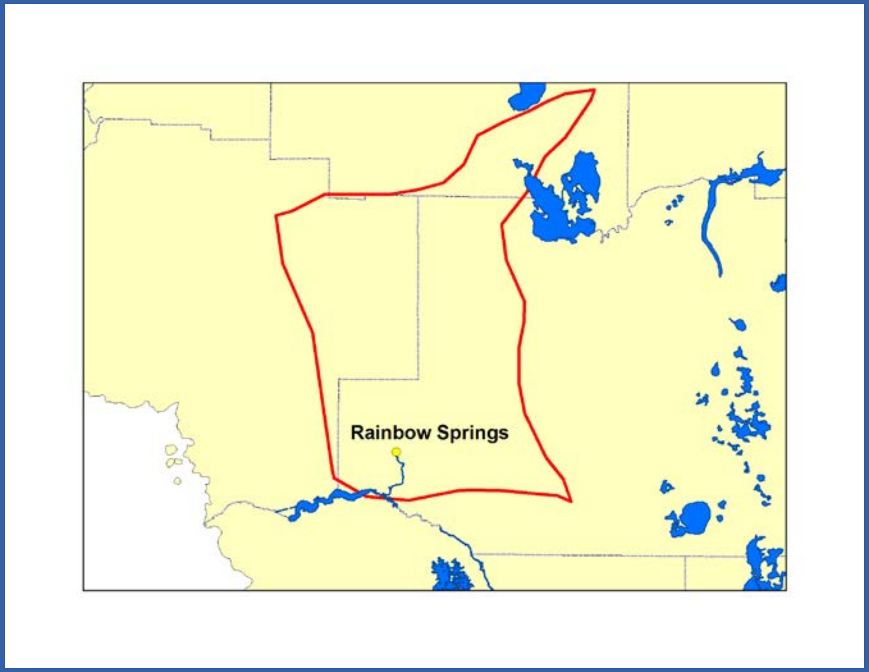
Groundwater Withdrawals in District's Northern Region

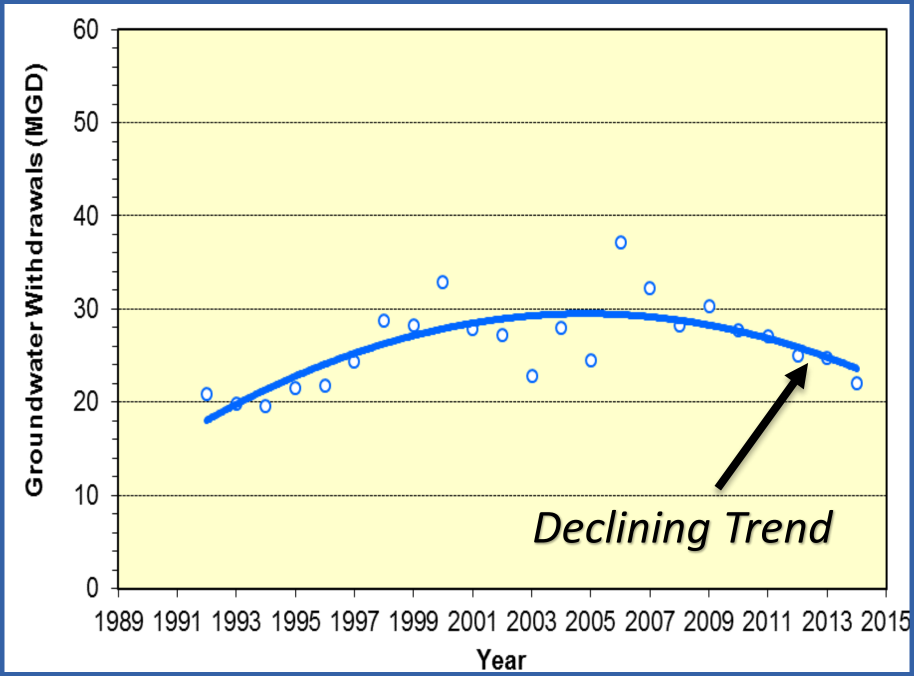


Northern Region Per Capita vs Population



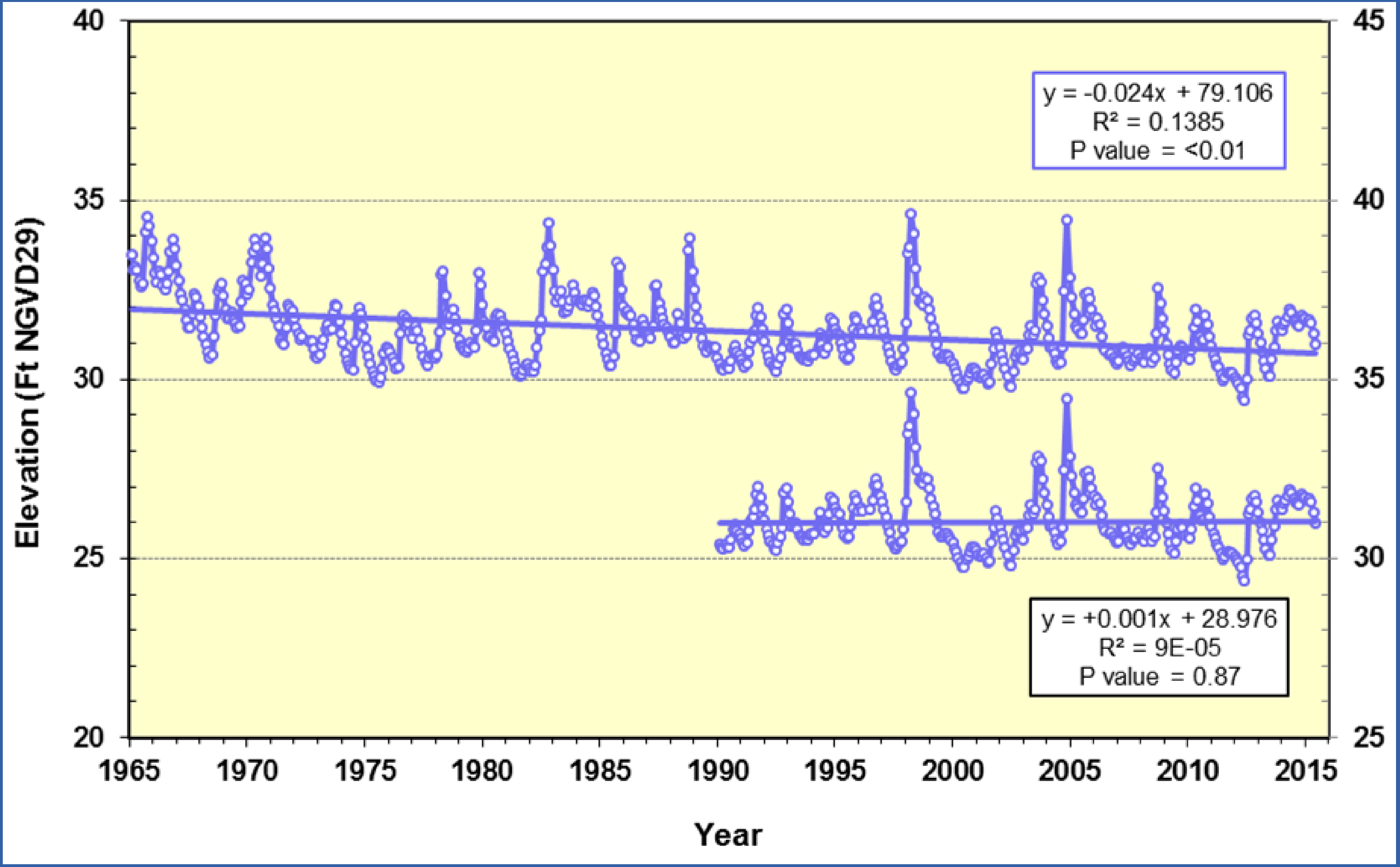
Rainbow Springshed Groundwater Withdrawals



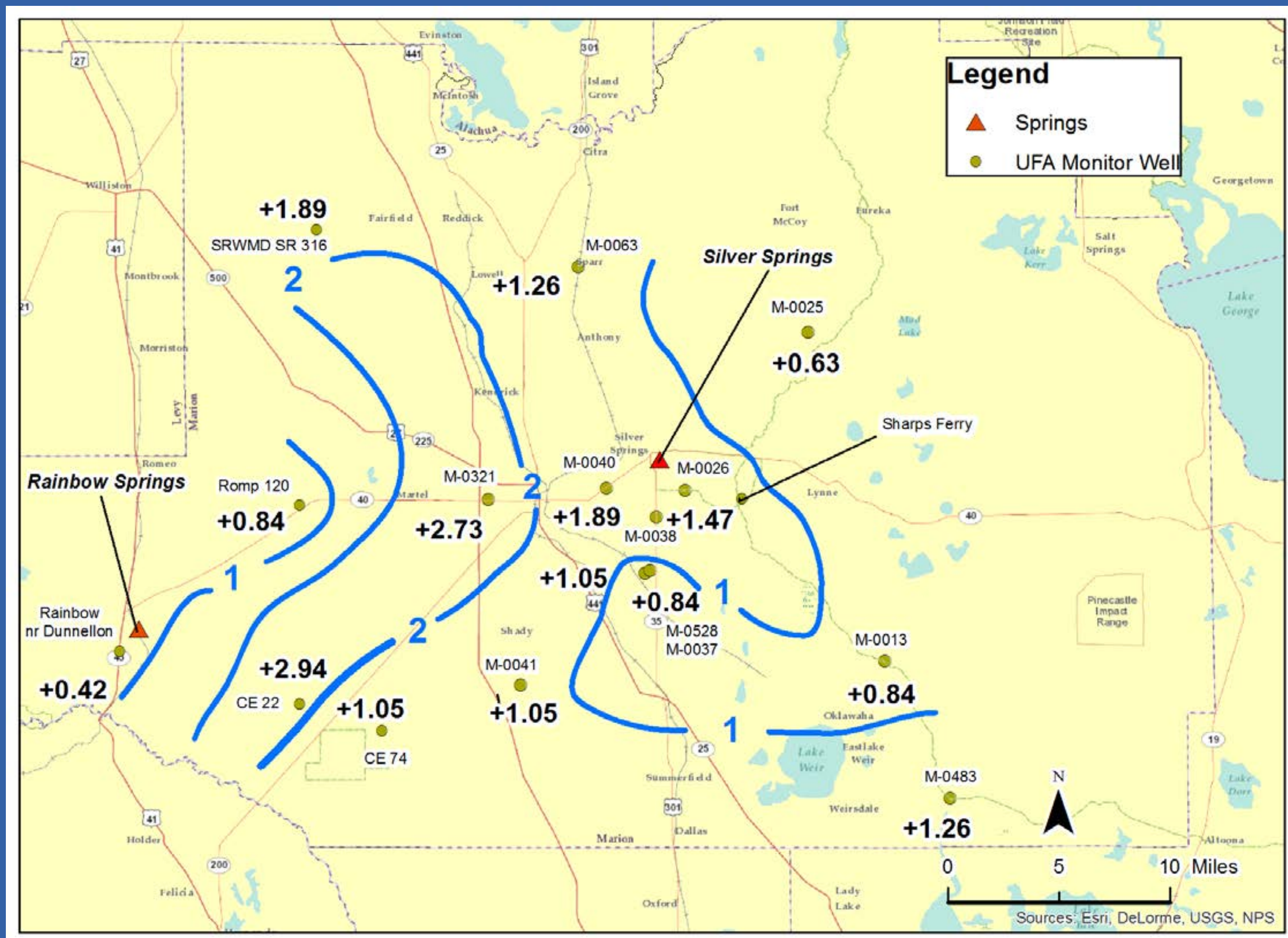


Springshed Pumping History (1992-2014)

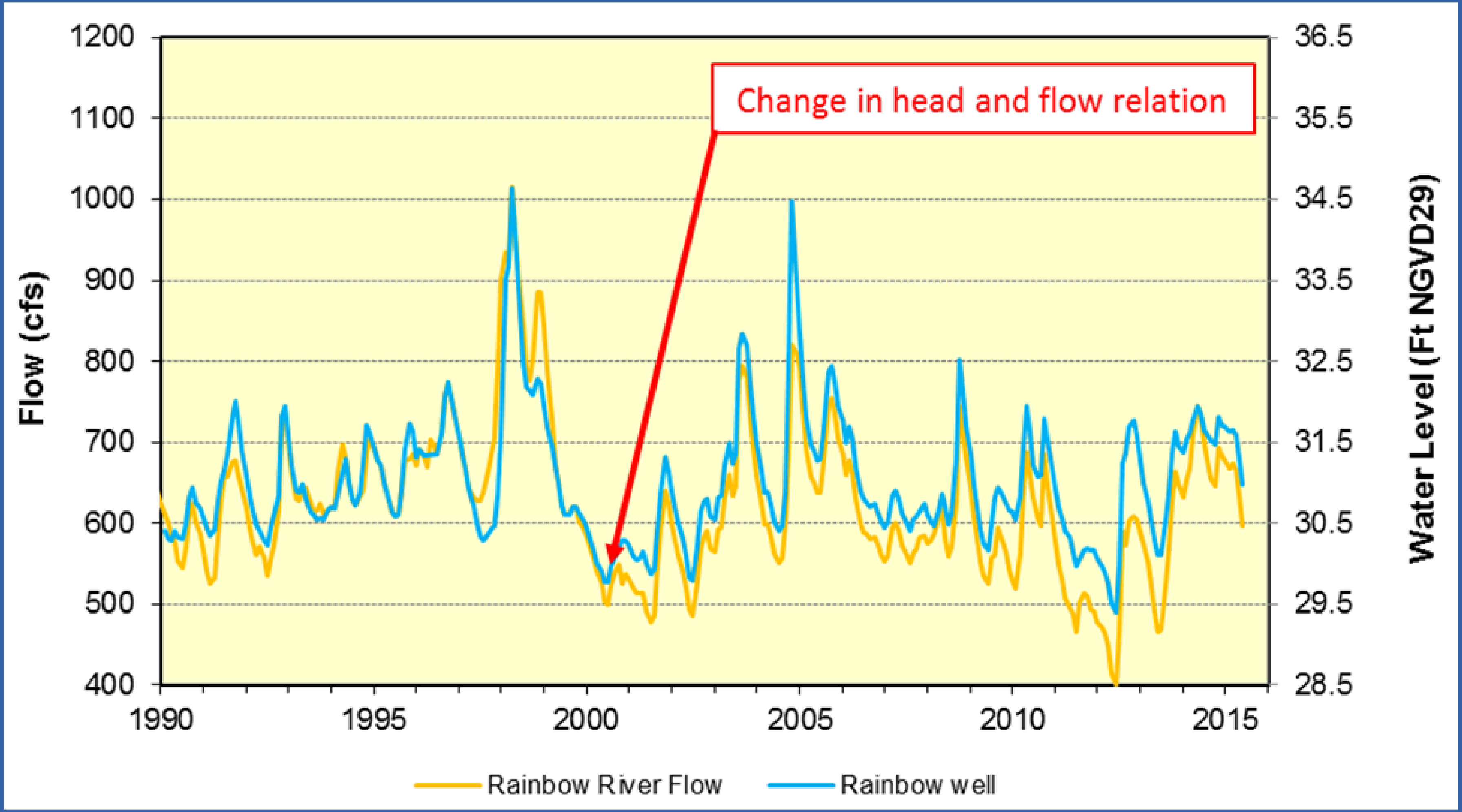
Rainbow well near Dunnellon
Water level trend from 1965-2015 and 1990-2015



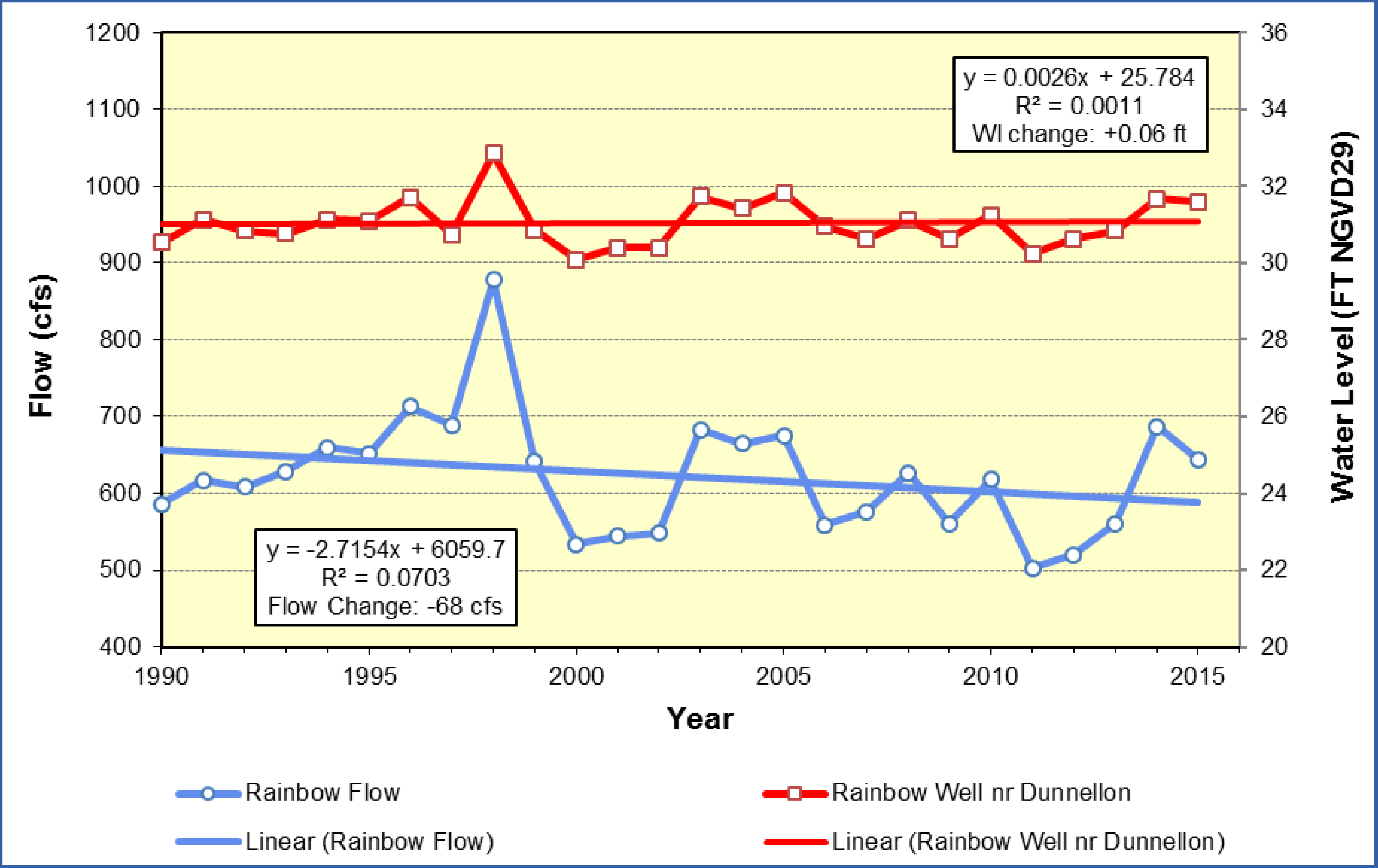
Water Level Change from 16 monitor wells (1990-2010)



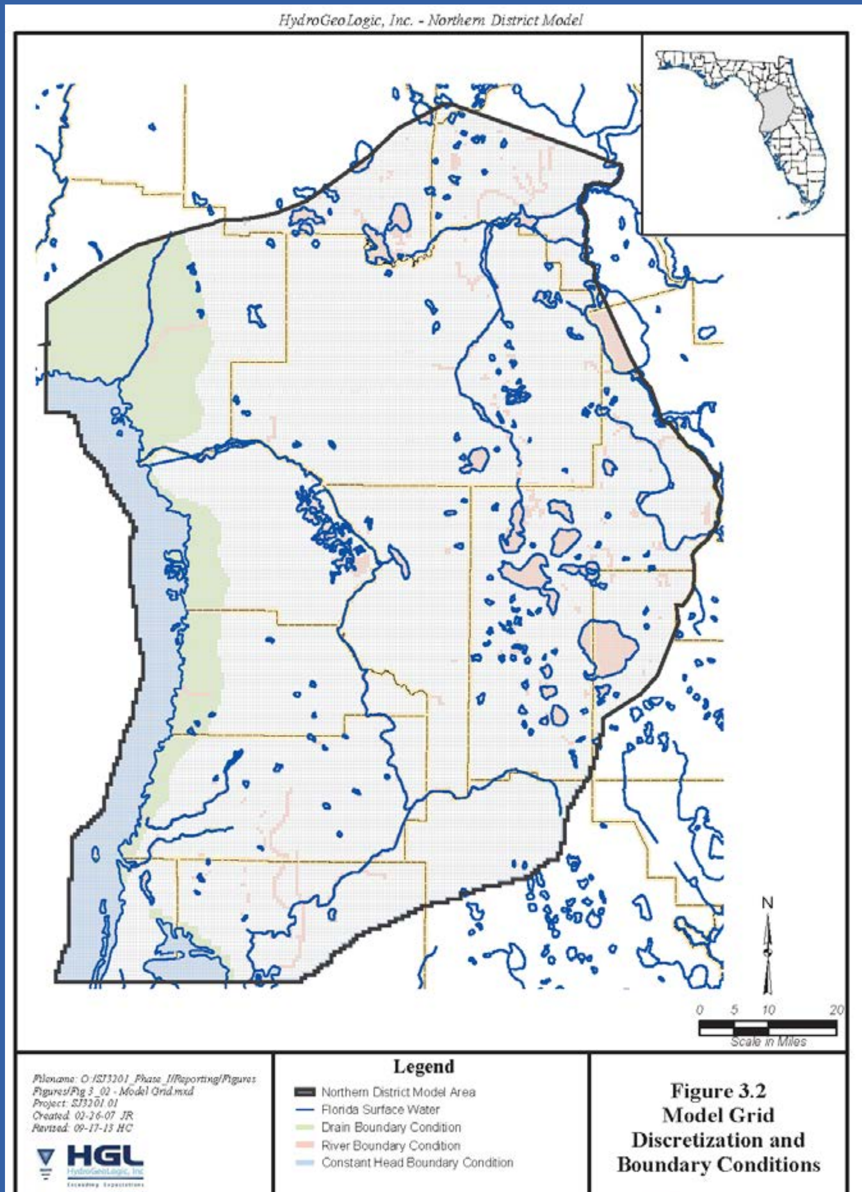
Rainbow Springs Flow versus UFA water Level at Rainbow well near Dunnellon



Rainbow Spring Flow and UFA Water Level (1990-2015)



Northern District Model (Version 5.0)



Layer 1 – Surficial Aquifer

Layer 2 – Intermediate Confining Unit (Hawthorn)

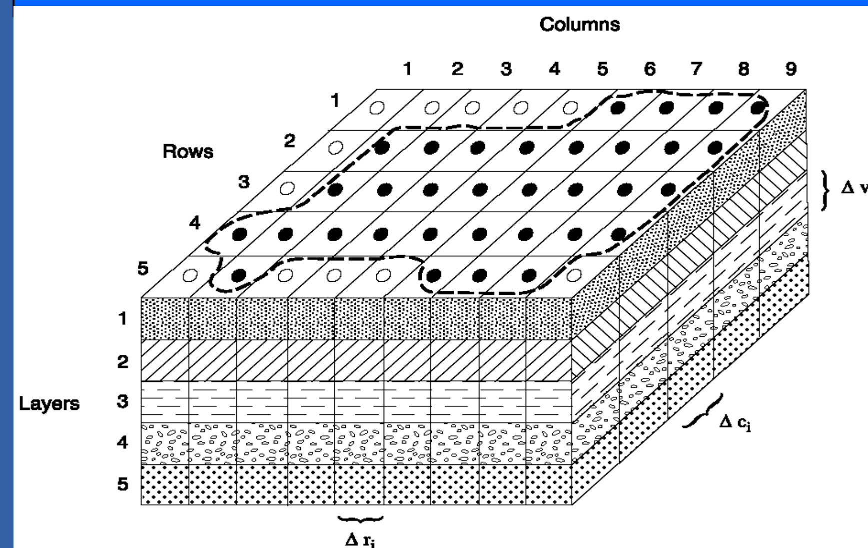
Layer 3 – Upper Floridan Aquifer (Suwanee)

Layer 4 – Upper Floridan Aquifer (Ocala)

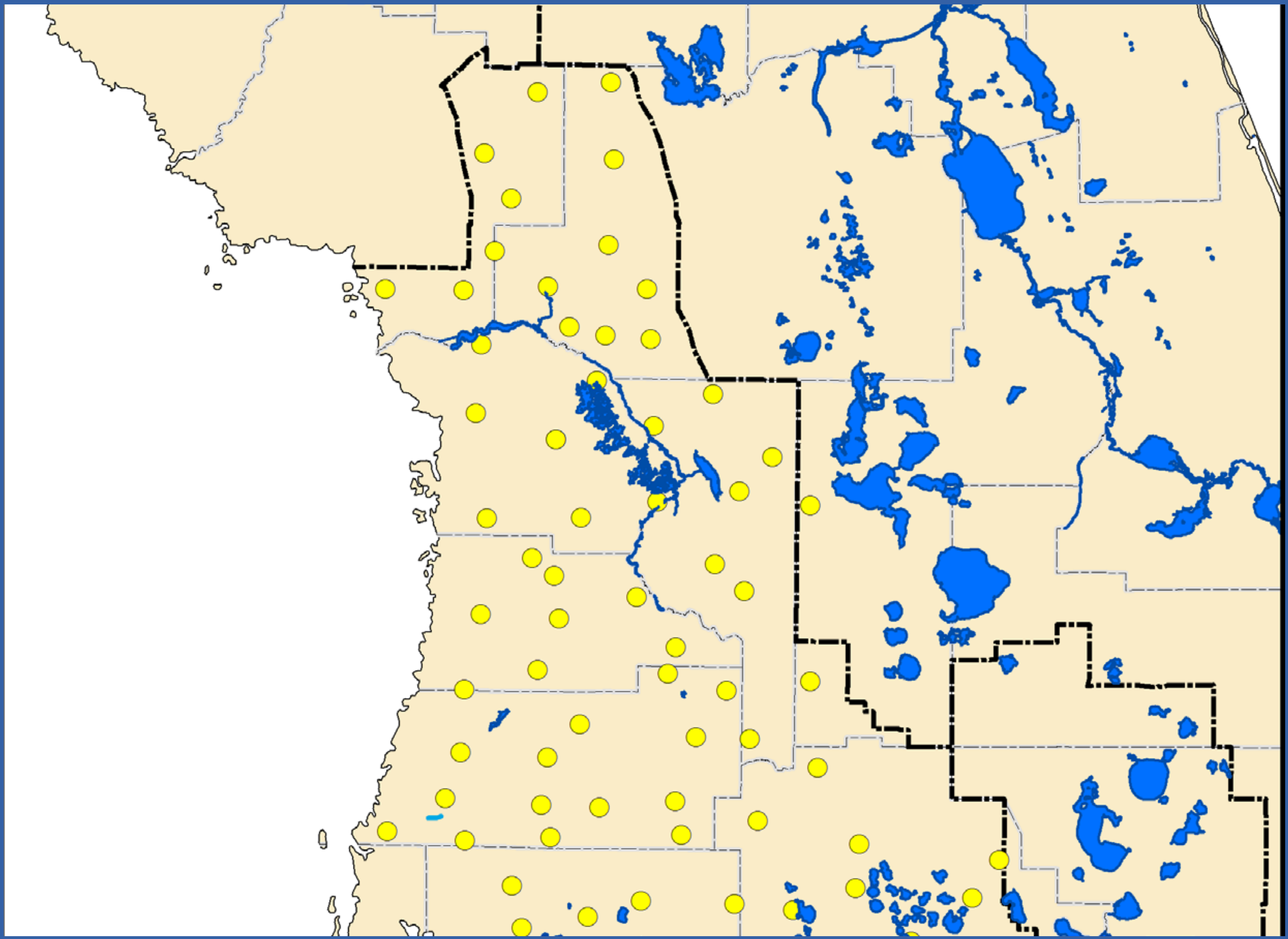
Layer 5 – Upper Floridan Aquifer (Upper Avon Park)

Layer 6 – Middle Confining Unit

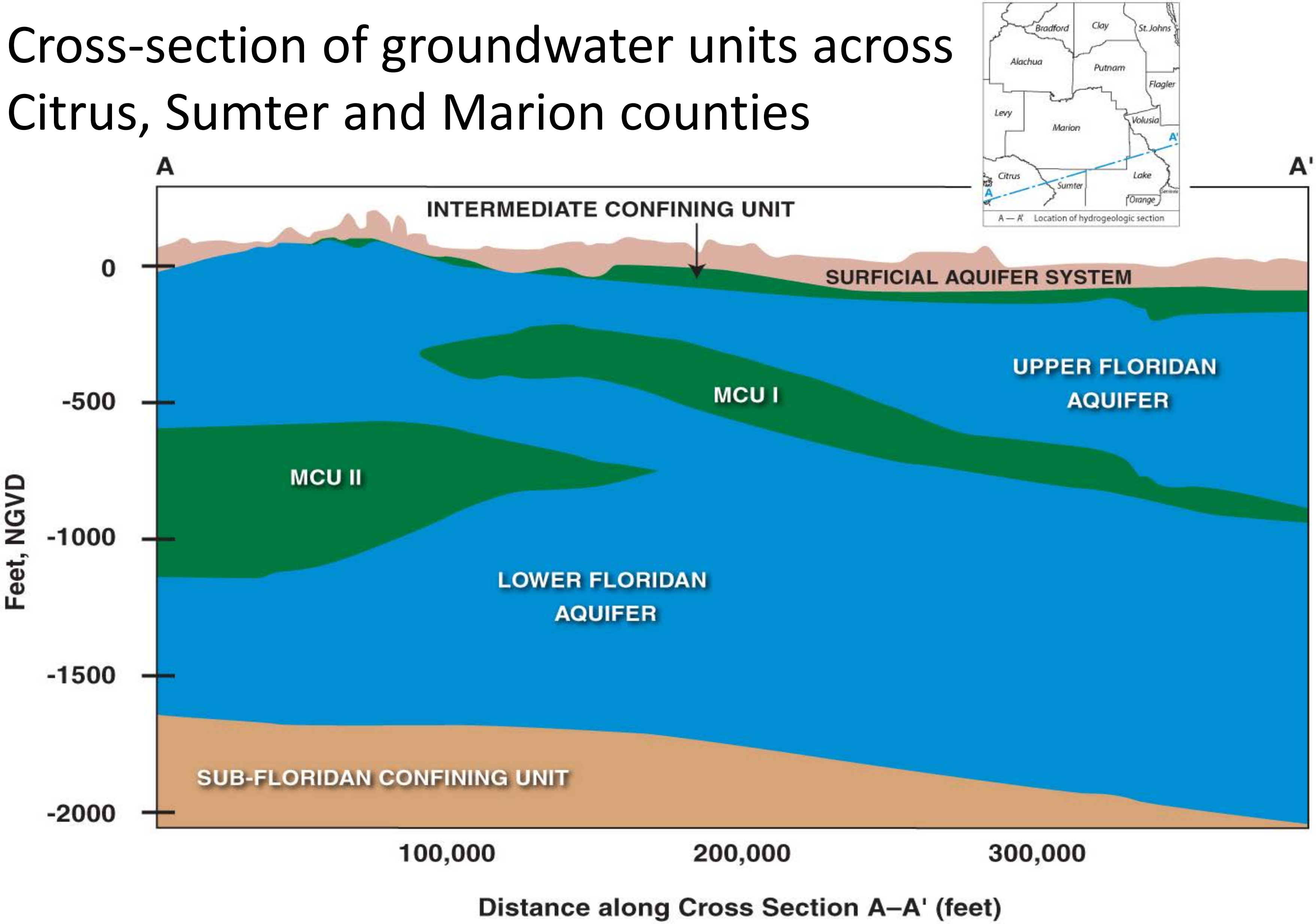
Layer 7 – Lower Floridan Aquifer (Lower Avon Park/Oldsmar)



Sites where geologic and hydraulic data was used for the NDM5



Cross-section of groundwater units across Citrus, Sumter and Marion counties



Rainbow Spring Flow Change from Groundwater Withdrawals

Year	Model GW Withdrawals (mgd)	Non-pumping flow (cfs)	Pumping Flow (cfs)	Difference (cfs)	Difference (percent)
2010	479.1	659.58	651.37	8.21	-1.2
2014	403.9	659.58	653.51	6.07	-0.9
2035	635.1	659.58	643.94	16.18	-2.5
2035 with Conservation & Reuse	576.6	659.58	646.13	13.45	-2.0

Note: Groundwater withdrawal impact based on Northern District Model Version 5

Dr. Stewart indicated in his most recent peer review that the *"NDM, Version 5.0, is the best numerical groundwater flow model currently available for assessing the effects of withdrawals in the central (Florida) springs region."*

Summary

- Rainfall deficits have contributed to most of the lower springflow since the 1960s
- Geology and relatively low groundwater use have led to small flow changes of one to two percent compared to flow changes caused by below average rainfall and other factors
- Springflow is lower post-2000 but not due to groundwater withdrawals
- Current groundwater use is lowest since the mid-1990s due to water conservation and slower population growth
- No recovery or additional prevention strategy is needed at this time based on current springflow decline of 1 to 2 percent due to withdrawals. This is projected to increase to 2.5 percent in 2035.

Questions and Comments

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Webpage:
WaterMatters.org/Rainbow


Recommended Minimum Flow for the Rainbow River System
DRAFT

February 2017

Southwest Florida Water Management District

Kym Rouse Holzwart, Yonas Ghile,
Ron Basso, Doug Leeper, Sean King
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Brooksville, Florida

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