Presentation Files

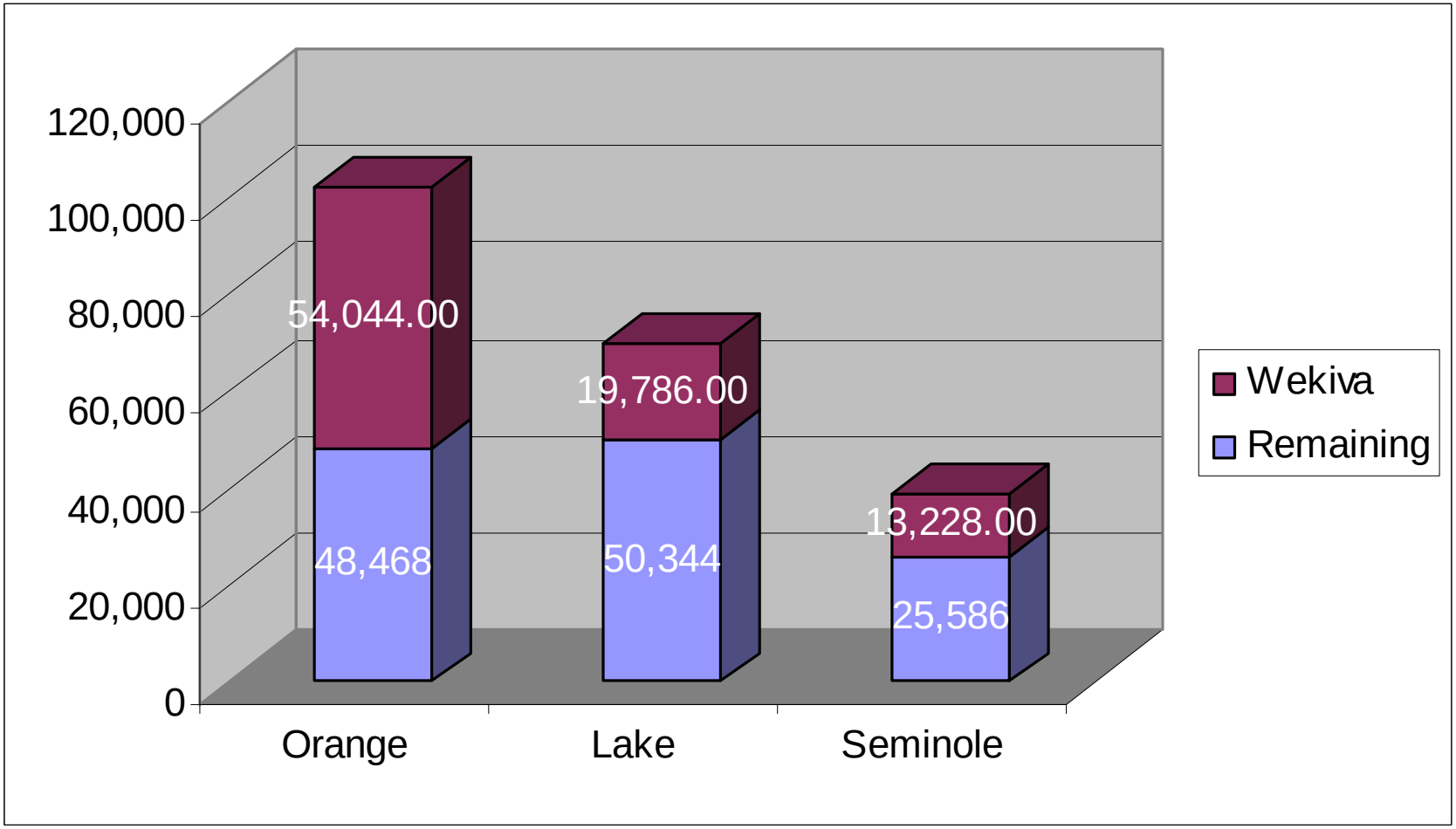
WEKIVA BASIN ONSITE SEWAGE TREATMENT AND DISPOSAL SYSTEM STUDY

Bureau of Onsite Sewage Programs
Division of Environmental Health
Florida Department of Health

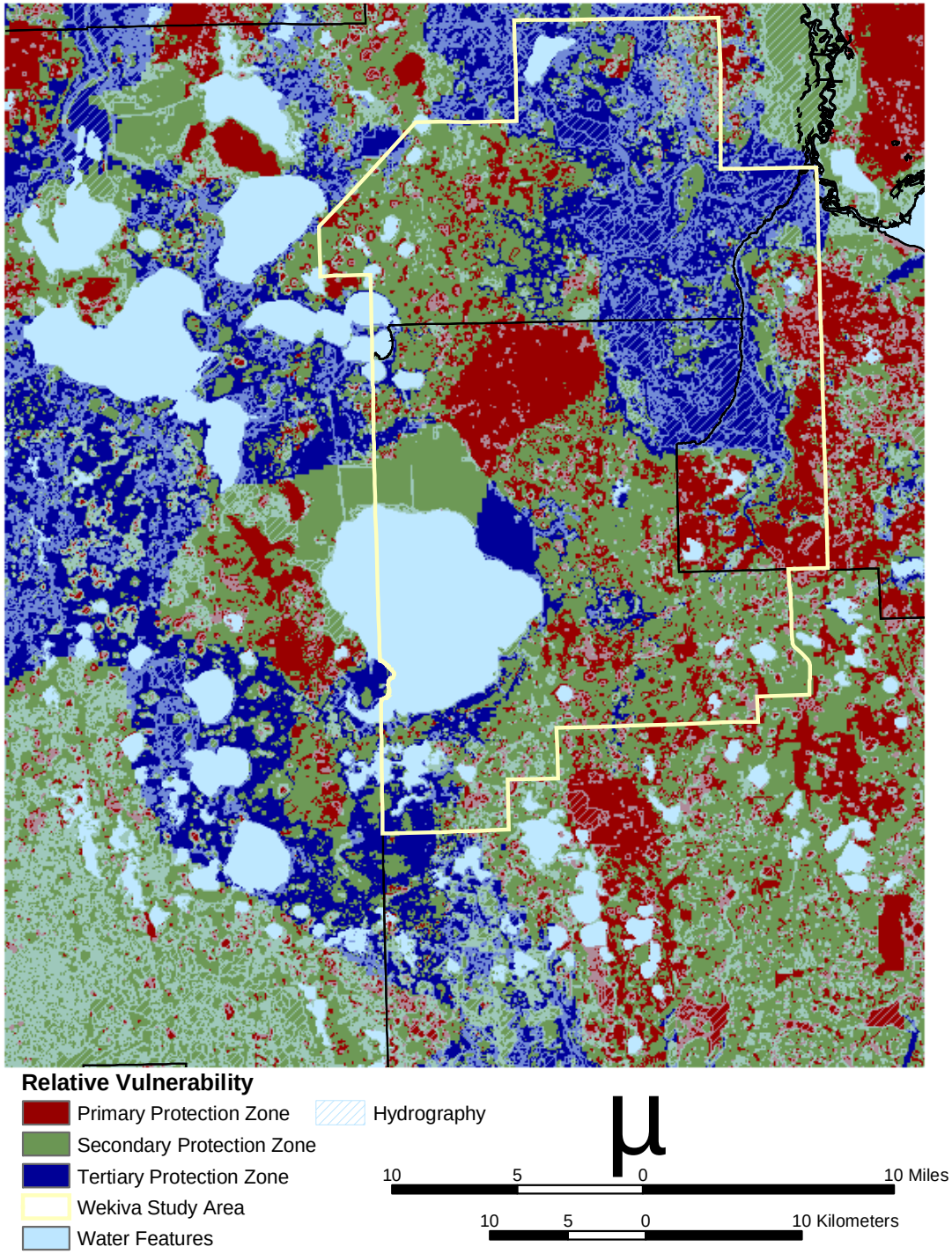
Today’s Presentation

- Existing Onsite Systems and Aquifer Vulnerability in the Wekiva Basin
- Department Recommendations
- DOH Rule Adoption Process

Existing Development on OSTDS



Protection zones based or aquifer vulnerability assessment



Department Recommendations

DOH Recommendations 1

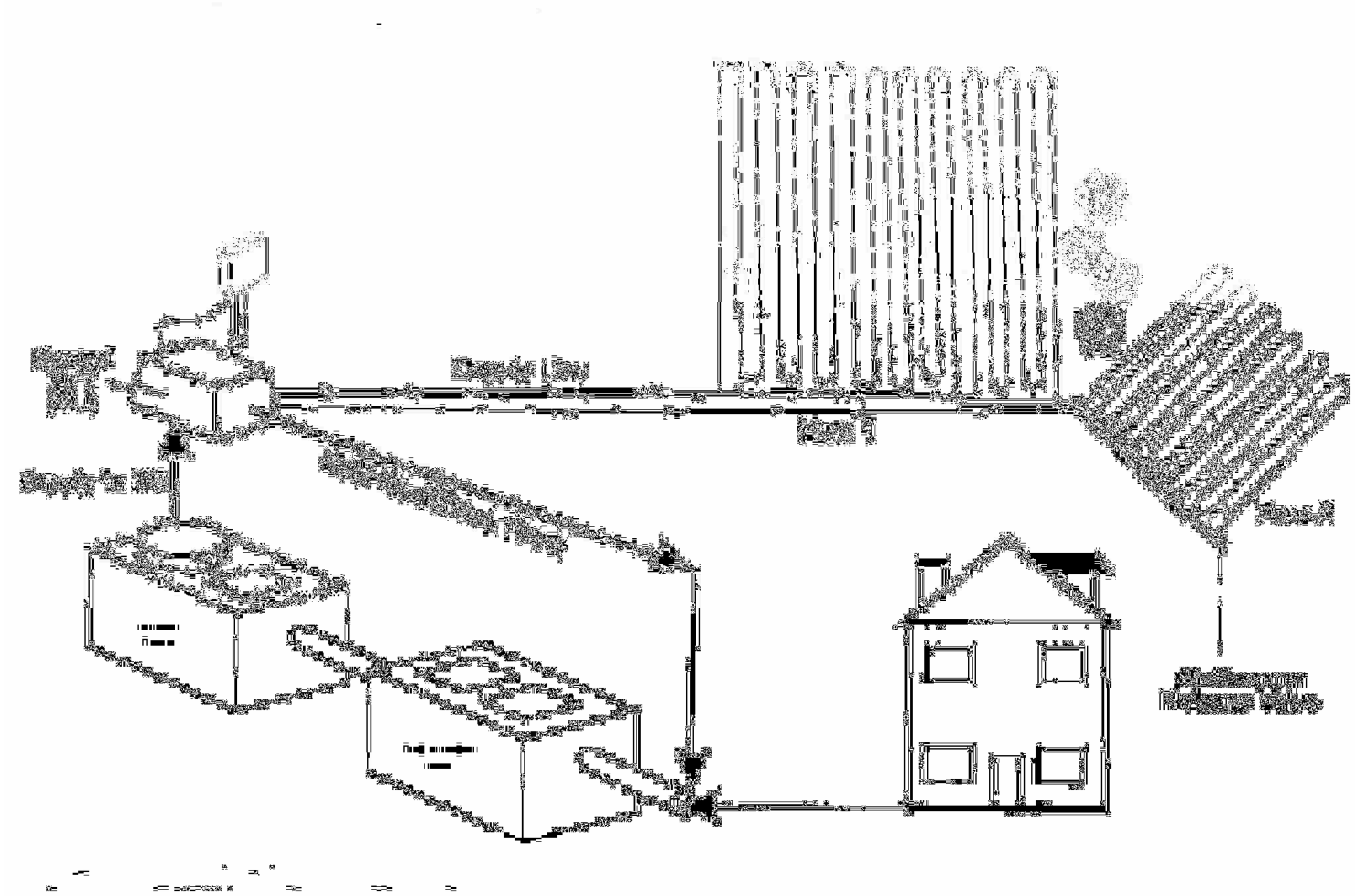
- Set a discharge limit of 10 milligrams per liter of total nitrogen for new systems, systems being modified, and for existing systems in the primary and secondary Wekiva Study Area protection zones.
- Prohibit the land-spreading of septage and grease trap waste in the Wekiva Study Area. Septage waste would be required to be disposed of at wastewater treatment plants.

DOH Recommendations 2

- Evaluate the economic feasibility of sewering versus nutrient removal upgrades to existing onsite sewage treatment and disposal systems. A phased-in approach to replacing the remaining existing systems should be developed with a target completion date of 2010.

- Establish new regional wastewater management entities or modify existing ones to oversee the maintenance of all wastewater discharged from onsite sewage treatment and disposal systems in the study area. These programs should take the privatization approach and contract with existing licensed septic tank contractors.

The Recommended System



A Nutrient Reducing System with Drip Irrigation

System Construction and Operating Costs

- Conventional system
  $5,500 to $7,000

  No operating permit
  except IM zoned areas

- Proposed system
  $7,500 to $9,000

  $100 operating permit
  Every 2 years

  $140 in annual
  electric costs

  Maintenance agreement

DOH Rule Adoption Process

Rule Adoption

- Primary issues are to adopt a nitrogen limit and require drip irrigation for onsite systems
- Permitting process is already in place in the rule

- Public Input - Technical Review and Advisory Panel (TRAP) established by 318.0068 FS
- Formal TRAP Meeting to review proposals in May, 2005;
- Anticipated rule implementation as early as March 2006

Solving Water Pollution Problems in the Wakulla Springshed

The City of Tallahassee's Efforts to Reduce Stormwater Pollution

Hydrogeology Workshop

May 12-13, 2005

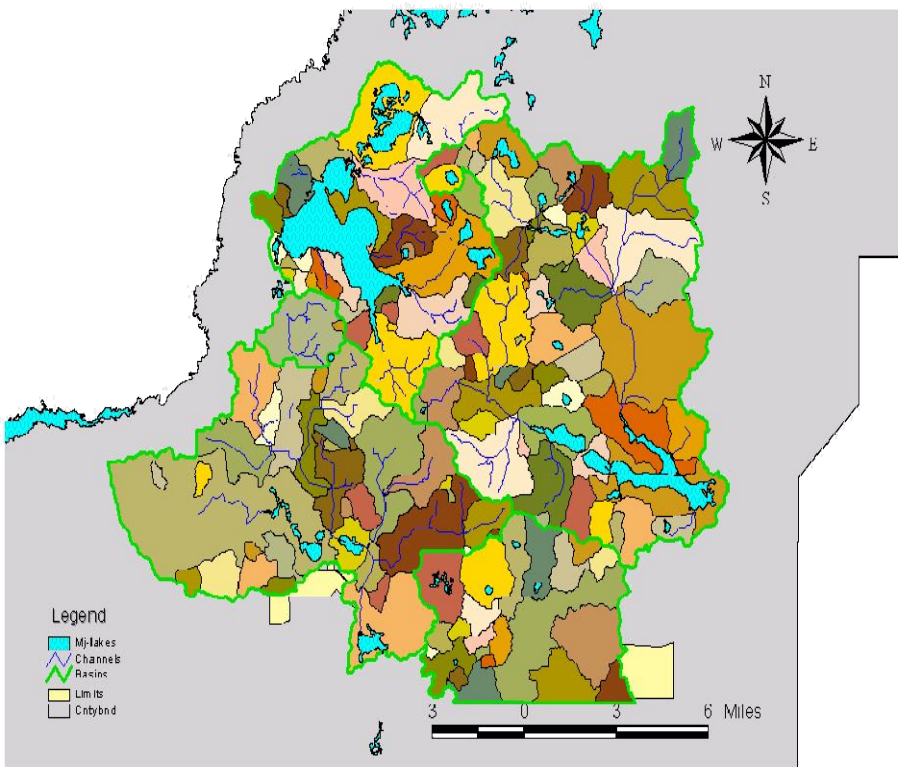
Water Quality and Stormwater Pollution

- City of Tallahassee shares the goal of preserving water quality with Leon and Wakulla Counties, FDEP, EPA, Friends of Wakulla Springs and all Stakeholders.
- Best accomplished through technically sound planning and goal setting.

The Reality of Our Working Environment

- There are many competing needs for a community's financial resources; fire, police, schools, roads…..
- Managing and improving water quality is an expensive endeavor.
- Due diligence must be used to ensure that the limited funding that is available, is effectively applied.
- Failure to do so, actually works against the goal of preserving water quality.

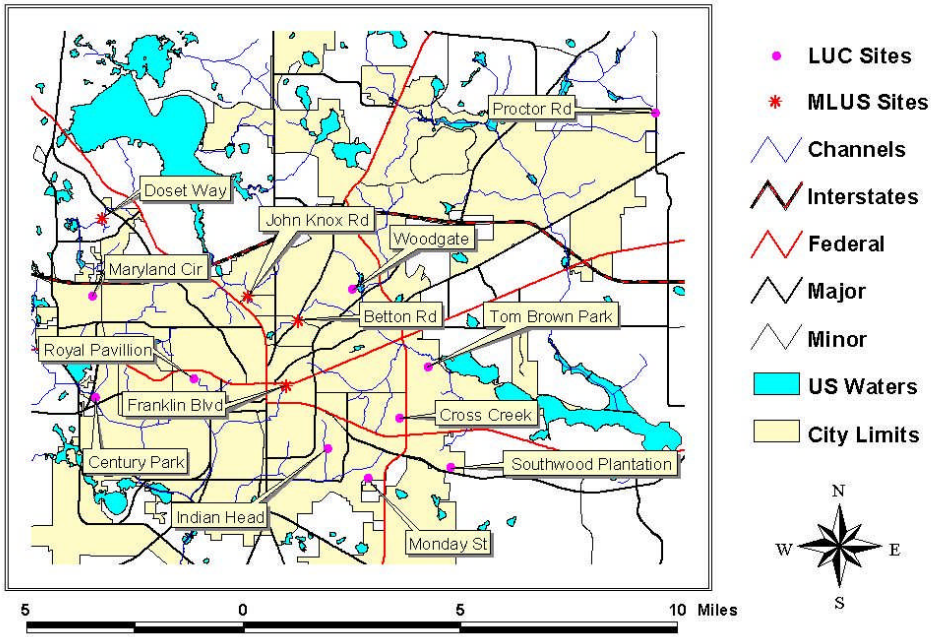
City of Tallahassee's – Stormwater Pollution Reduction Planning



- **The objective -- maximize progress with focus on problem magnitude and remediation effectiveness.**
- **140,000 acres modeled**
- **145 discrete catchments**

City of Tallahassee's – Stormwater Pollution Reduction Planning

Monitoring Sites Map



- **Monitoring sites were used to characterize the pollution in runoff from different land uses.**

City of Tallahassee's – Stormwater Pollution Reduction Planning

- **Typical monitoring site used to collect and measure the pollution in runoff.**

TALLAHASSEE STORMWATER

- **Nitrogen values**

  Less than National and Statewide Averages

- **Phosphorus, BOD, and TSS values**

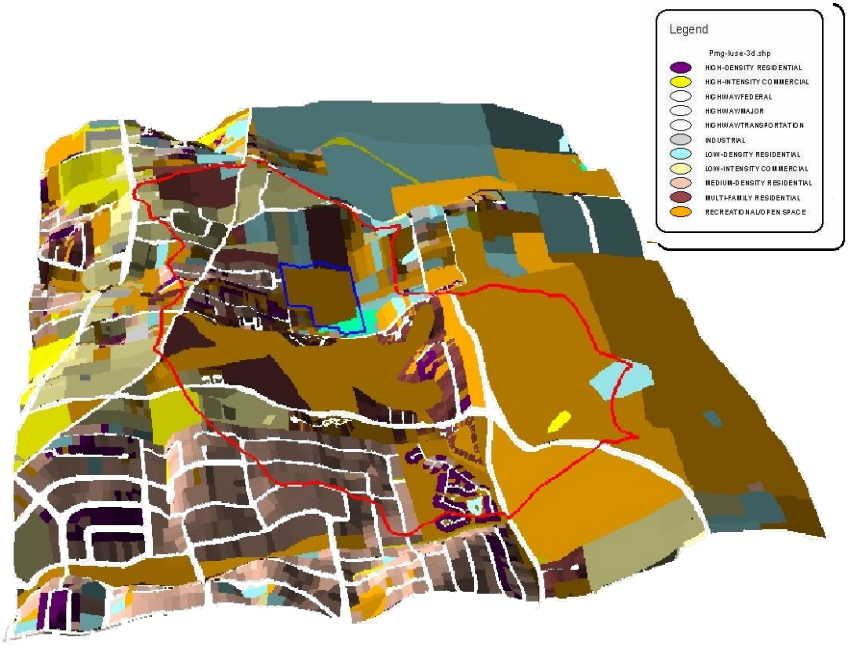
  Higher than National and Statewide Averages for Residential, Recreational and Open Land.

  Lower or equal to Statewide Averages for Other Land Uses.

- **Metals values**

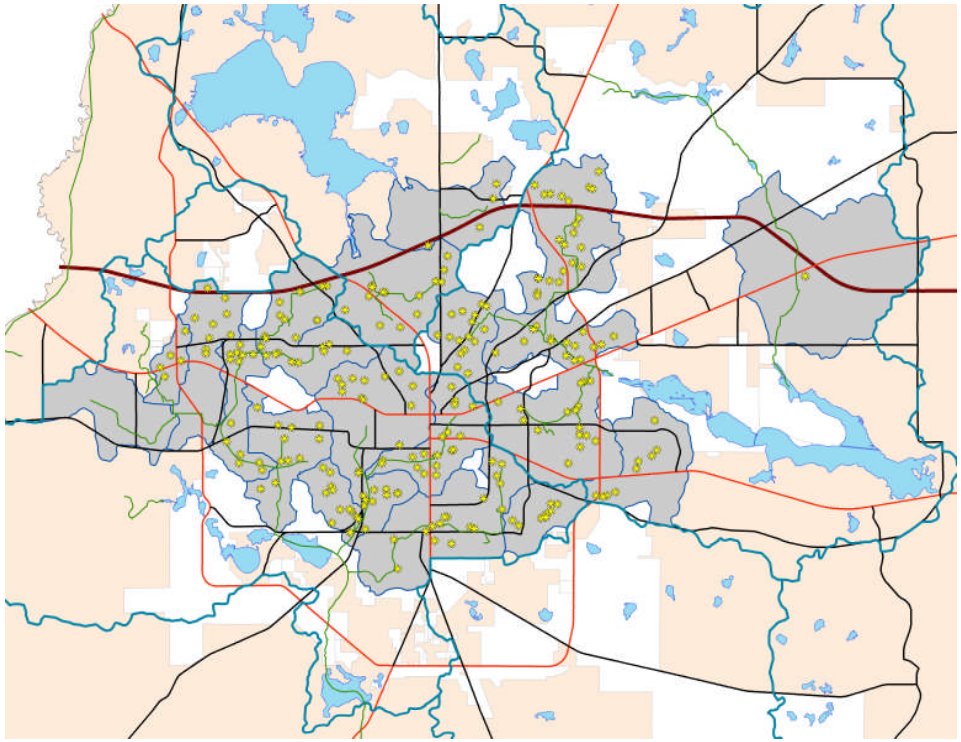
  Less than National and Statewide Averages except for Pb

City of Tallahassee's – Stormwater Pollution Reduction Planning



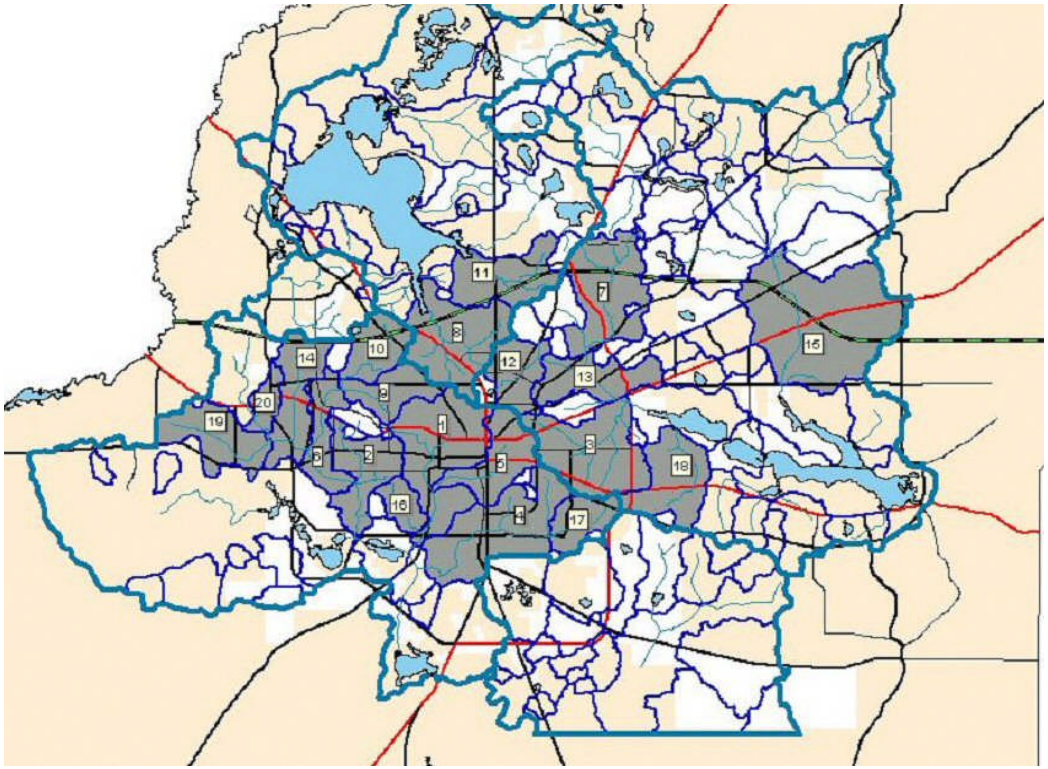
- **Pollutant loading data was applied to the land use map across 140,000 acres.**
- **This enables quantification of pollutant loads by watershed.**

City of Tallahassee's – Stormwater Pollution Reduction Planning



- Pollutant Loading Model was combined with BMP data to develop a Program Cost Model.
- Done by evaluating actual pond sites and developing cost estimates and removal rates.
- Yielded cost curves for a variety of alternative program levels.

Target Watersheds Alternative

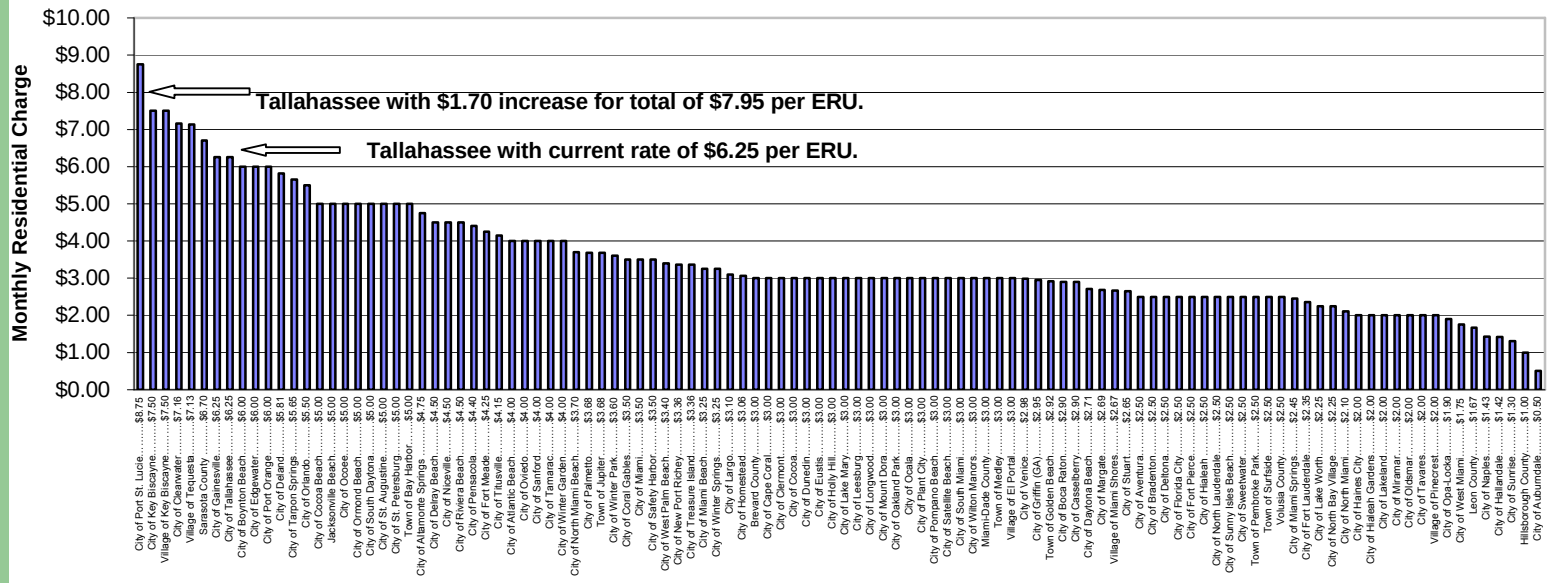


- Revenue limitations led to examination of alternative approaches.
- Identified 20 Target Watersheds with highest loadings.

Target Watersheds Alternative

- $60 million in investment over approx. 20 years
- Not a “end-all” solution but - a realistic start for what will be a long term effort.
- Even this approach presents challenges.

Tallahassee's SW Utility Fee With W/Q Increase



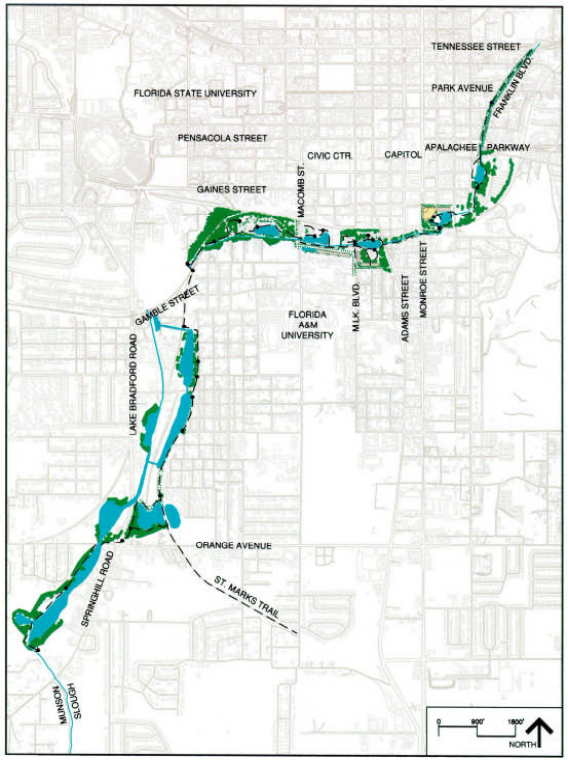
Florida Survey of Stormwater Utility Rates

Impact of $1.70 SW Fee Increase on 20 Largest Customers

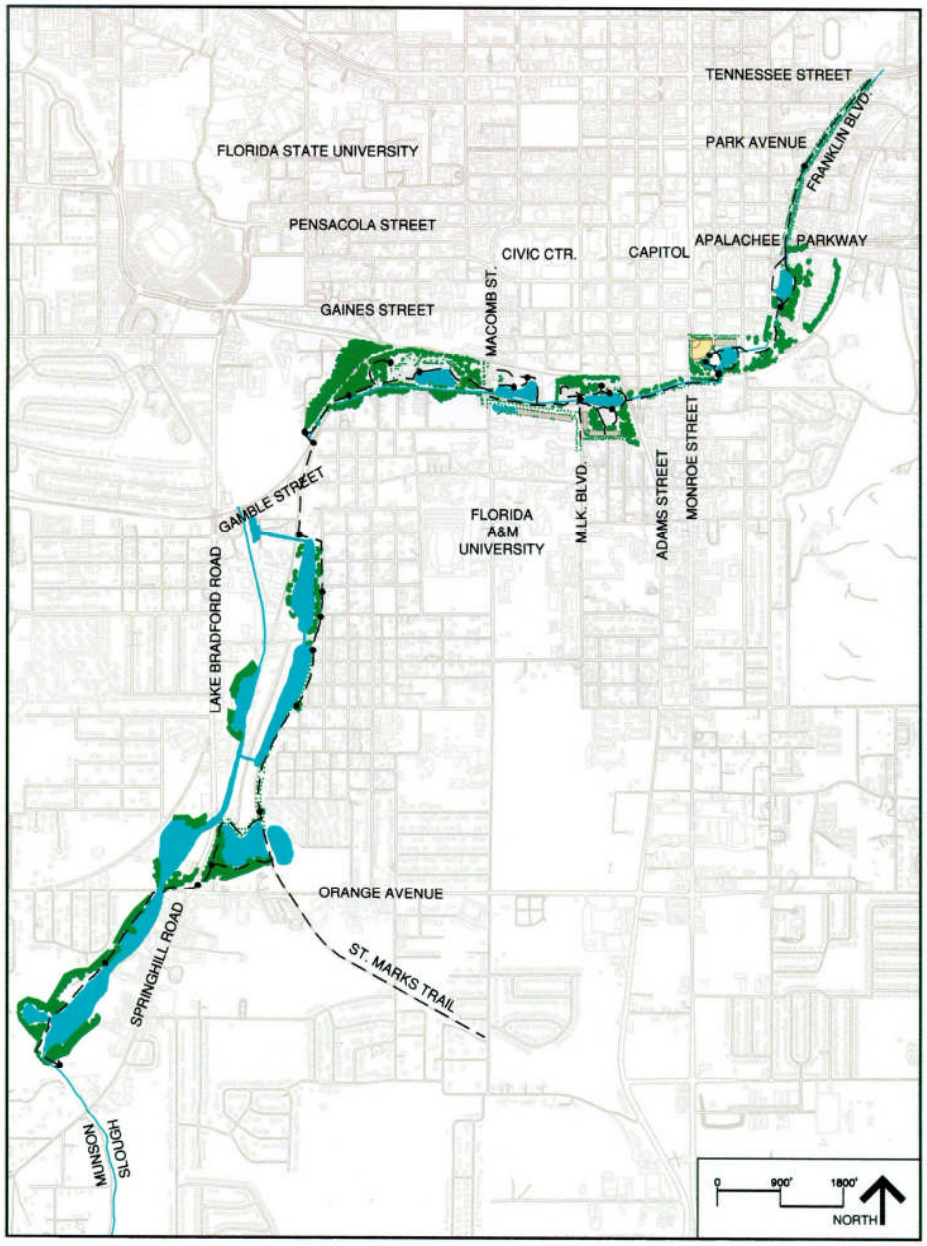
Current Annual	Annual Change with $1.70 Increase	Current Monthly	Monthly Change with $1.70 Increase
$458,663	$124,756	$38,222	$10,396
$397,185	$108,034	$33,099	$9,003
$350,243	$95,266	$29,187	$7,939
$341,303	$92,834	$28,442	$7,736
$159,465	$43,374	$13,289	$3,615
$103,688	$28,203	$8,641	$2,350
$94,470	$25,696	$7,873	$2,141
$89,550	$24,358	$7,463	$2,030
$49,380	$13,431	$4,115	$1,119
$48,525	$13,199	$4,044	$1,100
$46,650	$12,689	$3,888	$1,057
$45,518	$12,381	$3,793	$1,032
$42,533	$11,569	$3,544	$964
$41,535	$11,298	$3,461	$941
$35,430	$9,637	$2,953	$803
$19,545	$5,316	$1,629	$443
$19,328	$5,257	$1,611	$438
$18,690	$5,084	$1,558	$424
$18,473	$5,025	$1,539	$419
$17,183	$4,674	$1,432	$389

Continued Application of Conventional Stormwater Management Practices

Capital Cascades Trail Stormwater System



- **Cost - $110 million.**
- **Part of City & County Blue Print 2000 Initiative.**
- **15 New Ponds or Wetlands totaling 50 acres.**
- **Removes approximately**
  - **2000 lbs N / yr**
  - **600 lbs P / yr**



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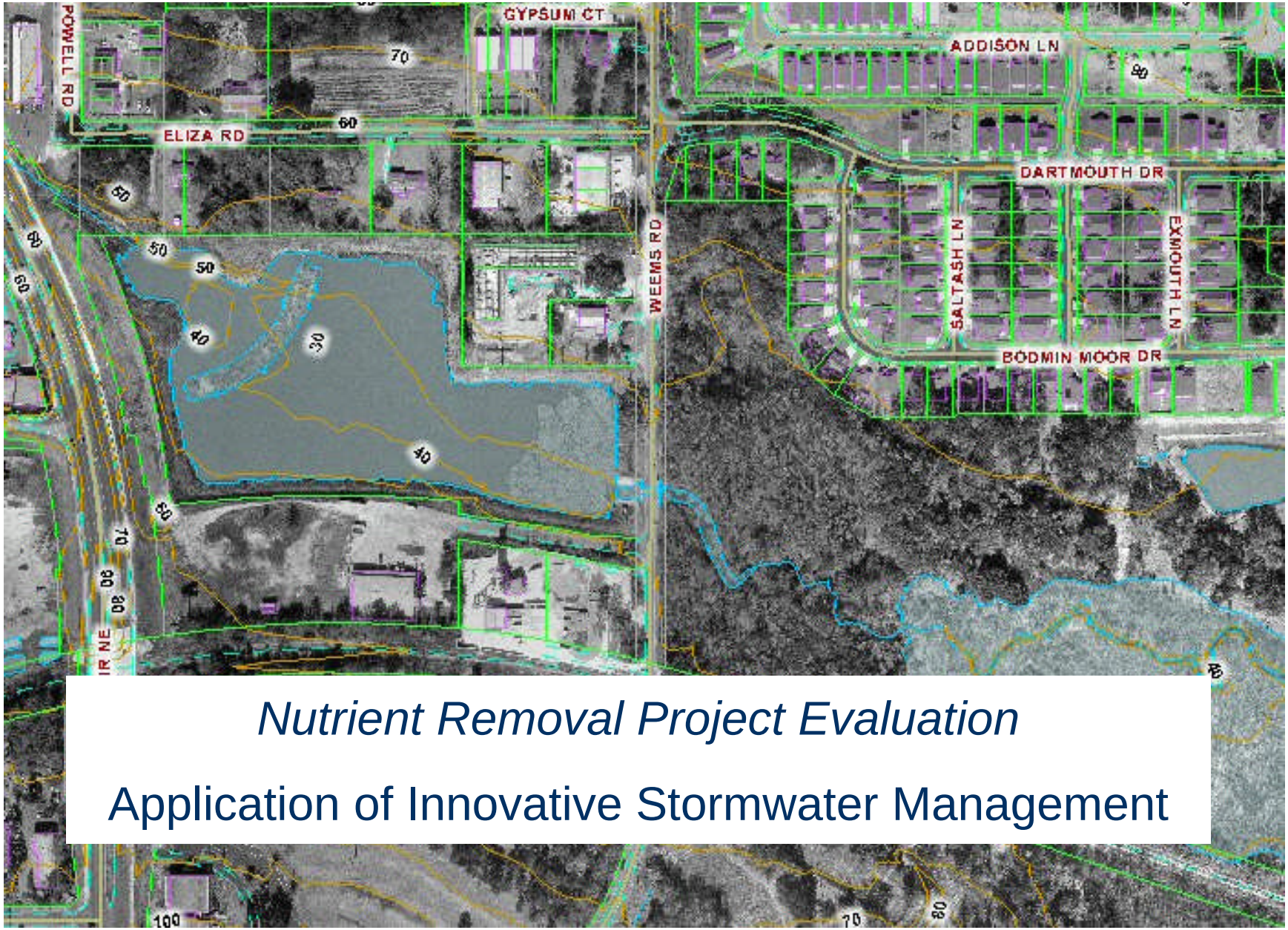


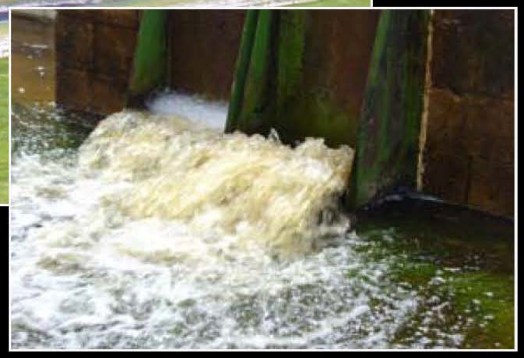
Nutrient Removal Project Evaluation

Application of Innovative Stormwater Management

Algal Turf Scrubber® (ATS™)

Nutrient Removal with Algal Turf Scrubber Process

A Working ATS™



Wave surge motion aids in nutrient exchange between algal cells and water medium

Algal Turf Scrubber® (ATS™)

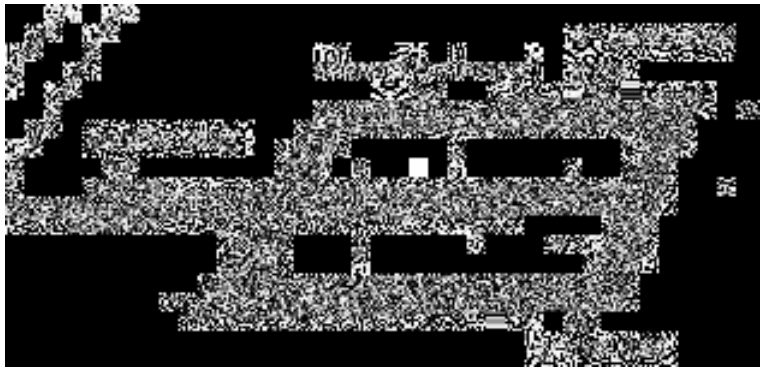
Highlights of Local Project Under Consideration Managed Aquatic Plant System

- Approximate Size = 12 ac.
- Harvest Cycle of 7 Days.
- Total Mass P Percent Removal 35% @ 25 MGD Avg Daily Flow.
- Removal Considers Warm Season (243 da.) and Cool Season (122 da.) Reduced Performance Period.
- Compost Assumed to be Most Likely End Product.

Estimated Cost and Performance of Managed Aquatic Plant System

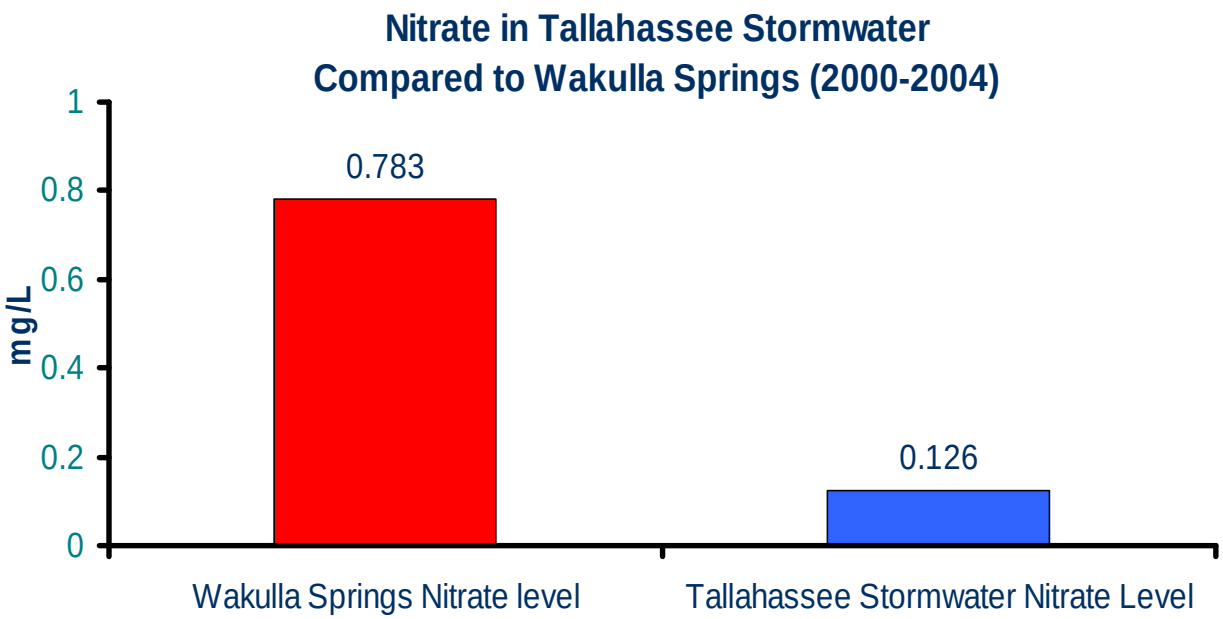
ITEM	Weems Pond NRF
Bench Scale Testing	$81,390
Capital Construction Cost	$2,484,000
Annual Operation	$252,000
Phosphorus Removal (Lbs/Yr)	3,560
Annual Compost (Tons /Yr)	331

Groundwater Nitrate Loading – Various Sources

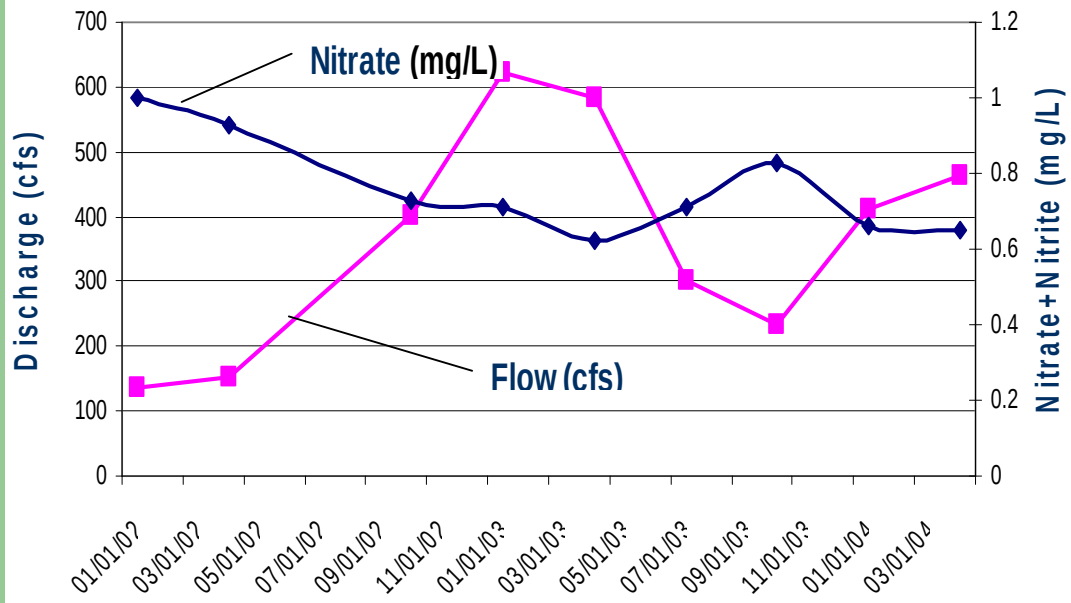


Nitrate Loading – Stormwater

Nitrate in Tallahassee Stormwater Compared to Wakulla Springs (2000-2004)

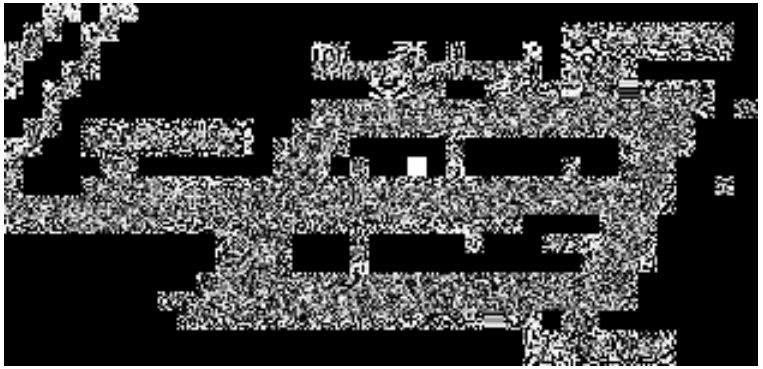


Wakulla Springs - Nitrate Concentration vs. Flow

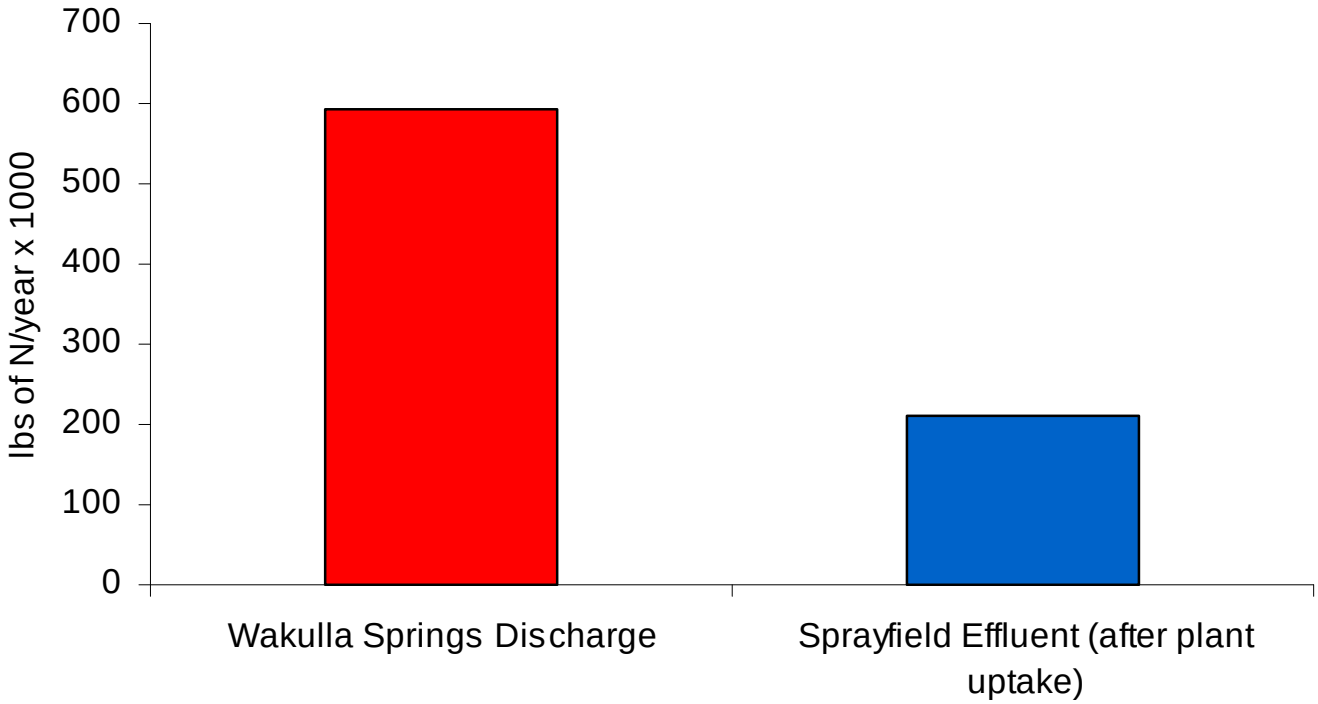


Inverse relationship between flow and Nitrate concentration indicates that stormwater is not the likely source of high nitrate levels at Wakulla Springs.

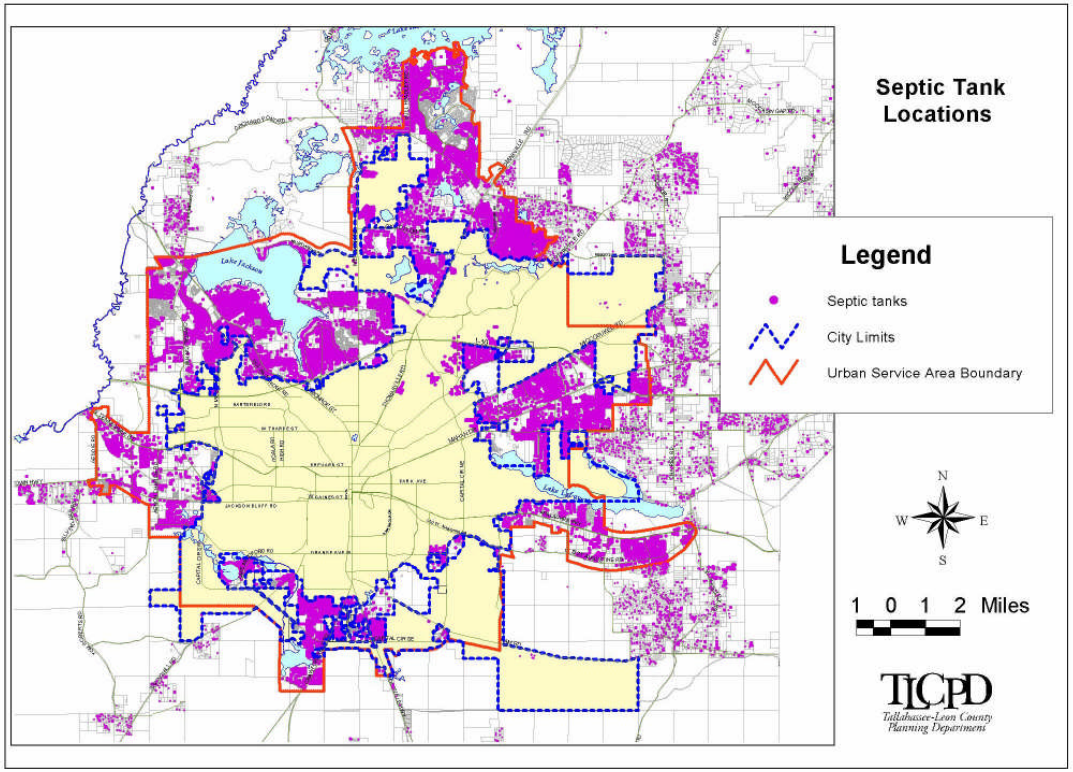
Nitrate Loading – Wastewater Systems



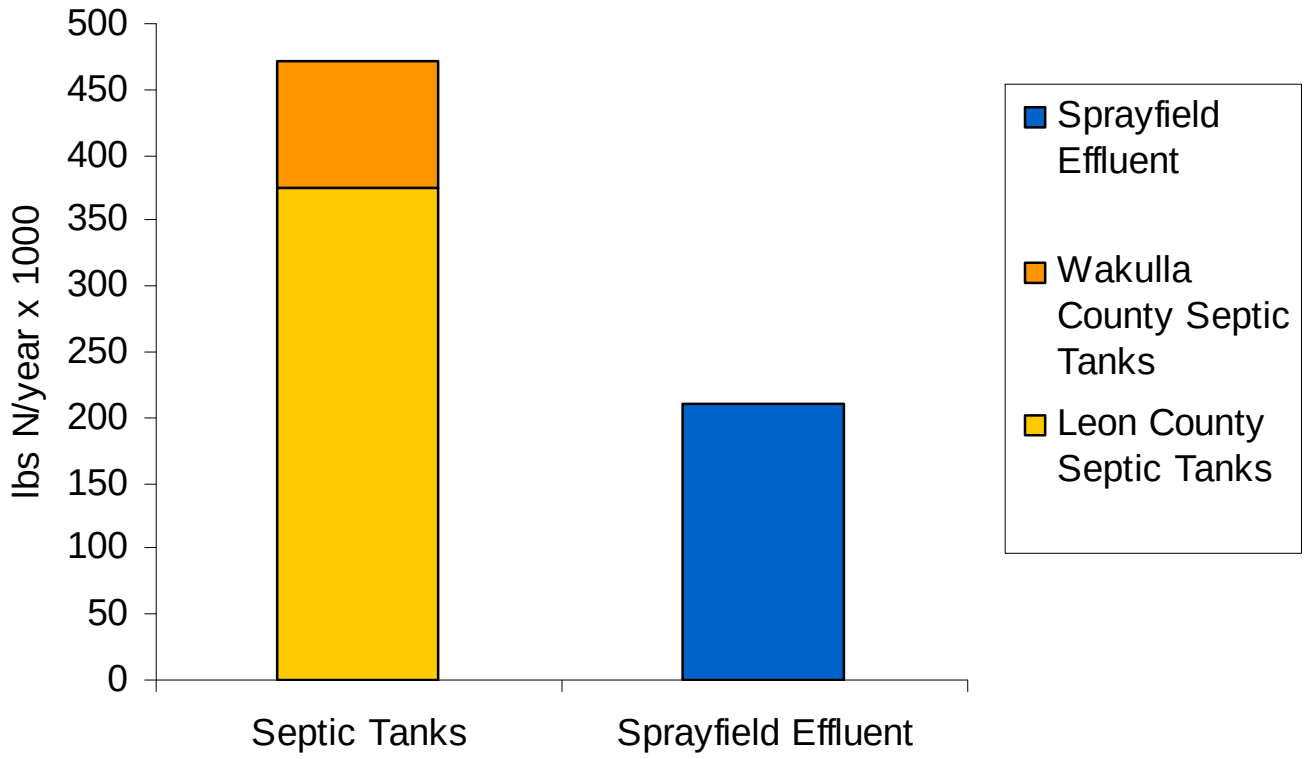
Comparison of Sprayfield Nitrogen Load with Nitrogen Discharge at Wakulla Springs



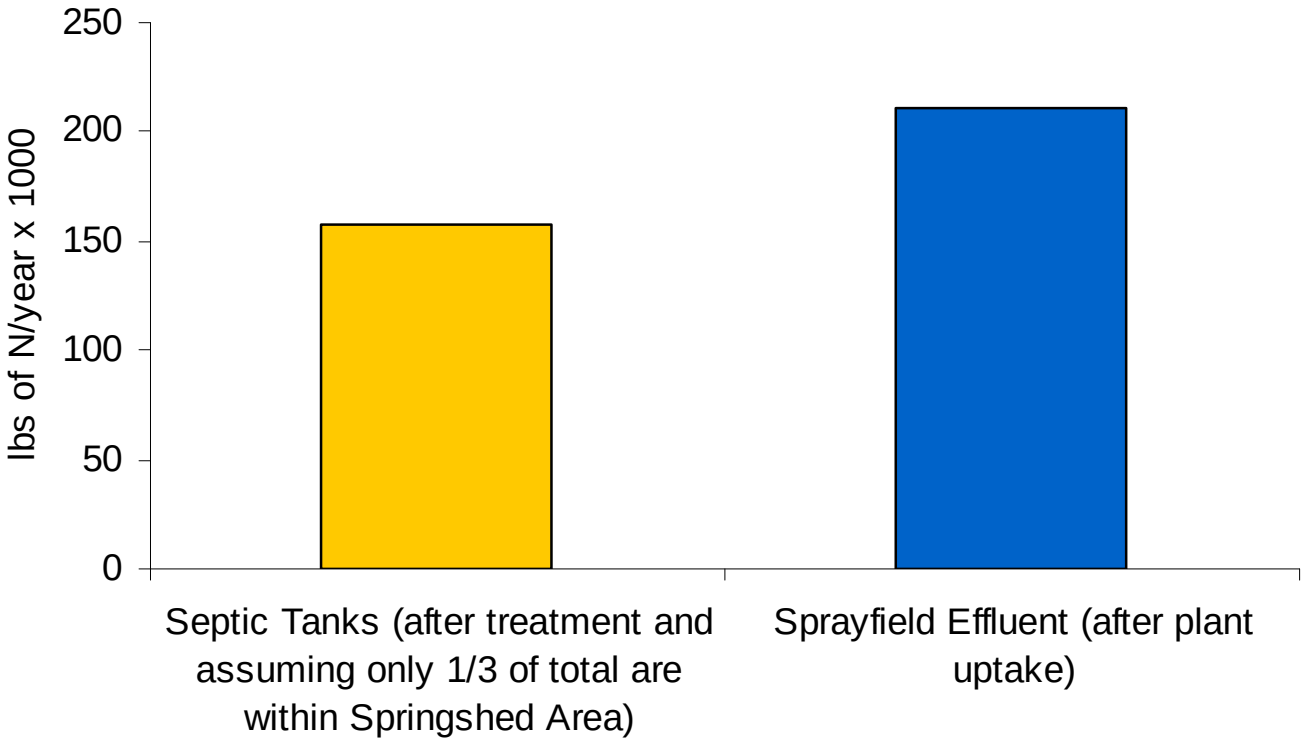
Nitrate Loading – Septic Tanks



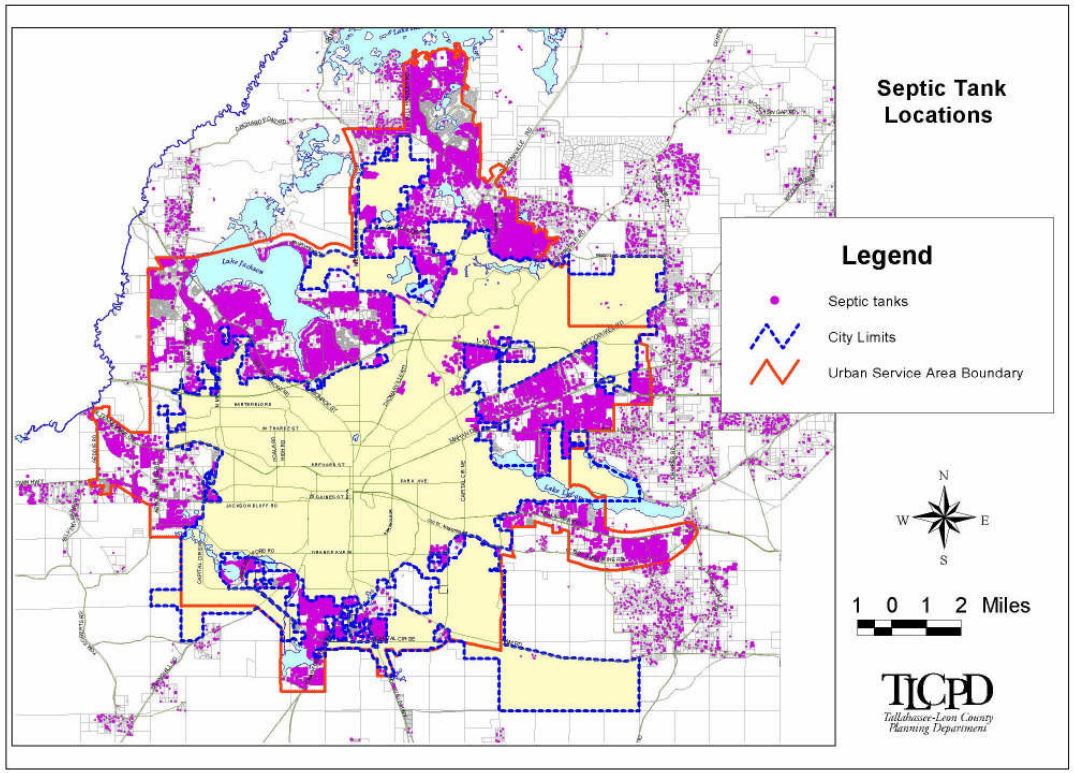
Comparison of Nitrogen Load From Sprayfield with Load from Leon and Wakulla County Septic Tanks



Comparison of Nitrogen Load from Sprayfield and Septic Tanks in Springshed Area



Septic Tanks – How To Manage Problem



Perhaps limit proliferation – by ordinance - No central water w/o central sewer.

Questions?

Solving Water Pollution Problems
in the Wakulla Springshed

Hydrogeology Workshop
May 12-13, 2005

FDEP: Wastewater Regulatory Perspective

Richard Drew, Chief

Bureau of Water Facilities Regulation, FDEP

Wastewater Facility Types

- Domestic – 61% ; Industrial – 39%

- Disposal Method
  - Surface Water --- 492 facilities
  - Non-surface Water --- 2508 facilities

* The Permit Cycle

Treatment Requirements for Non-surface Water Discharges

- Ground water quality standards
  - Primary & Secondary DWS
  - Or otherwise endanger
- Domestic Wastewater
  - Reclaimed water and land application systems
  - Residuals application

Spring Watersheds or Springsheds

- Blue Springs – Jackson County
- Wekiwa Study Area – Orange, Seminole and Lake Counties
- Ichetucknee Spring system – Columbia County
- Florida Keys??

Where to From Here?

- Springs Initiative
  - Springshed delineations
  - Specific spring studies
- FAVA/WAVA mapping
- Source Water Assessment Protection Program [SWAPP]
- Total Maximum Daily Load

WAVA Response Theme

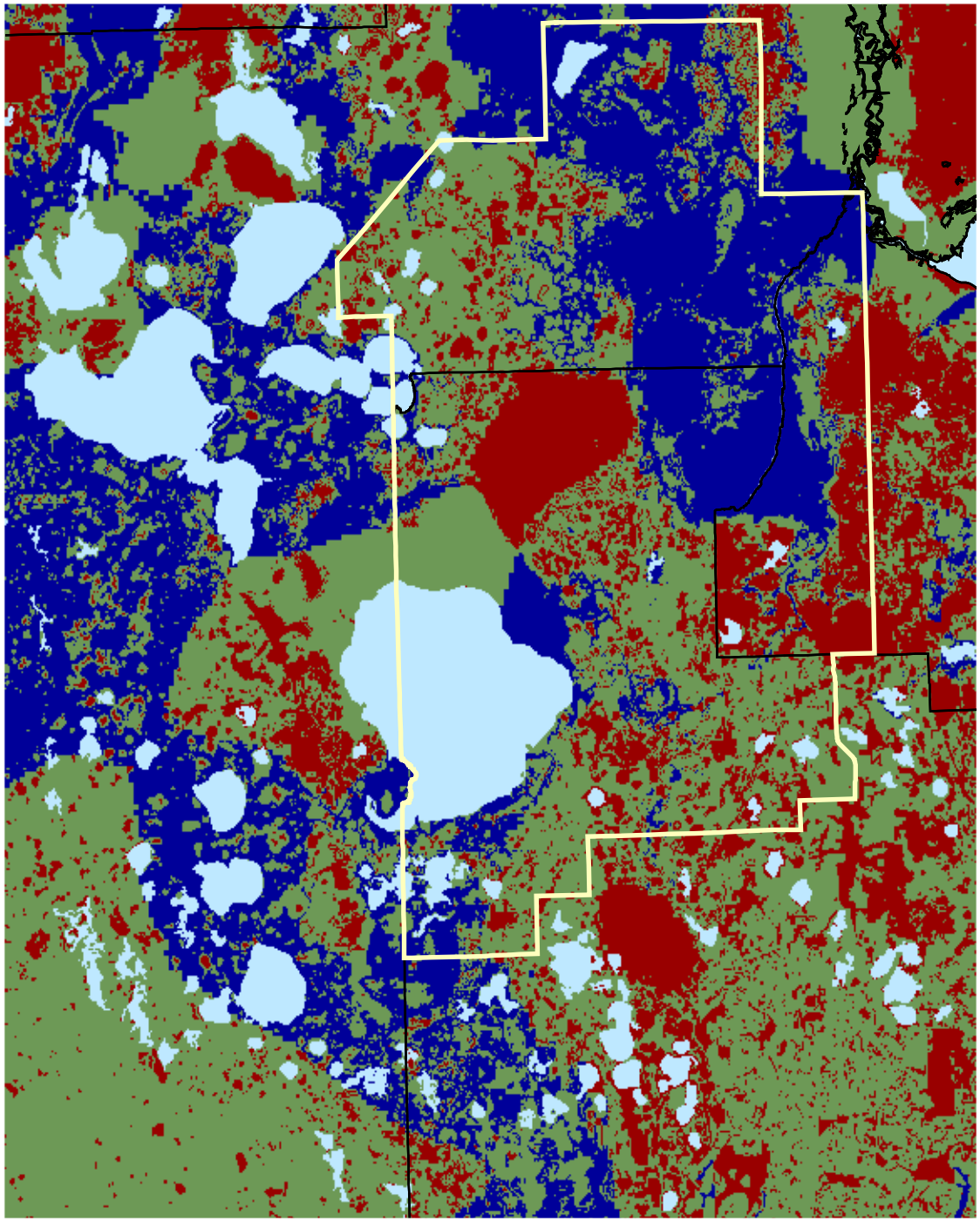
Relative Vulnerability

- Primary Protection Zone
- Secondary Protection Zone
- Tertiary Protection Zone
- Wekiva Study Area
- Water Features

10 5 0 10 Miles

10 5 0 10 Kilometers

N



Leon County Surface Water Management Activities

Theresa B. Heiker, P.E.
Stormwater Management Coordinator
Leon County Public Works Dept.

County activities involve many agencies

- Tallahassee/Leon County Planning Department
- Leon County Growth and Environmental Management
- Leon County Public Works Department
  - Parks and Recreation
  - Roadway Operations
  - Mosquito Control and Stormwater Maintenance
  - Solid Waste
  - Engineering Services

Joint City/County Planning

- Comprehensive Plan guides land use and infrastructure
- Sector studies of the community to determine site specific management goals
- Land use designation and management, such as site-specific zoning and delineating the Urban Services Area
- Greenway and sensitive land acquisition to protect natural habitat and other features

County Growth and Environmental Management

- Environmental permitting of development activity to comply with local standards
- Develop ordinances for resource protection county-wide (eg., volume control)
- Studies to establish basin-specific stormwater treatment and habitat protection standards (eg., Bradfordville)
- Lakes monitoring to document conditions and identify trends
- Map environmentally sensitive features
- Enforcement of environmental ordinances

County Public Works

- Parks and Recreation Department
  - Resource management
  - education

- Roadway Operations
  - Shoulder maintenance
  - Linear detention maintenance
  - Vegetation control

- Mosquito Control and Stormwater Maintenance
  - Stormwater facility maintenance
  - Natural drainage way monitoring and maintenance
  - Licensed operators

- Engineering Services
  - Stormwater Program
  - Infrastructure design
  - Construction management
  - Development review and coordination

Stormwater Program

- Utility management
- NPDES compliance
- TMDL coordination
- Capital program development
- Operations support
- Emergency response and planning

Improve data supporting modeling and analysis

- Improved watershed mapping detail with LIDAR (**LI**ght **D**etection **A**nd **R**anging)
- Real-time rainfall and stream level gauge reporting through CAFWN (**C**apital **A**rea **F**lood **W**arning **N**etwork)
- Countywide water quality and biological sampling program

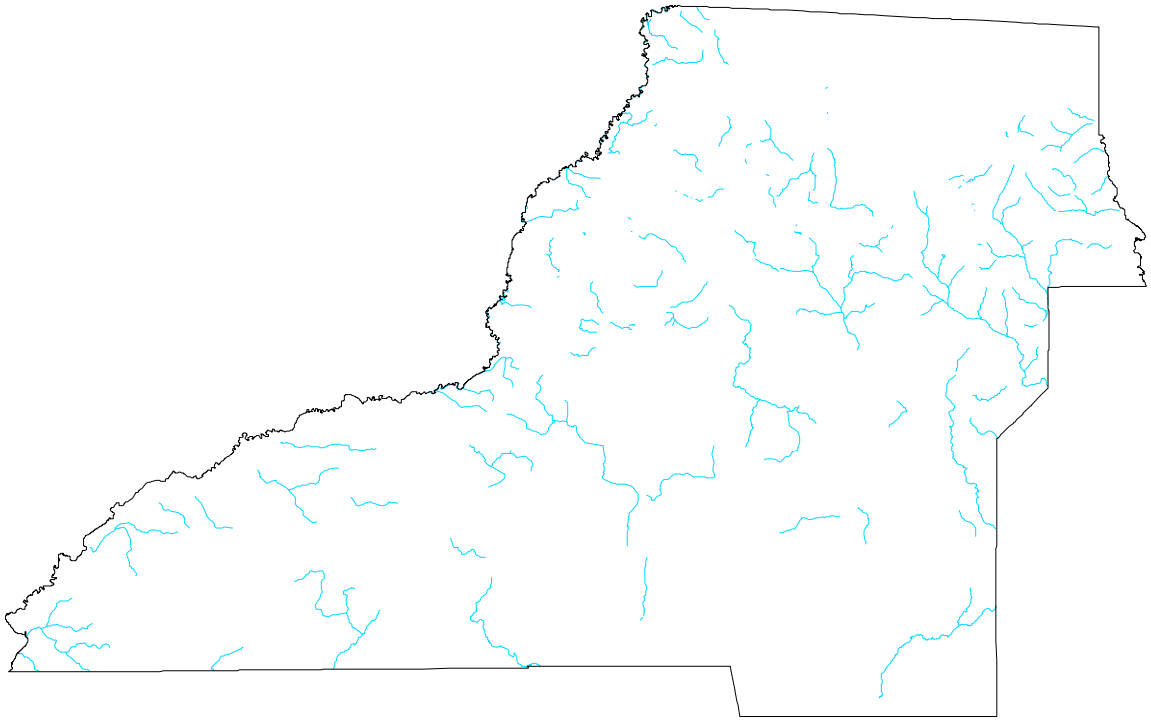
Water Quality and Habitat Sampling for NPDES Compliance

- Monitor inflow and discharge quality for existing treatment facilities to determine efficiency by facility type
- Perform Stream Condition Index for three areas in the Lake Munson system
- Quarterly trend monitoring in 12 tributaries
- Coliform characterization at 5 locations

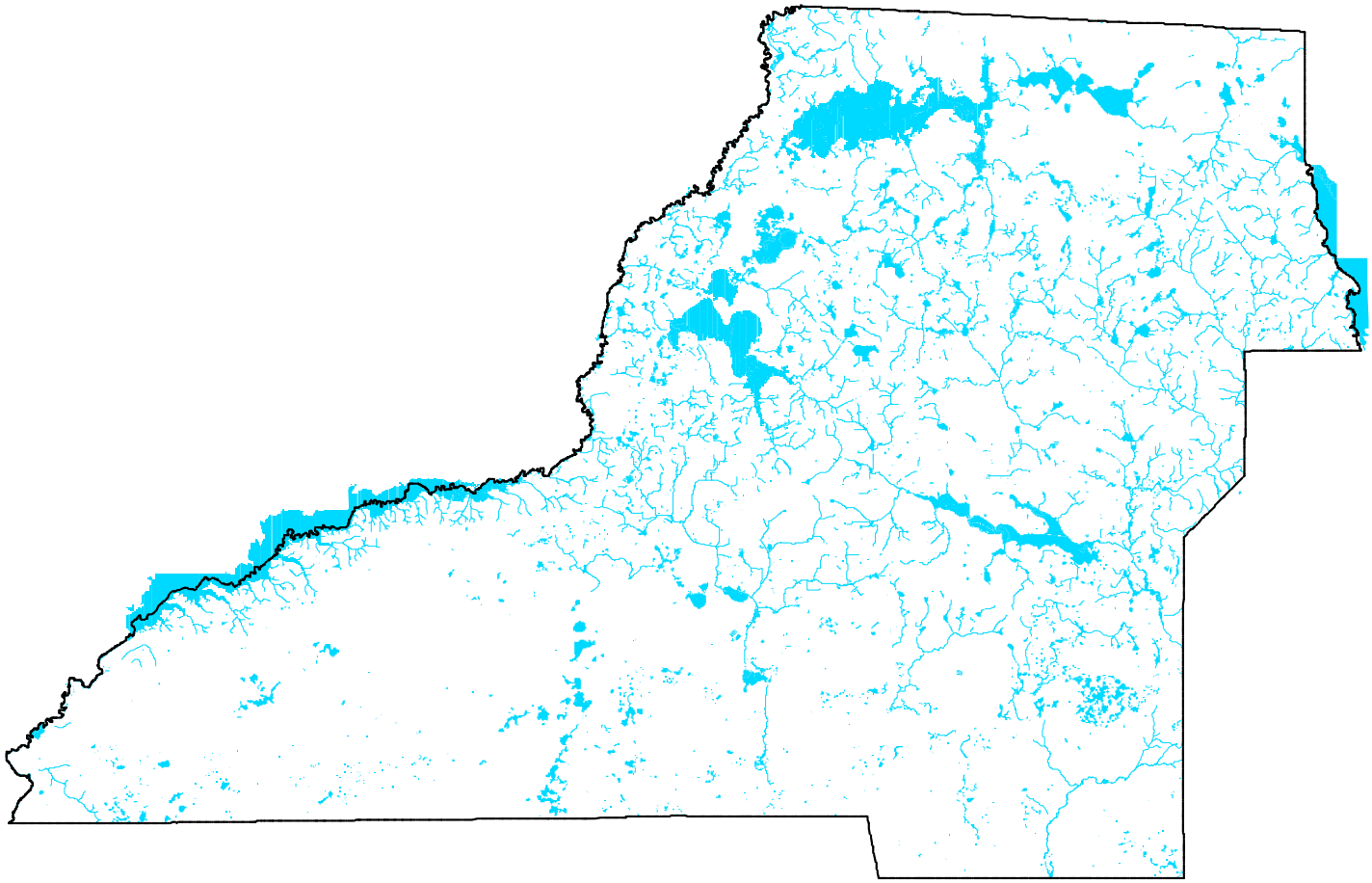
Program enhancements

- Improve GIS and base map data
- Increase knowledge of flowway function and rainfall distribution
- Document groundwater response to surface flows

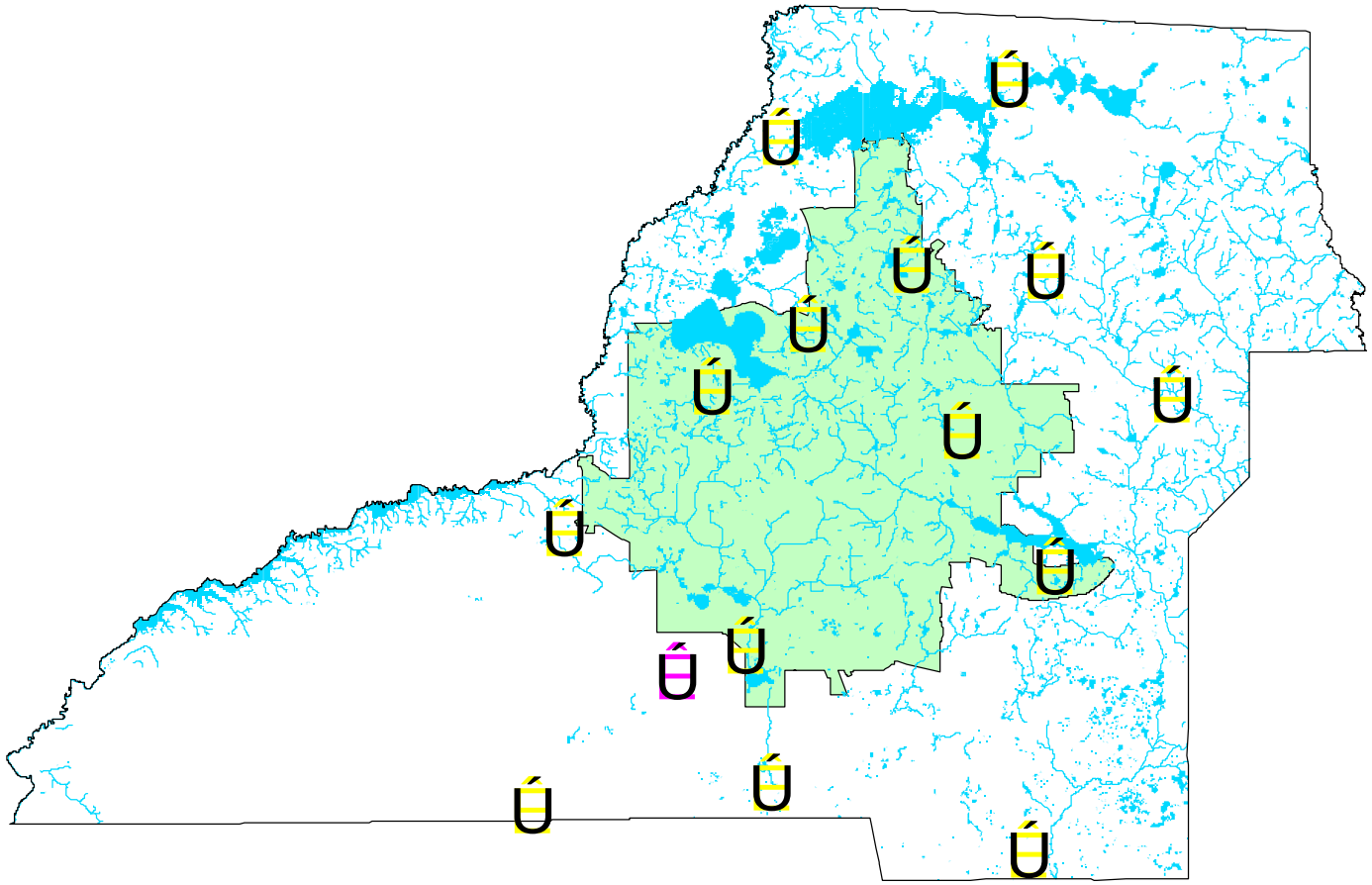
USGS Quadrangle - Hydrography



Leon County GIS - Hydrography



Capital Area Flood Warning Network



Capital Projects for Surface Water Management

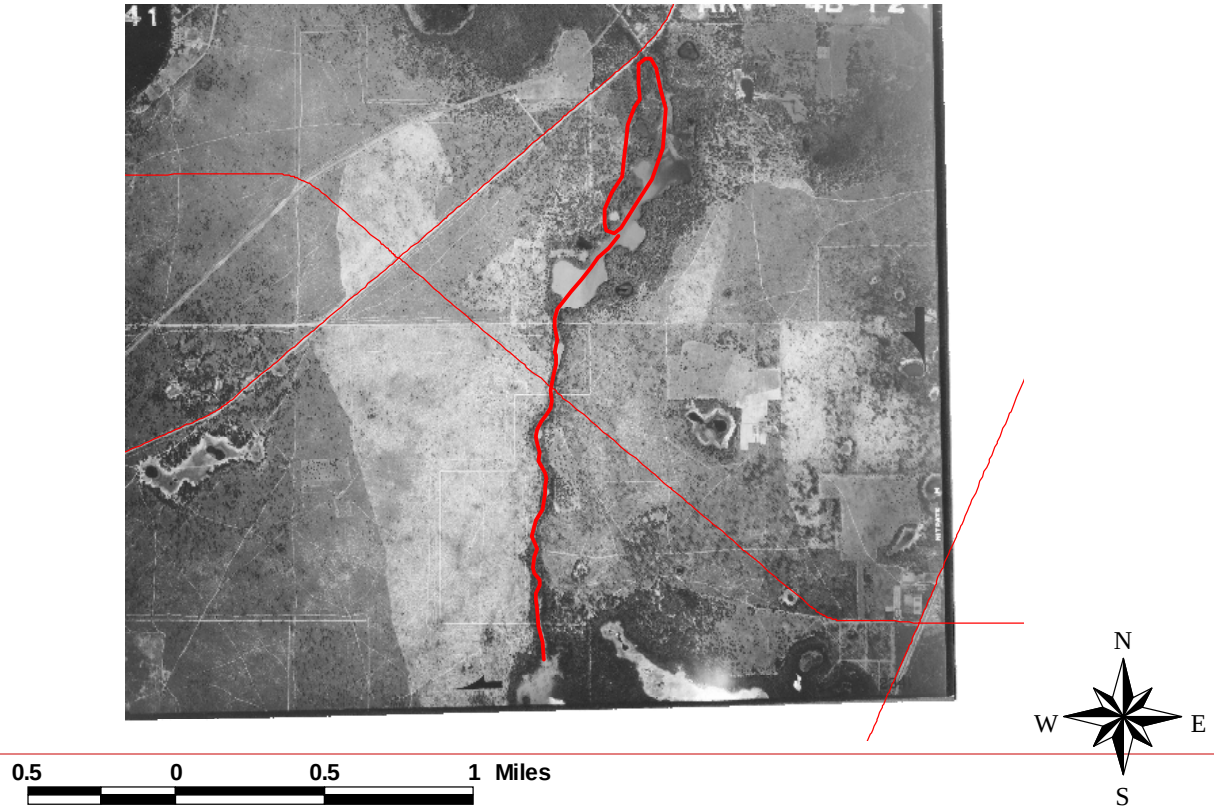
- Gum Swamp Restoration
  - Public health required mosquito control ditching of wetland
  - Drained swamp was timbered and developed
  - 1980's plan evolved to "restore" Gum Swamp, at least what remained
  - Rehydration has caused tree loss

Lake Henrietta

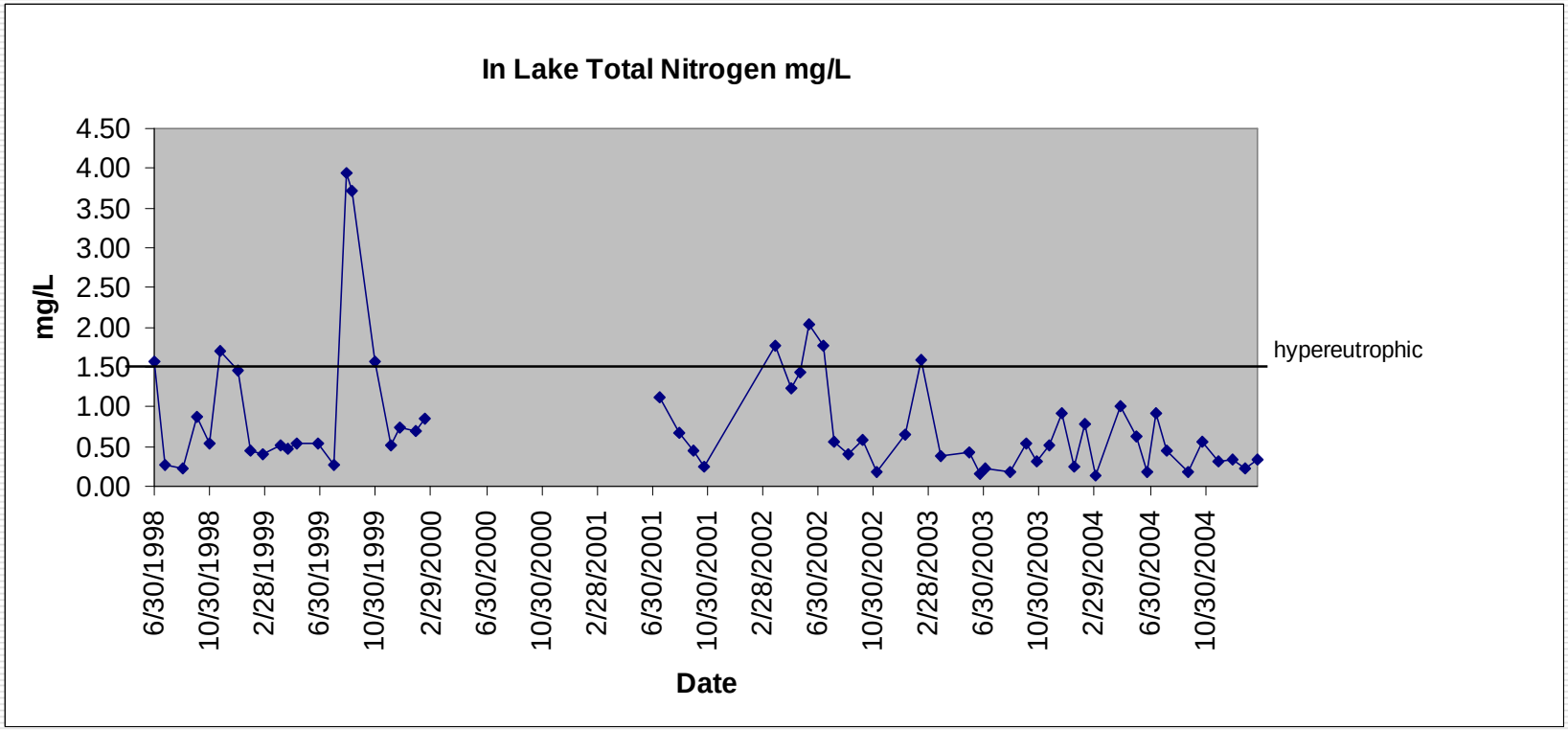
- Baseflow up to 2-year storm (1-inch) will be captured and treated
- High flows are directed through AND around the treatment pond
- Natural wetlands along slough are rehydrated to provide nutrient uptake and peak flow storage

Lake Henrietta Restoration

Lake Henrietta and
Munson Slough North



Lake Munson Response



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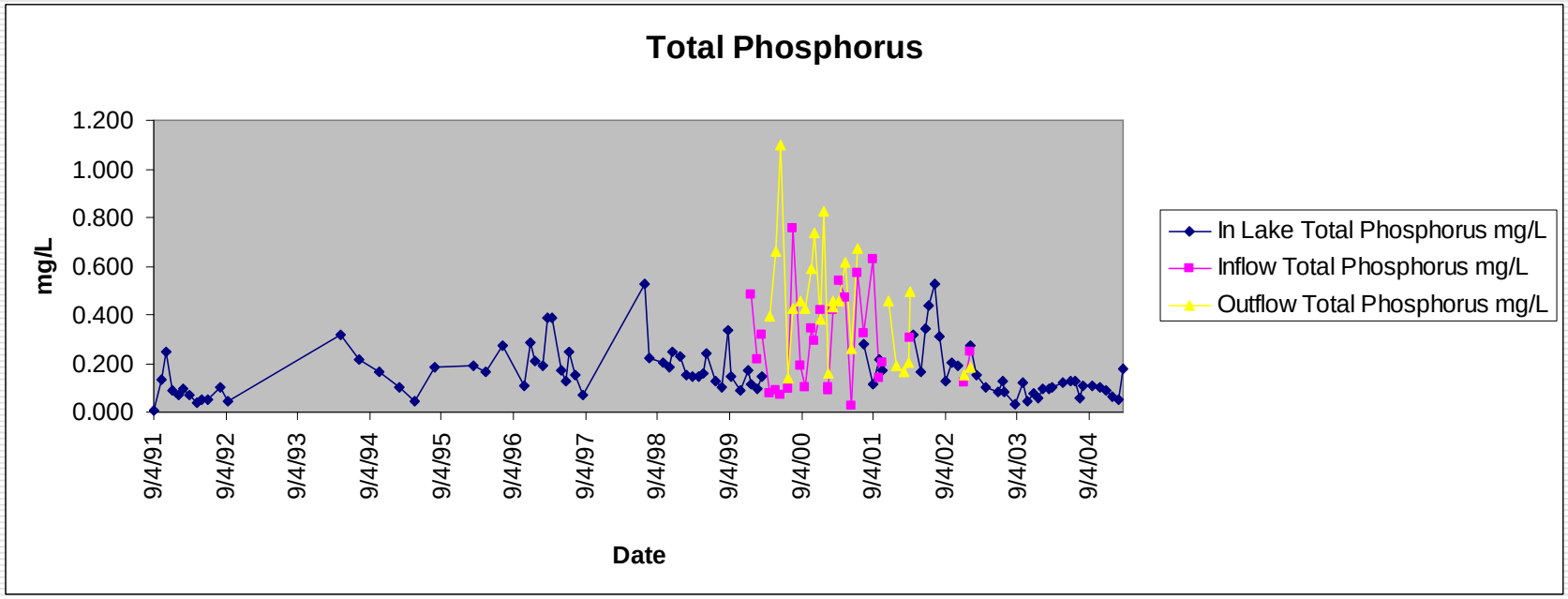

Habitat has value to be considered in the cost/benefit analysis

- Large regional ponds sacrifice creeks and wetlands
- Designing based on relative alternative costs rather than net improvement to habitat due to <u>intangible</u> value of system
- Altered hydroperiod of streams and receiving waters affect habitat

AN INTRODUCTION TO STORMWATER AND STORMWATER MANAGEMENT

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http://www.dep.state.fl.us/water/watershed

University of Central Florida

H2O4U

Hydrogeology Workshop 2005

Tallahassee FL

Water Budgets

Solving Water Pollution Problems in the Wakulla Springshed of North Florida

Marty Wanielista
Stormwater Academy
www.stormwater.ucf.edu

Solving Water Pollution Problems in the Wakulla Springshed

The City of Tallahassee's Efforts to Reduce Stormwater Pollution

John Buss, P.E.

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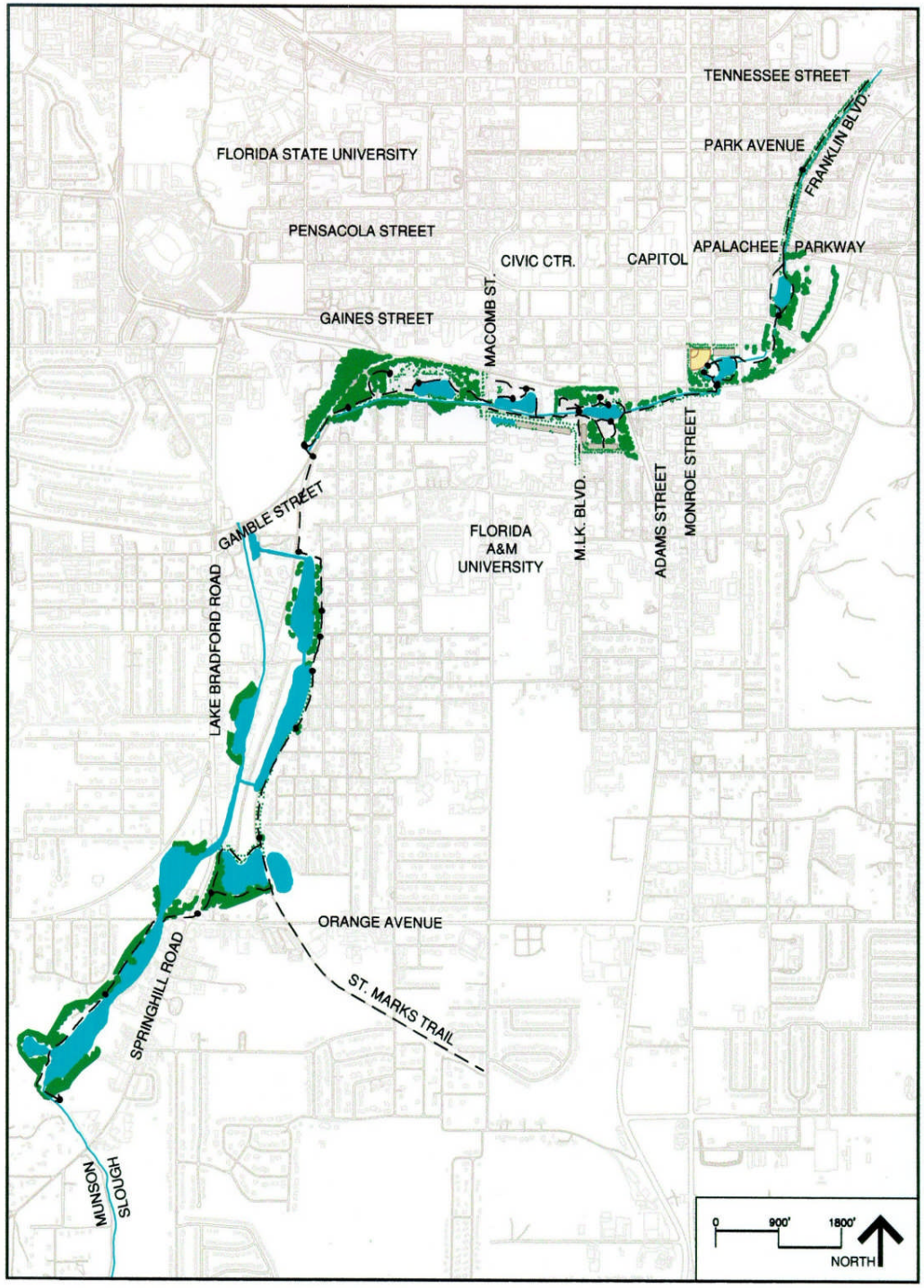

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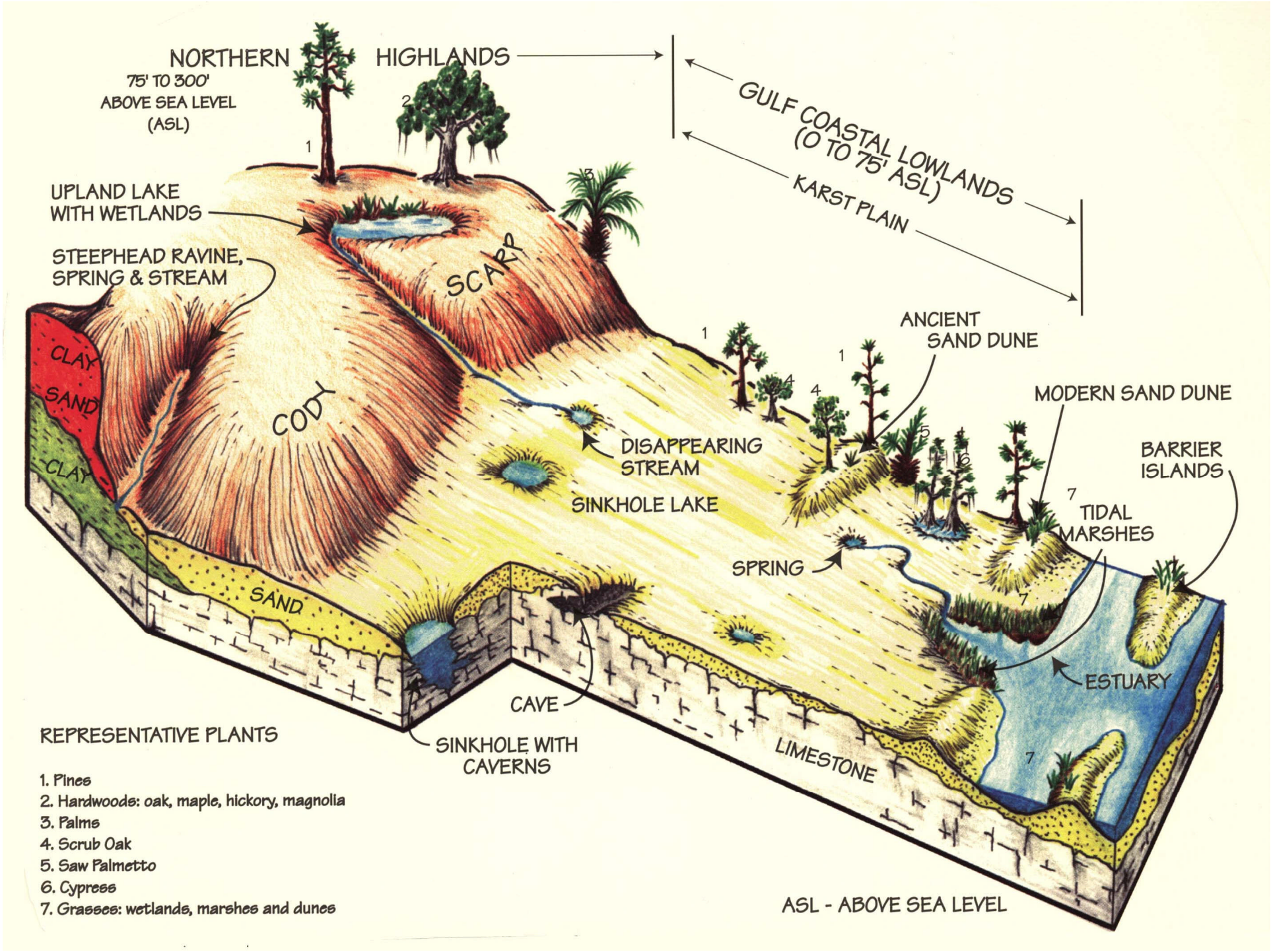
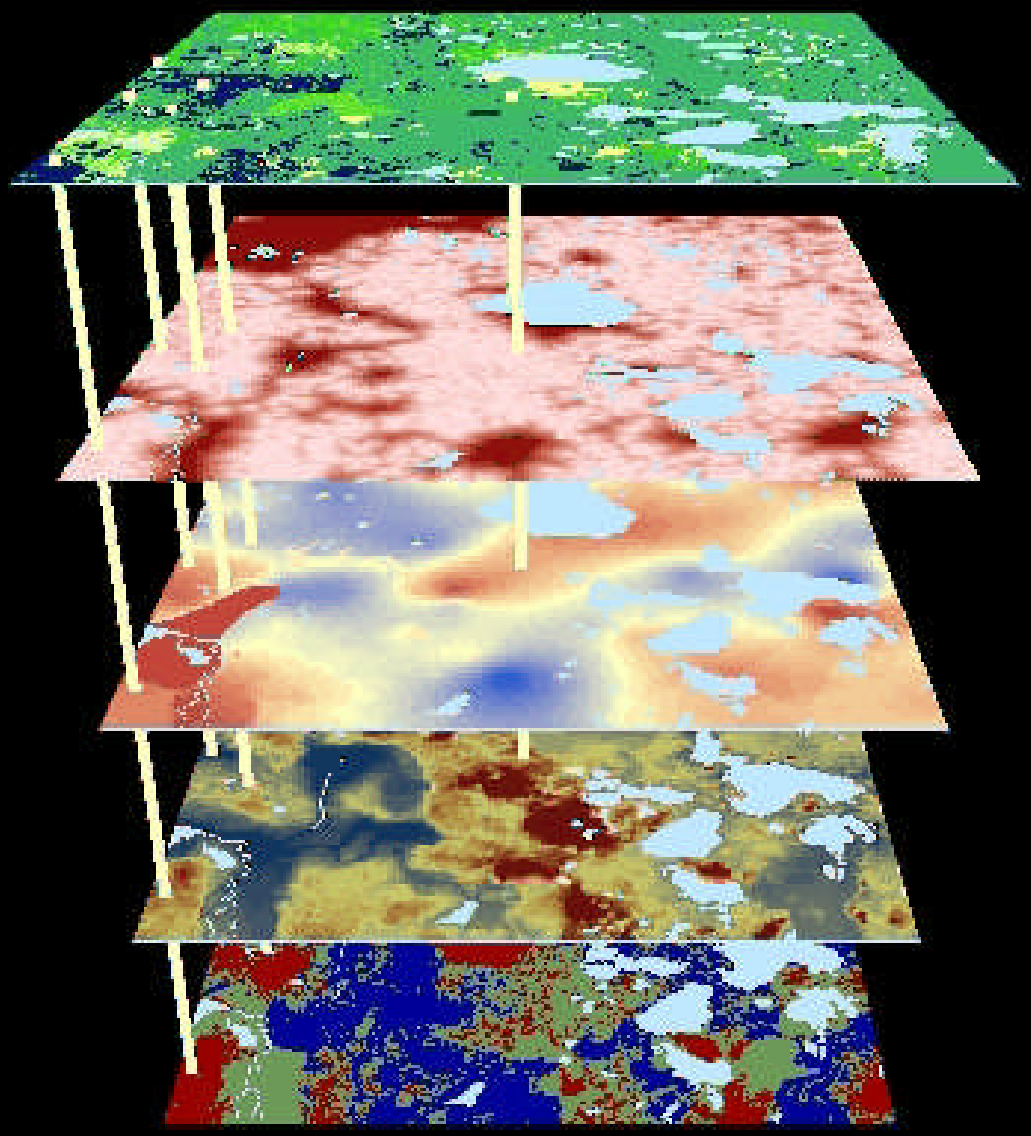
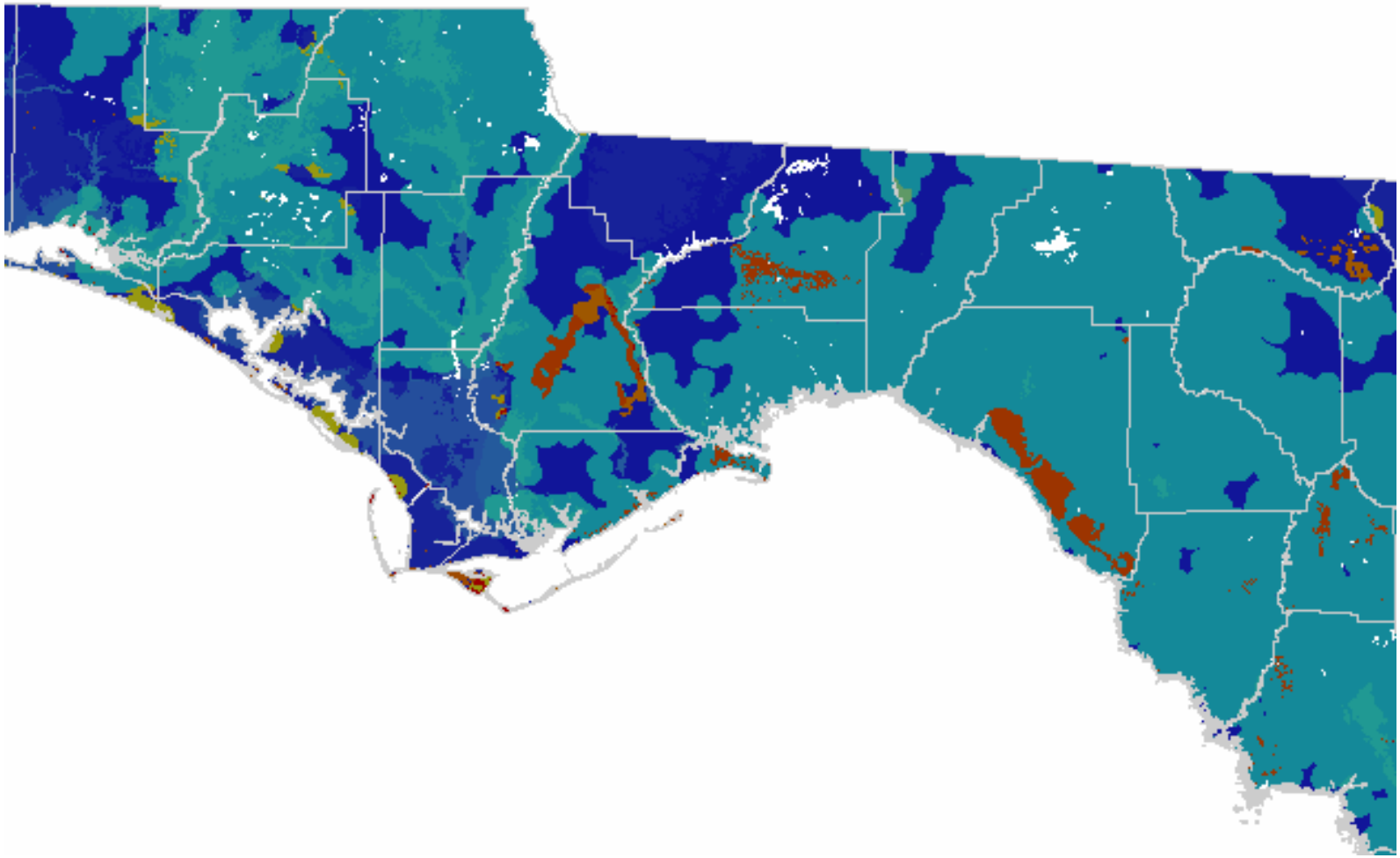
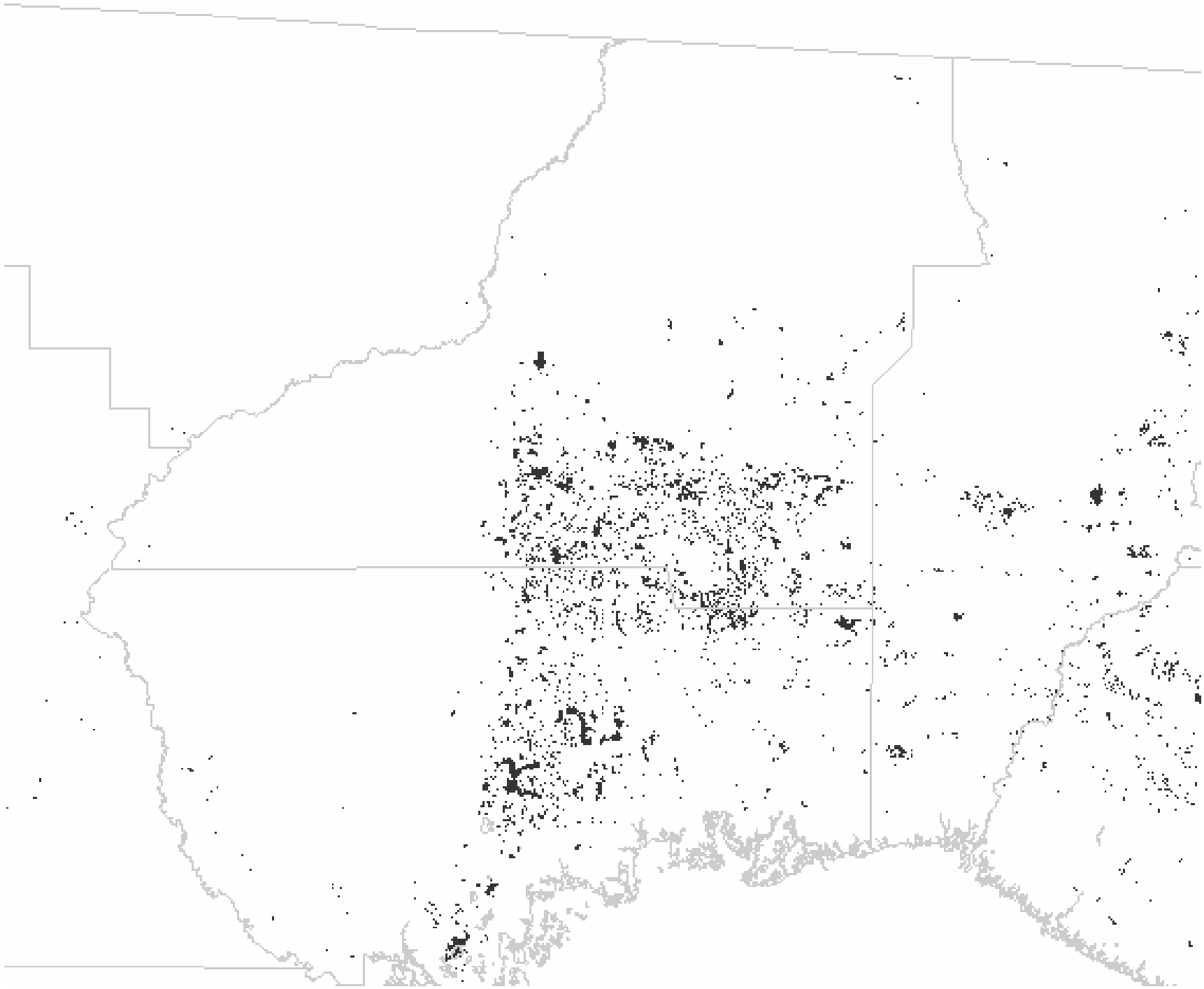


REPRESENTATIVE PLANTS

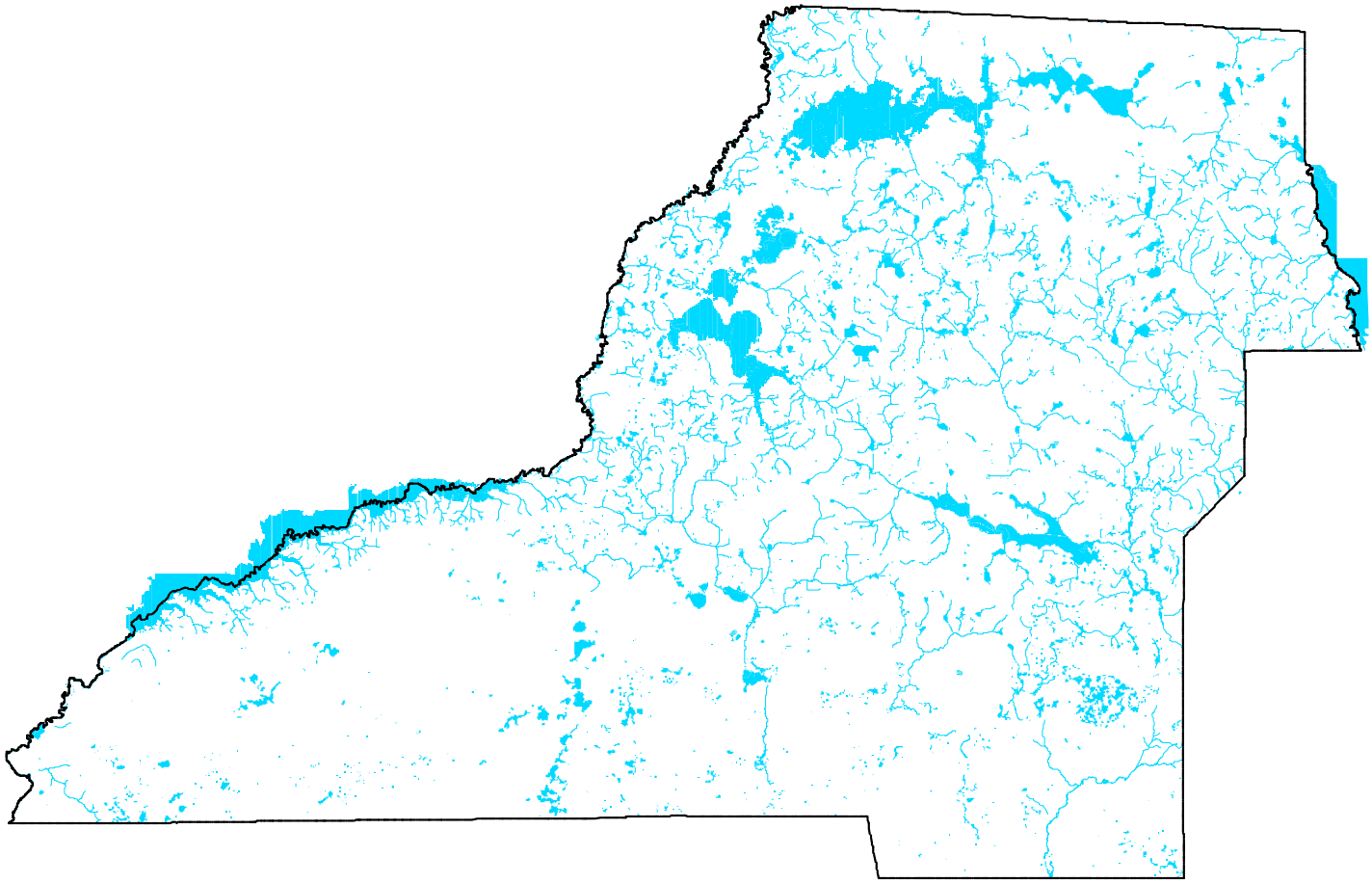
1. Pines
2. Hardwoods: oak, maple, hickory, magnolia
3. Palms
4. Scrub Oak
5. Saw Palmetto
6. Cypress
7. Grasses: wetlands, marshes and dunes







Leon County GIS - Hydrography



General

- Define the issue: is it water quality at springs or aquatic plant growth
- Stormwater perspectives: urban vs. national forest vs. county
- Increase ad valorem for NWFWMD
- Emphasize that loadings need to be delineated as accurately as possible, and have a good hydrogeological model
- TMDLs underway (assimilation capacity of water bodies to minimize water qual. and quant. impacts
- First address stormwater entering most vulnerable areas
- Continue working with DOT re: stormwater and hydrogeological issues

Higher-level issues

- Nutrient balance issue
- Need good hydrogeologic model
- Point versus non-point infiltration
- Influence of National Forest practices
- N-P removal technology
- Better understanding of clarity problem
- Pre=Post volume balance
- Relationship between P and geology (i.e., Hawthorn Group)

Higher-level issues

- Monitoring
- Nutrient balance in sinkhole lakes
- Cost-benefit of wetland treatment systems vs. sprayfield
- Education – Public schools
- Education – landowners
- Mass balance: How much of a problem is storm water in the big picture?

#1

Relative loadings: septic vs. storm water vs. agriculture/spray field, etc…

#2 Land-use; modify comp plan based on highly vulnerable areas

- Evaluate existing data
- Need LIDAR in Wakulla Co
- Stream to sink study
- Complete aquifer vulnerability assessment of natural system
- Define highly vulnerable areas
- Leon Co/TLH/Wakulla coordination
  - Interlocal agreement
- Phased in land use regulations (long term and short term)

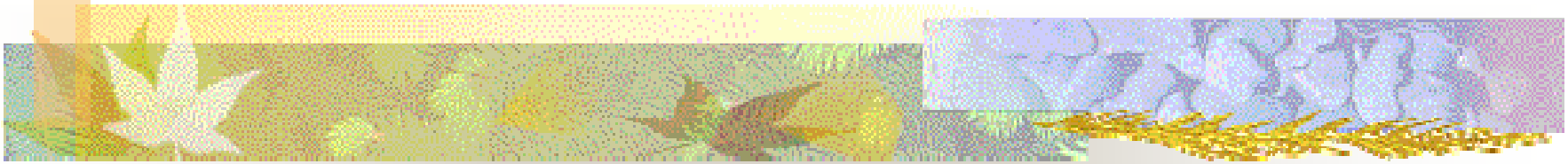
#2 Land-use; modify comp plan based on highly vulnerable areas

- Tie in FEMA flood zone remapping into land use plan
- Implement Model Code for highly vulnerable areas within all springsheds
- Evaluate and implement existing programs (i.e. ERP, other states dealing with karst, Wekiva Study)
  - Have all relevant agencies at table (i.e., DOT, DCA, DEP, WMD, etc.)
- Accountability and enforcement

#3 Minimize runoff

- All land-use regs need to focus on minimizing runoff
- Ordinance-development-enforcement targeting post=pre regarding quality and quantity
- Implement Source Water Pollution Prevention Plan (SWPPP)
- Revise Master SW Plan
  - Wakulla/Leon/TLH
  - Discourage impervious surfaces
- Landowner education
- Look at other states dealing with karst issues and how they address runoff
- Landowner incentives

City of Tallahassee Wastewater Treatment System

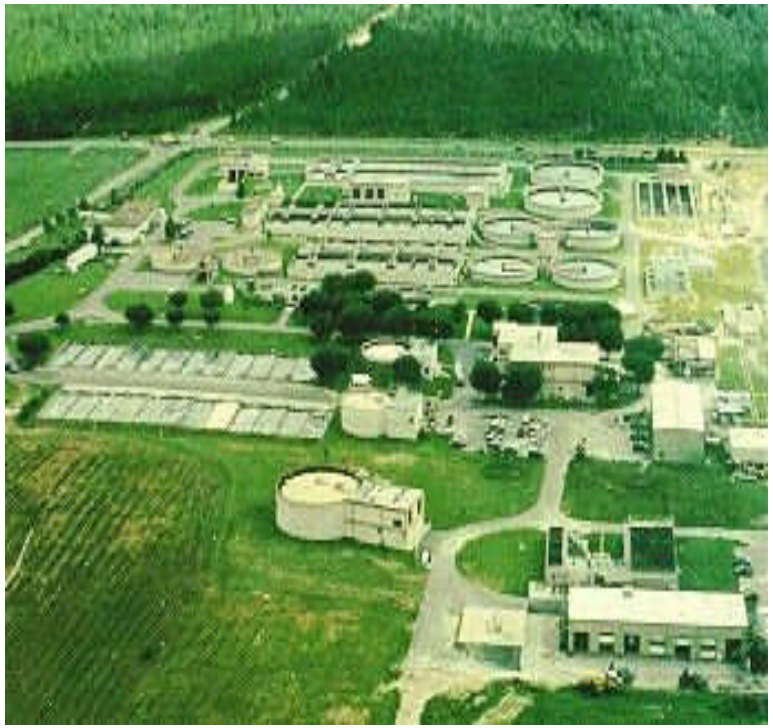


Hydrogeology Workshop – 2005

May 12 – 13, 2005

Description of System

- Population Served – 170,000+
- Treatment Plants:
  - LBR – 4.5 mgd
  - TPS – 27.5 mgd
  - Total = 32 mgd
  - Effluent Discharges:
  - SWS – 1.04 mgd
  - SEF – 27.39 mgd
  - Total = 28.43 mgd



City's Wastewater Treatment System Highly Regulated

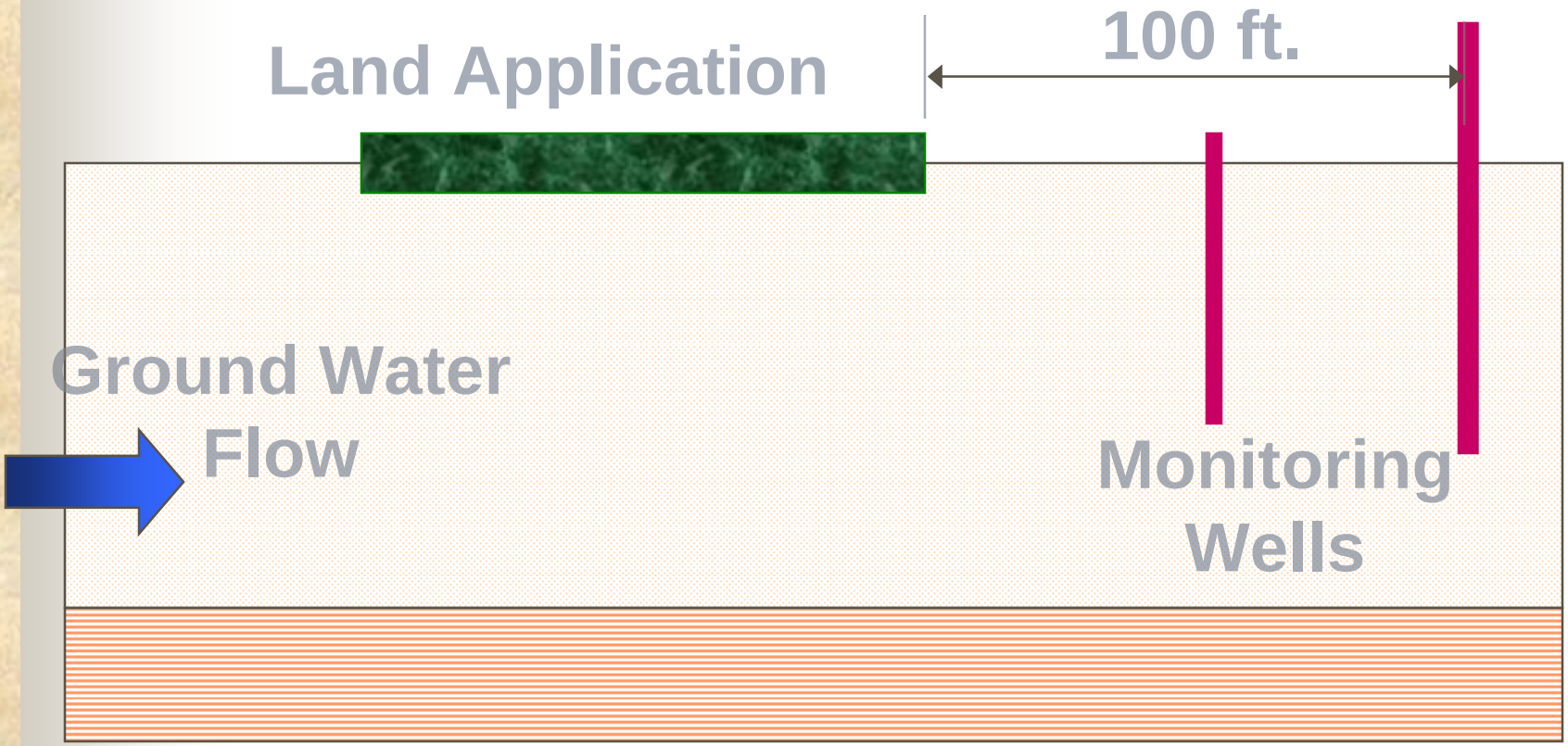
- FAC 62-610 – Reuse, including land application
- FAC 62-600 – Wastewater Treatment Facilities
- FAC 62-601 – Wastewater Monitoring
- 503 Rule – Federal Biosolids regulations

Myriad others regarding safety, chemicals, stormwater, etc.

Ground Water Standards

- Potable Ground Water
- Drinking Water Standards
  - Primary Standards
  - Secondary Standards
- Total Coliforms < 4/100 mL
- Nitrate - 10 mg/L (as N)

Zone of Discharge



SEF Monitoring Wells

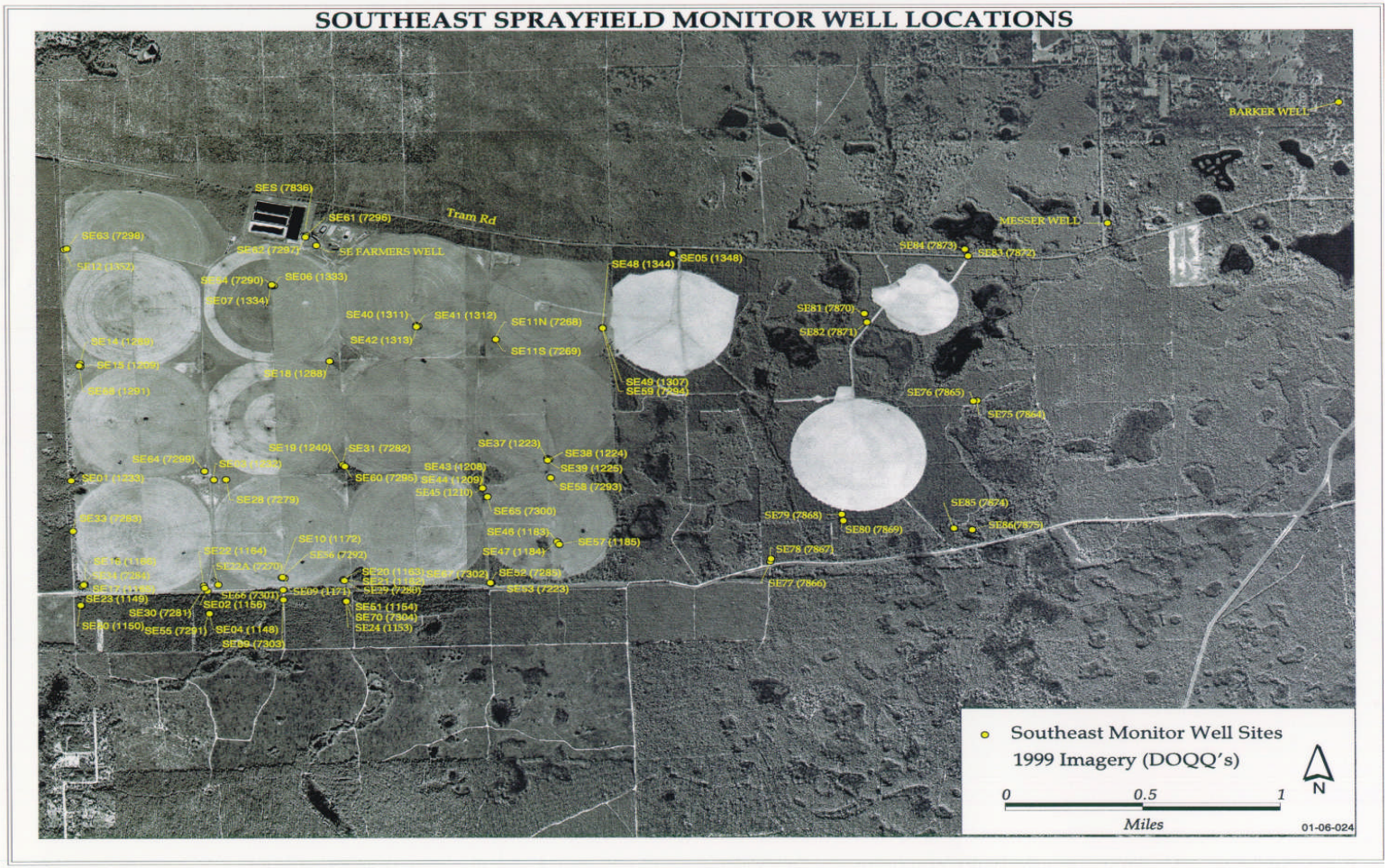
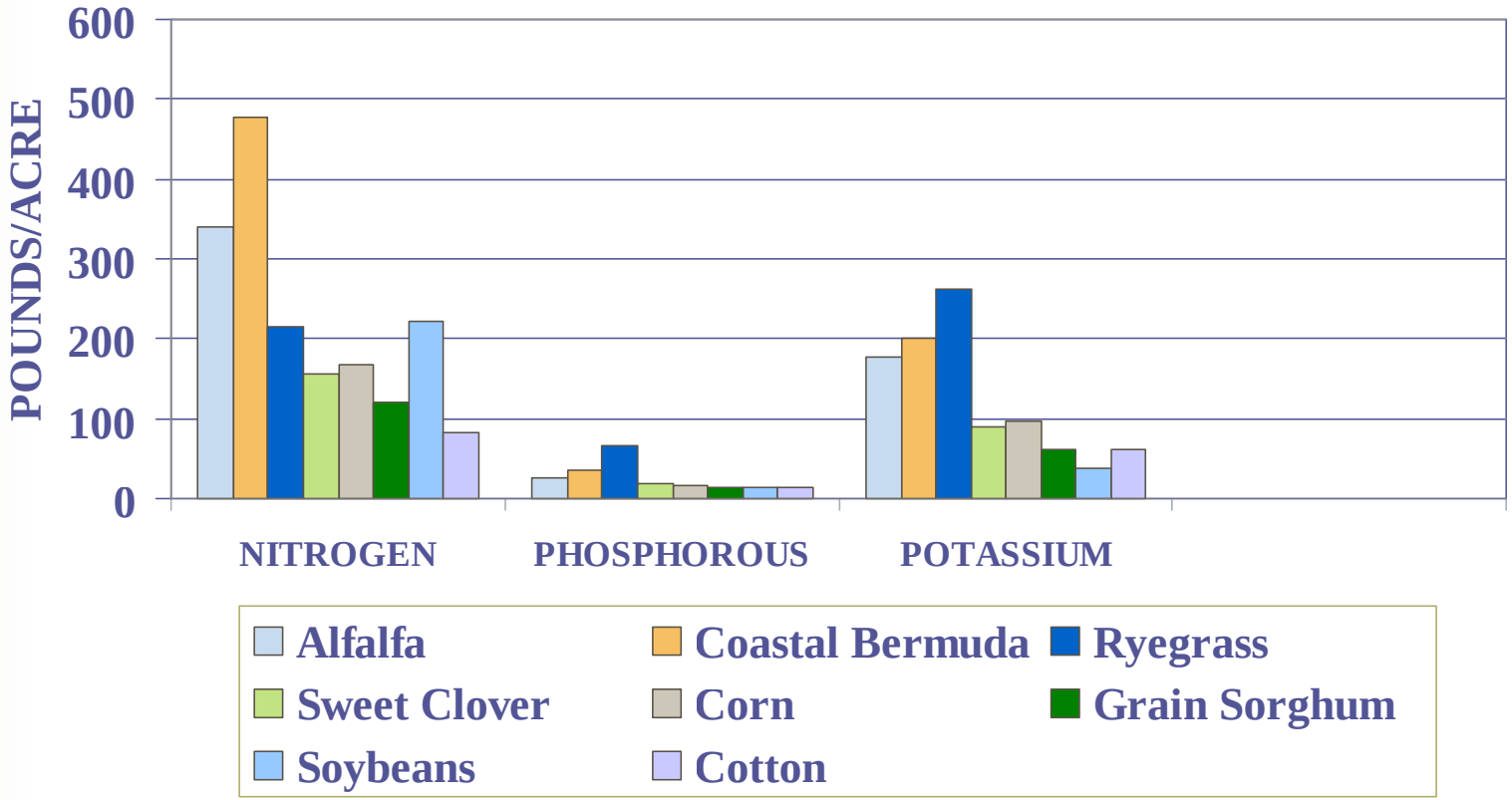


FIGURE 47

Levels of Nitrate (as N) in Compliance Wells (Limit 10 mg/l)

SE-2	4.34	SE-52	5.42
SE-15	1.14	SE-53	5.28
SE-16	0.05	SE-77	0.53
SE-17	0.43	SE-78	0.55
SE-22A	3.77	SE-79	2.8

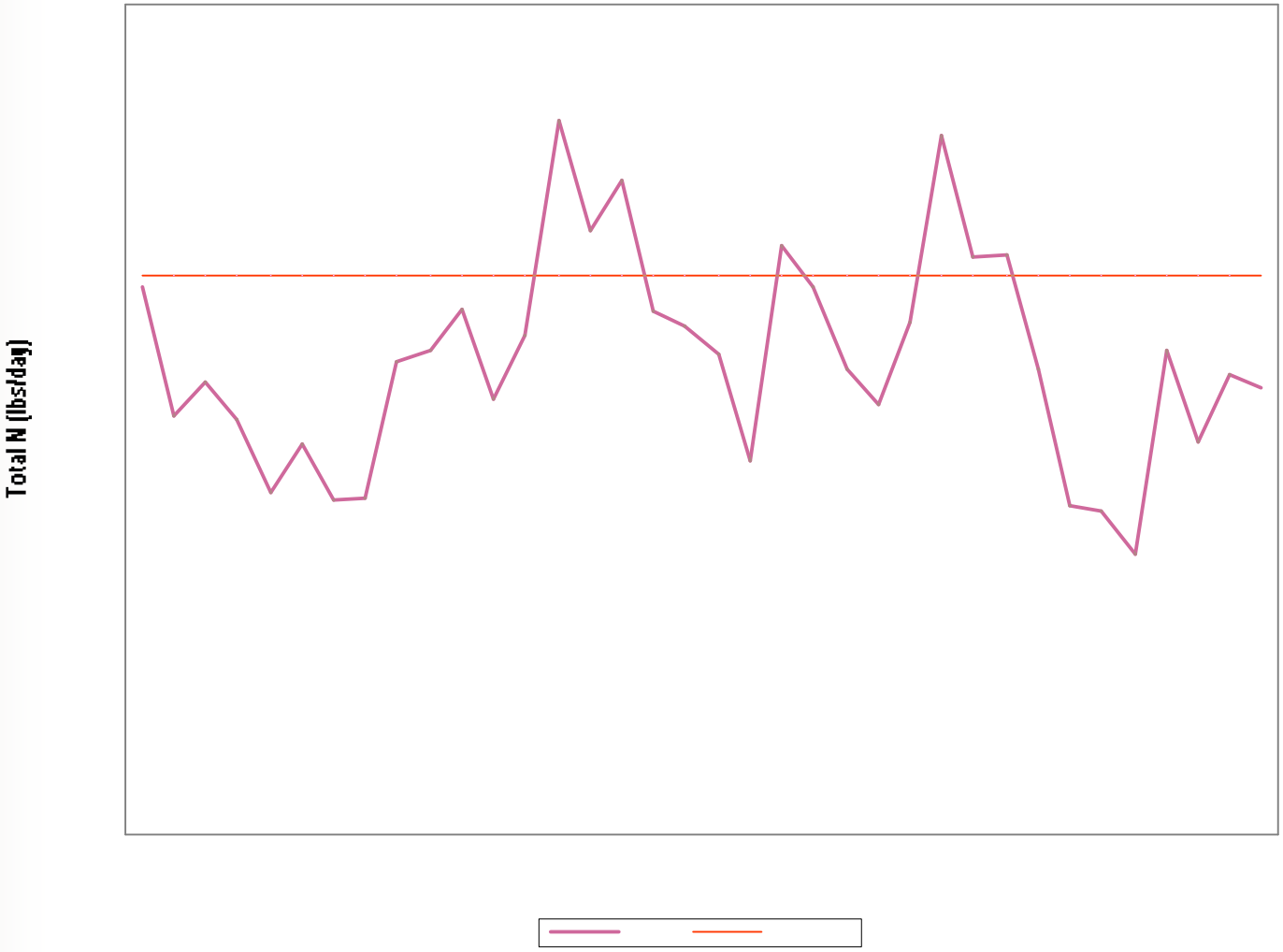
Nutrient Uptake Rates for Selected Crops



Estimated N Allowable at SEF

- Total acres in pivots = 2000+
- 85% in bermuda grass @ 400 lbs. N
- 10% in corn @ 210 lbs. N
- 5% in other crops @ 150 lbs. N
- Total N allowed per year = 737,000 lbs.
- Or 2019 lbs/day average

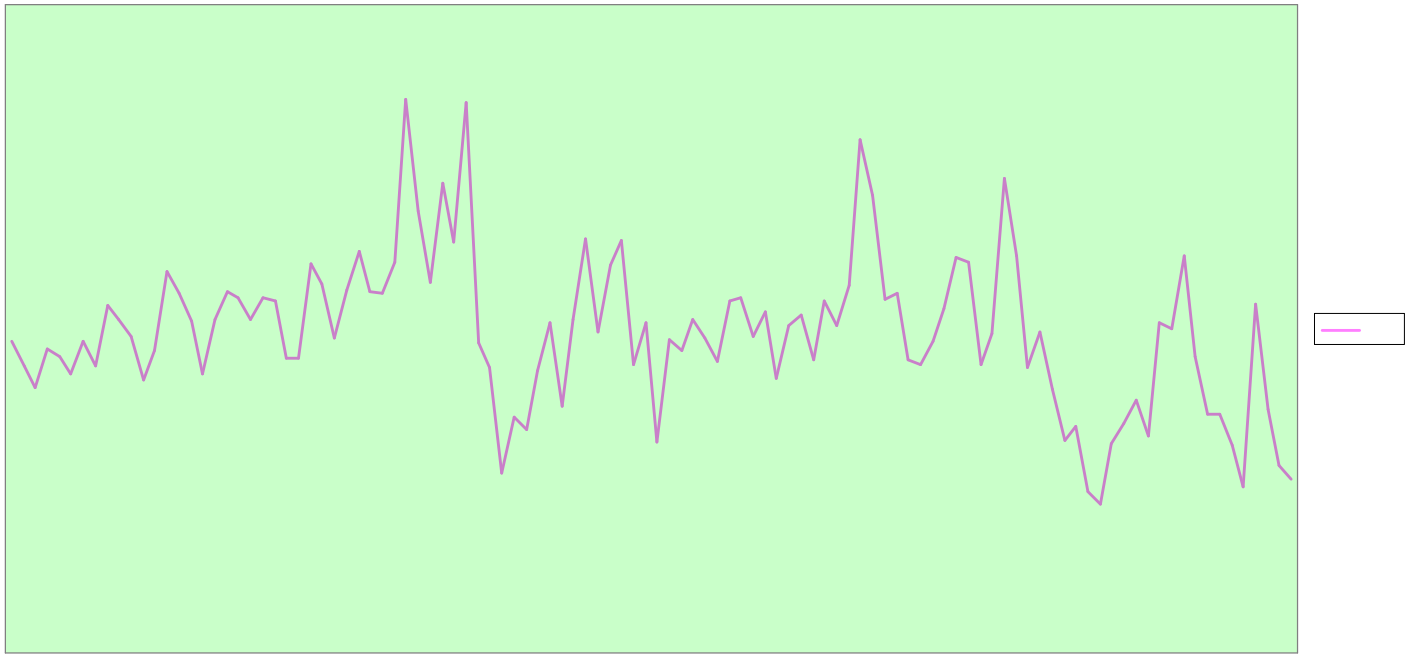
Total N Applied at SEF



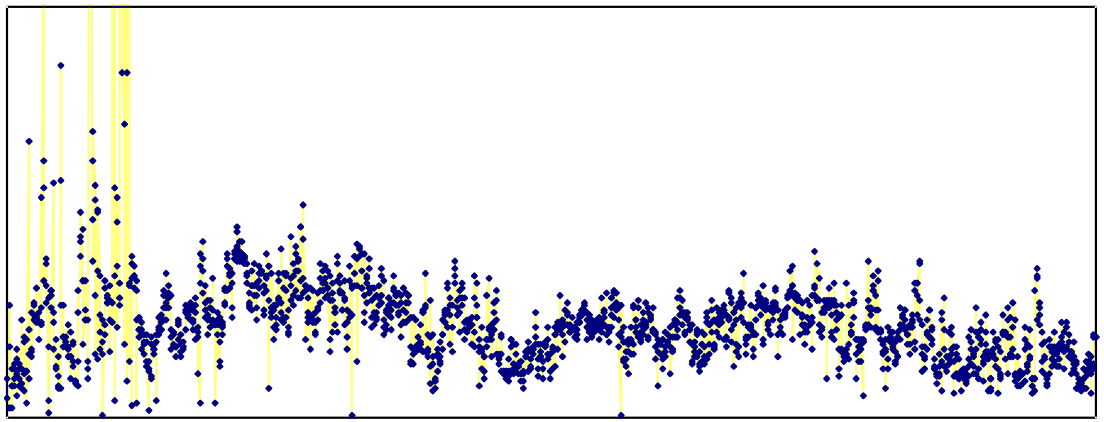
Successes in Reducing Nitrogen Loads

- Stopped applying biosolids in Wakulla County 2001
- Start-up of Class A dryer March 2004
- 85% reduction of total biosolids land applied at airport
- 85% Class A product or Class B to landfill
- Obtaining more N reduction at TPS effluent

Total Nitrogen from TPS, Lbs.



SE Farm Pond Effluent



Water Utility Approach

1. Collect Data; work cooperatively with other studies
2. Develop Alternatives through Master Plan
3. Prepare Plan of Action for Improvements
4. Obtain Funding & Implement Near-term Items
5. Participate in TMDL process to fine-tune Plan of Action and priorities

TMDL Schedule for Wakulla River

- **2007 - Begin developing TMDL**
- **2008 - Adopt TMDL by rule (APA)**
- **2009 - Establish TMDL implementation plan**
- **2010 – Implementation**

City Actions in Finding Solutions

- USGS Study - $495 K over three years
- Treatment Master Plan – Review treatment and disposal options for long-term sustainability
- Planning additional biosolids treatment to produce 100% Class A Biosolids for reuse
- Nutrient Management Plan for near-term Farm Operations

Economic Impacts

- $66 million proposed to upgrade TPS
- Additional $millions for full nutrient removal (2 ppm nitrates)
- Could lead to large rate increase
- Does not include O&M costs

City of Tallahassee Position

- Wakulla Springs is a valuable natural asset
- Good decisions are based on good science
- If we're part of the problem we want to be part of the solution
- Sources of nutrients are regional and mitigation requires a regional approach

Southeast Farm

Performance-Based Systems

- ***Or, the state of the art and industry for On-Site Treatment (and Disposal) Systems (OSTS) in Florida***

Mark D. Repasky, PE

HEADLINES

- 1000 square mile Dead Zone at mouth of Mississippi River
- Jefferson County: Nitrates pollute private wells
- Clermont: Excessive septic tank failures
- Keys: Mystery Bloom Appears in Bay
  - Researchers say no link apparent to “blackwater” mass from last spring
- North Carolina, Hurricane Floyd
  - Onsite systems shown to have minimal impact on pollutant load in flooding
  - Central plants dump millions of gallons of untreated waste
- Hurricanes, Florida 2004: lift station failures

1998:
FAC 10D-6 changed to 64E-6

- Allowed Engineers to design systems (Part IV)
- Basically, a Performance-Based System is a wastewater treatment system designed to treat waste—”perform”–to a certain level
- Requires a Florida Professional Engineer experienced in wastewater system design

Goal was to allow use of new technologies for onsite systems

- Could still use prescriptive Code for septic tank and drain field
- Higher treatment levels were rewarded:
  - Bigger house on a given lot
  - Smaller drain field
  - Reduced setbacks
- Indirect result: limits density

Onsite Wastewater Nutrient Reduction Systems Demonstration Project (OWNRS)

- Aka "Big Pine Key Prison Test"
- DEP, EPA, FDOH, NOAA
- 3rd Party, long term (> 1 year) testing
- Manufacturers invited to provide equipment to participate
- Notable were those who chose not to participate

OWNRS continued

- Two-each 1 year tests
- Bottom line:
  - Hundreds of FAST units have been installed in the Keys
  - Combination of FAST/Drip irrigation provides best bang for the buck
- Testing done—Owner/Utility doesn’t have to be the guinea pig

Management levels

- Standard DOH, individual contract with each owner
  - We currently operate our own database for clients statewide
  - Coordinate it with various websites and counties
- EPA Guidelines, 5 levels
  - Start with No management
  - Up to utility that owns all equipment

Descriptions of systems

Septic Tank to drainfield

- State-approved underground nutrient injection system
- Classic drainfield is designed to prevent plant roots from getting to the effluent
- Cannot denitrify to any great extent
- Initial cost is low
- Cost to environment is potentially very high

Aerobic Treatment Unit (ATU)

- Cannot denitrify in the tank
- DOH approved for drainfield size reduction of 25%
  - Results in 25% increase in nutrient loading per square foot of drainfield
- Subject to wash-out of suspended growth organisms during high flow events
- None provided for OWNRS (i.e. not subjected to 3rd party, long term, independent testing)

Peat Filters

- Excellent polishing filters
- Cannot denitrify
- Replacement of peat can be expensive & nasty!
- Initial cost is high
- None provided for OWNRS (i.e. not subjected to 3rd party, long term, independent testing)

Sequencing Batch Reactors

- Proven technology, but none provided for OWNRS
- Can denitrify, but have to add module/step
- Relatively complicated, lots of pumps, controls
- Requires large tank (3x maximum daily flow)
- Initial cost is high
- Not common on residential sites in Florida
- None provided for OWNRS (i.e. not subjected to 3rd party, long term, independent testing)

Submerged Bio-reactor

- FAST unit proven in OWNRS test
- Conservatively: 70% Nitrogen reduction
- BOD & TSS reduction >95%
- Fecal coliform reduction >98%
- Certified NSF Class 1 (to 1500 gpd)

Applications

- SFRs
  - Hundreds installed in Florida
  - Over 1,000 in Massachusetts alone
    - Martha's Vineyard, Cape Cod
  - Alaska, CA, NV, IL, dozens of other states
  - Caribbean

Applications *continued*

- Retrofit of existing septic tanks
  - Units as small as 250 gpd
  - Immediately reduces N
  - Extends life of drainfield
  - Can be used to rehabilitate failing drainfield
- NUCLEAR AIRCRAFT CARRIERS

USS Ronald Reagan utilizes FAST wastewater treatment

Applications *continued*

- Excellent for high-strength waste
- Modules available to 9,000 gpd
- For larger flows, use modules in parallel
- For higher strength,
  - Use larger modules
  - Use modules in series
- Agricultural and stormwater applications
  - LagoonFAST units float in ponds

Drip irrigation

- Puts reuse water in root zone
  - Irrigation of landscaping reduces load on municipal water supply or private well
  - Enables additional polishing of nutrients through plant uptake
  - Higher life forms consume any fecal coliform remaining
  - Increases evapotranspiration markedly over classic drainfield
- Proven technology
- Requires careful design, installation, maintenance

Best Bang for the Buck: FAST to drip

- Properly sized FAST gets:
  - >70% N reduction
  - >98% fecal kill in module
  - >95% BOD & TSS reduction
- Pump tank can be configured to act as anoxic biofilter, further reducing N

Best Bang for the Buck: FAST to drip

- FAST effluent minimizes impact on the environment
  - Plant uptake and evapotranspiration
  - Don’t usually take drainfield reduction, because want to irrigate yard more uniformly
- Maximizes site layout
  - Can be irregularly shaped
  - Mound systems are MUCH smaller and lower

Systems in Florida

- Keys
  - We have designed and permitted more than 350 SFRs, restaurants, Mobile Home/RV parks
- Coastal areas
  - Bay, Brevard, Broward, Charlotte, Citrus, Dade, Duval, Franklin, Volusia
- Others
  - Leon, Lafayette, Orange,


21425
BIO-MICROBICS
21405

LagoonFAST in operation


5a


SKILSAW
24

Example:
Total Maximum Daily Load

Family of four	House 1	House 2
Flow, gpd	500	250
TN, Influent	30 mg/l	60 mg/l
TN Reduction	70%	70%
TN Effluent	9 mg/l	18 mg/l
TN Effluent	0.038 lbs	0.038 lbs

Decentralized Overview

Mark D. Repasky, PE
Wastewater Specialist

Because in Florida, “It’s the water, stupid.”©

- When the water’s brown, ain’t no one coming down.

Plenty of studies have been done

- *We know what works*
- *And under what conditions*

- **Several things lacking:**
  - *Good Engineering design*
  - *Good Quality Control during installation*
  - *Professional management for ongoing O&M*

Current status quo

- DOH regulates
  - Has incomplete management mandate, and inadequate funding for same
- Maintenance entities too fragmented, also have inadequate rate structure

Institute EPA Level V Management structure for all new construction not connected to central sewer

- *Must be done "in quantity" for wholesale as opposed to retail costs*
- *EPA Model Code exists*

Utility, Level V

- Supplies
- Installs
- Maintains
- Billing is same as any utility:
  - On-site Treatment Systems
  - Cluster systems (parts of neighborhoods)
  - Package plants

Specify treatment levels based upon site sensitivity

- **Location**
  - **Springshed**
  - **Waterfront**
  - **Near water**
  - **Isolated from water**
- **Soil conditions**

For existing systems

- **Level IV or Level V**
- **Retrofit based upon site sensitivity, as required**

What problems does onsite/decentralized solve?

- **NIMBY: WWTP**
- **Land expense, direct as well as indirect cost and time lost during acquisition**
- **Controls-without stifling-development and density**
- **Virtually every property in our area already has an onsite system; they simply need to be upgraded, properly maintained, and managed**

- COST FOR COLLECTION SYSTEMS: ZERO
  - $$ can be used for treatment, management
- Reuse for landscape irrigation: demand reduction
- Rapidity with which we can attack problem systems/triage
- Concurrency: install as needed
- Rewards those that do (and especially have already) done the right thing by installing an appropriate onsite treatment system
- Stormwater work can be done on each site at the same time

- Additional capacity via soil treatment
- No point-source discharge of partially treated wastewater to surface waters
- Maintenance of ambience thru promulgation of native/desirable species, irrigated with reuse water
- This is accomplished onsite, without delay, without severe disruption of city life and concomitant indirect costs

Other notes

- **Drip: if dose properly, soil never saturated, then water must go up via capillary action, evapotranspiration—no impact upon ground water**

- **Irrational rules and requirements can SEVERELY impact cost efficiency**

Wakulla Springs Park & Lodge Septic system

- Any treatment added?
- Was simply large tanks, dosed drainfield, near spring
- Transient systems like these sometimes concentrate on ammonia, converting to nitrate, and dumping into drainfield/soil/groundwater

Onsite Systems, Nutrients, and the Wakulla Springshed

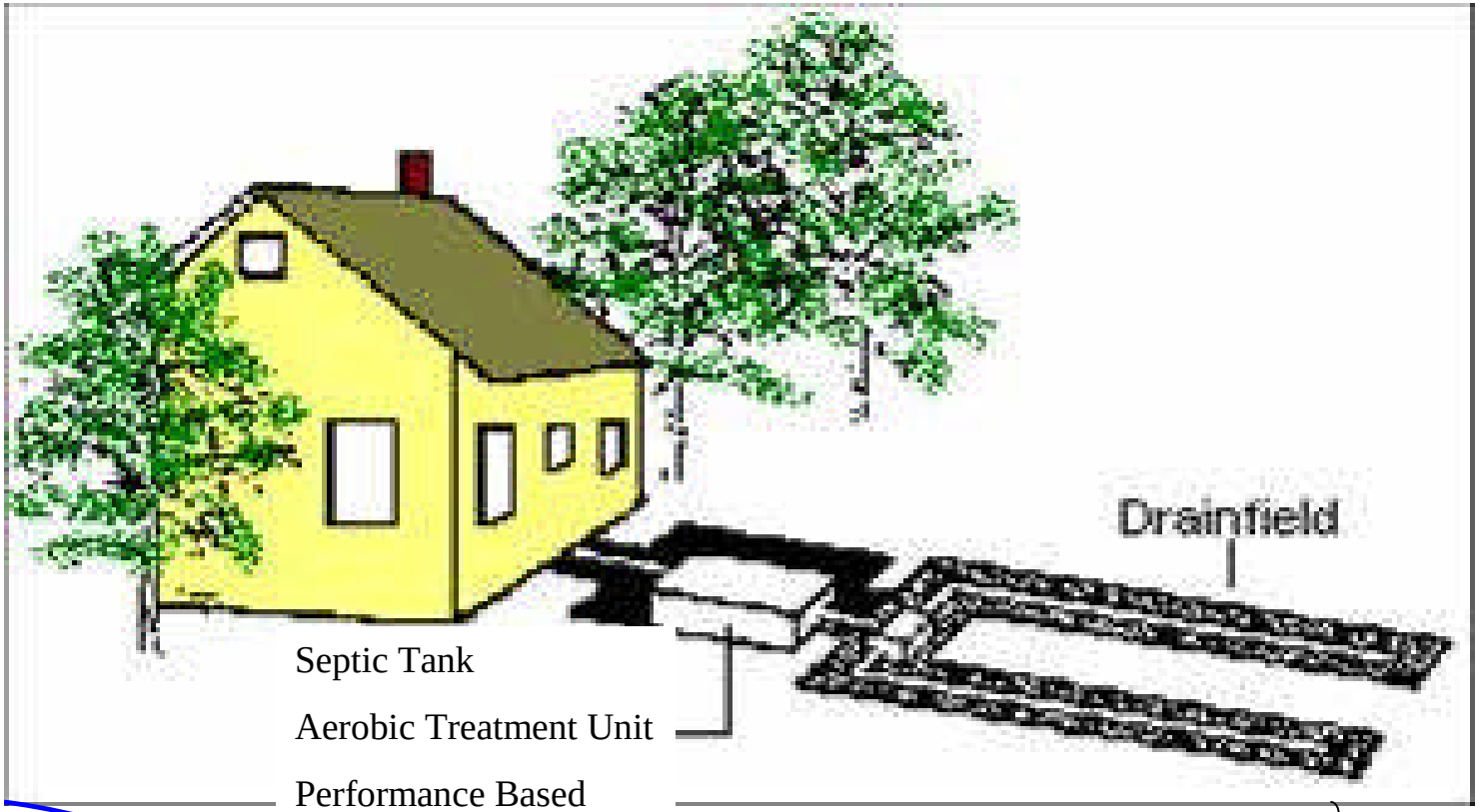
Wakulla Symposium
May 12, 2005

By Eberhard Roeder, Ph.D., P.E.
Bureau of Onsite Sewage Programs
FL Dept. of Health, Division of Environmental Health

Outline of the Presentation

- How do septic/onsite systems work?
- What can be done about nutrients?
- What are best management practices?
- What are suggestions for the Wakulla Springshed?

How do onsite systems work?



2 feet between bottom of drainfield and seasonal high water table

Groundwater

(Average) Treatment Expectations

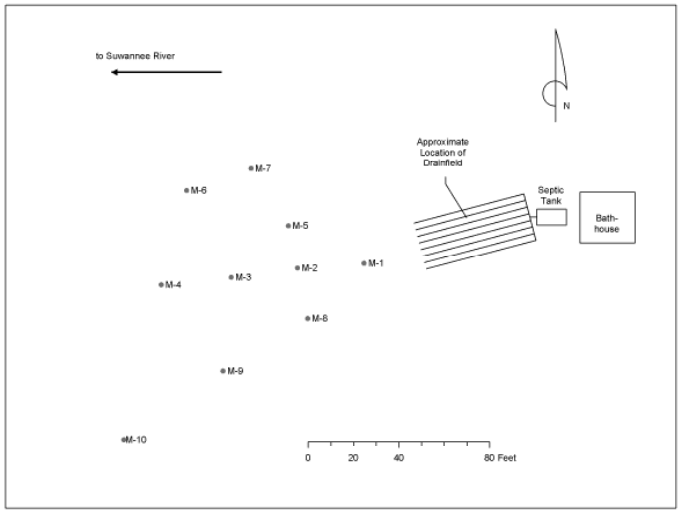
	cBOD5 (mg/L)	TSS (mg/L)	TN (mg/L)	TP (mg/L)	System Type
Standard Septic system below drainfield at groundwater interface	<5	<5	25-40	<5	
Secondary Treatment	<20	<20			ATU
Advanced Secondary Treatment	<10	<10	<20	<10	PBTS
Florida Keys	<10	<10	<10	<1	PBTS
Advanced Wastewater Treatment	<5	<5	<3	<1	

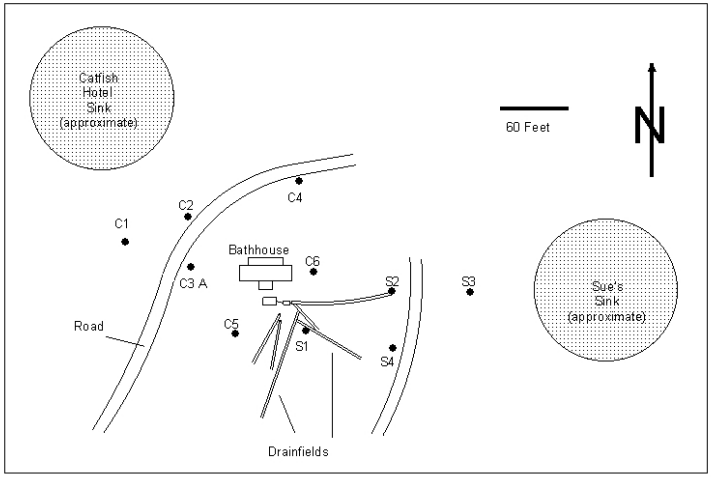
What can be done about nutrients?

- No sewage
- Limit flow and/or number of OSTDS per acre. This approach has been in Florida OSTDS rules for at least 30 years.
- Increased Treatment:
  - Recycle to plants (drip-irrigation, generally in conjunction with an ATU)
  - High-performance treatment at onsite scale (tested in Keys Demonstration Study, proposed for Wekiva).
- Natural attenuation:
  - In some areas, nitrogen and phosphorus decrease subsequent to the drainfield in the groundwater and don't appear to affect surface water (St George Island Study, Indian River Lagoon Study).
  - In some areas this natural attenuation process appears to be less important (Lake Okeechobee Study, Karst Study)

Karst Study

- Manatee Springs State Park Bath Houses
  - Rapid transport of tracers
  - Nitrate concentrations in excess of drinking water standards at many monitoring wells
  - Phosphorus elevated
  - Few fecal coliform observations

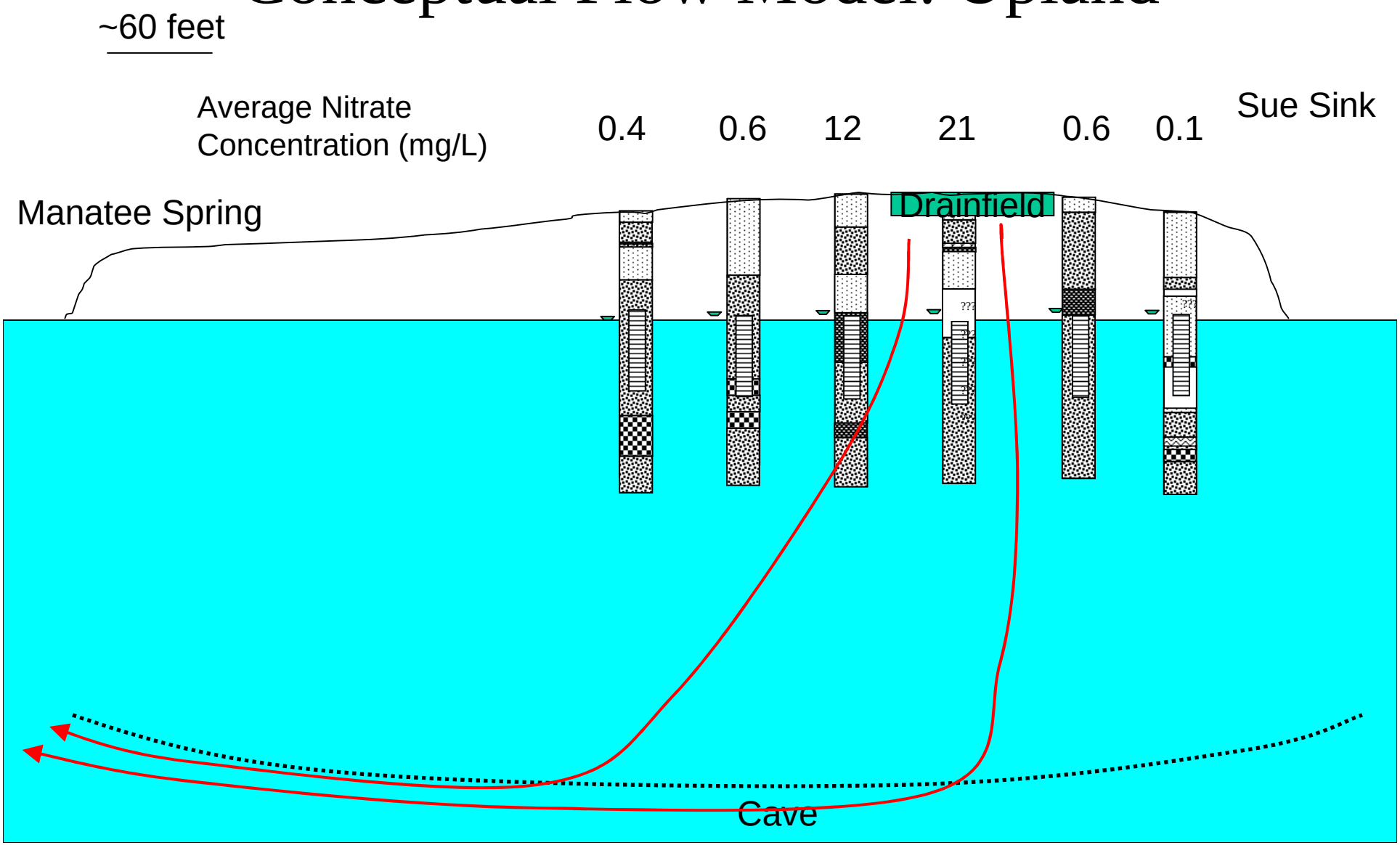




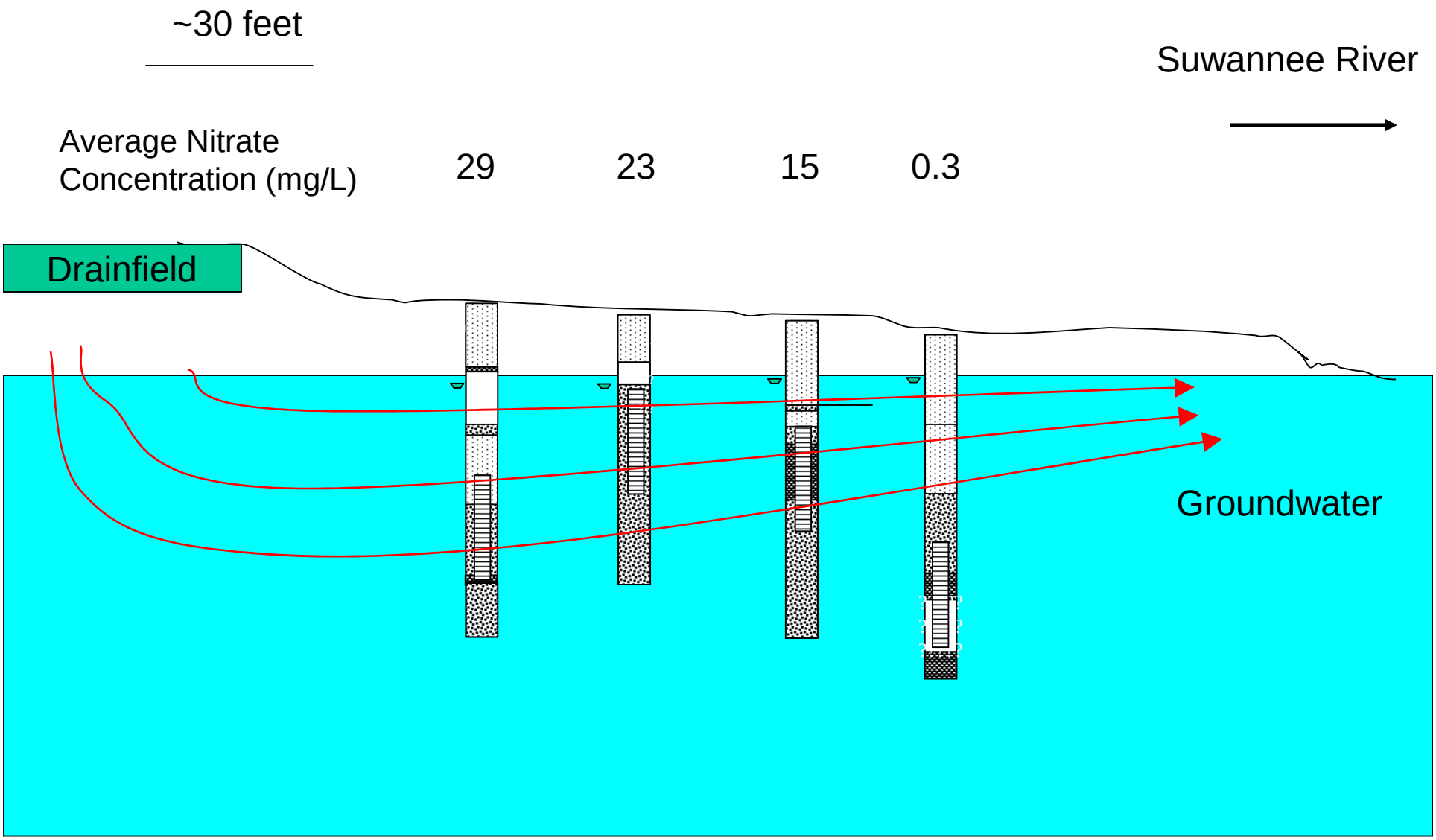
River Front

Upland (On top of cave)

Conceptual Flow Model: Upland



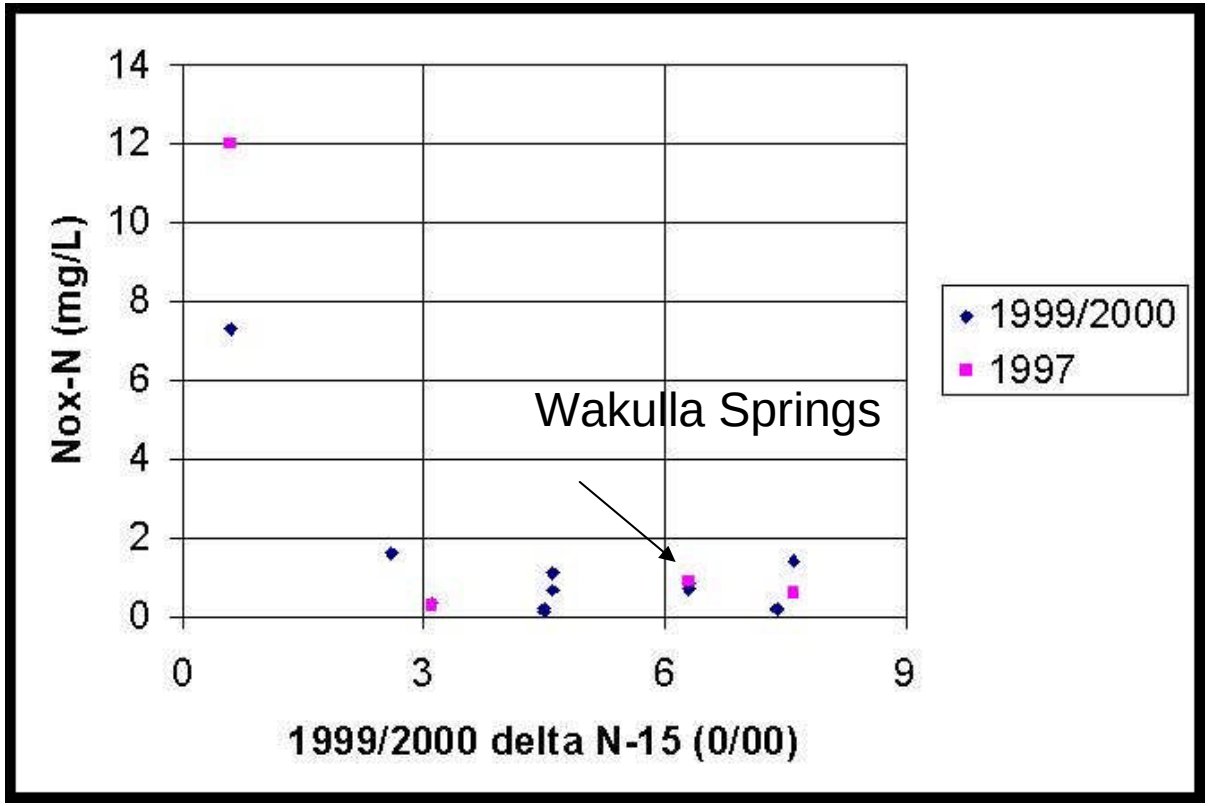
Conceptual Flow Model: River Front



Nitrogen in the Wakulla Springshed

Delta N-15 as indicator of N-source in residential drinking water wells in the Wakulla Springs area

- <3 artifical fertilizer
- >10 animals/sewage



Data from Chellette, Pratt and Katz, 2002

What are Florida's management practices?

- Standard Septic Systems:
  - Homeowner education
  - Design and construction (water table separation, soil textures) standards
  - Missing: regular inspection and maintenance requirement
- Aerobic treatment units:
  - Units third-party tested to meet performance criteria.
  - Operating permit requires homeowner contract with qualified maintenance entity.
  - Regular inspection required
- Performance-based treatment systems:
  - Engineer-designed and in most cases third-party tested
  - Operating permit requires homeowner contract with qualified maintenance entity
  - Regular inspection and sampling required

- Some demonstration/pilot projects have explored sewer districts with authority over onsite systems to achieve reliable maintenance and monitoring. EPA emphasizes this solution.

http://www.epa.gov/owm/septic/pubs/septic_guidelines.pdf

Some Suggestions for the Wakulla Springshed

- What is the problem?
  Nutrient contributions to groundwater (22% for TN) or possible pathogen indicator contributions to stormwater from failing systems
- Where is natural attenuation ineffective?
  Spring vulnerability mapping and groundwater monitoring to confirm priority (unconfined) areas for protection
- What is an effective mix of approaches?
  - Nnutrient-reducing treatment in vulnerable areas by either onsite systems, DEP package plants or connection to a larger WWTP.
  - A funding and coordinating entity will be necessary, especially to involve onsite systems, which serve mostly populations in the urban fringe and rural areas (counties)

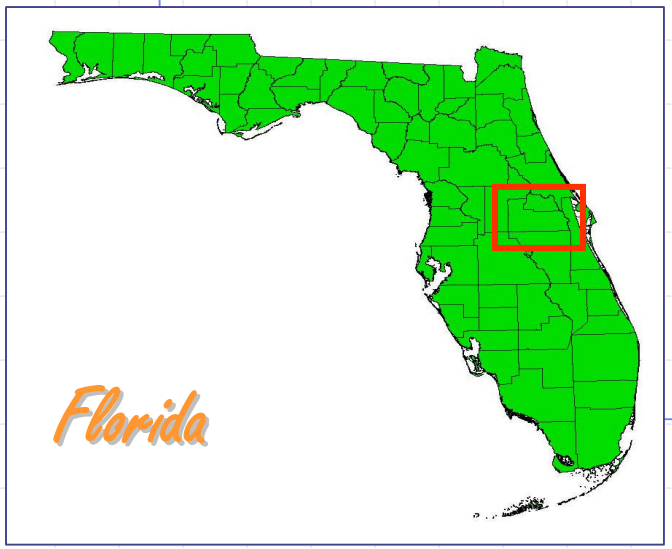
- Further information about onsite research
  http://www.doh.state.fl.us/environment/ostds/research/researchreports.htm

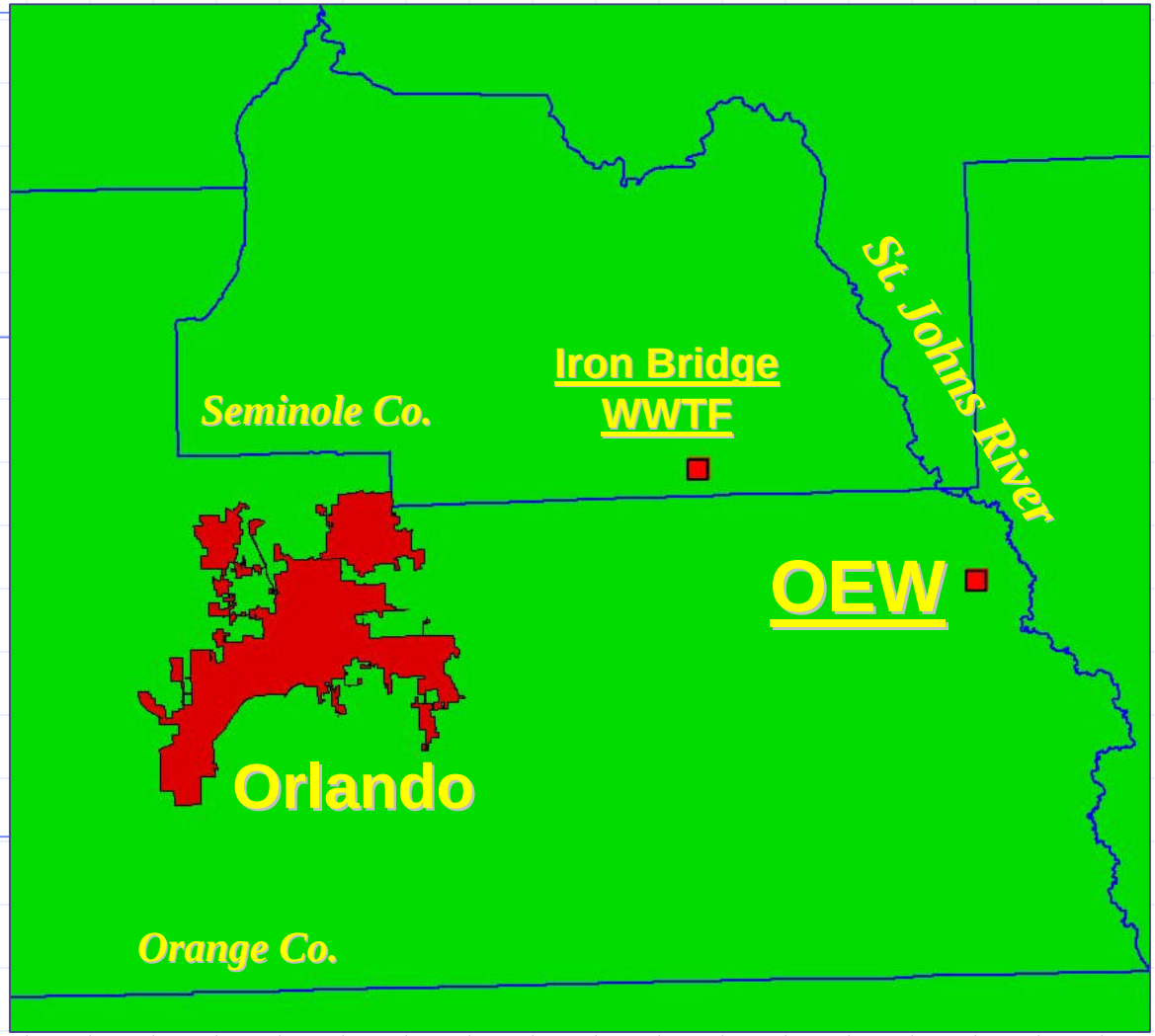
The Orlando Easterly Wetlands

Mark Sees
City of Orlando
Wastewater Division

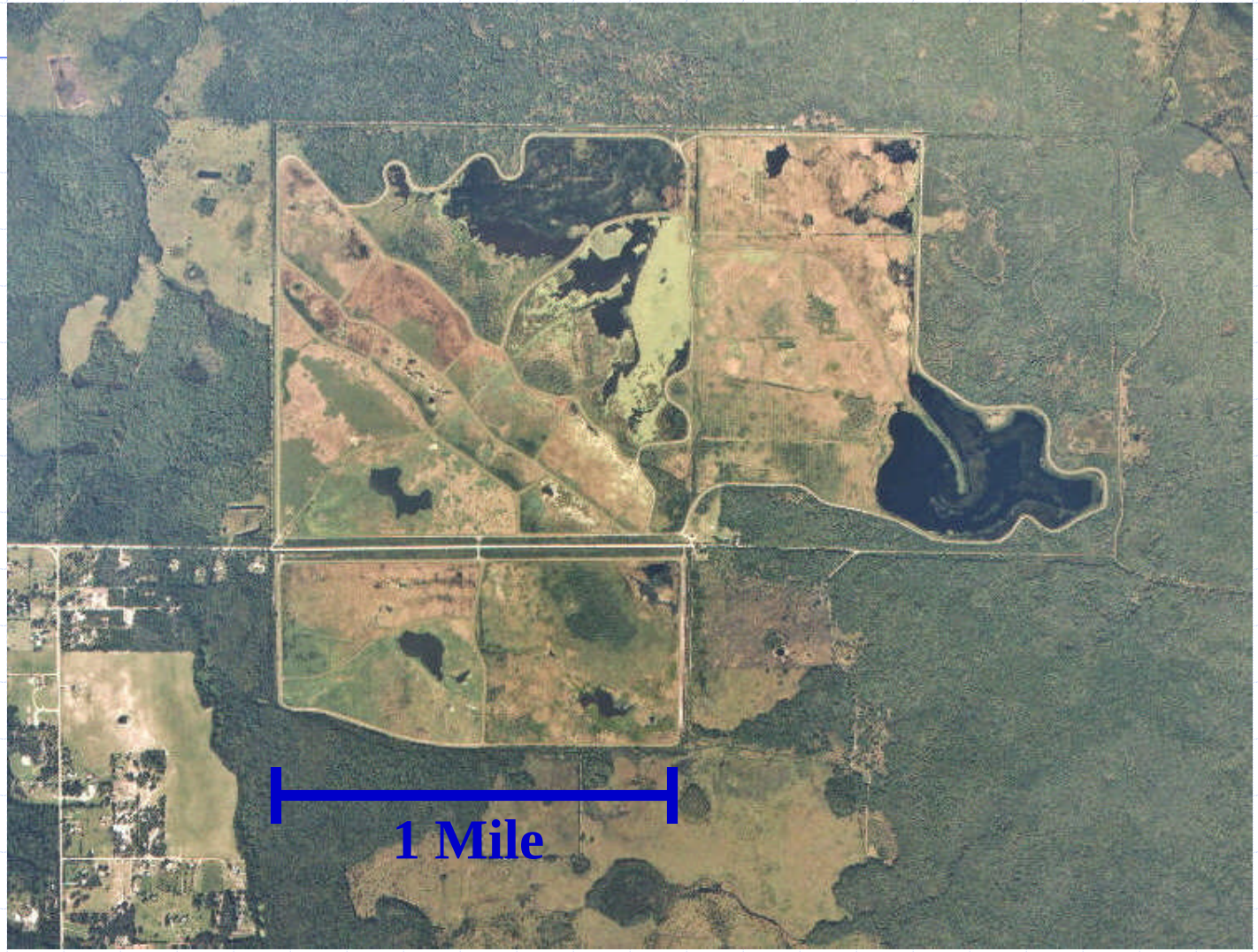
Orlando Easterly Wetland (OEW)

- **Built/operated by City of Orlando**
- **Receives AWT effluent from Iron Bridge WWTF**

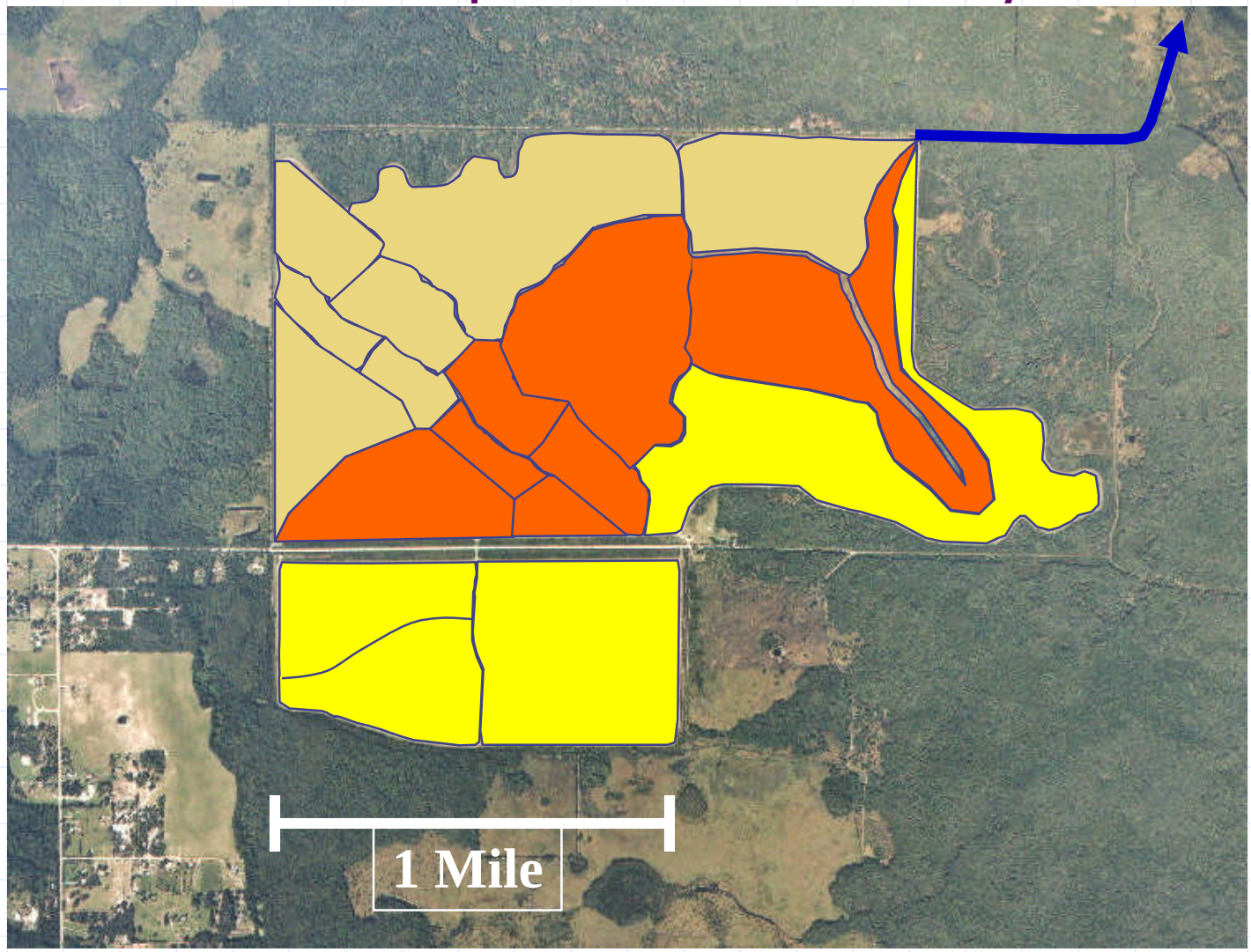




In July of 1987 the Orlando Easterly Wetlands began receiving flow from Iron Bridge.



The OEW is divided into 3 different flow trains for maintenance and operational flexibility.



Influent

OEW Water Quality

Influent

- TN - 2.4 mg/l
- TP - 0.28 mg/l
- TSS - <1.0 mg/l
- NH3N - <0.1 mg/l
- BOD - 1.5 mg/l

Effluent

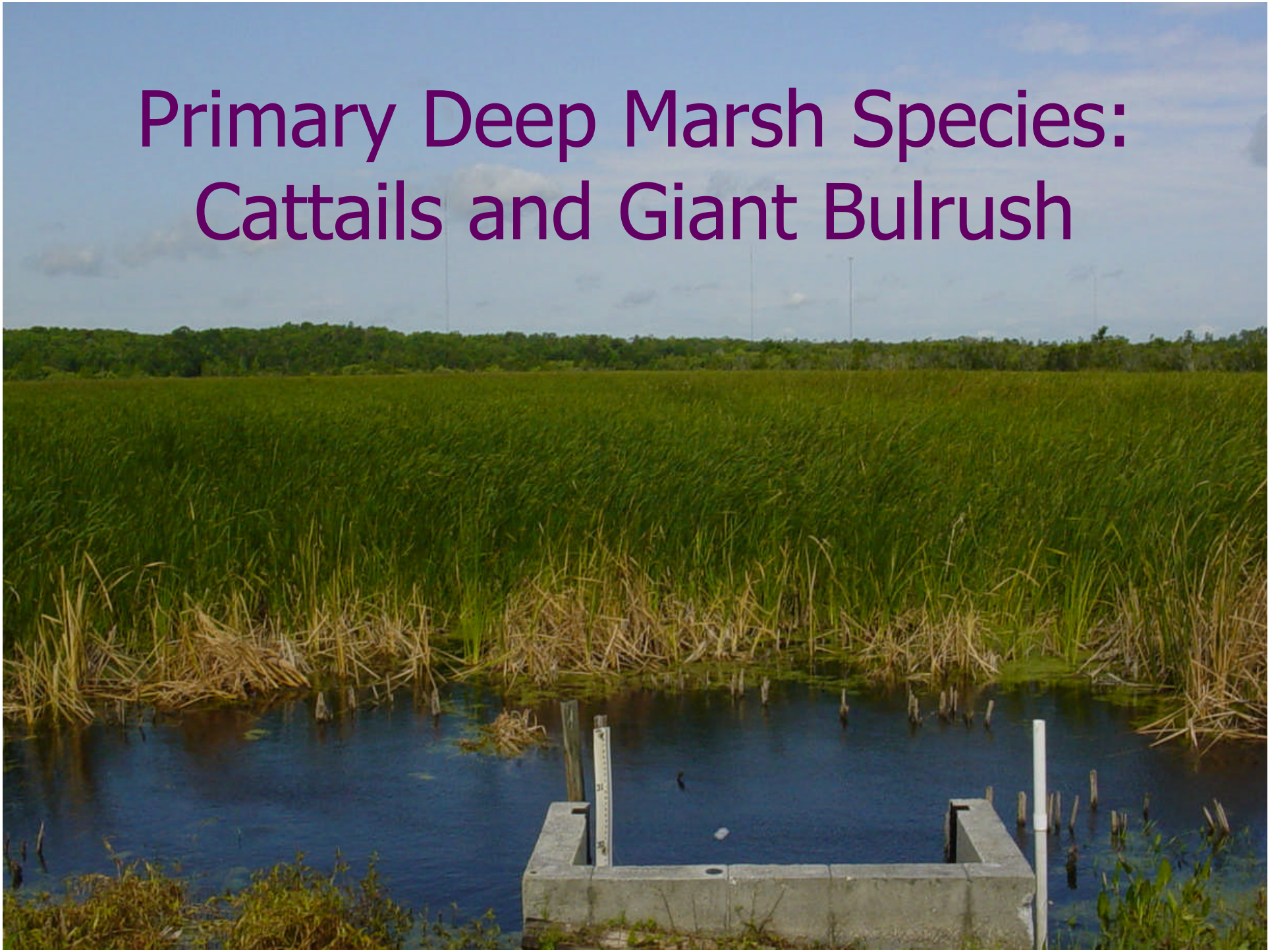
- TN - 0.80 mg/l
- TP - 0.06 mg/l
- TSS - <1.0 mg/l
- NH3N - <0.1 mg/l
- BOD - 1.8 mg/l

OEW Key Features

- The OEW represents the world's first large scale man-made wetland designed to treat reclaimed water and provide wildlife habitat!
- Over 2,000,000 aquatic plants were installed and over 200,000 trees to create this impressive, viable wetlands!
- The system receives approximately 20,000,000 gallons of reclaimed wastewater each day.
- It takes approximately 30 days for the water to travel through the treatment system.
- Over 12,000 people visit the Park annually.
- The OEW has won numerous awards.
- Represents a cost effective solution for Wastewater Disposal.


3. 7

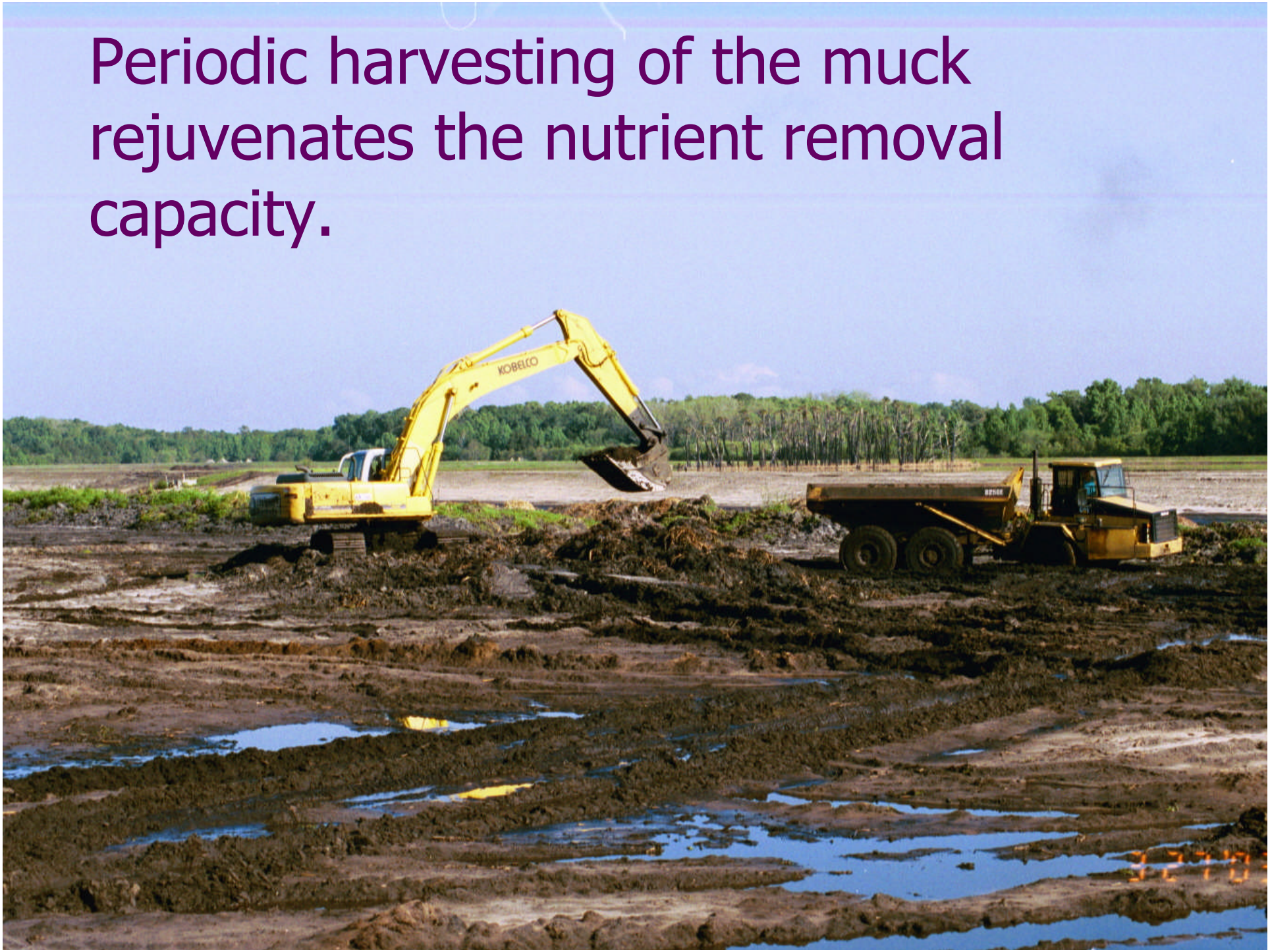
Primary Deep Marsh Species: Cattails and Giant Bulrush




The mixed marsh contains over 60 emergent, submerged and floating leaved aquatic plants.

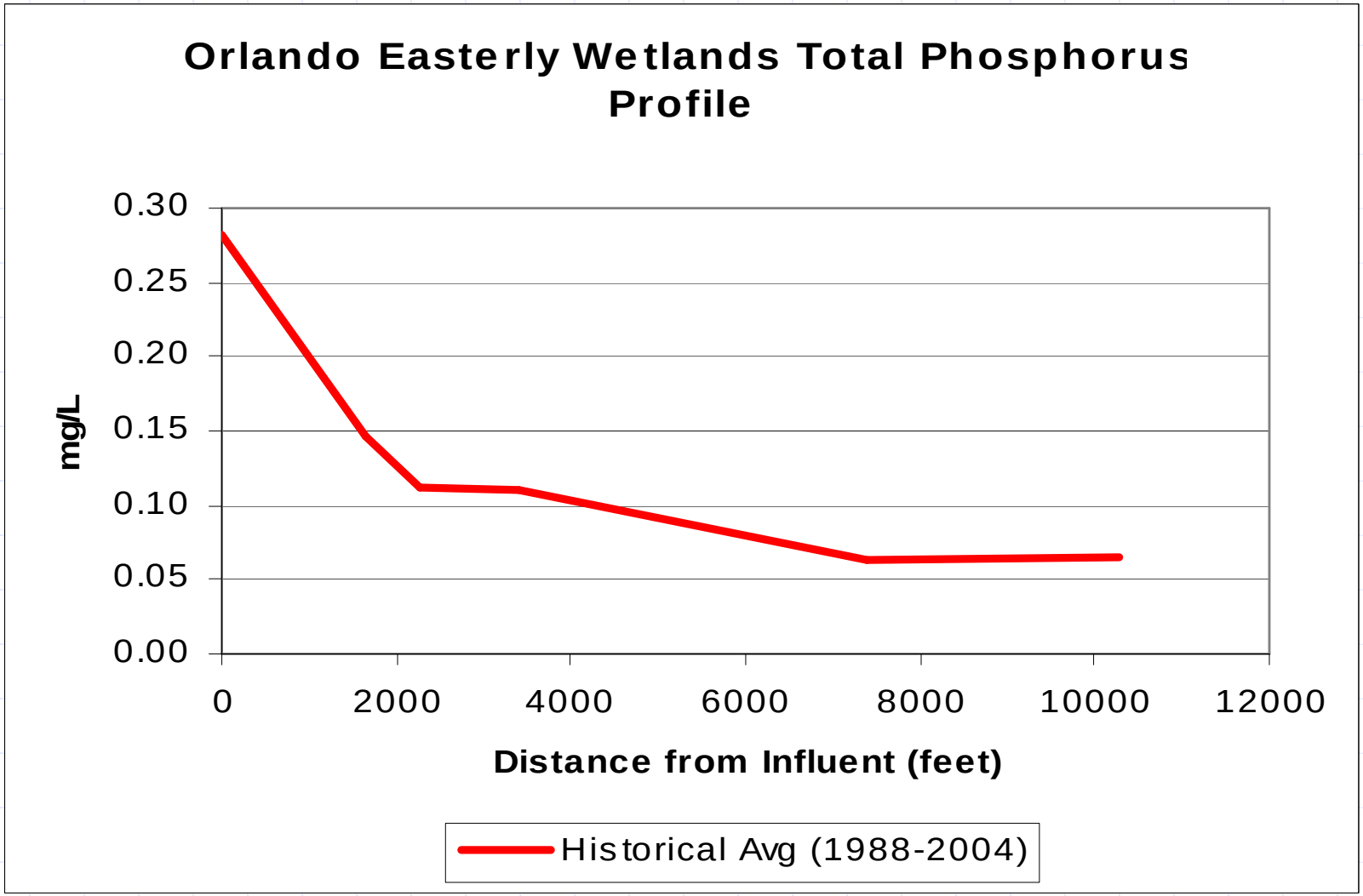
The diversity of plants promotes incredible wildlife habitat!!

Periodic harvesting of the muck rejuvenates the nutrient removal capacity.

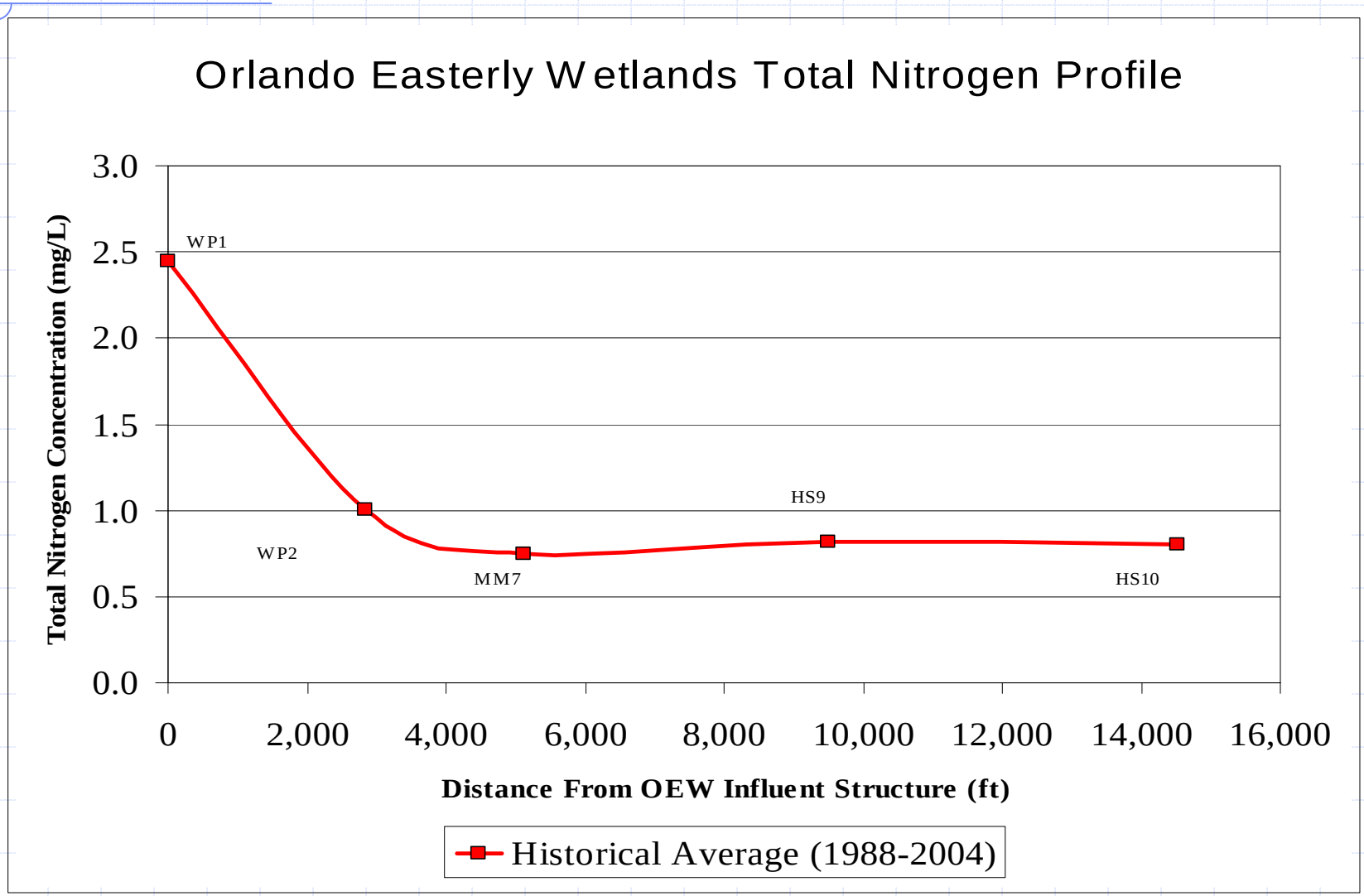


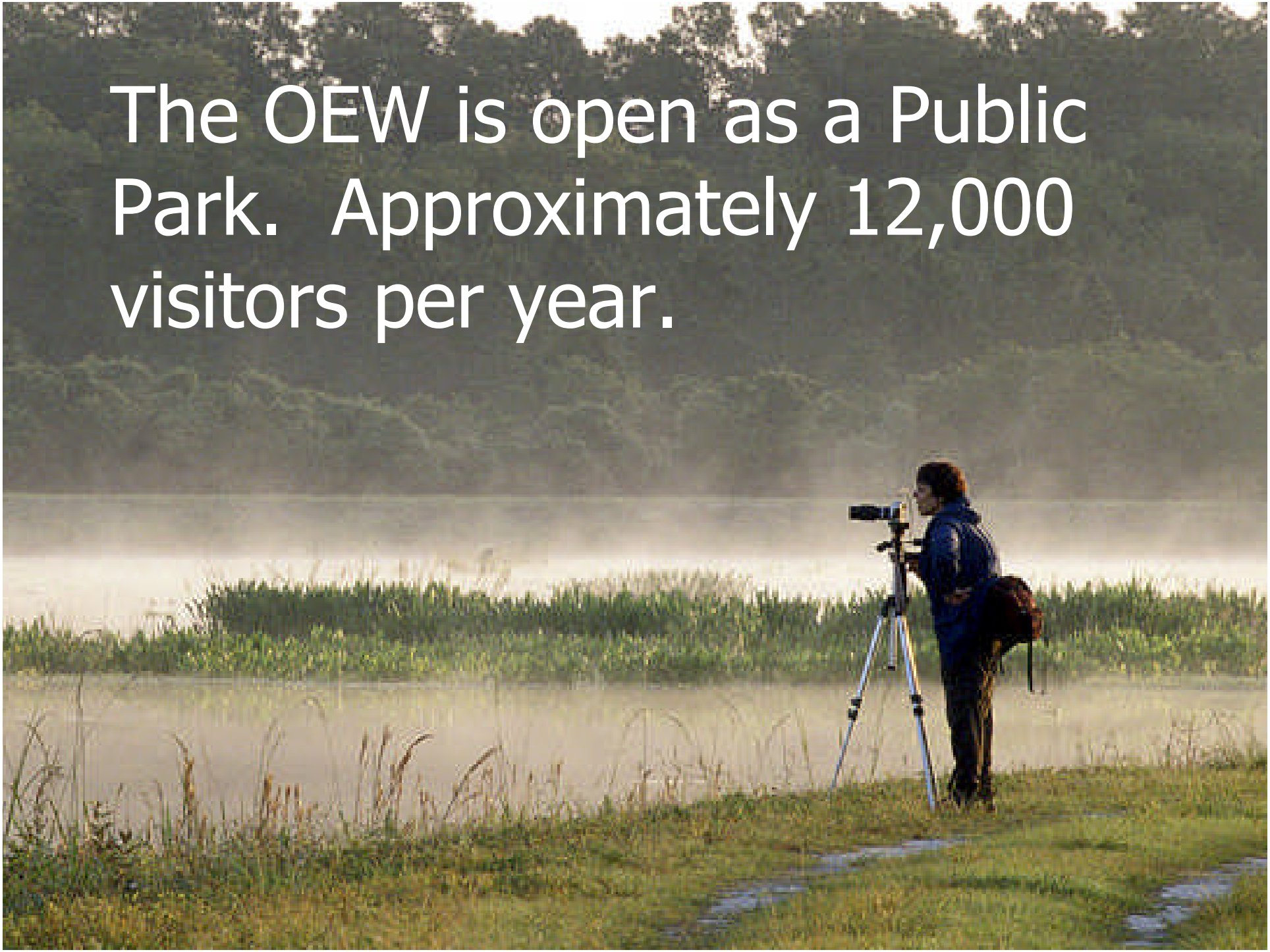
Treatment cells are reflooded and replanted.

Water Quality Performance Through the Wetlands



Water Quality Performance Through the Wetlands




The OEW is open as a Public Park. Approximately 12,000 visitors per year.


Any Questions?

1000 Friends of Florida Presentation on May 12, 2005

Presenter: Kart Vaith/CDM
vaithk@cdm.com

Wastewater Treatment can be really simple and it is in all our control

"Quit Producing it (and we'll find ways to quit treating and getting rid of it)"

QUOTE AT MANY WASTEWATER OPERATOR TRAINING SCHOOLS

Wastewater treatment plant effluent has only two places to go: surface water and/or groundwater

- What we do with the treated wastewater defines what's needed for treatment
  - Groundwater Discharges:
    - Land Application (slow rate)
      - Reuse, etc.
    - Land Application (high rate)
      - Rapid infiltration basins
      - Exfiltration trenches, etc.
    - Injection
  - Surface Water Discharges
    - Wetlands Treatment Systems
    - Into surface water bodies
- Biosolids Treatment requirements are defined similarly, and are not considered in this presentation

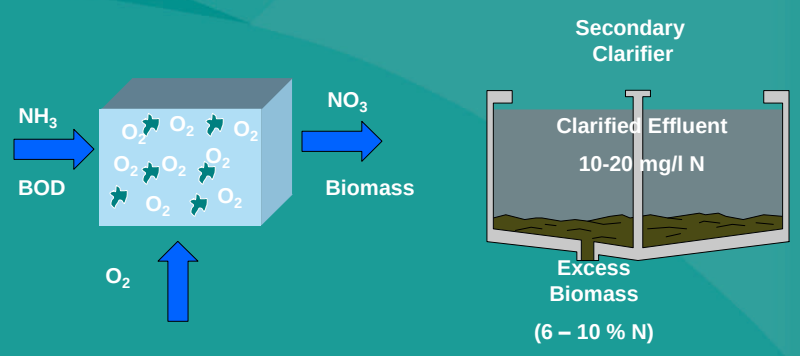
Wastewater disposal application rates and effluent parameter limits are dictated by stringent FDEP regulations

Disposal Method	Limiting Parameters (key parameters from FDEP regulations)
Ground Water Discharge with slow rate land application	1. Agronomic uptake rates 2. Groundwater constraints
Ground Water Discharge with rapid rate land application	1. Groundwater constraints
Injection (Class I or V)	1. Groundwater constraints
Surface water discharges	1. Receiving water characteristics

Wastewater Treatment technologies must consider effluent disposal needs

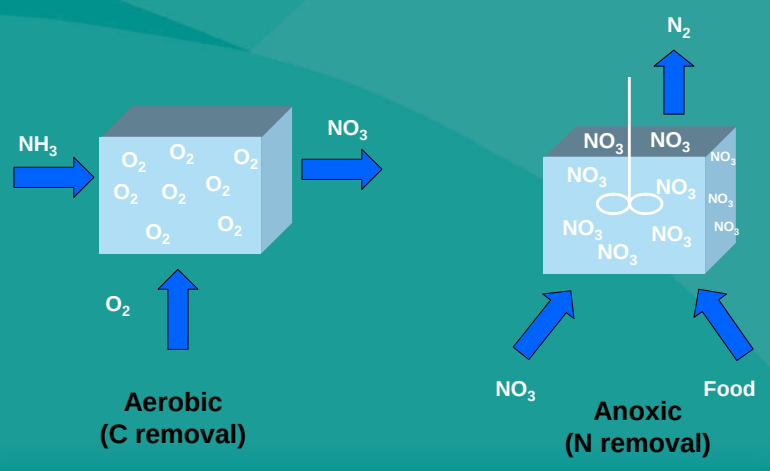
Reuse	1. Too much nitrogen removal will result in farmer/homeowner adding fertilizer 2. Some TN/TP limits are appropriate
Class V Injection	1. Need to meet more stringent criteria 2. Drinking water limits may apply
Class I Injection	1. Less stringent criteria than Class V
Wetlands Disposal	1. Need to reduce TN below 2-3 mg/L moot due to bird/animal habitat and algae

Conventional Wastewater Treatment will meet reasonable effluent parameters of 20/20/10*



* Wastewater effluent concentrations are reported as BOD/TSS/N/P

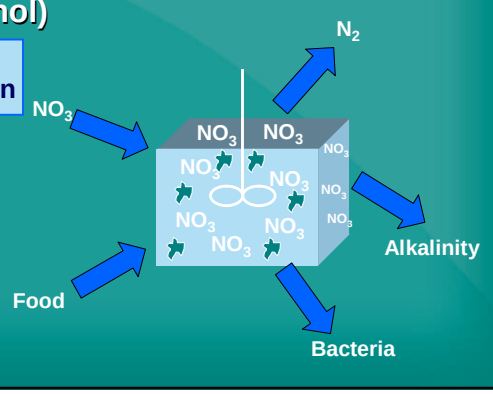
Biological Nutrient Removal (BNR) wastewater treatment will remove a high percentage of total nitrogen



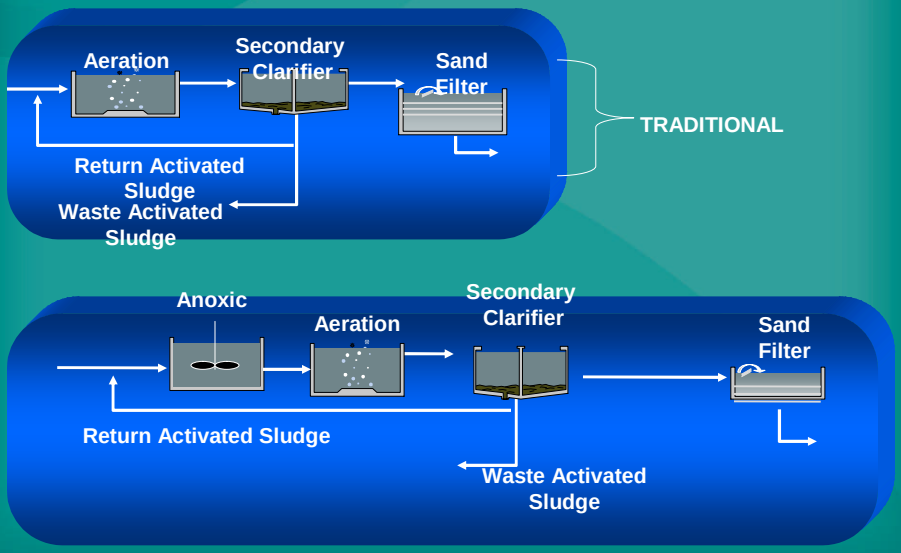
Environmental Conditions For Denitrification must be Created for Nitrogen Removal

- Denitrifying (facultative heterotrophic) bacteria
- Food (BOD or methanol)
- Nitrate
- No oxygen

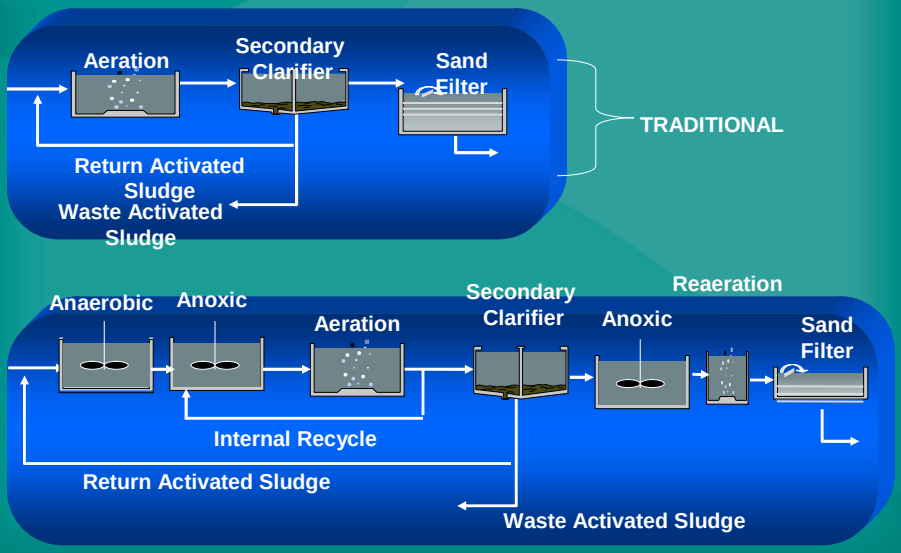
Anoxic Condition



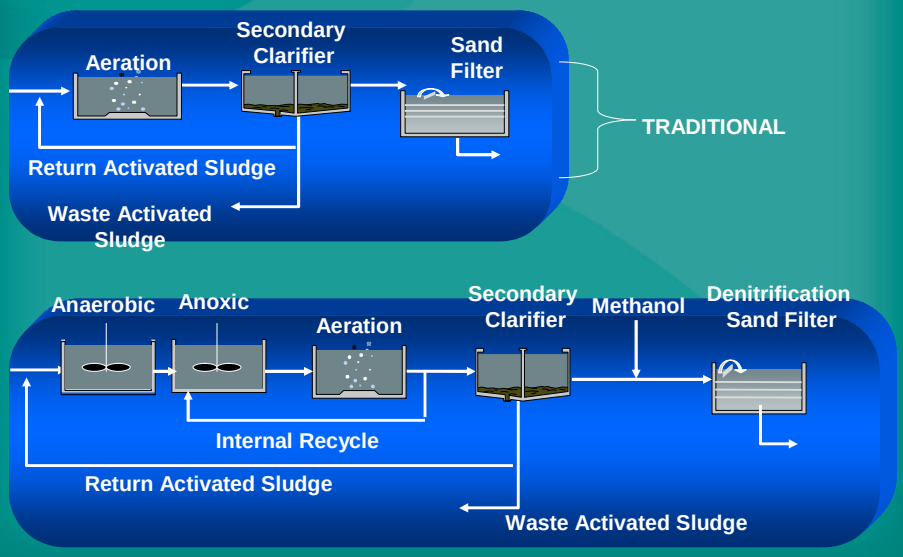
Modified Ludzack-Ettinger (MLE) can meet limits of 5/5/6



5-Stage Bardenpho™ can produce effluent parameters of 5/5/3/1



3-Stage Bardenpho™ w/ Denitrification Filters can produce an effluent of 5/5/2/1



Choosing the right technology for implementation is critical to manage utility rates

Treatment Method	Effluent Parameters	Approximate Cost for Liquid Treatment Train (Solids Handling will cost more)
Conventional	20/20/10 +/-	Approximately $60 million for 20 mgd
MLE with filtration	5/5/6 +/-	Approximately $90 million for 20 mgd
Bardenpho without filtration	5/5/3/1 +/-	Approximately $110 million for 20 mgd
Bardenpho with filtration	5/5/2/1 +/-	Approximately $130 million for 20 mgd

In conclusion, planning to meet effluent limits will drive level of treatment, but there are limits

- Treating to the appropriate level is important, difficult to treat better than 5/5/2
- Over treating can result in additional costs for no benefit:
  - Treating with a nutrient removal process and then disposing the effluent through reuse may require fertilizer addition
- Determining the desired effluent level of BOD, TSS, TN, and TP (if applicable) will allow cost optimization for the ratepayers

Water Budgets

Solving Water Pollution Problems in the Wakulla Springshed of North Florida

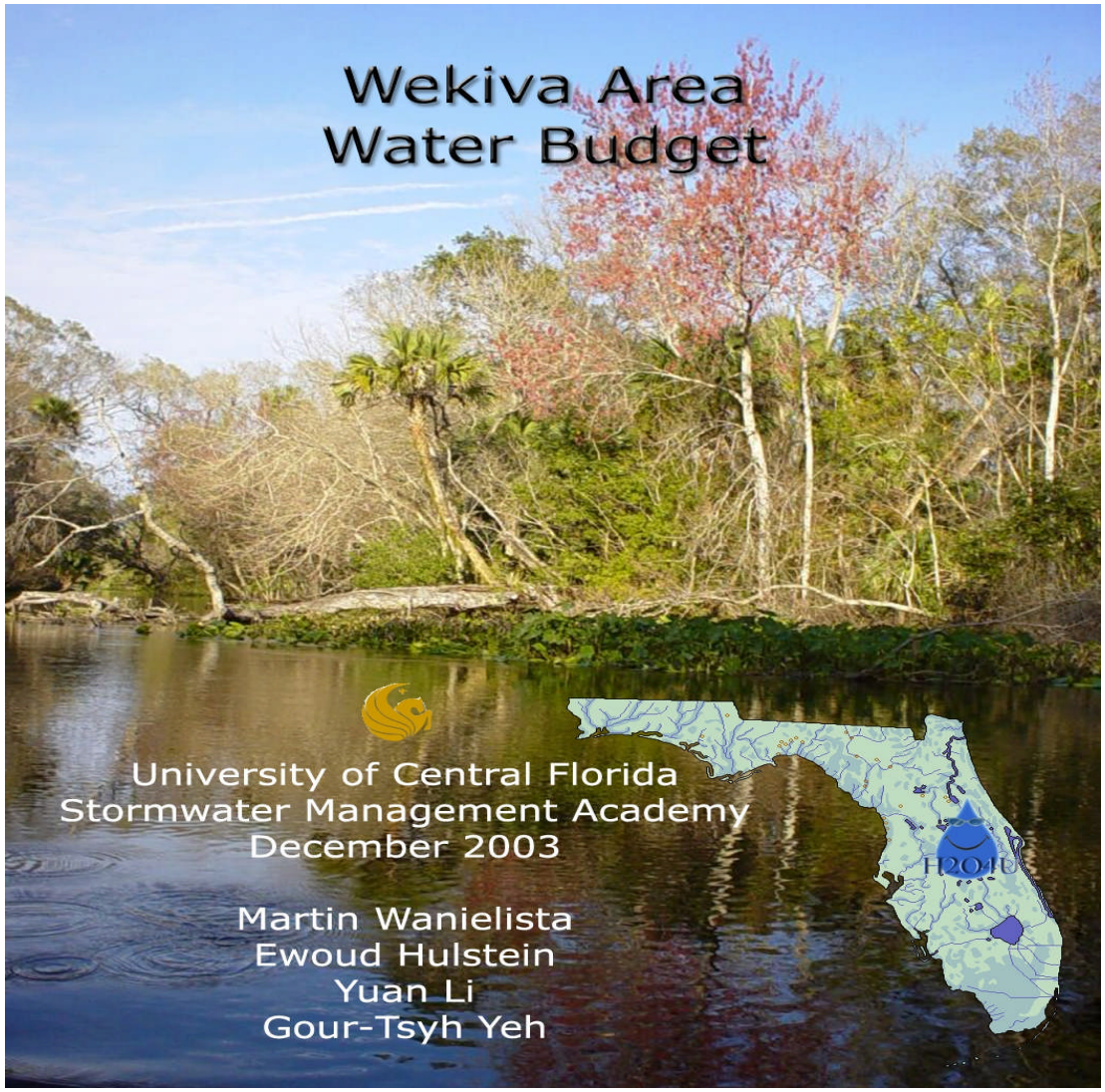
Thanks to:

- Eric Livingston, FDEP
- Rick Renna, FDOT
- Richard Deadman, FDCA
- Many Students
- Mike Hess, Green Time
- Nina Powers, Sarasota County
- Gerry Hartman, Hartman Consulting

Florida: Water Crisis

Spring Flow is decreasing when water budgets are not maintained

Refer to: www.stormwater.ucf.edu



Florida: Water Crisis

Groundwater Elevations

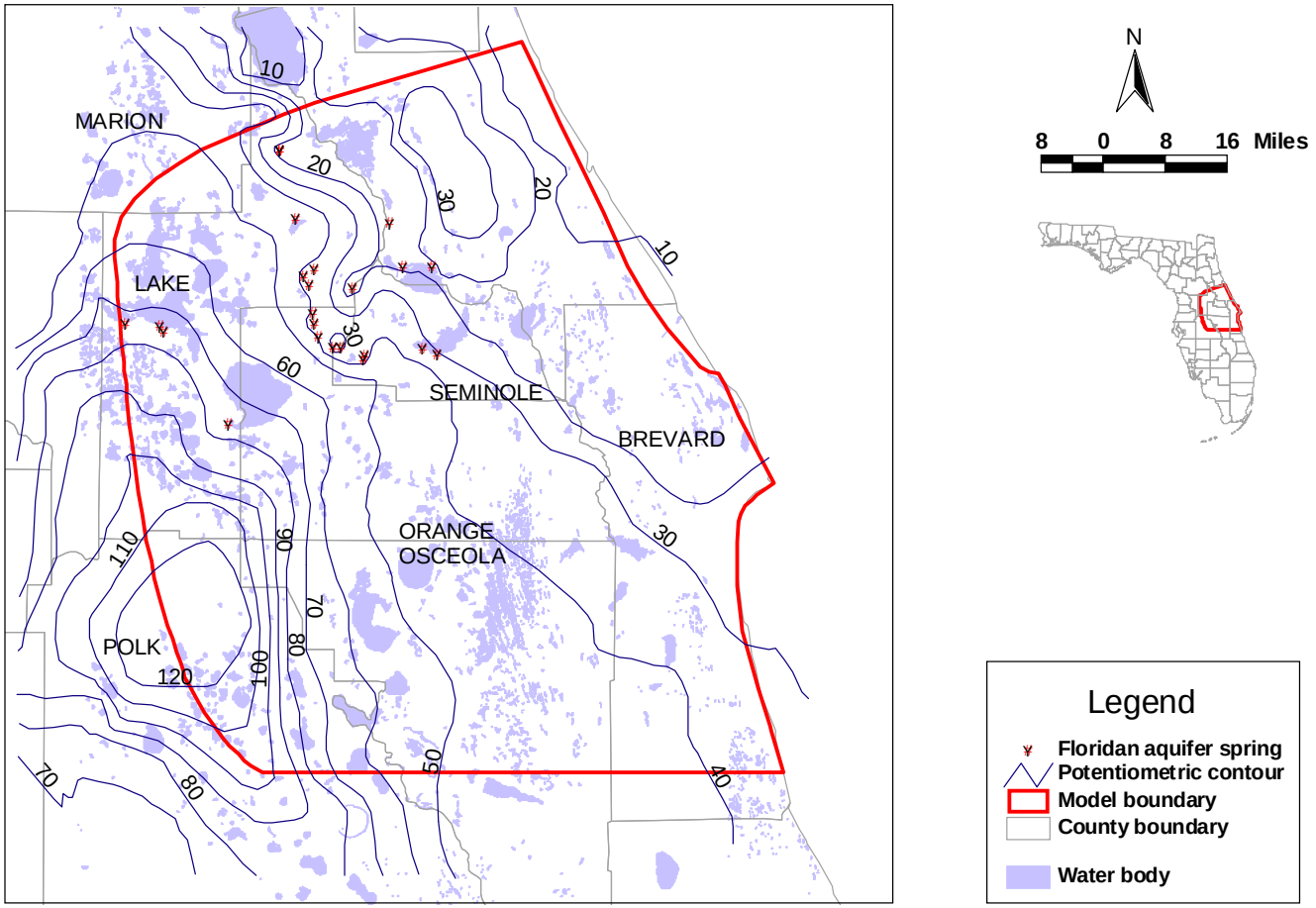
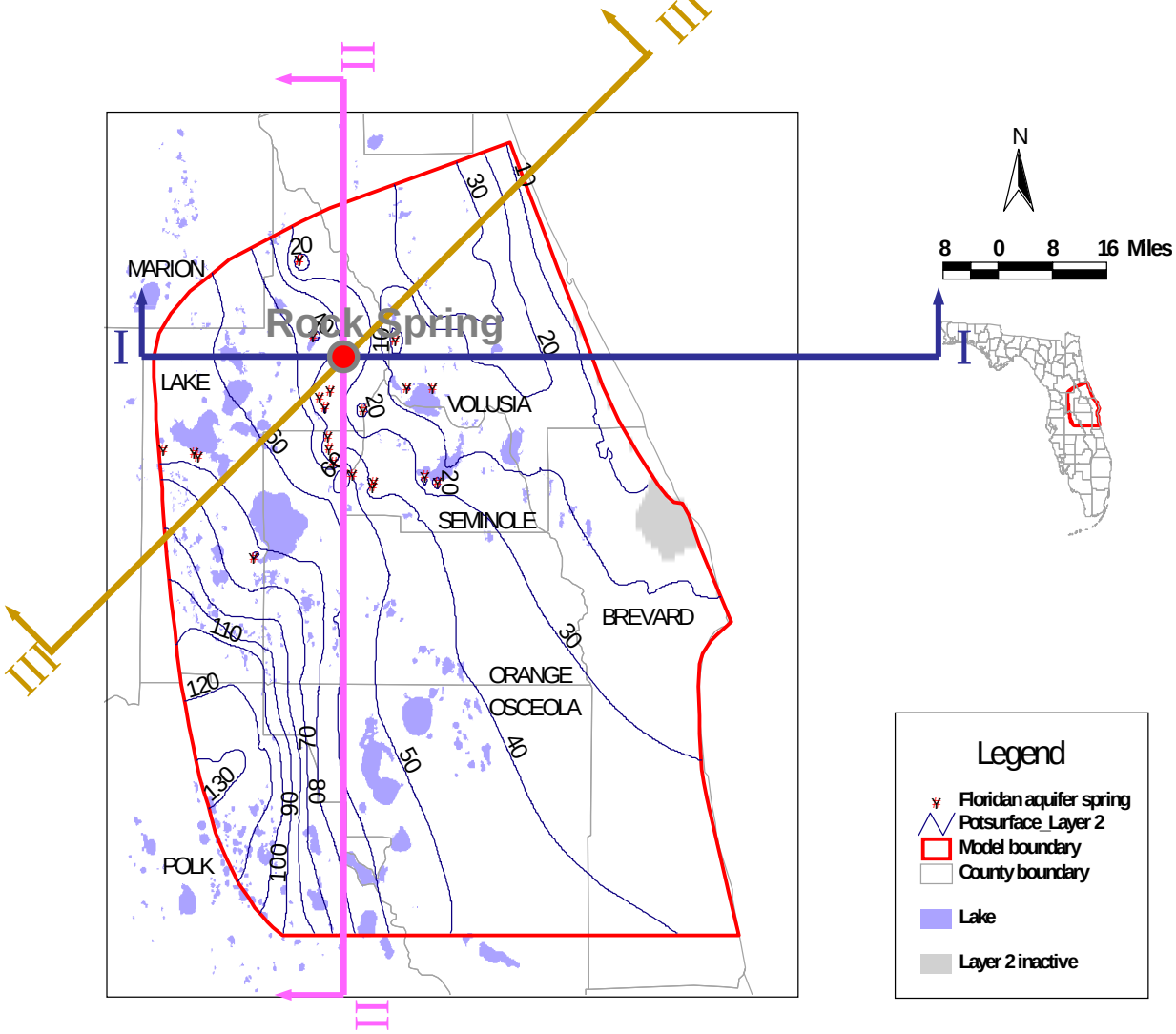


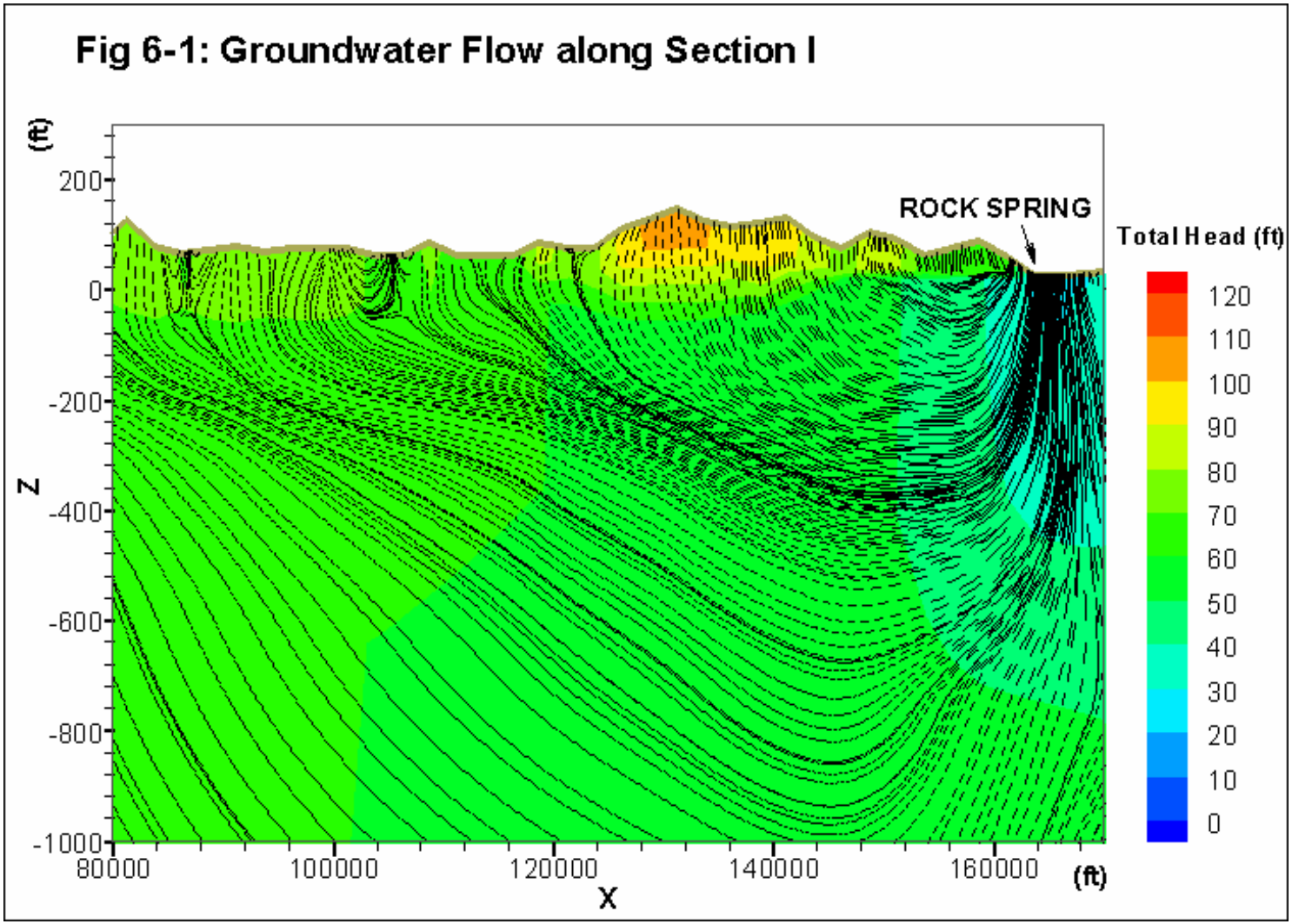
Figure 1: Estimated average 1995 potentiometric surface of the Upper Floridan aquifer (adapted from Knowles et al.1995 and O'Reilly et al.1996)

Florida: Water Crisis

Sections Along the Rock Spring



Florida: Water Crisis



Florida: Water Crisis

99.9% confident spring flow is decreasing

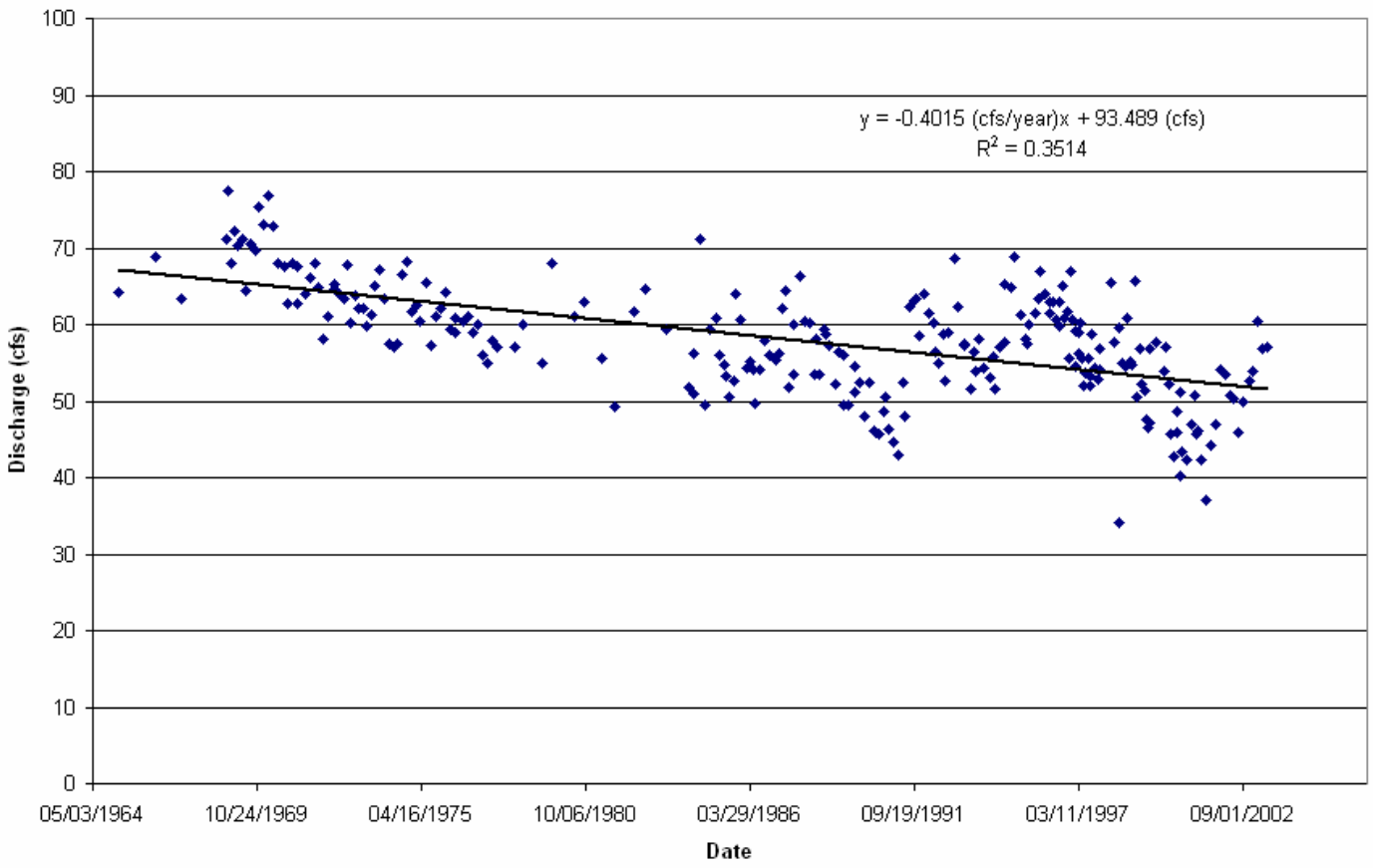


FIG 9.4 - Discharge versus Time for Rock Spring

Springshed Water Crisis

April 5, 2004 Orlando Sentinel

<u>Manatee Refuge Facing Water Crisis, Study Says</u>

- "Fast-growing Volusia County will have to rely less on wells that use Blue Spring's aquifer"
- "To keep Blue Spring flowing for manatees, Volusia County residents need to be prepared for a future without cheap underground well water"

Springshed Water Crisis

April 11, 2004 Orlando Sentinel

<u>Expect to Pay More For Sip of Tap Water</u>

- "As underground supplies near the limit, utilities turn to surface water"
- "pumping from rivers will bring serious harm to waters already sickened by decades of pollution"
- "pump more than the current rate from the Floridan Aquifer – and that risks drying up overlying wetlands, springs and even lakes"
- "One County was hit with staggering projections that it may need a $350 million water plant"

Rainfall and Stormwater Harvesting

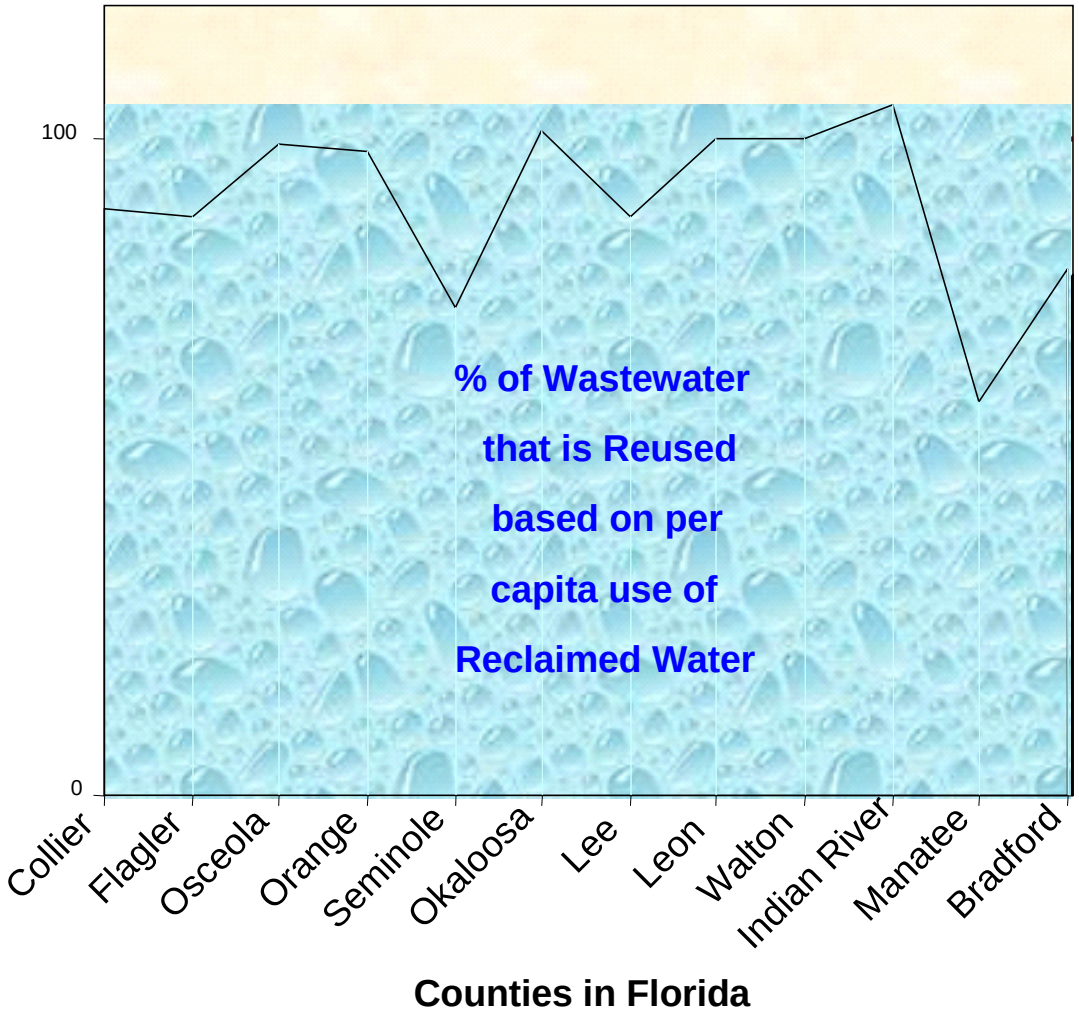
Expand Sources

- Rainbarrels
- Greenroofs with Cisterns
- Irrigation Ponds
- Retention Areas
- Get the Wastewater and Water folks to work with the stormwater folks…. Water is water…

NOTE: Also provides stored water for emergencies (i.e. losing the water plant during a hurricane!)

Working together

Need to expand out sources of water



Source: 2001 Reuse Inventory (7)

Water Reuse for Florida 4/15/03

Florida: Water Solutions

- **Smart Stormwater Development some examples**
  - ✓ Depression areas, reverse berms, swales
  - ✓ Pervious Concrete and other pervious cover
  - ✓ Reduce PPP Pointless Personal Pollution (oil disposal, grass clippings, pet waste, erosion control)
  - ✓ Green Roofs
  - ✓ Irrigation Ponds

AND ALL so we do not have to endanger our health and safety, or drive in water..

Pervious Parking Lot in Florida

Sidewalks also

Results at Test Cells

Test Location	Test Date	Volume of Rainfall (in)	Infiltration Rate (in/hr)
Core A	1/19/05	1.94	2.40
Core B	1/19/05	1.49	2.41
Core C	1/03/05	2.27	2.51
Core A	1/20/05	0.85	1.16
Core B	1/20/05	0.89	1.21
Core A	1/21/05	0.93	1.03
Core B	1/21/05	1.03	1.45
Core A	1/25/05	1.37	1.48
Core B	1/25/05	1.21	1.45

Green Roofs

Rendering of Green Roof at the University of Central Florida

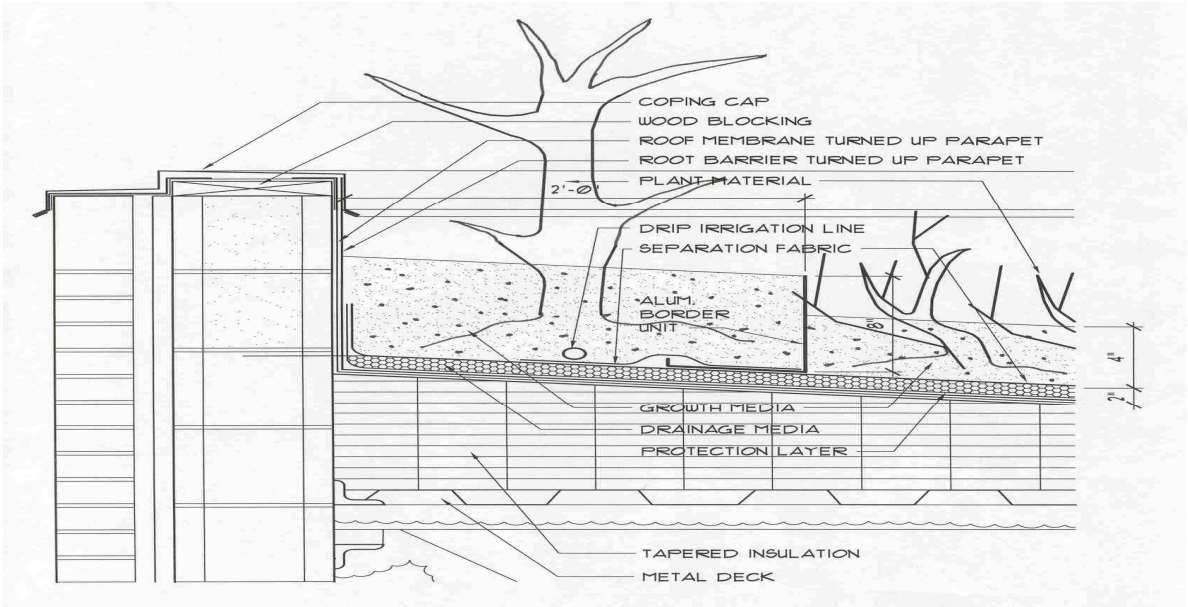
Objectives are:

- Maintain the water balance
- Reduce the stormwater pollution
- Reduce the internal energy demand for cooling and heating.

Green Roofs

Plant Selection based on:

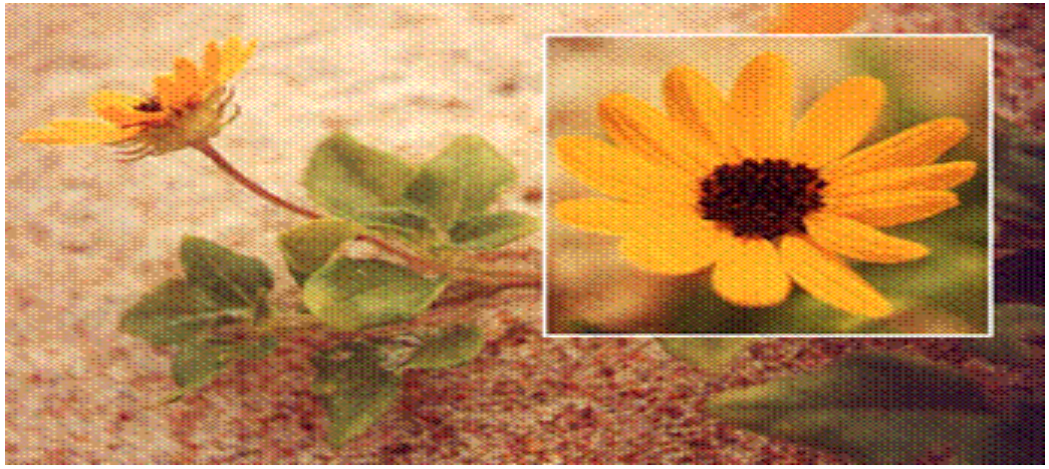
- Perennial with color, preferably woody (having secondary growth), creeping prostrate, or shrubby plants with full sun, high temperature, low soil nutrient, and severe drought tolerances.
- Shallow, fibrous rooting habit
- Cold hardiness to just below freezing



Green Roofs

(Continued) Plant Selection based on:

- No severe pest problems or special horticultural requirements
- Florida native species preferred when suitable and available
- Evergreen foliage preferred, to maintain higher ET and cover and attractiveness all year
- Bloom or fruit display desirable but not mandatory



Florida Native Dune or Beach Sunflower Helianthus Deblis

UCF Student Union

Green Roofs

Media Selection Criteria:

- Lightweight
- Plants can take root in it
- Capacity to hold water

Selected Media:

- Expanded Clay: 42-48 LBS/CF

  25-32 % water holding
- Tire Black and Gold: 30 LBS/CF

  30% water holding (estimated)

Landscaping

Solutions:

- Use Stormwater Irrigation Ponds
- Reduce Sod
- Right plant, right place (consider native plants)
- Water efficiently
- Retention Areas for infiltration

Reduce Sodded Areas

- Reduce costs and energy use
  - ✓ Lawnmower in use for 1 hour produces as much air pollutants as driving a car for 350 miles

- Replace non-essential lawn areas with mulched landscaped beds
  - ✓ Shade the soil to lower soil temperature and reduce moisture loss and weeds

Right Plant, Right Place

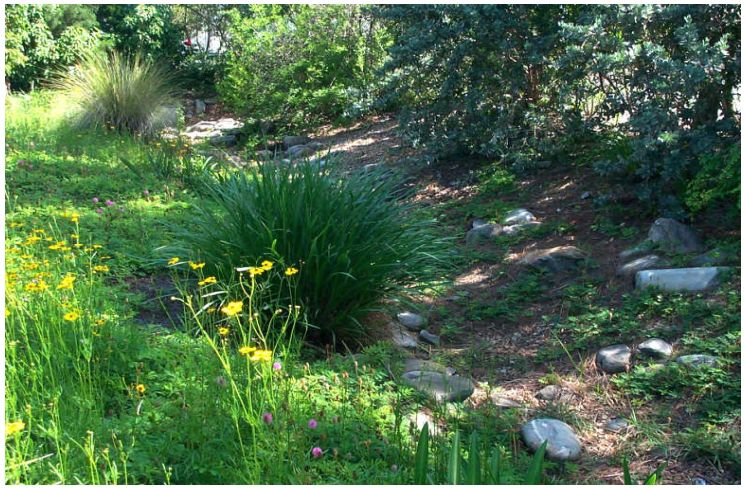
Plant selection is critical

- Reduce maintenance costs
- Reduce water use
- Reduce pesticide use (many native plants are inherently resistant
- Reduce fertilization requirements
- Attract wildlife

Retention Area Alternatives

In lieu of sod:

- Landscape fabric and rip-rap
- Rocks to replicate a natural stream bed
- Native Plants, such as Fakahatchee grass, and Alligator lillies prevent erosion
- Native wildflowers re-seed constantly, providing slope stabilization and beauty



Retention Area Alternatives

Detention Pond Aquascaping

- Upland vegetation and semi-emergent species reduce erosion and pollutant run-off
- Landscaping along shoreline provides beneficial wildlife habitat and looks more natural

Rain Barrels

- Economic alternate supply of water
- Supplements the demand for municipal water
- Low quantities of any chemicals and/or dissolved salts
- Plants flourish more with rainwater than municipal water (b/c of the nutrients in rainwater)
- Collection of rainwater can help reduce erosion
- Collection of rainwater can help meet TMDL's

Rainwater Harvesting

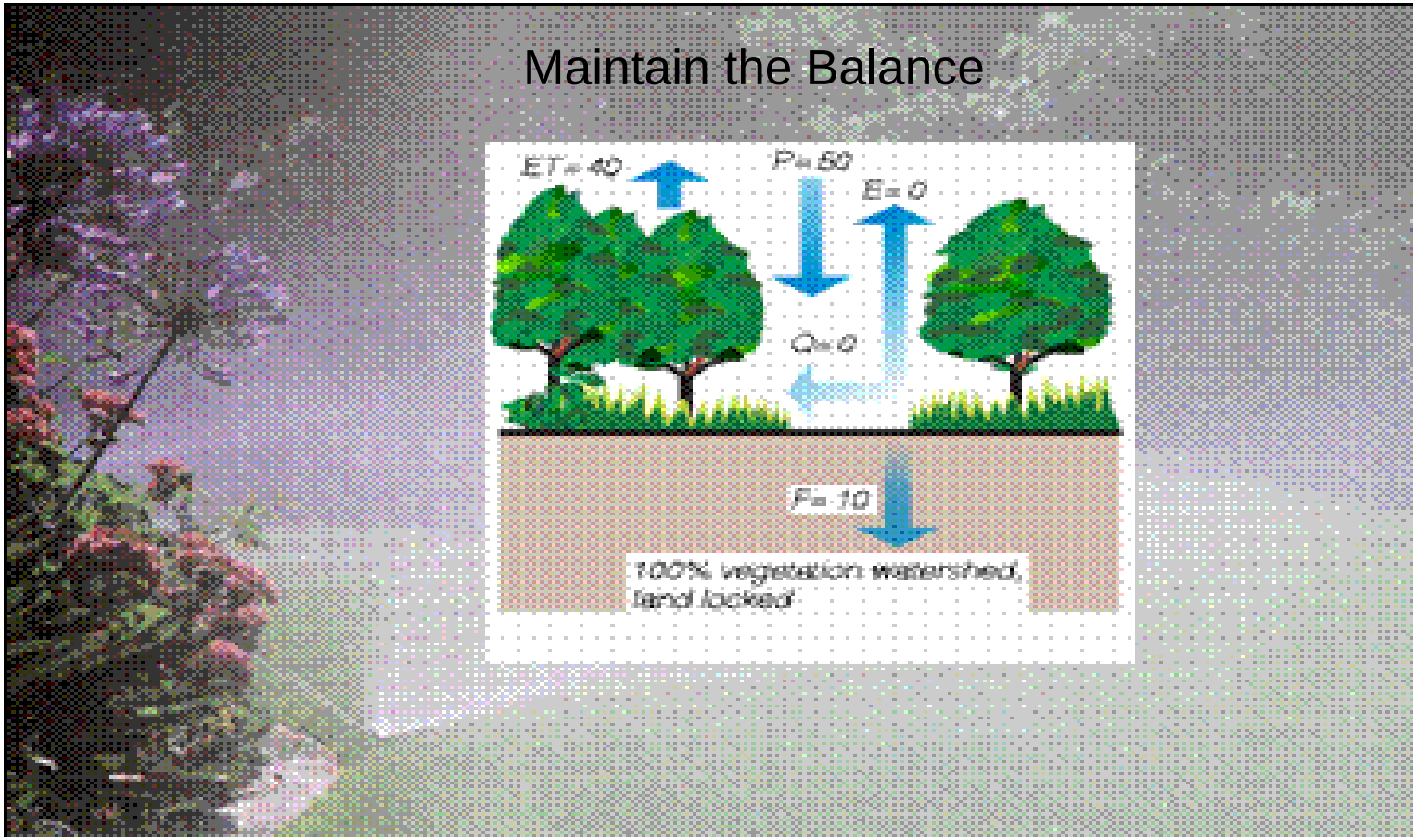
More water falls on a typical Florida building in a year than we need!

Consider a 15,000 sq. ft. 2-story office building…

- Approximately 100 occupants
- 7,500 sq ft of roof with 50 inches of rain could generate = 233,750 gallons per year (neglecting inefficiencies)
- Dividing 233,750 gallons among 100 people for 250 work days in a year allows each occupant more than 9 gallons per day.

Stormwater Irrigation

- Irrigation accounts for nearly 50% of the potable supply
- Potable supplies are decreasing
- Reclaimed water is being used to a maximum
- Thus use stormwater to irrigate



Irrigation Pond

COLLECTS RUNOFF WATER

City Cost is $0.07 per 1000 gallons

AND REUSES THE WATER

Island Lake,
Winter Park, Florida

CONTROLS POLLUTION

South Bay Utilities Inc.

- Upscale residential
- Some Commercial
- No CUP
- No FPSC

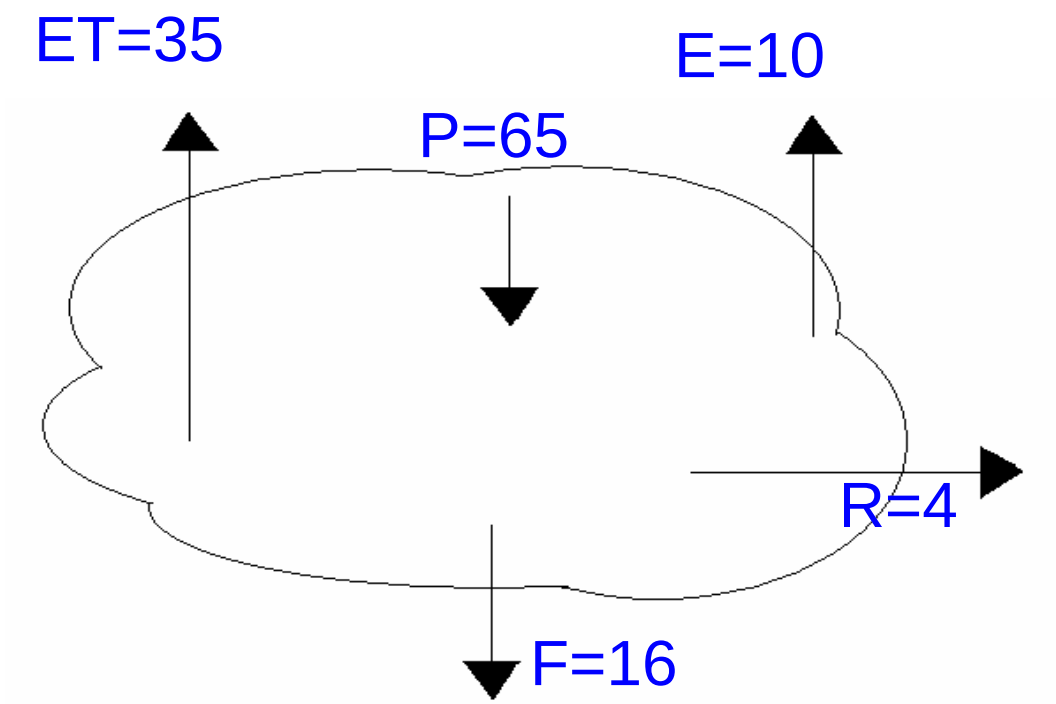
- 50¢/1,000 gallons
- Shallow wells
- Customer agreements 900 homes - HOA
- Coastal / fragile resource

Schroeder Manatee Utilities, Inc.

- Approximately 32,000 acre service area
- Lower potable water requirements
- Exclusive service area

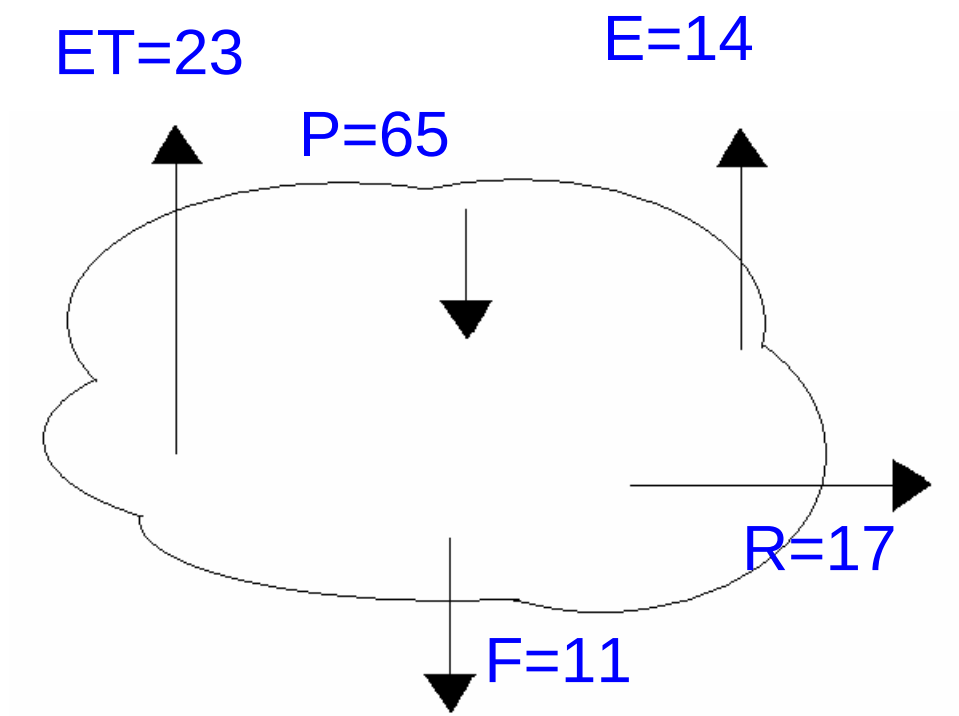
- 27¢/1,000 gallons FPSC
- Horizontal wells, lakes, canals, shallow 4” wells
- Use of approximately 4 MGD

Undeveloped Watershed



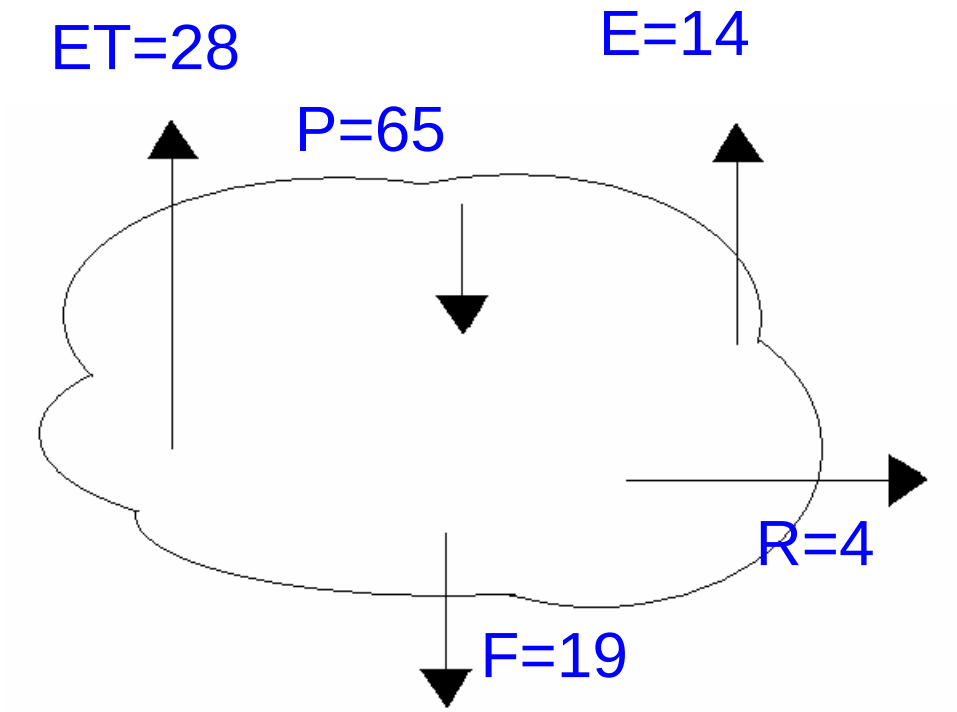
Yearly rates expressed as inches

Developed Watershed



20% DCIA, no Water Budget Management

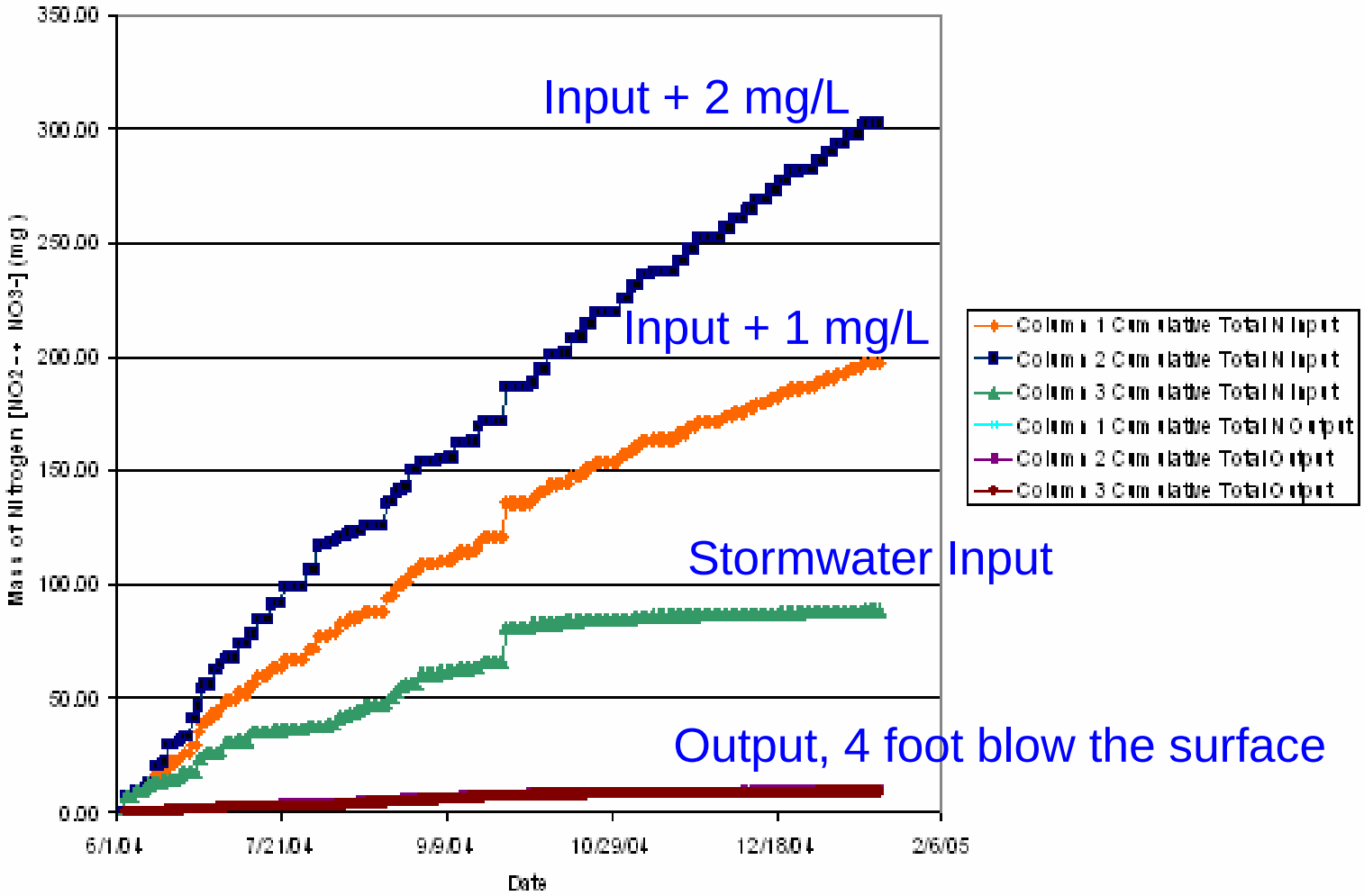
Stormwater Irrigation with the 20% DCIA



Stormwater Management with Pre = Post Discharge
No change in stormwater pond size

Nitrate Removal

Irrigation of Detained Stormwater Does Not affect the Nitrate Concentration of Groundwater



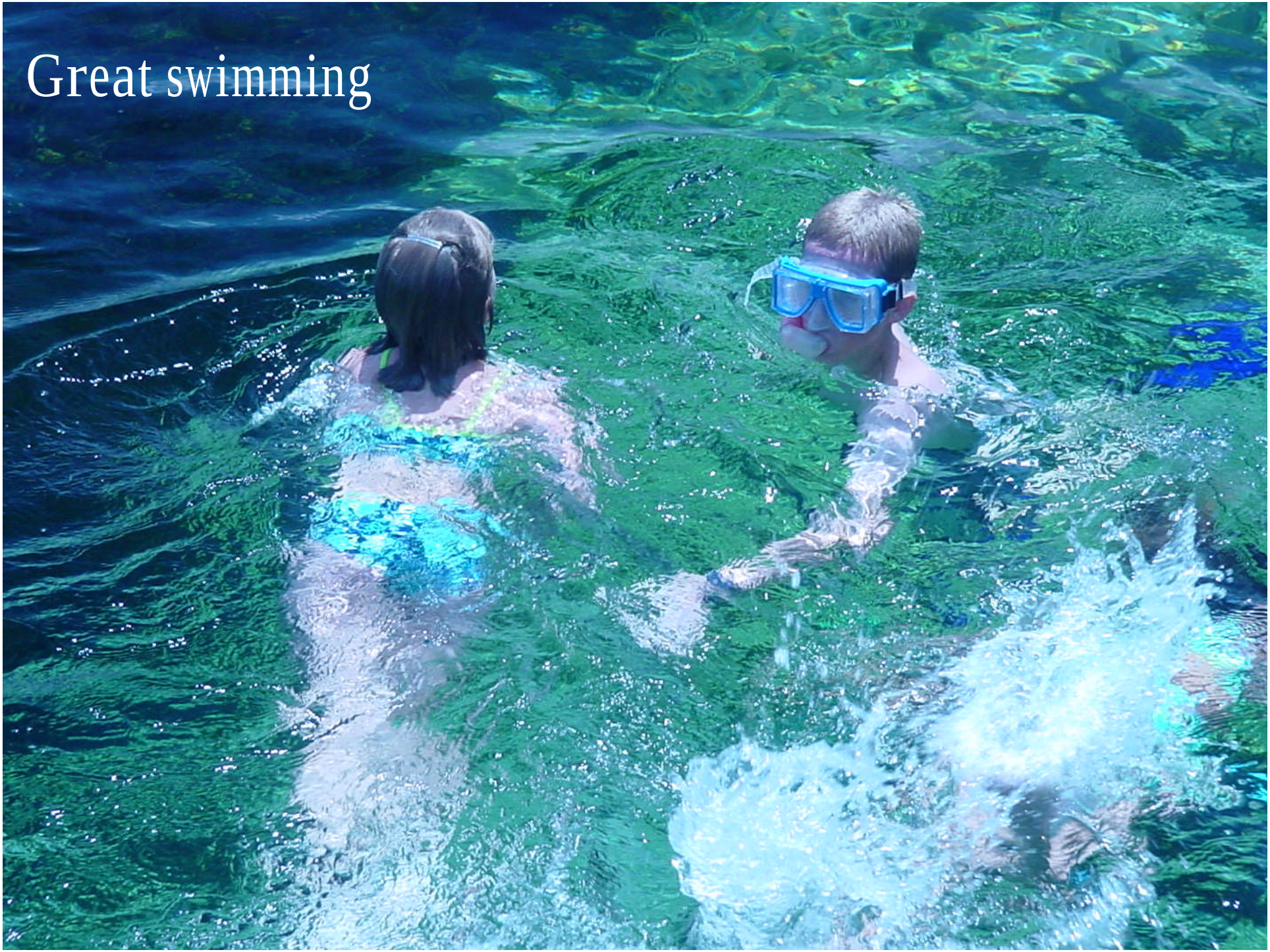
QUESTIONS and DISCUSSION

Wakulla Springs

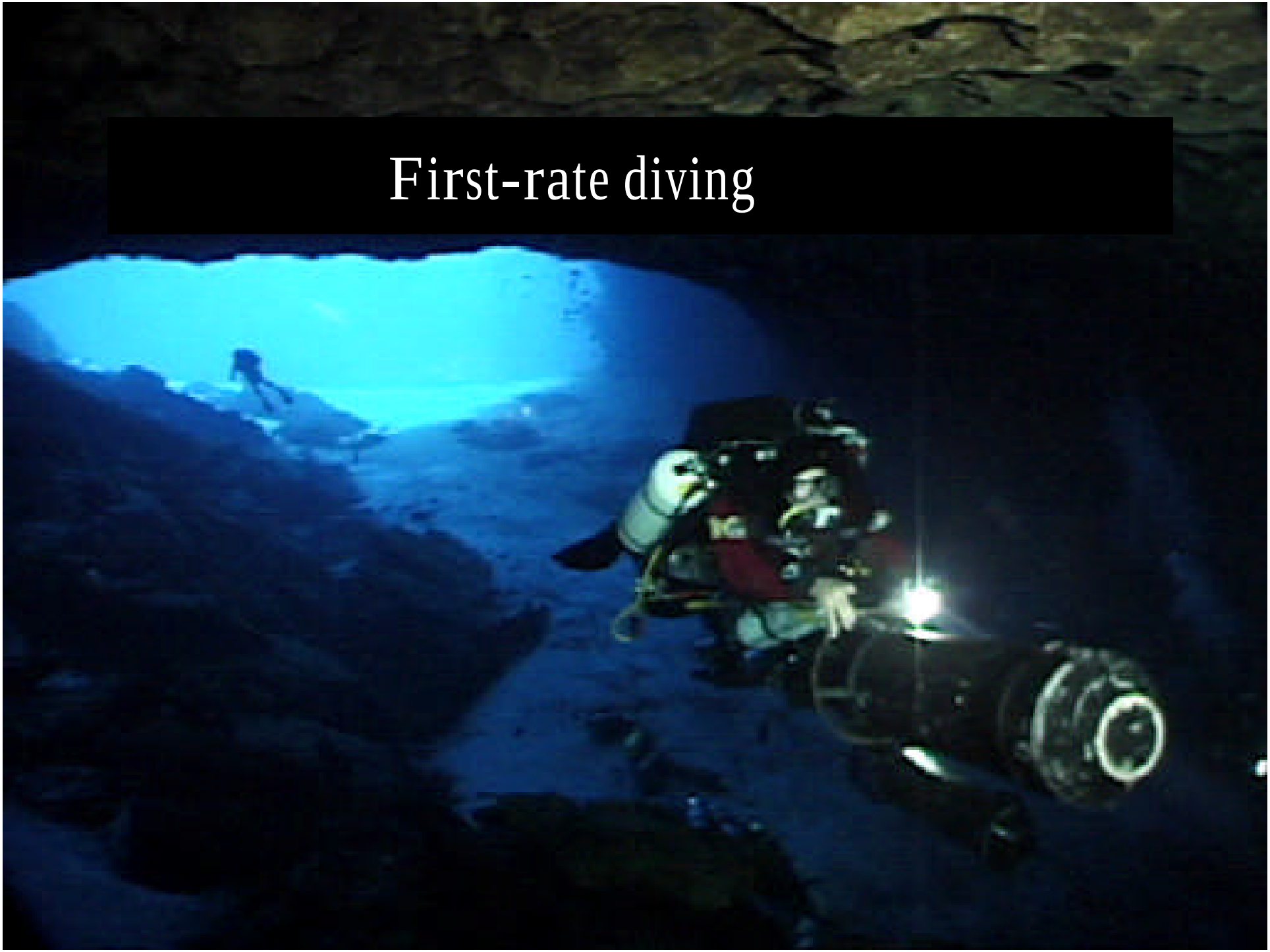
Yesterday . . .


Trees, clouds, fish seen from 60 feet down


Crystal-
clear water


Great swimming

First-rate diving



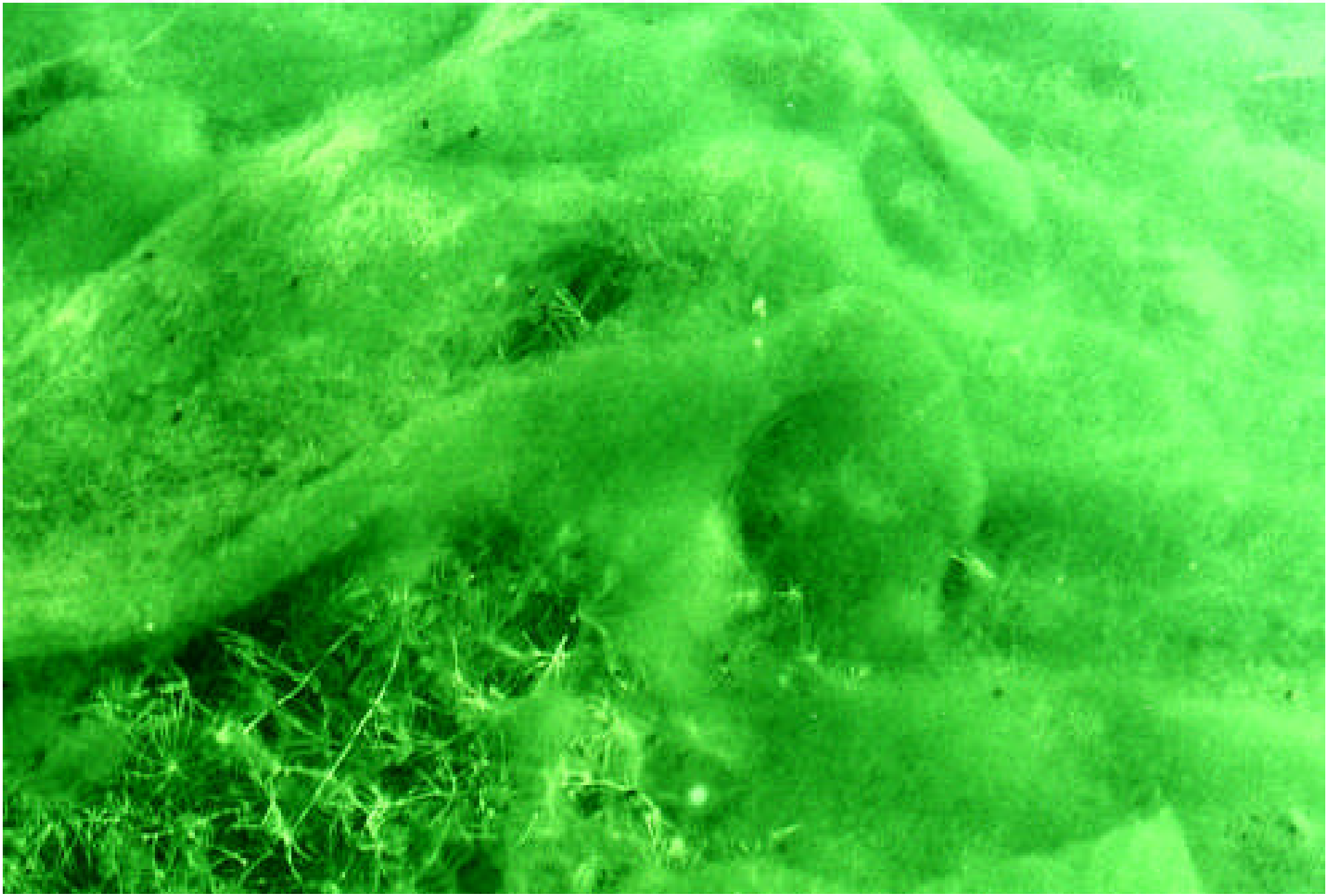
Today . . .

The health of the Springs is declining . . .

Nuisance plants have invaded the Springs . . .

Hydrilla attack!
Hydrilla with a vengeance!

On top of the Hydrilla, the alga Spirogyra grows:



The Springs are less suitable than in the past, for:

- swimming
- diving
- glass-bottom boat rides
- wildlife viewing

How bad is the decline?

Enter the biologists, to compute a Stream Condition Index (SCI).

The SCI is a measure of the stream's quality as habitat. Does the stream support:

- A flourishing system of native plants?
- Healthy reproducing native fish and other large animals?
- Diverse small, native animals?

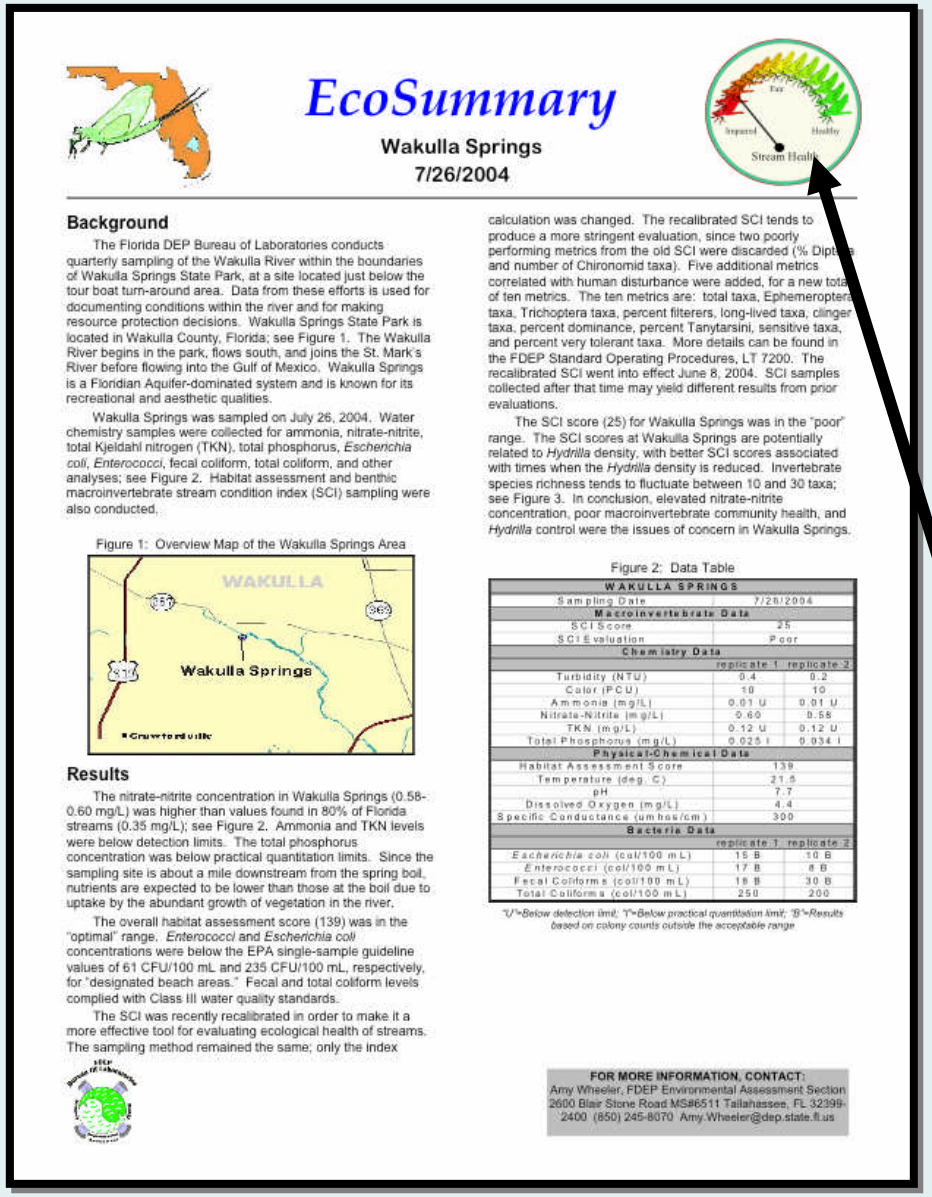
Biologists collect samples to determine the SCI.*

*Stream Condition Index

Biologists collect samples to determine the SCI.*

*Stream Condition Index

How does Wakulla Springs Rate?



EcoSummary

Wakulla Springs
7/26/2004

Background

The Florida DEP Bureau of Laboratories conducts quarterly sampling of the Wakulla River within the boundaries of Wakulla Springs State Park, at a site located just below the tour boat turn-around area. Data from these efforts is used for documenting conditions within the river and for making resource protection decisions. Wakulla Springs State Park is located in Wakulla County, Florida; see Figure 1. The Wakulla River begins in the park, flows south, and joins the St. Mark's River before flowing into the Gulf of Mexico. Wakulla Springs is a Floridian Aquifer-dominated system and is known for its recreational and aesthetic qualities.

Wakulla Springs was sampled on July 26, 2004. Water chemistry samples were collected for ammonia, nitrate-nitrite, total Kjeldahl nitrogen (TKN), total phosphorus, *Escherichia coli*, *Enterococci*, fecal coliform, total coliform, and other analyses; see Figure 2. Habitat assessment and benthic macroinvertebrate stream condition index (SCI) sampling were also conducted.

Figure 1: Overview Map of the Wakulla Springs Area

Results

The nitrate-nitrite concentration in Wakulla Springs (0.58-0.60 mg/L) was higher than values found in 80% of Florida streams (0.35 mg/L); see Figure 2. Ammonia and TKN levels were below detection limits. The total phosphorus concentration was below practical quantitation limits. Since the sampling site is about a mile downstream from the spring boil, nutrients are expected to be lower than those at the boil due to uptake by the abundant growth of vegetation in the river.

The overall habitat assessment score (139) was in the "optimal" range. *Enterococci* and *Escherichia coli* concentrations were below the EPA single-sample guideline values of 61 CFU/100 mL and 235 CFU/100 mL, respectively, for "designated beach areas." Fecal and total coliform levels complied with Class III water quality standards.

The SCI was recently recalibrated in order to make it a more effective tool for evaluating ecological health of streams. The sampling method remained the same; only the index calculation was changed. The recalibrated SCI tends to produce a more stringent evaluation, since two poorly performing metrics from the old SCI were discarded (% Diptera and number of Chironomid taxa). Five additional metrics correlated with human disturbance were added, for a new total of ten metrics. The ten metrics are: total taxa, Ephemeroptera taxa, Trichoptera taxa, percent filterers, long-lived taxa, clinger taxa, percent dominance, percent Tanytarsini, sensitive taxa, and percent very tolerant taxa. More details can be found in the FDEP Standard Operating Procedures, LT 7200. The recalibrated SCI went into effect June 8, 2004. SCI samples collected after that time may yield different results from prior evaluations.

The SCI score (25) for Wakulla Springs was in the "poor" range. The SCI scores at Wakulla Springs are potentially related to *Hydrilla* density, with better SCI scores associated with times when the *Hydrilla* density is reduced. Invertebrate species richness tends to fluctuate between 10 and 30 taxa; see Figure 3. In conclusion, elevated nitrate-nitrite concentration, poor macroinvertebrate community health, and *Hydrilla* control were the issues of concern in Wakulla Springs.

Figure 2: Data Table

WAKULLA SPRINGS		
Sampling Date	7/26/2004	
Macroinvertebrate Data		
SCI Score	25	
SCI Evaluation	Poor	
Chemistry Data		
	replicate 1	replicate 2
Turbidity (NTU)	0.4	0.2
Color (PCU)	10	10
Ammonia (mg/L)	0.01 U	0.01 U
Nitrate-Nitrite (mg/L)	0.60	0.58
TKN (mg/L)	0.12 U	0.12 U
Total Phosphorus (mg/L)	0.025 I	0.034 I
Physical-Chemical Data		
Habitat Assessment Score	139	
Temperature (deg. C)	21.5	
pH	7.7	
Dissolved Oxygen (mg/L)	4.4	
Specific Conductance (umhos/cm)	300	
Bacteria Data		
	replicate 1	replicate 2
Escherichia coli (col/100 mL)	15 B	10 B
Enterococci (col/100 mL)	17 B	8 B
Fecal Coliforms (col/100 mL)	18 B	30 B
Total Coliforms (col/100 mL)	250	200

"U"=Below detection limit; "I"=Below practical quantitation limit; "B"=Results based on colony counts outside the acceptable range

FOR MORE INFORMATION, CONTACT:
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2600 Blair Stone Road MS#6511 Tallahassee, FL 32399-2400 (850) 245-8070 Amy.Wheeler@dep.state.fl.us

Rated in five SCI studies . . .

Wakulla Springs' SCI score was

. . . **POOR**

Wakulla Springs' ranking relative to other rivers in the state?

THE BOTTOM 20 PERCENT ←

The Wakulla River is on Florida's list of impaired rivers.

WHY?

One major problem:

- Nitrate concentrations are much higher than in the past . . .

And we know that . . .

Hydrilla and Spirogyra thrive on high nitrates.

Today versus yesterday:

- Historically, nitrate in the Springs' water was below 0.2 mg/liter.
- Today, nitrate ranges from 0.6 to above 1.0 mg/liter.

Another problem:

- Phosphates are other substances of concern.

How can these problems be remedied?

From 25 years of DEP assessments,

we need to remove:

55 percent of the nitrates

and

40 percent of the phosphates

To support our traditional uses of the springs

According to a study by the NWFWMD,* 80 percent of the nitrates in the water flowing to Wakulla Springs can be properly managed and controlled

The findings follow . . .

NWFWMD = Northwest Florida Water Management District

Let's focus on the nitrates in wastewater

Major contributors of nitrates are:

- Sewage sludge
- Sewage effluent
- Animal droppings (manure)
- Commercial fertilizer

Are the nitrates coming from our sewage-treatment facilities?

Enter the groundwater scientists, to track the underground flows of water . . .

Wakulla River Nutrient Study

Nitrate loading as an indicator of nonpoint source pollution in the lower St. Marks - Wakulla Rivers watershed

Angela Chelette and Thomas E. Pratt

Northwest Florida Water Management District

2002

Two sites are of interest:

- "**The Airport**," together with an area of the National Forest that lies next to it

  This is where the City spreads the sewage sludge from its treatment plants

and

- "**The Sprayfield/Farm**"

  This is where the City sprays its sewage effluent and runs a farming operation

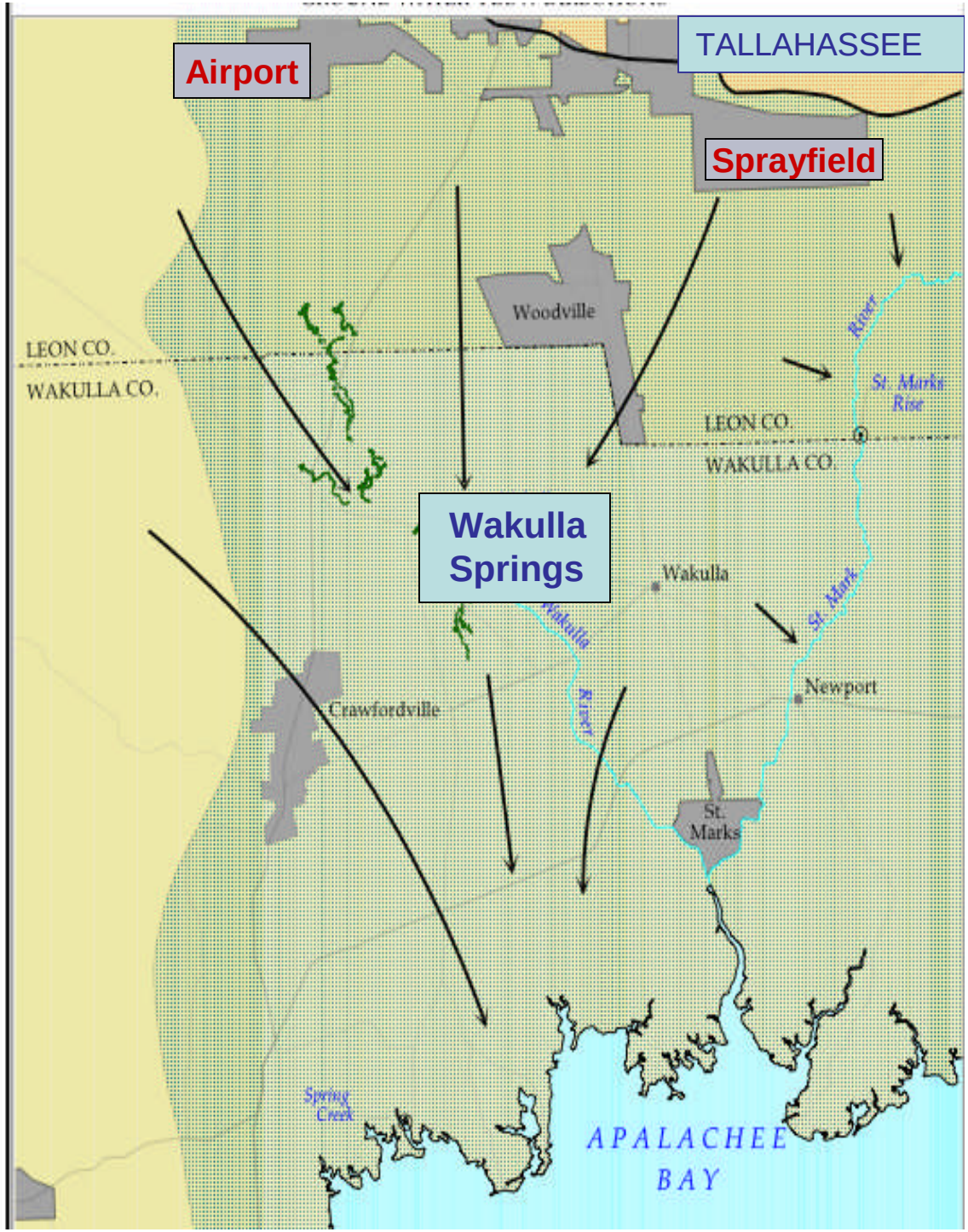
Notice these map locations:

Tallahassee

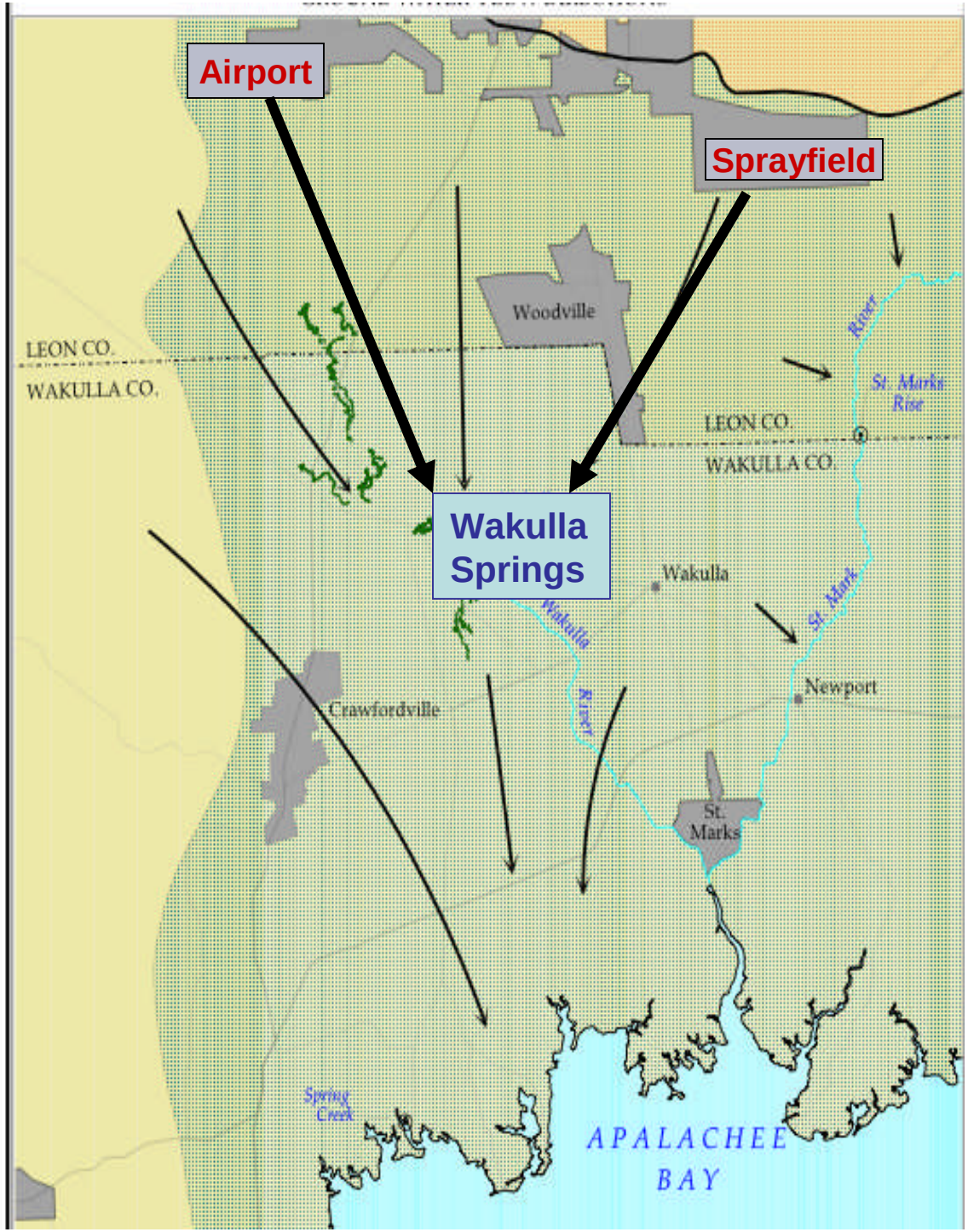
Wakulla Springs

Airport

Sprayfield/Farm

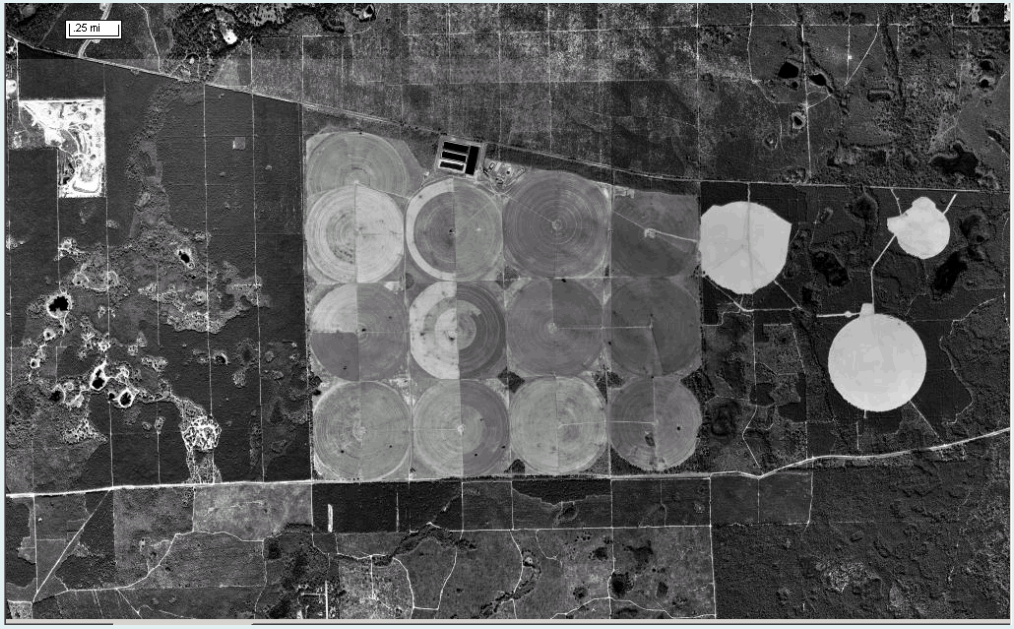


Now look how the ground-water flows:



Sludge spread next to the Airport = 3 tons a day

Sewage effluent applied to the Sprayfield = 20 million gallons a day



Sludge and effluent are rich in nitrates.

How do the nitrates get into the deep groundwater?

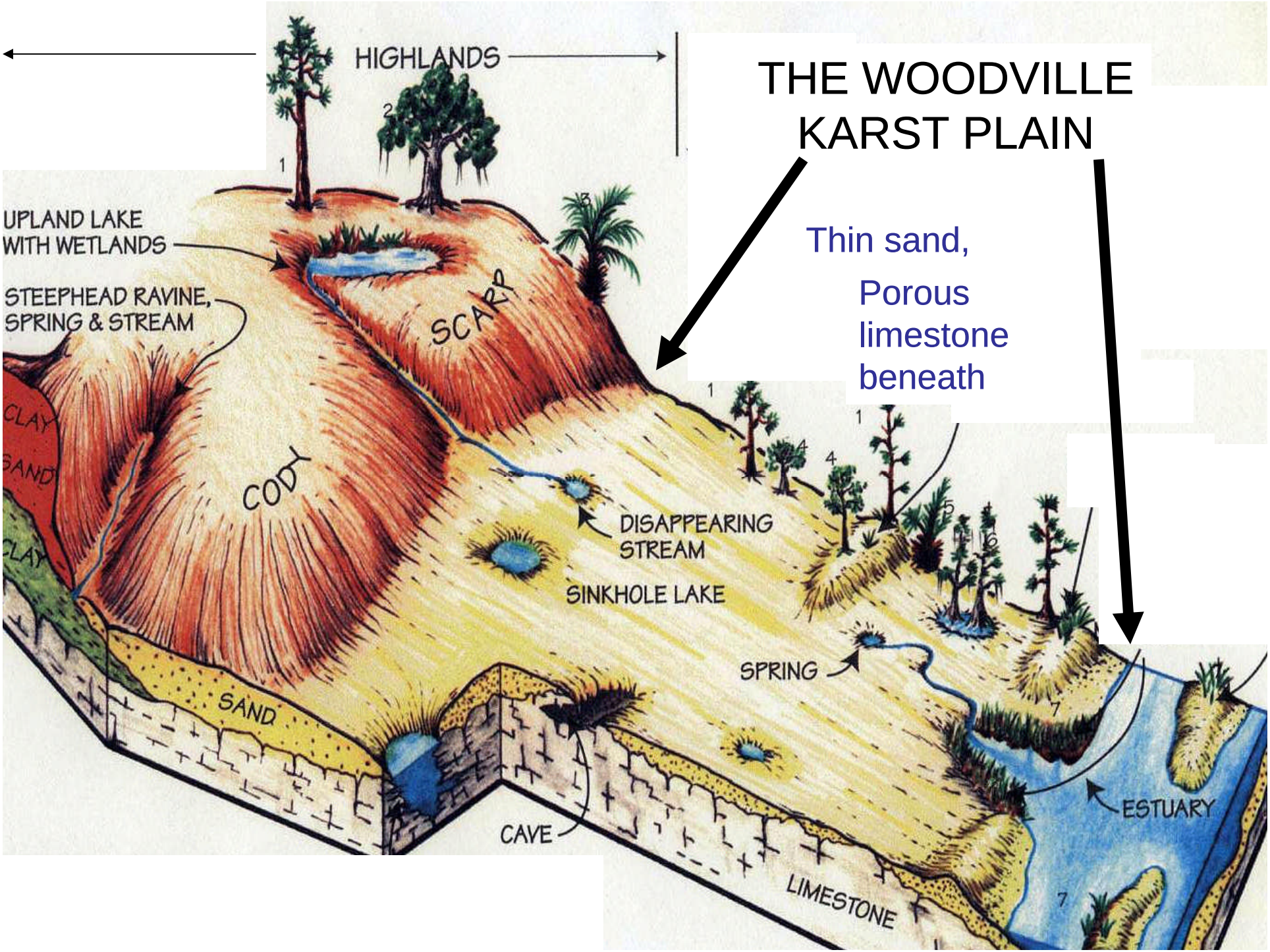
- The ground surface is a thin veneer of sand
- Porous limestone lies below the sand

These are the characteristics of a karst plain.

THE WOODVILLE KARST PLAIN

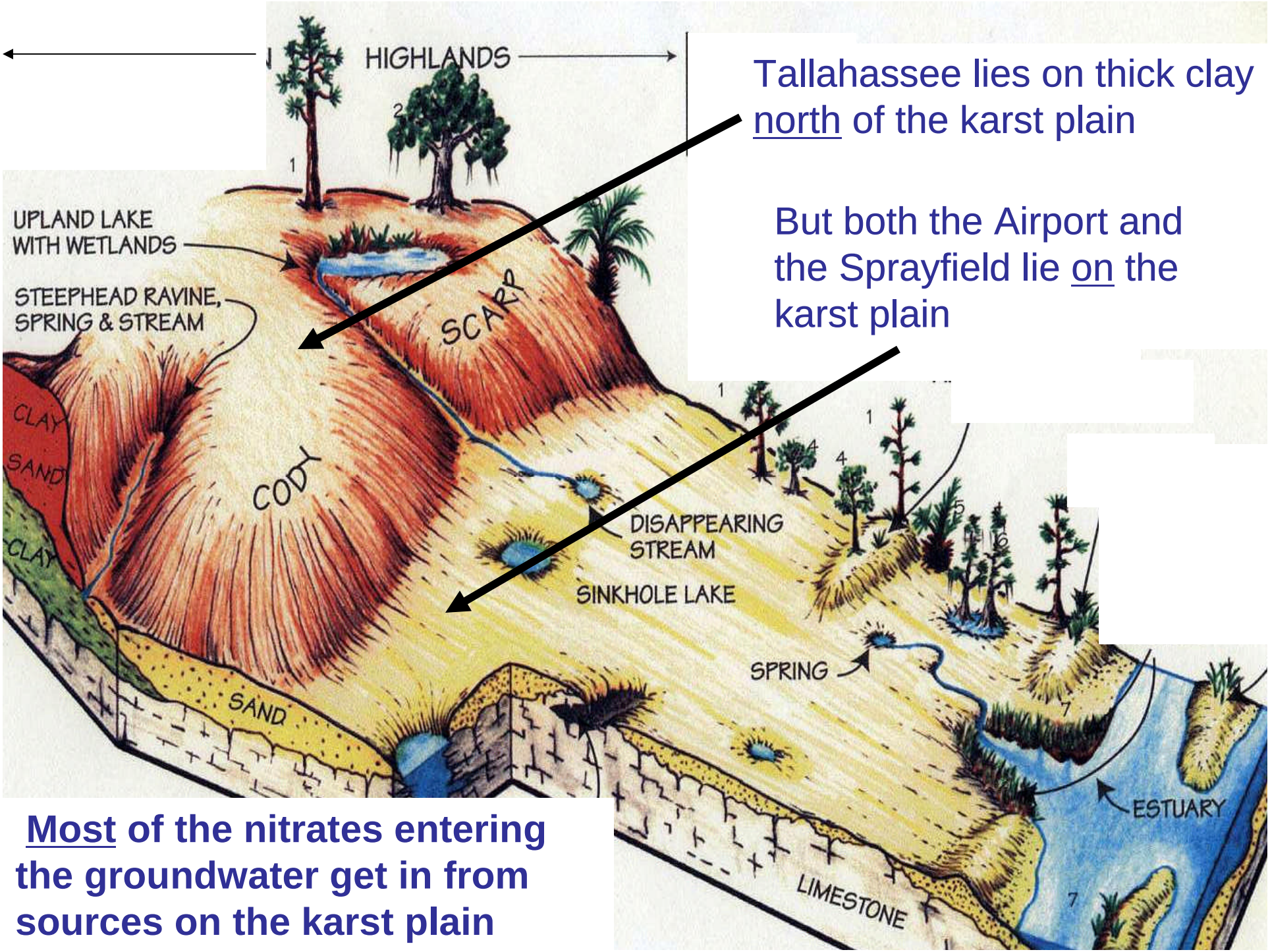
Thin sand,

Porous limestone beneath



Tallahassee lies on thick clay <u>north</u> of the karst plain

But both the Airport and the Sprayfield lie <u>on</u> the karst plain



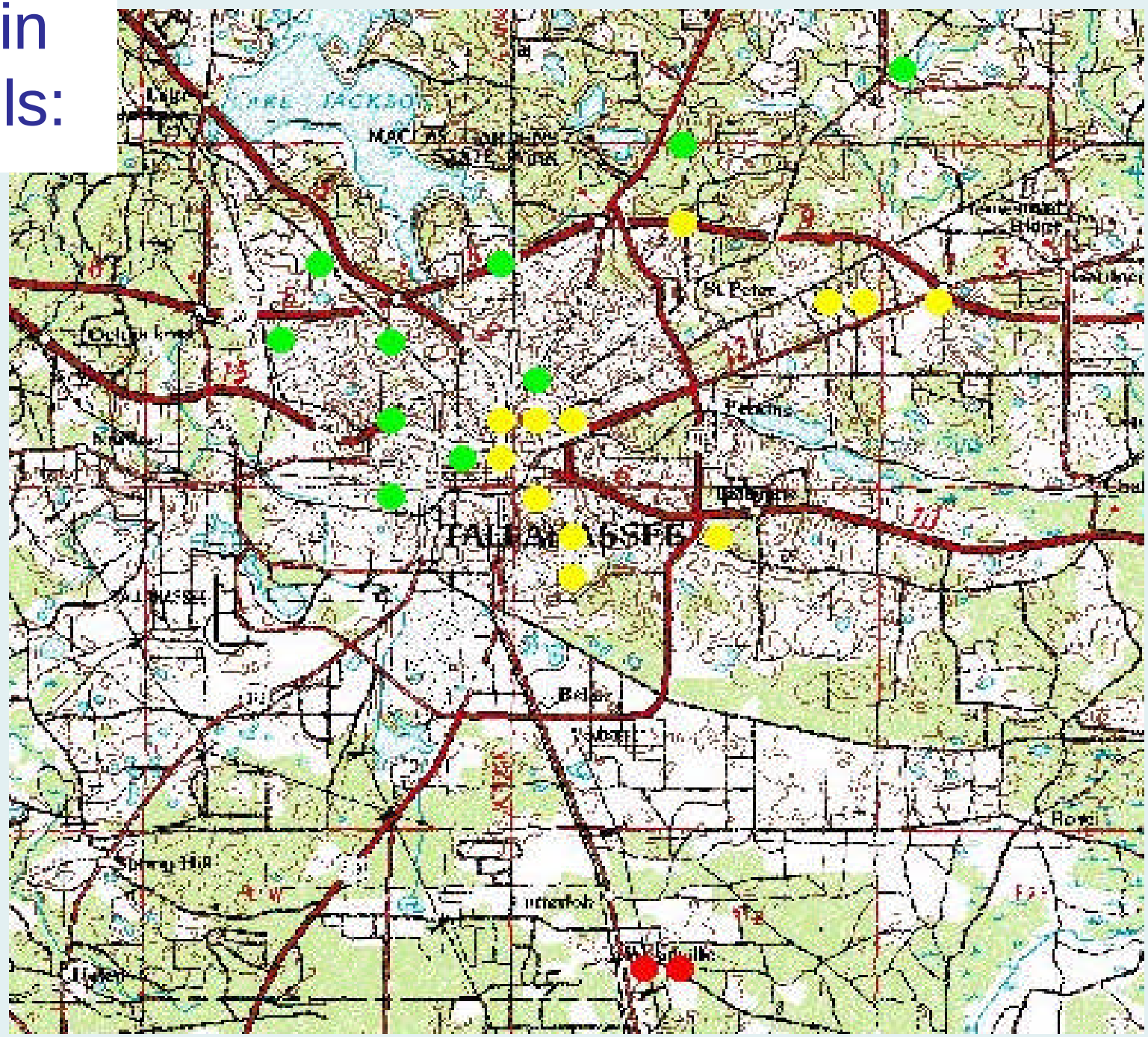
<u>Most</u> of the nitrates entering the groundwater get in from sources on the karst plain

Nitrates in area wells:

Low N

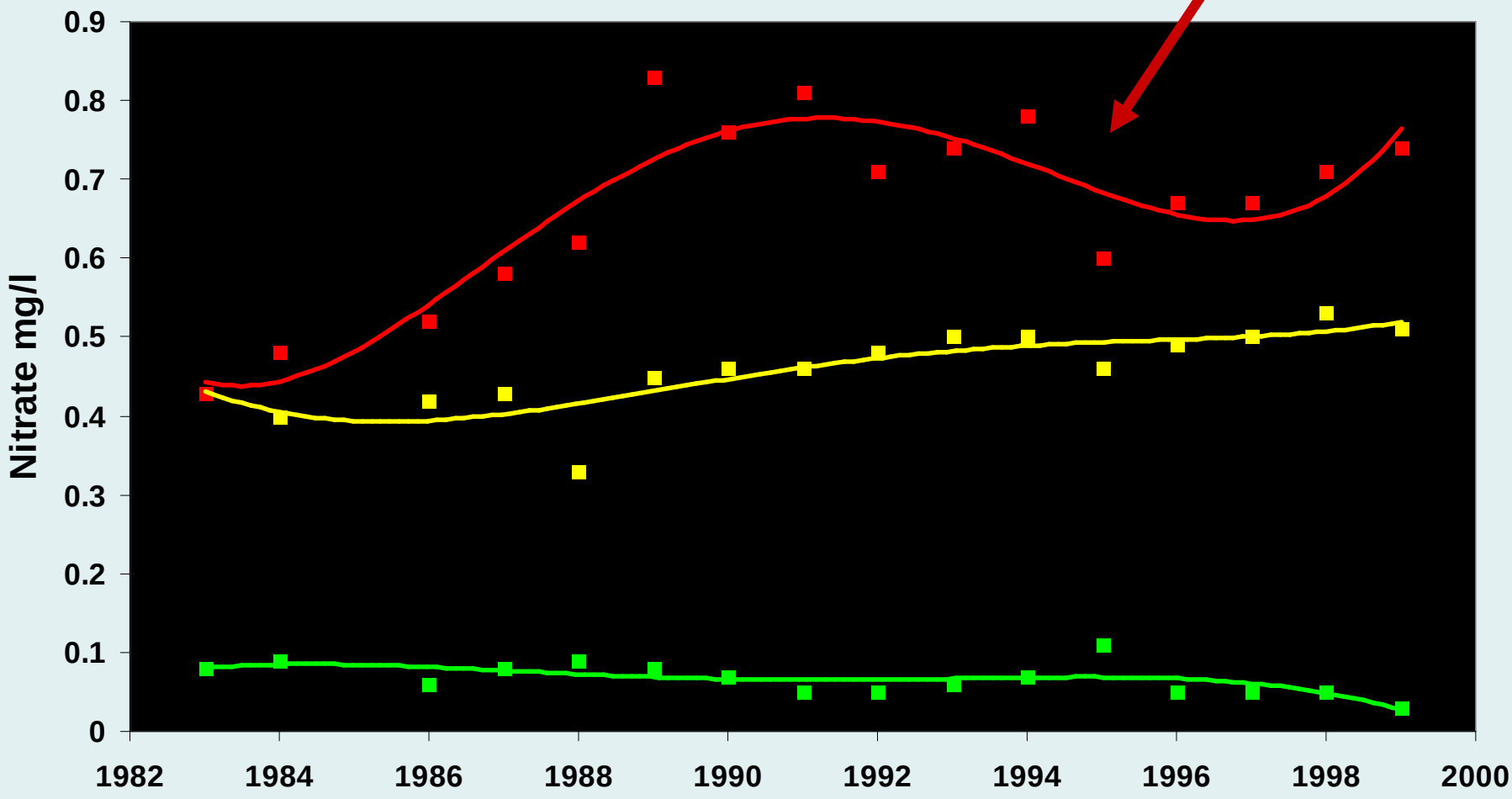
Medium

High



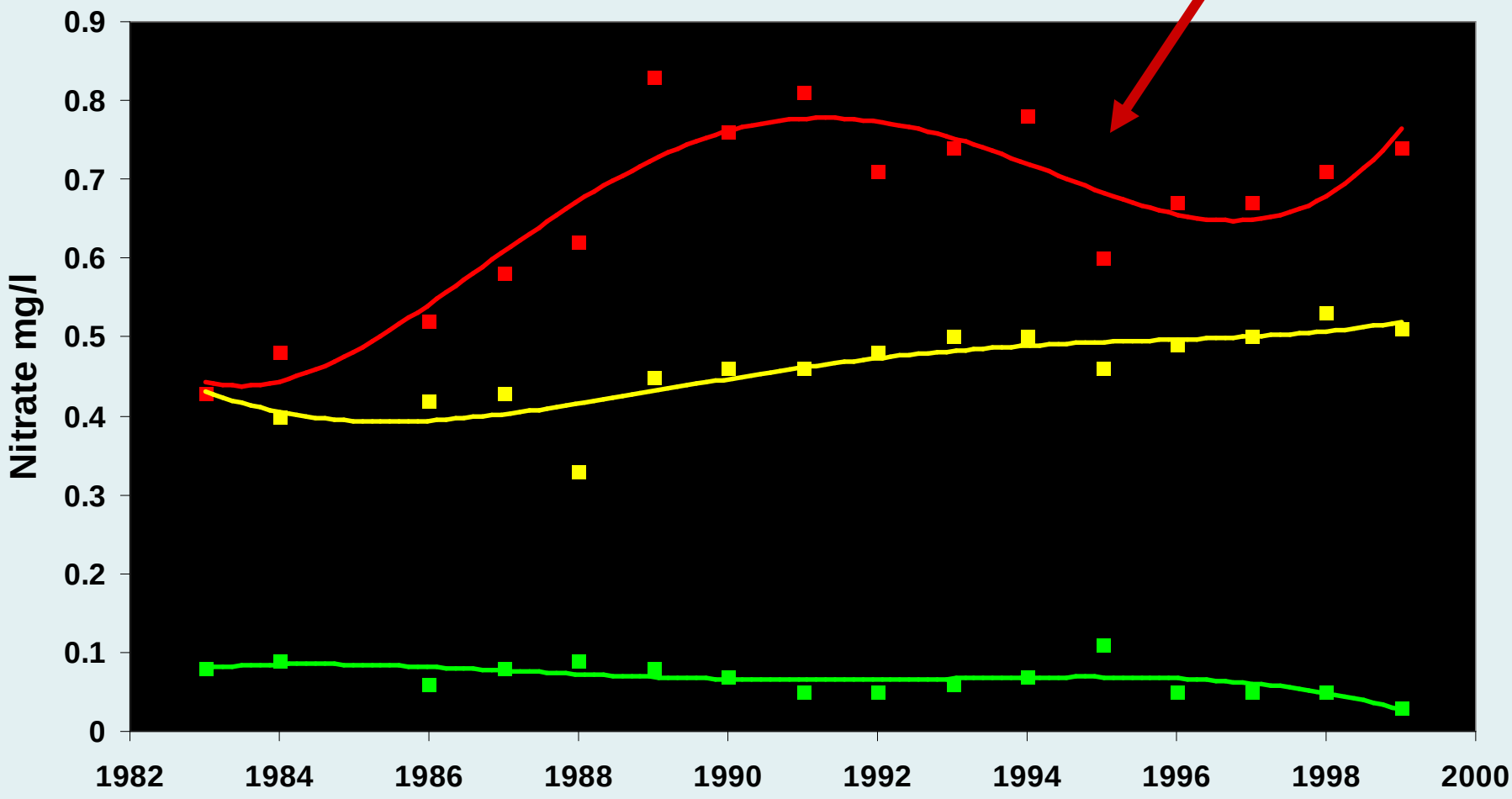
Nitrate Trend

City of Tallahassee's Drinking Water Supply Wells

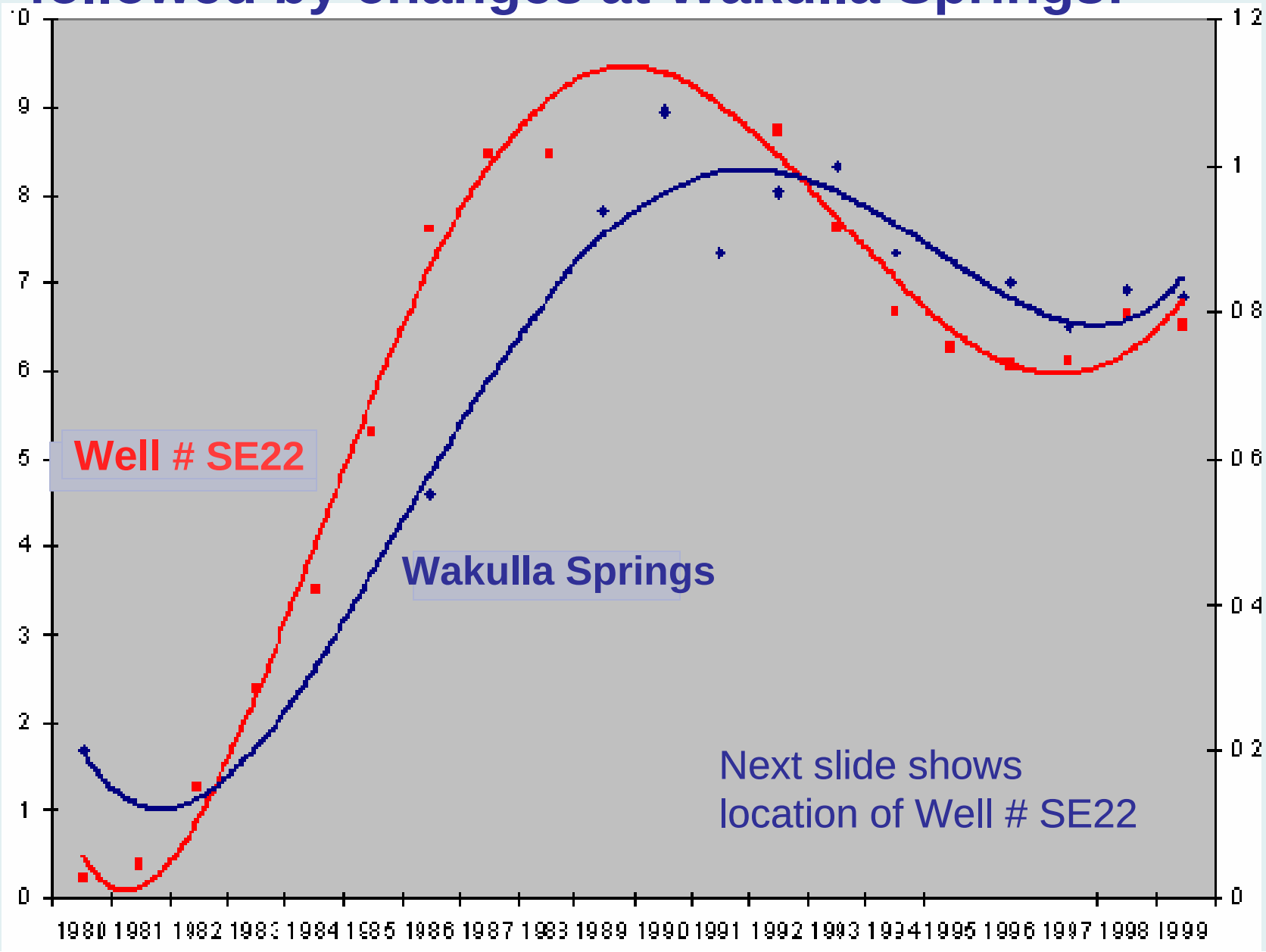


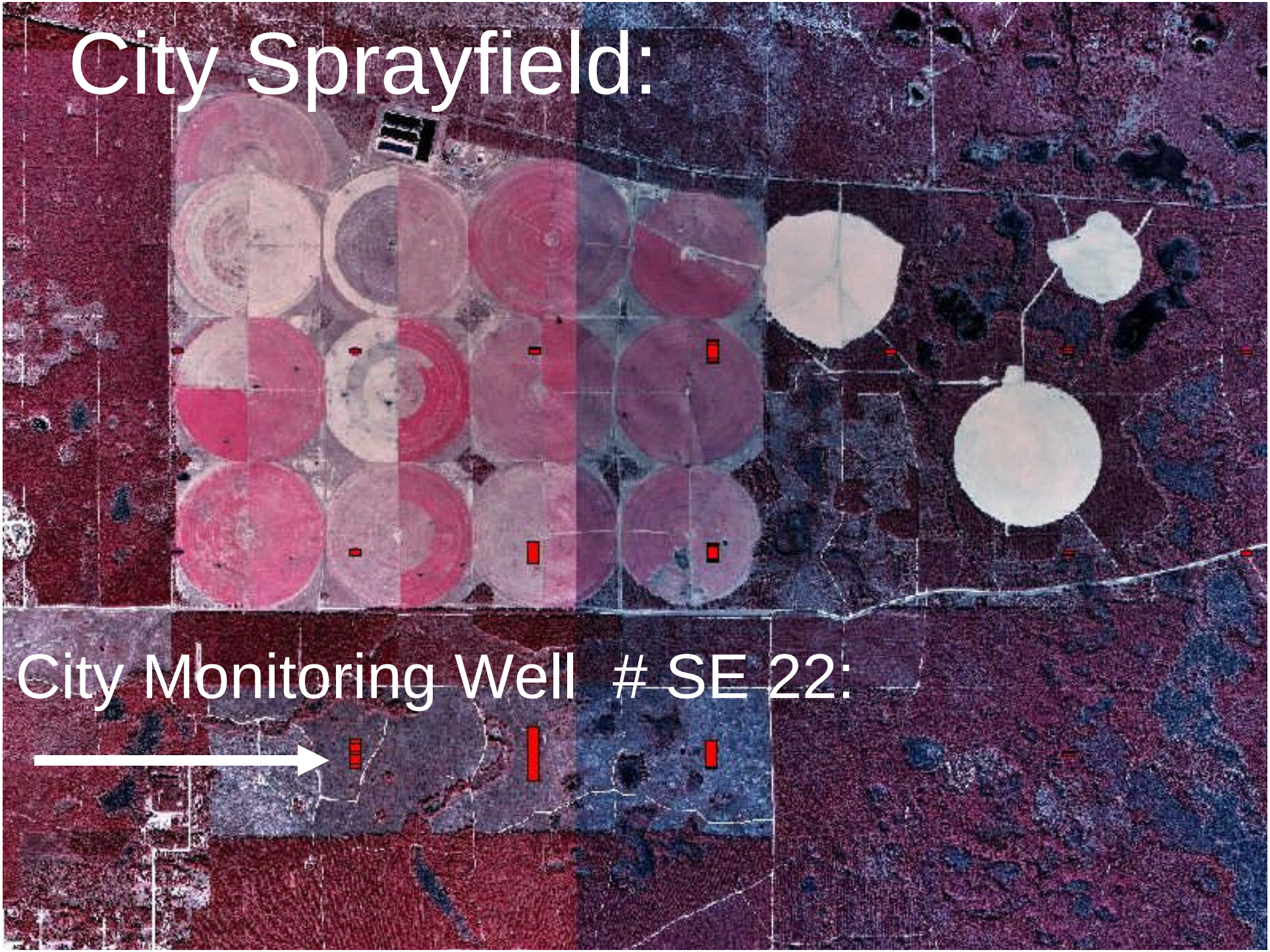
Nitrate Trend

City of Tallahassee's Drinking Water Supply Wells



Changes in nitrates in Well # SE22 are closely followed by changes at Wakulla Springs:

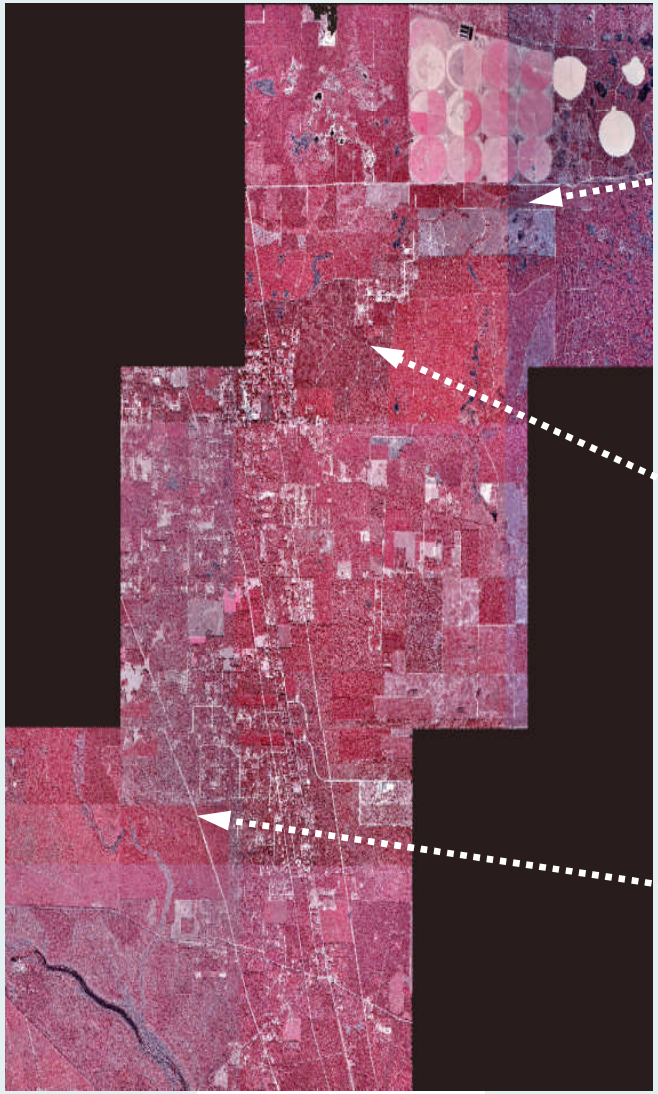



City Sprayfield:
City Monitoring Well # SE 22:

Well # SE22 is:

- 100 feet deep
- Directly south of the sprayfield
- In the flowpath to Wakulla Springs and
- Has yielded 25 years of data

Nitrates along the flowpath have all risen:



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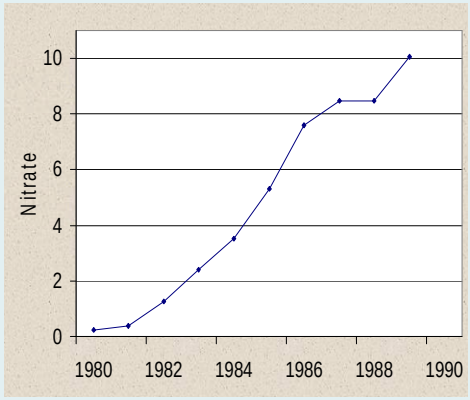
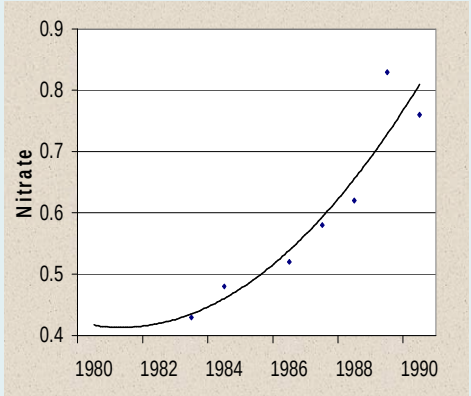
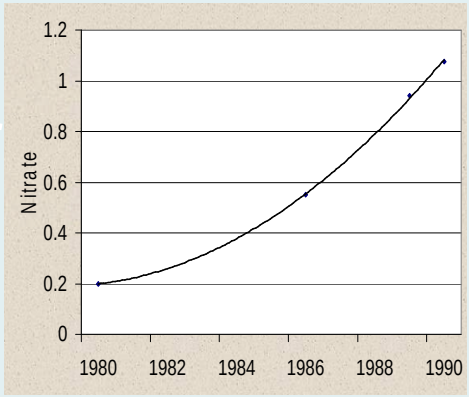


Under the Sprayfield



In Woodville



In Wakulla Springs

So we should focus on the Airport and the Sprayfield

AIRPORT:

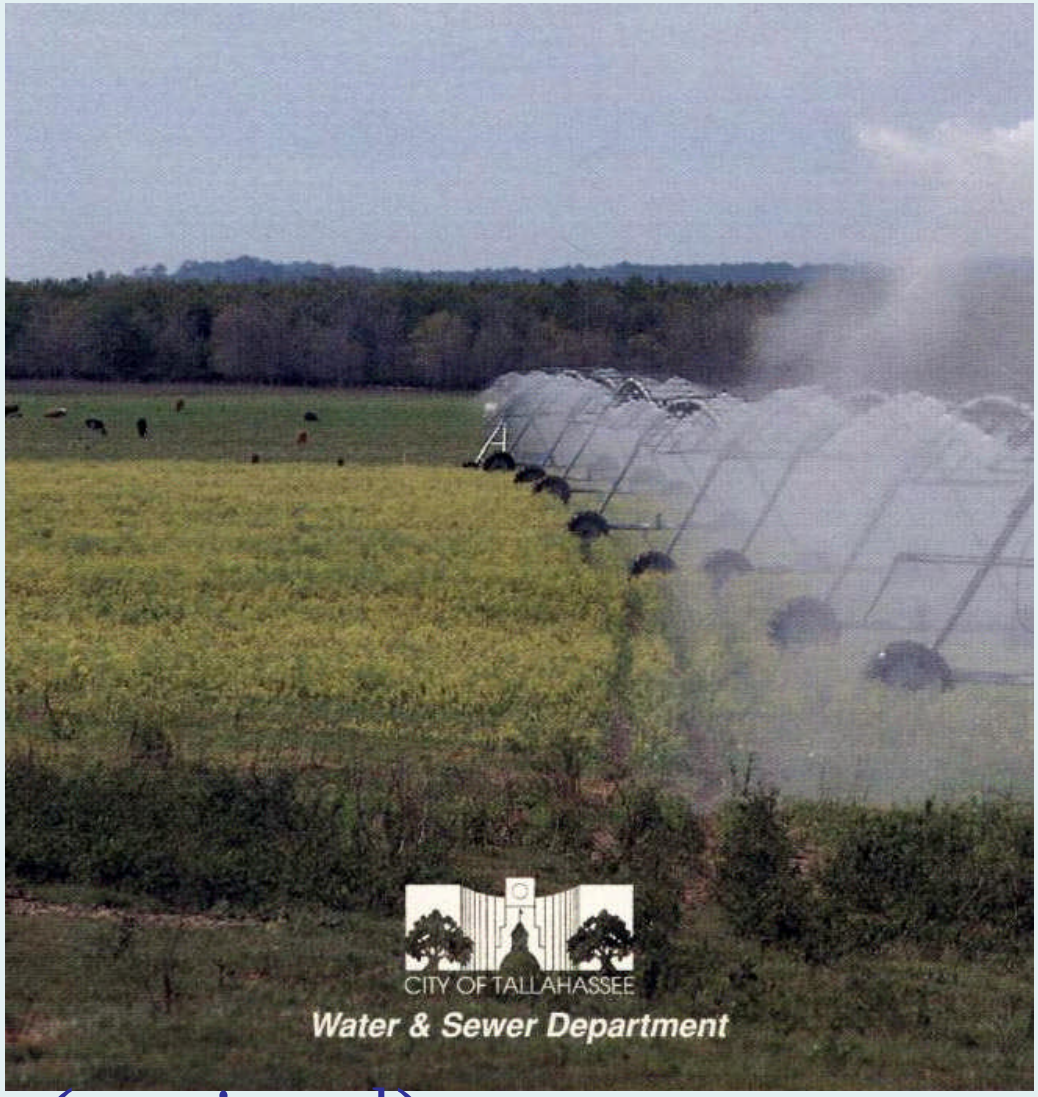
- **No sludge should be spread on the karst plain**
- **The spreading of sludge at the Airport is supposed to halt in a year or two**

SPRAYFIELD:

- **The sprayfield is not working as it should**

The theory of the sprayfield/farm:

Pipe treated sewage effluent to the farm and spray it on the fields . . .



(continued)

The theory (continued):

- Spray the effluent over a crop that will take up the nitrate.
- Then remove the crop.
- Nearly pure water will sink down through the soil into the groundwater.
- This was “state-of-the-art” tertiary treatment of sewage when the sprayfield went in, in 1980.

The sprayfield is now handling much more sewage effluent:

In 1980, 7 gallons a day were sprayed

Today, some 20 gallons a day are sprayed . . .

And the load is still growing.

Immense volumes of water are sprayed:

- 30 feet per year (more than in the Amazon rainforest)
- This drives the nitrates rapidly below the crops' root zone

  so they are not taken up
- The nitrates are forced 100 to 200 feet down

Also, the Farm is growing crops for sale, so

- Fertilizer is added to the crops

And also:

- Cattle are grazing there

All nitrate sources are significant and

ALL ARE GROWING

but

The major nitrate contributors are:

- The Sprayfield/Farm
- The sludge spread at the airport

Together these contribute ~50%

Summary of Today's Understanding:

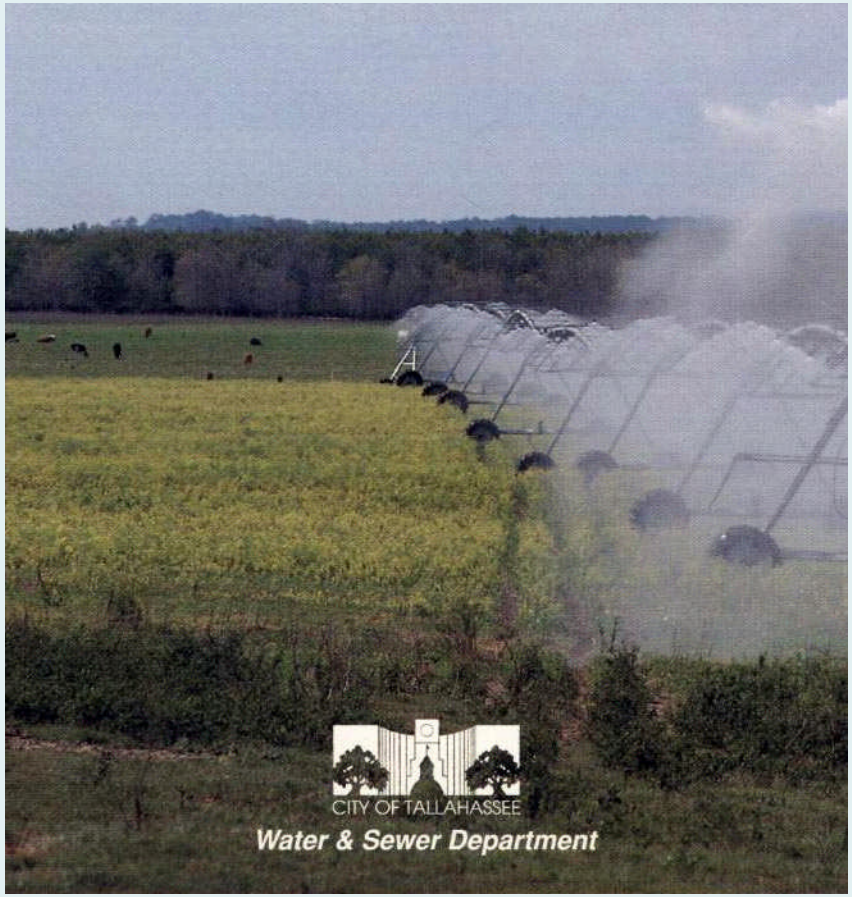
- Hydrilla and algae are degrading Wakulla Springs
- The main cause is high nutrient concentrations
- The main contributors of nitrates are the City's sewage disposal operations

Possible Steps to Recovery:

Focus on these seven areas (see next slides):

1. Sprayfield steps
2. Other treated effluent steps
3. Farm operation
4. Sludge disposal
5. Planning for growth
6. Stormwater runoff treatment
7. Septic system measures

1. Operate the sprayfield as originally intended:



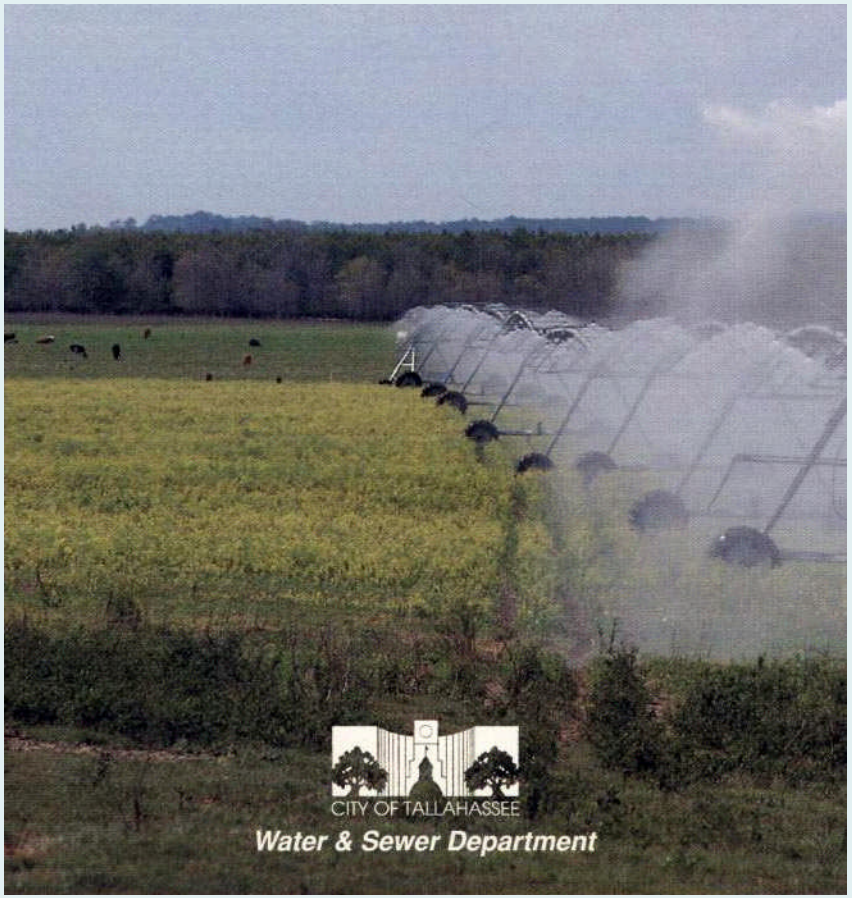
Spray ~7 million gallons of effluent a day

(not >20 million gallons as today)

2. Dispose of most treated effluent offsite <u>outside</u> of the Wakulla springshed:

- Make available to golf courses
- Give incentives to other large consumers to use the water
- Explore forest application opportunities

3. Operate the farm as originally intended ~ <u>to control nutrients</u>



- Grow crops that take up nitrate
- Remove crops offsite
- Use no fertilizer
- Graze no cattle

4. Dispose of sludge outside the Wakulla springshed

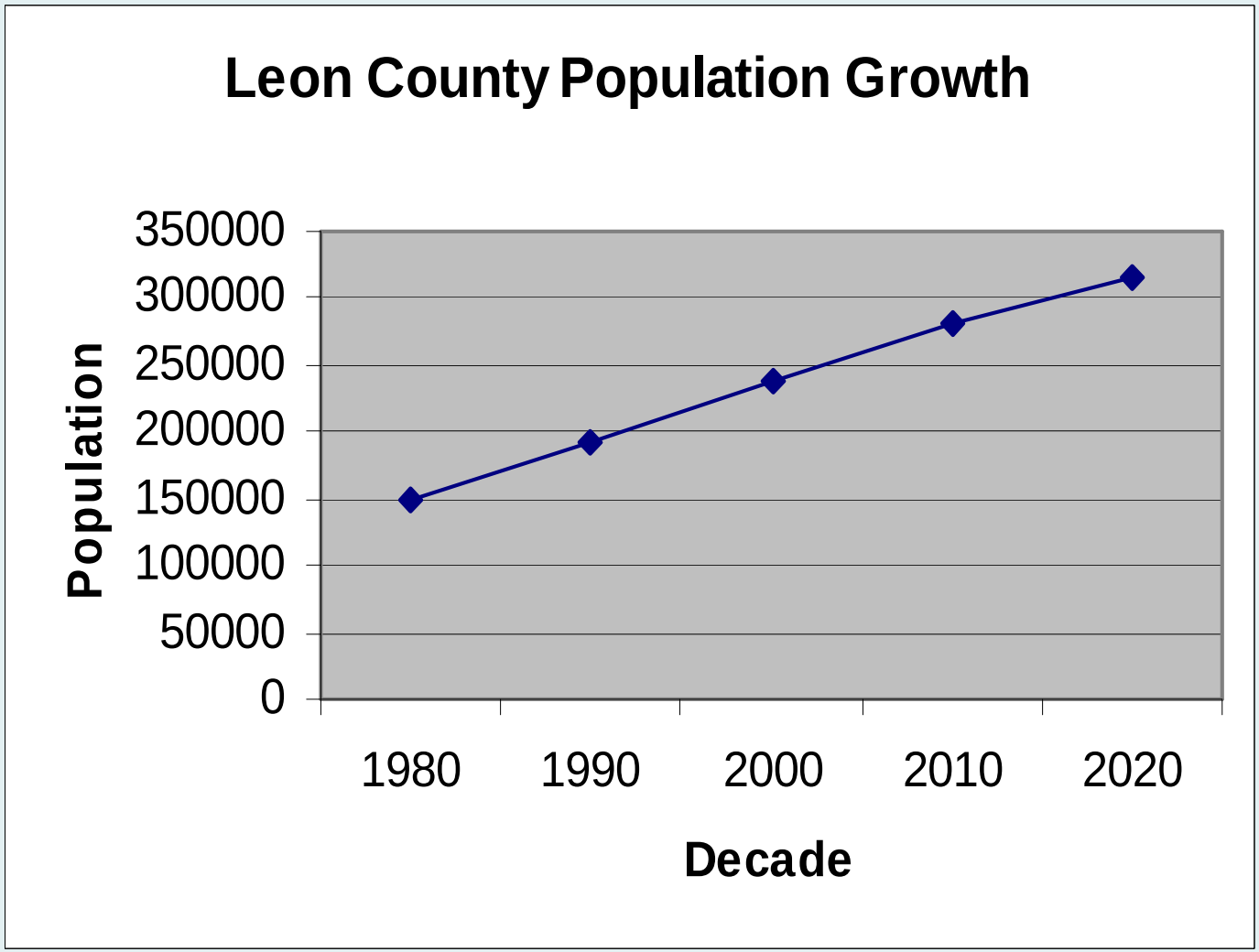
- Treat all sludge by pelletizing
- Sell in bulk to farming and other operations

5. Plan and build sewage facilities to cope with expected future growth:

- Leon County projects 3,551 more residences in the Wakulla springshed.

- Wakulla County projects 71,653 more residences in the springshed.

Here is one Leon County projection to 2020:



6. Control and treat stormwater runoff

7. Deal with septic tank problems:

- Pinpoint and upgrade failing septic systems
- Obtain and install state-of-the-art technology for future on-site wastewater management

Tomorrow . . . This?

Or this?

Today . . .

February 24, 2005

Tomorrow!

Restore Wakulla Springs Now!

- Write letters to the paper
- Call your Commissioners
- Display a bumper sticker
- Join the Friends of Wakulla Springs

- Support the Wakulla Springs Defense Fund
- Tell your friends to do the same

Produced by Friends of Wakulla Springs