Use of Reasonable Assurance Plans as Alternatives to TMDLs

Florida Stormwater Association

Winter 2017 Meeting

6 December 2017

Presentations by:

- Tony Janicki
- Julie Espy
- Tiffany Busby
- Judy Grim
- Brett Cunningham

Florida Reasonable Assurance Plans

Julie Espy
Florida Department of Environmental Protection

Florida Stormwater Association
Winter 2017 Meeting

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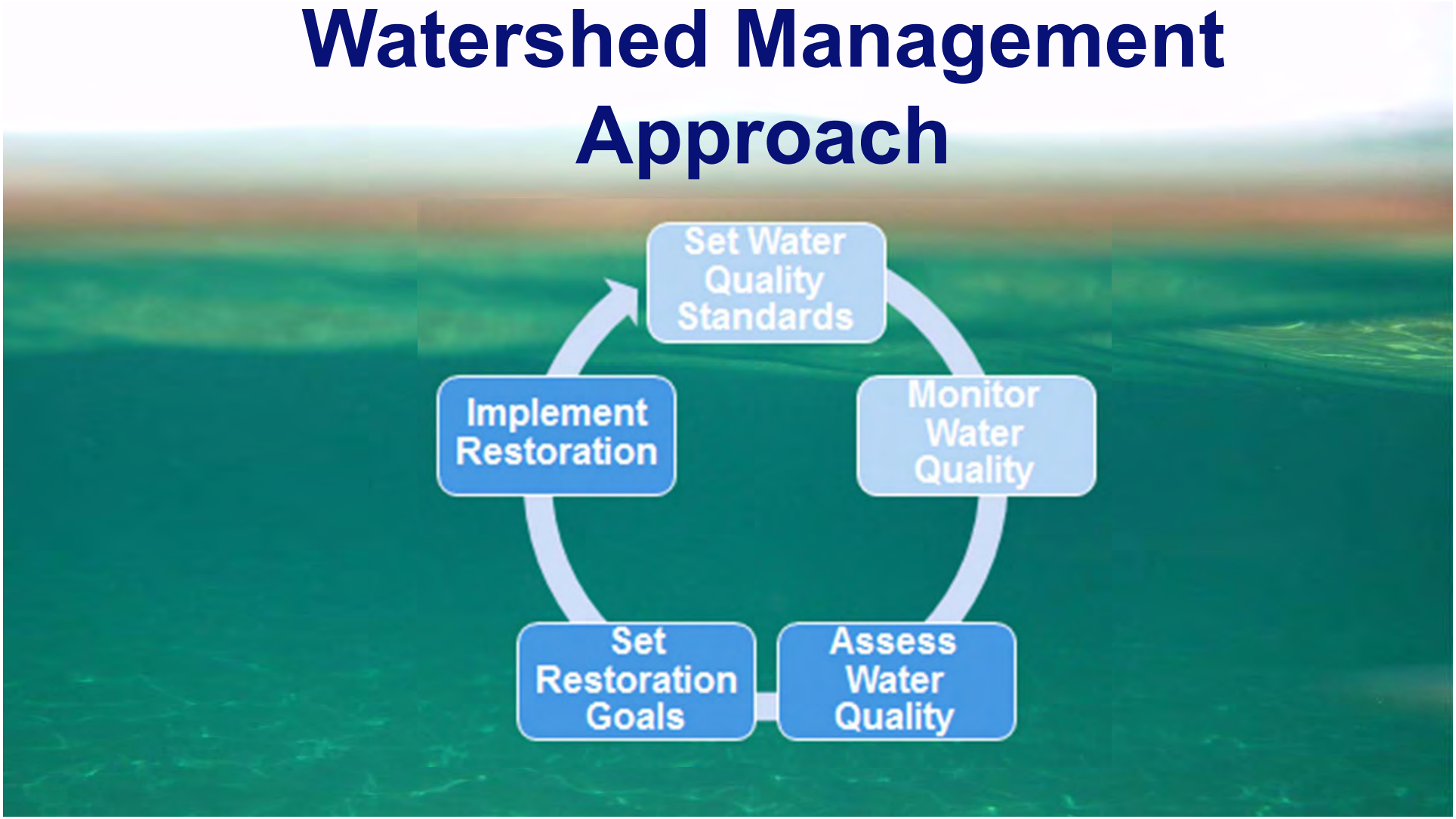
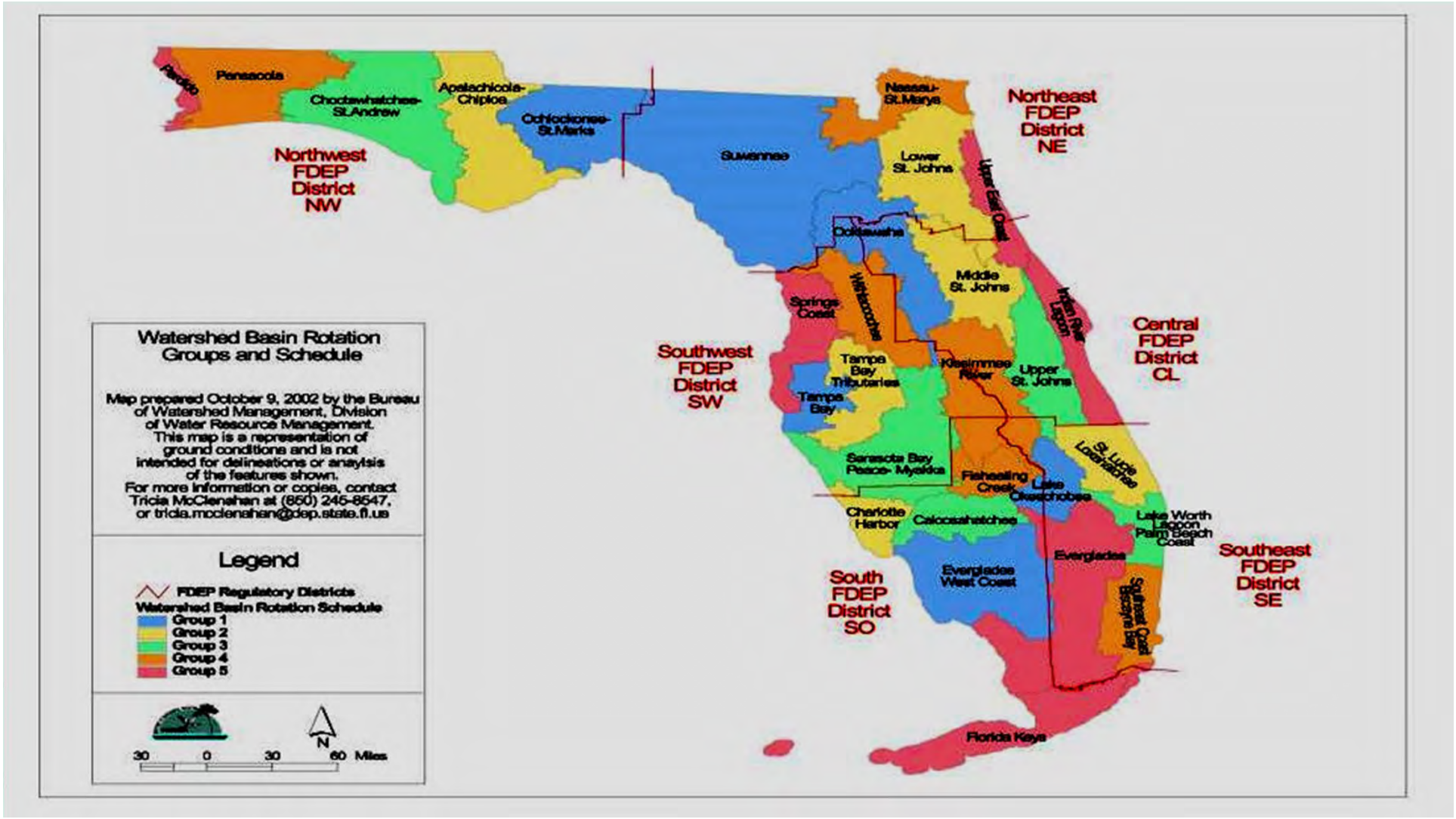
Florida's Requirements

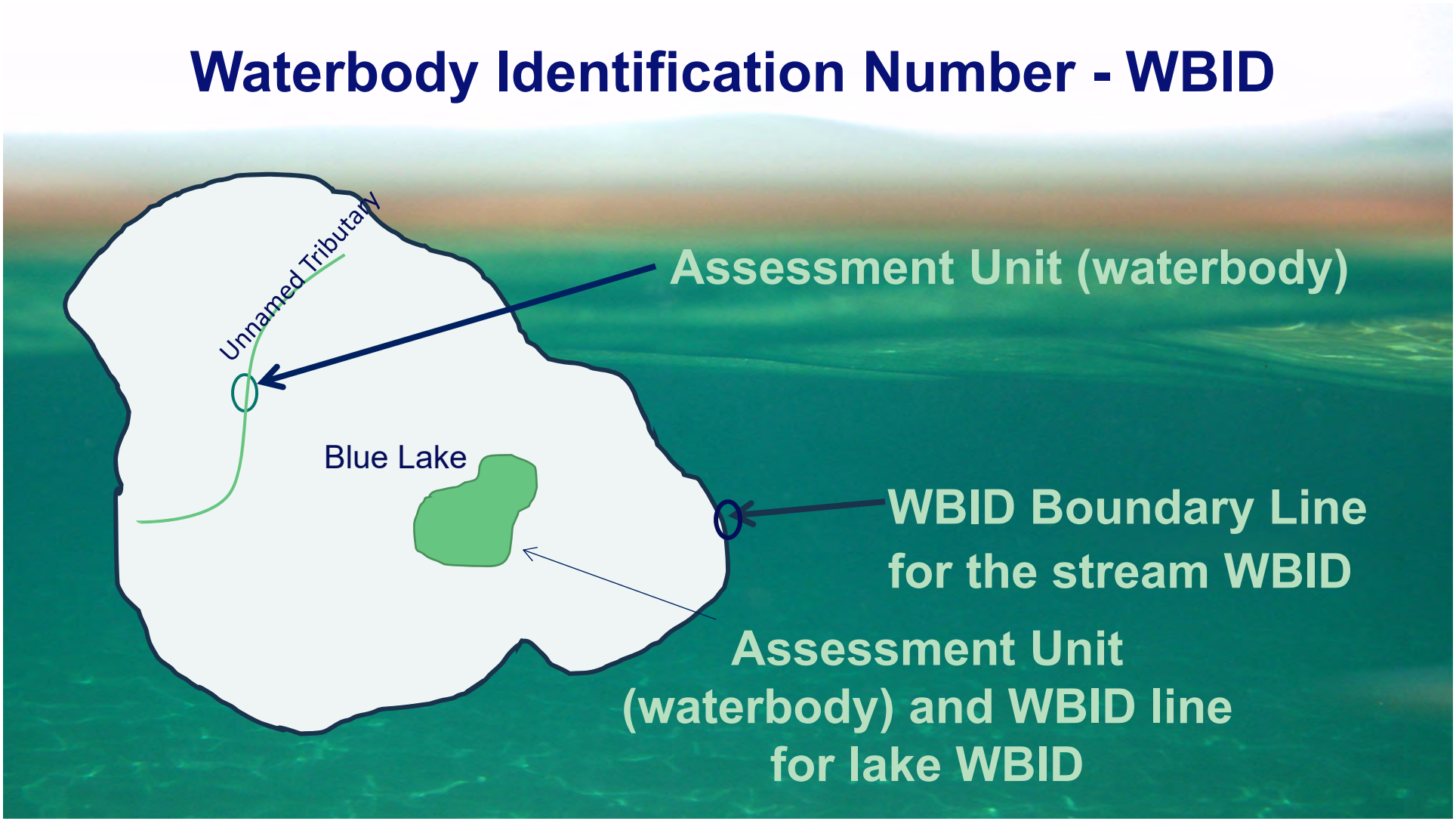
- Section 303(d) of the Federal CWA
- Florida statute 403.067 established the Florida Watershed Restoration Act in 1999
- Surface Water Quality Standards Rule 62-302, F A.C.
- Impaired Waters Rule (IWR) 62-303, F.A.C.

Watershed Management Approach




Perdido
Pensacola
Choctawhatchee-St.Andrew
Apalachicola-Chipola
Ochlockonee-St.Marks
Suwannee
Nassau-St.Marys
Lower St. Johns
Upper East Coast
Northeast FDEP District NE
Northwest FDEP District NW
Ocklawaha
Middle St. Johns
Withlacoochee
Springs Coast
Indian River Lagoon
Central FDEP District CL
Southwest FDEP District SW
Tampa Bay Tributaries
Tampa Bay
Kissimmee River
Upper St. Johns
Sarasota Bay Peace- Myakka
Fisheating Creek
Lake Okeechobee
St. Lucie Loxahatchee
Charlotte Harbor
Caloosahatchee
Lake Worth Lagoon Palm Beach Coast
Everglades
Southeast FDEP District SE
Everglades West Coast
South FDEP District SO
Southeast Coast Biscayne Bay
Florida Keys
Watershed Basin Rotation Groups and Schedule
Map prepared October 9, 2002 by the Bureau of Watershed Management, Division of Water Resource Management. This map is a representation of ground conditions and is not intended for delineations or anaylsis of the features shown. For more information or copies, contact Tricia McClenahan at (850) 245-8547, or tricia.mcclenahan@dep.state.fl.us
Legend
FDEP Regulatory Districts
Watershed Basin Rotation Schedule
Group 1
Group 2
Group 3
Group 4
Group 5
N
30 0 30 60 Miles

Waterbody Identification Number - WBID



Assessment Category Descriptions

Category 1 - Attaining all designated uses

Category 2 - Not impaired and no TMDL is needed

Category 3 - Insufficient data to verify impairment (3a, 3b, 3c)

Category 4 - Sufficient data to verify impairment, no TMDL is needed because:

- 4a – A TMDL has already been done
- 4b – Existing or proposed measures will attain water quality standards; Reasonable Assurance
- 4c – Impairment is not caused by a pollutant, natural conditions
- 4d – No causative pollutant has been identified for DO or Biology
- 4e – On-going restoration activities are underway to improve/restore the waterbody

Category 5 - Verified impaired and a TMDL is required

Descriptions of the Lists

- Planning list – used to plan for monitoring
- Study List – need additional study or information
- Master list – includes ALL assessments for every waterbody
- Verified list – impaired waterbodies, need a TMDL
- Delist list – waterbodies that do NOT need a TMDL
- 303(d) list – kept by EPA as the sum total of all waterbodies that do not meet surface water quality standards and/or designated uses

Pathways to Restoration

DEP Watershed Restoration Process

- Assessment of Waters
- TMDL Development for Waters Verified as Impaired
  - 1 year + for priority waters
  - 5-10 years for others
- Development of Basin Management Action Plan (BMAP)
  - 1-3 years
- Implementation of TMDL through BMAP
  - 1-10 years +

Restoration Alternatives

Two types of Restoration Alternative Plans

1) Reasonable Assurance Plan

- Assessment category 4b
- Not placed on the 303(d) list

2) Pollutant Reduction Plans

- Assessment category 4e
- Included on 303(d) list

These plans are addressed in the Impaired Waters Rule in section 62-303.600, F.A.C.

Benefits of an Alternative Restoration Plan

- Provides a faster path to restoration
- Allows stakeholders to control their destiny
  - Developing a plan prior to state or federal action provides the be way for stakeholders to plan for efficient and effective management
  - Avoid TMDL-related regulatory requirements
- Acknowledges proactive efforts
  - Stakeholders receive credit for pollutant reductions
  - Benefits to downstream impaired waters
- Provides time for good targets to be developed
- Enhances public relations

Reasonable Assurance Plans

- Basic Requirements:
  - Description of Impaired Waterbody
  - Description of Water Quality or Aquatic Ecological Goals
    - The water quality–based targets or aquatic ecological goals (both interim and final) that have been established for the pollutant(s) of concern.
  - Description of Proposed Management Actions To Be Undertaken
    - Schedule for restoration projects, including funding sources
  - Description of Procedures for Monitoring and Reporting Results
  - Description of and Commitment to Proposed Corrective Actions

Reasonable Assurance Plans

Reasonable Assurance plans (4b) provide an implementation schedule and resource commitments that there are, or will be, pollutant loading reductions that will result in the waterbody achieving water quality targets to attain and maintain the designated use.

Main inclusions in a Reasonable Assurance Plan:

- a restoration target (e.g. water quality, pollutant load)
- a list of projects and/or activities that will achieve the restoration target
- an implementation schedule that can span multiple years
- funding commitments
- requires EPA approval

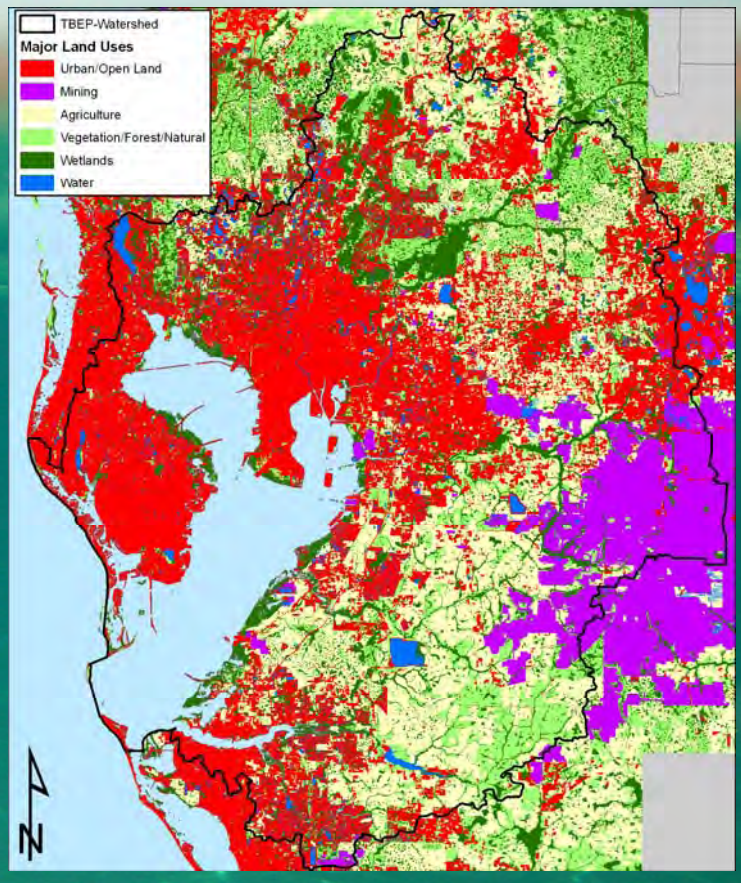
Tampa Bay RAP

Tony Janicki
Janicki Environmental
Florida Stormwater Association
Winter 2017 Meeting
6 December 2017

Janicki Environmental, Inc.

Tampa Bay - Fast Facts

- Florida's largest open-water estuary
- Open water: 400 sq miles
- Watershed: 2,600 sq miles
- Average water depth: 12 feet
- Population: > 3 million



Troubled Waters

- Half of Tampa Bay seagrasses lost by 1982
- Half of Tampa Bay's natural shoreline altered
- 40% of tidal marshes destroyed
- White ibis populations plummeted by 70%
- Visibility reduced to 2 feet
- Fish kills common

A "poster child" for polluted waters

- "60 Minutes" segment brought national attention
  - Poorly treated sewage
  - Unrestricted dredging and filling
  - Untreated stormwater runoff and industrial discharges

Citizens demanded action

- In 1978, State legislation required upgrades to all wastewater treatment plants
- By 1981, 90% reduction in nitrogen loading from treatment plants discharging to bay

The beginning of Tampa Bay's Collaborative Approach

- Public sector realized that nitrogen management goals were unattainable without private sector help.
- Private sector invited to participate with the public sector in the voluntary Nitrogen Management Consortium.
- Each partner contributed to nitrogen management goal as they were able - no requirements or allocations

The beginning of Tampa Bay's Collaborative Approach

Key Decision:
Collaborative Management Strategy

- Consortium participants willing to work together to develop voluntary allocations (caps) for nitrogen loads, for agencies' consideration.

- Decided they wanted to 'drive the bus'

What's this about a TMDL

- DEP proposed a TMDL for Tampa Bay that was eventually adopted by EPA
- The voluntary TN load reductions morphed into this TMDL
- DEP recognized the work of the TBNMC and together created a mechanism that built on voluntary efforts
- DEP required TBNMC to provide "reasonable assurance" that the load reductions and water quality targets would be met
- That mechanism lead to the first Reasonable Assurance Plan

Tampa Bay RAP

This RAP was developed by the Tampa Bay Estuary Program and members of the Tampa Bay Nitrogen Management Consortium in cooperation with EPA, DEP - accepted in 2002

The plan provided supporting documentation for site-specific alternative chlorophyll-a thresholds

Since 2010, updates submitted to the Department that demonstrated that there has been reasonable progress towards attaining the designated uses of waterbody segments within the Tampa Bay

Adopted RAPs
&
DEP Support for New RAPs

Tiffany Busby
Wildwood Consulting
Florida Stormwater Association
Winter 2017 Meeting
6 December 2017

Examples of Completed RAPs

- Tampa Bay
- Shell, Prairie, and Joshua Creeks
- Lake Seminole
- Florida Keys

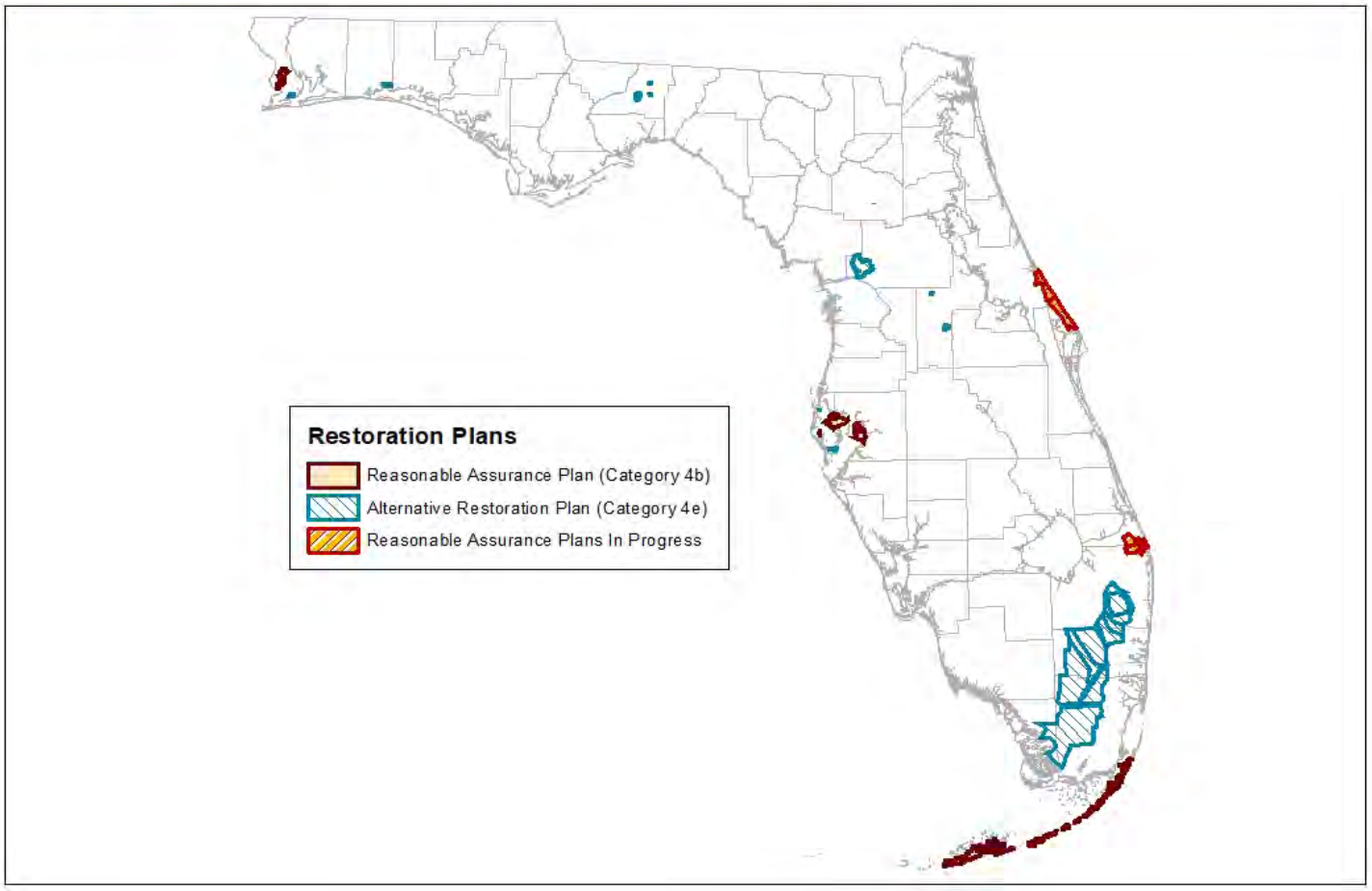
https://floridadep.gov/dear/watershed-assessment-section/content/4b-assessments-raps

RAPs in Development

- Mosquito Lagoon
- Loxahatchee River
- Also, Florida Keys Reasonable Assurance Document (RAD)

Update

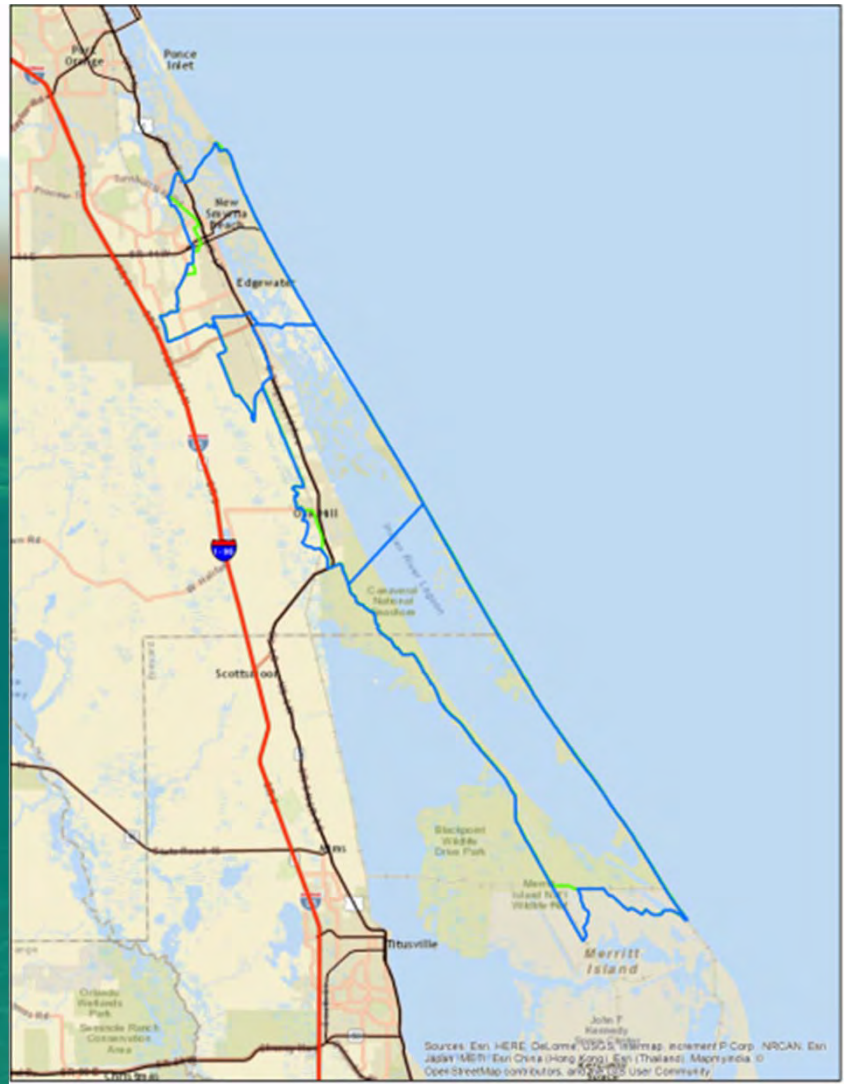
Florida Department of Environmental Protection



Mosquito Lagoon

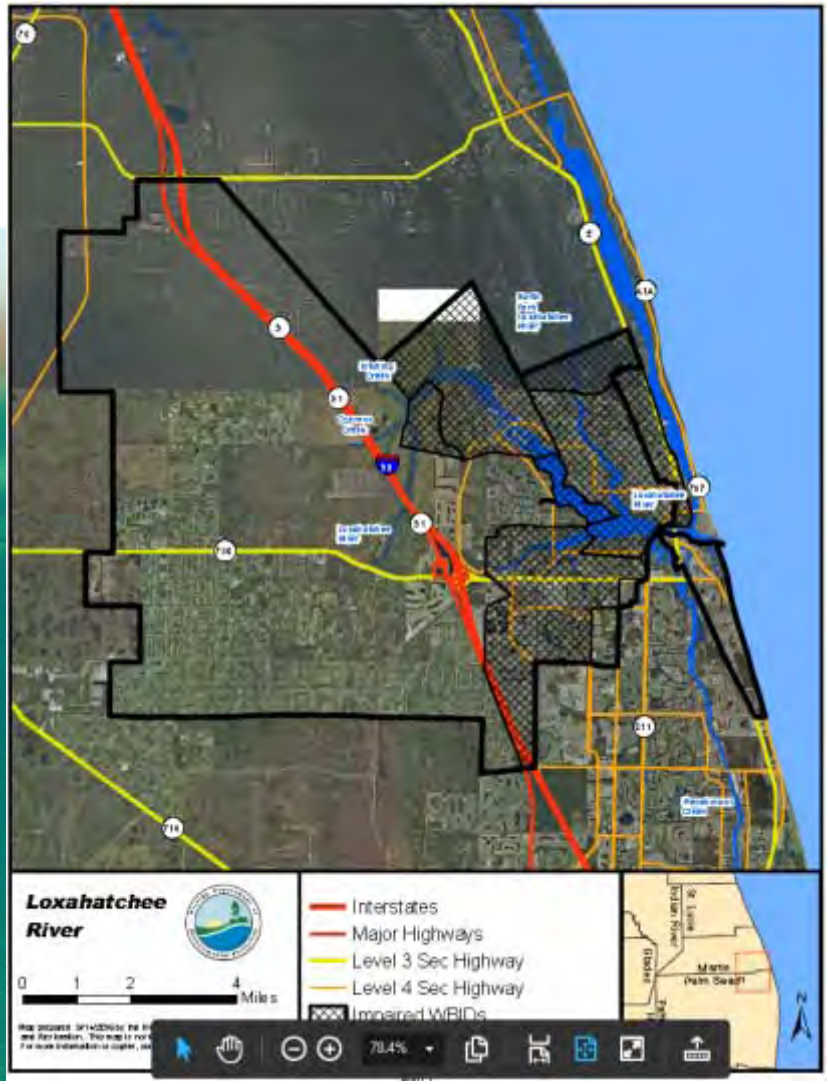
RAP Sponsors:

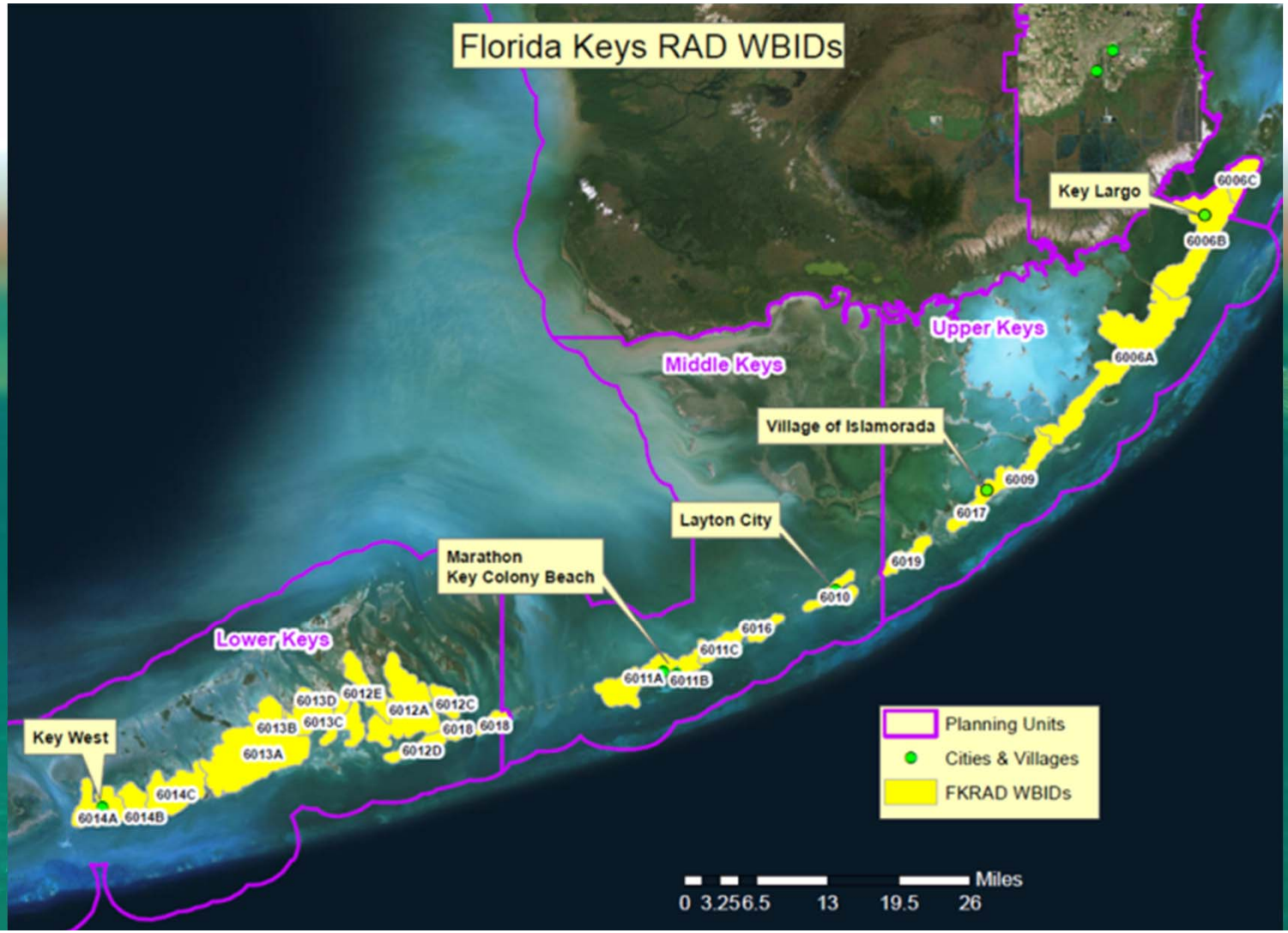
- **Edgewater**
- **Florida Department of Transportation (FDOT)**
- **New Smyrna Beach**
- **Oak Hill**
- **Volusia County**



Loxahatchee River

RAP Sponsor: Loxahatchee River Coordinating Council




Florida Keys RAD WBIDs
Key Largo
6006C
6006B
Upper Keys
6006A
Middle Keys
Village of Islamorada
6009
6017
Layton City
6019
Marathon
Key Colony Beach
6010
6016
6011C
6011A
6011B
Lower Keys
6013D
6012E
6012A
6012C
6013B
6013C
6018
6018
6013A
6012D
Key West
6014C
6014A
6014B
Planning Units
Cities & Villages
FKRAD WBIDs
Miles
0 3.256.5 13 19.5 26

DEP Role in RAPs

- Guidance
- Feedback
- Adoption
- Transmit plan
- Support EPA approval
- Facilitation support

Role of Facilitation

- Neutral party
- Action items
- Meetings
- Plan document
- Feedback

Some Lessons Learned

- Time and project commitments are necessary
- Technical support is beneficial
- Data limitations often affect management decisions
- Valuable to have local control of the process

Mosquito Lagoon RAP
A Stakeholder's Perspective

Judy Grim, Director
Volusia County Road and Bridge

Florida Stormwater Association
Winter 2017 Meeting

6 December 2017

Volusia County
FLORIDA

Water Quality Workshop

June 26, 2014 - County Council hosts a water quality workshop

Agenda:

- Priority Surface Waters
- Water Quality Overview
  - Surface Water Quality Monitoring
  - Common Pollutants and Sources
- Regulatory Protections of Water Bodies
- Volusia County Stormwater Management
- Wastewater/Septic Infrastructure
- City Presentations:

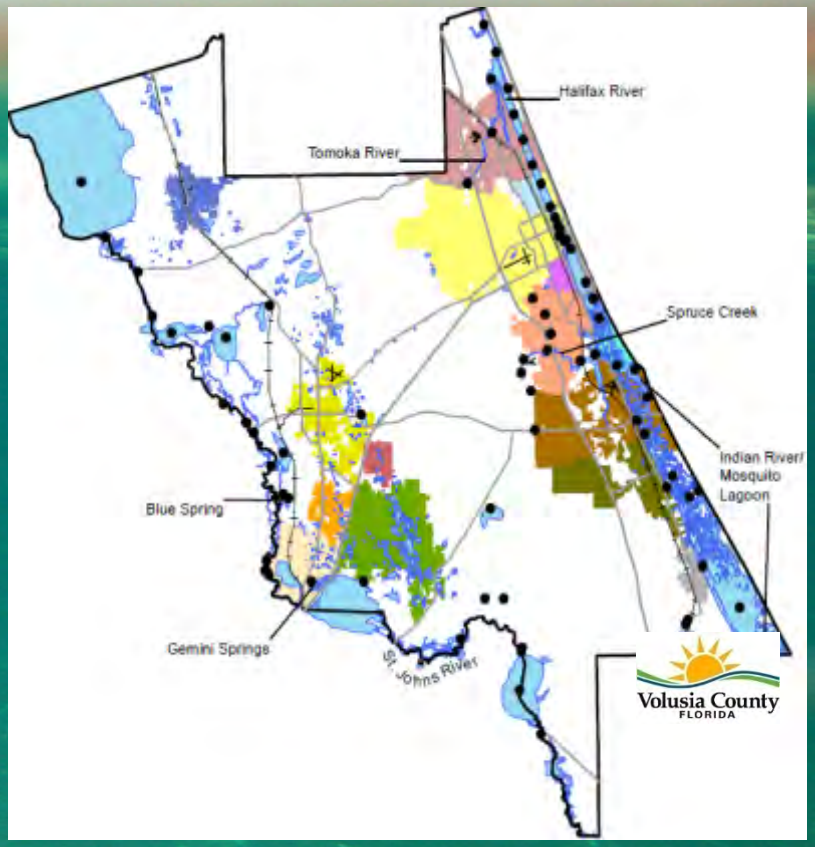
  Daytona Beach, Daytona Beach Shores, Deland, Deltona, Edgewater, Lake Helen, New Smyrna Beach, Orange City, Ormond Beach, Ponce Inlet, Port Orange, South Daytona

Priority Surface Waters

- Indian River/ Mosquito Lagoons
- Halifax River
- Tomoka River
- Spruce Creek
- St. Johns River
  - Blue Springs
  - Gemini Springs

Water Quality Monitoring

- Indian River/Mosquito Lagoons
- Tomoka River
- Halifax River
- Spruce Creek
- St. Johns River
  - Blue Spring
  - Gemini Springs

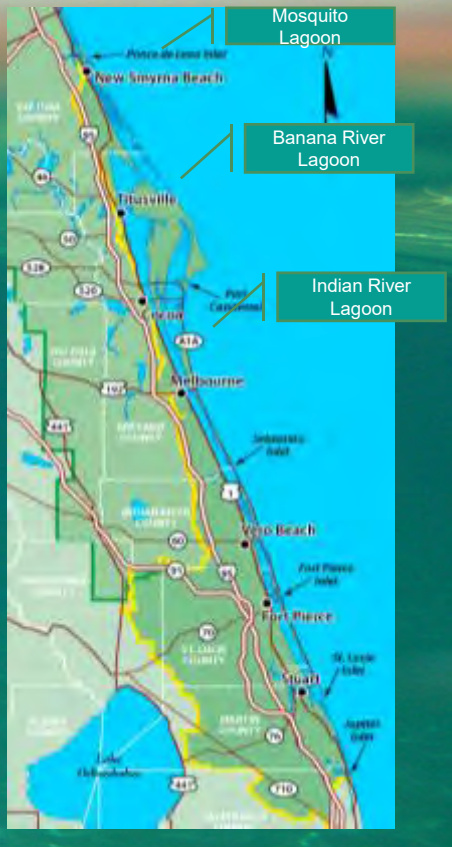


Water Quality Monitoring

- Collecting since 1988
- 90 Locations, quarterly or monthly
- Data is shared through the state and national database

Indian River Lagoon

- 156 miles long, 6 counties, 2 water management districts
- Algae blooms in 2011, 2012, 2013
- 3 distinct sections
  - Mosquito Lagoon
  - Banana River
  - Indian River



Mosquito Lagoon

60 square mile sub-basin

- Includes the 4,740 acre Mosquito Lagoon Aquatic Preserve
- Class II shellfish harvesting waters
- Very shallow, extreme salinities, long retention time

Water Quality

- Meets current criteria for chlorophyll, N and P
- May exceed proposed DEP criteria for chlorophyll, N and P

Volusia County Water Plan

Identifies four primary ways to improve water quality:

- Eliminating septic tanks in watersheds/spring sheds of priority water bodies;
- Improving stormwater conveyance and treatment systems to reduce nutrient pollution;
- Developing meaningful education and outreach programs to inform citizens about water quality;
- Reducing nutrients from wastewater plant discharges to surface or ground water.

Stormwater Management

Volusia County Stormwater Management Program:

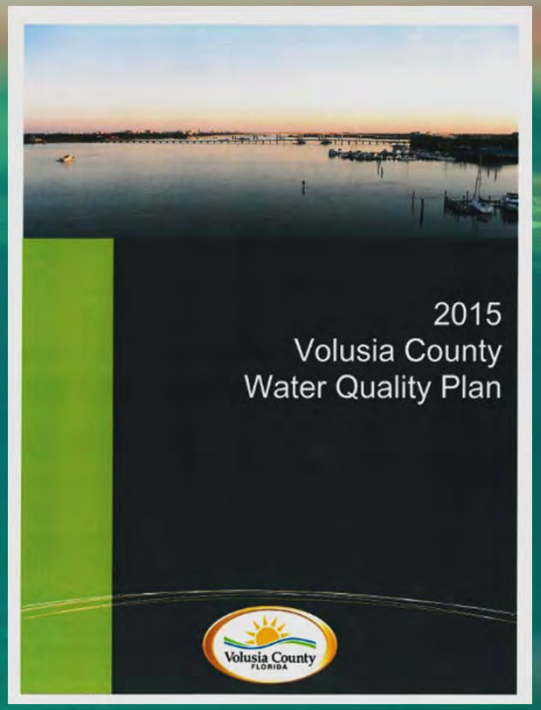
- Drainage basin studies
- Stormwater Capital Improvements Program
- Improving stormwater conveyance and treatment systems to reduce nutrient pollution
- Grant procurement
- Staff training and education

Regulatory Protections

- Water Quality appears to be declining
  - Pollutant sources: stormwater runoff; fertilizer; septic tanks; wastewater discharge
- Not considered impaired through the Total Maximum Daily Load (TMDL) regulatory process
- Implement proactive process to stop the decline and improve water quality

Water Quality Plan Updates

- September 18, 2014 – County Council adopts Resolution 2014-132 setting forth goals to improve water quality
- February 5, 2015 – County Council adopts a Water Quality Plan with specific goals and actions to implement water quality improvements
- September 18, 2015 – Funding for development of the Mosquito Lagoon Reasonable Assurance Plan (RAP) was approved.



Mosquito Lagoon RAP

2015 Water Quality Plan Goal 2:
Develop a Reasonable Assurance Plan (RAP) for Mosquito Lagoon

- Process to improve a water body where a TMDL has not been established
- Local control over development and implementation of prevention and restoration activities
- Makes grant funding more accessible

Stakeholders

Stakeholders within the Mosquito Lagoon Watershed:

- Volusia County
- City of Oak Hill
- City of Edgewater
- City of New Smyrna Beach
- Florida Department of Transportation

And collaboration with:

- Florida Department of Environmental Protection
- Indian River Lagoon Council
- St. Johns River Water Management District and others

Mosquito Lagoon Area

Land Area in Acres:

County 10,022 (includes ROW in Cities)
New Smyrna Beach 4,485
Edgewater 6,467
Oak Hill 2,608

FDOT Roads (approximately 492)

in County 121
in NSB 125
in EW 168
in OH

Joint Project Agreement

- Requires participation and funding from all stakeholders within the Mosquito Lagoon Watershed
- Between Volusia County and the cities of Edgewater, New Smyrna Beach and Oak Hill
- Separate funding agreement between FDOT and County

JPA Elements

- Scope of work for consultant contract
- Governance and management
  - Designate project administrator and alternate for each party
  - Each party has one vote plus FDOT a vote
  - Simple majority rules
- Funding
  - Cost allocation for project
  - Provisions for funding additional work
- Responsibility of parties
- Terms, amendments and termination

RAP Budget

- Stakeholders agreed to cost share allocation

• Volusia County	$190,000
• City of Edgewater	$93,000
• City of New Smyrna Beach	$63,000
• City of Oak Hill	$25,000
• FDOT	$7,000
Total funding	$378,000

Cost share allocation based on percentage of land in watershed basin.

RAP Progress

- Joint Participation Agreement (JPA)
  - Agreements between the Cities and Volusia County is Complete
  - Volusia County and FDOT have a separate agreement
- Consultant selection through CCNA
  - Contract with Jones Edmonds
- Project began March 2016
- Project scheduled to be completed by March 2018

Challenges

- Requires multiple sanctioning bodies to approve JAP and allocate funding
- RAP is very technical process and has a long duration
- Keeping parties on track
- Special interest groups

Results

- Successfully assessed and documented current water quality and biological conditions
- Established appropriate and measurable indicators, endpoints, goals, and targets
- Identified and prioritized appropriate prevention or restoration projects

Mosquito Lagoon Reasonable Assurance Plan Technical Approach

Brett Cunningham
Jones Edmunds & Associates
Florida Stormwater Association
Winter 2017 Meeting
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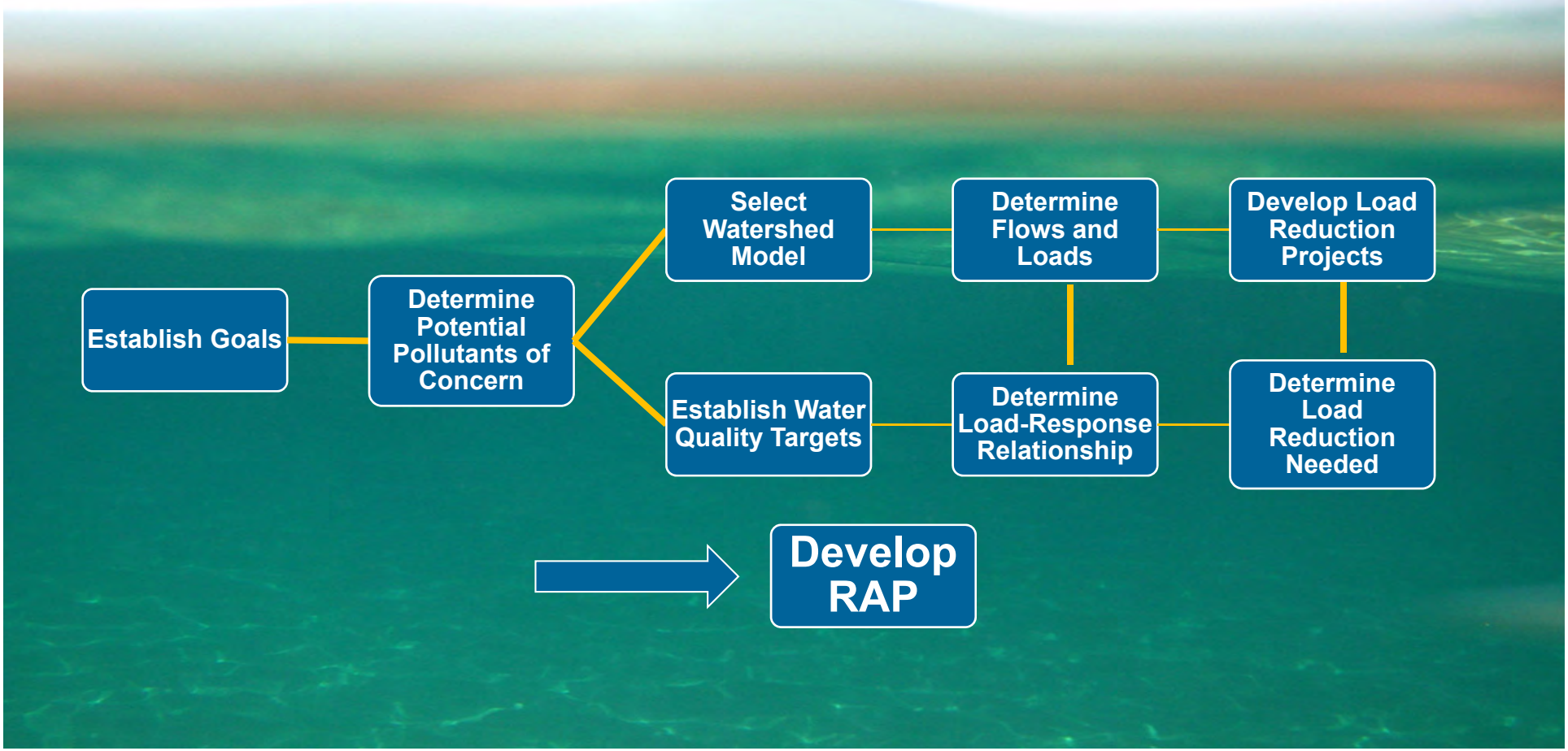
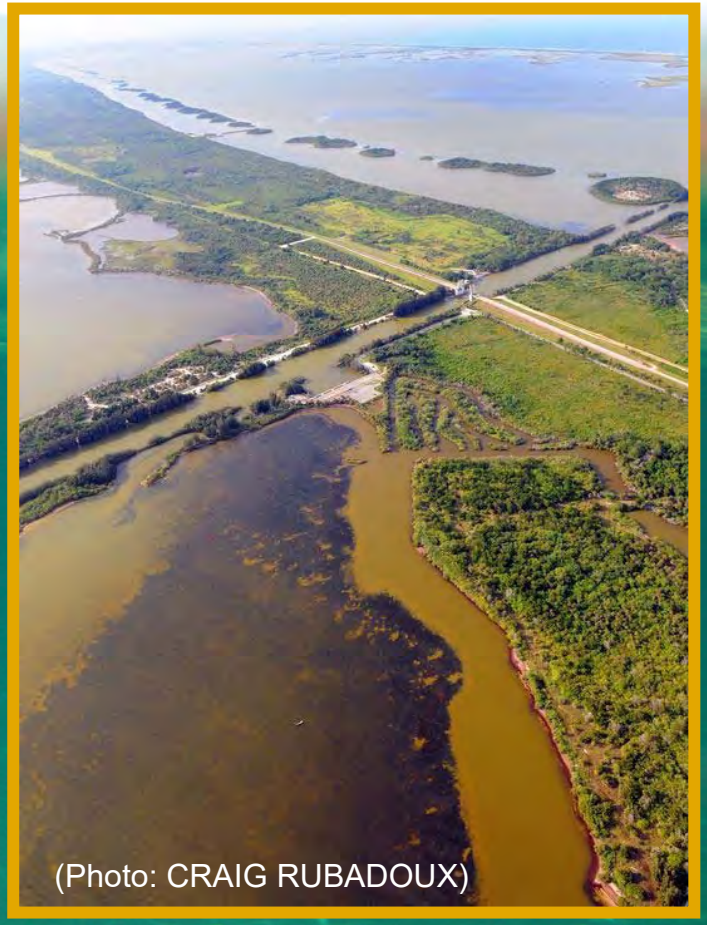
Technical Framework



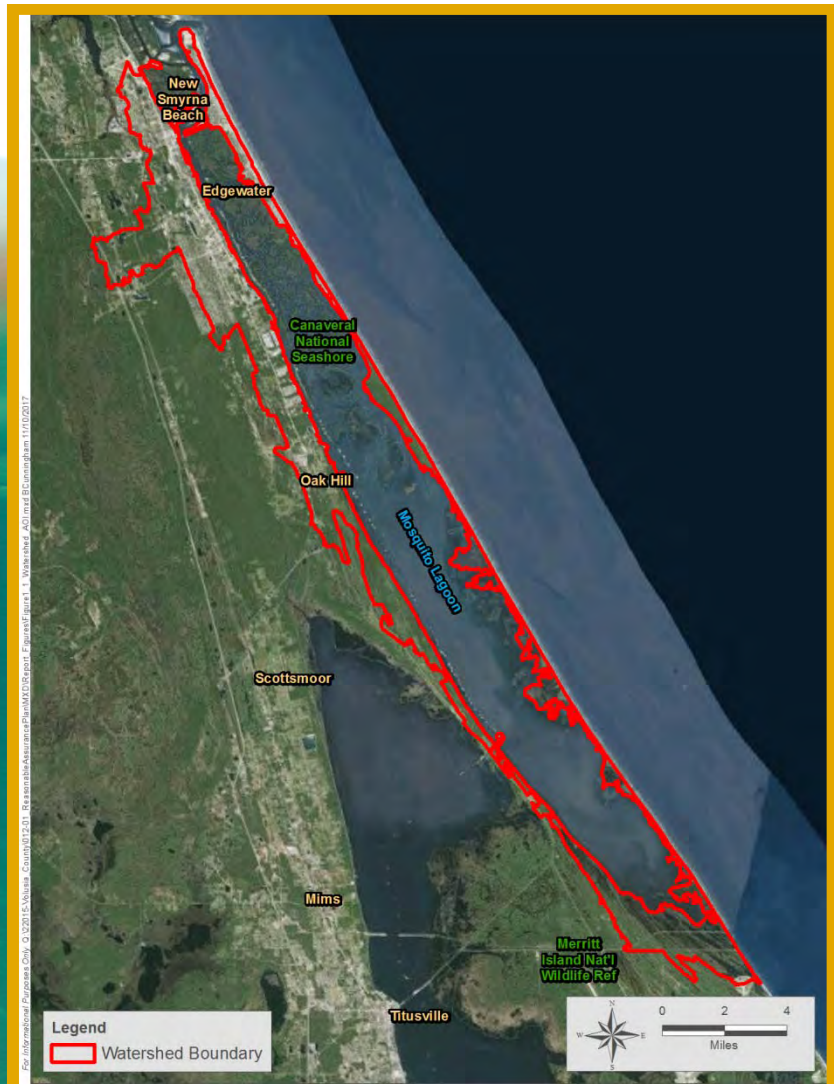
Potential Pollutants of Concern

- Total Nitrogen (TN)
- Total Phosphorus (TP)
- Possibly Biochemical Oxygen Demand (BOD)



Watershed Characteristics

- 36 Miles Long, 117 Square Miles
- Connected to Ponce Inlet and North IRL
- Watershed: Waterbody
- Small Subwatersheds
- Seasonal High Water Tables
- Mostly Sandy Soils



Importance of Transparency and Documentation

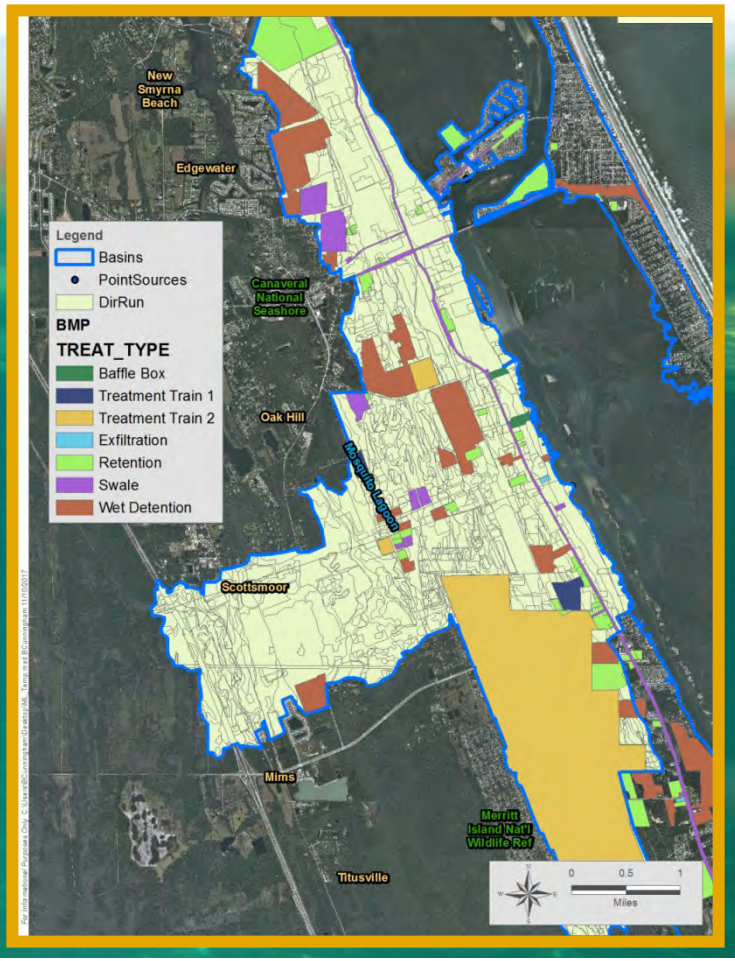
Pollutant Loading Model Selection

Key Watershed Characteristics and Simulation Capabilities

- Surface Water/Groundwater Interactions
- Flows and Loads from Direct Runoff and Base Flow
- Flows and Loads from WWTPs, Septic Tanks, and Atmospheric Deposition
- Account for Stormwater Best Management Practices
- Continuous Simulation
- Spatially enabled

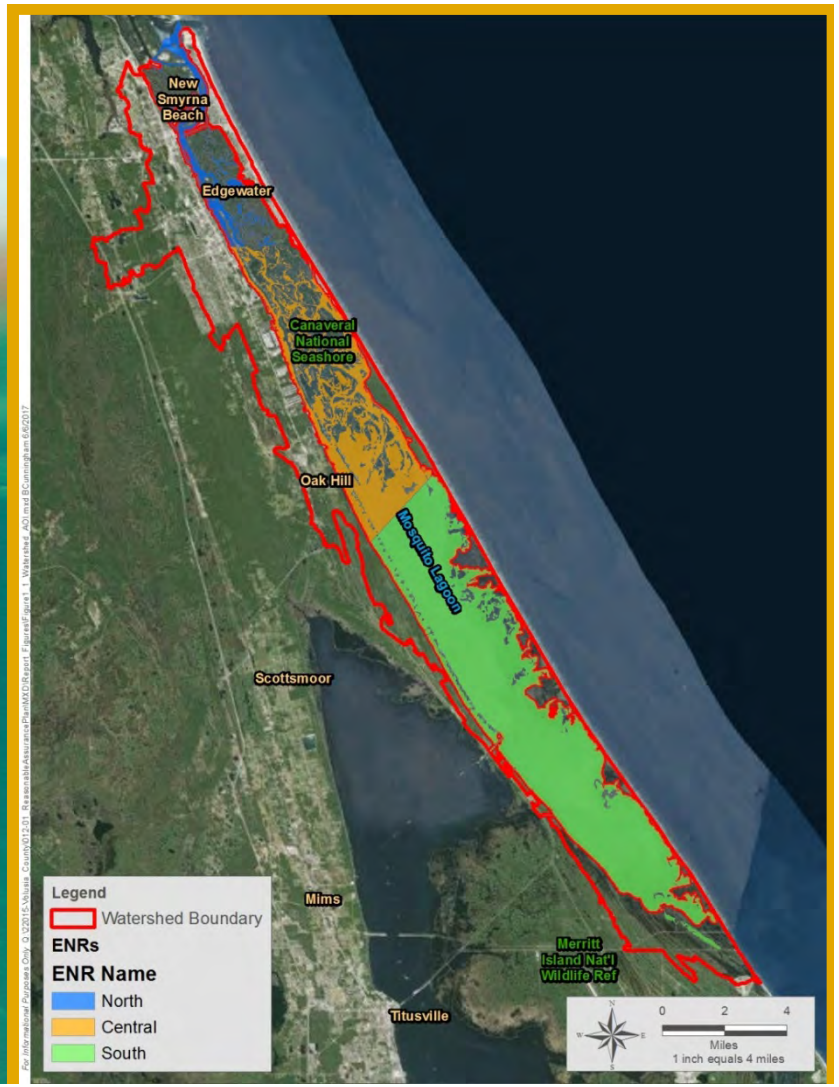
Watershed Model: SIMPLE

- Met criteria
- Transparency with Stakeholders
- Time-Enabled Data
- Flexible for Analyses of Options



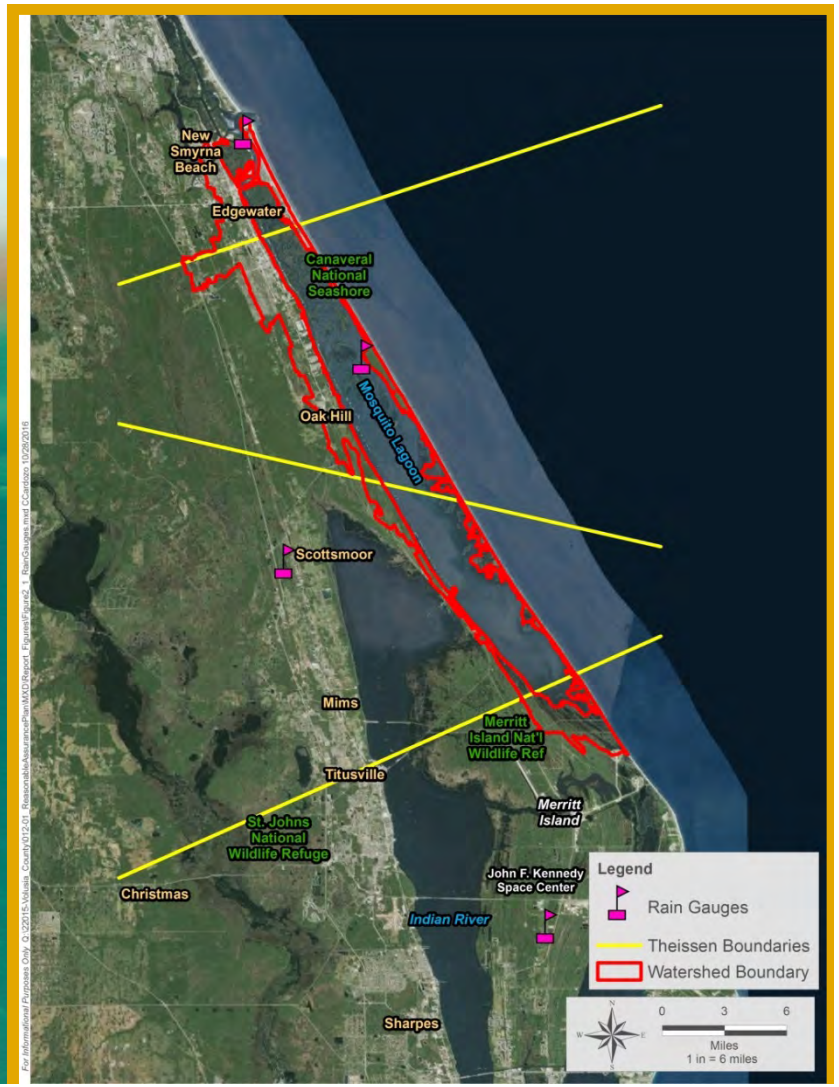
Watershed Boundary

- LiDAR
- Stormwater Infrastructure
- Considered Closed Basins



Spatial Distribution

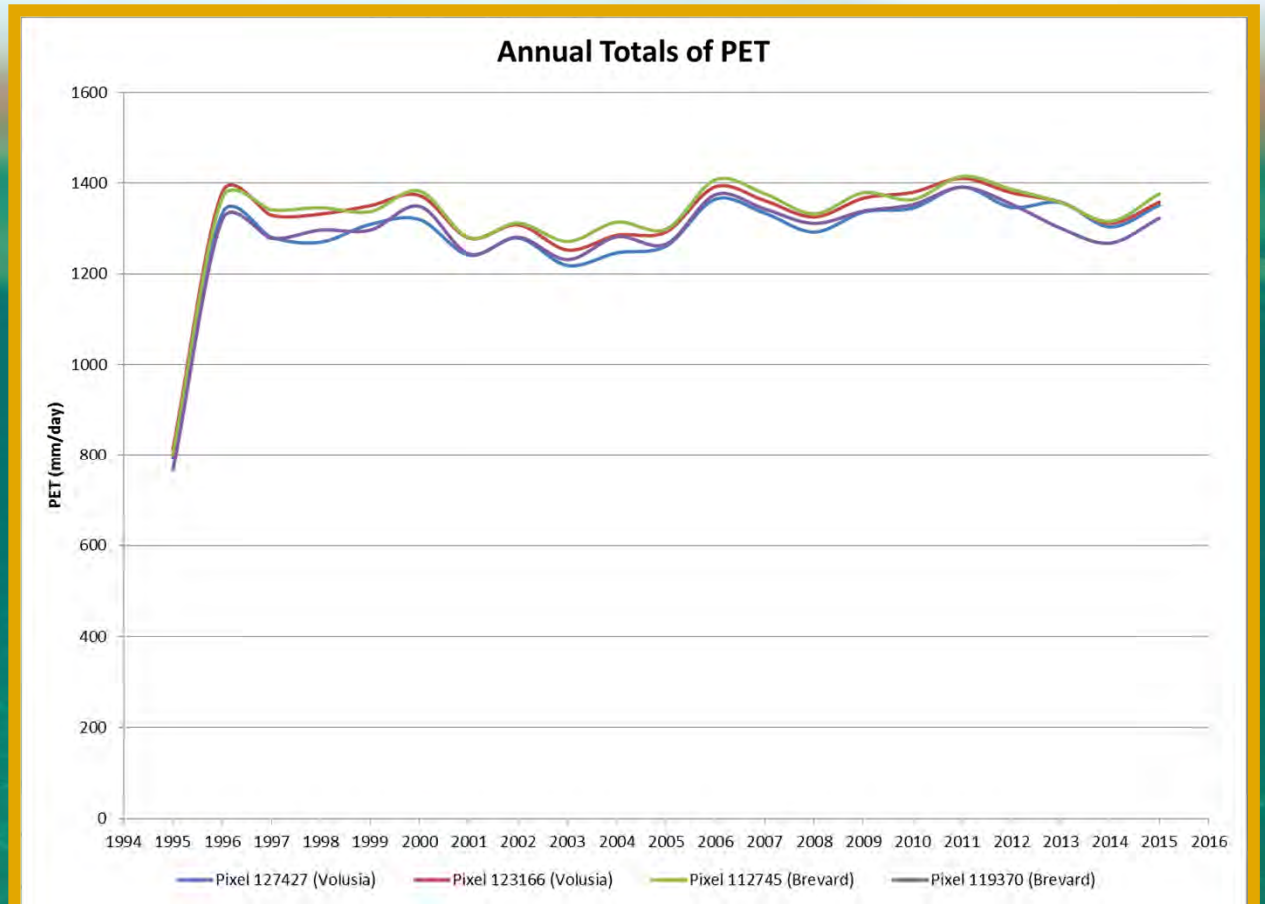
- Variability Across the Watershed



Spatial Distribution

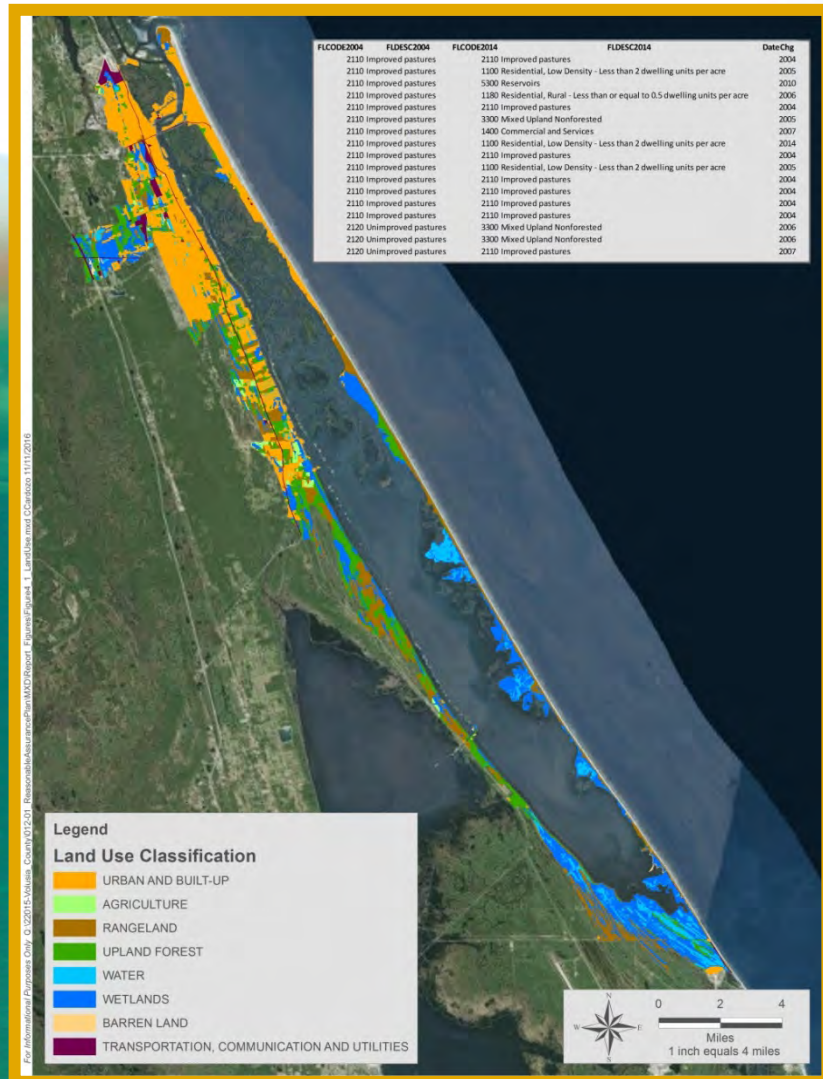
Station Name	Ransom Road at NASA	Ponce Inlet Weather Site at USCG Station	Playalinda at Turtle Mound	Parrish Park at Scottsmore
Station Number	15112758	18073682	1490678	1480674
Year	Annual Rainfall Total (Inches)			
2004	59.39	49.55	44.93	51.98
2005	62.60	49.23	45.33	49.37
2006	35.97	27.19	29.56	36.96
2007	50.86	35.55	42.17	50.15
2008	64.11	35.05	45.81	51.14
2009	39.84	54.38	46.75	42.02
2010	43.62	27.47	33.36	39.38
2011	45.98	35.36	40.82	50.22
2012	44.65	36.76	35.25	48.80
2013	42.36	40.23	39.32	42.01
2014	55.89	61.36	59.54	65.76
2015	42.42	33.20	33.67	42.30
Average (Inches)	48.97	40.44	41.38	47.51
Std Dev (Inches)	9.39	10.79	8.05	7.69

Spatial Distribution



Time-Aware Land Use

- Increases Credibility
- Removes Bias



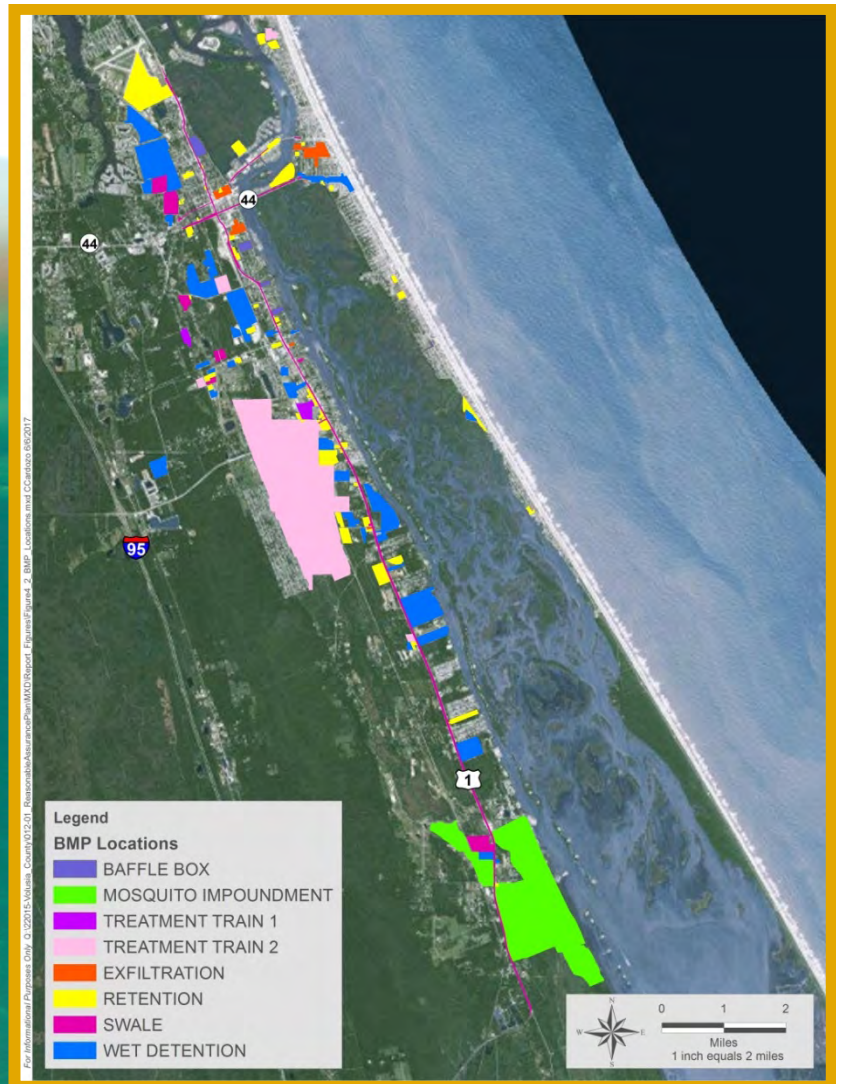
Concentrations

Land Use #	Description	BOD	TN	TP
1	Open	1.4	1.15	0.055
2	Forest	1.4	1.15	0.055
3	Pasture	5.1	3.47	0.62
4	Agriculture	3.8	2.61	0.49
5	Golf Courses	3.8	1.87	0.3
6	Low-Density Residential	4.7	1.51	0.18
7	Medium-Density Residential	7.9	1.87	0.3
8	High-Density Residential	11.3	2.4	0.50
9	Low-Intensity Commercial	7.7	1.18	0.18
10	High-Intensity Commercial	11.3	2.4	0.35
11	Light Industrial	7.6	1.2	0.26
12	Heavy Industrial	7.6	1.2	0.26
13	Wetlands	2.63	1.5	0.1
14	Water	1.6	0	0
15	Transportation	5.2	1.37	0.17

Constituent	TN	TP	BOD
Concentration (mg/L)	0.89	0.12	2.0

Best Management Practices

- Spatial Coverage
- Type
- Year Built



BMP Removal Efficiencies

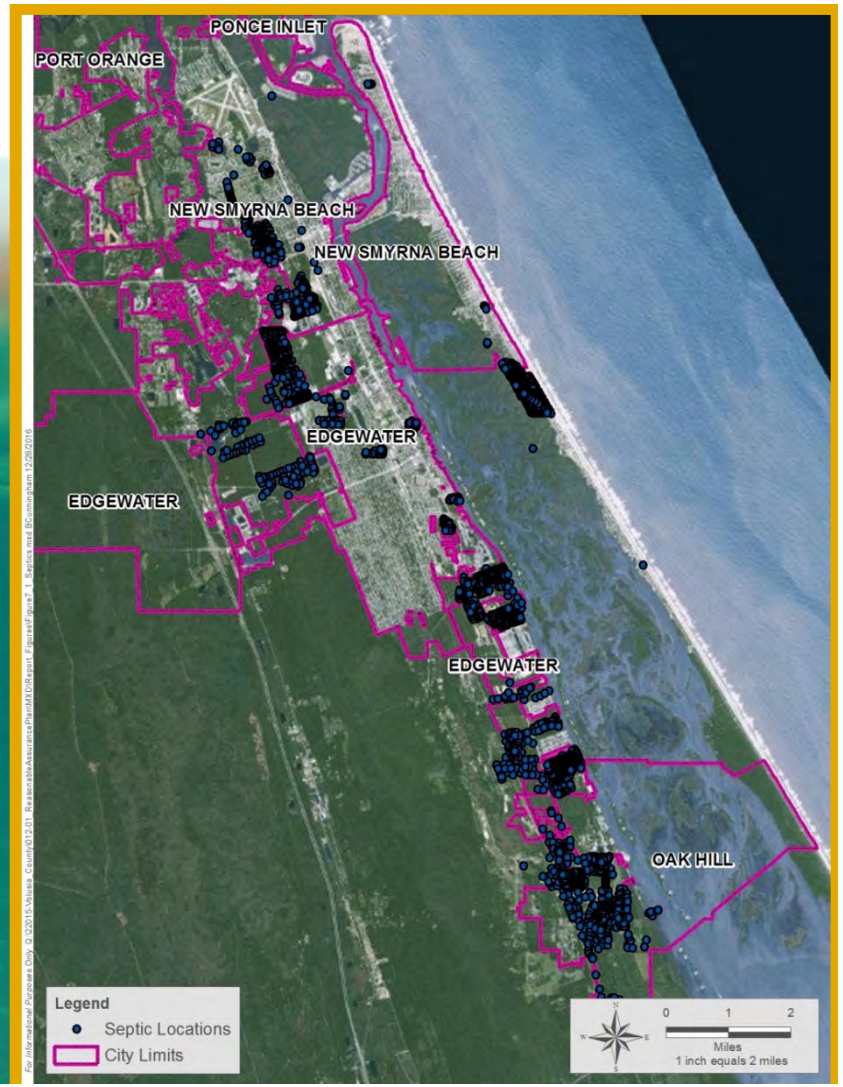
BMP Type	Constituent Removal Efficiency			
	Volume	TN	TP	BOD
Baffle Box (Generation 1)	0	.5	2.3	20
Baffle Box (Generation 2)	0	19	15.5	30
Exfiltration[1,2]	75	75	75	75
Mosquito Impoundment[3]	0	25	50	55
Retention[1,2]	75	75	75	75
Swale[1,2]	25	25	25	25
Treatment Train 1 (swale, wet detention, and possibly baffle box)	25	50	70	75
Treatment Train 2 (swale/retention and wet detention)	75	80	85	90
Wet Detention	20	36	62	70

Point Sources

Year	Annual Discharge Rate (MGD)				
	Edgewater Surface	Edgewater Reuse	New Smyrna Beach Surface	New Smyrna Beach Reuse	Volusia Southeast Reuse
2004	0.61	0.05	1.16	0.25	0.002
2005	0.99	0.03	1.39	0.22	0.002
2006	0.58	0.05	0.27	0.28	0.001
2007	0.62	0.06	0.32	0.29	0.001
2008	0.76	0.04	0.60	0.26	0.002
2009	0.81	0.05	0.13	0.23	0.002
2010	0.58	0.06	0.00	0.35	0.002
2011	0.42	0.08	0.00	0.31	0.002
2012	0.57	0.07	0.00	0.35	0.002
2013	0.49	0.08	0.00	0.24	0.001
2014	0.70	0.09	0.00	0.22	0.002
2015	0.67	0.08	0.00	0.34	0.002

Septic Systems

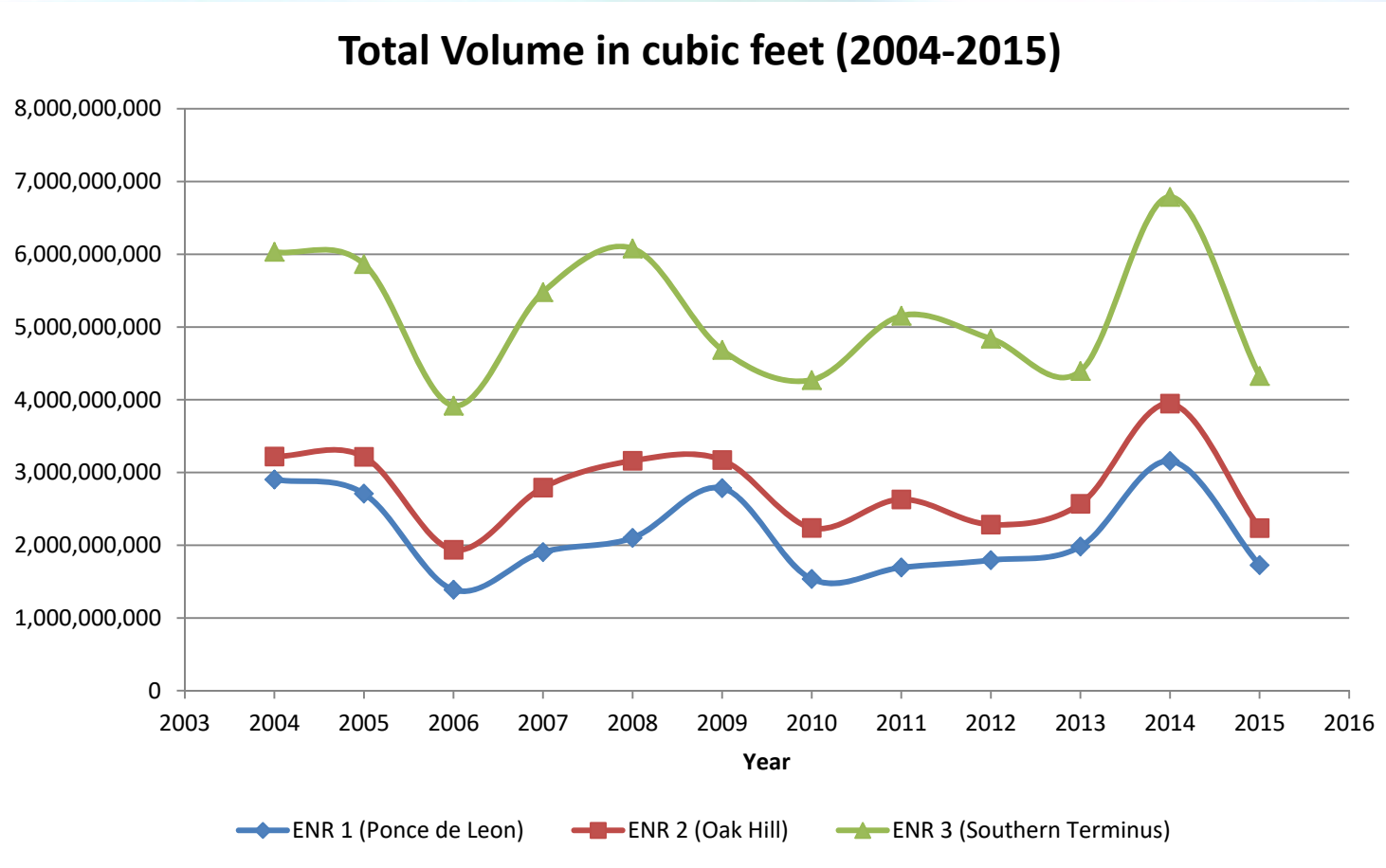
- ~2,800 Septic Systems
- Failure Rate
- Proximity to Waterbody
- Return Fraction



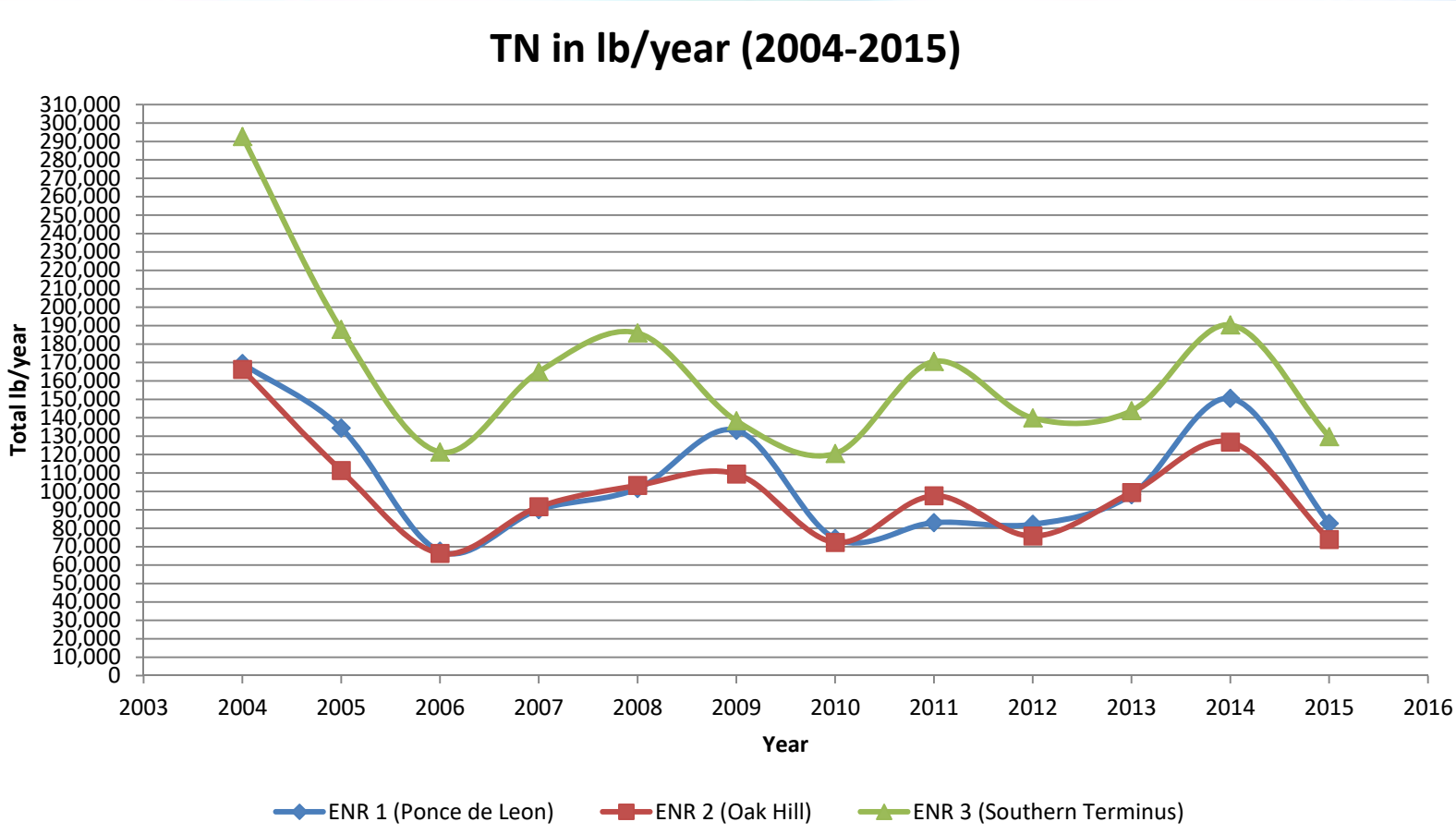
Atmospheric Deposition

- Four Rain Gages
- National Atmospheric Deposition Program Site FL99 at the Kennedy Space Center
- SJRWMD Site IRL141 (wet deposition) at Coconut Point in Sebastian Inlet
- Clean Air Status and Trends Network (CASTNET) (dry deposition) at the same location

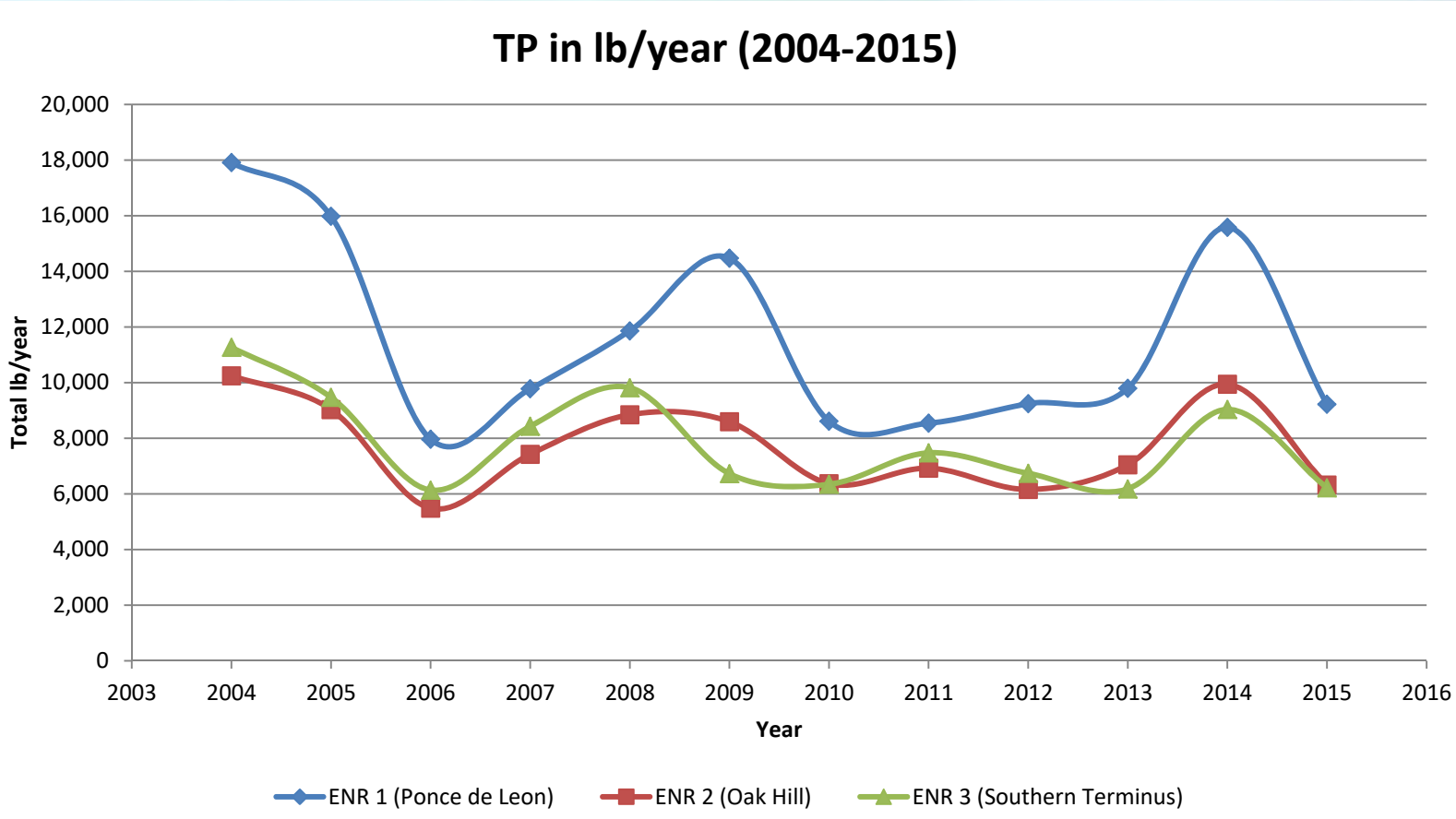
Total Volume Results



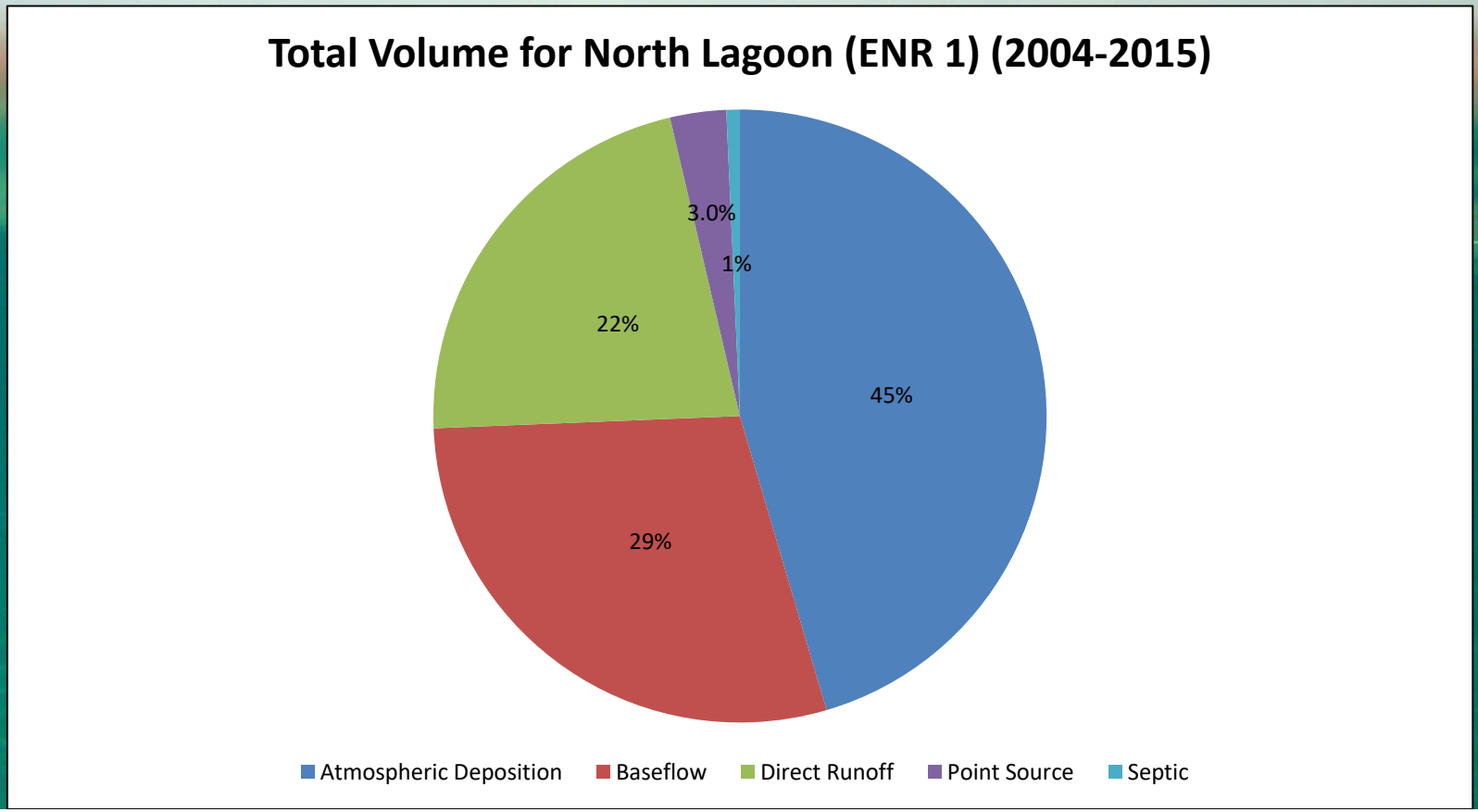
Total Nitrogen Results



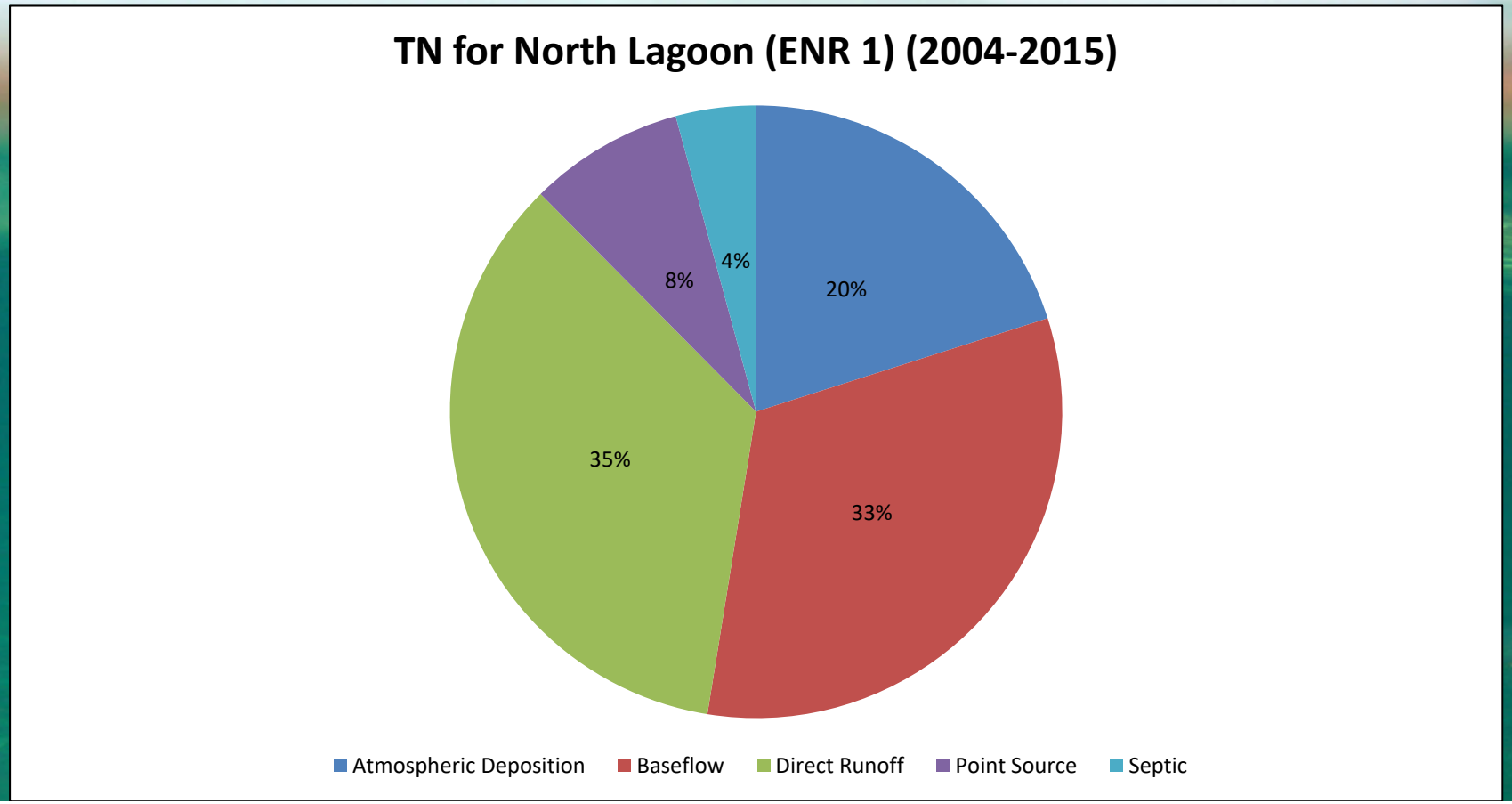
Total Phosphorus Results



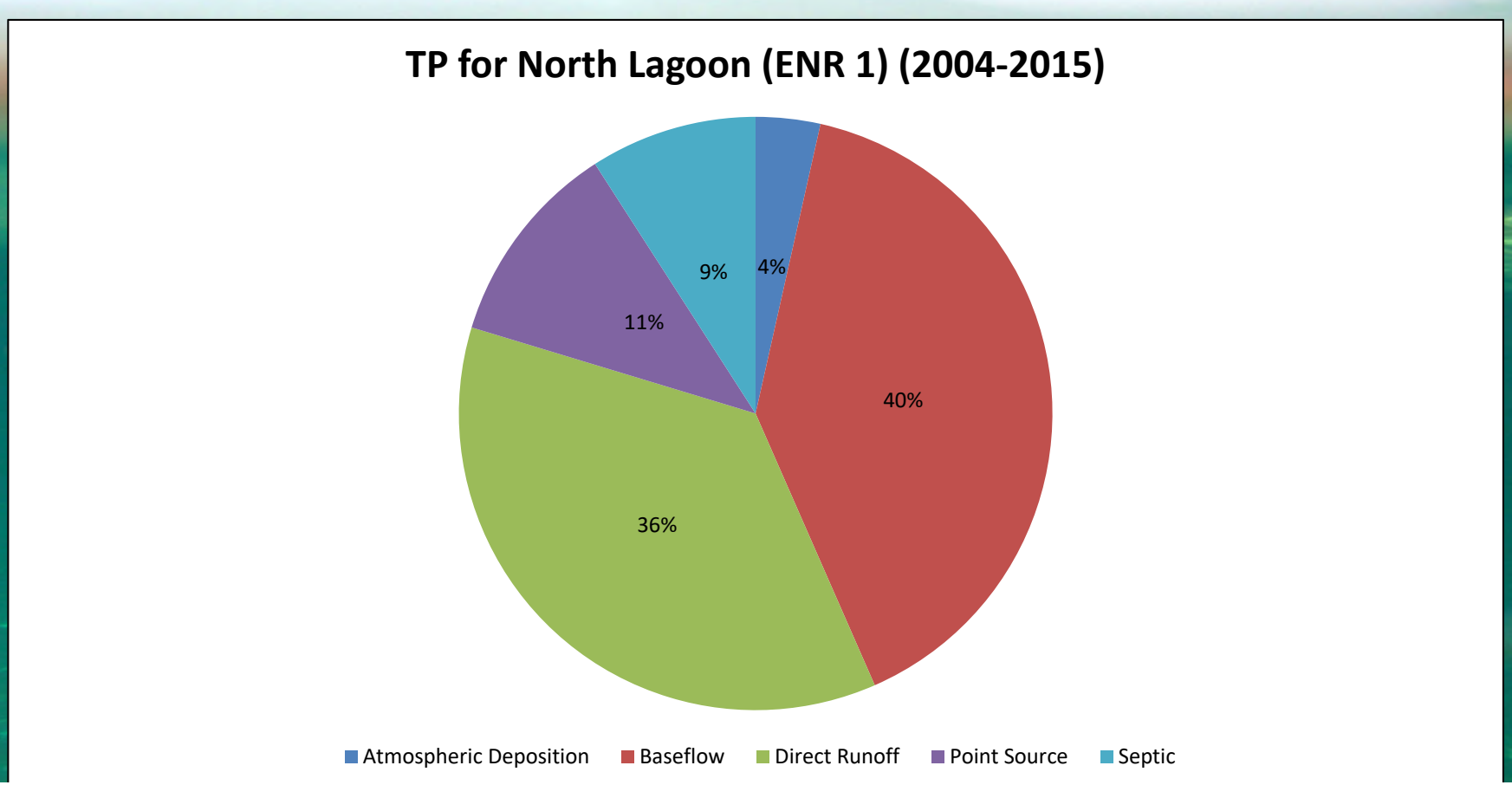
North ENR Total Volume Results



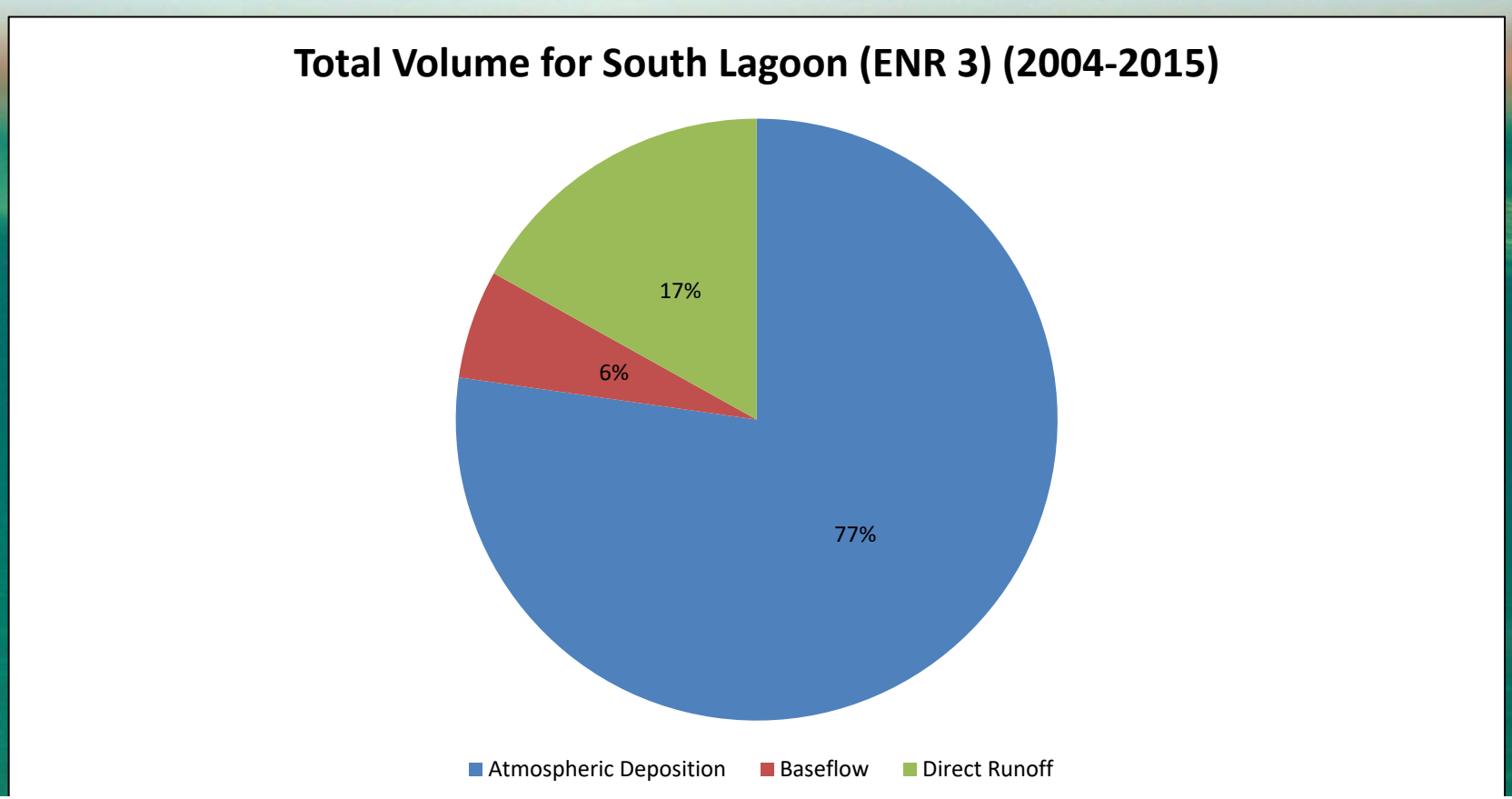
North ENR Total Nitrogen Results



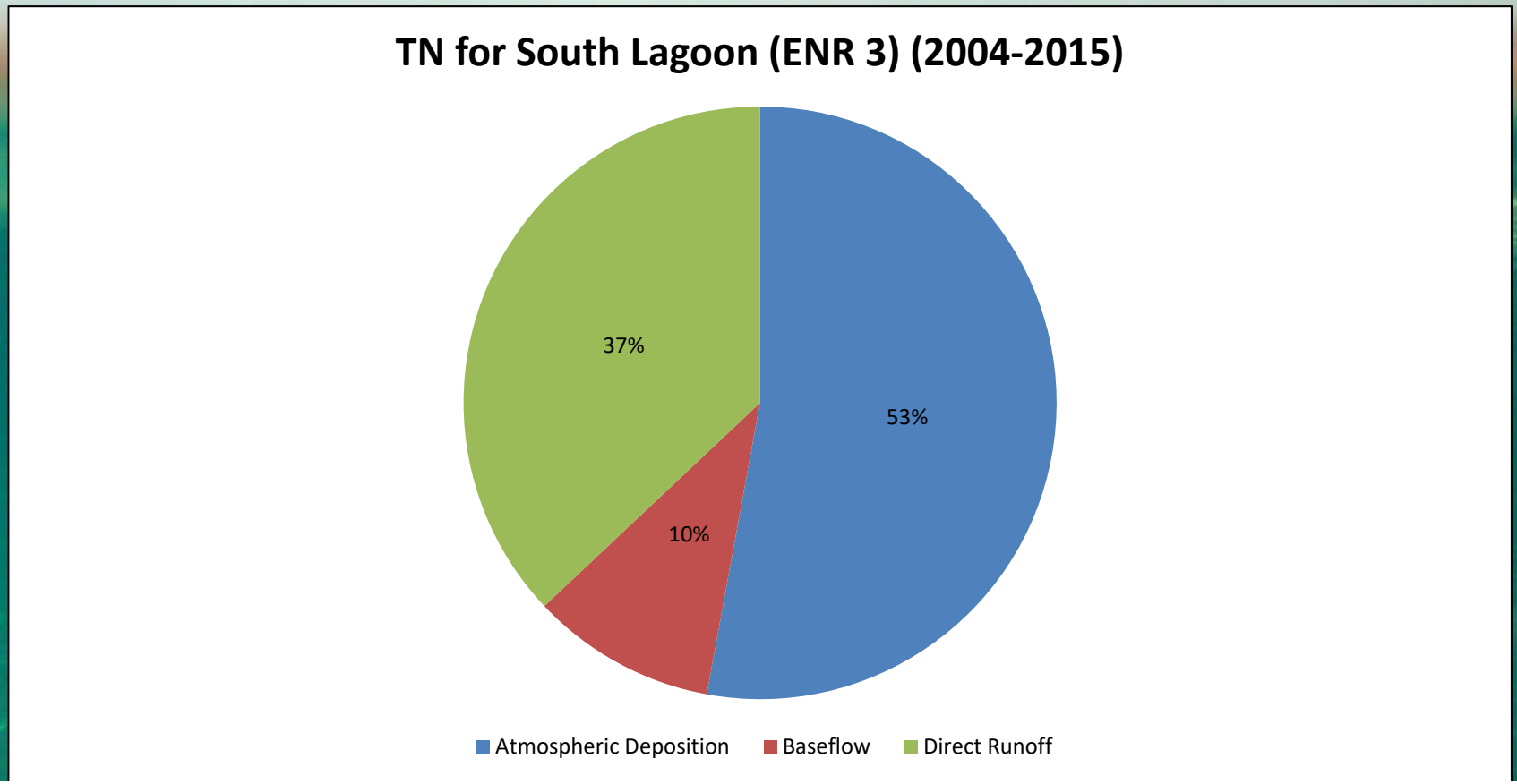
North ENR Total Phosphorus Results



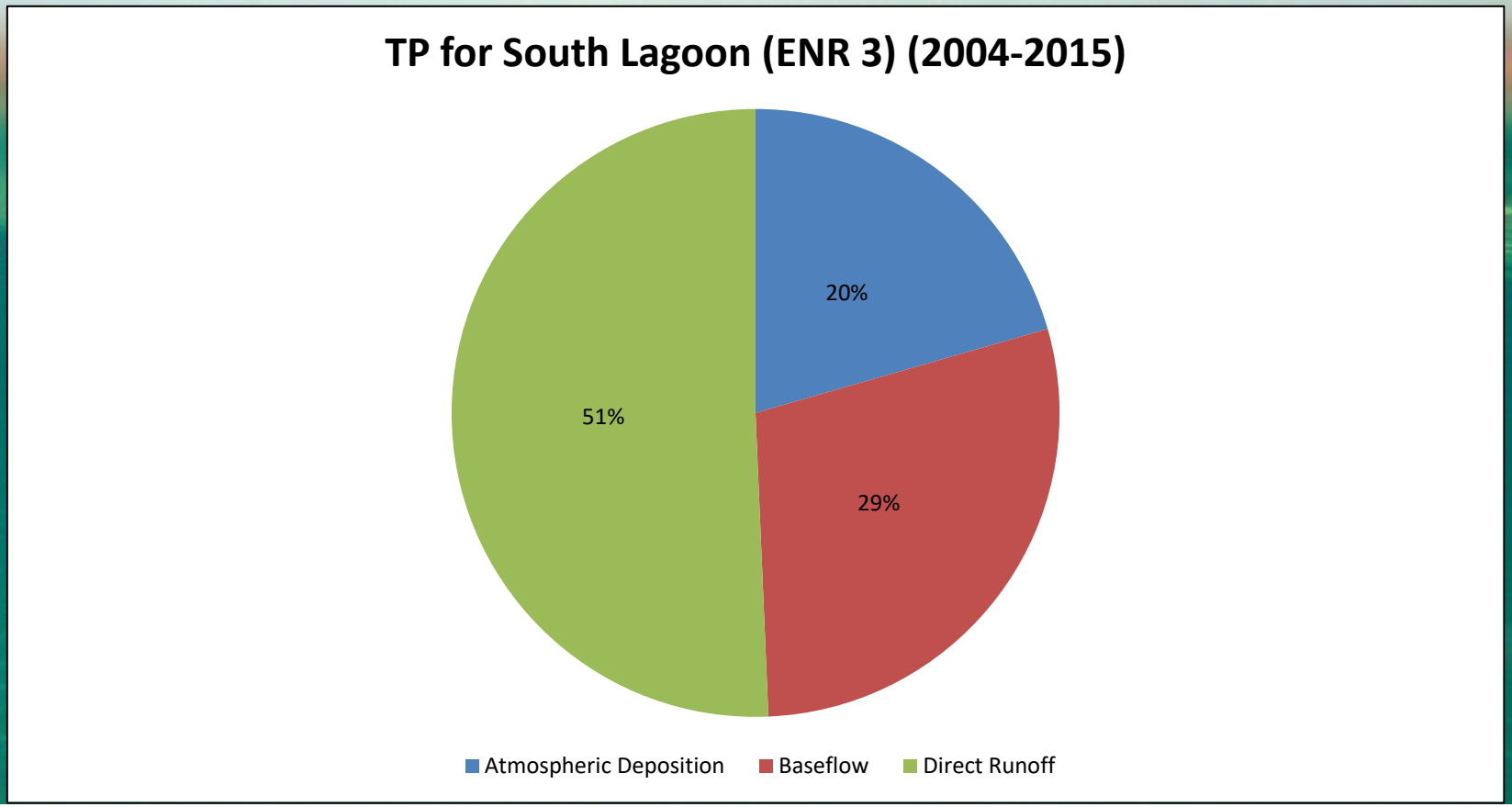
South ENR Total Volume Results



South ENR Total Nitrogen Results



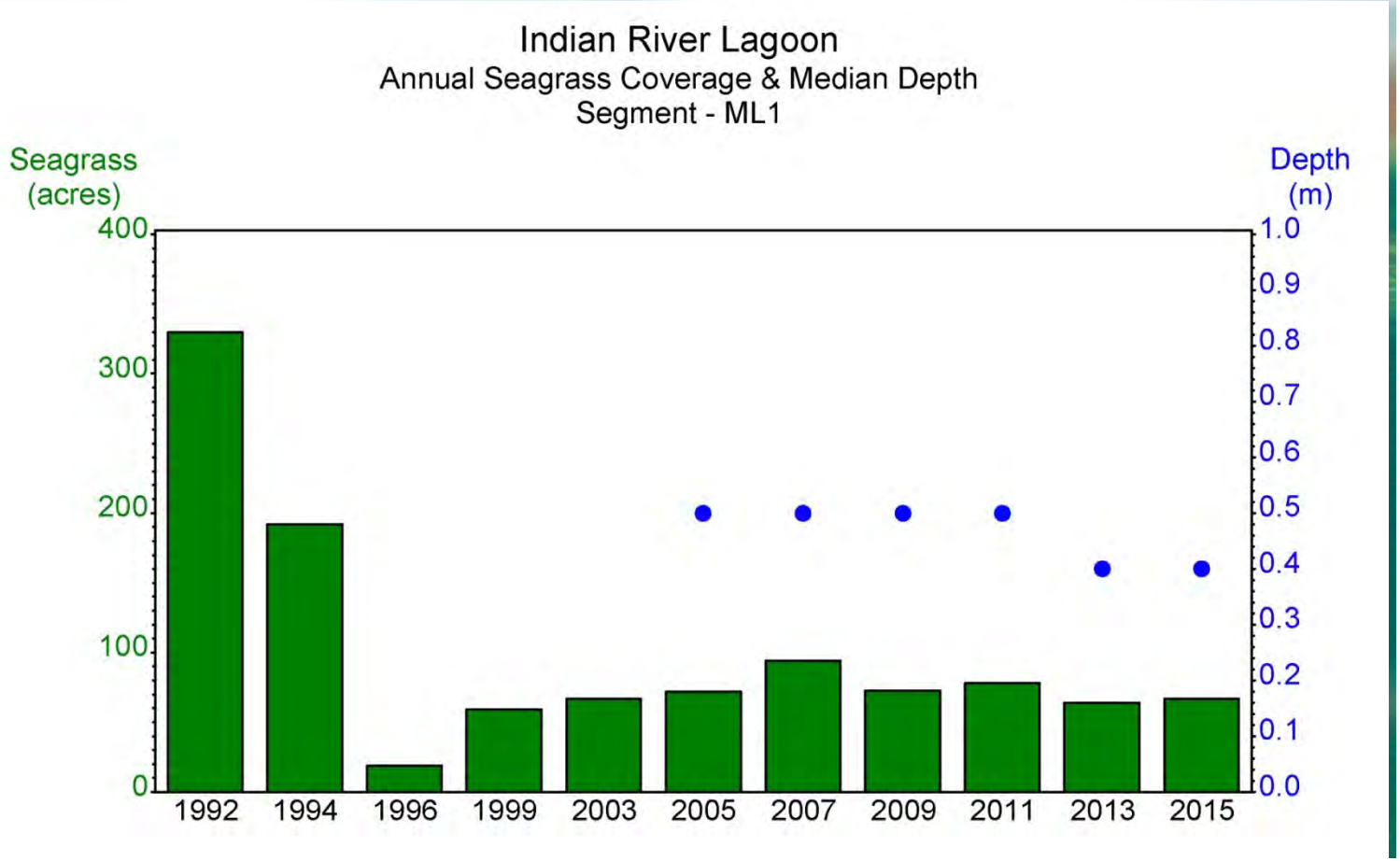
South ENR Total Phosphorus Results



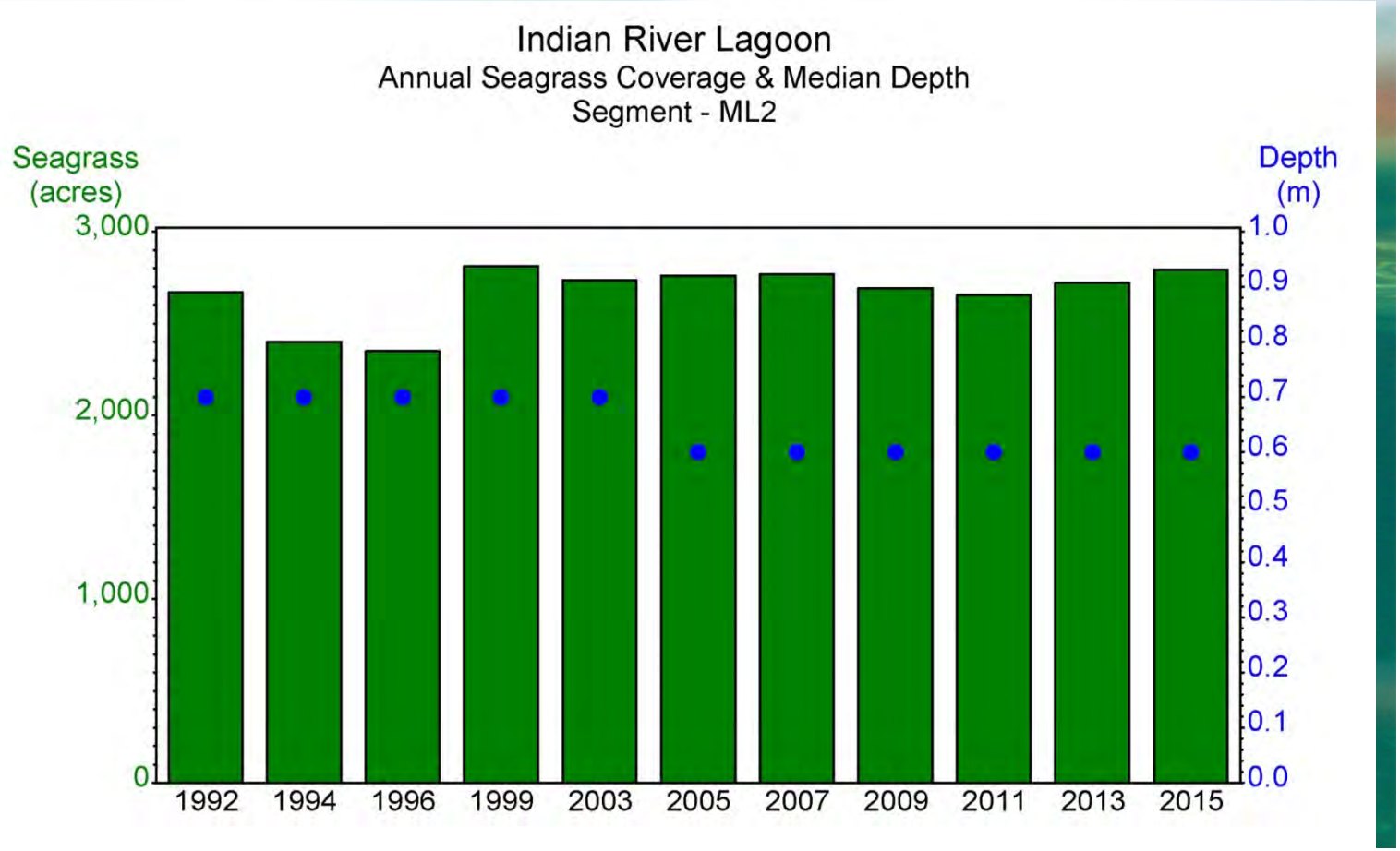
Mosquito Lagoon RAP

- Seagrasses
- NNC – water quality targets
- Stressor-response relationships
- Loading targets

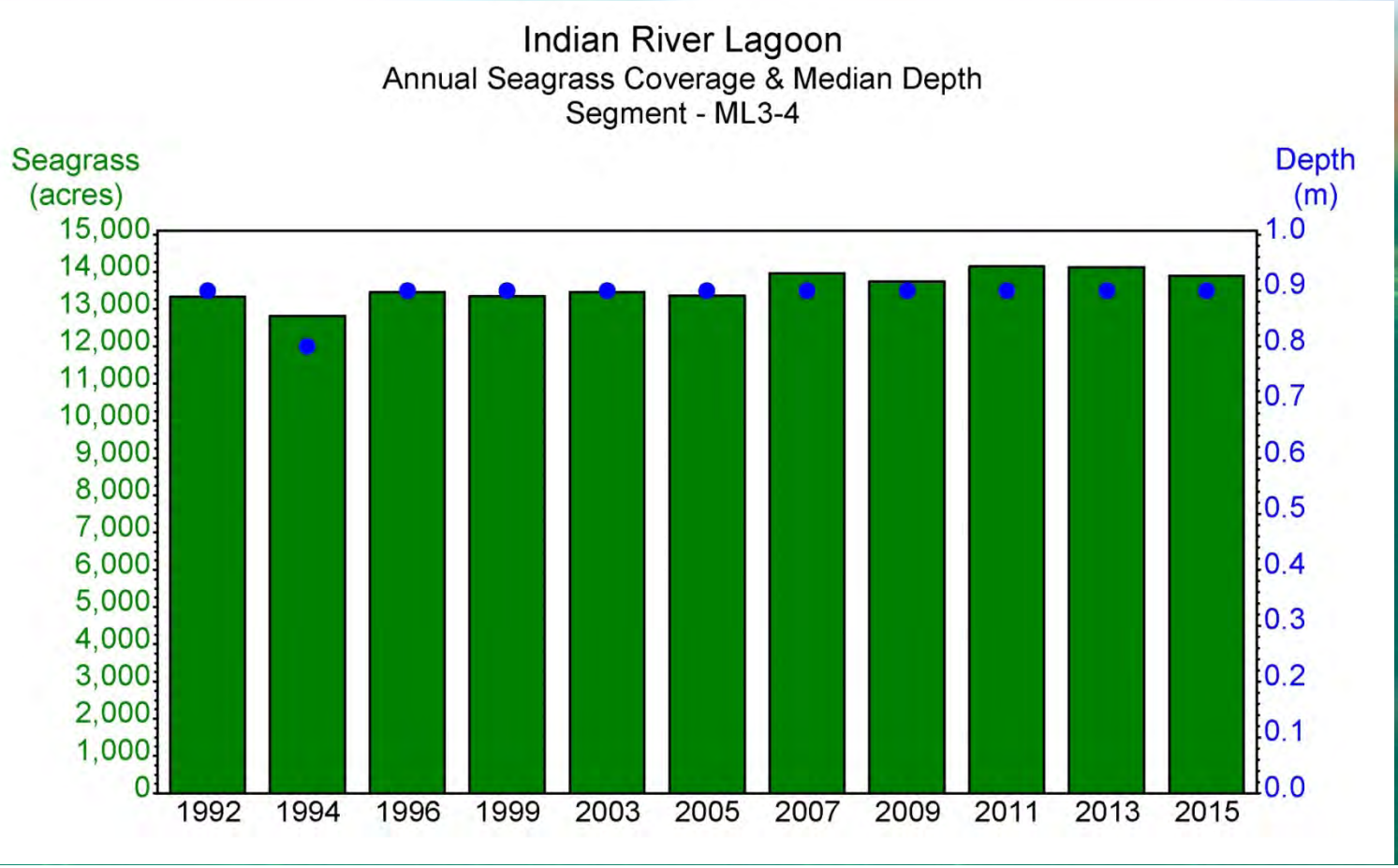
Seagrass


Indian River Lagoon
Annual Seagrass Coverage & Median Depth
Segment - ML1
Seagrass (acres)
Depth (m)
400
300
200
100
0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1992
1994
1996
1999
2003
2005
2007
2009
2011
2013
2015

Seagrass


Indian River Lagoon
Annual Seagrass Coverage & Median Depth
Segment - ML2
Seagrass (acres)
Depth (m)
3,000
2,000
1,000
0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1992
1994
1996
1999
2003
2005
2007
2009
2011
2013
2015

Seagrass


Indian River Lagoon
Annual Seagrass Coverage & Median Depth
Segment - ML3-4
Seagrass (acres)
Depth (m)
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1992
1994
1996
1999
2003
2005
2007
2009
2011
2013
2015

Water Quality Targets

- Establishment of water quality criteria that protect critical aquatic resources is a necessary element of the Reasonable Assurance Plan

Water Quality Targets

- Reasonable Assurance Plan provides focus for the management actions to restore and protect Mosquito Lagoon
- Important to neither fall short of the actions necessary to protect the Lagoon nor to exceed those actions adequate to protect the Lagoon
- Best science

Water Quality Targets

- In 2014, FDEP set criteria built on preliminary data analysis by the St. Johns River Water Management District (2010)
- Used a reference period of 2004-2008
- Did not include any data beyond 2008

Water Quality Targets

- Water quality targets in estuaries typically based on the protection of seagrasses and other aquatic life
- Seagrass health depends upon adequate light
- Water clarity driven by ambient water quality conditions including chlorophyll and nutrient concentrations

Water Quality Targets

- District seagrass show seagrasses were similar throughout the period 1992-2015 and were not exceptionally greater during the 2004-2008

- Based on the seagrass data a reference period of 1992-2010, which is more representative of long-term meteorological conditions, has been proposed.

Water Quality Targets

- Using the methodology used by FDEP in 2014, revised criteria have been proposed for TN, TP and chlorophyll

- The proposed targets have been reviewed by FDEP and will require acceptance by both FDEP and EPA.

Water Quality Targets

Comparison of current and proposed water quality targets

Estuarine Nutrient Region	Parameter	FDEP (2014)	Proposed
North	TN (mg/L)	0.51	0.65
	TP (mg/L)	0.05	0.06
	Chlorophyll a (µg/L)	4.0	4.9
Central	TN (mg/L)	0.65	0.85
	TP (mg/L)	0.05	0.06
	Chlorophyll a (µg/L)	3.4	5.0
South	TN (mg/L)	1.14	1.31
	TP (mg/L)	0.03	0.05
	Chlorophyll a (µg/L)	2.5	5.2

Loading Targets

- A primary objective in establishing a Reasonable Assurance Plan is to define the nutrient loading targets that are needed to restore and protect estuarine health

Loading Targets

- Definition of nutrient loading targets generally follows one of three alternative approaches
  - Empirical Modeling
  - Mechanistic Modeling
  - Reference Period

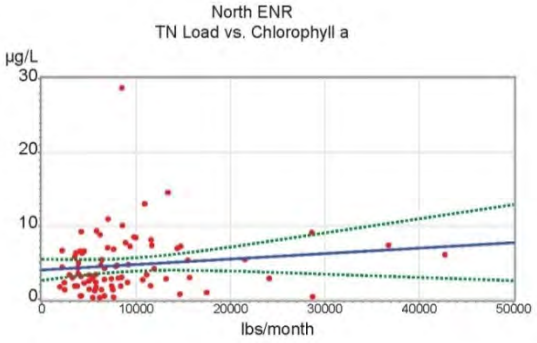
Loading Targets

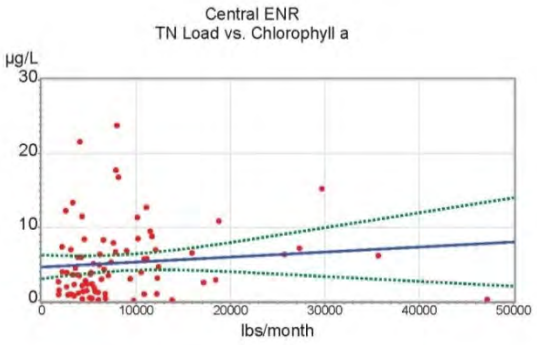
- Series of empirical relationships were examined using the available ambient water quality data and nutrient loading estimates
- Applied statistical techniques to define the relationships quantitatively for multiple temporal and spatial scales
- Confounding factors

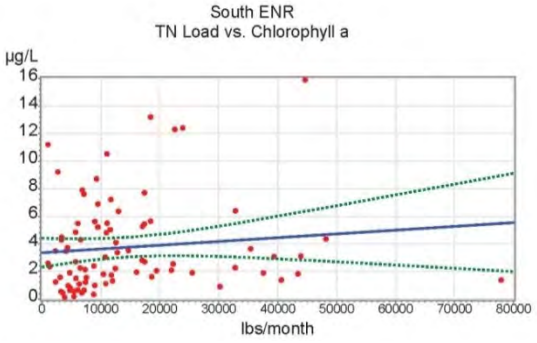
Loading Targets

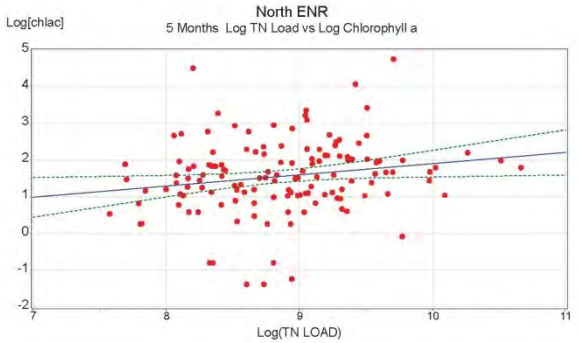
- Factors examined include:
  - Nutrient (TN and TP) concentrations
  - Nutrient (TN and TP) loadings
  - Lag effects of nutrient loading
  - Effects of residence time
  - Effects of fluxes

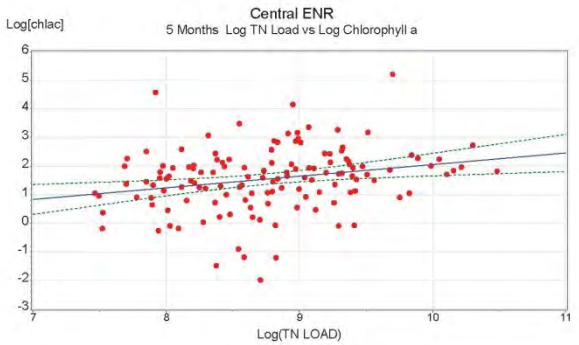
Empirical Modeling

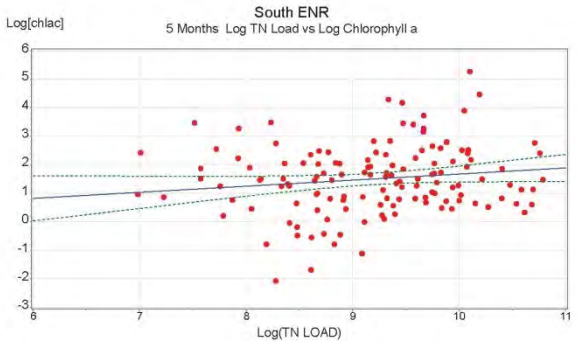




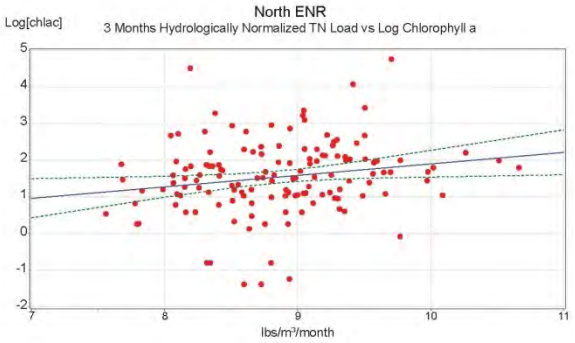


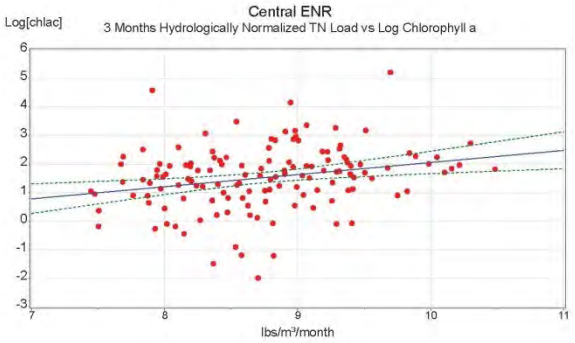


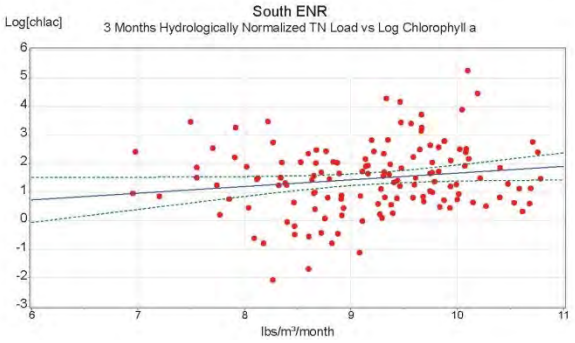


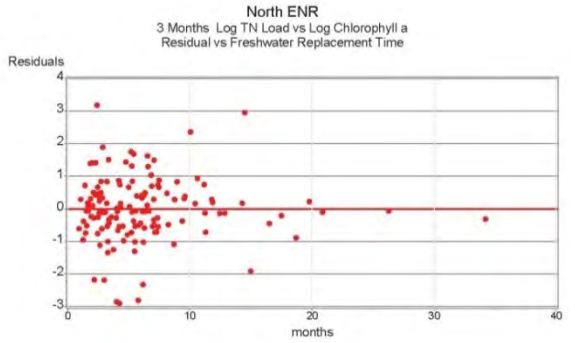


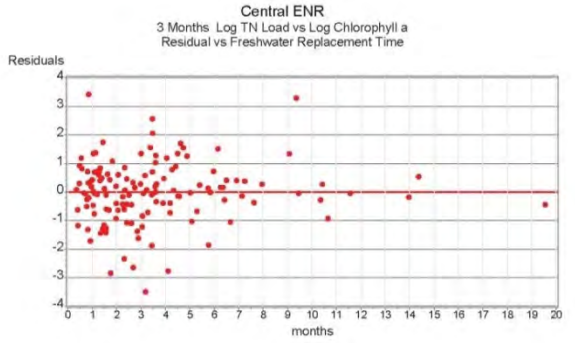
Empirical Modeling

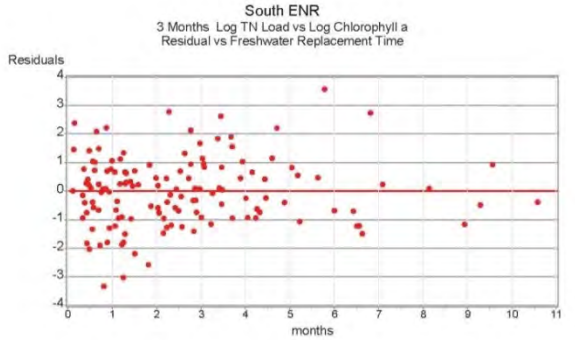




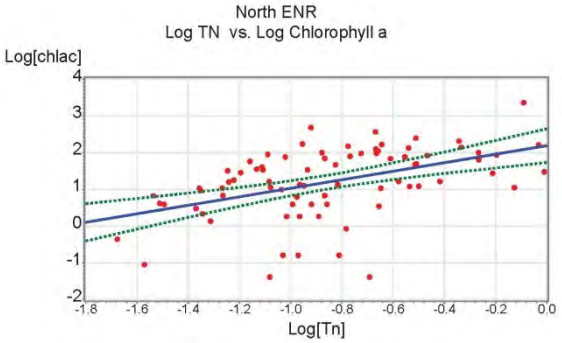


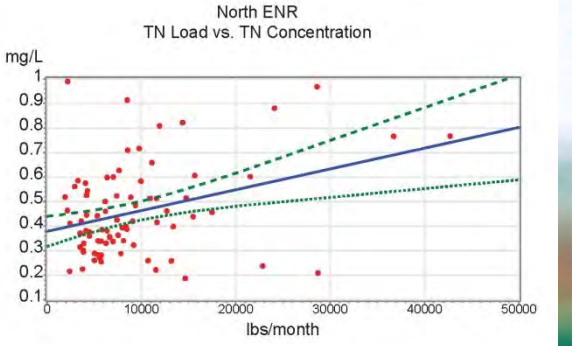


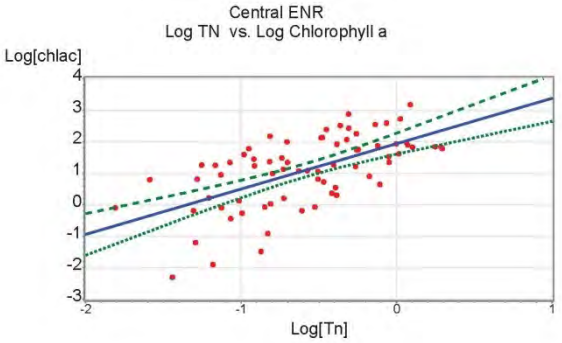


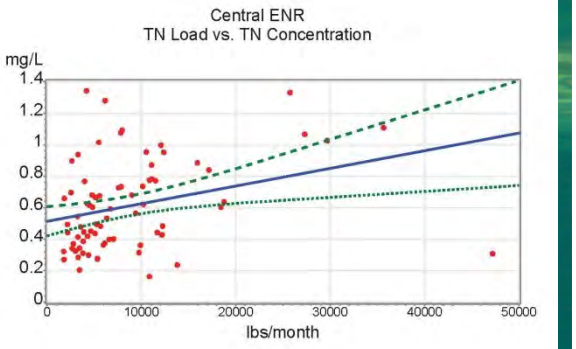


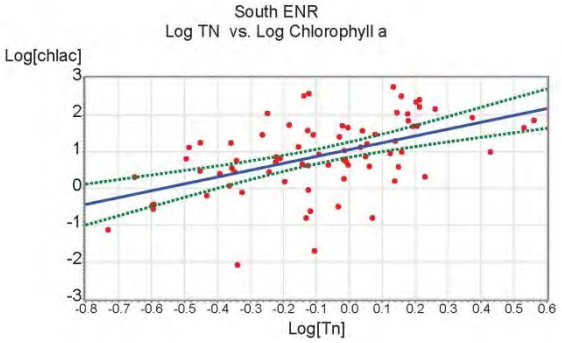
Empirical Modeling

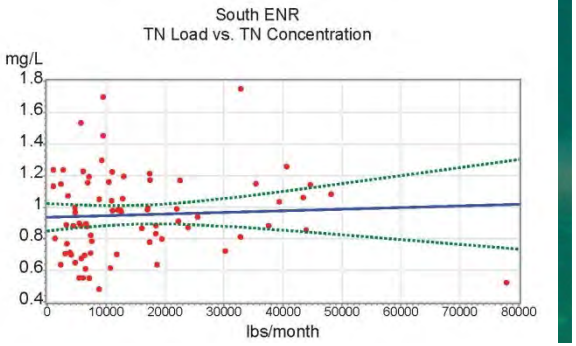












Empirical Modeling Conclusions

- No significant quantitative relationships between ambient water quality and nutrient loads were found
- It should not be inferred that chlorophyll is not dependent upon nutrient conditions
- Therefore, an alternative approach is needed to define nutrient loading targets

Other Approaches to Define Nutrient Loading Targets

- Current efforts to develop a mechanistic model building upon the existing EFDC hydrodynamic model are underway by the SJRWMD

- Given the complexity of Mosquito Lagoon this tool may be what is necessary to define the relationships between ambient water quality and nutrient loads

Other Approaches to Define Nutrient Loading Targets

- However, the timing of the availability of the model is uncertain
- Therefore, the Reference Period approach, i.e., the third commonly used alternative approach to establishing nutrient loading targets is recommended

Reference Period Approach

- A reference period approach was used to establish the current NNCs for Mosquito Lagoon
- That reference period was defined as 2004-2008
- Examine the nutrient loading for that period and compare to other potential reference periods

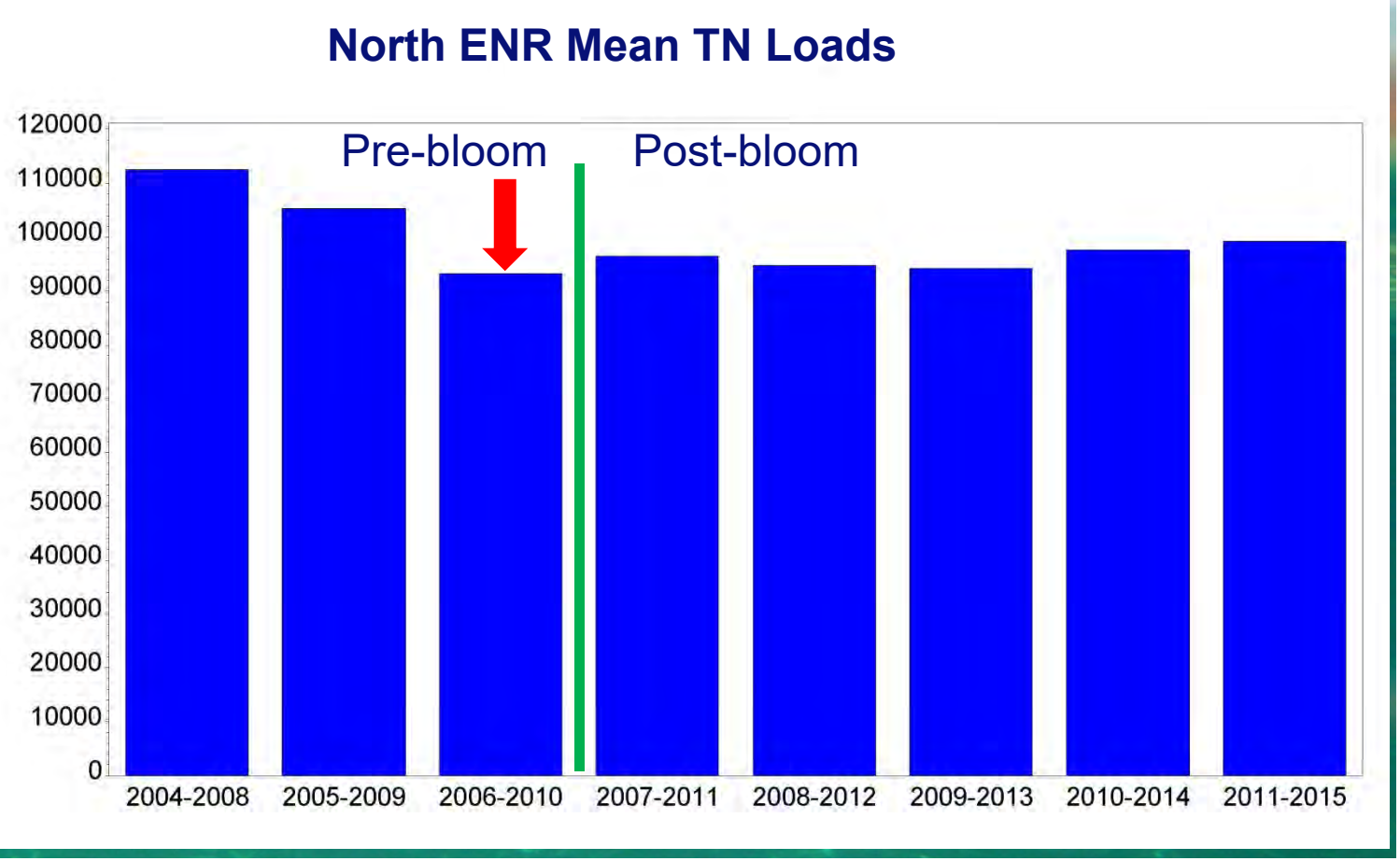
Reference Period Approach

- However, the timing of the availability of the model is uncertain
- Therefore, the Reference Period approach, i.e., the third commonly used alternative approach to establishing nutrient loading targets is recommended

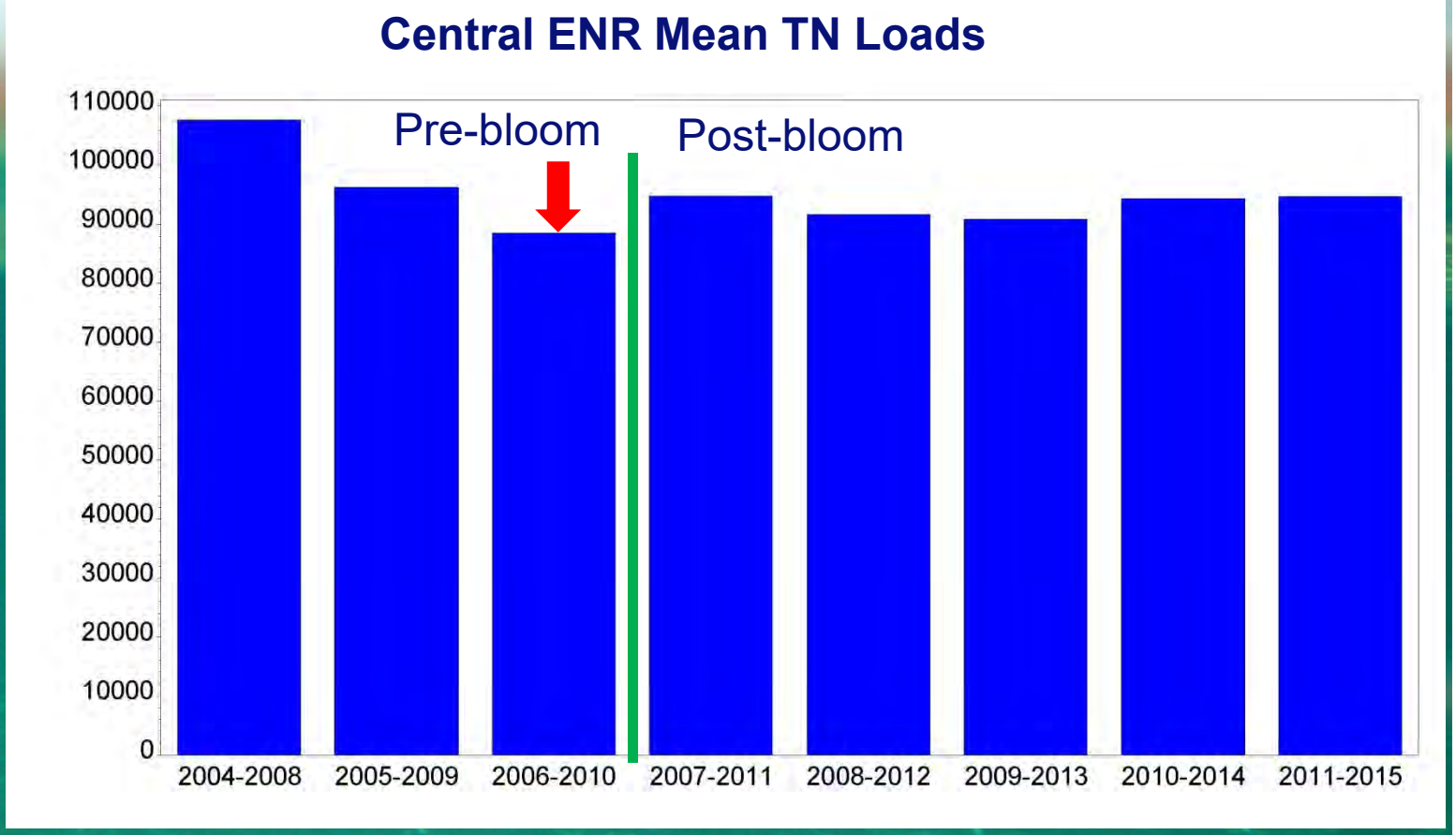
Reference Period Approach

- Four criteria:
  - Conservative, i.e., protective
  - Avoids the bloom period
  - Is not biased by excessively high or low rainfall
  - If possible, be reflective of management actions that have already been achieved

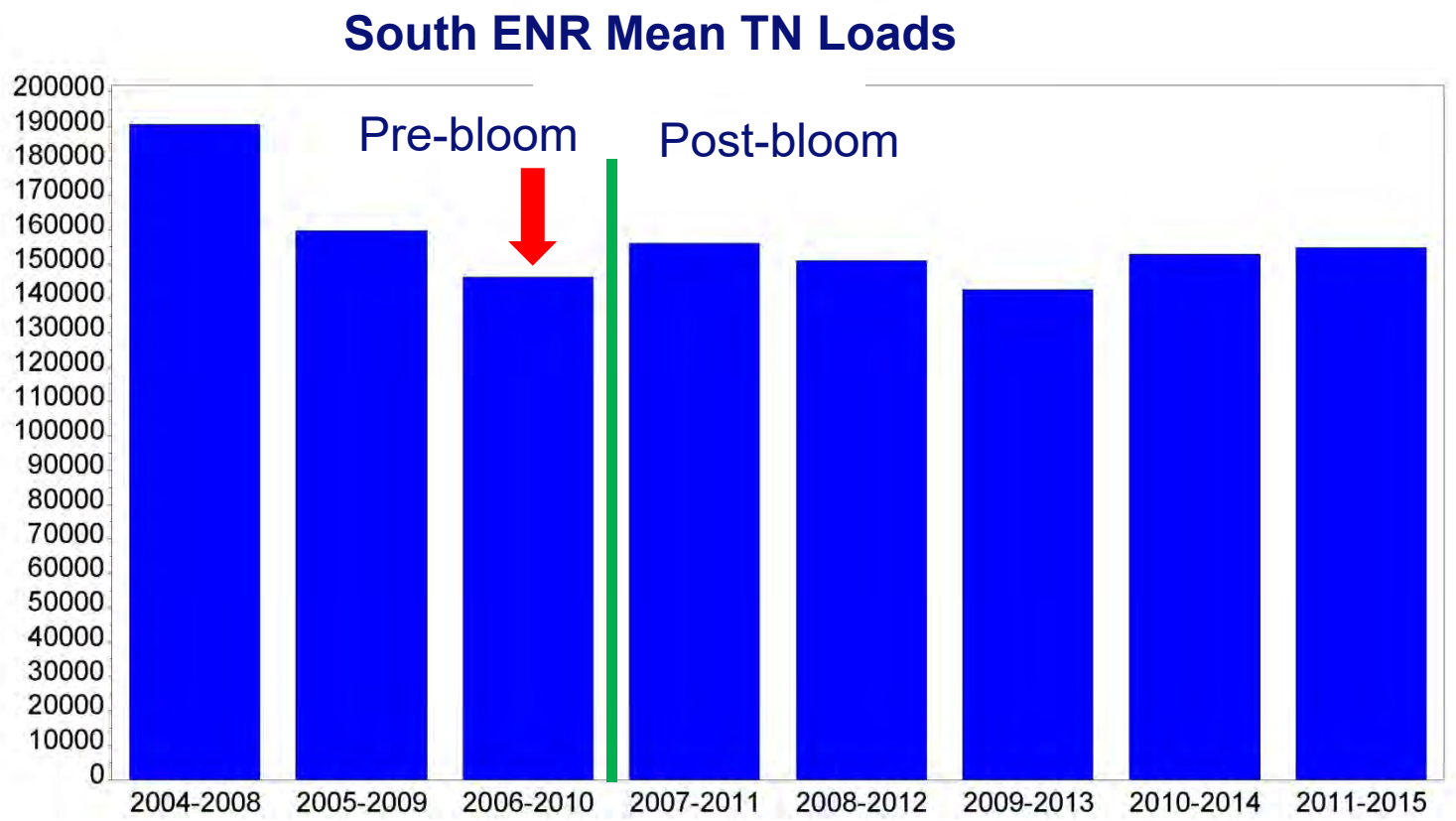
Reference Period Approach



Reference Period Approach



Reference Period Approach



Proposed Nutrient Loading Targets (lbs/year)

TN Loads			
ENR	Baseline	Target	% Reduction
North	110,059	93,328	15
Central	102,905	88,557	14
South	173,125	146,245	16

Proposed Nutrient Loading Targets (lbs/year)

TP Loads			
ENR	Baseline	Target	% Reduction
North	12,370	10,538	15
Central	8,000	7,343	8
South	8,314	7,492	10

Treatable Loads

- Total nutrient loads are the sum of:
  - Runoff
  - Baseflow
  - OSDS
  - Point Sources
  - Atmospheric Deposition
- Need to translate the % load reduction in terms of the portion of the total nutrient loads that can be treated locally as part of the RAP

Proposed Nutrient Loading Targets (lbs/year)

Treatable TN Loads			
ENR	Mean 2006-2010	% Reduction	Load Reduction
North	77,096	15	11,564
Central	7,520	14	7,520
South	77,441	16	12,391

Proposed Nutrient Loading Targets (lbs/year)

Treatable TP Loads			
ENR	Mean 2006-2010	% Reduction	Load Reduction
North	10,195	15	1,529
Central	6,620	8	530
South	6,125	10	613

Mosquito Lagoon RAP Project Options and Steps Forward

Florida Stormwater Association

Winter 2017 Meeting

6 December 2017

Retrofit Sizing

- Unit costs can be much lower based on knee of curve
- Beyond the knee may better than next best option
- Often site-constrained

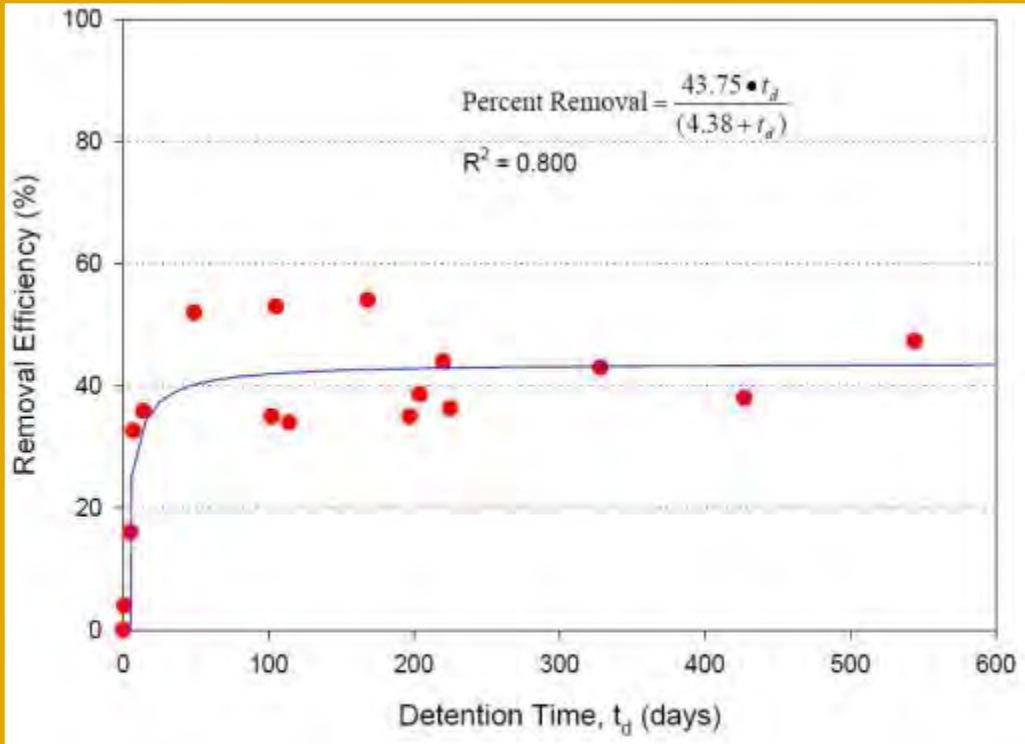
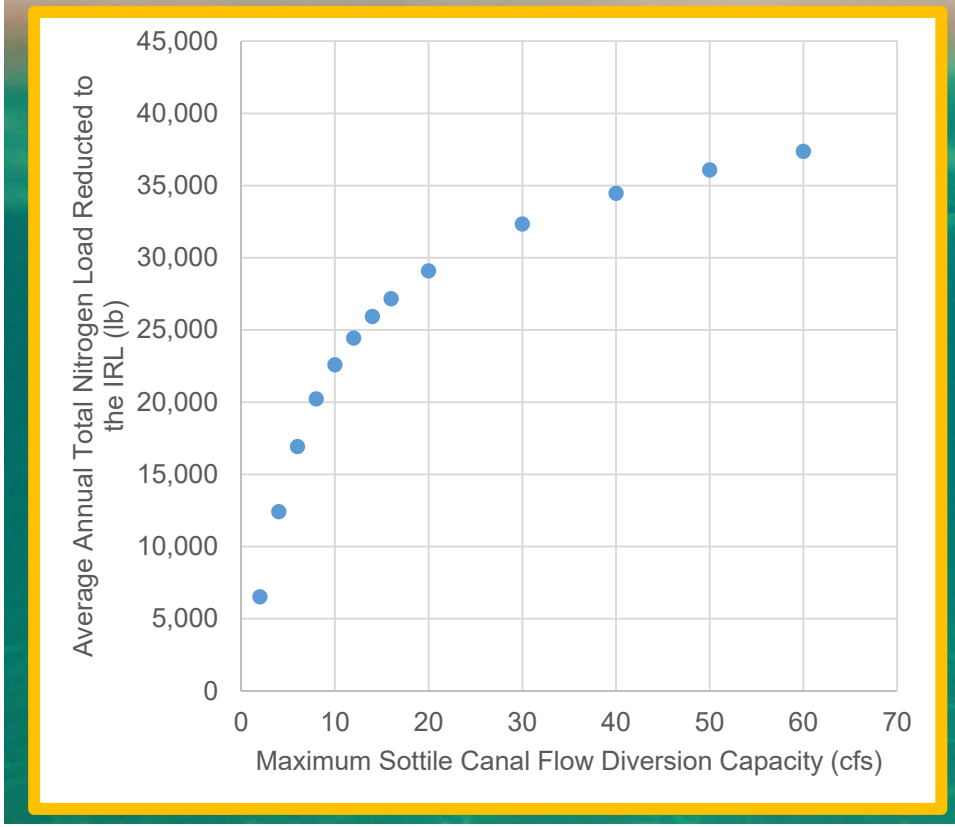
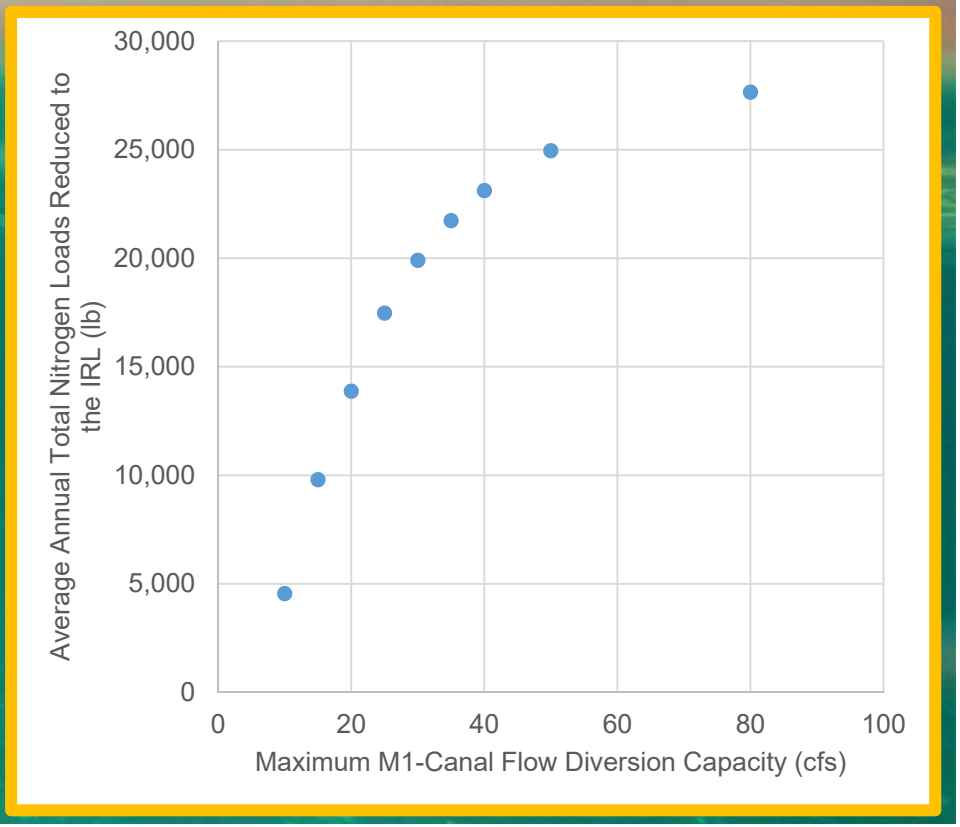


Figure 5-10. Removal Efficiency of Total Nitrogen in Wet Detention Ponds as a Function of Residence Time.

Retrofit Sizing



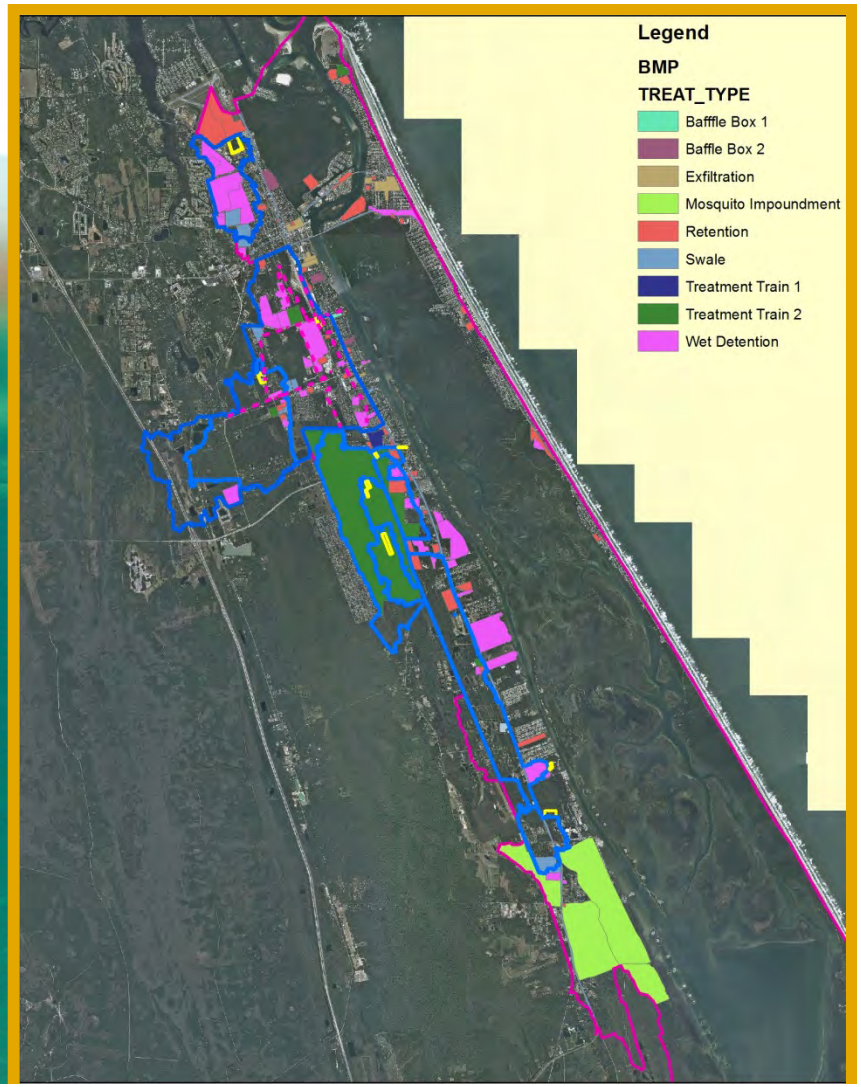


Life-Cycle Costing

- Capital costs ÷ Annual load reductions projected over economic life ($/lb)
- Annual O&M costs ÷ Annual load reductions ($/lb)
- Capital + O&M ($/lb)

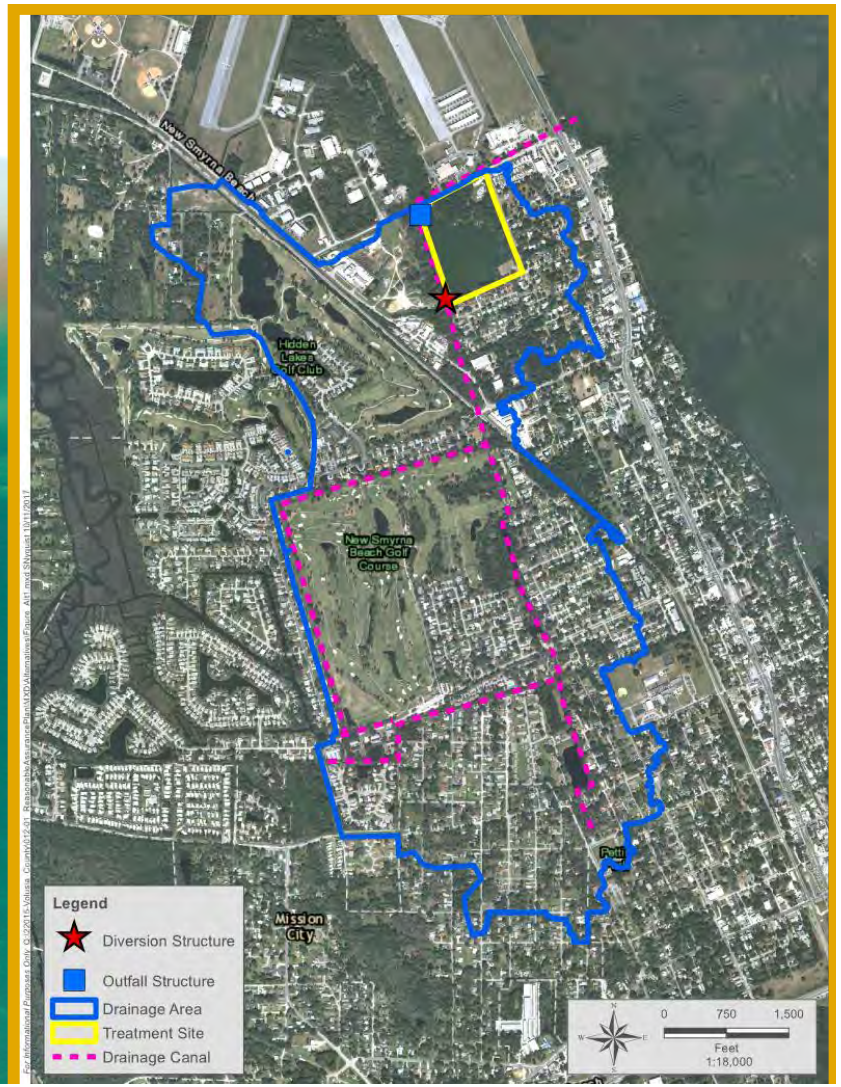
Project Options Overview

- Large Treatment Areas
  - Economies of Scale
- Untreated Areas
- Spread Across Stakeholders
- Flexibility
- Lowest Life-Cycle Costs
- 31,500 lb/yr TN



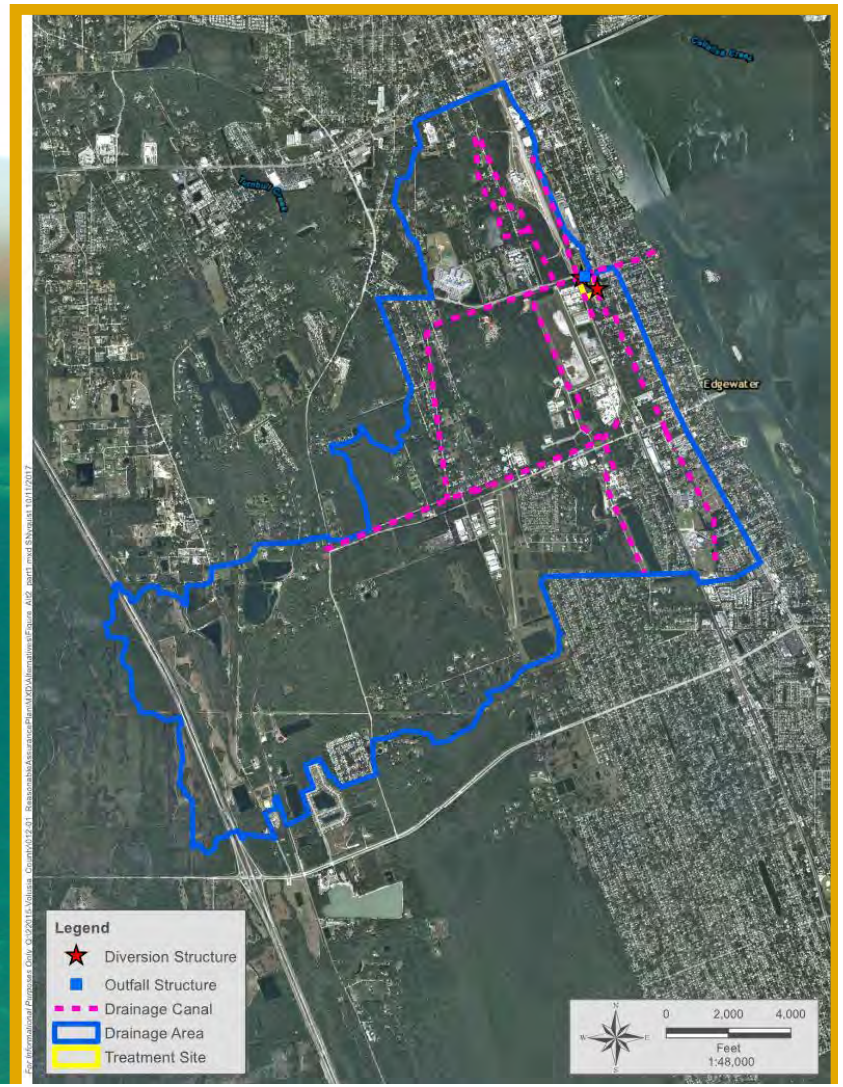
Option 1: Diversion to Borrow Pit South

- Avoids Large Excavation
- FAA Concerns
- Base Flow and Runoff
- Treats 640 acres
- 1,300 lb/yr TN
- $20/lb TN



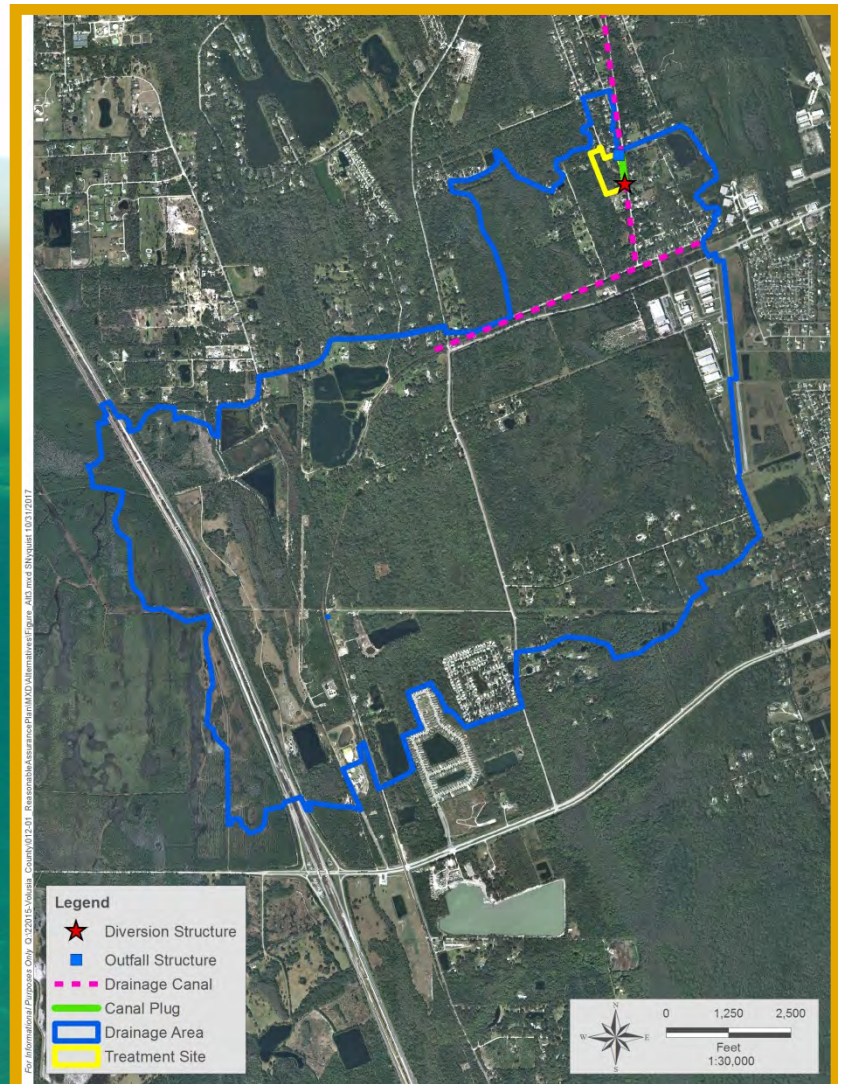
Option 2: 10th Street Treatment Facility

- Part of a Larger Project
- Base Flow and Runoff
- Treats 4,600 acres
- 5,600 lb/yr TN
- $20/lb TN



Option 3: Elizabeth Street Treatment Facility

- Fall back to Option 2
- Expansion of Previous Design
- Treats 2,300 acres
- 4,300 lb/yr TN
- Base Flow and Runoff
- $20/lb TN

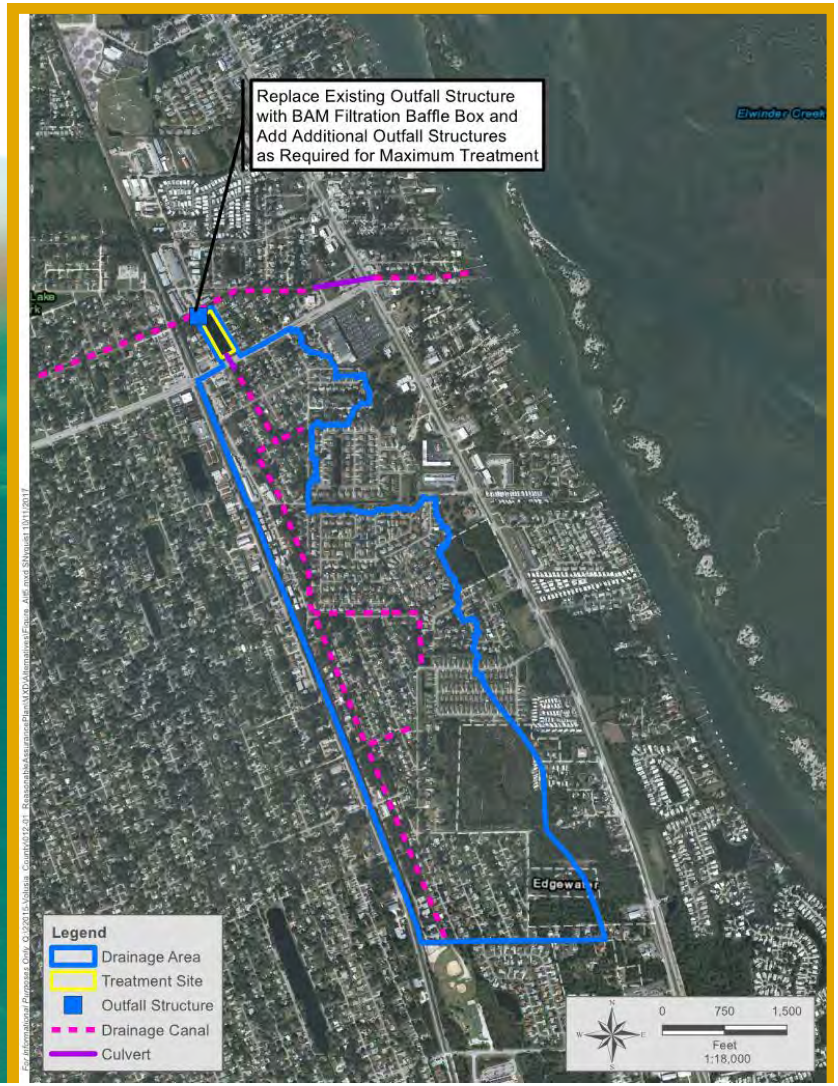


Option 4: East Indian River Boulevard Bioreactor

- Existing Swale and Wet Detention Treatment
- Treats 2,200 acres
- Mostly Base Flow
- Pumped System
- 3,900 lb/yr TN
- $50/lb TN

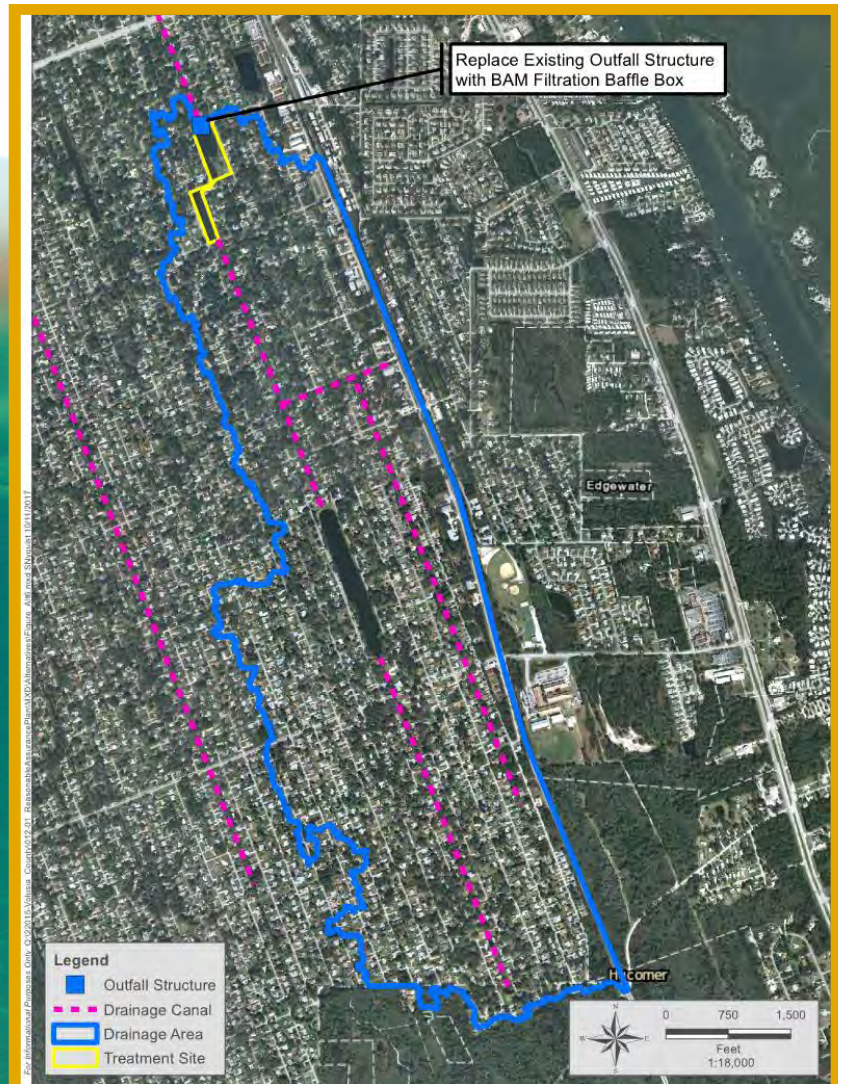
Option 5: Fern Palm Drive BAM Outfall

- Wet Detention Outfall Retrofit
- Part of Option 4 Fallback
- Treats 175 acres
- Base Flow and Runoff
- 630 lb/yr TN
- $35/lb TN



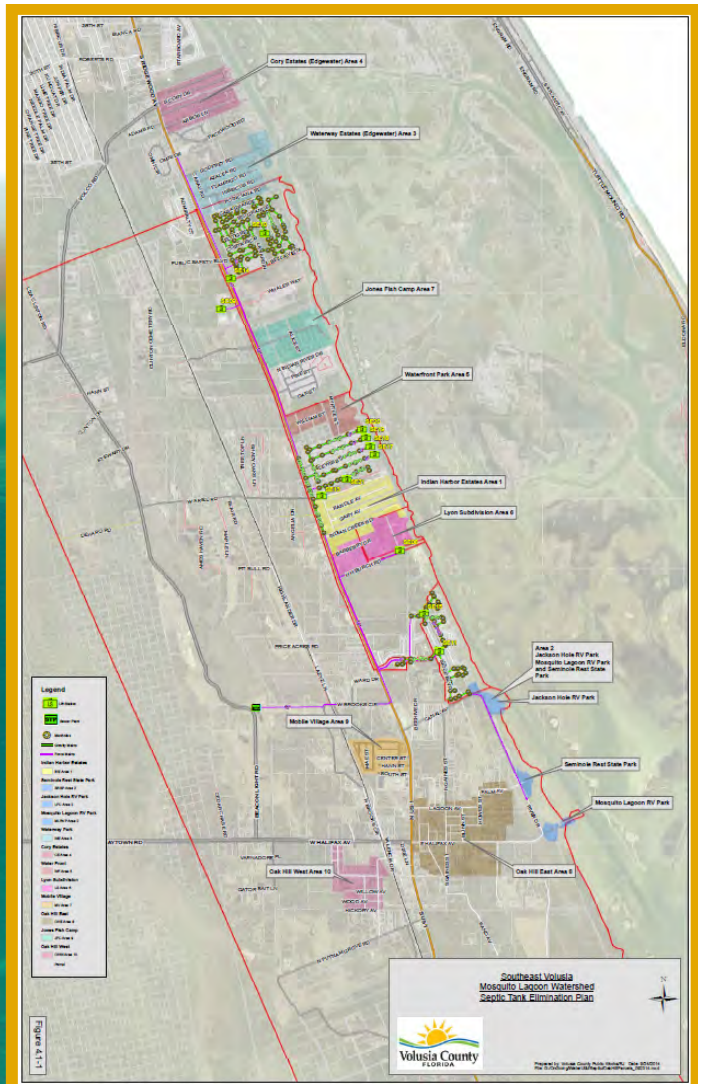
Options 6 and 7

- Similar to Option 5



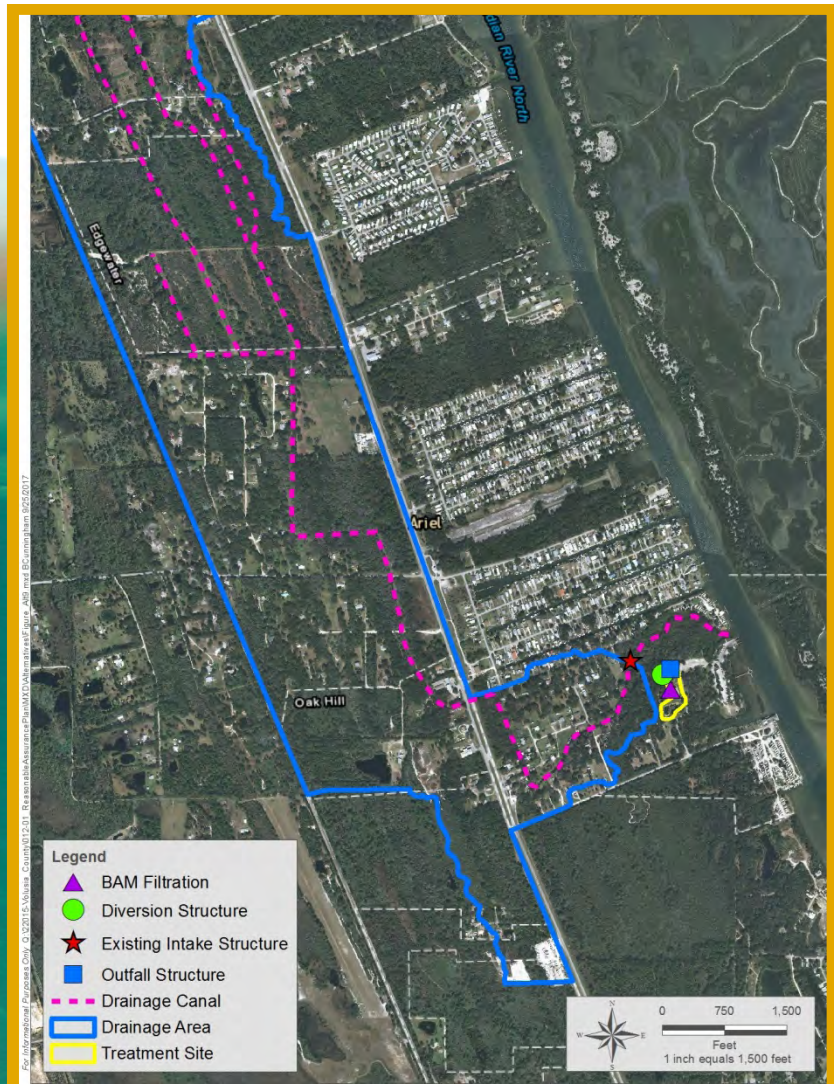
Option 8: Septic to Sewer

- 15 to 25 lb/yr TN for Close Proximity to Waterbody
- $900-$1,500/lb/yr TN w/no WWTP Upgrades
- Large Stormwater Projects ~$500 lb/yr TN
- 1000s of lb/yr TN
- Tied to Funding



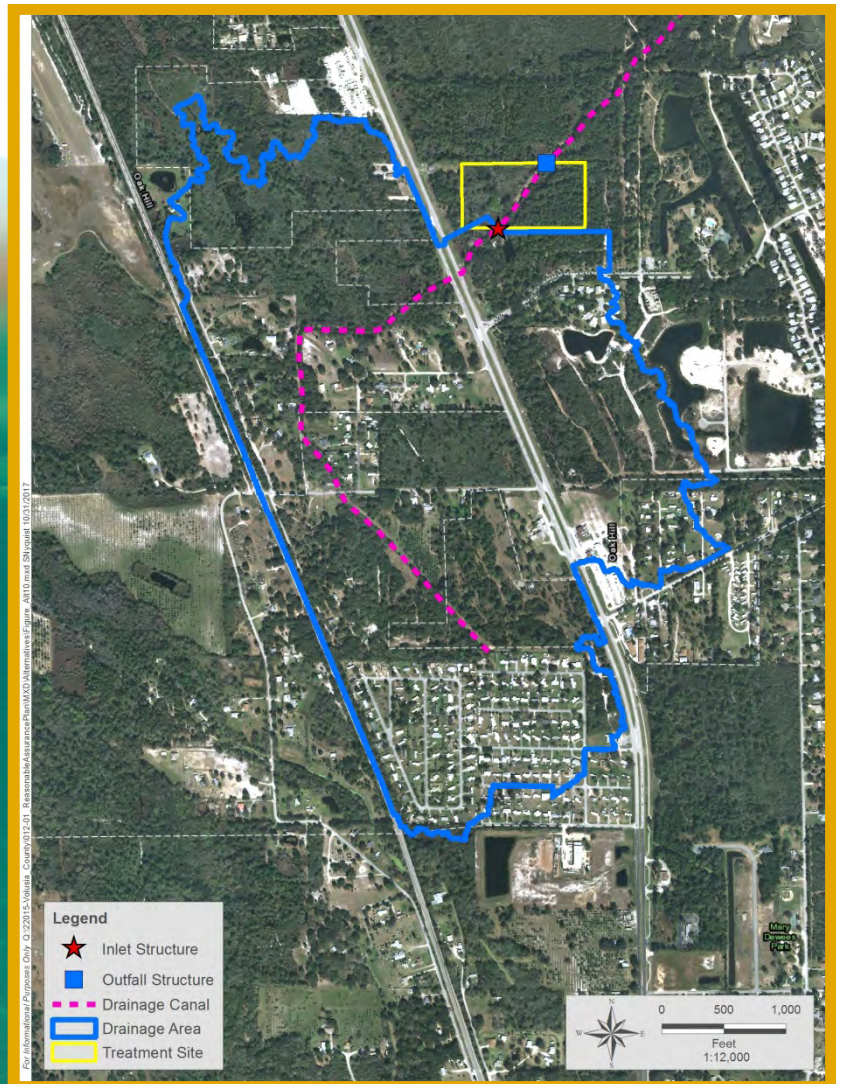
Option 9: Aerial Canal Water Quality Improvement

- Retrofit of a Retrofit
- BAM Outfall
- Treats 1,500 Acres
- 1,300 lb/yr TN
- $90 lb/yr TN



Option 10: Lighthouse Cove Treatment Facility

- Base Flow and Runoff
- Treats 420 acres
- 760 lb/yr TN
- $80/lb TN



Option 11:
Dragline Ditch Restoration

- Reviewed >>50 research papers
- Proposed: Difference between bare and vegetated denitrification rates
- Need site-specific research
- 1,300-acre restoration could be 13,000 lb/yr TN reduction

Option 12: Reduced Flux from North IRL

- TBD

Option 13:
Programmatic Changes

- 3% Current Reduction: 2,100 lb/yr TN
  - 1% for DOT
- 6% Reduction w/FYN: 4,100 lb/yr TN

Management Actions

- Large stormwater projects and progammatic solutions will account for 54% of the needed load reductions
- Select septic to sewer will likely be needed long-term
- Dragline ditch restoration could be significant
- Smaller projects will contribute to the solution

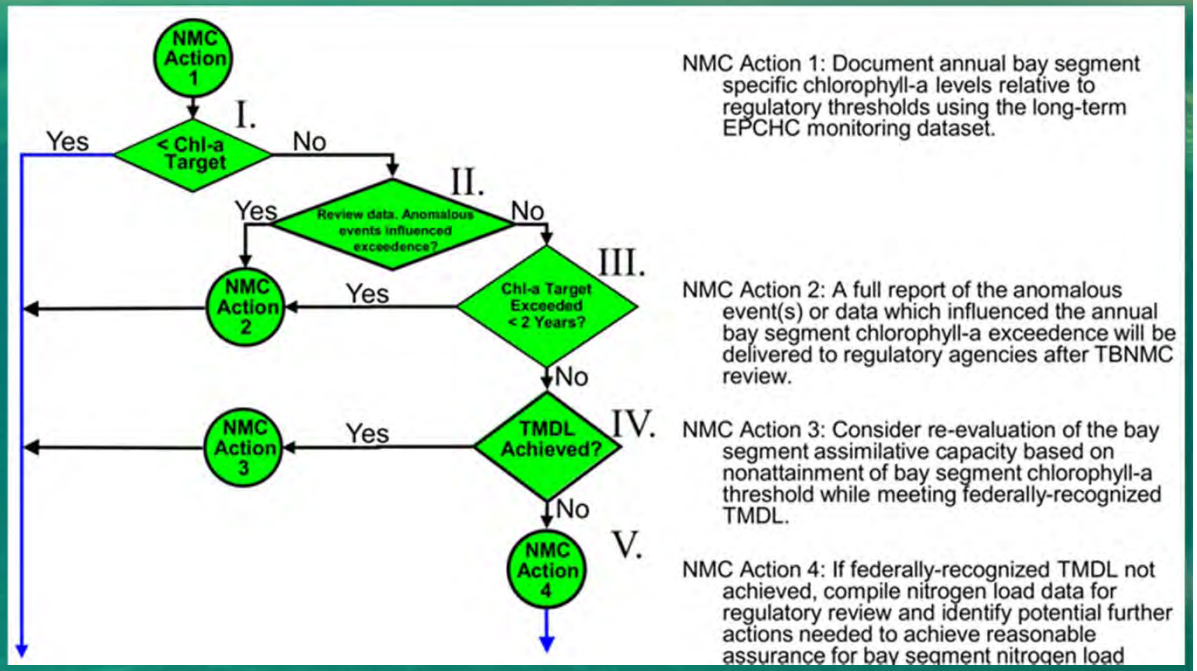
Monitoring Compliance and Reporting

- Annual
  - Ambient water quality monitoring
- 5-Year Updates
  - Nutrient loading
  - Seagrass
  - Project Tracking
  - Progress in existing projects
  - Identification of new projects

Year	Old Tampa Bay	Hillsbor-ough Bay	Middle Tampa Bay	Lower Tampa Bay
1974	No	No	No	Yes
1975	No	No	No	Yes
1976	No	No	No	Yes
1977	No	No	No	No
1978	No	No	No	Yes
1979	No	No	No	No
1980	No	No	No	No
1981	No	No	No	No
1982	No	No	No	No
1983	No	No	No	No
1984	Yes	Yes	No	Yes
1985	No	No	No	Yes
1986	No	No	Yes	Yes
1987	No	Yes	No	Yes
1988	Yes	Yes	Yes	Yes
1989	No	Yes	Yes	Yes
1990	No	Yes	Yes	Yes
1991	Yes	Yes	Yes	Yes
1992	Yes	Yes	Yes	Yes
1993	Yes	Yes	Yes	Yes
1994	No	No	No	No
1995	No	No	No	Yes
1996	Yes	Yes	Yes	Yes
1997	Yes	Yes	Yes	Yes
1998	No	No	No	No
1999	Yes	Yes	Yes	Yes
2000	Yes	Yes	Yes	Yes
2001	Yes	Yes	Yes	Yes
2002	Yes	Yes	Yes	Yes
2003	No	Yes	Yes	Yes
2004	No	Yes	Yes	Yes
2005	Yes	Yes	Yes	No
2006	Yes	Yes	Yes	Yes
2007	Yes	Yes	Yes	Yes
2008	Yes	Yes	Yes	Yes
2009	No	Yes	Yes	Yes
2010	Yes	Yes	Yes	Yes
2011	No	Yes	Yes	Yes
2012	Yes	Yes	Yes	Yes
2013	Yes	Yes	Yes	Yes
2014	Yes	Yes	Yes	Yes
2015	No	Yes	Yes	Yes
2016	Yes	Yes	Yes	Yes

Adaptive Management

- **Develop a series of "what ifs" and responses**



DISCUSSION

- THANK YOU