



Division of Environmental Assessment and Restoration Water Quality Evaluation and TMDL Program

**Development of Dissolved Oxygen TMDLs:
Townsend Canal (3235L), Long Hammock
Creek (3237B), Lake Hicpochee (3237C), C-
19 Canal (3237E), and S-4 Basin (3246)**

December 17, 2018



AGENDA

- Overview of Florida's TMDL Program
- Draft dissolved oxygen (DO) TMDL for Impaired Waters
- Remaining Schedule for Adopting TMDL
- Public Comment



Water Resources

Florida has:

- Population of ~20 million (US Census Bureau 2014)
 - 98 million tourists a year (Visit Florida Website 2015)
- >1,700 rivers and streams (26,960 miles)
- 44,850 miles of canals
- 1,607,261 acres of lakes
 - 2nd largest freshwater lake wholly within continental U.S. (Okeechobee)- 730 sq miles
- 1,702,390 acres of freshwater and tidal wetlands
- 2,154 coastal miles
- 1,013 known springs
- 6,573 total waterbody segments, or WBIDs



Water Quality Restoration

- Standards
- Monitoring
- Assessment
- **TMDL development**
- Basin management action plan (BMAPs)



Implemented on a rotating basin approach...



Total Maximum Daily Load

A TMDL is generally defined as:

The maximum amount of a pollutant that a waterbody can receive and still maintain its designated uses (e.g., drinking, fishing, swimming, shellfish harvesting)

$$\text{TMDL} = \text{LA} + \text{WLA} + \text{MOS}$$

LA = Load Allocation to non-point sources

WLA = Waste Load Allocation

Under Section 303(d) of the federal Clean Water Act and the Florida Watershed Restoration Act, TMDLs* must be developed for *impaired* waters.



Site Specific Restoration Targets

We call them **TMDLs** (Total Maximum Daily Loads)

- **TMDLs are water quality restoration thresholds produced for waterbodies that are “impaired”, which means that they do not meet water quality standards**
- They serve as the legal basis for future restoration action (federal CWA, state WRA), particularly for permitted entities. Adopted in state rules as Hierarchy 1 site specific water quality criteria.

Fact: 426 TMDLs adopted to date



Federal TMDL Program Responsibilities

The Federal Clean Water Act (1972) established requirements for states in section 303(d)

States must:

- Assess and provide lists of their impaired waters to EPA
- Develop TMDLs for impaired waters
- Identify pollutant reductions and allocations
- Develop implementation plans



Florida Watershed Protection Act

The Watershed Restoration Act of 1999* established a framework for identifying impaired waters, developing TMDLs and developing and implementing restoration plans:

- **Authorizes DEP to do these things**
- **Authorizes FDACS to work with agriculture to implement BMPs**

*(Section 403, Florida Statutes)



Stakeholder Involvement in TMDL

We need your help:

- Reviewing and commenting on draft document **comments due January 4th, 2019**
- Providing information on local water quality issues & projects that might influence the TMDL
- Assuring that pertinent local information is used in TMDL development
- Establishing contact with key stakeholders who will help us during the restoration process

*Report was posted on November 16th, 2018



QUESTIONS ???



Modeling



Watershed Model History

Hydrological Simulation Program - FORTRAN (HSPF):

- Comprehensive package for simulation of watershed hydrology and water quality
- Initially developed and used for the tidal Caloosahatchee River and Estuary TMDL (2009)
- During BMAP development stakeholders raised concerns about the models used to develop the TMDL
- In 2017, model was updated with extensive stakeholder involvement throughout the update process



HSPF Overview

Hydrological Simulation Program - FORTTRAN (HSPF):

- Simulates hydrologic and water quality processes on uplands and in streams and well-mixed impoundments
- Uses continuous rainfall and other meteorological records to continuously simulate:
 - Runoff and water quality loading from pervious land areas
 - Runoff and water quality loading from impervious land areas
 - Instream movement of runoff water and chemical processes
 - Fate and transport of dissolved oxygen, biochemical oxygen demand, temperature, sediment, ammonia, nitrite-nitrate, organic nitrogen, orthophosphate, organic phosphorus, and phytoplankton



2009 HSPF Model

Stakeholders concerns about the 2009 HSPF model:

- HSPF simulation period ends in 2011
- Uses old (2004) South Florida Water Management District (SFWMD) land use land cover (LULC) and cropland/improved pasture land cover should be two separate land covers
- Incorrect National Pollutant Discharge Elimination System (NPDES) permitted point sources are represented
- Septic systems are not represented
- Agricultural irrigation withdrawal sources and demand volumes may not be properly represented
- HSPF model needs to be calibrated to additional flow and water quality stations



Watershed Model 2017 Update

Extended simulation period:

- January 1, 1996 – December 31, 2014

Updated with the following major components:

- SFWMD Next-Generation Radar (NEXRAD) precipitation data
- Agricultural Field-Scale Irrigation Requirements Simulation (AFSIRS) evapotranspiration data
- Fort Myers Page Field Airport for climate variables
- 2008-2009 SFWMD and Southwest Florida Water Management District (SWFWMD) LULC and 2011 National Land Cover Database (NLCD) Impervious



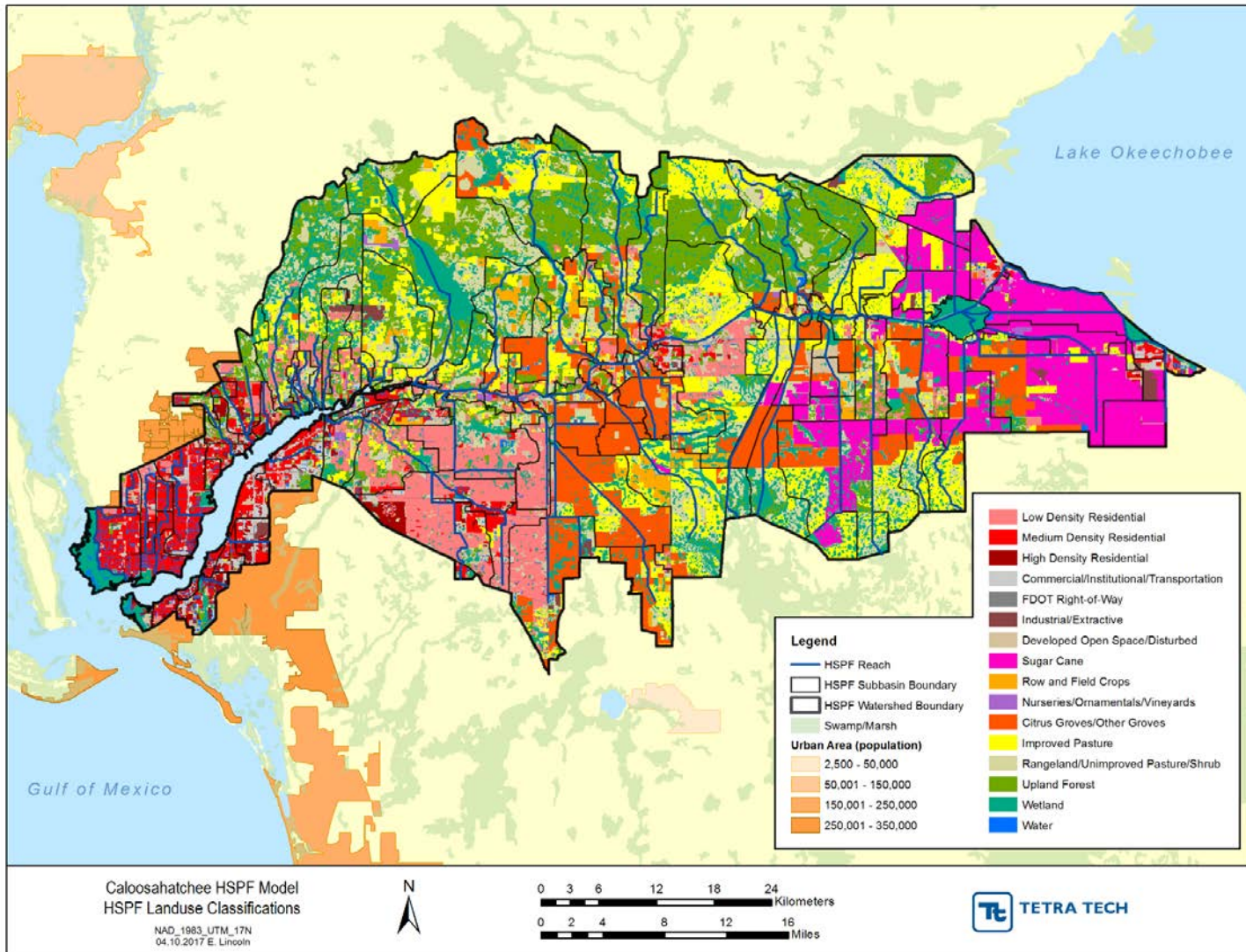
Watershed Model 2017 Update

Updated with the following major components:

- Explicit representation of correct NPDES discharge and reuse facilities
- Explicit representation of functioning and failing septic systems
- Updated representation of agricultural irrigation and applied water to land
- In-stream water quality calibration and validation locations increased for a total of 50 stations at 33 unique locations:
 - 32 stations have 5+ years of data
 - 15 calibration station locations
 - 18 validation stations locations

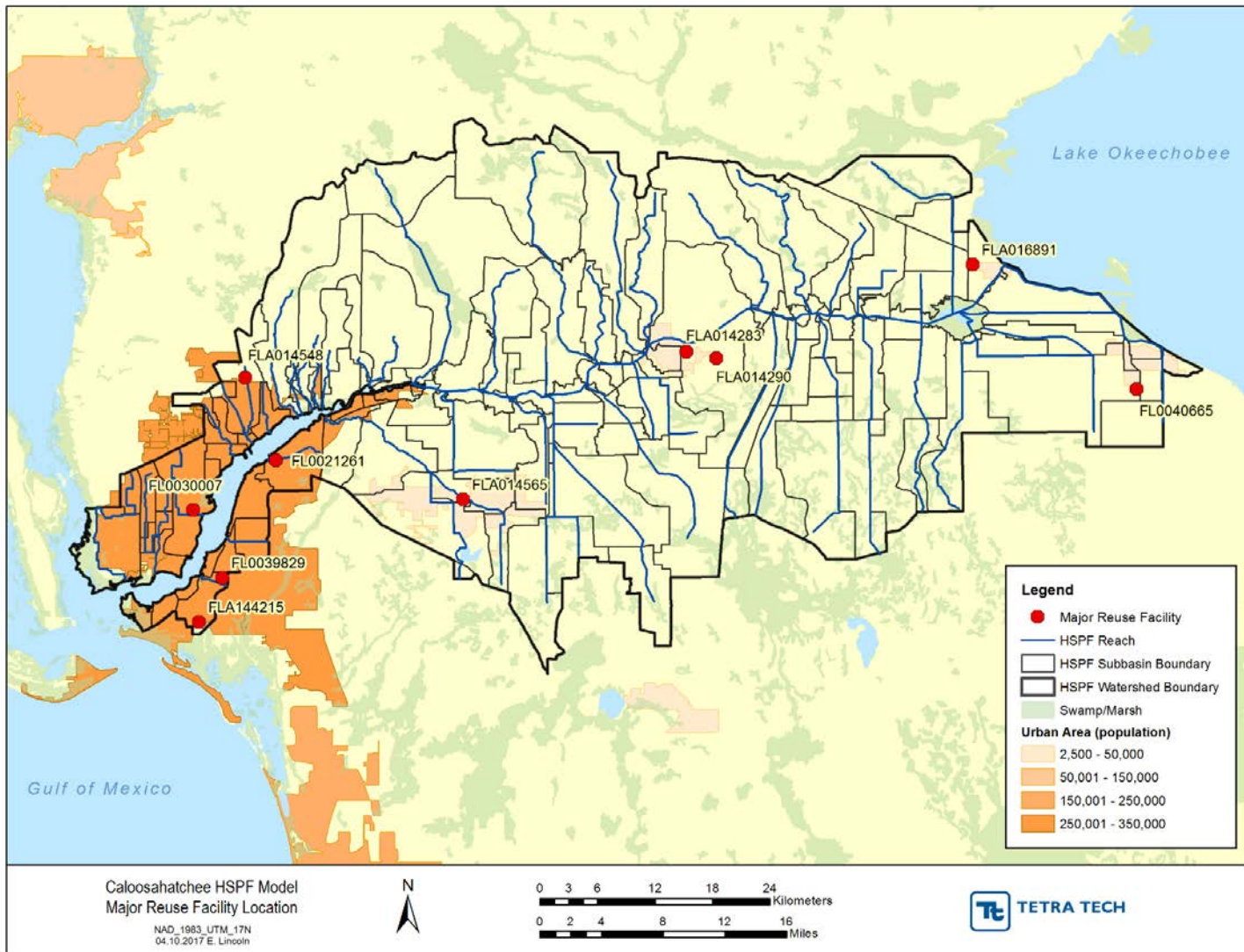


Land Use



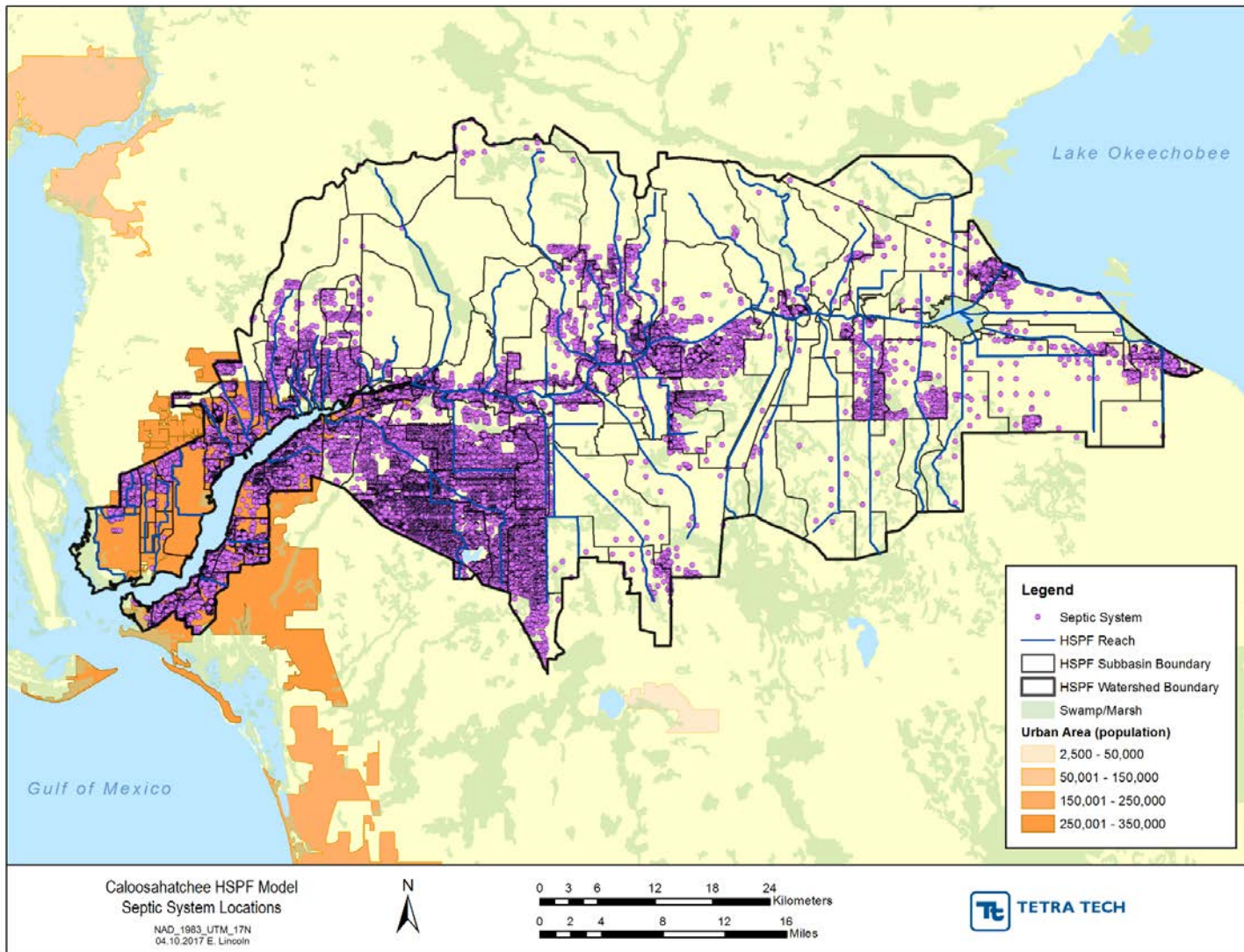


Reuse



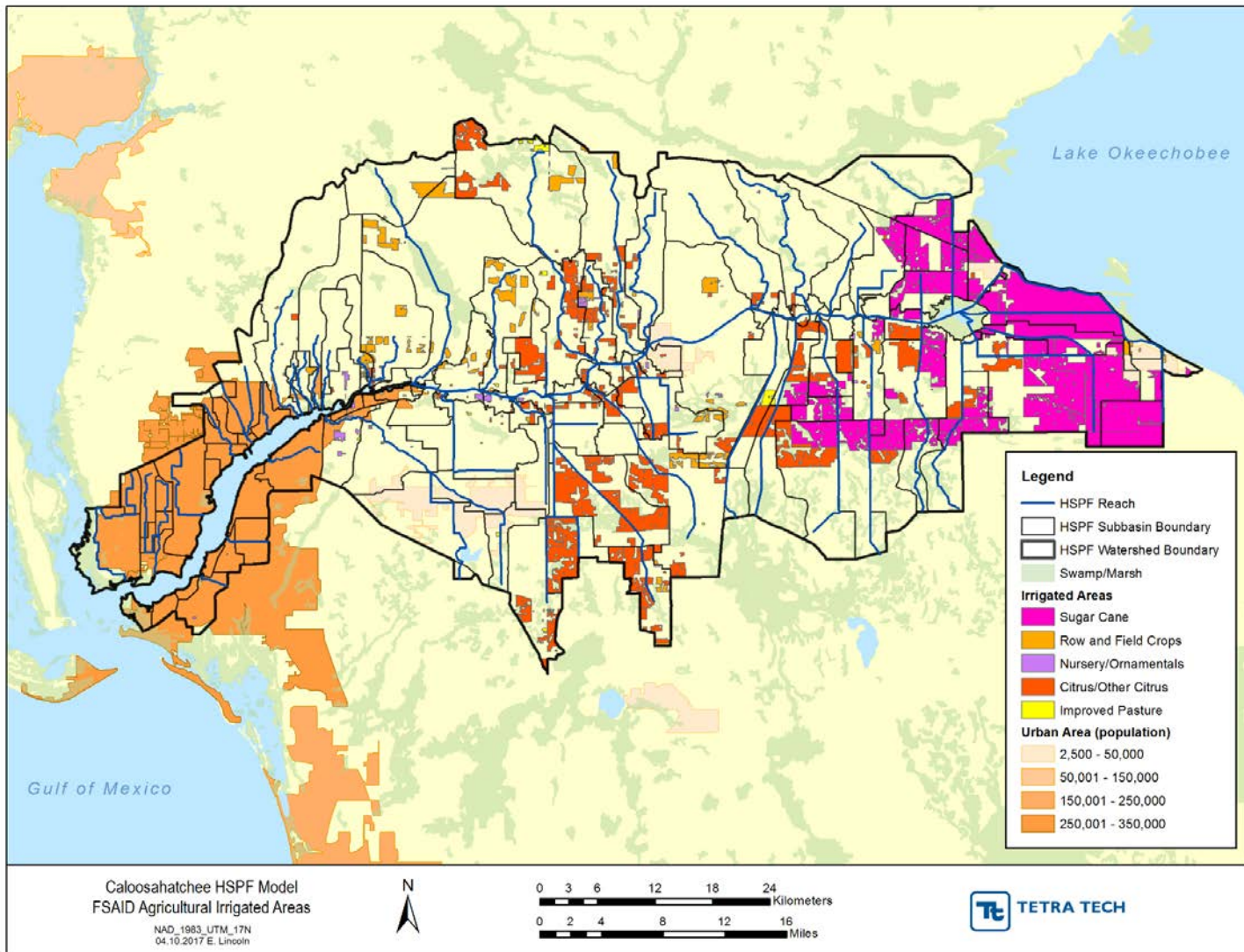


Septic Tanks



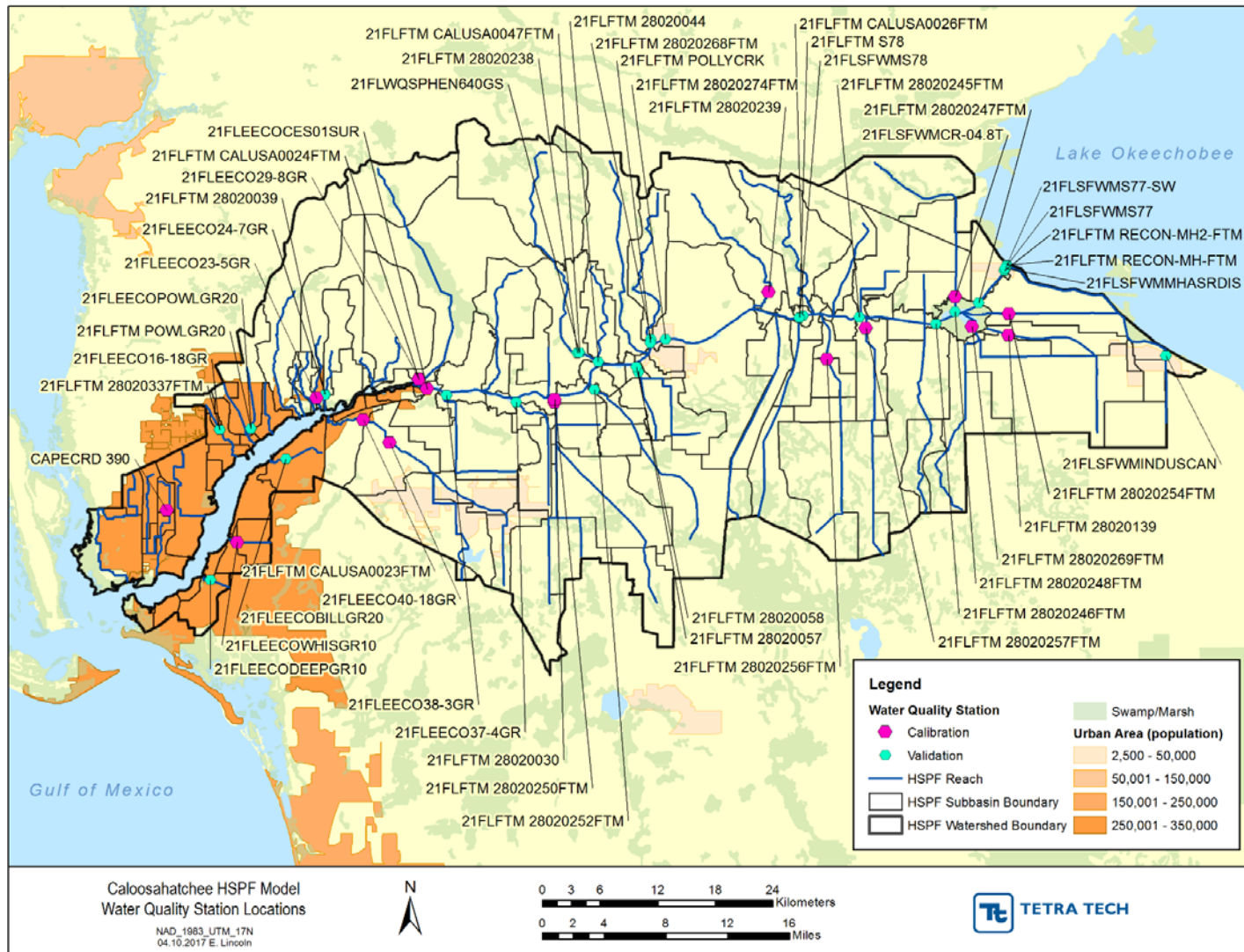


Irrigation





Calibration Stations





Watershed TMDL

2017 HSPF model initially calibrated to key locations:

- Impaired Waters Rule stations with long periods of data, in critical locations, or at flow station
- Assumed that key station locations would be representative of conditions within watershed/WBID
- However, calibration stations reflect conditions of sample location and were not always representative of all locations and streams within a WBID



TMDL Clipped Model Update

Clipped HSPF model to the upper portion of the Caloosahatchee River Watershed:

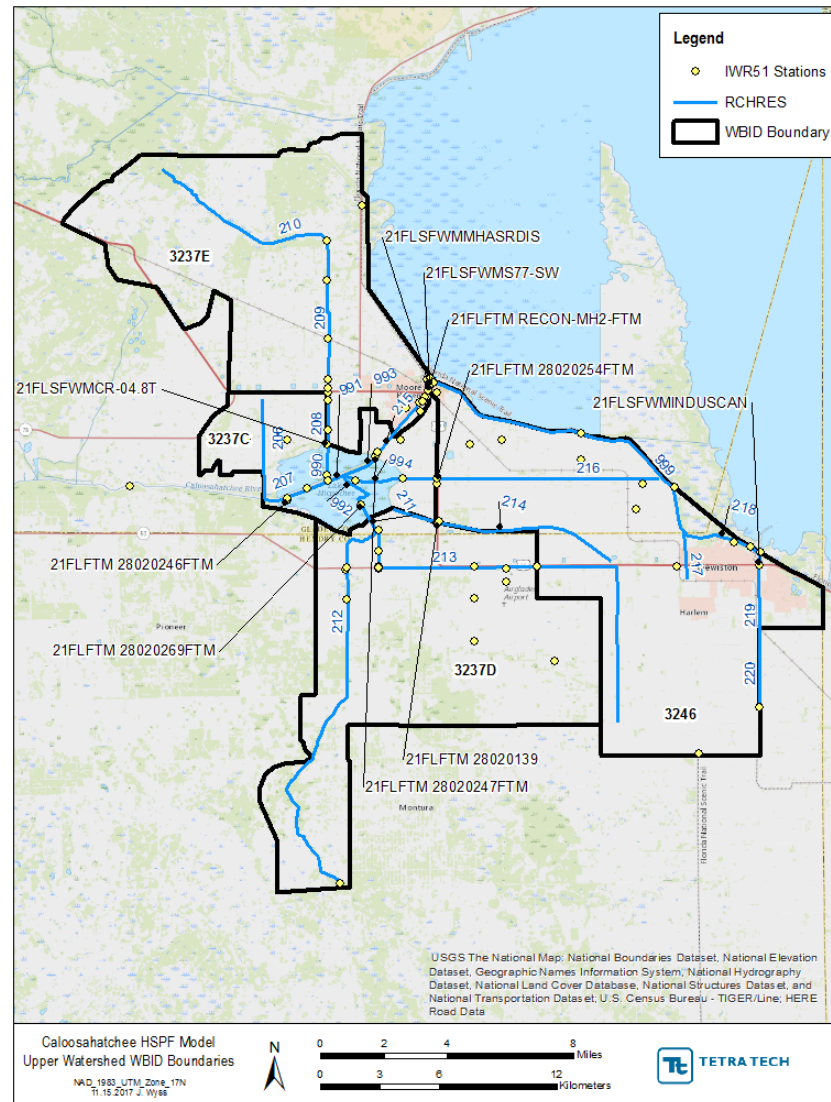
- Provided a more focused and faster model to investigate causative pollutant(s)

Refined calibration in clipped model:

- Lake Hicpochee, C-19 Canal, Ninemile Canal, and S-4 Basin WBIDs
- Refit nutrient, dissolved oxygen, and algae calibrations
 - Used all data sampled within impaired WBID
 - Examined water quality simulation of every stream within each WBID
 - Made parameter adjustments to improve model calibration fit

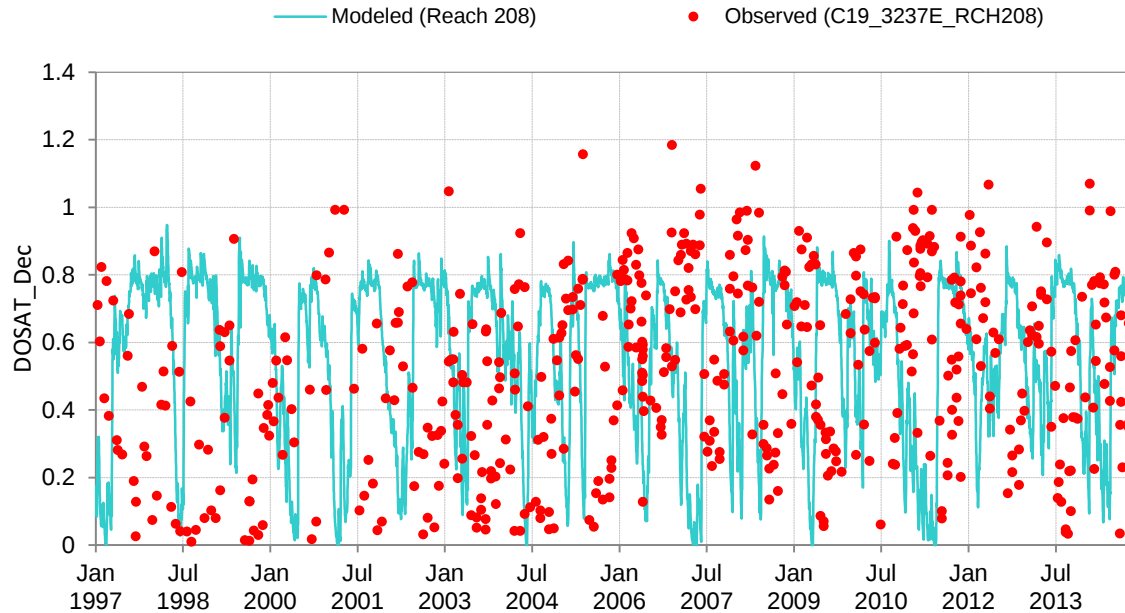


Clipped Model Area





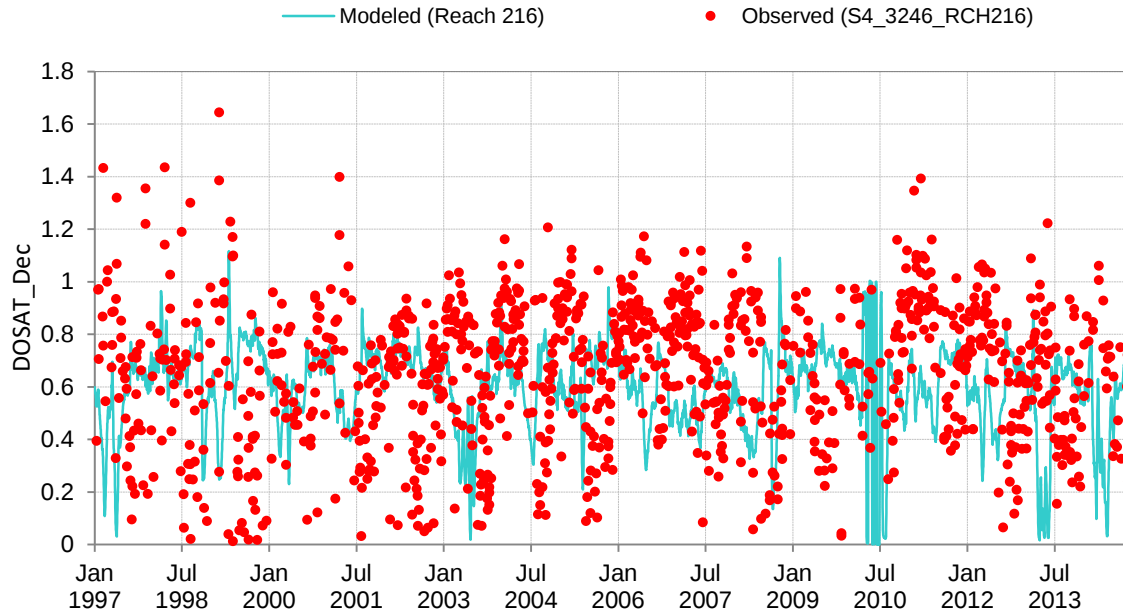
C-19 Results



Parameter	Average Annual % Error	Average Annual Error Rating	Median Annual % Error	Median Annual Error Rating
DOSAT	13.4%	Very Good	13.2%	Very Good
TN	17.8%	Very Good	21.0%	Very Good
TP	-20.6%	Very Good	-30.7%	Good



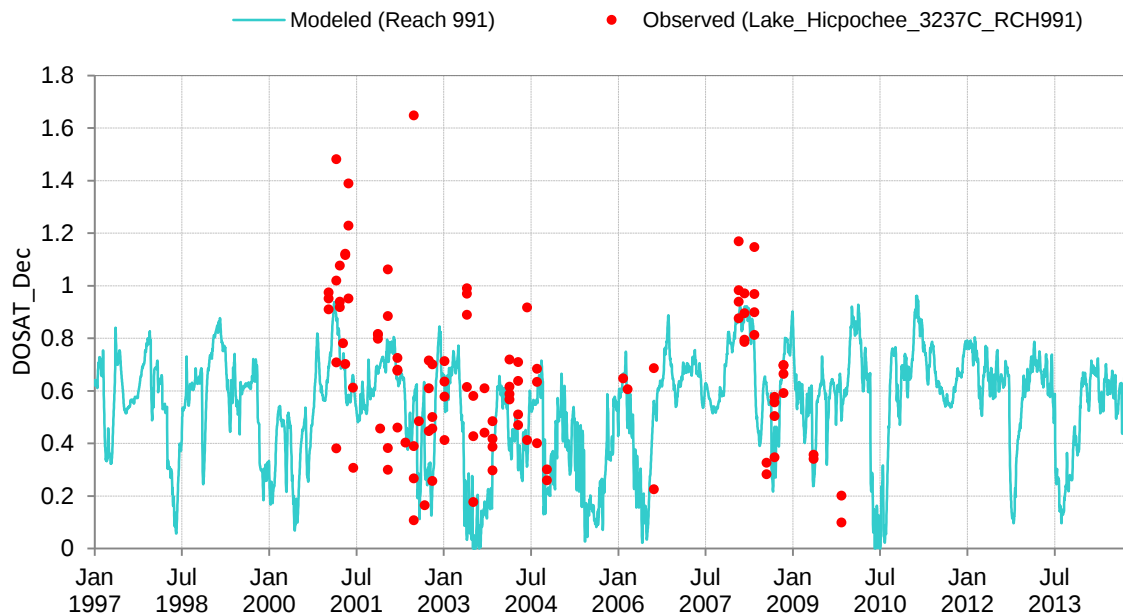
S4 Results



Parameter	Average Annual % Error	Average Annual Error Rating	Median Annual % Error	Median Annual Error Rating
DOSAT	-8.4%	Very Good	-7.2%	Very Good
TN	-24.5%	Very Good	-29.1%	Very Good
TP	-19.1%	Very Good	-32.7%	Good



Hicopochee Results



Parameter	Average Annual % Error	Average Annual Error Rating	Median Annual % Error	Median Annual Error Rating
DOSAT	-8.0%	Very Good	-1.5%	Very Good
TN	-2.0%	Very Good	6.7%	Very Good
TP	87.5%	Poor	162.5%	Poor



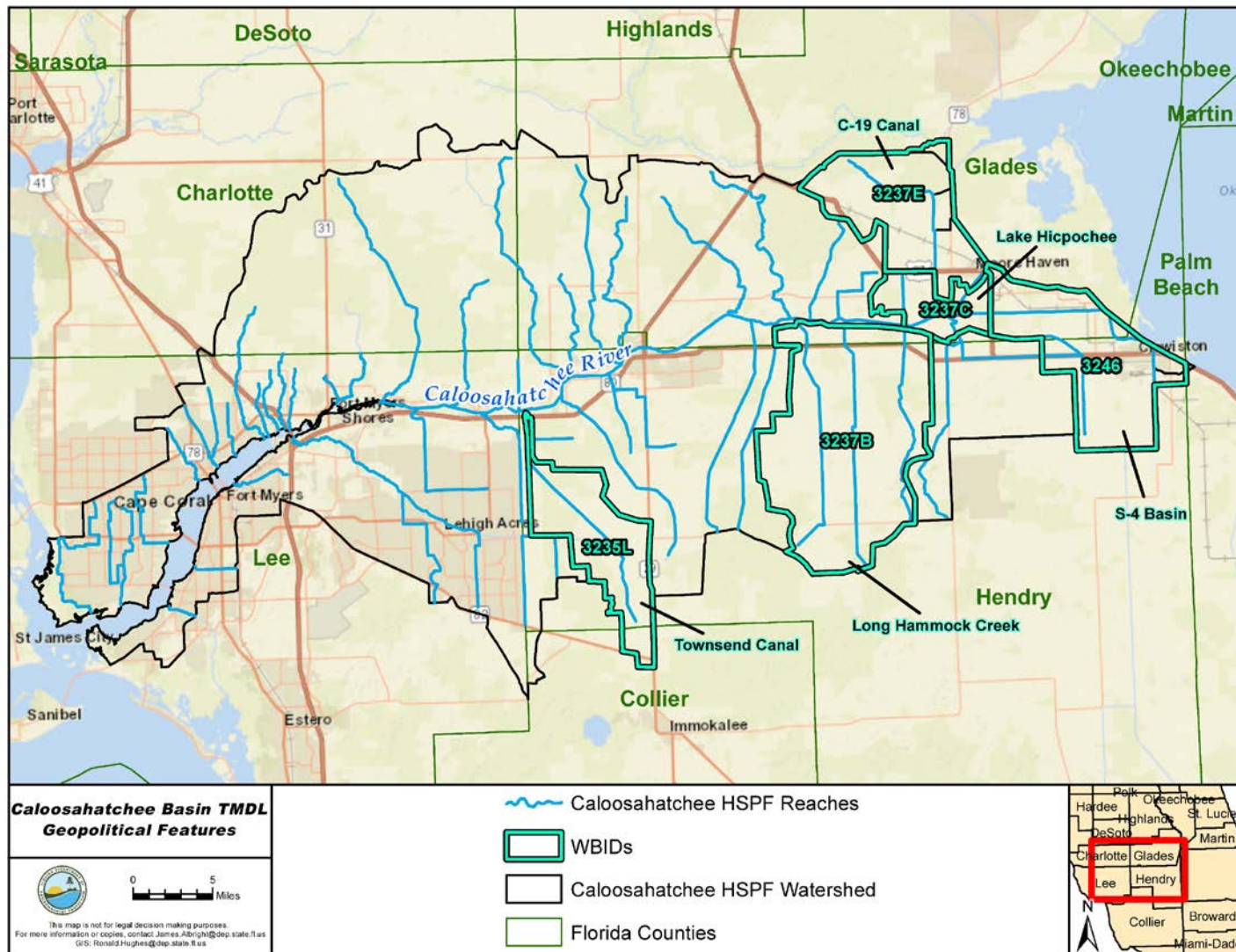
QUESTIONS ???



TMDL Development Process

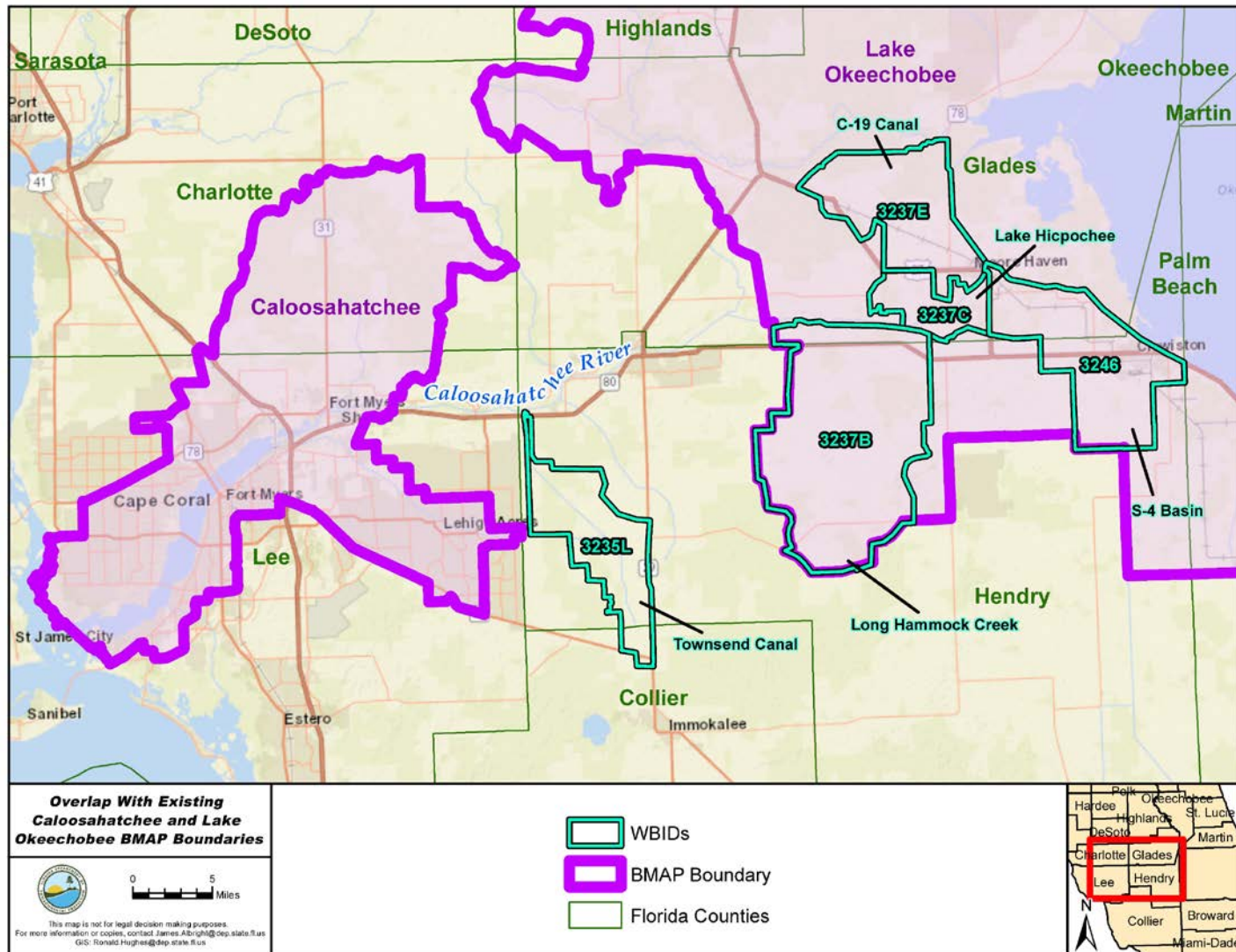


Location of the Caloosahatchee Tributary WBIDs Within the Caloosahatchee Basin





Existing Caloosahatchee Estuary and Lake Okeechobee BMAP Boundaries





Assessment Summary

Applicable Freshwater DO Criterion

> 10 % of daily average DO percent saturation values below
38 % saturation 62-302.533(1)(a)(2), F.A.C.

Impairment History

- Cycle 1 Assessment (2005): Long Hammock Creek originally impaired based on DO mg/L
- Cycle 2 Assessment (2010): Townsend Canal, Lake Hicpochee, and S-4 Basin originally impaired based on DO mg/L
- Cycle 3 Assessment (2016): Long Hammock Creek, Townsend Canal, Lake Hicpochee, S-4 Basin, and C-19 Canal all impaired based on current DO % saturation criterion



TMDL Development Approach

- Calibrated HSPF model was used to establish current baseline conditions in the system, to generate natural background loads in the system, and to determine TMDL loadings to meet the DO criterion
- For all modeling runs, Lake Okeechobee concentrations were estimated to be at their equivalents under the existing Lake Okeechobee TMDL



Model Load Calculations

- For the C-19 Canal, Long Hammock Creek, and Townsend Canal, the loads generated were strictly from the local watersheds
- The S-4 Basin and Lake Hicpochee included additional load contributions from upstream waterbodies
- Total loads in the S-4 Basin and Lake Hicpochee included the upstream contributions (set to their TMDL loadings)
- Modeled load reductions were applied to the local watershed loads, but not to external loads already subject to TMDLs



Model Load Calculations

- Seven year rolling averages of the modeled annual loads for TN, TP, & BOD were calculated for each modeling scenario
- The maximum of these rolling averages was selected for each modeling scenario (current conditions, natural background, and TMDL) for each WBID
- Refer to Sections 4.3.4 and 4.3.5 in Chapter 4 of the TMDL report



Current Conditions Simulation

Maximum 7-year Rolling Averages

Waterbody (WBID)	Maximum 7-Year Rolling Average TN Loads (lbs)	Maximum 7-Year Rolling Average TP Loads (lbs)	Maximum 7-Year Rolling Average BOD Loads (lbs)
S-4 Basin (3246)	559,666	39,269	921,340
C-19 Canal (3237E)	150,963	9,896	361,071
Lake Hicpochee (3237C)	4,282,254	232,916	5,927,159
Long Hammock Creek (3237B)	569,554	43,774	1,334,760
Townsend Canal (3235L)	480,366	46,063	1,077,001



TMDL Modeling

- TN, TP, & BOD concentrations from surface runoff were reduced by the same amount in iterative model runs until DO % saturation excursions (below 38 % saturation) occurred less than 10 % of the time



TMDL Scenario Maximum 7-year Rolling Averages

Waterbody (WBID)	Maximum 7-yr Rolling Average TN Loads (lbs)	Maximum 7-yr Rolling Average TP Loads (lbs)	Maximum 7-yr Rolling Average BOD Loads (lbs)
S-4 Basin (3246)	430,844	28,622	664,946
C-19 Canal (3237E)	78,114	5,167	186,354
Lake Hicpochee (3237C)	4,211,272	234,851	5,818,635
Long Hammock Creek (3237B)	330,381	25,384	773,946
Townsend Canal (3235L)	300,564	28,749	673,151

Final TMDL Loads & Percent Reductions

Waterbody (WBID)	Parameter	TMDL (maximum 7-year average load in lbs)	WLA Wastewater (% reduction)	WLA NPDES Stormwater % reduction	LA (% reduction)
S-4 Basin (3246)	TN	430,844	NA	NA	23
S-4 Basin (3246)	TP	28,622	NA	NA	27
S-4 Basin (3246)	BOD	664,946	NA	NA	28
C-19 Canal (3237E)	TN	78,114	NA	NA	48
C-19 Canal (3237E)	TP	5,167	NA	NA	48
C-19 Canal (3237E)	BOD	186,354	NA	NA	48
Lake Hicpochee (3237C)	TN	4,175,743	NA	NA	2
Lake Hicpochee (3237C)	TP	227,423	NA	NA	2
Lake Hicpochee (3237C)	BOD	5,768,701	NA	NA	3
Long Hammock Creek (3237B)	TN	330,381	NA	NA	42
Long Hammock Creek (3237B)	TP	25,384	NA	NA	42
Long Hammock Creek (3237B)	BOD	773,946	NA	NA	42
Townsend Canal (3235L)	TN	300,564	NA	37	37
Townsend Canal (3235L)	TP	28,749	NA	38	38
Townsend Canal (3235L)	BOD	673,151	NA	37	37



Stakeholder Involvement in TMDL

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comments due January 4th, 2019
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Steps Toward Adoption of TMDL

- Review report comments provided by stakeholders
- Edits incorporated into report, TMDL reviewed by Secretary of DEP (early Spring 2019)
- Goal is for final TMDL to be adopted into state rule by late Spring 2019
- EPA approval



Formal Public Comment



Draft Report can be found here:

<https://floridadep.gov/dear/water-quality-evaluation-tmdl/content/draft-tmdls>

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