



**St. Lucie River and Estuary Basin Management Action Plan (BMAP)
Hydrological Simulation Program – FORTRAN (HSPF) Model Technical Meeting**

Via Webinar

[Meeting Link](#)

Meeting ID: 294 373 158 844 05

Passcode: 8dm9S5tq

September 25, 2026

10 AM EDT

Agenda

- St. Lucie River and Estuary BMAP Model Background.
- Overview of St. Lucie River and Estuary HSPF Model Updates.
- Questions/Comments.

Please note the site for information relating to the St. Lucie River and Estuary BMAP:
[Basin Management Action Plans \(BMAPs\) | Florida Department of Environmental Protection](#)
For more information on the Caloosahatchee River and Estuary BMAP, contact: Tony Tomalewski, 850-245-8683.
Anthony.Tomalewski@FloridaDEP.gov



TECHNICAL MEETING FOR ST. LUCIE RIVER AND ESTUARY BASIN MANAGEMENT ACTION PLAN

Tony Tomalewski

Division of Environmental Assessment and Restoration
Water Quality Restoration Program
Florida Department of Environmental Protection

Virtual Webinar | Sept. 25, 2026



FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP)

Presentation Agenda

- Overview of Hydrological Simulation Program – FORTRAN (HSPF) Updates.
- Next Steps.
- DEP Resources.





PLANNED TIMELINE

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

November 16, 2026: Statewide Annual Report project collection period begins.

2027

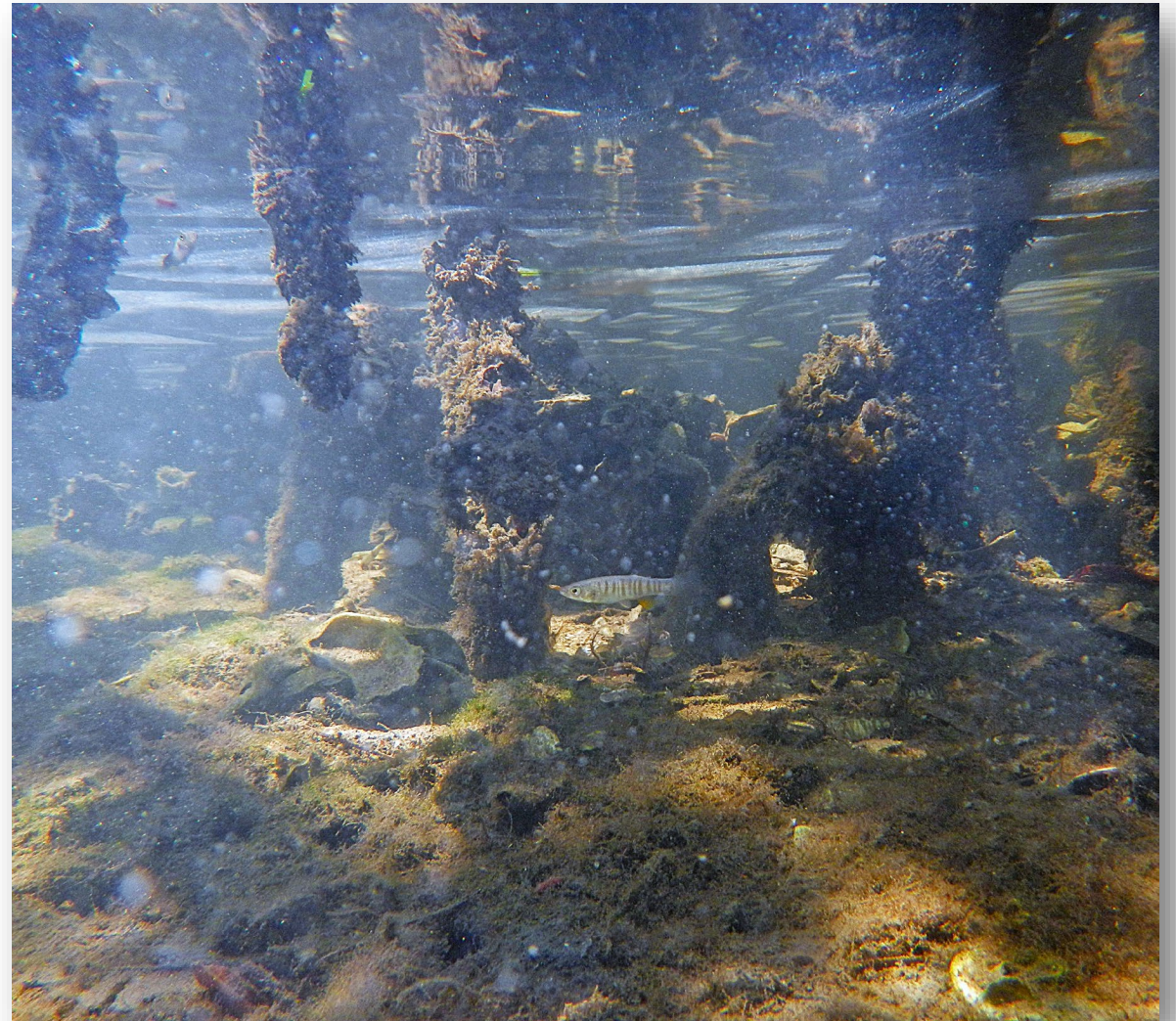
Final model report public meeting.

Determine starting loads from the load estimation tool (LET).

Meet with stakeholders:

- Confirm jurisdictional boundaries;
- Draft new allocation numbers; and
- Re-evaluate project lists.

Draft updated basin management action plan (BMAP) – before 2030.





TETRA TECH

St. Lucie River and Estuary Model Update

September 25, 2026

Marcy Frick, REM

Jeremy Wyss

Reminder – Model History and Scope Overview

- Current model is the Watershed Water Quality Simulation (WaSh).
- DEP's goal is to have one consistent modeling approach across the Northern Everglades BMAPs:
 - Hydrological Simulation Program – FORTRAN (HSPF) watershed model.
 - ArcGIS-Based Nutrient Load Estimation Toolbox in Python (ArcNLET-Py) for septic systems.
- Project is to prepare a model that represents total nitrogen (TN) and total phosphorus (TP) loading throughout the watershed.
 - Use to assist DEP with a future BMAP update.

Tasks

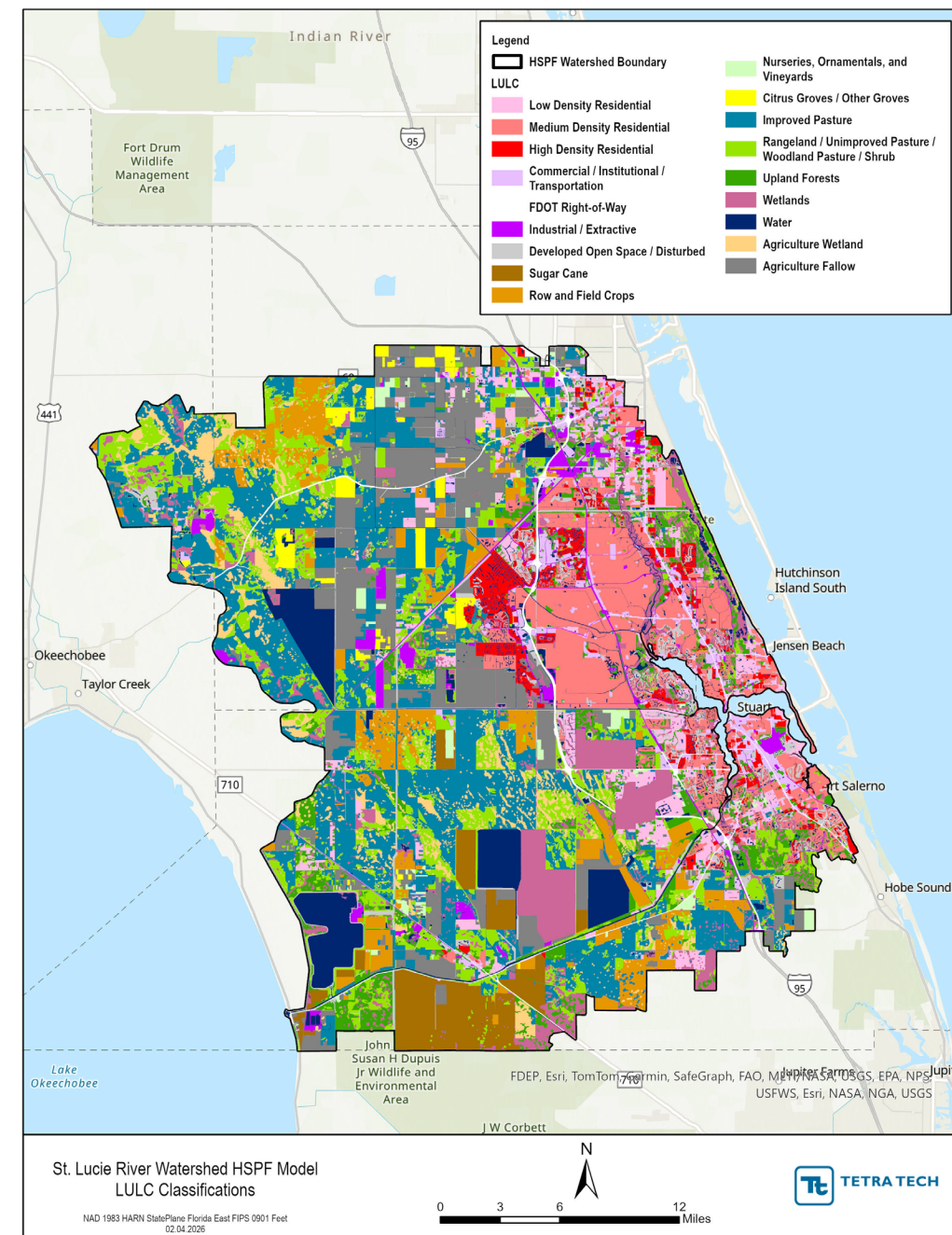
- Inventory available data.
 - Completed – memo provided for stakeholder input in August 2025.
- Delineate and setup model.
 - Completed – DEP and agency review occurred in November 2025.
- Calibrate watershed hydrology.
 - Completed – memo with results provided for stakeholder input in April 2026.
- Develop an ArcNLET-Py model to represent septic systems.
 - Completed – memo and shapefile provided for stakeholder input in April 2026.
- Calibrate watershed water quality.
 - Drafted – memo with results provided for stakeholder input on September 14, 2026.
- Prepare a final model report.
 - Underway – for DEP review.
- Prepare a load estimation tool (LET) for future BMAP update.



Water Quality Calibration

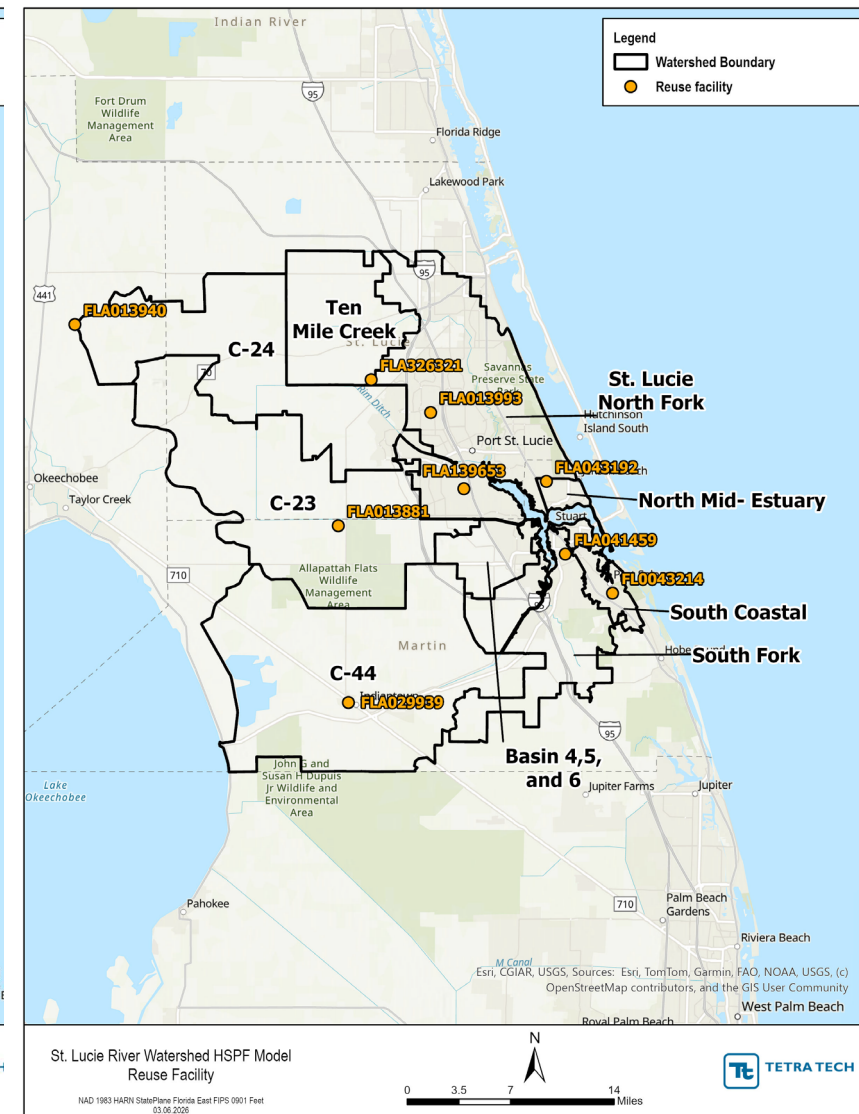
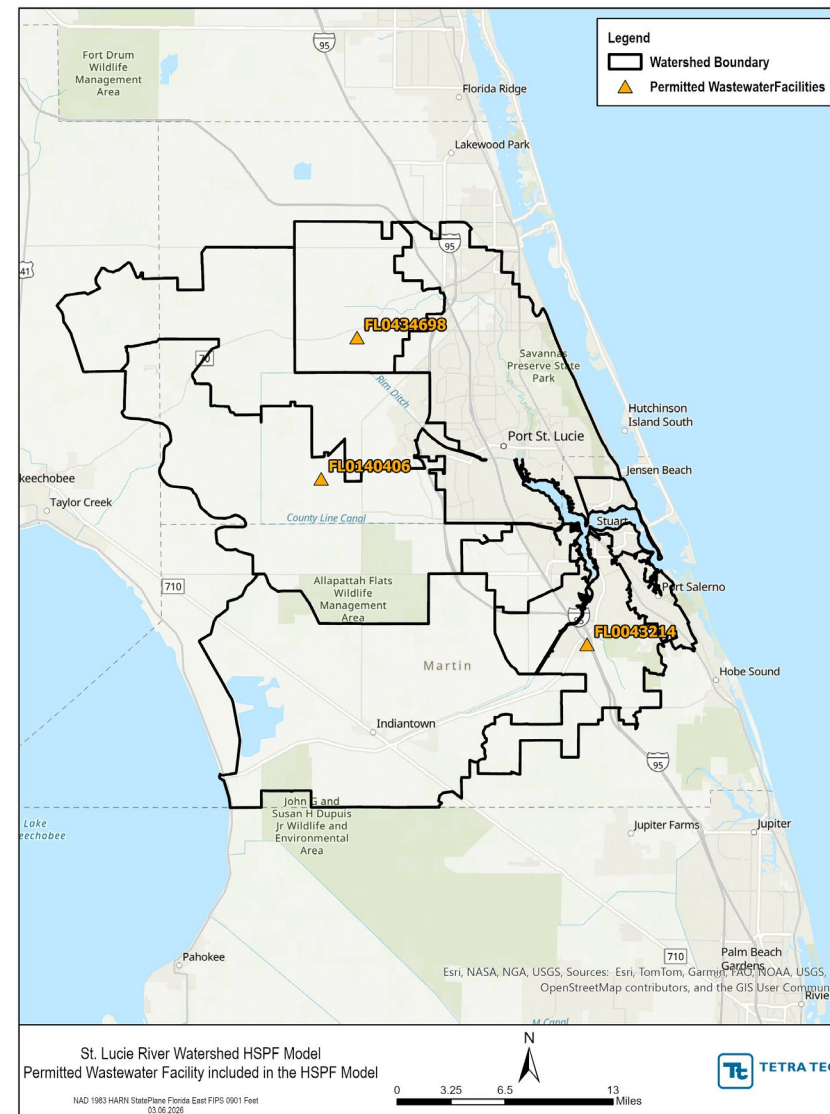
Land Use

- Combination of:
 - 2020–2023 DEP Statewide Land Use Land Cover.
 - 2023 National Land Cover Dataset (NLCD) impervious cover.
 - FDACS Florida Statewide Agricultural Irrigation Demand (FSAID) 12.
 - Florida Department of Transportation (FDOT) roads and rights-of-way.
- Rolled up to 18 land use categories in the HSPF model.
- For regional projects updated land use to:
 - Water for storage projects.
 - Wetland for water quality treatment projects.



Point Sources and Reuse Facilities

- Included in the model:
 - 3 NPDES domestic and industrial wastewater treatment facilities.
 - 9 reuse facilities.
- Missing values filled using assumptions outlined in memo.
- NPDES facilities set up as direct input timeseries.
- Reuse facilities were set up as lateral input timeseries.



Onsite Sewage Treatment and Disposal Systems (OSTDS)

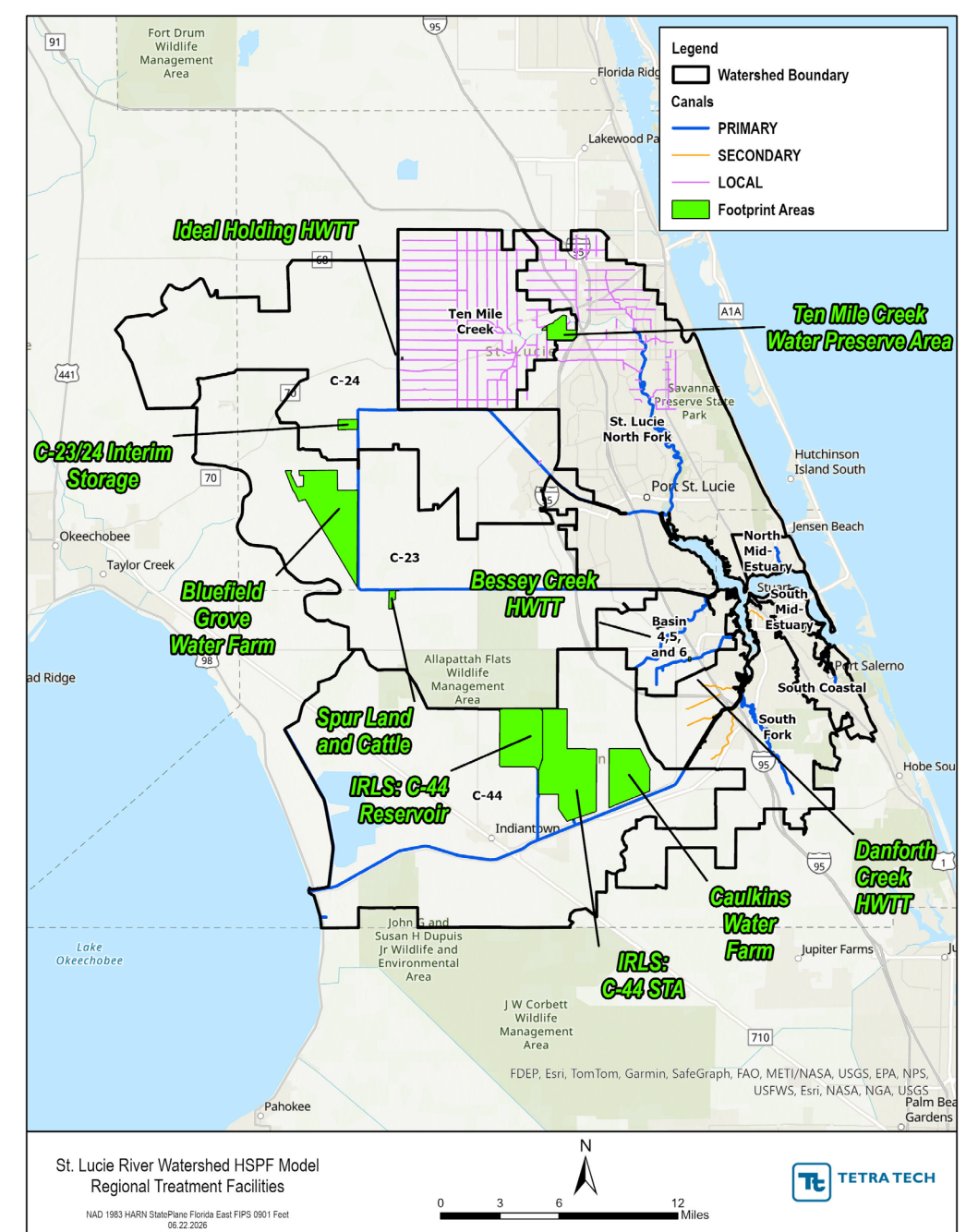
- OSTDS simulated in the ArcNLET-Py model:
 - Provided the fate and transport of nutrients (TN and TP) from each OSTDS.
- ArcNLET-Py water quality loads aggregated to the subbasin level and incorporated into the HSPF model as time variable subbasin loads.
 - Groundwater outflow was used to partition annual loads into daily loads based on the ratio of daily groundwater outflow to annual groundwater outflow.
 - Approach allows for more loading during times of high flow and less loading during times of low flow.
 - Predicted instream concentrations are more in range with the observed data.

Specialized Representations

- Lake Okeechobee boundary condition at the S-308 lock:
 - Water flowed from the lake to the river 65% of the time and from the river to the lake 35% of the time during the model period of record.
- C-25 Boundary with the C-24 Basin at the G-81 structure:
 - Used measured data to create a water quality timeseries of inputs from C-25.
- Ten Mile Creek at the GORDY_S station corrective flows and water quality to account for:
 - Presence of unaccounted groundwater contributions.
 - More irrigation water use.
 - Seepage flows from the Ten Mile Creek Water Preserve Area.
 - Other external water inputs that are not represented in the model.
- C105 Canal corrective flows and water quality concentrations to account for:
 - Additional baseflow from deep well injection of wastewater discharges, which is not represented in the model.
 - Potential errors in observed flow measurements.
 - Unique hydrologic conditions.
- L-65 Canal corrective flows and water quality concentrations at station S153 to account for:
 - S153L_S short-duration, discrete release pulses from the latching gate mechanism, which the continuous-simulation HSPF model cannot dynamically replicate.

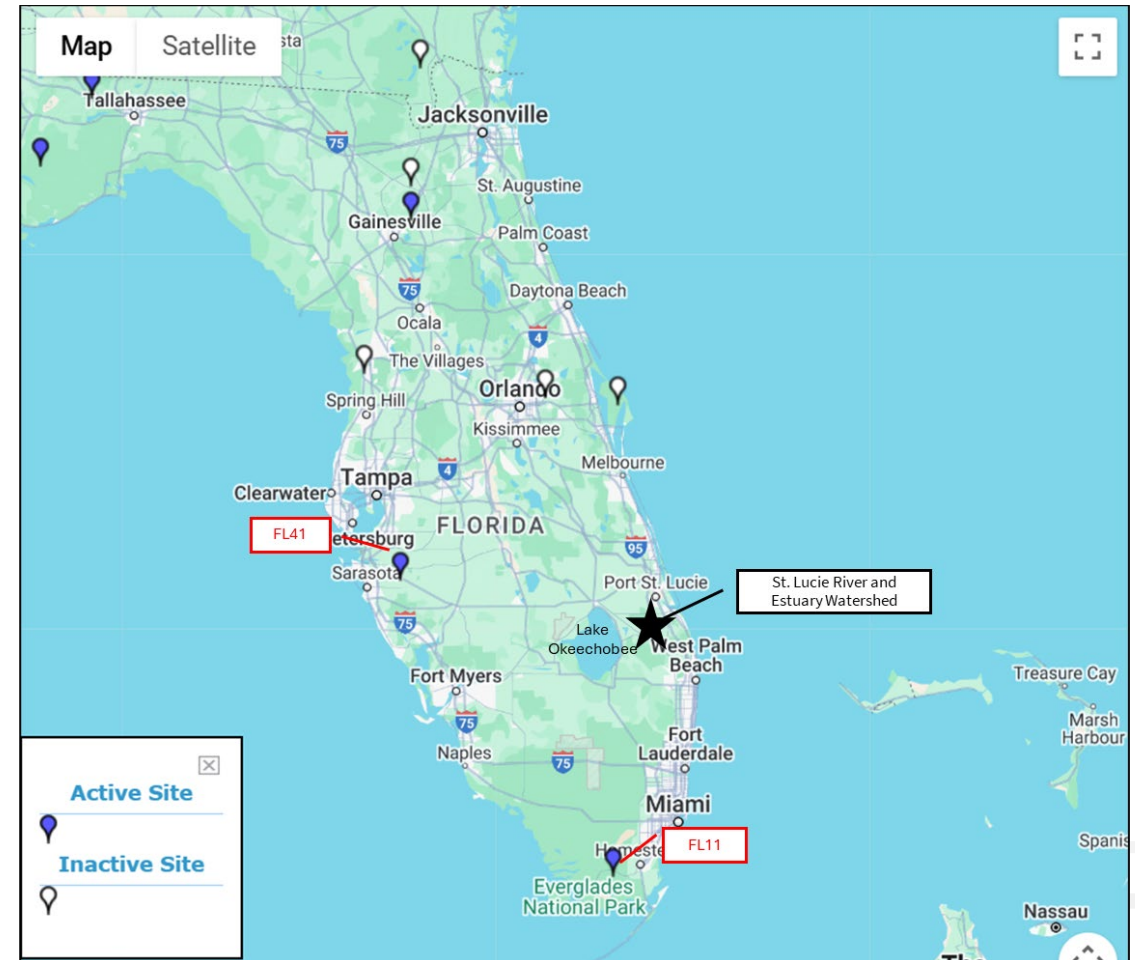
Regional Projects

- Regional projects represented in the model:
 - Bluefield Water Farm.
 - C-44 Reservoir and Stormwater Treatment Areas (STA).
 - Caulkins Water Farm.
 - C-23/C-24 Interim Storage Section C.
 - Spur Land and Cattle Water Farm.
 - Ten Mile Creek Water Preserve Area.
 - Bessey Creek Hybrid Wetland Treatment Technology (HWTT).
 - Danforth Creek HWTT.
 - Ideal Grove HWTT.
- Use data on flows and water quality into and out of (where applicable) each project.

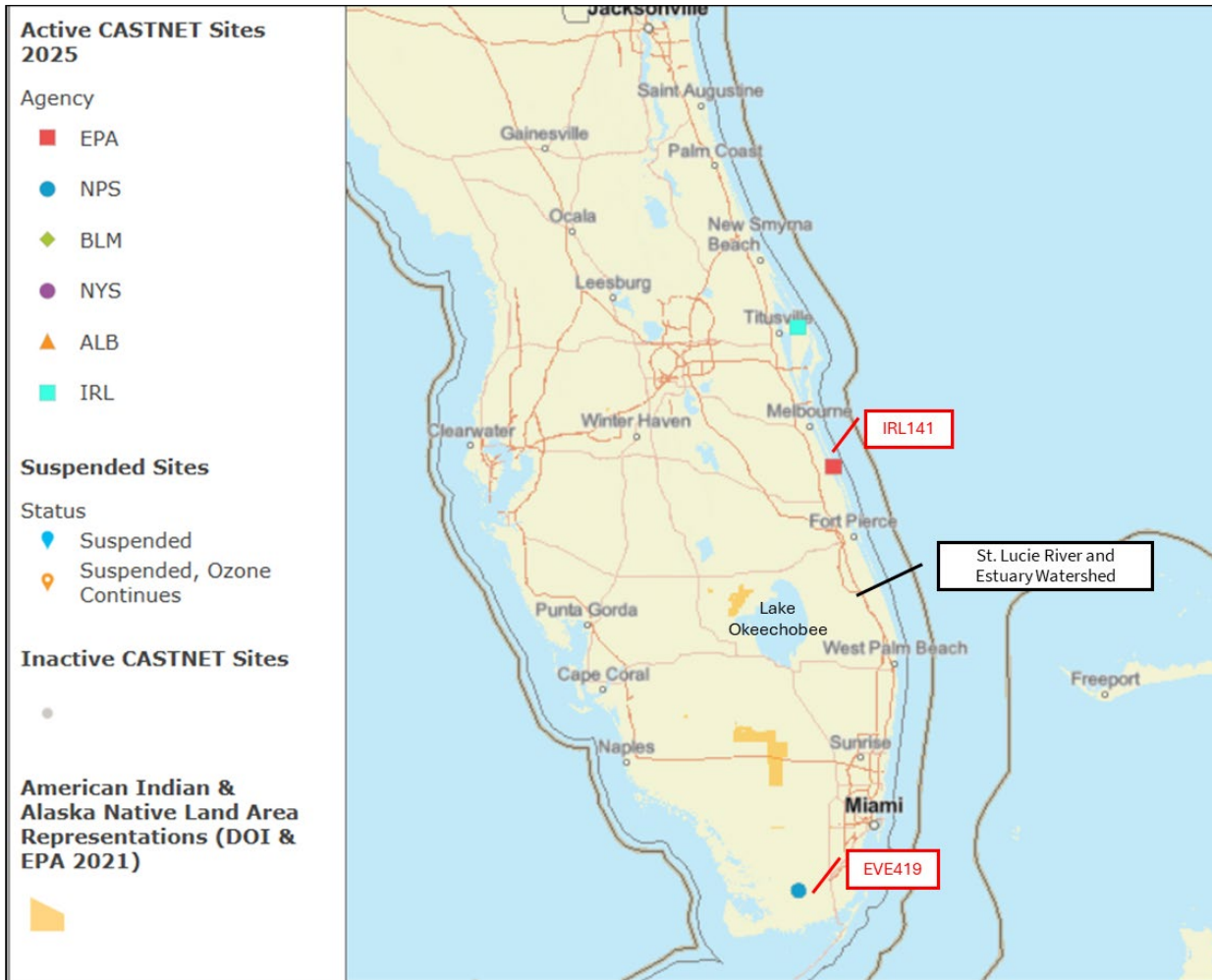


Atmospheric Deposition – Wet

- Wet deposition of ammonium and nitrate simulated using data from the National Trends Network of the National Atmospheric Deposition Program.
 - Active sites closest to the watershed are Verna Well Field in Sarasota County (FL41) and Everglades National Park Research Center in Dade County (FL11).
 - Data provided as monthly precipitation-weighted average concentrations.



Atmospheric Deposition – Dry

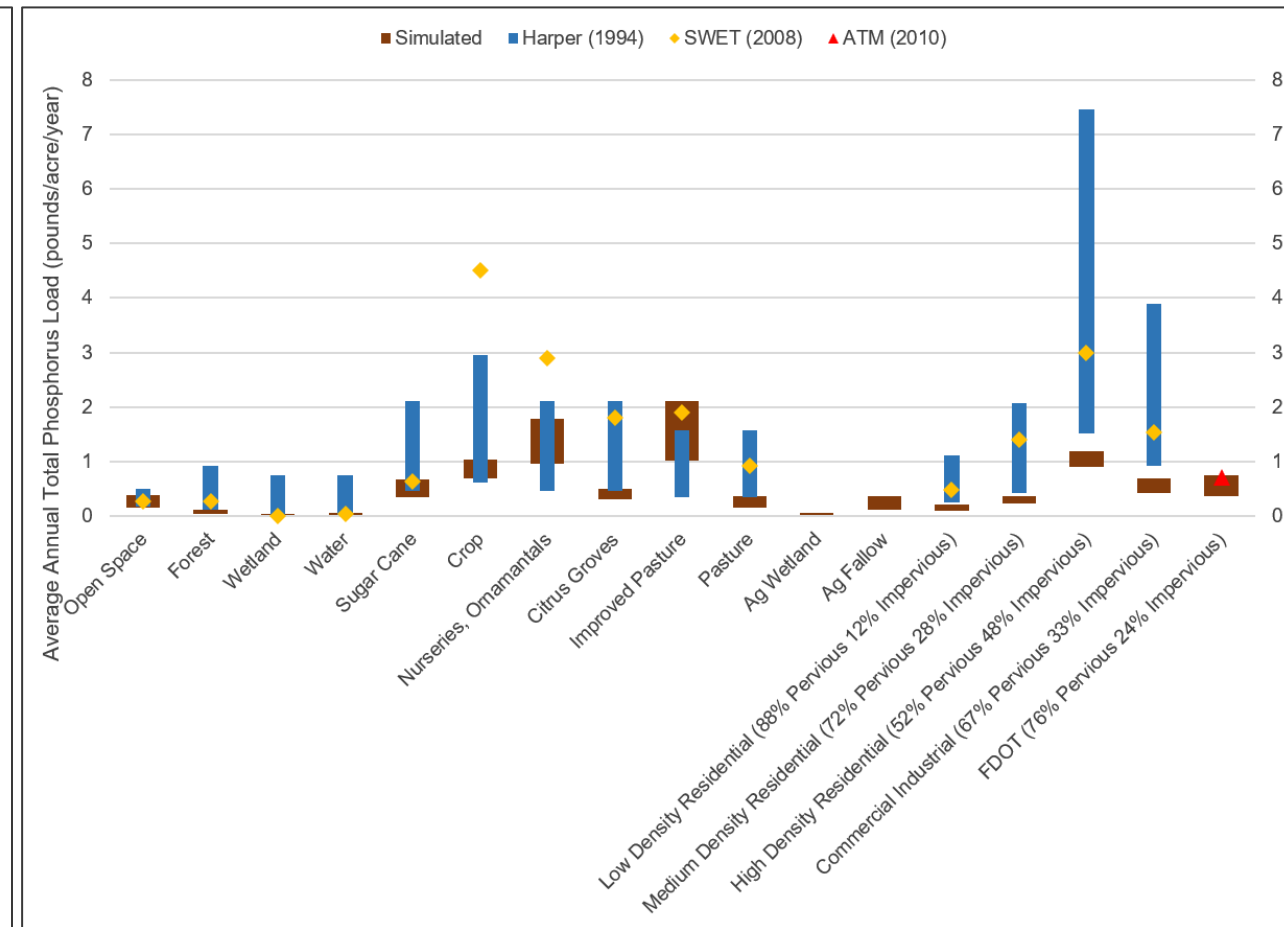
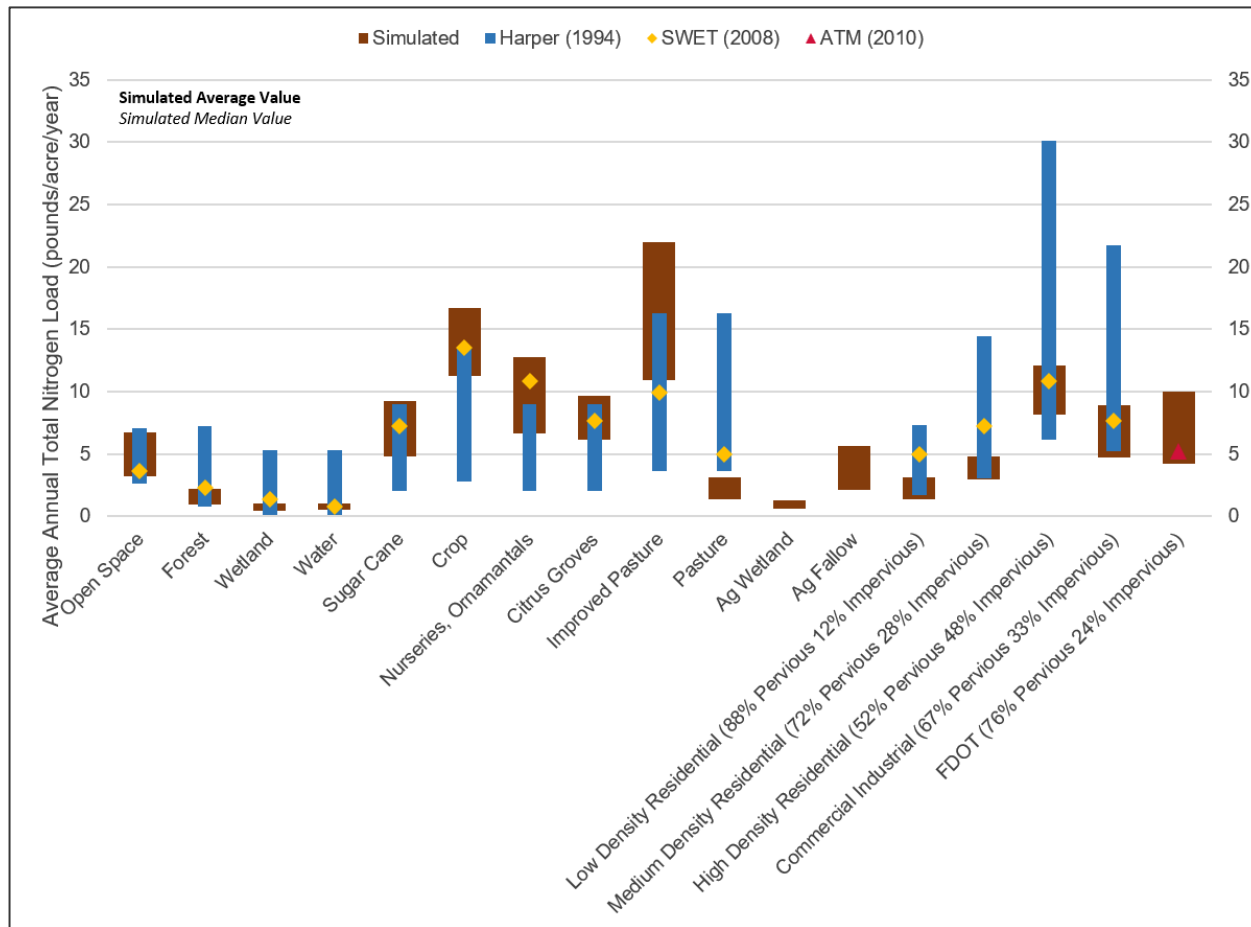


- Dry deposition of ammonium, nitric acid, and nitrate from U.S. Environmental Protection Agency's Clean Air Status and Trends Network (CASTNET).
 - Active sites closest to the watershed are the Indian River Lagoon in Indian River County (IRL141) and Everglades National Park in Dade County (EVE419).
 - Data provided as seasonal three-month totals.

Calibration and Validation Approach

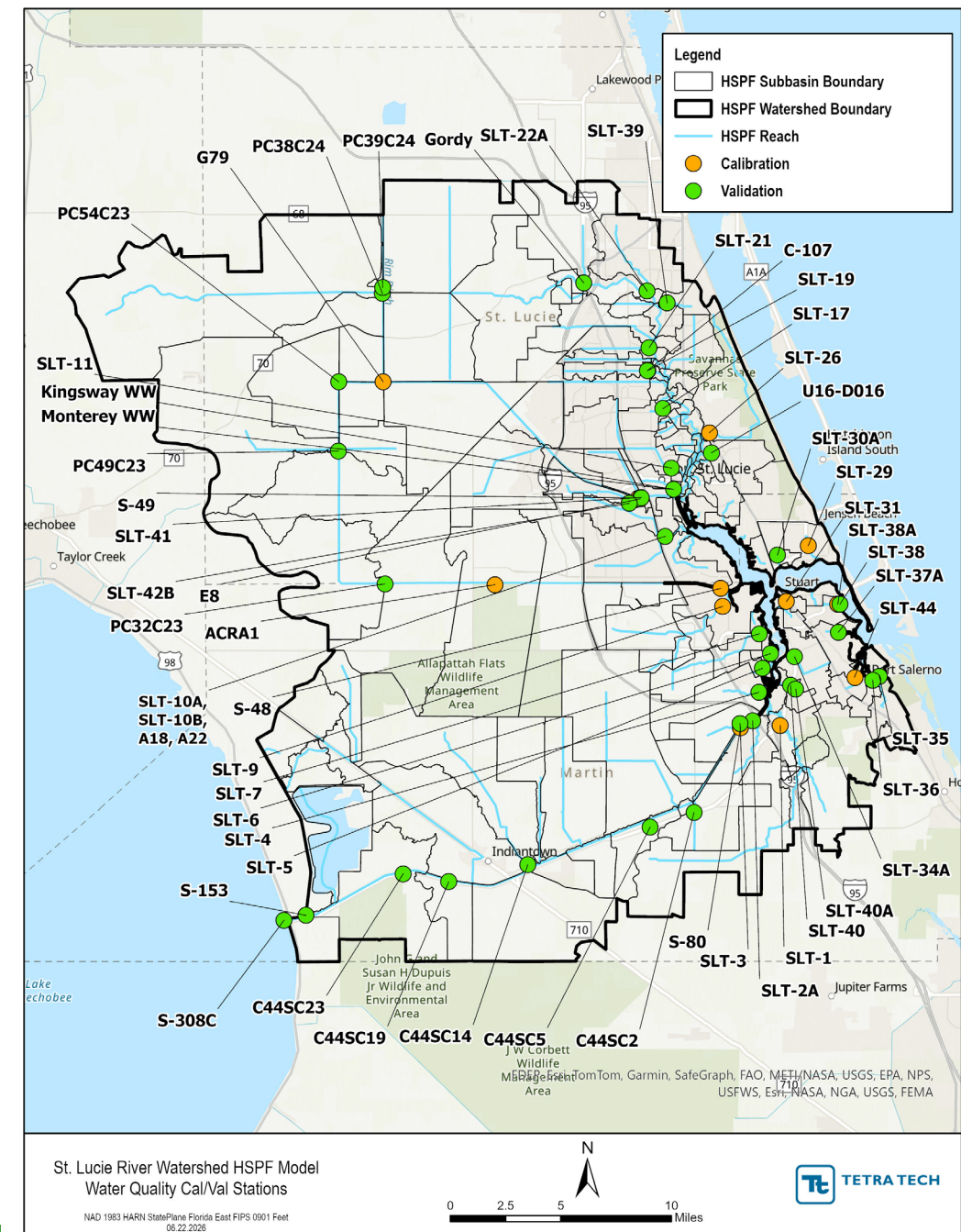
- Sediment:
 - Refined upland sediment yields to align with reference and field data.
 - Analyzed shear stress in the reaches and set channel erosion to values that achieved reasonable long-term behavior.
 - Compare instream modeled sediment to stream samples gathered during the calibration period.
- Water temperature:
 - Checked for reasonableness since it is important for processes that influence water quality.
- Instream nutrients:
 - Evaluated representation of long-term and seasonal trends in concentration and load.
 - Represented the relationship between flow and load.
- Upland nutrients:
 - Verified that unit area loading rates were reasonable compared to literature values.
 - Harper 1994 for urban areas, SWET 2008 for agricultural areas, and ATM 2010 for FDOT roads and rights-of-way.
 - Calibrated to instream observations to refine the simulation.

Upland Land Use Loading Rates



Water Quality Calibration

- Calibration and validation to observed water quality data at 53 locations:
 - 14 calibration.
 - 39 validation.
- Stations throughout the watershed.
 - Selected based on representation of each basin, location, and land use type.
 - Minimum data requirements to be included.



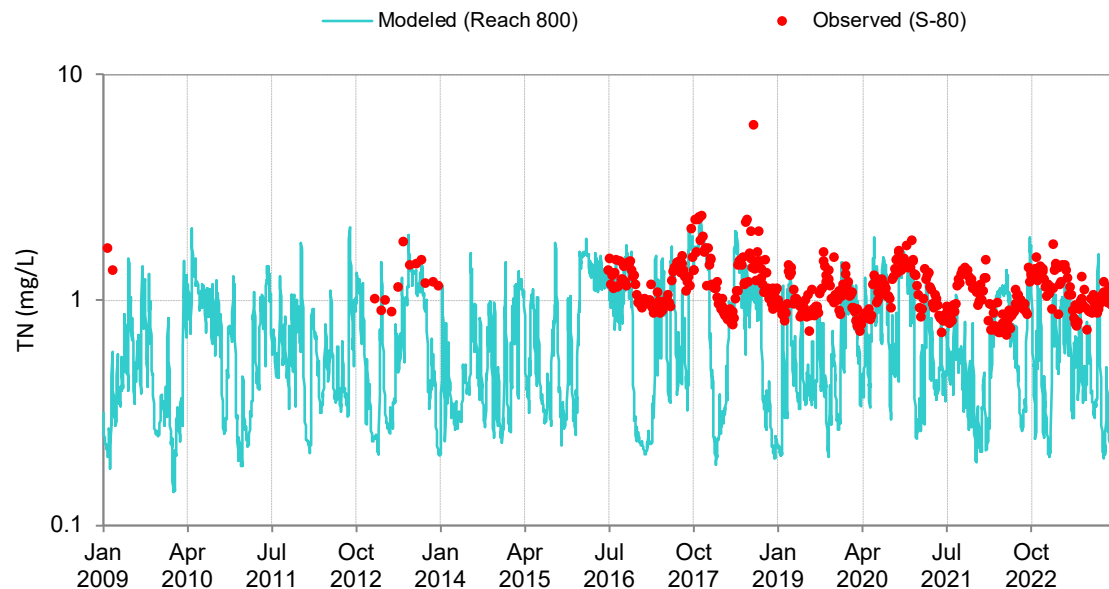
TN Calibration Statistical Summary

Station ID	Basin	Average Annual % Error	Average Annual % Error Rating	Median Annual % Error	Median Annual % Error Rating
SLT-9	Basin 4/5	-30.6	Good	-31.9	Good
SLT-7	Basin 6	-43.2	Good	-42.6	Good
ACRA1	C-23	4.2	Very Good	-6.7	Very Good
PC49C23	C-23	-16.3	Very Good	-15.4	Very Good
S48	C-23	-3.9	Very Good	-2.6	Very Good
PC54C23	C-24	-59.9	Fair	-58.9	Fair
S-49	C-24	-28.8	Very Good	-28.9	Very Good
S-80	C-44/S-153	-42.5	Good	-45.9	Fair
SLT-11	North Fork	-35.8	Good	-37.0	Good
SLT-17	North Fork	-12.2	Very Good	-15.2	Very Good
SLT-19	North Fork	-57.2	Fair	-57.4	Fair
SLT-21	North Fork	14.6	Very Good	16.0	Very Good
SLT-26	North Fork	-68.8	Poor	-66.6	Poor
SLT-10A, SLT-10B, A18, A22	North Fork	-21.0	Very Good	-21.9	Very Good
SLT-29	North Mid-Estuary	-5.0	Very Good	-8.3	Very Good
SLT-35	South Coastal	-53.6	Fair	-54.1	Fair
SLT-37A	South Coastal	1.7	Very Good	-2.4	Very Good
SLT-1	South Fork	-30.2	Good	-29.8	Very Good
SLT-2A	South Fork	-16.4	Very Good	-16.8	Very Good
SLT-3	South Fork	11.1	Very Good	12.3	Very Good
SLT-31	South Fork	-48.7	Fair	-49.5	Fair
SLT-34A	South Fork	-17.7	Very Good	-16.0	Very Good
SLT-40A	South Fork	-47.1	Fair	-46.1	Fair
SLT-38A	South Mid-Estuary	-42.1	Good	-41.1	Good
Gordy	Ten Mile	54.7	Fair	54.1	Fair

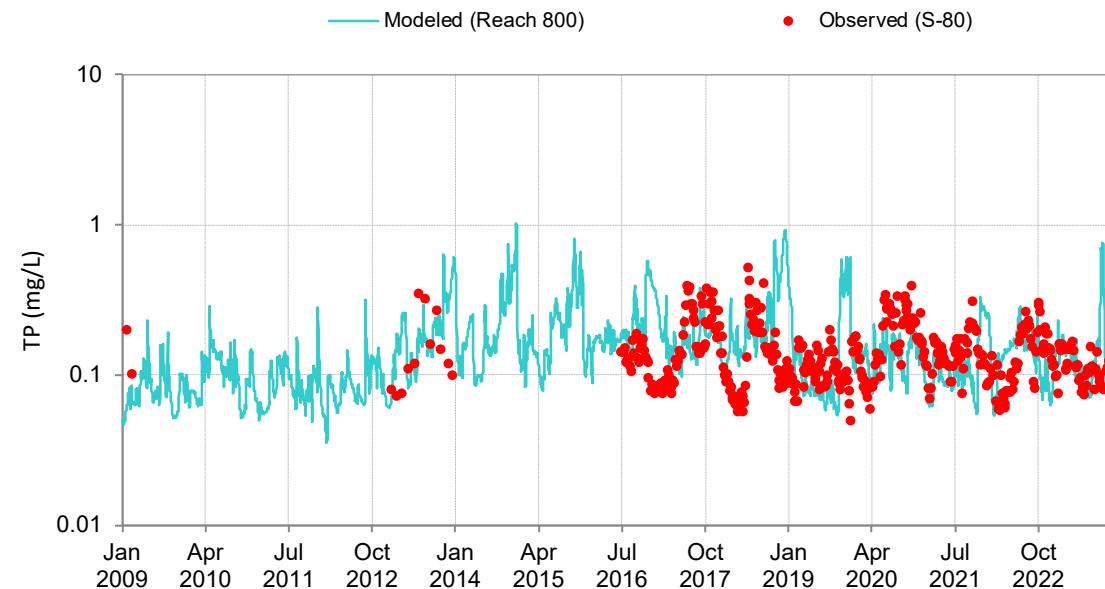
TP Calibration Statistical Summary

Station ID	Basin	Average Annual % Error	Average Annual % Error Rating	Median Annual % Error	Median Annual % Error Rating
SLT-9	Basin 4/5	-40.5	Good	-40.1	Good
SLT-7	Basin 6	-34.0	Good	-37.0	Good
ACRA1	C-23	-12.1	Very Good	2.0	Very Good
PC49C23	C-23	-68.8	Poor	-68.1	Poor
S48	C-23	11.5	Good	5.8	Very Good
PC54C23	C-24	-71.5	Poor	-71.5	Poor
S-49	C-24	-47.8	Fair	-51.3	Fair
S-80	C-44/S-153	8.0	Very Good	-1.1	Very Good
SLT-11	North Fork	88.5	Poor	73.8	Poor
SLT-17	North Fork	110.3	Poor	110.6	Poor
SLT-19	North Fork	63.7	Poor	80.5	Poor
SLT-21	North Fork	88.4	Poor	76.4	Poor
SLT-26	North Fork	19.3	Very Good	28.4	Very Good
SLT-10A, SLT-10B, A18, A22	North Fork	100.4	Poor	104.8	Poor
SLT-29	North Mid-Estuary	782.0	Poor	795.8	Poor
SLT-35	South Coastal	-21.4	Very Good	-18.1	Very Good
SLT-37A	South Coastal	475.7	Poor	477.0	Poor
SLT-1	South Fork	-36.0	Good	-35.8	Good
SLT-2A	South Fork	253.2	Poor	435.9	Poor
SLT-3	South Fork	-64.4	Poor	-60.7	Poor
SLT-31	South Fork	-5.3	Very Good	-6.0	Very Good
SLT-34A	South Fork	-24.9	Very Good	32.9	Good
SLT-40A	South Fork	65.0	Poor	67.2	Poor
SLT-38A	South Mid-Estuary	92.3	Poor	85.9	Poor
Gordy	Ten Mile	32.5	Good	30.0	Good

Example Water Quality Calibration Results – Outflow of C-44 Basin at S-80

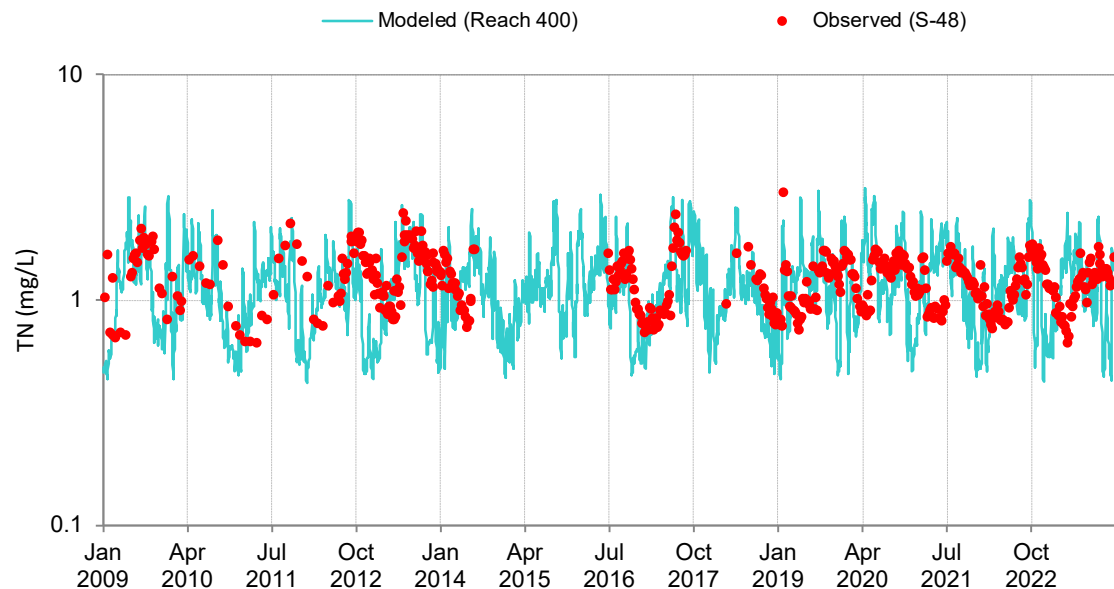


Statistic	Results	Rating
Count (number)	461	Not applicable (N/A)
Average Error (%)	-36.6	Good
Median Error (%)	-46.3	Fair
RMSE (mg/L)	0.62	N/A
R ²	0.16	N/A

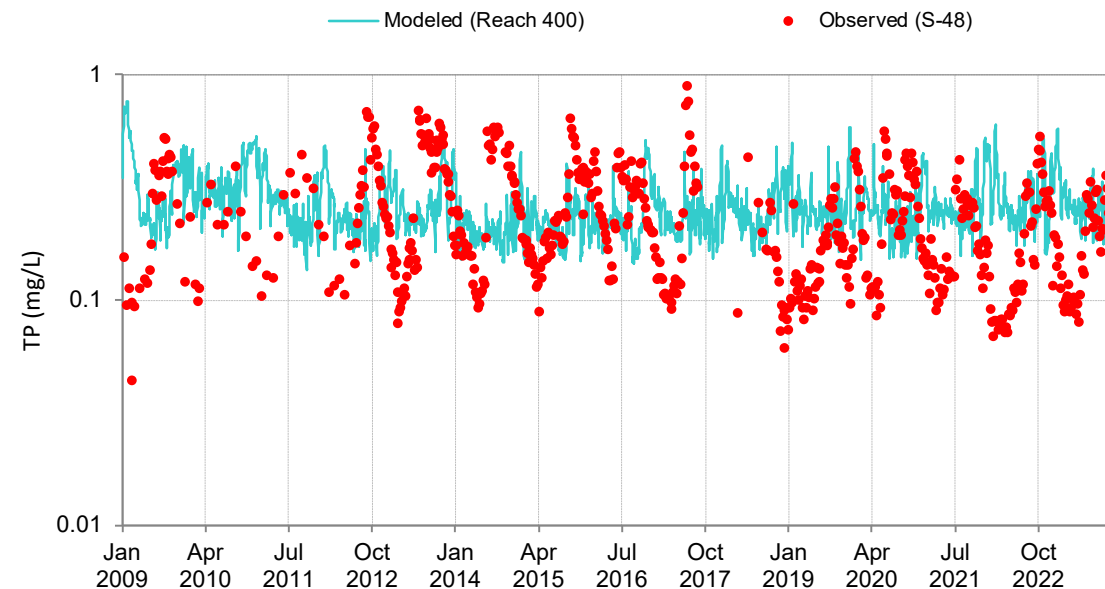


Statistic	Results	Rating
Count (number)	461	N/A
Average Error (%)	45.5	Fair
Median Error (%)	-0.7	Very Good
RMSE (mg/L)	0.15	N/A
R ²	0.00	N/A

Example Water Quality Calibration Results – Outflow of C-23 Basin at S-48

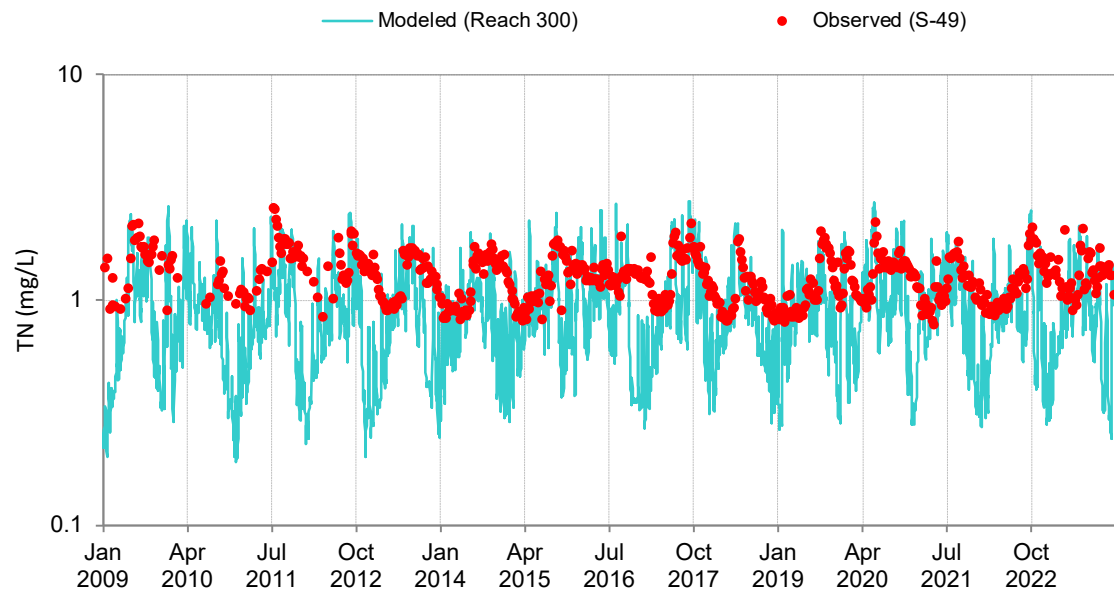


Statistic	Results	Rating
Count (number)	510	N/A
Average Error (%)	-0.2	Very Good
Median Error (%)	-10.3	Very Good
RMSE (mg/L)	0.52	N/A
R ²	0.10	N/A

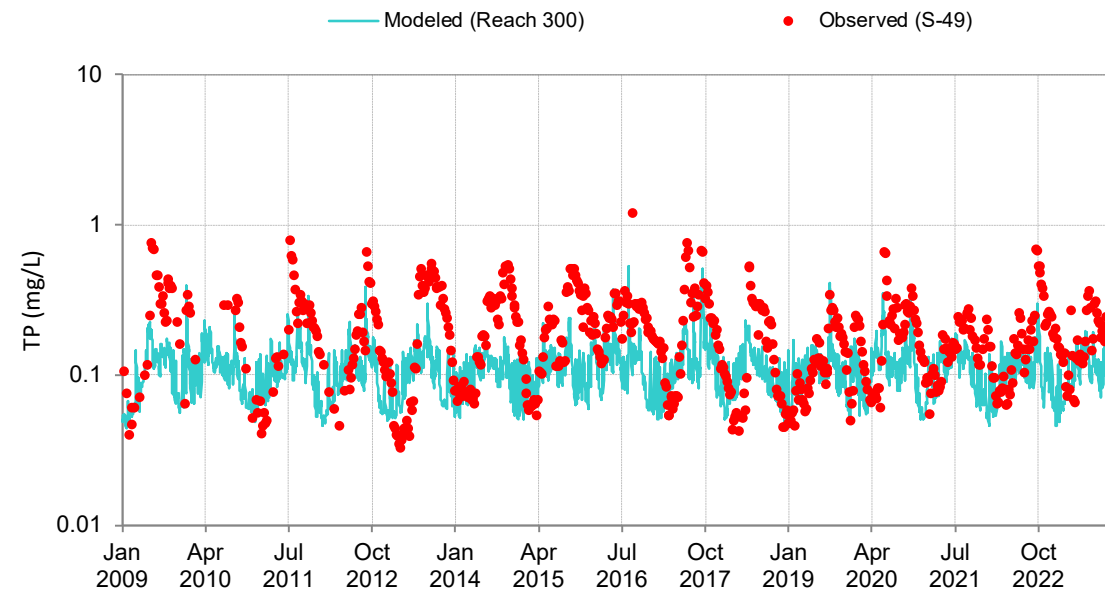


Statistic	Results	Rating
Count (number)	611	N/A
Average Error (%)	51.7	Fair
Median Error (%)	26.9	Very Good
RMSE (mg/L)	0.17	N/A
R ²	0.01	N/A

Example Water Quality Calibration Results – Outflow of C-24 Basin at S-49

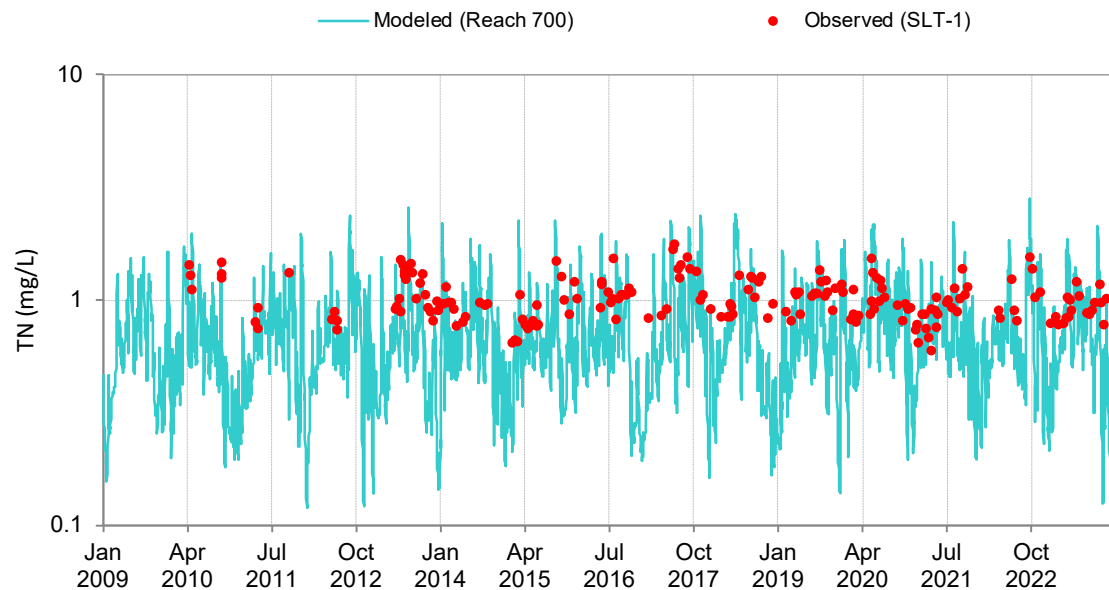


Statistic	Results	Rating
Count (number)	684	N/A
Average Error (%)	-24.6	Very Good
Median Error (%)	-29.1	Very Good
RMSE (mg/L)	0.59	N/A
R ²	0.09	N/A

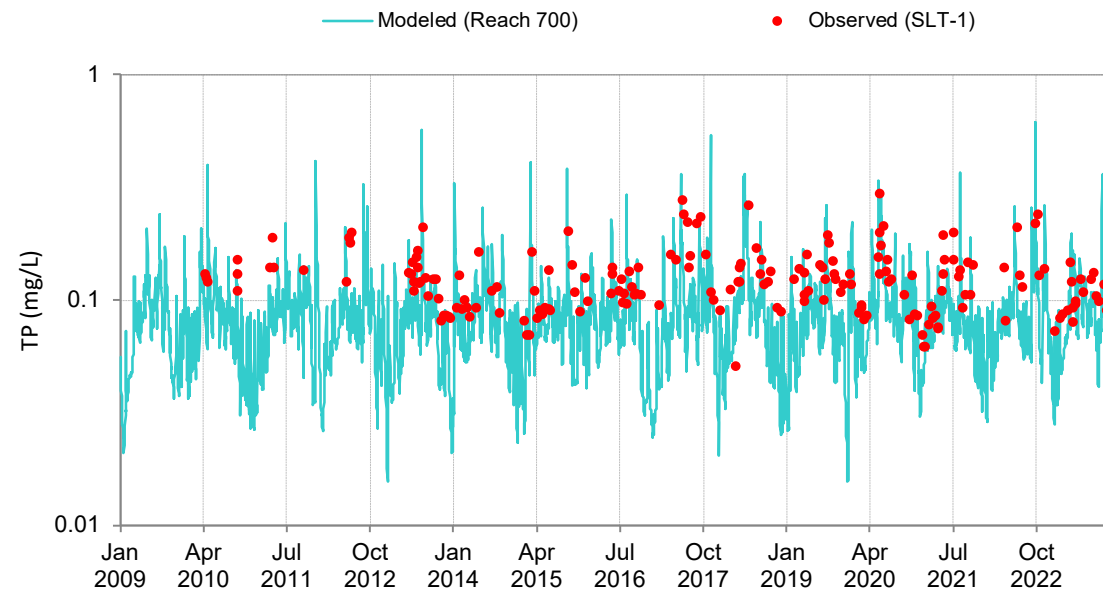


Statistic	Results	Rating
Count (number)	688	N/A
Average Error (%)	-24.2	Very Good
Median Error (%)	-40.5	Good
RMSE (mg/L)	0.16	N/A
R ²	0.17	N/A

Example Water Quality Calibration Results – South Fork Basin at SLT-1



Statistic	Results	Rating
Count (number)	198	N/A
Average Error (%)	-18.4	Very Good
Median Error (%)	-26.9	Very Good
RMSE (mg/L)	0.45	N/A
R ²	0.09	N/A



Statistic	Results	Rating
Count (number)	198	N/A
Average Error (%)	-20.7	Very Good
Median Error (%)	-30.4	Good
RMSE (mg/L)	0.06	N/A
R ²	0.09	N/A

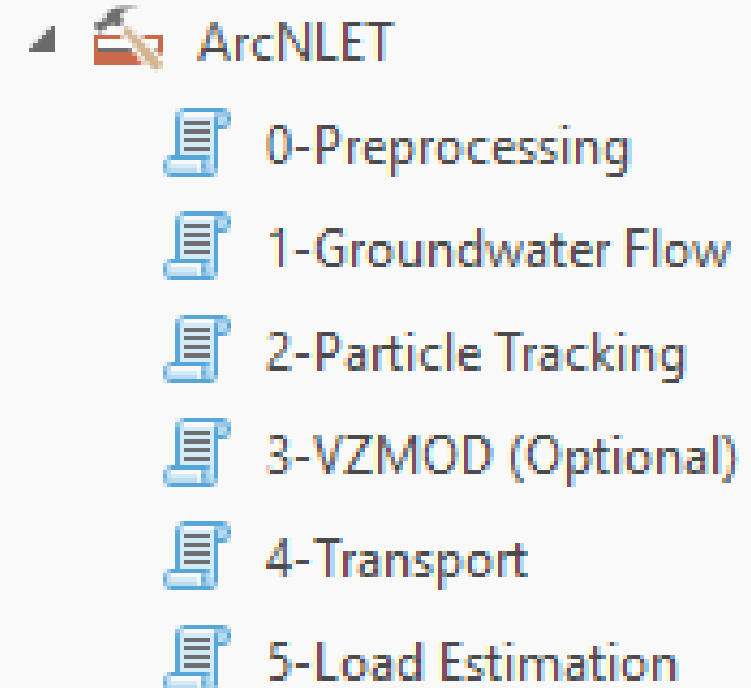
Questions?



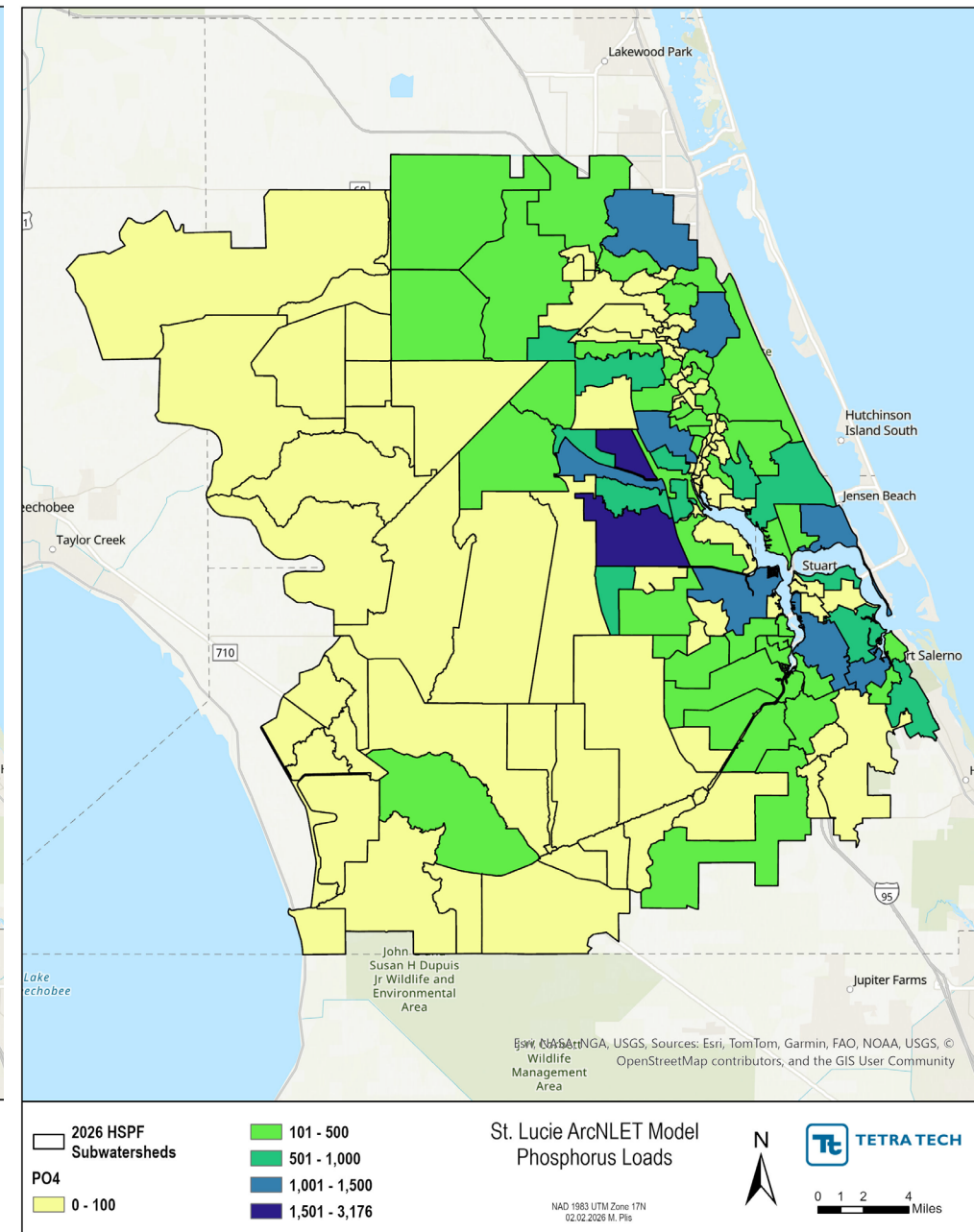
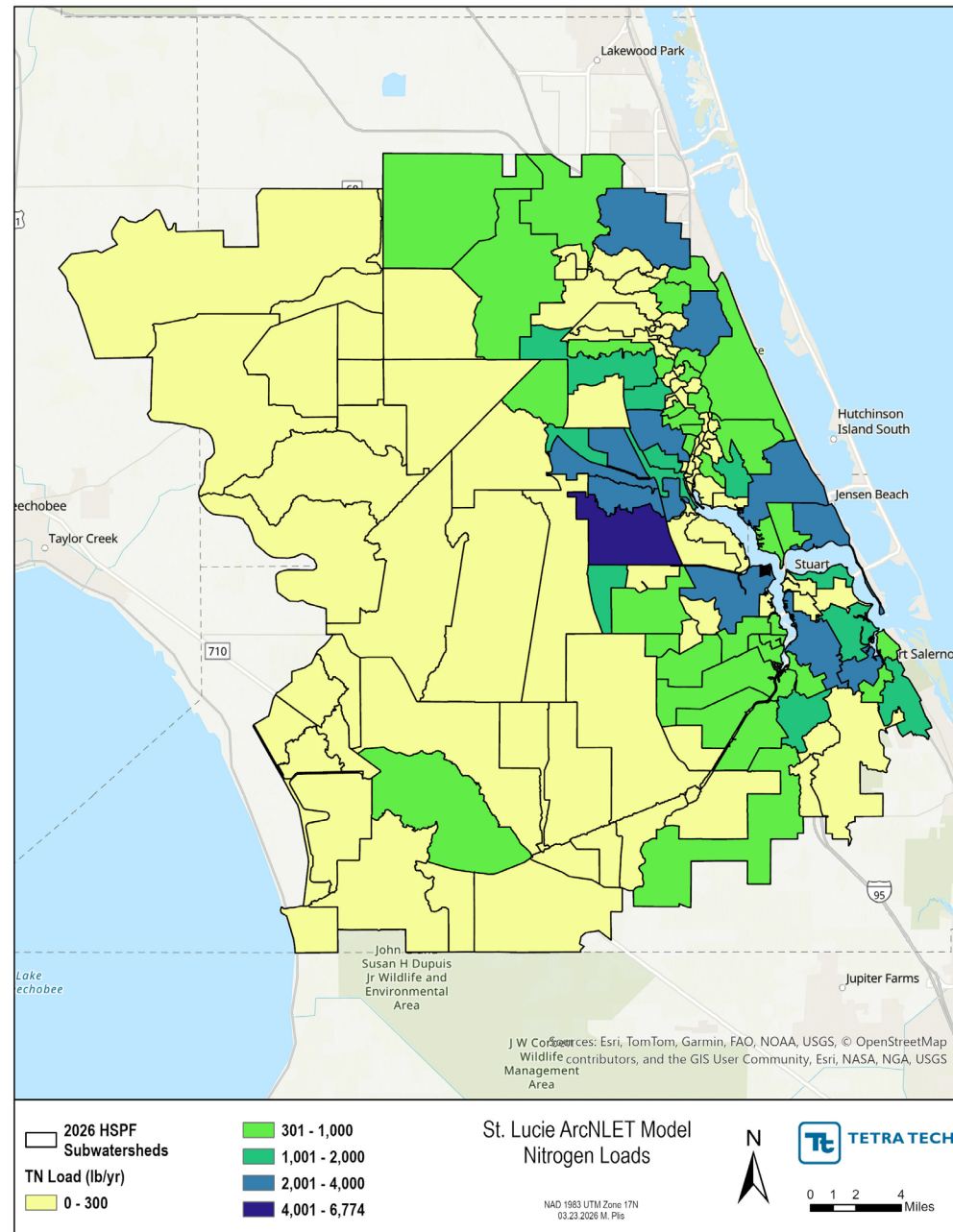
ArcNLET

Septic Systems Representation

- HSPF Model uses ArcNLET model to add septic system loads.
 - Added as point source input to each reach.
 - Consistent with BMAP crediting approach and provides tool for stakeholders.
- Used latest ArcNLET-Py model.
 - Simplified model of nitrogen and phosphorus transformation and transport.



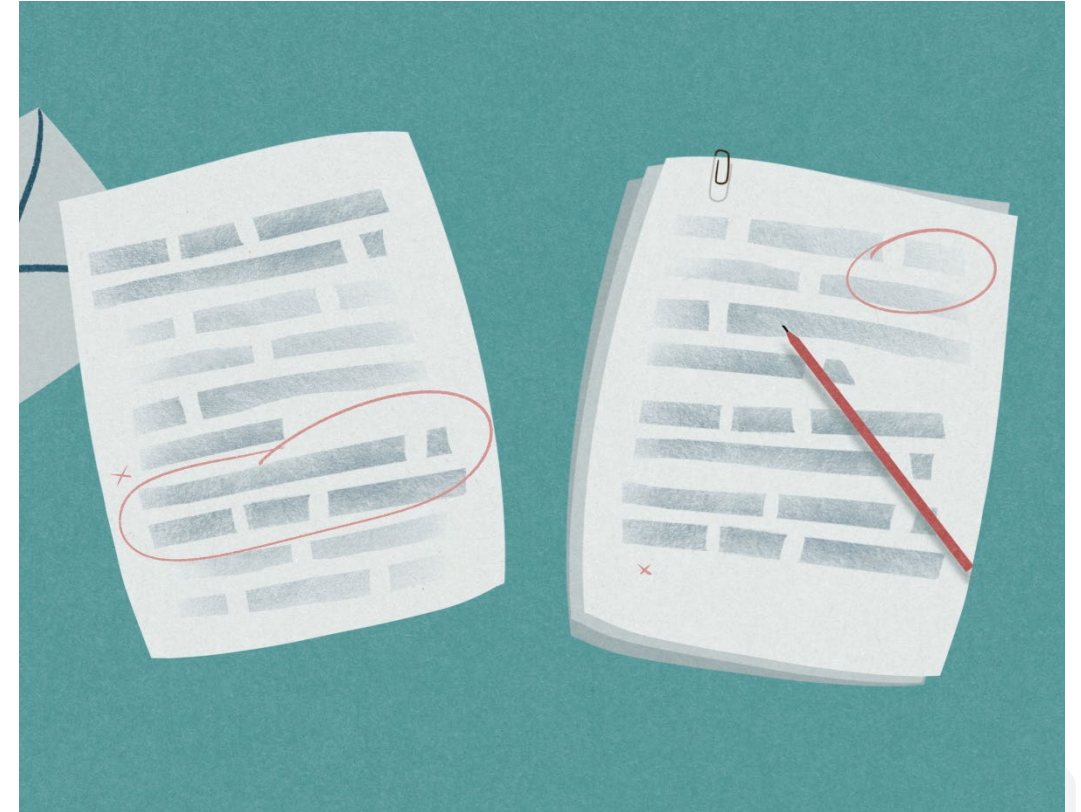
ArcNLET Results



Next Steps

Remaining Tasks

- Stakeholder comments on the water quality calibration memo due October 14.
- Finish preparing the HSPF Model report and share for stakeholder review.
- Create the LET.
- Final in-person stakeholder meeting.



Questions?



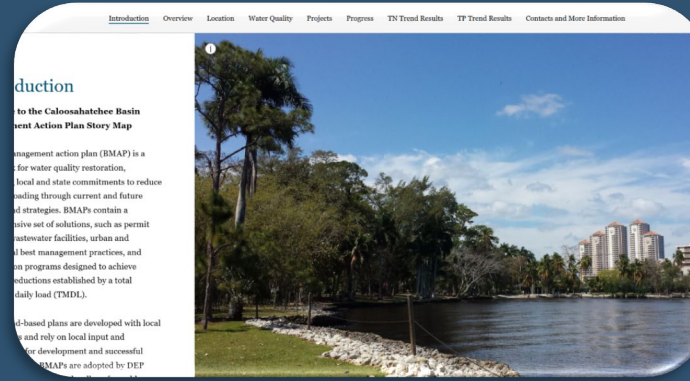


RESOURCES AND HELPFUL LINKS

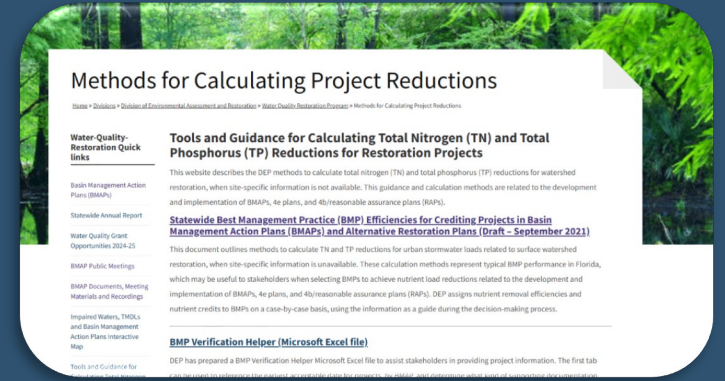
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION



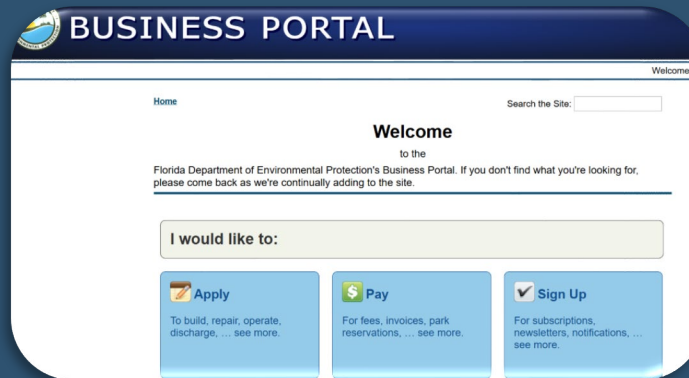
Basin Management Action Plans



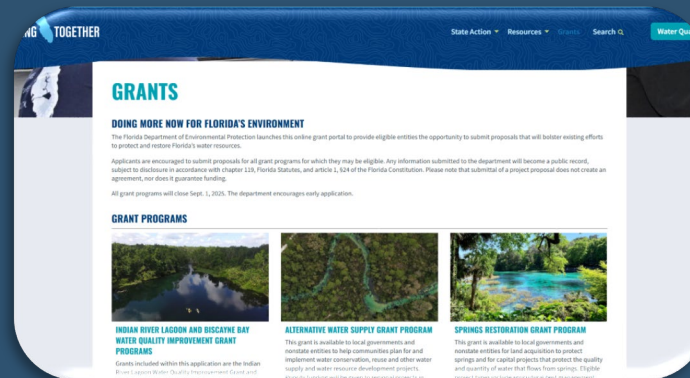
StoryMap



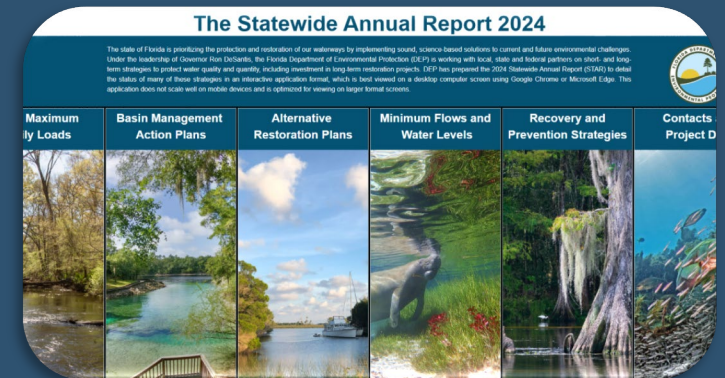
Project Calculation Methods



Project Portal



DEP Grants Portal



STAR



THANK YOU

Tony Tomalewski

Division of Environmental Assessment and Restoration
Water Quality Restoration Program
Florida Department of Environmental Protection

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850-245-8683

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St. Lucie River and Estuary Basin Management Action Plan (BMAP) Technical Meeting Webinar Summary

Friday, September 25, 2026

10:00 am – 10:35 am

Participants

Cora Aossey, DEP	Nick Linehan, St. Lucie County
Christian Avila, SFWMD	Stef Matthes, Culpepper & Terpening
Paulette Bell, St. Lucie County	Peter May, City of Port St. Lucie
Anthony Betts, SFWMD	Amanda McDonald, SFWMD
Kelley Breeden, DEP	Jennifer McGee, St. Lucie County
Roberto Cabrera, Culpepper & Terpening	Zach Mouw, Culpepper & Terpening
Barrett Carter, Geosyntec	Stacey Ollis, SFWMD
Luguey Dawson, FPUA	Steffany Olson, SFWMD
Patrick Dayan, St. Lucie County	Anita Stine, DEP
Amy Eason, Martin County	Jennifer Thera, FDACS
Jessica Fetgatter, DEP	Tony Tomalewski, DEP
Marcy Frick, Tetra Tech	Amanda Valdes, Alvarez Engineering
Raichel Gulde, RES	Hannah Vallero, Culpepper & Terpening
Moirra Homann, DEP	Rachel Vitek, RES
Chandler Keenan, DEP	Jeremy Wyss, Tetra Tech
Josh Killian, Culpepper & Terpening	

The webinar supporting materials are posted to the Florida Department of Environmental Protection (DEP) website at <https://floridadep.gov/dear/water-quality-restoration/content/bmap-documents-meeting-materials-and-recordings>.

Introduction

Tony Tomalewski welcomed everyone to the St. Lucie River and Estuary BMAP technical meeting and reviewed the meeting agenda. Tony noted that the Statewide Annual Report (STAR) project collection period begins on November 16. In 2027, DEP will hold a final model public meeting, use the model load estimation tool (LET) to evaluate starting loads, and meet with stakeholders to discuss allocations and projects lists. This information will be used in the next draft BMAP that must be completed before 2030.

Overview of Hydrological Simulation Program – FORTRAN (HSPF) Updates

Marcy Frick reviewed the history and scope of work for the HSPF model development. She noted that Tetra Tech is working through a series of tasks to develop the model. The available data were compiled and reviewed by the stakeholders in August 2025. The model was setup and calibrated for watershed hydrology, which was the focus of the April 2026 meeting. Also during the April meeting, there was discussion about the ArcGIS-Based Nutrient Load Estimation Toolbox in Python (ArcNLET-Py) model for onsite sewage treatment and disposal systems (OSTDS). The HSPF model was then calibrated for water quality, and Tony sent the draft memo to the stakeholders for review on September 14. Tetra Tech is working to draft the final model report and will prepare the LET for the future BMAP update.

For the HSPF model water quality calibration, several datasets were used. The land use coverage is a combination of the 2020–2023 DEP statewide coverage, 2023 National Land Cover Dataset impervious

cover, Florida Department of Agriculture and Consumer Services (FDACS) Florida Statewide Agricultural Irrigation Demand (FSAID) 12, and Florida Department of Transportation (FDOT) roads and rights-of-way. The land uses were rolled up into 18 categories for use in the model. Three domestic and industrial wastewater treatment facilities and nine reuse facilities were represented in the model, as well as OSDTS using information from the ArcNLET-Py model.

The model includes specialized representations for structures and corrective flows for the Lake Okeechobee boundary condition at the S-308 lock, C-25 boundary with the C-24 Basin at the G-81 structure, corrective flows and water quality at the GORDY_S station in Ten Mile Creek to account for water sources without data, C105 canal corrective flows and water quality to account for missing water sources, and L-65 canal corrective flows and water quality at station S153 to account for operations at the latching gate mechanism that cannot be simulated in HSPF. The HSPF model also represents flows and water quality for South Florida Water Management District (SFWMD) and FDACS regional projects. Both wet and dry atmospheric deposition of nutrients are included.

Marcy stated that the HSPF model was calibrated and validated for several parameters. Sediment was aligned with reference and field data for upland sources and then compared to instream samples. Water temperature was checked for reasonableness since it is important for water quality processes. Instream nutrients were evaluated for long-term and seasonal trends. Upland nutrients were compared to literature values, and Marcy showed figures of the model upload loading rates compared to these values for total nitrogen (TN) and total phosphorus (TP). The model was compared to data at 53 locations, 14 for calibration and 39 for validation. The locations were selected to represent each basin and required to have a certain amount of data. Marcy showed the TN and TP calibration statistic tables as well as example plots with results. She noted that the draft water quality memo includes more details and plots.

Marcy stated that the ArcNLET-Py model is complete and ready for stakeholder use. The model OSDTS loads were added to the HSPF model as time variable subbasin loads. Groundwater outflow data were used to partition annual loads into daily loads to allow for more loading during times of high flow and less loading during times of low flow, which better matched measured data. The ArcNLET-Py deliverables include a geographic information system (GIS) shapefile of the parcels in the BMAP and associated load from OSTDS, if applicable. The stakeholders can use this shapefile to estimate the benefits of their OSTDS projects.

Next Steps

Marcy stated that stakeholder comments on the water quality calibration memo are due October 14. Tetra Tech will incorporate the changes from the comments in the final HSPF model report, which will be shared with the stakeholders for review. Tetra Tech will also create the LET using the model output. As Tony noted earlier, the final in-person stakeholder meeting on the model will be held in 2027.

DEP Resources

Tony stated that the DEP website includes several helpful resources for stakeholders. The presentation includes links to the main BMAP page, BMAP StoryMap, project calculation methods, project portal, grants portal, and STAR.

Questions and Answers

There were no questions raised during the meeting.