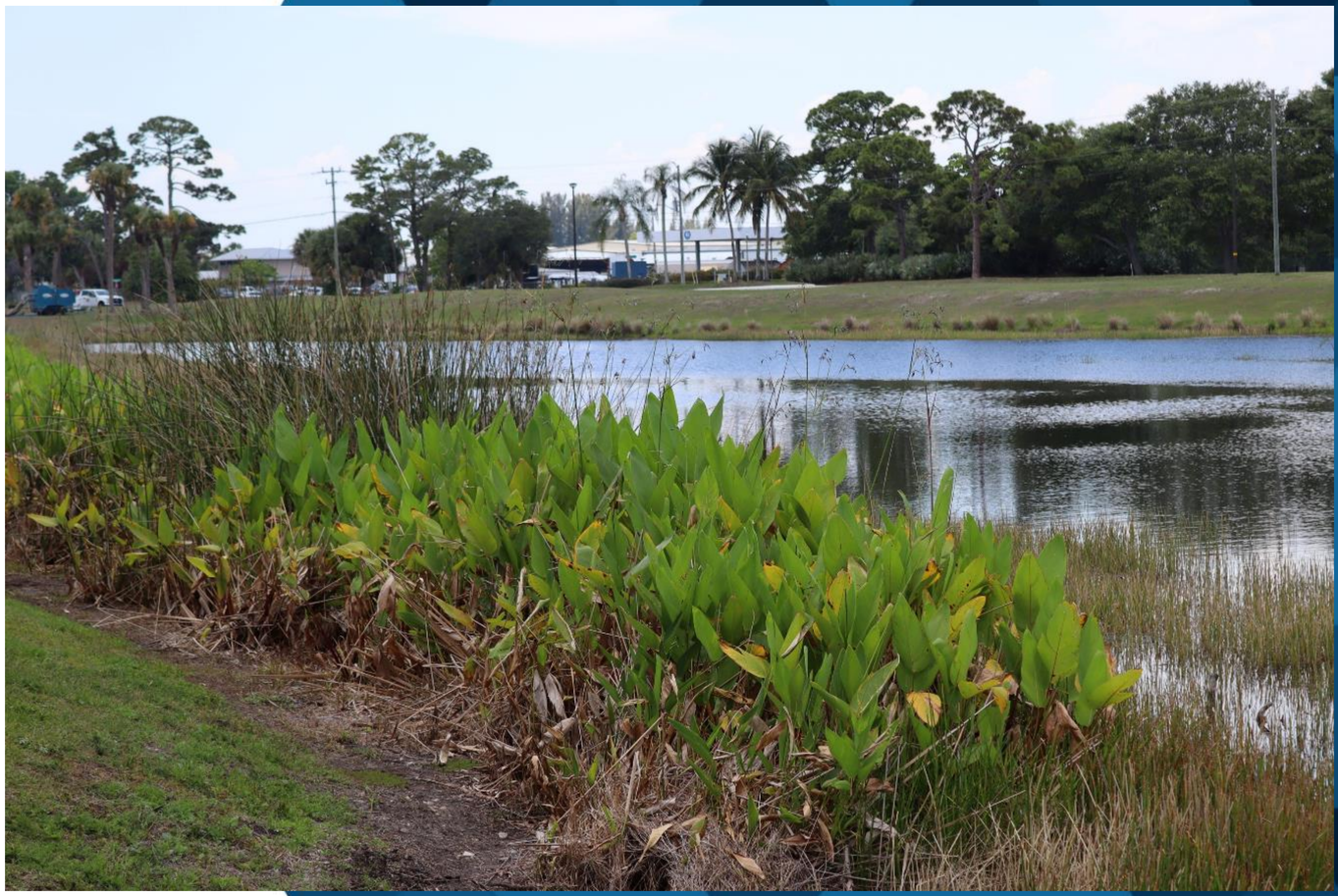
WHAT'S GOING ON?

MY STA IS NOT PERFORMING THE WAY I PLANNED



JUNE 13, 2024

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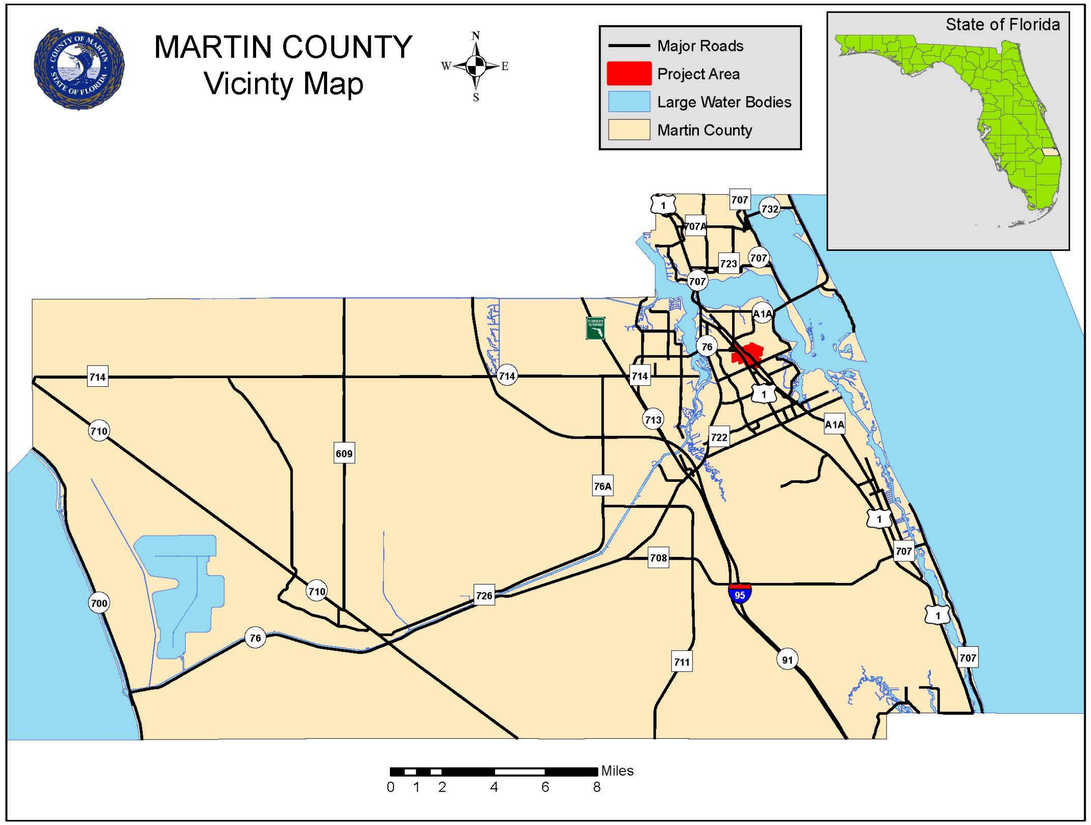
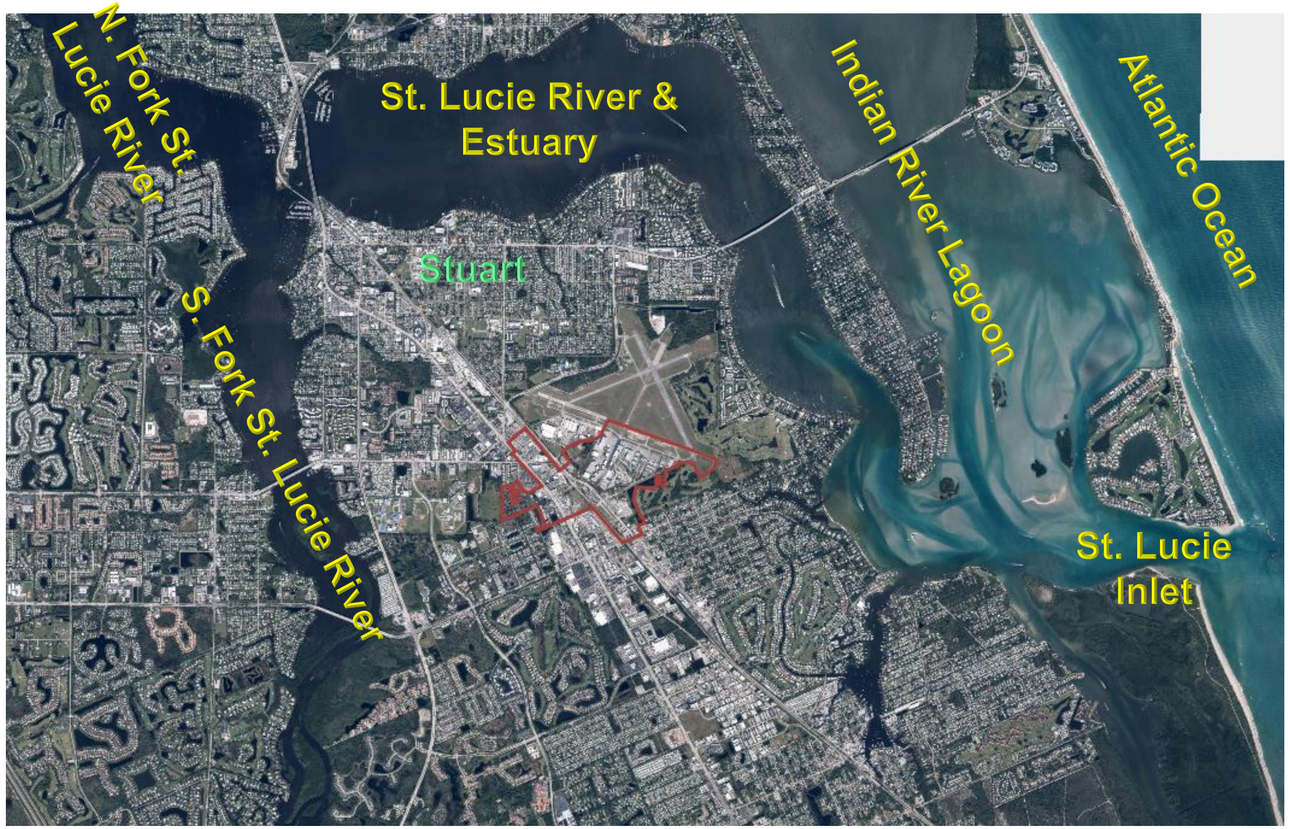
WILLOUGHBY CREEK LOCATION MAP





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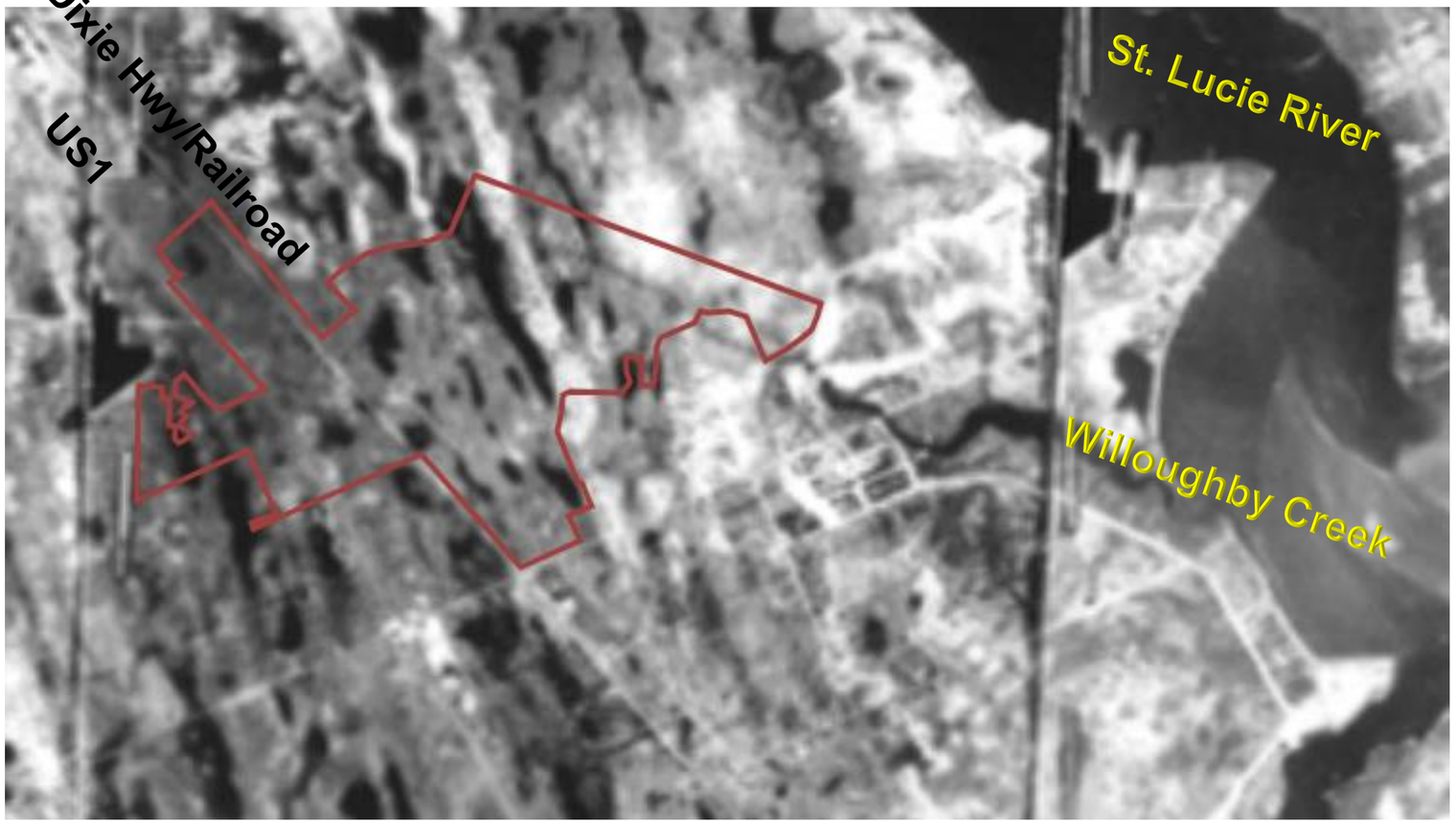
WILLOUGHBY CREEK DRAINAGE BASIN 1940



WILLOUGHBY CREEK DRAINAGE BASIN 1958

WILLOUGHBY CREEK DRAINAGE BASIN PRESENT DAY

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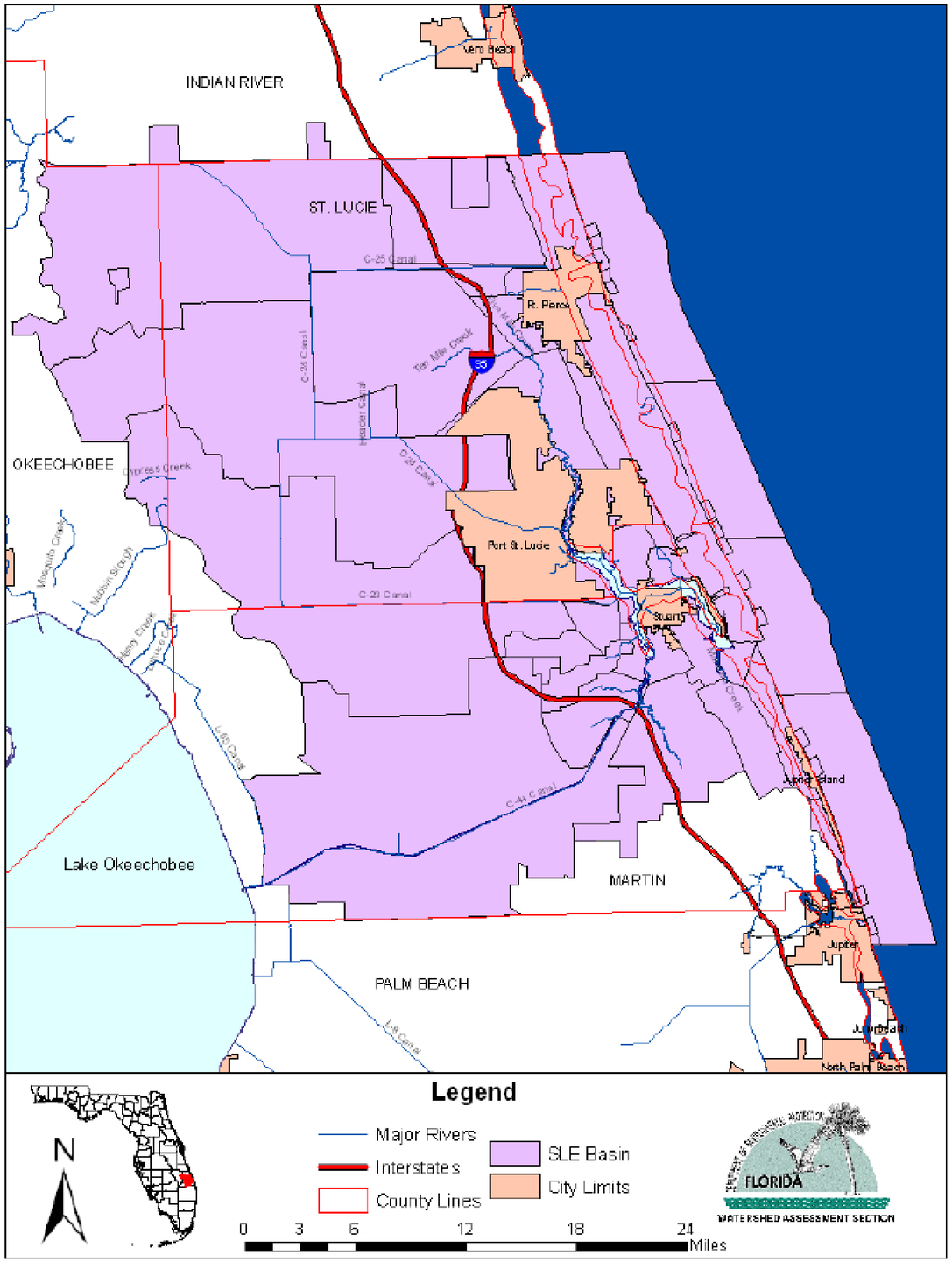
IMPAIRMENTS

- TMDL Report - Nutrient and Dissolved Oxygen TMDL for the St. Lucie Basin (October 2008)
- BMAP for the Implementation of Total Maximum Daily Loads for Nutrients and Dissolved Oxygen by the FDEP in the St. Lucie River and Estuary Basin (May 2013)
- Willoughby Creek Nutrient Loading Study (2014) February 13, 2015 – Draft Watershed Assessment Group 2, Cycle 3 – Martin County requested that WBID 3208B – Willoughby Creek be placed in Category 4e (On-going Restoration Activities) – Impairment is Chlorophyll-a (Nutrients)

TMDL – ST. LUCIE BASIN

- Established October 2008
- Adopted March 26, 2009
- Based on dissolved oxygen and chlorophyll-a exceeding the nutrient narrative criteria
- TMDL (based on IRL-S Plan)
  - 0.72 mg/L Total Nitrogen
  - 0.081 mg/L Total Phosphorus
  - 2.0 mg/L BOD



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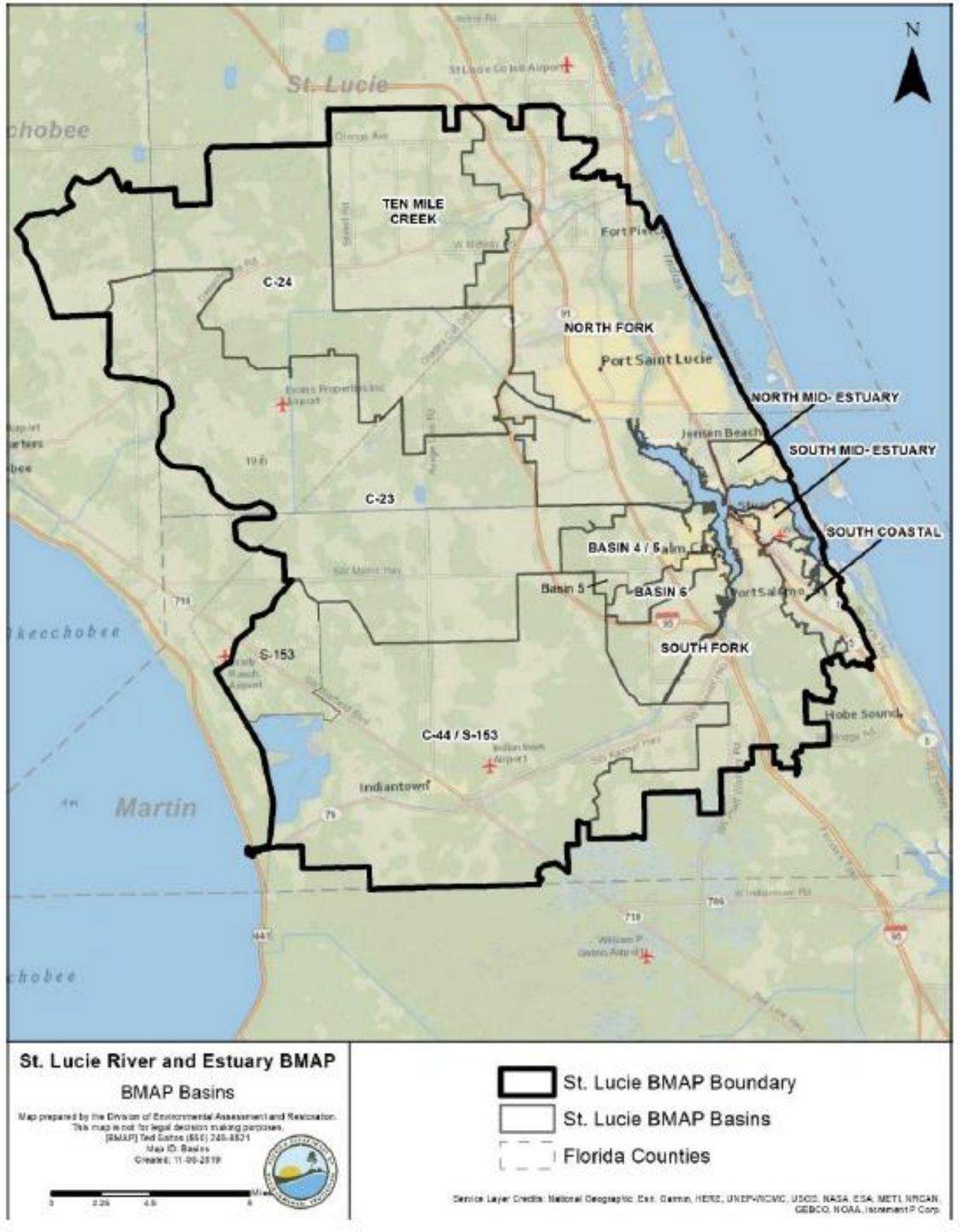
BMAP ST. LUCIE RIVER AND ESTUARY BASIN

- Established May 2013
- Originally did not include the Willoughby Basin
- Updated February 2020
  - Willoughby Basin located in the South Mid-Estuary
  - TN reduction 0%
  - TP reduction 31%



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PROJECT HISTORY

- Old Bulkhead Weir (1970s)
- 1995-Reconstructed Weir
  -25 ft weir at 2.44’ NAVD
- Willoughby Creek Basin Reconnaissance Study (June 2000)
- Nov 2000-Adjusted Weir
  -49 ft weir at 6.54’ NAVD
  -6” Bleeder at 4.54’ NAVD

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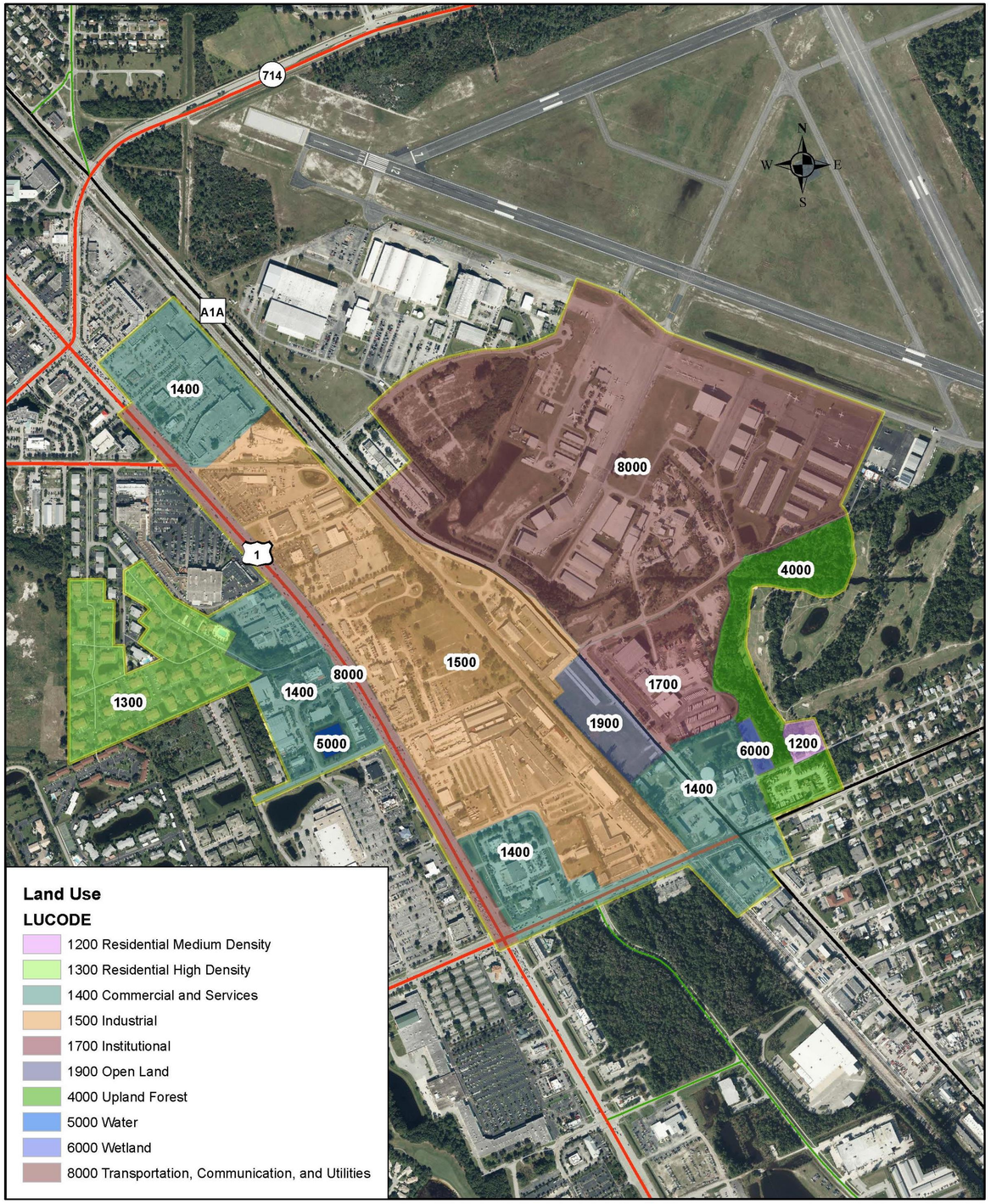
LAND USE

- 385 acres watershed
- Commercial
- Industrial
- Residential
- Airport
- Golf Course



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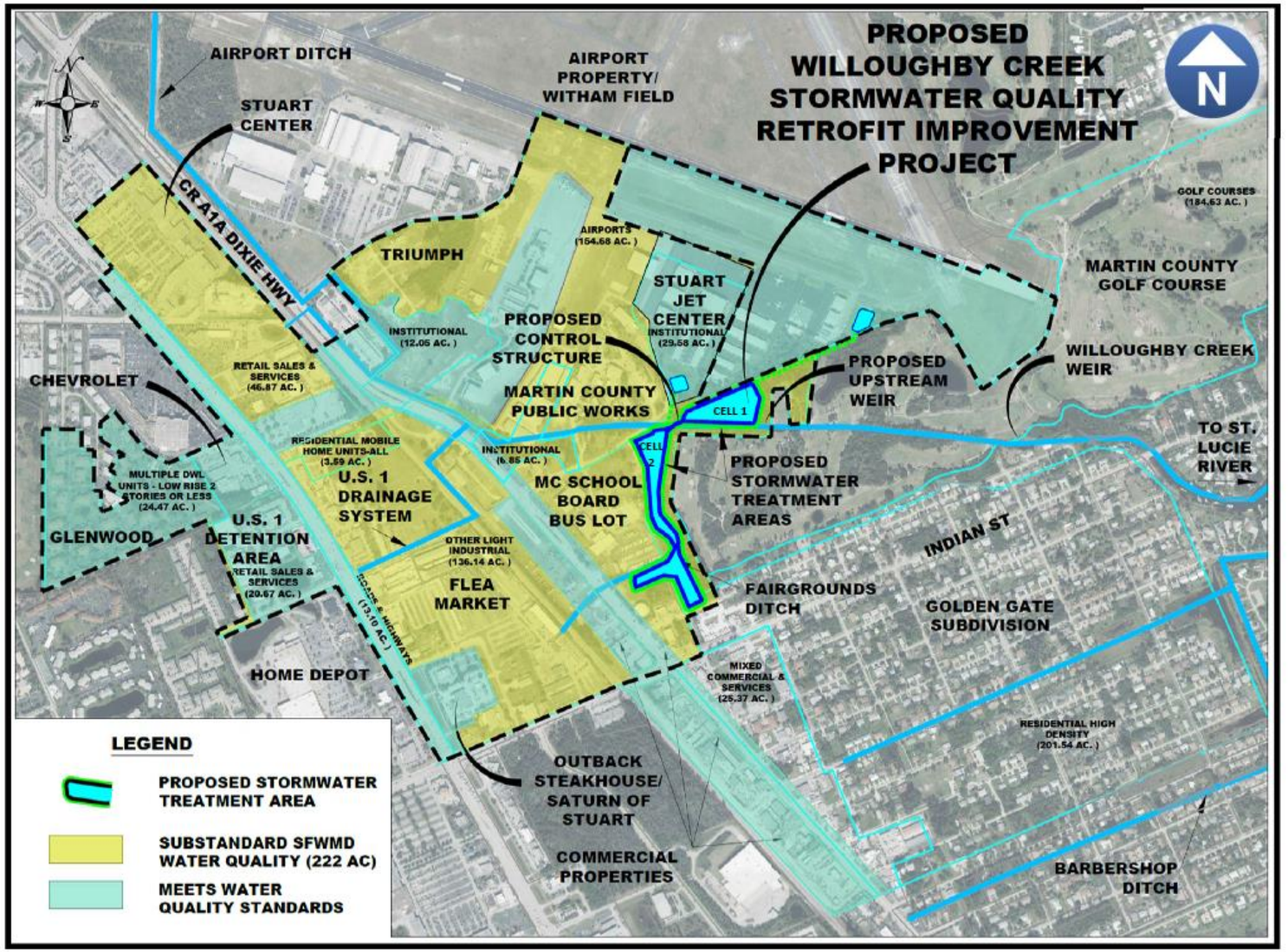
WILLOUGHBY CREEK BASIN

- 385 acres watershed
- 222 acres substandard water quality per SFMWD volumetric standards
- Need 18.5 acre-feet treatment



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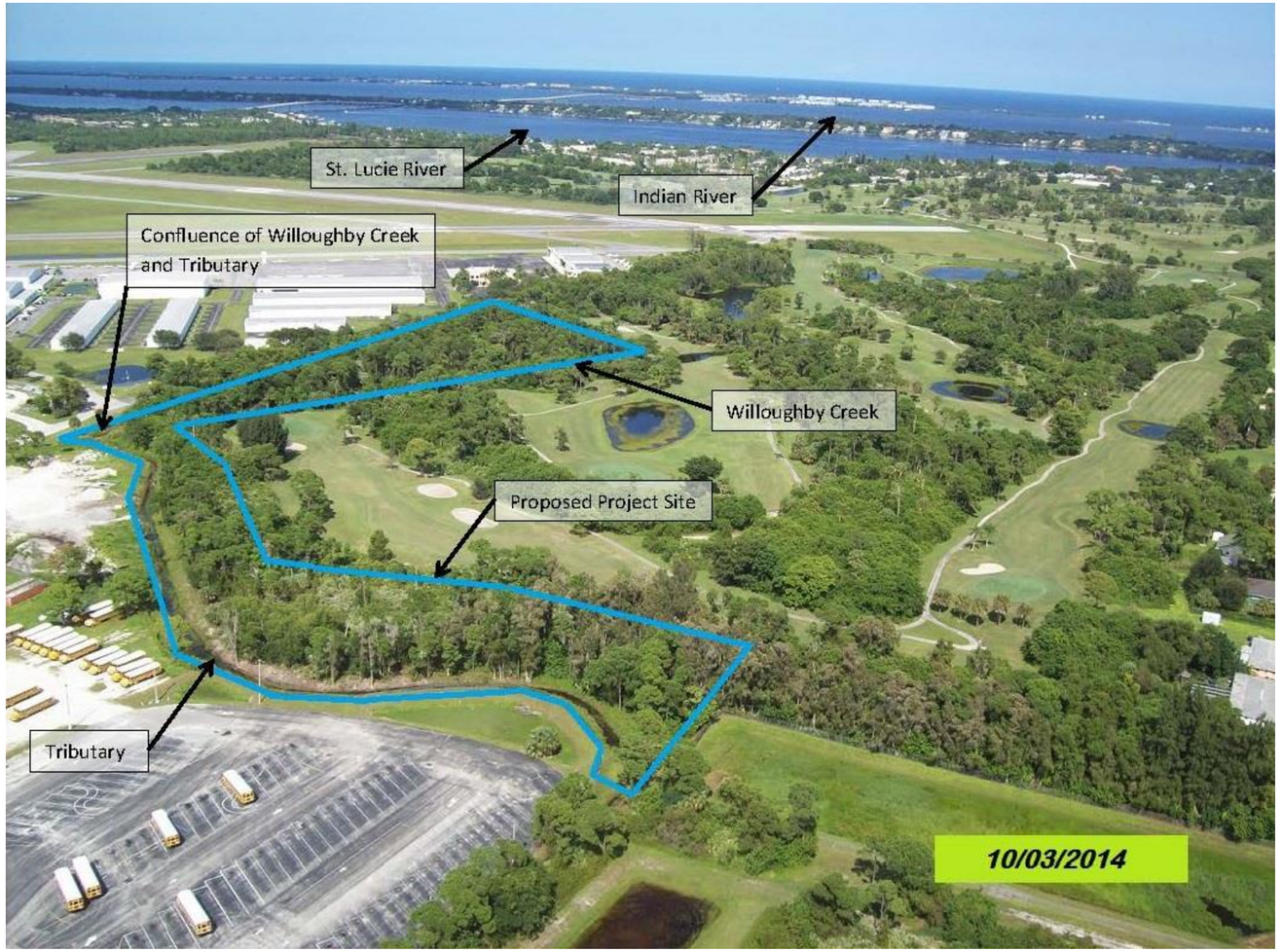
WILLOUGHBY CREEK STORMWATER QUALITY IMPROVEMENT PROJECT

- 8.24-acre combination system
  - deep wet detention lakes
  - shallow water Stormwater Treatment Areas (STA) with native herbaceous submergent and emergent plants
- Storm pipes, ditch bottom inlets, control structures
- Sheet pile weir
- Estimated 37% TN Reduction and 65% TP Reduction



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WILLOUGHBY CREEK STORMWATER QUALITY IMPROVEMENT PROJECT

WILLOUGHBY CREEK COSTS

Funding Source	Amount
FDEP Section 319 (Federal)	$475,200
FDEP Water Quality Restoration (TMDL) Grant	$210,847
State Legislative Appropriation	$794,800
Martin County	$524,941

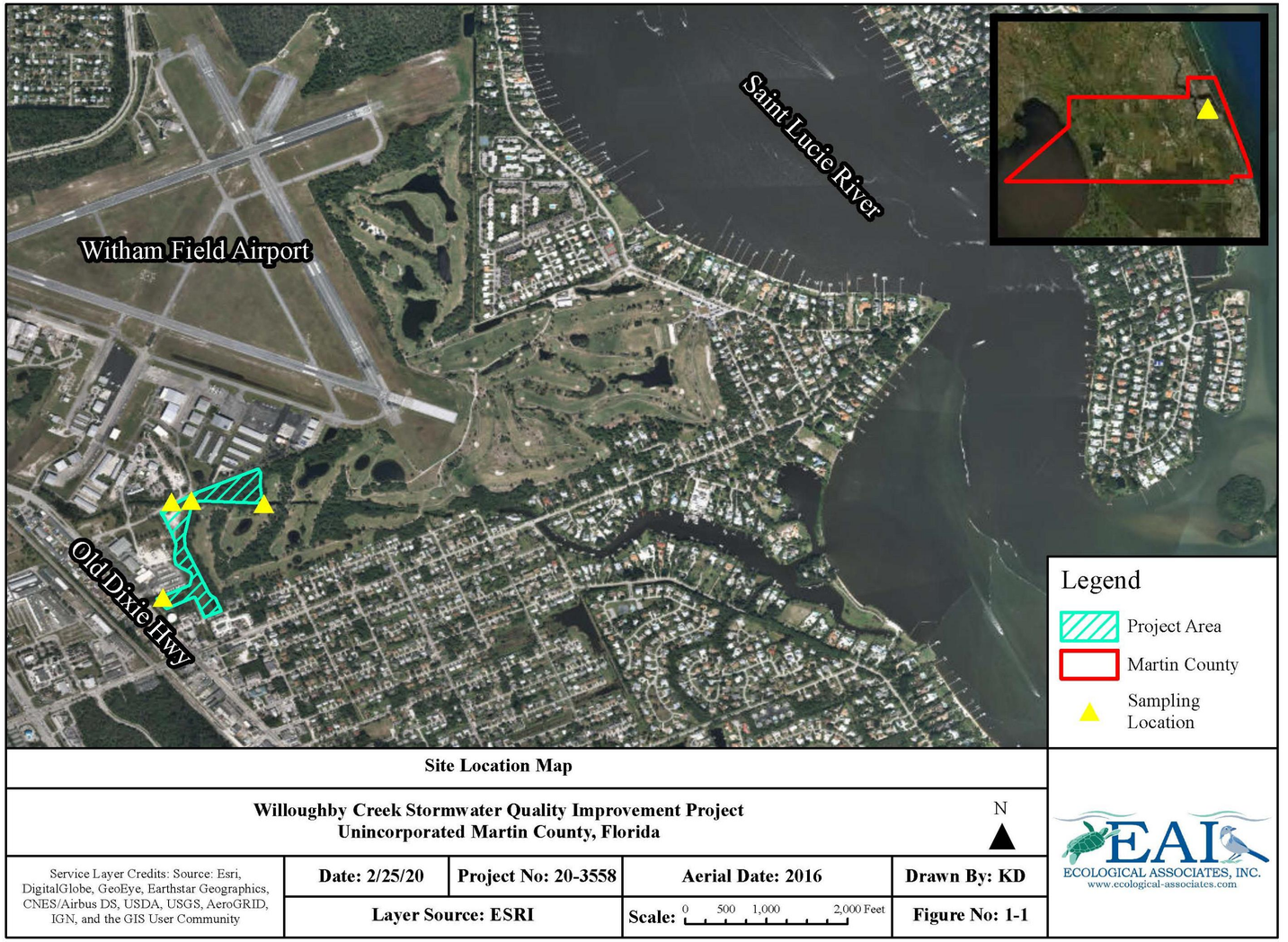
Total Cost = $2,005,788

PROJECT TIMELINE

Task	Date
Drainage Report	November 2017
Permits	December 2017
Construction	March 2019 – April 2020
Monitoring	August 2020 – July 2021

QUALITY ASSURANCE PLAN AND MONITORING

- 4 Sample Sites
  - 3 Sites via autosampler and grab
  - 1 Site Grab
- 13 Separate Events occurring between August 2020 and June 2021
  - Triggered at Rain Events with the sum of 0.2 to 1.5 in. of rain within 24 hrs
- Evaluated TN, TP, and TSS
- Measured flow, pH, temperature, specific conductivity, salinity, and dissolved oxygen



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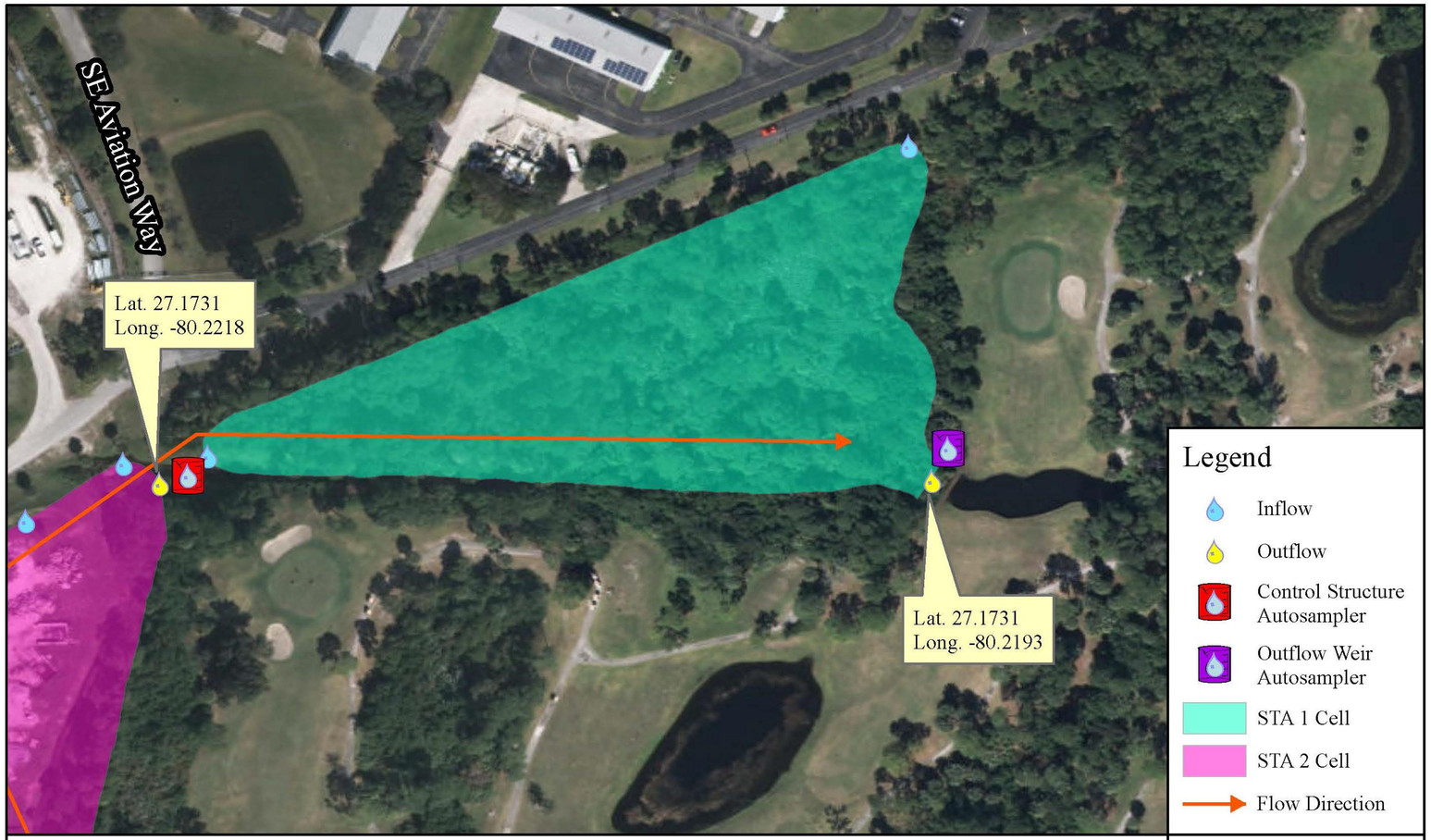
STA 1 SAMPLING



Site Location Map

Willoughby Creek Stormwater Quality Improvement Project
Unincorporated Martin County, Florida

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	**Date: 2/25/20**	**Project No: 20-3558**	**Aerial Date: 2016**	**Drawn By: KD**
	Layer Source: ESRI		**Scale:** 0 50 100 200 Feet	**Figure No: 1-2**

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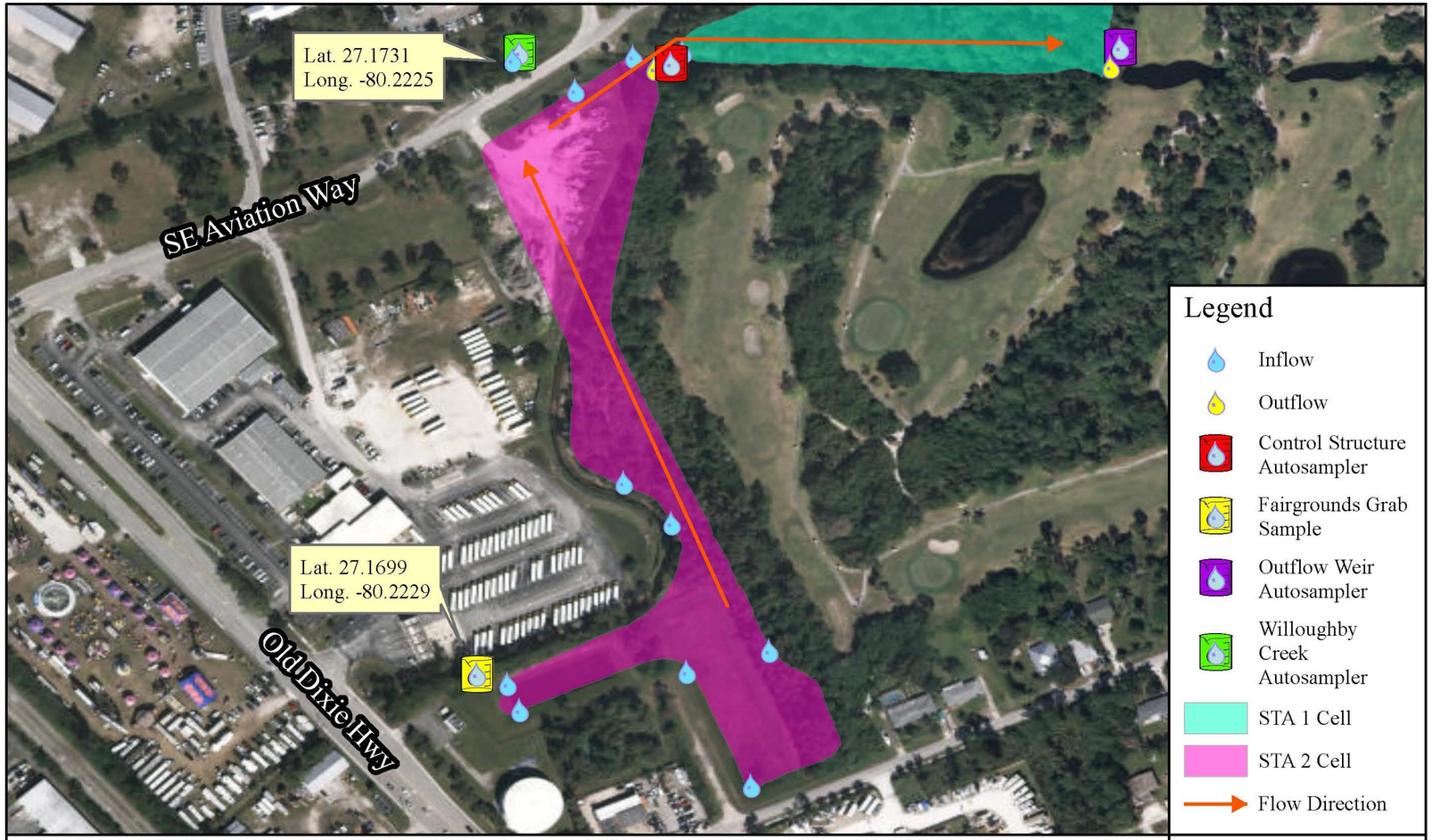
STA 2 SAMPLING



Site Location Map

Willoughby Creek Stormwater Quality Improvement Project
Unincorporated Martin County, Florida

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	**Date: 2/25/20**	**Project No: 20-3558**	**Aerial Date: 2016**	**Drawn By: KD**
	Layer Source: ESRI		**Scale:** 0 87.5 175 350 Feet	**Figure No: 1-3**

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MONITORING RESULTS

Site	Location	TP (mg/L)	TN (mg/L)	TSS (mg/L)
1	Creek Inflow	0.088	0.740	12.3
2	Control Structure	0.046	0.693	5.5
3	Outflow Weir	0.045	0.614	5.6
4	Fairground Ditch	0.049	0.281	8.6
Reduction from Inflow to Control Structure		**0.042**	**0.047**	**6.8**
Reduction from Control Structure to Outflow		**0.018**	**0.078**	**-0.1**
Reported Reduction from Inflow to Outflow		**0.043**	**0.126**	**6.7**

Pretty Good Results !?

REDUCTIONS

- A large portion of the inflow was not sampled. (There are 10 inflows into the system. 2 were sampled)
- Outflow = Inflow
- Assumed all inflow has the same concentration.

- Based on these sample points, TP was reduced by 49% instead of planned 65% and TN was reduced by 17% instead of 37%
- TSS was reduced by 54%

GOALS ACHIEVED?

Report conclusions

- The STA is trending toward effectiveness.
- Continued growth of wetland vegetation and the development of more natural chemical and biological processes throughout the project area, nutrient levels can be expected to decrease even more over time.

Not Yet?

LESSONS LEARNED

- Evaluate ratio of detention versus basin size (385 acres basin/8 acres of wet/dry detention space = 2%) Typically new development needs 10 to 18% stormwater management (flood and water quality)
- Although the system used a combination of BMPs, if you have the space create more deeper water cells to increase detention times, the removal would have been greater.
- If possible, monitor all the inflows. The Willoughby Ditch had 0.088 mg/L TP, 0.740 mg/L TN versus the Fairground Ditch had 0.049 mg/L TP, 0.281 mg/L TN. (The performance could be better or worse) The nutrients at the Willoughby Ditch was used to calculate performance because the Fairground ditch had less TN than the outflow weir.
- Location of the shallow vegetation to increase detention time
- Sampling before the project development

DISCUSSION AND QUESTIONS

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