

Florida Department of Environmental Protection

Office of Coastal and Aquatic Managed Areas
Rookery Bay National Estuarine Research Reserve



Restoring the Rookery Bay Estuary:
A project connecting people and science for
long-term community benefit

Presented by

Tabitha Whalen Stadler, Principal Investigator





Naples

Golden Gate/ Naples Bay Watershed

Rookery Bay Watershed

Marco Island

Rookery Bay National Estuarine Research Reserve



2014 Aerials Provided By
Collier County Property Appraiser
Map Produced By Rookery Bay Reserve
For Illustrative Purposes Only

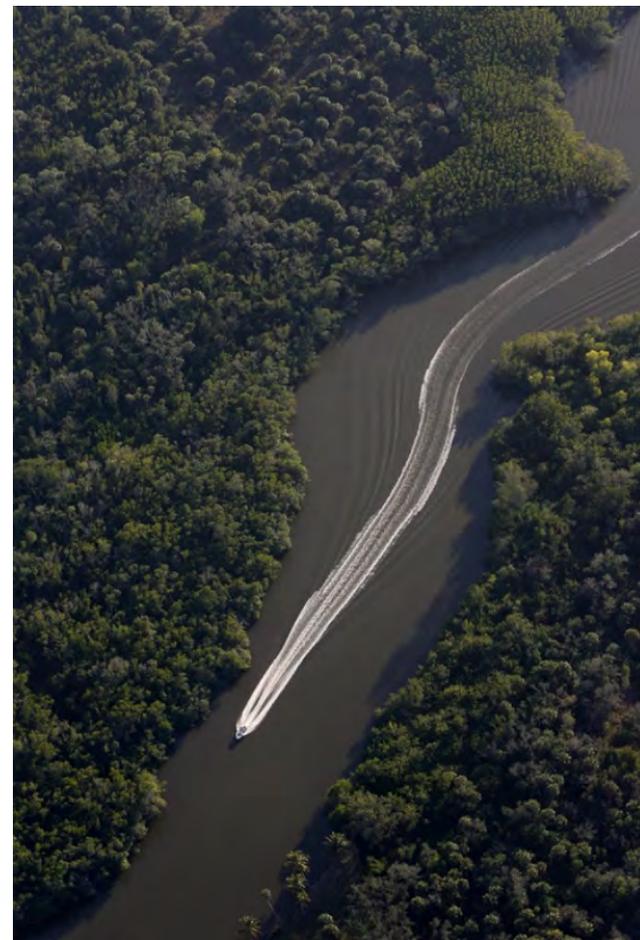


RESTORING THE ROOKERY BAY ESTUARY

A PROJECT CONNECTING PEOPLE AND SCIENCE FOR LONG-TERM COMMUNITY BENEFIT

Rookery Bay National Estuarine Research Reserve

- \$815,000 to Rookery Bay Reserve
- NOAA Science Collaborative
- March 2012 - May 2015
- Four Pieces, in two phases
 - Hydrology
 - Ecology
 - Water Quality
 - Human Dimensions





Project Overview



Two Main Goals:

- Better understand altered freshwater inflows to the Rookery Bay Estuary and how that has affected the ecologic health of the estuary, and,
- Better understand local water resource decision-making, at both the personal and institutional levels.

Apply the acquired knowledge, tools and data to improve management strategies.



Contracted Research



- Develop local scale hydrologic and hydraulic models for the Rookery Bay watershed and compare them
 - Existing/current conditions model
 - Natural Systems/historic conditions model
- Compare the hydrology in the Rookery Bay watershed to the hydrology in the Fakahatchee Watershed





Model Development



- Derived from the existing Big Cypress Basin and Collier County MIKE SHE/MIKE 11 regional model
- Refined the grid cell size from 1,500 square feet to 375 (3x better)
- Covers approximately 12% of the regional model domain
- Simulation period of 2002-2012 (regional model was 2002-2007)

Examples of Model Input Data

- Topography
- Rainfall
- ET
- Land-use
- Hydraulic Structures
- Vegetation crop data
- Aerial photos
- Saturated zone/groundwater
- Unsaturated flow & soil profiles
- Consumptive use of ground & surface water



- Flows include sheet flow overland, subsurface flows just beneath the surface, and aquifer flows
- Parameters (saturated zone layering, rainfall, potential ET, soils, and land-use dependent parameters, etc.) were held constant to ensure that differences are solely attributable to anthropogenic changes in the watershed.

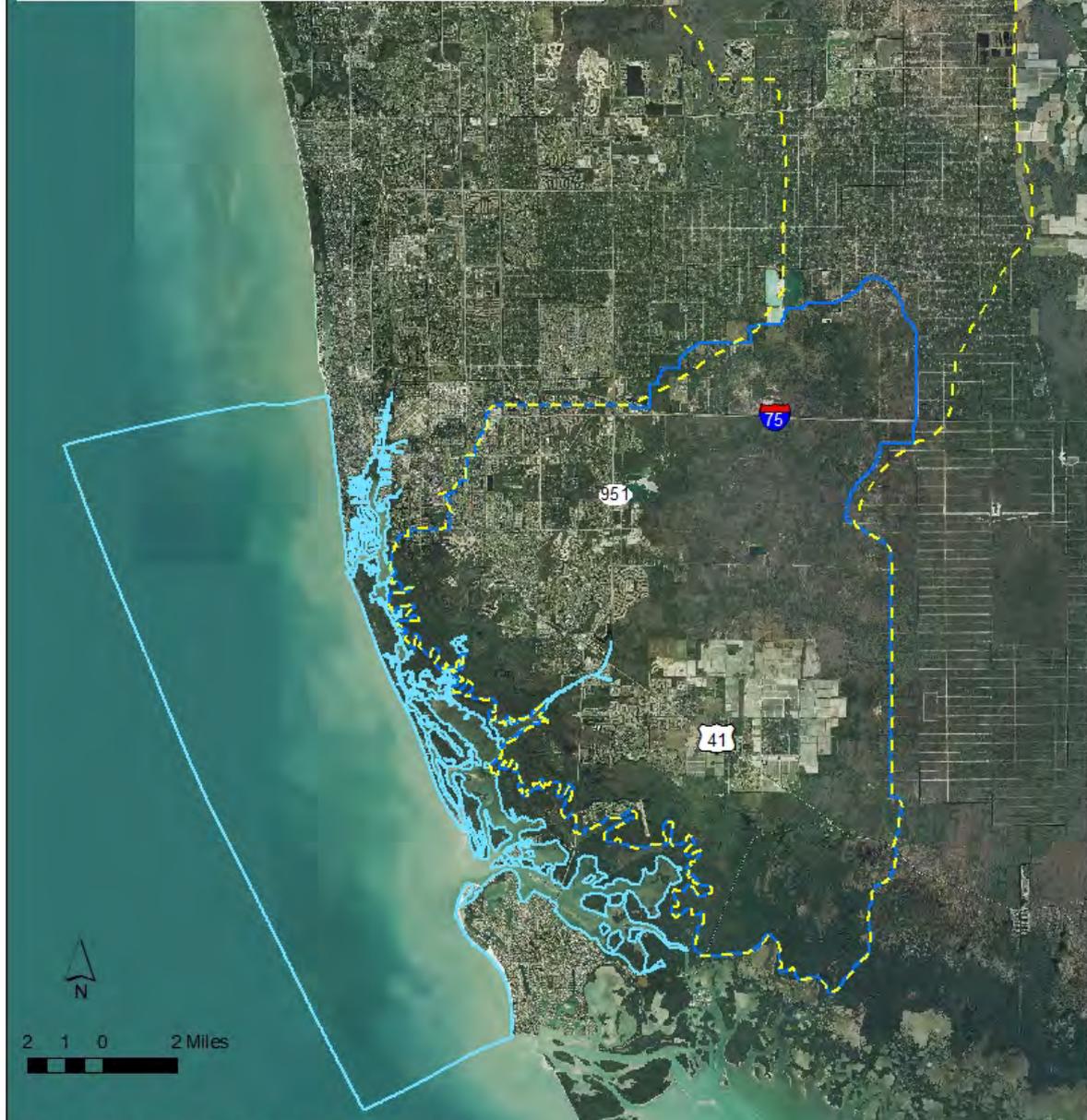


Model Limitations

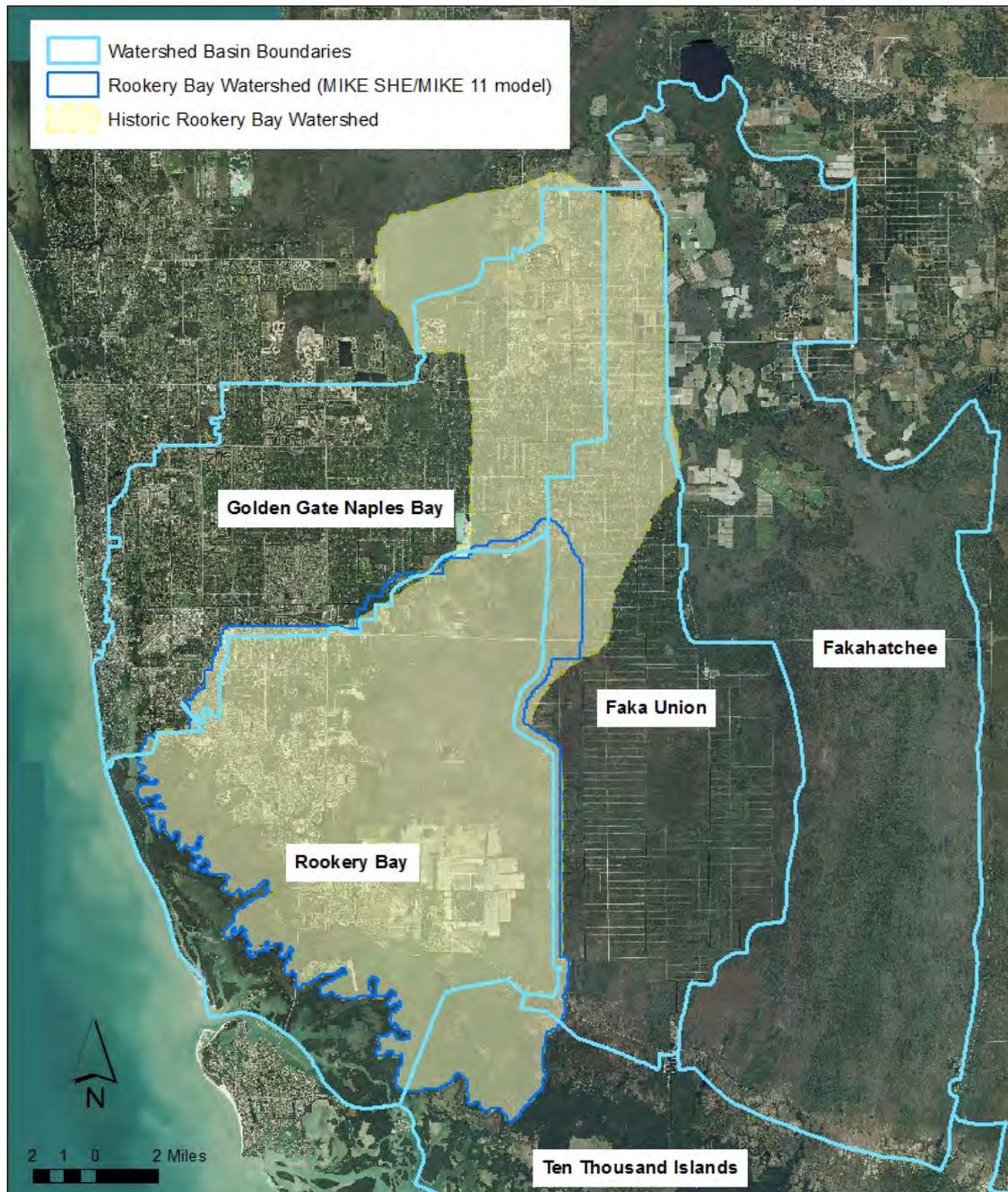
- No measurements exist of flows and water levels pre-dating the major hydrologic alterations in the watershed.
- Historical Conditions model results are only an estimate of flows and levels that may have occurred historically under climatic conditions similar to those of the recent ten-year period of 2003 – 2012.



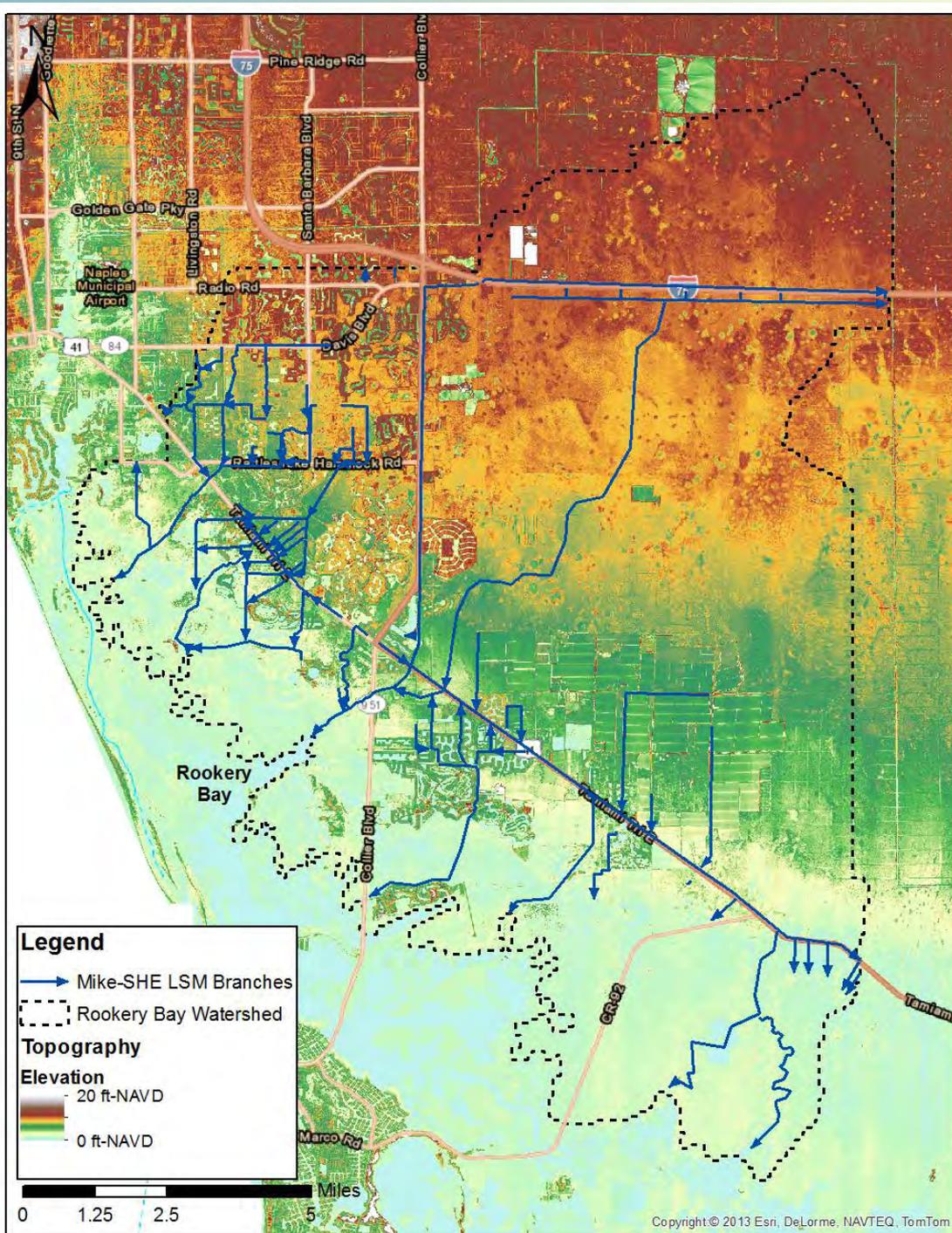
-  Historic Rookery Bay Watershed
-  Rookery Bay Watershed (MIKE SHE/MIKE 11 model)
-  Fresh and Saltwater Mixing Zone (CH3D model)

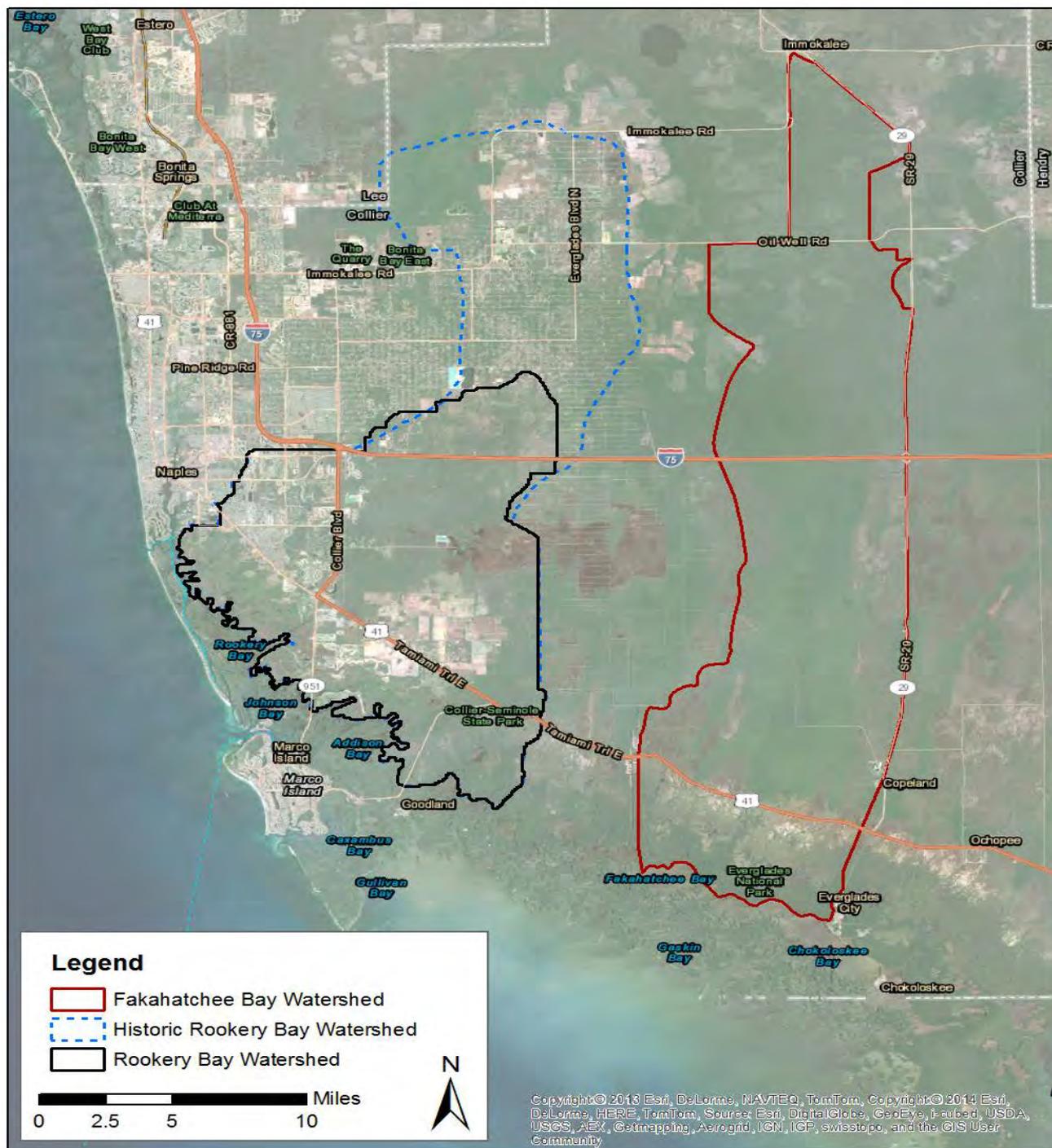


-  Watershed Basin Boundaries
-  Rookery Bay Watershed (MIKE SHE/MIKE 11 model)
-  Historic Rookery Bay Watershed



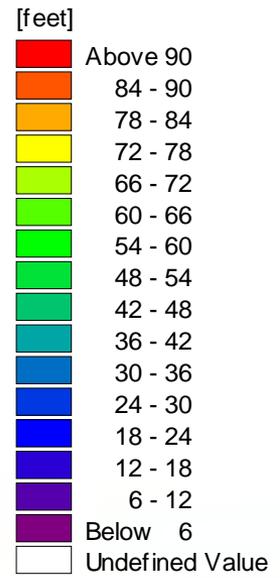
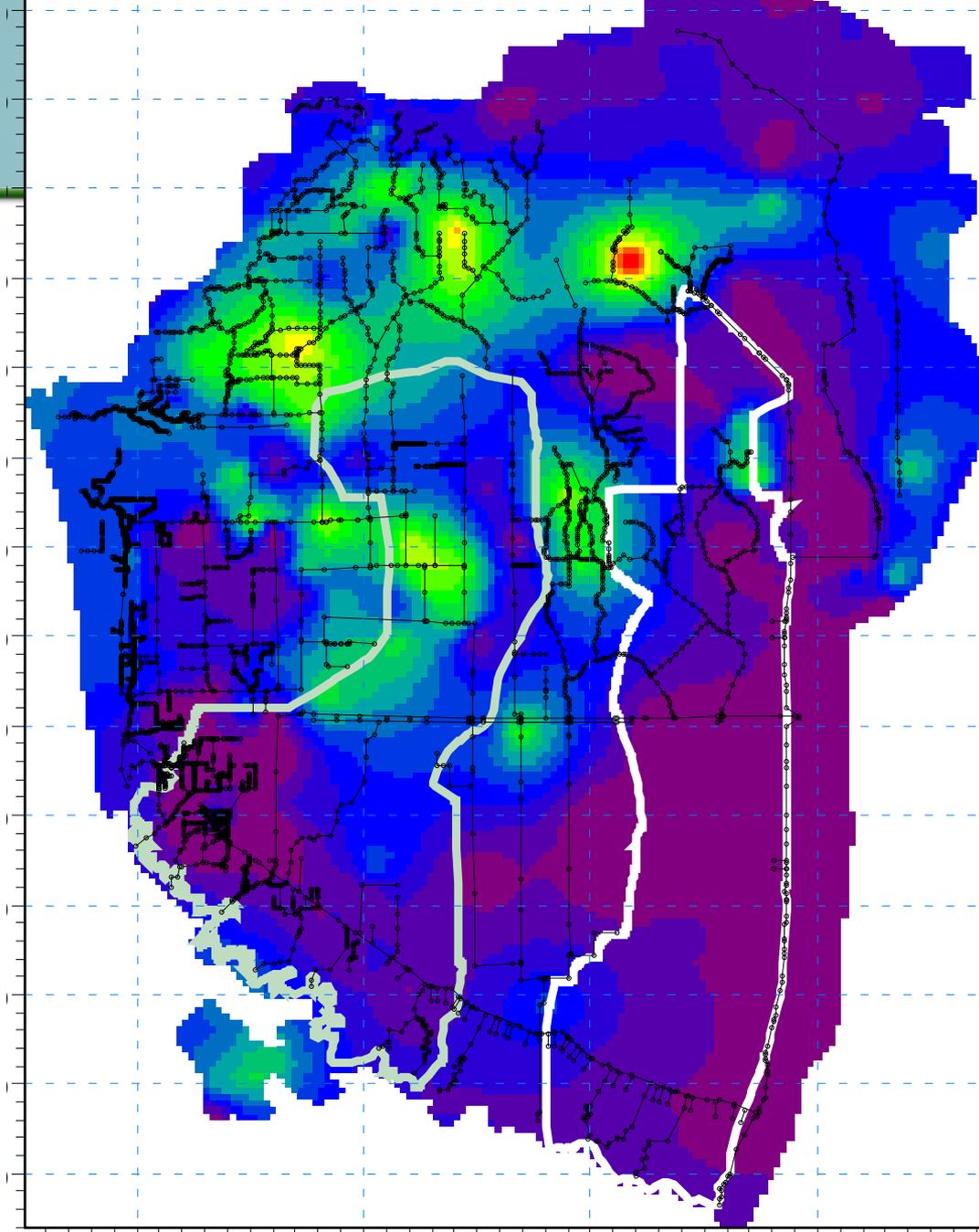
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Groudwater

Water Table
Aquifer
significantly
thicker in
Rookery Bay's
watershed than
in nearby
Fakahatachee
Bay watershed.





Water Budget Comparison

Annual Averages, 2003 through 2012



Water Budget Component	Historical Conditions (inches per year)	Existing Conditions (inches per year)	Difference
Rainfall	56.1	55.7	-0.4
Irrigation	0	2.2	+2.2
Pumping	0	2.3	+2.3
Evapotranspiration	45.0	42.0	-3.0
Overland flow to streams and canals	1.5	2.2	+0.7
Groundwater baseflow to streams and canals	0.8	6.6	+5.8
Overland flow to boundary	8.7	2.5	-6.2



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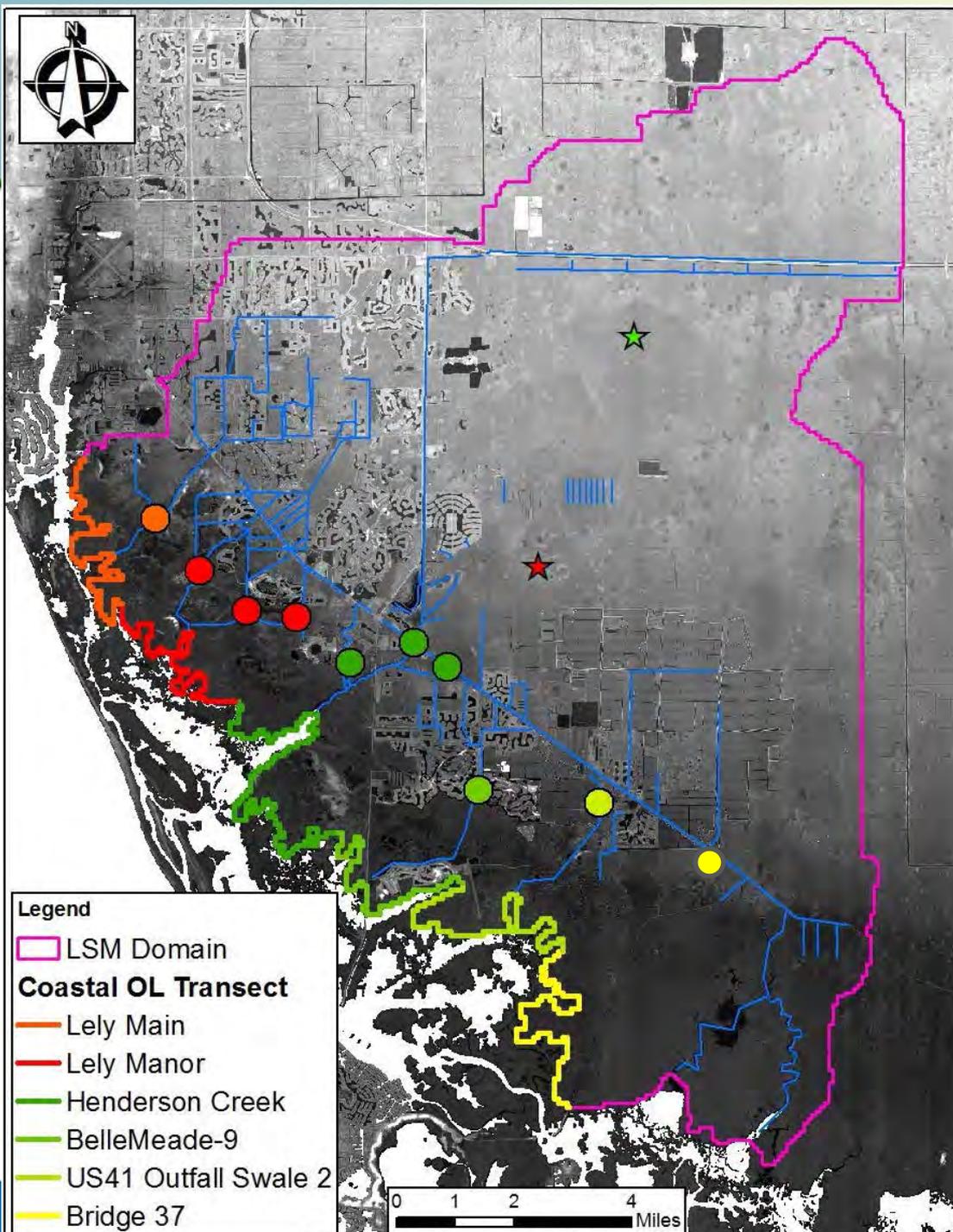


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Legend

LSM Domain

Coastal OL Transect

Lely Main

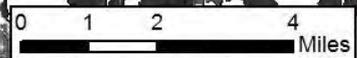
Lely Manor

Henderson Creek

BelleMeade-9

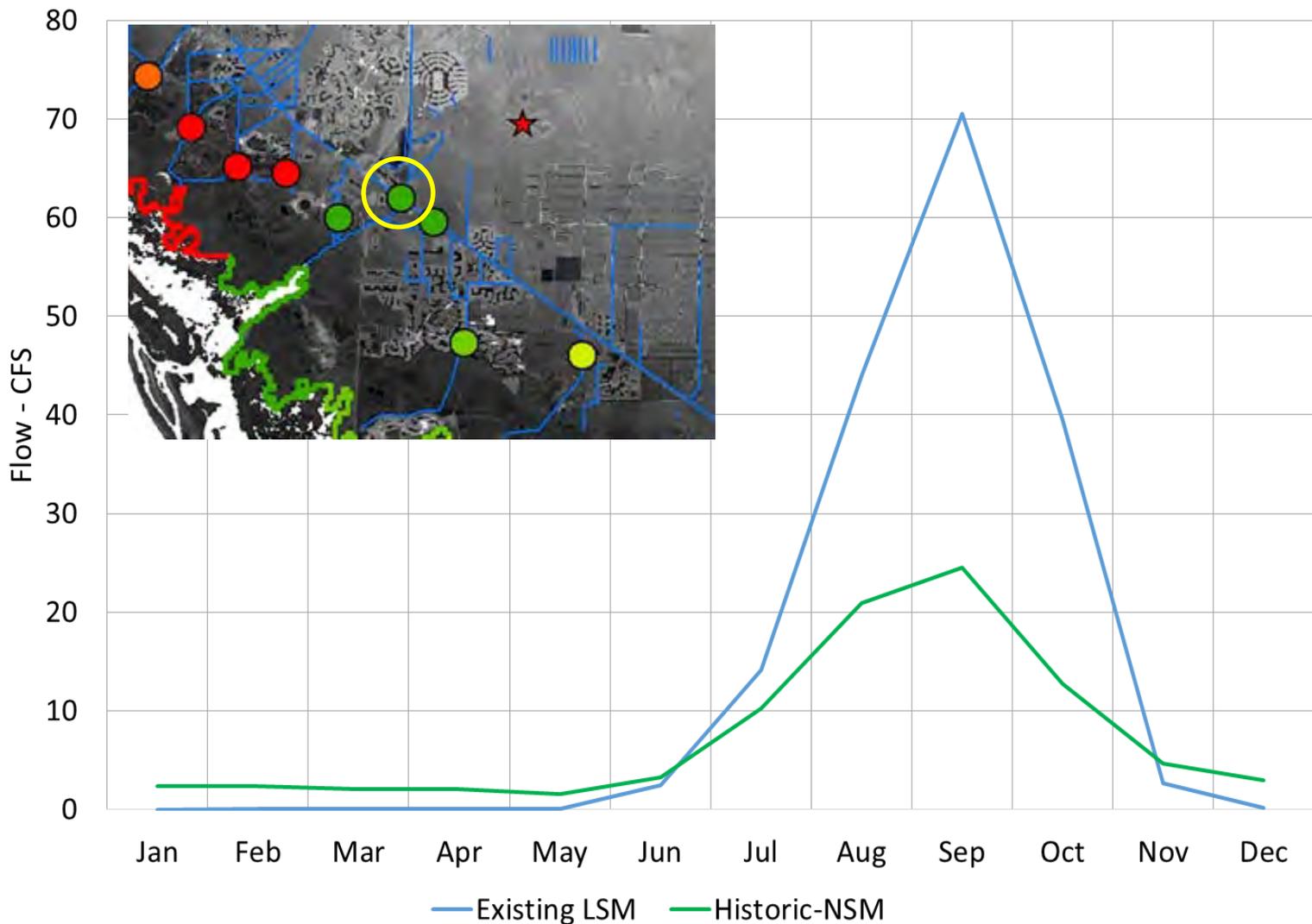
US41 Outfall Swale 2

Bridge 37



Henderson Creek Flow Analysis

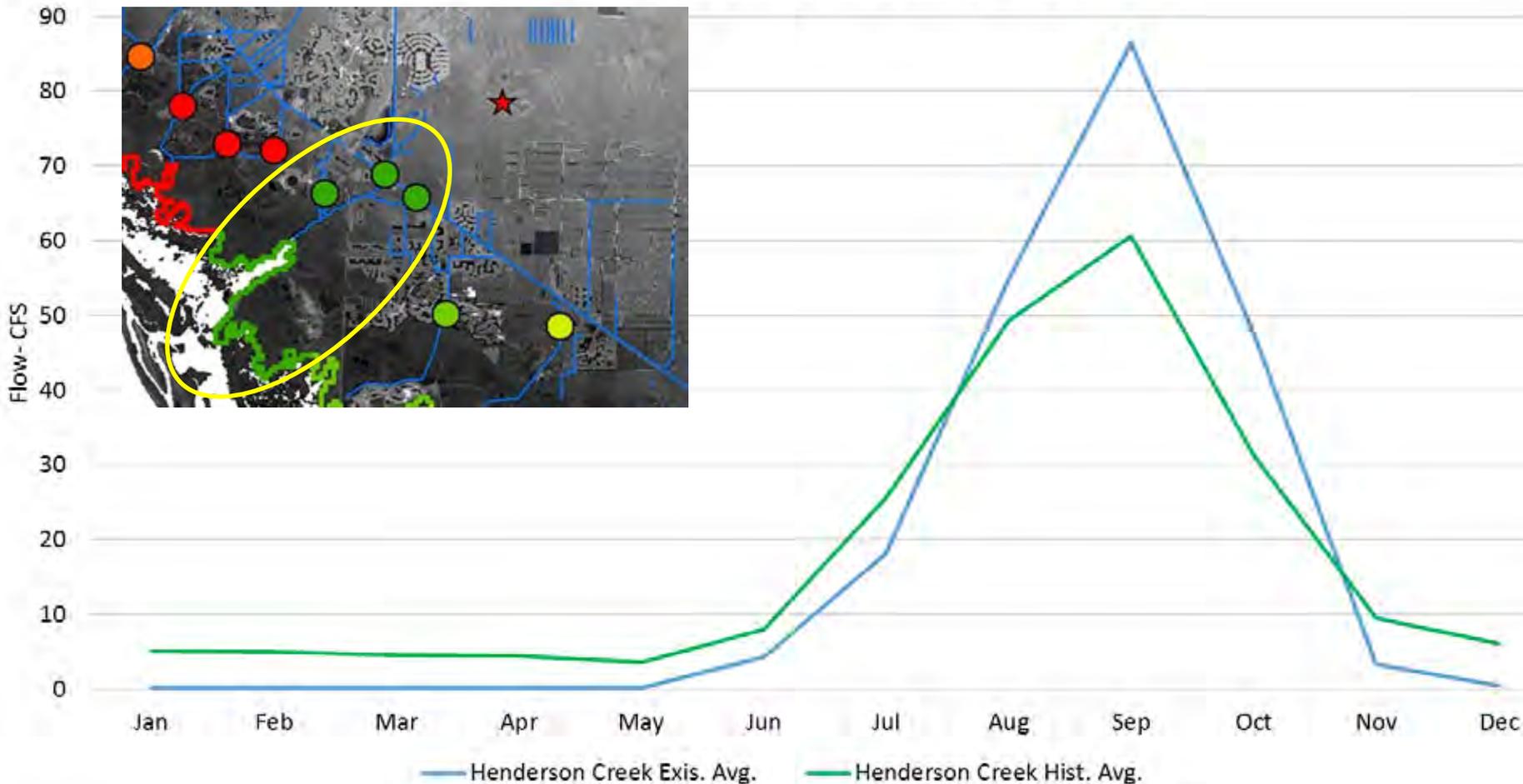
Existing vs Historic Avg. Monthly Flow at Henderson Creek Upstream of US-41



Henderson Creek Cumulative

All branches plus coastal transect

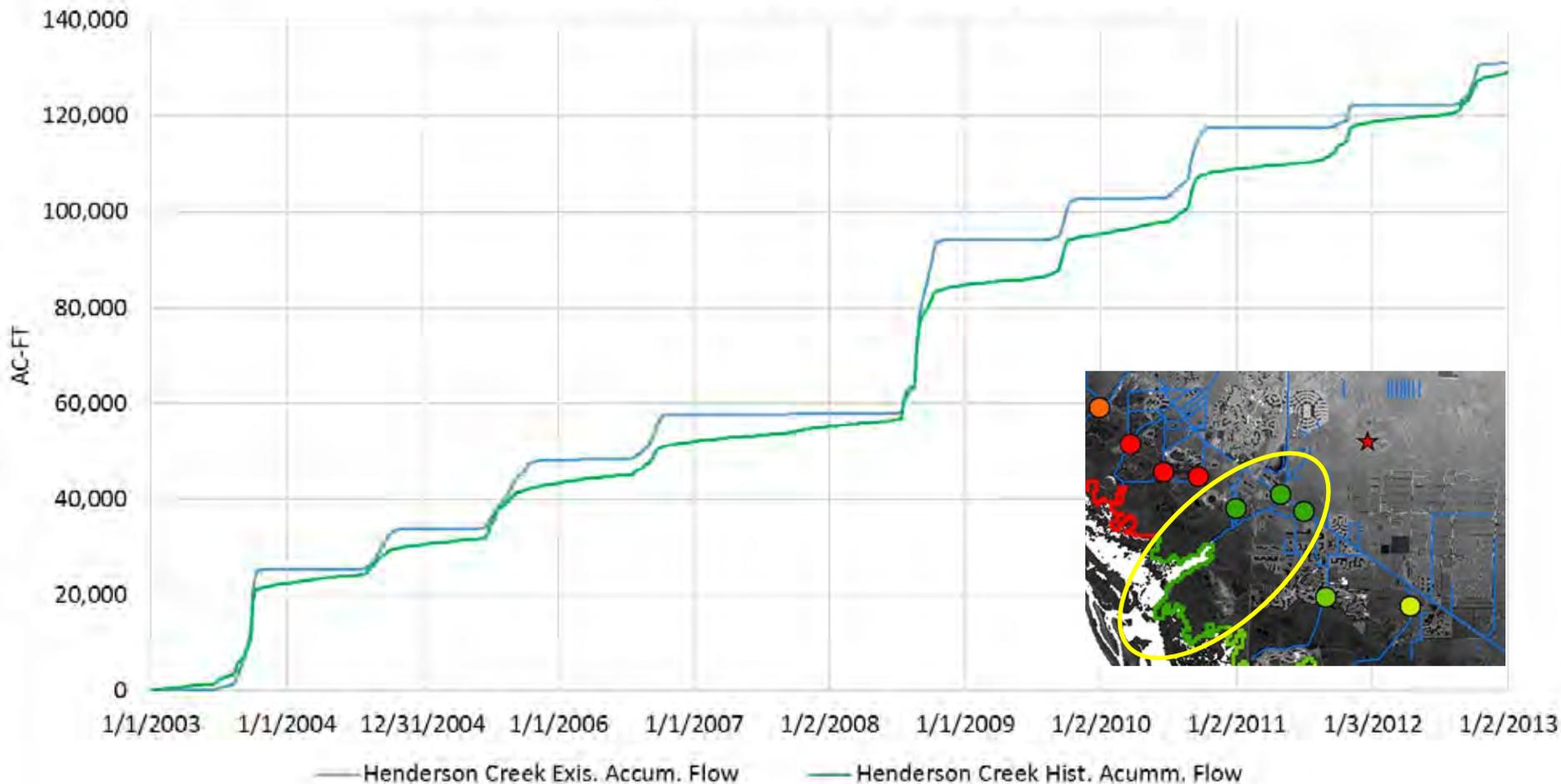
Henderson Creek Avg. Monthly Flow: Existing vs. Historic



Henderson Creek Flow Analysis

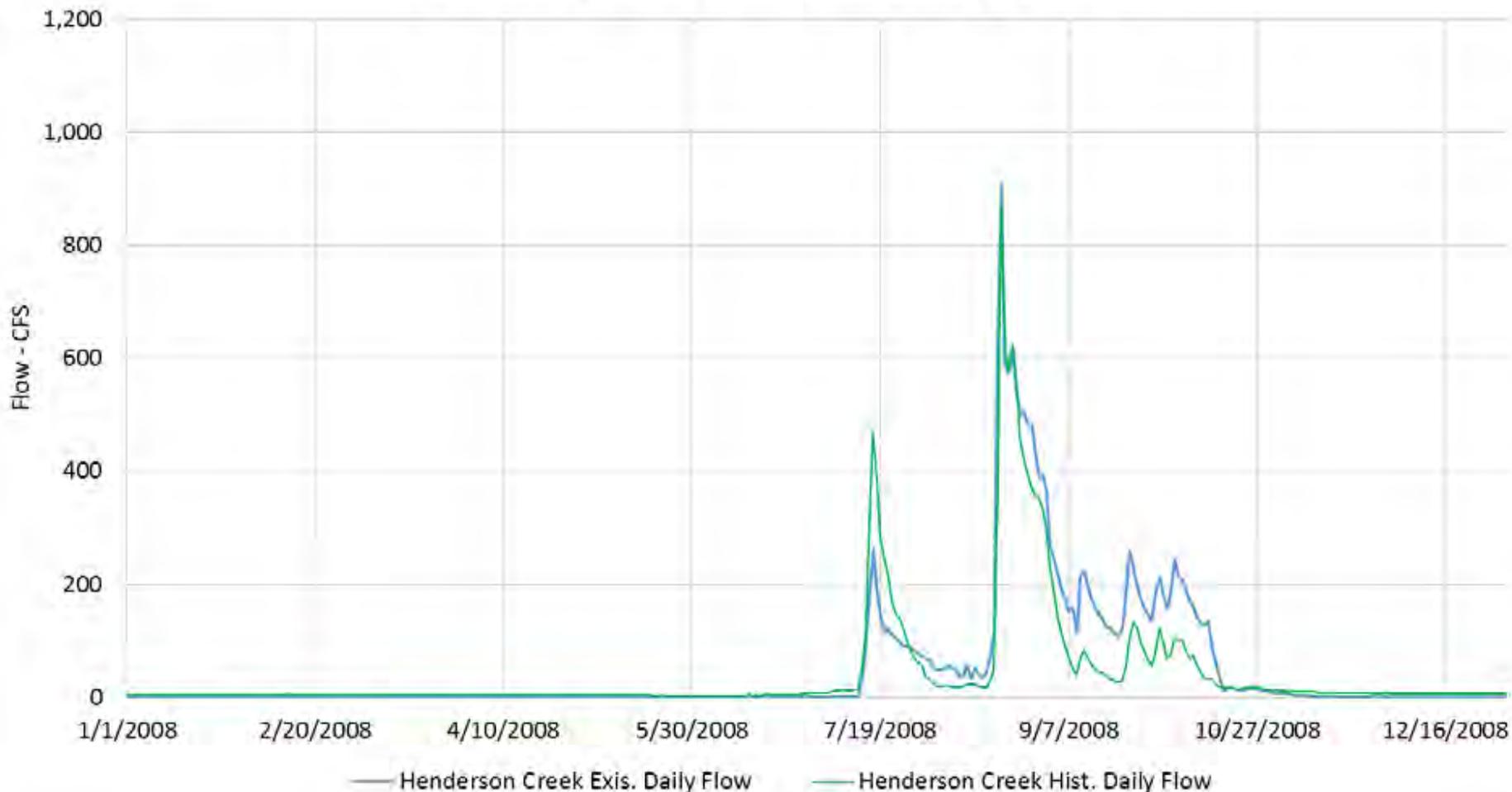
All branches plus coastal transect

Henderson Creek Accumulated Flow: Existing vs Historic

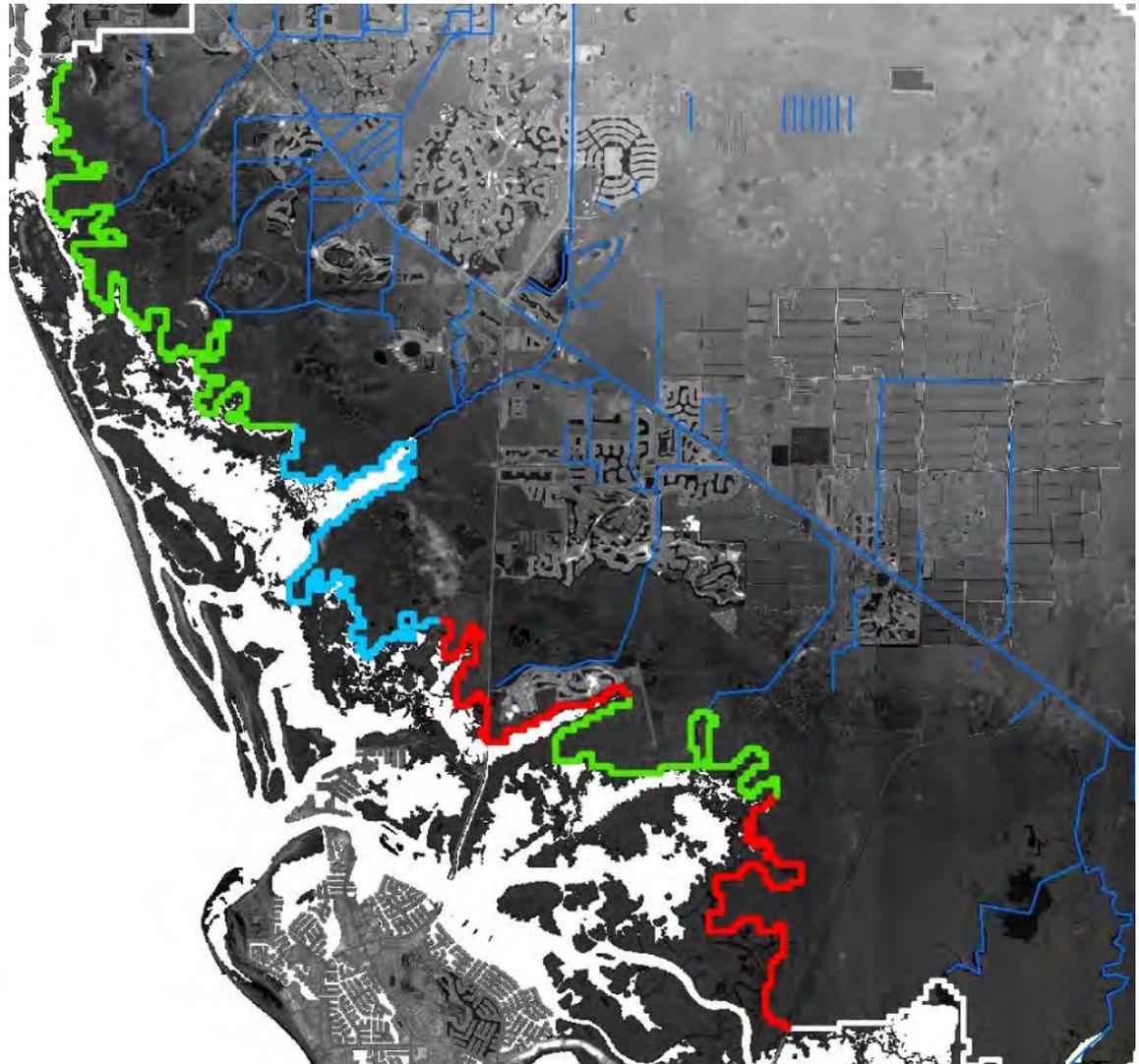


Henderson Creek Flow Analysis

Henderson Creek Avg. Daily Flow: Existing vs Historic

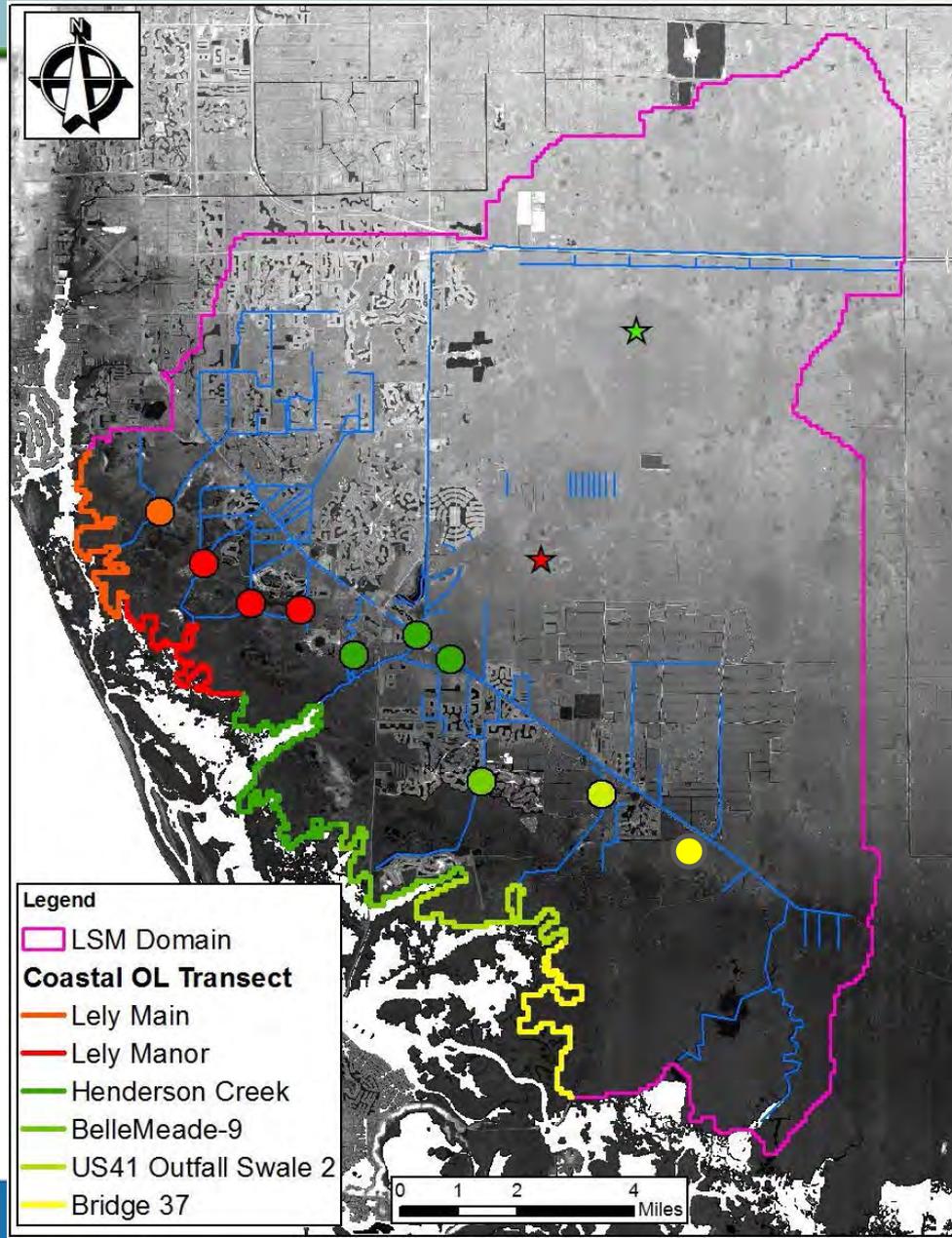


Overall Flow Changes



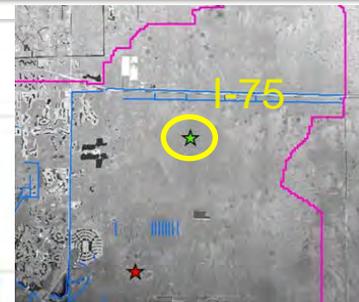
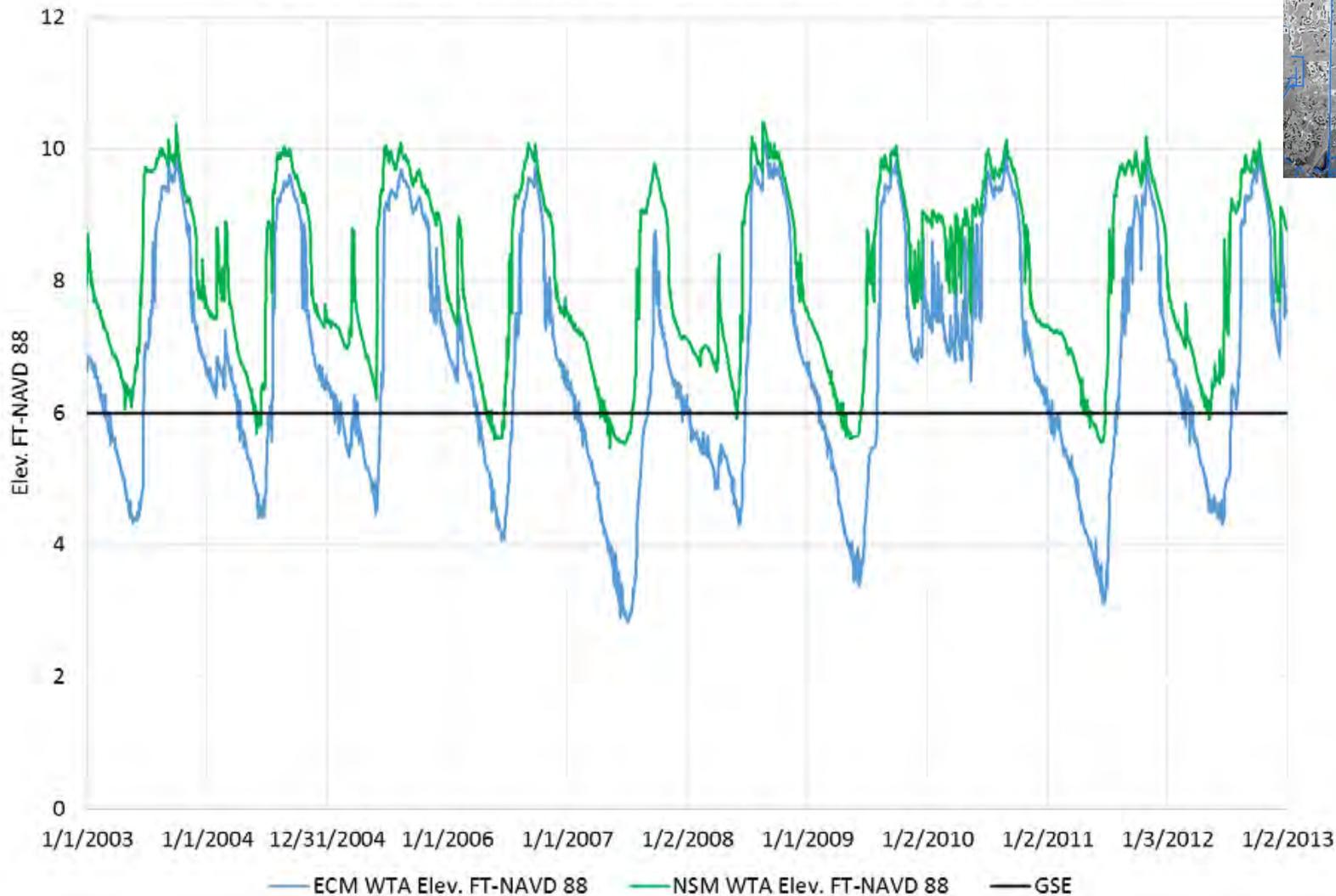
-  Overall flows have increased
-  Overall flows have decreased
-  Overall flows have stayed about the same

Water Depth Analysis



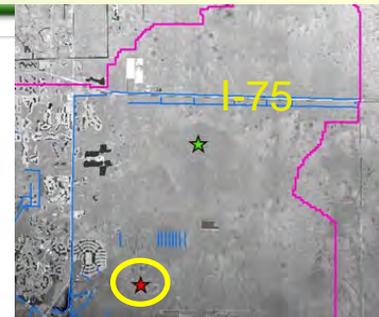
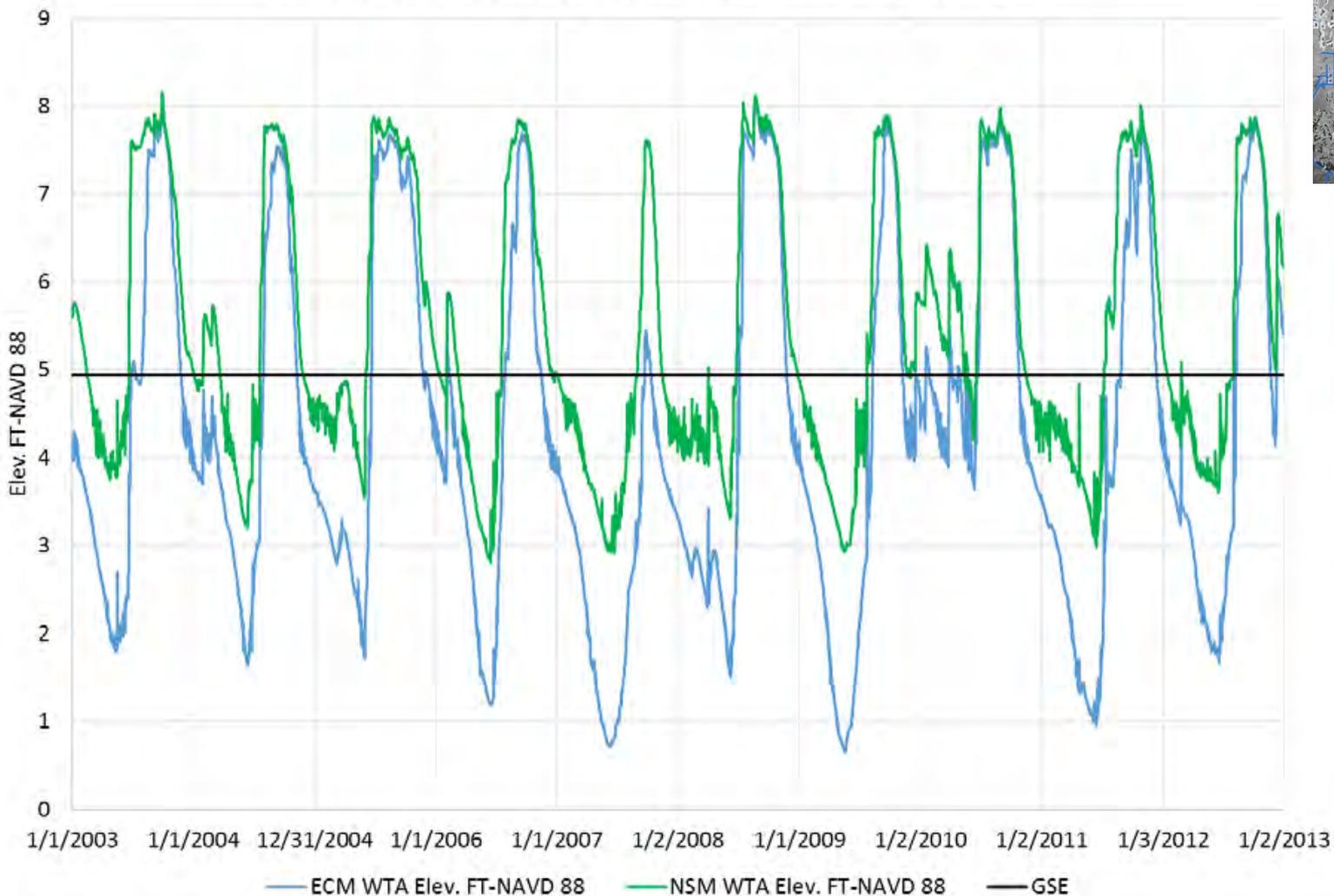
Water Level Depths

Belle Meade Flow-way North Comparison Point - WTA Elev



Water Level Depths

Belle Meade Flow-way South Comparison Point - WTA Elev







Summary of Model Findings



- Overall flow volume has not changed drastically
- Seasonal flow pattern changes were minimal
- Dry-season flows were historically small
- Channelization and development have changed the spatial distribution of flows and timing
 - Canals intercept shallow groundwater
 - Less sheet flow and more baseflow to canals
 - Increased pulse flows to the estuary
- Water is ponded on the watershed 2 months less than historically and drains more quickly at the end of the wet season



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