

Science, Service, Stewardship



Everglades to Reefs: Water Connects South Florida Ecosystems

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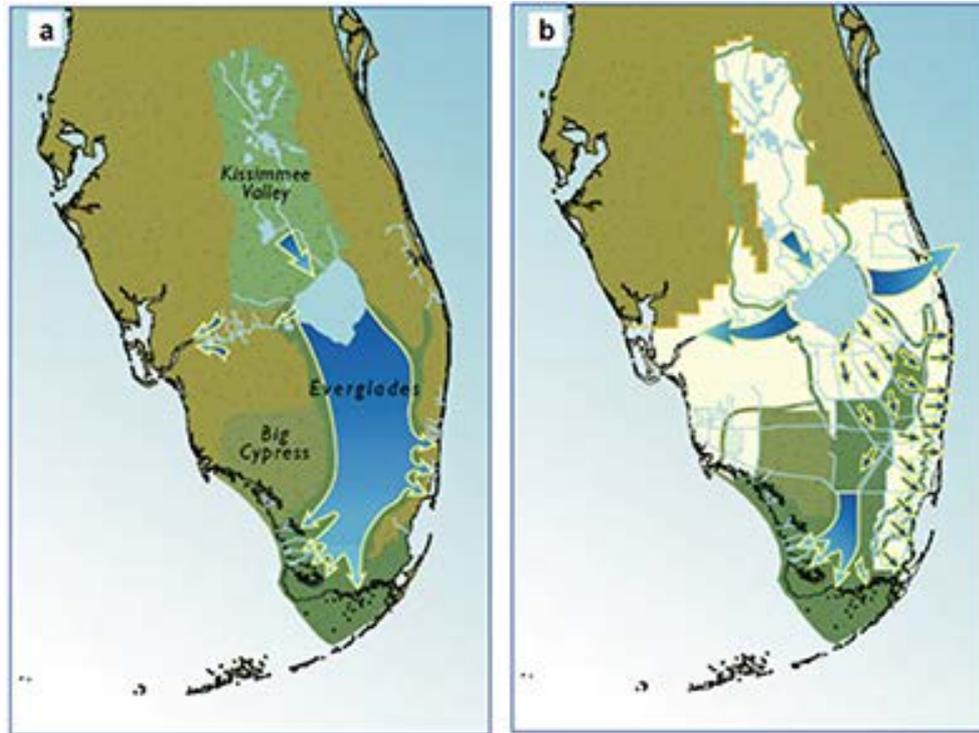
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Everglades-River of Grass: Past and Present



Pre-drainage Flow

Current Flow

Credit: U.S. Army Corps of Engineers, Jacksonville District.



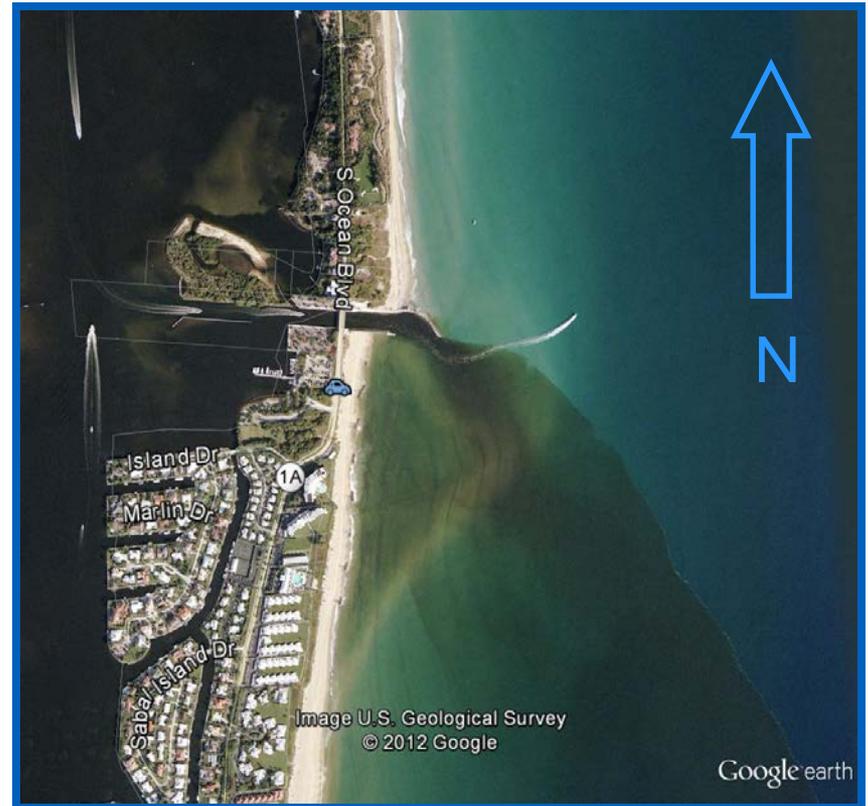
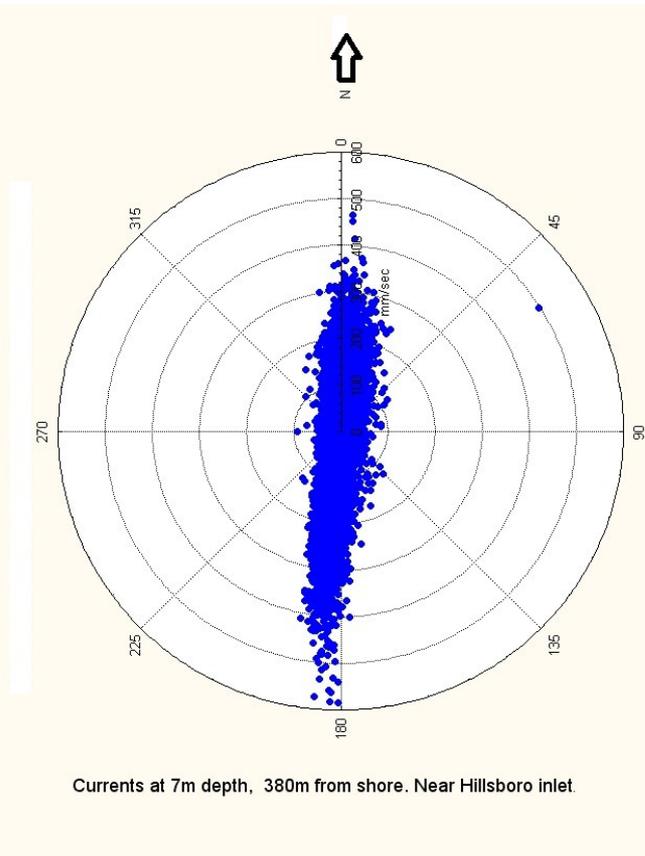
The Florida Current interacts with wind and tides to create a dynamic coastal ocean shelf environment



Map illustrating the Bathymetry of south Florida coastal waters and identification of coastal regions.
Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: Kruczynski, W.L. and P.J. Fletcher (eds.). 2012. Tropical Connections: South Florida's marine environment. IAN Press, University of Maryland Center for Environmental Science, Cambridge, Maryland. 492 pp.



Eddies change the direction and speed of nearshore coastal currents



Credit: NOAA AOML



Water Quality Stressors Affecting Southeast Florida Fish Habitats

- Nutrients (Nitrogen and Phosphorus)
- Salinity changes (especially freshwater pulses)
- Sedimentation
- Turbidity
- Pharmaceuticals and personal care products
- Other pollutants, like biocides, heavy metals and hydrocarbons



Nutrients affecting Southeast Florida coastal waters

Excessive nitrogen and phosphorus can result in adverse changes to estuarine and marine ecosystems.

Increases in nutrients have been shown to promote the growth of macroalgae and cyanobacteria that can smother benthic animals; and phytoplankton blooms that reduce light and dissolved oxygen levels when the phytoplankton die off.



Credit: Dave Gilliam, Nova Southeastern University



Credit: Karl Havens, Florida Sea Grant



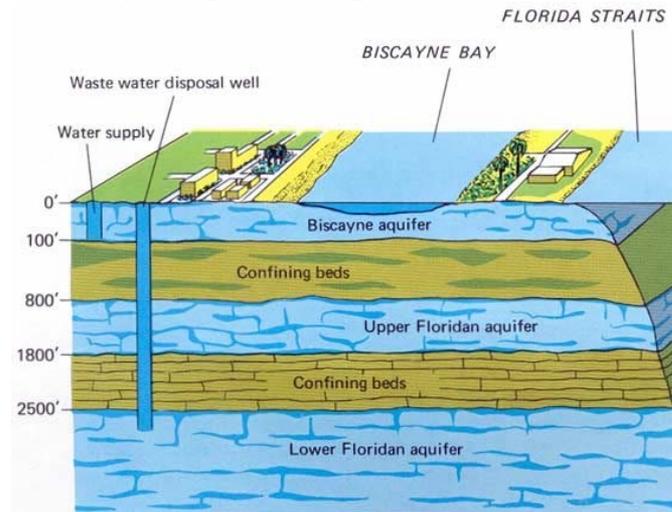
Wastewater Management in Southeast Florida

The four methods of municipal **wastewater** disposal in southeast Florida include:

- Surface discharge (after secondary treatment)
- Ocean outfalls (More than 400 MGD after secondary treatment)
- Deep well injection
- Wastewater reuse



Photo: Palm Beach Post 2010

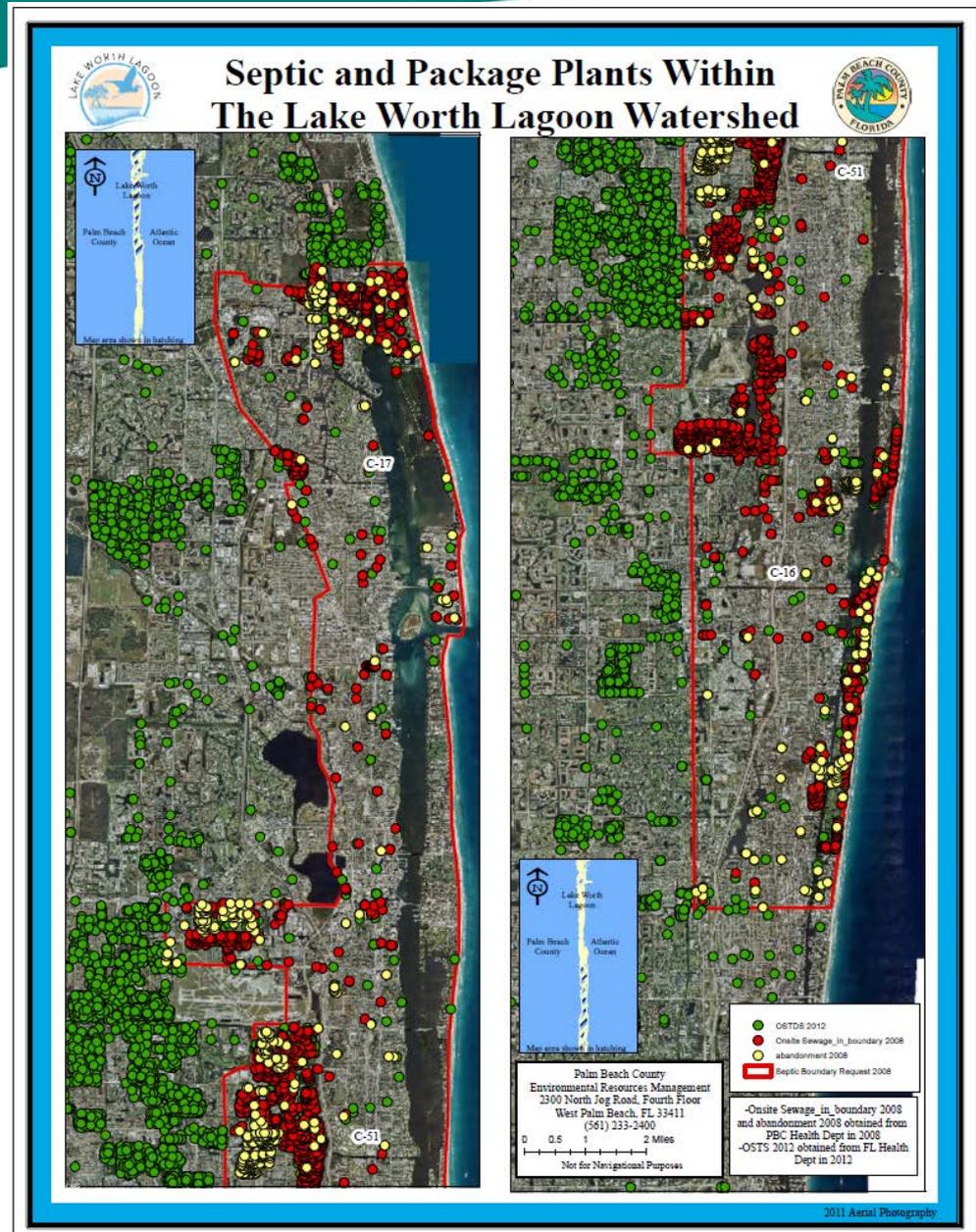


Graphic: USGS 2013



Septic Systems

Septic systems can adversely affect ground water quality (i.e. the Biscayne Aquifer) and surface waters with human pathogens (bacteria and viruses) and high nutrient levels.

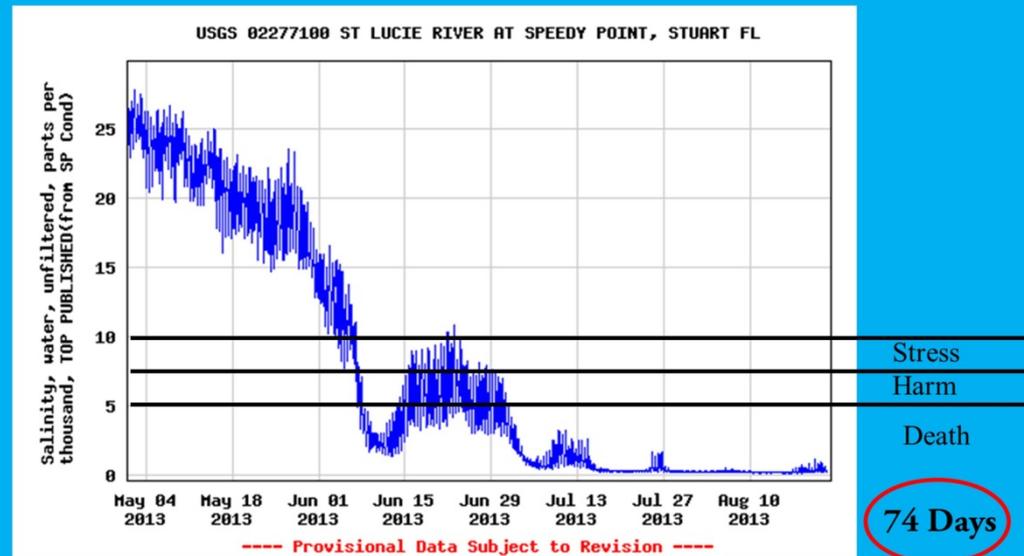




Salinity Changes

Changes in salinity can stress or kill important plants (e.g. seagrass) and animals (e.g. oysters and sponges) in southeast Florida estuaries.

While the St. Lucie River estuary was in the news over the last few years, other southeast Florida estuaries also faced similar impacts from low salinity.



Salinity Tolerance for Oysters



Death

7 Days For Spat & Juveniles

14 – 28 Days For Adults

Credit: Florida Oceanographic Society



Sediment and Turbidity

Sedimentation can kill filter feeding animals like corals, by smothering, burial or inhibiting feeding

Right: Montastrea cavernosa with sediment from a dredging project.



Credit: NOAA Fisheries Service

Turbidity decreases light penetration and reduces photosynthetic production by seagrass, algae and coral zooxanthellae in coastal waters.

Right: Turbidity plume extends 2,400m North and 350m south from the spider barge.



Credit: Google Earth December 2014

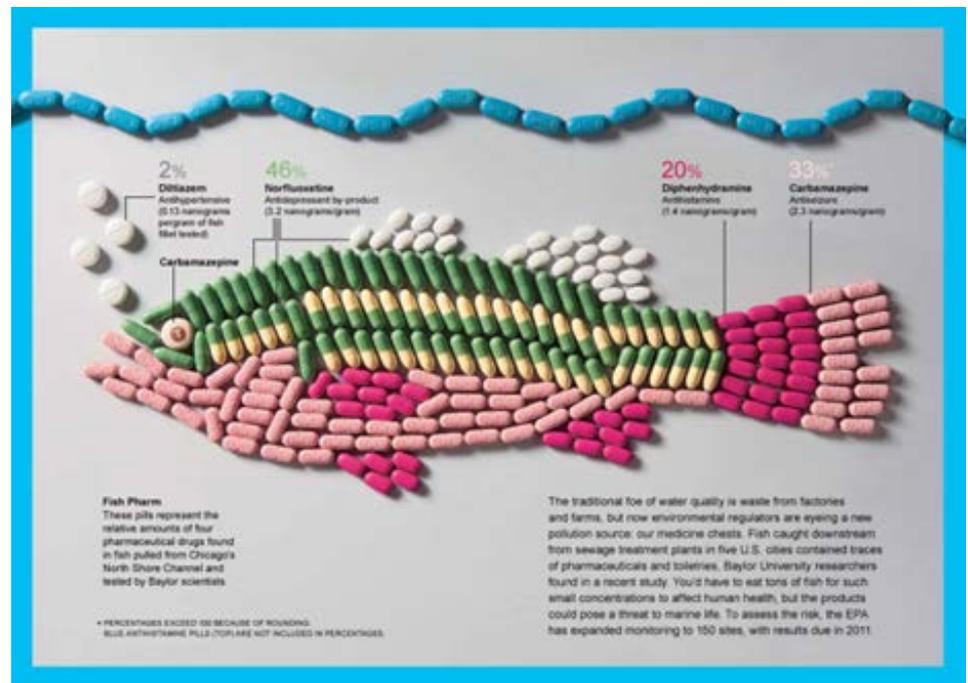


Pharmaceuticals & Personal Care Products

Pharmaceuticals

(medications and hormones) and **Personal care products**, (e.g., sun screens, lotions, fragrances, and insect repellent), end up in estuarine and marine waters of southeast Florida.

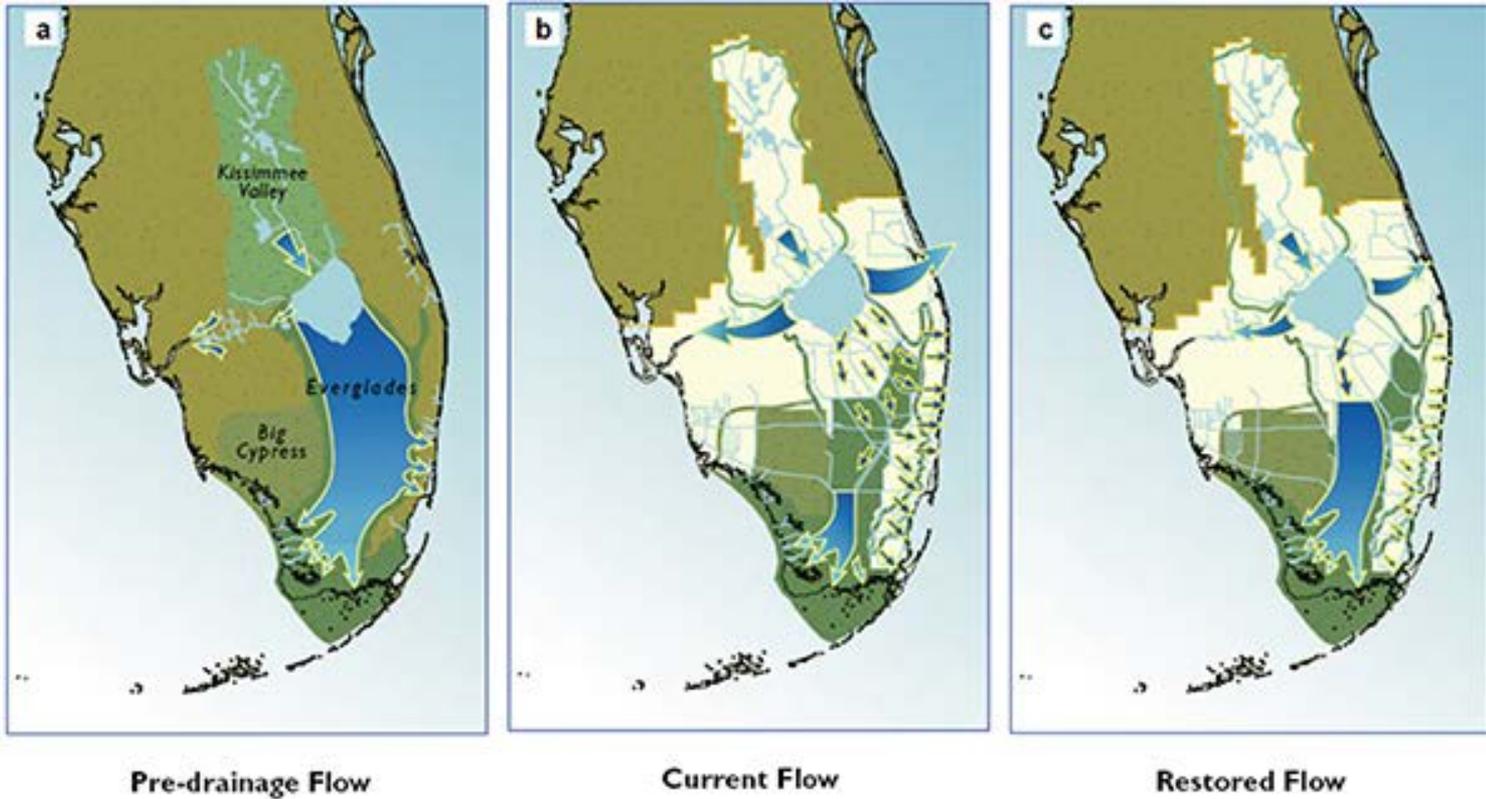
These pollutants are not removed by secondary treatment, but can be removed by advanced treatment of wastewater.



Credit: Alejandro Ramirez, Baylor University
<http://ngm.nationalgeographic.com/2010/04/pollution/fish-pharm>



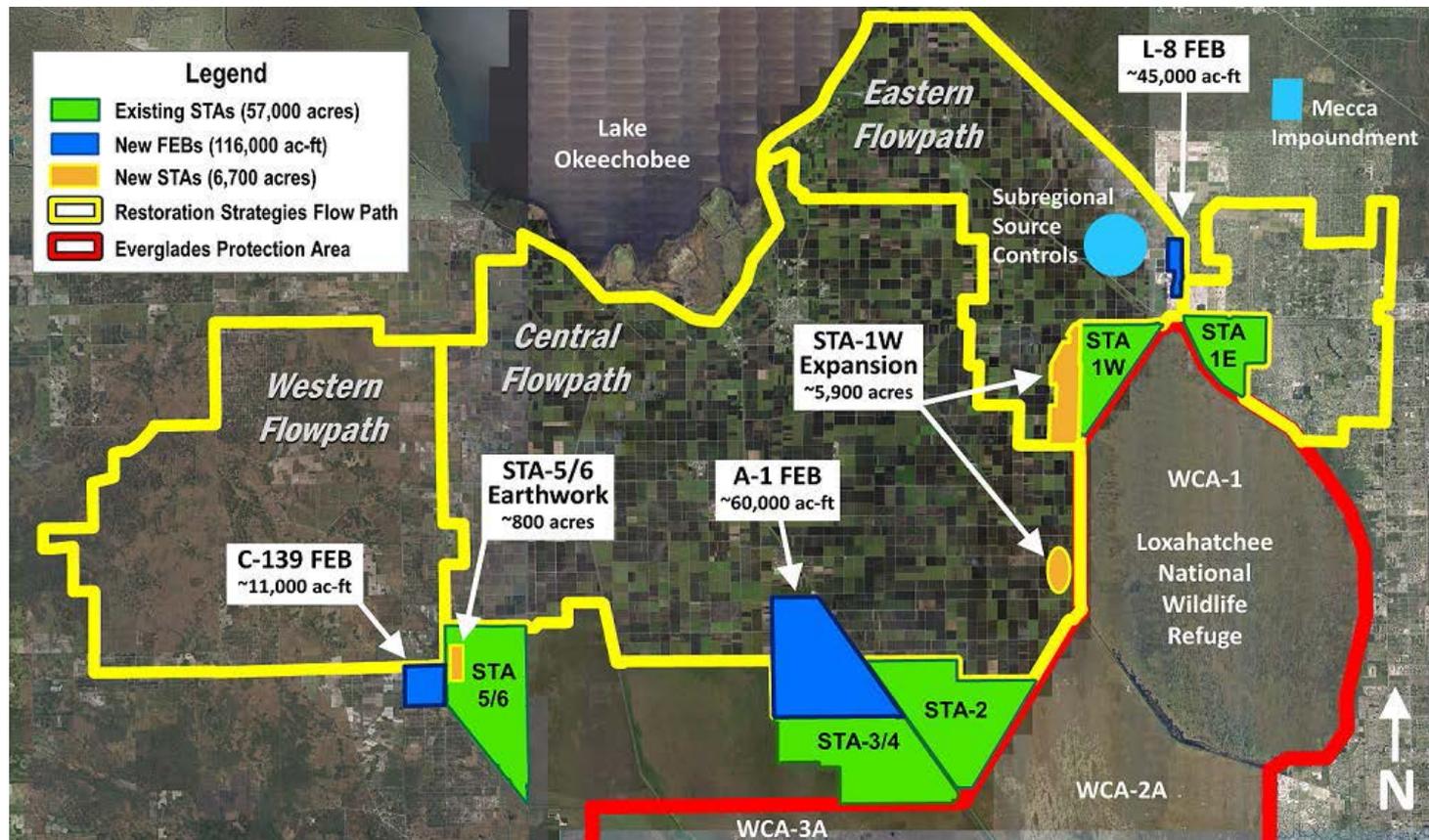
Everglades-River of Grass: Past, Present, and Future



Credit: U.S. Army Corps of Engineers, Jacksonville District.



Rain gardens and rain barrels on the landscape scale



Credit: South Florida Water Management District



Why does Everglades restoration matter to Florida's coral reef ecosystem?

Florida coral reefs evolved in an environment that provided clean, clear water with low nutrient concentrations and slow movement of stormwater to the ocean.

These are not the conditions currently observed in south Florida's ecosystems.



Credit: Dave Gilliam, Nova Southeastern University



Florida Coral Reef Tract





Florida Keys: Wastewater Master Planning Efforts 1997 to 2010

- 137.5 square miles of land area
- ~72,000 Full time residents
- ~18 million Annual Visitors (Person-Days)
- ~7.2 million gallons per day of waste water is generated



EXHIBIT ES-1

Thirty percent, or 7,200 of the 23,000 onsite wastewater systems in the Keys are not permitted, and may include up to 2,800 illegal cesspools.

Credit: Monroe County Sanitary Wastewater Master Plan



Florida Keys: Wastewater Master Planning Efforts 1997 to 2010

Waste Water Treatment Plant
Service Areas for 17 WWTP
Estimated Cost: \$438 million

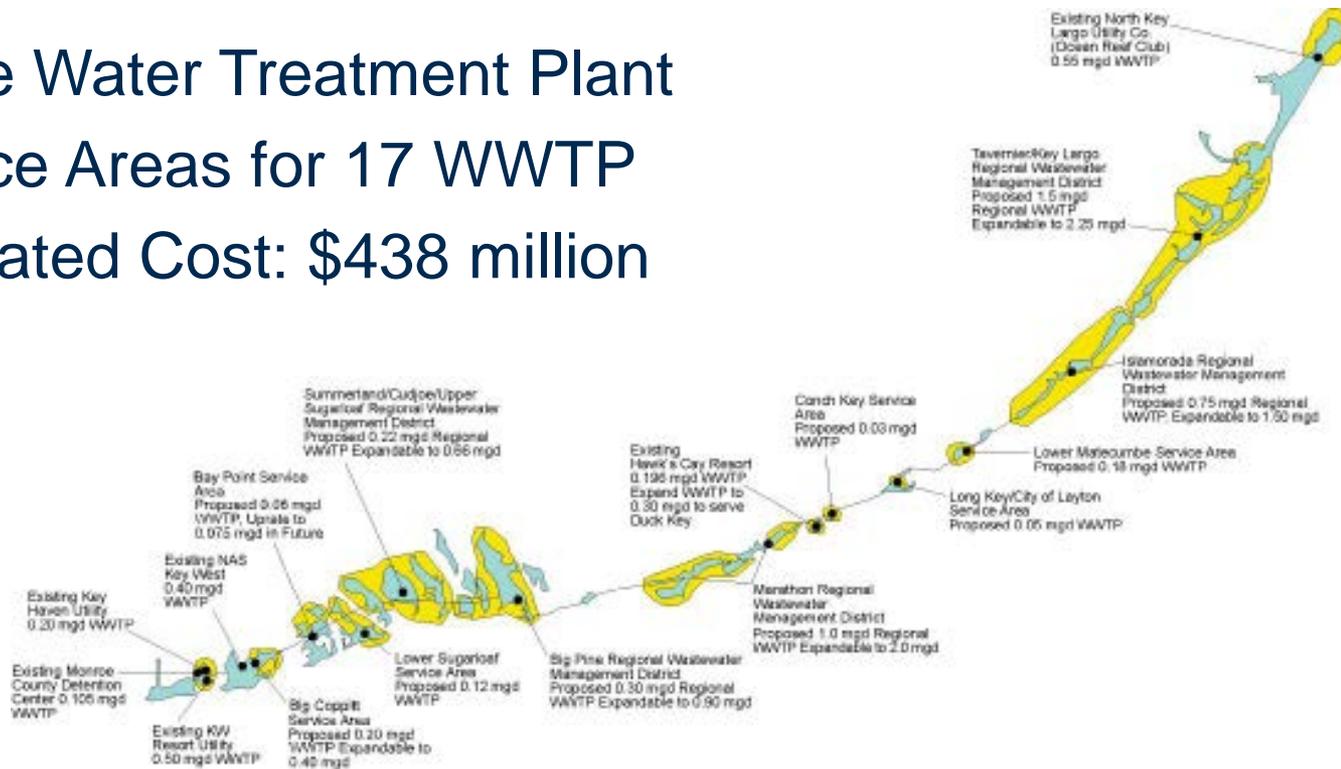


EXHIBIT 7-1
Recommended Wastewater Master Plan Service Areas and Wastewater Treatment Plants



The Southeast Florida Coral Reef Tract

The southeast Florida coral reef tract is approximately 105 miles long and generally varies from half a mile to three miles from shore off Miami-Dade, Broward, Palm Beach and Martin counties.

Over 6 million people live, work and play here, and another 25 million visitors enjoy the beaches, waterways, and reefs of southeast Florida each year.

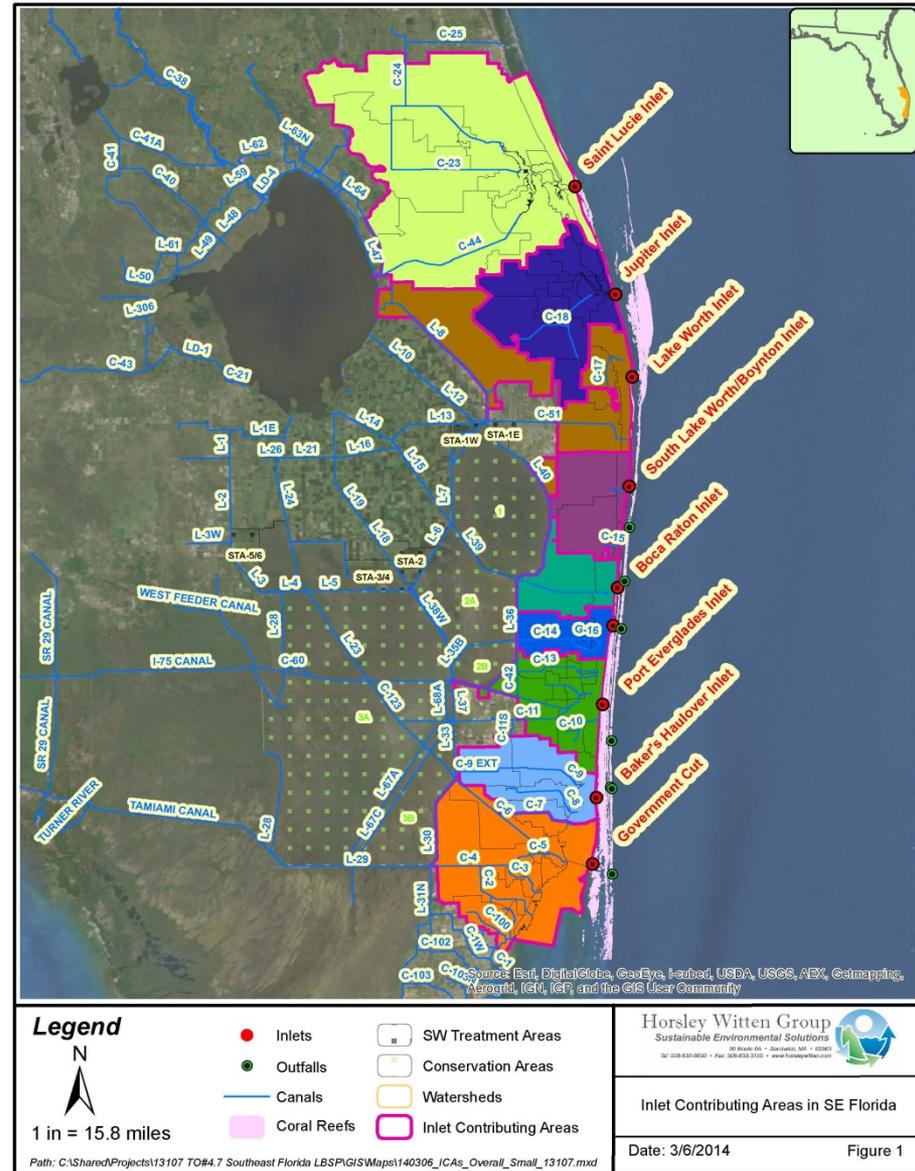


Credit: DEP, CRCP



Southeast Florida Inlet Contributing Areas

- The nine ICAs total ~2,500 square miles of urban and agricultural development
- Extensive watershed modifications have occurred in Florida for flood control, human use and more recently, environmental restoration.
- To understand how water and pollution loads move in southeast Florida, Inlet Contributing Areas (ICA) were delineated with guidance from the South Florida Water Management District.



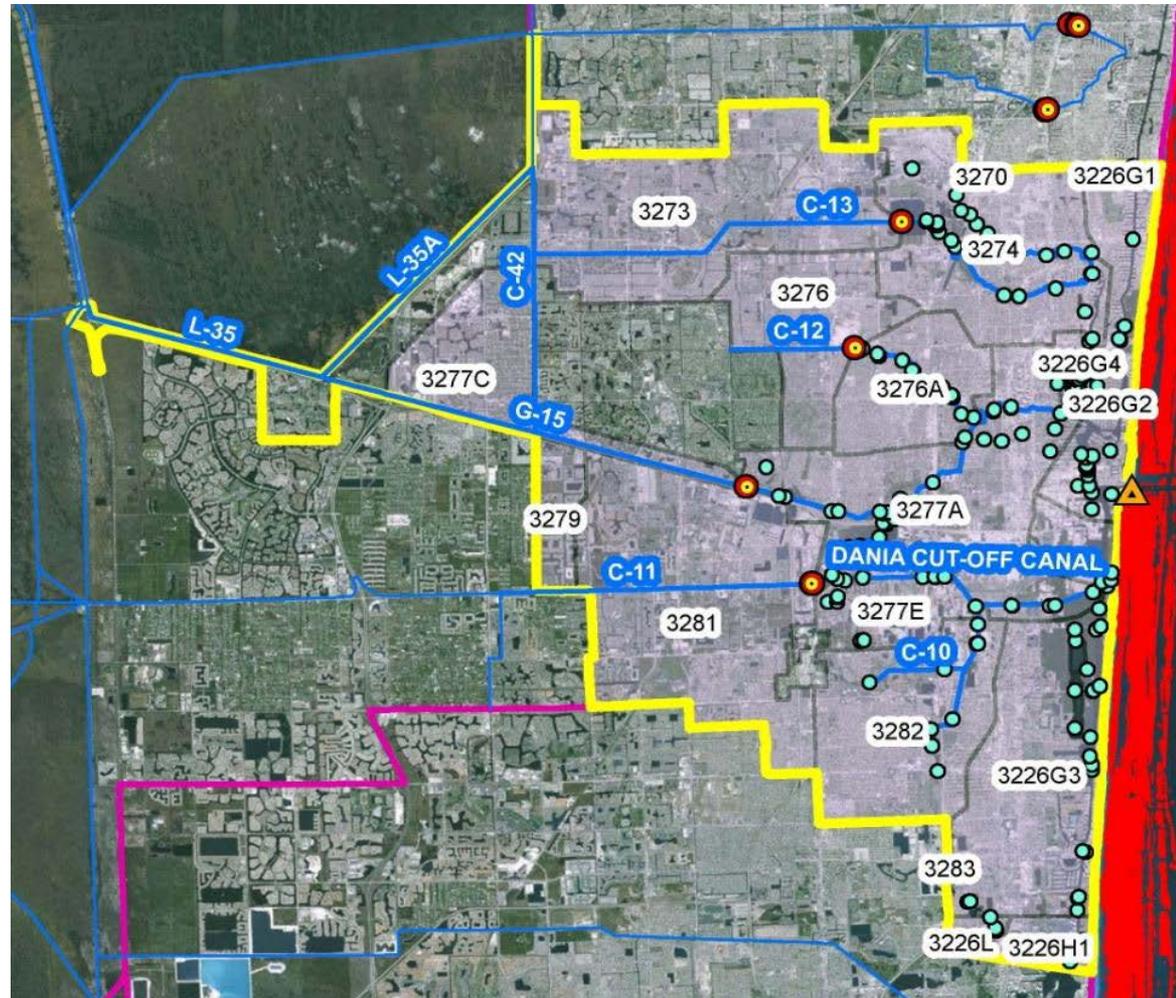


Urbanized Southeast Florida

PORT EVERGLADES ICA:

- Total Area: 174 square miles
- Urban Land: 149 square miles (86%)
- Water/Wetlands: 19 square miles
- 5th largest of the 9 ICAs in southeast Florida

Much of the stormwater and sanitary sewer infrastructure is at or beyond its design life.





Key Recommendations

- **Reduce nutrient loading** from all human-induced sources and pathways, including stormwater (with fertilizer runoff), septic systems and ocean outfall discharges.
- **Upgrade to advanced wastewater treatment** to reduce effects of pharmaceutical and personal care products on the coral reef ecosystem.
- **Support construction of additional water storage reservoirs, stormwater treatment areas, flow equalization basins, and use of appropriate technologies.**
- **Upgrade stormwater and sanitary sewer systems** to improve water quality in Florida's estuaries.
- **Modify beach nourishment and port dredging activities** to minimize sedimentation and turbidity impacts.



Questions?



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Credit: NOAA 2012