



Florida Power & Light

Reclaimed Water Opportunities

AIF Water Forum

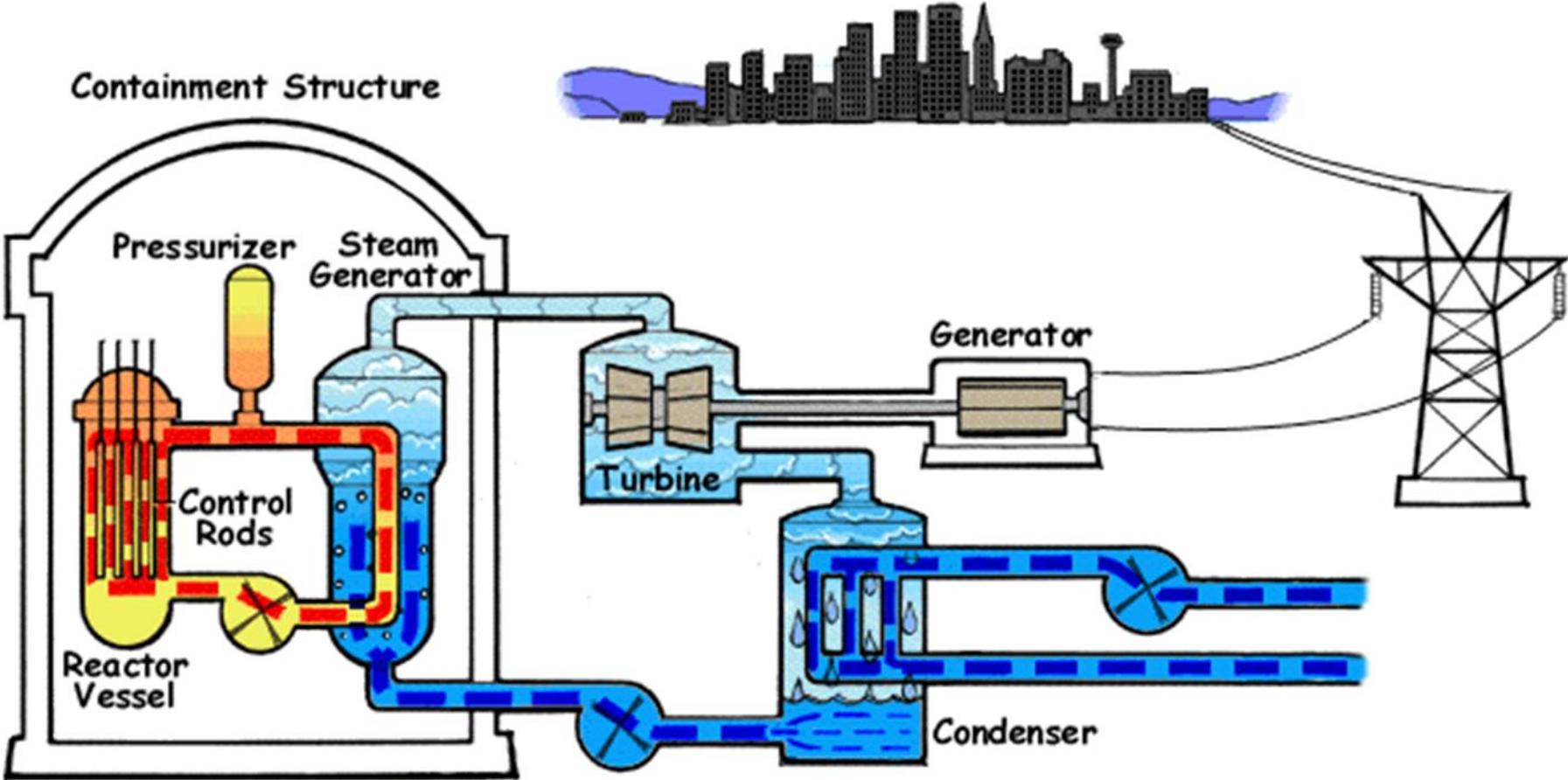
Orlando, FL

October 5, 2018

Agenda

-  Water Use at FPL Facilities
- FPL Experience with Reclaimed Water
- Changing Water Landscape in Miami-Dade County
- Opportunities for Reclaimed Water at Turkey Point

Cooling water is a necessary part of baseload power generation designs



Primary Cycle

Secondary Cycle

Tertiary Cycle

Prior to 1980's common cooling sources were once through marine intakes on the coast or cooling ponds at inland sites

Cooling Ponds in Florida



Manatee cooling pond (7.5 square miles)

Newer facilities generally use forced draft cooling towers and a range of water sources



Martin cooling pond (15 square miles)

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FPL's has experience operating on reclaimed water in Rhode Island, Texas and Florida

Reclaimed Water as a Source

- **Rhode Island State Energy Center (RISEC)**
 - Retrofit of a 550 MW combined cycle gas turbine facility
 - Difference in “operational cultures” challenged early communications
- **Forney Energy Center (Garland, Tx)**
 - 1,824 MW combined cycle gas turbine facility
 - Uses 14 MGD of reclaimed water from City of Garland
 - Water quality of effluent high, and reliable
- **West County Energy Center (Palm Beach County, FL)**
 - Three natural gas combined-cycle units - 3,750 MW
 - Original design used Floridan well supply, converted in 2011
 - Uses 22 MGD of reclaimed water from East Coast Regional treatment
 - Water quality and quality issues have been challenging

Each project has had challenges, some similar and some unique

FPL's West County Energy Center



APS Palo Verde Nuclear Generating Station



Palo Verde operates on 90 mgd of reclaimed water from nearby Phoenix, AZ metropolitan area water utilities



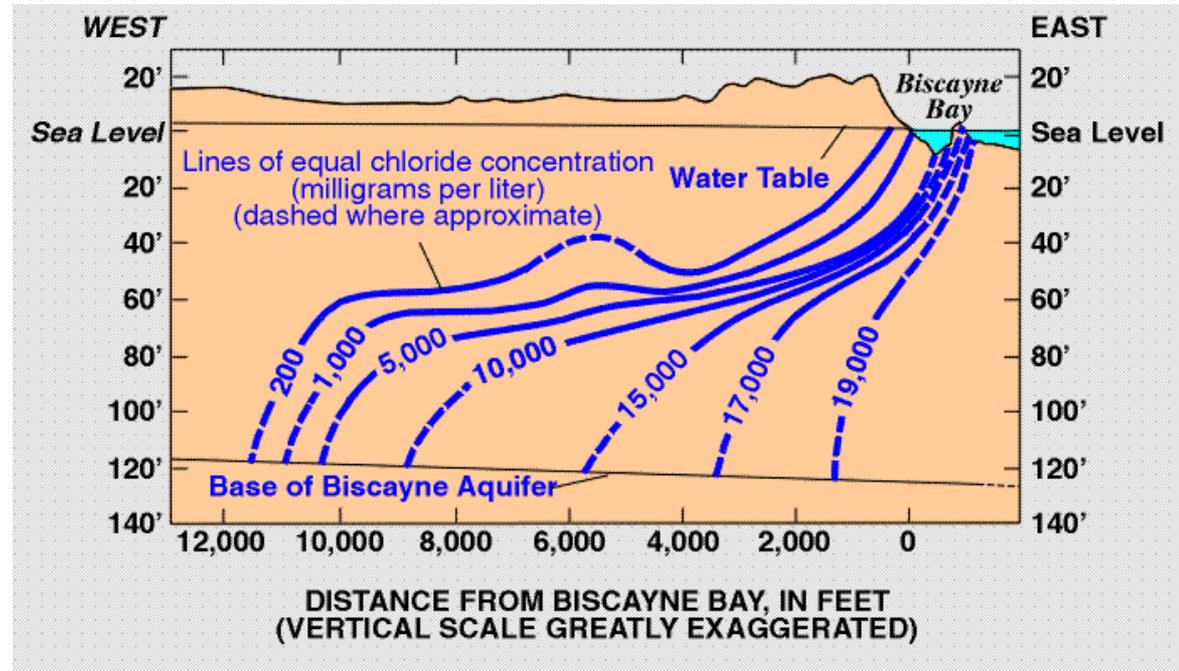
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Saltwater intrusion is a result of Florida's porous geology, allowing heavier saltwater to push into freshwater aquifers

Saltwater Intrusion

- The surficial aquifer (Biscayne) aquifer in the area of the Turkey Point plant is fully saltwater intruded
- Saline water is heavier than fresh water, so it sinks to the bottom of the aquifer
- Saltwater has intruded about 6-7 miles west of the coast, at the base of the aquifer
- Multiple factors affect the movement of saltwater in the aquifer



Cross section of the Biscayne Aquifer showing saltwater intrusion (Kohout, 1960)

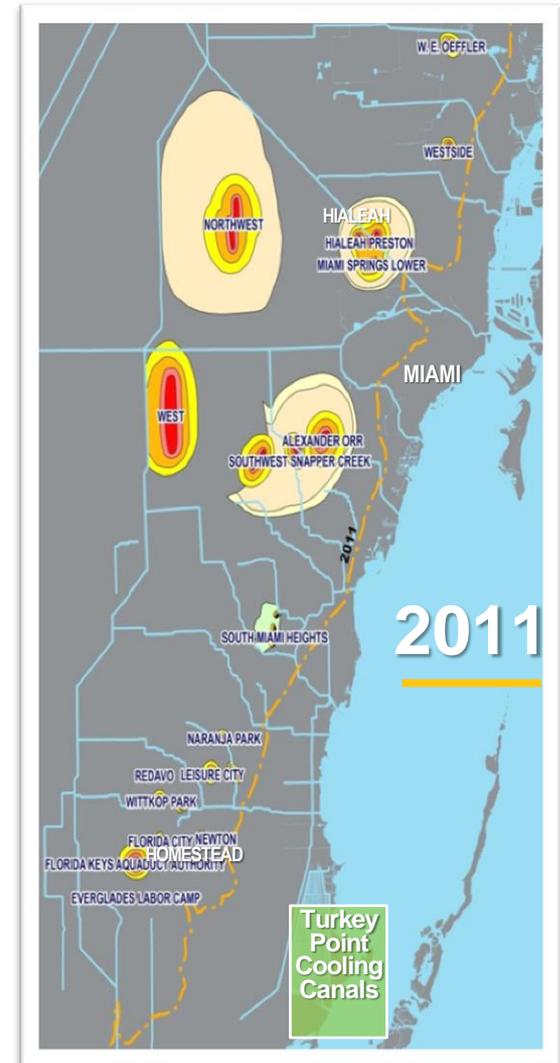
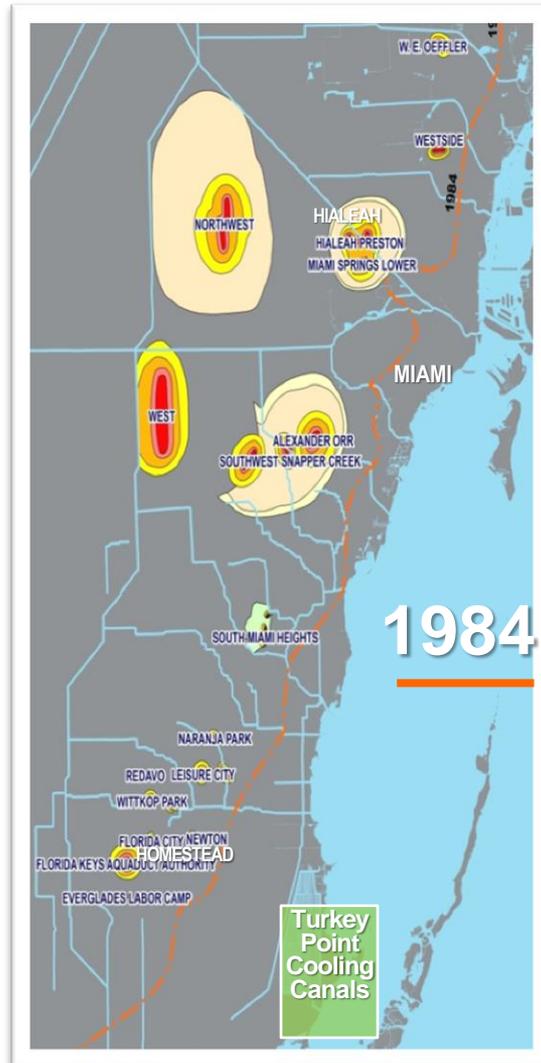
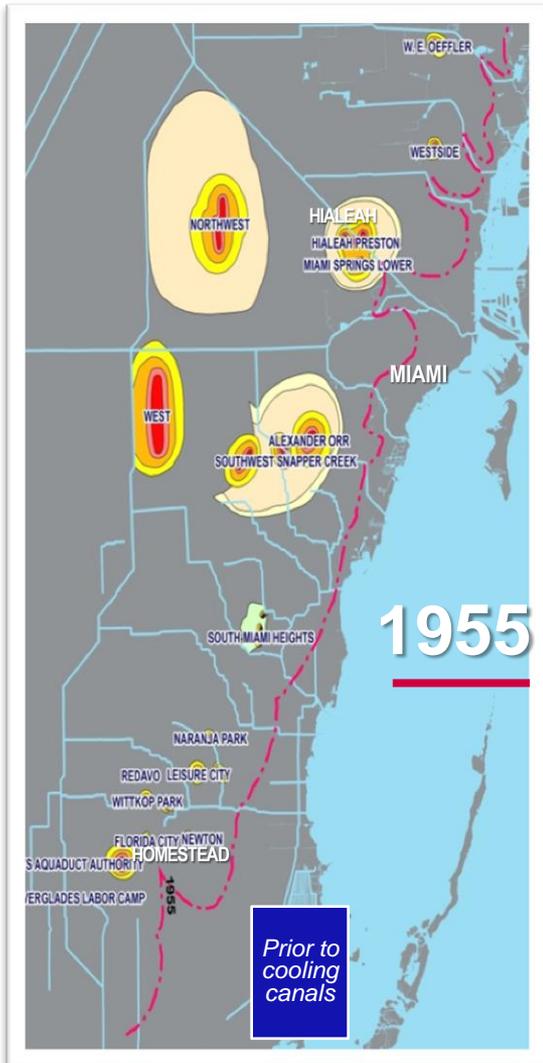
Saltwater intrusion is an issue in coastal Florida and can be affected by many factors

Saltwater Intrusion in Miami-Dade

Historic Condition

Increased Development

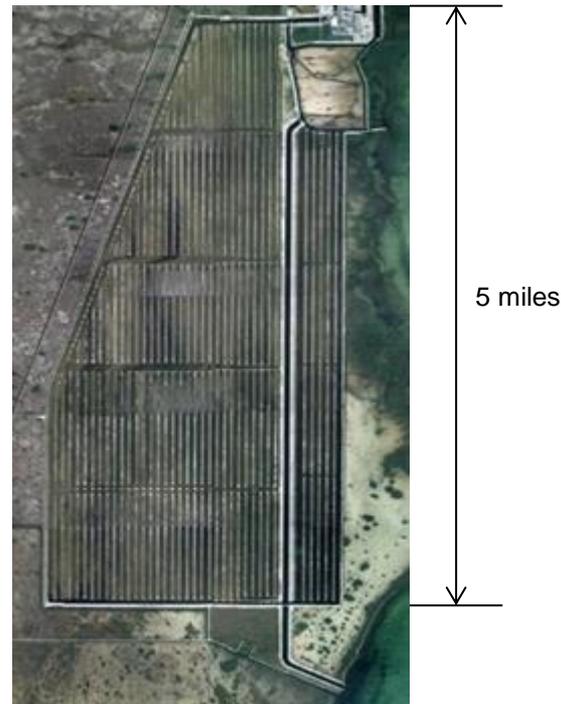
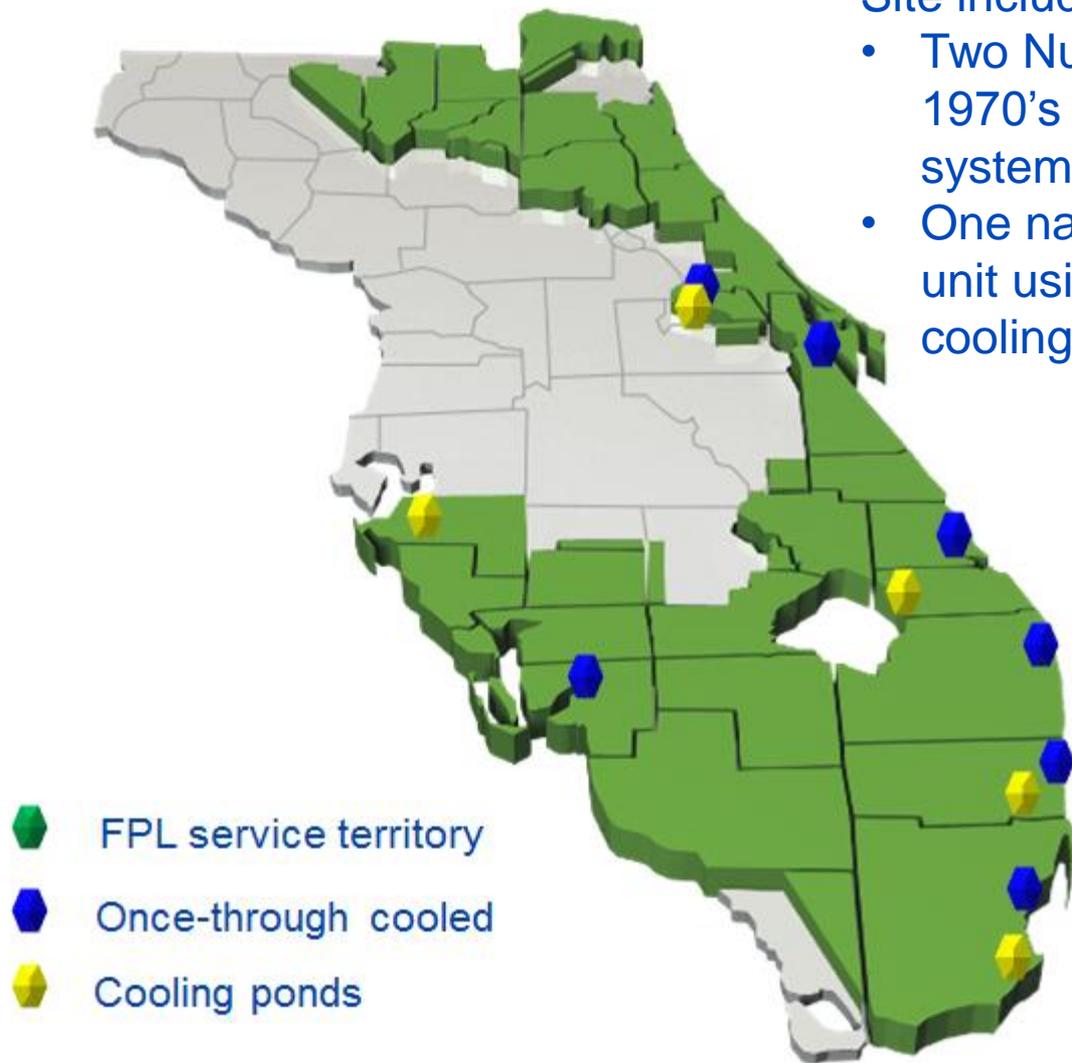
Current



Turkey Point was originally a once-through marine intake design, but was converted to cooling canals in 1972

Site includes:

- Two Nuclear Units designed in 1970's to use the cooling canal system
- One natural gas combined cycle unit using Floridan wells and cooling towers



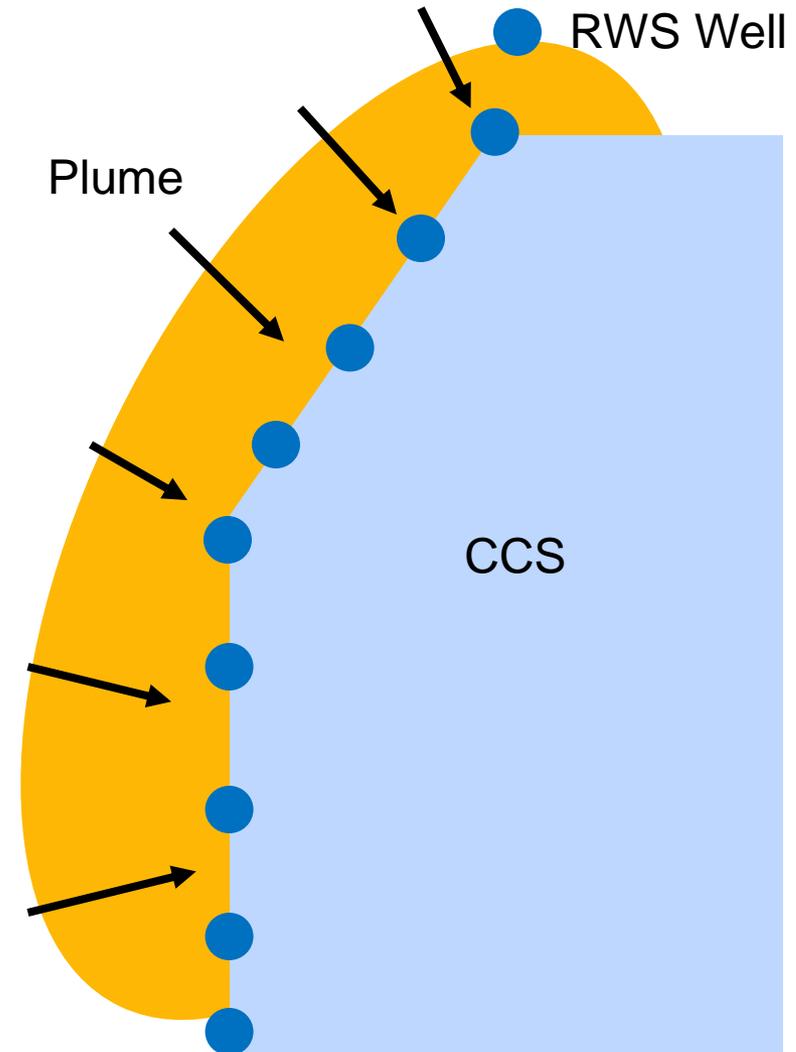
Turkey Point cooling canal system



The Cooling Canal System (CCS) is unlined and permitted to interface with the aquifer below

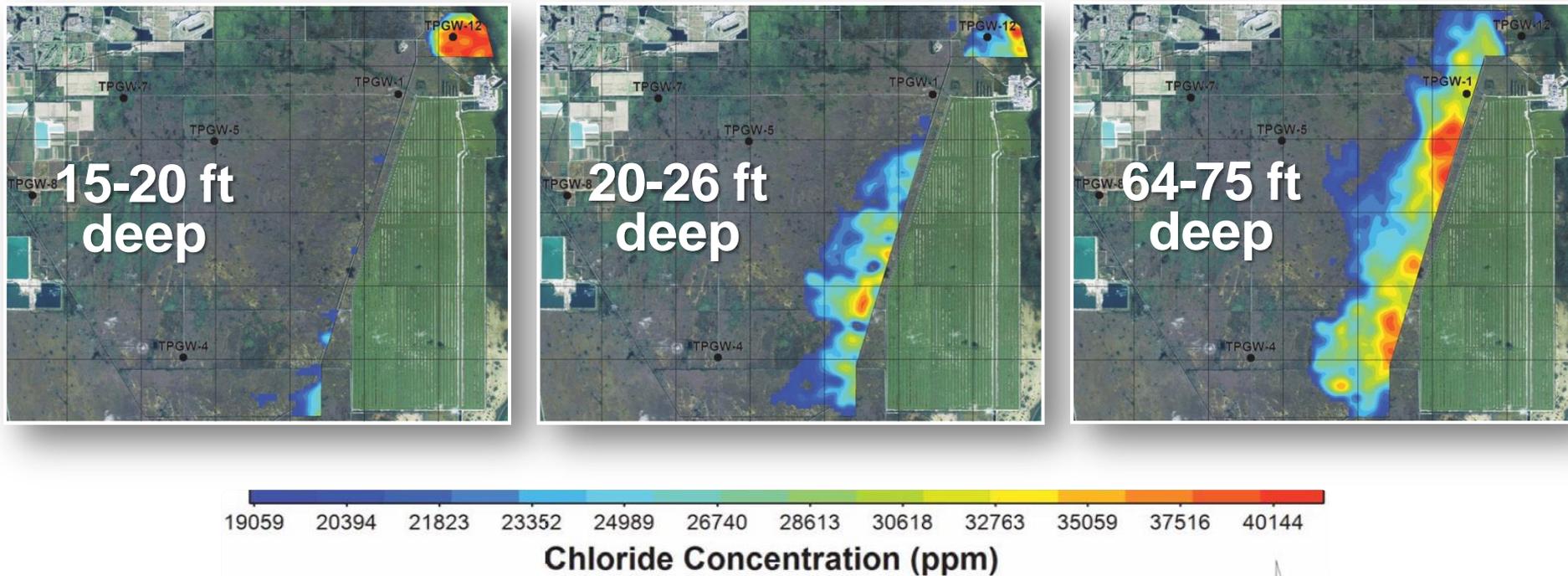
Hypersalinity

- Similar to Everglades Bay, the CCS is a shallow saline water body, subject to salinity excursions
- Historic rainfall deficits raised average salinity in the CCS
- A hypersaline plume was created that extends about 1 mile west at the base of the aquifer
- A Recovery Well System (RWS) was installed to retract the plume
- Reduced salinity in the CCS will mitigate future seepage, and the RWS will contain it



The location of the hypersaline water (> seawater salinity) can be located by scanning technology

Plume Location is Depth Dependent (1)



The Recovery Well system will retract the plume, but active management of CCS surface water salinity will avoid a recurrence

1) Continuous Surface Electromagnetic Mapping technology allows for high spatial resolution

Miami-Dade County and FPL have a mutual interest in finding creative options to address water challenges

Opportunities in Miami-Dade

- **Aging infrastructure has required rebuilding of much Water and Sewer Department infrastructure**
- **Ocean Outfall Legislation will require two key changes in how Miami-Dade handles wastewater**
 - Currently up to 60% of treated wastewater goes to ocean outfalls; this will not be an option after 2025
 - A target to reuse 117 mgd of treated wastewater has been set
- **Use of treated wastewater at Turkey Point has long been a goal of FPL and Miami-Dade County**
- **Opportunities for environmental use of reclaimed water exist in southeastern Miami-Dade County**
- **The Board of County Commissioners approved a Joint Participation Agreement earlier this year to pursue options**

FPL and Miami-Dade County are exploring a project that could jointly serve customers at a lower cost than independent projects

Water conservation strategies at power plants involve new technologies and better use of degraded sources

Executive Summary

- **Power generation requires use of water resources throughout the facility**
 - Conservation in response to economic and environmental motivators continue to change the options available to designers and operators
- **The Florida Power & Light (FPL) system tells the story of how these approaches have been implemented over time**
 - Implementation of natural gas combined cycle facilities over the past 20 years have significantly reduced water use
 - Exploration and implementation of different water resources has been a recent focus
- **Uniquely located, Turkey Point offers a range of resources and beneficial secondary reuse opportunities**

A recent initiative between FPL and Miami-Dade County is pursuing these opportunities in southeastern Miami-Dade

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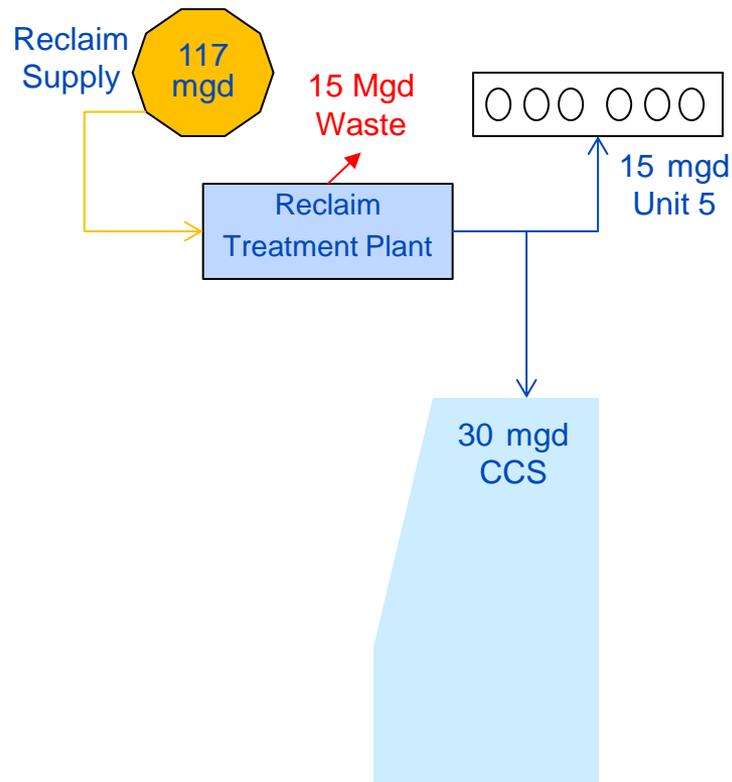
Using innovative technology, reclaimed water would be treated and delivered to site via a large dedicated pipeline

Reclaimed Opportunities at Turkey Point

- **Joint Participation Agreement with Miami-Dade envisions up to 60 mgd**

- 15 mgd for Unit 5 makeup water
- 30 mgd for cooling canal freshening water

- **Existing Floridan wells would be converted to backup sources**

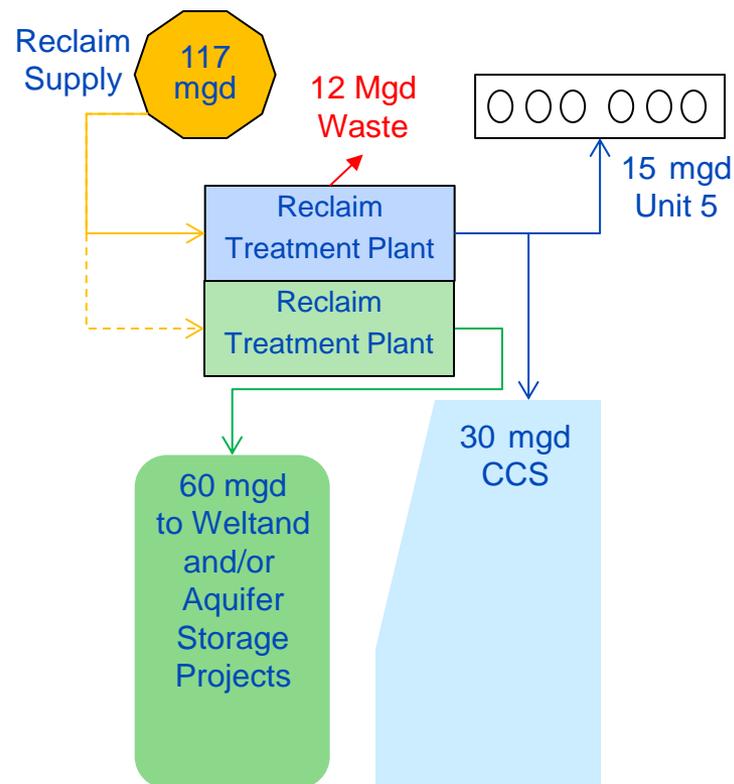


Reclaimed water used by Turkey Point does not compete with reclaimed water reserved for Everglades restoration

Using innovative technology, reclaimed water would be treated and delivered to site via a large dedicated pipeline

Reclaimed Opportunities at Turkey Point

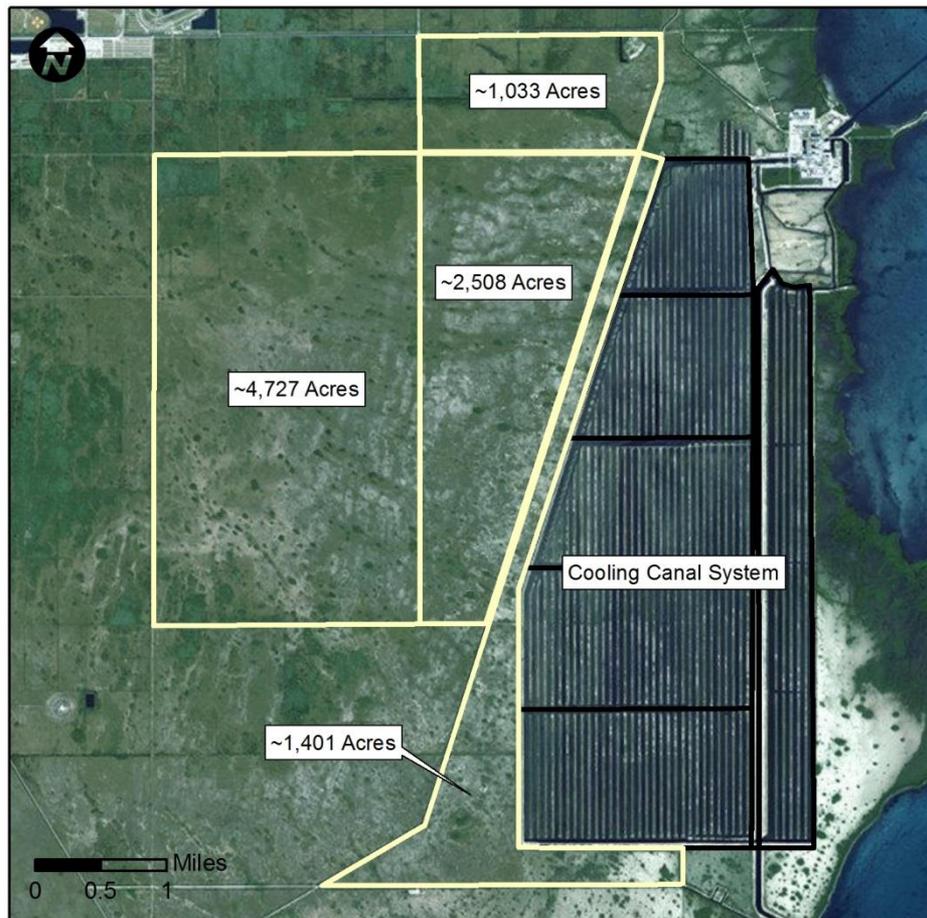
- **Joint Participation Agreement with Miami-Dade envisions up to 60 mgd**
 - 15 mgd for Unit 5 makeup water
 - 45 mgd for cooling canal freshening water
- **Existing Floridan wells would be converted to backup sources**
- **Additional treatment of another 60 mgd could support wetland hydration projects**



Reclaimed water used by Turkey Point does not compete with reclaimed water reserved for Everglades restoration

The region around Turkey Point could host environmental projects that are being successfully deployed in Florida

Environmental Project Opportunities



- **Treatment Marshes**
 - Engineered to hold water and reduce nutrients through natural filtration stages
- **Wetland Rehydration**
 - A long held goal of Everglades Restoration
 - Recent trial projects identified concerns
- **Aquifer Storage**
 - Inject treated reclaim into Floridan aquifer for future use

FPL is currently investigating the designs that will best meet economic and environmental constraints

Defining the Treatment Plant

- **A technology selection process is underway**
 - Phosphorous is the limiting constituent
 - Emerging Pollutants in the reclaimed supply must also be addressed
 - A hybrid approach using biologic and membrane technology is likely
- **Two possible locations are being investigated:**
 - North location would allow waste to be piped back to South District plant
 - South location would require waste to be trucked to a landfill

