# Restoration Benefits Observed from the Biscayne Bay Coastal Wetlands Project Phase 1

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## Biscayne Bay Coastal Wetlands Restoration Project Goals

#### Biscayne Bay Coastal Wetlands Alternative O-Phase 1 Project Objectives

- ✓ Improve freshwater and estuarine habitat
- ✓ Improve salinity distribution and reestablish productive nursery habitat along the shoreline
- Restore the quantity, quality, timing and distribution of fresh water to Biscayne Bay and Biscayne National Park
- Preserve and restore the spatial extent of natural coastal glades habitat within the BBCW Project's study area

Monitoring is currently underway at completed components to track project performance restoration targets and for adaptive management purposes



# Biscayne Bay Coastal Wetlands Restoration Project History

**Project Components** 

- ✓ Deering Estate
- ✓ Cutler Wetlands
- ✓ L-31E Flow way
- Project implementation report and environmental impact statement completed March 2012
- Project received congressional authorization in the Water Resources Development Act (WRDA) of 2014

□ Project partnership agreement executed 2016

SFWMD constructed the Deering Estate Component, installed culverts for L-31E Flow way, installed Interim Electric Pump to divert freshwater to the L-31E coastal wetlands and Biscayne Bay, and will complete construction of Cutler Wetlands Flow way



### Biscayne Bay Coastal Wetlands Restoration Deering Estate Hydrological Features

- Determined extent of inundation under various pumping rates
- Estimated acreage of impounded surface water under different pumping/flow rates within Deering Estate

Pumping Rate(cfs)	Duration of Testing	Estimated Acres of Impounded Surface Water	Percentage of Inundate Historic Remnant Wetlands
	(hours)		within Cutler Creek
0	5	0	0%
25	5	19	58%
50	5	25	76%
75	5	27	82%
100	5	31	94%



## Biscayne Bay Coastal Wetlands Restoration Deering Estate Hydrologic Operations

- Redistributes fresh water to the coast to hydrate coastal wetlands and help moderate near shore salinities
- In WY2017, a pump test compared pulse releases versus continuous pumping at rates of 25-100 cfs
- Results led to the recommendation to change from pulsed to continuous operation to keep wetlands hydrated and provide steady, low volume flow to the coast
- Additional freshwater is thought to be linked to the observation of an offshore freshwater spring in Biscayne Bay



Approximately 104,000 ac-ft. of freshwater redirected to historic remnant wetlands and Biscayne Bay

Timing of flows to the wetlands at Deering Estate and Biscayne Bay has been improved



- Groundwater salinity also responded to the input of fresh water from Deering Estate pump station
- Groundwater salinity at a nearshore station rose above 17 during Hurricane Irma and was reduced to less than 2 after pump station resumed normal operation salinity
- Groundwater levels rose noticeably compared to baseline levels at groundwater monitoring stations







#### Biscayne Bay Coastal Wetlands Restoration Response to Hurricane Irma

- Comparison of salinity in nearshore groundwater versus wetland and groundwater stage during Hurricane Irma
- Comparison of salinity levels at groundwater monitoring stations and daily flow at the Deering Estate Pump Station





### Biscayne Bay Coastal Wetlands Restoration Hydrologic Response to Irma



#### Biscayne Bay Coastal Wetlands Restoration Salinity Conditions



V WEIR

Wetland staff Gauge -Data

ogger unit

Groundwater Monitoring Station Salinity Monitoring Station in Cutler Creek

Salinity Monitoring Station at mouth of Cutler Creek

CERP-RECOVER Nearshore Salinity Monitoring Station

Notched box plots of daily mean salinity in Biscayne Bay nearshore stations (BISC62, BISCD2, and BISCD6) and Deering Estate creek stations (CC2, CC3, and DNC01) by water year (Note: The two black horizontal lines indicate the 95% confidence interval around the median daily salinity for WY2018.)

# Biscayne Bay Coastal Wetlands Restoration Deering Estate Vegetation Monitoring

Major findings can be summarized as follows:

- Sawgrass has begun to establish naturally in the slough
- The abundance of woody seedlings decreased from WY2017 to WY2018 across all plots
- ✓ Hurricane Irma caused significant canopy loss
- State-endangered ferns increased in abundance in both hammock plots



 10x10m plots
Retention pond & pump
W Weir Historical sloughCutler Creek

Roads and Trails

0 25 50 100 M

Southwest Corner of hammock Plot #153

BBCW Deering
Estate component
Vegetation
Changes

November 2016



November 2018







### Biscayne Bay Coastal Wetlands Restoration L-31E Flow-way

Construction completed June 2010

 Environmental benefits from the L-31E culverts are already being realized

Installed additional culverts and Interim electric pump to divert freshwater to the L-31E coastal wetlands and Biscayne Bay



#### Biscayne Bay Coastal Wetlands Restoration L-31E Flow-way Pump Operations

- Interim electric pump dry season operations started August 2017
- Enhanced sheet flow to the costal wetlands and Biscayne Bay
- Pumping maintained L-31E canal stage at optimal level ~2.20 ft-NGVD29

### BISCAYNE BAY COASTAL WETLANDS L-31E Interim Electric Pump

### **Biscayne Bay Coastal Wetlands Restoration** L-31E Flow-way Pump Operations

L-31E Flow way Interim electric pump project diverted approximately 44,000 ac-ft of freshwater to the coastal wetlands and Biscayne Bay since August 2017





#### **Biscayne Bay Coastal Wetlands Restoration** L-31E Flow-way Vegetation Response

Increases in sawgrass acreage assessed by mapping

 Sawgrass acreage increased more than 9 acres since 2013

SFWMD initiated annual vegetation and periphyton monitoring in L-31E Flow way coastal wetlands in WY2018



WY2018 sawgrass recruitment east of the L-31E levee



WY2018 sawgrass recruitment west of the L-31E levee 16

### **Hurricane Irma Impact on L-31E Culverts**

Hurricane Irma impacted the BBCW L-31E component in September 2017

Stages in the L-31E canal and at associated coastal structures rose above 4 ft NGVD29 in September 2017





Erosion 4 ft deep and slope length of 12 ft, at culvert S-712A on L-31E levee Erosion entire length from south from S-20G to S-20F, 6,928 ft.

SFWMD completed repair of L-31E levee in 2018

Hurricane Irma impacted the L-31E component in September 2017

Comparison of stages at the L-31E Culverts in WY2018, highlighting water levels during Hurricane Irma.

#### Biscayne Bay Coastal Wetlands Project Restoration L-31E Flow-way Salinity Response



(Note: The two black horizontal lines indicate the 95% confidence interval around the median daily salinity for WY2018.)

CERP RECOVER IBBEAM Sampling Site (source: Annual report IBBEEAM May, 2017)

# **Cutler Flow-way Component**

□ Cutler Flow way component

- ✓ Design completed November 2009
- ✓ Design update scheduled for 2019
- ✓ Construction scheduled 2020 to 2021

✓ To be constructed by SFWMD



# CONCLUSIONS

Recommended and implemented various CERP Adaptive Management processes to enhance and improve performance of the project

- Improve quality, quantity, timing, and distribution of freshwater to Biscayne Bay and minimize point source discharges
- Flow to the coastal wetlands at the Deering Estate and L-31E components has been enhanced
- Wetland stage and inundation have been increased in Deering Estate historical sloughs and L-31E coastal wetlands as a result of redirection of flow from C-100 via the S-700 and from C-103 via interim Pump (S-709)
- Vegetation within vicinity of Deering Estate component and L-31E Flow-way responding to changed hydrology
- Reduced non-native vegetation percentage cover of Category I and II invasive exotic plants within vicinity of the L-31E Flow- way to less than five percent

# CONCLUSIONS

Reduced salinity in groundwater and surface water of Deering Estate coastal wetlands, and in the Deering Estate creeks as a result of freshwater diverted from C- 100 by Deering Estate pump station

Reduced salinity in the L-31E coastal wetlands within vicinity of Interim Pump S-709 as a result of freshwater diverted from C- 103 by interim pump S-709, L-31E canal, and L-31E culverts

# QUESTIONS?