BISCAYNE BAY
COASTAL WETLANDS
RESTORATION BENEFITS

Presented by
Bahram Charkhian
Lead Environmental Scientist
Coastal Ecosystems Section
Re-establish productive nursery habitat

Improve quantity, quality, timing and distribution of freshwater to Biscayne Bay

Redistribute freshwater flow and minimize point source discharges

Preserve and restore natural coastal glades habitat

Re-establish connectivity between the coastal and adjacent wetlands

Improve near-shore and saltwater wetland salinity regimes
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

SFWMD PHASE 1 EXPEDITED PROJECTS

- Expedited design, construction and pilot testing on several Phase 1 project components
  - L-31E Tidal Restoration Components
  - L-31E Pilot Pump Test
  - L-31E Interim Pump
  - Deering Estate Flow-way
  - Cutler Flow-way

- Provides for early ecosystem restoration benefits by distribution flows along coast and near shore including Biscayne National Park
SFWMD EXPEDITED PROJECT

- L-31 E Tidal Restoration

✓ Construction completed June 2010
Purpose:

- The L-31E Pilot Pump Test was used to verify that the pump station identified in the Biscayne Bay Coastal Wetlands Phase 1 PIR;

  - Pump Station is properly located and sized for redirecting available water through four flap-gated culverts in the L-31E Levee that open to adjacent coastal wetlands
  - Divert water from point source discharge and redistribute through culverts to remnant tidal creeks
BISCAYNE BAY
COASTAL WETLANDS
L-31E Pilot Pump Test
BBCW L-31E PILOT PUMP TEST PROJECT

- Temporary pilot pump dry season operations started October 2014
- Enhanced sheetflow to historic tidal creeks
- Pumping maintained L-31E canal stage at optimal level ~2.20 FT-NGVD29
BBCW L-31E INTERIM OPERATIONS and PUMP INSTALLATION

- BBCW L-31E Interim electric Pump installation completed March 2016
**BBCW RESTORATION BENEFITS L-31E CULVERTS**

- L-31E Culverts diverted +28,638 ac-ft of water from the C-102 and C-103 canals since November 2010

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dry Season</td>
<td>Wet Season</td>
<td>Dry Season</td>
<td>Wet Season</td>
<td>Dry Season</td>
<td>Wet Season</td>
</tr>
<tr>
<td>S-23A</td>
<td>0</td>
<td>957</td>
<td>141</td>
<td>785</td>
<td>32</td>
<td>444</td>
</tr>
<tr>
<td>S-23B</td>
<td>0</td>
<td>232</td>
<td>13</td>
<td>487</td>
<td>0</td>
<td>390</td>
</tr>
<tr>
<td>S-23C</td>
<td>0</td>
<td>1610</td>
<td>183</td>
<td>1265</td>
<td>93</td>
<td>129</td>
</tr>
<tr>
<td>S-23D</td>
<td>0</td>
<td>2190</td>
<td>70</td>
<td>2043</td>
<td>0</td>
<td>865</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0</td>
<td>4989</td>
<td>407</td>
<td>4580</td>
<td>125</td>
<td>1828</td>
</tr>
</tbody>
</table>
**BBCW RESTORATION BENEFITS L-31E PILOT PUMP TEST PROJECT**

- + 3,300 acre-feet of freshwater diverted from point source to overland flow
- Improved tidal wetlands and near shore salinity conditions

**Comparison of Monthly Total Flow in Acre-Feet (ac-ft) through L-31E Pilot Pump**

- October 14: 339 ac-ft
- November 14: 492 ac-ft
- December 14: 559 ac-ft
- January 15: 529 ac-ft
- February 15: 535 ac-ft
- March 15: 607 ac-ft
- April 15: 264 ac-ft

[Bar chart showing monthly flow data]
BBCW RESTORATION BENEFITS L-31E PILOT PUMP TEST PROJECT

- Rehydration of coastal wetlands along east & west sides of L-31E Canal
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

BBCW RESTORATION BENEFITS L-31E PILOT PUMP TEST PROJECT

Nearshore Biscayne Bay Salinity Within Vicinity of L-31E Flow-way (RECOVER/BNP Monitoring Stations)

Salinity at nearshore RECOVER monitoring stations within vicinity of the L-31E Culverts

Comparison of salinity measured at BISC14 (50 meters off shore) and BISC16 (300 meters off shore)
BBCW RESTORATION BENEFITS
L-31E CULVERTS

- Expansion of sawgrass observed
- Various species of birds, amphibians, invertebrates, fish, and reptiles were observed
**BBCW RESTORATION BENEFITS**

**L-31E CULVERTS**

- Increases in sawgrass acreage assessed by mapping
  - 2013 mapping - 43 acres
  - 2015 mapping - 48 acres
  - 2016 mapping - 50 acres
The Deering Estate Flow-way is located in Southeastern Miami-Dade County

- Construction completed April 2012

The goals include:

- Redirect up to 100 cfs freshwater to the coastal wetlands
- Re-hydrate the historic wetland and restore a more natural freshwater flow regime
- Establish an educational wetland
Delineation of the Historical Freshwater Wetland Slough in Deering Estate and Areas of Inundation at Different Pump Rates

Estimated Acreage of Impounded Surface Water Under Different Pumping/Flow Rates within Deering Estate

<table>
<thead>
<tr>
<th>Pumping Rate (cfs)</th>
<th>Duration of Testing (hours)</th>
<th>Estimated Acres of Impounded Surface Water</th>
<th>Percentage of Inundate Historic Remnant Wetlands within Cutler Creek</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>25</td>
<td>5</td>
<td>19</td>
<td>58%</td>
</tr>
<tr>
<td>50</td>
<td>5</td>
<td>25</td>
<td>76%</td>
</tr>
<tr>
<td>75</td>
<td>5</td>
<td>27</td>
<td>82%</td>
</tr>
<tr>
<td>100</td>
<td>5</td>
<td>31</td>
<td>94%</td>
</tr>
</tbody>
</table>
Approximately 45,233 ac-ft of freshwater redirected to historic remnant wetlands

Timing of flows to the wetlands at Deering Estate has been improved
BBCW RESTORATION BENEFITS
DEERING ESTATE FLOW-WAY

- Stage declines with distance from pump
BBCW RESTORATION BENEFITS
DEERING ESTATE FLOW-WAY

- Verification of pump operation under fix stage range (25 cfs)
BBCW RESTORATION BENEFITS
DEERING ESTATE FLOW-WAY

- Verification of pump operation under fix stage range (50 cfs)
BBCW RESTORATION BENEFITS
DEERING ESTATE FLOW-WAY

- Comparison of pulse versus continuous pumping

<table>
<thead>
<tr>
<th>Rate (cfs)</th>
<th>Pump</th>
<th>Location</th>
<th>Pumping</th>
<th>Duration (hours)</th>
<th>Water Level</th>
<th>Changes in stage (ft-NGVD29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>On</td>
<td>Station#1</td>
<td>Pulse</td>
<td>7</td>
<td>4.80</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Continuous</td>
<td>30</td>
<td>4.90</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Station#2</td>
<td>Pulse</td>
<td>7</td>
<td>4.10</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Continuous</td>
<td>30</td>
<td>4.17</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Station#3</td>
<td>Pulse</td>
<td>7</td>
<td>3.26</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Continuous</td>
<td>30</td>
<td>3.36</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rate (cfs)</th>
<th>Pump</th>
<th>Location</th>
<th>Pumping</th>
<th>Duration (hours)</th>
<th>Water Level</th>
<th>Changes in stage (ft-NGVD29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>On</td>
<td>Station#1</td>
<td>Pulse</td>
<td>7</td>
<td>3.37</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Continuous</td>
<td>22</td>
<td>4.36</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Station#2</td>
<td>Pulse</td>
<td>7</td>
<td>4.71</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Continuous</td>
<td>22</td>
<td>4.86</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Station#3</td>
<td>Pulse</td>
<td>7</td>
<td>3.58</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Continuous</td>
<td>22</td>
<td>4.01</td>
<td></td>
</tr>
</tbody>
</table>
Reduced salinity in groundwater
Reduced salinity in surface water
Groundwater stage rose noticeably at Groundwater monitoring stations, and water levels varied according to pump operations.
BBCW RESTORATION BENEFITS
DEERING ESTATE FLOW-WAY

- Improved salinity regimes for the Deering Estate Flow-way Creeks
BBCW RESTORATION BENEFITS
DEERING ESTATE FLOW-WAY
US Army Corps of Engineers is the lead agency for design and construction of remaining phase 1 features

- 2015-2016 Fiscal Year $2.6 million for Design

- Five pump Stations
  - S-703 (50 cubic feet per second)
  - S-705 (100 cubic feet per second)
  - S-709 (40 cubic feet per second)
  - S-710 (40 cubic feet per second)
  - S-711 (40 cubic feet per second)

- Inverted siphon (S-707)

- Six L-31E Culverts

- Freshwater wetland between C-103 Canal and North Canal
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

SFWMD EXPEDITED PROJECT

- Cutler Flow-way Features

  ✓ Design completed November 2009

  ✓ Design update schedule for 2019

  ✓ Construction schedule 2020 to 2021
CONCLUSIONS

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

  - Point source discharges from the C-103 Canal were reduced or eliminated
  - Monitoring results demonstrated an improvement of hydrologic conditions in response to the pump test
  - The L-31E Pilot Pump Test resulted in improved saltwater wetlands salinity regimes, enhanced sheet flow, rehydration of freshwater and saltwater wetlands
  - Pumping maintained the stage within the L-31E Canal at the optimal level of approximately 2.20 feet NGVD
CONCLUSIONS

- Environmental benefits from the Deering Estate Flow-way are already being realized
  - Reduced point source discharge from canals has been reduced
  - Improved quality of water and timing of flows to the wetlands has been improved
  - Rehydration of historic coastal wetlands
  - Wetland plant species are proliferating including expansion of sawgrass, upland plants have died off and new wetland vegetation species are emerging

All metrics indicate a successful project.
Thank You

BISCAYNE BAY
COASTAL WETLANDS

Bahram Charkhian
Lead Environmental Scientist
Coastal Ecosystems Section

sfwmd.gov