



Stormwater Outfall Resiliency Master Planning in the Nation's Oldest City

FSA 2020 Annual Conference

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Presentation Outline

- ❖ Background of the City – Flood Perspective
- ❖ Resiliency Planning Efforts
- ❖ **Stormwater Outfall Resiliency Master Plan**
- ❖ Implementation of Resiliency Projects
- ❖ Grant Funding of Projects





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Background

- St. Augustine is the oldest continuously occupied settlement of European and African-American origin in the United States
- 6 million visitors each year; \$1 Billion in tourism
- City population, less than 15,000 past 50 years = small tax base





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Background



Flooding is not new to the City



-4-



However, the frequency of "sunny day" flooding is on the rise



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Background

Current City Challenges (stormwater):

- Aging infrastructure
- Undersized collection system
- Low-lying and coastal location (within a flood zone)
- Highly developed (high impervious area)
- **Subject to flooding – both from rainfall and tidal influence**





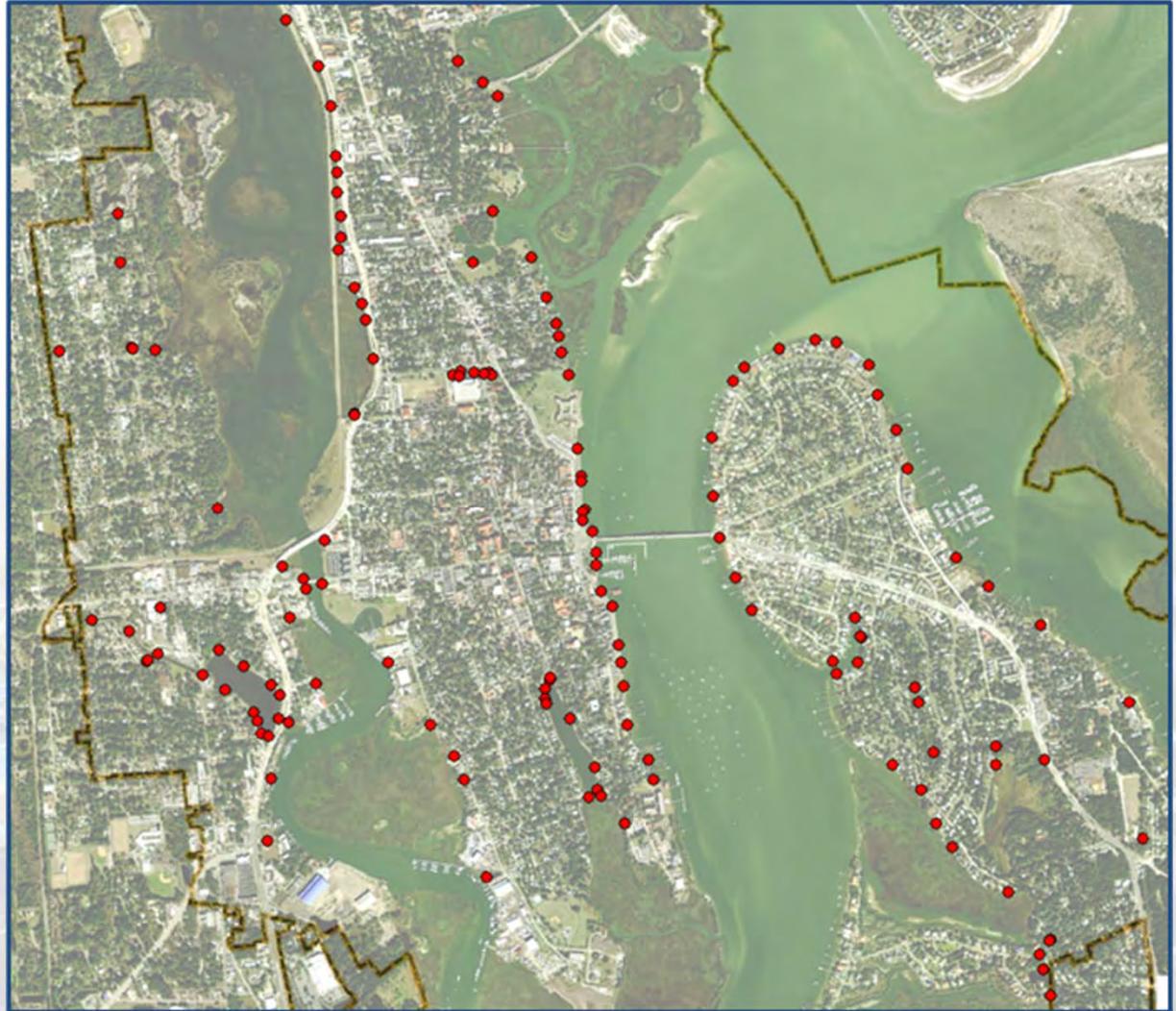
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Background

Stormwater Infrastructure:

- 103 Outfalls
Tidally
Influenced
- 949 Storm Inlets
- 20 miles of pipe

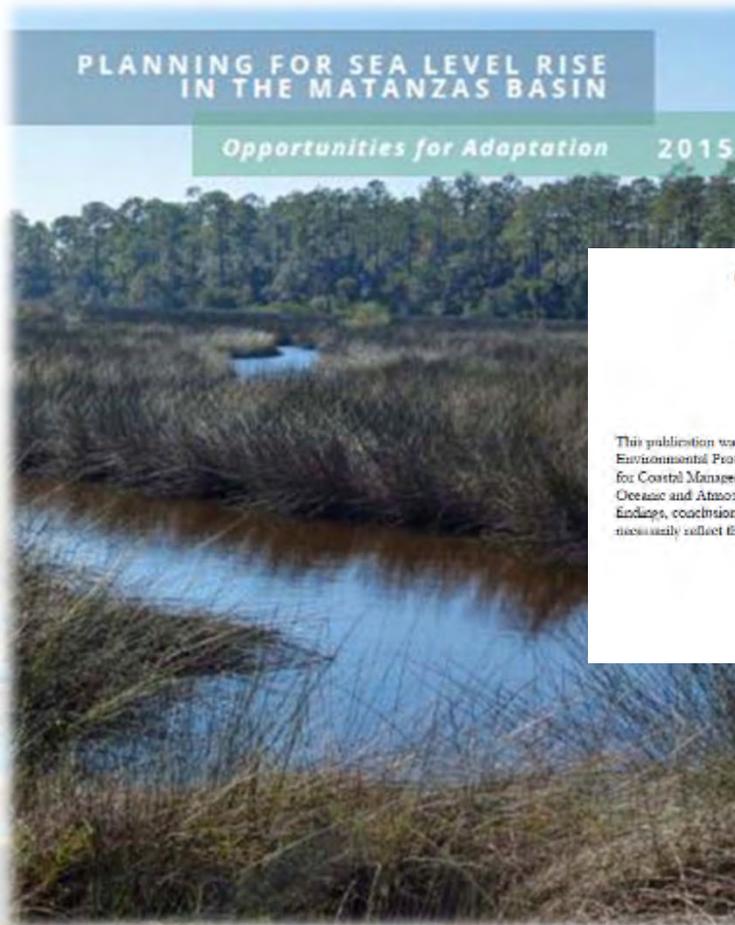




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Planning Efforts

- ✓ Planning for Sea Level Rise in the Matanzas Basin (2015)¹
- ✓ Community Resilience Initiative – Pilot Project (2016 – 2017)
 - ❑ Coastal Vulnerability Assessment ²
 - ❑ Strategic Adaptation Plan ³



Coastal Vulnerability Assessment: City of St. Augustine, Florida

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June 24, 2016

Florida Community Resiliency Initiative Pilot Project

Adaptation Plan
for St. Augustine, Florida

May 2017



UF UNIVERSITY OF
FLORIDA



NATIONAL ESTUARINE
RESEARCH RESERVE SYSTEM
SCIENCE COLLABORATIVE



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Planning Efforts

Coastal Vulnerability Assessment evaluated 3 types of coastal flooding:

- Mean Higher High Water (MHHW)
- *Nuisance flooding*
- 1% annual chance (i.e. 100-year flood)





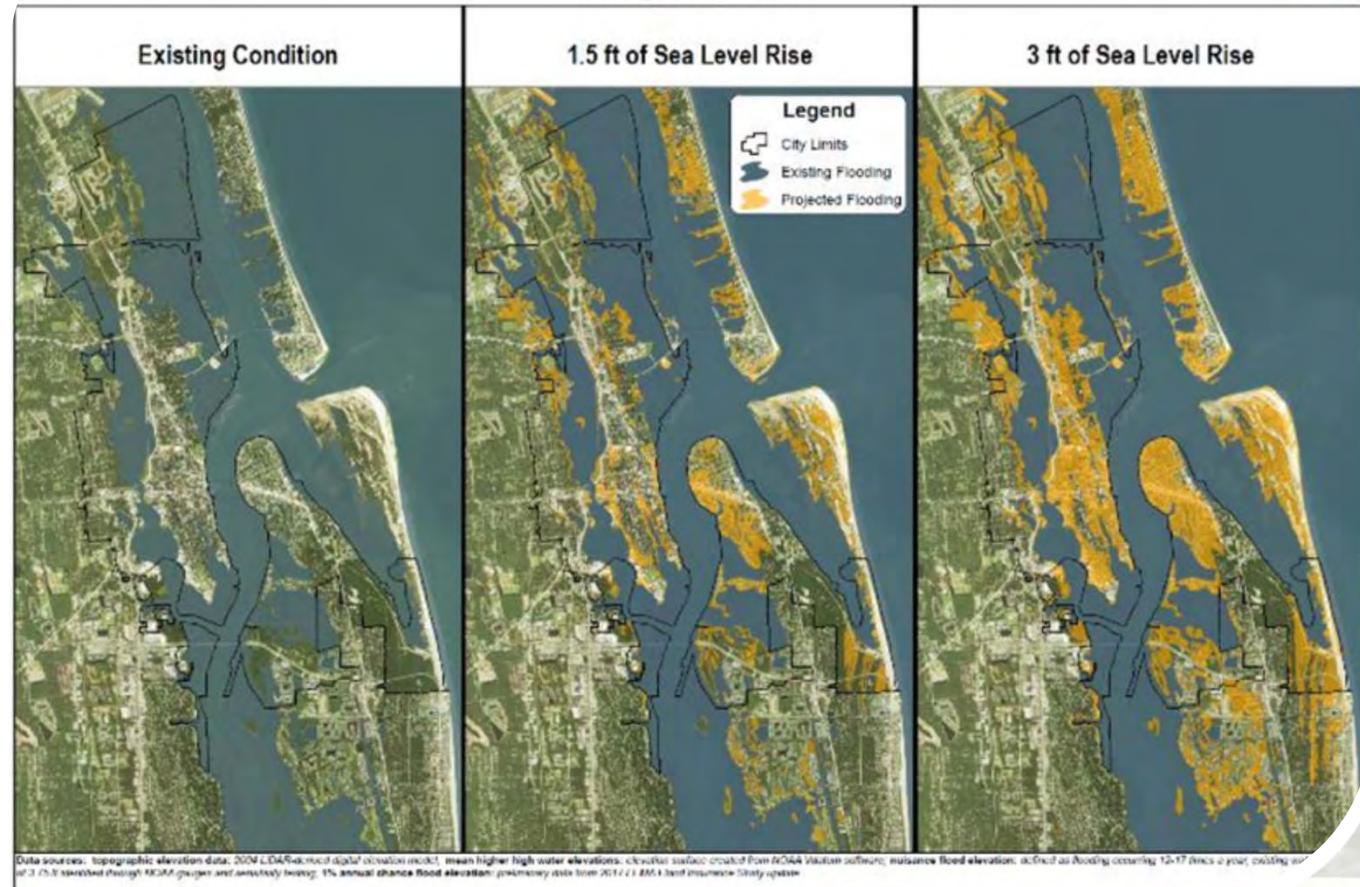
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Planning Efforts

Strategic Adaptation Plan:

- ✓ Educate the public about SLR & policy responses
- ✓ Develop baseline budgets
- ✓ Adopt policies that limit spending in areas where retreat or re-design are more effective
- ✓ Base decisions on FEMA's updated FIRMs
- ✓ Install LID/Green infrastructure
- ✓ *Targeted upgrades to City's stormwater system*
- ✓ WWTP options
- ✓ FDOT roadway improvements for resiliency
- ✓ Historic Preservation Comprehensive Plan

Existing and Future Coastal Floodplains Nuisance Flooding St. Augustine, Florida





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Stormwater Resiliency Master Outfall Plan

1. Data collection
2. Coordination with FDOT
3. Comprehensive Outfall Atlas
4. *Field Confirmation of Outfall Data*
5. Future Resiliency & Adaptation Criteria Evaluation
6. Outfall Improvement Assessment & Prioritization
7. Master Plan





Stormwater Resiliency Master Outfall Plan

1. Data collection, compilation and review:

- a. City GIS information (boundary, infrastructure, environmental, hydrographic, etc.).
- b. City previous study and model information (Stormwater Master Plan, Coastal Vulnerability Assessment etc.)
- c. City drainage map atlas and plans archives relative to drainage system location and improvements.
- d. Historical aerials from City, County, FDOT, and other relevant sources.
- e. Latest topographical information in LiDAR derived format from St. Johns County.
- f. City complaint logs, records, or other information related to known flooding locations and flood prone areas based on inland runoff or tide impacts.
- g. City standard GIS data model prepared by City's consultant Jones Edmunds and Associates.

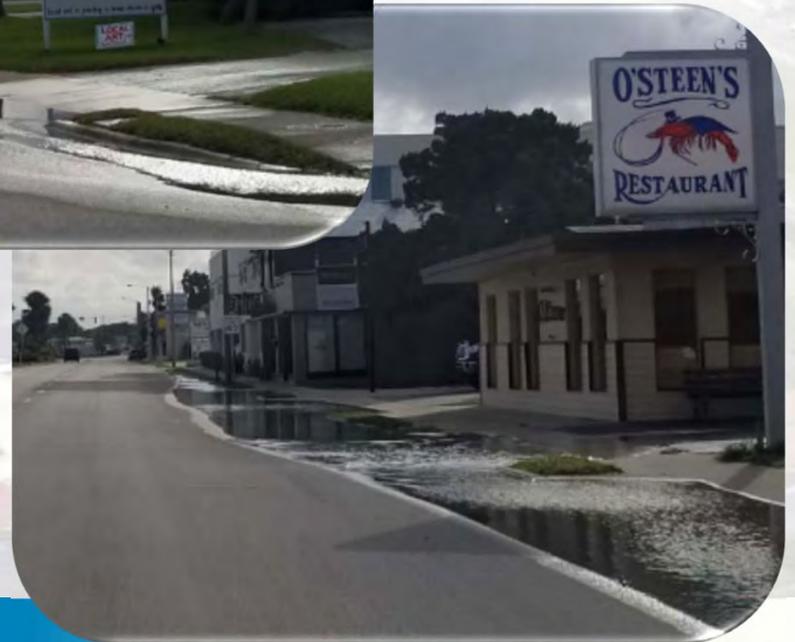


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Stormwater Resiliency Master Outfall Plan

2. Coordination with FDOT

- a. City storm infrastructure ties into FDOT storm infrastructure on a number of major FDOT roads
- b. Flooding resulting from FDOT outfalls within City roads
- c. Collaborate with FDOT on a prioritization of retrofits





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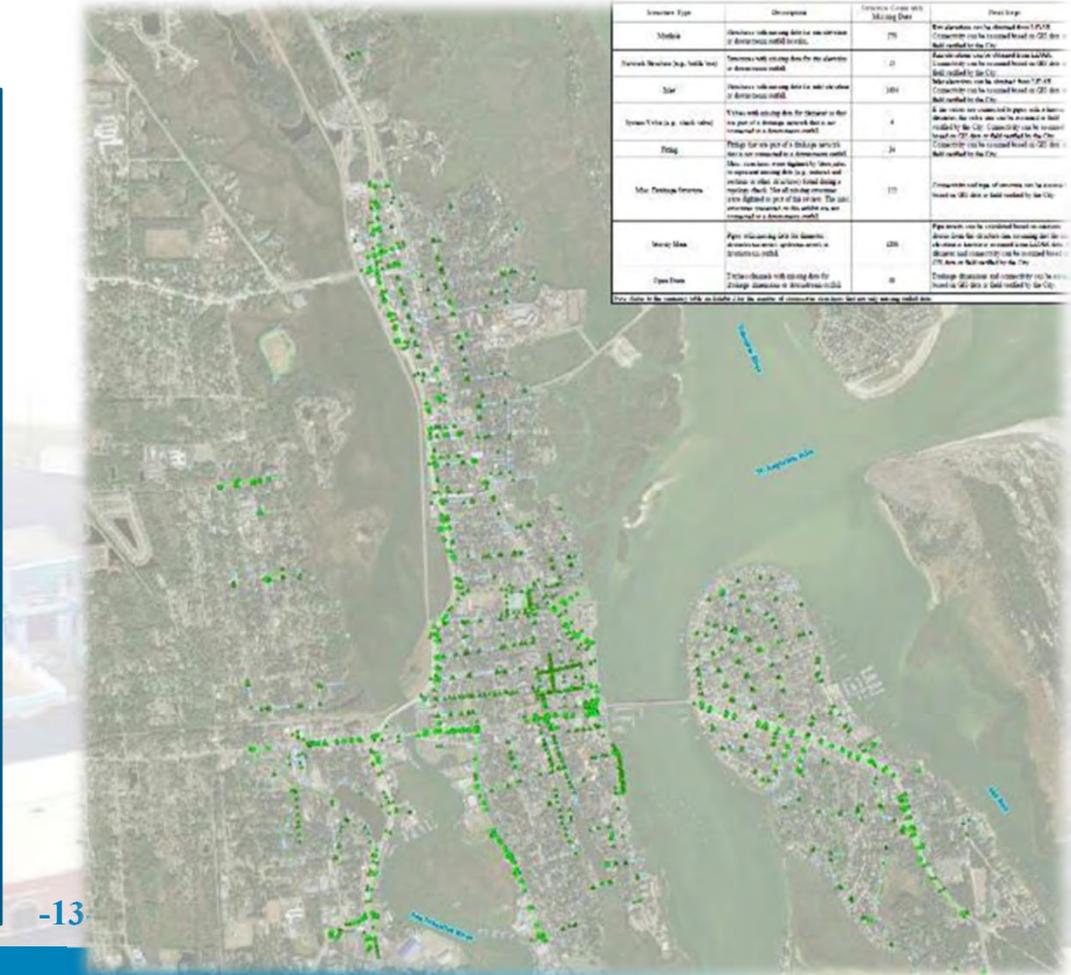
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Stormwater Resiliency Master Outfall Plan

3. Comprehensive Outfall Atlas

- a. Multiple data sets exist (City, FDOT, NPDES). Data compiled into one set to represent the complete “existing conditions” of the City’s GIS stormwater infrastructure.
- b. Stormwater systems are connected in a topologically consistent manner to create drainage networks capable of effectively assessing stormwater interconnects.
- c. Data gaps identified (missing elevation, dimensions, outfall info etc.)

| Structure Type | Description | Structure Count with Missing Data | Notes |
|---------------------------------------|---|-----------------------------------|--|
| Manhole | Manholes with missing data for elevation or dimensions will be added. | 270 | Manholes can be checked from FDOT. Connections can be checked from GIS data or field verified by the City. |
| Network Structure (e.g., catch basin) | Structures with missing data for the structure or dimensions will be added. | 11 | Manholes can be checked from FDOT. Connections can be checked from GIS data or field verified by the City. |
| Stair | Manholes with missing data for the structure or dimensions will be added. | 1001 | Manholes can be checked from FDOT. Connections can be checked from GIS data or field verified by the City. |
| Storm Water (e.g., catch basin) | Structures with missing data for elevation or dimensions will be added. | 4 | Manholes can be checked from FDOT. Connections can be checked from GIS data or field verified by the City. |
| Piling | Piling for any part of a bridge structure is not included in a stormwater model. | 34 | Manholes can be checked from FDOT. Connections can be checked from GIS data or field verified by the City. |
| Man/Pipeline Structure | Manholes with missing data for elevation or dimensions will be added. The data for the structure is not included in a stormwater model. | 171 | Manholes can be checked from FDOT. Connections can be checked from GIS data or field verified by the City. |
| Manhole | Pipe structure with missing data for elevation or dimensions will be added. | 420 | Pipe structure can be checked from FDOT. Connections can be checked from GIS data or field verified by the City. |
| Open Flow | Structures with missing data for elevation or dimensions will be added. | 0 | Manholes can be checked from FDOT. Connections can be checked from GIS data or field verified by the City. |





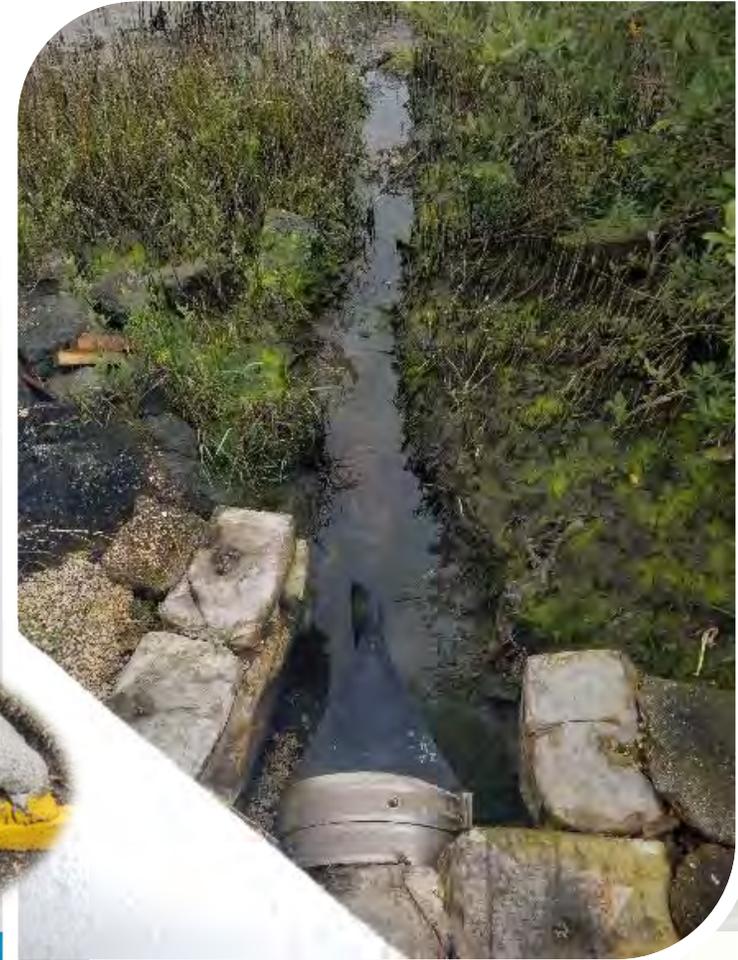
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Stormwater Resiliency Master Outfall Plan

4. Field Confirmation of Outfall Data (Fill in Data Gaps)

- ✓ Each outfall inspected
- ✓ Outfall and condition assessed
- ✓ Measurements taken
- ✓ Data collected in a custom form created in CityWorks
- ✓ Can be utilized for NPDES and CRS reporting and documentation





Stormwater Resiliency Master Outfall Plan

Cityworks User Guides | Public Works | NPDES | Storm Water Discharge Inspections

STORM - Discharge Point Inspection Tracking

STORM - Discharge Cond Insp (Open)

No Results

Rows 5 | 1 - 0 of 0

STORM - Discharge Cond Insp (Complete)

| Insp | Inspection Type | Date Inspected | Inspected By |
|------|-----------------------------|---------------------|--------------|
| 427 | STORM - Discharge Cond Insp | 2019-06-24 1:35 PM | Potts, Jesse |
| 428 | STORM - Discharge Cond Insp | 2019-06-24 10:08 AM | Potts, Jesse |
| 430 | STORM - Discharge Cond Insp | 2019-06-24 11:31 AM | Potts, Jesse |
| 431 | STORM - Discharge Cond Insp | 2019-06-25 11:25 AM | Potts, Jesse |
| 432 | STORM - Discharge Cond Insp | 2019-06-24 11:22 AM | Potts, Jesse |

Rows 5 | 1 - 5 of 44

STORM - Discharge Cond Inspection (Closed)

| Insp | Inspection Type | Date Inspected | Inspected By |
|------|-----------------------------|---------------------|--------------|
| 167 | STORM - Discharge Cond Insp | 2019-03-14 2:22 PM | Potts, Jesse |
| 169 | STORM - Discharge Cond Insp | 2019-03-14 9:32 AM | Potts, Jesse |
| 170 | STORM - Discharge Cond Insp | 2019-09-16 10:59 AM | Potts, Jesse |
| 171 | STORM - Discharge Cond Insp | 2019-03-18 1:38 PM | Potts, Jesse |
| 171 | STORM - Discharge Cond Insp | 2019-03-18 1:51 PM | Potts, Jesse |

Rows 5 | 1 - 5 of 91

STORM - Discharge Struct Insp (Open)

No Results

Rows 5 | 1 - 0 of 0

STORM - Discharge Struct Insp (Complete)

No Results

Rows 5 | 1 - 0 of 0

STORM - Discharge Struct Insp - (Closed)

| Insp | Inspection Type | Date Inspected | Inspected By |
|------|-------------------------------|---------------------|--------------|
| 189 | STORM - Discharge Struct Insp | 2019-03-18 1:23 PM | Potts, Jesse |
| 190 | STORM - Discharge Struct Insp | 2019-03-14 10:41 AM | Potts, Jesse |
| 191 | STORM - Discharge Struct Insp | 2019-05-14 9:27 AM | Potts, Jesse |
| 192 | STORM - Discharge Struct Insp | 2019-05-14 9:37 AM | Potts, Jesse |
| 193 | STORM - Discharge Struct Insp | 2019-03-14 2:18 PM | Potts, Jesse |

Rows 5 | 1 - 5 of 133

Storm Discharge Inspection Status

4. Field Confirmation of Outfall Data (Fill in Data Gaps)

- ✓ Data collected in a form created in CityWorks
- ✓ Photos, measurements, condition of outfall, valve present etc.



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Stormwater Resiliency Master Outfall Plan

4. Field Confirmation of Outfall Data (Fill in Data Gaps)

- ✓ Data collected in a form created in CityWorks
- ✓ Photos, measurements, condition of outfall, valve present etc.

Cityworks | Inbox | Recent Activity | Assets | New Work Order | Ne

Inspection | Email | Print | Save | Close

Inspection | Details

Type: STORM - Discharge Struct Insp

Insp Id: 189

Location: 178 RIBERIA ST. Saint Augustine

Submit To: Beach, Jessica L | Date: 03/13/2019 9:09 AM

Inspected By: Potts, Jesse | Insp. Date: 03/18/2019 1:23 PM

Status: Closed | Resolution: City Issue

Activity Type: | Weather: |

Temperature: | Rain in last 3 days?: |

Comments

Comments: Duck bill valve, cleaned several weeks prior to inspection

Repair

Recommendations:

Attachments

+ Add attachments... | Remove all attachments

 15613980288161632346209122537825.jpg | 4.43 MB | Attached by Potts, Jesse | 08/24/2019 1:37 PM

Observations

Discharge Structure Diameter (inches only add number)

48

Sedimentation

Not Visible

Discharge Structure Shape

Circular

Discharge Structure Material

RCP

Valve Present

Yes

Condition of Valve

Good

Depth of ground to top of pipe (ft) - only enter number

0000

Discharge Structure Invert (ft) - only enter number

10

Clear Answers



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Stormwater Resiliency Master Outfall Plan

5. Future Resiliency & Adaptation Criteria Evaluation

- a. Assess the City's current outfall program with respect to future resiliency and adaptation to future conditions.
- b. This effort will include a future hydrological impact evaluation to project applicable rainfall intensity/depth/duration impacts and sea-level rise to support adaptation strategies as part of the outfall improvement evaluations. An appropriate future planning horizon will be identified (e.g., 2050) for infrastructure improvement planning purposes.
- c. Incorporate existing and/or future private development and redevelopment within the City, into the master plan goals.
- d. This could include updates to the City's code of ordinances to include impact fees, or other policy guidance recommendations, that would help offset the City's cost burden to install city-wide backflow prevention that benefits businesses and residents.



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Stormwater Resiliency Master Outfall Plan

6. Outfall Improvement Assessment & Prioritization

- a. Improvement recommendations such as: backflow prevention, ID capacity and/or connection issues, easement/right-of-way issues; pipe material issues (e.g., existing clay storm sewers), and obstructions such as buried pipes, silting, sedimentation, oyster mounds, rocks, decks, pylons, etc., that could block/ inhibit/ impact backflow installation
- b. Estimates of peak runoff flows to outfalls for design storms with expected peak tailwater stages at each outfall based on normal tailwater (mean water), current mean high-water tide, and projected future tide scenarios based on climate change impacts from the FDEO study.
- c. Flood stage inundation backwater analysis will be conducted at each outfall system using LiDAR and identified tailwater conditions. The inundation extents and depths will be evaluated under current and future storm stage and high-tide scenarios.
- c. Improvement recommendations will be developed for each outfall based. Opportunities to piggy-back improvement measures with other planned infrastructure improvements will also be considered.
- d. Outfall prioritization will be weighted to take into account resiliency, contributing area served, cost, permit-ability, constructability, flood mitigation, water quality improvements, long-term maintenance impacts, public safety, proximity to critical City assets, aesthetics, socioeconomics, political divisions, and other relevant criteria. This data will be used to support the City's evaluation of the sufficiency of the stormwater utility to help fund projects under a 10-year capital improvement program (CIP).

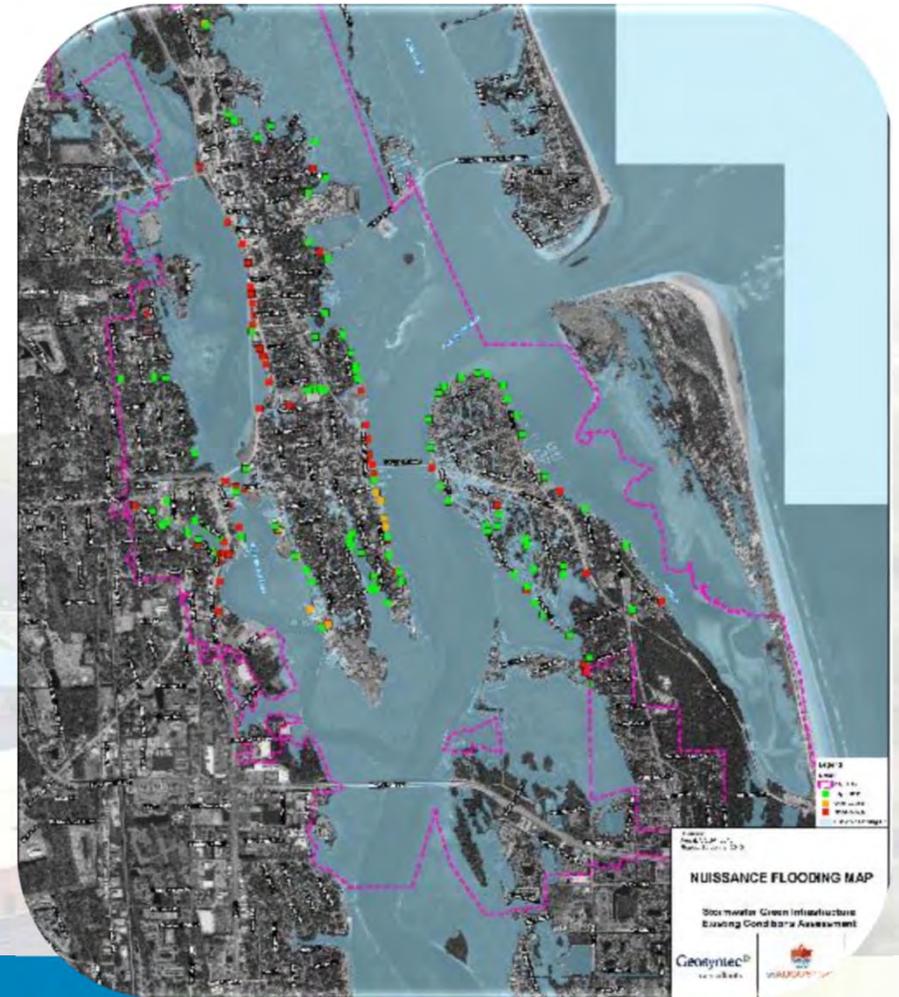


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Stormwater Resiliency Master Outfall Plan

7. Master Plan

- The results of the previous tasks will be compiled into a comprehensive stormwater resiliency master outfall plan.
- Utilized to prioritize projects through the CIP process.
- Ability to seek alternative funding to support the CIP.





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Implementation of Resiliency Projects

❖ Davis Shores –

- 27 Outfalls
- Retrofitted with Tideflex Checkmate³ and WaPro WaStop⁴ Inline Check Valves



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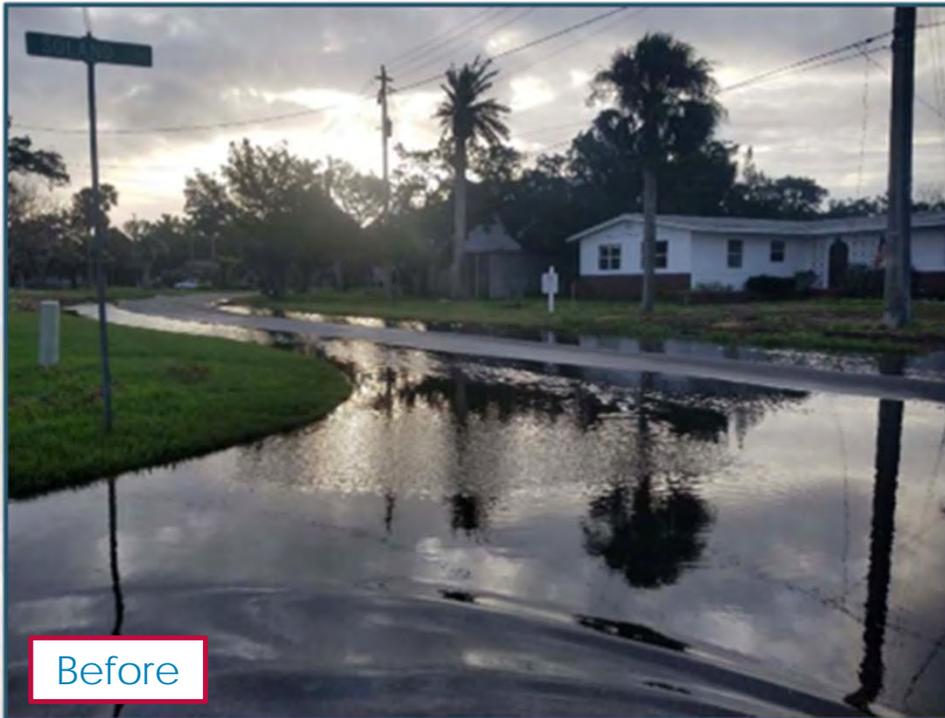
WAPRO

Red Valve Tideflex



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Implementation of Resiliency Projects



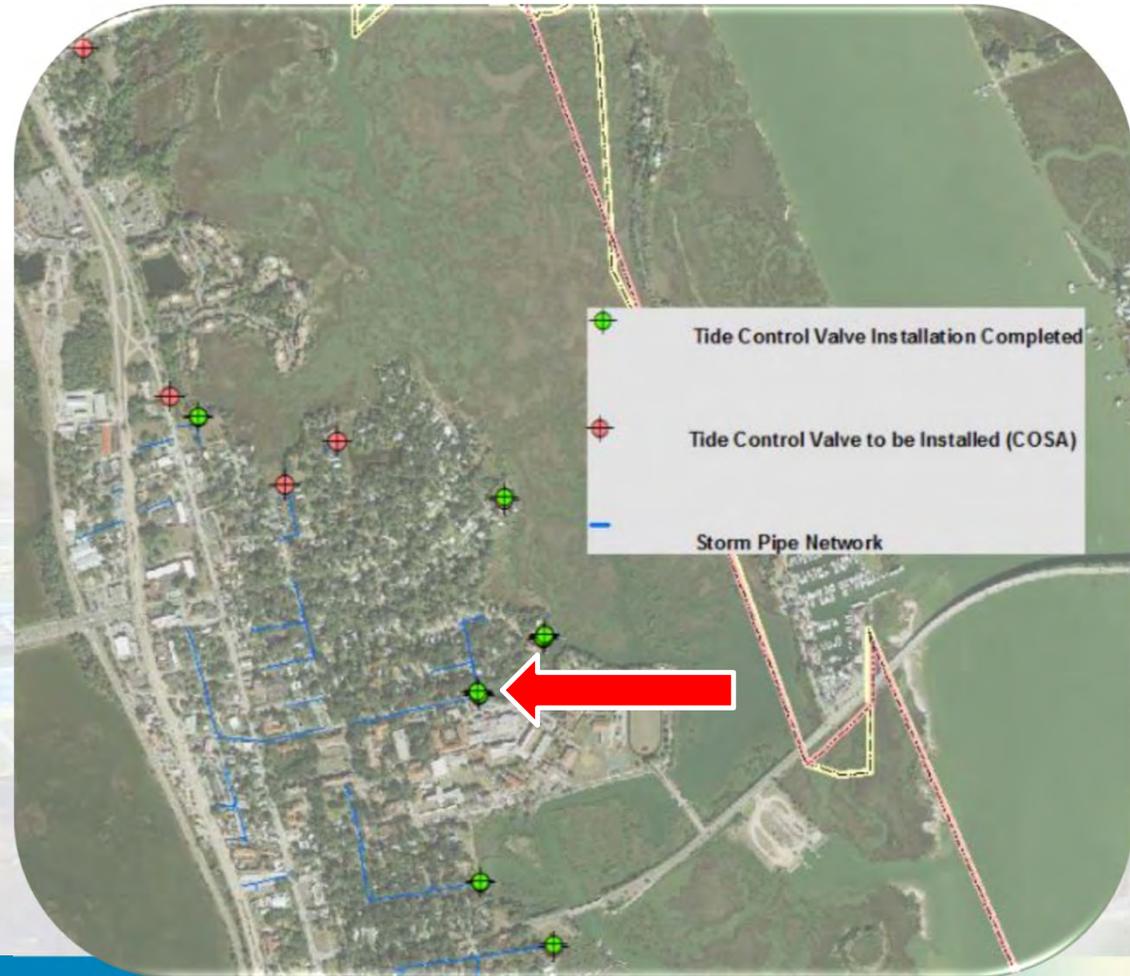
Davis Shores – 27 Outfalls Retrofitted with Tideflex Checkmate³ and WaPro WaStop⁴ Inline Check Valves



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Implementation of Resiliency Projects

- ❖ **Macaris-**
 - 2 Outfalls
 - Retrofitted with WaPro WaStop⁴ Inline Check Valves



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Implementation of Resiliency Projects



Before - 66-inch Stormwater Outfall



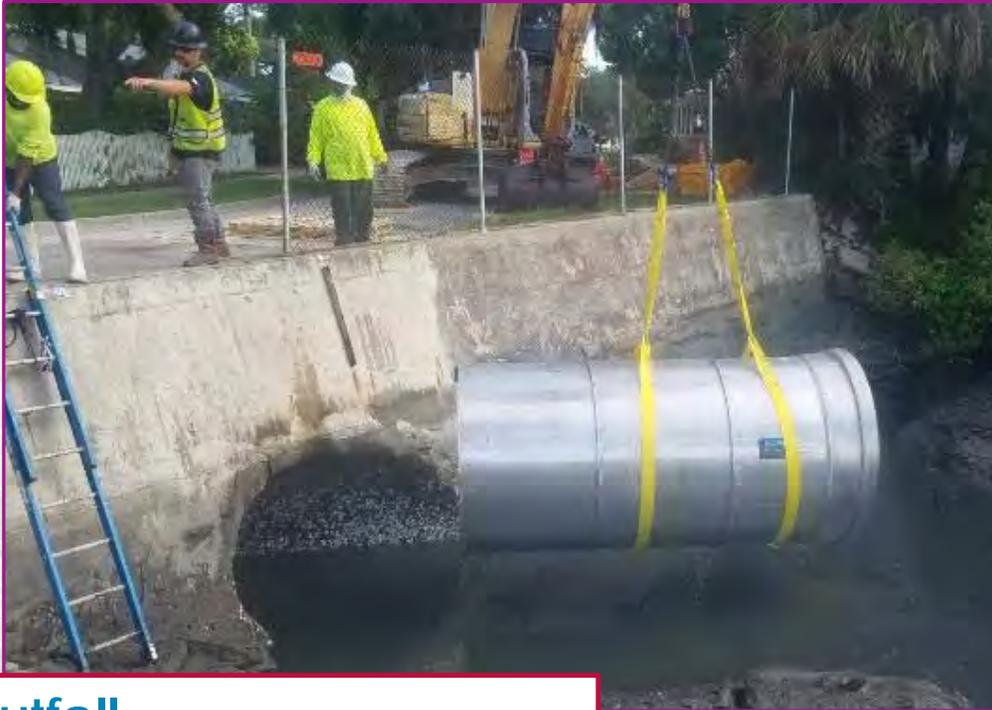
Before - 30-inch Stormwater Outfall

Macaris - 2 Outfalls Retrofitted with WaPro WaStop⁴ Inline Check Valves



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Implementation of Resiliency Projects



❖ Macaris Outfall –

- Pre-cleaned and flushed the pipe
- Installed partial plug in pipe
- Desilted outfall area
- Valve installation



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Implementation of Resiliency Projects



After: 30-inch
Stormwater Outfall

After: 66-inch
Stormwater Outfall

**Macaris Outfall –
After Install**



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Implementation of Resiliency Projects

Before



After

Before



After

**Macaris
Outfall -
Nuisance
Flooding
Comparison**



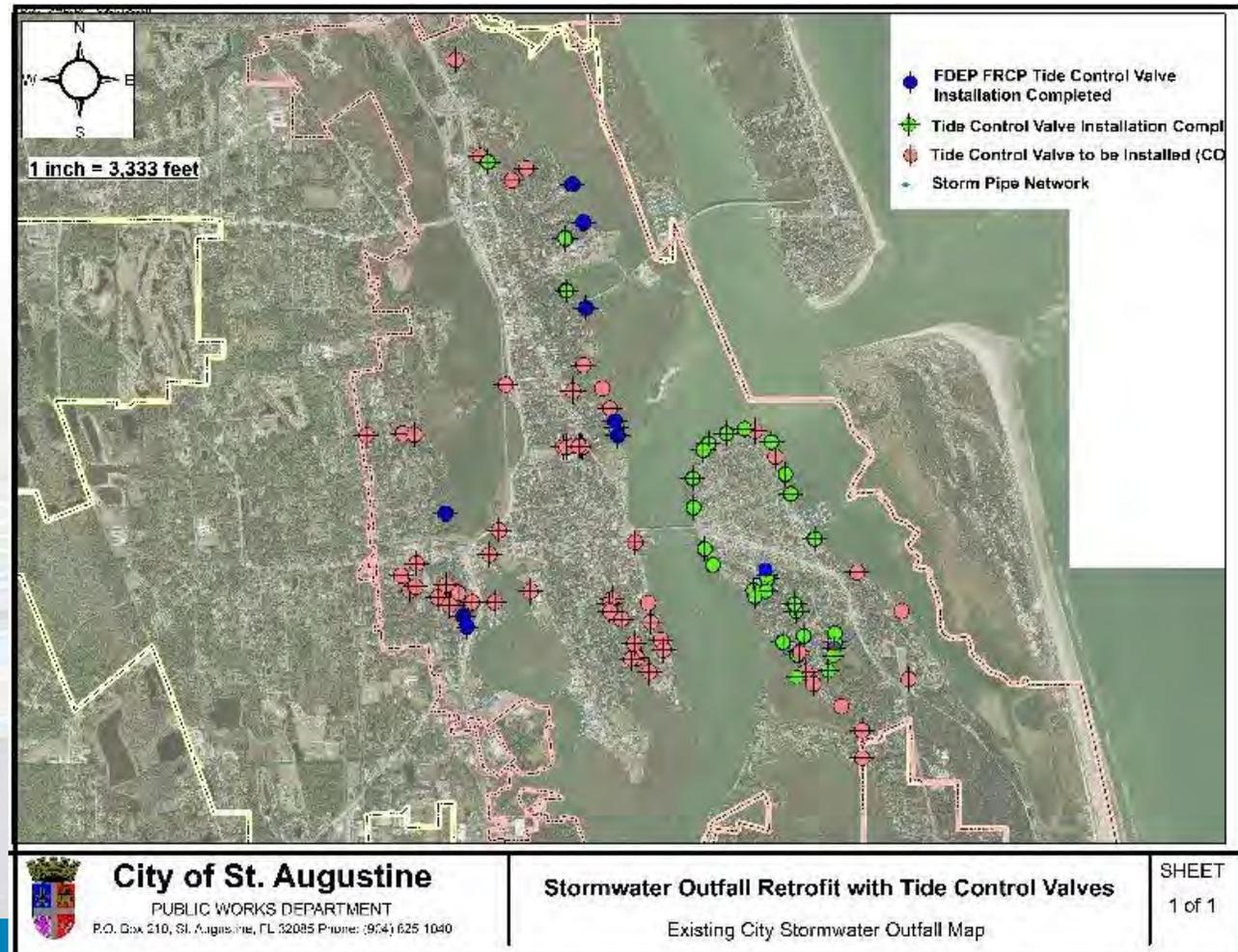
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FDEP Florida Resilient Coastlines Program (FRCP) Grant for 10 more outfalls

- ✓ City selected 10 additional outfalls for retrofitting with tide check valves
- ✓ Blue dots are the valves as part of the grant
- ✓ Green dots are completed retrofits
- ✓ Red dots are outfalls that remain for retrofitting



Implementation of Resiliency Projects



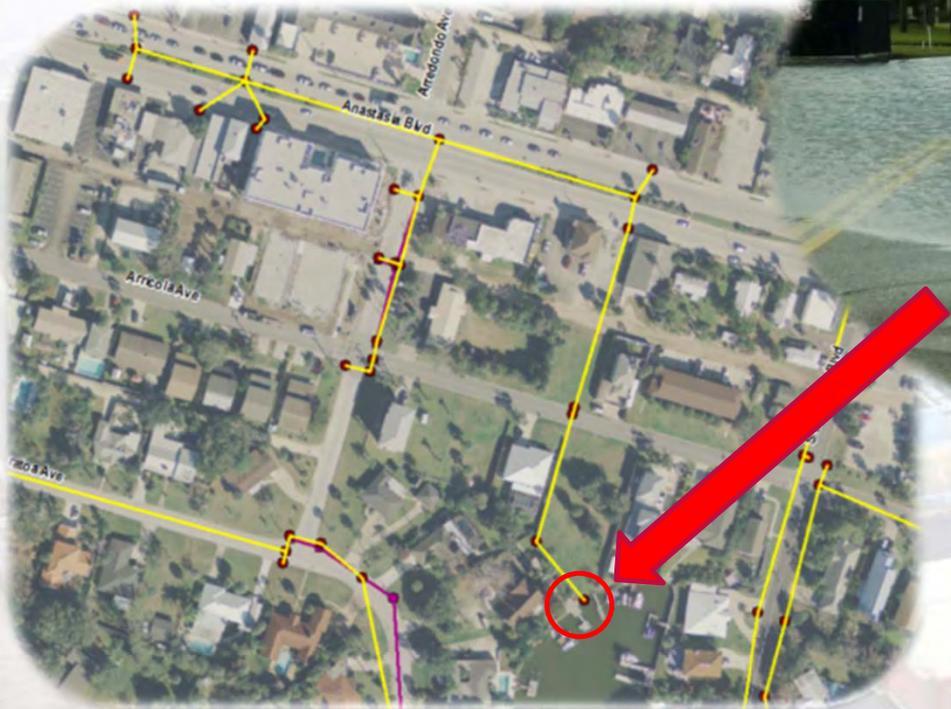


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Implementation of Resiliency Projects

FDEP FRCP

Nuisance Flooding
Before Valve
Installation



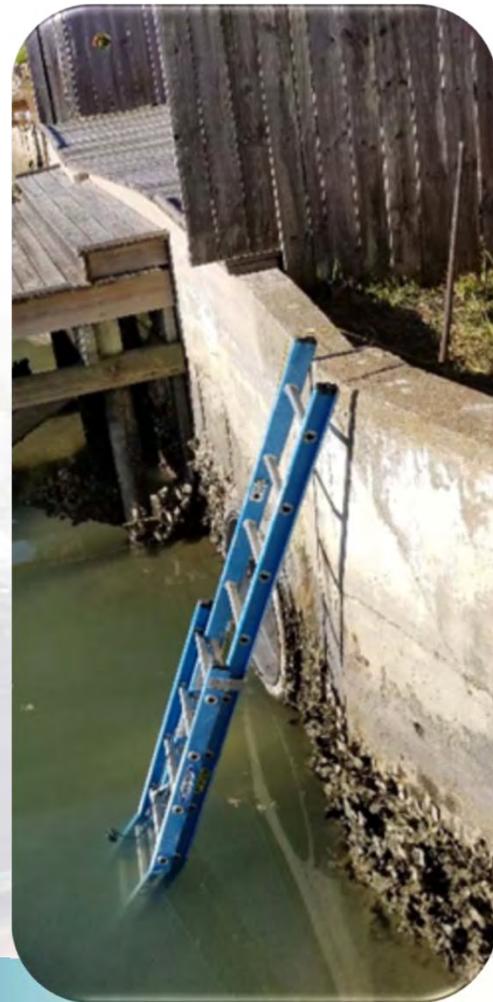


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Implementation of Resiliency Projects

**FDEP
FRCP**

Valve
Installation





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Implementation of Resiliency Projects



FDEP FRCP

Nuisance Flooding
Eliminated After Valve
Installation



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Grant Funding for Implementation of Projects

St Johns River Water Management District ⁷

- ✓ Cost-Share Funding programs available:
 - ✓ **District-wide**
 - ✓ Redi-Innovative
 - ✓ Agricultural
 - ✓ Central Florid Water Initiative Planning Area
- ✓ Projects that benefit at least one of the 4 District core missions
- ✓ Program info:
<https://www.sjrwmd.com/localgovernments/funding/>



Water quality

Projects might include water quality/nutrient-loading reduction.



Water supply

Projects might include water conservation, alternative water supply development or water resource development.



Flood protection

Projects should address flood protection issues on a local, intermediate or regional scale.



Natural systems restoration

Projects should show measurable resource benefits to streams, lakes, wetlands, springs or aquifers.



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Grant Funding for Implementation of Projects

St Johns River Water Management District

- ✓ Not covered – O&M, design, studies etc.
- ✓ Covers up to 33% of construction costs
- ✓ Contracts begin October
- ✓ Stick to the project schedule and scope
- ✓ Reporting requirements – bi-weekly (informal), quarterly progress reports and invoicing
- ✓ Keep your grant project manager apprized of any project changes
- ✓ Caution in mixing with other grant funding as it could impact project schedule





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Grant Funding for Implementation of Projects

FDEP Florida Resilient Coastlines Program (FRCP) ⁸

- ✓ Synergizing community resilience planning, natural resource protection tools and funding to prepare Florida's coastal communities for the effects of climate change
- ✓ Program Info: <https://floridadep.gov/rcp/florida-resilient-coastlines-program>



RESOURCES

Florida Adaptation Planning
Guidebook & Technical
Assistance



FUNDING

Resilience Planning &
Implementation Grants



COORDINATION

Quarterly Coastal
Resilience Forum





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Grant Funding for Implementation of Projects

FDEP FRCP

- ✓ Resilience Implementation Grant
- ✓ Website has a number of resources, forms and helpful information
- ✓ Pay attention to your contract timeframes and requirements
- ✓ Quarterly reporting and invoicing – prompt reporting
- ✓ Work with your grant program project manager

DEP Resiliency

Florida Resilient Coastlines Program [↗](#)



Resiliency

Natural Infrastructure

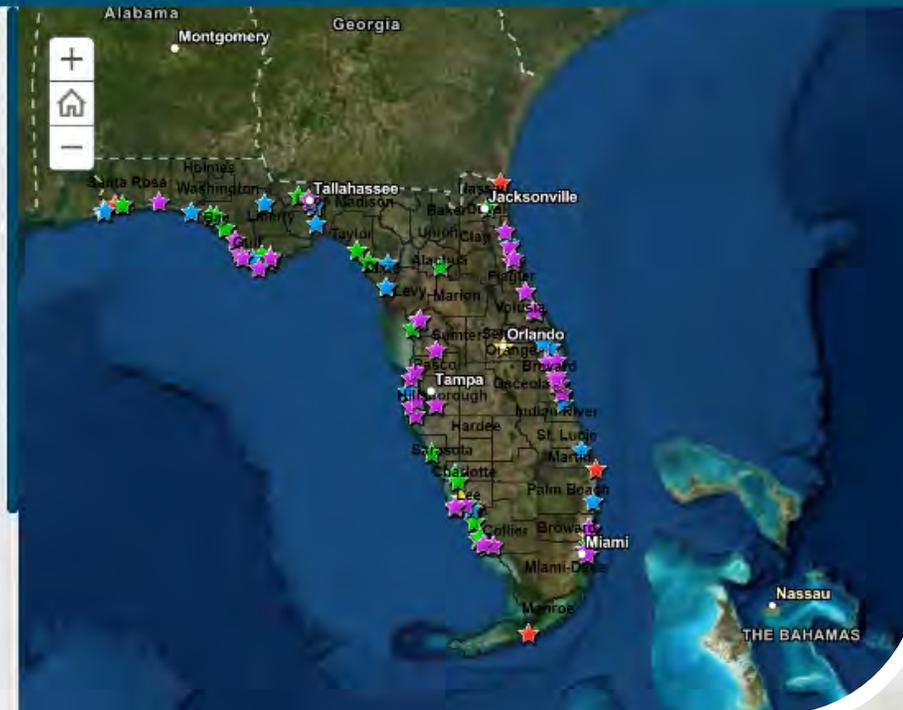
Data & Monitoring

Community Planning

Education & Outreach

For Florida's coastal communities, resilience is the ability to recover quickly from disasters and to adapt to future conditions such as sea level rise. The Florida Resilient Coastlines Program is DEP's effort to synergize community resilience planning, natural resource protection tools, and funding to prepare Florida's coastline for the effects of climate change, especially rising sea levels. DEP's vision is that Florida's coastal communities are resilient and prepared for the effects of rising sea levels, including coastal flooding, erosion and ecosystem changes. Our history of protecting, preserving and restoring habitats has set the stage for this continuing effort.

We continue to partner with federal, regional, state and local





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Grant Funding (SJRWMD) – Davis Shores

| Cost Comparison* (2017 data*) | 24-inch In House Install | 30-inch In House Install | 30-inch Contractor Install |
|--|---------------------------------------|--|----------------------------------|
| Materials + Valve + Labor | \$8,678 | \$11,068 | \$30,609 |
| Cost Savings | \$21,930.82 | \$19,541 | |
| % Cost Savings | 72% | 64% | |
| Cost Share Funding - SJRWMD | 33% Construction Costs | Total Project Costs (COISA): \$198,000 SJRWMD Cost Share: \$ 61,189 | |

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WAPRO

Red Valve Tideflex

St. Johns River
Water Management District



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Grant Funding (SJRWMD) - Macaris

| Task | Schedule | Comment |
|---|--|--|
|  Design | Dec. 2017 – Nov. 2018 | Included cost share application support |
|  30-inch Valve Install | Valve – 3 weeks Installation – < 1 day | Self-performed install \$11,130* (*includes valve, labor, materials) |
|  66-inch Valve Install | Valve – custom order – 3 months (12 weeks) Installation – 1 week | Contractor install \$98,457* (*includes valve, labor, materials) |
|  Cost Share Funding - SJRWMD | <ul style="list-style-type: none"> • Application – Feb. 2018 • Grant Award - Apr. 2018 • Contract – Oct. 2018 –Sept. 2019 | Total Project Cost = \$109,587 (COSA) 33% Reimbursable Construction Costs \$36,164 (SJRWMD) |



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Grant Funding (FDEP FRCP) – 10 More Outfalls



| Task | Schedule | Comment |
|---|--|---|
| Grant Duration | <ul style="list-style-type: none"> • Award – July 2019 • Execution – October 2019 • Contract End Date – June 30, 2020 | Implementation Grant 100% Reimbursable Construction Costs up to \$155,641 |
| Field Evaluation and Priority List of Outfalls | <ul style="list-style-type: none"> • November 2019 – February 2020 • Order valves based on finalized list – February 2020 | Need to consider valve order/delivery lead time, especially for larger valves |
| Installation | Valve Delivery – 2 -12 weeks* Installation – < 1 day -37- | \$155,641 Self-performed install (*includes valve, labor, materials) |





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WAPRO

Red Valve Tideflex

HENANDOAH

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References and Recognition

1. Planning in the Matanzas Basin: Opportunities for Adaptation. Kathryn Frank, Ph.D.; Michael Volk, MLA; Dawn Jourdan, Ph.D., Esq.; August 2015.
2. Coastal Vulnerability Assessment: City of St., Augustine, FL. June 2016. <https://www.citystaug.com/570/Coastal-Vulnerability>
3. Florida Community Resiliency Initiative Pilot Project: Adaptation Plan for St. Augustine, FL. May 2017. <https://www.citystaug.com/570/Coastal-Vulnerability>
4. Tideflex Technologies - Tideflex Checkmate Ultraflex Slip-in Inline Check Valves. <http://www.redvalve.com/tideflex/tideflex-products/checkmate-inline-check-valve/>
5. Wapro - Wastop Inline Check Valve. <http://www.wapro.com/en-us/content/wastopr-inline-check-valve>
6. Photo credits: Alamy Stock Photo – Sean Pavone (bridge at sea), Rob Clement (Castillo de San Marcos), AP Photo – John Bazemore (flooding at bayfront/fort),
7. St Johns River Water Management District Cost Share Programs –Dale Jenkins, Division Director, Email: drjenkins@sjrwmd.com <https://www.sjrwmd.com/localgovernments/funding/>
8. Florida Department of Environmental Protection Florida Resilient Grant Program – Whitney Gray, Program Administrator, email: Whitney.Gray@FloridaDEP.gov



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Presentation

Questions & Answers

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