



ROLE OF BROWARD COUNTY SWM PROGRAM IN IMPLEMENTATION OF RESILIENCE POLICIES



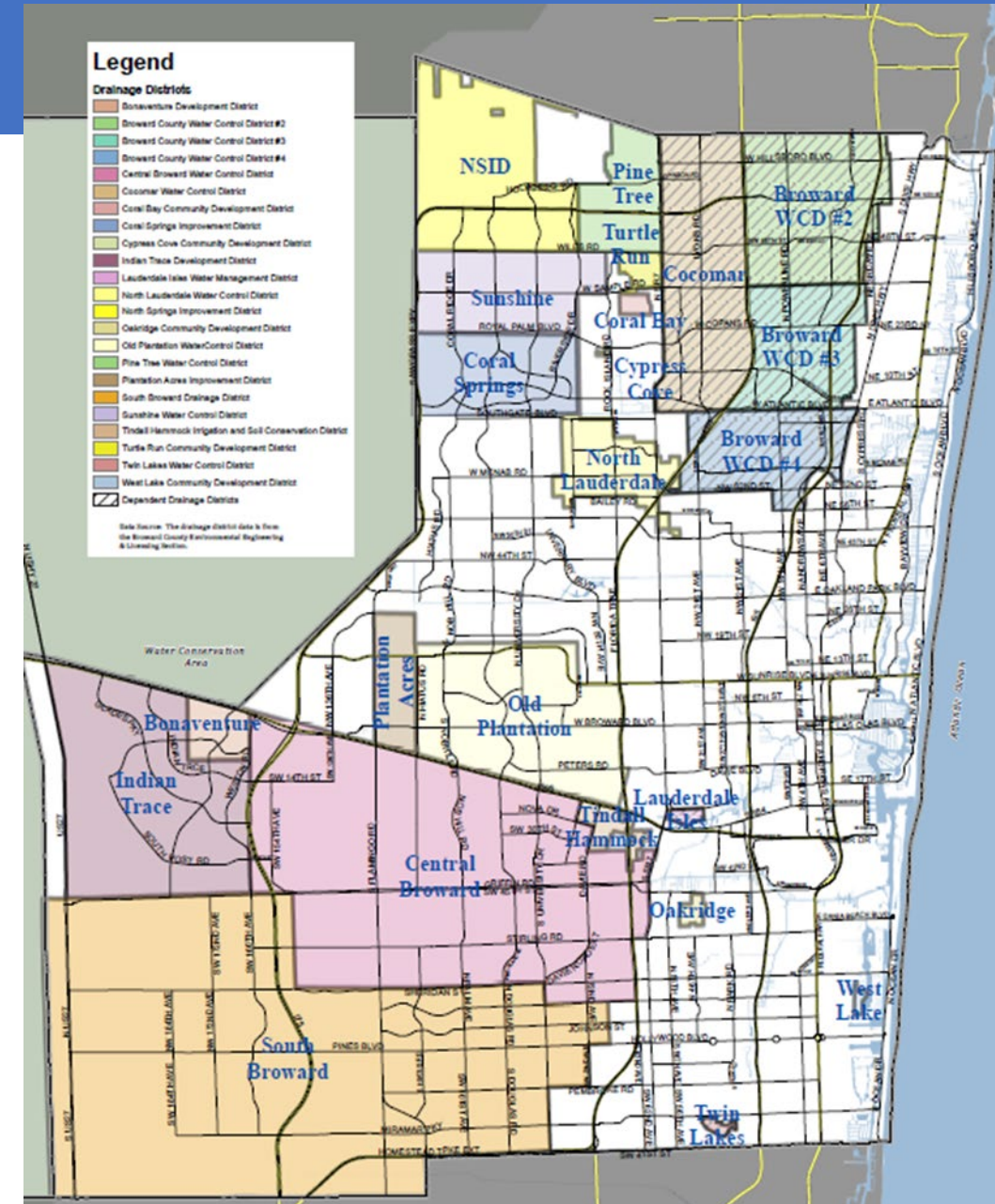
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ENVIRONMENTAL PERMITTING DIVISION
OCTOBER 17, 2024

Outline

- Broward County Surface Water Management (SWM) Licensing Program
- SWM Program Requirements
- SWM Systems Design
- Future Conditions Map Series
- Development and Redevelopment Patterns
- Innovative Designs for SWM Systems

Broward County Surface Water Management (SWM) Licensing Program

- Broward County Code of Ordinances – Chapter 27, Article V
- Established in 1989
- Jurisdiction: Countywide, except for Independent Drainage Districts, Seminole Tribe of Florida Reservation, SFWMD and FDOT ROW, TIFF and Submerged Lands
- Licensing Exemption: Single-family dwellings or duplexes on lots less than two (2) acres in size (must still comply with Code requirements)



SWM Licensing Program

- Section §27-54 of Code: “Prior to the commencement of construction, modification, alteration, replacement or operation of any facility or the commencement of any activity that may cause or be a source of pollution, or that may impact, eliminate, reduce or control pollution of the air, ground, groundwaters, surface waters or other natural or biological resources, the owner and/or operator shall obtain a RED license”
- Purpose of SWM License:
 - Protection of Finished Floor Elevations (FFE), parking areas and roadways
 - No flooding impacts to adjacent properties (pre vs post conditions)
 - Meet allowable discharges and water quality requirements



SWM License Requirements

- Finished Floor Elevations – set at or above of 100-year elevations
 - 1977 Broward County (BC) 100-year Flood Elevation Map
 - 2021 BC 100-year Future Conditions Flood Elevation Map
 - Site-specific 100-year Flood Elevation or Master License
 - FEMA Maps 100-year elevation plus a free board (1' to 2') – FL Building Code
 - Crown of Road plus 18"; CCCL; Manufactured Home; City Code Requirements
- Water quantity or stormwater runoff attenuation (elevation and discharge limitations) - controls to protect existing and proposed buildings, roadways, parking lots, etc. from flooding
- Water quality treatment (must retain “first-flush” of stormwater on site) - protects receiving waters such as lakes, canals, the Everglades, and the ocean from pollutants in stormwater runoff

SWM System Design

- Stormwater management systems are designed to control discharges by collecting, conveying, storing, absorbing, inhibiting, treating, using, and reusing stormwater



SWM System – Typical Components

- Swales
- Storm drains
- Exfiltration trenches
- Underground storage/vaults
- Detention/Retention areas
- Drainage wells
- Culverts
- Lakes and wetlands
- Grading (pervious, impervious, and buildings areas)



Typical SWM Systems

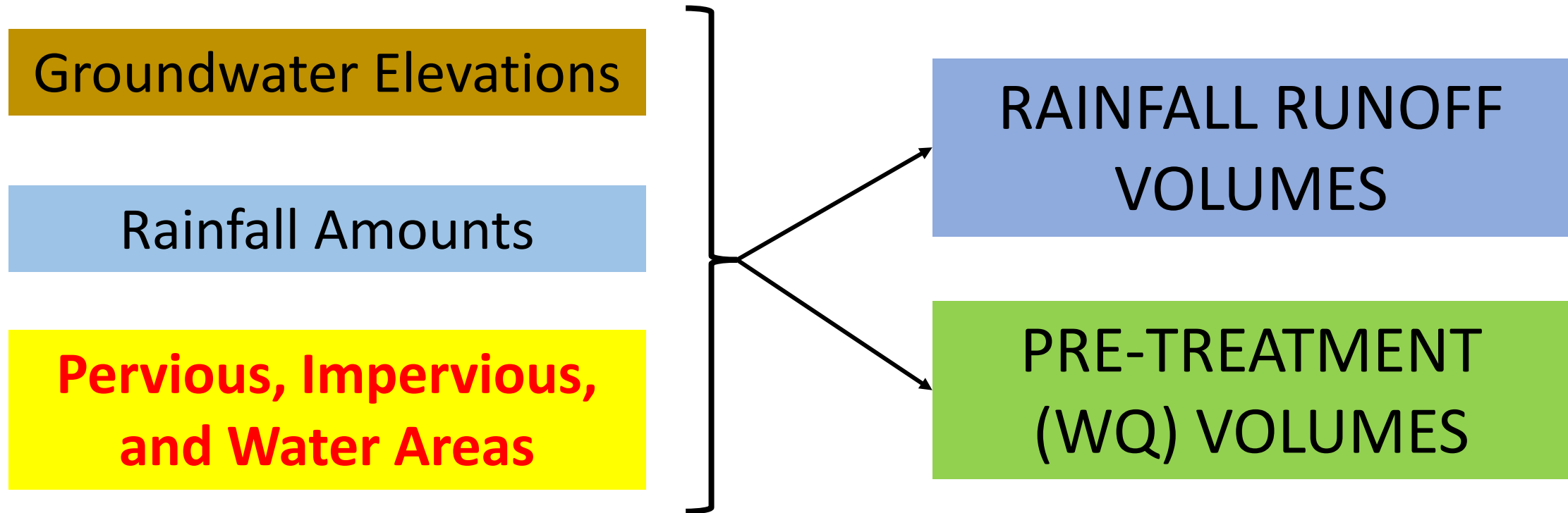
Western part of County; large parcels; meets SWM rules and regulation adopted in the 1970s and 1980's



Key Factors in Designing of SWM Systems

- Groundwater Elevations (SWM Code)
- Rainfall Amounts (SWM Code)
- Pervious, Impervious, and Water Areas (Designer)
- Runoff Volumes (SWM Code-calculated)
- Pre-treatment (Water Quality) Volumes (SWM Code-calculated)
- Allowable Discharge (SWM Code)
- Storage of Runoff Volumes on site's SWM System (Designer)

Runoff and Pre-treatment (WQ) Volumes



*Controlled by SWM Code

***Controlled by Designer (and Planning Code)**

Runoff and Pre-treatment (WQ) Volumes (Cont'd)

HIGHER GROUNDWATER
ELEVATIONS = LOWER
INFILTRATION STORAGE

LARGER AMOUNT OF
RAINFALL

INCREASING
RAINFALL RUNOFF
(STORMWATER)
VOLUMES

- Higher sea level
- Changes in temperature and evapotranspiration patterns

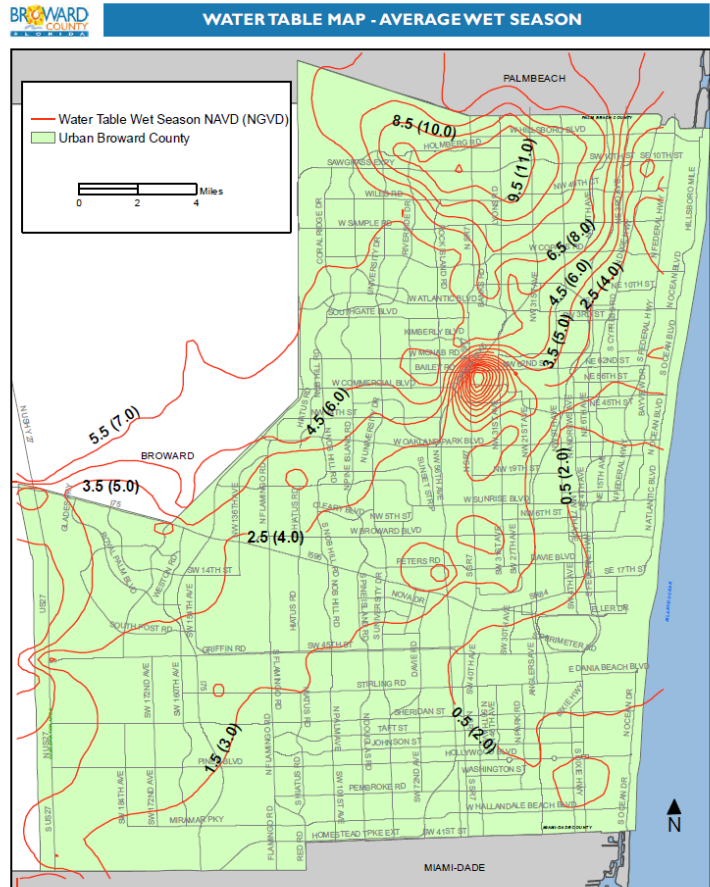
- More severe and more frequent flooding
- Increasing pollution into waterways

Broward County Groundwater Maps

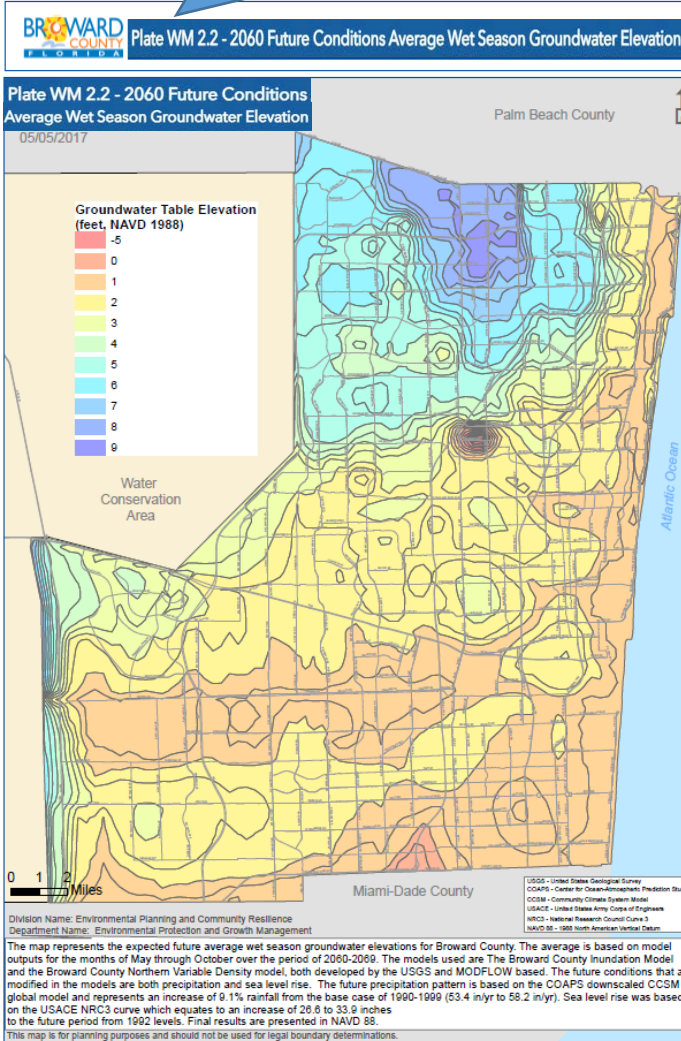
Plate WM 2.1
Adopted in 2000

Plate WM 2.2
2060 Future Conditions Map
Adopted in 2017

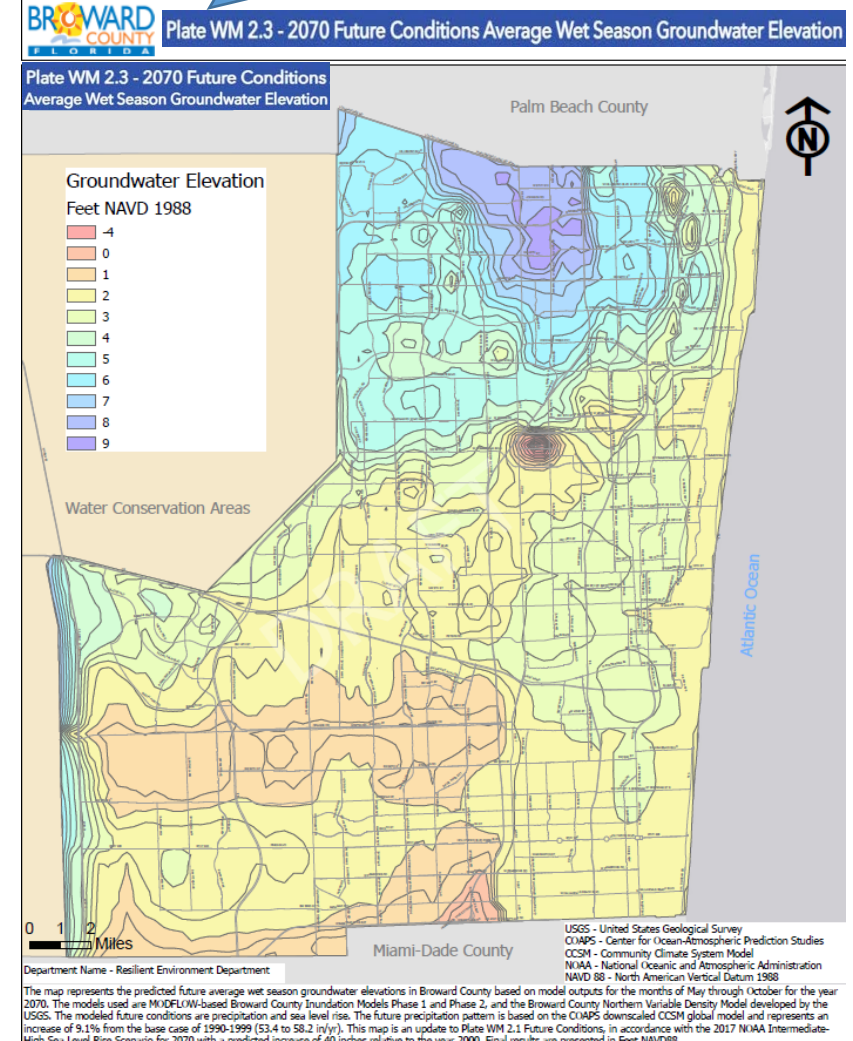
Plate WM 2.3
2070 Future Conditions Map
Adopted in 2024



Division Name: Planning and Environmental Regulation
Department Name: Environmental Protection and Growth Management
This map is for conceptual purposes only and should not be used for legal boundary determinations.
Elevation converted from NGVD to NAVD using the FEMA approved conversion factor by Broward County of (-) 1.5



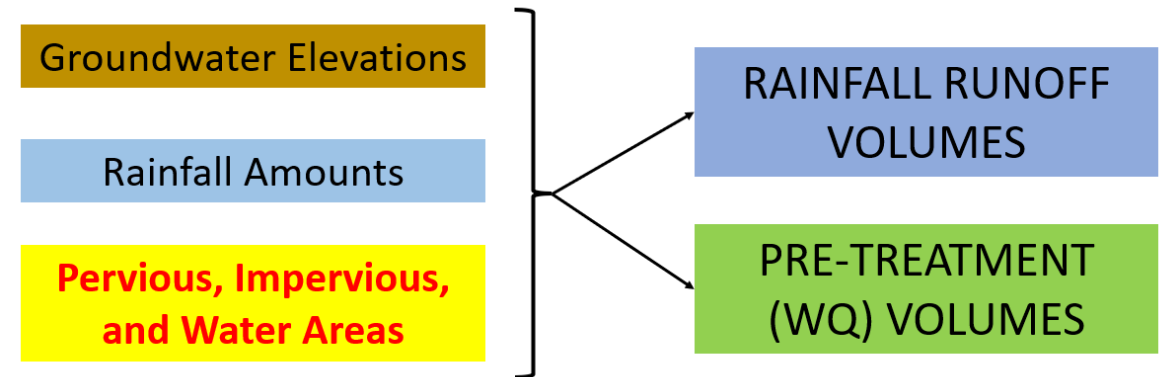
Division Name: Environmental Planning and Community Resilience
Department Name: Environmental Protection and Growth Management
The map represents the expected future average wet season groundwater elevations for Broward County. The average is based on model outputs for the months of May through October over the period of 2060-2069. The models used are The Broward County Inundation Model and the Broward County Northern Variable Density model, both developed by the USGS and MODFLOW based. The future conditions that are modified in the models are both precipitation and sea level rise. The future precipitation pattern is based on the COAPS downscaled CCSM global model and represents an increase of 9.1% rainfall from the base case of 1990-1999 (53.4 in/yr to 58.2 in/yr). Sea level rise was based on the USACE NRC3 curve which equates to an increase of 26.6 to 33.9 inches to the future period from 1992 levels. Final results are presented in NAVD 88.
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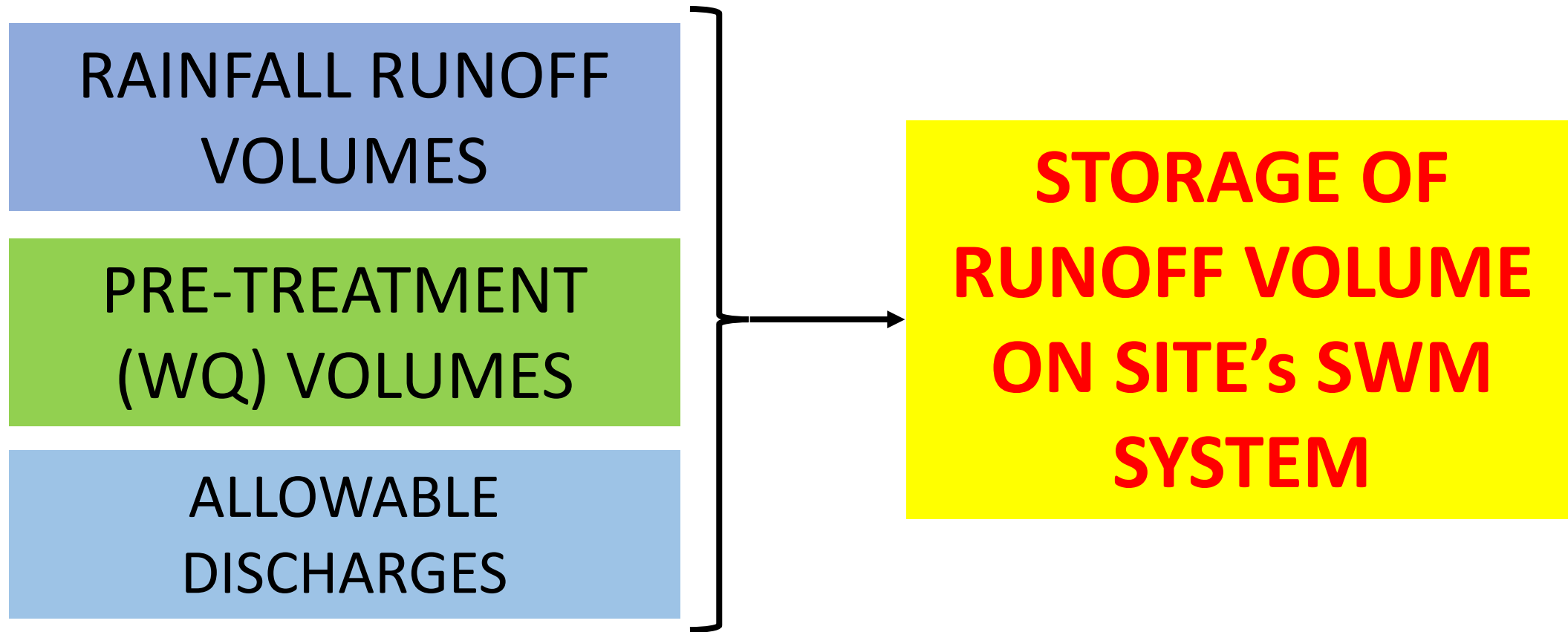
Division Name: Resilient Environment Department
The map represents the predicted future average wet season groundwater elevations in Broward County based on model outputs for the months of May through October for the year 2070. The models used are MODFLOW-based Broward County Inundation Models Phase 1 and Phase 2, and the Broward County Northern Variable Density Model developed by the USGS. The modeled future conditions are precipitation and sea level rise. The future precipitation pattern is based on the COAPS downscaled CCSM global model and represents an increase of 9.1% from the base case of 1990-1999 (53.4 to 58.2 in/yr). This map is an update to Plate WM 2.1 Future Conditions, in accordance with the 2017 NOAA Intermediate-High Sea Level Rise Scenario for 2070 with a predicted increase of 40 inches relative to the year 2000. Final results are presented in Feet NAVD88.

Key Factors in Designing of SWM Systems

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Designing of SWM Systems



*Controlled by SWM Code

***Controlled by Designer**

Designing of SWM Systems vs. Code Requirements

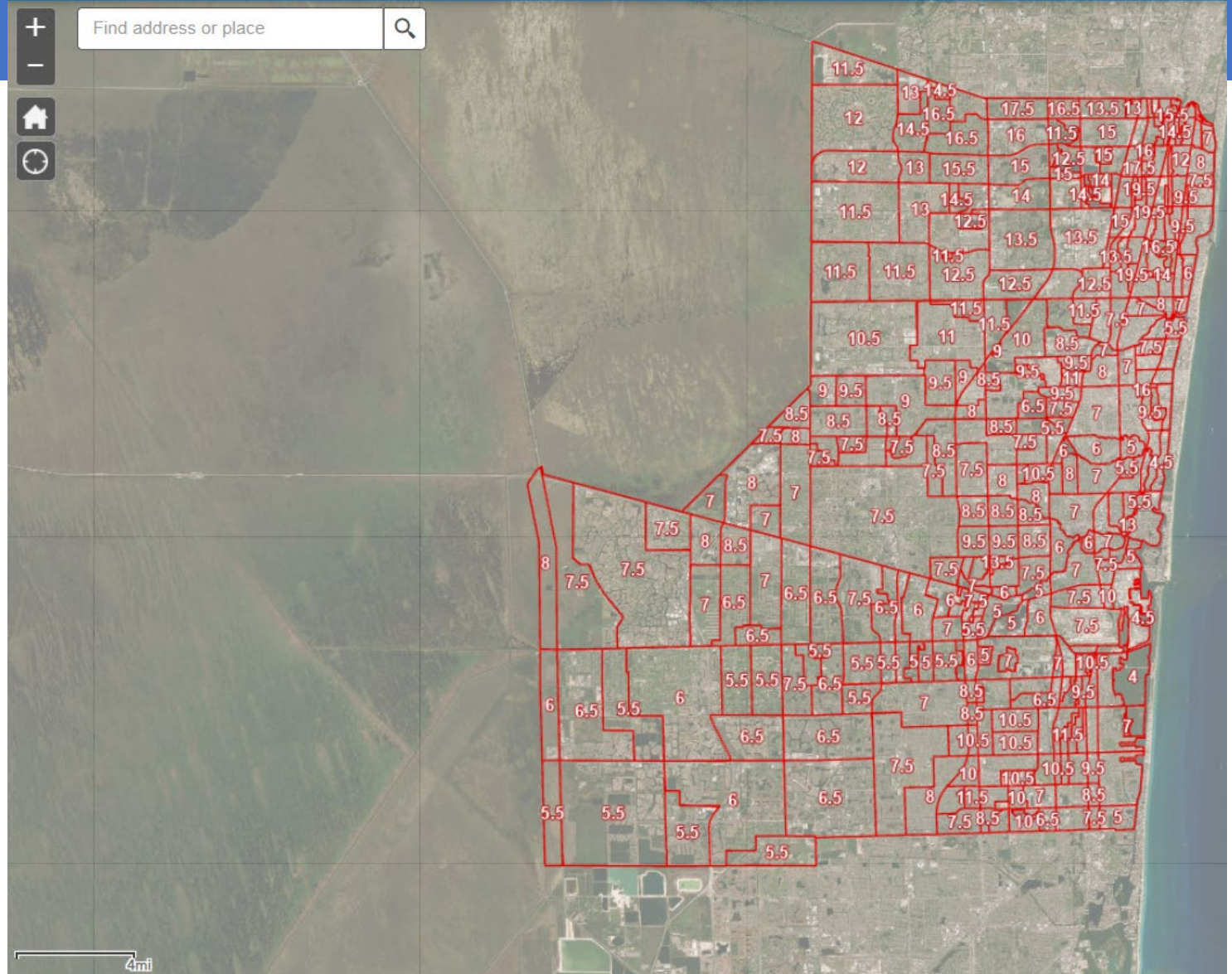
- SWM System design determines (pre and post conditions):
 - Site-specific elevations for 5-, 10-, 25-, and 100-year events
 - Discharge rates for 5-, 10-, 25-, and 100-year events
- Broward County Code requirements:
 - Pre-treatment volume (WQ) is provided prior to any discharge
 - Meet allowable discharges (25-year event)
 - Parking areas and roadways are not flooded during 5-year and 10-year events
 - Minimum FFE is at highest of applicable 100-year elevation
 - No flooding impacts to adjacent properties (pre vs post conditions)

Finished Floor Elevations (FFE) Requirements

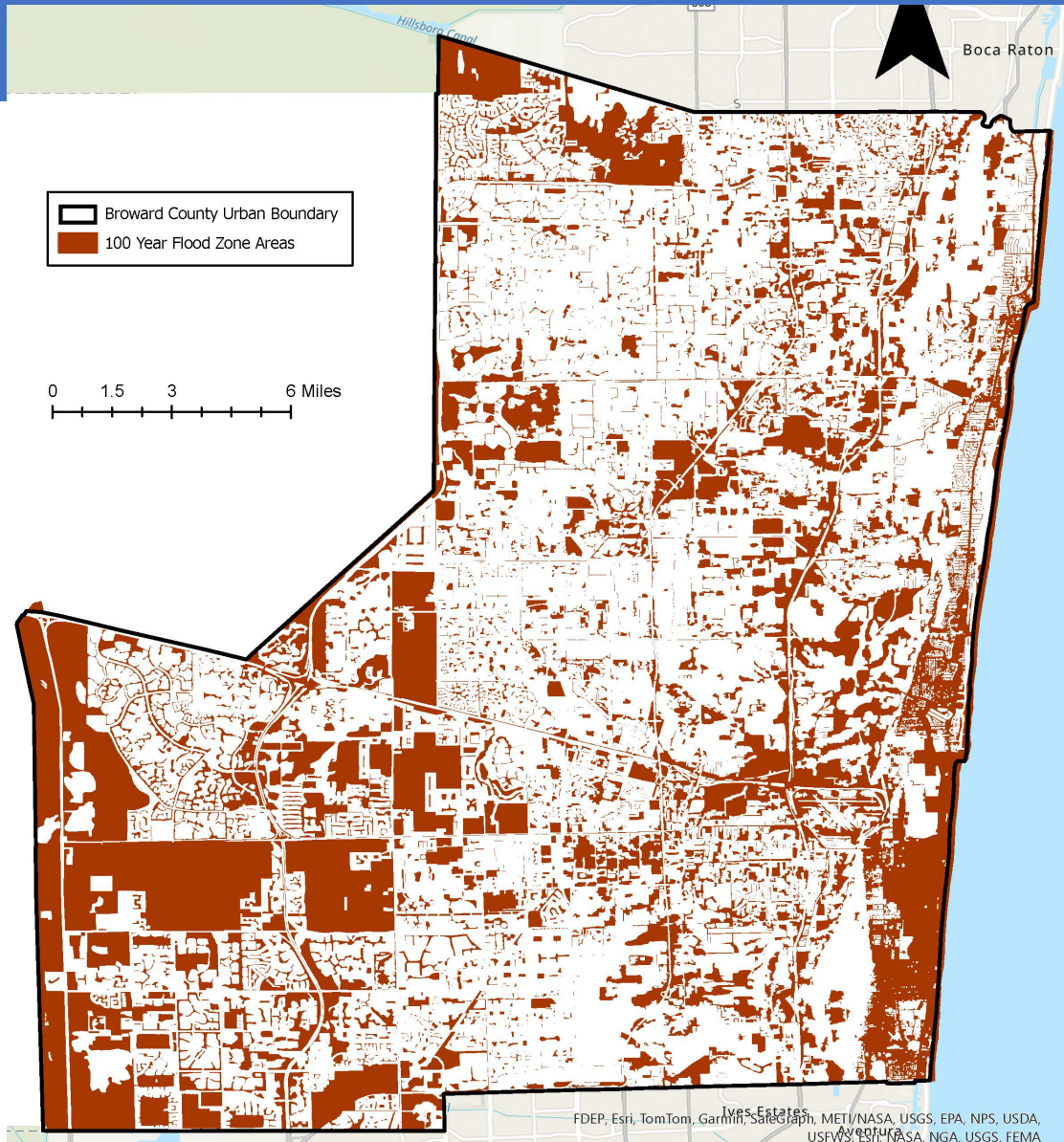
- FFE must be set at or above of 100-year elevations as determined by:
 - 1977 Broward County 100-year Flood Elevation Map
 - 2021 Broward County 100-year Future Conditions Flood Elevation Map
 - Site-specific 100-year Flood Elevation or Master License
 - FEMA Maps 100-year elevation plus free board (1' to 2') – FL Building Code
 - FDEP Coastal Construction Control (CCCL) – FL Building Code
 - Crown of Road plus 18"; Manufactured Home; City Code Requirements
- Non-residential properties have option to dry-floodproofed

2021: Broward County 100-year Future Conditions Flood Elevation Map

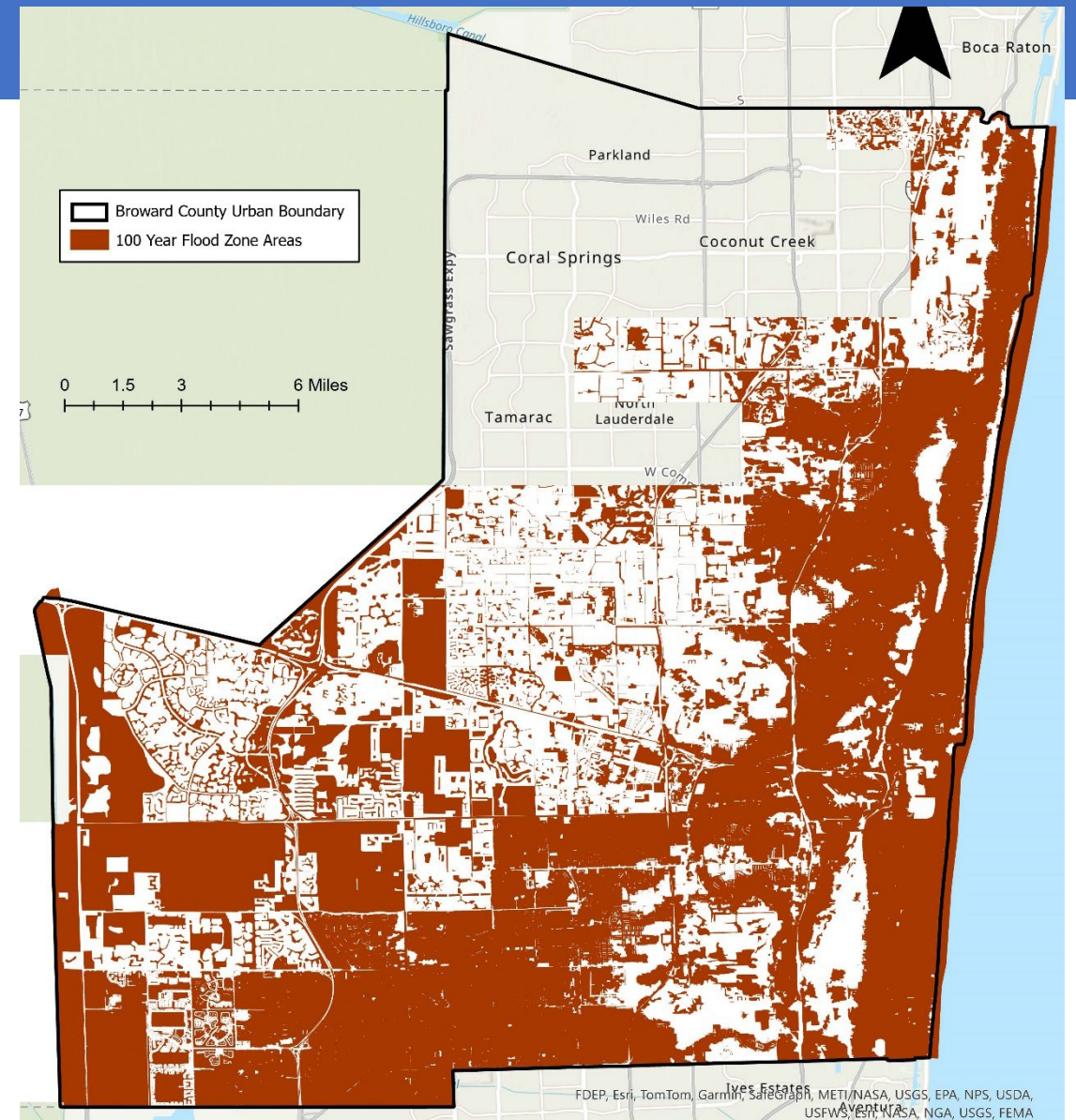
Plate WM 13.1 - Future Conditions 100-Year Flood Map 2060



FEMA Map (8/18/2014)

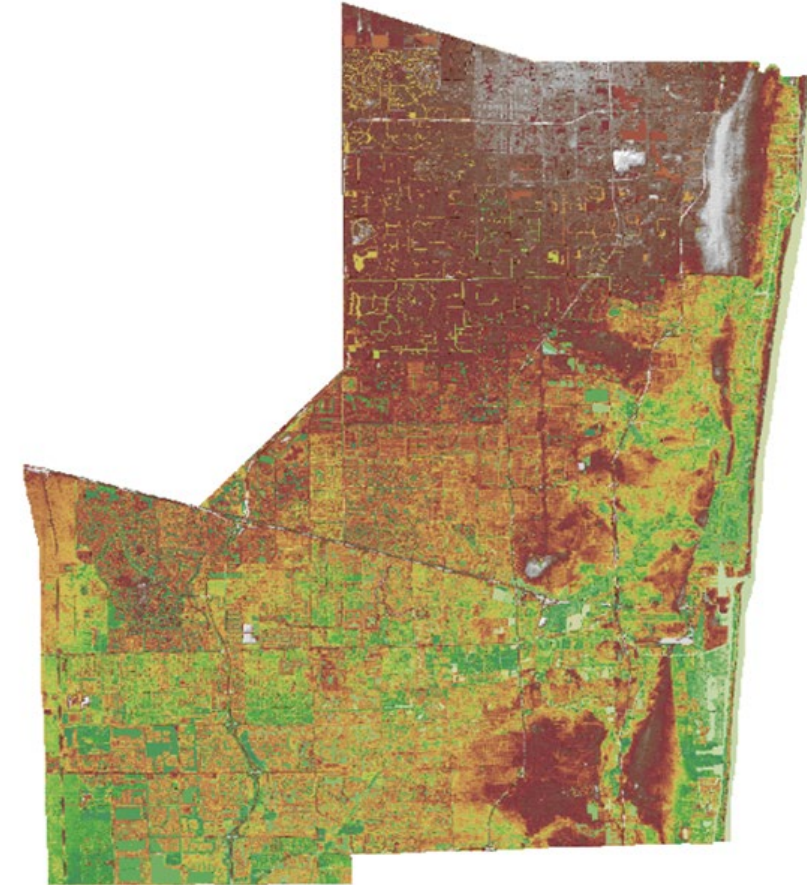
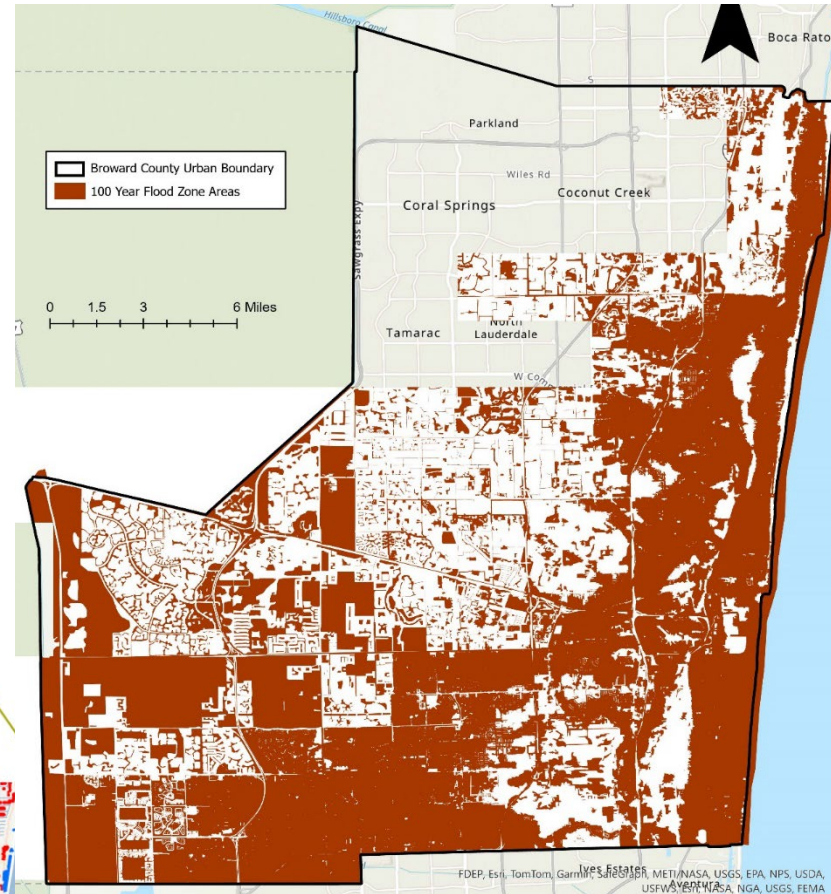
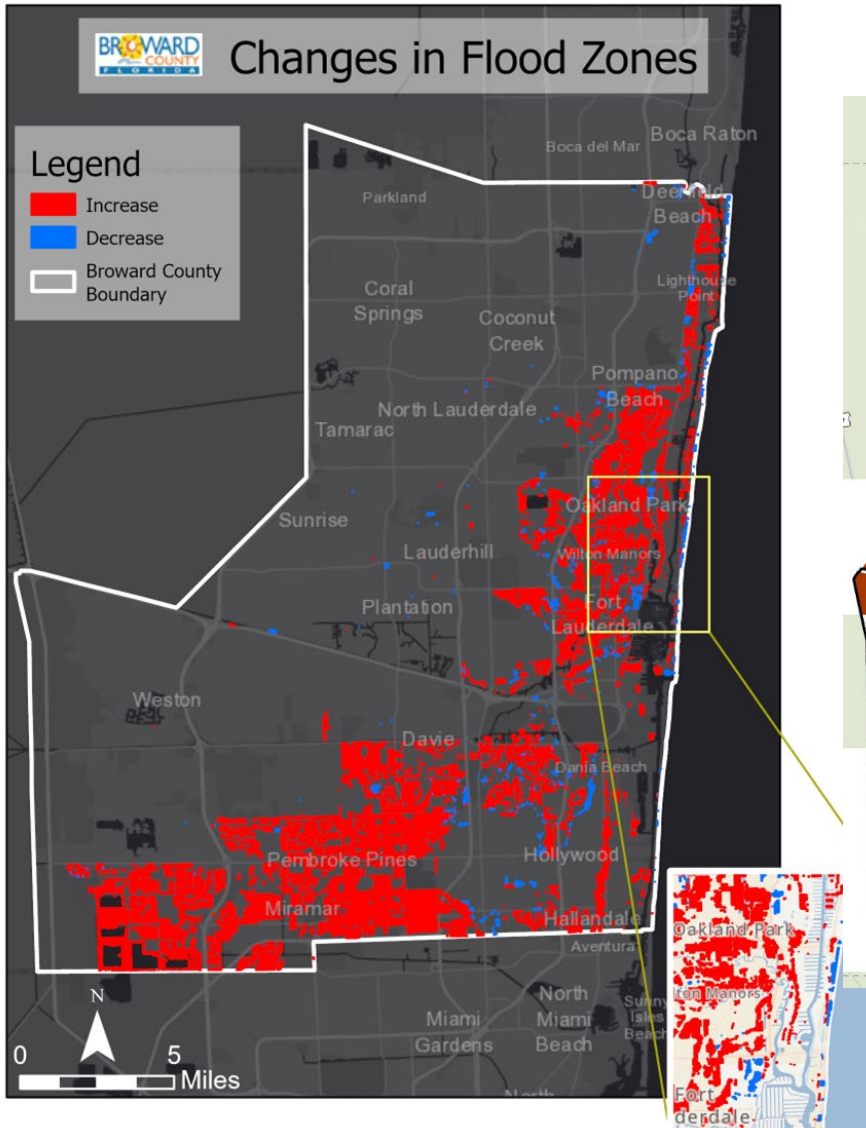


Revised FEMA Map (7/31/2024)



7/31/2024 FEMA MAP and LIDAR ELEVATIONS

■ LIDAR ELEVATIONS



Development Timeline

1924



1965



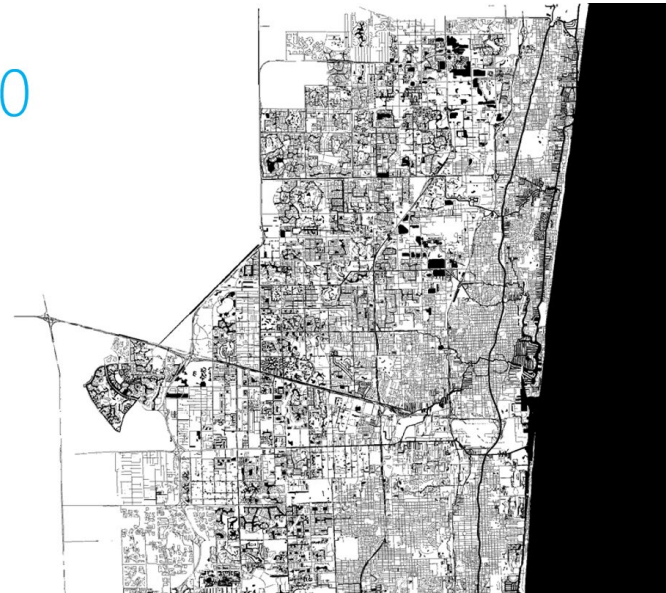
1970



1980



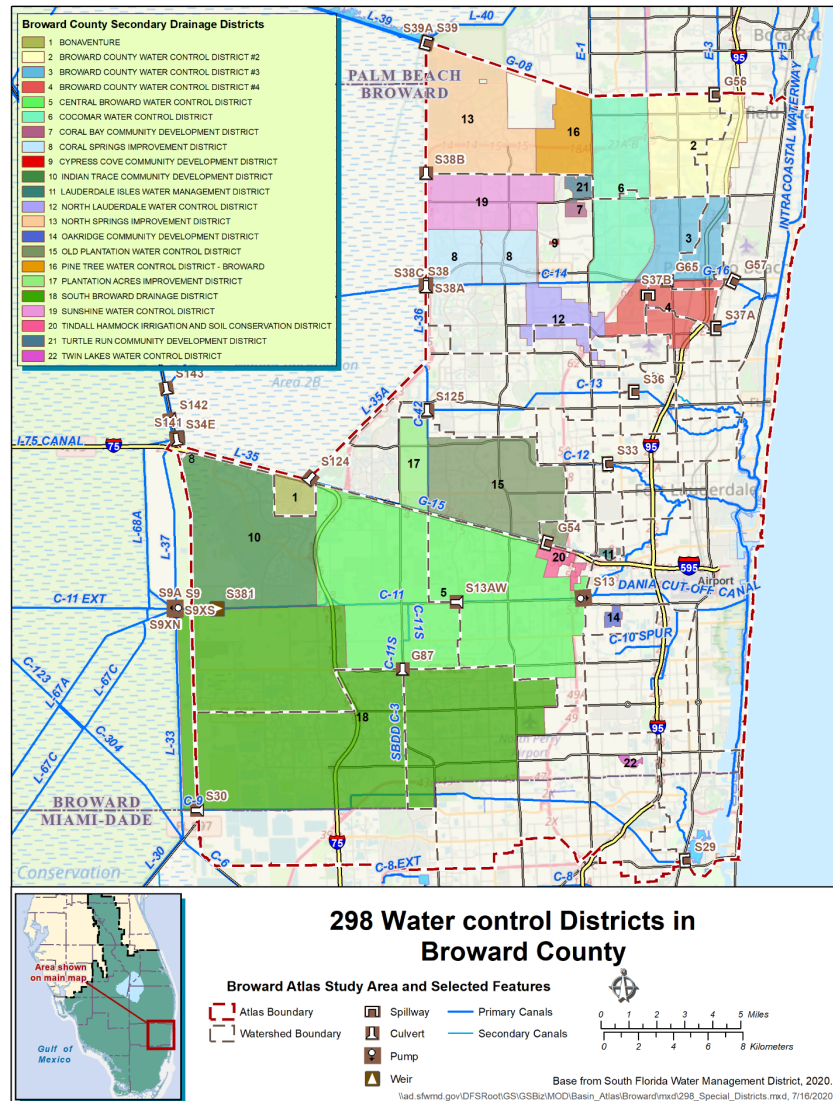
1990



2000

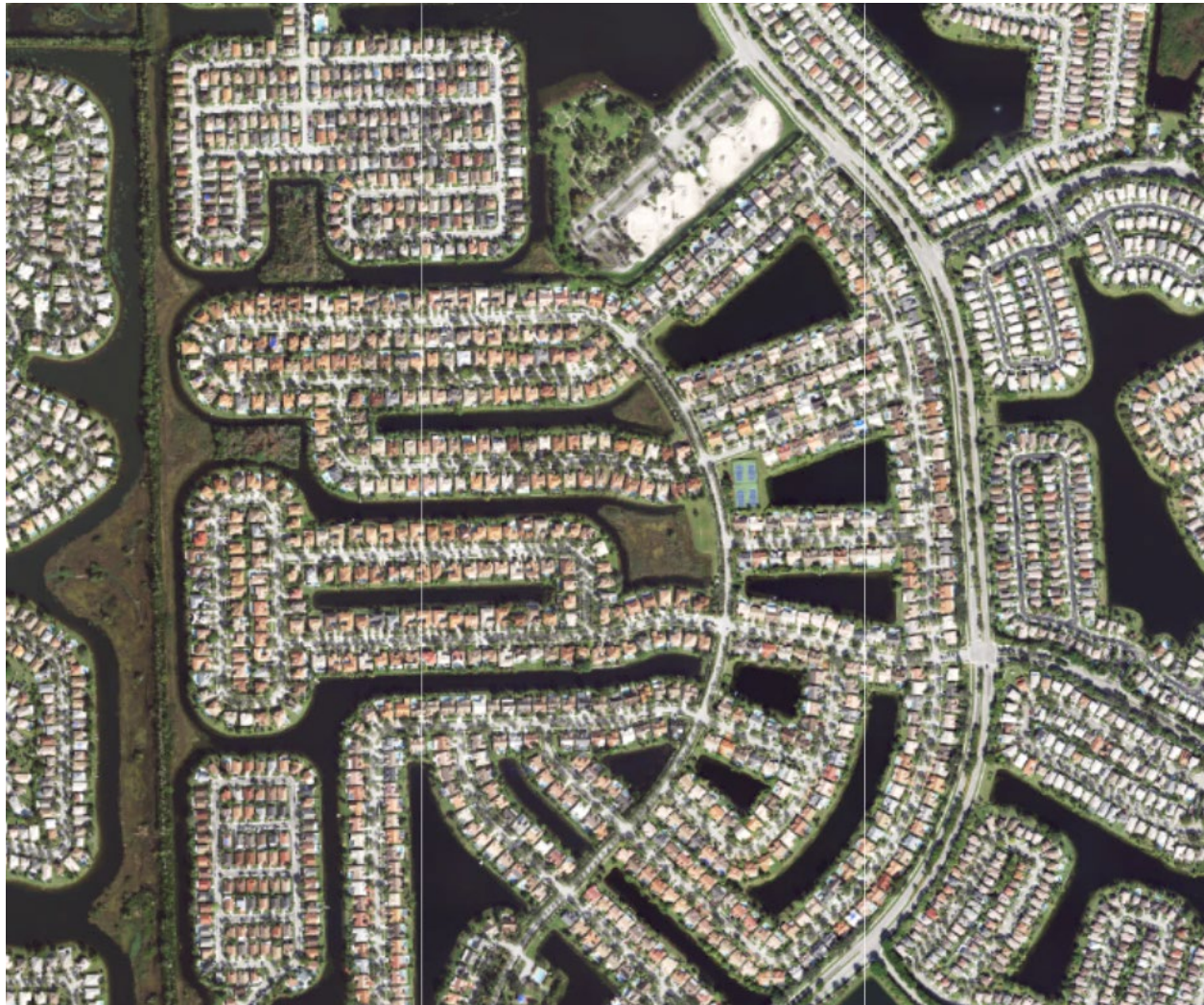


Development and Redevelopment Patterns

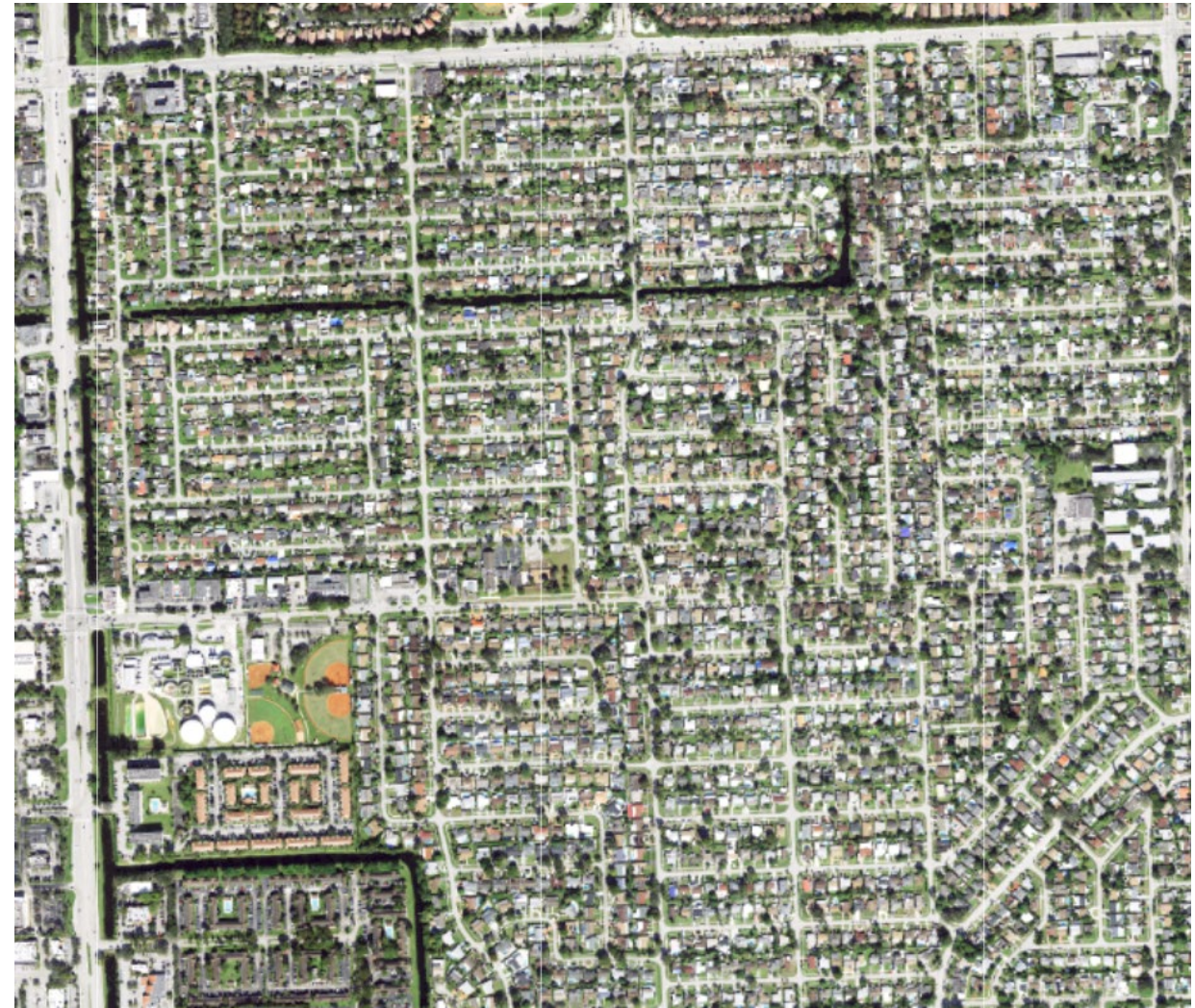


Development and Redevelopment Patterns (Cont'd)

Typical SWM Systems
Pembroke Pines – 1990s



Hollywood – 1960s



Development and Redevelopment Patterns (Cont'd)

Typical SWM Systems (University Dr. b/n Johnson and Sheridan)

1963



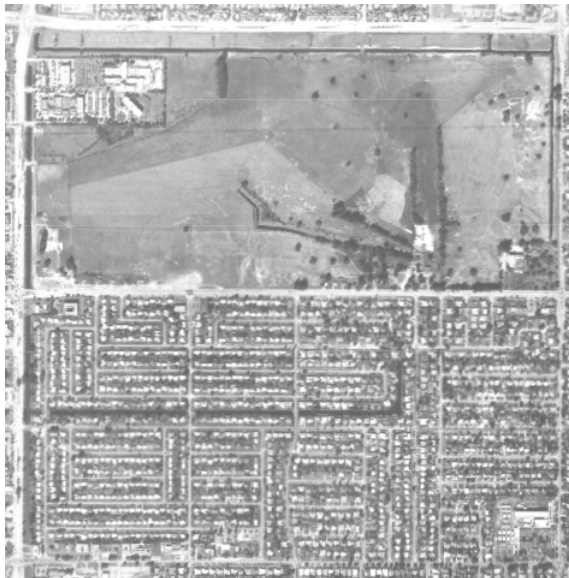
1967



1969



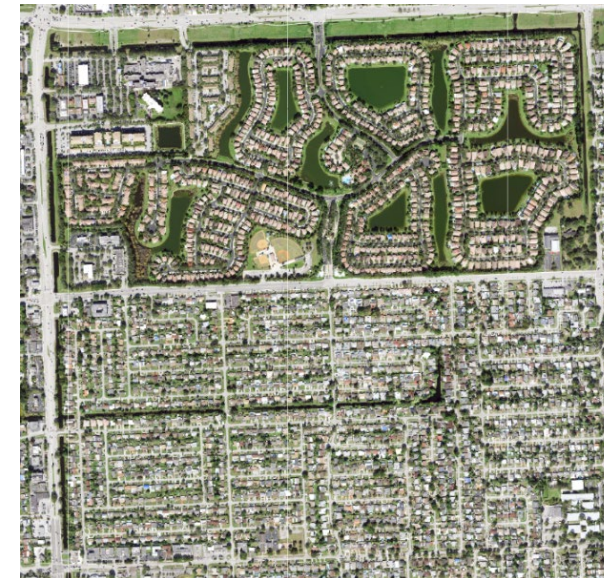
1995



2000



2024



Development and Redevelopment Patterns (Cont'd)

**Typical SWM Systems
Hollywood <1950s**



Development and Redevelopment Patterns (Cont'd)

Redevelopment of Golf Course into Residential (Single Family)

2015



2024



Development and Redevelopment Patterns (Cont'd)

Typical Redevelopment - Residential Multifamily SWM System (highly impervious)

2015



2024



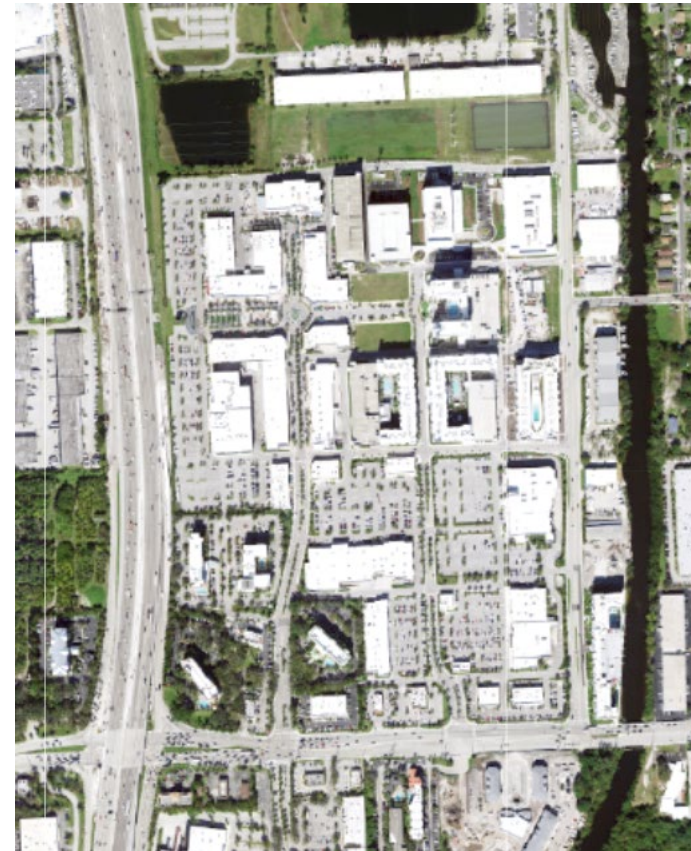
Development and Redevelopment Patterns (Cont'd)

Typical Redevelopment - Commercial SWM System (highly impervious)

2015



2024



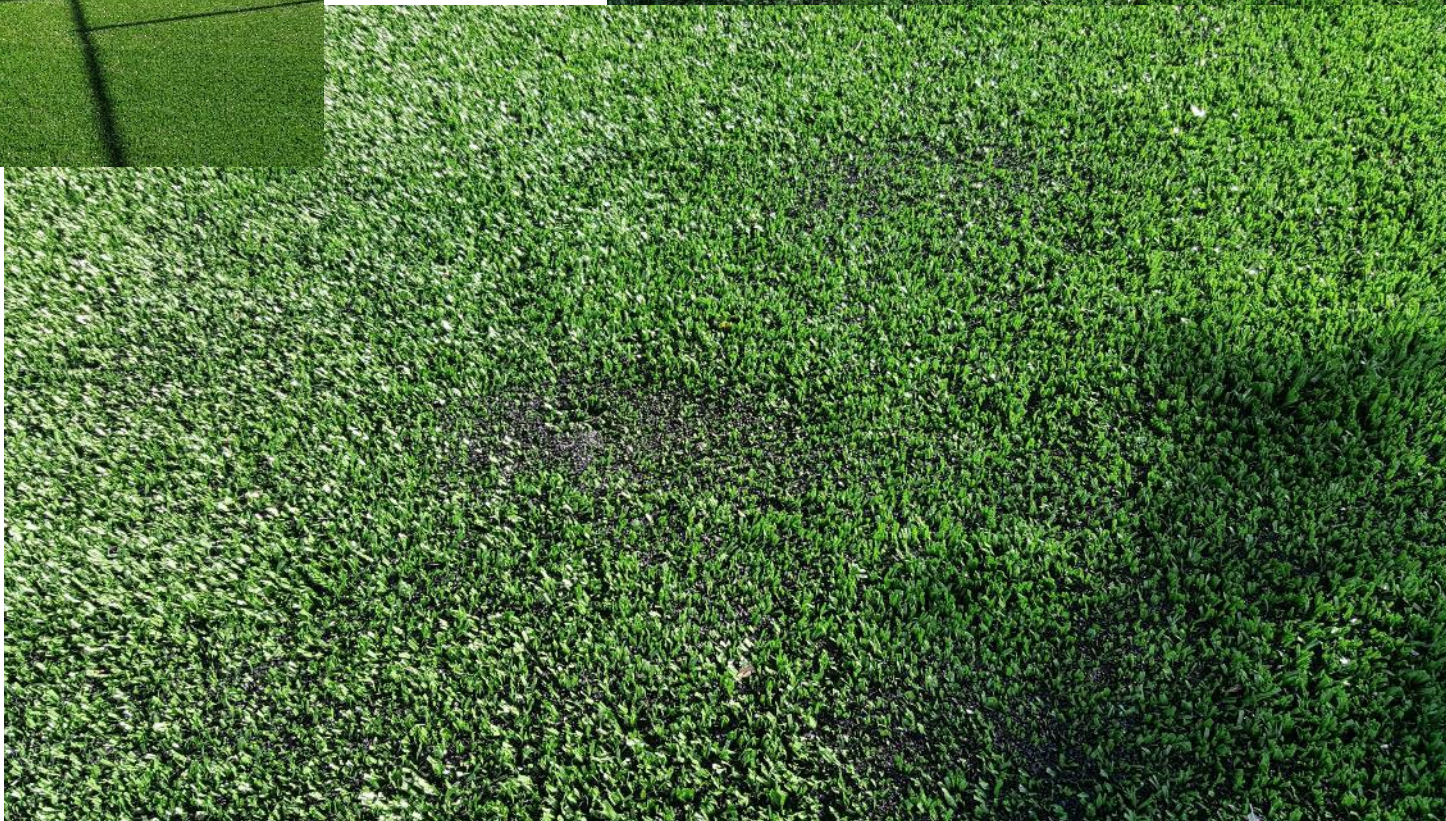
Innovative Designs for SWM Systems

- Pervious Pavements
- Artificial Turf
- Rainwater Tanks

Pervious Pavements



Artificial Turf



Rainwater Tanks



Considerations for Broward Next

- Increase community resilience, minimize flood impacts, and protect infrastructure
- Continue identifying needs for upgrades in the current flood control system
- Promote/Require use of alternative stormwater storage options and/or increase storage
- Promote/Require more pervious cover

Questions?