



# LEE COUNTY FLOOD MITIGATION PLAN

## INVEST 92L & HURRICANE IRMA 2017

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Lee County Board of County Commissioners  
Public Workshops 2019

# Invest 92L (August 25-27, 2017) & Hurricane Irma (September 10, 2017)

- Rain Events Triggered a 3 Phase Flood Response Plan
- Phases 1& 2 Complete and Summary of Findings
- Phase 3 Southern Lee County Flood Mitigation Plan
- Follow our progress on [www.leegov.com/flooding](http://www.leegov.com/flooding)



# FLOOD RESPONSE PLAN

**1** PHASE

Immediate Storm Debris Removal from Obstructed Waterways

**2** PHASE

Flood Assessments – Identify Impediments to Storm Flow for Near Term or Short Term Remedial Efforts

**3** PHASE

Long Term Plan – Stormwater Master Plans Updates to Address Long Term Remedial Projects: Southern Lee County Flood Mitigation Plan



# PHASE 1: Scope of Work

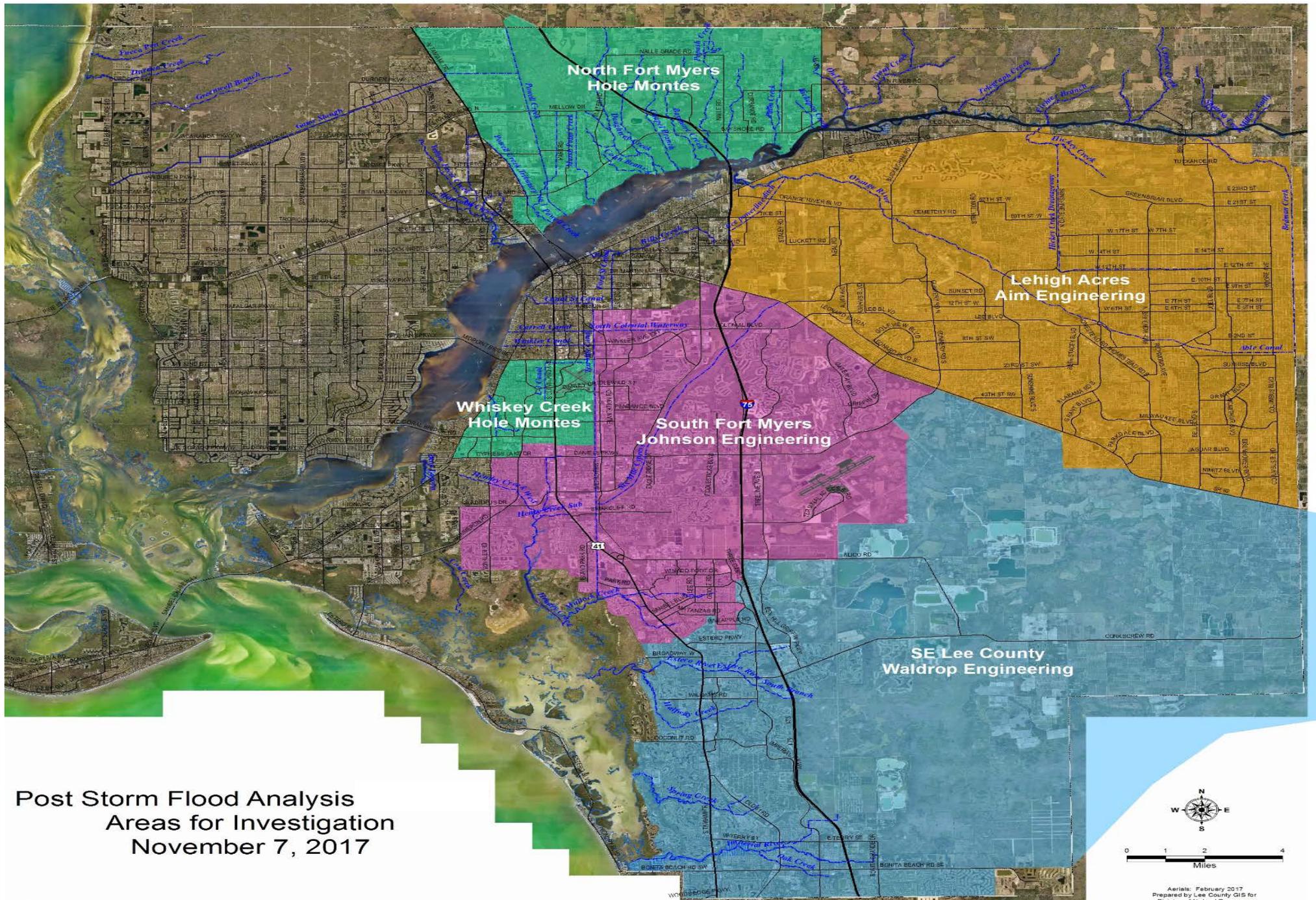
- **Immediate Storm Debris Removal from Obstructed Waterways:**
  - Aerial Recon and Field Inspections
  - Orange River, Hickey Creek, Bedman Creek
  - Estero River
  - East Mulloch Water Control District (fka EMDD)
  - County Canals
  - Pursued FEMA and Natural Resources Conservation Services (NRCS) funding



# PHASE 2: Scope of Work

- **Preliminary Assessment to Identify Short-term Relief Activities:**
  - Review Current Water Management Plans
  - Field Inspections & Collect Information About Flooding
  - Interact With Public & Review Observation Form Submittals & Requests For Action (RFAs)
  - Prioritization Based on Watersheds that Suffered Significant Home & Structural Flooding
  - Identify Conceptual Engineered Solutions for Long-term Mitigation Study





Post Storm Flood Analysis  
 Areas for Investigation  
 November 7, 2017



Aerials: February 2017  
 Prepared by Lee County GIS for  
 Division of Natural Resources



# FINDINGS

- Rainfall/ Runoff
- Impediments to Flow
- Permitting Observations
- Long-term Planning



# RAINFALL & RUNOFF

"A massive amount of rainfall of 13.06 to 17.45 inches from Hurricane Irma (possibly a 1,000-year storm event) fell on eastern Lee County." - *Aim Engineering, Inc*

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"While the rainfall totals alone were significant and were expected to cause flooding, the very short time period between events, exacerbated conditions, as the Estero River North Branch and Imperial River were unable to recover from the Invest 92L rainfall before Hurricane Irma." - *Waldrop Engineering*

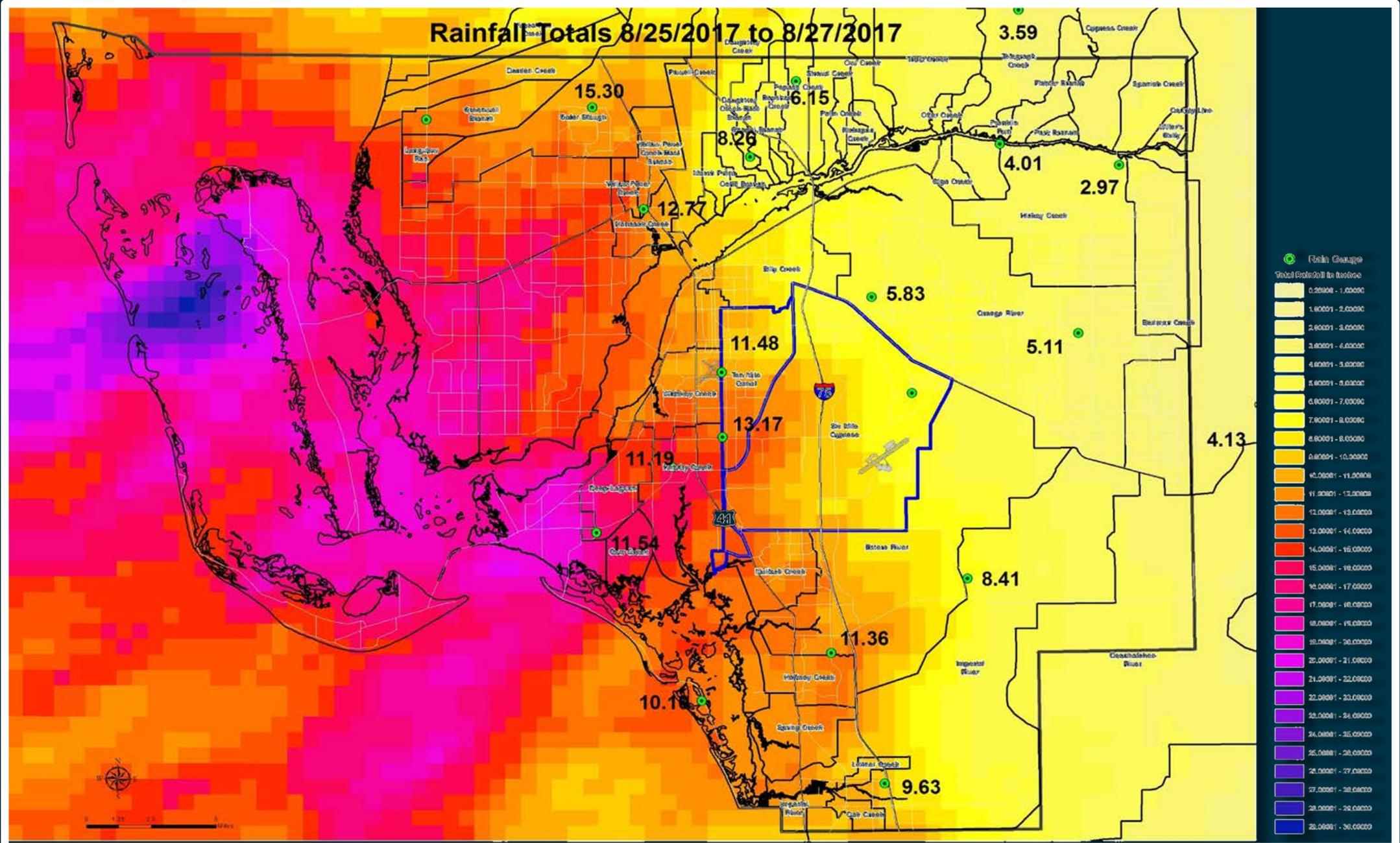


# RAINFALL & RUNOFF

- Invest 92L (August 22-25, 2017) & Hurricane Irma were major rainfall events singularly and cumulatively.
  - Storm frequency depended on location within County
- Impacts to multiple jurisdictions – municipalities, agencies, private property
- Drainage system was overwhelmed by run-off resulting in extensive flooding, exceeded most design standards & natural carrying capacity of creeks, streams, rivers
- Water levels did not fully recover from Invest 92L before Hurricane Irma arrived
- Storm surge in the Caloosahatchee restricted discharge capabilities of tributaries (Orange River, Bedman, Hickey Creek)

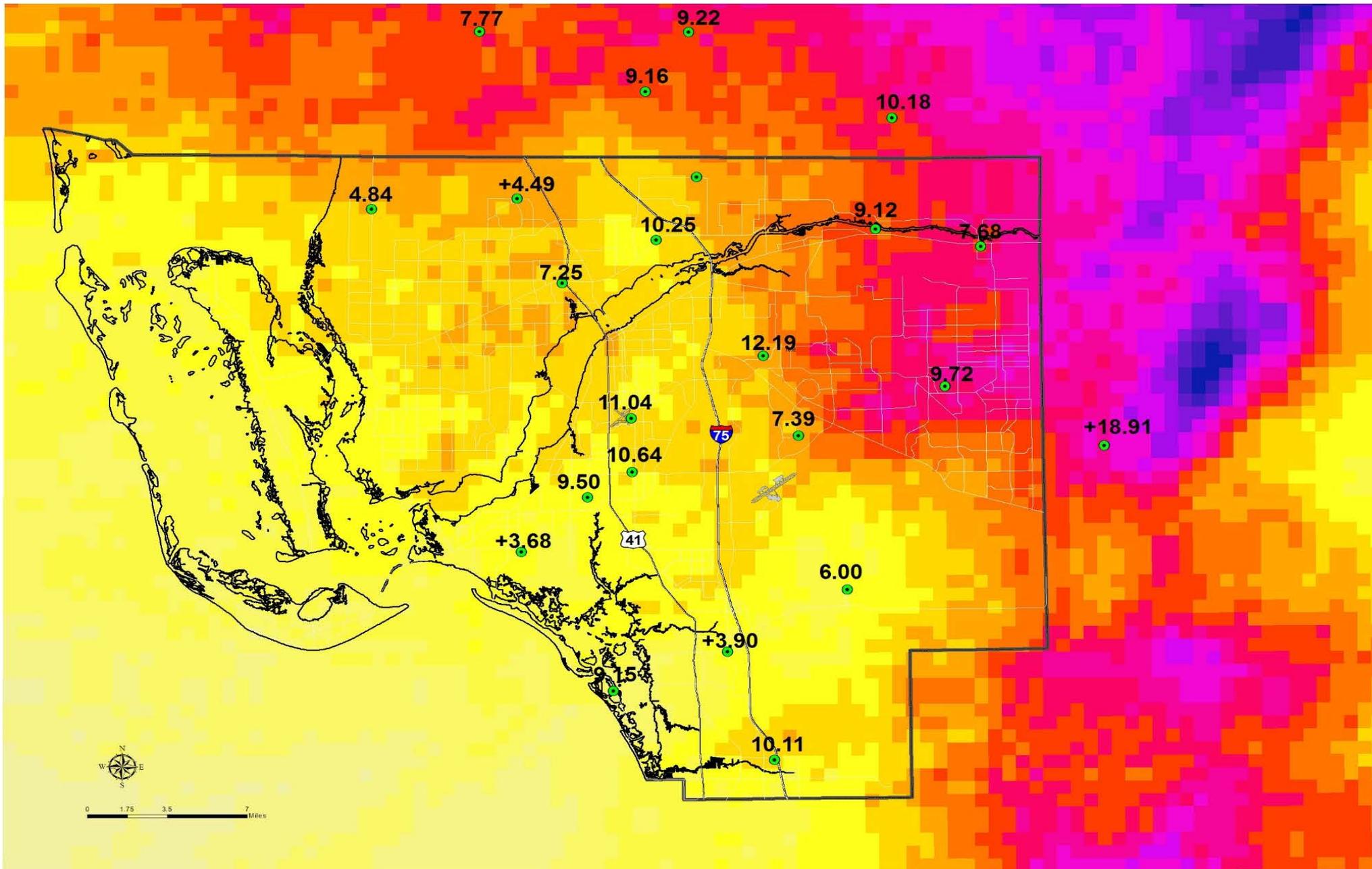


# Rainfall Totals 8/25/2017 to 8/27/2017



# Hurricane Irma

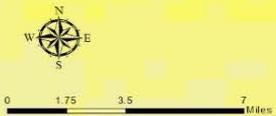
Rainfall Total  
9/9/17-9/11/17



+ = Partial reading;

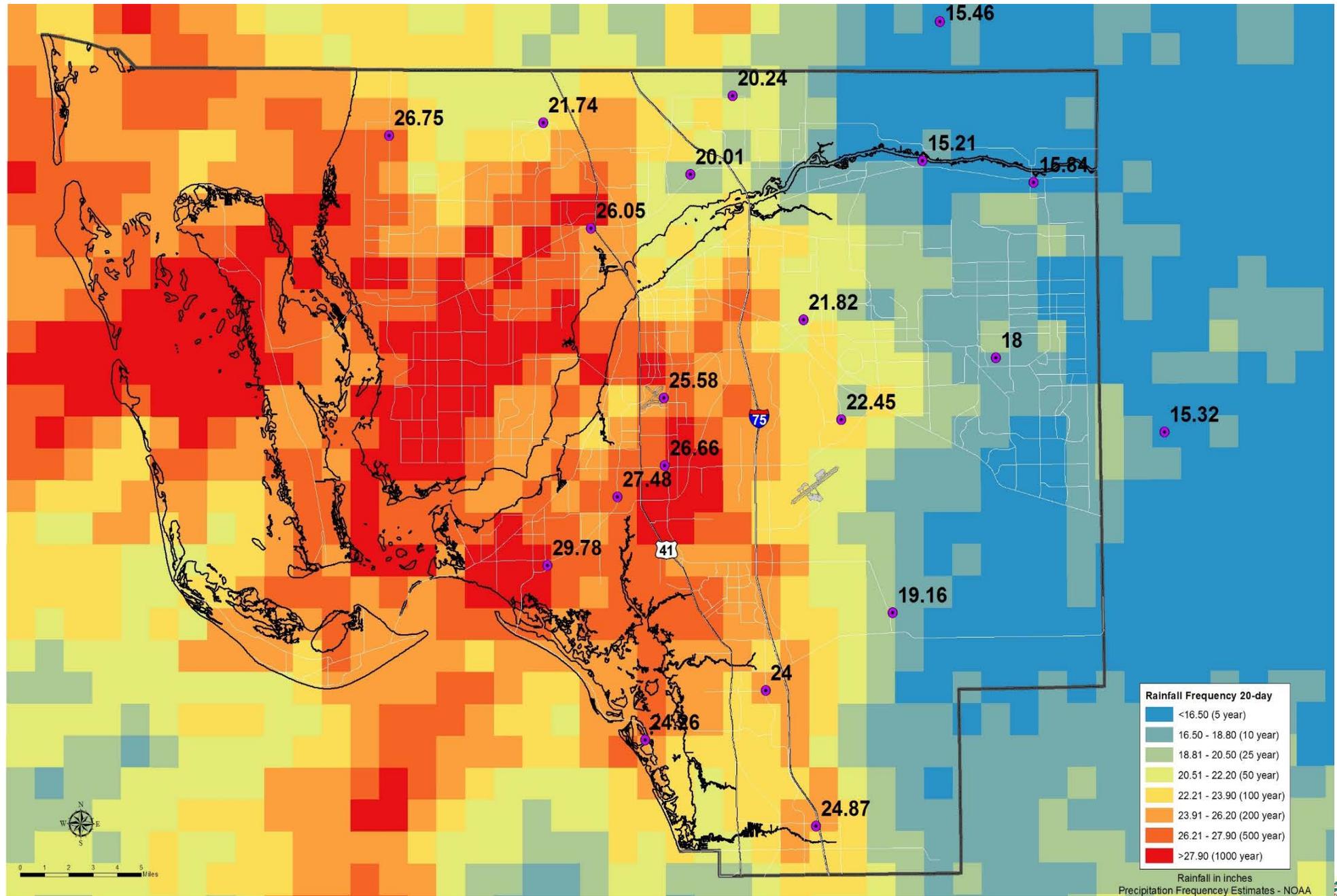
● Rain Gauge

Rainfall



# 20-Day Rainfall

Totals & Frequency  
8/23/17 – 9/11/17



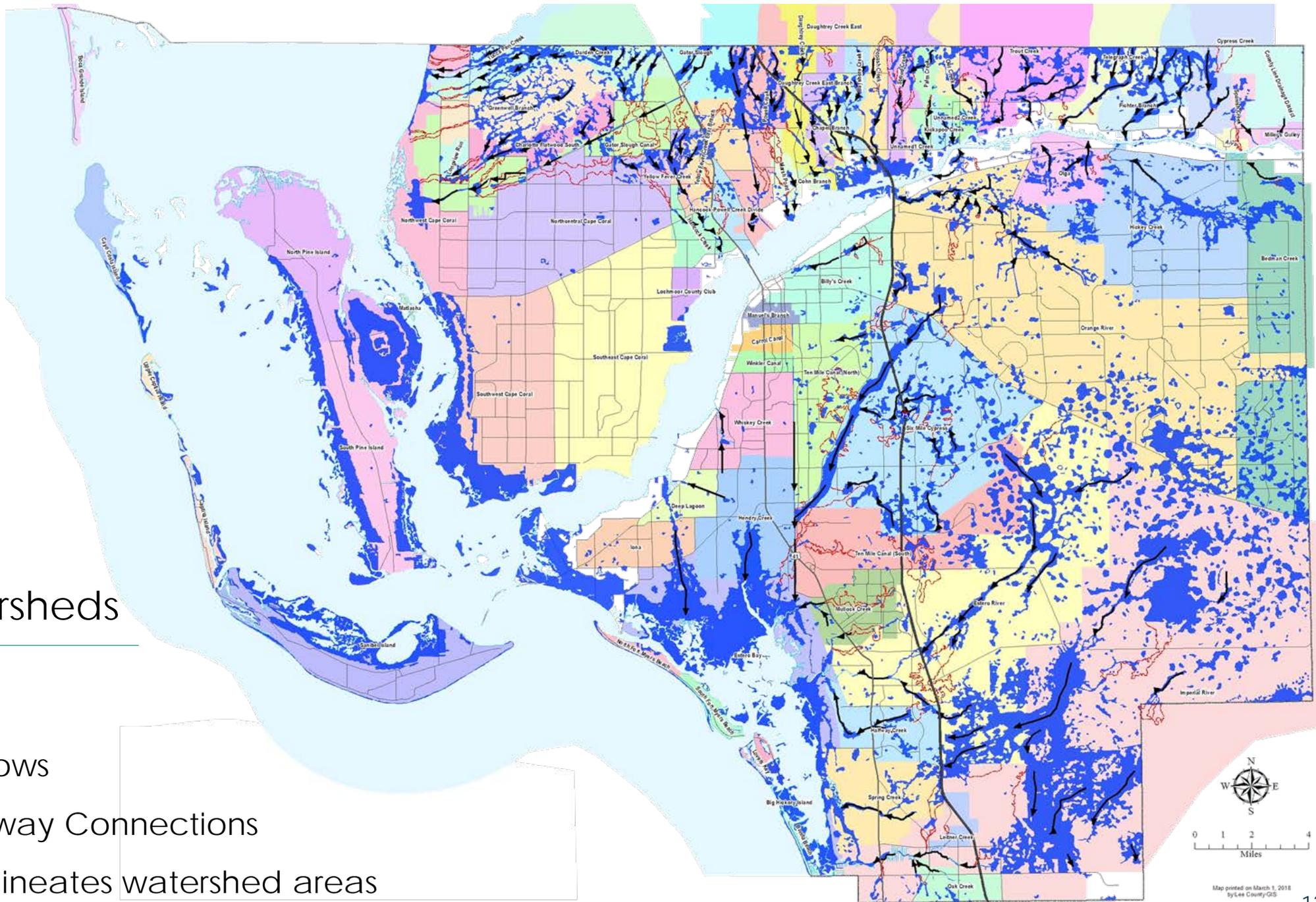
# Lee County Waterways & Historic Watersheds

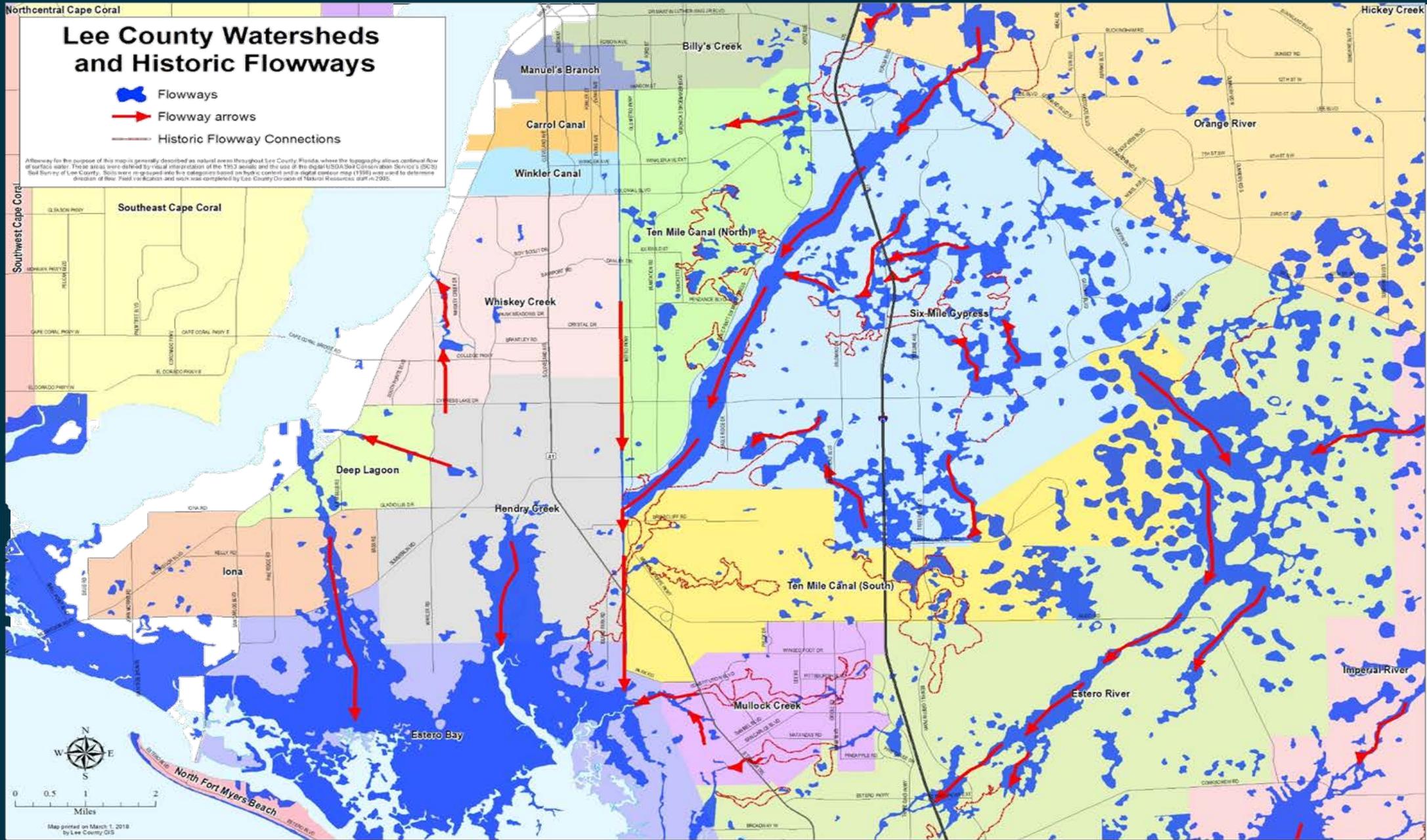
 Flowways

 Flowway Arrows

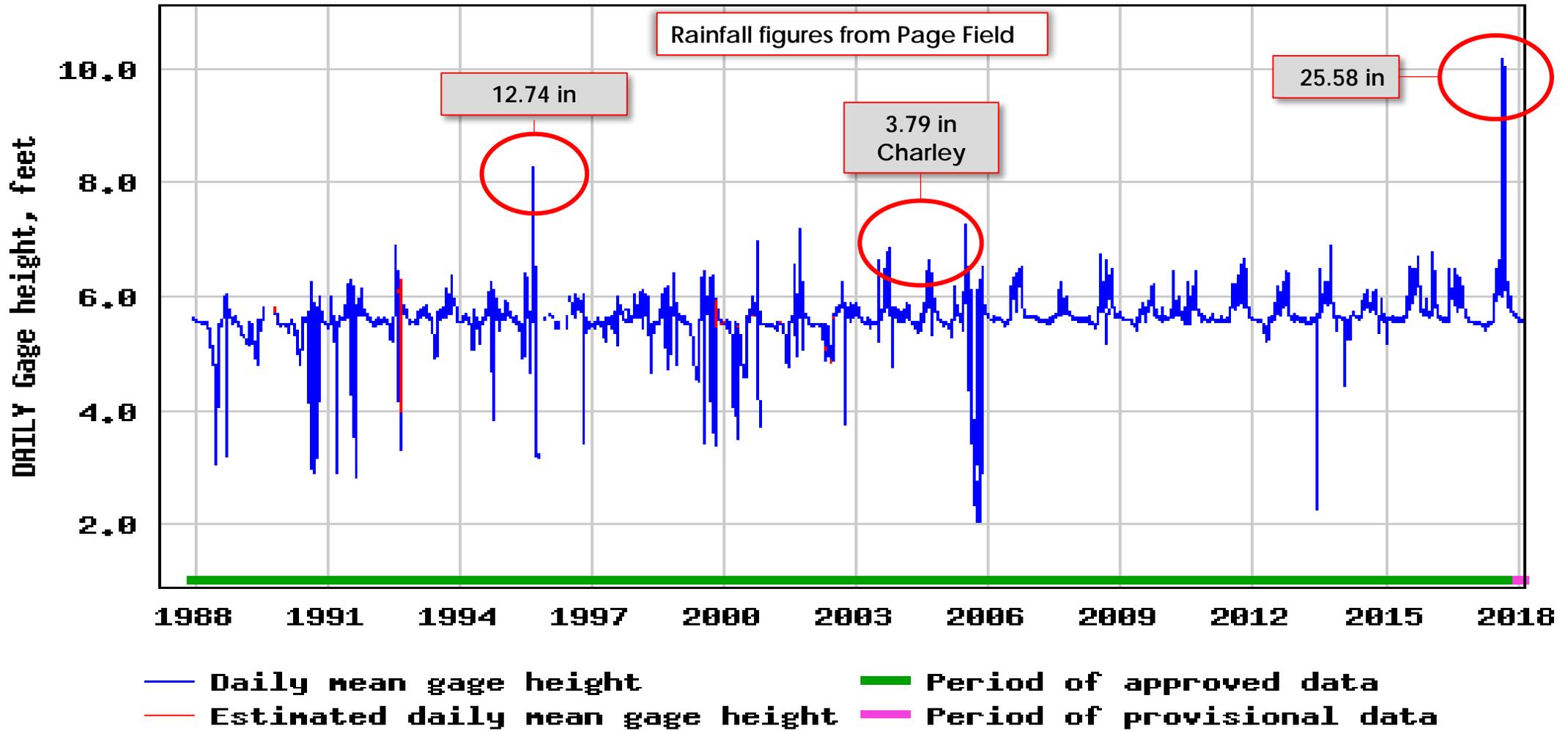
 Historic Flowway Connections

\*Shading delineates watershed areas



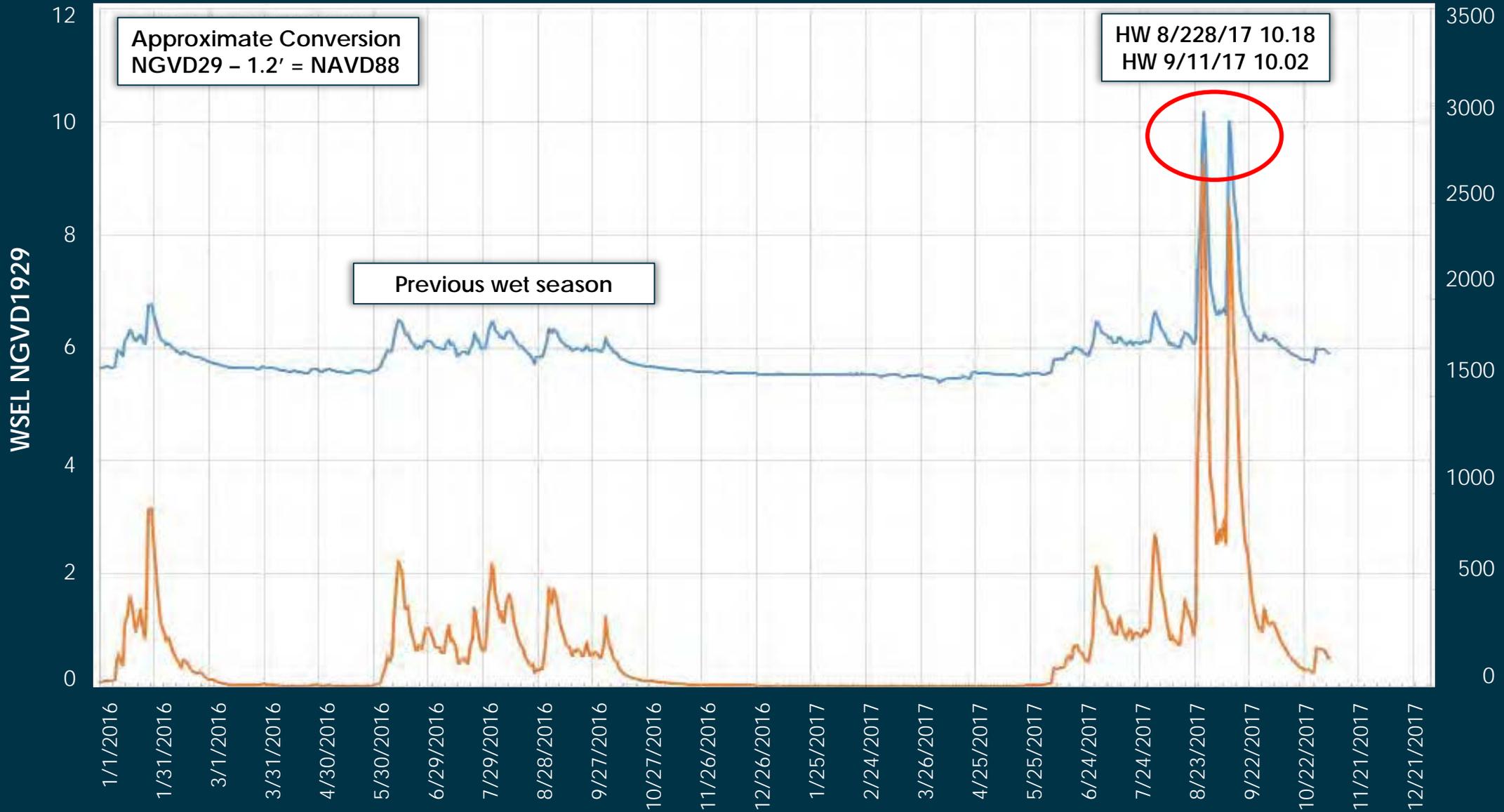


# USGS 02291673 TENMILE CANAL AT CONTROL NEAR ESTERO, FL

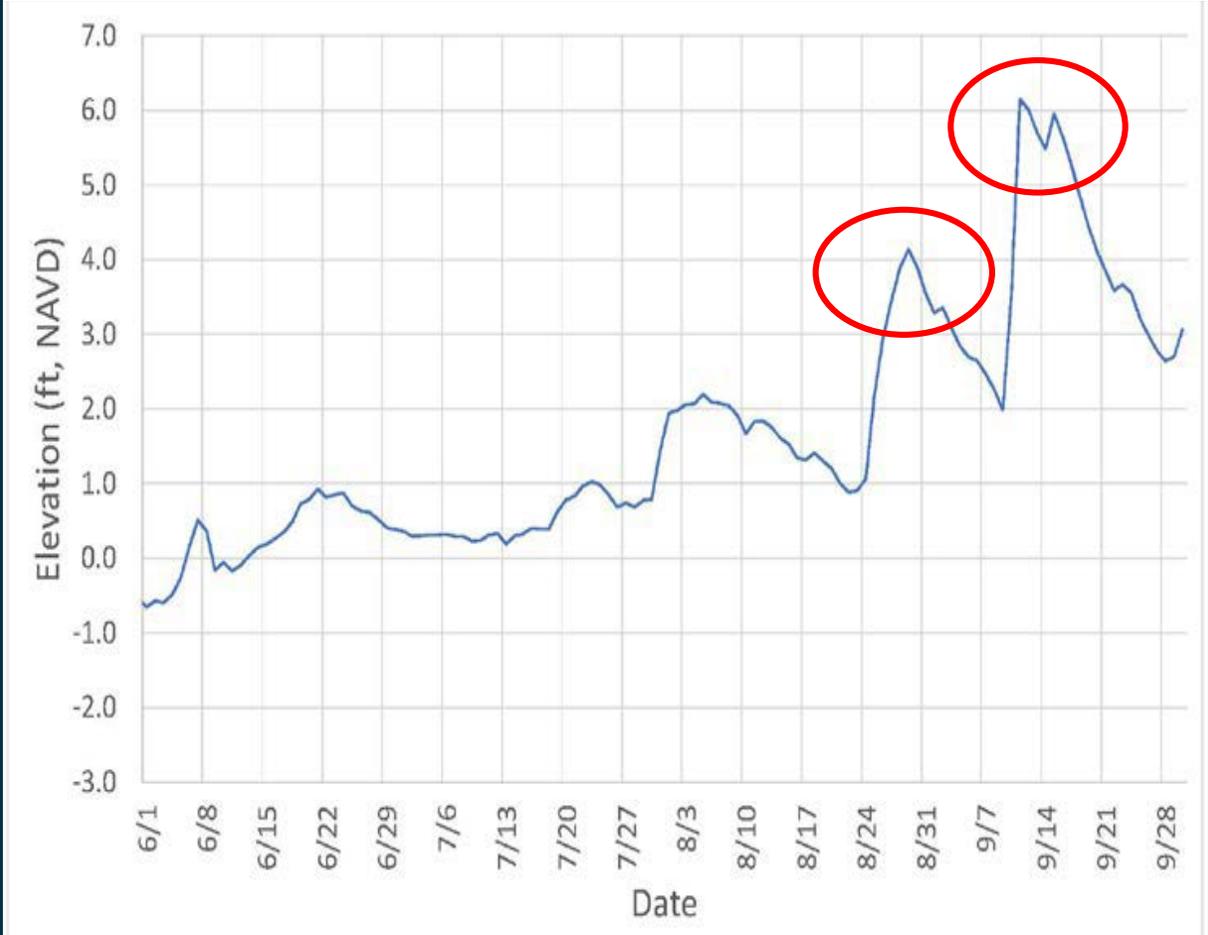


# Water Surface Elevation at Ten Mile Canal at Old US 41 Weir

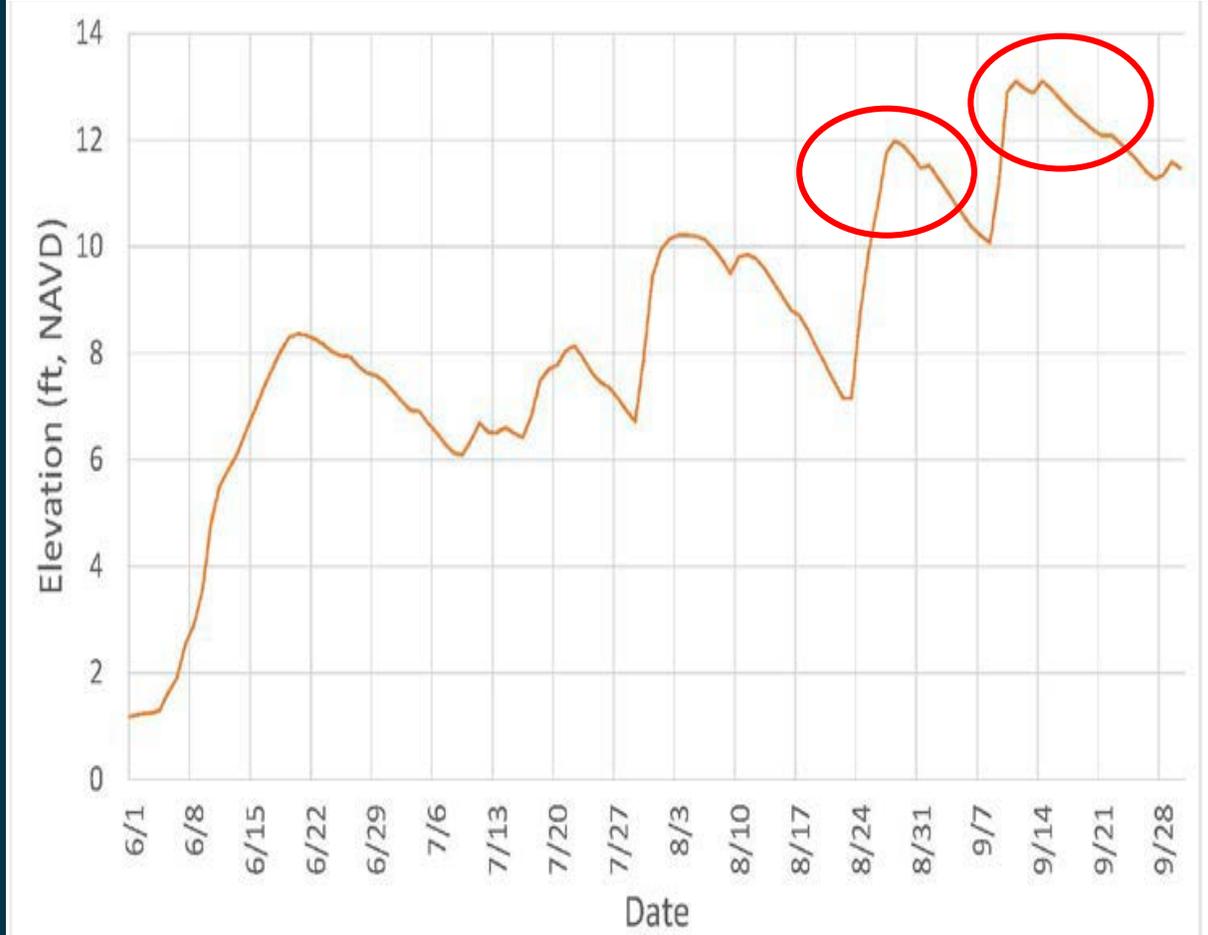
Source: USGS  
Station 02291673



Imperial River at Felts Avenue  
2017 Water Elevations



Imperial River at Bonita Grande  
2017 Water Elevations



# IMPEDIMENTS TO FLOW

- Inventory Created Based on Field Observations
  - Vegetation – excessive growth
  - Debris-blocking catch basins, culverts, ditches, canals- existing & storm generated
  - Fences across waterways
  - Erosion and siltation
  - Structural failures- culverts, private bridges, control structures
- Affected the depth and duration of flooding
- Multi-jurisdictional, lack of system continuity and inconsistent operations and maintenance (O&M)
- Removing blockages can bring back built capacity at best, flooding still expected for similar sized storm events







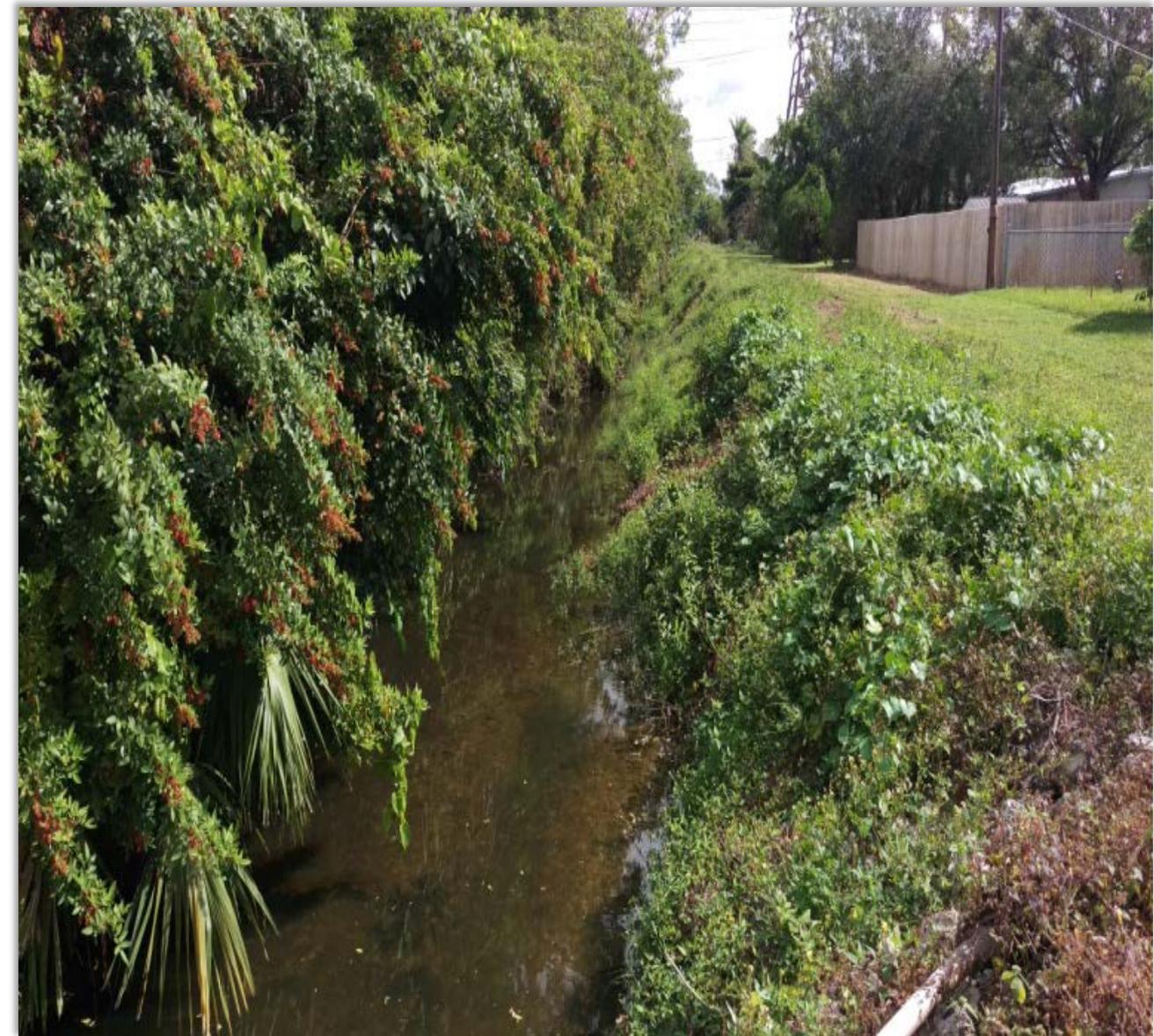
**IMPEDIMENTS TO FLOW**





**IMPEDIMENTS TO FLOW**





# PERMITTING OBSERVATIONS

- Homes Built To Current FEMA 100 Year Elevation Were Not Flooded (Post '92)
- Rainfall Event Exceeded Design Capacity Of System
- Permit Criteria Addresses Differing Elements Of The Community: Road Elevations, Stormwater System, House Pads, Dialogue With South Florida Water Management District (SFWMD) Recommended
- Development Patterns Impact Flooding - Master Planning
- Lack Of Continuity Throughout Watershed, Multiple Entity/Jurisdictions, Lack Of Downstream Impact Review
- Older Development Has Encroached Into Floodways & Reduced Historic Conveyance Capacity
- Need for Communities to Maintain Stormwater System in Accordance With SFWMD Permit

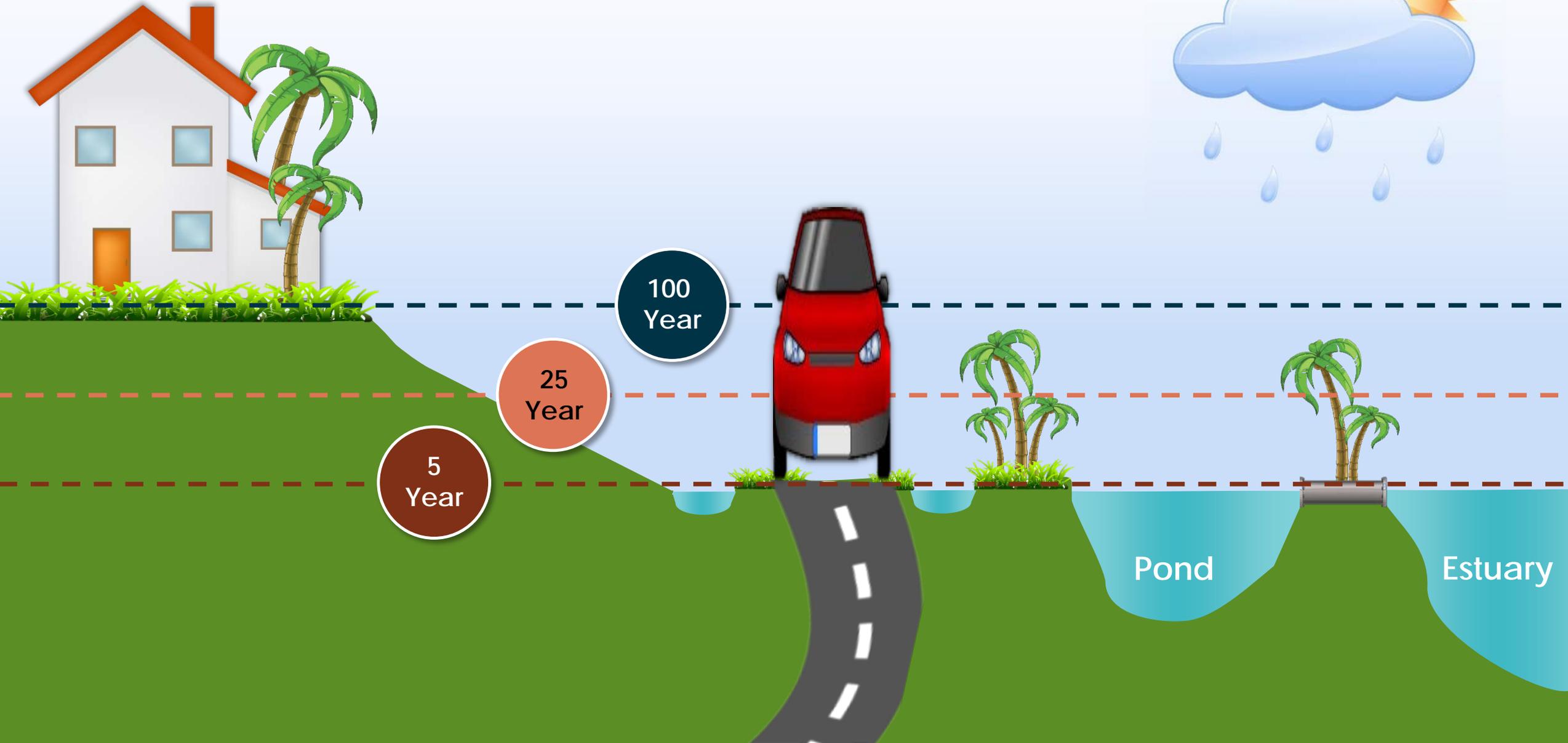








# DESIGN LEVELS: FLOOD PROTECTION



# PHASE 2: Action

- **Continued Clearing Obstructions Identified in Assessments**
  - County crews in the Villas
  - Cleaning and snagging efforts in the following waterbodies: Whiskey Creek, FPL ditch, Nine Mile Run, Buckingham Trails, Buckingham Airfield ditch, Bayshore Creek
  - Next phase of East Mulloch Water Control District (fka EMDD) clearing – Natural Resources Conservation Service (NRCS)
  - EMDD weir repair and sediment removal – NRCS
  - Ten Mile Canal Sediment Removal- NRCS
- **Pursue Funding for Projects – Hazard Mitigation Grant Program, legislative requests**





East Mulloch Water Control District Weir at US 41



East Mulloch Water Control District Debris Removal





Ten Mile Canal Sediment Removal

# PHASE 3: LONG-TERM PLAN

- Provide an overall assessment of different geographic regions of the county regarding surface water management. The goal of this project is to establish plans to reduce flooding on a larger regional scale.
- Examine potential capital projects identified in Phase 2 reports, require further investigation.
- Selected Watersheds south of Caloosahatchee due to extent of impact and age/accuracy of existing planning efforts, existing studies for North Fort Myers are most recent and remain valid.



# PHASE 3: LONG-TERM PLAN (cont)

- Advertised and selected through Competitive Negotiations process professional consultant services
- Project Team – Lee County, AIM Engineering, Johnson Engineering, ATM Engineering, ADA Engineering



# PHASE 3: Scope of Work

- **Southern Lee County Flood Mitigation Plan**
  - Task 1 Project Coordination
  - Task 2 Identify Potential Flood Improvement Projects
  - Task 3 Regional Model Development
  - Task 4 Modeling of Flood Protection Projects
  - Task 5 Surveying
  - Task 6 Agency Coordination
  - Task 7 Project Evaluation Reports



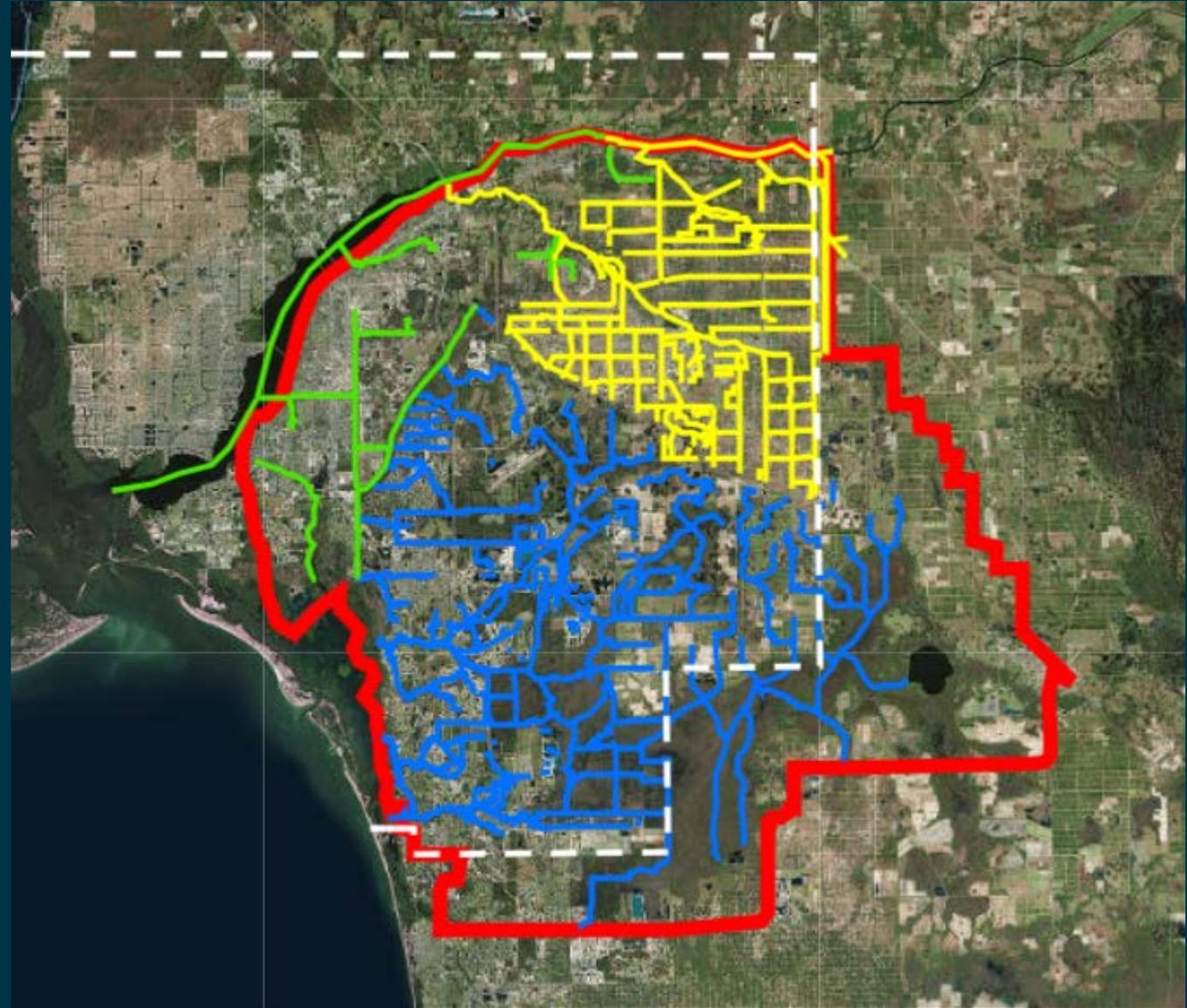
# PHASE 3: Scope of Work

- **Southern Lee County Flood Mitigation Plan**
  - Task 8 Priority Matrix
  - Task 9 Public Involvement
  - Task 10 Build Out Analysis
  - Task 11 Basin Storage/ Discharge Analysis
  - Task 12 Summary Report



# Task 3 Regional Model Development

- Computer Generated Simulation of Regional Hydrology in Response to Storm Events
- Utilizes Extensive Survey, Topography, Water Level, Flow information
- Proposed Projects can be evaluated for their ability to reduce level and duration of flooding



# PHASE 3: LONG-TERM PLAN

## Expectations

- Lee County subject to major tropical activity
- Invest 92L and Irma were extraordinary events
- Overall land grade is very flat
- Historic flow patterns relied on large expanses of floodplain
- Sheet flow in headwaters collect to shallow tributaries to tidal creeks
- Tide and storm surge effects ability to drain
- Cannot “flood proof” all property

## Priorities

- Eliminate flood intrusion into homes
- Evacuation and collector routes provide safe passage



# Interactive Website [www.leegov.com/ flooding](http://www.leegov.com/flooding)

- Stay Updated/ Track Progress
- Story Board provides interesting and valuable information
- <http://www.leegov.com/flooding>

