



2020 Hurricane Season Impacts on Water Management in Florida

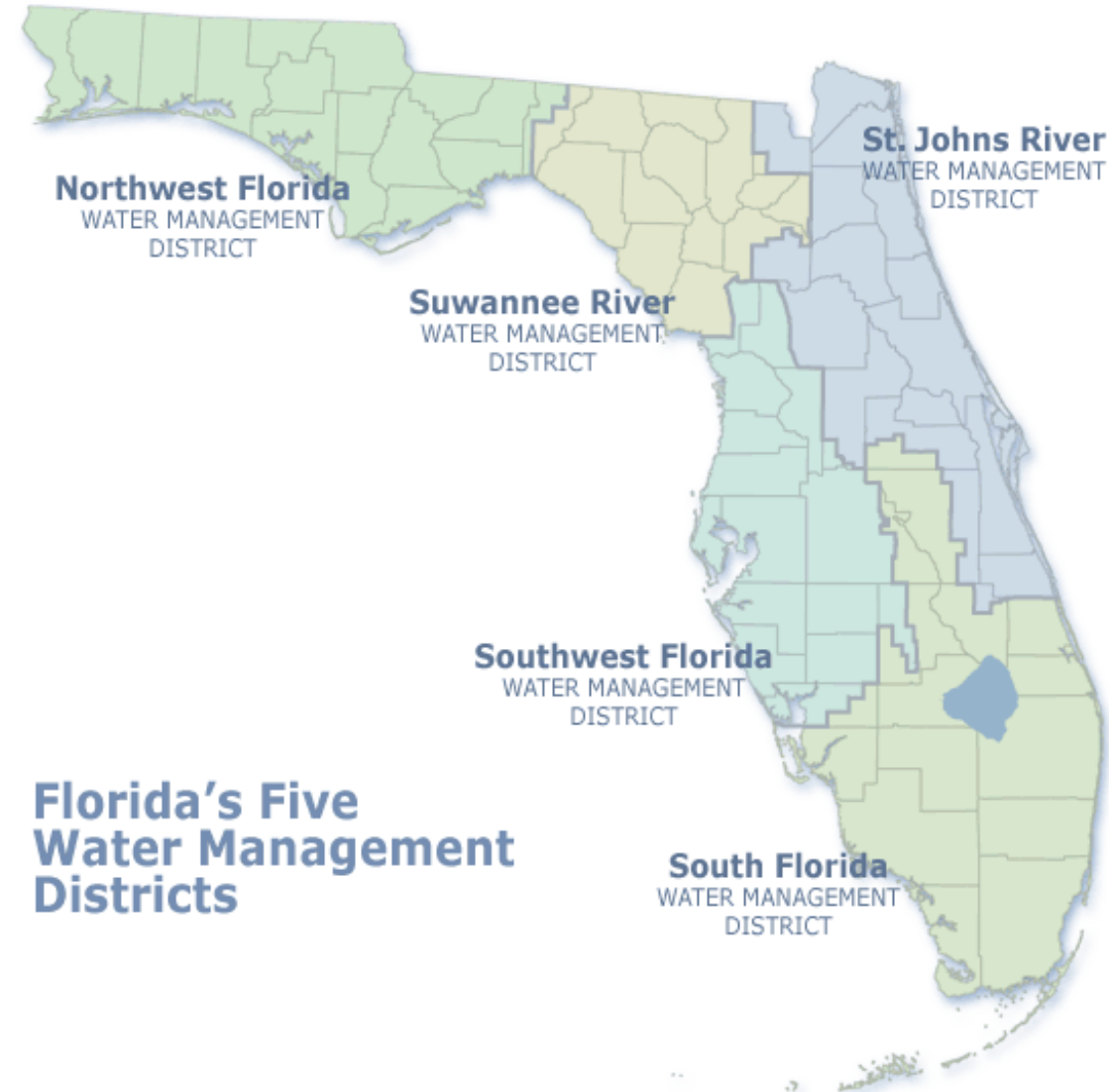
Carolina Maran, P.E., Ph.D., District Resiliency Officer

April 7, 2021

South Florida Water Management District

- Created in 1949, oldest and largest of the state's five water management districts
- 16 counties from Orlando to the Florida Keys
- Serves a population of 8.7 million residents
- 2,200 miles of canals; 2,100 miles of levees/berms, 84 pump stations, 778 water control structures and weirs and 621 project culverts

MISSION: to safeguard and restore South Florida's water resources and ecosystems, protect our communities from flooding, and meet the region's water needs while connecting with the public and stakeholders.

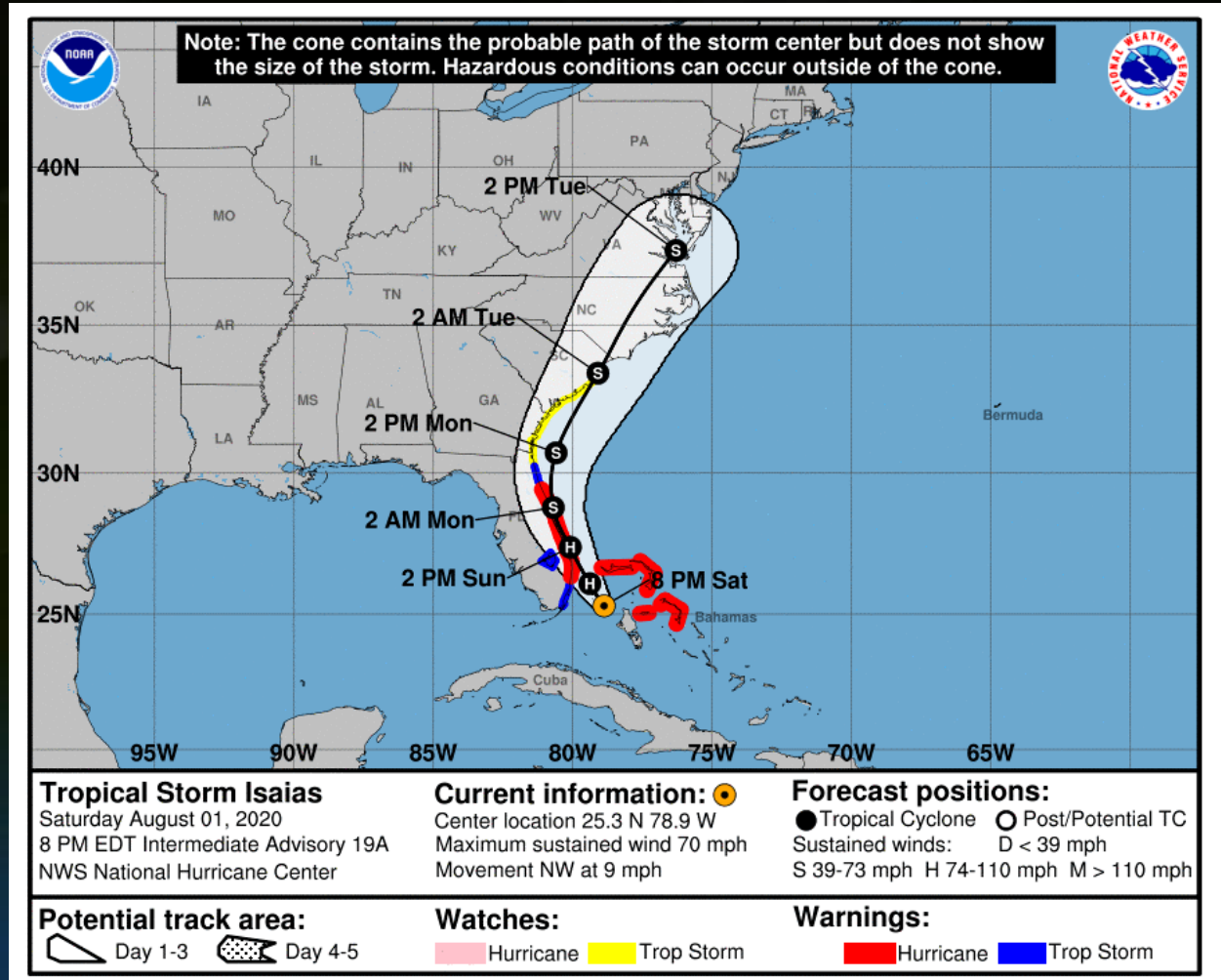


Water Management & Hurricane Season

- Fifth consecutive year with above normal Atlantic Hurricane Season; 18 above normal seasons out of past 26
- Warm phase of AMO, since 1995 (last 25-40years)
- Recent studies: associating this intensification with observed increasing global temperatures
- District's EOC was activated twice in 2020: Hurricane Isaias and Tropical Storm Eta
- Next slides: Water management impacts and Resiliency
 - Hurricane Isaias – Forward Pump Operations
 - TS Eta – Compound Flooding Impacts

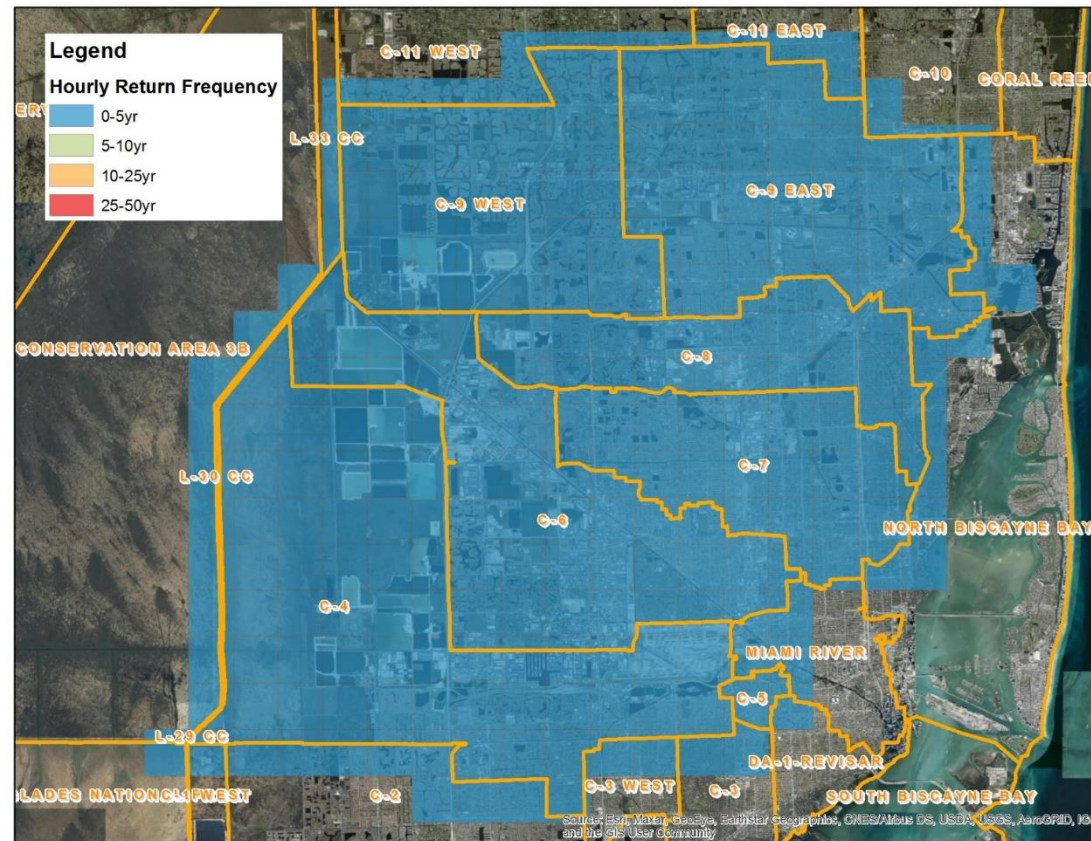
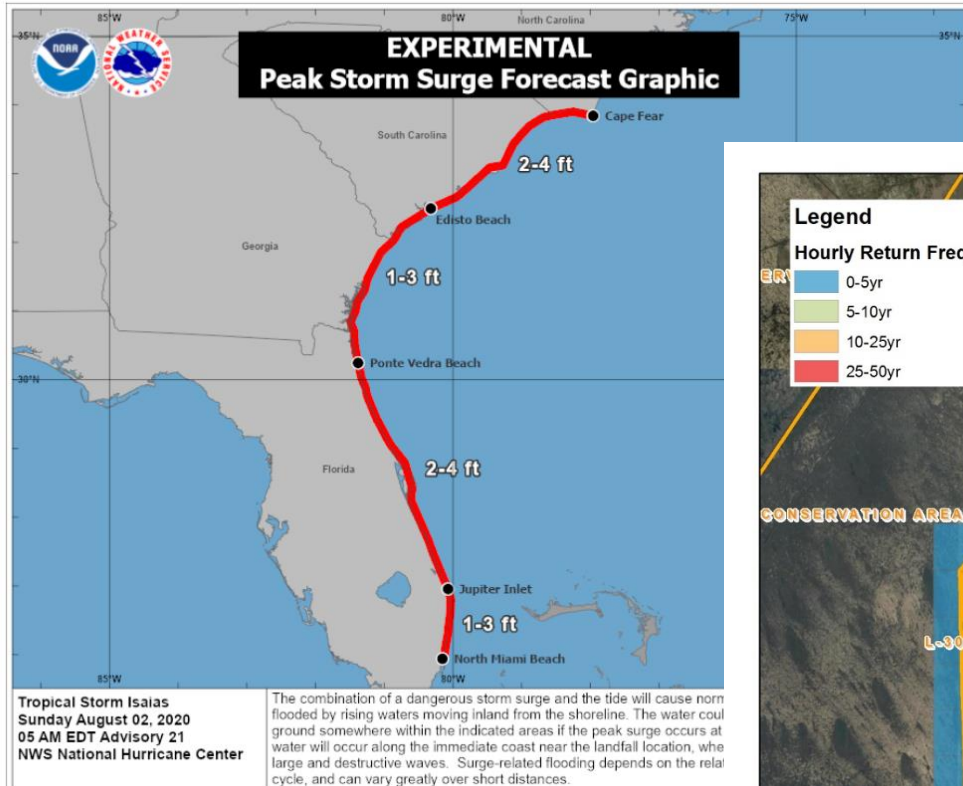


Hurricane Isaias, August 1-2, 2020



Rainfall & Storm Surge

Experimental Peak Storm Surge Forecast



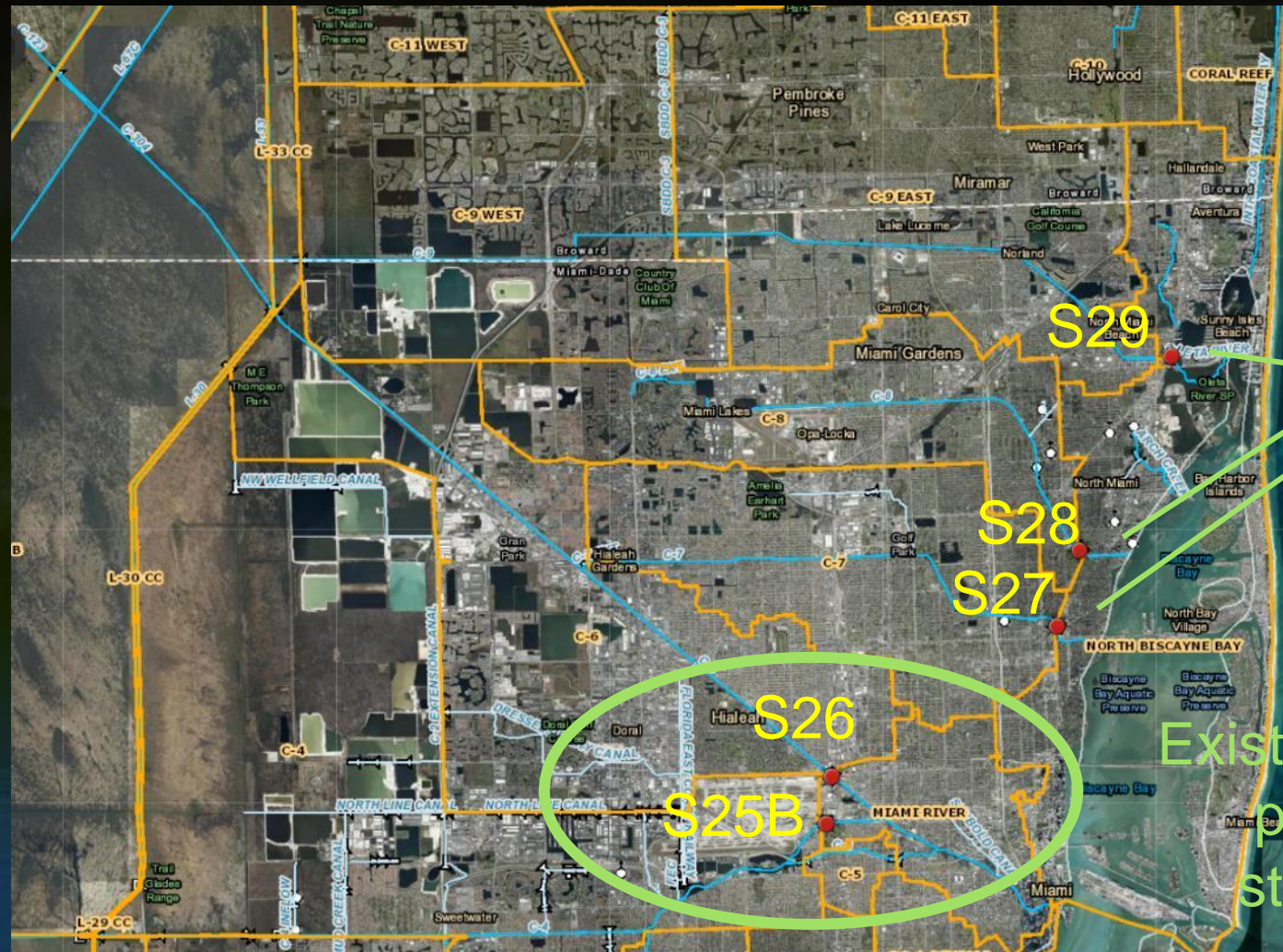
Radar Rainfall in Inches

Basin	3-day Total
C-4	1.655
C-5	2.085
C-8	1.214
C-6	1.668
C-7	1.45
C-9 WEST	0.992
C-9 EAST	0.849

Not a very significant rainfall event

(less than 1 in 5-year return frequency)

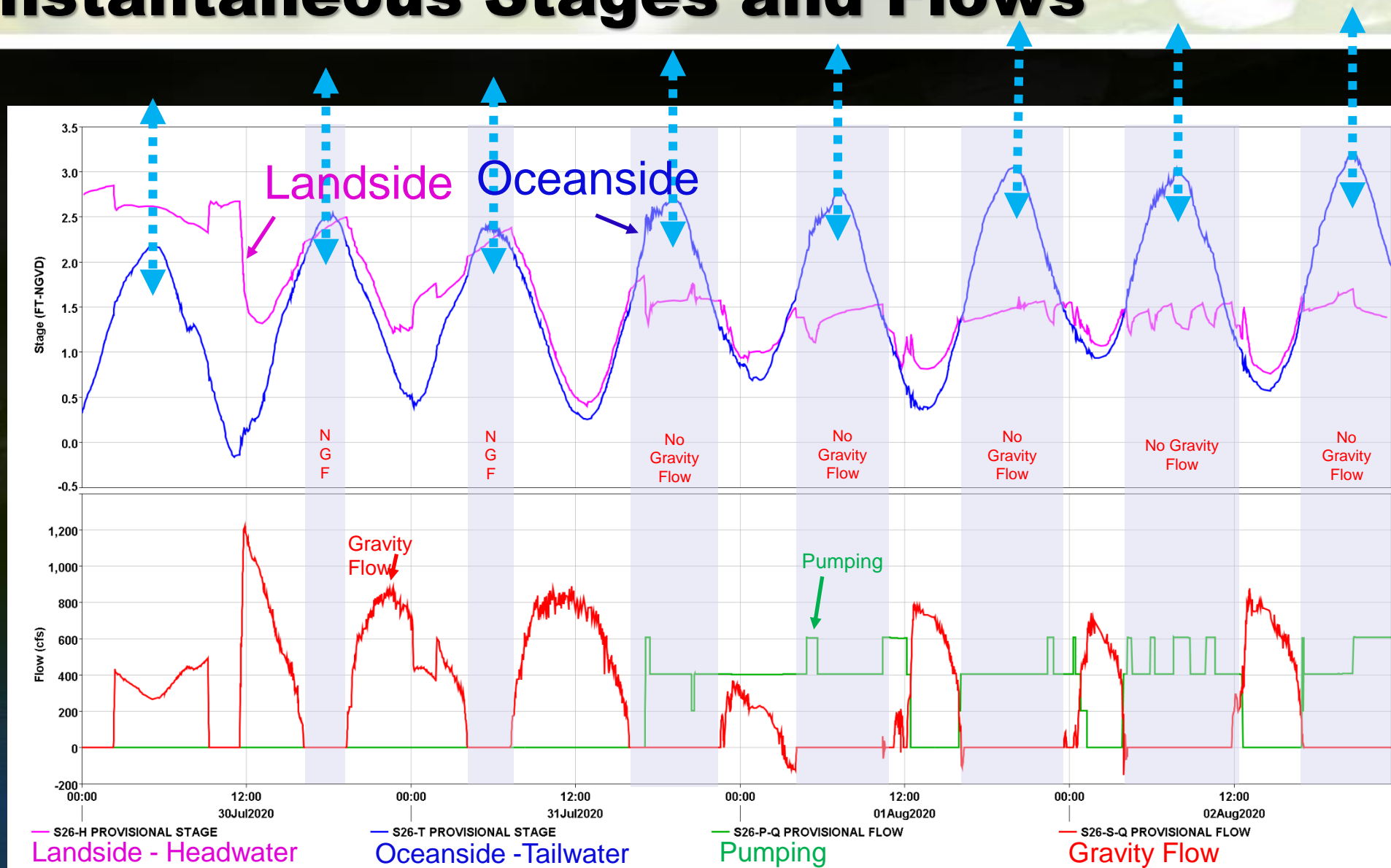
Forward Pumping Operations



Gravity driven
discharges
only

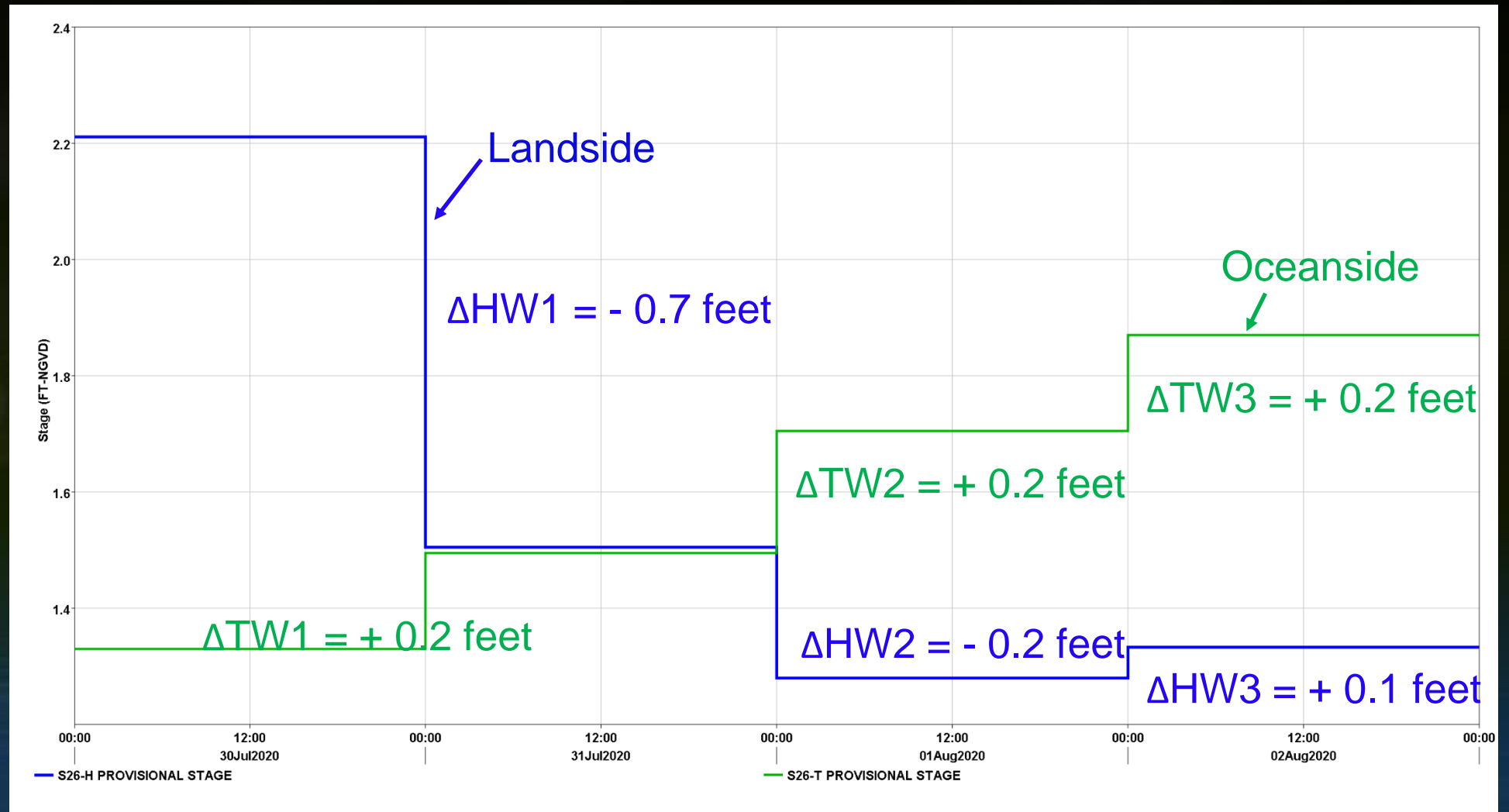
Existing forward
pumping
structures

S26 (Gravity and Forward Pump) Instantaneous Stages and Flows



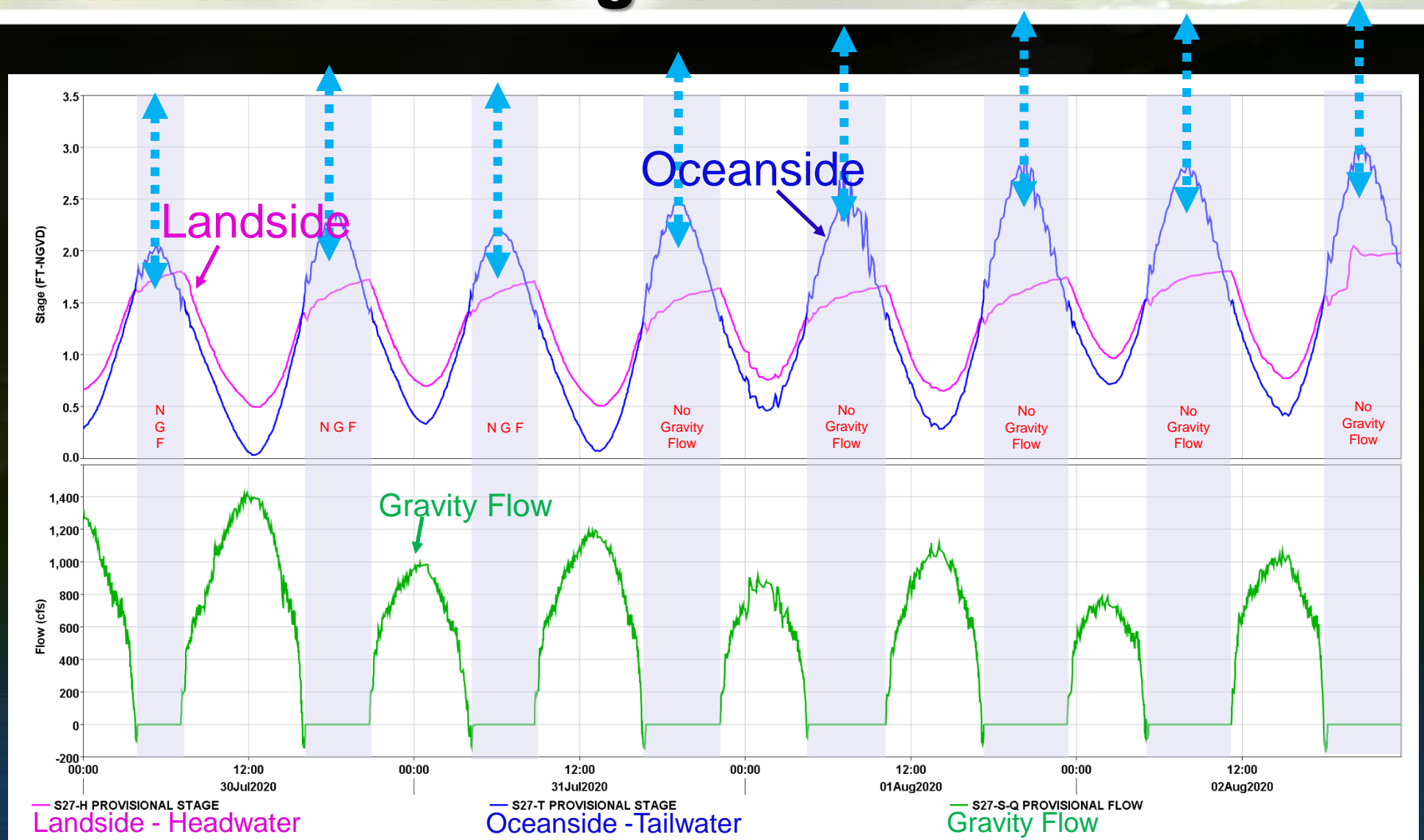
▲ Sea Level Rise Estimated Range
- 0.53 ft in 1985
▲ +17 inches in 2040 (NOAA Intermediate High)

S26 (Gravity and Forward Pump) Average Daily Stage



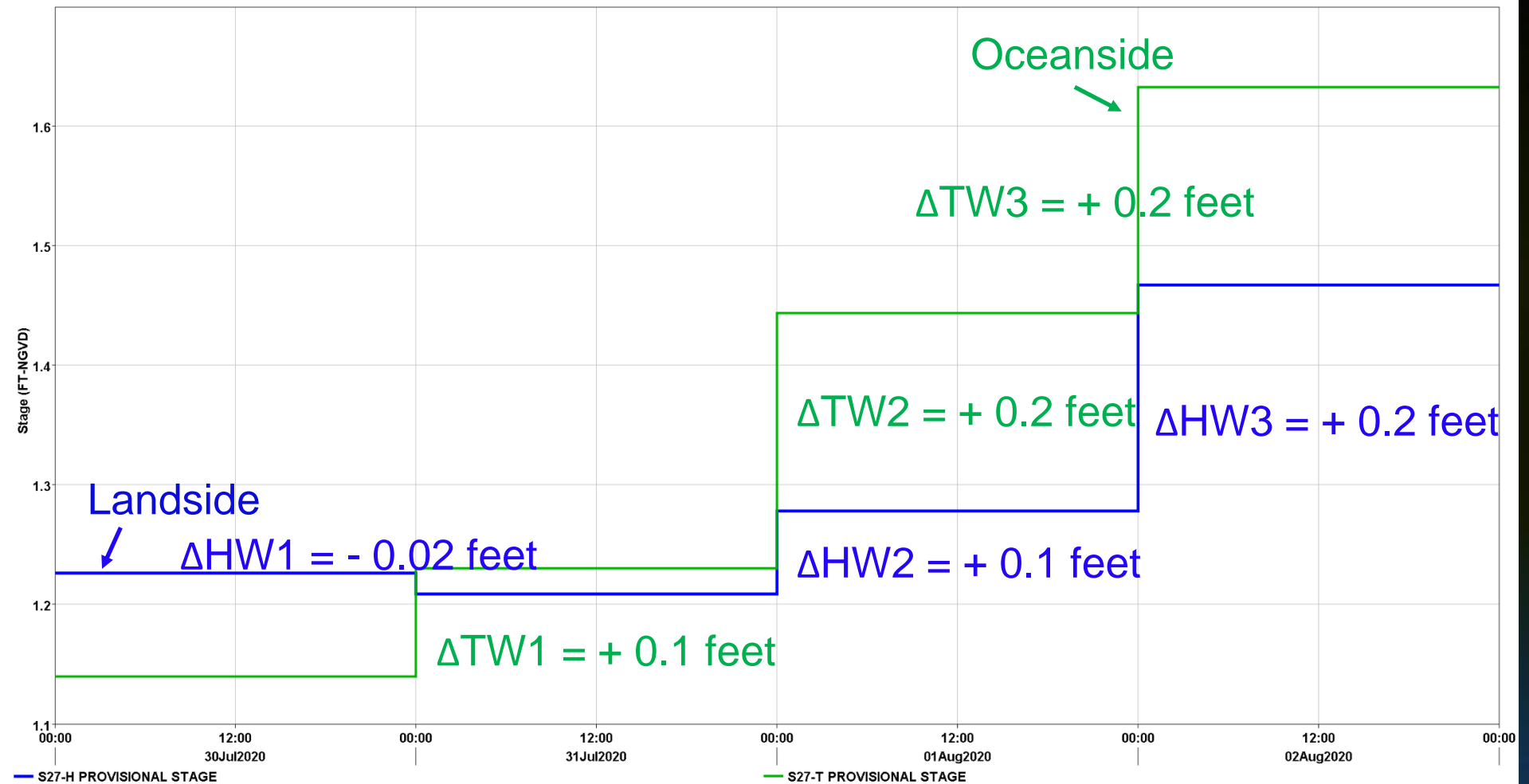
S27 (Gravity)

Instantaneous Stages and Flows

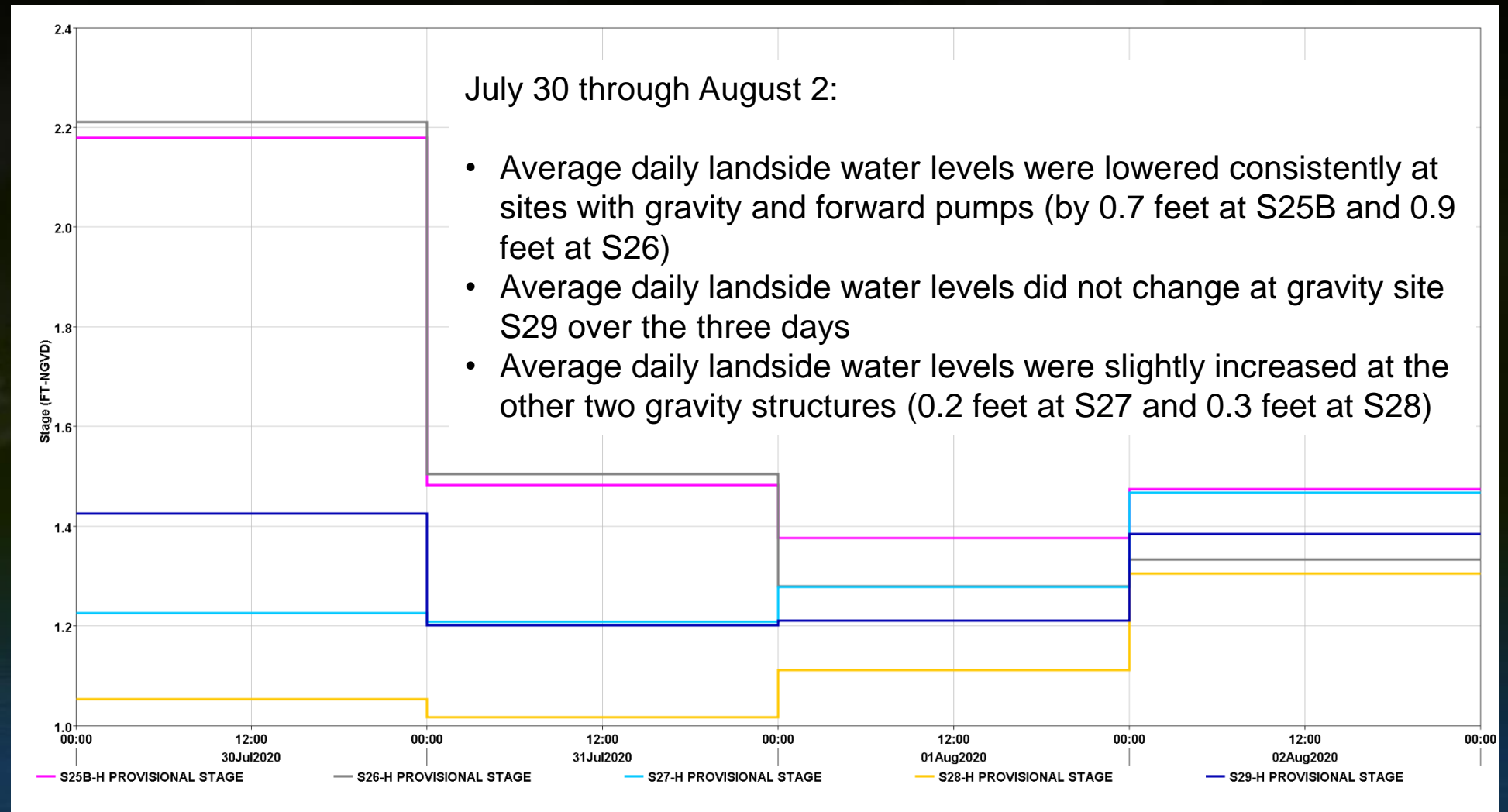


▲ Sea Level Rise Estimated Range
- 0.45 ft in 1989
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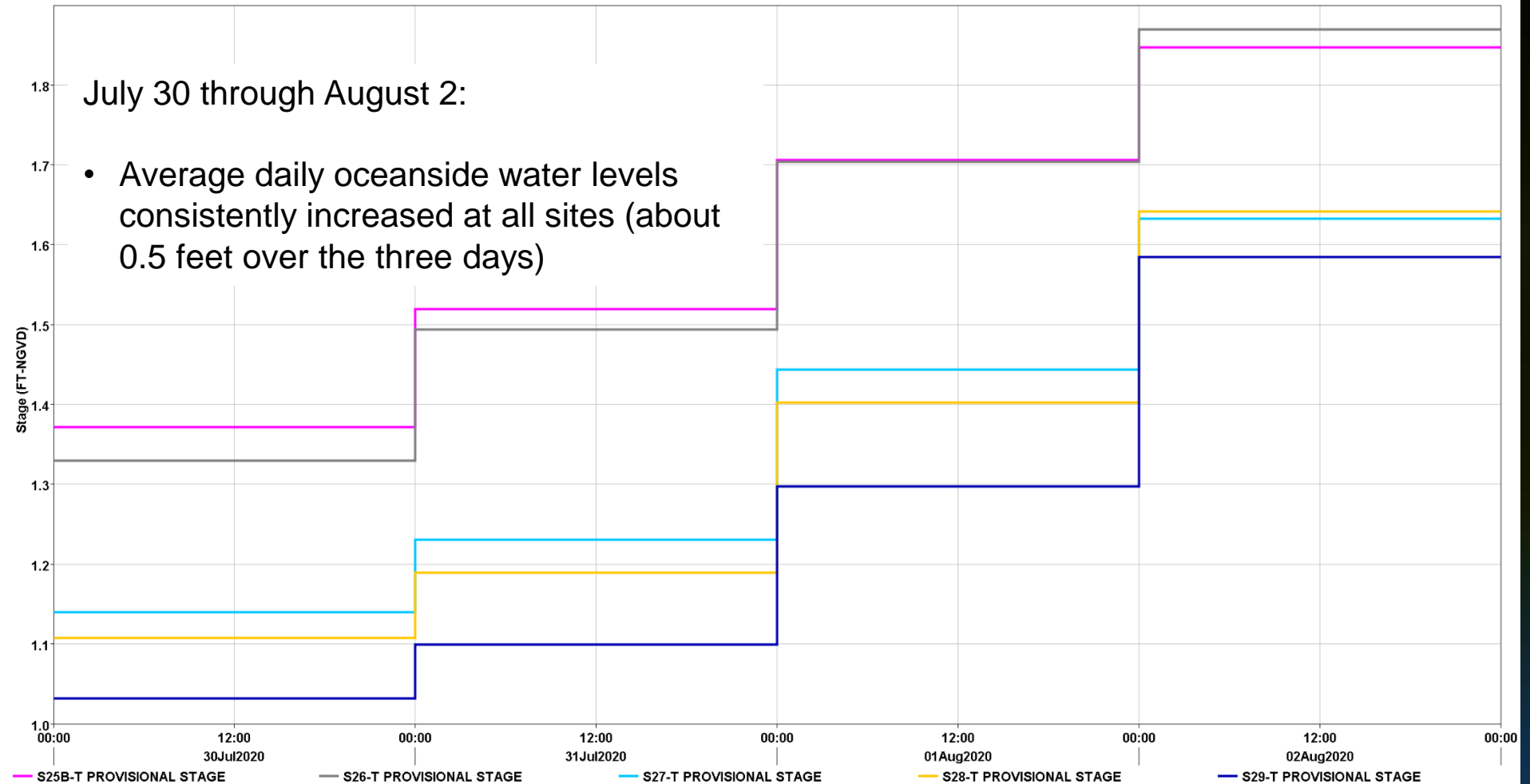
S27 (Gravity) Average Daily Stage



Average Daily Landside Water Levels



Average Daily Oceanside Water Levels





C-11 East

Tailwater Elevations

* Temporary Pump at S13 was utilized 11/13 through 12/1

Headwater Elevations

S13 Pump

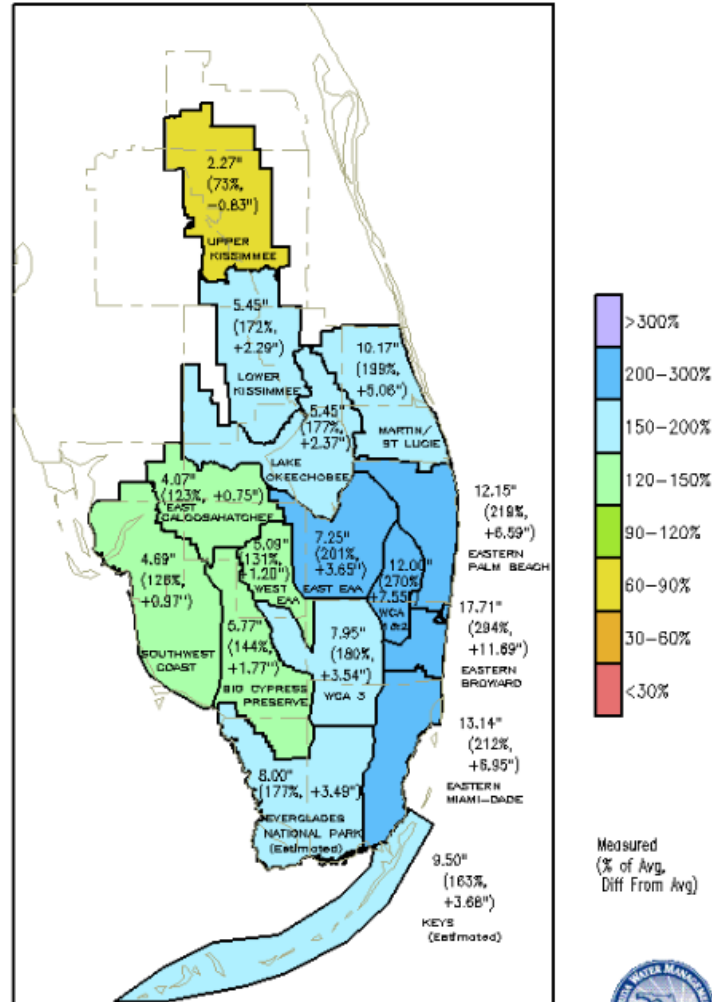
S13 Gravity

S13 Temporary Pump

Dec 2020

Antecedent Rainfall Conditions

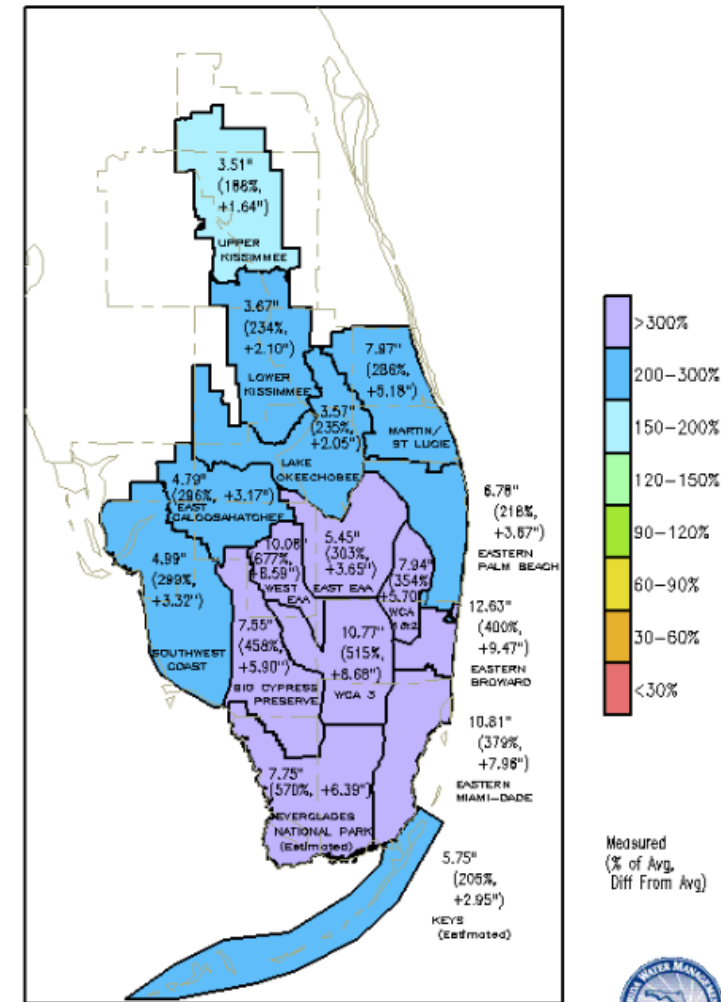
SFWMD Rainfall
02-Oct-2020 to 01-Nov-2020



DISTRICT-WIDE: 7.01" (174%, +2.98")



SFWMD Rainfall
02-Nov-2020 to 01-Dec-2020

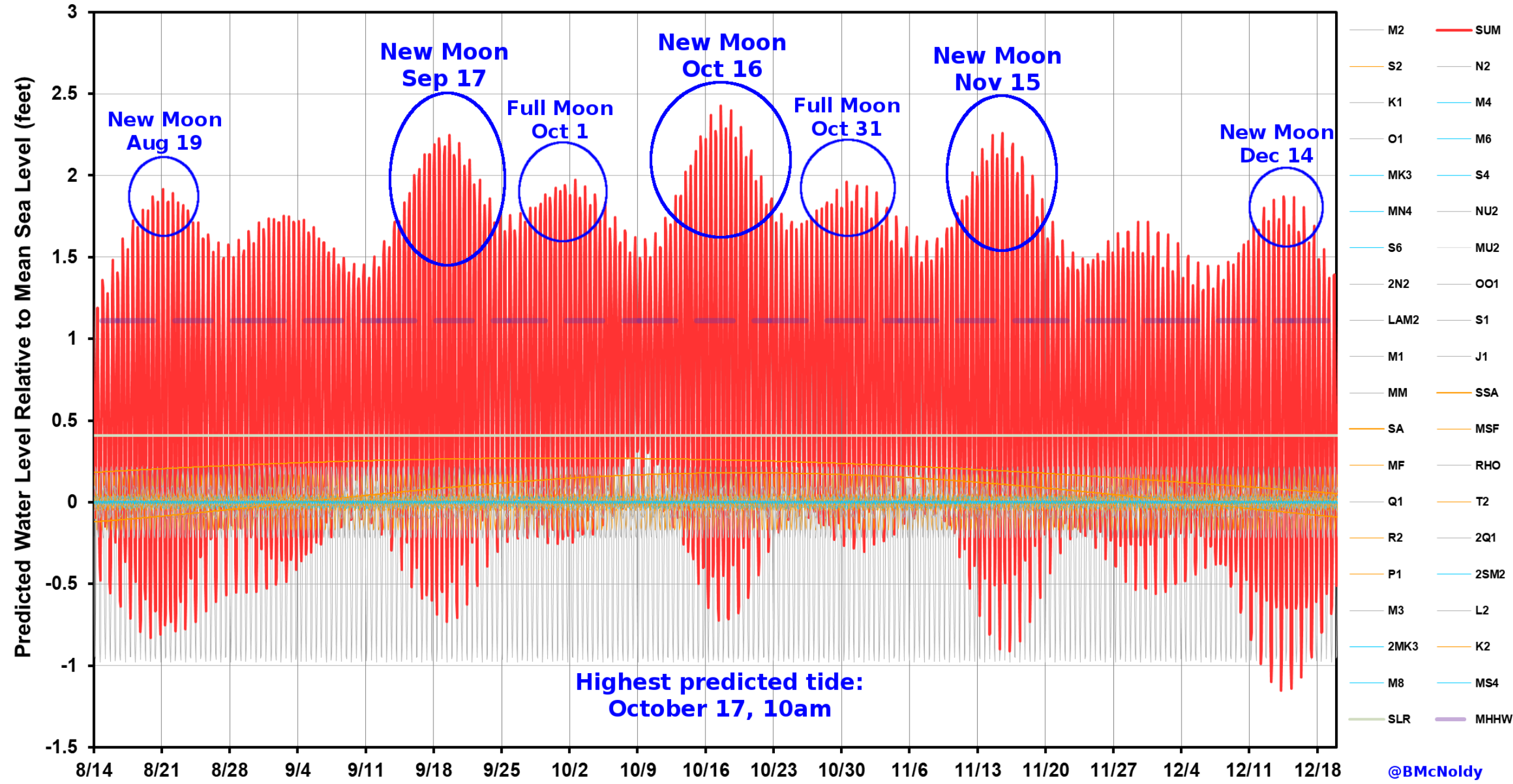


DISTRICT-WIDE: 6.39" (321%, +4.40")



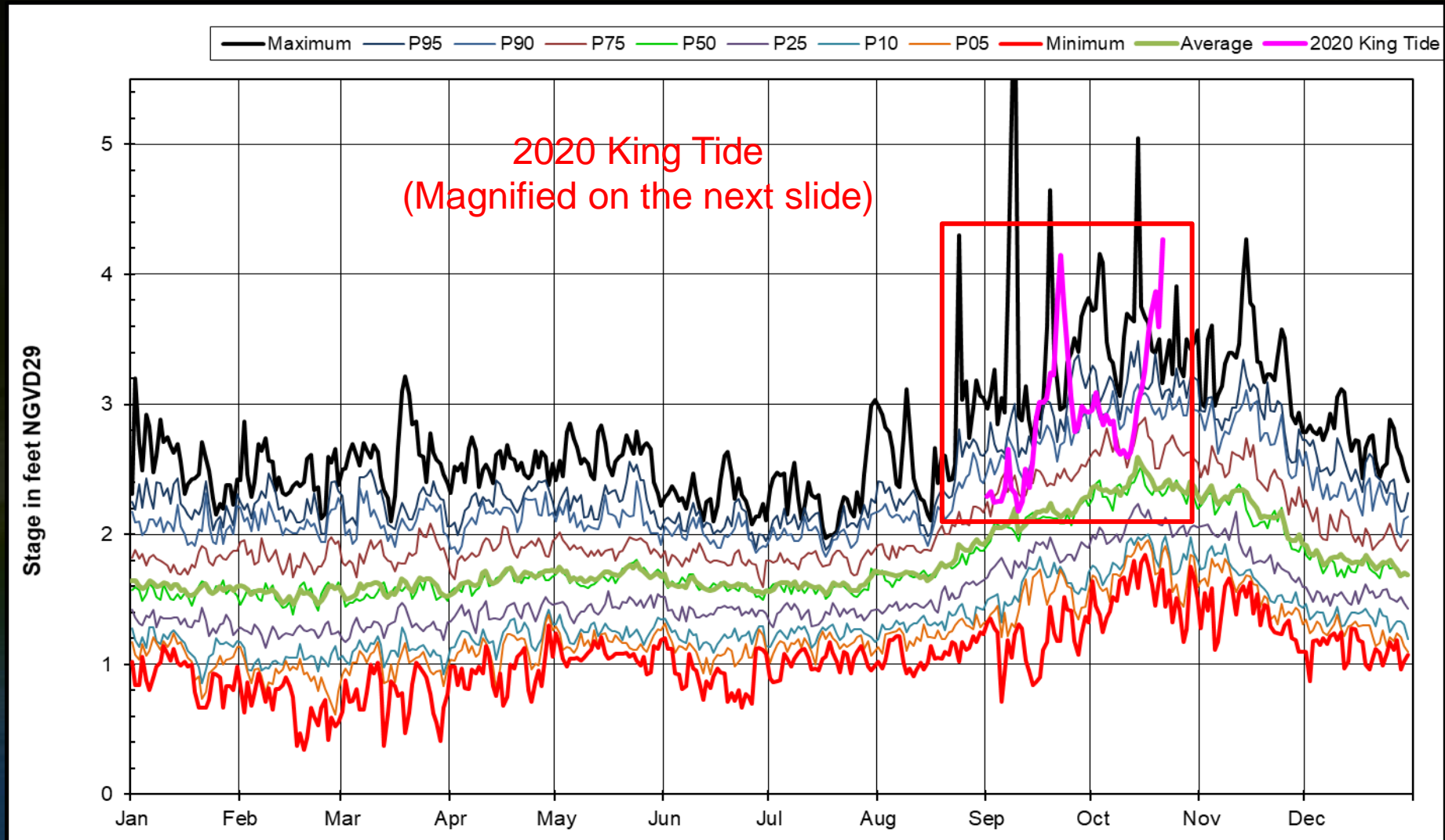
Hourly Water Level Predictions at Virginia Key, FL for 2020

(includes contributions from the standard 37 harmonic constituents + SLR)



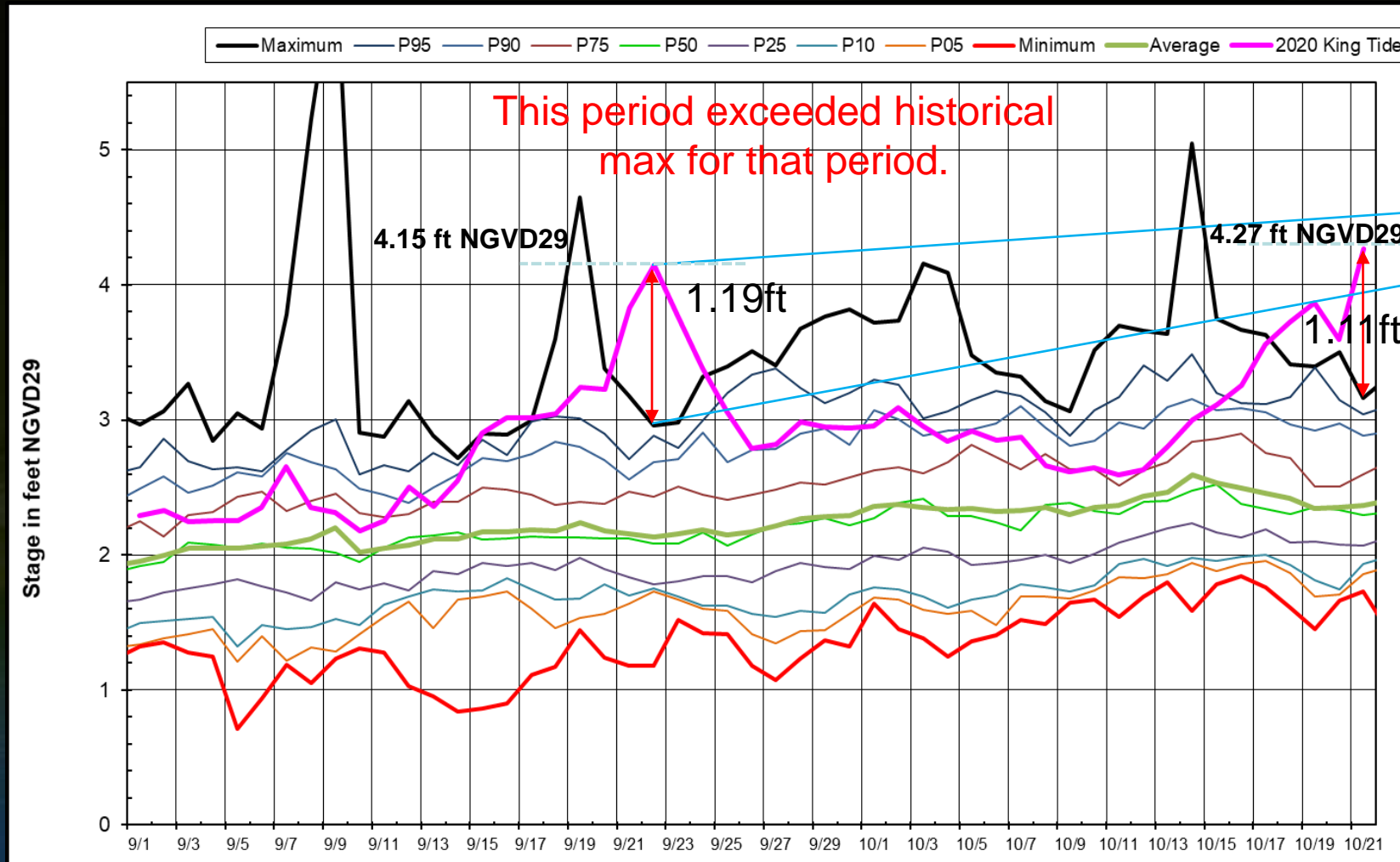
Cyclic Analysis of Maximum Daily TW stages

(Jan 1, 1986 – Dec 31, 2019) at S-20F



Cyclic Analysis of Maximum Daily TW stages

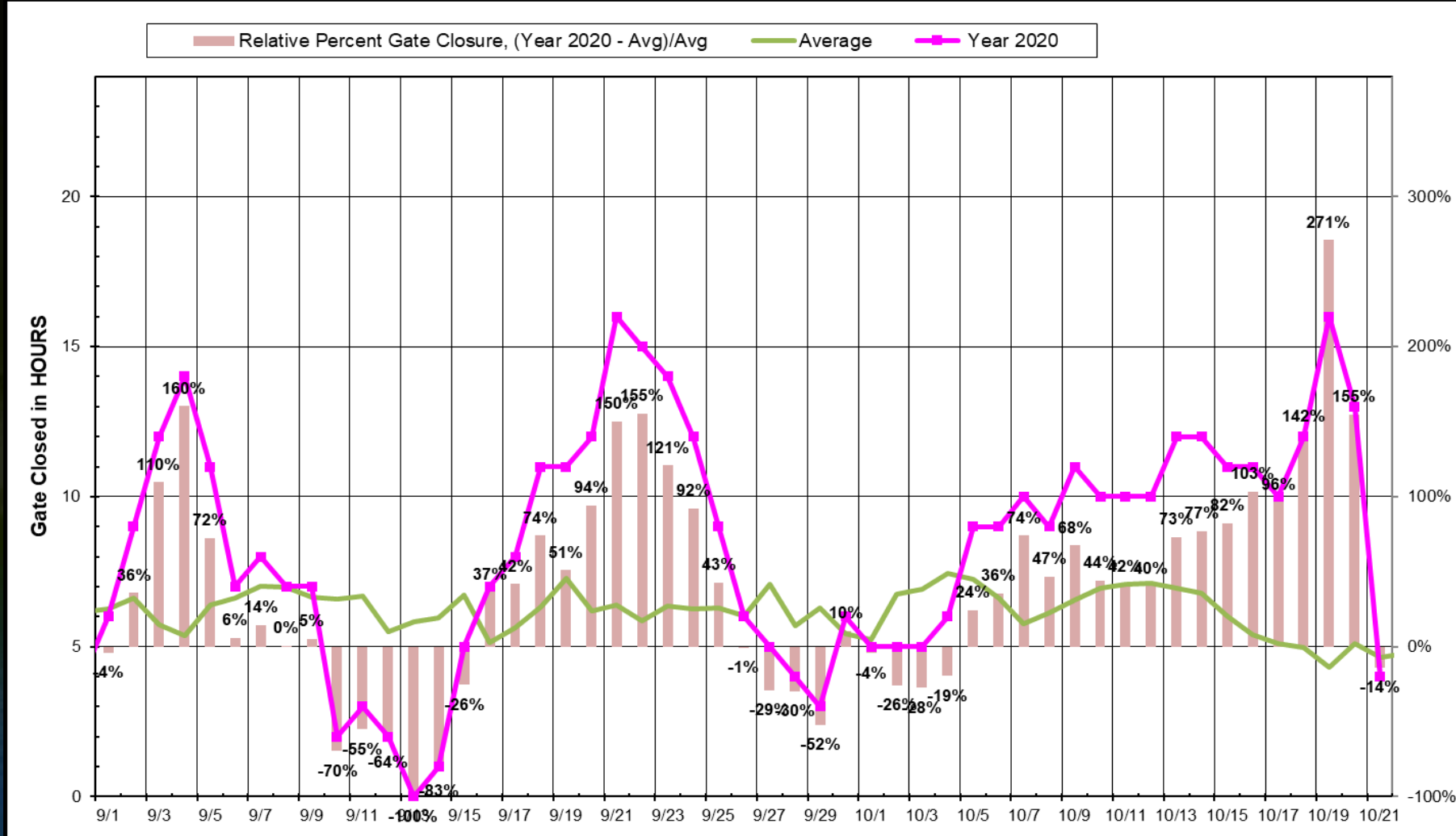
(Jan 1, 1986 – Dec 31, 2019) at S-20F



Date	09/22
2020 King Tide	4.15
Average	2.13
Maximum	2.96
Minimum	1.18
P100	2.96
P99	2.95
P98	2.95
P95	2.88
P90	2.69
P75	2.43
P50	2.08
P25	1.78
P10	1.76
P05	1.73
P00	1.18

Relative Percent Gate Closure

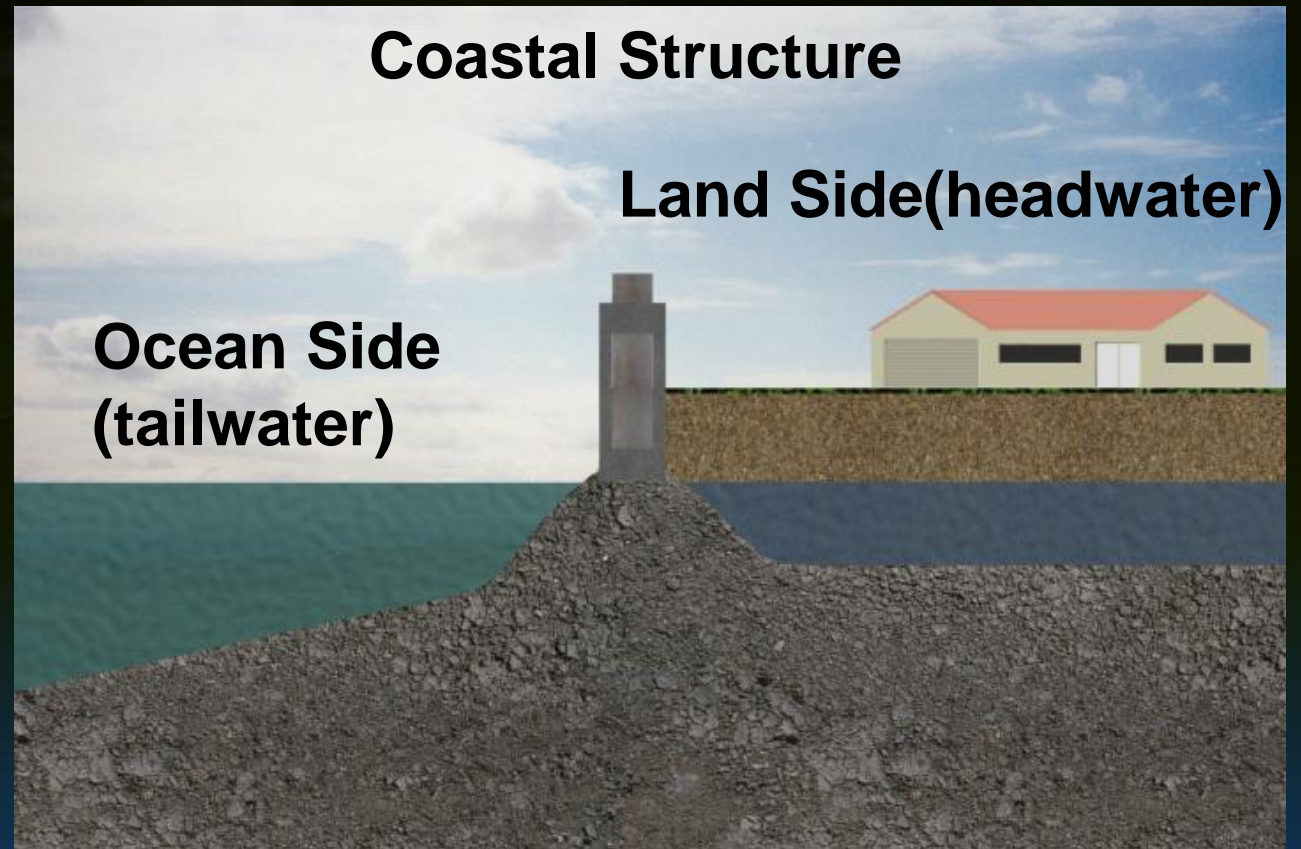
(Year 2020 – Avg)/Avg at S20F , when S-20F HW > 1.7 ft NVGD29



Impacts of Sea Level Rise Already Being Observed



October 2019: Gates closed, high tide water reverse flowing over the top



Resiliency among District Priority Actions

EXPANDING MONITORING AND DATA ANALYSIS

ADVANCING FUTURE CONDITIONS ASSESSMENTS

HARDENING FLOOD PROTECTION INFRASTRUCTURE

INVESTING IN ALTERNATIVE WATER SUPPLY SOURCES

RESTORING NATURAL SYSTEMS

PROMOTING STAKEHOLDER ENGAGEMENT AND OUTREACH



Resiliency Issues on the Horizon

- There is a problem and there are opportunities
- It will take time and money to solve
- Collaboration is key: solutions span multiple boundaries
- SFWMD is strongly committed to address sea level and other changing climate impacts



Photo by Paul Krashefski

Carolina Maran, Ph.D., P.E.,

cmaran@sfwmd.gov

District Resiliency Officer

South Florida Water Management District

www.sfwmd.gov/resiliency

Thanks!

Discussions?