LAKE OKEECHOBEE SYSTEM OPERATING MANUAL (LOSOM)

COMMITTEE ON INDEPENDENT SCIENTIFIC REVIEW OF EVERGLADES RESTORATION PROGRESS

February 4, 2020
Fort Myers

U.S. Army Corps of Engineers
Jacksonville District

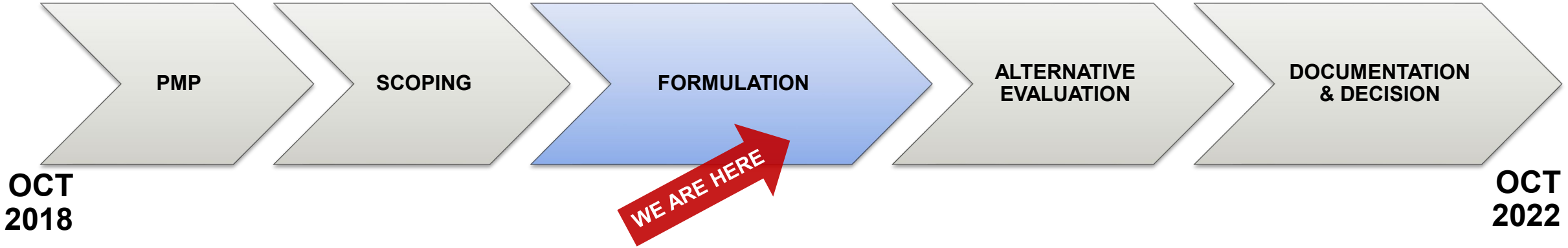
US Army Corps of Engineers®

DISCUSSION TOPICS

- RECAP OBJECTIVES AND PROJECT CONSTRAINTS THAT LOSOM MUST WORK WITHIN. IMPLICATIONS OF THOSE CONSTRAINTS ON MOVING MORE WATER SOUTH.
  - CAN THE LOSOM ACCOMMODATE NEW INFRASTRUCTURE COMING ON LINE, OR WILL A NEW LAKE SCHEDULE BE REQUIRED FOR C-43, C-44?
- DISCUSSION OF PLANNING PROGRESS. WHAT SCENARIOS ARE BEING CONSIDERED AND ANALYZED? PRELIMINARY RESULTS OF SCENARIO ANALYSES.
  - HAVE ANY DECISIONS BEEN MADE/PROPOSED REGARDING HOLDING MORE WATER IN THE LAKE?
- DISCUSSION OF SOME ISSUES RAISED IN GRAHAM ET AL., 2020 REPORT AND CAPACITY TO INCORPORATE IN CURRENT LOSOM PROCESS

SCHEDULE OVERVIEW

LOSOM SCHEDULE



MILESTONE	DATE
Scoping Meetings (complete)	February - March 2019
Identify Initial Array of Alternatives & Evaluation Methodology (Increment 1)	May 2020
Alternative Evaluation Increment I, Increment II	May 2020 – April 2021
Draft Report Release	January 2022
Final Report Release	July 2022
Record of Decision (ROD)	October 2022

90 DAY LOOK AHEAD

FEB 2020

- PDT Meeting (February 27 Web meeting)
- Begin Development of Operational Alternatives
- Development of Evaluation Process and Metrics
- Preliminary Model Assumptions for Existing and No Action Alternatives

MAR 2020

- PDT Meeting (March 31 Okeechobee)
- Continue Development of Evaluation Process and Metrics
- Continue Development of Operational Alternatives
- Draft Model Assumptions for Existing and No Action Alternative

APR 2020

- PDT Meeting (April 23 web meeting)
- Draft Evaluation Process and Metrics
- Draft Alternative Array
- Finalize Model Assumptions for Existing and No Action Alternative

PLANNING FRAMEWORK

GOAL OF LOSOM

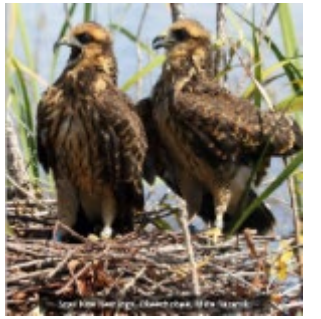
Incorporate flexibility in Lake Okeechobee operations while balancing congressionally authorized project purposes.

Flood Control

Water Supply

Navigation

Recreation



Preservation of Fish & Wildlife

OBJECTIVES

- Continue to meet authorized purposes for navigation, recreation and flood control
- Enhance ecology in Lake Okeechobee, northern estuaries and across the south Florida system.
- Improve water supply performance
- Manage risk to public health and safety, life and property

CONSTRAINTS

- Herbert Hoover Dike (Dam Safety Risk)

- Comply with all Applicable Federal Laws including, but not limited to:
  - Public Law 100-228 regarding Seminole water rights compact
  - Endangered Species Act (ESA)

- Design and operational capacity of major outlets and their downstream canals and the Okeechobee Waterway (OWW)
  - However, no new infrastructure will be authorized by LOSOM

WATER QUALITY CONSIDERATIONS

- Affected areas:
  - Inflows to Lake Okeechobee
  - Within Lake Okeechobee
  - St. Lucie River and Estuary
  - Caloosahatchee River and Estuary
  - Everglades Protection Area

- Harmful Algal Blooms (HABs)
- Stormwater Treatment Area Capacity

WATER SUPPLY CONSIDERATIONS

- Tribal water rights
- State's water supply authority
- Agricultural needs
- Everglades National Park
- Municipal and industrial needs
- Saltwater intrusion

ENVIRONMENTAL CONSIDERATIONS

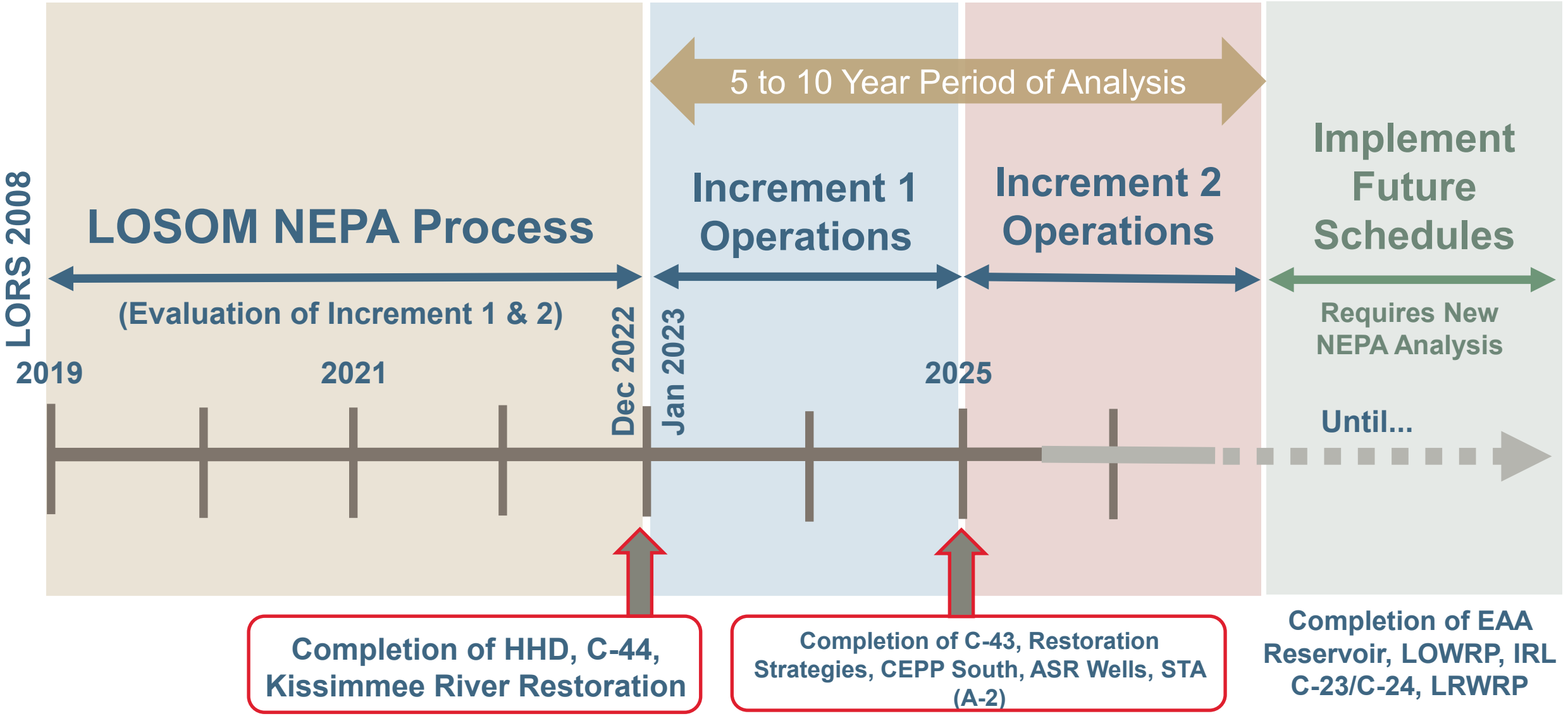
- Affected ecosystems:
  - Lake Okeechobee
  - St. Lucie River and Estuary
  - Caloosahatchee River and Estuary
  - Everglades National Park
  - Loxahatchee River
  - Florida Bay
  - Indian River Lagoon
  - Biscayne Bay
  - Lake Worth Lagoon
  - Nearshore and Offshore Resources on the East and West Coast
  - National Wildlife Refuges throughout South Florida

OTHER CONSIDERATIONS

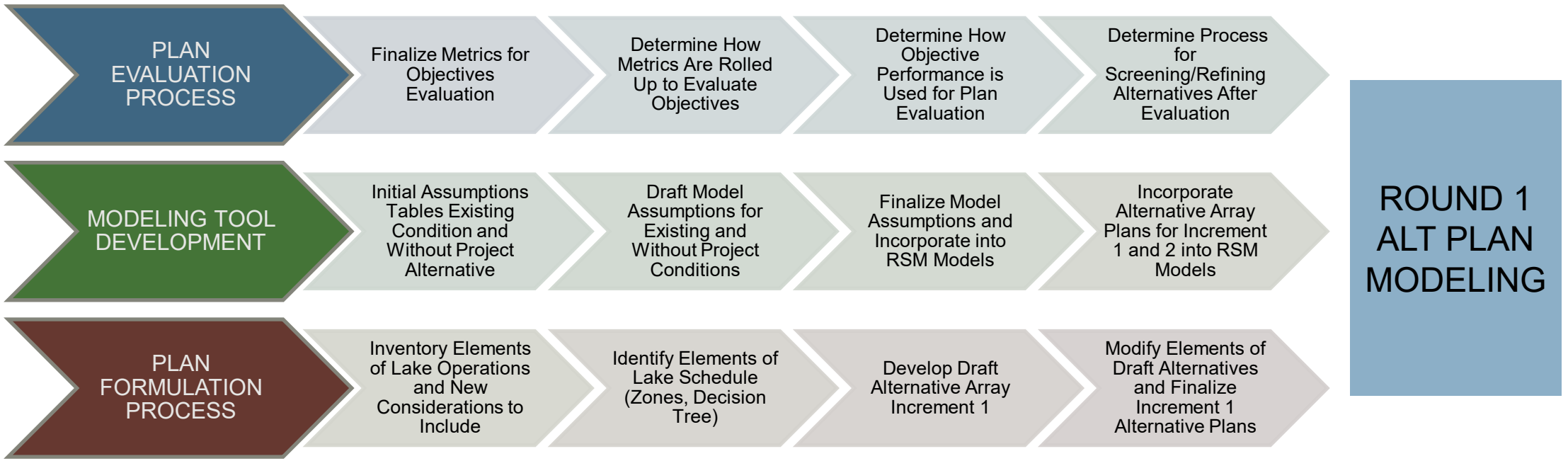
- Cultural Resources
- Economic impacts across the system
- Downstream stages in:
  - Water Conservation Areas (WCAs)
  - Wildlife Management Areas (WMAs)
  - Reservoirs
- Climate Change

FORMULATION PROCESSES

LOSOM INCREMENTS



EFFORTS TO ALTERNATIVE MODELING



SENSITIVITY RUNS

SENSITIVITY RUNS

WHAT?

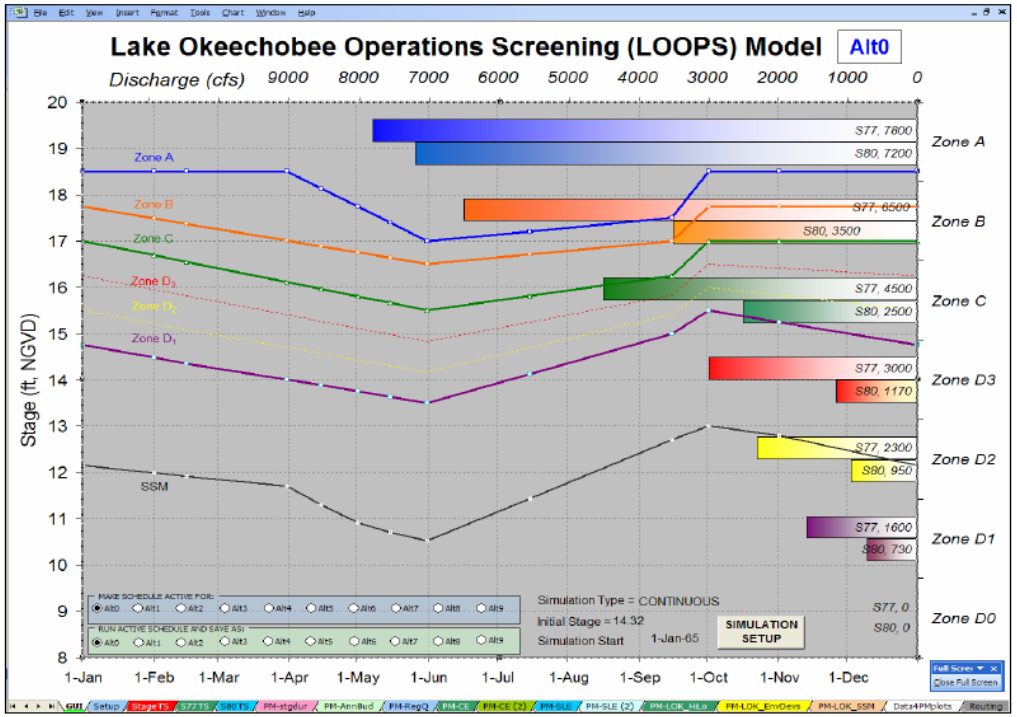
- Simplified models and data processing techniques to analyze a broad range of options and to identify ideas that warrant further in-depth analysis.
- Sensitivity runs are NOT alternatives and are not designed to result in a balance between the multiple project purposes.

WHY?

- Use simulation modeling to test effects from specific changes to Lake O operations.
- Gather information that can be used in development of alternatives.
- Evaluate stakeholder concepts generated during the NEPA scoping process.

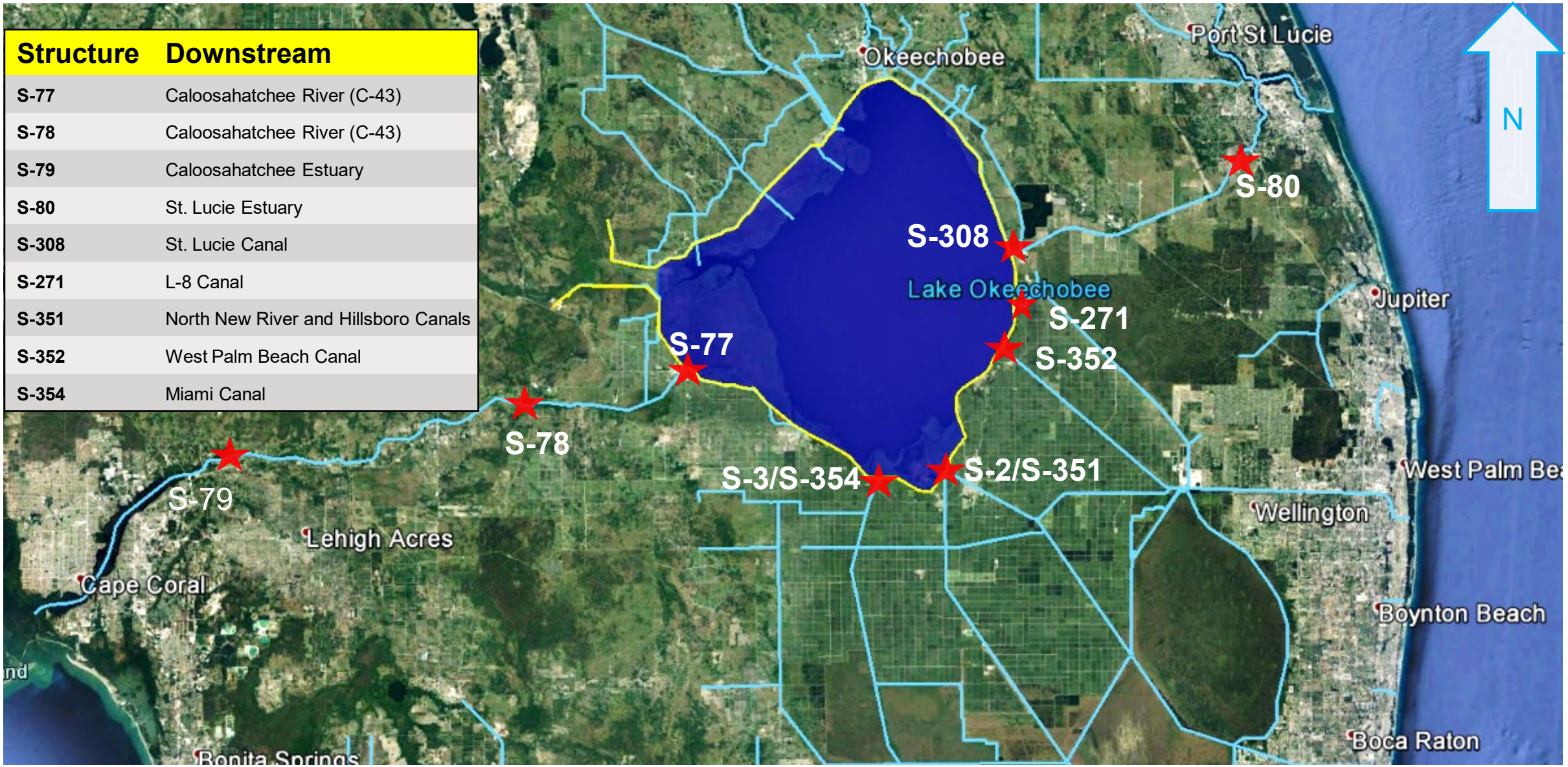
LAKE OKEECHOBEE OPERATIONS SCREENING (LOOPS) MODEL

- LOOPS is a hydrologic routing screening model that simulates Lake Okeechobee stages and discharges through the primary outlets as prescribed by a user-defined regulation schedule.
- Contains batch-processing algorithms to allow for rapid testing of multiple Lake Okeechobee schedules.
- LOOPS does not simulate project storage features in the south Florida system.
- Performs 46-year continuous simulation (daily time-step) of the hydrology and operations of the water management system. POR=1965-2012.



STRUCTURES CURRENTLY USED TO REGULATE LAKE OKEECHOBEE

Structure	Downstream
S-77	Caloosahatchee River (C-43)
S-78	Caloosahatchee River (C-43)
S-79	Caloosahatchee Estuary
S-80	St. Lucie Estuary
S-308	St. Lucie Canal
S-271	L-8 Canal
S-351	North New River and Hillsboro Canals
S-352	West Palm Beach Canal
S-354	Miami Canal



ROUND 1 SENSITIVITY RUNS

Run #	Title	Description
Run 0	LORS08	LORS08: Preliminary Existing Condition Baseline
Run 1	NoS308	S-308 closed for regulatory releases, C-44 basin backflow, and C-44 basin water supply
Run 2	10.5-6/1	Modify LORS08 to target stage of 10.5 feet NGVD on May 31st
Run 3	S77cap	Limit S-77 regulatory release to not exceed 1250 cfs at S-79 when C-43 runoff < 1250 cfs
Run 4	LOStgEnv	Modify LORS08 to use Stage Envelope bounds as operating bands
Run 5	RgSo240	Modify LOSRS08 to allow additional regulatory release to WCAs
Run 6	LOSA1:10	Raise LORS08 bands by 1.42 ft to achieve no more than 5 of 45 water years with cutbacks > 100kaf

ROUND 2 SENSITIVITY RUNS

Run #	Title	Description
Run 0	LORS08	LORS08: Preliminary Existing Condition Baseline
Run 1	5%CB	Reduce LOWSM cutbacks to 5% for Phases 1-4 to achieve 1:10 cutback frequency (yrs>100kaf)
Run 2A	11.5-6/1	Modify LORS08 to target stage of 11.5 feet NGVD on May 31st
Run 4A	S77<2k	Limit S77 RegQ to not exceed 2000 cfs at S79 when C43 runoff < 2000 cfs
Run 4B	S77<2.8k	Limit S77 RegQ to not exceed 2800 cfs at S79 when C43 runoff < 2800 cfs

ROUND 2 SENSITIVITY RUNS

Run #	Title	Description
Run 5	NoL8reg	No Lake O regulatory releases to L-8 Canal via C10A. C10A open for water supply and backflow as needed.
Run 6	NoS308rg	No Lake O regulatory release from S308. S308 opens for water supply releases and backflow as needed.
Run 3	S79-457	Use Lake O to supplement C43 runoff to always deliver at least 457 cfs. No S308 Reg Discharge.
Run 10	&LOMFL	S79-457 run with raised LORS bands to recover LORS08 Lake O MFL performance.

LOOPS SENSITIVITY ANALYSIS PMs

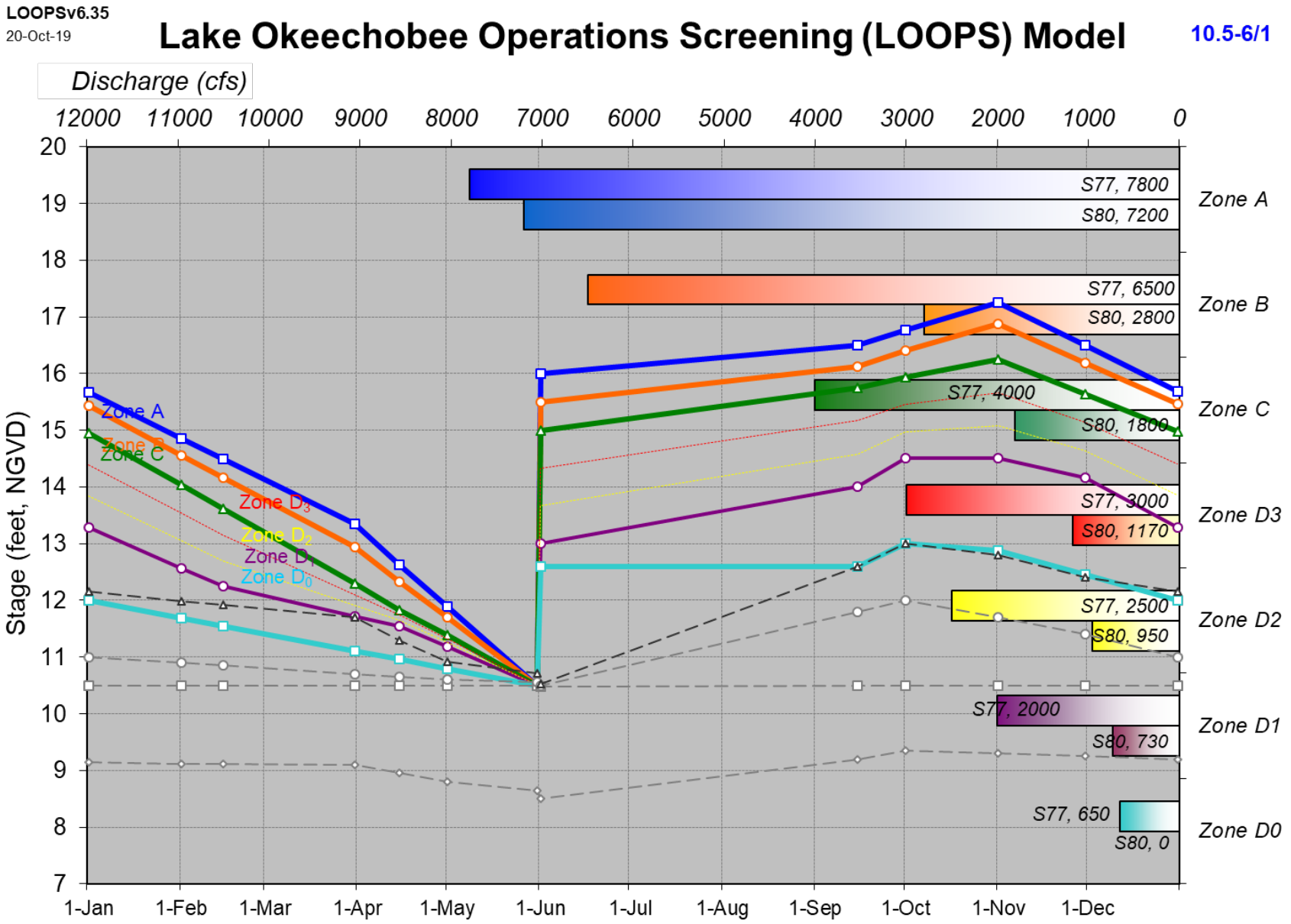
1.	Mean Annual Regulatory Release Volumes South, East & West
2.	Lake O Stage Duration Curves
3.	Percent of time Lake O stage exceeds specified thresholds
4.	Lake O Stage Envelope Standard Scores
5.	Lake O % of Time Stage was below, inside, & above Stage Envelope
6.	Lake O % of Time Stage was below, inside, & above Stage Envelope for May-Aug
7.	Lake O Minimum Flow & Level (MFL) Rule Exceedance Events
8.	Caloosahatchee Estuary High Release Months
9.	Caloosahatchee Estuary Flow Distribution
10.	Caloosahatchee Estuary: S79 Flow Table
11.	St. Lucie Estuary High Release Months

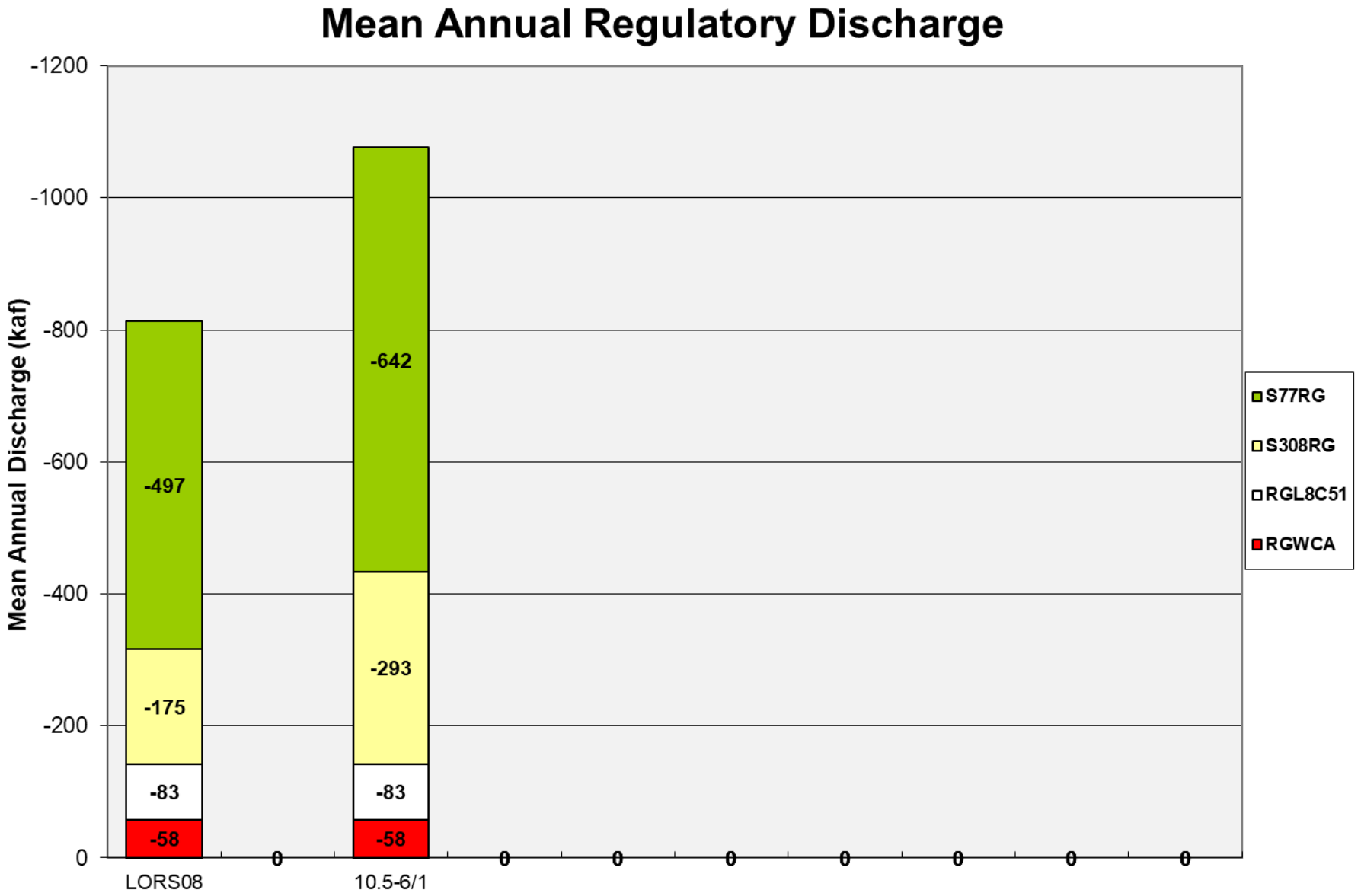
LOOPS SENSITIVITY ANALYSIS PMs

12.	St. Lucie Estuary Flow Distribution
13.	St. Lucie Estuary: SLE Flow Table
14.	Lake O Service Area (LOSA) - Frequency & Duration of Water Shortages
15.	Lake O Service Area (LOSA) - Water Shortage Volumes in Drought Years
16.	Lake O Regulatory Releases to WCAs
17.	Lake O Regulatory Releases South
18.	Lake O Regulatory Releases to Caloosahatchee Estuary via S-77
19.	S-79 Releases to Caloosahatchee Estuary
20.	Lake O Regulatory Release to St. Lucie Estuary via S-308
21.	Releases to St. Lucie Estuary from Lake O and basin runoff

ROUND 1 SENSITIVITY ANALYSIS RESULTS

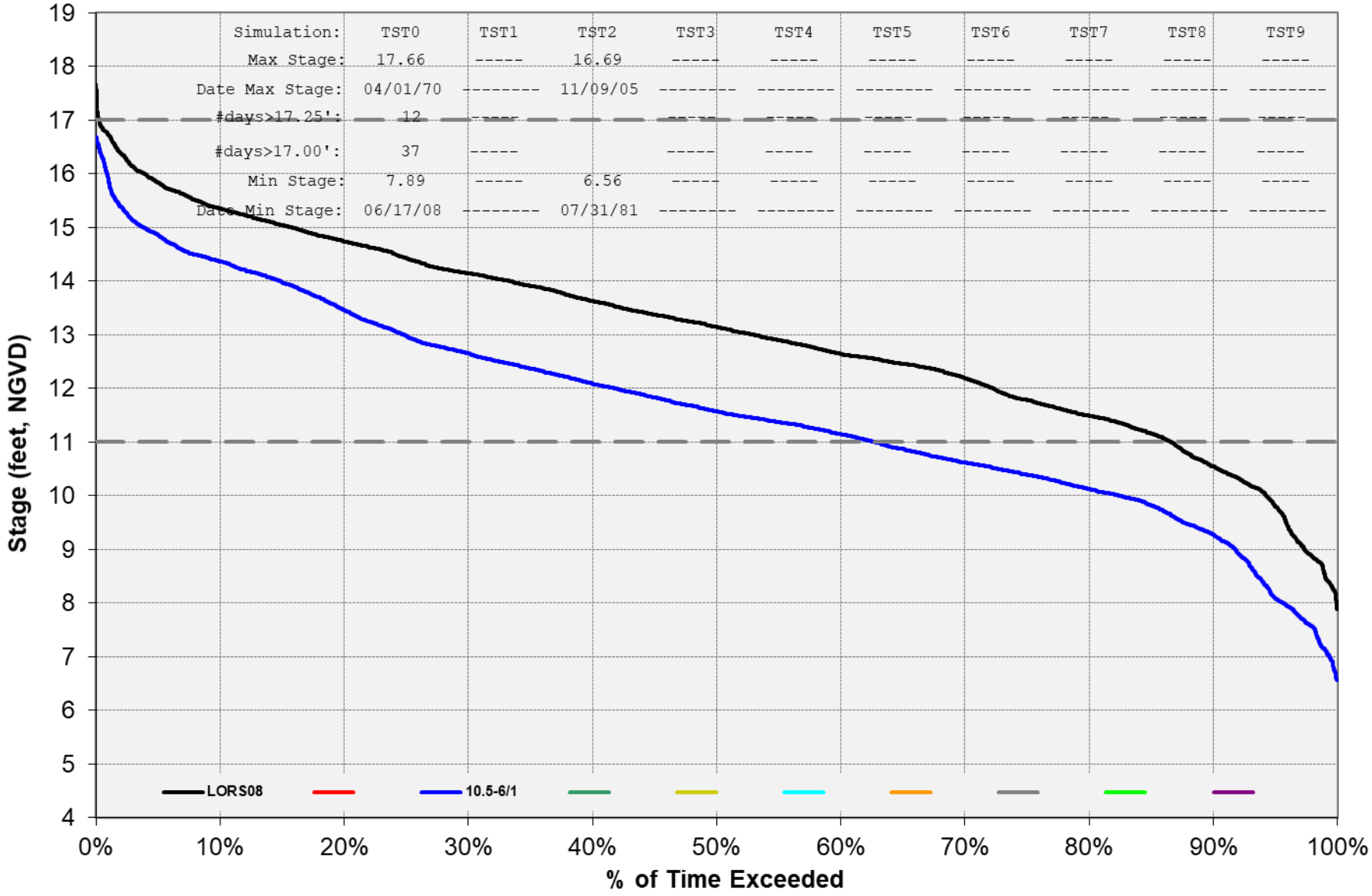
RUN 2: 10.5-6/1


LOOPSv6.35
20-Oct-19
Lake Okeechobee Operations Screening (LOOPS) Model
10.5-6/1
Discharge (cfs)
12000 11000 10000 9000 8000 7000 6000 5000 4000 3000 2000 1000 0
Stage (feet, NGVD)
20 19 18 17 16 15 14 13 12 11 10 9 8 7
1-Jan 1-Feb 1-Mar 1-Apr 1-May 1-Jun 1-Jul 1-Aug 1-Sep 1-Oct 1-Nov 1-Dec
S77, 7800
S80, 7200
Zone A
S77, 6500
S80, 2800
Zone B
S77, 4000
S80, 1800
Zone C
S77, 3000
S80, 1170
Zone D3
S77, 2500
S80, 950
Zone D2
S77, 2000
S80, 730
Zone D1
S77, 650
S80, 0
Zone D0
Zone A
Zone B
Zone C
Zone D3
Zone D2
Zone D1
Zone D0


Mean Annual Regulatory Discharge
Mean Annual Discharge (kaf)
-1200
-1000
-800
-600
-400
-200
0
-497
-175
-83
-58
-642
-293
-83
-58
0
0
0
0
0
0
0
0
LORS08
10.5-6/1
S77RG
S308RG
RGL8C51
RGWCA

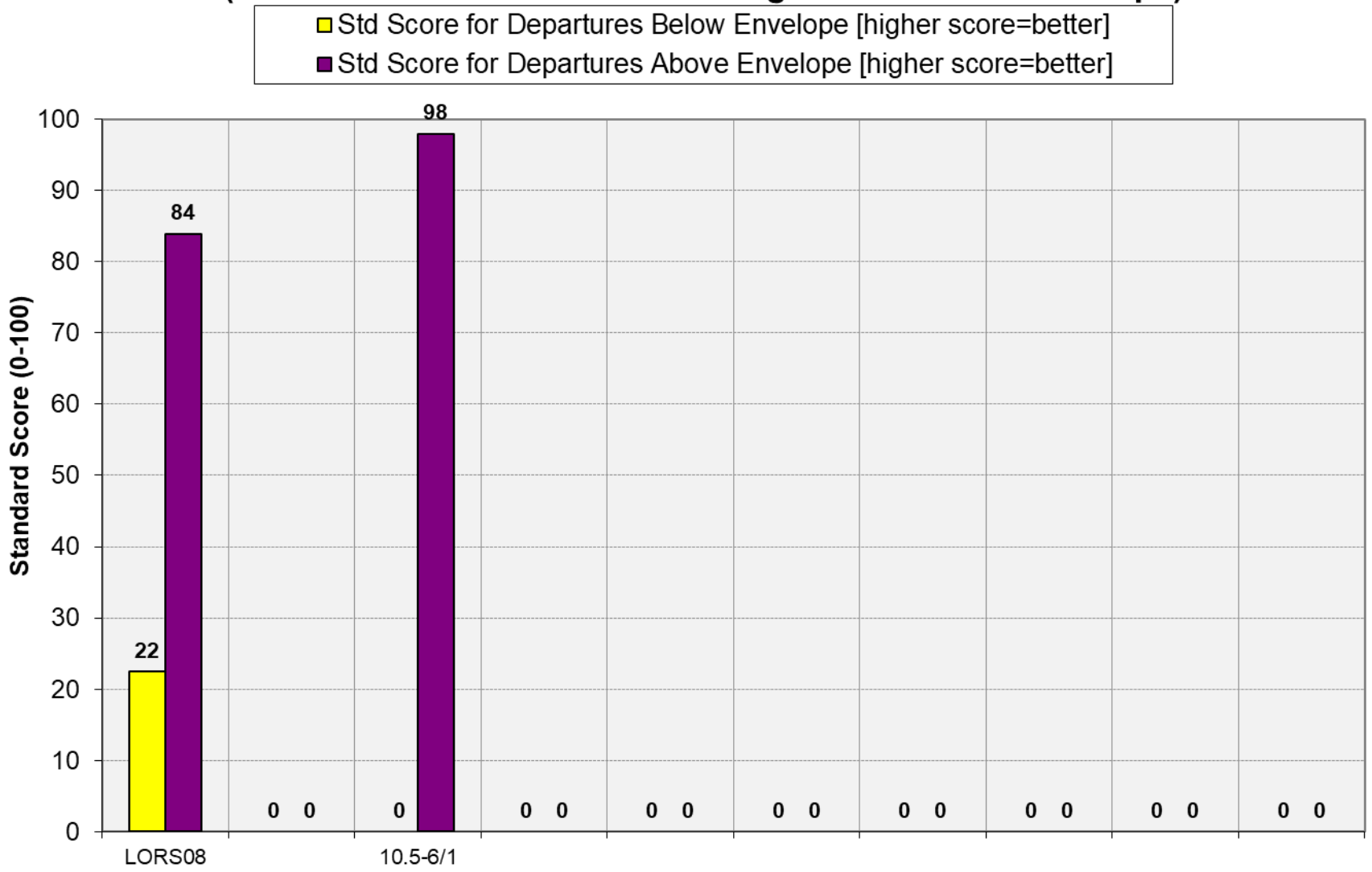
RUN 2: 10.5-6/1

Lake Okeechobee Stage Duration Curves



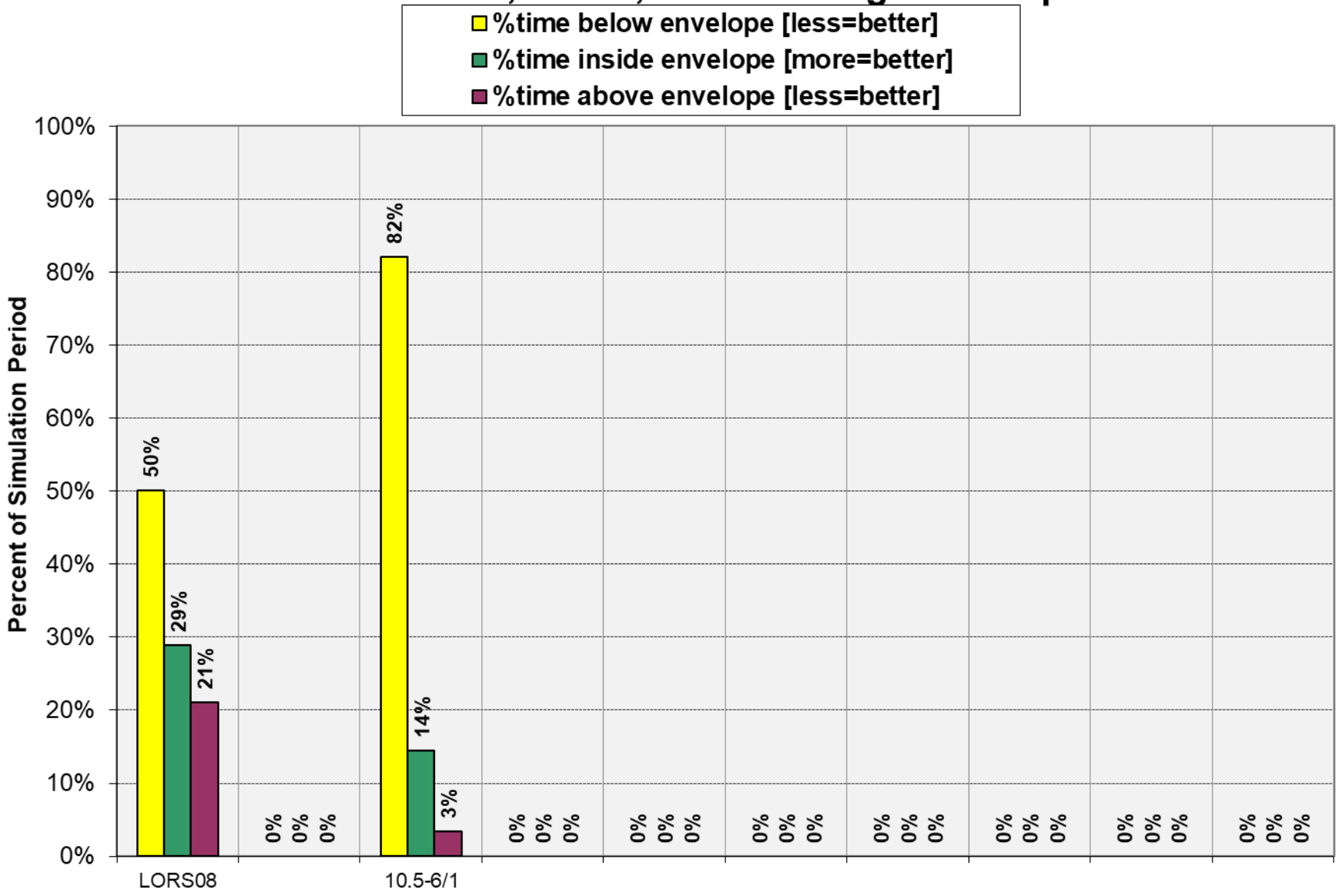
RUN 2: 10.5-6/1

Lake Okeechobee Stage Envelope Standard Scores
(Goal is to minimize times the stage falls outside envelope)



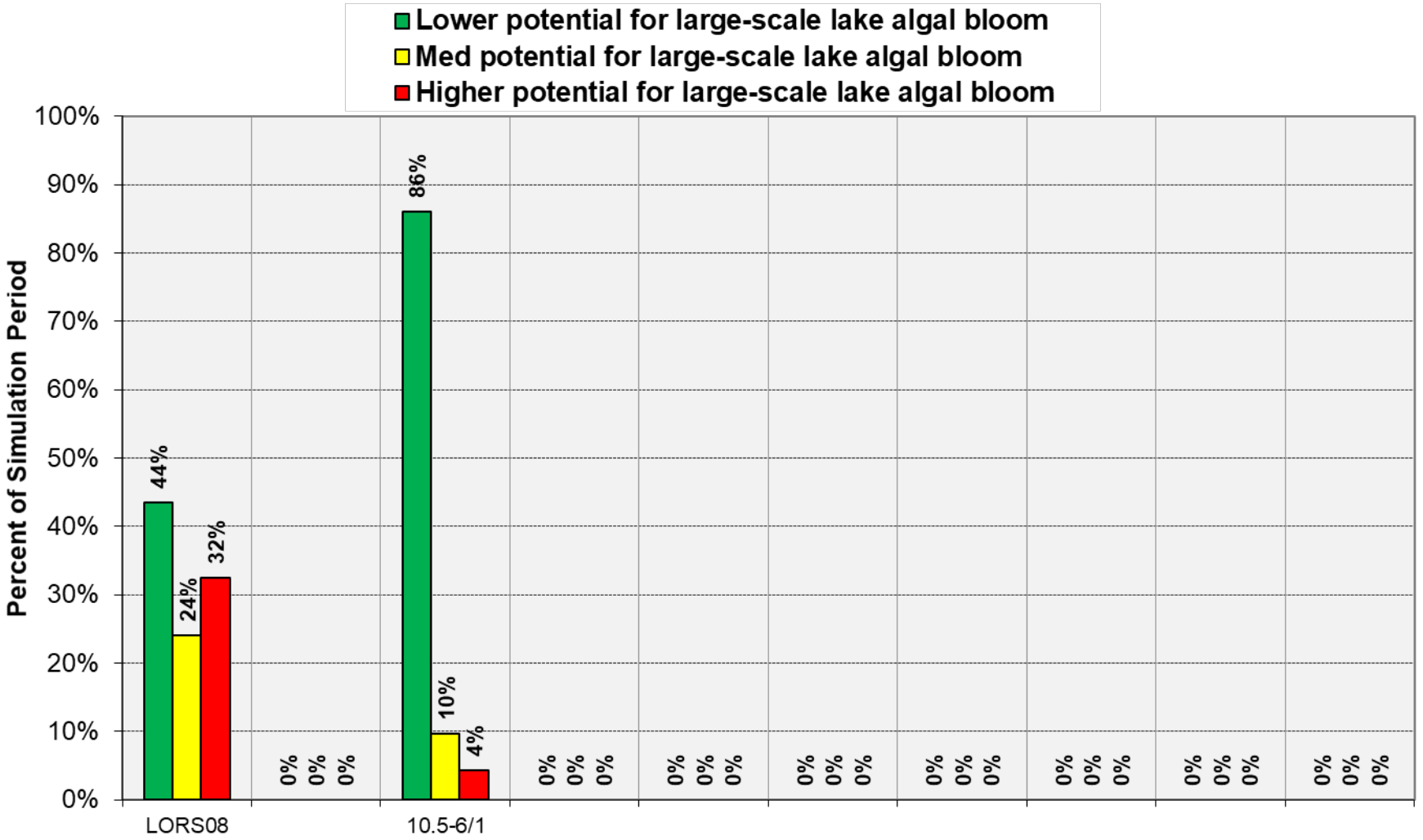
RUN 2: 10.5-6/1

Percent of Time Simulated Lake Okeechobee Stage was below, inside, & above Stage Envelope



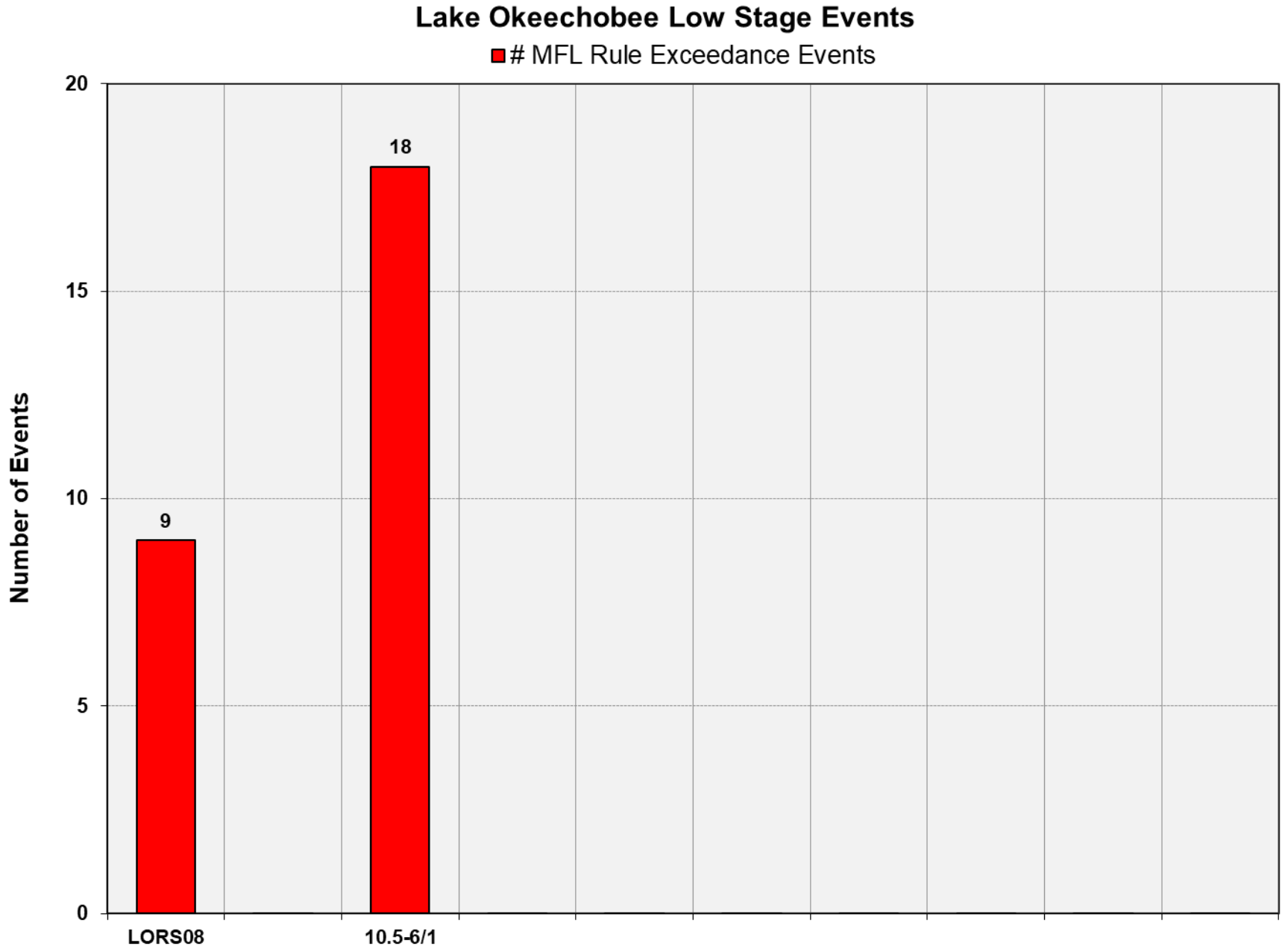
RUN 2: 10.5-6/1

Potential* for Large-scale Algal Blooms on Lake Okeechobee Based on Percent of Time Simulated Stage was Below, Inside, & Above Stage Envelope from May-Aug

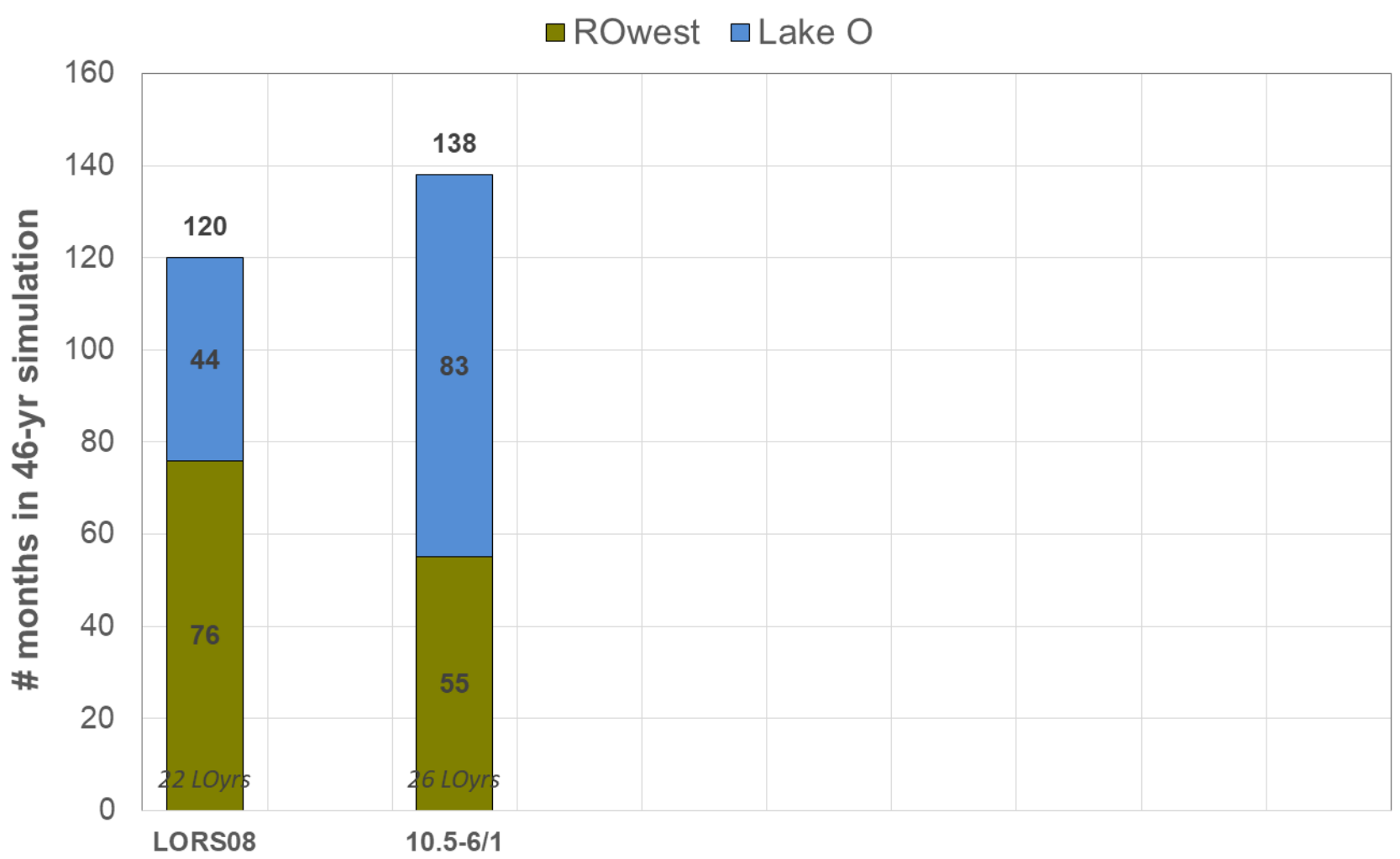


* Summer lake stage affects lateral movement of turbid lake-water into nearshore zones, in turn affecting nutrient concentrations, light penetration, plant and algal growth in areas of the lake where blooms originate.

RUN 2: 10.5-6/1


Lake Okeechobee Low Stage Events
MFL Rule Exceedance Events
Number of Events
20
15
10
5
0
18
9
LORS08
10.5-6/1

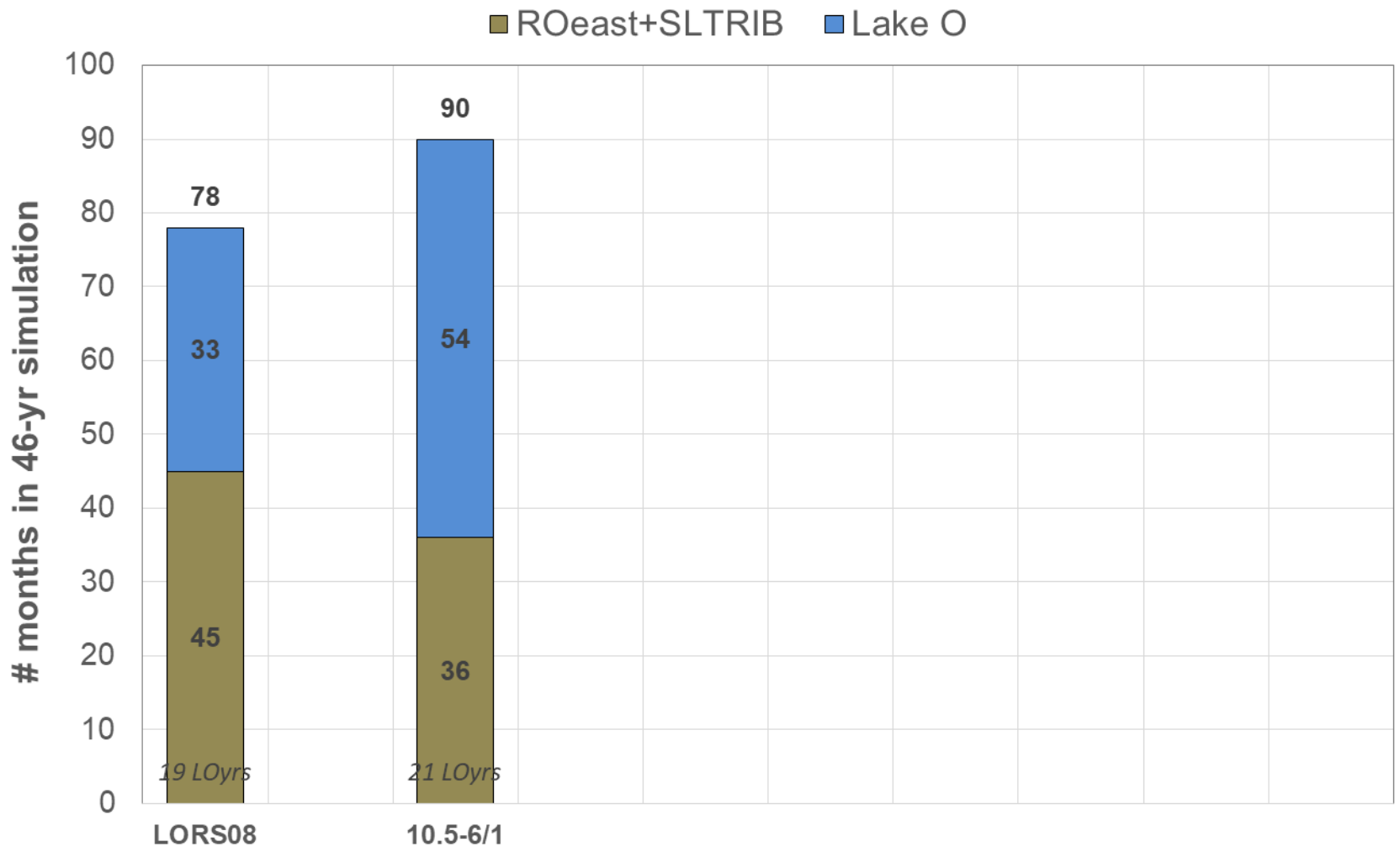
RUN 2: 10.5-6/1



Note: Runoff is counted as the reason for exceedance if it exceeds the threshold; otherwise, Lake O is counted as the reason for exceedance if Runoff + Lake discharge exceeds the threshold.

RUN 2: 10.5-6/1

St. Lucie Estuary High Discharge Months (>2000 cfs) Triggered by Runoff and Lake O Discharge



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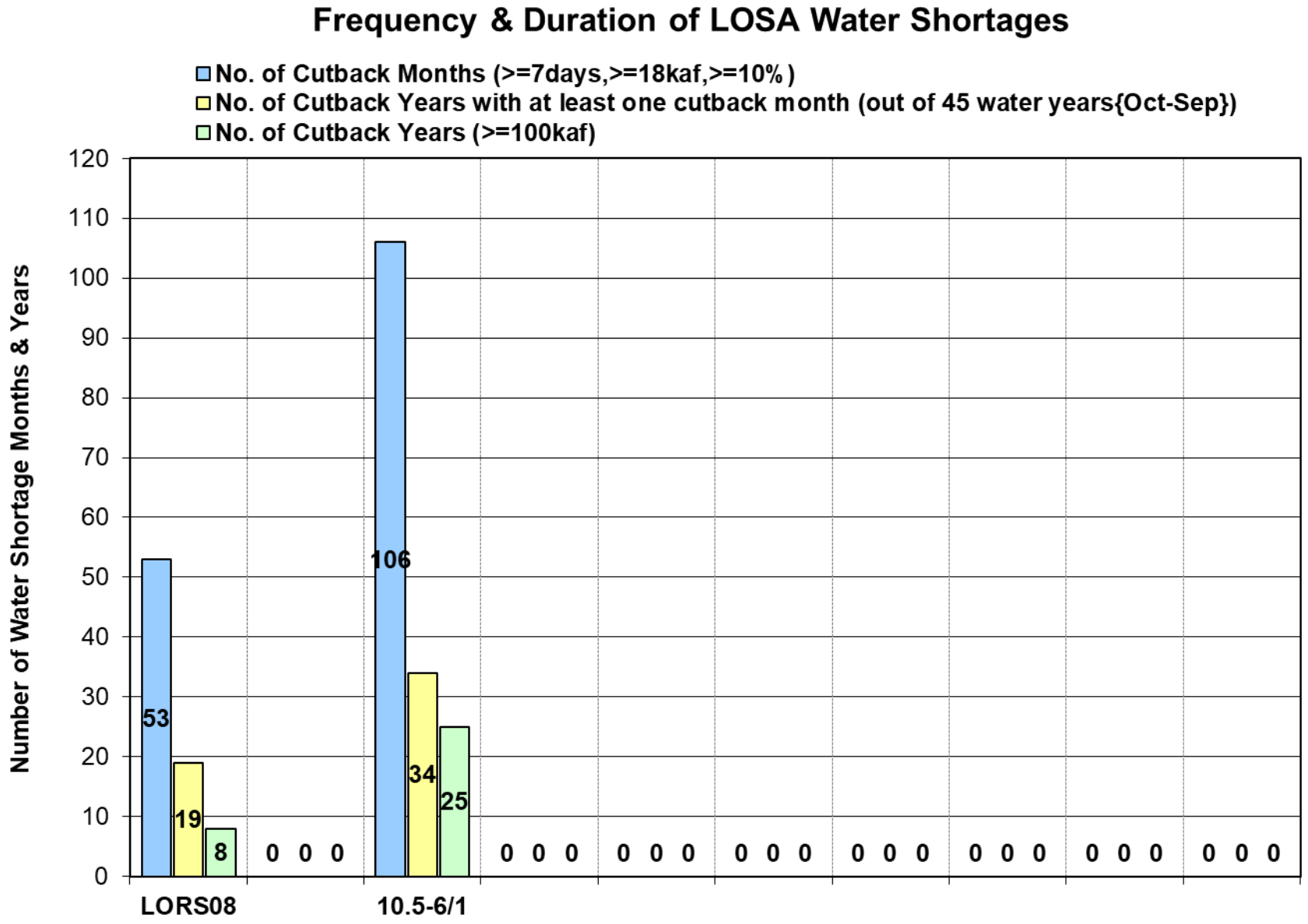
RUN 2: 10.5-6/1


Frequency & Duration of LOSA Water Shortages
No. of Cutback Months (>=7days,>=18kaf,>=10%)
No. of Cutback Years with at least one cutback month (out of 45 water years{Oct-Sep})
No. of Cutback Years (>=100kaf)
Number of Water Shortage Months & Years
120
110
100
90
80
70
60
50
40
30
20
10
0
53
19
8
0 0 0
106
34
25
0 0 0
0 0 0
0 0 0
0 0 0
0 0 0
0 0 0
0 0 0
LORS08
10.5-6/1

RUN 2: 10.5-6/1

UF IWR RECOMMENDATIONS

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Currently reviewing recommendations to determine:

- What we can incorporate into the LOSOM process
  - May include recommendations for tools to use in analysis, ideas to consider for inclusion in operational plans, or ideas for adaptive management or to inform future operational decisions
- What we can support and help coordinate for future efforts
  - May include development of tools or collection of data that fall outside of LOSOM timeframe but would be useful for future water resource planning
- What is purview of other partner agencies
  - Items that fall outside Corps authority

DISCUSSION