Summary of Additional Analyses for Stakeholders

Adaptive Protocols for Lake Okeechobee Operations

Informal Stakeholder Meeting

25-May-2010

West Palm Beach, Florida

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Chief Engineer, Operations Department

Additional Analyses for Stakeholders

- New performance measures
  - Frequency of Lake O Service Area water shortages
  - Frequency of Caloosahatchee Estuary high salinity events
- Performance Trade-off Plots (using new PMs)
- Summary of Sensitivity Analysis of the "Low Chance" parameter (using new PMs)
- Summary statistics for AP5 flowchart outcomes

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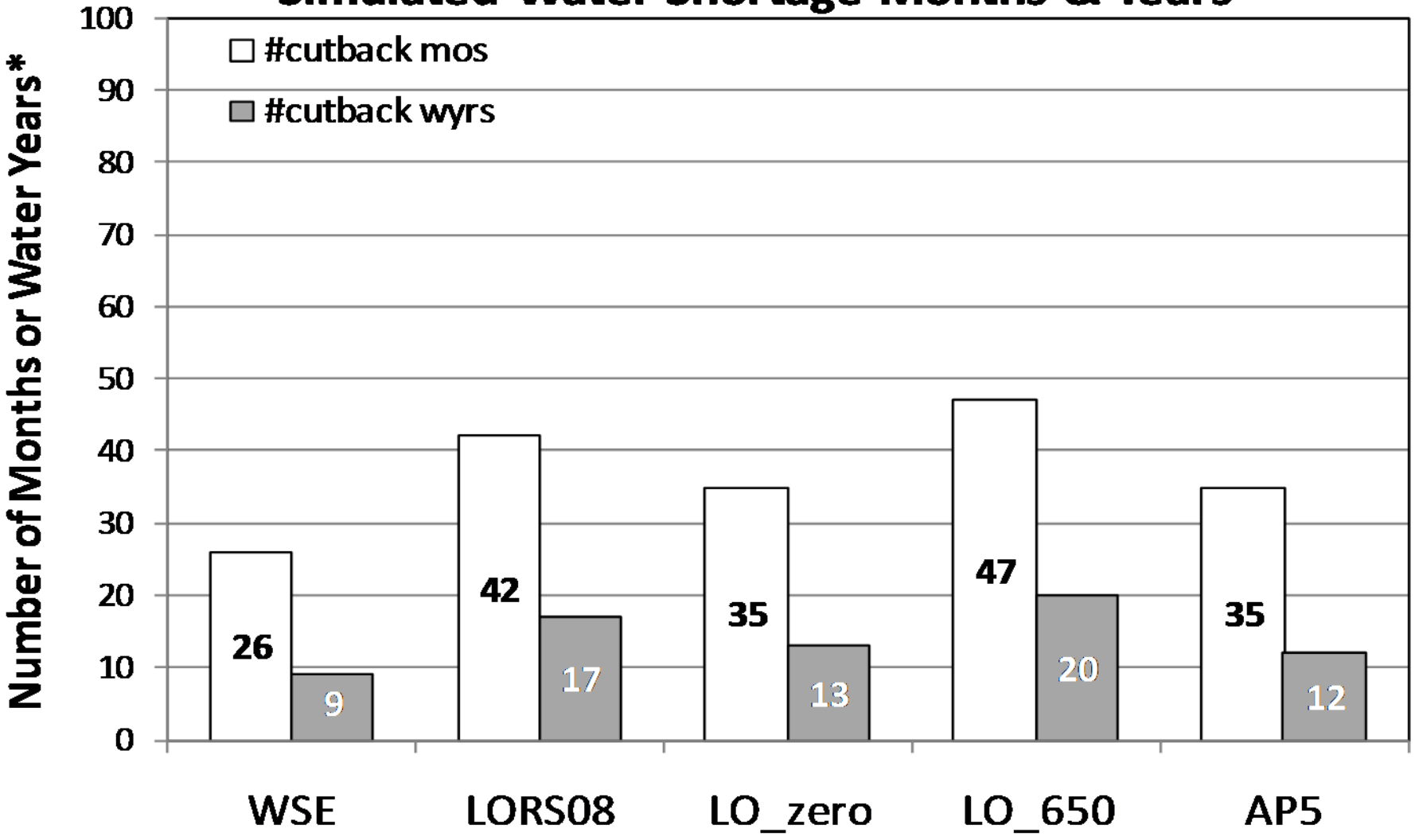
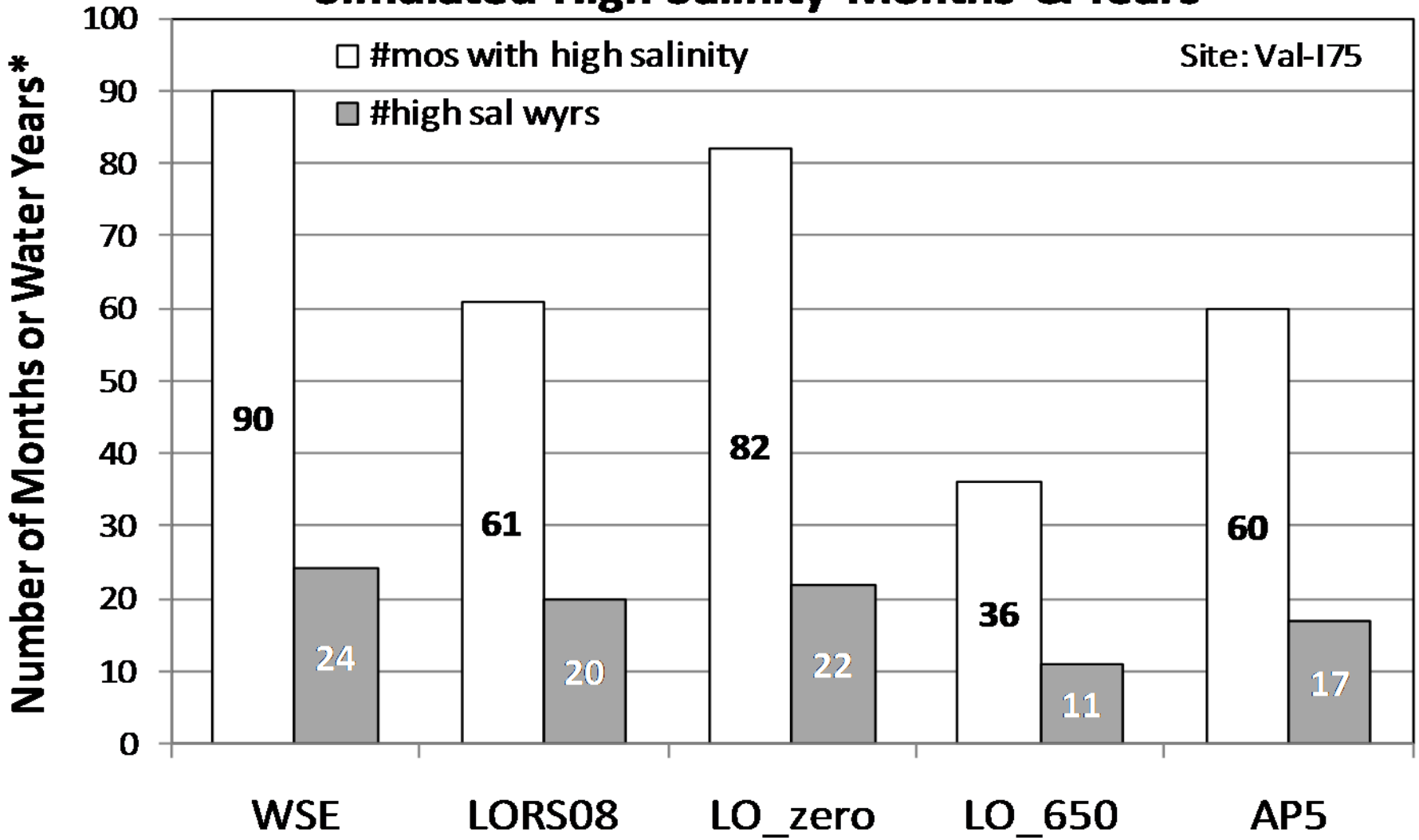
Lake Okeechobee Service Area
Simulated Water Shortage Months & Years



A cutback month has: (1) duration ≥ 7days, (2) cutback ≥ 18,000 af, cutback/demand ≥ 10%
A cutback water year is a water year (Oct-Sep) with at least one cutback month
*LOOPS Model (daily time-step) simulation period: 492 months, 41 calendar yrs, (40 water yrs)

Caloosahatchee Estuary
Simulated High Salinity Months & Years



A high salinity event is: 30-day moving average salinity > 10 psu for duration ≥ 7days

The #months with high salinity = (#days 30-day moving avg salinity > 10 psu) /30.4

A high salinity water year is a water year (Oct-Sep) with at least one high salinity event

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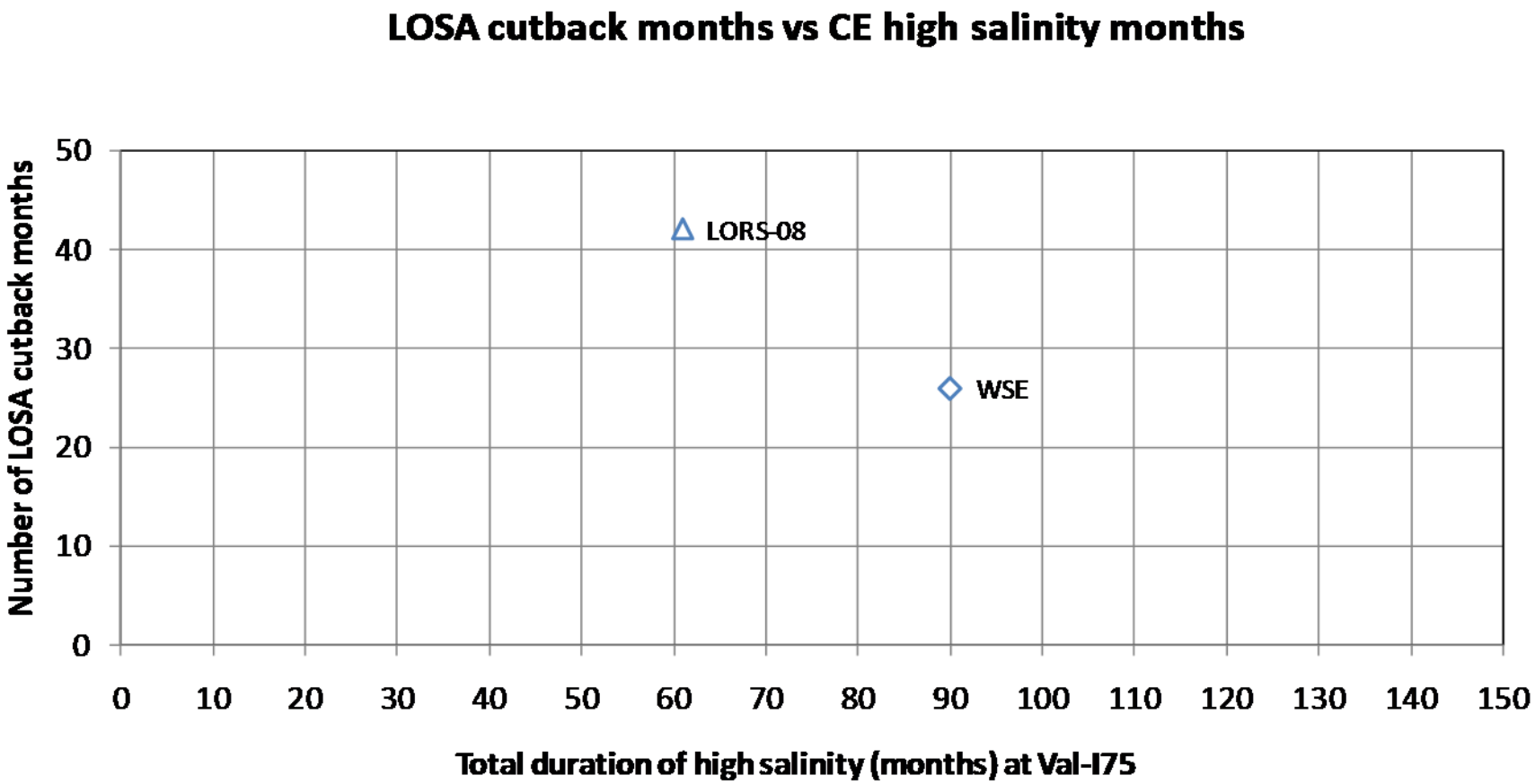
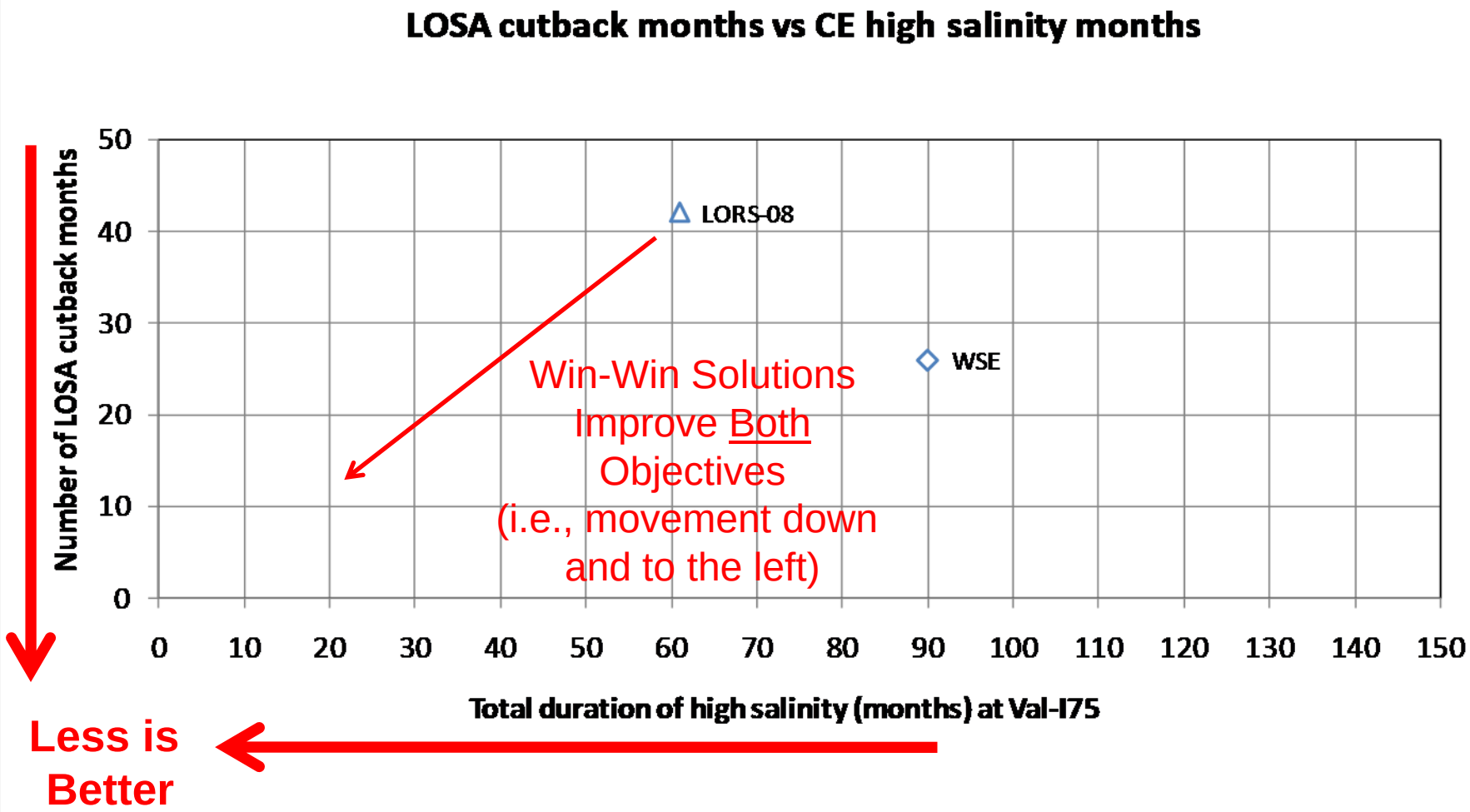
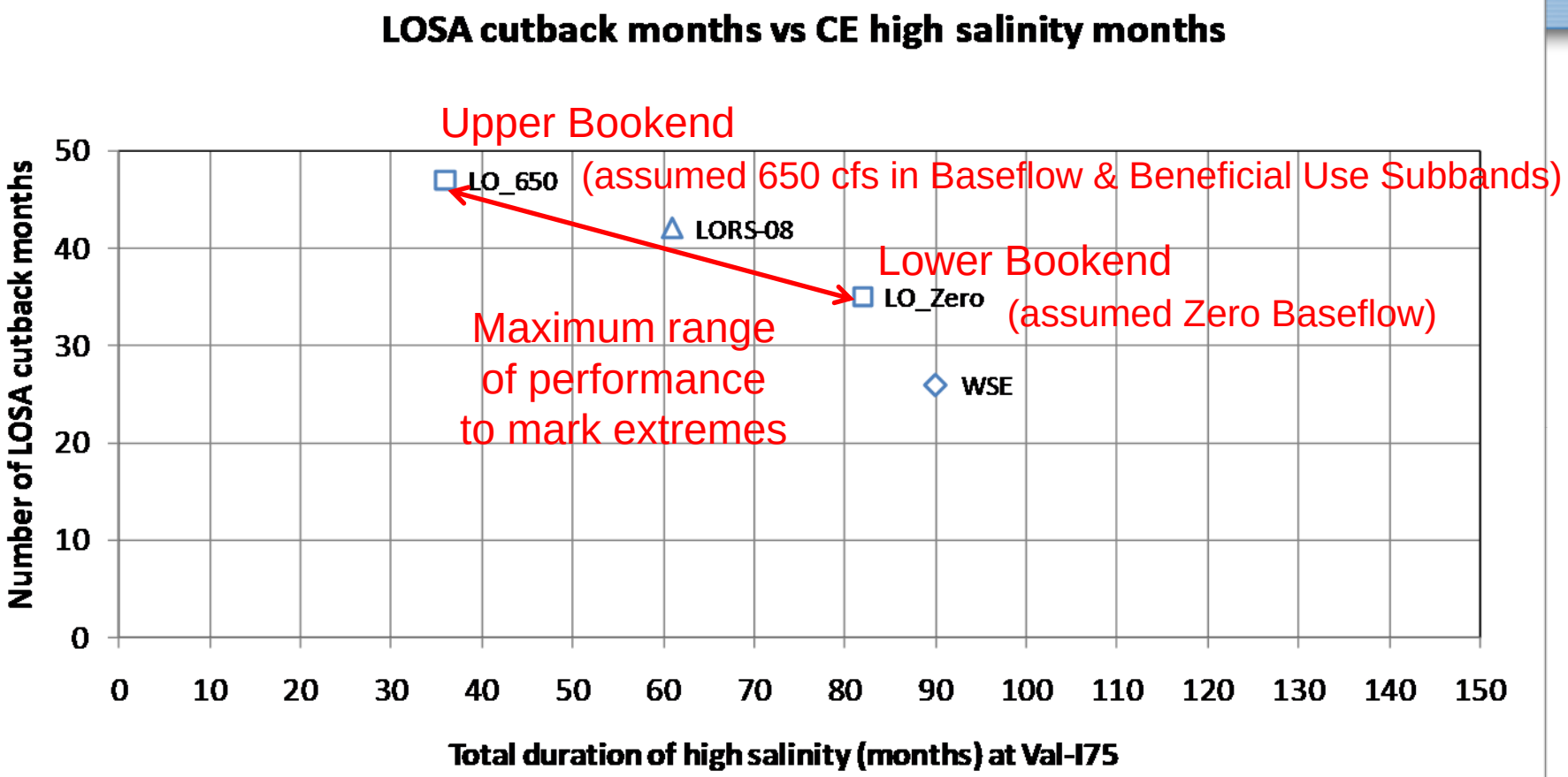
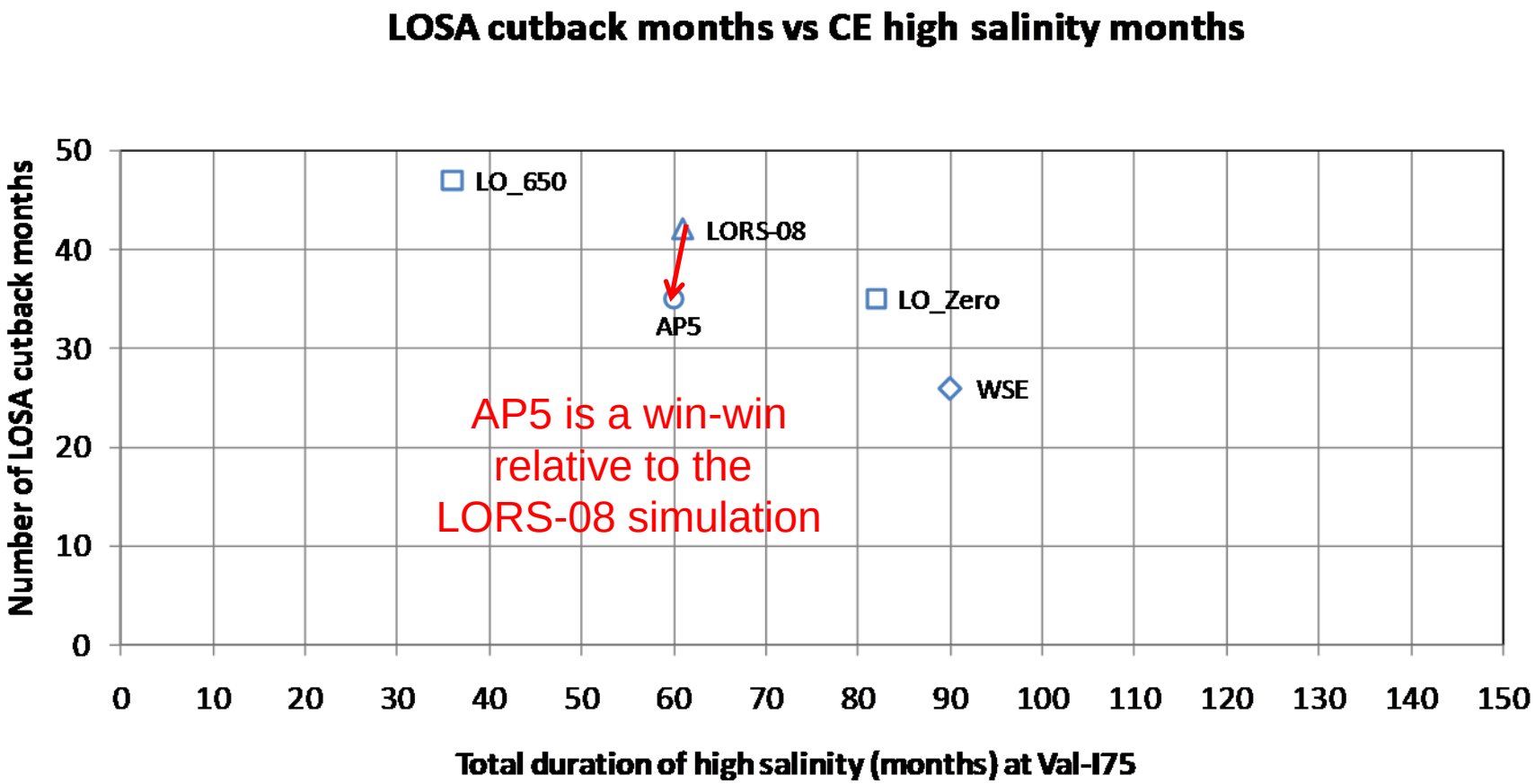
Multi-Objective Performance Trade-off #1



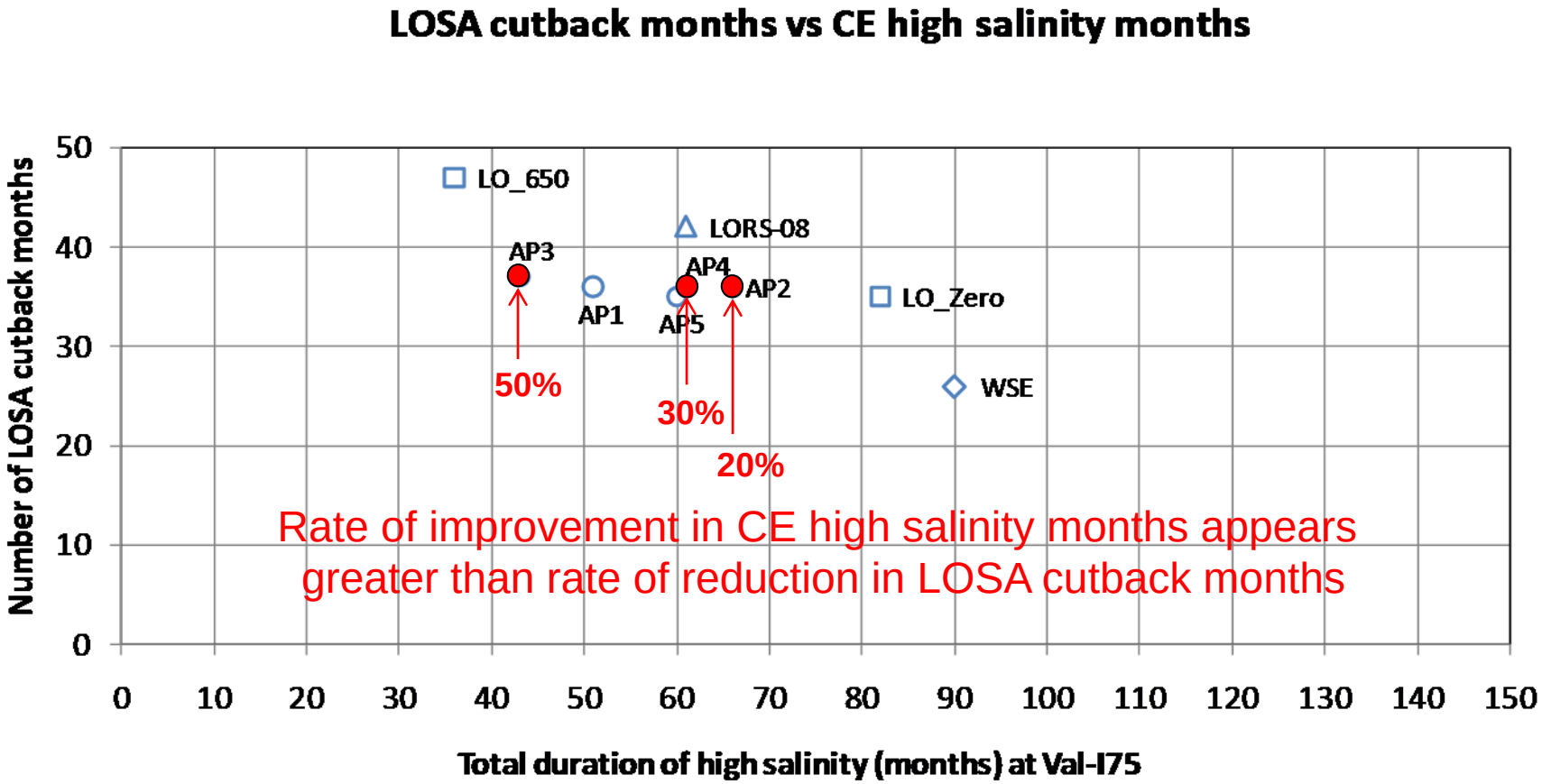
- Simulation of LORS-08 shows improvement for CE and adverse impact to LOSA
- Is one month of high salinity impact equal to one month of LOSA cutback???
- For the following trade-off analysis they are assumed equal


LOSA cutback months vs CE high salinity months
Number of LOSA cutback months
50
40
30
20
10
0
LORS-08
WSE
Win-Win Solutions
Improve Both
Objectives
(i.e., movement down
and to the left)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Total duration of high salinity (months) at Val-I75
Less is
Better


LOSA cutback months vs CE high salinity months
Upper Bookend
(assumed 650 cfs in Baseflow & Beneficial Use Subbands)
LO_650
LORS-08
Lower Bookend
LO_Zero
(assumed Zero Baseflow)
Maximum range
of performance
to mark extremes
WSE
Number of LOSA cutback months
0
10
20
30
40
50
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Total duration of high salinity (months) at Val-I75


LOSA cutback months vs CE high salinity months
Number of LOSA cutback months
Total duration of high salinity (months) at Val-I75
0
10
20
30
40
50
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
LO_650
LORS-08
AP5
LO_Zero
WSE
AP5 is a win-win relative to the LORS-08 simulation

Performance of Other Alternatives & Initial Sensitivity Analysis



AP1: 50% reduction in Low Subband release limits during dry season
AP2: Release Flowchart with Low Chance parameter = 20%
AP3: Release Flowchart with Low Chance parameter = 50%
AP4: Release Flowchart with Low Chance parameter = 30%
AP5: Hybrid of AP1 and AP4

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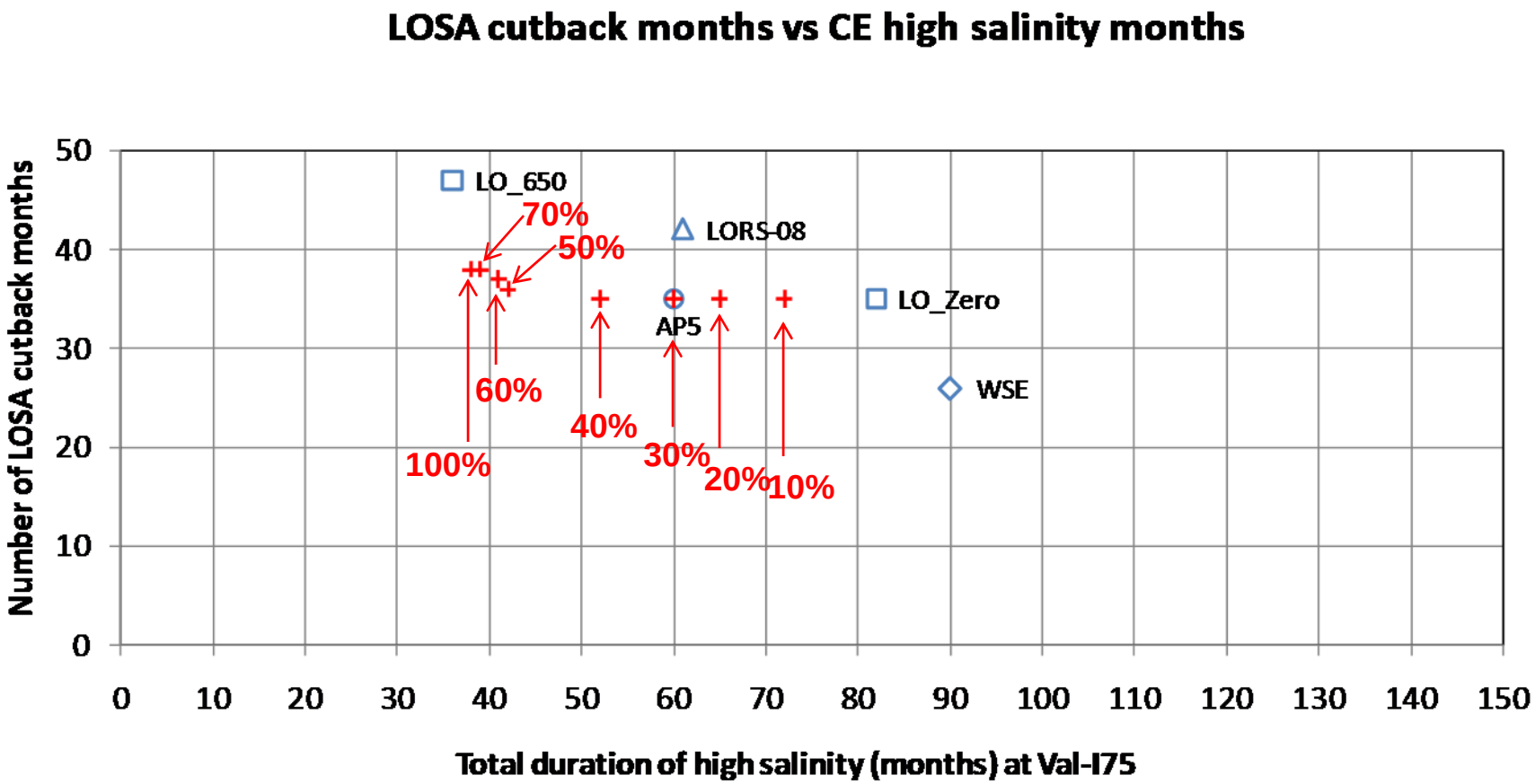
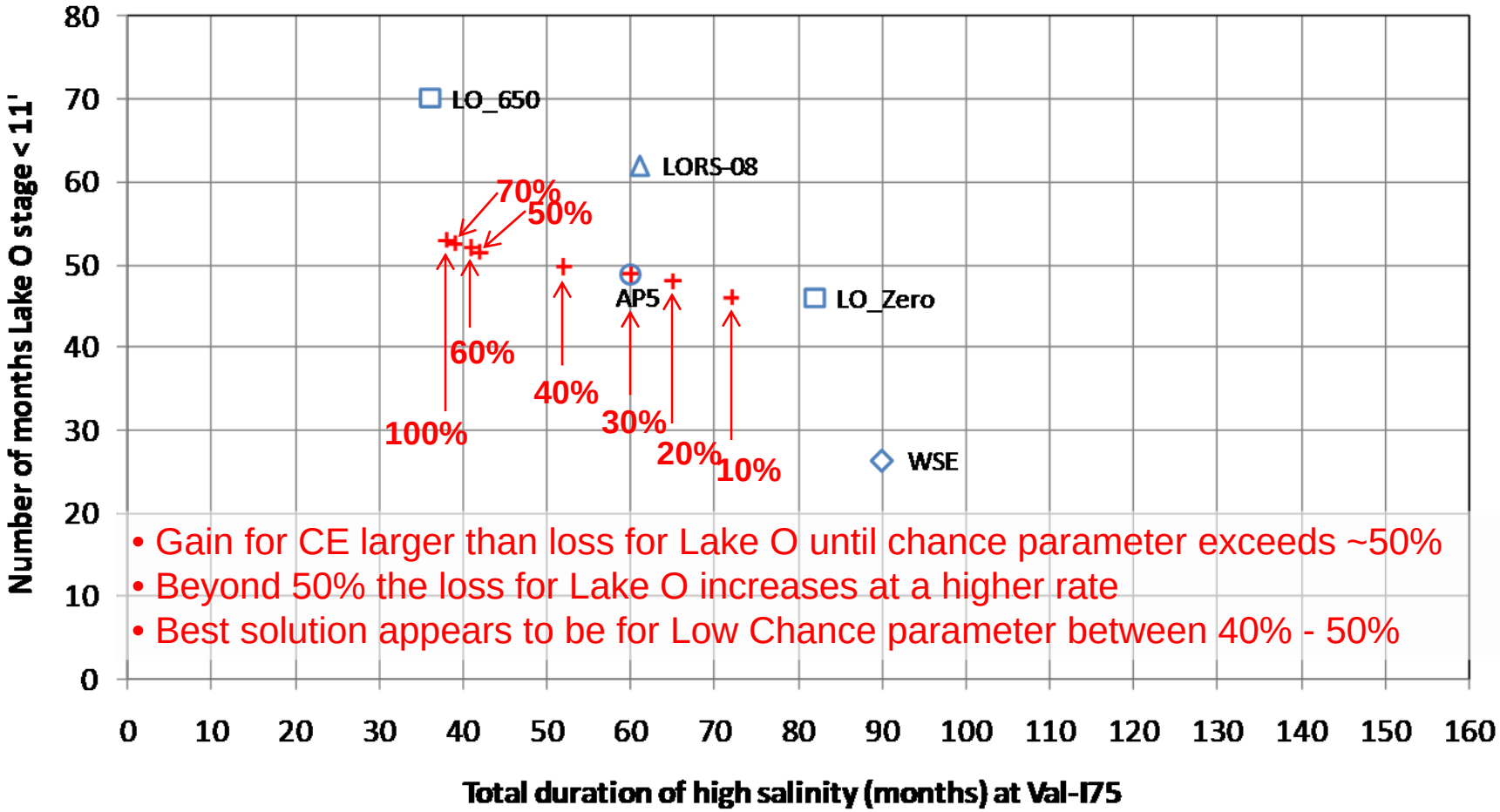
New Sensitivity Analysis based on AP5



- Gain for CE at no expense to LOSA until chance parameter is about 50%
- Beyond 50% the incremental gain for CE is equal to the incremental loss for LOSA
- Best solution appears to be for Low Chance parameter between 40% - 50%

Multi-Objective Performance Trade-off #2

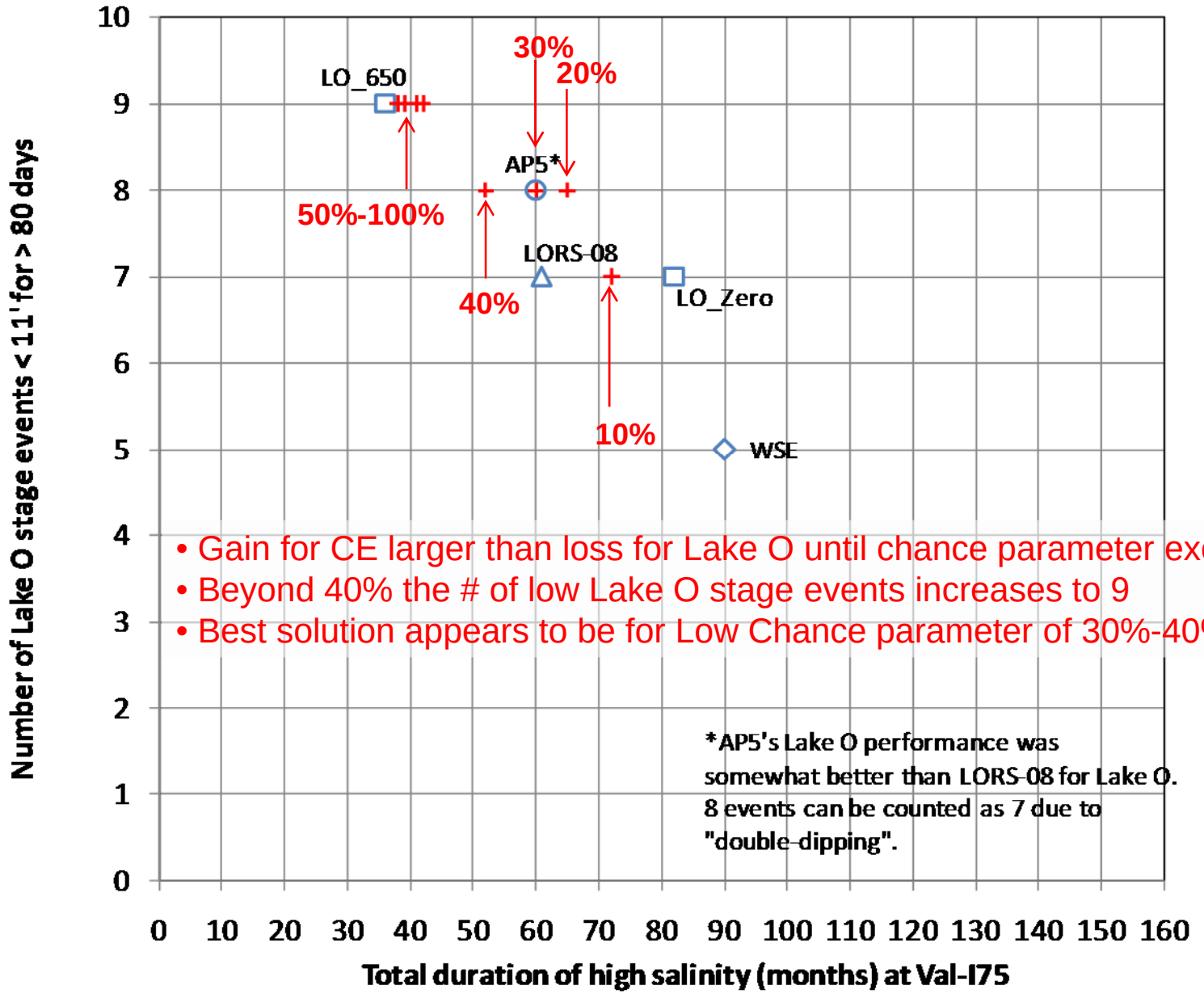
Lake O duration < 11' vs CE high salinity months



- Gain for CE larger than loss for Lake O until chance parameter exceeds ~50%
- Beyond 50% the loss for Lake O increases at a higher rate
- Best solution appears to be for Low Chance parameter between 40% - 50%

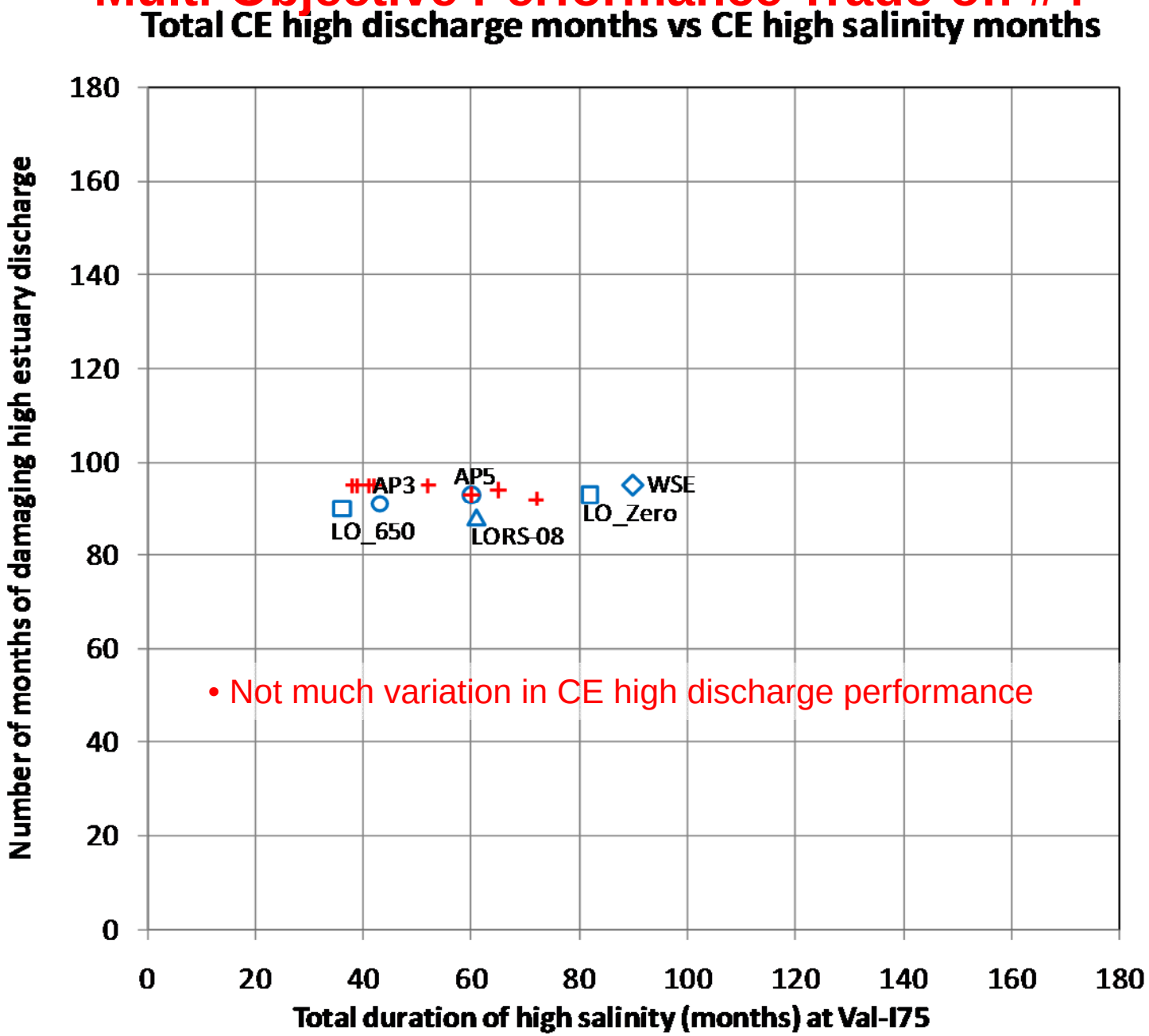
Multi-Objective Performance Trade-off #3

Lake O Low Stage events vs CE high salinity event yrs



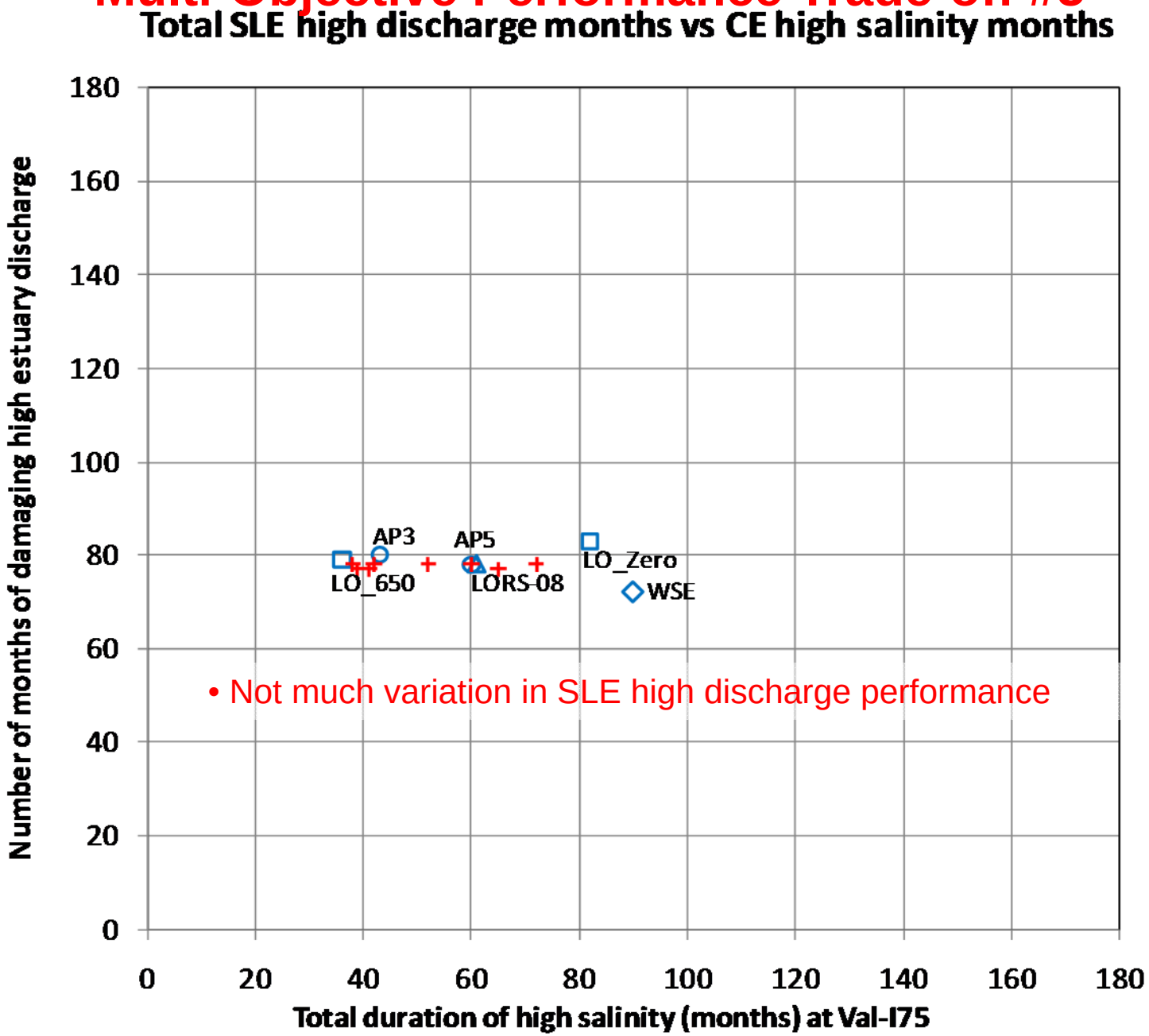
- Gain for CE larger than loss for Lake O until chance parameter exceeds 40%
- Beyond 40% the # of low Lake O stage events increases to 9
- Best solution appears to be for Low Chance parameter of 30%-40%

Multi-Objective Performance Trade-off #4



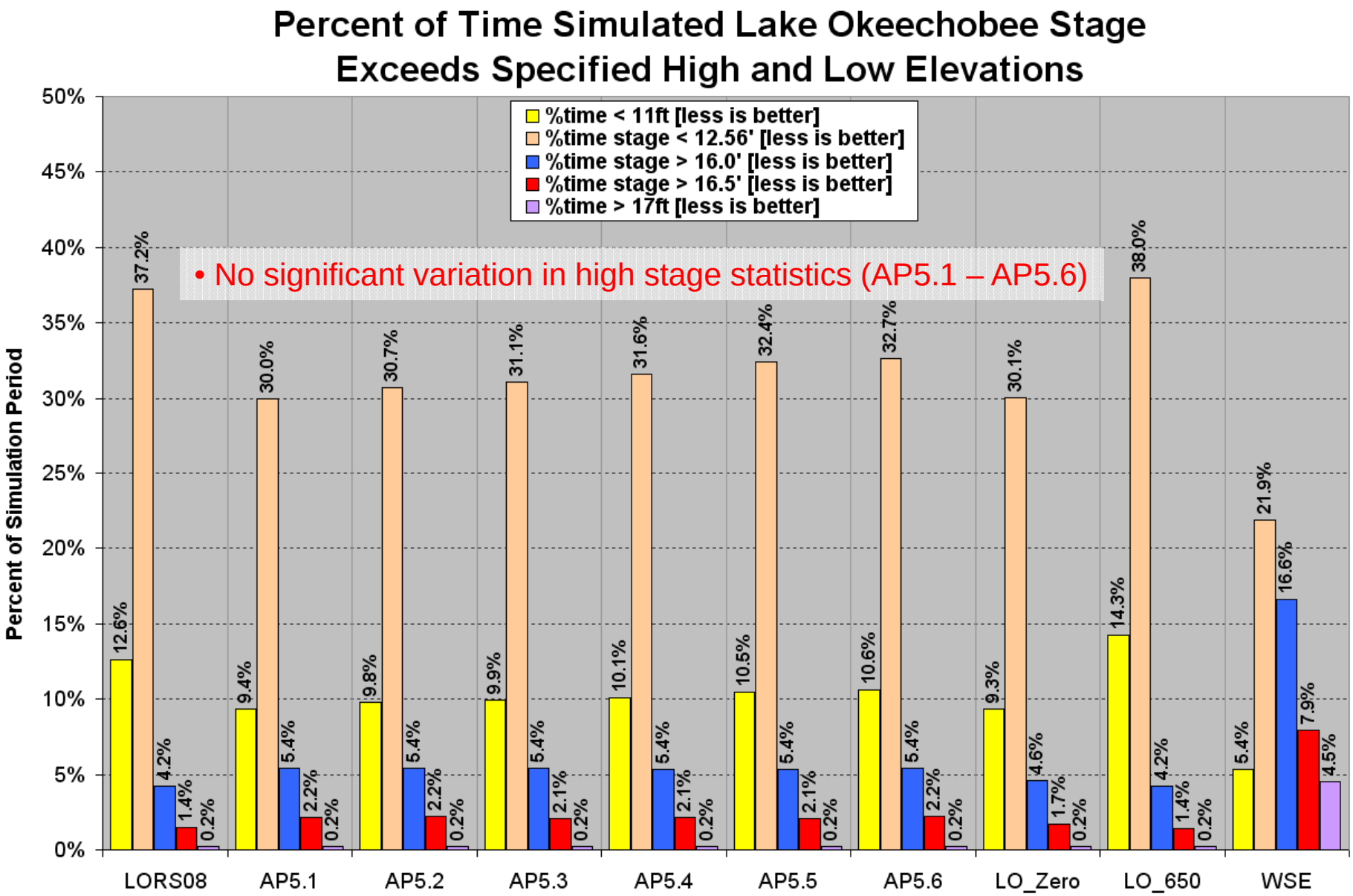
- Not much variation in CE high discharge performance

Multi-Objective Performance Trade-off #5



- Not much variation in SLE high discharge performance

Lake O High Stage Performance



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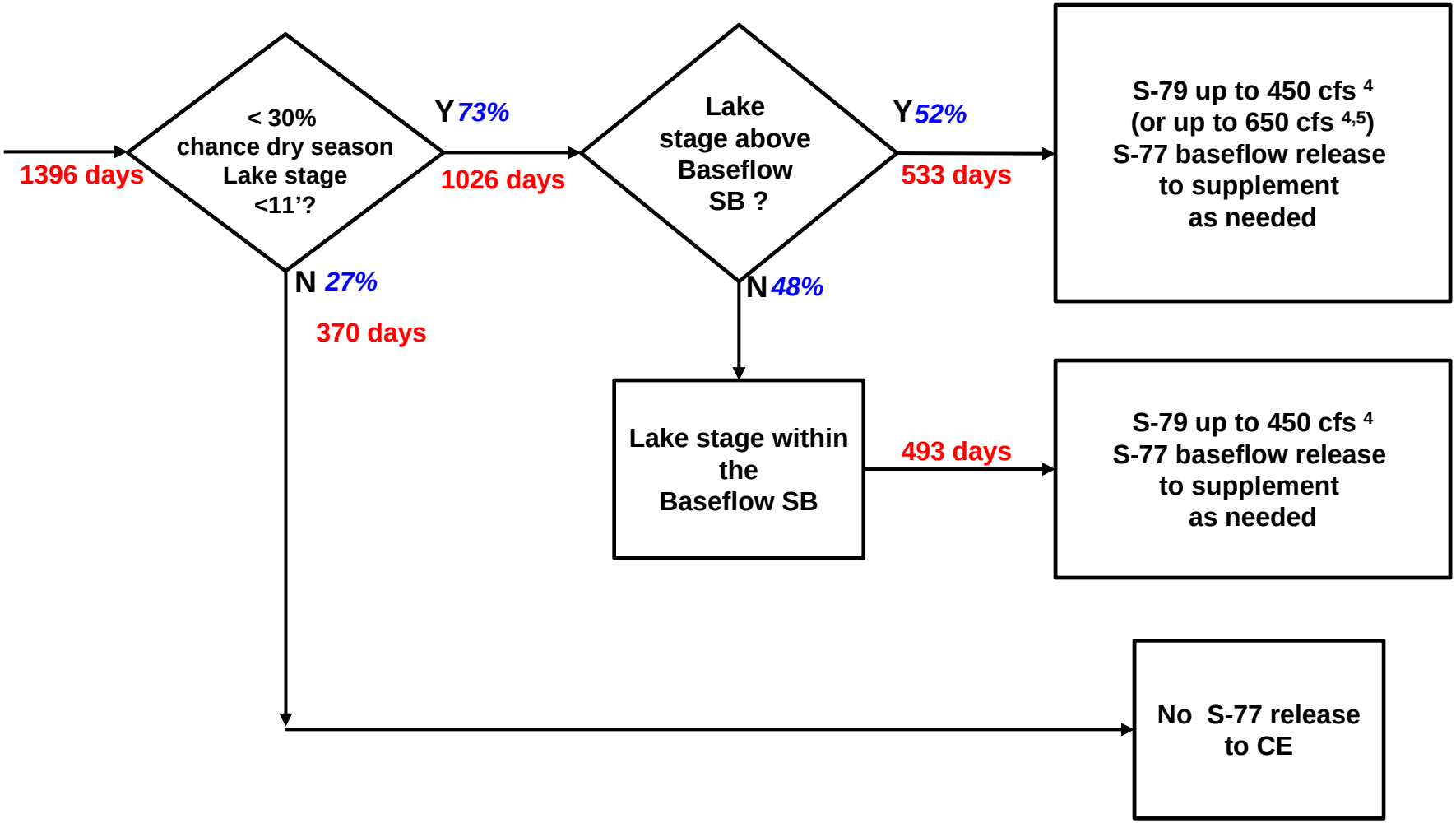
Flowchart to Guide Recommendations for Lake Okeechobee Releases to the Caloosahatchee Estuary

LORS-2008 Baseflow Guidance

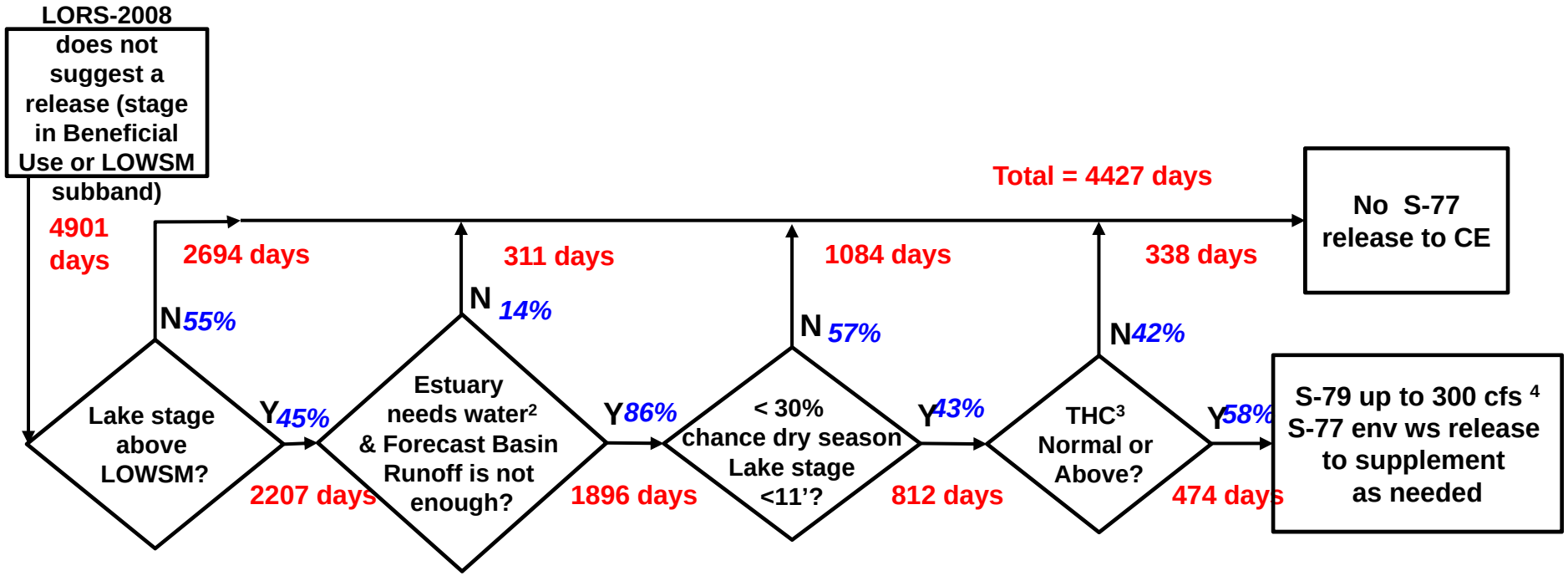


AP5 LOOPS Model (v5.5) 41yr simulation period=14975 days

Note: These statistics are gross summaries of the AP5 simulation & show the sum of the days that the flowchart branches are traversed. These stats are not measures of CE performance. For evaluating CE performance, refer to the high salinity performance measures.

Flowchart to Guide Recommendations for Lake Okeechobee Releases to the Caloosahatchee Estuary

Environmental Water Supply Guidance



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MISCELLANEOUS BACKUP SLIDES

Background & Problem Definition

- Baseflow release provision added to LORS-2008
- USACE added operational flexibility to LORS-2008
- 2008-09 dry season experience illustrated the effect of early dry season regulatory releases on late dry season Lake O stages
- **Additional release guidance is needed to maximize benefits of baseflow releases (& environmental water deliveries) and minimize adverse impacts to Lake O water levels & to permitted water supply users.**
- This is a multi-objective problem with conflicting objectives & inherent trade-offs
- Solution should consider ways to conserve dry season storage by releasing less than the LORS-08 “up-to” amounts during the dry season

AP5 Objectives

(1) Low Subband Dry Season Guidance:
Objective: back-off from maximum releases during the early dry season in order to conserve storage and thus have more supply available to all users in the late dry season.
Criteria**:** Limit LORS-2008 releases (except baseflow) to 50% of maximum limit when stage is within the Low Subband during dry season

(2) Baseflow & Beneficial Use Subband Guidance:
Objective: maximize benefits of baseflow releases (and environmental water deliveries) and minimize adverse impacts to Lake O water levels & to permitted water users.
Criteria: Flowchart to Guide release recommendations for Baseflow & Environmental Water Supply

Simulation Modeling Scenarios

- **WSE** = Previous Lake O Regulation Schedule (LORS-2000) with current Lake O Water Shortage Management Plan.
- **LORS-08** = Current Lake O Regulation Schedule (LORS-2008) with current Lake O Water Shortage Mgt Plan.
- **AP5** = Proposed Protocol to guide Lake O release recommendation to USACE (2 parts)

  (1) Low Subband Dry Season Guidance:
  50% of max release in Low Subband during dry season

  (2) Baseflow & Beneficial Use Subband Guidance:
  Flowchart to Guide release recommendations for Baseflow & Environmental Water Supply

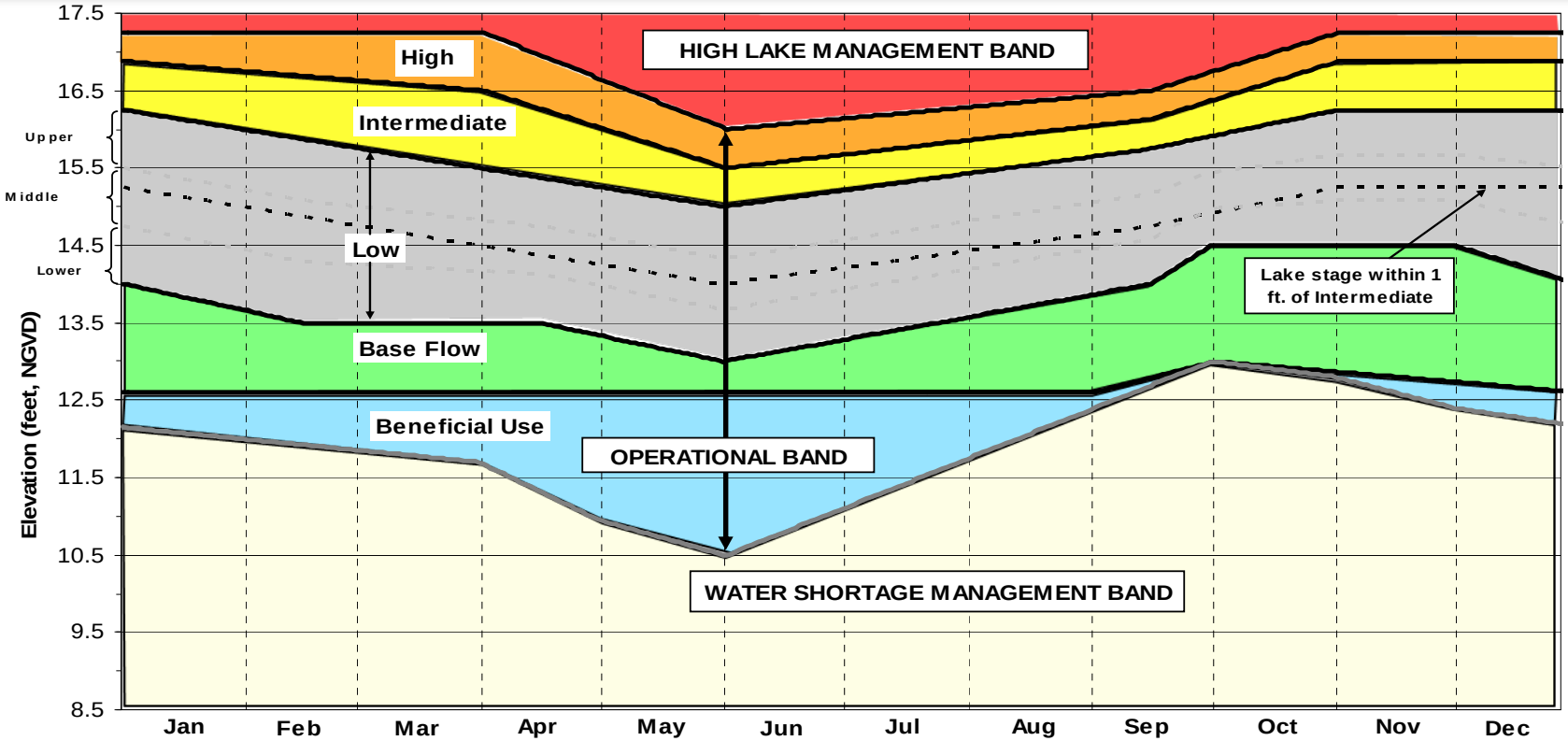
Simulation Modeling Scenarios

- Two “Bookend” Simulations designed to identify and bound the range of performance of alternative AP’s
  - **LO_650** = Current operations with up to 650 cfs base flow releases in the Base Flow sub-band & up to 650 cfs environmental water supply deliveries in the beneficial use sub-band.
  - **LO_zero** = Current operations with zero base flow releases & zero Environmental water supply deliveries
- Recent stakeholder questions regarding NEPA coverage in USACE’s Final Supplemental EIS for LORS-2008
  - The extremes defined by the bookends may not be covered by the FSEIS

Simulation Names & Short Descriptions

1. LORS-08 = current Lake O Regulation Schedule with current Lake O Water Shortage Mgt (LOWSM)
2. LO_zero = min AP bookend
3. LO_650 = max AP bookend
4. AP1 = 50% reduction in Low Subband release limits during the dry season (does not apply to baseflow)
5. AP4 = Adaptive Protocol Flowchart with "LowChance" = 30%
6. AP5 = Hybrid 1 (features of both AP1 and AP4)
7. WSE = previous LORS with LOWSM

2008 Lake Okeechobee Interim Regulation Schedule
(aka LORS-2008)



NOTES:

High Lake Management Band: Outlet canals may be maintained above their optimum water management elevations.
Operational Band: Outlet canals should be maintained within their optimum water management elevations.
Water Shortage Management Band: Outlet canals may be maintained below optimum water management elevations.

CENTRAL AND SOUTHERN FLORIDA PROJECT

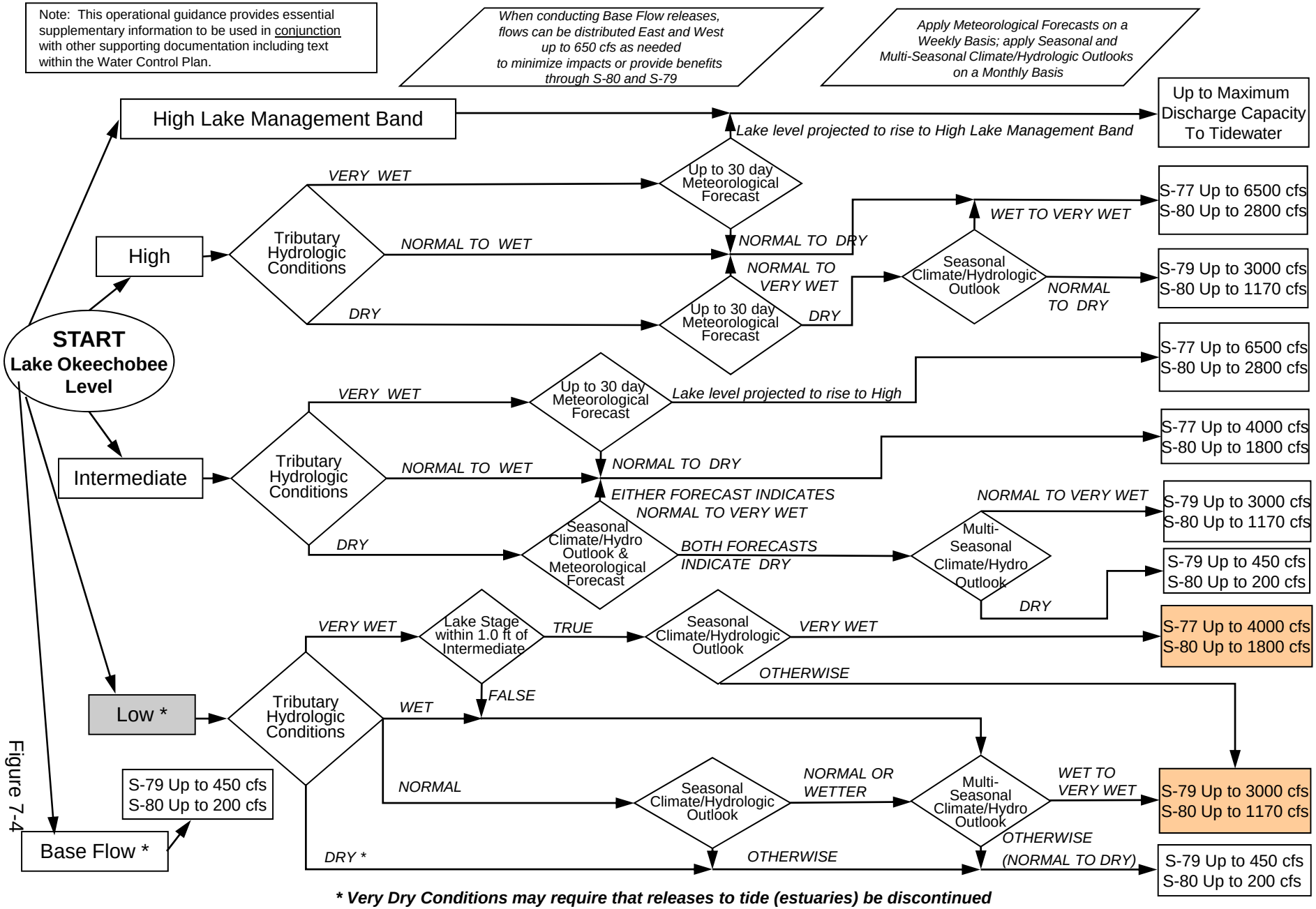
2008 LAKE OKEECHOBEE
INTERIM REGULATION SCHEDULE
PART B

DATED: March 2008
DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

Figure 7-2

2008 LORS

Part D: Establish Allowable Lake Okeechobee Releases to Tide (Estuaries)



*** Very Dry Conditions may require that releases to tide (estuaries) be discontinued**

Figure 7-4

2008 LORS

Part D: Establish Allowable Lake Okeechobee Releases to Tide (Estuaries)

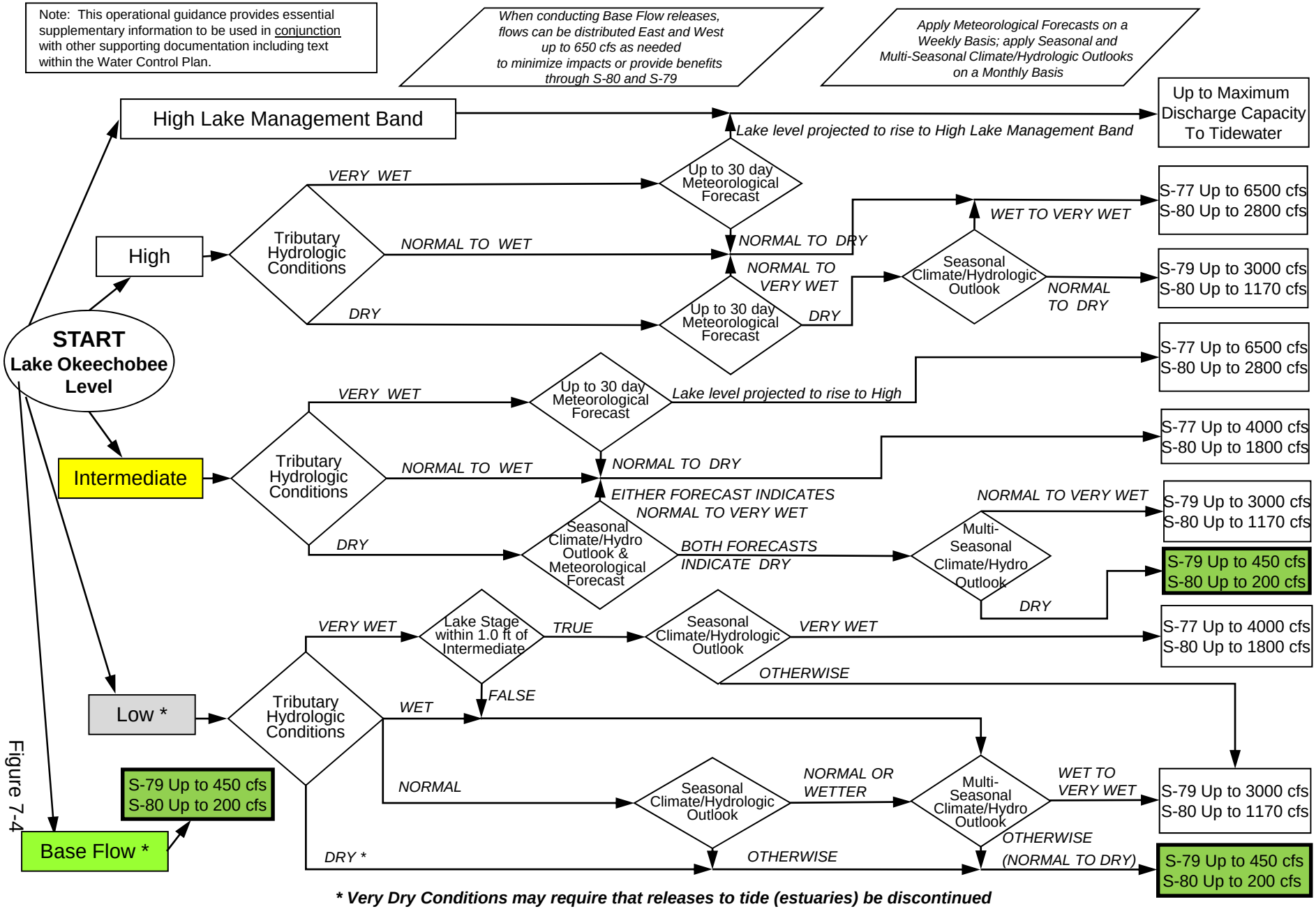


Figure 7-4

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