

# Lake Okeechobee System Operating Manual


## Iteration 3 - Phase 1 Technical Evaluation

*Sanibel-Captiva Conservation Foundation*

*Conservancy of Southwest Florida*

**DRAFT** - September 30, 2021  
(Updated: October 12, 2021 )

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# Iteration 3 Modeling

- Requested all output data (i.e. .DSS files for each alternative) from SFWMD/IMC

## Phase 1

- Initial sensitivity runs based on Alternative CC & Iteration 3 goals
- Simplify release guidance and reduce dimensionality for optimization
- Test schedule components based on simplified schedule & Iteration 3 goals

## Notes

Alternative Naming (in USACE presentation 16-17 Sept 2021)

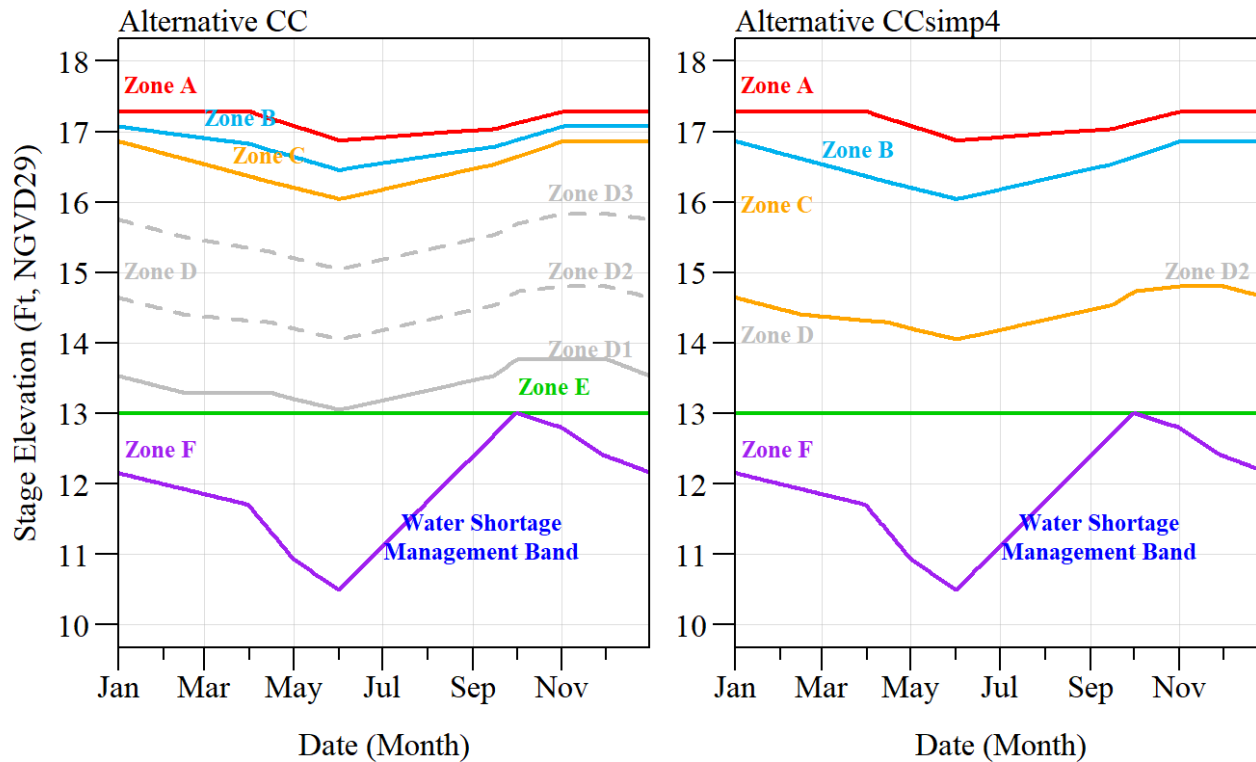
- CC == CCTSP
- CCsimp4 == simp4
- 2 versions of CCsimp4 - After simp4s1 (*Phase 1 - Test Flows to St Lucie Estuary*) was run it was renamed as CCsimp4. Therefore in this presentation the second CCsimp4 was renamed to CCsimp4(2).

# Phase 1 - Initial Sensitivity Runs

- **S1:** Preserve opportunity to send water out of the lake for longer which addresses the goal of increasing flexibility in the lower portions of the schedule.
- **S2:** Regulate CRE releases by using flows at S-79 in all conditions in all zones except in Zone A
- **S3:** Reduce stress to CRE by incorporating friendly estuary release concepts from 4BC-1
- **S4:** Reduce stress to CRE by incorporating alternating estuary release concept from 4BC-2
- **S3-4:** Combination of friendly estuary release concepts and alternating estuary release concepts
- **S5:** Reduce stress to CRE by reducing maximum up to flows in Zone D
- **S6:** Combine zones B & C
- **S7:** Address algae by incorporating no releases to the Northern Estuaries in the months June –August except in Zone A

# Phase 1 - Simplify Release Guidance

- Combine zones, simplify release guidance flowcharts
- Add complexity where it is needed to meet the goals of Iteration 3 optimization



CC and 'CCsimp4' simplified regulation schedule.

# Phase 1 - Test Schedule Components – CCsimp4

- Flows to St. Lucie Estuary (simp4 and simp4s1)
- Increased flexibility in lower portion of the schedule (simp4ZFS, simp4ZFW, simp4ZFSW)
  - simp4ZFS - Flow to LOWSM line (removal of Zone F) for flows south only
  - simp4ZFW - Flow to LOWSM line (removal of Zone F) for flows west only
  - simp4ZFSW - Flow to LOWSM line (removal of Zone F) for flows south and west
- Opportunity to send desirable dry season flows to Lake Worth Lagoon (271DS, 271DSZC)
  - 271DS - S271 sends 200 cfs when S155A 14-day moving average is  $\leq 100$  during dry season
  - S71DSZC - Same as S271DS but flood control level is above Zone C line.
- Zone B regulation point for CRE (S77 vs S79) (ZB\_S77)

# Phase 1 - Test Schedule Components – CCR1

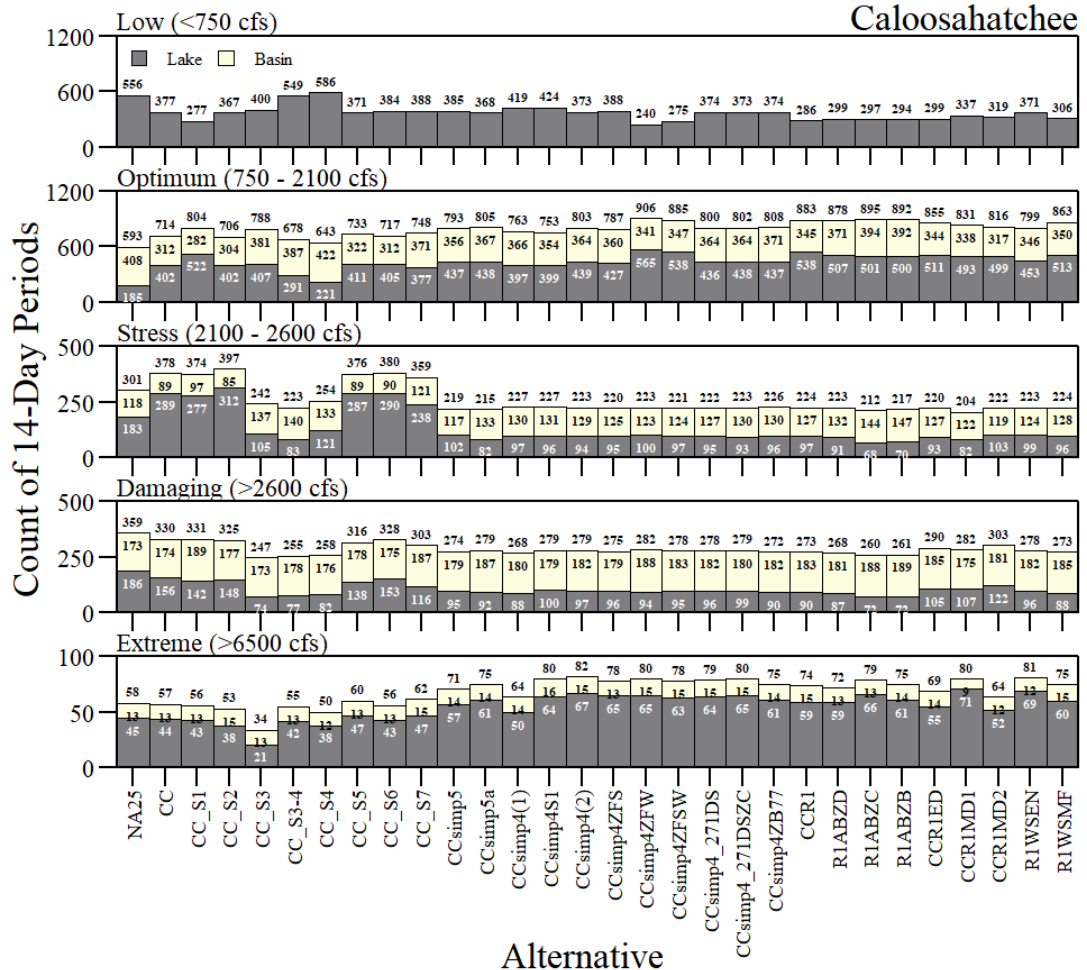
- CCR1 used CCsimp4 as base and incorporated features from smp4ZFSW, 271DS and ZB\_S77
  - ZFSW logic - flow south and west to LOWSM line
  - 271DS logic - S271 sends 200 cfs when S155A 14-day moving average is  $\leq 100$  during dry season
  - ZB\_S77 - Zone B regulation point for CRE - S77 instead of S79

## Evaluated:

- Opportunities to reduce algal bloom risk in the northern estuaries (R1ABZD, R1ABZC, R1ABZB)
  - all reg releases in June, July, August set to 0 in Zone D, C and B and lower (R1ABZD, R1ABZC, R1ABZB, respectively)
- Opportunities to improve lake health by incorporating extreme and moderate recovery operations (CCR1ED, CCR1MD1, CCRMD2)
  - Takes into account El Niño forecast, recovery envelope counts and <11 Ft stage threshold
- Opportunities to address water supply performance by modifying operations in lower portions of the schedule (R1WSEN, R1WSMF)
  - Full flows being ~750 cfs west and up to max south
  - R1WSMF - Lake forecasted to enter into WSM band
  - R1WSEN - Cutbacks during ENSO conditions

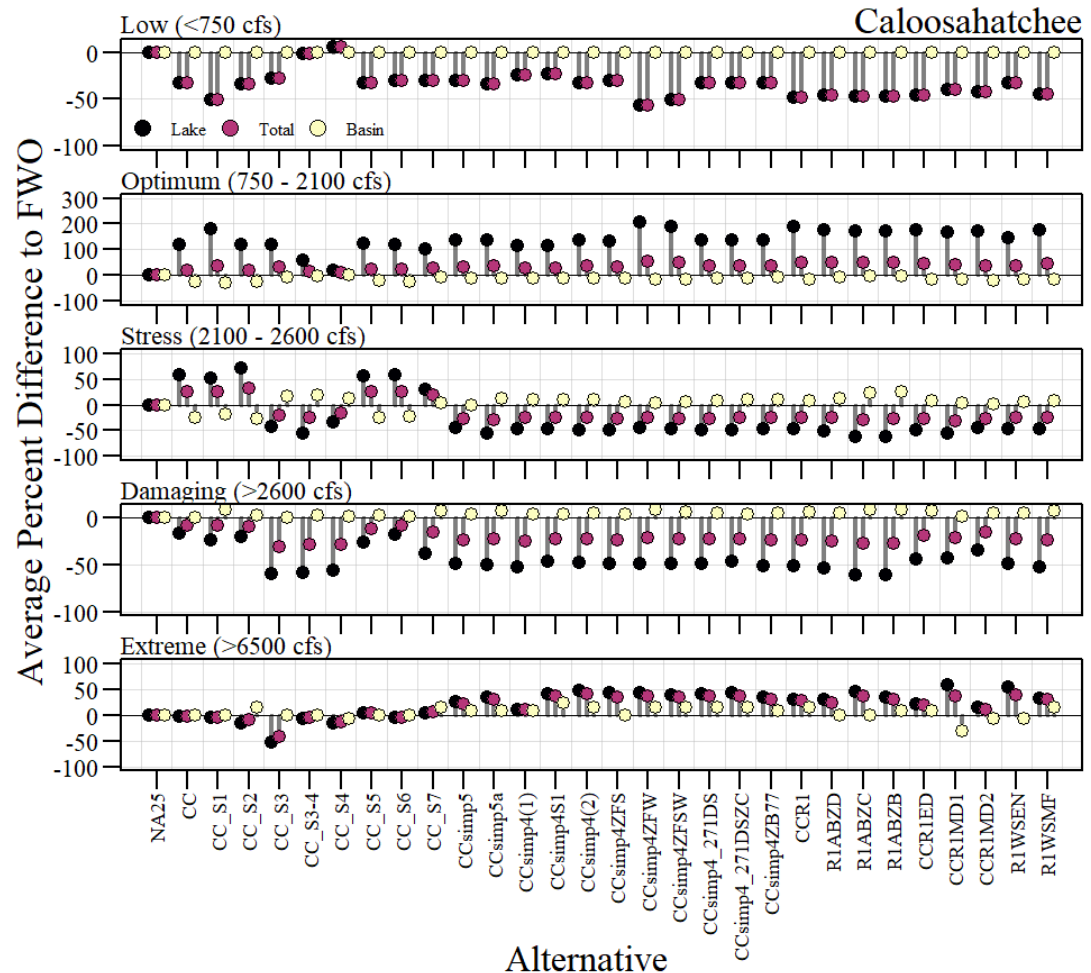
# CRE RECOVER metrics

RECOVER  
salinity envelope  
evaluation during  
the simulation  
period of record  
for  
Caloosahatchee  
with Lake (LOK)  
and Basin  
contributions  
delineated.



# CRE RECOVER metrics

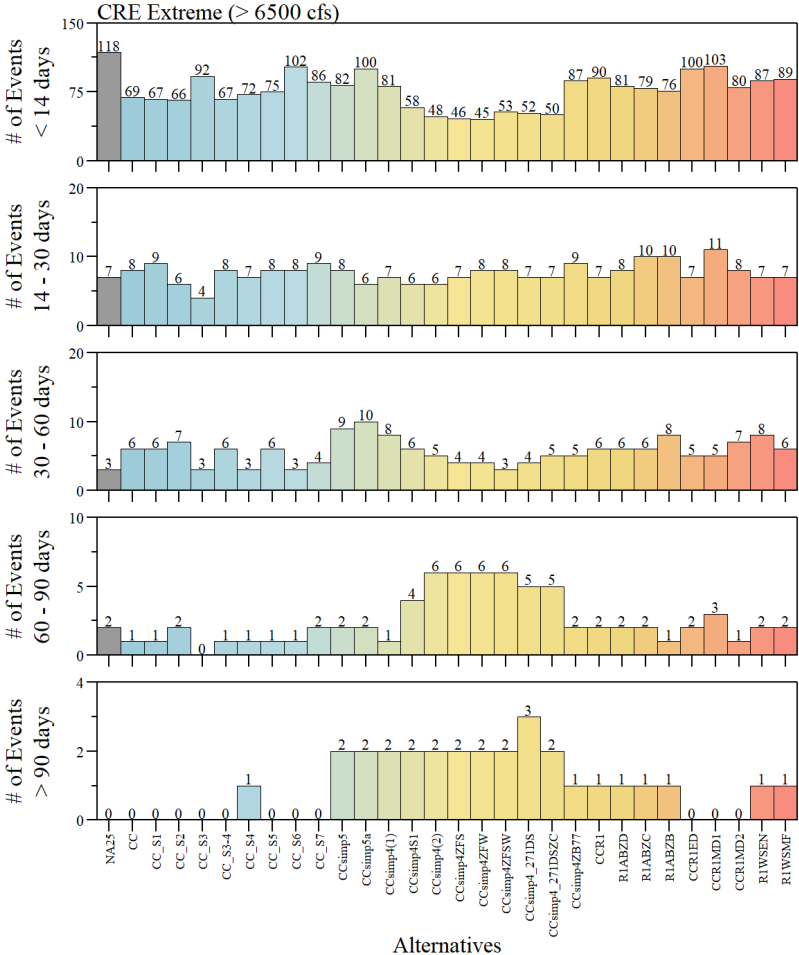
RECOVER salinity envelope evaluation relative to FWO (NA25) during the simulation period of record for Caloosahatchee specific to Lake, Basin and total counts.





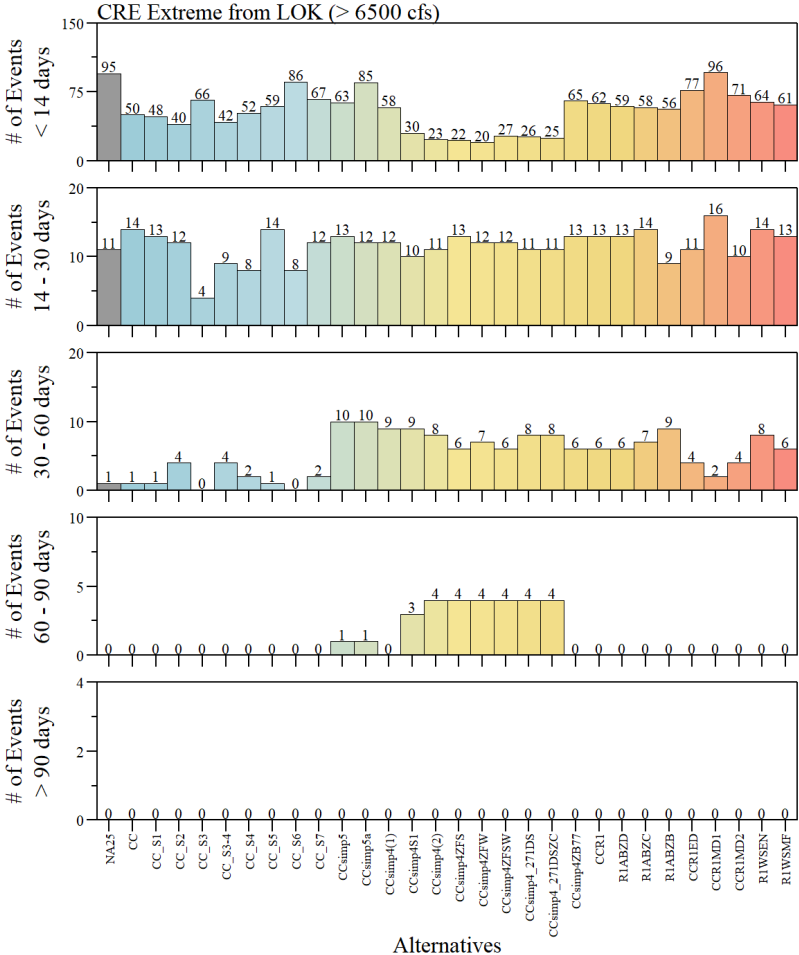
# CRE Extreme Flow Events

Number of events and duration of events of extreme flow events (>6500 cfs) for the Caloosahatchee Basin+LOK).

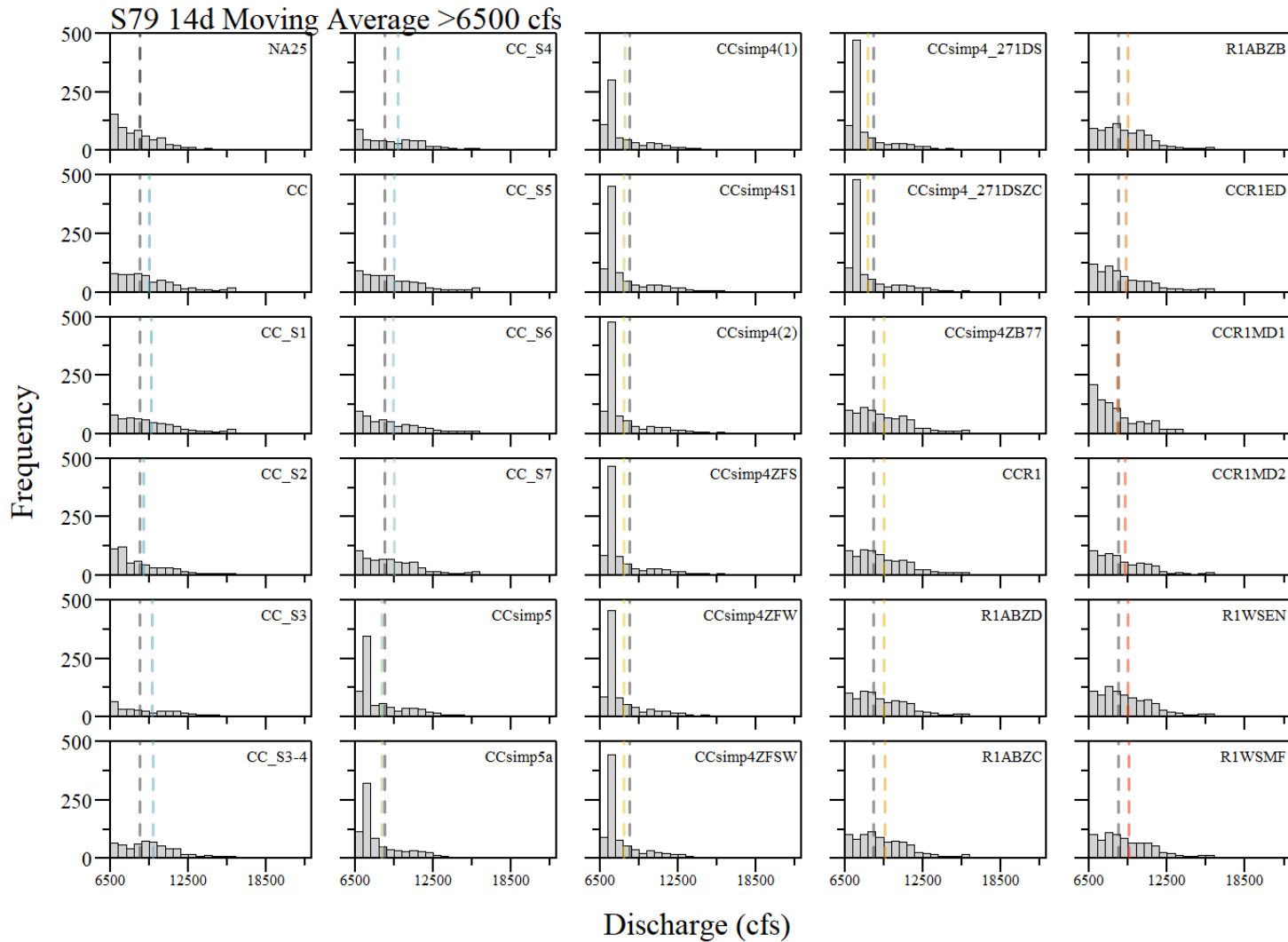


# CRE Extreme Flow Events

Number of events and duration of events of extreme flow events (>6500 cfs) for the Caloosahatchee from Lake Okeechobee.



# CRE Extreme Flow Events



# CRE Discharge

Mean annual total S-79 discharge during the period of simulation

Alternative	S-79 (x1000 Ac-Ft Y <sup>-1</sup> )	S-79 (% Diff FWO)
NA25	1294	0.0
CC	1347	4.1
CC_S1	1352	4.5
CC_S2	1319	1.9
CC_S3	1183	-8.5
CC_S3-4	1168	-9.7
CC_S4	1123	-13.2
CC_S5	1342	3.7
CC_S6	1333	3.0
CC_S7	1318	1.9
CCsimp5	1258	-2.8
CCsimp5a	1244	-3.9
CCsimp4(1)	1307	1.0
CCsimp4S1	1348	4.2
CCsimp4(2)	1353	4.6

Alternative	S-79 (x1000 Ac-Ft Y <sup>-1</sup> )	S-79 (% Diff FWO)
CCsimp4ZFS	1331	2.9
CCsimp4ZFW	1377	6.4
CCsimp4ZFSW	1355	4.7
CCsimp4_271DS	1351	4.4
CCsimp4_271DSZC	1353	4.6
CCsimp4ZB77	1375	6.3
CCR1	1374	6.2
R1ABZD	1369	5.8
R1ABZC	1361	5.2
R1ABZB	1349	4.3
CCR1ED	1361	5.2
CCR1MD1	1330	2.8
CCR1MD2	1350	4.3
R1WSEN	1364	5.5
R1WSMF	1373	6.1

# CRE Discharge

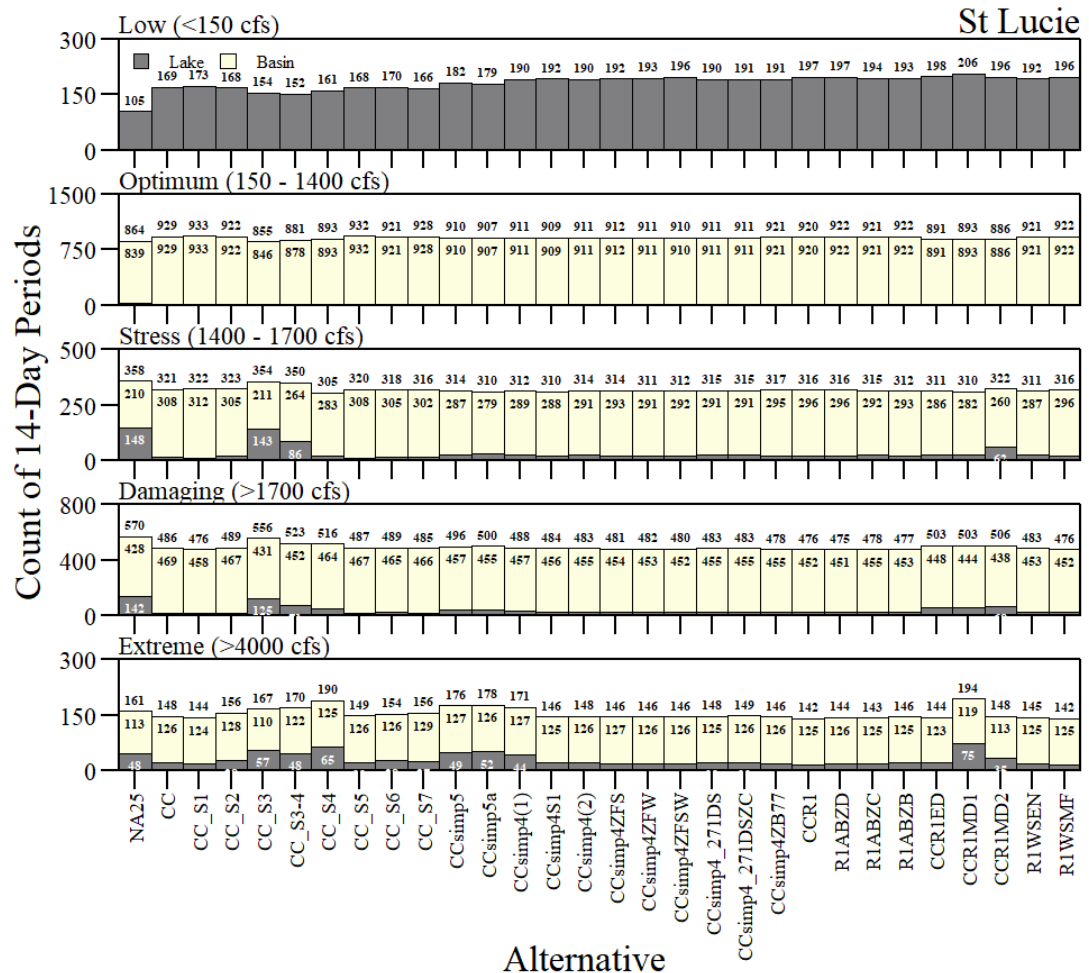
Mean annual total S-77 regulatory (flood protection) discharge during the period of simulation

Alternative	S-77 Reg Q (x1000 Ac-Ft Y <sup>-1</sup> )	S-77 Reg Q (% Diff FWO)
NA25	528	0.0
CC	578	9.5
CC_S1	595	12.7
CC_S2	548	3.9
CC_S3	414	-21.5
CC_S3-4	391	-26.0
CC_S4	344	-34.7
CC_S5	572	8.4
CC_S6	565	7.0
CC_S7	547	3.6
CCsimp5	485	-8.1
CCsimp5a	468	-11.3
CCsimp4(1)	537	1.8
CCsimp4S1	580	9.9
CCsimp4(2)	586	11.0

Alternative	S-77 Reg Q (x1000 Ac-Ft Y <sup>-1</sup> )	S-77 Reg Q (% Diff FWO)
CCsimp4ZFS	569	7.8
CCsimp4ZFW	615	16.5
CCsimp4ZFSW	598	13.4
CCsimp4_271DS	583	10.5
CCsimp4_271DSZC	586	11.0
CCsimp4ZB77	608	15.1
CCR1	618	17.1
R1ABZD	613	16.1
R1ABZC	604	14.4
R1ABZB	592	12.2
CCR1ED	610	15.6
CCR1MD1	583	10.4
CCR1MD2	596	12.8
R1WSEN	599	13.4
R1WSMF	614	16.4

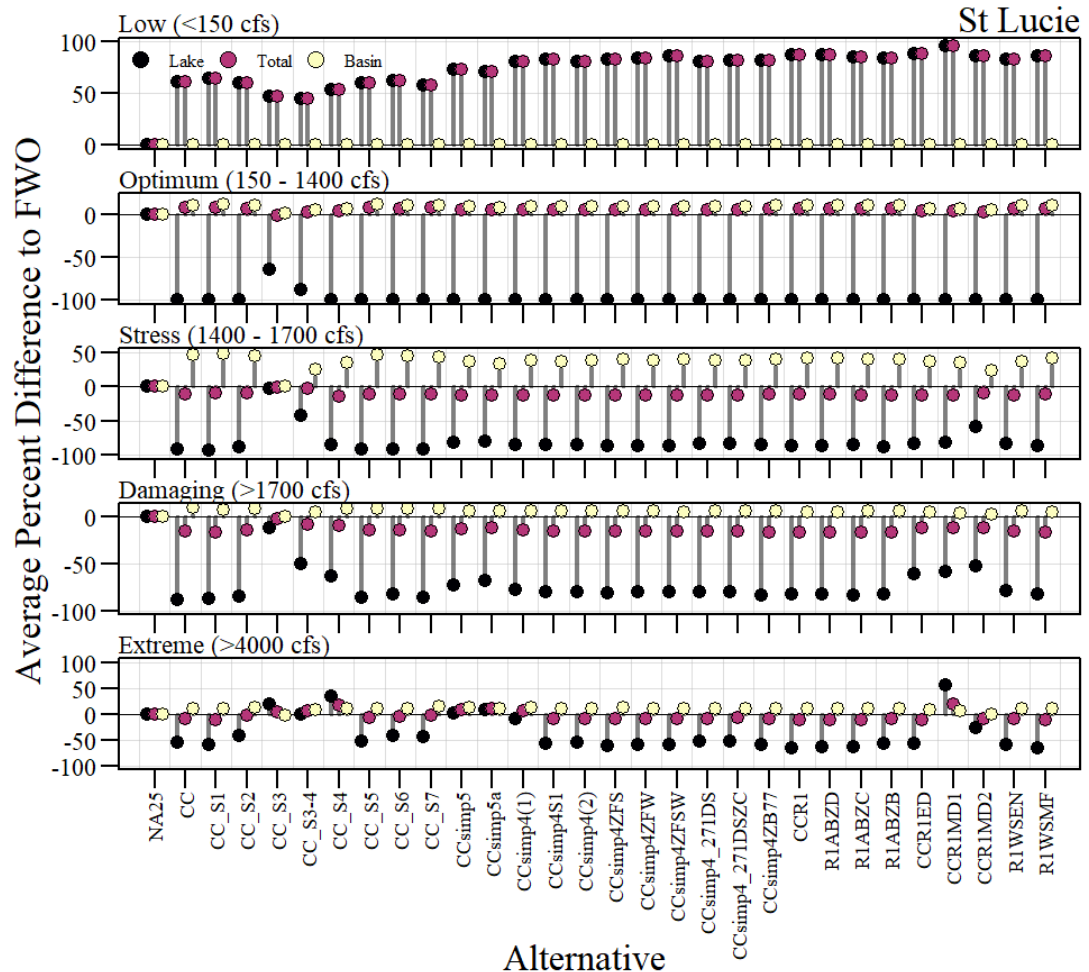
# SLE RECOVER metrics

RECOVER salinity envelope evaluation during the simulation period of record for St Lucie with Lake (LOK) and Basin contributions delineated.



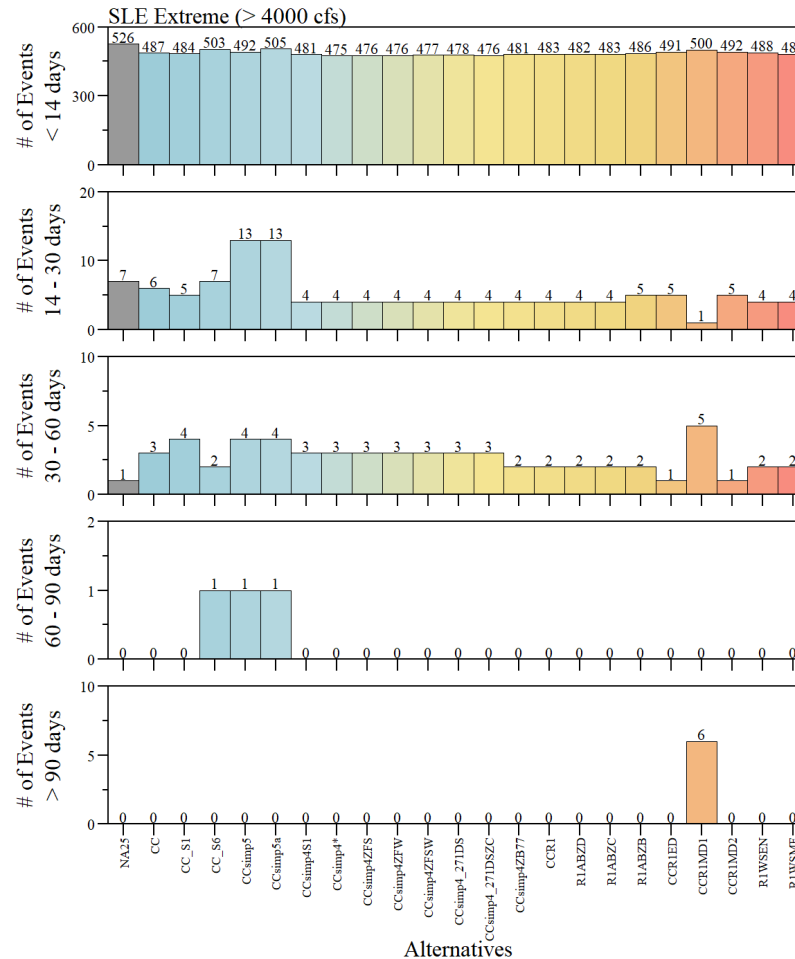
# SLE RECOVER metrics

RECOVER salinity envelope evaluation relative to FWO (NA25) during the simulation period of record for St Lucie specific to Lake, Basin and total counts.



# SLE Extreme Flow Events

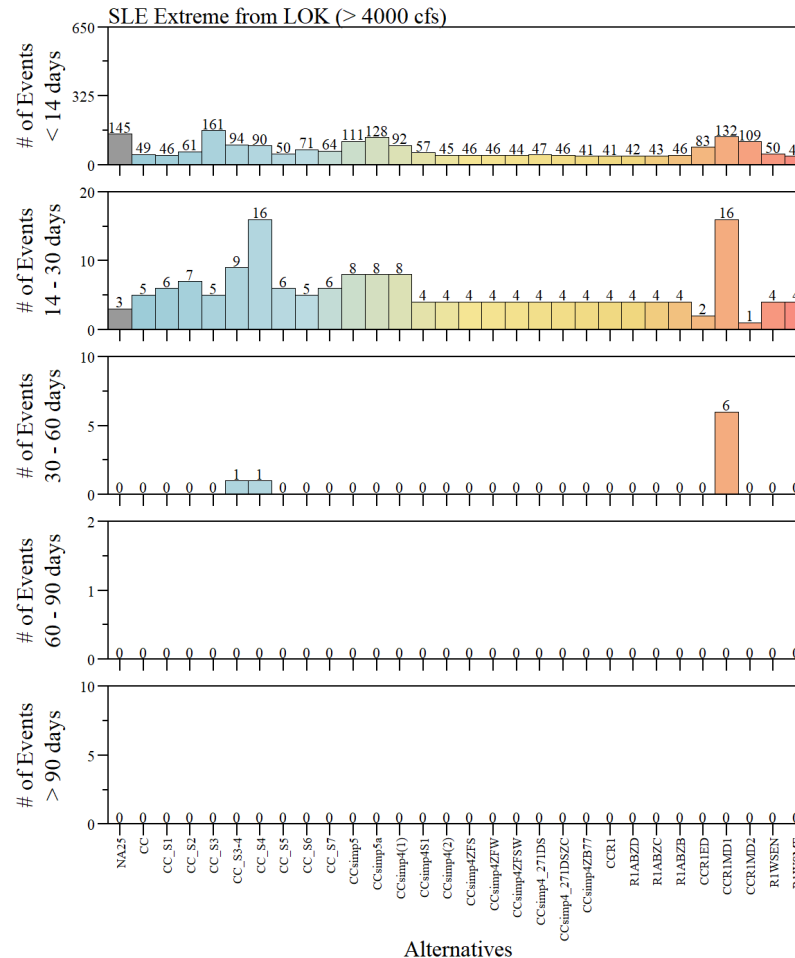
Number of events and duration of events of extreme flow events (>4000 cfs) for the St Lucie (all flows; Basin+LOK).





# SLE Extreme Flow Events

Number of events and duration of events of extreme flow events (>4000 cfs) for the St Lucie from Lake Okeechobee.



Alternatives

# SLE Discharge

Mean annual total S-80 discharge during the period of simulation

Alternative	S-80 (x1000 Ac-Ft Y <sup>-1</sup> )	S-80 (% Diff FWO)
NA25	276	0.0
CC	153	-44.5
CC_S1	143	-48.2
CC_S2	177	-36.0
CC_S3	286	3.5
CC_S3-4	274	-0.8
CC_S4	322	16.6
CC_S5	156	-43.4
CC_S6	171	-38.1
CC_S7	172	-37.8
CCsimp5	211	-23.7
CCsimp5a	220	-20.6
CCsimp4(1)	184	-33.4
CCsimp4S1	146	-47.2
CCsimp4(2)	143	-48.4

Alternative	S-80 (x1000 Ac-Ft Y <sup>-1</sup> )	S-80 (% Diff FWO)
CCsimp4ZFS	139	-49.7
CCsimp4ZFW	137	-50.4
CCsimp4ZFSW	135	-51.3
CCsimp4_271DS	143	-48.2
CCsimp4_271DSZC	144	-48.0
CCsimp4ZB77	124	-55.2
CCR1	116	-58.2
R1ABZD	117	-57.8
R1ABZC	121	-56.3
R1ABZB	132	-52.4
CCR1ED	141	-49.1
CCR1MD1	228	-17.4
CCR1MD2	160	-42.1
R1WSEN	124	-55.3
R1WSMF	117	-57.8

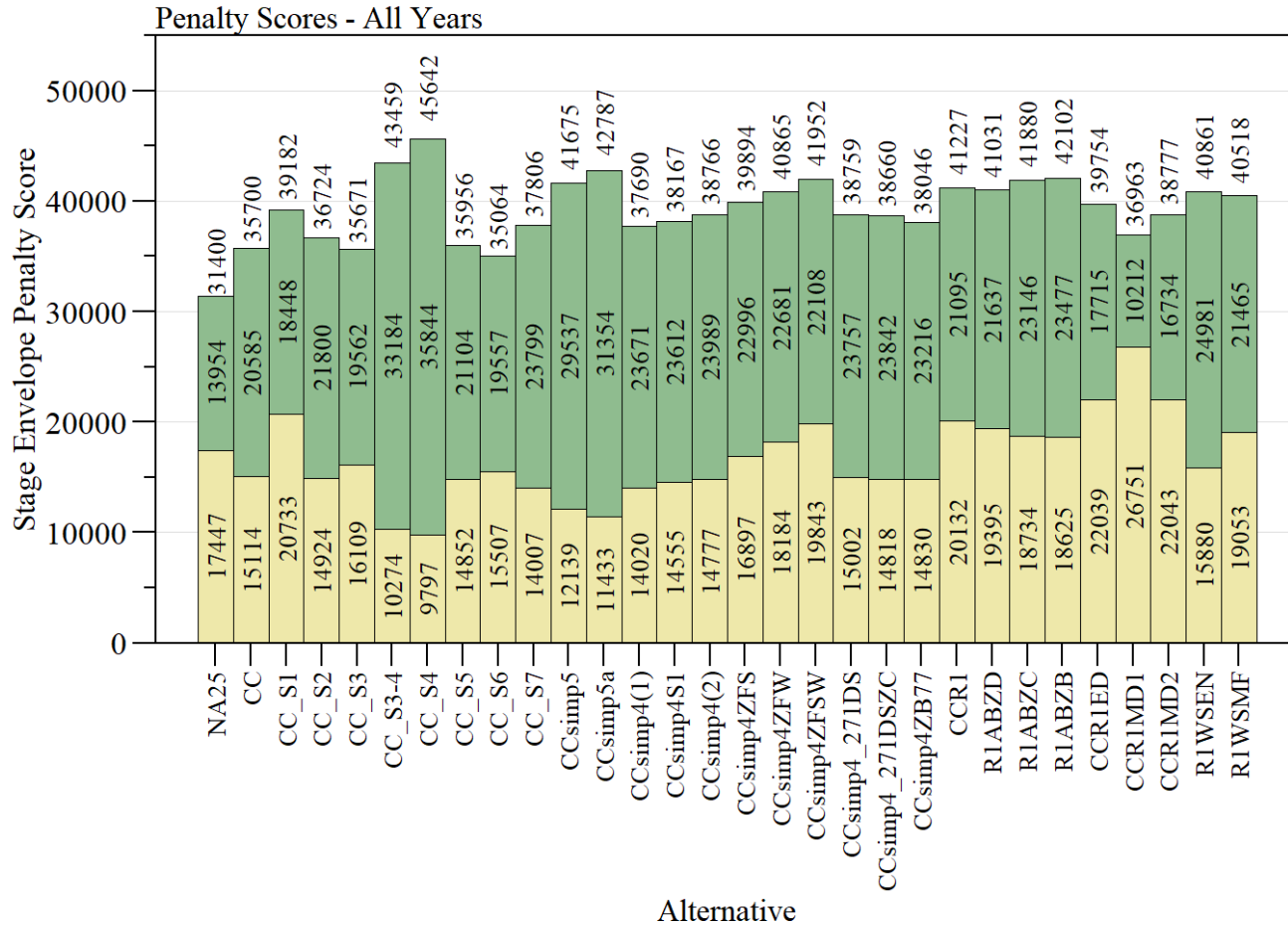
# SLE Discharge

Mean annual total S-308 regulatory (flood protection) discharge during the period of simulation

Alternative	S-308 Reg Q (x1000 Ac-Ft Y <sup>-1</sup> )	S-308 Reg Q (% Diff FWO)
NA25	187	0.0
CC	72	-61.7
CC_S1	68	-63.8
CC_S2	95	-49.3
CC_S3	202	8.0
CC_S3-4	187	-0.1
CC_S4	232	23.7
CC_S5	75	-60.1
CC_S6	90	-52.2
CC_S7	88	-52.8
CCsimp5	138	-26.2
CCsimp5a	145	-22.9
CCsimp4(1)	116	-38.3
CCsimp4S1	78	-58.1
CCsimp4(2)	74	-60.3

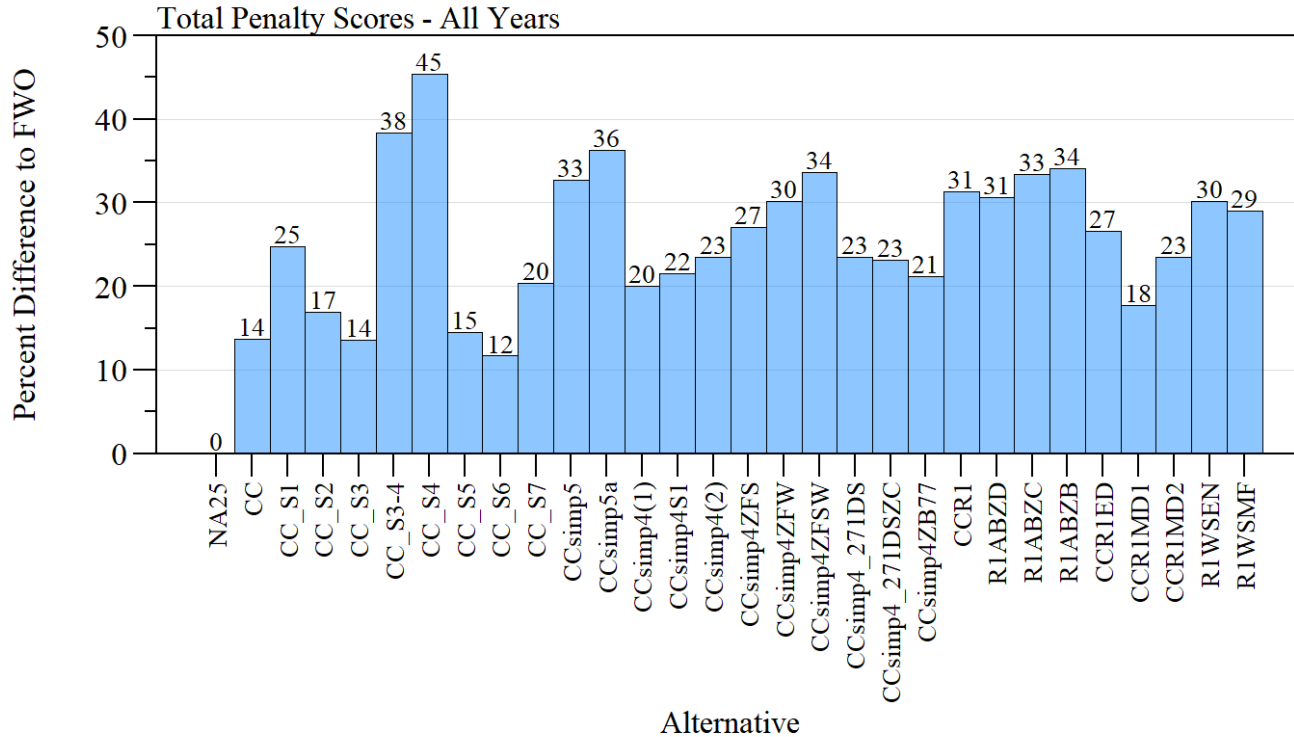
Alternative	S-308 Reg Q (x1000 Ac-Ft Y <sup>-1</sup> )	S-308 Reg Q (% Diff FWO)
CCsimp4ZFS	74	-60.7
CCsimp4ZFW	73	-61.0
CCsimp4ZFSW	72	-61.3
CCsimp4_271DS	76	-59.7
CCsimp4_271DSZC	76	-59.7
CCsimp4ZB77	56	-70.3
CCR1	54	-71.3
R1ABZD	54	-71.0
R1ABZC	57	-69.7
R1ABZB	68	-63.9
CCR1ED	82	-56.2
CCR1MD1	179	-4.7
CCR1MD2	99	-46.9
R1WSEN	60	-68.2
R1WSMF	54	-71.1

# Lake Okeechobee Stage Envelope



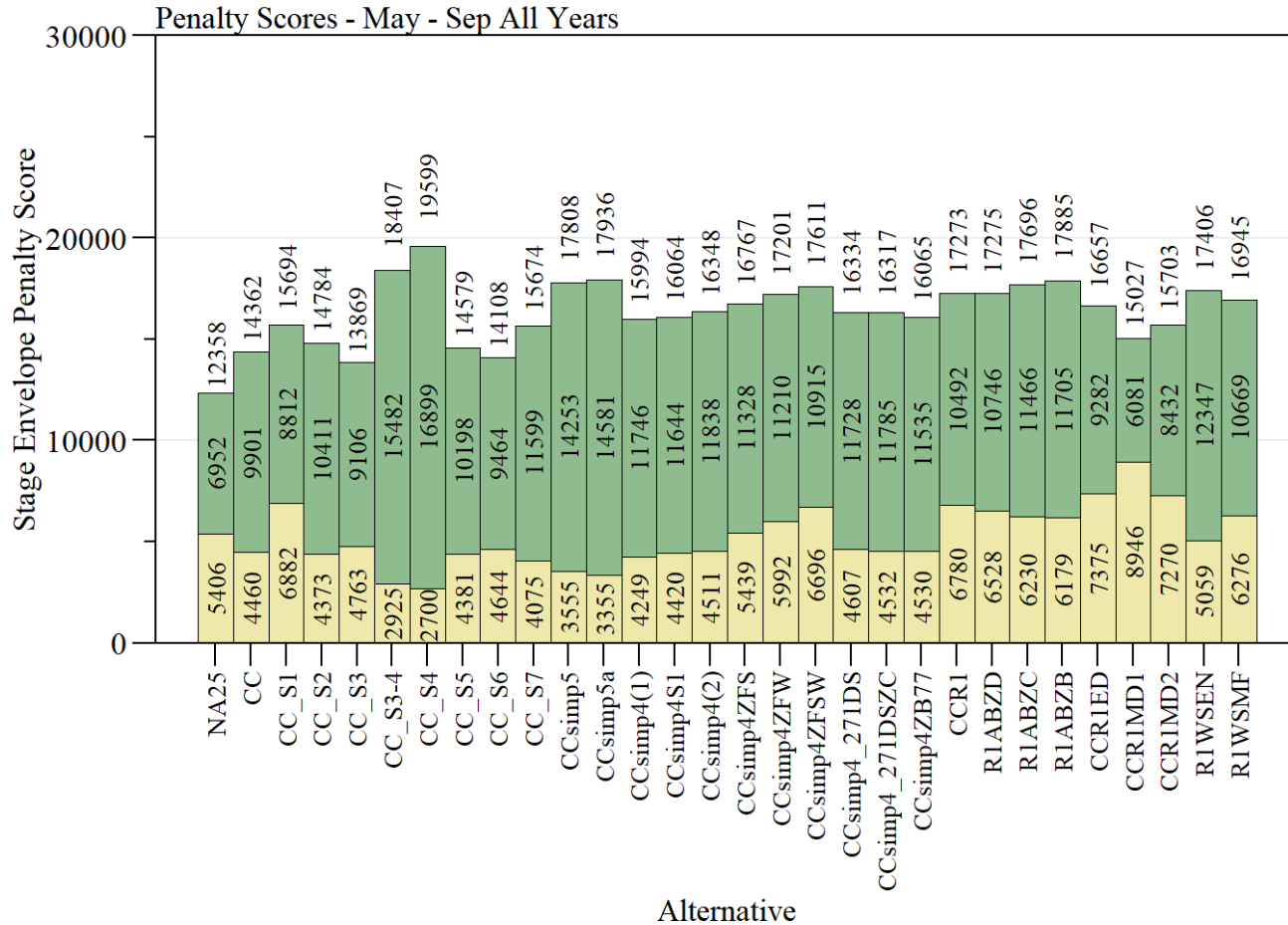
Annual lake stage envelope scores (below, above and total).

# Lake Okeechobee Stage Envelope



Total score percent difference to FWO.

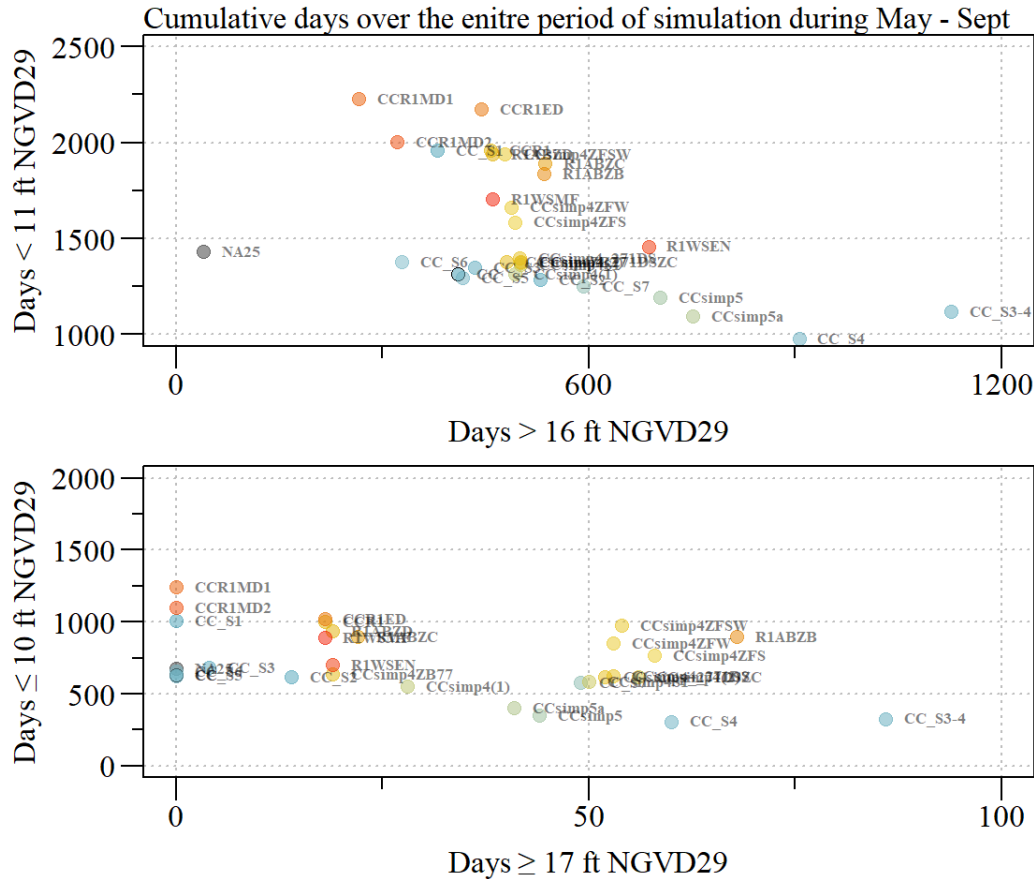
# Lake Okeechobee Stage Envelope



May to September lake stage envelope scores (below, above and total).



# Lake Okeechobee Stage Envelope

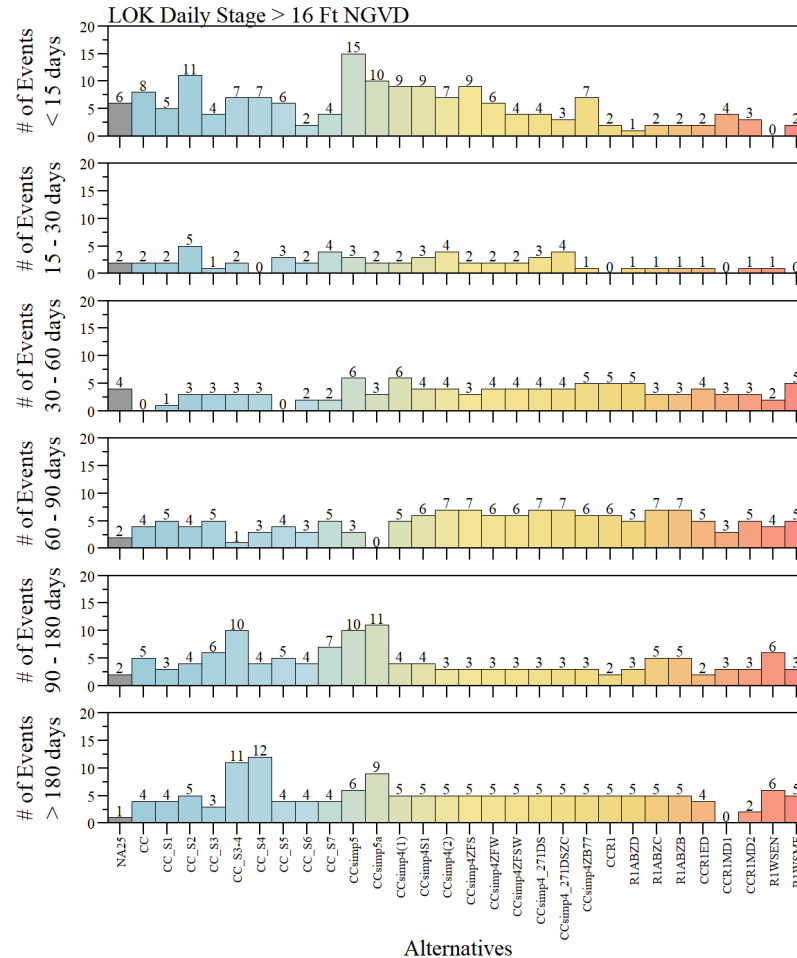


Frequency of high and low stages across alternatives during May to September.



# Lake High Stage Events

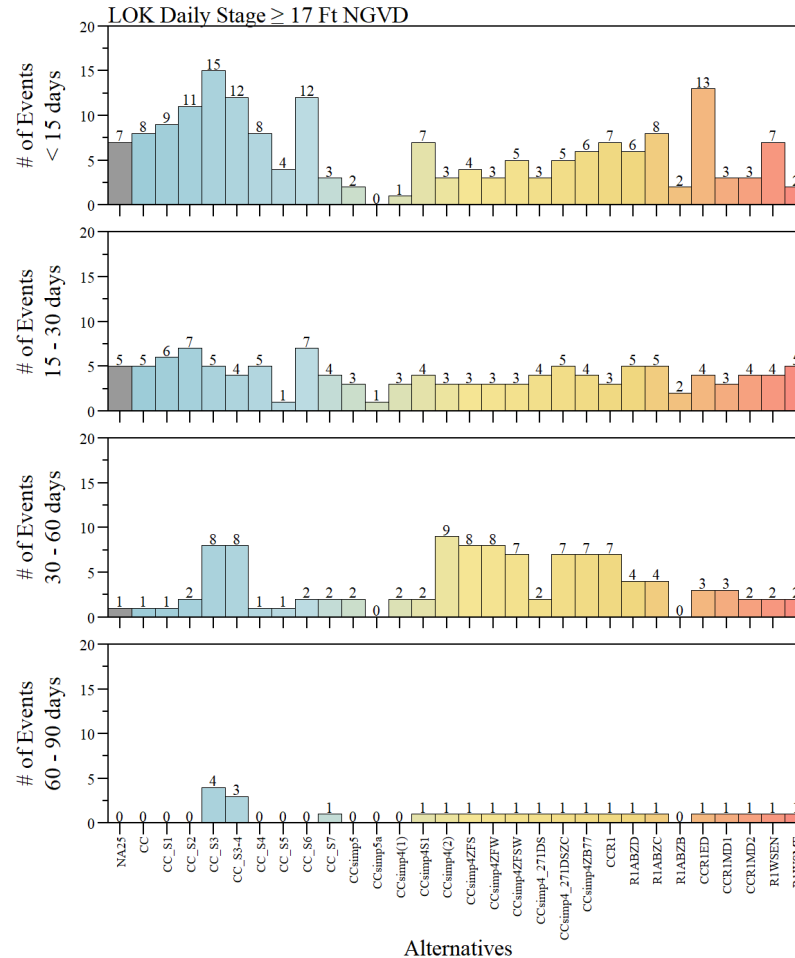
Number and duration of events with stage elevations >16 Ft NGVD29.



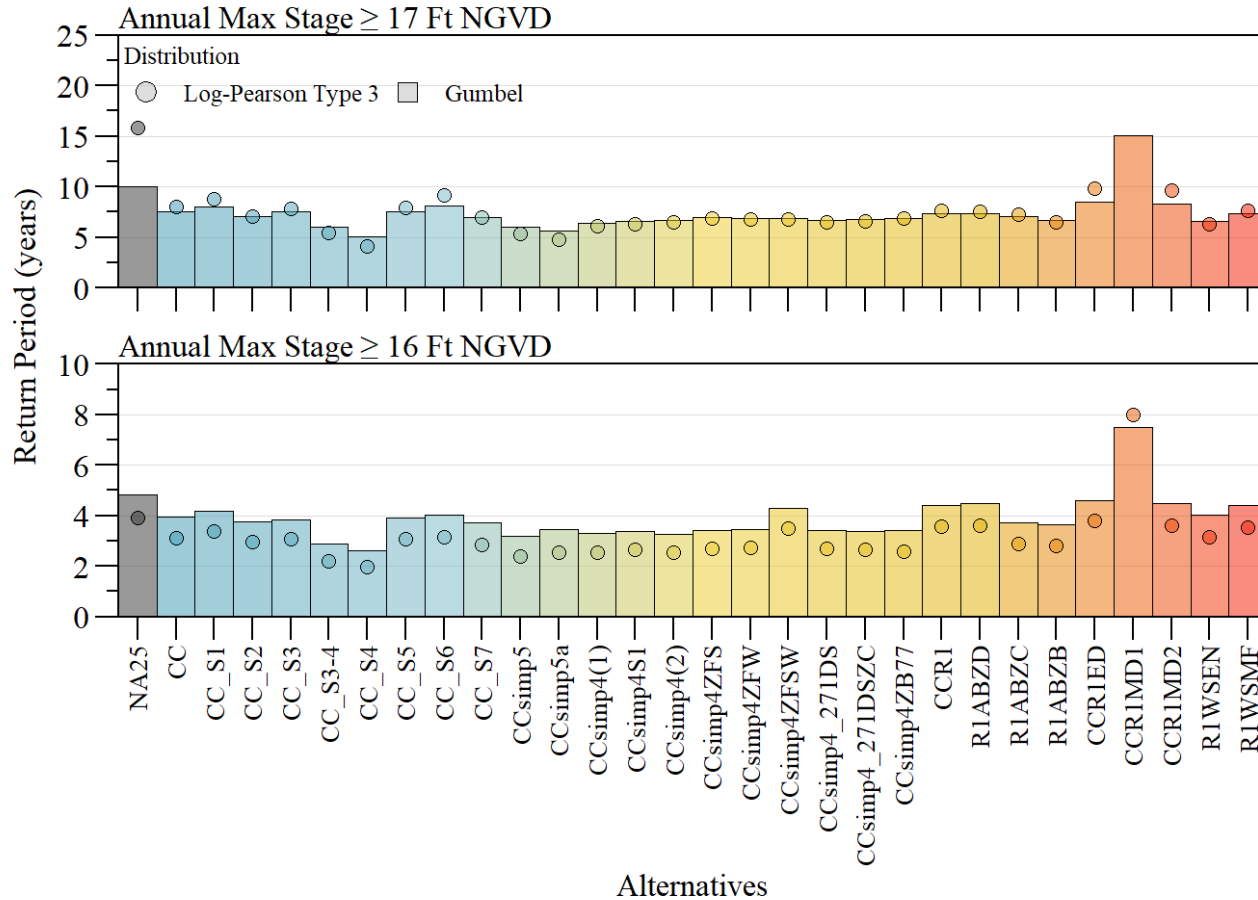
Alternatives

# Lake High Stage Events

Number and duration of events with stage elevations  $\geq 17$  Ft NGVD29.



# Lake High Stage Return Period



Return/recurrence period of annual maximum stage for each alternative.