APPENDIX H

COMBINED OPERATIONAL PLAN

HYDRAULICS & HYDROLOGY

ANNEX 4
SENSITIVITY RUNS

This page intentionally left blank

H-4 SENSITIVITY RUNS

H-4.1 ROUND 2 SENSITIVITY RUNS

H-4.1.1 SCOPE FOR ROUND 2 SENSITIVITY RUNS

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
September 2018

SENSITIVITY RUN OVERVIEW

Sensitivity Runs were recommended for inclusion in the hydrologic modeling schedule for the Combined Operating Plan (COP) based on coordination with the COP Cooperating Agencies (USACE, SFWMD, and ENP) conducted during April 2018. Informed by previous COP modeled alternative scenarios, sensitivity runs will be designed to change to a minimum number of variables so that the project performance from these changes can be effectively distinguished.

Based on coordination at the 17 April 2018 COP Cooperating Agencies' meeting, the agencies jointly agreed to a preliminary list of Sensitivity Runs with potential to carry forward into further discussion after Round 1 modeling and analysis was completed. This preliminary list, which was developed for scheduling considerations, was anticipated to further evolve after Round 1 reviews and based on consideration of comments from the COP PDT during development of the Round 2 alternatives. The Round 2 hydrologic modeling duration was extended from 1 month to 2 months in the COP project schedule as a conditional placeholder for these Sensitivity Runs. Similarly, 1 additional month for Sensitivity Runs after Round 3 modeling (optimization for the Preliminary Preferred Alternative) was included in the COP project schedule as a conditional placeholder.

Two general categories of Sensitivity Runs were defined for COP:

- EIS Support
  - Assess uncertainties with an implementable plan, and/or for inclusion in adaptive management (for example, existing FDOT/USACE high-water constraints for the L-29 Canal)
- Non EIS Support
  - not considered in the implementable plan or for inclusion in adaptive management but provides valuable near future information (for example, additional seepage barrier construction, or raising the L-29 Canal maximum operating limit up to 9.7)

SENSITIVITY RUNS TO COMPLEMENT COP ROUND 2 ALTERNATIVE MODELING

Following completion of the Round 1 analyses and formulation of the Round 2 alternatives, the COP Cooperating Agencies re-convened on 18 and 25 September 2018 to identify a limited number of Sensitivity Runs to complement the Round 2 alternatives. Although both the RSM-GL and the MD-RSM models will be used to evaluate the Round 2 alternatives, only the RSM-GL will be applied for the COP Sensitivity Runs.

The following list of four total COP Sensitivity Runs were jointly recommended the agencies for completion immediately following the RSM-GL Round 2 alternative modeling. Each Sensitivity Run will be developed starting from the RSM-GL Round 2 alternatives.

a. Conditional Closures for the S12s (Apply to both Round 2 alternatives: #SR1, #SR2)
   - targets from Imodel vs prescribed seasonal closure dates at S-12A/B, S-343A/B, and S-344 currently required through the 2016 USFWS Biological Opinion

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
September 2018

- iModel will apply spatial targets for CSSS performance derived from Jason Godin's work that has been detailed to the COP Ecological subteam
- Preliminary iModel outcomes were shared with USFWS on 27 September

b. Lower Canal Levels in South Dade (Apply to Alternative N2 only: #SR3)
- Operational criteria for the following structures will be revised to match lower canal levels included in Alternative O for the South Dade Canal reaches between S-331 and S-177 (reference COP Round 2 Alternatives table for all criteria):
    - S-332BW: total operating range 3.8-4.8 feet NGVD (4.5-5.0 in Alternative N2)
    - S-332BN: total operating range 3.8-4.8 feet NGVD (4.5-5.0 in Alternative N2)
    - S-332C: total operating range 3.8-4.8 feet NGVD (4.5-5.0 in Alternative N2)
    - S-332D: total operating range 3.8-4.8 feet NGVD (4.4-4.7 in Alternative N2)
    - S-176: operating range 4.5-5.0 feet NGVD with CSSS criteria for increasing discharge by 200 cfs (4.75-5.0, no CSSS criteria in Alternative N2)
    - S-177: operating range 3.6-4.2 feet NGVD with high-rainfall criteria for increasing discharge by 200 cfs (3.6-4.2 with high-rainfall criteria for lowering HW criteria to 3.3 in Alternative N2)
    - No changes to S-199 and S-200 criteria (same for Alternatives O and N2)
    - No changes to S-194 and S-196 criteria (retain from Alternative N2, which are very similar to Alternative O ranges)
- responsive to stakeholder input received during Round 2 alternative development
- responsive to COP "Planning Consideration" to "explore opportunities to enhance flood control and mitigation"

c. Refinement of operational criteria for coastal divide structures to opportunistically provide improved timing and spatial distribution of flows to Biscayne Bay (Apply to Alternative O only: #SR4)
- responsive to recommendations from the COP Ecological subteam ensure COP operations maintain the "do no harm" standard for Biscayne Bay while aiming to prioritize spatial location of inflows to the South Bay (Round 1 flow effects to Biscayne Bay were characterized as minimal by the Ecological subteam)
- Alternative O selected since this alternative does not include supplemental regulatory deliveries from WCA-3A to the South Dade Conveyance System
- Opportunity to further explore feasibility of opportunistic Biscayne Bay operational criteria in advance of Round 3

SENSITIVITY RUNS TO COMPLEMENT COP ROUND 3 ALTERNATIVE MODELING

The following list of potential COP Sensitivity Runs have additionally been identified as candidates for consideration after Round 3 modeling (optimization), after completion of the Round 2 reviews and based on consideration of comments from the COP PDT. Sensitivity Runs conducted concurrent with the Round 2 modeling (a through c above) may also be carried forward for further assessment after Round 3, if necessary. Further coordination between the COP Cooperating Agencies will be conducted following completion of the Round 2 evaluations,

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
September 2018

prior to making any decisions regarding the appropriateness of conducting any or all of the these candidate Sensitivity Runs.

d. Relax L-29 FDOT constraint
   - Based on the USACE Increment 2 Operational Strategy limit of 90 days per water year with stages above 8.3 feet NGVD, the Round 1 and Round 2 alternatives limit the L-29 Canal maximum operating limit to 8.5 feet NGVD during October through February and 8.25 feet NGVD for the remaining 8 months of each year
   - nothing higher than 8.5 feet NGVD, consistent with prescribed COP constraints
e. WCA 1 and 2 schedules
   - Could be used to verify forward compatibility of TSP with potential future changes
   - changes to these Regulation Schedules are outside of the COP scope
f. Improve timing for water quality of SRS inflow (further scope details and justification to be determined)
g. Effects of Sea-Level Change on Future COP Performance (further scope details and justification to be determined)

H-4.1.2 MODELING RESULTS FOR ROUND 2 SENSITIVITY RUNS

H-4.1.2.1 CRITICAL FLOWS REPORT

Critical Flows Report....[1]

Date: 2018/10/26
P.O.R: 1965--2005
Files are---->
ECB19RR /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ECB19/output_100218_svn13937_rsm5354/RSMGL_SD_outp
ALTN2 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ALTN2/output_102018_svn14033_rsm5426/RSMGL_SD_output
SR1 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SR1/output_102318_svn14046_rsm5426/RSMGL_SD_output.dss
SR2 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SR2/output_102518_svn14062_rsm5426/RSMGL_SD_output.dss
SR3 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SR3/output_102018_svn14030_rsm5426/RSMGL_SD_output.dss
ECB19RR /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ECB19/output_100218_svn13937_rsm5354/wsfc_post_pro
ALTN2 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ALTN2/output_102018_svn14033_rsm5426/wsfc_post_proc.
SR1 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SR1/output_102318_svn14046_rsm5426/wsfc_post_proc.dss
SR2 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SR2/output_102518_svn14062_rsm5426/wsfc_post_proc.dss
SR3 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SR3/output_102018_svn14030_rsm5426/wsfc_post_proc.dss
ECB19RR /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ECB19/input/dss_files/RSMBN_ECB19.dss
ALTN2 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ALTN2/input/dss_files/RSMBN_ECB19.dss
SR1 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SR1/input/dss_files/RSMBN_ECB19.dss
SR2 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SR2/input/dss_files/RSMBN_ECB19.dss
SR3 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SR3/input/dss_files/RSMBN_ECB19.dss

All values (annual average are in Kac-ft)

Table 1. WCA-1

	ECB19RR	ALTN2	SR1	SR2	SR3
G94	36.8	36.8	36.8	36.8	36.8
S10	308.9	308.9	308.9	308.9	308.9
S39	37.1	37.1	37.1	37.1	37.1
S6FC	0.0	0.0	0.0	0.0	0.0
S6WS	0.8	0.8	0.8	0.8	0.8

[1] Modeling Section
South Florida Water Management District

1

Table 2. WCA-2A

	ECB19RR	ALTN2	SR1	SR2	SR3
S7FC	56.4	56.4	56.4	56.4	56.4
S7WS	11.5	11.5	11.5	11.5	11.5
STA20+BYP2N	371.3	371.3	371.3	371.3	371.3
STA20+BYP2S	8.1	8.1	8.1	8.1	8.1
S38	77.3	76.9	76.9	77.4	76.9
S143	26.5	26.1	26.1	26.5	26.1
S144	44.5	44.5	44.5	44.6	44.5
S145	47.7	47.8	47.8	47.8	47.8
S146	46.3	46.4	46.4	46.4	46.4

Table 3. WCA-3A/L-29

	ECB19RR	ALTN2	SR1	SR2	SR3
NWA3A-L28	203.1	203.1	203.1	203.1	203.1
S8FC	341.4	341.4	341.4	341.4	341.4
S8WS	27.8	28.0	28.0	28.0	28.0
S339	19.8	20.0	20.1	20.1	20.0
S340	19.3	19.6	19.6	19.6	19.6
S150	0.0	0.0	0.0	0.0	0.0
S140	124.3	124.2	124.1	124.4	124.2
S9	150.3	141.9	139.7	141.2	141.7
S11	481.8	482.0	482.0	481.0	482.0
S343	14.9	11.7	25.0	17.9	11.6
S344	7.0	5.7	5.5	2.4	5.6
S333	262.8	522.0	518.1	490.7	522.4
S333N	0.1	0.2	0.3	5.1	0.2
S12A	29.8	20.3	35.5	27.5	20.3
S12A_WEIR	5.9	4.3	4.3	6.6	4.3
S12B	34.9	25.2	40.1	39.2	25.1
S12B_WEIR	4.7	3.6	3.5	5.4	3.6
S12C	142.9	97.0	92.7	65.6	96.8
S12D	218.6	162.7	156.3	186.9	162.4
S334	0.4	0.2	0.0	0.0	1.1
S356	125.3	189.5	185.5	172.2	189.3

Table 4. WCA-3B

	ECB19RR	ALTN2	SR1	SR2	SR3
S151FC	185.1	141.3	133.4	124.5	140.9
S151WS	76.4	57.2	56.3	53.0	57.8
S152	73.9	58.1	54.0	67.5	58.1
S31FC	7.9	6.6	6.5	6.9	6.6
S31WS	0.1	0.1	0.1	0.1	0.1
S337FC	1.1	0.4	0.4	0.0	0.3
S337WS	71.5	54.2	53.5	50.3	54.8
S355A	18.5	9.5	9.1	9.3	9.4
S355B	14.8	6.6	6.4	5.5	6.6
TTBRIDGE1MILE	208.8	286.3	283.0	277.5	285.8
TTBRIDGE2.6MILE	177.2	351.4	345.5	322.5	351.0

Table 5. ENP-Detention-Areas

	ECB19RR	ALTN2	SR1	SR2	SR3
S357	45.5	79.9	77.3	54.6	−901.0
S357N	5.8	5.7	5.1	5.5	5.7
S332BN	64.8	34.9	31.2	77.2	40.8
S332B	64.8	34.9	31.2	84.1	49.3
S332C	109.5	48.7	41.1	52.7	39.7
S332D	111.4	119.5	124.5	146.2	−901.0
S332DX1	4.1	4.3	0.0	0.0	0.2
S199	51.0	49.3	48.3	59.1	50.2
S200	50.2	49.0	47.8	59.0	50.0
G737	10.3	9.3	8.9	10.2	8.7
S328	34.4	41.2	48.0	51.8	39.7
SDNWE	1.7	2.9	4.7	5.8	4.0
S329	0.9	1.2	2.1	2.4	1.6
S205	0.0	0.1	0.1	0.1	0.1

Table 6. South-Dade

	ECB19RR	ALTN2	SR1	SR2	SR3
G211FC	95.3	54.1	49.7	79.0	56.0
G211WS	43.2	30.7	30.1	27.1	31.1
S335FC	166.4	99.3	94.8	23.8	96.0
S335WS	42.5	35.5	34.9	38.0	35.8
S335_2	−901.0	47.8	47.1	65.8	52.3
S335_3	−901.0	−901.0	−901.0	55.2	−901.0
S336	6.0	5.0	5.0	4.6	5.1
S338	58.2	67.8	67.0	57.0	67.5
S331FC	153.2	72.4	66.9	146.8	72.7
S331WS	42.7	30.7	30.1	24.3	31.2
S194	39.2	31.2	29.3	36.7	29.0
S196	26.4	21.6	19.0	22.6	19.4
S165	9.5	9.7	9.2	9.1	9.2
S166	0.3	0.3	0.3	0.3	0.3
S148	36.5	43.4	43.2	35.2	42.6
S176	27.3	24.2	18.7	16.6	24.7
S176_2	9.3	−901.0	−901.0	1.3	1.8
S177	76.2	65.5	63.2	62.5	65.2
S177_2	1.9	−901.0	−901.0	0.9	0.7
S178	8.7	18.2	18.1	9.3	18.3
S18C	147.2	135.2	133.6	139.9	136.6
S197	60.4	20.2	19.8	12.6	20.8

Table 7. BiscayneBay

	ECB19RR	ALTN2	SR1	SR2	SR3
NorthBay	509.3	498.8	494.7	494.1	498.3
CentralBay	106.9	106.5	105.7	104.6	106.3
SouthBay	248.9	257.5	253.9	245.7	250.9

Table 8. CoastalStructures

	ECB19RR	ALTN2	SR1	SR2	SR3
S20	12.6	12.7	12.6	12.5	12.6
S20F	108.7	107.9	105.8	107.7	104.4
S20G	5.8	5.8	5.8	5.8	5.8
S21A	59.9	60.2	59.2	59.2	58.2
S21	74.4	83.5	83.0	73.0	82.5
S123	11.4	11.7	11.6	11.4	11.6
S22	77.3	76.9	76.3	75.5	76.8
G93	18.1	17.9	17.8	17.7	17.9

H-4.1.2.2 HYDROPERIOD DIFFERENCE MAPS

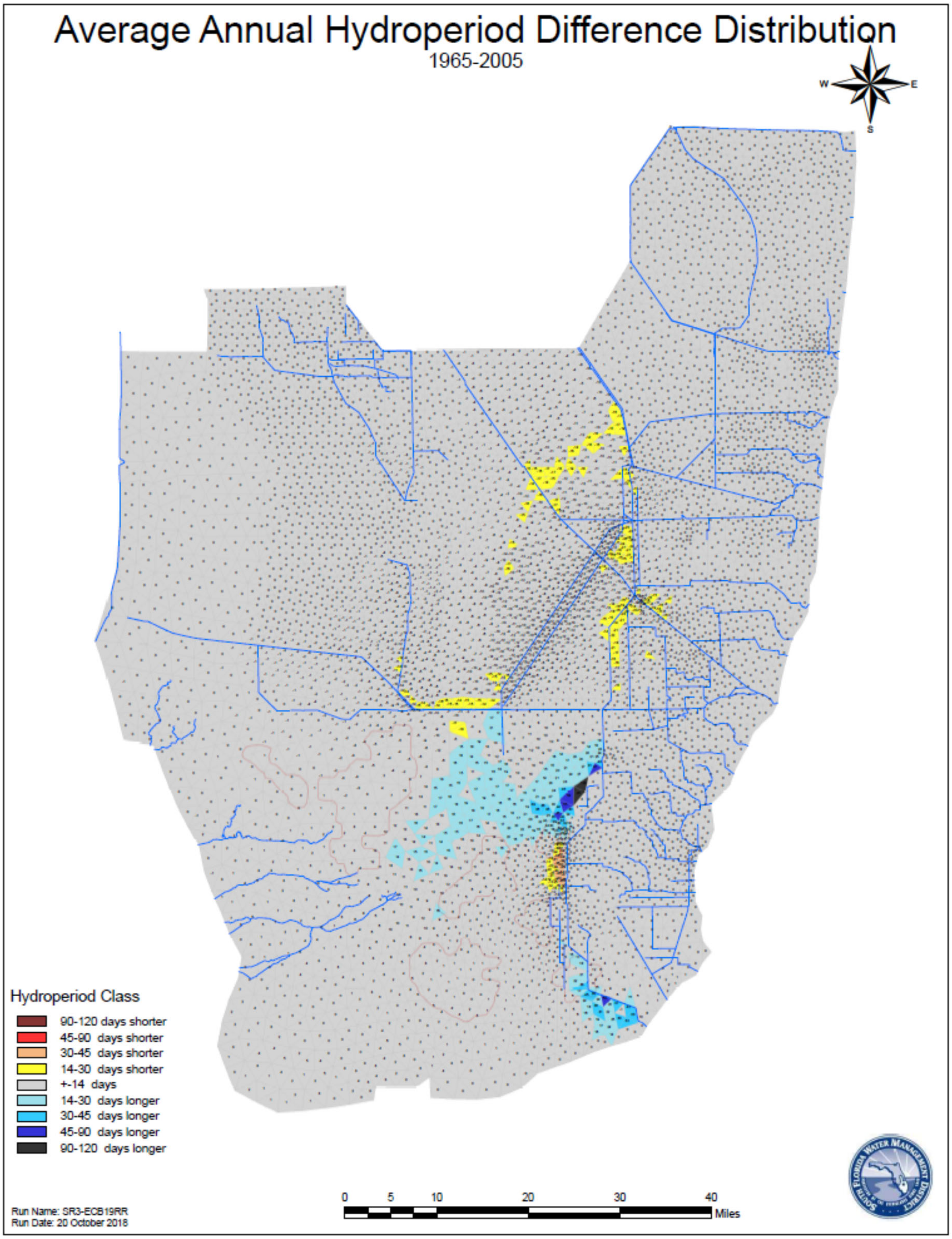

Figure H-4. 1. Average annual hydroperiod differences for Sensitivity Run SR3 and ECB19RR Base.

H-4.1.2.3 PONDING DEPTH DIFFERENCE MAPS

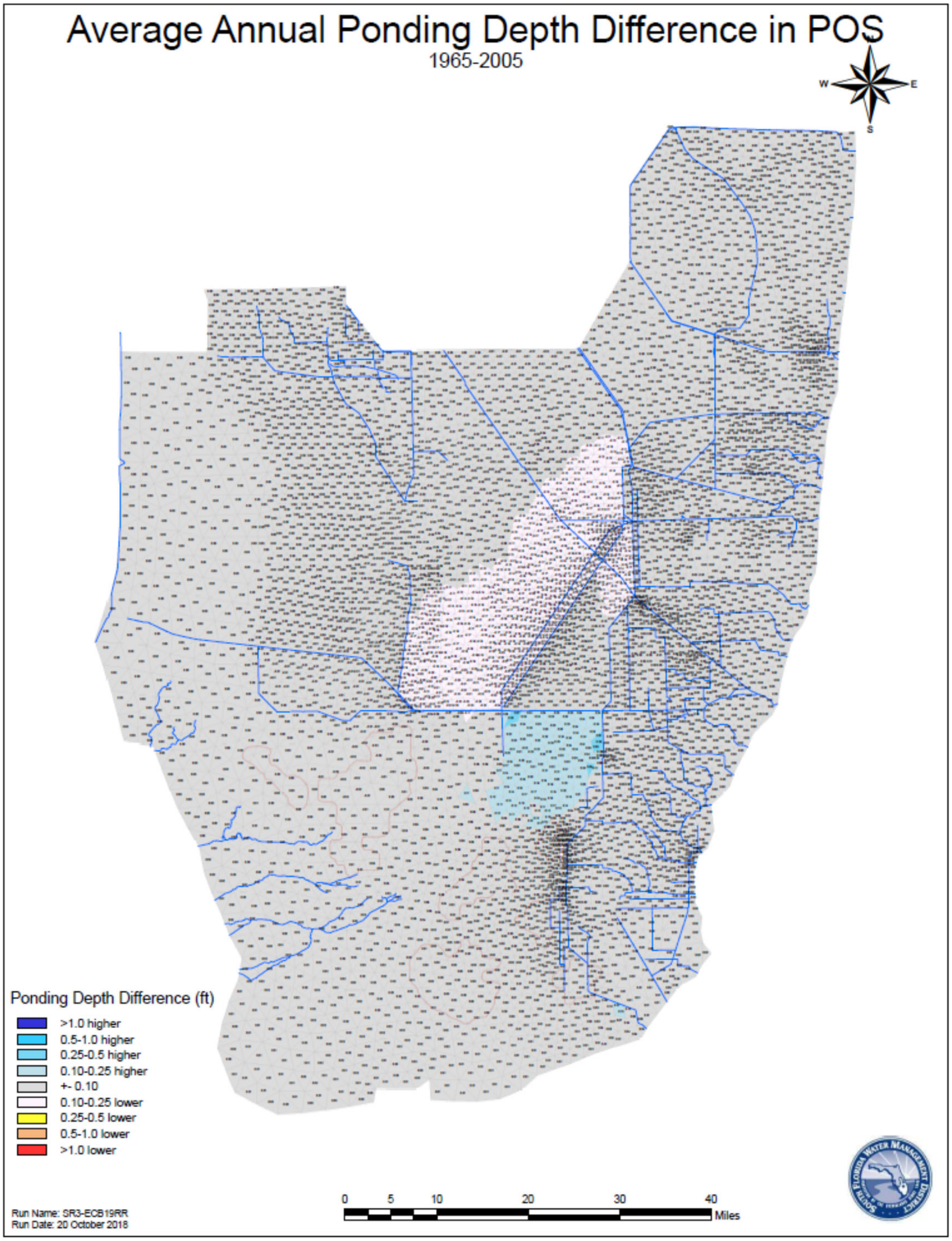

Figure H-4. 2. Average annual ponding depth difference map for Sensitivity Run SR3 and ECB19RR Base.

H-4.1.2.4 ANNUAL AVERAGE STAGE DIFFERENCE MAPS

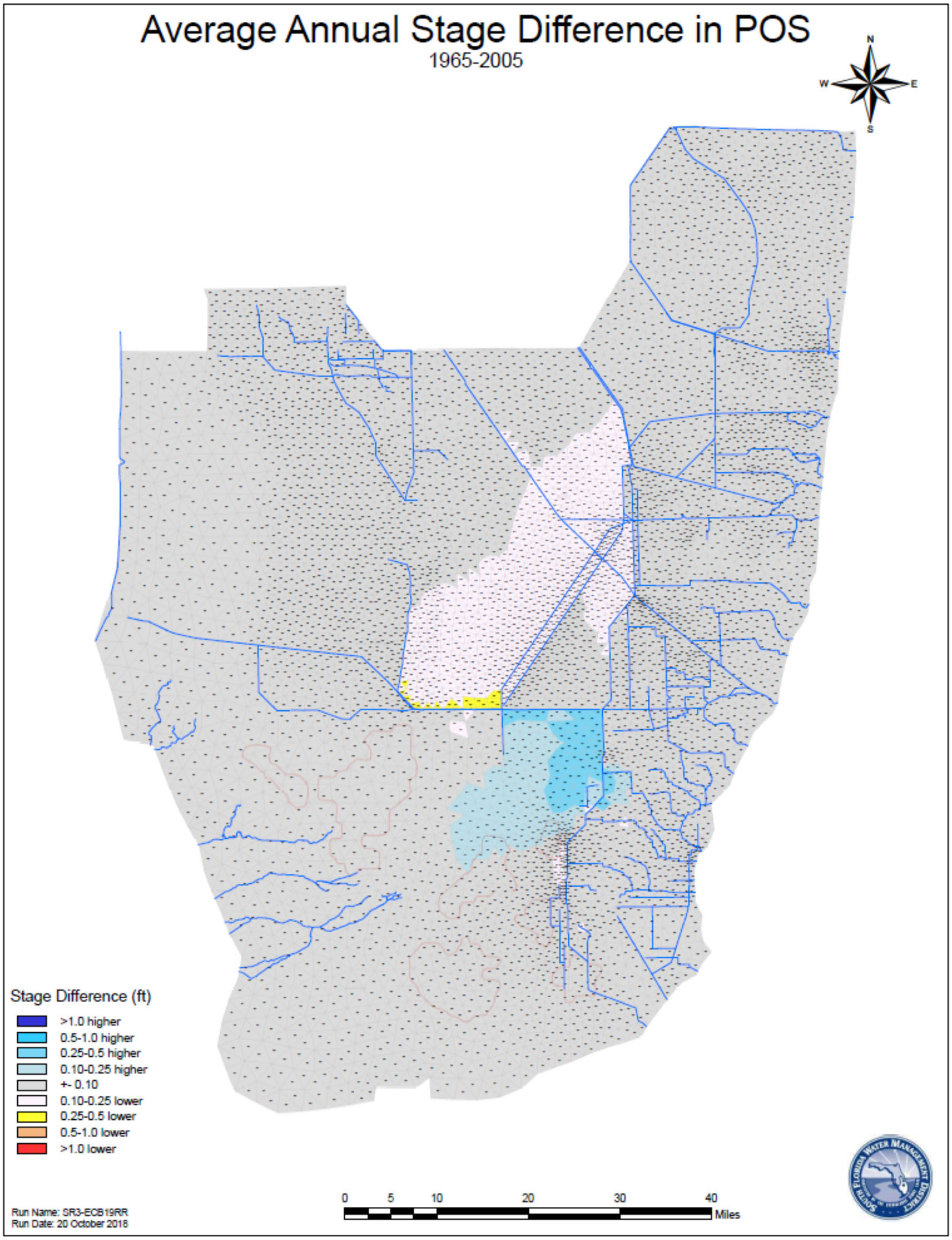

Figure H-4. 3. Average annual stage difference map for Sensitivity Run SR3 and ECB19RR Base.

H-4.1.2.5 CANAL DURATION CURVES

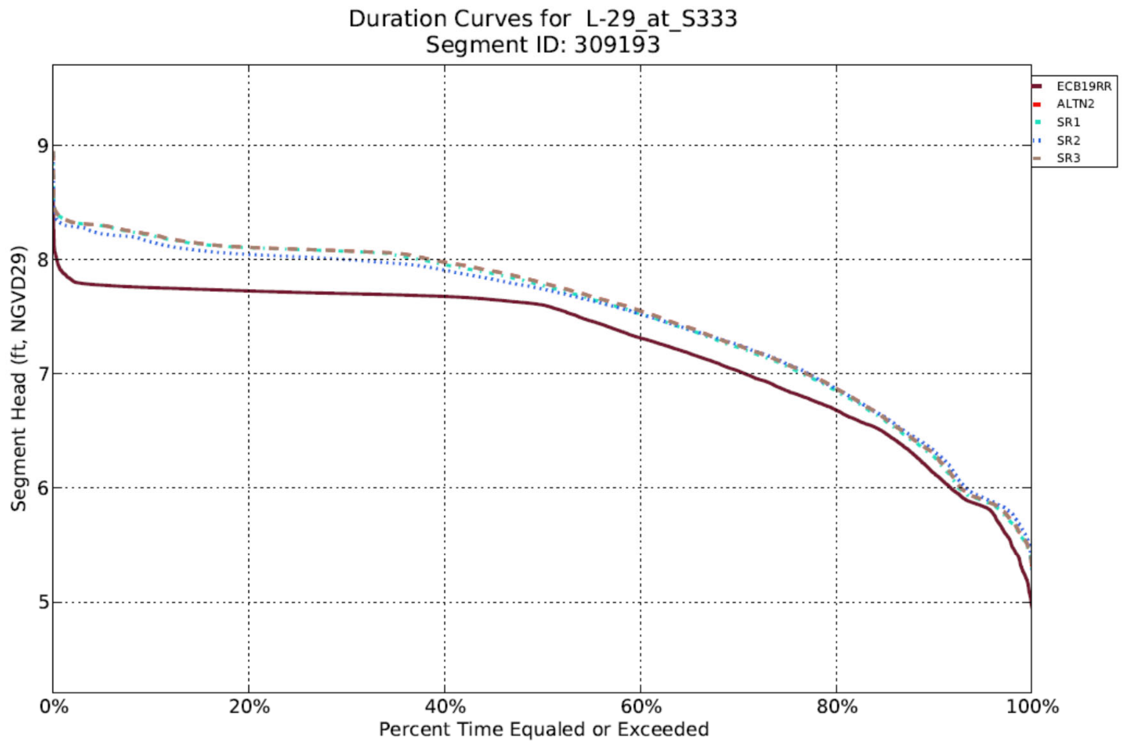

Figure H-4. 4. L-29 Canal stage duration curves for Round 2 sensitivity runs, ALTN2 and ECB19RR Base.

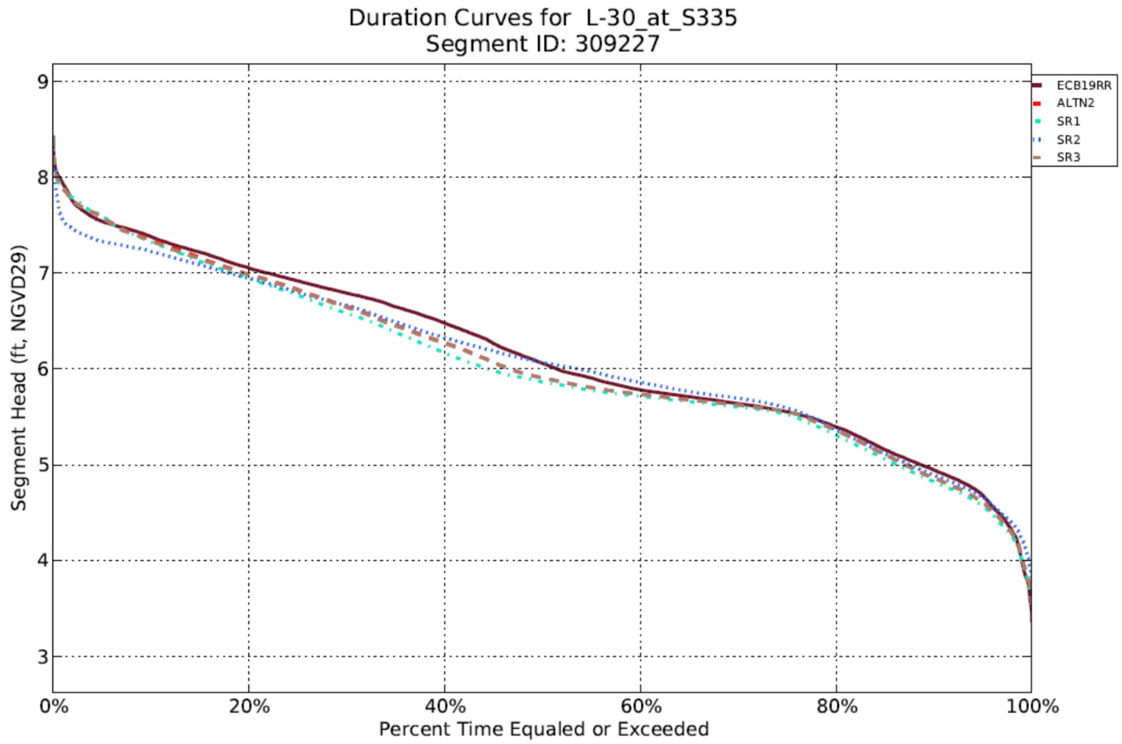

Figure H-4. 5. L-30 Canal stage duration curves for L-30 Canal at S-335 for Round 2 sensitivity runs, ALTN2 and ECB19RR Base.

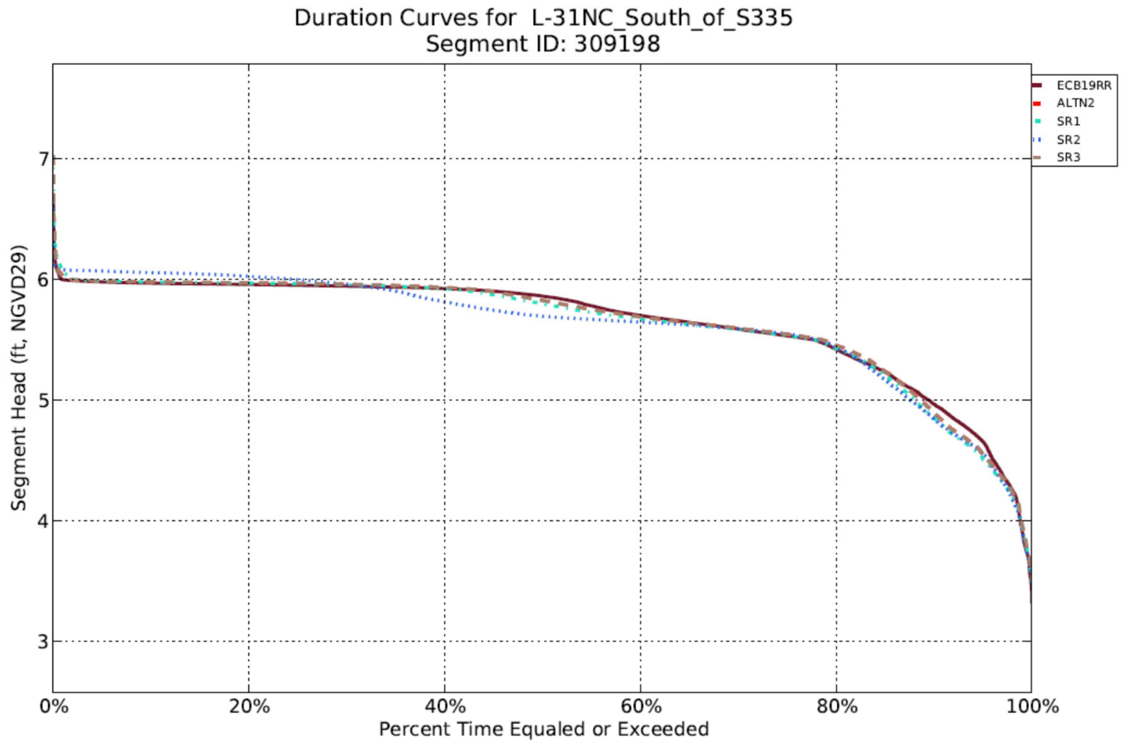

Figure H-4. 6. L-31N Canal stage duration curves South of S-335 for Round 2 sensitivity runs, ALTN2 and ECB19RR Base.

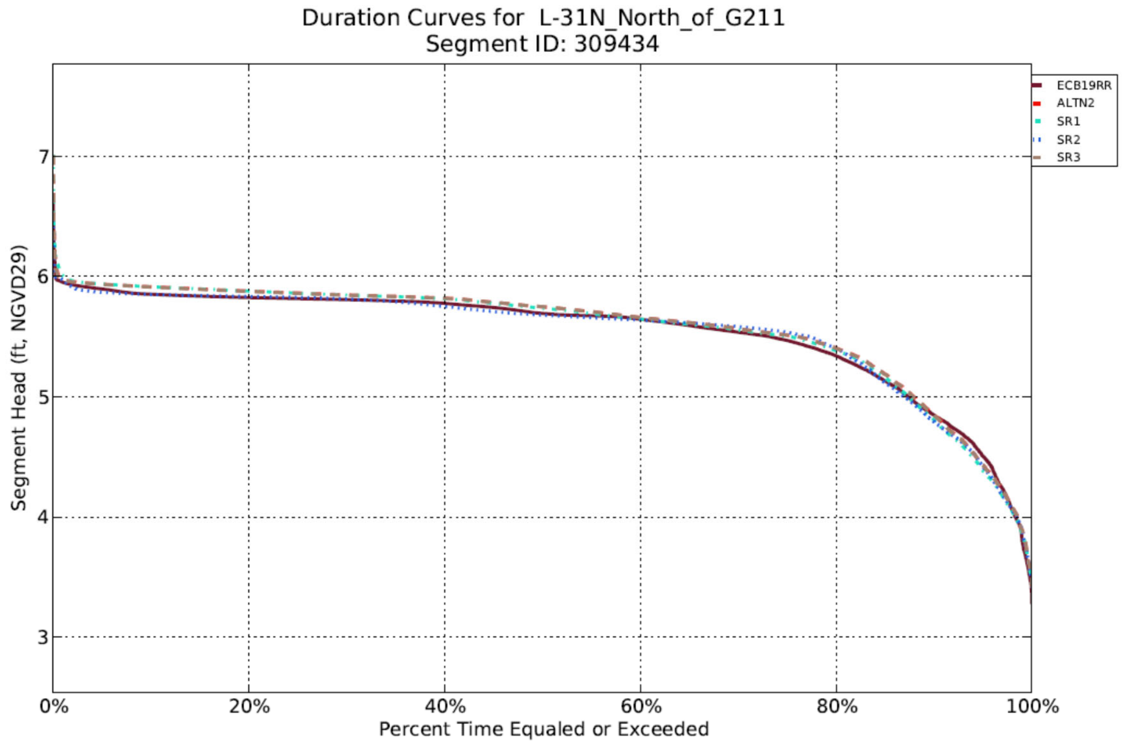

Figure H-4. 7. L-31N Canal stage duration curves north of G-211 for Round 2 sensitivity runs, ALTN2 and ECB19RR Base.

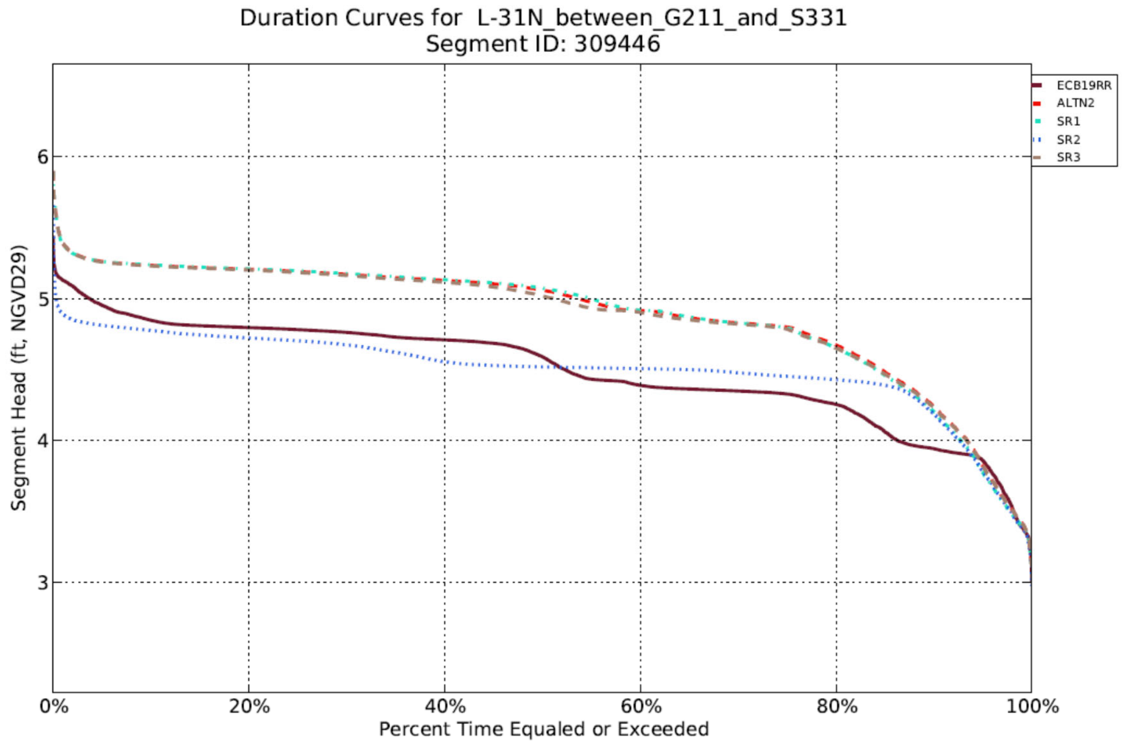

Figure H-4. 8. L-31N Canal stage duration curves between G211 and S-331 for Round 2 sensitivity runs, ALTN2 and ECB19RR Base.

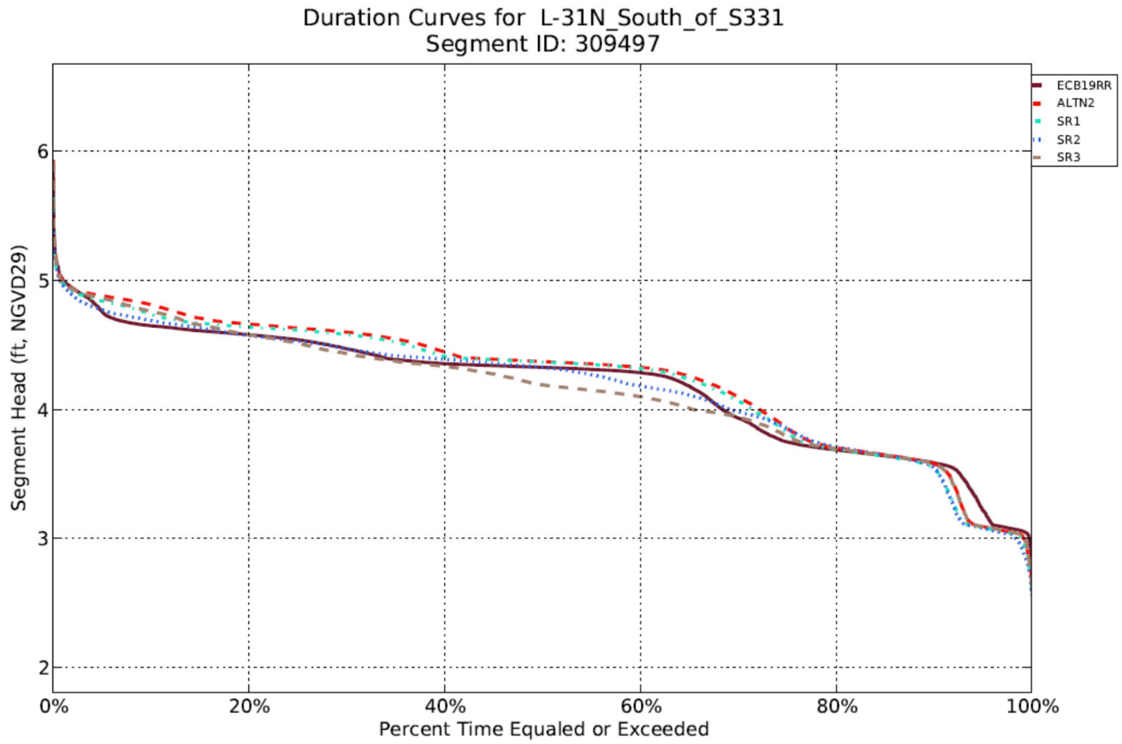

Figure H-4. 9. L-31N Canal stage duration curves south of S-331 for Round 2 sensitivity runs, ALTN2 and ECB19RR Base.

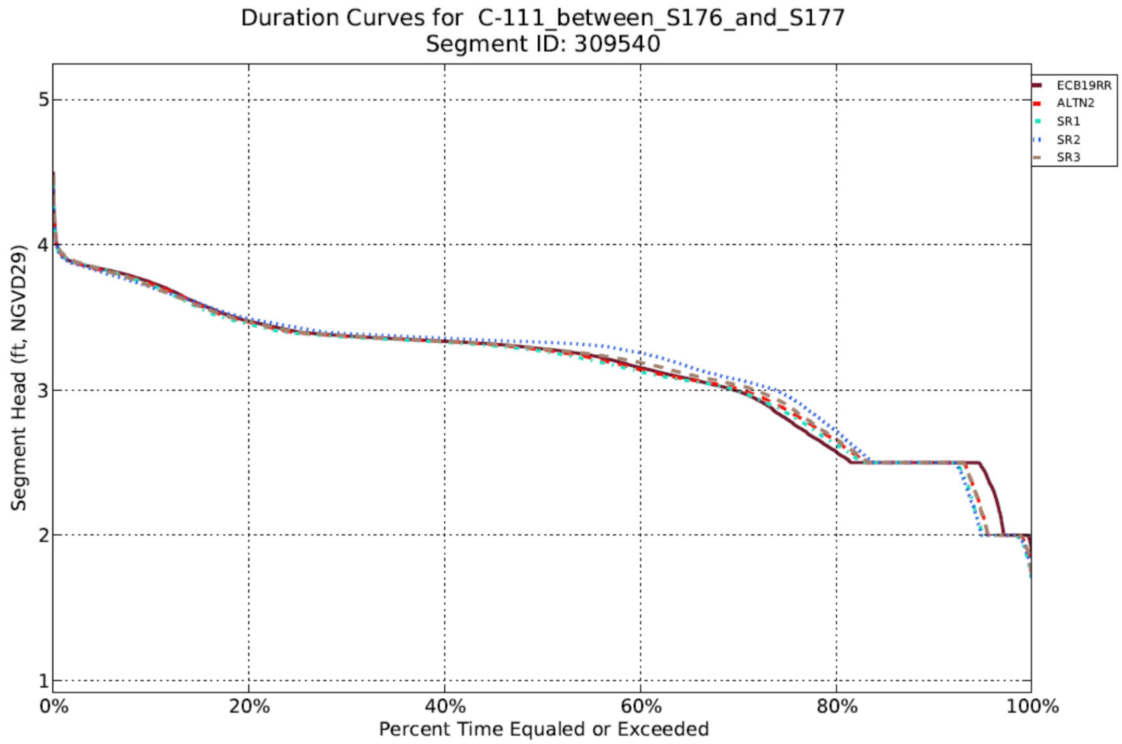

Figure H-4. 10. C-111 Canal stage duration curves between S-176 and S-177 for Round 2 sensitivity runs, ALTN2 and ECB19RR Base.

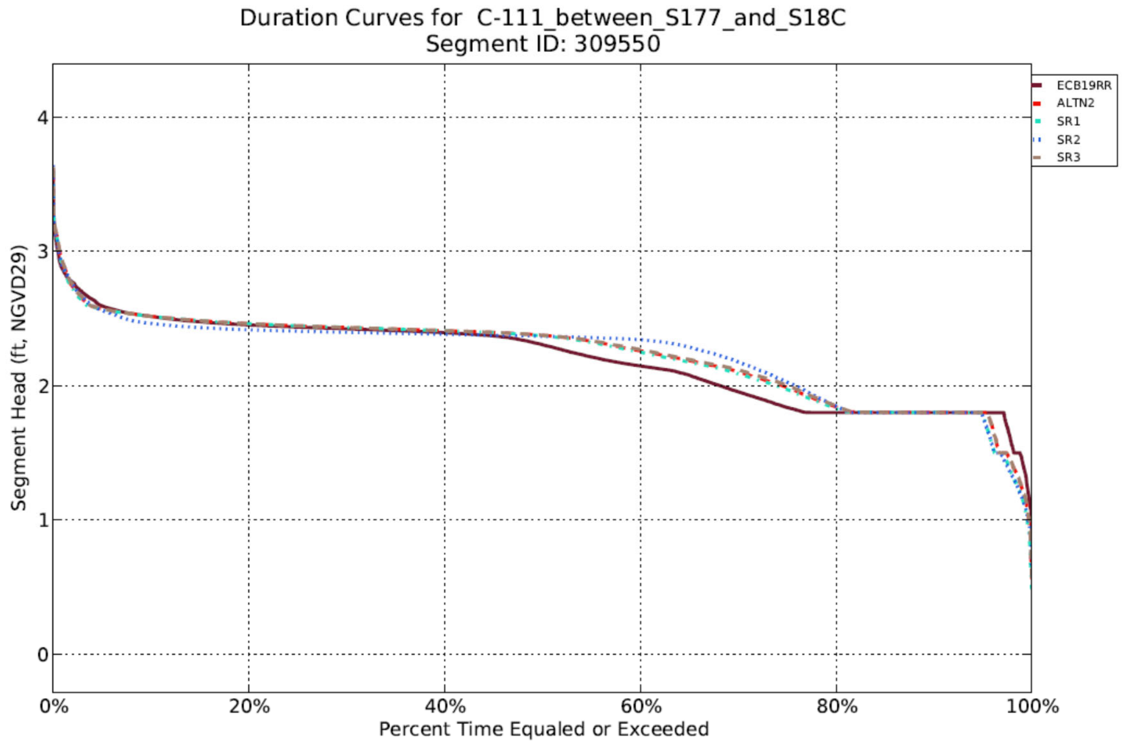

Figure H-4. 11. C-111 Canal stage duration curves between S-177 and S-18C for Round 2 sensitivity runs, ALTN2 and ECB19RR Base.

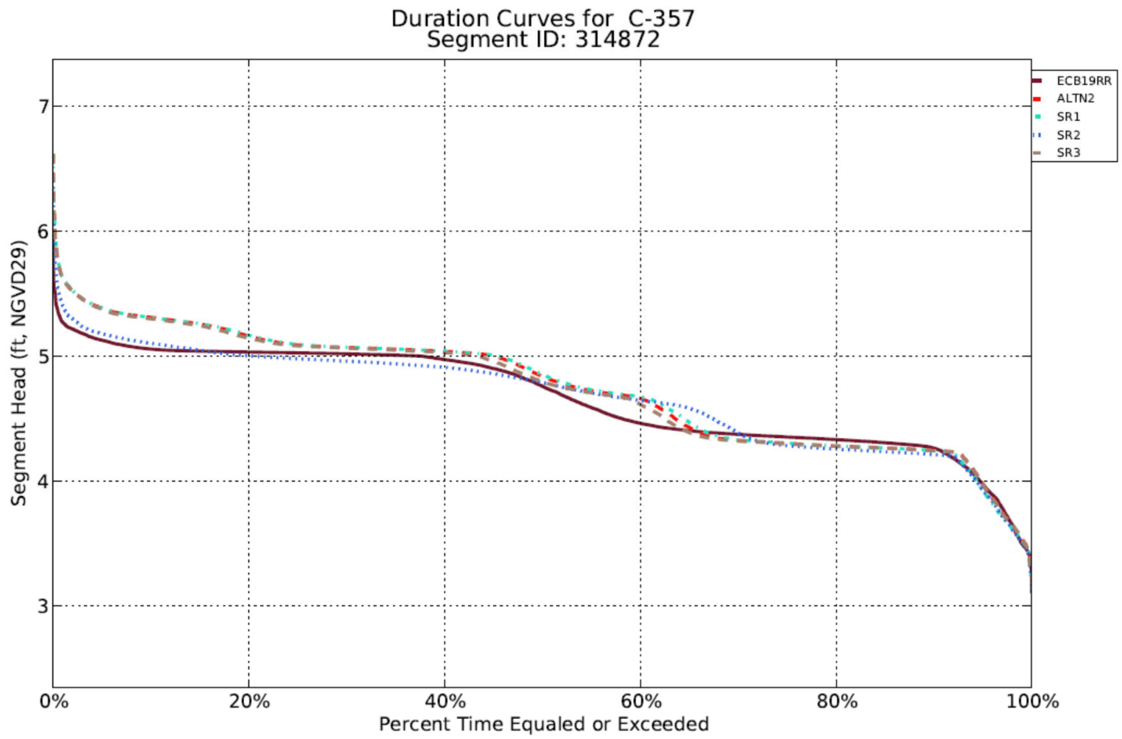

Figure H-4. 12. C-357 Canal stage duration for Round 2 sensitivity runs, ALTN2 and ECB19RR Base.

H-4.1.2.6 GAUGE DURATION CURVES

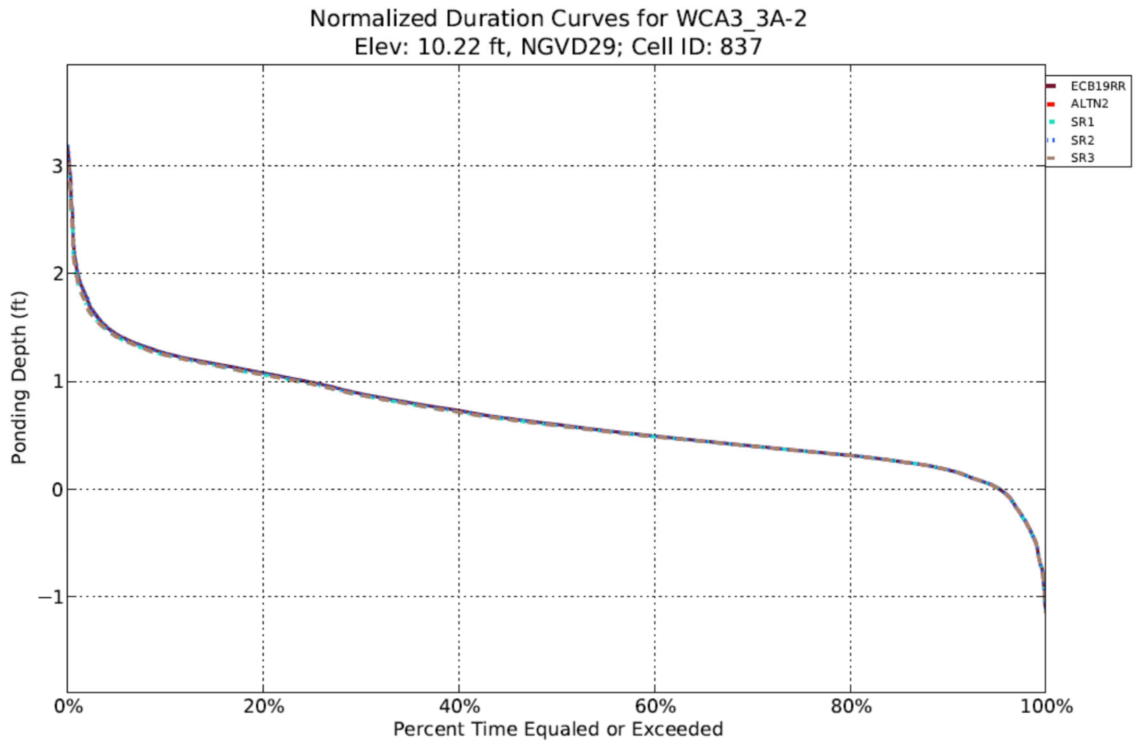

Figure H-4. 13. Ponding depth duration curves at Gauge WCA3_3A-2 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

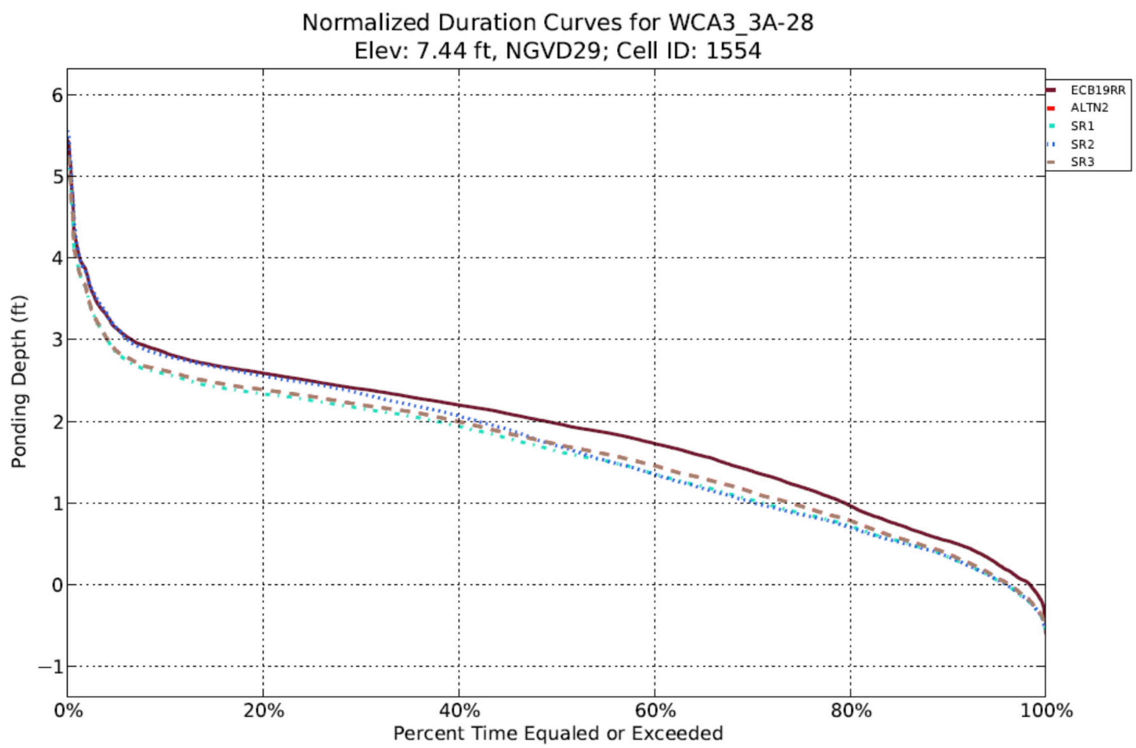

Figure H-4. 14. Ponding depth duration curves at Gauge WCA3_3A-28 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

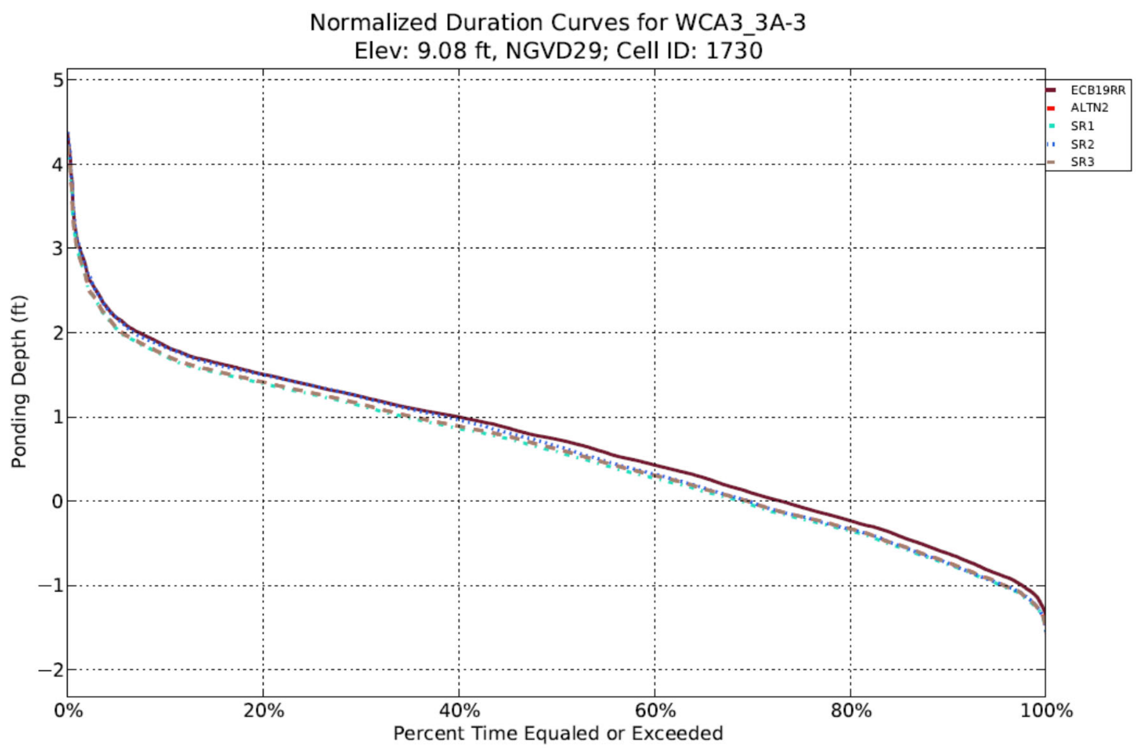

Figure H-4. 15. Ponding depth duration curves at Gauge WCA3_3A-3 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

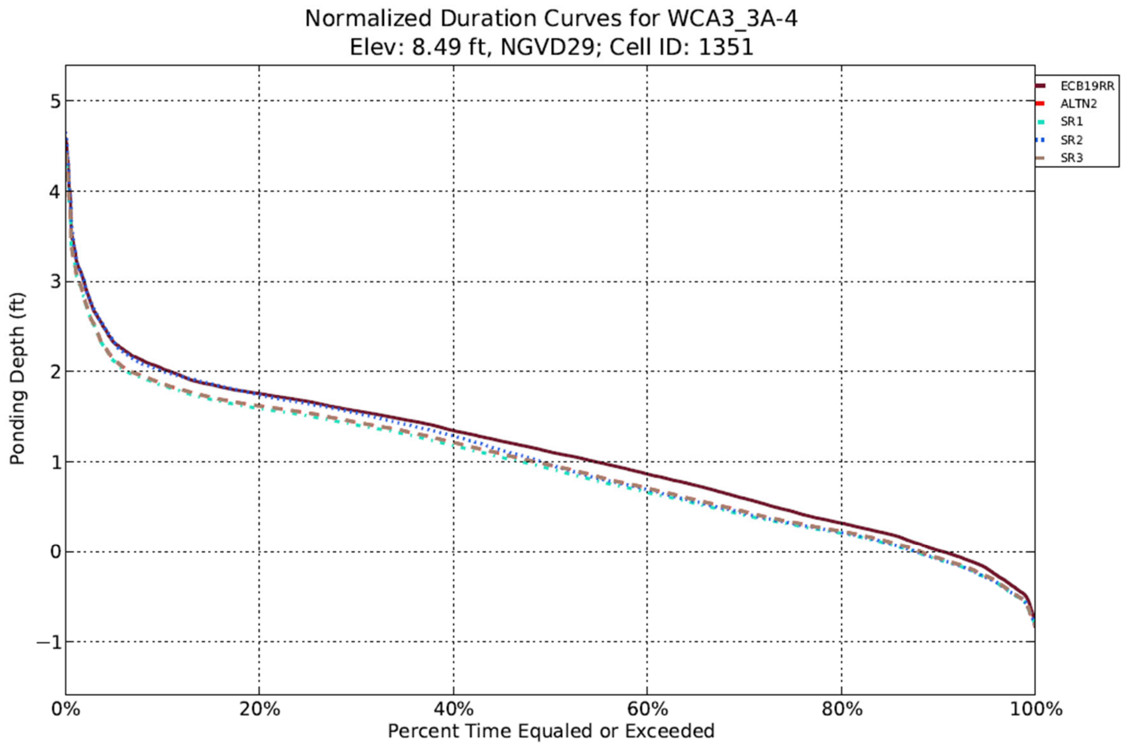

Figure H-4. 16. Ponding depth duration curves at Gauge WCA3_3A-4 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

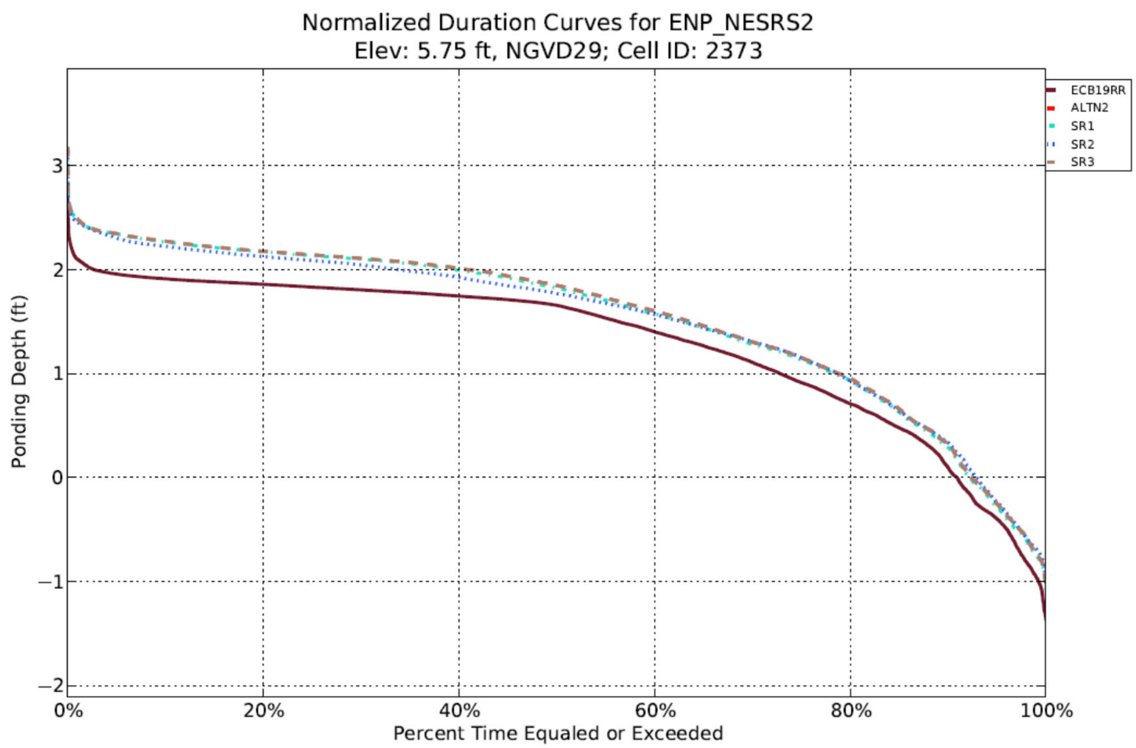

Figure H-4. 17. Ponding depth duration curves at Gauge NESRS2 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

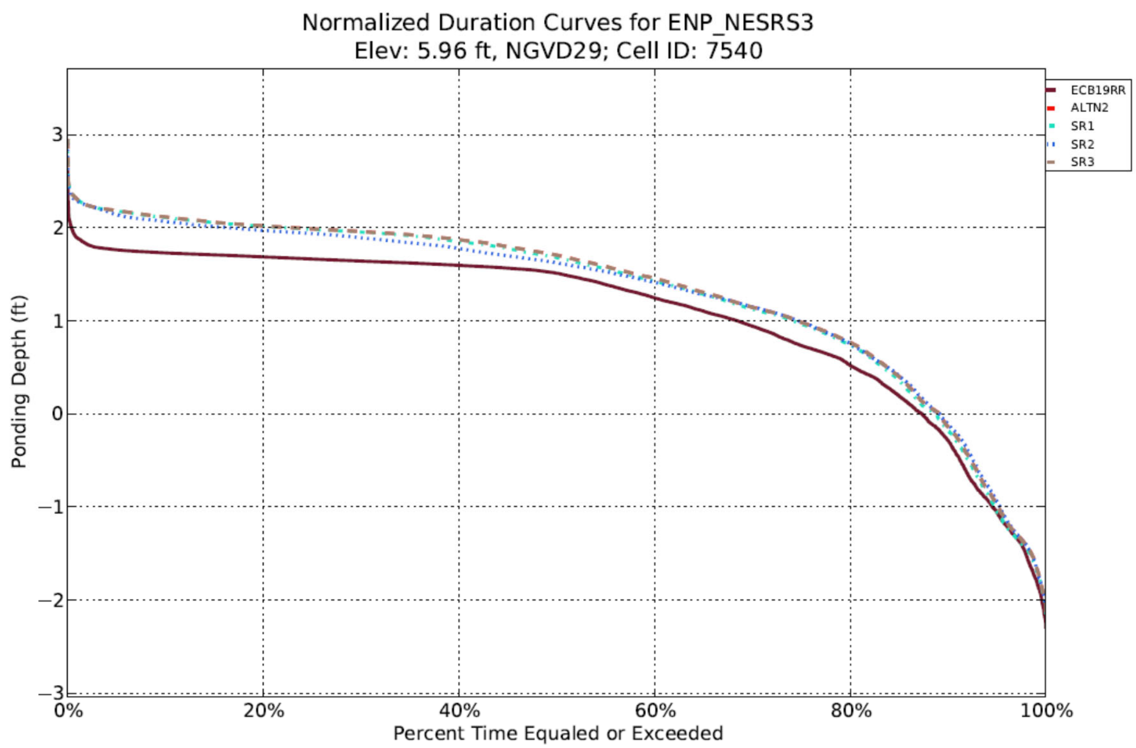

Figure H-4. 18. Ponding depth duration curves at Gauge NESRS3 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

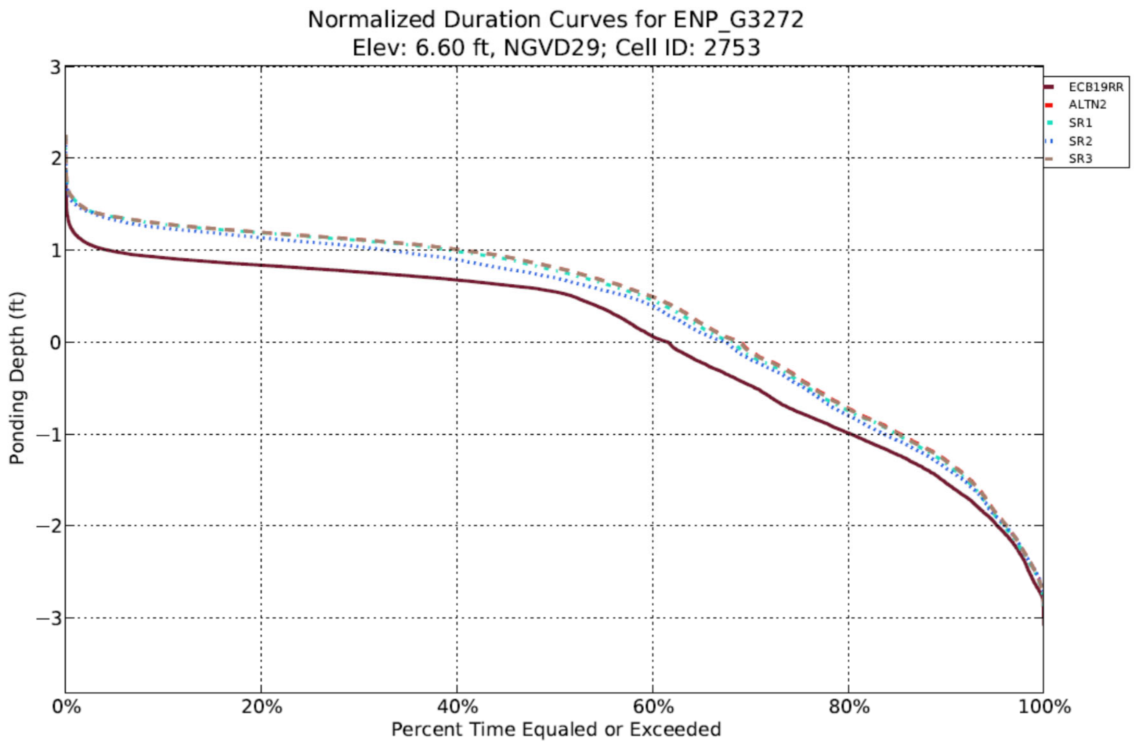

Figure H-4. 19. Ponding depth duration curves at Gauge ENP-G3272 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

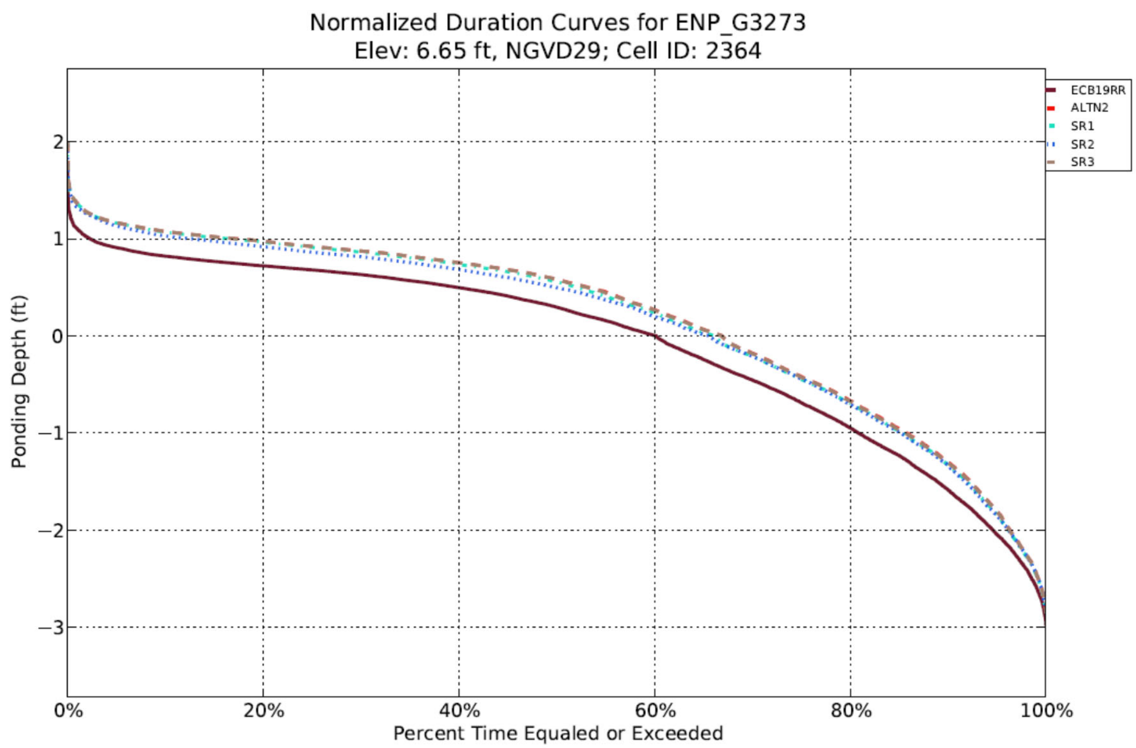

Figure H-4. 20. Ponding depth duration curves at Gauge ENP-G3273 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

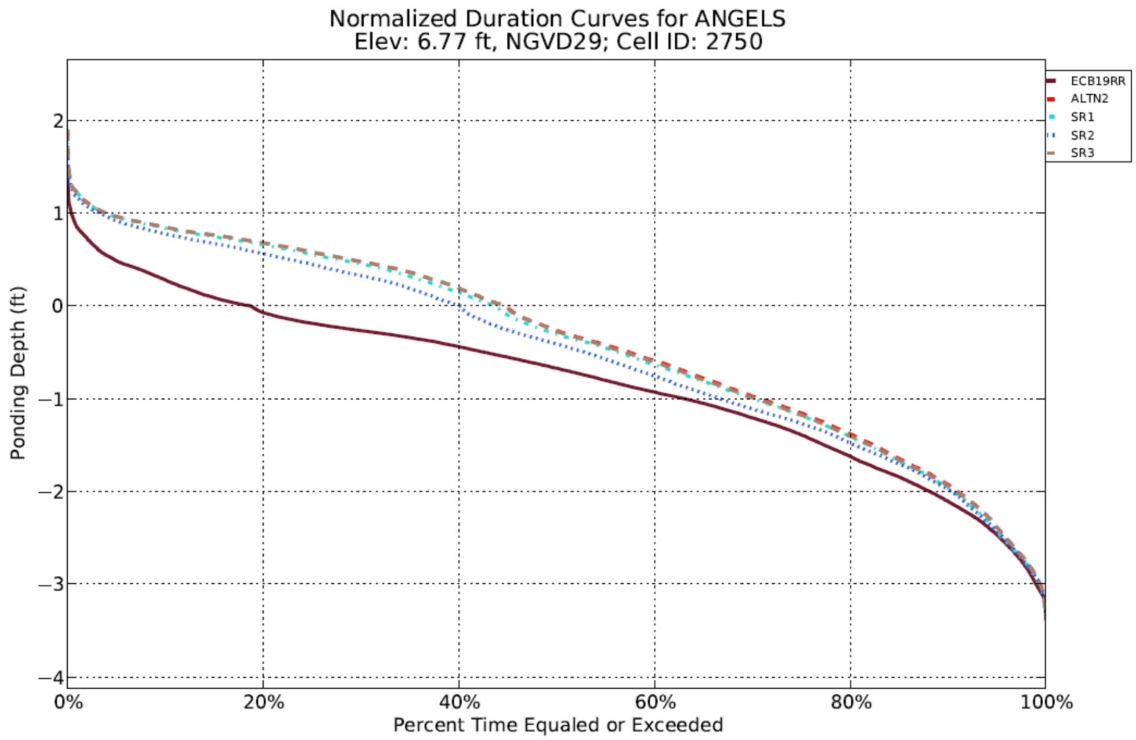

Figure H-4. 21. Ponding depth duration curves at Gauge ANGELS for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

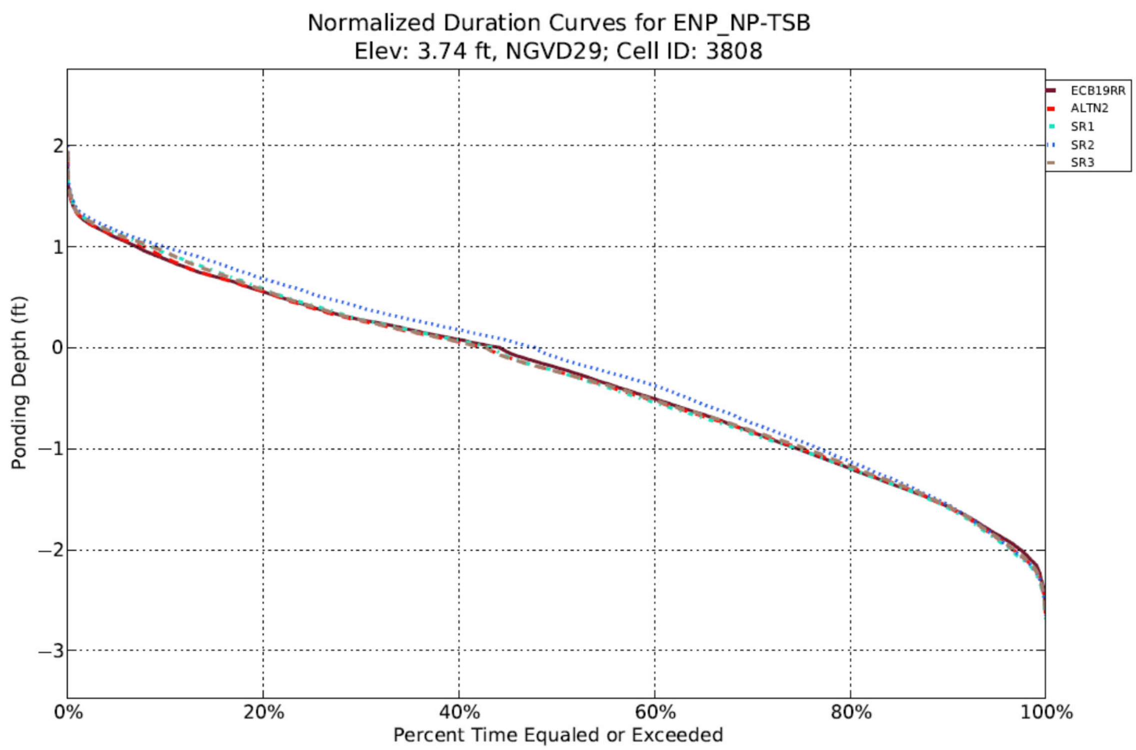

Figure H-4. 22. Ponding depth duration curves at Gauge ENP_NP-TSB for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

H-4.1.2.7 TRANSECT FLOWS

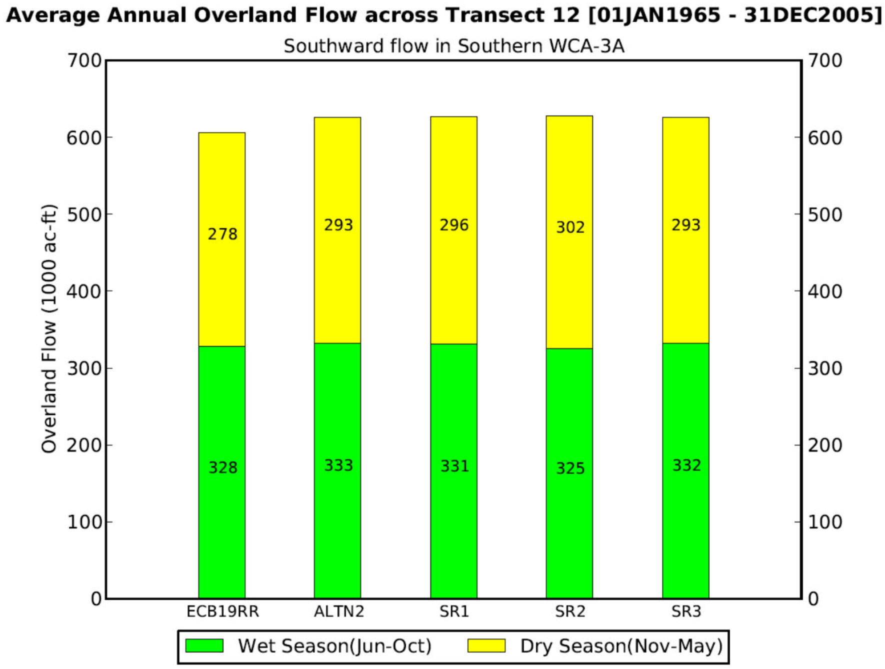

Figure H-4. 23. Average annual overland flows across Transect 12 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

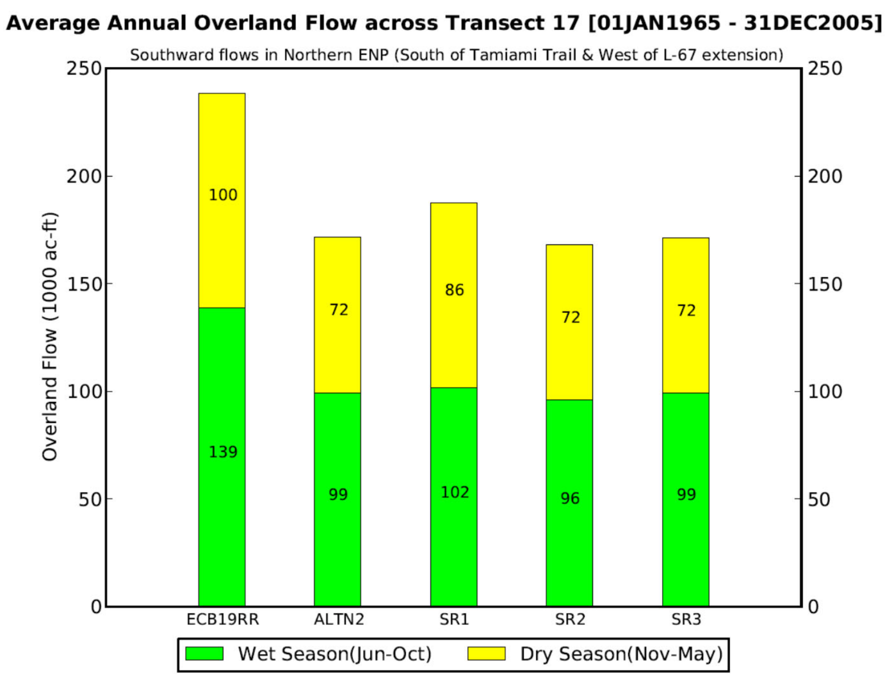

Figure H-4. 24. Average annual overland flows across Transect 17 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

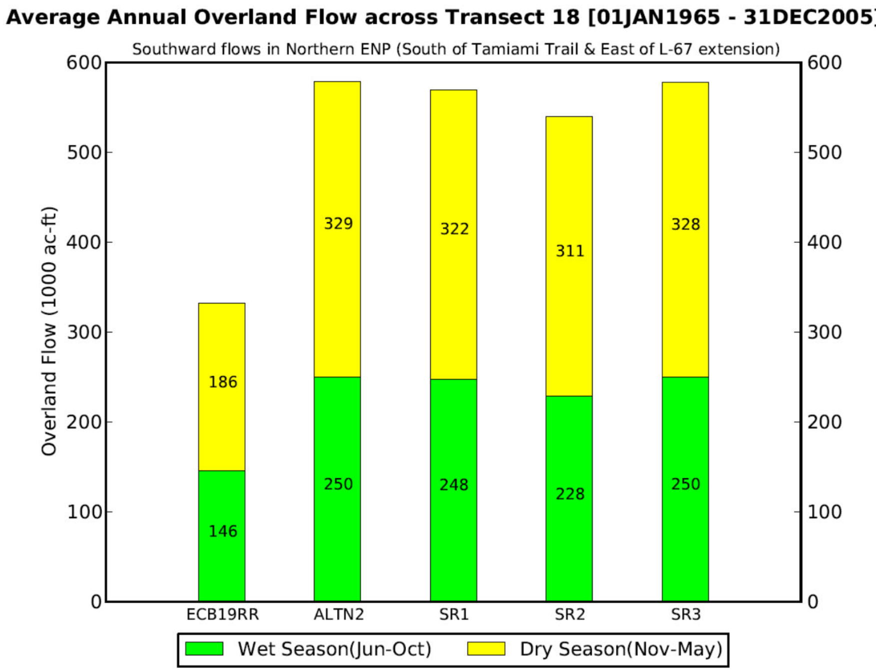

Figure H-4. 25. Average annual overland flows across Transect 18 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

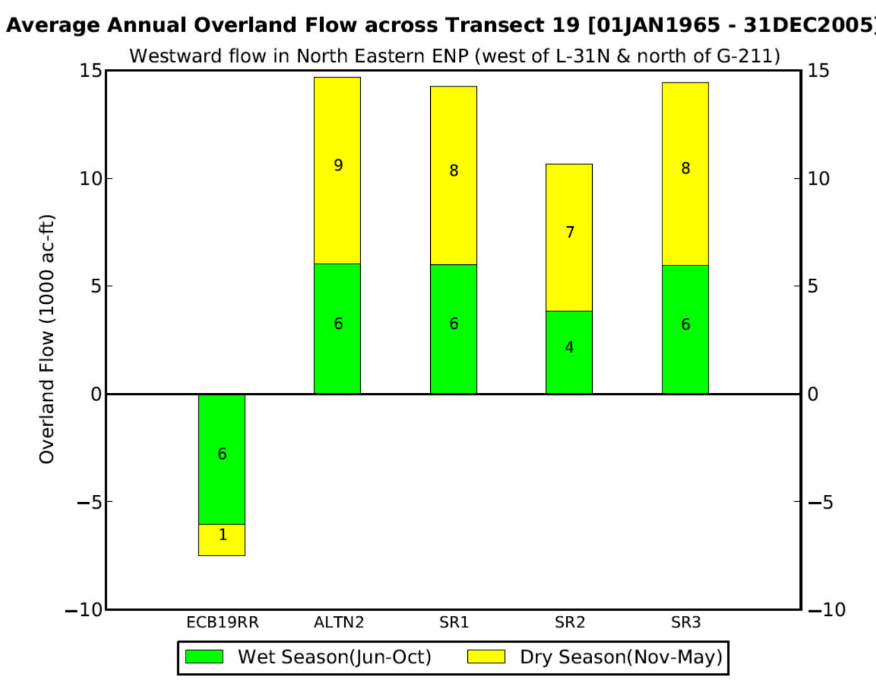

Figure H-4. 26. Average annual overland flows across Transect 19 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

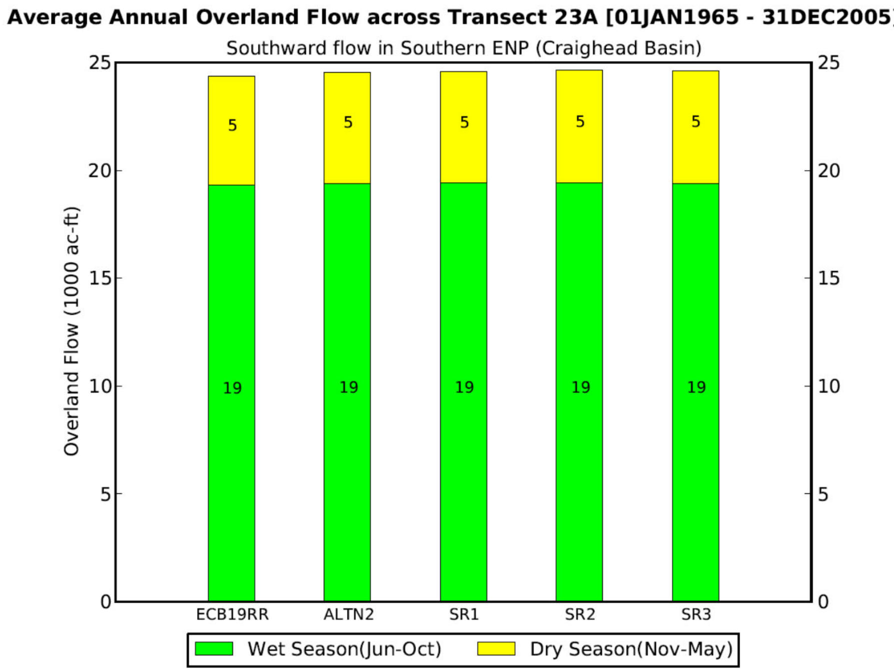

Figure H-4. 27. Average annual overland flows across Transect 23A for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

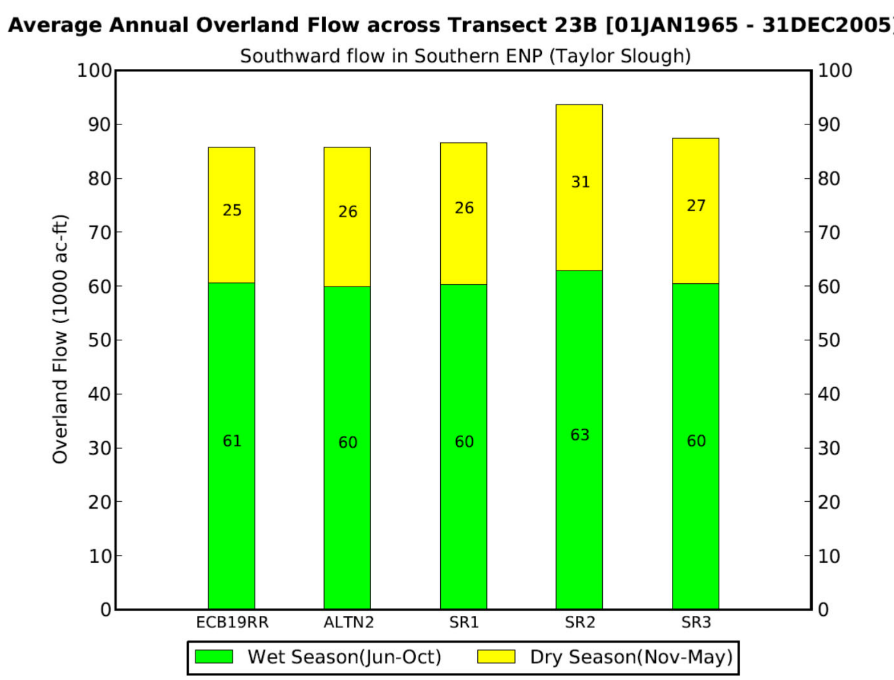

Figure H-4. 28. Average annual overland flows across Transect 23B for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

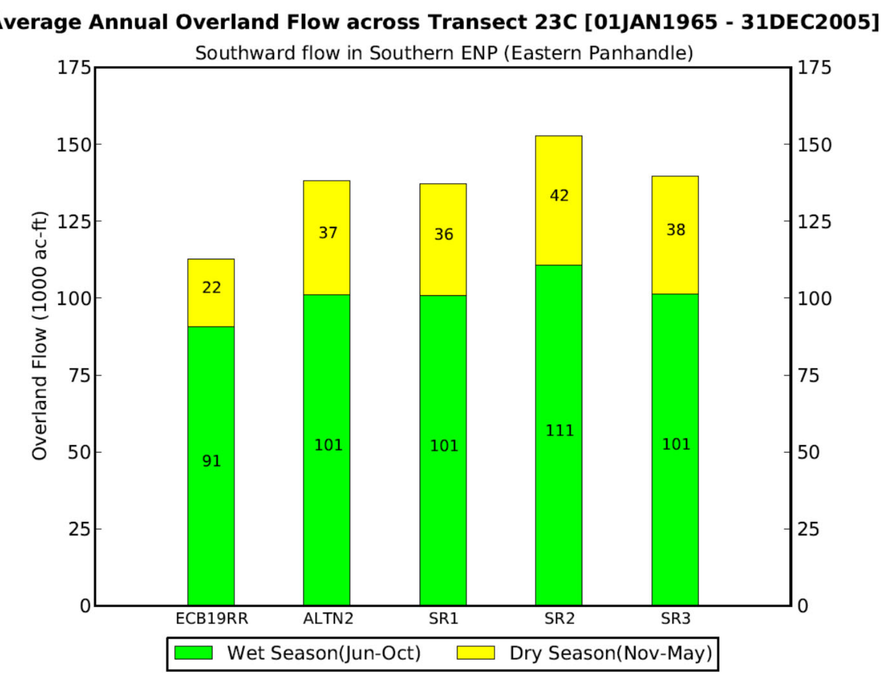

Figure H-4. 29. Average annual overland flows across Transect 23C for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

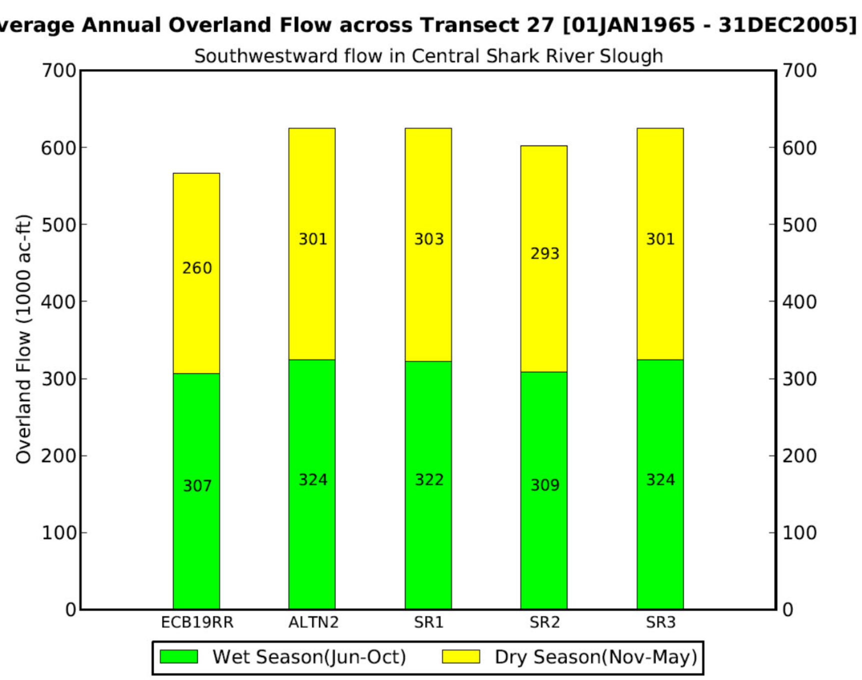

Figure H-4. 30. Average annual overland flows across Transect 27 for Round 2 sensitivity runs, ALTN2, and ECB19RR Base.

H-4.2 ROUND 3 SENSITIVITY RUNS

H-4.2.1 SCOPE FOR ROUND 3 SENSITIVITY RUNS

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
April 2019

I. SENSITIVITY RUN OVERVIEW

Sensitivity Runs were recommended for inclusion in the hydrologic modeling schedule for the Combined Operating Plan (COP) based on coordination with the COP Cooperating Agencies (USACE, SFWMD, and ENP) conducted during April 2018. Informed by previous COP modeled alternative scenarios, sensitivity runs will be designed to change to a minimum number of variables so that the project performance from these changes can be effectively distinguished.

Based on coordination at the 17 April 2018 COP Cooperating Agencies' meeting, the agencies jointly agreed to a preliminary list of Sensitivity Runs with potential to carry forward into further discussion after Round 1 modeling and analysis was completed. This preliminary list, which was developed for scheduling considerations, was anticipated to further evolve after review of the Round 1 alternative results and based on consideration of comments from the COP PDT during development of the Round 2 alternatives. The Round 2 hydrologic modeling duration was extended from 1 month to 2 months in the COP project schedule as a conditional placeholder for these Sensitivity Runs. Similarly, 1 additional month for Sensitivity Runs after Round 3 modeling (optimization for the Preliminary Preferred Alternative) was included in the COP project schedule as a conditional placeholder following this initial coordination.

Two general categories of Sensitivity Runs were defined for COP:

- EIS Support
  - Assess uncertainties with an implementable plan, and/or for inclusion in adaptive management (for example, existing FDOT/USACE high-water constraints for the L-29 Canal)
- Non EIS Support
  - Not considered in the implementable plan or for inclusion in adaptive management, but provides valuable near future information (for example, additional seepage barrier construction, WCA-1/WCA-2A Regulation Schedule changes, and raising the L-29 Canal maximum operating limit up to 9.7)

II. SENSITIVITY RUNS TO COMPLEMENT COP ROUND 2 ALTERNATIVE MODELING

Following completion of the Round 1 analyses and formulation of the Round 2 alternatives (Alternative N2 and Alternative O), the COP Cooperating Agencies re-convened on 18 and 25 September 2018 to identify a limited number of Sensitivity Runs to complement the Round 2 alternatives. Although both the RSM-GL and the MD-RSM models will be used to evaluate the Round 2 alternatives, only the RSM-GL will be applied for the COP Sensitivity Runs.

The following list of four total COP Sensitivity Runs were jointly recommended the COP Cooperating Agencies for completion immediately following the RSM-GL Round 2 alternative modeling. Each Sensitivity Run will be developed starting from one or both of the RSM-GL Round 2 alternatives, as indicated next to each scenario.

1

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
April 2019

a. Conditional Closures for the S12s (Apply to both Round 2 alternatives: #SR1, #SR2)
- targets from i-Model vs prescribed seasonal closure dates at S-12A/B, S-343A/B, and S-344 currently required through the 2016 USFWS Biological Opinion
- i-Model will apply spatial targets for CSSS performance derived from Jason Godin's work that has been detailed to the COP Ecological subteam
- Preliminary iModel outcomes were shared with USFWS on 27 September 2018

b. Lower Canal Levels in South Dade (Apply to Alternative N2 only: #SR3)
- Operational criteria for the following structures will be revised to match lower canal levels included in Alternative O for the South Dade Canal reaches between S-331 and S-177 (reference COP Round 2 Alternatives table for all criteria):
  - S-332BW: total operating range 3.8-4.8 feet NGVD (4.5-5.0 in Alternative N2)
  - S-332BN: total operating range 3.8-4.8 feet NGVD (4.5-5.0 in Alternative N2)
  - S-332C: total operating range 3.8-4.8 feet NGVD (4.5-5.0 in Alternative N2)
  - S-332D: total operating range 3.8-4.8 feet NGVD (4.4-4.7 in Alternative N2)
  - S-176: operating range 4.5-5.0 feet NGVD with CSSS criteria for increasing discharge by 200 cfs (4.75-5.0, no CSSS criteria in Alternative N2)
  - S-177: operating range 3.6-4.2 feet NGVD with high-rainfall criteria for increasing discharge by 200 cfs (3.6-4.2 with high-rainfall criteria for lowering HW criteria to 3.3 in Alternative N2)
  - No changes to S-199 and S-200 criteria (same for Alternatives O and N2)
  - No changes to S-194 and S-196 criteria (retain from Alternative N2, which are very similar to Alternative O ranges)
- responsive to stakeholder input received during Round 2 alternative development
- responsive to COP "Planning Consideration" to "explore opportunities to enhance flood control and mitigation"

c. Refinement of operational criteria for coastal divide structures to opportunistically provide improved timing and spatial distribution of flows to Biscayne Bay (Apply to Alternative O only: #SR4)
- responsive to recommendations from the COP Ecological subteam ensure COP operations maintain the "do no harm" standard for Biscayne Bay while aiming to prioritize spatial location of inflows to the South Bay (Round 1 flow effects to Biscayne Bay were characterized as minimal by the Ecological subteam)
- Alternative O selected since this alternative does not include supplemental regulatory deliveries from WCA-3A to the South Dade Conveyance System
- Opportunity to further explore feasibility of opportunistic Biscayne Bay operational criteria in advance of Round 3
- Specific operational criteria for Round 2 Sensitivity Run listed below:
  - S-31 operates for water supply only
  - Decrease S-338 open by 0.1 ft (from 5.8 to 5.7, close remains 5.5)
  - Decrease S-194/S-196 open/close by 0.1 ft in rule curves (see below for open-close levels)
  - 01jan 4.7/4.1; 14feb 4.7/4.1; 15feb 4.65/4.1; 31jul 4.65/4.1; 01aug 4.7/4.1; 31dec 4.7/4.1

2

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
April 2019

These four RSM-GL sensitivity runs were completed and the simulation results were posted for the COP PDT on 02 November 2018, one week after posting of the RSM-GL results for the Round 2 alternatives. The hydrologic performance overview presentation for the Round 2 modeled alternative and sensitivity runs was provided at the COP interagency PDT meeting on 09 November 2018, and a condensed recap presentation was also provided at the COP interagency PDT workshop on 12 December 2018. Technical meetings were also completed by the COP Ecological/Water Quality and Flood Risk sub-teams during November-March 2018, and the sub-team evaluations were presented at both the PDT meetings on 12 December 2018 and 18 March 2019. The MD-RSM results for the Round 2 alternatives (no MD-RSM sensitivity runs were conducted) were completed and the simulation results were posted for the COP PDT on 30 January 2019, with a hydrologic performance overview presentation provided to the PDT on 20 February 2019.

III. SENSITIVITY RUNS TO COMPLEMENT COP ROUND 3 ALTERNATIVE MODELING: PLACEHOLDER LIST FROM PRIOR TO ROUND 2 COP MODELING

Based on the COP Cooperating Agency meetings in September 2018, the following list of potential COP Sensitivity Runs were additionally identified as candidates to complete after Round 3 modeling (optimization), after completion of the Round 2 reviews and based on consideration of comments from the COP PDT. Sensitivity Runs conducted following the Round 2 modeling (II.a through II.c above) may also be carried forward for further assessment after Round 3, if necessary, and/or may be incorporated into the Round 3 alternative. Further coordination between the COP Cooperating Agencies and the interagency PDT was planned to be conducted following completion of the Round 2 evaluations, prior to making any decisions regarding the appropriateness of conducting any or all of the these candidate Sensitivity Runs.

d. Relax L-29 FDOT constraint
   - Based on the USACE Increment 2 Operational Strategy limit of 90 days per water year with stages above 8.3 feet NGVD, the Round 1 and Round 2 alternatives limit the L-29 Canal maximum operating limit to 8.5 feet NGVD during October through February and 8.25 feet NGVD for the remaining 8 months of each year
   - Maximum L-29 stage constraint limited to 8.5 feet NGVD, consistent with prescribed COP constraints
e. WCA 1 and 2 schedules
   - Could be used to verify forward compatibility of TSP with potential future changes
   - Changes to these Regulation Schedules are outside of the COP scope
   - If pursued by SFWMD, sensitivity runs would be conducted by the SFWMD in parallel to the COP interagency process (results would be briefed to the COP PDT by SFWMD)
f. Improve timing for water quality of SRS inflow (further scope details and justification to be determined by the COP Ecological/Water Quality sub-team)
g. Effects of Sea-Level Change on Future COP Performance (further scope details and justification to be determined by the COP Cooperating Agencies)

3

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
April 2019

IV. SENSITIVITY RUNS TO COMPLEMENT COP ROUND 3 ALTERNATIVE MODELING: UPDATED LIST BASED ON EVALUATIONS AFTER ROUND 2 COP MODELING

The initial meeting of the COP Cooperating Agencies to re-assess the potential candidate sensitivity runs for completion after the Round 3 alternative modeling was conducted on 12 March 2019. An initial set of proposed sensitivity runs was identified, as summarized below; for completeness, the status of all previously conducted and/or proposed sensitivity runs are each reported within this list:

a. Conditional Closures for the S12s (conducted during Round 2: SR #1, SR #2)
   - Not retained based on technical review by USFWS and COP ECO sub-team
   - No further sensitivity runs recommended following future Round 3 modeling
b. Lower Canal Levels in South Dade (conducted during Round 2: SR #3)
   - Operational criteria for the following structures will be revised to match lower canal levels included in Alternative O for the South Dade Canal reaches between S-331 and S-177
   - Retained in proposed Round 3 alternative, which is derived from Alternative O
   - No further sensitivity runs recommended following future Round 3 modeling
c. Refinement of operational criteria for coastal divide structures to opportunistically provide improved timing and spatial distribution of flows to Biscayne Bay (conducted during Round 2: #SR4)
   - Retained in proposed Round 3 alternative, based on recommendations from COP ECO sub-team
   - No further sensitivity runs recommended following future Round 3 modeling
d. Relax L-29 FDOT constraint (retained from September 2018; refer to Section III)
   - Based on the USACE Increment 2 Operational Strategy limit of 90 days per water year with stages above 8.3 feet NGVD, the Round 1 and Round 2 alternatives limit the L-29 Canal maximum operating limit to 8.5 feet NGVD during October through February and 8.25 feet NGVD for the remaining 8 months of each year
   - Maximum L-29 stage constraint limited to 8.5 feet NGVD, consistent with prescribed COP constraints
e. WCA 1 and 2 schedules (retained from September 2018; refer to Section III)
   - Could be used to verify forward compatibility of TSP with potential future changes
   - Changes to these Regulation Schedules are outside of the COP scope
   - Will not be used to provide NEPA coverage in the COP EIS documentation
   - If pursued by SFWMD, sensitivity runs would be conducted by the SFWMD in parallel to the COP interagency process (results would be briefed to the COP PDT by SFWMD)
f. Improve timing for water quality of SRS inflow (retained from September 2018; refer to Section III)
   - Two operational scenarios are recommended by the COP Water Quality sub-team, as a result of a series of coordination meetings during Feb.-March 2019
   - Summary narrative to be provided by the Water Quality sub-team, if pursued

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
April 2019

g. Effects of Sea-Level Change on Future COP Performance (retained from September 2018; refer to Section III)
   - Further scope details and justification to be determined by the COP Cooperating agencies, if pursued
   - Will not be used to provide NEPA coverage in the COP EIS documentation
   - Scheduled for completion subsequent to sensitivity runs needed to inform COP NEPA, System Operating Manual, and/or Adaptive Management Plan

h. Conditional opening for S-344 and removal of seasonal CSSS constraints at S-332D
   - New proposed sensitivity run based on deviation operations during 2017-2018 and preliminary coordination with USFWS concurrent with COP Round 2 sub-team evaluations

Additional sensitivity runs may also be proposed by the interagency COP PDT, based on presentation of the above list of Round 3 proposed sensitivity runs at the PDT meeting on 18 March 2019. PDT Comments/input on the proposed Round 3 Alternative Q and sensitivity runs were due to the USACE by COB on 25 March 2019.

During the COP PDT meeting to finalize the Round 3 alternative (Alternative Q) on 02 April 2019, the SFWMD also proposed inclusion of an additional sensitivity run to address performance concerns with saline water intrusion into the Biscayne Aquifer for the SDCS canal reaches between S-176 and S-177 and between S-177 and S-18C.

i. WCA-3A Low-Water Action Line
   - Two operational scenarios are recommended by the COP Water Supply sub-team, as a result of the sub-team meeting on 19 April 2019
   - Summary narrative to be provided by the Water Quality sub-team, if pursued

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
April 2019

V. **SENSITIVITY RUNS TO COMPLEMENT COP ROUND 3 ALTERNATIVE MODELING: FINAL LIST**

Following completion of formulation for the Round 3 Alternative Q and review of the PDT comments, the COP Cooperating Agencies re-convened on 27 March and 04 April 2019 to identify a limited number of Sensitivity Runs to complement the Round 3 Alternative Q. Although both the RSM-GL and the MD-RSM models will be used to evaluate the Round 3 Alternative Q, only the RSM-GL will be applied for the COP Sensitivity Runs.

The following list of six total COP Sensitivity Runs were jointly recommended the COP Cooperating Agencies for completion immediately following the RSM-GL Round 3 Alternative Q modeling, which is scheduled for completion on 06 May 2019. Each Sensitivity Run will be developed starting from the RSM-GL Round 3 Alternative Q simulation. The numbering convention is retained from Section IV, for clarity.

d. Relax L-29 FDOT constraint (#SR Q1)
   - Based on the USACE Increment 2 Operational Strategy limit of 90 days per water year with stages above 8.3 feet NGVD, the Round 1 and Round 2 alternatives limit the L-29 Canal maximum operating limit to 8.5 feet NGVD during October through February and 8.25 feet NGVD for the remaining 8 months of each year
   - Maximum L-29 stage constraint limited to 8.5 feet NGVD, consistent with prescribed COP constraints

f. Improve timing for water quality of SRS inflow (#SR Q2; #SR Q3)
   - Two operational scenarios are recommended by the COP Water Quality sub-team, as a result of a series of coordination meetings during Feb.-March 2019
   - Summary narrative provided by the Water Quality sub-team is attached as Annex 1 (sub-team may re-visit requested scope if there is an opportunity to preview the RSM-GL sensitivity run results in advance of the 26 May 2019 planned modeling deliverable date)

h. Conditional opening for S-344 and removal of seasonal CSSS constraints at S-332D (#SR Q4)
   - No seasonal closures at S-344 (Alternative Q seasonal closure dates: 01 October through 14 July)
   - No seasonal constraints at S-332D (Alternative Q seasonal constraints are listed below)
     - 01 December – 31 January: Limited to 325 cfs (Note: for Round 2 and Round 3 COP modeling, if S-332DX1 is able to direct 75 cfs to the SDA, the effective S-332D discharge limit is raised to 375 cfs)
     - 01 February – 14 July: Limited to 250 cfs (Note: for Round 2 and Round 3 COP modeling, if S-332DX1 is able to direct 75 cfs to the SDA, the effective S-332D discharge limit is raised to 325 cfs)
     - 15 February – 30 November: No capacity limit (up to 575 cfs)

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
April 2019

i. WCA-3A Low-Water Action Line (#SR Q5; #SR Q6)
   - Two operational scenarios are recommended by the COP Water Supply sub-team, as a result of the sub-team meeting on 19 April 2019
   - Summary narrative provided by the Water Quality sub-team is attached as Annex 2

The Round 3 sensitivity will be compared against the COP 2019 Existing Condition Baseline (ECB19RR unchanged from Round 2) and Alternative Q through the following performance measure (PM) sets.

PM Set 1: PM_ECB19RR_ALTQ_#SR Q1_#SR Q2_#SR Q3
PM Set 2: PM_ECB19RR_ALTQ_#SR Q4_#SR Q5_#SR Q6

Only the RSM-GL Standard Hydrologic model output will be generated and posted for each of the Round 3 sensitivity runs and PM Sets, with annual difference maps (hydroperiod, ponding, and stage) and monthly stage difference maps (April and October) produced which compare each sensitivity run against both the ECB19RR and Alternative Q.

If an additional sensitivity run for the WCA 1 and 2 Regulation Schedules (item e in Section IV; #SR Q7) is pursued by SFWMD, this sensitivity run would be included in a separate PM set.

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
April 2019

Annex 1:

COP Round 3 Sensitivity Runs to Improve Timing for Water Quality of SRS inflow

COP Water Quality Sensitivity Run Request

The wq subteam requests two water quality scenarios/concepts be run in addition to the round 3 alternatives. The subteam has designated the two water quality concepts as “XX” and “YY”. Please refer to the attached matrix for details.

Scenario “XX” is a combination of all criteria identified within concepts A , B and E. Please see attached matrix for description of concepts A, B and E.

Scenario “YY” is a combination of all criteria identified within concepts A, B, E and G. Please see attached matrix for description of concepts A, B, E and G.

Each concept contains a general overview of the criteria within the description/additional description (green shaded “Concepts” column). Any constraints for each concept, if any (such as time of year etc) are addressed within the constraints column (yellow shaded “Constraints” column) for each concept.

FINAL 4/16/2019

COP Water Quality Sensitivity Run Concepts, Constraints, & Mechanisms

Concepts			Hydro Modeling	Constraints				Mechanisms					
Concept	Description	Additional Description	Hydro Modeling Effort	S333H Stage Constraint for Reducing Flow	Season	Minimum Flow Constraint	Other Constraints	Allow time delay following marsh inundation prior to release to SRS	Relocate discharge point in hopes of reducing ENP inflow concentrations	Divert initial WCA-3A flush away from SRS	Reduce ENP inflow under stage conditions when high P concentrations have been observed historically	Reduce P recycling from WCA-3A soils & vegetation by reducing spatial & temporal dryout frequency	Increase P uptake in WCA-3A marsh by increasing water depths
Concepts													
A	Do not discharge more than 50 cfs thru S12D/S333 when S333H stage is below 8.2 ft	RSM will automatically compensate for reduced dry season flow by increasing wet season flow, triggered by WCA3A stage	REASONABLE/LOW	< 8.2 Feet	All	Total Flow thru S12D + S333 = Minimum (50 cfs, Scheduled Flow)					X	X	X
B	Do not discharge more than 50 cfs thru the combined S12D & S333 until either S333H stage rises above 9.2 ft; or	Until (Stage > May 15 Stage + 1.0 Feet)	REASONABLE/LOW	< 9.2 Feet and <1.0 ft above May 15 stage	May 15 -> June 30	Total Flow thru S12D + S333 = Minimum (50 cfs, Scheduled Flow)		X			X	X	X
E	Shift 25% of S12D discharge to S12C	Account for structure flow capacities Do not increase flow thru S12AB	REASONABLE/LOW REASONABLE/LOW		All	~~Total Flow thru S12D + S333 = Minimum (50 cfs, Scheduled Flow)~~	Structure Hydraulics; Sparrow		X				
G	Reduce dry-season recession rates and achieve May stage objective by reducing target outflow volumes (S12X+S333) between December & May in water years with Dec 1 stage <=10 ft	Stage Objective: Long-term May average >= ECB19R2 average (~7.7 ft) in years when Dec 1 stage is <= 10 ft. Calibrate Concept G % Reductions independently (without A or B constraints); Taper % Reductions (higher in December, lower in May) to reduce impact on flows when stage is relatively low. Expected % Reductions ~30% in December ---> 6% in May; not accounting for seepage & ET losses Maximum flow reduction of 50% on any day Same % Reductions for each structure (S12A, S12B, S12C, S12D, S333) on a given day	REASONABLE/LOW		Dec-May	Total Flow thru S12D + S333 = Minimum (50 cfs, Scheduled Flow)	Exclude years when Dec 1 stage > 10 ft (low risk of dry-out)				X	X	X
Proposed Scenarios for COP Water Quality Sensitivity Runs													
XX	All Except G (A + B + E)	Lower Priority					Overriding water management constraints & objectives, as represented in RSMGL	X	X		X	X	X
YY	All (A + B + E + G)	Higher Priority					Overriding water management constraints & objectives, as represented in RSMGL	X	X		X	X	X

Cooperating Agencies Coordination Summary:
COP Sensitivity Runs
April 2019

Annex 2:

COP Round 3 Sensitivity Runs for the WCA-3A Low-Water Action Line

8

April 2019 DRAFT

COMBINED OPERATIONAL PLAN (COP) WATER SUPPLY EVALUATION AND SENSITIVITY RUN PROPOSAL

BACKGROUND

The primary purpose of the Combined Operational Plan (COP) is to modify the location, seasonal timing, and total volume of water deliveries from Water Conservation Area 3A (WCA-3A) into Everglades National Park (ENP). These changes are made possible as a result of new infrastructure constructed under the authorities of the Modified Water Deliveries ENP and C-111 Canal South Dade projects. Maintaining canal stage elevations to prevent saline water intrusion is an essential purpose of the Central and Southern Florida Project that the COP must fulfill. A water supply analysis of several simulated COP alternatives identified the potential risk of increasing saline water intrusion. Models simulated changes in canal stage elevations based on proposed operational changes. South Florida Water Management District (District) Water Supply staff evaluated the three alternatives in Round 1. The Round 1 model results indicated that C-111 Canal stage elevations would fall below canal maintenance stage elevations for a longer duration in the project alternatives compared to the Existing Condition Baseline (ECB). Falling below these canal stage elevations is likely to result in the movement of saline groundwater and could potentially affect existing legal users in the southern reaches of the COP project area. Based on input from COP subteams and the Project Delivery Team, two alternatives (N2 and O) were simulated during Round 2. District Water Supply staff evaluated the effects these proposed COP alternatives would have on water supply and found that both alternatives increased the risk of saline water intrusion compared to the ECB. The sensitivity run suggested here is proposed with the intention of finding a mechanism that could effectively reduce the duration that canal levels fall below maintenance stages.

RISKS

Round 2 model results indicated canal stage elevations would fall below the maintenance stage elevations sooner and for increased duration (increase in number of days not events) under alternatives N2 and O compared to the existing base condition. This occurred in the southern reaches of the COP project area, specifically the canal reaches between structures S176 and S177 and between structures S177 and S18C, as shown in the stage duration curves (**Figures 1** and **2**). Prolonged reduction in canal stage elevations could affect groundwater levels, which could result in movement of saline water into the Biscayne aquifer, resulting in harmful impacts to public water supply wellfields and other existing legal users during drier conditions. **Figure 3** compares water levels of the Florida Keys Aqueduct Authority (FKAA) Biscayne aquifer groundwater monitor wells (G864 and FKS-9) to S176 and S177 canal stage elevations. As shown in **Figure 3**, groundwater levels correlate and respond quickly to canal stage elevation changes in this area. If saline water intrusion occurs in the Biscayne aquifer, many permitted users in this area would be adversely affected as a result of prolonged reductions in canal stage elevations below the existing base condition.

1

April 2019 DRAFT

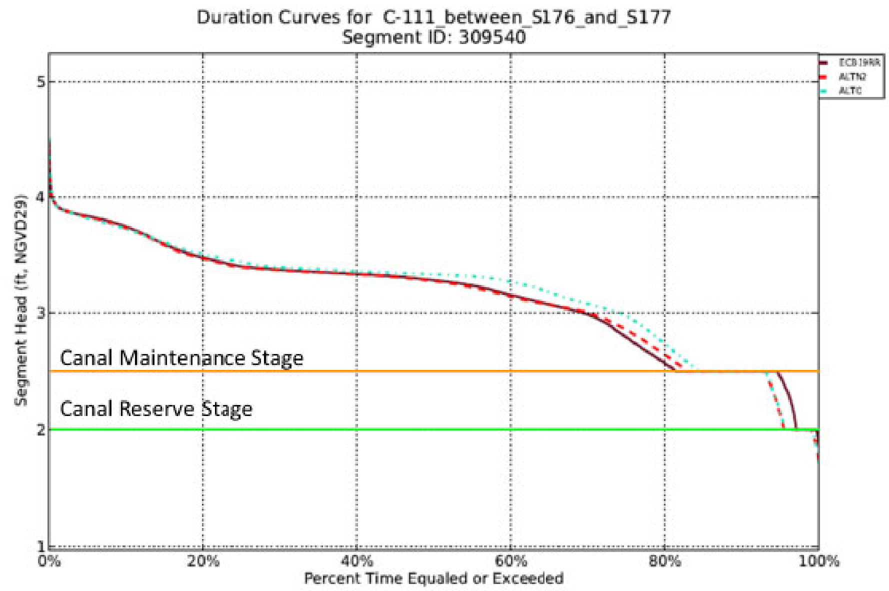

Figure 1. Stage duration curve between the S176 and S177 structures for Round 2 alternatives.

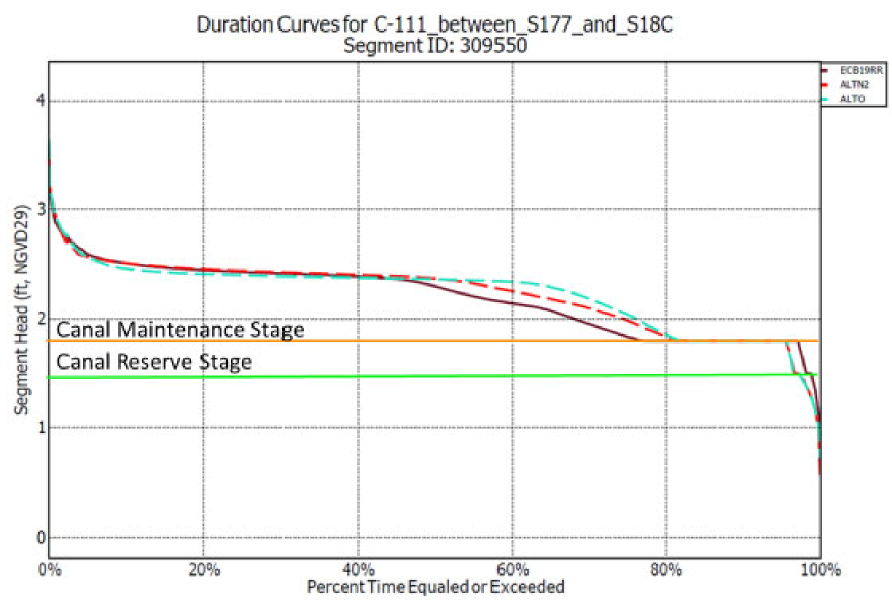

Figure 2. Stage duration curve between the S177 and S18C structures for Round 2 alternatives.

2

April 2019 DRAFT

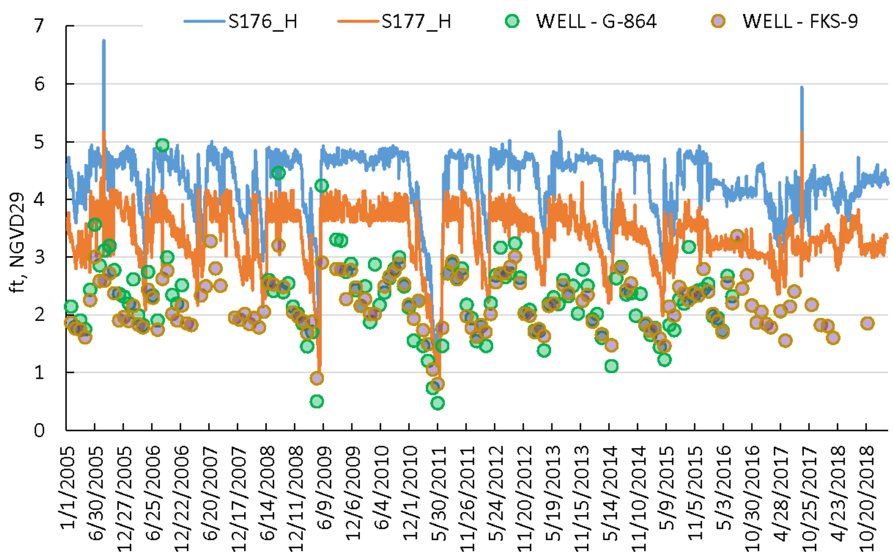

Figure 3. FKAA monitor wells and C-111 canal stages.

Proposal

Based on the increased risk to water supply shown in the modeling, District staff investigated different methods to increase the available water in WCA-3A to meet the various demands. A WCA-3A recession management measures approach is proposed to reduce the risk to water supply due to saline water intrusion. By reducing flows from WCA-3A to ENP, supplies should remain available longer through the dry season for water supply and environmental purposes. The proposed WCA-3A recession management measures approach builds on the concept already implemented in the model and during real time operations to reduce deliveries when water supplies are low. This only adds explicit criteria to the approach.

The proposed WCA-3A recession management measures approach consists of a low-water action line and a moderate reduction in WCA-3A water deliveries to ENP. As determined by a desktop analysis, the low-water action line ranges between 7.5 and 10 feet NGVD, which correlated the WCA-3A stages with the canal stages. When the stage elevation in WCA-3A falls below the low-water action line, flows could be reduced to ensure sufficient water is available to maintain existing base condition stage elevations. Use of the low-water action line also prolongs the hydroperiods of wetlands in WCA-3A. The percent flow reduction would depend on the difference between the low-water action line and the WCA-3A three-gauge average stage elevation. In addition to the low-water action line, regional environmental conditions, rainfall forecasts, and stages in the water conservation areas and Lake Okeechobee would be considered when deciding whether to implement recession management measures during real-time operations. If the difference between the low-water action line and the WCA-3A three-gauge average is less than 0.5 feet, then a 10 percent flow reduction would be implemented. Flows would be reduced by

3

April 2019 DRAFT

20 percent if the difference between the low-water action line and the WCA-3A three-gauge average is more than 0.5 feet. **Figure 4** illustrates the original, low-water action line concept which SFWMD initially discussed at the COP interagency meeting on December 14, 2018 and provided a desktop analysis for further discussion at the COP interagency Project Delivery Team (PDT) meeting on April 2, 2019. The initial desktop analysis of the SFWMD proposal indicates that stages in WCA 3A are below the low water action line criteria approximately 26 percent of the period of record and the proposed flow reduction percentage applies to 12 percent of the flows. Based on input from the COP Water Supply subteam, which was initially convened on April 19, 2019, additional versions of the low-water action line were developed and examined to address concerns about the original proposal. The new versions attempt to reduce the volume of flows affected and apply the recession management measures less frequently.

District staff propose including the low-water action line in two model sensitivity runs based on the Round 3 Alternative Q to determine if the existing base condition water supply performance can be maintained. The original proposal, Alternative 1A, and Alternative 3 as described in the **Attachment** will be the basis for the two sensitivity runs. Alternative 3 includes a different low-water action line and maintains a 100 cfs flow to ENP. These two model simulations will explore if these operations will substantively increase water deliveries to ENP as shown in Alternative O without creating additional risk to water supply beyond the existing base condition.

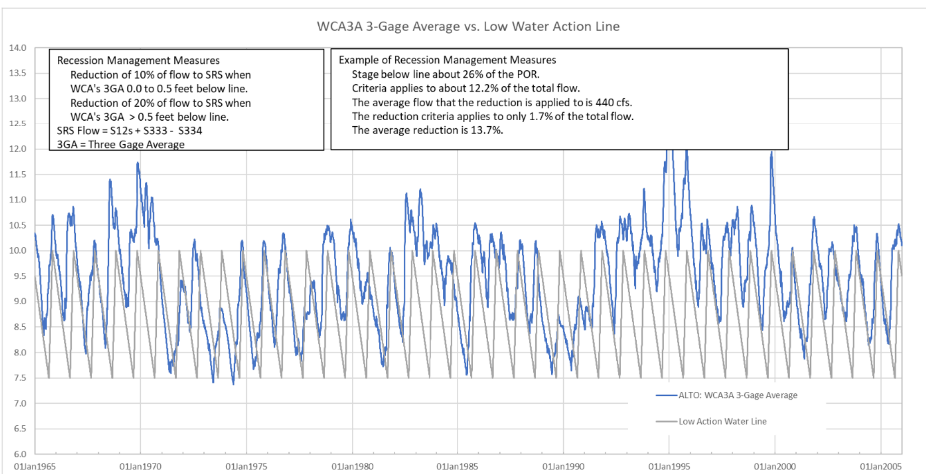

Figure 4. Low-water action line compared to WCA-3A three-gage stages.

4

April 2019 DRAFT

ATTACHMENT: LOW-WATER ACTION LINE ALTERNATIVES

INTRODUCTION

The low-water action line (LWAL), indicates when water likely needs to be conserved (i.e., a flow reduction) in order to ensure the Combined Operational Plan (COP) project does not limit system operators ability to prevent salt-water intrusion or water supply. The reduction of flow also has the benefit of moderating low stages and recession rates in Water Conservation Area 3A (WCA-3A), albeit to a minor extent. This potentially minor benefit to WCA3A clearly comes at the cost of potentially accelerating recession rates and increasing drought intensity in ENP. Flow reductions associated with this conservation of water are not expected to prevent late dry season recession rates exceeding the 0.31 feet per month rate above which the United States Fish and Wildlife Service (USFWS) has directed the United States Army Corps of Engineers (USACE)/South Florida Water Management District (SFWMD) to moderate to the extent practical in previous Biological Opinions for WCA-3A.

The maximum flow reduction of 10 to 20 percent is moderate, and because it is applied only during drier times, it is applied to relatively small flows. **Given the WCA3A-ENP tradeoff identified above, the clear goal is to limit how frequently this operational strategy is employed**. Anytime water stages in WCA-3A approach low-water action line an evaluation of the water available locally and regionally will occur. The Water Control Plan WCP for COP implementation should include a requirement to assess the availability of water, time of year, short-term (7-day) forecast, and long-term (seasonal) forecast. Based on this evaluation and the availability of water, all, a portion of, or none of the flow reduction prescribed by the low-water action line would be implemented. The availability of water is determined by two components: 1) how much regional water has been historically available (relative to previous times with similar stages and rain); and 2) the availability of new water and the ability to deliver it. The WCP should have the flexibility to allow the use of available water to offset the calculated reduction on a weekly basis.

DESCRIPTION OF ALTERNATIVES

To address the concern that the previous low-water action line resulted in more frequent than necessary reductions, four additional alternatives were evaluated using a spreadsheet analysis. A criterion was added that turns off any flow reduction when the Tamiami Trail Flow Formula is below 100 cfs. The rationale is that the water conservation savings would be small and this condition is when Northeast Shark River Slough needs the water the most. The configuration of the four additional alternatives is shown in **Table A-1** and in **Figure A-1**. The evaluation results are shown in **Table A-2**.

Alternative 3 appears to be the best balance between conserving enough water and triggering the water conservation criteria more often than desired. The next section describes the criteria and provides the recommended operational flexibility. Alternative 4 does not appear to conserve enough water as the flows are smaller by the time the stages fall below Alternative 4's low-water action line.

5

April 2019 DRAFT

Table A-1. Summary of alternatives for the low-water action line.

Alternative	Break Points for the LWAL (ft NGVD)			Tamiami Trail Flow Formula Reduction Criteria		Minimum Tamiami Trail Flow for Application of Flow Reduction (cfs)	2000-2001 Dry Season Equivalent Depth for 3GA of 8.0 ft NGVD29
	11/01	04/01	09/01	0.0 – 0.5 ft below LWAL (%)	>0.5 ft below LWAL (%)		
01A (original)	10.00	8.75	7.50	10	20	0	0.114
01B	10.00	8.75	7.50	10	20	100	0.112
02	10.00	8.00	7.50	20	20	100	0.176
03	10.00	8.50	7.50	10	20	100	0.105
04	9.50	8.50	7.50	20	20	100	0.060

cfs = cubic feet per second; ft = foot; NGVD29 = National Geodetic Vertical Datum of 1929.

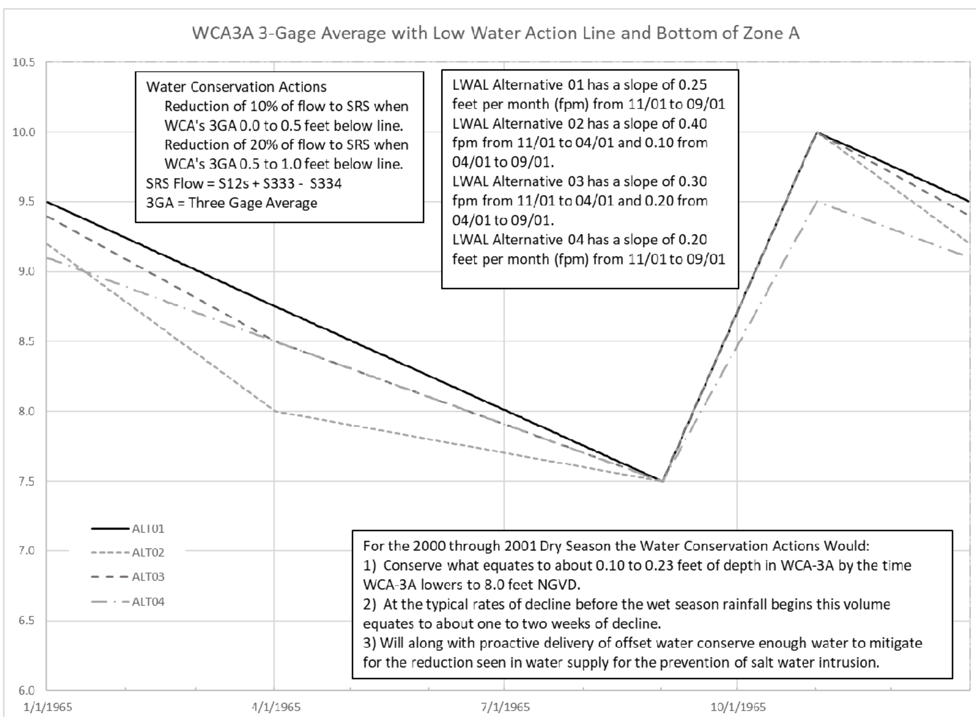

Figure A-1. The low-water action lines for the four proposed alternatives.

6

April 2019 DRAFT

Table A-2. Summary of results.

Alternative	Break Points for the LWAL (ft NGVD)			Time Below LWAL (%)	Fraction of Flow Reductions are Applied (%)	Average Flow Reductions Applied (cfs)	Volume of Reduction as Fraction of Total Flow Volume (%)	Average Reduction Equivalent Depth for Average Reduction (ft)
	11/01	04/01	09/01					
01A	10.00	8.75	7.50	24.8	12.2	454	1.7	14.6
01B	10.00	8.75	7.50	24.8	11.7	681	1.6	14.3
02	10.00	8.00	7.50	8.6	7.0	754	1.4	20.0
03	10.00	8.50	7.50	12.8	9.4	683	1.4	14.7
04	9.50	8.50	7.50	8.8	5.3	554	1.1	20.0

cfs = cubic feet per second; ft = foot; NGVD29 = National Geodetic Vertical Datum of 1929

H-4.2.2 MODELING RESULTS FOR ROUND 3 SENSITIVITY RUNS

H-4.2.2.1 CRITICAL FLOWS REPORT

Critical Flows Report....[1]

Date: 2019/05/21
P.O.R: 1965--2005
Files are---->
*ECB19RR /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ECB19/output_100218_svn13937_rsm5354/RSMGL_SD_*
ALTQ /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ALTQ/output_042019_svn14781/RSMGL_SD_output.dss
SRQ1 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SRQ1/output_042319_svn14802/RSMGL_SD_output.dss
SRQ2 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SRQ2/output_051419_svn14948/RSMGL_SD_output.dss
SRQ3 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SRQ3/output_051519_svn14957/RSMGL_SD_output.dss
ECB19RR /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ECB19/output_100218_svn13937_rsm5354/wsfc_post
ALTQ /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ALTQ/output_042019_svn14781/wsfc_post_proc.dss
SRQ1 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SRQ1/output_042319_svn14802/wsfc_post_proc.dss
SRQ2 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SRQ2/output_051419_svn14948/wsfc_post_proc.dss
SRQ3 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SRQ3/output_051519_svn14957/wsfc_post_proc.dss
ECB19RR /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ECB19/input/dss_files/RSMBN_ECB19.dss
ALTQ /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/ALTQ/input/dss_files/RSMBN_ECB19.dss
SRQ1 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SRQ1/input/dss_files/RSMBN_ECB19.dss
SRQ2 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SRQ2/input/dss_files/RSMBN_ECB19.dss
SRQ3 /nw/hesm_nas/projects/MWD_SouthDade/RSMGL_SouthDade/COP/SRQ3/input/dss_files/RSMBN_ECB19.dss
All values (annual average are in Kac-ft)

Table 1. WCA-1

	ECB19RR	ALTQ	SRQ1	SRQ2	SRQ3
G94	36.8	36.8	36.8	36.8	36.8
S10	308.9	308.9	308.9	308.9	308.9
S39	37.1	37.1	37.1	37.1	37.1
S6FC	0.0	0.0	0.0	0.0	0.0
S6WS	0.8	0.8	0.8	0.8	0.8

Table 2. WCA-2A

	ECB19RR	ALTQ	SRQ1	SRQ2	SRQ3
S7FC	56.4	56.4	56.4	56.4	56.4
S7WS	11.5	11.5	11.5	11.5	11.5
STA2O+BYP2N	371.3	371.3	371.3	371.3	371.3
STA2O+BYP2S	8.1	8.1	8.1	8.1	8.1
S38	77.3	77.1	77.0	77.1	77.1
S143	26.5	26.3	26.2	26.3	26.3
S144	44.5	44.6	44.6	44.6	44.5
S145	47.7	47.8	47.8	47.8	47.7
S146	46.3	46.4	46.4	46.5	46.4

[1] Modeling Section
South Florida Water Management District

1

Table 3. WCA-3A/L-29

	ECB19RR	ALTQ	SRQ1	SRQ2	SRQ3
NWA3A-L28	203.1	203.1	203.1	203.1	203.1
S8FC	341.4	341.4	341.4	341.4	341.4
S8WS	27.8	26.9	26.9	26.0	26.0
S339	19.8	19.2	19.2	18.5	18.5
S340	19.3	18.8	18.8	18.1	18.1
S150	0.0	0.0	0.0	0.0	0.0
S140	124.3	124.2	124.2	124.3	124.2
S9	150.3	139.9	138.7	141.4	141.8
S11	481.8	481.7	481.8	481.6	481.9
S343	14.9	4.1	3.9	4.4	4.3
S344	7.0	2.1	1.9	2.2	2.1
S333	262.8	533.7	578.9	511.9	503.1
S333N	0.1	5.8	9.4	5.9	5.8
S12A	29.8	21.4	18.8	22.9	22.6
S12A_WEIR	5.9	5.0	4.8	5.0	5.0
S12B	34.9	24.9	22.5	26.2	25.9
S12B_WEIR	4.7	4.0	3.9	4.0	4.0
S12C	142.9	93.1	83.6	133.0	130.9
S12D	218.6	172.9	150.3	131.9	131.1
S334	0.4	0.0	0.0	0.0	0.0
S356	125.3	170.3	173.7	168.2	168.7

Table 4. WCA-3B

	ECB19RR	ALTQ	SRQ1	SRQ2	SRQ3
S151FC	185.1	110.1	102.3	115.5	114.6
S151WS	76.4	62.0	61.8	63.2	68.0
S152	73.9	56.7	55.7	58.3	60.4
S31FC	7.9	0.0	0.0	0.0	0.0
S31WS	0.1	0.1	0.1	0.1	0.1
S337FC	1.1	0.0	0.0	0.0	0.0
S337WS	71.5	58.3	58.1	59.3	63.5
S355A	18.5	0.6	0.5	0.6	0.6
S355B	14.8	0.6	0.5	0.6	0.6
TTBRIDGE1MILE	208.8	284.6	296.7	277.3	276.3
TTBRIDGE2.6MILE	177.2	337.7	370.0	328.6	322.7

Table 5. ENP-Detention-Areas

	ECB19RR	ALTQ	SRQ1	SRQ2	SRQ3
S357	45.5	58.6	64.7	57.0	57.0
S357N	5.8	5.5	6.0	5.3	5.5
S332BN	64.8	76.5	77.9	75.9	76.4
S332B	64.8	84.2	85.4	83.7	83.7
S332C	109.5	75.2	78.1	74.7	75.4
S332D	111.4	132.1	134.3	131.8	131.6
S332DX1	4.1	0.1	0.1	0.1	0.1
S199	51.0	58.0	58.9	58.0	58.0
S200	50.2	58.4	59.2	58.3	58.3
G737	10.3	11.0	10.8	11.1	11.0
S328	34.4	37.0	37.7	37.1	37.1
SDNWE	1.7	5.2	5.8	5.1	5.2
S329	0.9	2.0	2.4	2.0	2.0
S205	0.0	0.1	0.1	0.1	0.1

Table 6. South-Dade

	ECB19RR	ALTQ	SRQ1	SRQ2	SRQ3
G211FC	95.3	72.0	72.0	73.0	72.9
G211WS	43.2	31.8	31.5	32.5	35.4
S335FC	166.4	22.6	22.2	23.4	23.4
S335WS	42.5	43.9	43.6	45.5	49.1
S335_2	−901.0	66.6	66.2	67.2	67.8
S335_3	−901.0	54.8	54.2	55.5	55.9
S336	6.0	5.6	5.6	5.7	5.9
S338	58.2	71.6	71.7	71.3	71.4
S331FC	153.2	141.3	141.0	141.8	141.0
S331WS	42.7	29.3	29.1	30.1	33.4
S194	39.2	41.6	42.2	41.5	42.3
S196	26.4	29.3	30.1	29.0	29.6
S165	9.5	9.4	9.5	9.4	9.5
S166	0.3	0.3	0.3	0.3	0.3
S148	36.5	41.6	41.9	41.0	42.1
S176	27.3	20.3	20.5	20.3	21.0
S176_2	9.3	1.1	1.2	1.2	1.1
S177	76.2	64.7	65.6	64.2	65.2
S177_2	1.9	0.8	0.8	0.8	0.8
S178	8.7	9.3	9.4	9.3	9.3
S18C	147.2	135.8	137.6	135.1	136.0
S197	60.4	18.9	19.1	18.8	18.9

Table 7. BiscayneBay

	ECB19RR	ALTQ	SRQ1	SRQ2	SRQ3
NorthBay	509.3	487.7	486.2	489.5	490.8
CentralBay	106.9	104.7	104.6	105.0	105.4
SouthBay	248.9	259.2	260.4	258.3	259.5

Table 8. CoastalStructures

	ECB19RR	ALTQ	SRQ1	SRQ2	SRQ3
S20	12.6	12.6	12.6	12.6	12.6
S20F	108.7	111.1	111.7	110.8	111.0
S20G	5.8	5.8	5.8	5.8	5.8
S21A	59.9	61.2	61.6	61.2	61.2
S21	74.4	81.0	81.3	80.5	81.4
S123	11.4	11.6	11.6	11.6	11.7
S22	77.3	75.8	75.5	75.8	76.1
G93	18.1	17.3	17.5	17.6	17.6

H-4.2.2.2 HYDROPERIOD DIFFERENCE MAPS

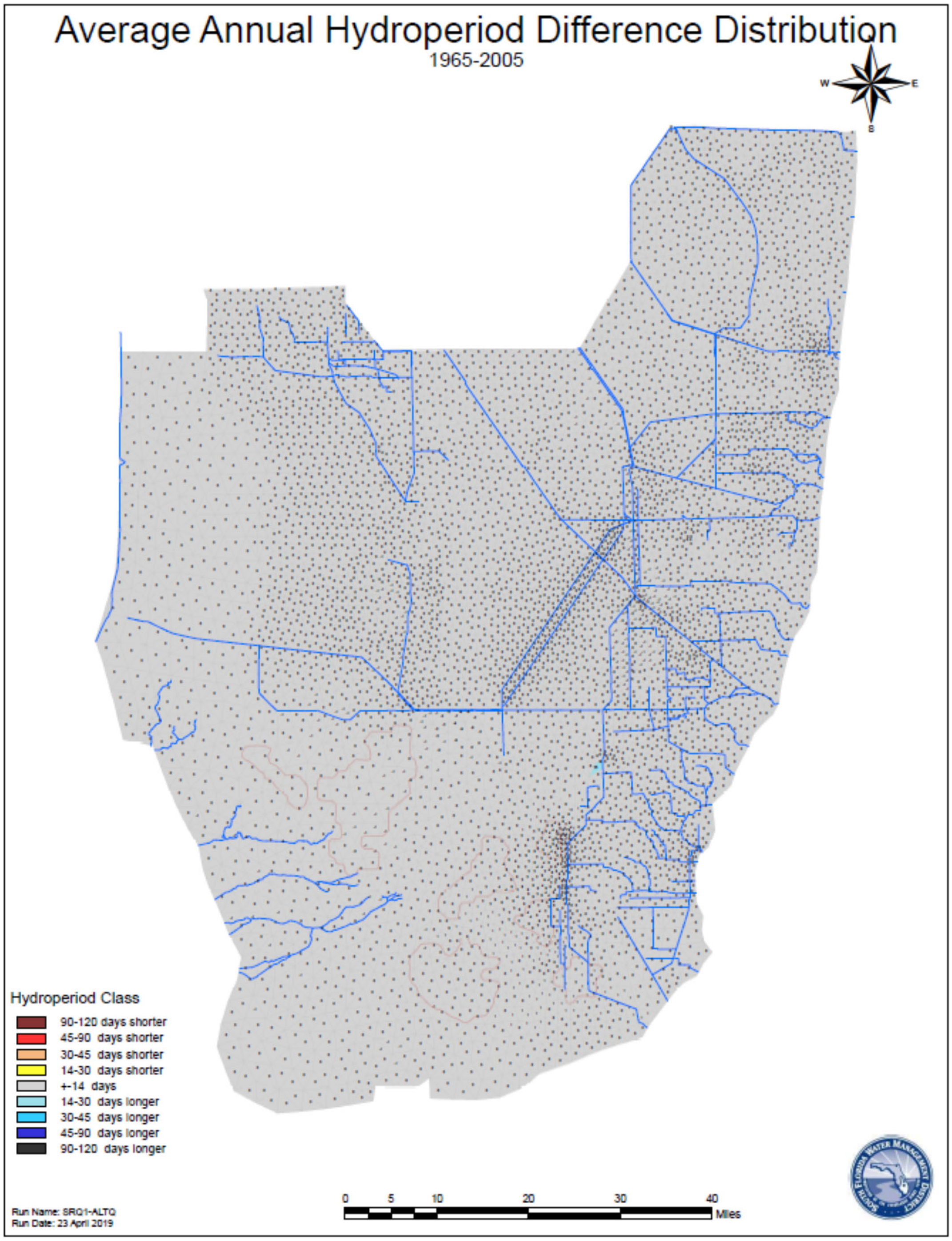

Figure H-4. 31. Average annual hydroperiod differences for Sensitivity Run SRQ1 and ALTQ

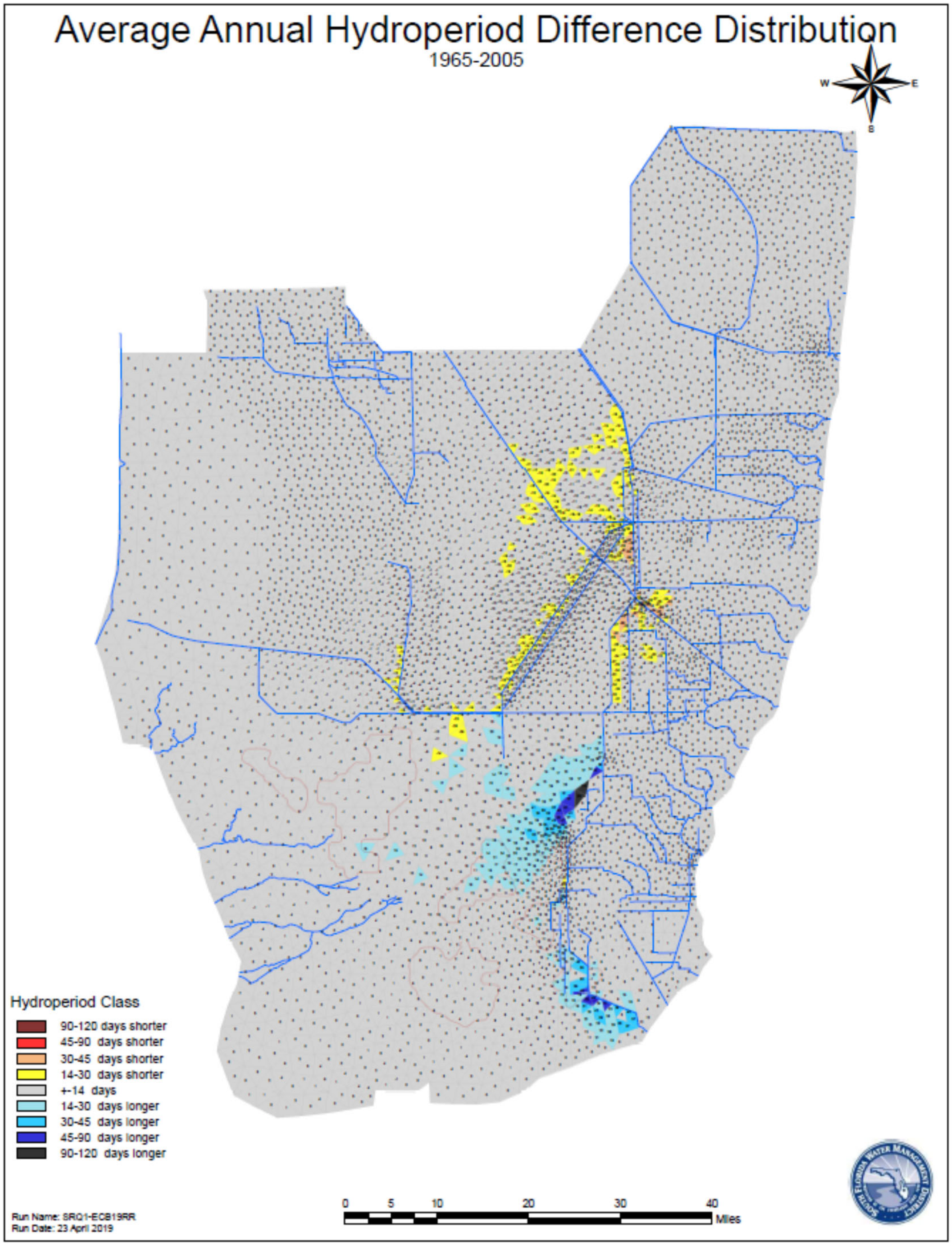

Figure H-4. 32. Average annual hydroperiod differences for Sensitivity Run SRQ1 and ECB19RR Base.

H-4.2.2.3 PONDING DEPTH DIFFERENCE MAPS

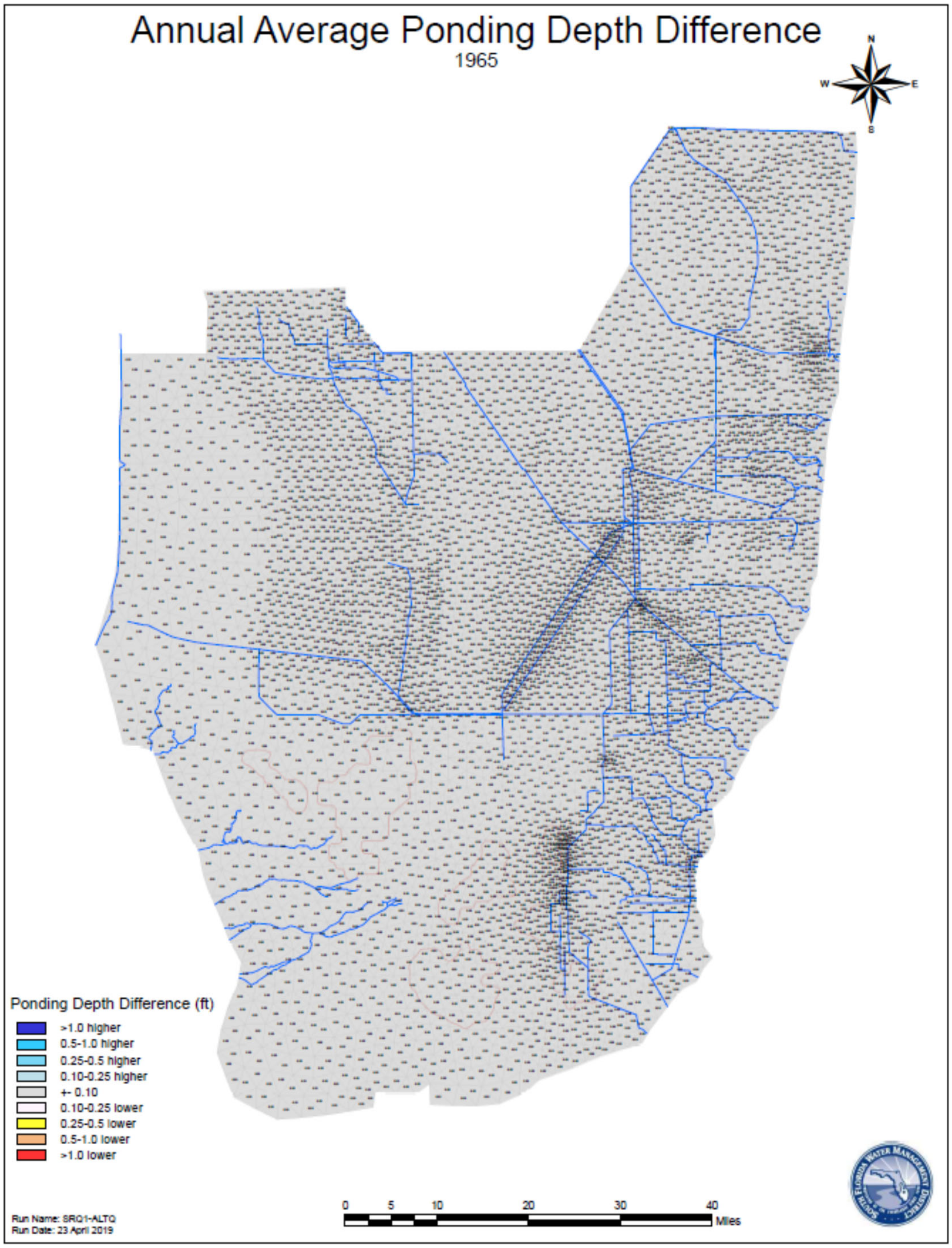

Figure H-4. 33. Average annual ponding depth differences for Sensitivity Run SRQ1 and ALTQ.

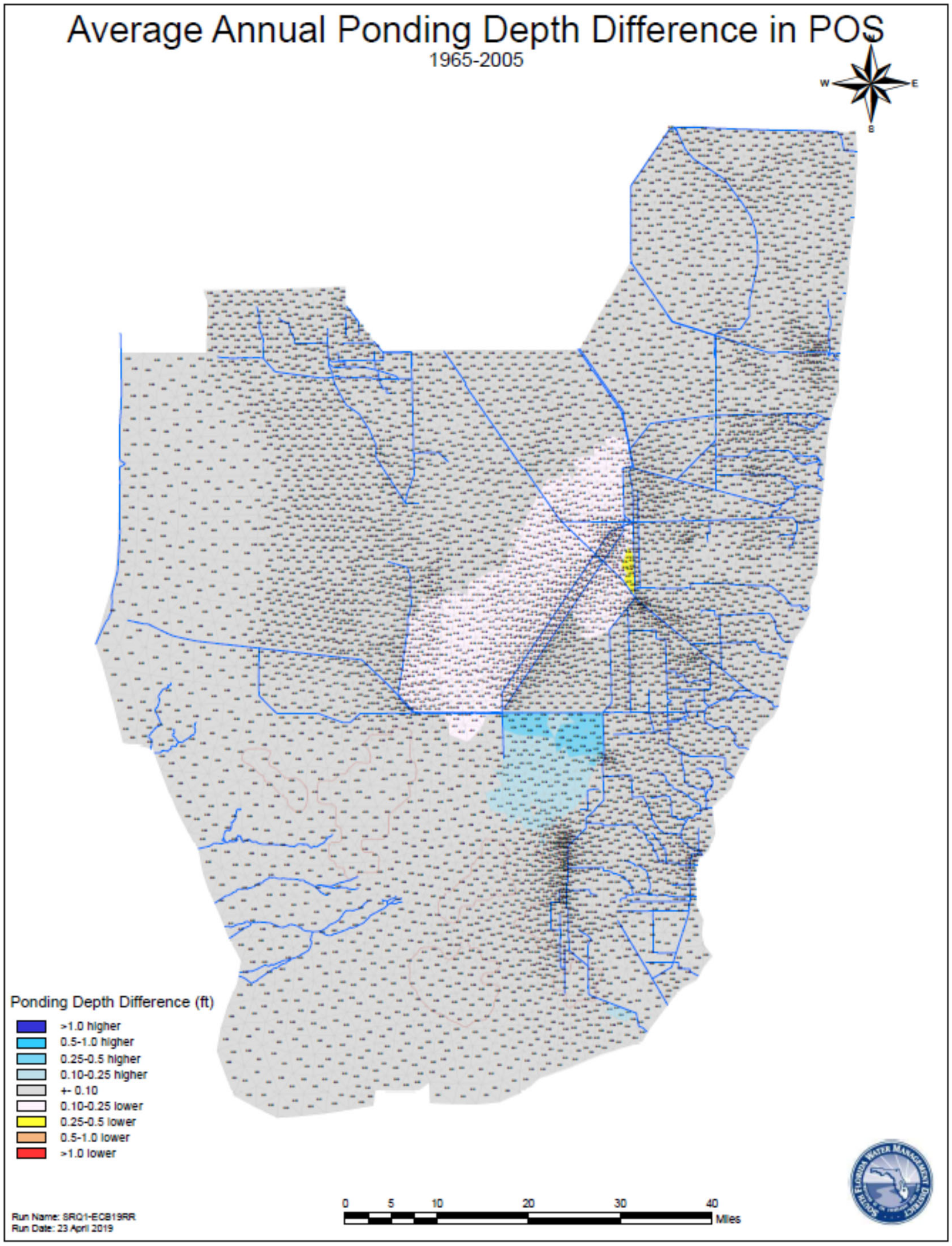

Figure H-4. 34. Average annual ponding depth differences for Sensitivity Run SRQ1 and EBC19RR Base.

H-4.2.2.4 ANNUAL AVERAGE STAGE DIFFERENCE MAPS

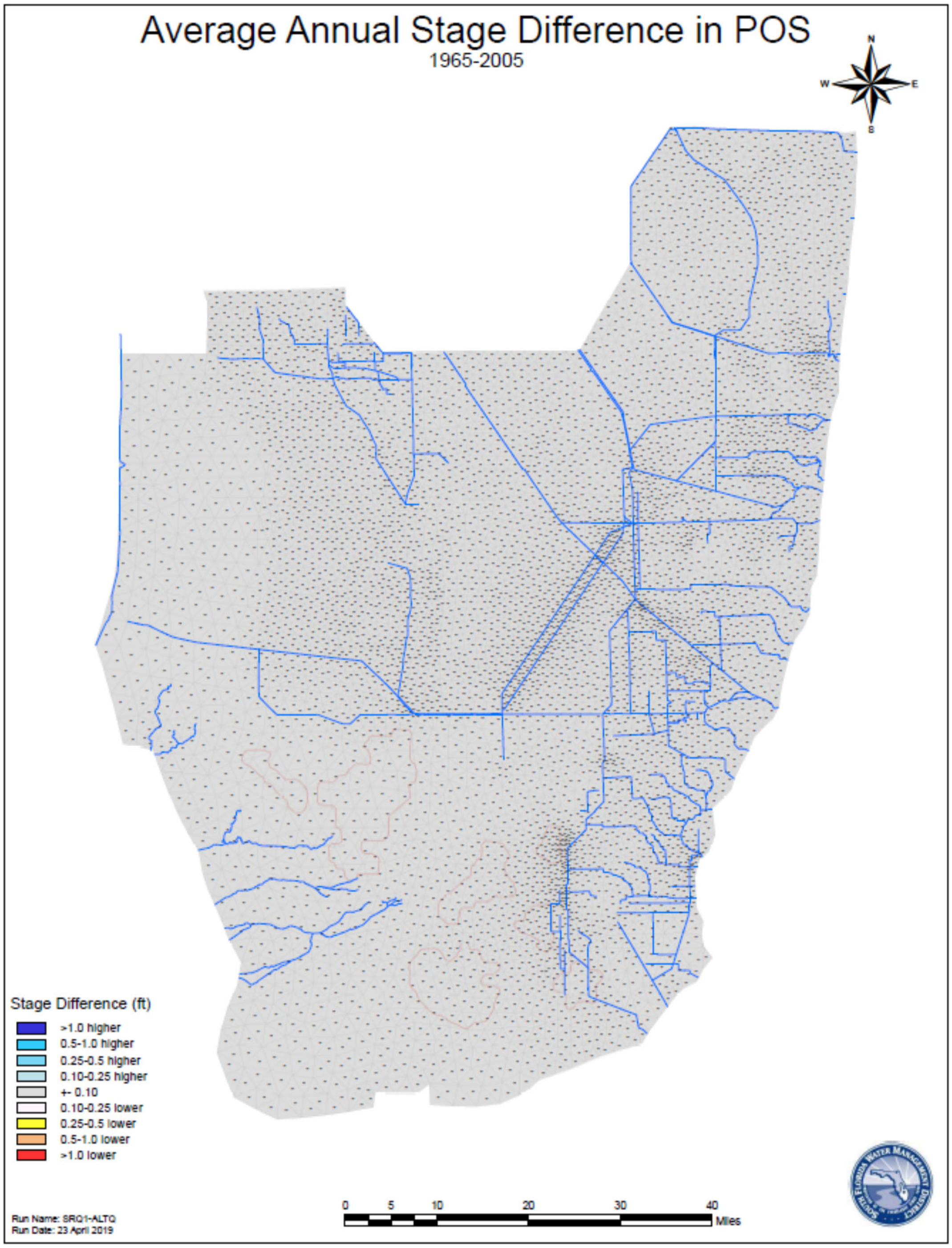

Figure H-4. 35. Annual average stage differences for Sensitivity Run SRQ1 and ALTQ.

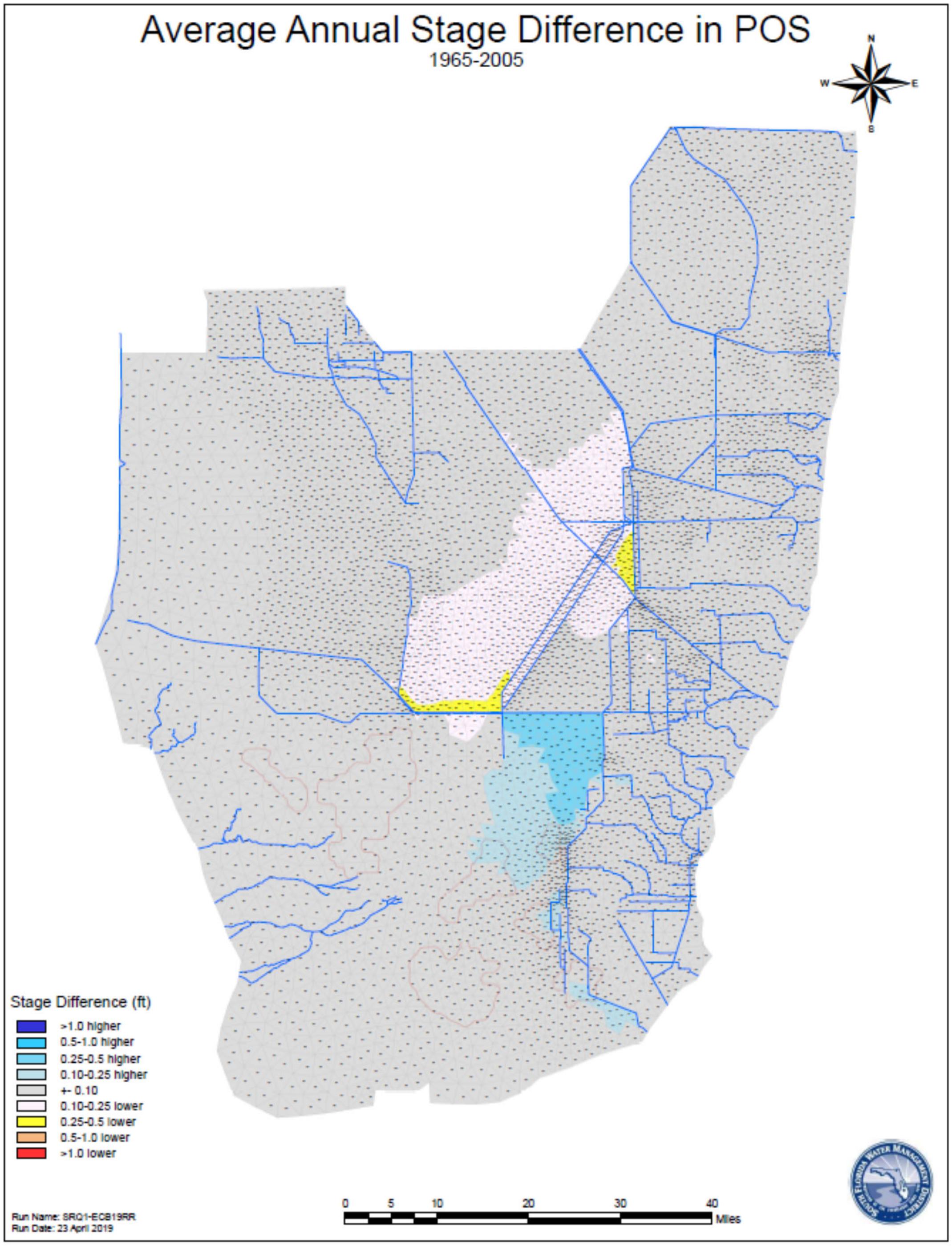

Figure H-4. 36. Annual average stage differences for Sensitivity Run SRQ1 and ECB19RR Base.

H-4.2.2.5 CANAL DURATION CURVES

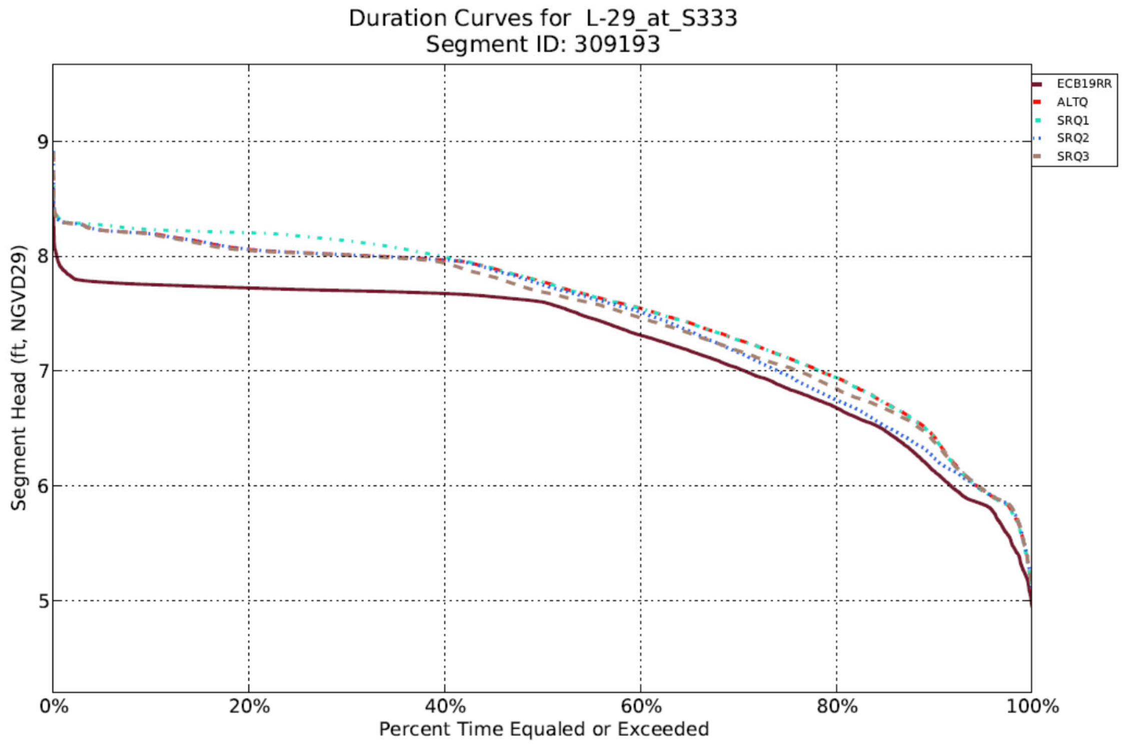

Figure H-4. 37. L-29 Canal stage duration curves for Round 3 sensitivity runs, ALTQ and ECB19RR Base.

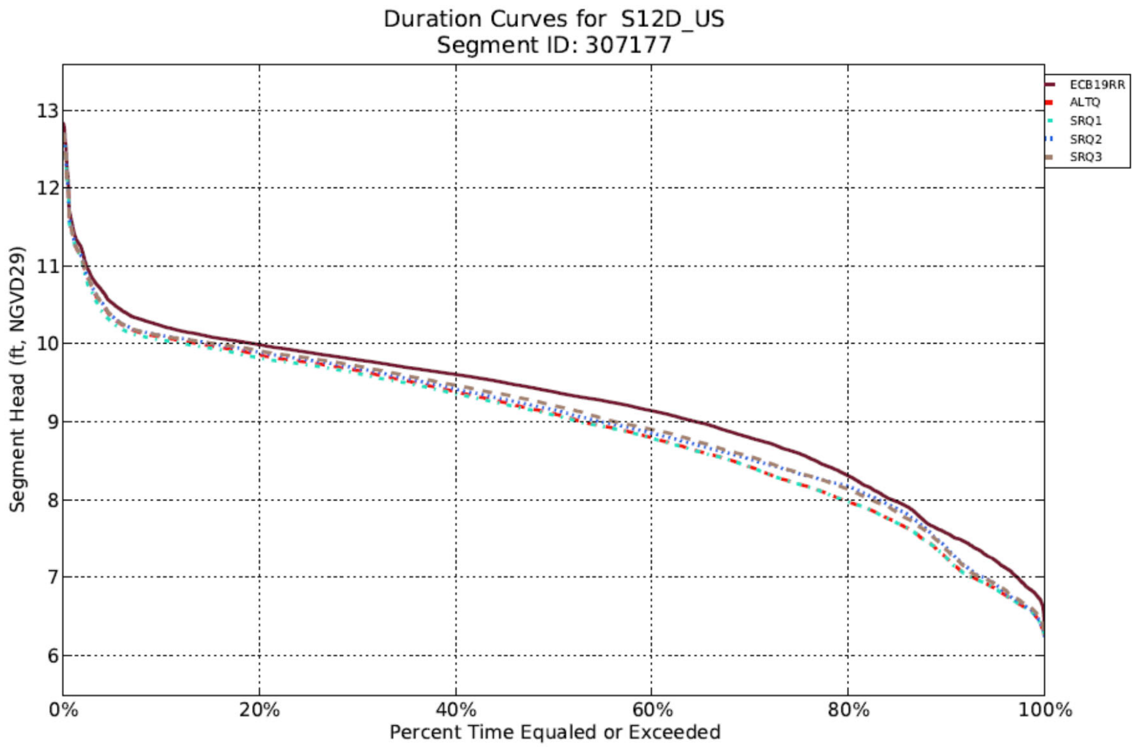

Figure H-4. 38. Canal stage duration curves at upstream of S12D for Round 3 sensitivity runs, ALTQ and ECB19RR Base.

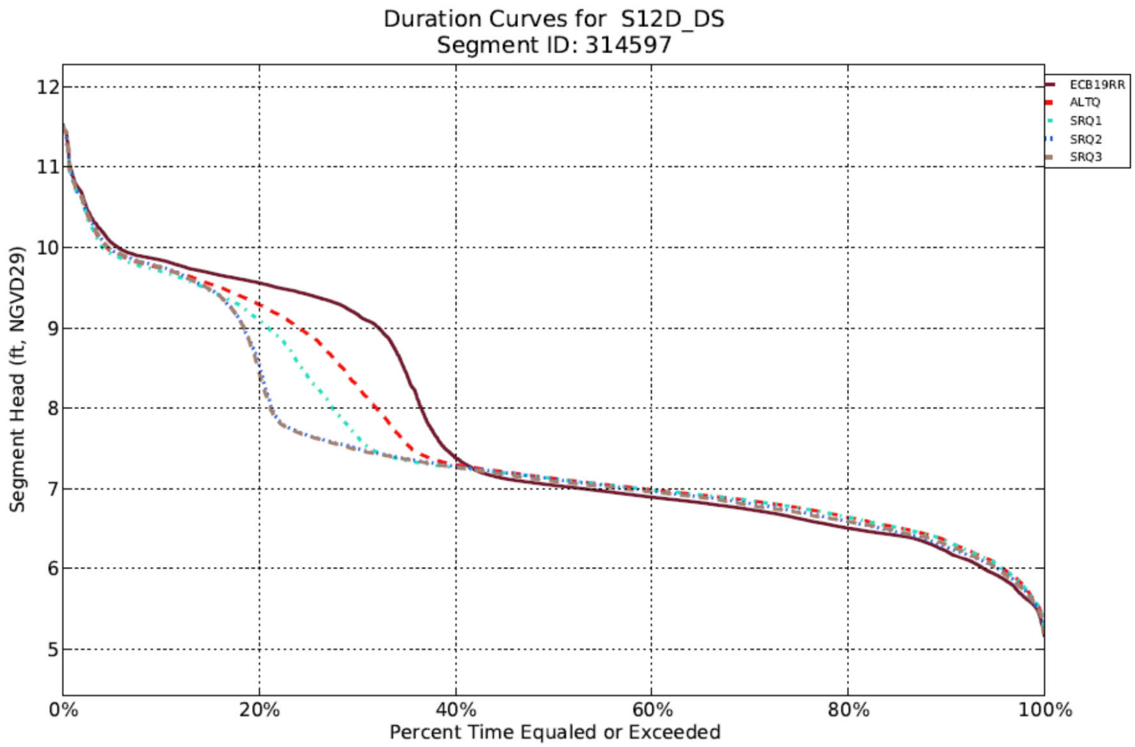

Figure H-4. 39. Canal stage duration curves at downstream of S12D for Round 3 sensitivity runs, ALTQ and ECB19RR Base.

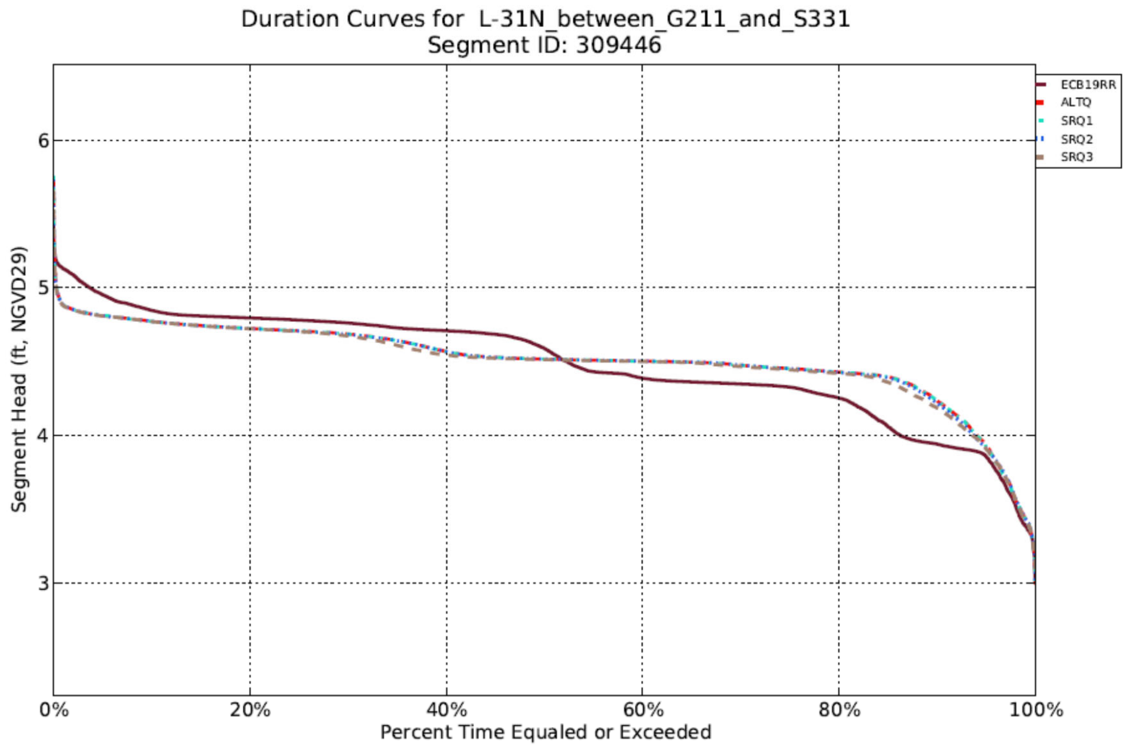

Figure H-4. 40. L-31N Canal stage duration curves between G211 and S-331 for Round 3 sensitivity runs, ALTQ and ECB19RR Base.

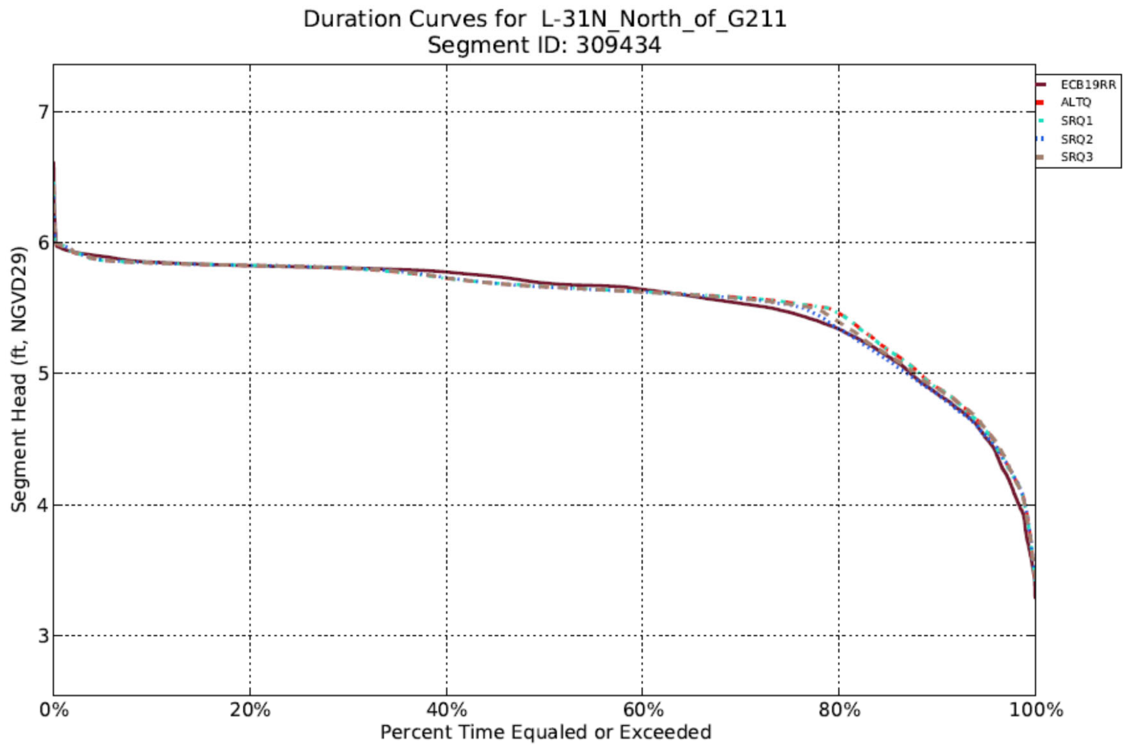

Figure H-4. 41. L-31N Canal stage duration curves north of G211 for Round 3 sensitivity runs, ALTQ and ECB19RR Base.

H-4.2.2.6 GAUGE DURATION CURVES

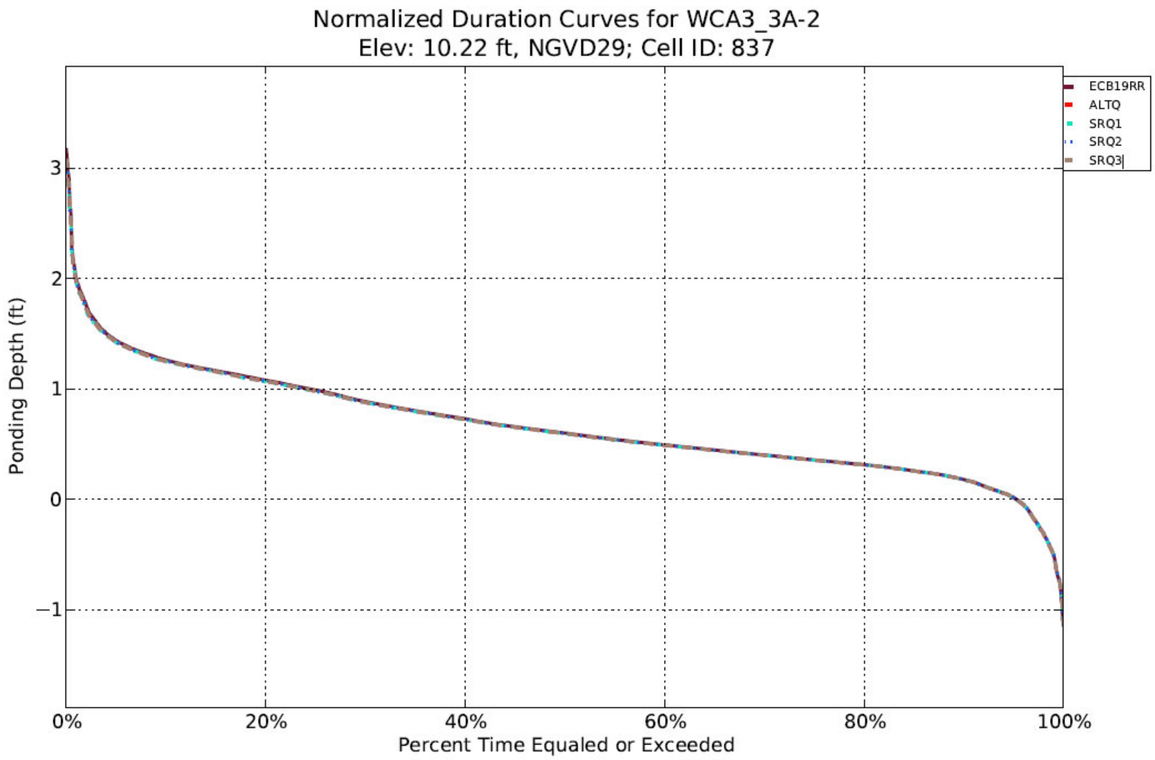

Figure H-4. 42. Ponding depth duration curves at Gauge WCA3_3A-2 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

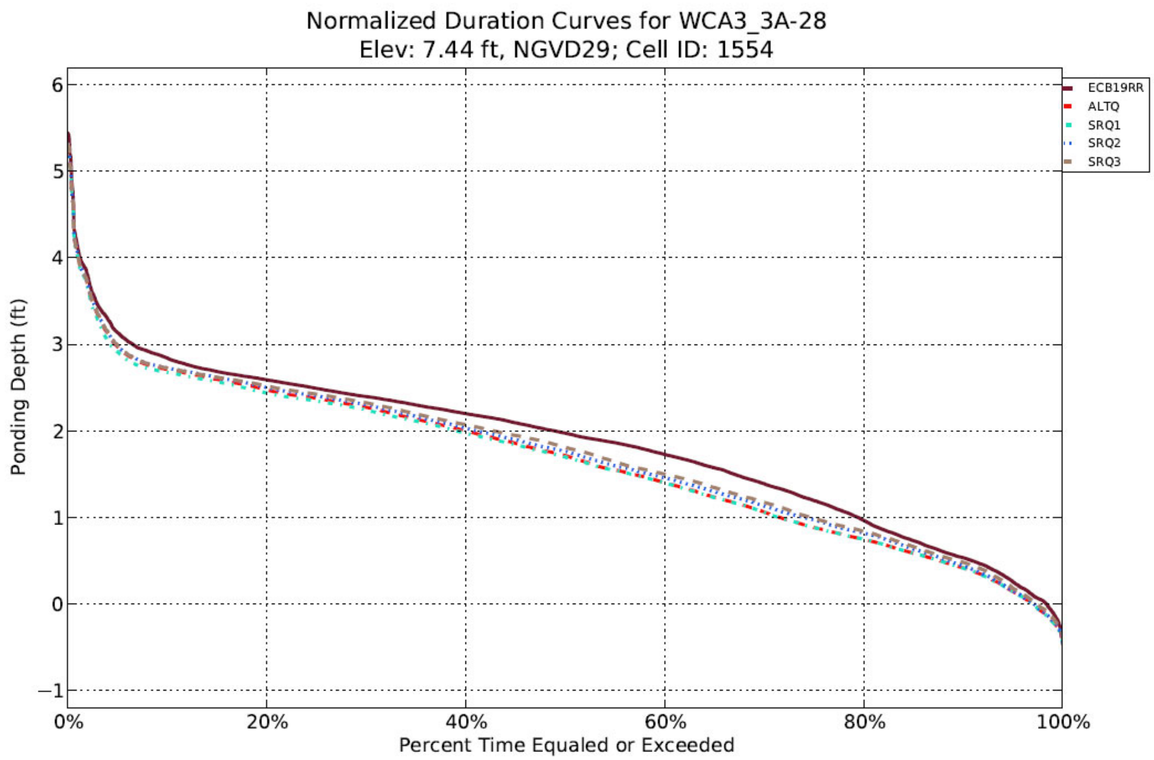

Figure H-4. 43. Ponding depth duration curves at Gauge WCA3_3A-28 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

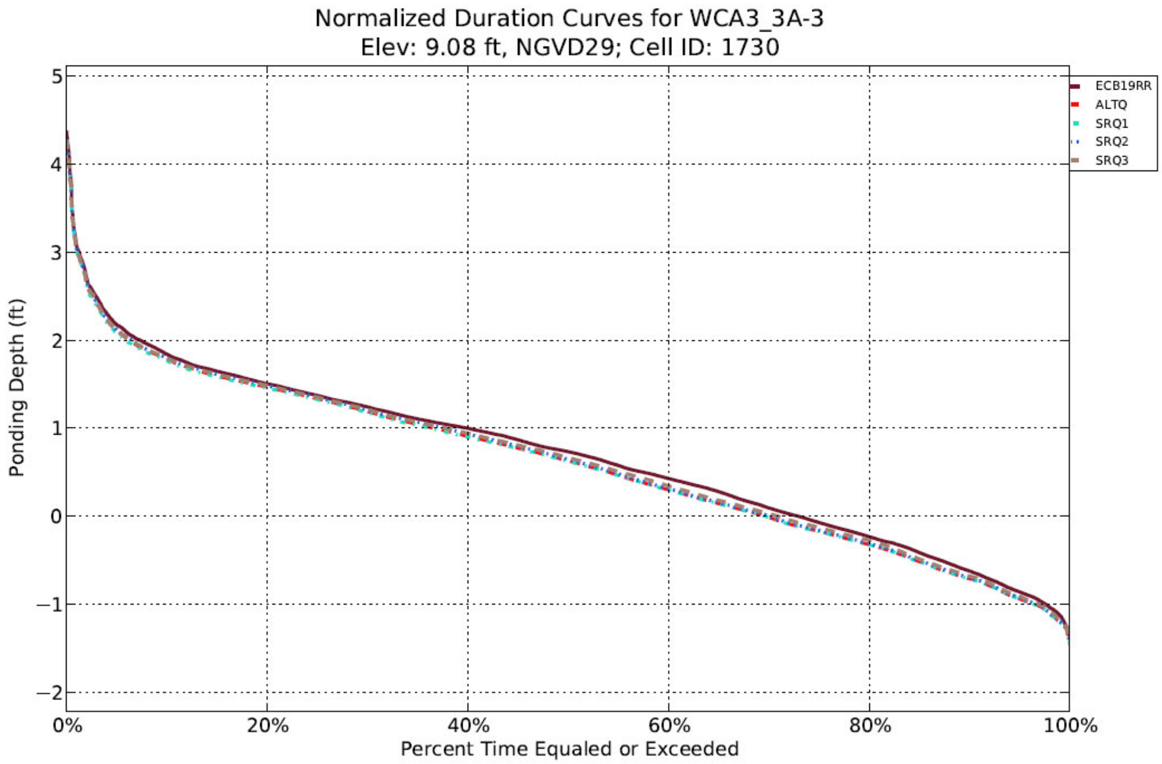

Figure H-4. 44. Ponding depth duration curves at Gauge WCA3_3A-3 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

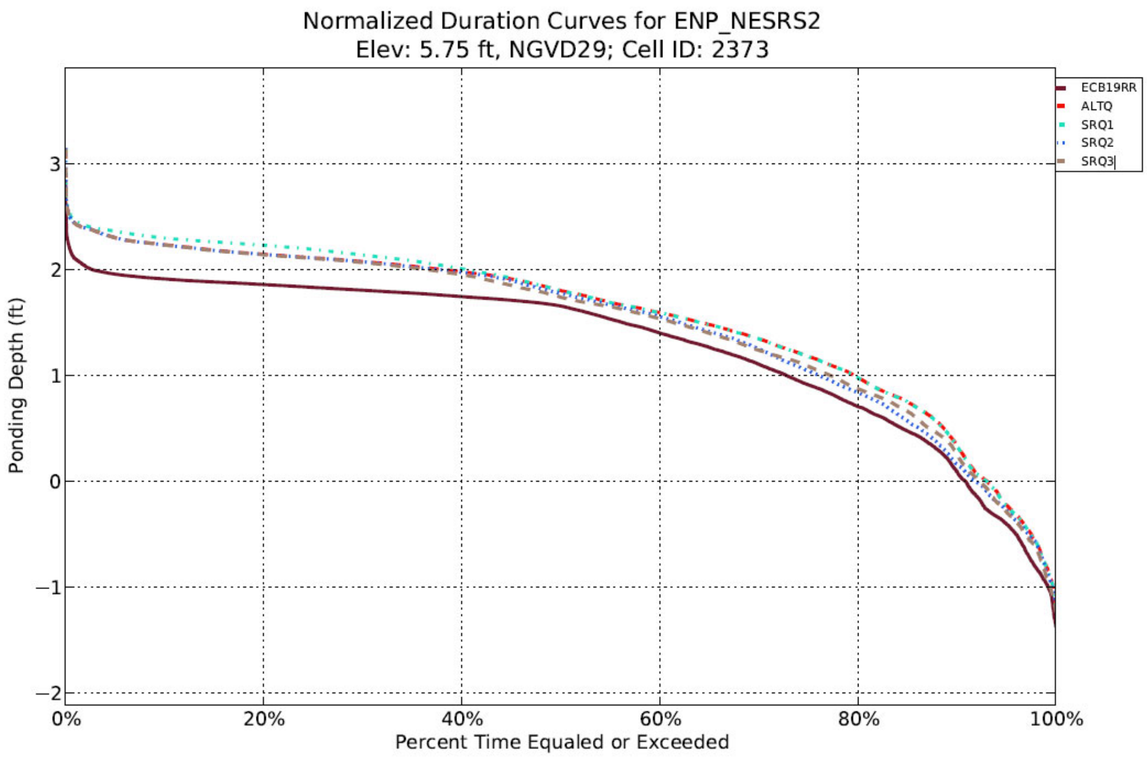

Figure H-4. 45. Ponding depth duration curves at Gauge ENP_NESRS2 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

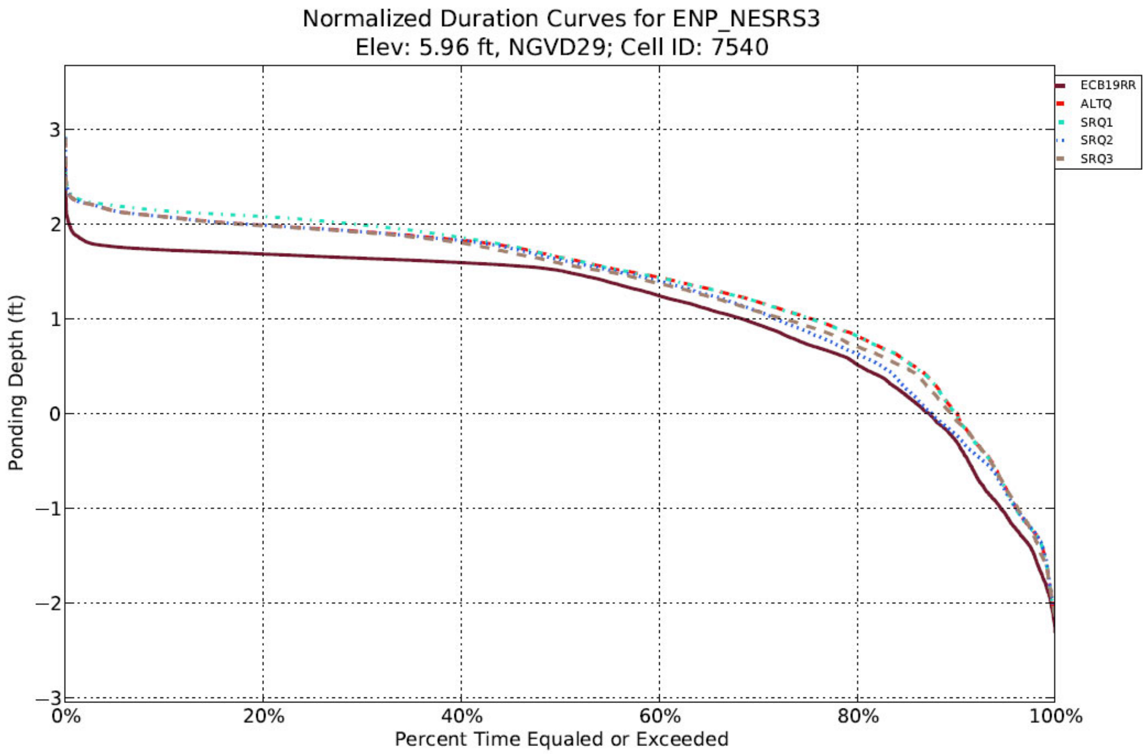

Figure H-4. 46. Ponding depth duration curves at Gauge ENP_NESRS3 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

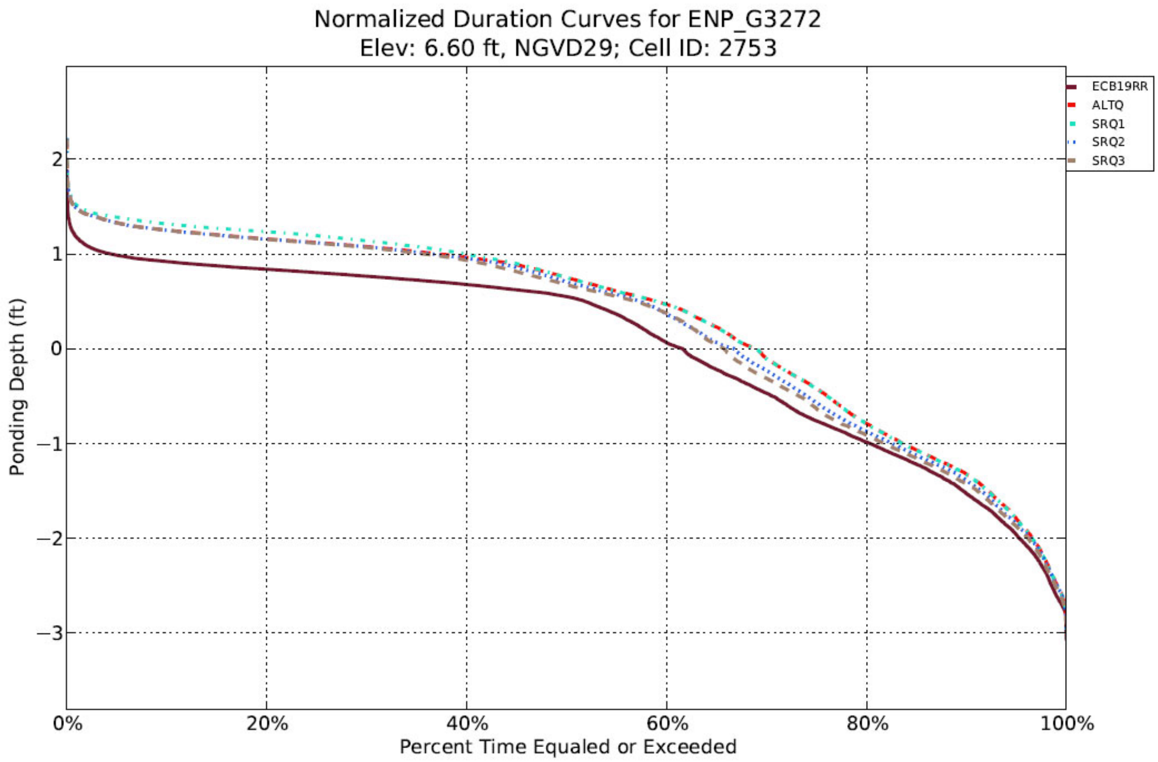

Figure H-4. 47. Ponding depth duration curves at Gauge ENP_G3272 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

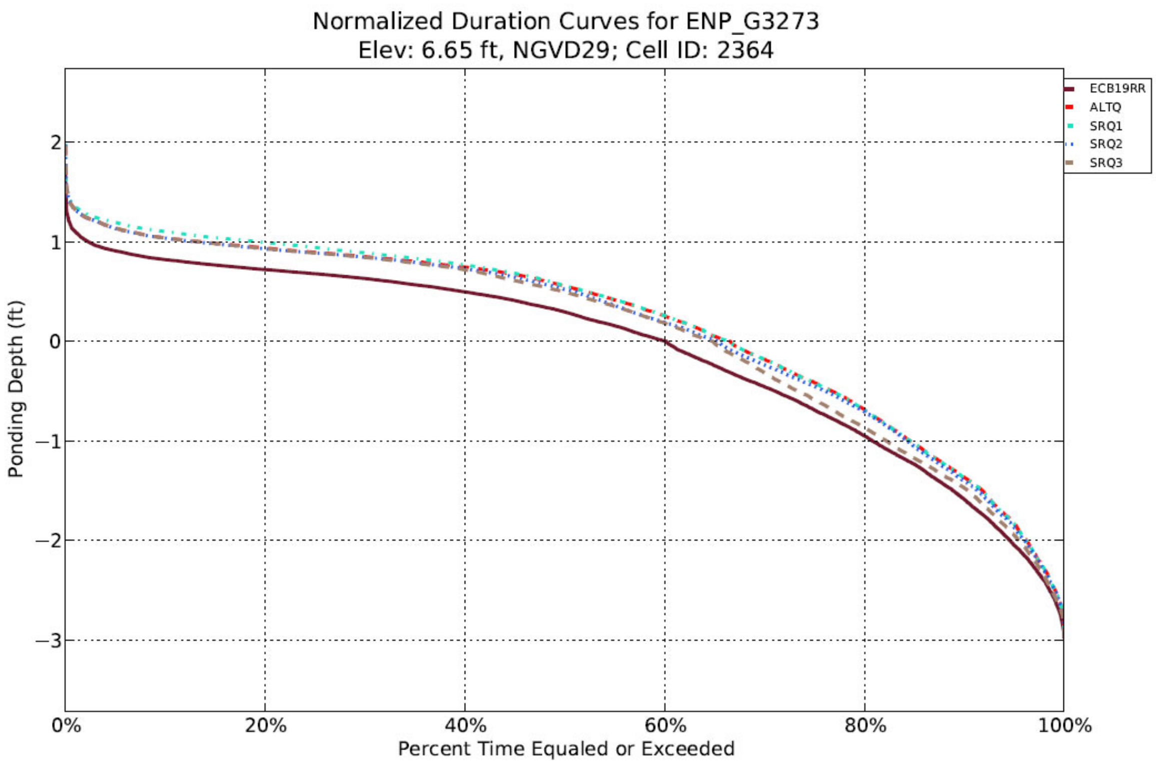

Figure H-4. 48. Ponding depth duration curves at Gauge ENP_G3273 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

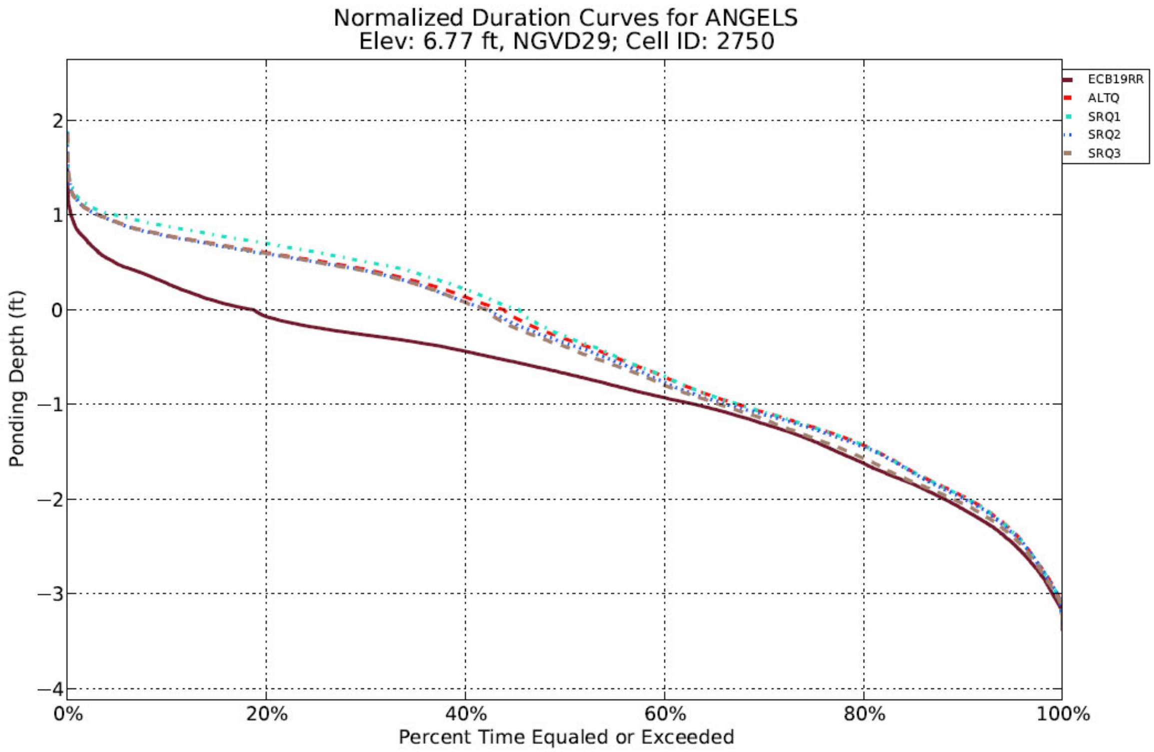

Figure H-4. 49. Ponding depth duration curves at Gauge ANGELS for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

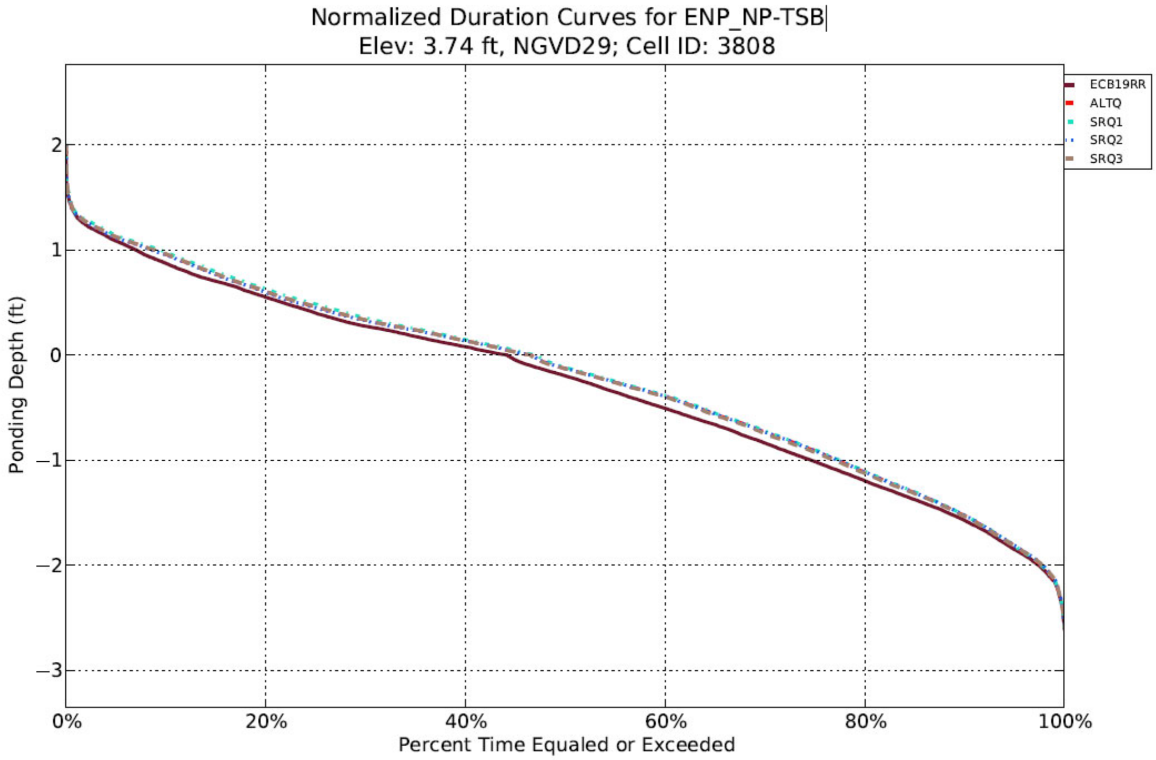

Figure H-4. 50. Ponding depth duration curves at Gauge ENP_NP-TSB for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

H-4.2.2.7 TRANSECT FLOWS

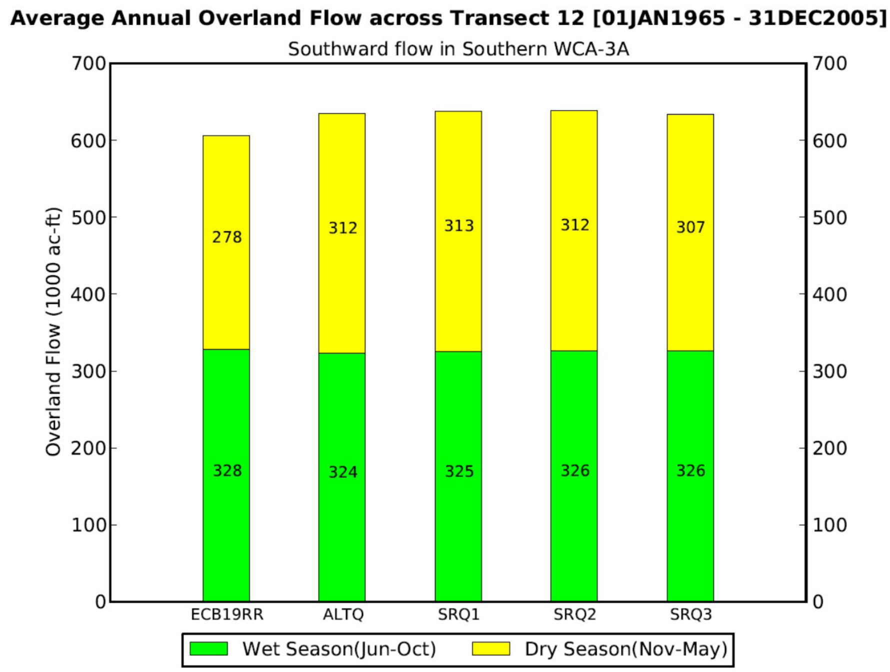

Figure H-4. 51 Average annual overland flows across Transect 12 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

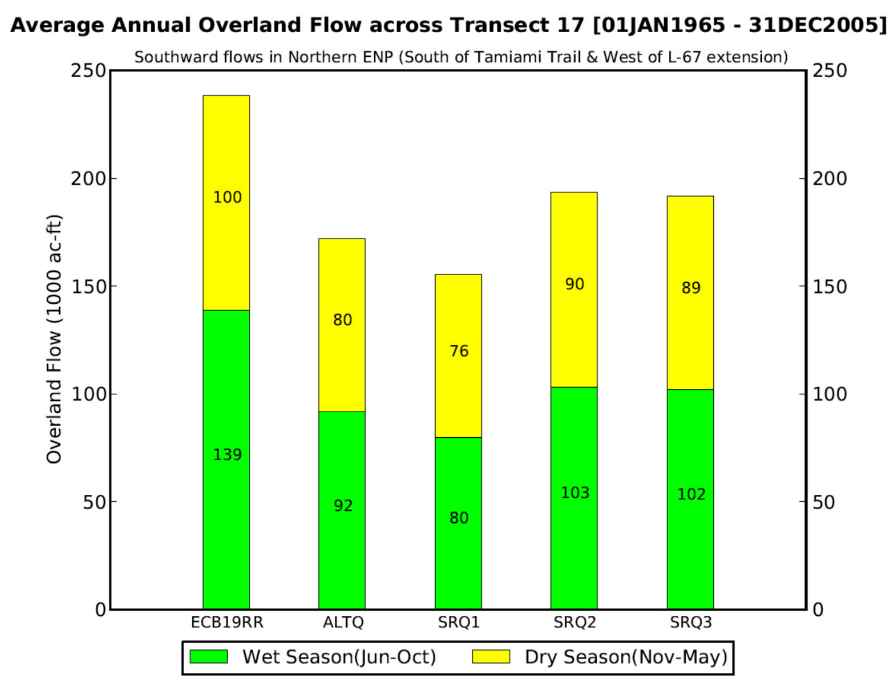

Figure H-4. 52 Average annual overland flows across Transect 13 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

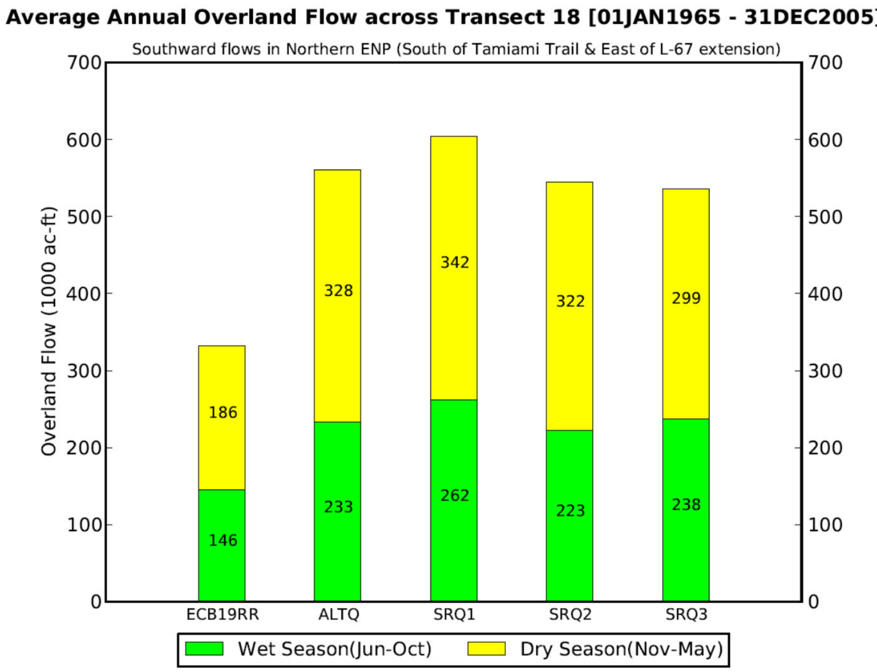

Figure H-4. 53 Average annual overland flows across Transect 18 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

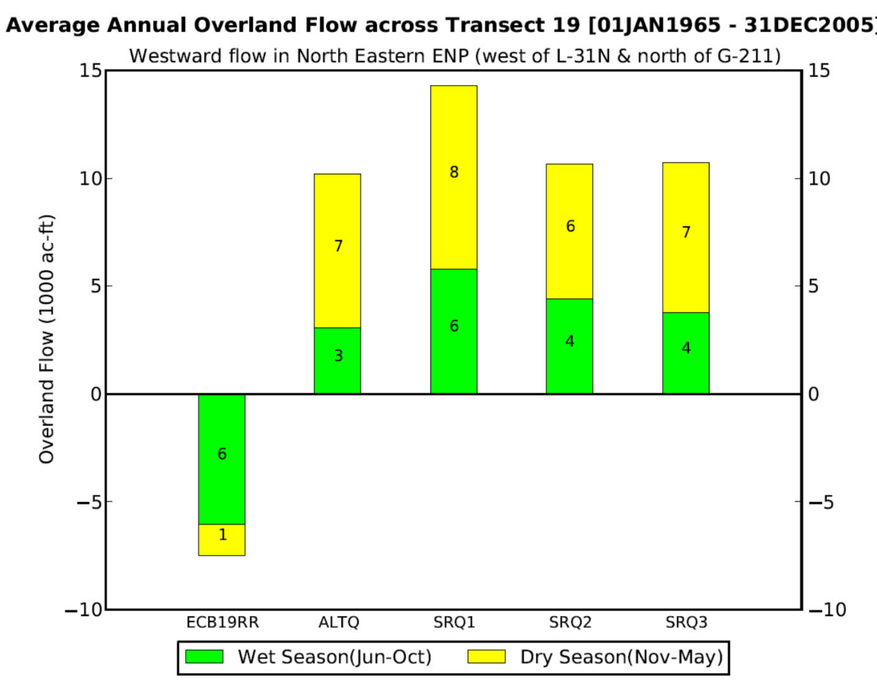

Figure H-4. 54 Average annual overland flows across Transect 19 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

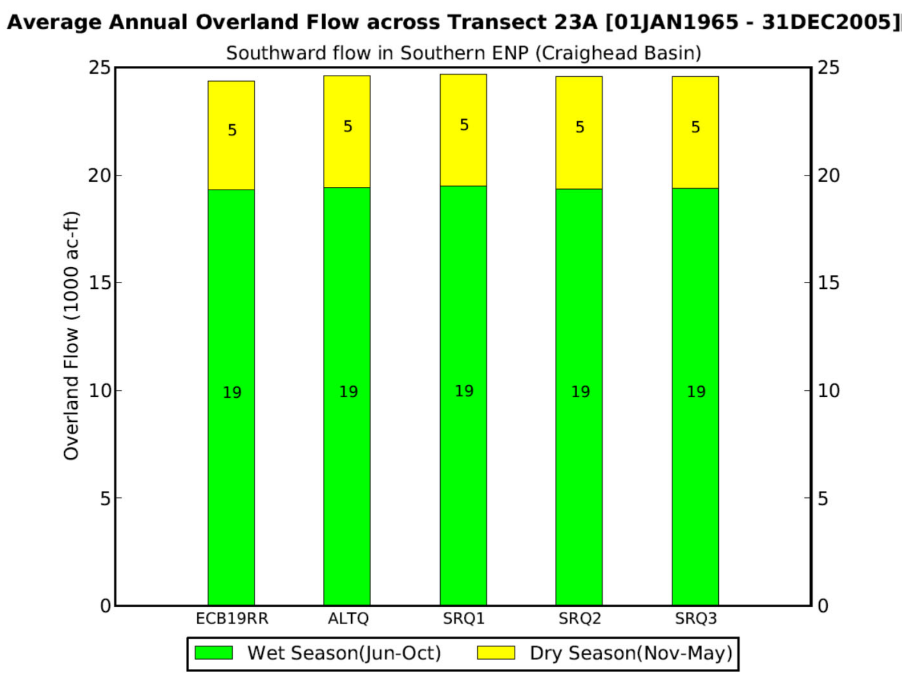

Figure H-4. 55 Average annual overland flows across Transect 23A for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

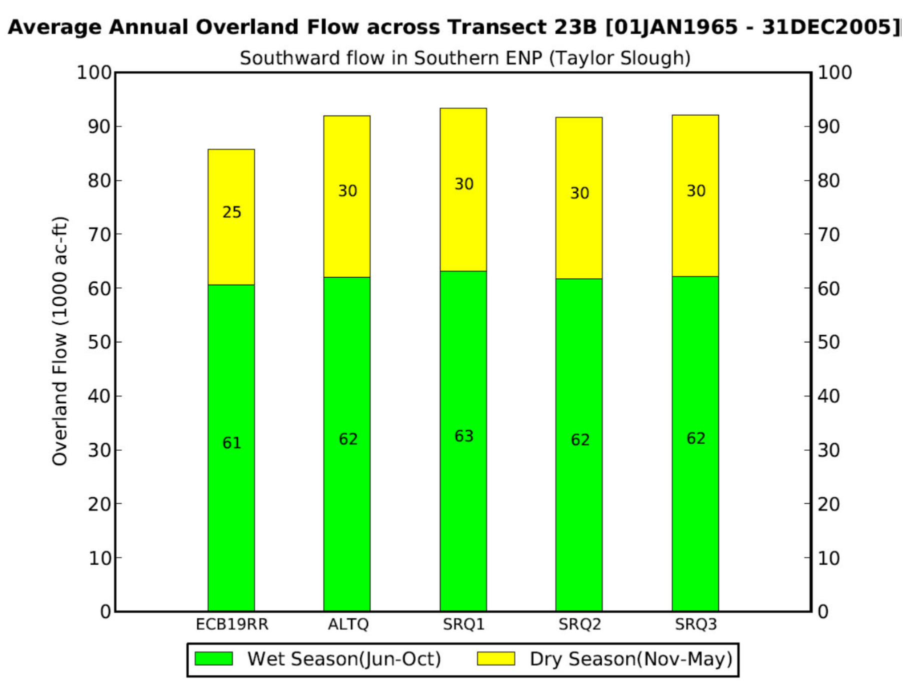

Figure H-4. 56 Average annual overland flows across Transect 23B for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

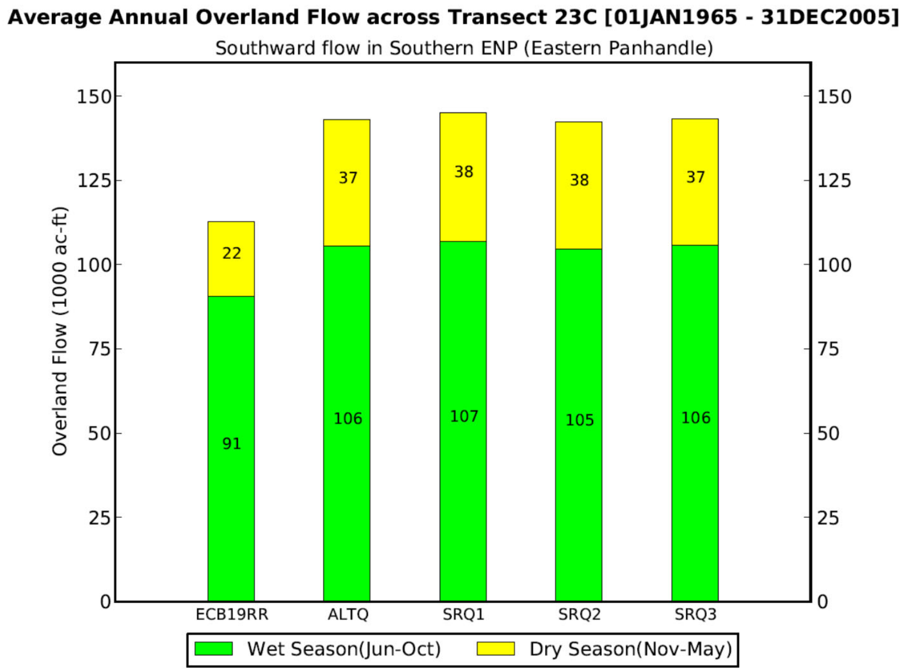

Figure H-4. 57 Average annual overland flows across Transect 23C for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

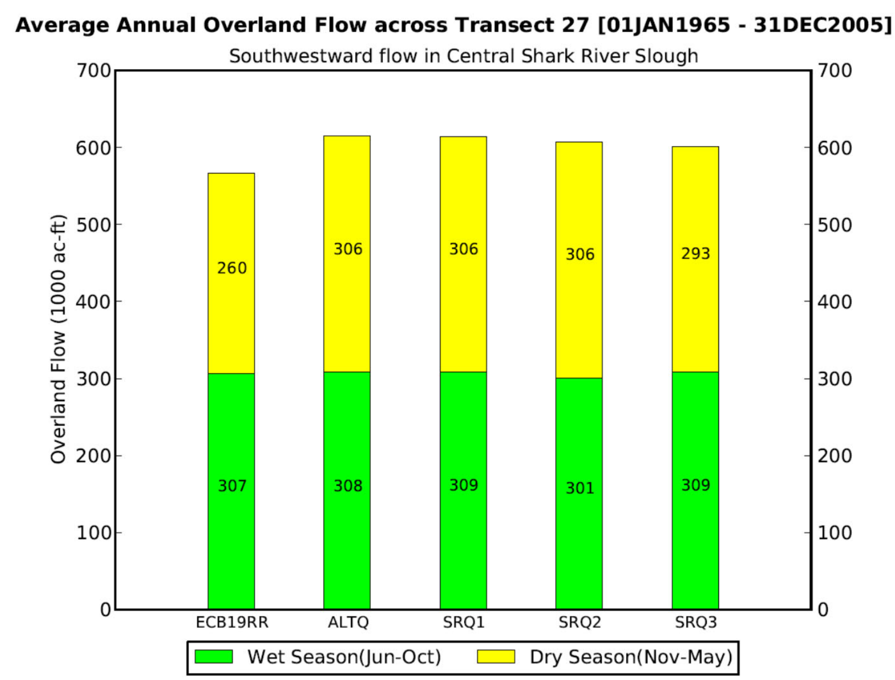

Figure H-4. 58 Average annual overland flows across Transect 27 for Round 3 sensitivity runs, ALTQ, and ECB19RR Base.

This page intentionally left blank