APPENDIX D – ADDITIONAL INFORMATION

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Sensitivity Analysis of Operations to Reduce Observed February 2016 High Water Conditions in WCA-3A

Modeling Section, Hydrology & Hydraulics Bureau, SFWMD
15-Feb-2016

Background

High water levels throughout Central and Southern Florida due to well-above-average rainfall from Nov 2015 – Jan 2016 prompted the design of a water management strategy aimed at moving more water from WCA-3A to ENP and the SDCS. A regional-scale hydrologic sensitivity analysis is being performed to estimate the potential system response to this proposed operating strategy.

Four simulations built off the February 2016 Position Analysis were developed:
(1) BASE: A no-action baseline simulation that reflects the current standard operating policies and regulations. This simulation is the same as the February PA simulation with changes to reflect current standard operations in the SDCS as described below.

(2) SENS1: Sensitivity simulation to reflect the proposed operations as of 2/9/16 (See Attachment A). This simulation was built using the BASE simulation with several changes in modeled operations described below.

(3) SENS2: Same as SENS1 with inclusion of Decomp Physical Model (DPM) location to try to release more from WCA-3A to WCA-3B via S-152. Releases ok if Site71 < 8.5'. Cap S-152 at 400 cfs.

(4) SENS3: Same as SENS2 with S337FC and S335 Column 2 operations assumed to promote additional flow opportunity from WCA3A to SDCS. Reflects updated proposed operations as of 2/11/16 (See Attachment B).

Modeling Assumptions

Four simulations building from the February 2016 Position Analysis were developed. Analysis of results of these position analysis simulations was limited to the period Feb-May, with emphasis on the relatively short duration (90-days or less) of the proposed operations. All simulations assume that WCA-3A stage levels will remain above the Increment 1 Action Line (10.0-10.75 feet NGVD) for the period Feb-May. Thus S-356 will not be used.

(1) BASE

A baseline simulation that reflects the current standard operating policies and regulations. This simulation is the same as the February PA simulation with some minor changes to reflect current standard operations in the SDCS.

a. G-3273 constraint relaxed
b. S-356 pump not used

c. S-332D discharge limited to 250 cfs from Feb-July (was 165 cfs)
d. S-199 & S-200 included. Only 5 of 6 pumps are available (one out at S199). And March 1 CSSS constraint on use is to be applied.
e. Force ERTP Column 2 operations for all pertinent SDCS structures regardless of whether S-334 is open; and use Column 2 operations at G-211 and S-338 during S-334 Column 2 releases.
f. S337FC set to zero
g. Limit S334FC to 250 cfs (surrogate for Increment 1 operations)
h. Cap S-197 Level 1 releases at 500 cfs if S-18C HW is above 2.8
i. Use operating ranges for S380{R} that keeps structure full open (no reverse flow)
j. C-111 South Dade North Detention Area not constructed/operational
k. 8.5 SMA C-358 and S-357N not operational

(2) SENS1

Sensitivity simulation to reflect the proposed operations as of 2/9/16 (Attachment A). This simulation was built from the BASE simulation with several changes in modeled operations shown below. Note that not all of the specific detail shown on the Attachments can be simulated by the SFWMM.

a. L-29 stage constraint relaxed from 7.5' to 8.5' (all stages shown in feet, NGVD)
b. S-335 closed
c. S-334 flows maximized, subject to downstream water levels
d. S-338 5.7/5.3 & reduce operating range of S-148 to open/close of 3.0/2.5
e. G-211 open to convey remaining S-334 discharge with ERTP Col2 operating range 5.7/5.3
f. S-331 pump ranges reduced by 0.2 feet to 4.6/4.0
g. S-332B & S-332C on/off 4.6/4.3 (0.2 feet lower than Col2)
h. S-332D used to manage L31S 4.6/4.3 and limited to 575 cfs year-round. Note the SFWMM cannot model detail of S332DX1.
i. S-194 4.6/4.3 - keep structure open and operating S-165 at low range 3.0/1.9
j. S-196 4.6/4.3 - keep structure open and operating S-167 & S-179 at low ranges (3.0/1.9 & 3.1/2.7, respectively)
k. S-176 operated to manage L31S 4.6/4.3. Limiting daily flow by S331 flow not possible with SFWMM.
l. S-199 & S-200 use same assumptions as baseline.
m. S-177 3.6/3.4 open/close
n. S-18C fully open 1.6/1.3 (lowered maintenance level to 0.8)
o. Ramp up S-197 from 0 cfs at 2.4 to 400 cfs at 2.6 feet NGVD. Higher flows to be triggered by S-18C stage. For stages higher than 2.6, discharge ramp up to same max (2400 cfs) as BASE.

(3) SENS2

Same as SENS1 with inclusion of Decomp Physical Model (DPM) location to try to release more from

WCA-3A to WCA-3B via S-152 (modeled as STRDPM). Releases ok if Site71 < 8.5' (in model, equivalent constraint is 8.2'). Cap S-152 at 400 cfs. Scenario utilizes a model version with a code change to apply S152 TW constraint.

(4) SENS3

Sensitivity simulation to reflect the proposed operations as of 2/11/16 (Attachment B). Same as SENS2 with S337FC turned on and S335 operated per column 2 criteria. Scenario utilizes a model version with a code change to apply S152 TW constraint. Note that not all of the specific detail shown on the Attachments can be simulated by the SFWMM. This run provides a bracketing scenario to compare with SENS1 & SENS2. It is expected that real-world operations will consider more factors than those captured by the model simulation and as such, the utilization of the S337/S335/L32N/SDCS route will likely fall between the conditions represented in the SENS runs.

Attachment A (Guidance as of 2/9/16)

Protective Operational Criteria to Compensate for Sustained L-29 Stage of 8.5 feet NGVD

The following criteria are protective and implementable operation criteria to compensate for sustained L-29 Stages of about 8.5 feet NGVD.

These operations described below are expect to be of a relatively short duration (90 days or less).

S-335 closed with western Reaches (S-336 to G-119 and G-119 to S-380) of the C-4 Canal lowered to the extent practical.

S-334 flows maximized to the extent the following constraints allow. However, if the L-31N stage rises above the operation ranges prescribed below then S-334 discharges will be reduced to 250 cfs or less until the canal daily average stage returns to within the prescribed ranges.

S-338 discharge maximized (e.g. 250 to 300 cfs) to the extent that downstream conditions allow. Includes operating S-148 with an open/close of 3.0/2.5 for S-148 flows of less than 700 cfs and with an open/close of 3.5/3.0 (lower half of the low range) for S-148 flow greater than 700 cfs.

G-211 discharging to the extent practical to convey S-334 discharges and to maintain the L-31N with the 5.7/5.3 stage range prescribed by Column 2 operations.

S-331 pumping ranges lower by 0.2 feet with the remaining criteria unchanged.

S-332B and S-332C operated to maintain the L-31N's average daily stage between 4.6 and 4.3; which is 0.2 feet lower than the Column 2 ranges of 4.8 and 4.5 feet NGVD.

Operate S-332D to discharge up to 250 cfs to S-332D's detention area and up to 325 cfs to the Southern Detention Area (SDA) through S-332DX1 to maintain the L-31N's average daily stage between 4.6 and 4.3 feet NGVD.

Discharge to tide through the C-102 Canal will be maximized to the extent that downstream conditions allow. The SFWMD will continue to have full operational flexibility to operate S-165 within the low range of 3.0 to 1.9 feet NGVD. It is acknowledged that without remote control of S-194 (manually operated structure) that changes to S-194 will occur less frequently.

Discharge to tide through the C-103 Canal will be maximized to the extent that downstream conditions allow. The SFWMD will continue to have full operational flexibility to operate S-167 and S-179 within their low ranges of 3.0 to 1.9 feet NGVD and 3.1 to 2.7 feet NGVD. It is acknowledged that without remote control of S-196 (manually operated structure) that changes to S-196 will occur less frequently.

S-176 will be operated to discharge up to the larger of the average daily/24-hour or instantaneous discharge from S-331 while maintaining the L-31N average daily stage within the operational range.

S-199 will be operate with all available capacity until March 1, 2016 at which time the availability of the pumps will require compliance with the criteria for the Cape Cable Seaside Sparrow Critical Habitat Unit 3 (formerly known as Sub-Population D) ; stage at EVER4 below 2.36 feet NGVD.

S-200 will be operate with all available capacity until March 1, 2016 at which time the availability of the pumps will require compliance with the criteria for the Cape Cable Seaside Sparrow Critical Habitat Unit 3 (formerly known as Sub-Population D) ; stage at R3110 below 4.95 feet NGVD.

S-177 will be operated with an open and close of 3.6 and 3.4 feet NGVD to prevent the accumulation of water discharge by S-176.

S-18C will be fully open (gates out of the water).

S-197 will be operate to maintain the S-18C's Daily Average HW between 2.6 and 2.4 feet NGVD with a daily discharge limit which does not exceed the smaller of 1) the previous day's average pumping at S-331, 2) the previous day's average discharge through S-176, 3) the previous days average discharge through S-177, and 4) 400 cfs (half of the typical flow for a one third opening of S-197. This will result in discharges larger than those prescribed by the ERTP Increment 1 when WCA-3A is above the High Water Action Line (Case 3).

Attachment B (Guidance as of 2/11/16)

Protective Operational Criteria to Compensate for Sustained L-29 Stage of 8.5 feet NGVD

To provide high water relief for WCA-3A it is possible to substantively increase the available discharge capacity through S-333 by raising the L-29 stage limit.

The following criteria are protective and implementable operational criteria to compensate for the sustained increased flow to Northeast Shark River Slough (NESRS) associated with raising the L-29 Stage Limit from 7.5 to 8.5 feet NGVD. It is expected that over the period when flows to NESRS are increased that the water level in NESRS, and along the entire eastern boundary of Everglades National Park (ENP), will rise meaningfully.

The increased S-333 discharges associated with this action are expected to be of a relatively short duration. A fixed duration or target line (e.g. at or below the Zone A Regulation Schedule Line for WCA-3A) or a combination of both will need to be determined. There will be a meaningful (e.g. 60 day) recovery period once the L-29 constraint is returned to 7.5 feet NGVD, during which the water level would recede to stages typical of the recent hydrological conditions and the operational criteria of ERTP Increment 1. The lowered operational ranges will remain until this recovery period is completed. A fixed duration or target stages [e.g. being below the upper quartile (P75) at representative gages along the eastern boundary of ENP] or a combination of both will need to be determined.

To the extent that the raised L-29 stage limit allows, S-333 discharges will be sent to Northeast Shark River Slough (NESRS). S-334 will only be used to the extent that is required to maintain the L-29 stage below the temporary stage limit of 8.5 feet while operating S-333 within its MAGO limits (maximum of 1,350 cfs). It is expected that if the L-29 stage limit is raised to 8.5 feet NGVD that initially there will be sufficient capacity for most if not all of S-333's full capacity. If the L-29 stage is below the raised L-29 stage limit with S-333 discharging at its' full capacity (1,350 cfs) the USACE may use S-356 to reduce the flow south and control the L-31N stage north of G-211. In addition, if the L-29 stage peaks well below the 8.5 feet- NGVD limit, with S-333 discharging at the maximum rate allowed by its MAGO limits, water from WCA-3A could be delivered through the manual route of S-151, S-337, and S-356 as long as the pumping rate at S-356 exceeds the discharge rate at S-335.

S-335 discharges will be minimized with the western reaches (S-336 to G-119 and G-119 to S-380) of the C-4 Canal lowered to the extent practical. S-335 flows will be minimized to free up downstream capacity until WCA-3A condition becomes more normal, or WCA-3B conditions become acutely adverse, or the headwater (HW) stage rises to above the top of S-335's gate at 8.0 feet NGVD. If S-335's HW stage rises above 8.0 feet S-335 gate may be opened as necessary prevent flow over the top of the gate.

Should flow through S-334 be needed then flows will be maximized to the extent the following constraints allow. However, if the L-31N stage rises above the operation ranges prescribed below then S-334 discharges will be reduced to 250 cfs or less until the canal daily average stage returns to within the prescribed ranges. If the available capacity at S-332B, S-332C, and S-332D is insufficient to maintain the L-31N below the top of the lowered operational range for more than 24 hours then all S-334 flow

will be ceased until the L-31N stage is lowered and maintained in the lowered operational range for 24 hours.

S-338 discharges will be maximized (e.g. 250 to 300 cfs) to the extent that downstream conditions allow. This includes operating S-148 with an open/close of 3.0/2.5 for S-148 flows of less than 700 cfs and with an open/close of 3.5/3.0 (lower half of the low range) for S-148 flow greater than 700 cfs.

G-211 will discharge to the extent practical to convey S-334 discharges, and to maintain the L-31N with the 5.7/5.3 stage range prescribed by Column 2 operations.

S-331 will be operated to maintain S-331's HW using the standard ranges lowered by 0.2 feet (normal 4.3 to 4.8 and low from 3.8 to 4.3) with the remaining criteria unchanged.

S-332B and S-332C will be operated to maintain the L-31N's average daily stage between 4.6 and 4.3; which is 0.2 feet lower than the Column 2 ranges of 4.8 and 4.5 feet NGVD.

S-332D will be operated to discharge up to 250 cfs to S-332D's detention area and up to 325 cfs to the Southern Detention Area (SDA) through S-332DX1 to maintain the L-31N's average daily stage between 4.6 and 4.3 feet NGVD.

Discharge to tide through the C-102 Canal will be maximized to the extent that downstream conditions allow. The SFWMD will continue to have full operational flexibility to operate S-165 within the low range of 3.0 to 1.9 feet NGVD. It is acknowledged that without remote control of S-194 (manually operated structure) that changes to S-194 will occur less frequently.

Discharge to tide through the C-103 Canal will be maximized to the extent that downstream conditions allow. The SFWMD will continue to have full operational flexibility to operate S-167 and S-179 within their low ranges of 3.0 to 1.9 feet NGVD and 3.1 to 2.7 feet NGVD. It is acknowledged that without remote control of S-196 (manually operated structure) that changes to S-196 will occur less frequently.

S-176 will be operated to maintain the L-31N average daily stage within the operational range. The amount of inflow from S-334 and discharge through S-176 will be adjusted to compensate for the available pumping capacity at S-332B, S-332C, and S-332D to 1) maintain the L-31N average daily stage within the operational range of 4.6 to 4.3 feet NGVD while facilitating S-334 flows. The SFWMD has complete discretion to increase pumping to proactively maintain the stage near the bottom of the range. The intention is to make full use the available capacity at S-332B, S-332C, and S-332D while allowing normal maintenance. During period of higher than normal rainfall S-334 discharges will be reduced as required to assist S-332B, S-332C, and S-332D in maintaining the canal stage at the bottom of the range.

S-199 will be operated with all available capacity until March 1, 2016 at which time the availability of the pumps will require compliance with the criteria for the Cape Cable Seaside Sparrow Critical Habitat Unit 3 (formerly known as Sub-Population D) ; stage at EVER4 below 2.36 feet NGVD.

S-200 will be operated with all available capacity until March 1, 2016 at which time the availability of the pumps will require compliance with the criteria for the Cape Cable Seaside Sparrow Critical Habitat Unit 3 (formerly known as Sub-Population D) ; stage at R3110 below 4.95 feet NGVD.

S-177 will be operated to maintain an average daily stage below 3.6 in the upstream reach of the C-111 Canal. The goal will be to maintain a fairly steady discharge through S-177 based on, but not limited to, the average daily/24-hour or instantaneous discharge from S-176 minus the flow through S-199. At times it will be necessary to discharge more than this amount due to rapid changes in the canal stage from rainfall and or increased inflow from S-176.

S-18C will be fully open (gates out of the water) to maintain the Column 2 operational range of 2.25 to 2.0.

S-197 will be operated to maintain the S-18C's Daily Average HW between 2.6 and 2.4 feet NGVD with a daily discharge limit which does not exceed the smaller of 1) the previous day's average pumping at S-331, 2) the previous day's average discharge through S-176, 3) the previous days average discharge through S-177, and 4) 400 cfs (half of the typical flow for a one third opening of S-197. This will result in discharges larger than those prescribed by the ERTP Increment 1 when WCA-3A is above the High Water Action Line (Case 3).

Operational Changes for WCA-3B in Response to High Water in WCA-3A

To provide some high water relief for WCA-3A the S-151 and S-152 structure will be used to release water from WCA-3A into WCA-3B to the extent that the Trigger Stage (measured at Site 71) of 8.5 feet NGVD allows. The preferred inflow route for WCA-3B is through S-152 but S-151 may be used if S-152 is unavailable. The operation of S-152 can be partially or fully open with the expectation that S-152 will initially be fully opened and then could be partially closed when the stage at Site 71 approaches the Trigger Stage. If the Trigger stage is exceeded for more than 24 hours then all inflows shall be closed until the stage at Site 71 declines to below the Trigger Stage for more than 24 hours.

Sensitivity Analysis of Operations to Reduce Observed February 2016 High Water Conditions in WCA-3A

15-Feb-2016

Hydrology & Hydraulics Bureau - Modeling Section
Operations, Engineering & Construction Division
SFWMD

Background

- High water levels throughout Central and Southern Florida due to well-above-average rainfall from Nov 2015 – Jan 2016 prompted the design of a water management strategy aimed at moving more water from WCA-3A to ENP and the SDCS
- A regional-scale hydrologic sensitivity analysis has been performed to estimate the potential system response to this proposed operating strategy
- Specific details can be found in the accompanying modeling assumptions document:

  HighWaterSensitivityAnalysis_Assumptions_15Feb2016.docx

Typical Influence of an El Niño Winter on Central & Southern Florida

- Above-normal rainfall
- Less ET - more cloudy skies and cooler temps
- Reduced irrigation demand
- Increased basin runoff
- Higher than normal water levels
- Higher than normal discharges at water control structures

SFWMD Projections of System Response using Position Analysis

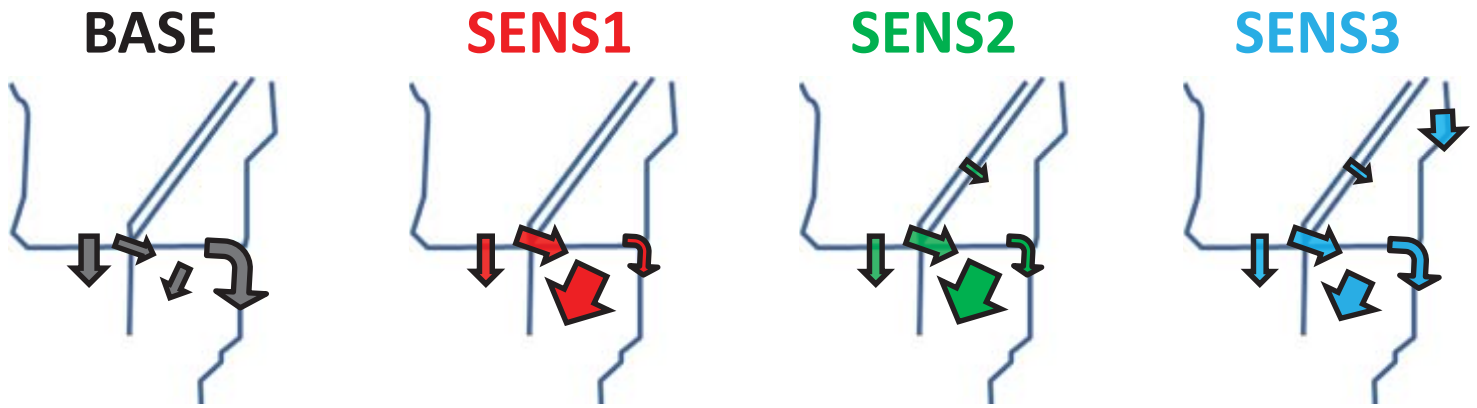
- 41 one-water-year simulations of system response to historical rainfall conditions (in this case with Feb starting water year)
- Each year initialized with observed antecedent hydrologic conditions (in this case Jan/Feb 2016)
- Given current conditions and forecast conditions, 7 El Niño analog years are examined since they have increased likelihood of occurring in 2015-16
  - 1965-66, 1972-73, 1982-83, 1987-88, 1994-95, 1997-98, 2002-03
  - Simulated responses to these years' historic rainfall

Simulations

- Four simulations were developed using the February 2016 Position Analysis as a foundation. Analysis of results of these simulations is limited to the period Feb-May, with emphasis on the relatively short duration (90-days or less) of the proposed nonstandard operations
  - **BASE**: A no-action baseline simulation will reflect the current standard operating policies and regulations. This simulation is the same as the February PA simulation with some minor changes to reflect current standard operations in the SDCS
  - **SENS1**: Sensitivity simulation to reflect the proposed nonstandard operations. This simulation was built using the BASE simulation with several changes in modeled operations
  - **SENS2**: Same as SENS1 with inclusion of Decomp Physical Model (DPM) location to try to release more from WCA-3A to WCA-3B via S-152
  - **SENS3**: Same as SENS2 with increased usage of S-337 to move excess WCA-3B water to the SDCS
- All simulations assume that WCA-3A stage levels will remain above the Increment 1 Action Line (10.0-10.75 feet NGVD) for the period Feb-May. Thus S-356 will not be used.

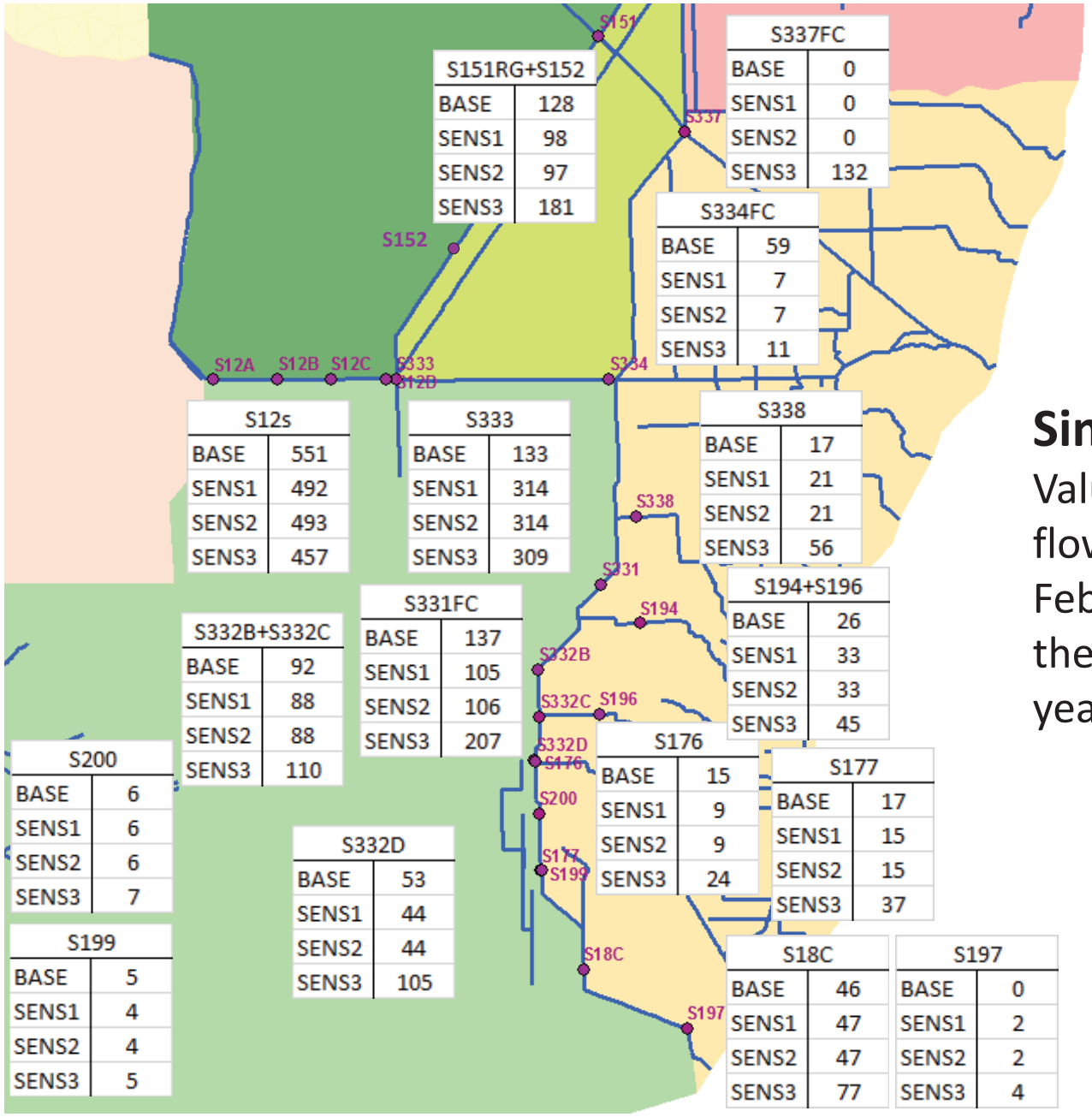
Hydrograph Color Code for 4 Simulations

1. **BASE**: Current Operations with L29 Constraint at 7.5’
2. **SENS1**: Base with L29 Constraint at 8.5’ and Modified L31N/SDCS Operations
3. **SENS2**: SENS1 with S-152 discharging to 3B
4. **SENS3**: SENS2 with more flow to SDCS via S-337/S-335



Results Provided

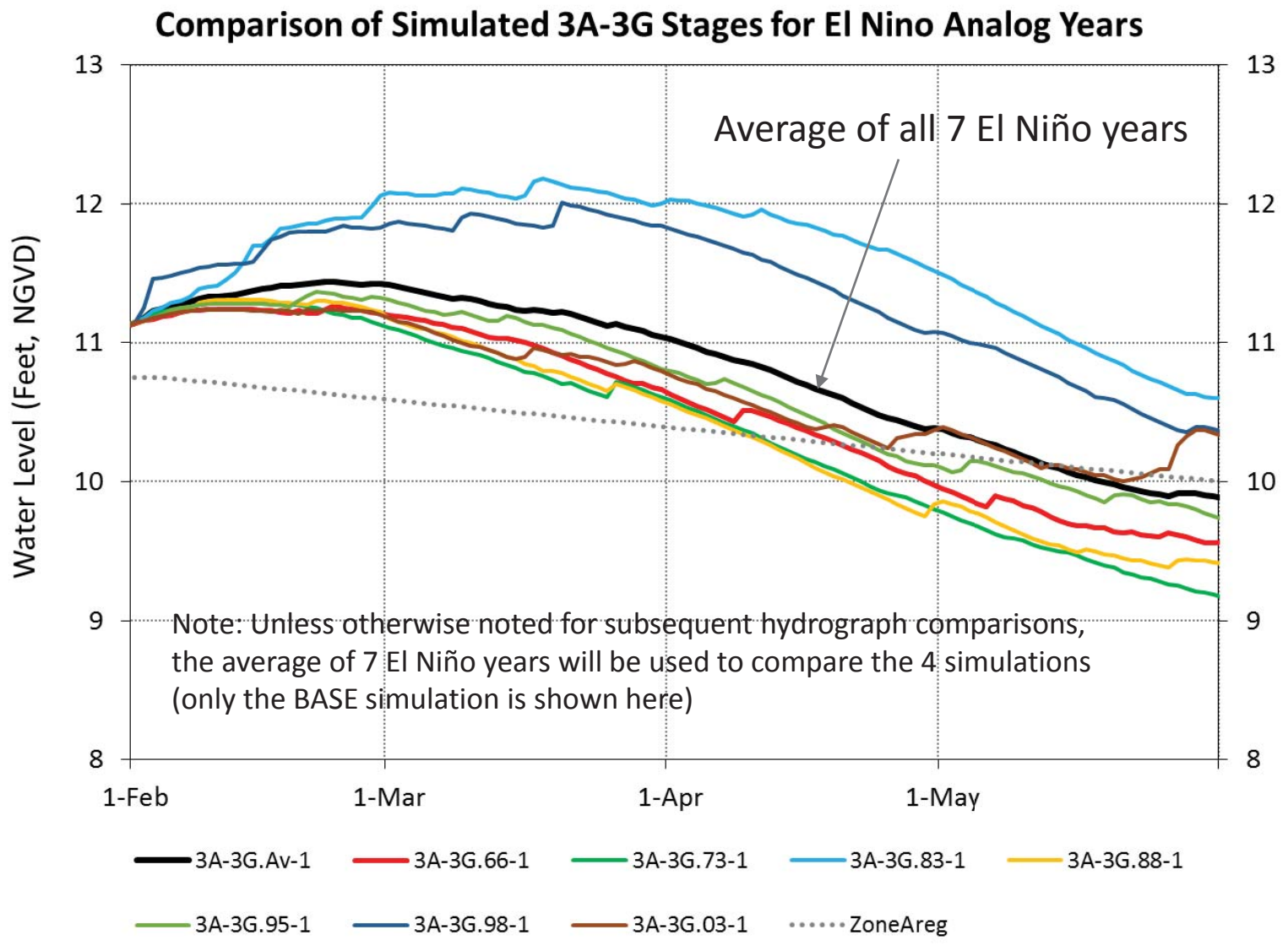
- Map showing structure flow volumes at key sites for Feb-May period
- Stage and discharge hydrographs comparing the simulations
- Flows and Stages averaged for 7 El Niño Analog Years
  - {1966, 1973, 1983, 1988, 1995, 1998, 2003}
  - Individual high or low years shown for some sites
- Modeling Scenarios posted to: ftp://ftp.sfwmd.gov/pub/fkhatun/HighWater_Modeling/



Simulated Flows

Values represent the flow volumes during Feb-May averaged for the 7 El Nino analog years (thousand ac-ft)

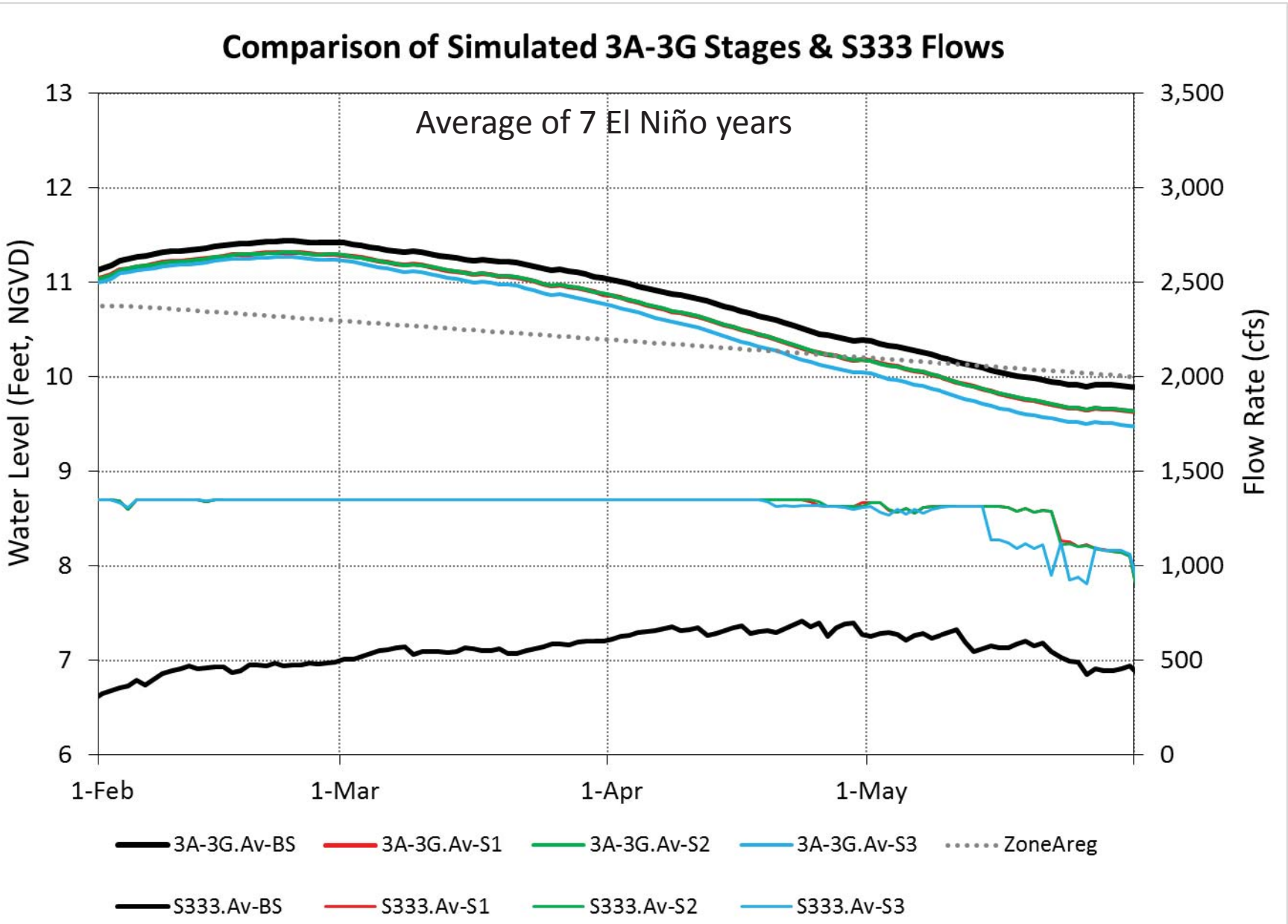
Example of Summarization Technique:

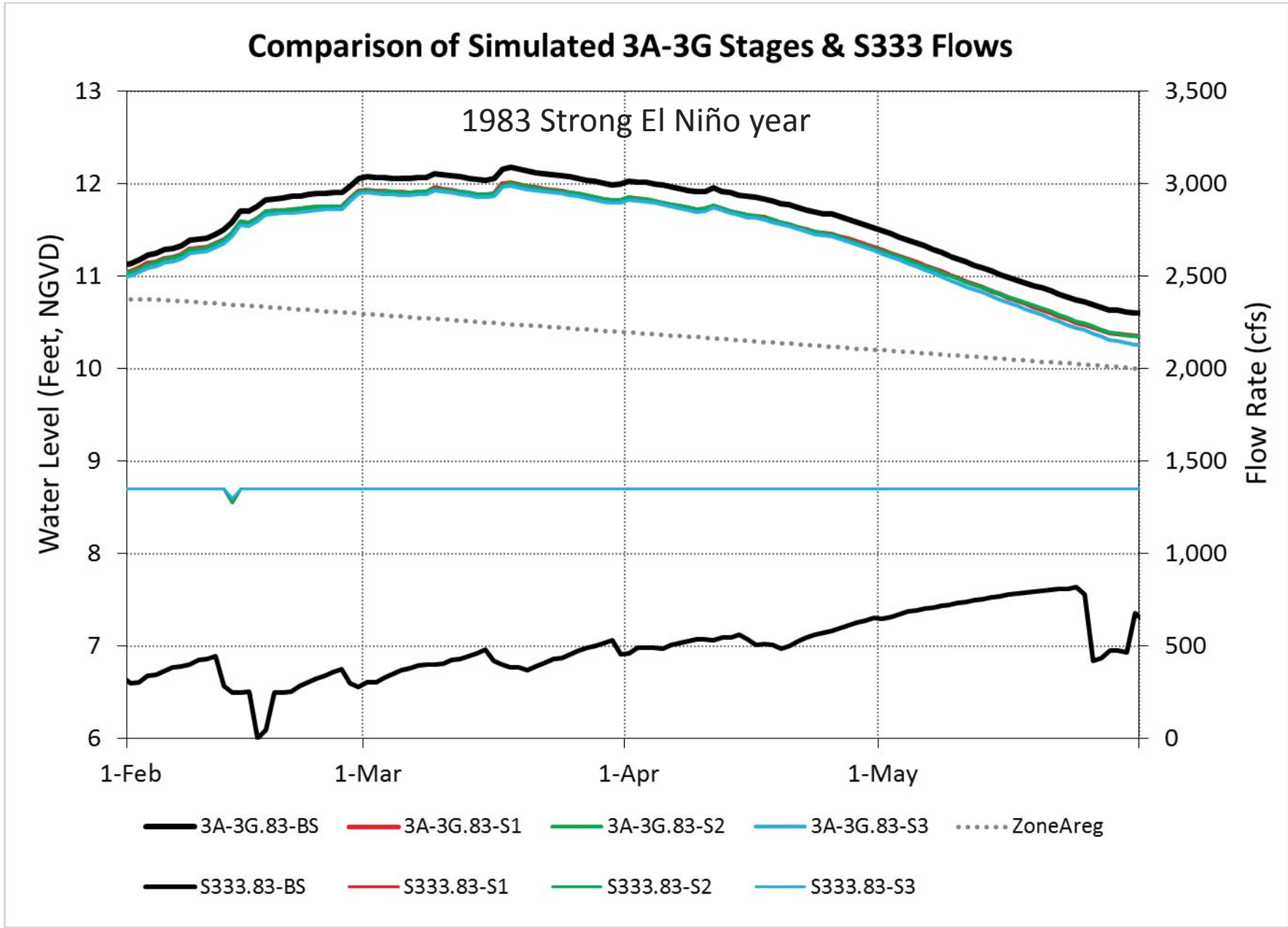


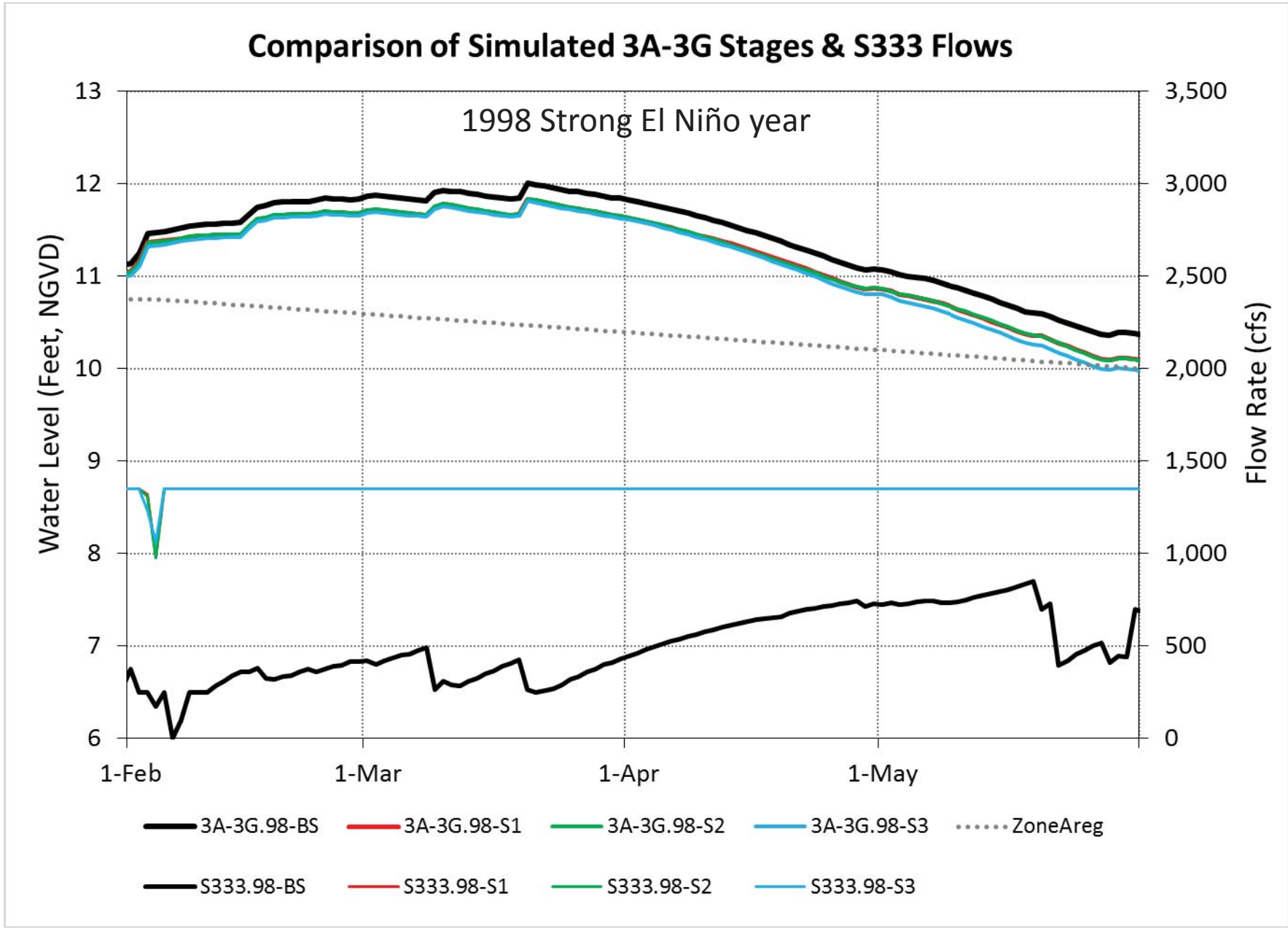
With the proposed operations, what are expected changes in WCA-3A stages and discharges from WCA-3A to ENP/WCA3B?

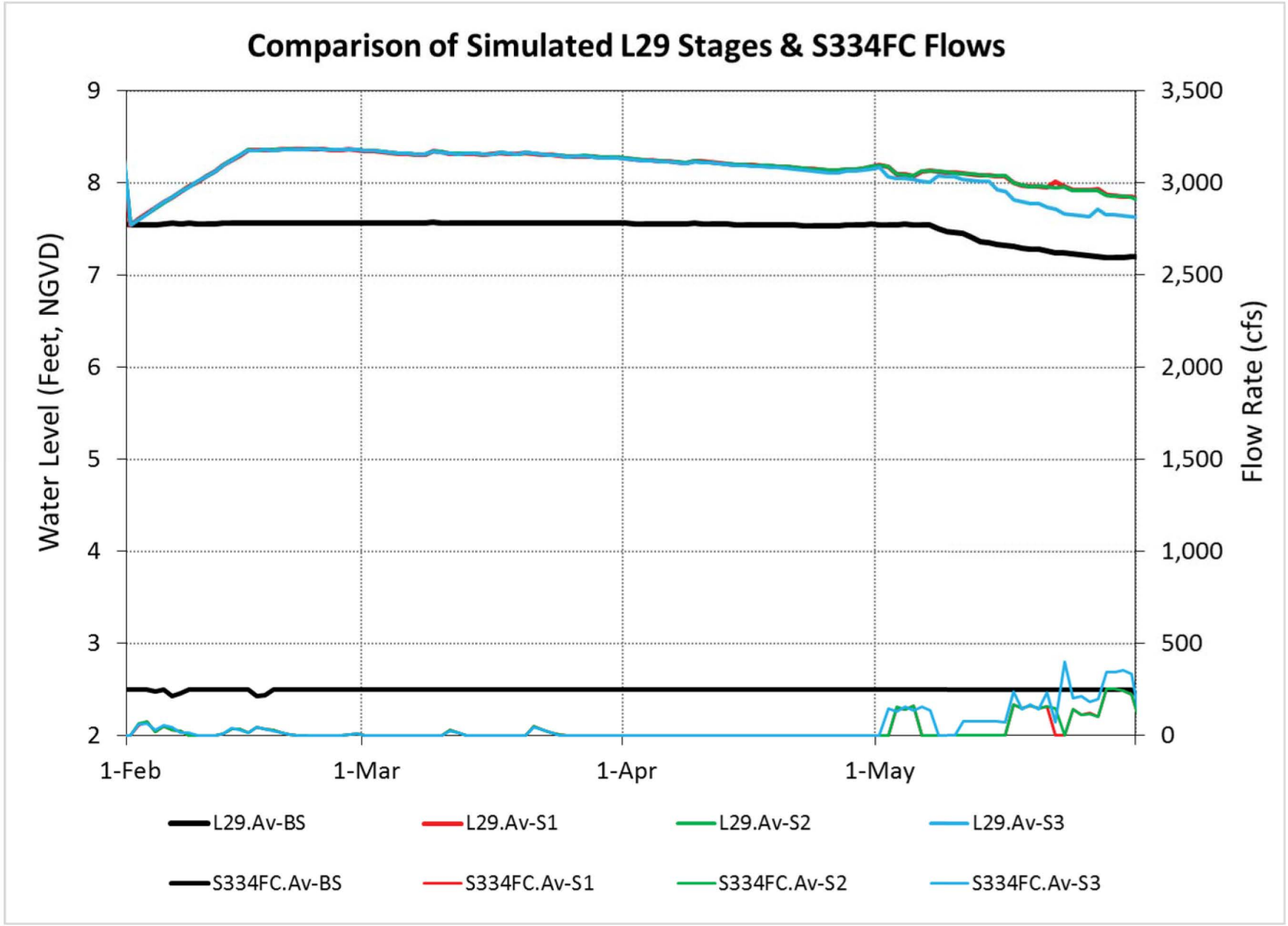
Comparing the SENS runs to the BASE identifies:

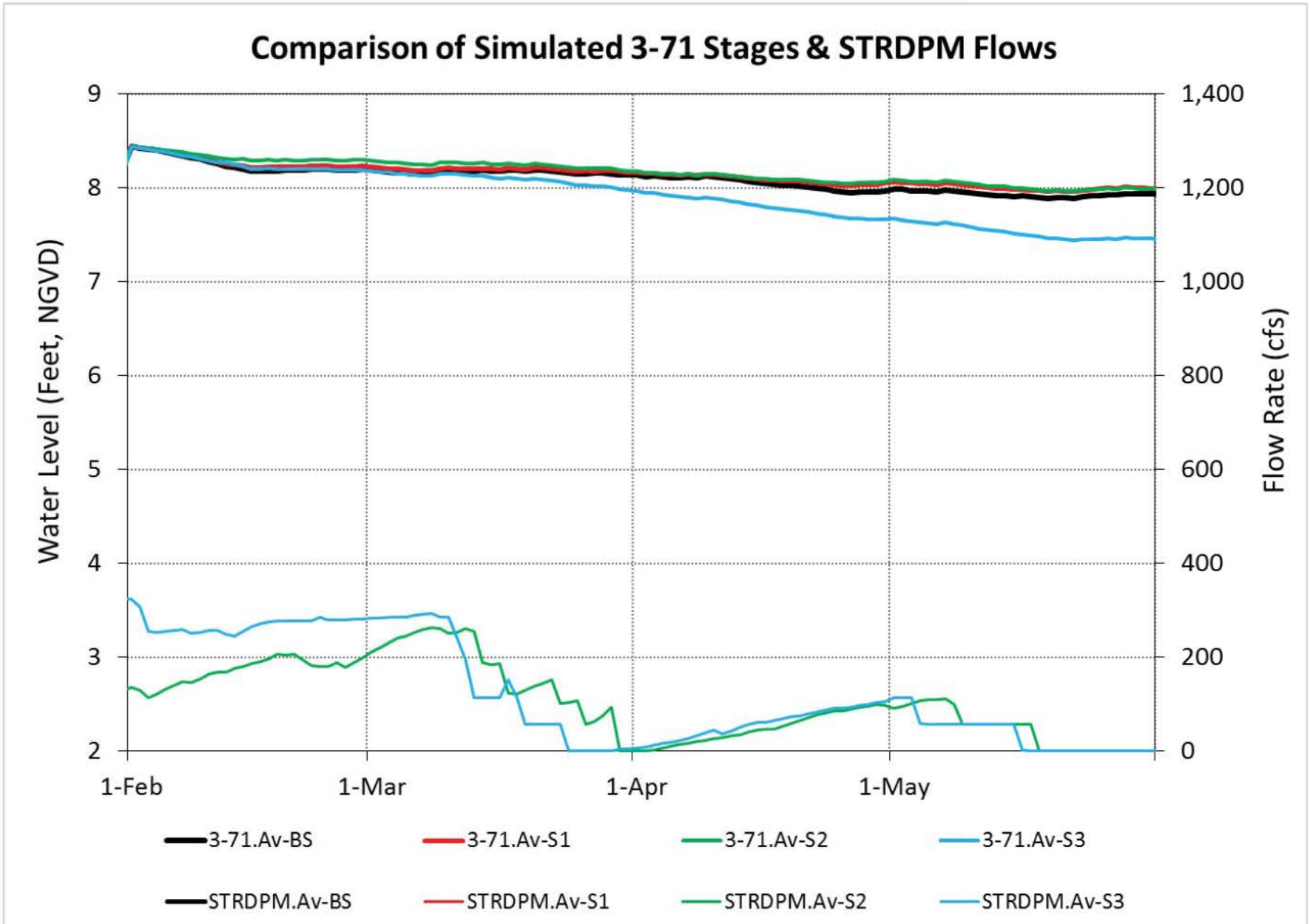
- Lower water levels in WCA3A, with 3-gauge average stage decreases ranging from ~0.2 ft up to ~0.5 ft
  - Stage differences even during strong El Nino years
- A significant increase in total flow across Tamiami Trail, on the order of up to ~20% increase during El Nino years
- Utilization of S333 up to full capacity (1350 cfs) for the majority of the dry season; corresponding increase in L29 stages
- Somewhat limited opportunity to utilize the S152 (Decomp Physical Model) structure; note that in the model, S151 is the priority for flows


Comparison of Simulated 3A-3G Stages & S333 Flows
Average of 7 El Niño years
Water Level (Feet, NGVD)
Flow Rate (cfs)
13
12
11
10
9
8
7
6
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1-Feb
1-Mar
1-Apr
1-May
3A-3G.Av-BS
3A-3G.Av-S1
3A-3G.Av-S2
3A-3G.Av-S3
ZoneAreg
S333.Av-BS
S333.Av-S1
S333.Av-S2
S333.Av-S3


Comparison of Simulated 3A-3G Stages & S333 Flows
1983 Strong El Niño year
Water Level (Feet, NGVD)
Flow Rate (cfs)
13
12
11
10
9
8
7
6
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1-Feb
1-Mar
1-Apr
1-May
3A-3G.83-BS
3A-3G.83-S1
3A-3G.83-S2
3A-3G.83-S3
ZoneAreg
S333.83-BS
S333.83-S1
S333.83-S2
S333.83-S3


Comparison of Simulated 3A-3G Stages & S333 Flows
1998 Strong El Niño year
Water Level (Feet, NGVD)
Flow Rate (cfs)
13
12
11
10
9
8
7
6
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1-Feb
1-Mar
1-Apr
1-May
3A-3G.98-BS
3A-3G.98-S1
3A-3G.98-S2
3A-3G.98-S3
ZoneAreg
S333.98-BS
S333.98-S1
S333.98-S2
S333.98-S3

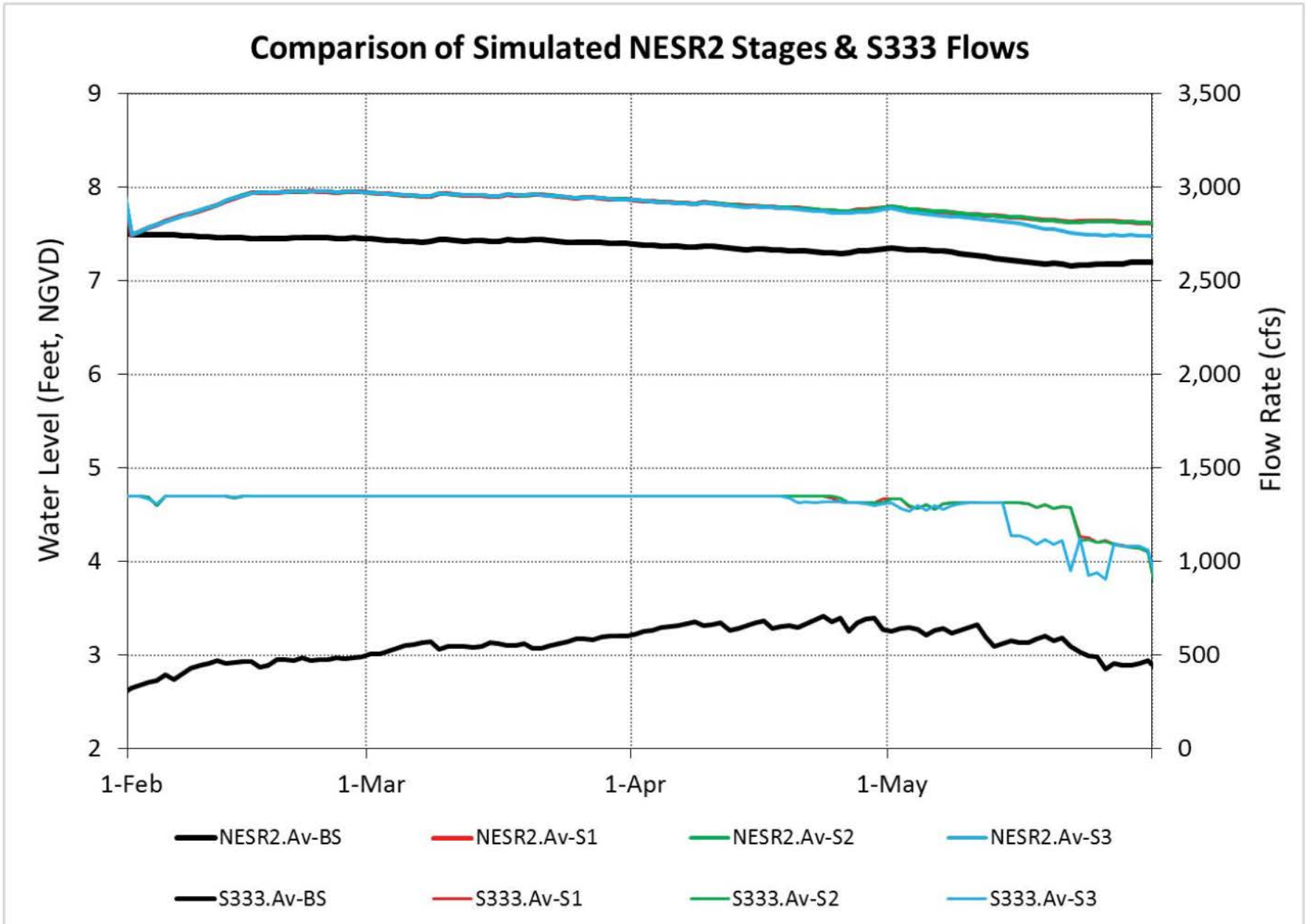

Comparison of Simulated L29 Stages & S334FC Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
9
8
7
6
5
4
3
2
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1-Feb
1-Mar
1-Apr
1-May
L29.Av-BS
L29.Av-S1
L29.Av-S2
L29.Av-S3
S334FC.Av-BS
S334FC.Av-S1
S334FC.Av-S2
S334FC.Av-S3

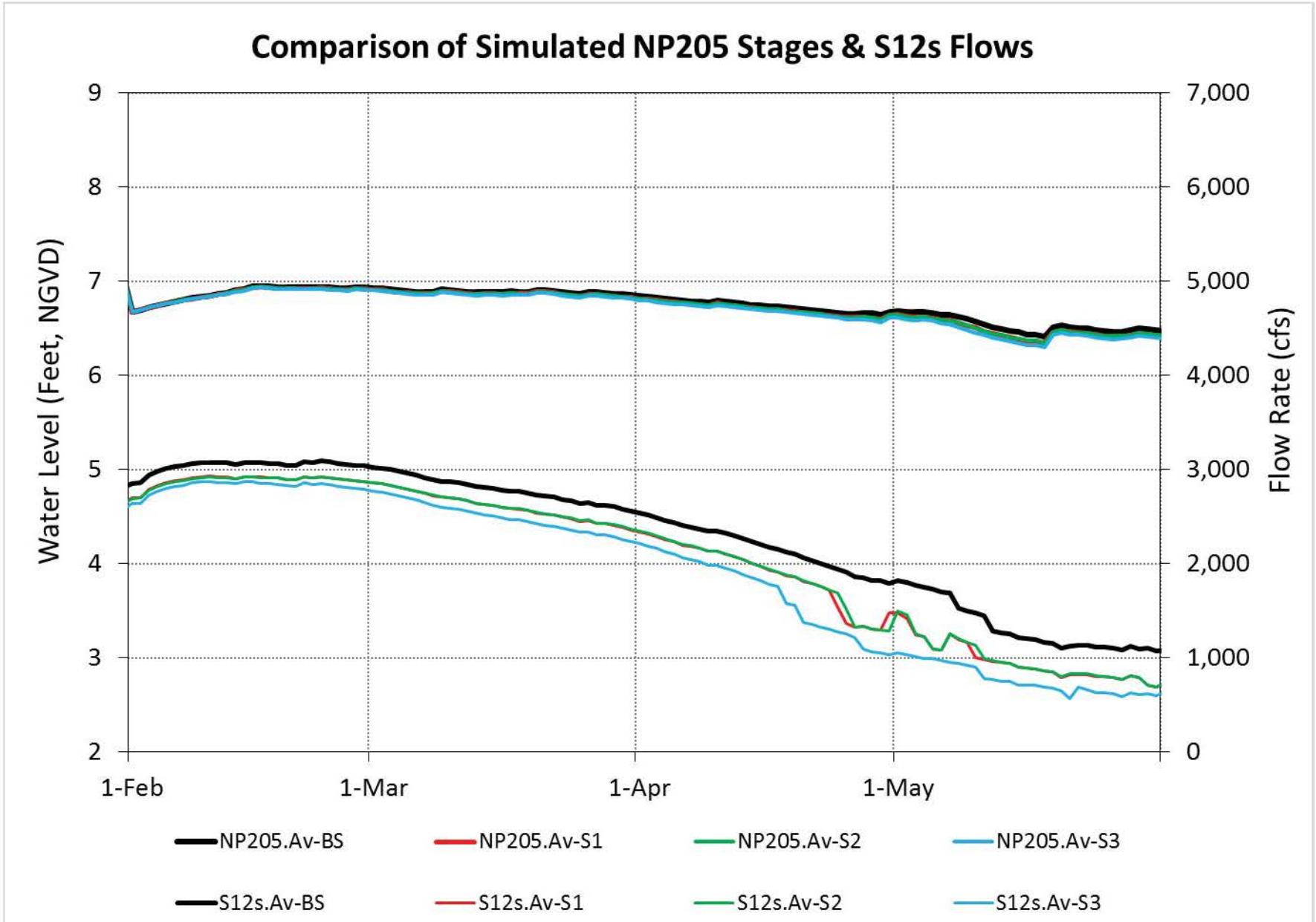

Comparison of Simulated 3-71 Stages & STRDPM Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
9
8
7
6
5
4
3
2
1,400
1,200
1,000
800
600
400
200
0
1-Feb
1-Mar
1-Apr
1-May
3-71.Av-BS
3-71.Av-S1
3-71.Av-S2
3-71.Av-S3
STRDPM.Av-BS
STRDPM.Av-S1
STRDPM.Av-S2
STRDPM.Av-S3

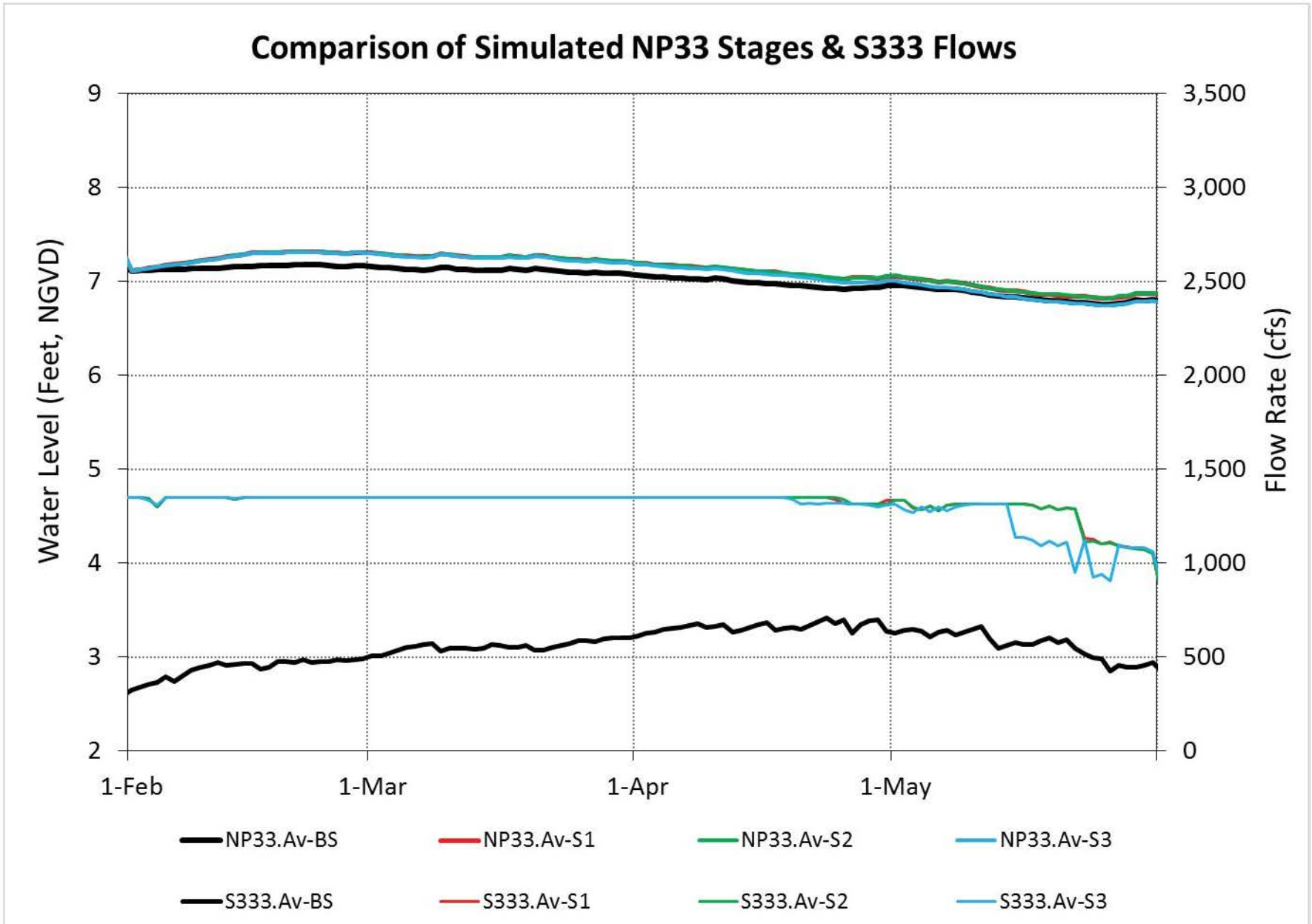
How much will the change in WCA-3A releases affect water levels and flows in ENP?

Comparing the SENS runs to the BASE identifies:

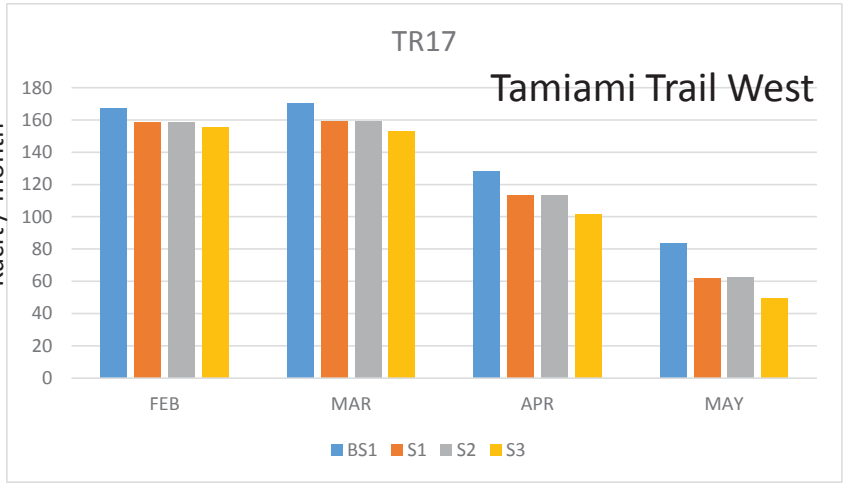
- Higher water levels in NorthEast ENP & the northern Rocky Glades (adjacent to S332B&C)
- Lower water levels in NorthWest ENP
- Higher water levels in Central Shark River Slough
- Increased flow down NorthEast and Central Shark River Slough, persisting through the dry season
- Conditions in Taylor Slough vary in SENS1 & SENS2 relative to SENS3 and depend on the amount of water conveyed to S332D

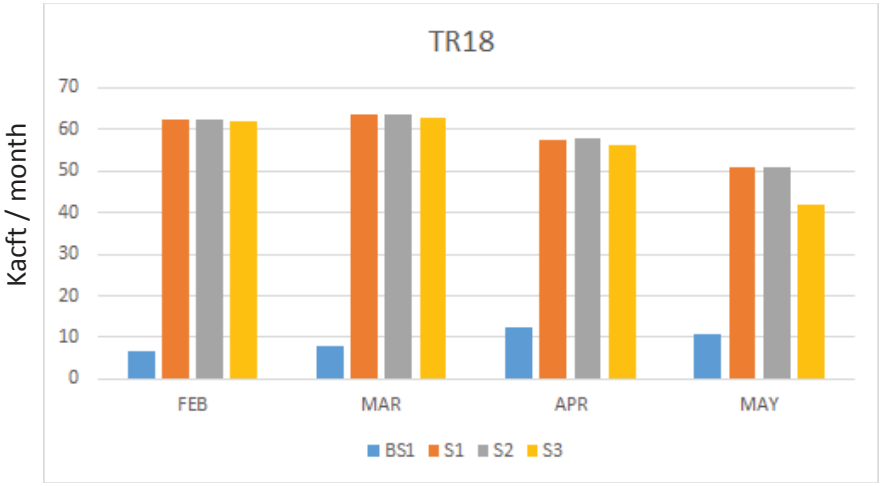

Comparison of Simulated NESR2 Stages & S333 Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
9
8
7
6
5
4
3
2
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1-Feb
1-Mar
1-Apr
1-May
NESR2.Av-BS
NESR2.Av-S1
NESR2.Av-S2
NESR2.Av-S3
S333.Av-BS
S333.Av-S1
S333.Av-S2
S333.Av-S3

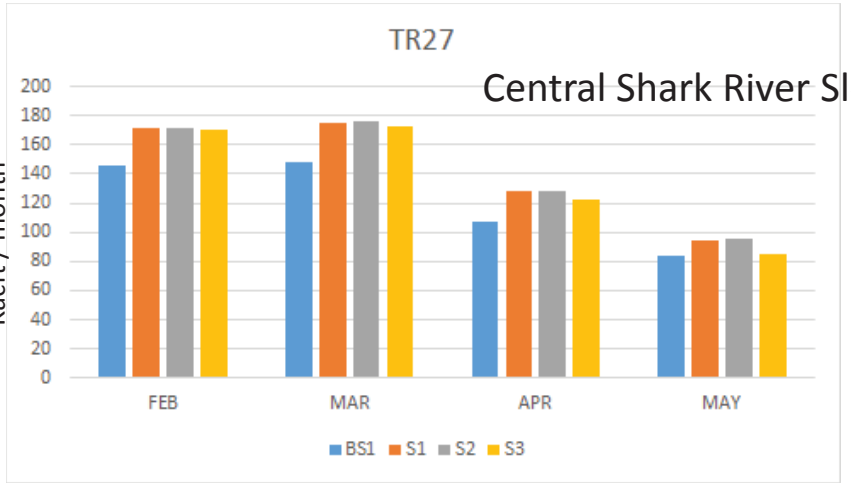

Comparison of Simulated NP205 Stages & S12s Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
9
8
7
6
5
4
3
2
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1-Feb
1-Mar
1-Apr
1-May
NP205.Av-BS
NP205.Av-S1
NP205.Av-S2
NP205.Av-S3
S12s.Av-BS
S12s.Av-S1
S12s.Av-S2
S12s.Av-S3

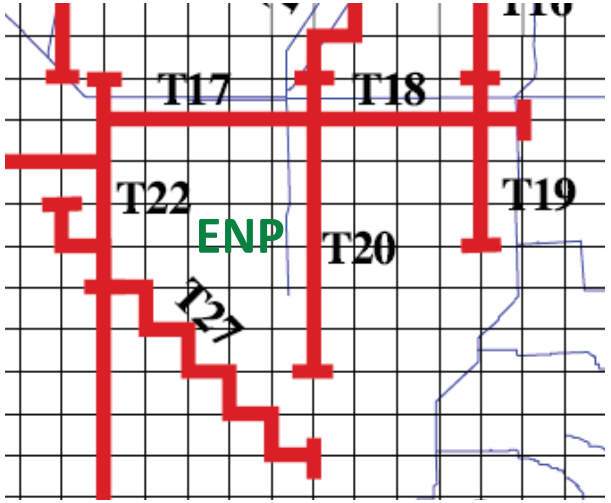

Comparison of Simulated NP33 Stages & S333 Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
9
8
7
6
5
4
3
2
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1-Feb
1-Mar
1-Apr
1-May
NP33.Av-BS
NP33.Av-S1
NP33.Av-S2
NP33.Av-S3
S333.Av-BS
S333.Av-S1
S333.Av-S2
S333.Av-S3

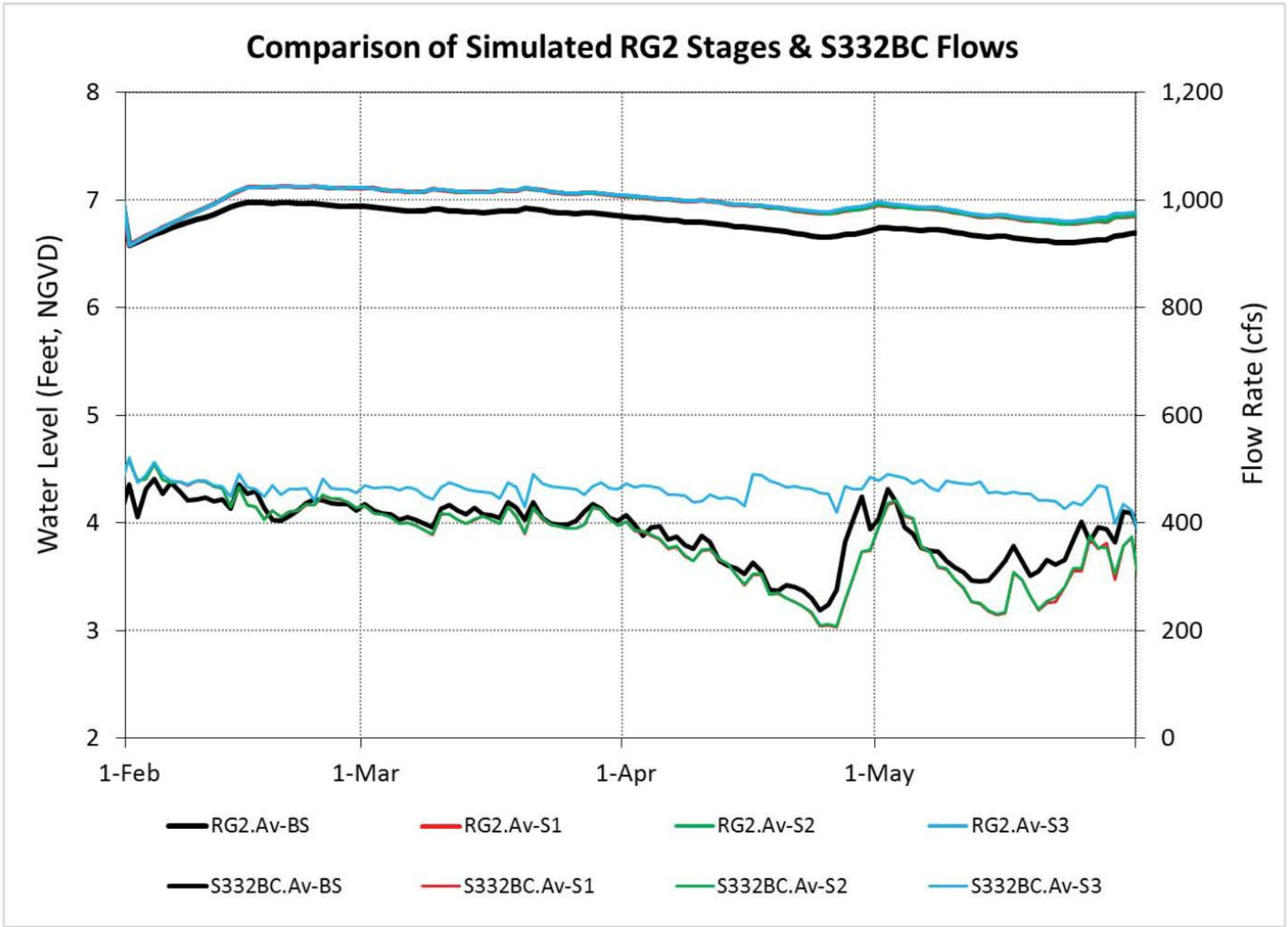
Flow Transects in Everglades National Park

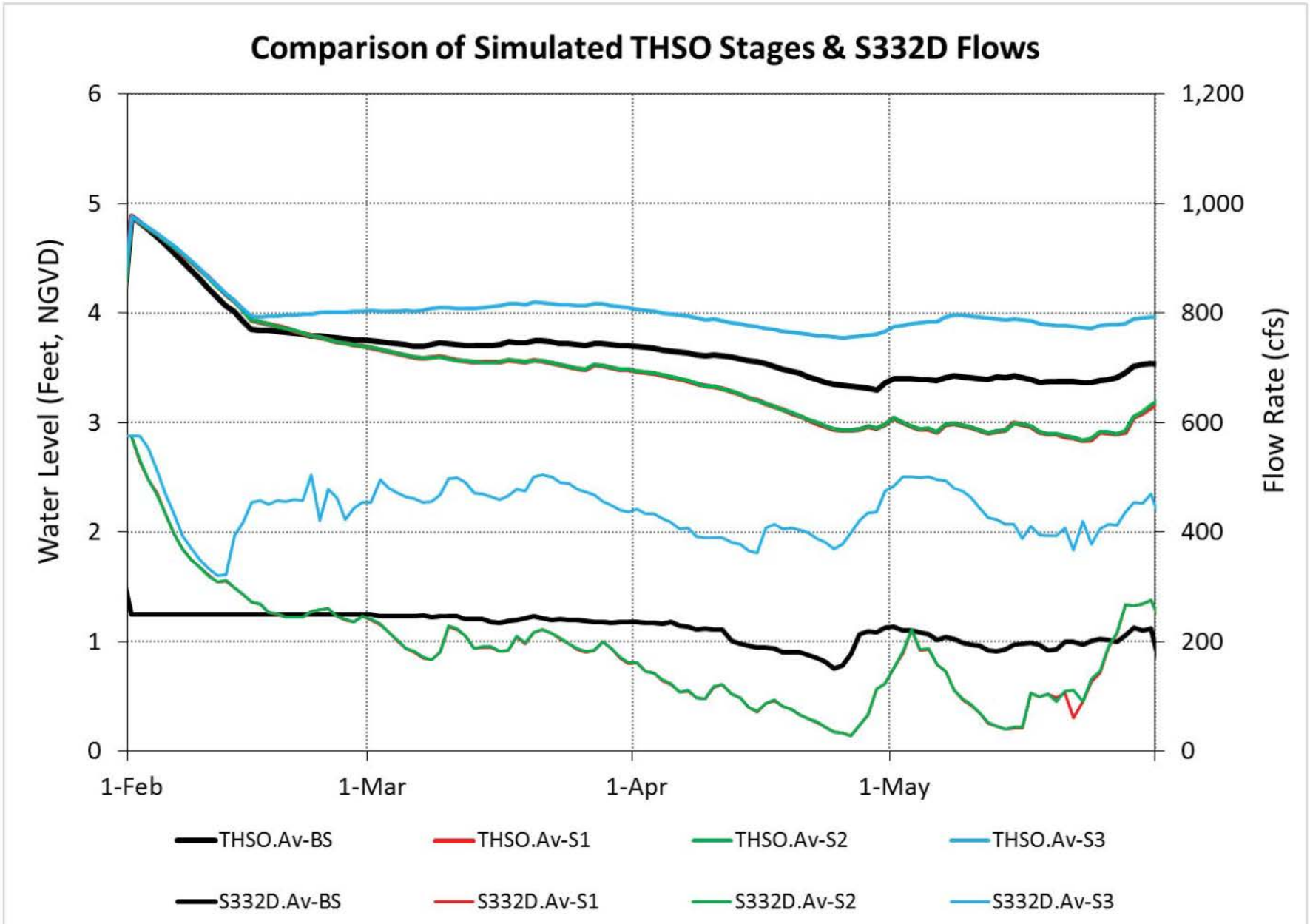








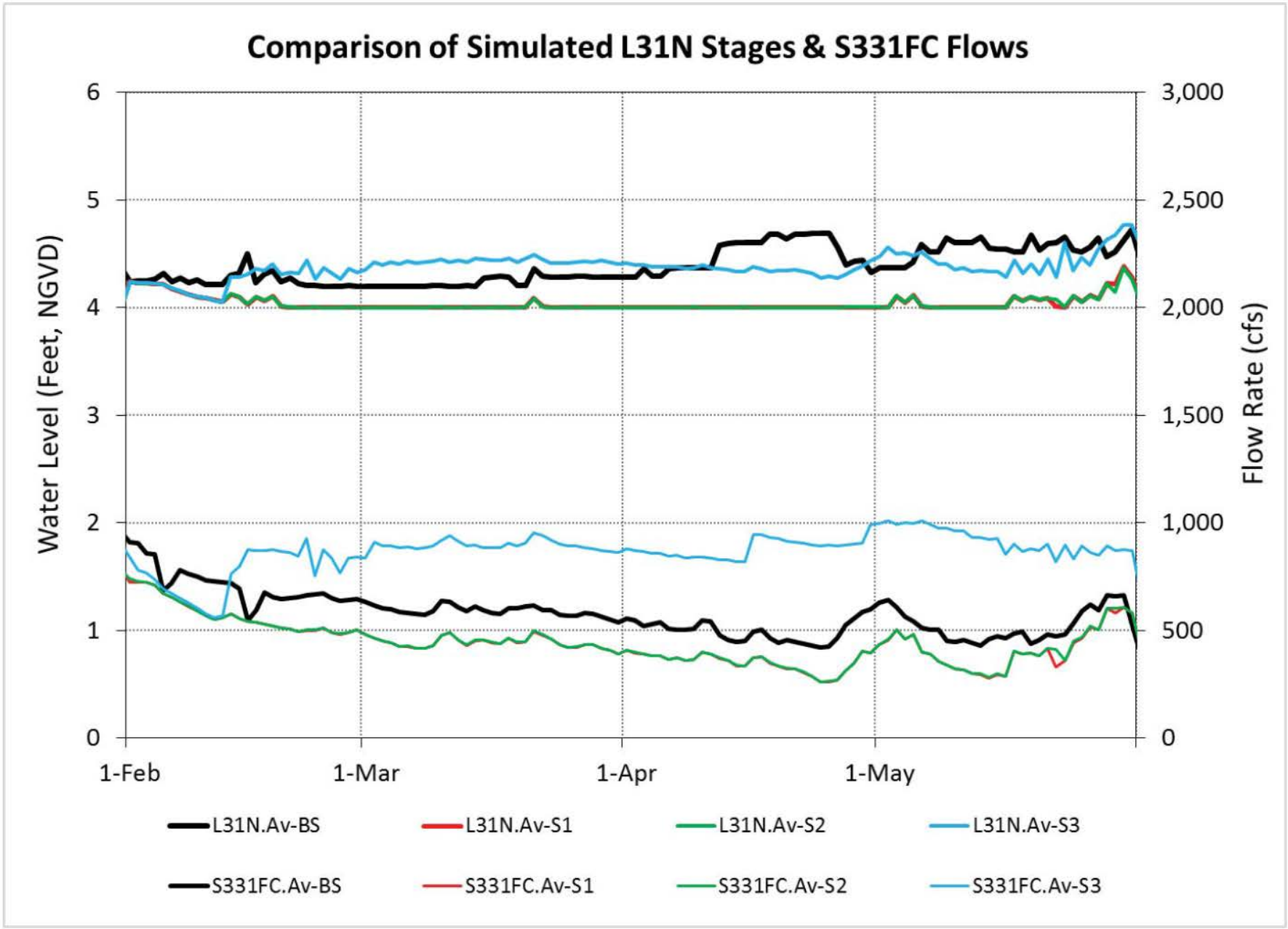

Comparison of Simulated RG2 Stages & S332BC Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
8
7
6
5
4
3
2
1,200
1,000
800
600
400
200
0
1-Feb
1-Mar
1-Apr
1-May
RG2.Av-BS
RG2.Av-S1
RG2.Av-S2
RG2.Av-S3
S332BC.Av-BS
S332BC.Av-S1
S332BC.Av-S2
S332BC.Av-S3

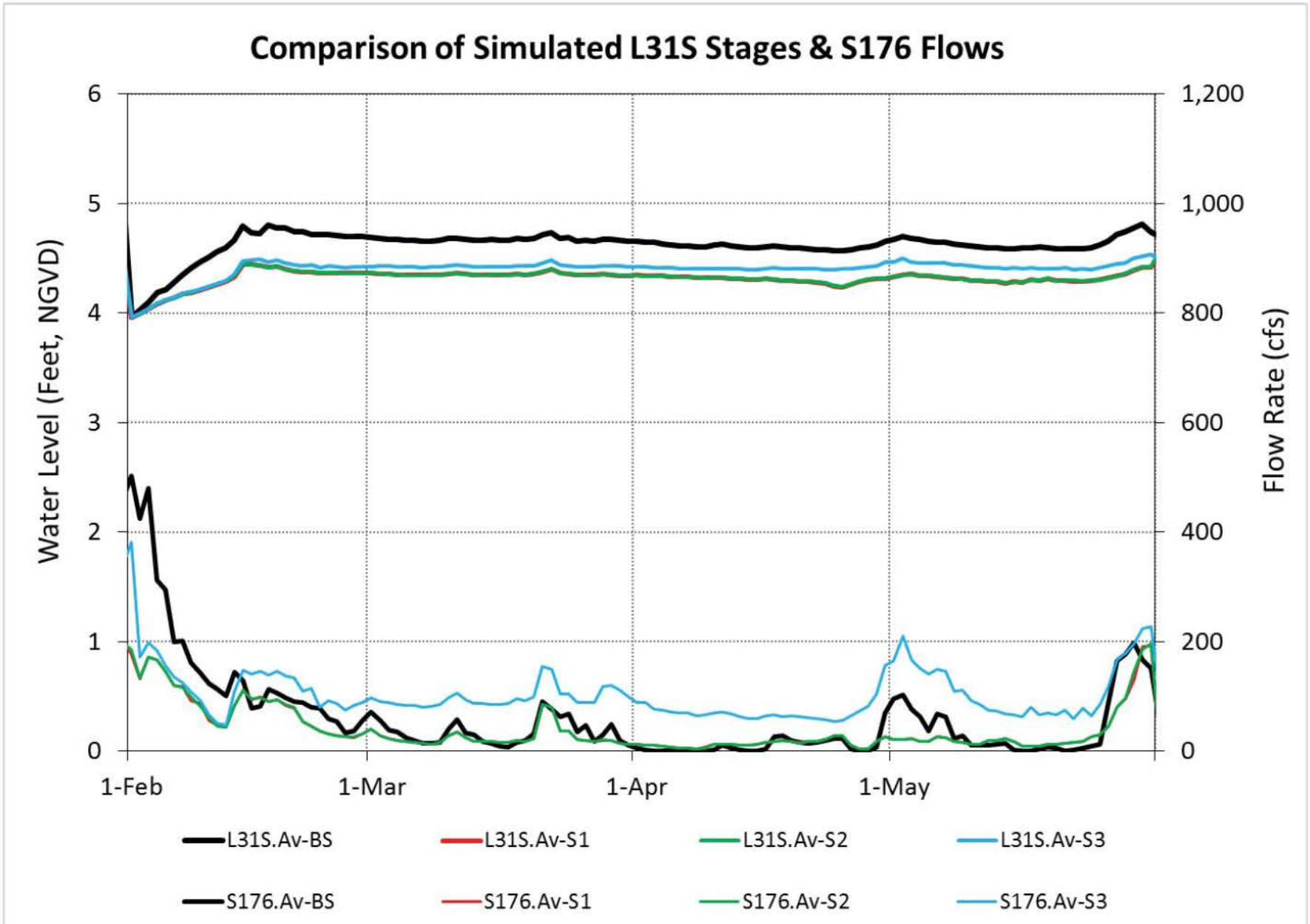

Comparison of Simulated THSO Stages & S332D Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
6
5
4
3
2
1
0
1,200
1,000
800
600
400
200
0
1-Feb
1-Mar
1-Apr
1-May
THSO.Av-BS
THSO.Av-S1
THSO.Av-S2
THSO.Av-S3
S332D.Av-BS
S332D.Av-S1
S332D.Av-S2
S332D.Av-S3

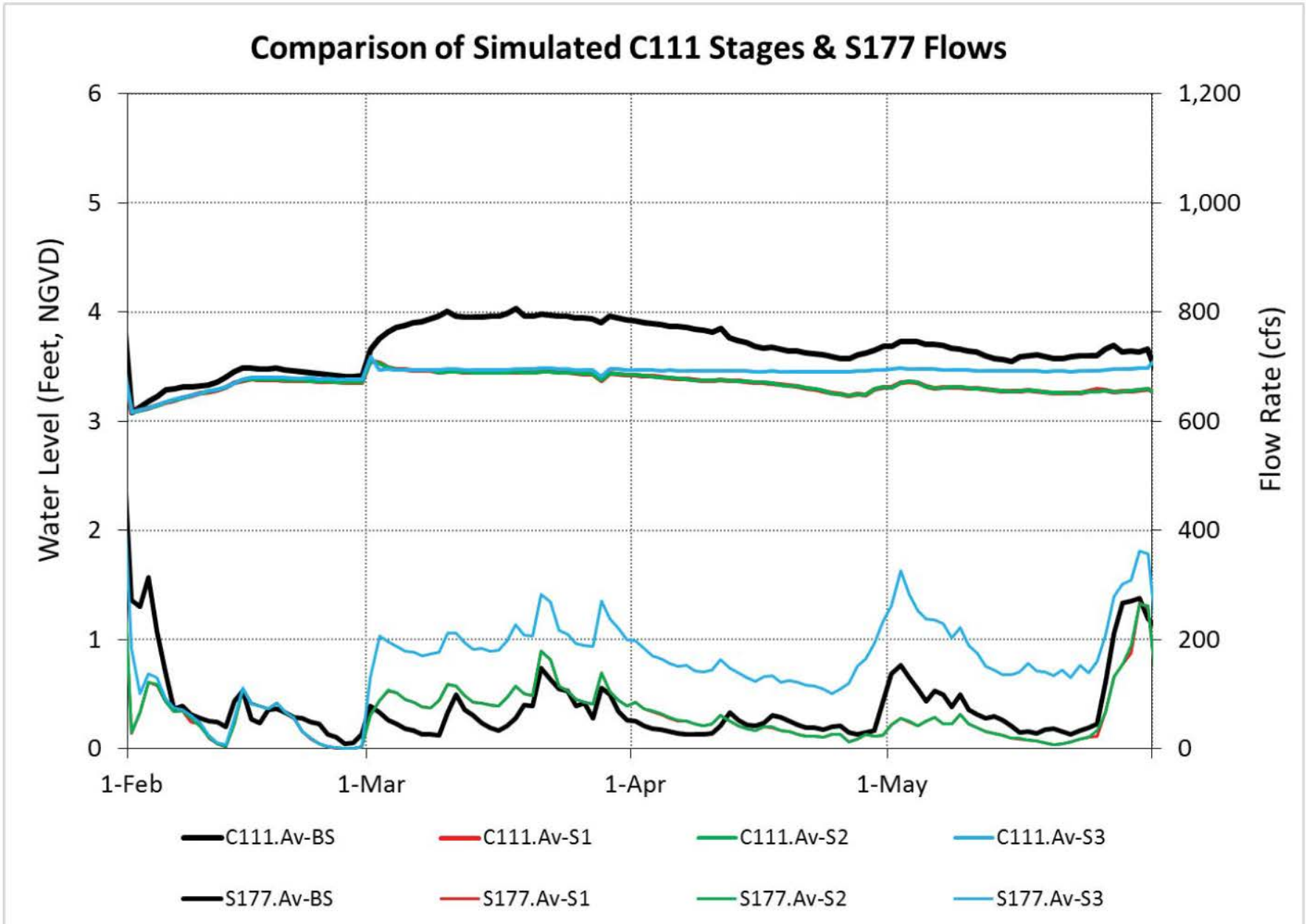
What are the effects on water levels and flows in the SDCS?

Comparing the SENS runs to the BASE identifies:

- Similar or lowered canal water levels along the L31N and SDCS in all SENS runs
- Decreased flow at S331 and through SDCS for SENS1 and SENS2
- Increased flow at S331 and through SDCS for SENS3


Comparison of Simulated L31N Stages & S331FC Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
6
5
4
3
2
1
0
3,000
2,500
2,000
1,500
1,000
500
0
1-Feb
1-Mar
1-Apr
1-May
L31N.Av-BS
L31N.Av-S1
L31N.Av-S2
L31N.Av-S3
S331FC.Av-BS
S331FC.Av-S1
S331FC.Av-S2
S331FC.Av-S3

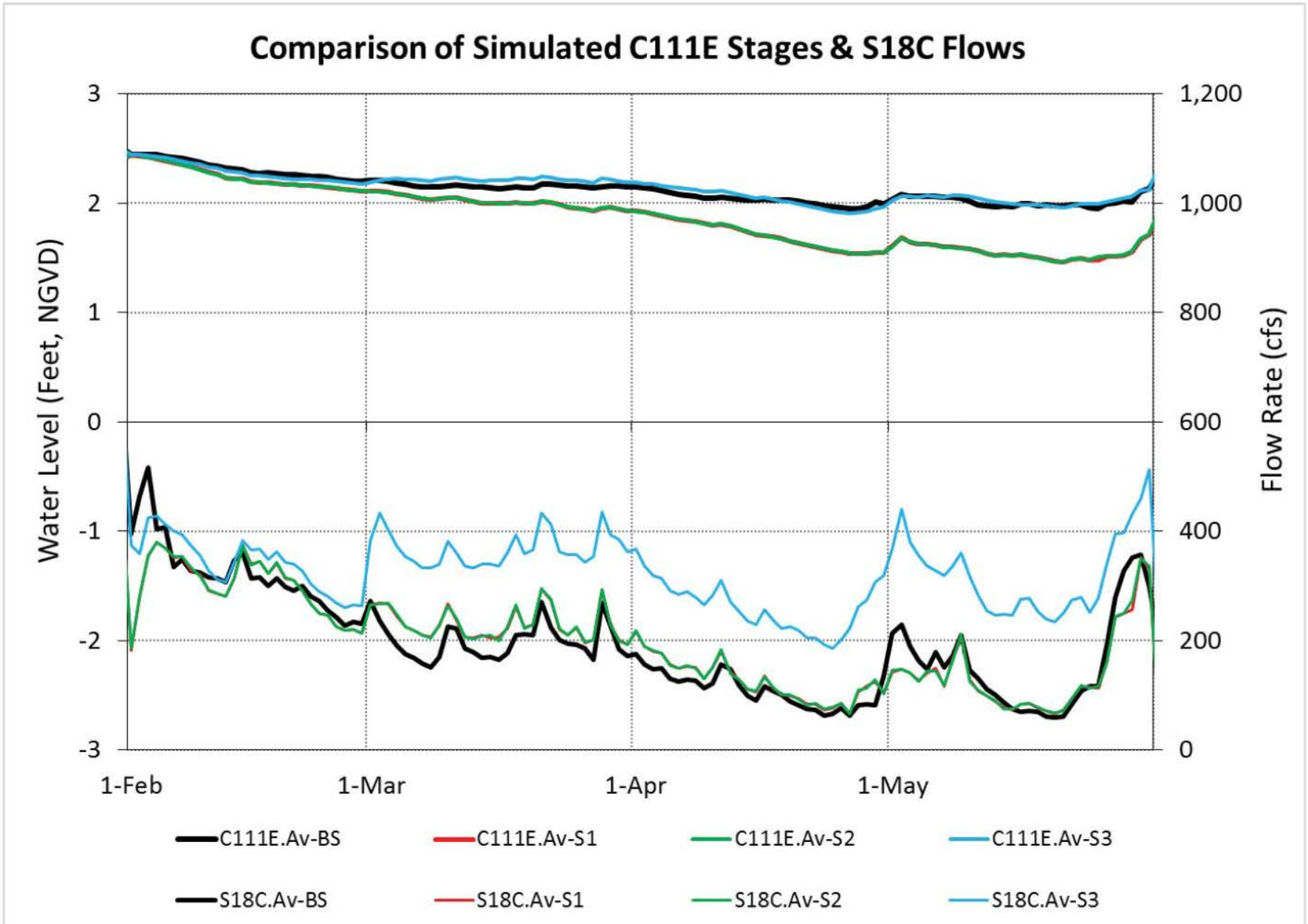

Comparison of Simulated L31S Stages & S176 Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
6
5
4
3
2
1
0
1,200
1,000
800
600
400
200
0
1-Feb
1-Mar
1-Apr
1-May
L31S.Av-BS
L31S.Av-S1
L31S.Av-S2
L31S.Av-S3
S176.Av-BS
S176.Av-S1
S176.Av-S2
S176.Av-S3

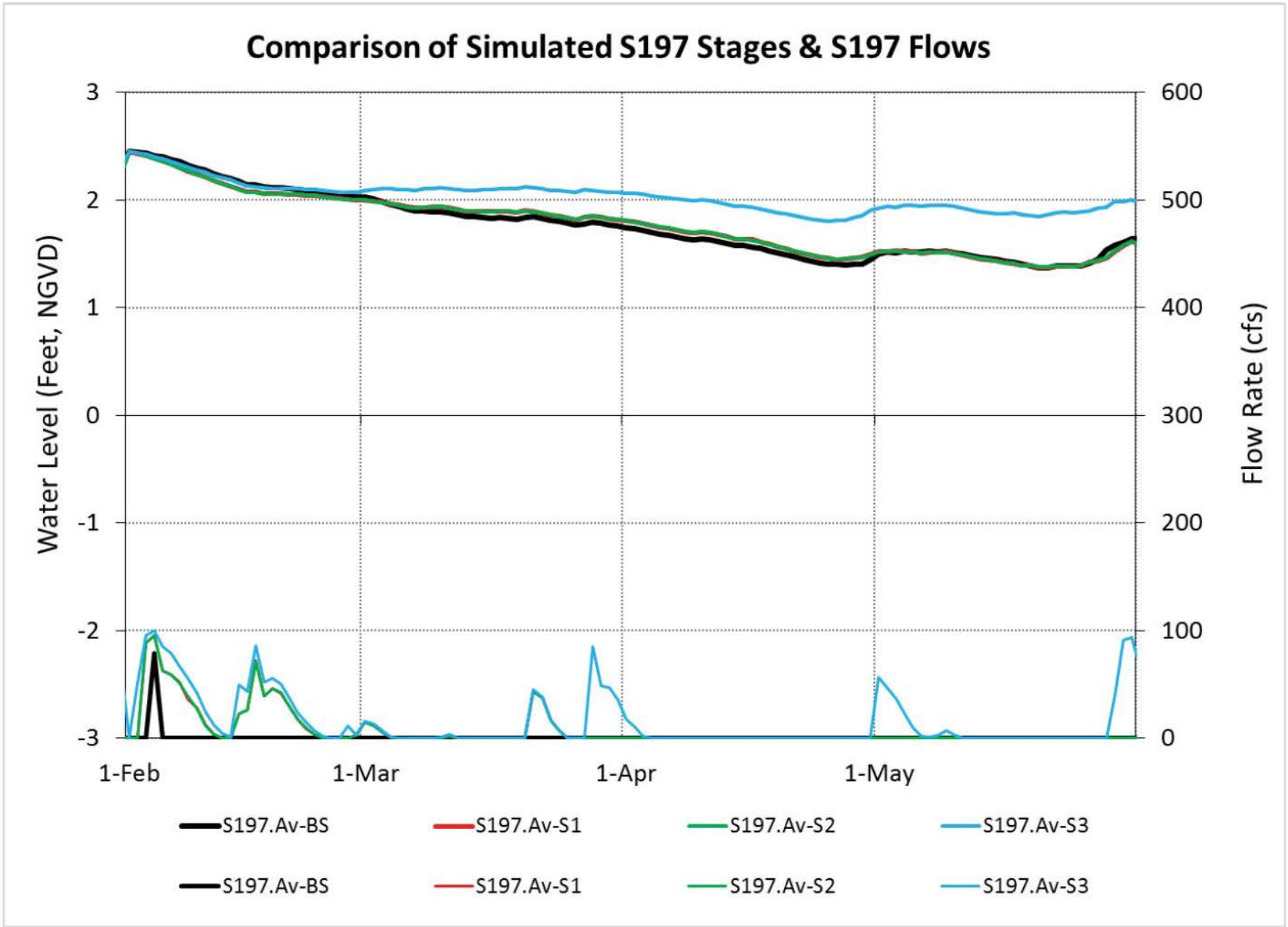

Comparison of Simulated C111 Stages & S177 Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
6
5
4
3
2
1
0
1,200
1,000
800
600
400
200
0
1-Feb
1-Mar
1-Apr
1-May
C111.Av-BS
C111.Av-S1
C111.Av-S2
C111.Av-S3
S177.Av-BS
S177.Av-S1
S177.Av-S2
S177.Av-S3

What are the effects in the Southern Glades & Southern Estuaries?

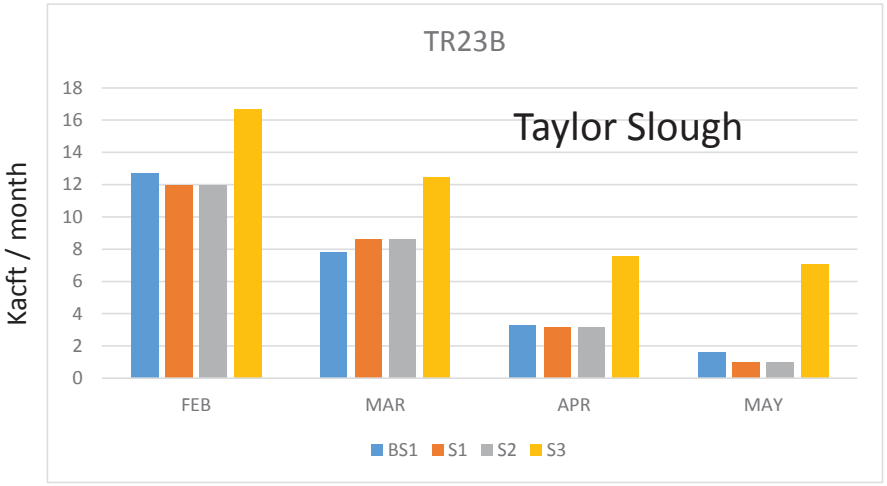
Comparing the SENS runs to the BASE identifies:

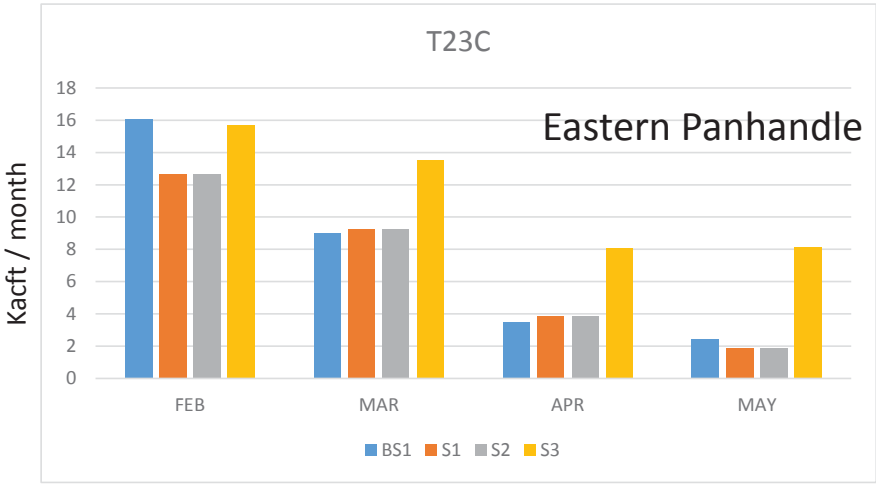
- SENS1 and SENS2 show lower water levels upstream of S18C and similar water levels upstream of S197
- SENS3 shows similar water levels upstream of S18C and higher water levels upstream of S197
- S197 discharges are relatively small in all cases, but most common in SENS3
- Beyond the effect of antecedent conditions, flows down Taylor Slough and the Eastern Panhandle are comparable in the BASE, SENS1 and SENS2 runs and are higher in SENS3

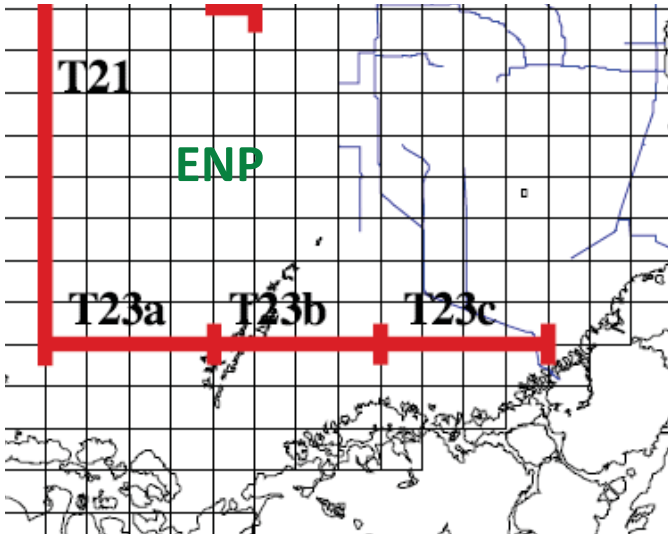

Comparison of Simulated C111E Stages & S18C Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
3
2
1
0
-1
-2
-3
1,200
1,000
800
600
400
200
0
1-Feb
1-Mar
1-Apr
1-May
C111E.Av-BS
C111E.Av-S1
C111E.Av-S2
C111E.Av-S3
S18C.Av-BS
S18C.Av-S1
S18C.Av-S2
S18C.Av-S3


Comparison of Simulated S197 Stages & S197 Flows
Water Level (Feet, NGVD)
Flow Rate (cfs)
3
2
1
0
-1
-2
-3
600
500
400
300
200
100
0
1-Feb
1-Mar
1-Apr
1-May
S197.Av-BS
S197.Av-S1
S197.Av-S2
S197.Av-S3
S197.Av-BS
S197.Av-S1
S197.Av-S2
S197.Av-S3

Flow Transects in Southern Everglades National Park

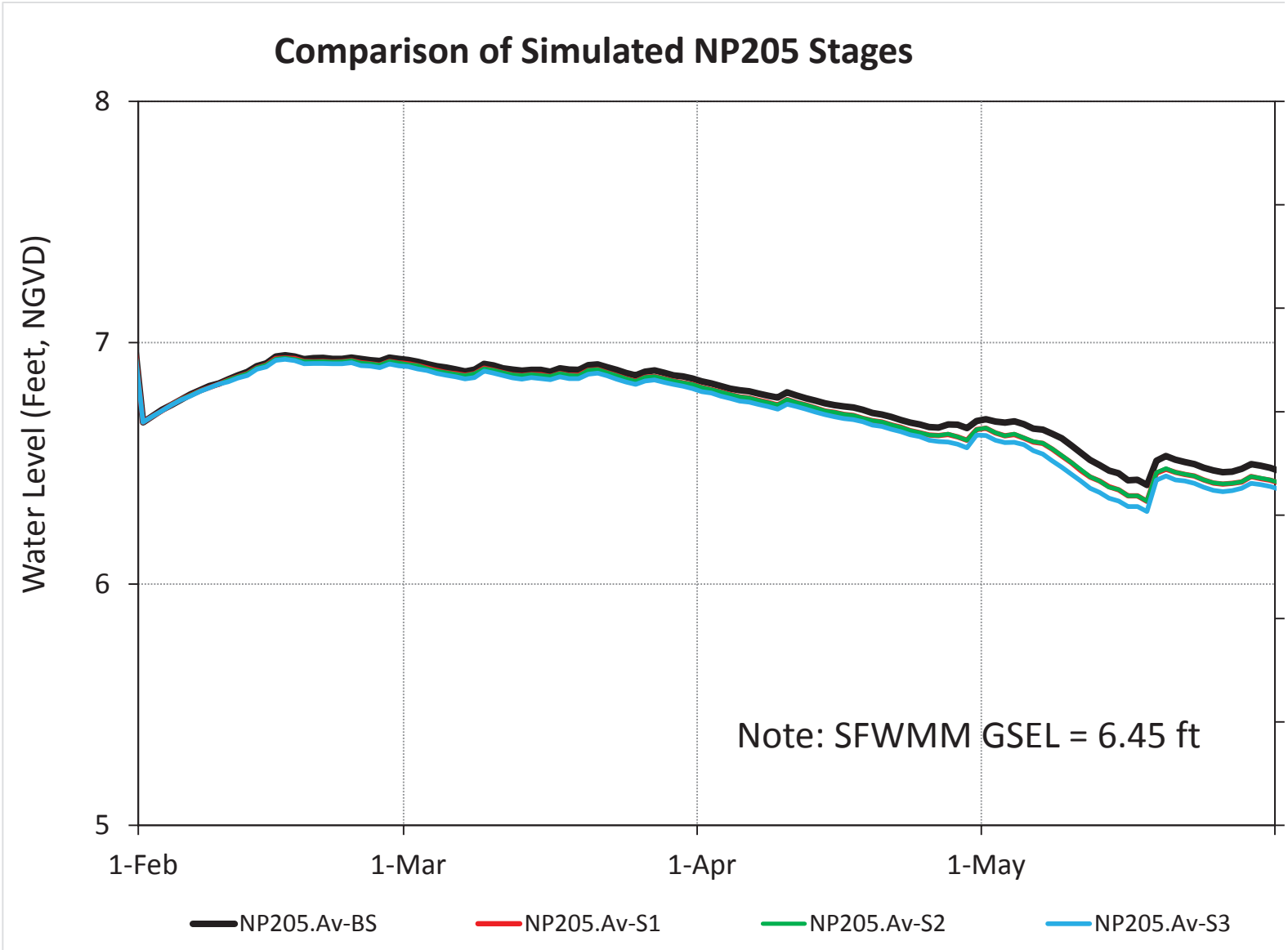


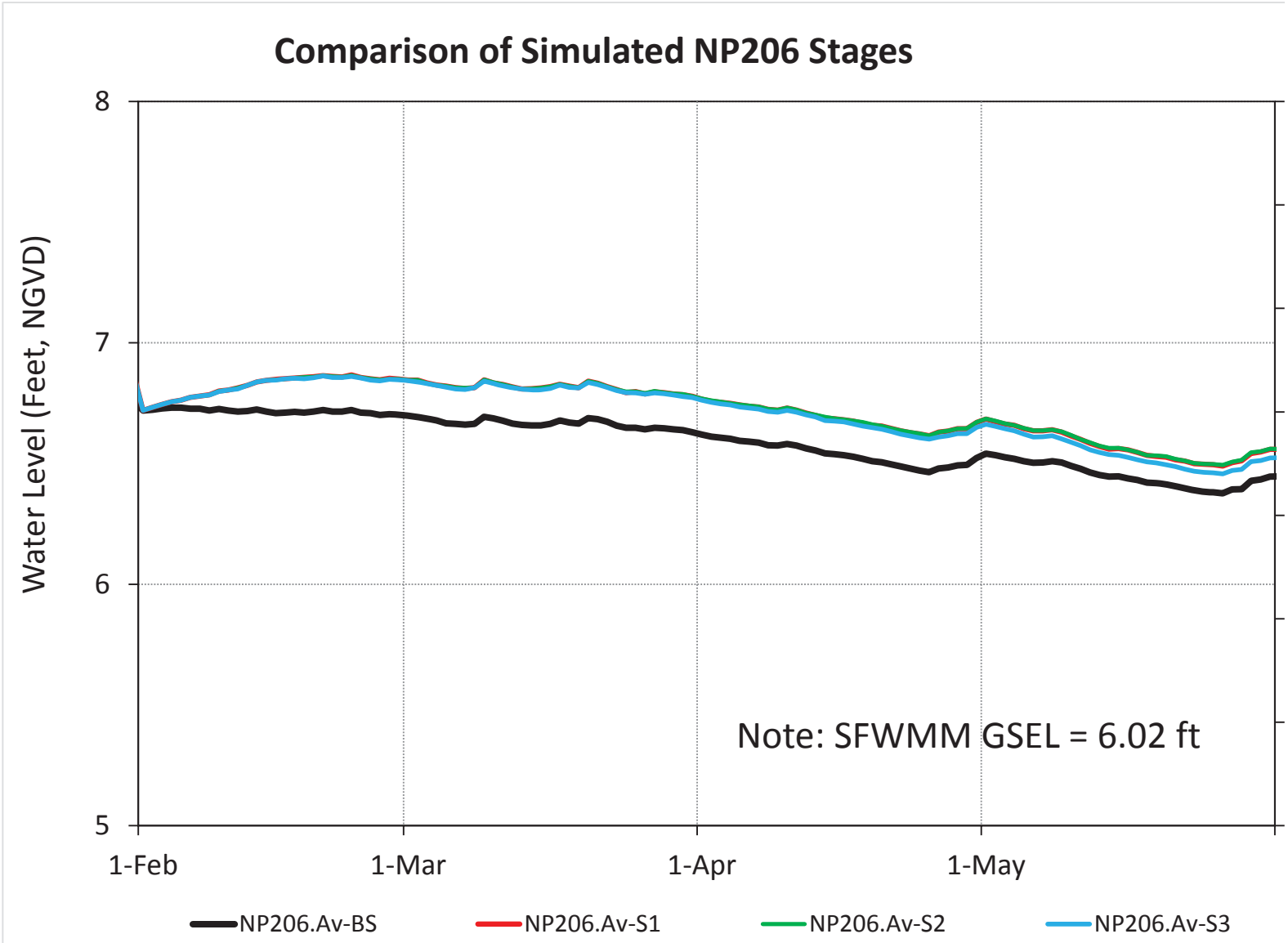


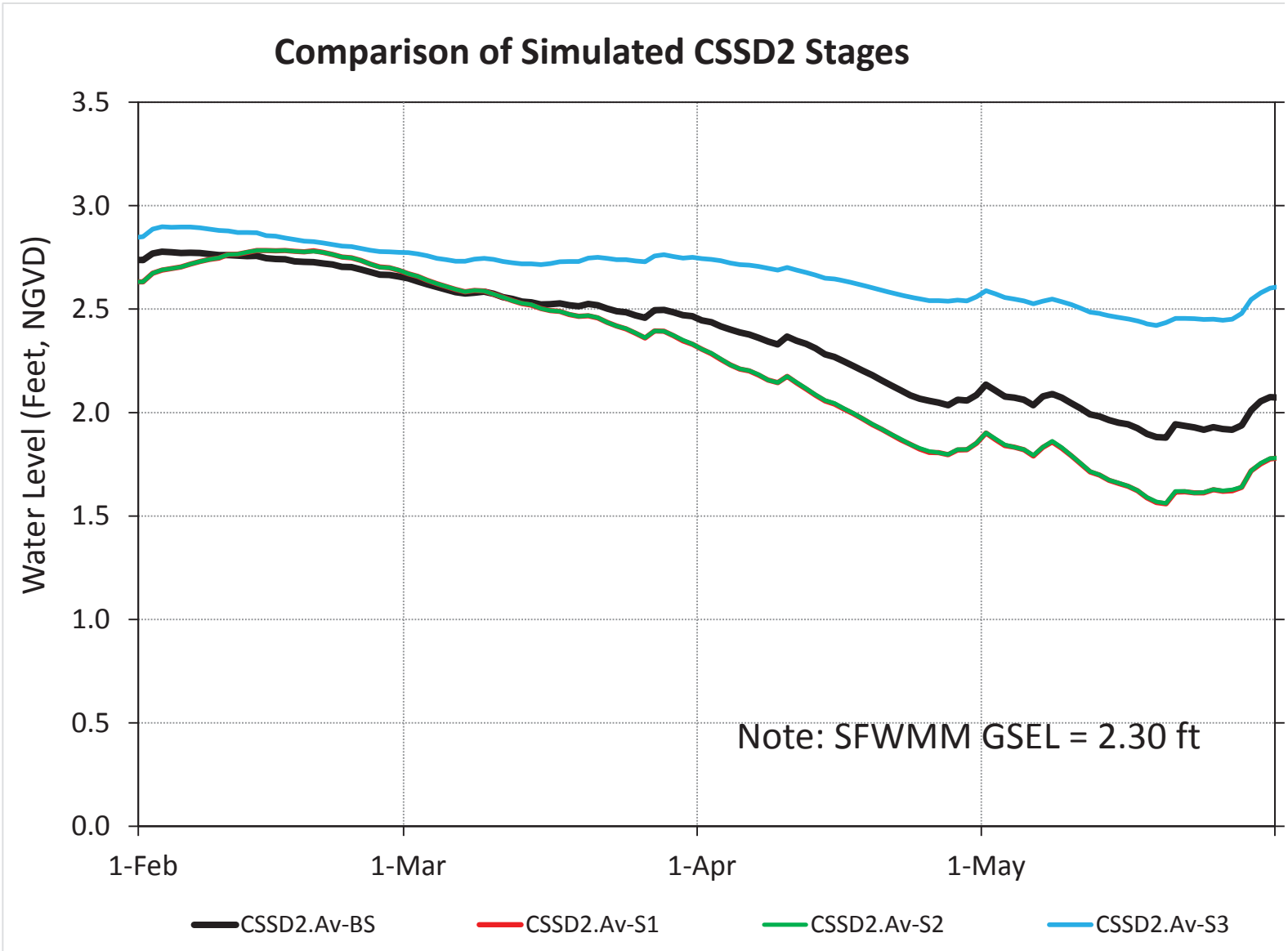


What are the effects on water levels in CSSS regions?

- Western Sparrow populations experience lower water levels in the SENS runs compared to the BASE.
- Sparrow populations adjacent to Shark River Slough and in the northern Rocky Glades experience higher water levels in the SENS runs compared to the BASE.
- Sparrow populations in the vicinity of Taylor Slough or the Southern Glades experience lower water levels in the SENS1/2 runs and higher water levels in the SENS3 run compared to the BASE.


Comparison of Simulated NP205 Stages
Water Level (Feet, NGVD)
8
7
6
5
1-Feb
1-Mar
1-Apr
1-May
Note: SFWMM GSEL = 6.45 ft
NP205.Av-BS
NP205.Av-S1
NP205.Av-S2
NP205.Av-S3


Comparison of Simulated NP206 Stages
Water Level (Feet, NGVD)
8
7
6
5
1-Feb
1-Mar
1-Apr
1-May
Note: SFWMM GSEL = 6.02 ft
NP206.Av-BS
NP206.Av-S1
NP206.Av-S2
NP206.Av-S3


Comparison of Simulated CSSD2 Stages
Water Level (Feet, NGVD)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1-Feb
1-Mar
1-Apr
1-May
Note: SFWMM GSEL = 2.30 ft
CSSD2.Av-BS
CSSD2.Av-S1
CSSD2.Av-S2
CSSD2.Av-S3

Summary

- Extraordinary high water conditions in south Florida prompted design & proposal for operations intended to release additional water from WCA-3A to ENP and the SDCS
- SFWMD H&H Bureau's Modeling Section developed four simulations to assist with identifying effects of the potential operations
- Simulation results indicate generally:
  - Lower water levels in WCA3A & NorthWest ENP
  - Higher water levels and flows in NorthEast and Central Shark River Slough in ENP
  - A range of possible conditions along eastern ENP, depending on utilization of the S337 route to convey additional flows to the SDCS
  - Similar or lowered canal water levels along the L31N and SDCS