APPENDIX D – MODEL DOCUMENTATION REPORT

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Modeling Documentation Report: S190 Operations Study

US Army Corps of Engineers ®
Jacksonville District

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LIST OF ACRONYMS

CESAJ	Corps of Engineers South Atlantic Jacksonville
FCB	Feeder Canal Basin
NGVD	National Geodetic Vertical Datum of 1929
SFWMD	South Florida Water Management District
USACE	United States Army Corps of Engineers

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1 INTRODUCTION

This report documents the hydrology and hydraulic analysis performed in support of the S190 Operations Study. The S190 structure is located in the Feeder Canal System (Figure 1) and controls the water levels of the north and west branches of the canal system. The West Feeder canal intersects the northern part of the Seminole Tribe of Florida (STOF) reservation, and water levels in the canal are correlated with hydrologic conditions in the STOF lands.

In a letter dated October 24, 2011 to the CESAJ District Commander, the STOF requested the U.S. Army Corps of Engineers to investigate the possibility of operating the S190 Structure utilizing the 15.2 to 15.8 ft. operating range year round. The current operating criteria (USACE, 1996) identifies normal and dry conditions, with different operating ranges dependant on conditions. Although the "normal condition" is not defined in USACE (1996), for the purposes of this report, the normal conditions will be assumed to refer to the wet season which, in south Florida, typically span from May 1st to Oct. 31st. The current structure operating criteria is to maintain a water stage upstream of the structure between 14.2-14.8ft during "normal condition" and 15.2-15.8ft (NGVD) during "dry condition". Like the "normal condition", the "dry condition" is not defined in USACE (1996); in this report, this condition will be presumed to refer to the dry season which spans from Nov. 1st to Apr. 30th.

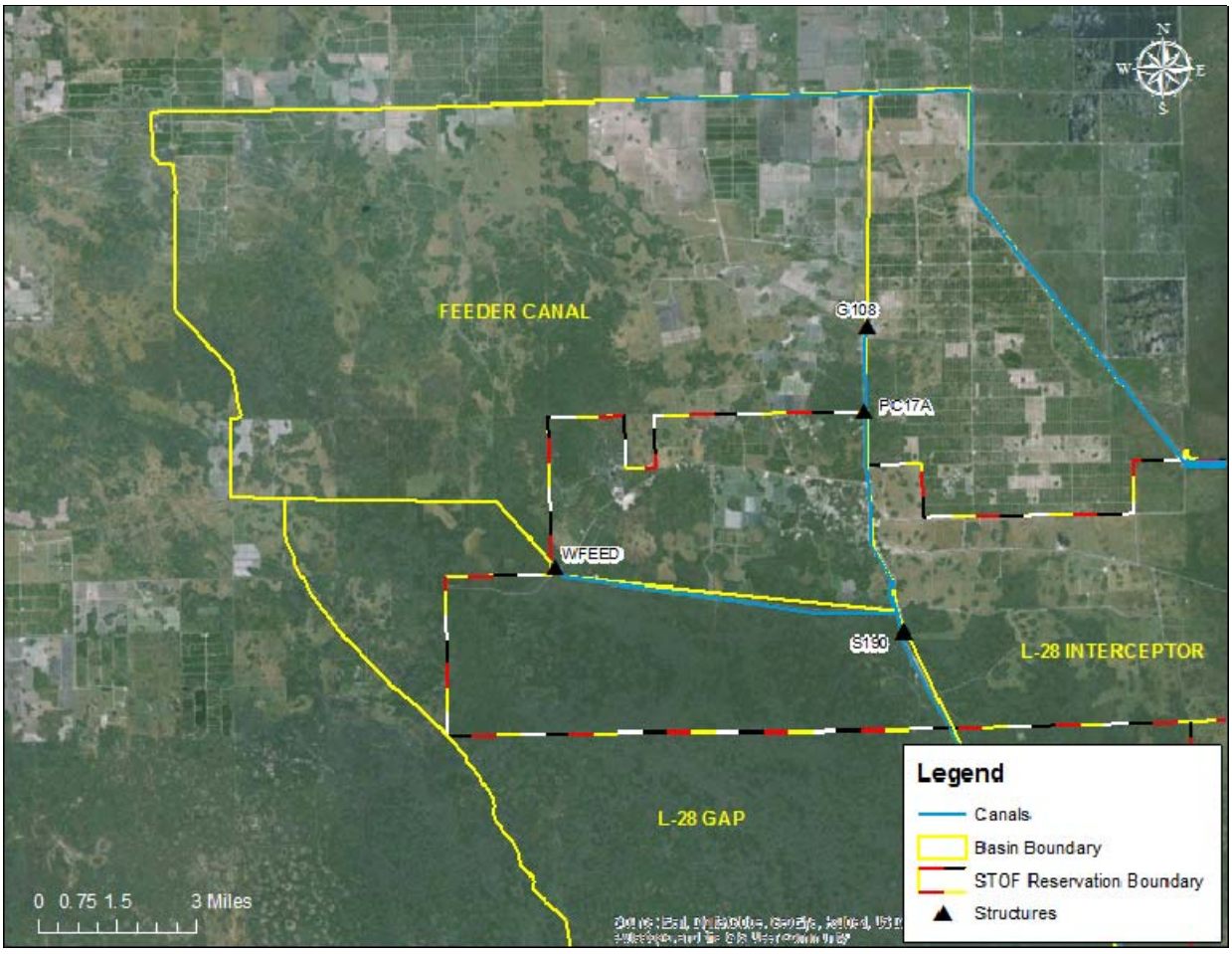

Figure 1. Feeder Canal Basin and main hydraulic structures.

As part of the hydrologic and hydraulic analysis, the Project Delivery Team (PDT) identified four S190 headwater stage operating criteria alternatives to be analyzed. These are summarized in Table 1.

Table 1. S190 headwater stage criteria derived from S-190 Operations Study alternatives.

Criteria derived from	S190 Headwater Stage Criteria (NGVD)	Notes
Alternative 1	14.5ft "normal condition"– Represents the average stage of the low setting range as defined in USACE, 1996. 15.5ft "dry condition" - Represents the average stage of the high setting range as defined in USACE, 1996.	For the purpose of this document, "normal conditions" are assumed to refer to the "wet season" which spans from May 1st – Oct 31st. "Dry conditions" are assumed to refer to the "dry season" which spans from Nov. 1st – Aprl 30th.
Alternative 2	15.5ft optimum stage "normal and dry conditions"	Year round stage criteria to be maintained. For "normal" and "dry conditions" definition see note on above criteria.
Alternative 3	15.8ft optimum stage "normal and dry conditions"	See note on above criteria.
Alternative 4	16.0ft optimum stage "normal and dry conditions"	See note on criteria for Alternative 2

The hydraulic and hydrologic analysis was divided into two major components. The first component is the hydraulic analysis for the existing infrastructure in the Feeder Canal System. The purpose was to investigate the hydraulic characteristics of the Feeder Canal System with respect to changes in the hydrology of the system and to obtain a perspective of the performances of the existing structures in the system.

The second component is an analysis of the groundwater hydrology within the basin relative to the observed headwater stages of the S-190 structure. The following sections describe in detail the analysis made for the evaluation of these two components.

2 HYDRAULIC ANALYSIS ON FEEDER CANAL SYSTEM INFRASTRUCTURE

2.1 S190 Hydraulic Design Criteria

This structure was sized to pass the ten-year flood from the drainage area with 0.5 foot of head loss and a tailwater elevation of 16.1ft (USACE, 1963). The North and West Feeder canals were

designed and built to maintain flood control under that condition. Furthermore, the secondary inlet structures were built along these canals since their initial construction purpose was to remove the runoff under that condition. Some of the secondary inlet structures along the Feeder canals have been replaced, due to various reasons (e.g. beyond design life, need for drainage, etc.), with in-kind structures to maintain drainage.

Since none of the proposed S-190 operating headwater alternatives exceed the headwater design elevation of 16.6 ft., the structure shall be able to pass the design discharge (ten-year flood) under the stage criteria for all alternatives analyzed in this study.

2.2 PC17A Hydraulic Analysis

The PC17A structure is located in the Feeder Canal Basin at the east terminus of a canal known as the Southern Boundary Canal (northernmost Seminole Big Cypress Reservation boundary). The purpose of this structure is to discharge excess runoff from the private farms north of the reservation (approximately 36 square miles or 23,040 acres) into the North Feeder Canal. Per USACE (1963), this structure is considered as a secondary inlet structure connected to the North Feeder Canal. PC17A consists of a two-barrel, 72-inch corrugated aluminum pipe (CAP) culvert, located at the southeast corner of the McDaniel Ranch Area. It also has a riser with four 3-foot high gates (two per barrel) each of which is 3.65 feet wide (Figure 2). Only the top and middle plates are removable. The structure is operated by the land owners in consultation with the SFWMD.

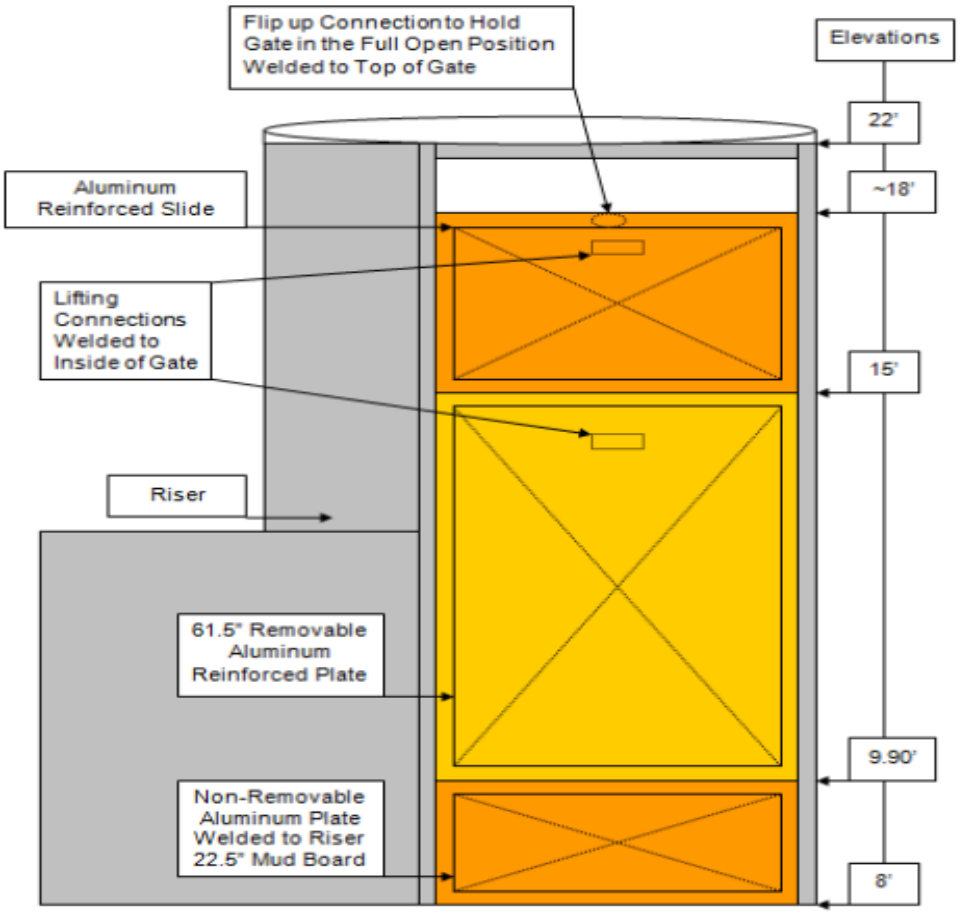

Figure 2. PC17A structure schematic.

Whenever the top four 3-foot top plates are removed, and for tailwater conditions (S190 headwaters) below 15.0ft (NGVD), the structure operates as a headwater controlled weir. Whenever the tailwater stage rises above 15.0ft, the structure operates as a submerged weir controlled by the gradient between the head and tailwater stages. When the top four plates are in place, the structure operates as a headwater controlled weir for tailwater conditions at 18.0ft or below.

Tailwater stages for this structure; controlled by the operations of the S190, are the North Feeder Canal water levels just downstream of the structure. Thus, evaluation of the proposed operations of the S190 needs to include a hydraulic assessment of the flow capacity at PC17A. The South Florida Water Management District (SFWMD, 2010) developed theoretical stage-discharge relationships for PC-17A under two different tailwater conditions (Figure 3) when the top four 3-foot plates are removed. Based on this curve, an increase in tailwater condition from 14.86ft to 15.70ft (NGVD) results in a change in maximum discharge capacity at PC-17A from 267.64 cfs to 259.81 cfs. The maximum headwater stages at PC-17A in this study were derived from routing of a 25yr/3d storm event in the tributary watershed.

To investigate the effect in discharge capacity relative to the alternatives in this study, the stage-discharge relationship developed by SFWMD (2010) was applied to the four S190

headwater criteria proposed, assuming the top four 3-foot plates are removed. The resulting curves are also included in Figure 3. For the maximum PC-17A headwater stage considered (18.6ft for a 25yr/3d storm event), the discharge capacity at this structure changed from 267.6cfs to 263.3cfs when the tailwater increased from 14.5ft (Alt1) to 15.5ft (Alt2). When the tailwater is further increased to 16.0ft, the resulting discharge was 253.2cfs. Table 2 shows the discharges at the structure for the proposed conditions under four different PC-17A headwater conditions.

From Figure 3, the maximum PC17A headwater change when the tailwater is raised from 14.5ft to 16.0ft (NGVD) is about 0.15ft. Based on the report by SFWMD (2010), it is not anticipated the discharge capacity of the structures on the McDaniels Ranch property that discharge excess runoff to the South Boundary Canal to be affected. Thus, a change in stage in this area is not anticipated under the S190 stage criteria analyzed in this study.

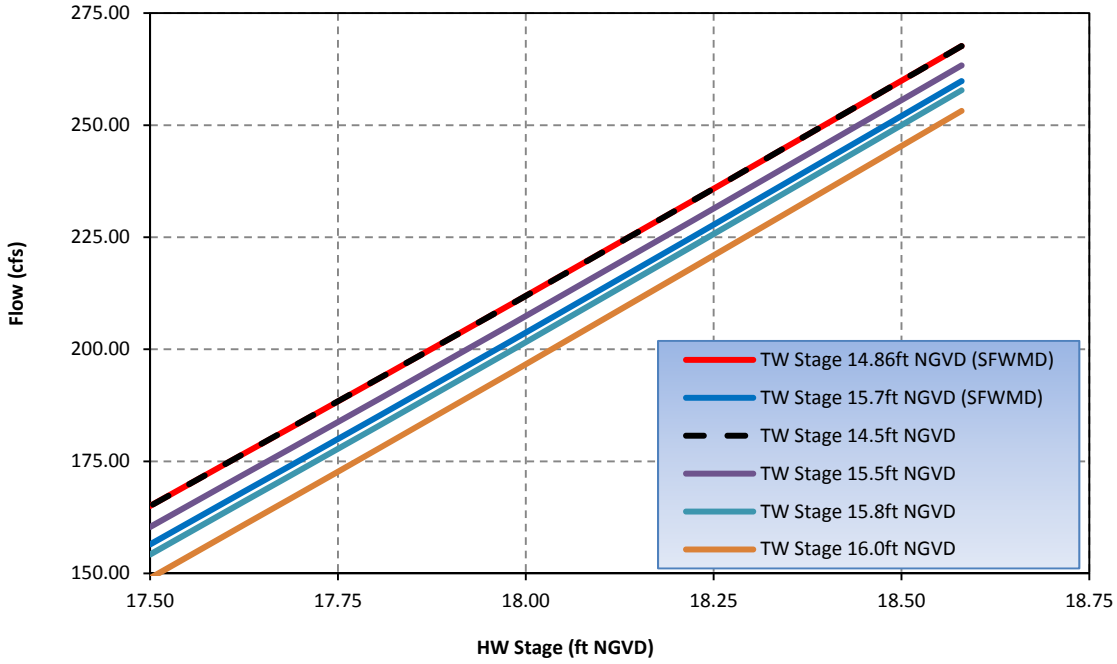

Figure 3. PC-17A Structure flow discharges for HW stages from 17.50 to 18.58 ft NGVD and different TW stages (SFWMD, 2010).

Table 2. Discharge capacity at PC17A for the proposed alternatives.

PC17A HW, ft	PC17A discharge capacity, cfs			
	Alt1 (TW @14.5ft)	Alt2 (TW@15.5ft)	Alt3 (TW@15.8ft)	Alt4 (TW@16.0ft)
17.50	165.06	160.39	154.22	148.97
18.00	211.92	207.42	201.57	196.67
18.50	259.91	255.57	249.98	245.34
18.58	267.64	263.33	257.77	253.17

2.3 WFEED Hydraulic Analysis

The WFEED weir is located on the West Feeder canal next to the western boundary of the STOF (Figure 1). This structure discharges runoff from the western portion of the Feeder Canal Basin into the West Feeder Canal. Crest elevation for the WFEED weir is at 16.9ft (NGVD). In order for backwater effects to develop at this structure, S190 stages would have to be higher than the crest elevation of the WFEED weir. The maximum regulated stage for the S190 headwater for the operational alternatives under consideration is 16.0ft, which is 0.8ft lower than the WFEED crest elevation. Therefore, backwater effects upstream to this weir are not expected to occur and the hydraulic capacity of this structure is not expected to be affected in this study.

3 GROUNDWATER HYDROLOGY ANALYSIS

The purpose of the groundwater hydrology analysis is to evaluate the responses of groundwater in the FCB to changes in S-190 headwater stages. This analysis focused on examining and analyzing observed canal and groundwater stage data in the FCB and adjacent water level recorder data collected in groundwater monitoring wells in the recent past. It is recognized elsewhere (Schlumberger, 2014), that due to the paucity and inadequate groundwater level records in the Seminole Big Cypress Reservation, the quantification of this relationship cannot be described with the available data in the basin. Therefore, this section is based on a qualitative assessment of groundwater/surface water interaction in response to changes in S190 Headwater stages based on hygrographs developed with the data available.

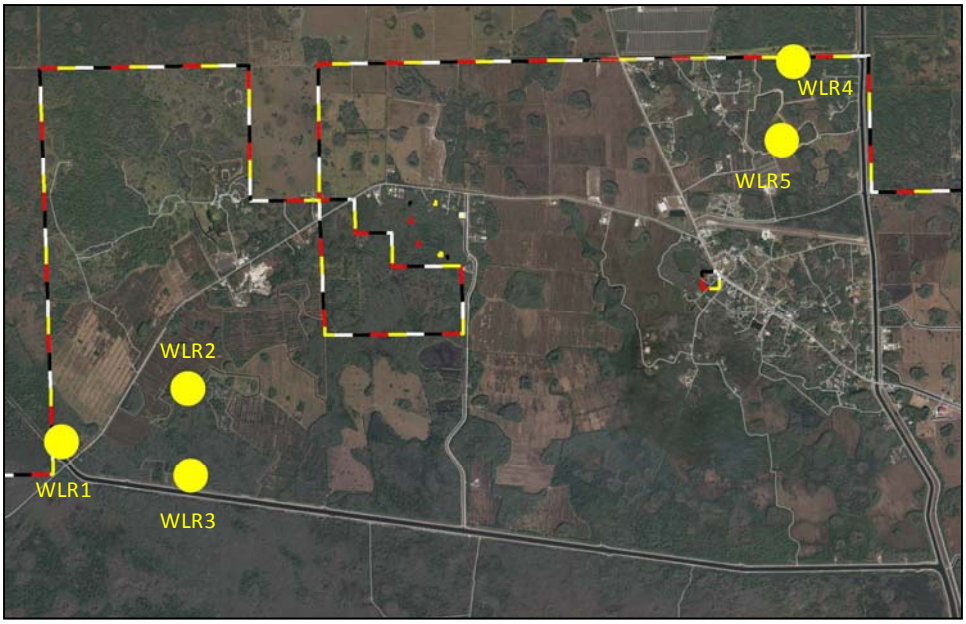

Figure 4. Location of Water Level Recorders (WLR) in the study area.

3.1 Ground-surface water hydrographs

Groundwater level data from recorders in the locations shown in Figure 4 for the period of October 2013 through January 2015 were provided by the Seminole Tribe of Florida and compared to the S190 headwater stages for the same period. Hydrographs generated for the groundwater level and the S-190 headwater stages are shown in Figures 5 to 7. Data from the groundwater level recorders were grouped into the three hydrographs based on their relative locations with respect to North and West Feeder Canals.

During the period of record for this data set, attempts were made to maintain operation of the S-190 at the regulatory headwater stages between 15.2-15.8ft. However, it can be observed from the POR, that the S-190 headwater stage was not consistently maintained at the regulatory stage and extended periods within this POR exist where the S190 stage dropped below the intended regulatory stage. The difficulty in maintaining the S-190 headwater stage at the regulatory stage appears to have occurred mainly during dry conditions.

3.1.1 WLR1 Stage Hydrograph

Figure 5 shows the stage hydrograph for WLR1 and the S190 headwaters. The WLR1 was isolated in this hydrograph due to its relative location with respect to the WFEED weir in the West Feeder Canal. WLR1 is located west of the West Feeder weir (on the headwater side of the weir). From this hydrograph, it can be seen that from October 9th to November 9th, 2013, the headwater stage in S190 was maintained around 15.5ft and the groundwater level dropped sharply but was quickly recovered to the initial level. Around November 9th, 2013, both stages declined which could be indicative of the dry season patterns. Groundwater levels from November 9th, 2013, through February 9th, 2014, followed closely the trend in the S-190 headwater stage and deviation in head difference was almost negligible. Groundwater levels and S190 headwater stages increased by mid-summer of 2014 which could be a response to the typical sub-tropical Florida climate. Within this period it seems that both S-190 headwater and groundwater levels responded to rainfall, however, the influence of the operations could be observed around the September timeframe where the S190 headwaters dropped to 14.5ft and the groundwater levels decreased accordingly. In the subsequent dry season, it can be observed that the groundwater levels dropped, consistent with the regional trend, and not necessarily affected by the S190 levels. Due to the relative location of the WLR1 with respect to the WFEED weir, it is hypothesized that surface water levels upstream of the weir correlate with groundwater levels in WLR1 more so than water levels downstream of the weir.

3.1.2 WLR2 and WLR3 Stage Hydrographs

Figure 6 shows the stage hydrograph for WLR2, WLR3 and the S190 headwaters. WLR2 and WLR3 hydrographs were grouped in this figure due to their relative location and proximity to the West Feeder Canal downstream of the WFEED weir. It can be seen that trends in these hydrographs are similar to that of WLR1 except for a few differences. Overall, WLR2 and WLR3 hydrographs are parallel and, for the most part, overlap each other. Their major difference lies

in the paucity of data for WLR3 from around March 9th, 2014 to July 9th, 2014. During this period, the data for WLR3 appears as a flat line indicating that water level could have dropped below the recorder level. Since the hydrographs generally overlapped each other for the rest of the period, groundwater level behavior for these two wells could be considered similar.

For the period October 9th, 2013 to November 9th, 2013, the S-190 headwater stage was maintained at the regulatory 15.5 ft, while the stage hydrographs for both wells overlapped and maintained almost similar stages higher than the S-190 headwater stage. For the dry season period of November 9th, 2013 through February 9th, 2014, it appeared that dry conditions prevented S-190 headwater stages to be maintained at 15.5ft. During this period, groundwater levels for both wells, as well as the S-190, declined gradually, but remained generally above and parallel to the S-190 headwater stage up until around February 9th, 2014 when the S-190 headwater stage climbed sharply. At this point, both wells simultaneously recovered sharply but their head differences with respect to the S-190 headwater stage was drastically reduced such that stages in the wells appeared to be a very small fraction of a foot above the S-190 headwater stage. After a short period of recovery to 15.5 ft., the S-190 headwater stage dropped below the 15.5ft. The WLR3 and WLR4 followed the same pattern maintaining a very small head differences with the S-190 headwater stage.

WLR2 continued to follow closely the S-190 headwater stage until around May 9th, 2014, when it deviated substantially from the S-190 headwater stage until around July 9th, 2014. Around this time, S-190 headwater stage made a steep recovery up to the regulatory 15.5 ft and was maintained at this stage from July 9th, 2014, through the remainder of the POR. Simultaneously, as the S-190 stage recovered to 15.5 ft., the WLR2 water level rose steeply and resembled the WLR1 water level steep climb around the same time. WLR2 and WLR3 water levels continued to increase sharply, dropping slightly within the period August 9th, 2014 to September 23rd, 2014, and reached a peak significantly lower than that reached by the WLR1.

The water levels for both wells began to decline simultaneously around September 23rd, 2014. Although the S-190 headwater stage was maintained at the regulatory 15.5 ft., the levels of the wells continued to decline consistent with water levels observed in other wells.

For the POR examined, the hydrographs for WLR2 and WLR3 generally appeared to remain above the S-190 hydrograph indicating that even during the dry periods, S-190 could have contributed to the hydrologic performance of the WLR2 and WLR3. However, it is likely that regional trends may have played a more dominant role in the subsidence of well water levels even when the S-190 headwater stage was maintained at the regulatory 15.5 ft. For the periods of subsiding S-190 headwater stages, it may be possible that a combination of the S-190 headwater and the water stages in the West Feeder Canal contributed hydrologically to the maintenance of the elevated well water levels relative to the S-190 headwater stage.

3.1.3 WLR4 and WLR5 Stage Hydrographs

Figure 7 shows the stage hydrograph for WLR4, WLR5 and the S190 headwaters. WLR4 and WLR5 were grouped in this chart due to their relative location and proximity to the North Feeder and Southern Boundary Canals. The trend in these hydrographs is similar to that of the WLR1, WLR2 and WLR3 hydrographs except for a few differences. For most of the POR, it can be seen that WLR4 and WLR5 hydrographs were basically parallel to each other. Around November 9th, 2014, however, the hydrographs crossed, but continued to run parallel to each other up to the end of the POR. The head difference between the two hydrographs remained within a fraction of a foot. The major difference in the wells' hydrographs lies in the paucity of data for WLR4 from around July 9th, 2014 to October 9th, 2014, and for WLR5 from around April 9th, 2014 to July 9th, 2014.

For the period October 9th, 2013 to November 9th, 2013, when the S-190 headwater stage was maintained at the regulatory 15.5 ft, WLR4 appeared to be increasing to a peak and then began declining while the WLR5 appeared to be descending. From the period November 9th, 2013 to February 9th, 2014, which falls in the dry season, it appeared that difficulty was encountered in maintaining the S-190 headwater stage at the regulatory 15.5ft. During this period, levels for both wells declined gradually along with the S-190 headwater stage and were generally above and parallel to the S-190 headwater stage up until around February 9th, 2014, when the S-190 headwater stage recovered sharply from a decline below the 15.5 ft. regulatory stage. Both wells simultaneously recovered sharply but their head difference with respect to the S-190 headwater stage was reduced.

After a short period of recovery to 15.5 ft., the S-190 headwater stage again began to drop below the 15.5 ft. WLR4 and WLR5 water levels followed the same pattern. Head differences with respect to the S-190 headwater stage tapered slightly until around May 9th, 2014, when they again increased overall until around July 9th, 2014. Around this time, the S-190 headwater stage made a steep recovery up to the regulatory 15.5 ft. Since well level data was missing for WLR4 around this time, only WLR5 could be analyzed. WLR5 water level simultaneously rose steeply around the same time. Although the S-190 headwater stage was maintained at 15.5ft from July 9th, 2014, to the remainder of the POR; except for a drop in the stage within this period from August 9th, 2014 to around September 23rd, 2014, the WLR5 water level continued to increase sharply. The WLR5 water level began to decline simultaneously with the start of the stage drop for the S-190 for the period August 9th, 2014 to September 23rd, 2014. Although the S-190 headwater stage recovered to the regulatory 15.5 ft., levels in the wells continued to decline in a manner similar to the other wells. Head differences for the WLR4 and WLR5 with respect to the S-190 headwater stage was considerably larger than that for the other wells for the tail end of the POR.

Hydrographs for WLR4 and WLR5 generally appeared to remain relatively higher above the S-190 hydrograph than the hydrographs for the other wells considered in this study. This is also the case in the dry season in which the well levels, although declining, maintained an almost constant head difference with the declining S-190 headwater stage. For the periods of

declining S-190 headwater stages, it may be possible that a combination of the S-190 headwater and the water stages in the Southern Boundary Canal contributed hydrologically to the maintenance of the elevated well water levels relative to the S-190 headwater stage. Also, due to the relative locations of WLR4 and WLR5 to the North Feeder Canal, and their similar hydrographs, it appears that the hydrologic effects of the S-190 headwater and the Southern Boundary Canal may have extended further out from the edges of the canals.

Based on the groundwater hydrographs in this figure, a relationship is apparent between Big Cypress Reservation ground water levels and the S190 headwater levels. Stage in the canal appears to influence the water table elevation of the local groundwater.

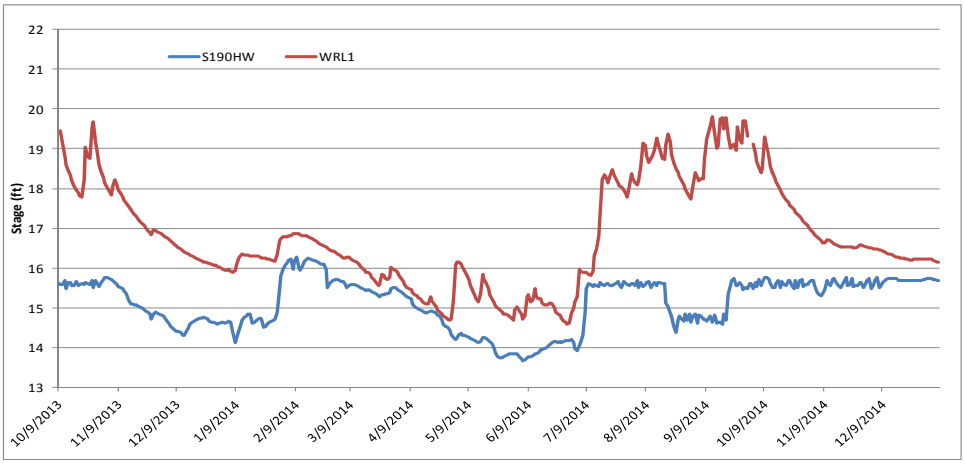

Figure 5. WLR1 and S190 Headwater hydrograph.

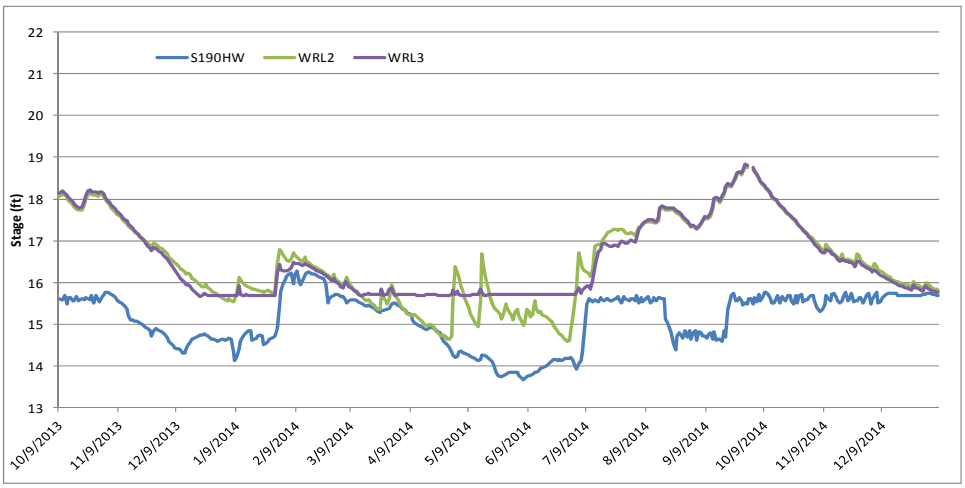

Figure 6. WLR2, WLR3, and S190 headwaters hydrographs.

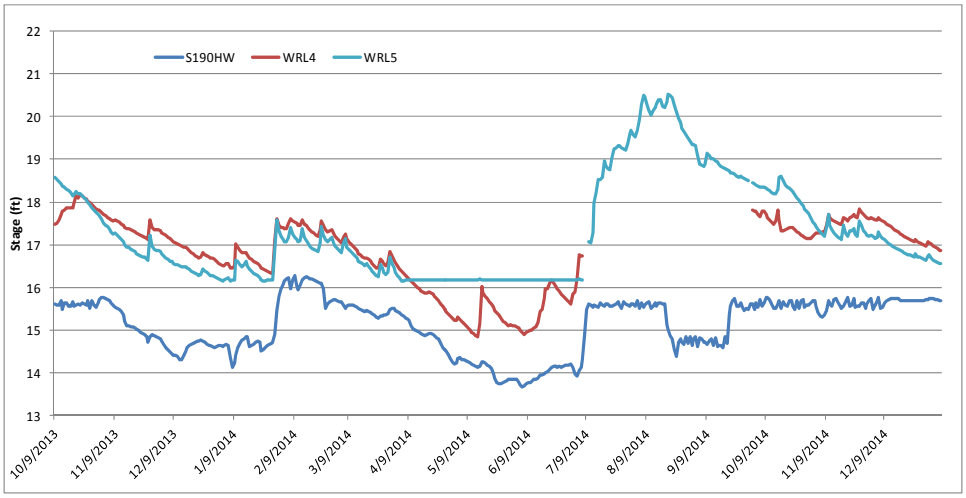

Figure 7. WLR4, WLR5, and S190 headwaters hydrographs.

4 ANALYSIS OF HYDROLOGY IN ADJACENT AREAS (BCNP AND WCA3A).

To investigate the effects of the S-190 on groundwater in basins away from the FCB, such as the Big Cypress National Preserve (BCNP) and Water Conservation Area 3A (WCA-3A), a hydrologic analysis was performed on wells in these basins. Observed S190 headwater and tailwater stages were compared with water levels in these basins for the 2004-2014 period of record. Four stations were selected for this analysis (Figure 8): BCNPA12 and BCA18 in the Big Cypress National Preserve; and 3A-NW, 3AN1-GW1 in Water Conservation Area 3A.

The stage hydrographs for the BCNPA12 and BCA18 monitoring stations are shown in Figure 9 and Figure 10, respectively. For BCNPA12, the water levels appear to correlate well with the S190 tailwater stages where these two stages follow a similar trend. It can be seen that during normal conditions , when the headwaters were maintained at 14.5ft, there is correlation between the water level at the station and the tailwater of the structure, but little to no correlation with the headwaters. This was also observed in the hydrographs for monitoring station BCA18.

For the stations in WCA3A (Figure 11 and Figure 12), the stage hydrographs showed an even stronger correlation with the tailwaters of the S190 structure where the plots for these two hydrographs traced almost parallel to each other (Figure 11) and, in the case of station 3A1N1W1_G, the traces overlap each other(Figure 12).

Based on this analysis, it can be concluded that adjacent basins to the Feeder Canal Basin responded more to regional groundwater patterns and not as much to local influence of the operational changes upstream of the S190 structure.

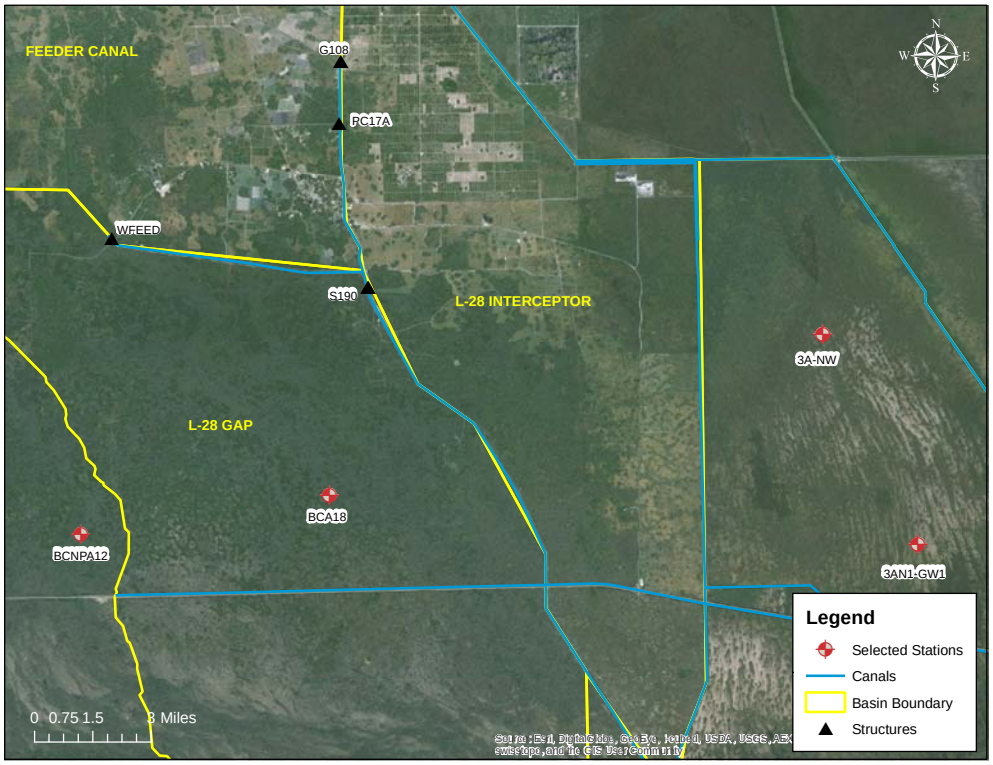

Figure 8. Monitoring stations for groundwater impact analysis in adjacent basins.

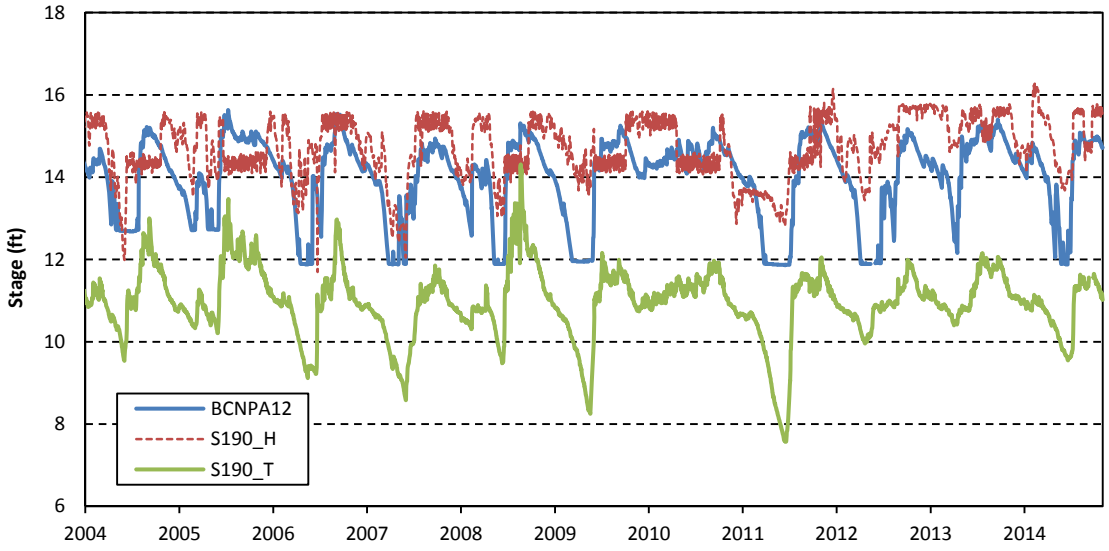

Figure 9. Stage hydrographs for the head and tailwater of S190 and station BCNPA12.

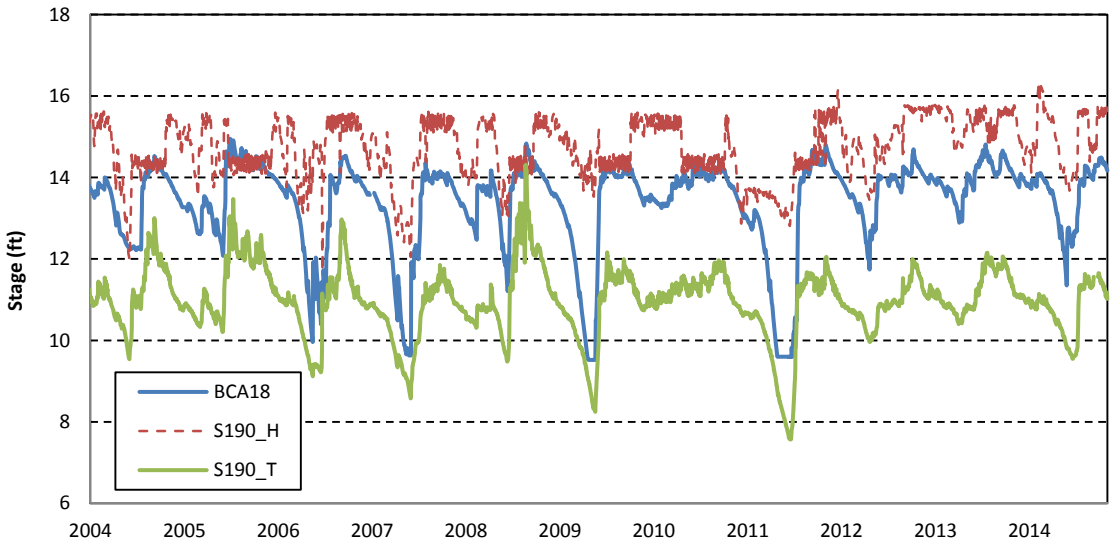

Figure 10. Stage hydrographs for the head and tailwater of S190 and station BCA18.

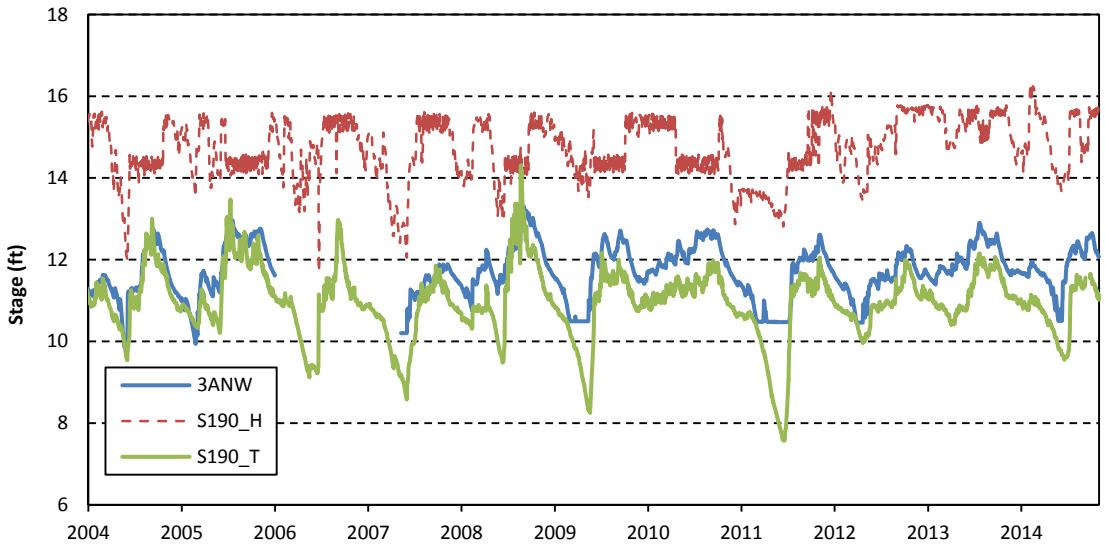

Figure 11. Stage hydrographs for the head and tailwater of S190 and station 3ANW.

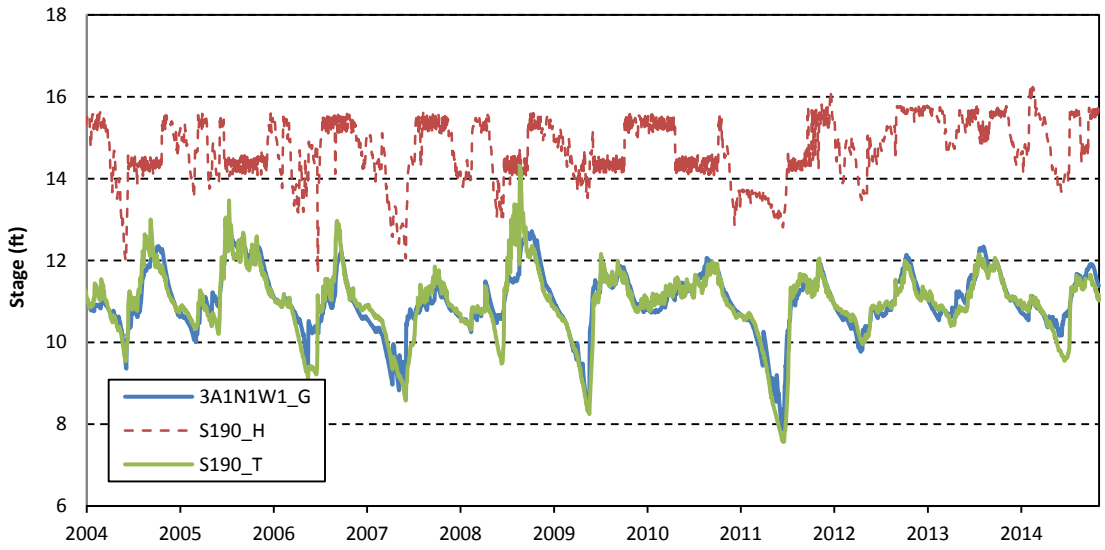

Figure 12. Stage hydrographs for the head and tailwater of S190 and station 3A1N1W1_G.

5 SUMMARY AND CONCLUSIONS

The analysis conducted in this report investigated the hydraulic and hydrologic effects in the FCB resulting from changes in the S-190 headwater stage. The analysis was conducted in two parts. The first was to investigate the effects on existing infrastructure with respect to changes in the hydrology of the system and to obtain a perspective of the performances of the structures in the system, particularly S190, PC17A, and WFEED. The second was to investigate the groundwater hydrology within the FCB relative to changes in the headwater stages of the S-190 structure.

Based on the PC-17A stage-discharge relationships, alternatives proposed in this study caused submerged weir conditions at this structure at tailwater conditions above 15.0ft (Alt2, Alt3, and Alt4) when the top four 3-foot plates are removed. Flow equations developed by SFWMD for this structure (SFWMD, 2010) under this condition showed the maximum discharge capacity at PC-17A to be higher in Alt2 (i.e., authorized project conditions (USACE, 1968)) relative to Alt 3 and Alt 4.

It is not expected the proposed alternatives to have an effect on the western portion of the FCB which discharges runoff through the WFEED weir into the West Feeder Canal. The crest of this weir is at 16.89ft and the proposed alternatives in this study are all below this elevation.

Due to the paucity of reliable groundwater level data, the surface-groundwater interaction in this area is challenging to quantify. However, higher S190 headwater stages in normal conditions should result in proportional increases in groundwater levels, particularly in areas adjacent to the FCB. More long-term monitoring data should help in describing this relationship quantitatively.

Based on the comparison of the observed S190 headwater and tailwater stages with water levels in selected monitoring stations in the Big Cypress National Park and the Water Conservation Area 3A,

it can be concluded that the effects of S190 headwater in these areas is minimal.

6 REFERENCES

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Comment No.	Comment	Reviewer	Agency	Office Symbol	CESAJ-EN-WI Response	Page No.	Critical/non-critical	
1	Define Q(T0970) and why is it only referenced in Figures 3 and 4?	Nassuti, Melissa A.	USACE	CESAJ-PD-ES	Noted. Q(T0970) is a place holder that should have been changed. This notation is actually the flows at the G108 Structure using flow information from DBKEY T0970 in the DBHYDRO database. It is referenced only in figs 3 and 4 because these figures are for hydrographs for 2003 and 2005 when the G108 was in existence. G108 was removed in 2009.	10	NC	Done
2	Include a list of Acronyms (i.e. ft = feet, NGVD 29 = National Geodetic Vertical Datum 1929, cfs = cubic feet per second, etc.)	Weston, David M.	USACE	CESAJ-OD-MW	Noted.	iv	NC	
3	Explain how the tested alternatives were chosen, especially Alternatives 3 and 4.	Potel, Ceyda	SFWMD	Applied Hydraulics	The alternatives were derived and recommended as a result of efforts by the PDT for the S190 Project.	5, 21	NC	Done
	Comment [LM1]: This disclaimer is interesting - what are the purposes for it?	Seminole Tribe	STOF	STOF	During the meeting with SAJs Deputy District Engineer, Mr. Tim Murphy, and the STOF, the Tribe counselor recommended to include this disclaimer to ensure this report is not used for any other purpose than the S190 Opertations Study.	i	C	Done
	Comment [LM2]: I have never seen this area referred to as the Feeder Canal System. Recommend staying with Feeder Canal Basin if the area needs a term or an acronym.	Seminole Tribe	STOF	STOF	Will change to 'FCB'	ii	NC	Done

Comment No.	Comment	Reviewer	Agency	Office Symbol	CESAJ-EN-WI Response	Page No.	Critical/non-critical	
1	revise language see comment below with respect to "normal condition" because there is no "normal setting".	Weston, David M.	USACE	CESAJ-OD-MW	This language is consistent with the USACE, C&SF Project for Flood Control and Other Purposed, Master Water Control Manual, WCAs, ENP, and ENP-South Dade Conveyance System, Volume 4 dated June 1996, Appendix A-S190-1 - A-S190-6.	5	NC	Done
2	Change average state to optimum stage.	Weston, David M.	USACE	CESAJ-OD-MW	15.5ft is average for the 15.2 ft and 15.8 ft stages. Optimum would apply more to the 15.2 ft and 15.8 ft stages.	5	NC	Done
3	NGVD 29 = National Geodetic Vertical Datum 1929. Suggest adding a foot note to every page citing all elevation are in NGVD 29 ft unless otherwise specified.	Weston, David M.	USACE	CESAJ-OD-MW	Will state in report 'all elevation is NGVD29 unless otherwise specified' rather than add footnote in every page of report.	5	NC	Done
4	The current optimum levels are between 14.2 ft - 14.8 ft NGVD during the normal condition (i.e. "low setting") and 15.2 ft - 15.8 ft during the dry condition (i.e. "high setting"). In general, the high setting condition is applied during the dry season and the low setting condition is applied during the wet season. As part of the hydrologic and hydraulic analyses, four alternatives for the S-190 optimum headwater stage were developed, which is noted on Table 1 below.	Weston, David M.	USACE	CESAJ-OD-MW	Noted	5	NC	
5	S-190 Optimum Stages	Weston, David M.	USACE	CESAJ-OD-MW	The alternatives, which were the averages of the optimum values,were the recommended operating criteria to be investigated.	5	NC	Done
6	Noted, recommend routing to Office of Counsel to ensure a "legal" determination was completed by the appropriate staff.	Weston, David M.	USACE	CESAJ-OD-MW	The PM and/or PDT may want to decide on this recommendation if feels necessary.	5	NC	
7	Pg. 5, Para 1, 4th and 5th lines (STOF Comment 1)	Seminole Tribe	STOF	STOF	Noted	5	NC	
	Pg. 5, Para 3, 2nd line (STOF Comment 2)	Seminole Tribe	STOF	STOF	MDR revised to focus on hydraulic and hydrologic analysis on Feeder Canal System rather than flood control and BC benefits	5	NC	
	Comment [LM3]: shouldn't the original purpose of the structure be added here as well?	Seminole Tribe	STOF	STOF	Original purpose will be added in the EA	6	NC	Done
	Comment [LM4]: The Tribe requested the 12.2 - 15.8 range year round. The Tribe didn't request an optimum level during the normal condition (10/11 letter, page 5-Demonstration Option #1)	Seminole Tribe	STOF	STOF	Will change to be consistent with the letter from STOF to USACE.	6	C	Done
	Comment [LM5]: This isn't the way the current (1996) criteria is written - it misrepresents Alternative 1 by not putting in the existing condition as written	Seminole Tribe	STOF	STOF	How the structure is operated will be addressed in the water control amnual. The MDR addresses the optimum level to be maintained. "Normal Operating Conditions" is what is referred to in the Water Control Manual". Eliminate references to "dry/normal conditions"	8	C	Done
	Comment [LM6]: This isn't the way the originalauthorized operating criteria is written and wouldmisrepresent Alternative 2 by not putting in theoriginal conditions as written.	Seminole Tribe	STOF	STOF		8	C	Done

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38	STOF (3): Pg. 6, Section 2.1: 3a. 1st line 3b. 2nd line 3c. 8th line 3d. 9th line	Seminole Tribe	STOF	STOF	a. 1st line: noted, changed to land owners to north of reservation b. 2nd line: noted, however, regardless of how and from where water gets to the Southern boundary canals, this water eventually flows through the PC-17A and the G108 Structures and are accounted for c. 8th line: Noted. MDR revised to remove flood control language d. 9th line: noted. MDR revised.	6	NC	Done
39	STOF(4): Pg.7, Fig. 2... 4a. 4b. 4c. 4d. 4e.	Seminole Tribe	STOF	STOF	a through f: noted, may be not-relevant for MDR purpose which is to provide a hydraulic and hydrologic analysis of the Feeder Canal System. This will be addressed in the EA document. *Note: SFWMD Operations have discourage the use of the document referrenced in 4a. because this draft document was not properly QA/QC'ed by SFWMD.*	7	NC	Done
40	STOF(5): Pg 7, last paragraph, 4th sentence... 5a. 5b. 5c.	Seminole Tribe	STOF	STOF	Underlined and added text in red noted; a. b. yes c. water quality should be considered separately from the hydraulic and hydrologic analysis provided in this MDR. This will be addressed in the EA.	7	NC	Done
41	STOF(6): Pg. 7, last paragraph	Seminole Tribe	STOF	STOF	Noted. MDR revised to differentiate between the "Existing" vs. "design" operating criteria.	7	NC	Done
42	STOF(7): Pg. 8, 1st paragraph, 1st sentence	Seminole Tribe	STOF	STOF	Noted. MDR will be revised.	8	NC	Done
43	STOF(8): Pg. 8, 2nd para, last sentence	Seminole Tribe	STOF	STOF	Noted. Charts provided in Fig 6-8 shows dry season's stages held at 15.2-15.8 for most of the wet season. Language will be revised to included "most fo the wet season".	8	NC	Done
44	STOF(9): Pg. 8, 3rd paragraph, last sentence	Seminole Tribe	STOF	STOF	Noted	8	NC	Done
45	STOF(10): Pg. 9, 2nd paragraph	Seminole Tribe	STOF	STOF	Noted	9	NC	Done
46	STOF(11): Pg. 9, Table 2	Seminole Tribe	STOF	STOF	Noted. Table footnotes describe the meaning of the negative sign.	9	NC	Done
47	STOF(12): Pg. 12, last paragraph, last sentence	Seminole Tribe	STOF	STOF	Noted. Typo corrected in MDR.	12	NC	Done
48	STOF(13): Pg. 13, 1st para, 1st sentence	Seminole Tribe	STOF	STOF	Sentence rephrased to remove speculation about operation of PC-17A	13	NC	Done
49	STOF(14): Pg.13, 2nd para, 3rd sentence	Seminole Tribe	STOF	STOF	Noted. Typo corrected.	13	NC	Done
50	STOF(15): Pg.13, 2nd para, 4th sentence	Seminole Tribe	STOF	STOF	MDR not focused on operation of PC-17A but on H&H analysis based upon historical/observed PC-17A flow and stage data. Refererences on PC17A operations were eliminated from MDR.	13	NC	Done
	Comment [LM7]: McDaniels (Paul Whalen) and SFWMD document the 3' top plates are in the structure for the sole purpose of water conservation. SFWMD PC17A Pilot Study page 2: 'in addition to allowing McDaniel to install and operate 4 extra removable upper plates at the top of the structure for the sole purpose of maintining water during dry conditions at a headwater stage above elevations typically maintained during wet conditions. The 4 extra removable upper plateswere intended, designed, installed and operated by McDaniel solely to conserve water during dry conditions when rainfall and flooding are less likely to occur"	Seminole Tribe	STOF	STOF	Noted. Language will be kept as is.	10	C	Done
	Comment [LM8]: I would take this section out and use a qualitative analysis for this section as was changed for BC. There are too many variables that weren't considered for this to be meaningful. A qualitative assessment is provided after Figure 10. I started making comments within this section, before I struck it all out. I left the comments I had done within it for reference.	Seminole Tribe	STOF	STOF	Noted. This section will remain as quantitative since the hydraulics of the structure are generally known.	10	C	Done
	Comment [LM9]: What about the impact of whether the 3' boards were in or removed on PC17A's discharge capacity? The board positions were different each year of the 6 years in the analysis...-I will add charts in Figures 3+.	Seminole Tribe	STOF	STOF	Not necessary to address boards removed or in place.	11	NC	Done
	Comment [LM10]: Tribe's prior comment about other significant changes was not included in this revision . Significant changes between the 14.2 - 14.8 period wet seasons include no Tribe Critical Restoration Basins, no Tribe E Canals, and 2 of 3 years with no McDaniel's operating storm water management system.	Seminole Tribe	STOF	STOF	This document is not intended to address "significant" changes as PDT agreed this will be addressed in the PDT.	11	C	Done
	Comment [LM11]: This is not a true statement so delete it. It may mean that the S190 gates weren't opened to reduce the stage; but the stages dropped below 15.2 during the dry seasons: 11.1 May 2003, 12.02' May 2004; 12.8' December 2010; 12.8' June 2011, 13.4' April 2012	Seminole Tribe	STOF	STOF	Intention was to try to be maintained at these stages. Will clarify this language	11	C	Done
	Comment [LM12]: which key #s specifically? To get 1978-2014, multiple keys need to be used. Usually, when DBKeys are referenced, the actual key numbers are put in...	Seminole Tribe	STOF	STOF	Replace with DBHYDRO	11	NC	Done
	Comment [LM13]: This shows the 3' water conservation boards in for the majority of the wet season (gate/board height on the left axis. Changes in PC17A HW level directly related to 3' boards being removed or replaced. Discharges are also a function of board height	Seminole Tribe	STOF	STOF	Not addressing operations of the PC17A structure in the MDR.	13	C	Done
	Comment [LM14]: This shows the board operations wet season 2005 - boards were up and down; mostly up throughout the late wet season - again flows influenced by board position; not just S190 HW	Seminole Tribe	STOF	STOF	Noted	14	NC	Done
	Comment [LM15]: 2010 shows all the boards out during the wet season (left axis) - right axis is PC17A HW and TW - here PC17A HW level was impacted by S190 HW level	Seminole Tribe	STOF	STOF	Noted	15	NC	Done
	Comment [LM16]: This chart shows the PC17Aboards were all in throughout the wet season (leftaxis) PC17A HW level a function of holding waterback during the wet season; not only related toS190 HW stages	Seminole Tribe	STOF	STOF	Noted	16	NC	Done
	Comment [LM17]: This chart shows PC17Aboards dropped down in late June; put back in, andthen taken out again through October (left axis).PC17A HW responses to board placement areevident.	Seminole Tribe	STOF	STOF	Noted	17	NC	Done
	Comment [LM18]: This chart shows the boardstaken out in July and ¾ replaced in mid Oct and the4th replaced in Nov. Board placement effect onPC17A HW level is evident; not just S190 HW level.	Seminole Tribe	STOF	STOF	Noted	18	NC	Done
	Comment [LM19]: Discharge is also a functionof boards in or out	Seminole Tribe	STOF	STOF	Noted	19	NC	Done
	Comment [LM20]: The data in these charts isimpacted by whether the PC17A 3' extra waterconservation boards were in or out during the wetseason	Seminole Tribe	STOF	STOF	Trend in the chart might reflect the operations of PC17A. However, the intent was to look at magnitude of discharge under different ranges in hydraulic gradient.	19		Done
	Comment [LM21]: The data in these charts isimpacted by whether the PC17A 3' extra waterconservation boards were in or out during the wetseason	Seminole Tribe	STOF	STOF	Do not concur. This was derived based on the quantitative analysis using the rating curves for the structures.	20	C	Done
	Comment [LM22]: This part could be the newqualitative analysis (only) for PC17A.	Seminole Tribe	STOF	STOF	Do not concur.	20	NC	Done
	Comment [LM23]: runoff over the weir is onlypossible if the water level on the headwater side ishigher than the weir crest. Normal USACE orSFWMD operation conditions don't have any effecton water levels coming over the weir from thissource	Seminole Tribe	STOF	STOF	Noted	21	NC	Done

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19	STOF(16): Pg.16, 1st para, last bullet	Seminole Tribe	STOF	STOF	Noted. Relative to the structural flow components, the non-point sources are considered to be negligible. Text will be revised to explicitly state this.	16		Done
20	STOF(17): Pg.16, 2nd para, 2nd sentence	Seminole Tribe	STOF	STOF	The data utilized for the modeling was appropriate for the approach undertaken by the PDT to support the evaluation of the alternatives. Additional data became available after the approach was vetted thru the PDT. However, this data was also limited to Basin 4 and Basin 1 and was not consistent with the vetted approach. Moreover, the data is limited to the wet season of 2014. (POR: Oct 2013-Jan2015) The modeling team agreed that this data will be useful for a more comprehensive development of an integrated GW/SW modeling application but the PDT rejected that approach due to time and constraints of the project scheduel and budget. This data shall be considered and should continue to be collected in the development of such a tool.	16		Done
21	STOF(18): Schlumber Comments a;b;c;d;e;f	Seminole Tribe	STOF	STOF	a. The tool was not designed to estimate the magnitude of the water levels but the relative change wrt Alt1. MDR revised charts illustrated this. b. Noted. See response to 18(a). c. Noted. The modeling team inlcuded the Feeder Canal System Water Budget in the analysis. d. Calibration approach explained that the purpose was to find a "K" value that would result in minimizing the "R^{2}" between GW fluxes as estimated from the water balance and the darcy equation. This was further applied to back-calculate a stage resulting from applying the darcy eqn to the water budget components in the 2004-2014 period with the caveat that magnitues of stages were highly uncertain. e. Noted. A more comprehensive tool would be needed to address this comment. f. Noted. The K value was compared with other SFWMD H&H tool and is similar to the value used in those tools within this region.			Done
22	STOF(19): Model Discussion- general	Seminole Tribe	STOF	STOF	Noted and, as stated, well data was sparse			Done
23	STOF(20): Pg. 19, 1st para, last 3 sentences a;b	Seminole Tribe	STOF	STOF	a. The RMS value is not correlated with the Tribe's entitelement. It is merely a difference in the groundwater exchange between the approaches as described in the report. b. Noted. The report states that 0.45 correlation is not "strong" but the directonality of the gw exchange is reasonable (0.90) correlation.	19		Done
24	STOF(21): Pgs. 23 - 28, figs. 17 - 28, a;b;c;d	Seminole Tribe	STOF	STOF	a. b.c .d. MDR revised and well levels responding to the 4 alternatives are replaced with % change in alt2, alt3 and alt4 levels with respect to alt1	23 - 28		Done
25	STOF(22): pg 29 Table 4	Seminole Tribe	STOF	STOF	MDR revised and Table 4 regarding inundation is replaced with % change in well levels for alts2,3 and 4 with respect to alt 1	29		Done
26	STOF(23): pg 29, sect. 3.3, 2nd line	Seminole Tribe	STOF	STOF	Noted	29		Done
27	STOF(24): pg 29, sect. 3.3, 4th sentence	Seminole Tribe	STOF	STOF	Noted. Information was provided due to a PDT request.	29		Done
28	STOF(25): pg 29, sect. 3.3, 2nd para, 3rd sentence	Seminole Tribe	STOF	STOF	Noted. Information was provided due to a PDT request.	29		Done
29	STOF(26): :Pgs. 30 - 32, charts of S190 HW/TW and BCNP/ENP gw wells, a;b	Seminole Tribe	STOF	STOF	a. Noted; b. Noted	30 -32		Done
	Comment [LM24]: I have never seen this areadescribed as the Feeder Canal System or with theacronym FCS. Recommend keeping it the FeederCanal Basin.	Seminole Tribe	STOF	STOF	Will be change to the Feeder Canal Basin.	22	NC	Done
	Comment [LM25]: This is an additional benefitof returning S190 to original operating criteria asmany wet seasons in the past ended with S190 inthe 14' range, and plummeted from there as the dryseason ensued. Keeping it higher during the wetseason provides an additional foot of water to beginthe dry season with.	Seminole Tribe	STOF	STOF	Benefits/Impacts to be addressed in the EA. Not the MDR.	23	NC	Done
	Comment [LM26]: of 2013 or 2014?	Seminole Tribe	STOF	STOF	2013	23	NC	Done
	Comment [LM27]: the term condition can beconfused with 1996 S190 operating criteria whichset ranges based on normal and dry conditions – isthat what is meant here – or is condition meant asclimate conditions/season? Season is more relatedto climate and not related to operating criteriaterms.	Seminole Tribe	STOF	STOF	No. the Water control manual refers to dry conditions.	23	C	Done
	Comment [LM28]: This whole paragraph isdevoted to 1 recorder located west of the WestFeeder Weir.	Seminole Tribe	STOF	STOF	noted. Only available information in the area.	23	NC	Done
	Comment [LM29]: what does this mean? WhenS190 was running at 14.2-14.8? the wet season?	Seminole Tribe	STOF	STOF	This is a factual observation in the stage hydrographs.	23	NC	Done
	Comment [LM30]: This paragraph is devoted tothe remaining 4 water level recorders and is theonly basis of any benefit for the Tribe.	Seminole Tribe	STOF	STOF	Noted. Only available data.	23	NC	Done
	Comment [LM31]: I added this as a referencefor this statement – it would need to be included inthe bibliography	Seminole Tribe	STOF	STOF	Noted.	24	NC	Done
	Comment [LM32]: "Intuitive" is a weak andunscientific term to use to show the benefit to BigCypress Reservation.	Seminole Tribe	STOF	STOF	Will change the word "intuitive" for "it can be inferred".	24	NC	Done
	Comment [LM33]: Doesn't USACE or SFWMDhave any technical reports on how groundwaterlevels are influenced by structures that could beused as a reference it would really need to be"intuitive"?	Seminole Tribe	STOF	STOF	Due to some of the local effects on the ground/surface water interaction in south Florida, extrapolating the relationships from other structures to the S190 would be highly uncertain.	24	NC	Done

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		Seminole T	STOF	STOF	Will be included in the EA.	Not in MDR.	26	NC	Done
	S190 was designed in the 1960s inresponse to Department of Interior Bureau of Indian Affair concern of over drainage to the BigCypress Reservation resulting from the construction of the C&SF FEEDER CANAL BASIN canals.S190 serves an upstream purpose, therefore the downstream impacts are unchanged from original C&SF design.								

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15	STOF(27): pg 32, summary and conclusions, a. 1st para, 2nd sentence; b. 2nd para - 1st and 2nd sentences	Seminole Tribe	STOF	STOF	a. b. MDR language revised	32		Done
16	STOF(28): pg 33, 2nd para	Seminole Tribe	STOF	STOF	MDR language revised regarding benefits	33		Done
17	STOF(29): pg 33, 3rd para, last sentence	Seminole Tribe	STOF	STOF	MDR language revised regarding benefits	33		Done
					Do not concur.	28	NC	Done
	Comment [LM34]: Does this seem backwards?Or is that a Freudian slip? The sentence says "Thereport investigated the effects OF the Basin onchanges to S190 HW stages" – is that supposed tomean the Basin as a whole decides what happens toS190 when it was put in for the sole purpose ofprotecting Big Cypress Reservation and was changedwithout examining the impact of the change to BigCypress Reservation? I thought the purpose of theanalysis for the EA was to investigate the effects ONthe Basin from the changes to the S190 HW stages.	Seminole Tribe	STOF	STOF				
	Comment [LM35]: The 2010 flow equationsrepresent a condition where water previouslyreleased from G108 directly into the North FeederCanal, now enters PC17A. The current conditionwhere discharge capacities at PC17A are limited wascreated by the SFWMD removing a Terminusstructure of the Feeder Canal Basin withoutexamining the impact to Big Cypress Reservation	Seminole Tribe	STOF	STOF	Flow equations do not depend on the discharge areas. It all depends on the headwater/tailwater criteria.	29	C	Done
	Comment [LM36]: Can the exact page referenceof the 2010 report be provided to clearlysubstantiate this statement?	Seminole Tribe	STOF	STOF	Citing the exact page number in citations is not standard practice and would not be consistent throughout the document.	29	NC	Done
	recent ground water data obtained in Big CypressReservation indicates a direct relationship between ground water levels and S190 HW levels whichconfirms Tribal member oral reporting. ~~intuitively higher S190 headwater stages in normalconditions should result in proportional increases in groundwater levels, particularly in areasadjacent to the FCS.~~ The increase in ground water levels is a positive effect in Big CypressReservation as S190 was designed and constructed to protect Big Cypress Reservation from overdrainage. During the wet season, S190 HW levels have been operated, in majority, at the original,authorized criteria of 15.2-15.8 (Alternative 2), and higher since 2012. ~~More long-term monitoringdata should help in describing this relationship quantitatively.~~				Do not concur with edits.	29	NC	Done
		Seminole Tribe	STOF	STOF				
	~~Based on the combined analysis of observed hydrologic data for selected years' normal conditionsin the FCS and the PC-17A stage-discharge relationships, alternatives proposed in this study causedsubmerged weir conditions at this structure at tailwater conditions above 15.0ft (Alt2, Alt3, and Alt4).Under this condition, the observed data showed that headwaters at PC-17A are always higher thanthe tailwater stage. The stage-discharge relationship developed from observed data under twodifferent S190 operating criteria showed that the magnitude of flows and the general pattern ofthe stage-discharge relationship are comparable.~~ The maximum PC17A headwater change whenthe tailwater is raised from 14.5ft to 16.0ft (NGVD) is about 0.15ft. Based on the report bySFWMD (2010), this change does not seem to reduce significantly the discharge capacity of thestructures on the McDaniels Ranch area property that discharge excess runoff to the SouthBoundary Canal				Do not concur. This language was agreed upon the PDT.	29	C	Done
		Seminole Tribe	STOF	STOF				

Reviewer	Agency	Office Symbol
Nassuti, Melissa A.	USACE	CESAJ-PD-ES
Weston, David M.	USACE	CESAJ-OD-MW
Potel, Ceyda	SFWMD	Applied Hydraulics
Mirza, Adnan	SFWMD	Applied Hydraulics
Jinks, Tiphanie	USACE	CESAJ-PM-EE
Seminole Tribe	STOF	STOF

Sources of Data Used during the study

Source	Description	Reference
DBHYDRO	Used for structural flows/stages in main Feeder Canal System Infrastructure	SFWMD DBHYDRO
BC SW GW Interaction Study	Well information collected as part of an FAU Study. This data was used for the development of the tool because the consistency of the data with the vetted approach.	Email from Lisa Meday to Jaime A. Graulau dated 11/20/2014. Note: cc'ed Cherise Maples and Tiphanie Jinks Email from Lisa Meday to Tiphanie Jinks and Jaime A. Graulau dated 5/29/2015.
Geologic Report South Boundary Canal	Report contains hydrogeologic characterization of basin 4. Reviewed for the development of the tool. No time series of water level data included that could be used for the application developed.	Note: CC'ed Cherise Maples Email from Lisa Meday to Tiphanie Jinks and Jaime A. Graulau dated 5/29/2015.
Basin 2 Geotech Data	USACE report containing the geologic characterization of basin 2.	Note: CC'ed Cherise Maples Email from Lisa Meday to Tiphanie Jinks and Jaime A. Graulau dated 5/29/2015.
BC Well Survey	BC well survey with elevations of the wells in the water resource areas.	Note: CC'ed Cherise Maples Email from Lisa Meday to Tiphanie Jinks and Jaime A. Graulau dated 5/29/2015.
Data Mining Matrix	Table with the available data in the BC area from the Task Force	Note: CC'ed Stacy Myers Email from Lisa Meday to Jaime A. Graulau dated 5/29/2015.
Big Cypress Basin 1 and Basin 4 Water Level	Excel spreadsheet with water level recorders WRL1-WLR5 in basins 1 and 4. Also included a map of the locations of these recorders. POR from 10/2013-1/2015.	Note: CC'ed Cherise Maples, Tiphanie Jinks Email from Lisa Meday to Jaime A. Graulau dated 5/29/2015.
WRA2 east, WRA1 siphon, WRA4, Middle slough	Attachments with pictures of the WLR in these basins. Pictures report altitues of recorders or ground elevation (not specified).	Note: CC'ed Cherise Maples, Tiphanie Jinks, and Stacy Myers

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