

**OPERATIONS REPORT**  
Of the South Miami-Dade Seasonal Operations  
For October 2009 through April 2010

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## I. INTRODUCTION

The seasonal water level draw-downs of the coastal structures in the south Miami-Dade County area for agricultural purposes have occurred for over thirty years. The authorization is provided by specific South Florida Water Management District (SFWMD) Governing Board actions. The key affected structures are S-21A, S-20F and S-179. The specific operational actions are taken by the Water Management District (District) operations staff based upon field visits to agricultural operations, predicted and past precipitation events, observed water levels in the areas, and proposed planting schedules by local growers.

### A. PURPOSE

The purpose of this report is to document, for the 2009/2010 dry season, the actual procedures, field conditions and observations affecting the seasonal operations.

### B. BACKGROUND

The operations and maintenance of the S-21A, S-20F and S-179 structures is the responsibility of the South Florida Water Management District, acting as local sponsor for the federally authorized Central and Southern Florida Flood Control Project. These structures were designed and constructed by the U. S. Army Corps of Engineers (USACE). Structure S-21A was transferred from the USACE to the Water Management District for operations and maintenance in 1966 and S-20F and S-179 were transferred in 1967. The seasonal operations of these water control structures to facilitate agricultural practices in the South Miami-Dade County area has occurred for over 30 years. For this dry season (2009/2010) the Governing Board of the District authorized a modified operational range beginning on October 15<sup>th</sup>. Structures S-20F and S-179 were to be set at their low ranges whereas Structure S-21A would be set at an “interim” level with gate openings set at 2.0 feet NGVD and closings at 1.6 feet NGVD.

## II. STRUCTURES

### A. STRUCTURE S-21A

This is a concrete, gated spillway with two vertical lift gates located on the C-102 canal at its junction with the L-31E levee. The design of this structure was to pass the design flood flows without exceeding upstream design flood stages. It is designed to pass 1330 cfs with a design upstream stage of 1.9 feet NGVD.



Figure 1 – Structure S-21A

There are three operational ranges in effect for this structure: the High (upstream held between 2.2 and 1.8 feet NGVD), Intermediate (upstream held between 1.8 and 1.4 feet NGVD) and Low (upstream held between 1.4 and 1.0 feet NGVD) Ranges. Normal operations would schedule these three ranges as follows: High – from April 30<sup>th</sup> to October 15<sup>th</sup>; Intermediate – from December 30<sup>th</sup> to April 30<sup>th</sup>; and Low – from October 15<sup>th</sup> to December 30<sup>th</sup>. The selection of operational range is meant to be flexible based upon field conditions and agricultural activity.

For the 2009/2010 Dry Season an “interim” range of 2.0 to 1.6 feet NGVD was established. As long as rainfall persists within the basin, the low range setting will remain in effect until the water table recedes below the root zone of the seasonal crops. The details on structure operations are in Appendix A.

#### B. STRUCTURE S-20F

This is a concrete gated spillway with three vertical lift gates located near the mouth of C-103 at its junction with the L-31E levee. The design of this structure was to pass the design flood flows without exceeding upstream design flood stages. It is designed to pass 2900 cfs with a design upstream stage of 1.9 feet NGVD.



Figure 2 – Structure S-20F

There are three operational ranges in effect for this structure: the High (upstream held between 2.2 and 1.8 feet NGVD), Intermediate (upstream held between 1.7 and 1.3 feet NGVD) and Low (upstream held between 1.4 and 1.0 feet NGVD) Ranges. Normal operations would schedule these three ranges as follows: High – from April 30<sup>th</sup> to October 15<sup>th</sup>; Intermediate – from

December 30<sup>th</sup> to April 30<sup>th</sup>; and Low – from October 15<sup>th</sup> to December 30<sup>th</sup>. The selection of operational range is meant to be flexible based upon field conditions and agricultural activity. As long as rainfall persists within the basin, the low range setting will remain in effect until the water table recedes below the root zone of the seasonal crops. The details on structure operations are in Appendix A.

### C. STRUCTURE S-179

This is a concrete gated spillway with two vertical lift gates located on C-103 upstream of S-20F. The design of this structure was to pass the design flood flows without exceeding upstream design flood stages. It is designed to pass 1920 cfs with a design upstream stage of 3.8 feet NGVD. There are two operational ranges in effect for this structure: the High (upstream held between 3.9 and 3.1 feet NGVD) and the Low (upstream held between 3.1 and 2.7 feet NGVD) Ranges. Normal operations would attempt to maintain an optimum headwater elevation which varies seasonally. Most of the time the target optimum level is 3.5 feet NGVD. During the first month of the growing season (October to April) the automatic operation is set to the Low Range, then, depending on weather conditions, the high setting is used. During wet conditions the low setting may be used. As long as rainfall persists within the basin, the low range setting may remain in effect until the water table recedes below the root zone of the crops. The details on structure operations are in Appendix A.

## III. OPERATIONS COORDINATION

During this period of operations (October 1, 2009 through April 30, 2010) the observed and documented communication protocols for structure operations involved the growers, the Homestead Field Station staff and the Operations staff at District headquarters. Several key

agricultural sites were selected and monitored during this draw-down period. These sites and associated canals and structures are shown in Figure 3.

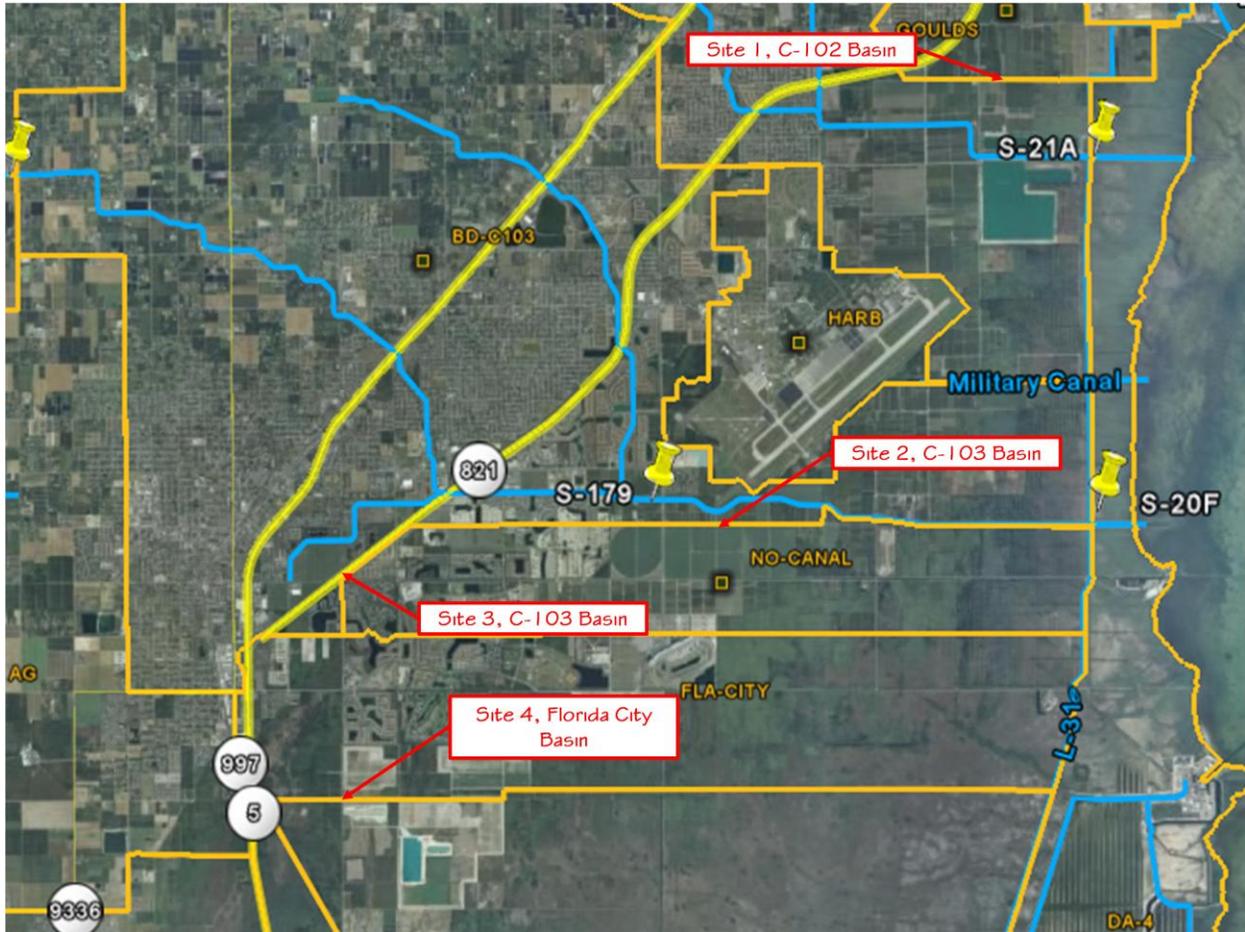


Figure 3 – Agricultural Indicator Sites

These four sites within the South Dade Agricultural Area were visited by field station personnel and photo-documented on October 7, November 9, November 25 and December 29 of 2009, as well as on January 11, February 3, March 15 and April 12, 2010. The photos are available for each site for background information. Prior to and after each visit the Director of the Homestead Field Station discussed with the on-duty operations manager the conditions observed, past and predicted precipitation, water levels and appropriate actions to be taken to minimize property damages. When the operations manager felt that conditions warranted structural operation

changes, he would direct the Control Staff as such. His decisions were recorded in a set of official log books maintained in the Control Room. Example sheets from this period are included in Appendix B to show the types of operational decisions and actions taken.

#### IV. RAINFALL

##### A. ANTECEDENT CONDITIONS

The precipitation records for the period of June 1 through September 30<sup>th</sup> were evaluated to determine the general water resource conditions in the basins prior to the draw-down period. Rainfall at the Homestead Field Station was evaluated in relation to the previous 40-year period as shown on Figure 4.

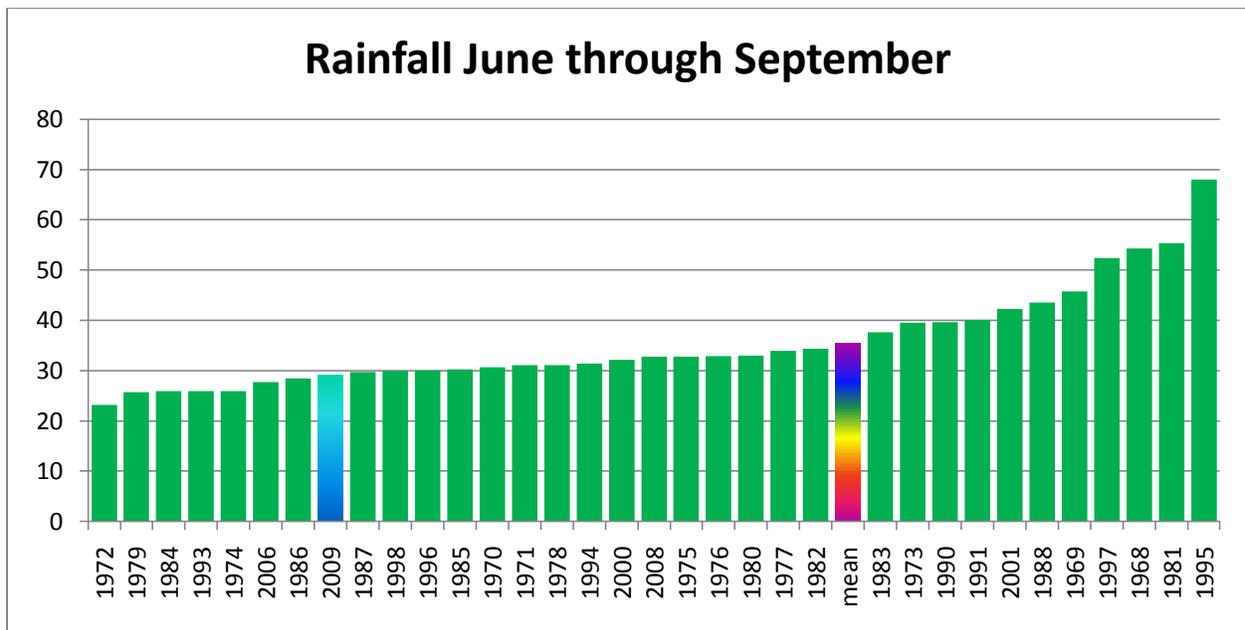


Figure 4 – Rainfall at Homestead Field Station from June to September

The value for 2009 was 29.05 inches which was the 8<sup>th</sup> lowest in the period of record and more than 5 inches below the mean. This resulted in “naturally” lower water levels as the area entered into the draw-down period. The result is that the field conditions, as will be seen in the October 7, 2009 photos, were almost ready for cultivation with very little standing water remaining to be

removed. In accordance with the agreed operating criteria the structures were placed on lower operating ranges on October 15, 2009. A look at one of the indicator sites in Figure 5 gives a view of conditions prior to and during the draw-down. As seen on October 7<sup>th</sup>, the water levels are just below the surface but still too shallow to bring in equipment for cultivation, whereas by November 9<sup>th</sup> the field conditions were compatible with the necessary land forming and planting processes.



Figure 5 – Field Conditions at Site 1 on October 7, 2009 (Looking West)



Figure 6 – Field Conditions at Site 1 on November 9, 2009

Figure 7 gives a time-elapsd photographic journal of the field conditions at Site 1 throughout the draw-down period. It is important to note that even with the draw-down, which allowed for the land preparation and planting of seeds, there were still periods of significant above-ground ponding which impacted the productivity of the area. An additional meteorological condition that had an effect on the crops was a very unusual cold period during the winter that inhibited some crop growth success.



Figure 7 – Chronological Photography of Site 1

## B. RAINFALL DURING DRAW-DOWN

The rainfall at the Homestead Field Station from October 1, 2009 to January 31, 2010 was 13.05 inches (shown in blue), which was only about one-half inch more than the mean (shown as multi-colored) for the period of record as shown in Figure 8a. The rainfall for the

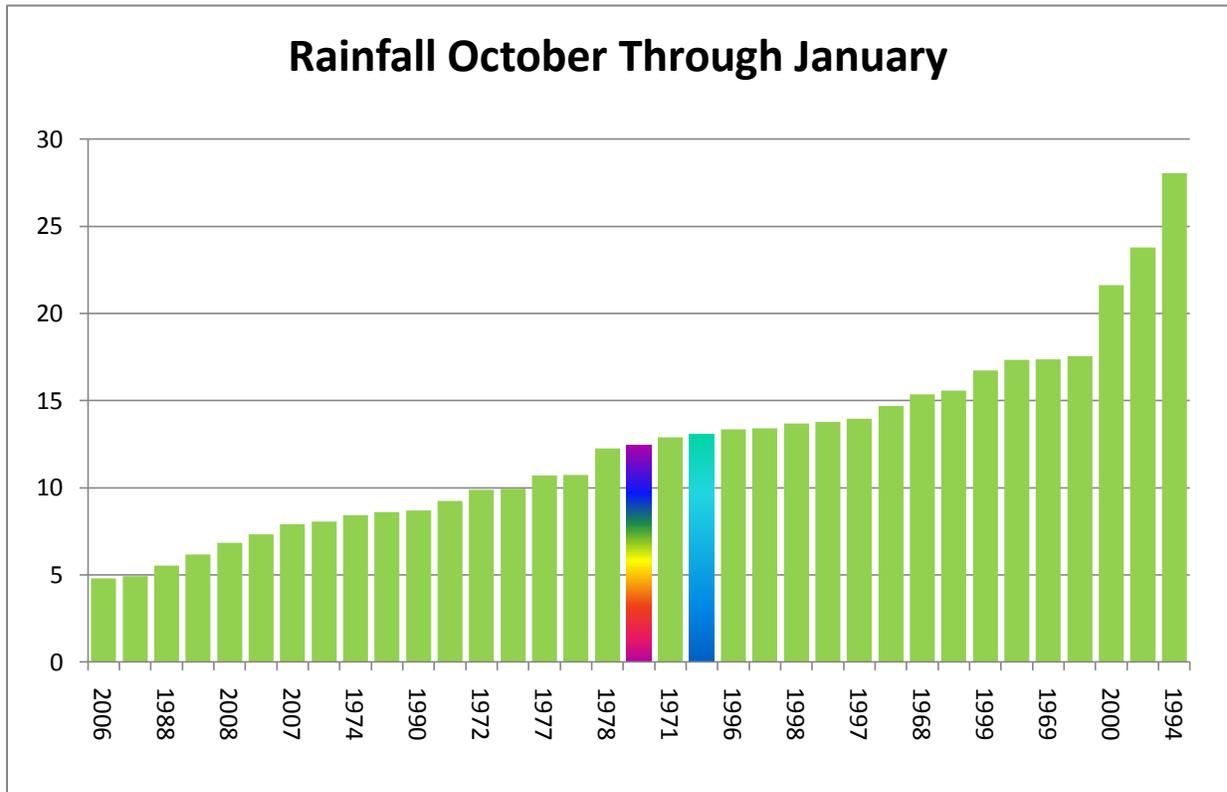


Figure 8a – Rainfall for period of October through January at HFS

period of October 1, 2009 to April 30, 2010 was 22.6 inches (shown in red), which was 3 inches more than the mean (shown as multi-colored) as shown in Figure 8b. The daily distribution is shown in Figure 9. The area received over 5 inches of rain on November 25<sup>th</sup> which explains the extensive field flooding at Site 1 for that date shown in Figure 7.

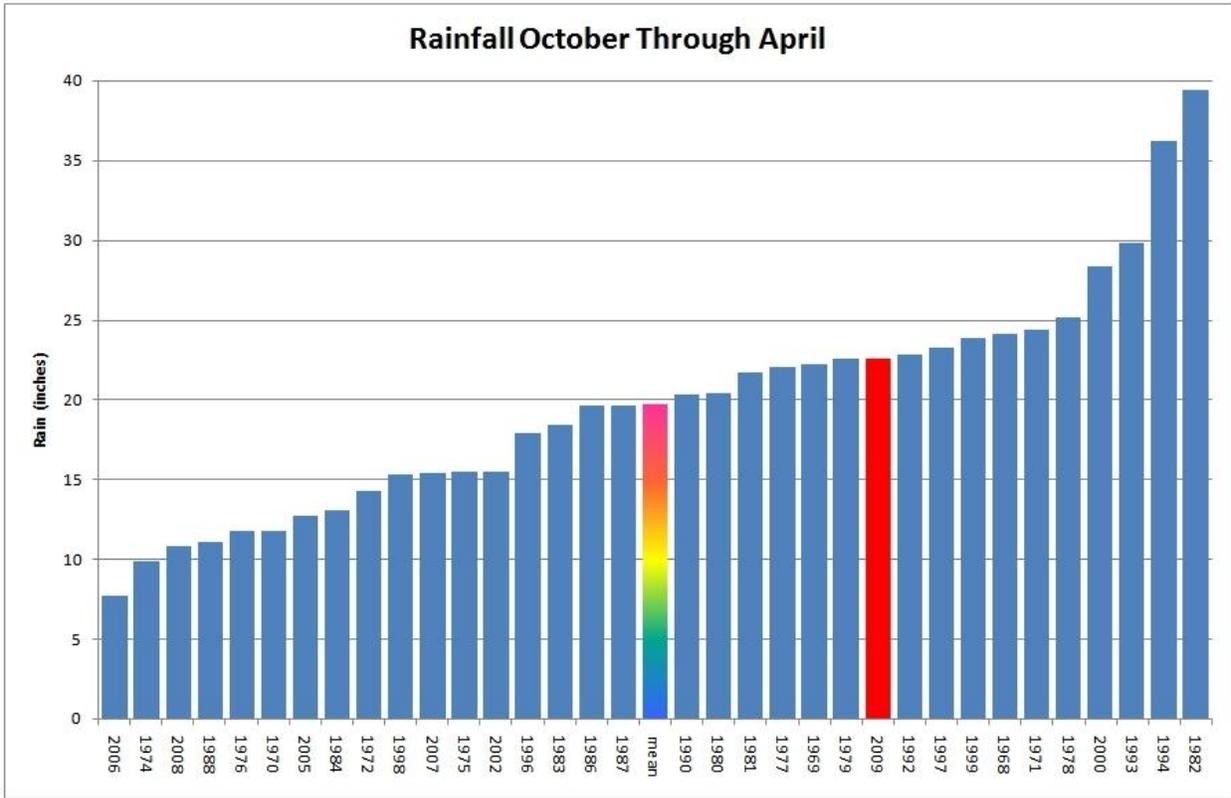


Figure 8b – Rainfall for period of October through April at HFS

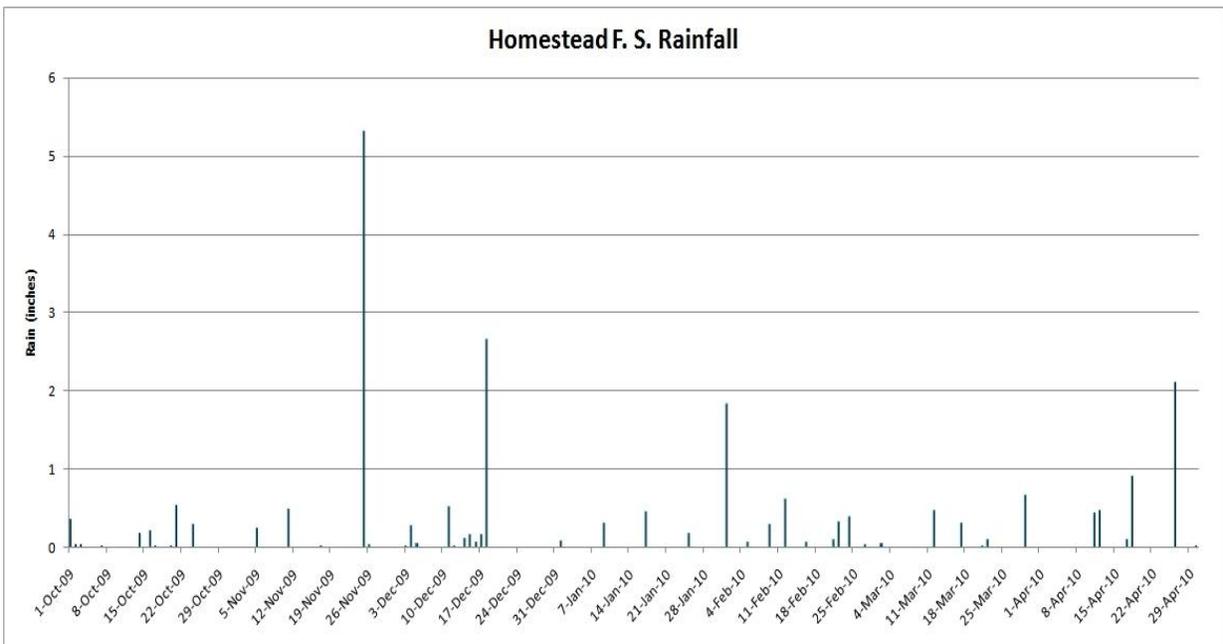


Figure 9 – Daily Distribution of Rainfall at HFS

## V. WATER LEVEL DATA

The next series of Figures will show the headwater stages that occurred at the associated structures for the period of October 1, 2009 through April 30, 2010. An extensive surface and groundwater collection effort is underway by the District. Figure 10 shows the distribution of the monitoring sites.

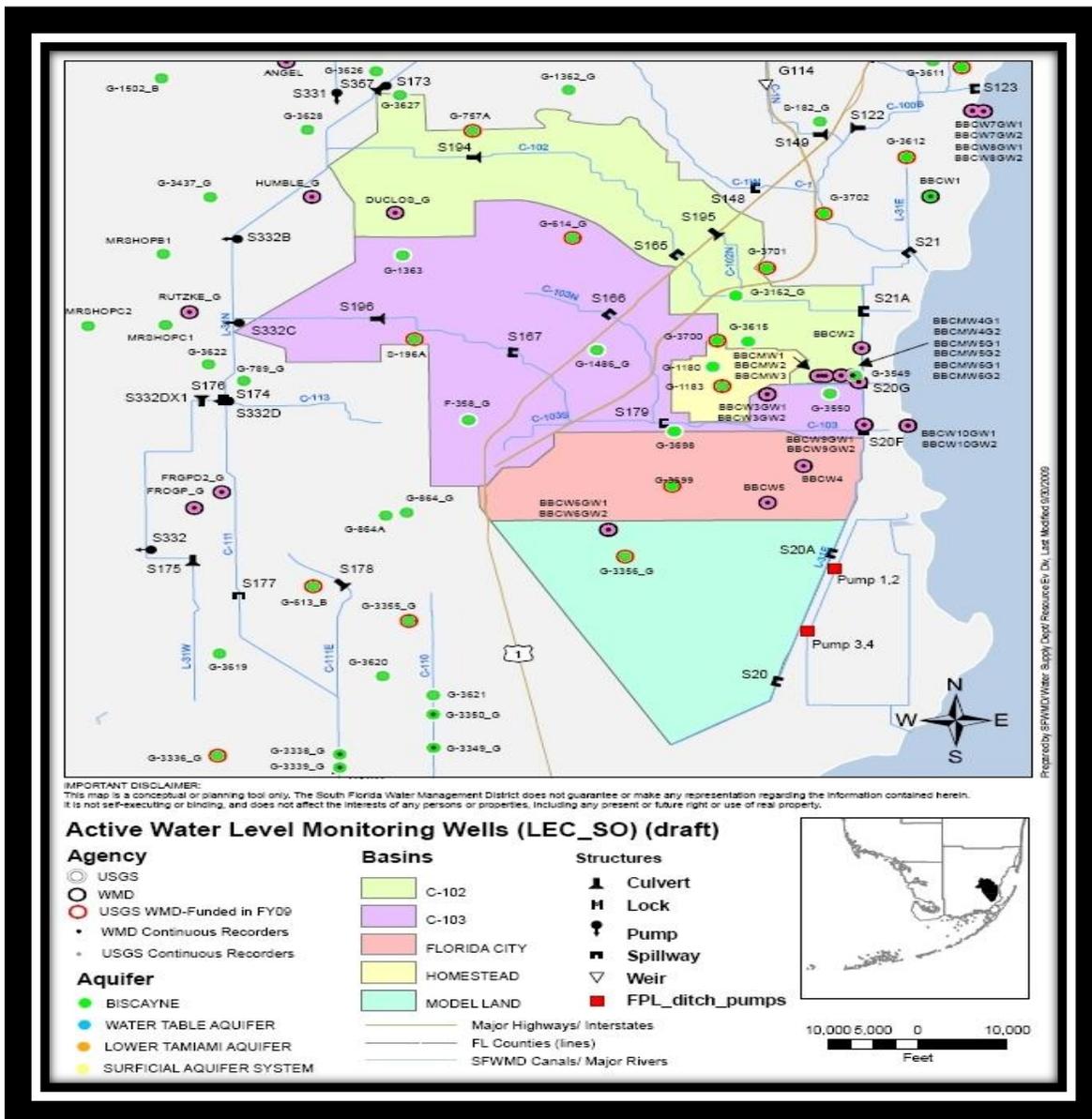


Figure 10 – South Miami-Dade County Monitoring Stations

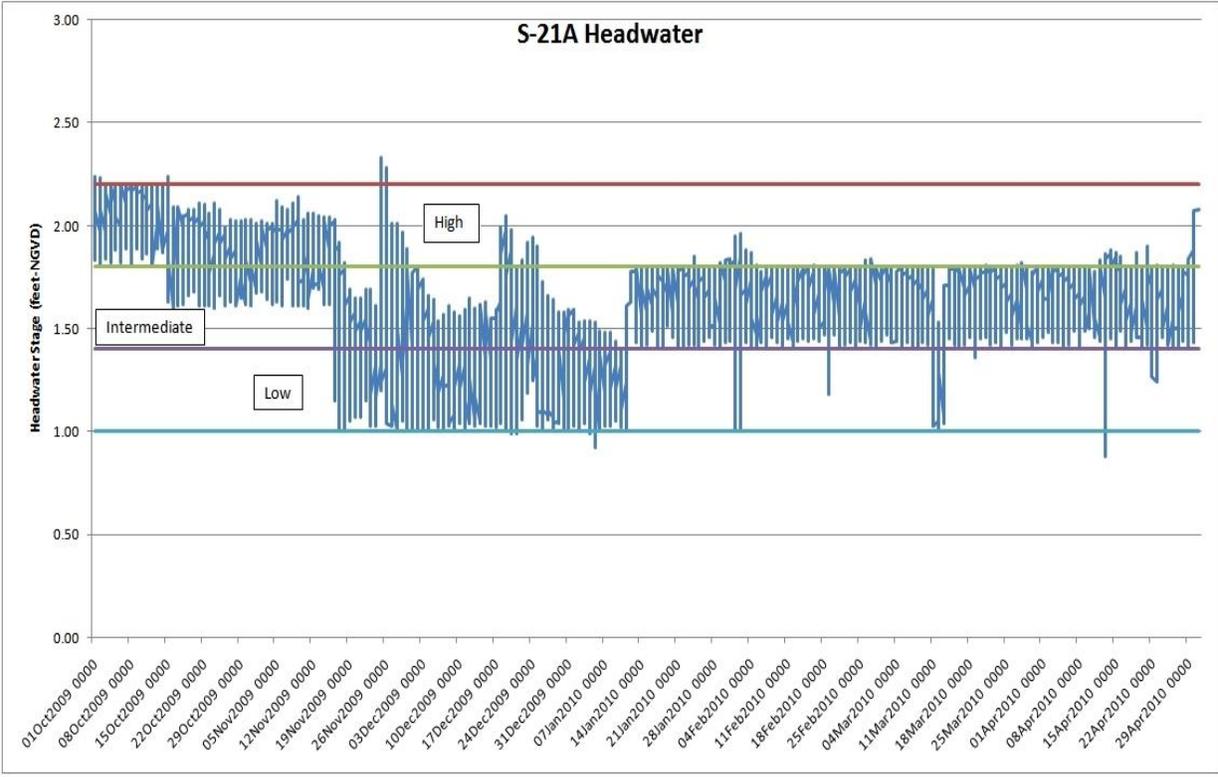


Figure 11 – S-21A Headwater during Draw-down Period

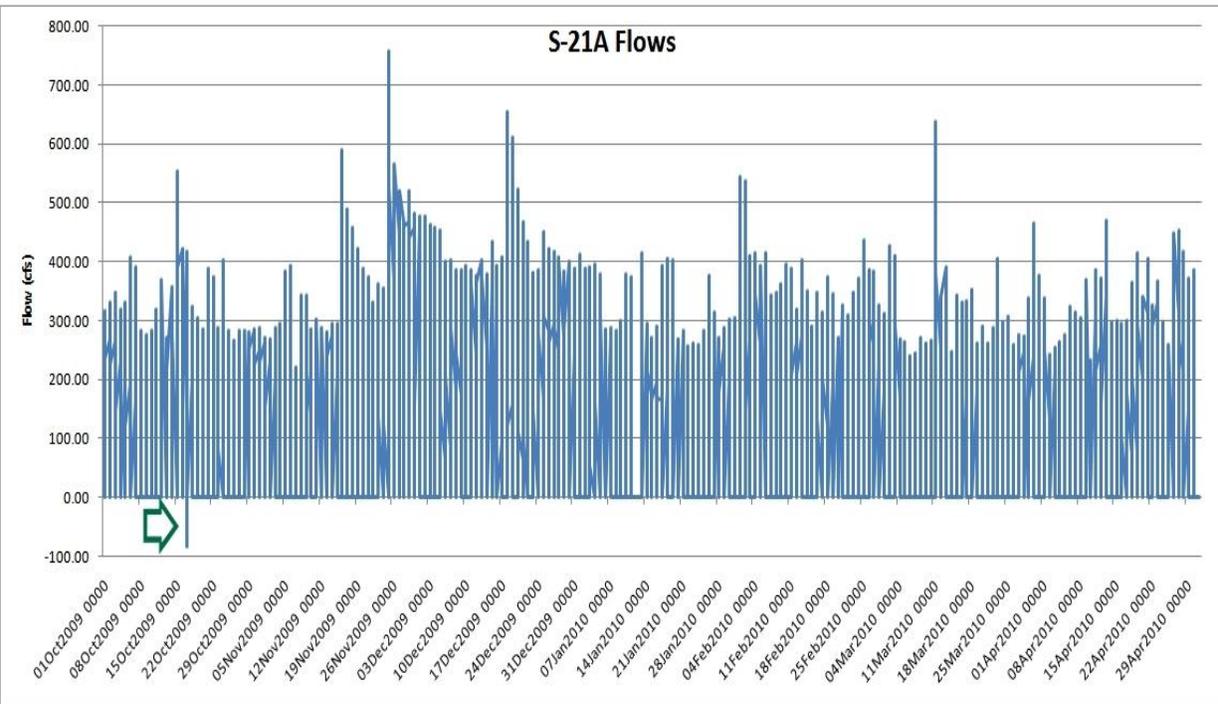


Figure 12 – S-21A Discharges during Draw-down Period

The management of the water levels during this draw-down period in relation to the multiple operating zones can best be viewed on individual plots for the structures. For example, Figure 11 shows the headwater stages held at S-21A in relation to its three normal operational ranges. It is clear to see that the use of an “interim” water level zone of 2.0 to 1.6 feet NGVD helped in the management of the water levels at S-21A such that the minimum amount of water was lost from the basin while balancing the needs of the individual growers. In reality, it can be seen that it was not really necessary to bring the water levels all the way down to the lowest range until the onset of the November 25<sup>th</sup> precipitation event. By lowering the stage by two tenths on October 15<sup>th</sup> the growers were able to get their equipment in and prepare the fields. One positive contributor to this somewhat unique opportunity was the significantly below normal antecedent rainfall season. This way the District water managers were able to balance water resource protection with the local agricultural requirements.

An interesting observation can be made from the discharge data shown in Figure 12. This plot is hourly data retrieved from the USACE web-site. If this were the only data downloaded then someone would get the impression that the gates on S-21A were open during a tailwater/headwater reversal caused by high tides and that a flow of over 80 cfs would have come from the saltwater side into the fresh (headwater) water side. By looking at the data for the month of October using this data (Figure 13) it can also be seen that the tailwater is higher than the headwater with anticipated backflow rates predicted. It can be seen that the tailwater did rise above 2.5 feet NGVD during this period. However, by taking a close look at the telemetry data for the incident it can be seen that there was in reality very little reversal of flow as the gates automatically closed when the high tailwater was measured. The tailwater began to rise above the headwater at 19:57 on October 17<sup>th</sup> and the gates began closing and were fully closed 4

minutes later at 20:01. The point here is simply that assumptions cannot be made about structure operations based upon a limited data set (hourly in this case).

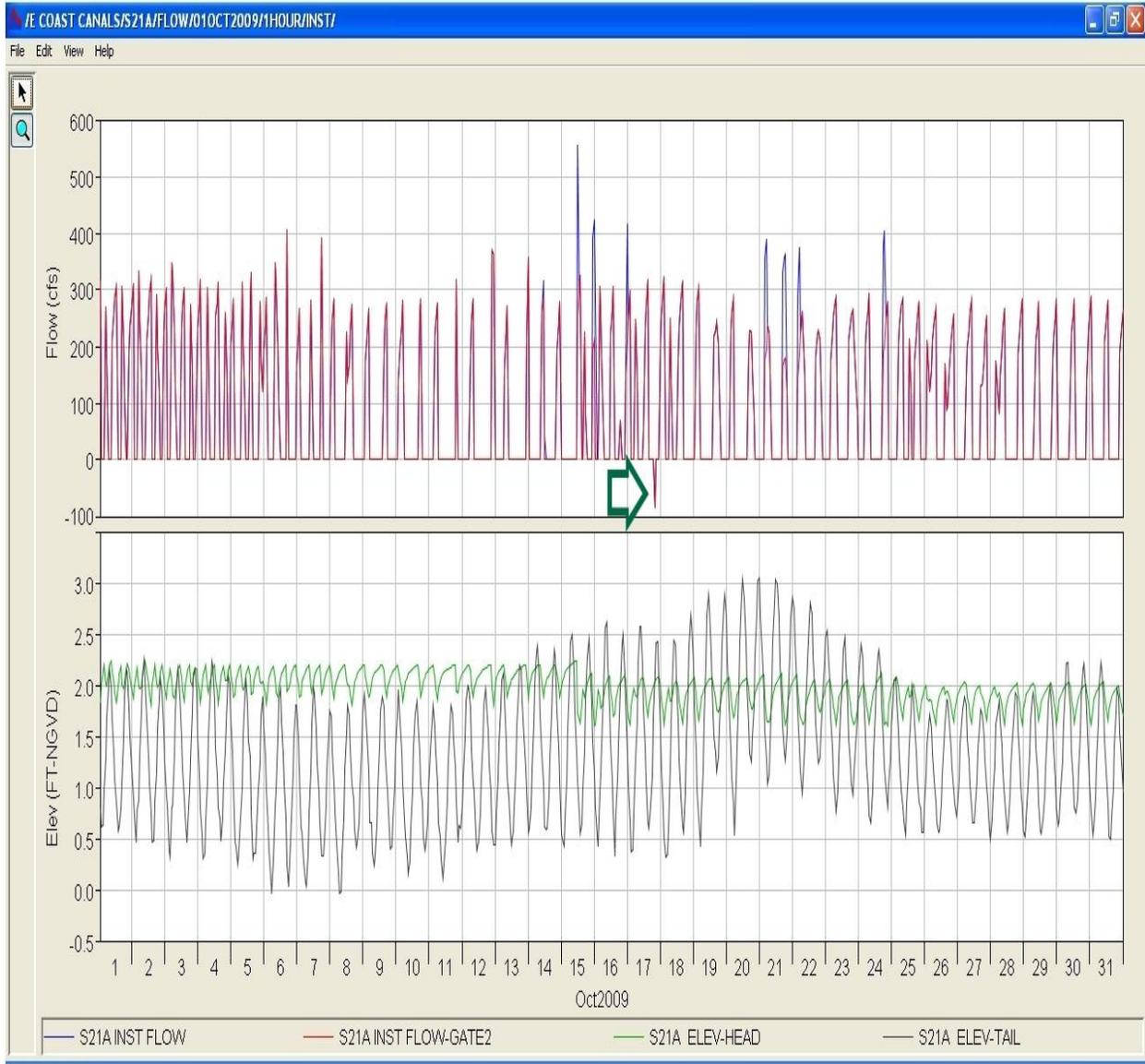


Figure 13 – HEC-DSS plot of S-21A data for October 2009

Figure 14 shows the headwater stages at S-20F for the full period of October 1, 2009 through April 30, 2010. The only unusual period is the morning of January 6<sup>th</sup> when the headwater stage fell below the bottom of the low range for a 7-hour period. There was no recorded precipitation event or written operational order that identified why. There may have

been a malfunction of the gate operator. Some detailed investigation discovered that there was a malfunction in the software (DDSP protocols) that was detected on that day and rectified within a short time period. There were no instances of back-flow as there was sufficient freshwater flow during the period to maintain a positive head balance.

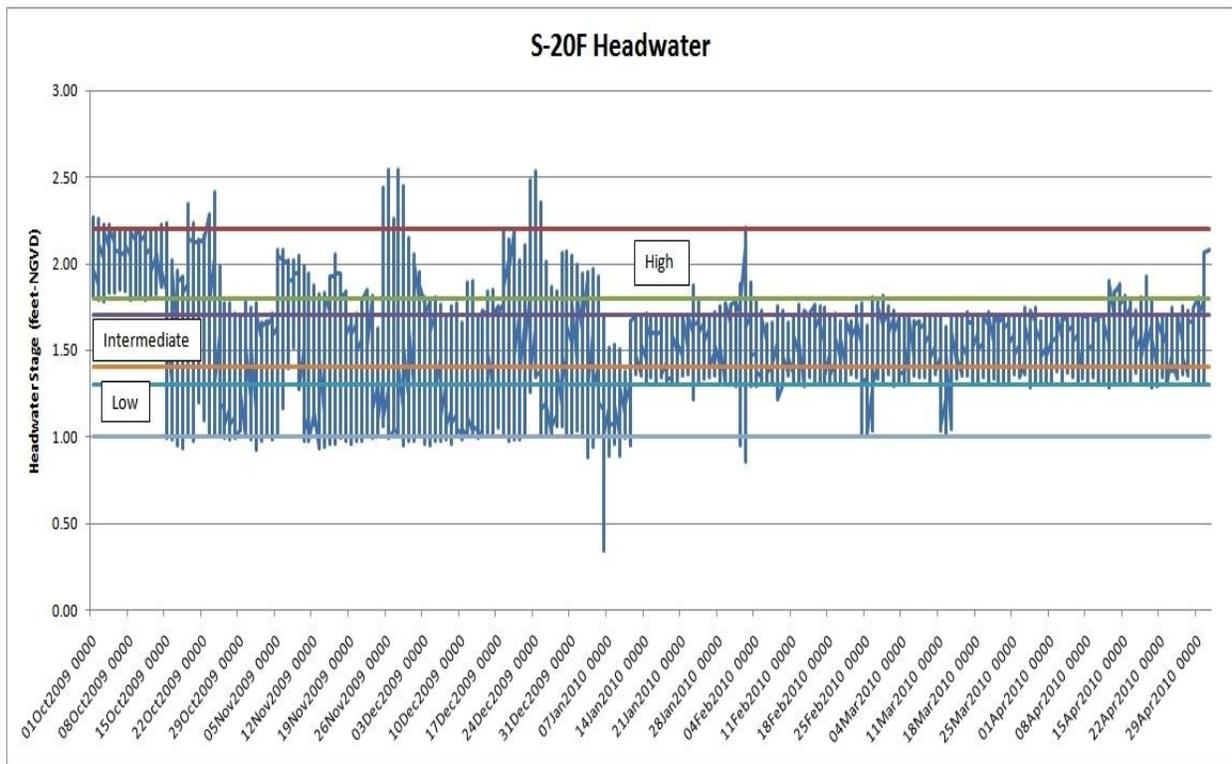


Figure 14 – S-20F Headwater Stages

During the draw-down operations, as can be seen from Figure 14, it was not necessary to pull the stages down to the lowest operational levels because of the below-normal antecedent conditions and the fact that, except for the heaviest rainfall, the operations were adequately managed within the Intermediate Range. There were no complaints received from the agricultural community and the water resources upstream were preserved by these operations. As can be seen in Figure 15, ground water levels responded soon after the rise and fall of the nearby control structure.

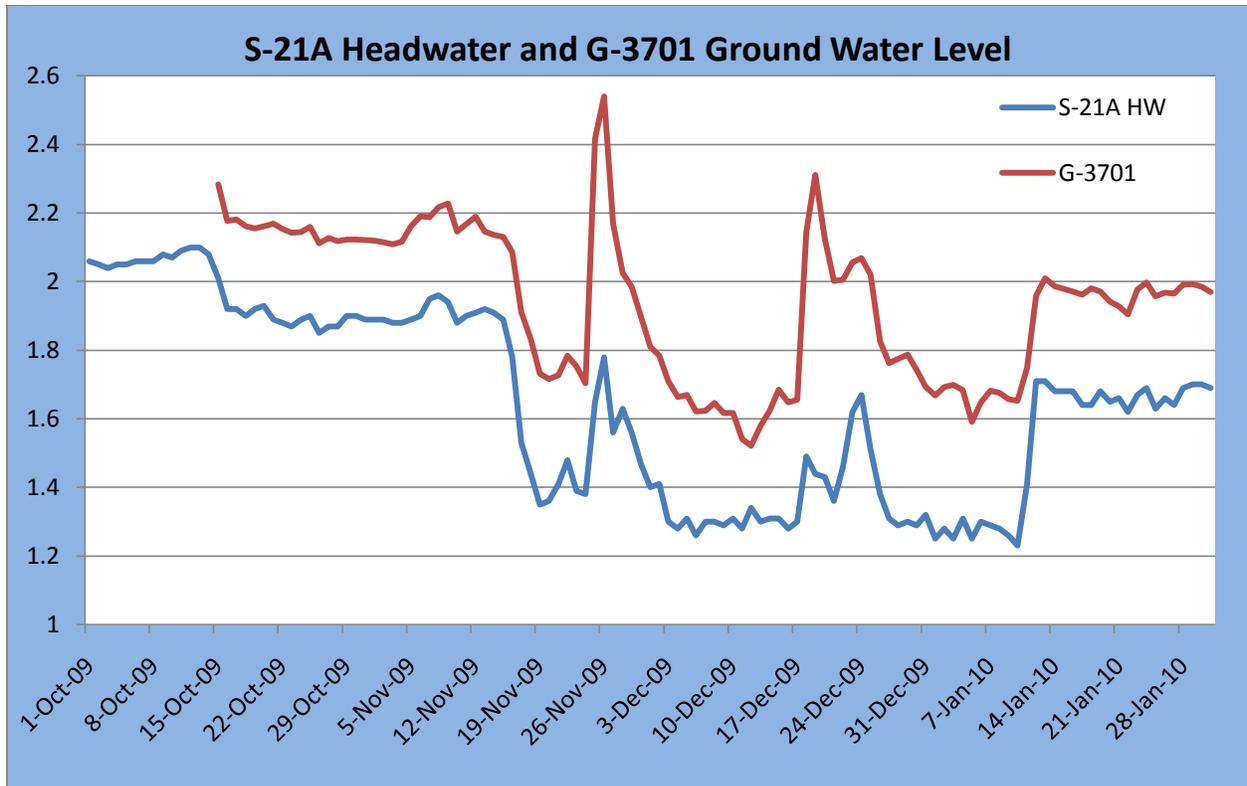


Figure 15 – Relationship Between S-21A and G-3701 Levels

## VI. SUMMARY

The management of the water levels in the South Miami-Dade County area during the period of October 1, 2009 through April 30, 2010 has been presented herein along with supporting data to demonstrate the overall system performance. The water control operations considered both the agricultural needs and the preservation of the water resources of the area with a balancing process. The system skills and experience of the Operation Managers and the Homestead field staff along with the field observations were critical for operating the system to optimize performance. Substantial data has been collected and is available for review. Within the appendices to this report are detailed operational guidelines, operational logs and field inspection photographs.

## APPENDIX A

### Detailed Structure Operations

## **STRUCTURE 20F**

This structure is a reinforced concrete, gated spillway with discharge controlled by three cable operated, vertical lift gates. Operation of the gates is automatically controlled so that the gate hydraulic operating system opens or closes the gates in accordance with the operational criteria. The structure is located near the mouth of Canal 103 at its junction with Levee 31E and about 2000 feet from the shore of Biscayne Bay.

### **PURPOSE**

This structure maintains optimum water control stages upstream in Canal 103; it passes the design flood (40 percent of the Standard Project Flood) without exceeding upstream flood design stage, and restricts downstream flood stages and discharge velocities to non-damaging levels; and it prevents saline intrusion during periods of high flood tides.

### **OPERATION**

This structure will operate to maintain an optimum headwater elevation which varies seasonally from a low during the dry season of 1.4 feet to a maximum during the wet season of 2.2 feet, when sufficient water is available to maintain this level. The automatic controls on gates will function as follows:

#### **High Range**

When the headwater elevation rises to 2.2 feet, the gates will open at six inches per minute;  
When the headwater elevation rises or falls to 2.0 feet, the gates will become stationary;  
When the headwater elevation falls to 1.8 feet, the gates will close.

#### **Intermediate Range**

When the headwater elevation rises to 1.7 feet, the gates will open at six inches per minute;  
When the headwater elevation rises or falls to 1.5 feet, the gates will become stationary;  
When the headwater elevation falls to 1.3 feet, the gates will close.

#### **Low Range**

When the headwater elevation rises to 1.40 feet, the gates will open at six inches per minute;  
When the headwater elevation rises or falls to 1.20 feet, the gates will become stationary;  
When the headwater elevation falls to 1.00 feet, the gates will close.

The selection of the operational range will be based on the field conditions and agricultural activity. The approximate periods for the three modes of operation are:

High Range Operation (April 30th to October 15th)

Intermediate Range Operation (December 30th to April 30th)

Low Range Operation (October 15th to December 30th)

Note: As long as rainfall persists within the basin, the low range setting will remain in effect until the water table within the basin recedes below the root zone of seasonal crops. This operating criteria is used for seasonal agriculture. It does not provide any protection for year-round agriculture below the high range settings, from April 30th to October 15th.

### **Salinity Regulation**

In addition to maintaining optimum upstream fresh water control, as described above under Flood Control Regulation, the automatic controls on this structure have an over-riding control which closes the gates, regardless of the upstream level in the rare event of a high tide, whenever the differential between the head and tailwater pool elevations reaches 0.3 feet.

## **STRUCTURE 21A**

This structure is a reinforced concrete, gated spillway, with discharge controlled by two cable operated, vertical lift gates. Operation of the gates is automatically controlled so that the gate hydraulic operating system opens or closed the gates in accordance with the seasonal operational criteria. The structure is located near the mouth of Canal 102 at its junction with Levee 31E and about a mile from the shore of Biscayne Bay.

### **PURPOSE**

This structure maintains optimum water control stages upstream in Canal 102; it passes the design flood (40 percent of the Standard Project Flood) without exceeding upstream flood design stage, and restricts downstream flood stages and discharge velocities to non-damaging levels; and it prevents saline intrusion during periods of high flood tides.

### **OPERATION**

This structure will be operated to maintain an optimum headwater elevation which varies seasonally from a low during the dry season of 1.4 to a maximum during the flood season of 2.2 feet, when sufficient water is available to maintain this level. The automatic controls on gates function as follows:

#### **High Range**

When the headwater elevation rises to 2.20 feet, the gates will open at six inches per minute;  
When the headwater elevation rises or falls to 2.0 feet, the gates will become stationary;  
When the headwater elevation falls to 1.8 feet, the gates will close at six inches per minute.

#### **Intermediate Range**

When the headwater elevation rises to 1.8 feet, the gates will open at six inches per minute;  
When the headwater elevation rises or falls to 1.6 feet, the gates will become stationary;  
When the headwater elevation falls to 1.4 feet, the gates will close at six inches per minute.

#### **Low Range**

When the headwater elevation rises to 1.40 feet, the gates will open at six inches per minute;  
When the headwater elevation rises or falls to 1.20 feet, the gates will become stationary;  
When the headwater elevation falls to 1.0 feet, the gates will close.

The selection of operational range will be based on field conditions and agricultural activity. The approximate periods for the three modes of operation are:

High Range Operation (April 30th to October 15th)

Intermediate Range Operation (December 30th to April 30th)

Low Range Operation (October 15th to December 30th)

Note: As long as rainfall persists within the basin, the low range setting will remain in effect until the water table within the basin recedes below the root zone of seasonal crops. This operating criteria is used for seasonal agriculture. It does not provide any protection for year-round agriculture below the high range settings, from April 30th to October 15th.

### **Salinity Regulation**

In addition to maintaining optimum upstream fresh water control, as described above under Flood Control Regulation, the automatic controls on this structure have an over-riding control which closes the gates, regardless of the upstream water level in the rare event of a high flood tide, whenever the differential between the head and tailwater pool elevations reaches 0.2 feet.

## **STRUCTURE 179**

This structure is a reinforced concrete, gated spillway with discharge controlled by cable operated, vertical lift gates. Operation of the gates is automatically controlled so that the gate operating system opens or closes the gates in accordance with the operational criteria. The structure is located on Canal 103 about 650 feet west of Tallahassee Road in Southern Dade County.

### **PURPOSE**

This structure maintains optimum upstream water control stages in Canal 103; it passes the design flood (40% of the Standard Project Flood) without exceeding the upstream flood design stage, and restricts downstream flood stages and channel velocities to non-damaging levels.

### **OPERATION**

This structure will be operated to maintain an optimum headwater elevation which varies seasonally. Most of the time, this optimum is 3.5 feet, when sufficient water is available to maintain this level. During the first month of the growing season (October 15 to the end of April), the automatic operation is adjusted to the low setting. And then, depending on weather conditions, the high setting is used. During wet conditions, that is, when the high setting would raise the water table into the root zone, the low setting is used. During the non-growing season, the high setting is used. The automatic controls function as follows:

#### **Low Setting**

When the headwater elevation rises to 3.1 feet, the gates will open at six inches per minute;  
When the headwater elevation rises or falls to 2.9 feet, the gates will become stationary;  
When the headwater elevation falls to 2.7 feet, the gates will close at six inches per minute.

#### **High Setting**

When the headwater elevation rises to 3.9 feet, the gates will open at six inches per minute;  
When the headwater elevation rises or falls to 3.5 feet, the gates will become stationary;  
When the headwater elevation falls to 3.1 feet, the gates will close at six inches per minute.

## APPENDIX B

### Control Room Operational Logs



**"Avoid Verbal Orders"**

[Always Log ALL Water Managers' "Phone-In" Directives Below.]

Pg. 1 of     

Date: 10/15/09

Memo To	Init.	Directives / Remarks	Why	Time	Init.
FTL	PFL	OPEN (6') S144, S145, S146		07:24	<del>NB</del>
WPB	PFL	C-18 LADAL RAISE STRUCTURE		06:41	<del>NB</del>
		crest of ~16.9 at C-14A & C-12		↓	↓
OPPS	PFL	S68MS Gate #2 to 0.40' DDSP on		05:35	JR
↓	↓	S82 BOTH GATES TO 0.15'		↓	↓
↓	↓	S75 OPEN GATE TO 0.30'		↓	↓
↓	↓	S70 GATE #1 TO 0.10'		↓	↓
↓	↓	S38 GATE #1 TO 0.50'		↓	↓
↓	↓	S37B GATE #1 TO 0.20'		↓	↓
OCC	ZC	G342EF set DDSP to M3/5.5/ <sup>14.5</sup> <del>14.0</del> /0.2/0.1		08:24	<del>CB</del>
↓	↓	DDSP on.		↓	↓
clw FS	ZC	G151, G152 set top of the board elevation	C603	08:54	CB
↓	↓	at 18.5		↓	↓
↓	↓	G150 set over gates to 0.3		08:54	CB
DKEE	PFL	S390 PUMP REG SHIFT TODAY &		09:45	CB
↓	↓	FRIDAY. OFF WHEN S.391 HW ≥ 24.1		↓	↓
OCC	ZC	G409 Run pumps to keep TW 13.5-13.8	C414	09:54	CB
		<small>(weekdays only M-F)</small>			
WPB FS	ZC	S319 pump one unit (550 cfs) regular shift		09:58	CB
↓	↓	tomorrow. If HW = 11.0, secure pumping		↓	↓
OCC	WX	S20F set to low DDSP	C603	1006	<del>CB</del>
↓	↓	S179 set to low DDSP		↓	↓
↓	↓	S21A set M3/5.0/2.0/1.6/0.3/0.1		↓	↓
OCC		S40, S41, S155 to High Range		12:45	CB
OCC	PFL	S70 GATE 2 FROM 0.0 TO 0.1		1311	<del>CB</del>
OCC	PFL	S148 CLOSE BOTM GATE		↓	↓



"Avoid Verbal Orders"

[Always Log ALL Water Managers' "Phone-In" Directives Below.]

Pg. 1 of

Date: 11/25/09

Memo To	Init.	Directives / Remarks	Why	Time	Init.
Op	PFL	S179 open 2 @ 1.0'		0502	R
		Let ddsp run site		1	1
Op	PFL	S82 open #1 p ch to .50'		0636	R
		S75 open gate p ch to .50'		1	1
OCC	PFL	S13AN to Normal DDSP open gate to 0.50		07 <sup>30</sup>	R
Home	PFL	S21A open gates (gate off comm 7h)		0746	R
		down		↓	↓
OCC	PFL	S381 open 3 gates to (-11.50)		0749	R
FHL	PFL	S9 Pump to keep Hw 3.50 - 3.00'		↓	↓
OCC	PFL	S29, Custom DDSP, M3, 5, 2, 1.5, 0.5, 0.1		0847	R
OCC	PFL	S13 DDSP → low		0847	R
OCC	PFL	S179 open 2 gates to 3.00 Kpddsp on		08:49	R
WPS 3	AMB	S-6 test pump OK - regular shift	C419	09:05	R
Chenich 3	AMB	G-372 pump regular shift	C427	09:14	R
OCC	AMB	S-40, S-41, S-155 to normal DDSP	C60	09:17	R
WPS 3	AMB	S-362 pump regular shift	C409	09:16	R
OCC	PFL	S179 open 2 gates from 3.00' to 4.00'		0951	R
OCC	PFL	S179 to DDSP / M3 / 1.5 / 2.5 / 2.0 / 0.5 / 0.1		10:06	R
		open gates to 6.0		↓	↓
Hmsl Chenich 3	PFL	S197 open 3 culverts open full		10:00	R
	AMB	G-370 pump regular shift	C427	10:10	R
		G-307 see pumping today		↓	↓
		G-409 will not pump on Thru Sat.		↓	↓
		SUN will pump on Fri.		↓	↓
		G-410 will not pump Thru ~ Sun.		↓	↓



"Avoid Verbal Orders"

[Always Log ALL Water Managers' "Phone-In" Directives Below.]

Pg. 1 of 1

Date: 11/16/09

Memo To	Init.	Directives / Remarks	Why	Time	Init.
WPB	ZC	RUN 1 550 CFS PUMP		0657	KA
1	1	FOR EMISSIONS TEST APPROX 4hr		1	1
Uke	PFI	S136 OPEN 2 gates to 1.0		07:00	M
OPR		S75 close gate to 0.1		↓	↓
OCC	ZC	G161 set all gates to 0.2. DDSP off		0832	RM
WPB FS	ZC	S319 when <sup>pump</sup> emission test starts, siphon to		0837	RM
↓	↓	provide water for the pumping. stop siphon		↓	↓
↓	↓	when <del>S319</del> emission test finishes		↓	↓
clow FS	ZC	G507 secure pumping		1031	RM
OCC	ZC	S351 From 3@1.05 to 3@1.5 DDSP on	C603	10:50	CB
↓	↓	S351 DDSP to M4/1.5/10.6/10.4/0.2/0.1 DDSP on	C603	11:10	CB
OCC	MJ	S21A set DDSP to low range	C603	14:24	RM
OCC	ZC	S363 close gates and cancel DDSP	C409	14:50	CB
↓	↓	when S319 pump emission test ends, set		15:48	CB
↓	↓	S155A DDSP to M4/0.6/8.7/8.6/0.2/0.1 and		↓	↓
↓	↓	turn DDSP on		↓	↓
OCC	PFL	S177 GATE FROM 0.3 to 0.2		17:10	CB
OCC	PFL	S18C BOTH GATES 0.3 to 0.4		17:12	CB
OCC	PFL	S38 DDSP ON		17:05	CB
OCC	PFL	S177 move gate from 0.20 to 0.10		2134	MJ
OCC	ZC	S155A TO HIGH DDSP		22:25	MJ



### "Avoid Verbal Orders"

[Always Log ALL Water Managers' "Phone-In" Directives Below.]

Pg. 1 of 1

Date: 1/11/10

Memo To	Init.	Directives / Remarks	Why	Time	Init.
WIB/FS	PFL	PB Aggrey L8 reservoir open North gate from 0.40' to 0.60 feet.		06:44	CB
OCC	ZC	SSAW move 2 gates to 0.9 DDSP off		06:36	AV
OCC	PFL	SSAE open 2 gates to 0.20 feet		06:43	CB
op	PFL	S70 2 @ .10' to #2 @ closed		07:59	CB
		S75 #1 @ .10'			
		S82 2 @ 0.1' to 0.2'			
OCC	ZC	S150 close gates and cancel DDSP	C409	08:04	RB
OCC	ZC	G56 DDSP to "High", DDSP on		08:14	RB
		S361 pump to keep Hw 10.5 - 10.0	C409	08:35	RB
		At 1/2 6.00, try to get Hw to #10.0. (No flow on Tuesday for 24 hrs for the construction work)			
OCC	ZC	S155A DDSP to "low"	C603	09:12	RB
OCC	MX	S20F set to (intermediate) normal DDSP	C603	10:27	CB
		S21A set to normal DDSP			
		S21 to high DDSP		10:38	RB
SFC/MS	PFL	S60 FROM 0.5 TO 0.1		11:40	CB
OCC	PFL	S63 FROM 0.2 TO 0.0			
OCC	PFL	S57 BOTH GATES 0.9 TO 0.9			
OCC	PFL	S61 FROM 0.3 TO 0.4			
FTL	PFL	S144, S145, S146 OPERATE 6.0' BY 1500 HRS		12:55	RB
OCC	PFL	S38 DDSP ON BOTH GATES TO 0.4'		12:55	RB
OCC	PFL	G160 GATE 1 FROM 0.0 TO 0.1'		12:55	RB



### "Avoid Verbal Orders"

[Always Log ALL Water Managers' "Phone-In" Directives Below.]

Pg. 1 of     

Date: 02/01/2010

Memo To	Init.	Directives / Remarks	Why	Time	Init.
Okce	PFL	S131 Pump regular shift off @ 12.75		0630	R
	PFA	S129 Pump regular shift off @ 12.75		↓	↓
OCC	ZC	S150 Reacture DDSP		0815	RB
↓	↓	S40, S41, S155 DDSP to "Normal" DDSP on	C603	1	1
↓	↓	G384 cancel DDSP. <del>From 2.0</del> Move all gates to 7.0		0827	RS
↓	↓	G259 DDSP to M3/2.0/11.5/11.3/2/1 DDSP on	C409	1	1
↓	↓	S150 Move gates to 5.5 DDSP on	↓	0854	RB
FTL	ML	S9 pump regular shift	C427	0917	<del>RB</del>
claw FS	ZC	G370, G372 pump night shift	C427	0943	RB
WPB FS	ZC	S6, S5A pump night shift	C427	0943	RB
FTL	ML	S13 pump regular shift	C427	1001	<del>RB</del>
↓	↓	S29 set to low DDSP	C603	1015	RB
↓	↓	S26 set to low DDSP	↓	↓	↓
↓	↓	S25 set to low DDSP	↓	↓	↓
↓	↓	S25B set to low DDSP	↓	↓	↓
↓	↓	S93 set to low DDSP	↓	↓	↓
↓	↓	S22 set to	↓	↓	↓
OCC	ML	S20F set to low DDSP	↓	1041	RB
↓	↓	S21A set to low DDSP	↓	1	1
↓	↓	S173 open 1.0' keep DDSP on	↓	1042	RB
OCC	ML	S381 open <sup>(det/late)</sup> gates to 3 @ -11.5'	C427	1052	<del>RB</del>
OCC	ML	<del>S30 set to low DDSP</del>	↓	↓	↓
↓	ML	G54 set to low DDSP	↓	1114	RB
1154	ZC	S370 pump rest of 999 shift + pump night shift	C427	1154	<del>RB</del>





**"Avoid Verbal Orders"**

[Always Log ALL Water Managers' "Phone-In" Directives Below.]

Pg. 1 of     

Date: 2/24/10

Memo To	Init.	Directives / Remarks	Why	Time	Init.
OCC	PFL	S59 Reduce gate fr 2.5 to 2.0		0740	RB
OCC	PFL	S61 Reduce gate fr 4.0 to 3.5		0740	RB
OCC	ZC	S40, S41, S15 DDSP to "Normal". DDSP on	C603	0936	MB
↓	↓	G56 Move all available gates to 0.5. DDSP on	↓	Divers @ Site	
↓	↓	<del>G56</del> G374 DDSP to M3/7.5/14.5/14.0/0.2/0.1. DDSP on	C409	0940	HB
↓	↓	S351, S352, S354 DDSP off	C603	0941	HB
OCC	ZC	G343EA DDSP max gate to 0.5 DDSP on	C409	1033	MB
OCC	PFL	<b>S20P LOW REGIME</b>		1036	RB
PFL	MI	S9 pump night shift	C427	1137	MB
↓	↓	S13 pump night shift	↓	1153	MB
OCC	ZC	S155A DDSP to "Low". DDSP on	C603	1140	MB
clwFs	ZC	G370, G372 pump extended regular shift today	C427	1203	MB
WIBFs	ZC	S6 pump extended regular shift today	C427	1204	MB
OCC	ZC	G56 DDSP to M3/5.0/8.2/7.5/0.3/0.1.	C603	1804	MB
↓	↓	DDSP on	↓		↓
OCC	MI	S381 open to -11.5' (deflate)	C603	1322	MB
clwFs	ZC	G372 <del>is</del> secure pumping now	C427	1712	MB
OCC	MI	S13AW set ddsp M3/1.00/3.0/2.5/1.0/1.0		19:46	MB
↓	↓	and open 2 gates to 0.50'		↓	↓



### "Avoid Verbal Orders"

[Always Log ALL Water Managers' "Phone-In" Directives Below.]

Pg. 1 of     

Date: 2/26/10

Memo To	Init.	Directives / Remarks	Why	Time	Init.
OCC	ZC	G353AB cancel DDSP due to work at STA-6.		06:57	CB
				↓	↓
OCC	ZC	G396 cancel DDSP due to work at STA-6.		06:57	CB
				↓	↓
OCC	ZC	G352 cancel DDSP due to work at STA-6.		07:05	CB
				↓	↓
OCC	PFL	S82 open 2 gates to 0.10		07:29	CB
OCC	PFL	S131, S129 pump reculture shift		07:31	CB
		today off 12.75 feet		↓	↓
OCC	PFL	S57 both gates fr 3.0 to 3.5'		07:55	RB
	PFL	S65 Reduce gates 2,3,4,5 to 1.5'		07:57	RB
OCC	MJL	S381 close gates to 5.5' (inflate)	CG03	08:20	JM
OCC	ZC	G351, G352, G354 <sup>Turn</sup> DDSP on	CG03	08:27	RB
OCC	ZC	STA 6 <del>Route</del> Remote control of structures between 7:00 am <del>and</del> 17:00 pm not available during weekdays (Mon.-Fri). Remote control available between 17:00 pm and 7:00 am weekdays and all time weekend. During the period of no-remote control, cancel DDSP. When remote control is available, restore DDSP at G396.		09:24	JM
				↓	↓
<del>HOME</del> OCC	MJL	S331 secure pumping, revert to siphoning and keep hws 5.0' ~ 5.5'	CG03	9:19	JM
			↓	↓	↓
OCC		S20F to normal DDSP	↓	9:19	JM
OCC	ZC	when S6 pumps, set		10:55	RB

FAP JM



### "Avoid Verbal Orders"

[Always Log ALL Water Managers' "Phone-In" Directives Below.]

Pg. 2 of 3

Date: 03/11/2010

Memo To	Init.	Directives / Remarks	Why	Time	Init.
066	PFL	S13 From close to 1.0		1457	ad
066	PFL	S62 From close to 0.5			ad
066	PFL	S65 From 0.3 to 1.0 FOR Gates 2,3,4,5			ad
op&ad	cm3	G-56 cancel DOSP, open 2 @ 2'	C603	1556	W
op&ad	cm3	S-20F, S-21A to low DOSP	C602	16 <sup>30</sup>	W
		(consult with Scott based on rain forecasted)		↓	↓
WDB	ML	S319 pump regular shift tomorrow	C227	16 <sup>31</sup>	M.
OPR	PFL	S179 to Low Range		1645	W
opr	PFL	S99 gate from 1.7 to 4.0		17 <sup>00</sup>	W
		↓ S61 gate from 2.5 to 6.0			↓
Lakt	PFL	S65 gates 2,3,4,5 from 1.0 to 2.0			↓
		Removal S61A of gate changes @ S65			↓
op&ad	cm3	S-97 2 @ 0.5 to 2 @ 1'	C603	17 <sup>26</sup>	W
		set site to normal DOSP		↓	↓
		G-56 to normal DOSP		↓	↓
S61 gate	WDB	S61 to main gate to 5.0' due to bad control relay.		1845	W
SCC	WDB	S99 to Normal depth		2027	W
		↓ S61 normal depth			↓
		↓ S62 main gate to 1.0 ft			↓
		↓ S63 main gate to 2.0 ft			↓
		↓ S79 change to 17.3, 3.20, 20, 1A, 50, 0.30, 10'			↓
	MI	S155 All gates to 1.0, DOSP ON		1117	RB
	MI	S155A All gates to 2.8, DOSP ON		1117	RB



**"Avoid Verbal Orders"**

[Always Log ALL Water Managers' "Phone-In" Directives Below.]

Pg. 2 of     

Date: 3/13/2010

Memo To	Init.	Directives / Remarks	Why	Time	Init.
FTL	PFL	S120 extended shift until 1800. Pump regular shift on Sunday	C427	09 <sup>11</sup>	M
		S <sub>9</sub> secure End regular shift.			
		S13 secure End regular shift.			
Oke	PFL	S135 pump regular shift. off 13.25	C427		
		S127 pump regular shift off 13.30.			
		S131 N.S			
		S129 N.S			
occ	GH	S49 set normal regimen.		09:40	CB
occ	MI	S169 close gates and cancel Ddsp		09:45	CB
occ	GH	S20F S21A To normal Ddsp		10 <sup>09</sup>	M
Oke	PFL	S135, S127, S133 N.S		10 <sup>27</sup>	M
		S131 extended shift til 18 <sup>00</sup>			
clew	MI	S2, S3 pump night shift	C427	11 <sup>50</sup>	CB
clew	MI	G370, G372 pump night shift	C427	11 <sup>50</sup>	CB
FT/Low	MI	S8 secure after regular shift today	C409	11 <sup>50</sup>	M
WPB	MI	S6, S5A, and S31A pump night shift	C427	11 <sup>52</sup>	CB
WPB	MI	G335, G310, and S36Z pump night shift	C409	11 <sup>52</sup>	CB
clew	MI	S4 pump night shift	C427	11 <sup>50</sup>	CB
occ	MI	S36SA set M3/2.0/12.50/12.0/a20/0.10		12 <sup>04</sup>	CB
occ	PFL	S49 gate 1 to 100 Ddsp on		15 <sup>12</sup>	M
Rise/Lock	PFL	S6S increase gates 1 to 5 e 3.10' to 1 to 5 e 4.0'		15 <sup>20</sup>	CB
LUCAS CONST	PFC	S49 close #2 gate from 1.50' to 0.50'	C603	17:05	PK
occ	PFC	S13AW increase max. from 2.0 to 3.0'		16.45	SK
↓		open both gate from 2.0 to 2.5'			

## APPENDIX C

### Field Inspection Documentation



October 7, 2009



November 9, 2009



November 25, 2009



January 11, 2010



February 3, 2010

SITE 1



October 7, 2009



November 9, 2009



November 25, 2009



December 29, 2009



January 11, 2010



February 3, 2010

## Site 2



October 7, 2009



November 9, 2009



November 25, 2009



December 29, 2009



January 11, 2010



February 3, 2010

**Site 3**