Appendix 5-7: Calculation Methodology for Estimating Flow and Total Phosphorus Loads and for Determining Effective Treatment Areas for the STAs

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EFFECTIVE TREATMENT AREA ESTIMATES

The effective treatment area equates to acreage within the flow path and which contains the treatment vegetation, while total area of the project site includes canals, levees, control structures and all other areas that are not directly removing total phosphorus (TP). Effective treatment area is based upon the stage-area relationship derived from topography data and is the wetted area corresponding to the target stage. Target stage is estimated as the average ground elevation in a cell plus the target depth. Typically, the total area is about 15 percent larger than the effective treatment area.

Additionally, the Water Year 2008 (WY2008) (May 1, 2007–April 30, 2008) effective treatment areas for each Stormwater Treatment Area (STA) were estimated based on (1) whether the STA or STA cell was able to discharge water, (2) an assessment of the health and stability of the vegetation within each treatment cell, and (3) review of recorded flow measurements. An STA or STA cell can typically discharge water once net improvement water quality (start-up) tests are completed; however, an STA may be considered offline until inflows and/or outflows have occurred (i.e., if operational constraints exist or if it is recovering from or undergoing vegetation reestablishment following construction or rehabilitation efforts).

Prior to WY2008, the acreage of a treatment cell was included in the effective treatment area estimates if the cell was able to receive inflow, regardless of whether there was outflow. In WY2008, the treatment cell was considered to be online when the cell was able to receive inflow and when the cell had discharges considered to be proportional to the expected amounts. For some STAs, the total effective treatment area used to calculate the time-weighted WY2008 effective treatment areas shown in this appendix have been updated based on best available information and may be different than what is contained in permits and/or operation plans. The permits and/or operation plans will be updated as appropriate for consistency with the updated effective treatment area estimates.

WY2008 TIME-WEIGHTED EFFECTIVE TREATMENT AREA ESTIMATES

STA-1E = 4,024 acres. The effective treatment area includes the areas of the central (1,986 acres [ac]) and western (2,038 ac) flow-ways. The eastern flow-way (1,108 ac) was not included as effective treatment area during WY2008 due to the operational restrictions of the U.S. Army Corps of Engineers (USACE) Periphyton Stormwater Treatment Area (PSTA) Research Project. Minor discharges from the eastern flow-way occurred due to USACE requests to lower water levels for the PSTA Project; these discharges accounted for ~0.5 percent of the total outflows of STA-1E during WY2008.

STA-1W = 5,289 acres. The effective treatment area was calculated to incorporate flow-ways being offline for recovery activities during portions of WY2008. Soil stabilization activities and vegetation maintenance and rehabilitation activities were performed within the eastern and western flow-ways from May 2007 through mid-September 2007. As a result, the eastern and western flow-ways were not included in the effective treatment area calculation for portions of WY2008. Details of the calculation are provided below.

- May 1, 2007–August 26, 2007: The northern flow-way (2,855 ac) was online and the eastern and western flow-ways were offline.
- August 27, 2007–September 17, 2007: The western flow-way (1,299 ac) was online and discharges began on August 27, 2007. The northern flow-way was online. The eastern flow-way was offline.
- September 18, 2007–April 30, 2008: The eastern flow-way (2,516 ac) was online and discharges began on September 18, 2007. The northern and western flow-ways were online.
- Effective area calculation for WY2008 = (2,855 ac * 118 days + 4,154 ac * 22 days + 6,670 ac * 226 days)/366 days = 5,289 ac.

STA-2 = 6,712 acres. The effective treatment area was calculated to incorporate Cell 4 being offline during portions of WY2008. While Cell 4 passed start-up in September 2007, discharges did not begin until February 2008.

- May 1, 2007–February 18, 2008: Cells 1-3 (6,388 ac) were online and Cell 4 (1,902 ac) was offline.
- February 19, 2008–April 30, 2008: Entire STA (Cells 1-4) were online.
- Effective treatment area calculation for WY2008 = (6,338 ac * 294 days + 8,240 ac * 72 days) /366 days = 6,712 ac

STA-3/4 = 16,543 acres. The entire STA was considered effective treatment area.

STA-5 = 4,110 acres. The effective treatment area included the areas of the northern (2,055 ac) and central (2,055 ac) flow-ways. The southern flow-way (1,985 ac) was not included as effective treatment area as it had not passed start-up as of the end of WY2008.

STA-6 = 870 acres. The effective treatment area included the areas of Cell 3 (245 ac) and Cell 5 (625 ac). While Section 2 (1,387 ac) passed start-up in August 2007, it was not included as effective treatment area as it had no inflows or outflows during WY2008.

CALCULATION OF THE STA FLOWS AND TP LOADS

The TP loads in surface water inflow and outflow were calculated for each STA using two applications of the Nutrient Load Program, one was a Microsoft® Excel VBA application (Reardon and Germain, 2005) and the other was a web-based JAVA application that accesses DBHYDRO, the District's water quality and hydrologic database. Flow that moves in the opposite direction than intended is termed negative or reverse flow. Both positive and negative flows at water control structures were used in these calculations. The STA flow volumes were based on surface water daily average flow and the TP loads were calculated using flow or time-proportional auto-sampler data. If auto-sampler data was not available, then TP data from grab samples collected during flow events were used instead. The combination of stations that were used to estimate the overall STA inflow and outflow volumes and TP loads are listed in **Table 1** along with the specific station names used to query the databases.

STA-6 LOAD CALCULATIONS FOR WY2008

Loads for STA-6 Section 2 could not be calculated for WY2008 because (1) flow data was not available for this period and (2) water quality grab sampling at the inflow and outflow sites was begun in July 2007. Prior to completion of Section 2, the G-600 structure was the designated STA-6 inflow site for flow and water quality data. When Section 2 was built, new water control structures were installed (G-353A–C), replacing G-600. Flow and water quality monitoring at G-600 was discontinued in September 2007 when a plug was constructed in the inflow canal in February 2007, stopping flows from going into STA-6.

Inflow load estimates were calculated for Cells 3 and 5 by using water quality data from the new inflow structure G-353B and flow data from G-601, G-602, and G-603 because there was no flow data available for WY2008 at G-353B and no water quality data for G-601, G-602, or G-603. Loads for outflow structures G-393B and G-354C from Cells 3 and 5 were calculated using the water quality concentrations from these structures along with the combined flows from G393A–C and G354A–C as they have in the past.

Table 1. Water quality and flow stations used to calculate total phosphorus (TP) load for each STA. The station names are listed as they appear in the South Florida Water Management District's hydrological and water quality database (DBHYDRO).

STA-1E			
Inflow Calculation = S319_P + G311_S + S361_P Outflow Calculation = S362_P Diversion Calculation = G300_S			
Flow Station Name	**Preferred DBKEY**	**Source DBKEY**	**WQ Station Name**
S319_P	TP366	SD029	S319
S361_P	TP368	T0904	S361
G311_S (when positive)	TP367	TA933	G311
G311_S (when negative)	TP367	TA933	S319
S362_P	TP369	T0897	S362
G300_S (when positive)	TA411	KD315	G300
STA-1W			
Inflow calculations = G-302_S Outflow Calculation = G251_P + G310_P Diversion Calculation = G301_S			
Flow Station Name	**Preferred DBKEY**	**Source DBKEY**	**WQ Station Name**
G302_S	JW221	JJ806	G302
G251_P	JW222	15848	ENR012
G310_P	M2901	PK919	G310
G301_S (when positive)	TA412	JJ809	G301

Table 1. Continued.

STA-2

Inflow = S6_P + G328_P – G328I_P – G328I_C – G338_C – G339_S
Outflow = G335
Diversion Calculation = G338_C + G339_S

Flow Station Name	Preferred DBKEY	Source DBKEY	WQ Station Name
S6_P	15034	06741	
G328_P	J0718	MQ903	S6 G328
G328I_P		TA605	G328R
G328I_C		TA607	G328R
G338_C (when positive)		MC705	S6 (Grab)
G338_C (when negative)		MC705	Grab sample at S10D
G339_S (when positive)		MC706	S6
G339_S (when negative)			Grab sample at G339 or G335
G335_P	N0659	LG726	G335

STA-3/4

Inflow = G-370 + (G372 - G372HL)
Outflow = G376A-C_T+G376D-F_T+ G379A-C_T+G379D-E_T+G381A-B_T + G381C-F_T
Diversion calculations = G371_S+G-373_S

Flow Station Name	Preferred DBKEY	Source DBKEY	WQ Station Name
G372	TA437	T0975	G372
G372HL	TS285		
G372 - G372HL			G372
G376A-C_T	TA445		G376B
G376D-F_T	TA446		G376E
G379A-C_T	TA449		G379B
G379D-E_T	TA450		G379D
G381A-B_T	TA447		G381B
G381C-F_T	TA448		G381E
G371 (if positive)	TS261	TA936	G371
G373 (if positive)	TS260	TP345	G373

Table 1. Continued.

STA-5			
Inflow = G-342A_C +G342B_C +G342C_C +G342D_C Outflow = G-344A_C +G-344B_C +G-344C_C +G-344D_C			
Flow Station Name	**Preferred DBKEY**	**Source DBKEY**	**WQ Station Name**
G342A_C	J6406	JJ111	G342A
G342B_C	J6398	JJ116	G342B
G342C_C	J6407	JJ125	G342C
G342D_C	J6405	JJ126	G342D
G344A_C	J0719	JJ117	G344A
G344B_C	J0720	JJ118	G344B
G344C_C	J0721	JJ119	G344C
G344D_C	J0722	JJ120	G344D
STA-6			
Inflow prior to WY2008 = G600_P WY2008 Inflow = G601 + G602 + G603 Outflow = G393B_C and G354_C			
Flow Station Name	**Preferred DBKEY**	**Source DBKEY**	**WQ Station Name**
G601	J5566		G353B
G602	J5567		G353B
G603	J5568		G353B
G354_C	MC958	J0939	G354C
G393_C	MC959	J5569	G393B