

Table 8.1. Nutrient loading figures for each sub-watershed within the Caloosahatchee Watershed. Please refer to Figure 8.1 for the locations of these sub-watersheds. Figures are provided for total nitrogen (TN) and total phosphorus (TP) in units of metric tons per year (mt/yr). Data were obtained from the Caloosahatchee River Watershed Protection Plan (2009).

Sub-watershed	Annual TN load (mt/yr)	Annual TP load (mt/yr)
Lake Okeechobee	1,950.9	104.46
S-4	93.0	13.58
East Caloosahatchee (S77 to S78)	460.4	41.26
West Caloosahatchee (S78 to S79)	1,121.9	118.29
Tidal Caloosahatchee (S79 to Shell Point)	863.6	118.22
Coastal (Shell Point to Causeway)	360.8	34.77
Total	4,850.6	430.65

Table 8.2. Average nutrient loads in metric tons/year (mt/yr) at S-77, S-78, S-79 in the Caloosahatchee (C-43) Basin (based on data from SFWMD DBHYDRO). Table adapted from SFWMD (2005).

Parameter	S-77	S-78	Increase (mt/yr)	S-79	Increase (mt/yr)
TN	1,087	1,287	210	2,635	1,338
TP	44.8	91.6	46.8	236	144.4
Period of Record	1973-2003	1998-2003			1981-2003

Table 8.3. Estimated 2000 existing water and nutrient loads within the Caloosahatchee River/Estuary Watershed Basin (from USACE and SFWMD 2005). Table adapted from SFWMD (2005).

Watershed Source	Flow (hm <sup>3</sup> /yr)	TN load (mt/yr)	TP load (mt/yr)
Lake Okeechobee	680	1,127	48
Caloosahatchee (above S-79)	988	2,002	284
Agriculture	640	1,469	218
Urban/Disturbed	129	260	39
Upland Forest	89	97	4
Wetland/Water	130	176	23
Caloosahatchee (below S-79)	493	836	116
Agriculture	101	187	25
Urban/Disturbed	270	503	77
Upland Forest	57	63	3
Wetland/Water	65	83	11
Total Watershed	2,161	3,965	448

Table 8.4. Total nitrogen (TN) and phosphorus (TP) loadings for discharges into the Tidal Caloosahatchee during dry and wet season. Values are given as kilograms per day (kg/d) as reported by ERD (2003) and as metric tons per year (mt/yr) as reported elsewhere in this section of the report. The % increase between dry and wet season loadings is also provided for each input. “nd” indicates that the percentage could not be determined. The % of total discharges for the wet season is also calculated.

Site	dry season		wet season		dry season		wet season		% increase (dry to wet)		% of total (wet season)	
	TN	TP	TN	TP	TN	TP	TN	TP	TN	TP	TN	TP
	(kg/d)	(kg/d)	(kg/d)	(kg/d)	(mt/yr)	(mt/yr)	(mt/yr)	(mt/yr)				
Trout Creek	2.8	0.2	80	9.7	1	0.1	29.2	3.5	2757%	6353%	97%	98%
Telegraph Creek	8.5	0.3	329	24.1	3.1	0.1	120	8.8	3766%	8210%	97%	99%
Popash Creek	3.4	0.8	75	12.1	1.2	0.3	27.4	4.4	2112%	1376%	96%	94%
Daughtrey Creek	4.2	1.3	111	10.8	1.5	0.5	40.5	3.9	2556%	724%	96%	89%
Powell Creek	0	0	12.8	1.9	0	0	4.7	0.7	nd	nd	100%	100%
Hancock Creek	0.5	0.2	2.31	0.4	0.2	0.1	0.8	0.1	344%	64%	82%	67%
Billy Creek	-0.3	-0.1	25.3	5.5	-0.1	-0.04	9.2	2	8624%	5380%	101%	102%
Whiskey Creek	0.3	0.02	19	2.4	0.1	0.01	6.9	0.9	6233%	12050%	98%	99%
Orange River	97.9	4.2	356	26.2	35.7	1.5	130	9.6	264%	527%	78%	86%
S79	2,408	355	11,051	1,040	879	129.6	4,034	380	359%	193%	82%	75%
Waterway Estates STP	3.7	0.2	5.5	0.3	1.4	0.1	2	0.1	47%	63%	60%	60%
Fort Myers South STP	40	8.3	108	15.8	14.6	3	39.4	5.8	170%	90%	73%	66%
Fiesta Village STP	5	0.3	7.7	0.7	1.8	0.1	2.8	0.3	54%	119%	61%	70%
Fort Myers Central STP	28.7	3.2	81.6	4.8	10.5	1.2	29.8	1.7	184%	49%	74%	60%
Total (or average %)					950	136	4,476	421	2113%	2708%	85%	83%

Table 8.5. Nutrient loading figures total nitrogen (TN) and phosphorus (TP in metric tons per year (mt/yr) for the Tidal Caloosahatchee Watershed (from CHNEP 1999). Each sub-watershed refers to a location shown on Figure 8.2.

Sub-watershed	TN (mt/yr)	TP (mt/yr)
Pine Island Sound/Matlacha Pass	236	70
Telegraph Swamp	77	15
Orange River	201	54
Lower Caloosahatchee	391	83
Total	905	221

Table 8.6. Total nitrogen (TN) and phosphorus (TP) loading (mt/yr and %) of the various land use activities within the Pine Island Sound/Matlacha Pass sub-watershed (data from CHNEP 1999).

Land use type	TN		TP	
	mt/yr	%	mt/yr	%
Residential	29	12%	5	6%
Commercial	3	1%	0	1%
Industrial	36	15%	6	9%
Mining	1	0%	0	0%
Utilities, other	1	0%	0	0%
Range lands	93	39%	46	67%
Barren lands	2	1%	0	0%
Pasture	5	2%	2	3%
Groves	1	0%	0	0%
Feedlots	1	1%	0	0%
Nursery	1	0%	0	0%
Row and field crops	1	0%	0	1%
Upland forests	63	27%	9	13%
Total	236	100%	69	100%

Table 8.7. Total nitrogen (TN) and phosphorus (TP) loading (mt/yr and %) of the various land use activities within the Telegraph Swamp, Orange River, and Lower Caloosahatchee sub-watersheds (data from CHNEP 1999).

Land use type	Telegraph Swamp				Orange River				Lower Caloosahatchee			
	TN		TP		TN		TP		TN		TP	
	mt/yr	%	mt/yr	%	mt/yr	%	mt/yr	%	mt/yr	%	mt/yr	%
Residential	0	2%	0	0%	71	35%	11	22%	154	39%	24	29%
Commercial	0	0%	0	0%	2	1%	0	0%	26	7%	4	4%
Industrial	0	0%	0	0%	4	2%	1	10%	7	2%	1	1%
Mining	0	0%	0	0%	2	1%	0	10%	5	1%	1	1%
Utilities, other	0	0%	0	0%	4	2%	0	0%	8	2%	1	1%
Range lands	2	2%	1	6%	51	25%	25	47%	24	6%	12	15%
Barren lands	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Pasture	25	33%	7	49%	18	9%	5	10%	91	23%	28	33%
Groves	0	0%	0	0%	1	0%	0	0%	1	0%	0	0%
Feedlots	0	0%	0	0%	27	14%	5	10%	4	1%	1	1%
Nursery	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Row and field crops	0	0%	0	0%	4	2%	1	3%	9	2%	4	4%
Upland forests	50	65%	7	45%	21	10%	3	6%	62	16%	9	11%
Total	77	100%	15	100%	201	100%	54	100%	391	100%	83	100%

Table 8.8. Total nitrogen (TN) and phosphorus (TP) loadings from known sources into the Tidal Caloosahatchee. Estimated seasonal loadings are given in italics (see text).

Inputs	Dry Season		Wet Season		Total Annual		Percent Annual	
	TN (mt/yr)	TP (mt/yr)	TN (mt/yr)	TP (mt/yr)	TN (mt/yr)	TP (mt/yr)	TN (%)	TP (%)
<sup>1</sup> Lake Okeechobee	<i>293</i>	<i>17.8</i>	<i>1,658</i>	<i>86.7</i>	1,951	104	27	18
<sup>1</sup> S-4	<i>14</i>	<i>2.3</i>	<i>79</i>	<i>11.3</i>	93.0	13.6	1	2
<sup>1</sup> East Caloosahatchee (S-77 to S-78)	<i>69</i>	<i>7.0</i>	<i>391</i>	<i>34.2</i>	460	41.3	6	7
<sup>1</sup> West Caloosahatchee (S-78 to S-79)	<i>168</i>	<i>20.1</i>	<i>954</i>	<i>98.2</i>	1,122	118	16	20
Total S-79	<i>544</i>	<i>47.2</i>	<i>3,082</i>	<i>230</i>	3,626	278	51	47
<sup>2</sup> Total Sewage Treatment Plants (STP)	28.3	4.4	74	7.9	102	12.3	1	2
<sup>3</sup> Total Non-point Sources (S-79 to Shell Point)	<i>114</i>	<i>18</i>	<i>647</i>	<i>88</i>	761	106	11	18
<sup>1</sup> Total Tidal Caloosahatchee (S-79 to Shell Point)	<i>142</i>	<i>22</i>	<i>721</i>	<i>96</i>	864	118	12	20
<sup>1</sup> Coastal (Shell Point to Causeway)	<i>54</i>	<i>6</i>	<i>307</i>	<i>29</i>	361	34.8	5	6
<sup>4</sup> Submarine Groundwater	1,245	81.0	511	76.1	1,756	157	25	27
<sup>5</sup> Sediment Fluxes (S-79 to Shell Point)	179	5.48	<i>179</i>	<i>5</i>	358	11	5	2
<sup>6</sup> Sediment Fluxes (San Carlos Bay)	208	37.8	<i>-70.5</i>	<i>-46.9</i>	137	-9.1	2	-2
Total Sediment Fluxes	387	43.3	108	-41.4	495	1.9	7	0
Total Inputs	2,372	200	4,729	390	7,101	590	100	100

<sup>1</sup>From Table 8.1 (CRWPP, 2009); seasonal loadings were estimated (see text).

<sup>2</sup>From Table 8.4 (ERD, 2003).

<sup>3</sup>Total non-point sources are calculated by subtracting the total STP loads from the total Tidal Caloosahatchee loads. Seasonal loadings were estimated (see text).

<sup>4</sup>From Objective 3 (this study, see text).

<sup>5</sup>South Florida Water Management District (2008); wet season loadings were estimated (see text).

<sup>6</sup>From Objective 2 (this study, see text).

Table 8.9. Total nitrogen (TN) and phosphorus (TP) Residence Times for Tidal Caloosahatchee.

Inputs	Dry Season		Wet Season	
	TN	TP	TN	TP
<sup>1</sup> Total Inputs (mt/yr)	2,372	200	4,729	390
Total Inputs (kg/d)	6,498	547	12,957	1,068
<sup>2</sup> Average Concentration (ug/L)	918	59.9	999	84.3
Average Concentration (kg/m <sup>3</sup> )	9.18E-04	5.99E-05	9.99E-04	8.43E-05
<sup>3</sup> Total Volume (m <sup>3</sup> )	1.36E+08	1.36E+08	1.36E+08	1.36E+08
Residence Time (days)	19	15	10	11

<sup>1</sup>From Table 8.8.

<sup>2</sup>From Objective 1 (this study, see text).

<sup>3</sup>From C. Buzzelli (personal communication).

Figure 8.10: Average monthly discharges (cfs) and rainfall (inches) recorded at S-79 (data from DBHYDRO) for three time periods: 2003 – 2005 (P1); 2005 – 2007 (P2); and 2008 – 2010 (P3). The Multivariate ENSO Index (MEI) indicates El Niño conditions (positive values) and La Niña conditions (negative values). MEI data are from the Earth System Research Laboratory, NOAA.

<b>Period</b>	<b>P1 2003-2005</b>	<b>P2 2005-2007</b>	<b>P3 2008-2010</b>	<b>% diff P1 vs P3</b>
Average flow through S79	3810	2260	1467	61%
Maximum monthly-averaged flow through S79	11592	11592	5815	50%
Average rainfall at S79	0.42	0.32	0.13	69%
Maximum monthly-averaged rainfall at S79	2.80	2.28	0.53	81%
Average flow through S79: dry season (Dec - May)	1689	967	850	50%
Maximum monthly-averaged flow through S79: dry season (Dec - May)	3860	5726	4674	-21%
Average precipitation at S79: dry season (Dec - May)	0.10	0.06	0.08	26%
Maximum monthly-averaged precipitation at S79: dry season (Dec - May)	0.23	0.23	0.27	-16%
Average flow through S79: wet season (Jun - Nov)	5707	3235	2116	63%
Maximum monthly-averaged flow through S79: wet season (Jun - Nov)	11592	11592	5815	50%
Average precipitation at S79: wet season (Jun - Nov)	0.74	0.57	0.18	75%
Maximum monthly-averaged precipitation at S79: wet season (Jun - Nov)	2.80	2.28	0.53	81%
MEI	0.39	0.09	-0.23	159%

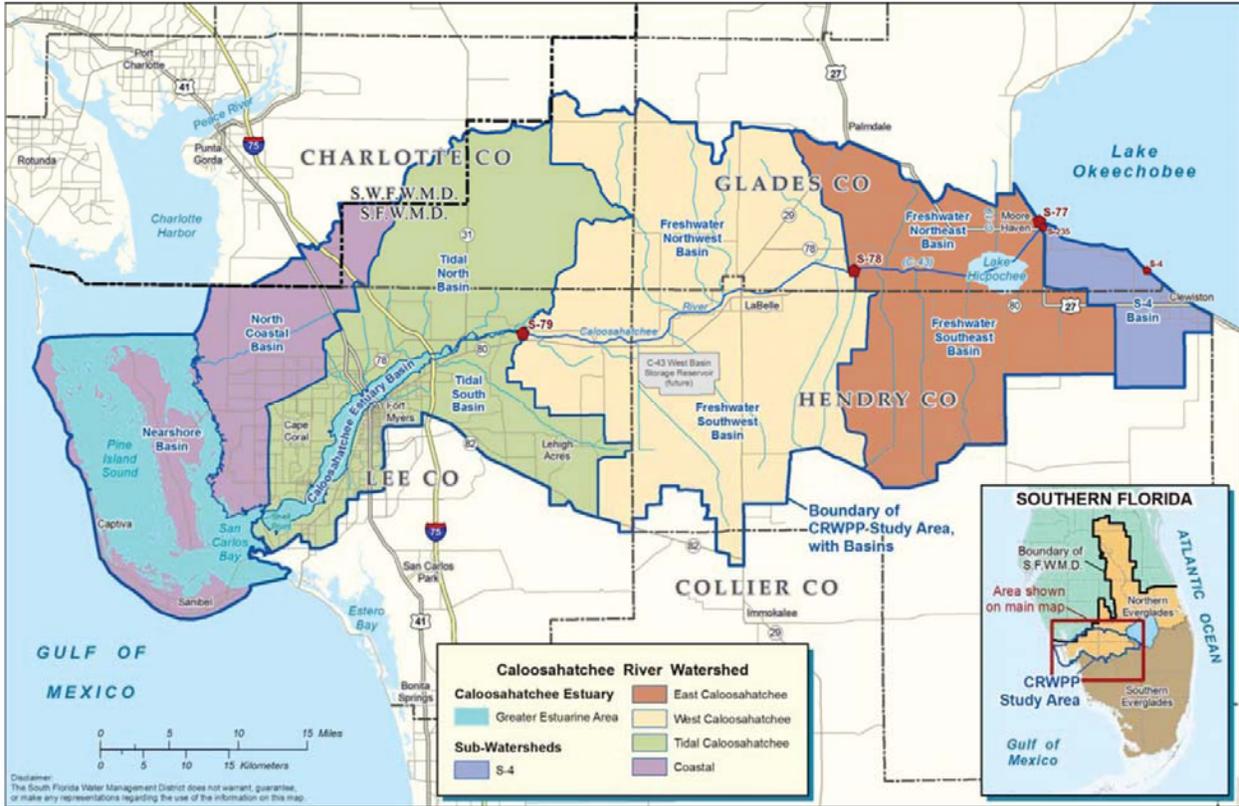


Figure 8.1. Caloosahatchee River watershed and sub-basin watershed map (adapted from CRWPP 2009).

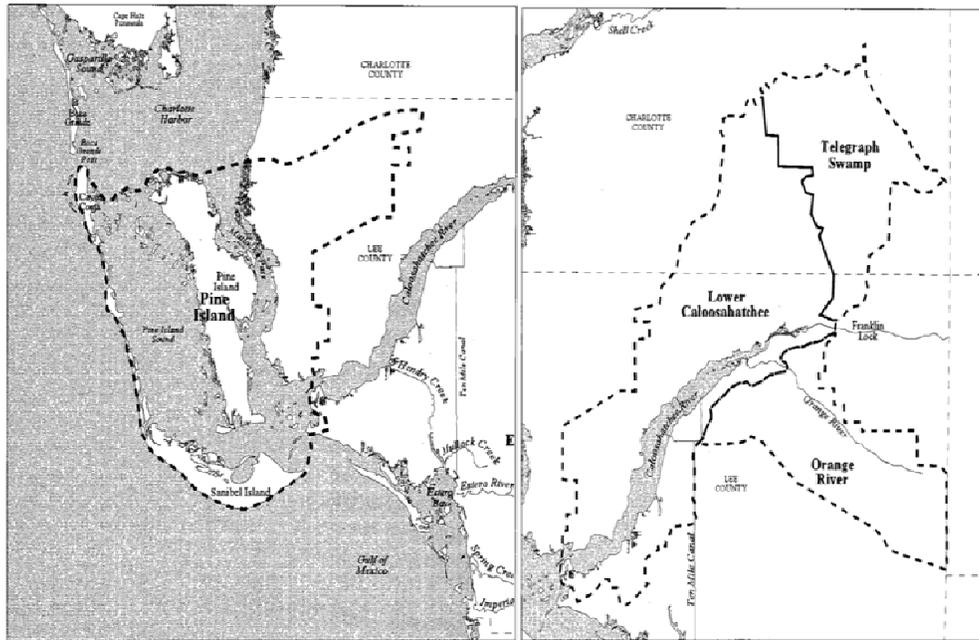


Figure 8.2. The sub-watersheds of Pine Island Sound/Matlacha Pass (left) and the Lower Caloosahatchee, Telegraph Swamp, and Orange River (right). Adapted from CHNEP (1999).