
Appendix H
Alternate Loading Estimate for the Wekiva Study Area

Appendix H

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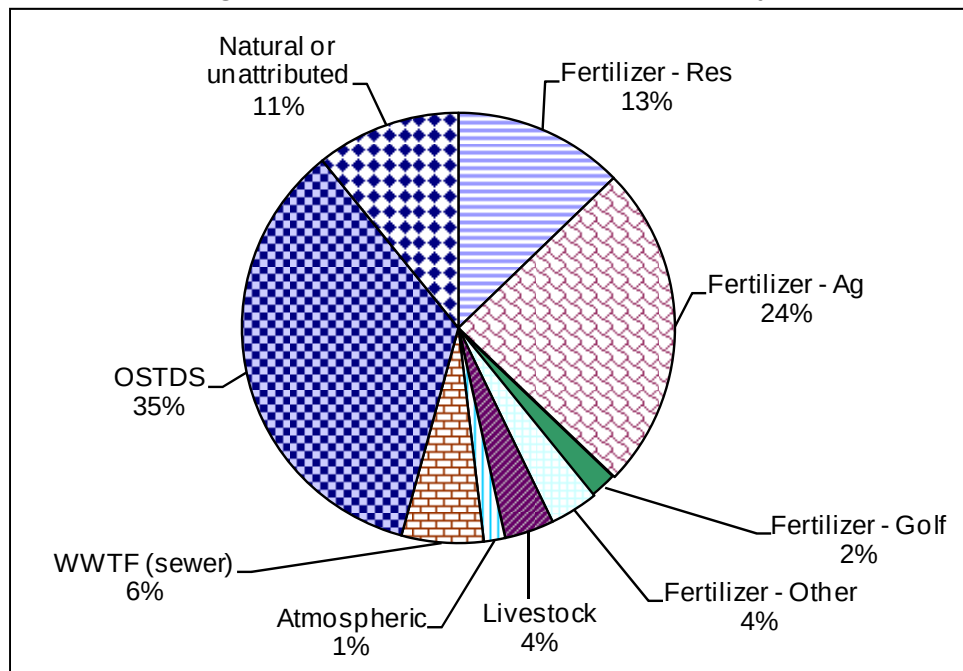
This report focused on estimating sources of nitrate to the Wekiva River Basin, including the watershed of the Wekiva River and the springsheds for springs discharging to the Wekiva River. The basin is generally consistent with the Wekiva Study Area (WSA) as defined by F.S. Chapter 369.316, but not identical. The Wekiva Basin, which includes portions of Lake, Orange, Seminole, and Marion Counties, has an area of 415,000 acres (ac) [648 square miles (mi²)], which is 37% larger in area than the WSA (303,000 ac or 473 mi²). The population of the Wekiva Basin was approximately 423,000 in 2000, or 9% greater than the population of the WSA (388,000 in 2000). The portion of the Wekiva Basin that is not part of the WSA is generally to the west and southwest of the WSA, in Lake County, and in areas that are less densely populated. The additional area included within the Wekiva Basin for the purpose of this study is somewhat more rural and agricultural than the portion of the Basin included within the WSA.

It is appropriate that this study address all areas contributing water to the Wekiva River. However, it is possible that some administrative actions would only address the Wekiva Study Area considering its special designation by F.S. Chapter 369.316. Therefore the FDEP requested that analogous results be calculated for the WSA. These calculations would also permit more transparent comparison with comparable estimates made by Roeder (2008) for the WSA. This Appendix presents loadings apportioned by major source categories for the WSA only. These estimates were generally made following the same methodology as described in the main body of the report, but limiting the area of interest to the WSA.

Figure H-1 presents the attribution of nitrate loadings by source type for the WSA. Total loading to the Wekiva River from the WSA is 1,100 MT/yr (compared with 1,800 MT/yr for the entire basin). This estimate of total load compares favorably with the estimate by Roeder (2008). Roeder estimated that 1,150 MT/yr of total nitrogen reach groundwater from the WSA; while the MACTEC procedure finds 1,100 MT/yr of nitrate nitrogen reach surface and ground waters of the basin.

The relative contributions of the major source types are similar to those obtained by Roeder (2008), who estimated total nitrogen loading to groundwater only. The results presented here are for nitrate loading to both surface and ground water discharging to the Wekiva River. Roeder (2008) estimated the OSTDS contribution to nitrogen loading of groundwater of 39%; while in this estimate of nitrate loading to surface and ground water discharging to the Wekiva River, OSTDS contribute 35%. Other meaningful differences include the contribution of livestock and residential fertilizer. Roeder's livestock contribution is 11%, while this estimate is only 4%. Roeder's residential fertilizer contribution is 8%, while this procedure produces an estimate of 13%. Overall the procedures used here produced similar results to those reported by Roeder (2008).

Figure H-1. Nitrate Loadings to the Wekiva Basin from the Wekiva Study Area, Partitioned by Source



Appendix H. Loading Summary

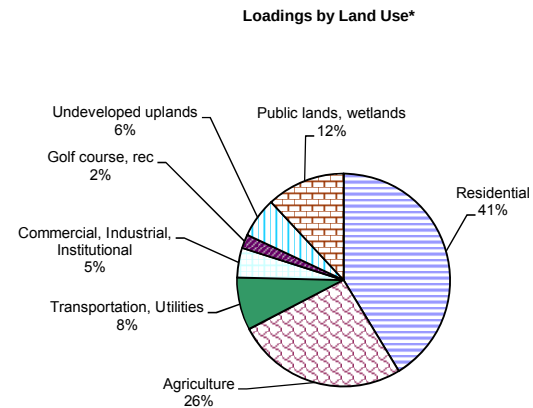
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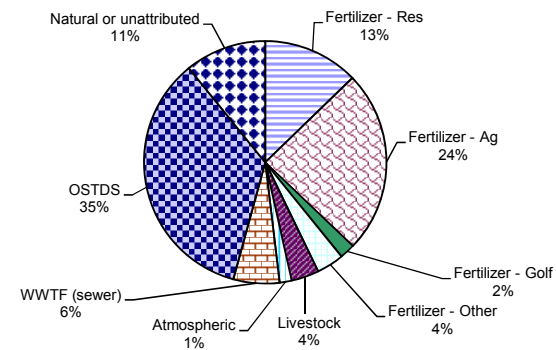
Table 1. Loadings Inputs by Land Use and Source Type

LAND USE		
Land Use Description		Nitrate in GW mg/L
Feeding operations		18
Row crops		23
Golf courses		8
Improved pastures, unimproved pastures, woodland pastures, horse farms, cropland and pastureland		5.5
Tree crops		15
Nurseries, vineyards, ornamentals, floriculture, specialty farms		6
Field crops, sod farms		4
Low, medium and high density residential, commercial, institutional, recreational, transportation		2
Industrial, open land, rural areas, upland nonforested, upland forests, water, wetlands, barren land, extractive		0.1
SOURCE TYPE		
Septic Tanks	Loading Rate lb N/year	16.3
Livestock Waste	Pasture Cattle/acre	0.3
	Nitrate from Cattle kg/year	56
Pasture Fertilizer	Loading Rate kg/ha/year	63
Atmospheric Deposition	"Natural" groundwater concentration mg/L	0.1
Domestic Wastewater - Disposed		
	to Ground Water MT/year	60
	to Surface Water MT/year	10
	Loading %	88%
Domestic Wastewater - Reused		
	MT/year	31
	Reused Water Loading Percent	20%

0



* - same figure as Figure 3.4 in Section 3.2.



* - same figure as Figure 3.2 in Section 3.2.

Prepared by: WAT 1/7/10
 Checked by: JAT 2/8/10

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Table 2. Loadings Results by Land Use and Source Type

Loadings by Land Use															Loadings by Source Type																	
Land Use Type	Nitrate in GW (mg/L) (see Table 1)	Recharge Rates (MT/year)						Subtotal (excluding No Data areas)		Concentration Total (including		Weighted Average Recharge Rate	OWTS		Domestic Wastewater ^(a)		Stormwater		WWTF to Surface Water (MT/yr)	GRAND TOTAL	Fertilizer				Livestock	Atmospheric Deposition	WWTF	OSTDS	Natural or unattributed	GRAND TOTAL		
		No data	Discharge Area	0 to 4 in	4 to 8 in/yr	8 to 12 in/yr	12 to 20 in/yr	more than 20 in/yr	MT/yr	MT/acre/yr	MT/yr	kg/ha/yr	in/yr	# Tanks	Loading from OWTS (MT/yr)	Reused (MT/yr)	Disposed (MT/yr)	Stormwater - Diffuse (MT/yr)			Stormwater - Direct (MT/yr)	Residential (MT/yr)	Agriculture (MT/yr)	Golf Courses (MT/yr)	Other (MT/yr)	(MT/yr)	(MT/yr)	(MT/yr)	(MT/yr)	(MT/yr)	(MT/yr)	
1100: Residential, low density - less than 2 dwelling units/acre	2.0	0.00	0.00	0.68	4.50	7.00	13.65	11.14	36.96	2.45E-03	36.96	6.1	11.9	4,859	35.96	0.23		10.85	6.29		90.29	43.57					1.85		35.96	8.69	90.06	
1200: Residential, medium density - 2-5 dwelling units/acre	2.0	0.00	0.00	0.76	9.74	16.54	22.62	7.47	57.12	2.16E-03	57.12	5.3	10.5	35,073	259.55	1.34		21.28	20.48		359.76	76.11					2.86		259.55	19.92	358.43	
1300: Residential, high density - 6 or more dwelling units/acre	2.0	0.00	0.00	0.23	1.75	3.22	6.05	3.06	14.30	2.34E-03	14.30	5.8	11.4	5,499	40.69	0.39		6.31	7.71		69.40	21.12					0.72		40.69	6.49	69.01	
1400: Commercial and services	2.0	0.00	0.00	0.19	1.79	3.08	5.62	1.11	11.79	2.18E-03	11.79	5.4	10.6	1,204	8.91	0.51		4.38	9.04		34.64			18.42			0.59		8.91	6.21	34.13	
1500: Industrial	0.1	0.00	0.00	0.00	0.04	0.08	0.09	0.04	0.25	1.16E-04	0.25	0.3	11.3	380	2.81	0.03		3.32	3.12		9.54						0.25		2.81	6.45	9.51	
1600: Extractive	0.1	0.00	0.00	0.00	0.01	0.02	0.06	0.03	0.12	1.45E-04	0.12	0.4	14.1	9	0.07	0.00		0.00	0.00		0.19						0.12		0.07	0.00	0.19	
1700: Institutional	2.0	0.00	0.00	0.03	0.56	0.83	1.79	1.08	4.29	2.53E-03	4.29	6.3	12.3	184	1.36	0.06		3.23	3.52		12.47				8.83		0.21		1.36	1.99	12.40	
1800: Recreational	2.0	0.00	0.00	0.02	0.18	0.44	0.31	0.26	1.22	1.89E-03	1.22	4.7	9.2	37	0.27	0.08		0.00	0.00		1.57					1.15		0.06		0.27	0.00	1.49
1820: Golf courses	8.0	0.00	0.00	0.17	1.04	3.88	8.49	7.95	21.54	1.15E-02	21.54	28.5	14.0	98	0.73	0.34		1.42	0.79		24.82			22.30			0.27		0.73	1.18	24.48	
1900: Open land	0.1	0.00	0.00	0.01	0.06	0.08	0.17	0.11	0.43	1.22E-04	0.43	0.3	11.9	493	3.65	0.10		0.00	0.00		4.17						0.43		3.65	0.00	4.07	
2100: Cropland and pastureland	6.0	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.03	3.64E-03	0.03	9.0	5.9	0	0.00	0.00					0.03		0.02				0.01		0.00	0.00	0.03	
2110: Improved pastures (monocult, planted forage crops)	5.5	0.00	0.00	1.58	8.86	10.59	27.02	28.54	76.60	6.94E-03	76.60	17.2	12.3	431	3.19	0.15		4.33	2.90		87.17		48.71			29.87	1.39		3.19	3.86	87.02	
2120: Unimproved pastures	5.5	0.00	0.00	0.03	0.02	0.19	1.81	4.38	6.43	1.09E-02	6.43	26.9	19.3	32	0.24	0.01					6.68		3.81			2.51	0.12		0.24	0.00	6.67	
2130: Woodland pastures	5.5	0.00	0.00	0.11	1.75	1.96	3.43	3.50	10.74	6.75E-03	10.74	16.7	11.9	35	0.26	0.07					11.08		6.36			4.19	0.20		0.26	0.00	11.00	
2140: Row crops	23.0	0.00	0.00	0.13	7.43	0.91	1.13	0.00	9.60	1.55E-02	9.60	38.3	6.6	2	0.01	0.00		0.04			9.65		9.57				0.04		0.01	0.02	9.65	
2150: Field crops	4.0	0.00	0.00	0.21	1.45	1.75	2.86	3.12	9.39	4.62E-03	9.39	11.4	11.2	63	0.47	0.14		0.49	0.78		11.26		9.74				0.23		0.47	0.68	11.13	
2200: Tree crops	15.0	0.00	0.00	1.71	31.50	22.40	45.20	39.96	140.76	1.69E-02	140.76	41.9	11.0	319	2.36	0.09		1.57	0.35		145.14		140.72				0.94		2.36	1.03	145.05	
2300: Feeding operations	18.0	0.00	0.00	0.00	0.39	0.42	1.67	0.00	2.49	2.16E-02	2.49	53.2	11.6	3	0.02	0.01		0.04	0.03		2.58				2.47	0.01		0.02	0.07	2.57		
2400: Nurseries and vineyards	6.0	0.00	0.00	0.01	0.02	0.03	0.29	0.13	0.47	8.97E-03	0.47	22.1	14.5	4	0.03	0.00		1.61	0.22		2.34		1.32				0.01		0.03	0.98	2.33	
2410: Tree nurseries	6.0	0.00	0.00	0.00	0.01	0.08	0.12	0.02	0.24	7.71E-03	0.24	19.0	12.5	2	0.01	0.00					0.26		0.24				0.00		0.01	0.00	0.26	
2420: Sod farms	4.0	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.25	8.24E-04	0.25	2.0	2.0	0	0.00	0.00					0.25		0.24				0.01		0.00	0.00	0.25	
2430: Ornamentals	6.0	0.00	0.00	0.48	3.14	5.18	17.00	15.76	41.56	8.56E-03	41.56	21.1	13.9	480	3.55	0.05					45.16		40.87				0.69		3.55	0.00	45.11	
2450: Floriculture	6.0	0.00	0.00	0.00	0.04	0.00	0.15	0.00	0.20	6.44E-03	0.20	15.9	10.4	3	0.02	0.00					0.22		0.20				0.00		0.02	0.00	0.22	
2500: Specialty farms	6.0	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.06	7.46E-03	0.06	18.4	12.1	2	0.01	0.00		0.29	0.10		0.47		0.24				0.00		0.01	0.21	0.47	
2510: Horse farms	5.5	0.00	0.00	0.17	1.03	0.79	1.84	0.83	4.65	5.42E-03	4.65	13.4	9.6	28	0.21	0.02					4.88		2.75			1.81	0.08		0.21	0.00	4.86	
2540: Aquaculture*														0																		
2600: Other open lands - rural	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	8.45E-05	0.01	0.2	8.2	5	0.04	0.01					0.06						0.01		0.04	0.00	0.04	
3000: Upland Nonforested	0.1	0.00	0.00	0.03	0.21	0.28	0.68	0.55	1.74	1.27E-04	1.74	0.3	12.3	789	5.84	0.26					7.83						1.74		5.84	0.00	7.58	
4000: Upland Forests (25% forested cover)	0.1	0.00	0.00	0.03	0.38	0.51	1.07	0.99	2.99	1.28E-04	2.99	0.3	12.4	1,325	9.81	0.70		6.18	7.39		27.06					2.99		9.81	13.57	26.36		
5000: Water	0.1	0.00	0.00	0.15	0.15	0.14	0.16	0.03	0.64	5.19E-05	0.64	0.1	5.0		0.00	0.22		1.60	2.82		5.27						0.64		0.00	4.42	5.05	
6000: Wetlands	0.1	0.00	0.00	0.08	0.21	0.13	0.14	0.09	0.64	6.36E-05	0.64	0.2	6.2	479	3.54	0.29		2.24	24.44		31.16						0.64		3.54	26.67	30.86	
7000: Barren land	0.1	0.00	0.00	0.20	0.02	0.01	0.02	0.02	0.28	2.66E-05	0.28	0.1	2.6	73	0.54	0.09		0.00	0.00		0.91						0.28		0.54	0.00	0.82	
8000: Transportation, Communication, and Utilities	2.0	0.00	0.00	0.11	1.10	1.96	2.83	1.06	7.07	2.20E-03	7.07	5.4	10.7	58	0.43	0.27	61.60	9.79	12.44	8.80	100.40				11.72		0.35	67.80	0.43	17.23	97.53	
TOTALS											465				51,969	385	5.46	62	79	102		1107	141	269	22	40	41	18	68	385	120	1103

Notes:

* Aquaculture row here is a place holder. No loadings were calculated for aquaculture land use, which is less than 0.005% of total acres.

(a) - Calculated from data in Appendix E, Table 2.

**Wekiva River and Basin Nitrate Sourcing Study
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APPENDIX H. WASTEWATER FACILITIES SUMMARY

Table 1. Summary of groundwater, surface water, and reuse Total Nitrogen discharge.

FACILITY ID	NAME	Current Condition			Implementation of 62-600.550 (WSA only)		
		GW DISCHARGE (MT/YR)	SW DISCHARGE (MT/YR)	REUSE (MT/YR)	GW DISCHARGE (MT/YR)	SW DISCHARGE (MT/YR)	REUSE (MT/YR)
FLA010798	OCUD/NORTHWEST WATER RECLAMATION FACILITY	29.6	1.4	0.0	9.6	1.2	0.0
		18.0	0.0	0.0	5.1	0.0	0.0
FLA010818	APOPKA WRF - PROJECT ARROW	1.5	0.0	5.0	0.7	0.0	2.2
FL0036251	WEKIVA HUNT CLUB	6.2	8.8	19.0	1.4	2.0	4.3
FLA010815	OCOEE, CITY OF	1.4	0.0	7.1	1.0	0.0	5.2
FLA010865	ZELLWOOD STATION MHP	1.5	0.0	0.0	0.2	0.0	0.0
FLA010855	COCA-COLA/APOPKA FACILITY	0.0	0.0	0.0	0.0	0.0	0.0
FLA295965	EUSTIS - EASTERN	0.8	0.0	0.0	0.0	0.0	0.0
FLA010541	WEKIVA FALLS RESORT	0.3	0.0	0.0	0.3	0.0	0.0
FLA010851	CLARCONA RESORT CONDO	0.6	0.0	0.0	0.3	0.0	0.0
FLA010833	MONTEREY MUSHROOM FARM (TERRY FARMS)	0.0	0.0	0.0	0.0	0.0	0.0
FLA010498	SEMINOLE SPRINGS ELEMENTARY SCHOOL WWTF	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL DISCHARGE (MT/YR)		60	10	31	19	3	12
GRAND TOTAL DISCHARGE (MT/YR)		101			34		

Notes:

MT/YR = metric tons per year

 = indicates change in amount of groundwater discharge due to implementation of 62-600.550, FAC.

WSA Subtotals

60

10

31

19

3

12

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APPENDIX H. WASTEWATER FACILITIES SUMMARY

Table 2. Groundwater, surface water, and reuse nitrate discharge by facility, current condition.

GW DISCHARGE (MT/YR)	SW DISCHARGE (MT/YR)	REUSE (MT/YR)	FACILITY ID	NAME	CAPACITY (MGD)	GROUNDWATER DISCHARGE	ALLOWABLE DISCHARGE (MGD)	ACTUAL DISCHARGE (MGD)	NITRATE CONCENTRATION (MG/L)	TN RELEASE (MT/YR)	SURFACE WATER DISCHARGE	ALLOWABLE DISCHARGE (MGD)	ACTUAL DISCHARGE (MGD)	NITRATE CONCENTRATION (MG/L)	TN RELEASE (MT/YR)	RECLAMATION/R EUSE	ALLOWABLE DISCHARGE	ACTUAL DISCHARGE	NITRATE CONCENTRATION (MG/L)	TN RELEASE (MT/YR)	WAVA PROTECTION ZONE	WSA
29.6	1.4	0.0	FLA010798	OCUD/NORTHWEST WATER RECLAMATION FACILITY	7.9	RIBS	4.5	3.3	5.7	29.6	Effluent to Lake Marden	3		0.3	1.4				5.7	0.0	SECONDARY	YES
18.0	0.0	0.0				slow rate restricted public access system (enhanced wetlands)	3	1.762	6.5	18.0											SECONDARY	YES
1.5	0.0	5.0	FLA010818	APOPKA WRF - PROJECT ARROW	4	slow rate restricted public access land application system	2	0.6	1.6	1.5						slow rate public access land application system	4.0	1.99	1.6	5.0	SECONDARY	YES
6.2	8.8	19.0	FL0036251	WEKIVA HUNT CLUB	2.9	RIBS	0.4	0.423	9.3	6.2	surface water discharge Sweetwater Creek/Cove Lake	2.9	0.599	9.3	8.8	slow rate public access reuse system	2.603	1.298	9.3	19.0	SECONDARY	YES
1.4	0.0	7.1	FLA010815	OCOEE, CITY OF	1.6	RIBS	0.35	0.271	3.2	1.4						slow rate public access reuse system 2.25		1.4	3.2	7.1	SECONDARY	YES
1.5	0.0	0.0	FLA010865	ZELLWOOD STATION MHP	0.3	RIBS	0.3	0.137	7	1.5											PRIMARY	YES
0.02	0.0	0.0	FLA010855	COCA-COLA/APOPKA FACILITY	0.255	land application system (spray irrigation field)	0.117	0.053	0.21	0.02											SECONDARY	YES
0.8	0.0	0.0	FLA295965	EUSTIS - EASTERN	0.19	RIBS	0.19	0.022	23	0.8											SECONDARY	YES
0.3	0.0	0.0	FLA010541	WEKIVA FALLS RESORT	0.0990	RIBS	0.099	0.099	2	0.3											SECONDARY	YES
0.6	0.0	0.0	FLA010851	CLARCONA RESORT CONDO	0.06	RIBS	0.06	0.06	6	0.6											SECONDARY	YES
0.0	0.0	0.0	FLA010833	MONTEREY MUSHROOM FARM (TERRY FARMS)	0.076	perc ponds	0.076	0.061	0.3	0.03											SECONDARY	YES
0.0	0.0	0.0	FLA010498	SEMINOLE SPRINGS ELEMENTARY SCHOOL WWTF	0.01	absorption field/drainfield	0.01	0.003	4	0.02											TERTIARY	YES
60	10	31	TOTAL ALLOWABLE DISCHARGE			22.9220	11.1220				5.9					8.853						
TOTAL DISCHARGE (MT/YR)			TOTAL ACTUAL DISCHARGE			12.0780	6.7910				0.599					4.688						
GRAND TOTAL DISCHARGE (MT/YR)						101																

Notes:
MT/YR = metric tons per year
MGD = million gallons per day
MG/L = milligrams per liter

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Edited by: JAT 2/2/10
Checked by: WAT 2/11/10

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APPENDIX H. WASTEWATER FACILITIES SUMMARY

Table 3. Groundwater, surface water, and reuse nitrate discharge by facility from implementation of 62-600.550, FAC (Wekiva Study Area only).

GW DISCHARGE (MT/YR)	SW DISCHARGE (MT/YR)	REUSE (MT/YR)	FACILITY ID	NAME	CAPACITY (MGD)	GROUNDWATER DISCHARGE	ALLOWABLE DISCHARGE (MGD)	ACTUAL DISCHARGE (MGD)	CONCENTRATION (MG/L)	RELEASE (MT/YR)	SURFACE WATER DISCHARGE	ALLOWABLE DISCHARGE (MGD)	ACTUAL DISCHARGE (MGD)	CONCENTRATION (MG/L)	RELEASE (MT/YR)	RECLAMATION/RE USE	ALLOWABLE DISCHARGE	ACTUAL DISCHARGE	CONCENTRATION (MG/L)	RELEASE (MT/YR)	WAVA PROTECTION ZONE	WSA
9.6	1.2	0.0	FLA010798	OCUD/NORTHWEST WATER RECLAMATION FACILITY	7.9	RIBS	4.5	3.3	2.1	9.6	Effluent to Lake Marden	3		0.3	1.2						SECONDARY	YES
5.1	0.0	0.0	FLA010798	OCUD/NORTHWEST WATER RECLAMATION FACILITY	7.9	slow rate restricted public access system (enhanced wetlands)	3	1.762	2.1	5.1											SECONDARY	YES
0.7	0.0	2.2	FLA010818	APOPKA WRF - PROJECT ARROW	4	slow rate restricted public access land application system	2	0.6	0.8	0.7						slow rate public access land application system	4	1.99	0.8	2.2	SECONDARY	YES
1.4	2.0	4.3	FL0036251	Sanlando Utilities;"WEKIVA HUNT CLUB	2.9	RIBS	0.4	0.423	2.4	1.4	surface water discharge Sweetwater Creek/Cove Lake	2.9	0.599	2.4	2.0	slow rate public access reuse system	2.603	1.298	2.4	4.3	SECONDARY	YES
1.0	0.0	5.2	FLA010815	OCOEE, CITY OF	1.6	RIBS	0.35	0.271	2.7	1.0						slow rate public access reuse system	2.25	1.4	2.7	5.2	SECONDARY	YES
0.2	0.0	0.0	FLA010865	ZELLWOOD STATION MHP	0.3	RIBS	0.3	0.137	1	0.2											PRIMARY YES	
0.0	0.0	0.0	FLA010855	COCA-COLA/APOPKA FACILITY	0.255	land application system (spray irrigation field)	0.117	0.053	0.21	0.0											SECONDARY	YES
0.0	0.0	0.0	FLA295965	EUSTIS - EASTERN	0.19	RIBS	0.19	0.022	1.6	0.0											SECONDARY	YES
0.3	0.0	0.0	FLA010541	Wekiva Falls Resort	0.0990	RIBS	0.099	0.099	2	0.3											SECONDARY	YES
0.3	0.0	0.0	FLA010851	CLARCONA RESORT CONDO	0.08	RIBS	0.08	0.06	3.3	0.3											SECONDARY	YES
0.0	0.0	0.0	FLA010833	MONTEREY MUSHROOM FARM (TERRY FARMS)	0.076	perc ponds	0.076	0.061	0.3	0.0											SECONDARY	YES
0.0	0.0	0.0	FLA010498	SEMINOLE SPRINGS ELEMENTARY SCHOOL WWTF	0.01	absorption field/drainfield	0.01	0.003	4	0.0											TERTIARY	YES
19	3	12	TOTAL ALLOWABLE DISCHARGE		22.9220	TOTAL ACTUAL DISCHARGE		12.0780					5.9	0.599			8.853	4.688				
TOTAL DISCHARGE (MT/YR)																						
GRAND TOTAL DISCHARGE (MT/YR)	34																					

Notes:
MT/YR = metric tons per year
MGD = million gallons per day
MG/L = milligrams per liter
= change in discharge/concentration from current condition

Created by: SAR 3/19/07
Edited by: JAT 2/11/10
Checked by: WAT 2/11/10