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**Increment 1 Buildout
at Seminole Generating Station Landfill**

Putnam County, Florida

Stormwater Management Plan

September 24, 2010

**INCREMENT 1 BUILDOUT
AT SEMINOLE GENERATING STATION LANDFILL
PUTNAM COUNTY, FLORIDA**

**STORMWATER MANAGEMENT PLAN
SEPTEMBER 24, 2010**

Background

As part of the proposed Increment 1 Buildout at Seminole Generating Station Landfill in Putnam County, Florida, a stormwater management pond (i.e., Pond B) has been designed to accommodate the entire 118.7-acre landfill drainage area at ultimate buildout and closure conditions (see Figure 2, Stormwater Pond B Ultimate Buildout Drainage Basin Map which follows).

Pond B is located along the southeastern perimeter of the Increment 1 Buildout area in the southeastern portion of the landfill, and will outfall toward the existing wetlands to the east. Pond B will provide water quality treatment over the 118.7-acre landfill drainage area at 95% imperviousness to meet Florida Department of Environmental Protection (FDEP) and St. Johns River Water Management District (SJRWMD) criteria. Pond B will provide peak discharge attenuation for the Mean Annual and 24-Year / 24-Hour Storm events so that post-development peak discharge rates does not exceed those of pre-development (i.e., pre-landfill) conditions.

Pre-Landfill Hydrology

Before any of the current Seminole Generating Station Landfill was constructed, the site consisted of wooded areas in good condition with elevations ranging from approximately 81 (feet, NGVD 1929) at the southern end of the site to approximately 25 at the northeast corner (see Figure 1 in the Geotechnical Investigation Report provided in Section 5 of this document for a site vicinity map based upon USGS Quadrangle Map Palatka, Fla.). The primary pre-landfill drainage pattern was generally from southwest to northeast (see Figure 1 which follows for a Pre-Development Drainage Basin Map, also based upon USGS Quadrangle Map Palatka, Fla.).

The soil types located within the site are comprised of Tavares Fine Sand (6) over roughly the southern half of the site, with the northern half comprised of St. Johns Fine Sand, Depressional (13) and Myakka Fine Sand (3), all as classified by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) in the "Soil Survey of Putnam County, Florida (see Figure 2 in the Geotechnical Investigation Report provided in Section 5 of this document).

SCS classifies Tavares Fine Sand as Hydrologic Soil Group A, whereas St. Johns Fine Sand, Depressional is classified as Group D, and Myakka Fine Sand is classified as Group B/D. Assuming there was no drainage system before the landfill to allow the Group B/D soil to act as a Group B soil, Myakka Fine Sand was considered as a Group D soil for runoff calculation purposes.

As a result, the following hydrologic characteristics for pre-development (i.e., pre-landfill) conditions were determined for the site:

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Pre-Development Conditions

Area	=	118.7 acres
Curve Number (CN)	=	55
Time of concentration (Tc)	=	1.82 hours

Using these values for the 118.7-acre drainage area, the peak runoff rate from the site under pre-landfill conditions in the Mean Annual / 24-Hour Storm (4.4 inches Rainfall; SCS Type II Florida Modified Distribution) was calculated to be 19.05 cfs; the peak runoff rate from the site under pre-landfill conditions in the 25-Year / 24-Hour Storm (7.9 inches Rainfall; SCS Type II Florida Modified Distribution) was calculated to be 95.03 cfs

The computer program "Interconnected Channel and Pond Routing Model" (ICPR v3.0) by Streamline Technologies, Inc. was used for computing the pre-development runoff hydrographs for the project. The SCS Unit Hydrograph Method was used with a Peaking Factor of 484.

Please see the Pre-Development Conditions Hydrology Calculations and Pre-Development Conditions ICPR Runoff Calculations which follow.

Post-Development Hydrology

For design of stormwater management Pond B, it was assumed that the entire 118.7-acre landfill drainage area will be 95% impervious at ultimate buildout and closure conditions. It was assumed that 95% of the area will be Capped Landfill at 100% impervious, including the water surface of Pond B for conservatism. The remaining 5% of the site was assumed to be Open Space, Good Condition in Group A soils since the majority of open space will be around proposed Pond B which is located in Group A soils.

As a result, the following hydrologic characteristics for post-development conditions were determined for the site:

Post-Development Conditions

Area	=	118.7 acres
Curve Number (CN)	=	95
Time of concentration (Tc)	=	0.70 hours

Using these values for the 118.7-acre drainage area, the peak runoff rate from the site to proposed Pond B under Post-Development conditions in the Mean Annual / 24-Hour Storm (4.4 inches Rainfall; SCS Type II Florida Modified Distribution) was calculated to be 239.12 cfs; the peak runoff rate from the site under Post-Development conditions in the 25-Year / 24-Hour Storm (7.9 inches Rainfall; SCS Type II Florida Modified Distribution) was calculated to be 442.26 cfs. Therefore, Pond B will need to provide peak discharge attenuation to reduce these

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runoff rates from the site for the Mean Annual / 24-Hour Storm and the 25-Year/24-Hour Storm to a maximum of 19.05 cfs and 95.03 cfs, respectively.

The computer program "Interconnected Channel and Pond Routing Model" (ICPR v3.0) by Streamline Technologies, Inc. was used for computing the Post-Development runoff hydrographs for the project. The SCS Unit Hydrograph Method was used with a Peaking Factor of 484.

Please see the Post-Development Conditions Hydrology Calculations and Post-Development Conditions ICPR Runoff Calculations which follow.

Proposed Stormwater Management Pond

Below is a summary of the information used in the design of stormwater management Pond B in order to provide the required water quality treatment and peak discharge attenuation volumes for the project:

- The pond has been designed as a Wet Detention System according to the Section 14.0 of the SJRWMD Applicant's Handbook for Regulation of Stormwater Management Systems, Ch. 40C-42, F.A.C.
- The water quality treatment volume provided in the pond is for Wet Detention per the Applicant's Handbook, determined to be the greater of the first one inch of runoff or 2.5 inches of runoff from the impervious area, for the entire 118.7-acre landfill drainage area at 95% imperviousness at ultimate buildout.
- The pond provides for peak discharge attenuation of the Mean Annual and 25-Year / 24-Hour Storm events so that the peak discharge rate at 95% imperviousness at ultimate buildout does not exceed those for pre-development (i.e., pre-landfill) conditions per FDEP criteria.
- A seasonal high groundwater table elevation of 58.0 was used for design of the pond, which was obtained from the Geotechnical Investigation Report provided in Section 5 of this document. From the Geotechnical Investigation Report, it was stated that the seasonal high groundwater table is expected to rise to approximately 3 to 5 feet below ground surface. The seasonal high groundwater table estimate of elevation of 58.0 is based on boring TB-10 taken in the area of the proposed pond, at 5 feet below existing ground elevation 63.0. Encountered water table at boring TB-10 was at elevation 55.0. Therefore, the seasonal high groundwater table elevation for design of Pond B was estimated at 5 feet below existing ground elevation 63.0 at TB-10, or elevation 58.0, which is also 3 feet higher than encountered water table elevation 55.0 at this boring.

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- The normal water level of the pond will be at elevation 58.0, which is the estimated seasonal high groundwater table elevation discussed above. The pond top-of-bank will be at elevation 66.0. A stage vs. area and storage relationship for Pond B is provided in the Post-Development Conditions Water Quality Treatment Calculations which follow.
- The permanent pool for Pond B was designed using the Non-Littoral Zone Option with a 21-day residence time, or 50% additional permanent pool volume than that of the Littoral Zone Option.
- The computer program "Interconnected Channel and Pond Routing Model" (ICPR v3.0) by Streamline Technologies, Inc. was used to perform design routings of the pond to determine peak stages and discharges for the Mean Annual, 25-Year and 100-Year / 24-Hour Storm events.
- The pond's outfall control structure is a modified FDOT Type H ditch bottom inlet, located at the north end of the pond, with a 4.0-foot weir notch at elevation 61.30 to provide required wet detention water quality treatment volume, and a 54-inch RCP outfall pipe. Discharge from the pipe's mitered section will be over a rip-rap rubble blanket for erosion protection before flowing to the receiving wetland to the north and east. The structure will also include two (2) 5-inch diameter orifices at invert elevation 58.0 to drawdown one-half the required treatment volume in 24 to 30 hours following a storm event.
- An emergency overflow spillway at 0.5-foot below the pond top-of-bank elevation 66.0, or elevation 65.5, will be installed near the southeast corner of the pond to allow for emergency discharges in excess of the 100-Year / 24-Hour Storm event.
- There will be no wetland impacts due to the project, and a minimum 15-foot, average 25-foot buffer adjacent to jurisdictional wetlands will be provided.

The peak discharge rate from the proposed Pond B in the Mean Annual / 24 Hour Storm is 9.50 cfs, which is less than the pre-development (i.e., pre-landfill) peak discharge rate of 19.05 cfs. The peak discharge rate from the proposed Pond B in the 25-Year / 24 Hour Storm is 60.90 cfs, which is less than the pre-development (i.e., pre-landfill) peak discharge rate of 95.03 cfs. The pond was also analyzed for the 100-Year / 24-Hour Storm event to confirm that the maximum stage is contained within the pond banks. Below is a summary of results from the Post-Development Conditions ICPR Pond Routing Design and Analysis:

Mean Annual, 24-Hour Storm (4.4" Rainfall; SCS Type II Florida Modified Distribution)

Maximum Pond Stage	=	62.12	
Maximum Pond Discharge	=	9.50 cfs	< 19.05 cfs Pre-Development

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25-Year/24-Hour Storm (7.9" Rainfall; SCS Type II Florida Modified Distribution)

Maximum Pond Stage	=	64.13	1.87 ft freeboard below TOB 66.0
Maximum Pond Discharge	=	60.90 cfs	< 95.03 cfs Pre-Development

100-Year/24-Hour Storm (10.0" Rainfall; SCS Type II Florida Modified Distribution)

Maximum Pond Stage	=	65.14	0.86 ft freeboard below TOB 66.0
Maximum Pond Discharge	=	148.99 cfs	

Please see the Post-Development Conditions Water Quality Treatment Calculations and Post-Development Conditions ICPR Pond Routing Design and Analysis which follow.

Alternative Treatment System Considerations

Alternative treatment systems specified in the SJRWMD Applicant's Handbook were explored in the process of designing Pond B before concluding that the preferred option for the site was a Wet Detention System. Below is a summary of the treatment system alternatives that were considered:

Dry Retention – A dry retention pond was the first treatment system explored due to its simplicity, effectiveness as Best Management Practice for the type of final land use (closed landfill with grass cover), depth of water table, and high soil permeability. However, it was not selected due to an inability to demonstrate recovery of the treatment volume in the pond within 72 hours following a storm event with the site's given soil parameters.

Dry Detention – A dry detention pond system appeared to be a viable solution since a positive discharge device could be utilized at the bottom of the pond to satisfactorily recover one-half of the required treatment volume between 24 and 30 hours following a storm event. However, a dry detention system was eliminated from further consideration since it is limited to systems within project areas less than 5 acres in size, and which serve a drainage area less than 5 acres in size.

Side Bank Filtration System – A side bank filtration system (i.e., a dry pond with a side bank perforated pipe underdrain for treatment volume recovery within 72 hours of a storm event per Section 23.0 of the SJRWMD Applicant's Handbook) was initially proposed for the design of Pond B. However, this system is considered as an alternative method that is not yet adopted by rule by SJRWMD and presented challenges in demonstrating that the system could meet all FDEP and SJRWMD criteria.

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Stormwater Underdrain System – A stormwater underdrain system (i.e., a dry pond underlain with perforated drainage pipe to collect and convey stormwater following percolation from the basin through suitable soil) was explored for design of Pond B but was eliminated due to inadequate pond bottom area to provide the required length of underdrain system.

Wet Detention – A wet detention pond option was the final treatment system explored for design of Pond B and was ultimately selected for the following reasons:

- There is sufficient storage capacity to provide for wet detention water quality treatment volume per the Applicant's Handbook.
- There is sufficient permanent pool volume to provide for pollutant removal below the normal water level.
- Ability to recover the required treatment volume within the required timeframe without the assistance of underdrain systems.
- Lower operation and maintenance costs than stormwater underdrain systems.

Consequently, Pond B was designed as a Wet Detention System to meet the water quality treatment and recovery requirements from Section 14.0 of the SJRWMD Applicant's Handbook.

Operation and Maintenance Plan

Operation and maintenance of Pond B will include a recommended periodic inspection and maintenance frequency to ensure proper operation of the proposed pond. This information will be included in the site's Stormwater Pollution Prevention Plan (SWPPP).

Summary

Proposed stormwater management Pond B, as designed as a Wet Detention System, has sufficient capacity to provide water quality treatment and peak discharge attenuation for the entire 118.7-acre landfill drainage area at ultimate buildout and closure conditions of 95% imperviousness to meet the criteria of the Florida Department of Environmental Protection and St. Johns River Water Management District.

Figure 1
Pre-Development Drainage Basin Map

Figure 2
Stormwater Pond B Ultimate Buildout
Drainage Basin Map

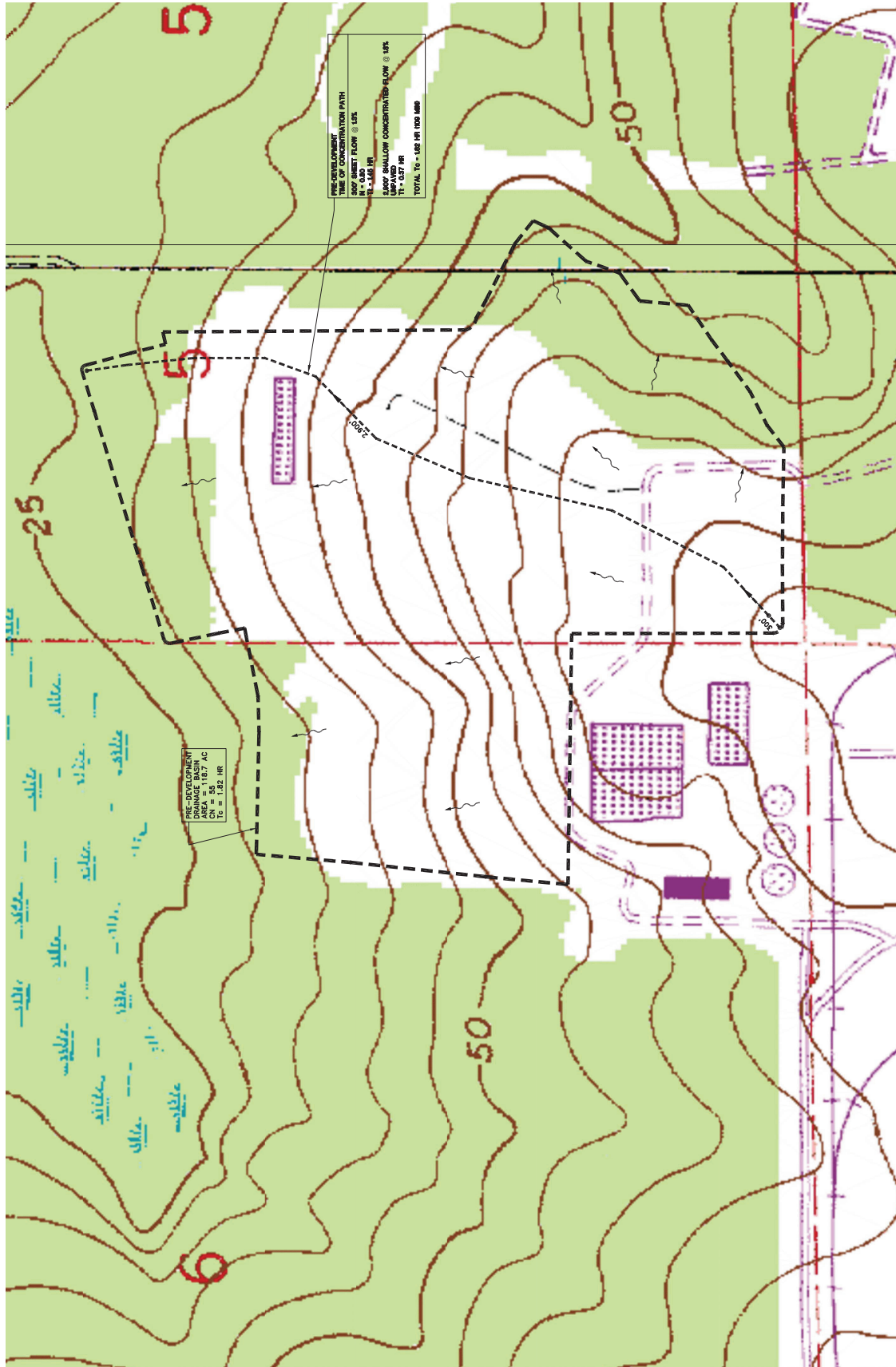
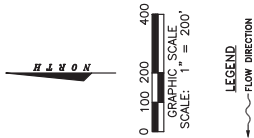


FIGURE 1

CLIENT SEMINOLE ELECTRIC COOPERATIVE, INC (SECI)	PROJECT INCREMENT 1 BUILDOUT AT SEMINOLE GENERATING STATION (SGS)	TASK PRE-DEVELOPMENT DRAINAGE BASIN MAP	REVISIONS: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____	ORIGINAL JULY 16, 2010 6. _____ 7. _____ 8. _____ 9. _____ 10. _____ 11. _____ 12. _____	JOB NO: 00015496 DRAWN: BGC DESIGN: BGC/JLM CHECKED: JLM Q.C.: DED SHEET / 4
					Name: JOSEPH L. MILLER Florida P.E. No.: 38177 Address: 482 S. Keller Road Ocala, FL 32668-5011 Signature: _____ Date: _____

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Pre- and Post-Development Conditions Hydrology Calculations

Seminole Generating Station Landfill

Weighted Curve Number Calculations

Pre-Development Conditions

Area : **Seminole Generating Station Landfill**
 Basin : **Pre-Dev**

Drainage Area : **118.7 acres**
 Normal Water Elev. : **N/A**

Curve Number (CN):

(ref. SCS TR-55, Second Ed., June 1986, Table 2-2a.)

Land Use	Hydrologic Soil Group								Product ac x CN	Total Area	% of Total
	A		B		C		D				
	acres	CN	acres	CN	acres	CN	acres	CN			
Woods, Good Condition	59.35	30		60		73	59.35	79	6469.15	118.70	100%
Totals	59.35		0.00		0.00		59.35		6469.15	118.70	100%

Weighted CN = Total Product / Total Area = **55**

Seminole Generating Station Landfill Weighted Curve Number Calculations Post-Development Conditions

Area : **Seminole Generating Station Landfill**
Basin : **Post-Dev**

Drainage Area : **118.7 acres**
Normal Water Elev. : **58.0**

Curve Number (CN):

(ref. SCS TR-55, Second Ed., June 1986, Table 2-2a.)

Land Use	Hydrologic Soil Group								Product ac x CN	Total Area	% of Total
	A		B		C		D				
	acres	CN	acres	CN	acres	CN	acres	CN			
Capped Landfill ¹	112.77	98							11050.97	112.77	95%
Open Space, Good Condition ²	5.94	39							231.47	5.94	5%
Totals	118.70		0.00		0.00		0.00		11282.44	118.70	100%

Weighted CN = Total Product / Total Area = 95

Notes : ¹ Impervious. 95% of Total Area. Includes Stormwater Pond water surface.

² Pervious. 5% of Total Area. Includes Stormwater Pond side slopes.

Pre-Development Conditions

Post-Development Conditions

Note: Time of Concentration (T_c) calculations based on SCS TR-55, Second Ed., June 1986

$$Tt = L / v / 3600$$

**Pre-Development Conditions
ICPR Runoff Calculations**

==== Basins =====

Name: Pre-Dev	Node: Pre-Dev	Status: Onsite
Group: BASE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph: Uh484	Peaking Factor: 484.0	
Rainfall File:	Storm Duration(hrs): 0.00	
Rainfall Amount(in): 0.000	Time of Conc(min): 109.00	
Area(ac): 118.700	Time Shift(hrs): 0.00	
Curve Number: 55.00	Max Allowable Q(cfs): 999999.000	
DCIA(%): 0.00		

==== Hydrology Simulations =====

Name: 25y24h-Pre
Filename: G:\PROJECTS\Seminole Electric Landfill\Engd\ICPR\25y24h-Pre.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 7.90

Time(hrs)	Print Inc(min)
30.000	5.00

Name: Mean Annual-Pre
Filename: G:\PROJECTS\Seminole Electric Landfill\Engd\ICPR\Mean Annual-Pre.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 4.40

Time(hrs)	Print Inc(min)
30.000	5.00

Basin Name: Pre-Dev
Group Name: BASE
Simulation: 25y24h-Pre
Node Name: Pre-Dev
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484
Peaking Fator: 484.0
Spec Time Inc (min): 14.53
Comp Time Inc (min): 5.00
Rainfall File: Flmod
Rainfall Amount (in): 7.900
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 109.00
Time Shift (hrs): 0.00
Area (ac): 118.700
Vol of Unit Hyd (in): 1.001
Curve Number: 55.000
DCIA (%): 0.000

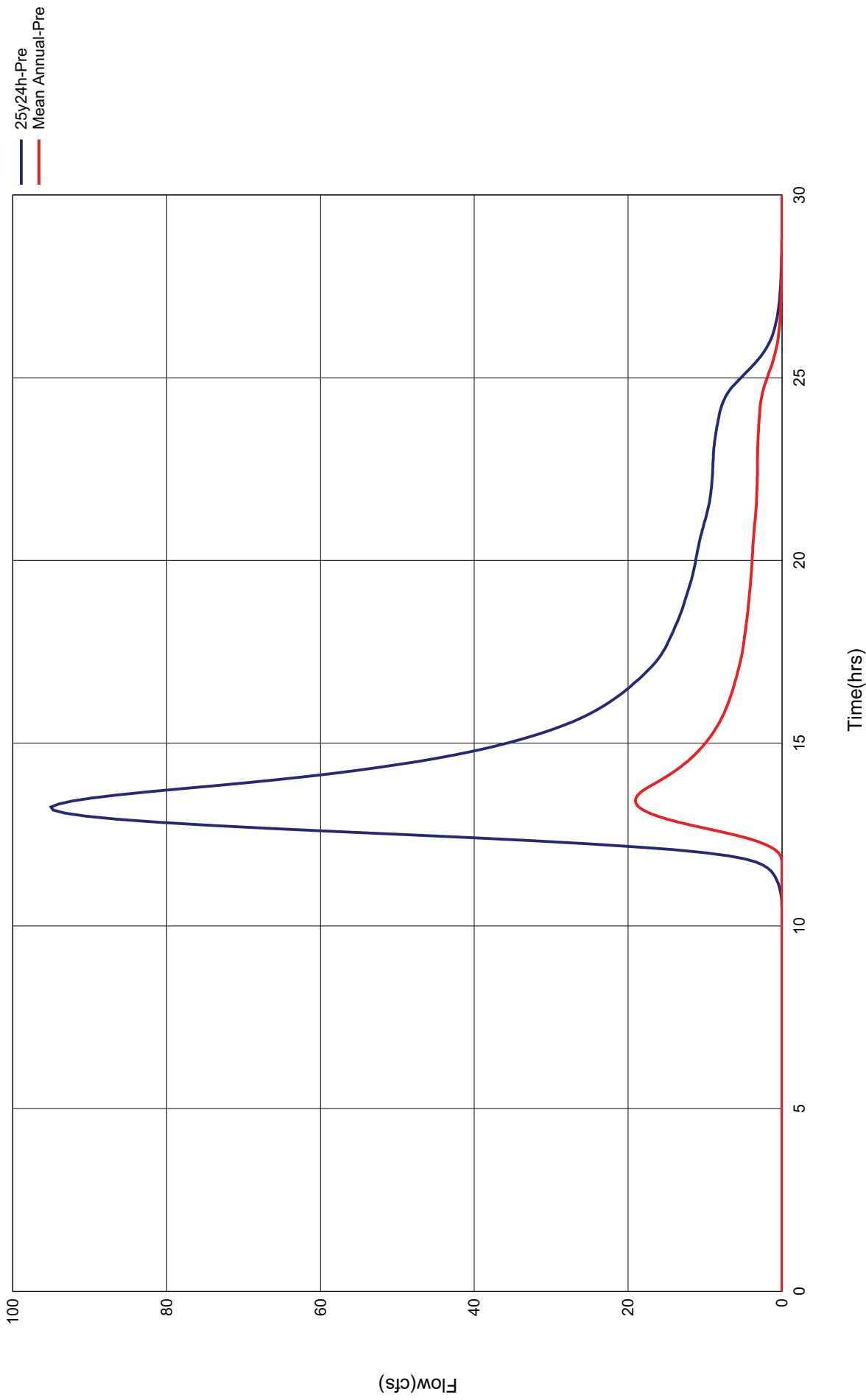
Time Max (hrs): 13.25
Flow Max (cfs): 95.03
Runoff Volume (in): 2.716
Runoff Volume (ft3): 1170461

Basin Name: Pre-Dev
Group Name: BASE
Simulation: Mean Annual-Pre
Node Name: Pre-Dev
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484
Peaking Fator: 484.0
Spec Time Inc (min): 14.53
Comp Time Inc (min): 5.00
Rainfall File: Flmod
Rainfall Amount (in): 4.400
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 109.00
Time Shift (hrs): 0.00
Area (ac): 118.700
Vol of Unit Hyd (in): 1.001
Curve Number: 55.000
DCIA (%): 0.000

Time Max (hrs): 13.42
Flow Max (cfs): 19.05
Runoff Volume (in): 0.698
Runoff Volume (ft3): 300721

Basin Pre-Dev



**Post-Development Conditions
Water Quality Treatment Calculations**

Seminole Generating Station Landfill Water Quality Treatment Calculations Post-Development Conditions

Data sources and methodologies from SJRWMD Applicant's Handbook: Regulation of Stormwater Management Systems
Chapter 40C-42, F.A.C., Revised December 3, 2006

Area : **Seminole Generating Station Landfill**
Basin : **Post-Dev**

Drainage Area : **118.7 acres**
Normal Water Elev. : **58.0**

Impervious Surfaces

Assume 95% Imperviousness over Drainage Area for water quality treatment volume determination purposes:

$$\text{Impervious Area} = \text{Drainage Area} * 95\% = 112.77 \text{ acres}$$

Wet Detention Stormwater Management System Requirements:

(ref. SJRWMD Applicant's Handbook, Ch. 40C-42.026(4))

(a) Provide a treatment volume of the greater of the following:

1. First one inch of runoff; or
2. 2.5 inches of runoff from the impervious area.

$$\begin{aligned} \text{First one inch of runoff} &= (1" * \text{Drainage Area} * 1'/12") = 9.89 \text{ ac-ft} \\ \text{2.5 inches of runoff from the impervious area} &= (2.5" * \text{Impervious Area} * 1'/12") = 23.49 \text{ ac-ft} \quad (\text{greater}) \end{aligned}$$

Permanent Pool Volume Requirements:

$$\text{Runoff Coefficient (C)} = (\text{Impervious Area} * 0.9) + (\text{Pervious Area} * 0.2) = 0.87$$

$$\text{Permanent Pool} = \text{DA} * \text{C} * \text{R} * \text{RT} / (\text{WS} * \text{CF}) = 36.41 \text{ ac-ft}$$

DA	Drainage Area	118.70 ac	
C	Runoff Coefficient	0.87	
R	Wet Season Rainfall	31 in	SJRWMD Fig. 29-1 for Palatka
RT	Residence Time	21 days	Non-Littoral Zone Option
WS	Wet Season	153 days	SJRWMD, June-October
CF	Conversion Factor	12 in/ft	

Pond Stage-Area-Storage Tabulations:

	Stage (ft, NGVD)	Area (ac)	Storage (ac-ft)	Perm. Pool (ac-ft)	Treat. Vol. (ac-ft)	Side Slopes
Top of Bank El.	66.00	9.82	116.35	-	66.06	
	65.00	9.43	106.72	-	56.43	
	64.00	9.03	97.49	-	47.20	
	63.00	8.64	88.66	-	38.37	
	62.00	8.25	80.22	-	29.92	
Actual Weir El.	61.30			-	24.29	
Min. Weir El.	61.20			-	23.49	
	61.00	7.86	72.16	-	21.87	
	60.00	7.48	64.49	-	14.20	
	59.00	7.10	57.20	-	6.91	
NWL El.	58.00	6.73	50.29	50.29	0.00	
	57.00	6.36	43.75	43.75	-	
	56.00	5.99	37.58	37.58	-	
	55.00	5.81	31.67	31.67	-	
	54.00	5.63	25.95	25.95	-	
	53.00	5.45	20.41	20.41	-	
	52.00	5.28	15.04	15.04	-	
	51.00	5.10	9.85	9.85	-	
	50.00	4.93	4.84	4.84	-	
Bottom El.	49.00	4.75	0.00	0.00	-	

$$\text{Permanent Pool Volume Provided} = 50.29 \text{ ac-ft} > 36.41 \text{ ac-ft}$$

$$\text{Wet Detention Treatment Volume Provided} = 24.29 \text{ ac-ft} > 23.49 \text{ ac-ft}$$

$$\text{Mean Depth} = \text{Perm. Pool Vol.} / \text{NWL Area} = 7.48 \text{ ft} (> 2 \text{ ft}, < 8 \text{ ft})$$

Seminole Generating Station Landfill Water Quality Treatment Calculations Post-Development Conditions

Data sources and methodologies from SJRWMD Applicant's Handbook: Regulation of Stormwater Management Systems
Chapter 40C-42, F.A.C., Revised December 3, 2006

Orifice Sizing Calculations

The orifice is sized to discharge one-half the treatment volume in 24 - 30 hours

Size orifice for 27-hour drawdown (avg. of 24 and 30):

$$Q = TV * CF1 / (2 * t * CF2) = 5.442 \text{ cfs}$$

TV = Treatment Volume = 24.29 ac-ft
 t = Recovery Time (Minimum) = 27 hrs
 CF1 = Conversion Factor = 43560 sf/ac
 CF2 = Conversion Factor = 3600 sec/hr
 BASEFLOW = 0 cfs

$$h = (h1 + h2) / 2 = 2.48 \text{ ft}$$

h1 = Total TV Depth = 3.30 ft
 h2 = Depth @ 1/2 TV = 1.65 ft

$$A = Q / (C * (2 * 32.2 \text{ ft/sec}^2 * h)^{0.5}) = 0.718 \text{ sf} \quad \text{(rearrangement of orifice eq'n where C = 0.6)}$$

$$D = (4 * A / 3.14)^{0.5} * 12 \text{ in/ft} = 11.48 \text{ in} \quad 5.7385 \text{ in}$$

use **12 in** (w/ elbow turned down) or **(2) 5 in**

Pre-Development Runoff Analysis

Computer program "Interconnected Channel and Pond Routing Model (ICPR) Version 3" was used to compute runoff hydrographs from the site under pre-development conditions for the Mean Annual and 25-year/24-hour storm events using the SCS Unit Hydrograph Method, Peaking Factor = 484 (ICPR input and results follow).

Below is a summary of results from the ICPR Version 3 Pre-Development Runoff Analysis:

<u>Mean Annual /24-Hour Storm</u>	(4.4" Rainfall; SCS Type II Florida Modified Distribution)
Maximum Runoff Flow	= 19.05 (cfs)
<u>25-Year / 24-Hour Storm</u>	(7.9" Rainfall; SCS Type II Florida Modified Distribution)
Maximum Runoff Flow	= 95.03 (cfs)

Post-Development Pond Routing Design and Analysis

Computer program "Interconnected Channel and Pond Routing Model (ICPR) Version 3" was used to design the pond to limit the post-development peak discharge to not exceed pre-development for the Mean Annual and 25-year/24-hour storm event and to contain the 100-year/24-hour storm event (ICPR input and results follow).

Outfall control structure CS-1 for the pond will be a drop structure and contain the following weir and pipe characteristics:

Weir #1 - Rectangular Weir

Weir Elevation	=	61.30 (ft)	(Water Quality Treatment EI.)
Weir Coefficient	=	3.2	
Weir Length	=	4.0 (ft)	
Weir Exponent	=	1.5	

Weir #2 - Inlet Top (for Discharges > 25-year/24-hour storm)

Weir Elevation	=	64.25 (ft)	
Weir Coefficient	=	3.2	
Weir Length	=	19.2 (ft)	(6'-7" x 3'-0")
Weir Exponent	=	1.5	

Seminole Generating Station Landfill Water Quality Treatment Calculations Post-Development Conditions

Data sources and methodologies from SJRWMD Applicant's Handbook: Regulation of Stormwater Management Systems
Chapter 40C-42, F.A.C., Revised December 3, 2006

Outfall Pipe (RCP, Manning's n = 0.012)

Pipe Diameter	=	54 (in)
Pipe Length (control struct. to drop MH)	=	86 (ft)
Pipe Length (drop MH to MES at outfall)	=	40 (ft)
Pipe Inverts (control struct. to drop MH)	=	57.0 / 51.5
Pipe Inverts (drop MH to MES at outfall)	=	47.6 / 47.5

Below is a summary of results from the ICPR Version 3 Post-Development Pond Routing Design and Analysis:

<u>Mean Annual /24-Hour Storm</u>	<u>(4.4" Rainfall; SCS Type II Florida Modified Distribution)</u>			
Maximum Pond Stage	=	62.12 (ft)		
Maximum Pond Discharge	=	9.50 (cfs)	<	19.05 (cfs) Pre-Dev.
<u>25-year/24-hour Storm</u>	<u>(7.9" Rainfall; SCS Type II Florida Modified Distribution)</u>			
Maximum Pond Stage	=	64.13 (ft)		1.87 ft freeboard below TOB 66.0
Maximum Pond Discharge	=	60.90 (cfs)	<	95.03 (cfs) Pre-Dev.
<u>100-year/24-hour Storm</u>	<u>(10.0" Rainfall; SCS Type II Florida Modified Distribution)</u>			
Maximum Pond Stage	=	65.14 (ft)		0.86 ft freeboard below TOB 66.0
Maximum Pond Discharge	=	137.42 (cfs)		

The calculation that follows is for the last 40 LF of 54" pipe from the drop manhole for energy dissipation to the receiving wetland.

Diameter = 54" RCP Manning's n = 0.012 Slope = 0.15%

<u>25-Year / 24-Hour Storm</u>		
Discharge	=	60.90 (cfs)
Velocity at Outfall	=	3.83 (fps)
<u>100-Year / 24-Hour Storm</u>		
Discharge	=	137.42 (cfs)
Velocity at Outfall	=	8.64 (fps)

**Post-Development Conditions
ICPR Runoff Calculations
and
Pond Routing Design and Analysis**

=====
Basins
=====

Name: Post-Dev Node: Pond Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh484 Peaking Factor: 484.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 42.00
Area(ac): 118.700 Time Shift(hrs): 0.00
Curve Number: 95.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

=====
Nodes
=====

Name: D-1 Base Flow(cfs): 0.000 Init Stage(ft): 51.500
Group: BASE Warn Stage(ft): 56.500
Type: Stage/Area

Stage(ft) Area(ac)

Name: Pond Base Flow(cfs): 0.000 Init Stage(ft): 58.000
Group: BASE Warn Stage(ft): 65.000
Type: Stage/Area

Stage(ft) Area(ac)

58.000 6.7300
59.000 7.1000
60.000 7.4800
61.000 7.8600
62.000 8.2500
63.000 8.6400
64.000 9.0300
65.000 9.4300
66.000 9.8200

Name: Wetland Base Flow(cfs): 0.000 Init Stage(ft): 52.000
Group: BASE Warn Stage(ft): 52.000
Type: Time/Stage

Time(hrs) Stage(ft)

0.00 52.000
100.00 52.000

=====
Pipes
=====

Name: D-1 TO WETLAND From Node: D-1 Length(ft): 40.00
Group: BASE To Node: Wetland Count: 1

UPSTREAM DOWNSTREAM Friction Equation: Automatic
Geometry: Circular Circular Solution Algorithm: Most Restrictive
Span(in): 54.00 54.00 Flow: Both
Rise(in): 54.00 54.00 Entrance Loss Coef: 0.50
Invert(ft): 47.600 47.500 Exit Loss Coef: 1.00
Manning's N: 0.012000 0.012000 Bend Loss Coef: 0.00
Top Clip(in): 0.000 0.000 Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 0.000 0.000 Inlet Ctrl Spec: Use dc
Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

==== Drop Structures =====

Name: CS-1	From Node: Pond	Length(ft): 86.00
Group: BASE	To Node: D-1	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 54.00	54.00	Flow: Both
Rise(in): 54.00	54.00	Entrance Loss Coef: 0.500
Invert(ft): 57.000	51.500	Exit Loss Coef: 1.000
Manning's N: 0.012000	0.012000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000	0.000	Solution Incs: 10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

*** Weir 1 of 2 for Drop Structure CS-1 ***

Count: 1	Bottom Clip(in): 0.000
Type: Vertical: Mavis	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 48.00	Invert(ft): 61.300
Rise(in): 35.40	Control Elev(ft): 61.300

TABLE

*** Weir 2 of 2 for Drop Structure CS-1 ***

Count: 1	Bottom Clip(in): 0.000
Type: Horizontal	Top Clip(in): 0.000
Flow: Both	Weir Disc Coef: 3.200
Geometry: Rectangular	Orifice Disc Coef: 0.600
Span(in): 79.00	Invert(ft): 64.250
Rise(in): 36.00	Control Elev(ft): 64.250

TABLE

==== Hydrology Simulations =====

Name: 100y24h-Post
Filename: G:\PROJECTS\Seminole Electric Landfill\Engd\ICPR\100y24h-Post.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 10.00

Time(hrs)	Print Inc(min)
30.000	5.00

Name: 25y24h-Post
Filename: G:\PROJECTS\Seminole Electric Landfill\Engd\ICPR\25y24h-Post.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 7.90

Time(hrs)	Print Inc(min)
30.000	5.00

Name: Mean Annual-Pos
Filename: G:\PROJECTS\Seminole Electric Landfill\Engd\ICPR\Mean Annual-Pos.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 4.40

Time(hrs)	Print Inc(min)
30.000	5.00

==== Routing Simulations =====

Name: 100y24h-Post Hydrology Sim: 100y24h-Post
Filename: G:\PROJECTS\Seminole Electric Landfill\Engd\ICPR\100y24h-Post.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

48.000 15.000

Group Run

BASE Yes

Name: 25y24h-Post Hydrology Sim: 25y24h-Post
Filename: G:\PROJECTS\Seminole Electric Landfill\Engd\ICPR\25y24h-Post.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

48.000 15.000

Group Run

BASE Yes

Name: Mean Annual-Pos Hydrology Sim: Mean Annual-Pos
Filename: G:\PROJECTS\Seminole Electric Landfill\Engd\ICPR\Mean Annual-Pos.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 30.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

48.000 15.000

Group Run

BASE Yes

Basin Name: Post-Dev
Group Name: BASE
Simulation: 100y24h-Post
Node Name: Pond
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484
Peaking Fator: 484.0
Spec Time Inc (min): 5.60
Comp Time Inc (min): 5.00
Rainfall File: Flmod
Rainfall Amount (in): 10.000
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 42.00
Time Shift (hrs): 0.00
Area (ac): 118.700
Vol of Unit Hyd (in): 1.001
Curve Number: 95.000
DCIA (%): 0.000

Time Max (hrs): 12.33
Flow Max (cfs): 563.09
Runoff Volume (in): 9.400
Runoff Volume (ft3): 4050129

Basin Name: Post-Dev
Group Name: BASE
Simulation: 25y24h-Post
Node Name: Pond
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484
Peaking Fator: 484.0
Spec Time Inc (min): 5.60
Comp Time Inc (min): 5.00
Rainfall File: Flmod
Rainfall Amount (in): 7.900
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 42.00
Time Shift (hrs): 0.00
Area (ac): 118.700
Vol of Unit Hyd (in): 1.001
Curve Number: 95.000
DCIA (%): 0.000

Time Max (hrs): 12.33
Flow Max (cfs): 442.26
Runoff Volume (in): 7.305
Runoff Volume (ft3): 3147724

Basin Name: Post-Dev
Group Name: BASE
Simulation: Mean Annual-Pos
Node Name: Pond
Basin Type: SCS Unit Hydrograph

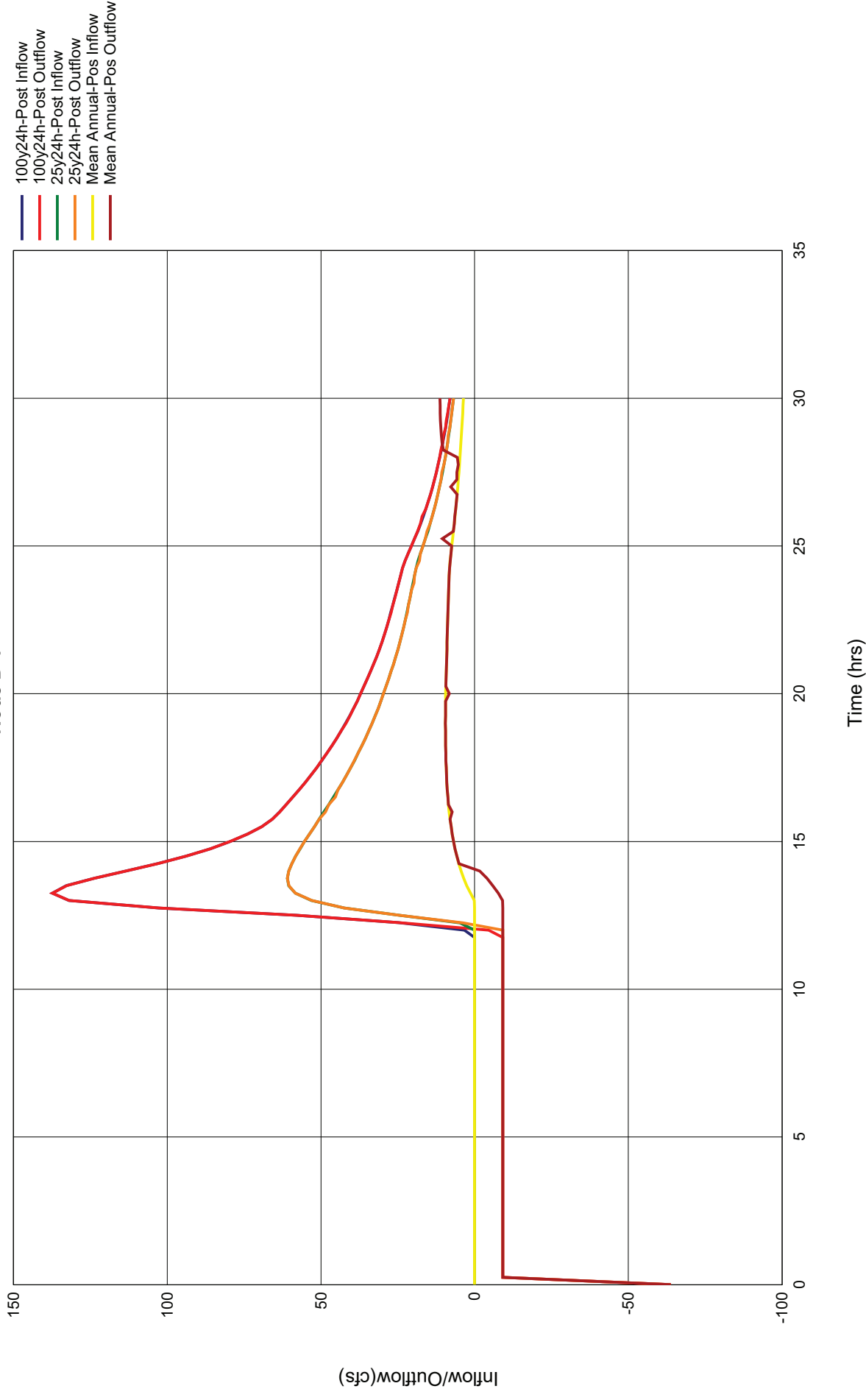
Unit Hydrograph: Uh484
Peaking Fator: 484.0
Spec Time Inc (min): 5.60
Comp Time Inc (min): 5.00
Rainfall File: Flmod
Rainfall Amount (in): 4.400
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 42.00
Time Shift (hrs): 0.00
Area (ac): 118.700
Vol of Unit Hyd (in): 1.001
Curve Number: 95.000
DCIA (%): 0.000

Time Max (hrs): 12.33
Flow Max (cfs): 239.12
Runoff Volume (in): 3.828
Runoff Volume (ft3): 1649313

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
D-1	BASE	100y24h-Post	13.23	53.91	56.50	0.1932	118	13.23	137.42	13.23	137.42
D-1	BASE	25y24h-Post	13.74	52.37	56.50	0.1932	118	13.74	60.90	13.74	60.90
D-1	BASE	Mean Annual-Pos	19.29	52.01	56.50	0.1932	132	18.94	9.50	19.29	12.02
Pond	BASE	100y24h-Post	13.23	65.14	65.00	0.0031	413127	12.33	563.07	13.23	137.42
Pond	BASE	25y24h-Post	13.74	64.13	65.00	0.0031	395593	12.33	442.26	13.74	60.90
Pond	BASE	Mean Annual-Pos	18.94	62.12	65.00	0.0004	361401	12.33	239.12	18.94	9.50
Wetland	BASE	100y24h-Post	0.00	52.00	52.00	0.0000	19	13.23	137.42	0.00	0.00
Wetland	BASE	25y24h-Post	0.00	52.00	52.00	0.0000	19	13.74	60.90	0.00	0.00
Wetland	BASE	Mean Annual-Pos	0.00	52.00	52.00	0.0000	19	19.29	12.02	0.00	0.00

Seminole Electric Cooperative, Inc. Landfill
Mean Annual, 25-year and 100-year Post-Development Conditions

Node D-1



Control Structure Outfall Pipe Calculations

**Seminole Generating Station Landfill
Stormwater Pond B
Control Structure Outfall Pipe Calculations**

Design of outfall pipe from manhole drop structure to mitered end section at outfall:

Pipe Size [in]	Slope	Manning's n	Max Capacity Full Flow [cfs]	Max Full Flow Velocity [fps]
54	0.15%	0.012	82.73	5.20

Pipe Size [in]	25 Yr Design Flow [cfs]	25 Yr Design Velocity [fps]	100 Yr Design Flow [cfs]	100 Yr Design Velocity [fps]
54	60.90	3.83	137.42	8.64