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Increment 1 Buildout at Seminole Generating Station Landfill

Putnam County, Florida

Stormwater Management Plan

July 16, 2010

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

STORMWATER MANAGEMENT PLAN
JULY 16, 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 the 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. Also, since there will be no wetland impacts with the Increment 1 Buildout or future work at the landfill, Pond B will provide peak discharge attenuation for the Mean Annual / 24-Hour Storm so that post-development peak discharge rate does not exceed that 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 83 (feet, NGVD 1929) at the southern end of the site to approximately 35 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.

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:

Pre-Development Conditions

Area	=	118.7 acres
Curve Number (CN)	=	55
Time of concentration (Tc)	=	1.99 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 12.27 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 hydrograph for the project.

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 bottom of Pond B for conservatism. The remaining 5% of the site was assumed to be Open Space, Good Condition in Type A soils since this is the area of the proposed Pond B.

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)	=	0.57 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 184.80 cfs. Therefore, Pond B will need to provide peak discharge attenuation to reduce this runoff rate from the site to a maximum of 12.27 cfs.

Please see the following for Post-Development Conditions Hydrology Calculations and Post-Development Conditions PONDS runoff and routing calculations.

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The computer program "PONDS Version 3.2.0207 Retention Pond Recovery – Refined Method" was used for computing the post-development runoff hydrograph for the project to be consistent with the PONDS pond routing design analysis also performed.

Please see the Post-Development Conditions Hydrology Calculations and PONDS Analysis 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 Stormwater Underdrain System according to St. Johns River Water Management District's (SJRWMD) Applicant's Handbook for Regulation of Stormwater Management Systems, Ch. 40C-42, F.A.C. (i.e., a dry pond with a side bank perforated pipe underdrain for treatment volume recovery within 72 hours of a storm event).

- The water quality treatment volume provided in the pond is for Online Retention per the Applicant's Handbook, determined to be the greater of the first one-half inch of runoff or 1.25 inches of runoff from the impervious area, plus an additional one half inch of runoff from the drainage 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 / 24-hour storm event so that the peak discharge rate at 95% imperviousness at ultimate buildout does not exceed that for pre-development (i.e., pre-landfill) conditions.

- 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.

- The pond bottom will be at elevation 60.0, which is 2 feet above the estimated seasonal high groundwater table elevation 58.0 discussed above. The pond top-of-bank will be at elevation 70.0.

- The computer program "PONDS Version 3.2.0207 Retention Pond Recovery – Refined Method" was used to perform a routing with infiltration design of the pond to determine peak stages and discharges for the Mean Annual / 24-Hour, 25-Year / 24-Hour, and 100-Year / 24-Hour Storm events. The PONDS analysis takes into account groundwater mounding as required in the SJRWMD Applicant's Handbook in support of treatment volume recovery calculations.

- Since the calculations showed that the treatment volume does not fully recover within 72 hours, the computer program "PONDS Side/Bottom Drain Analysis for Filtration System Version 3.2.0030" was also used to design a total of 2,200 lineal feet of 12-inch perforated underdrain for volume recovery.

- Input parameters obtained from the Geotechnical Investigation Report for performing the PONDS routing design analysis are as follows:

Unsaturated Vertical Infiltration Rate	=	6 ft/day (incl. F.S. of 2)
Horizontal Saturated Hydraulic Conductivity	=	12 ft/day (incl. F.S. of 2)
Fillable Porosity	=	20 %
Base Of Aquifer Elevation	=	15 (from TB-10)
Seasonal High Groundwater Table Elev.	=	58 (as discussed above)

- Input parameters obtained from the Geotechnical Investigation Report for performing the PONDS side bank underdrain design analysis are as follows:

Permeability of filter sand	=	24 ft/day
Factor of safety for analysis	=	2

  The permeability used is the Horizontal Saturated Hydraulic Conductivity value of 12 ft/day doubled to 24 ft/day to account for the safety factor of 2 used in the analysis.

- The pond's outfall control structure is a modified FDOT Type H ditch bottom inlet with a weir notch at elevation 64.40 to provide required water quality treatment volume and a 54-inch RCP outfall pipe at the north end of the pond. 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 side bank underdrain pipes will connect to the outfall control structure.

- An emergency overflow spillway at 0.5-foot below the pond top-of-bank elevation 70.0, or elevation 69.5, 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 11.83 cfs, which is less than the pre-development (i.e., pre-landfill) peak discharge rate of 12.27 cfs. The pond was also analyzed for the 25-Year / 24-Hour and 100-Year / 24-Hour Storm events. Below is a summary of results from the PONDS Pond Routing with Infiltration Analysis:

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

Maximum Pond Stage	=	65.91	
Maximum Pond Discharge	=	11.83 cfs	< 12.27 cfs Pre-Development

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

Maximum Pond Stage	=	68.42	1.58 ft freeboard below TOB 70.0
Maximum Pond Discharge	=	68.05 cfs	

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

Maximum Pond Stage	=	69.22	0.78 ft freeboard below TOB 70.0
Maximum Pond Discharge	=	148.99 cfs	

Please see the Post-Development Conditions Water Quality Treatment Calculations, PONDS Routing Analysis and PONDS Side/Bottom Drain 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 Stormwater Underdrain 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.

Wet Detention – A wet detention pond option was then explored but was not selected because of the difficulty in accommodating the treatment volume requirement which is significantly higher than for dry retention, but the biggest problem was the inability to meet the permanent pool requirement below the normal water level due to the narrow width of the pond.

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.

Stormwater Underdrain System – A stormwater underdrain system (i.e., a dry pond with a side bank perforated pipe underdrain for treatment volume recovery within 72 hours of a storm event) 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 Online Retention water quality treatment volume per the Applicant's Handbook.
- The pond can infiltrate most of the runoff from the three storm events analyzed but needs the side bank filter underdrain system to recover the entire treatment volume within 72 hours following a storm event.

Consequently, Pond B was designed as a Stormwater Underdrain System to meet the water quality treatment and recovery requirements from 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 including the side bank underdrain system. This information will be included in the site's Stormwater Pollution Prevention Plan (SWPPP).

Summary

Proposed stormwater management Pond B, as designed as a Stormwater Underdrain 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.

Ultimate Buildout Drainage Basin to Stormwater Pond B Map

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POST, BUCKLEY, SCHUH & JERNIGAN, Inc.
d/b/a PBS&J
5300 West Cypress Street, Suite 200,
Tampa, fl 33607
FBPR Certificate of Authorization No.: 24

CLIENT	PROJECT	TASK
SEMINOLE ELECTRIC COOPERATIVE, INC (SECI)	INCREMENT 1 BUILDOUT AT SEMINOLE GENERATING STATION (SGS)	ULTIMATE BUILDOUT DRAINAGE BASIN TO STORMWATER POND B

ORIGINAL JULY 16, 2010
REVISIONS:
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4.
5.
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7.
8.
9.
10.
11.
12.

Name: JOSEPH L. MILLER
Florida P.E. No.: 39177
Address: PBS&J
482 S. Keller Road
Orlando, FL 32810-6101
Signature Date

JOB NO. 100013496
DRAWN RGC
DESIGN RGC/JLM
CHECKED JLM
Q.C. DED
SHEET /17

Pre- and Post-Development Conditions Hydrology Calculations

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

Area : **Seminole Generating Station Landfill** Drainage Area : **118.7 acres**

Basin : **Pre-Dev (i.e., Pre-Landfill)** 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	Total	% of
	A		B		C		D				
	acres	CN	acres	CN	acres	CN	acres	CN	ac x CN	Area	Total
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** Drainage Area : **118.7 acres**

Basin : **Post-Dev** Normal Water Elev. : **N/A (dry pond)**

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

Land Use	Hydrologic Soil Group								Product	Total	% of
	A		B		C		D				
	acres	CN	acres	CN	acres	CN	acres	CN	ac x CN	Area	Total
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 bottom.

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

Seminole Generating Station Landfill
Time of Concentration Calculations

Pre-Development Conditions

Basin ID	Sheet Flow							Shallow Concentrated Flow										Ditch Flow			Pipe Flow			Total	Total
								Paved					Unpaved												
	n	L	P2	Beg. El.	End. El.	s	Tt	L	Beg. El.	End. El.	s	Tt	L	Beg. El.	End. El.	s	Tt	L	V	Tt	L	V	Tt	Tc	Tc
	---	ft	in	ft	ft	ft/ft	hr	ft	ft	ft	ft/ft	hr	ft	ft	ft	ft/ft	hr	ft	ft/sec	hr	ft	ft/sec	hr	hr	min
Pre-Dev	0.80	300	4.75	83.0	80.0	0.010	1.63					0.00	2700	80.0	35.0	0.017	0.36		2	0.00		5	0.00	**1.99**	**119**

Post-Development Conditions

Basin ID	Sheet Flow							Shallow Concentrated Flow										Ditch Flow			Pipe Flow			Total	Total
								Paved					Unpaved												
	n	L	P2	Beg. El.	End. El.	s	Tt	L	Beg. El.	End. El.	s	Tt	L	Beg. El.	End. El.	s	Tt	L	V	Tt	L	V	Tt	Tc	Tc
	---	ft	in	ft	ft	ft/ft	hr	ft	ft	ft	ft/ft	hr	ft	ft	ft	ft/ft	hr	ft	ft/sec	hr	ft	ft/sec	hr	hr	min
Post-Dev	0.40	200	4.75	200.0	195.0	0.025	0.47					0.00	800	195.0	75.0	0.150	0.04		2	0.00	1000	5	0.06	**0.57**	**34**

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

Equations

Sheet Flow: Tt = 0.007 (nL)^0.8 / (P2)^0.5 / s^0.4 (Eq. 3-3)

Shallow Concentrated Flow:

Paved: Tt = L / 20.3282 (s)^0.5 / 3600 (Eq. for Fig. 3-1, Paved)

Unpaved: Tt = L / 16.1345 (s)^0.5 / 3600 (Eq. for Fig. 3-1, Unpaved)

Ditch Flow: Tt = L / v / 3600 v = 2 ft/sec (assumed)

Pipe Flow: Tt = L / v / 3600 v = 5 ft/sec (assumed)

Pre-Development Conditions
ICPR Runoff Calculations

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

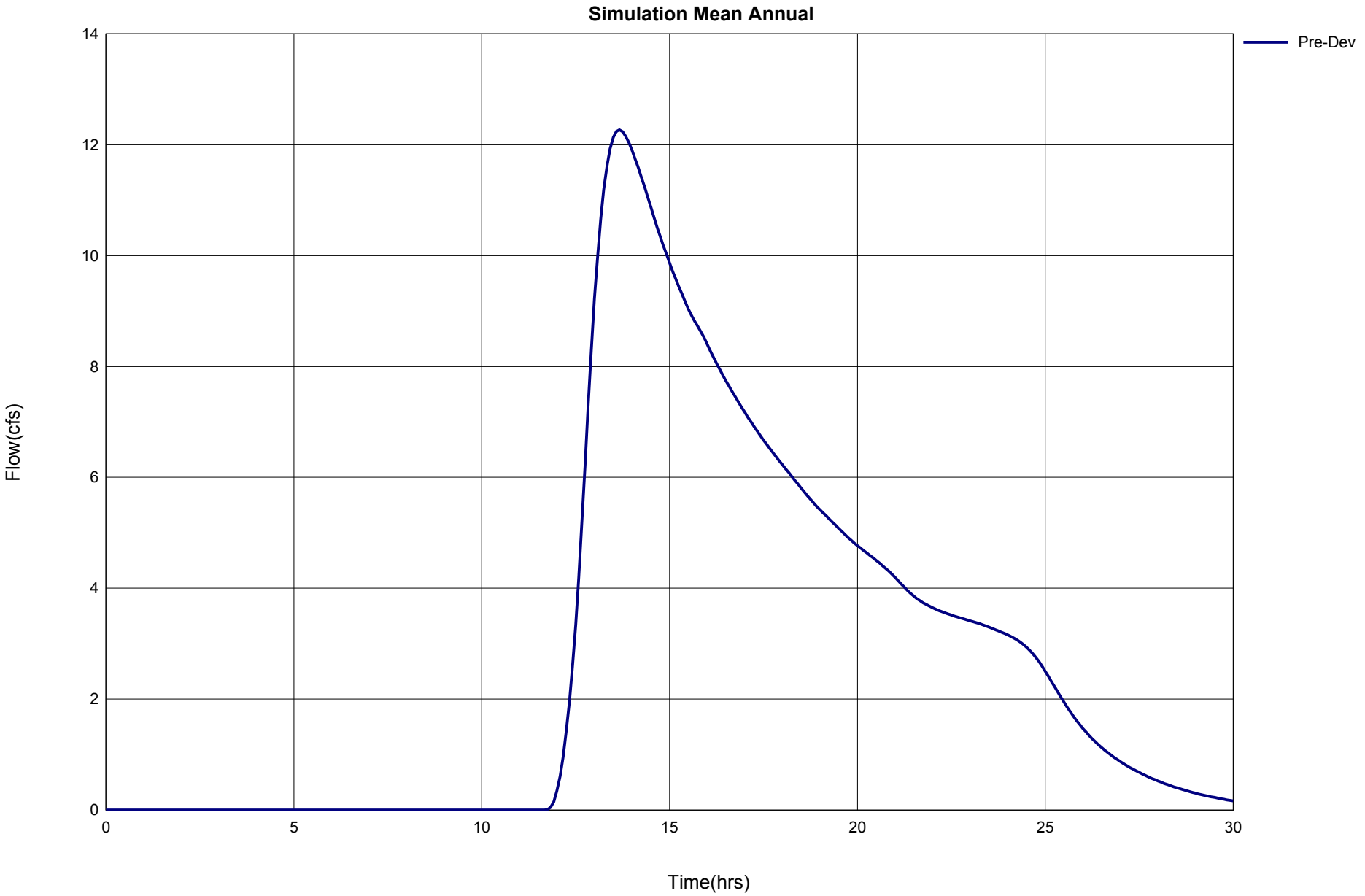
Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 4.40

Time(hrs)	Print Inc(min)
30.000	5.00

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

       Unit Hydrograph: Uh323
         Peaking Fator: 323.0
   Spec Time Inc (min): 15.87
   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): 119.00
      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): 13.67
       Flow Max (cfs): 12.27
    Runoff Volume (in): 0.698
   Runoff Volume (ft3): 300604
```


Simulation Mean Annual
Pre-Dev
Flow(cfs)
Time(hrs)
0
2
4
6
8
10
12
14
0
5
10
15
20
25
30

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.

Area : **Seminole Generating Station Landfill** Drainage Area : **118.7 acres**

Basin : **Post-Dev** Normal Water Elev. : **N/A (dry pond)**

Impervious Surfaces

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

Impervious Area = Drainage Area * 95% = 112.77 acres

Stormwater Underdrain System Treatment Volume Requirements: (ref. SJRWMD Applicant's Handbook, Sec. 12.2)

(a) Off-line retention of the first one-half inch of runoff or 1.25 inches of runoff from the impervious area, whichever is greater.
(b) On-line retention of an additional one half inch of runoff from the drainage area over that volume specified for off-line treatment.

The proposed pond will be an On-line dry pond with underdrains.

First one-half inch of runoff = (0.5" * Drainage Area * 1'/12")	=	4.95 ac-ft	
1.25 inches of runoff from impervious area = (1.25" * Impervious Area * 1'/12")	=	11.75 ac-ft	(greater)
Additional one-half inch of runoff = (0.5" * Drainage Area * 1'/12")	=	4.95 ac-ft	
Total On-line retention volume requirement	=	16.69 ac-ft	

Pond Stage-Area-Storage Tabulations:

	Stage (ft, NGVD)	Area (ac)	Storage (ac-ft)
Bottom El.	60.00	1.50	0.00
	61.00	2.41	1.96
	62.00	3.89	5.11
	63.00	5.00	9.55
	64.00	5.37	14.74
	65.00	5.81	20.33
	66.00	6.32	26.39
	67.00	6.91	33.01
	68.00	7.59	40.26
	69.00	8.00	48.05
Top of Bank El.	70.00	8.41	56.26

Treatment Volume Provided:

Minimum Weir Elevation Required	=	64.35	(ft)	to provide	16.69	ac-ft
Weir Elevation Provided	=	**64.40**	**(ft)**			
Treatment Volume Provided	=	**16.97**	**(ac-ft)**			
Extra Treatment Volume Provided	=	0.28	(ac-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.

Recovery Time Requirements: (ref. SJRWMD Applicant's Handbook, Sec. 12.3)

The system should be designed to provide for the drawdown of the appropriate treatment volume specified in section 12.2 within 72 hours following a storm event. The treatment volume is recovered by percolation through the soil with subsequent transport through the underdrain pipes. The system should only contain standing water within 72 hours of a storm event.

Computer program "PONDS Side/Bottom Drain Analysis for Filtration System Version 3.2.0030" was used to determine the length of side/bottom drain filter required to provide for the drawdown of the required treatment volume within 72 hours following a storm event (see PONDS analysis input data and results that follows).

Minimum Side/Bottom Drain Filter Required	=	2,196	(ft)
Side/Bottom Drain Filter Provided	=	**2,200**	**(ft)**
Perforated Pipe Diameter to be used	=	12	(in)

Pre-Development Runoff Analysis

Computer program "Interconnected Channel and Pond Routing Model (ICPR) Version 3" was used to compute the runoff hydrograph from the site under pre-development conditions (ICPR input and results follow).

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

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

Maximum Runoff Flow	=	**12.27**	**(cfs)**

Pond Routing with Infiltration Analysis

Computer program “PONDS Version 3.2.0207 Retention Pond Recovery – Refined Method” was used with the routing with infiltration design and analyze the pond for the 25-year/24-hour and 100-year/24-hour storm events (PONDS analysis input data and results follow).

The outfall control structure for the pond will contain the following weir characteristics:

Weir #1 - Rectangular Weir

Weir Elevation	=	64.40	(ft)	(Water Quality Treatment El.)
Weir Coefficient	=	3.2		
Weir Length	=	2	(ft)	
Weir Exponent	=	1.5		

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

Weir Elevation	=	68.00	(ft)
Weir Coefficient	=	3.13	
Weir Length	=	19.2	(ft)
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.

Below is a summary of results from the PONDS Pond Routing with Infiltration Analysis:

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

Maximum Pond Stage	=	**65.91**	**(ft)**			
Maximum Pond Discharge	=	**11.93**	**(cfs)**	<	12.27 (cfs)	Pre-Development

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

Maximum Pond Stage	=	**68.42**	**(ft)**	1.58 ft freeboard below Top of Bank 70.0
Maximum Pond Discharge	=	**68.05**	**(cfs)**	

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

Maximum Pond Stage	=	**69.22**	**(ft)**	0.78 ft freeboard below Top of Bank 70.0
Maximum Pond Discharge	=	**148.99**	**(cfs)**	

The outfall control structure will have a 54" outfall pipe to convey pond discharge. 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%

25-Year / 24-Hour Storm

Discharge	=	**68.05**	**(cfs)**
Velocity at Outfall	=	**4.28**	**(fps)**

100-Year / 24-Hour Storm

Discharge	=	**148.99**	**(cfs)**
Velocity at Outfall	=	**9.37**	**(fps)**

PONDS Side/Bottom Drain Analysis for Filtration System Version 3.2.0030 Design Analysis

PONDS
Side/Bottom Drain Analysis For Filtration System
Version 3.2.0030
Copyright 2000
Devo Seereeram, Ph.D., P.E.

Job Information

Job Name:	Seminole Electric Landfill
Engineer:	MDC
Date:	7-13-10

Input Data

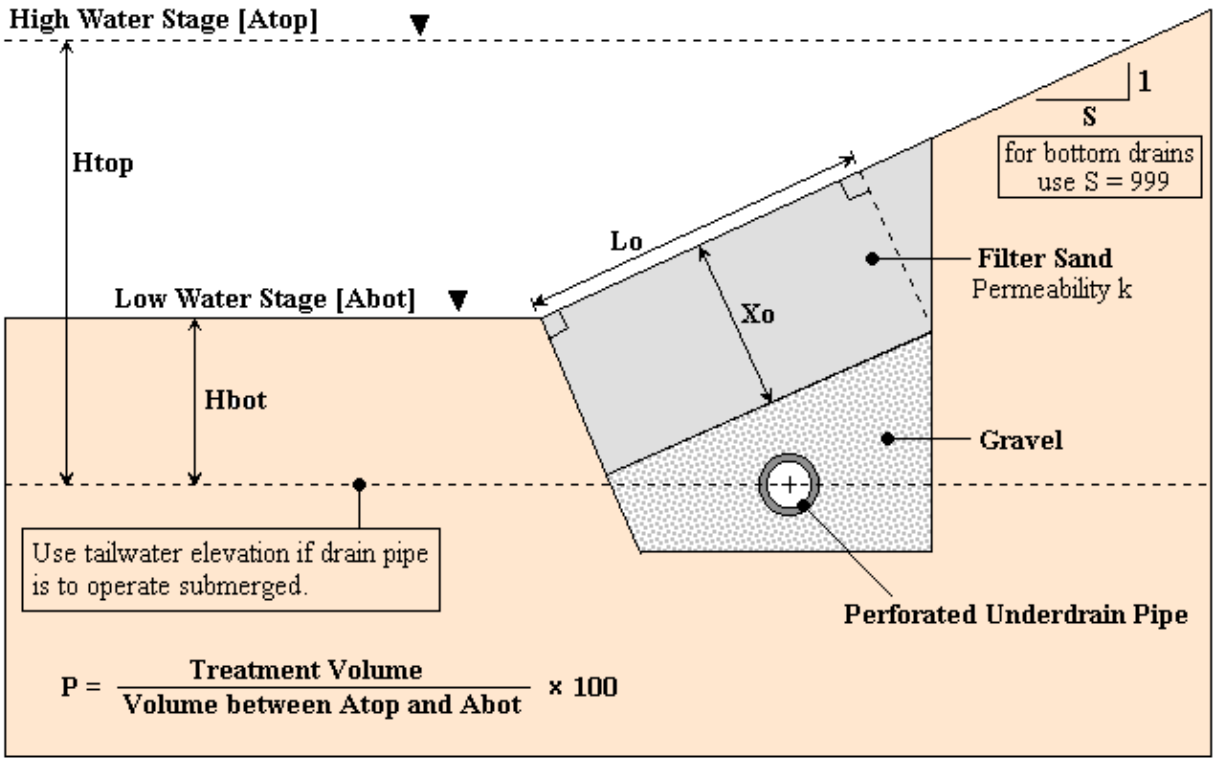
Surface area at high water stage, [Atop]:	241758	ft²
Surface area at low water stage, [Abot]:	94248	ft²
Permeability of filter sand, [k]:	24	ft/day
Driving head at high water stage, [Htop]:	6.9	ft
Driving head at low water stage, [Hbot]:	2.5	ft
Drawdown time, [t]:	3	days
Average flow path length, [Xo]:	2	ft
Exposed underdrain width, [Lo]:	4	ft
Slope of underdrain face, [S]:	4	?H : 1V
Factor of safety for analysis, [FS]:	2	
Percent drawdown for analysis, [P]:	95	%
Background seepage rate, [Q]:	.0001	gpm

Results

Total length of side/bottom drain filter required:	2178.237	ft
Total length of side/bottom drain filter required to recover treatment volume only:	2178.236	ft
Total length of side/bottom drain filter required to accomodate background seepage:	2.324792E-04	ft
Maximum flow rate through filter:	1.720584	gpm / lin ft
Average flow rate through filter:	0.860292	gpm / lin ft
Volume of water between Atop and Abot:	5530054	gallons
Recovery (or treatment) volume:	5253552	gallons
Recovery (or treatment) volume:	16.1215	acre-ft

Note

Drain pipe diameter should be checked to insure that peak flow can be accomodated.


High Water Stage [Atop]
Htop
Low Water Stage [Abot]
Hbot
Use tailwater elevation if drain pipe is to operate submerged.
Lo
Xo
1
S
for bottom drains use S = 999
Filter Sand
Permeability k
Gravel
Perforated Underdrain Pipe
P = Treatment Volume / Volume between Atop and Abot × 100

PONDS Version 3.2.0207 Retention Pond Recovery – Refined Method Design Analysis

PONDS Version 3.2.0207
Retention Pond Recovery - Refined Method
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Devo Seereeram, Ph.D., P.E.

Project Data

Project Name: Seminole Electric Landfill

Simulation Description:
Project Number:

Engineer : MDC

Supervising Engineer: WHT

Date: 07-13-2010

Aquifer Data

Base Of Aquifer Elevation, [B] (ft datum):	15.00
Water Table Elevation, [WT] (ft datum):	58.00
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day):	12.00
Fillable Porosity, [n] (%):	20.00
Unsaturated Vertical Infiltration Rate, [Iv] (ft/day):	6.0
Maximum Area For Unsaturated Infiltration, [Av] (ft^2):	65340.0

Geometry Data

Equivalent Pond Length, [L] (ft): 1000.0

Equivalent Pond Width, [W] (ft): 225.0

Ground water mound is expected to intersect the pond bottom

Stage vs Area Data

Stage (ft datum)	Area (ft^2)
60.00	65340.0
61.00	104979.6
62.00	169448.4
63.00	217800.0
64.00	233917.2
65.00	253083.6
66.00	275299.2
67.00	300999.6
68.00	330620.4
69.00	348480.0
70.00	366339.6

Discharge Structures

Discharge Structure #1 is active as weir

Structure Parameters

Description: Rectangular Weir

Weir elevation, (ft datum):	64.4
Weir coefficient:	3.2
Weir length, (ft):	2
Weir exponent:	1.5

Tailwater - disabled, free discharge

Discharge Structure #2 is active as weir

Structure Parameters

Description: Inlet Top

Weir elevation, (ft datum):	68
Weir coefficient:	3.13
Weir length, (ft):	19.2
Weir exponent:	1.5

Tailwater - disabled, free discharge

Discharge Structure #3 is inactive

Scenario Input Data

Scenario 1 :: 25yr24hr

Hydrograph Type:	Inline SCS
Modflow Routing:	Routed with infiltration
Repetitions:	1

Basin Area (acres)	118.700
Time Of Concentration (minutes)	34.0
DCIA (%)	0.0
Curve Number	95
Design Rainfall Depth (inches)	7.9
Design Rainfall Duration (hours)	24.0
Shape Factor	UHG 323
Rainfall Distribution	SCS Type II Florida Modified

Initial ground water level (ft datum) default, 58.00

Time After Storm Event (days)
1.000
2.000
3.000
4.000

Scenario 2 :: 100yr24hr

Hydrograph Type:	Inline SCS
Modflow Routing:	Routed with infiltration
Repetitions:	1

Basin Area (acres)	118.700
Time Of Concentration (minutes)	34.0
DCIA (%)	0.0
Curve Number	95
Design Rainfall Depth (inches)	10.0
Design Rainfall Duration (hours)	24.0
Shape Factor	UHG 323
Rainfall Distribution	SCS Type II Florida Modified

Initial ground water level (ft datum) default, 58.00

Time After Storm Event (days)
1.000
2.000
3.000
4.000

Scenario Input Data (cont'd.)

Scenario 3 :: Mean Annual

Hydrograph Type:	Inline SCS
Modflow Routing:	Routed with infiltration
Repetitions:	1

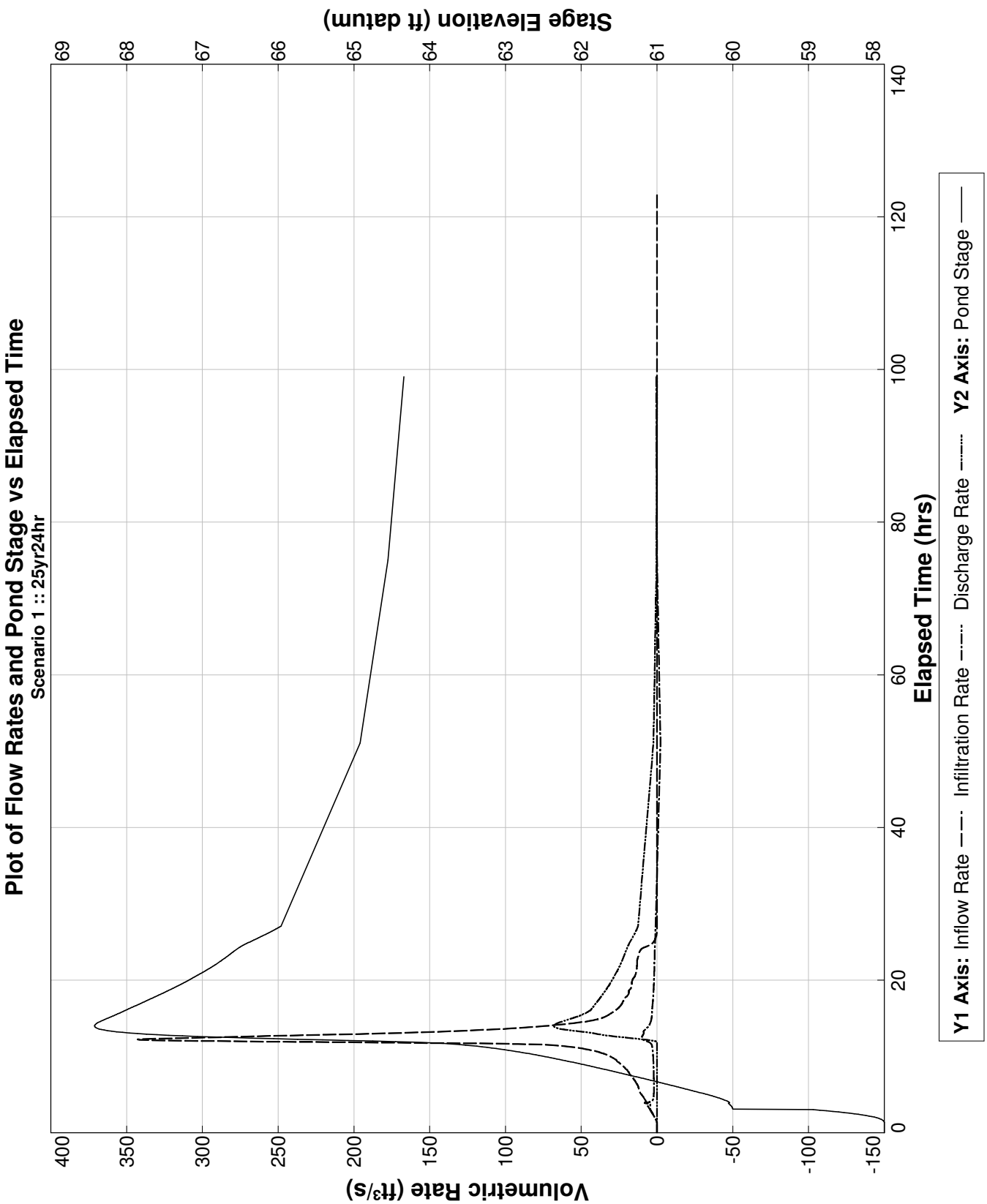
Basin Area (acres)	118.700
Time Of Concentration (minutes)	34.0
DCIA (%)	0.0
Curve Number	95
Design Rainfall Depth (inches)	4.4
Design Rainfall Duration (hours)	24.0
Shape Factor	UHG 323
Rainfall Distribution	SCS Type II Florida Modified

Initial ground water level (ft datum) default, 58.00

Time After Storm Event (days)
1.000
2.000
3.000
4.000

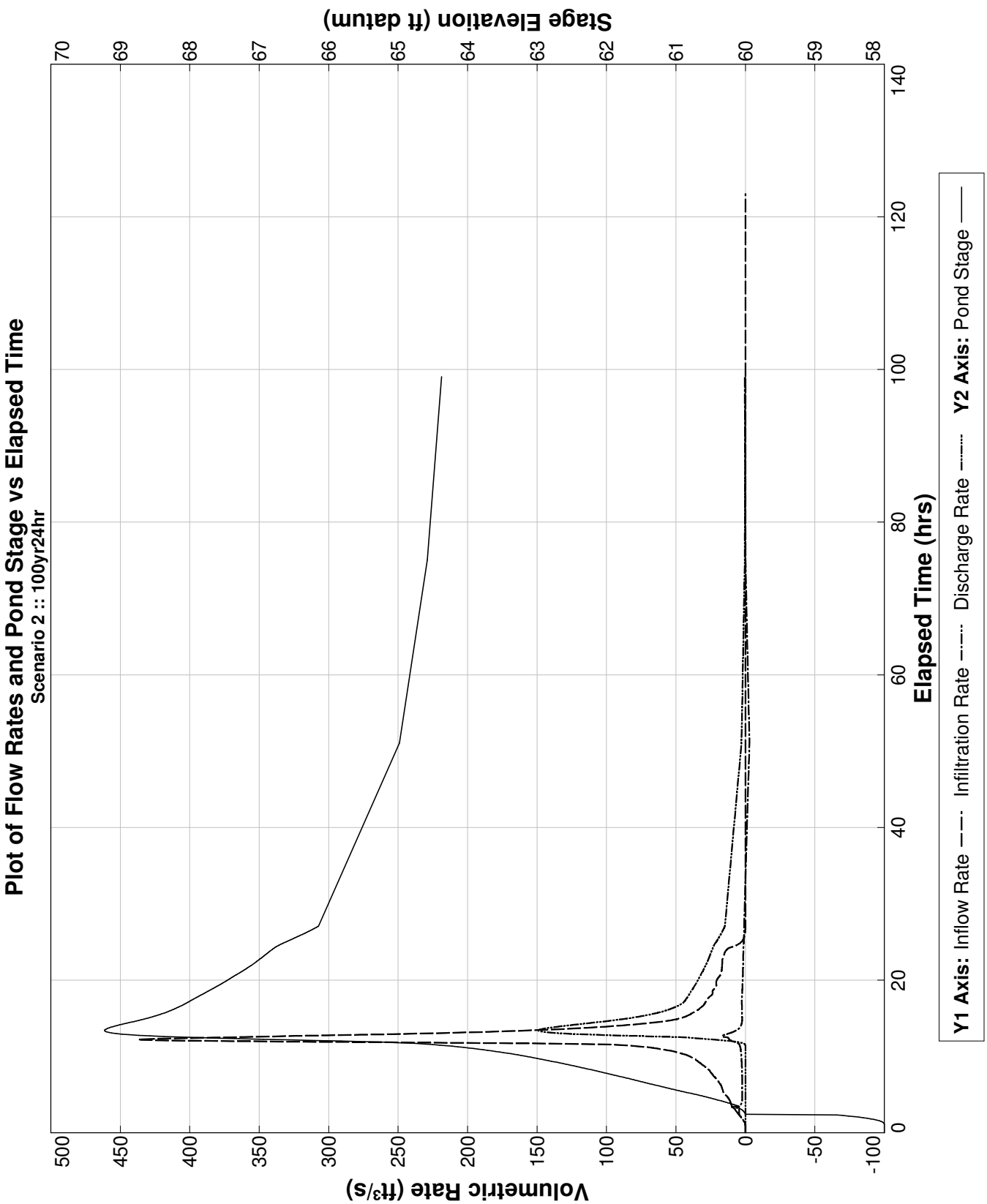
Summary of Results *:: Scenario 1 :: 25yr24hr*

	Time (hours)	Stage (ft datum)	Rate (ft^3/s)	Volume (ft^3)
Stage				
Minimum	0.000	58.00		
Maximum	13.978	68.42		
Inflow				
Rate - Maximum - Positive	12.240		342.8481	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	26.898			3155718.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			3155718.0
Infiltration				
Rate - Maximum - Positive	12.467		9.9883	
Rate - Maximum - Negative	51.049		-2.2953	
Cumulative Volume - Maximum Positive	27.049			265277.3
Cumulative Volume - Maximum Negative	75.049			-131345.5
Cumulative Volume - End of Simulation	123.049			-52494.8
Combined Discharge				
Rate - Maximum - Positive	13.978		68.0498	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	99.049			2529639.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			2529639.0
Discharge Structure 1 - simple weir				
Rate - Maximum - Positive	13.978		51.6072	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	99.049			2437789.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			2437789.0
Discharge Structure 2 - simple weir				
Rate - Maximum - Positive	13.978		16.4426	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	16.169			91849.5
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			91849.5
Discharge Structure 3 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Pollution Abatement:				
36 Hour Stage and Infiltration Volume	N.A.	N.A.		N.A.
72 Hour Stage and Infiltration Volume	N.A.	N.A.		N.A.


Plot of Flow Rates and Pond Stage vs Elapsed Time
Scenario 1 :: 25yr24hr
Volumetric Rate (ft³/s)
Stage Elevation (ft datum)
Elapsed Time (hrs)
Y1 Axis: Inflow Rate Infiltration Rate Discharge Rate Y2 Axis: Pond Stage

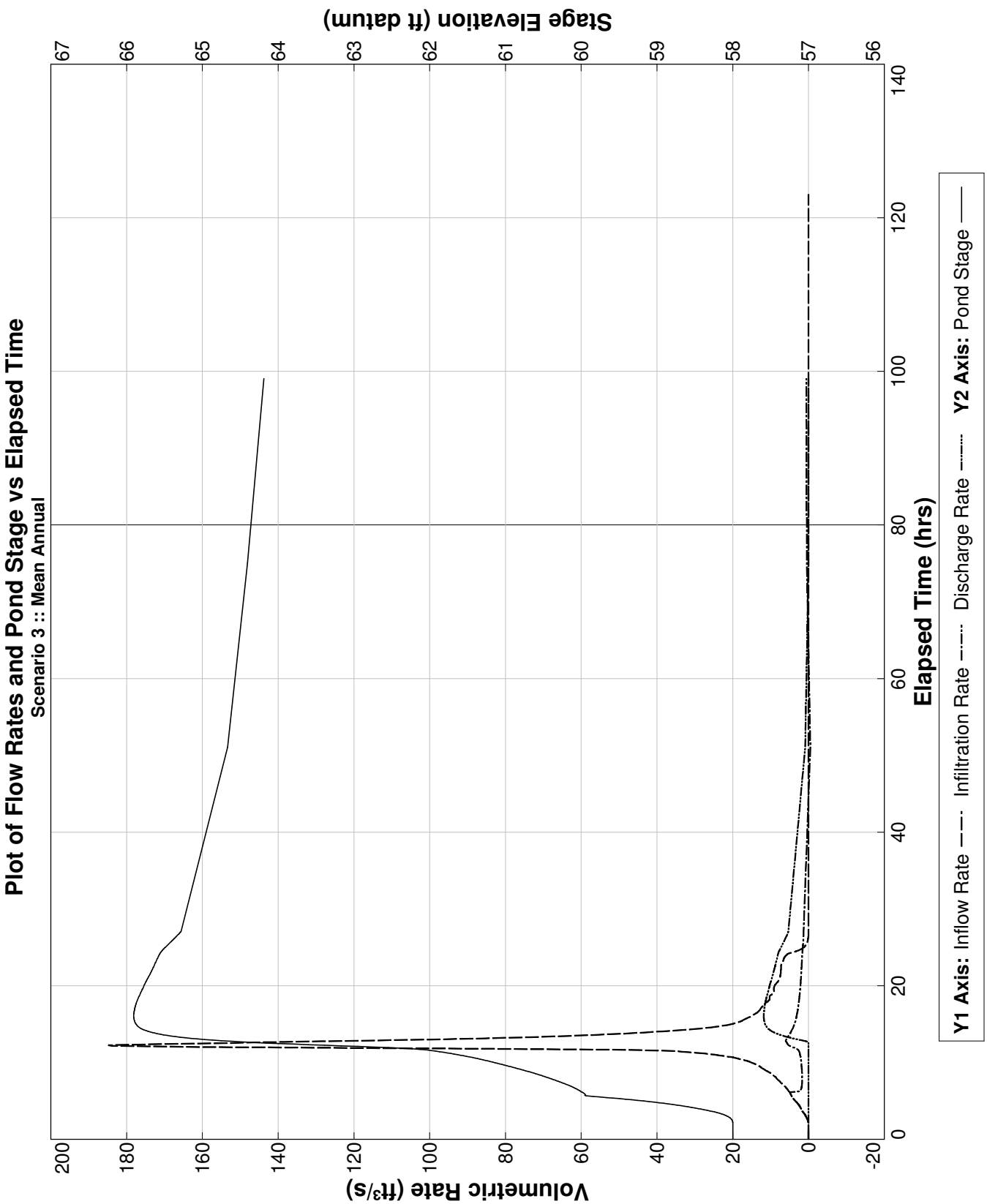
Summary of Results *:: Scenario 2 :: 100yr24hr*

	Time (hours)	Stage (ft datum)	Rate (ft^3/s)	Volume (ft^3)
Stage				
Minimum	0.000	58.00		
Maximum	13.373	69.22		
Inflow				
Rate - Maximum - Positive	12.240		436.8203	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	26.973			4060415.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			4060415.0
Infiltration				
Rate - Maximum - Positive	12.693		16.8794	
Rate - Maximum - Negative	51.049		-2.8606	
Cumulative Volume - Maximum Positive	27.049			277873.3
Cumulative Volume - Maximum Negative	75.049			-216444.3
Cumulative Volume - End of Simulation	123.049			-143394.2
Combined Discharge				
Rate - Maximum - Positive	13.373		148.9908	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	99.049			3517176.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			3517176.0
Discharge Structure 1 - simple weir				
Rate - Maximum - Positive	13.373		67.7721	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	99.049			2938616.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			2938616.0
Discharge Structure 2 - simple weir				
Rate - Maximum - Positive	13.373		81.2187	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	17.302			578559.3
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			578559.3
Discharge Structure 3 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Pollution Abatement:				
36 Hour Stage and Infiltration Volume	N.A.	N.A.		N.A.
72 Hour Stage and Infiltration Volume	N.A.	N.A.		N.A.


Plot of Flow Rates and Pond Stage vs Elapsed Time
Scenario 2 :: 100yr24hr
Volumetric Rate (ft³/s)
Stage Elevation (ft datum)
Elapsed Time (hrs)
Y1 Axis: Inflow Rate Infiltration Rate Discharge Rate Y2 Axis: Pond Stage

Summary of Results *:: Scenario 3 :: Mean Annual*

	Time (hours)	Stage (ft datum)	Rate (ft^3/s)	Volume (ft^3)
Stage				
Minimum	0.000	58.00		
Maximum	16.093	65.91		
Inflow				
Rate - Maximum - Positive	12.240		184.8005	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	26.973			1653502.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			1653502.0
Infiltration				
Rate - Maximum - Positive	12.844		6.0174	
Rate - Maximum - Negative	51.049		-0.4991	
Cumulative Volume - Maximum Positive	123.049			232632.7
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			232632.7
Combined Discharge				
Rate - Maximum - Positive	16.093		11.8290	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	99.049			779241.4
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			779241.4
Discharge Structure 1 - simple weir				
Rate - Maximum - Positive	16.093		11.8290	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	99.049			779241.4
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			779241.4
Discharge Structure 2 - simple weir				
Rate - Maximum - Positive	None		None	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	None			None
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	123.049			0.0
Discharge Structure 3 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Pollution Abatement:				
36 Hour Stage and Infiltration Volume	N.A.	N.A.		N.A.
72 Hour Stage and Infiltration Volume	N.A.	N.A.		N.A.


Plot of Flow Rates and Pond Stage vs Elapsed Time
Scenario 3 :: Mean Annual
Volumetric Rate (ft³/s)
Stage Elevation (ft datum)
Elapsed Time (hrs)
Y1 Axis: Inflow Rate
Infiltration Rate
Discharge Rate
Y2 Axis: Pond Stage

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	68.05	4.28	148.99	9.37