# DESIGN-LEVEL GEOTECHNICAL ENGINEERING REPORT HARTWOOD MARSH RESIDENTIAL Proposed Single Family Residential Subdivision

120± Acres, Hartwood Marsh Road, off U.S. Highway 27, City of Clermont, Lake County, Florida [Section 9 & 16, Township 23 South, Range 26 East]



DEVE	Pringening
CONSULTING GEOTECHNICAL ENGINEERS	SH9P
5500 Alhambra Drive, Orlando, Florida 32808 Phone: (407) 290-2371	E-Mail addresss: devo@devoeng.com Website: http://www.devoeng.com

Date: September 26, 2019	Devo's Project No: 19-585.18
To:	
LAKE WEBSTER, LLC	
401 Ferguson Drive	
Orlando, FL 32805	
(407)-293-6562; jeff@amickinc.com	
attention: Jeff B. Fuoua, Ph.D.	
<i>Rę:</i>	
STORMWATER POND - GEOTECHNICAL ENGINEER	RING <b>R</b> EPORT
HARTWOOD MARSH RESIDENTIAL	
Proposed Single Family Residential Subdivision	
120 ± Acres, Hartwood Marsh Road, off U.S. Highway 2	7, City of Clermont, Lake County, Florida
[Sections 9 & 16, Township 23 South, Range 26 East]	

Dear Mr. Fuqua:

The purpose of this revised report is to document the **pond-specific** geotechnical data, stormwater recovery analyses, grading recommendations, and berm stability analysis for the proposed dry retention pond at the above-captioned subdivision. The previous version of this report was provided on July 9, 2019.

Note that a more comprehensive geotechnical report (dated August 2, 2019) for the non-pond portions of the subdivision and those data and recommendations has been provided in a separate report.

We trust that the geotechnical data, assessment, and recommendations in this report are responsive to the needs of the permitting agencies and the civil engineer at this phase of the design process. Feel free to contact us if there are any questions regarding this report.

Sincerely,

Devo Seereeram, Ph.D., P.E. Florida Registration No. 48303 Date: September 26, 2019

.....



This item has been digitally signed and sealed by Devo Seereeram, P.E. on .....using a Digital Signature.

Printed copies of this document are not considered signed and sealed and the SHA authentication code must be verified on any electronic copies.

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Attachment A.	25 yr/96 hr Pre-Post Storm Volume Recovery
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Attachment B. Water Quality Volume Recovery

# I.0 POND TYPE & LOCATION

A conventional, dry-bottom stormwater retention pond (no underdrains, etc.) is proposed for the proposed Hartwood Marsh single-family residential subdivision in Clermont, Lake County, Florida. Exhibit 1 shows the subdivision boundary of this undeveloped land which sits on a high sandy ridge (of the Lake Wales Ridge) with a deep water table.

The pond layout within the subdivision is in Exhibit 2 and is divided into a north and a south lobe, equalized by a pipe so the lobes function as a single pond. The specific purpose of this report is to document the geotechnical data within the pond area and to present the results of the stormwater recovery analyses which are required to check for compliance with SJRWMD recovery time criteria. Fill berm specifications are also provided since the downhill side of the ponds will be bermed above natural land surface.



Exhibit 1. Subdivision Boundary

Exhibits 3.1 and 3.2 show the existing ground surface contours within the pond footprint and bear in mind the pond bottom elevation +92 ft NAVD when reviewing these contours. Within the bottom area of the south lobe, predevelopment ground surface is a high of about +100 ft to a low of about +94 ft. This compares to a high of +108 ft to a low of +94 ft within the bottom area of the north lobe.



Exhibit 2. Pond Layout Within The Subdivision



Exhibit 3.1. Pond footprint on predevelopment topography note: pond bottom elevation at +92 ft NAVD



Exhibit 3.2. Predevelopment ground surface within ponds and surveyed borehole locations note: pond bottom elevation at +92 ft NAVD

# 2.0 GEOTECHNICAL DATA

Eighteen (18) 30 ft deep borings were drilled within the pond footprint and these are labeled B-9, B-12, B-13, B-21, B-23, B-27 and B-33 to B-44 in Exhibit 4. Boring profiles are presented in Figures 1.1 to 1.6 (attached). Water table depth measurements and laboratory test results are annotated adjacent to these graphic soil profiles. All test locations were surveyed by the project surveyor except for B23 and B43 which were relocated due to site access. All borings show deep layers of permeable fine sands except for one small zone within the southern lobe. This zone is identified in Exhibit 5 where the base elevation of the permeable sand layer is above elevation +85 ft, compared to below elevation +65 ft in the other parts of the pond.



Exhibit 4. Boring Location Plan



Exhibit 5. Base Elevation of Permeable Sand (ft NAVD)

Permeability tests on vertically oriented samples of the sand layer are in the general range 55 to 67 ft/day. These results are typical for the ridge areas of Clermont and are comparatively high when compared to sand permeability in other parts of Central Florida. Test results are summarized in Table 1 and are also annotated adjacent to the soil profiles in Figures 1.1 to 1.6.

Table 1. Summary of Permeability Test Results				
Location	Sample Depth (ft)	Soil Description	Measured Vertical Permeability (ft/day)	
	SAND			
B-9	15.0 to 15.5	Very Light Brown Fine Sand	55.3	
B-27	6.0 to 6.5	Light Brown Fine Sand	66.8	
B-36	10.0 to 10.5	Very Light Brown Fine Sand	62.5	
B-38	16.0 to 16.5	Light Brown Fine Sand	57.2	
B-40	16.0 to 16.5	Brown Fine Sand	54.9	
CLAYEY SAND				
B-42	12.0 to 12.5	Orange Clayey Fine Sand	26.8	

Water table altitudes for measured and estimated seasonal high scenarios are shown in Exhibits 6 and 7 and these digital data are in Table 2. There was a fair amount of rainfall at Hartwood Marsh in June 2019 as a buildup to the wet season.

Table 2. Measured Water Table Elevations and Seasonal High Water Table (SHWT)					
	Ground	Water Table Meas	ured on June 26, 2019	Estimated SHWT	
	Surface	Depth Below		Depth Below	
Boring	Elevation	Ground	Elevation	Ground	Elevation
No.	(ft NAVD)	(ft)	(ft NAVD)	(ft)	(ft NAVD)
		30 FT PON	d Borings		
B-9	99.9	16.40	83.5	13.4	86.5
B-12	84.8	1.20	83.6	-1.7	86.5
B-13	94.3	10.95	83.4	7.8	86.5
B-21	94.5	10.00	84.5	7.5	87.0
B-23	85.3	-0.70	86.0	-2.7	88.0
B-23A	94.1	9.65	84.5	6.7	87.5
B-27	95.1	9.10	86.0	9.1	86.0
B-33	108.1	24.73	83.4	21.6	86.5
B-34	110.4	26.75	83.7	23.4	87.0
B-35	101.3	17.25	84.1	14.3	87.0
B-36	98.2	14.85	83.4	11.7	86.5
B-37	96.1	12.75	83.4	9.6	86.5
B-38	94.6	11.45	83.2	8.1	86.5
B-39	100.5	16.45	84.1	13.6	87.0
B-40	86.9	2.60	84.3	-0.1	87.0
B-41	94.4	9.40	85.0	6.9	87.5
B-42	95.6	10.85	84.8	8.1	87.5
B-43	86.2	0.20	86.0	-1.8	88.0
B-43A	94.1	8.80	85.3	6.1	88.0
B-44	97.0	11.95	85.1	9.5	87.5



Exhibit 6. Measured Water Table Elevation (ft NAVD)



Exhibit 7. Estimated Seasonal High Water Table Elevation (ft NAVD)

# 3.0 RECOVERY ANALYSES

Table 3. Pond Stage / Storage Table						
Stage (FT)	Stage (FT) Area (AC) $ft^2$ $\Delta$ Vol. (AF) $\Sigma$ Vol. (AF)					
92.0	5.46	237,838		0.000		
93.0	5.84	254,390	5.650	5.650		
94.0	6.21	270,508	6.030	11.680		
95.0	6.58	286,625	6.400	18.070		
96.0	6.97	303,613	6.780	24.850		
97.0	7.36	320,602	7.170	32.010		
98.0	7.76	338,026	7.560	39.570		
98.5	7.95	346,302	3.930	43.500		
99.0	8.95	389,862	4.230	47.720		

Table 3 summarizes the stage-area-volume relationship for the pond.

Note that there is a high level overflow structure (5 ft weir) at an elevation of +98.5 ft NAVD. Pond fill berm side slopes are 4H:1V with a 10 ft width at the top of berm.

The idealized and other input parameters for this pond are listed in Table 4. Simulation results (PONDS Refined method Module) for the 25 yr/96 hr storm recovery is in Attachment A and the corresponding water quality volume recovery is in Attachment B. These results show that both SJRWMD criteria are satisfied for recovery.

The slope stability of the fill berm is also above 1.2 for full saturation of the slope which is an acceptable safety factor.

Table 4. Stormwater Pond {Key Parameters & Results}				
Parameter	Unit	Magnitude		
Top of Bank Elevation	ft NAVD	99.0		
Weir Elevation	ft NAVD	98.50		
Pond Bottom Elevation	ft NAVD	92.0		
Seasonal High Water Table (SHWT)	ft NAVD	87.0		
Base of Aquifer (permeable sand)	ft NAVD	70.0		
Horizontal Hydraulic Conductivity, Kh	ft/day	45.0		
Fillable Porosity, n	%	30.0		
Unsaturated vertical infiltration rate	ft/day	5.0		
Projection area for unsaturated infiltration	ft²	270,508		
Separation between pond bottom & SHWT	ft	5.0		
Water Quality Volume (72 hr recevery)	ac-ft	11.28		
	ft <sup>3</sup>	491,357		
25 yr/06 br yelume (14 day recevery)	ac-ft	43.34		
	ft <sup>3</sup>	1,887,891		
Equivalent pond length	ft	1430		
Equivalent pond width	ft	290		
KEY RESULTS OF	COMPUTER RUNS			
Recovery time for water quality volume	hr	12		
Recovery time for 25 yr/96 hr volume	days	13		
COMPUTER PRINTOUTS	<b>OF RECOVERY ANALYS</b>	ES		
Attachment containing PONDS computer printout	-	А, В		
BERM STABILI	TY PARAMETERS			
Top of fill berm	ft NAVD	99.0		
Predevelopment ground surface in fill berm	ft NAVD	93.0		
Maximum height of fill berm (downhill)	ft	6.0		
Weir Elevation	ft NAVD	98.50		
Top width of berm	ft	10		
Outside side slope for fill berm	?H:1V	4		
Inside side slope for fill berm	?H:1V	4		
Factor of safety for slope stability failure (FS $\geq$ 1.2) .		1.2		

# 4.0 POND BERM FILL RECOMMENDATIONS

Where the pond's perimeter berm is to be constructed above natural grade, the following are the recommended specifications for berm construction. With the exception of the topsoil, the soils are of a type and consistency suitable for the support of the proposed earthen berms, provided that they are prepared as described hereunder. The following berm construction specifications have been prepared as a guide to the design engineer for the Hartwood Marsh residential subdivision in Clermont, FL. These recommendations should be incorporated into the general project specifications.

- 1. The berm footprint plus a minimum margin of 3 feet should be cleared, stripped and grubbed to remove all surface vegetation, roots, topsoil and other deleterious materials. Materials generated during this process should be removed from the site and/or stockpiled onsite as directed by the owner/engineer.
- 2. Within the berm footprint, plus a minimum margin of 3 feet on either side, the resulting cleared surface and the exposed natural soils should be proof rolled to detect unstable conditions such as yielding or pumping soils. Soft areas or excessively wet soils should be excavated, removed, dried and/or replaced with suitable compacted fill, as described below.
- 3. No construction dewatering is anticipated.
- 4. The resulting cleared surface should be leveled and then compacted by means of a large self-propelled vibratory roller which has a minimum static weight of 12,000 pounds and is capable of exerting a minimum impact energy of 20,000 pounds (i.e., DYNAPAC CA-15 or equivalent) in areas more than 75 feet away from existing structure(s). Within 75 feet of an existing structure(s) and areas where the groundwater table is within 2 feet of the ground surface, compaction should be achieved with a vibratory roller in the static mode or the use of non-vibratory compaction equipment, such as a heavy rubber tired front end loader. The front end loader should have a minimum bucket size of 3 cubic yards which should remain full during the compaction operation.
- 5. The compaction efforts should continue until the subsoils within the proposed berm footprint are compacted to a minimum density equivalent to 95 percent of the soils' Maximum Modified Proctor Density value (AASHTO T-180), as tested to a minimum depth of 1 foot below the bottom of the exposed subgrade.
- 6. Fill material required to attain finished grade should comprise the fine sands from the onsite excavation. The fill soils should be placed in lifts not exceeding 12 inches loose thickness and compacted to the minimum density specified above (≥95% Modified Proctor). No tree limbs or other debris should be emplaced in the fill berm or pond bottom without the approval of the geotechnical engineer. Such inclusions in the fill berm can cause settlement and provide preferential pathways for seepage through the berm and result in berm failure. Do not bury trees or vegetation debris within the berm fill.
- 7. The intent of the compaction requirements outlined herein is to provide compacted soils to the top of the berm.
- 8. A representative of the project geotechnical engineer should be retained to provide on-site inspection and testing during the site preparation activities so that proper documentation and compliance of the recommendations outlined above can be provided.



1.0 - (1.2') <u>▼</u>	
Fine Sand	
4.0 ω = 17.8 Greyish Brown 200 = 0.8 Fine Sand	
<b>5.0</b> $\omega = 7.0$ Light Reddish Brown Fine Sand	ω =
	-200 =
	(11.0')
11.0 $\omega = 7.2$ Very Light Brown $\omega = 21.0$ -200 = 2.4     Fine Sand     -200 = 2.3	(11.0)
	ω = 9 -200 =
$ \begin{array}{c} 15.0 \\ \hline \\ 10.0 \\ \hline \\ 200 \\ \hline \\ 10 \\ \hline \\ \\ 200 \\ \hline \\ 10 \\ \hline \\ \\ \\ 200 \\ \hline \\ \\ 10 \\ \hline \\ \\ \end{array} $	
$K_V = 55.3$	
Dark Brown       Dark Brown       Fine Sand	
$\omega = 20.8$ -200 = 1.1	
20.0 Brownish Grey Slightly Silty Fine Sand	
$\omega = 7.1$ -200 = 5.7	(v = 1)
	-200 =
27.0	
28.0	
Ierminated @ 30.0"     Terminated @ 30.0"       Drilled on: 06-18-19     Drilled on: 06-19-19	
NOTES:     LEGEND:     Typical Correlations between SPT "N" Values and Soil Properties     NOTES:       Suitable fill for veneer (fine sands     Granular Materials     Silt and Clay	
& slightly silty fine sands) (i) = Field moisture content (%) (ii) = Field moisture content (%) (iii) = Field moistu	UE
Suitable but w/ limitations on placement/compaction (Silty fine sands & slightly clayey fine sands)	CONSULTING GEOTECHN
Unsuitable for fill (Clayey fine sand, sandy clay, clays, muck) $Vertical Hydraulic Conductivity (ft/Day)$ $Very$ $30 to 50$ Stiff $8 to 15$ $N$ Water level measured on June 26, 2019.Unsuitable for fill (Clayey fine sand, sandy clay, clays, muck)Kv = Vertical Hydraulic Conductivity (ft/Day) $Very$ $30 to 50$ Stiff $8 to 15$ $N$ Standard Penetration Test Resistance (blos/ft)	5500 Alhambra Drive . Orlar Phone: (407) 290-2371 . Fa Checked & Approved Bv:

B-13						
	G.S.E:	+ 94	.3 ft			_0.0
			Brown Fine	Sand		1.0
			with Roots			2.0
						<u>3.0</u>
			Brownish Gr Fine Sand w	ey vith Roots		4.0
						5.0
7.0			Grey Fine S with Roots	and		6.0
						7.0
			Reddish Bro	wn		- 8.0
			Fine Sand			9.0
-						 
93	1		Grevish Bro	wn		 
1.7			Fine Sand			12.0 
						15.0 
						- 10.0
						<u> </u>
						<u>    18.0                                </u>
						<u>    19.0                                </u>
						<u>    20.0                               </u>
	_					21.0 _
15.0 1.0			Very Light E Fine Sand	Brown		<u>    22.0                               </u>
		_				23.0
						24.0
						25.0
		_				26.0
						27.0
						28.0
		_				29.0
					-	30.0
T D	ermina rilled o	nted @ n: 06	) 30.0' -19-19			
VO angineering			incering	Figure Name: SOIL B-	PROFILES 9, B-12 & B-	FOR 13
HNICAL I	rida 32808	E-Mail addre Website: ht	sss: devo@devoeng.com tp://www.devoeng.com	Project Name: Fuqua -	Hartwood Marsh	Residential
DS	Drawn By:	RB	Date: 06.27.2019	Scale: NOTED	Project # <b>19-585.18</b>	Figure 1.1



	<b>B-27</b>	4.9			
	G.S.E: + 95	ο.1 π		r	_0.0
		Dark Brown			1.0
		Fine Sand			2.0
					3.0
		Dark Brown with roots	Fine Sand		<b>4.0</b>
				-	5.0
2.7		(v) = 2	27.0		6.0
		-200 =	1.1		
			0.0		 
					0.0 0_0
<b>—</b>	-	Linkt Drawn			<u> </u>
		Fine Sand			10.0
					<u>- 1</u> 1.0
					<u>    12.0                                </u>
					13.0
					14.0
					15.0
					16.0
3.2					17.0
.2					18.0
					19.0
					20.0
					21.0
		Very Light E	Brown		22.0
		Fine Sand		-	23.0
					- 24.0
					- 20.0
5.7		Silty Fine Sa	and		<u> </u>
.5					<u>    29.0                                </u>
					30.0
T D	erminated @ rilled on: 06	) 30.0' -19-19			
VO and Mening			Figure Name: SOIL B-2	PROFILES 21, B-23 & B-	FOR 27
CHNICAL	ENGINEERS	ssss: devo@devoeng.com	Project Name:	Hartwood Mareh	Residential
DS	Drawn By: RB	Date: 06.27.2019	Scale: NOTED	Project # 19-585.18	Figure 1.2
				· · · · · · · · · · · · · · · · · · ·	

	B-33	B-34	4
<b>0.0</b> G	G.S.E: + 108.1 ft	G.S.E: + 1 <sup>-</sup>	10.4 ft
1.0			
2.0	Dark Brown Fine Sand		Dark Brown Fine Sand
3.0			
4.0		ω = 4.0	Brown
5.0		-200 = 1.3	Fine Sand
6.0	Orangish Brown Fine Sand		
7.0			$\omega = 1.8$
8.0			Fine Sand
9.0			
10.0ω= 2.2	Light Orangish Brown		
<b>11.0</b> -200 = 1.2	Fine Sand		
12.0			
; ₩ 13.0		$\omega = 2.6$	
⊕ 14.0 <u></u>			ω = 3.9
Ξ 15.0 Ξ			
	—		
□ 17.0 <u>-</u>			(17.3')
18.0 =			Very Light Brown
19.0	Very Light Brown		Fine Sand
20.0	Slightly Silty Fine Sand	ω = 2.7 -200 = 4.2	
21.0			
22.0			
23.0			
26.0		(26.8') 🚽	
27.0	Van dight Brown	` <del>````</del>	$\omega = 15.7$ -200 = 14.5
$\omega = 14.0$	Silty Fine Sand	$\omega = 16.0$	Very Light Brown
<b>29.0</b> -200 = 13.8		-200 = 15.7	Silty Fine Sand
Te Dri	rminated @ 30.0' illed on: 06-17-19	Terminated ( Drilled on: 06	<u>መ</u> 30.0' ፩-19-19
NOTES:	LEGEND :	Typical Correlations between SPT "N" Values and Soil Properties Granular Materials Silt and Clay	NOTES:
& slightly silty fine sands		Relative Density SPT (Blows/ft) Versitive Density SPT (Blows/ft) Versitive Density SPT (Blows/ft)	Borings drilled on the date noted
Suitable but w/ limitations on placement/compaction	$\omega$ = Field moisture content (%)	very Loose         Less than 4         Very Soft         Less than 2           Loose         4 to 10         Soft         2 to 4	G.S.E Surveyed ground surface elevation (ft NAVD)
Unsuitable for fill (Clayey fine sand,	-200 = Percent passing US#200 Sieve Ky = Vertical Hydraulic Conductivity (ft/Dav)	Meduum Dense         10 to 30         Firm         4 to 8           Very         30 to 50         Stiff         8 to 15	Water level measured on June 26, 2019.
sandy clay, clays, muck)		Very Lense Greater than 30 Very Sulf 15 to 30 Hard Greater than 30	N Standard Penetration lest Resistance (blos/ft) Checked & Approved By: D

<b>B-35</b>	<b>5</b> 11 3 <del>ft</del>			
	/1.5 ft		ļ	0.0
	Light Doddi	ah Drawn		1.0
	Fine Sand			<u> </u>
				3.0
				4.0
				5.0
				6.0
	Light Orang	ish Brown		
1.5				
				0.0 0.0
				<u> </u>
				<u>    10.0                               </u>
	Light Brown Fine Sand	<u> </u>		<u>- 1</u> 1.0 =
				<u>    12.0                                </u>
				<u>    13.0                                </u>
3.9 3.9				<u>    14.0                                </u>
				15.0
				16.0
				<u> </u>
÷	Very Light E	Brown		
	Fine Sand			 19.0
				20.0
				21.0
				22.0
7	Von Light R	rown		
1.5	Silty Fine Sa	and		
				28.0
				<u>    29.0                                </u>
				30.0
Terminated ( Drilled on: 0	@ 30.0' 6-18-19			
	gineering	Figure Name: SOIL B-3	PROFILES 33, B-34 & B	FOR -35
HNICAL ENGINEERS Irlando, Florida 32808 Fax: (407) 298-9011	fresss: devo@devoeng.com http://www.devoeng.com	Project Name: Fuqua -	Hartwood Marsh	Residential
DS Drawn By: RB	Date: 06.27.2019	Scale: NOTED	Project # 19-585.18	Figure 1.3

				<b>B-</b>	<b>36</b>				<b>B-3</b>	<b>7</b>		
	0.0		C	J.J.E. +	- 30.2 IL				G.S.E: + 9	90. T IL		
	1.0_				Dark Greyish Brown					Dark	Grey	
	2.0									Fille		
	3.0				Light Brown					Light	Brown	
	4.0				Fine Sand					Fine	Sand	
	5.0		ω = 4.8 -200 = 1.3		Very Dark Reddish					<u> </u>		
	6.0				Brown Fine Sand					Light Fine	Greyish Brown Sand	
	7.0											ω = 6
	8.0											-200 = 1
	9.0											
	10.0				$\omega = 23.0$		-	ω = 5.3 200 = 1.5				
	11.0_				-200 = 0.5 Kv = 62.5							(11 5)
	12.0_											(11.5)
(Jé	13.0		ω = 6.2		Very Light Brown			(12.8')				ω = 17
fee	14.0		-200 = 2.4		Fine Sand			-		Light	Brown	-200 = 1
H (jr	15.0		(14.9' <u>)</u>							Fine	Sand	
L	16.0		-									
	17.0											
	18.0											
	19.0		ω = 15.1					ω = 17.1				
	20.0		-200 = 1.5					200 = 1.3				
	21.0											
	22.0											ω = 20
	23.0											-200 – 1
	24.0											
	25.0											
	26.0											
	27.0							$\omega = 24.3$		Dark	Brown Slightly	
	28.0									Silly I		
	29.0											
	30.0									) Lign Eine	Sand	
			Te	rminated	d @ 30.0'			Т	erminated (	@ 30.0'		
			Dri	lled on:	06-18-19			D	rilled on: 0	6-18-19		
NOT	ES:		do	LEGE	<u>ND :</u>	Typical Correlatio	ns between SPT "N" aterials	alues and Soil Prop	erties Ind Clay	NOTES	<u>.</u>	
	& slightly silt	by veneer ( tine sand ty fine sands)	us		<b>-</b>	Relative Density	SPT (Blows/ft)	Consistency	SPT (Blows/ft)		Borings drilled on the date noted	DE
	Suitable but	w/ limitations on pla	cement/compaction	ω =	Field moisture content (%)	Loose	Less than 4 4 to 10	Very Soft Soft	Less than 2 2 to 4	G.S.E	Surveyed ground surface elevation (ft NAVD)	CONSULTING GEOTECHNI
	Unsuitable f	or fill (Clavev fine sa	ind.	-200 =	Verticel Hydroulie Conductivity (#/Duc)	Meduim Dense Very	10 to 30 30 to 50	Firm Stiff	4 to 8 8 to 15	Į ₹	Water level measured on June 26, 2019.	5500 Alhambra Drive . Orland Phone: (407) 290-2371 . Fax
	sandy clay, o	clays, muck)		KV =	vertical Hydraulic Conductivity (ft/Day)	Very Dense	Greater than 50	Very Stiff Hard	15 to 30 Greater than 30	<u>N</u>	Standard Penetration Test Resistance (blos/ft)	Checked & DS Approved By: DS

	<b>B-38</b>	- <i>1</i>			
G.S	5.E + 94	6 ft			0.0
					1.0
		Reddish Bro	own		2.0
		Fine Sand			3.0
					4.0
		Crew Fires 6			<u>5.0</u>
		Grey Fine S	and		<u>      6.0       </u>
= 6.3					7.0
= 1.0					8.0
					9.0
				-	
		Light Brown	I	-	
)		Fine Sand			
17.6					- 13.0
1.8					
	-	-200	= 20.1 = 1.0		
		Kv	= 57.2		 
					10.0
					20.0 
20.2		Brown			
= 1.8		Fine Sanu			22.0 
					<u> </u>
					24.0  25.0
					25.0
					20.0 
	_				
	-	Dark Brown Fine Sand			28.0 
					<u>    29.0                                </u>
				t	30.0
Term Drille	inated @ d on: 06	〕30.0' -19-19			
		aineening	Figure Name: SOIL B-	PROFILES 36, B-37 & B-	FOR -38
CHNICAL ENGINE	E-Mail addre Website: h	esss: devo@devoeng.com ttp://www.devoeng.com	Project Name: Fuqua -	Hartwood Marsh	Residential
DS Drawn	By: RB	Date: 06.27.2019	Scale: NOTED	Project # 19-585.18	Figure 1.4



B- GSE:	- <b>41</b> + 94 4 ft		
N		F	0.0
11	Brown		1.0
18	Fine Sanu		<u>    2.0    </u>
12			3.0
11	Greyish Bro Fine Sand	own	4.0
15			5.0
22	Light Brown	n	6.0
21	Fine Sand		7.0
2.7			8.0
18	Very Light Slightly Silt	Brown v Fine Sand	9.0
÷ 15			
13_			 
6.1	Very Light	Brown	
5.3	Silly Fine S	and	12.0 
53			14.0 
			<u>    15.0                                </u>
	Light Grey		<u>    16.0                                </u>
	Fine Sand		<u> </u>
			<u></u> 18.0 _
			19.0 _
19			20.0
			21.0
			22.0
	Very Light	Grev	23.0
	Silty Fine S	Sand	24.0
20			25.0
9.5			26.0
.9			27.0
			28.0
			29.0
6			
Tormino	ad @ 20.0'		
Drilled o	n: 06-20-19		
	aning	Figure Name: SOIL PROFILES	FOR
	1 all	B-39, B-40 & B-	41
CHNICAL ENGINEERS	Mail addresss: devo@devoeng.com	Project Name: Fugue - Hartwood March	Residential
Fax: (407) 298-9011 ■ V Drawn By:	RB Date: 06.27.2019	Scale: NOTED Project #	Figure 1.5

			<b>B-42</b>	D 5 #				<b>B-4</b>	<b>3</b>		
	0.0	G	.S.E: + 100	υ.ο π				U.S.E	56.2 ft		
	1.0							_9_	Gre	yish Brown	
	2.0			Dark Brownish Grey			0.01)	12	FINE	Sand	
	3.0			Fine Sand		(	8.8')	14			
	4.0							20			
	5.0						ω = 3.1	35			
	6.0			Grey Fine Sand			-200 = 1.2	49	Brov	vn Fine Sand	
	7.0	$\omega = 11.9$						28			
	8.0	-200 = 17.7						46			$\omega = 1.9$ -200 = 2.5
	9.0			Orange Clayey				31			(12.0')
	10.0	ω = 12.6		Fine Sand				42			
	11.0_	-200 = 18.4									
	12.0			(v) = 14.1			ω = 18.7 -200 = 1.4		Darl Fine	< Brown	
et)	13.0			-200 = 18.0 Ky = 26.8							
) fee	14.0	ω = 17.7									
E I	15.0_	-200 = 17.1						23			ω = 15.4
L	16.0	(40.02)									-200 = 1.1
B	17.0	(10.9 <u>)</u>									
	18.0	ω = 18.9									
	19.0	-200 = 15.2					ω = 22.0				
	20.0						-200 = 2.0	38			
	21.0	ω = 20.2		Light Brown Clayey Fine Sand							
	22.0	-200 = 15.5							Ligh	t Brown	
	23.0								Fine	Sand	
	24.0										
	25.0							37			ω = 19.2
	26.0										-200 = 4.6
	27.0										
	28.0	ω = 20.3									
	29.0	-200 = 15.0									
	30.0 =							70			
		Ter	minated @	2 30.0'			г	Terminated (	@ 30.0'		
		Dri	lled on: 06-	19-19			D	orilled on: 0	6-21-19		
NOTE	<u>S:</u>		LEGEND	<u>:</u>	Typical Correlation	ons between SPT "N"	Values and Soil Pro	perties	NOTE	<u>S:</u>	
	Suitable fill fe & slightly silt	tor veneer ( tine sands ty fine sands)			Granular N Relative Density	SPT (Blows/ft)	Consistency	SPT (Blows/ft)		Borings drilled on the date noted	DE
	Suitable but	w/ limitations on placement/compaction	ω = Fie	eld moisture content (%)	Very Loose	Less than 4 4 to 10	Very Soft Soft	Less than 2 2 to 4	G.S.E	Surveyed ground surface elevation (ft NAVD)	
	Conty TINE Sa	anus a signity clayey line sands)	-200 = Pe	rcent passing US#200 Sieve	Meduim Dense Very	10 to 30 30 to 50	Firm Stiff	4 to 8 8 to 15	Į ₹	Water level measured on June 26, 2019.	5500 Alhambra Drive , Orland Phone: (407) 290-2371 , Fax:
	sandy clay, o	clays, muck)	Kv = Vei	rtical Hydraulic Conductivity (ft/Day)	Very Dense	Greater than 50	Very Stiff Hard	15 to 30 Greater than 30	<u>N</u>	Standard Penetration Test Resistance (blos/ft)	Checked & DS Approved By: DS

<b>B-4</b>	<b>4</b>		
U.S.E. + 3	17.0 IL		0.0
			1.0
	Grey Fine S	and	2.0
			3.0
	Dark Brown		4.0
	Fine Sand		5.0
	Brown Fine Sand		6.0
			7.0
1.9 2.5			8.0
<u>,                                     </u>			9.0
' <u>₹</u>	Grey Fine S	and	
			12.0 13.0
			14.0
5.4 1.1			<u>    15.0                                </u>
			<u>    16.0                                </u>
	Greyish Bro Fine Sand	wn	<u>    17.0                                </u>
			18.0 
			<u>    19.0                                </u>
			<u>    20.0                               </u>
			<u>    21.0                                </u>
			<u>    22.0                               </u>
	Dark Brown		<u>    23.0                                </u>
			<u>    24.0    </u>
9.2			25.0
+.0			26.0
			27.0
			28.0
	Brown Fine	Sand	29.0
			30.0
Torminated	@ 20.0'		
Drilled on: 0	@ 30.0 )6-20-19		
	poning	Figure Name: SOIL PROFILES	FOR
	GUIL	B-42, B-43 & B	-44
DHNICAL ENGINEERS Driando, Florida 32808 . Fax: (407) 298-9011	ddresss: devo@devoeng.com : http://www.devoeng.com	Project Name: Fuqua - Hartwood Marsh	Residential
DS Drawn By: RB	Date: 06.27.2019	Scale: NOTED Project #	Figure 1.6

# **ATTACHMENT A**

25 YR/96 HR PRE-POST STORM VOLUME RECOVERY

#### Project Data

Project Name:	Fuqua - Hartwood Marsh
Simulation Description:	Combined Pond - 25 YR / 96 HR Volume Run
Project Number:	19-585.18
Engineer :	Reidel Gardon
Supervising Engineer:	Devo Seereeram
Date:	09-26-2019

#### Aquifer Data

Base Of Aquifer Elevation, [B] (ft datum):	70.00
Water Table Elevation, [WT] (ft datum):	87.00
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day):	45.00
Fillable Porosity, [n] (%):	30.00
Unsaturated Vertical Infiltration Rate, [Iv] (ft/day):	5.0
Maximum Area For Unsaturated Infiltration, [Av] (ft <sup>2</sup> ):	270508.0

#### **Geometry Data**

Equivalent Pond Length, [L] (ft):	1430.0
Equivalent Pond Width, [W] (ft):	290.0

Ground water mound is expected to intersect the pond bottom

## Stage vs Area Data

Stage (ft datum)	Area (ft²)
92.00	237838.0
93.00	254390.0
94.00	270508.0
95.00	286625.0
96.00	303613.0
97.00	320602.0
98.00	338026.0
98.50	346302.0
99.00	389862.0

#### Ditch Data

Ditch (or interceptor trench) parallel to length axis is inactive

Ditch (or interceptor trench) parallel to width axis is inactive

#### **Discharge Structures**

**Discharge Structure #1 is inactive** 

**Discharge Structure #2 is inactive** 

**Discharge Structure #3 is inactive** 

#### Scenario Input Data

Scenario 1 :: 1887891 ft<sup>3</sup> slug load

Hydrograph Type: Modflow Routing:	Slug Load Routed with inf	iltration				
Treatment Volume (ft <sup>3</sup> ) 1887891						
Initial ground water le	evel (ft datum) 8	37.00 (default)				
Time After Storm Event (days)	Time After Storm Event (days)	Time After Storm Event (days)	Time After Storm Event (days)	Time After Storm Event (days)		
0.100	2.000	5.000	10.000	15.000		
0.250	2.500	6.000	11.000	16.000		
0.500	3.000	7.000	12.000			
1.000	3.500	8.000	13.000			
1.500	4.000	9.000	14.000			

Detailed Results :: Scenario 1 :: 1887891 ft<sup>3</sup> slug load

						Combined					
	Elapsed	Instantaneous	Outside	Stage	Infiltration	Instantaneous	Cumulative	Cumulative	Combined		
	Time	Inflow Rate	Recharge	Elevation	Rate	Discharge	Inflow	Infiltration	Cumulative	Flow	
_	(hours)	(ft³/s)	(ft/day)	(ft datum)	(ft³/s)	Rate (ft <sup>3</sup> /s)	Volume (ft <sup>3</sup> )	Volume (ft <sup>3</sup> )	Discharge (ft <sup>3</sup> )	Туре	
	0.000	314648.5000	0.00000	87.00000	0.00000	0	0.000	0.0	0	N.A.	
	0.002	314648.5000	0.00000	98.47990	15.65440	0	1887891.000	93.9	0	U/P	
	2.400	0.0000	0.00000	98.08552	15.65440	0	1887891.000	135254.0	0	U/P	
	6.000	0.0000	0.00000	97.47849	16.14012	0	1887891.000	338135.0	0	U/P	
	12.000	0.0000	0.00000	96.33090	12.92153	0	1887891.000	704247.3	0	U/S	
	24.000	0.0000	0.00000	95.63803	4.00615	0	1887891.000	914427.9	0	S	
	36.000	0.0000	0.00000	95.17487	2.76150	0	1887891.000	1050379.0	0	S	
	48.000	0.0000	0.00000	94.81673	2.15101	0	1887891.000	1153021.0	0	S	
	60.000	0.0000	0.00000	94.52093	1.77614	0	1887891.000	1236226.0	0	S	
	72.000	0.0000	0.00000	94.26717	1.51811	0	1887891.000	1306480.0	0	S	
	84.000	0.0000	0.00000	94.04408	1.32774	0	1887891.000	1367391.0	0	S	
	96.000	0.0000	0.00000	93.84451	1.17205	0	1887891.000	1421197.0	0	S	
	120.000	0.0000	0.00000	93.51067	0.94607	0	1887891.000	1509768.0	0	S	
	144.000	0.0000	0.00000	93.22289	0.80769	0	1887891.000	1584677.0	0	S	
	168.000	0.0000	0.00000	92.97026	0.70223	0	1887891.000	1649336.0	0	S	
	192.000	0.0000	0.00000	92.74535	0.61920	0	1887891.000	1706022.0	0	S	
	216.000	0.0000	0.00000	92.54288	0.55219	0	1887891.000	1756334.0	0	S	
	240.000	0.0000	0.00000	92.35901	0.49699	0	1887891.000	1801439.0	0	S	
	264.000	0.0000	0.00000	92.19079	0.45076	0	1887891.000	1842213.0	0	S	
	288.000	0.0000	0.00000	92.03594	0.26434	0	1887891.000	1879331.0	0	S	
	312.000	0.0000	0.00000	91.82780	0.04954	0	1887891.000	1887891.0	0	S	
	336.000	0.0000	0.00000	91.62651	0.00000	0	1887891.000	1887891.0	0	S	
	360.000	0.0000	0.00000	91.44981	0.00000	0	1887891.000	1887891.0	0	S	
	384.000	0.0000	0.00000	91.29171			1887891.000	1887891.0	0	N.A.	

# Summary of Results :: Scenario 1 :: 1887891 ft<sup>3</sup> slug load

Stage Minimum       0.000       87.00         Maximum       0.002       98.48         Inflow Rate - Maximum - Positive       0.002       314648.5000         Rate - Maximum - Negative       None       None         Cumulative Volume - Maximum Positive       0.002       1887891.0         Cumulative Volume - Maximum Positive       0.002       1887891.0         Infiltration       Rate - Maximum - Positive       6.000       16.1401         Rate - Maximum - Positive       6.000       16.1401       None         Cumulative Volume - Maximum Positive       312.000       None       None         Cumulative Volume - Maximum Positive       None       None       None         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Namum Positive       disabled <th></th> <th>Time (hours)</th> <th>Stage (ft datum)</th> <th>Rate (ft<sup>3</sup>/s)</th> <th>Volume (ft<sup>3</sup>)</th>		Time (hours)	Stage (ft datum)	Rate (ft <sup>3</sup> /s)	Volume (ft <sup>3</sup> )
Minimum         0.000         87.00           Maximum         0.002         98.48           Inflow         Rate - Maximum - Positive         0.002         98.48           Inflow         Rate - Maximum - Negative         None         None           Cumulative Volume - Maximum Positive         0.002         1887891.0         None           Cumulative Volume - Maximum Negative         None         None         None           Cumulative Volume - Maximum Negative         None         None         1887891.0           Inflitration         Rate - Maximum - Positive         6.000         16.1401         Rate - Maximum - Negative         None         None           Cumulative Volume - Maximum Positive         312.000         1887891.0         None         None           Cumulative Volume - Maximum Negative         None         None         None         None           Cumulative Volume - Maximum Positive         None         None         None         None           Cumulative Volume - Maximum Negative         None         None         None         None           Cumulative Volume - Maximum Positive         disabled         disabled         disabled         disabled         disabled         disabled         disabled         disabled         disabled <td>Stage</td> <td></td> <td></td> <td></td> <td></td>	Stage				
Inflow       Rate - Maximum - Positive       0.002       314648.5000         Rate - Maximum - Negative       None       None         Cumulative Volume - End of Simulation       384.000       1887891.0         Infiltration       Rate - Maximum - Positive       6.000       16.1401         Rate - Maximum - Positive       6.000       1887891.0         Cumulative Volume - End of Simulation       384.000       1887891.0         Infiltration       Rate - Maximum - Positive       312.000       1887891.0         Cumulative Volume - Maximum Positive       312.000       1887891.0       None         Cumulative Volume - Maximum Positive       312.000       1887891.0       None         Cumulative Volume - Maximum Positive       None       None       None         Cumulative Volume - Maximum Positive       None       None       None         Rate - Maximum - Positive       None       None       None         Cumulative Volume - Maximum Positive       None       None       None         Cumulative Volume - Maximum Negative       None       None       None         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabl	Minimum Maximum	0.000 0.002	87.00 98.48		
Rate     Maximum     Positive     0.002     314648.5000       Rate     Maximum     None     None       Cumulative Volume     Maximum Negative     None     None       Cumulative Volume     Maximum Negative     None     None       Cumulative Volume     Ed of Simulation     384.000     1887891.0       None     None     None     None       Cumulative Volume     Ed of Simulation     384.000     1887891.0       National     None     None     None       Cumulative Volume     Maximum Negative     None     None       Cumulative Volume     Ed of Simulation     384.000     0.0       Discharge Structure 1 - inactive     Giaabled<	Inflow				
Rate - Maximum - Negative     None     None       Cumulative Volume - Maximum Negative     0.002     1887891.0       Cumulative Volume - End of Simulation     384.000     1887891.0       Infiltration     Rate - Maximum - Positive     6.000     16.1401       Rate - Maximum - Positive     6.000     16.1401       Rate - Maximum - Positive     6.000     1887891.0       Cumulative Volume - Maximum Negative     None     None       Rate - Maximum - Positive     None     None       Rate - Maximum - Regative     None     None       Cumulative Volume - Maximum Negative     disabled     disabled       Cumulative Volume - Maximum Negative     disabled     disabled       Cumulative Volume - Maximum Negative     disabled     disabled       Cumulative Volume - Maximum Negative     disabled     disabled    <	Rate - Maximum - Positive	0.002		314648.5000	
Cumulative Volume - Maximum Positive       0.002       1887891.0         Cumulative Volume - Maximum Negative       None       None         Cumulative Volume - End of Simulation       384.000       1887891.0         Infiltration       Rate - Maximum - Positive       6.000       16.1401         Rate - Maximum - Negative       None       None       None         Cumulative Volume - Maximum Positive       312.000       1887891.0       1887891.0         Cumulative Volume - Maximum Positive       312.000       1887891.0       None       None         Cumulative Volume - End of Simulation       384.000       1887891.0       None       None         Cumulative Volume - End of Simulation       384.000       1887891.0       None       Stattatatatatatatatatatatatatatatatatat	Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Negative         None         None           Cumulative Volume - End of Simulation         384.000         1887891.0           Infiltration         Rate - Maximum - Positive         6.000         16.1401           Rate - Maximum - Negative         None         None         1887891.0           Cumulative Volume - Maximum Negative         None         None         None           Cumulative Volume - Maximum Negative         None         None         None           Cumulative Volume - Maximum Negative         None         None         None           Combined Discharge         Rate - Maximum - Negative         None         None           Rate - Maximum - Regative         None         None         None           Cumulative Volume - Maximum Negative         None         None         None           Cumulative Volume - End of Simulation         384.000         0.0         0.0           Discharge Structure 1 - inactive         Gisabled         disabled         disabled         disabled           Cumulative Volume - Maximum Negative         disabled         d	Cumulative Volume - Maximum Positive	0.002			1887891.0
Cumulative Volume - End of Simulation       384.000       1887691.0         Infiltration       Rate - Maximum - Positive       6.000       16.1401         Rate - Maximum - Negative       None       None         Cumulative Volume - Maximum Positive       312.000       1887891.0         Cumulative Volume - Maximum Negative       None       None         Cumulative Volume - End of Simulation       384.000       1887891.0         Combined Discharge       Rate - Maximum - Positive       None       None         Cumulative Volume - Maximum Positive       None       None       None         Cumulative Volume - Maximum Positive       None       None       None         Cumulative Volume - Maximum Positive       None       None       None         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled	Cumulative Volume - Maximum Negative	None			None
Infiltration       Rate - Maximum - Positive       6.000       16.1401         Rate - Maximum - Negative       None       None         Cumulative Volume - Maximum Positive       312.000       1887891.0         Cumulative Volume - Maximum Negative       None       None         Cumulative Volume - Maximum Negative       None       None         Combined Discharge       Rate - Maximum - Positive       None       None         Rate - Maximum - Negative       None       None       None         Cumulative Volume - Maximum Positive       None       None       None         Cumulative Volume - Maximum Negative       None       None       None         Cumulative Volume - Maximum Negative       None       None       None         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Cumulative Volume - End of Simulation       384.000       0.0       0.0         Discharge Structure 1 - inactive       Rate - Maximum - Negative       disabled       disabled         Cumulative Volume - End of Simulation       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled	Cumulative Volume - End of Simulation	384.000			1887891.0
Rate - Maximum - Positive       6.000       16.1401         Rate - Maximum - Negative       None       None         Cumulative Volume - Maximum Negative       None       None         Cumulative Volume - Maximum Negative       None       None         Combined Discharge       Rate - Maximum - Positive       None       None         Rate - Maximum - Positive       None       None       None         Combined Discharge       Rate - Maximum - Positive       None       None         Cumulative Volume - Maximum Negative       None       None       None         Cumulative Volume - Maximum Negative       None       None       None         Cumulative Volume - Maximum Negative       None       None       None         Cumulative Volume - Maximum Negative       Mone       None       None         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disab	Infiltration				
Rate - Maximum - Negative     None     None       Cumulative Volume - Maximum Negative     312,000     1887891.0       Cumulative Volume - Maximum Negative     None     None       Cumulative Volume - End of Simulation     384.000     1887891.0       Combined Discharge     Rate - Maximum - Positive     None     None       Rate - Maximum - Positive     None     None     None       Cumulative Volume - Maximum Positive     None     None     None       Cumulative Volume - Maximum Negative     Gisabled     disabled     0.0       Discharge Structure 1 - inactive     Rate - Maximum - Positive     disabled     disabled       Cumulative Volume - Maximum Negative     disabled     disabled     disabled       Cumulative Volume - Maximum Negative     disabled     disabled     disabled       Cumulative Volume - Maximum Positive     disabled     disabled     disabled       Cumulative Volume - Maximum Positive     disabled     disabled     disabled       Cumulative Volume - Maximum Negative     disabled     disabled     disabled    <	Rate - Maximum - Positive	6.000		16.1401	
Cumulative Volume - Maximum Positive       312.000       1887891.0         Cumulative Volume - End of Simulation       384.000       1887891.0         Combined Discharge       Rate - Maximum - Positive       None       None         Rate - Maximum - Positive       None       None       None         Cumulative Volume - Interview       None       None       None         Cumulative Volume - Maximum Positive       None       None       None         Cumulative Volume - Maximum Negative       None       None       None         Cumulative Volume - Maximum Negative       None       None       None         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumu	Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Negative       None       None         Cumulative Volume - End of Simulation       384.000       1887891.0         Combined Discharge       None       None         Rate - Maximum - Positive       None       None         Cumulative Volume - Maximum Positive       None       None         Cumulative Volume - Maximum Positive       None       None         Cumulative Volume - Maximum Negative       None       None         Cumulative Volume - Maximum Positive       disabled       disabled         Cumulative Volume - End of Simulation       384.000       0.0         Discharge Structure 1 - inactive       Rate - Maximum - Positive       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - End of Simulation       disabled       disabled       disabled         Cumulative Volume - End of Simulation       disabled       disabled       disabled         Cumulative Volume - End of Simulation       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Cumulati	Cumulative Volume - Maximum Positive	312.000			1887891.0
Cumulative Volume - End of Simulation       384.000       1887891.0         Combined Discharge       Rate - Maximum - Positive       None       None         Rate - Maximum - Negative       None       None       None         Cumulative Volume - Maximum Positive       None       None       None         Cumulative Volume - Maximum Negative       None       None       None         Cumulative Volume - End of Simulation       384.000       0.0         Discharge Structure 1 - inactive       Rate - Maximum - Positive       disabled       disabled         Rate - Maximum - Negative       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Cumulative Volume - End of Simulation       disabled       disabled       disabled         Discharge Structure 2 - inactive       giabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabled	Cumulative Volume - Maximum Negative	None			None
Combined Discharge       None       None         Rate - Maximum - Positive       None       None         Rate - Maximum - Negative       None       None         Cumulative Volume - Maximum Negative       None       None         Cumulative Volume - Maximum Negative       None       None         Cumulative Volume - Maximum Negative       None       None         Cumulative Volume - End of Simulation       384.000       0.0         Discharge Structure 1 - inactive       disabled       disabled         Rate - Maximum - Positive       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled         Cumulative Volume - End of Simulation       disabled       disabled         Discharge Structure 2 - inactive       Rate - Maximum - Positive       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Cumulative Volume - End of Simulation       disabled       disabled       disabled	Cumulative Volume - End of Simulation	384.000			1887891.0
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Cumulative Volume - End of Simulation       384.000       0.0         Discharge Structure 1 - inactive       Rate - Maximum - Positive       disabled       disabled         Rate - Maximum - Negative       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Discharge Structure 2 - inactive       Rate - Maximum - Positive       disabled       disabled         Rate - Maximum - Negative       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Cumulative Volume - End of Simulation       disabled       disabled       disabled         Discharge Structure 3 - inactive       Inactive       disabled       disabled       disabled         Rate - Maximum - Negative       disabled       disabled       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled <td< td=""><td>Cumulative Volume - Maximum Negative</td><td>None</td><td></td><td></td><td>None</td></td<>	Cumulative Volume - Maximum Negative	None			None
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Rate - Maximum - NegativedisableddisabledCumulative Volume - Maximum PositivedisableddisabledCumulative Volume - End of SimulationdisableddisabledDischarge Structure 3 - inactivedisableddisabledRate - Maximum - PositivedisableddisabledRate - Maximum - NegativedisableddisabledCumulative Volume - NegativedisableddisabledCumulative Volume - Maximum PositivedisableddisabledCumulative Volume - Maximum PositivedisableddisabledCumulative Volume - Maximum NegativedisableddisabledCumulative Volume - Maximum NegativedisableddisabledCumulative Volume - End of SimulationdisableddisabledPollution Abatement:36.00095.171050379.072 Hour Stage and Infiltration Volume72.00094.271306480.0	Rate - Maximum - Positive	disabled		disabled	
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Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Cumulative Volume - End of Simulation       disabled       disabled       disabled         Discharge Structure 3 - inactive       Rate - Maximum - Positive       disabled       disabled         Rate - Maximum - Positive       disabled       disabled       disabled         Cumulative Volume - Negative       disabled       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled       disabled         Pollution Abatement:       36 Hour Stage and Infiltration Volume       36.000       95.17       1050379.0         72 Hour Stage and Infiltration Volume       72.000       94.27       1306480.0	Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - End of Simulation       disabled       disabled         Discharge Structure 3 - inactive       disabled       disabled         Rate - Maximum - Positive       disabled       disabled         Rate - Maximum - Negative       disabled       disabled         Cumulative Volume - Maximum Positive       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled         Cumulative Volume - Maximum Negative       disabled       disabled         Cumulative Volume - End of Simulation       disabled       disabled         Pollution Abatement:       36.000       95.17       1050379.0         72 Hour Stage and Infiltration Volume       72.000       94.27       1306480.0	Cumulative Volume - Maximum Negative	disabled			disabled
Discharge Structure 3 - inactive       disabled         Rate - Maximum - Positive       disabled         Rate - Maximum - Negative       disabled         Cumulative Volume - Maximum Positive       disabled         Cumulative Volume - Maximum Negative       disabled         Cumulative Volume - Maximum Negative       disabled         Cumulative Volume - End of Simulation       disabled         Pollution Abatement:       36 Hour Stage and Infiltration Volume         36 Hour Stage and Infiltration Volume       36.000       95.17         72 Hour Stage and Infiltration Volume       72.000       94.27	Cumulative Volume - End of Simulation	disabled			disabled
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:       36.000       95.17       1050379.0         72 Hour Stage and Infiltration Volume       72.000       94.27       1306480.0	Discharge Structure 3 - inactive	al:		al;l-ll	
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:       36.000       95.17       1050379.0         72 Hour Stage and Infiltration Volume       72.000       94.27       1306480.0	Rate - Maximum - Positive	disabled		disabled	
Currulative 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       36.000       95.17       1050379.0         72 Hour Stage and Infiltration Volume       72.000       94.27       1306480.0	Rate - Maximum - Negative	disabled		disabled	ا با با م
Cumulative volume - Maximum Negative       disabled       disabled       disabled         Cumulative Volume - End of Simulation       disabled       disabled       disabled         Pollution Abatement:       36 Hour Stage and Infiltration Volume       36.000       95.17       1050379.0         72 Hour Stage and Infiltration Volume       72.000       94.27       1306480.0	Cumulative Volume - Maximum Positive	disabled			disabled
Commanye volume - End of SimulationdisableddisabledPollution Abatement: 36 Hour Stage and Infiltration Volume36.00095.171050379.072 Hour Stage and Infiltration Volume72.00094.271306480.0	Cumulative Volume - Maximum Negative	disabled			disabled
Pollution Abatement: 36 Hour Stage and Infiltration Volume 36.000 95.17 1050379.0 72 Hour Stage and Infiltration Volume 72.000 94.27 1306480.0	Cumulative volume - End of Simulation	uisabied			uisabied
72 Hour Stage and Infiltration Volume 36.000 95.17 1050379.0 1306480.0	Pollution Abatement:	26.000	05 47		1050270 0
	72 Hour Stage and Infiltration Volume	30.000 72 000	90.17 QA 27		1306480 0





# ATTACHMENT B

WATER QUALITY VOLUME RECOVERY

#### Project Data

Project Name:	Fuqua - Hartwood Marsh
Simulation Description:	Combined Pond - Water Quality Treatment Volume Run
Project Number:	19-585.18
Engineer :	Reidel Gardon
Supervising Engineer:	Devo Seereeram
Date:	09-26-2019

#### Aquifer Data

Base Of Aquifer Elevation, [B] (ft datum):	70.00
Water Table Elevation, [WT] (ft datum):	87.00
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day):	45.00
Fillable Porosity, [n] (%):	30.00
Unsaturated Vertical Infiltration Rate, [Iv] (ft/day):	5.0
Maximum Area For Unsaturated Infiltration, [Av] (ft <sup>2</sup> ):	270508.0

#### **Geometry Data**

Equivalent Pond Length, [L] (ft):	1430.0
Equivalent Pond Width, [W] (ft):	290.0

Ground water mound is expected to intersect the pond bottom

## Stage vs Area Data

Stage (ft datum)	Area (ft²)
92.00	237838.0
93.00	254390.0
94.00	270508.0
95.00	286625.0
96.00	303613.0
97.00	320602.0
98.00	338026.0
98.50	346302.0
99.00	389862.0

#### Ditch Data

Ditch (or interceptor trench) parallel to length axis is inactive

Ditch (or interceptor trench) parallel to width axis is inactive

#### **Discharge Structures**

**Discharge Structure #1 is inactive** 

**Discharge Structure #2 is inactive** 

**Discharge Structure #3 is inactive** 

#### Scenario Input Data

Scenario 1 :: 491357 ft<sup>3</sup> slug load

g Load uted with infiltration	I		
491357			
datum) 87.00 (d	lefault)		
e After Tir n Event Sto ays)	me After rm Event (days)	Time After Storm Event (days)	Time After Storm Event (days)
2.000 2.500 3.000 3.500 4.000	5.000 6.000 7.000 8.000 9.000	10.000 11.000 12.000 13.000 14.000	15.000 16.000
	g Load uted with infiltration 491357 datum) 87.00 (d e After Tii n Event Sto ays) 2.000 2.500 3.000 3.500 4.000	g Load uted with infiltration 491357 datum) 87.00 (default) e After Time After n Event Storm Event ays) (days) 2.000 5.000 2.500 6.000 3.000 7.000 3.500 8.000 4.000 9.000	g Load uted with infiltration 491357 datum) 87.00 (default) e After Time After Time After h Event Storm Event Storm Event ays) (days) (days) 2.000 5.000 10.000 2.500 6.000 11.000 3.000 7.000 12.000 3.500 8.000 13.000 4.000 9.000 14.000

Detailed Results :: Scenario 1 :: 491357 ft<sup>3</sup> slug load

	Combined								
Elapsed	Instantaneous	Outside	Stage	Infiltration	Instantaneous	Cumulative	Cumulative	Combined	
Time	Inflow Rate	Recharge	Elevation	Rate	Discharge	Inflow	Infiltration	Cumulative	Flow
(hours)	(ft³/s)	(ft/day)	(ft datum)	(ft³/s)	Rate (ft <sup>3</sup> /s)	Volume (ft <sup>3</sup> )	Volume (ft <sup>3</sup> )	Discharge (ft <sup>3</sup> )	Туре
0.000	81892 8400	0.0000	87 00000	0.0000	0	0.000		0	Ν Δ
0.000	81802.8400	0.00000	03 03503	15 59/80	0	401357 000	0.0	0	11/P
2.400	01032.0400	0.00000	02 42506	15.00400	0	401257.000	122000.2	0	
2.400	0.0000	0.00000	93.43590	10.13/30	0	491337.000	132000.3	0	
6.000	0.0000	0.00000	92.08040	12.13938	0	491357.000	324440.7	0	U/P
12.000	0.0000	0.00000	91.55759	5.15174	0	491357.000	491357.0	0	0/5
24.000	0.0000	0.00000	90.89655	0.00000	0	491357.000	491357.0	0	S
36.000	0.0000	0.00000	90.50702	0.00000	0	491357.000	491357.0	0	S
48.000	0.0000	0.00000	90.23192	0.00000	0	491357.000	491357.0	0	S
60.000	0.0000	0.00000	90.02018	0.00000	0	491357.000	491357.0	0	S
72.000	0.0000	0.00000	89.84879	0.00000	0	491357.000	491357.0	0	S
84.000	0.0000	0.00000	89.70534	0.00000	0	491357.000	491357.0	0	S
96.000	0.0000	0.00000	89.58241	0.00000	0	491357.000	491357.0	0	S
120.000	0.0000	0.00000	89.38895	0.00000	0	491357.000	491357.0	0	S
144.000	0.0000	0.00000	89.23126	0.00000	0	491357.000	491357.0	0	S
168.000	0.0000	0.00000	89.09931	0.00000	0	491357.000	491357.0	0	S
192.000	0.0000	0.00000	88.98666	0.00000	0	491357.000	491357.0	0	S
216.000	0.0000	0.00000	88.88892	0.00000	0	491357.000	491357.0	0	S
240.000	0.0000	0.00000	88.80302	0.00000	0	491357.000	491357.0	0	S
264.000	0.0000	0.00000	88.72670	0.00000	0	491357.000	491357.0	0	S
288.000	0.0000	0.00000	88.65827	0.00000	0	491357.000	491357.0	0	S
312.000	0.0000	0.00000	88.59646	0.00000	0	491357.000	491357.0	0	S
336.000	0.0000	0.00000	88.54023	0.00000	0	491357.000	491357.0	0	S
360.000	0.0000	0.00000	88.48879	0.00000	0	491357.000	491357.0	0	S
384.000	0.0000	0.00000	88.44150			491357.000	491357.0	0	N.A.

# Summary of Results :: Scenario 1 :: 491357 ft<sup>3</sup> slug load

	Time (hours)	Stage _(ft datum)	Rate (ft³/s)	Volume (ft <sup>3</sup> )
Stage				
Minimum Maximum	0.000 0.002	87.00 93.94		
Inflow				
Rate - Maximum - Positive	0.002		81892.8400	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	0.002			491357.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	384.000			491357.0
Infiltration				
Rate - Maximum - Positive	0.002		15.5948	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	12.000			491357.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	384.000			491357.0
Combined Discharge				
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	384.000			0.0
Discharge Structure 1 - 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
Discharge Structure 2 - 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
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	36.000	90.51		491357.0
72 Hour Stage and Infiltration Volume	72.000	89.85		491357.0



