WHITAKER LABORATORY, INC.

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April 3, 2018

Ussery Rule Architects, P.C.
1804-A Frederica Road
St Simons Island, GA 31522
912-638-6688

Attention: Mr. Robert Ussery
russery@urarch.com

Referencing: Hydraulic Conductivity Testing and Seasonal High Groundwater Determinations
Fifty Oaks – St. Simons Island, GA
Report No.: 4-3-18-7

Dear Mr. Ussery:

As requested, Whitaker personnel performed hydraulic conductivity testing utilizing an Aardvark Permeameter at four locations on the above referenced site. Please see the attached plan for referencing test locations denoted as P1 though P4.

Hydraulic conductivity testing was performed at depths of 30-36 inches below the existing ground surface elevation for P1 and P3, 48-54 inches below the existing ground surface for P-2, and, 42-48 inches below the existing ground surface for P-4. We have attached the Aardvark Permeameter data sheets for your information and review. The below chart provides a general overview of our findings:

Test #	Location	Test Depth (inches) BGS*	Soil Description at test depth	Design Loading Rate (gdsf)	Depth to Groundwater (Feet) BGS*	SHGW (Feet) BGS*	
P1	See Plan	30 - 36	Fine Sand (SP-SM)	8.24	5.5	SHGW-1	4
P2	See Plan	48-54	Fine Sand (SP-SM)	6.15	5.5		
P3	See Plan	30 - 36	Fine Sand (SP-SM)	7.40	5.0	SHGW-2	4
P4	See Plan	42-48	Fine Sand (SP-SM)	6.62	5.0		

*BGS = Below Ground Surface

Please note that Whitaker recommends applying an appropriate factor of safety to the hydraulic conductivity values prior to utilizing in site design.

It is a pleasure to provide our services to you and we look forward to further opportunities to assist you on this and other projects.

Respectfully submitted,
WHITAKER LABORATORY, INC.

Jason H. Follo, P.E.
Project Engineer

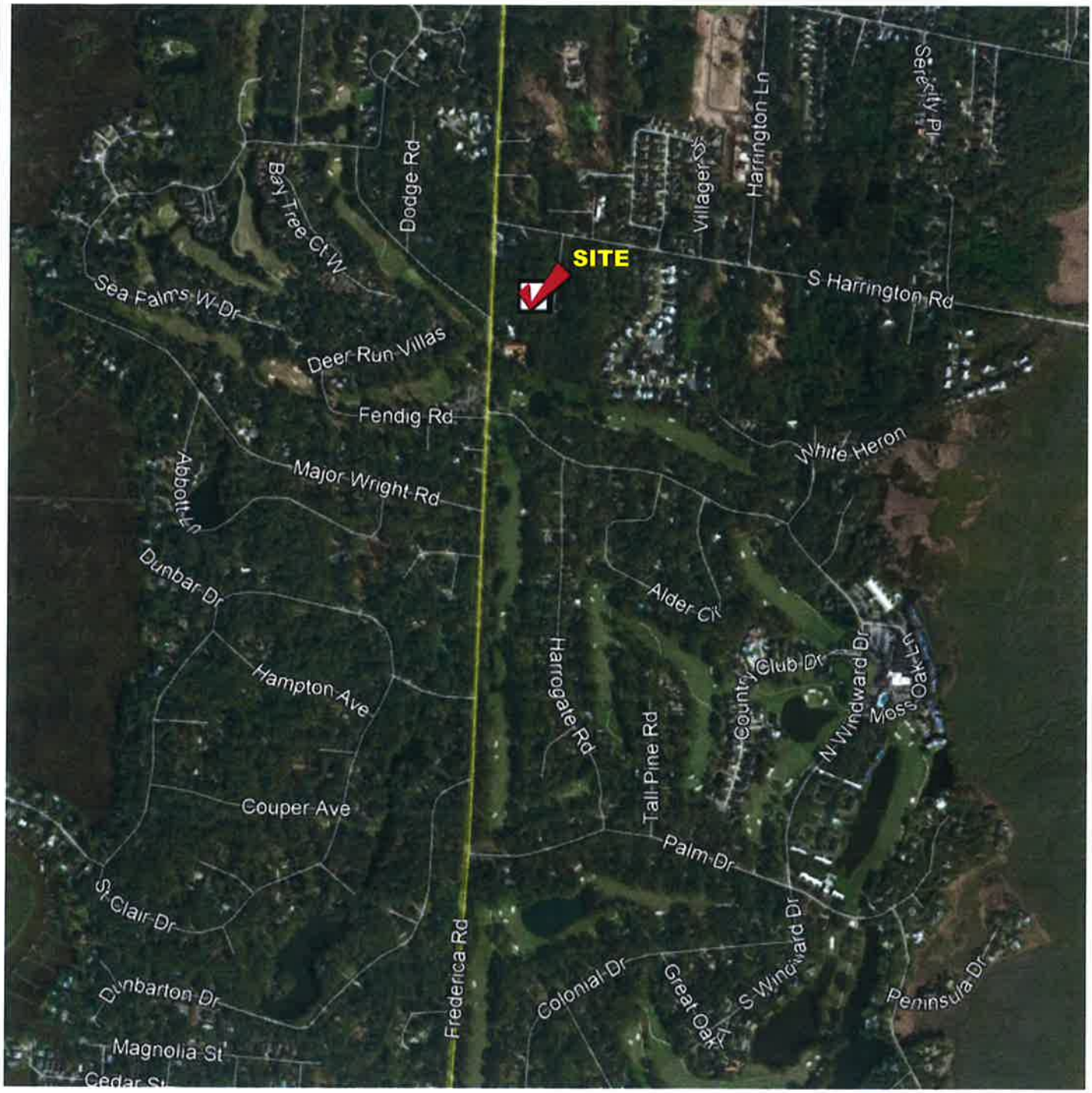
Blake Jones, E.I.T.
Staff Engineer

Attachments

Site Vicinity Plan

Boring Location Plan

Aardvark Data Sheets



Site Vicinity Map

50 Oaks
5514 Frederica Road
Saint Simons, Glynn County, Georgia

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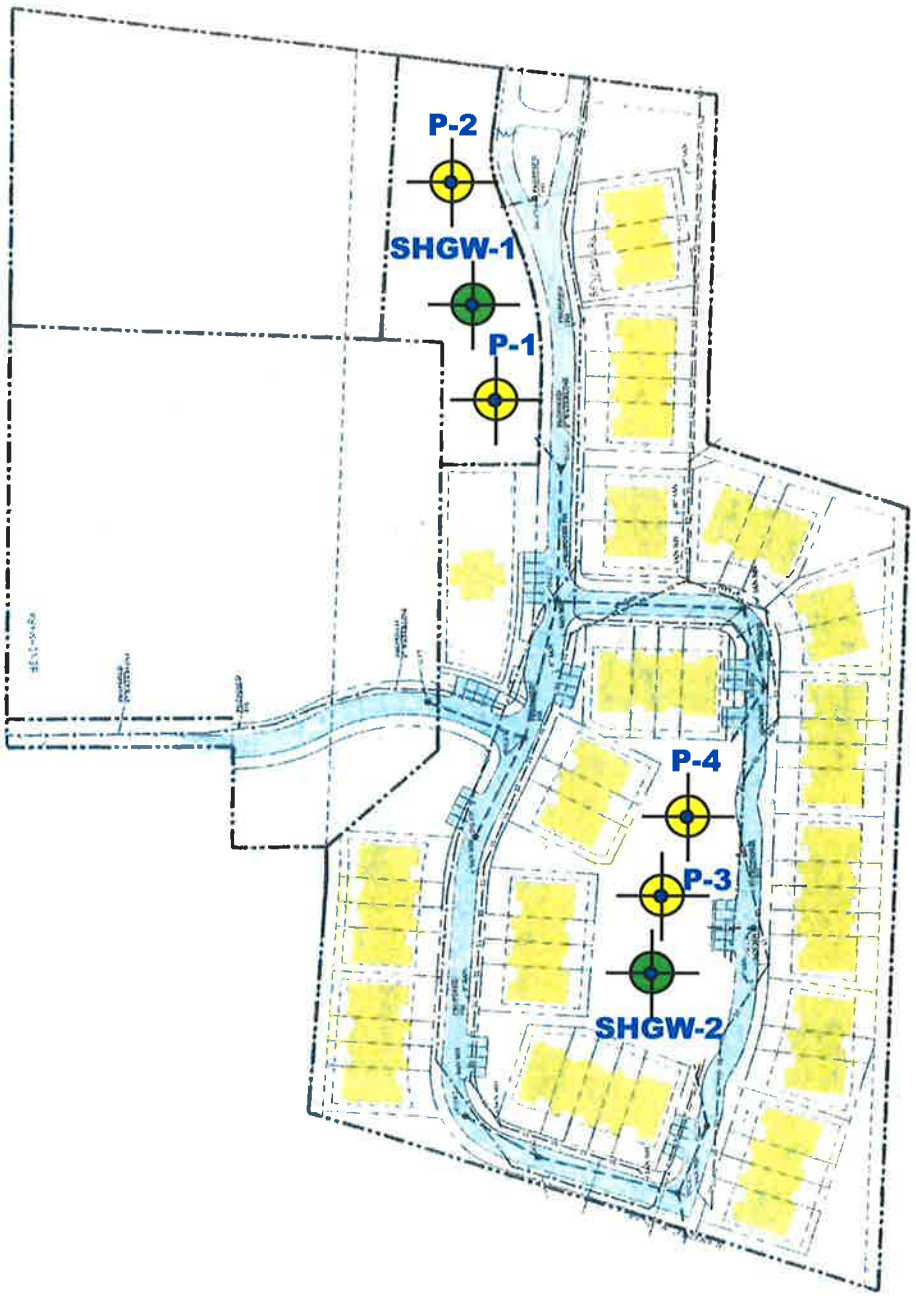

Boring Location Plan

50 Oaks
5514 Frederica Oaks
Saint Simons, Glynn County, Georgia

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ALL BORING LOCATIONS ARE APPROXIMATE, & ARE BASED ONLY ON FIELD ESTIMATES.

Percolation or Ksat Rates using Aardvark Soil Permeameter

Perc Rate: min/in | **Ksat:** in/hr | **LR:** gdsf

Date: 29-Mar-18 **Operator:** Blake Jones

Site: Fifty Oaks- St. Simons Island, GA

Soil Series: **Soil Horizon:**

Boring Number: P1

Boring Depth (in) : 30-36

Diameter of Hole(in): 4.25 **Water Column Height (in):** 6 **Head Conversion Factor (HCF):** 1.00

Boring Conversion Factor (BCF): 1 **EPA Design Loading Rate = Ksat*14.96*(safety factor of 0.04 to 0.5 system dependent)**

Boring Conversion Factor (BCF) = 5.06 for Aardvark Reservoir/((radius)squared)

BCF of 4 in auger is 4.25 in diameter boring = 1

BCF of 3.25 in auger is 3.5 in diameter boring = 1.65

BCF of a 2.5 in auger is 2.75 in diameter boring = 2.86

Head Conversion Factor (HCF) = Water Column Ht inches / 6 inches, or Htcm/15cm

Example is 3.5in boring with 7 in water column in boring, 0.5 in head drop over 45 minutes in a structureded clay loam soil

F Value (Radcliffe and West, 2000) Perc min/in to Ksat in/hr

	Borehole diameter		
Texture	3.5 in	4.0 in	4.5 in
Sands	0.107	0.124	0.141
Structured loams and clays	0.082	0.096	0.11
Unstructured loams and clays	0.048	0.057	0.065

Time T0	Time x	Time	Hours	Reservoir	Reservoir	Reservoir	Percolation	BCF	HCF	Percolation	F value	Ksat	Design Loading
2400 hours	2400 hours	Elapsed	Elapsed	Reading	Reading	Change	Rate (min/in)			Rate	from table	= F(1/P)	Rate gdsf
ti	t+1	(ti+1)-ti	dt/60min/hr	h	h+1	(h+1)-h	dt/dh			Adjusted			with a 0.10
		dt				dh				(P*HCF)/BCF			Safety Factor
	initial	next		initial	next		P			Adj P			of Ksat
		min	hr	in	in	in	min/in			min/in		in/hr	gdsf
8:00	*8:45*	*45*	*0.75*	*14.5*	*14*	*0.5*	*90*	*1.65*	*1.17*	*64*	0.082	0.08	0.12
1:00	*1:10*	*10*	*0.166667*	*16.7*	*8.8*	*7.9*	*1.265822785*	1	1.00	***1.3***	0.124	**5.88**	**8.79**
1:10	*1:20*	*10*	*0.166667*	*16.7*	*8.8*	*7.9*	*1.265822785*	1	1.00	***1.3***	0.124	**5.88**	**8.79**
1:20	*1:30*	*10*	*0.166667*	*16.7*	*7.9*	*8.8*	*1.136363636*	1	1.00	***1.1***	0.124	**6.55**	**9.79**
1:30	*1:40*	*10*	*0.166667*	*16.7*	*8.1*	*8.6*	*1.162790698*	1	1.00	***1.2***	0.124	**6.40**	**9.57**
1:40	*1:50*	*10*	*0.166667*	*16.7*	*9.0*	*7.7*	*1.298701299*	1	1.00	***1.3***	0.124	**5.73**	**8.57**
1:50	*2:00*	*10*	*0.166667*	*16.7*	*9.4*	*7.3*	*1.369863014*	1	1.00	***1.4***	0.124	**5.43**	**8.13**
2:00	*2:10*	*10*	*0.166667*	*16.7*	*9.2*	*7.5*	*1.333333333*	1	1.00	***1.3***	0.124	**5.58**	**8.35**
2:10	*2:20*	*10*	*0.166667*	*16.7*	*9.3*	*7.4*	*1.351351351*	1	1.00	***1.4***	0.124	**5.51**	**8.24**
2:20	*2:30*	*10*	*0.166667*	*16.7*	*9.3*	*7.4*	*1.351351351*	1	1.00	***1.4***	0.124	**5.51**	**8.24**
STEADY STATE ARITHMETIC AVERAGE (last 4 readings)										**1.4**		**5.51**	**8.24**

Pedon Description

Depth	Horizon	Color	Texture	Structure	Horizon Notes
0-8"					Topsoil
8-72"					Tan Sand (SP-SM)

User is responsible for confirming all Stand Operation Procedures for their area and type of study,

Aardvark Systems International, LLC or third parties do not assume any responsibility for misuse of devices or spreadsheets or calculations

Site Notes:

Percolation or Ksat Rates using Aardvark Soil Permeameter

Perc Rate: min/in | **Ksat:** in/hr | **LR:** gdsf

Date: 29-Mar-18 **Operator:** Blake Jones

Site: Fifty Oaks- St. Simons Island, GA

Soil Series: **Soil Horizon:**

Boring Number: P2

Boring Depth (in) : 48-54

Diameter of Hole(in): 4.25 **Water Column Height (in):** 6 **Head Conversion Factor (HCF):** 1.00

Boring Conversion Factor (BCF): 1 **EPA Design Loading Rate = Ksat*14.96*(safety factor of 0.04 to 0.5 system dependent)**

Boring Conversion Factor (BCF) = 5.06 for Aardvark Reservoir/((radius)squared)

BCF of 4 in auger is 4.25 in diameter boring = 1

BCF of 3.25 in auger is 3.5 in diameter boring = 1.65

BCF of a 2.5 in auger is 2.75 in diameter boring = 2.86

Head Conversion Factor (HCF) = Water Column Ht inches / 6 inches, or Htcm/15cm

Example is 3.5in boring with 7 in water column in boring, 0.5 in head drop over 45 minutes in a structureded clay loam soil

F Value (Radcliffe and West, 2000) Perc min/in to Ksat in/hr

Texture	Borehole diameter 3.5 in	4.0 in	4.5 in
Sands	0.107	0.124	0.141
Structured loams and clays	0.082	0.096	0.11
Unstructured loams and clays	0.048	0.057	0.065

Time T0	Time x	Time	Hours	Reservoir	Reservoir	Reservoir	Percolation	BCF	HCF	Percolation	F value	Ksat	Design Loading
2400 hours	2400 hours	Elapsed	Elapsed	Reading	Reading	Change	Rate (min/in)			Rate	from table	= F(1/P)	Rate gsdf
ti	t+1	(ti+1)-ti	dt/60min/hr	h	h+1	(h+1)-h	dt/dh			Adjusted			with a 0.10
		dt				dh				(P*HCF)/BCF			Safety Factor
	initial	next		initial	next		P			Adj P			of Ksat
		min	hr	in	in	in	min/in			min/in		in/hr	gdsf
8:00	*8:45*	*45*	*0.75*	*14.5*	*14*	*0.5*	*90*	*1.65*	*1.17*	*64*	0.082	0.08	0.12
1:00	*1:10*	*10*	*0.166667*	*16.7*	*9.4*	*7.3*	*1.369863014*	1	1.00	***1.4***	0.124	**5.43**	**8.13**
1:10	*1:20*	*10*	*0.166667*	*16.7*	*9.8*	*6.9*	*1.449275362*	1	1.00	***1.4***	0.124	**5.13**	**7.68**
1:20	*1:30*	*10*	*0.166667*	*16.7*	*9.8*	*6.9*	*1.449275362*	1	1.00	***1.4***	0.124	**5.13**	**7.68**
1:30	*1:40*	*10*	*0.166667*	*16.7*	*10.3*	*6.4*	*1.5625*	1	1.00	***1.6***	0.124	**4.76**	**7.12**
1:40	*1:50*	*10*	*0.166667*	*16.7*	*10.7*	*6.0*	*1.666666667*	1	1.00	***1.7***	0.124	**4.46**	**6.68**
1:50	*2:00*	*10*	*0.166667*	*16.7*	*11.1*	*5.6*	*1.785714286*	1	1.00	***1.8***	0.124	**4.17**	**6.23**
2:00	*2:10*	*10*	*0.166667*	*16.7*	*11.2*	*5.5*	*1.818181818*	1	1.00	***1.8***	0.124	**4.09**	**6.12**
2:10	*2:20*	*10*	*0.166667*	*16.7*	*11.2*	*5.5*	*1.818181818*	1	1.00	***1.8***	0.124	**4.09**	**6.12**
2:20	*2:30*	*10*	*0.166667*	*16.7*	*11.2*	*5.5*	*1.818181818*	1	1.00	***1.8***	0.124	**4.09**	**6.12**
STEADY STATE ARITHMETIC AVERAGE (last 4 readings)										**1.8**		**4.11**	**6.15**

Pedon Description

Depth	Horizon	Color	Texture	Structure	Horizon Notes
0-6"					Topsoil
6-72"					Tan Sand (SP-SM)

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Site Notes:

Percolation or Ksat Rates using Aardvark Soil Permeameter

Perc Rate: min/in | **Ksat:** in/hr | **LR:** gdsf

Date: 2-Apr-18 **Operator:** Blake Jones

Site: Fifty Oaks- St. Simons Island, GA

Soil Series: **Soil Horizon:**

Boring Number: P3

Boring Depth (in) : 30-36

Diameter of Hole(in): 4.25 **Water Column Height (in):** 6 **Head Conversion Factor (HCF):** 1.00

Boring Conversion Factor (BCF): 1 **EPA Design Loading Rate = Ksat*14.96*(safety factor of 0.04 to 0.5 system dependent)**

Boring Conversion Factor (BCF) = 5.06 for Aardvark Reservoir/((radius)squared)

BCF of 4 in auger is 4.25 in diameter boring = 1

BCF of 3.25 in auger is 3.5 in diameter boring = 1.65

BCF of a 2.5 in auger is 2.75 in diameter boring = 2.86

Head Conversion Factor (HCF) = Water Column Ht inches / 6 inches, or Htcm/15cm

Example is 3.5in boring with 7 in water column in boring, 0.5 in head drop over 45 minutes in a structureded clay loam soil

F Value (Radcliffe and West, 2000) Perc min/in to Ksat in/hr

	Borehole diameter		
Texture	3.5 in	4.0 in	4.5 in
Sands	0.107	0.124	0.141
Structured loams and clays	0.082	0.096	0.11
Unstructured loams and clays	0.048	0.057	0.065

Time T0	Time x	Time	Hours	Reservoir	Reservoir	Reservoir	Percolation	BCF	HCF	Percolation	F value	Ksat	Design Loading
2400 hours	2400 hours	Elapsed	Elapsed	Reading	Reading	Change	Rate (min/in)			Rate	from table	= F(1/P)	Rate gdsf
ti	t+1	(ti+1)-ti	dt/60min/hr	h	h+1	(h+1)-h	dt/dh			Adjusted			with a 0.10
		dt				dh				(P*HCF)/BCF			Safety Factor
	initial	next		initial	next		P			Adj P			of Ksat
		min	hr	in	in	in	min/in			min/in		in/hr	gdsf
8:00	*8:45*	*45*	*0.75*	*14.5*	*14*	*0.5*	*90*	*1.65*	*1.17*	*64*	0.082	0.08	0.12
1:00	*1:10*	*10*	*0.166667*	*16.7*	*7.4*	*9.3*	*1.075268817*	1	1.00	***1.1***	0.124	**6.92**	**10.35**
1:10	*1:20*	*10*	*0.166667*	*16.7*	*8.3*	*8.4*	*1.19047619*	1	1.00	***1.2***	0.124	**6.25**	**9.35**
1:20	*1:30*	*10*	*0.166667*	*16.7*	*8.2*	*8.5*	*1.176470588*	1	1.00	***1.2***	0.124	**6.32**	**9.46**
1:30	*1:40*	*10*	*0.166667*	*16.7*	*8.2*	*8.5*	*1.176470588*	1	1.00	***1.2***	0.124	**6.32**	**9.46**
1:40	*1:50*	*10*	*0.166667*	*16.7*	*9.4*	*7.3*	*1.369863014*	1	1.00	***1.4***	0.124	**5.43**	**8.13**
1:50	*2:00*	*10*	*0.166667*	*16.7*	*10.0*	*6.7*	*1.492537313*	1	1.00	***1.5***	0.124	**4.98**	**7.46**
2:00	*2:10*	*10*	*0.166667*	*16.7*	*10.1*	*6.6*	*1.515151515*	1	1.00	***1.5***	0.124	**4.91**	**7.35**
2:10	*2:20*	*10*	*0.166667*	*16.7*	*10.1*	*6.6*	*1.515151515*	1	1.00	***1.5***	0.124	**4.91**	**7.35**
2:20	*2:30*	*10*	*0.166667*	*16.7*	*10.0*	*6.7*	*1.492537313*	1	1.00	***1.5***	0.124	**4.98**	**7.46**
STEADY STATE ARITHMETIC AVERAGE (last 4 readings)										**1.5**		**4.95**	**7.40**

Pedon Description

Depth	Horizon	Color	Texture	Structure	Horizon Notes
0-6"					Topsoil
6-72"					Tan Sand (SP-SM)

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Site Notes:

Percolation or Ksat Rates using Aardvark Soil Permeameter

Perc Rate: min/in | **Ksat:** in/hr | **LR:** gdsf

Date: 2-Apr-18 **Operator:** Blake Jones

Site: Fifty Oaks- St. Simons Island, GA

Soil Series: **Soil Horizon:**

Boring Number: P4

Boring Depth (in) : 42-48

Diameter of Hole(in): 4.25 **Water Column Height (in):** 6 **Head Conversion Factor (HCF):** 1.00

Boring Conversion Factor (BCF): 1 **EPA Design Loading Rate = Ksat*14.96*(safety factor of 0.04 to 0.5 system dependent)**

Boring Conversion Factor (BCF) = 5.06 for Aardvark Reservoir/((radius)squared)

BCF of 4 in auger is 4.25 in diameter boring = 1

BCF of 3.25 in auger is 3.5 in diameter boring = 1.65

BCF of a 2.5 in auger is 2.75 in diameter boring = 2.86

Head Conversion Factor (HCF) = Water Column Ht inches / 6 inches, or Htcm/15cm

Example is 3.5in boring with 7 in water column in boring, 0.5 in head drop over 45 minutes in a structureded clay loam soil

F Value (Radcliffe and West, 2000) Perc min/in to Ksat in/hr

	Borehole diameter		
Texture	3.5 in	4.0 in	4.5 in
Sands	0.107	0.124	0.141
Structured loams and clays	0.082	0.096	0.11
Unstructured loams and clays	0.048	0.057	0.065

Time T0	Time x	Time	Hours	Reservoir	Reservoir	Reservoir	Percolation	BCF	HCF	Percolation	F value	Ksat	Design Loading
2400 hours	2400 hours	Elapsed	Elapsed	Reading	Reading	Change	Rate (min/in)			Rate	from table	= F(1/P)	Rate gdsf
ti	t+1	(ti+1)-ti	dt/60min/hr	h	h+1	(h+1)-h	dt/dh			Adjusted			with a 0.10
		dt				dh				(P*HCF)/BCF			Safety Factor
	initial	next		initial	next		P			Adj P			of Ksat
		min	hr	in	in	in	min/in			min/in		in/hr	gdsf
8:00	*8:45*	*45*	*0.75*	*14.5*	*14*	*0.5*	*90*	*1.65*	*1.17*	*64*	0.082	0.08	0.12
1:00	*1:10*	*10*	*0.166667*	*16.7*	*7.9*	*8.8*	*1.136363636*	1	1.00	***1.1***	0.124	**6.55**	**9.79**
1:10	*1:20*	*10*	*0.166667*	*16.7*	*8.9*	*7.8*	*1.282051282*	1	1.00	***1.3***	0.124	**5.80**	**8.68**
1:20	*1:30*	*10*	*0.166667*	*16.7*	*9.3*	*7.4*	*1.351351351*	1	1.00	***1.4***	0.124	**5.51**	**8.24**
1:30	*1:40*	*10*	*0.166667*	*16.7*	*9.7*	*7*	*1.428571429*	1	1.00	***1.4***	0.124	**5.21**	**7.79**
1:40	*1:50*	*10*	*0.166667*	*16.7*	*10.1*	*6.6*	*1.515151515*	1	1.00	***1.5***	0.124	**4.91**	**7.35**
1:50	*2:00*	*10*	*0.166667*	*16.7*	*10.6*	*6.1*	*1.639344262*	1	1.00	***1.6***	0.124	**4.54**	**6.79**
2:00	*2:10*	*10*	*0.166667*	*16.7*	*10.8*	*5.9*	*1.694915254*	1	1.00	***1.7***	0.124	**4.39**	**6.57**
2:10	*2:20*	*10*	*0.166667*	*16.7*	*10.8*	*5.9*	*1.694915254*	1	1.00	***1.7***	0.124	**4.39**	**6.57**
2:20	*2:30*	*10*	*0.166667*	*16.7*	*10.8*	*5.9*	*1.694915254*	1	1.00	***1.7***	0.124	**4.39**	**6.57**
STEADY STATE ARITHMETIC AVERAGE (last 4 readings)										**1.7**		**4.43**	**6.62**

Pedon Description

Depth	Horizon	Color	Texture	Structure	Horizon Notes
0-6"					Topsoil
6-72"					Tan Sand (SP-SM)

User is responsible for confirming all Stand Operation Procedures for their area and type of study,

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Site Notes: