ATTACHMENT 2

R-Tank System

Maintenance Row Performance Testing

Via ASTM C1746

Submitted to:

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R-Tank System, Maintenance Row Performance Testing
Hydraulic Performance and Sediment Removal Efficiency via ASTM C1746

Executive Summary

The R-Tank system is underground stormwater storage system comprised of interlocking plastic modules. The R-Tank System includes five different module configurations, providing system height options from 2" to over 7' tall. The R-Tank system is designed for inflow rates ranging from 20 to 100 gallons per minute and commonly incorporates a Maintenance Row at the initial in-flow point. The Maintenance Row is surrounded by R-Tank modules, as needed, to increase the detention volume and infiltration footprint. The Maintenance Row is comprised of Maintenance Modules that are designed to trap solid pollutants where they can be easily removed. These modules are wrapped in geotextile to retain solids and are fully accessible by conventional jet-vac systems to remove captured pollutants.

Hydraulic performance and sediment removal efficiency testing was performed on the Maintenance Row components of ACF Environmental's R-Tank System at TRI Environmental's TRI South Carolina lab in accordance with ASTM C1746/C1746M-12. Testing was done at flow rates representing the full range of design flows. The testing used commonly manufactured components, manufacturer's published installation details, and actual in-service flow conditions. Hydraulic performance was based on flow rate monitoring and water depth measurements within the test chamber. Sediment removal efficiency was based on both direct measurements (collecting, drying, and weighing input, captured, and passing sediments) and indirect measurements (suspended sediment concentration determination of influent and effluent bottle samples).

Both direct and indirect measurements found very high sediment removal efficiencies over the range of design flow rates. At all flow rates, using both direct and indirect measurements, the sediment removal efficiency exceeded 94%.

The highest removal rates were at the lowest flow rates but were only slightly reduced as the flow rates increased. The direct measures showed the highest removal efficiencies. These direct measurements used the known weight of sediment introduced into the system influent during the testing and the accurate measurement of all sediments collected in the sump, dried, and weighed. Simply put, sediment in minus sediment out equals the sediment trapped/removed by the system.

Hydraulic performance in terms of the relationships between hydraulic loading rate versus detention time and hydraulic loading rate versus water depth in the test basin was also measured. The detention time is the flow rate divided by the volume of the test basin at the water depth measured in the basin. As the flow rate increased the detention time decreased and the water volume (depth within the basin and depth within modules) increased.

Both the hydraulic loading rate vs. detention time and the hydraulic loading rate vs. stage depth graphs suggests that the perforated system discharge (effluent) pipe begins to slightly limit system discharge as the flow rate into the system increases.

R-Tank System, Maintenance Row Performance Testing
Hydraulic Performance and Sediment Removal Efficiency via ASTM C1746

Overview

This report presents the results of hydraulic performance and sediment removal efficiency testing performed on the Maintenance Row components of ACF Environmental's R-Tank System. The testing was performed at TRI Environmental's TRI South Carolina lab in accordance with ASTM C1746/C1746M-12. The testing used commonly manufactured components, manufacturer's published installation details, and actual in-service flow conditions. Hydraulic performance was based on flow rate monitoring and water depth measurements within the test chamber. Sediment removal efficiency was based on both direct measurements (collecting, drying, and weighing input, captured, and passing sediments) and indirect measurements (suspended sediment concentration determination of influent and effluent bottle samples).

The R-Tank System

The R-Tank system is underground stormwater storage system comprised of interlocking plastic modules. The R-Tank System includes five different module configurations, providing system height options from 2" to over 7' tall. Maintenance Modules can be assembled into a "Maintenance Row" to trap solid pollutants where they can be easily removed. These modules are wrapped in geotextile to retain solids and are fully accessible by conventional jet-vac systems to remove captured pollutants.

Test Setup

The test setup includes a test basin and adjoining sump, a water reservoir connected to the test basin and sump by a pumping/piping system, and a sediment injection system. Figure 1a shows the test setup used in the testing reported herein. A schematic is included in Appendix A.

The test basin must be of sufficient size to accommodate a representative array of modules to be tested and to permit the test modules to be deployed according to the manufacturer's published installation guidelines. The sump must be of a sufficient size to assure that sediments contained in the effluent draining from the test basin can settle before sump waters are recirculated through a 50 µm filter sock. The test basin measured 6 ft wide x 12 ft long and the sump measured 6 ft wide x 8ft long.

The 2400 gallon potable water reservoir system was comprised of eight 300 gallon "totes" connected to the pump/pipe recirculation system through a 2 inch PVC header system. The pump/pipe recirculation system was comprised of 2 inch PVC pipe and fittings and a variable speed 3 hp pump. The recirculation system was able to maintain constant flows through the test basin and sump system at a wide range of flow rates.

The sediment injection was accomplished using vibrating screw auger system. The auger system was able to maintain a constant feed rate into the influent flows at a wide range of feed settings enabling an accurate infiltrate concentration at any given flow rate.

Figure 1a. Test Apparatus Setup

Testing Parameters

The R-Tank system is designed for inflow rates ranging from 20 to 100 gallons per minute and commonly incorporates a Maintenance Row at the initial in-flow point. The Maintenance Row is surrounded by R-Tank modules, as needed, to increase the detention volume and infiltration footprint. Testing was done at flow rates representing the full range of design flows.

Fifteen (15) modules were used in the tested array. Ten (10) R-Tank modules and five (5) Maintenance modules. All modules measured 28.15 inches long x 15.75 inches wide x 17.32 inches tall. The central (maintenance) row was underlain by two layers of woven geotextile (type S300) and covered on the top and sides by a nonwoven geotextile (8 osy). Figure 1b shows the installed modules.

Figure 1b. R-Tank System Array Being Installed

Sediments were introduced into the inflow to create an influent having a target concentration of 200 mg/L. The sediments used for this testing were manufactured silica sand (AGSCO #110). The manufacturer's information on the AGSCO #110 is included in Appendix B.

Testing Procedures

Testing was done in accordance with ASTM C1746. The pre-test, component preparation, test setup, procedural, and breakdown steps are detailed in Tables 1a, 1b, 1c, and 1d.

Table 1a. Pre-Test Determinations (example values shown)

Pre-1	Select the target influent suspended sediment concentration (SSC).	200	mg/L
Pre-2	Select the total amount of sediment to be injected into the test.	22	lbs
Pre-3	Calculate the total flow needed to achieve the targe SSC. (Pre-2/Pre-1)	13193	gal
Pre-4	Select the desired test flow rate.	120	gpm
Pre-5	Calculate the total test time. (Pre-3/Pre-4)	110	minutes
Pre-6	Calculate the required sampling interval based on 6 even intervals. (Pre-5/6)	18	minutes

Table 1b. Component Preparation Steps (example values shown)

1	Cut/Weigh woven geotextile: 2 pieces @ 31" by 12.5 ft	2.826	lbs
2	Cut/Weigh nonwoven geotextile: 1 piece @ 5.5 ft by 15 ft	4.088	lbs
3	Filter sock: Cut steel band (but leave in) & Weigh	0.330	lbs
4	Cut/Weigh wash geotextile: 1 piece approx 4 ft x 4ft (to collect spray from units)	0.444	lbs
5	Weigh out 36 lbs of test sand in clean bucket	36	lbs

Table 1c. Test Setup Steps

6	Install 2 pieces of woven geotextile (one on top of the other) along the centerline of the test basin. Be sure to secure against the upstream basin wall.
7	Install the R-Tank Maintenance Row units along the centerline of the test basin over the woven geotextiles. There should be no gaps between the units. There should be at least 6 inches of woven geotextile extending beyond the sides of the units.
8	Install the nonwoven geotextile over and down the sides of the Maintenance Row units. The nonwoven should be turned horizontal at the bottom of the units and lay on top of the woven geotextile at least 6 in.
9	Install R-Tank Standard units on either side of the Maintenance Row leaving no gaps between the units.
10	Place precast weights on top to of the R-Tank units to assure no shifting during testing.
11	Create access to sample influent by cutting and fold back approximately 12 inches of the nonwoven geotextile overlying the top of the first Maintenance Row unit. Cut and remove the portion of the top panel of the first Maintenance Row unit corresponding to the folded back geotextile.
12	Insert the perforated PVC pipe section into the filter sock and then slide the filter sock over the sump outlet assembly. Secure the filter sock to the sump wall.
13	Pour the preweighed 36 lbs of sand into the vibrating auger feeder.

Table 1d. Test Procedure and Breakdown Steps

14	Turn on the system flow meter.
15	Open the valve to the water supply to the pump while keeping the sump discharge valve closed. Also open the valve to the test basin influent pipe and close the valve to the water supply recirculation.
16	Set RPMs on the variable speed pump to the pre-calibrated speed for the desired test flow rate.
17	Turn on the pump and allow the flow to proceed into and through the test basin and collect in the sump until such time as the flow becomes uniform and the sump reaches the depth that was used to calibrate flows. Minor adjustments to the pump RPMs may be necessary to achieve the desired test flow rate.
18	Open the sump discharge valve while closing the water supply inflow valve to create a closed system for the test. This begins the "Equilibrium Phase". Record the time and water temperature in the sump.
19	Allow the Equilibrium Phase to run for 10 detention times. The detention time is the volume of the test basin holding water during the test divided by the test flow rate.
20	At the end of the Equilibrium Phase, draw a 1L bottle sample of the influent as it enters the first module. This sample will provide a typical "background" suspended sediment concentration (SSC).
21	Select the setting on the variable speed vibrating auger feeder to the pre-calibrated speed for the desired test sediment injection rate. Minor adjustments to the feeder setting may be necessary during the test to maintain the desired test injection rate.
22	After one detention time, draw a 1L bottle sample of effluent from the test basin discharge pipe.
23	As soon as the initial effluent sample is taken, record the temperature of the sump water and initiate the sediment feed from the vibrating auger feeder. This is the beginning of the test time.
24	Both system flow rate and auger feed rate are to be monitored regularly throughout the test and adjusted, as necessary, to maintain uniform conditions.
25	1L influent bottle samples shall be taken at the prescribed sampling interval throughout the test.
26	A 1 minute dry feed sample shall be taken immediately following the influent 1L bottle sampling.
27	A 1L Effluent bottle sample shall be taken 1 detention time after each Influent sample.
28	Immediately following the final effluent bottle sample, the variable speed pump and auger feeder are turned off, and the sump discharge is diverted to effluent settlement vessels until the water level reaches 4± inches. The sump water temperature is measured one final time.
29	Sediments are allowed to settle prior to syphoning of remaining clear water. (Step 32 is initiated)
30	When the water depth is too shallow to support syphoning, remaining liquids and settled solids are vacuumed and collected in buckets.
31	The filter sock is removed.
32	The R-Tank array in the test basin is carefully disassembled, including removing the geotextiles and all the sediments held.
33	R-Tank units are spray-washed, as necessary, over a "wash" geotextile to collect any sediments that are retained within the units.
34	Vacuum / Weigh sediment remaining in auger feeder.
35	Geotextiles and filter sock are spread out on plastic to dry. Bucket(s) of vacuumed water/solids are allowed to settle.
36	Weigh dry geotextiles and associated sediments and filter sock.
37	Decant clear water from above settled solids in bucket and vacuum filter/dry settled solids.

Testing Results

Hydraulic performance was based on flow rate monitoring and water depth measurements within the test chamber. Sediment removal efficiency was based on both direct measurements (collecting, drying, and weighing input, captured, and passing sediments) and indirect measurements (suspended sediment concentration determination of influent and effluent bottle samples). The data sheets for each test (i.e. flow level) are included in Appendix C. Primary test parameters are summarized in Table 2. Sediment removal efficiencies and hydraulic performance are summarized in Table 3 and Figures 2 and 3.

Table 2. Test Parameters

Total Influent (gal)	Flow (gpm)	Hydraulic Loading Rate* (gpm/ft^2)	Flow (cfs)	Maximum Stage (in)	Total Volume (gal)	Detention Time (min)	Test Length (min)	Sampling Interval (min)	Sediment Delivery (lb/min)	Influent Conc. (mg/L)
2200	20.1	1.30	0.04	4.25	191	9.50	657	110	0.036	217
2200	39.9	2.59	0.09	6.0	269	6.75	331	55	0.067	202
2200	58.9	3.83	0.13	7.0	314	5.33	224	37	0.107	217
2200	80.8	5.25	0.18	8.0	359	4.44	163	27	0.140	208
2200	101.2	6.57	0.23	9.0	404	3.99	130	22	0.171	203
2200	119.9	7.79	0.27	10.0	449	3.74	110	18	0.197	197

*Flow per Area of Maintenance Row Footprint Area - 5 chambers (ft^2): 15.4

Table 3. Hydraulic Performance And Sediment Removal Efficiency

Test Date:	9/19/18	9/18/18	9/17/18	9/20/18	9/20/18	9/25/18
Flow Rate (gpm):	20.1	39.9	58.9	80.8	101.2	119.9
Hydraulic Loading Rate (gpm/ft^2):	1.30	2.59	3.83	5.25	6.57	7.79
Maximum Stage (in):	4.25	6.00	7.00	8.00	9.00	10.00
Depth in Chamber (in):	1.75	2.00	2.25	2.50	2.75	3.00
SOLIDS MASS BALANCE:						
Retained Solids - Within Units (lbs):	16.68	14.81	13.43	12.09	11.99	11.71
Passed Solids (lbs):	0.12	0.19	0.22	0.28	0.36	0.50
Actual Solids Injected (lbs):	23.12	22.59	23.58	22.73	23.00	22.92
Unaccounted Solids - Within Basin (lbs):	6.32	7.59	9.93	10.35	10.66	10.71
DIRECT - USING SEDIMENT WEIGHTS:						
Solids in Influent (lbs):	23.12	22.59	23.58	22.73	23.00	22.92
Passed Solids (lbs):	0.12	0.19	0.22	0.28	0.36	0.50
Direct Removal Efficiency (%):	99.48%	99.16%	99.06%	98.75%	98.46%	97.81%
INDIRECT - USING CONCENTRATIONS:						
Average Concentration in Influent (mg/L):	217.17	201.71	217.32	208.15	202.77	197.25
Average Concentration in Effluent (mg/L):	1.95	3.42	5.97	7.39	8.86	11.16
Indirect Removal Efficiency (%):	99.10%	98.30%	97.25%	96.45%	95.63%	94.34%

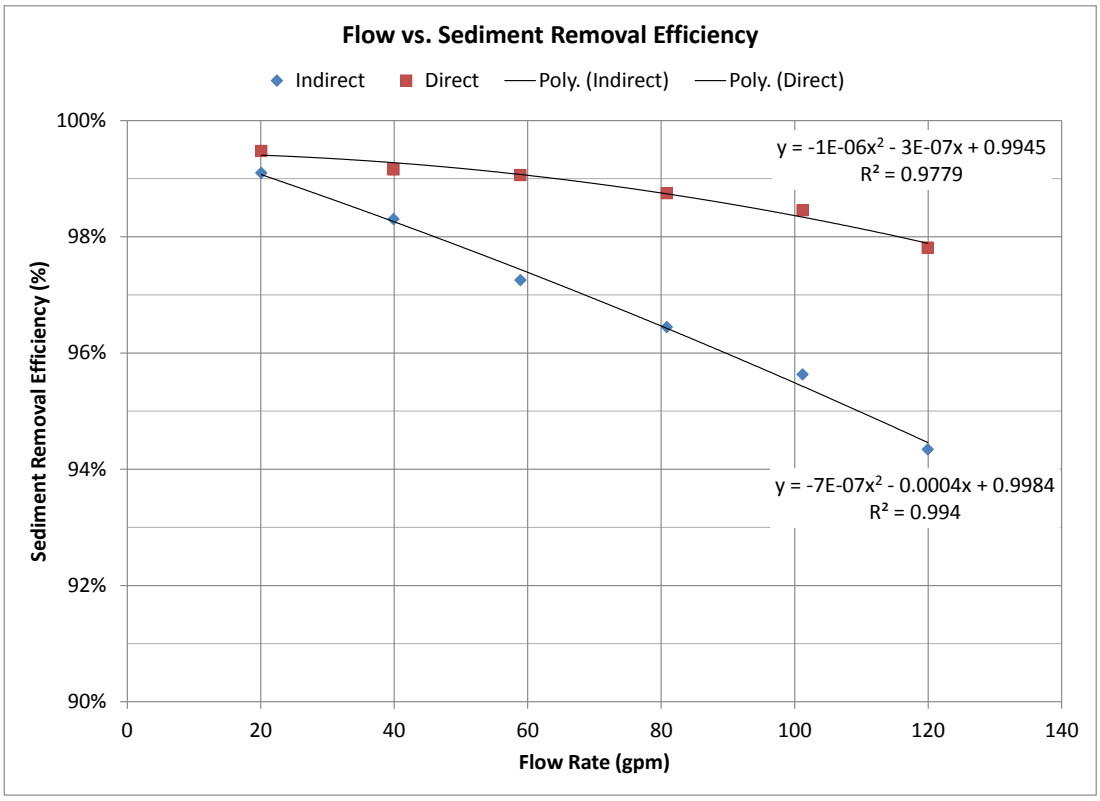


Figure 2. Flow Rate vs. Sediment Removal Efficiency

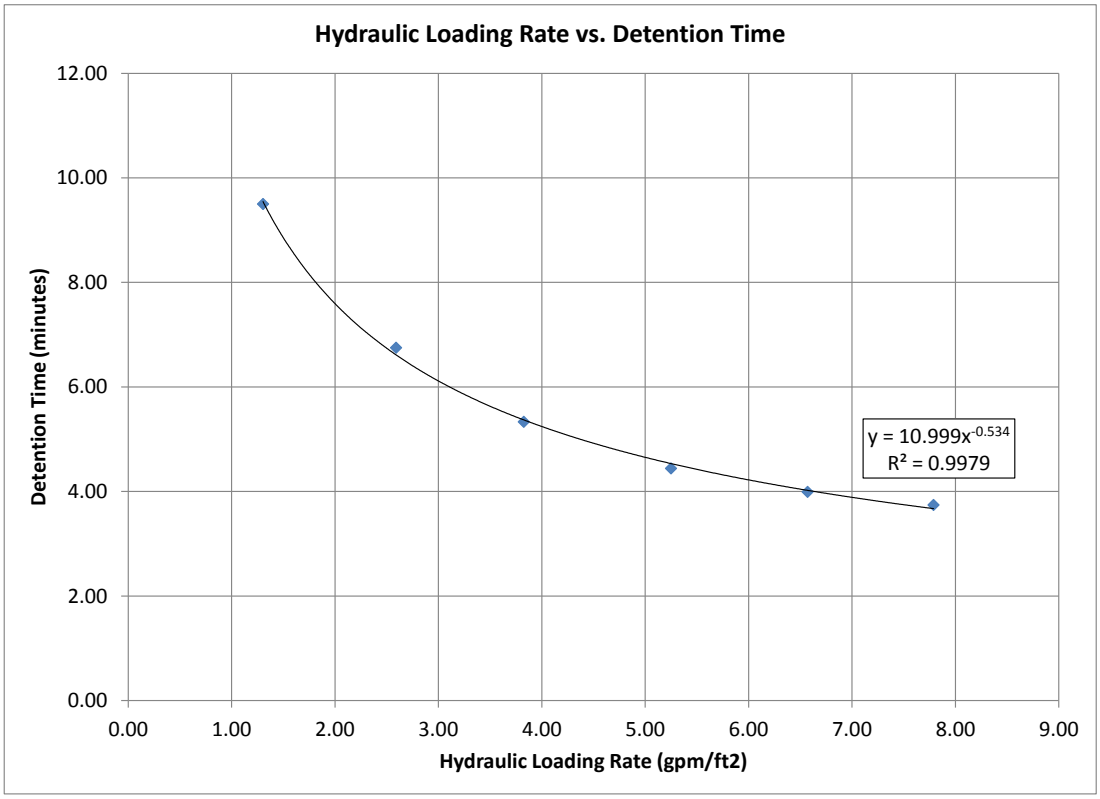


Figure 3. Hydraulic Loading Rate vs. Detention Time

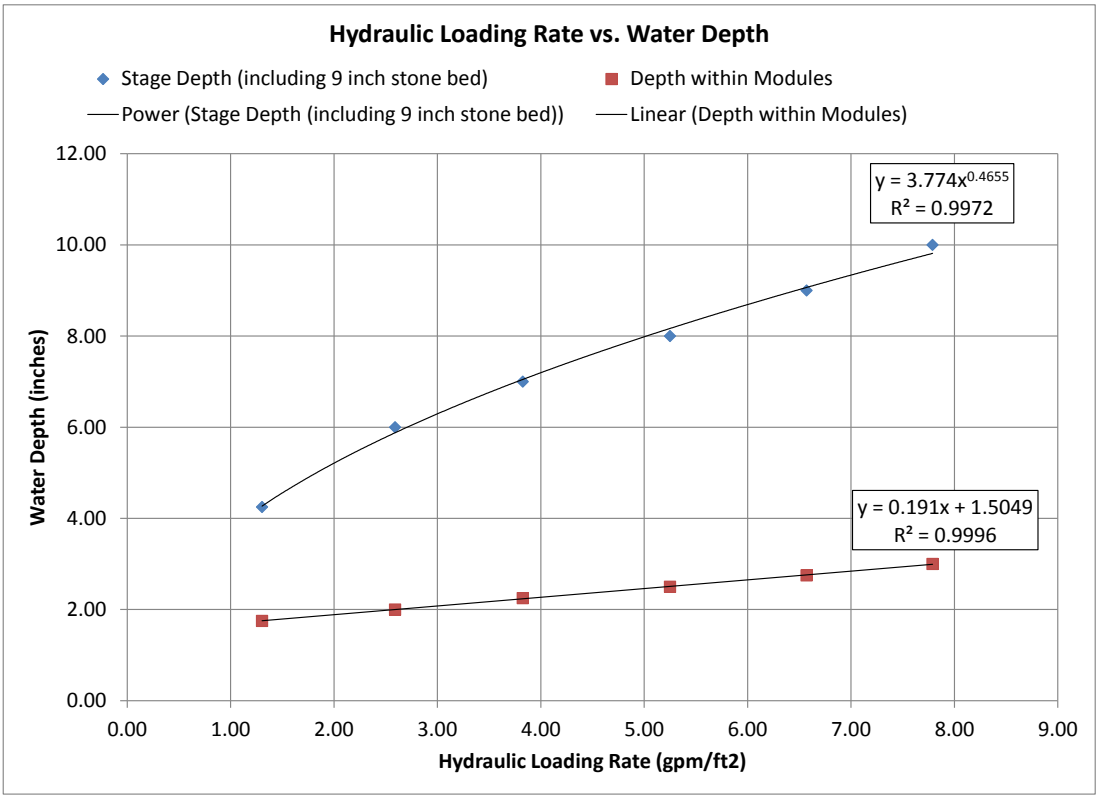


Figure 4. Hydraulic Loading Rate vs. Water Depth

Discussion

Sediment Removal Efficiency: As shown in Figure 2, by both direct and indirect measures the testing demonstrated very high sediment removal efficiencies over the range of design flow rates. At all flow rates, using both direct and indirect measurements, the sediment removal efficiency exceeded 94%.

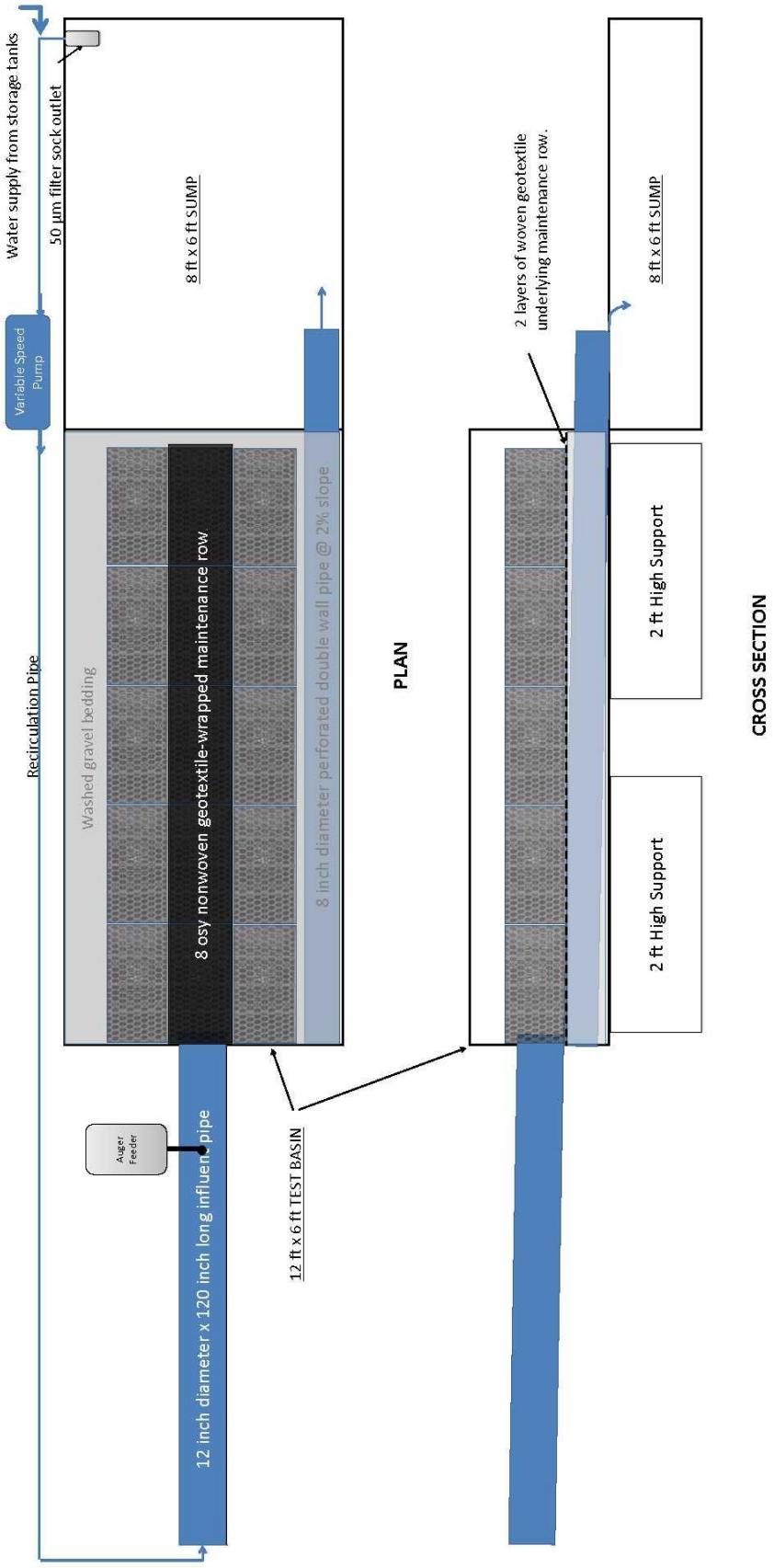
The highest removal rates were at the lowest flow rates but were only slightly reduced as the flow rates increased. The direct measures showed the highest removal efficiencies. These direct measurements used the known weight of sediment introduced into the system influent during the testing and the accurate measurement of all sediments collected in the sump, dried, and weighed. Simply put, sediment in minus sediment out equals sediment trapped/removed by the system.

The indirect measure was based on bottle samples taken to determine suspended sediment concentrations (SSC) in accordance with ASTM D3977. It is believed that the bottle sampling technique is somewhat less accurate as it can be difficult to take a truly representative sample of influent and effluent, especially as the flow rate increases and the sample bottle fills in a fraction of a second. Still the indirect samples results were within a few percentage of the direct measures and generally demonstrated a similar trend associated with decreasing efficiency with increasing flow.

Hydraulic Performance: Figures 3 and 4 show the relationships between hydraulic loading rate versus detention time and hydraulic loading rate versus water depth in the test basin, respectively. The detention time is the flow rate divided by the volume of the test basin at the water depth measured in the basin. As the flow rate increased the detention time decreased and the water volume (stage depth – depth within the basin - and depth within modules) increased.

The parabolic shape of both the hydraulic loading rate vs. detention time and the hydraulic loading rate vs. stage depth graphs suggests that the perforated system discharge (effluent) pipe begins to slightly limit system discharge as the flow rate into the system increases. Still, the hydraulic relationships defined during testing have very significant correlations (high R^2 values).

Appendix A: Test Setup Schematic


Water supply from storage tanks
50 µm filter sock outlet
8 ft x 6 ft SUMP
Variable Speed Pump
Recirculation Pipe
Washed gravel bedding
8 osy nonwoven geotextile-wrapped maintenance row
8 inch diameter perforated double wall pipe @ 2% slope
PLAN
Auger Feeder
12 inch diameter x 120 inch long influent pipe
12 ft x 6 ft TEST BASIN
2 layers of woven geotextile underlying maintenance row.
8 ft x 6 ft SUMP
2 ft High Support
2 ft High Support
CROSS SECTION

Appendix B: Silica Sand (AGSCO #110)

AGSCO CORPORATION

TECHNICAL DATA

AGSCO SILICA SAND

TYPICAL PHYSICAL PROPERTIES

FUSION POINT	3135 ^{O}F
HARDNESS	Knoop - 820; Mohs - 7
GRAIN SHAPE	Spherical
SPECIFIC GRAVITY	2.65 g/cm^3
LOOSE PACK BULK DENSITY	1.60 g/cm^3 (100 lbs/ft^3)
pH	6.8 to 7.2

TYPICAL CHEMICAL PROPERTIES

#10-20 and Coarser Sizes		#12-20 and Finer Sizes	
SiO_2	98.2 %	SiO_2	99.8 %
Fe_2O_3	0.14	Fe_2O_3	0.016
Al_2O_3	0.49	Al_2O_3	0.034
TiO_2	0.02	TiO_2	0.007
CaO	0.02	CaO	0.011
MgO	0.01	MgO	0.007
K_2O	0.21	Loss on Ignition	0.094
Na_2O	0.06		
Loss on Ignition	0.40		

TYPICAL SCREEN ANALYSIS

(Percent Retained)

US SIEVE	#4-8	#8-12	#10-16	#10-20
6	3.4			
7	21.7			
8		6.0	2.8	
10	74.4	54.0	16.6	
12	0.5	35.3	30.7	1.6
14		4.7	32.7	35.3
16		T	13.7	40.4
18			2.4	17.7
20			1.1	4.0
25				0.9
40				
Pan				0.1
	100.0	100.0	100.0	100.0
Effective Size (mm)	2.00	1.70	1.20	1.00

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AGSCO CORPORATION

TECHNICAL DATA

TYPICAL SCREEN ANALYSIS

(Percent Retained)

US SIEVE	12-20	16-30	20-40	(#1) 35-50	(#2) 40-70	50-80	(#7) 70-100	(#10) 100-140	(#110) 140-200	(#16) 140-270
12										
14										
16	70.5									
18	26.0	1.3								
20	1.8	48.2	0.2							
25	0.5	45.4	7.0	0.3						
30	0.3	3.8	20.6	2.0	0.3					
35	0.5	0.9	42.8	20.5	5.2					
40	0.3	0.4	23.3	35.3	16.5	2.7	2.9	1.2	0.3	
50			6.0	32.7	37.0	39.3	17.4	2.9	1.5	
60				4.7	14.2	23.8	---	---	---	
70				2.2	9.3	16.2	39.9	13.2	4.4	
80				2.3	5.5	9.1	---	---	---	
100					4.8	5.4	27.7	41.4	19.8	
120					7.2	3.5	---	---	---	---
140							11.2	36.3	42.8	27.8
170							---	---	---	---
200							0.9	4.8	20.5	50.9
230								---	---	---
270								0.1	8.3	19.3
325/PAN	0.1								2.3	2.0
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

AFS Grain Number	11	15	25	35	47	50	59.6	80.3	111.8	144
Effective Size (mm).	1.0	0.71	0.43	0.30	.15	.15	.11			

SILICA FLOUR

(Typical Percent Retained/Passing)

U.S. Sieve	#70 / 250u	#140 / 106u	#200 / 90u	#230/63u	#270/53u	#325 / 45u
70	3					
100	11	T				
140	8	1	T			
200	14	6	3	1	T	
270	9	10	7	4	3	T
325	5	8	7	5	4	2
Passing 325	50	75	83	90	93	98
Totals	100	100	100	100	100	100

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Revised: 2/10/2015

Appendix C: Test Data Sheets

Test Summary

Test Date:	9/25/2018			
Test ID:	R-Tank_120			
Influent Volume per Sample:	2200	gallons		
Sample Interval:	18	minutes		
Sample Interval:	0:18	hours:minutes		(convert decimal to minutes:seconds)
Approx. Test Length:	110	minutes		
Detention Time:	3.74	minutes		
Detention Time:	03:45.0	minutes:seconds		(convert decimal to minutes:seconds)
Target Influent Concentration:	200	mg/L		
Target Sediment Injected:	22	lbs		
Target Sediment Injection Rate:	0.200	lb/min	90.75 g/min	(40 setting on auger)
Target Flow Rate:	120	gpm	454 lpm	

Test Data Collection

DIRECT - USING SEDIMENT MEASUREMENTS:

(4.088 NW + 1.428 W + 1.398 W + 0.444 Wash)	Dry Geotextile Weight - Initial:	7.358	lbs	
	Dry Geotextile Weight - Final:	19.068	lbs	
(0.330 + 0)	Dry Filter Sock & Vacuum Filter Weights - Initial:	0.330	lbs	
(0.440 + 0.391)	Dry Filter Sock & Vacuum Filter Weights - Final:	0.831	lbs	
	Dry Weight in Feeder - Initial:	36.000	lbs	
	Dry Weight in Feeder - Final:	13.082	lbs	

SOLIDS MASS BALANCE

Retained Solids - Within Units (lbs):	11.71
Passed Solids (lbs):	0.501
Actual Solids Injected (lbs):	22.9
Unaccounted Solids - Within Basin (lbs):	10.7

Solids in Influent (lbs): 22.9 Solids Retained (lbs): 22.4 **Direct Removal Efficiency (%): 97.8%**

INDIRECT - USING CONCENTRATION MEASUREMENTS:

Flow Rate:	454	lpm	(2900 rpm on pump)
Flow Rate:	120	gpm	0.267 cfs
R-Tank Footprint Area:	15.4	ft^2	(15.75" W x 28.15" L x 17.34" H) x 5
Hydraulic Loading Rate (flow per area):	7.79	gpm/ft^2	

(Fill system from reservoirs at target flow rate until sump reaches the desired fill line. Close/open valves to create closed loop.)

Stage Relative to Outlet (in)	10	inches	(Measure in well near start of test.)
Total Volume:	60	ft^3	448.80 gallons
Equilibrium Start Time:	8:40:00	min.:sec.	(Begin recirc for 10 detention times;Take sump temp.)
Equilibrium End Time:	9:17:30	min.:sec.	(Take first influent/effluent samples, then start feeder.)
Sump Water Temp / Time:	25.7	°C	/ 8:40:00
Initial Sample Time:	9:17:30	hours:minutes:sec	
Initial Sample - Sump Water Temp / Time:	25.7	°C	/ 9:26:00
Final Sample - Sump Water Temp / Time:	26.0	°C	/ 11:12:00
Depth in Chamber:	3	inches	(Measure near end of test.)

Sample Data Collection (ASTM D3977)

Sample Time hrs:min:sec	1 min. dry feed (g)	Sample	Time to Fill 1L, sec	Bottle Tare (g)	Bottle Gross (g)	Bottle Net (g)	Water (mL)	Filtrate Tare (g)	Filtrate Dry (g)	Solids (mg)	Concentration (mg/L) Dry Feed Calc.	Concentration (mg/L) Bottle Sample Calc
9:17:30		Influent 0	< 1 sec	50.45	1075.64	1025.19	1025.19	104.6663	104.6724	6.1	0.0	6.0
9:39:15	87.40	Influent 1	< 1 sec	49.49	1075.40	1025.91	1025.91	103.6036	103.8019	198.3	192.5	193.3
9:57:15	87.90	Influent 2	< 1 sec	50.48	1079.70	1029.22	1029.22	105.3073	105.5147	207.4	193.6	201.5
10:15:15	89.32	Influent 3	< 1 sec	50.50	1077.44	1026.94	1026.94	104.2367	104.4389	202.2	196.7	196.9
10:33:15	89.24	Influent 4	< 1 sec	49.70	1081.15	1031.45	1031.45	104.4590	104.6615	202.5	196.6	196.3
10:51:15	89.80	Influent 5	< 1 sec	50.36	1079.14	1028.78	1028.78	104.1951	104.4068	211.7	197.8	205.8
11:09:15	93.65	Influent 6	< 1 sec	49.41	1078.68	1029.27	1029.27	104.5469	104.7504	203.5	206.3	197.7
(Take initial sump temp.)									Average Concentration:		**197.3**	**198.6**
9:21:15		Effluent 0	< 1 sec	49.43	1058.09	1008.66	1008.66	103.6772	103.6785	1.3	1.3	1.3
9:43:00		Effluent 1	< 1 sec	49.60	1074.14	1024.54	1024.54	103.1229	103.1362	13.3	13.0	13.0
10:01:00		Effluent 2	< 1 sec	50.58	1072.53	1021.95	1021.95	104.2605	104.2728	12.3	12.0	12.0
10:19:00		Effluent 3	< 1 sec	49.77	1065.49	1015.72	1015.72	104.9544	104.9673	12.9	12.7	12.7
10:37:00		Effluent 4	< 1 sec	49.42	1055.55	1006.13	1006.13	104.4083	104.4183	10.0	9.9	9.9
10:55:00		Effluent 5	< 1 sec	49.55	1055.14	1005.59	1005.59	103.8415	103.8521	10.6	10.5	10.5
11:13:00		Effluent 6	< 1 sec	50.52	1067.08	1016.56	1016.56	103.5248	103.5337	8.9	8.8	8.8
(Take final sump temp.)									Average Concentration:		**11.2**	**11.2**

Influent Dry Feed Samples	Average Concentration in Influent (mg/L):	197.3	Average Concentration in Effluent (mg/L):	11.2	**Indirect Removal Efficiency (%)** **94.3%**
Influent Bottle Samples	Average Concentration in Influent (mg/L):	198.6	Average Concentration in Effluent (mg/L):	11.2	**Indirect Removal Efficiency (%)** **94.4%**

Test Summary

Test Date:	9/20/2018			
Test ID:	R-Tank_100			
Influent Volume per Sample:	2200	gallons		
Sample Interval:	22	minutes		
Sample Interval:	0:22	hours:minutes		(convert decimal to minutes:seconds)
Approx. Test Length:	130	minutes		
Detention Time:	3.99	minutes		
Detention Time:	04:00.0	minutes:seconds		(convert decimal to minutes:seconds)
Target Influent Concentration:	200	mg/L		
Target Sediment Injected:	22	lbs		
Target Sediment Injection Rate:	0.169	lb/min	76.56 g/min	(35 setting on auger)
Target Flow Rate:	100	gpm	379 lpm	

Test Data Collection

DIRECT - USING SEDIMENT MEASUREMENTS:

(4.222 NW + 1.402 W + 1.376 W + 0.558 Wash)	Dry Geotextile Weight - Initial:	7.558	lbs	
	Dry Geotextile Weight - Final:	19.544	lbs	
(0.350 + 0)	Dry Filter Sock & Vacuum Filter Weights - Initial:	0.350	lbs	
(0.382 + 0.323)	Dry Filter Sock & Vacuum Filter Weights - Final:	0.705	lbs	
	Dry Weight in Feeder - Initial:	36.000	lbs	
	Dry Weight in Feeder - Final:	12.996	lbs	

SOLIDS MASS BALANCE

Retained Solids - Within Units (lbs):	11.986
Passed Solids (lbs):	0.355
Actual Solids Injected (lbs):	23.0
Unaccounted Solids - Within Basin (lbs):	10.7

Solids in Influent (lbs): 23.0 Solids Retained (lbs): 22.6 **Direct Removal Efficiency (%): 98.5%**

INDIRECT - USING CONCENTRATION MEASUREMENTS:

Flow Rate:	383	lpm	(2450 rpm on pump)
Flow Rate:	101	gpm	0.225 cfs
R-Tank Footprint Area:	15.4	ft^2	(15.75" W x 28.15" L x 17.34" H) x 5
Hydraulic Loading Rate (flow per area):	6.57	gpm/ft^2	

(Fill system from reservoirs at target flow rate until sump reaches the desired fill line. Close/open valves to create closed loop.)

Stage Relative to Outlet (in)	9	inches	(Measure in well near start of test.)
Total Volume:	54	ft^3	403.92 gallons
Equilibrium Start Time:	14:00:00	min.:sec.	(Begin recirc for 10 detention times;Take sump temp.)
Equilibrium End Time:	14:40:00	min.:sec.	(Take first influent/effluent samples, then start feeder.)
Sump Water Temp / Time:	26.1	°C	/ 14:00:00
Initial Sample Time:	14:40:00	hours:minutes:sec	
Initial Sample - Sump Water Temp / Time:	27.4	°C	/ 14:45:00
Final Sample - Sump Water Temp / Time:	28.0	°C	/ 17:01:00
Depth in Chamber:	2.75	inches	(Measure near end of test.)

Sample Data Collection (ASTM D3977)

Sample Time hrs:min:sec	1 min. dry feed (g)	Sample	Time to Fill 1L, sec	Bottle Tare (g)	Bottle Gross (g)	Bottle Net (g)	Water (mL)	Filtrate Tare (g)	Filtrate Dry (g)	Solids (mg)	Concentration (mg/L) Dry Feed Calc.	Concentration (mg/L) Bottle Sample Calc
14:40:00		Influent 0	< 1 sec	50.45	1075.88	1025.43	1025.43	103.8294	103.8347	5.3	0.0	5.2
15:06:00	78.09	Influent 1	< 1 sec	49.48	1082.10	1032.62	1032.62	104.6705	104.8885	218.0	203.9	211.1
15:28:00	76.90	Influent 2	< 1 sec	50.50	1079.80	1029.30	1029.30	104.5519	104.7633	211.4	200.8	205.4
15:50:00	76.19	Influent 3	< 1 sec	50.42	1080.83	1030.41	1030.41	104.2045	104.4099	205.4	198.9	199.3
16:12:00	77.46	Influent 4	< 1 sec	49.71	1081.71	1032.00	1032.00	105.3107	105.5190	208.3	202.2	201.8
16:34:00	77.66	Influent 5	< 1 sec	50.36	1080.51	1030.15	1030.15	103.5315	103.7412	209.7	202.8	203.6
16:56:00	79.66	Influent 6	< 1 sec	49.38	1078.59	1029.21	1029.21	104.9598	105.1775	217.7	208.0	211.5
(Take initial sump temp.)									Average Concentration:		**202.8**	**205.5**
14:44:00		Effluent 0	< 1 sec	49.41	1051.33	1001.92	1001.92	104.2693	104.2729	3.6	3.6	3.6
15:10:00		Effluent 1	< 1 sec	49.60	1057.56	1007.96	1007.96	104.4253	104.4355	10.2	10.1	10.1
15:32:00		Effluent 2	< 1 sec	50.58	1053.06	1002.48	1002.48	104.2396	104.2501	10.5	10.5	10.5
15:54:00		Effluent 3	< 1 sec	49.77	1072.63	1022.86	1022.86	103.5944	103.6045	10.1	9.9	9.9
16:16:00		Effluent 4	< 1 sec	49.42	1054.78	1005.36	1005.36	104.4420	104.4518	9.8	9.7	9.7
16:38:00		Effluent 5	< 1 sec	49.55	1068.11	1018.56	1018.56	103.1266	103.1357	9.1	8.9	8.9
17:00:00		Effluent 6	< 1 sec	50.54	1053.12	1002.58	1002.58	103.6741	103.6781	4.0	4.0	4.0
(Take final sump temp.)									Average Concentration:		**8.9**	**8.9**

Influent Dry Feed Samples	Average Concentration in Influent (mg/L):	202.8	Average Concentration in Effluent (mg/L):	8.9	**Indirect Removal Efficiency (%)**	**95.6%**
Influent Bottle Samples	Average Concentration in Influent (mg/L):	205.5	Average Concentration in Effluent (mg/L):	8.9	**Indirect Removal Efficiency (%)**	**95.7%**

Test Summary

Test Date:	9/20/2018			
Test ID:	R-Tank_80			
Influent Volume per Sample:	2200	gallons		
Sample Interval:	27	minutes		
Sample Interval:	0:27	hours:minutes		(convert decimal to minutes:seconds)
Approx. Test Length:	163	minutes		
Detention Time:	4.44	minutes		
Detention Time:	04:43.0	minutes:seconds		(convert decimal to minutes:seconds)
Target Influent Concentration:	200	mg/L		
Target Sediment Injected:	22	lbs		
Target Sediment Injection Rate:	0.135	lb/min	61.17 g/min	(30 setting on auger)
Target Flow Rate:	80	gpm	303 lpm	

Test Data Collection

DIRECT - USING SEDIMENT MEASUREMENTS:

(4.222 NW + 1.402 W + 1.252 W + 0.776 Wash)	Dry Geotextile Weight - Initial:	7.652	lbs	SOLIDS MASS BALANCE
	Dry Geotextile Weight - Final:	19.746	lbs	Retained Solids - Within Units (lbs): 12.094
(0.334 + 0)	Dry Filter Sock & Vacuum Filter Weights - Initial:	0.334	lbs	Passed Solids (lbs): 0.284
(0.360 + 0.258)	Dry Filter Sock & Vacuum Filter Weights - Final:	0.618	lbs	
	Dry Weight in Feeder - Initial:	36.000	lbs	Actual Solids Injected (lbs): 22.7
	Dry Weight in Feeder - Final:	13.268	lbs	
				Unaccounted Solids - Within Basin (lbs): 10.4

Solids in Influent (lbs): 22.7 Solids Retained (lbs): 22.4 **Direct Removal Efficiency (%): 98.8%**

INDIRECT - USING CONCENTRATION MEASUREMENTS:

Flow Rate:	306	lpm	(2000 rpm on pump)
Flow Rate:	81	gpm	0.180 cfs
R-Tank Footprint Area:	15.4	ft^2	(15.75" W x 28.15" L x 17.34" H) x 5
Hydraulic Loading Rate (flow per area):	5.25	gpm/ft^2	

(Fill system from reservoirs at target flow rate until sump reaches the desired fill line. Close/open valves to create closed loop.)

Stage Relative to Outlet (in)	8	inches	(Measure in well near start of test.)
Total Volume:	48	ft^3	359.04 gallons
Equilibrium Start Time:	8:35:00	min.:sec.	(Begin recirc for 10 detention times;Take sump temp.)
Equilibrium End Time:	9:22:10	min.:sec.	(Take first influent/effluent samples, then start feeder.)
Sump Water Temp / Time:	26.6	°C	/ 8:35:00
Initial Sample Time:	9:22:10	hours:minutes:sec	
Initial Sample - Sump Water Temp / Time:	26.7	°C	/ 9:26:00
Final Sample - Sump Water Temp / Time:	26.9	°C	/ 12:14:00
Depth in Chamber:	2.5	inches	(Measure near end of test.)

Sample Data Collection (ASTM D3977)

Sample Time hrs:min:sec	1 min. dry feed (g)	Sample	Time to Fill 1L, sec	Bottle Tare (g)	Bottle Gross (g)	Bottle Net (g)	Water (mL)	Filtrate Tare (g)	Filtrate Dry (g)	Solids (mg)	Concentration (mg/L) Dry Feed Calc.	Concentration (mg/L) Bottle Sample Calc
9:22:10		Influent 0	< 1 sec	50.00	1074.13	1024.13	1024.13	102.9639	102.9679	4.0	0.0	3.9
9:53:53	65.49	Influent 1	< 1 sec	50.61	1078.20	1027.59	1027.59	101.6652	101.8798	214.6	214.0	208.8
10:20:53	64.36	Influent 2	< 1 sec	50.47	1079.90	1029.43	1029.43	101.3517	101.5736	221.9	210.3	215.6
10:47:53	65.96	Influent 3	< 1 sec	49.07	1078.16	1029.09	1029.09	100.7423	100.9571	214.8	215.6	208.7
11:14:53	63.13	Influent 4	< 1 sec	49.66	1079.68	1030.02	1030.02	102.0552	102.2759	220.7	206.3	214.3
11:41:53	62.30	Influent 5	< 1 sec	50.42	1080.18	1029.76	1029.76	100.9438	101.1638	220.0	203.6	213.6
12:08:53	60.93	Influent 6	< 1 sec	49.25	1080.30	1031.05	1031.05	101.0648	101.2844	219.6	199.1	213.0
(Take initial sump temp.)									Average Concentration:		**208.2**	**212.3**
9:26:53		Effluent 0	< 1 sec	49.57	1056.71	1007.14	1007.14	100.9458	100.9502	4.4	4.4	4.4
9:58:36		Effluent 1	< 1 sec	49.63	1061.59	1011.96	1011.96	101.6796	101.6889	9.3	9.2	9.2
10:25:36		Effluent 2	< 1 sec	49.73	1061.36	1011.63	1011.63	102.8029	102.8117	8.8	8.7	8.7
10:52:36		Effluent 3	< 1 sec	50.47	1075.67	1025.20	1025.20	100.7668	100.7742	7.4	7.2	7.2
11:19:36		Effluent 4	< 1 sec	50.40	1055.74	1005.34	1005.34	102.8149	102.8218	6.9	6.9	6.9
11:46:36		Effluent 5	< 1 sec	50.37	1055.63	1005.26	1005.26	101.4183	101.4256	7.3	7.3	7.3
12:13:36		Effluent 6	< 1 sec	50.42	1062.78	1012.36	1012.36	102.5306	102.5358	5.2	5.1	5.1
(Take final sump temp.)									Average Concentration:		**7.4**	**7.4**

Influent Dry Feed Samples	Average Concentration in Influent (mg/L):	208.2	Average Concentration in Effluent (mg/L):	7.4	**Indirect Removal Efficiency (%)**	**96.4%**
Influent Bottle Samples	Average Concentration in Influent (mg/L):	212.3	Average Concentration in Effluent (mg/L):	7.4	**Indirect Removal Efficiency (%)**	**96.5%**

Test Summary

Test Date:	9/17/2018			
Test ID:	R-Tank_60			
Influent Volume per Sample:	2200	gallons		
Sample Interval:	37	minutes		
Sample Interval:	0:37	hours:minutes		(convert decimal to minutes:seconds)
Approx. Test Length:	224	minutes		
Detention Time:	5.33	minutes		
Detention Time:	05:20.0	minutes:seconds		(convert decimal to minutes:seconds)
Target Influent Concentration:	200	mg/L		
Target Sediment Injected:	22	lbs		
Target Sediment Injection Rate:	0.098	lb/min	44.58 g/min	(20 setting on auger)
Target Flow Rate:	60	gpm	227 lpm	

Test Data Collection

DIRECT - USING SEDIMENT MEASUREMENTS:

(3.898 NW + 1.234 W + 1.252 W + 1.012 Wash)	Dry Geotextile Weight - Initial:	7.396	lbs	
	Dry Geotextile Weight - Final:	20.826	lbs	
(0.280 + 0)	Dry Filter Sock & Vacuum Filter Weights - Initial:	0.280	lbs	
(0.292 + 0.209)	Dry Filter Sock & Vacuum Filter Weights - Final:	0.501	lbs	
	Dry Weight in Feeder - Initial:	36.000	lbs	
	Dry Weight in Feeder - Final:	12.422	lbs	

SOLIDS MASS BALANCE

Retained Solids - Within Units (lbs):	13.43
Passed Solids (lbs):	0.221
Actual Solids Injected (lbs):	23.6
Unaccounted Solids - Within Basin (lbs):	9.9

Solids in Influent (lbs): 23.6 Solids Retained (lbs): 23.4 **Direct Removal Efficiency (%): 99.1%**

INDIRECT - USING CONCENTRATION MEASUREMENTS:

Flow Rate:	223	lpm	(1500 rpm on pump)
Flow Rate:	59	gpm	0.131 cfs
R-Tank Footprint Area:	15.4	ft^2	(15.75" W x 28.15" L x 17.34" H) x 5
Hydraulic Loading Rate (flow per area):	3.83	gpm/ft^2	

(Fill system from reservoirs at target flow rate until sump reaches the desired fill line. Close/open valves to create closed loop.)

Stage Relative to Outlet (in)	7	inches	(Measure in well near start of test.)
Total Volume:	42	ft^3	314.16 gallons
Equilibrium Start Time:	12:47:00	min.:sec.	(Begin recirc for 10 detention times;Take sump temp.)
Equilibrium End Time:	13:40:20	min.:sec.	(Take first influent/effluent samples, then start feeder.)
Sump Water Temp / Time:	26.0	°C	/ 12:47:00
Initial Sample Time:	13:40:20	hours:minutes:sec	
Initial Sample - Sump Water Temp / Time:	26.1	°C	/ 13:46:00
Final Sample - Sump Water Temp / Time:	26.5	°C	/ 17:34:00
Depth in Chamber:	2.25	inches	(Measure near end of test.)

Sample Data Collection (ASTM D3977)

Sample Time hrs:min:sec	1 min. dry feed (g)	Sample	Time to Fill 1L, sec	Bottle Tare (g)	Bottle Gross (g)	Bottle Net (g)	Water (mL)	Filtrate Tare (g)	Filtrate Dry (g)	Solids (mg)	Concentration (mg/L) Dry Feed Calc.	Concentration (mg/L) Bottle Sample Calc
13:40:20		Influent 0	< 1 sec	50.27	1075.71	1025.44	1025.44	0.5582	0.5696	11.4	0.0	11.1
14:22:40	45.86	Influent 1	< 1 sec	51.15	1053.23	1002.08	1002.08	0.5567	0.7566	199.9	205.7	199.5
14:59:40	49.95	Influent 2	< 1 sec	51.05	1074.36	1023.31	1023.31	0.5609	0.7768	215.9	224.0	211.0
15:36:40	47.21	Influent 3	< 1 sec	49.66	1080.67	1031.01	1031.01	0.5598	0.7496	189.8	211.7	184.1
16:13:40	48.73	Influent 4	< 1 sec	50.20	1078.57	1028.37	1028.37	0.5560	0.7646	208.6	218.5	202.8
16:50:40	53.34	Influent 5	< 1 sec	50.85	1081.24	1030.39	1030.39	0.5620	0.7738	211.8	239.2	205.6
17:27:40	45.68	Influent 6	< 1 sec	51.00	1079.53	1028.53	1028.53	0.5555	0.7599	204.4	204.8	198.7
(Take initial sump temp.)									Average Concentration:		**217.3**	**200.3**
13:45:40		Effluent 0	< 1 sec	50.01	1048.47	998.46	998.46	0.5616	0.5668	5.2	5.2	5.2
14:28:00		Effluent 1	< 1 sec	50.17	1050.52	1000.35	1000.35	0.5585	0.5655	7.0	7.0	7.0
15:05:00		Effluent 2	< 1 sec	50.17	1043.42	993.25	993.25	0.5644	0.5705	6.1	6.1	6.1
15:42:00		Effluent 3	< 1 sec	50.89	1047.75	996.86	996.86	1.1218	1.1284	6.6	6.6	6.6
16:19:00		Effluent 4	< 1 sec	50.90	1054.76	1003.86	1003.86	0.5613	0.5675	6.2	6.2	6.2
16:56:00		Effluent 5	< 1 sec	50.90	1054.83	1003.93	1003.93	0.5550	0.5611	6.1	6.1	6.1
17:33:00		Effluent 6	< 1 sec	50.83	1029.20	978.37	978.37	0.5535	0.5572	3.7	3.8	3.8
(Take final sump temp.)									Average Concentration:		**6.0**	**6.0**

Influent Dry Feed Samples	Average Concentration in Influent (mg/L):	217.3	Average Concentration in Effluent (mg/L):	6.0	**Indirect Removal Efficiency (%)**	**97.3%**
Influent Bottle Samples	Average Concentration in Influent (mg/L):	200.3	Average Concentration in Effluent (mg/L):	6.0	**Indirect Removal Efficiency (%)**	**97.0%**

Test Summary

Test Date:	9/18/2018			
Test ID:	R-Tank_40			
Influent Volume per Sample:	2200	gallons		
Sample Interval:	55	minutes		
Sample Interval:	0:55	hours:minutes		(convert decimal to minutes:seconds)
Approx. Test Length:	331	minutes		
Detention Time:	6.75	minutes		
Detention Time:	06:45.0	minutes:seconds		(convert decimal to minutes:seconds)
Target Influent Concentration:	200	mg/L		
Target Sediment Injected:	22	lbs		
Target Sediment Injection Rate:	0.066	lb/min	30.18 g/min	(15 setting on auger)
Target Flow Rate:	40	gpm	151 lpm	

Test Data Collection

DIRECT - USING SEDIMENT MEASUREMENTS:

(3.898 NW + 1.234 W + 1.252 W + 0.880 Wash)	Dry Geotextile Weight - Initial:	6.384	lbs	
	Dry Geotextile Weight - Final:	21.196	lbs	
(0.365 + 0)	Dry Filter Sock & Vacuum Filter Weights - Initial:	0.365	lbs	
(0.406 + 0.149)	Dry Filter Sock & Vacuum Filter Weights - Final:	0.555	lbs	
	Dry Weight in Feeder - Initial:	36.000	lbs	
	Dry Weight in Feeder - Final:	13.412	lbs	

SOLIDS MASS BALANCE

Retained Solids - Within Units (lbs):	14.812
Passed Solids (lbs):	0.19
Actual Solids Injected (lbs):	22.6
Unaccounted Solids - Within Basin (lbs):	7.6

Solids in Influent (lbs): 22.6 Solids Retained (lbs): 22.4 **Direct Removal Efficiency (%): 99.2%**

INDIRECT - USING CONCENTRATION MEASUREMENTS:

Flow Rate:	151	lpm	(1100 rpm on pump)
Flow Rate:	40	gpm	0.089 cfs
R-Tank Footprint Area:	15.4	ft^2	(15.75" W x 28.15" L x 17.34" H) x 5
Hydraulic Loading Rate (flow per area):	2.59	gpm/ft^2	

(Fill system from reservoirs at target flow rate until sump reaches the desired fill line. Close/open valves to create closed loop.)

Stage Relative to Outlet (in)	6	inches	(Measure in well near start of test.)
Total Volume:	36	ft^3	269.28 gallons
Equilibrium Start Time:	9:45:00	min.:sec.	(Begin recirc for 10 detention times;Take sump temp.)
Equilibrium End Time:	10:52:30	min.:sec.	(Take first influent/effluent samples, then start feeder.)
Sump Water Temp / Time:	26.0	°C	/ 9:45:00
Initial Sample Time:	10:52:30	hours:minutes:sec	
Initial Sample - Sump Water Temp / Time:	26.0	°C	/ 10:59:00
Final Sample - Sump Water Temp / Time:	26.2	°C	/ 16:30:00
Depth in Chamber:	2	inches	(Measure near end of test.)

Sample Data Collection (ASTM D3977)

Sample Time hrs:min:sec	1 min. dry feed (g)	Sample	Time to Fill 1L, sec	Bottle Tare (g)	Bottle Gross (g)	Bottle Net (g)	Water (mL)	Filtrate Tare (g)	Filtrate Dry (g)	Solids (mg)	Concentration (mg/L) Dry Feed Calc.	Concentration (mg/L) Bottle Sample Calc
10:52:30	0.00	Influent 0	< 1 sec	51.23	1080.65	1029.42	1029.42	102.0440	102.0511	7.1	0.0	6.9
11:54:15	30.34	Influent 1	< 1 sec	49.94	1063.21	1013.27	1013.27	100.7382	100.9251	186.9	200.9	184.5
12:49:15	26.34	Influent 2	< 1 sec	51.14	1081.26	1030.12	1030.12	101.6606	101.8276	167.0	174.4	162.1
13:44:15	29.43	Influent 3	< 1 sec	50.83	1079.97	1029.14	1029.14	102.1394	102.3253	185.9	194.9	180.6
14:39:15	32.35	Influent 4	< 1 sec	51.02	1072.62	1021.60	1021.60	101.3476	101.5324	184.8	214.2	180.9
15:34:15	31.80	Influent 5	< 1 sec	49.90	1080.71	1030.81	1030.81	101.4191	101.6278	208.7	210.6	202.5
16:29:15	32.49	Influent 6	< 1 sec	50.20	1082.83	1032.63	1032.63	100.5333	100.7288	195.5	215.2	189.3
(Take initial sump temp.)									Average Concentration:		**201.7**	**183.3**
10:59:15		Effluent 0	< 1 sec	51.00	1060.31	1009.31	1009.31	100.7669	100.7709	4.0	4.0	4.0
12:01:00		Effluent 1	< 1 sec	50.05	1058.84	1008.79	1008.79	102.5333	102.5375	4.2	4.2	4.2
12:56:00		Effluent 2	< 1 sec	50.05	1066.55	1016.50	1016.50	100.9437	100.9478	4.1	4.0	4.0
13:51:00		Effluent 3	< 1 sec	49.62	1063.35	1013.73	1013.73	101.6787	101.6824	3.7	3.6	3.6
14:46:00		Effluent 4	< 1 sec	50.97	1067.87	1016.90	1016.90	102.8154	102.8188	3.4	3.3	3.3
15:41:00		Effluent 5	< 1 sec	50.74	1068.65	1017.91	1017.91	101.0627	101.0660	3.3	3.2	3.2
16:36:00		Effluent 6	< 1 sec	51.23	1057.76	1006.53	1006.53	102.7903	102.7924	2.1	2.1	2.1
(Take final sump temp.)									Average Concentration:		**3.4**	**3.4**

Influent Dry Feed Samples	Average Concentration in Influent (mg/L):	201.7	Average Concentration in Effluent (mg/L):	3.4	**Indirect Removal Efficiency (%)** **98.3%**
Influent Bottle Samples	Average Concentration in Influent (mg/L):	183.3	Average Concentration in Effluent (mg/L):	3.4	**Indirect Removal Efficiency (%)** **98.1%**

Test Summary

Test Date:	9/19/2018				
Test ID:	R-Tank_20				
Influent Volume per Sample:	2200	gallons			
Sample Interval:	110	minutes			
Sample Interval:	1:50	hours:minutes			(convert decimal to minutes:seconds)
Approx. Test Length:	657	minutes			
Detention Time:	9.50	minutes			
Detention Time:	09:30.0	minutes:seconds			(convert decimal to minutes:seconds)
Target Influent Concentration:	200	mg/L			
Target Sediment Injected:	22	lbs			
Target Sediment Injection Rate:	0.033	lb/min	15.19	g/min	(8 setting on auger)
Target Flow Rate:	20	gpm	76	lpm	

Test Data Collection

DIRECT - USING SEDIMENT WEIGHTS:

				SOLIDS MASS BALANCE	
(3.898 NW + 1.234 W + 1.252 W + 0.820 Wash)	Dry Geotextile Weight - Initial:	6.384	lbs	Retained Solids - Within Units (lbs):	16.68
	Dry Geotextile Weight - Final:	23.064	lbs		
(0.350 + 0)	Dry Filter Sock & Vacuum Filter Weights - Initial:	0.350	lbs	Passed Solids (lbs):	0.121
(0.410 + 0.061)	Dry Filter Sock & Vacuum Filter Weights - Final:	0.471	lbs		
	Dry Weight in Feeder - Initial:	36.000	lbs	Actual Solids Injected (lbs):	23.1
	Dry Weight in Feeder - Final:	12.880	lbs		
				Unaccounted Solids - Within Basin (lbs):	6.3

Solids in Influent (lbs): 23.1 Solids Retained (lbs): 23.0 **Direct Removal Efficiency (%): 99.5%**

INDIRECT - USING CONCENTRATIONS:

Flow Rate (lpm):	76		(800 rpm on pump)
Flow Rate (gpm):	20		0.045 cfs
R-Tank Footprint Area:	15.4	ft^2	(15.75" W x 28.15" L x 17.34" H) x 5
Hydraulic Loading Rate (flow per area):	1.30	gpm/ft^2	

(Fill system from reservoirs at target flow rate until sump reaches the desired fill line. Close/open valves to create closed loop.)

Stage Relative to Outlet (in)	4.25		(Measure in well near start of test.)	
Total Volume:	25.5	ft^3	190.74	gallons
Equilibrium Start Time:	6:00:00	min.:sec.	(Begin recirc for 10 detention times;Take sump temp.)	
Equilibrium End Time:	7:35:00	min.:sec.	(Take first influent/effluent samples, then start feeder.)	
Sump Water Temp / Time:	26.1	°C	/	6:00:00
Initial Sample Time:	7:35:00	hours:minutes:sec		
Initial Sample - Sump Water Temp / Time:	25.9	°C	/	6:00:00
Final Sample - Sump Water Temp / Time:	26.3	°C	/	18:54:00
Depth in Chamber (in):	1.75		(Measure near end of test.)	

Sample Data Collection (ASTM D3977)

Sample Time hrs:min:sec	1 min. dry feed (g)	Sample	Time to Fill 1L, sec	Bottle Tare (g)	Bottle Gross (g)	Bottle Net (g)	Water (mL)	Filtrate Tare (g)	Filtrate Dry (g)	Solids (mg)	Concentration (mg/L) Dry Feed Calc.	Concentration (mg/L) Bottle Sample Calc
7:35:00		Influent 0	< 1 sec	50.84	1075.45	1024.61	1024.61	102.8037	102.8082	4.5	0.0	4.4
9:34:30	18.16	Influent 1	< 1 sec	49.85	1081.86	1032.01	1032.01	101.6810	101.9315	250.5	238.9	242.7
11:24:30	13.74	Influent 2	< 1 sec	50.49	1080.97	1030.48	1030.48	100.7620	100.9674	205.4	180.8	199.3
13:14:30	16.14	Influent 3	< 1 sec	50.42	1081.36	1030.94	1030.94	102.5535	102.7813	227.8	212.4	221.0
15:04:30	17.71	Influent 4	< 1 sec	49.71	1080.92	1031.21	1031.21	102.0682	102.3204	252.2	233.0	244.6
16:54:30	18.43	Influent 5	< 1 sec	50.43	1076.90	1026.47	1026.47	102.8334	103.0863	252.9	242.5	246.4
18:44:30	14.85	Influent 6	< 1 sec	49.43	1080.69	1031.26	1031.26	102.1568	102.3678	211.0	195.4	204.6
(Take initial sump temp.)									Average Concentration:		**217.2**	**226.4**
7:44:30		Effluent 0	< 1 sec	50.80	1059.00	1008.20	1008.20	102.9854	102.9901	4.7	4.7	4.7
9:44:00		Effluent 1	< 1 sec	50.03	1063.35	1013.32	1013.32	101.0846	101.0867	2.1	2.1	2.1
11:34:00		Effluent 2	< 1 sec	50.60	1064.80	1014.20	1014.20	101.3713	101.3738	2.5	2.5	2.5
13:24:00		Effluent 3	< 1 sec	49.78	1070.54	1020.76	1020.76	101.6692	101.6717	2.5	2.4	2.4
15:14:00		Effluent 4	< 1 sec	50.41	1064.55	1014.14	1014.14	100.7982	100.7997	1.5	1.5	1.5
17:04:00		Effluent 5	< 1 sec	50.38	1061.12	1010.74	1010.74	100.9633	100.9647	1.4	1.4	1.4
18:54:00		Effluent 6	< 1 sec	50.38	1065.51	1015.13	1015.13	100.5550	100.5569	1.9	1.9	1.9
(Take final sump temp.)									Average Concentration:		**2.0**	**2.0**

Influent Dry Feed Samples	Average Concentration in Influent (mg/L):	217.2	Average Concentration in Effluent (mg/L):	2.0	**Indirect Removal Efficiency (%):**	**99.1%**
Influent Bottle Samples	Average Concentration in Influent (mg/L):	226.4	Average Concentration in Effluent (mg/L):	2.0	**Indirect Removal Efficiency (%)**	**99.1%**