



Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

B-HS6 Field System Monitoring Report No. 3

Progress Report

May 2014

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In association with:



AET
Applied Environmental Technology

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Consultants, LLC**

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TASK B.7 PROGRESS REPORT

B-HS6 Field System Monitoring Report No. 3

Prepared for:

Florida Department of Health
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Bureau of Environmental Health
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1.0 Background

Task B of the Florida Onsite Sewage Nitrogen Reduction Strategies Study (FOSNRS) includes performing field experiments to critically evaluate the performance of nitrogen removal technologies that were identified in FOSNRS Task A.9 and pilot tested in PNRS II. To meet this objective, full scale treatment systems are being installed at various residential sites in Florida and monitored over an extended timeframe under actual onsite conditions. The Task B Quality Assurance Project Plan (Task B.5) documents the objectives, monitoring framework, sample frequency and duration, and analytical methods to be used at the home sites. This report documents the third sample event of the passive nitrogen reduction system at home site B-HS6 in Wakulla County, Florida.

2.0 Purpose

This monitoring report documents data collected from the third B-HS6 monitoring and sampling event conducted on May 7, 2014 (Experimental Day 174). This monitoring event consisted of collecting flow measurements from the household water use meter, treatment system flow meters, recording electricity use, monitoring of field parameters, collection of water samples from seven points in the treatment system, and chemical analyses of water samples by a NELAC certified laboratory.

3.0 Materials and Methods

3.1 Project Site

The B-HS6 field site is located in Wakulla County, FL. The nitrogen reducing onsite treatment system for the single family residence was installed in November 2013. Operation commenced on November 14, 2013. Design and construction details were presented previously in the Task B.6 document. Figure 1 is a system schematic showing the system components and layout of the installation. A flow schematic of the system is shown in Figure 2. The new system replaced the previously installed PNRS system installed at field site B-HS1. The previously installed Aerocell™ unsaturated media filter chamber, Nitrex™ media and split recirculation device were removed from the system.

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The existing 1,500 gallon dual chamber septic tank will continue to provide primary treatment for the new PNRS system. However, the effluent screen was moved to the outlet and a vented tee was installed between the chambers per 64E-6.013(2)(h). The existing pump and floats were moved from the second chamber of the primary tank into a new 275 gallon pump tank. A 1,650 gallon concrete combined Stage 1 and Stage 2a media biofilter was installed. The existing 1,500 gallon concrete single chamber tank which contained the Nitrex™ media was converted to a Stage 2b saturated sulfur media biofilter. The denitrified treated effluent is discharged into the soil via the existing drain-field (standard trenches).

PRELIMINARY

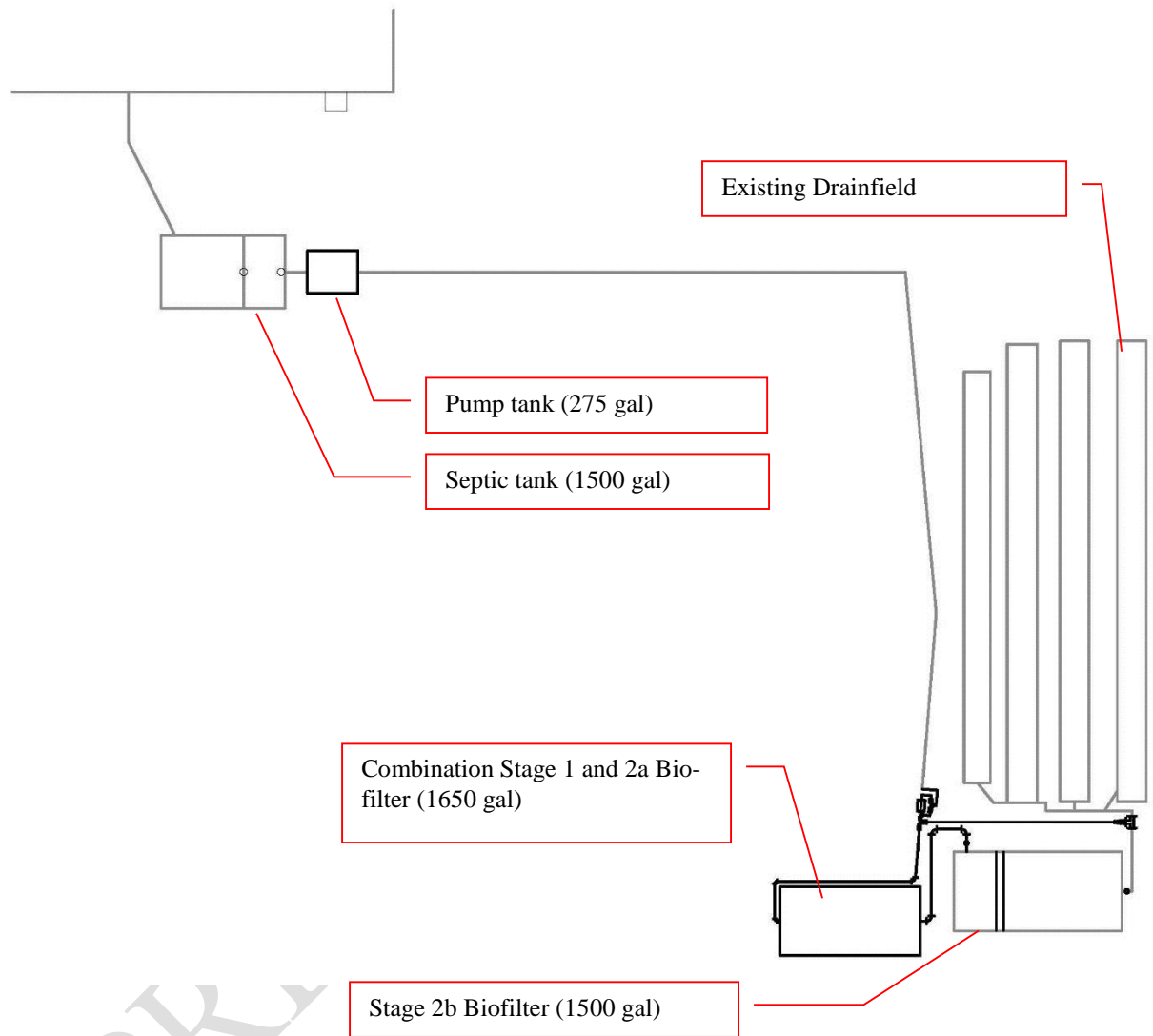


Figure 1
Plan view of B-HS6 system layout installed in Wakulla County

June 2014

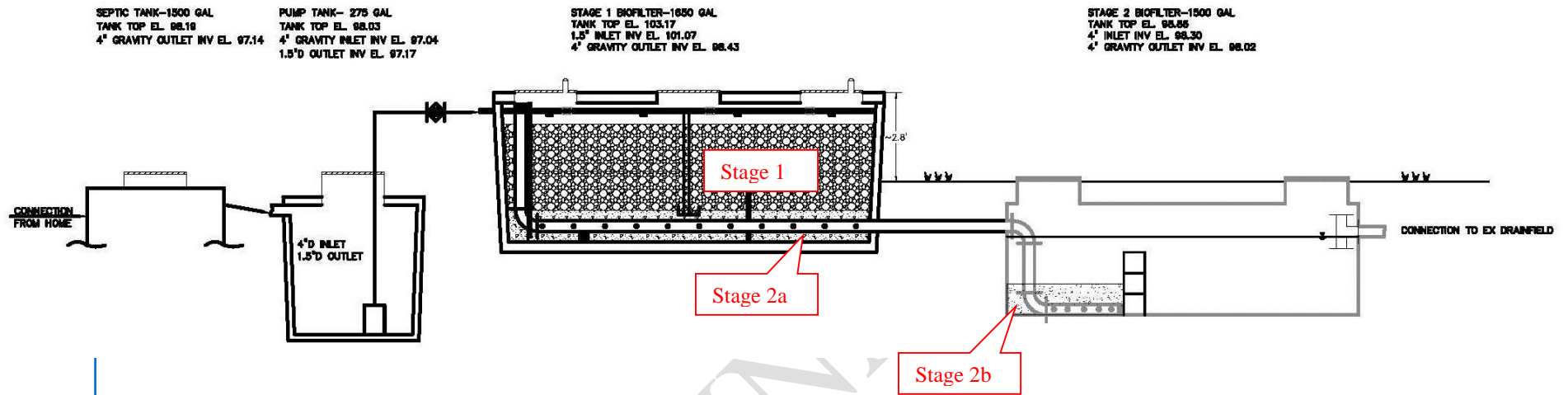


Figure 2
Flow Schematic of B-HS6 PNRS installed in Wakulla County

3.2 Monitoring and Sample Locations and Identification

Seven of the eight monitoring points shown in Figure 3 were sampled for this sample event. Monitoring point B-HS6-ST2-T was not sampled as the water quality was very similar to the adjacent monitoring point B-HS6-ST-P. Household wastewater enters the 1st chamber of the primary tank and exits the second chamber as septic tank effluent through an effluent screen into the pump tank (which contains the pump and float switches). The first monitoring point, B-HS6-STE, is the effluent sampled from a sample port on the pump discharge line (Figure 4), which is referred to as primary effluent or septic tank effluent (STE). Samples from monitoring point B-HS6-STE are representative of the whole household wastewater and represent the influent to the remainder of the onsite nitrogen reduction system.

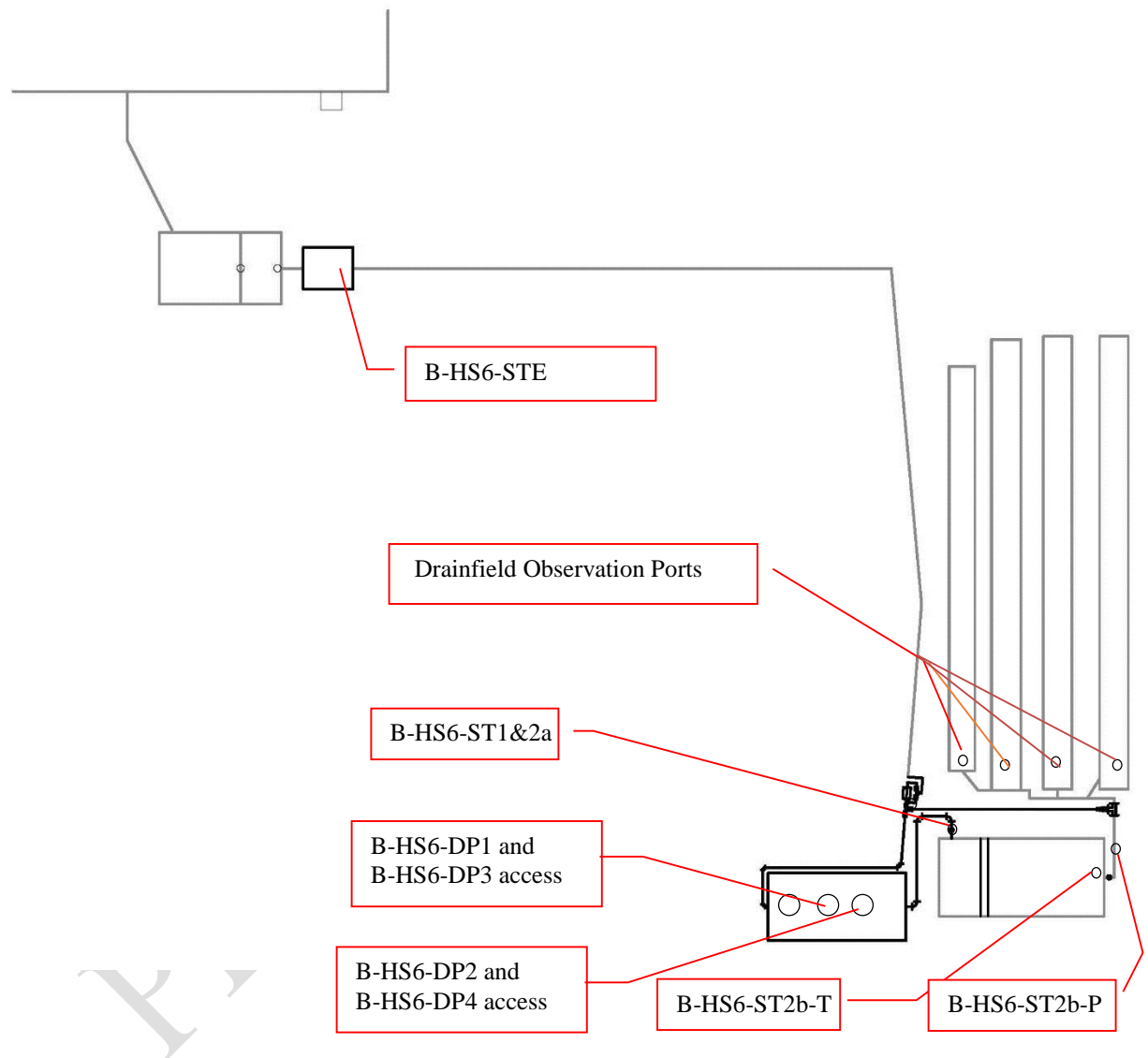


Figure 3
B-HS6 Treatment System Sampling and Monitoring Locations

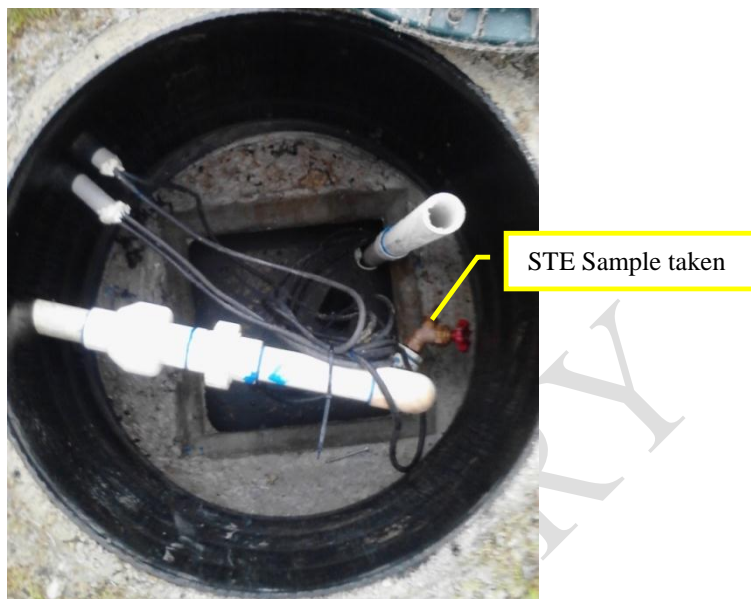


Figure 4
Primary Effluent (B-HS6-STE sample)

The pump tank contents are discharged to the top of the Stage 1 biofilter through three Orenco™ spin nozzles. The spin nozzles were installed on March 20, 2014 and replaced the original four spray nozzles that were installed at system start-up. Monitoring for this current report (Sample Event No. 3) is the first to be conducted with the Orenco™ spin nozzles in place. In the Stage 1 biofilter, wastewater percolates downward through the unsaturated expanded clay media where nitrification occurs. The Stage 1 biofilter contains 30 inches of coarse expanded clay media (Riverlite™ 1/4; 1.1 to 4.8 mm). Two shallow pans, each containing a drive point sampler, were installed underneath the expanded clay layer and on top of the Stage 2a lignocellulosic media (see Figure 5). The second and third sampling points (B-HS6-DP1 and B-HS6-DP2) are sampled by connecting a peristaltic pump to the drivepoint tubing, representing the Stage 1 biofilter effluent.



Figure 5

Stage 1 Unsaturated Biofilter Effluent (B-HS6-DP1 and B-HS6-DP2 sample)

Twelve inches of lignocellulosic media, a blended waste wood from AAA Tree Experts, Tallahassee, FL, was installed underneath the expanded clay media as a supplemental carbon source for denitrification. The combination Stage 1&2a tank outlet pipe invert was installed 4-inches above the interior bottom of the tank. Therefore, approximately 4-inches of the lignocellulosic media is saturated, promoting oxygen depletion and denitrification of the nitrified effluent. Two additional stainless steel drive points were installed at the bottom of the Stage 2a saturated lignocellulosic media (see Figure 6). The fourth and fifth sampling points (B-HS6-DP3 and B-HS6-DP4) are sampled by connecting a peristaltic pump to the drivepoint tubing, representing the Stage 2a saturated biofilter effluent.



Figure 6
Stage 2a Saturated Biofilter Effluent (B-HS6-DP3 and B-HS6-DP4) sample tubing

The tubing for sample points B-HS6-DP1 and B-HS6-DP3 are accessed via the middle tank cover (Figure 7), and B-HS6-DP2 and B-HS6-DP4 are accessed through the tank cover on the outlet side of the tank.

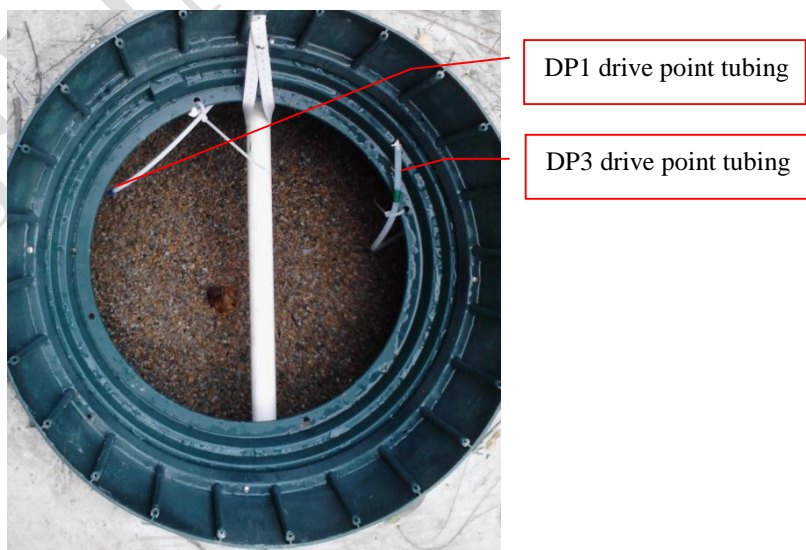


Figure 7
Drivepoint tubing access (B-HS6-DP1 and B-HS6-DP3 sample)

The effluent from the Stage 1&2a biofilter flows into the Stage 2b biofilter by gravity. The sixth sampling point (B-HS6-ST1&2a) is taken from a sample port in the gravity pipe connecting the Stage 1&2a biofilter outlet to the Stage 2b biofilter inlet representing the Stage 1&2a biofilter effluent (see Figure 8).

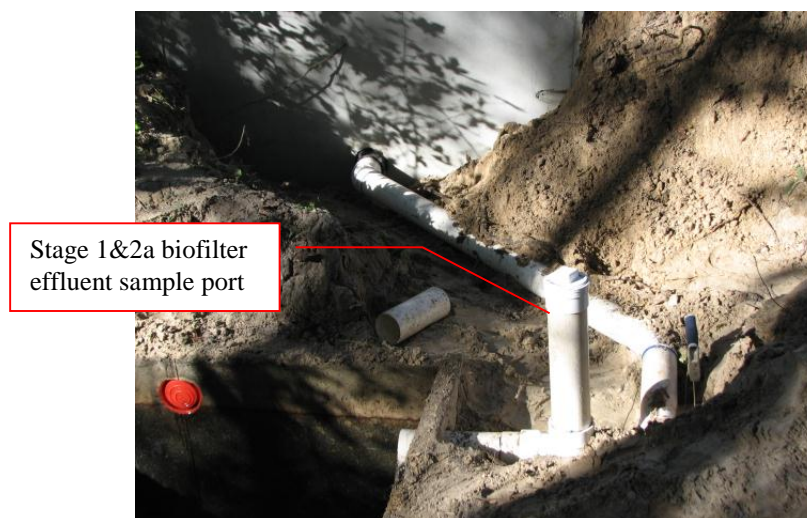


Figure 8
Stage 1&2a Biofilter Effluent Sample Port (B-HS6-ST1&2a sample)

Effluent from the Stage 1&2a biofilter enters the saturated denitrification (Stage 2b) biofilter at the bottom of the tank through a 4-inch diameter perforated pipe, flows upward through the 12-inches of elemental sulfur and oyster shell media mixture, and moves laterally over a concrete block wall to the second chamber. The Stage 2b biofilter effluent discharges near the top of the tank; therefore denitrification occurs in the saturated environment. The seventh primary sampling point, (B-HS6-ST2b-T) is the second chamber of the Stage 2 biofilter effluent which is sampled approximately 1 foot below the surface of the effluent baffle tee. This sample location is after passage through the sulfur media; it is the final effluent from the treatment system prior to being discharged to the soil infiltration system, or drainfield (Figure 9).



Figure 9
Stage 2b Biofilter Effluent (B-HS6-ST2b-T sample)

The eighth sampling point (B-HS6-ST2b-P) is taken from a sample port in the gravity pipe connecting the Stage 2b biofilter outlet to the drainfield inlet also representing the treated effluent (Figure 10).



Figure 10
Stage 2b Biofilter Effluent (B-HS6-ST2b-P sample)

Treated effluent is discharged to a soil dispersal system (drainfield) consisting of four Infiltrator trenches. Three of the four Infiltrator trenches are 40 feet in length, and the fourth is 36 feet. A flow schematic of the system is depicted in Figure 2.

3.3 Operational Monitoring

Start-up of the system occurred on November 14, 2013 (Experimental Day 0). The PNRS system has operated continually since that date. For this third formal sampling event, the water meter for the house and treatment system flow meters were read and recorded on May 7, 2014 (Experimental Day 174). The household water meter is located on the potable water line from the onsite well prior to entering the household plumbing. The water meter does not include the irrigation water use. Therefore, the water meter reading should be indicative of the wastewater flow to the system.

The PNRS treatment system flow meter (Figure 11) is located on the pump tank discharge line and records the cumulative flow in gallons pumped from the pump chamber to the combined Stage 1&2a biofilter. The control panel includes telemetry where reports are generated regarding alarms, pump cycles, and other information using a Vericomm control panel system.



Figure 11
Treatment system flow meter

3.4 Energy Consumption

Energy consumption was monitored using an electrical meter installed between the main power box for the house and the control panel. The electrical meter records the cumulative power usage of the system in kilowatt-hours. The power usage of the system is primarily due to the single lift station pump installed within the pump tank, although a small amount of power is used by the control panel itself. There are no chemicals added to the system. However, the Stage 2 biofilter media (lignocellulosic and sulfur) are “reactive” media which will be consumed during operation. The Stage 1&2a biofilter was ini-

tially filled with 12 inches of lignocellulosic media. The Stage 2b biofilter was filled with 12 inches of sulfur and oyster shell mixture media, which ostensibly will last for many years without replenishment or replacement.

3.5 Water Quality Sample Collection and Analyses

The third formal sample event (Sample Event No. 3), which is the subject of this report, was conducted on May 7, 2014 (Experimental Day 174). A full suite of influent, intermediate and effluent water quality samples were collected from the system for water quality analysis. Samples were collected at seven monitoring points described in Section 3.2: B-HS6-STE, B-HS6-DP1, B-HS6-DP2, B-HS6-DP3, B-HS6-DP4, B-HS6-ST1&2a, B-HS6-ST2b-P. A duplicate sample was also taken at B-HS6-ST1&2a. A peristaltic pump was used to collect samples and route them directly into analysis-specific containers after sufficient flushing of the tubing had occurred. Field parameters were then recorded. For sample B-HS6-STE, the system pump was briefly turned on to collect sample from the spigot.

The analysis-specific containers were supplied by the analytical laboratory and contained appropriate preservatives. The analysis-specific containers were labeled, placed in coolers and transported on ice to the analytical laboratories. Each sample container was secured in packing material as appropriate to prevent damage and spills, and was recorded on chain-of-custody forms supplied by the laboratory. Chain of custody forms, provided in Appendix A, were used to document the transfer of samples from field personnel to the analytical laboratory.

Field parameters were measured using portable electronic probes and included temperature (Temp), dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, and specific conductance. Field parameters were measured directly in the tank/port for the B-HS6-STE, B-HS6-ST1, and B-HS6-ST2-P samples. Due to the design of the probe, ORP was measured in a container overflowing with sample water. All field parameters were measured in an overflowing container for samples B-HS6-DP3 and B-HS6-DP4. Due to low sample volume, no field parameters were taken during sampling of B-HS6-DP1 and B-HS6-DP2.

The influent, intermediate, and effluent samples were analyzed by the laboratory for: total alkalinity, chemical oxygen demand (COD), total Kjeldahl nitrogen (TKN-N), ammonia nitrogen ($\text{NH}_3\text{-N}$), nitrate nitrogen ($\text{NO}_3\text{-N}$), nitrite nitrogen ($\text{NO}_2\text{-N}$), total phosphorus (TP), orthophosphate (Ortho P), total suspended solids (TSS), volatile suspended solids (VSS), total organic carbon (TOC), fecal coliform (fecal), and E. coli. The influent and sulfur media samples included sulfate, sulfide, and hydrogen sulfide (unionized). Due to sample size, B-HS6-DP1 and B-HS6-DP2 were only analyzed for the nitrogen

species. All analyses were performed by independent and fully NELAC certified analytical laboratories (Southern Analytical Laboratory and Ackurilabs, Inc.). Table 1 lists the analytical parameters, analytical methods, and detection limits for laboratory analyses.

Table 1
Analytical Parameters, Method of Analysis, and Detection Limits

Analytical Parameter	Method of Analysis	Method Detection Limit (mg/L)
Total Alkalinity as CaCO ₃	SM 2320B	2 mg/L
Chemical Oxygen Demand (COD)	EPA 410.4	10 mg/L
Total Kjeldahl Nitrogen (TKN-N)	EPA 351.2	0.05 mg/L
Ammonia Nitrogen (NH ₃ -N)	EPA 350.1	0.005 mg/L
Nitrate Nitrogen (NO ₃ -N)	EPA 300.0	0.01 mg/L
Nitrite Nitrogen (NO ₂ -N)	EPA 300.0	0.01 mg/L
Nitrate+Nitrite Nitrogen (NOX-N)	EPA 300.0	0.02 mg/L
Total Phosphorus (TP)	SM 4500P-E	0.01 mg/L
Orthophosphate as P (Ortho P)	EPA 300.0	0.01 mg/L
Carbonaceous Biological Oxygen Demand (CBOD ₅)	SM5210B	2 mg/L
Total Solids (TS)	EPA 160.3	.01 % by wt
Total Suspended Solids (TSS)	SM 2540D	1 mg/L
Volatile Suspended Solids (VSS)	EPA 160.4	1 mg/L
Total Organic Carbon (TOC)	SM5310B	0.06 mg/L
Sulfate	EPA 300.0	2.0 mg/L
Sulfide	SM 4500SF	0.10 mg/L
Hydrogen Sulfide (unionized)	SM 4550SF	0.01 mg/L
Fecal Coliform (fecal)	SM9222D	1 ct/100mL
E.coli	EPA1603	2 ct/100mL

4.0 Results and Discussion

4.1 Operational Monitoring

Table 2 provides a summary of the household water use since the new treatment system installation on November 6, 2013. The treatment system flow meter readings for the B-HS6 field site are summarized in Table 2. The operation and maintenance log which includes actions taken since start-up is provided in Appendix B. Summary tables of the Vericomm PLC recorded data are provided in Appendix C. These include daily and cumulative pump runtime and system alarms that are used to check general pump operation and performance.

Table 2
Summary of Flowmeters

Date and Time Read	Household Water Meter Reading	Average Daily Household Flow between readings	PNRS Flow Meter Reading	Average Daily PNRS Flow between readings
	Cumulative Volume (gallons)	gallons/day	Cumulative Volume (gallons)	gallons/day
11/6/2013 12:15	99,030.4	Installed	1,027,435.3	Installed
11/14/2013 12:30	100,113.9	135.3	1,027,435.3	0.0
11/20/2013 8:04	100,925.7	139.6	1,028,375.4	161.7
12/4/2013 7:52	102,616.8	120.9	1,030,645.4	162.3
12/20/2013 12:46	104,570.6	120.6	1,033,374.2	168.4
1/9/2014 11:49	107,163.1	129.9	1,036,306.1	146.9
1/22/2014 8:55	109,061.5	147.4	1,038,248.5	150.8
3/7/2014 10:30	115,093.0	136.9	1,045,302.0	160.1
3/20/2014 11:45	116,543.0	111.1	1,047,111.1	138.6
3/24/2014 10:50	116,979.0	110.1	1,047,597.8	122.9
4/10/2014 9:29	118,873.3	111.8	1,050,015.7	142.7
4/14/2014 19:15	119,370.5	112.8	1,050,622.9	137.8
4/16/2014 14:29	119,594.6	124.4	1,050,904.4	156.3
4/28/2014 12:47	120,956.3	114.1	1,052,696.0	150.2
5/7/2014 9:33	122,109.1	130.0	1,054,174.5	166.8
Average since start-up to May 7, 2014		126.5		153.8

On November 14, 2014, an alarm indicated a pump failure and upon inspection loose wiring was discovered and repaired. PNRS flow readings indicated that the pump had not run since installation until the time the wiring was repaired, therefore the official start-up of the PNRS system was November 14, 2014. From system installation through May 7, 2014, the household water use average was 126.5 gallons per day with periods of higher and lower flows (Table 2). The average pumped flow to the PNRS was 153.8 gallons per day from start-up through May 7, 2014 and PNRS flowrates leading up to this sampling event are consistent with the average flows.

While purging the Stage 1 effluent drive points DP1 and DP2 during Sample Event No. 2, it was observed that the water level in the Stage 1&2a tank was elevated above the pans holding the drive points. The water level in the Stage 1&2a tank was found to be elevated approximately 10-inches during this sample event. This water level would saturate all 12-inches of the lignocellulosic media and approximately 2-inches of the expanded clay media. The elevated water level could quite possibly have affected the performance of the system. A piezometer was installed within the Stage 1&2a tank on April

10, 2014 to allow for observation of the water level (Figure 12). Table 3 summarizes the water level readings recorded. On April 14, 2014, it was determined the clog in the system was in the inlet pipe of the Stage 2b sulfur tank. An unsuccessful attempt was made with a plumbing snake to clear the clog. On April 16, 2014, the clog was cleared using compressed air and a 4-inch rubber bladder; the normal operational water level was restored in the Stage 1&2a tank (21 days before the Sample Event No. 3).



Figure 12

Piezometer installed on April 19, 2014 in the Stage 1&2a Tank

Table 3
Summary of Stage 1&2a Water Level

Date and Time Read	Water level In Stage1&2a PZ from TOC	Water Elev	Water level above bottom of tank¹	Water level above outlet invert
	(ft)	(ft)	(in)	(in)
4/14/2014 19:20	3.74	99.57	17.63	13.63
4/14/2014 19:35	3.75	99.56	17.51	13.51
4/16/2014 14:35	3.77	99.54	17.27	13.27
4/16/2014 16:16	4.76	98.55	5.39	1.39
4/16/2014 16:25	4.79	98.52	5.03	1.03
4/16/2014 16:49	4.81	98.50	4.79	0.79
5/6/2014 9:35	4.71	98.60	5.99	1.99
5/6/2014 9:58	4.66	98.65	6.59	2.59
5/7/2014 9:39	4.68	98.63	6.35	2.35
5/7/2014 10:51	4.70	98.61	6.11	2.11

¹Stage 1&2a tank interior bottom elev = 98.10 ft

4.2 Energy Consumption

Energy consumption is monitored using an electrical meter installed between the main power box for the house and the control panel to record cumulative power usage of the pump in kilowatt-hours. The recorded electrical use for the system is summarized in Table 4.

Table 4
Summary of System Electrical Use

Date and Time Read	Electrical Meter Reading	Average Daily Electrical Use	Average Electrical Use per Gallon Treated	Average Electrical Use per 1,000 Gallons Treated
	Cumulative (kWh)	(kWh/day)	(kWh/gal)	(kWh/ 1,000 gal)
11/6/2013 12:22	2,749	0.00		
11/14/2013 12:32	2,749	0.00		
11/20/2013 8:08	2,751	0.34	0.0021	2.127
12/4/2013 7:54	2,757	0.43	0.0026	2.643
12/20/2013 12:48	2,764	0.43	0.0026	2.565
1/9/2014 11:53	2,772	0.40	0.0027	2.729
1/22/2014 8:57	2,777	0.39	0.0026	2.574
3/7/2014 10:32	2,797	0.45	0.0028	2.836
3/20/14 11:47	2,802	0.38	0.0028	2.764
3/24/2014 10:51	2,803	0.25	0.0021	2.054
4/10/2014 9:32	2,811	0.47	0.0033	3.309
4/14/2014 19:17	2,813	0.45	0.0033	3.293
4/16/2014 14:31	2,814	0.56	0.0036	3.552
4/28/2014 12:48	2,820	0.50	0.0033	3.349
5/7/2014 9:34	2,825	0.99	0.0034	3.382
Total average start-up to 5/7/2014		0.44	0.0028	2.842

The total average electrical use through May 7, 2014 was 0.44 kWh per day. The average electrical use per 1,000 gallons treated was 2.84 kWh per 1,000 gallons treated, and this parameter has been fairly stable since start-up.

4.3 Water Quality

As discussed in the Sample Event No. 1 (SE1) report, the preliminary sampling results indicated that ammonia reduction through the Stage 1 biofilter was limited. During preliminary sampling (prior to SE1), it was observed that the sprayers were not spraying uniformly over the Stage 1 media surface. To improve wastewater distribution over the media surface, the sprayers were rotated on December 21, 2013 to spray up on the tank lid rather than straight down to the media. The results from the SE1 DP1 and DP2 samples indicated significant nitrification was occurring with the sprayer set-up; however, the long-term operation and maintenance of the sprayers in this set-up was a concern. Therefore, on March 20, 2014, the four originally installed spray nozzles were replaced by three Orenco™ spin nozzles positioned under the tank lids allowing for easy maintenance and maximum spray coverage. This sampling event occurred with the Orenco™ spin nozzles in place.

Water quality results for the third full sampling event (Sample Event No. 3) are listed in Table 5. Nitrogen results are graphically displayed in Figure 13. The laboratory report containing the raw analytical data is included in Appendix A. The following discussion summarizes the water quality analytical results for Sample Event No. 3. The performance of the various system components was compared by considering the changes through treatment of nitrogen species (TKN, NH₃-N, and NO_x-N), as well as supporting water quality parameters. A summary of the water quality data collected to date for the test system is presented in Table 6.

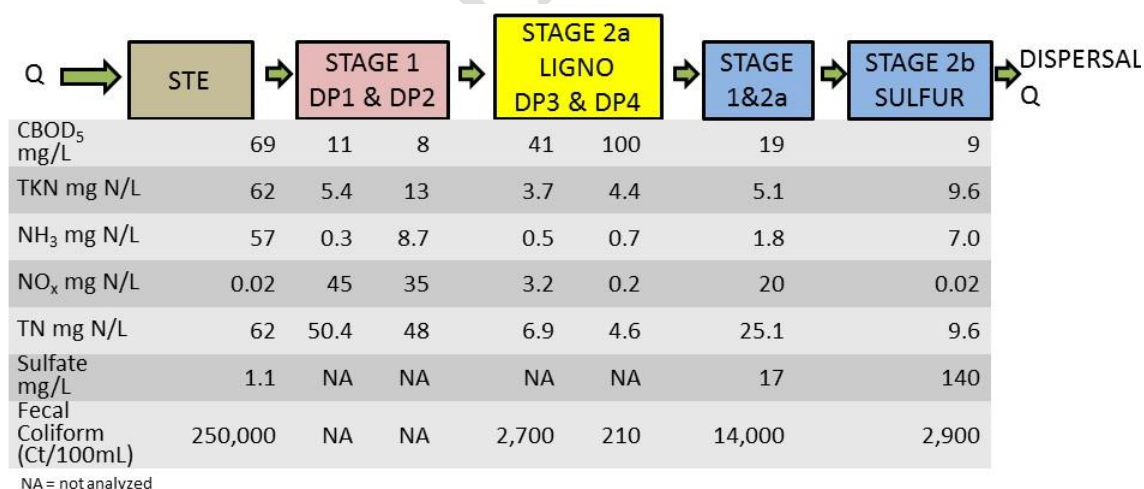


Figure 13
Graphical Representation of Nitrogen Results
Sample Event 3 May 7, 2014 (Experimental Day 174)

Septic Tank Effluent (STE) Quality: The water quality characteristics of STE collected in Sample Event 3 were within the typical range generally expected for domestic STE. The measured TKN concentration for this sample event was 62 mg-N/L, which is in the range typically seen for this household.

Stage 1 Unsaturated Effluent (DP1 and DP2): Stage 1 effluent (DP1 and DP2) NO_x-N concentration were 45 and 36 mg/L for samples DP1 and DP2, respectively. The TKN and NH₃-N concentrations in sample DP1 were significantly lower, 5.4 mg/L and 0.3 mg/L than in the DP2 sample 13 mg/L and 8.7 mg/L, respectively.

Stage 2a Saturated Effluent (DP3 and DP4): Stage 2a saturated effluent is collected from two drive points (DP3 and DP4) located on the bottom of the Stage 1&2a combination tank. DP3 and DP4 saturated effluent TKN concentrations were similar from both drive points, 3.7 mg/L and 4.4 mg/L as were the NH₃-N concentrations of 0.5 mg/L and 0.7 mg/L, respectively. DP3 and DP4 NO_x-N concentrations were 3.2 mg/L and 0.2 mg/L, respectively, and were accompanied by a measured 0.5 and 0.1 mg/L DO and -167 and -173 mV ORP, respectively. The TN concentrations in samples DP3 (6.9 mg/L) and DP4 (4.6 mg/L) indicate that the Stage 1&2a combination tank is effectively reducing nitrogen.

Stage 1&2a Tank Effluent (ST1&2a): The sample port between the Stage 1&2a combination tank and the Stage 2b sulfur tank represents the influent to the Stage 2b biofilter. The Stage 1&2a sample port effluent TKN was 5.1 mg/L of which 1.8 mg/L was NH₃-N. The NO_x-N concentration of 20 mg/L was accompanied by a measured 0.23 mg/L DO and -106 mV ORP. The Stage 1&2a effluent TSS concentration was 10 mg/L and CBOD₅ was 19 mg/L. The ST1&2a sample indicates incomplete nitrification and partial denitrification in the Stage 1&2a biofilter.

As discussed above, the samples from inside the Stage 1&2a tank (DP3 and DP4) had different water quality characteristics as compared to the effluent from the outlet sample port (ST1&2a). The ST1&2a sample TKN was similar to the 2a tank samples and ST1&2a ammonia was somewhat higher. However the ST1&2a sample had an unexpectedly high NO_x-N of 20 mg/L as compared to the 2a tank samples which were less than 5 mg/L NO_x-N. These results suggest that the water at the bottom of the tank is different than what is actually entering the exit pipe of the tank.

Stage 2b Tank Effluent (ST2b): In Sample Events SE1 and SE2 the monitoring points, B-HS6-ST2-T and B-HS6-ST2-P had nearly identical nitrogen concentrations. For this sample event, B-HS6-ST2-T was not sampled. B-HS6-ST2-P was chosen as the pre-

ferred sample point as it is located in the pipe leading from the PNRS system to the drainfield.

Effluent $\text{NO}_x\text{-N}$ from the Stage 2b biofilter was below the detection limit of 0.02 mg/L. The low $\text{NO}_x\text{-N}$ was accompanied by a measured DO of 0.16 mg/L DO and -203 mV ORP. The Stage 2b biofilter produced a highly reducing environment and achieved complete $\text{NO}_x\text{-N}$ reduction. However, the only partially successful $\text{NH}_3\text{-N}$ reduction through the Stage 1 biofilter, was evidenced in the Stage 2 effluent $\text{NH}_3\text{-N}$ concentration of 7.0 mg/L and TKN of 9.6 mg/L. Final total nitrogen (TN) in the treatment system effluent was 9.6 mg/L. The Stage 2b effluent sulfate concentration was 140 mg/L.

May 2014

Table 5
Water Quality Analytical Results

Sample ID	Sample Date/Time	Temp (°C)	pH	Total Alkalinity (mg/L)	DO (mg/L)	ORP (mV)	Specific Conductance (µS)	TSS (mg/L)	VSS (mg/L)	CBOD ₅ (mg/L)	COD (mg/L)	TN (mg/L N) ¹	TKN (mg/L N)	Organic N (mg/L N) ²	NH ₃ -N (mg/L N)	NO ₃ -N (mg/L N)	NO ₂ -N (mg/L N)	NO _x (mg/L N)	TIN (mg/L N) ³	TP (mg/L)	Ortho P (mg/L P)	Sulfate (mg/L)	H ₂ S (mg/L)	Sulfide (mg/L)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)
BHS6-STE	5/7/14 11:16	20.6	7.25	470	0.04	-113	1086	42	38	69	170	62.0	62	5.0	57	0.01	0.01	0.02	57.0	12	5.3	1.1	0.76	2	250,000	64,000
BHS6-DP01	5/7/14 11:40			140						11	23	50.4	5.4	5.1	0.33	45	0.01	45	45.3							
BHS6-DP02	5/7/14 11:36			190						8	35	48.6	13	4.3	8.7	35	0.56	35.56	44.3							
BHS6-DP03	5/7/14 10:50	20.9	6.33	410	0.49	-167	884	10	9	41	130	6.9	3.7	3.2	0.5	2.5	0.66	3.2	3.7						2,700	2,100
BHS6-DP04	5/7/14 11:06	20.9	6.33	480	0.10	-173	986	8	8	100	180	4.6	4.4	3.7	0.7	0.19	0.01	0.2	0.9						210	180
BHS6-ST1&2a	5/7/14 10:44	21.2	6.24	260	0.23	-106	849	10	10	19	64	25.2	5.1	3.3	1.8	19	1.1	20.1	21.9	4.6	1.4	17	0.17	0.2	14,000	10,000
BHS6-ST1&2a-DUP	5/7/14 10:45	21.1	6.25	280	0.21	-109	852	10	9	20	70	25.4	5.3	3.6	1.7	19	1.1	20.1	21.8	4.2	1.5	17	0.17	0.2	11,000	11,000
BHS6-ST2b-Port	5/7/14 10:12	19.5	6.54	360	0.16	-203	1032	4	4	9	50	9.6	9.6	2.6	7	0.01	0.01	0.02	7.0	4.7	2	140	3.6	4.8	2,900	2,800
BHS6-EB	5/7/14 11:28	23.3	5.68	2	4.2	78	6.08	1	1	2	10	0.07	0.05	0.041	0.009	0.01	0.01	0.02	0.029	0.01	0.01	1.3	0.01	0.1	2	2

Notes:

1Total Nitrogen (TN) is a calculated value equal to the sum of TKN and NO_x.

2Organic Nitrogen (ON) is a calculated value equal to the difference of TKN and NH₃.

3Total Inorganic Nitrogen (TIN) is a calculated value equal to the sum of NH₃ and NO_x.

D.O. - Dissolved oxygen

G - Grab sample

Gray-shaded data points indicate values below method detection level (mdl), mdl value used for statistical analyses.

Yellow-shaded data points indicate the reported value is between the laboratory method detection limit and the laboratory practical quantitation limit, value used for statistical analysis.

Orange-shaded data points indicate results based upon colony counts exceeded the ideal range of 20-60 (fecal coliform) or 20-80 (E. coli) colonies per plate.

Table 6
Summary of Water Quality Data

Sample ID	Statistical Parameter	Temp (°C)	pH ⁴	Total Alkalinity (mg/L)	DO (mg/L)	ORP (mV)	Specific Conductance (µS)	TSS (mg/L)	VSS (mg/L)	CBOD ₅ (mg/L)	COD (mg/L)	TN (mg/L N) ¹	TKN (mg/L N)	Organic N (mg/L N) ²	NH ₃ -N (mg/L N)	NO ₃ -N (mg/L N)	NO ₂ -N (mg/L N)	NO _x (mg/L N)	TIN (mg/L N) ³	TP (mg/L)	Ortho P (mg/L P)	Sulfate (mg/L)	H ₂ S (mg/L)	Sulfide (mg/L)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)
BHS6-STE	n	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	4	4
	MEAN	19.10	7.18	508.00	0.13	-186.80	1,117.80	29.60	26.40	65.60	162.00	58.22	58.20	9.80	48.40	0.01	0.01	0.02	48.42	11.42	5.08	1.86	1.39	3.00	373,111	242,462
	STD. DEV.	1.84		32.71	0.07	47.89	40.11	7.64	7.64	6.31	24.90	17.23	17.22	6.61	14.89	0.00	0.00	0.01	14.90	4.02	0.56	1.34	0.71	1.36	0	0
	MIN	16.10	7.08	470.00	0.04	-225.00	1,086.00	24.00	19.00	60.00	140.00	33.01	33.00	3.00	23.00	0.01	0.01	0.01	23.01	7.00	4.40	0.45	0.76	1.80	120,000	64,000
	MAX	20.60	7.25	560.00	0.22	-113.00	1,177.00	42.00	38.00	75.00	200.00	77.01	77.00	20.00	58.00	0.01	0.01	0.02	58.02	17.00	5.90	3.40	2.00	4.70	1,900,000	1,800,000
BHS6-DP01 (Stage 1)	n	1	1	1	1	1	1	0	0	1	1	2	2	2	4	4	4	4	4	0	0	0	0	0	0	0
	MEAN	19.70	6.93	140.00	2.45	40.00	929.00			11.00	23.00	53.71	10.70	4.54	18.06	31.01	0.67	31.51	49.57							
	STD. DEV.											4.66	7.50	0.76	27.13	20.84	0.68	20.85	7.60							
	MIN	19.70	6.93	140.00	2.45	40.00	929.00			11.00	23.00	50.41	5.40	4.00	0.33	0.05	0.01	0.42	41.50							
	MAX	19.70	6.93	140.00	2.45	40.00	929.00			11.00	23.00	57.00	16.00	5.07	58.00	45.00	1.60	45.01	58.42							
BHS6-DP02 (Stage 1)	n	1	1	1	1	1	1	0	0	1	1	2	2	2	4	4	4	4	4	0	0	0	0	0	0	0
	MEAN	19.80	7.01	190.00	3.39	12.00	917.00			8.00	35.00	49.28	12.50	3.30	17.60	28.83	0.96	29.62	47.22							
	STD. DEV.														21.87	19.23	0.76	18.37	3.79							
	MIN	19.80	7.01	190.00	3.39	12.00	917.00			8.00	35.00	48.56	12.00	2.30	2.00	0.30	0.52	2.40	44.26							
	MAX	19.80	7.01	190.00	3.39	12.00	917.00			8.00	35.00	50.00	13.00	4.30	50.00	42.00	2.10	42.52	52.40							
BHS6-ST1&2a	n	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	4	4
	MEAN	18.60	6.54	368.00	0.66	-126.60	974.60	12.00	11.40	37.60	233.60	32.76	21.82	5.84	15.98	10.23	1.02	10.94	26.92	12.12	3.88	15.33	1.45	2.00	16,771	13,666
	STD. DEV.	2.96		94.18	0.63	70.74	109.13	7.78	7.47	25.85	292.63	9.84	17.91	2.99	15.14	10.54	0.46	10.47	8.09	13.16	3.27	5.69	1.79	2.61	0	0
	MIN	13.80	6.24	260.00	0.15	-224.00	849.00	4.00	4.00	10.00	37.00	25.20	5.10	2.90	1.80	0.01	0.51	0.57	21.80	2.80	1.40	9.00	0.17	0.20	6,900	5,700
	MAX	21.20	7.00	500.00	1.71	-28.00	1091.00	25.00	24.00	72.00	740.00	49.73	48.00	9.00	39.00	23.00	1.50	23.51	40.73	34.00	9.50	20.00	3.50	5.00	63,000	51,000
BHS6-DP03 (Stage 2a)	n	4	4	0	4	4	4	0	0	4	0	4	4	4	4	4	4	4	4	0	0	0	0	0	2	2
	MEAN	18.18	6.25		0.42	-132.00	973.50			111.75		18.57	11.93	5.18	6.75	5.95	0.87	6.64	13.39						6,573	2,337
	STD. DEV.	2.72			0.29	30.99	103.78			152.21		10.03	5.80	4.53	5.81	8.77	0.88	8.44	11.58						0	0
	MIN	14.40	5.50		0.17	-167.00	884.00			33.00		6.86	3.70	2.00	0.50	0.01	0.01	0.01	3.66						2,700	2,100
	MAX	20.90	6.79		0.79	-93.00	1101.00			340.00		31.00	16.00	11.90	14.00	19.00	2.10	19.00	27.40						16,000	2,600
BHS6-DP04 (Stage 2a)	n	4	4	0	4	4	4	0	0	4	0	4	4	4	4	4	4	4	4	0	0	0	0	0	2	2
	MEAN	17.98	6.12		0.41	-125.50	1013.75			168.50		14.80	12.10	6.05	6.05	2.43	0.45	2.70	8.75						4,347	377
	STD. DEV.	2.78			0.33	46.34	115.13			191.06		7.02	5.47	5.89	6.34	3.95	0.53	3.87	8.89						0	0
	MIN	14.20	5.30		0.10	-173.00	888.00			24.00		4.60	4.40	2.00	0.70	0.01	0.01	0.01	0.90						210	180
	MAX	20.90	6.47		0.86	-80.00	1166.00			450.00		20.30	16.00	14.80	14.00	8.30	1.10	8.30	16.60						90,000	790
BHS6-ST2b-T	n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	MEAN	17.03	6.55	397.50	0.22	-183.00	1069.00	12.25	9.25	23.50	128.75	15.67	15.65	3.18	12.48	0.02	0.01	0.02	12.50	6.73	2.93	106.75	8.71	10.88	3,903	3,647
	STD. DEV.	2.64		188.20	0.09	82.78	123.11	17.17	11.18	36.43	167.65	11.31	10.25	2.21	7.37	0.01	0.00	0.01	7.36	5.56	1.27	34.94	11.64	13.04	0	0
	MIN	13.60	6.20	320.00	0.16	-239.00	895.00	3.00	3.00	3.00	35.00	9.62	9.60	1.50	7.00	0.01	0.01	0.01	7.02	3.00	2.00	64.00	0.74	1.00	2,900	2,700
	MAX	19.50	6.88	480.00	0.34	-71.00	1216.00	38.00	26.00	78.00	380.00	31.01	31.00	6.00	25.00	0.04	0.01	0.04	25.01	15.00	4.70	140.00	26.00	30.00	5,800	5,200
BHS6-ST2b-P	n	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	MEAN	16.27	6.57	400.00	0.13	-181.00	1082.67	21.00	18.67	32.00	146.33	20.37	20.33	6.27	14.07	0.04	0.01	0.04	14.10	6.87	3.17	95.00	7.93	10.33	4,320	3,729
	STD. DEV.	2.25		88.88	0.01	95.27	166.06	18.08	16.62	21.38	167.72	15.31	15.31	6.76	8.61	0.03	0.00	0.03	8.61	6.18	1.26	33.60	8.21	9.32	0	0
	MIN	13.70	6.24	300.00	0.13	-237.00	897.00	2.00	1.00	15.00	49.00	11.01	11.00	1.50	8.70	0.01	0.01	0.01	8.76	3.00	2.00	63.00	1.00	1.40	1,800	1,800
	MAX	17.90	6.88	470.00	0.14	-71.00	1217.00	38.00	34.00	56.00	340.00	38.04	38.00	14.00	24.00	0.06	0.01	0.06	24.04	14.00	4.50	130.00	17.00	20.00	8,000	6,000

Notes:

¹Total Nitrogen (TN) is a calculated value equal to the sum of TKN and NO_x.²Organic Nitrogen (ON) is a calculated value equal to the difference of TKN and NH₃.³Total Inorganic Nitrogen (TIN) is a calculated value equal to the sum of NH₃ and NO_x.⁴Geometric mean provided rather than arithmetic mean.

5.0 B-HS5 Sample Event No. 3: Summary

5.1 Summary

The Sample Event No. 3 results indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality. The total nitrogen concentration of 62 mg/L is in the typical range of values typically reported for Florida single family residence STE.
- The Stage 1 biofilter samples DP1 and DP2 showed 99% and 85% reduction in ammonium concentration, respectively; effluent in the DP1 sample contained less than 0.4 mg/L ammonia-N and 45 mg/l NO_x-N. In contrast, the DP2 sample contained 8.7 mg/L ammonia-N and a NO_x-N concentration of approximately 36 mg/L.
- The Stage 2a biofilter lignocellulosic media produced partial denitrification with effluent NO_x-N concentration less than 4 mg/L.
- TKN and NH₃-N concentrations in Stage 2a biofilter effluent were approximately 4 mg/L and less than 0.7 mg/L, respectively.
- The Stage 1&2a effluent sample port (ST1&2a) between the Stage 1&2a combination tank outlet and the Stage 2b sulfur tank inlet, showed 97% reduction in ammonium concentration from STE. The effluent indicated partial denitrification evidenced by a NO_x-N concentration of 20 mg/L.
- The Stage 2b sulfur biofilter (ST2b) produced a highly reducing environment and effluent NO_x-N was less than the method detection limit of 0.02 mg N/L.
- The total nitrogen concentration in the final effluent from the total treatment system was 9.6 mg/L, of which 7 mg/L was NH₃-N, an approximately 84% reduction from STE.



Appendix A: Laboratory Report

PRELIMINARY

o:\44237-001\Wpdocs\Report\Draft

Hazen and Sawyer
10002 Princess Palm Ave, Suite 200
Tampa, FL 33619

June 2, 2014
Work Order: 1404340

Laboratory Report

Project Name		BHS6 SE#4						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS6-STE						
Matrix		Wastewater						
SAL Sample Number		1404340-01						
Date/Time Collected		05/07/14 11:16						
Collected by		Harmon Harden						
Date/Time Received		05/08/14 10:15						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	0.76	SM 4550SF	0.04	0.01		05/09/14 10:00	1
Ammonia as N	mg/L	57	EPA 350.1	2.0	0.47		05/20/14 11:58	50
Carbonaceous BOD	mg/L	69	SM 5210B	2	2	05/08/14 10:08	05/13/14 13:12	1
Chemical Oxygen Demand	mg/L	170	EPA 410.4	25	10		05/14/14 16:05	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/09/14 04:19	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/09/14 04:19	1
Orthophosphate as P	mg/L	5.3	EPA 300.0	0.040	0.010		05/09/14 04:19	1
Phosphorous - Total as P	mg/L	12	SM 4500P-E	0.80	0.20	05/28/14 15:49	05/30/14 11:56	20
Sulfate	mg/L	1.1	EPA 300.0	0.60	0.20		05/09/14 04:19	1
Sulfide	mg/L	2.0	SM 4500SF	0.40	0.10		05/13/14 11:26	1
Total Alkalinity	mg/L	470	SM 2320B	8.0	2.0		05/15/14 12:29	1
Total Kjeldahl Nitrogen	mg/L	62	EPA 351.2	4.2	1.0	05/28/14 10:57	05/30/14 11:51	20.83
Total Suspended Solids	mg/L	42	SM 2540D	1	1	05/09/14 09:48	05/12/14 17:30	1
Volatile Suspended Solids	mg/L	38	EPA 160.4	1	1	05/09/14 09:48	05/12/14 17:30	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		05/09/14 04:19	1
Sample Description		BHS6-DP01						
Matrix		Wastewater						
SAL Sample Number		1404340-02						
Date/Time Collected		05/07/14 11:40						
Collected by		Harmon Harden						
Date/Time Received		05/08/14 10:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.33	EPA 350.1	0.040	0.009		05/20/14 12:00	1
Carbonaceous BOD	mg/L	11	SM 5210B	2	2	05/09/14 10:43	05/14/14 08:26	1
Chemical Oxygen Demand	mg/L	23 I	EPA 410.4	25	10		05/14/14 16:05	1
Nitrate (as N)	mg/L	45	EPA 300.0	0.40	0.10		05/09/14 05:30	10
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/09/14 04:31	1
Total Alkalinity	mg/L	140	SM 2320B	8.0	2.0		05/15/14 12:35	1
Total Kjeldahl Nitrogen	mg/L	5.4	EPA 351.2	1.0	0.25	05/28/14 10:57	05/30/14 13:26	5
Nitrate+Nitrite (N)	mg/L	45	EPA 300.0	0.44	0.11		05/09/14 05:30	10

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Tampa, FL 33619

June 2, 2014
Work Order: 1404340

Laboratory Report

Project Name		BHS6 SE#4						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS6-DP02						
Matrix		Wastewater						
SAL Sample Number		1404340-03						
Date/Time Collected		05/07/14 11:36						
Collected by		Harmon Harden						
Date/Time Received		05/08/14 10:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	8.7	EPA 350.1	0.20	0.047		05/20/14 13:45	5
Carbonaceous BOD	mg/L	8	SM 5210B	2	2	05/09/14 10:43	05/14/14 08:26	1
Chemical Oxygen Demand	mg/L	35	EPA 410.4	25	10		05/14/14 16:05	1
Nitrate (as N)	mg/L	35	EPA 300.0	0.40	0.10		05/09/14 05:41	10
Nitrite (as N)	mg/L	0.56	EPA 300.0	0.04	0.01		05/09/14 04:42	1
Total Alkalinity	mg/L	190	SM 2320B	8.0	2.0		05/15/14 12:41	1
Total Kjeldahl Nitrogen	mg/L	13	EPA 351.2	1.0	0.25	05/28/14 10:57	05/30/14 13:27	5
Nitrate+Nitrite (N)	mg/L	35	EPA 300.0	0.44	0.11		05/09/14 05:41	10
Sample Description		BHS6-DP03						
Matrix		Wastewater						
SAL Sample Number		1404340-04						
Date/Time Collected		05/07/14 10:50						
Collected by		Harmon Harden						
Date/Time Received		05/08/14 10:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.50	EPA 350.1	0.040	0.009		05/20/14 12:04	1
Carbonaceous BOD	mg/L	41	SM 5210B	2	2	05/08/14 10:08	05/13/14 13:12	1
Chemical Oxygen Demand	mg/L	130	EPA 410.4	25	10		05/14/14 16:05	1
Nitrate (as N)	mg/L	2.5	EPA 300.0	0.04	0.01		05/09/14 04:53	1
Nitrite (as N)	mg/L	0.66	EPA 300.0	0.04	0.01		05/09/14 04:53	1
Total Alkalinity	mg/L	410	SM 2320B	8.0	2.0		05/15/14 12:56	1
Total Kjeldahl Nitrogen	mg/L	3.7	EPA 351.2	0.20	0.05	05/28/14 10:57	05/30/14 11:56	1
Total Suspended Solids	mg/L	10	SM 2540D	1	1	05/09/14 09:48	05/12/14 17:30	1
Volatile Suspended Solids	mg/L	9	EPA 160.4	1	1	05/09/14 09:48	05/12/14 17:30	1
Nitrate+Nitrite (N)	mg/L	3.2	EPA 300.0	0.08	0.02		05/09/14 04:53	1
Sample Description		BHS6-DP04						
Matrix		Wastewater						
SAL Sample Number		1404340-05						
Date/Time Collected		05/07/14 11:06						
Collected by		Harmon Harden						
Date/Time Received		05/08/14 10:15						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.70	EPA 350.1	0.040	0.009		05/20/14 12:06	1

Hazen and Sawyer
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Tampa, FL 33619

June 2, 2014
Work Order: 1404340

Laboratory Report

Project Name		BHS6 SE#4						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS6-DP04						
Matrix		Wastewater						
SAL Sample Number		1404340-05						
Date/Time Collected		05/07/14 11:06						
Collected by		Harmon Harden						
Date/Time Received		05/08/14 10:15						
Carbonaceous BOD	mg/L	100	SM 5210B	2	2	05/08/14 10:08	05/13/14 13:12	1
Chemical Oxygen Demand	mg/L	180	EPA 410.4	25	10		05/14/14 16:05	1
Nitrate (as N)	mg/L	0.19	EPA 300.0	0.04	0.01		05/09/14 05:05	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/09/14 05:05	1
Total Alkalinity	mg/L	480	SM 2320B	8.0	2.0		05/15/14 13:15	1
Total Kjeldahl Nitrogen	mg/L	4.4	EPA 351.2	0.20	0.05	05/28/14 10:57	05/30/14 11:58	1
Total Suspended Solids	mg/L	8	SM 2540D	1	1	05/09/14 09:48	05/12/14 17:30	1
Volatile Suspended Solids	mg/L	8	EPA 160.4	1	1	05/09/14 09:48	05/12/14 17:30	1
Nitrate+Nitrite (N)	mg/L	0.19	EPA 300.0	0.08	0.02		05/09/14 05:05	1
Sample Description		BHS6-ST1&2a						
Matrix		Wastewater						
SAL Sample Number		1404340-06						
Date/Time Collected		05/07/14 10:44						
Collected by		Harmon Harden						
Date/Time Received		05/08/14 10:15						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	0.17	SM 4550SF	0.04	0.01		05/09/14 10:00	1
Ammonia as N	mg/L	1.8	EPA 350.1	0.040	0.009		05/20/14 12:08	1
Carbonaceous BOD	mg/L	19	SM 5210B	2	2	05/08/14 10:08	05/13/14 13:12	1
Chemical Oxygen Demand	mg/L	64	EPA 410.4	25	10		05/14/14 16:05	1
Nitrate (as N)	mg/L	19	EPA 300.0	0.40	0.10		05/09/14 05:53	10
Nitrite (as N)	mg/L	1.1	EPA 300.0	0.04	0.01		05/09/14 05:16	1
Orthophosphate as P	mg/L	1.4	EPA 300.0	0.040	0.010		05/09/14 05:16	1
Phosphorous - Total as P	mg/L	4.6	SM 4500P-E	0.080	0.020	05/28/14 15:49	05/30/14 11:57	2
Sulfate	mg/L	17	EPA 300.0	0.60	0.20		05/09/14 05:16	1
Sulfide	mg/L	0.20 I	SM 4500SF	0.40	0.10		05/13/14 11:26	1
Total Alkalinity	mg/L	260	SM 2320B	8.0	2.0		05/15/14 13:23	1
Total Kjeldahl Nitrogen	mg/L	5.1	EPA 351.2	1.0	0.25	05/28/14 10:57	05/30/14 14:48	5
Total Suspended Solids	mg/L	10	SM 2540D	1	1	05/09/14 09:48	05/12/14 17:30	1
Volatile Suspended Solids	mg/L	10	EPA 160.4	1	1	05/09/14 09:48	05/12/14 17:30	1
Nitrate+Nitrite (N)	mg/L	20	EPA 300.0	0.44	0.11		05/09/14 05:53	10

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June 2, 2014
Work Order: 1404340

Laboratory Report

Project Name		BHS6 SE#4						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS6-ST1&2a-DUP						
Matrix		Wastewater						
SAL Sample Number		1404340-07						
Date/Time Collected		05/07/14 10:45						
Collected by		Harmon Harden						
Date/Time Received		05/08/14 10:15						
Inorganics								
Hydrogen Sulfide (Unionized)	mg/L	0.17	SM 4550SF	0.04	0.01		05/09/14 10:00	1
Ammonia as N	mg/L	1.7	EPA 350.1	0.040	0.009		05/20/14 15:09	1
Carbonaceous BOD	mg/L	20	SM 5210B	2	2	05/08/14 10:08	05/13/14 13:12	1
Chemical Oxygen Demand	mg/L	70	EPA 410.4	25	10	05/19/14 14:03	05/19/14 14:11	1
Nitrate (as N)	mg/L	19	EPA 300.0	0.40	0.10		05/09/14 06:04	10
Nitrite (as N)	mg/L	1.1	EPA 300.0	0.04	0.01		05/09/14 05:27	1
Orthophosphate as P	mg/L	1.5	EPA 300.0	0.040	0.010		05/09/14 05:27	1
Phosphorous - Total as P	mg/L	4.2	SM 4500P-E	0.080	0.020	05/28/14 15:49	05/30/14 11:58	2
Sulfate	mg/L	17	EPA 300.0	0.60	0.20		05/09/14 05:27	1
Sulfide	mg/L	0.20 I	SM 4500SF	0.40	0.10		05/13/14 11:26	1
Total Alkalinity	mg/L	280	SM 2320B	8.0	2.0		05/15/14 13:39	1
Total Kjeldahl Nitrogen	mg/L	5.3	EPA 351.2	1.0	0.25	05/28/14 10:57	05/30/14 13:29	5
Total Suspended Solids	mg/L	10	SM 2540D	1	1	05/09/14 09:48	05/12/14 17:30	1
Volatile Suspended Solids	mg/L	9	EPA 160.4	1	1	05/09/14 09:48	05/12/14 17:30	1
Nitrate+Nitrite (N)	mg/L	20	EPA 300.0	0.44	0.11		05/09/14 06:04	10
Sample Description		BHS6-ST2b-T						
Matrix		Wastewater						
SAL Sample Number		1404340-08						
Date/Time Collected		05/07/14 10:12						
Collected by		Harmon Harden						
Date/Time Received		05/08/14 10:15						
Inorganics								
Hydrogen Sulfide (Unionized)	mg/L	3.6	SM 4550SF	0.04	0.01		05/09/14 10:00	1
Ammonia as N	mg/L	7.0	EPA 350.1	0.20	0.047		05/21/14 06:24	5
Carbonaceous BOD	mg/L	9	SM 5210B	2	2	05/08/14 10:08	05/13/14 13:12	1
Chemical Oxygen Demand	mg/L	50	EPA 410.4	25	10		05/14/14 16:05	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/09/14 05:39	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/09/14 05:39	1
Orthophosphate as P	mg/L	2.0	EPA 300.0	0.040	0.010		05/09/14 05:39	1
Phosphorous - Total as P	mg/L	4.7	SM 4500P-E	0.040	0.010	05/28/14 15:49	05/30/14 11:59	1
Sulfate	mg/L	140	EPA 300.0	6.0	2.0		05/10/14 06:15	10
Sulfide	mg/L	4.8	SM 4500SF	0.40	0.10		05/13/14 11:26	1
Total Alkalinity	mg/L	360	SM 2320B	8.0	2.0		05/15/14 13:49	1
Total Kjeldahl Nitrogen	mg/L	9.6	EPA 351.2	1.0	0.25	05/28/14 10:57	05/30/14 13:31	5
Total Suspended Solids	mg/L	4	SM 2540D	1	1	05/09/14 09:48	05/12/14 17:30	1

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June 2, 2014
Work Order: 1404340

Laboratory Report

Project Name		BHS6 SE#4						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS6-ST2b-T						
Matrix		Wastewater						
SAL Sample Number		1404340-08						
Date/Time Collected		05/07/14 10:12						
Collected by		Harmon Harden						
Date/Time Received		05/08/14 10:15						
Volatile Suspended Solids	mg/L	4	EPA 160.4	1	1	05/09/14 09:48	05/12/14 17:30	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		05/09/14 05:39	1
Sample Description		BHS6-EB						
Matrix		Reagent Water						
SAL Sample Number		1404340-09						
Date/Time Collected		05/07/14 11:28						
Collected by		Harmon Harden						
Date/Time Received		05/08/14 10:15						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	0.01 U	SM 4550SF	0.04	0.01		05/09/14 10:00	1
Ammonia as N	mg/L	0.009 U	EPA 350.1	0.040	0.009		05/21/14 07:30	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	05/08/14 10:08	05/13/14 13:12	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10		05/14/14 16:05	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/09/14 10:27	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/09/14 10:27	1
Orthophosphate as P	mg/L	0.010 U	EPA 300.0	0.040	0.010		05/09/14 10:27	1
Phosphorous - Total as P	mg/L	0.010 U	SM 4500P-E	0.040	0.010	05/28/14 15:49	05/30/14 12:00	1
Sulfate	mg/L	1.3	EPA 300.0	0.60	0.20		05/09/14 10:27	1
Sulfide	mg/L	0.10 U	SM 4500SF	0.40	0.10		05/13/14 11:26	1
Total Alkalinity	mg/L	2.0 U	SM 2320B	8.0	2.0		05/15/14 15:29	1
Total Kjeldahl Nitrogen	mg/L	0.05 U	EPA 351.2	0.20	0.05	05/28/14 15:49	05/30/14 12:00	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	05/09/14 09:48	05/12/14 17:30	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	05/09/14 09:48	05/12/14 17:30	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		05/09/14 10:27	1

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June 2, 2014
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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE40812 - BOD										
Blank (BE40812-BLK1)					Prepared: 05/08/14 Analyzed: 05/13/14 13:12					
Carbonaceous BOD	2 U	2	2	mg/L						
Blank (BE40812-BLK2)					Prepared: 05/08/14 Analyzed: 05/13/14 13:12					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BE40812-BS1)					Prepared: 05/08/14 Analyzed: 05/13/14 13:12					
Carbonaceous BOD	184	2	2	mg/L	200		92	85-115		
LCS (BE40812-BS2)					Prepared: 05/08/14 Analyzed: 05/13/14 13:12					
Carbonaceous BOD	187	2	2	mg/L	200		93	85-115		
LCS Dup (BE40812-BSD1)					Prepared: 05/08/14 Analyzed: 05/13/14 13:12					
Carbonaceous BOD	185	2	2	mg/L	200		93	85-115	0.8	200
LCS Dup (BE40812-BSD2)					Prepared: 05/08/14 Analyzed: 05/13/14 13:12					
Carbonaceous BOD	189	2	2	mg/L	200		95	85-115	1	200
Duplicate (BE40812-DUP1)					Source: 1404585-01 Prepared: 05/08/14 Analyzed: 05/13/14 13:12					
Carbonaceous BOD	130	2	2	mg/L		120			1	25
Duplicate (BE40812-DUP2)					Source: 1404640-01 Prepared: 05/08/14 Analyzed: 05/13/14 13:12					
Carbonaceous BOD	34	2	2	mg/L		39			13	25
Batch BE40816 - Ion Chromatography 300.0 Prep										
Blank (BE40816-BLK1)					Prepared & Analyzed: 05/09/14 03:46					
Nitrate (as N)	0.01 U	0.04	0.01	mg/L						
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
Orthophosphate as P	0.010 U	0.040	0.010	mg/L						
Sulfate	0.20 U	0.60	0.20	mg/L						
Surrogate: Dichloroacetate	0.914			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.914			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.914			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.914			mg/L	1.0		91	90-115		

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June 2, 2014

Work Order: 1404340

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE40816 - Ion Chromatography 300.0 Prep										
LCS (BE40816-BS1)					Prepared & Analyzed: 05/09/14 03:57					
Orthophosphate as P	0.847	0.040	0.010	mg/L	0.90		94	85-115		
Sulfate	9.19	0.60	0.20	mg/L	9.0		102	85-115		
Nitrate (as N)	1.85	0.04	0.01	mg/L	1.7		109	85-115		
Nitrite (as N)	1.44	0.04	0.01	mg/L	1.4		103	85-115		
Surrogate: Dichloroacetate	1.06			mg/L	1.0		106	90-115		
Surrogate: Dichloroacetate	1.06			mg/L	1.0		106	90-115		
Surrogate: Dichloroacetate	1.06			mg/L	1.0		106	90-115		
Surrogate: Dichloroacetate	1.06			mg/L	1.0		106	90-115		
LCS Dup (BE40816-BSD1)					Prepared & Analyzed: 05/09/14 04:08					
Sulfate	9.30	0.60	0.20	mg/L	9.0		103	85-115	1	200
Orthophosphate as P	0.857	0.040	0.010	mg/L	0.90		95	85-115	1	200
Nitrite (as N)	1.45	0.04	0.01	mg/L	1.4		104	85-115	0.3	200
Nitrate (as N)	1.85	0.04	0.01	mg/L	1.7		109	85-115	0.05	200
Surrogate: Dichloroacetate	1.11			mg/L	1.0		111	90-115		
Surrogate: Dichloroacetate	1.11			mg/L	1.0		111	90-115		
Surrogate: Dichloroacetate	1.11			mg/L	1.0		111	90-115		
Surrogate: Dichloroacetate	1.11			mg/L	1.0		111	90-115		
Matrix Spike (BE40816-MS1)					Source: 1404340-08		Prepared & Analyzed: 05/09/14 05:50			
Nitrite (as N)	1.41	0.04	0.01	mg/L	1.4	ND	101	85-115		
Orthophosphate as P	2.84	0.040	0.010	mg/L	0.90	1.96	98	85-115		
Nitrate (as N)	1.66	0.04	0.01	mg/L	1.7	ND	97	85-115		
Sulfate	90.0 L	0.60	0.20	mg/L	9.0	139	NR	85-115		
Surrogate: Dichloroacetate	0.912			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.912			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.912			mg/L	1.0		91	90-115		
Surrogate: Dichloroacetate	0.912			mg/L	1.0		91	90-115		

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June 2, 2014

Work Order: 1404340

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE40827 - Ion Chromatography 300.0 Prep										
Blank (BE40827-BLK1)					Prepared & Analyzed: 05/10/14 02:06					
Nitrate (as N)	0.01 U	0.04	0.01	mg/L						
Sulfate	0.20 U	0.60	0.20	mg/L						
Surrogate: Dichloroacetate	0.923			mg/L	1.0		92	90-115		
Surrogate: Dichloroacetate	0.923			mg/L	1.0		92	90-115		
LCS (BE40827-BS1)					Prepared & Analyzed: 05/10/14 02:17					
Sulfate	9.34	0.60	0.20	mg/L	9.0		104	85-115		
Nitrate (as N)	1.91	0.04	0.01	mg/L	1.7		112	85-115		
Surrogate: Dichloroacetate	1.15			mg/L	1.0		115	90-115		
Surrogate: Dichloroacetate	1.15			mg/L	1.0		115	90-115		
LCS Dup (BE40827-BSD1)					Prepared & Analyzed: 05/10/14 02:29					
Nitrate (as N)	1.90	0.04	0.01	mg/L	1.7		112	85-115	0.1	200
Sulfate	9.41	0.60	0.20	mg/L	9.0		105	85-115	0.7	200
Surrogate: Dichloroacetate	1.14			mg/L	1.0		114	90-115		
Surrogate: Dichloroacetate	1.14			mg/L	1.0		114	90-115		
Matrix Spike (BE40827-MS1)					Source: 1404447-28		Prepared & Analyzed: 05/10/14 03:37			
Nitrate (as N)	1.90	0.04	0.01	mg/L	1.7	0.225	99	85-115		
Sulfate	12.8	0.60	0.20	mg/L	9.0	4.05	98	85-115		
Surrogate: Dichloroacetate	1.12			mg/L	1.0		112	90-115		
Surrogate: Dichloroacetate	1.12			mg/L	1.0		112	90-115		
Matrix Spike (BE40827-MS2)					Source: 1404795-01		Prepared & Analyzed: 05/10/14 05:19			
Sulfate	12.7	0.60	0.20	mg/L	9.0	4.15	95	85-115		
Nitrate (as N)	6.86	0.04	0.01	mg/L	1.7	4.95	112	85-115		
Surrogate: Dichloroacetate	0.934			mg/L	1.0		93	90-115		
Surrogate: Dichloroacetate	0.934			mg/L	1.0		93	90-115		

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June 2, 2014
Work Order: 1404340

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE40910 - BOD										
Blank (BE40910-BLK1)					Prepared: 05/09/14 Analyzed: 05/14/14 08:26					
Carbonaceous BOD	2 U	2	2	mg/L						
Blank (BE40910-BLK2)					Prepared: 05/09/14 Analyzed: 05/14/14 08:26					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BE40910-BS1)					Prepared: 05/09/14 Analyzed: 05/14/14 08:26					
Carbonaceous BOD	213	2	2	mg/L	200		107	85-115		
LCS (BE40910-BS2)					Prepared: 05/09/14 Analyzed: 05/14/14 08:26					
Carbonaceous BOD	186	2	2	mg/L	200		93	85-115		
LCS Dup (BE40910-BSD1)					Prepared: 05/09/14 Analyzed: 05/14/14 08:26					
Carbonaceous BOD	184	2	2	mg/L	200		92	85-115	15	200
LCS Dup (BE40910-BSD2)					Prepared: 05/09/14 Analyzed: 05/14/14 08:26					
Carbonaceous BOD	180	2	2	mg/L	200		90	85-115	3	200
Duplicate (BE40910-DUP1)					Source: 1404803-01 Prepared: 05/09/14 Analyzed: 05/14/14 08:26					
Carbonaceous BOD	140	2	2	mg/L		130			6	25
Duplicate (BE40910-DUP2)					Source: 1404849-01 Prepared: 05/09/14 Analyzed: 05/14/14 08:26					
Carbonaceous BOD	330	2	2	mg/L		330			1	25
Batch BE40923 - Sulfide prep										
Blank (BE40923-BLK1)					Prepared & Analyzed: 05/13/14 11:26					
Sulfide	0.10 U	0.40	0.10	mg/L						

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE40923 - Sulfide prep										
LCS (BE40923-BS1)					Prepared & Analyzed: 05/13/14 11:26					
Sulfide	4.82	0.40	0.10	mg/L	5.0		96	85-115		
Matrix Spike (BE40923-MS1)					Source: 1404340-09 Prepared & Analyzed: 05/13/14 11:26					
Sulfide	4.82	0.40	0.10	mg/L	5.0	ND	96	85-115		
Matrix Spike Dup (BE40923-MSD1)					Source: 1404340-09 Prepared & Analyzed: 05/13/14 11:26					
Sulfide	4.62	0.40	0.10	mg/L	5.0	ND	92	85-115	4	14
Batch BE41316 - TSS prep										
Blank (BE41316-BLK1)					Prepared: 05/09/14 Analyzed: 05/12/14 17:30					
Volatile Suspended Solids	1 U	1		mg/L						
Total Suspended Solids	1 U	1	1	mg/L						
Blank (BE41316-BLK2)					Prepared: 05/09/14 Analyzed: 05/12/14 17:30					
Volatile Suspended Solids	1 U	1		mg/L						
Total Suspended Solids	1 U	1	1	mg/L						
LCS (BE41316-BS1)					Prepared: 05/09/14 Analyzed: 05/12/14 17:30					
Total Suspended Solids	50.5	1	1	mg/L	50		101	85-115		
LCS (BE41316-BS2)					Prepared: 05/09/14 Analyzed: 05/12/14 17:30					
Total Suspended Solids	48.5	1	1	mg/L	50		97	85-115		
Duplicate (BE41316-DUP1)					Source: 1404340-01 Prepared: 05/09/14 Analyzed: 05/12/14 17:30					
Volatile Suspended Solids	40.0	1		mg/L		38.0			5	20
Total Suspended Solids	46.0	1	1	mg/L		42.0			9	30

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Work Order: 1404340

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE41316 - TSS prep										
Duplicate (BE41316-DUP2)		Source: 1404522-03			Prepared: 05/09/14 Analyzed: 05/12/14 17:30					
Volatile Suspended Solids	1,960	1		mg/L		1960			0.4	20
Total Suspended Solids	2,310	1	1	mg/L		2300			0.4	30
Batch BE41435 - alkalinity										
Blank (BE41435-BLK1)		Prepared & Analyzed: 05/15/14 11:56								
Total Alkalinity	2.0 U	8.0	2.0	mg/L						
LCS (BE41435-BS1)		Prepared & Analyzed: 05/15/14 12:02								
Total Alkalinity	120	8.0	2.0	mg/L	120		100	90-110		
Matrix Spike (BE41435-MS1)		Source: 1404604-01			Prepared & Analyzed: 05/15/14 15:09					
Total Alkalinity	270	8.0	2.0	mg/L	120	150	98	80-120		
Matrix Spike Dup (BE41435-MSD1)		Source: 1404604-01			Prepared & Analyzed: 05/15/14 15:18					
Total Alkalinity	280	8.0	2.0	mg/L	120	150	103	80-120	2	26
Batch BE41449 - COD prep										
Blank (BE41449-BLK1)		Prepared & Analyzed: 05/14/14 16:05								
Chemical Oxygen Demand	10 U	25	10	mg/L						
LCS (BE41449-BS1)		Prepared & Analyzed: 05/14/14 16:05								
Chemical Oxygen Demand	50	25	10	mg/L	50		100	90-110		
Matrix Spike (BE41449-MS1)		Source: 1404340-09			Prepared & Analyzed: 05/14/14 16:05					
Chemical Oxygen Demand	50	25	10	mg/L	50	ND	100	85-115		

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Tampa, FL 33619

June 2, 2014
Work Order: 1404340

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE41449 - COD prep										
Matrix Spike Dup (BE41449-MSD1)		Source: 1404340-09			Prepared & Analyzed: 05/14/14 16:05					
Chemical Oxygen Demand	50	25	10	mg/L	50	ND	100	85-115	0	32
Batch BE41934 - COD prep										
Blank (BE41934-BLK1)				Prepared & Analyzed: 05/19/14 14:11						
Chemical Oxygen Demand	10 U	25	10	mg/L						
LCS (BE41934-BS1)				Prepared & Analyzed: 05/19/14 14:11						
Chemical Oxygen Demand	50	25	10	mg/L	50		100	90-110		
Matrix Spike (BE41934-MS1)		Source: 1404393-01			Prepared & Analyzed: 05/19/14 14:11					
Chemical Oxygen Demand	60	25	10	mg/L	50	10	100	85-115		
Matrix Spike Dup (BE41934-MSD1)		Source: 1404393-01			Prepared & Analyzed: 05/19/14 14:11					
Chemical Oxygen Demand	56	25	10	mg/L	50	10	92	85-115	7	32
Batch BE42004 - Ammonia by SEAL										
Blank (BE42004-BLK1)				Prepared & Analyzed: 05/20/14 11:50						
Ammonia as N	0.009 U	0.040	0.009	mg/L						
LCS (BE42004-BS1)				Prepared & Analyzed: 05/20/14 11:52						
Ammonia as N	0.53	0.040	0.009	mg/L	0.50		105	90-110		
Matrix Spike (BE42004-MS1)		Source: 1404849-07			Prepared & Analyzed: 05/20/14 14:10					
Ammonia as N	0.54	0.040	0.009	mg/L	0.50	0.077	93	90-110		

Hazen and Sawyer
 10002 Princess Palm Ave, Suite 200
 Tampa, FL 33619

June 2, 2014
 Work Order: 1404340

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE42004 - Ammonia by SEAL										
Matrix Spike (BE42004-MS2)		Source: 1404912-07			Prepared & Analyzed: 05/20/14 12:19					
Ammonia as N	0.61	0.040	0.009	mg/L	0.50	0.080	105	90-110		
Matrix Spike Dup (BE42004-MSD1)		Source: 1404849-07			Prepared & Analyzed: 05/20/14 11:56					
Ammonia as N	0.53	0.040	0.009	mg/L	0.50	0.077	91	90-110	2	10
Matrix Spike Dup (BE42004-MSD2)		Source: 1404912-07			Prepared & Analyzed: 05/20/14 12:21					
Ammonia as N	0.62	0.040	0.009	mg/L	0.50	0.080	108	90-110	2	10
Batch BE42018 - Ammonia by SEAL										
Blank (BE42018-BLK1)		Prepared & Analyzed: 05/20/14 15:01								
Ammonia as N	0.009 U	0.040	0.009	mg/L						
LCS (BE42018-BS1)		Prepared & Analyzed: 05/20/14 15:03								
Ammonia as N	0.53	0.040	0.009	mg/L	0.50		105	90-110		
Matrix Spike (BE42018-MS1)		Source: 1404340-09			Prepared & Analyzed: 05/20/14 15:05					
Ammonia as N	0.51	0.040	0.009	mg/L	0.50	ND	102	90-110		
Matrix Spike (BE42018-MS2)		Source: 1405046-07			Prepared & Analyzed: 05/20/14 15:29					
Ammonia as N	0.54	0.040	0.009	mg/L	0.50	0.057	97	90-110		
Matrix Spike Dup (BE42018-MSD1)		Source: 1404340-09			Prepared & Analyzed: 05/20/14 15:07					
Ammonia as N	0.54	0.040	0.009	mg/L	0.50	ND	107	90-110	4	10
Matrix Spike Dup (BE42018-MSD2)		Source: 1405046-07			Prepared & Analyzed: 05/20/14 15:31					
Ammonia as N	0.55	0.040	0.009	mg/L	0.50	0.057	99	90-110	2	10

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218



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Tampa, FL 33619

June 2, 2014
Work Order: 1404340

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE42804 - Digestion for TP and TKN										
Blank (BE42804-BLK1)					Prepared: 05/28/14 Analyzed: 05/30/14 13:55					
Total Kjeldahl Nitrogen	0.05 U	0.20	0.05	mg/L						
LCS (BE42804-BS1)					Prepared: 05/28/14 Analyzed: 05/30/14 11:46					
Total Kjeldahl Nitrogen	1.10	0.20	0.05	mg/L	1.0		110	90-110		
Matrix Spike (BE42804-MS1)					Source: 1404801-01 Prepared: 05/28/14 Analyzed: 05/30/14 15:31					
Total Kjeldahl Nitrogen	2.34	0.20	0.05	mg/L	1.0	1.39	94	90-110		
Matrix Spike (BE42804-MS2)					Source: 1404801-06 Prepared: 05/28/14 Analyzed: 05/30/14 16:13					
Total Kjeldahl Nitrogen	2.04	0.20	0.05	mg/L	1.0	1.06	98	90-110		
Matrix Spike Dup (BE42804-MSD1)					Source: 1404801-01 Prepared: 05/28/14 Analyzed: 05/30/14 14:47					
Total Kjeldahl Nitrogen	2.40	0.20	0.05	mg/L	1.0	1.39	101	90-110	3	20
Matrix Spike Dup (BE42804-MSD2)					Source: 1404801-06 Prepared: 05/28/14 Analyzed: 05/30/14 15:33					
Total Kjeldahl Nitrogen	1.98	0.20	0.05	mg/L	1.0	1.06	92	90-110	3	20
Batch BE42826 - Digestion for TP and TKN										
Blank (BE42826-BLK1)					Prepared: 05/28/14 Analyzed: 05/30/14 11:52					
Phosphorous - Total as P	0.010 U	0.040	0.010	mg/L						
Total Kjeldahl Nitrogen	0.05 U	0.20	0.05	mg/L						
LCS (BE42826-BS1)					Prepared: 05/28/14 Analyzed: 05/30/14 11:53					
Total Kjeldahl Nitrogen	1.01	0.20	0.05	mg/L	1.0		101	90-110		
Phosphorous - Total as P	0.543	0.040	0.010	mg/L	0.50		109	90-110		

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Tampa, FL 33619

June 2, 2014
Work Order: 1404340

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE42826 - Digestion for TP and TKN										
Matrix Spike (BE42826-MS1)		Source: 1404340-09			Prepared: 05/28/14 Analyzed: 05/30/14 11:54					
Phosphorous - Total as P	0.515	0.040	0.010	mg/L	0.50	ND	103	90-110		
Total Kjeldahl Nitrogen	1.05	0.20	0.05	mg/L	1.0	ND	105	90-110		
Matrix Spike (BE42826-MS2)		Source: 1405104-07			Prepared: 05/28/14 Analyzed: 05/30/14 12:06					
Phosphorous - Total as P	0.543	0.040	0.010	mg/L	0.50	0.0639	96	90-110		
Total Kjeldahl Nitrogen	1.53	0.20	0.05	mg/L	1.0	0.588	94	90-110		
Matrix Spike Dup (BE42826-MSD1)		Source: 1404340-09			Prepared: 05/28/14 Analyzed: 05/30/14 11:55					
Phosphorous - Total as P	0.489	0.040	0.010	mg/L	0.50	ND	98	90-110	5	25
Total Kjeldahl Nitrogen	1.06	0.20	0.05	mg/L	1.0	ND	106	90-110	1	20
Matrix Spike Dup (BE42826-MSD2)		Source: 1405104-07			Prepared: 05/28/14 Analyzed: 05/30/14 12:07					
Total Kjeldahl Nitrogen	1.54	0.20	0.05	mg/L	1.0	0.588	95	90-110	0.7	20
Phosphorous - Total as P	0.521	0.040	0.010	mg/L	0.50	0.0639	91	90-110	4	25

Hazen and Sawyer

10002 Princess Palm Ave, Suite 200

Tampa, FL 33619

June 2, 2014

Work Order: 1404340

*** Qualifiers, Notes and Definitions**

Results followed by a "U" indicate that the sample was analyzed but the compound was not detected. Results followed by "I" indicate that the reported value is between the laboratory method detection limits and the laboratory practical quantitation limit.

A statement of estimated uncertainty of test results is available upon request.

For methods marked with **, all QC criteria have been met for this method which is equivalent to a SAL certified method.

Test results in this report meet all the requirements of the NELAC standards. Any applicable qualifiers are shown below.

L Off-scale high. Result exceeded highest calibration standard.

Questions regarding this report should be directed to :

Kathryn Nordmark

Telephone (813) 855-1844 FAX (813) 855-2218

Kathryn@southernanalyticalabs.com



SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No.

1404340

Client Name Hazen and Sawyer										Contact / Phone:									
Project Name / Location BHS6 SE#4																			
Samplers: (Signature) <i>[Signature]</i>										PARAMETER / CONTAINER DESCRIPTION									
Matrix Codes: DW-Drinking Water WW-Wastewater SW-Surface Water SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water		Date	Time	Matrix	Composite	Grab	500mLP, Cool Total Alkalinity, TSS, VSS, CBOD, NOx, OP, SO ₄	125mLP, H ₂ SO ₄ COD, TKN, NH ₃ , TP	500mLP, NaOH & Zn Acetate H ₂ S	125mLP, Cool Total Alkalinity, TSS, VSS, CBOD, NOx	125mLP, H ₂ SO ₄ COD, TKN, NH ₃	500mLP, Cool Total Alkalinity, TSS, VSS, CBOD, NOx	Field pH	Field Temperature	Field Conductivity	Field DO	No. of Containers (Total per each location)		
Sample Description																			
01	BHS6-STE	5/7	11:16	WW		X	2	1	1				7.25	20.6	1086	.04			
02	BHS6-DP01	5/7	11:40	WW		X				1	1								
03	BHS6-DP02	5/7	11:36	WW		X				1	1								
04	BHS6-DP03	5/7	10:56	WW		X					1	2	6.33	20.9	884	.49			
05	BHS6-DP04	5/7	11:06	WW		X					1	2	6.34	21.0	992	.09			
06	BHS6-ST1&2a	5/7	10:44	WW		X	2	1	1				6.25	21.2	849	.23			
07	BHS6-ST1&2a-DUP	5/7	10:45	WW		X	2	1	1				6.25	21.1	852	.21			
08	BHS6-ST2b-T	5/7	10:12	WW		X	2	1	1				6.54	19.5	1031	.16			
09	BHS6-EB	5/7	11:28	WW		X	2	1	1				5.55	23.1	2.6	6.26			
Containers Prepared/ Relinquished: <i>[Signature]</i>		Date/Time: 5/5/14	Received: <i>[Signature]</i>		Date/Time: 5/5/14 14:00	Seal intact?		<input type="radio"/> N <input checked="" type="radio"/> NA		Instructions / Remarks: Ship to: Harmon Harden 1825 Cottage Grove Rd. Tallahassee, FL 32303 850-212-4378 1404340									
Relinquished: <i>[Signature]</i>		Date/Time: 5/7/14	Received: <i>[Signature]</i>		Date/Time:	Samples intact upon arrival?		<input type="radio"/> N <input checked="" type="radio"/> NA											
Relinquished: <i>[Signature]</i>		Date/Time:	Received: <i>[Signature]</i>		Date/Time: 5-5-14 10:15	Received on ice? Temp. 46		<input type="radio"/> N <input checked="" type="radio"/> NA											
Relinquished:		Date/Time:	Received:		Date/Time:	Proper preservatives indicated?		<input checked="" type="radio"/> N <input type="radio"/> NA											
Relinquished:		Date/Time:	Received:		Date/Time:	Rec'd within holding time?		<input checked="" type="radio"/> N <input type="radio"/> NA											
Relinquished:		Date/Time:	Received:		Date/Time:	Volatiles rec'd w/out headspace?		Y <input type="radio"/> N <input checked="" type="radio"/>											
Relinquished:		Date/Time:	Received:		Date/Time:	Proper containers used?		<input checked="" type="radio"/> N <input type="radio"/> NA											

REPORT OF MICROBIOLOGICAL ANALYSIS

Hazen and Sawyer, P.C.
 Attn: Josefin Edeback-Hirst, PE
 10002 Princess Palm Avenue
 Suite 200
 Tampa, FL 33619

Report #: 24430
 Report Date: May 12, 2014
 NELAC#: E81350
 FDEPQA#: 920087G
 Project#: 211296
 Sampled By: Mark Busby
 Sample Site: [REDACTED] Drive Septic System
 Sample Date: 05-07-14

Table 1. Samples received 05-07-14.

Units:	Fecal Coliform # colonies/100 mL	Dilution Factor	<i>E. coli</i> # colonies/100 mL	Dilution Factor
Methodology:	SM 9222D		EPA 1603	
Detection Limit:	2.0		2.0	
Analysis Date:	05-07-14		05-07-14	
Analysis Time:	13:50		13:50	
Analyst:	AL		AL	
Sample Location/Time:				
Lab Number:				
ST2, 10:12				
#122487	2,900	100	2,800	100
ST1, 10:44				
#122488	14,000	1,000	10,000	1,000
ST1 Dup, 10:45				
#122489	11,000	1,000	11,000	1,000
DP3, 10:56				
#122490	2,700	100	2,100	100
DP4, 11:06				
#122491	210	10	180	10
STE, 11:16				
#122492	250,000	10,000	64,000	1,000
Rinse Blank, 11:28				
#122493	2.0 U	2	2.0 U	2

Data Qualifiers that may apply:

U = Analyte was not detected and the indicated value is the detection limit.

B = Colony count exceeded the ideal of 20-60 (fecal coliform) or 20-80 (*E. coli*) colonies per plate.

Data Release Authorization:

Sample integrity and reliability certified by lab personnel prior to analysis. All quality assurance samples met quality control limits unless otherwise specified. The reported analytical results relate only to the sample submitted. This report shall not be reproduced, except in full, without the written approval of Ackuritlabs. Please contact the undersigned at the above phone number with any questions regarding this report.

Amanda Lawhon 5-12-14
 Amanda Lawhon, QA Officer

3345 N. Monroe Street, Tallahassee, FL 32303 • Telephone (850) 562-7751

CHAIN OF CUSTODY RECORD

Page 1 of 1

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Appendix B: Operation & Maintenance Log

Table B.1
Operation and Maintenance Log

Date	Description
9/12/2013	Checked system. Met with contractor regarding second system construction.
11/5/2013	Started installation of second passive treatment system.
11/6/2013	Finished installation
11/14/2013	High water alarm in pump tank. Pump was not working.
	Contractor repaired loose wiring. Pump had not run from time of installation.
	Cleaned two Stage 1 sprayers clogged with construction debris.
11/20/2013	Preliminary Sample Event No. 1 (STE and ST1).
	No ponding in drainfield observation ports.
	Cleaned all four Stage 1 sprayers - not clogged but were not spraying properly.
12/4/2013	Preliminary Sample Event No. 2
	Ponding of 1.5 inches in drainfield obs. port #2, other three ports were dry.
12/20/2013	Preliminary sampling indicated nitrification was insufficient
	Checked and cleaned Stage 1 sprayers.
	Even after cleaning, majority of spray going straight down.
12/21/2013	Rotated Stage 1 sprayers so they are spraying straight up on the tank lid.
	Observed better coverage of Stage 1 media
1/9/2014	Site visit. System ok. Observed that vents on Stage 1 tank were pushed down.
	Vents were pulled back up and resealed with existing mastic.
1/22/2014	Sample Event No. 1
3/7/2014	Site visit. System ok. Observed one of the sprayers had a broken tip.
	Ponding of ¼ inch in observation port #2, all others dry.
3/20/2014	Removed existing sprayers. Installed 3 Orenco sprayers.
3/24/2014	Site visit. System ok. Ponding of 1/4 inch in observation port #2, all others dry.
	Sprayers working well.
4/10/2014	Sample Event No. 2
	Water level within Stage 1&2a tank elevated approximately 14-inches.
4/10/2014	Installed piezometer in the Stage 1&2a tank.
4/14/2014	Attempt to clear clog in the inlet pipe to Stage 2b tank with plumbing snake.
4/16/2014	Cleared clog in inlet pipe to Stage 2b tank with compressed air and rubber bladder.
	Water level in piezometer in Stage 1&2a tank dropped by approximately 12 inches.
4/28/2014	System Check. Ponding of 1/4 inch in observation port #2, all others dry.
	Sprayers working well. Water level in ST1 sample port elevated by less than 2 inches.
5/7/2014	Sample Event No. 3.
	Water level in ST1 sample port elevated by approximately 4 inches.

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Appendix C: Vericomm PLC Data

System Status			7-May-14	3-May-14	28-Apr-14	14-Apr-14
Point	Description	Status	Value	Value	Value	Value
1	Alarm Status	Automatic	OK	OK	OK	OK
2	Alert Status	Automatic	OK	OK	OK	OK
3	System Mode	Automatic	Normal	Normal	Normal	Normal
5	Timer Mode	Automatic	Normal	Normal	Normal	Normal
6	Active Off Time	Automatic	180.0 Minutes	180.0 Minutes	180.0 Minutes	240.0 Minutes
7	Active On Time	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
9	Pump Mode	Automatic	OffCycl	OffCycl	OffCycl	OffCycl
10	Pump Status	Automatic	Off	Off	Off	Off
12	Pump Cycles Today	Automatic	4.0 Cycles	10.0 Cycles	4.0 Cycles	5.0 Cycles
13	Override Cycles Today	Automatic	0.0 Cycles	3.0 Cycles	0.0 Cycles	0.0 Cycles
14	Pump Run Time Today	Automatic	8.1 Minutes	23.2 Minutes	8.0 Minutes	10.1 Minutes
Settings						
Point	Description	Status	Value	Value	Value	Value
17	Off Cycle Time	Constant/Setpoint	180.0 Minutes	180.0 Minutes	180.0 Minutes	240.0 Minutes
18	On Cycle Time	Constant/Setpoint	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
19	Override Off Cycle Time	Constant/Setpoint	30.0 Minutes	30.0 Minutes	30.0 Minutes	30.0 Minutes
20	Override On Cycle Time	Constant/Setpoint	2.0 Minutes	2.0 Minutes	2.0 Minutes	5.0 Minutes
21	Minimum Override Cycles	Automatic	3.0 Cycles	3.0 Cycles	3.0 Cycles	3.0 Cycles
23	Override Cycle Limit per Day	Constant/Setpoint	21.0 Cycles	21.0 Cycles	21.0 Cycles	21.0 Cycles
24	Time Limit per Day	Constant/Setpoint	200.0 Minutes	200.0 Minutes	200.0 Minutes	200.0 Minutes
25	High Level Pump Test	Constant/Setpoint	5.0 Minutes	5.0 Minutes	5.0 Minutes	5.0 Minutes
28	Alarm Update Interval	Timing Override	120.0 Minutes	240.0 Minutes	240.0 Minutes	120.0 Minutes
29	Page Delay	Automatic	960.0 Minutes	960.0 Minutes	960.0 Minutes	960.0 Minutes
30	Page Interval	Automatic	30.0 Minutes	30.0 Minutes	30.0 Minutes	30.0 Minutes
31	Local Alarm Delay	Constant/Setpoint	1140.0 Minutes	1140.0 Minutes	1140.0 Minutes	1140.0 Minutes
32	Local Reactivate Delay	Automatic	120.0 Minutes	120.0 Minutes	120.0 Minutes	120.0 Minutes
Troubleshooting						
Point	Description	Status	Value	Value	Value	Value
33	Top Float Status	Automatic	OK	OK	OK	OK
34	Middle Float Status	Automatic	OK	OK	OK	OK
35	Bottom Float Status	Automatic	OK	OK	OK	OK
37	Contactors Status	Automatic	OK	OK	OK	OK
38	Pump Status	Automatic	OK	OK	OK	OK
40	Filter Status	Automatic	OK	OK	OK	OK
41	Tank Status	Automatic	OK	OK	OK	OK
43	Power Status	Automatic	OK	OK	OK	OK
Flow Data						
Point	Description	Status	Value	Value	Value	Value
49	Pump Run Time Today	Automatic	8.1 Minutes	23.2 Minutes	8.0 Minutes	10.1 Minutes
50	Override Cycles Today	Automatic	0.0	3.0	0.0	0.0
51	Pump Cycles Today	Automatic	4.0 Cycles	10.0 Cycles	4.0 Cycles	5.0 Cycles
52	Average Run Time per Cycle Today	Automatic	2.0 Minutes	2.3 Minutes	2.0 Minutes	2.0 Minutes
54	Brownouts Today	Automatic	0.0	0.0	0.0	0.0

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30-Day History Data			7-May-14	3-May-14	28-Apr-14	14-Apr-14
Point	Description	Status	Value	Value	Value	Value
65	30 Day Average Run Time per Day	Automatic	16.8 Minutes	16.4 Minutes	15.9 Minutes	14.5 Minutes
66	30 Day Average Override Cycles per Day	Automatic	1.6 Cycles	1.5 Cycles	1.4 Cycles	0.8 Cycles
67	30 Day Average Cycles per Day	Automatic	7.6 Cycles	7.1 Cycles	6.8 Cycles	5.8 Cycles
68	30 Day Average Run Time per Cycle	Automatic	2.2 Minutes	2.3 Minutes	2.3 Minutes	2.5 Minutes
71	30 Day Total Pump Run Time	Automatic	505.3 Minutes	492.6 Minutes	476.5 Minutes	434.9 Minutes
72	30 Day Total Override Cycles	Automatic	49.0 Cycles	45.0 Cycles	43.0 Cycles	25.0 Cycles
73	30 Day Total Cycles	Automatic	228.0 Cycles	214.0 Cycles	203.0 Cycles	173.0 Cycles
76	30 Day Total Brownouts	Automatic	0.0	0.0	0.0	0.0
Totalized Pump Data						
Point	Description	Status	Value	Value	Value	Value
82	Pump Total Run Time	Automatic	1621.4 Hours	1620.3 Hours	1618.7 Hours	1614.7 Hours
83	Pump Total Cycles	Automatic	48892.0 Cycles	48858.0 Cycles	48813.0 Cycles	48706.0 Cycles
Miscellaneous						
Point	Description	Status	Value	Value	Value	Value
145	Pump On Auto	Automatic	Off	Off	Off	Off
147	Pump Test Today	Automatic	Off	On	Off	Off
148	Pump Check Enable	Automatic	Off	Off	Off	Off
149	Total Override Cycles	Automatic	0.0	0.0	0.0	0.0
150	High Level Condition	Automatic	Off	Off	Off	Off
151	Leak Check Enable	Automatic	On	On	On	On
152	Brownout State	Automatic	Off	Off	Off	Off
153	Test Mode	Automatic	Off	Off	Off	Off
Alarm Points						
Point	Description	Status	Value	Value	Value	Value
161	General Alarm	Automatic	Off	Off	Off	Off
162	New Alarm	Automatic	Off	Off	Off	Off
163	Update Central Enable	Automatic	On	On	On	On
167	Page Alarm Start	Automatic	Off	Off	Off	Off
168	Pager Signal	Override Off	Off	Off	Off	Off
169	Local Alarm Start	Automatic	Off	Off	Off	Off
170	Local Alarm Silence	Automatic	Off	Off	Off	Off
Inputs & Outputs						
Point	Description	Status	Value	Value	Value	Value
177	High Level/Override Timer Float Input	Automatic	Off	Off	Off	Off
178	Timer Float Input	Automatic	On	On	On	On
179	Redundant Off Float & Low Level Alarm Input	Automatic	On	On	On	On
181	Push To Silence Input	Automatic	Off	Off	Off	Off
182	Auxiliary Contact Input	Automatic	Off	Off	Off	Off
186	Pump Output	Automatic	Off	Off	Off	Off
188	Alarm Light Output	Automatic	Off	Off	Off	Off
189	Audible Alarm Output	Override Off	Off	Off	Off	Off

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