



Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

B-HS5 Field System Monitoring Report No. 5

Progress Report

June 2014

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In association with:



AET
Applied Environmental Technology

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TASK B.7 PROGRESS REPORT

B-HS5 Field System Monitoring Report No. 5

Prepared for:

Florida Department of Health
Division of Disease Control and Health Protection
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 Task A.26. 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 fifth sample event of the passive nitrogen reduction system at home site B-HS5 in Seminole County, Florida.

2.0 Purpose

Operation of the B-HS5 system was initiated on July 9, 2013. This monitoring report documents data collected from the fifth B-HS5 monitoring and sampling event conducted on May 28, 2014 (Experimental Day 323). 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 nine 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-HS5 field site is located in Seminole County, FL. The nitrogen reducing onsite treatment system for the single family residence was installed in June 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 PNRS system consists of the addition of three tanks to the existing permitted system: a 1500 gallon plastic tank Stage 1 unsaturated media filter; 300 gallon concrete pump tank; and 1,500 gallon two

chamber concrete Stage 2 saturated media biofilter. The existing 1,350 gallon concrete septic tank continues to provide primary treatment for the PNRS system. Based on measured average wastewater flow and tank volumes, there is over a ten day transit time through the treatment system prior to dispersal. The denitrified treated effluent is discharged into the soil via the existing drainfield which is a standard bed.

3.2 PNRS System Modification

As recommended in the fourth sample event report, the recirculation mode of operation was modified prior to the fifth sample event. The pump tank discharge is split via two throttling gate valves which allow for optional recycling of a portion of the Stage 1 biofilter effluent with the balance proceeding to the Stage 2 biofilter. The system was designed with two operational modes. The first operating mode (which was initially tested) 100 percent of the Stage 1 effluent is discharged to the Stage 2 biofilter. Following the fourth sample event, the recirculation mode of operation was modified to test the second option. The second operating mode is to recirculate a portion (3:1 target ratio) of the Stage 1 effluent to the top of the Stage 1 biofilter and disperse it by five spray nozzles. The recirculated effluent would have an opportunity to mix with incoming septic tank effluent discharged by the distribution box. Recirculation back to the Stage 1 biofilter increases the hydraulic loading on the Stage 1 biofilter.

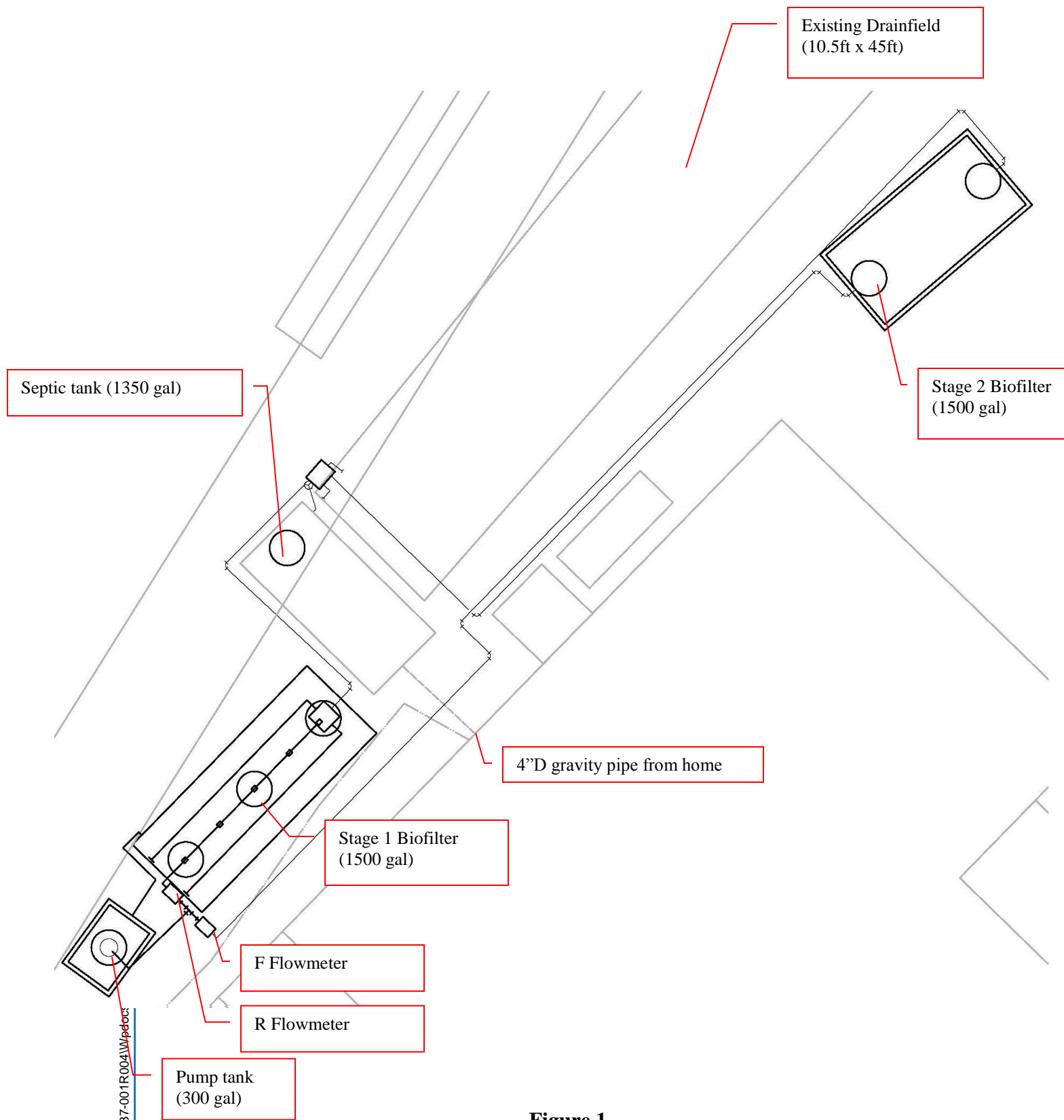


Figure 1
Plan View of B-HS5 System Layout

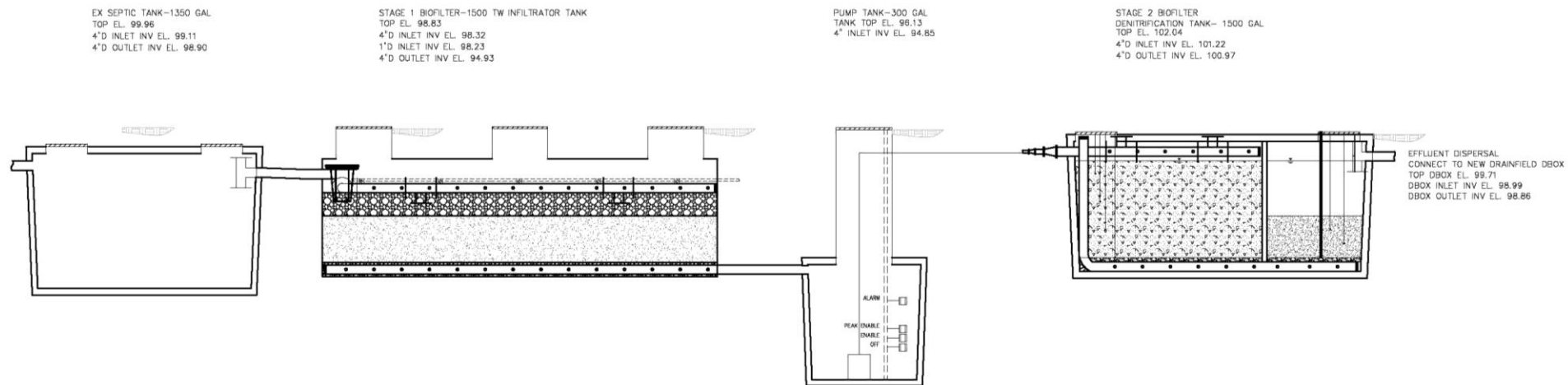


Figure 2
Flow Schematic of B-HS5 PNRS

3.3 Monitoring and Sample Locations and Identification

This monitoring event included sample collection from four points within the treatment system (Figure 3). Household wastewater enters the primary tank and exits as septic tank effluent through an effluent filter screen into the Stage 1 biofilter. The first monitoring point, B-HS5-STE, is the effluent sampled approximately 1.5 feet below the surface of the primary tank prior to the effluent filter (Figure 4), which is referred to as primary effluent or septic tank effluent (STE). Samples from monitoring point B-HS5-STE are representative of the whole household wastewater and represent the influent to the remainder of the onsite nitrogen reduction system.

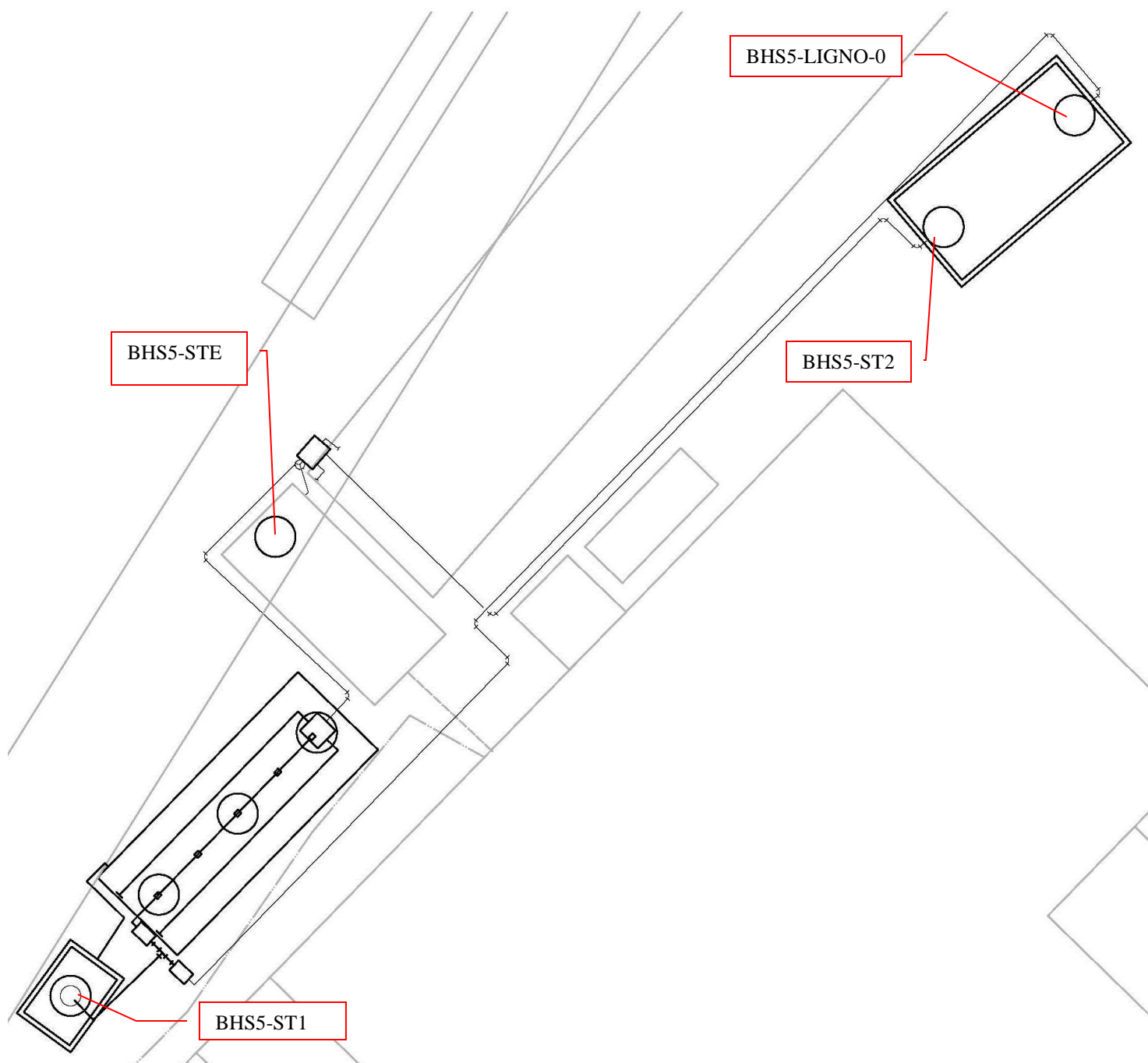


Figure 3
B-HS5 Sample and Monitoring Locations

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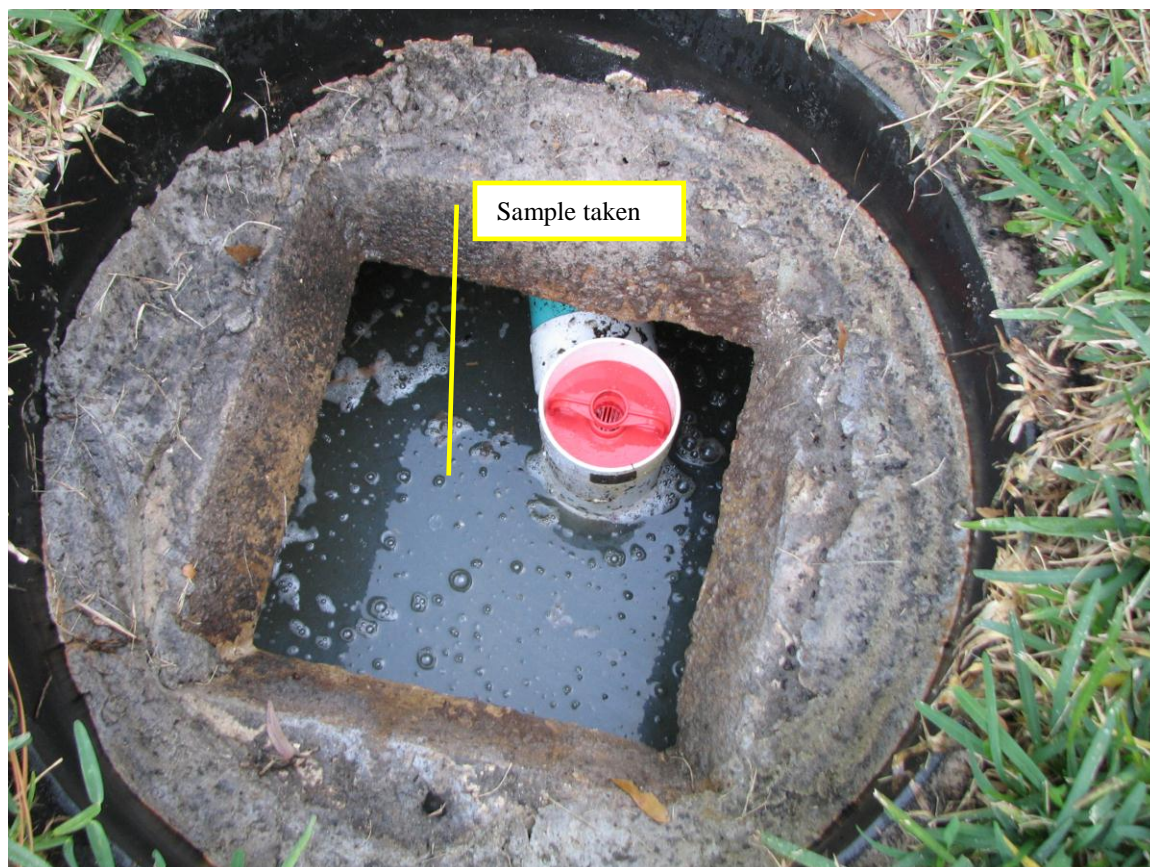


Figure 4
Primary Tank (B-HS5-STE sample)

The primary tank contents are discharged by gravity to a distribution box, located inside the Stage 1 biofilter, which splits the flow between three perforated distribution pipes along the top of the unsaturated Stage 1 biofilter media. In the Stage 1 biofilter, wastewater percolates downward through the unsaturated expanded clay media where nitrification occurs. The Stage 1 biofilter contains 12.8 inches of coarse expanded clay media (Riverlite™ 1/4; 1.1 to 4.8 mm) above 21 inches of finer expanded clay media (Riverlite™ 3/16; 0.6 to 2.4 mm). Stage 1 biofilter effluent flows into the pump tank by gravity. The second sampling point (B-HS5-ST1), is sampled approximately 1.5 feet below the surface of the pump tank representing the Stage 1 biofilter effluent (Figure 5).

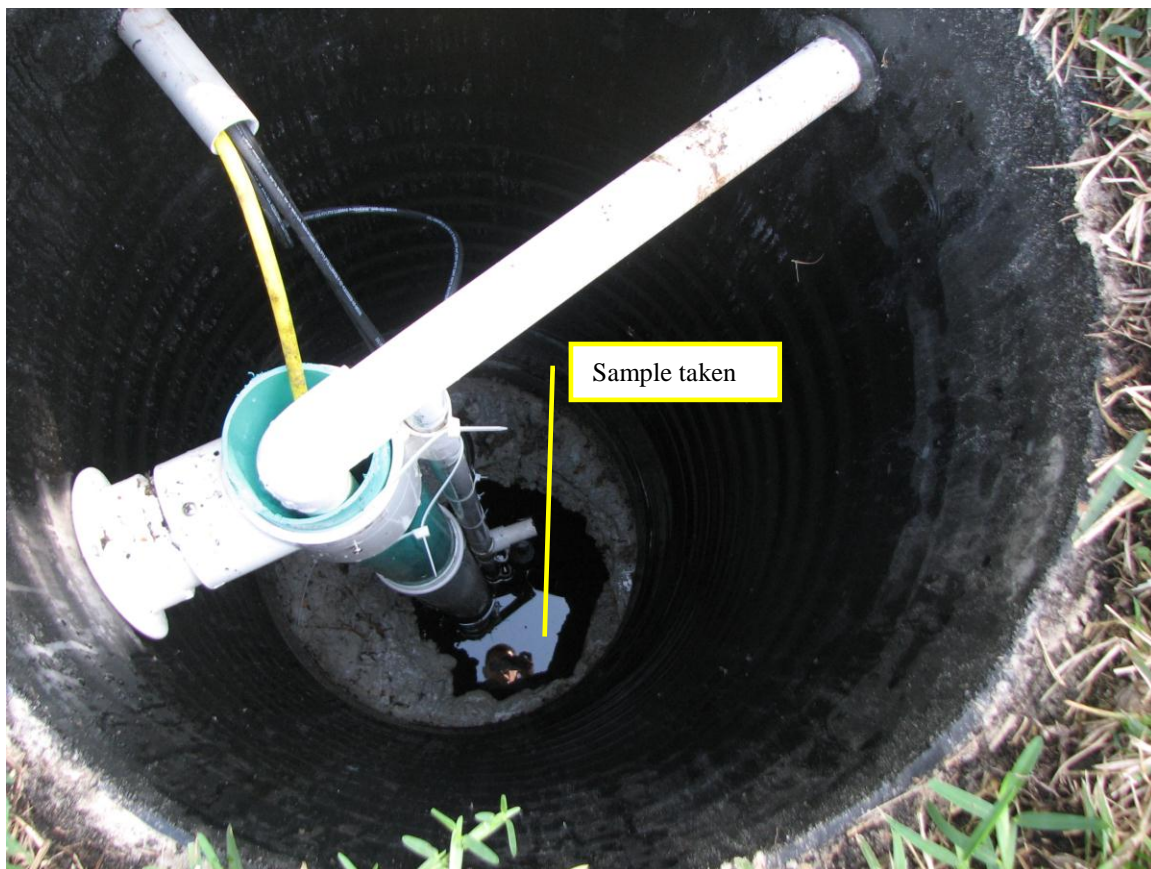


Figure 5
Stage 1 Effluent in Pump Tank (B-HS5-ST1 sample)

The pump tank discharge is split via two throttling gate valves which allow for optional recycling of a portion of the Stage 1 biofilter effluent with the balance proceeding to the Stage 2 biofilter. The system was designed with two operational modes. In the first mode, 100 percent of the Stage 1 effluent is discharged to the Stage 2 biofilter. Initial operation of B-HS5 was in the non-recirculation mode, which was in effect from system start-up through Experimental Day 290. Thirty-three days prior to this sample event, the system was revised to the second operating mode which is to recirculate a portion of Stage 1 effluent to the top of the Stage 1 biofilter and disperse it by five spray nozzles. The recirculated effluent has an opportunity to mix with incoming septic tank effluent discharged by the distribution box. Recirculation back to the Stage 1 biofilter increases the hydraulic loading on the Stage 1 biofilter.

Effluent from the unsaturated (Stage 1) media tank enters the denitrification (Stage 2) biofilter at the top of the media in the first chamber (lignocellulosic media), flows downward through the media, moves laterally through the baffle wall to the bottom of the

second chamber, and upward through the media in the second chamber (elemental sulfur and oyster shell).

The first chamber of the Stage 2 biofilter contains 42-inches of lignocellulosic media as a supplemental carbon source for denitrification, a blended urban waste wood from Mother's Organics, Inc., Thonotosassa, FL. Stainless steel samplers are positioned at 12-inch increments for vertical profiling throughout the lignocellulosic media. The third primary sampling point is a stainless steel sampler positioned at the bottom of the lignocellulosic media (B-HS5-LIGNO-0) with tubing to the surface. Twelve inches above B-HS5-LIGNO-0 is another stainless steel drivepoint sampler B-HS5-LIGNO-12, and so forth (B-HS5-LIGNO-24 and B-HS5-LIGNO-36). The B-HS5-LIGNO-0 sample represents the lignocellulosic media effluent (Figure 6).



Figure 6
First chamber of Stage 2 biofilter (B-HS5-LIGNO-0" sample)

A collection pipe along the bottom transfers the first chamber (lignocellulosic media) effluent to the second chamber, which contains 18-inches of elemental sulfur mixed with oyster shell media. Similar to the lignocellulosic media chamber, stainless steel drivepoint samplers are positioned to create a vertical profile. B-HS5-SULFUR-6 and B-HS5-SULFUR-12 are positioned 6-inches and 12-inches, respectively, above the bottom of the sulfur media. The fourth primary sampling point, B-HS5-ST2, 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 7).



Figure 7
Second chamber of Stage 2 biofilter (B-HS5-ST2 sample)

3.4 Operational Monitoring

Start-up of the system occurred on July 9, 2013 (Experimental Day 0). The PNRS system has operated continually since that date. For this fifth formal sampling event, the water meter for the house and treatment system flow meters were read and recorded on April 11, 2014. 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.

As previously discussed in Section 3.2, the pump tank discharge is split via two throttling gate valves which allow for a portion of the Stage 1 biofilter effluent to be sent back to the Stage 1 biofilter spray nozzles (for recirculation) with the rest proceeding to the Stage 2 biofilter. The treatment system flow meters (Figure 1) are located on the pump tank discharge lines following the flow split, and record the cumulative flow in gallons pumped from the pump chamber to the Stage 1 biofilter (R flowmeter) and Stage 2 biofilter (F flowmeter).

3.5 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 2 biofilter was initially filled with 42 inches of lignocellulosic media and 18 inches of sulfur and oyster shell mixture media, which ostensibly will last for many years without replenishment or replacement.

3.6 Water Quality Sample Collection and Analyses

The fifth formal sample event (Sample Event No. 9) was conducted on May 28, 2014 (Experimental Day 323). A full suite of influent, intermediate and effluent water quality samples were collected from the system for water quality analysis. Samples were collected at each of the four monitoring points described in Section 3.3: B-HS5-STE, B-HS5-ST1, B-HS5-LIGNO-36, B-HS5-LIGNO-24, B-HS5-LIGNO-12, B-HS5-LIGNO-0, B-HS5-SULFUR-6, B-HS5-SULFUR-12 and B-HS5-ST2. 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.

Immediately subsequent to the regular samples for each primary monitoring point, additional sample was collected to be filtered at the laboratory (0.45 micron filter) for analysis of CBOD₅ and the nitrogen species to allow for comparison to the unfiltered sample water quality results. In addition, a field sample duplicate was taken. The field sample duplicate (B-HS5-ST1) was collected immediately subsequent to the regular samples.

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. The field parameters were measured by placing the analytical probes in a container overflowing with sample water. The influent, intermediate, and effluent samples were analyzed by the laboratory for: total alkalinity, chemical oxygen demand (COD), total Kjeldahl nitrogen (TKN), ammonia nitrogen (NH₃-N), nitrate nitrogen (NO₃-N), nitrite nitrogen (NO₂-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). All analyses were performed by an independent and fully NELAC certified analytical laboratory (Southern Analytical Laboratory). 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 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	SM9223B	2 ct/100mL

4.0 Results and Discussion

4.1 Operational Monitoring

Table 2 provides a summary of the household water use since the water meter installation on February 12, 2013. The treatment system flow meter readings for the B-HS5 field site are summarized in Table 3. The operation and maintenance log which includes actions taken since start-up is provided in Appendix B. Summary tables of the Vericom PLC recorded data are provided in Appendix C, Table C.1 and Table C.2. These include daily and cumulative pump runtime and system alarms that are used to check general pump operation and performance.

Table 2
Summary of Household Water Use Flowmeter

Date and Time Read	Cumulative Volume (gallons)	Average Daily Household Flow between readings, Q (gpd)	Average Daily Household Flow Since start-up, Q (gpd)
2/12/2013 10:30	166.0	INSTALLED	INSTALLED
2/21/2013 10:45	1,130.3	107.0	107.0
2/28/2013 11:45	2,323.9	169.5	134.4
3/7/2013 10:25	2,832.1	73.2	115.9
6/14/2013 13:00	13,460.9	107.2	108.9
6/25/2013 8:53	14,860.1	129.2	110.5
7/23/2013 8:31	17,659.4	100.0	108.7
7/29/2013 11:10	18,769.2	181.6	111.4
8/15/2013 12:28	21,078.4	135.4	113.6
8/27/2013 9:15	22,427.8	113.7	113.6
9/27/2013 10:40	25,738.3	106.6	112.6
11/8/2013 10:30	31,992.8	148.9	118.3
11/27/2013 11:12	34,400.8	126.5	118.9
12/4/2013 14:34	35,292.8	124.9	119.0
12/23/2013 12:38	37,649.1	124.5	119.3
1/23/2014 10:00	42,526.6	157.9	122.8
1/31/2014 13:00	43,688.6	143.0	123.3
2/3/2014 8:40	43,688.6	0.0	122.3
2/4/2014 11:45	43,841.1	135.1	122.3
2/5/2014 9:45	43,928.5	95.3	122.3
2/6/2014 8:20	44,029.1	106.9	122.2
2/7/2014 10:30	44,175.2	134.0	122.2
2/12/2014 11:00	44,987.4	161.8	122.8
3/14/2014 9:50	48,684.9	123.5	122.8
4/11/2014 9:00	52,272.6	128.3	123.2
4/25/2014 10:05	54,087.0	128.9	123.4
4/29/2014 11:45	54,618.0	131.5	123.5
5/28/2014 10:00	59,552.4	170.6	126.4

From start-up through May 28, 2014, the average household water use was 126.4 gallons per day with periods of higher and lower flows (Table 2).

Table 3
Summary of Treatment System Flowmeters

Date	Recirculation Pumped Flow, R Water Meter Reading	Recirculation Pumped Flow, R Water Meter Reading	Average Recirc Ratio	Stage 2 Biofilter Pumped Flow, F Water Meter Reading	Average Daily Stage 2, Q between readings
	Cumulative Volume (gallons)	Gallons/Day	Recycle: Forward Flow	Cumulative Volume (gallons)	Gallons/Day
7/5/2013 12:00	286.1	0.0	0.0		Installed
7/9/2013 15:20	286.1	0.0	0.0	167.5	Following testing
7/12/2013 14:13	286.1	0.0	0.0	207.4	13.5
7/17/2013 9:02	286.1	0.0	0.0	995.6	164.8
7/23/2013 8:31	286.1	0.0	0.0	1,642.9	108.3
7/29/2013 11:10	286.1	0.0	0.0	2,733.4	178.5
8/6/2013 8:51	286.1	0.0	0.0	3,894.7	146.9
8/15/2013 11:40	286.1	0.0	0.0	4,884.6	108.6
8/27/2013 9:15	286.1	0.0	0.0	6,135.4	105.1
9/27/2013 10:40	286.1	0.0	0.0	9,035.2	93.4
11/8/2013 10:30	286.1	0.0	0.0	14,347.7	126.5
11/27/2013 10:55	286.1	0.0	0.0	16,591.6	118.0
12/4/2013 13:45	286.1	0.0	0.0	17,474.0	124.0
12/23/2013 12:38	286.1	0.0	0.0	19,610.1	112.7
1/23/2014 10:00	286.1	0.0	0.0	24,359.1	153.7
1/31/2014 13:00	286.1	0.0	0.0	25,506.3	141.2
2/3/2014 8:40	286.1	0.0	0.0	25,551.0	15.9
2/4/2014 11:45	286.1	0.0	0.0	25,659.1	95.7
2/5/2014 9:45	286.1	0.0	0.0	25,737.2	85.3
2/6/2014 8:20	286.1	0.0	0.0	25,836.3	105.3
2/7/2014 10:30	286.1	0.0	0.0	25,952.1	106.2
2/12/2014 11:00	286.1	0.0	0.0	26,756.2	160.2
3/14/2014 9:50	286.1	0.0	0.0	30,148.2	113.3
4/11/2014 9:00	286.1	0.0	0.0	33,578.8	122.7
4/25/2014 10:50	286.1	0.0	0.0	35,326.6	124.2
Total average start-up to 4/25/14		0.0	0.0		121.3
Switched to recirculation mode of operation: Stage 1 sprayers					
4/25/2014 12:00	314.1	0.0		35,355.0	
4/29/2014 13:00	1,626.0	324.6	3.2:1	35,768.8	102.4
5/28/2014 10:22	13,966.4	427.1	3.4:1	39,443.6	127.2
Total average to 5/28/14		414.6	3.3:1		124.2

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The two throttling gate valves control the fraction of Stage 1 effluent that is recirculated and the fraction sent to the Stage 2 biofilter. As previously discussed, the recirculation mode of operation was modified following the fourth sample event. The gate valves were set so that 3 parts went back to the Stage 1 sprayers and 1 part went to the Stage 2 tank (3:1 recycle ratio). The average recirculated pumped flow (to the Stage 1 biofilter), following the modification to the recirculation mode of operation, was 414.6 gallons per day, and the average forward flow to the Stage 2 biofilter was 124.2 gallons per day. Therefore, the corresponding average recirculation ratio was 3.3:1 following the modification to the recirculation mode of operation.

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.

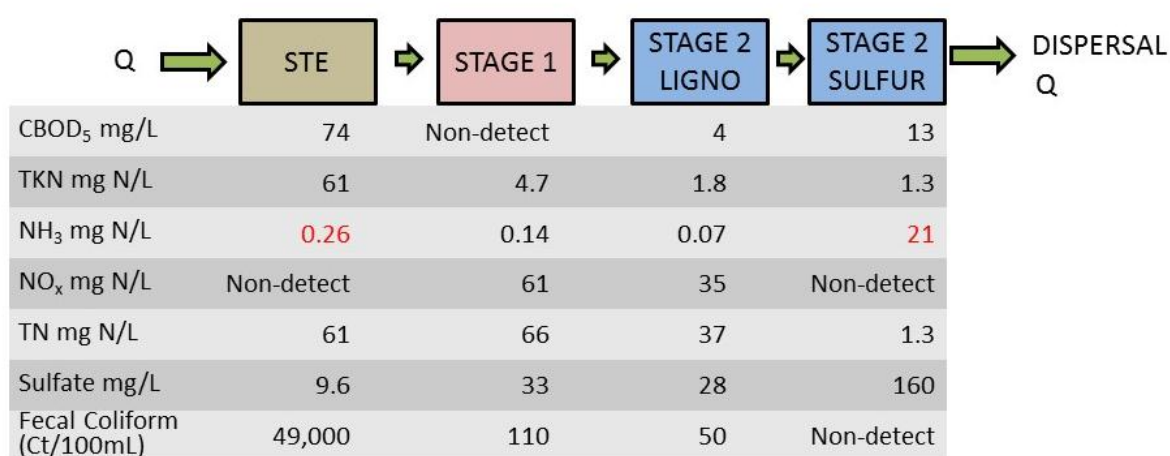
Table 4
Summary of System Electrical Use

Date and Time Read	Electrical Meter Reading	Average Daily Electrical Use between readings	Average Electrical Use per Gallon Treated	Average Electrical Use Per 1,000 Gallons Treated
	Cumulative (kWh)	(kWh/day)	(kWh/gal)	(kWh/1000 gal)
7/5/2013 12:00		Installed		
7/9/2013 15:20	0.3	Start-up		
7/12/2013 14:13	0.4	0.03	0.0025	2.5063
7/17/2013 9:02	0.6	0.04	0.0003	0.2537
7/23/2013 8:32	0.8	0.03	0.0003	0.3089
7/29/2013 11:10	1.2	0.07	0.0004	0.3669
8/6/2013 8:51	1.5	0.04	0.0003	0.2583
8/15/2013 11:40	1.8	0.03	0.0003	0.3030
8/27/2013 9:15	2.2	0.03	0.0003	0.3198
9/27/2013 10:40	3.1	0.03	0.0003	0.3104
11/8/2013 10:30	4.8	0.04	0.0003	0.3200
11/27/2013 10:55	5.5	0.04	0.0003	0.3119
12/4/2013 13:45	5.8	0.04	0.0003	0.3400
12/23/2013 12:38	6.5	0.04	0.0003	0.3277
1/23/2014 10:00	8.0	0.05	0.0003	0.3159
1/31/2014 13:00	8.4	0.05	0.0003	0.3487
2/3/2014 8:40	8.4	0.00	0.0000	0.0000
2/12/2014 11:00	8.8	0.04	0.0002	0.2487
3/14/2014 9:50	9.9	0.04	0.0003	0.3243
4/11/2014 9:00	11.0	0.04	0.0003	0.3206
4/25/2014 10:50	11.6	0.04	0.0003	0.3433
Total average start-up to 4/25/14		0.04	0.0003	0.3214
Switched to recirculation mode of operation: Stage 1 sprayers				
4/25/2014 12:00	11.6			
4/29/2014 13:00	12.1	0.12	0.0012	1.2083
5/28/2014 10:22	16.5	0.15	0.0012	1.1973
Total average to 5/28/14		0.15	0.0012	1.1984

The total average electrical use prior to switching to the recirculation mode of operation (through April 25, 2014) was 0.04 kWh per day, and the corresponding average electrical use per 1,000 gallons treated was 0.3214 kWh per 1,000 gallons treated. The average electrical use increased, as expected, following the revised recirculation mode of operation to 0.15 kWh per day, and the corresponding average electrical use per 1,000 gallons treated was 1.1984 kWh per 1,000 gallons treated.

4.3 Water Quality

Water quality analytical results for Sample Event No. 5 are listed in Table 5. Nitrogen results are graphically displayed in Figure 8. A summary of the water quality data collected to date for the test system is presented in Table 6. The laboratory report containing the raw analytical data is included in Appendix A. The following discussion summarizes the water quality analytical results. The performance of the various system components was compared by considering the changes through treatment of nitrogen species (TKN, $\text{NH}_3\text{-N}$, and $\text{NO}_x\text{-N}$), as well as supporting water quality parameters.



Note: Ammonia N values in red font are likely an analytical error and have been requested to be re-run by the laboratory.

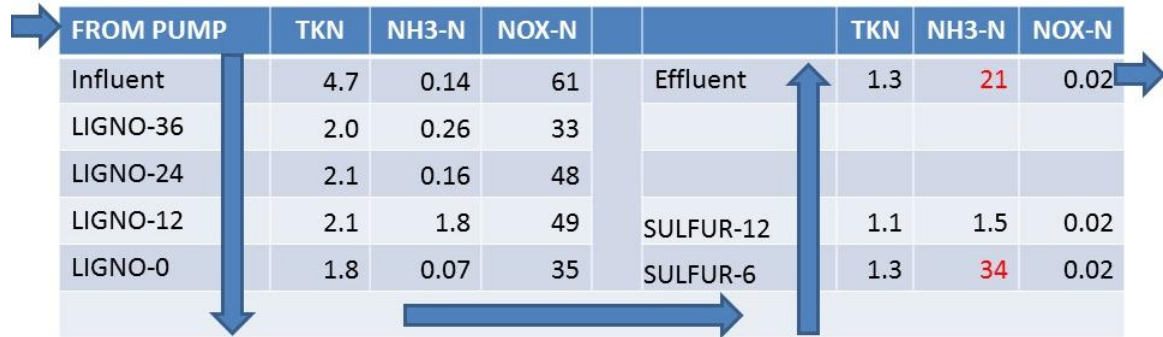
Figure 8
Graphical Representation of Nitrogen Results
Sample Event No. 5, May 28, 2014 (Experimental Day 323)

Septic Tank Effluent (STE) Quality: The water quality characteristics of STE collected in Sample Event 5 were within the typical range generally expected for domestic STE. The measured STE total nitrogen (TN) concentration was 61 mg/L, which is within the range that has been typically reported for Florida single family residence STE.

Stage 1 Effluent (ST1): The Stage 1 effluent $\text{NH}_3\text{-N}$ levels was 0.14 mg/L with a DO level at 3.48 mg/L (Table 5). The Stage 1 effluent TSS and CBOD₅ concentrations were below the method detection limit, 1 mg/L and 2 mg/L, respectively. The Stage 1 biofilter showed nearly complete nitrification with an effluent $\text{NH}_3\text{-N}$ concentration of 0.14 mg/L and TKN of 4.7 mg/L. The Stage 1 effluent $\text{NO}_x\text{-N}$ was 61 mg/L. The Stage 1 effluent TN was 66 mg/L.

Stage 2 Biofilter Effluent (LIGNO-0" and ST2): The Stage 2 system produced a highly reducing environment and achieved essentially complete $\text{NO}_x\text{-N}$ reduction. Effluent $\text{NO}_x\text{-N}$ from the Stage 2 biofilter monitoring point was below the method detection limit of 0.02 mg/L. The low $\text{NO}_x\text{-N}$ was accompanied by a measured 0.08 mg/L DO and -209 mV ORP. The lignocellulosic media effluent $\text{NO}_x\text{-N}$ was 35 mg/L. Final total nitrogen (TN) in the treatment system effluent was 1.32 mg/L. The Stage 2 biofilter lignocellulosic media effluent and sulfur media effluent CBOD_5 were 4 and 13 mg/L, respectively. The Stage 2 effluent sulfate concentration was 160 mg/L.

As previously discussed in Section 3.3, Sample Event 5 also included Stage 2 biofilter profile samples. As depicted in Figure 9, the unsaturated Stage 1 biofilter effluent is pumped to the top of the first chamber of the Stage 2 biofilter which contains lignocellulosic media. The effluent flows downward through the lignocellulosic media, moves laterally in a perforated 4-inch pipe through the baffle wall to the bottom of the second chamber, and upward through the sulfur media mixture in the second chamber. The nitrogen results at the various depths of the Stage 2 biofilter are graphically displayed in Figure 9. Each stainless steel drivepoint sampler was assigned a unique identification indicating the depth (in inches) the sampler was placed above the bottom of the media. For example LIGNO-36 is a stainless steel drivepoint sampler located at 36 inches above the bottom of the lignocellulosic media. The profile results from this event indicate that the $\text{NO}_x\text{-N}$ was effectively reduced below the method detection limit at profile sampler SULFUR-6. The $\text{NO}_x\text{-N}$ concentration progressively decreased with passage through the lignocellulosic media in the downflow biofilter, which accounted for approximately 43 percent of the $\text{NO}_x\text{-N}$ reduction. Residual $\text{NO}_x\text{-N}$ in the effluent of the downflow biofilter was reduced to non-detection at the 6-inch depth through the sulfur media.



FROM PUMP	TKN	NH3-N	NOX-N		TKN	NH3-N	NOX-N
Influent	4.7	0.14	61	Effluent	1.3	21	0.02
LIGNO-36	2.0	0.26	33				
LIGNO-24	2.1	0.16	48				
LIGNO-12	2.1	1.8	49	SULFUR-12	1.1	1.5	0.02
LIGNO-0	1.8	0.07	35	SULFUR-6	1.3	34	0.02

Note: Ammonia N values in red font are likely an analytical error and have been requested to be re-run by the laboratory.

Figure 9
Graphical Representation of Stage 2 Biofilter Profile Nitrogen Results

Table 5
Water Quality Analytical Results

Sample ID	Sample Date/Time	Temp (°C)	pH	Specific Conductance (uS/cm)	DO (mg/L)	ORP (mV)	Total Alkalinity (mg/L)	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)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	TOC (mg/L)
BHSS-STE	5/28/14 11:36	26.41	7.09	1254	0.05	-235.0	410	34	31	74	180	61.02	61	60.74	0.26	0.01	0.01	0.02	0.28	5.3	5.1	9.6	4.6	9.7	49000	24000	51
BHSS-STE-FILTERED	5/28/14 11:36	26.41	7.09	1254	0.05	-235.0				37		68.08	68	9.00	59			0.08	59.08								
BHSS-ST1	5/28/14 11:15	24.92	6.65	1240	3.48	29.1	180	1	1	2	10	65.70	4.7	4.56	0.14			61	61.14	2.1	1.3	33	0.28	0.39	110	2	8.6
BHSS-ST1-DUP	5/28/14 11:20	24.92	6.65	1240	3.48	29.1	180	2	2	2	10	65.90	2.9	2.58	0.32			63	63.32	2	1.6	31	0.28	0.39	100	2	7.1
BHSS-ST1-FILTERED	5/28/14 11:15	24.92	6.65	1240	3.48	29.1				2		66.50	2.5	2.38	0.12			64	64.12								
BHSS-LIGNO-36	5/28/14 11:10	27.30	6.63	1160	0.12	-146.2						35.00	2	1.74	0.26			33	33.26			26					
BHSS-LIGNO-24	5/28/14 11:00	26.80	6.73	1196	0.35	42.4						50.10	2.1	1.94	0.16			48	48.16			39					
BHSS-LIGNO-12	5/28/14 10:50	25.30	6.58	1201	0.45	103.8						51.10	2.1	0.30	1.8			49	50.80			30					
BHSS-LIGNO-0	5/28/14 10:30	27.50	6.44	1166	0.23	-50.5	270	6	6	4	22	36.80	1.8	1.73	0.069			35	35.07	1.6	0.78	28	0.63	0.79	50	2	12
BHSS-LIGNO-0-FILTERED	5/28/14 10:30	27.50	6.44	1166	0.23	-50.5				2		38.20	2.2	2.08	0.12			36	36.12								
BHSS-SULFUR-6	5/28/14 10:43	27.10	6.48	1257	0.20	-189.8						1.32	1.3	-32.70	34	0.01	0.01	0.02	34.02			99					
BHSS-SULFUR-12	5/28/14 10:50	26.30	6.51	1299	0.20	-215.4						1.12	1.1	-0.40	1.5	0.01	0.01	0.02	1.52			110					
BHSS-ST2	5/28/14 10:25	25.16	6.41	1249	0.08	-208.9	370	4	4	13	27	1.32	1.3	-19.70	21	0.01	0.01	0.02	21.02	0.89	0.38	160	6.3	7.7	1	2	13
BHSS-ST2-FILTERED	5/28/14 10:25	25.16	6.41	1249	0.08	-208.9				10		1.12	1.1	0.49	0.61	0.01	0.01	0.02	0.63			170					
BHSS-EB	5/28/14 12:23	31.3	5.57	2	6.50	112.0	2.1	1	1	2	27	0.11	0.09	-0.39	0.48	0.01	0.01	0.02	0.50	0.01	0.01	0.2	0.01	0.1	1	2	0.06

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.

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.

Too many colonies were present. The numeric value represents the filtration volume.

Results based on colony counts outside the ideal range.

Note: Ammonia N values in red font are likely an analytical error and have been requested to be re-run by the laboratory.

Table 6
Summary of Water Quality Data

Sample ID	Statistics	Temp (°C)	pH	Specific Conductance (uS/cm)	DO (mg/L)	ORP (mV)	Total Alkalinity (mg/L)	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)	NOx (mg/L N)	TIN (mg/L N) ³	TP (mg/L)	Ortho P (mg/L P)	Sulfate (mg/L)	Hydroge n Sulfide (mg/L)	Sulfide (mg/L)	Fecal (Ct/100 mL)	E-coli (Ct/100 mL)	TOC (mg/L)
STE	n	11	11	11	11	11	9	11	9	11	9	11	11	10	11	11	11	11	11	9	9	11	11	11	9	9	9
	MEAN	23.41	7.25	1187.36	0.07	-281.55	406.67	39.27	34.89	76.91	145.33	70.66	70.64	14.77	57.21	0.02	0.01	0.03	57.23	7.22	5.01	4.32	3.52	8.58	42,757	5,855	37
	STD. DEV.	3.84		65.20	0.03	41.62	19.36	13.70	12.76	23.59	72.85	8.05	8.05	17.43	19.96	0.02	0.00	0.02	19.97	2.04	0.61	3.95	1.53	2.07			10
	MIN	19.10	6.99	1048.00	0.01	-341.90	370.00	22.00	22.00	32.00	37.00	61.02	61.00	2.00	0.26	0.01	0.01	0.02	0.28	5.30	3.70	1.30	1.60	5.10	3,100	1,700	20
	MAX	28.90	7.63	1294.00	0.11	-226.80	430.00	60.00	56.00	120.00	270.00	87.02	87.00	60.74	76.00	0.08	0.01	0.08	76.02	12.00	5.50	14.00	6.90	12.00	160,000	24,000	51
Stage 1	n	11	11	11	11	11	9	9	9	9	9	11	11	11	11	10	10	11	11	9	9	7	6	6	9	9	9
	MEAN	23.28	6.87	1154.00	2.45	-9.33	208.89	2.11	1.89	9.33	15.56	50.80	6.53	3.16	3.37	42.30	0.45	44.27	47.64	2.47	1.66	29.86	0.26	0.43	1,708	104	7
	STD. DEV.	3.25		78.48	0.78	92.54	13.64	1.05	1.17	5.52	8.06	8.51	2.62	1.53	2.64	6.52	0.52	8.28	8.09	0.45	0.23	6.09	0.29	0.40			2
	MIN	20.11	6.65	1057.00	1.64	-127.90	180.00	1.00	1.00	2.00	10.00	37.60	3.60	1.60	0.14	33.00	0.01	34.00	34.39	2.00	1.30	21.00	0.01	0.10	110	2	5
	MAX	28.20	7.18	1249.00	3.48	130.00	230.00	4.00	4.00	18.00	33.00	65.70	10.00	6.50	7.50	52.00	1.80	61.00	61.14	3.10	1.90	37.00	0.79	1.20	8,100	3,600	12
Stage 2 Ligno	n	11	11	11	11	11	9	11	9	11	9	11	11	11	11	10	10	11	11	9	9	8	7	7	9	9	9
	MEAN	23.47	6.62	1073.82	0.63	-102.64	362.22	5.91	3.33	13.64	41.67	9.63	3.09	2.16	0.93	2.67	1.03	6.54	7.47	1.11	0.56	24.63	0.20	0.33	329	26	13
	STD. DEV.	4.37		74.30	0.70	81.05	44.94	6.41	1.80	9.54	39.28	9.59	2.40	1.34	1.46	3.78	0.78	10.05	9.64	0.41	0.27	3.34	0.27	0.33			6
	MIN	18.40	6.25	946.00	0.13	-230.80	270.00	2.00	1.00	2.00	12.00	2.70	0.88	0.00	0.05	0.01	0.01	0.02	0.42	0.51	0.13	18.00	0.01	0.10	50	2	9
	MAX	30.20	7.38	1182.00	2.50	9.70	410.00	24.00	6.00	38.00	140.00	36.80	8.30	4.32	4.60	12.00	2.00	35.00	35.07	1.60	1.00	28.00	0.63	0.81	1,000	740	29
Stage 2 Sulfur	n	11	11	11	11	11	9	9	9	9	9	11	11	11	11	11	11	11	11	9	9	11	11	11	9	9	9
	MEAN	22.79	6.73	1196.27	0.16	-254.87	380.00	2.44	2.44	9.78	32.33	2.89	2.85	-0.42	3.27	0.03	0.01	0.04	3.31	1.07	0.63	88.45	8.13	12.17	16	7	12
	STD. DEV.	4.68		231.67	0.11	54.13	41.23	1.42	1.42	5.80	6.84	2.89	2.91	6.48	6.18	0.05	0.00	0.05	6.17	0.31	0.27	49.31	12.97	18.54			5
	MIN	18.30	6.41	991.00	0.03	-357.00	350.00	1.00	1.00	2.00	23.00	1.12	1.00	-19.70	0.16	0.01	0.01	0.02	0.18	0.42	0.18	29.00	0.25	0.40	1	2	7
	MAX	30.40	7.04	1781.00	0.38	-195.40	480.00	5.00	5.00	19.00	43.00	10.02	10.00	4.20	21.00	0.17	0.01	0.18	21.02	1.50	0.96	200.00	45.00	64.00	1,000	52	25
Tap	n	3	3	3	3	3	1	1	1	1	1	3	3	3	3	3	3	3	3	1	1	3	1	1	1	1	1
	MEAN	26.47	7.28	448.00	3.94	98.53	130.00	1.00	1.00	2.00	10.00	0.32	0.10	0.07	0.03	0.22	0.01	0.22	0.25	0.06	0.03	12.67	2.60	4.10	1	2	3
	STD. DEV.	3.01		15.72	2.22	173.67						0.18	0.01	0.03	0.02	0.18	0.00	0.18	0.19			0.58					
	MIN	23.60	6.73	431.00	2.31	-65.30	130.00	1.00	1.00	2.00	10.00	0.12	0.09	0.04	0.01	0.01	0.01	0.02	0.03	0.06	0.03	12.00	2.60	4.10	1	2	3
	MAX	29.60	7.60	462.00	6.47	280.60	130.00	1.00	1.00	2.00	10.00	0.44	0.11	0.09	0.05	0.33	0.01	0.33	0.37	0.06	0.03	13.00	2.60	4.10	1	2	3

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.

⁴Fecal coliform and pH values are reported as geometric mean.

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.

Too many colonies were present. The numeric value represents the filtration volume.

Sample held beyond the acceptable holding time

5.0 B-HS5 Sample Event No. 5: Summary and Recommendations

5.1 Summary

The results of the fifth sampling event indicate that the system is operating well and no adjustments are recommended at this time. The Sample Event No. 5 results indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality. The total nitrogen concentration of 61 mg/L is within the range of values typically reported for Florida single family residence STE.
- The Stage 1 biofilter converted most of the ammonia N to oxidized nitrogen; effluent contained 4.7 mg/L TKN, of which 0.14 mg/L was ammonia.
- The Stage 2 biofilter effluent NO_x-N was below the method detection limit of 0.02 mg N/L.
- The total nitrogen concentration in the final effluent from the total treatment system was 1.32 mg/L, an approximately 98% reduction from STE.
- The modification in mode of recirculation to the Stage 1 sprayers does not appear to have changed the overall performance of the treatment system.



Appendix A: Laboratory Report

PRELIMINARY

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

July 24, 2014
Work Order: 1405267
Revised Report

Laboratory Report

Project Name		B-HS5 SE#9						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS5-STE						
Matrix		Wastewater						
SAL Sample Number		1405267-01						
Date/Time Collected		05/28/14 11:36						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	4.6	SM 4550SF	0.04	0.01	06/03/14 17:02	06/03/14 17:05	1
Ammonia as N	mg/L	0.26	EPA 350.1	0.040	0.009	06/23/14 11:01	06/23/14 11:07	1
Carbonaceous BOD	mg/L	74	SM 5210B	2	2	05/29/14 09:04	06/03/14 09:42	1
Chemical Oxygen Demand	mg/L	180	EPA 410.4	25	10	06/11/14 17:07	06/23/14 17:44	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Orthophosphate as P	mg/L	5.1	EPA 300.0	0.040	0.010		05/29/14 11:43	1
Phosphorous - Total as P	mg/L	5.3	SM 4500P-E	0.040	0.010	06/11/14 09:57	06/24/14 12:12	1
Sulfate	mg/L	9.6	EPA 300.0	0.60	0.20		05/29/14 11:43	1
Sulfide	mg/L	9.7	SM 4500SF	0.40	0.10		06/03/14 16:28	1
Total Alkalinity	mg/L	410	SM 2320B	8.0	2.0		05/30/14 12:33	1
Total Kjeldahl Nitrogen	mg/L	61	EPA 351.2	0.20	0.05	06/11/14 09:57	06/24/14 12:12	1
Total Organic Carbon	mg/L	51	SM 5310B	1.0	0.060		06/02/14 13:35	1
Total Suspended Solids	mg/L	34	SM 2540D	1	1	05/29/14 14:13	06/04/14 09:54	1
Volatile Suspended Solids	mg/L	31	EPA 160.4	1	1	05/29/14 14:13	06/04/14 09:57	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		05/29/14 11:43	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	24,000	SM 9223B	2.0	2.0	05/28/14 15:15	05/29/14 09:47	1
Fecal Coliforms	CFU/100 ml	49,000	SM 9222D	1	1	05/28/14 15:23	05/29/14 14:24	1
Sample Description		BHS5-STE-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1405267-02						
Date/Time Collected		05/28/14 11:36						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganic, Dissolved</u>								
Ammonia as N	mg/L	59	EPA 350.1	2.0	0.47		06/25/14 17:46	50
Carbonaceous BOD	mg/L	37	SM 5210B	2	2	05/29/14 12:05	06/03/14 09:47	1
Total Kjeldahl Nitrogen	mg/L	68	EPA 351.2	0.20	0.050	06/23/14 15:10	06/25/14 12:09	1
Nitrate+Nitrite (N)	mg/L	0.08	EPA 353.2	0.04	0.01		06/20/14 09:49	1
Lab filtration for diss. analytes							05/29/14 12:05	

Hazen and Sawyer
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Tampa, FL 33619

July 24, 2014
Work Order: 1405267
Revised Report

Laboratory Report

Project Name		B-HS5 SE#9						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS5-ST1						
Matrix		Wastewater						
SAL Sample Number		1405267-03						
Date/Time Collected		05/28/14 11:15						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	0.28	SM 4550SF	0.04	0.01	06/03/14 17:02	06/03/14 17:05	1
Ammonia as N	mg/L	0.14	EPA 350.1	0.040	0.009	06/23/14 11:01	06/23/14 11:07	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	05/29/14 09:04	06/03/14 09:42	1
Chemical Oxygen Demand	mg/L	10 I	EPA 410.4	25	10	06/11/14 17:07	06/23/14 17:44	1
Nitrate+Nitrite (N)	mg/L	61	EPA 353.2	0.04	0.01		06/20/14 09:49	1
Orthophosphate as P	mg/L	1.3	EPA 300.0	0.040	0.010		05/29/14 11:43	1
Phosphorous - Total as P	mg/L	2.1	SM 4500P-E	0.040	0.010	06/11/14 09:57	06/24/14 12:12	1
Sulfate	mg/L	33	EPA 300.0	0.60	0.20		05/29/14 11:43	1
Sulfide	mg/L	0.39 I	SM 4500SF	0.40	0.10		06/03/14 16:28	1
Total Alkalinity	mg/L	180	SM 2320B	8.0	2.0		05/30/14 12:41	1
Total Kjeldahl Nitrogen	mg/L	4.7	EPA 351.2	0.20	0.05	06/11/14 09:57	06/23/14 14:25	1
Total Organic Carbon	mg/L	8.6	SM 5310B	1.0	0.060		06/02/14 13:49	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	05/29/14 14:13	06/04/14 09:54	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	05/29/14 14:13	06/04/14 09:57	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	05/28/14 15:15	05/29/14 09:47	1
Fecal Coliforms	CFU/100 ml	110	SM 9222D	1	1	05/28/14 15:23	05/29/14 14:24	1
Sample Description		BHS5-ST1-DUP						
Matrix		Wastewater						
SAL Sample Number		1405267-04						
Date/Time Collected		05/28/14 11:20						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	0.28	SM 4550SF	0.04	0.01	06/03/14 17:02	06/03/14 17:05	1
Ammonia as N	mg/L	0.32	EPA 350.1	0.040	0.009	06/23/14 11:01	06/23/14 11:07	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	05/29/14 09:04	06/03/14 09:42	1
Chemical Oxygen Demand	mg/L	10 U	EPA 410.4	25	10	06/11/14 17:07	06/23/14 17:44	1
Nitrate+Nitrite (N)	mg/L	63	EPA 353.2	0.04	0.01		06/20/14 09:49	1
Orthophosphate as P	mg/L	1.6	EPA 300.0	0.040	0.010		05/29/14 11:43	1
Phosphorous - Total as P	mg/L	2.0	SM 4500P-E	0.040	0.010	06/11/14 09:57	06/24/14 12:12	1
Sulfate	mg/L	31	EPA 300.0	0.60	0.20		05/29/14 11:43	1
Sulfide	mg/L	0.39 I	SM 4500SF	0.40	0.10		06/03/14 16:28	1
Total Alkalinity	mg/L	180	SM 2320B	8.0	2.0		05/30/14 12:47	1
Total Kjeldahl Nitrogen	mg/L	2.9	EPA 351.2	0.20	0.05	06/11/14 09:57	06/23/14 14:25	1

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

July 24, 2014
Work Order: 1405267
Revised Report

Laboratory Report

Project Name		B-HS5 SE#9						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS5-ST1-DUP						
Matrix		Wastewater						
SAL Sample Number		1405267-04						
Date/Time Collected		05/28/14 11:20						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
Total Organic Carbon	mg/L	7.1	SM 5310B	1.0	0.060		06/02/14 14:03	1
Total Suspended Solids	mg/L	2	SM 2540D	1	1	05/29/14 14:13	06/04/14 09:54	1
Volatile Suspended Solids	mg/L	2	EPA 160.4	1	1	05/29/14 14:13	06/04/14 09:57	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	05/28/14 15:15	05/29/14 09:47	1
Fecal Coliforms	CFU/100 ml	100	SM 9222D	1	1	05/28/14 15:23	05/29/14 14:24	1
Sample Description		BHS5-ST1-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1405267-05						
Date/Time Collected		05/28/14 11:15						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganic, Dissolved</u>								
Ammonia as N	mg/L	0.12	EPA 350.1	0.040	0.009		06/25/14 17:46	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	05/29/14 12:05	06/03/14 09:47	1
Total Kjeldahl Nitrogen	mg/L	2.5	EPA 351.2	0.20	0.050	06/23/14 15:10	06/25/14 12:09	1
Nitrate+Nitrite (N)	mg/L	64	EPA 353.2	0.04	0.01		06/20/14 09:49	1
Lab filtration for diss. analytes							05/29/14 12:05	
Sample Description		BHS5-LIGNO-36						
Matrix		Wastewater						
SAL Sample Number		1405267-06						
Date/Time Collected		05/28/14 11:10						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.26	EPA 350.1	0.040	0.009	06/23/14 11:01	06/23/14 11:07	1
Nitrate+Nitrite (N)	mg/L	33	EPA 353.2	0.04	0.01		06/20/14 09:49	1
Sulfate	mg/L	26	EPA 300.0	0.60	0.20		05/29/14 11:43	1
Total Kjeldahl Nitrogen	mg/L	2.0	EPA 351.2	0.20	0.05	06/11/14 09:57	06/23/14 14:25	1

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Laboratory Report

Project Name		B-HS5 SE#9						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS5-LIGNO-24						
Matrix		Wastewater						
SAL Sample Number		1405267-07						
Date/Time Collected		05/28/14 11:00						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Ammonia as N	mg/L	0.16	EPA 350.1	0.040	0.009	06/23/14 11:01	06/23/14 11:07	1
Nitrate+Nitrite (N)	mg/L	48	EPA 353.2	0.04	0.01		06/20/14 09:49	1
Sulfate	mg/L	39	EPA 300.0	0.60	0.20		05/29/14 11:43	1
Total Kjeldahl Nitrogen	mg/L	2.1	EPA 351.2	0.20	0.05	06/11/14 09:57	06/23/14 14:25	1
Sample Description		BHS5-LIGNO-12						
Matrix		Wastewater						
SAL Sample Number		1405267-08						
Date/Time Collected		05/28/14 10:50						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Ammonia as N	mg/L	1.8	EPA 350.1	0.040	0.009	06/23/14 11:01	06/23/14 11:07	1
Nitrate+Nitrite (N)	mg/L	49	EPA 353.2	0.04	0.01		06/20/14 09:49	1
Sulfate	mg/L	30	EPA 300.0	0.60	0.20		05/29/14 11:43	1
Total Kjeldahl Nitrogen	mg/L	2.1	EPA 351.2	0.20	0.05	06/11/14 09:57	06/23/14 14:25	1
Sample Description		BHS5-LIGNO-0						
Matrix		Wastewater						
SAL Sample Number		1405267-09						
Date/Time Collected		05/28/14 10:30						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	0.63	SM 4550SF	0.04	0.01	06/03/14 17:02	06/03/14 17:05	1
Ammonia as N	mg/L	0.069	EPA 350.1	0.040	0.009	06/23/14 11:01	06/23/14 11:07	1
Carbonaceous BOD	mg/L	4	SM 5210B	2	2	05/29/14 09:04	06/03/14 09:42	1
Chemical Oxygen Demand	mg/L	22	EPA 410.4	25	10	06/11/14 17:07	06/23/14 17:44	1
Nitrate+Nitrite (N)	mg/L	35	EPA 353.2	0.04	0.01		06/20/14 09:49	1
Orthophosphate as P	mg/L	0.78	EPA 300.0	0.040	0.010		05/29/14 11:43	1
Phosphorous - Total as P	mg/L	1.6	SM 4500P-E	0.040	0.010	06/11/14 09:57	06/24/14 12:12	1
Sulfate	mg/L	28	EPA 300.0	0.60	0.20		05/29/14 11:43	1
Sulfide	mg/L	0.79	SM 4500SF	0.40	0.10		06/03/14 16:28	1
Total Alkalinity	mg/L	270	SM 2320B	8.0	2.0		05/30/14 12:57	1
Total Kjeldahl Nitrogen	mg/L	1.8	EPA 351.2	0.20	0.05	06/11/14 09:57	06/23/14 14:25	1
Total Organic Carbon	mg/L	12	SM 5310B	1.0	0.060		06/02/14 14:16	1

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Project Name		B-HS5 SE#9						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS5-LIGNO-0						
Matrix		Wastewater						
SAL Sample Number		1405267-09						
Date/Time Collected		05/28/14 10:30						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
Total Suspended Solids	mg/L	6	SM 2540D	1	1	05/29/14 14:13	06/04/14 09:54	1
Volatile Suspended Solids	mg/L	6	EPA 160.4	1	1	05/29/14 14:13	06/04/14 09:57	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	05/28/14 15:15	05/29/14 09:47	1
Fecal Coliforms	CFU/100 ml	50	SM 9222D	1	1	05/28/14 15:23	05/29/14 14:24	1
Sample Description		BHS5-LIGNO-0-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1405267-10						
Date/Time Collected		05/28/14 10:30						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganic, Dissolved</u>								
Ammonia as N	mg/L	0.12	EPA 350.1	0.040	0.009		06/25/14 17:46	1
Carbonaceous BOD	mg/L	2	SM 5210B	2	2	05/29/14 12:05	06/03/14 09:47	1
Total Kjeldahl Nitrogen	mg/L	2.2	EPA 351.2	0.20	0.050	06/23/14 15:10	06/25/14 12:09	1
Nitrate+Nitrite (N)	mg/L	36	EPA 353.2	0.04	0.01		06/20/14 09:49	1
Lab filtration for diss. analytes							05/29/14 12:05	
Sample Description		BHS5-SULFUR-6						
Matrix		Wastewater						
SAL Sample Number		1405267-11						
Date/Time Collected		05/28/14 10:43						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Ammonia as N	mg/L	34	EPA 350.1	0.040	0.009	06/23/14 11:01	06/23/14 11:07	1
Nitrate (as N)	mg/L	0.01 I	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Sulfate	mg/L	99	EPA 300.0	6.0	2.0		06/14/14 01:11	10
Total Kjeldahl Nitrogen	mg/L	1.3	EPA 351.2	0.20	0.05	06/11/14 09:57	06/23/14 14:25	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		05/29/14 11:43	1

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Laboratory Report

Project Name		B-HS5 SE#9						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS5-SULFUR-12						
Matrix		Wastewater						
SAL Sample Number		1405267-12						
Date/Time Collected		05/28/14 10:50						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Ammonia as N	mg/L	1.5	EPA 350.1	0.040	0.009	06/23/14 11:01	06/23/14 11:07	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Sulfate	mg/L	110	EPA 300.0	6.0	2.0		06/14/14 01:23	10
Total Kjeldahl Nitrogen	mg/L	1.1	EPA 351.2	0.20	0.05	06/11/14 09:57	06/23/14 14:25	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		05/29/14 11:43	1
Sample Description		BHS5-ST2						
Matrix		Wastewater						
SAL Sample Number		1405267-13						
Date/Time Collected		05/28/14 10:25						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	6.3	SM 4550SF	0.04	0.01	06/03/14 17:02	06/03/14 17:05	1
Ammonia as N	mg/L	21	EPA 350.1	0.040	0.009	06/23/14 11:01	06/23/14 11:07	1
Carbonaceous BOD	mg/L	13	SM 5210B	2	2	05/29/14 09:04	06/03/14 09:42	1
Chemical Oxygen Demand	mg/L	27	EPA 410.4	25	10	06/24/14 10:02	06/24/14 13:34	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Orthophosphate as P	mg/L	0.38	EPA 300.0	0.040	0.010		05/29/14 11:43	1
Phosphorous - Total as P	mg/L	0.89	SM 4500P-E	0.040	0.010	06/11/14 09:57	06/24/14 12:12	1
Sulfate	mg/L	160	EPA 300.0	6.0	2.0		06/13/14 08:42	10
Sulfide	mg/L	7.7	SM 4500SF	0.40	0.10		06/03/14 16:28	1
Total Alkalinity	mg/L	370	SM 2320B	8.0	2.0		05/30/14 13:10	1
Total Kjeldahl Nitrogen	mg/L	1.3	EPA 351.2	0.20	0.05	06/11/14 09:57	06/23/14 14:25	1
Total Organic Carbon	mg/L	13	SM 5310B	1.0	0.060		06/02/14 14:30	1
Total Suspended Solids	mg/L	4	SM 2540D	1	1	05/29/14 14:13	06/04/14 09:54	1
Volatile Suspended Solids	mg/L	4	EPA 160.4	1	1	05/29/14 14:13	06/04/14 09:57	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		05/29/14 11:43	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	05/28/14 15:15	05/29/14 09:47	1
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	05/28/14 15:23	05/29/14 14:24	1

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Laboratory Report

Project Name		B-HS5 SE#9						
Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	Dilution
Sample Description		BHS5-ST2-FILTERED						
Matrix		Wastewater						
SAL Sample Number		1405267-14						
Date/Time Collected		05/28/14 10:25						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Sulfate	mg/L	170	EPA 300.0	6.0	2.0		06/13/14 08:54	10
<u>Inorganic, Dissolved</u>								
Ammonia as N	mg/L	0.61	EPA 350.1	0.040	0.009		06/25/14 17:46	1
Carbonaceous BOD	mg/L	10	SM 5210B	2	2	05/29/14 12:05	06/03/14 09:47	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Total Kjeldahl Nitrogen	mg/L	1.1	EPA 351.2	0.20	0.050	06/23/14 15:10	06/25/14 12:09	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		05/29/14 11:43	1
Lab filtration for diss. analytes							05/29/14 12:05	
Sample Description		BHS5-EB						
Matrix		Reagent Water						
SAL Sample Number		1405267-15						
Date/Time Collected		05/28/14 12:23						
Collected by		Josefin Hirst						
Date/Time Received		05/28/14 14:35						
<u>Inorganics</u>								
Hydrogen Sulfide (Unionized)	mg/L	0.01 U	SM 4550SF	0.04	0.01	06/03/14 17:02	06/03/14 17:05	1
Ammonia as N	mg/L	0.48	EPA 350.1	0.040	0.009	06/23/14 11:01	06/23/14 11:07	1
Carbonaceous BOD	mg/L	2 U	SM 5210B	2	2	05/29/14 09:04	06/03/14 09:42	1
Chemical Oxygen Demand	mg/L	27	EPA 410.4	25	10	06/24/14 10:02	06/24/14 13:34	1
Nitrate (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/29/14 11:43	1
Orthophosphate as P	mg/L	0.010 U	EPA 300.0	0.040	0.010		05/29/14 11:43	1
Phosphorous - Total as P	mg/L	0.010 U	SM 4500P-E	0.040	0.010	06/11/14 09:57	06/24/14 12:12	1
Sulfate	mg/L	0.20 U	EPA 300.0	0.60	0.20		05/29/14 11:43	1
Sulfide	mg/L	0.10 U	SM 4500SF	0.40	0.10		06/03/14 16:28	1
Total Alkalinity	mg/L	2.1 I	SM 2320B	8.0	2.0		05/30/14 13:14	1
Total Kjeldahl Nitrogen	mg/L	0.09 I	EPA 351.2	0.20	0.05	06/11/14 09:57	06/23/14 14:25	1
Total Organic Carbon	mg/L	0.060 U	SM 5310B	1.0	0.060		06/02/14 14:44	1
Total Suspended Solids	mg/L	1 U	SM 2540D	1	1	05/29/14 14:13	06/04/14 09:54	1
Volatile Suspended Solids	mg/L	1 U	EPA 160.4	1	1	05/29/14 14:13	06/04/14 09:57	1
Nitrate+Nitrite (N)	mg/L	0.02 U	EPA 300.0	0.08	0.02		05/29/14 11:43	1
<u>Microbiology</u>								
E. Coli	MPN/100 mL	2.0 U	SM 9223B	2.0	2.0	05/28/14 15:15	05/29/14 09:47	1
Fecal Coliforms	CFU/100 ml	1 U	SM 9222D	1	1	05/28/14 15:23	05/29/14 14:24	1

SOUTHERN ANALYTICAL LABORATORIES, INC.

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE42905 - BOD										
Blank (BE42905-BLK1)					Prepared: 05/29/14 Analyzed: 06/03/14 09:42					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BE42905-BS1)					Prepared: 05/29/14 Analyzed: 06/03/14 09:42					
Carbonaceous BOD	200	2	2	mg/L	200		100	85-115		
LCS Dup (BE42905-BS1)					Prepared: 05/29/14 Analyzed: 06/03/14 09:42					
Carbonaceous BOD	195	2	2	mg/L	200		97	85-115	3	200
Duplicate (BE42905-DUP1)					Source: 1405267-03 Prepared: 05/29/14 Analyzed: 06/03/14 09:42					
Carbonaceous BOD	2 U	2	2	mg/L		ND				25
Batch BE42912 - Ion Chromatography 300.0 Prep										
Blank (BE42912-BLK1)					Prepared & Analyzed: 05/29/14 11:43					
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	0.951			mg/L	1.0		95	78-120		
Surrogate: Dichloroacetate	0.951			mg/L	1.0		95	78-120		
Surrogate: Dichloroacetate	0.951			mg/L	1.0		95	78-120		
Surrogate: Dichloroacetate	0.951			mg/L	1.0		95	78-120		
LCS (BE42912-BS1)					Prepared & Analyzed: 05/29/14 11:43					
Nitrite (as N)	1.42	0.04	0.01	mg/L	1.4		101	85-115		
Orthophosphate as P	0.936	0.040	0.010	mg/L	0.90		104	85-115		
Sulfate	9.05	0.60	0.20	mg/L	9.0		101	85-115		
Nitrate (as N)	1.64	0.04	0.01	mg/L	1.7		97	85-115		
Surrogate: Dichloroacetate	1.05			mg/L	1.0		105	78-120		
Surrogate: Dichloroacetate	1.05			mg/L	1.0		105	78-120		
Surrogate: Dichloroacetate	1.05			mg/L	1.0		105	78-120		
Surrogate: Dichloroacetate	1.05			mg/L	1.0		105	78-120		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE42912 - Ion Chromatography 300.0 Prep										
LCS Dup (BE42912-BSD1)					Prepared & Analyzed: 05/29/14 11:43					
Nitrite (as N)	1.42	0.04	0.01	mg/L	1.4		101	85-115	0.2	200
Sulfate	9.06	0.60	0.20	mg/L	9.0		101	85-115	0.1	200
Nitrate (as N)	1.64	0.04	0.01	mg/L	1.7		97	85-115	0	200
Orthophosphate as P	0.926	0.040	0.010	mg/L	0.90		103	85-115	1	200
Surrogate: Dichloroacetate	1.05			mg/L	1.0		105	78-120		
Surrogate: Dichloroacetate	1.05			mg/L	1.0		105	78-120		
Surrogate: Dichloroacetate	1.05			mg/L	1.0		105	78-120		
Surrogate: Dichloroacetate	1.05			mg/L	1.0		105	78-120		
Matrix Spike (BE42912-MS1)					Source: 1405267-02		Prepared & Analyzed: 05/29/14 11:43			
Nitrate (as N)	0.359 J2,J6	0.04	0.01	mg/L	1.7	ND	21	85-115		
Nitrite (as N)	2.86 J2,J6	0.04	0.01	mg/L	1.4	ND	204	85-115		
Orthophosphate as P	6.19	0.040	0.010	mg/L	0.90	5.16	115	85-115		
Sulfate	21.5 J2,J6	0.60	0.20	mg/L	9.0	9.61	132	85-115		
Surrogate: Dichloroacetate	0.932			mg/L	1.0		93	78-120		
Surrogate: Dichloroacetate	0.932			mg/L	1.0		93	78-120		
Surrogate: Dichloroacetate	0.932			mg/L	1.0		93	78-120		
Surrogate: Dichloroacetate	0.932			mg/L	1.0		93	78-120		
Matrix Spike (BE42912-MS2)					Source: 1405267-12		Prepared & Analyzed: 05/29/14 11:43			
Orthophosphate as P	1.43	0.040	0.010	mg/L	0.90	0.450	108	85-115		
Nitrate (as N)	1.66	0.04	0.01	mg/L	1.7	ND	98	85-115		
Sulfate	137 L	0.60	0.20	mg/L	9.0	105	357	85-115		
Nitrite (as N)	2.22 J2,J6	0.04	0.01	mg/L	1.4	ND	159	85-115		
Surrogate: Dichloroacetate	0.949			mg/L	1.0		95	78-120		
Surrogate: Dichloroacetate	0.949			mg/L	1.0		95	78-120		
Surrogate: Dichloroacetate	0.949			mg/L	1.0		95	78-120		
Surrogate: Dichloroacetate	0.949			mg/L	1.0		95	78-120		

SOUTHERN ANALYTICAL LABORATORIES, INC.

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10002 Princess Palm Ave, Suite 200

Tampa, FL 33619

July 24, 2014

Work Order: 1405267

Revised Report

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE42914 - Ion Chromatography 300.0 Prep										
Blank (BE42914-BLK1)					Prepared & Analyzed: 05/29/14 11:43					
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	0.930			mg/L	1.0		93	90-115		
Surrogate: Dichloroacetate	0.930			mg/L	1.0		93	90-115		
Surrogate: Dichloroacetate	0.930			mg/L	1.0		93	90-115		
Surrogate: Dichloroacetate	0.930			mg/L	1.0		93	90-115		
LCS (BE42914-BS1)					Prepared & Analyzed: 05/29/14 11:43					
Nitrite (as N)	1.46	0.04	0.01	mg/L	1.4		104	85-115		
Nitrate (as N)	1.68	0.04	0.01	mg/L	1.7		99	85-115		
Orthophosphate as P	0.937	0.040	0.010	mg/L	0.90		104	85-115		
Sulfate	9.27	0.60	0.20	mg/L	9.0		103	85-115		
Surrogate: Dichloroacetate	1.02			mg/L	1.0		102	90-115		
Surrogate: Dichloroacetate	1.02			mg/L	1.0		102	90-115		
Surrogate: Dichloroacetate	1.02			mg/L	1.0		102	90-115		
Surrogate: Dichloroacetate	1.02			mg/L	1.0		102	90-115		
LCS Dup (BE42914-BSD1)					Prepared & Analyzed: 05/29/14 11:43					
Orthophosphate as P	0.950	0.040	0.010	mg/L	0.90		106	85-115	1	200
Sulfate	9.30	0.60	0.20	mg/L	9.0		103	85-115	0.4	200
Nitrite (as N)	1.46	0.04	0.01	mg/L	1.4		104	85-115	0.2	200
Nitrate (as N)	1.67	0.04	0.01	mg/L	1.7		98	85-115	0.2	200
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		

SOUTHERN ANALYTICAL LABORATORIES, INC.

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**Hazen and Sawyer****10002 Princess Palm Ave, Suite 200****Tampa, FL 33619****July 24, 2014****Work Order: 1405267****Revised Report****Inorganics - Quality Control**

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
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Batch BE42914 - Ion Chromatography 300.0 Prep**Matrix Spike (BE42914-MS1)****Source: 1405401-04**

Prepared & Analyzed: 05/29/14 11:43

Orthophosphate as P	0.842	0.040	0.010	mg/L	0.90	ND	94	85-115
Nitrate (as N)	6.39	0.04	0.01	mg/L	1.7	4.58	106	85-115
Sulfate	20.1	0.60	0.20	mg/L	9.0	10.4	108	85-115
Nitrite (as N)	1.35	0.04	0.01	mg/L	1.4	ND	96	85-115
Surrogate: Dichloroacetate	0.976			mg/L	1.0		98	90-115
Surrogate: Dichloroacetate	0.976			mg/L	1.0		98	90-115
Surrogate: Dichloroacetate	0.976			mg/L	1.0		98	90-115
Surrogate: Dichloroacetate	0.976			mg/L	1.0		98	90-115

Matrix Spike (BE42914-MS2)**Source: 1404937-04**

Prepared & Analyzed: 05/29/14 11:43

Sulfate	122	6.0	2.0	mg/L	90	32.9	99	85-115
Nitrate (as N)	16.0	0.40	0.10	mg/L	17	0.220	93	85-115
Nitrite (as N)	13.6	0.40	0.10	mg/L	14	ND	97	85-115
Orthophosphate as P	9.68	0.40	0.10	mg/L	9.0	0.700	100	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

Batch BE42927 - TSS prep**Blank (BE42927-BLK1)**

Prepared: 05/29/14 Analyzed: 06/04/14 09:57

Volatile Suspended Solids	1 U	1		mg/L
Total Suspended Solids	1 U	1	1	mg/L

LCS (BE42927-BS1)

Prepared: 05/29/14 Analyzed: 06/04/14 09:54

Total Suspended Solids	50.5	1	1	mg/L	50	101	85-115
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July 24, 2014
Work Order: 1405267
Revised Report

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE42927 - TSS prep										
Duplicate (BE42927-DUP1)		Source: 1405267-01			Prepared: 05/29/14 Analyzed: 06/04/14 09:54					
Total Suspended Solids	34.0	1	1	mg/L		34.0			0	30
Volatile Suspended Solids	30.8	1		mg/L		30.8			0	20
Batch BE43007 - alkalinity										
Blank (BE43007-BLK1)		Prepared & Analyzed: 05/30/14 11:00								
Total Alkalinity	2.0 U	8.0	2.0	mg/L						
LCS (BE43007-BS1)		Prepared & Analyzed: 05/30/14 11:05								
Total Alkalinity	130	8.0	2.0	mg/L	120		102	90-110		
Matrix Spike (BE43007-MS1)		Source: 1405298-01			Prepared & Analyzed: 05/30/14 14:07					
Total Alkalinity	220	8.0	2.0	mg/L	120	100	94	80-120		
Matrix Spike Dup (BE43007-MSD1)		Source: 1405298-01			Prepared & Analyzed: 05/30/14 14:15					
Total Alkalinity	220	8.0	2.0	mg/L	120	100	94	80-120	0.2	26
Batch BF40207 - TOC prep										
Blank (BF40207-BLK1)		Prepared & Analyzed: 06/02/14 11:58								
Total Organic Carbon	0.060 U	1.0	0.060	mg/L						
LCS (BF40207-BS1)		Prepared & Analyzed: 06/02/14 12:12								
Total Organic Carbon	9.93	1.0	0.060	mg/L	10		99	90-110		
Matrix Spike (BF40207-MS1)		Source: 1405482-01			Prepared & Analyzed: 06/02/14 15:17					
Total Organic Carbon	14.7	1.0	0.060	mg/L	10	3.28	115	85-115		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BF40207 - TOC prep										
Matrix Spike Dup (BF40207-MSD1)		Source: 1405482-01			Prepared & Analyzed: 06/02/14 15:35					
Total Organic Carbon	14.4	1.0	0.060	mg/L	10	3.28	111	85-115	2	10
Batch BF40331 - Sulfide prep										
Blank (BF40331-BLK1)					Prepared & Analyzed: 06/03/14 16:28					
Sulfide	0.10 U	0.40	0.10	mg/L						
Blank (BF40331-BLK2)					Prepared & Analyzed: 06/03/14 16:28					
Sulfide	0.10 U	0.40	0.10	mg/L						
LCS (BF40331-BS1)					Prepared & Analyzed: 06/03/14 16:28					
Sulfide	4.95	0.40	0.10	mg/L	5.0		99	85-115		
LCS (BF40331-BS2)					Prepared & Analyzed: 06/03/14 16:28					
Sulfide	4.75	0.40	0.10	mg/L	5.0		95	85-115		
Matrix Spike (BF40331-MS1)		Source: 1405266-15			Prepared & Analyzed: 06/03/14 16:28					
Sulfide	4.75	0.40	0.10	mg/L	5.0	ND	95	85-115		
Matrix Spike (BF40331-MS2)		Source: 1405631-05			Prepared & Analyzed: 06/03/14 16:28					
Sulfide	5.54	0.40	0.10	mg/L	5.0	0.590	99	85-115		
Matrix Spike Dup (BF40331-MSD1)		Source: 1405266-15			Prepared & Analyzed: 06/03/14 16:28					
Sulfide	4.75	0.40	0.10	mg/L	5.0	ND	95	85-115	0	14
Matrix Spike Dup (BF40331-MSD2)		Source: 1405631-05			Prepared & Analyzed: 06/03/14 16:28					
Sulfide	5.74	0.40	0.10	mg/L	5.0	0.590	103	85-115	4	14

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BF41111 - Digestion for TP and TKN										
Blank (BF41111-BLK1)					Prepared: 06/11/14 Analyzed: 06/23/14 14:25					
Total Kjeldahl Nitrogen	0.05 U	0.20	0.05	mg/L						
Phosphorous - Total as P	0.010 U	0.040	0.010	mg/L						
LCS (BF41111-BS1)					Prepared: 06/11/14 Analyzed: 06/24/14 12:12					
Phosphorous - Total as P	0.537	0.040	0.010	mg/L	0.50		107	90-110		
Total Kjeldahl Nitrogen	0.998	0.20	0.05	mg/L	1.0		100	90-110		
LCS (BF41111-BS2)					Prepared: 06/11/14 Analyzed: 06/24/14 12:12					
Phosphorous - Total as P	0.452	0.040	0.010	mg/L	0.50		90	90-110		
Total Kjeldahl Nitrogen	0.987	0.20	0.05	mg/L	1.0		99	90-110		
Matrix Spike (BF41111-MS1)					Source: 1405266-08		Prepared: 06/11/14 Analyzed: 06/23/14 14:25			
Total Kjeldahl Nitrogen	3.30	0.20	0.05	mg/L	1.0	2.42	88	90-110		
Phosphorous - Total as P	2.87	0.040	0.010	mg/L	0.50	2.39	97	90-110		
Matrix Spike (BF41111-MS2)					Source: 1405267-07		Prepared: 06/11/14 Analyzed: 06/23/14 14:25			
Total Kjeldahl Nitrogen	2.15 J2	0.20	0.05	mg/L	1.0	2.12	3	90-110		
Phosphorous - Total as P	2.40 J2	0.040	0.010	mg/L	0.50	1.81	119	90-110		
Matrix Spike Dup (BF41111-MSD1)					Source: 1405266-08		Prepared: 06/11/14 Analyzed: 06/24/14 12:12			
Phosphorous - Total as P	2.88	0.040	0.010	mg/L	0.50	2.39	98	90-110	0.1	25
Total Kjeldahl Nitrogen	3.34	0.20	0.05	mg/L	1.0	2.42	92	90-110	1	20
Matrix Spike Dup (BF41111-MSD2)					Source: 1405267-07		Prepared: 06/11/14 Analyzed: 06/23/14 14:25			
Total Kjeldahl Nitrogen	3.44 J3	0.20	0.05	mg/L	1.0	2.12	132	90-110	46	20
Phosphorous - Total as P	2.26 J2	0.040	0.010	mg/L	0.50	1.81	90	90-110	6	25

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July 24, 2014
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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BF41141 - COD prep										
Blank (BF41141-BLK1)					Prepared: 06/11/14 Analyzed: 06/23/14 17:44					
Chemical Oxygen Demand	10 U	25	10	mg/L						
LCS (BF41141-BS1)					Prepared: 06/11/14 Analyzed: 06/23/14 17:44					
Chemical Oxygen Demand	45	25	10	mg/L	50		90	90-110		
Matrix Spike (BF41141-MS1)					Source: 1405265-09		Prepared: 06/11/14 Analyzed: 06/23/14 17:44			
Chemical Oxygen Demand	70	25	10	mg/L	50	16	108	85-115		
Matrix Spike Dup (BF41141-MSD1)					Source: 1405265-09		Prepared: 06/11/14 Analyzed: 06/23/14 17:44			
Chemical Oxygen Demand	72	25	10	mg/L	50	16	112	85-115	3	32
Batch BF41215 - Ion Chromatography 300.0 Prep										
Blank (BF41215-BLK1)					Prepared & Analyzed: 06/13/14 04:01					
Sulfate	0.20 U	0.60	0.20	mg/L						
Surrogate: Dichloroacetate	0.889			mg/L	1.0		89	78-120		
LCS (BF41215-BS1)					Prepared & Analyzed: 06/13/14 04:12					
Sulfate	8.84	0.60	0.20	mg/L	9.0		98	85-115		
Surrogate: Dichloroacetate	1.06			mg/L	1.0		106	78-120		
LCS Dup (BF41215-BSD1)					Prepared & Analyzed: 06/13/14 04:23					
Sulfate	8.83	0.60	0.20	mg/L	9.0		98	85-115	0.2	200
Surrogate: Dichloroacetate	1.06			mg/L	1.0		106	78-120		
Matrix Spike (BF41215-MS1)					Source: 1405683-10		Prepared & Analyzed: 06/13/14 06:27			
Sulfate	106	6.0	2.0	mg/L	90	21.1	94	85-115		
Surrogate: Dichloroacetate	1.12			mg/L	1.0		112	78-120		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BF41215 - Ion Chromatography 300.0 Prep										
Matrix Spike (BF41215-MS2)		Source: 1405683-12			Prepared & Analyzed: 06/13/14 07:24					
Sulfate	95.7	6.0	2.0	mg/L	90	11.9	93	85-115		
Surrogate: Dichloroacetate	1.10			mg/L	1.0		110	78-120		
Batch BF41311 - Ion Chromatography 300.0 Prep										
Blank (BF41311-BLK1)					Prepared & Analyzed: 06/13/14 23:52					
Sulfate	0.20 U	0.60	0.20	mg/L						
Surrogate: Dichloroacetate	0.852			mg/L	1.0		85	78-120		
LCS (BF41311-BS1)					Prepared & Analyzed: 06/14/14 00:04					
Sulfate	8.74	0.60	0.20	mg/L	9.0		97	85-115		
Surrogate: Dichloroacetate	0.986			mg/L	1.0		99	78-120		
LCS Dup (BF41311-BSD1)					Prepared & Analyzed: 06/14/14 00:15					
Sulfate	8.76	0.60	0.20	mg/L	9.0		97	85-115	0.2	200
Surrogate: Dichloroacetate	0.988			mg/L	1.0		99	78-120		
Matrix Spike (BF41311-MS1)		Source: 1405267-12			Prepared & Analyzed: 06/14/14 01:34					
Sulfate	201	6.0	2.0	mg/L	90	105	107	85-115		
Surrogate: Dichloroacetate	0.908			mg/L	1.0		91	78-120		
Matrix Spike (BF41311-MS2)		Source: 1405849-05			Prepared & Analyzed: 06/14/14 03:04					
Sulfate	1,430	60	20	mg/L	900	520	101	85-115		
Surrogate: Dichloroacetate	0.883			mg/L	1.0		88	78-120		
Batch BF41906 - Nitrate 353.2 by seal										
Blank (BF41906-BLK1)					Prepared & Analyzed: 06/20/14 09:49					
Nitrate+Nitrite (N)	0.01 U	0.04	0.01	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 BF41906 - Nitrate 353.2 by seal										
LCS (BF41906-BS1)					Prepared & Analyzed: 06/20/14 09:49					
Nitrate+Nitrite (N)	0.836	0.04	0.01	mg/L	0.80		105	90-110		
Matrix Spike (BF41906-MS1)					Source: 1405748-01 Prepared & Analyzed: 06/20/14 09:49					
Nitrate+Nitrite (N)	1.03	0.04	0.01	mg/L	1.0	0.0248	101	90-110		
Matrix Spike (BF41906-MS2)					Source: 1405791-01 Prepared & Analyzed: 06/20/14 09:49					
Nitrate+Nitrite (N)	1.94 J2	0.04	0.01	mg/L	1.0	1.18	76	90-110		
Matrix Spike Dup (BF41906-MSD1)					Source: 1405748-01 Prepared & Analyzed: 06/20/14 09:49					
Nitrate+Nitrite (N)	1.04	0.04	0.01	mg/L	1.0	0.0248	102	90-110	1	20
Matrix Spike Dup (BF41906-MSD2)					Source: 1405791-01 Prepared & Analyzed: 06/20/14 09:49					
Nitrate+Nitrite (N)	1.92 J2	0.04	0.01	mg/L	1.0	1.18	73	90-110	1	20
Batch BF42316 - Ammonia by SEAL										
Blank (BF42316-BLK1)					Prepared & Analyzed: 06/23/14 11:07					
Ammonia as N	0.009 U	0.040	0.009	mg/L						
LCS (BF42316-BS1)					Prepared & Analyzed: 06/23/14 11:07					
Ammonia as N	0.51	0.040	0.009	mg/L	0.50		101	90-110		
Matrix Spike (BF42316-MS1)					Source: 1405266-04 Prepared & Analyzed: 06/23/14 11:07					
Ammonia as N	0.45 J4	0.040	0.009	mg/L	0.50	2.6	NR	90-110		
Matrix Spike (BF42316-MS2)					Source: 1405267-15 Prepared & Analyzed: 06/23/14 11:07					
Ammonia as N	1.7 L	0.040	0.009	mg/L	0.50	0.48	252	90-110		

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BF42316 - Ammonia by SEAL										
Matrix Spike Dup (BF42316-MSD1)		Source: 1405266-04			Prepared & Analyzed: 06/23/14 11:07					
Ammonia as N	0.44 J4	0.040	0.009	mg/L	0.50	2.6	NR	90-110	3	10
Matrix Spike Dup (BF42316-MSD2)		Source: 1405267-15			Prepared & Analyzed: 06/23/14 11:07					
Ammonia as N	2.4 L	0.040	0.009	mg/L	0.50	0.48	384	90-110	32	10
Batch BF42405 - COD prep										
Blank (BF42405-BLK1)					Prepared & Analyzed: 06/24/14 13:34					
Chemical Oxygen Demand	10 U	25	10	mg/L						
LCS (BF42405-BS1)					Prepared & Analyzed: 06/24/14 13:34					
Chemical Oxygen Demand	50	25	10	mg/L	50		100	90-110		
Matrix Spike (BF42405-MS1)		Source: 1405266-01			Prepared & Analyzed: 06/24/14 13:34					
Chemical Oxygen Demand	450 L2	25	10	mg/L	50	250	404	85-115		
Matrix Spike Dup (BF42405-MSD1)		Source: 1405266-01			Prepared & Analyzed: 06/24/14 13:34					
Chemical Oxygen Demand	440 L2	25	10	mg/L	50	250	386	85-115	2	32

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Inorganic, Dissolved - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE42907 - BOD Dissolved										
Blank (BE42907-BLK1)					Prepared: 05/29/14 Analyzed: 06/03/14 09:47					
Carbonaceous BOD	2 U	2	2	mg/L						
LCS (BE42907-BS1)					Prepared: 05/29/14 Analyzed: 06/03/14 09:47					
Carbonaceous BOD	205	2	2	mg/L	200		103	85-115		
LCS Dup (BE42907-BSD1)					Prepared: 05/29/14 Analyzed: 06/03/14 09:47					
Carbonaceous BOD	210	2	2	mg/L	200		105	85-115	2	200
Duplicate (BE42907-DUP1)					Source: 1405267-14 Prepared: 05/29/14 Analyzed: 06/03/14 09:47					
Carbonaceous BOD	10	2	2	mg/L		10			5	25
Batch BE42914 - Ion Chromatography 300.0 Prep										
Blank (BE42914-BLK1)					Prepared & Analyzed: 05/29/14 11:43					
Nitrite (as N)	0.01 U	0.04	0.01	mg/L						
Nitrate (as N)	0.01 U	0.04	0.01	mg/L						
Surrogate: Dichloroacetate	0.930			mg/L	1.0		93	90-115		
Surrogate: Dichloroacetate	0.930			mg/L	1.0		93	90-115		
LCS (BE42914-BS1)					Prepared & Analyzed: 05/29/14 11:43					
Nitrate (as N)	1.68	0.04	0.01	mg/L	1.7		99	85-115		
Nitrite (as N)	1.46	0.04	0.01	mg/L	1.4		104	85-115		
Surrogate: Dichloroacetate	1.02			mg/L	1.0		102	90-115		
Surrogate: Dichloroacetate	1.02			mg/L	1.0		102	90-115		
LCS Dup (BE42914-BSD1)					Prepared & Analyzed: 05/29/14 11:43					
Nitrate (as N)	1.67	0.04	0.01	mg/L	1.7		98	85-115	0.2	200
Nitrite (as N)	1.46	0.04	0.01	mg/L	1.4		104	85-115	0.2	200
Surrogate: Dichloroacetate	1.06			mg/L	1.0		106	90-115		
Surrogate: Dichloroacetate	1.06			mg/L	1.0		106	90-115		

SOUTHERN ANALYTICAL LABORATORIES, INC.

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

July 24, 2014
Work Order: 1405267
Revised Report

Inorganic, Dissolved - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE42914 - Ion Chromatography 300.0 Prep										
Matrix Spike (BE42914-MS1)		Source: 1405401-04			Prepared & Analyzed: 05/29/14 11:43					
Nitrate (as N)	6.39	0.04	0.01	mg/L	1.7	4.58	106	85-115		
Nitrite (as N)	1.35	0.04	0.01	mg/L	1.4	ND	96	85-115		
Surrogate: Dichloroacetate	0.976			mg/L	1.0		98	90-115		
Surrogate: Dichloroacetate	0.976			mg/L	1.0		98	90-115		
Matrix Spike (BE42914-MS2)		Source: 1404937-04			Prepared & Analyzed: 05/29/14 11:43					
Nitrate (as N)	16.0	0.40	0.10	mg/L	17	0.220	93	85-115		
Nitrite (as N)	13.6	0.40	0.10	mg/L	14	ND	97	85-115		
Surrogate: Dichloroacetate	1.06			mg/L	1.0		106	90-115		
Surrogate: Dichloroacetate	1.06			mg/L	1.0		106	90-115		
Batch BF41906 - Nitrate 353.2 by seal										
Blank (BF41906-BLK1)		Prepared & Analyzed: 06/20/14 09:49								
Nitrate+Nitrite (N)	0.01 U	0.04	0.01	mg/L						
LCS (BF41906-BS1)		Prepared & Analyzed: 06/20/14 09:49								
Nitrate+Nitrite (N)	0.804	0.04	0.01	mg/L	0.80		100	90-110		
Matrix Spike (BF41906-MS1)		Source: 1405748-01			Prepared & Analyzed: 06/20/14 09:49					
Nitrate+Nitrite (N)	1.03	0.04	0.01	mg/L	1.0	0.0248	101	80-120		
Matrix Spike (BF41906-MS2)		Source: 1405791-01			Prepared & Analyzed: 06/20/14 09:49					
Nitrate+Nitrite (N)	1.94 J2	0.04	0.01	mg/L	1.0	1.18	76	80-120		
Matrix Spike Dup (BF41906-MSD1)		Source: 1405748-01			Prepared & Analyzed: 06/20/14 09:49					
Nitrate+Nitrite (N)	1.04	0.04	0.01	mg/L	1.0	0.0248	102	80-120	1	20

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Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BF41906 - Nitrate 353.2 by seal										
Matrix Spike Dup (BF41906-MSD2)		Source: 1405791-01			Prepared & Analyzed: 06/20/14 09:49					
Nitrate+Nitrite (N)	1.92 J2	0.04	0.01	mg/L	1.0	1.18	73	80-120	1	20
Batch BF42328 - Digestion for TP and TKN										
Blank (BF42328-BLK1)					Prepared: 06/23/14 Analyzed: 06/25/14 12:09					
Total Kjeldahl Nitrogen	0.050 U	0.20	0.050	mg/L						
LCS (BF42328-BS1)					Prepared: 06/23/14 Analyzed: 06/25/14 12:09					
Total Kjeldahl Nitrogen	1.28	0.20	0.050	mg/L	1.3		96	90-110		
Matrix Spike (BF42328-MS1)		Source: 1405265-10			Prepared: 06/23/14 Analyzed: 06/25/14 12:09					
Total Kjeldahl Nitrogen	2.51 J2	0.20	0.050	mg/L	1.3	4.75	NR	90-110		
Matrix Spike (BF42328-MS2)		Source: 1405267-14			Prepared: 06/23/14 Analyzed: 06/25/14 12:09					
Total Kjeldahl Nitrogen	2.52	0.20	0.050	mg/L	1.3	1.11	106	90-110		
Matrix Spike Dup (BF42328-MSD1)		Source: 1405265-10			Prepared: 06/23/14 Analyzed: 06/25/14 12:09					
Total Kjeldahl Nitrogen	2.88 J2	0.20	0.050	mg/L	1.3	4.75	NR	90-110	14	20
Matrix Spike Dup (BF42328-MSD2)		Source: 1405267-14			Prepared: 06/23/14 Analyzed: 06/25/14 12:09					
Total Kjeldahl Nitrogen	2.35	0.20	0.050	mg/L	1.3	1.11	93	90-110	7	20
Batch BF43031 - Ammonia Dissolved by Seal										
Blank (BF43031-BLK1)					Prepared & Analyzed: 06/25/14 17:46					
Ammonia as N	0.009 U	0.040	0.009	mg/L						

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Inorganic, Dissolved - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BF43031 - Ammonia Dissolved by Seal										
LCS (BF43031-BS1)					Prepared & Analyzed: 06/25/14 17:46					
Ammonia as N	0.50	0.040	0.009	mg/L	0.50		101	90-110		
Matrix Spike (BF43031-MS1)					Source: 1405265-02 Prepared & Analyzed: 06/25/14 17:46					
Ammonia as N	93	0.040	0.009	mg/L	50	49	88	90-110		
Matrix Spike (BF43031-MS2)					Source: 1405267-14 Prepared & Analyzed: 06/25/14 17:46					
Ammonia as N	1.1	0.040	0.009	mg/L	0.50	0.61	88	90-110		
Matrix Spike Dup (BF43031-MSD1)					Source: 1405265-02 Prepared & Analyzed: 06/25/14 17:46					
Ammonia as N	94	0.040	0.009	mg/L	50	49	90	90-110	0.9	10
Matrix Spike Dup (BF43031-MSD2)					Source: 1405267-14 Prepared & Analyzed: 06/25/14 17:46					
Ammonia as N	1.1	0.040	0.009	mg/L	0.50	0.61	95	90-110	3	10

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Microbiology - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE42825 - FC-MF										
Blank (BE42825-BLK1)					Prepared: 05/28/14 Analyzed: 05/29/14 14:24					
Fecal Coliforms	1 U	1	1	CFU/100 ml						
Duplicate (BE42825-DUP1)					Source: 1405487-02 Prepared: 05/28/14 Analyzed: 05/29/14 14:24					
Fecal Coliforms	6.00	1	1	CFU/100 ml		ND				200
Duplicate (BE42825-DUP2)					Source: 1405489-02 Prepared: 05/28/14 Analyzed: 05/29/14 14:24					
Fecal Coliforms	1 U	1	1	CFU/100 ml		ND				200

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* 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.

- L2 Analyte level in sample invalidated Matrix Spike.
- L Off-scale high. Result exceeded highest calibration standard.
- J6 The sample matrix interfered with the ability to make any accurate determination.
- J4 Quality control sample(s) associated with this sample did not meet established criteria.
- J3 Quality control value for precision was outside control limits.
- J2 Quality control value for accuracy was outside control limits.

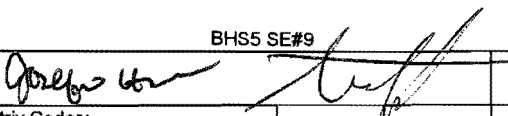
Questions regarding this report should be directed to :

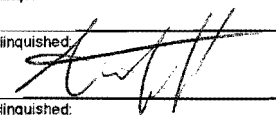
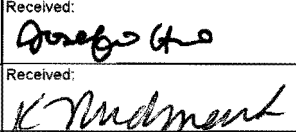
Kathryn Nordmark

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

Kathryn@southernanalyticallabs.com



Client Name Hazan and Sawyer										Contact / Phone: Josefin Hirst 813-630-4498									
Project Name / Location BHS5 SE#9																			
Samplers: (Signature) 										PARAMETER / CONTAINER DESCRIPTION									
<p>Matrix Codes: DW-Drinking Water WW-Wastewater SW-Surface Water SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water</p>																			
SAL Use Only	Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	125mLP, Na ₂ S ₂ O ₃ FC-MF, FC-QT	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	40mLaV, HCl TOC	500mLP, Cool Lab Filtered(CBOD, TKN, NH ₃ , NOx)	125mLP, H ₂ SO ₄ TKN, NH ₃	500mLP, Cool NOx, SO ₄	pH	Temperature	Conductivity	DO
	01	BHS5-STE	5/28/14	11:36	WW		X	4	2	1	1	2				7.09	26.4	1254	0.05
	02	BHS5-STE-FILTERED		11:36	WW		X						1			7.09	26.4	1254	0.05
	03	BHS5-ST1		11:15	WW		X	4	2	1	1	2				6.65	24.9	1240	3.48
	04	BHS5-ST1-DUP		11:20	WW		X	4	2	1	1	2				6.65	24.9	1240	3.48
	05	BHS5-ST1-FILTERED		11:15	WW		X						1			6.65	24.9	1240	3.48
	06	BHS5-LIGNO-36		11:10	WW		X							1	1	6.63	27.3	1160	0.12
	07	BHS5-LIGNO-24		11:00	WW		X							1	1	6.73	26.8	1196	0.35
	08	BHS5-LIGNO-12		10:50	WW		X							1	1	6.58	25.3	1201	0.45
	09	BHS5-LIGNO-0		10:30	WW		X	4	2	1	1	2				6.44	27.5	1166	0.23
	10	BHS5-LIGNO-0-FILTERED		10:30	WW		X						1			6.44	27.5	1166	0.23
	11	BHS5-SULFUR-6		10:43	WW		X							1	1	6.48	27.1	1257	0.20
	12	BHS5-SULFUR-12		10:50	WW		X							1	1	6.51	26.3	1299	0.20

Containers Prepared/Relinquished:		Date/Time:	Received:	Date/Time:	Seal intact?	Y N <input checked="" type="radio"/>	Instructions / Remarks <div style="font-size: 2em; text-align: center;">1405267</div>
Relinquished: 		Date/Time: 5/28/14	Received: 	Date/Time: 5/23/14 1200	Samples intact upon arrival?	<input checked="" type="radio"/> N NA	
Relinquished:		Date/Time:	Received:	Date/Time: 4:35 5/28/14	Received on ice? Temp _____	<input checked="" type="radio"/> N NA	
Relinquished:		Date/Time:	Received:	Date/Time:	Proper preservatives indicated?	<input checked="" type="radio"/> N NA	
Relinquished:		Date/Time:	Received:	Date/Time:	Rec'd w/ in holding time?	<input checked="" type="radio"/> N NA	
Relinquished:		Date/Time:	Received:	Date/Time:	Volatiles rec'd w/ out headspace	Y N <input checked="" type="radio"/>	
Relinquished:		Date/Time:	Received:	Date/Time:	Proper containers used?	<input checked="" type="radio"/> N NA	

[illegible]



Appendix B: Operation & Maintenance Log

Table B.1
Operation and Maintenance Log

Date	Description
6/24/2013	Construction - Stage 1 and Stage 2 tanks installed
6/25/2013	Construction - Drainfield distribution box installed and all pipework
7/9/2013	System Start-up
	Bull run valve switched from drainfield to Stage 1 biofilter
7/17/2013	System check
7/23/2013	Construction - sod installation
7/29/2013	Preliminary sample event No. 1
8/6/2013	Site visit. System ok.
	Need to add soil around low side of pump tank riser
8/15/2013	Preliminary sample event No. 2
9/27/2013	Sample Event No. 1
11/8/2013	Site visit. System ok.
11/27/2013	Site visit. System ok.
12/4/2013	Sample Event No. 2
12/23/2013	Site visit. System ok.
1/23/2014	Site visit. System ok.
1/31/2014	Site visit. System ok.
2/3/2014	Sample Event No. 3
2/4/2014	Sample Event No. 4
2/5/2014	Sample Event No. 5
2/6/2014	Sample Event No. 6
2/7/2014	Sample Event No. 7
2/12/2014	Site visit. System ok.
3/14/2014	Site visit. System ok.
4/11/2014	Sample Event No. 8
4/25/2014	Site visit. System ok.
	Revised mode of operation to recirculation to the Stage 1 biofilter sprayers.
	Set recirc ratio to 3:1.
	Installed Stage 1 biofilter piezometer for water level monitoring.

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Table B.1 (con't)
Operation and Maintenance Log

4/29/2014	Site visit. System ok.
5/28/2014	Sample Event No. 9 (formal No. 5)
5/29/2014	Collected samples for product composition testing.

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Appendix C: Vericomm PLC Data

Table C.1
Vericomm Data April 11, 2014 through May 28, 2014

System Status		5/28/2014	5/8/2014	4/25/2014	4/11/2014
Point	Description	Value	Value	Value	Value
1	Alarm Status	OK	OK	OK	OK
2	Alert Status	OK	OK	OK	OK
3	System Mode	Normal	Normal	Normal	Normal
5	Timer Mode	Off	Off	Off	Normal
6	Active Off Time	60.0 Minutes	60.0 Minutes	60.0 Minutes	60.0 Minutes
7	Active On Time	2.1 Minutes	2.1 Minutes	0.7 Minutes	0.7 Minutes
9	Pump Mode	Off	Off	Off	OffCycl
10	Pump Status	Off	Off	Off	Off
12	Pump Cycles Today	7.0 Cycles	15.0 Cycles	2.0 Cycles	1.0 Cycles
13	Override Cycles Today	0.0 Cycles	0.0 Cycles	0.0 Cycles	0.0 Cycles
14	Pump Run Time Today	6.7 Minutes	17.6 Minutes	1.4 Minutes	0.7 Minutes
Settings					
Point	Description	Value	Value	Value	Value
17	Off Cycle Time	60.0 Minutes	60.0 Minutes	60.0 Minutes	60.0 Minutes
18	On Cycle Time	2.1 Minutes	2.1 Minutes	0.7 Minutes	0.7 Minutes
19	Override Off Cycle Time	30.0 Minutes	30.0 Minutes	30.0 Minutes	30.0 Minutes
20	Override On Cycle Time	0.7 Minutes	0.7 Minutes	0.7 Minutes	0.7 Minutes
21	Minimum Override Cycles	3.0 Cycles	3.0 Cycles	3.0 Cycles	3.0 Cycles
23	Override Cycle Limit per Day	7.0 Cycles	7.0 Cycles	7.0 Cycles	7.0 Cycles
24	Time Limit per Day	26.0 Minutes	26.0 Minutes	16.0 Minutes	16.0 Minutes
25	High Level Pump Test	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
28	Alarm Update Interval	240.0 Minutes	120.0 Minutes	120.0 Minutes	120.0 Minutes
29	Page Delay	960.0 Minutes	960.0 Minutes	960.0 Minutes	960.0 Minutes
30	Page Interval	30.0 Minutes	30.0 Minutes	30.0 Minutes	30.0 Minutes
31	Local Alarm Delay	1140.0 Minutes	1140.0 Minutes	1140.0 Minutes	1140.0 Minutes
32	Local Reactivate Delay	120.0 Minutes	120.0 Minutes	120.0 Minutes	120.0 Minutes
Troubleshooting					
Point	Description	Value	Value	Value	Value
33	Top Float Status	OK	OK	OK	OK
34	Middle Float Status	OK	OK	OK	OK
35	Bottom Float Status	OK	OK	OK	OK
37	Contactor Status	OK	OK	OK	OK
38	Pump Status	OK	OK	OK	OK
40	Filter Status	OK	OK	OK	OK
41	Tank Status	OK	OK	OK	OK
43	Power Status	OK	OK	OK	OK
Flow Data					
Point	Description	Value	Value	Value	Value
49	Pump Run Time Today	6.7 Minutes	17.7 Minutes	1.4 Minutes	0.7 Minutes
50	Override Cycles Today	0	0	0	0
51	Pump Cycles Today	7.0 Cycles	15.0 Cycles	2.0 Cycles	1.0 Cycles
52	Average Run Time per Cycle Today	1.0 Minutes	1.2 Minutes	0.7 Minutes	0.7 Minutes
54	Brownouts Today	0	0	0	0

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Table C.1 (continued)
Vericomm Data April 11, 2014 through May 28, 2014

		5/28/2014	5/8/2014	4/25/2014	4/11/2014
30-Day History Data					
Point	Description	Value	Value	Value	Value
65	30 Day Average Run Time per Day	17.5 Minutes	9.2 Minutes	4.5 Minutes	4.5 Minutes
66	30 Day Average Override Cycles per Day	0.0 Cycles	0.0 Cycles	0.0 Cycles	0.0 Cycles
67	30 Day Average Cycles per Day	15.3 Cycles	10.2 Cycles	6.2 Cycles	6.3 Cycles
68	30 Day Average Run Time per Cycle	1.1 Minutes	0.9 Minutes	0.7 Minutes	0.7 Minutes
71	30 Day Total Pump Run Time	525.6 Minutes	274.6 Minutes	133.6 Minutes	134.9 Minutes
72	30 Day Total Override Cycles	0.0 Cycles	0.0 Cycles	0.0 Cycles	0.0 Cycles
73	30 Day Total Cycles	458.0 Cycles	305.0 Cycles	187.0 Cycles	189.0 Cycles
76	30 Day Total Brownouts	0	0	0	0
Totalized Pump Data					
Point	Description	Value	Value	Value	Value
82	Pump Total Run Time	31.4 Hours	25.6 Hours	22.0 Hours	21.0 Hours
83	Pump Total Cycles	2372.0 Cycles	2073.0 Cycles	1863.0 Cycles	1773.0 Cycles
Miscellaneous					
Point	Description	Value	Value	Value	Value
145	Pump On Auto	Off	Off	Off	Off
147	Pump Test Today	Off	Off	Off	Off
148	Pump Check Enable	Off	Off	Off	Off
149	Total Override Cycles	0	0	0	0
150	High Level Condition	Off	Off	Off	Off
151	Leak Check Enable	Off	Off	Off	On
152	Brownout State	Off	Off	Off	Off
153	Test Mode	Off	Off	Off	Off
Alarm Points					
Point	Description	Value	Value	Value	Value
161	General Alarm	Off	Off	Off	Off
162	New Alarm	Off	Off	Off	Off
163	Update Central Enable	On	On	On	On
167	Page Alarm Start	Off	Off	Off	Off
168	Pager Signal	Off	Off	Off	Off
169	Local Alarm Start	Off	Off	Off	Off
170	Local Alarm Silence	Off	Off	Off	Off
Inputs & Outputs					
Point	Description	Value	Value	Value	Value
177	High Level/Override Timer Float Input	Off	Off	Off	Off
178	Timer Float Input	Off	Off	Off	On
179	Redundant Off Float & Low Level Alarm Input	On	On	On	On
181	Push To Silence Input	Off	Off	Off	Off
182	Auxiliary Contact Input	Off	Off	Off	Off
186	Pump Output	Off	Off	Off	Off
188	Alarm Light Output	Off	Off	Off	Off
189	Audible Alarm Output	Off	Off	Off	Off

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