

Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

B-HS1 Field System Monitoring Report No. 6

Progress Report

October 2012



HAZEN AND SAWYER Environmental Engineers & Scientists In association with



OTIS ENVIRONMENTAL CONSULTANTS, LLC

Florida Onsite Sewage Nitrogen Reduction Strategies Study

TASK B.7 PROGRESS REPORT

B-HS1 Field System Monitoring Report No. 6

Prepared for:

Florida Department of Health Division of Disease Control and Health Protection Bureau of Environmental Health Onsite Sewage Programs 4042 Bald Cypress Way Bin #A-08 Tallahassee, FL 32399-1713

FDOH Contract CORCL

October 2012

Prepared by:



In Association With:





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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. 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 sixth sample event of a passive nitrogen reduction system at a home site in Wakulla County, Florida (site B-HS1).

2.0 Purpose

This monitoring report documents data collected from the sixth B-HS1 monitoring and sampling event conducted on September 26, 2012. This monitoring event consisted of collecting flow measurements from the household water use meter and the treatment system internal water meter, recording electricity use, monitoring of field parameters, collection of water samples from five points in the treatment system, and sample analyses by a NELAC certified laboratory.

3.0 Materials and Methods

3.1 Project Site

The B-HS1 field site is located in Wakulla County, FL. The nitrogen reducing onsite treatment system for the single family residence was installed in June 2011. Design and construction details were presented previously in the Task B.6 document. The B-HS1 system consists of a 1,500 gallon two chamber concrete tank with a 1,000 gallon primary treatment tank (primary chamber) and a 500 gallon pump chamber (pump chamber); an Aerocell[™] unsaturated media filter; and a 1,500 gallon single chamber upflow tank containing Nitrex[™] media. Treated effluent from the Nitrex[™] unit 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. Based on measured average wastewater flow and tank volumes, there is over a ten day transit time through the treatment system prior to dispersal. Figure 1 is a site schematic showing the system components and layout of the installation.





B-HS1 MONITORING REPORT NO. 6

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3.2 Monitoring and Sample Locations and Identification

The four monitoring points for this sample event are shown in Figure 2. The first monitoring point, B-HS1-STE, is the effluent sampled approximately 1.5 feet below the surface of the first chamber of the primary tank, which is referred to as primary effluent or septic tank effluent (STE). Samples from monitoring point B-HS1-STE represent the whole household wastewater and are the influent to the remainder of the onsite nitrogen reduction system. The STE chamber is accessed from the middle tank lid of the primary treatment tank. The second sampling point (B-HS1-PUMP) was taken approximately 1.5 feet below the surface of the second chamber of the primary tank, which serves as the pump chamber and contains a mixture of primary effluent (STE) and recirculated effluent from the Aerocell[™] unsaturated biofilter.



The pump discharges wastewater to the top of the unsaturated AerocellTM chamber. The AerocellTM effluent flows into an adjustable split recirculation device which allows for a portion of the effluent to be sent back to the pump chamber. The remainder of the AerocellTM effluent proceeds to the NitrexTM tank. Samples from the third monitoring location are taken from the middle of the split recirculation device (B-HS1-AEROCELL) and represent AerocellTM effluent (Figure 3).



Figure 3 Recirculation Device (B-HS1-AEROCELL sample)

The fourth monitoring location is the NitrexTM tank sample tube that is connected to the NitrexTM effluent pipe which is located on the bottom of the NitrexTM tank (Figure 4). This sample represents the NitrexTM effluent, which is the final effluent from the treatment system prior to being discharged to the soil infiltration system, or drainfield. Each drainfield line has an observation port installed at the end near the Nitrex system for monitoring (see Figure 2)



Figure 4 NitrexTM Tank (B-HS1-NITREX sample)

3.3 Operational Monitoring

Start-up of the system occurred on June 10, 2011 and the system has operated continually since that date. For this sixth sampling event, the water meter for the house and the Aerocell[™] flow meter were read and recorded on September 26, 2012. The Aerocell[™] flow meter is located on the line leading from the pump/recirculation tank to the Aerocell[™] chamber and records the cumulative flow in gallons pumped from the pump chamber. The measurement of the Aerocell[™] flow meter includes both the forward wastewater flow from the household and the recirculation flow. The control panel includes telemetry where reports are generated regarding alarms, pump cycles, and other information using a Vericomm panel system.

3.4 Energy, Chemical and/or Additives 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 recirculation pump in the pump chamber, although a small amount of power is used by the control panel itself. There are no chemicals added to the system. However, the NitrexTM media is a "reactive" media which will be consumed

during operation. The Nitrex[™] tank was initially filled with 42 inches of media, which ostensibly will last for many years without replenishment or replacement.

3.5 Water Quality Sample Collection

Influent, intermediate, and effluent water quality samples from the system were collected September 26, 2012 for water quality analysis. Samples were collected at each of the four monitoring points described in Section 3.2: B-HS1-STE, B-HS1-PUMP, B-HS1-AEROCELL, and B-HS1-NITREX. A duplicate sample was taken at monitoring point B-HS1-NITREX. 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. The sampling tube was placed approximately 1.5 feet below the surface in the STE and pump chamber samples and at mid-depth in the split recirculation device.

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 laboratory. 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, total Kjeldahl nitrogen (TKN-N), ammonia nitrogen (NH₃-N), nitrate nitrogen (NO₃-N), nitrite nitrogen (NO₂-N), total phosphorus (TP), orthophosphate (Ortho P), total suspended solids (TSS), fecal coliform (fecal), and E.coli. All analyses were performed by independent and fully NELAC certified analytical laboratories (Southern Analytical Laboratory and Ackuritlabs, Inc.). Table 1 lists the analytical parameters, analytical methods, and detection limits for these analyses.

| Analytical Parameters, | Method of Analysis, and | d 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 |
| 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) | SM 2540E | 1 mg/L |
| Fecal Coliform (fecal) | SM9222D | 2 ct/100mL |
| E.coli | EPA1603 | 2 ct/100mL |

Table 1

4.0 Results and Discussion

4.1 **Operational Monitoring**

The flow meter readings, recycle ratio, and average daily water use for the B-HS1 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.

| | Summ | ary of System | Flow Rates | | |
|--|------------------------------------|--|---|--|-----------------------------|
| Date and Time Read | House Water Meter Reading | Average Daily Household Flow, Q | Aerocell [™] Flow Meter Reading | Average Daily Flow Total Q + R ¹ | Average Recycle Ratio |
| | Cumulative Volume (gallons) | Gallons/ day | Cumulative Volume (gallons) | Gallons/ Day | Recycle: Forward Flow |
| 6/8/2011 14:10 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6/9/2011 17:10 | 87.3 | 77.6 | 2.1 | 0.0 | 0.0 : 1 |
| 6/10/2011 12:25 | 148.2 | 75.9 | 629.2 | 668.9 | 7.8 : 1 |
| 7/6/2011 11:20 | 2,884.8 | 105.4 | 35,025.2 | 1,325.2 | 11.6 : 1 |
| 7/7/2011 17:10 | 3,088.6 | 164.0 | 38,272.2 | 2,612.1 | 14.9 : 1 |
| 7/19/2011 10:30 | 4,254.0 | 99.4 | 40,756.0 | 212.0 | 1.1 : 1 |
| 9/13/2011 | 9904.0 | 101.7 | 60,840.0 | 361.5 | 2.6 : 1 |
| 10/26/2011 8:24 | 13804.7 | 90.0 | 118,640.9 | 1333.3 | 13.8 : 1 |
| 11/30/2011 | 17673.0 | 111.6 | 125,260.0 | 191.0 | 0.7 : 1 |
| Total average prior to | | | | | |
| SRD ² replacement | | 101.3 | | 722.3 | 6.1 : 1 |
| 12/23/2011 | 20,280.0 | 113.3 | 153,930.0 | 1,246.5 | 10.0 : 1 |
| 1/25/2012 9:00 | 23,871.3 | 107.6 | 192,410.5 | 1,154.4 | 9.7 :1 |
| 1/30/2012 10:10 | 24,443.3 | 113.3 | 198,874.8 | 1,268.5 | 10.2: 1 |
| 2/24/2012 11:08 | 27,458.0 | 120.4 | 231,640.5 | 1,308.7 | 9.9 : 1 |
| 3/27/2012 9:56 | 30,820.2 | 105.2 | 267,763.0 | 1,130.4 | 9.7 : 1 |
| 4/20/2012 11:45 | <u>33</u> ,379.8 | 106.3 | 291,392.5 | 981.6 | 8.2 : 1 |
| 5/24/2012 8:55 | 36,914.4 | 104.3 | 323,118.2 | 936.4 | 8.0 : 1 |
| 6/22/2012 9:13 | 39,954.4 | 104.8 | 351,626.7 | 982.6 | 8.4 : 1 |
| 8/6/2012 8:52 | 45,137.0 | 115.2 | 413,985.7 | 1,386.2 | 11.0 : 1 |
| 8/30/2012 11:16 | 47,678.9 | 105.5 | 444,272.1 | 1,257.8 | 10.9 : 1 |
| 9/26/2012 11:19 | 51,047.0 | 124.7 | 478,626.3 | 1,271.3 | 9.2 : 1 |
| Total average after SRD ² replacement | | 110.5 | | 1,166.0 | 9.6 : 1 |
| Total average start-up to 9/26/12 | | 107.3 | | 1,007.9 | 8.4 : 1 |

Table 2

¹Household (Q) + Recirculation (R)

²Split recirculation device (SRD) was replaced December 9, 2011.

The split recirculation device (SRD) controls the fraction of Aerocell[™] effluent that is recirculated and the fraction sent to the Nitrex[™] tank. The SRD was initially set so that 5 parts went back to the pump chamber and 1 part went to the Nitrex[™] tank (5:1 recycle ratio). While calibrating the replacement SRD, the vendor increased the recycle ratio target to 10:1 to improve performance of the nitrification unit. The recycle ratio drifted downward towards 8:1 from April through June. The calculated recycle ratio for the September 26, 2012 monitoring event was close to the manufacturer's set point. It is not clear why the recycle ratio was lower during preceding months.

Prior to the SRD replacement, the household flow average was 101.3 gallons per day with periods of higher and lower flows. The average flow to the Aerocell[™] unit was 722.3 gallons per day with a corresponding average recycle ratio of 6.1:1. Following the SRD replacement, the household flow average was 110.5 gallons per day, and the average flow to the Aerocell[™] unit was 1166.0 gallons per day with a corresponding average recycle ratio of 9.6:1. The household flow average between start-up and September 26, 2012 was 107.3 gallons per day, and the average flow to the Aerocell[™] unit was 1,007.9 gallons per day.

4.2 Energy, Chemical and/or Additives 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 3.

| | Summary Of System | | |
|--|-----------------------------|---------------------------------|---|
| Date and Time Read | Electrical Meter Reading | Average Daily Electrical Use | Average Electrical Use per Gallon Pumped to Aerocell |
| | Cumulative (kWh) | (kWh/day) | (kWh/gal) |
| 6/9/2011 17:10 | 1 | | |
| 6/10/2011 12:25 | 2 | 1.25 | 0.0019 |
| 7/6/2011 11:30 | 40 | 1.46 | 0.0011 |
| 7/7/2011 19:30 | 44 | 3.00 | 0.0011 |
| 7/19/2011 11:00 | 49 | 0.43 | 0.0020 |
| 9/13/2011 | 74 | 0.45 | 0.0012 |
| 10/26/2011 8:27 | 80 | 0.14 | 0.0001 |
| Total average prior to SRD ¹ replacement | | 0.57 | 0.0012 |
| 1/25/2012 8:30 | 268 | 2.07 | 0.0018 |
| 1/30/2012 10:26 | 286 | 3.54 | 0.0028 |
| 2/24/2012 11:15 | 378 | 3.67 | 0.0028 |
| 3/27/2012 10:06 | 486 | 3.38 | 0.0030 |
| 4/20/2012 11:46 | 558 | 2.99 | 0.0030 |
| 5/24/2012 8:58 | 652 | 2.77 | 0.0030 |
| 6/22/2012 9:14 | 734 | 2.83 | 0.0029 |
| 8/6/2012 8:50 | 910 | 3.91 | 0.0028 |
| 8/30/2012 11:14 | 994 | 3.49 | 0.0028 |
| 9/26/2012 11:21 | 1088 | 3.48 | 0.0027 |
| Total average after SRD ¹ replacement | | 3.35 | 0.0029 |
| Total average start-up to 9/26/12 | | 2.29 | 0.0023 |

 Table 3

 Summary of System Electrical Use

¹Split recirculation device (SRD) was replaced December 9, 2011.

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The total average electrical use through September 26, 2012 was 2.29 kWh per day. The higher readings, following the SRD replacement, are attributed to the increased pump runtime due to the increased target recycle ratio. The average electrical use following the SRD replacement was 3.35 kWh per day. The average electrical use per gallon pumped to the Aerocell[™] following the SRD replacement is 0.0029 kWh per gallon and this parameter appears fairly stable in the period of January 30th to September 29, 2012. Figure 5 shows a plot of the average electrical use per gallon pumped versus time of experiment.



Figure 5 Plot of Average Electrical Use per Gallon Pumped

4.3 Water Quality

Water quality analytical results, for Sample Event No.6, are listed in Table 4. 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-N, NH_3 -N, and NO_X -N), as well as supporting water quality parameters. The nitrogen results are graphically displayed in Figure 6. A summary of the water quality data collected to date for the test system is presented in Table 5.



Figure 6 Graphical Representation of Nitrogen Results

Septic Tank Effluent (STE) Quality: The water quality characteristics of STE collected in Sample Event 6 were within the typical range generally expected for domestic STE. The measured STE total nitrogen (TN) concentration was 81 mg/L, which is in the upper range of values typically reported for Florida single family residence STE.

Pump Chamber and AerocellTM Effluent: The pump chamber and AerocellTM effluent NH₃-N levels were 9.1 mg/L and 7.9 mg/L, respectively with a DO level at 4.4 mg/L in the AerocellTM effluent (Table 4). The pump chamber TSS was 2 mg/L and CBOD₅ was 20 mg/L. The AerocellTM effluent TSS was slightly higher at 6 mg/L and CBOD₅ was also 20 mg/L. The pump chamber effluent NO_x-N was 22.4 mg/L, and AerocellTM effluent NO_x-N was 24.6 mg/L. These results indicate significant denitrification (approximately 50% reduction of STE nitrogen) was occurring as the effluent was recirculated back into

the pump chamber. However, the AerocellTM unit was not obtaining complete nitrification $(NH_3-N \text{ concentration of } 7.9 \text{ mg/L} \text{ and TKN of } 19 \text{ mg/L}).$

NitrexTM Effluent: Effluent NO_x-N from the NitrexTM unit was 0.3 mg/L. The low NO_x-N was accompanied by a measured 0.3 mg/L DO and -217 mV ORP. The DO sampling methodology was revised back to the previous method of taking the sample reading in a secondary container. Extra care was taken to assure no bubbles were present in the sample tubing with a steady overflow of fresh sample during the multiple recorded readings. The NitrexTM system was effective in producing a reducing environment and achieving the NO_x-N reduction goals. Final total nitrogen (TN) in the treatment system effluent was 3 mg/L. The NitrexTM unit effluent CBOD₅ of 17 mg/L was higher than the previous sample event which was below 2 mg/L, the method detection limit. Fecal coliform and E. coli were all effectively reduced to 4 colonies/100 mL.

Table 4Water Quality Analytical Results

| | | | | 1 | Total | | ĥ | Specific | | | | | | | | La constante de | | ase a | | - CLEANING | | | | Fecal | E-coli |
|--|---------------------------------|------------------------------|----------------------------|------------------------|----------------------|--------------|--------------|---------------------|---------------|---------------|--------------------------|----------|----------------------------|-----------------|------------------------------------|---|------------------|--------------------------------|--------------------------------|------------------|----------------------------|--------------|---------------------|----------------|----------------|
| Sample ID | Sample Date/Time | Sample Type | Temp (°C) | рН | Alkalinity (mg/L) | DO (mg/L) | ORP (mV) | Conductance (µS) | TSS (mg/L) | VSS (mg/L) | CBOD ₅ (mg/L) | COD | TN (mg/LN) ¹ | TKN (mg/L N) | Organic N (mg/L N) ² | NH ₃ -N (mg/L N) | NH4-N (mg/LN) | NO ₃ -N (mg/L N) | NO ₂ -N (mg/L N) | NOx (mg/LN) (| TIN mg/LN) ³ | TP (mg/L) | Ortho P (mg/L P) | (Ct/100 mL) | (Ct/100 mL) |
| B-HS1-STE | 9/26/12 13:12 | G | 24.7 | 6.94 | 910 | 0.1 | -252.0 | 1173.0 | 45 | 48 | 54 | 240 | 81.3 | 81 | 25.0 | 56 | 72 | 0.26 | 0.01 | 0.27 | 56.27 | 6.6 | 5.5 | 36,000 | 20,000 |
| B-HS1-PUMP | 9/26/12 13:30 | G | 24.5 | 6.89 | 240 | 1.7 | -24.0 | 839.0 | 2 | 8 | 20 | 38 | 40.4 | 18 | 8.9 | 9.1 | 12 | 22 | 0.44 | 22.44 | 31.54 | 6 | 4.1 | 3,300 | 1,600 |
| B-HS1-AEROCELL | 9/26/12 12:50 | G | 24.4 | 7.07 | 220 | 4.4 | 25.0 | 823.0 | 6 | 6 | 20 | 40 | 43.6 | 19 | 11.1 | 7.9 | 10 | 24 | 0.56 | 24.56 | 32.46 | 6.1 | 3.3 | 2400 | 1000 |
| B-HS1-NITREX | 9/26/12 12:26 | G | 24.2 | 6.49 | 310 | 0.3 | -217.0 | 717.0 | 3 | 8 | 17 | 49 | 3.0 | 2.7 | 1.8 | 0.94 | 1.2 | 0.26 | 0.01 | 0.27 | 1.21 | 5.9 | 3.2 | 4 | 2 |
| B-HS1-NITREX DUP | 9/26/12 12:28 | G | 24.2 | 6.49 | 320 | 0.3 | -217.0 | 717.0 | 2 | 3 | 12 | 49 | 3.2 | 2.9 | 2.0 | 0.9 | 1.2 | 0.25 | 0.01 | 0.26 | 1.16 | 6 | 2.5 | 4 | 4 |
| Notes: ¹ Total Nitrogen (TN) is a c | alculated value equa | I to the sum | of TKN and NO _x | | | | | | | | | | | | | | | | | | | | | | |
| *Organic Nitrogen (ON) is *Total Increases Nitrogen | a calculated value e | qual to the | difference of IKN | and NH3. | | | | | | | | | | | | | | | | | | | | | |
| D.O. Dissaluad aurogen (| (TIN) IS a calculated | value equal | to the sum of NH | 3 and NO _{X.} | | | | | | | | | | | | | | | | | | | | | |
| D.O Dissolved oxygen | | | | | | | | | | | | | | | | | | | | | | | | | |
| G - Grab sample | indicate values below | mathad do | tection level (mdl | 1 mall value | used for sta | tictical an | alugas | | | | | | | | | | | | | | | | | | |
| Gray-snaded data points i Vollow shaded data points | ndicate values below | v methoù de velvelve ie b | stucen the leber | j, moi value | d detection l | limit and th | alyses. | u practical quar | titation limi | it unlue un | d for statistical a | nalvaia | | | | | | | | _ | | _ | _ | | - |
| Orango chaded data points | s indicate the reporte | ed value is d | alony counts over | adod tha i | deal range of | | al coliform) | or 20.80 /E or | | n, value use | eu for statistical a | naiysis. | | | | | | | | | | | | | |
| Erroneous instrument rea | ding | aed upon co | biony counts exc | eeded the l | deal range of | 20-00 (180 | ar conform) | 01 20-00 (E. CC | n / colomes | per place. | | | | | | | | | | | | | | | |
| | 237-001R004\Wpdocs\Report\Final | | | | Ś | | Ŝ | | | | | | | | | | | | | | | | | | |

Table 5 Summary of Water Quality Data

| Sample ID | Statistical Parameter | Temp (°C) | рН ⁴ | Total Alkalinity (mg/L) | DO (mg/L) | ORP (mV) | Specific Conductance (µS) | TSS (mg/L) | VSS (mg/L) | TVS (mg/L) | CBOD ₅ (mg/L) | COD | TN (mg/L N) ¹ | TKN (mg/L N) | Organic N (mg/L N) ² | NH ₃ -N (mg/L N) | NH4-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) | Fecal ⁴ (Ct/100 mL) | E-coli ⁴ (Ct/100 mL) |
|----------------|-----------------------|--------------|-----------------|-------------------------------|--------------|-------------|---------------------------------|---------------|---------------|---------------|-----------------------------|--------|-----------------------------|-----------------|------------------------------------|--------------------------------|-------------------|--------------------------------|--------------------------------|-----------------|------------------------------|--------------|---------------------|--------------------------------------|---------------------------------------|
| | n | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 2 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |
| | MEAN | 22.73 | | 613.33 | 0.30 | -143.18 | 1155.00 | 52.67 | 44.20 | 210.00 | 90.67 | 265.00 | 78.47 | 78.33 | 18.00 | 60.33 | 77.33 | 0.09 | 0.17 | 0.14 | 60.47 | 8.33 | 4.37 | | |
| B-HS1-STE | STD. DEV. | 2.43 | | 147.87 | 0.45 | 184.97 | 69.09 | 8.69 | 7.50 | 28.28 | 44.48 | 92.68 | 8.93 | 8.91 | 7.77 | 5.20 | 6.86 | 0.10 | 0.19 | 0.12 | 5.25 | 1.36 | 1.08 | 6 | |
| | MIN | 19.80 | 6.77 | 530.00 | 0.00 | -298.10 | 1019.00 | 40.00 | 32.00 | 190.00 | 30.00 | 170.00 | 71.13 | 71_00 | 10.00 | 55.00 | 70.00 | 0.01 | 0.01 | 0.01 | 55.01 | 6.60 | 2.60 | 36,000 | 20,000 |
| | MAX | 26.10 | 7.02 | 910.00 | 1.19 | 192.00 | 1208.00 | 63.00 | 52.00 | 230.00 | 150.00 | 380.00 | 95.09 | 95.00 | 29.00 | 67.00 | 86.00 | 0.26 | 0.46 | 0.30 | 67.30 | 10.00 | 5.50 | 800,000 | 740,000 |
| | n | 6 | 6 | 6 | 5 | 6 | 6 | 6 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |
| | MEAN | 22.25 | | 246.67 | 1.50 | 59.00 | 882.83 | 8.17 | 6.00 | 78.00 | 12.50 | 50.17 | 48.95 | 20.55 | 4.10 | 16.45 | 21.17 | 33.20 | 0.82 | 28.40 | 44.85 | 8.12 | 2.72 | 3,190.98 | 2,590.02 |
| B-HS1-PUMP | STD. DEV. | 3.00 | | 125.01 | 0.74 | 50.22 | 72.83 | 4.58 | 4.47 | 126.17 | 7.50 | 21.75 | 12.29 | 14.15 | 2.60 | 14.22 | 18.38 | 9.60 | 0.77 | 16.13 | 13.64 | 1.47 | 0.93 | | |
| | MIN | 18.40 | 6.16 | 110.00 | 0.71 | -24.00 | 756.00 | 2.00 | 3.00 | 0.00 | 3.00 | 34.00 | 35.27 | 6.30 | 1.30 | 5.00 | 6.40 | 22.00 | 0.44 | 0.27 | 31.27 | 6.00 | 1.30 | 8 | E |
| | MAX | 26.30 | 7.03 | 470.00 | 2.21 | 109.00 | 951.00 | 14.00 | 13.00 | 290.00 | 22.00 | 90.00 | 70.20 | 41.00 | 8.90 | 38.00 | 49.00 | 47.00 | 2.20 | 47.53 | 67.20 | 9.50 | 4.10 | 80,000 | 50,000 |
| | n | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 3 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |
| | MEAN | 21.73 | | 211.00 | 2.67 | 16.28 | 861.50 | 5.67 | 3.10 | 133.33 | 10.67 | 36.17 | 46.48 | 13.80 | 3.84 | 9.96 | 12.99 | 38.00 | 0.58 | 32.68 | 42.65 | 8.10 | 1.98 | 6327.33 | 5418.67 |
| B-HS1-AEROCELL | STD. DEV. | 3.46 | | 100.47 | 1.17 | 55.84 | 65.05 | 6.47 | 1 | 119.30 | 12.16 | 15.45 | 12.16 | 10.88 | 3.60 | 10.15 | 13.36 | 10.42 | 0.42 | 17.09 | 13.13 | 1.46 | 0.92 | | |
| | MIN | 17.50 | 5.82 | 86.00 | 1.12 | -93.30 | 754.00 | 1.00 | 1.50 | 0.00 | 2.00 | 18.00 | 26.20 | 2.40 | 1.60 | 0.08 | 0.11 | 24.00 | 0.27 | 3.20 | 23.20 | 6.10 | 0.66 | 18 | 18 |
| | MAX | 26.10 | 7.07 | 380.00 | 4.42 | 57.00 | 939.00 | 18.00 | 6.00 | 230.00 | 31.00 | 61.00 | 62.30 | 28.00 | 11.10 | 25.00 | 33.00 | 52.00 | 1.30 | 52.27 | 59.30 | 9.60 | 3.30 | 35,000 | 31,000 |
| | n | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | E |
| | MEAN | 21.28 | | 375.00 | 1.24 | -149.65 | 792.50 | 4.17 | 6.10 | 40.60 | 33.83 | 84.17 | 8.03 | 7.93 | 2.69 | 5.24 | 6.82 | 0.11 | 0.01 | 0.10 | 5.34 | 7.27 | 2.50 | 103.33 | 102.33 |
| B-HS1-NITREX | STD. DEV. | 3.35 | | 59.58 | 1.29 | 142.33 | 86.57 | 1.94 | 3.51 | 61.90 | 38.76 | 43.23 | 6.45 | 6.51 | 2.05 | 5.15 | 6.91 | 0.10 | 0.00 | 0.10 | 5.10 | 1.16 | 0.74 | | |
| | MIN | 16.90 | 5.75 | 310.00 | 0.00 | -284.90 | 669.00 | 2.00 | 1.00 | 0.00 | 2.00 | 49.00 | 2.97 | 2.70 | 0.80 | 0.94 | 1.20 | 0.02 | 0.01 | 0.01 | 1.21 | 5.90 | 1.60 | 2 | 2 |
| | MAX | 25.40 | 7.33 | 470.00 | 3.46 | 126.00 | 882.00 | 7.00 | 9.50 | 140.00 | 110.00 | 170.00 | 20.03 | 20.00 | 5.60 | 15.00 | 20.00 | 0.26 | 0.01 | 0.27 | 15.03 | 8.70 | 3.20 | 600 | 600 |

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 NH_{3.}

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

⁴Geometric mean provided rather than arithmetic mean.

D.O. - Dissolved oxygen G - Grab sample

Crav-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.

o:\44237-001R004\\Wpdocs\Report\Final

5.0 B-HS1 Sample Event No. 6: Summary and Recommendations

5.1 Summary

The results of the sixth sampling event indicate that the system is operating well and no adjustments are recommended at this time. For this sampling event, incomplete nitrification was indicated by the AerocellTM sample values of 24.6 mg/L NO_x-N and 19 mg/L TKN-N. The Sample Event No. 6 results indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality. The nitrogen concentration is within is in the upper range of values typically reported for Florida single family residence STE.
- The Aerocell[™] biofilter was effective in converting ammonium to oxidized nitrogen; however, the effluent contained 19 mg/L TKN, of which 7.9 mg/L was ammonia.
- The Nitrex[™] system was effective in producing a reducing environment and achieving the NO_x-N reduction goals. The Nitrex[™] unit effluent fecal coliform and E. coli were effectively reduced to low levels.
- The total nitrogen concentration in the final effluent from the total treatment system was approximately 3 mg/L, an approximately 96% reduction from STE.

5.2 Recommendations

No operational adjustments are recommended at this time, and continued sampling should provide additional insight to system performance.



Appendix A: Laboratory Report

FLORIDA ONSITE SEWAGE NITROGEN REDUCTION STRATEGIES STUDY B-HS1 MONITORING REPORT NO. 6

PAGE A-1 HAZEN AND SAWYER, P.C. 110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218



Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021 October 9, 2012 Work Order: 1211317

| Project Name | | Wakulla County | B-HS1 SE#6 | | | | | |
|--|-------|--|-------------|-------|-------|----------------|----------------|-----|
| Sample Description Matrix SAL Sample Number Date/Time Collected Collected by Date/Time Received | | B-HS1-STE Wastewater 1211317-01 09/26/12 13:12 Harmon Harden 09/27/12 09:17 | | | | | | |
| Parameters | Units | Results * | Method | PQL | MDL | Prepared | Analyzed | Ву |
| Client Provided Field Data | | | | | | | | |
| pH Temperature Conductivity | | 6.93 24.7 °C 1173 umhos | s/cm | | | | | |
| Inorganics | | | | | | | | |
| Ammonia as N | mg/L | 56 | EPA 350.1 | 4.0 | 0.95 | | 10/01/12 15:45 | MMF |
| Ammonium as NH4 | mg/L | 72 | EPA 350.1 | 0.01 | 0.005 | 10/04/12 13:27 | 10/04/12 13:28 | MMF |
| Carbonaceous BOD | mg/L | 54 | SM 5210B | 2 | 2 | 09/27/12 07:38 | 10/02/12 16:03 | MEJ |
| Chemical Oxygen Demand | mg/L | 240 | EPA 410.4 | 25 | 10 | 10/04/12 12:30 | 10/04/12 14:30 | CDB |
| Nitrate (as N) | mg/L | 0.26 | EPA 300.0 | 0.04 | 0.01 | | 09/27/12 16:17 | JAG |
| Nitrite (as N) | mg/L | 0.01 U | EPA 300.0 | 0.04 | 0.01 | | 09/27/12 16:17 | JAG |
| Orthophosphate as P | mg/L | 5.5 | EPA 300.0 | 0.040 | 0.010 | | 09/27/12 16:17 | JAG |
| Phosphorous - Total as P | mg/L | 6.6 | SM 4500P-E | 0.20 | 0.050 | 10/02/12 11:08 | 10/03/12 13:49 | MMF |
| Total Alkalinity | mg/L | 910 | SM 2320B | 8.0 | 2.0 | | 09/27/12 15:03 | TJH |
| Total Kjeldahl Nitrogen | mg/L | 81 | EPA 351.2 | 0.20 | 0.05 | 10/02/12 08:11 | 10/04/12 13:04 | MMF |
| Total Suspended Solids | mg/L | 45 | SM 2540D | 1 | 1 | 10/02/12 08:47 | 10/03/12 12:57 | RFC |
| Volatile Suspended Solids | mg/L | 48 | EPA 160.4** | 1 | 1 | 09/28/12 14:49 | 09/30/12 15:35 | MEJ |

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Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021

Nitrate (as N)

Nitrite (as N)

Total Alkalinity

Carbonaceous BOD

Orthophosphate as P

Total Kjeldahl Nitrogen

Total Suspended Solids

Volatile Suspended Solids

Phosphorous - Total as P

Chemical Oxygen Demand

October 9, 2012 Work Order: 1211317

Ву

MMF

MMF

MEJ

CDB

JAG

JAG

JAG

MMF

TJH

MMF

RFC

MEJ

10/02/12 16:03

10/04/12 14:30

09/27/12 16:17

09/27/12 16:17

09/27/12 16:17

10/03/12 13:50

09/27/12 15:03

10/04/12 12:25

10/03/12 12:57

09/30/12 15:35

| Project Name | | Wakulla County | B-HS1 SE#6 | | | | |
|----------------------------|-------|----------------|------------|------|-------|----------------|----------------|
| Sample Description | | B-HS1-PUMP | | | | | |
| Matrix | | Wastewater | | | | | |
| SAL Sample Number | | 1211317-02 | | | | | |
| Date/Time Collected | | 09/26/12 13:30 | | | | | |
| Collected by | | Harmon Harden | | | | | |
| Date/Time Received | | 09/27/12 09:17 | | | | | |
| Parameters | Units | Results * | Method | PQL | MDL | Prepared | Analyzed |
| Client Provided Field Data | | | | | | | |
| рН | | 6.88 | | | | | |
| Temperature | | 24.5 °C | | | | | |
| Conductivity | | 839 umhos/ | cm | | | | |
| Inorganics | | | | | | | |
| Ammonia as N | mg/L | 9.1 | EPA 350.1 | 0.40 | 0.095 | | 10/01/12 15:25 |
| Ammonium as NH4 | mg/L | 12 | EPA 350.1 | 0.01 | 0.005 | 10/04/12 13:27 | 10/04/12 13:28 |

SM 5210B

EPA 410.4

EPA 300.0

EPA 300.0

EPA 300.0

SM 4500P-E

SM 2320B

EPA 351.2

SM 2540D

EPA 160.4**

2

25

0.04

0.04

0.040

0.20

8.0

0.20

1

1

2

10

0.01

0.01

0.010

0.050

2.0

0.05

1

1

09/27/12 07:38

10/04/12 12:30

10/02/12 11:08

10/02/12 08:11

10/02/12 08:47

09/28/12 14:49

20

38

22

0.44

4.1

6.0

240

18

2

8

mg/L

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



Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021 October 9, 2012 Work Order: 1211317

| Project Name | | Wakulla County B | B-HS1 SE#6 | | | | | |
|--|-------|---|-------------|-------|-------|----------------|----------------|-----|
| Sample Description Matrix SAL Sample Number Date/Time Collected Collected by Date/Time Received | | B-HS1-AEROCELL Wastewater 1211317-03 09/26/12 12:50 Harmon Harden 09/27/12 09:17 | | | | | | |
| Parameters | Units | Results * | Method | PQL | MDL | Prepared | Analyzed | Ву |
| Client Provided Field Data | | | | | | | | |
| pH Temperature Conductivity | | 7.10 24.4 °C 830 umhos/c | m | | | | | |
| Inorganics | | | | | | | | |
| Ammonia as N | mg/L | 7.9 | EPA 350.1 | 0.40 | 0.095 | | 10/01/12 15:27 | MMF |
| Ammonium as NH4 | mg/L | 10 | EPA 350.1 | 0.01 | 0.005 | 10/04/12 13:27 | 10/04/12 13:28 | MMF |
| Carbonaceous BOD | mg/L | 20 | SM 5210B | 2 | 2 | 09/27/12 07:38 | 10/02/12 16:03 | MEJ |
| Chemical Oxygen Demand | mg/L | 40 | EPA 410.4 | 25 | 10 | 10/04/12 12:30 | 10/04/12 14:30 | CDB |
| Nitrate (as N) | mg/L | 24 | EPA 300.0 | 0.04 | 0.01 | | 09/27/12 16:17 | JAG |
| Nitrite (as N) | mg/L | 0.56 | EPA 300.0 | 0.04 | 0.01 | | 09/27/12 16:17 | JAG |
| Orthophosphate as P | mg/L | 3.3 | EPA 300.0 | 0.040 | 0.010 | | 09/27/12 16:17 | JAG |
| Phosphorous - Total as P | mg/L | 6.1 | SM 4500P-E | 0.20 | 0.050 | 10/02/12 11:08 | 10/03/12 13:51 | MMF |
| Total Alkalinity | mg/L | 220 | SM 2320B | 8.0 | 2.0 | | 09/27/12 15:03 | TJH |
| Total Kjeldahl Nitrogen | mg/L | 19 | EPA 351.2 | 0.20 | 0.05 | 10/02/12 08:11 | 10/04/12 12:26 | MMF |
| Total Suspended Solids | mg/L | 6 | SM 2540D | 1 | 1 | 10/02/12 08:47 | 10/03/12 12:57 | RFC |
| Volatile Suspended Solids | mg/L | 6 | EPA 160.4** | 1 | 1 | 09/28/12 14:49 | 09/30/12 15:35 | MEJ |

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Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021 October 9, 2012 Work Order: 1211317

| Project Name | | Wakulla County | B-HS1 SE#6 | | | | | |
|--|-------|---|-------------|-------|-------|----------------|----------------|-----|
| Sample Description Matrix SAL Sample Number Date/Time Collected Collected by Date/Time Received | | B-HS1-NITREX Wastewater 1211317-04 09/26/12 12:26 Harmon Harden 09/27/12 09:17 | | | | | | |
| Parameters | Units | Results * | Method | PQL | MDL | Prepared | Analyzed | Ву |
| Client Provided Field Data | | | | | | | | |
| pH Temperature Conductivity | | 6.49 24.2 °C 715 umhos/ | cm | | | | | |
| Inorganics | | | | | | | | |
| Ammonia as N | mg/L | 0.94 | EPA 350.1 | 0.040 | 0.009 | | 10/01/12 14:39 | MMF |
| Ammonium as NH4 | mg/L | 1.2 | EPA 350.1 | 0.01 | 0.005 | 10/04/12 13:27 | 10/04/12 13:28 | MMF |
| Carbonaceous BOD | mg/L | 17 | SM 5210B | 2 | 2 | 09/27/12 07:38 | 10/02/12 16:03 | MEJ |
| Chemical Oxygen Demand | mg/L | 49 | EPA 410.4 | 25 | 10 | 10/04/12 12:30 | 10/04/12 14:30 | CDB |
| Nitrate (as N) | mg/L | 0.26 | EPA 300.0 | 0.04 | 0.01 | | 09/27/12 16:17 | JAG |
| Nitrite (as N) | mg/L | 0.01 U | EPA 300.0 | 0.04 | 0.01 | | 09/27/12 16:17 | JAG |
| Orthophosphate as P | mg/L | 3.2 | EPA 300.0 | 0.040 | 0.010 | | 09/27/12 16:17 | JAG |
| Phosphorous - Total as P | mg/L | 5.9 | SM 4500P-E | 0.20 | 0.050 | 10/02/12 11:08 | 10/03/12 13:52 | MMF |
| Total Alkalinity | mg/L | 310 | SM 2320B | 8.0 | 2.0 | | 09/27/12 15:03 | TJH |
| Total Kjeldahl Nitrogen | mg/L | 2.7 | EPA 351.2 | 0.20 | 0.05 | 10/02/12 08:11 | 10/04/12 13:45 | MMF |
| Total Suspended Solids | mg/L | 3 | SM 2540D | 1 | 1 | 10/02/12 08:47 | 10/03/12 12:57 | RFC |
| Volatile Suspended Solids | mg/L | 8 | EPA 160.4** | 1 | 1 | 09/28/12 14:49 | 09/30/12 15:35 | MEJ |

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

mg/L



Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021

Matrix

pН

Carbonaceous BOD

Orthophosphate as P

Total Kjeldahl Nitrogen

Total Suspended Solids

Volatile Suspended Solids

Phosphorous - Total as P

Nitrate (as N)

Nitrite (as N)

Total Alkalinity

Chemical Oxygen Demand

October 9, 2012 Work Order: 1211317

Ву

MMF

MMF

MEJ

CDB

JAG

JAG

JAG

MMF

TJH

MMF

RFC

MEJ

10/02/12 16:03

10/04/12 14:30

09/27/12 16:17

09/27/12 16:17

09/27/12 16:17

10/03/12 13:53

09/27/12 15:03

10/04/12 13:46

10/03/12 12:57

09/30/12 15:35

Project Name Wakulla County B-HS1 SE#6 **B-HS1-NITREX-DUP** Sample Description Wastewater SAL Sample Number 1211317-05 Date/Time Collected 09/26/12 12:28 Collected by Harmon Harden Date/Time Received 09/27/12 09:17 MDL Units **Results** * Method PQL Parameters Prepared Analyzed **Client Provided Field Data** 6.49 Temperature 24.2 °C Conductivity 713 umhos/cm **Inorganics** Ammonia as N mg/L 0.90 EPA 350.1 0.040 0.009 10/01/12 14:40 Ammonium as NH4 mg/L 1.2 EPA 350.1 0.01 0.005 10/04/12 13:27 10/04/12 13:28

12

49

0.01 U

2.5

6.0

320

2.9

2

3

0.25

SM 5210B

EPA 410.4

EPA 300.0

EPA 300.0

EPA 300.0

SM 4500P-E

SM 2320B

FPA 351 2

SM 2540D

EPA 160.4**

2

25

0.04

0.04

0.040

0.20

8.0

0.20

1

1

2

10

0.01

0.01

0.010

0.050

2.0

0.05

1

1

09/27/12 07:38

10/04/12 12:30

10/02/12 11:08

10/02/12 08:11

10/02/12 08:47

09/28/12 14:49

| FDOH Laboratory No.E84129 | |
|---------------------------|--|
| NELAP Accredited | |

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October 9, 2012

Work Order: 1211317

Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021

Inorganics - Quality Control

| Analyte | Result | PQL | MDL | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit |
|----------------------------|----------------|-----------|-----------|-------|----------------|------------------|-------------|----------------|-----|--------------|
| Batch BI22701 - BOD | | | | | | | | | | |
| Blank (BI22701-BLK1) | | | | | Prepared: | 09/27/12 Ar | nalyzed: 10 | /02/12 | | |
| Carbonaceous BOD | 2 U | 2 | 2 | mg/L | • | | | | | |
| Blank (BI22701-BLK2) | | | | Ū | Prepared: | 09/27/12 Ar | nalyzed: 10 | /02/12 | | |
| Carbonaceous BOD | 2 U | 2 | 2 | mg/L | | | | | | |
| LCS (BI22701-BS1) | | | | | Prepared: | 09/27/12 Ar | nalyzed: 10 | /02/12 | | |
| Carbonaceous BOD | 186 | 2 | 2 | mg/L | 200 | | 93 | 85-115 | | |
| LCS (BI22701-BS2) | | | | | Prepared: | 09/27/12 Ar | nalyzed: 10 | /02/12 | | |
| Carbonaceous BOD | 184 | 2 | 2 | mg/L | 200 | | 92 | 85-115 | | |
| LCS Dup (BI22701-BSD1) | | | | | Prepared: | 09/27/12 Ar | nalyzed: 10 | /02/12 | | |
| Carbonaceous BOD | 184 | 2 | 2 | mg/L | 200 | | 92 | 85-115 | 1 | 200 |
| LCS Dup (BI22701-BSD2) | | | | | Prepared: | 09/27/12 Ar | nalyzed: 10 | /02/12 | | |
| Carbonaceous BOD | 188 | 2 | 2 | mg/L | 200 | | 94 | 85-115 | 2 | 200 |
| Duplicate (BI22701-DUP1) | | Source: 1 | 211285-02 | | Prepared: | 09/27/12 Ar | nalyzed: 10 | /02/12 | | |
| Carbonaceous BOD | 3 | 2 | 2 | mg/L | | 3 | | | 6 | 25 |
| Duplicate (BI22701-DUP2) | | Source: 1 | 211317-05 | | Prepared: | 09/27/12 Ar | nalyzed: 10 | /02/12 | | |
| Carbonaceous BOD | 11 | 2 | 2 | mg/L | | 12 | | | 10 | 25 |
| Batch Bl22723 - Ion Chroma | tography 300.0 | Prep | | | | | | | | |
| Blank (BI22723-BLK1) | | | | | Prepared & | & Analyzed: | 09/27/12 | | | |
| Orthophosphate as P | 0.010 U | 0.040 | 0.010 | mg/L | | | | | | |
| Nitrite (as N) | 0.01 U | 0.04 | 0.01 | mg/L | | | | | | |

mg/L

Nitrate (as N) 0.01 U 0.04 0.01

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October 9, 2012

Work Order: 1211317

Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021

Inorganics - Quality Control

| Analvte | Result | PQL | MDL | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit |
|-----------------------------|---------------|-----------|-----------|-------|----------------|------------------|----------|----------------|-----|--------------|
| Detek Di00700 Jan Chromet | | Dream | | | | | | | | - |
| Batch Bizz/23 - Ion Chromat | ograpny 300.0 | Prep | | | | | | | | |
| LCS (BI22723-BS1) | | | | | Prepared & | Analyzed: | 09/27/12 | | | |
| Nitrate (as N) | 1.61 | 0.04 | 0.01 | mg/L | 1.7 | | 95 | 85-115 | | |
| Orthophosphate as P | 0.897 | 0.040 | 0.010 | mg/L | 0.90 | | 100 | 85-115 | | |
| Nitrite (as N) | 1.40 | 0.04 | 0.01 | mg/L | 1.4 | | 100 | 85-115 | | |
| LCS Dup (BI22723-BSD1) | | | | | Prepared & | Analyzed: | 09/27/12 | | | |
| Nitrite (as N) | 1.38 | 0.04 | 0.01 | mg/L | 1.4 | | 99 | 85-115 | 1 | 200 |
| Orthophosphate as P | 0.965 | 0.040 | 0.010 | mg/L | 0.90 | | 107 | 85-115 | 7 | 200 |
| Nitrate (as N) | 1.63 | 0.04 | 0.01 | mg/L | 1.7 | | 96 | 85-115 | 1 | 200 |
| Matrix Spike (BI22723-MS1) | | Source: 1 | 211324-02 | | Prepared & | Analyzed: | 09/27/12 | | | |
| Nitrite (as N) | 1.62 | 0.04 | 0.01 | mg/L | 1.4 | 0.336 | 92 | 85-115 | | |
| Nitrate (as N) | 2.45 | 0.04 | 0.01 | mg/L | 1.7 | 0.771 | 99 | 85-115 | | |
| Orthophosphate as P | 2.76 | 0.040 | 0.010 | mg/L | 0.90 | 1.91 | 94 | 85-115 | | |
| Batch BI22724 - Ammonia by | SEAL | | | | | | | | | |
| Blank (BI22724-BLK1) | | | | | Prepared & | Analyzed: | 10/01/12 | | | |
| Ammonia as N | 0.009 U | 0.040 | 0.009 | mg/L | | | | | | |
| LCS (BI22724-BS1) | | | | | Prepared & | Analyzed: | 10/01/12 | | | |
| Ammonia as N | 0.49 | 0.040 | 0.009 | mg/L | 0.50 | | 98 | 90-110 | | |
| Matrix Spike (BI22724-MS1) | | Source: 1 | 211214-01 | | Prepared 8 | Analyzed: | 10/01/12 | | | |

ND

0.046

Prepared & Analyzed: 10/01/12

0.50

0.50

mg/L

mg/L

93

91

90-110

90-110

Ammonia as N

Ammonia as N

Matrix Spike (BI22724-MS2)

0.47

0.50

0.040

0.040

0.009

0.009

Source: 1211286-07

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October 9, 2012

Work Order: 1211317

Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021

Inorganics - Quality Control

| | | | | | Spike | Source | | %REC | | RPD | | | |
|---------------------------------|--------|-----------|-----------|-------|-------------------------------|-------------|--------------|--------|-----|-------|--|--|--|
| Analyte | Result | PQL | MDL | Units | Level | Result | %REC | Limits | RPD | Limit | | | |
| Batch BI22724 - Ammonia by S | EAL | | | | | | | | | | | | |
| Matrix Spike Dup (BI22724-MSD1) | | Source: 1 | 211214-01 | | Prepared & | Analyzed: | 10/01/12 | | | | | | |
| Ammonia as N | 0.46 | 0.040 | 0.009 | mg/L | 0.50 | ND | 93 | 90-110 | 0.7 | 10 | | | |
| Matrix Spike Dup (Bl22724-MSD2) | | Source: 1 | 211286-07 | | Prepared & Analyzed: 10/01/12 | | | | | | | | |
| Ammonia as N | 0.50 | 0.040 | 0.009 | mg/L | 0.50 | 0.046 | 90 | 90-110 | 0.3 | 10 | | | |
| Batch Bl22739 - alkalinity | | | | | | | | | | | | | |
| Blank (Bl22739-BLK1) | | | | | Prepared 8 | Analyzed: | 09/27/12 | | | | | | |
| Total Alkalinity | 2.0 U | 8.0 | 2.0 | mg/L | | | | | | | | | |
| LCS (BI22739-BS1) | | | | | Prepared & | & Analyzed: | 09/27/12 | | | | | | |
| Total Alkalinity | 130 | 8.0 | 2.0 | mg/L | 120 | | 103 | 90-110 | | | | | |
| Matrix Spike (Bl22739-MS1) | | Source: 1 | 211317-05 | | Prepared & | Analyzed: | 09/27/12 | | | | | | |
| Total Alkalinity | 440 | 8.0 | 2.0 | mg/L | 120 | 320 | 95 | 80-120 | | | | | |
| Matrix Spike Dup (Bl22739-MSD1) | | Source: 1 | 211317-05 | | Prepared & | Analyzed: | 09/27/12 | | | | | | |
| Total Alkalinity | 440 | 8.0 | 2.0 | mg/L | 120 | 320 | 95 | 80-120 | 0 | 26 | | | |
| Batch Bl22819 - VSS Prep | | | | | | | | | | | | | |
| Blank (BI22819-BLK1) | | | | | Prepared: | 09/28/12 Ar | nalyzed: 09/ | /30/12 | | | | | |
| Volatile Suspended Solids | 1 U | 1 | | mg/L | | | | | | | | | |
| Duplicate (BI22819-DUP1) | | Source: 1 | 211317-01 | | Prepared: | 09/28/12 Ar | nalyzed: 09/ | /30/12 | | | | | |
| Volatile Suspended Solids | 48.5 | 1 | | mg/L | | 48.5 | | | 0 | 20 | | | |

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October 9, 2012

Work Order: 1211317

Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021

Inorganics - Quality Control

| | | | | | Spike | Source | | %REC | | RPD |
|---------------------------------|--------------|-----------|-----------|-------|-----------|-------------|-------------|--------|-----|-------|
| Analyte | Result | PQL | MDL | Units | Level | Result | %REC | Limits | RPD | Limit |
| Batch BJ20201 - Digestion for | TKN by EPA 3 | 51.2 | | | | | | | | |
| Blank (BJ20201-BLK1) | | | | | Prepared: | 10/02/12 Ar | nalyzed: 10 | /04/12 | | |
| Total Kjeldahl Nitrogen | 0.05 U | 0.20 | 0.05 | mg/L | | | | | | |
| LCS (BJ20201-BS1) | | | | | Prepared: | 10/02/12 Ar | nalyzed: 10 | /04/12 | | |
| Total Kjeldahl Nitrogen | 2.33 | 0.20 | 0.05 | mg/L | 2.5 | | 92 | 90-110 | | |
| Matrix Spike (BJ20201-MS1) | | Source: 1 | 211284-01 | | Prepared: | 10/02/12 Ar | nalyzed: 10 | /04/12 | | |
| Total Kjeldahl Nitrogen | 22.2 | 0.20 | 0.05 | mg/L | 2.5 | 19.7 | 97 | 90-110 | | |
| Matrix Spike (BJ20201-MS2) | | Source: 1 | 211391-01 | | Prepared: | 10/02/12 Ar | nalyzed: 10 | /04/12 | | |
| Total Kjeldahl Nitrogen | 3.77 | 0.20 | 0.05 | mg/L | 2.5 | 1.36 | 95 | 90-110 | | |
| Matrix Spike Dup (BJ20201-MSD1) | | Source: 1 | 211284-01 | | Prepared: | 10/02/12 Ar | nalyzed: 10 | /04/12 | | |
| Total Kjeldahl Nitrogen | 21.9 CP | 0.20 | 0.05 | mg/L | 2.5 | 19.7 | 89 | 90-110 | 1 | 20 |
| Matrix Spike Dup (BJ20201-MSD2) | | Source: 1 | 211391-01 | | Prepared: | 10/02/12 Ar | nalyzed: 10 | /04/12 | | |
| Total Kjeldahl Nitrogen | 3.74 | 0.20 | 0.05 | mg/L | 2.5 | 1.36 | 94 | 90-110 | 0.8 | 20 |
| Batch BJ20205 - TSS prep | | | | | | | | | | |
| Blank (BJ20205-BLK1) | | | | | Prepared: | 10/02/12 Ar | nalyzed: 10 | /03/12 | | |
| Total Suspended Solids | 1 U | 1 | 1 | mg/L | | | | | | |
| LCS (BJ20205-BS1) | | | | | Prepared: | 10/02/12 Ar | nalyzed: 10 | /03/12 | | |
| Total Suspended Solids | 44.5 | 1 | 1 | mg/L | 50 | | 89 | 85-115 | | |
| Duplicate (BJ20205-DUP1) | | Source: 1 | 211304-03 | | Prepared: | 10/02/12 Ar | nalyzed: 10 | /03/12 | | |
| Total Suspended Solids | 1 U | 1 | 1 | mg/L | | ND | | | | 30 |

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October 9, 2012

Work Order: 1211317

Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021

Inorganics - Quality Control

| Analyte | Result | PQL | MDL | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit |
|-------------------------------|----------------|------------|-----------|-------|----------------|------------------|-------------|----------------|------|--------------|
| Batch BJ20205 - TSS prep | | | | | | | | | | |
| Duplicate (BJ20205-DUP2) | | Source: 1 | 211305-01 | | Prepared: | 10/02/12 Ar | nalyzed: 10 |)/03/12 | | |
| Total Suspended Solids | 464 | 1 | 1 | mg/L | | 460 | | | 0.9 | 30 |
| Batch BJ20225 - Digestion fo | r TP by EPA 36 | 5.2/SM4500 | PE | | | | | | | |
| Blank (BJ20225-BLK1) | | | | | Prepared: | 10/02/12 Ar | nalyzed: 10 |)/03/12 | | |
| Phosphorous - Total as P | 0.010 U | 0.040 | 0.010 | mg/L | | | | | | |
| LCS (BJ20225-BS1) | | | | | Prepared: | 10/02/12 Ar | nalyzed: 10 |)/03/12 | | |
| Phosphorous - Total as P | 0.768 | 0.040 | 0.010 | mg/L | 0.80 | | 96 | 90-110 | | |
| Matrix Spike (BJ20225-MS1) | | Source: 1 | 211279-01 | | Prepared: | 10/02/12 Ar | nalyzed: 10 |)/03/12 | | |
| Phosphorous - Total as P | 0.959 | 0.040 | 0.010 | mg/L | 1.0 | 0.0533 | 91 | 75-125 | | |
| Matrix Spike (BJ20225-MS2) | | Source: 1 | 211286-07 | | Prepared: | 10/02/12 Ar | nalyzed: 10 |)/03/12 | | |
| Phosphorous - Total as P | 1.01 | 0.040 | 0.010 | mg/L | 1.0 | 0.0794 | 93 | 75-125 | | |
| Matrix Spike Dup (BJ20225-MSD | 1) | Source: 1 | 211279-01 | | Prepared: | 10/02/12 Ar | nalyzed: 10 |)/03/12 | | |
| Phosphorous - Total as P | 0.968 | 0.040 | 0.010 | mg/L | 1.0 | 0.0533 | 91 | 75-125 | 1 | 25 |
| Matrix Spike Dup (BJ20225-MSD | 2) | Source: 1 | 211286-07 | | Prepared: | 10/02/12 Ar | nalyzed: 10 |)/03/12 | | |
| Phosphorous - Total as P | 1.01 | 0.040 | 0.010 | mg/L | 1.0 | 0.0794 | 93 | 75-125 | 0.02 | 25 |
| Batch BJ20235 - Ion Chroma | tography 300.0 | Prep | | | | | | | | |
| Blank (BJ20235-BLK1) | | | | | Prepared 8 | & Analyzed: | 10/02/12 | | | |
| Orthophosphate as P | 0.010 U | 0.040 | 0.010 | mg/L | | | | | | |
| Nitrite (as N) | 0.01 U | 0.04 | 0.01 | mg/L | | | | | | |

mg/L

Nitrate (as N) 0.01 U 0.04 0.01

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October 9, 2012

Work Order: 1211317

Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021

Inorganics - Quality Control

| | | | | | Spike | Source | | %REC | | RPD |
|-----------------------------|---------------|-----------|-----------|-------|------------|-----------|----------|--------|-----|-------|
| Analyte | Result | PQL | MDL | Units | Level | Result | %REC | Limits | RPD | Limit |
| Batch BJ20235 - Ion Chromat | ography 300.0 | Prep | | | | | | | | |
| LCS (BJ20235-BS1) | | | | | Prepared 8 | Analyzed: | 10/02/12 | | | |
| Nitrite (as N) | 1.52 | 0.04 | 0.01 | mg/L | 1.4 | | 109 | 85-115 | | |
| Orthophosphate as P | 0.875 | 0.040 | 0.010 | mg/L | 0.90 | | 97 | 85-115 | | |
| Nitrate (as N) | 1.58 | 0.04 | 0.01 | mg/L | 1.7 | | 93 | 85-115 | | |
| LCS Dup (BJ20235-BSD1) | | | | | Prepared 8 | Analyzed: | 10/02/12 | | | |
| Nitrate (as N) | 1.59 | 0.04 | 0.01 | mg/L | 1.7 | | 94 | 85-115 | 0.6 | 200 |
| Orthophosphate as P | 0.888 | 0.040 | 0.010 | mg/L | 0.90 | | 99 | 85-115 | 1 | 200 |
| Nitrite (as N) | 1.53 | 0.04 | 0.01 | mg/L | 1.4 | | 109 | 85-115 | 0.7 | 200 |
| Matrix Spike (BJ20235-MS1) | | Source: 1 | 210722-02 | | Prepared 8 | Analyzed: | 10/02/12 | | | |
| Orthophosphate as P | 10.7 | 0.040 | 0.010 | mg/L | 9.0 | | 119 | 85-115 | | |
| Nitrite (as N) | 14.7 | 0.04 | 0.01 | mg/L | 14 | ND | 105 | 85-115 | | |
| Nitrate (as N) | 15.7 | 0.04 | 0.01 | mg/L | 17 | 0.259 | 91 | 85-115 | | |
| Matrix Spike (BJ20235-MS2) | | Source: 1 | 211177-02 | | Prepared 8 | Analyzed: | 10/02/12 | | | |
| Nitrate (as N) | 18.0 | 0.04 | 0.01 | mg/L | 17 | 0.958 | 100 | 85-115 | | |
| Orthophosphate as P | 9.22 | 0.040 | 0.010 | mg/L | 9.0 | | 102 | 85-115 | | |
| Nitrite (as N) | 14.7 | 0.04 | 0.01 | mg/L | 14 | | 105 | 85-115 | | |
| Batch BJ20439 - COD prep | | | | | | | | | | |
| Blank (BJ20439-BLK1) | | | | | Prepared 8 | Analyzed: | 10/04/12 | | | |
| Chemical Oxygen Demand | 10 U | 25 | 10 | mg/L | | | | | | |
| LCS (BJ20439-BS1) | | | | | Prepared 8 | Analyzed: | 10/04/12 | | | |
| Chemical Oxygen Demand | 54 | 25 | 10 | mg/L | 50 | | 108 | 90-110 | | |

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October 9, 2012

Work Order: 1211317

Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021

Inorganics - Quality Control

| | | | | | Spike | Source | | %REC | | RPD |
|---------------------------------|--------|-----------|-----------|-------|------------|-------------|----------|--------|-----|-------|
| Analyte | Result | PQL | MDL | Units | Level | Result | %REC | Limits | RPD | Limit |
| Batch BJ20439 - COD prep | | | | | | | | | | |
| Matrix Spike (BJ20439-MS1) | | Source: 1 | 211152-09 | | Prepared & | & Analyzed: | 10/04/12 | | | |
| Chemical Oxygen Demand | 56 | 25 | 10 | mg/L | 50 | ND | 112 | 85-115 | | |
| Matrix Spike Dup (BJ20439-MSD1) | | Source: 1 | 211152-09 | | Prepared & | & Analyzed: | 10/04/12 | | | |
| Chemical Oxygen Demand | 56 | 25 | 10 | mg/L | 50 | ND | 112 | 85-115 | 0 | 32 |

AND COROAN

October 9, 2012

Work Order: 1211317

Hazen and Sawyer 4000 Hollywood Blvd, Sute 750N Hollywood, FL 33021

* 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 limts 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. Questions regarding this report should be directed to Client Services at 813-855-1844.



Francis I. Daniels, Laboratory Director Leslie C. Boardman, Q.A. Manager

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

| Client | Name Hazan | and Sawver | | | | | | | | Contact / I Josephin I | Phone: Edeback-Hi | irst 813-63 | 0-4498 | | |
|--|--|---|------------|---------|--------------|--------------------------------|--|---|---|---|--|-------------|------------|----------|--|
| Projec | t Name / Location | | C1 0545 | St Hela | | | | | | jedeback(| Dhazanand | sawyer.con | 1 | | |
| Sampl | ers: (Signature) Harmsn Harmsn | Hard | en | | | | | PARA | METER / (| | R DESCRI | PTION | | | |
| SAL Use Only Sample No. | Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water Sample Description | Date | цше | Matrix | Composite | Grab | 1LP, Cool Total Alkalinity, NO ₃ , NO ₂ , TSS, VSS, CBOD, OP | 250mL P, H ₂ SO4 TKN, NH4, COD, TP | 125mL P. 11325.03 FC-IME | | | Field Temp | Field Cond | Field pH | No. of Containers (Total per each location) |
| 01 | B-HS1-STE | 9/26/12 | 13:12 | ww | | x | 1 | 1 | 4 | | | 24.7 | 1173 | 6.93 | 2 |
| 02 | B-HS1-PUMP | 9/20/12 | 13:30 | ww | | x | 1 | 1 | | | | 24.5 | 839 | 6.88 | 2 |
| 03 | B-HS1-AEROCELL | 9/20/12 | 12:50 | ww | | x | 1 | 1 | | | | 24.4 | 830 | 7,10 | 2 |
| 04 | B-HS1-NITREX | 9/26/1 | -12:26 | ww | | x | 1 | 1 | 1 2 24.2 715 6.49 | | | | | | 2 |
| 05 | B-HS1-NITREX-DUP | 9/26/12 | 12:28 | ww | | x | 1 | 1 2 | | | | 24.2 | 713 | 6.49 | 2 |
| | | + | | | | | | | | | | | | | |
| | | <u></u> | | | | | | | | | | | | | |
| | | <u> </u> | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Contain Relinqu Relinqu Relinqu | ers Prepared/ ished ished: ished: ished: Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: | Received: Darko Received: Fed Received: | efn) ex | L | Date Date | /Time | e: 12 12:00pm e: | Seal inta Samples Received Proper p | ct? intact upon a l on ice? Ter reservatives | arrival? (np <u>3,1</u> (indicated? | 3) N NA 3) N NA 3) N NA 4) N NA | Instructio | ns / Rema | rks | L |
| Relinqu | ished: Date/Time: 3:45 Phile: Date/Time: 3:45 9/26/12 Date/Time: Date/Time: | Received: | | | Date 9- | /Time 2. <u>2.</u> /Time | 917 11. | Rec'd within holding time? V N N/A 9/7 Volatiles rec'd w/out headspace Y N ØA L Proper containers used? Ø N N/A | | | | | | | |



Ackuritlabs, Inc.

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

Environmental Services Section

REVISED REPORT OF MICROBIOLOGICAL ANALYSIS

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

| Report #: | 21862 |
|--------------|---------------------|
| Report Date: | November 16, 2012 |
| NELAC#: | E81350 |
| FDEPQA#: | 920087G |
| Project#: | 211296 |
| Sampled By: | Mark Busby |
| Sample Site: | Drive Septic System |
| Sample Date: | 09-26-12 |

Table 1. Samples received 09-26-12.

| Units: Methodology: Detection Limit: Analysis Date: Analysis Time: Analyst: Sample Location/Time: Lab Number: | Fecal Coliform # colonies/100 mL SM 9222D 2.0 09-26-12 15:40 AL | Dilution Factor | <i>E. coli</i> # colonies/100 mL EPA 1603 2.0 09-26-12 15:40 AL | Dilution Factor |
|--|---|-------------------------------|---|-------------------------------|
| Nitrex Tank, 12:26 #112192 Aerocell Tank, 12:50 #112193 Pump Tank, 13:30 #112194 STE Tank, 13:12 #112195 Nitrex Tank Dup, 12:28 #112196 | 4 2,400 3,300 36,000 4 | 2 100 100 1,000 2 | 2.0 U 1,000 1,600 20,000 4 | 2 100 100 1,000 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.

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Environmental Services Section

REVISED FIELD DATA

Hazen and Sawyer, P.C. Attn: Josefin Edeback-Hirst, PE 10002 Princess Paim Avenue Suite 200 Tampa, FL 33619 Report #:21862Report Date:November 16, 2012NELAC#:E81350FDEPQA#:920087GProject#:211296Sampled By:Mark BusbySample Site:DriveSample Date:09-26-12

Table 2. Samples received 09-26-12.

| | рН | Temperature | Conductivity | DO | ORP |
|------------------------|------|-------------|--------------|------|------|
| Nitrex Tank, 12:26 | | | | | |
| #112192 | 6.48 | 24.2 | 713 | 0.18 | -216 |
| Aerocell Tank, 12:50 | | | | | |
| #112193 | 6.97 | 24.2 | 818 | 3.70 | 42 |
| Pump Tank, 13:30 | | | | | |
| #112194 | 6.89 | 24.5 | 839 | 1.67 | -18 |
| STE Tank, 13:12 | | | | | |
| #112195 | 6.94 | 24.7 | 1,172 | 0.12 | -254 |
| Nitrex Tank Dup, 12:28 | | | | | |
| #112196 | 6.48 | 24.2 | 713 | 0.18 | -216 |
| | | | | | |

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. *This report has been revised to correct the conductivity value for sample number 112195*.

11-16-12

Todd J. Acker, Laboratory Director

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

| CLIENT NAME & ADDRESS: Harzen + Sonny | | | | | LAB PROJECT #: 7,117,6/ | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------|-----------------|--|---------------|-------------------|-------------------------|-------------|--------------|-------------------------------|----------------|-----------|--------------------------|-------------------------|------------------|------------|------------|-----------------|--------------|----------------------|---------|---------------------|-----------------|------------|-------------|----------------|-----------------------|-------------------|-----------------|
| PROJECT N | IAME: | | | | | | Ĺ | kin | u 1, | Ir, i | ~ | Sip | tic | / | | | | CON | VTACT | PERSO | ON: | | h | far. | me. | 1 | |
| | | | | F | PRES | ERV | ΆΤΙν | Έ | | | | P | LAST | | ONT | AINE | RS | | | GL | ASS | CON | FAIN | ERS | | | |
| SAMPLE CONTAINER | 15 | A | 8 8 | s o | H | в | 2,H3O2)2 N | ² 0 ³ Т | | | mL | mL | mL | er | RLPAK - DW | RLPAK - WW | RLPAK - ICE | | - | ٦L | Ę | Ĩ | P | | | BLANK | |
| QUANTI | TY | NH | ONH | H ₂ S(| HCI | NaO | Zn(C | Na ₂ S | | | 125 | 250 | 500 | 1 Lib | MHI | MHII | IIHM | | 40 m | 125 1 | 250 1 | 500 1 | 1 Lit | | | TRIP | REMARKS |
| 5 | · | | | | | | | Y | | | ٨ | | | | | ¥ | 0 | 9.24 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | L | | | | | | | | | |
| | $ \rightarrow $ | | | | 12 | | | | | | | | | | | | | | | | | | | | | | |
| | $ \downarrow$ | | | | | | | | | | | | | | | | - 18 | | | | | | | | | | |
| DECLEANE | | | | FUNO | | DBV | | | | DATE | | | 71145 | | | DEOD | | 014 | | | | | | DATE | | | |
| RELINQUISH | ED BY | : | | | | | | | - | DATE | : | | TIME: | | | RECE | | BY: MK BY: | Best | 1 | | | | DATE | 25= | 12 | 1700 TIME: |
| SAMPLE | | | | | - | SAMP | LERS: | (PRIN | TNAM | ĨE) | 1, 1 P | | 7.1 | | | SITE | RS | a. 999 Aur 14 | ** | | P and the state | AN | ALYSE | S REC | UEST | ED · | |
| FIELD ID | | DN MARK Baby SAMPLERS: (SIGNATURE) Mail Ling Date TIME STATION LOCATH | | | | | | | | E) | A THIX A B OR CONTAIN | | | | | | | k | N. S. | Le li | | | | | | | |
| NUMBER | MM | DD/Y | <u>۲</u> | | | | | 15 | | Ŧ | | | | | W | 5 | Ň, | <u> </u> | | 4 | | | 4 | 4 | \leftarrow | 4 | LAB ID# |
| | 09- | 76-1 | 2 / | 22 | 6 | | 1 | 1/1 | <u>4</u> 11 | [n. Ta | 18 | | | | ~~ | 6 | 1 | M | - | | | | | | | | 112167 |
| | 04- | 1.1 | $\frac{2}{2}$ | 272 | | |) | 00. | Ta Ta | 14 | | | | | - | - | \mathbf{T} | | | | | | | | | _ | 112.19V |
| | 55-7 | 5-1 | - / | 17:1 | , | / | Um T | <u> </u> | 74 Tu | 46 | | | | | | + | | | | _ | - | | - | _ | | | 112195 |
| | 65-5 | 1-1 | 2 | 310 | | | ANT | tri | × // | 1 1 | nu la | | Λ. | | | + | + | + | / | | | | | | | | 117146 |
| | | | + | 29 | | / | | 00 | | / | | | PYL | | | | | | | | | | | | | | 1101.9 |
| | | | | | | | | | | | | | <i>i</i> . | | | | | | | | | | | | | | |
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| | | | +- | | -+ | | | | | | | | | | | | _ | | - | | | | | _ | | \neg | |
| COMMENTS: | I | | | | | | | | | | · <u> </u> | | | | SAM TEM | 1 PLES P: | RECI | |): | ICED HOL | | N E (Y) | N | l | ROPE | I R PRI | ESERVATION Y/ N |
| MACK | | sign | | AF | ek | | ATE & | пме 5/ 7 | 2 | | 1.75 | Ø | | | HECE | IVED | BY(SIG | inatu | HE) / A | FFILIA | IION / | DATE | s TIME | : | | | - |
| RELINQUISH | EDBI | | | A A A | | | | TIME | 1/2 | | 14 | :3 | 5 | | RECE | An | BY(SIG | h | RE) / A | FFILIA | MON/ | PATE | | 9- | 26 - | (2) | 2 14:35 |
| RELINQUISH | ED BY(| SIGN | ATURÉ |) / AFI | FILIATI | ON / D | DATE & | TIME | | | | | | | RECE | IVED | BY(SIG | INATU | RE) / A | FFILIA | TION / | DATE | & TIME | | | | |
| MATRIX TYPE | ES: | | | | SW WW GW | SURF WAS | ACE WATE WAT | VATER TER ATER | 1 | | D F S | W DRI T FIS O SOI | INKING H TISS | WAT SUE | ER | | | SL S Mi M SH S | LUDGI | e Enthic Fish | C INVE | RTEBR/ | ATES | HZ SE OT | HAZA SEDIN OTHE | RDOU IENT R | S WASTE |
| | | | | | | | | | | | | | | | | | | | | F | àc | 18 | 3 | ; | of | | 3 |

CHAIN OF CUSTODY RECORD

Page ____ of ____



Appendix B: Operation & Maintenance Log

| | Table B.1 |
|----------|---|
| | Operation and Maintenance Log |
| Date | Description |
| 6/10/11 | Start-up of system |
| 7/6/11 | Homeowner reported that over the weekend the alarm kept sounding. |
| 7/7/11 | Contractor made site visit. The flow splitter device was adjusted. |
| | Some of the recirculation tubes seemed to be too low. |
| | Recirculation rate higher than intended. |
| | The wiring was not done correctly at install. Contractor rewired panel. |
| | Noted that the Nitrex sampling port has water which indicates that |
| | the Nitrex tank is now full. |
| 7/19/11 | Override float still triggering alarm. |
| | Contractor raised override float up, because of the float error. |
| | Contractor read water meter and adjusted flow splitter again. |
| | Contractor also checked the pump rate which is reading low. |
| | Pump flow rate measured at 12.5 gallons per minute. |
| 8/18/11 | Vericomm system panel installed to replace existing control panel. |
| | Drainfield observation ports installed. |
| 9/13/11 | FDOH collected samples. |
| | Contractor checked system and detected that a malfunction of the |
| | dosing floats for the pump causes a lack of dosing to the Aerocell unit. |
| 9/20/11 | Contractor checked system. |
| 10/17/11 | New sampling port for Nitrex sample installed by contractor. |
| | A tee was placed in the outlet pipe, so that a sample is taken directly |
| | from the effluent pipe. |
| | The pump vault was causing the floats to get stuck. |
| | Contractor removed pump vault within the second champer of the primary |
| 10/26/11 | Idlik. Menitoring comple event No.1 |
| 10/20/11 | Normoning sample event No. 1. |
| | Water level within the split regire device approximately 1-inch below return |
| | tubes. |
| | Sand was noted in the return pipe leading into the pump chamber. |
| 11/30/11 | Contractor checked system. |
| 12/9/11 | Replacement of splitter recirculation device by vendor. |
| 12/23/11 | Vendor checked system. |
| 1/25/12 | Monitoring sample event No.2. |
| | Drainfield observation port #3 had ponded water ~0.25 inch in height. All other |
| | ports were dry. |
| | |

| Date | Description |
|---------|--|
| 1/30/12 | Recorded flows to verify recycle ratio. |
| | Drainfield observation port #3 had ponded water ~0.25 inch in height. All other ports were dry. |
| 2/24/12 | Site visit. |
| | Drainfield observation port #3 had ponded water ~0.25 inch in height. All other ports were dry. |
| 3/27/12 | Monitoring sample event No.3. |
| | Drainfield observation port #3 had ponded water ~0.125 inch in height. All other ports were dry. |
| 4/20/12 | Site visit. |
| | Drainfield observation port #3 had ponded water ~0.5 inch in height. All other ports were dry. |
| 5/24/12 | Monitoring sample event No.4. |
| | Drainfield observation port #3 had ponded water ~0.125 inch in height. All other ports were dry. |
| 6/22/12 | Site visit. |
| | Drainfield observation port #3 had ponding of ~ 0.25 inch to 0.5 inch in height |
| | (uneven bottom) water across entire field of vision. All other ports dry. |
| 7/26/12 | Site visit. Discussed with homeowner his concerns about the system. |
| | Sampling called off due to rain from Tropical Depression Debby. |
| 7/30/12 | Site visit. Heavy, intermittent rain, cancelled sampling again. |
| 8/6/12 | Monitoring sample event No.5. |
| | Drainfield observation port #3 had ponded water ~0.125 inch in height. |
| | All other ports dry. Ground saturated from recent heavy rains. |
| 8/30/12 | Site visit. |
| | Drainfield observation port #2 had ponded water ~3/8" inch water across entire |
| | field of vision. |
| | Port #3 had ponded water ~1/8" in a puddle ~1/2 field of view. Ports #1 and #4 were dry |
| 9/26/12 | Monitoring sample event No 6 |
| 0,20,12 | All drainfield observation ports were dry |
| | |



Appendix C: Vericomm PLC Data

| System | Status | | 26-Sep-12 | 5-Sep-12 | 30-Aug-12 |
|-----------------|----------------------------------|-------------------|----------------|----------------|----------------|
| Point | Description | Status | Value | Value | Value |
| 1 | Alarm Status | Automatic | ОК | OK | OK |
| 2 | Alert Status | Automatic | ОК | OK | OK |
| 3 | System Mode | Automatic | Normal | Normal | Normal |
| 5 | Timer Mode | Automatic | Off | Normal | Normal |
| 6 | Active Off Time | Automatic | 15.0 Minutes | 15.0 Minutes | 15.0 Minutes |
| 7 | Active On Time | Automatic | 2.0 Minutes | 2.0 Minutes | 2.0 Minutes |
| 9 | Pump Mode | Automatic | Off | OffCycl | OffCycl |
| 10 | Pump Status | Automatic | Off | Off | Off |
| 12 | Pump Cycles Today | Automatic | 13.0 Cycles | 8.0 Cycles | 37.0 Cycles |
| 13 | Override Cycles Today | Automatic | 0.0 Cycles | 0.0 Cycles | 0.0 Cycles |
| 14 | Pump Run Time Today | Automatic | 26.3 Minutes | 16.2 Minutes | 75.2 Minutes |
| Setting | s | | | | |
| Point | Description | Status | Value | Value | Value |
| 17 | Off Cycle Time | Constant/Setpoint | 15.0 Minutes | 15.0 Minutes | 15.0 Minutes |
| 18 | On Cycle Time | Constant/Setpoint | 2.0 Minutes | 2.0 Minutes | 2.0 Minutes |
| 19 | Override Off Cycle Time | Constant/Setpoint | 7.0 Minutes | 7.0 Minutes | 7.0 Minutes |
| 20 | Override On Cycle Time | Constant/Setpoint | 1.7 Minutes | 1.7 Minutes | 1.7 Minutes |
| 21 | Minimum Override Cycles | Automatic | 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 |
| 24 | Time Limit per Dav | Constant/Setpoint | 200.0 Minutes | 200.0 Minutes | 200.0 Minutes |
| 25 | High Level Pump Test | Automatic | 2.0 Minutes | 2.0 Minutes | 2.0 Minutes |
| 28 | Alarm Update Interval | Timing Override | 120.0 Minutes | 120.0 Minutes | 120.0 Minutes |
| 29 | Page Delay | Automatic | 960.0 Minutes | 960.0 Minutes | 960.0 Minutes |
| 30 | Page Interval | Automatic | 30.0 Minutes | 30.0 Minutes | 30.0 Minutes |
| 31 | Local Alarm Delay | Constant/Setpoint | 1140.0 Minutes | 1140.0 Minutes | 1140.0 Minutes |
| 32 | Local Reactivate Delay | Automatic | 120.0 Minutes | 120.0 Minutes | 120.0 Minutes |
| Troubleshooting | | | | | |
| Point | Description | Status | Value | Value | Value |
| 33 | Top Float Status | Automatic | ОК | ОК | OK |
| 34 | Middle Float Status | Automatic | ОК | OK | OK |
| 35 | Bottom Float Status | Automatic | ОК | ОК | OK |
| 37 | Contactor Status | Automatic | OK | OK | OK |
| 38 | Pump Status | Automatic | OK | OK | OK |
| 40 | Filter Status | Automatic | OK | OK | OK |
| 41 | Tank Status | Automatic | OK | OK | OK |
| 43 | Power Status | Automatic | OK | OK | OK |
| Flow Data | | | | | |
| Point | Description | Status | Value | Value | Value |
| 49 | Pump Run Time Today | Automatic | 26.3 Minutes | 16.2 Minutes | 75.2 Minutes |
| 50 | Override Cycles Today | Automatic | 0.0 | 0.0 | 0.0 |
| 51 | Pump Cycles Today | Automatic | 13.0 Cycles | 8.0 Cycles | 37.0 Ovcles |
| 52 | Average Run Time per Cycle Today | Automatic | 2 0 Minutes | 2 0 Minutes | 2 0 Minutes |
| 54 | Brownouts Today | Automatic | 0.0 | 0.0 | 0.0 |
| - 54 | Di Omnoulo i Ouay | Automatic | 0.0 | 0.0 | 0.0 |

PAGE C-1 HAZEN AND SAWYER, P.C.

Appendix C

| System | Status | | 26-Sep-12 | 5-Sep-12 | 30-Aug-12 |
|----------|--|--------------|----------------|----------------|----------------|
| 30-Day | History Data | | | | |
| Point | Description | Status | Value | Value | Value |
| 65 | 30 Day Average Run Time per Day | Automatic | 117.7 Minutes | 124.0 Minutes | 117.9 Minutes |
| 66 | 30 Day Average Override Cycles per Day | Automatic | 0.0 Cycles | 0.0 Cycles | 0.0 Cycles |
| 67 | 30 Day Average Cycles per Day | Automatic | 58.4 Cycles | 61.4 Cycles | 58.4 Cycles |
| 68 | 30 Day Average Run Time per Cycle | Automatic | 2.0 Minutes | 2.0 Minutes | 2.0 Minutes |
| 71 | 30 Day Total Pump Run Time | Automatic | 3532.3 Minutes | 3721.3 Minutes | 3537.2 Minutes |
| 72 | 30 Day Total Override Cycles | Automatic | 0.0 Cycles | 0.0 Cycles | 0.0 Cycles |
| 73 | 30 Day Total Cycles | Automatic | 1751.0 Cycles | 1843.0 Cycles | 1752.0 Cycles |
| 76 | 30 Day Total Brownouts | Automatic | 0.0 | 0.0 | 0.0 |
| Totalize | ed Pump Data | | | | |
| Point | Description | Status | Value | Value | Value |
| 82 | Pump Total Run Time | Automatic | 646.9 Hours | 608.7 Hours | 594.6 Hours |
| 83 | Pump Total Cycles | Automatic | 20136.0 Cycles | 18998.0 Cycles | 18579.0 Cycles |
| Miscell | aneous | | | | |
| Point | Description | Status | Value | Value | Value |
| 145 | Pump On Auto | Automatic | Off | Off | Off |
| 147 | Pump Test Today | Automatic | Off | Off | Off |
| 148 | Pump Check Enable | Automatic | Off | Off | Off |
| 149 | Total Override Cycles | Automatic | 0.0 | 0.0 | 0.0 |
| 150 | High Level Condition | Automatic | Off | Off | Off |
| 151 | Leak Check Enable | Automatic | Off | On | On |
| 152 | Brownout State | Automatic | Off | Off | Off |
| 153 | Test Mode | Automatic | Off | Off | Off |
| Alarm F | Points | | | | |
| Point | Description | Status | Value | Value | Value |
| 161 | General Alarm | Automatic | Off | Off | Off |
| 162 | New Alarm | Automatic | Off | Off | Off |
| 163 | Update Central Enable | Automatic | On | On | On |
| 167 | Page Alarm Start | Automatic | Off | Off | Off |
| 168 | Pager Signal | Override Off | Off | Off | Off |
| 169 | Local Alarm Start | Automatic | Off | Off | Off |
| 170 | Local Alarm Silence | Automatic | Off | Off | Off |
| Inputs | & Outputs | | | | |
| Point | Description | Status | Value | Value | Value |
| 177 | High Level/Override Timer Float Input | Automatic | Off | Off | Off |
| 178 | Timer Float Input | Automatic | Off | On | On |
| 179 | Redundant Off Float & Low Level Alarm Input | Automatic | On | On | On |
| 181 | Push To Silence Input | Automatic | Off | Off | Off |
| 182 | Auxiliary Contact Input | Automatic | Off | Off | Off |
| 186 | Pump Output | Automatic | Off | Off | Off |
| 188 | Alarm Light Output | Automatic | Off | Off | Off |
| 189 | Audible Alarm Output | Override Off | Off | Off | Off |