FLORIDA DEPARTMENT OF HEALTH

Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task B.7

B-HS1 Field System Monitoring Report No. 4

Progress Report

June 2012

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In association with

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AET
Applied Environmental Technology

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Florida Onsite Sewage Nitrogen Reduction Strategies Study

TASK B.7
PROGRESS REPORT

B-HS1 Field System
Monitoring Report No. 4

Prepared for:

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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 fourth 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 fourth B-HS1 monitoring and sampling event conducted on May 24, 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 four 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 onsite sewage treatment and disposal system (OSTDS) 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.

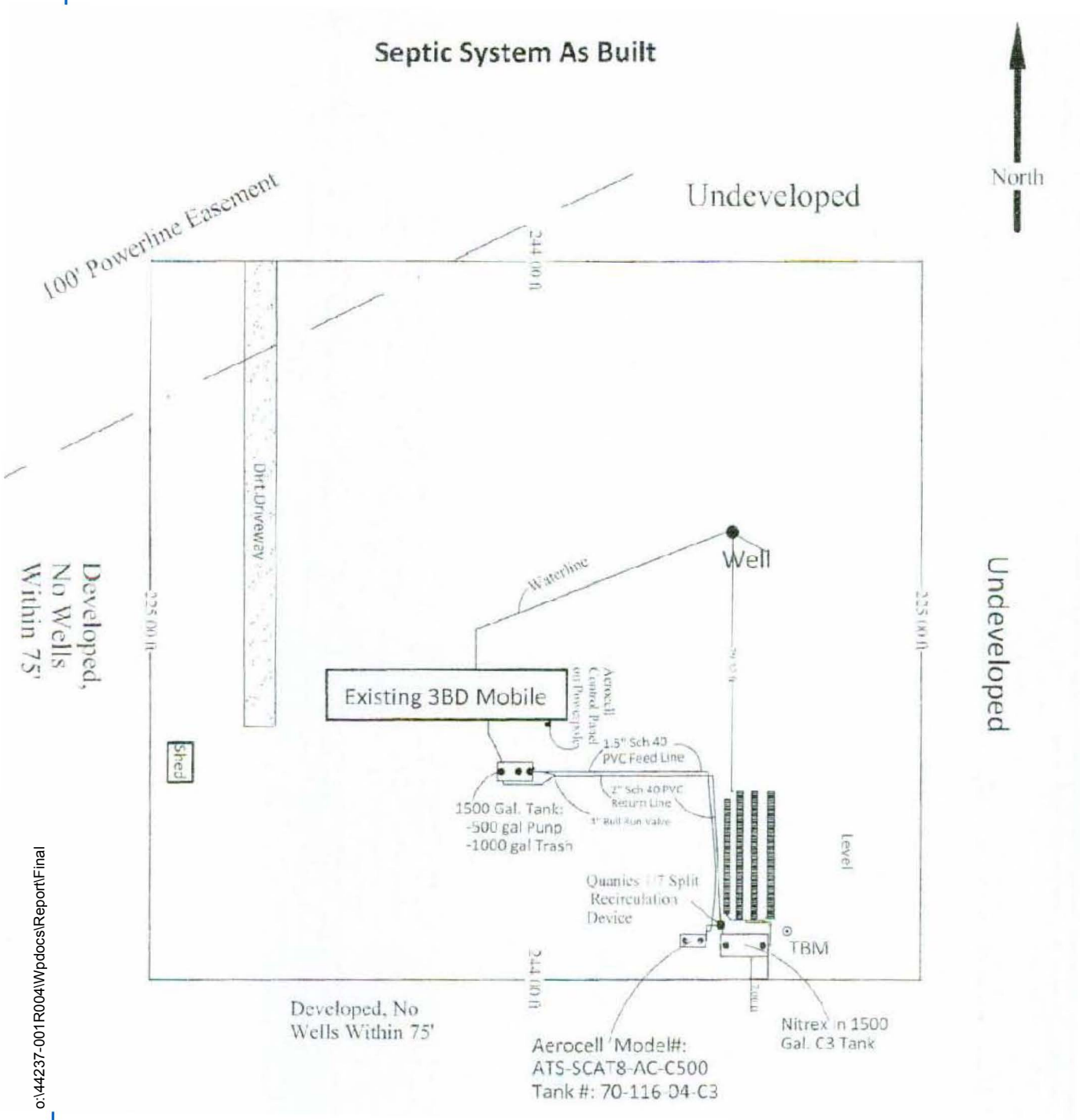

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Figure 1
B-HS1 Site Schematic

3.2 Monitoring and Sample Locations and Identification

The four monitoring points are shown in Figure 2. The first monitoring point, B-HS1-STE, is the effluent from 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 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.

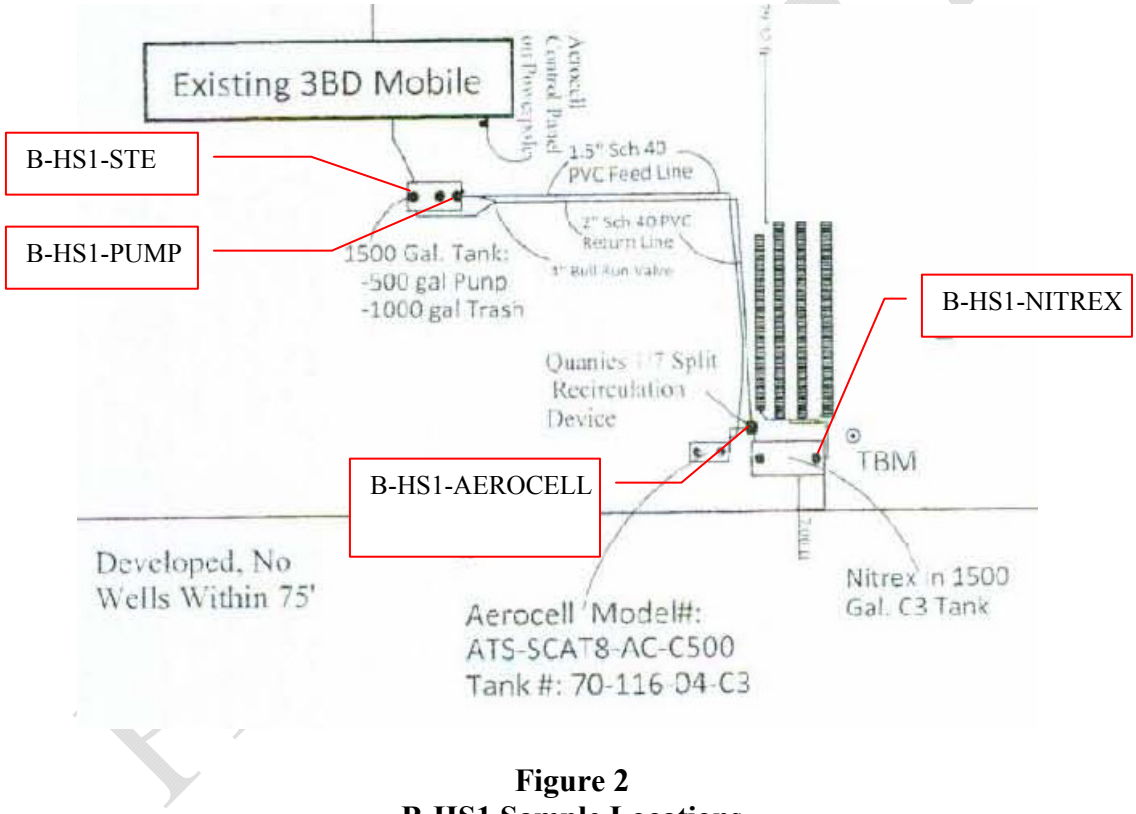


Figure 2
B-HS1 Sample Locations

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

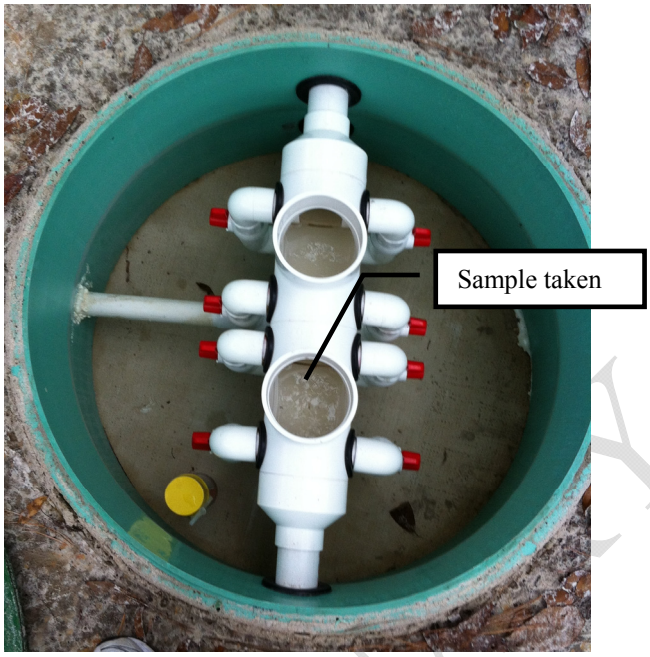


Figure 3
Recirculation Device (B-HS1-AEROCELL sample)

The forth monitoring location is the Nitrex™ tank sample tube that is connected to the Nitrex™ effluent pipe which is located on the bottom of the Nitrex™ tank (Figure 4). This sample represents the Nitrex™ effluent, which is the final effluent from the treatment system prior to being discharged to the soil infiltration system, or drainfield.

Figure 4
Nitrex™ 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 fourth sampling event, the water meter for the house and the Aerocell™ flow meter were read and recorded on May 24, 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 solely due to the single recirculation pump in the pump chamber. There are no chemicals added to the system. However, the Nitrex™ 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 and Analyses

Influent, intermediate, and effluent water quality samples from the system were collected May 24, 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 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 using external sample collection reservoirs. The influent, intermediate, and effluent samples were analyzed by the laboratory for: total alkalinity, total Kjeldahl nitrogen (TKN-N), ammonia nitrogen (NH_3-N), nitrate nitrogen (NO_3-N), nitrite nitrogen (NO_2-N), total phosphorus (TP), ortho-phosphate (Ortho P), carbonaceous biochemical oxygen demand ($CBOD_5$), chemical oxygen demand (COD), total suspended solids (TSS), volatile suspended solids (VSS), fecal coliform (fecal), and E.coli. All analyses were performed by independent and fully certified analytical laboratories (Southern Analytical Laboratory and Ackuritlabs, Inc.). Table 1 lists the analytical parameters, analytical methods, and detection limits for these 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
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

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.

Table 2
Summary 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	33,379.8	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
Total average after SRD[2] replacement		108.5		1,103.1	9.2 : 1
Total average start-up to 3/27/12		105.2		923.7	7.8 : 1

[1]Household (Q) + Recirculation (R)

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

The split recirculation device (SRD) controls the fraction of Aerocell™ effluent that is re-circulated 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.

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 108.5 gallons per day, and the average flow to the Aerocell™ unit was 1,103.1 gallons per day with a corresponding average recycle ratio of 9.2:1. The average recycle flow and corresponding recycle ratio has decreased following the third sample event in March averaging 8.0:1 during the month preceding this sample event. The household flow average between start-up and May 24, 2012 was 105.2 gallons per day, and the average flow to the Aerocell™ unit was 923.7 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.

Table 3
Summary of System Electrical Use

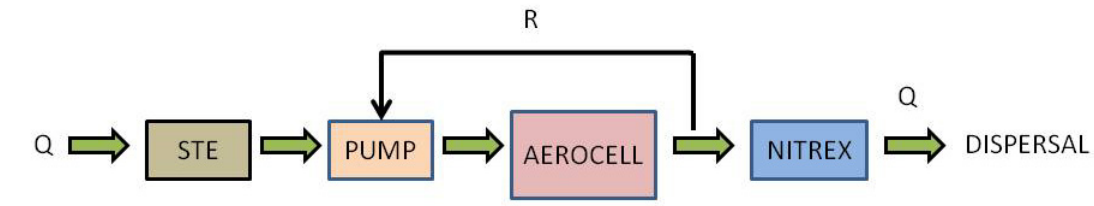
Date and Time Read	Electrical Meter Reading	Average Daily Electrical Use	Average Electrical Use per Gallon Pumped to Aerocell
	Cumulative (kWh)	(kWh/day)	(kWh/gal)
6/9/2011 17:10	1		
6/10/2011 12:25	2	1.25	0.0019
7/6/2011 11:30	40	1.46	0.0011
7/7/2011 19:30	44	3.00	0.0011
7/19/2011 11:00	49	0.43	0.0020
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
Total average after SRD[1] replacement		3.20	0.0027
Total average start-up to 5/24/12		1.86	0.0020

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

The total average electrical use through May 24, 2012 was 1.86 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 3.20 kWh per day. The average electrical use per gallon pumped to the Aerocell™ following the SRD replacement is 0.0027 kWh per gallon.

4.3 Water Quality

Water quality analytical results, for Sample Event No. 4, 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 5. A summary of the water quality data collected to date for the test system is presented in Table 5.



$CBOD_5$ mg/L	110	14	7	20
TKN mg N/L	95	41	28	20
NH_3 mg N/L	66	38	25	15
NO_x mg N/L	0.09	29.2	34.3	0.03
TN mg N/L	95.1	70.2	62.3	20.0

Figure 5
Graphical Representation of Nitrogen Results

Septic Tank Effluent (STE) Quality: The water quality characteristics of STE collected in Sample Event 4 were within the typical range generally expected for domestic STE. However, the measured STE total nitrogen (TN) concentration was 95 mg/L, which is somewhat higher than has been typically reported for Florida single family residence STE.

Pump Chamber and Aerocell™ Effluent: The pump chamber and Aerocell™ effluent NH_3-N levels were 38 mg/L and 25 mg/L with DO levels at 0.74 and 1.12 mg/L respectively (Table 4). TSS and $CBOD_5$ were below 15 mg/L. Organic N was below 5 mg/L in both samples. The pump chamber effluent NO_x-N was 29.2 mg/L, and Aerocell™ effluent NO_x-N was 34.3 mg/L. These results indicate some denitrification was occurring in the recirculation chamber but also that incomplete nitrification occurred in the Aerocell™. However, the influent total nitrogen concentration was the highest measured to date. The vendor will be notified, and adjustments to the Aerocell™ operation may be warranted prior to the next sample event. As discussed in Section 4.1, the recycle rate decreased to 8:1 during the moth preceding this sample event.

Nitrex™ Effluent: Effluent NO_x-N from the Nitrex™ unit was 0.03 mg/L. The low NO_x-N was accompanied by 2.00 mg/L DO and -191 mV ORP. However, the DO reading may not represent conditions in the Nitrex unit due to the sampling methodology where the reading is taken after the sample volume is pumped to a secondary container at the ground surface. The methodology in collecting the field reading parameters will be evaluated prior to the next sample. The Nitrex™ system was effective in producing a reducing environment and achieving the NO_x-N reduction goals. However, the total nitrogen and ammonium levels in Nitrex™ effluent were 20 mg/L and 15 mg/L, respectively, indicating that organic and ammonium nitrogen was carried over from the Aerocell™ effluent. Final total nitrogen in the treatment system effluent was dominated by reduced nitrogen forms which largely determined the overall removal efficiency and effluent N achieved by the system. The Nitrex™ unit effluent $CBOD_5$ was 20 mg/L which is an increase as compared to the upgradient Aerocell™ effluent which was 7 mg/L. However, the fecal coliform and E-coli were effectively reduced to below the method detection limit.

Table 4
Water Quality Analytical Results

Sample ID	Sample Date/Time	Sample Type	Temp (°C)	pH	Total Alkalinity (mg/L)	DO (mg/L)	ORP (mV)	Specific Conductance (µS)	TSS (mg/L)	VSS (mg/L)	$CBOD_5$ (mg/L)	COD	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 (Ct/100 mL)	E-coli (Ct/100 mL)
B-HS1-STE	5/24/12 10:05	G	23.4	6.77	570	0.35	-214	1208	63	52	110	380	95.09	95	29	66	85	0.08	0.01	0.09	66.09	9.2	4	130,000	100,000
B-HS1-PUMP	5/24/12 9:55	G	23.4	7.01	290	0.74	82	951	12	13	14	61	70.2	41	3	38	49	27	2.2	29.2	67.2	9.1	2.6	8	6
B-HS1-AEROCELL	5/24/12 9:35	G	23.5	7.03	250	1.12	50	939	6	4	7	44	62.3	28	3	25	33	33	1.3	34.3	59.3	9.1	1.3	18	18
B-HS1-AEROCELL-DUP	5/24/12 9:37	G	23.5	7.03	260	1.12	50	939	4	4	5	44	53	18	1	17	22	34	1	35	52	8.8	1.2	2	2
B-HS1-NITREX	5/24/12 9:18	G	22.5	6.58	410	2.00	-191	882	3	1	20	71	20.03	20	5	15	20	0.02	0.01	0.03	15.03	7.4	3.1	2	2

Notes:

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

[2]Organic Nitrogen (ON) is a calculated value equal to the difference of TKN and NH_3.

[3]Total Inorganic Nitrogen (TIN) is a calculated value equal to the sum of NH_3 and NO_X.

D.O. - Dissolved oxygen

G - Grab sample

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

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

Orange - shaded data points indicate results based upon colony counts exceeding the ideal range of 20-60 colonies per plate.

Table 5
Summary of Water Quality Data

Sample ID	Statistical Parameter	Temp (°C)	pH	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 (Ct/100 mL)	E-coli (Ct/100 mL)
B-HS1-STE	n	4	4	4	4	4	4	4	3	2	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4
	MEAN	21.40		560.00	0.42	-77.25	1184.50	57.75	47.00	210.00	102.50	280.00	79.13	79.00	16.75	62.25	79.75	0.05	0.12	0.13	62.38	9.15	3.83		
	STD. DEV.	1.54		31.62	0.53	198.19	22.87	4.27		28.28	51.23	115.76	10.95	10.95	9.00	5.50	7.41			0.12	5.59	0.64	0.88		
	MIN	19.80	6.77	530.00	0.05	-238.00	1159.00	53.00	44.00	190.00	30.00	170.00	71.13	71.00	10.00	55.00	70.00	0.01	0.01	0.01	55.01	8.50	2.60	130,000	100,000
	MAX	23.40	7.02	600.00	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	0.08	0.24	0.30	67.30	10.00	4.70	800,000	740,000
B-HS1-PUMP	n	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4
	MEAN	20.68		262.50	1.46	67.25	925.50	10.25	6.33	130.00	12.00	56.25	52.20	23.58	3.20	20.38	26.25	37.00	1.07	28.62	49.00	9.00	2.28		
	STD. DEV.	2.13		156.92	0.85	31.36	20.24	3.86		147.31	8.04	25.30	14.38	17.00	1.41	16.59	21.43			20.33	14.99	0.62	0.69		
	MIN	18.40	6.16	110.00	0.71	21.00	906.00	5.00	3.00	0.00	3.00	34.00	35.27	6.30	1.30	5.00	6.40	27.00	0.48	0.27	31.27	8.10	1.30	8	6
	MAX	23.40	7.03	470.00	2.21	90.00	951.00	14.00	13.00	290.00	22.00	90.00	70.20	41.00	4.50	38.00	49.00	47.00	2.20	47.53	67.20	9.50	2.90	80,000	50,000
B-HS1-AEROCELL	n	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4
	MEAN	19.98		216.50	2.43	41.50	898.00	6.75	2.50	133.33	10.50	37.75	47.56	14.53	2.48	12.05	15.78	42.33	0.65	33.04	45.08	8.98	1.59		
	STD. DEV.	2.67		128.20	1.00	17.94	30.50	7.80		119.30	13.87	18.84	15.54	12.87	0.67	12.30	16.18			21.21	15.64	0.68	0.79		
	MIN	17.50	5.82	86.00	1.12	16.00	867.00	1.00	1.50	0.00	2.00	18.00	26.20	2.40	1.60	0.08	0.11	33.00	0.27	3.20	23.20	8.00	0.66	18	18
	MAX	23.50	7.03	380.00	3.46	57.00	939.00	18.00	4.00	230.00	31.00	61.00	62.30	28.00	3.00	25.00	33.00	52.00	1.30	52.27	59.30	9.60	2.50	35,000	31,000
B-HS1-NITREX	n	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4
	MEAN	19.53		405.00	1.79	-99.00	842.25	3.75	4.83	67.67	46.00	97.75	10.54	10.48	3.23	7.25	9.45	0.07	0.01	0.07	7.32	7.88	2.48		
	STD. DEV.	2.48		47.96	1.25	150.77	46.98	1.71		70.12	43.29	48.31	6.65	6.69	2.43	5.29	7.19			0.06	5.27	0.87	0.80		
	MIN	16.90	5.75	360.00	0.66	-191.00	786.00	2.00	1.00	0.00	19.00	71.00	5.05	4.90	0.80	3.40	4.30	0.02	0.01	0.01	3.55	6.90	1.60	2	2
	MAX	22.50	7.33	470.00	3.46	126.00	882.00	6.00	9.50	140.00	110.00	170.00	20.03	20.00	5.60	15.00	20.00	0.14	0.01	0.15	15.03	8.70	3.20	600	600

Notes:

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

[2]Organic Nitrogen (ON) is a calculated value equal to the difference of TKN and NH_3.

[3]Total Inorganic Nitrogen (TIN) is a calculated value equal to the sum of NH_3 and NO_x.

D.O. - Dissolved oxygen

G - Grab sample

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

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

Orange - shaded data points indicate results based upon colony counts exceeding the ideal range of 20-60 colonies per plate.

5.0 B-HS1 Sample Event No. 4: Summary and Recommendations

5.1 Summary

The results of the fourth sampling event indicate that the system is operating reasonably well, with the possible exception of ammonium removal in the Aerocell™ unit operation. The Aerocell™ unit may need to be adjusted to optimize nitrification. The Sample Event No. 4 results indicate that:

- Septic tank effluent (STE) quality is characteristic of typical household STE quality. The nitrogen concentration is within the high end of the range that has been typically reported for Florida single family residence STE, however this sample event yielded total nitrogen concentrations higher than previous events.

- The Aerocell™ biofilter was somewhat effective in converting ammonium to oxidized nitrogen. However, ammonium removal was incomplete. The ammonium levels in the Nitrex™ effluent also indicate that some ammonium was carried over from the Aerocell™ effluent.

- The total nitrogen concentration in the final effluent from the total treatment system was approximately 20 mg/L.

- Final effluent TN was dominated by reduced nitrogen forms of organic and ammonium indicating incomplete nitrification.

5.2 Recommendations

The next sample event should provide continued insight to system performance.

5.2.1 Aerocell™ Nitrification

As previously discussed, the Aerocell™ biofilter was not performing as intended in converting all ammonium to oxidized nitrogen. The incomplete nitrification may be attributed to the high nitrogen concentration in the influent STE or to the decreased recycle ratio, which was approximately 8:1 for the two months leading up to the sample event, as compared to the initial target of 10:1. It is also noted that the Aerocell™ effluent DO was only 1.12 mg/L. The vendor will be notified.

Appendix A: Laboratory Report

SOUTHERN ANALYTICAL LABORATORIES, INC.
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Hazen and Sawyer
10002 Princess Palm Ave, Suite 200
Tampa, FL 33619

June 6, 2012
Work Order: 1205694

Laboratory Report

Project Name **Wakulla County B-HS1-SE#4**

Sample Description	**B-HS1-NITREX**
Matrix	**Wastewater**
SAL Sample Number	**1205694-01**
Date/Time Collected	**05/24/12 09:18**
Collected by	**Client**
Date/Time Received	**05/25/12 09:20**

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	By
Inorganics								
Ammonia as N	mg/L	15	EPA 350.1	4.0	0.95		05/30/12 16:29	MMF
Ammonium as NH4	mg/L	20	EPA 350.1	0.01	0.005	06/01/12 12:10	06/01/12 12:11	MMF
Carbonaceous BOD	mg/L	20	SM 5210B	2	2	05/25/12 15:59	05/30/12 14:53	MEJ
Chemical Oxygen Demand	mg/L	71	EPA 410.4	25	10	05/30/12 13:00	05/30/12 15:49	LAS
Nitrate (as N)	mg/L	0.02 I	EPA 300.0	0.04	0.01		05/26/12 08:41	JAG
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/26/12 08:41	JAG
Orthophosphate as P	mg/L	3.1	EPA 300.0	0.040	0.010		05/26/12 08:41	JAG
Phosphorous - Total as P	mg/L	7.4	SM 4500P-E	0.20	0.050	06/01/12 11:14	06/04/12 12:10	MMF
Total Alkalinity	mg/L	410	SM 2320B	8.0	2.0		05/29/12 16:56	MBC
Total Kjeldahl Nitrogen	mg/L	20	EPA 351.2	0.20	0.05	05/29/12 14:32	05/31/12 13:14	MMF
Total Suspended Solids	mg/L	3	SM 2540D	1	1	05/31/12 09:25	05/31/12 17:00	AES
Volatile Suspended Solids	mg/L	1 U	SM 2540E**	1	1	05/29/12 15:36	05/30/12 09:31	AES

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June 6, 2012
Work Order: 1205694

Laboratory Report

Project Name **Wakulla County B-HS1-SE#4**

Sample Description	**B-HS1-Pump**
Matrix	**Wastewater**
SAL Sample Number	**1205694-02**
Date/Time Collected	**05/24/12 09:55**
Collected by	**Client**
Date/Time Received	**05/25/12 09:20**

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	By
Inorganics								
Ammonia as N	mg/L	38	EPA 350.1	4.0	0.95		05/30/12 16:31	MMF
Ammonium as NH4	mg/L	49	EPA 350.1	0.01	0.005	06/01/12 12:10	06/01/12 12:11	MMF
Carbonaceous BOD	mg/L	14	SM 5210B	2	2	05/25/12 15:59	05/30/12 14:53	MEJ
Chemical Oxygen Demand	mg/L	61	EPA 410.4	25	10	05/30/12 13:00	05/30/12 15:49	LAS
Nitrate (as N)	mg/L	27	EPA 300.0	0.04	0.01		05/26/12 08:41	JAG
Nitrite (as N)	mg/L	2.2	EPA 300.0	0.04	0.01		05/26/12 08:41	JAG
Orthophosphate as P	mg/L	2.6	EPA 300.0	0.040	0.010		05/26/12 08:41	JAG
Phosphorous - Total as P	mg/L	9.1	SM 4500P-E	0.20	0.050	06/01/12 11:14	06/04/12 12:11	MMF
Total Alkalinity	mg/L	290	SM 2320B	8.0	2.0		05/29/12 16:56	MBC
Total Kjeldahl Nitrogen	mg/L	41	EPA 351.2	0.20	0.05	05/29/12 14:32	05/31/12 13:15	MMF
Total Suspended Solids	mg/L	12	SM 2540D	1	1	05/31/12 09:25	05/31/12 17:00	AES
Volatile Suspended Solids	mg/L	13	SM 2540E**	1	1	05/29/12 15:36	05/30/12 09:31	AES

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June 6, 2012
Work Order: 1205694

Laboratory Report

Project Name **Wakulla County B-HS1-SE#4**

Sample Description	**B-HS1-Aerocell**
Matrix	**Wastewater**
SAL Sample Number	**1205694-03**
Date/Time Collected	**05/24/12 09:35**
Collected by	**Client**
Date/Time Received	**05/25/12 09:20**

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	By
Inorganics								
Ammonia as N	mg/L	25	EPA 350.1	4.0	0.95		05/30/12 16:33	MMF
Ammonium as NH4	mg/L	33	EPA 350.1	0.01	0.005	06/01/12 12:10	06/01/12 12:11	MMF
Carbonaceous BOD	mg/L	7	SM 5210B	2	2	05/25/12 15:59	05/30/12 14:53	MEJ
Chemical Oxygen Demand	mg/L	44	EPA 410.4	25	10	05/30/12 13:00	05/30/12 15:49	LAS
Nitrate (as N)	mg/L	33	EPA 300.0	0.04	0.01		05/26/12 08:41	JAG
Nitrite (as N)	mg/L	1.3	EPA 300.0	0.04	0.01		05/26/12 08:41	JAG
Orthophosphate as P	mg/L	1.3	EPA 300.0	0.040	0.010		05/26/12 08:41	JAG
Phosphorous - Total as P	mg/L	9.1	SM 4500P-E	0.20	0.050	06/01/12 11:14	06/04/12 12:13	MMF
Total Alkalinity	mg/L	250	SM 2320B	8.0	2.0		05/29/12 16:56	MBC
Total Kjeldahl Nitrogen	mg/L	28	EPA 351.2	0.20	0.05	05/29/12 14:32	05/31/12 13:16	MMF
Total Suspended Solids	mg/L	6	SM 2540D	1	1	05/31/12 09:25	05/31/12 17:00	AES
Volatile Suspended Solids	mg/L	4	SM 2540E**	1	1	05/29/12 15:36	05/30/12 09:31	AES

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June 6, 2012
Work Order: 1205694

Laboratory Report

Project Name **Wakulla County B-HS1-SE#4**

Sample Description	**B-HS1-Aerocell-D**
Matrix	**Wastewater**
SAL Sample Number	**1205694-04**
Date/Time Collected	**05/24/12 09:37**
Collected by	**Client**
Date/Time Received	**05/25/12 09:20**

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	By
Inorganics								
Ammonia as N	mg/L	17	EPA 350.1	4.0	0.95		05/31/12 08:52	MMF
Ammonium as NH4	mg/L	22	EPA 350.1	0.01	0.005	06/01/12 12:10	06/01/12 12:11	MMF
Carbonaceous BOD	mg/L	5	SM 5210B	2	2	05/25/12 15:59	05/30/12 14:53	MEJ
Chemical Oxygen Demand	mg/L	44	EPA 410.4	25	10	05/30/12 13:00	05/30/12 15:49	LAS
Nitrate (as N)	mg/L	34	EPA 300.0	0.04	0.01		05/26/12 08:41	JAG
Nitrite (as N)	mg/L	1.0	EPA 300.0	0.04	0.01		05/26/12 08:41	JAG
Orthophosphate as P	mg/L	1.2	EPA 300.0	0.040	0.010		05/26/12 08:41	JAG
Phosphorous - Total as P	mg/L	8.8	SM 4500P-E	0.20	0.050	06/01/12 11:14	06/04/12 12:14	MMF
Total Alkalinity	mg/L	260	SM 2320B	8.0	2.0		05/29/12 16:56	MBC
Total Kjeldahl Nitrogen	mg/L	18	EPA 351.2	0.20	0.05	05/29/12 14:32	05/31/12 12:25	MMF
Total Suspended Solids	mg/L	4	SM 2540D	1	1	05/31/12 09:25	05/31/12 17:00	AES
Volatile Suspended Solids	mg/L	4	SM 2540E**	1	1	05/29/12 15:36	05/30/12 09:31	AES

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June 6, 2012
Work Order: 1205694

Laboratory Report

Project Name **Wakulla County B-HS1-SE#4**

Sample Description	**B-HS1-STE**
Matrix	**Wastewater**
SAL Sample Number	**1205694-05**
Date/Time Collected	**05/24/12 10:05**
Collected by	**Client**
Date/Time Received	**05/25/12 09:20**

Parameters	Units	Results *	Method	PQL	MDL	Prepared	Analyzed	By
Inorganics								
Ammonia as N	mg/L	66	EPA 350.1	4.0	0.95		05/30/12 15:08	MMF
Ammonium as NH4	mg/L	85	EPA 350.1	0.01	0.005	06/01/12 12:10	06/01/12 12:11	MMF
Carbonaceous BOD	mg/L	110	SM 5210B	2	2	05/25/12 15:59	05/30/12 14:53	MEJ
Chemical Oxygen Demand	mg/L	380	EPA 410.4	25	10	05/30/12 13:00	05/30/12 15:49	LAS
Nitrate (as N)	mg/L	0.08	EPA 300.0	0.04	0.01		05/26/12 08:41	JAG
Nitrite (as N)	mg/L	0.01 U	EPA 300.0	0.04	0.01		05/26/12 08:41	JAG
Orthophosphate as P	mg/L	4.0	EPA 300.0	0.040	0.010		05/26/12 08:41	JAG
Phosphorous - Total as P	mg/L	9.2	SM 4500P-E	0.20	0.050	06/01/12 11:14	06/04/12 12:15	MMF
Total Alkalinity	mg/L	570	SM 2320B	8.0	2.0		05/29/12 16:56	MBC
Total Kjeldahl Nitrogen	mg/L	95	EPA 351.2	0.20	0.05	05/29/12 14:32	05/31/12 12:27	MMF
Total Suspended Solids	mg/L	63	SM 2540D	1	1	05/31/12 09:25	05/31/12 17:00	AES
Volatile Suspended Solids	mg/L	52	SM 2540E**	1	1	05/29/12 15:36	05/30/12 09:31	AES

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Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE22540 - Ion Chromatography 300.0 Prep										
Blank (BE22540-BLK1)					Prepared & Analyzed: 05/26/12					
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						
LCS (BE22540-BS1)					Prepared & Analyzed: 05/26/12					
Nitrate (as N)	1.71	0.04	0.01	mg/L	1.7		101	85-115		
Nitrite (as N)	1.41	0.04	0.01	mg/L	1.4		101	85-115		
Orthophosphate as P	0.899	0.040	0.010	mg/L	0.90		100	85-115		
LCS Dup (BE22540-BSD1)					Prepared & Analyzed: 05/26/12					
Nitrate (as N)	1.71	0.04	0.01	mg/L	1.7		101	85-115	0	200
Nitrite (as N)	1.42	0.04	0.01	mg/L	1.4		101	85-115	0.7	200
Orthophosphate as P	0.904	0.040	0.010	mg/L	0.90		100	85-115	0.6	200
Matrix Spike (BE22540-MS1)		**Source: 1205694-05**			Prepared & Analyzed: 05/26/12					
Nitrate (as N)	1.77	0.04	0.01	mg/L	1.7	0.0794	99	85-115		
Nitrite (as N)	1.47	0.04	0.01	mg/L	1.4	ND	105	85-115		
Orthophosphate as P	4.91	0.040	0.010	mg/L	0.90	4.01	100	85-115		
Batch BE22542 - BOD										
Blank (BE22542-BLK1)					Prepared: 05/25/12 Analyzed: 05/30/12					
Carbonaceous BOD	2 U	2	2	mg/L						
Blank (BE22542-BLK2)					Prepared: 05/25/12 Analyzed: 05/30/12					
Carbonaceous BOD	2 U	2	2	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 BE22542 - BOD										
LCS (BE22542-BS1)					Prepared: 05/25/12 Analyzed: 05/30/12					
Carbonaceous BOD	203	2	2	mg/L	200		101	85-115		
LCS Dup (BE22542-BSD1)					Prepared: 05/25/12 Analyzed: 05/30/12					
Carbonaceous BOD	201	2	2	mg/L	200		100	85-115	1	200
Duplicate (BE22542-DUP1)		**Source: 1205684-01**			Prepared: 05/25/12 Analyzed: 05/30/12					
Carbonaceous BOD	230	2	2	mg/L		210			5	25
Duplicate (BE22542-DUP2)		**Source: 1205708-01**			Prepared: 05/25/12 Analyzed: 05/30/12					
Carbonaceous BOD	220	2	2	mg/L		230			1	25
Batch BE22914 - Ion Chromatography 300.0 Prep										
Blank (BE22914-BLK1)					Prepared & Analyzed: 05/29/12					
Nitrate (as N)	0.01 U	0.04	0.01	mg/L						
LCS (BE22914-BS1)					Prepared & Analyzed: 05/29/12					
Nitrate (as N)	1.71	0.04	0.01	mg/L	1.7		101	85-115		
LCS Dup (BE22914-BSD1)					Prepared & Analyzed: 05/29/12					
Nitrate (as N)	1.73	0.04	0.01	mg/L	1.7		102	85-115	1	200
Matrix Spike (BE22914-MS1)		**Source: 1205632-01**			Prepared & Analyzed: 05/29/12					
Nitrate (as N)	16.8	0.04	0.01	mg/L	17	0.123	98	85-115		
Matrix Spike (BE22914-MS2)		**Source: 1205648-50**			Prepared & Analyzed: 05/29/12					
Nitrate (as N)	17.0	0.04	0.01	mg/L	17	ND	100	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 BE22925 - Digestion for TKN by EPA 351.2										
Blank (BE22925-BLK1)					Prepared: 05/29/12 Analyzed: 05/31/12					
Total Kjeldahl Nitrogen	0.05 U	0.20	0.05	mg/L						
LCS (BE22925-BS1)					Prepared: 05/29/12 Analyzed: 05/31/12					
Total Kjeldahl Nitrogen	2.45	0.20	0.05	mg/L	2.5		97	90-110		
Matrix Spike (BE22925-MS1)		**Source: 1205539-02**			Prepared: 05/29/12 Analyzed: 05/31/12					
Total Kjeldahl Nitrogen	2.80	0.20	0.05	mg/L	2.5	0.653	85	80-120		
Matrix Spike Dup (BE22925-MSD1)		**Source: 1205539-02**			Prepared: 05/29/12 Analyzed: 05/31/12					
Total Kjeldahl Nitrogen	2.73	0.20	0.05	mg/L	2.5	0.653	82	80-120	2	20
Batch BE22930 -										
Blank (BE22930-BLK1)					Prepared: 05/29/12 Analyzed: 05/30/12					
Volatile Suspended Solids	1 U	1		mg/L						
Duplicate (BE22930-DUP1)		**Source: 1205694-01**			Prepared: 05/29/12 Analyzed: 05/30/12					
Volatile Suspended Solids	2.00	1		mg/L		ND				20
Batch BE22935 - alkalinity										
Blank (BE22935-BLK1)					Prepared & Analyzed: 05/29/12					
Total Alkalinity	2.0 U	8.0	2.0	mg/L						
Blank (BE22935-BLK2)					Prepared & Analyzed: 05/29/12					
Total Alkalinity	2.0 U	8.0	2.0	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 BE22935 - alkalinity										
LCS (BE22935-BS1)					Prepared & Analyzed: 05/29/12					
Total Alkalinity	130	8.0	2.0	mg/L	120		103	90-110		
LCS (BE22935-BS2)					Prepared & Analyzed: 05/29/12					
Total Alkalinity	130	8.0	2.0	mg/L	120		103	90-110		
Matrix Spike (BE22935-MS1)		**Source: 1205519-01**			Prepared & Analyzed: 05/29/12					
Total Alkalinity	320	8.0	2.0	mg/L	120	200	95	80-120		
Matrix Spike Dup (BE22935-MSD1)		**Source: 1205519-01**			Prepared & Analyzed: 05/29/12					
Total Alkalinity	320	8.0	2.0	mg/L	120	200	95	80-120	0	26
Batch BE23015 - COD prep										
Blank (BE23015-BLK1)					Prepared & Analyzed: 05/30/12					
Chemical Oxygen Demand	10 U	25	10	mg/L						
LCS (BE23015-BS1)					Prepared & Analyzed: 05/30/12					
Chemical Oxygen Demand	50	25	10	mg/L	50		100	90-110		
Matrix Spike (BE23015-MS1)		**Source: 1205694-01**			Prepared & Analyzed: 05/30/12					
Chemical Oxygen Demand	120	25	10	mg/L	50	71	94	85-115		
Matrix Spike Dup (BE23015-MSD1)		**Source: 1205694-01**			Prepared & Analyzed: 05/30/12					
Chemical Oxygen Demand	120	25	10	mg/L	50	71	100	85-115	3	32
Batch BE23019 - Ammonia by SEAL										
Blank (BE23019-BLK1)					Prepared & Analyzed: 05/30/12					
Ammonia as N	0.009 U	0.040	0.009	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 BE23019 - Ammonia by SEAL										
Blank (BE23019-BLK2)					Prepared & Analyzed: 05/31/12					
Ammonia as N	0.009 U	0.040	0.009	mg/L						
LCS (BE23019-BS1)					Prepared & Analyzed: 05/30/12					
Ammonia as N	0.47	0.040	0.009	mg/L	0.50		94	90-110		
LCS (BE23019-BS2)					Prepared & Analyzed: 05/30/12					
Ammonia as N	0.50	0.040	0.009	mg/L	0.50		100	90-110		
Matrix Spike (BE23019-MS1)		**Source: 1205658-02**			Prepared & Analyzed: 05/30/12					
Ammonia as N	0.51	0.040	0.009	mg/L	0.50	ND	103	90-110		
Matrix Spike (BE23019-MS2)		**Source: 1205757-01**			Prepared & Analyzed: 05/30/12					
Ammonia as N	0.56	0.040	0.009	mg/L	0.50	0.087	95	90-110		
Matrix Spike Dup (BE23019-MSD1)		**Source: 1205658-02**			Prepared & Analyzed: 05/30/12					
Ammonia as N	0.53	0.040	0.009	mg/L	0.50	ND	107	90-110	4	10
Matrix Spike Dup (BE23019-MSD2)		**Source: 1205757-01**			Prepared & Analyzed: 05/30/12					
Ammonia as N	0.57	0.040	0.009	mg/L	0.50	0.087	97	90-110	2	10
Batch BE23105 - TSS prep										
Blank (BE23105-BLK1)					Prepared & Analyzed: 05/31/12					
Total Suspended Solids	1 U	1	1	mg/L						
Blank (BE23105-BLK2)					Prepared & Analyzed: 05/31/12					
Total Suspended Solids	1 U	1	1	mg/L						

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10002 Princess Palm Ave, Suite 200
Tampa, FL 33619

June 6, 2012
Work Order: 1205694

Inorganics - Quality Control

Analyte	Result	PQL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch BE23105 - TSS prep										
LCS (BE23105-BS1)					Prepared & Analyzed: 05/31/12					
Total Suspended Solids	43.5	1	1	mg/L	50		87	85-115		
LCS (BE23105-BS2)					Prepared & Analyzed: 05/31/12					
Total Suspended Solids	43.5	1	1	mg/L	50		87	85-115		
Duplicate (BE23105-DUP1)		**Source: 1205688-17**			Prepared & Analyzed: 05/31/12					
Total Suspended Solids	5.00	1	1	mg/L		5.25			5	30
Duplicate (BE23105-DUP2)		**Source: 1205708-01**			Prepared & Analyzed: 05/31/12					
Total Suspended Solids	170	1	1	mg/L		154			10	30
Batch BF20120 - Digestion for TP by EPA 365.2/SM4500PE										
Blank (BF20120-BLK1)					Prepared: 06/01/12 Analyzed: 06/04/12					
Phosphorous - Total as P	0.010 U	0.040	0.010	mg/L						
LCS (BF20120-BS1)					Prepared: 06/01/12 Analyzed: 06/04/12					
Phosphorous - Total as P	0.840	0.040	0.010	mg/L	0.80		105	90-110		
Matrix Spike (BF20120-MS1)		**Source: 1205178-01**			Prepared: 06/01/12 Analyzed: 06/04/12					
Phosphorous - Total as P	1.07	0.040	0.010	mg/L	1.0	ND	107	75-125		
Matrix Spike Dup (BF20120-MSD1)		**Source: 1205178-01**			Prepared: 06/01/12 Analyzed: 06/04/12					
Phosphorous - Total as P	1.01	0.040	0.010	mg/L	1.0	ND	101	75-125	5	25

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218

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

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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 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.

SOUTHERN ANALYTICAL LABORATORIES, INC.

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

SAL Project No. 1205694

Client Name	Contact / Phone:
Hazan and Sawyer	Josephin Edeback-Hirst 813-630-4498
Project Name / Location: Wakulla County B-HS1 SE#4	jedeback@hazanandsawyer.com
Samplers: (Signature)	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	PARAMETER / CONTAINER DESCRIPTION: 1LP, Cool Total Alkalinity, NO_3, NO_2, TSS, VSS, CBOD, Ortho P	250mL P, H_2SO_4 TKN, NH_4, COD, TP				Field Temp	Field Cond	Field pH	No. of Containers (Total per each location)
01	B-HS1-~~STE~~ Nitrex	5/24/12	9:18	WW		X	1	1				22.5	882	6.58	2
02	B-HS1-PUMP	5/24/12	9:55	WW		X	1	1				23.4	951	7.01	2
03	B-HS1-AEROCELL	5/24/12	9:35	WW		X	1	1				23.5	939	7.03	2
04	B-HS1-AEROCELL-D	5/24/12	9:37	WW		X	1	1				↓	↓	↓	2
05	B-HS1-~~NITREX~~ STE	5/24/12	10:05	WW		X	1	1				23.4	1208	6.77	2

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
Bowling	1530 5/11/12		13:30 5/13/24
Relinquished:	Date/Time:	Received:	Date/Time:
	16:30 5/24/12	Fedex	
Relinquished: Fedex	Date/Time:	Received:	Date/Time: 9:20 5-25-12
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact? (Y) N N/A
Samples intact upon arrival? (Y) N N/A
Received on ice? Temp 0.4 (Y) N N/A
Proper preservatives indicated? (Y) N N/A
Rec'd within holding time? (Y) N N/A
Volatiles rec'd w/out headspace Y N (N/A)
Proper containers used? (Y) N N/A

Instructions / Remarks

Chain of Custody.xls
Rev.Date 11/19/01

Chain of Custody

Ackuritlabs, Inc.

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

Environmental Services Section

REPORT OF MICROBIOLOGICAL ANALYSIS

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

Report #: 21147
Report Date: May 29, 2012
NELAC#: E81350
FDEPQA#: 920087G
Project#: 211296
Sampled By: Harmon Harden
Sample Site: [redacted] Drive Septic System
Sample Date: 05-24-12

Table 1. Samples received 05-24-12.

	Fecal Coliform	Dilution	*E. coli*	Dilution
Units:	# colonies/100 mL	Factor	# colonies/100 mL	Factor
Methodology:	SM 9222D		EPA 1603	
Detection Limit:	2.0		2.0	
Analysis Date:	05-24-12		05-24-12	
Analysis Time:	14:00		14:00	
Analyst:	AL		AL	
Sample Location/Time:				
Lab Number:				
Nitrex Tank, 09:18				
#109647	2.0 U	2	2.0 U	2
Aerocell Tank, 09:35				
#109648	18	2	18	2
Pump Tank, 09:55				
#109649	8	2	6	2
STE Tank, 10:05				
#109650	130,000	10,000	100,000	10,000
Aerocell Tank Dup, 09:37				
#109651	2.0 U	2	2.0 U	2

Data Qualifiers that may apply:
U = Analyte was not detected and the indicated value is the detection limit.
B = Colony count exceeded the ideal of 20-60 (fecal coliform) or 20-80 (*E. coli*) colonies per plate.

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

Amanda Lawhon 5-29-12
Amanda Lawhon, QA Officer

Ackuritlabs, Inc.

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

№ 121147

CHAIN OF CUSTODY RECORD

Page 1 of 1

CLIENT NAME & ADDRESS: Halen & Sawyer

LAB PROJECT #: 21296

PROJECT NAME:

CONTACT PERSON: Harmen

SAMPLE CONTAINERS	PRESERVATIVE									PLASTIC CONTAINERS								GLASS CONTAINERS									
	A	N	S	H	B	Z	T																				
QUANTITY	NH_4Cl	HNO_3	H_2SO_4	HCl	NaOH	$Zn(C_2H_3O_2)_2$	$Na_2S_2O_3$			125 mL	250 mL	500 mL	1 Liter	WHIRLPAK - DW	WHIRLPAK - WW	WHIRLPAK - ICE		40 mL	125 mL	250 mL	500 mL	1 Liter			TRIP BLANK	REMARKS
4							X																			

PRECLEANED CONTAINERS RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
Mark Busby	5-23-12	0500	Mark Busby	5-23-12	0900
RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:

SAMPLE COLLECTION 2012

SAMPLERS: (PRINT NAME) Harmen Herdon

SAMPLERS: (SIGNATURE)

FIELD ID NUMBER	DATE MM/DD/YY	TIME	STATION LOCATION/NUMBER	MATRIX	GRAB OR COMPOSITE	NO. OF CONTAINERS	ANALYSES REQUESTED: Fecal / E Coli	LAB ID#
#1	5-24-12	0918	Nitrex Tank	WW	G	2	X X	109647
#2		0935	Aerocell Tank					109648
#3		0955	Pump Tank					109649
#4		1005	STE Tank					109650
#5		0937	Aerocell Tank Dup.					109651

COMMENTS:

SAMPLES RECEIVED: ICED Y / N

TEMP: _____ ° C HOLD TIME Y / N PROPER PRESERVATION Y / N

RELINQUISHED BY(SIGNATURE) / AFFILIATION / DATE & TIME: Mark Busby / ACK 5-24-12 1241

RECEIVED BY(SIGNATURE) / AFFILIATION / DATE & TIME:

RELINQUISHED BY(SIGNATURE) / AFFILIATION / DATE & TIME:

RECEIVED BY(SIGNATURE) / AFFILIATION / DATE & TIME:

RELINQUISHED BY(SIGNATURE) / AFFILIATION / DATE & TIME:

RECEIVED BY(SIGNATURE) / AFFILIATION / DATE & TIME:

Page 2 of 2

MATRIX TYPES:

SW SURFACE WATER
WW WASTE WATER
GW GROUND WATER
DW DRINKING WATER
FT FISH TISSUE
SO SOIL
SL SLUDGE
MI MICROBENTHIC INVERTEBRATES
SH SHELLFISH
HZ HAZARDOUS WASTE
SE SEDIMENT
OT OTHER

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 chamber of the primary tank.
10/26/11	Monitoring sample event No.1. Leaks apparent on Aerocell split recirculation device. Water level within the split recirc 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. Observed within 1 of 4 drainfield observation ports 0.25 inch of ponded water

Date	Description
1/30/12	Recorded flows to verify recycle ratio.
	Observed within 1 of 4 drainfield observation ports 0.25 inch of ponded water
2/24/12	Site visit.
	Observed within 1 of 4 drainfield observation ports 0.25 inch of ponded water
3/27/12	Monitoring sample event No.3.
	Observed within 1 of 4 drainfield observation ports 0.125 inch of ponded water
4/20/12	Site visit.
	Observed within 1 of 4 drainfield observation ports 0.5 inch of ponded water
5/24/12	Monitoring sample event No.4.
	Observed within 1 of 4 drainfield observation ports 0.125 inch of ponded water

Appendix C: Vericomm PLC Data

System Status			24-May-12	5-May-12	20-Apr-12	5-Apr-12
Point	Description	Status	Value	Value	Value	Value
1	Alarm Status	Automatic	OK	OK	OK	OK
2	Alert Status	Automatic	OK	OK	OK	OK
3	System Mode	Automatic	Normal	Normal	Normal	Normal
5	Timer Mode	Automatic	Normal	Off	Normal	Normal
6	Active Off Time	Automatic	15.0 Minutes	15.0 Minutes	15.0 Minutes	15.0 Minutes
7	Active On Time	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
9	Pump Mode	Automatic	OffCycl	Off	OffCycl	OffCycl
10	Pump Status	Automatic	Off	Off	Off	Off
12	Pump Cycles Today	Automatic	10.0 Cycles	7.0 Cycles	41.0 Cycles	8.0 Cycles
13	Override Cycles Today	Automatic	0.0 Cycles	0.0 Cycles	0.0 Cycles	0.0 Cycles
14	Pump Run Time Today	Automatic	20.2 Minutes	14.1 Minutes	83.6 Minutes	16.1 Minutes
Settings						
Point	Description	Status	Value	Value	Value	Value
17	Off Cycle Time	Constant/Setpoint	15.0 Minutes	15.0 Minutes	15.0 Minutes	15.0 Minutes
18	On Cycle Time	Constant/Setpoint	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
19	Override Off Cycle Time	Constant/Setpoint	7.0 Minutes	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	1.7 Minutes
21	Minimum Override Cycles	Automatic	3.0 Cycles	3.0 Cycles	3.0 Cycles	3.0 Cycles
23	Override Cycle Limit per Day	Constant/Setpoint	21.0 Cycles	21.0 Cycles	21.0 Cycles	21.0 Cycles
24	Time Limit per Day	Constant/Setpoint	200.0 Minutes	200.0 Minutes	200.0 Minutes	200.0 Minutes
25	High Level Pump Test	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
28	Alarm Update Interval	Timing Override	120.0 Minutes	120.0 Minutes	120.0 Minutes	120.0 Minutes
29	Page Delay	Automatic	960.0 Minutes	960.0 Minutes	960.0 Minutes	960.0 Minutes
30	Page Interval	Automatic	30.0 Minutes	30.0 Minutes	30.0 Minutes	30.0 Minutes
31	Local Alarm Delay	Constant/Setpoint	1140.0 Minutes	1140.0 Minutes	1140.0 Minutes	1140.0 Minutes
32	Local Reactivate Delay	Automatic	120.0 Minutes	120.0 Minutes	120.0 Minutes	120.0 Minutes
Troubleshooting						
Point	Description	Status	Value	Value	Value	Value
33	Top Float Status	Automatic	OK	OK	OK	OK
34	Middle Float Status	Automatic	OK	OK	OK	OK
35	Bottom Float Status	Automatic	OK	OK	OK	OK
37	Contactor Status	Automatic	OK	OK	OK	OK
38	Pump Status	Automatic	OK	OK	OK	OK
40	Filter Status	Automatic	OK	OK	OK	OK
41	Tank Status	Automatic	OK	OK	OK	OK
43	Power Status	Automatic	OK	OK	OK	OK
Flow Data						
Point	Description	Status	Value	Value	Value	Value
49	Pump Run Time Today	Automatic	20.2 Minutes	14.1 Minutes	83.6 Minutes	16.1 Minutes
50	Override Cycles Today	Automatic	0.0	0.0	0.0	0.0
51	Pump Cycles Today	Automatic	10.0 Cycles	7.0 Cycles	41.0 Cycles	8.0 Cycles
52	Average Run Time per Cycle Today	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
54	Brownouts Today	Automatic	0.0	0.0	0.0	0.0

System Status			24-May-12	5-May-12	20-Apr-12	5-Apr-12
30-Day History Data						
Point	Description	Status	Value	Value	Value	Value
65	30 Day Average Run Time per Day	Automatic	88.0 Minutes	104.4 Minutes	107.2 Minutes	100.1 Minutes
66	30 Day Average Override Cycles per Day	Automatic	0.0 Cycles	0.0 Cycles	0.0 Cycles	0.0 Cycles
67	30 Day Average Cycles per Day	Automatic	43.6 Cycles	51.8 Cycles	53.2 Cycles	49.7 Cycles
68	30 Day Average Run Time per Cycle	Automatic	2.0 Minutes	2.0 Minutes	2.0 Minutes	2.0 Minutes
71	30 Day Total Pump Run Time	Automatic	2638.5 Minutes	3131.6 Minutes	3216.2 Minutes	3001.8 Minutes
72	30 Day Total Override Cycles	Automatic	0.0 Cycles	0.0 Cycles	0.0 Cycles	0.0 Cycles
73	30 Day Total Cycles	Automatic	1309.0 Cycles	1553.0 Cycles	1596.0 Cycles	1490.0 Cycles
76	30 Day Total Brownouts	Automatic	0.0	0.0	0.0	0.0
Totalized Pump Data						
Point	Description	Status	Value	Value	Value	Value
82	Pump Total Run Time	Automatic	403.5 Hours	375.9 Hours	350.9 Hours	323.7 Hours
83	Pump Total Cycles	Automatic	12896.0 Cycles	12074.0 Cycles	11331.0 Cycles	10522.0 Cycles
Miscellaneous						
Point	Description	Status	Value	Value	Value	Value
145	Pump On Auto	Automatic	Off	Off	Off	Off
147	Pump Test Today	Automatic	Off	Off	Off	Off
148	Pump Check Enable	Automatic	Off	Off	Off	Off
149	Total Override Cycles	Automatic	0.0	0.0	0.0	0.0
150	High Level Condition	Automatic	Off	Off	Off	Off
151	Leak Check Enable	Automatic	On	Off	On	On
152	Brownout State	Automatic	Off	Off	Off	Off
153	Test Mode	Automatic	Off	Off	Off	Off
Alarm Points						
Point	Description	Status	Value	Value	Value	Value
161	General Alarm	Automatic	Off	Off	Off	Off
162	New Alarm	Automatic	Off	Off	Off	Off
163	Update Central Enable	Automatic	On	On	On	On
167	Page Alarm Start	Automatic	Off	Off	Off	Off
168	Pager Signal	Override Off	Off	Off	Off	Off
169	Local Alarm Start	Automatic	Off	Off	Off	Off
170	Local Alarm Silence	Automatic	Off	Off	Off	Off
Inputs & Outputs						
Point	Description	Status	Value	Value	Value	Value
177	High Level/Override Timer Float Input	Automatic	Off	Off	Off	Off
178	Timer Float Input	Automatic	On	Off	On	On
179	Redundant Off Float & Low Level Alarm Input	Automatic	On	On	On	On
181	Push To Silence Input	Automatic	Off	Off	Off	Off
182	Auxiliary Contact Input	Automatic	Off	Off	Off	Off
186	Pump Output	Automatic	Off	Off	Off	Off
188	Alarm Light Output	Automatic	Off	Off	Off	Off
189	Audible Alarm Output	Override Off	Off	Off	Off	Off