

Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task A.25PNRS II Test Facility Sample Event Report No. 4

Progress Report

January 2011



HAZEN AND SAWYER Environmental Engineers & Scientists In association with



OTIS ENVIRONMENTAL CONSULTANTS, LLC

Florida Onsite Sewage Nitrogen Reduction Strategies Study

TASK A.25 PROGRESS REPORT

PNRS II Test Facility Sample Event Report No. 4

Prepared for:

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

FDOH Contract CORCL

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Prepared by:



In Association With:





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1.0 Background

Task A of the Florida Onsite Sewage Nitrogen Reduction Strategies Study includes the evaluation of passive treatment systems to remove nitrogen from septic tank effluent. The Passive Nitrogen Removal Study II (PNRS II) is a follow-up to the previous experimental evaluations of passive nitrogen removal technologies conducted in Passive Nitrogen Removal Study I. The objective of the PNRS II study is to extend and expand into field pilot testing the two-stage biofiltration process that was initiated in PNRS I. A unique test facility was constructed for the purpose of this evaluation. The Task A.15 PNRS II Quality Assurance Project Plan (QAPP) documents the objectives, experimental biofiltration systems, monitoring framework, sample frequency and duration, and analytical methods to be used at the PNRS II Test Facility.

2.0 Purpose

This sample event report documents data collected from the fourth PNRS II monitoring and sampling event which was conducted January 13, 2011. This monitoring event consisted of an assessment and evaluation of PNRS II operation, measurement of flowrates for all systems, measurement of field parameters, and collection of biofilter influent and effluent samples and their analyses in a NELAC certified laboratory.

3.0 Materials and Methods

3.1 Project Site

The PNRS II Test Facility is located at the University of Florida Gulf Coast Research and Education Center (GCREC) in southeast Hillsborough County, Florida. The specially designed facility enables the simultaneous operation and performance testing of numerous biofilter treatment trains in parallel using the same wastewater source. The source of the influent wastewater is the septic tank effluent from the existing onsite wastewater system serving the GCREC. Details of the design and construction of the PNRS II test facility were presented previously in Task A.17, A.18, A.19, and A.24 documents.

3.2 Monitoring and Sampling Locations and Identification

A schematic of the PNRS II test facility is shown in Figure 1. Septic tank effluent (STE) from GCREC is pumped from PNRS II-STE-T1 into the PNRS II systems through four points of entry: Hydro-1, Hydro-2, UNSAT-IS-1, and UNSAT-IS3. PNRS II biofilters are grouped into the four types of systems shown in Figure 1. The nomenclature and reactor/sample identification used for the PNRS II test facility sampling events are listed in Table 1. The sample designations listed in Table 1 also largely correspond to the locations at which flow volumes are measured in each sample event.

The previously submitted Data Summary Report No. 3 recommended several modifications to address performance issues with the test systems. Modifications that were implemented before this sample event include:

• The recirculating biofilter with polystyrene media (UNSAT-PS1) target recycle ratio was increased to 6:1 from the 3:1 ratio.

	PNRS II Sample Identification	
Group (Figure 1)	Sample Location	Sample Identification
	STE PNRS II Storage Tank 1	PNRS II-STE-T1
		UNSAT-EC1
	Stage 1 Single Pass Biofilters	UNSAT-EC3
		UNSAT-CL1
		UNSAT-CL3
I		DENIT-SU4
		DENIT-LS3
	Stage 2 Single Pass Upflow Biofilters	DENIT-SU3
		DENIT-LS2
		DENIT-LS4
		RC1
		RC2
	Recirculation Tanks	RC3
		RC4
		RC5
II		UNSAT-SA2
		UNSAT-EC4
	Stage 1 Recirculating Biofilters	UNSAT-CL2
		UNSAT-CL4
		UNSAT-PS1
	Pump 15 Tank	P15-T
	Denite Feed Collection Tank	DFT
		UNSAT-SU1
III	Stage 2 Herizontal Diefiltere	UNSAT-SU2
	Stage 2 Holizofital Bioliliers	UNSAT-LS1
		UNSAT-GL1
		UNSAT-IS1
11/	In Situ In Tank Simulator Single Dage Disfilter	UNSAT-IS2
IV	In-Situ In-Tank Simulator Single Pass Biofilter	UNSAT-IS2 UNSAT-IS3

Table 1



PNRS II Test Facility System Schematic

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3.3 Operational Monitoring

Start-up of the PNRS II test facility occurred on May 17th, 2010 and all systems have operated continually since that time. The entire facility operation is checked at least once per week and a detailed log of operational observations and activities is maintained. In addition, the programmable logic controller (PLC) which controls many of the dosing and pump controls also records pump run times and flow data from flow meters at the facility, and these data can provide useful insight into facility operations. Appendix A provides summary tables of the PLC recorded data of daily runtimes and flows for the test facility between November 11th and January 12th (Day 178 through Day 240 since start-up) used to check general pump operation and performance. On the sample event day during a dose to the UNSAT-IS1 and UNSAT-IS2 biofilters, ponding at the surface was witnessed in both biofilters. An inspection of the systems will be conducted following the sample event to determine the cause.

3.4 Water Quality Sample Collection and Analyses

Influent and effluent water quality samples from the PNRS II test systems for Sample Event 4 were collected January 13, 2011. A sample of STE was collected from the feed line connecting STE Storage Tank 1 (PNRS II-STE-T1) to Hydrosplitter 1 which supplies STE to the single pass Stage 1 biofilters (Figure 1). A manual dose event was initiated on the control panel until sufficient STE sample volume was collected in a clean sample container. Stage 1, 2, and in-situ simulator biofilter and recirculation tank effluents were each sampled by directing the entire flow from the biofilter into a large, clean sample container over a period of time sufficient to obtain the desired sample volume (approximately 3.5 liters). Sample containers were immediately placed in coolers on ice prior to subdivision of the composited sample.

The composite samples in the 3.5 liter sample containers were then subdivided into analysis-specific sample containers. 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 D, were used to document the transfer of samples from field personnel to the analytical laboratory. One chain of custody form was filled out for each set of samples and placed inside the cooler.

Equipment blank, field blank, and field sample duplicates were taken. The equipment blank was collected using a previously cleaned STE sample collection bottle. The bottle was filled with distilled water provided by the laboratory and allowed to sit for eight mi-

nutes. The sample containers were then analyzed for the same parameters as the samples. The field blank was collected by filling sample containers with distilled water that had been transported from the laboratory into the field along with other sample containers. The field sample duplicates were collected immediately subsequent to the regular samples. The duplicate sample containers were filled with PNRS II T1-STE effluent, UNSAT-CL3 effluent, UNSAT-EC1 effluent, and UNSAT-CL1 effluent. Additionally, laboratory split samples were collected immediately subsequent to the regular samples. The laboratory split sample containers were filled with PNRS II T1-STE effluent, UNSAT-CL3 effluent, UNSAT-EC1 effluent, and UNSAT-CL1 effluent, UNSAT-EC3 effluent, UNSAT-IS3 effluent, UNSAT-IS4 effluent.

Field parameters were measured using portable electronic probes and included temperature (Temp), dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, and specific conductance. Temperature (Temp), dissolved oxygen (DO), and oxidation-reduction potential (ORP) were measured with probe tips placed in flow through samplers located directly in the outlet pipe at each sample location. Specific conductance and pH were measured using external sample collection reservoirs. Field parameter results are listed in Appendix B. The influent 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), carbonaceous biochemical oxygen demand (CBOD₅), total dissolved solids (TDS), total suspended solids (TSS), chemical oxygen demand (COD), total phosphorus (TP), and fecal coliform (fecal). For some of the denitrification biofilters containing elemental sulfur media, influent and effluent sample analyses were also conducted for sulfate (SO₄) and hydrogen sulfide (H₂S). Table 2 lists the analytical parameters, analytical methods, and detection limits for these analyses.

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Table 2	
Analytical Parameters, Method of Analysis, and Detection Limits	

Analytical Parameter	Method of Analysis	Laboratory Detection Limit (mg/L)
Total Alkalinity as CaCO ₃	SM 2320B	2 mg/L
Total Kjeldahl Nitrogen (TKN-N)	EPA351.2	0.05 mg/L
Ammonia Nitrogen (NH ₃ -N)	EPA350.1	0.01 mg/L
Nitrate/Nitrite Nitrogen (NO _X -N)	EPA353.2	0.01 mg/L
Carbonaceous BOD (CBOD ₅)	SM 5210B	2 mg/L
Total Dissolved Solids (TDS)	SM 2540C	10 mg/L
Total Suspended Solids (TSS)	SM 2540D	1 mg/L
Chemical Oxygen Demand (COD)	EPA 410.4	10 mg/L
Total Phosphorus (TP)	SM 4500PE	0.01 mg/L
Fecal Coliform (fecal)	SM9222D	1 ct/100mL
Sulfate (SO ₄)	EPA300.0	0.2 mg/L
Hydrogen Sulfide Unionized (H ₂ S)	SM4500S F	0.01 mg/L
Sulfide	SM4500S F	0.1 mg/L

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3.5 Flow Monitoring

Flow rates for all PNRS II systems were calibrated at initial start-up. The flow rates are measured at each sampling event and adjusted as necessary to maintain flow rates consistent with the experimental design. Flow measurements and adjustments are made after collection of liquid samples and field parameter analyses.

A flow test was conducted January 17, 2011. These flow measurements are considered to represent those in effect leading up to and during the Sample Event 4. The measured volumes and relative errors between measured and target flow rates are presented in Appendix C, Table 1. For the Group 1 systems, measured STE inputs to four of the five Stage 1 biofilters were within the 15% operational target that is considered acceptable for PNRS II flow rates. The measured influent volume of UNSAT-PS1 was - 24.3% of the target volume. Measured effluent volumes for Stage 1 single pass biofilters (Stage 2 influent) were within 14% of the target volume for four of the five systems (Appendix C, Table 1). The DENIT-LS4 influent pipe was substantially clogged which led to UNSAT-PS1 effluent backing up within the Pump 15 holding tank. Therefore a measurement of influent volume to DENIT-LS4 was unable to be taken.

For the Group 2 systems, all measured STE volumes to the Stage 1 recirculation tanks were within 14% of target volumes. All recycle flow volumes as recorded by the PLC were within 5% of target volumes based on the experimental design recycle ratio of 3.0. The calculated recycle ratios (i.e. recycle flow volume divided by the STE flow volume) for four of the five recirculation systems were within 12% of the target recycle ratio of 3.0. Although the recycle rate to the UNSAT-PS1 was close to target, the recycle ratio was high due to the low influent STE flow that was previously discussed.

For Group 3 systems, the measured influent volumes to the Stage 2 horizontal denitrification biofilters were all within 4% of target.

For Group 4 biofilters, the UNSAT-IS1 and UNSAT-IS2 measured influent volumes were within 15% of target volumes. The UNSAT-IS3 and UNSAT-IS4 measured influent volumes were within 3% of target volumes.

After evaluating the influent flow test results, a few maintenance items were conducted:

• Hydrosplitter 1 petcock valves were adjusted January 18th to provide equal distribution of flow to each of the five Stage 1 biofilters with input volumes as close to the target volume as possible. • Influent pipe to DENIT-LS4 was unclogged January 18th

The flows were rechecked after modifications to the systems were made and are provided in Appendix C, Table 2. The UNSAT-PS1 measured influent volume is closer to the target as measured on January 18th which will continue to be monitored.



Appendix A: PLC Data

	Sum	Ta mary of PLC /11/11/	able A.1 Record 10 – 1/12	ed Dail 2/11)	y Flow	S	
Date Range		Average Recorded Flow (gpd)	Std. Dev.	MIN (gpd)	MAX (gpd)	Target Flow (gpd)	Relative Error ¹ (%)
	Pump 4 to Hy- dro 1	70	16.84	0	118	73.7	-5.0%
	Pump 14 to Hy- dro 2	57	11.40	0	62	58.9	-2.6%
11/11/10-	Pump 6 to Re- circ. System 1	41	8.01	0	44	44.2	-7.4%
1/12/11	Pump 7 to Re- circ. System 2	42	8.20	0	45	44.2	-5.3%
	Pump 8 to Re- circ. System 3	41	8.05	0	44	44.2	-7.0%
	Pump 9 to Re- circ. System 4	41	8.42	0	44	44.2	-8.3%
UNSAT-PS1 Target 3:1 Recycle Ratio							
11/11/10- 12/13/10	Pump 15 to Re- circ. System 5	40 11.71 0 64 44.2 -10.6		-10.6%			
UNSAT-PS1 T	Target 6:1 Recycle I	Ratio					
12/15/10- 1/12/11	Pump 15 to Re- circ. System 5	91	5.43	89	119	88.4	2.8%

¹Relative Error = (Recorded Flow – Target Flow)/ Target Flow *100

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	Sur	nmary of PLC (1/11	Table Reco I/10 –	A.2 rded Daily 1/12/11)	Runtimes		
Date Range		Average Recorded Daily Runtime (minutes/day)	Std. Dev.	MIN (minutes)	MAX (minutes)	Target Daily Runtime (minutes)	Relative Error ¹ (%)
P4 Runtime Ta	arget = 31 seco	nds/dose					
11/11/10- 12/6/10	Pump 4 to Hydro 1	11.4	3.6	0.0	13.0	12.4	-7.9%
P4 Runtime Ta	arget = 44 ² sec	onds/dose		-			-
12/8/10- 1/12/11	Pump 4 to Hydro 1	18.2	1.1	17.0	24.0	17.6	3.5%
	Pump 14 to Hydro 2	10.3	2.0	0.0	11.0	10.4	-1.1%
	Pump 6 to Recirc. System 1	6.1	1.3	0.0	7.0	6.0	1.6%
11/11/10- 1/12/11	Pump 7 to Recirc. System 2	6.1	1.3	0.0	7.0	6.0	1.6%
	Pump 8 to Recirc. System 3	6.1	1.3	0.0	7.0	6.0	1.6%
	Pump 9 to Recirc. System 4	6.1	1.3	0.0	7.0	6.0	1.6%
UNSAT-PS1 T	arget 3:1 Recy	cle Ratio		1			
11/11/10- 12/13/10	Pump 15 to Recirc. System 5	6.1	1.9	0.0	10.0	6.0	2.0%
UNSAT-PS1 T	arget 6:1 Recy	cle Ratio					
12/15/10- 1/12/11	Pump 15 to Recirc. System 5	14.2	0.9	14.0	19.0	14.0	1.2%

¹Relative Error = (Recorded Runtime – Target Runtime)/ Target Runtime *100 ²Pump 4 Runtime was increased to increase UNSAT-PS1 STE influent volume to target level



Appendix B: Field Parameter Analyses

(January 13, 2011)									
Sample Identification	рН	Temperature (°C)	Specific Conductance (μS)	Dissolved Oxygen (mg/L)	ORP ¹ (mV)				
STE			•						
STE-Tank 1	7.1	13.7	1,220	2.71	-236.5				
STE-Tank 1-D	7.1	13.7	1,220	2.71	-236.5				
Stage 1 Single Pass Bio	filter Efflue	nt							
UNSAT-EC1	6.7	7.8	1,110	7.93	36.5				
UNSAT-EC1-D	6.7	7.8	1,110	7.93	36.5				
UNSAT-EC3	6.8	6.3	1,150	7.89	38.7				
UNSAT-CL1	7.2	8.2	1,200	8.82	32.3				
UNSAT-CL1-D	7.2	8.2	1,200	8.82	32.3				
UNSAT-CL3	7.3	8.3	1,300	9.91	20.2				
UNSAT-CL3-D	7.3	8.3	1,300	9.91	20.2				
Stage 2 Single Pass Up	low Biofilte	r Effluent							
DENIT-SU4	6.8	7.0	1,350	4.24	-99.6				
DENIT-LS3	6.7	6.6	1,150	5.36	-79.0				
DENIT-SU3	6.9	6.9	1,420	2.84	-208.7				
DENIT-LS2	7.3	6.8	1,300	4.95	-135.0				
DENIT-LS4	7.3	7.4	810	5.23	-98.6				
Recirculation Tank Effl	uent								
RC1	7.2	7.2	950	1.63	-0.90				
RC2	7.1	7.4	1,000	2.54	-5.00				
RC3	6.9	7.4	990	2.04	-21.7				
RC4	7.3	8.3	1,050	0.35	-121.9				
RC5	7.1	7.9	930	1.47	-120.7				
Stage 1 Recirculating B	iofilter Efflu	ent							
UNSAT-CL4	7.3	7.9	970	10.90	55.5				
UNSAT-CL2	7.0	6.0	990	7.91	-88.9				
UNSAT-EC4	6.9	7.0	960	10.28	-88.8				
UNSAT-SA2	6.8	6.2	900	9.58	-70.8				

Table B.1 Field Parameter Results (January 13, 2011)

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Sample Identification	рН	Temperature (°C)	Specific Conductance (µS)	Dissolved Oxygen (mg/L)	ORP ¹ (mV)
UNSAT-PS1	7.3	5.8	930	5.24	-28.5
P15-Tank	7.0	5.0	900	6.39	-26.9
Denite Feed Tank (Tan	k 3)				
DFT	7.0	6.4	950	9.77	-40.9
Stage 2 Horizontal Bio	filters Efflue	nt			
DENIT-SU1	6.8	0.2	1,080	1.22	-231.2
DENIT-SU2	6.8	0.3	1,130	1.63	-212.2
DENIT-LS1	7.0	0.3	910	0.55	-173.1
DENIT-GL1	6.6	0.3	1,000	0.89	-208.7
In-situ Simulator Biofil	ter Effluent				
UNSAT-IS1 (STE)	6.7	1.2	1,200	0.41	-141.2
UNSAT-IS2 (Nitrified STE)	6.8	6.2	680	3.89	-234.5
UNSAT-IS3 (STE)	6.97	11.6	1,331	0.43	136.5
UNSAT-IS3-SP (STE)	7.5	4.0	980	11.90	39.2
UNSAT-IS4 (Nitrified STE)	7.0	11.6	993	0.98	150.4
UNSAT-IS4-SP (Nitrified STE)	6.6	5.1	1,050	11.94	35.1
Blanks					
Field Blank	7.0	5.0	40	9.79	-54.6
Equipment Blank	7.0	5.3	40	9.79	-54.6

¹ORP readings are suspect and will be checked.

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Appendix C: Flow Test Results

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Table C.1 Flow Test Results

			Target Input		Measure	ed Input		Recycle Ratio	
Group (Figure 1)	Biofilter/Flow	Target Input Volume	Dose/day	Target Input Volume	Measured Input Volume	Relative Error (%)	Target Recycle Ratio (RR)	Calculated Recycle Ratio (RR)	Relative Error (%)
		(mL/day)	(Dose/day)	(mL/dose)	(mL/dose)	(Measured Input -Target Input) / Target Input * 100	Volume Recycle / Volume STE	Volume Recycle / Volume STE	Measured RR - Target RR / Measured RR * 100
	Stage 1 Single Pass Biofilters								
	(Hydrospinter 1)				1/17/2011 Dose @				
	Date				9:00 am				
	UNSAT-PS1				1,755	-24.3%			
	UNSAT-CL1	55 656	24	2 319	2,630	14.3% 8.7%			
	UNSAT-EC3	55,050		2,515	2,620	13.0%			
	UNSAT-EC1				2,580	11.3%			
	Mean				2,425	4.6%			
1	Stage 2 Single Pass Upflow Biofilters								
	Date				1/17/2011 8:00- 9:00 am				
	DENIT-LS4				Plugged				
	DENIT-LS2				2,580	11.3%			
	DENIT-SU3	55,656	24	2,319	2,165	-6.6%			
	DENIT-LS3				2,640	13.8%			
	DENIT-SU4				2,245	-3.2%			
	Mean				2,408	3.8%			
	(Hydrosplitter 2)								
	Date				(1/17/2011) dose @ 10:30 am				
	RC1 : UNSAT-SA2				2,000	-13.8%			
	RC2 : UNSAT-EC4	55 656	24	2 319	2,080	-10.3%			
	RC3 : UNSAT-CL2	55,650	24	2,515	2,290	-1.3%			
	RC4 : UNSAT-CL4				2,260	-2.5%			
	Mean Stage 1 Recirculating Biofilters				2,158 Flowmeter	-7.0%			
	(Recycle)				1/17/2011				
	RC1 : UNSAT-SA2				6,781	-2.5%		3.39	11.5%
2	RC2 : UNSAT-EC4	166.968	24	6.957	6,939	-0.3%	3:1	3.34	10.1%
	RC3 : UNSAT-CL2	100,500		0,557	6,781	-2.5%	5.1	2.96	-1.3%
	RC4 : UNSAT-CL4				6,624	-4.8%		2.93	-2.4%
	Mean	222.026	24	12 014	6,781	-2.5%	6.1	3.15	4.5%
	Stage 1 Recirculating Biofilters	333,930	24	15,914	14,030	0.9%	0.1	8.00	23.0%
	(Hydrosplitter + Recycle)								
	RC1 : UNSAT-SA2				8,781				
	RC2 : UNSAT-EC4	222,624	24	9,276	9,019				
	RC3 : UNSAT-CL2				9,071				
	RC4 : UNSAT-CL4				8,884				
	RC5 : UNSAT-PS1	389,592	24	16.233	6,939 15,791				
	Horizontal Denitrification Diofilters	,552							
	Date				1/17/2011 dose @				
2	DENIT-SU1			1	311	0.7%			
3	DENIT-SU2	7 400	24	200 7	311	0.7%			
	DENIT-GL1	7,409	24	508.7	298	-3.5%			
	DENIT-LS1				300	-2.8%			
	Mean				305	-1.2%			
	In-Situ Simulators				1/17/2011 manual				
	Date				dose				
4	UNSAT-IS1 (STE)	14,814	6	2,469	2,590	4.9%			
	UNSAT-IS2 (Nitrified STE)	,-	-	,	2,830	14.6%			
	UNSAT-IS3 (STE)	594	6	99	96	-3.0%			
	UNSA1-IS4 (Nitrified STE)		1		101	2.0%			

Notes: Yellow-shaded cells are measured values; grey-shaded cells are calculated values

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			Target Input	:	Measure	ed Input		Recycle Ratio						
Group (Figure 1)	Biofilter/Flow	Target Input Volume	Dose/day	Target Input Volume	Measured Input Volume	Relative Error (%)	Target Recycle Ratio (RR)	Calculated Recycle Ratio (RR)	Relative Error (%)					
((mL/day)	(Dose/day)	(mL/dose)	(mL/dose)	(Measured Input -Target Input) / Target Input * 100	Volume Recycle / Volume STE	Volume Recycle / Volume STE	Measured RR - Target RR / Measured RR * 100					
	Stage 1 Single Pass Biofilters													
	Date				(1/18/11) manual									
	LINEAT DC1				dose @ 9:55 am	14.1%								
	UNSAT-CL3				2,645	4.1%								
	UNSAT-CL1	55,656	24	2,319	2,410	3.9%								
	UNSAT-EC3				2,310	-0.4%								
	UNSAT-EC1				2,250	-3.0%								
1	Mean				2,407	3.8%								
1	Stage 2 Single Pass Upflow Biofilters													
	Date				1/17/2011 8:00- 9:00 am									
	DENIT-LS4				Plugged									
	DENIT-LS2				2,580	11.3%								
	DENIT-SU3	55,656	24	24	24	2,319	2,165	-6.6%						
	DENIT-LS3				2,640	13.8%								
	DENIT-SU4				2,245	-3.2%								
	Stage 1 Recirculating Biofilters (Hydrosplitter 2)				2,100	5.677								
	Date				(1/17/2011) dose @ 10:30 am									
	RC1 : UNSAT-SA2				2,000	-13.8%								
	RC2 : UNSAT-EC4	55,656	24	2,319	2,080	-10.3%								
	RC3 : UNSAT-CL2								2,515	2,290	-1.3%			
	RC4 : UNSAT-CL4 Mean				2,260	-2.5%								
	Stage 1 Recirculating Biofilters				Flowmeter	7.670								
	(Recycle)				1/17/2011	2.5%		2.20	44 50/					
2	RC1: UNSAT-SAZ RC2: UNSAT-EC4				6,781	-2.5%		3.39	10.1%					
-	RC3 : UNSAT-CL2	166,968	24	6,957	6,957	6,781	-2.5%	3:1	2.96	-1.3%				
	RC4 : UNSAT-CL4				6,624	-4.8%		2.93	-2.4%					
	Mean				6,781	-2.5%		3.15	4.5%					
	RC5 : UNSAT-PS1	333,936	24	13,914	14,036	0.9%	6:1	5.31	-13.1%					
	Stage 1 Recirculating Biofilters (Hydrosplitter + Recycle)													
	RC1 : UNSAT-SA2				8,781									
	RC2 : UNSAT-EC4	222.624	24	9.276	9,019									
	RC3 : UNSAT-CL2	,		-,	9,071									
	KC4 : UNSAT-CL4				8,884									
	RC5 : UNSAT-PS1	389,592	24	16,233	16,681									
	Horizontal Denitrification Biofilters													
	Date				1/17/2011 dose @ 10:40 am									
3	DENIT-SU1				311	0.7%								
-	DENIT-SU2	7,409	24	308.7	311	0.7%								
	DENIT-GL1				298	-3.5%								
	Mean		1		305	-2.8%			1					
	In-Situ Simulators													
л	Date				1/17/2011 manual dose									
4	UNSAT-IS1 (STE)	14,814	6	2,469	2,590	4.9%			-					
	UNSAT-IS2 (NITRIFIED STE)				2,830	-3.0%								
	UNSAT-IS4 (Nitrified STE)	594	6	99	101	2.0%								

Table C.2 Flow Test Results following Modifications

Notes: Yellow-shaded cells are measured values; grey-shaded cells are calculated values FLORIDA DEPARTMENT OF HEALTH PNRS II TEST FACILITY SAMPLE EVENT REPORT NO. 4

PAGE C-3 HAZEN AND SAWYER, P.C.



Appendix D: Chain of Custody Forms

FLORIDA ONSITE SEWAGE NITROGEN REDUCTION STRATEGIES STUDY PNRS II TEST FACILITY SAMPLE EVENT REPORT NO. 4

SOUTHERN ANALYTICAL LABORATORIES, INC.

SAL Project No 1100384

Client	t Name Hazan	and Sawver						Los	itact / Phone: ephin Edeback-	-lirst 813-6	30-4498			
Projec	ct Name / Location	of mon						jed	eback@hazanar	dsawyer.co	E L			
2	PURS	II SE4 Waste	Avater System	Analyses										
Samp	olers: (Signature)	M	ſ			11-	٩٩	RAMETER	CONTAINER [ESCRIPTI	NO			
	Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water					n-1-17	5 0 N (7	200		meter)				
SAL Use Onty ^{Sample} No.	Sample Description		əmiT	xinteM	Composite Grab	NO [®] NO ³	125mL P, Cd SO4 , N C			овр (Client	Hq blsif	qməT bləi7	Field Cond	Field DO
10	DENIT-SU1-36	14/11	: \$ 2 3	ΜM	×	, ,	-	-						
02	DENIT-SU1-48		2,20	ŴŴ	×	Z	-	-						
03	DENIT-SU1-60		1020	MM	×	¥	-	+						
04	DENIT-SU2-12		e 820	MM	×	*	-	-						
05	DENIT-SU2-24		0320	ŴŴ	×	×	+	-						
90	DENIT-SU2-36		1020	MM	×	\mathbf{x}	-	+						
07	DENIT-SU3-3		1110	MM	×	\mathbf{k}	-	-						
08	DENIT-SU3-7		Sall	ŴŴ	×	∕-	-	-						
60	DENIT-SU3-12		1100	MM	×	\mathbf{X}	-	-						
10	DENIT-SU3-18		1055	MM	×	\checkmark	-	-						
11	DENIT-SU4-3	-	1233	MM	×	ŕ	-	-						
12	DENIT-SU4-7	$\sum_{i=1}^{n}$	221	MM	×	ŕ	.	-	_((
Reline	ustreet Date Time. 1 UST 1 Mai 10 MB 1000	Received		\bigwedge	Date/Time:	1600	Seal intact? Samples int	act upon arriv			Instructio	ns / Remark	s +	
	university Date Time: 1400	Received:			Date/Time:		Received or	mice? Temp			00 00	21010.	آرز ا	
Relinqu	ushed: Date/Time:	Received:			Date/Time:		Proper pres Rec'd withir	ervatives indic holding time?	ated?		λ 	any when	54.3	
Relinqu	ushed: Date/Time:	Received:			Date/Time:		Volatiles red	c'd w/out head	space Y NWD	\sim	\$	front	502	
Relinqu	uished: Date/Time	Received:			Date/Time:		5		AN NP			>.		

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SAL Project No. 1100384

110 BAYVIEW BOULEVARD, OLDSMAR, FL. (34677 - 813-855-1844 fax 813-855)-22218

Client Name								Contac Joseph	t / Phone: in Edeback-Hi	irst 813-630	-4498			
	Нагап	and Sawyer						ledebad	ck@hazanand	sawyer.com				
Project Name / Location	PNRS	II SE4 Wastev	vater System	Analyses										
Samplers: (Signature)	lom /						PAR	AMETER / CC	NTAINER DE	SCRIPTION	_		-	1
Matrix Codes: / DW-Drinking Water WWV-W SW-SurfaceWater SL-Sludg GW-Groundwater SA-Saline Wi R-Reagent Water SAL	astewater je SO-Soil ater O-Other				9 	1 COOI	*0s²H 8 0γ (* 0)			ient meter)	ŀ	dwa	puo	C
Use Only Sample No	ption		əmiT	xinteM	Composit Grab 120mL P.	N O, NO	122ml P,	COD		овь (си	Iq bleif	əT bləif	Field C	Field D(
25 DENIT-LS3-18)	1/14/11	0/11	MM	×	×								
26 DENIT-LS4-3		•	Č Ś cu	MM	×	×								
27 DENIT-LS4-7			つならく	MM	×	~		-						
28 DENIT-LS4-12			5850	MM	×	*		-		_				
29 DENIT-LS4-18			545	MM	×	\	_					_		
30 DENIT-GL1-12			0830	MM	×	<u>ب</u>								
31 DENIT-GL1-24			5920	MM	×	~		-						
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		~												
				\bigcirc										
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Chain of Custody Mis Rev Date 11/19/01						_				C	lain of Custod	dy b		

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SOUTHERN ANALYTICAL LABORATORIES, INC.

10033	
SAL Project No.	

lient Name								Jos Jos	ntact / Phone: ephin Edeback-F	Hirst 813-6	330-4498			
	Hazan	and Sawyer				ŝ		, pai	ahark@hazanan	dsawver c	mo			
roject Name / Location	PARS	II SE4 Waste	ewater System	Analyses			ļ							
amplers: (Signature)	(m)					١	/d	RAMETER	/ CONTAINER D	ESCRIPT	NOI			
Matrix Codes: DW-Drinking Water WW SW-SurfaceWater SL-Slu GW-Groundwater SA-Saline R-Reagent Wat	Wastewater dge SO-Soil Vater O-Other er					hi-in	دی مراجع موا	*00		t meter)		d	p	
SAL Use Only Sample Desc	ription	 Date	əmi⊺	XittixM	Grab Grab	иО ^{5,} ИО ³	125mL P, Cd	COD		n9ilO) ЯЯО	Hq blai7	ıməT blai7	onoO blai7	Field DO
13 DENIT-SU4-12		Vigla	1220	ww	×	\checkmark		-						
14 DENIT-SU4-18		,	1215	ww	×	7		-						
15 DENIT-LS1-36			0324	MM	×	¥	_	-	-					
16 DENIT-LS1-48			0920	MM	×	X	-	-					_	
17 DENIT-LS1-60			1020	MM	×	×	-	-						
18 DENIT-LS2-3			1005	MM	×	\mathcal{F}		-						
19 DENIT-LS2-7			1000	MM	×	٢		-						
20 DENIT-LS2-12			د955	MM	×	\checkmark	_	-						
21 DENIT-LS2-18			6973	MM	×	¥	-	-					-	
22 DENIT-LS3-3			1155	MM	×	×	_	-						
23 DENIT-LS3-7			1130	MM	×	ł		-						
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celinguishes Prepared	Date/Time: 173-11 1100	Received			Date/Time	160	Seal intact Samples in	atact upon arriv		<i></i>	Instructi	ons / Remai	ks	
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SOUTHERN ANALYTICAL LABORATORIES, INC.

SAL Project No. 1100335

Cliem	t Name Ha	zan and Sawyer				-		<u>ठ</u> २	ontact / PI sephin Er	hone: deback-Hi	st 813-63	0-4498		
Proje	ct Name / Location	IRS II Wastewate	ir System And	alvses				jec	leback@	hazanands	sawyer.con			
Samp	olers: (Signature)		- -				PARA	METER / CO	NTAINEF	2 DESCRI	PTION			
	Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water					405 '00	ארא י אייליי ארא י אייליי דסל	ate/NaOH fide, Sulfide se		meter)				
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6	UNSAT-IS3	1/4/4	R : R	MM	×	1	1	ł		136.5	46.9	11.6	135(6.63
02	UNSAT-IS4	1)11/11	\$:30	MM	×	ł	· –	£		150.4	80.F	11.6	113	0.95
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Chain of Custody



8 East Tower Circle Ormond Beach, FL 32174 (386)672-5668

SAMPLE ACKNOWLEDGMENT

Samples Submitted By: Client Project ID:	Hazen and Sawyer, P.C FDOH	Pace Project Manager:	Sakina Mckenzie Phone (386)672-5668 sakina.mckenzie@pacelabs.com
Client PO#:		Pace Analytical Project ID:	3524641
		Samples Received:	January 11, 2011 11:11 AM
		Estimated Completion:	January 25, 2011

CC: Ms. Josefin Edebeck-Hirst

Customer Sample ID	Pace Analytical Lab ID	Matrix	Date/Time Collected	Method
UNSAT-IS3	3524641001	Water	01/11/11 08:20	2320B Alkalinity
				2540C Total Dissolved Solids
				2540D Total Suspended Solids
				300.0 IC Anions
				300.0 IC Anions 28 Days
				350.1 Ammonia
				351.2 Total Kjeldahl Nitrogen
				365.4 Phosphorus, Total
				410.4 COD
				9222D Fecal Coliform Tampa
UNSAT-IS4	3524641002	Water	01/11/11 08:30	2320B Alkalinity
				2540C Total Dissolved Solids
				2540D Total Suspended Solids
				300.0 IC Anions
				300.0 IC Anions 28 Days
				350.1 Ammonia
				351.2 Total Kjeldahl Nitrogen
				365.4 Phosphorus, Total
				410.4 COD
				9222D Fecal Coliform Tampa



8 East Tower Circle Ormond Beach, FL 32174 (386)672-5668

SAMPLE ACKNOWLEDGMENT

Samples Submitted By: Client Project ID:	Hazen and Sawyer, P.C FDOH	Pace Project Manager:	Sakina Mckenzie Phone (386)672-5668 sakina mckenzie@nacelabs.com
Client PO#:		Pace Analytical Project ID:	3524876
		Samples Received:	January 14, 2011 07:00 AM
		Estimated Completion:	January 28, 2011

CC: Ms. Josefin Edebeck-Hirst

Customer Sample ID	Pace Analytical Lab ID	Matrix	Date/Time Collected	Method
DENIT-LS1	3524876001	Water	01/13/11 08:00	2320B Alkalinity
				2540C Total Dissolved Solids
				2540D Total Suspended Solids
				300.0 IC Anions
				300.0 IC Anions 28 Days
				350.1 Ammonia
				351.2 Total Kjeldahl Nitrogen
				365.4 Phosphorus, Total
				410.4 COD
				5210B cBOD, 5 day
				9222D Fecal Coliform Tampa
UNSAT-EC3	3524876002	Water	01/13/11 12:05	2320B Alkalinity
				2540C Total Dissolved Solids
				2540D Total Suspended Solids
				300.0 IC Anions
				300.0 IC Anions 28 Days
				350.1 Ammonia
				351.2 Total Kjeldahl Nitrogen
				365.4 Phosphorus, Total
				410.4 COD
				5210B cBOD, 5 day
				9222D Fecal Coliform Tampa
PNRSII STE-T1	3524876003	Water	01/13/11 13:30	2320B Alkalinity
				2540C Total Dissolved Solids
				2540D Total Suspended Solids
				300.0 IC Anions
				300.0 IC Anions 28 Days
				350.1 Ammonia
				351.2 Total Kjeldahl Nitrogen
				365.4 Phosphorus, Total
				410.4 COD
				5210B cBOD, 5 day
				9222D Fecal Coliform Tampa

Please contact your project manager if you recognize any discrepancy in this form or have any questions about your project.

Thank you for choosing Pace Analytical Services, Inc.