



Florida Onsite Sewage Nitrogen Reduction Strategies Study

Task A.25

PNRS II Test Facility Sample Event Report No. 1

Progress Report

June 2010

44237-001

HAZEN AND SAWYER
Environmental Engineers & Scientists

In association with



AET
Applied Environmental Technology

**OTIS
ENVIRONMENTAL
CONSULTANTS, LLC**

Florida Onsite Sewage Nitrogen Reduction Strategies Study

TASK A.25 PROGRESS REPORT

PNRS II Test Facility Sample Event Report No. 1

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:

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In Association With:

AET
Applied Environmental Technology



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Task A of the Florida Onsite Nitrogen Reduction Strategies Study continues the study of passive nitrogen removal (PNRS II) from septic tank effluent. PNRS II is a follow-up to the previous experimental evaluations of passive nitrogen removal technologies conducted under Contract CORY (Passive Nitrogen Removal Study I). The purpose of the PNRS II study is to extend and expand into field pilot testing the previous experimental studies of the two-stage biofiltration process that were initiated in PNRS I. The Task A.15 PNRS II QAPP documents the objectives, monitoring framework, sample frequency and duration, and analytical methods to be used at the PNRS II Test Facility. This report documents the first sampling event conducted June 30 - July 1, 2010. The sampling event consisted of monitoring of flowrates, monitoring of field parameters, and collection of influent and biofilter effluent samples for laboratory analyses. The samples were collected, labeled and preserved, then placed in a cooler and transported on ice to Southern Analytical laboratories. Each sample container was secured in packing material as appropriate to prevent damage and spills.

Nomenclature for Reactor/Sample Identification

Table 1 outlines the nomenclature for reactor/sample identification used for the PNRS II test facility. Figure 1 details the biofilter arrangement for the PNRS II test facility.

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Table 1
PNRS II Sample Identification

Sample Location	Sample Identification
STE PNRS II Storage Tank 1	PNRS II - STE-T1
Stage 1 Single Pass Biofilters	UNSAT-EC1
	UNSAT-EC3
	UNSAT-CL1
	UNSAT-CL3
	UNSAT-PS1
Stage 2 Single Pass Upflow Biofilters	DENIT-SU4
	DENIT-LS3
	DENIT-SU3
	DENIT-LS2
	DENIT-LS4
Recirculation Tanks	RC1
	RC2
	RC3
	RC4
Stage 1 Recirculating Biofilters	UNSAT-SA2
	UNSAT-EC4
	UNSAT-CL2
	UNSAT-CL4
Denite Feed Collection Tank	DFT
Stage 2 Horizontal Biofilters	UNSAT-SU1
	UNSAT-SU2
	UNSAT-LS1
	UNSAT-GL1
In-situ In-Tank Simulator Single Pass Biofilter	UNSAT-IS1
	UNSAT-IS2

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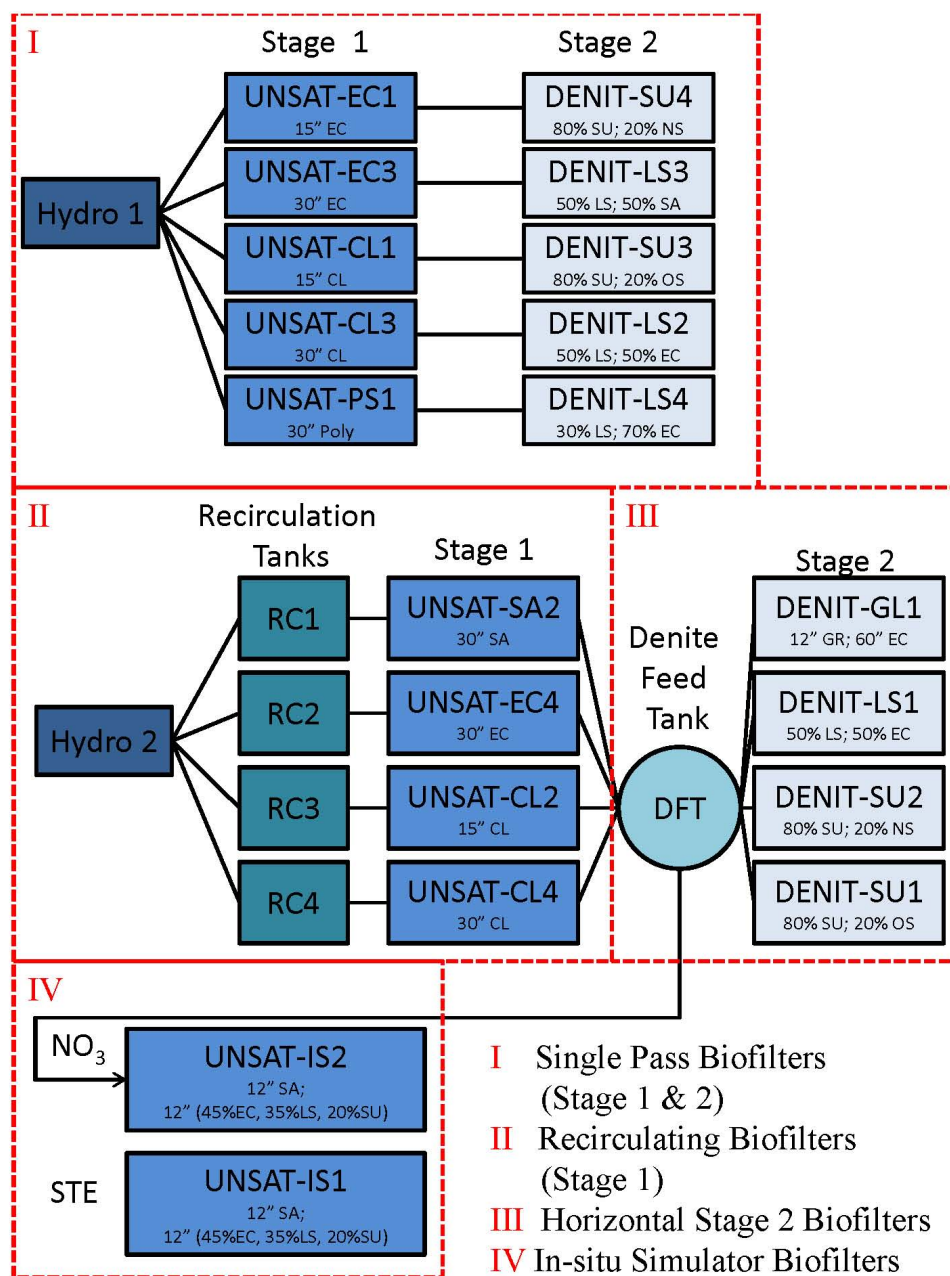


Figure 1
PNRS II Test Facility Site Schematic

Operation of Test Systems

Construction of the PNRS II test systems was started February 15, 2010 and completed April 30, 2010. Upon construction completion, storage tank 1 was filled with tap water and all pumps, valves, meters and other equipment were tested. Flow rates were checked and calibration of flows was conducted. Start up of the test facility occurred on May 17, 2010. The test systems have been operated continuously since the May 17th start up, with the exception of two power outages that occurred June 20th and June 28th. The power outages were of relatively short duration and operation of much of the pilot biofilters resumed when power was restored. The only exception was the two peristaltic pumps: Pump 5 which supplies the two in situ simulators and Pump 11 which supplies the four horizontal flow denitrification biofilters. The peristaltic pumps displayed an error message, required manual restarting, and their off time was somewhat longer than the other system pumps. The peristaltic pump settings were saved through the power outage, and the pumps resumed operation once the error code was acknowledged. Appendix A provides the PLC recorded data tables for daily runtimes and flows for the test facility.

Flow Rate Monitoring

The test system dose rates were calibrated at start up. A flow test was performed July 8, 2010 (Day 42) to verify the single dose event volumes and to derive the average hydraulic loading rates. Appendix B provides the single dose event volumes measured on July 8. The dose volumes measured on July 8 were reasonably close to target levels for all systems with the exception of the in situ simulators IS1 and IS2. The peristaltic pump was recalibrated to correct dosing volume.

Field Parameter Results

As provided in Appendix C, the bioreactor influent and effluents were analyzed for field parameters at the time of sample collection [pH, specific conductance, temperature (Temp), and dissolved oxygen (DO)].

Chain of Custody

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. For all samples, analytes include: total alkalinity, total Kjeldahl nitrogen (TKN-N), ammonia nitrogen ($\text{NH}_3\text{-N}$), nitrate/nitrite nitrogen ($\text{NO}_x\text{-N}$), carbonaceous biochemical oxygen demand (CBOD_5), total dissolved solids (TDS), and total suspended solids (TSS). For the biofilters with elemental sulfur media, the influent and effluent samples also include laboratory analysis of sulfate (SO_4) and hydrogen sulfide (H_2S).

Appendix A: PLC Data Tables

Table A.1
PLC Recorded Daily Flows

Days Since Start-Up	Date	Pump 4 to Hydro 1	Pump 14 to Hydro 2	Pump 6 Recirculating System 1	Pump 7 Recirculating System 2	Pump 8 Recirculating System 3	Pump 9 Recirculating System 4
	(month/day)	(Gallons)	(Gallons)	(Gallons)	(Gallons)	(Gallons)	(Gallons)
0	05 17	43	37	24	25	24	25
1	05 18	76	67	44	47	44	44
2	05 19	75	64	44	46	44	44
3	05 20	68	61	42	44	42	43
4	05 21	77	68	45	46	45	44
5	05 22	77	67	45	47	44	45
6	05 23	76	68	44	47	44	44
7	05 24	75	65	45	48	44	45
8	05 25	64	56	39	41	38	39
9	05 26	51	43	28	30	28	28
10	05 27	77	67	45	47	44	44
11	05 28	77	68	45	47	44	45
12	05 29	77	69	44	47	44	45
13	05 30	76	66	45	47	44	44
14	05 31	74	65	45	48	44	45
15	06 01	69	61	41	43	41	41
16	06 02	77	67	45	48	45	45
17	06 03	75	67	45	47	44	44
18	06 04	77	65	44	47	42	44
19	06 05	76	67	45	47	45	45
20	06 06	77	68	45	47	44	44
21	06 07	77	68	44	47	45	45
22	06 08	76	68	45	48	44	45
23	06 09	77	68	45	47	45	44

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Days Since Start-Up	Date	Pump 4 to Hydro 1	Pump 14 to Hydro 2	Pump 6 Recirculating System 1	Pump 7 Recirculating System 2	Pump 8 Recirculating System 3	Pump 9 Recirculating System 4
	(month/day)	(Gallons)	(Gallons)	(Gallons)	(Gallons)	(Gallons)	(Gallons)
24	06 10	76	67	45	47	45	45
25	06 11	77	68	45	48	45	45
26	06 12	76	68	44	47	44	44
27	06 13	76	68	45	47	45	45
28	06 14	76	72	45	48	45	45
29	06 15	76	73	45	47	45	44
30	06 16	77	71	45	48	45	45
31	06 17	75	71	44	47	34	45
32	06 18	76	71	45	47	0	44
33	06 19	76	72	44	48	0	45
34	06 20	75	71	45	47	0	44
35	06 21	73	69	42	45	12	43
36	06 22	75	71	45	47	45	45
37	06 23	76	72	44	48	45	44
38	06 24	75	72	45	48	44	45
39	06 25	75	72	45	47	45	45
40	06 26	76	71	44	48	45	44
41	06 27	75	72	45	47	44	45
42	06 28	75	71	44	48	44	43
43	06 29	75	71	44	47	44	45
44	06 30	74	71	44	48	44	44
45	07 01	71	68	44	47	44	45

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Table A.2
PLC Recorded Daily Runtimes

Days Since Start-Up	Date	STE Pump 1 to Tank 1	Pump 4 to Hydro 1	Pump 14 to Hydro 2	Pump 6 Recirculating System 1	Pump 7 Recirculating System 2	Pump 8 Recirculating System 3	Pump 9 Recirculating System 4
	(month /day)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)
0	05 17	0	7	6	4	4	4	4
1	05 18	0	13	11	6	7	6	6
2	05 19	0	13	10	7	6	6	6
3	05 20	16	11	11	6	7	6	6
4	05 21	0	13	11	6	7	7	7
5	05 22	8	13	10	7	6	6	6
6	05 23	0	13	11	6	7	7	7
7	05 24	0	12	11	6	7	6	6
8	05 25	0	12	9	6	6	6	6
9	05 26	17	8	7	4	4	4	4
10	05 27	0	13	11	6	7	6	6
11	05 28	18	13	11	7	7	6	6
12	05 29	0	12	10	6	6	7	7
13	05 30	719	13	11	6	7	6	6
14	05 31	1440	13	11	7	7	6	6
15	06 01	543	12	10	6	6	6	6
16	06 02	2	12	11	6	7	7	7
17	06 03	0	13	10	6	7	6	6
18	06 04	13	13	11	7	7	6	6
19	06 05	6	13	11	6	6	7	7
20	06 06	5	12	11	6	7	6	6
21	06 07	5	13	10	7	7	7	7
22	06 08	0	13	11	6	7	6	6
23	06 09	6	13	11	7	7	6	6
24	06 10	5	13	11	6	6	7	7
25	06 11	7	12	11	6	7	6	6
26	06 12	6	13	10	7	7	7	7
27	06 13	6	13	11	6	7	6	6

Days Since Start-Up	Date	STE Pump 1 to Tank 1	Pump 4 to Hydro 1	Pump 14 to Hydro 2	Pump 6 Recirculating System 1	Pump 7 Recirculating System 2	Pump 8 Recirculating System 3	Pump 9 Recirculating System 4
	(month /day)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)	(minutes)
28	06 14	7	13	11	7	6	6	6
29	06 15	7	13	11	6	7	7	7
30	06 16	659	12	11	6	7	6	6
31	06 17	973	13	11	7	7	5	6
32	06 18	6	13	10	6	7	0	7
33	06 19	6	13	11	6	6	0	6
34	06 20	5	12	11	7	7	0	7
35	06 21	5	13	11	6	7	2	6
36	06 22	5	13	10	7	7	6	6
37	06 23	6	13	11	6	7	7	7
38	06 24	5	13	11	6	6	6	6
39	06 25	0	12	11	7	7	7	7
40	06 26	5	13	11	6	7	6	6
41	06 27	6	13	10	7	7	6	6
42	06 28	5	13	11	6	6	7	7
43	06 29	6	13	11	6	7	6	6
44	06 30	6	12	11	7	7	6	6
45	07 01	6	13	10	6	7	7	7

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Appendix B: Flow Test Results

Table B.1
Flow Test Results Performed July 8, 2010

	Target volume	Measured volume	
	ml	ml	gallons
Dose of STE to Stage 1 Single Pass Biofilters (Hydrosplitter 1)			
UNSAT-PS1	2,319	2,235	0.59
UNSAT-CL3		2,440	0.64
UNSAT-CL1		2,400	0.63
UNSAT-EC3		2,350	0.62
UNSAT-EC1		2,310	0.61
Average		2,347	
Dose of STE to Stage 1 Recirculating Biofilters (Hydrosplitter 2)			
RC1	2,319	2,542	0.67
RC2		2,434	0.64
RC3		2,580	0.68
RC4		2,595	0.69
Average		2,538	
Dose of Combined Stage 1 Effluent to Horizontal Denitrification Biofilters			
Biofilter Designation			
DENIT-SU1	308.7	298	0.08
DENIT-SU2		298	0.08
DENIT-GL1		282	0.07
DENIT-LS1		290	0.08
Average		292	
Dose to In-Situ Simulators			
UNSAT-IS1 (STE)	2,500	1,940	0.51
UNSAT-IS2 (Nitrified STE)		2,380	0.63
Average		2,160	

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Appendix C: Field Parameter Analyses

Table C.1
Field Parameter Analyses Results

Sample Identification	pH ¹	Temperature ¹ (°C)	Specific Conductance ¹ (µS)	Dissolved Oxygen ² (mg/L)	Temperature ² (°C)
STE Sample					
STE-Tank 1	6.91	31.3	649	<0.1	26.0
Stage 1 Single Pass Biofilter Effluent					
UNSAT-EC1	7.25	29.5	617	7.08	27.2
UNSAT-EC3	7.34	28.8	712	6.94	27.6
UNSAT-CL1	8.30	30.0	857	3.53	27.2
UNSAT-CL3	8.64	28.7	974	6.85	26.6
UNSAT-PS1	7.28	28.8	599	2.70	27.0
Stage 2 Single Pass Upflow Biofilter Effluent					
DENIT-SU4	7.30	27.1	929	<0.1	27.1
DENIT-LS3	7.70	27.4	695	<0.1	28.1
DENIT-SU3	7.17	27.0	1,257	<0.1	27.6
DENIT-LS2	8.14	27.1	998	<0.1	27.2
DENIT-LS4	7.62	27.3	618	0.46	28.1
Recirculation Tank Effluent					
RC1	7.28	30.8	637		
RC2	7.27	30.5	679		
RC3	7.61	29.2	760		
RC4	7.61	28.8	811		
Stage 1 Recirculating Biofilter Effluent					
UNSAT-CL4	6.72	27.9	860	7.28	27.6
UNSAT-CL2	7.85	28.1	781	6.69	27.1
UNSAT-EC4	7.28	28.2	661	7.21	27.4
UNSAT-SA2	6.04	27.7	604	6.96	26.7
Denite Feed Tank (Tank 3)					
DFT	8.06	29.9	744	7.31	26.9
Stage 2 Horizontal Biofilters Effluent					
DENIT-SU1	7.15	31.8	1,192	0.53	27.5
DENIT-SU2	9.08	31.4	1,398	1.23	27.9

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Sample Identification	pH ¹	Temperature ¹ (°C)	Specific Conductance ¹ (µS)	Dissolved Oxygen ² (mg/L)	Temperature ² (°C)
Stage 2 Horizontal Biofilter Effluent (con't)					
DENIT-LS1	7.51	31.3	738	0.45	27.3
DENIT-GL1	7.96	30.1	794	1.54	27.8
In-situ Simulator Biofilter Effluent					
UNSAT-IS1 (STE)	6.39	30.1	2,438	<0.1	26.7
UNSAT-IS2 (Nitrified STE)	6.14	30.8	3,506	0.41	26.6

¹ Field Parameter was measured and recorded July 1, 2010

² Field Parameter was measured and recorded July 8, 2010



Appendix D: Chain of Custody Forms

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SAL Project No.

jedeback@hazanandsavver.com

Hazan and Sawyer

PNRS || Wastewater System Analyses

PARAMETER / CONTAINER DESCRIPTION

80D, TSS,	80D, TSS,	SO ₄ , NO _x	Sulfate/NaOH	SO ₄ , NO _x	Alkylamines (Total

Alkalinity, (TDS	1LP, Cool Alkalinity, (TDS, SO4	1LP, Zn Ac Hydrogen	250 ml P, TKN, NH ₃ ,	Field pH	Field Temp	Field Conductivity	No. of Contaminants per each location
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[illegible]

2	3	3	3	3	3	3
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7	11	700	750	✓
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2	110	0	11	
2	110	0	11	

[illegible]

3	308	614		
3	301	614		

7.25	295	617	3
7.25	295	617	3

6.04	EC	604	2
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7.34	28.8	712	2
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1	7.29	38.2	665	2
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1	1	1	857	36,0	3
1	1	1	857	36,0	3

Seal intact? ☒ NA

Instructions / Remarks

9

— 4 —

6000

2

Donor containers used?

3

[illegible]

Chain of Custody

SAL Project No. 102787

1108AYVIEW BOULEVARD, OLDSMAR, F. 34677 813-855-1844 fax 813-855-2218

Contact / Phone:

Josephin Edeback-Hirst 813-630-4498

jiedeback@hazanandsawyer.com

PNRS II Wastewater System Analyses

Samplers: (Signature)		PARAMETER / CONTAINER DESCRIPTION				No. of Containers (Total per each location)	
Matrix Codes: DW-Drinking Water WW-Wastewater SW-Surface Water SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water		Sample Description	Date	Time	Matrix	Composite	Grab
SAL Use Only							
Sample No.							
13	GC-CL2		7/1/10	11:20am	WW	X	
14	GC-CL3		7/1/10	1:20pm	WW	X	
15	GC-CL4		7/1/10	11:15am	WW	X	
16	GC-PS1		7/1/10	1:15pm	WW	X	
17	GC-SU1		7/1/10	2:30pm	WW	X	
18	GC-SU2		7/1/10	2:25pm	WW	X	
19	GC-SU3		7/1/10	10:10am	WW	X	
20	GC-SU4		7/1/10	10:40am	WW	X	
21	GC-LS1		7/1/10	1:05pm	WW	X	
22	GC-LS2		7/1/10	10:00am	WW	X	
23	GC-LS3	7.30pH, 6.95ms, 27.4°C	7/1/10	10:30am	WW	X	
24	GC-LS4	7.62pH, 6.18ms, 27.3°C	7/1/10	9:45am	WW	X	
Containers Prepared/Relinquished:		Date/Time: 1300	Received: George Hume	Date/Time: 6/30 8:45am	Seal intact?		
Relinquished:		Date/Time: 06:29-10	Received: George Hume	Date/Time: 7/1/10	Samples intact upon arrival?		
Relinquished:		Date/Time: 7/1/10 2:45pm	Received: George Hume	Date/Time: 7/1/10 2:45	Received on ice? Temp		
Relinquished:		Date/Time: 7-1-10 1600	Received: K. Muddmunk	Date/Time: 7-1-10 1600	Proper preservatives indicated?		
Relinquished:		Date/Time: 7-1-10	Received: K. Muddmunk	Date/Time: 7-1-10	Rec'd within holding time?		
Relinquished:		Date/Time:	Received:	Date/Time:	Volatiles rec'd w/out headspace?		
Relinquished:		Date/Time:	Received:	Date/Time:	Proper containers used?		

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Rev.Date 11/19/01

Chain of Custody

SOUTHERN ANALYTICAL LABORATORIES, INC.

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

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