Florida Department of Health
Onsite Nitrogen Reduction Strategies Study

Contract CORCL

TASK C.20
INSTRUMENTATION OF GCREC MOUND MONITORING SYSTEM & PLUME IDENTIFICATION

PROGRESS REPORT #1

June 30, 2010

Task C of the Florida Onsite Nitrogen Reduction Strategies Study includes monitoring at field sites in Florida to evaluate nitrogen reduction in soil and groundwater, to assess groundwater impacts due to conventional and nitrogen removal systems, and to provide data for parameter estimation, verification, and validation of models developed in Task D. The existing mound system at the Gulf Coast Research and Education Center (GCREC) is being monitored to serve as a bridge between the controlled GCREC pilot-scale testing conducted within the same type of soils and the uncontrolled monitoring at home sites in different soils throughout the state. The Task C QAPP documents the objectives, monitoring framework, sample frequency and duration, and analytical methods to be used at the GCREC existing mound system site. This report documents the GCREC mound plume identification and instrumentation of the monitoring framework.

Figure 1 depicts the sampling grid for groundwater screening developed downgradient of the soil treatment unit. A 25 ft by 25 ft grid was staked then locations surveyed (x, y, and z). Transect lines C through M are parallel to the southern edge of the mound and increase (higher letter identification) moving southward from the mound. Transect lines 1 through 12 (from east to west) are perpendicular to the southern edge of the mound. Groundwater monitoring points were installed on the grid by both hand and direct push methods. Two types of monitoring points were installed: drive point samplers and standpipe piezometers. Drive point samplers consist of a stainless steel drive tip and attached 1" long screen with a protective "umbrella" (to prevent soil entering and clogging the screen), and flexible tubing that extends to the ground surface (Figure 2). Standpipe piezometers consist of either 1 ¼" or ¾" diameter, 5' long PVC screen with PVC extending to the ground surface (refer to the Task C QAPP for additional detail).

Initially handheld (electric powered hammer drill or auger) methods were used to place fourteen drive point samplers and three standpipe piezometers within the monitoring area (Figures 3 and 4). The auger was advanced to the maximum depth feasible retrieving a soil sample during augering. The drive point sampler or standpipe piezometer was then installed into the open hole. After installation, native sand was backfilled into the borehole (Figure 5 and 6) and a water sample was collected to track preliminary plume identification. However, the hard spodic horizon located at approximately 6' below ground surface made it difficult to use handheld methods and a small direct push rig (Geoprobe™ –

Figure 7) was therefore brought to the site for subsequent monitoring point installation, and to more efficiently install additional drive point samplers and standpipe piezometers. However, the small direct push rig had difficulty going through the thick and hard spodic layer as well except when using the smaller diameter water sampler.

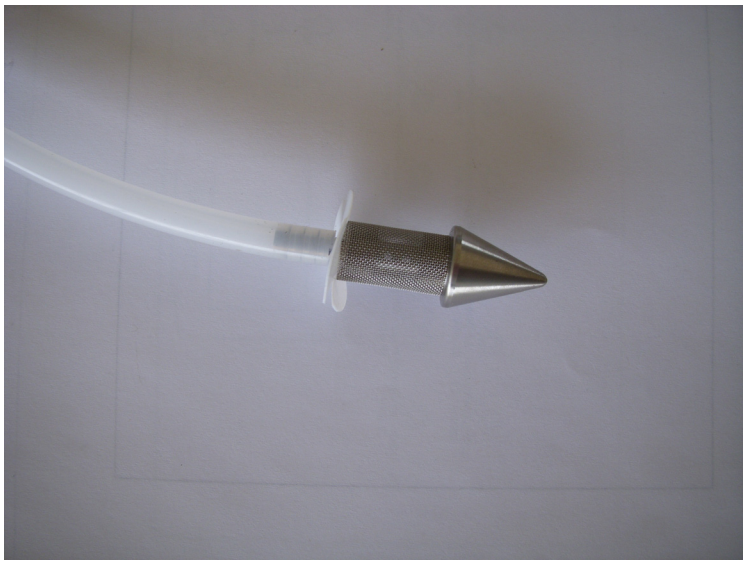

Figure 2
Stainless Steel Drive Point with Mesh Screen, Umbrella and Tubing

Drive point samplers were installed with the small rig by advancing a disposable drive tip attached to a hollow core barrel to the desired depth. The drive point sampler was then inserted into the hollow core barrel (Figure 8), approximately 1 linear foot of filter sand was added around the stainless steel drive point and screen, and the core barrels retrieved to the surface. Prior to installation of standpipe piezometers, continuous soil cores were collected (Figure 9 and 10). Soil samples were collected from the soil borings during standpipe installation to determine general soil properties (lithology, soil features, organic matter content, grain size, etc). In addition, at two locations, in situ groundwater samples were collected using the Geoprobe™ water sampler below the spodic horizon (Figure 11 and 12). At the first location (M12) four depths were tested: 9-10 ft, 12-13 ft, 15-16 ft and 29-30 ft. At the second location (I5) one depth was tested 26-28 ft. The Geoprobe™ water sampler is a less credible measurement due to the fact that the sampler is driven to a specific depth then the protective casing is raised exposing a screen over a target interval. In this case, a one foot section was sampled (i.e., protective casing raised one foot) compared to the approximately 2 inch drive point sampler interval. The data provides screening level information only. Standpipe piezometers (¾" diameter PVC with 5' long screen) were then installed similar to the drive point samplers (Figure 13 and 14). Four standpipe piezometers were installed: one upgradient of the plume and three within the plume downgradient of the soil treatment unit. The drive point samplers and standpipe piezometers were developed by purging until the water was clear (i.e., no turbidity) and the specific conductance stabilized.

The specific conductance, pH, and temperature of the groundwater at the standpipe piezometers and drive point locations were measured and recorded (Figure 15 and 16). For some of the locations,

nitrogen measurements were taken using nitrate, nitrite and ammonia HACH test strips. Based on the groundwater specific conductivity, the general plume location and extent was determined. A total of sixty-two drive point samplers and seven standpipe piezometers were installed within the grid using both hand-held and GeoProbe™ methods.

Figure 3
Hand-held Augering

Figure 4
Soil Sample from Hand-held Auger

Figure 5

Bundled Drive Point Tubing

Figure 6
Standpipe Piezometer Installed

Figure 7
GeoProbe™ Rig

Figure 8
Drive Point Sampler Installed - Adding Sand Pack

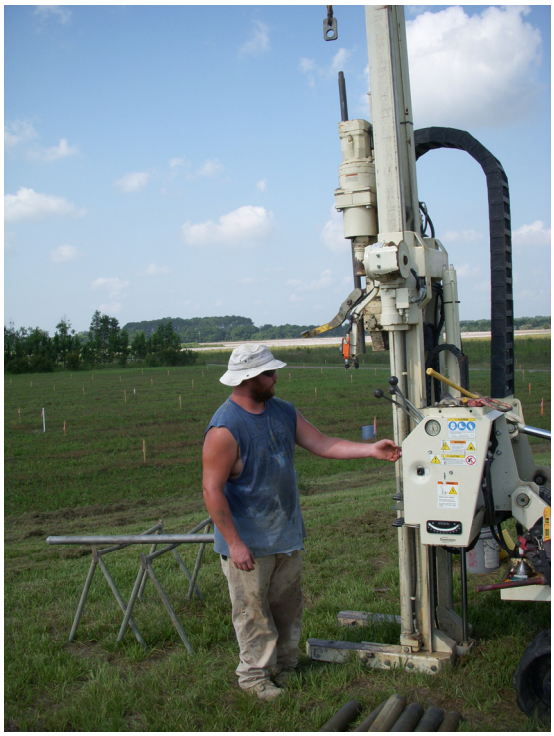

Figure 9
Collecting Soil Cores

Figure 10
Examining Continuous Core Sample

Figure 11
In Situ Water Sampling with Tubing extending to the Surface

Figure 12
In Situ Water Sampling – Conductivity, pH, Temperature Measurement

Figure 13
Installing Standpipe Piezometer

Figure 14
Installing Standpipe Piezometer (Sand Pack)

Figure 15
Probing for Conductivity

Figure 16
Measuring Conductivity, pH, Temperature

Results from the monitoring point installation and groundwater testing are presented in Tables 1 and 2. Table 1 summarizes the monitoring equipment currently installed for the GCREC mound and the locations where the Geoprobe™ water sampler was utilized. The bottom elevation above MSL and depth below ground surface (BGS) that the drive point samplers and standpipe piezometers are installed is provided. Table 2 outlines the initial specific conductance, pH, nitrate and temperature groundwater measurements recorded for the Geoprobe™ water sampler, standpipe piezometers and drive point locations. Ammonium was non-detect throughout the plume. Analysis of this data is underway to determine what additional sample points are needed to complete the monitoring grid.

Table 1
Monitoring Equipment Installed

	Grid Location	Identification	Notes	Bottom Elevation above MSL (ft)	Depth BGS (ft)	GW Elevation 7/12/10 (ft)
1	A7	PZ10	3/4" Standpipe Piezometer	116.03		122.06
2	C11	DPC11	SST Drive Point	116.18	7.67	
3	D5.5	PZ7	1 1/4" Standpipe Piezometer	118.89		121.77
4	D7	DPD7-Shallow	SST Drive Point	120.82	4.91	
5	D7	DPD7-Middle	SST Drive Point	118.86	6.87	
6	D7	DPD7-Deep	SST Drive Point	116.79	8.94	
7	D8	DPD8	SST Drive Point	116.31	8.86	
8	D9	DPD9-Shallow	SST Drive Point	118.35	5.90	
9	D9	DPD9-Deep	SST Drive Point	116.45	7.80	
10	D10	DPD10	SST Drive Point	116.31	7.78	
11	D11	DPD11	SST Drive Point	113.29	10.65	
12	D12	DPD12	SST Drive Point	112.46	11.10	
13	E2	DPE2-Shallow	SST Drive Point	119.55	5.65	
14	E2	DPE2-Deep	SST Drive Point	117.55	7.65	
15	E3	DPE3	SST Drive Point	115.26	9.83	
16	E4	DPE4-Shallow	SST Drive Point	119.71	6.20	
17	E4	DPE4-Deep	SST Drive Point	117.71	8.20	
18	E5	DPE5	SST Drive Point	118.58	5.80	
19	E6	DPE6-Shallow	SST Drive Point	118.86	5.95	
20	E6	DPE6-Deep	SST Drive Point	116.86	7.95	
21	E7	DPE7	SST Drive Point	114.77	9.80	
22	E8	DPE8-Shallow	SST Drive Point	118.41	6.00	
23	E8	DPE8-Deep	SST Drive Point	116.41	8.00	
24	E9	PZ11	¾” Standpipe Piezometer	114.56		121.01
25	E10	DPE10	SST Drive Point	118.21	5.80	
26	E11	DPE11	SST Drive Point	111.98	11.85	
27	E12	DPE12	SST Drive Point	113.22	10.25	

Table 1
Monitoring Equipment Installed

	Grid Location	Identification	Notes	Bottom Elevation above MSL (ft)	Depth BGS (ft)	GW Elevation 7/12/10 (ft)
28	F3	DPF3	SST Drive Point	116.44	8.35	
29	F4	PZ13	¾" Standpipe Piezometer	116.31		121.63
30	F5	DPF5	SST Drive Point	119.94	4.80	
31	F6	DPF6	SST Drive Point	115.03	9.50	
32	F7	DPF7	SST Drive Point	118.25	6.25	
33	FG7	PZ8	1 ¼" Standpipe Piezometer	118.25		120.94
34	F8	DPF8	SST Drive Point	115.83	8.40	
35	F9	DPF9	SST Drive Point	118.98	5.45	
36	F10	DPF10	SST Drive Point	112.93	10.85	
37	F11	DPF11	SST Drive Point	112.68	10.95	
38	F12	DPF12	SST Drive Point	112.82	10.45	
39	G5	DPG5	SST Drive Point	118.51	5.96	
40	G6	DPG6	SST Drive Point	116.95	7.37	
41	G7	DPG7	SST Drive Point	111.63	12.58	
42	G8	DPG8	SST Drive Point	119.54	4.71	
43	G9	DPG9	SST Drive Point	112.99	11.00	
44	G10	PZ12	¾" Standpipe Piezometer			
45	G11	DPG11	SST Drive Point	117.93	7.88	
46	G12	DPG12	SST Drive Point	114.44	8.83	
47	H5	DPH5	SST Drive Point	117.13	7.42	
48	H6	DPH6	SST Drive Point	117.33	6.90	
49	H7	DPH7	SST Drive Point	116.32	7.67	
50	H8	DPH8	SST Drive Point	113.84	10.25	
51	H9	DPH9	SST Drive Point	111.74	12.17	
52	H10	DPH10	SST Drive Point	112.68	11.02	
53	H12	DPH12	SST Drive Point	117.96	5.29	
54	I5	WSI5	28' BGS Geoprobe™ Water Sample	96.01	28.00	
55	I7	DPI7	SST Drive Point	115.67	8.34	
56	I8	DPI8	SST Drive Point	118.56	5.27	
57	I8.5	PZ9	1 1/4" Standpipe Piezometer	118.93		120.22
58	I9	DPI9	SST Drive Point	112.96	10.71	
59	I10	DPI10	SST Drive Point	117.72	6.46	
60	I11	DPI11	SST Drive Point	113.5	10.05	
61	I12	DPI12	SST Drive Point	117.54	5.71	
62	J8	DPJ8	SST Drive Point	118.02	5.79	

Table 1
Monitoring Equipment Installed

	Grid Location	Identification	Notes	Bottom Elevation above MSL (ft)	Depth BGS (ft)	GW Elevation 7/12/10 (ft)
63	J9	DPJ9	SST Drive Point	112.05	11.56	
64	J10	DPJ10	SST Drive Point	117.32	6.19	
65	J11	DPJ11	SST Drive Point	111.99	11.50	
66	J12	DPJ12	SST Drive Point	110.44	12.67	
67	K10	DPK10	SST Drive Point	116.41	6.84	
68	K11	DPK11	SST Drive Point	110.43	12.80	
69	K12	DPK12	SST Drive Point	117.68	5.33	
70	M12	DPM12	SST Drive Point	112.79	10.06	
71	M12	WSM12-1	10' BGS Geoprobe™ Water Sample	112.85	10.00	
72	M12	WSM12-2	13' BGS Geoprobe™ Water Sample	109.85	13.00	
73	M12	WSM12-3	16' BGS Geoprobe™ Water Sample	106.85	16.00	
74	M12	WSM12-4	30' BGS Geoprobe™ Water Sample	92.85	30.00	

Table 2
Field Parameter Measurements

	Location	Identification	Specific Conductance (µS)	pH	Estimated NO_X [1] (Test Strip) (ppm)	Temperature (°C)
1	A7	PZ10				
2	C11	DPC11				
3	D5.5	PZ7	466	4.3	30	25.4
4	D7	DPD7-Shallow	Dry			
5	D7	DPD7-Middle	431	4.29	30	26.9
6	D7	DPD7-Deep	538	4.26	30	26.3
7	D8	DPD8	590	4.82	20	26
8	D9	DPD9-Shallow	377	4.75	20	28.8
9	D9	DPD9-Deep	497	4.37	20	26.2
10	D10	DPD10	425	5.54	2	28.1
11	D11	DPD11	518	5.44	20	26.5
12	D12	DPD12	585	5.69	30	25.6
13	E2	DPE2-Shallow	165	5		30.2
14	E2	DPE2-Deep	165	4.8	3	25.8
15	E3	DPE3	247	5.74	3	26.2
16	E4	DPE4-Shallow	143	5.6	0	29.4
17	E4	DPE4-Deep	194	5.16	0.3	26.3
18	E5	DPE5	Dry			
19	E6	DPE6-Shallow	195	4.8		32.2
20	E6	DPE6-Deep	232	4.5	4	27.2
21	E7	DPE7	465	6.13	9	26.6
22	E8	DPE8-Shallow	280	5.51		29.6
23	E8	DPE8-Deep	318	4.67	10	28.1
24	E9	PZ11	606	6.11	10	26.7
25	E10	DPE10	412	4.7	15	27.5
26	E11	DPE11	478	5.71	10	26.2
27	E12	DPE12	563	5.63	20	26
28	F3	DPF3	257	5.52	0	28.7
29	F4	PZ13	441	4.51	0	27
30	F5	DPF5	Dry			
31	F6	DPF6	224	4.97	0.5	27
32	F7	DPF7	Dry			
33	FG7	PZ8	151	4.25	3	26.4
34	F8	DPF8	715	6.32	4	28.1
35	F9	DPF9	Dry			

Table 2
Field Parameter Measurements

	Location	Identification	Specific Conductance (µS)	pH	Estimated NO_X [1] (Test Strip) (ppm)	Temperature (°C)
36	F10	DPF10	497	5.23	18	26.4
37	F11	DPF11	557	5.4	3	27
38	F12	DPF12	495	5.08	1	25.7
39	G5	DPG5	Dry			
40	G6	DPG6	345	5.99		30.4
41	G7	DPG7	476	5.54		29.4
42	G8	DPG8	Dry			
43	G9	DPG9	356	5.52	9	27.4
44	G10	PZ12				
45	G11	DPG11	349	5.25	2	26.6
46	G12	DPG12	375	5.15	1	28.5
47	H5	DPH5	219	5.57	1	26.5
48	H6	DPH6	265	6.04		26.5
49	H7	DPH7	185	5.57	0	26.8
50	H8	DPH8	546	5.85	0	27.3
51	H9	DPH9	294	5.26	4	26.6
52	H10	DPH10	344	6.27	0	29.1
53	H12	DPH12	229	5.02	3	29.2
54	I5	WSI5	281	5.18	5	25
55	I7	DPI7	251	5.77	0.5	29.9
56	I8	DPI8	578	6.29	0.3	6.29
57	I8.5	PZ9	363	4.38	40	27.3
58	I9	DPI9	193	5.31		27.1
59	I10	DPI10	230	6.17		29.9
60	I11	DPI11	358	6.14		27
61	I12	DPI12	159	5.35		28.5
62	J8	DPJ8	240	5.73		29.4
63	J9	DPJ9	206	4.73		26.7
64	J10	DPJ10	261	5.73		29.8
65	J11	DPJ11	256	5.92		31.7
66	J12	DPJ12	298	6.04		26.4
67	K10	DPK10	215	5.56		30.8
68	K11	DPK11	239	5.78		25.7
69	K12	DPK12	358	6.08		28.9
70	M12	DPM12	316	6.28		27.8
71	M12	WSM12-1	131	4.53		28.7

Table 2
Field Parameter Measurements

	Location	Identification	Specific Conductance (µS)	pH	Estimated NO_X [1] (Test Strip) (ppm)	Temperature (°C)
72	M12	WSM12-2	168	4.96	0.3	26.7
73	M12	WSM12-3	197	5.46	2	29.1
74	M12	WSM12-4	352	5.04	7	26.4

[1] NO_X=NO_3