Florida Department of Health
Onsite Nitrogen Reduction Strategies Study

Contract CORCL

TASK B.6

Installation Report for Passive Nitrogen Reduction System B-HS6

November 2013

Task B of the Florida Onsite Nitrogen Reduction Strategies Study (FOSNRS) includes performing field experiments to critically evaluate the performance of nitrogen removal technologies that were identified and pilot tested in FOSNRS Task A. To meet this objective, full scale treatment systems will be installed at various residential sites in Florida, operated on septic tank effluent under actual onsite conditions, and monitored over an extended timeframe. 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 installation of a passive nitrogen reduction system at a home site in Wakulla County, Florida (B-HS6).

System Overview

The B-HS6 passive nitrogen reduction system (PNRS) was installed in Wakulla County, Florida in November 2013. The new system replaced the previously installed PNRS system installed at field site B-HS1. The previously installed Aerocell™ unsaturated media filter chamber, Nitrex™ media and split recirculation device were removed from the system. The existing 1,500 gallon dual chamber septic tank will continue to provide primary treatment for the new PNRS system. However, the effluent screen was moved to the outlet and a vented tee was installed between the chambers per 64E-6.013(2)(h). The existing pump and floats were moved from the second chamber of the primary tank into a new 275 gallon pump tank. A 1,650 gallon concrete combined Stage 1 and Stage 2 media biofilter was installed. The existing 1,500 gallon concrete single chamber tank which contained the Nitrex™ media was converted to a Stage 2 saturated sulfur media biofilter. Figure 1 is a site schematic showing the system components and layout of the installation. The complete as-built system drawings are included in Appendix A.

Household wastewater enters the 1st chamber of the primary tank and exits the second chamber as septic tank effluent through an effluent screen into the pump tank (which contains the pump and float switches). The pump tank contents are discharged to the top of the Stage 1 biofilter, dispersed by four spray nozzles. The Stage 1 biofilter contains 30 inches of coarse expanded clay media (Riverlite™ 1/4; 1.1 to 4.8 mm). Wastewater proceeds in downward unsaturated flow through the expanded clay media where nitrification occurs. Twelve inches of lignocellulosic media was installed underneath the

expanded clay media. The tank's outlet invert was installed 4-inches above the interior bottom of the tank. Therefore, approximately 4-inches of the lignocellulosic media is saturated, promoting oxygen depletion and denitrification of the nitrified effluent. The combination Stage 1 and Stage 2a biofilter effluent then flows into the bottom of the denitrification (Stage 2b) biofilter, where it proceeds upward through the elemental sulfur and oyster shell media mixture. The Stage 2b biofilter effluent discharges near the top of the tank; therefore denitrification occurs in the saturated environment. The denitrified treated effluent is discharged into the soil via the existing drainfield (standard trenches). A flow schematic of the system is shown on Figure 2.

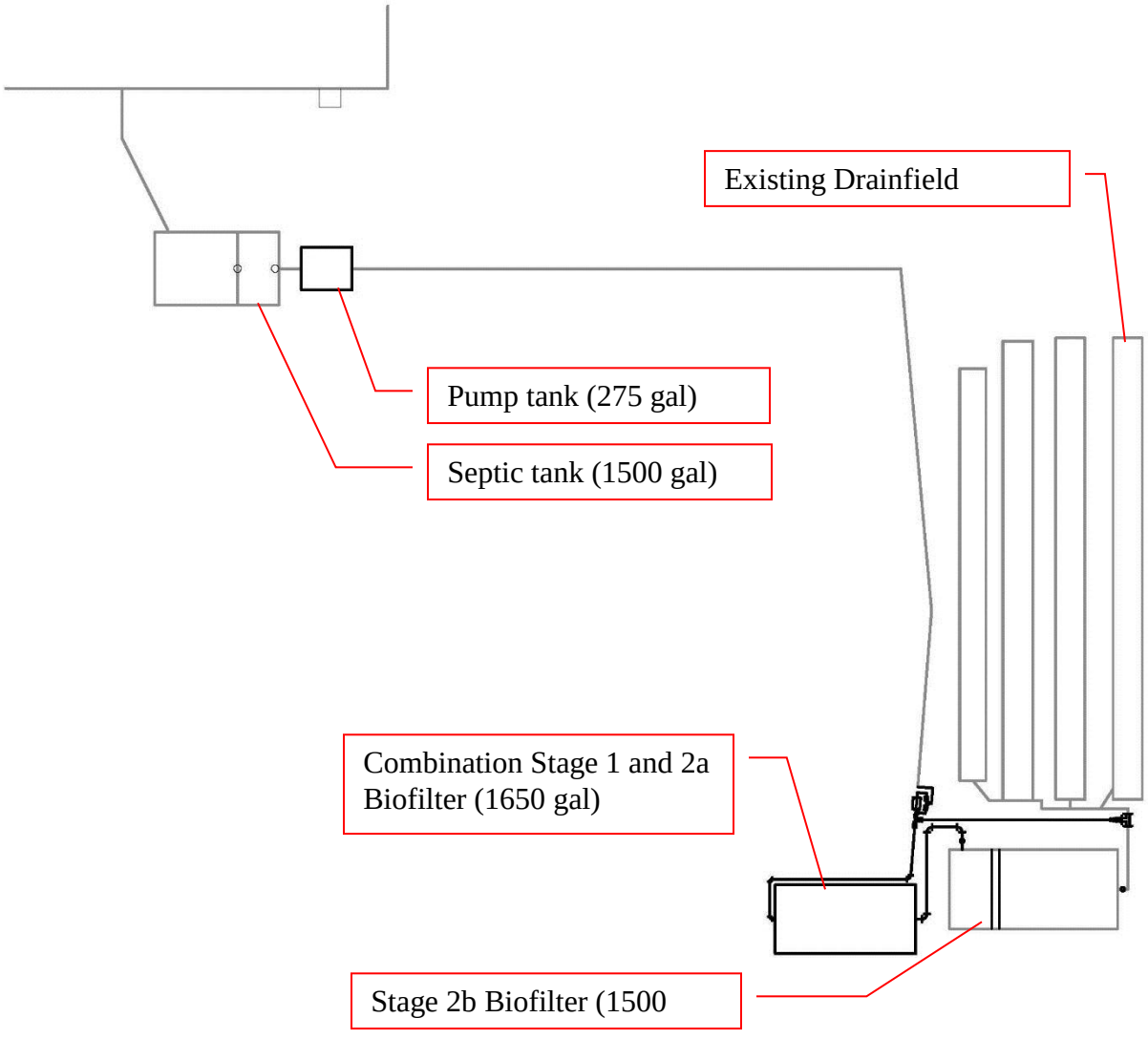


Figure 1
Schematic of B-HS6 PNRS installed in Wakulla county

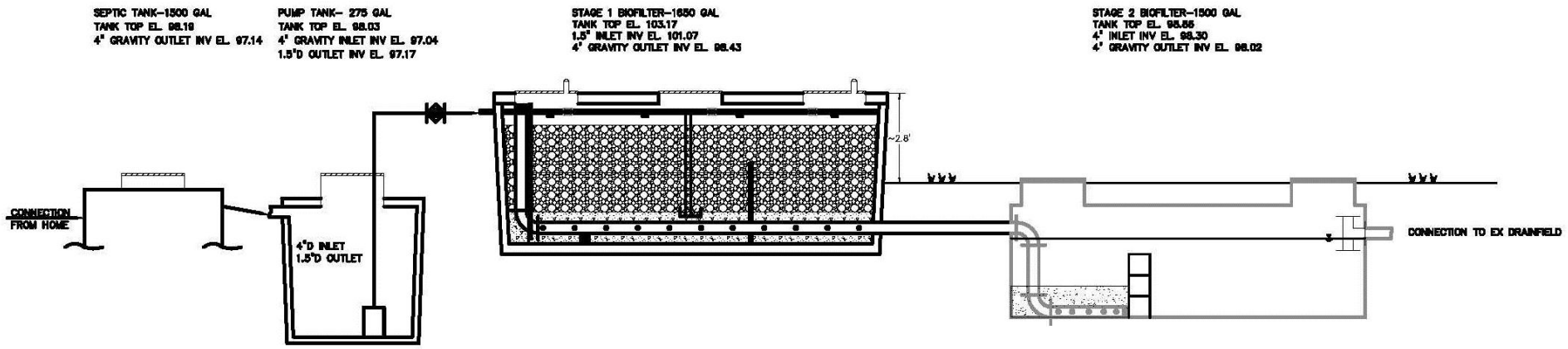


Figure 2
Flow Schematic of B-HS6 PNRS installed in Wakulla county

Installation

Installation of the system commenced November 5, 2013 and was completed on November 6, 2013. As previously discussed, the existing 1,500 gallon septic tank will continue to provide primary treatment. A vented tee was installed between the chambers (Figure 3) and the effluent screen was moved to the outlet (Figure 4).

Figure 3
Primary tank vented tee between chambers

Figure 4
Primary tank effluent screen moved to outlet

Following the primary tank modifications, the previously installed passive nitrogen reduction system components were removed. The previously installed Aerocell™ unsaturated media filter chamber (Figure 5), Nitrex™ media (Figure 6) and split recirculation device (Figure 7) were removed from the system.

Figure 5
Aerocell™ unsaturated media filter chamber removal

Figure 6
Nitrex™ media removal

Figure 7
Split Recirculation Device removal

Following the removal of the old system components, the remaining passive nitrogen reduction system components were installed (Table 1). A 275 gallon concrete pump tank was installed beside the primary tank (Figure 8). The 4"D inlet of the pump tank is connected (gravity flow) to the septic tank discharge. On the pump discharge line, the existing system flow meter was installed with a bypass line for the flowmeter (Figure 9). In addition, a PNRS system bypass for the Stage 1, 2a, and 2b biofilters was installed that connects the pump discharge directly to the drainfield (Figure 10). A single chamber (1,650 gallon) concrete tank was installed near the existing 1,500 gallon tank (Figure 11). The purpose of this tank is to hold the Stage 1 expanded clay media and Stage 2a lignocellulosic media. The Stage 1 and 2a combination tank 4"D outlet (Figure 11) is located near the bottom of the tank to allow for unsaturated operation through the expanded clay media and some saturation operation through the lignocellulosic media. The 4"D underdrain pipe (perforated) was installed along the centerline, 4-inches above the interior bottom of the tank for effluent collection. A 12-inch layer of lignocellulosic media, a blended urban waste wood from AAA Tree Experts, Tallahassee, FL, was installed in the bottom of the tank (Figure 12). Following lignocellulosic installation and leveling, 30-inches of coarse (1/4 Riverlite^{TM}) expanded clay media was installed (Figure 13) above a plastic mesh screen separating the two media layers. Following media installation and leveling, the influent distribution network was installed. The 1.5"D influent pipe, connected to the pump tank discharge, disperses the effluent through four spray nozzles (Figure 13). Vents were installed on the covers of the tank (Figure 14) to allow air into the tank promoting aerobic conditions for nitrification. The Stage 1 biofilter outlet pipe includes a sample port (Figure 15). The tank was hidden with a berm surrounding the tank (Figure 16).

Table 1
Passive Nitrogen Reduction System Components

	Tank Volume (gal)	Surface Area (ft^2)	Media
Primary Tank	1,500	67	none
Pump Tank	275	13	none
Stage 1 Biofilter and Stage 2a Biofilter	1,650	67	• 30" Riverlite 1/4 • 12" Lignocellulosic
Stage 2b Biofilter, upflow	~500 (1,500 total)	~20 (61 total)	12" Elemental sulfur (90%) & oyster shell mixture (10%)

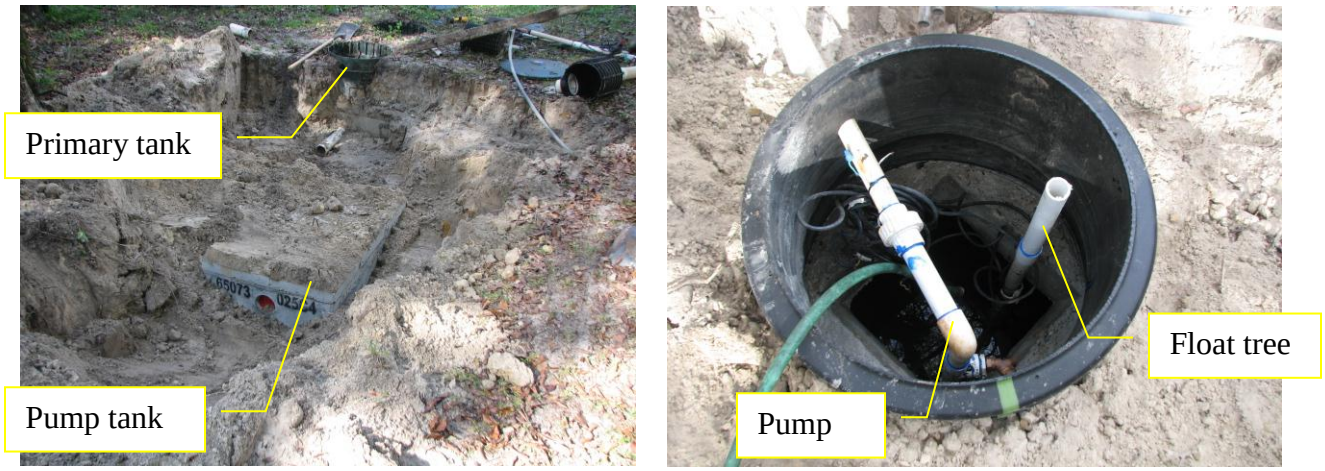


Figure 8
Pump tank (275 gallon)

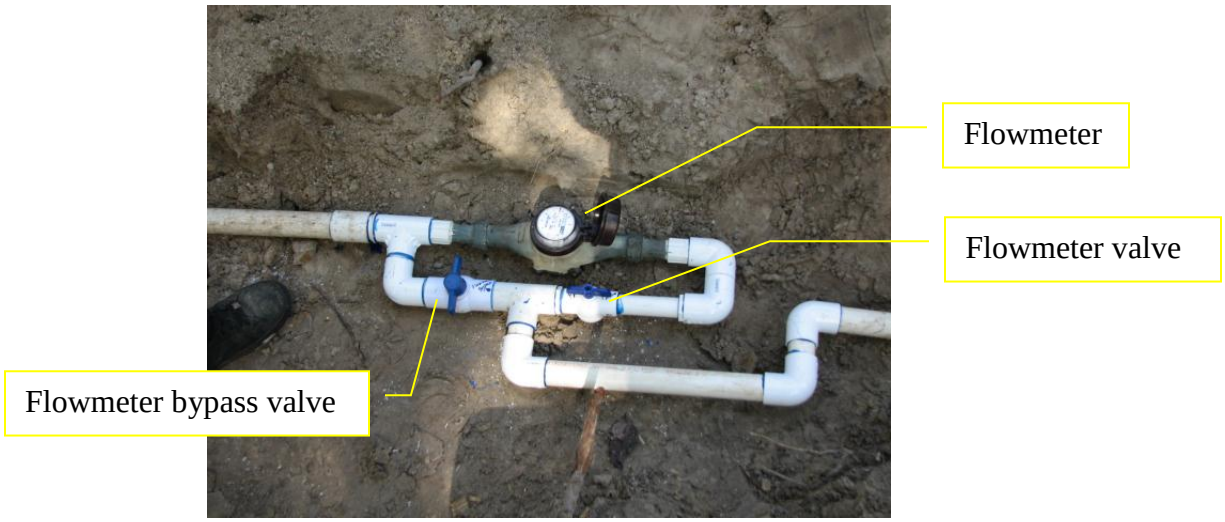


Figure 9
System flow meter

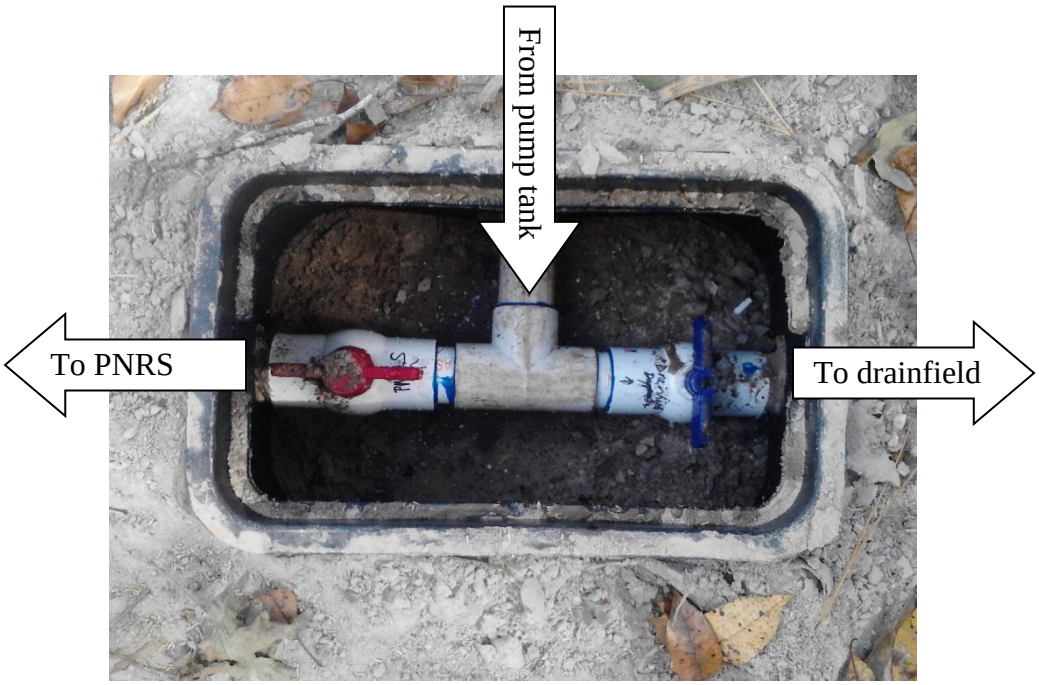


Figure 10
PNRS system bypass

Figure 11
Combination Stage 1 and 2a Biofilter (1650 gallon)

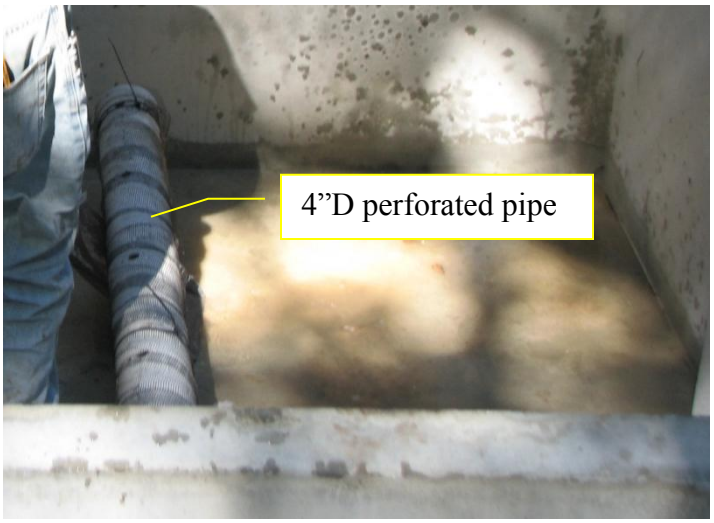


Figure 12
Lignocellulosic media installation

Figure 13
Expanded clay media installation

Figure 14
Vents on the covers

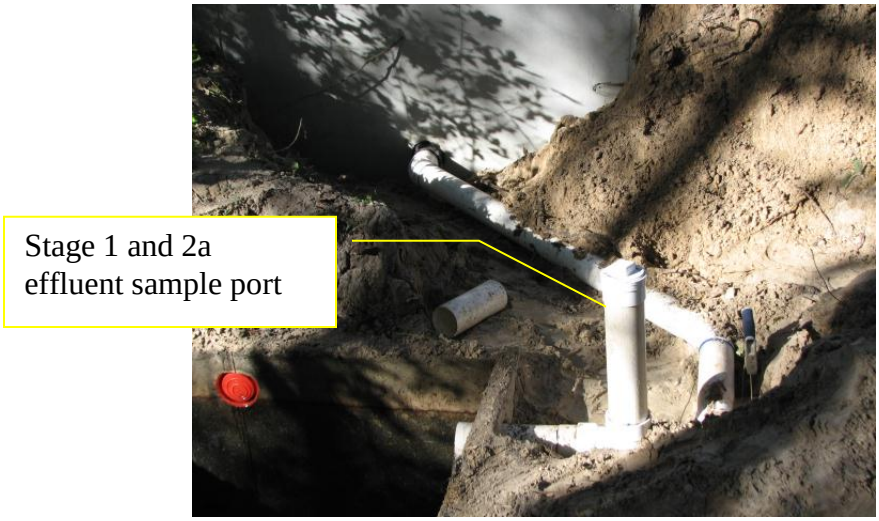


Figure 15
Stage 1 and Stage 2a effluent sample port

Figure 16
Stage 1 and Stage 2a berm hiding tank

The 1,500 gallon concrete tank that previously contained the Nitrex™ media (Figure 17) was converted to the new Stage 2b tank containing 90% pastille-shaped elemental sulfur (GreenSun® ES-99) and 10% oyster shell media (Remington Feed) mixture. The volume of sulfur media required for treatment is significantly less than lignocellulosic media; therefore a cinder block wall (3 blocks in height) was installed inside the tank to create two chambers. The inlet chamber created with the wall holds the sulfur media mixture and is approximately one-third of the tank volume (Figure 18). The 4"D pipe from the Stage 1 and 2a biofilter connects to a perforated pipe along the bottom of the inlet chamber (Figure 18). Above the perforated pipe, 12-inches of elemental sulfur and oyster shell media was installed and mixed (Figure 18). The outlet pipe is connected to the existing drainfield and contains a new sample port (Figure 19).

Figure 17
Cleaned Stage 2b tank (1500 gallon)

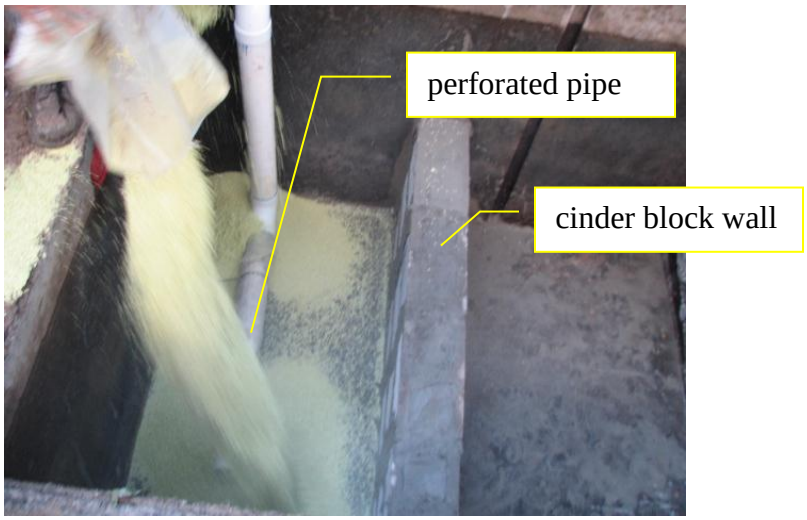


Figure 18
Stage 2b tank (1500 gallon)

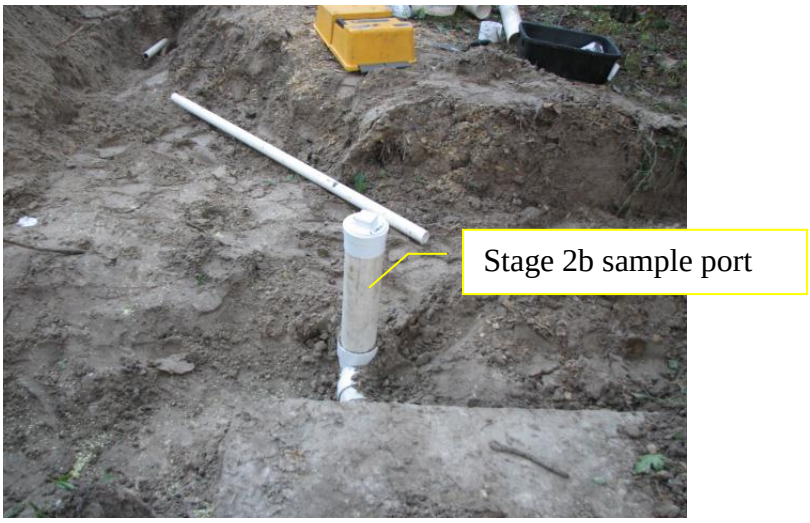


Figure 19
Stage 2b tank (1500 gallon) sample port

The previously installed power meter between the main power box of the house and the Vericomm control panel remains to record cumulative power usage of the pump in kilowatt-hours. Figure 20 shows the power meter installed inside an outdoor enclosure above the control panel.

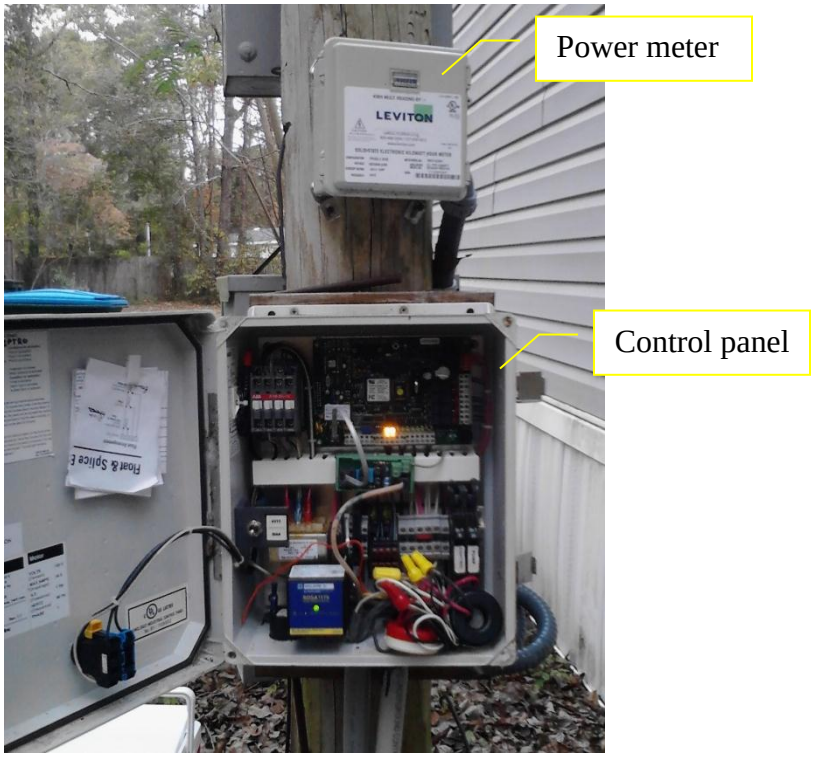


Figure 20
Power meter and Control Panel

During final testing of the system, the system operated with no visible signs of leaks, etc. The system area was filled and all disturbed areas on the property were graded (Figure 21).

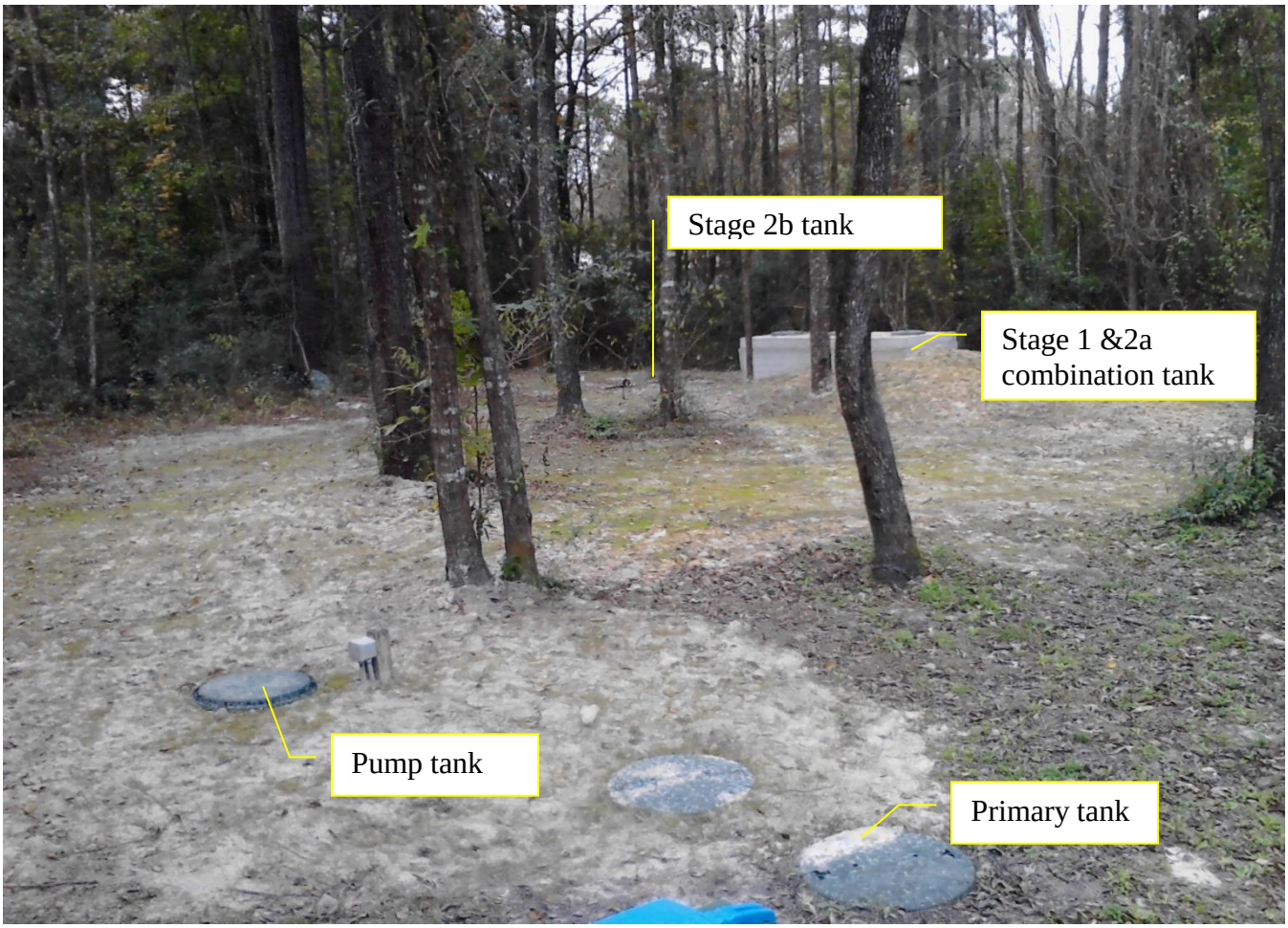


Figure 21
Overall PNRS system installed

Estimated Cost

The final construction cost for the installed system was $13,727.12 as detailed in Appendix B.

System Start-up

The system was started up November 6, 2013, when all flow was diverted to the new passive system. Routine checks of the system were made for the first two weeks to ensure the system was functioning as intended. Preliminary sampling will begin in November to monitor nitrification.

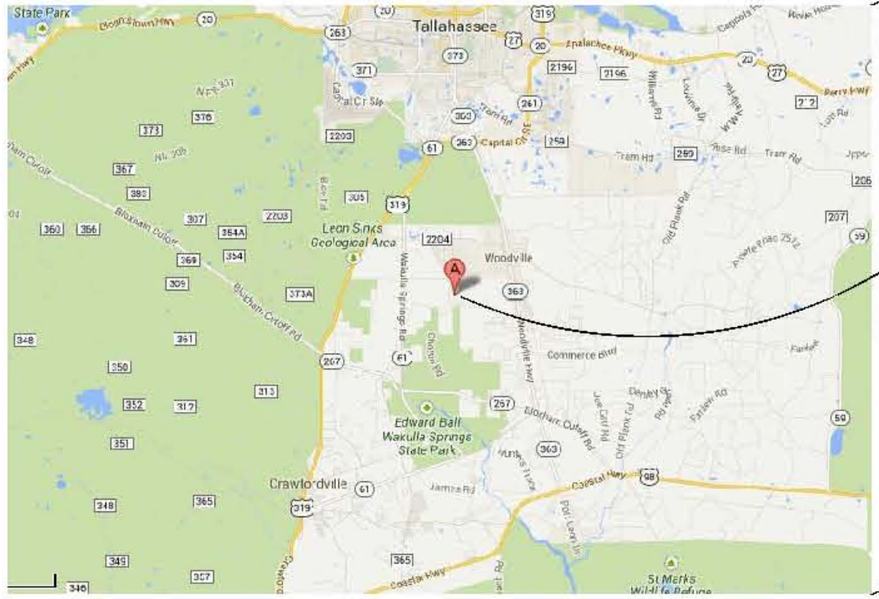
APPENDIX A

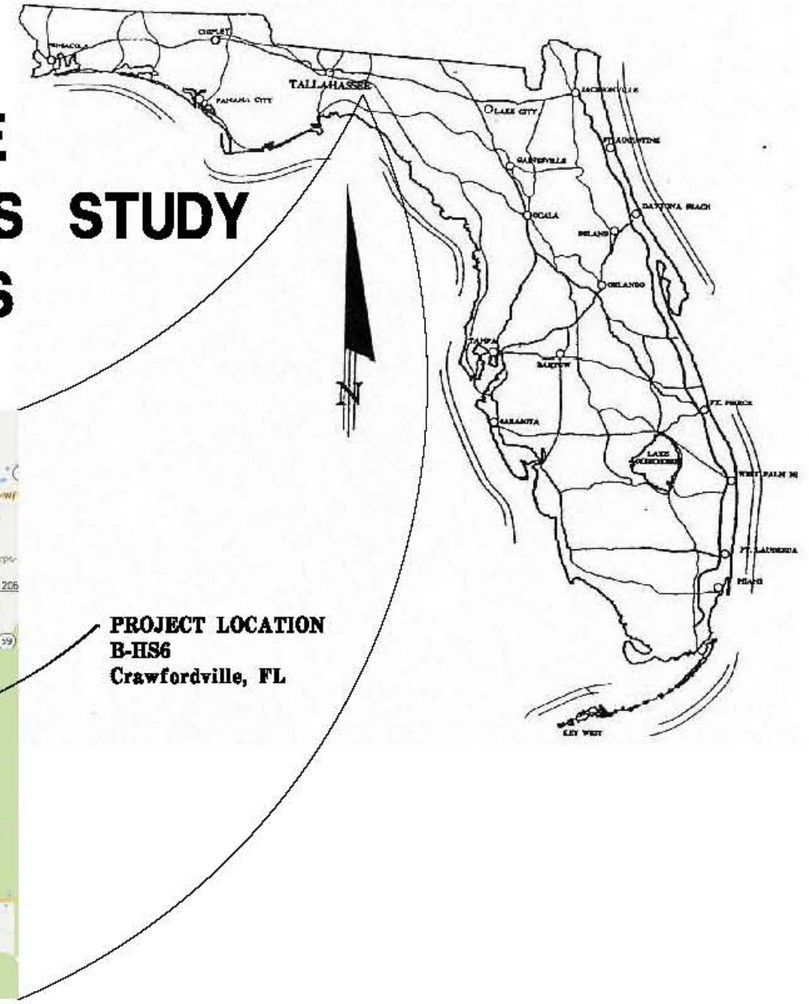
RECORD DRAWINGS

FLORIDA ONSITE SEWAGE NITROGEN REDUCTION STRATEGIES STUDY
B-HS6 RECORD DRAWINGS

LIST OF DRAWINGS

SHEET COUNT	SHEET NUMBER	SHEET TITLE
		GENERAL
1	G-1	COVER SHEET AND INDEX OF DRAWINGS
		CIVIL
2	C-1	SITE PLAN
3	C-2	PROPOSED SYSTEM LAYOUT
4	C-3	CROSS SECTIONS
5	C-4	SYSTEM FLOW DIAGRAM





PROJECT LOCATION
B-HS6
Crawfordville, FL

LOCATION MAP
N.T.S.

NOTICE

THESE "RECORD DRAWINGS" REPRESENT THE FINAL "AS BUILT" CONDITIONS OF THE CONSTRUCTION PROJECT BASED UPON FIELD OBSERVATION AND SUPPORTING PROJECT RECORDS. UNLESS OTHERWISE NOTED ON THE DRAWINGS, WORK SHOWN AS PROPOSED OR TENTATIVE HAS BEEN COMPLETED, AND DIMENSIONS SHOWN AS PROPOSED OR TENTATIVE ARE FINAL. NOTES DIRECTING THE CONTRACTOR TO PERFORM SPECIFIC TASKS REMAIN ON THE DRAWINGS AS A RECORD OF CONSTRUCTION ACTIVITIES.

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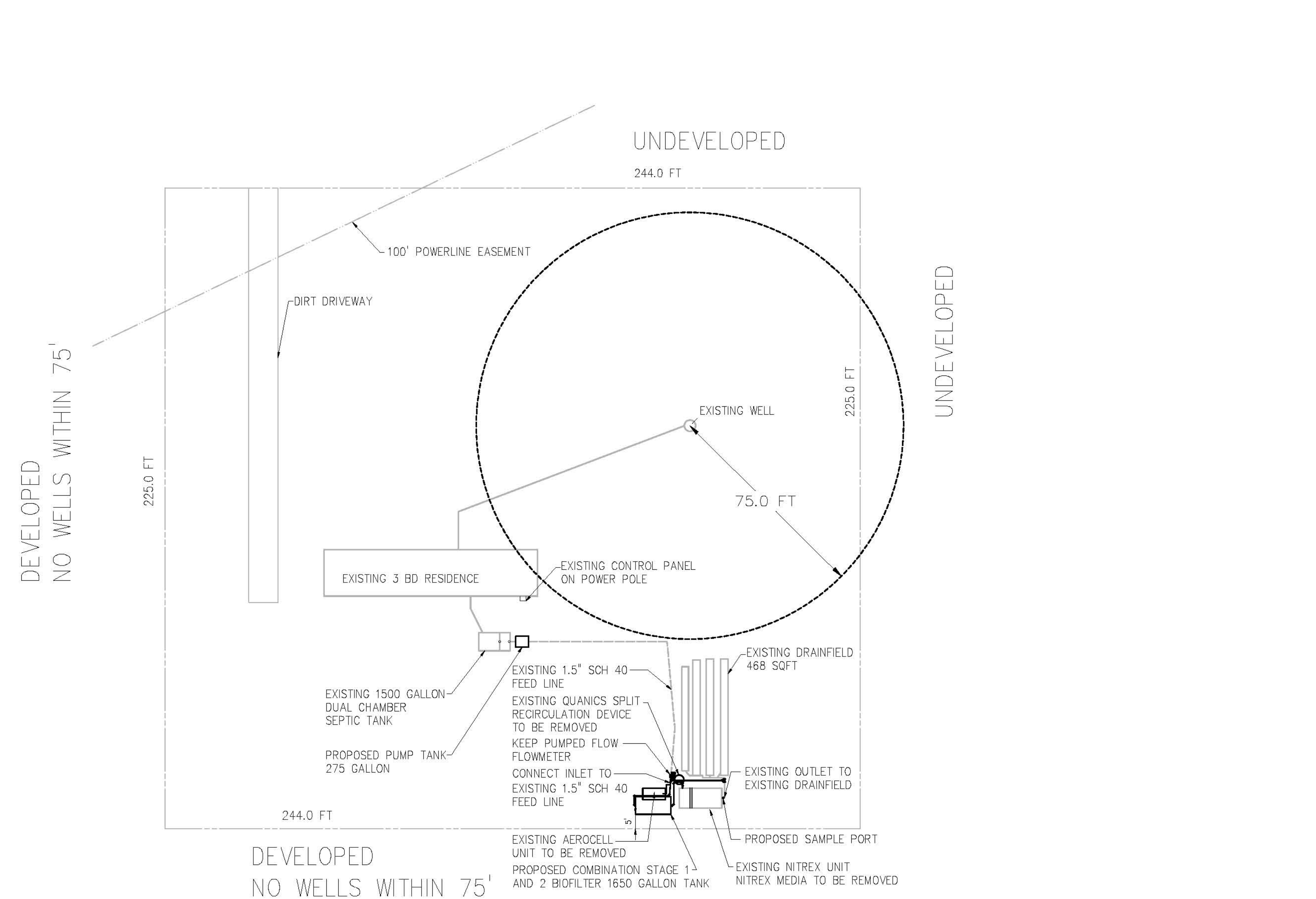
Environmental Engineers & Scientists
10002 Princess Palm Ave., Suite 200
Tampa, Florida 33619
Certificate of Authorization Number: 2771

IN ASSOCIATION WITH

OTIS ENVIRONMENTAL CONSULTANTS, LLC

AET

FLORIDA DEPARTMENT OF HEALTH
4052 BALD CYPRESS WAY, BIN A08
TALLAHASSEE, FLORIDA 32399-1713
(850)-245-4070



PROPOSED SITE PLAN

1"=20'

1"=20'-0"

20 10 0 20'

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NO.	ISSUED FOR	DATE	BY
2	RECORD DRAWINGS	11/13	JEH
1	PERMIT DOCUMENTS	09/13	JEH

DESIGNED JEH
DRAWN CMS
CHECKED DBS
PROJ. ENGR. JME
DLA
APPROVED

JOSEFIN EDEBACK-HIRST
Name: Date:
Florida Professional Engineer's Registration Number: 69835

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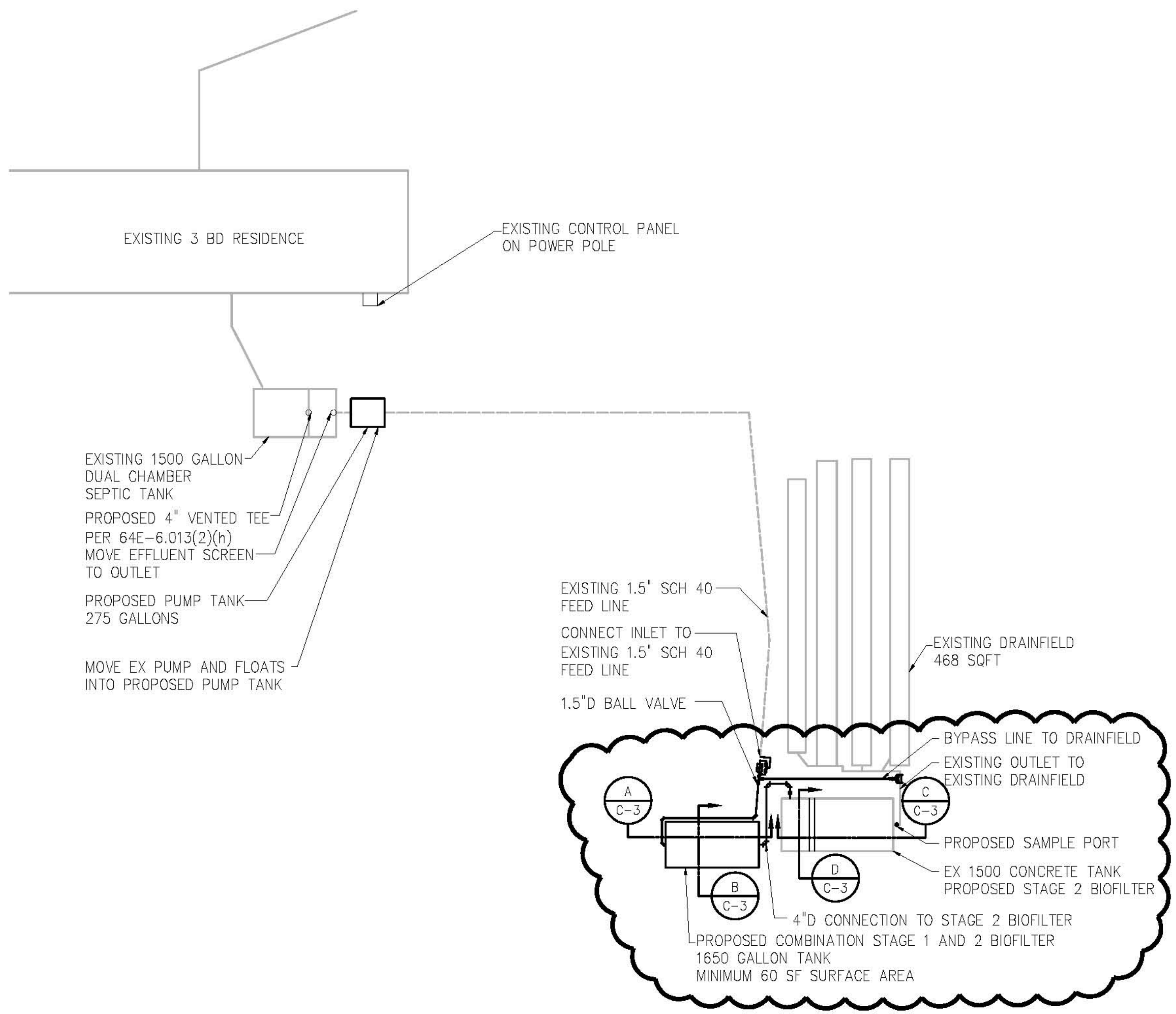
FLORIDA DEPARTMENT OF HEALTH
FLORIDA ONSITE SEWAGE NITROGEN REDUCTION STRATIGIES STUDY

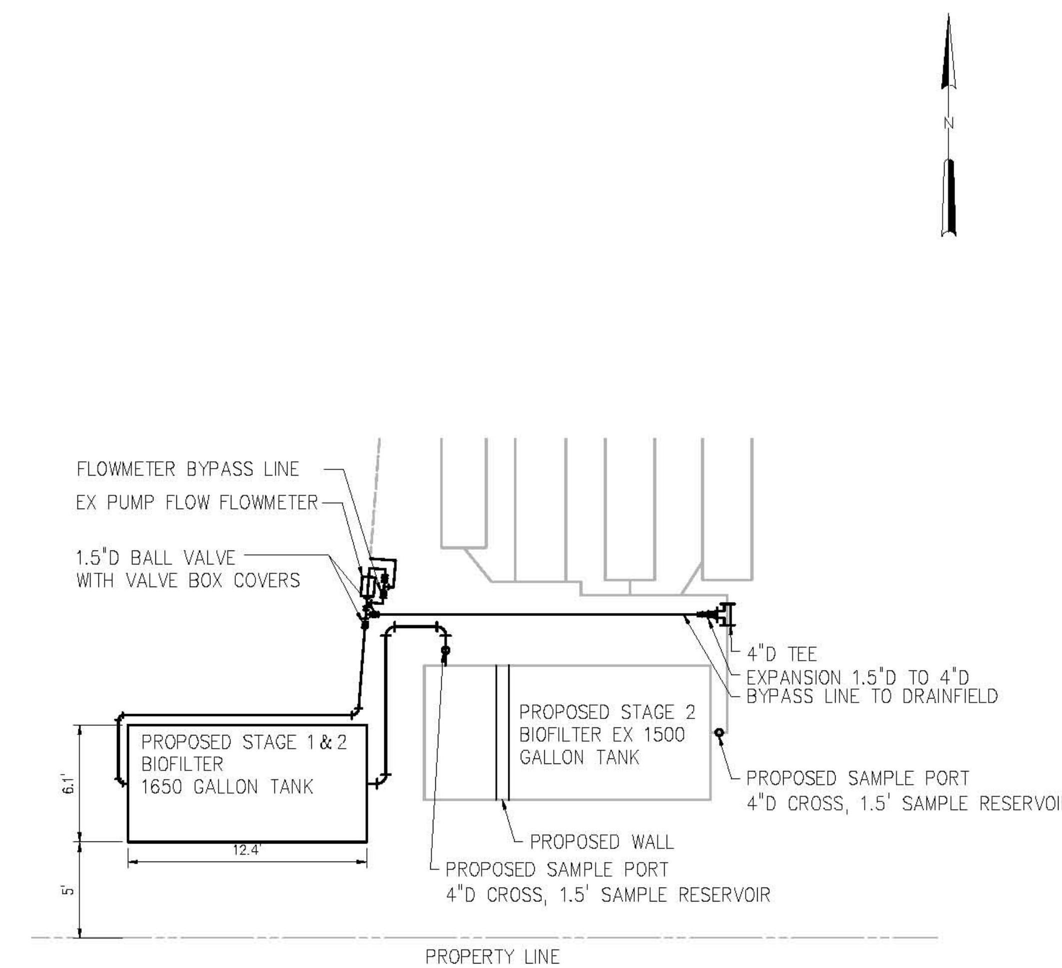
FOSNRS SITE B-HS6
SITE PLAN

THE SCALE BAR SHOWN BELOW MEASURES ONE INCH LONG ON THE ORIGINAL DRAWING.

DATE NOVEMBER 2013
H & S JOB NUMBER 44237-001
CONTRACT NUMBER CORCL
DRAWING NUMBER C-1

PLOT DATE: 11/21/2013 11:19 AM BY: JEDEBACK





PROPOSED SYSTEM LAYOUT

DETAIL	1
1" = 5'-0"	C-1

1"=5'-0" — 5 2.5 0 5'

1"=10'-0" — 10 5 0 10'

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PROPOSED SYSTEM LAYOUT

1"=10'

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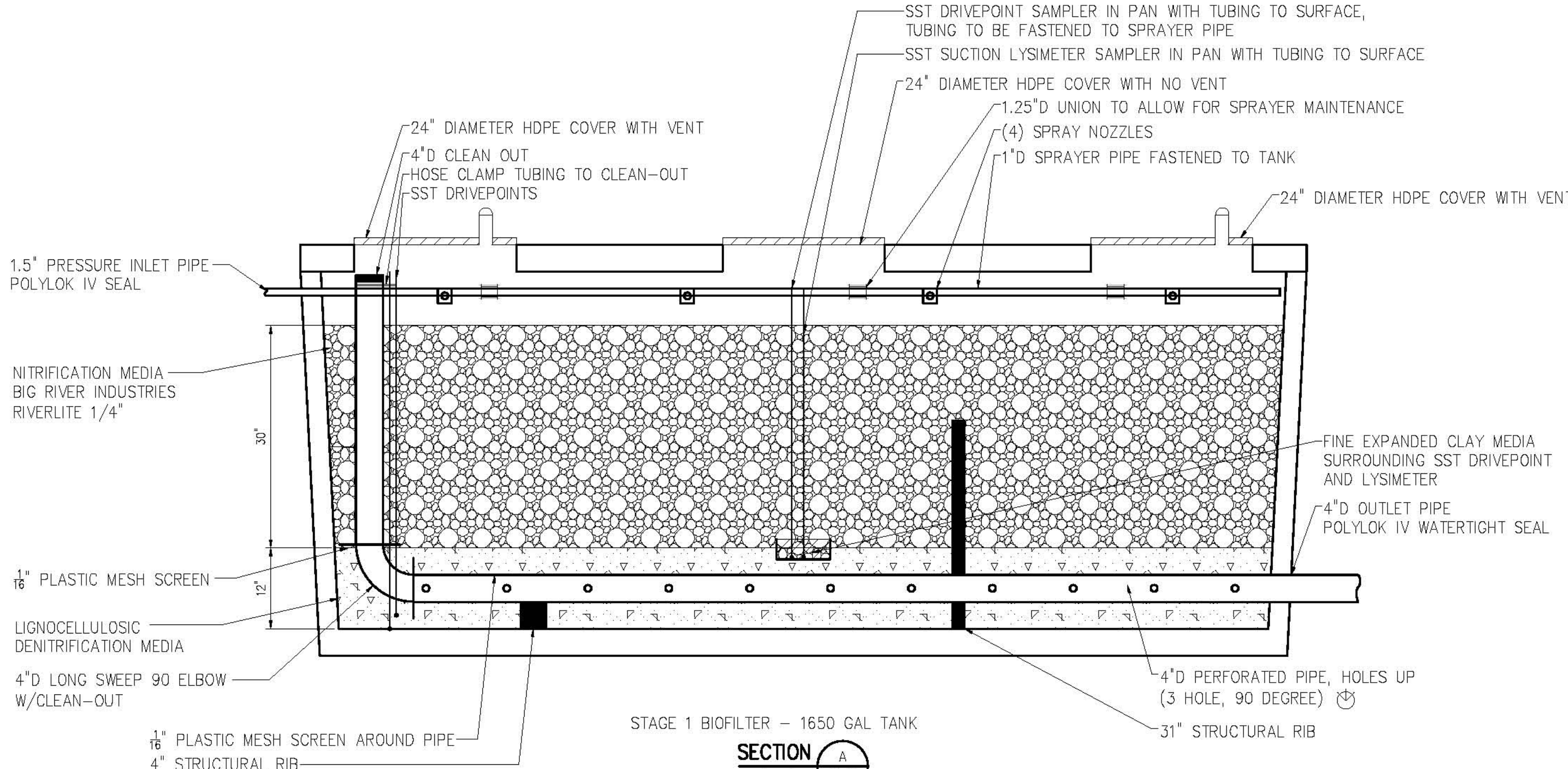
FOSNRS SITE B-HS6
PROPOSED SYSTEM LAYOUT

THE SCALE BAR SHOWN BELOW MEASURES ONE INCH LONG ON THE ORIGINAL DRAWING.

DATE NOVEMBER 2013
H & S JOB NUMBER 44237-001
CONTRACT NUMBER CORCL
DRAWING NUMBER C-2

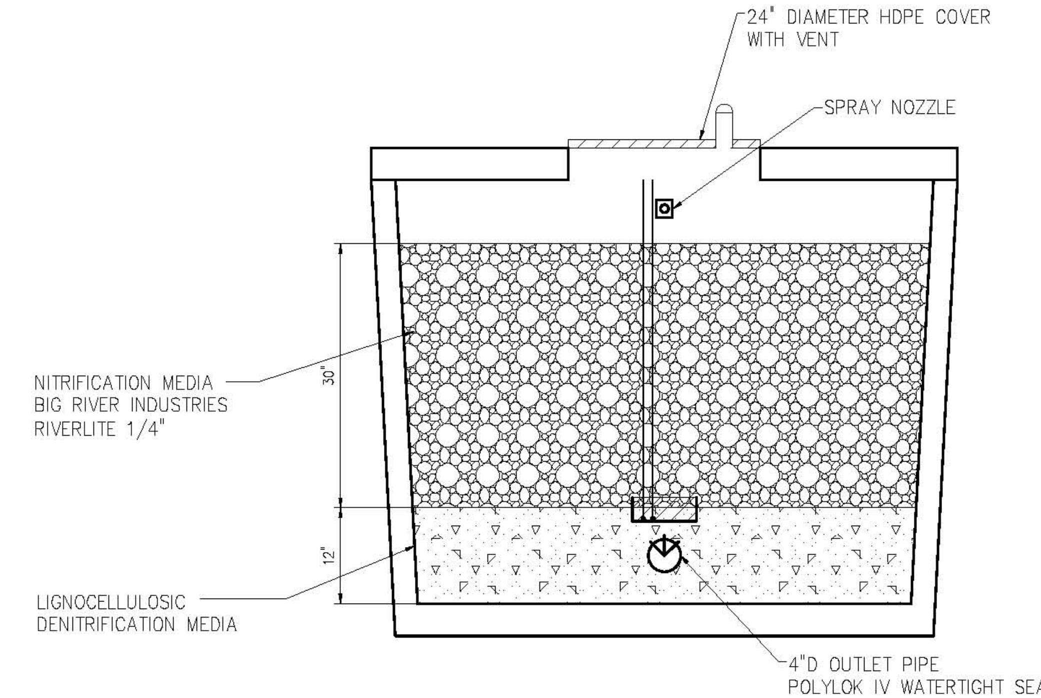
PLOT DATE: 11/21/2013 11:19 AM BY: JEDEBACK



STAGE 1 BIOFILTER – 1650 GAL TANK

SECTION A / C-2

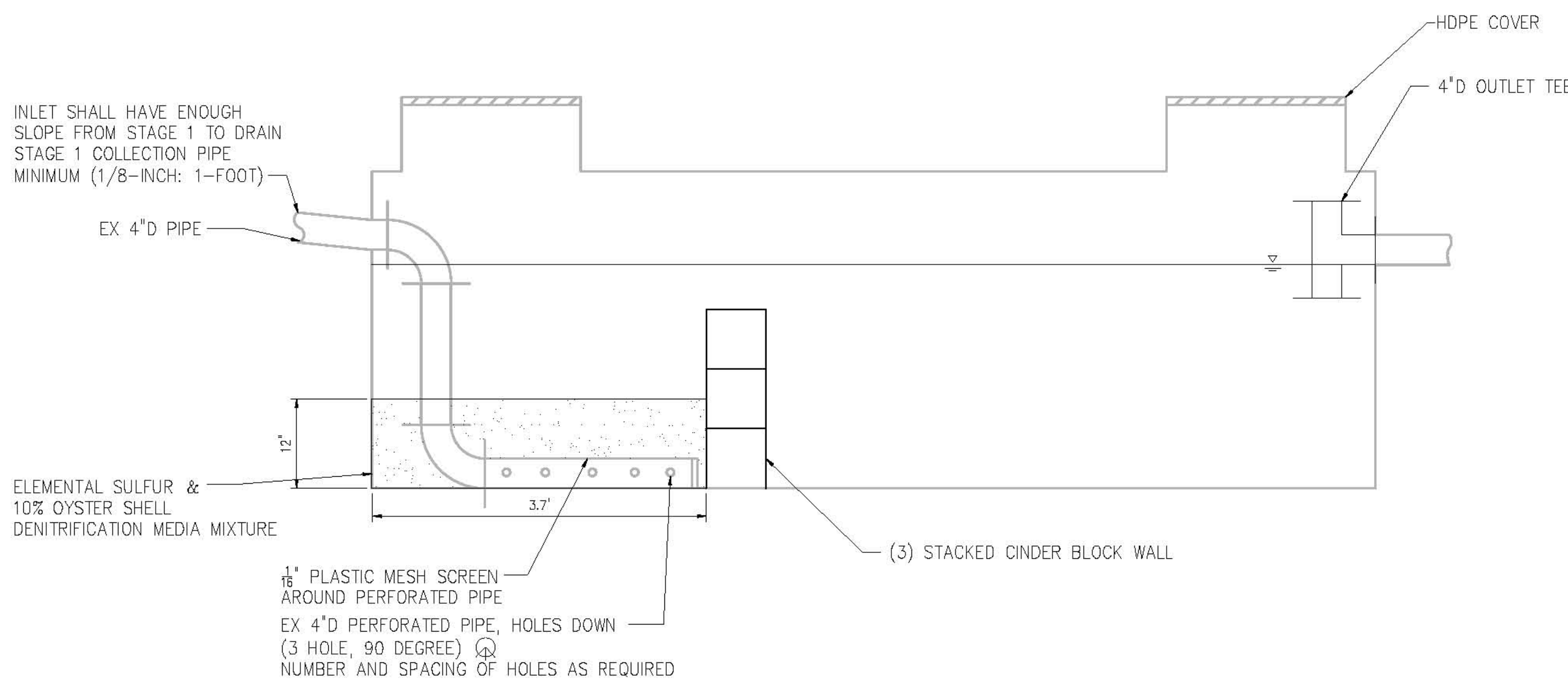
1" = 1'



STAGE 1 BIOFILTER – 1650 GAL TANK

SECTION B / C-2

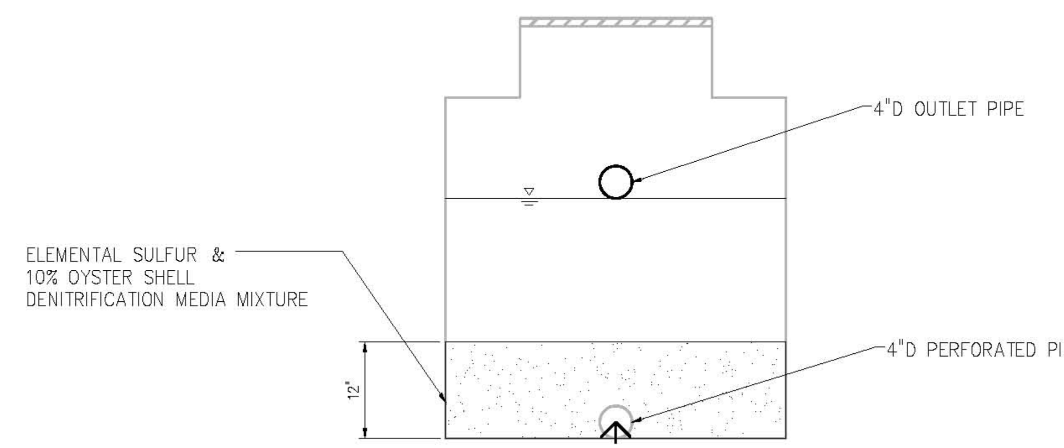
1" = 1'



STAGE 2 BIOFILTER – 1500 GAL TANK

SECTION C / C-2

1" = 1'



STAGE 2 BIOFILTER – 1500 GAL TANK

SECTION D / C-2

1" = 1'

12' 6 0 1'

1"=1'-0"

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FOSNRS SITE B-HS6
CROSS SECTIONS

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DATE NOVEMBER 2013
H & S JOB NUMBER 44237-001
CONTRACT NUMBER CORCL
DRAWING NUMBER C-3

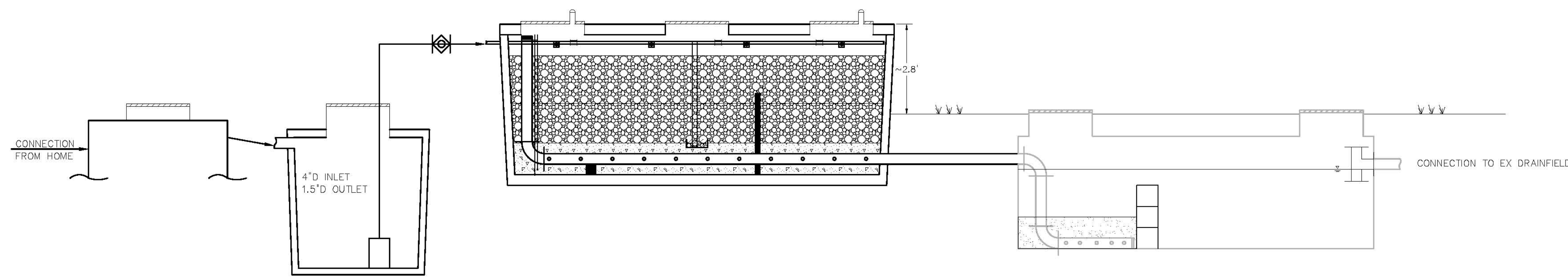
PLOT DATE: 11/21/2013 11:18 AM BY: JEDEBACK

SEPTIC TANK–1500 GAL
TANK TOP EL. 98.19
4" GRAVITY OUTLET INV EL. 97.14

PUMP TANK– 275 GAL
TANK TOP EL. 98.03
4" GRAVITY INLET INV EL. 97.04
1.5"D OUTLET INV EL. 97.17

STAGE 1 BIOFILTER–1650 GAL
TANK TOP EL. 103.17
1.5" INLET INV EL. 101.07
4" GRAVITY OUTLET INV EL. 98.43

STAGE 2 BIOFILTER–1500 GAL
TANK TOP EL. 98.86
4" INLET INV EL. 98.30
4" GRAVITY OUTLET INV EL. 98.02



DESIGN CALCULATIONS

A. FLOW CALCULATIONS

NUMBER OF BEDROOMS = 3
BUILDING AREA = 1200 SF
Q = (3 BR X 100 GPD/BR) + ((1200 SF – 1200 SF) X 100 GPD/750 SF)
F.A.C. MINIMUM DESIGN FLOW = 300 GPD

B. TREATMENT DESIGN

STAGE 1 BIOFILTER = 1650 GAL = 66.9 SF
STAGE 2 BIOFILTER = 1500 GAL = 58 SF

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FOSNRS SITE B–HS6
SYSTEM FLOW DIAGRAM

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DATE NOVEMBER 2013
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CONTRACT NUMBER CORCL
DRAWING NUMBER C–4

PLOT DATE: 11/21/2013 11:19 AM BY: JEDEBACK

APPENDIX B

CONSTRUCTION COSTS

HAZEN AND SAWYER
Environmental Engineers & Scientists

PROJECT: **FOSNRS Study Field Site Installation B-HS6**
CLIENT: **FDOH**

TOTAL **$ 13,727.12**

ITEM NO.	DESCRIPTION	ENGINEER OR CONTRACTOR SUPPLIED	QUANTITY	UNIT	UNIT PRICE	TOTAL
Existing STE Tank						$ 230.00
1	Move effluent screen to outlet tee	Contractor	1	LS	$ 40.00	$ 40.00
2	Move pump to new pump tank	Contractor	1	LS	$ 65.00	$ 65.00
3	Installed vented 4"D tee in septic tank flow-through hole	Contractor	1	LS	$ 125.00	$ 125.00
New Pump Tank						$ 860.00
4	Minimum 225 gallon pump tank	Contractor	1	LS	$ 650.00	$ 650.00
5	Set existing pump and floats, plumb discharge pipe	Contractor	1	LS	$ 210.00	$ 210.00
Stage 1 and 2 Combination tank						$ 7,911.19
6	Extend 1.5"D feed pipe from Aerocell to new Stage1 tank	Contractor	1	LS	$ 120.00	$ 120.00
7	Prepare area for Stage 1 tank for FL Septic installation	Contractor	1	LS	$ 375.00	$ 375.00
8	1650 FL Septic tank	Engineer	1	LS	$ 4,626.68	$ 4,626.68
9	Add vents to Polylok covers	Contractor	1	LS	$ 40.00	$ 40.00
10	Move sprayers and pipe to new tank, add unions	Contractor	1	LS	$ 120.00	$ 120.00
11	Install 30 inches of Riverlite 1/4 media	Contractor	1	LS	$ 520.00	$ 520.00
12	Riverlite 1/4 media	Engineer	4	EA	$ 271.67	$ 1,086.67
13	Install SST drivepoint in pan	Contractor	1	LS	$ 70.00	$ 70.00
14	1/16" plastic mesh screen (41.5"W x 50'L)	Engineer	1	EA	$ 79.96	$ 79.96
15	Install 1/16" plastic mesh screen between media layers	Contractor	1	LS	$ 72.00	$ 72.00
16	Install 12" of lignogellulocis media	Contractor	1	LS	$ 280.00	$ 280.00
17	lignocellulosic media	Engineer	4	CY	$ 37.00	$ 148.00
18	Install SST drivepoints within lignocellulosic media	Contractor	1	LS	$ 70.00	$ 70.00
19	SST drivepoints * SST lysimeter from USF with tubing	Engineer	4	LS	$ 23.22	$ 92.88
20	Perforated pipe along bottom	Contractor	1	LS	$ 85.00	$ 85.00
21	Install sample port cross in outlet pipe	Contractor	1	LS	$ 125.00	$ 125.00
Stage 2 Biofilter						$ 1,935.92
22	Install new inlet from Stage 1&2 biofilter	Contractor	1	LS	$ 50.00	$ 50.00
23	Provide and install cinder block wall (3 blocks high)	Contractor	1	LS	$ 550.00	$ 550.00
24	Install 12 inches of sulfur and oyster shell mixture	Contractor	1	LS	$ 590.00	$ 590.00
25	Elemental sulfur media	Engineer	28	EA	$ 19.40	$ 543.17
26	Oyster shell media	Engineer	3	EA	$ 14.25	$ 42.75
27	Install outlet tee	Contractor	1	LS	$ 35.00	$ 35.00
28	Install sample port cross in outlet pipe	Contractor	1	LS	$ 125.00	$ 125.00
Demolition						$ 1,895.00
29	Aerocell, splittler box removal	Contractor	1	LS	$ 350.00	$ 350.00
30	Add drainfield bypass line, valves, expansion fittings	Contractor	1	LS	$ 195.00	$ 195.00
31	Pump water out of 1500 gallon Nitrex tank	Contractor	1	EA	$350.00	$ 350.00
32	Remove Nitrex media	Contractor	1	LS	$ 375.00	$ 375.00
33	Haul away and dispose of Nitrex media	Contractor	1	EA	$625.00	$ 625.00
Site Restoration						$ 515.00
34	Berm surrounding Stage 1&2 combination tank	Contractor	1	EA	$175.00	$ 175.00