

**Florida Department of Health  
Florida Onsite Sewage Nitrogen Reduction Strategies Study**

**Contract CORCL**

**TASK B.8**

**Operation, Maintenance and Repairs Report for  
Passive Nitrogen Reduction System  
B-HS3**

**January, 2015**

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 and pilot tested in Task A.26. To meet this objective, full-scale treatment systems were installed at various residential sites in Florida, operated on septic tank effluent under actual onsite conditions, and monitored over an extended timeframe.

This report summarizes the operation, maintenance, and repairs required for the passive nitrogen reduction system installed at a home site in Seminole County, Florida (B-HS3) in July, 2013. Design and construction details were presented previously in the Task B.6 Field System Installation Report for this system. The field system monitoring reports that document system performance, operation, and maintenance issues were presented previously in Task B.7 documents for each monitoring event. The B-HS3 system performance was monitored from August 2013 to December 2014.

The B-HS3 system includes a 2-zone Perc-Rite (TM) drip system which incorporates filtration, time, and level controlled application of effluent to two ultra-low rate drip distribution zones. One drip zone receives septic tank effluent (STE) for treatment in a stage 1 biofilter immediately below, while the second drip zone receives stage 2, final treated effluent for landscape irrigation and dispersal. The system is operated by a controller, which is activated by level sensing devices (mechanical differential float switches) located in the STE dose tank and Stage 2 biofilter effluent zone. When activated by a rising level of effluent in the tank, the controller will enable the dispersal cycle, and as dictated by the time clock, pump effluent through a 100-micron disc filter and then to the applicable drip dispersal zone (depending on the source tank). The disc filter backflushing schedule is triggered at the beginning of each dose cycle. The drip feed and return lines for each zone have an air release valve housed in a small valve box at the highest point of the manifold pipe. The valve will close when the water pressure arrives at the valve during each dose. The air release valve allows air to reenter the tubing after each dose to allow the drip tubing to drain. The drip field supply line conveys the effluent to the drip zone that is being dosed where it is discharged below the soil surface through pressure compensating self-cleaning poly-tubing drip emitters. The emitters are located every two feet in the tubing and emit 0.65 gallons per hour per emitter. The dripper lines are automatically scoured (forward flushing) every 25 dosing cycles. This function is activated by the controller, which opens the field flush valve (zone return), thus allowing the flushed effluent to be returned to the primary tank.

As described above, the system has automated cleaning for maintenance which is dependent on multiple solenoid valves opening and closing. Therefore, if the solenoid valves fail the automated cleaning sequence cannot occur. During system start-up, as outlined in Table 1 below, a few of the solenoid valves had issues because of construction debris being lodged in the diaphragm of the valve.

As a result, a disc filter backflush solenoid valve coil failed and would not open. Following system troubleshooting and the installation of a new coil on September 17, 2013, the system required very little maintenance. A Hazen and Sawyer technician visited the site on a monthly basis; however, the only regular maintenance required was cleaning of the septic tank effluent screen and STE dose tank effluent screen. It is also important that the technician check the float switches and air release valves. The float switches did not have issues during the monitoring period; however one of the air release valves needed to be replaced at the end of the study period.

A description of the start-up issues, routine operation and maintenance items (O&M), the entity that performed the repair/maintenance, and the associated cost are included in Table 1. Table 2 is the summary log of repairs, maintenance actions, inspection results and system observations since start-up. This data, along with data from the other full-scale systems evaluated in Task B, will be used to estimate O&M effort and cost for full-scale passive nitrogen reduction systems (PNRS) in the Life Cycle Cost Analysis (Task B.13).

**Table 1. Site B-HS3: Summary of start-up, routine operation and maintenance issues, repairs and refinement actions**

| Date     | Start-up Issues  | Routine Operations & Maintenance Issues  | Repairs   | System Refinement                      | Time Required (hr) | Estimated Cost <sup>1</sup> |
|----------|--|--|---|--|--------------------|-----------------------------|
| 9/9/13   | H&S cleaned hydraulic unit disc filters; cleaned solenoid valve diaphragms   |  |   |  | 1                  | \$75                        |
| 9/10/13  | H&S troubleshooting - cleaned hydraulic unit disc filters; cleaned solenoid valve diaphragms; determined coil failed |  |   |  | 4                  | \$300                       |
| 9/10/13  | ME pumped primary tank and STE dose tank   |  |   |  | N/A                | \$550                       |
| 9/17/13  | H&S replaced solenoid coil and checked system operation.   |  |   |  | 1                  | \$75                        |
| 9/27/13  |  | H&S cleaned primary tank effluent screen   |   |  | 0.5                | \$38                        |
| 10/11/13 |  |  |   | H&S uploaded new program to controller | 0.5                | \$38                        |
| 10/17/13 |  |  | H&S cleaned sand out from under diaphragm in Stage 1 biofilter solenoid valve |  | 0.5                | \$38                        |
| 7/11/14  |  | H&S cleaned primary tank and STE dose tank effluent screens  |   |  | 1                  | \$75                        |
| 12/17/14 |  | H&S cleaned primary tank and STE dose tank effluent screens; H&S replaced air release valve on feed line to treated effluent drip zone |   |  | 1                  | \$75                        |

ME = maintenance entity = Enviro Services, Inc.

H&S = Hazen and Sawyer (field technician)

HO = homeowner

CHD = county health department

<sup>1</sup>An hourly rate of \$75 was assumed for maintenance entity labor.

**Table 2. Site B-HS3: System inspections, observations, maintenance actions, and repairs log**

| Date       | Description  |
|------------|--|
| 6/14/2013  | PNRS Pre-construction sample event   |
| 6/17/2013  | PNRS construction. Old septic tank removed, new septic tank installed      |
|            | Stage 2 biofilter installed  |
| 6/18/2013  | PNRS construction - backfill to set tanks, anchor trench for liner area    |
| 6/19/2013  | PNRS construction - liner installed by Comanco                             |
|            | Ligno and sand 50/50 filled to toe of lined area, fill dirt to grade       |
| 6/24/2013  | New piezometers PZ-07, PZ-08, and PZ-09 installed and developed            |
|            | 4 Lysimeters installed   |
| 6/26/2013  | Both drip systems covered  |
| 7/9/2013   | Electrician installed panel for system                                     |
| 7/11/2013  | Electrician set up panel for hydraulic unit                                |
|            | Dose times and volumes set   |
| 7/12/2013  | System start-up  |
|            | Installed priming tee on pump. Installed treated effluent flowmeter        |
| 7/17/2013  | Site visit. System ok.   |
| 7/22/2013  | Repaired leaks in feed and return drip lines                               |
|            | Installed new fittings for air release valves                              |
| 7/29/2013  | Site visit. System ok.   |
| 7/31/2013  | Sod installation   |
| 8/15/2013  | Preliminary SE#1   |
| 9/5/2013   | Site visit. System ok.   |
| 9/8/2013   | Homeowner reported alarm went off at 9 pm                                  |
| 9/9/2013   | System check - high water level in STE dose tank                           |
|            | Both hydraulic unit disc filters severely clogged - not able to dose       |
| 9/10/2013  | System check, still high alarm - high water level in STE dose tank         |
| 9/10/2013  | Not able to fix system - need replacement part for hydraulic unit          |
|            | Septic tank was pumped at 4 pm   |
| 9/11/2013  | Homeowner reported no alarms   |
| 9/13/2013  | Site visit. System ok.   |
| 9/17/2013  | Installed replacement solenoid coil on backwash filter valve #2            |
|            | System operational again, septic tank very low volume still after pump-out |
| 9/27/2013  | SE#1 prep  |
|            | Applied vacuum to lysimeters   |
|            | Cleaned primary tank effluent screen                                       |
| 9/30/2013  | Sample Event No. 1   |
| 10/11/2013 | Site visit. System ok. Uploaded new program                                |
| 10/17/2013 | System check   |
|            | Bio solenoid valve ahead of pump had sand under the diaphragm in valve     |
| 11/8/2013  | Site visit. System ok.   |
| 11/15/2013 | Site visit. System ok.   |
| 11/27/2013 | Site visit. System ok.   |
| 12/2/2013  | Sample Event No. 2 preparation   |
| 12/4/2013  | Sample Event No. 2   |
| 12/23/2013 | Site visit. System ok.   |
| 1/23/2014  | Site visit. System ok.   |
| 1/30/2014  | Sample Event No. 3 preparation   |
| 2/3/2014   | Sample Event No. 3   |
| 2/4/2014   | Sample Event No. 4   |
| 2/5/2014   | Sample Event No. 5   |
| 2/6/2014   | Sample Event No. 6   |

**Table 2 (cont.). Site B-HS2: System inspections, observations, maintenance actions, and repairs log**

| Date       | Description  |
|------------|--|
| 2/7/2014   | Sample Event No. 7                                       |
| 2/12/2014  | Site visit. System ok.                                   |
| 3/14/2014  | Site visit. System ok.                                   |
| 4/3/2014   | Sample Event No. 8 (formal No. 4)                        |
| 4/25/2014  | Site visit. System ok.                                   |
| 4/29/2014  | Site visit. System ok.                                   |
| 5/28/2014  | Sample Event No. 9 (formal No. 5)                        |
| 5/29/2014  | Sample Event No. 9 (formal No. 5)                        |
|            | Collected additives testing samples.                     |
| 6/9/2014   | Re-sampled BHS3-STE for toxicity testing.                |
| 7/11/2014  | Site visit. Primary tank water level elevated.           |
|            | Cleaned primary tank effluent screen; severely clogged.  |
|            | Pumped down STE dose tank to below high level float.     |
| 7/29/2014  | Site visit. System ok.                                   |
| 8/21/2014  | Sample Event No. 10 (formal No. 6)                       |
| 8/22/2014  | Sample Event No. 10 (formal No. 6)                       |
| 9/19/2014  | Site visit. System ok.                                   |
| 10/21/2014 | Sample Event No. 11 (formal No. 7) preparation.          |
| 10/23/2014 | Sample Event No. 11 (formal No. 7)                       |
| 10/24/2014 | Sample Event No. 11 (formal No. 7)                       |
| 11/21/2014 | Site visit. System ok.                                   |
| 12/16/2014 | Sample Event No. 12 (formal No. 8) preparation.          |
| 12/17/2014 | Sample Event No. 12 (formal No. 8)                       |
|            | Cleaned primary tank and STE dose tank effluent screens. |
|            | Replaced treated effluent drip feed air relief valve.    |