WASTEWATER TREATMENT SITE EVALUATION
LEBANON VALLEY MOBILE HOME COMMUNITY STP

BETHEL TOWNSHIP, LEBANON COUNTY, PA

NPDES #PA0039551

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTEWATER TECHNICAL ASSISTANCE PROGRAM

Bureau of Clean Water

January 2016

On January 20, 2016, staff from the U.S. Environmental Protection Agency, Region 3, and Pennsylvania DEP visited the Lebanon Valley Mobile Home Community Wastewater Treatment Plant. The purpose of the visit was to discuss with the wastewater treatment plant (WWTP) management and staff possibilities for nutrient reduction and chemical and energy savings, through Process Control / Process Optimization.

The WWTP is a minor facility, which discharges to an unnamed tributary of Little Swatara Creek, located within the Chesapeake Bay Watershed. During the visit, EPA discussed the importance of an activated sludge process-control strategy and possible options for nutrient and energy use reductions.

The WWTP flow consists of the following unit processes:

Liquid Stream	**Solids Stream**
Bar Screen and Commutator	Aerobic Digester/Holding Tank
Equalization Tank	
Aeration Tank	
Secondary Clarifier	
Sand Filters (2)	
Chlorine Contact Tank	

Current Conditions:

The design flow and actual flow are 0.012mgd and approximately 0.05mgd respectively. The WWTP is designed to remove cBOD, TSS, and ammonia-nitrogen. Waste activated sludge is aerobically digested and ultimately hauled out to another WWTP for dewatering and disposal.

At the time of the visit, the sand filter/chlorine contact tank appeared to be in very poor condition due to corrosion of the tank walls, etc. It is suggested that the owner contact his preferred consulting engineer to discuss long-term options for this unit. One possible option discussed with the contract operations firm was a replacement precast concrete filter/disinfection unit. Companies that supply these types of products regularly to small package plants should have design and process engineers on staff to assist the owner with the design, installation, and operation of a new unit.

Many process units are open tanks at ground level. Several sections of grating or covers are missing from these tanks and constitute hazards to worker and community safety, despite the presence of a complete perimeter fence. Because many pipes traverse the surface of the ground, they may be considered trip and fall hazards in conjunction with the open tanks. We recommend covering process tanks with suitable grating and painting the pipes with OSHA safety yellow to make them more visible.

Importance of a Process Control Strategy:

Prior to optimizing a biological nutrient removal process, it is critical for the operations staff to have a good process control strategy in place. The facility superintendent ought to expand the existing process control testing. Having a good process control strategy is a proactive way to operate a WWTP. The additional data gathered and charted can help identify plant upsets and violations before they happen, increase removal efficiency of the WWTP, and aid in the troubleshooting process when issues arise. EPA staff is happy to help develop an appropriate process control strategy and assist with any other recommendations highlighted in this report.

Following are two (2) Optimization Steps offering the facility owner and operator options to consider prior to undertaking significant capital upgrades.

Optimization Step 1 – Clarifier Performance:

Settling of floc particles containing cBOD, nitrogen, and phosphorus normally occurs within secondary clarifiers. However, in order to reduce cBOD and nutrient carry-over in the effluent, the operator must optimize solids settleability.

If greater TSS removal is needed, the facility operator should consider evaluating the performance of the clarifiers. Several adverse factors may reduce the ability of the clarifier to remove solids. Short-circuiting, energy dissipation, high velocity currents, and effluent baffling are all potential issues with an existing clarifier. A detailed study by a specialized engineering firm can quickly identify issues that are hurting performance and limiting TSS removal.

Polymer addition to the clarifiers is a proven way to improve settling. Many proprietary blends that include a mix of metal salts and polymers in one formulation are available. Adding polymers just prior to the final clarifiers may help with aiding the removal of the particles containing phosphorus.

RECOMMENDATION: Request your chemical vendor assist with evaluating products on site. Enquire about blended chemicals with metal salts and polymers in one formulation as this may help with settling.

Optimization Step 2 – Biological Nitrogen Removal:

Biological nitrogen removal is a two-step process that includes nitrification and denitrification. The WWTP aeration blowers are currently controlled manually and operate continuously. Presently, one 5 horsepower (hp) blower aerates the secondary treatment tank and one 3hp blower aerates the equalization tank.

RECOMMENDATION: Consider two options for biological nitrogen removal.

- Option 1: Install a timer to cycle the secondary treatment tank blower on and off, alternating oxic and anoxic conditions, potentially reducing total nitrogen while increasing alkalinity. Many facility operators time the “on” phase for 2-3 hours and the “off” phase for 1-2 hours, assuming the solids will re-suspend.

  This recommendation offers an approximate energy saving benefit of $653/yr. Assumptions and calculations:

  - 5hp blower at 50% load during operation
  - Actual hp would be 2.5
  - Timer set for 2hr. on and 2hr. off

- Total run time per day is 12hrs.
- Total run time per year is 12 hours x 365 days = 4,380 hr. /yr.
- Approximate cost per kWh is $0.08 (including demand charge)
- 2.5hp x 0.746 kW/hp x 4,380 hr./yr. x $0.08/kWh = $653/yr. savings

- Option 2: Create an anoxic zone in the influent section of the existing aeration tank by installing baffle or curtain to separate the two zones. Anoxic zones are typically 35 to 50 percent of the secondary treatment process by volume.[1] An approximate target size is 35-50% of the secondary treatment time. The facility's engineer should evaluate the ideal HDT and size, while specifying subsurface mixers to maximize nitrogen removal.

Nitrate recycling is also critical. Two options identified below:

- Option 1: The return activated sludge flow may have to be maximized to return as much of the nitrate-nitrogen as possible.
- Option 2: Install an internal mixed liquor recycle pump at a point where it can deliver the bulk of the aerobic tank effluent back to the head of the anoxic zone, having the capacity to deliver approximately four times the influent flow of the facility.

To determine if the efficiency of the listed options, design should incorporate the following conditions:

- The anoxic zone should have an Oxidation-Reduction Potential within the range of 50 to -50.[2]
- When compared to the return activated sludge or effluent of the aeration tank, there should be a decrease of nitrite-nitrogen and nitrate-nitrogen.

If the removal of total nitrogen is minimal, it may be due to the lack of a carbon source in the anoxic zone. A possible option would be to convert the sludge digester into a sludge fermenter. Install a small transfer pump to return a portion of the sludge fermenter liquid (high in volatile fatty acids) to the head of the anoxic zone. This provides a supplemental carbon source for denitrification.

- Option 3: Convert the existing equalization tank into an anoxic tank. The same principles follow for this option as for option 2. Extend the return activated sludge pipes to the equalization tank or, to achieve higher denitrification rate, install an adequately sized internal recycle pump. The existing equalization lift pump will have to have the capacity to handle the increased flow. Eliminate the cascade of falling water, which introduces additional dissolved oxygen into what ought to be anoxic, from the equalization tank's flow splitter box by redesigning its plumbing. All discharge piping into the new anoxic zone should be below liquid level to keep the DO at 0mg/l.

[1] EPA Nutrient Removal Technologies Reference Document Volume 1

[2] YSI Article: ORP Management in Wastewater as an Indicator of Process Efficiency

Notify the PA Department of Environmental Protection (DEP) prior to implementing any modification to the approved treatment pattern, and obtain written approval, even for temporary or experimental changes. DEP is able to consider low-cost re-purposing of tankage as a pilot study. Plans for retooling or replacing processes at this facility may require the permitee to submit a Part II NPDES Permit application to the DEP regional office prior to the start of any work.

ATTACHMENT 1: SITE PHOTOGRAPHS

Photo 1: STP view due south, (Google Earth)

Photo 2: Pretreatment Headworks

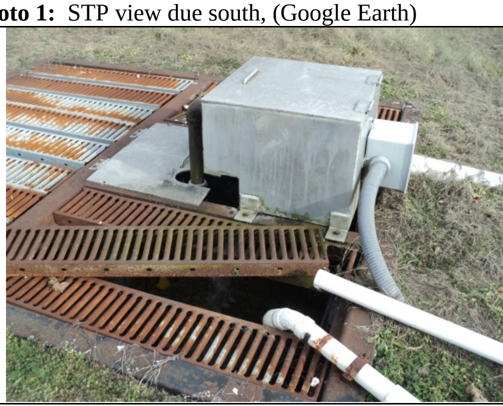

Photo 3: Equalization Tank & Inflow Lift Pumps

Photo 4: View from EQT to Secondary Treatment Unit

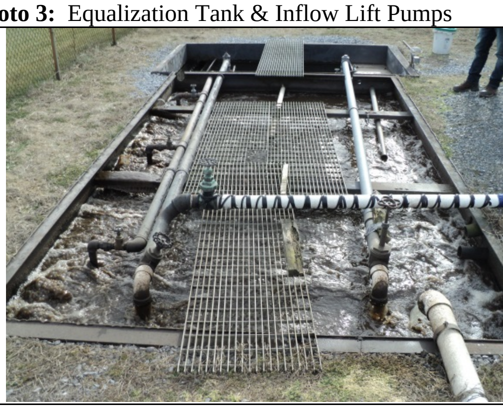

Photo 5: Secondary Treatment Unit

Photo 6: Sludge Holding Tank / Digester

Photo 7: Clarifiers with air-lift pumps

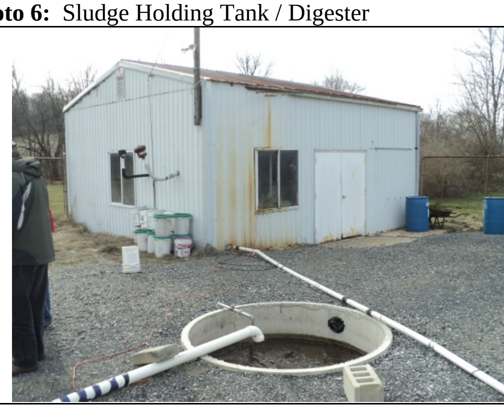

Photo 8: View of Existing Filter/Blower Building

Photographs, continued…

Photo 9: Air Compressors / PD Blowers

Photo 10: Disinfectant tank & Flow Meters

Photo 11: View of Filter Cells

Photo 12: View of tank corrosion

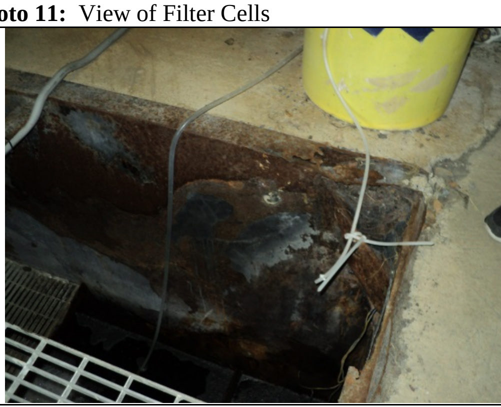

Photo 13: View of tank corrosion

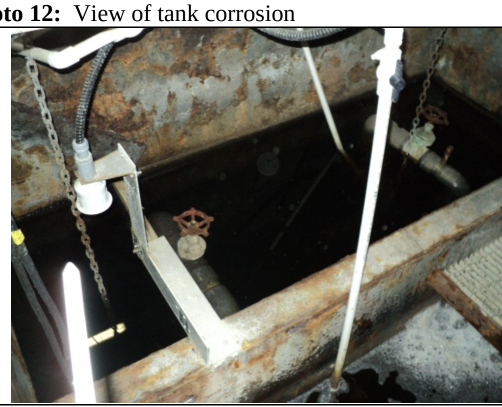

Photo 14: View of Flowmeter head and valve controls

ATTACHMENT 2: NPDES PERMIT LIMITS

Parameter	Effluent Limitations						Monitoring Requirements	
	Mass Units (lb./day) (1)		Concentrations (mg/L)				Minimum (2) Measurement Frequency	Required Sample Type
	Average Monthly	Total Annual	Minimum	Average Monthly		Instant. Maximum		
Flow (MGD)	Report	Report Daily Max	XXX	XXX	XXX	XXX	Continuous	Measured
pH (S.U.)	XXX	XXX	6	XXX	XXX	9	1/day	Grab
Dissolved Oxygen	XXX	XXX	5	XXX	XXX	XXX	1/day	Grab
Total Residual Chlorine	XXX	XXX	XXX	0.1	XXX	0.33	1/day	Grab
CBOD5	XXX	XXX	XXX	10	XXX	20	2/month	8-Hr Composite
Total Suspended Solids	XXX	XXX	XXX	10	XXX	20	2/month	8-Hr Composite
Fecal Coliform (CFU/100 ml) May 1 - Sep 30	XXX	XXX	XXX	200 Geo Mean	XXX	1,000	2/month	Grab
Fecal Coliform (CFU/100 ml) Oct 1 - Apr 30	XXX	XXX	XXX	2,000 Geo Mean	XXX	10,000	2/month	Grab
Ammonia-Nitrogen May 1 - Oct 31	XXX	XXX	XXX	3.0	XXX	6.0	2/month	8-Hr Composite
Ammonia-Nitrogen Nov 1 - Apr 30	XXX	XXX	XXX	9.0	XXX	18.0	2/month	8-Hr Composite
Total Phosphorus(3)	XXX	XXX	XXX	Report Annl Avg	XXX	XXX	1/year	8-Hr Composite
Total Nitrogen(3)	XXX	Report	XXX	Report Annl Avg	XXX	XXX	1/year	Calculation