Bureau of Point and Non-Point Source Management
Technical Assistance Program

ENHANCED TECHNICAL ASSISTANCE EVALUATION

Jackson Center Borough
Wastewater Treatment Plant

Jackson Center Borough, Mercer County

NPDES #PA0103331

The Pennsylvania Department of Environmental Protection (DEP) conducted an Enhanced Technical Assistance Evaluation (ETAE) of the Jackson Center Borough (JCB) wastewater treatment plant (WWTP) from March 2013 through April 2013. An ETAE is an evaluation of existing operations and practices followed by small-scale operational changes meant to optimize effluent quality. The purpose for optimizing effluent quality is to reduce nutrients in the final effluent, with an overall goal of improving surface water quality. The ETAE was performed by staff of DEP's Bureau of Point and Non-Point Source Management (BPNSM), Technical Assistance Section.

This project was conducted at the request of the DEP Regional office staff. The JCB plant has a history of effluent violations over the past several years and is attempting to improve operations and effluent quality while complying with a Consent Order and Agreement.

JCB owns a sewage treatment plant (treatment plant) and collection system that serves Jackson Center Borough and a portion of Jackson Township under National Pollutant Discharge Elimination System (NPDES) Permit No. PA0103331.

The current treatment plant consists of two treatment trains; one primarily for domestic sewage and the other for industrial waste with some minimal sewage. The industrial train treats all waste streams collected from the industrial park. The trains are nearly equal in size, the sewage train is rated at 0.05 MGD and the industrial train is rated at 0.048 MGD. There is some common piping between the two trains to allow waste sludge to be transferred from one train to another and serves various other functions. The industrial train treats waste from several facilities including a veneer plant which is a Significant Industrial User (SIU).

Findings

1. In general the findings of the ETAE concur with those identified in the Northwest Engineering, Inc. Engineering Evaluation Report provided to Jackson Center Borough on June 6, 2012.
2. The sludge wasting frequency from the domestic sewage train should be increased to prevent denitrification and rising chunks of solids. This should significantly aide in reducing the volume of solids discharged to the chlorine contact tank and the receiving stream Generally, the sewage sludge is "wasted" from the sewage clarifier to the aeration tank of the industrial plant as seed sludge on a weekly basis. As shown in Figure 1 above, it appears that weekly wasting of sludge is not adequate. This frequency would not be typical at a traditional wastewater plant and appears to not be very effective here either. More frequent wasting should reduce denitrification in the clarifier which appears to be causing the excess sludge rising to the surface. Excess nitrate trapped in the sludge converts to nitrogen gas while sitting in the clarifier with no oxygen and rises with the sludge to the surface. This will lead to excess solids discharged in the effluent. On several occasions the clarifier was covered with sludge which is attributed to the infrequent wasting. See Figure 1 below.
3. There are many air leaks and pipe leaks throughout the facility that should be repaired.
4. Much of the grating is rusted and its safety/stability is questionable.

5. Test results indicate a level of nitrification was occurring in both treatment trains during the evaluation. The domestic sewage train was much more effective with nitrification than the industrial waste train.
6. The nitrogen components of the industrial waste stream are near levels where a nutrient deficiency is a concern. In instances where Biological Oxygen Demand (BOD) levels were drastically higher, which do occur, and there are not associated increases with the nutrients this would be more of a concern. The yearlong data collection effort directed by the engineer should provide useful data to address this issue.

7. As with any wastewater plant, having enough operational data to represent the influent, effluent, and operations within the tankage is essential. At this facility it is essential due to the distinct waste streams and operations occurring within each treatment train. The collection of data as referenced in the Engineering evaluation will be key to successfully operating this facility.

8. One of the skimmers nearest the influent end of the sewage clarifier appears to be out of operation as evidenced by missing piping for the airlift portion of a skimmer. A skimmer in this location would assist in removing the floating solids as pictured above. Increasing or adjusting the return activated sludge rates may also help to reduce this situation.

Figure 1: Photo of clarifier for the domestic sewage plant.

More frequent feeding of healthy biomass to the industrial side of the plant should provide that train with more active and healthy biomass in turn improving the industrial waste (IW) train performance. Several microscopic evaluations of the IW train mixed liquor revealed nearly no active protozoa.

The domestic sewage train had an appearance typical of a wastewater plant, while the industrial treatment plant train had a dark colored influent which carried through to the effluent as seen in the Figure 2.

Figure 2: Industrial waste treatment plant effluent on the left and sewage treatment plant effluent on the right.

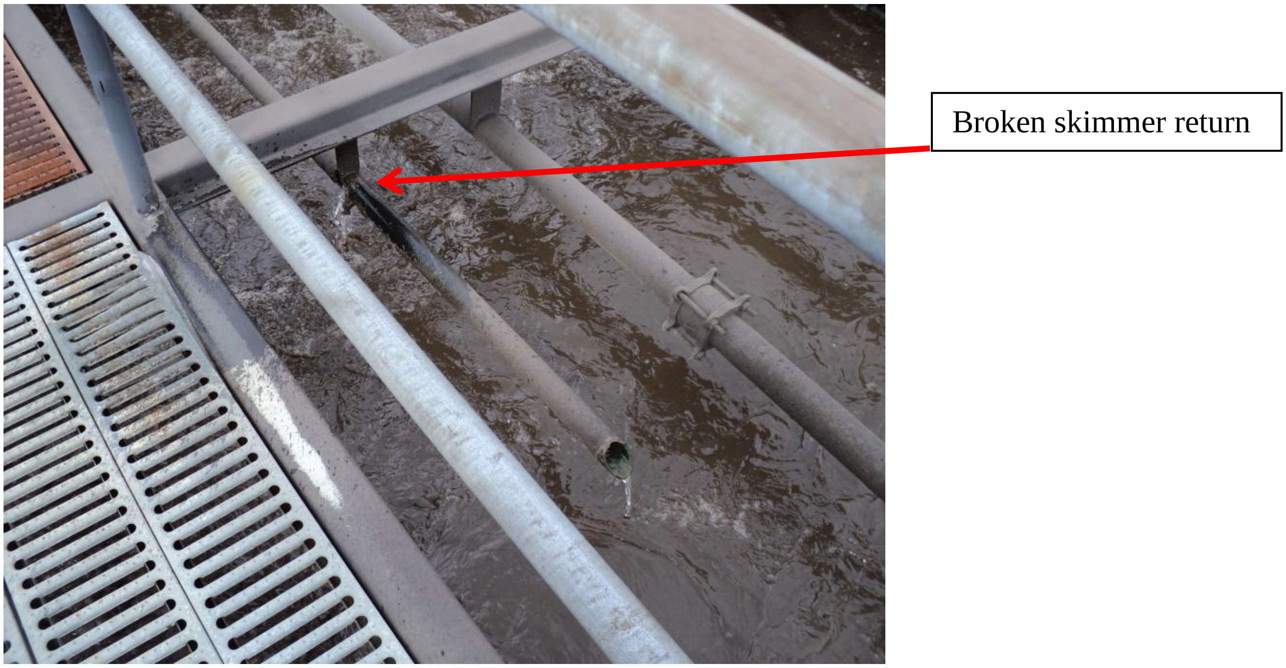

Figure 3: Broken skimmer return piping in the domestic sewage train.

There are several areas in the wastewater plants with leaking air lines, broken or cracked waste lines, and grating that is thoroughly rusted; the safety of the grating is questionable at best.

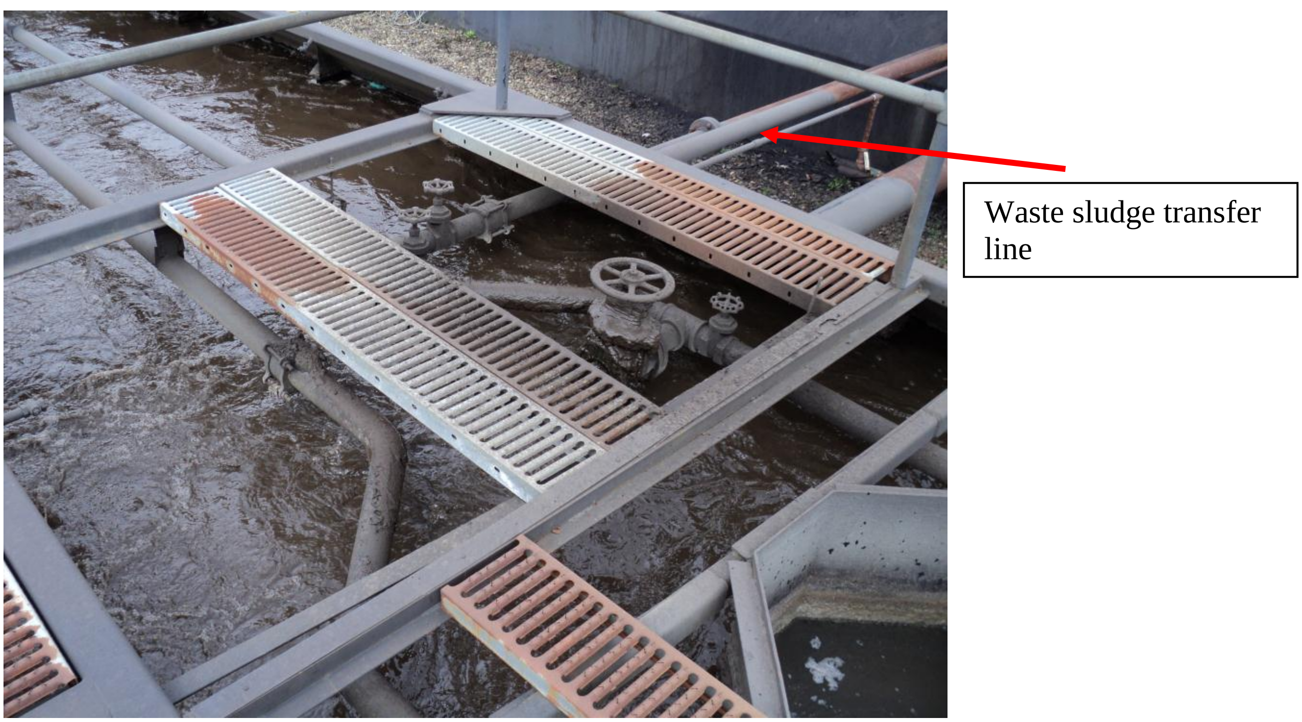

Figure 4: The waste sludge transfer line to move domestic waste sludge to the industrial side aeration tank.

In order to identify the relative health and/or toxicity affecting the mixed liquor of each treatment train, the DEP conducted some preliminary Oxygen Uptake Rate (OUR) testing. These tests show the consumption of oxygen as the bacteria respire. Results of this testing indicate the relative activity of the biomass to be on the lower end of the scale. Less oxygen consumption indicates a less healthy biomass. There was not much difference in the respiration rates of the mixed liquor in each treatment train. While the initial Dissolved Oxygen (DO) levels were much higher in the domestic side, the respiration rate was slightly higher in the industrial side treatment train.

Additional samples of the domestic mixed liquor were collected and seeded with aliquots of domestic sewage and industrial waste influents to further analyze the effects. Utilizing the mixed liquor readings averaging 1800 mg/l and assuming 75% volatile solids, the Mixed Liquor Volatile Suspended Solids (MLVSS) would have been approximately 1350 mg/l. The Specific Oxygen Uptake Rate (SOUR) is calculated by taking the ((OUR x 1000)/MLVSS). Calculating the Specific Oxygen Uptake Rate (SOUR) for each train indicates the results to be approximately in the 8-10 mg O2/g-MLVSS-h, the higher values are associated with the domestic sewage and the aliquot of mixed liquor. These values are low when compared to healthy mixed liquor at traditional wastewater plant; a more desirable target range would be 12-20 mg O2/g-MLVSS-h. The results are in the range that indicates high solids and endogenous respiration, poor settling, and/or a toxicity effect. Further sampling should be conducted to get a better representation of the relative health of the biomass and effects of the waste streams.

Jackson Center				**Date:**	4/18/2013	
OUR Testing						
Location:	Domestic MLSS				Time	D.O.
					0	4.6
OUR = slope x 60					1	4.39
					2	4.23
slope =	1.08				3	4.1
	10				4	3.97
					5	3.85
OUR =	1.08	x	60		6	3.74
	10				7	3.63
					8	3.51
OUR =	6.48	mg O2/L-h			9	3.41
					10	3.31

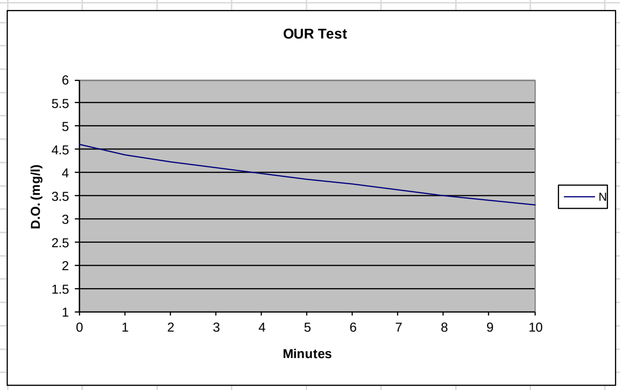

Figure 5: Oxygen Uptake Rate (OUR) results for a sample of the mixed liquor from the domestic sewage treatment train.

Location: Industrial MLSS

OUR = slope x 60

slope = 1.28 / 10

OUR = 1.28 / 10 x 60

OUR = 7.68 mg O2/L-h

Time	D.O.
0	3.15
1	2.7
2	2.45
3	2.3
4	2.16
5	2.03
6	1.9
7	1.78
8	1.66
9	1.53
10	1.42

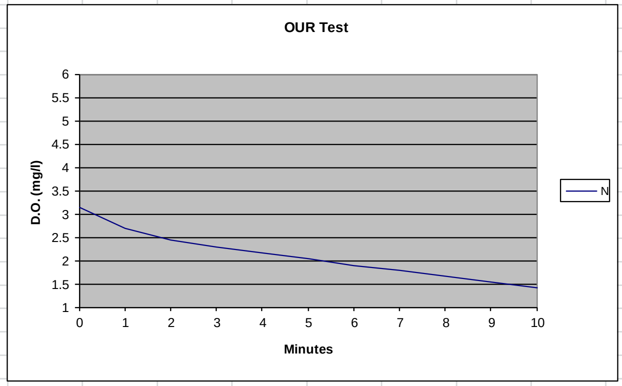

Figure 6: Oxygen Uptake Rate (OUR) results for a sample of the mixed liquor from the industrial waste treatment train.

Jackson Center **Date:** 4/18/2013

OUR Testing

Location: Municipal Influent & MLSS

OUR = slope x 60

slope = 2.30 / 10

OUR = 2.30 / 10 x 60

OUR = 13.8 mg O2/L-h

Time	D.O.
0	5.75
1	5.25
2	4.99
3	4.73
4	4.48
5	4.22
6	3.97
7	3.72
8	3.45
9	3.2
10	2.95

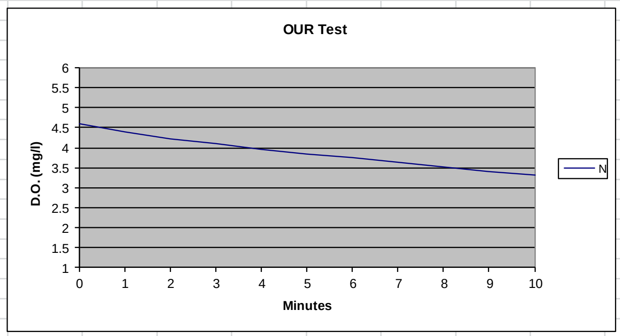

Figure 7: Oxygen Uptake Rate (OUR) results for a sample of the mixed liquor from the domestic sewage treatment train and an aliquot of the raw sewage.

Location: Industrial Influent & MLSS

OUR = slope x 60

slope = 1.98 / 10

OUR = 1.98 / 10 x 60

OUR = 11.88 mg O2/L-h

Time	D.O.
0	3.39
1	3.04
2	2.8
3	2.57
4	2.34
5	2.12
6	1.91
7	1.69
8	1.48
9	1.27
10	1.06

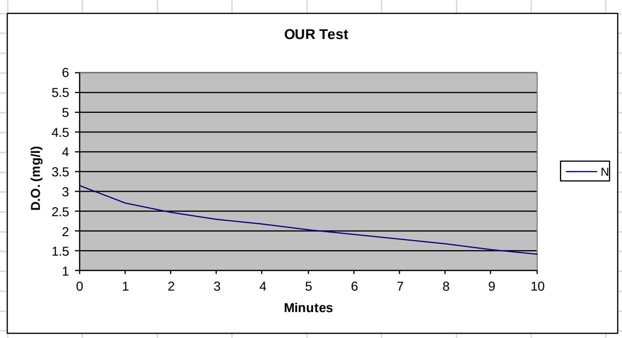

Figure 8: Oxygen Uptake Rate (OUR) results for a sample of the mixed liquor from the domestic sewage treatment train and an aliquot of the raw industrial waste.

There appears to be several air leaks throughout the facility that can be heard while standing near the treatment units. This in conjunction with high DO levels in both treatment trains represents wasted energy and the potential for energy savings. As referenced in the engineer review, a DO level of 2-4 mg/l is usually sufficient for treatment of domestic sewage. The industrial side should maintain DO levels of at least 4-5 mg/l. This is especially important because of the overall characteristics of the industrial wastewater which, while having high DO levels in the aeration tank, has very minimal Oxidation Reduction Potential (ORP) measurements. This appears to be to the chemical makeup of the industrial wastewater itself. If the air leaks were repaired and the DO levels dropped to target ranges the blowers could possibly be run in an on/off configuration or at reduced speeds to conserve energy costs. Further coordination with your engineer could allow JCB to realize these savings.

Permit Modifications— Any modifications to the permitted treatment process may require an amendment to the Water Management Permit. If you are unsure whether a permit modification is necessary, please contact the DEP regional office that supports your wastewater facility prior to making any modifications.

Disclaimers:
The mention of a particular brand of equipment is in no way an endorsement for any specific company. DEP urges the permittee to research available products and select those which are the most applicable for its situation. The goal of the Enhanced Technical Assistance Evaluation is to reduce nutrients in wastewater plant discharges. This often times involves permittees achieving effluent quality above and beyond any permit requirements.

Attachment A— ETAE Team

JCB Wastewater Treatment Plant

ETAE Team

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Wastewater plant representative

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Attachment B— Equipment Deployed

Digital, Continuously Monitoring Probes

Laboratory Equipment On-Loan

Digital, Continuously Monitoring Probes:

1 – Laptop computer with signal converter, 2 – SC1000s, 2 – LDO probes, 1– pH probe, 2 – ORP probes, 1 – NH_4D, 1 – Nitrate Probe, 1 – Solitax probe

Laboratory Equipment On-loan:

1 – Hach HQ40d handheld pH and LDO meter, 1 – DR2800 spectrophotometer, TNTplus test vials for measuring Nitrate-LR, Ammonia-LR, Alkalinity, Digital Reactor Block, Phosphorus-Total-HR

Figure B.1: Photo showing example of online monitoring equipment installed on the industrial train. Much of the grating throughout the facility is heavily rusted similar to that shown in the picture.

Attachment C— Sampling Data

						Lab Resutls-Jackson Center WWTP							
Date	Location	Sample #	BOD5	TSS	NH3-N	NO2-N	NO3-N	TKN	Tot Phos	Alkalinity	SPC Cond	COD	BOD/COD %
4/8/2013	Ind plant influent from EQ	3344001	138	234	.72	.01	.04	10.04	3.461	220.4	1212	439.9	31.4
4/8/2013	Ind effl from disch to CCT	3344002	54.6	120	0.28	0.1	5.89	10.4	1.966	212.6	1440	191.9	28.5
4/8/2013	STP influent to aeration	3344003	212	158	35.64	0.08	0.31	43.3	5.317	327.2	2270	359.1	59.0
4/8/2013	STP effl from disch to CCT	3344004	16.6	5	1.5	0.27	24.28	3.49	1.609	97.6	1649	33.6	49.4
5/6/2013	Ind plant influent from EQ	3344001	133	180	4.7	0.01	0.04	11.8	3.048	256.4	1720	375	35.5
5/6/2013	Ind effl from disch to CCT	3344002	10.5	39	0.35	0.11	6.13	3.39	0.557	192.4	1168	42.3	24.8
5/6/2013	STP influent to aeration	3344003	201	228	27.07	0.03	0.09	39.8	7.114	287.8		393.7	51.1
5/6/2013	STP effl from disch to CCT	3344004	6.1	8	0.14	0.04	29.42	2.17	3.192	86		28.6	21.3
5/6/2013	infl mix	3344005	160	206	16.06	0.02	0.04	26.4	4.942	260.8		706.2	22.7
5/6/2013	effl mix	3344006	3.4	26	0.18	0.01	15.86	2.72	1.609	150		35.2	9.7

Table C.1: This table shows results of influent and effluent grab samples collected by the DEP.

Attachment D— Continuous Monitoring Charts

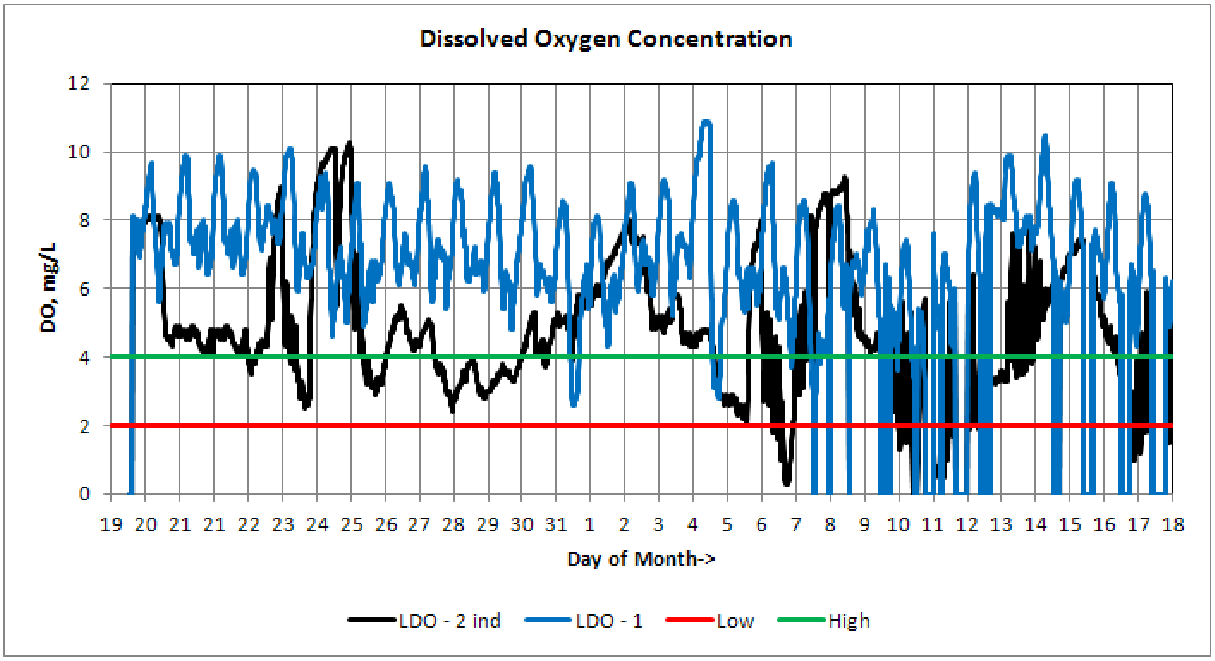

Figure D.1: This figure shows the Dissoloved Oxygen (DO) in the domestic and industrial sides. There is excess DO present in both sides of the treatment processes. Equipment errors led to the numbers dips in the readings toward the last 10 days of the evaluation.

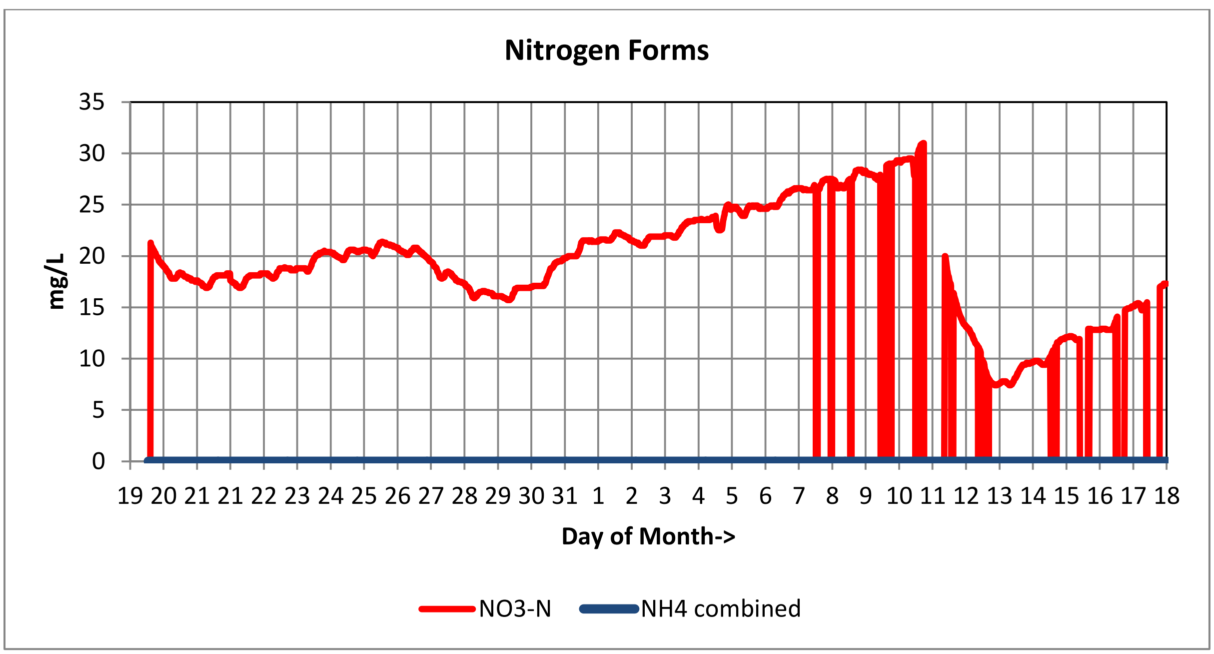

Figure D.2: This figure shows nitrification occurring during the ETAE; ammonia values were negligible while the nitrate levels were elevated. This data was collected from the chlorine contact tank which would only represent the domestic sewage side of the facility.

Attachment E—NPDES Effluent Discharge Limits

JCB Sewage Treatment Plant
NPDES PA0103331

Discharge Parameter	Effluent Limitations							
	Mass Units (lbs/day)		Concentrations (mg/L)				Monitoring Requirements	
	Average	Maximum	Minimum	Monthly Average	Weekly Average	Maximum	Minimum Measurement Frequency	Required Sample Type
$CBOD_5$ (11/01 – 4/30)	21	33		25	40		1/week	24-hr comp
Total Suspended Solids	25	37		30	45		1/week	24-hr comp
Ammonia – N (05/01 – 10/31)	7.0			8.5			1/week	24-hr comp
Ammonia –N (11/01 – 04/30)	21			25			1/week	24-hr comp
Total Residual Chlorine				0.5			30/month	Grab
Dissolved Oxygen			3.0				1/week	Grab
pH			6.0			9.0	1/week	Grab
Fecal Coliform 5/1 - 9/0			200/100 ml as a geometric average, not greater than 1,000/100 ml in more than 10% of the samples tested				1/week	Grab
10/1 - 4/30			2000/100 ml as a geometric average				1/week	Grab

Table E.1. JCB- NPDES effluent limitations