Case studies:
Biological dredging™ and enhanced biogas generation at industrial lagoon systems

Drylet,Inc.

Contents

Section 1 – Executive summary of projects

Drylet was tasked with analyzing and making a recommendation for three separate facilities that were experiencing difficulties breaking down accumulated solids in wastewater lagoons systems utilized by a major industrial client. The client's lagoon sites are located in Oklahoma and Texas. Two of the lagoon systems (Facilities A, B) had a significant buildup of solids from biomass as well as fats, oils and grease over several years of use. The third facility (Facility C) was a greenfield anaerobic digestion plant constructed and commissioned in early 2019. The greenfield system had experienced several operational upsets that caused a diminished amount of biogas production and poor treatment.

The **Facility A** site is comprised of 5 lagoons and a finishing pond. The first 2 lagoons (Lagoons 1, 2) are anaerobic digesters which operate in series. Downstream of Lagoons 1 and 2 are three aerobic lagoons (Lagoons 3, 4, 5) which also operate in series. Both Lagoons 1 and 2 had been experiencing poor biogas production performance over several months before Drylet was contacted to help. The poor performance was due to overloading the wastewater plant, which led to an accumulation of solids throughout the system. Lagoon 3 images below (Figure 1) provide visual evidence of the quantity of solids that had accumulated and illustrate the before/after changes in the lagoon from treatment using Drylet's biocatalyst.

September 2018 – Before product addition

April 2019 – After product addition (3 months)

Figure 1 - Before and after product performance for Lagoon 3 at Facility A

Facility A’s treatment consisted of one dosing in January, followed by a second dosing in March. Drylet took samples and detailed measurements throughout the treatment period. As shown on the image at right, the team analyzed the first anaerobic digester influent (point 1), first anaerobic digester effluent (point 2), second anaerobic digester effluent (point 3), first aerobic lagoon effluent (point 4), second aerobic lagoon effluent (point 5), final aerobic lagoon effluent (point 6), and the finishing pond (point 7).

Atypical response to solids breakdown is shownin Figure 2.

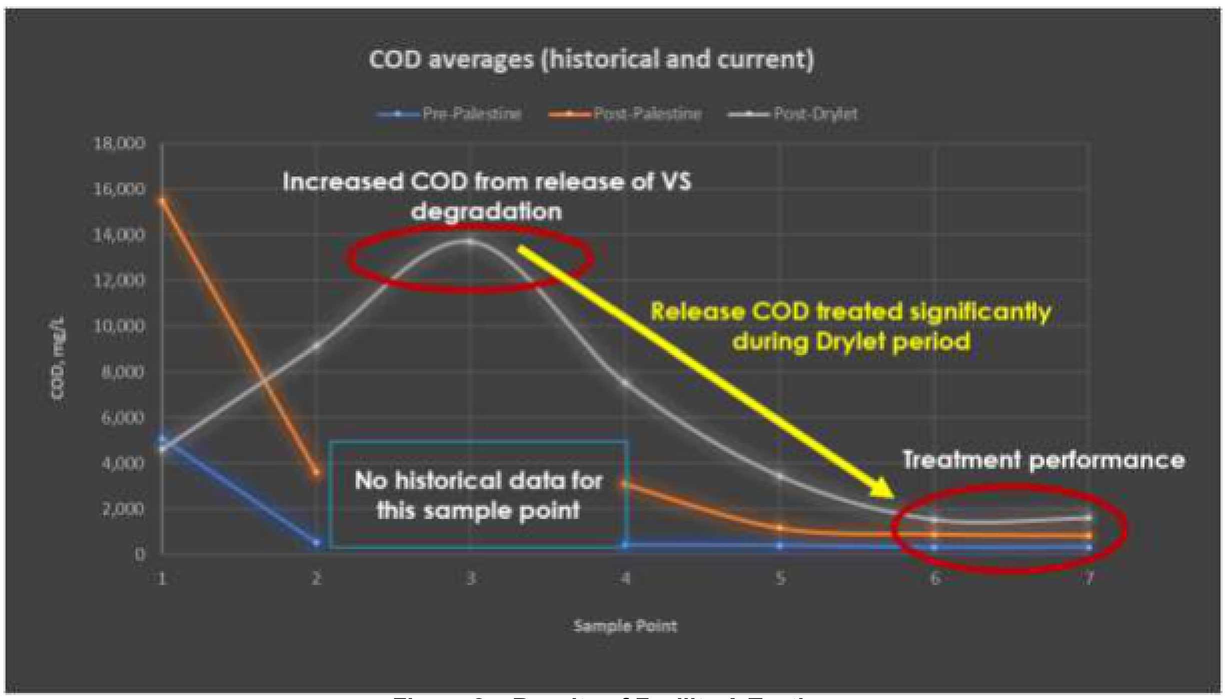

Figure 2 – Results of Facility A Testing

Prior to the Drylet treatment period (gray trend line), the wastewater treatment facility was in good operational condition as shown by the blue trend line in Figure 2. The orange trend line represents the lagoon operational upset as the wastewater treatment system was overloaded by excess waste from the production facility due to an increase in production load over a period of 12 months.

The overloaded production plant led to an increase in the COD load to the wastewater treatment facility resulting in undigested solids being accumulated throughout each lagoon, primarily in anaerobic Lagoons 1 and 2. Though the COD concentration is shown to decrease from point 1 to point 2 for the orange trend line, solids were accumulating in the anaerobic digesters while the rate of biogas flaring decreased dramatically from 12 hours per day to 2 hours per day.

To remedy the poor performance, Drylet treated the anaerobic digesters and the downstream aerobic lagoons. It was anticipated that the excess particulate or solids COD would be broken down in Lagoons 1 and 2, thus leading to higher COD released downstream. This can be seen by the peak in COD concentration (gray trend line in Figure 2) for point 3 (anaerobic lagoon 2 effluent). This peak in COD is indicative indeed of cell lysing of the accumulated cell debris, in addition to the decomposition of the solids phase accumulation of fats, oil, proteins, and greases in the anaerobic digester system. In addition to breaking down solids build-up in Lagoons 1 and 2, dosing Drylet's biocatalyst throughout the system caused also the drastic reduction of soluble COD throughout Lagoons 3, 4 and 5 -- as can be seen on the graph – indicative of high treatment efficacy.

The **Facility B** site is a 600,000-gallon covered lagoon (anaerobic digester) which had accumulated solids mostly from the solidification of fats, oils and greases. Drylet's technical team took composite samples from each port located on the covered lagoon and analyzed the existing Total Solids (TS) and sludge concentration.

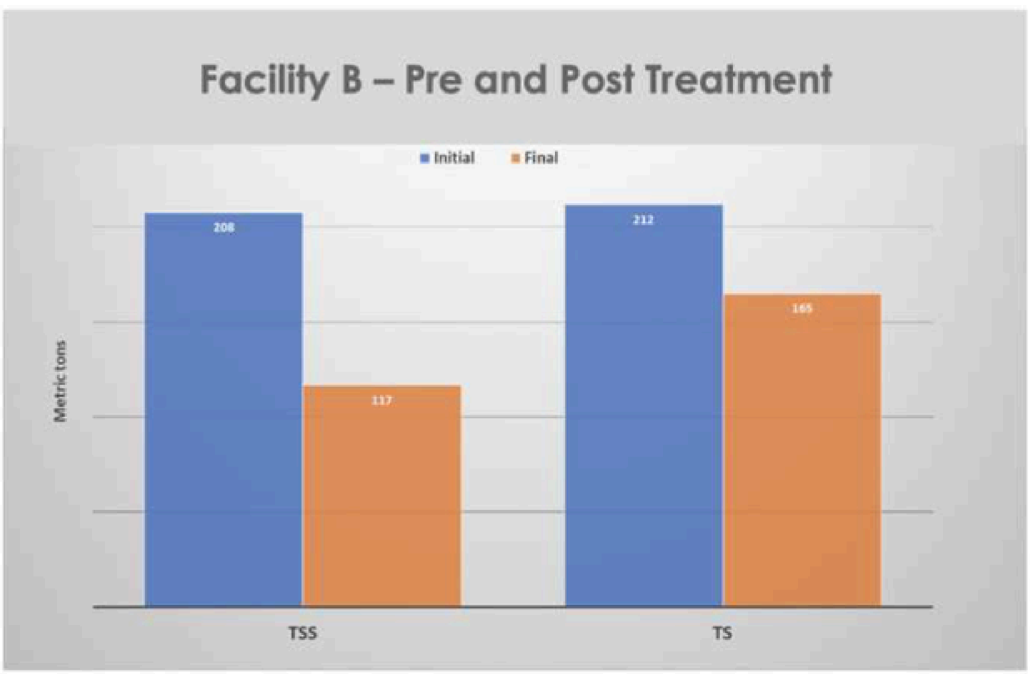

Figure 3 - Solids reduction on mass basis

Once the sampling was complete, Drylet's product was applied directly into each portand added in the lagoon influent. The results shown in Figure 3 highlight the changes fromthe initial solids content to the final solids content. The measurements included a 44% reduction in Total Suspended Solids (TSS) and a 22% reduction in Total Solids (TS).

The **Facility C** site is a new processing plant with a design capacity of 3 million gallons. The lagoon is covered and operates as an anaerobic digester. Both the process plant and wastewater plant had been operational for about 11 weeks when the wastewater plant lost most of its biogas production and anaerobic treatment capabilities, as seen by the “trough” in biogas production in Figure 4 (starting around June 9th, 2019.)

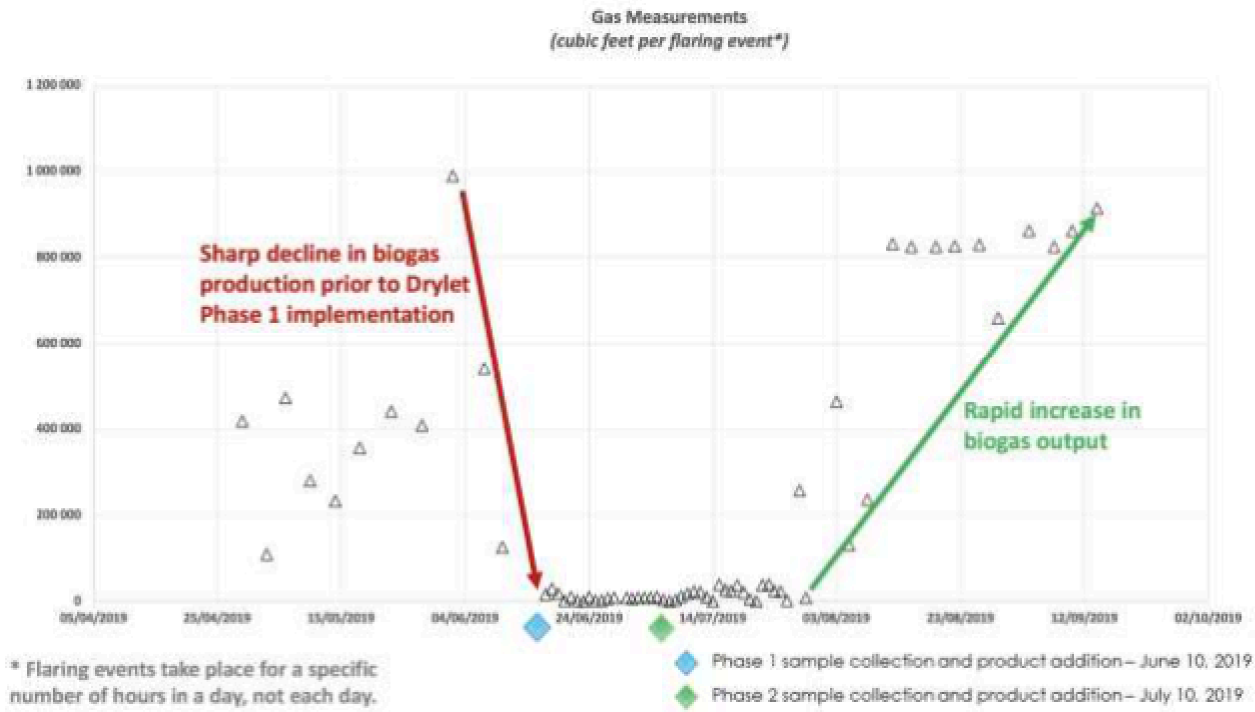

Figure 4 – Biogas output from Facility C

Prior to the addition of Drylet’s product, Facility C’s anaerobic digester was averaging approximately 400,000 cubic feet of biogas per week, as measured through flaring events running for a specific number of hours in a day but not necessarily each day. By the middle of August 2019, it was producing biogas in the range of 1.5 to 4 million cubic feet of biogas per week with a 10-week average of 2 million cubic feet per week.

Takeaway

Drylet’s biocatalyst is a microbe-delivery platform comprised of highly porous precipitated silica (food grade) combined with a specific consortia of organic matter consuming bacteria. In all three cases introduced above, using Drylet’s proprietary technology led to the significantly improved breakdown of accumulated solids (cell debris and accumulated fats, oils, proteins and grease). The improved breakdown of these organic materials led to improved lagoon capacity, increased biogas production, and overall better treatment for lagoon systems.

Drylet’s product has demonstrated efficacy in lagoon systems that have historically experienced difficulties such as influent COD overloading and plant startup/commissioning issues. Even in the absence of operational or performance issues, however, Drylet’s product provides tangible benefits, including:

- cost savings

- operational improvements
- superior performance and solids reduction relative to traditional methods of dredging and solids disposal
- non-disruptive treatment method of dredging and solids disposal

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Section 2 – Facility A results and data analysis

2.1 Executive Summary

Products developed from Drylet's technology are used for enhancing microbial activity in biological wastewater and solids treatment systems. In this specific case, Aqua Assist and Bio Dredger biocatalysts were applied to help boost anaerobic digestion in Lagoons 1 and 2 and to enhance solids reduction in aerobic lagoons 3, 4 and 5. Bio Dredger, in particular, is a lagoon treatment product pre-loaded with selective bacteria that will alter their metabolic process between aerobic and anaerobic states to achieve the desired outcome of solids reduction. The bacteria will hydrolyze the particulate organic matter comprised of lipids, carbohydrates, proteins, cell debris and other biochemical molecules forming smaller hydrocarbon building blocks for both new cell growth and cell maintenance. Ultimately, this will lead to increased gas production, mostly in the form of carbon dioxide and methane. It is expected that increased biological activity leads to simultaneous decreased solids concentration and increased gas released from organic matter degradation.

The results obtained indicate that total solids in the lagoons were reduced by 42% over the first 83 days following the application of the product. Total solids avoided was estimated to be 1.3 million lbs (634 tons) comprised of 0.5 million lbs (256 tons) solids destroyed in the lagoons and 0.8 million lbs (378 tons) in avoided solids accumulation from the treatment of 2.7 million lbs (1,341 tons) of COD received during the period.

2.2 Overview and Analytical approach

Prior to the start of the trial dosing, detailed assessments of the solids levels in each of the lagoons were undertaken. Composite sampling methods were utilized (see **Figures 1 and 2**), which allowed Drylet to determine the average solids quantity across all the depth layers at any specific location in the lagoons.

Multiple sampling locations (7 – 11) were identified per lagoon (see **Table 1** below and **Appendix** for details). Samples collected from each of the locations were analyzed and the Total Solids (TS) and Volatile Solids (VS) values were determined. Sampling was carried out twice – at the beginning of the demonstration on November 1, 2018 and on January 23rd, 2019. The time lag between the two sampling events was 83 days. Detailed information on the sampling locations can be found in the appendix.

Figure 1 and 2: Composite sampling equipment used at Facility A

2.3 Lagoon samples, volumes and layout

The solids inventory for Lagoons 2, 3, 4, and 5 was calculated based on the average solids concentration from the composite samples. The number of samples collected for each lagoon isshown in **Table 1**. The site wastewater treatment layout is shown in **Figure 3**.

Lagoon location	Number of samples	Volumes (MGD)
Lagoon 2	8	1.2
Lagoon 3	11	2.0
Lagoon 4	7	1.1
Lagoon 5	7	1.1

Table 1 - Number of samples collected for each lagoon

Note: Lagoon 1 was not sampled due to high levels of hydrogen sulfide gas; however, solids reduction results are expected to be enhanced due to significant increases in observed biogas volume at Lagoon 1.

Figure 3 – Facility A, treatment lagoon layout

Note: L6 is a storm water sink and not part of the wastewater treatment process. L7 is the finishing pond.

2.4 Results for total solids removed from system

Theestimated total solids avoided for the 83-day Drylet period is 1.27 million pounds or 634 tons.Thisreduction in total solids amounts to a 42% overall reduction based on the accumulated solidsinlagoons 2, 3, 4 and 5 while accounting for incremental solids generated from the COD loadtotheplant of approximately 32,312 pounds of COD per day. The results summary is providedbelow in **Table 2**.

Solids analysis during Drylet period	
Biomass yield	0.30
Load to system (lbs COD per day)	32,312
Total solids in lagoons at start (lbs)	2,275,657
Totals solids in lagoon at end (lbs)	1,764,172
Total accumulated solids change (lbs)	-511,485
Total solids generated from COD removed (lbs)	756,253
Solids avoided with Drylet (lbs)	***1,267,738***
Solids avoided with Drylet (lbs/day)	***15,274***
Solids avoided with Drylet (tons)	***634***
Solids avoided per day over Drylet period (tons/day)	***7.6***
Drylet added during period (lbs)	2,370
Solids avoided per unit mass of Drylet (lbs solids/lbs Drylet)	***535***
% reduction in totals solids (accumulated + solids generated)	***42%***

Table 2 - Results summary for total solids

2.5 Composite samples analysis for TS, VS and inert materials and mass calculations

The initial samples were collected on November 1, 2018 and the final samples were collected on January 23, 2019. Due to the difficulties in collecting composites from the middle of lagoons 3, 4, and 5, representative composites were taken from the sides of each lagoon to a depth ranging from 4 to 5 feet per sample.

The composite samples analysis for the aerobic and anaerobic lagoons are listed in **Table 3** representing the mass ratios of TS and VS. The description of the sample analysis is provided below for each type:

- i, initial sample collected
- f, final sample collected

- TS, Total Solids
- VS, Volatile Solids
- Inert materials, non-biodegradable fraction

The inert materials were calculated by observing the difference between the TS and VS values.

The mass of accumulated total solids and volatile solids is based on the product of the lagoon volume, the average TS or VS mass ratio and a density of 8.59 pounds per gallons.

$$\boldsymbol{Mass\ (pounds) = Volume\ (MG) \times Mass\ ratio\ \left(\frac{mg}{kg}\right) \times Density\ \left(\frac{pounds}{gallon}\right)}$$

Based on the results of the accumulated solids for the lagoon system, a total of 511,485 pounds of solids were removed from the system (see **Total Solids results**).

Totals solids results

Lagoon #	TS, i (mg/kg)	TS, f (mg/kg)	TS, i (lbs)	TS, f (lbs)	*Delta TS (lbs)
Lagoon 2	54,118	27,486	557,866	283,333	-274,533
Lagoon 3	26,858	37,908	461,431	651,274	189,843
Lagoon 4	51,887	47,733	490,295	451,038	-39,257
Lagoon 5	81,072	40,059	766,065	378,527	-387,538
Totals (lbs)			2,275,657	1,764,172	-511,485
Totals (tons)			1,138	882	-256

*** negative value denotes decrease/postive value denotes increase**

Volatile solids results

Lagoon #	VS, i (mg/kg)	VS, f (mg/kg)	VS, i (lbs)	VS, f (lbs)	*Delta VS (lbs)
Lagoon 2	28,853	21,291	297,421	219,478	-77,943
Lagoon 3	12,829	26,036	220,410	447,311	226,902
Lagoon 4	22,211	31,575	209,881	298,356	88,475
Lagoon 5	24,832	20,432	234,639	193,063	-41,577
Totals (lbs)			962,351	1,158,207	195,856
Totals (tons)			481	579	98

*** negative value denotes decrease/postive value denotes increase**

Inerts results

Lagoon 2 Lagoon #	Inerts, i (mg/kg)	Inerts, f (mg/kg)	Inerts, i (lbs)	Inerts, f (lbs)	*Delta VS (lbs)
Lagoon 3	25,266	6,195	260,444	63,855	-190,864
Lagoon 4	14,029	11,872	241,021	203,963	-35,979
Lagoon 5	29,676	16,158	280,414	152,682	-124,012
	56,240	19,627	531,425	185,464	-335,885
Totals (lbs)			1,313,305	605,965	-686,739
Totals (tons)			657	303	-343

*** negative value denotes decrease/postive value denotes increase**

Table 3 – Results for lagoons 2, 3, 4 and 5 showing Total Solids, Volatile Solids and Inerts

There was significant change in the volatile and inert solids fractions. Increased volatile fractions were likely due to the enhanced availability of biodegradable substrate and hydrolyzed solids (e.g., as found in Lagoon 3). Given the plant's historical observation of inert precipitation (Struvite), changes in pH observed in the process would likely influence the precipitation of particulates and inert materials.

2.6 Effect of Yield Assumption on Solids Removal Estimates

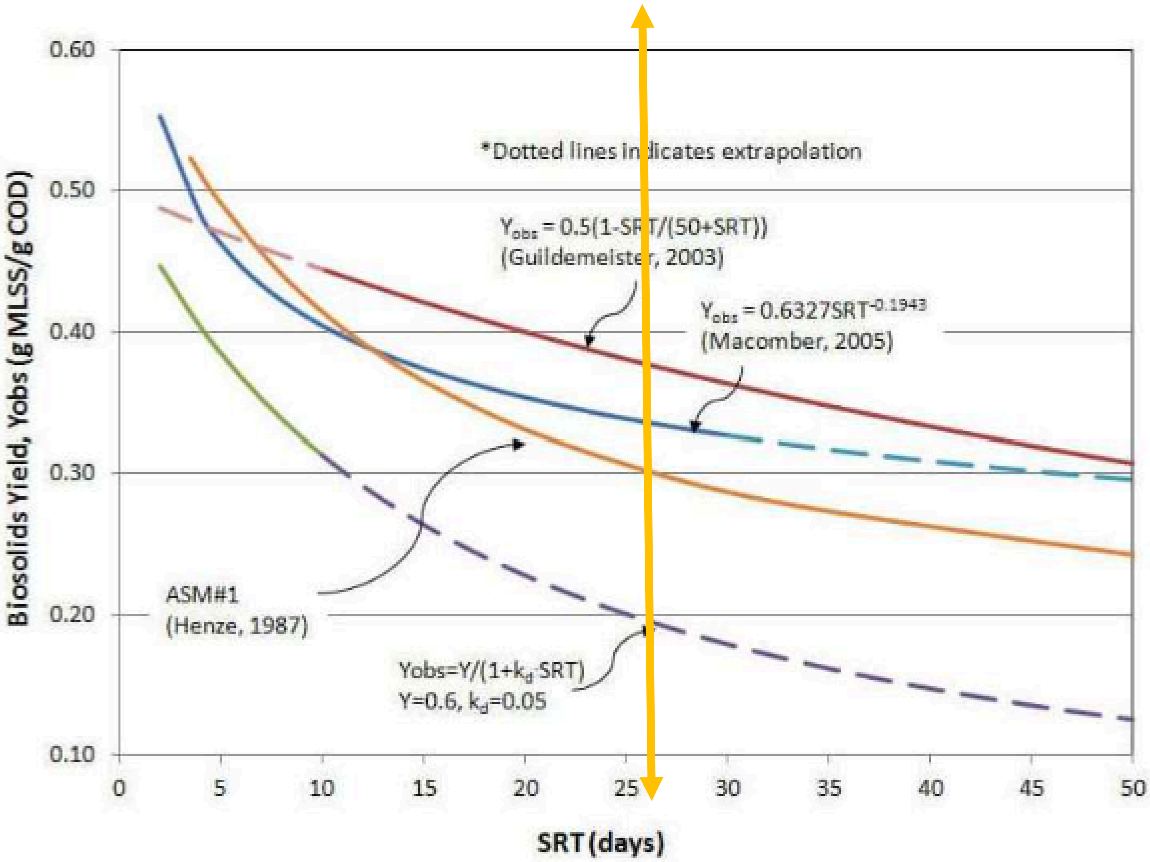

Figure 4: Yield vs SRT

The quantity of solids generated from the removal of COD in a wastewater process variesbased on the solids retention time of the bacterial cells in the treatment system, the type of bacteriain the process and the type of substrate being treated. Generally, longer solids retention (orsludge age) leads to lower yield[1]. Anaerobic systems also tend to generate lower solids yieldsthan aerobic systems. **Figure 4** outlines several yield curves generated from various typesof wastewater operations.

The hydraulic retention time in the Facility A wastewater treatment facility is about 26 days. Although most of the lagoons are reasonably well mixed, we anticipate that the solids retention time would likely be slightly more than 26 days. At the 26-day mark, the sludge yields range from about 0.20 to 0.38 g solids / g COD removed. We have used the Henze et al (1987)[2] solids yield estimate of about 0.3 g solids / g COD removed for our estimation of the solids generated during COD removal at Facility A.

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1 http://onlinembr.info/mbr-design/observed-biosolids-yield-yobs/

2 Henze, M., Grady, C.P.L., Gujer, W., Marais, G.v.R, and Matsuo, T. (1987). Activated Sludge Model 1, IAWPRC Scientific and Technical Report No. 1, IAWPRC, London.

2.7 COD loading calculations

The COD loading calculations are based on the historical average of COD measurements provided by Facility A operations. **Table 4** summarizes the average COD concentrations for each stream in the wastewater treatment process and **Table 5** represents the total COD mass rate and aggregate of COD load, COD removed, and the totals solids generated from COD removal.

Sample location	mg COD/L
Post DAF	40,150
Sump #1	15,498
Anaerobic 2	4,615
Anoxic	2,932
Aerobic #1	1,161
Aerobic #2	931
Finish Pond	873

Table 4 - COD loading averages

Approximately 70% of the total COD is removed by the combination of anaerobic lagoons 1 and 2. This can be seen by the drop of the incoming influent COD concentration of 15,498 mg COD per liter to 4,615 mg COD per liter in lagoon 3's influent COD concentration (see "Sump #1" and "Anaerobic 2" in **Table 4**).

The total COD mass load was 32,312 pounds of COD per day with an estimated 9,111 pounds of biomass produced per day based on a conservative assumed biomass yield factor of 0.30 pounds of solids per pound of COD removed (see **Table 5**). We note that the HRT within the Facility A system is about 26 days. The SRT is expected to be higher than that due to the mixing conditions within the wastewater process.

Plant COD loading						
Lagoon #	**L1**	**L2**	**L3**	**L4**	**L5**	**L7**
COD influent conc. (mg/L)	**15,498**		**4,615**	**2,932**	**1,161**	**931**
COD % reduction	N/A	70%	36%	60%	20%	
Load to system (lbs COD per day)	32,312		9,622	6,114	2,420	1,941
COD removed (lbs/day)		22,690	3,508	3,694	479	
Solids generated from COD removed (lbs/day)		6,807	1,052	1,108	144	
Solids generated during Drylet period (in lbs)		564,981	87,352	91,985	11,935	N/A

Table 5 - COD mass loading for each lagoon and solids generated

As was previously noted, the solids yield estimates the expected generation of solids obtained during COD removal. Based on the HRT, we used the yield curves in Figure 4, to adopt a yield of 0.3 g solids per g COD removed. Table 6 provides an overview of how the overall solids removal in Facility A changes based on the yield assumptions that are utilized. For all scenarios, the total solids reduction of 0.5 million lbs (256 tons) achieved directly in the aeration basins is maintained, while the avoided sludge based on the increased expected from yield estimates varies from 0 to 1.7 million lbs (882 tons)at yield estimates of 0 and 0.5 g solids per g COD removed respectively.

Assumed Biomass yield	0	0.1	0.2	0.3	0.4	0.5
Solids Reduced In Basin (lbs)	511,485	511,485	511,485	511,485	511,485	511,485
Avoided Solids from COD removal (lbs)	-	252,084	504,169	756,253	1,008,338	1,260,422
Total Solids Removed (lbs)	511,484.67	763,569.08				
Total Solids at Start in Lagoons 2-5 (lbs)			1,015,653.49	1,267,737.90	1,519,822.32	1,771,906.73
Total Solids Expected Without Drylet (lbs)	2,275,656.61	2,275,656.61	2,275,656.61	2,275,656.61	2,275,656.61	2,275,656.61
Total Solids Observed with Drylet (lbs)	2,275,656.61	2,527,741.02	2,779,825.43	3,031,909.84	3,283,994.25	3,536,078.66
% Reduction (as % Initial)	1,764,171.94 22%	1,764,171.94 34%	1,764,171.94 45%	1,764,171.94 56%	1,764,171.94 67%	1,764,171.94 78%
% Reduction (as % Expected solids without Drylet)	22%	30%	37%	42%	46%	50%
lbs Solids Removed/ lbsDrylet	215.82	322.18	428.55	534.91	641.28	747.64

Table 6: Effect of yield assumptions on solids reduction estimates

Section 3 – Facility A conclusions

Adding Drylet's biocatalyst significantly enhanced the solids destruction in the Facility A wastewater treatment lagoon system. Given that the reduction in total solids was 1,267,738 lbs (634 tons) from 2,370 lbs of dosed biocatalyst product, the solids destruction rate is 571 lbs of solids per lb of Drylet's biocatalyst. This is in the typical range observed when using the product for lagoon systems.

Further evidence of solids destruction is observed by the increase in biogas generated in Lagoons 1 and 2, based on the reported daily increase in flare runtime hours relative to results obtained prior to the use of Drylet's technology at Facility A.

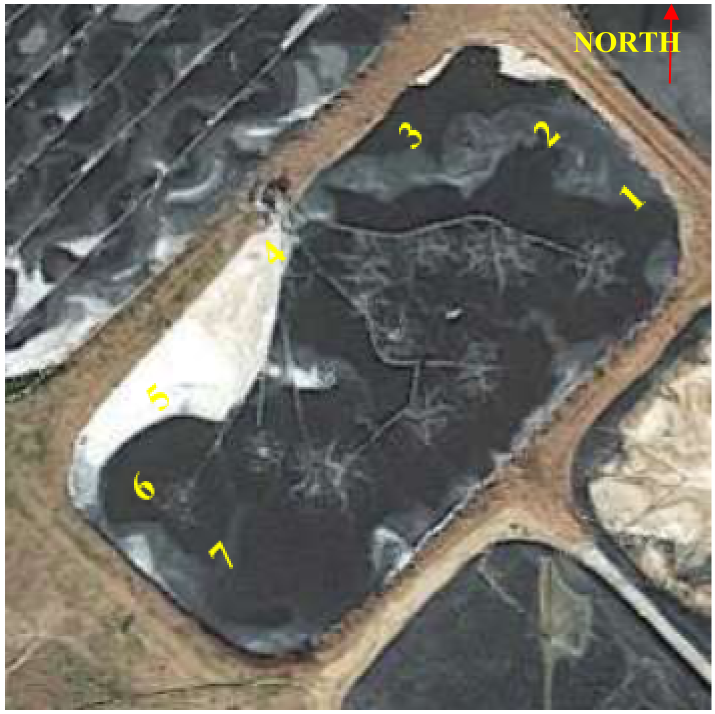
Section 4 – Facility A appendix

4.1 Sampling Points

Anaerobic Lagoon 2(L 2) with ports location

Aerobic Lagoon 3(L3) with sample points

Aerobic Lagoon 4(L4) with sample points



Aerobic Lagoon 5(L5) with sample points

Section 5 – Facility B introduction

5.1 Objective

The biogas digester at Facility B ("Lagoon 1") operates under anaerobic conditions to treat the incoming daily influent from the production plant while producing methane. The purpose of the Drylet product demonstration was to assess the efficacy of solids reduction using Bio Dredger in order to restore lagoon capacity. Reducing solids biologically would allow the plant operator to postpone costly measures for solids removal involving mechanical dredging.

The lagoon treatment demonstration was to rely on comparing the initial quantity of solids prior to the application of Bio Dredger with the final solids quantity. The difference would quantify the solids reduced during the product demonstration period. The initial samples were taken on July 16, 2018 and the final samples were taken on October 3, 2018, a total duration of 80 days.

The samples consisted of composites taken from Ports 1 through 6 for the solids reduction measurements. Each sample was analyzed for Total Solids (TS) and Total Suspended Solids (TSS).

5.2 Sampling plan

The recommended sampling plan described herein has been developed by Drylet and in accordance with Standard Method 2540 B (see **Appendix: Analytical Procedure**) to properly quantify the solids concentration in a lagoon system. Coupled with sonar dimensions of the lagoon, the solids concentration analysis provides a constructive quantification of total solids in a lagoon. The sampling process is comprised of an initial collection of composites from each port followed by a final composite collection. The difference between the initial and final composite averages of the solids concentration quantifies the changes in total solids in the lagoon.

Section 6 – Facility B analysis of composite samples and lagoon solids mass

6.1 Lagoon dimensions

The solids inventory of Lagoon 1 was calculated based on the average solids concentration from the composite samples for Port 1 through 6 and the estimated volume of the lagoon. The height of the lagoon sludge from the liquid top to the lagoon bottom was measured at each port. The average sludge height (i.e. top of the liquid to the bottom of the lagoon) of those six (6) ports was calculated from the individual readings of the sludge height at each port. The lagoon volume was utilized from the AA Technology sonar survey (see **Figure 1**).

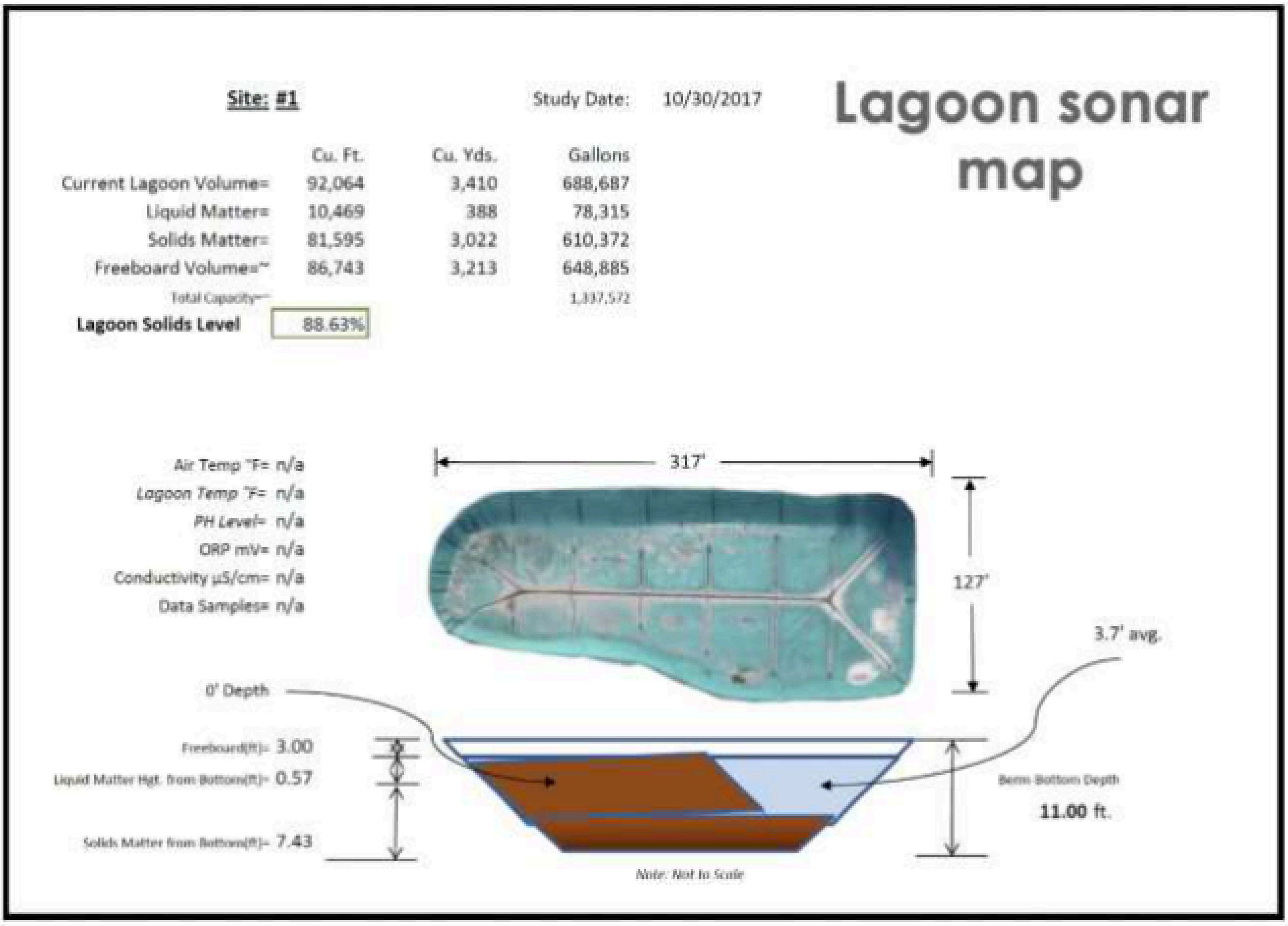


Figure 1 – Sonar map of Lagoon 1 dimensions

Based on the lagoon volume from the lagoon survey, the initial volume was estimated to be 688,687 gallons. The initial average height of sludge from the measurements taken from Ports 1 through 6 is 5.25 feet and the final average height of sludge is 5.86 feet with the average increase of 0.61 feet or a 10.4% increase (see **Table 1**). The new operating volume was determined by the increase of the initial volume by the 10.4% increase in the sludge height. This is typical as the sludge layer will be temporarily "lifted" by the increase in gases released from the increased biological activity from Drylet's products. The final sludge volume was calculated to be 760,552 gallons or a change in volume of 71,865 gallons.

6.2 Composite samples analysis for TSS, and TS

The composite samples analysis can be seen in **Table 3**. The description of the sample analysis is provided below for each type:

- i, initial sample collected
- f, final sample collected
- TSS, Total Suspended Solids
- TS, Total Solids

The following results, also seen in **Table 3** for concentrations and **Table 4** for mass, represent the outcome of the product demonstration.
Concentration basis results:

1. The initial TSS concentration for all six (6) ports averaged 80 grams per liter and the final TSS concentration averaged 41 grams per liter. This represents a 49% reduction in TSS on a concentration basis.

2. The initial TS concentration for all six (6) ports averaged 81 grams per liter and the final TS concentration averaged 57 grams per liter; representing a 29% reduction in Total Solids concentration.

Mass basis results:

1. The initial TSS mass for Lagoon 1 (see **Table 4**) was 208 metric tons and the final TSS mass is 117 metric tons; a 44% reduction TSS on a mass basis.

2. The initial TS mass for Lagoon 1 was 212 metric tons and the final TS mass is 165 metric tons; representing a 22% reduction in Total Solids mass.

Table1 - Sludgeheight for eachportwithaveragesforintialand finalmeasurements			
Sample location	**Initial, feet**	**Final, ft**	**Difference, ft**
Access port 1	**4.50**	**5.25**	**0.75**
Access port 2	**5.75**	**6.33**	**0.58**
Access port 3	**5.50**	**6.67**	**1.17**
Access port 4	**4.50**	**5.00**	**0.50**
Access port 5	**6.75**	**7.00**	**0.25**
Access port 6	**4.50**	**4.92**	**0.42**
Averages, ft	**5.25**	**5.86**	**0.61**

Table 2 - Lagoon 1 initial and final sludge volume			
Volume	**Initial**	**Final**	**Change**
Volume, ft3	92,070	101,678	9,608
Volume, gallons	688,687	760,552	71,865
Volume, liters	2,606,956	2,878,992	272,037

	Table 3 - Composite sample analysis for intial and final values of TS and TSS (grams per liter) with reported percent (%) reduction					
Sample location	**TSS, i**	**TSS, f**	**TSS, % reduction**	**TS, i**	**TS, f**	**TS, % reduction**
Access port 1	**59**	**26**	**56%**	**84**	**32**	**61%**
Access port 2	**143**	**46**	**68%**	**149**	**83**	**44%**
Access port 3	**69**	**81**	**-18%**	**69**	**128**	**-87%**
Access port 4	**53**	**31**	**42%**	**29**	**35**	**-22%**
Access port 5	**92**	**36**	**61%**	**97**	**38**	**61%**
Access port 6	**62**	**23**	**63%**	**61**	**27**	**55%**
Averages	***80***	***41***	***49%***	***81***	***57***	***29%***

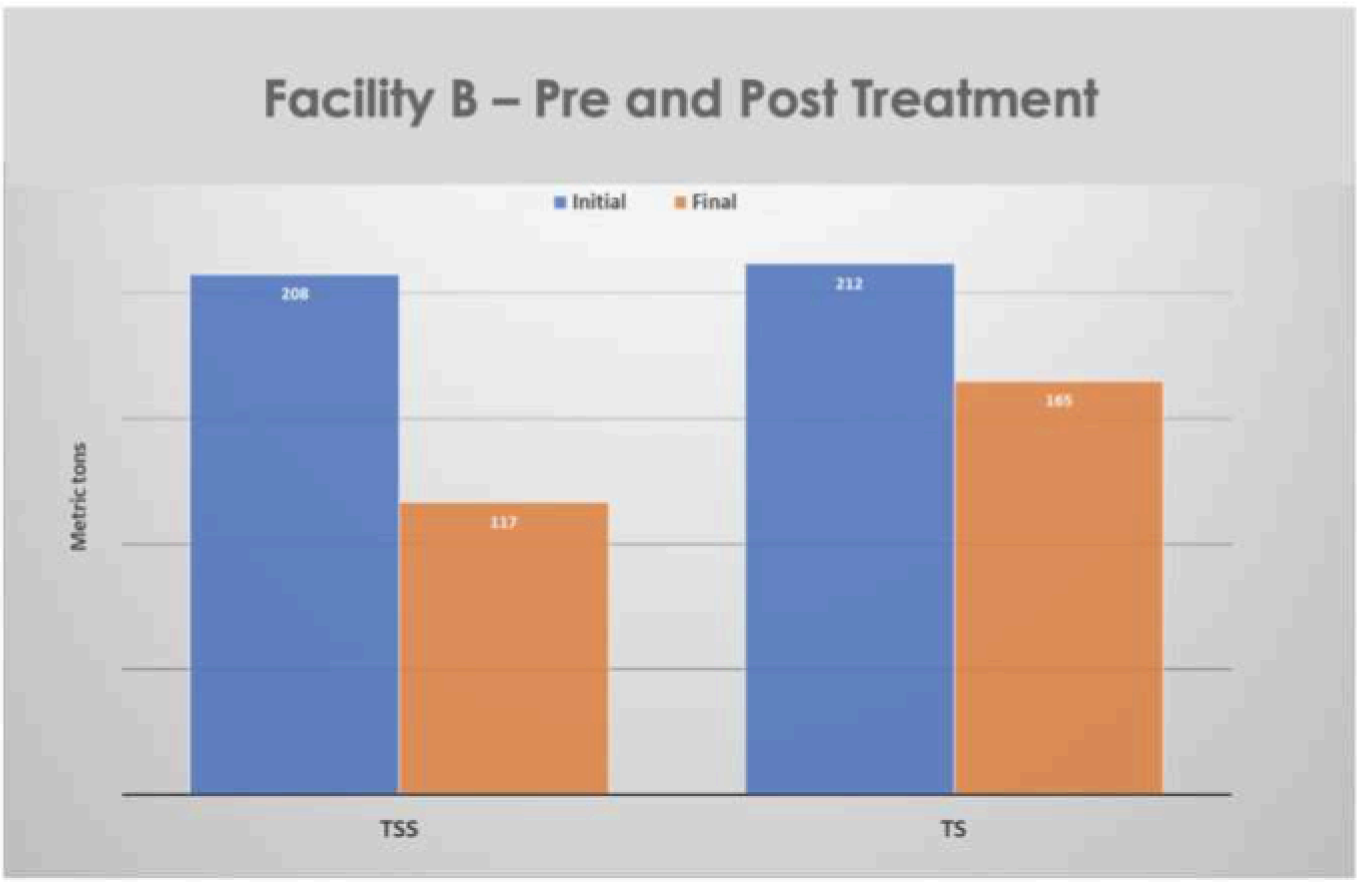
	Table 4 - Total solids expressed in metric tons with percent (%) reduction for each type of measurement					
Sample location	**TSS, i**	**TSS, f**	**TSS, % reduction**	**TS, i**	**TS, f**	**TS, % reduction**
Total lagoon 1, tonnes	**208**	**117**	**44%**	**212**	**165**	**22%**

Section 7– Facility B results summary

The total solids in Lagoon 1 decreased significantly from 212 metric tons to 165 metric tons (see **Figure 1**) or by 47 metric tons in 77 days. The percent total solids reduction is 22% on a mass basis.

Figure 1 also shows the changes on the mass basis for TSS of 44%.

Figure 1 - Solids reduction on mass basis



Section 8 – Facility B appendix: Analytical procedure

8.1 Total Solids Procedure (Based on Standard Method 2540B)

8.1.1 Summary of Method

A well-mixed sample is measured into a weighed dish and dried to constant weight in an oven at 103°C to 105°C. The increase in weight over that of the empty dish represents the total solids.

8.1.2 Sample Handling

Bottles are sealed and placed on ice in a cooler for transport to the laboratory. The samples are required to be refrigerated to 4ºC in the laboratory to minimize microbiological decomposition of solids. The maximum holding time for sample is seven (7) days.

8.1.3 Apparatus

- Aluminum weighing dishes with 100-mL capacity
- Desiccator, with a desiccant containing a color indicator of moisture concentration
- Quincy Lab Gravity Convention Oven Model:10GC (**Figure 1**)
- Analytical balance, capable of weighing to 0.1 mg
- Magnetic stirrer with stirring bar
- Pipettes

Figure 1: Quincy Lab GravityConvention Oven Model:10GC

8.1.4 Total Solids Procedure

- Preparation of evaporating dish:
  - o If volatile solids are to be measured, ignite clean aluminum dish at 550°C for 1 hour in a muffle furnace.

- o If only total solids are to be measured, heat clean dish to 103 to 105°C for 1 hour
- o Store and cool dish in desiccator until needed.
- o Weigh immediately before use

- Sample Analysis:
    - o Pipet a measured volume of well-mixed sample, during mixing, to a pre-weighed dish.
    - o For homogenous samples, pipet from the approximate midpoint of container but not in the vortex.
    - o Evaporate the sample to dryness in a drying oven
    - o When evaporating in a drying oven, lower temperature to approximately 2°C below boiling to prevent splattering
    - o Dry evaporated sample at 103 to 105°C overnight
    - o Cool dish in desiccator to balance temperature, and weigh
    - o Repeat cycle of drying, cooling, desiccating, and weighing until a constant weight isobtained, or until weight change is less than 4% of previous weight or 0.5 mg, whichever is less.

8.1.5 Calculation for Total Solids

- Total Solids, mg/L= [(A-B) * 1000]/C

  Where:

  A= weight of dried residue + dish, mg

  B= weight of dish, mg

  C= sample volume, mL

8.1.6 References

- Standard Methods for the Examination of Water and Wastewater. Method 2540B, APHA, 21st Edition, 2005.

8.2 Total Suspended Solids Procedure (Based on Standard Method 2540D)

8.2.1 Summary of Method

- A well-mixed sample is filtered through a standard glass fiber filter, and the residue retained on the filter is dried to constant weight at 103 degrees Celsius -105ºC.

8.2.2 Sample Handling

- Bottles are sealed and placed on ice in a cooler for transport to the laboratory. The samples are required to be refrigerated to 4ºC in the laboratory to minimize microbiological decomposition of solids. The maximum holding time for sample is seven (7) days.

8.2.3 *Apparatus*

- Pre-prepared and pre-weighed standard glass fiber filter: 110 mm diameter, 1.5 µm nominal pore size
- Filtration apparatus
- Vacuum pump
- A 1-L filter flask
- Filter funnel
- Vacuum tubing, ¼" inside diameter
- Drying oven for operation at 103-105ºC
- Desiccator
- Aluminum weighing dishes (or equivalent)
- Analytical balance, capable of weighing to 0.1 mg

8.2.4 *Reagents and standards*

- Deionized water (DI): water that has been passed through a purification system

8.2.5 *Procedure for Total Suspended Solids*

- Set up the filtration apparatus, insert a pre-weighed filter, and apply vacuum.
- Wet the filter with a small volume of deionized water to seat it.
- Stir sample with a magnetic stirrer at a speed to shear larger particles to obtain a more uniform (homogenous) particle size.
- While stirring, pipet a measured volume onto the seated glass-fiber filter. For homogenous samples, pipet from the approximate midpoint of container but not in vortex.
- Wash filter with three successive 10-mL volumes of reagent-grade water, allowing complete drainage between washings
- Continue suction for about 3 min after filtration is complete
- Remove filter from filtration apparatus and transfer to aluminum weighing dish as a support
- Dry for at least 1 hour at 103 to 105ºC in an oven, cool in a dessicator to balance temperature, and weigh
- Repeat the cycle of drying, cooling, desiccating, and weighing until a constant weight is obtained or until the weight change is less than 4% of the previous weight or 0.5 mg, whichever is less
- If volatile solids are to be determined, treat the residue according to Standard Method 2540E

8.2.6 *Calculation of Total Suspended Solids*

- Total Suspended Solids, mg/L = [(A-B) * 1,000]/C

  Where:
  A = weight of filter + dried residue, mg
  B = weight of filter, mg
  C = volume of sample filtered, mL

8.2.7 References

- Standard Methods for the Examination of Water and Wastewater. Method 2540D, APHA, 21st Edition, 2005.

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Section 9 – Facility B Lagoon 4 results and data analysis

9.1 Lagoon samples, depths and estimated volumes

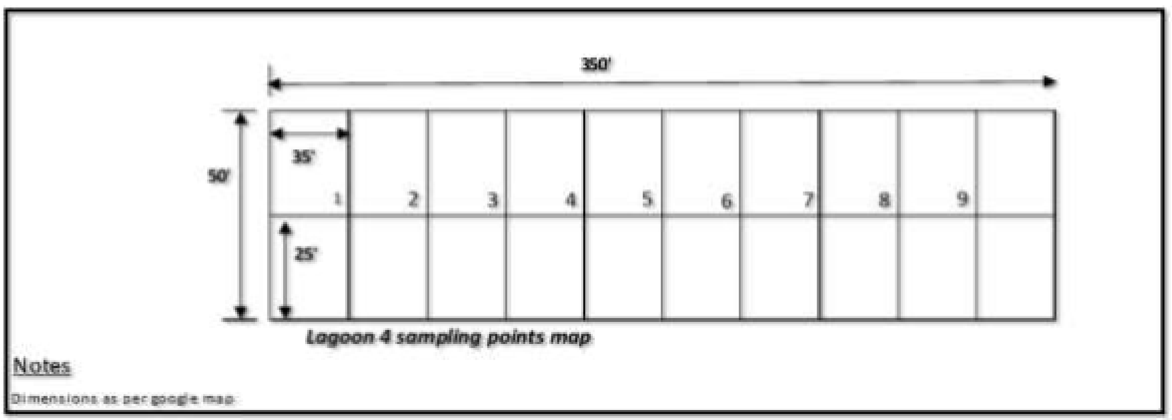
The solids inventory for Lagoon 4 was calculated based on the average solids concentration from the composite samples taken at equidistant points (total of 9) along the length of the lagoon. The depth at each sample point was measured for Lagoon 4 and is listed in **Table 1**.

Depth measurements

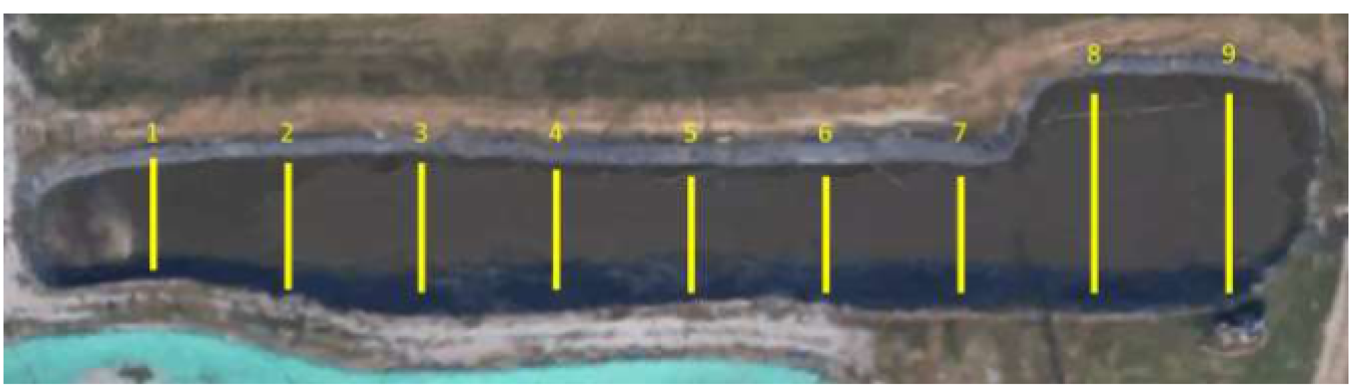
Date	10/3/2018	1/29/2019
Sample point	Depth (ft)	Depth (ft)
1	5.7	4
2	5.3	4
3	5.4	4
4	5.4	5
5	5.3	5
6	5.1	5
7	5.2	6
8	5.8	6
9	6.8	6
Average depth (ft)	5.6	5.0

Table 3 – Sample point depths

The sample locations are depicted in the following diagram and photo of Lagoon 4.



***Note that the dimensions represent estimate of the as-built capacity.**



The volume of Lagoon 4 was estimated to be 299,200 gallons at the initial operating volume on 10/3/2018 and a final volume of 254,217 gallons. The volume was estimated based on the length, width, and average height (from **Table 1**) of the operating volume with a 75% factor accounting for the sloped sides to reflect a more accurate volume estimate (see **Table 2**).

Operational capacity

Date	10/3/2018	1/29/2019
Length (ft)	320.0	318.0
Width (ft)	30.0	28.5
Height, avg.	5.6	5.0
Volume (gals)	299,200	254,217
Estimated % volume change	15%	

***** represents decrease from initial on 10/3/18 to final on 1/29/19***

Table 4 - Estimates of initial and final volumes of lagoon

From **Figure 1**, the visibility of the effluent discharge pipe in Lagoon 4 provides visual evidence of the increased volume at the initial sampling versus the final sampling. Coupled with the lagoon depth measurements, the change in volume is approximated to be a decrease by 44,983 gallons.

Figure 1 - Initial and final images of Lagoon 4 referencing effluent discharge pipe

9.2 Results for total solids removed from system

The estimated total solids avoided for the 118-day Drylet testing period is 176,354 pounds (88 tons). This reduction in total solids amounts to an 82% overall reduction based on the accumulated solids in Lagoon 4 while accounting for incremental solids load to Lagoon 4 from Lagoon 3. The results summary is provided below in **Table 3** and the percent solids is shown in **Table 4** for initial and final values for both lagoons 3 and 4.

Total change in solids over period

Change in accumulated solids	
Total solids, lbs	3,207
Volatile solids, lbs	-3,262
Avoided solids from feed to Lagoon 4	
Total solids, lbs	173,147
Volatile solids, lbs	103,879
Net change in total avoided solids	
Total solids, lbs	176,354
Volatile solids, lbs	100,617
Net change in total avoided solids (in tons)	
Total solids, tons	88
Volatile solids, tons	50

**** negative indicates in increase in volatile solids***

Table 5 - Results summary for total solids

Mass fractions of accumulated solids (Lagoon 4)	**TS %**	**VS %**	**VS/TS**
Initial value	1.65	1.09	0.66
Final value	1.79	1.43	0.80
% change	9%	31%	21%

Total and volatile solids (Lagoon 3)	**TS %**	**VS %**	**VS/TS**
Initial measurements for TS and VS	0.18	0.03	0.19
Final measurements for TS and VS	0.29	0.17	0.60
% change	60%	399%	211%

Table 6 - Initial and final massfractions in lagoons 3 and 4

9.3 Composite samples analysis for TS, VS, and mass calculations

The initial samples were collected on October 3, 2018 and the final samples were collected on January 29, 2019. The total duration for the testing period was 118 days.

The full spectrum of samples analyzed for Lagoon 4 are listed in **Table 5** representing the mass ratios of TS and VS. The description of the sample analysis is provided below for each type:

- i, initial sample collected

- f, final sample collected
- TS, total solids
- VS, volatile solids
- Inerts, non-biodegradable fraction

The mass of accumulated Total Solids and Volatile Solids is based on the product of the lagoon volume, the average TS or VS mass ratio and a density of 8.59 pounds per gallons.

$$\boldsymbol{Mass\ (pounds) = Volume\ (MG) \times Mass\ ratio\ \left(\frac{mg}{kg}\right) \times Density\ \left(\frac{pounds}{gallon}\right)}$$

Based on the results of the accumulated solids for the lagoon system, a total of 3,207 pounds of solids were removed from the system.

INITIAL AVERAGES

Samplelocation	TS, avg (g/kg)	TS, avg (mg/kg)	%TS, avg	VS, avg (g/kg)	VS, avg (mg/kg)	%VS, avg	VS/TS, avg
DAR_COLL_L3	1.8	1,808	0.18%	0.3	348	0.03%	0.20
DAR_COLL_L4-1 COMP	14.9	14,873	1.49%	10.2	10,197	1.02%	0.69
DAR_COLL_L4-2 COMP	22.7	22,721	2.27%	15.6	15,563	1.56%	0.68
DAR_COLL_L4-3 COMP	19.7	19,667	1.97%	12.7	12,694	1.27%	0.65
DAR_COLL_L4-4 COMP	21.3	21,349	2.13%	13.2	13,247	1.32%	0.62
DAR_COLL_L4-5 COMP	19.0	18,983	1.90%	12.0	12,017	1.20%	0.63
DAR_COLL_L4-6 COMP	17.1	17,056	1.71%	12.4	12,440	1.24%	0.73
DAR_COLL_L4-7 COMP	20.4	20,394	2.04%	13.2	13,162	1.32%	0.65
DAR_COLL_L4-8 COMP	18.5	18,521	1.85%	12.9	12,908	1.29%	0.70
DAR_COLL_L4-9 COMP	17.3	17,310	1.73%	13.0	12,993	1.30%	0.75

FINAL AVERAGES

Samplelocation	TS, avg (g/kg)	TS, avg (mg/kg)	%TS, avg	VS, avg (g/kg)	VS, avg (mg/kg)	%VS, avg	VS/TS, avg
DAR_COLL_L3	2.9	2,895	0.29%	1.7	1,737	0.17%	0.60
DAR_COLL_L4-1 COMP	30.2	30,233	3.02%	24.6	24,608	2.46%	0.81
DAR_COLL_L4-2 COMP	20.7	20,746	2.07%	17.3	17,263	1.73%	0.83
DAR_COLL_L4-3 COMP	24.4	24,379	2.44%	18.6	18,613	1.86%	0.76
DAR_COLL_L4-4 COMP	19.9	19,855	1.99%	15.5	15,481	1.55%	0.78
DAR_COLL_L4-5 COMP	20.5	20,499	2.05%	13.9	13,911	1.39%	0.68
DAR_COLL_L4-6 COMP	18.9	18,921	1.89%	15.3	15,342	0.17%	0.81
DAR_COLL_L4-7 COMP	21.8	21,787	2.18%	18.0	17,956	1.80%	0.82
DAR_COLL_L4-8 COMP	22.1	22,147	2.21%	16.9	16,874	1.69%	0.76
DAR_COLL_L4-9 COMP	29.5	29,455	2.95%	21.3	21,345	2.13%	0.72

Table 7 - Initial and final TS and VS values for lagoon 4 for each sampling point

9.4 TS/VS loading calculations for flow from lagoon 3 to lagoon 4

The TS and VS loading calculations are based on the initial and final TS/VS measurements sampled on 10/3/2018 for the initial sample and 1/29/2019 for the final sample. **Tables 4** and **5**, previously mentioned, show the changes in the TS/VS mass ratios for the load of TS and VS from Lagoon 3 to Lagoon 4. Based on the estimated flow rate of 59,000 gallons per day, the TS load increased from 916 pounds per day to 1,467 pounds per day and the VS load increased from 177 pounds per day to 880 pounds per day.

Mass rate to Lagoon 4	TS (lbs/d)	VS (lbs/d)	TS (tons/d)	VS (tons/d)
Initial mass loading	916	177	0.46	0.09
Final mass loading	1,467	880	0.73	0.44

Table 6 – TS and VS mass loading rates to lagoon 4 from lagoon 3

Section 10 – Facility B Lagoon 4 conclusions

The addition of Drylet significantly enhanced the solids destruction at the Facility B Lagoon 4. This lagoon has been utilized as a solids collection point to prevent overflow into the final finishing lagoon. The reduction in total avoided solids was approximately 82%, which corresponds to a solids destruction rate of 1,176 pounds of solids per pound of Drylet's product, which is in the typical range observed when using the product for lagoon systems. The typical range is approximately 500 to 1,500 pounds of avoided solids per pound of Drylet's product. Results are influenced by solids composition, nutrient composition, process design, ambient conditions and operating procedures.

Section 11– Facility C executive summary

Biogas output at the Facility C anaerobic digester collapsed following influent flow reduction because of system overload. Drylet was asked to provide analysis and solution to remedy the situation. Six weeks after Drylet's first product dosing in the digester, gas production started to increase significantly (see week 30 in Figure 1). By week 34, the total weekly gas production was an estimated 2.5 million cubic feet of gas, surpassing the previous high amount in the total weekly production measured in week 23 of 1.6 million cubic feet of gas.

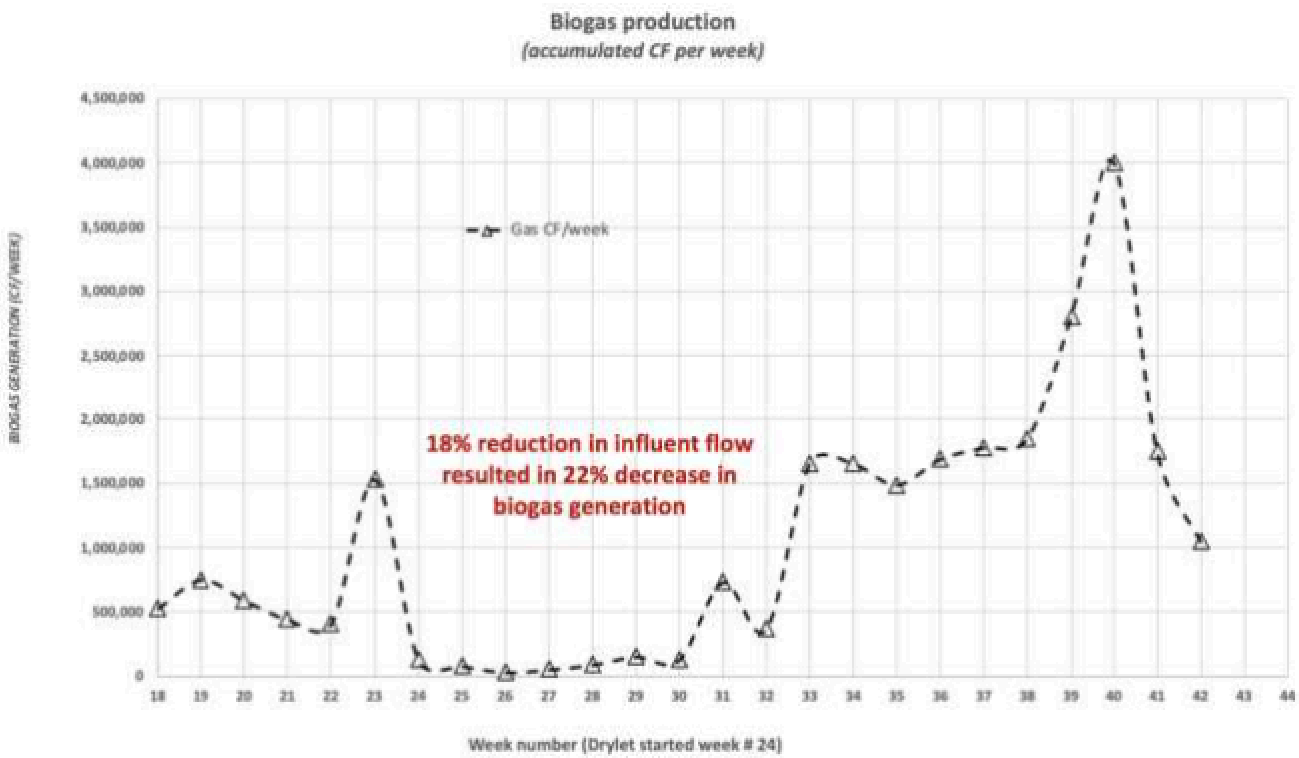


Figure 1 - Weekly aggregate gas production (cubic feet per week)

Section 12 – Facility C volumetric and load conditions (COD/BOD) to the aeration tank

12.1 Volumetric rate to aeration tank

The peak daily load to the aeration tank ("AT") reached 270,000 gallons per day. The aggregate monthly flow for July reached a total of 5 million gallons which is a 153% increase of the aggregate of flow of 1.98 million gallons for March (see **Figure 3)**.

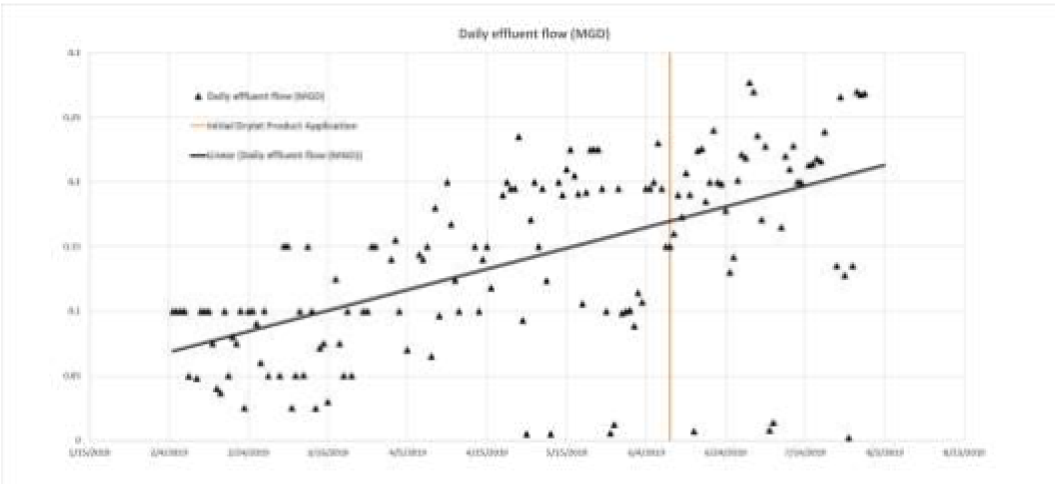


Figure 8 – AT Influent flow measured as anaerobic effluent flow

12.2 COD daily load to AT

The COD load to the aeration tank increased over fourfold from the initial startup to the June/July period. This was an anticipated load increase due to the increase from the blood and feathers operations.

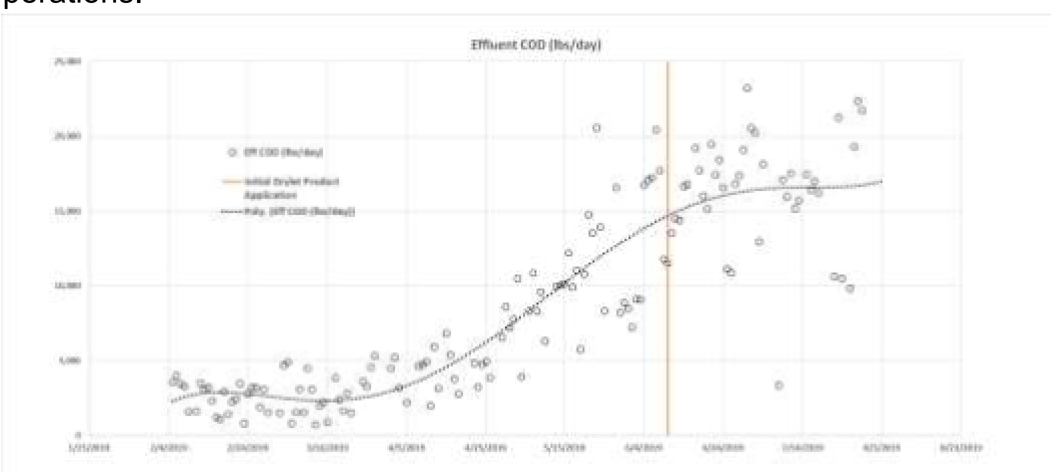


Figure 4 – COD load in pounds per day to the AT

12.3 Ammonia daily load to AT

The daily ammonia load appears to be consistent on a pounds per day basis when using a factor of 100x for the ammonia concentration from February 5th to June 14th, 2019. For that period, the ammonia in milligrams per liter ranged from 1.0 to 36.0 (mg/L). This range increased to an average daily ammonia in the AD effluent to 922 mg/L.

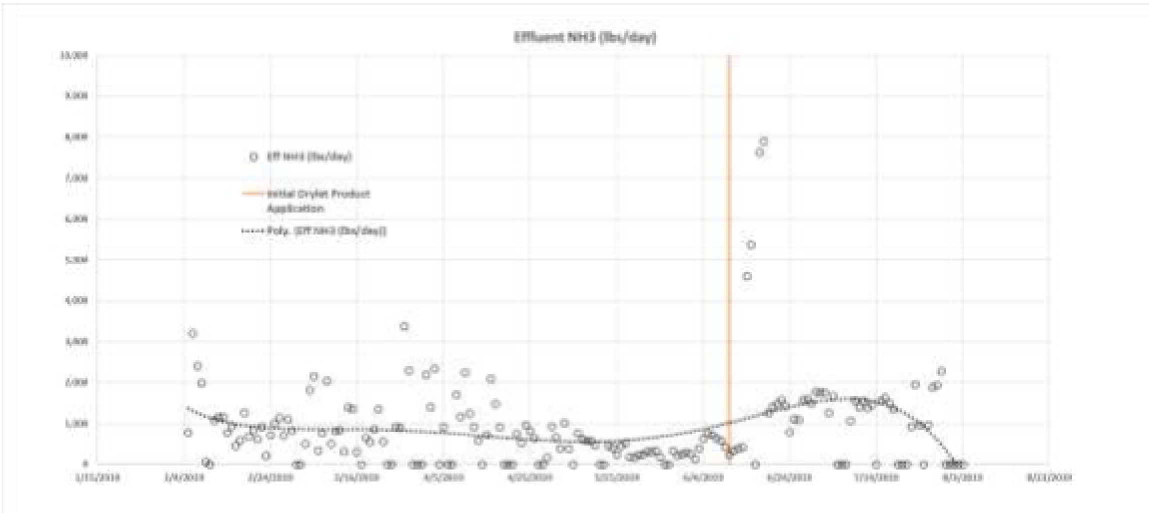


Figure 5 - Ammonia daily load to aeration tank

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Section 13 – Facility C gas production and volumetric flow trends

A precipitous decline in gas production was observed,from 1,000,000 cubic feet on June 2 to 125,000 cubic feet on June 10, as well as an almost complete lack of methanogenesis, as shown in Figure 6. Drylet was asked to dose BioReact AD to reestablish biogas production.

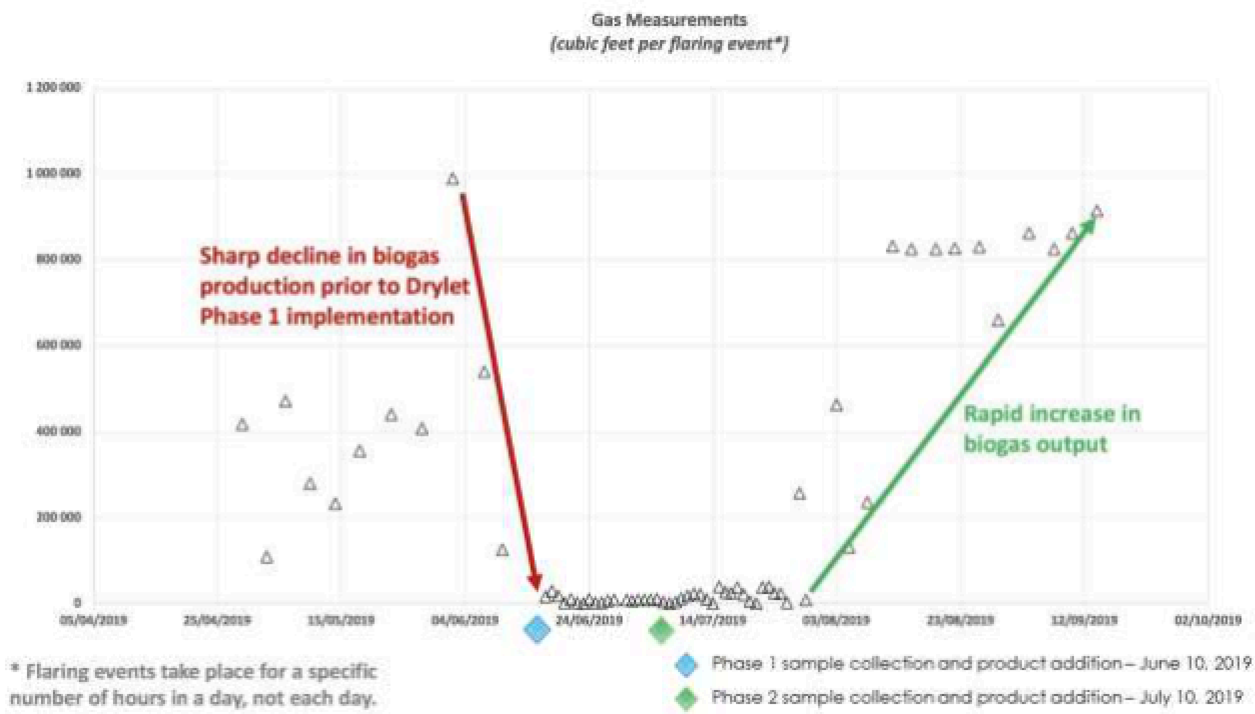

Figure 6 - Gas production (cubic feet per flaring event)

The first sample collection and dosing phase of the project is notated by a blue diamond (see above) and was completed on June 10th. The second sample and dosing phase of the project is notated by a green diamond (see above) and was completed July 10, one month after the first dosing. The daily gas production rate remained low from June 13th until the first week of August 2019, increasing to 257,000 cubic feet per day on July 28th and then to 457,000 cubic feet per day on August 3rd 2019. For the period mid-August 2019 through late September, weekly gas production averaged 1.8 million cubic feet of gas per week. On several days between August 20 and September 16th, the daily output exceeded 800,000 cubic feet per day, which ranked among the highest daily output recorded.

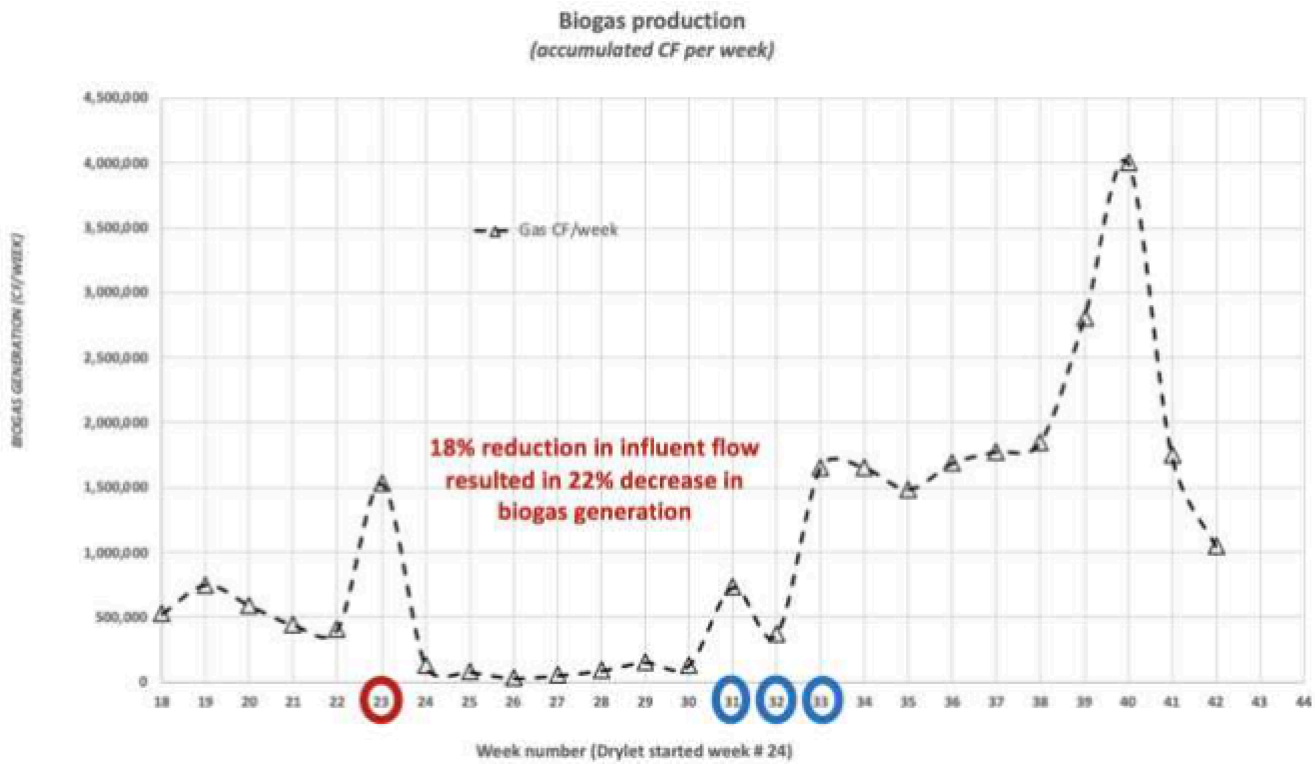

Figure 7 – Weekly gas production (cubic feet per week)

Itis important to note that the dips in weeks 32 and 35 do not reflect a decline in production, but rather represent the timing of gas production vs. flaring events. The circles in Figure 7 represent the weeks when digestate was added to the system. The red circle illustrates the timing for the initial digestate addition, and the blue circles illustrates the timing for the additional digestate additions. Approximately 24 truckloads of 7,000 gallons each of digestate (168,000 gallons total) were hauled and offloaded added into the Facility C digester. This represents approximately 16,800 pounds of COD added to the anaerobic digester at Facility C when using the previous averages of Lagoons 1 and 2 COD measurements of 12,000 mg COD/L.

The corresponding Volatile Solids (VS) destroyed based on the biogas output is illustrated in **Figure 8**. Using a ratio of 15 scf of biogas per pound of VS destroyed (typical ratio of anaerobic digestion gas output) the trend obviously matches that of the weekly biogas output.

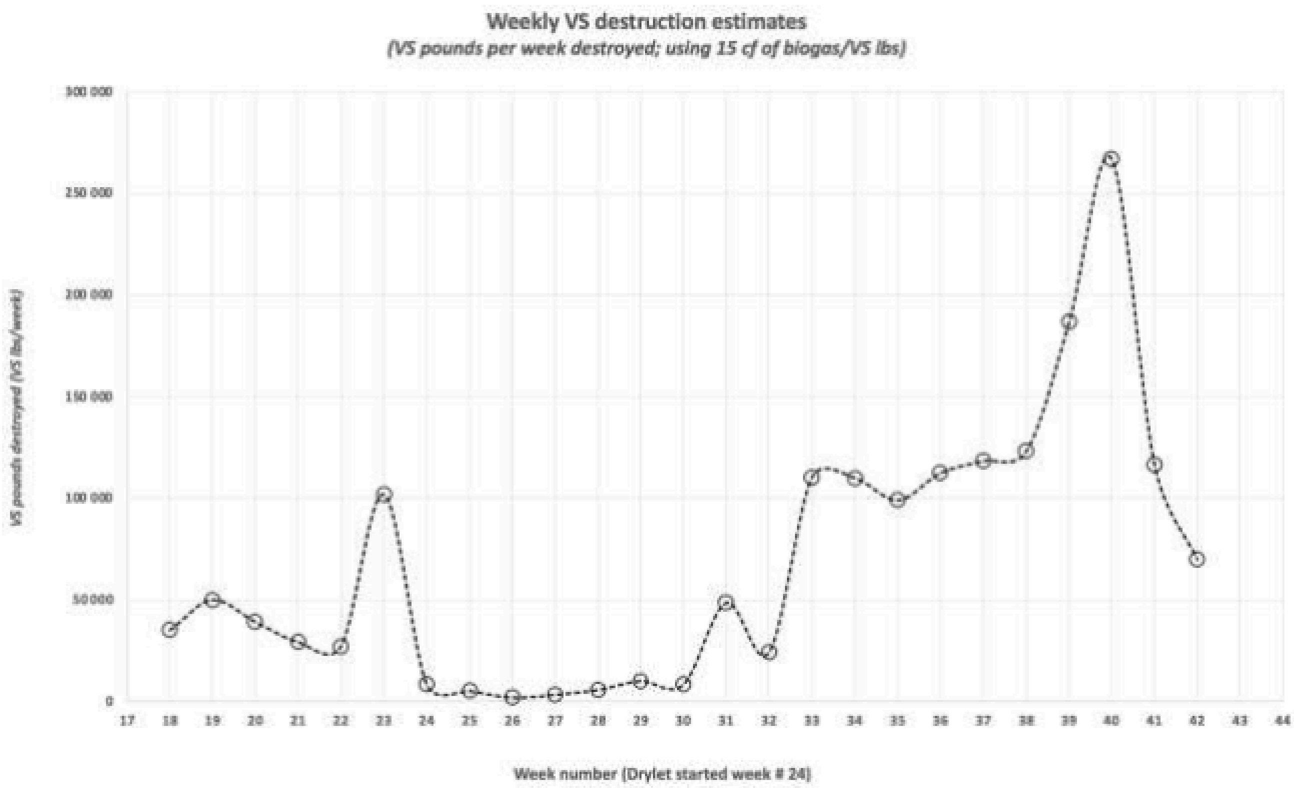

Figure 8 - Volatile solids destroyed based on biogas output

<u>Because it is critical to understand the influent characterization, Drylet recommended that Facility C implement a weekly sample of the condensate, DAF effluent and/or composite to monitor the removal efficiency of COD and BOD for the anaerobic digester.</u>

Samples were collected from various influent and effluent streams along with a composite of the anaerobic digester and separately a sample from Port 7 (the closest of the anaerobic ports to the digester influent) was taken.

Drylet took an additional sample on August 8, 2019. Two observations were made that led to this additional sample analysis: i) The digester influent sample taken on July 10th, 2019 was so high for COD and TSS that it did not remotely match with an expected range of concentrations. It was discovered through discussions with Facility C, and based on observations, that the digester influent sample location was too close to the anaerobic digester; there existed the potential for sample contamination due to backflow from the digester (i.e. high solids inference in mixing with the influent).

Based on the sample analysis, it appears that the COD loading concentration from the plant facility ranges from about 8,000 mg/L to 13,000 mg/L, the BOD loading concentration ranges

2,000 mg/L to 5,000 mg/L (see **Table 1**). The estimated COD removal is approximately 52% and the BOD removal is 31%.

	Date	TKN	BOD 5	COD	NH3-N	NO3-N	Oil-HEM	OP	% TS	TP	TSS	TVSS	% VS
Dig inf	6/10/2019	755	2,040	7,840	691	1	1,080	28	0	35	1,250	1,250	80
	7/10/2019	196	7,700	39,800	1,970	10	23,900	35	72	964	384,000	0	98
	8/8/2019		4,900	12,600			395				880	880	
Dig eff	6/10/2019	683	1,980	3,960	815	1	60	43	0	58	600	590	55
	7/10/2019	924	6,900	9,600	1,060	13	276	245	0	294	980	840	74
	8/8/2019		3,400	5,930			15				410	360	
Port 7	6/10/2019	1,010	2,040	15,200	752	1	1,430	46	1	50	12,800	12,600	80
	7/10/2019	1,400	7,500	19,500	1,120	16	4,830	46	2	328	7,220	7,140	90
	8/8/2019		4,550	19,800			715				3,080	3,000	
Mixed Dig	6/10/2019	867	2,100	4,643	806	2	112	42	0	125	2,608	2,385	60
	7/10/2019	1,016	7,267	12,768	1,144	14	267	263	0	302	2,237	2,120	82
	8/8/2019		3,700	6,910			39				1,620	1,560	

Table 9 - Sample analysis

An analysis of the characterization ratios (see **Table 2**) shows that the anaerobic digester soluble COD and BOD is 80% and 84%, respectively. This indicates a high breakdown of organic load into the constituent components readily available for conversion.

Ratios - August 8, 2019	DAF inf	Cond/DAF eff	DAF eff	Dig inf	Port 7	Digestate (mix)	Dig eff
sCOD/COD	0.90	0.79	0.67	0.39	0.30	0.80	0.84
sBOD/BOD	0.79	0.83	0.75	0.42	0.78	0.84	0.73
TVSS/TSS	0.98	1.00	0.99	1.00	0.97	0.96	0.88
COD/BOD	2.1	2.6	2.5	1.8	4.4	1.9	1.7

Table 10 - Characterization ratios for various streams and anaerobic digester

Section 14 – Facility C conclusions

The influent characterization analysis shows sufficient quantities of the macronutrients, nitrogen and phosphate, a COD load ranging from 8,000 to 13,000 mg/L, and a BOD loading ranging from 2,000 to 5,000 mg/L. The gas production recovered significantly in week 34 from the rapid decline during weeks 23 to week 24. The gas decline was likely a result of the combination of higher COD loads leading into week 24 and a low relative abundance of methanogens. The addition of Drylet's product coupled with additional digestate from another anaerobic facility rapidly increased the total aggregate gas generation over five weeks through week 37, averaging 1.8 million cubic feet of gas per week during that period.

The ammonia levels decreased dramatically in the aerobic tank from 400 to 600 mg NH3-N per liter to the low single digits to mid-teens. This resulted in the steady decline of the ammonia-nitrogen levels in the finishing pond from 300 mg NH3-N per liter to 78 mg NH3-N per liter. As the trend continued in the aerobic reactor, the dilution effect in the accumulated ammonia in the finishing pond continued to decline as well.

Micronutrient analysis does not show any deficiencies that would impact biogas production (see **Table 4** and references in **Table 5**).

Sample location	**Influent**	**Influent**	**Digestate**	**Digester Effluent**	**Digestate**	**Dig. Eff**
Analyte	***Unfiltered***	***Filtered***	***Liquid***	***Filtrate***	***So lid s***	***Filtered solids***
Aluminum	1.3	1.0	0.20	0.032	7.57	0.923
Calcium	103	114	7	0.50	26.6	9.52
Cobalt	0.12	0.12	0.01	0.002	0.0026	0.0001
Copper	0.91	0.36	0.02	0.004	0.0944	0.0902
Iron	18.6	0.1	0.2	0.1	4.15	10.9
Magnesium	42.6	34.4	5.0	2.4	13.5	8.07
Manganese	0.38	0.38	0.00	0.00	0.174	0.174
Molybednum	0.019	0.020	0.003	0.001	0.0005	0.0001
Nickel	0.19	0.20	0.02	0.01	0.0175	0.0132
Potassium	73	60	73	96	3.74	0.394
So dium	943	924	269	311	3.61	0.982
Zinc	1.31	1.84	0.25	0.21	0.292	0.119

Table 11 - Micronutrient analysis

TABLE I
RECOMMENDED CONCENTRATION OF TRACE ELEMENTS IN ANAEROBIC DIGESTION [5].

		Weiland (2006)	Bischofsberger (2005)	Mudrack and kunst (2003)	Seyfried at al. (1990)	Takashima Speece (1990)
Element	Symbol	Concentration (mg/l)				
Boron	B	-	-	-	-	-
Calcium	Ca	-	-	-	-	>0.54-40
Cobalt	Co	0.003-0.06	0.06	0.003-0.06	0.003-0.06	>0.00059-0.12
Chromium	Cr	-	0.005-50	-	-	-
Copper	Cu	-	-	-	-	-
Iron	Fe	1-10	-	1-10	1-10	>0.28-50.4
Magnesium	Mg	-	0.005-50	-	-	360-4800
Manganese	Mn	-	0.005-50	-	-	-
Molybdenum	Mo	0.005-0.05	0.05	0.005-0.05	0.005-0.05	>0.00096-0.048
Nickel	Ni	0.005-0.5	0.006	0.005-0.5	0.005-0.5	0.0059-5
Lead	Pb	-	0.02-200	-	-	-
Sulphur	S	-	-	-	-	0.32-13000
Selenium	Se	-	0.008	-	0.008	0.079-0.79
Tungsten	W	-	-	-	0.1-0.4	0.018-18.3
Zinc	Zn	-	-	-	-	-

Table 12 - Research journal listings of micronutrient requirements for biogas generation

Section 15 – Facility C analytical results

June 10, 2019 sampling results

6/10/2019												
External lab	TKN	BOD 5	COD	NH3-N	NO3-N	Oil-HEM	OP	% TS	TP	TSS	TVSS	% VS
ANAEROBIC DIGESTER INFLUENT	755	2040	7840	691	1	1080	27.9	0.3	35	1250	1250	80.2
ANAEROBIC DIGESTER EFFLUENT	683	1980	3960	815	1	60	42.8	0.1	58	600	590	54.9
ANAEROBIC DIGESTER_1	826	2220	4780	858	3.58	100	36.4	0.2	49.5	2010	1870	48.7
ANAEROBIC DIGESTER_2	795	2040	3960	812	2.66	79	43.4	0.2	220	1040	940	44.8
ANAEROBIC DIGESTER_3	812	2220	4580	787	1.88	87	40.6	0.3	75	2570	2370	61.9
ANAEROBIC DIGESTER_4	1020	2040	4980	806	1.92	85	43.5	0.5	224	3720	3230	71.1
ANAEROBIC DIGESTER_5	910	2040	4980	813	1.24	126	44	0.4	118.5	4450	4090	72.9
ANAEROBIC DIGESTER_6	840	2040	4580	762	1.05	194	43.1	0.2	62	1860	1810	63.1
ANAEROBIC DIGESTER_7	1010	2040	15200	752	1.09	1430	45.6	0.7	49.5	12800	12600	80.4
FINISHING POND_1	11.2	11.2	37.6	14.1	136	8.3	10.8	0.2	11.5	9.6	8.7	35.2
FINISHING POND_2	11.9	6.8	29.4	14.5	144	7.1	12.8	0.2	11.25	6.3	6	28.5
FINISHING POND_3	9.4	9.6	25.3	13	139	7.6	9.25	0.2	11	7.1	6.2	21.4
FINISHING POND_4	8.5	7.2	23.3	13.5	141	6.8	9.95	0.2	10.9	7	6.5	32.1
FINISHING POND_5	10.6	9.6	62.7	13.2	140	6.6	10.2	0.2	12.6	6.8	6.3	16.3
FINISHING POND_6	9.1	7.2	29.4	12.8	137	8.3	9.5	0.2	12.35	5.8	5.7	14.8
DAF EFFLUENT	3.8	10	146	2.53	96.2	12.8	12.7	0.2	20.35	30	28	12.6
DAF SOLID	3630	2670	44400	34.6	1	35	40.2	6	358	13900	12200	82.2
AERATION TANK	294	400	2000	3.57	84.2	6	41.3	0.5	49.5	3700	3110	70.3

July 10, 2019 sampling results

7/10/2019												
External lab	TKN	BOD 5	COD	NH3-N	NO3-N	Oil-HEM	OP	% TS	TP	TSS	TVSS	% VS
ANAEROBIC DIGESTER INFLUENT	196	7700	39800	1970	10	23900	34.7	71.8	964	384000		97.9
ANAEROBIC DIGESTER EFFLUENT	924	6900	9600	1060	13.2	276	245	0.3	294	980	840	73.9
ANAEROBIC DIGESTER_1	1000	6900	13200	1050	9.75	238	268	0.4	274	2560	2440	77.2
ANAEROBIC DIGESTER_2	1040	7600	14200	1280	14.1	341	274	0.6	307	3600	3440	90.9
ANAEROBIC DIGESTER_3	1120	7700	9210	1340	15.5	356	257	0.6	304	2560	2480	84.5
ANAEROBIC DIGESTER_4	924	6800	12800	976	14.8	180	274	0.4	357	1720	1680	80.8
ANAEROBIC DIGESTER_5	952	6900	13600	1210	15	168	256	0.3	274	1540	1440	78.5
ANAEROBIC DIGESTER_6	1060	7700	13600	1010	14.4	320	248	0.4	294	1440	1240	80.3
ANAEROBIC DIGESTER_7	1400	7500	19500	1120	16	4830	46	2.2	328	7220	7140	90
FINISHING POND_1	158	13.8	92.1	166	66.3	6	18.6	0.1	21.15	32	14.6	17.9
FINISHING POND_2	155	6	76.3	164	72.4	6.6	20.3	0.1	21.6	9.6	8	19.3
FINISHING POND_3	159	6.6	80.2	164	73.4	6.2	11.8	0.1	21	8.8	7.8	46.5
FINISHING POND_4	161	6	74.3	160	73.1	6.2	18.4	0.1	21	8.8	7.6	16.3
FINISHING POND_5	161	7.2	72.3	197	74	6.4	13	0.1	22	9	8.2	20.2
FINISHING POND_6	166	8.4	78.3	184	67.5	6	7.35	0.1	23	11	8.6	23
DAF EFFLUENT	560	36	266	605	1	8	34	0.13	38.5	81.3	73.3	30.2
DAF SOLID	3390	2470	37700	658	1	70	310	3.8	289	18600	17400	92
AERATION TANK	577	435	2130	594	1	44	43	0.5	43.1	3700	3560	76

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