WASTEWATER PLANT PERFORMANCE EVALUATION

August 23, 2011 – October 21, 2011

Borough of Corsica

Wastewater Treatment Plant

NPDES #PA0222283

Bureau of Water Standards & Facility Regulation
Wastewater Optimization Program

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

1. Optimization Report

The Pennsylvania Department of Environmental Protection (DEP) conducted a Wastewater Plant Performance Evaluation (WPPE) of the Borough of Corsica's (BOC) wastewater treatment plant (WWTP) from August 2011 through October 2011. A WPPE 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.

An overall rating is assigned based on a review of the plants past performance and current operating conditions.

The WPPE was performed by staff of DEP's Operations Monitoring and Training Division, Bureau of Water Standards and Facility Regulation (BWSFR). The WPPE program is conducted under terms of a federal grant administered by the United States Environmental Protection Agency (USEPA). The primary objective of the site study is to determine if wastewater treatment plant optimization through process control is sufficient to reduce nutrient levels in the finished effluent. This is of concern because excess nutrients cause impairments to waterways.

There is a large amount of additional analytical information included on the CD-ROM accompanying this report that has not been included in this written report.

1.1 Operational Strengths

The following items are Operational Strengths that were identified during the WPPE. These include strengths of both the operators and the facility itself.

- Corsica Borough and its operator made several improvements to the wastewater plant that were necessary due to sludge holding tanks being full, imbalanced solids inventory, and inoperable equipment.
- The Brookville Municipal Authority operators were very involved in the optimization process and should be commended for their dedication to improving plant operations during the WPPE.
- Effluent Ammonia Nitrogen and Total Phosphorus levels were reduced over the course of the WPPE.
- The facilities' rate of effluent violations was significantly reduced and is expected to be eliminated within the next 30 days.
- Modified operations at the wastewater plant are estimated to save at least $2300 per year in electrical consumption.

1.2. Focus Points for Improvement

The following items have been identified as focus points to assist in optimization efforts, and they are ranked "High," "Medium," and "Low" in terms of their importance to optimized functioning of the treatment facility. Focus points include both operational tactics and physical plant issues that can or do impact optimization efforts. These items generally demand more of the operator's attention and therefore require more of the operator's time to perform. The benefits are expected to be favorable by improving the plants discharge quality and thereby improving downstream water quality. The priority levels are defined as follows:

High- Major impact on plant performance on a repetitive basis and/or has been associated with a regulatory violation

Medium- Minimal impact on plant performance on a repetitive basis

Low- Minimal impact on plant performance on a rare basis or has the potential to impact plant performance

High:

- Sludge solids should be removed from the plant on a routine basis, determined on the capacity in the holding tanks. Current estimates are 4,600 gallons per month, 1 truck load, based on 2010 data. See section C - Solids Handling for a more in depth discussion.
- The muffin monster appears to be ineffective at reducing influent solids materials due to the grinding teeth being worn or possible other cause. The solids passing through the plant cause a significant amount of clogging in the return sludge lines. The unit should be rebuilt or replaced as necessary.
- The Dissolved Oxygen (D.O.) concentrations in the aeration basins fluctuate wildly from daytime hours to evening hours; ranges from 1.6 mg/L during the day to over 6.0 mg/L at night are common. DO levels above 3.5 mg/L are generally excessive and can lead to floc shear which impacts the ability of the floc particles to settle well in the clarifiers.
- The influent flows vary with rainfall, sometimes doubling, with significant rainfalls indicating I&I issues within the collection system which should be investigated.
- The Mixed Liquor Suspended Solids levels were very high within the treatment process, over 6,000 mg/L. This appears to be the main cause of effluent compliance issues at the plant. Maintaining mixed liquor levels that are high prevents effective treatment leading to Ammonia and Suspended Solids violations typically seen at the plant. In addition, suspended solids in the effluent will reduce the effectiveness of the UV light leading to fecal coliform violations. A target is 2300 mg/L MLSS. Once this level is achieved then operations can be modified to either maintain that level or slightly increase as necessary.
- Raw influent BOD levels fluctuate for calendar year 2010 from a low of 16.8 mg/L to a high of 410 mg/L. This implies that the influent sampling protocol is in need of modification. Samples are currently taken by grab sample but should be modified to be taken by composite sample. An effective composite sample would be at least an 8 hour composite made up of 4 samples collected over the course of the day. The 24 hour composite sample is preferred. An influent sampling point was established during the WPPE to allow for use of the composite sampler. Sampler hose was replaced and operational performance was verified.
- Target Food to Mass ratio (F/M) for an extended aeration treatment plant is .05 to .15. During half of the project the F/M was well below .05 indicating the mixed liquor

solids levels were higher than the influent was capable of providing food. Since influent concentrations cannot be adjusted; modifying F/M ratios lies in adjusting the levels of mixed liquor in the aeration basins. Reducing the levels would increase the F/M ratio to the desired levels. These values are directly affected by BOD levels.

- The authority should purchase an ammonia test kit that can be used by the operator for weekly monitoring of levels in the plant. This kit would be for process control only, not effluent compliance testing. Ensure the range of the kit will encompass the range of values typically present in the plant. A color wheel type kit would give the operator a quick idea of ammonia levels within the plant. The data gathered from this kit could only be used for process monitoring; not to be included with monthly DMR reporting.
- The low pH of the mixed liquor during the project was 5.5 S.U., much below the desired range for nitrification to occur. Caustic soda was added to the equalization tank but it did not provide for much alkalinity adjustment. The chemical feed line was moved to the first aeration tank and the operators switched to soda ash. Lime was also added during the time between caustic soda addition and the initiation of the soda ash feed. The authority should investigate the use of magnesium hydroxide for alkalinity control.
- Effluent samples are required to be composited over at least an 8 hour period. A composite sampler is on site and should be utilized. Operation of the unit was verified during the WPPE and a dedicated sampling point was established during the WPPE. A composite sample should also be used for Influent sampling.
- A blower motor failed on the evening of October 21st and resulted in a plant upset which was rectified by the Brookville operators. Had the second blower motor been set to auto and the relay in use, the blowers would have alternated usage and there would not have been an extended period of no oxygen in the plant averting a treatment plant upset.
- The belts on the blowers and/or ventilation fan squeal quite often and should be inspected. These belts should be replaced as necessary per the equipment O&M manual suggestions. Failure of a blower could cause a significant treatment upset.
- A schedule should be created that identifies critical maintenance items; all maintenance should be documented in a logbook.
- An important note regarding the use of chlorine and the UV light system. The addition of chlorine, an oxidant, can increase the oxidation reduction potential. This associated ORP increase has been shown to increase fouling in UV systems. If chlorine is routinely used, then routine cleaning and close monitoring of the UV light system and its effectiveness will be necessary.

<u>Medium:</u>

- The return sludge system is a traditional airlift system and is not capable of operating at low return rates without clogging or stopping. A Geyser airlift pump is one type of pump that still operates with air but is much more adjustable at low flow rates. Since the influent flow rates are much lower than plant capacity and the return sludge rates should approximately equal the forward flow rates (50 – 150 % of influent flow); this type of application should be considered. Other types of pumps may be available to accomplish this task.

- The operators should have available a skimmer, such as a pool skimmer, to remove leaves and other debris from the surface of the clarifiers.
- The operators should have available a squeegee to clean the walls of the clarifiers on a routine basis, preferably after wasting so the clarifiers will have time to settle again prior to discharging. The clarifier walls should be squeegeed on a weekly basis.
- The backup generator pad is sinking. This could cause stress on electrical lines from the generator to the plant and could cause a failure. The generator pad should be leveled as soon as possible.
- The operators should conduct routine maintenance on the UV system to ensure proper disinfection. Maintain daily log to document that performance is within operational limits.
- The operators should conduct routine maintenance on aeration diffusers so they provide efficient aeration.
- As part of process control management, the operator should continue using microscopic evaluation of the mixed liquor to assist in examining the health of the biomass. This is discussed in more detail in Attachment D.

BOC has had several modifications to the treatment plant and its operations over the course of the WPPE including:

- Removal of sludge solids from the holding tanks and cleaning of the post settling and post aeration tanks
- Increase solids removal from the treatment process
- Moving chemical feed line to the aeration tanks
- Cleaning diffusers in the aeration tanks
- Adjustment of blower timer settings to achieve optimal DO range
- Reduced excessive usage of blowers in equalization and sludge holding tanks
- Repair of the ultraviolet light system
- The second influent pump has been installed in the equalization tank as of the end of the WPPE

1.4 WPPE Rating

The background of the rating system for WPPE is described in Attachment A. As a result of our evaluation, the Department has assigned a facility rating of **Needs Improvement**, because the plant routinely faces challenges with its wastewater treatment based on limitations that appear to be directly related to solids management. While the facility has made significant improvements over the course of the WPPE, there is more work to be done.

Current operations are certain to result in a much improved rating during a future WPPE.

During the initial visit to the plant on Thursday, August 18th, there were several operational problems occurring.
Some of these issues include the following:

- Sludge holding tanks were full and recirculating to the equalization tanks. Sludge wasting was occurring but since the tanks were full the wasting was routed to the equalization tanks through the plant again. Solids levels in the aeration basins were nearly 7,000 mg/L at the beginning of the WPPE, suggested levels are 2,000 to 3,000 mg/L.

- The airlift line to decant sludge from the north sludge holding tank was disconnected.
- The airlift line in the first hopper section of the north clarifier was leaking causing turbulence in the tank.
- The post settling and post aeration tanks were nearly full of sludge solids.
- The Ultraviolet light system was totally inoperable.
- The skimmer piping was missing from the south clarifier.
- Only one lift pump present in the equalization tank

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

Attachment A— Program Description

Wastewater Optimization Program

Description and goals

As part of an EPA-sponsored grant, the DEP has created a Wastewater Optimization Program to enhance surface water quality by improving sewage treatment plant performance beyond that expected by existing limits of the plants' National Pollutant Discharge Elimination System (NPDES) Permits.

The goal of this program is to encourage wastewater treatment facilities to voluntarily produce higher-quality effluent than mandated by the limits set in their NPDES permits and to optimize treatment in such a way that reduces nutrients in surface waters. This program is modeled after DEP's Filter Plant Performance Evaluations (FPPEs) conducted at Drinking Water facilities.

DEP will conduct Wastewater Plant Performance Evaluations (WPPEs) to assist municipal and private wastewater systems in optimizing their wastewater treatment plant processes as part of the Wastewater Optimization Program. Each evaluation is expected to last up to 2 months.

This program is not part of the Field Operations, Monitoring and Compliance Section. Sample collection methods utilized during this evaluation generally do not conform with 40 CFR Part 136, therefore the data collected will not be used, and in some cases is not permitted to be used for determining compliance with a facility's effluent limits established in its NPDES permit.

Wastewater plant performance evaluation

- Department staff will consult with the plant operators to explain the program, the goals, the equipment used, and the expectations for participation.
- Upon arrival at the wastewater plant, Department staff will set up equipment, including meters capable of continuous, in-line monitoring for pH, Oxidation-Reduction Potential, Ammonia, Nitrates, Dissolved Oxygen, Suspended Solids, and other parameters.
- The Department will utilize the equipment to gather data on system performance, show the operator how to gather similar data, and explain the value of gathering the data. The Department will also explain how operators could choose to modify their treatment processes based on interpretation of the data collected.
- Although the Department may show operators how to achieve effective process control by using these process monitoring tools, the operators will continue to make all process control decisions, in conformance with their licensing requirements, and retain responsibility for those changes.
- The Department will also lend the facility additional laboratory equipment which will remain on site during the WPPE to assist in data collection and interpretation.
- During this time, the operator may need to spend more time performing routine testing at the treatment plant than was done previously. This will allow correlations to be made between process modifications and the process response.
- One major goal of the program is to provide the operator with the process monitoring knowledge and experience necessary to gather useful data and utilize it to make beneficial changes in the treatment process and the receiving stream long after the Department and its equipment have been removed.

- There is no charge for the Department's review of the treatment process, setup of all equipment, the process control monitoring that will take place, lending meters to the plant during the WPPE, data collection and explanation of potential effects that process modifications can have on the treatment process.
- The municipality will be responsible for providing laboratory bench space and 120 VAC power for the instrumentation. Any costs associated with process modifications (such as equipment upgrades, chemical purchases, etc.) that the municipality deems appropriate and beneficial as a result of the WPPE remain the responsibility of the municipality. The municipality reserves the right to cease participation in the WPPE at any time.
- Following the equipment set-up, the Department will observe the facilities and review operational practices, treatment processes, chemical treatment, operational data currently collected, and overall system performance.
- During the evaluation, the Department will review monitoring records, laboratory sheets, operations log sheets, and any drawings and specifications for the treatment facility. Also of interest is data currently collected and how it is utilized for daily process modifications. This information is usually available from existing reports.

Program evaluation team will consist of 1 to 2 people: Water Program Specialists, PA licensed as wastewater plant operators with operations and compliance assistance experience.

Potential Benefits

- Use of online process control monitoring equipment during the WPPE, use of hand held meters and portable lab equipment during the WPPE, and furthering the operators' knowledge of process control strategies and monitoring techniques,
- Producing a cleaner effluent discharge which minimizes impacts to the environment and downstream water users, and possible identification of process modifications that could result in real cost savings.
- Where the optimization goals may be more stringent than current requirements of your NPDES permit, they are completely voluntary. The WPPE objective is to optimize wastewater treatment plant performance in order to enhance surface water quality, minimizing the effects of pathogen and nutrient loading to downstream drinking water plant intakes.
- Furthermore, pursuit of a good rating in the WPPE program may place the wastewater system in a better position to meet more stringent regulatory requirements in the future, should they occur. For example, regulatory changes over the last ten years have reduced the final effluent Total Chlorine Residual limits requiring dechlorination or optimization of treatment processes to reduce the levels of chlorine added to the process for disinfection. Facilities who have voluntarily maintained lower residuals than listed in their permit have found it easier to comply with the updated regulations.

Potential Obstructions to Success

Many factors may present obstructions to a successful plant optimization. Some of these are listed below:

- Inadequate use or interpretation of regular process monitoring test results

- Inadequate funding of facility operating expenses, including staff training, chemical and energy usage, equipment maintenance
- Miscommunication as to program goals and methodologies
- Obsolete, inadequate, or out-dated treatment equipment and methods

WPPE Rating System

WPPE Staff use the following categories to rate each facility, based on observations and data developed during the evaluation. The ratings are based on the facility's capabilities and the operators' skill levels to maintain optimal performance over the long term. Please note that while WPPEs may discover treatment problems or identify potential or actual violations of regulations, the rating system is not based upon regulatory compliance.

- **"Commendable"**
  Department staff has identified only minor operational, equipment, and / or performance problems that affect the plant's ability to maintain optimized performance. Plant personnel have already taken steps to improve overall facility performance, maintain high effluent quality, and consistently preserve the long-term reliability of the facility.

- **"Satisfactory"**
  Department staff has identified operational, equipment, engineering, and / or performance problems that may affect the facility's ability to maintain optimized performance. Facility personnel appear willing and capable of improving overall performance; however, one or more treatment processes showed areas of weakness in operational, equipment, and/or performance that, if corrected, will improve treatment performance and maintain the long-term reliability of the facility.

- **"Needs Improvement"**
  Department staff has identified considerable operational, equipment, and/or performance problems that are affecting the facility's ability to maintain optimized performance. Limitations are apparent that hinder improvement of overall filter plant performance. Areas of weakness affect the capability and dependability of the plant in producing a quality final effluent, increasing the potential for degradation of the receiving stream through increased nutrient and/or pathogen loading.

Attachment B— WPPE Team

Borough of Corsica Wastewater Treatment Plant

WPPE Team

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Brookville, PA 15825

Additional Brookville Municipal Authority wastewater plant personnel assisting in the WPPE project:
Terry O'Neill – Commissioner
Clyde Bullers – Assistant Commissioner – Technical
Dan Means – Operator
Don Swineford – Operator
Jeff Hetrick – Operator

Attachment C— Plant Description and Treatment Schematic

The BOC currently operates an extended aeration treatment process utilizing a package treatment plant constructed of concrete. The treatment plant is reportedly under capacity for both hydraulic and organic loadings. The features of the treatment plant are discussed below and a treatment schematic, based on design drawings, follows.

Operations—BOC retains the services of one operator in responsible charge and relies on the Brookville Municipal Authority for performance of daily operations based upon a verbal agreement contingent upon the transfer of wastewater plant ownership between the two entities.

Headworks—The headworks include a muffin monster and manual bar screen prior to the equalization tank. The equalization tank consists of two tanks with an approximate 0.014 MGD capacity and lift pumps controlled by a bubbler system. The muffin monster is in need of repair since it is not effectively grinding the solid materials present in the raw wastewater. In its current condition, it is contributing to frequent clogs in the return activated sludge lines. When these lines clog overnight and no one is present, the clarifiers accumulate a blanket of sludge on the surface and sludge solids can be discharged to the post settling tank, not to mention there is much work involved in getting the clarifier back into proper operation.

Influent Sampling—The influent samples are collected manually by grab sample. This does not allow for accurate representation of influent BOD strength which is necessary for optimum plant operation and reporting in the Department's Annual Wasteload Management Report (Chp 94 Report). As part of the WPPE, a sampling collection point was established after the muffin monster, before the equalization tank and return flows. A sample hose was permanently mounted for convenience so the composite sampler may be taken to the location plugged into the sample hose and immediately put into operation. A 24 hour composite sample would be optimum for accurate representation of plant influent.

Aeration—There are five aeration tanks, with a total approximate capacity of 0.051 MG. Submerged coarse bubble diffusers provide air and mixing. The DO levels in these units were between 0.0 and 6.2 mg/L over the entire project. Traditional aeration calls for DO levels between 1.5 and 3.5 mg/L. The diffusers in the aeration tanks have been cleaned and appear to be operating properly. If DO levels cannot be controlled through the timer settings another fix may be the installation of variable speed drives on the blower motors or dissolved oxygen probes in the aeration tanks used to control blower motor speed and/or run time.

Clarifiers—There are two clarifiers providing an approximate 0.01032 MGD combined capacity and 238 sq ft of settling area. Each clarifier has two hopper sections with return sludge lines from each to the first aeration tank. There are skimmers only in the section nearest the aeration tanks; not near the discharge end of the clarifiers. Target sludge blanket levels should be 1 to 3 feet.

Disinfection—The disinfection process is achieved utilizing ultraviolet disinfection. At the start of the WPPE the UV system was inoperable. The ballast and bulbs were replaced during the WPPE, but the top bulb in each of the two banks of bulbs again failed. Further system repair in mid-October corrected the operation of the UV system and all bulbs were in operation from that time forward. Effluent fecal coliform values were still slightly over 1000 / 100 ml at the end of the WPPE but were within the winter limits.

Discharge—Final effluent flows from the post aeration tank and V notch weir to its discharge location at Outfall 001 on Welch Run. The effluent composite sampler was not used over the course of the WPPE. The NPDES permit requires composite sampling for all parameters other than fecal coliform which is a grab sample. The composite sampler was confirmed operational during the WPPE and a sample collection point was established at the discharge from the post aeration tank. A sample hose was permanently mounted for convenience so the composite sampler may be taken to the location plugged into the sample hose and immediately put into operation.

Solids Handling—Solids are wasted from the clarifiers to sludge holding tanks. There is a sludge holding tank for each clarifier, each with a capacity of approximately 7,600 gallons. The sludge holding tanks are interconnected and also have an overflow line going back to the equalization tank. Decant water from the sludge holding tanks is returned to the equalization tank.

At the beginning of the project sludge holding tanks were full and overflowing to the equalization tank. At normal levels it should take approximately one week to fill the sludge holding tanks. Further wasting to the holding tanks without decanting and hauling sludge as necessary would effectively keep all solids in the plant, elevate the mixed liquor levels, and greatly increase the sludge age. This was the case upon the start of the WPPE as solids had not been removed from the plant for approximately one year. This likely also contributed to the discharge of elevated solids that was ongoing during the start of the WPPE.

Mass balance calculations were performed based on information provided in the 2010 Chp 94 Report. Attachment K outlines the calculation. There appears to be a large variation between loadings reported in the Chp 94 reports and estimated values based on population and industry accepted values for sludge production. This reinforces the need for a good influent sampling plan including composite samples representative of the actual flows. Using either value for calculating the loadings, there exists a significant difference in the amount of biosolids that were actually removed from the facility and what the facility generated, based on calculations. Over the course of the WPPE, the frequency of solids removal increased significantly.

Solids accumulate in the waste treatment process routinely and must be wasted to the holding tank and removed from the plant as necessary. Based upon 2010 data provided in the Chp 94 report and DMRs, it is estimated that there would be approximately 56,200 gallons of sludge generated yearly. This would equate to 4,600 gallons per month; this is approximately one truck of waste solids generated per month and would necessitate this volume be removed on a monthly basis. Using the 2010 data adjusted for BOD loading based on population, the sludge generation jumps to 149,520 gallons per year or 12,460 gallons per month which equates to nearly 3 trucks of waste solids per month. Once more accurate influent data has been collected and an accurate baseline can be established, a more definite waste hauling schedule can be established. For now, it appears that one truck, 4500 gallons, of waste sludge removed from the holding tanks each month is appropriate.

The former operator calculated volumes for sludge wasting based on tank volume. Based on these calculations, 1 inch of sludge in 1 holding tank equals approximately 85 gallons. During the WPPE, the sludge wasting rates equaled approximately 6 inches or 510 gallons, which would be a waste rate of approximately 34 gallons per minute. Since both clarifiers return at the same rate, the total volume wasted in 15 minutes is approximately 1020 gallons. The sludge waste rates are equal to the return sludge rates since only the valve positions are changed between operations and not flow rates. Therefore the return sludge rate to the first aeration tank would be 34 gallons per minute from each clarifier for a total of 68 gpm. This return rate is much higher than the average forward flow rate. Generally extended aeration plants call for a 50 to 150% return sludge flow rate while the return sludge flow rate is currently about 540%. This can lead to hydraulic overloading of the clarifiers and associated reduced performance. The current use of traditional airlift pumps prevents the operators from adjusting the return sludge rates much lower than the current settings. If the air input is adjusted from its current position, the above values would need to be recalculated. This excessive return sludge flow rate was adjusted as low as possible with the air lift return system. It will be necessary to investigate replacing the air lift system with another, possible geyser style pump that can be adjusted to a much lower flow rate.

Performance Track Record: Past Performance—The plant has experienced violations over the past 18 months including Biochemical Oxygen Demand, Total Suspended Solids, Ammonia-Nitrogen, and Fecal Coliform.

Current Performance—As of the completion of the WPPE, the facility is currently meeting permitted effluent limits for BOD, Ammonia, Total Suspended Solids, and Fecal Coliform in weekly samples collected by the Department. Several process modifications including the reduction of solids in the treatment process were key aspects of the plants operational improvements. Further work is necessary to fully operate the facility to its fullest potential.

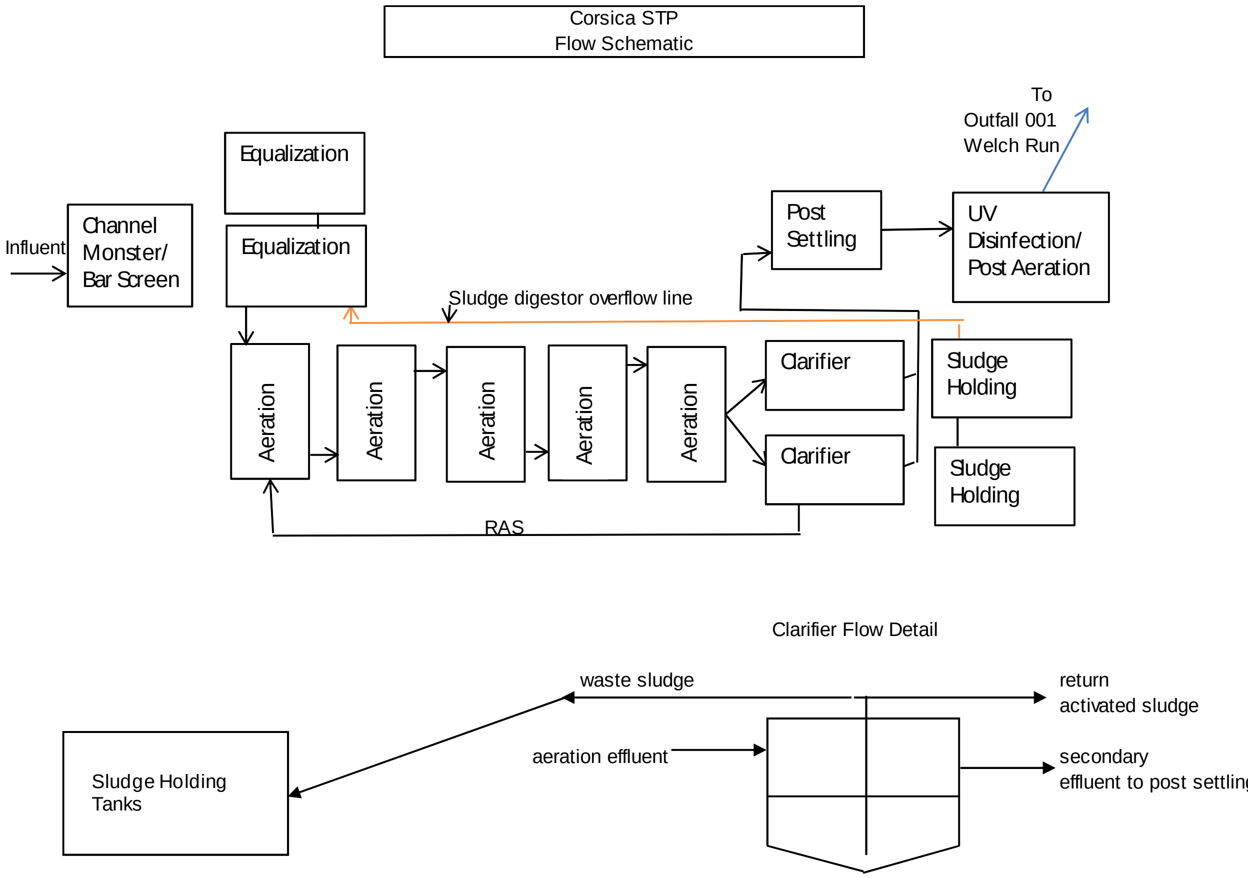


Figure C.1 Corsica Borough wastewater treatment plant process flow schematic

Attachment D— 2011 Process Monitoring and Control

Equipment Deployment—During May 2011, the Department deployed 5 in-line process monitoring probes to monitor the activated sludge treatment process. These included dissolved oxygen (DO), oxidation/reduction potential (ORP), pH probe, ammonia-nitrogen (NH3-N), and mixed liquor suspended solids probes installed in the aeration tanks.

The probes were installed and calibrated, then recorded readings every fifteen minutes to a laptop computer for the duration of the study. The purpose of these probes was to monitor the conditions and efficiency of the treatment process. The data generated allow the operator to observe trends and the impacts of various process modifications throughout the treatment process over the course of the project. The ammonia probe is intended to serve as a trending device and not for compliance purposes.

Laboratory Equipment—DEP staff deployed a portable wastewater lab for process monitoring, including: Centrifuge Solids inventory by Volume Percent, Settleometry for Sludge Volume Index (SVI) development, Microscopy with Digital Photography, and a Spectrophotometer for interpreting wet-chemistry tests for nutrients.

Sampling and Off-site Analyses—Weekly samples of the raw wastewater, final effluent, upstream (background) and downstream (impacted) waters were taken for analysis at our off-site laboratory, to characterize the plant operating conditions by assaying several wastewater treatment parameters. In addition, sampling and testing was performed on mixed liquor suspended solids and return activated sludge. A table of test results for these samples follows in Attachment J.

Interpretation of Data—

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.

Solids Management

The solids management and inventory control program is based primarily on ½ hour settleability tests performed on mixed liquor samples. Additionally, gravimetric tests are being performed on a monthly basis. The ½ hours settleability tests should be performed at least three times per week and the gravimetric tests (MLSS samples sent to the lab) should be performed at least twice per month, preferably more often until the solids handling issues have been resolved.

The current practices include wasting solids based on settleability test results. Settleability testing alone does not give an accurate picture of the mass of solids present under aeration. While it can be effective, it best represents conditions present in the clarifier.

MLSS vs. Centrifuge Solids comparison charts were prepared for the operator’s use should they acquire a centrifuge, which is encouraged. With a centrifuge, an operator can use the attached charts to estimate MLSS levels after performing a % solids test which should give a good indication of solids levels and help with deciding when to waste solids. These charts would need to be updated regularly to ensure changes in plant conditions are considered, especially seasonal considerations. In addition, the values will not be representative if treatment should be impacted.

Table D.1, below, depicts the mixed liquor suspended solids in relation to the respective centrifuge solids reading. By plotting the data and inserting a best fit line, one can use a centrifuge solids reading to estimate the MLSS reading. Attachment I, Figure I.7 graphically depicts the MLSS / % solids relationship. To utilize the chart, find the % solids result along the x axis and draw a line vertically to the black line to find the approximate MLSS result.

While these MLSS results fluctuated over the project, more data points would increase the reliability of the predicted values. Using the chart below, the average of the centrifuge multiplier values is 1051. Therefore, when performing MLSS centrifuge tests, multiplying the resultant % solids value by 1051 will give a good approximation of the actual MLSS value for that sample.

	10/4/11	9/22/11	10/12/11	9/8/11	9/1/11
MLSS-BOL	3124	2936	2632	3972	6488
Centrifuge	2.6	2.75	2.75	4.4	5.75
MLSS/Cent solids ratio:	99.92%	99.91%	99.90%	99.89%	99.91%
Centrifuge # multiplier	1202	1068	957	903	1128

Table D.1: MLSS vs. Centrifuge solids, Aeration Tank

The ½ hour settleability test results were initially on the very high side near 640ml or more per 1000 ml at the beginning of the WPPE. The Brookville operators were very effective at reducing the MLSS to more manageable levels. Toward the end of the WPPE the settleability test results indicated an old sludge with very fast initial settling and suspended floc in the supernate.

Table I.1 outlines the results of additional process control testing collected over the course of the WPPE.

SOUR/OUR testing—This procedure will tell you how fast the biomass or bugs are metabolizing the wastewater. Oxygen uptake rate (OUR) and Specific oxygen uptake rate (SOUR or Respiration Rate) tests are a way to quickly monitor the toxicity or food value of sewage and wastewater to the living and breathing biomass within a wastewater treatment plant. These tests can show the rate at which oxygen is used by the bugs in the activated sludge system. They can indicate if the bugs are consuming the oxygen at a normal rate; assuming several tests are done over time to establish a baseline for a particular facility. In general, plants with high MLSS levels will use more oxygen than those with lower MLSS levels. While the OUR test looks at oxygen consumption based on MLSS levels, the SOUR test looks at oxygen consumption based upon the living biomass and its ability to metabolize the wastewater. OUR testing measures milligrams of oxygen used by a liter of mixed liquor per hour and SOUR testing measures milligrams of oxygen used per hour by a gram of mixed liquor volatile suspended solids.

A SOUR less than 12 mgO2/hr/gm MLVSS can be indicative of endogenous respiration and can be accompanied by pin floc. A SOUR in the 12-20 range is usually indicative of a healthier biomass and improved settling. The SOUR rates at the facility increased slightly over the course of the project, attributed to decreases in MLVSS levels.

The SOUR measurements at the BOC plant were all much under 12 which is attributed to high sludge age within the treatment plant. This high sludge age finding is also supported by the very fast settling sludge with pin floc, the rotifers and nematodes under the microscope, and the sludge age calculations.

Food to Mass Ratio—The target F/M ratio for this type of extended aeration treatment facility is generally 0.05 to 0.15. Influent grab samples collected after the muffin monster varied in BOD strength over a large range, 137 – 592 mg/L. After calibrating and replacing hose on the BOC composite sampler, a permanent sampling point was established for influent composite sampling. For three weeks in November, personnel collected influent 24 hour composite sample along with a grab samples for comparison. While the results for the composite sampling is not available for this report it will be provided to BOC for further process modification. Once a consistent influent loading is established then a target mixed liquor solids level can be calculated to maintain a consistent F/M ratio. Using 2010 DMR data for average influent BOD loadings of 111.6 mg/L, 0.0095 MGD flow, and a target F/M of 0.05, the desired mixed liquor volatile solids level would be 610 mg/L in the aeration basin. This is extremely low and does not compare to samples collected during the WPPE. The average BOD of grab samples collected during the WPPE was 377 mg/L and the average flow was 0.0095 MGD. Using those numbers and an F/M of 0.05, the desired MLVSS is 2798 mg/L. This value is rather high for this facility, it would equate to a MLSS of approximately 3700 mg/L.

The F/M ratio issue will need to be revisited once representative influent loading data has been collected. This data will affect the MLSS levels and the volume of sewage sludge that will be generated and must be routinely hauled out.

Microscopic Exam— During the WPPE, microscopic evaluation of the mixed liquor identified minimal biological lift in the form of protozoa. The operator should routinely perform microscopic examination of the mixed liquor to observe biomass conditions and look for the presence of indicator organisms. A microscope is present on site and some of the operators are familiar with microscopic evaluation of mixed liquor. Additionally, training courses are available from various sources dealing with the microscopic evaluation of mixed liquor as a process monitoring tool.

Indicator organisms can be used to determine relative sludge age: More free swimming ciliates usually indicates a "young sludge", while the presence of mostly rotifers and nematodes indicate "old sludge." The presence of equal numbers of free swimming ciliates and stalked ciliates usually suggests a biomass that exhibits good settleability and optimal conditions for treating wastewater. As seen in the photographs below, which are indicative of the entire slide contents, the aeration basin contained mostly nematodes and rotifers, which are indicative of a very old sludge. Near the end of the project, more free swimming ciliates and stalked ciliates were present in the slide samples.

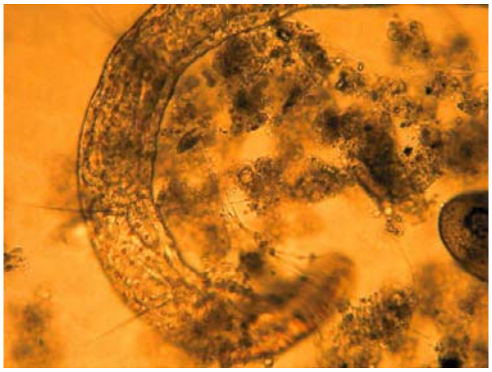


Figure D.1: Microscopic evaluation of aeration tank

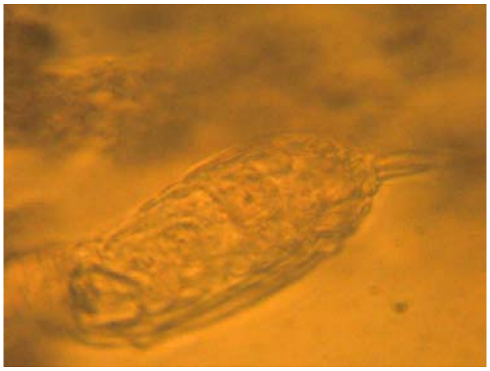


Figure D.2: Microscopic evaluation of aeration tank

Mean Cell Residence Time—The MCRT varied greatly between 28 days 15 days. The average MCRT was approximately 23 days.

DO Findings—DO levels between the aeration tanks themselves varied greatly and had typical diurnal effects over the evening hours. The DO levels within the tanks were adjusted to maintain consistency. A blower failure at the end of the project and further blower valve adjustments will require further reevaluation of DO levels and adjustments to equalize the levels.

DO Grab Testing—DO was measured in the aeration tank, near the on-line probe, using a hand-held LDO probe. The purpose of this was to confirm readings measured by the in-line process monitoring probes. Additional DO measurements were collected around the tank to profile the pattern of available oxygen. There were no indications of significant variations in the readings.

Effluent DO samples typically measured in the 8.0 mg/L range, attributed to the aeration provided in the post aeration tank.

Flow Measurement—BOC utilizes effluent flow monitoring in its operation. Yearly calibration of the flow meter is necessary to comply with annual reporting requirements. The meter was calibrated during the WPPE.

Method of Sludge Inventory Control—Weekly observations included Solids by volume, 30-minute Settleability, Sludge Volume Index, and Gravimetric testing.

eDMR—The facility records used in this report were obtained from hard copy data sent to DEP and from the electronic DMR reporting system (eDMR). The facility began using eDMR earlier this year for NPDES reporting requirements. When submitting documents for eDMR reporting, all supporting documents required by the NPDES permit should be submitted along with the DMR form itself. These include supplemental forms, bio-solids forms, and other forms as required by the Department. The permittee is responsible for all DMR submissions whether hard copy or electronic submissions.

Raw Influent Data—Current customer base includes: Domestic sewage. Plant design data utilizes 88 lbs/day BOD loading equating to approximately 518 persons. The 2010 Chp 94 Report identifies 165 EDUs currently connected to the plant. Assuming 2.5 persons per EDU, this equates to a population of approximately 412 residents connected to the wastewater plant.

Assuming BOD production of 0.17 lb BOD/person/day, the daily plant loading is expected to be in the vicinity of 70 lbs/day.

This data supports the need for a more representative influent sampling plan including the gathering of composite samples. 24 hour Composite influent sample should be collected at least two times per month.

Oxidation Reduction Potential—Also referred to as ORP, measures the ability of the wastewater to oxidize waste material. The following chart identifies select ranges of measurement.

ORP (mV)	Process	Electron Acceptors	Condition
> +100	1	O2	Aerobic
≤ +100	2	NO3	Anoxic
≥ -100	2	NO3	Anoxic
< -100	3	SO4	Anaerobic

1= Nitrification

2= De-Nitrification

3= Methane Formation

Table D.2: Oxidation Reduction Potential (ORP) ranges for bacterial activity

The ORP levels at BOC ranged between 127 mv to 342 mv. All measurements were within ranges expected to be favorable for nitrification to occur.

Energy Consumption—During the WPPE several procedures were enacted to reduce electrical usage and costs. In wastewater plant operations, electricity is usually the largest cost. After monitoring the DO levels for a period of time, approximately one month, it was determined that the levels were much higher than necessary over the night time hours, 6.0-7.0 mg/L. (Excessive over aeration can lead to floc shear and poor settling.) The blower run times were modified since the aeration tank blowers were set with relays to alternate between blowers and a timer to control blower run time. Over the evening hours, once DO levels begin to continuously climb, the blowers are alternated on and off. Current settings are ½ hour off and 45 minutes on. This off aeration provides approximately 6 hours of off aeration over the course of the day. This is approximately ¼ of the aeration blowers' previous usage. The spreadsheets in Appendix G identify the cost breakdown for each motor based on the original and modified operations schema.

Also, and more importantly from a cost savings standpoint, there were two blowers providing air to the sludge holding tanks, equalization tanks, and post aeration tank. After verifying operating conditions, it was determined that only one blower was necessary to provide air and mixing in those tanks. This has removed one blower motor from continuous operation which should noticeably reduce electrical costs over a one month period.

The overall energy savings as a result of the WPPE is estimated to be nearly $2,300.00 per year.

Attachment E— Equipment Deployed

Digital, Continuously Monitoring Probes

Laboratory Equipment On-Loan

Digital, Continuously Monitoring Probes:

1 – Laptop computer with signal converter, 2 – SC1000s, 1 – LDO probe, 1– pH probe,

1 – ORP probes, 1 – NH_4D probe w/Cleaning System, 1 – Solitax probe

Laboratory Equipment On-loan:

1 – Hach HQ40d handheld pH and LDO meter 1 – LBOD probe 1 – DR2800 spectrophotometer 1 – Wastewater Field Test Kit 1 – Raven centrifuge 1 – Raven Core Taker sampler 1 – Raven settleometers

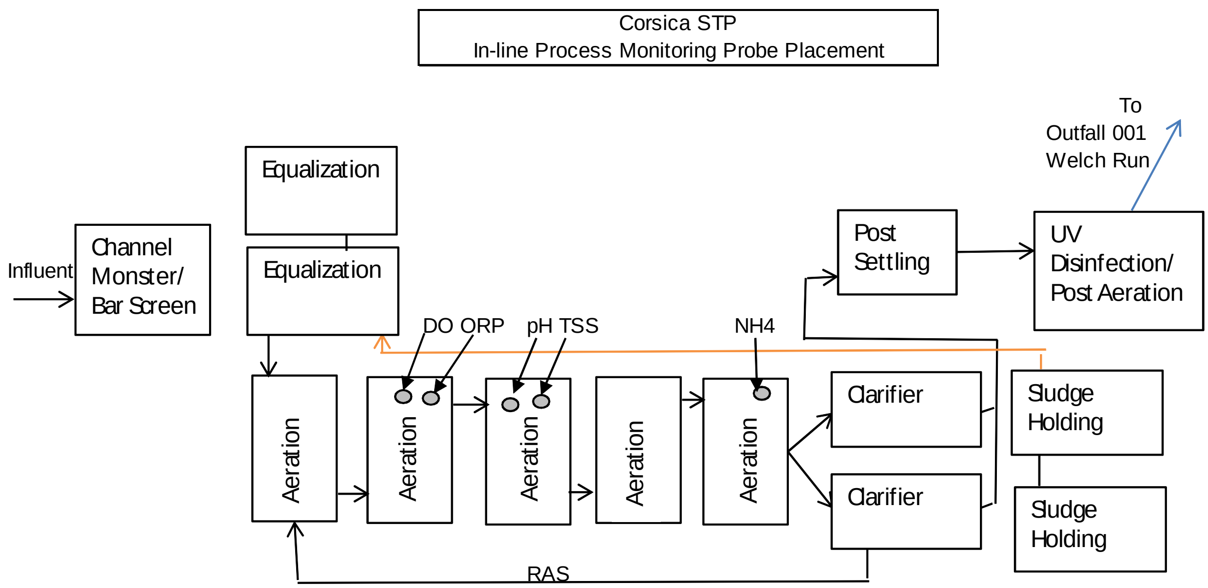


Figure E.1 Locations of on-line process monitoring equipment

Attachment F—Equipment Placement Photos

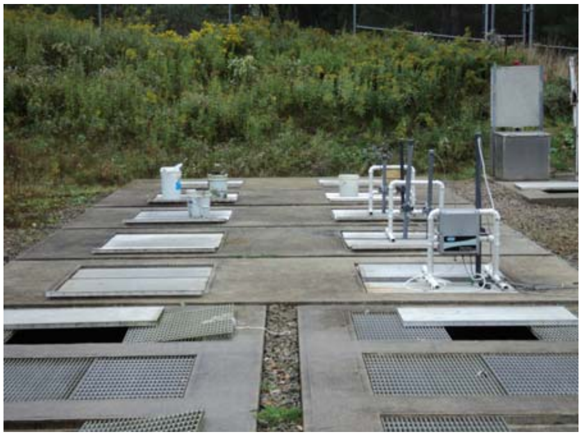


Figure F.1: On-line monitoring probes in aeration tanks

Figure F.2: Equalization tanks/splitter box

Figure F.3: SC1000 display at post aeration tank

Figure F.4: Laboratory equipment setup

Figure F.5: Sludge holding tanks, post settling, post aeration

Figure F.6: Muffin monster/ manual bar screen

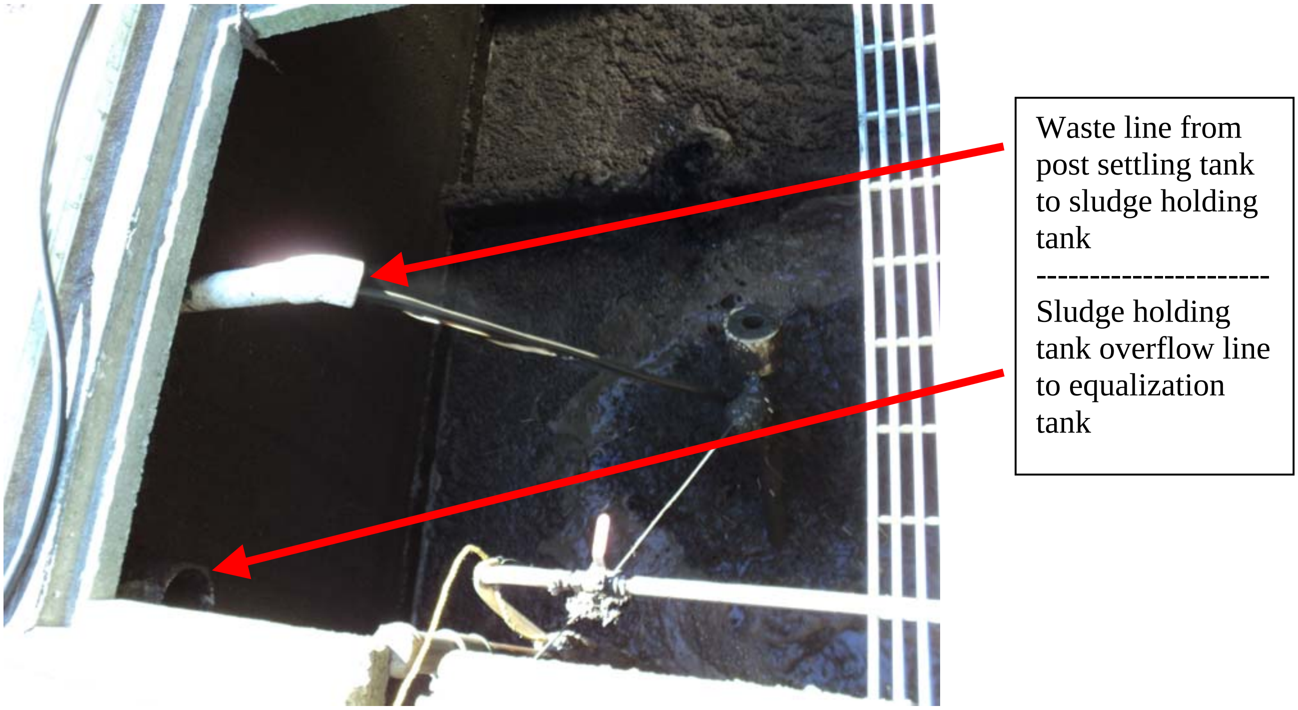


Figure F.7: North sludge holding tank

Figure F.8: Accumulation of chlorine tablets at the bottom of the post settling tank

Attachment G— Continuous Digital Monitoring Charts

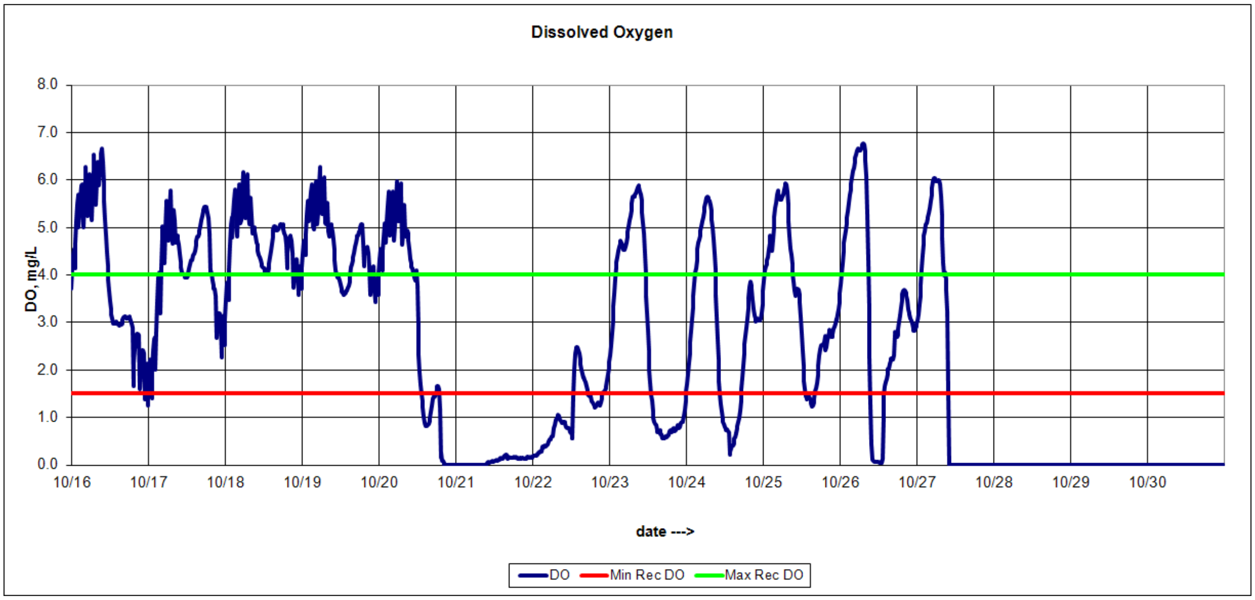


Figure G.1: Sample Dissolved Oxygen monitoring data, October 16 through 27, 2011, note the blower failure on Friday evening Oct 20 and the startup of the backup blower and changing of air valve positions in the aeration tanks the following day. One blower was turned off and had to be manually started on Oct 21 instead of starting automatically via the timer / relay settings. The blowers / relays are now set to alternate to prevent a similar occurrence.

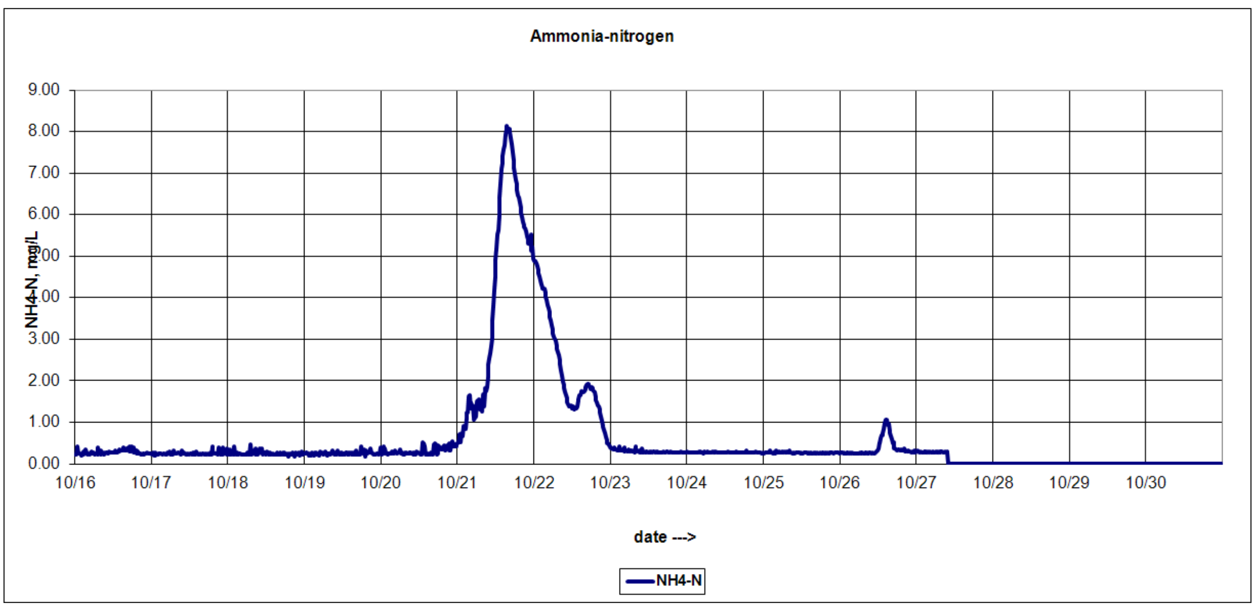


Figure G.2: Sample Ammonia nitrogen data from October 16 through 27, 2011. Note the spike in ammonia on Oct 21 due to the blower failure on late Oct 20th.

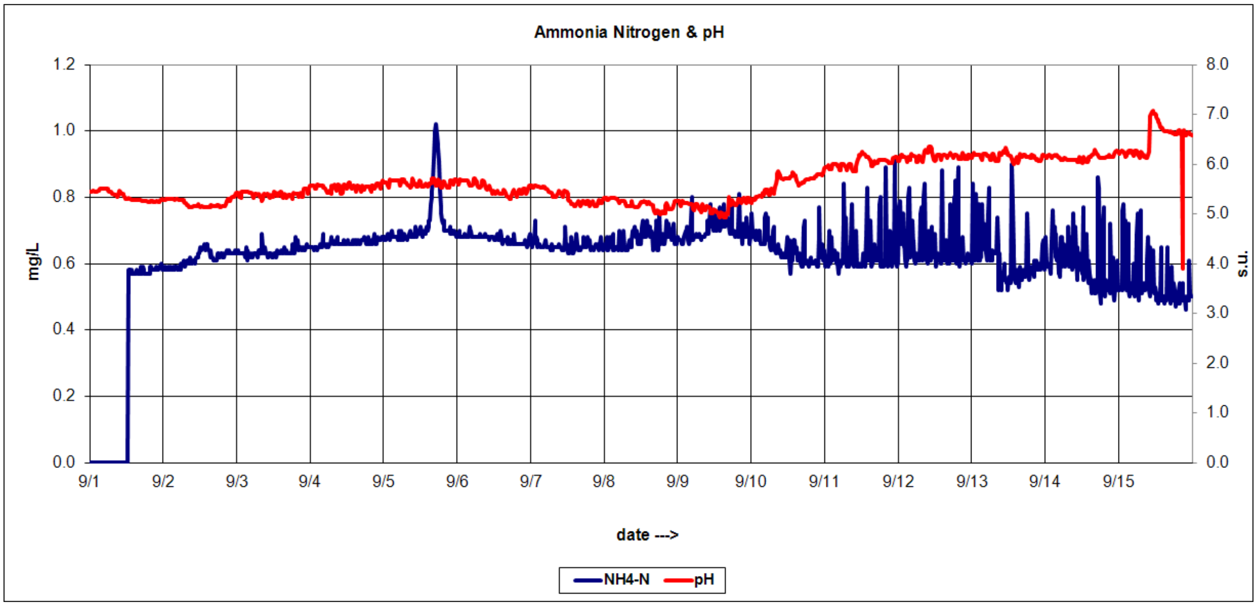


Figure G.3: Sample Ammonia and pH data. Maintaining a constant source of alkalinity is essential to ensuring availability for nitrification to occur. This graph depicts problems with a dropping pH impacting nitrification due to the lack of alkalinity.

Attachment H—Process Monitoring Tests: Example WPPE Daily/Weekly Bench Data

Corsica STP
Bench Sheet

Date: 10/4/2011 Time:

Lab Tech: DiGilarmo

Raw Wastewater (INF)		
Flow	0.018	MGD
Influent TSS	161.00	mg/L
Influent BOD	426.00	mg/L
Effluent TSS	28.00	mg/L
Volume waste slugde	0.00100	MG
Desired MCRT	12	days

Loc	Aer	clar	RAS	WAS				
Spin Solids	2.60		6.50					
Tank vol. (MGD)	0.052	0.010						
surface area(ft^2)		238.00						

Location	MLSS	MLSS		
Time	SSV	SSC		SSC
0.00	1000.00	2.60	1000.00	2.60
5.00	300.00	8.67		#DIV/0!
10.00	220.00	11.82		#DIV/0!
15.00	190.00	13.68		#DIV/0!
20.00	170.00	15.29		#DIV/0!
25.00	160.00	16.25		#DIV/0!
30.00	150.00	17.33		#DIV/0!
40.00	150.00	17.33		#DIV/0!
50.00	150.00	17.33		#DIV/0!
60.00	150.00	17.33		#DIV/0!

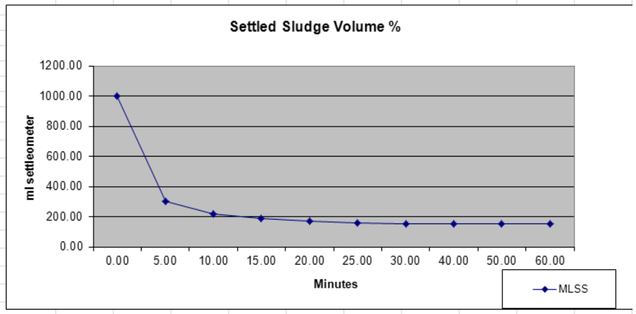
SSC=[(Spin%) x 1000] ÷ SSV

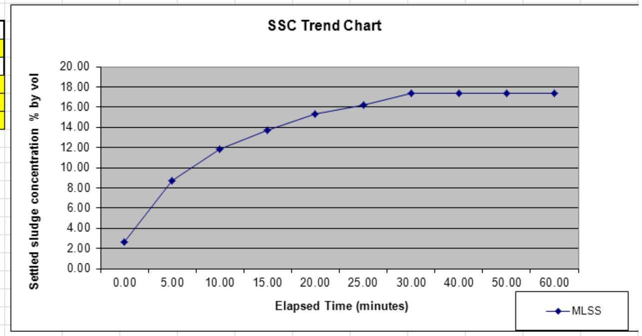
WCR=TSS ÷ Spin%

	Aer	
TSS	3124	
WCR	1201.54	
MLVSS	1990	
RAS solids	5964	
RAS VSS	3332	

	N-Aer				Target Range
SVI	48.02				100 ml/gram
Sludge Age	55.82	days			30 to 40 days
HRT-Aeration	69.05	hours	2.88		16 to 24 hours
F/M Ratio	0.07				0.05 to 0.15
MCRT	26.83	days			at least 10 to 13 days

	N-Clar		
Surface overflow rate	76		gpd/sf
HRT	13.76		hours





Bench Tests	INF	Aer	Aer	RAS	N Clar	Effl	SC1000	Effl-Lab	S Clar
Nitrate									
Phosphate-P									
Ammonia-N		0.078					0.220		
COD									
pH						7.42			
DO						8.70			
TRC									
Alkalinity		170.00							
Blanket Depth									
Temp°F						60.60			
COD-Hg Free									
MLSS									

Notes:
RAS VSS used as WAS sludge VSS for MCRT calculation

viewed slides of biomass
many worms, some rotifers

settling very fast with straggler floc

Figure H.1: Bench test results, operational test parameters

Corsica STP
Bench Sheet

Date: 10/4/2011 **Time:**

Lab Tech: DiGilarmo

OUR Testing

Location: Aertaion

Time	D.O.
0	9.28
1	9.18
2	9.07
3	8.97
4	8.88
5	8.78
6	8.68
7	8.59
8	8.49
9	8.39
10	8.3

OUR = slope x 60

slope = 0.98 / 10

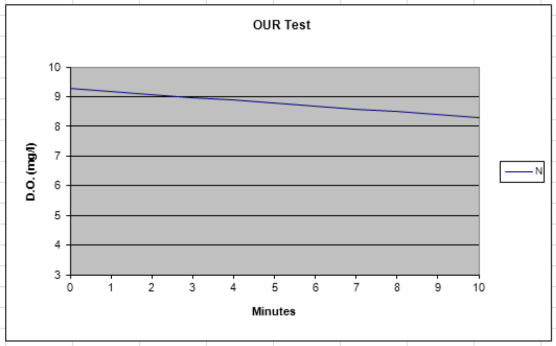
OUR = 0.98 / 10 x 60

OUR = 5.88 mg O2/L-h

RR= (1000 x OUR) ÷ VSS

= 1000 / 1990.00 x 5.88

RR = 2.95 mg O2/g-MLVSS-h



SOUR >20mgO2/hr/gm MLVSS	SOUR 12-20mgO2/hr/gm MLVSS	Sour <12mgO2/hr/gm MLVSS
Logarithmic growth, Flagellates, dispersed flock	Declining growth, Ciliates, Flocks forming	Endogenous Respiration, Rotifers and higher life
Settling Slow SSV5>750ml/L	Settling normal SSV5=600-750 ml/L	Pin Flock
		Settling Fast, SSV5<600ml/L

Figure H.2: Bench test results, OUR/SOUR testing

Attachment I—Graphs: Process Monitoring Test Results

Borough of Corsica STP

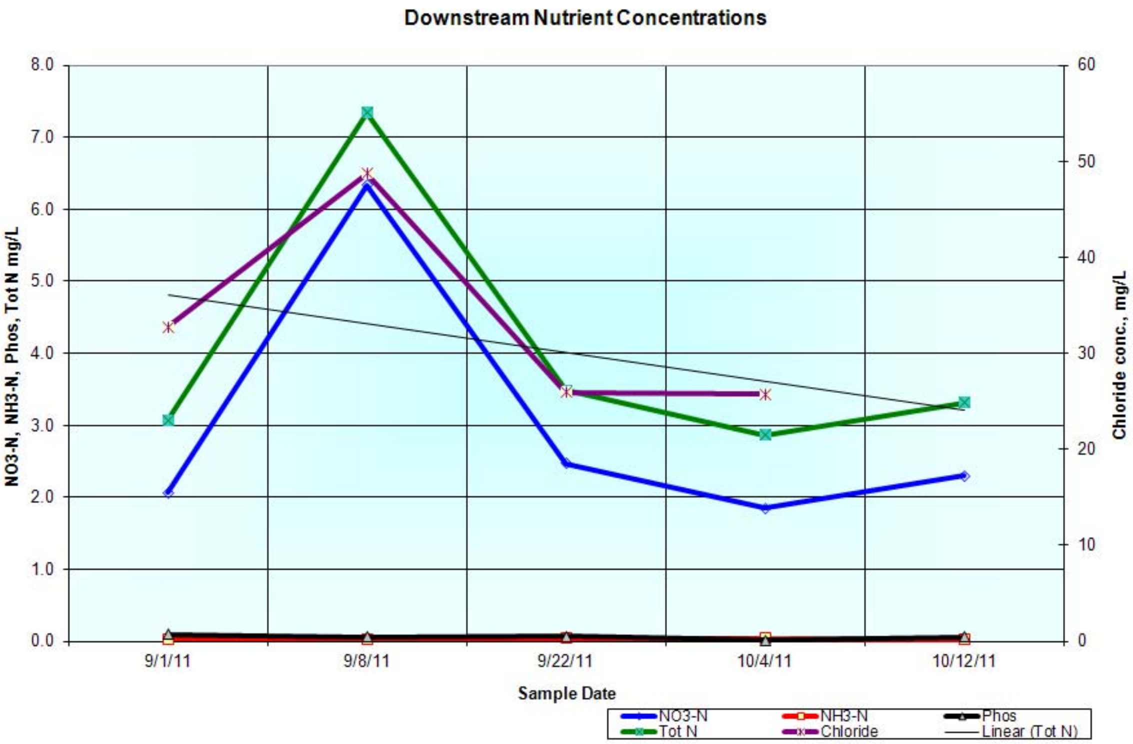


Figure I.1: Overall reduction in downstream nutrient concentrations

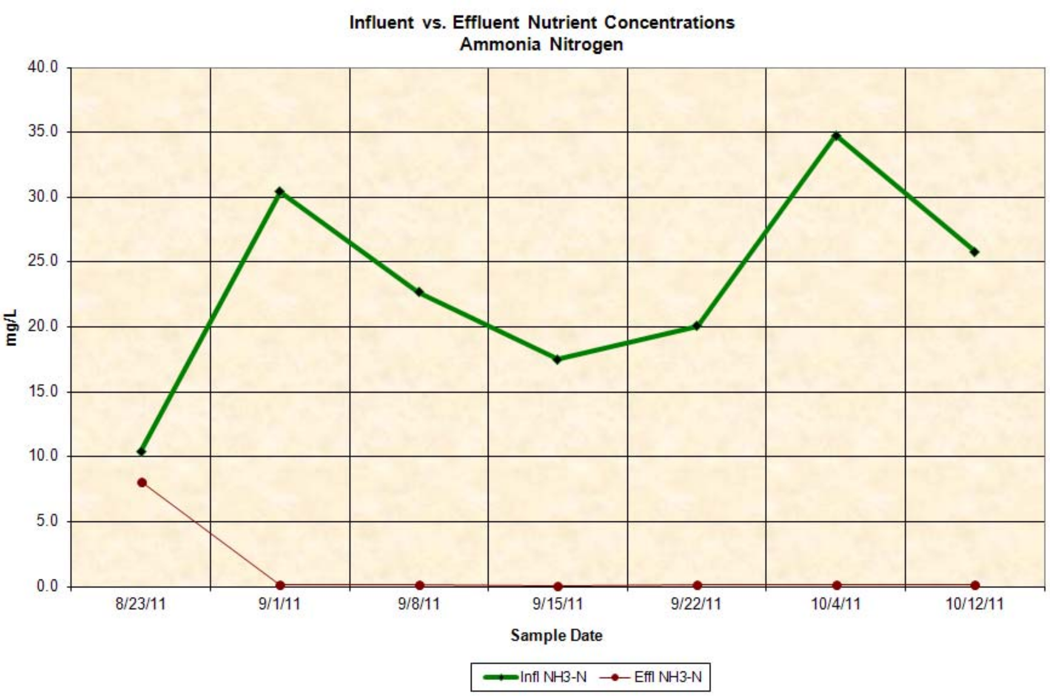


Figure I.2: Reduction in ammonia nitrogen levels in the effluent through process optimization (from 8 mg/L to 0 mg/L)

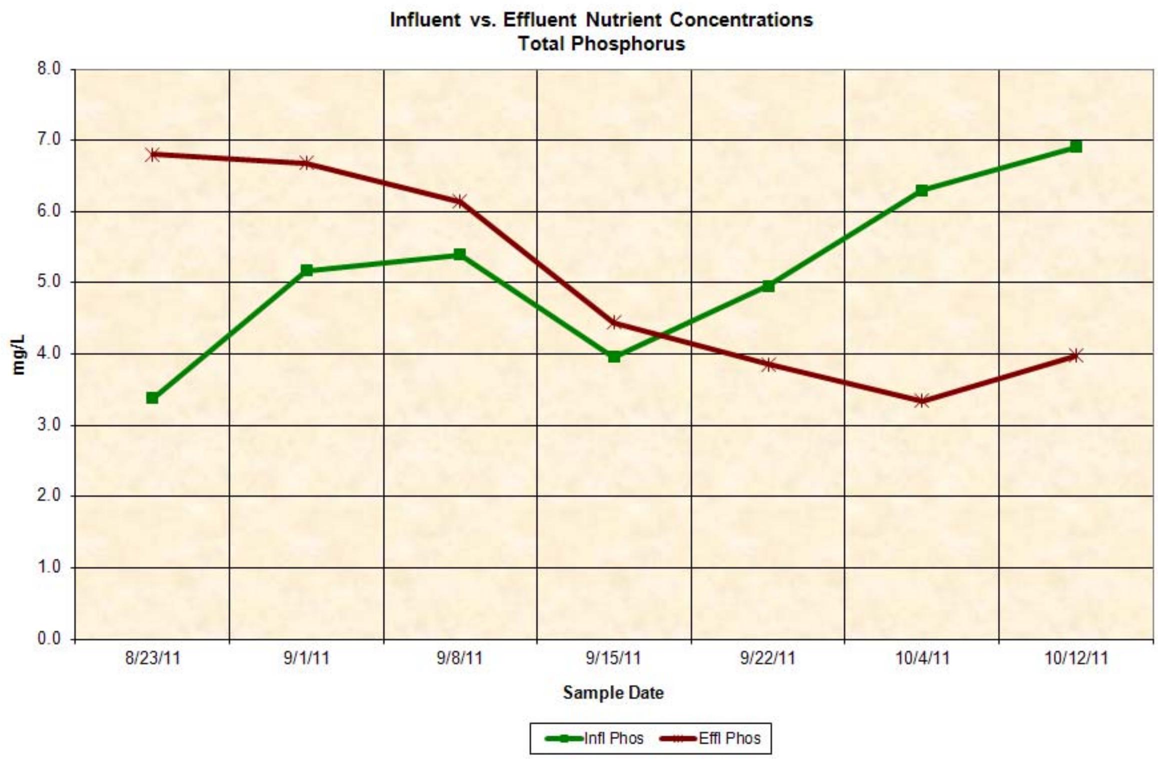


Figure I.3: Reduction in Total Phosphorus levels in the effluent through process optimization (from nearly 7 mg/L to 4 mg/L). While influent phosphorus levels were increasing, the effluent phosphorous levels were steadily decreasing.

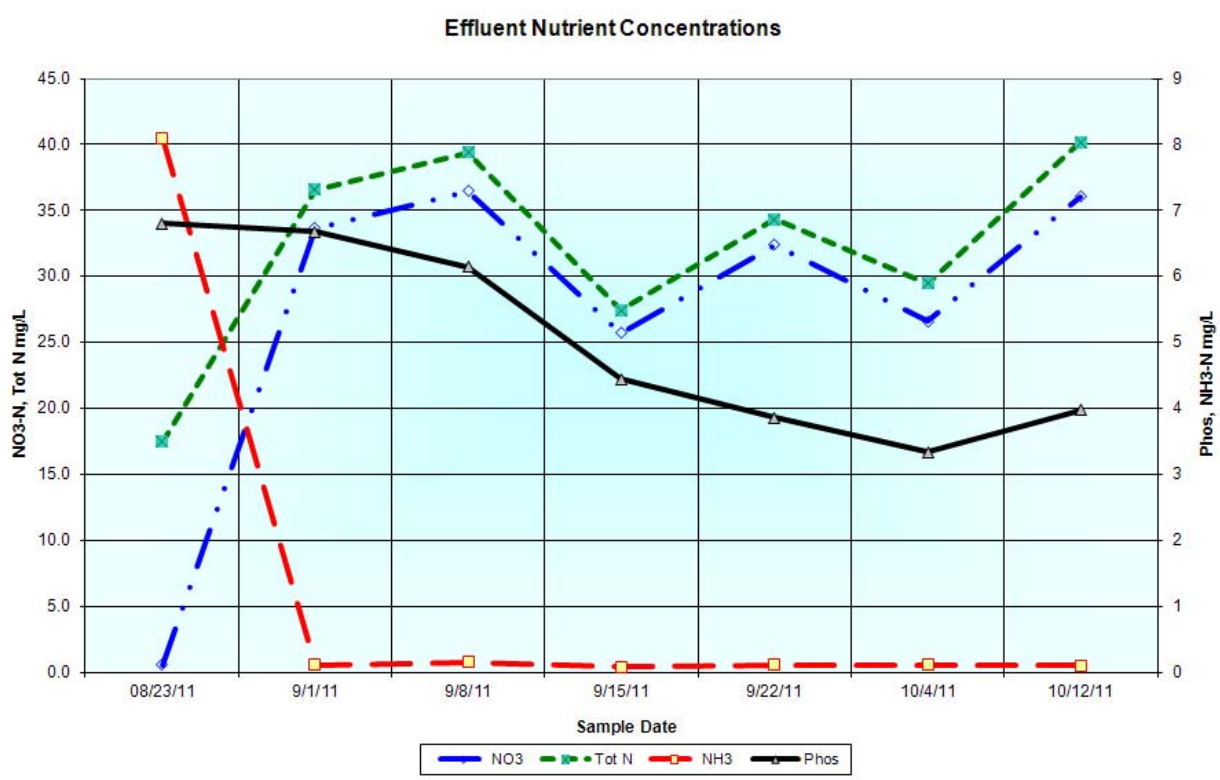


Figure I.4: BOC effluent nutrient levels from DEP, BOL testing

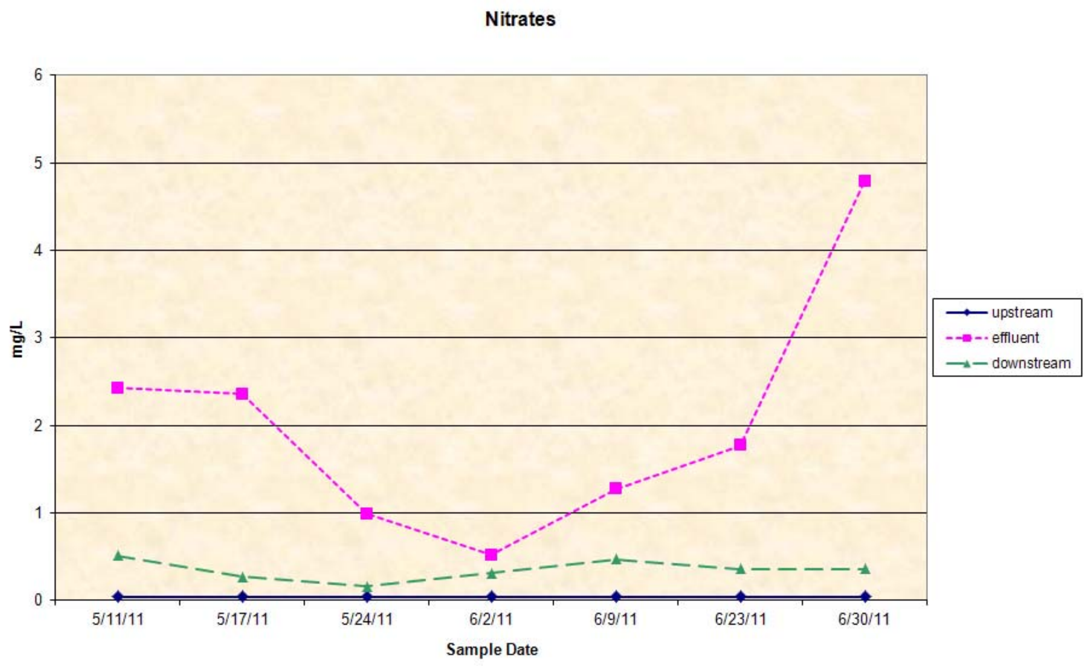


Figure I.5: Nitrate levels from DEP, BOL testing: upstream, effluent, and downstream samples

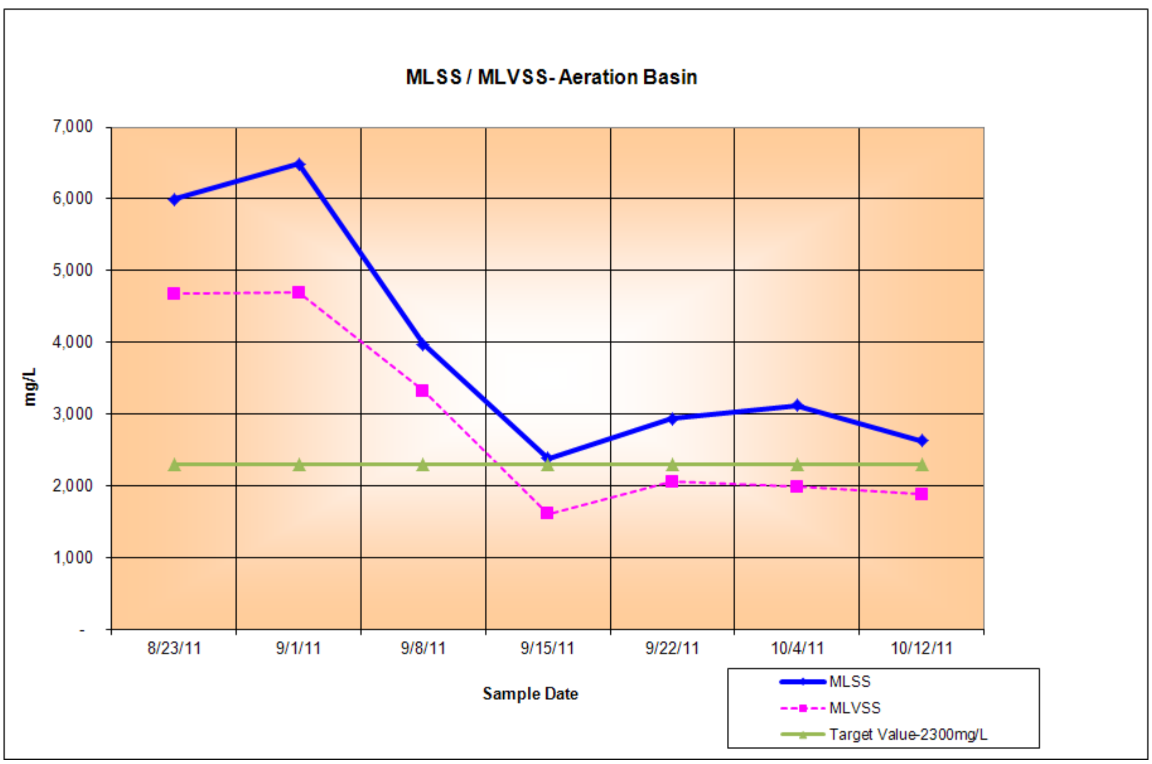


Figure I.6: Aeration Tank, MLSS and MLVSS

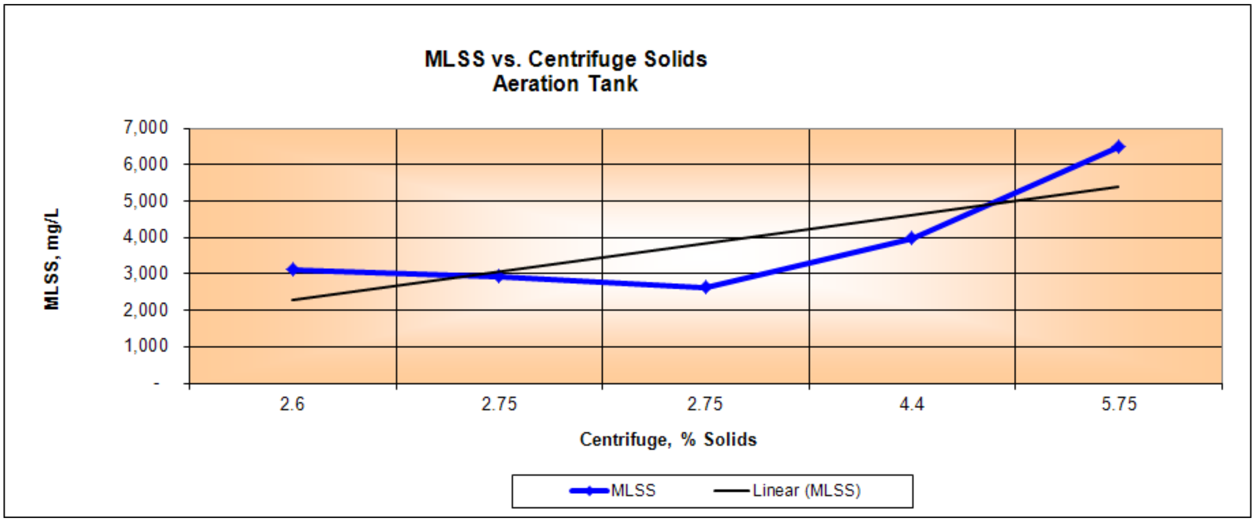


Figure I.7: MLSS vs. Centrifuge Solids process control chart

Corsica STP												
Target Ranges		300 - 500	2000-5000	1400-3500	100	.05 - .15			12 - 20	225	1	10 - 13
Date	Flow	1/2 hr	MLSS	MLVSS	SVI	F/M	Cent	OUR	RR	Inf BOD	HRT (days)	MCRT * (days)
9/1	0.013	640	6488	4696	98.64	0.01	5.75	13.02	2.77	273	4.07	25
9/8	0.008	330	3972	3324	83.08	0.01	4.4	8.94	2.69	209	6.46	15
9/15	0.018	350	2382	1610	147	0.03	5	9.48	5.89	137	2.9	27
9/22	0.02	200	2936	2056	68	0.11	2.75	8.28	4.03	592	2.6	16
10/4	0.018	150	3124	1990	48	0.07	2.6	5.88	2.95	426	2.90	27
10/12	0.014	130	2632	1880	49	0.06	2.75	10.14	5.39	443	3.70	28
						** MCRT estimated based on estimate of waste sludge flow*						

Table I.1: Process monitoring data

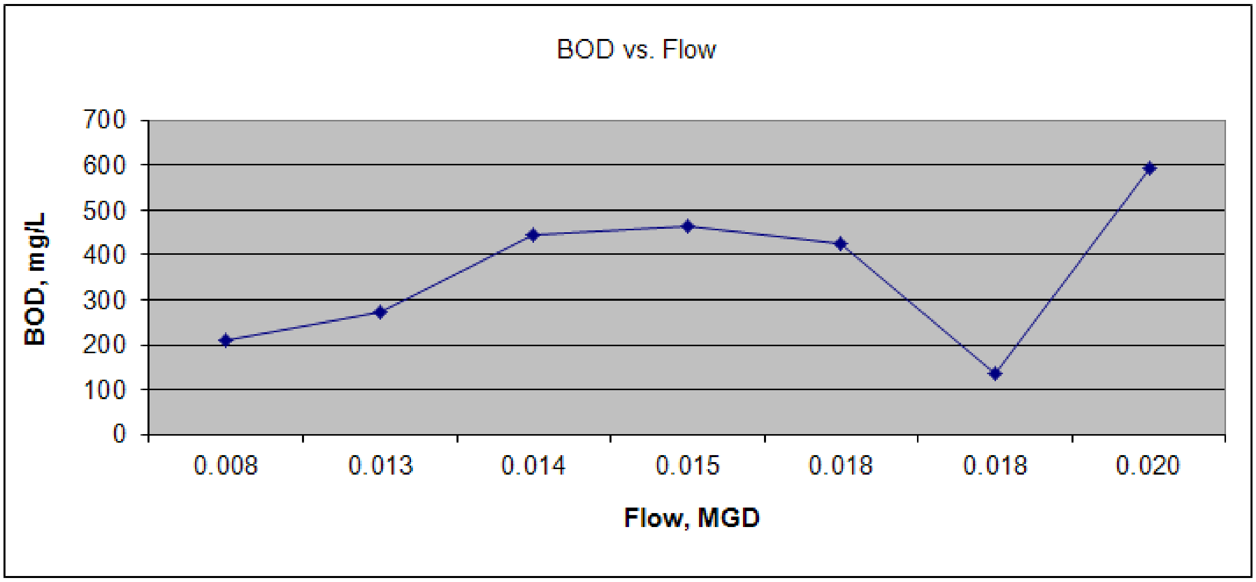


Figure I.8: BOD_5 vs. Flow during the WPPE project

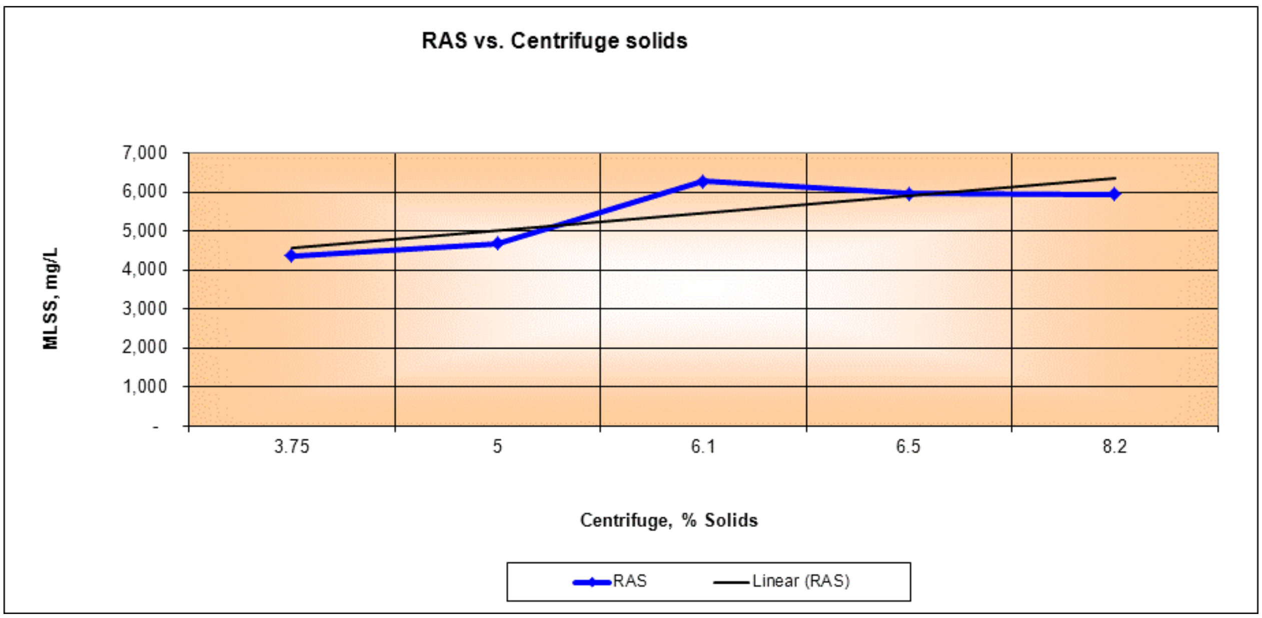


Figure I.9: RAS vs. Centrifuge Solids process control chart

Attachment J—Tables of Data from Bureau of Labs Testing

The following tables summarize all sample data collected during the WPPE.

					Lab Resutls-Corsica WWTP			
	08/23/11	9/1/11	9/8/11	9/15/11	9/22/11	10/4/11	10/12/11	Avg.
Effluent-Sample #	0331096	0331102	0331108	0331114	0331120	0331126	0331132	
CBOD	10.9	2.7	1.9	1.2	2.4	4	5.7	4.1
TSS	132	51	28	13	12	28	36	43
Alkalinity	123.4	4.2	3.2	20.6	73	95.4	151	67.3
NO2-N	0.03	***0.01***	***0.01***	***0.01***	0.01	0.04	0.05	0.02
NO3-N	0.56	33.63	36.48	25.69	32.41	26.59	36.06	27.35
NH3-N	8.1	0.11	0.15	0.08	0.11	0.11	0.1	1.25
TKN	16.88	2.94	2.89	1.71	1.93	2.85	4.04	4.75
Phos	6.804	6.679	6.141	4.44	3.859	3.34	3.976	5.034
TOT N(TKN+NO3+NO2)	17.47	36.58	39.38	27.41	34.35	29.48	40.15	32.12
Fecal Coliform	12300	80	9200	4600	3600	1100	1300	1305
Chloride	57.5	57.2	56.1	47.8	47.3	49.2	46.8	51.7
pH	7.6	6.3	6	7.2	7.5	7.8	8.2	7.2
STP Flow, MGD	0.0145	0.0127	0.00818	0.0184	0.0199	0.018	0.014	0.015
TDS		422	420	368	432	440	570	442
Specific Conductivity	537	592	626	507	652	591	791	614
Sulfate	36.91	35.1	36.24	32.8	32.4	44.15	41.34	37.0
Ratio TDS: Spec Cond.		0.713	0.671	0.726	0.663	0.745	0.721	0.706
Upstream-Sample #		0331103	0331109		0331121	0331127	0331133	Avg.
BOD		1.1	***0.2***		0.4	0.3	2.5	0.9
TSS		***5***	***5***		***5***	***5***	11	6
Alkalinity		77.6	73		71.8	54.8	58.4	67.1
NO2-N		***0.01***	***0.01***		***0.01***	***0.01***	***0.01***	0.01
NO3-N		1.33	1.34		2.16	2.35	1.02	1.64
NH3-N		0.03	0.03		0.04	0.04	***0.02***	0.03
TKN		***1***	***1***		***1***	***1***	***1***	1
Phos		0.026	0.014		0.032	0.014	0.06	0.029
TOT N(TKN+NO3+NO2)		2.34	2.35		3.17	3.36	2.03	2.65
Fecal Coliform		1200	***10***		240	20	3700	184
Chloride		35.1	42.1		24.1	20.2	23.4	29.0
pH		7.7	7.6		7.7	7.3	7.4	7.5
Specific Conductivity		397	428		311	240	267	329
Sulfate		47.8	60.17		26.8	29.99	31.76	39.30
TDS		248	254		214	164	176	211
Ratio TDS: Spec Cond.		0.625	0.593		0.688	0.683	0.659	0.650
Downstream-Sample #		0331104	0331110		0331122	0331128	0331134	Avg.
BOD		1.2	0.6		0.4	0.2	2.6	1.0
TSS		10	6		8	***5***	8	7
Alkalinity		44.6	43.4		46.6	39	48.8	44.5
NO2-N		***0.01***	***0.01***		***0.01***	***0.01***	***0.01***	0.01
NO3-N		2.06	6.33		2.47	1.85	2.3	3.00
NH3-N		0.03	0.03		0.04	0.04	***0.02***	0.03
TKN		***1***	***1***		***1***	***1***	***1***	1
Phos		0.098	0.059		0.066	0.015	0.062	0.060
TOT N(TKN+NO3+NO2)		3.07	7.34		3.48	2.86	3.31	4.01
Fecal Coliform		1300	180		580	80	630	369
Chloride		32.7	48.7		25.9	25.7	33	33.2
pH		7.6	7.7		7.7	7.5	7.5	7.6
Specific Conductivity		472	619		370	329	430	444
Sulfate		117.6	152		73.7	76.91	108	105.6
TDS		320	380		250	226	292	294
Ratio TDS: Spec Cond.		0.678	0.614		0.676	0.687	0.679	0.667
Bold, italics values are "Less than", meaning belowing detection limit or method limit								
- Fecal Coliform average is a geometric mean								

Table J.1: DEP, BOL testing results for effluent, upstream, and downstream sampling locations

				Lab Resutls-Corsica WWTP				
	8/23/11	9/1/11	9/8/11	9/15/11	9/22/11	10/4/11	10/12/11	
MLSS - Sample #	0331099	0331105	0331111	0331117	0331123	0331129	0331135	Avg.
MLSS	5992	6488	3972	2382	2936	3124	2632	3932
MLVSS	4680	4696	3324	1610	2056	1990	1880	2891
MLSS/MLVSS ratio:	78.1%	72.4%	83.7%	67.6%	70.0%	63.7%	71.4%	72.4%
Alkalinity	190.2	48.8	74.8	147.6	161.4	201.4	421.8	178.0
MLSS probe		9980	4200	4300	3000	2700	2512	
		0.65	0.95	0.55	0.98	1.16	1.05	
RAS - Sample #	0331100	0331106	0331112	0331118	0331124	0331130	0331136	Avg.
MLSS	8000	6280	5944	2036	4672	5964	4372	5324
MLVSS	6920	4564	5496	1438	3304	3332	2972	4004
MLSS/MLVSS ratio:	86.5%	72.7%	92.5%	70.6%	70.7%	55.9%	68.0%	73.8%
Influent -Sample #	0331095	0331101	0331107	0331113	0331119	0331125	0331131	Avg.
BOD	465	273	209	137	592	426	443	364
TSS	5.2	122	148	92	446	161	136	159
Alkalinity	147.6	206.4	169.2	151.8	151.8	208	160.8	170.8
NO2-N	***0.01***	0.06	***0.01***	***0.12***	0.17	0.03	0.04	0.06
NO3-N	***0.04***	***0.04***	***0.04***	***0.75***	0.94	0.09	0.15	0.29
NH3-N	10.4	30.41	22.69	17.49	20.06	34.75	25.81	23.09
TKN	21.96	40.96	34.44	32.55	30.79	50.71	54.53	37.99
Phos	3.381	5.172	5.398	3.956	4.952	6.298	6.904	5.152
TOT N	22.01	41.06	34.49	33.42	31.9	50.83	54.72	38.35
Chloride	74.3	52	40.2	56.6	41	61.8	34.9	51.5
pH	7.1	7.6	7.4	7.8	7.3	7.5	7.6	7.5
STP Flow, MGD	0.0145	0.0127	0.00818	0.0184	0.0199	0.018	0.014	0.015
Bold, italics values are "Less than", meaning belowing detection limit or method limit								

Table J.2: DEP, BOL testing results for influent and aeration basin

Attachment K—Biosolids production worksheets

Borough of Corsica STP

Date:	**10/12/2011**		BOD mass removed by STP					
			influent pounds BOD/day		29	lbs/day	*from plant data*	
Plant Name:	**Corsica STP**		effluent pounds BOD/day	–	4.3	lbs/day	*from DMRs*	
			BOD mass removed by STP	=	24.7	lbs/day		
Design Flow:	**0.043**							
Design Loading:	**88**		pre-digestion sludge mass produced by STP					** sludge production factors*
Avg Daily Flow	0.018		BOD mass removed by STP		24.7	lbs/day		extended aeration = .65
Months	Actual Sludge Disposed		sludge production factor *	x	0.65			oxidation ditches = .65
Jan			pre-digested sludge mass	=	16.055	lbs/day		conventional activated sludge = .85
Feb								contact stabilization = 1.0
Mar			post-digestion sludge mass produced by STP **					
Apr			***calculate only if plant has a digestor*					*solids reduction in digestors*
May			pre-digestion sludge mass		16.055	lbs/day		0 days (no digestor)= 1
Jun			% of pre-digestion solids remaining	x	0.8			10 days = .9
Jul	0.751		post-digested sludge mass	=	12.844	lbs/day		15 days = .8 **default value**
Aug								20 days = .7
Sep			estimated amount of sludge to be removed					>30 days = .65
Oct			sludge mass (pre or post)		12.844	lbs/day		
Nov			days per year	x	365	days/yr		
Dec			estimated sludge mass for disposal	=	4,688.06	lbs/yr		
0	0.751							
x	2000lbs/ ton		percentage of sludge mass for disposal					
	1,502.00		actual		1,502.00	lbs		
	actual lbs removed		estimated	/	4,688.06	lbs		
					0.32038839			
				x	100	%		
					32.0388	%		Sludge Removal Percentage
	Estimated tonnage calculated by:							
	gallons sludge hauled x 1% solids x 0.0000417							
	18000 x 1 x 0.0000417 = 0.751 tons							
	- loading data from chp 94 and DMRs							

Figure K.1 Borough of Corsica Sludge Volume Calculation for 2010

This calculation of sewage sludge removal shows that only 32 % of the sewage solids were removed from the facility leaving 68% of sewage sludge unaccounted for.

Date:	**10/12/2011**	BOD mass removed by STP				
		influent pounds BOD/day		70	lbs/day	*based on Population of 412 X 0.17*
Plant Name:	**Corsica STP**	effluent pounds BOD/day	–	4.3	lbs/day	*from DMRs*
		BOD mass removed by STP	=	65.7	lbs/day	
Design Flow:	**0.043**					
Design Loading:	**88**	pre-digestion sludge mass produced by STP				** sludge production factors*
Avg Daily Flow	0.018	BOD mass removed by STP		65.7	lbs/day	extended aeration = .65
Months	Actual Sludge Disposed	sludge production factor *	x	0.65		oxidation ditches = .65
Jan		pre-digested sludge mass	=	42.705	lbs/day	conventional activated sludge = .85
Feb						contact stabilization = 1.0
Mar		post-digestion sludge mass produced by STP **				
Apr		***calculate only if plant has a digestor*				*solids reduction in digestors*
May		pre-digestion sludge mass		42.705	lbs/day	0 days (no digestor)= 1
Jun		% of pre-digestion solids remaining	x	0.8		10 days = .9
Jul	0.751	post-digested sludge mass	=	34.164	lbs/day	15 days = .8 **default value**
Aug						20 days = .7
Sep		estimated amount of sludge to be removed				>30 days = .65
Oct		sludge mass (pre or post)		34.164	lbs/day	
Nov		days per year	x	365	days/yr	
Dec		estimated sludge mass for disposal	=	12,469.86	lbs/yr	
0	0.751					
x	2000lbs/ ton	percentage of sludge mass for disposal				
	1,502.00	actual		1,502.00	lbs	
	actual lbs removed	estimated	/	12,469.86	lbs	
				0.12045043		
			x	100	%	
				12.045	%	Sludge Removal Percentage
	Estimated tonnage calculated by:					
	gallons sludge hauled x 1% solids x 0.0000417					
	Loading based on Population of 412 X .17 lbs BOD per person/day					

Figure K.2 Borough of Corsica Sludge Volume Calculation based on expected BOD loadings based on population.

This sludge volume calculation was based on 2009 customer data provided in the 2010 Chp 94 report. In addition, a BOD load of 0.17 lbs/person/day was used to calculate the expected BOD loading of 70 lbs/day.

In this case, there is approximately 88%, or 11,000 pounds of sewage solids missing or unaccounted for.

Influent samples should be composited either manually or with an automatic composite sampler to acquire accurate influent loading data to be used in future Chp 94 Reports.

Attachment L—Electrical Costs / Power Savings

Motor Description	Motor HP*	Motor kw	Efficiency*	Virtual kW	Duty cycle* (hours/day)	Electricity charge* (¢/kwh)	Distribution charge* ($/kw)
Aeration tank blower 1	10	7	91.7%	8	24	8.2	3.63
Aeration tank blower 2	10	7	89.5%	8	0	0.0	0.00
Sludge Hold Blower 3	5	4	87.5%	4	24	8.2	3.63
Sludge Hold Blower 4	5	4	89.5%	4	24	8.2	3.63

	# of motors*	Annual kwh Cost	Annual Distribution Cost	Daily Electricity Cost	Annual Electricity Cost
Aeration tank blower 1	1	**$5,844**	**$354**	$17	**$6,198**
Aeration tank blower 2	1	**$0**	**$0**	$0	**$0**
Sludge Hold Blower 3	1	**$3,062**	**$186**	$9	**$3,248**
Sludge Hold Blower 4	1	**$2,994**	**$182**	$9	**$3,175**
				DAILY	ANNUALLY
			Total Costs	***$26***	***$9,373***

Figure L.1 Estimated annual electrical costs for blower motors based on original plant operations prior to the WPPE

Motor Description	Motor HP*	Motor kw	Efficiency*	Virtual kW	Duty cycle* (hours/day)	Electricity charge* (¢/kwh)	Distribution charge* ($/kw)
Aeration tank blower 1	10	7	91.7%	8	9.5	8.2	3.63
Aeration tank blower 2	10	7	89.5%	8	9.5	8.2	3.63
Sludge Hold Blower 3	5	4	87.5%	4	12	8.2	3.63
Sludge Hold Blower 4	5	4	89.5%	4	12	8.2	3.63

	# of motors*	Annual kwh Cost	Annual Distribution Cost	Daily Electricity Cost	Annual Electricity Cost
Aeration tank blower 1	1	**$2,313**	**$354**	$7	**$2,667**
Aeration tank blower 2	1	**$2,370**	**$363**	$7	**$2,733**
Sludge Hold Blower 3	1	**$1,531**	**$186**	$5	**$1,717**
Sludge Hold Blower 4	1	**$1,497**	**$182**	$5	**$1,678**

	DAILY	ANNUALLY
Total Costs	***$19***	***$7,079***

*required field

Electricity Savings based on modified plant opertaions = $2,294 per year

Figure L.2 Estimated annual electrical costs for blower motors based on modified plant operations as a result of the WPPE. Estimated yearly cost savings of $ 2,300.00.

Attachment M—NPDES Effluent Discharge Limits

Borough of Corsica STP
NPDES PA0221520

Discharge Parameter	Effluent Limitations						Monitoring Requirements	
	Mass Units (lbs/day)		Concentrations (mg/L)					
	Average	Maximum	Minimum	Monthly Average	Weekly Average	Maximum	Minimum Measurement Frequency	Required Sample Type
$CBOD_5$ (05/01 – 10/31)	9	14		25	40	50	2/month	8-hr comp
Total Suspended Solids (05/01 – 10/31)	10.8	16		30	45	60	2/month	8-hr comp
Ammonia – N (05/01 – 10/31)				8.5		17	2/month	8-hr comp
Ammonia –N (11/01 – 04/30)				XX		XX	2/month	8-hr comp
Ultraviolet Light Intensity			Monitor and report (on monthly DMRs) the average intensity meter readings in microwatts/square centimeter for each bank of modules				2/month	Measured
Dissolved Oxygen			3.0				Weekly	Grab
pH			6.0			9.0	Weekly	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				2/month	Grab
10/1 - 4/30			2000/100 ml as a geometric average				2/month	Grab

XX – Monitor and report on DMRs

Table M.1. BOC NPDES effluent limitations