WASTEWATER PLANT PERFORMANCE EVALUATION

February 4 – April 15, 2009

MCCONNELLSBURG SEWER AUTHORITY
WATER POLLUTION CONTROL FACILITY

NPDES #PA0020508

Bureau of Water Standards & Facility Regulation
POTW Optimization Program

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Table of Contents

Attachments

A—Plant Background
Location
Process Description
Treatment Schematic

B—Equipment Deployed
Continuous Monitoring
Laboratory

C—Graphs: Monthly Monitoring Examples
Histogram: March 2009 Dissolved Oxygen
Histogram: March 2009 Oxidation/Reduction Potential and Dissolved Oxygen

D—Graphs: Daily Monitoring Examples
Histogram: DO & ORP for 4/11/2009
Histogram: DO & NH3-N for 4/4/2009
Histogram: ORP & NH3-N for 4/4/2009
Histogram: Sludge Blanket Depth, South Secondary Clarifier

E— Equipment Placement Photographs
Modbus & Probes, South End of East Aerator
Modbus & Probes, North End of East Aerator
Solids Level Monitor, South Secondary Clarifier
Nitrate Probe, East Disinfection Tank

F— Program Description
POTW Optimization Program
Wastewater Plant Performance Evaluation

G— Laboratory Sampling Results
Method 1623 Cryptosporidia and Giardia Counts
Inorganics & Bacteriologics

H—Suggested Minimum Sampling Frequencies

I— WPPE Team

1. Executive Summary

The Pennsylvania Department of Environmental Protection (DEP) initiated a new program aimed at reducing pathogens in the effluents of wastewater treatment plants by optimizing plant performance while employing continuous monitoring and portable laboratory equipment. The objective is to acquaint plant operators with regular process monitoring and control techniques, thereby assuring higher quality effluents than mandated by the National Pollutant Discharge Elimination System (NPDES). The program is called the Wastewater Plant Performance Evaluation (WPPE).

At the invitation of the McConnellsburg Sewerage Authority, DEP personnel deployed new continuous digital equipment for process monitoring at the MSA wastewater treatment facility and observed the equipment during a period from February 4 through April 14, 2009. In conjunction with using these monitoring probes, we also conducted process control tests using portable laboratory equipment and obtained water pathogen samples for analysis by Bureau of Laboratory Services (BOL), measuring the quantities of *Cryptosporidium* and *Giardia* oocyst present in the plant effluent and in the receiving stream.

Our findings represent items that we identified throughout the course of the project that are relevant to the wastewater plant operations. Additional data collected by the plant operators and operations by operators of similar type facilities were used in compiling this report. There follows a list of Focus Points for the operating staff, based on our observations, that may enhance plant operations and improve effluent quality beyond that expected by the NPDES Permit Limits. In the body of the report, we summarize our activities and tests. Lastly, we provide several attachments in support of the report and its findings.

Chief findings using the continuously monitoring in-situ probes were:

- Diurnal dissolved oxygen swings in the aeration tanks are significant and may lead to deterioration of effluent quality due to floc-shearing, hindering flocculation and settling in the secondary clarifiers. It may be advantageous to install continuous DO monitoring and link it to blower operation through automatic motor pacing and motor starters.
- DO above 4.0 mg/L in the aeration tanks essentially represents wasted energy. During the period of the day when DO has been significantly higher than this, less blower capacity is required. It may be advantageous to install continuous DO monitoring and link it to blower operation through automatic motor pacing and motor starters.
- Oxidation-Reduction Potential (ORP) is an excellent indicator of nitrification in extended air systems. ORP monitoring may be used to quickly predict nitrification performance.
- A comparison of digital DO metering and the current method of manually determining DO showed a disparity in test results. The DO test in use by the lab has been to draw a sample, return it to the lab, and then test for DO in a BOD bottle using a BOD probe. This test actually results in the saturation DO for the temperature of the water at that time. We recommend that DO be spot checked by immersing a portable DO probe into the aeration tanks and reading the DO output on the meter after the meter stabilizes.
- Solids control is very important to extended air processes. We recommend that sludge wasting occur on a more frequent basis to provide better consistency of sludge age.
- Filamentous bacteria outbreaks are often related to elevated solids levels, low DO in the aeration basin, and an old sludge age which may be the cause of its presence in late March and early April

We recommend that the Authority review the report and that plant operators continue to maintain and improve plant performance through the use of regular process monitoring and control, and we believe that by doing so, the facility is capable of producing effluent water quality that exceeds current and planned future concentration and loading limits.

2. Focus Points

The following items have been identified as focus points to assist in optimization efforts. The operators should review the focus points and are encouraged to incorporate them into their daily operating procedures when feasible. While some of these items will require more of the operator's time to perform the outcome is expected to be favorable by improving the plants discharge quality and thereby improving downstream water quality at the drinking water intake. Focus Points are listed in priority order.

Focus Points:

- Often times at similar sized wastewater plants, solids are wasted from the process clarifiers, on a daily or semi daily basis. Performing sludge wasting on a regular basis will allow the operator to target and calculate sludge age more effectively. Also this can prevent the accumulation of undesirable bacteria within the aeration basins which inhibit nitrification and settling.
- Closely monitor solids and dissolved oxygen in the aeration basins, especially in the spring so they can be maintained at levels that will help prevent filamentous bacterial growth
- While monitoring for Dissolved Oxygen in the aeration basins, take the handheld DO meter to the basin and insert the probe in the contents of the aeration tank. This provides the most accurate DO reading possible by reducing external interferences.
- Continue using centrifuge measurements along with total solids testing of the mixed liquor to identify solids levels within the treatment process. Refer to Attachment H for suggested process control testing frequencies.
- Consider increasing the frequency of cleaning the chlorine contact tank from annually to quarterly. Utilizing a sludge blanket tool could help establish the frequency necessary for your facility.
- If construction of the new facilities does occur, the above mentioned in-line monitoring equipment along with ORP sensors would provide the operators with enough information, along with regular process control testing, to maximize the effectiveness of the Biological Nutrient Reduction (BNR) treatment process.
- If the construction of new wastewater treatment facilities does not occur then it would be helpful to utilize in-line monitoring of DO and Solids within the aeration basins. By tying the DO sensors to blower motors one could provide only the amount of air necessary to maintain the biomass at the proper level of aeration. Over aeration of the mixed liquor does not provide additional treatment, increases utility costs, and actually can harm the nitrification process by encouraging the growth of undesired bacteria.
- As with most wastewater plants, there are times when inflow and infiltration (I&I) impact the influent flows at the wastewater plant. Continuing your efforts to identify sources of I&I and removing them from the collection system will not only help with reducing flows at the wastewater plant but also preserve capacity at the plant that can be used for development or increasing the availability of public sewers to areas currently utilizing on-lot systems.

3. Background

The Pennsylvania Department of Environmental Protection (PADEP) has undertaken a new project in its Bureau of Water Standards and Facility Regulation (BWSFR) to improve the quality of surface waters used for drinking water by optimizing sewage treatment plant operations to reduce pathogens and nutrients in the effluent from the wastewater treatment plant. Prior to working with client sites throughout the Commonwealth, DEP staff had the opportunity to conduct trials of new instrumentation and laboratory equipment purchased in support of this new program. BWSFR's optimization program is called the Wastewater Plant Performance Evaluation (WPPE) and is modeled on the successful program for drinking water filtration plants that has been operating for the past twenty one years, the Filter Plant Performance Evaluation (FPPE) program.

Some of the new equipment purchased to support the WPPE program includes proprietary digital in-line sensors. This equipment provides continuous digital monitoring of various parameters used to analyze sewage treatment processes. Deployment of this equipment required the WPPE staff to learn how to properly install, utilize, and remove the instruments.

DEP contacted the McConnellsburg Sewerage Authority (MSA) with a request to deploy and operate the instrumentation at their wastewater treatment plant (WWTP) located in Ayr Township, Fulton County, for a period of two months in order to provide training for DEP staff and to allow for further development of the WPPE program.

DEP installed at least one of each type of probe in the secondary treatment processes. This equipment is detailed in Attachment D. In addition, DEP brought to the facility's laboratory instruments and test kits that its personnel will be both using in the field and training plant operators to use. This equipment supplements the in-line continuous monitoring.

4. Initial Observations

Plant Description

MSA's WWTP treats domestic sewage and some industrial wastewater from its collection system servicing McConnellsburg Borough, the county seat, and parts of the surrounding Todd and Ayr Townships. The facility was built in 1970 and significantly upgraded in 1994. A site engineering study is currently underway to upgrade the facility again to meet new water quality demands.

This site was chosen for the Instrument Trials because its overall operating efficiency is very good and there have been no violations of MSA's operating permit within the past few years. Following deployment, the new instrumentation was used to collect data that will supplement MSA's ongoing studies for pending facility upgrades that are anticipated to meet new demands of its clients and regulatory changes required by the Chesapeake Bay Nutrient Reduction Strategy.

The McConnellsburg WWTP discharges treated effluent to Big Cove Creek, designated as a cold water fishery. Big Cove Creek is in the 13B watershed- Licking - Tonoloway Creeks tributary to the Potomac River. Background samples were collected on February 11 and the results are listed in Attachment G.

There are no downstream water intakes/withdrawals within 38 miles downstream of the McConnellsburg WWTP discharge.

Past Performance

A review of plant records showed that there have been no permit violations from this facility in recent memory. MSA's operators and management staff are to be commended for the consistently high effluent quality produced from this facility.

During file review, we reviewed the facility's NPDES Permit, its Part II Permit, Water Quality Protection Report, monthly Discharge Monitoring Reports (DMR), Chapter 94 Report, as-built drawings, and available daily process monitoring records. Because we were not conducting a formal WPPE evaluation, we did not stress a full records review and did not observe maintenance records or chart all recent operating data.

DMRs for all of 2008 were reviewed in order to develop understanding of the facility's daily operating ranges. For 2008, the annual average flow was 0.282 MGD and the peak daily flow was 0.963 MGD. These records indicate that the collection system is impacted by inflow/infiltration during wet weather events. However, the operators reported there are no combined sewers in the collection system.

The McConnellsburg WWTP consistently produces effluent of a high quality; this is why we asked to perform field trials of the WPPE process monitoring equipment. Review of DMRs for calendar year 2008 supported this conclusion:

McConnellsburg WWTP
2008 DMR Data

Date	Flow Avg. Mon	Flow Max Daily	pH min	pH max	DO min	TRC min	TRC avg	TRC max	Fecal Avg Mon	TSS Avg Mon	TSS Avg Wkly	Influent BOD-load Avg Mon	Influent BOD-conc Avg Mon	Effluent CBOD-5 Avg Mon	Effluent CBOD-5 Avg Wkly	NH3-N Avg Mon	Copper Avg Mon	Biosolids removed
Jan	0.31529	0.626	6.9	7.6	9.2	0.01	0.1	0.79	1	9.2	14	1003	402	3	3.2	0.42	0.028	0
Feb	0.34259	0.556	7	7.7	7.3	0	0.03	0.13	3	5	10	674	225	3.06	3.3	0.23	0.016	0
Mar	0.3862	0.934	7	7.5	8.4	0.02	0.03	0.14	17	5	8	1024	318	3.75	5	0.19	0.028	
Apr	0.32577	0.746	7.1	7.5	9	0	0.02	0.05	8	4.6	7	801	318	6.2	18	0.26	0.034	22.23
May	0.38813	0.963	7.2	7.6	8.8	0	0.02	0.04	33	5	8	686	215	4	7	0.13	0.027	0
Jun	0.24727	0.327	7	7.8	8.2	0	0.02	0.08	7	4.5	6	504	233	3.75	6	1.68	0.034	0
Jul	0.23736	0.331	7.1	7.7	7.8	0.01	0.02	0.2	51	6.8	13	511	237	3.4	4	0.21	0.034	0
Aug	0.21885	0.317	6.5	7.8	8.1	0	0.02	0.08	33	4	4	397	201	5	11	0.13	0.036	0
Sep	0.2255	0.317	7.1	7.8	8.1	0	0.09	1.29	20	4	4	410	210	4	7	0.1	0.03	0
Oct	0.20323	0.263	7.2	7.9	7.6	0	0.02	0.05	23	4.2	5	454	252	3	3	0.1	0.026	18.44
Nov	0.201933	0.261	7.1	7.5	8.8	0	0.02	0.12	7	6	8	594	340	3.25	4	0.1	0.024	0
Dec	0.31571	0.648	6.8	7.6	9.4	0	0.06	0.83	6	4	4	562	231	3.1	3.49	0.1	0.017	0

Table 1. McConnellsburg WWTP 2008 DMR data summary

Current Performance

During the period of the evaluation, we observed that the facility was experiencing low dissolved oxygen (DO) and high mixed liquor suspended solids (MLSS) through the early running, with filamentous organisms attempting to become dominant through early March. Effluent quality may have been impacted; however, permit conditions were not exceeded during the study. We noted that the occurrence of pin floc did hinder performance of the Sonatax sludge blanket sonar.

Headworks

The facility headworks provide for removal of nondegradable solids through use of an automatic bar-screen and comminutor. Solids removed at this point are bagged for disposal at a landfill site. Our study did not include an assessment of the quantity or nature of solids removed at this point.

According to the facility's most recent Chapter 94 reports, the facility is not running near its hydraulic and organic operating capacity, and inflow-infiltration is considered average but not threatening to plant performance. Figure 1 depicts the 2008 flows including average monthly, maximum daily, and design values.

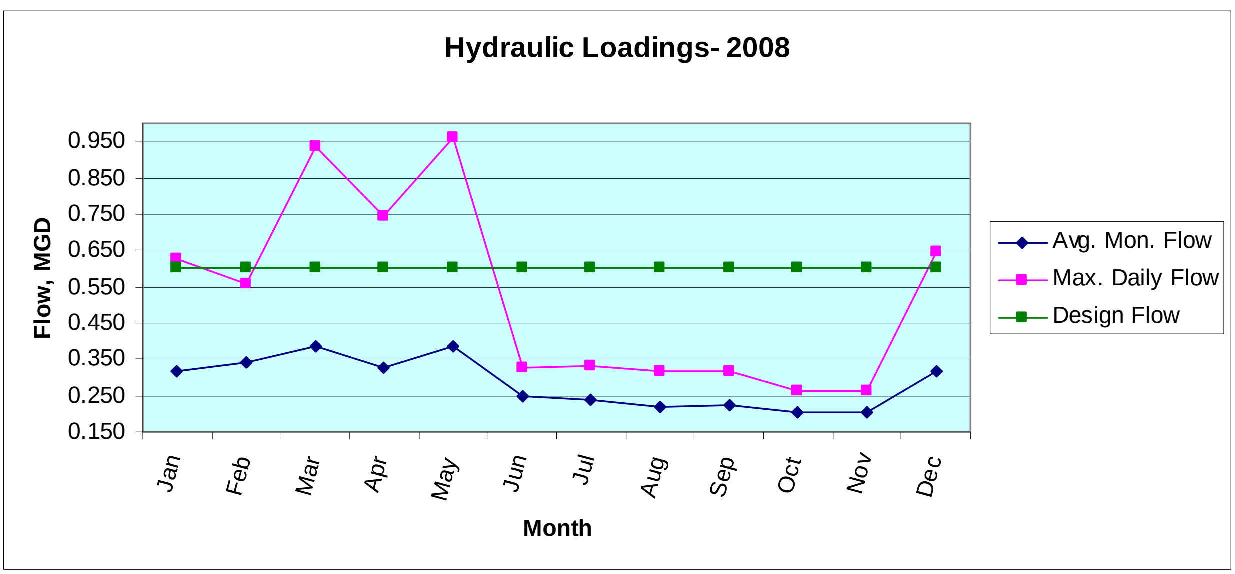


Figure 1. 2008 Hydraulic Loadings

Flow Equalization

MSA currently uses a flow equalization tank. We did not examine this process during our site visits, because MSA plans to replace it during a pending upgrade. Visual inspection of the flow equalization tank showed that it is operating within its normal design parameters.

Aeration

Two secondary aeration tanks having a total capacity of 314,000 gallons provide the bulk of treatment at the facility. These tanks are configured for extended aeration. Fine bubble diffusers were installed during the 1994 upgrade. For our instrumentation study, we installed instruments in the east aerator. Flow entering the aeration tanks is split upstream of the tanks into a 50:50 pattern. Likewise, return activated sludge is continuously pumped from two secondary clarifiers back to the aeration tanks through the same splitting mechanism. In the course of our study, we confirmed the operator's statement that the two aeration tanks function quite independently from one another, with the west aerator usually exhibiting higher dissolved oxygen (DO) than the east aerator. It appears that air is withdrawn from the east aerator to also provide mixing for a sludge holding tank that had been configured within one of the original, 1970 clarifier tanks. Air is also withdrawn from the aeration tanks for use in the chlorine contact tank, to provide mixing, and to aerate the effluent prior to discharge. This may be the cause of the discrepancy between the DO levels in the two aeration tanks.

Initially, our plan had been to install all of the Hach equipment at the MSA plant; however, due to availability of the Hach technicians and because of equipment availability, we decided to install equipment into only one of the two aeration tanks. At the advice of the plant manager, we installed most probes into the East Aerator tank. The installations were:

- 2 Hach Modbus base units, on the aerator railings, located at the north and south ends;
- DO and ORP probe at the head of the aeration tank (north end);
- pH, DO, and nitrate sensors at the tail of the aeration tank (south end);
- Nitrate sensor at one of the disinfection tanks (east side);
- Sludge Blanket detector (Sonatax) in one of the secondary clarifiers (south unit);
- Ammonia nitrogen probe at the south end of the aeration tank was "roughed in" pending arrival of necessary parts.

Attachment B shows a diagram of the where we installed the continuous monitoring probes.

Secondary Settling

Effluent from the two aeration tanks mixes and splits between two secondary settling tanks, or clarifiers. Here, activated sludge solids settle by gravity and are withdrawn using return sludge pumps, for reintroduction to the aeration tanks or for wasting to the aerobic digester. The clarifiers are oriented along a north/south axis, and it was into the south clarifier that we installed the Hach sludge blanket detector.

Disinfection

The MSA facility employs sodium hypochlorite (bleach) solution for disinfection of the treated wastewater, injecting it at the head of two chlorine contact tanks. Following sufficient contact time, the effluent from these tanks is treated with sodium bisulfite to dechlorinate the water prior to its discharge. The treated water falls through a V-notch weir for re-aeration prior to discharge. The outfall at Big Cove Creek is only a short distance from this final process.

Equipment Installation & Calibration

On February 4, 2009, Bob DiGilarmo, Kevin Anderson, and Marc Neville arrived at MSA to diagram the instrument layout and install the mechanical connections for the probe holders.

The next day, representatives and technicians from Hach Company came to the facility to assist us in setting our probes and connecting the communications lines between two Modbus units. We discovered early that we were missing some critical items for utilizing the ammonia nitrogen probes and for making the interface with a notebook computer in the laboratory, and additional supplies had to be ordered. Hach's technicians connected power cables to the Modbus units, and we installed probes according to a diagram we had devised during site reconnaissance.

Hach's equipment is described as having microprocessor technology built into each probe. Each probe has sufficient memory to retain several days' worth of readings. The Modbus base units are microprocessor-driven routing and transit units, working in conjunction with detachable display units that have SCADA-interface capability. The display units are used to calibrate the attached instruments, in addition to relaying information to other microprocessors. The technology allows plant operators to observe and track operational trends that can be interpreted using readily available literature, reinforcing an operator's process control decisions and showing him, in real time, the results of process changes that affect plant performance.

In the laboratory, we set up a portable notebook computer for displaying the continuous signals from the digital probes. This is an enhancement, as the Modbus units installed on the railings of the aeration tanks also support color LCD displays that provide graphical depiction of trends collated from the data recorded by the probes. At the outset, we had no signal converter for the notebook computer, but Kevin Anderson and Paul Handke of the FPPE staff came to MSA to install one on February 6.

Continuous Digital Monitoring

Following installation of the signal converter, we began recording data from our digital probes. Initially, the signal interval was set at five minutes, but after a few days we changed the interval to fifteen minutes, because the treatment process is quite stable, and changes are often not observed immediately.

Laboratory Equipment

The continuous monitoring digital probes provide the plant operators with graphical output that allows them to see how the tested parameters fluctuate during a variety of conditions. However, we supplemented their use by making available less expensive portable laboratory equipment for obtaining "snapshots" of plant conditions using relatively simple test methods.

In addition to the digital probes, we brought the following laboratory equipment:

- Microscope with digital recording camera and computer interface;
- Raven Products centrifuge, settlometers, and clarifier core-taker for sampling and testing according to sludge inventory methods developed by Al West and cited in <u>Activated Sludge Manual of Practice No. OM-9</u>

- Portable LDO and pH/temperature instruments;
- Portable spectrophotometer and packaged wastewater lab, for colorimetric analyses of water and wastewater;
- Chemical oxygen demand (COD) heater block and test kit.

The purpose of this equipment is to supplement the digital recording probes with a variety of lab tests that can be used by plant operators to track solids inventory, health and condition of the biomass, and relative strength of incoming wastewater. This equipment may be purchased through several vendors and can provide sufficient test data for an operator to make process control decisions, even in the absence of the digital, in-line continuous monitoring equipment.

The purpose of the additional testing is to provide an operator with data needed to develop Mean Cell Residence Time (MCRT), Food to Mass Ratio (F/M), or Sludge Age (AGE) methods of managing activated sludge treatment facilities.

MSA already has a complete set of laboratory equipment. Plant staff routinely check some parameters, such as effluent quality, influent settled solids, mixed liquor settleability, pH, temperature, DO, and –on a weekly basis or more often—MLSS, MLVSS, and mixed liquor percent by volume (centrifuge spin). Other equipment in the laboratory dates to a time when the facility's workers conducted their own biochemical oxygen demand (BOD) and coliform testing.

Our purpose in bringing the lab equipment was to familiarize ourselves with its operation, not to instruct the plant's operators on their use. However, we did make it available to them for their use.

Sampling & Tests Ordered

Initial aqueous samples were taken on February 11:

Location	Sample Number	Analyses	Sampler
100 yds. Upstream of Outfall 001 on Big Cove Creek	0907007	Method 1623 and Chloride	Neville
Chlorine contact tank discharge	0907008	Method 1623, Alkalinity, Fecal coliform	Neville
50 yds. Downstream of Outfall 001 on Big Cove Creek	0907009	Method 1623	Neville
East Aerator mixed liquor	0907009	Alkalinity, MLSS, MLVSS	Neville
Chlorine contact tank discharge	0907011	Method 1623	Neville
East Aerator mixed liquor	0907012	NH3-N	Neville
Chlorine contact tank discharge	0907015	Method 1623	Neville

The test results are reproduced in Attachment G.

Table 2. Sampling locations and analyses

5. Process Monitoring

Beginning on February 9, and lasting until April 14, with some interruption, we nearly continuously obtained digital data from the installed probes at MSA. Some interruptions of data collection occurred because of power interruption and due to power surges during a thunder storm. After these interruptions, DEP staff had to return to MSA to re-establish communication from the probes to the Modbus units and to the notebook computer. In a facility that has supervisory control and data acquisition (SCADA) systems, some of this restart can be done remotely; however, MSA does not have SCADA installed. We learned that our equipment would require both surge protectors and uninterrupted power supply/battery backup.

Attachments C and D include graphs of monthly and daily data, respectively, collected by the digital probes. These graphs were developed in-house using MS Excel: As of this project date, the vendor does not have available a program that will automatically collate and graph the data. The vendor's display units, when attached to the Modbus base units, allow for instantaneous graphical display and trending, but the only data recorded is numerical.

It is vital for plant operators to perform regular process monitoring tests to assay the condition of their facility and to look for trends that both support process control decision-making as well as predict future plant performance under changing conditions. The manufacturer of the centrifuge equipment, sludge settleometers, and core-taker suggests that their equipment be employed on a daily basis in order to monitor the health of the facility. Likewise, use of the digital spectrophotometer and accompanying portable wastewater lab chemical test kits will allow an operator to assay any number of chemical parameters for process monitoring and control purposes. Even those operators who employ an independent contractor for compliance reporting lab tests do need to regularly conduct process monitoring tests of their facility systems.

Interpretation of Data

Shown here is an example graph of ORP versus time. This example shows how ORP levels in the east aerator were generally in the high positive millivolt range throughout the study, as is expected for placement in extended aeration tanks. The substantial dip around day 6 into the negative millivolt range shows the effect of shutting off air to the tank, which was

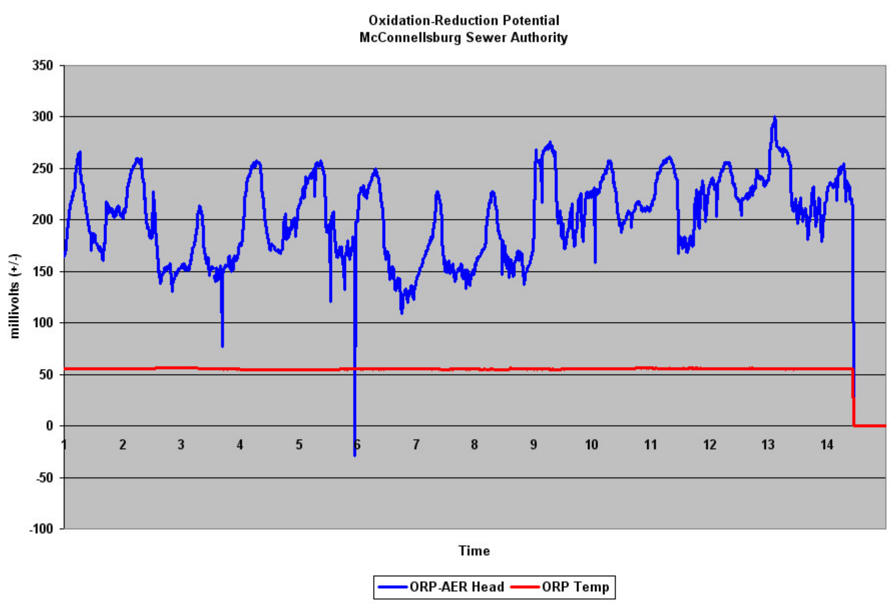


Figure 2. ORP vs time

done in order for operators to remove a scum layer that had accumulated on the surface. ORP trending into the negative range can be used to indicate optimal periods of denitrification, when certain bacteria are best able to metabolize nitrate to nitrogen gas, an effective method for naturally removing nitrogen from the wastewater. Prolonged periods where ORP trends into the negative hundred millivolt range, or greater, will indicate to the plant operator that the biomass in the tank is becoming anaerobic: deprived of air, beneficial microorganisms begin to die and release toxins. Filamentous organisms become better-suited to survive in such conditions, thereby destroying settling in the clarifiers.

At MSA, ORP levels in February peaked at 340 mV and averaged 255. During the month of March the ORP levels spiked at 328 but the overall average dropped to 205. During April the ORP peaked at 300 and the average dropped slightly more to 201mV. The data validated an operational reduction of nitrification beginning in March with a hard drop at the end of the first week of March and again the last week of March with the values not stabilizing until the second week of April.

Similarly, Dissolved Oxygen (DO) indicates the available oxygen in the system. DO values fluctuated on a daily basis at the MSA plant, predicting changes in nitrification efficiency. Overall for the period, DO levels dropped from February through April. This was due in part to increasing water temperature with the arrival of spring; however, lower DO readings also indicated that aeration was becoming insufficient for maintaining the biomass through the period. During the final week of March, minimum DO levels neared zero, and in early April, we saw the maximum diurnal DO levels had dropped from approximately 8 mg/L to some as low as 2mg/L, and daytime levels approached highs of only 0.5 mg/L. On April 7, the operator increased air supply to the aeration tank, and within 48 hours of this change, DO levels nearly doubled and nitrification efficiency, defined by reduced ammonium levels and increased nitrate residuals, began to recover. It is important to note that appearance alone cannot be a method of operating a wastewater treatment plant. Throughout the project, the aeration tanks maintained a medium brown color indicative of a healthy biomass.

Oftentimes during the late spring when water temperature rises, the concentration of MLSS needs be lowered from the levels that sustained the plant through cold weather. Treatment efficiency rises as a function of temperature, and fewer MLSS is needed to accomplish the same amount of waste treatment as may be necessary during winter months. Regular sludge wasting is a vital part of maintaining a healthy biomass. We observed that the operators at MSA tend to base their wasting rates on jar-test settling performance, as well as daily centrifuge test results and weekly MLSS gravimetric tests, and that they waste sludge from the aeration tanks on an infrequent basis. The method closely resembles the methods used for small package treatment systems found in manufactured housing communities or state recreation parks, where biomass wasting may occur once every two weeks.

In order to maintain a healthy biomass and an optimally performing treatment system, we suggest that sludge wasting should be adjusted as a daily or semi daily operating event. If solids are wasted from the process less frequently and in large volume then large amounts of nitrifying bacteria will be removed from the process all at once. In this case, both the continual-monitoring probes and the laboratory bench tests showed that the facility could have anticipated the change in operating conditions as the weather became warmer. Instead of wasting much MLSS over a few days to transition the operation from winter to spring conditions, the operators would better withdraw waste solids for about thirty to forty-five minutes per day, gradually reaching a solids concentration where biomass growth rate is nearing the peak of log growth, where treatment efficiency is optimal, and the potential for negative indicators such as filamentous organisms are reduced.

It is generally best to maintain a consistent solids management plan that includes wasting solids based on process control testing that includes monitoring the food to mass ratios (F/M), mean cell residence time (MCRT), sludge volume index (SVI), and mixed liquor suspended solids (MLSS).

In this case it is possible that the increase in overall temperature and a full sludge holding tank that prevented consistent wasting contributed to the loss of nitrification in late March and April. Since the operators were forced to waste hard to catch up and reduce solids levels there was also a loss of nitrifying bacteria. As this was occurring the D.O. levels in the aeration tanks were dropping and this allowed the filamentous bacteria to take hold causing additional operational problems. Once the solids levels were stabilized with wasting and the DO levels in the aeration tanks increased, along with the reduction of filamentous bacteria through disinfection, the nitrifying bacteria were able to regain the majority of the population in the biomass. While the filamentous bacteria are never totally gone; effective solids management and DO monitoring will be essential to prevent them from over populating the biomass and causing decreased treatment efficiency.

Figure 3, below, depicts the diurnal nature of DO levels recorded for the east aerator. We observed that, as presently operated using manual valves, the air supply to the aerator is fairly constant. As BOD-loading drops during the later part of the night, DO rises, reaching peak around mid- to late-morning. When the activated sludge biomass goes without food during these hours, it becomes endogenous and feeds upon itself (digestion). These DO spikes indicate wasted energy, as blower power need not be as high during these periods. Ideally, the DO probe could be used to interface with dedicated, soft-start, variable speed blower motors to maintain the aeration DO in the optimal range of 1.5 mg/L to 3.5 mg/L.

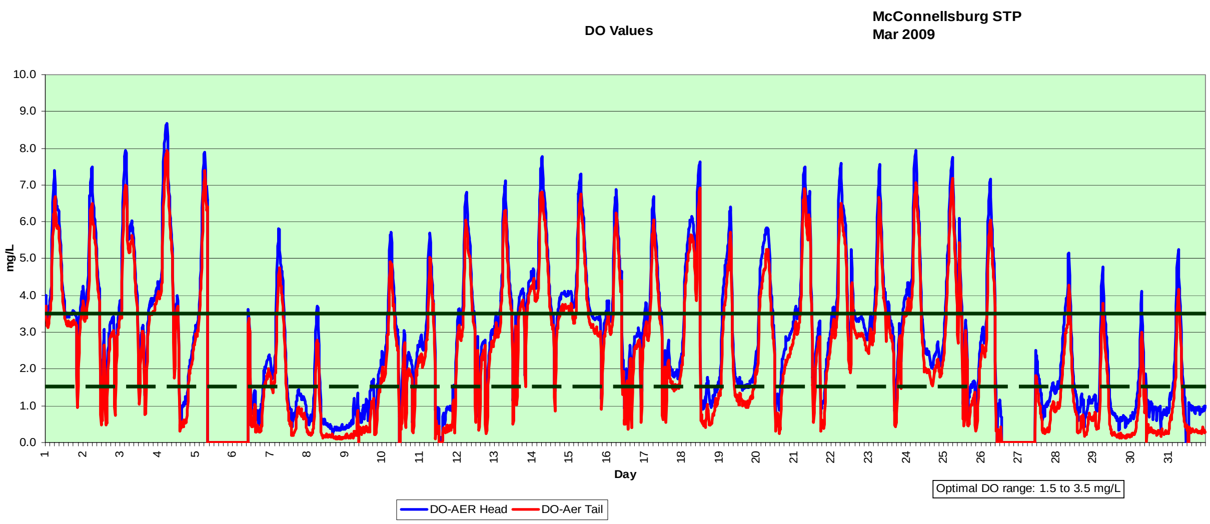


Figure 3: Diurnal effect of DO concentration in the East Aerator

At the MSA plant, we observed that DO levels in the east aerator were consistently low once warmer spring weather had arrived. A downward trend in a graph of DO over time (histogram) may indicate higher organic loading to the facility, increased activated sludge solids retention, or insufficient aeration from either the blower or the delivery system. At MSA, the low DO in the aeration tank pointed mainly to an excessive accumulation of biomass and to insufficient aeration for the increase in bioactivity.

Figure 4, below, shows how ammonia-nitrogen increases during periods of low DO residual in this histogram from the first half of April 2009. This is expected, as the biomass cannot efficiently nitrify during conditions of low DO.

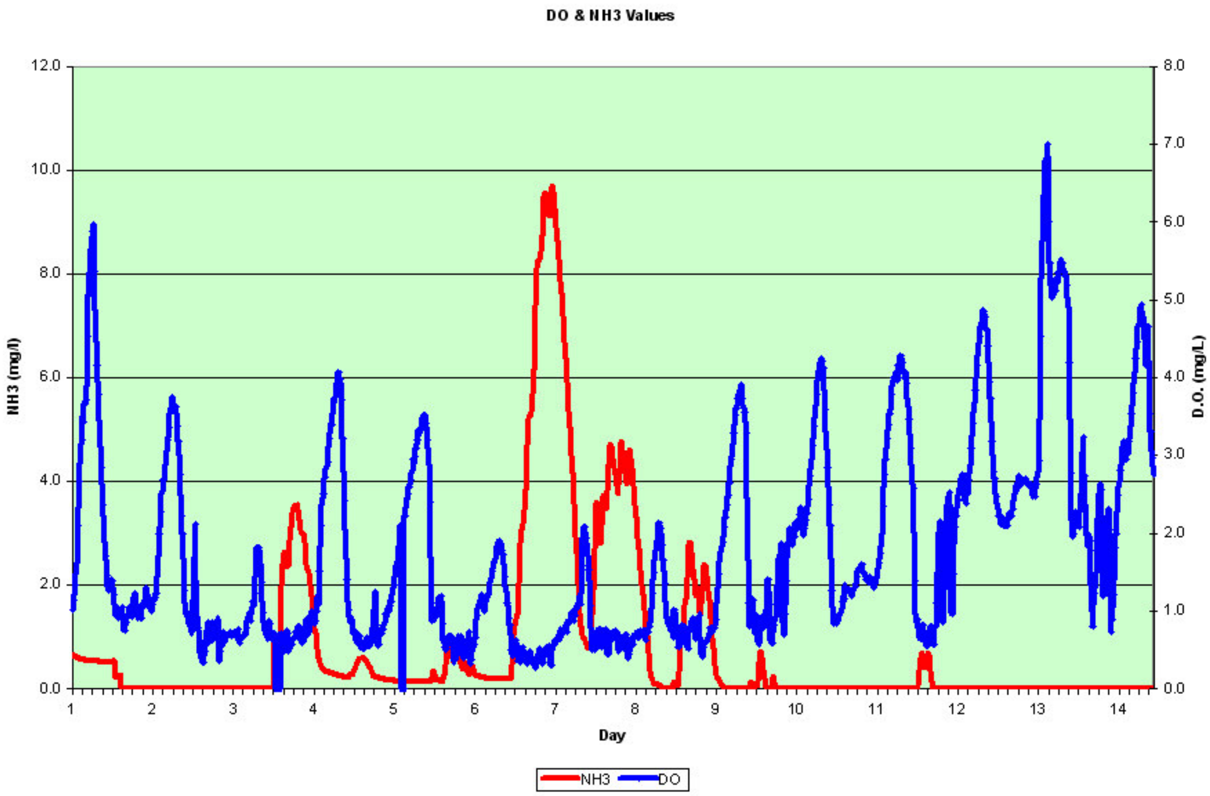


Figure 4: NH4+ as inverse function of DO residual over time, April 2009.

Figure 5, on the following page, shows a single-day in the data set for April, 4/4/09. Here, we observed a regular diurnal peak of ammonia-nitrogen as an inverse function of dissolved oxygen concentration.

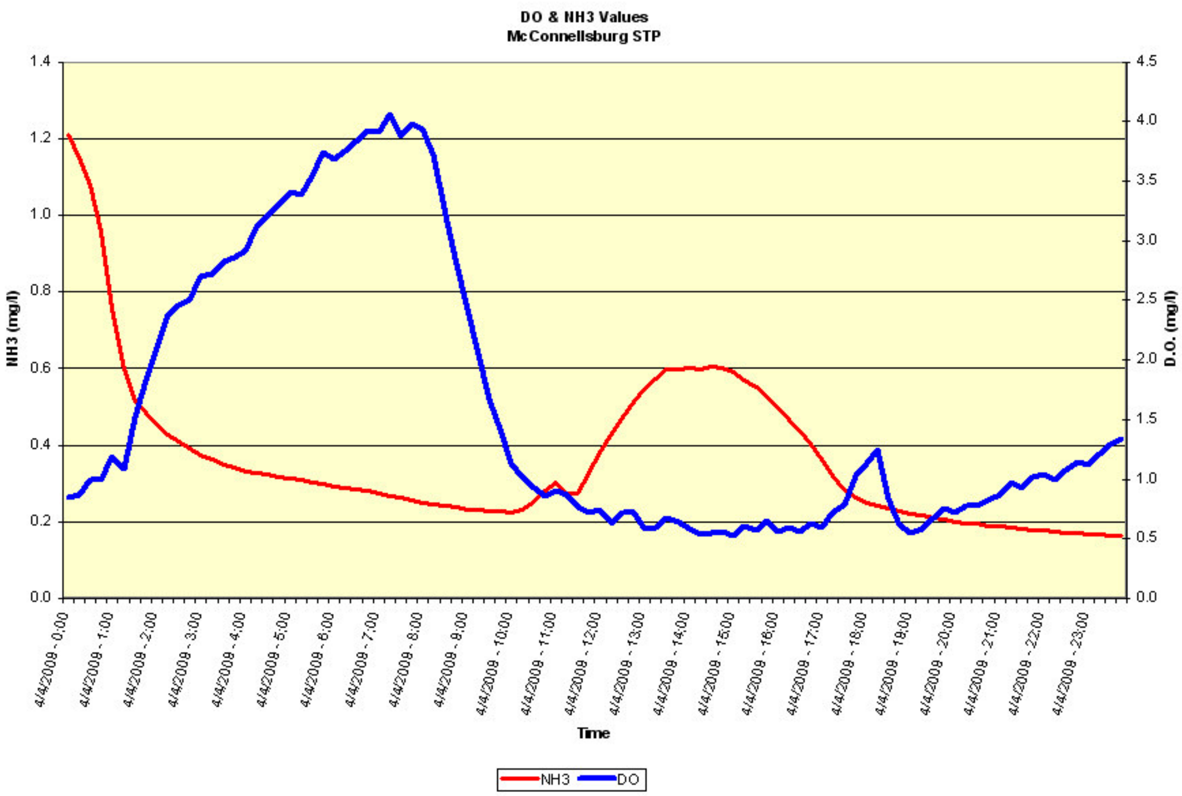
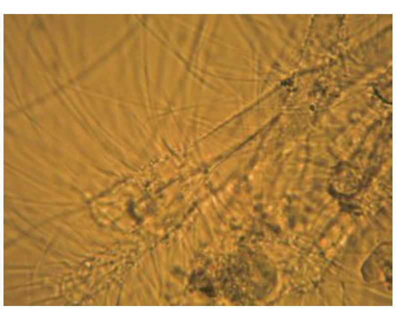


Figure 5: DO and NH4+ plotted as a function of time

Microscopy with Digital Photography

A microscope is a beneficial addition to any wastewater laboratory. DEP is providing temporary use of a microscope in this program so that operators become familiar with the organisms of the activated sludge process, including indicator organisms that may be used to predict the relative health of the biomass and the operating condition of the facility. Following are some example photographs of the MSA activated sludge samples taken during early and mid March.

Figure 6, below, shows the condition evident in mid-March, when filamentous organisms were crowding out beneficial ones. Referring to one of the activated sludge textbooks told us that this is not *Nocardia*, a typical filament, but instead is of another type which was not keyed out during this project. Our initial description of the foam on the aerator was "nocardial"; however, this proved not to be the case when viewed under the scope.



Filamentous growth is able to crowd out beneficial bacteria because filaments possess a very high surface area to volume ratio. This allows them greater access to available oxygen in anoxic conditions. Note that the stalked ciliate in this picture has died, leaving only naked branches behind. Ciliates require much more oxygen level in the mixed liquor than do filaments.

Figure 6. Filamentous bacteria in biomass at McConnellsburg

Here, we observed a bristle worm consuming bacteria in the biomass during the same period. Large amounts of worms and nematodes are indicative of a very old, endogenous biomass. This unhealthy sludge may exist because sludge wasting has not occurred on a regular basis. Old sludge has poor settling characteristics that degrade clarifier performance and can discharge solids and pathogens to the effluent.

Figure 7. Bristle worm in biomass at McConnellsburg WWTP

Microscopic evaluation of the biomass during the last weeks of March confirmed the presence of filamentous type bacteria which contributed to the decrease in settleability with the clarifiers. This condition continued for approximately a week and a half until treating the foam on the aeration tank surface with powdered HTH on March 11. Prior to treating with the HTH the operator shut the air off to the aeration tank for approximately 3 hours to allow the foam to amass in larger areas for ease of treatment. D.O. and ORP data collected during the period when the air was off confirmed that the plant began denitrifying and consuming nitrate with the absence of elemental oxygen. Although the air was not off long enough to see a significant drop in nitrate, the reductions observed indicate that “on/off aeration” could work at this facility for reducing nitrate concentrations in the plant’s effluent.

Current configurations at the plant prevent the operators from using “on/off aeration” as a treatment process option. One blower is used to provide air to the aeration tanks, lift pumps in the clarifiers, aeration in the chlorine tanks. Shutting down the air to the aeration tanks could lead to bulking in the clarifiers and actually discharging more solids. One option is to add solenoid valves at various locations to control air flow at particular times, or to construct additional air headers to allow discreet air flow to particular treatment units when desired.

Sampling for Tests done elsewhere

Grab samples initially were taken for Method 1623 pathogens (*Cryptosporidium* and *Giardia lamblia*) at the treated plant effluent immediately prior to its discharge. Concurrent samples were taken one hundred yards upstream of the discharge outfall and fifty yards downstream, to note the effect of the discharge on the receiving stream.

At various times during the equipment trials, we sampled mixed liquor for suspended solids and for nitrate, and we ran chemical assays for chloride, nitrate, ammonia nitrogen, and phosphorus on plant effluent and on aeration tank supernatant. The lab reports are shown in Attachment G.

6. Process Control

General

The objective of Process Monitoring and Testing is to develop regular Process Control for the individual treatment facility. Typically, an operator chooses to maintain a facility according to mean cell residence time (MCRT) or food-to-mass (F/M) ratio. The objective of these broad parameters is to find a level where plant performance is optimal for the current conditions (including season, amount of precipitation, loading variations, industrial or commercial contributors) and then adjust the treatment processes in order to maintain a steady-state. For example, if an operator runs a facility according to constant Food to Mass ratio of 0.35, if the plant loading (the “food” value) is either naturally constant (based on collection system) or can be sufficiently buffered (using flow equalization tanks), then their objective in maintaining constant F/M is to assure that the biomass (the “mass” value, or the amount of MLSS in the system) can be adjusted through wasting in order to keep the ratio at or near a constant 0.35.

Mean Cell Residence Time is a method by which the operator adjusts solids retention to achieve a steady sludge age. MCRT incorporates a regularly tested solids inventory with adjustments to the wasting rates and an accounting for the expected growth rate due to plant loading. The end result of such operation is a MCRT of x-number days.

Guidance manuals generally suggest that an operator choose a parameter and then operate the facility accordingly. Operators have found that doing so maintains conditions in an optimized state whereby the chance of plant upsets is mitigated or controlled.

Solids Tracking

At present, the McConnellsburg facility tracks sludge solids in the two aeration tanks by performing gravimetric tests for mixed liquor suspended solids (MLSS) on a weekly basis and by conducting daily centrifugal solids percentage assays. Solids are maintained within optimal ranges on a seasonal basis. To develop and maintain a complete solids inventory, the clarifier solids need to be regularly assayed in a similar method. DEP provides, on loan, a clarifier core-taker sampler that is used to determine the level of the sludge blanket and which can be used to sample the entire clarifier for a percent solids number that, with measurements of the return and waste sludge values, may be used to determine an operational MCRT.

The MCRT method is described in earlier versions of WPCF’s Activated Sludge Manual of Practice No. OM-9 and in other sources. Calculation of a sludge inventory using undefined sludge units allows an operator to derive an MCRT value for his facility, and this can be done on a daily, semi-weekly, or weekly basis.

We employed a Hach Sonatax sc digital clarifier blanket instrument to track changes in the clarifier solids inventory on a continuous basis. After adjusting to rule out interferences from light floc particles, the sludge blanket in the clarifier was determined to be fairly constant between 1’-0” and 2’-6”, as shown in Attachment D. By itself, use of this instrument can provide the operator with intelligence on the state of his clarifier’s performance and warn for fluctuations of sludge blanket level. Also, this instrument can be used predictively to warn of impending blanket denitrification, poor settling, or solids ashing over the weirs. Used in concert with the core taker and the centrifugal solids inventory methods, one may calibrate sludge blanket level with clarifier solids concentration in order to determine clarifier sludge inventory on a constant basis. We intend to deploy the Sonatax at facilities where this intelligence can help operators optimize clarifier performance by reducing the amount of solids lost in clarifier effluent that should instead be returned to the aeration tanks as return activated sludge.

DO findings

The DO readings at this facility follow a typical diurnal pattern with peaks occurring over the nighttime hours and dropping after the morning flow increases. Generally, the optimal DO range for activated sludge plants is between 1.5 mg/L and 3.5 mg/L. Any DO over 3.5 mg/L usually represents wasted energy, because the biomass functions adequately within this prescribed range. At MSA, we believe the facility could benefit from continuous monitoring of DO, insofar as the operators may interconnect a DO probe with their blower system in order to achieve demand-based aeration. This should be discussed with the plant's consulting engineer in advance of the next facility upgrade. Modifications at the wastewater plant may require a Water Management Part II permit modification and should be approved by the Department prior to initiating any work.

ORP

ORP can be used by the operators to control periods of anoxic or aerobic treatment conditions, as described earlier, for the removal of nitrates. The following table depicts ORP values at which denitrification occurs; the operators may wish to pursue the use of timed intervals as a method to optimize nitrate removal, even in the absence of dedicated treatment units where denitrification would occur.

General values for ORP used to determine which biological condition exists within a particular treatment unit:

ORP (mV)	Process	Electron Acceptors	Condition
+300	1	O2	Aerobic
+200	1	O2	Aerobic
+100	1	O2	Aerobic
0	2	NO3	Anoxic
-100	2	NO3	Anoxic
-200	3	SO4	Anaerobic
-300	3	SO4	Anaerobic
-400	3	SO4	Anaerobic

1= Nitrification

2= De-Nitrification

3= Methane Formation

Table 2. ORP Chart

ORP readings are typically used in conjunction with the DO readings to identify the effectiveness of a given biological treatment process and the condition of each zone.

DO Profile

A dissolved oxygen (DO) profile was developed in March to characterize mixing in the two aeration tanks. For this, a Hach 40d digital meter and LDO portable probe were used. DO was

recorded at several locations in the aeration tanks, at varying depths marked “subsurface”, “mid-level”, and “deep”. Recordings were made approximately every 6’-0” along the length of the tanks, beginning at the north headwall of the tanks.
The complete DO profile is reproduced in Figure 8, below. Results of this analysis show that, for the most part, mixing within the tanks is complete and DO remains fairly even throughout the process. Lower DO was found near the bottom of the tank, where there may be eddy currents or dead zones formed by the diffuser configuration. While there did not appear to be any dead zones in the tanks, the difference in O_2 distribution between east and west aeration tanks was evident.

Operators at similar facilities have found that performing a DO profile on a monthly basis helps to characterize weak spots in the aeration grid and identify dead zones that may be caused by occluded diffuser outlets or by faulty baffling. Studying the DO profile over time also allows the operator to see the effects of plug-flow loading on the tanks, and data may be used to support arguments in favor of aeration balancing, step-feed processes, or the need to add more diffuser capacity to the tanks.

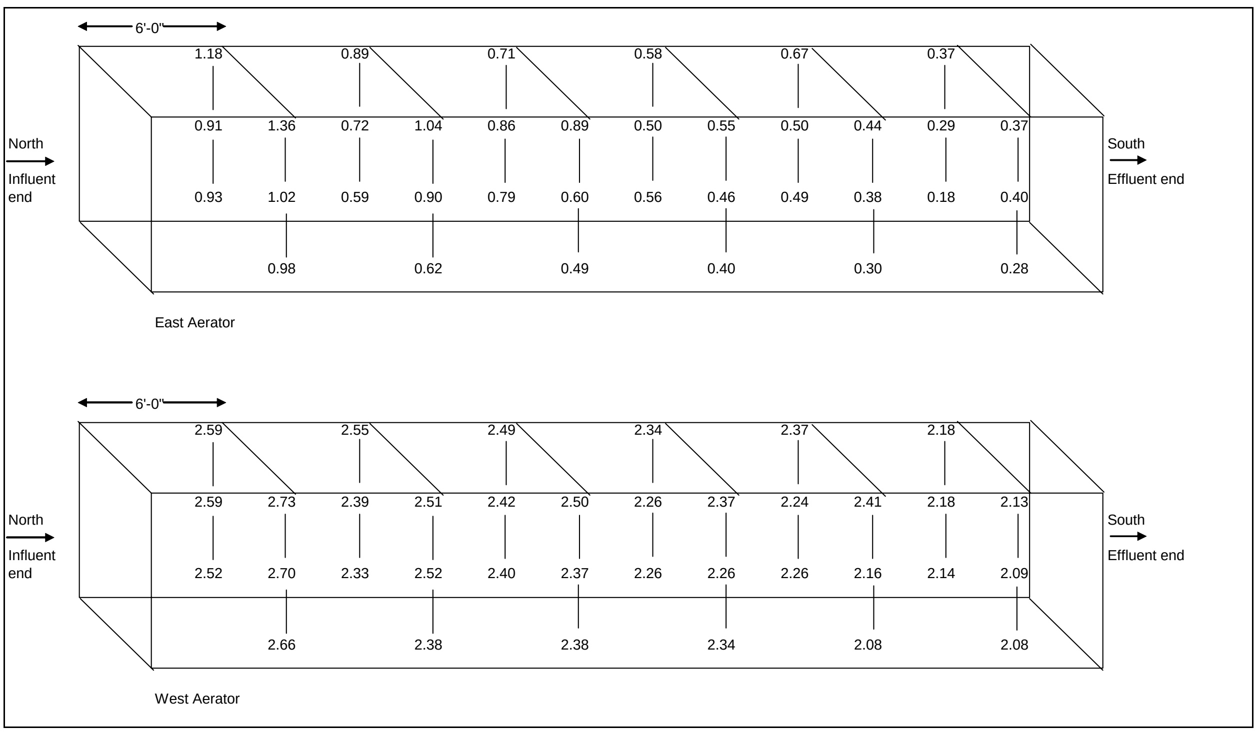


Figure 8. DO Profile of the McConnellsburg WWTP aeration units

DO Grab Testing

During the course of the study, it came to our attention that the method used for daily DO testing of the mixed liquor is performed by removing a sample to the laboratory, remixing it vigorously, and testing the DO in a BOD bottle, using a BOD-DO probe. This methodology resembles the oxygen uptake rate (OUR) test and, as performed, tests for the saturated dissolved oxygen of the liquid at its test temperature. The test result will usually be much higher than that produced by placing the DO probe into the mixed liquor at the aeration tank, whereby the DO is tested under

dynamic conditions. Whereas the process monitoring record typically shows DO readings in the range of 8.0 to 9.0 mg/L, the DO readings demonstrated by the LDO probes in the east aeration tank and by grab sampling using the portable LDO probe were more likely to range from 0.4 mg/L to 6.6 mg/L. Sustained low DO in the east aerator is a concern, because the conditions favor the growth of filamentous organisms that will adversely affect sludge settling.
When DO sampling is done for the purpose of process monitoring, operators find that immersing the probe into the aeration tank under dynamic operating conditions yields a more reliable and accurate measurement of DO within the tank or process being tested.

Chemical Oxygen Demand (COD)

Facilities that contract their compliance testing to independent laboratories typically do not test the strength of the raw wastewater on a frequent basis, although doing so provides a sure method of determining the loading to the facility. Textbooks on the subject typically recommend that at least one 24-hr composite sampling of the raw wastewater be tested for its load value at least three times per week, with daily testing being the optimum.

Because the standard test for loading, the Biochemical Oxygen Demand (BOD) test, takes five days to complete and is comprised of a number of difficult preparation steps and incubation under constant heat, some operators have found that the Chemical Oxygen Demand (COD) test provides a quicker, timelier indication of wastewater loading. The COD test takes about 150 minutes from start to end, and its results may be calibrated against the less-frequent BOD test in order for the operator to know his facility's wastewater loading on any given day.

Historically, BOD tends to be 72-85% of COD. The operator can use the following equation to find plant loading:

Load, lb/day = Q, MGD x (COD, mg/L / 0.72) x 8.34 lb/gal; hence,

Load, lb/day = 0.214 MGD x (1,820 mg/L / 0.72) x 8.34 lb/gal = 4,511 lb/day

The BOD/COD ratio should be regularly updated by split sampling and testing for both BOD and COD. The laboratory values for the 5-day BOD test may be incorporated into a rolling average in order to refine and update the ratio coefficient in the above equations, so that the operators may rely on substituting the COD test and performing it on those days when BOD testing is unavailable. The food loading value is then useful for operating the facility based on Food to Mass Ratio, discussed elsewhere in this report.

Nitrate and Ammonia Nitrogen

Use of the nitrate and ammonia nitrogen probes at the MSA plant showed that relatively high nitrate concentration tends to dominate. With extended aeration processes, ammonia-nitrogen tends to be quickly converted to nitrite and nitrate. Nitrate is a pollutant-of-concern in wastewater effluent because nitrate acts as a fertilizer, increasing algal growth that leads to eutrophication of streams and lakes and, ultimately, the mortality of higher life forms. Nitrates have also been indicated as damaging to human health, having both immediate and long-term effects.

Our study has shown that MSA could benefit from adopting flow and aeration configurations that favor denitrification, without excessive capital expense. Use of "on/off aeration" for several one to two hour periods per day, or establishment of "anoxic zones" in the aerators, could significantly reduce the nitrate concentrations in the plant's effluent.

pH, Temperature

Our study showed that the plant's operating pH and temperatures were normal for the times and conditions observed. Generally, the optimum pH for nitrification is in the 7.5 to 8.5 s.u. range. In MSA's case, pH values of 6.7 or 6.8 are typical. MSA adds lime on a routine basis to adjust the pH to desired levels and ensure enough alkalinity is present to allow nitrification to occur. It may be advantageous to add an automated lime slurry feed that is paced off of pH monitoring of the mixed liquor.

Regular testing of the pH of the raw wastewater, at the head of the plant or at the equalization tank, can predict the quality of the wastewater entering the aeration tanks and whether or not a customer in the collection system is discharging large amounts of chemical waste or detergents. The NPDES permit typically limits effluent pH to a range from 6.0 to 9.0.

Clarifier Blanket Level & Core Sampling

Two methods of analyzing the clarifier blanket were employed at the MSA plant: use of the continuous-monitoring sonar device, and use of the core-taker sampler. Clarifier sludge blanket should be regularly measured to determine at what plant conditions the best effluent is produced by the clarifiers. Typically, an operator should check the sludge blanket once or twice per shift. Rising sludge blanket can indicate trouble a day or two out; falling sludge blanket could indicate overwasting or short-circuiting.

We used the continuous sonar method to look for fluctuations in blanket levels, but we found none. Using the core-taker, we were able to obtain samples of the clarifier solids for the centrifuge test, which provides a sludge concentration-by-volume measurement that may be used for trending operations and in developing MCRT or AGE.

Flow Measurement

Although 4-20 mA processor cards were installed in the SC-1000 Modbus units, we were unable to interface with the facility's flow meters at this time, because the expertise for connecting *in series* to existing equipment was beyond our experience. However, the cards are available for future use, following consultations with vendors and technical persons supporting the manufacturers of the flow metering devices. We suspect that this will be done individually at each facility, because the equipment available varies so greatly.

Laboratory Tests

We employed the Raven Process Control products centrifuge for developing quick information on solids inventory and biomass condition. This equipment includes settleometers, which mimic clarifier performance, and a core-taker that is used to determine both clarifier sludge blanket level and percent solids of a representative sample, used in determining total plant inventory.

MSA already uses the centrifuge for sludge solids by volume percent. At present, only the aeration tanks and digester sludge are routinely tested. According to supplemental information provided by Raven, it is possible to determine a sludge age, similar to use of MCRT, for tracking overall plant performance. Doing so includes maintaining a running sludge solids inventory of all processes and tanks, including aeration, clarifiers, return and waste sludge volumes, and inflow and effluent solids. It is also recommended that the sludge solids by percent volume be calibrated to sludge solids by gravimetric analysis.

We also provided a hand-held dissolved oxygen probe and pH probe for use in field testing of the aeration tank mixed liquor. The preferred method of determining process DO is to immerse the DO probe into the aeration tank or effluent stream and to read the DO after the meter stabilizes.
To verify the accuracy of the digital probes, we provided a field spectrophotometry kit that included test materials for several water quality parameters. During the instrument trials, we used this kit to determine nitrate, phosphate, and ammonia nitrogen.

The digital-reading microscope is an excellent tool for observing the biomass for indicator organisms. Doing so helps plant operators to determine the relative sludge age and health of the system. Generally, the observance of only free-swimming amoeboids and ciliates indicates a very young sludge, while observance of rotifers and nematodes indicates an old sludge. Ideally, one would observe a dominance of free and stalked ciliates, indicator organisms that show sludge with optimal settling characteristics.

Method 1623 Pathogen Test Results:

Date	Sample Location	Weather	Sample Number	*Giardia* cysts/~10L	Crypto oocysts/~10L
2/10/09	100 yd UPS		0907007	40	5
2/10/09	Effluent	Dry	0907008	833	3
2/10/09	50 yd DWS		0907009	271	4
3/17/09	Effluent	Dry	0907011	10	0
4/15/09	Effluent	Wet	0907015	3,003	3

Table 3. Method 1623 test results

The table above shows the pathogen test results for *Giardia* and *Cryptosporidium*. On February 11, the only day we collected stream samples along with an effluent sample, the tests showed that contribution from the wastewater treatment facility does directly affect the quality of the water immediately downstream. Whether or not this would impact a drinking water intake five or more miles further downstream remains to be seen, especially as Big Cove Creek is situated among cattle pastures and farm fields.

The manager of MSA thought that the high initial *Giardia* number may have been the result of some pipe connections at a nearby agricultural facility, and he used the test result as evidence to have the pipe connection severed and capped. A month later, in similar dry conditions, the *Giardia* result was only 10 cysts per ~ 10 liters of effluent. Whether this was due to the pipe connection having been severed, we will never know for certain, for the disinfection tank was cleaned out on March 16.

Finally, a month later, after three consecutive days of heavy spring rains, the effluent sample yielded a surprising 3,003 cysts per ~ ten liters. The rain event was the first good flush of the season for MSA's collection system which traditionally causes materials built up in the piping to be "flushed" downstream to the plant. Often times this debris can add additional loading to the raw influent BOD and associated pathogen loadings.

These test results show how, in many ways, the data is subject to interpretation. Was there a wildcat source of *Giardia* during the dry winter? Did the first system flush with heavy rain in spring include stormwater runoff from nearby farms? Had cleaning the disinfection tank ridded it of solids that had been retaining *Giardia* cysts? These kinds of questions are sure to vex us as we endeavor to show a direct link between POTW Optimization and downstream drinking water quality.

In any case, it may be useful if operators of sewage treatment systems that are upstream of water filtration plants notify the operators of those downstream water plants when the first sustained spring rain occurs. This would give the water plant operators notice that a "spring flush" may result in increased levels of parasitic pathogens like *Giardia* in the source water. Water plant operators could then decide to close their intake during the spring flush.

7. Conclusion

Considerations for Operational Modifications

The following are possible modifications that could be made at the WWTP and are based on the data collected during this study and current operating practices commonly utilized at other WWTPs across the Commonwealth. These possible modifications are presented for the operators benefit but should only be instituted while cautiously observing the effects on the overall treatment efficiency. Since the WWTP process is a biological process, changes made on a particular day may not be visible until at least 24-48 hours later, or more. The responsibility for instituting changes and their outcomes remains with the Operator in Responsible Charge at the WWTP where the changes are made.

DO control

Currently, the plant lacks the ability to modify DO levels in the aeration tank without manually closing valves on other tanks, i.e. sludge return pumps and chlorine contact tank aeration.
Air supply to the aeration tanks is inconsistent. A more consistent air delivery system could save a considerable amount of money. Although MSA typically operates just one blower to deliver air to several treatment units, the current configuration does not allow for optimal energy efficiency or for operational modifications such as alternating DO levels in the mixed liquor in order to increase nitrification. The current air delivery system does not allow operators to adjust DO levels in the aeration basins without changing air delivery to the chorine contact tank and other units.

During the anticipated plant upgrade, the operators should consider employing modern, energy efficient motors with soft-start and variable-speed drive capability. By creating a feedback loop between the motor starters and the digital DO or ORP probes, the operators could efficiently regulate aeration capacity to support nitrification and denitrification, saving thousands of dollars over the long term on electric energy costs. MSA's consulting engineer could develop a depreciation and payback term for such equipment changes.

Meanwhile, trying on-off aeration can trigger the denitrification process. This could reduce the need for adding lime to the mixed liquor, since the denitrification process devours nitrate and creates alkalinity as a byproduct.

Optimum Levels for Nitrification

Nitrifying bacteria (autotrophic aerobes) convert NH3 to NO3 consuming inorganic carbon, DO, and alkalinity.
Generally, optimal conditions for nitrification are:

MCRT: 10 to 13 days Temperature: 60 - 95°F
MLSS: 2,000 to 3,500 mg/L pH: 7.5 – 8.5 s.u.
DO level: > 2.0 mg/L (4.6 lbs per lb of NH3 converted to NO3)
Sufficient alkalinity to provide 7.2 lbs per lb of NH3 converted to NO3

Pathogen control

Disinfection for fecal coliform reduction is currently performed by the addition of sodium hypochlorite solution and sodium bisulfite for neutralization of the chlorine residual. Generally, solids accumulate in all chlorine contact tanks and they were found in the chlorine contact tank to some extent at this location. The operators generally clean the tank annually but increased that frequency by performing an unscheduled cleaning in March. It may prove beneficial to establish a more frequent basis for cleaning the chlorine contact tanks, possibly on a quarterly basis. A sludge judge can be utilized in the chlorine contact tank to measure the depth of solids deposition. There are several drawbacks to solids accumulating in the chlorine contact tank including denitrification and discharge of solids and creating an unnecessary chlorine demand which increases the volume of hypochlorite necessary to disinfect the wastewater.

Laboratory methods

Mixed liquor suspended solids tests are usually conducted once weekly. Generally this practice would be acceptable for monitoring the biomass. During spring and fall times of year when the temperatures are changing it may be beneficial to monitor the MLSS more frequently, at least twice weekly. Also, once the MLSS test is complete, volatilizing any solids remaining in the muffle furnace will provide data on ML volatile suspended solids, which allows for the calculation of the mean cell residence time (MCRT). Generally, MCRTs in the 10 - 13 day range allow for optimum nitrification of the wastewater.

Use of the centrifuge, settleometers, and core-taker would allow the operators to develop a sludge inventory based on sludge units (SLU), which is a product of both solids-by-volume percent and process volume or total flow. Developing such a sludge inventory also allows the operators to determine a sludge age (AGE) for the process, which on a daily basis is used similar to the MCRT as an operational guideline.

In either case, whether using AGE or MCRT, it is beneficial to plant operators to find an ideal operational setpoint and then adjust the process to maintain the plant at or near that setpoint. It is somewhat like flying by instruments instead of using only visual flight rules. Intuition and experience with the appearance of the facility does help, but it only goes so far.

Inflow/Infiltration

As are many POTWs in the Commonwealth, the collection system is impacted by inflow and infiltration. A maximum daily flow of 0.9 MGD indicates that some I/I does exist and could adversely affect operations. Continued maintenance on the collection system is needed to reduce these impacts. MSA should maintain an aggressive policy to find and disconnect wildcat connections, storm drains and downspout connections, and root infiltration in its collection system. If manhole cap inserts are not in use, they should be installed to reduce inflow.

Solids Management and Inventory Control

The solids management and inventory control program is based on mixed liquor suspended solids analysis, percent solids analysis by centrifuge, settleability tests, and operator interpretation of the current operating conditions.

The current practices include wasting solids after they are allowed to accumulate in the system for some time. It appears that this practice may have led to significant DO drop within the aeration system which also contributed to an outbreak of filamentous bacteria. The filamentous affects all units to include settleability characteristics within the aeration tanks.

A sludge generation calculation was performed utilizing 2008 DMR data. The calculation supported the operational review that indicated McConnellsburg effectively disposes of the theoretical sludge generation amounts that were calculated considering the particular WWTP configuration, waste strength and effluent concentrations. The sludge generation calculation is depicted at Table 4.

Based on the calculations summarized below, we verified that MSA operators are disposing of an acceptable amount of sludge for their operation.

SLUDGE GENERATION CALCULATION

Facility Name: McConnellsburg STP
Permit Number: PA0020508
Date of Calculation: 5/4/2009

Required Information For Calculation

Average Daily Flow (mgd):	0.284	Digester Capacity (gal):	500,000
Influent BOD (mg/l):	265	%Solids of Outgoing Sludge:	1.8
Effluent BOD (mg/l):	3.8	Monitoring Period (days):	365

Wastewater Treatment Processes

Place an "X" in the box beside the corresponding treatment process. Select a maximum of Primary Clarification and one other treatment process.

Primary Clarification		Contact Stabilization		RBC	
Conventional Activated Sludge		SBR		ABF	
Extended Aeration	x	Trickling Filter		Small Plant with low SOR (<500 gpd/sq ft)	

Operational Information

BOD Removed (lbs/day):	619	TSS Removed (lbs/day):	402

Digester Information

Type of Digester

Place an "X" in the box beside the corresponding treatment process.

Aerobic Digestion	x	Anaerobic Digestion		None	

Sludge Feed Rate to Digesters (gpd):	6429.00267
Digester Hydraulic Detention Time (days):	78
Estimated Total Solids Reduction (%):	0.35

Sludge Generation

dry lbs/day	261	wet lbs/day	14522
dry tons/monitoring period	47.70	wet tons/monitoring period	2650
gal/day	1741	gal/monitoring period	635534

Amount of Sludge Reported as Being Generated by the Facility

wet tons/monitoring period: 0
OR
dry tons/monitoring period: 40.67

Enter only one of the above values. The remaining value should be "0".

Is the amount reported by the generator within 15% of the calculated value? **YES**

NO explanation:

What type of information was used to calculate the above information: 2008 DMR data
Dates used: 1/1/2008 TO 12/31/2008
Name of person performing the calculation: DiGilarmo

Table 4. McConnellsburg WWTP sludge generation calculation

WASTEWATER PLANT PERFORMANCE EVALUATION

McCONNELLSBURG SEWER AUTHORITY

<u>ATTACHMENTS</u>

Attachment A—Plant Background

Location

The McConnellsburg WWTP was originally constructed in 1970 and upgraded to activated sludge—extended aeration treatment in 1994. The design flow for the current facility is 0.600 MGD. The facility treats sewage from the Borough of McConnellsburg and parts of surrounding Ayr Township in Fulton County. According to the most recent Waste Management Report, The collection system includes two industrial contributors and two major sources, although the facility is not required by USEPA to have an Industrial Pretreatment Program.

Currently the facility is preparing for an upgrade of its facilities to include: a new equalization tank, tertiary filters, and Modified Bardenpho Process nutrient removal treatment units. This will allow the operators to greatly reduce the levels of nutrients and pathogens discharged to Big Cove Creek. The receiving stream is a tributary of the Potomac River and the Chesapeake Bay, thereby falling under new requirements for nutrient reduction.

NPDES Permit No. PA0020508 establishes the operations and monitoring requirement for treated sewage at the McConnellsburg WWTP.

The McConnellsburg WWTP is located in Ayr Township southwest of McConnellsburg Borough, the seat of Fulton County, between U.S. 522 (Big Cove Road) and Big Cove Creek.

Figure 9. McConnellsburg WWTP

Process Description:

MSA's treatment train is depicted in Figure 10, below, showing a conventional activated sludge, extended aeration treatment process employing aerobic digestion of waste solids. Plant headworks include a lift station with mechanical bar screen and flow equalization. Two aeration tanks provide for 327,000 gallons of capacity with an aeration requirement of 255 CFM. Secondary settling is provided in two 36'-0" diameter clarifiers having 15'-0" of headwall depth. Disinfection processes include two parallel tanks employing sodium hypochlorite to destroy pathogens, and dechlorination using sodium sulfite is then added to remove excess chlorine prior to discharge to the receiving stream. MSA's final outfall into Big Cove Creek employs a standard, shoreline point discharge and headwall.

Process alkalinity is manually supplemented using lime addition at the flow splitter box prior to the aeration tanks, and lime is also added to waste sludge prior to the aerobic digester.

Treatment Schematic

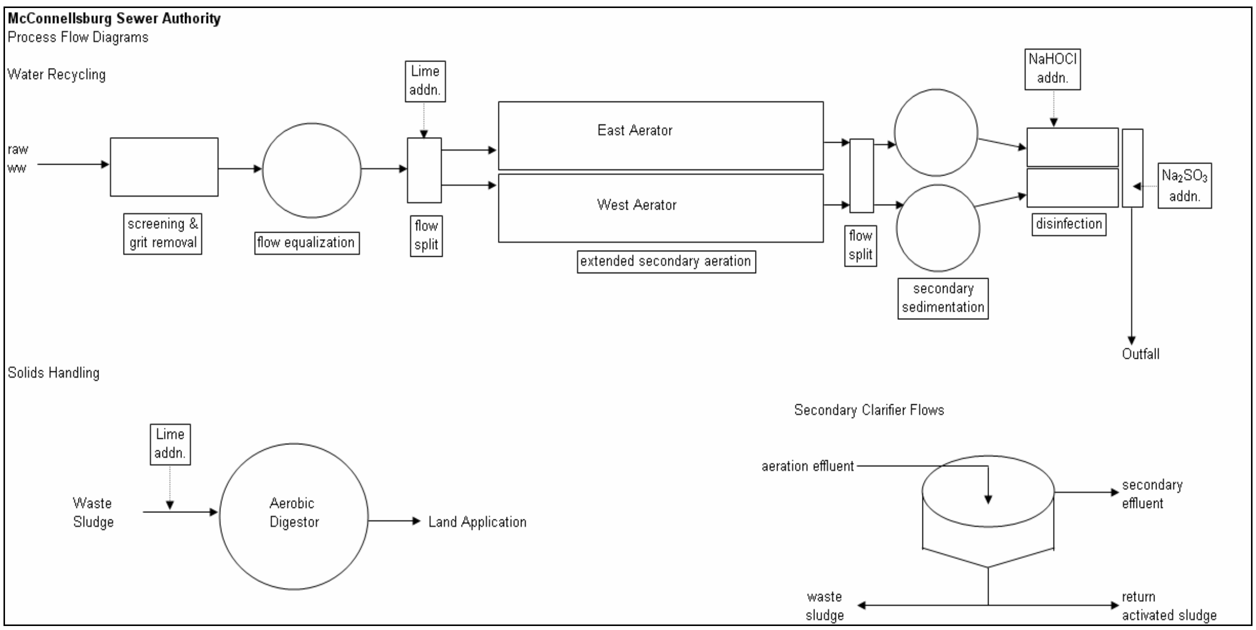


Figure 10. McConnellsburg WWTP process flow schematic

Attachment B—Equipment Deployed

Continuous monitoring

Table of equipment
1 – Laptop computer with 485 to 232 signal converter
2 – SC1000s
2 – LDO probes
1 – pH probe
1 – ORP probe
1 – NH_4D probe
2 – Nitratax probes
1 – Sonatax probe

Laboratory

Table of equipment
1 – Hach HQ40d handheld pH and LDO meter
1 – LBOD probe
1 – DR2800 spectrophotometer
1 – Raven centrifuge
1 – Raven Core Taker sampler
2 – Raven settleometers
1 – COD Heater Block
1 – Microscope with photographic/video capability

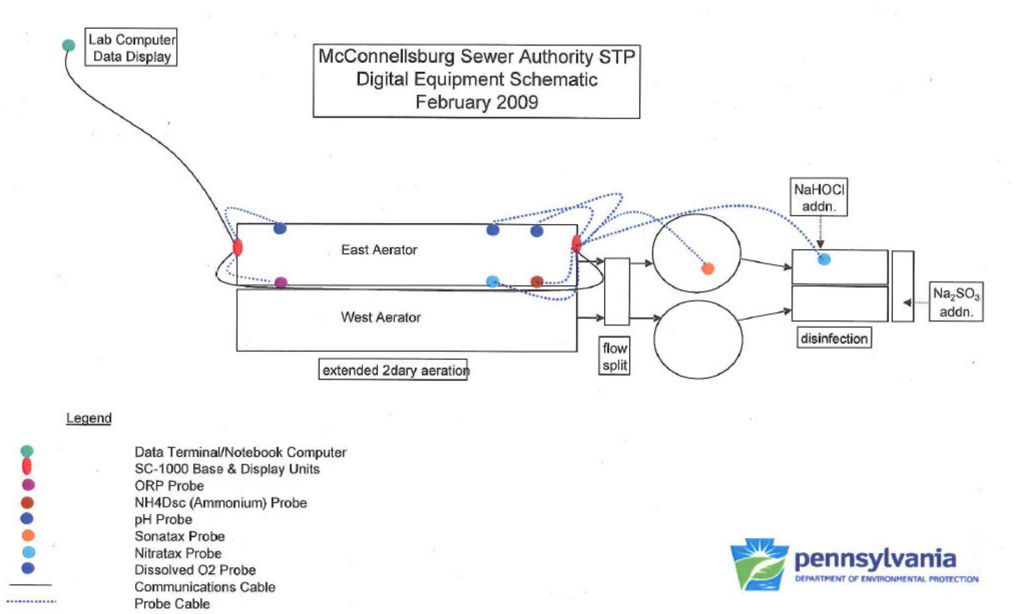


Figure 11. Locations of online process monitoring equipment

Attachment C—Graphs: Monthly Monitoring Examples

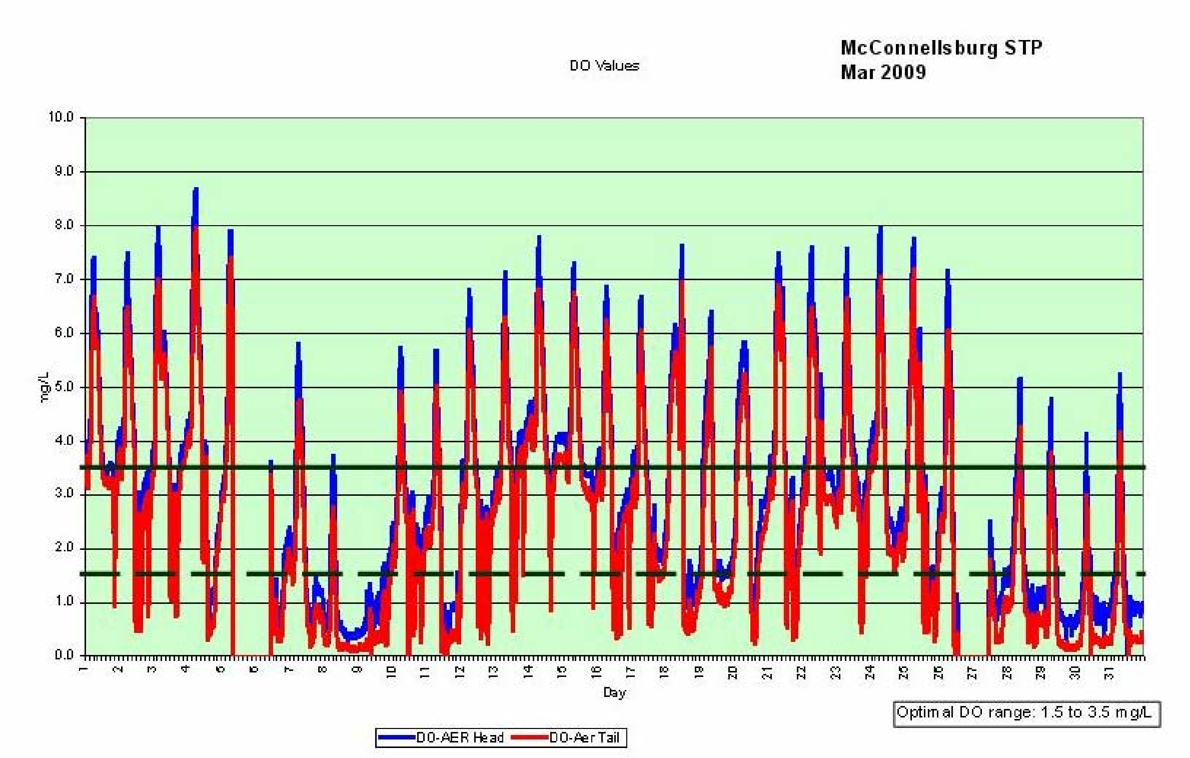


Figure 12. DO values during the month of March 2009

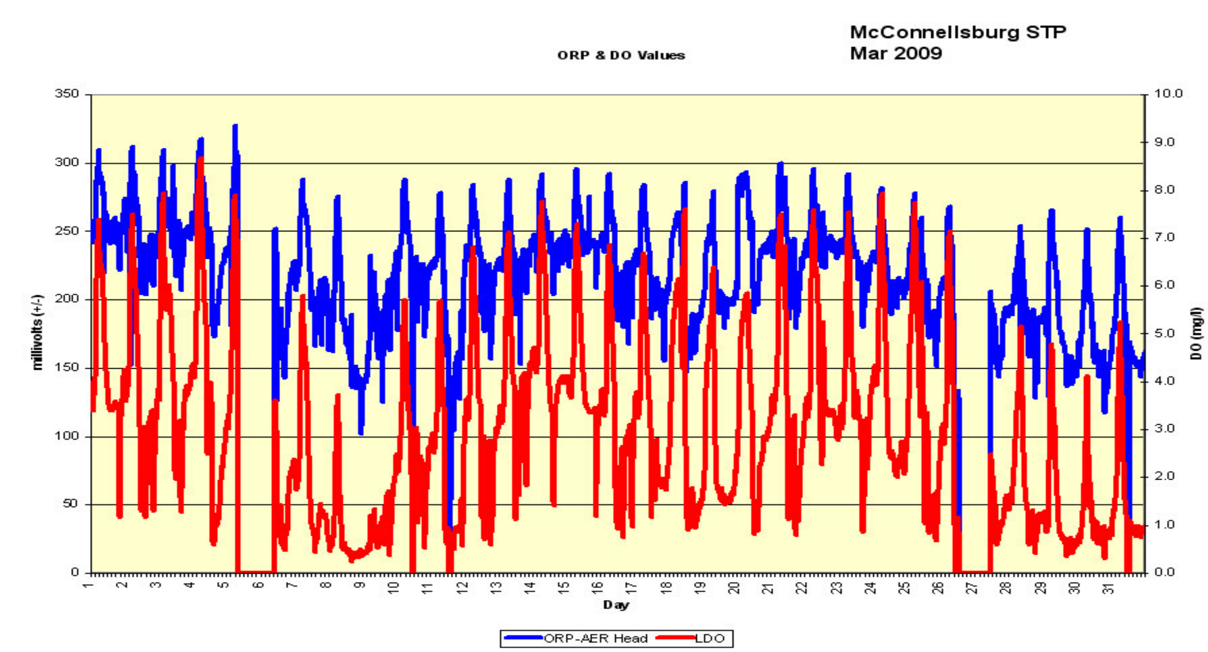


Figure 13. ORP and DO values during the month of March 2009

Attachment D—Graphs: Daily Monitoring Examples

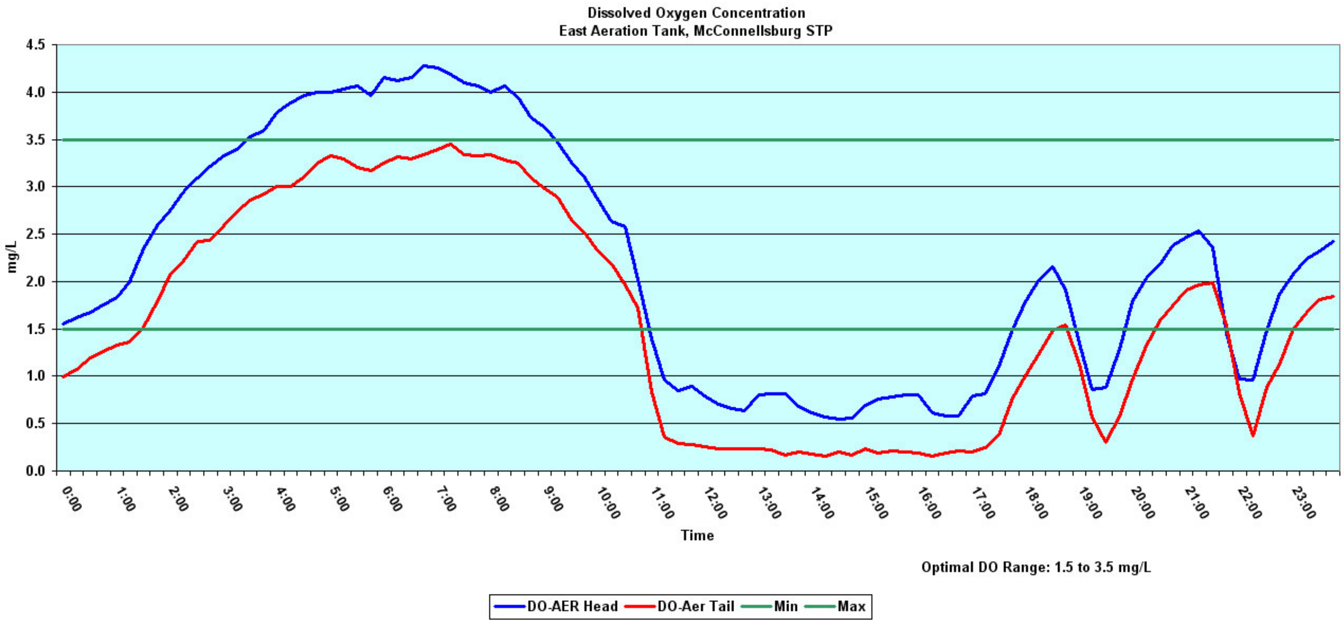


Figure 14. ORP and DO values for April 11, 2009

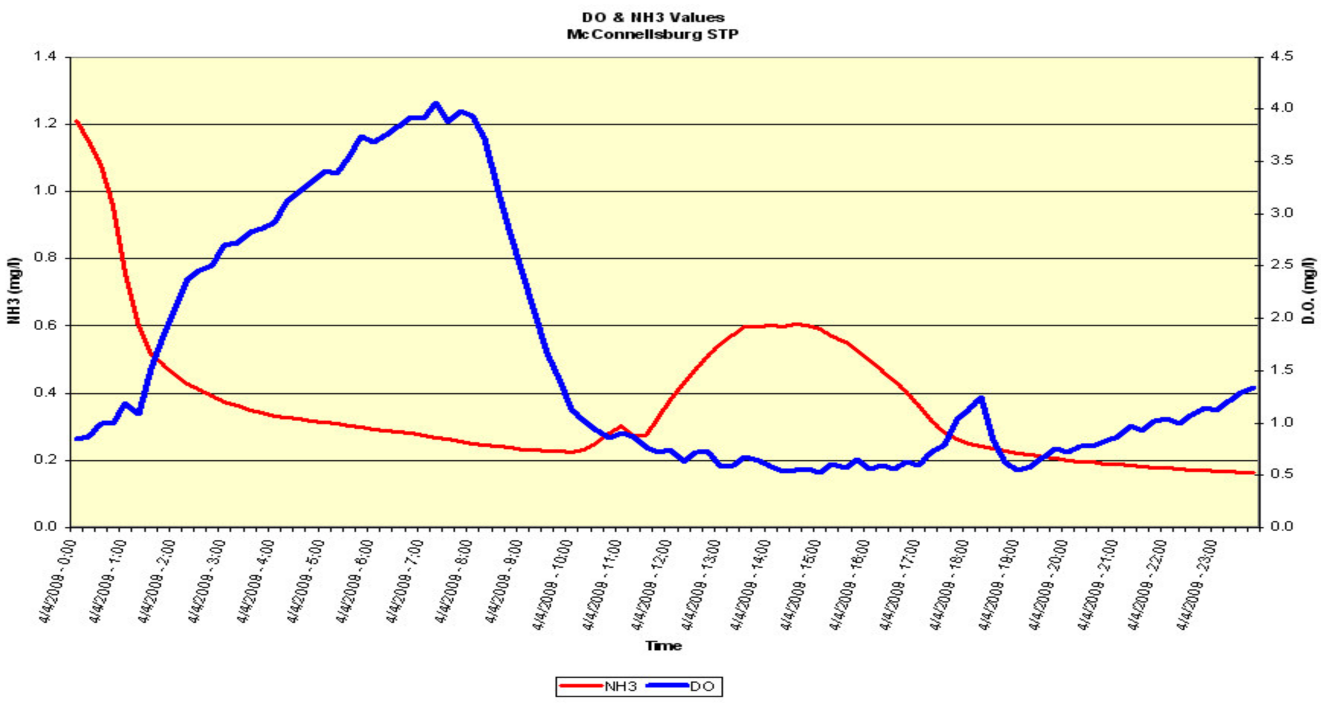


Figure 15. DO and NH3 values for April 4, 2009

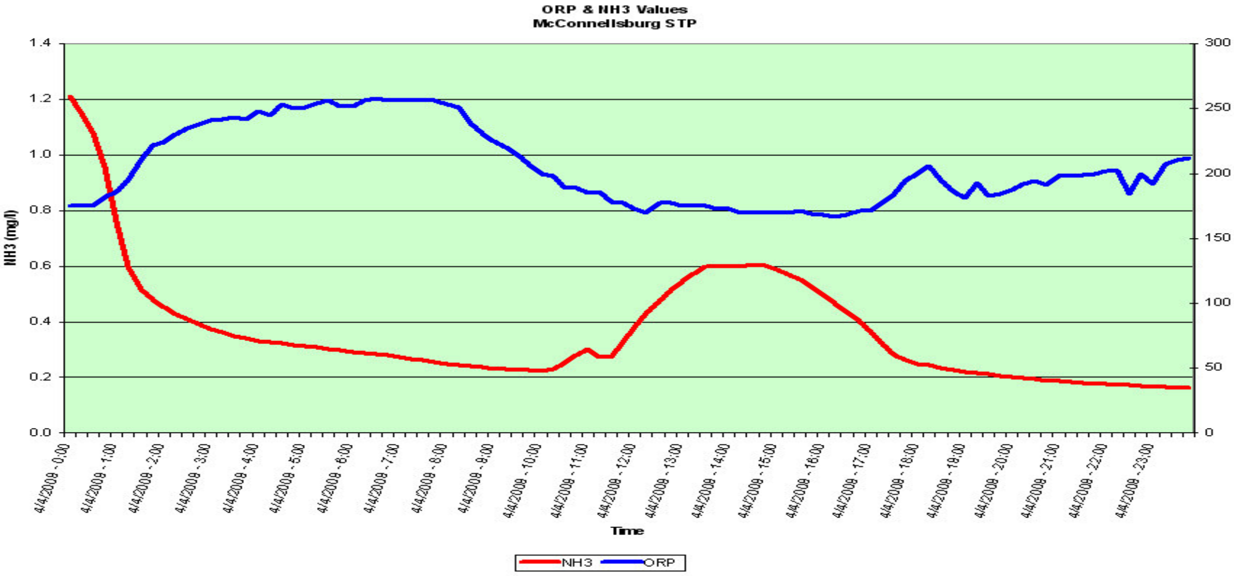


Figure 16. ORP and NH3 values for April 4, 2009

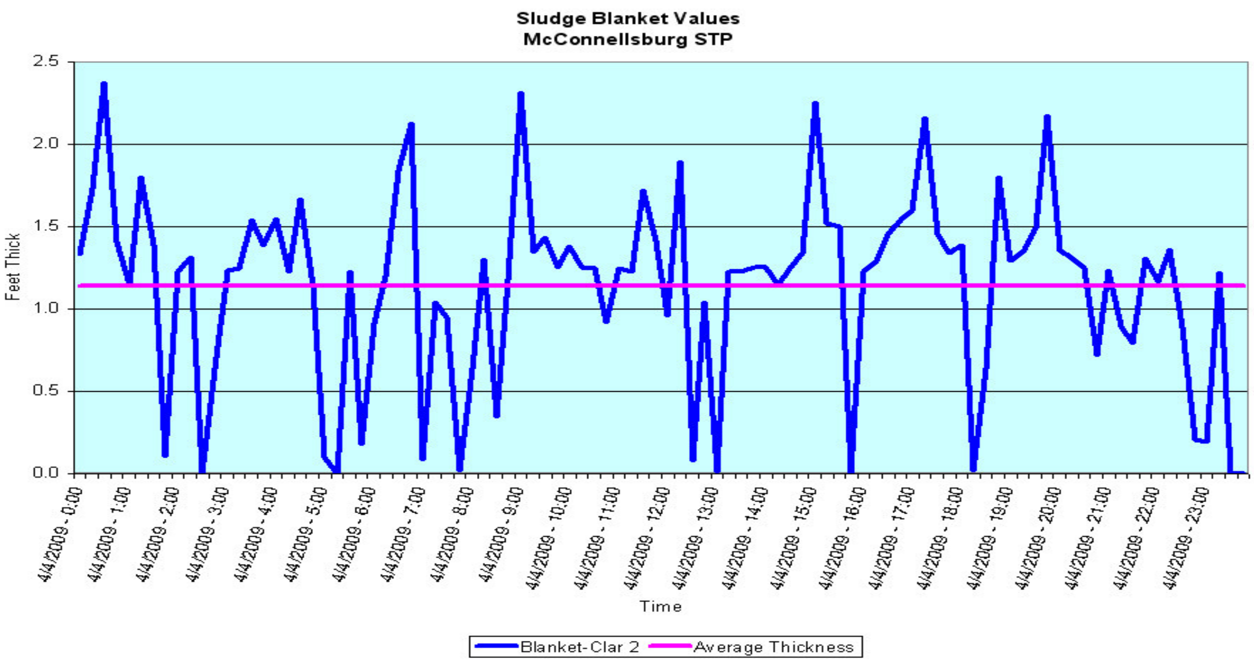


Figure 17. Sludge blanket depth in the south clarifier

Attachment E—Equipment Placement Photographs

WPPE Instrument Trials at
McConnellsburg Sewerage Authority
Fulton County, PA
February—April 2009

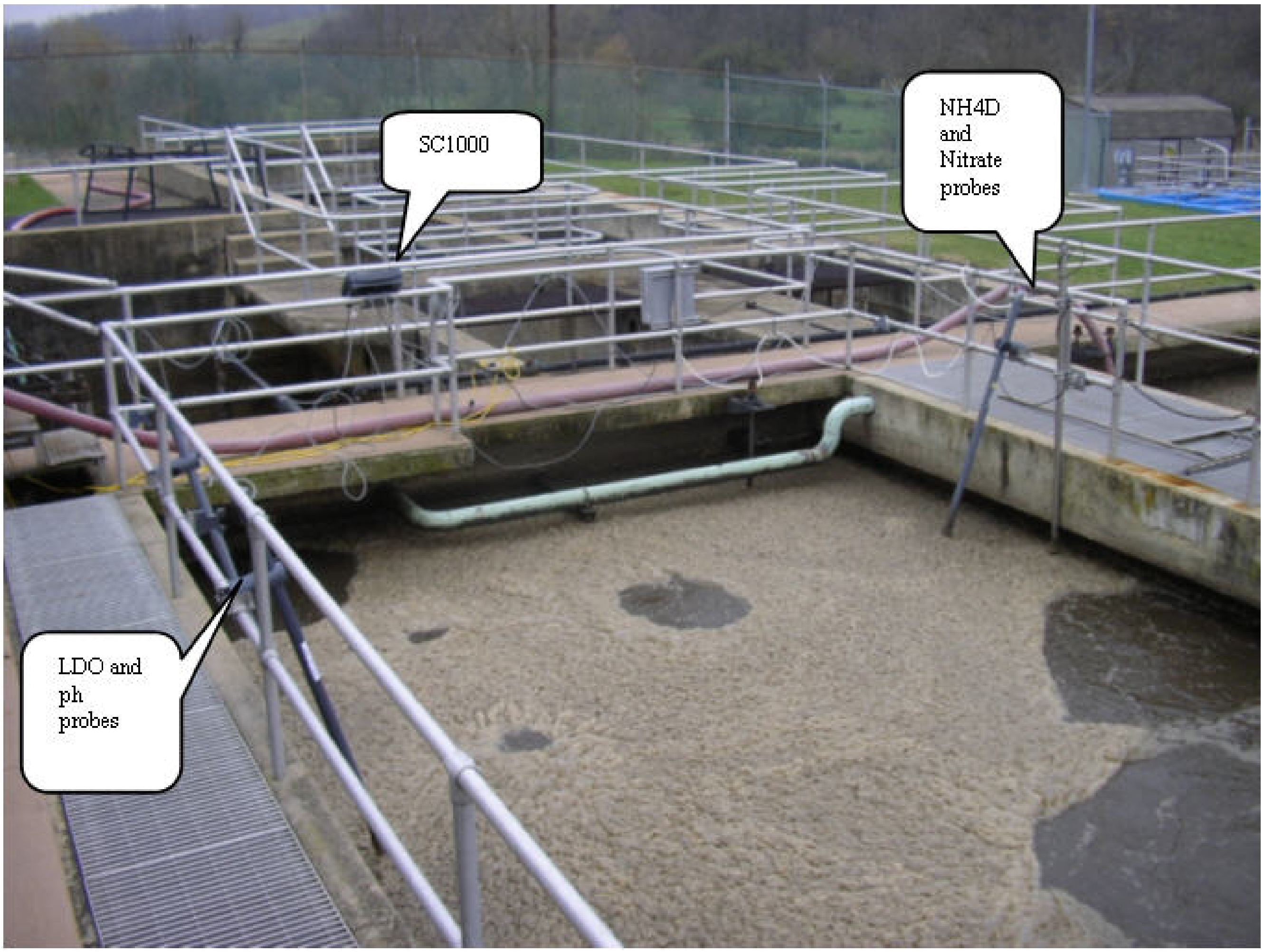


Figure 18. Probe/SC1000 placement at McConnellsburg WWTP, east aeration tank

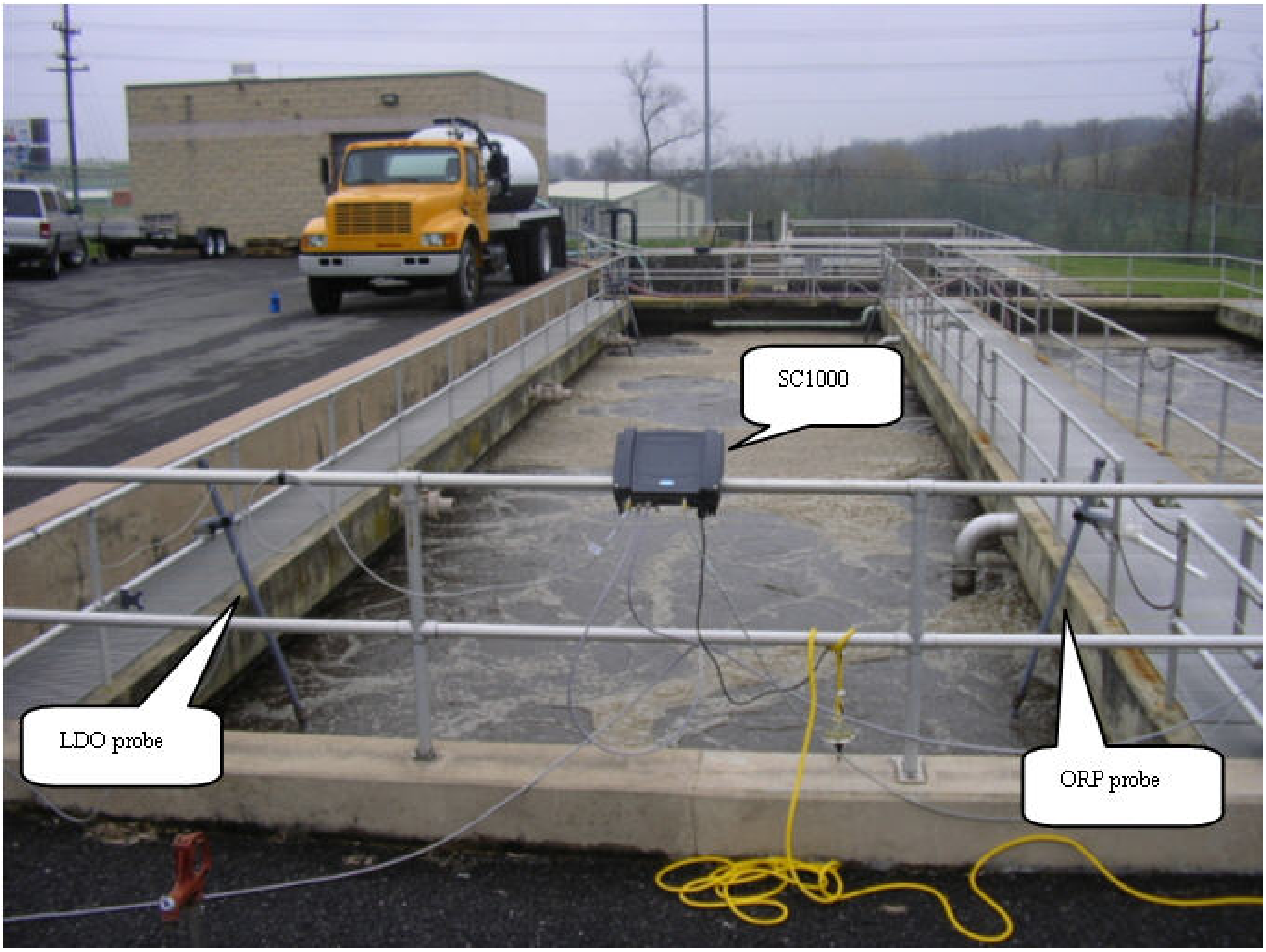


Figure 19. Probe/SC1000 placement at McConnellsburg WWTP, east aeration tank

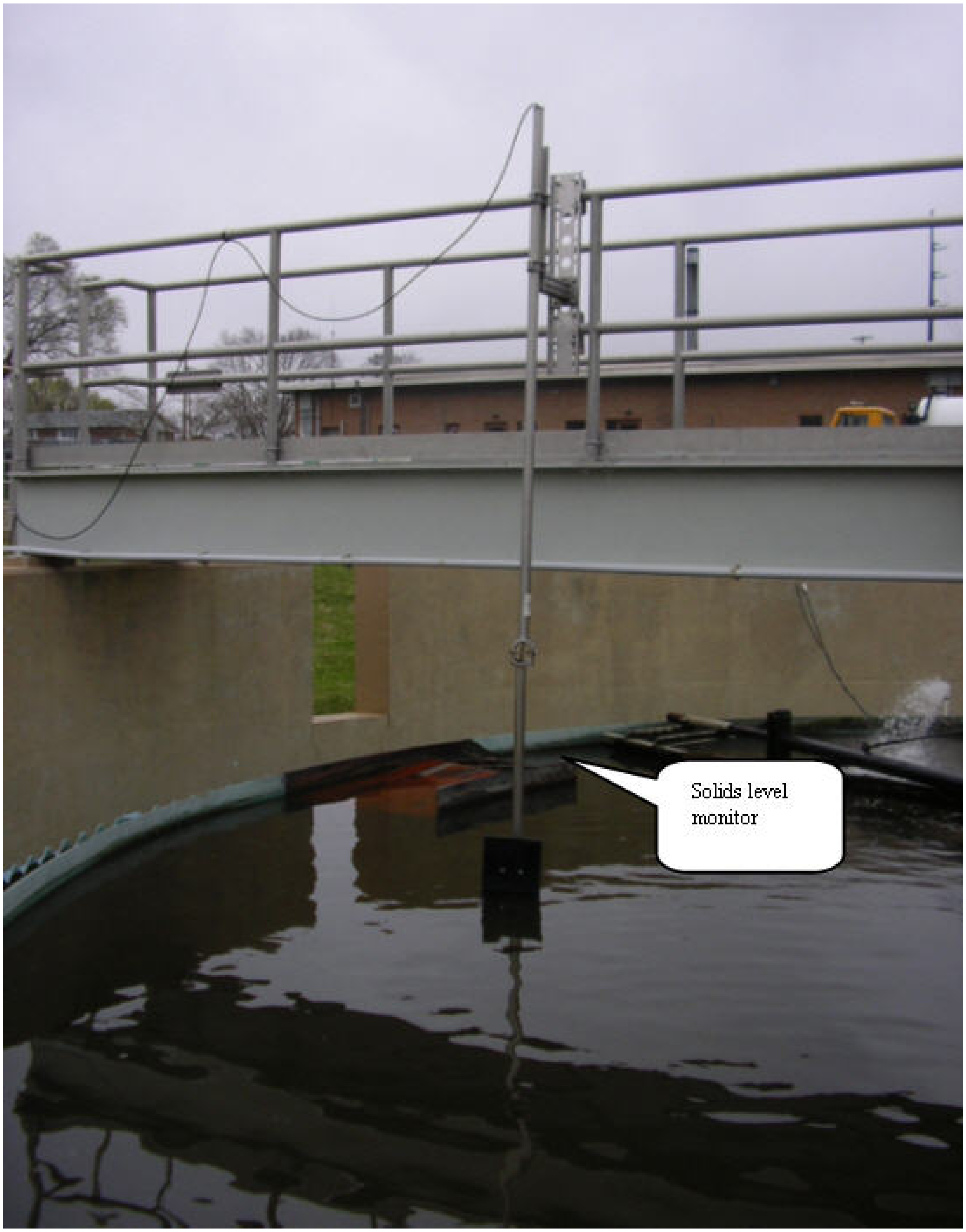


Figure 20. Solids level monitor at McConnellsburg WWTP, south clarifier

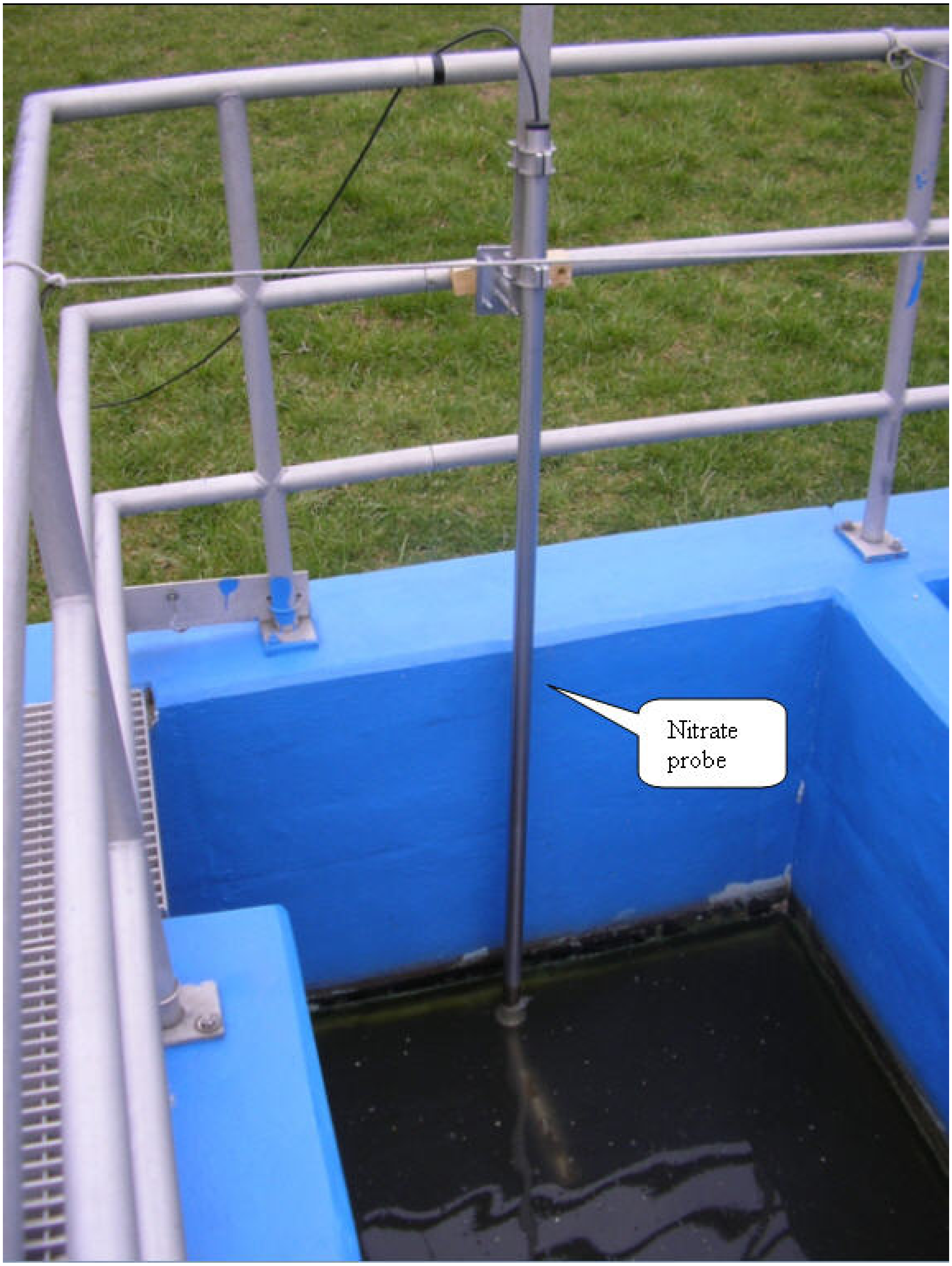


Figure 21. Nitrate monitor at McConnellsburg WWTP, chlorine contact tank

Attachment F— Program Description

POTW 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 reduce pathogen, nutrient, and emerging contaminant loadings to downstream drinking water facility intakes. The initial focus will be to work with wastewater treatment facilities within five miles upstream of these filter plant intakes.

DEP will conduct Wastewater Plant Performance Evaluations (WPPEs) to assist municipal 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 new program is modeled after DEP's Filter Plant Performance Evaluations (FPPEs) conducted at Drinking Water facilities.

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, 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. We'll 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 to 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: Wastewater Optimization Program Specialists, PA licensed as a 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.

Attachment G— Laboratory Sampling Results

McConnellsburg Sewer Authority Laboratory Sample Results

Upstream, Downstream, Effluent, Mixed Liquor Suspended Solids

The following pages represent the samples collected by Department personnel over the project period. These samples are for informational use in identifying trends and effects of process modifications where applicable. These samples were not collected with the intentions of being used for compliance purposes.

Microscopic Analysis

Rev. Sep 06

Public Water Filtration McCONNELLSBURG STP. **ID:** PA0020508

Collector: MARC NEVILLE **Received Date:** 2/12/2009

Raw Water Method 1623

Sample 907009
Sample DOWNSTREAM
Date 2/11/2009
Liters: 10.5
Total Sed. 0.2 ml.
Size 0-165 um

.

Particulate Debris Observed

ALGAE, DIATOMS, PROTOZOA,
ROTIFERS, HYPHAE, SPORES,
INSECT EGGS, AND AMORPHOUS DEBRIS

Giardia **: 271 GIARDIA CYSTS
cysts per liter: 25.605
Cryptosporidium* 4 CRYPTO OOCYSTS
oocysts per liter: 0.378

Analyzed ROGER L DIEHL **Date of** 2/13/2009

** Quantification figures are based on a 300 gallon sample. Particulate debris are scored in the following*

0 = None 1+ = Rare 2+ = Few 3+ = Moderate 4+ = Many

Crypto-sized Debris = 3-7 um Giardia-sized Debris = 8-19 um Large Part. Debris =

*** Giardia cyst identification is based on size, shape, and at least two identifiable internal*

**** Cryptosporidium oocysts are considered "presumptive" unless noted.*

Microscopic Analysis

Rev. Sep 06

Public Water Filtration McCONNELLSBURG STP. **ID:** PA0020508

Collector: MARC NEVILLE **Received Date:** 2/12/2009

Raw Water Method 1623

Sample 907007
Sample UPSTREAM
Date 2/11/2009
Liters: 10.75
Total Sed. 0.1 ml.
Size 0 - 77 um

Particulate Debris Observed:

INORGANIC AMORPHOUS DEBRIS, ALGAE, DIATOMS, POLLEN, PROTOZOA, FUNGAL HYPHAE AND SPORES.

Giardia **: 40 GIARDIA CYSTS
cysts per liter: 3.779
Cryptosporidium* 5 CRYPTO OOCYSTS
oocysts per liter: 0.472

Analyzed ROGER L. DIEHL **Date of** 2/13/2009

** Quantification figures are based on a 300 gallon sample. Particulate debris are scored in the following*
0 = None 1+ = Rare 2+ = Few 3+ = Moderate 4+ = Many
Crypto-sized Debris = 3-7 um Giardia-sized Debris = 8-19 um Large Part. Debris =
*** Giardia cyst identification is based on size, shape, and at least two identifiable internal*
**** Cryptosporidium oocysts are considered "presumptive" unless noted.*

Microscopic Analysis

Rev. Sep 06

Public Water Filtration MC CONNELLSBURG STP **ID:** PA0020508

Collector: MARC NEVILLE **Received Date:** 2/12/2009

Raw Water Method 1623

Sample 907008
Sample OUTFALL
Date 2/11/2009
Liters: 10.75 LITERS
Total Sed. 0.5 ml.
Size 0-230 um

Particulate Debris Observed

ROTIFERS,PROTOZOA,HYPHAE,SPORES, ALGAE,DIATOMS,NEMATODES AND AMORPHOUS DEBRIS.

Giardia **: 833 CYSTS
cysts per liter: 77.869
Cryptosporidium* 3 OOCYSTS
oocysts per liter: 0.280

Analyzed M.G.M. **Date of** 2/13/2009

** Quantification figures are based on a 300 gallon sample. Particulate debris are scored in the following*

0 = None 1+ = Rare 2+ = Few 3+ = Moderate 4+ = Many

Crypto-sized Debris = 3-7 um Giardia-sized Debris = 8-19 um Large Part. Debris =

*** Giardia cyst identification is based on size, shape, and at least two identifiable internal*

**** Cryptosporidium oocysts are considered "presumptive" unless noted.*

Date of Issue: 04/20/2009 11:01:01
DEP Bureau Of Laboratories - Harrisburg
P.O. Box 1467
2575 Interstate Drive
Harrisburg , PA 17105-1467

Contact Phone Number: (717) 346-7200

Analytical Report FOR
Water Supply Management

Sample ID: 0907 007 02/11/2009 Status: COMPLETED

Name of Sample Collector: Marc A Neville
Date Sample was Collected: 02/11/2009 01:50:00 PM

County: Fulton State: PA
Municipality: McConnellsburg Borough

Sample Medium: Water
Sample Medium Type: Aqueous

Location: Upstream of McConnellsburg Outfall 001
Reason: Routine Sampling

Laboratory Sample ID: I2009004230
COMPLETED
Standard Analysis: 070

Test/Codes	CAS# - Desc.	Reported Results	Date Approved	Approver	Test Method
00940A	CHLORIDE	34.3 MG/L	02/24/2009	CRADEK	SM 4500-CL

****
The results of the analyses provided in this laboratory report relate only to the sample(s) identified in the report.

Taru Upadhyay, Technical Director, Bureau of Laboratories

****

End of Report

Date of Issue: 04/20/2009 10:59:35

DEP Bureau Of Laboratories - Harrisburg
P.O. Box 1467
2575 Interstate Drive
Harrisburg , PA 17105-1467

Contact Phone Number: (717) 346-7200

Analytical Report FOR
Water Quality Protection

Sample ID: 0907 008 02/11/2009 Status: COMPLETED

Name of Sample Collector: Marc A Neville
Date Sample was Collected: 02/11/2009 01:40:00 PM

County: Fulton State: PA
Municipality: McConnellsburg Borough

Location: Effluent
Reason: Routine Sampling

Laboratory Sample ID: B2009000970 Date Received: 02/12/2009
COMPLETED
Standard Analysis: B002

Lab Sample Comment: Time Limit For Test Exceeded

Test/Codes CAS# - Description	Reported Results	Date Approved	Approver	Test Method
31616 FECAL COL	80 /100ML	02/13/2009	FBABICZ	SM 9222D

****

The results of the analyses provided in this laboratory report relate only to the sample(s) identified in the report.

Taru Upadhyay, Technical Director, Bureau of Laboratories

****

End of Report

Date of Issue: 04/20/2009 11:00:40

DEP Bureau Of Laboratories - Harrisburg
P.O. Box 1467
2575 Interstate Drive
Harrisburg , PA 17105-1467

Contact Phone Number: (717) 346-7200

Analytical Report FOR
Water Supply Management

Sample ID: 0907 009 02/11/2009 Status: COMPLETED

Name of Sample Collector: Marc A Neville
Date Sample was Collected: 02/11/2009 01:50:00 PM

County: Fulton State: PA
Municipality: McConnellsburg Borough

Sample Medium:
Sample Medium Type:

Location: East Aeration Tank
Reason: Routine Sampling

Laboratory Sample ID: I2009004232
COMPLETED
Standard Analysis: 070

Test/Codes CAS# - Desc.	Reported Results	Date Approved	Approver	Test Method
00410 ALKALINITY	292.8 MG/L	02/20/2009	SHUTCHISON	SM 2320B
** Comment **	Alkalinity Measured to Endpoint 4.5			
00535 RES VOL SUSP	4,084 MG/L	02/19/2009	LWILKINSON	USGS I-3767
00530 T SUSP SOLID	5,144 MG/L	02/23/2009	LWILKINSON	USGS I-3765

****

The results of the analyses provided in this laboratory report relate only to the sample(s) identified in the report.

Taru Upadhyay, Technical Director, Bureau of Laboratories

****

End of Report

DEP Bureau Of Laboratories - Harrisburg
P.O. Box 1467
2575 Interstate Drive
Harrisburg , PA 17105-1467

Contact Phone Number: (717) 346-7200

Analytical Report FOR
Water Supply Management

Sample ID: 0907 012 03/17/2009 Status: COMPLETED

Name of Sample Collector: Marc A Neville
Date Sample was Collected: 03/17/2009 01:50:00 PM

County: Fulton State: PA
Municipality: McConnellsburg Borough

Sample Medium:
Sample Medium Type:

Location: East Aeration MLSS
Reason: Routine Sampling

Laboratory Sample ID: I2009008677
COMPLETED
Standard Analysis: 075

Test/Codes CAS# - Desc.		Reported Results	Date Approved	Approver	Test Method
00610A	AMMONIA-N T	0.05 MG/L	04/07/2009	CRADEK	EPA 350.1

****
The results of the analyses provided in this laboratory report relate only to the sample(s) identified in the report.

Taru Upadhyay, Technical Director, Bureau of Laboratories

****

End of Report

Microscopic Analysis

Rev. Sep 06

Public Water Filtration MCCONNELLSBURG STP EFFLUENT **ID:** PA0020508

Collector: MARC NEVILLE **Received Date:** 3/18/2009

Raw Water Method 1623

Sample 907011
Sample STP EFFLUENT
Date 3/17/2009
Liters: 11.0 LITERS
Total Sed. 0.5 ml.
Size um

Particulate Debris Observed

Giardia **: 10 CYSTS
cysts per liter: 0.912
Cryptosporidium* NO OOCYSTS
oocysts per liter: 0.000

Analyzed M.G.M. **Date of** 3/20/2009

** Quantification figures are based on a 300 gallon sample. Particulate debris are scored in the following*

0 = None 1+ = Rare 2+ = Few 3+ = Moderate 4+ = Many

Crypto-sized Debris = 3-7 um Giardia-sized Debris = 8-19 um Large Part. Debris =

*** Giardia cyst identification is based on size, shape, and at least two identifiable internal*

**** Cryptosporidium oocysts are considered "presumptive" unless noted.*

Microscopic Analysis

Rev. Sep 06

Public Water MCCONNELLSBURG SEWER AUTH. **ID:** PA0020508
Filtration SEWER FINAL EFFLUENT
Collector: MARC NEVILLE **Received Date:** 4/16/2009

Raw Water Method 1623

Sample 907015
Sample SEWER EFFLUENT
Date 4/15/2009
Liters: 11.0 LITERS
Total Sed. 3 ml.
Size 0-375 um

Particulate Debris Observed

INORGANIC AMORPHOUS DEBRIS,
RARE DIATOMS,ROTIFERS,AMOEBAE,
SPORES AND NEMATODES.

Giardia **: 3,003 CYSTS
cysts per liter: 273.946
Cryptosporidium* 3 OOCYSTS
oocysts per liter: 0.274

Comment

Analyzed M.G.M. **Date of** 4/16/2009

** Quantification figures are based on a 300 gallon sample. Particulate debris are scored in the following*

0 = None 1+ = Rare 2+ = Few 3+ = Moderate 4+ = Many

Crypto-sized Debris = 3-7 um Giardia-sized Debris = 8-19 um Large Part. Debris =

*** Giardia cyst identification is based on size, shape, and at least two identifiable internal*

**** Cryptosporidium oocysts are considered "presumptive" unless noted.*

Attachment H— Suggested Minimum Sampling Frequencies

Operator Sample collection guidelines Plant Flow: Less than 1.0 MGD

Sample Parameter	Sample Location	Sample Type	3/Week	1/Week	2/Month
Raw Influent *					
BOD5 and TSS	Influent	Grab			x
Alkalinity	Influent	Grab			x
COD	Influent	Grab			x
NH3-N	Influent	Grab			x
pH	Influent	Grab		x	
Flow	Influent	Totalizer	Daily		
* Frequency of sampling may need to be increased or decreased depending on plant size or conditions					
Aeration Basin					
MLSS / MLVSS (or centrifuge, with coorelated data from periodic MLVSS values	Aeration Tank	Grab			x
Dissolved Oxygen	Aeration Tank	In Situ		x	
Settleability (SV30)	Aeration Tank	Grab	x		
pH	Aeration Tank	Grab		x	
Microscopic Evaluation	Aeration Tank	Grab			x
Return Activated Sludge, SS	RAS line	Grab			x
Computation of SVI, F/M, sludge age, and/or MCRT	-	-		As data collected	
Secondary Clarifier					
Sludge blanket depth	As appropriate	In situ		x	
Waste Activated Sludge, SS and VSS	Waste Line	Grab			X
Final Effluent					
Alkalinity	Effluent	Grab			x
Parameters, sample types, and frequencies required by permit					

Figure 22. Suggested minimum sampling frequencies

These parameters and frequencies are the minimum for facilities with flows rated less than 1.0 MGD. Operators are encouraged to sample more frequently as necessary to gather enough data to effectively make informed process control decisions. Depending on the chemical makeup of the wastewater, additional analyses may need to be performed to provide adequate treatment.

Attachment I— WPPE Team

McConnellsburg Sewer Authority

Evaluation Information

WPPE Team
Robert DiGilarmo, Water Program Specialist DEP – Ebensburg Office 286 Industrial Park Rd Ebensubrg, PA 15931 814.472.1819 rdigilarmo@state.pa.us
Marc Neville, Water Program Specialist DEP- RCSOB 400 Market St Harrisburg, PA 17105 717.772.4019 mneville@state.pa.us
Paul Handke, Water Program Specialist, Filter Plant Programs
Kevin Anderson, Environmental Group Manager, Filter Plant Programs

Plant personnel
Craig Strait, Chief Operator McConnellsburg Sewer Authority P.O. Box 681 McConnellsburg, PA 17233 717-485-4728
Gary Hopkins
Mark Weller